

## **2002 Hyundai Elantra GLS**

2002 ENGINE 2.0L 4 Cylinder DOHC - Elantra

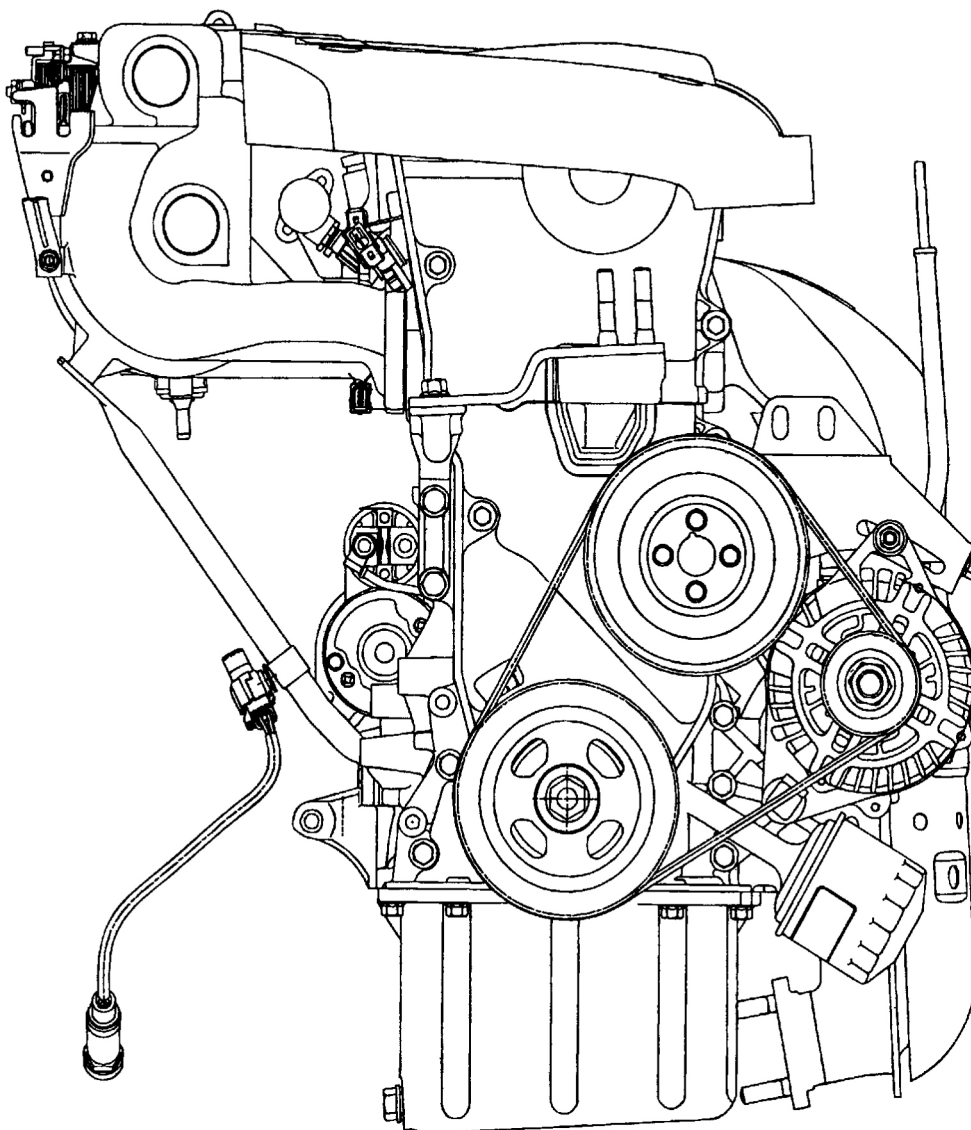
### **2002 ENGINE**

**2.0L 4 Cylinder DOHC - Elantra**

## **GENERAL**

### **BETA ENGINE APPEARANCE**

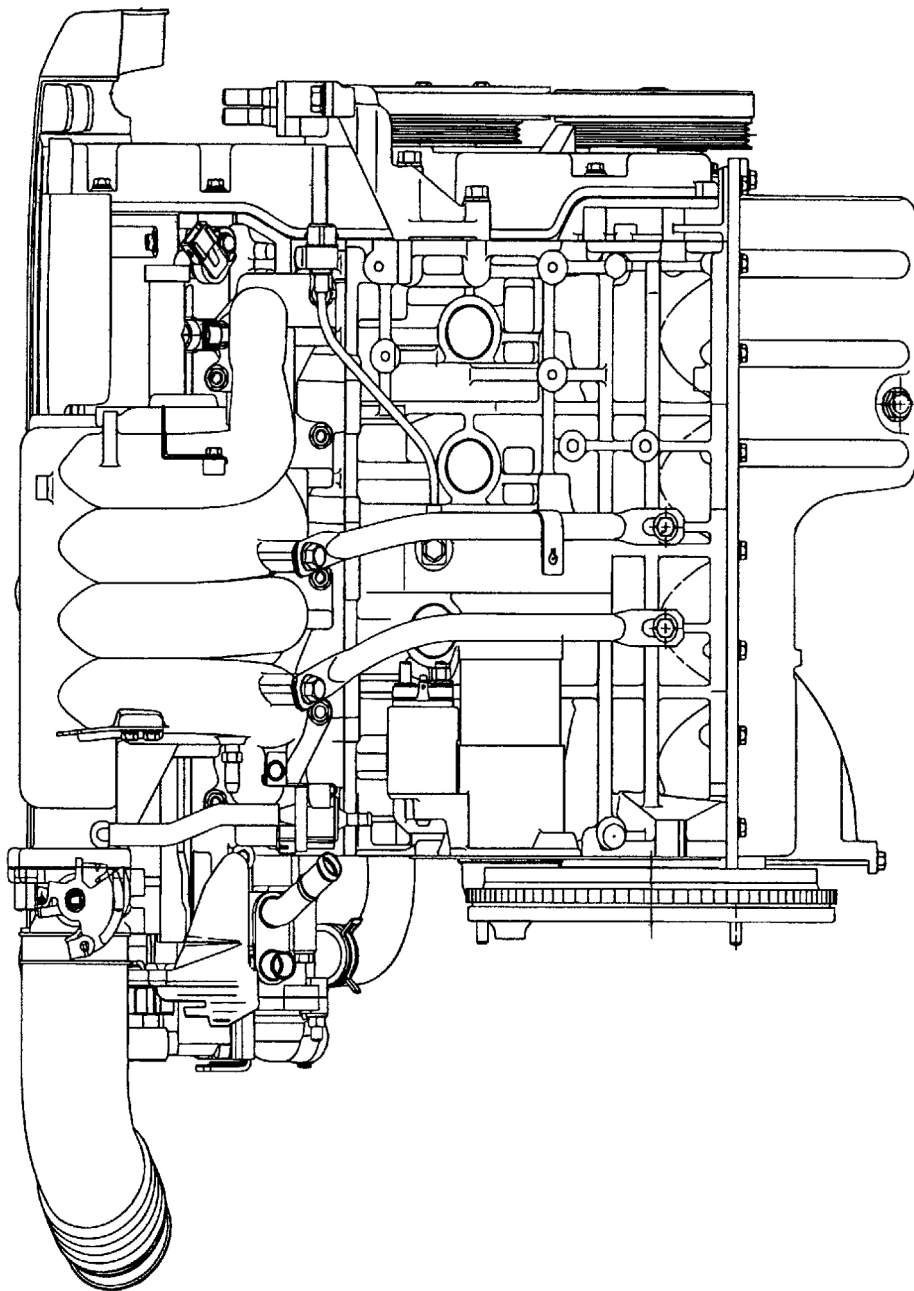
**FRONT VIEW**



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**Fig. 1: Front View Of Engine**  
Courtesy of HYUNDAI MOTOR CO.

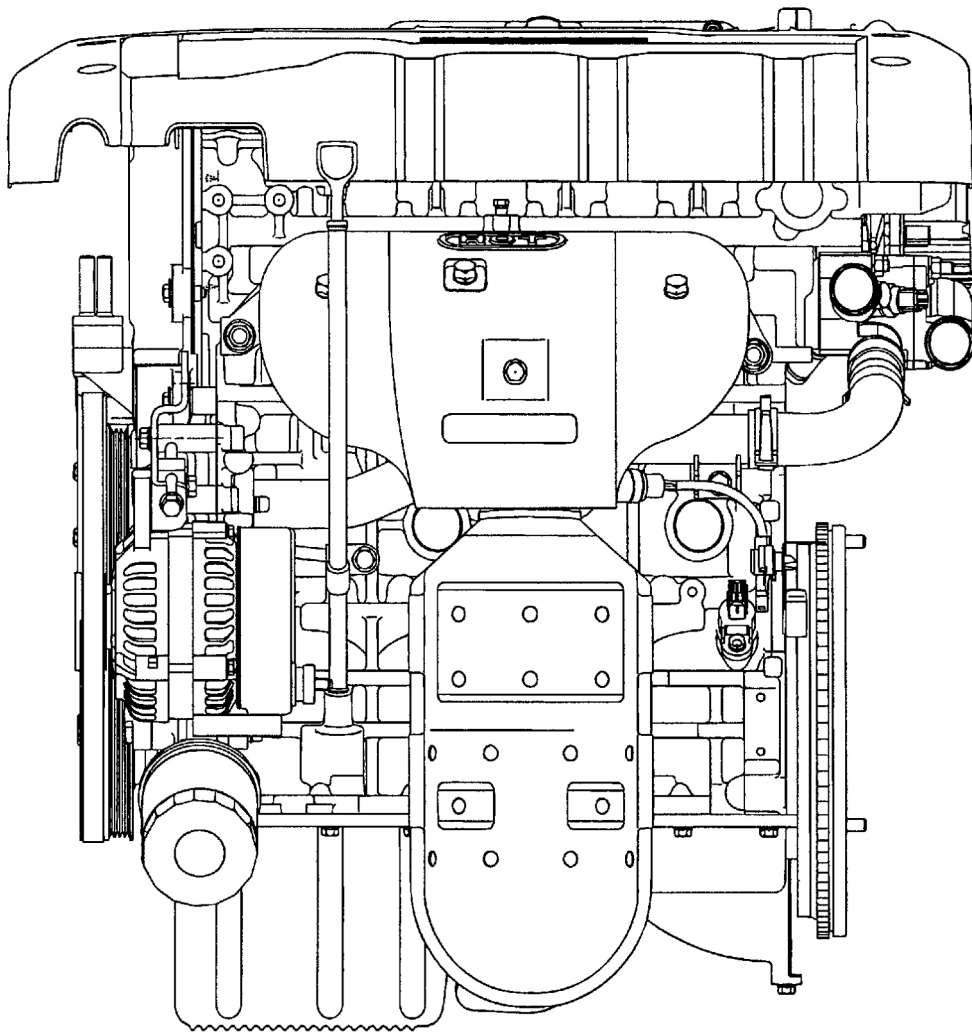
**RIGHT VIEW**



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**Fig. 2: Right View Of Engine**  
Courtesy of HYUNDAI MOTOR CO.

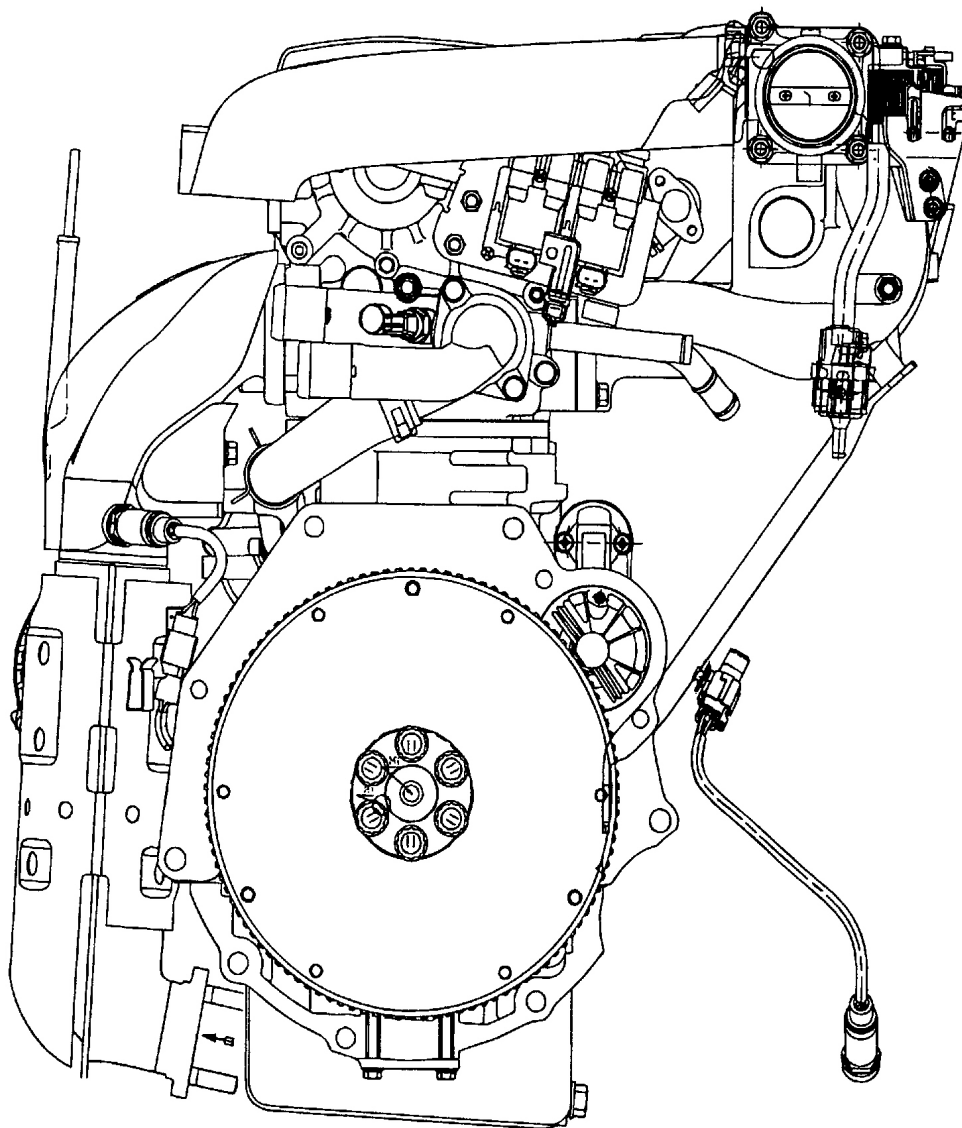
**LEFT VIEW**



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**Fig. 3: Left View Of Engine**  
Courtesy of HYUNDAI MOTOR CO.

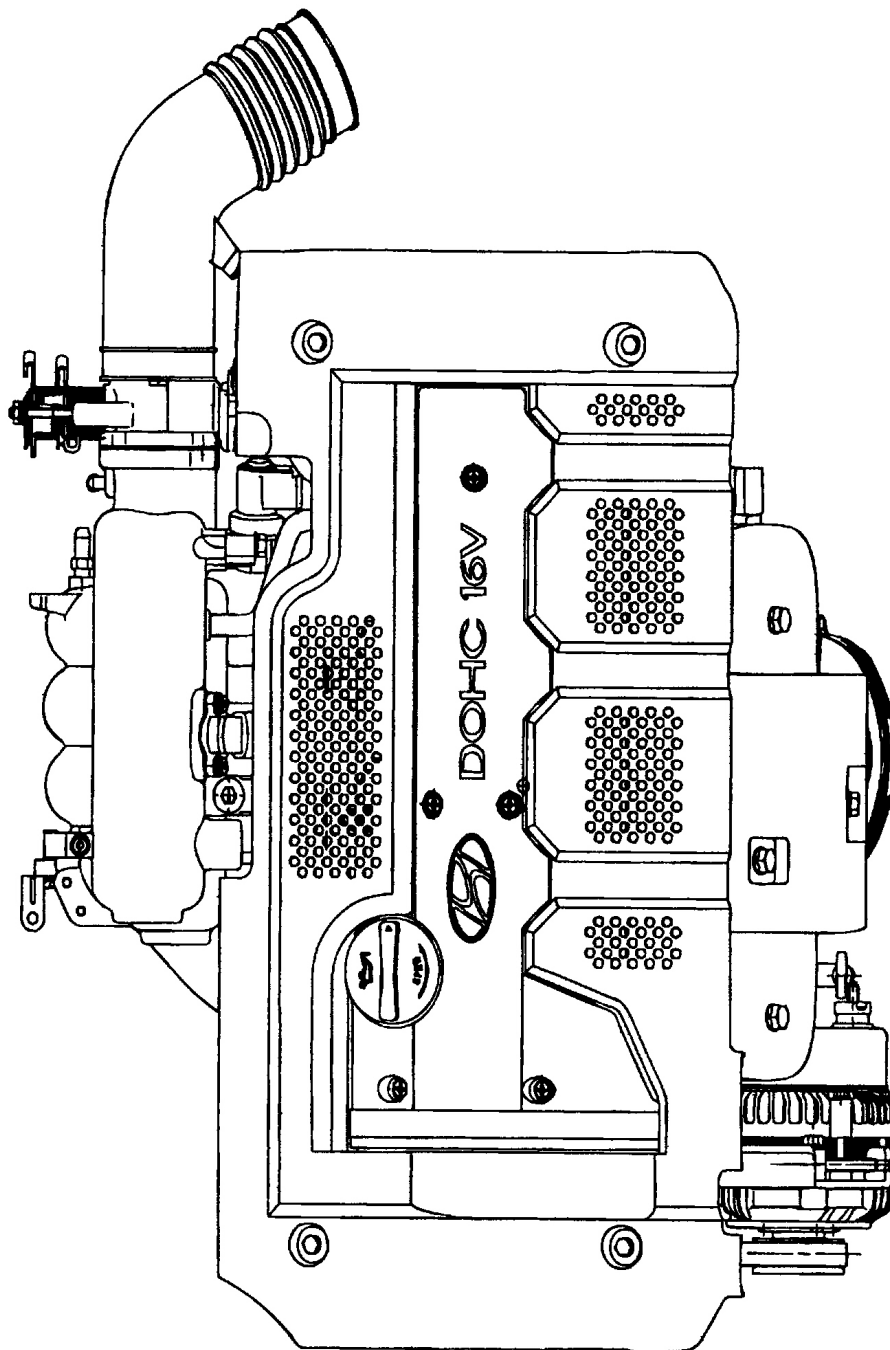
REAR VIEW



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**Fig. 4: Rear View Of Engine**  
Courtesy of HYUNDAI MOTOR CO.

**TOP VIEW**



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**Fig. 5: Top View Of Engine**  
Courtesy of HYUNDAI MOTOR CO.

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### SPECIFICATIONS

#### General Engine Specifications

| Description                                        |               | Specification                                                       | Limit              |
|----------------------------------------------------|---------------|---------------------------------------------------------------------|--------------------|
| <b>General</b>                                     |               |                                                                     |                    |
| Type                                               |               | In-line, Double Overhead Camshaft                                   |                    |
| Number of cylinder Bore                            |               | 4 82 mm (3.228 in.)                                                 |                    |
| Stroke                                             |               | 93.5 mm (3.681 in.)                                                 |                    |
| Total displacement                                 |               | 1975 cc (120.52 cu.in.)                                             |                    |
| Compression ratio                                  |               | 10.1                                                                |                    |
| Firing order                                       |               | 1-3-4-2                                                             |                    |
|                                                    | Idle R.P.M    | 700 ± 100                                                           |                    |
| Ignition timing at idling speed                    |               | BTDC 8° ±5°/700 rpm                                                 |                    |
| <b>Valve timing</b>                                |               |                                                                     |                    |
| Intake valve                                       |               |                                                                     |                    |
|                                                    | Opens (BTDC)  | 9°                                                                  |                    |
|                                                    | Closes (ABDC) | 43°                                                                 |                    |
| Exhaust valve                                      |               |                                                                     |                    |
|                                                    | Opens (BBDC)  | 50°                                                                 |                    |
|                                                    | Closes (ATDC) | 6°                                                                  |                    |
| <b>Cylinder block</b>                              |               |                                                                     |                    |
| Cylinder bore                                      |               | 82.00-82.03 mm (3.2283 - 3.2295 in.)                                |                    |
| Out-of-round and taper of cylinder bore            |               | Less than 0.01 mm (0.0004 in.)                                      |                    |
| Clearance with piston (To set limits to new parts) |               | 0.02 - 0.04 mm (0.0008 - 0.0016 in.)                                |                    |
| <b>Piston</b>                                      |               |                                                                     |                    |
| O.D. (To set limits to new parts)                  |               | 81.97 - 82.00 mm (3.2271 - 3.2283 in.)                              |                    |
| Service oversize                                   |               | 0.25, 0.50, 0.75, 1.00 mm (0.010, 0.020, 0.030, 0.039 in.) oversize |                    |
| <b>Piston ring</b>                                 |               |                                                                     |                    |
| Side clearance                                     |               |                                                                     |                    |
|                                                    | No. 1         | 0.04-0.08 mm (0.0015-0.0031 in.)                                    | 0.1 mm (0.004 in.) |
|                                                    | No. 2         | 0.03-0.07 mm (0.0012-0.0027 in.)                                    |                    |
| End gap                                            |               |                                                                     |                    |
|                                                    | No. 1         | 0.23-0.38 mm (0.0090-0.0149 in.)                                    | 1 mm (0.039 in.)   |
|                                                    | No. 2         | 0.33-0.48 mm (0.0130-                                               | 1 mm (0.039 in.)   |

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|                                                     |                                                                     |                                      |
|-----------------------------------------------------|---------------------------------------------------------------------|--------------------------------------|
| Oil ring side rail                                  | 0.0189 in.)<br>0.20-0.60 mm (0.0078-0.0236 in.)                     | 1 mm (0.039 in.)                     |
| Service oversize                                    | 0.25, 0.50, 0.75, 1.00 mm (0.010, 0.020, 0.030, 0.039 in.) oversize |                                      |
| <b>Connecting rod</b>                               |                                                                     |                                      |
| Bend                                                | 0.05 mm (0.0020 in.) or less                                        |                                      |
| Twist                                               | 0.1 mm (0.004 in.) or less                                          |                                      |
| Connecting rod big end to crankshaft side clearance | 0.100-0.250 mm (0.0039-0.0098 in.)                                  | 0.4 mm (0.0157 in.)                  |
| <b>Connecting rod bearing</b>                       |                                                                     |                                      |
| Oil clearance (To set limits to new parts)          | 0.024-0.044 mm (0.0009-0.0017 in.)                                  |                                      |
| Undersize                                           | 0.25, 0.50, 0.75 mm (0.01, 0.20, 0.03 in.)                          |                                      |
| <b>Camshaft</b>                                     |                                                                     |                                      |
| Cam lobe height                                     |                                                                     |                                      |
| Intake                                              | 44.820 mm (1.7646 in.)                                              | 44.720 mm (1.7606 in.)               |
| Exhaust                                             | 44.720 mm (1.7606 in.)                                              | 44.620 mm (1.7567 in.)               |
| Journal O.D.                                        | 28 mm (1.1023 in.)                                                  |                                      |
| Bearing oil clearance                               | 0.02-0.061 mm (0.0008-0.0024 in.)                                   | 0.1 mm (0.0039 in.)                  |
| End play                                            | 0.1-0.2 mm (0.004-0.008 in.)                                        |                                      |
| <b>Crankshaft</b>                                   |                                                                     |                                      |
| Pin O.D.                                            | 45 mm (1.77 in.)                                                    |                                      |
| Journal O.D.                                        | 57 mm (2.244 in.)                                                   |                                      |
| Bend                                                | 0.03 mm (0.0012 in.) or less                                        |                                      |
| Out-of-round, taper of journal and pin              | 0.01 mm (0.0004 in.) or less                                        |                                      |
| End play                                            | 0.06-0.260 mm (0.0023-0.010 in.)                                    | 0.30 mm (0.0118 in.)                 |
|                                                     | Undersize rework dimension of pin                                   |                                      |
|                                                     | 0.25 mm (0.010 in.)                                                 | 44.725-44.740 mm (1.7608-1.7614 in.) |
|                                                     | 0.50 mm (0.020 in.)                                                 | 44.475-44.490 mm (1.7509-1.7516 in.) |
|                                                     | 0.75 mm (0.030 in.)                                                 | 44.225-44.240 mm (1.7411-1.7417 in.) |
|                                                     | Undersize rework dimension of journal                               |                                      |
|                                                     | 0.25 mm (0.010 in.)                                                 | 56.727-56.742 mm                     |

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|                                                       |                     |                                                                   |                      |
|-------------------------------------------------------|---------------------|-------------------------------------------------------------------|----------------------|
|                                                       | 0.50 mm (0.020 in.) | (2.2333-2.2339 in.)<br>56.477-56.492 mm<br>(2.2235-2.2240 in.)    |                      |
|                                                       | 0.75 mm (0.030 in.) | 56.227-56.242 mm<br>(2.2136-2.2142 in.)                           |                      |
| <b>Flywheel</b>                                       |                     |                                                                   |                      |
| Runout                                                |                     | 0.1 mm (0.0039 in.)                                               | 0.13 mm (0.0051 in.) |
| <b>Cooling method</b>                                 |                     | Water-cooled, pressurized, Forced circulation with electrical fan |                      |
| <b>Coolant</b>                                        |                     |                                                                   |                      |
| Quantity                                              |                     | 6 liter (6.3 U.S qts., 5.2 Imp. qts.)                             |                      |
| <b>Radiator</b>                                       |                     |                                                                   |                      |
| Type                                                  |                     | Pressurized corrugated fin type                                   |                      |
| <b>Radiator cap</b>                                   |                     |                                                                   |                      |
| Main valve opening pressure                           |                     | 83-110 kpa (12-16 psi,<br>0.83-1.1 kg/cm <sup>2</sup> )           |                      |
| Vacuum valve opening pressure                         |                     | - 7 kpa (-1.00 psi, -0.07 kg/cm <sup>2</sup> ) or less            |                      |
| <b>Thermostat</b>                                     |                     |                                                                   |                      |
| Type                                                  |                     | Wax pellet type with jiggle valve                                 |                      |
| Valve opening temperature                             |                     | 82°C(177°F)                                                       |                      |
| Full-opening temperature                              |                     | 95°C(201°F)                                                       |                      |
| <b>Coolant pump</b>                                   |                     | Centrifugal type impeller                                         |                      |
| <b>Drive belt</b>                                     |                     |                                                                   |                      |
| Type                                                  |                     | V-ribbed belt                                                     |                      |
| <b>Engine coolant temperature sensor</b>              |                     |                                                                   |                      |
| Type                                                  |                     | Heat-sensitive thermistor type                                    |                      |
| Resistance                                            |                     | 2.31-2.59Kohms at 20°C (68°F)                                     |                      |
| <b>Oil pump</b>                                       |                     |                                                                   |                      |
| Clearance between outer circumference and front case. |                     | 0.120-0.185 mm (0.0047-0.0073 in.)                                |                      |
| Front case tip clearance                              |                     | 0.025-0.069 mm (0.0009-0.0027 in.)                                |                      |
| Side clearance                                        |                     |                                                                   |                      |
|                                                       | Inner gear          | 0.04-0.085 mm (0.0016-0.0033 in.)                                 |                      |
|                                                       | Outer gear          | 0.04-0.09 mm (0.0016-0.0035 in.)                                  |                      |
| Engine oil pressure at idle [Oil temperature is 90 to |                     |                                                                   |                      |

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|                                                    |                                                |                      |
|----------------------------------------------------|------------------------------------------------|----------------------|
| 100°C (194 to 215T)]                               | 166 KPa (1.7 kg/cm <sup>2</sup> ,<br>24.s psi) |                      |
| <b>Relief spring</b>                               |                                                |                      |
| Free height                                        | 43.8 mm (1.724 in.)                            |                      |
| Load                                               | 3.7kg at 40.1 mm (3.15<br>lb/1.578 in.)        |                      |
| <b>Air cleaner</b>                                 |                                                |                      |
| Type                                               | Dry type                                       |                      |
| Element                                            | Unwoven cloth type                             |                      |
| <b>Exhaust pipe</b>                                |                                                |                      |
| Muffler                                            | Expansion resonance type                       |                      |
| Suspension system                                  | Rubber hangers                                 |                      |
| <b>Valve</b>                                       |                                                |                      |
| Valve length                                       | 114.34 mm (4.5016 in.)                         |                      |
| Intake                                             | 116.8 mm (4.5984 in.)                          |                      |
| Exhaust                                            |                                                |                      |
| Stem O.D.                                          | 5.965-5.98 mm (0.2348-<br>0.2354 in.)          |                      |
| Intake                                             | 5.950-5.965 mm (0.2343-<br>0.2348 in.)         |                      |
| Exhaust                                            |                                                |                      |
| <b>Face angle thickness of valve head (Margin)</b> |                                                |                      |
| Intake                                             | 1.15 mm (0.0452 in.)                           | 0.8 mm (0.031 in.)   |
| Exhaust                                            | 1.35 mm (0.0531 in.)                           | 1.0 mm (0.039 in.)   |
| <b>Valve stem to valve guide clearance</b>         |                                                |                      |
| Intake                                             | 0.02-0.05 mm (0.0008-<br>0.0019 in.)           | 0.10 mm (0.0039 in.) |
| Exhaust                                            | 0.035-0.065 mm (0.0014-<br>0.0026 in.)         | 0.13 mm (0.0051 in.) |
| <b>Valve guide</b>                                 |                                                |                      |
| Installed dimension O.D.                           | 46 mm (1.811 in.)                              |                      |
| Intake                                             | 54.5 mm (2.146 in.)                            |                      |
| Exhaust                                            | 0.05, 0.25, 0.50 mm                            |                      |
| Service oversize                                   | (0.002, 0.010, 0.020 in.)<br>oversize          |                      |
| <b>Valve seat</b>                                  |                                                |                      |
| Width of seat contact                              |                                                |                      |
| Intake                                             | 1.1-1.5 mm (0.043-0.059<br>in.)                |                      |
| Exhaust                                            | 1.3-1.7 mm (0.051-0.066<br>in.)                |                      |
| Seat angle                                         | 45°                                            |                      |
| Oversize                                           | 0.3, 0.6 mm (0.012, 0.024<br>in.) oversize     |                      |

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|                                                                                 |                                    |                                      |
|---------------------------------------------------------------------------------|------------------------------------|--------------------------------------|
| <b>Valve spring</b>                                                             |                                    |                                      |
| Free length                                                                     | 48.86 mm (1.9236 in.)              |                                      |
| Load                                                                            | 18.3 kg / 39 mm, 40.0 kg / 30.5 mm |                                      |
| Installed height                                                                | 39 mm (1.5354 in.)                 |                                      |
| Squareness                                                                      | 1.5° or less                       |                                      |
| <b>Valve clearance (cold)</b>                                                   |                                    |                                      |
| Intake                                                                          | 0.20 mm (0.0079 in.)               | 0.12-0.28 mm (0.0047-0.0110 in.)     |
| Exhaust                                                                         | 0.28 mm (0.0110 in.)               | 0.20-0.36 mm (0.0079-0.0142 in.)     |
| <b>Cylinder head</b>                                                            |                                    |                                      |
| Flatness of gasket surface                                                      | Max. 0.03 mm (0.0012 in.)          | 0.06 mm (0.0024 in.)                 |
| Flatness of manifold mounting surface                                           | Max. 0.15 mm (0.0059 in.)          | Max. 0.03 mm (0.0118 in.)            |
| <b>Oversize rework dimensions of valve seat hole</b>                            |                                    |                                      |
| Intake                                                                          | 0.3 mm (0.012 in.) O.S.            | 33.300-33.325 mm (1.3110-1.3120 in.) |
|                                                                                 | 0.6 mm (0.024 in.) O.S.            | 33.600-33.625 mm (1.3228-1.3238 in.) |
| Exhaust                                                                         | 0.3 mm (0.012 in.) O.S.            | 28.800-28.821 mm (1.1338-1.1346 in.) |
|                                                                                 | 0.6 mm (0.024 in.) O.S.            | 29.100-29.121 mm (1.1456-1.1465 in.) |
| <b>Oversize rework dimensions of valve guide hole (both intake and exhaust)</b> |                                    |                                      |
|                                                                                 | 0.05 mm (0.002 in.) O.S.           | 11.05-11.068 mm (0.435-0.4357 in.)   |
|                                                                                 | 0.25 mm (0.010 in.) O.S.           | 11.25-11.268 mm (0.443-0.4436 in.)   |
|                                                                                 | 0.50 mm (0.020 in.) O.S.           | 11.50-11.518 mm (0.453-0.4535 in.)   |

### SERVICE STANDARDS

| Standard value                    |                                         |
|-----------------------------------|-----------------------------------------|
| Antifreeze                        | Mixture ratio of anti-freeze in coolant |
| ETHYLENE GLYCOL BASE FOR ALUMINUM | 50%                                     |

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**Fig. 6: Service Standards Table**

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Courtesy of HYUNDAI MOTOR CO.

**TORQUE SPECIFICATIONS**

**WARNING:** For updated reuse guidelines and tightening procedures of cylinder head, connecting rod and main bearing bolts, refer to **TSB 02-20-002 CYLINDER HEAD/CONNECTING ROD/MAIN BEARING BOLT REUSE GUIDELINES & TORQUE SPECS** .

**TORQUE SPECIFICATIONS**

| <b>Application</b>                                | <b>Ft. Lbs. (N.m)</b>            |
|---------------------------------------------------|----------------------------------|
| Alternator Brace Bolt                             | 15-20 (20-27)                    |
| Alternator Support Bolt                           | 15-18 (20-25)                    |
| Camshaft Bearing Cap Bolt                         | 10-11 (14-15)                    |
| Camshaft Sprocket Bolt                            | 74-89 (100-120)                  |
| Connecting Rod Cap Nut                            | 37-39 (50-53)                    |
| Coolant Inlet Fitting Nuts                        | 11-15 (15-20)                    |
| Coolant Pump Bolt                                 | 15-20 (20-27)                    |
| Coolant Temperature Sensor                        | 15-30 (20-40)                    |
| Crankshaft Bearing Cap Bolt                       |                                  |
| Step 1                                            | 22 (30)                          |
| Step 2                                            | Tighten An Additional 60 Degrees |
| Crankshaft Pulley Bolt                            | 125-133 (170-180)                |
| Cylinder Head Bolt <sup>(1)</sup>                 |                                  |
| M10                                               |                                  |
| Step 1                                            | 18 (25)                          |
| Step 2                                            | Tighten An Additional 60 Degrees |
| Step 3                                            | Tighten An Additional 60 Degrees |
| M12                                               |                                  |
| Step 1                                            | 22 (30)                          |
| Step 2                                            | Tighten An Additional 60 Degrees |
| Step 3                                            | Tighten An Additional 60 Degrees |
| Engine Mounts                                     |                                  |
| Front Engine Support Bracket Retainers            | 25-37 (35-50)                    |
| Front Roll Stopper Bracket Bolt                   | 51-65 (70-90)                    |
| Front Roll Stopper Bracket-To-Center Member Bolts | 30-37 (40-50)                    |
| Front Roll Stopper Insulator Nut                  | 37-48 (50-65)                    |
| Rear Engine Stopper Bracket Bolt                  | 25-37 (35-50)                    |
| Rear Roll Stopper Bracket Bolt                    | 51-65 (70-90)                    |
| Rear Roll Stopper Bracket-To-                     | 30-37 (40-50)                    |

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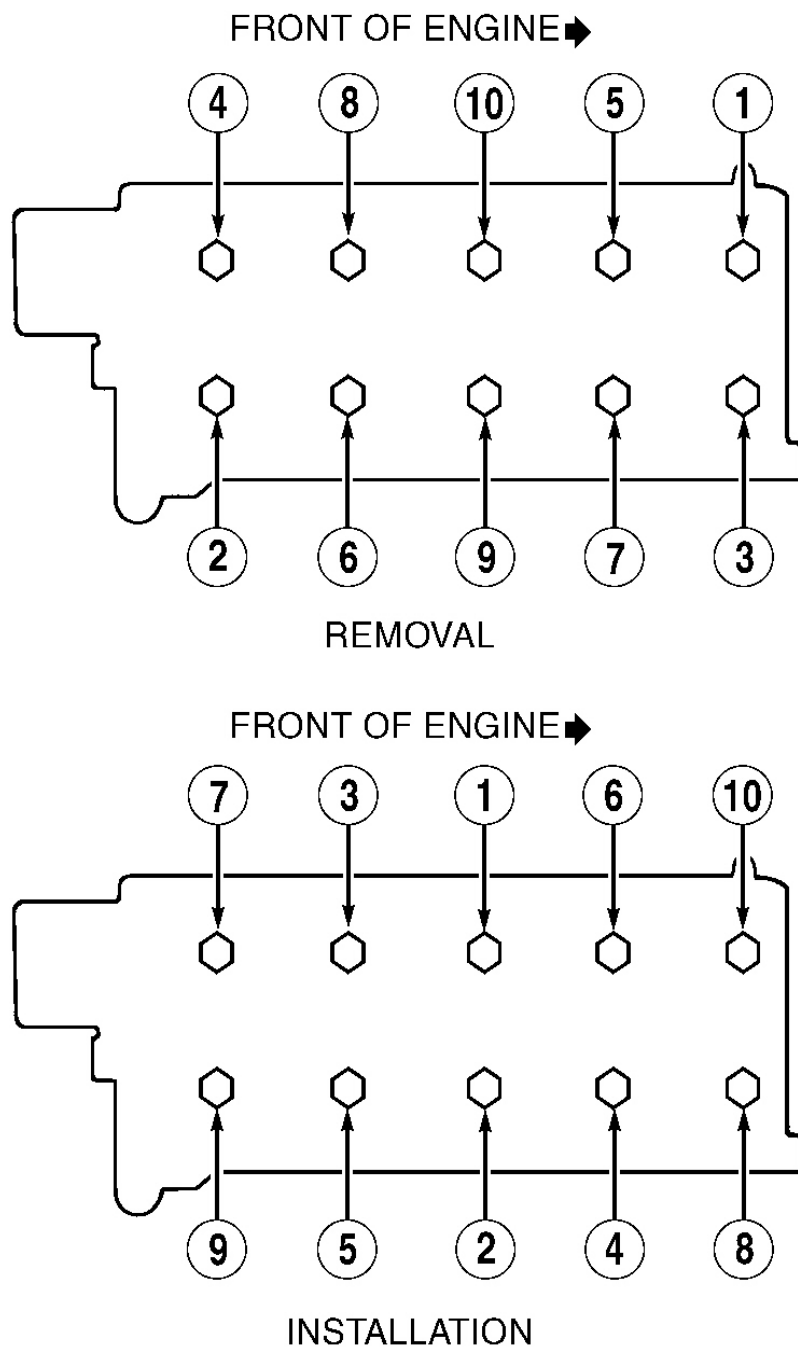
|                                                  |                          |
|--------------------------------------------------|--------------------------|
| Center Member Bolt                               |                          |
| Rear Roll Stopper Insulator Nut                  | 37-48 (50-65)            |
| Right Mounting Bracket-To-Engine Nuts & Bolts    | 37-48 (50-65)            |
| Right Mounting Insulator Nut (Large)             | 65-80 (90-110)           |
| Right Mounting Insulator Nut (Small)             | 33-44 (45-60)            |
| Transaxle Insulator Bracket-To-Side Member Bolts | 30-37 (40-50)            |
| Transaxle Mount Insulator Nut                    | 65-80 (90-110)           |
| Exhaust Components                               |                          |
| Exhaust Manifold Cover-To-Exhaust Manifold Bolts | 11-15 (15-20)            |
| Exhaust Manifold-To-Cylinder Head Nut            | 32-40 (43-55)            |
| Exhaust Pipe-To-Manifold Nut                     | 22-30 (30-40)            |
| Front Exhaust Pipe Bracket Bolts                 | 22-30 (30-40)            |
| Front Exhaust Pipe-To-Catalytic Converter Bolts  | 30-43 (40-60)            |
| Main Muffler Hanger Support Bracket Bolts        | 89-133 INCH Lbs. (10-15) |
| Flexplate-To-Crankshaft Bolt                     | 89-95 (120-129)          |
| Flywheel-To-Crankshaft Bolt                      | 89-95 (120-129)          |
| Front Case Bolts                                 | 14-20 (19-27)            |
| Heat Protector Bolts                             | 11-15 (15-20)            |
| Intake Manifold Bracket Bolts                    | 13-18 (18-24)            |
| Intake Manifold Nuts                             | 12-17 (16-23)            |
| Intake Manifold-To-Cylinder Head Bolts           | 12-17 (16-23)            |
| Oil Drain Plug                                   | 25-33 (35-45)            |
| Oil Filter                                       | 9-12 (12-16)             |
| Oil Pump Relief Valve                            | 30-37 (40-50)            |
| Oil Screen Bolt                                  | 11-16 (15-22)            |
| Oxygen Sensors                                   | 37-43 (50-60)            |
| Starter Bolt                                     | 20-25 (27-34)            |
| Thermostat Housing                               | 11-15 (15-20)            |
| Throttle Body-To-Intake Manifold Bolt            | 11-15 (15-20)            |
| Throttle Body-To-Surge Tank Bolts                | 11-15 (15-20)            |
| Timing Belt Idler Bolt                           | 31-40 (43-55)            |
| Timing Belt Tensioner Bolt                       | 31-40 (43-55)            |
| Torque Converter-To-Drive Plate Bolt             | 33-38 (45-52)            |

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|                                 | <b>INCH Lbs. (N.m)</b> |
|---------------------------------|------------------------|
| Air Cleaner Body Mounting Bolts | 71-89 (8-10)           |
| Alternator Lock Bolt            | 106-133 (12-15)        |
| Chain Guide                     | 71-89 (8-10)           |
| Coolant Pump Pulley Bolts       | 71-89 (8-10)           |
| Cylinder Head Cover Bolts       | 71-89 (8-10)           |
| Engine Cover                    | 27-35 (4-6)            |
| Oil Pan Bolt                    | 89-106 (10-12)         |
| Oil Pressure Switch             | 115-133 (13-15)        |
| Oil Pump Cover                  | 53-80 (6-9)            |
| Rear Oil Seal Case Bolt         | 89-106 (10-12)         |
| Rear Plate Bolts                | 71-89 (8-10)           |
| Resonator Mounting Bolts        | 27-35 (4-6)            |
| Rocker Cover Bolt               | 71-89 (8-10)           |
| Timing Belt Cover Bolt          | 71-89 (8-10)           |
| Water Pump Pulley Bolt          | 71-89 (8-10)           |

(1) Tighten cylinder head bolts in sequence with engine cold. See **Fig. 7**.



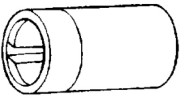
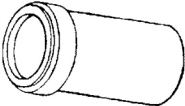
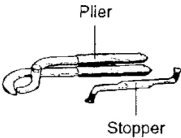
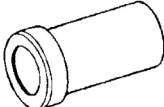
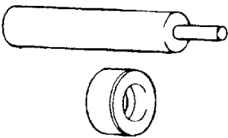
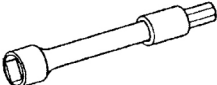
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**Fig. 7: Cylinder Head Bolt Removal & Installation Sequence**  
Courtesy of HYUNDAI MOTOR CO.

#### SPECIAL TOOLS

## 2002 Hyundai Elantra GLS

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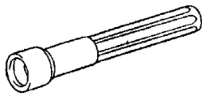
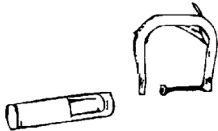
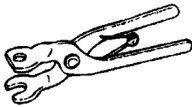
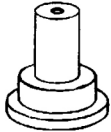
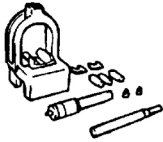
| Tool (Number and name)                               | Illustration                                                                                               | Use                                              |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Crankshaft front oil seal installer<br>(09214-32000) |                           | Installation of the front oil seal               |
| Crankshaft front oil seal guide<br>(09214-32100)     |                           | Installation of the front oil seal               |
| Valve clearance adjust tool set<br>(09220-2D000)     |  <p>Plier<br/>Stopper</p> | Removal and installation of the tappet shim      |
| Camshaft oil seal installer<br>(09221-21000)         |                         | Installation of the camshaft oil seal            |
| Valve guide installer<br>(09221-22000 A/B)           |                         | Removal and installation of the valve guide      |
| Cylinder head bolt wrench<br>(09221-32001)           |                         | Removal and tightening of the cylinder head bolt |

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**Fig. 8: Identifying Special Tools (1 Of 2)**  
Courtesy of HYUNDAI MOTOR CO.

## 2002 Hyundai Elantra GLS

2002 ENGINE 2.0L 4 Cylinder DOHC - Elantra

| Tool (Number and name)                                          | Illustration                                                                        | Use                                                                                                                                                    |
|-----------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Valve stem oil seal installer<br>(09222-22001)                  |    | Installation of the valve stem oil seal                                                                                                                |
| Valve spring compressor & adaptor<br>(09222-28000, 09222-28100) |    | Removal and installation of the intake or exhaust valve                                                                                                |
| Valve stem seal remover<br>(09222-29000)                        |    | Removal of the valve stem seal                                                                                                                         |
| Crankshaft rear oil seal installer<br>(09231-21000)             |  | <ol style="list-style-type: none"> <li>1. Installation of the engine rear oil seal</li> <li>2. Installation of the crankshaft rear oil seal</li> </ol> |
| Piston pin remover and installer kit<br>(09234-33001)           |  | Removal and installation of the piston pin<br>(Use with 09234-33003)                                                                                   |
| Piston pin setting tool insert<br>(09234-33002)                 |  | Removal and installation of the piston pin<br>(Use with 09234-33001)                                                                                   |

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**Fig. 9: Identifying Special Tools (2 Of 2)**  
Courtesy of HYUNDAI MOTOR CO.

### TROUBLESHOOTING

## 2002 Hyundai Elantra GLS

2002 ENGINE 2.0L 4 Cylinder DOHC - Elantra

| Symptom                               | Probable cause                                | Remedy                                             |
|---------------------------------------|-----------------------------------------------|----------------------------------------------------|
| Low compression                       | Blown cylinder head gasket                    | Replace gasket                                     |
|                                       | Worn or damaged piston rings                  | Replace rings                                      |
|                                       | Worn piston or cylinder                       | Repair or replace the piston and/or cylinder block |
|                                       | Worn or damaged valve seat                    | Repair or replace the valve and/or seat ring       |
| Low oil pressure                      | Low engine oil level                          | Check engine oil level                             |
|                                       | Faulty oil pressure switch                    | Replace                                            |
|                                       | Clogged oil filter                            | Replace                                            |
|                                       | Worn oil pump gears or cover                  | Replace                                            |
|                                       | Thin or diluted engine oil                    | Change and find out cause                          |
|                                       | Oil relief valve stuck (open)                 | Repair                                             |
|                                       | Excessive bearing clearance                   | Replace                                            |
| High oil pressure                     | Oil relief valve stuck (closed)               | Repair                                             |
| Excessive engine vibration            | Loose engine roll stopper (front, rear)       | Retighten                                          |
|                                       | Loose transaxle mount bracket                 | Retighten                                          |
|                                       | Loose engine mount bracket                    | Retighten                                          |
|                                       | Loose center member                           | Retighten                                          |
|                                       | Broken transaxle mount insulator              | Replace                                            |
|                                       | Broken engine mount insulator                 | Replace                                            |
|                                       | Broken engine roll stopper insulator          | Replace                                            |
| Noisy valves                          | Thin or diluted engine oil (Low oil pressure) | Change                                             |
|                                       | Worn or damaged valve stem or valve guide     | Replace                                            |
|                                       | Incorrect valve clearance                     | Adjust valve clearance                             |
| Connecting rod and main bearing noise | Insufficient oil supply                       | Check engine oil level                             |
|                                       | Thin or diluted engine oil                    | Change and find out cause                          |
|                                       | Excessive bearing clearance                   | Replace                                            |
| Timing belt noise                     | Incorrect belt tension                        | Adjust belt tension                                |
| Low coolant level                     | Leakage of coolant                            |                                                    |
|                                       | 1. Heater or radiator hose                    | Repair or replace parts                            |
|                                       | 2. Faulty radiator cap                        | Tighten or replace clamps                          |
|                                       | 3. Thermostat housing                         | Replace the gasket or housing                      |
|                                       | 4. Radiator                                   | Repair or replace                                  |
|                                       | 5. Engine coolant pump                        | Replace parts                                      |
| Clogged radiator                      | Foreign material in coolant                   | Replace coolant                                    |

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**Fig. 10: Troubleshooting Symptom Chart (1 Of 2)**  
 Courtesy of HYUNDAI MOTOR CO.

## 2002 Hyundai Elantra GLS

2002 ENGINE 2.0L 4 Cylinder DOHC - Elantra

| Symptom                             | Probable cause                                                                 | Remedy                             |
|-------------------------------------|--------------------------------------------------------------------------------|------------------------------------|
| Abnormally high coolant temperature | Faulty thermostat                                                              | Replace parts                      |
|                                     | Faulty radiator cap                                                            | Replace parts                      |
|                                     | Restricted flow in cooling system                                              | Clear restriction or replace parts |
|                                     | Loose or missing drive belt                                                    | Adjust or replace                  |
|                                     | Faulty water pump                                                              | Replace                            |
|                                     | Faulty temperature sensor or wiring                                            | Repair or replace                  |
|                                     | Faulty electric fan                                                            | Repair or replace                  |
|                                     | Insufficient coolant                                                           | Refill coolant                     |
| Abnormally low coolant temperature  | Faulty thermostat                                                              | Replace                            |
|                                     | Faulty temperature sensor or wiring                                            | Repair or replace                  |
| Inoperative electrical cooling fan  | Faulty temperature sensor, Electrical motor, Radiator fan relay, Wiring, Fuse. | Replace or repair                  |
| Exhaust gas leakage                 | Loose connections                                                              | Retighten                          |
|                                     | Broken pipe or muffler                                                         | Repair or replace                  |
| Abnormal noise                      | Detached baffle plate in muffler                                               | Replace                            |
|                                     | Broken rubber hanger                                                           | Replace                            |
|                                     | Pipe or muffler contacting vehicle body                                        | Correct                            |
|                                     | Broken pipe or muffler                                                         | Repair or replace                  |

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**Fig. 11: Troubleshooting Symptom Chart (2 Of 2)**  
Courtesy of HYUNDAI MOTOR CO.

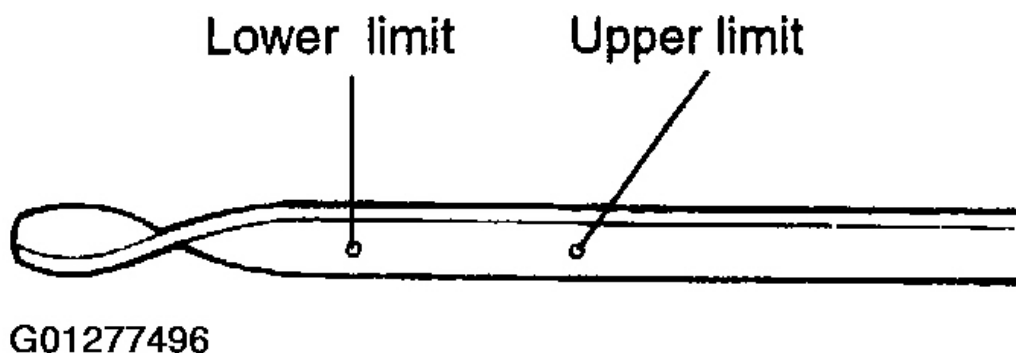
### MAINTENANCE

#### CHECKING ENGINE OIL

1. Position the vehicle on a level surface.
2. Warm up the engine.

**NOTE:** If the vehicle has been out of service for a prolonged period of time, warm up the engine for approximately 20 minutes.

3. Turn off the engine, and wait 2 or 3 minutes, then check the oil level.
4. Check that the engine oil level is within the level range indicated on the oil dipstick. If the oil level is found to have fallen to the lower limit (the "L" mark), refill to the "F" mark.



**Fig. 12: Identifying Engine Oil Level Range On Dipstick**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE:** When refilling, use the same type of engine oil.

5. Check that the oil is not dirty or contaminated with coolant or gasoline, and that it has the proper viscosity.

## CHANGING ENGINE OIL

**CAUTION:** Be careful not to burn yourself, as the engine oil is hot.

1. Run the engine until it reaches normal operating temperature.
2. Turn off the engine.
3. Remove the oil filler cap and the drain plug (on the oil pan). Drain the engine oil.
4. Install and tighten the drain plug to the specified torque.

### Tightening torque

Drain plug: 35-45 Nm (350-450 kg.cm, 25-33 lb.ft)

5. Fill the crankcase with fresh engine oil through the oil filler cap opening.

### Capacity

Drain and refill

Without oil filter: 3.7 liter (3.91 U.S.qts., 3.25 Imp.qts.)

With oil filter: 4.0 liter (4.23 U.S.qts., 3.51 Imp.qts.)

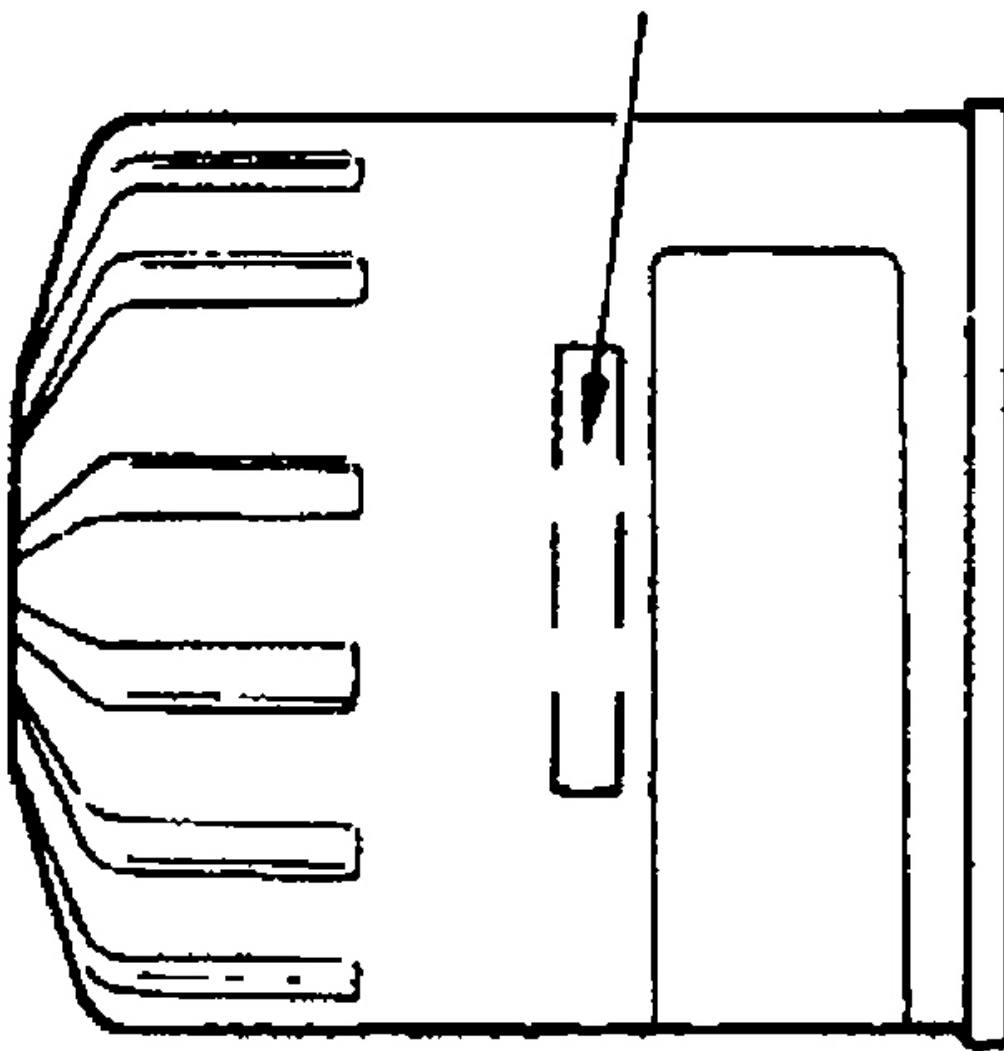
**CAUTION: Do not overfill the crankcase. This will cause oil aeration and loss of oil pressure.**

6. Install the oil filler cap.
7. Start and run the engine.
8. Turn off the engine and then check the oil level. Add oil if necessary.

### **FILTER SELECTION**

All Hyundai engines are equipped with a high quality, disposable oil filter. This filter is recommended as a replacement filter on all vehicles. The quality of replacement filters varies considerably. Only high quality filters should be used to assure the most efficient service. Make sure that the rubber gasket from the old oil filter is completely removed from the contact surface on the engine block before installing the new filter.

## Part number



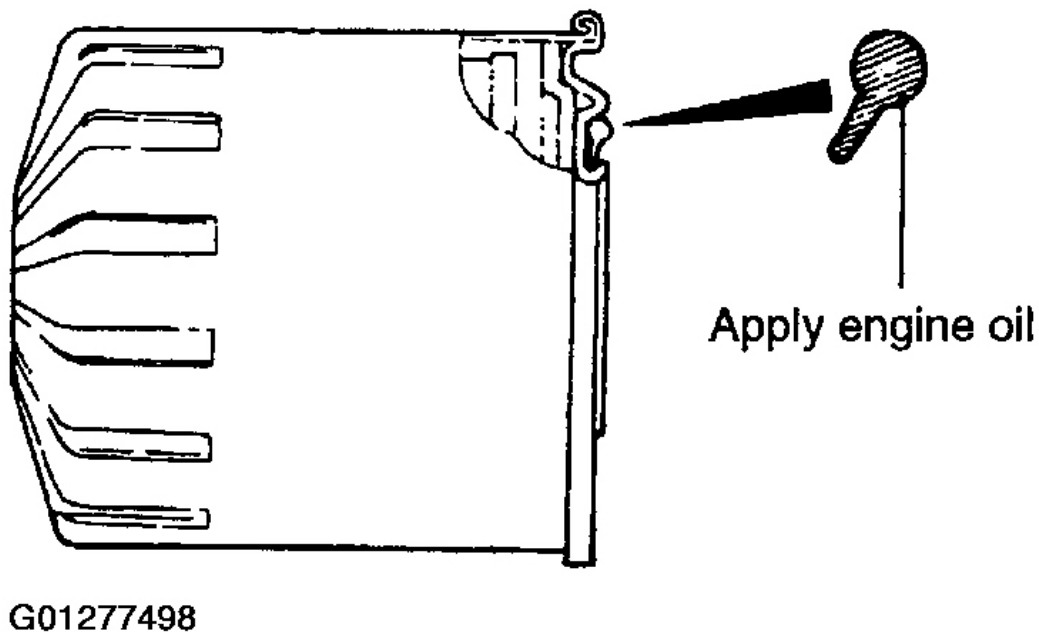
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**Fig. 13: Identifying Oil Filter Part Number**  
Courtesy of HYUNDAI MOTOR CO.

### PROCEDURE FOR REPLACING THE OIL FILTER

**CAUTION:** Be careful not to burn yourself, as the engine and engine oil are hot.

1. Use a filter wrench to remove the oil filter.
2. Before installing the new oil filter on the engine, apply clean engine oil to the surface of the rubber gasket.



**Fig. 14: Identifying Oil Application On New Oil Filter Gasket**  
Courtesy of HYUNDAI MOTOR CO.

3. Tighten the oil filter to the specified torque.

#### **Tightening torque**

Oil filter: 12-16 Nm (120-160 kg.cm, 9-12 lb.ft)

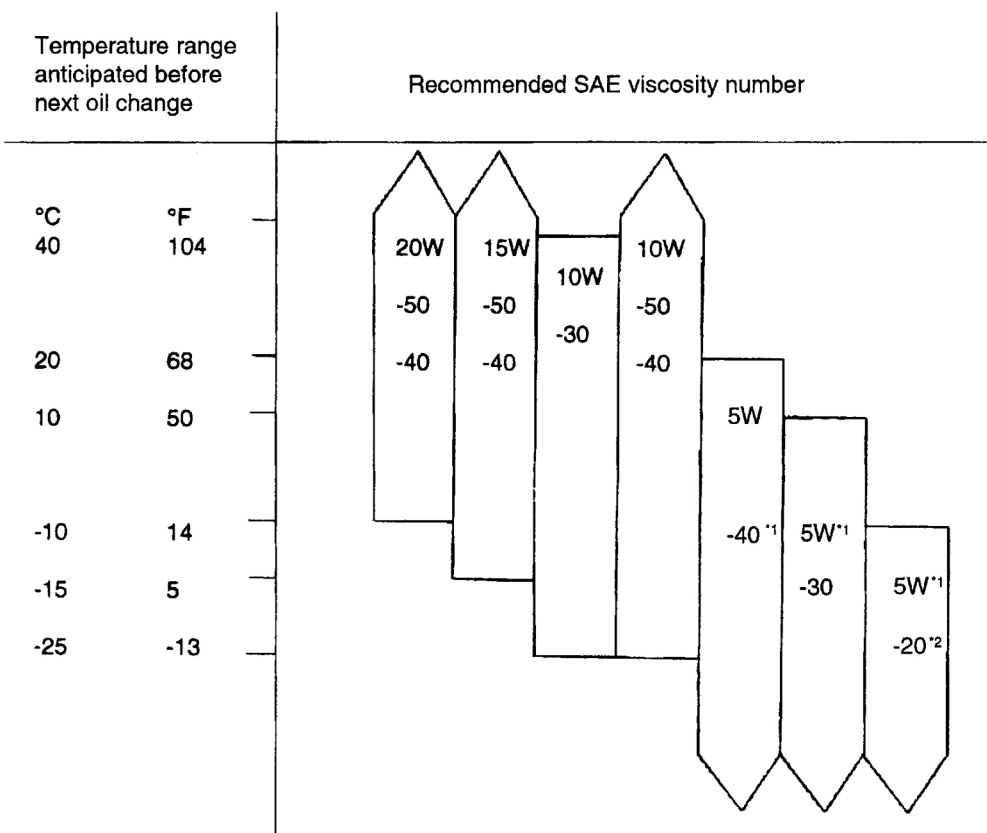
4. Run the engine to check for engine oil leaks.
5. After turning off the engine, check the oil level and add oil as necessary.

#### **SELECTION OF ENGINE OIL**

**Recommended API classification: SG OR ABOVE [For EC.]**

## 2002 Hyundai Elantra GLS

2002 ENGINE 2.0L 4 Cylinder DOHC - Elantra



\*1 Restricted by driving condition and environment.

\*2 Not recommended for sustained high speed vehicle operation

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**Fig. 15: Recommended SAE Viscosity Grades Chart**

Courtesy of HYUNDAI MOTOR CO.

**NOTE:** For best performance and maximum protection of all types of operation, select only those lubricants which:

1. Satisfy the requirements of the API classification.
2. Have proper SAE grade number for expected ambient temperature range.

Lubricants that do not have both an SAE grade number and an API service classification on the container should not be used.

### CHECKING COOLANT LEAK

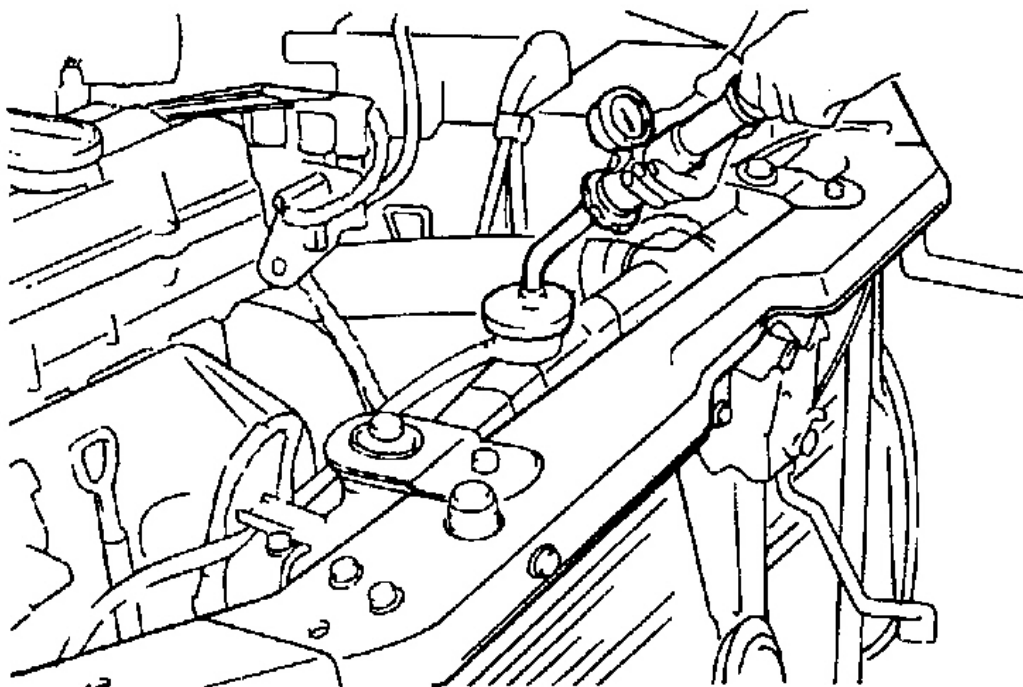
1. Loosen the radiator cap.
2. Confirm that the coolant level is up to the filler neck.
3. Install a radiator cap tester to the radiator filler neck and apply 140 kPa (1.4 kg/cm<sup>2</sup>, 20 psi ) pressure.

Hold it for two minutes in that condition, while checking for leakage from the radiator, hoses or connections.

**NOTE:**

1. Radiator coolant may be extremely hot. Do not open the system because hot, or scalding water could gush out causing personal injury. Allow the vehicle to cool before servicing this system.
2. Be sure to clean away any moisture from the places checked completely.
3. When the tester is removed, be careful not to spill any coolant from it.
4. Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.

4. If there is leakage, repair or replace with the appropriate part.



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**Fig. 16: Pressure Testing Cooling System**  
Courtesy of HYUNDAI MOTOR CO.

**RADIATOR CAP PRESSURE TEST**

1. Use an adapter to attach the cap to the tester.
2. Increase the pressure until the gauge stops moving.

Main valve opening pressure:

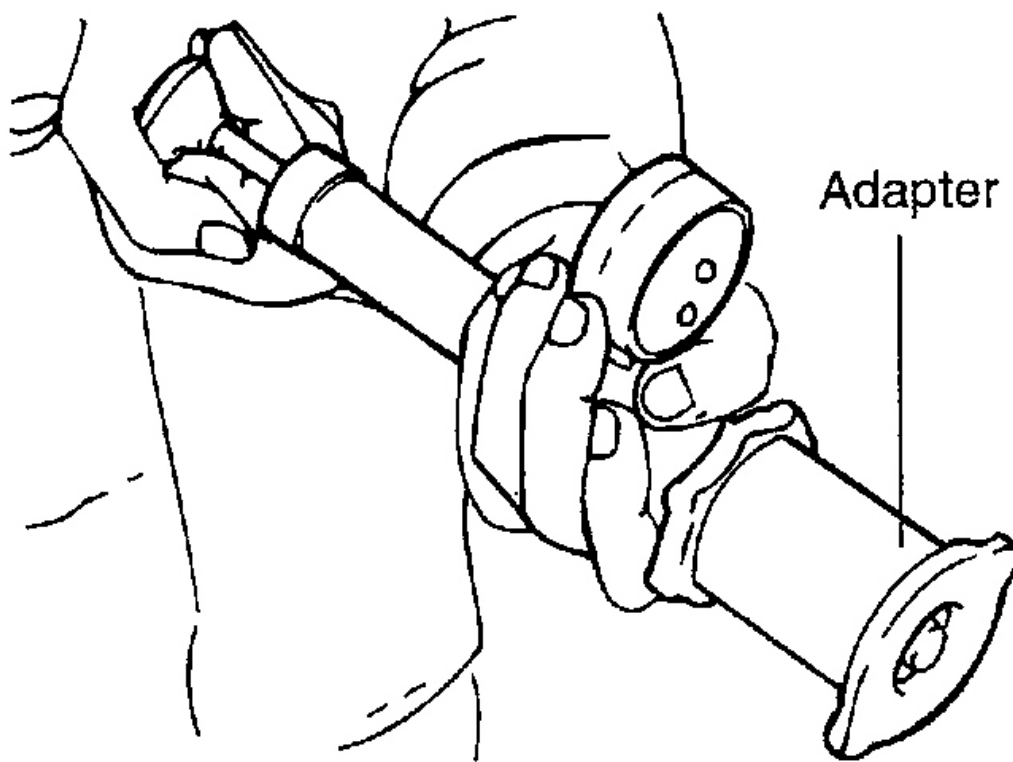
83-110 kPa (0.83-1.1 kg/cm<sup>2</sup> , 12-16 psi)

Vacuum valve opening pressure:

-7 kPa (-0.07 kg/cm<sup>2</sup> , -1.0 psi)

3. Check that the pressure level is maintained at or above the limit.
4. Replace the radiator cap if the reading does not remain at or above the limit.

**NOTE:** Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an incorrect reading.

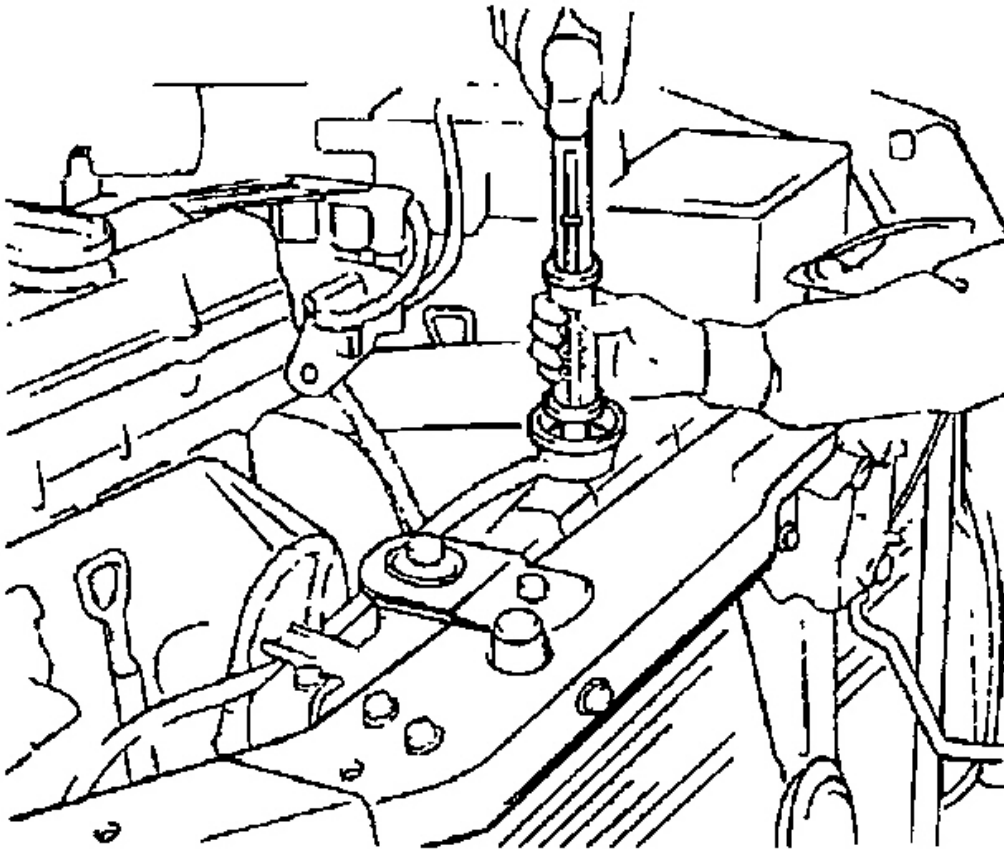


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**Fig. 17: Pressure Testing Radiator Cap**  
Courtesy of HYUNDAI MOTOR CO.

**SPECIFIC GRAVITY TEST**

1. Measure the specific gravity of the coolant with a hydrometer.
2. Measure the coolant temperature and calculate the concentration from the relation between the specific gravity and temperature, using the following table for reference.

**G01277502**

**Fig. 18: Measuring Coolant Specific Gravity**  
**Courtesy of HYUNDAI MOTOR CO.**

**RELATION BETWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY**

## 2002 Hyundai Elantra GLS

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| Coolant temperature °C (°F) and specific gravity |         |         |          |          | Freezing temperature °C (°F) | Safe operating temperature °C (°F) | Coolant concentration (Specific volume) |
|--------------------------------------------------|---------|---------|----------|----------|------------------------------|------------------------------------|-----------------------------------------|
| 10 (50)                                          | 20 (68) | 30 (86) | 40 (104) | 50 (122) |                              |                                    |                                         |
| 1.054                                            | 1.050   | 1.046   | 1.042    | 1.036    | -16 (3.2)                    | -11 (12.2)                         | 30%                                     |
| 1.063                                            | 1.058   | 1.054   | 1.049    | 1.044    | -20 (-4)                     | -15 (5)                            | 35%                                     |
| 1.071                                            | 1.067   | 1.062   | 1.057    | 1.052    | -25 (-13)                    | -20 (-4)                           | 40%                                     |
| 1.079                                            | 1.074   | 1.069   | 1.064    | 1.058    | -30 (-22)                    | -25 (-13)                          | 45%                                     |
| 1.087                                            | 1.082   | 1.076   | 1.070    | 1.064    | -36 (-32.8)                  | -31 (-23.8)                        | 50%                                     |
| 1.095                                            | 1.090   | 1.084   | 1.077    | 1.070    | -42 (-44)                    | -37 (-35)                          | 55%                                     |
| 1.103                                            | 1.098   | 1.092   | 1.084    | 1.076    | -50 (-58)                    | -45 (-49)                          | 60%                                     |

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**Fig. 19: Coolant Concentration Vs. Specific Gravity**  
Courtesy of HYUNDAI MOTOR CO.

### Example

The safe operating temperature is -15°C (5°F) when the measured specific gravity is 1.058 at coolant temperature of 20°C (68°F)

### CAUTION:

- If the concentration of the coolant is below 30%, its anti-corrosion properties will be adversely affected.
- If the concentration is above 60%, both the anti-freeze and engine cooling property will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.
- Do not use together with another brand's product.

### RECOMMENDED COOLANT

Antifreeze Mixture ratio of anti freeze in coolant

ETHYLENE GLYCOL BASE FOR ALUMINUM 50% [Except tropical areas] 40% [Tropical areas]

### CHECKING COMPRESSION PRESSURE

1. Before checking engine compression, check the engine oil level. Also check that the starter motor and battery are all in normal operating condition.
2. Start the engine and wait until engine coolant temperature reaches 80-95°C (176-205°F).
3. Turn off engine and disconnect the spark plug cables.
4. Remove the spark plugs.
5. Crank the engine to remove any foreign material in the cylinders.
6. Insert the compression gauge into the spark plug hole.
7. Depress the accelerator pedal to open the throttle fully.

8. Crank the engine and read the gauge.

Standard value: 1500 kPa (15 kg/cm<sup>2</sup> , 218 psi)

Limit: 1400 kPa (14 kg/cm<sup>2</sup> , 203 psi)

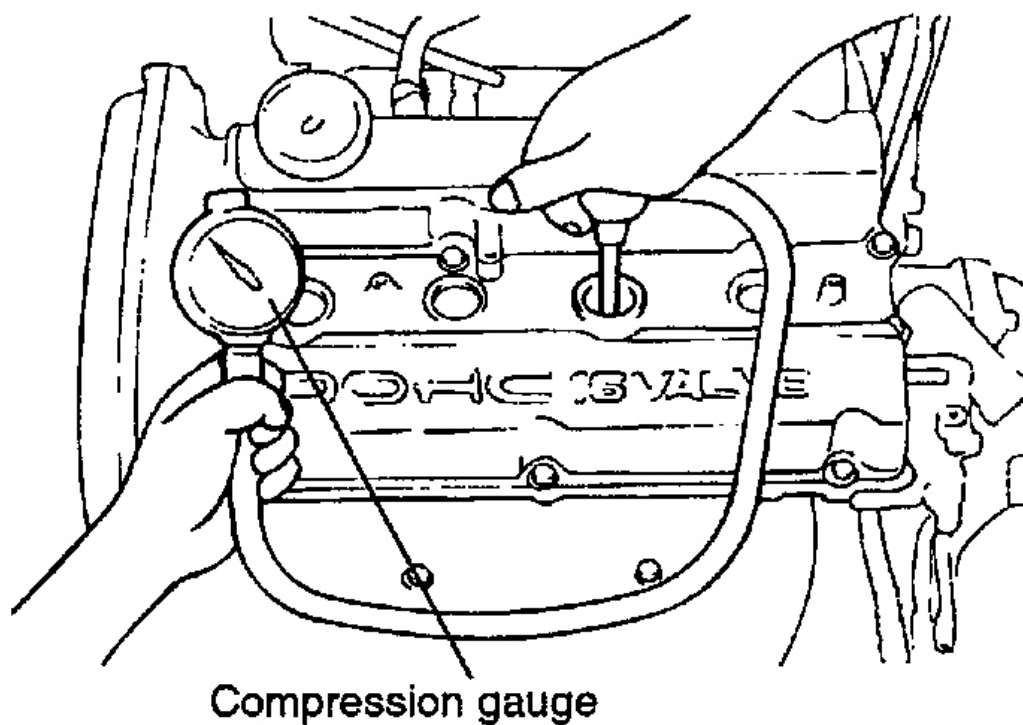
9. Repeat steps 6 to 8 over all cylinders, ensuring that the pressure differential for each of the cylinders is within the specified limit.

Limit: Max. 100 kPa (1.0 kg/cm<sup>2</sup> , 14 psi) between cylinders

10. If a cylinder's compression or pressure differential is outside the specification, add a small amount of oil through the spark plug hole, and repeat steps 6 to 9.
  1. If the addition of oil makes the compression to rise, it is likely that there may be wear between the piston ring and cylinder wall
  2. If compression remains the same, valve seizure, poor valve seating or a compression leak from the cylinder head gasket are all possible causes.

### **Tightening torque**

Spark plug: 20-30 Nm (200-300 kg.cm, 14-22 lb.ft)



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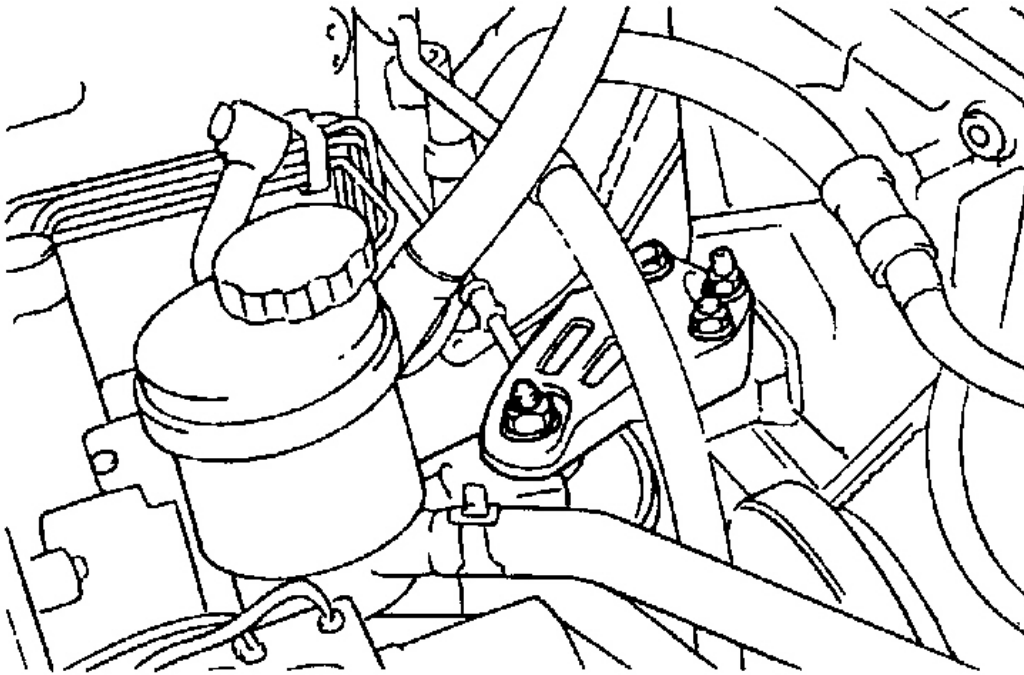
**Fig. 20: Checking Cylinder Compression**  
Courtesy of HYUNDAI MOTOR CO.

#### ADJUSTING TIMING BELT TENSION

1. Lift the vehicle by using of jack.
2. Rotate the steering wheel counter-clockwise thoroughly.

**NOTE:** Do watch not to over load.

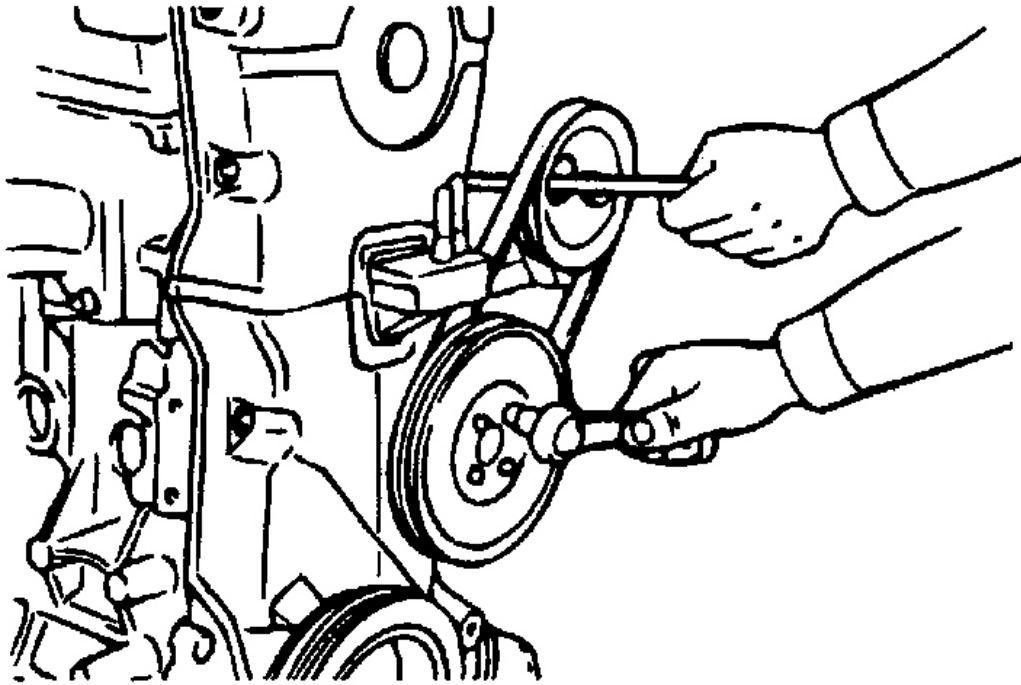
3. Remove the engine support bracket.



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**Fig. 21: Identifying Engine Support Bracket Nuts**  
Courtesy of HYUNDAI MOTOR CO.

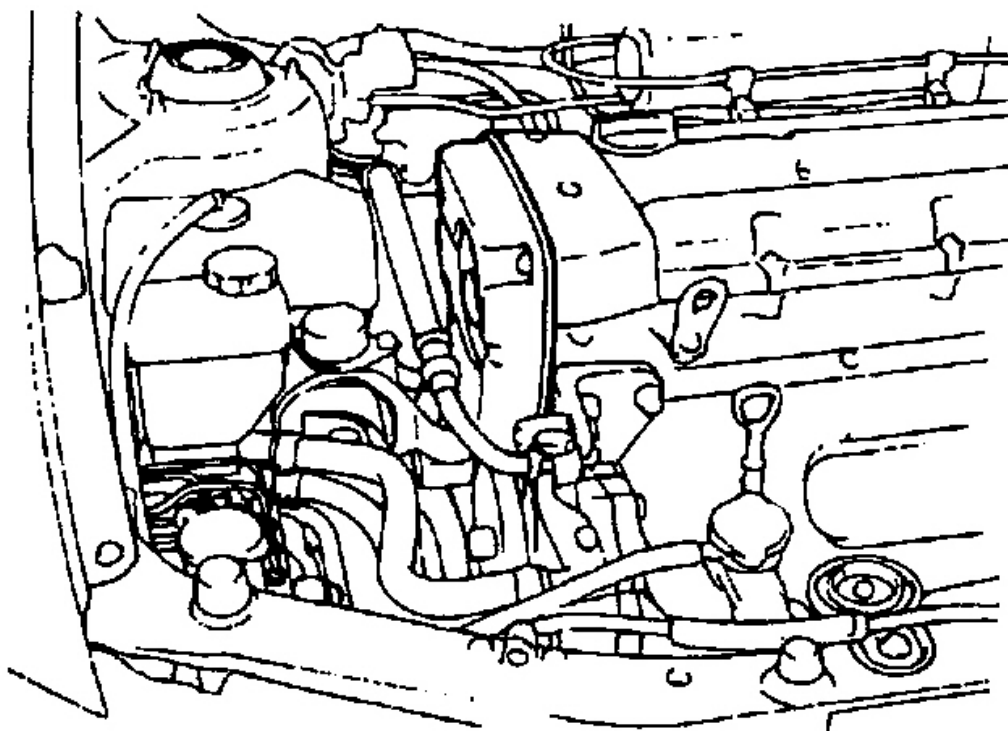
4. Remove the water pump pulley.



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**Fig. 22: Removing Water Pump Pulley**  
Courtesy of HYUNDAI MOTOR CO.

5. Remove the timing belt upper cover.

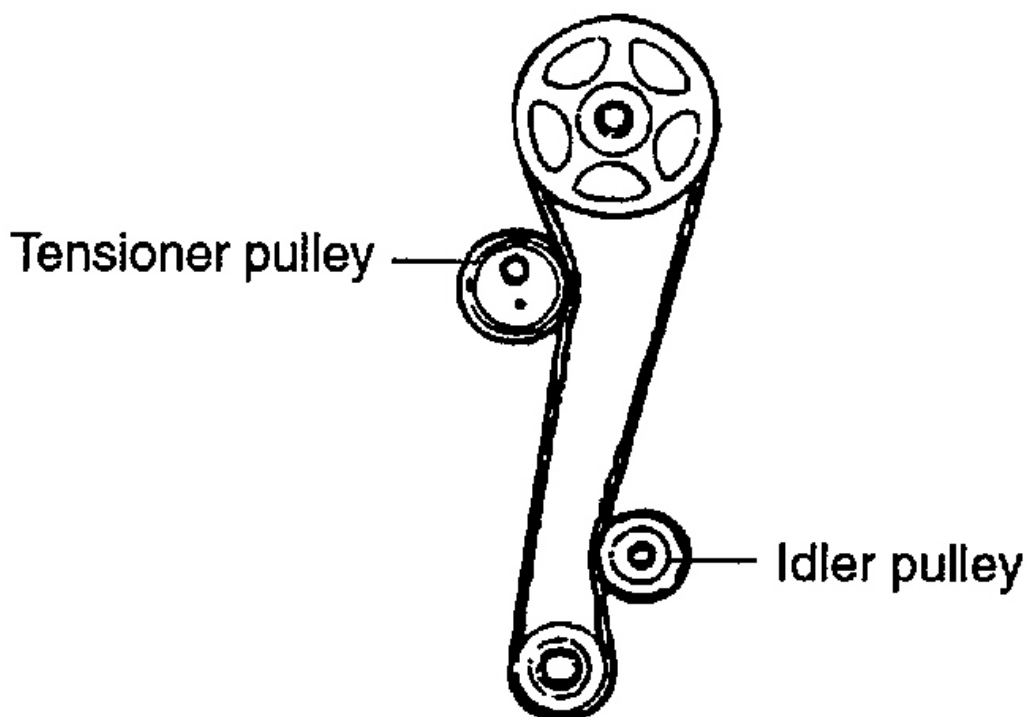


G01277507

**Fig. 23: Identifying Timing Belt Upper Cover**  
Courtesy of HYUNDAI MOTOR CO.

6. Remove the spark plug.
7. Place the piston of No. 1 cylinder to TDC of the compression stroke by rotating the crankshaft clockwise.

**NOTE:** Crankshaft is to be rotated clockwise. Otherwise, the tension is inadequately adjusted.



G01277508

**Fig. 24: Identifying Tensioner Pulley & Idler Pulley**  
Courtesy of HYUNDAI MOTOR CO.

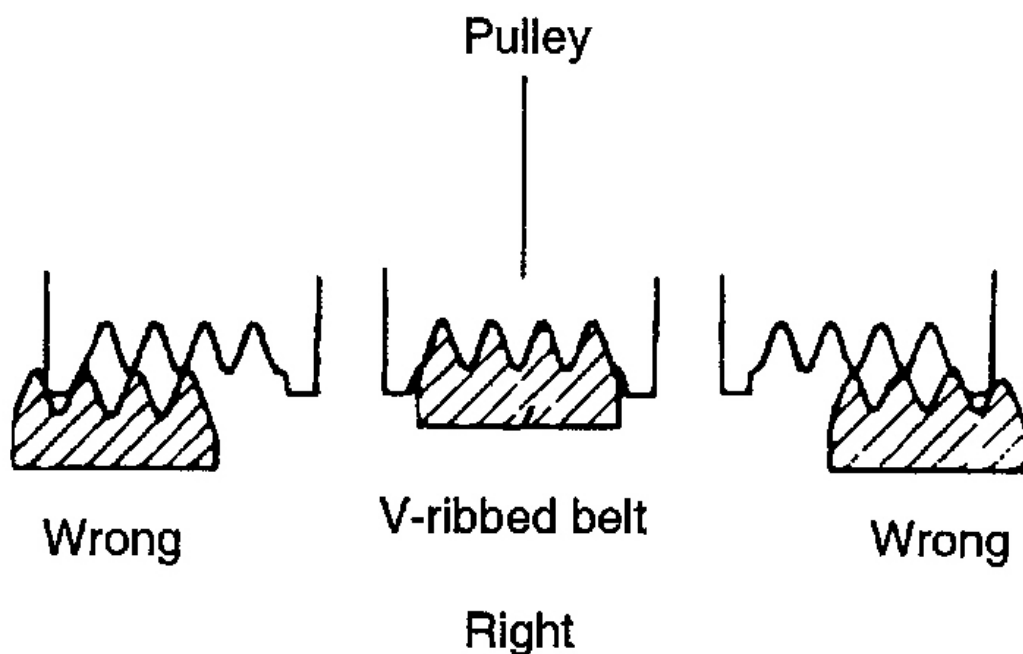
8. Loose the tensioner bolt of pivot side and slot side.
9. Rotate the crankshaft clockwise as many as 2 teeth of sprocket.

**NOTE:** Set the exhaust valve rocker arm to upper position of cam in order to be the specified tension.

10. Check that the teeth of sprocket and belt coincide with each other.
11. Tighten the bolt of slot side at first and then tighten the bolt of pivot side.
12. Install the timing belt tension.
13. Install the spark plug.
14. Install the timing belt upper cover.
15. Install the water pump pulley and engine support bracket.

#### ADJUSTING DRIVE BELT TENSION

1. Check that the belts are not damaged and are properly fit for the pulley grooves.
2. Apply 100 N (22 lbs.) force to the back and midway portion of the belt between the pulleys as shown in the illustration, measure the amount of deflection with a tension gauge.



G01277510

**Fig. 25: Identifying Popper Belt-To-Pulley Installation**  
Courtesy of HYUNDAI MOTOR CO.

- CAUTION:**
1. When installing the V-ribbed belt, check that the V-ribs are properly aligned.
  2. If noise or slippage is detected, check the belt for wear, damage, or breakage on the pulley contact surface, and check the pulley for scoring. Also check the degree that the belt is deflected.

**STANDARD VALUE:**

## 2002 Hyundai Elantra GLS

2002 ENGINE 2.0L 4 Cylinder DOHC - Elantra

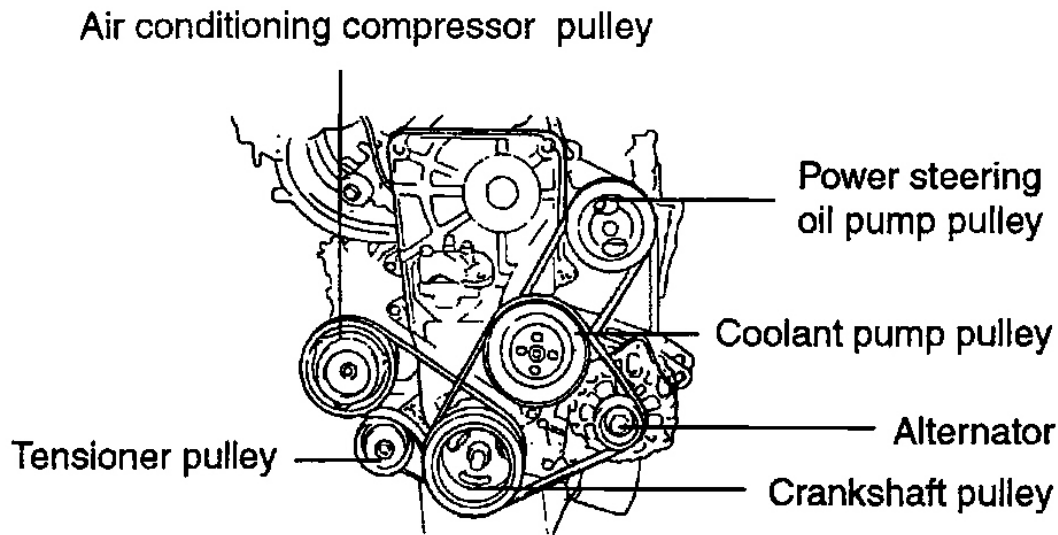
| Items               |                     | Inspection               | Adjustment               |                          |
|---------------------|---------------------|--------------------------|--------------------------|--------------------------|
|                     |                     |                          | New                      | Used                     |
| For alternator      | Deflection mm (in.) | 5.1-6.0<br>(0.200-0.236) | 4.0-4.4<br>(0.157-0.173) | 5.1-5.7<br>(0.200-0.224) |
|                     | Tension N (lb)      | 350-500<br>(79-112)      | 650-750<br>(143-165)     | 400-500<br>(88-110)      |
| For air conditioner | Deflection mm (in.) | 8<br>(0.31)              | 5.0-5.5<br>(0.20-0.22)   | 6.0-7.0<br>(0.24-0.28)   |
|                     | Tension N (lb)      | 250-500<br>(56-112)      | 470-570<br>(106-128)     | 320-400<br>(72-90)       |
| For power steering  | Deflection mm (in.) | 6.0-9.0<br>(0.24-0.35)   | -                        | -                        |

G01277511

**Fig. 26: Drive Belt Standard Value Table**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE:**

1. The belt tension must be measured half-way between the specified pulleys.
2. When a new belt is installed, adjust the tension to the central value of the standard range indicated under "New" in Fig. 26. Let the engine idle for 5 minutes or more, and check the standard value indicated under "Inspection."
3. When adjusting a belt which has been used or a belt installed newly after 5 minutes or more of operation, refer to Fig. 26 under "Used" in the above table.
4. Refer to Fig. 26 under "Inspection" for periodic inspections.

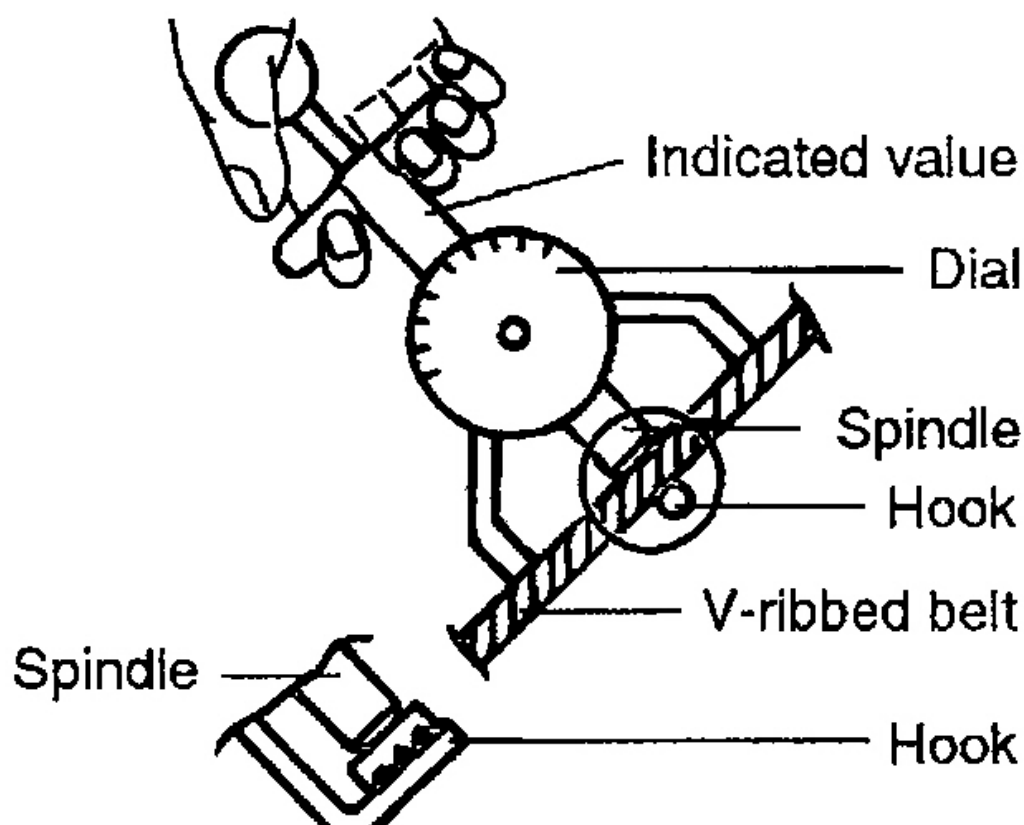


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**Fig. 27: Identifying Drive Belt Pulleys**  
Courtesy of HYUNDAI MOTOR CO.

**TYPE A TENSION GAUGE**

Do not let the dial section of the tension gauge contact other objects during measurement.

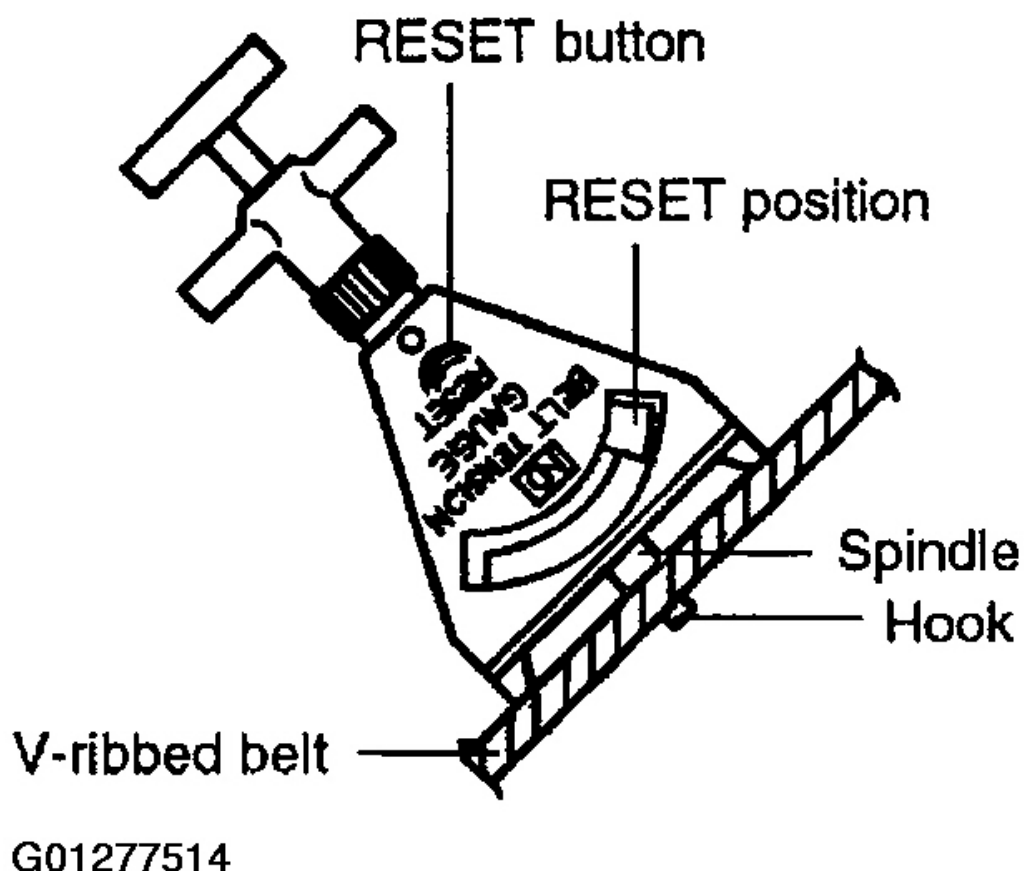


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**Fig. 28: Identifying Type A Tension Gauge**  
Courtesy of HYUNDAI MOTOR CO.

#### TYPE B TENSION GAUGE

1. When measuring, turn the reset button in the direction of the arrow and set the gauge needle to the RESET position.
2. If the tension gauge is removed from the belt, the needle will still indicate the tension. Read the tension value after removing the gauge.



**Fig. 29: Identifying Type B Tension Gauge**  
Courtesy of HYUNDAI MOTOR CO.

#### ADJUSTING THE ALTERNATOR BELT

**CAUTION:** If the belt is too loose, it will cause noise or sudden wear.  
If the belt is too tight, the engine coolant pump bearing or the alternator can get damaged.

1. Loosen the alternator nut "A" and the tension adjuster lock bolt "B".
2. Using the tension adjuster bolt, adjust the belt tension to the specification.
3. Tighten the adjuster lock bolt "B".
4. Tighten the alternator nut "A".
5. Check the tension or the deflection of belt, and readjust if necessary.

**Tightening torque**

Alternator support bolt and nut:

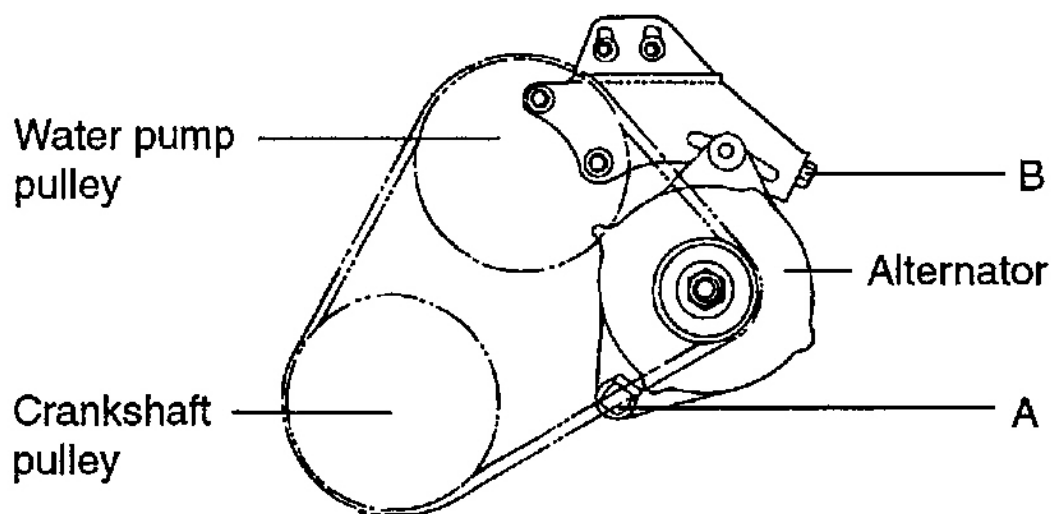
20-25 Nm (200-250 kg.cm, 14-18 lb.ft)

Alternator lock bolt B:

12-15 Nm (120-150 kg.cm, 9-11 lb.ft)

Alternator brace mounting bolt:

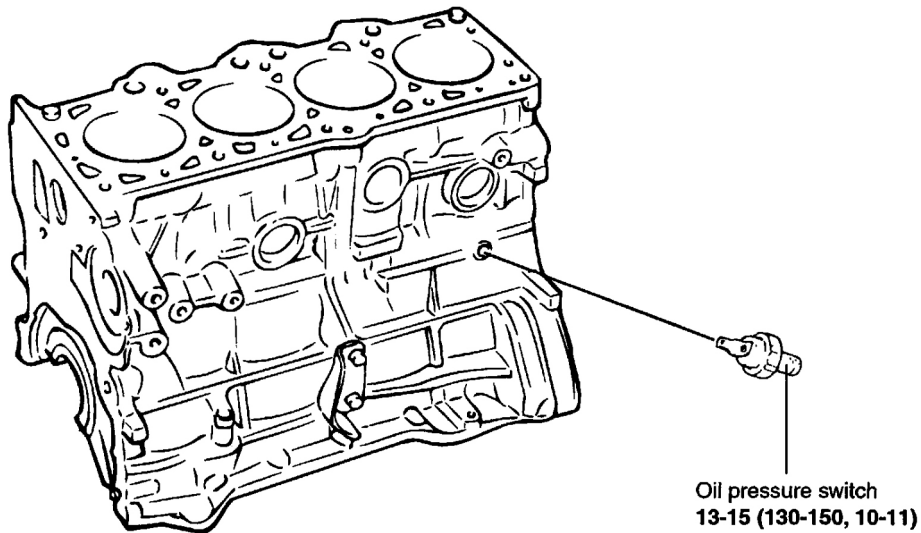
20-27 Nm (200-270 kg.cm, 15-20 lb.ft)



G01277515

**Fig. 30: Identifying Alternator Belt Tensioner**  
Courtesy of HYUNDAI MOTOR CO.

**ENGINE BLOCK****ENGINE BLOCK****COMPONENTS**



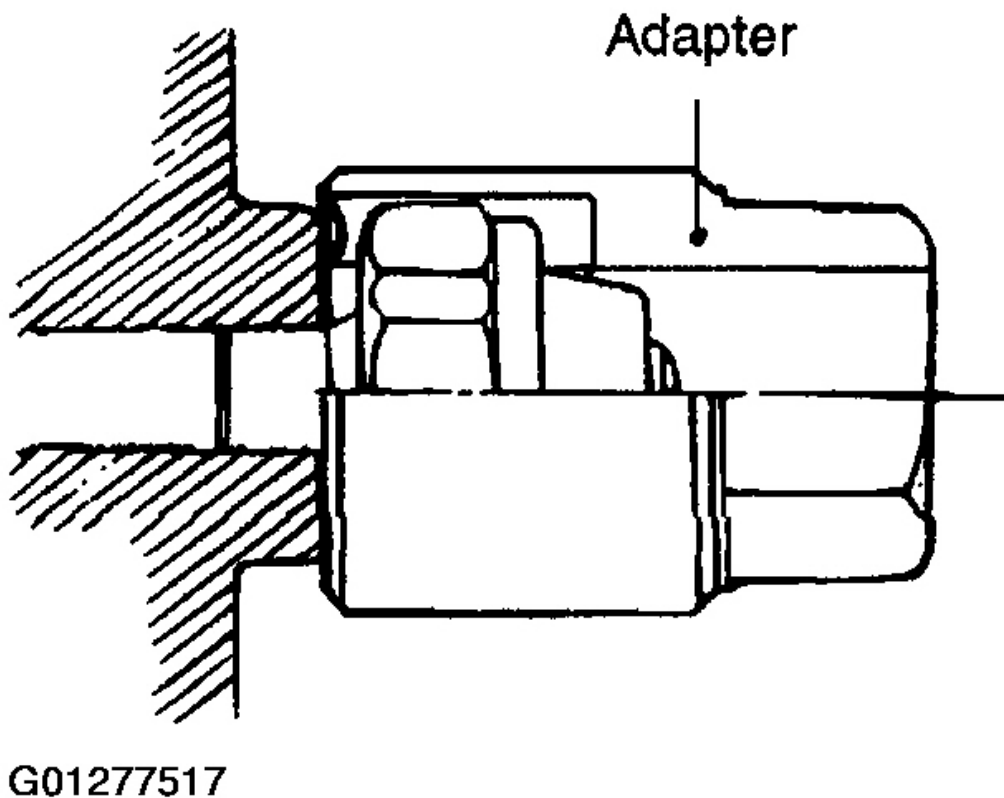
**TORQUE : Nm (kg.cm, lb.ft)**

G01277516

**Fig. 31: Engine Block Components**  
Courtesy of HYUNDAI MOTOR CO.

**DISASSEMBLY**

1. Remove the cylinder head, timing belt, front case, flywheel, pistons and crankshaft.
2. Remove the oil pressure switch.



**Fig. 32: Removing Oil Pressure Switch**  
Courtesy of HYUNDAI MOTOR CO.

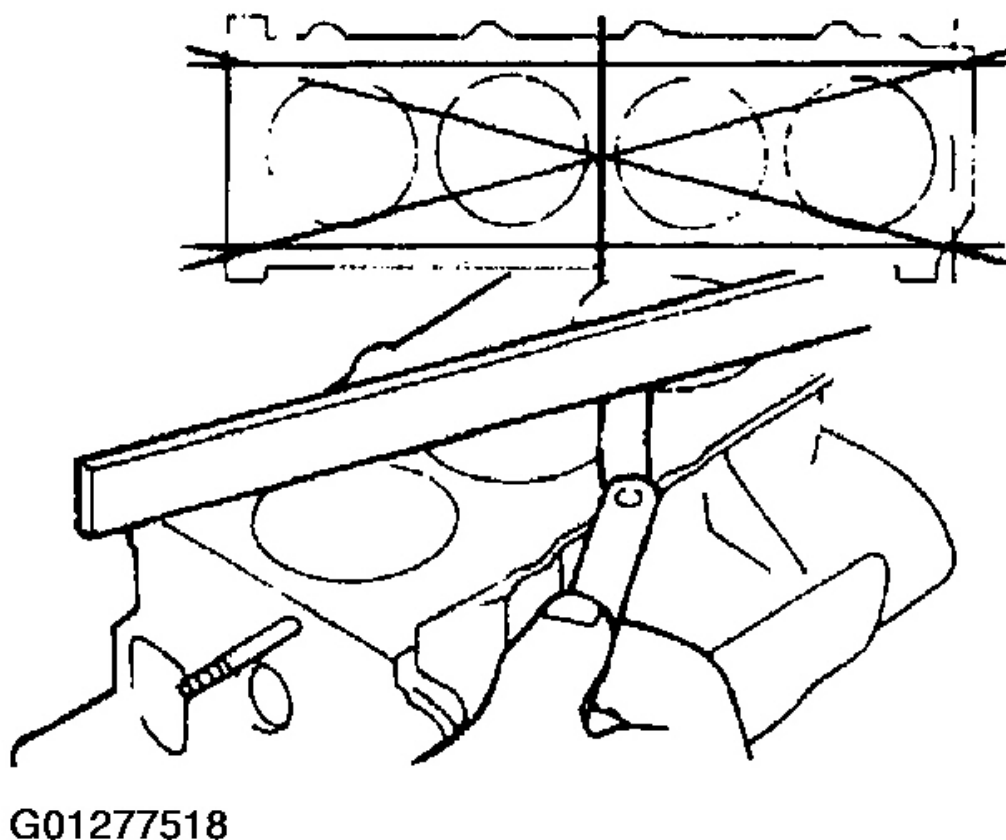
## INSPECTION

### CYLINDER BLOCK

1. Check the engine block for scores, rust and corrosion. Also check for cracks or any other defects. Replace the block if defective.
2. Using a straight edge and feeler gauge, check the top surface of the block for warpage. Make sure that the surface is free from gasket chips or other foreign material.

Standard: 0.03 mm (0.0012 in.) or less

Limit: 0.1 mm (0.0039 in.) or less

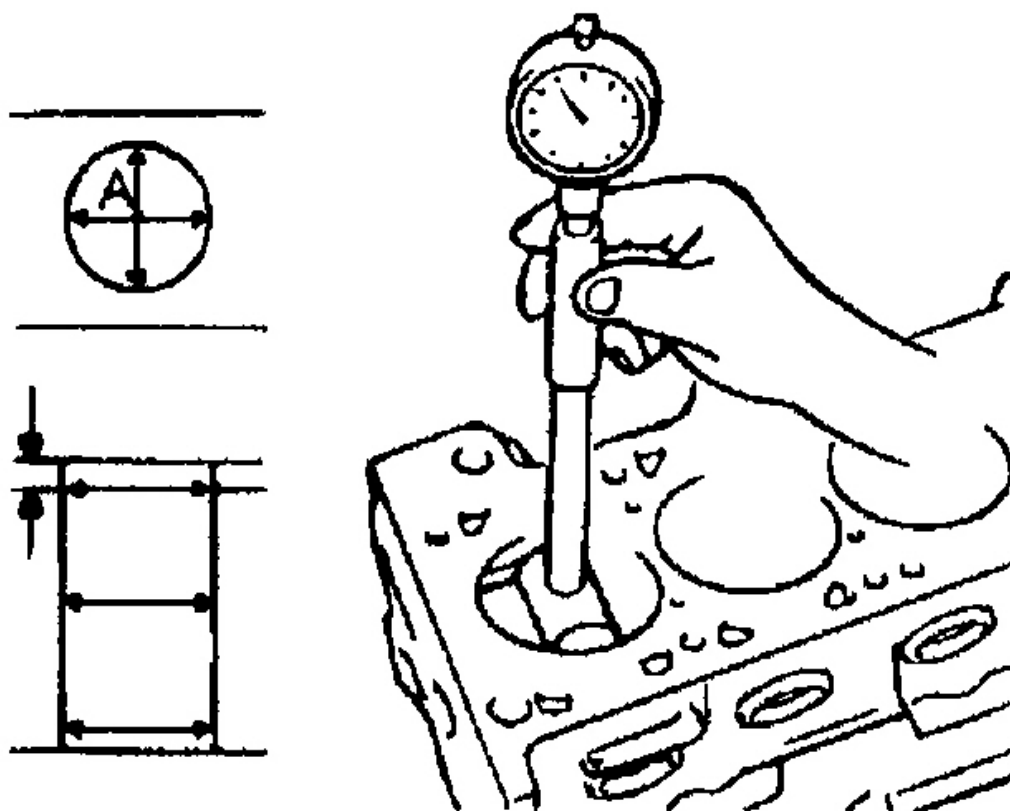


**Fig. 33: Checking Block Surface Flatness**  
Courtesy of HYUNDAI MOTOR CO.

3. Measure the cylinder bore with a cylinder gauge at three levels in the direction of A and B. If the cylinder bores show more than the specified out-of round or taper, or if the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed. Now oversize pistons and rings must be fitted. The value of measuring points are as shown.

Cylinder I.D: 82 mm (3.228 in.)

Cylinder I.D taper: 0.01 mm (0.0004 in.) or less



G01277519

**Fig. 34: Measuring Cylinder Bore**  
Courtesy of HYUNDAI MOTOR CO.

4. If a cylinder ridge exists, cut away with a ridge reamer.
5. Oversize pistons are available in four sizes.

**Piston service size and mark mm (in.)**

0.25 (0.010) O.S.: 0.25

0.50 (0.020) O.S.: 0.50

0.75 (0.030) O.S.: 0.75

1.00 (0.039) O.S.: 1.00

6. When boring the cylinder bore to the oversize, maintain the specified clearance between the oversize piston and the bore, and make sure that all pistons used are the same oversize.
7. The standard measurement of the piston outside diameter is taken 47 mm (1.85 in.) from the top land of the piston.

Piston-to-cylinder clearance (To set limits to new parts)

0.02-0.04 mm (0.0008-0.0016 in.)

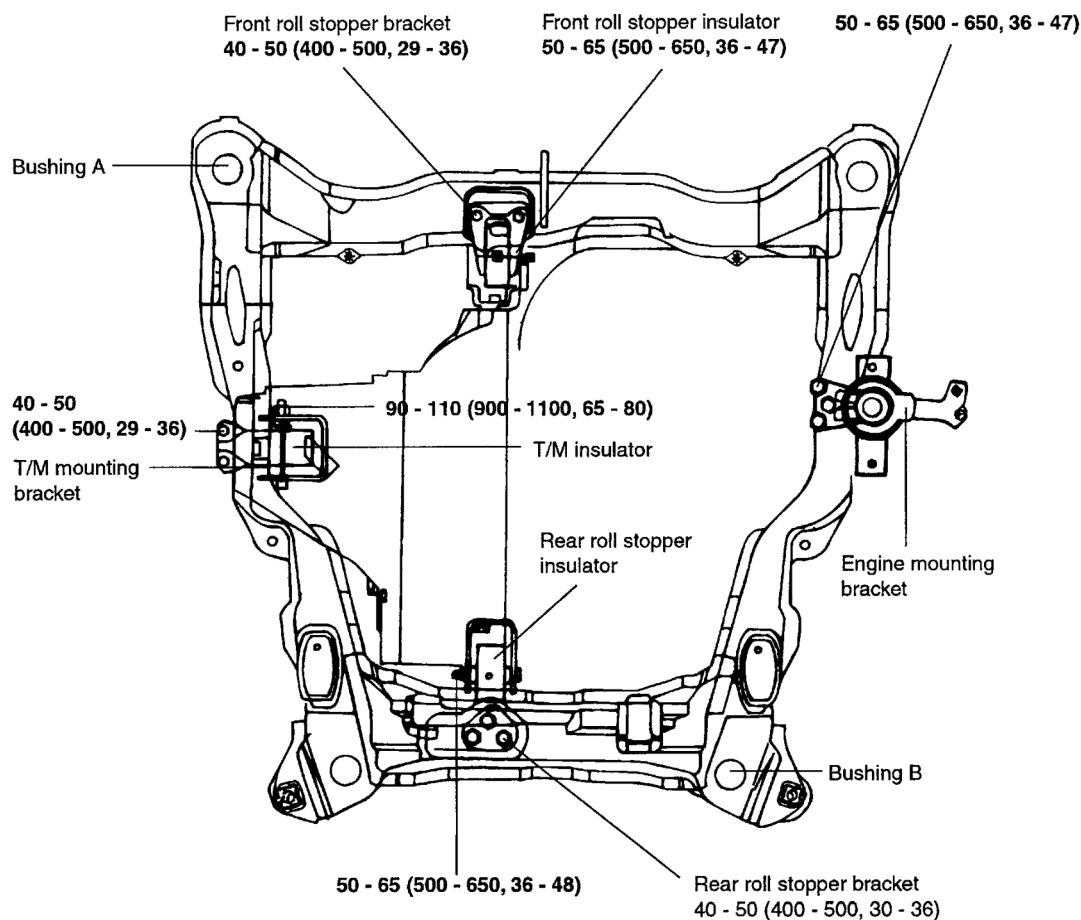
8. For used parts, it is acceptable if the maximum clearance is 85 mm or less.

## **ENGINE MOUNTS**

### **ENGINE MOUNTING**

## 2002 Hyundai Elantra GLS

2002 ENGINE 2.0L 4 Cylinder DOHC - Elantra



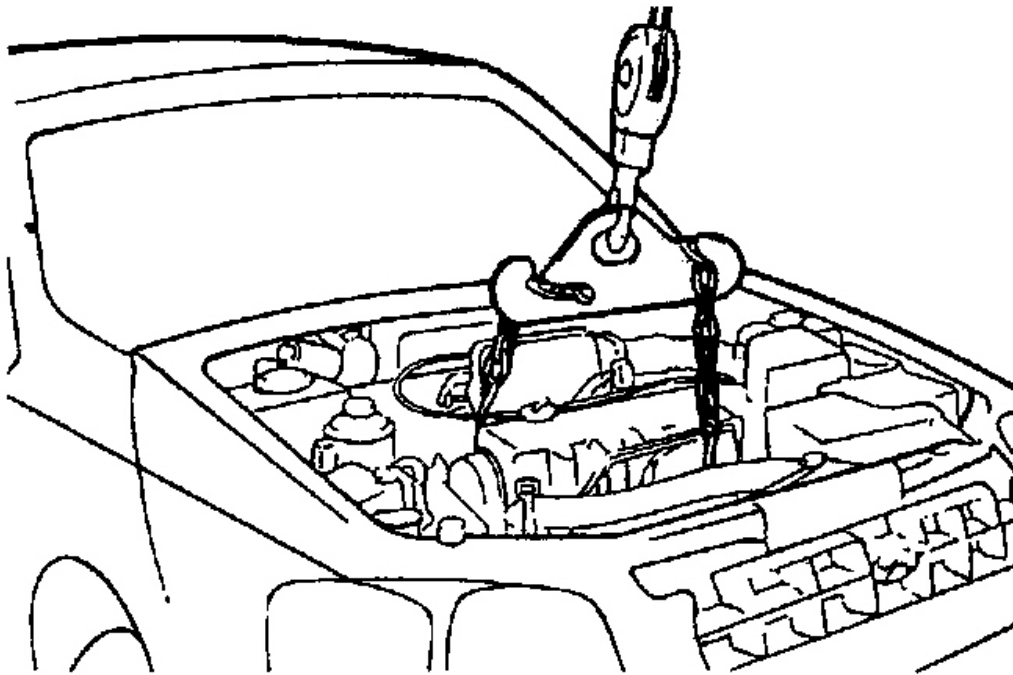
**TORQUE : Nm (kg.cm, lb.ft)**

G01277520

**Fig. 35: Identifying Engine Mounts**  
Courtesy of HYUNDAI MOTOR CO.

### REMOVAL

1. Attach an engine hoist to the engine hooks, and raise the engine just enough so that there is no pressure on the insulators.

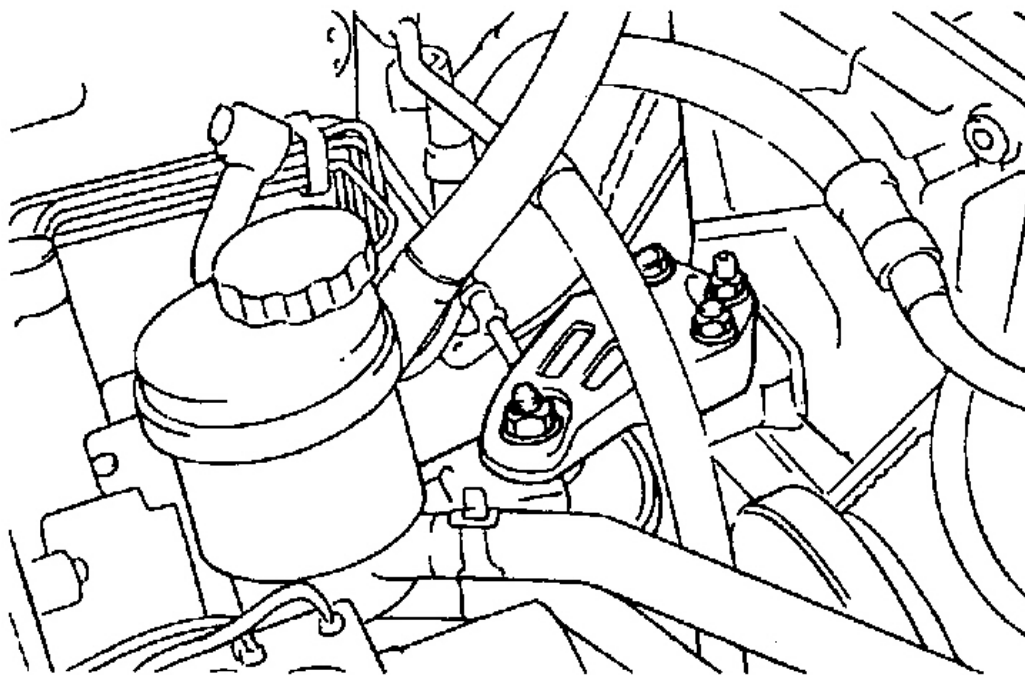


G01277521

**Fig. 36: Attaching Engine Hoist**  
Courtesy of HYUNDAI MOTOR CO.

#### ENGINE MOUNTING

1. Remove the engine mounting insulator bolts.
2. Remove the engine mounting bracket from the engine.

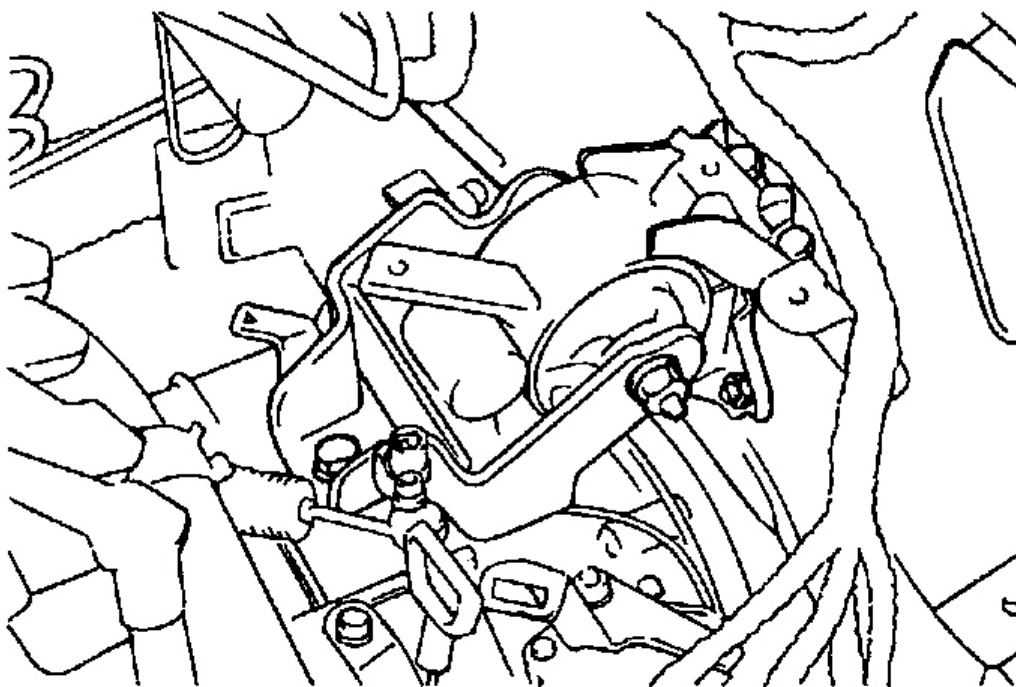


G01277522

**Fig. 37: Identifying Engine Mounting Bracket Nuts**  
Courtesy of HYUNDAI MOTOR CO.

#### TRANSMISSION MOUNTING

1. For vehicles with a 5-speed manual transmission, remove the select control valve.
2. Remove the transmission mounting bolt.

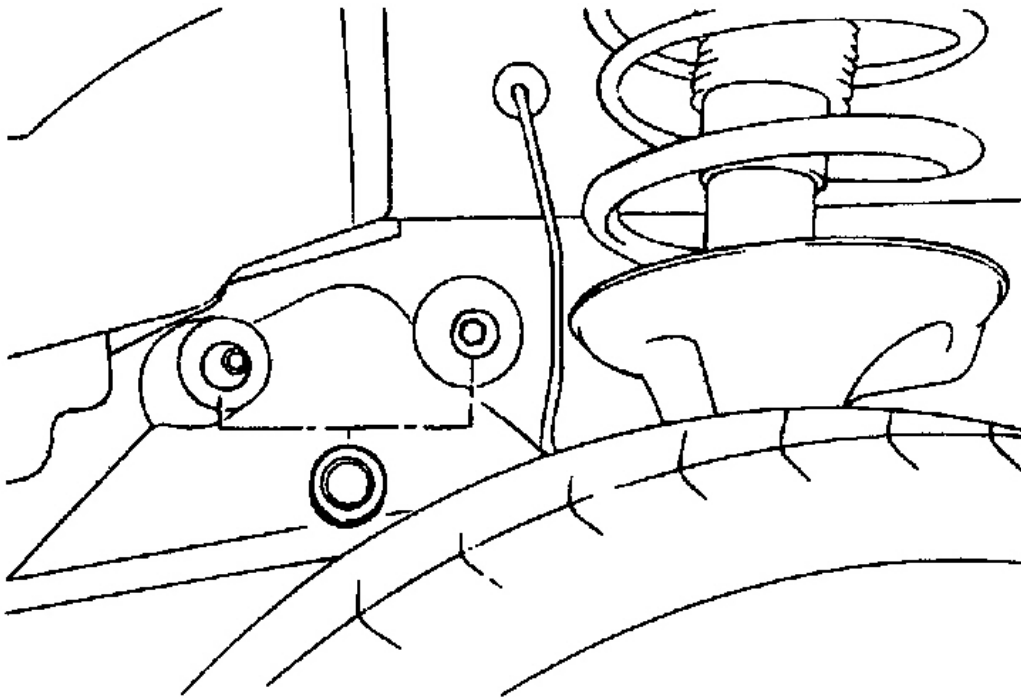


G01277523

**Fig. 38: Identifying Transmission Mounting Bolt**

Courtesy of HYUNDAI MOTOR CO.

3. Detach the cap from inside the right fender shield. Remove the transmission mounting bolts.
4. Remove the transmission bracket.

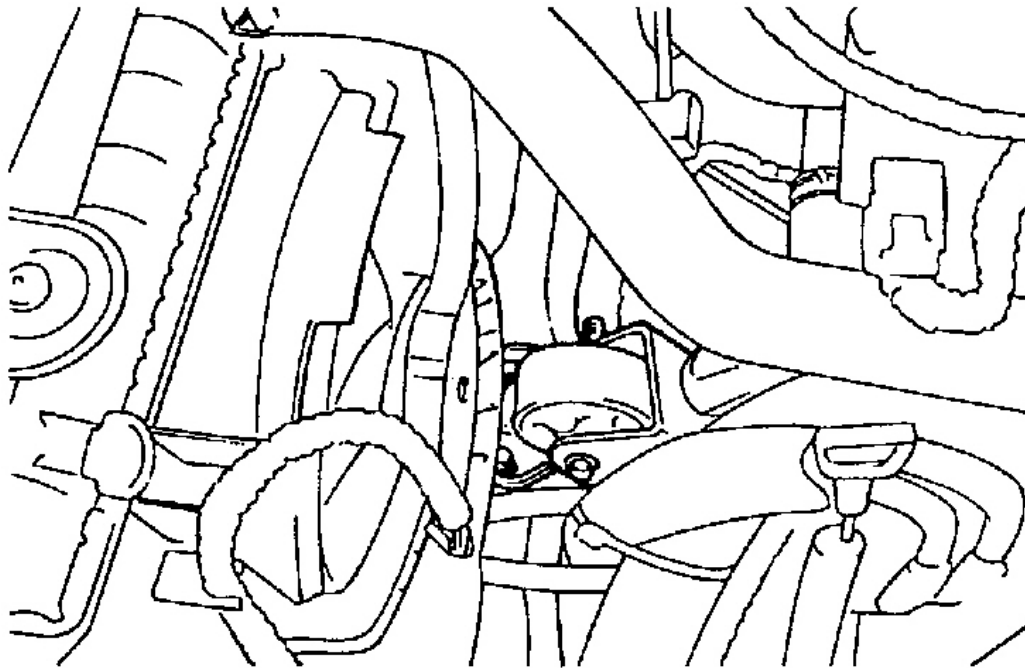


G01277524

**Fig. 39: Identifying Transmission Bracket Bolts**  
Courtesy of HYUNDAI MOTOR CO.

**FRONT ROLL STOPPER**

1. Remove the front roll stopper bracket from the subframe.

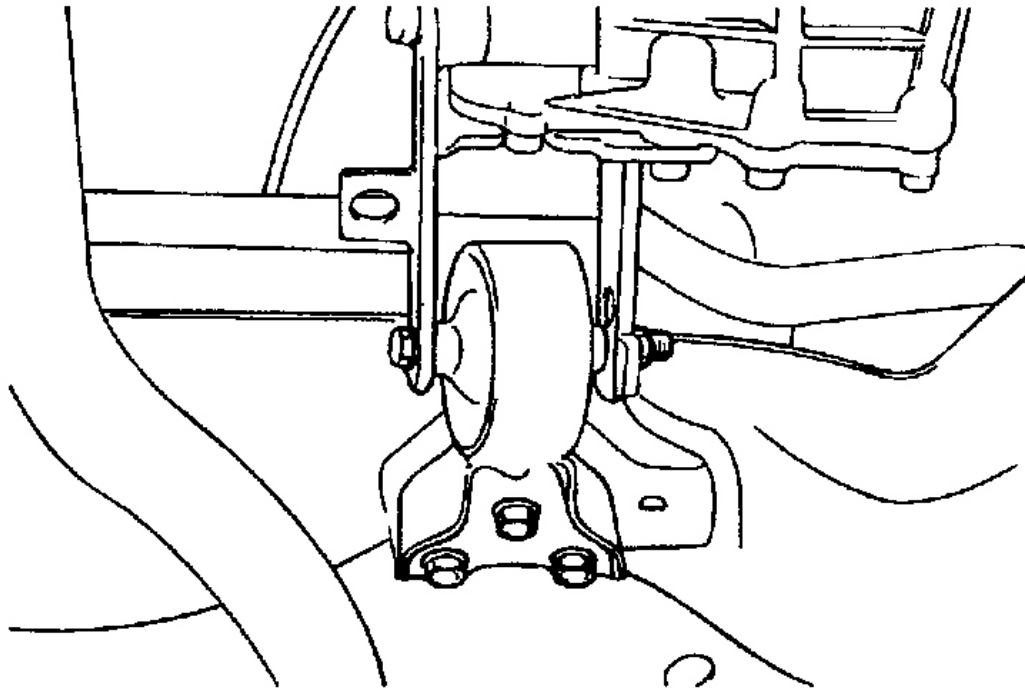


G01277525

**Fig. 40: Identifying Front Roll Stopper**  
Courtesy of HYUNDAI MOTOR CO.

#### REAR ROLL STOPPER

1. Remove the rear roll stopper from the subframe.



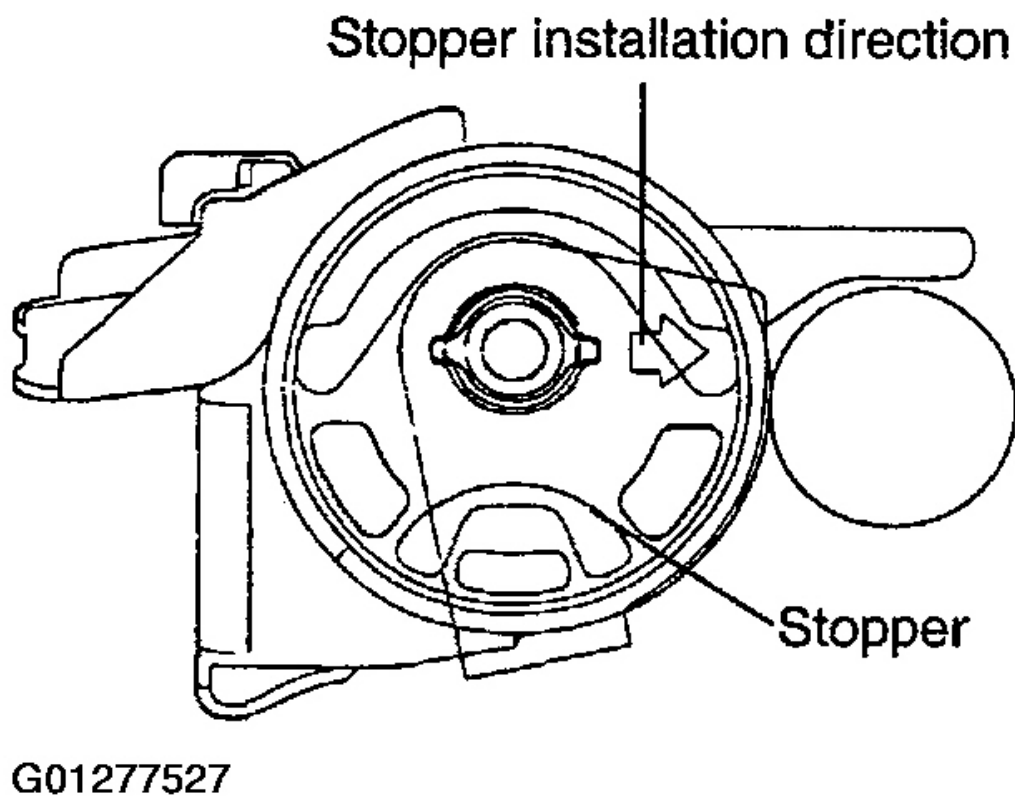
G01277526

**Fig. 41: Identifying Rear Roll Stopper**  
Courtesy of HYUNDAI MOTOR CO.

#### INSTALLATION

##### TRANSMISSION MOUNTING

1. Verify that the stopper is correctly inserted into the inner pipe in order not to move.
2. Install the stopper after making sure it is positioned correctly.



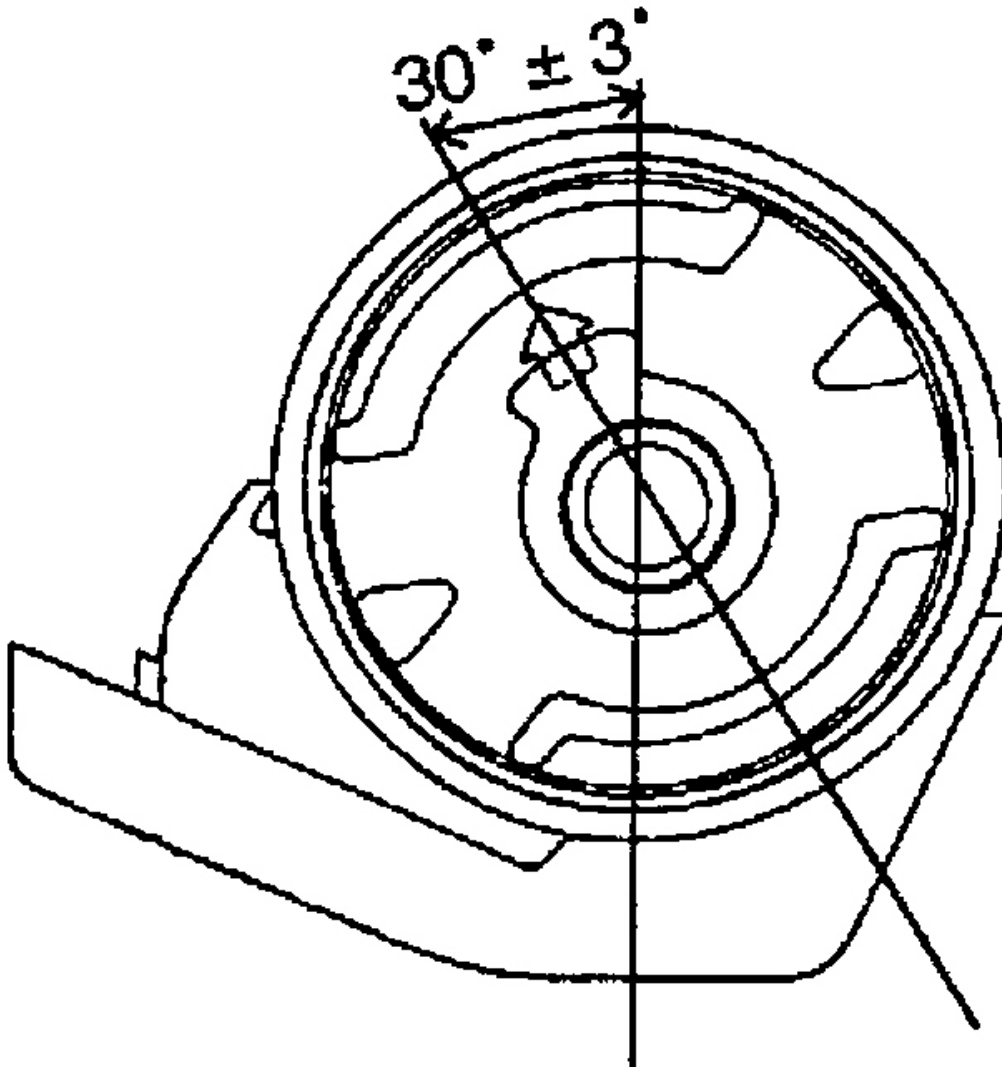
**Fig. 42: Identifying Proper Stopper Installation**  
Courtesy of HYUNDAI MOTOR CO.

**FRONT ROLL STOPPER**

1. Install the insulator in the correct angle.

A/T: 30 +/- 3°

M/T: 14 +/- 3°



G01277528

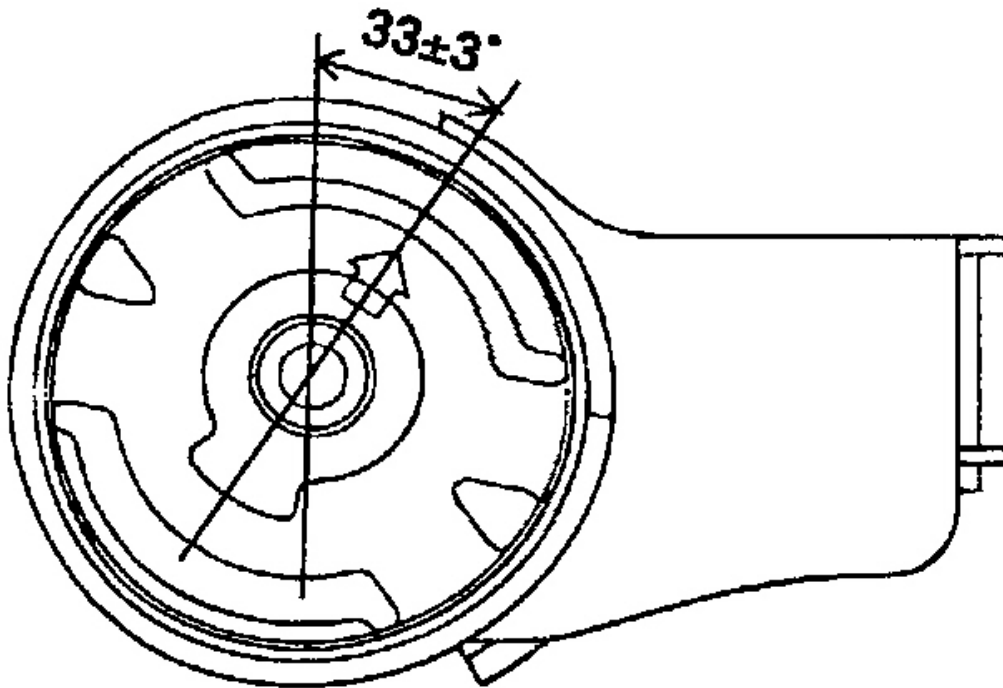
**Fig. 43: Identifying Proper Front Roll Stopper Installation**  
Courtesy of HYUNDAI MOTOR CO.

#### REAR ROLL STOPPER

1. Install the insulator in the correct angle.

A/T:  $33 \pm 3^{\circ}$

M/T: 20 +/- 3°



G01277529

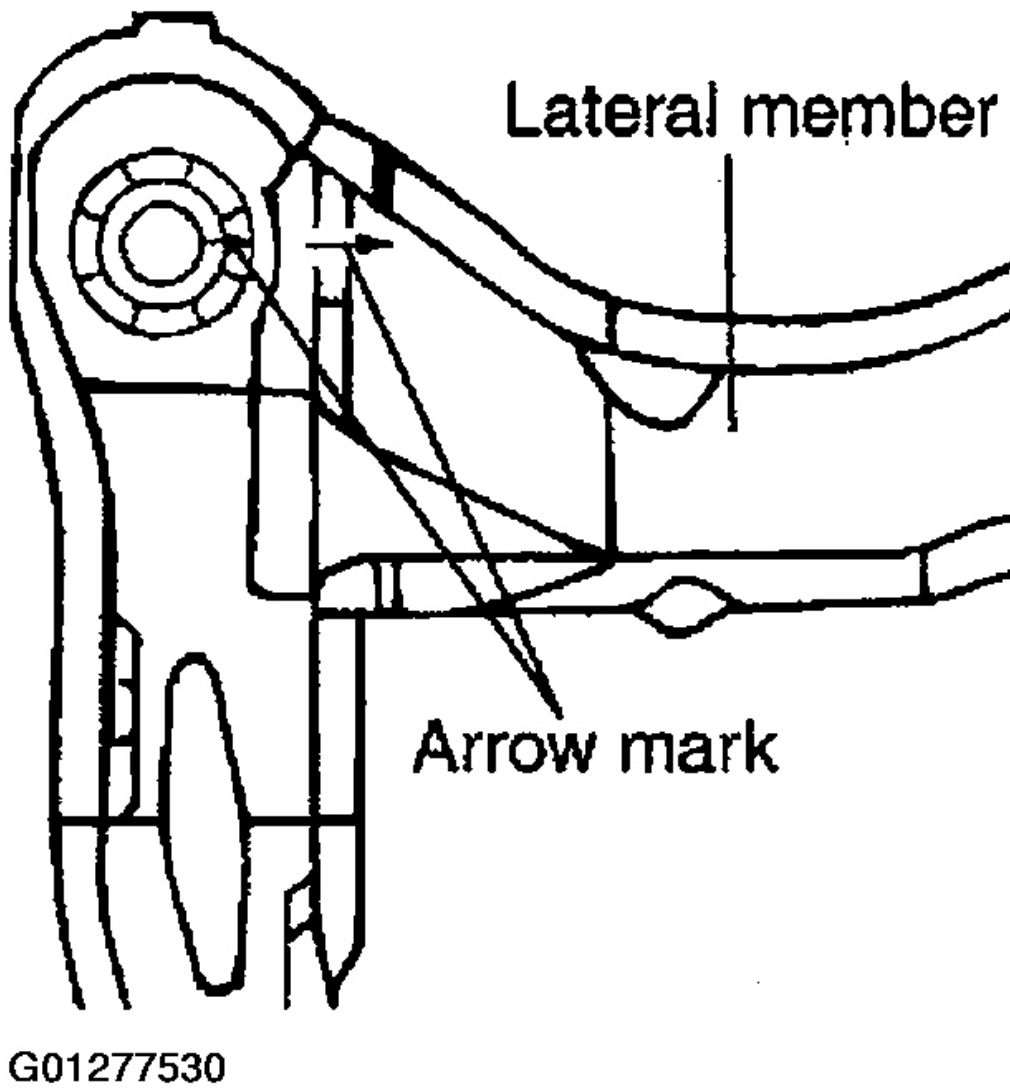
**Fig. 44: Identifying Proper Rear Roll Stopper Installation**  
Courtesy of HYUNDAI MOTOR CO.

#### MOUNTING BUSHING

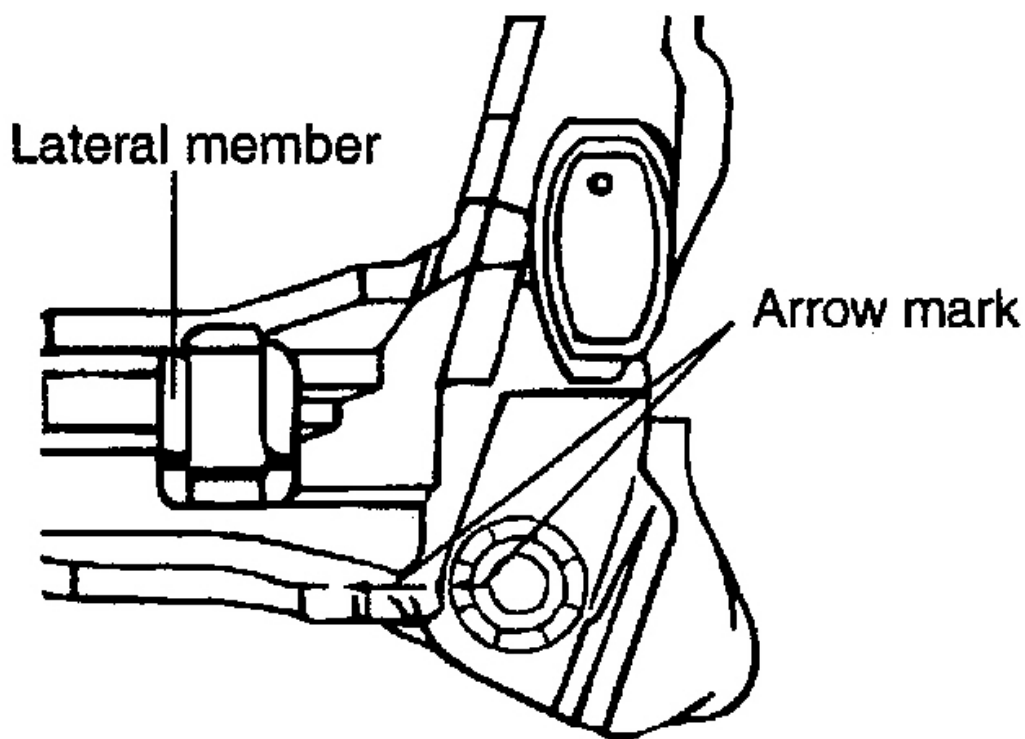
**NOTE:**

- The front and rear cross member mounting bushings are directional.
- Be sure to install the bushings in the correct direction.

1. There are 2 arrow marks on the upper side of the front and rear cross member mounting bushings.
2. When installing the bushings into the cross member inner pipe, align the arrow marks on the bushing with the lateral direction of the lateral member.



**Fig. 45: Identifying Proper Bushing Installation**  
Courtesy of HYUNDAI MOTOR CO.



G01277531

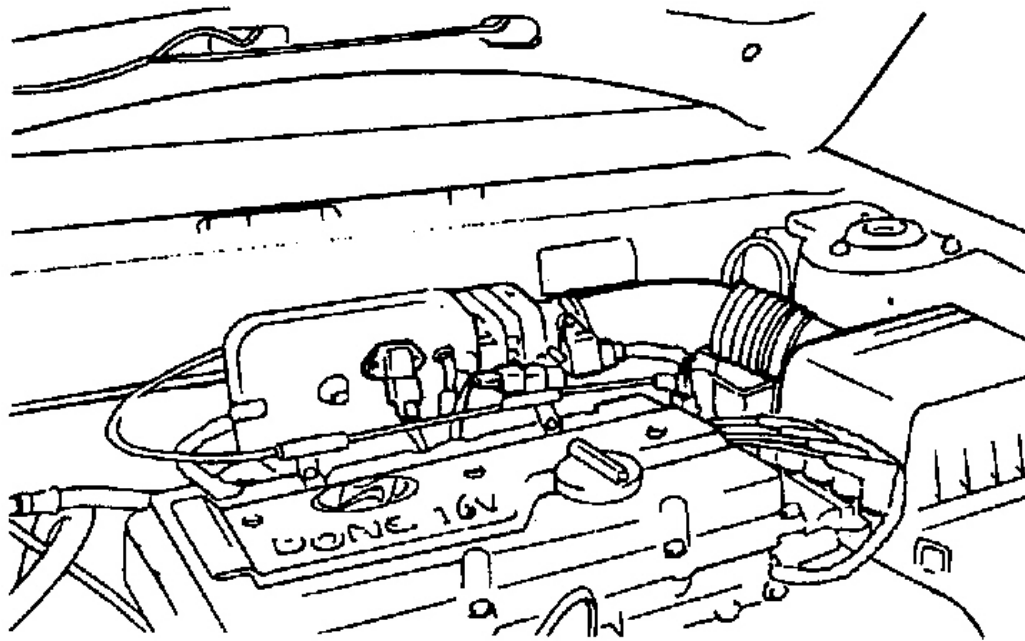
**Fig. 46: Identifying Proper Bushing Installation**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE:** Make sure the bushings are positioned parallel to the lateral member of the cross member. Be sure that the installation direction of the bushings do not deviate  $\pm 3^\circ$  from the lateral direction of the lateral member when they are installed to the member.

## ENGINE AND TRANSAXLE ASSEMBLY

### REMOVAL

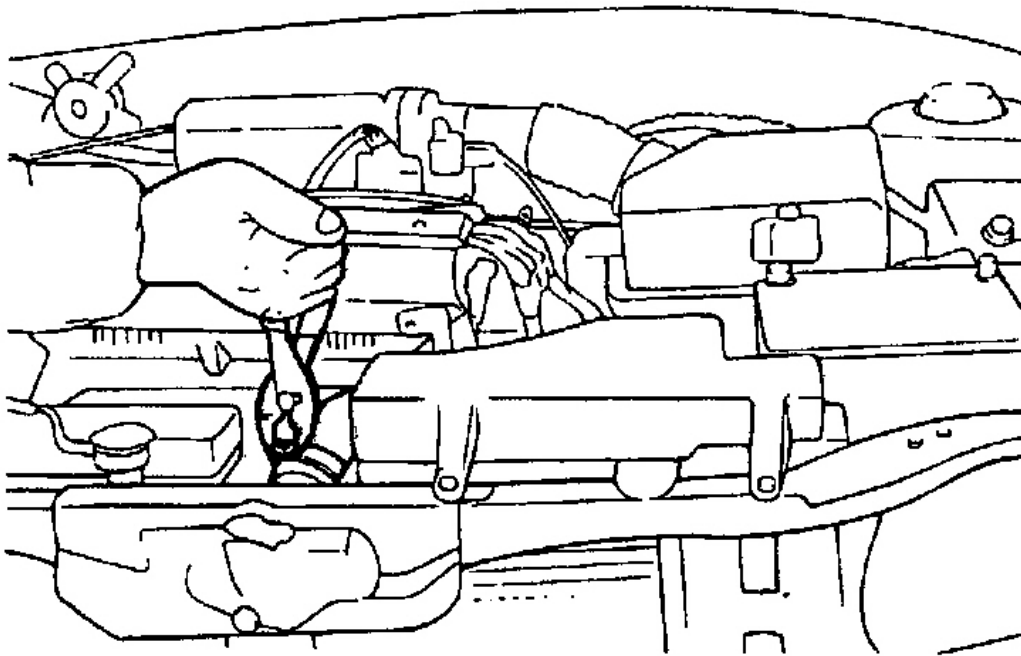
1. Remove the battery.
2. Detach the air cleaner.



G01277532

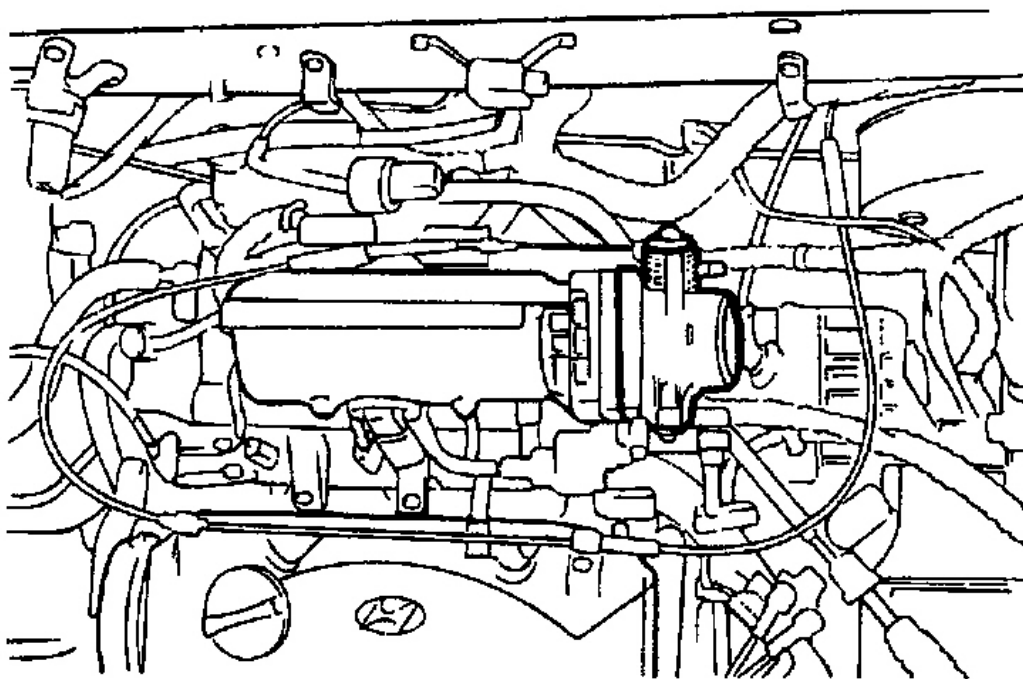
**Fig. 47: Identifying Air Cleaner**  
Courtesy of HYUNDAI MOTOR CO.

3. Disconnect the connectors for the backup lamp switch and engine harness.
4. For vehicles with a 5-speed manual transmission, disconnect the select control valve connector.
5. Disconnect the connectors for the alternator harness and the oil pressure gauge wiring.
6. Drain the engine coolant.



G01277533

**Fig. 48: Removing Radiator Hose**  
Courtesy of HYUNDAI MOTOR CO.



G01277534

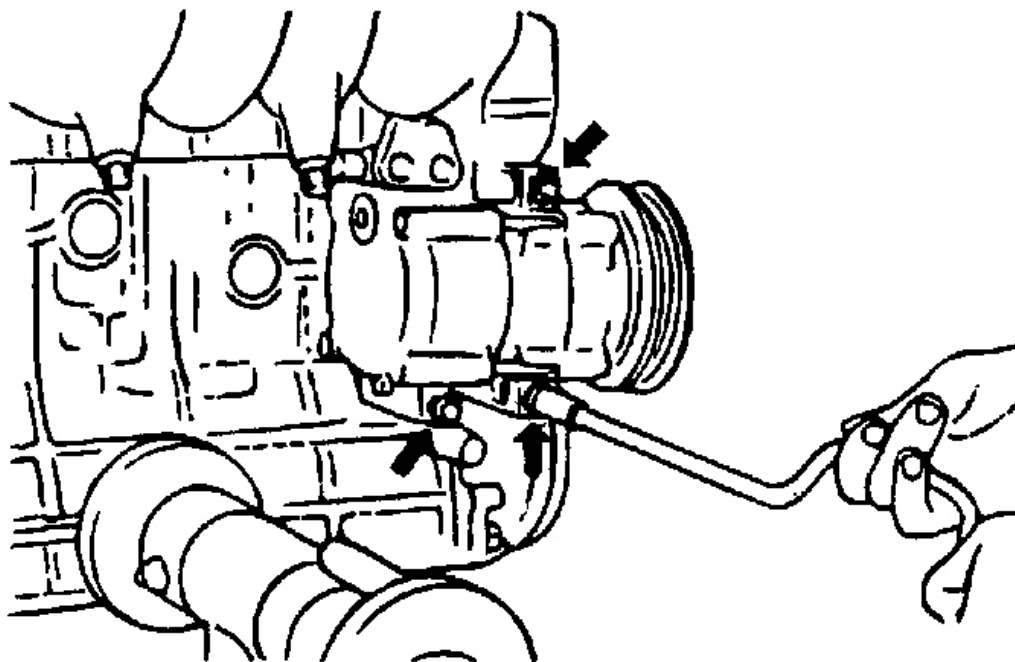
**Fig. 49: Identifying Accelerator Cable**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE:** When disconnecting hoses, make identification marks to ensure they are reconnected correctly.

**CAUTION:** Be careful not to spill oil or fluid from hoses. Plug the openings to prevent foreign material from entering.

7. Disconnect the radiator upper and lower hoses on the engine side, then remove the radiator assembly.
8. Disconnect the engine ground.
9. Disconnect the brake booster vacuum hose.
10. Remove the main fuel line, the return and vapor hoses from the engine side.
11. Disconnect the heater hoses (inlet and outlet) on the engine side.
12. Disconnect the accelerator cable at the engine side.
13. For vehicles with manual transmission, remove the control cable from the transmission.
14. For vehicles with automatic transmission, remove the control cable from the transmission.
15. Disconnect the speedometer cable from the transmission.

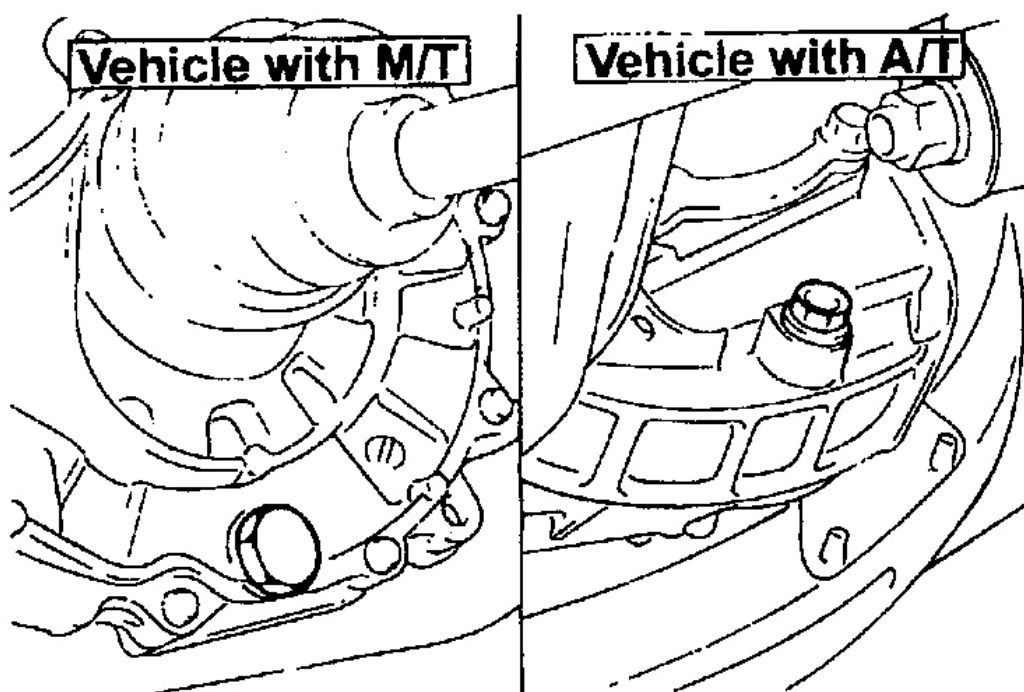
16. Disconnect the air conditioner compressor from the mounting bracket.



G01277535

**Fig. 50: Removing Air Conditioner Compressor**  
Courtesy of HYUNDAI MOTOR CO.

17. Jack up the vehicle.
18. Drain the transmission oil (or fluid).



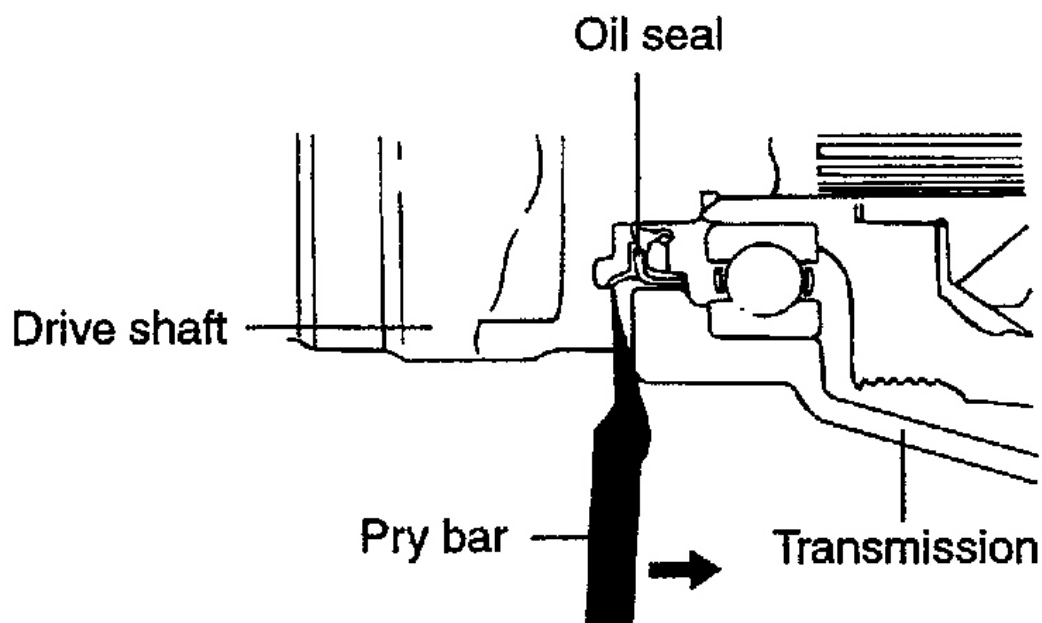
G01277536

**Fig. 51: Identifying Transmission Drain Plug**  
Courtesy of HYUNDAI MOTOR CO.

19. Disconnect the front exhaust pipe from the manifold.

**NOTE:** Use wire to suspend the exhaust pipe from the bottom of the vehicle.

20. For vehicles with manual transmission, remove the shift control rod and extension rod.
21. Remove the lower arm ball joint bolts and the stabilizer bar at the point where it is mounted to the lower arm.
22. Remove the drive shafts from the transmission case.



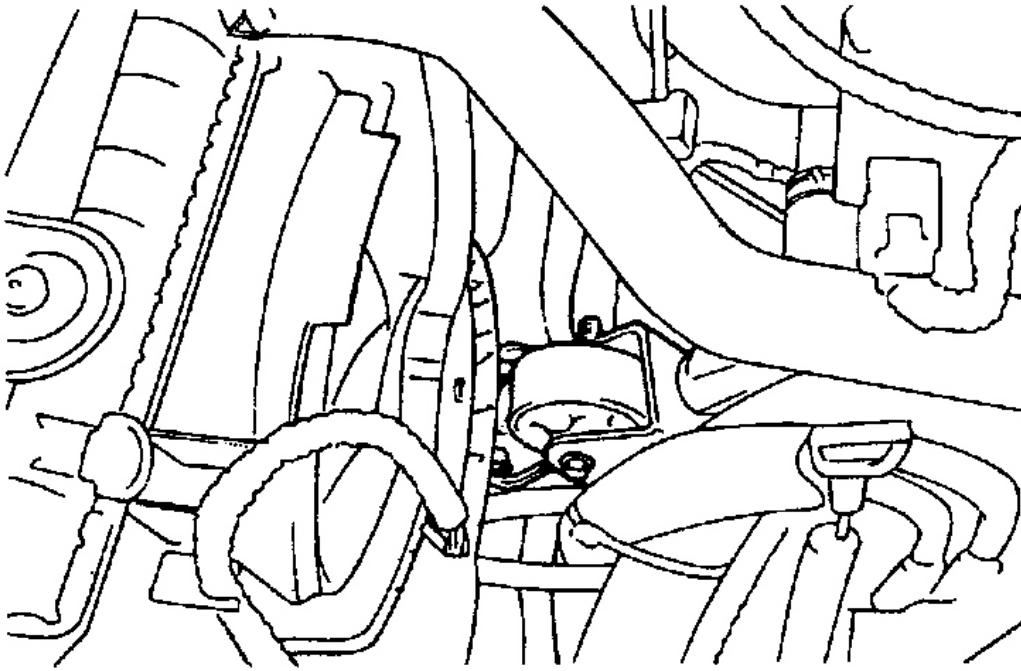
G01277538

**Fig. 52: Removing Drive Shaft From Transmission**  
Courtesy of HYUNDAI MOTOR CO.

**CAUTION:**

- Plug the axle holes of the transmission case to prevent entry of foreign material.
- Install new circlips on the drive shafts when reassembling.

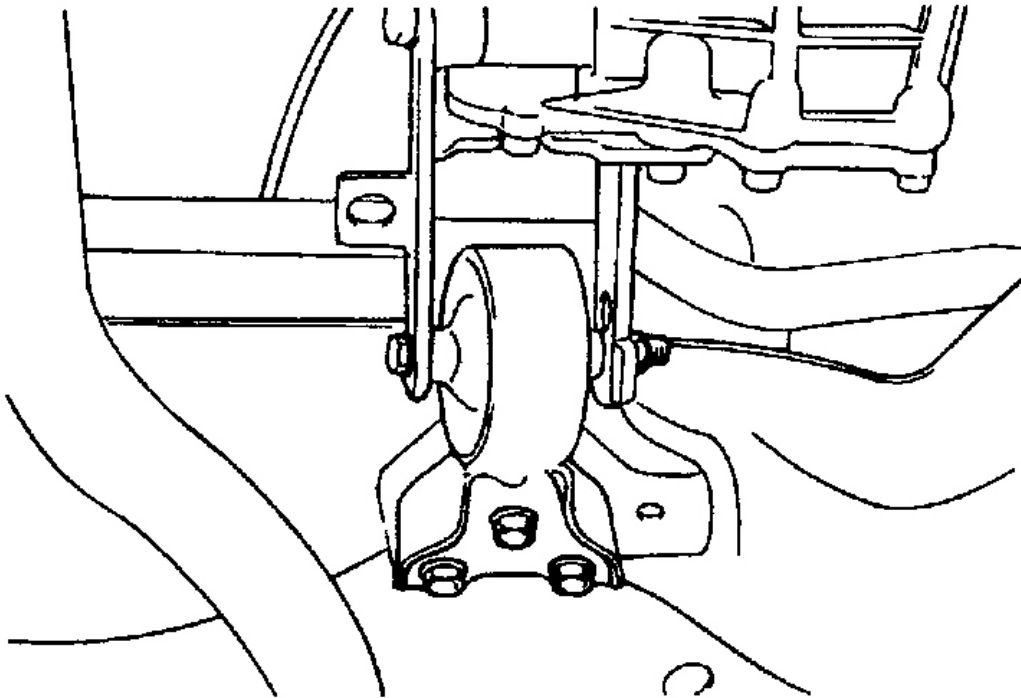
23. Hang the lower arm and drive shaft from the body with wire.
24. Attach a chains or cables to the engine. Use an engine hoist or a chain hoist to slightly raise the engine (enough to support the engine's weight while processing with the following steps).
25. Remove the front roll stopper.



G01277539

**Fig. 53: Identifying Front Roll Stopper**  
Courtesy of HYUNDAI MOTOR CO.

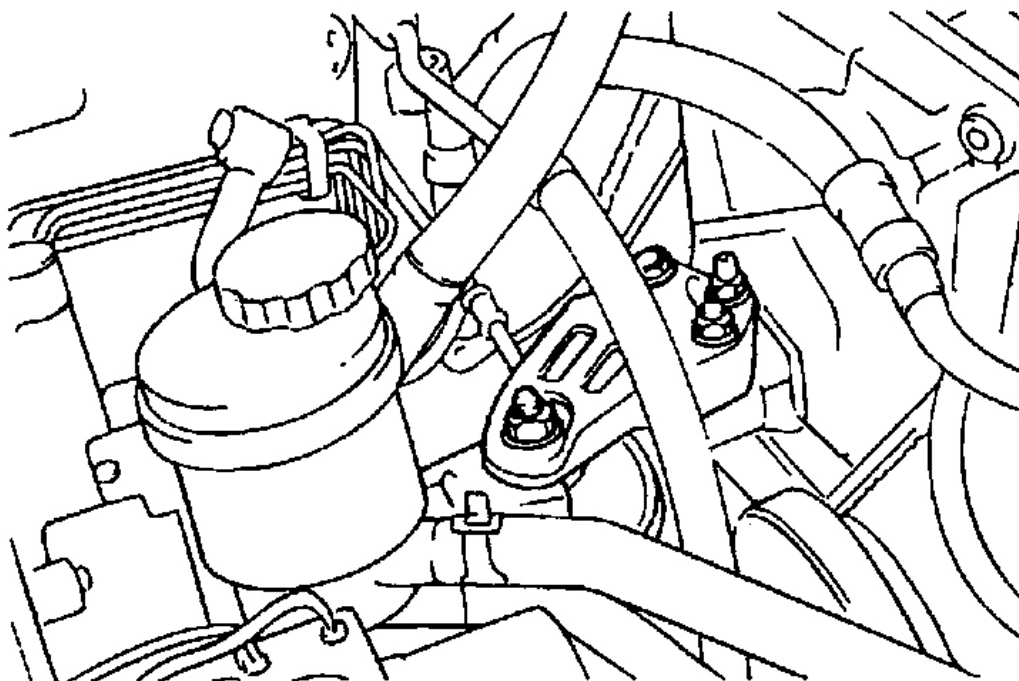
26. Separate the rear roll stopper.



G01277540

**Fig. 54: Identifying Rear Roll Stopper**  
Courtesy of HYUNDAI MOTOR CO.

27. Remove the engine mounting insulator bolts.
28. Remove the engine mounting bracket from the engine.



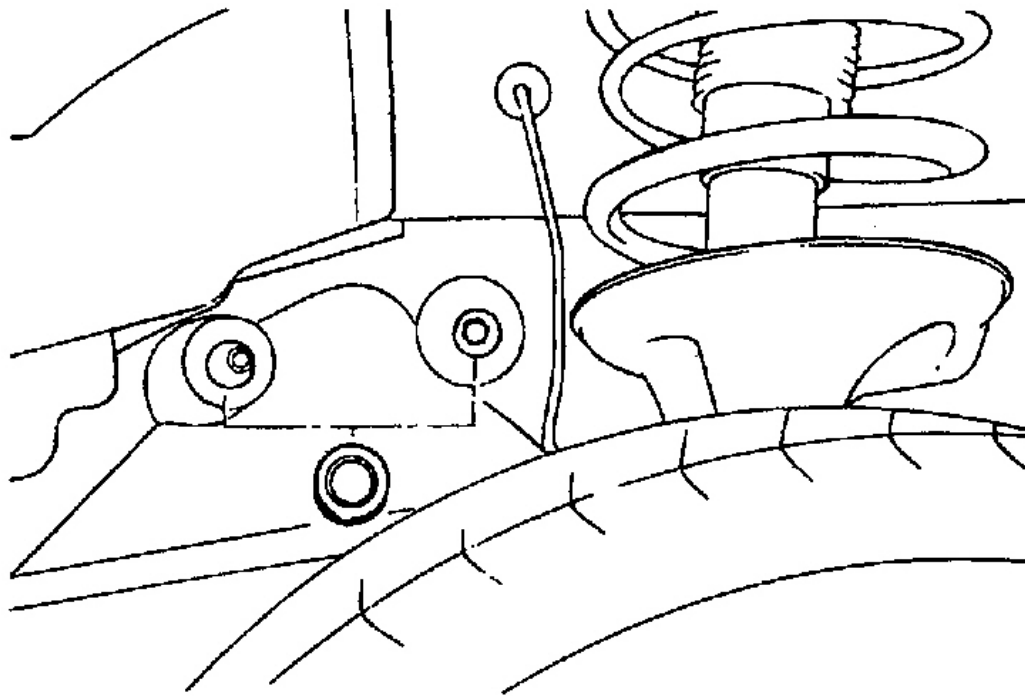
G01277541

**Fig. 55: Identifying Engine Mounting Bracket Nuts**  
Courtesy of HYUNDAI MOTOR CO.

29. Slowly raise the engine (to the extent that the weight of the engine and transmission assembly is not applied to the mounting portions) and temporarily hold it in the raised position.

**CAUTION: Check that all cables, hoses, harnesses, connectors etc. are disconnected from the engine.**

30. Remove the caps from the inside of the right fender shield and remove the transaxle mount bracket bolts.

**G01277542**

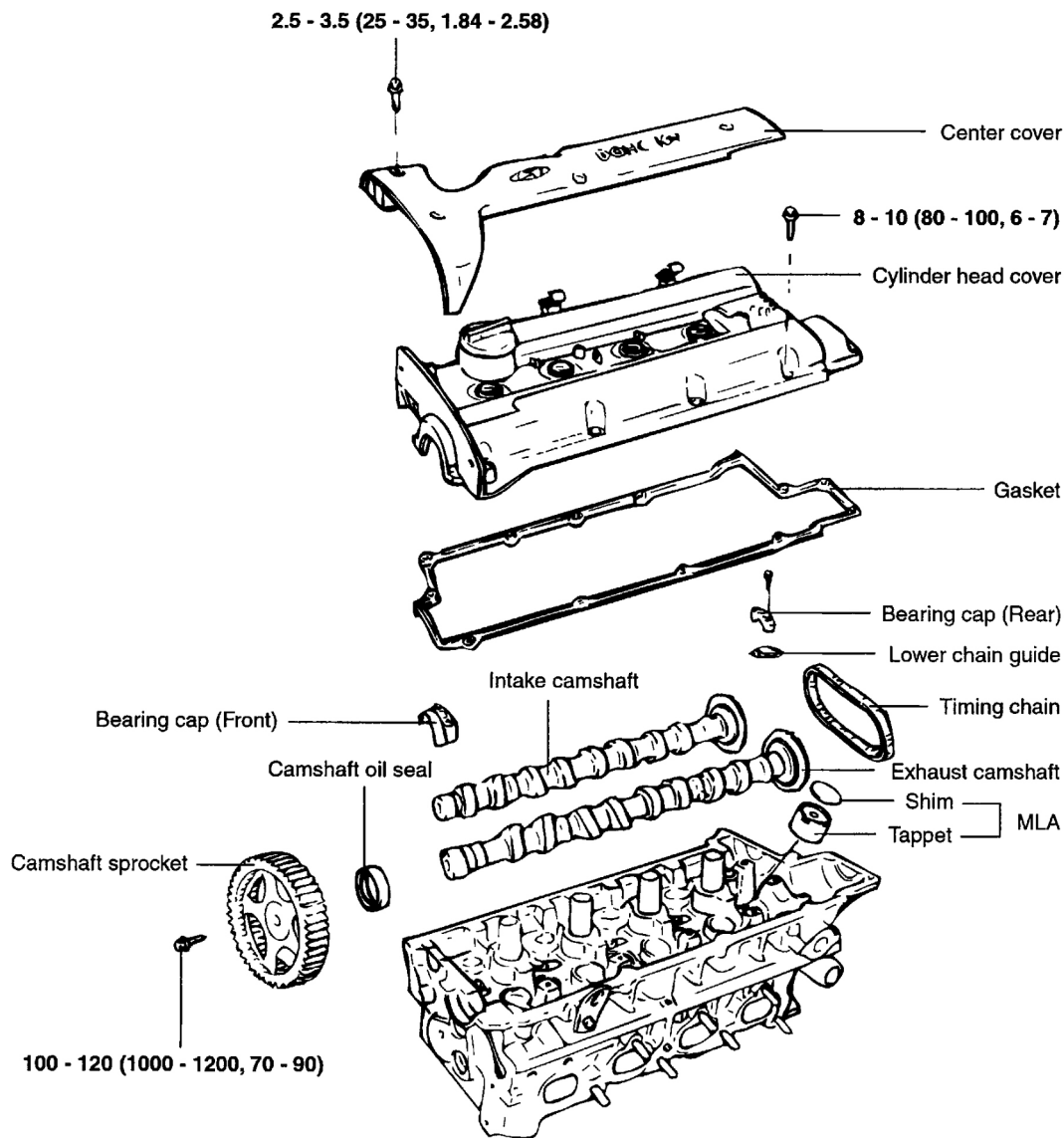
**Fig. 56: Identifying Transaxle Mount Bracket Bolts**  
Courtesy of HYUNDAI MOTOR CO.

31. While directing the transmission side downward, lift the engine and transmission assembly up and out of the vehicles.

## **MAIN MOVING SYSTEM**

### **CAMSHAFT**

#### **COMPONENTS**



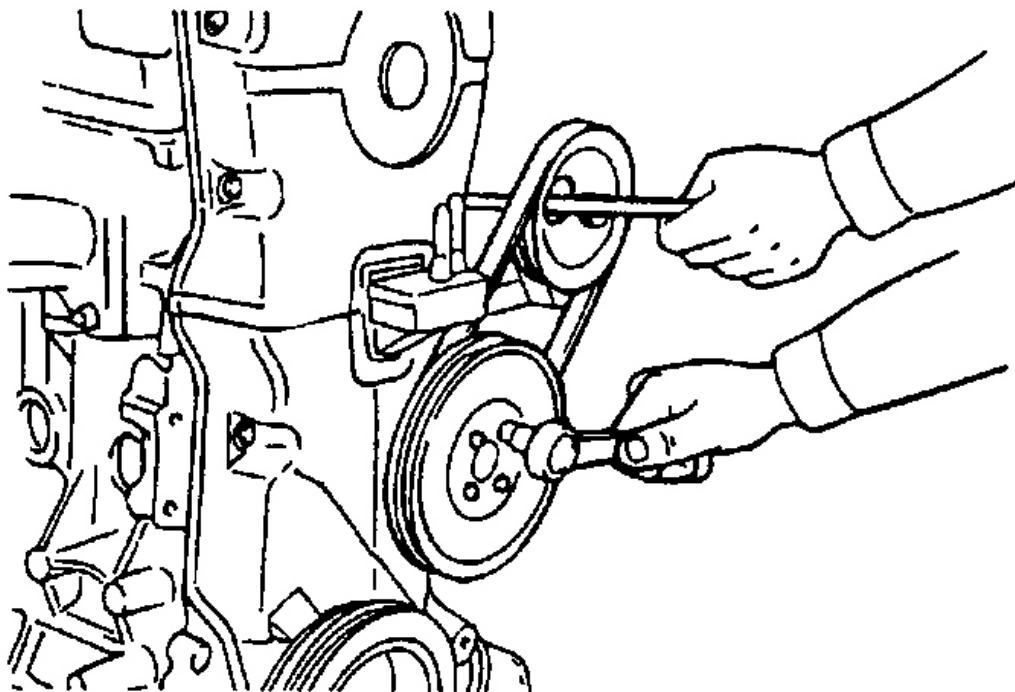
**TORQUE : Nm (kg.cm, lb.ft)**

G01277543

**Fig. 57: Camshaft Components**  
Courtesy of HYUNDAI MOTOR CO.

### DISASSEMBLY

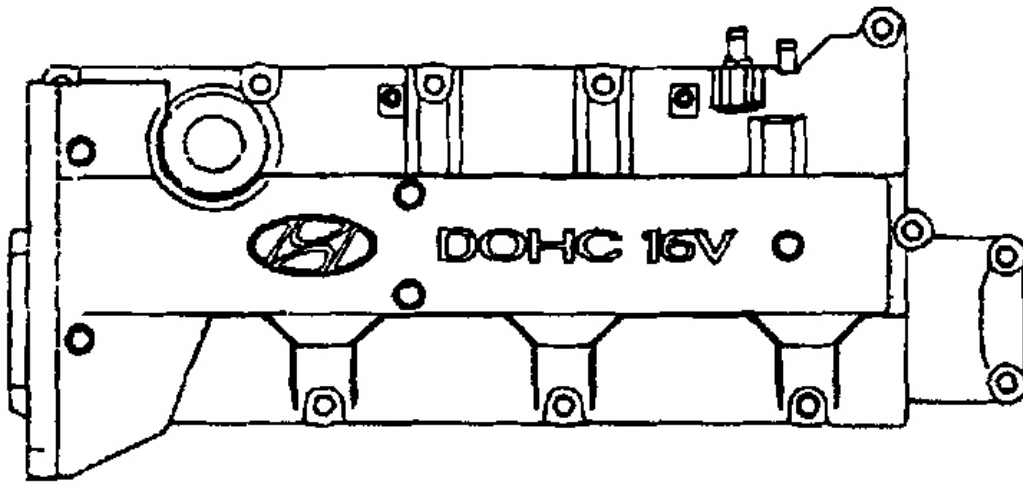
1. Disconnect the breather hose and the P.C.V. hose.
2. Remove the coolant pump pulley and crankshaft pulley.



G01277544

**Fig. 58: Removing Water Pump Pulley & Crankshaft Pulley**  
Courtesy of HYUNDAI MOTOR CO.

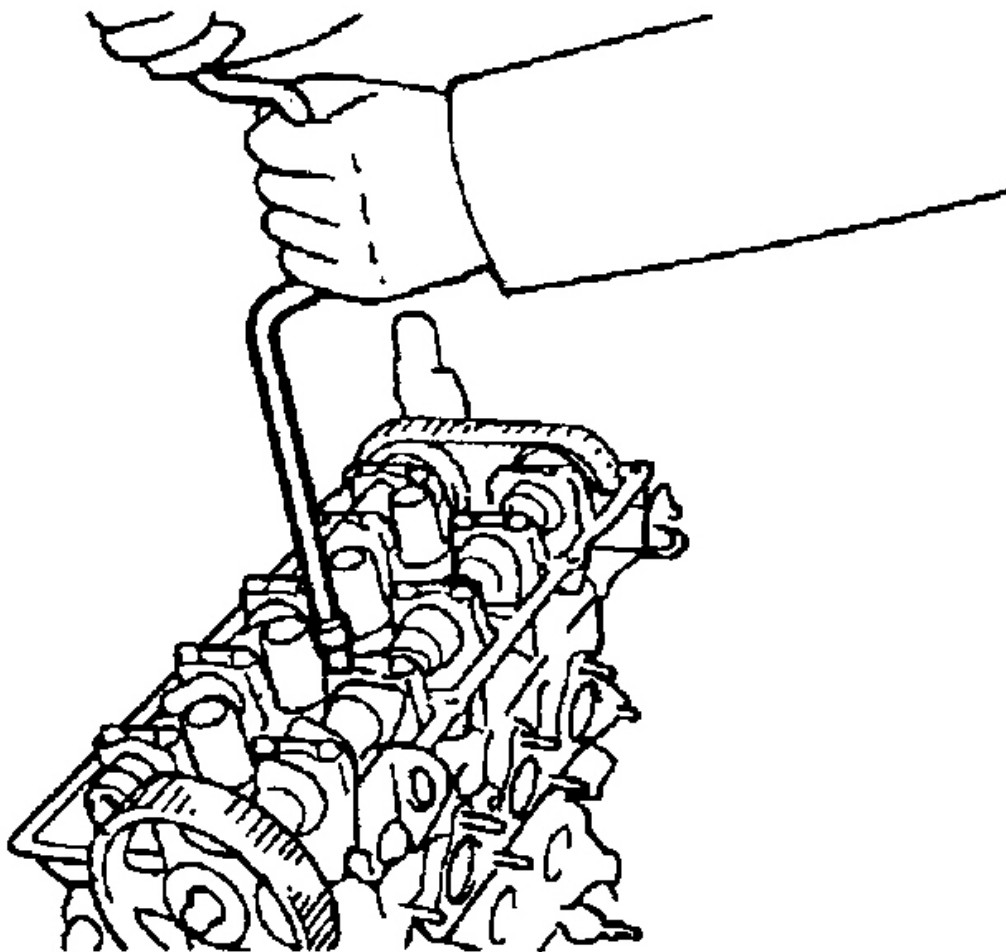
3. Remove the timing belt cover.
4. Loosen the timing belt tensioner pulley and temporarily secure it.
5. Remove the timing belt from the camshaft sprocket.
6. Loosen the center cover bolts and then remove the center cover.
7. Remove the ignition coil assembly.
8. Loosen the cylinder head cover bolts and then remove the cylinder head cover.



G01277545

**Fig. 59: Identifying Cylinder Head Cover**  
Courtesy of HYUNDAI MOTOR CO.

9. Remove the camshaft sprocket.
10. Remove the camshaft bearing caps and timing chain.



G01277546

**Fig. 60: Removing Camshaft Bearing Caps**  
Courtesy of HYUNDAI MOTOR CO.

11. Remove the camshaft.
12. Remove the mechanical tappets and shims.

**NOTE:**        **Arrange the mechanical tappets and shims in correct order.**

#### INSPECTION

#### CAMSHAFT

1. Check the camshaft journals for wear. If the journals are badly worn, replace the camshaft.
2. Check the cam lobes for damage. If the lobe is damaged or worn excessively, replace the camshaft.

### Cam height

[Standard value]

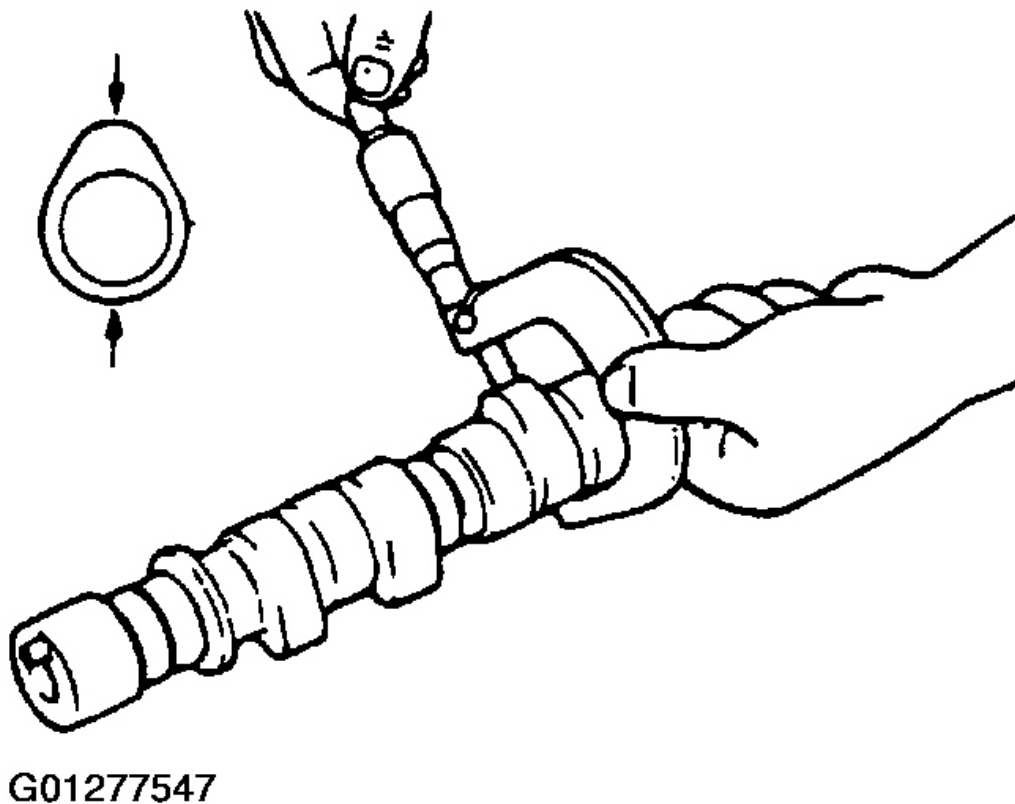
Intake: 44.820 mm (1.7646 in.)

Exhaust: 44.720 mm (1.7606 in.)

[Limit]

Intake: 44.720 mm (1.7606 in.)

Exhaust: 44.620 mm (1.7567 in.)



**Fig. 61: Measuring Camshaft Lobe**  
Courtesy of HYUNDAI MOTOR CO.

3. Check the cam surface for abnormal wear or damage, and replace if necessary.
4. Check each bearing for damage. If the bearing surface is excessively damaged, replace the cylinder head

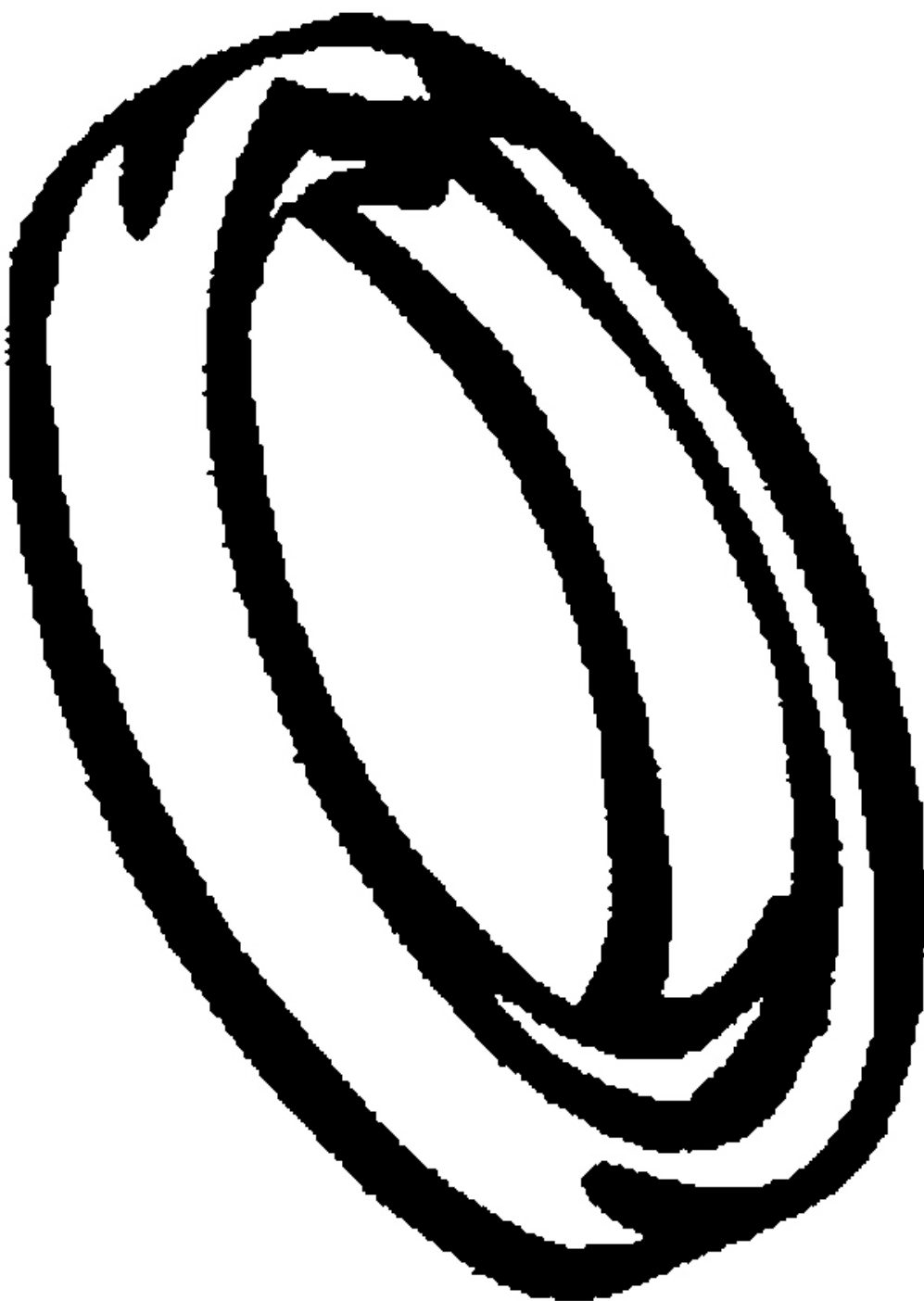
assembly or camshaft bearing cap, as necessary.

Camshaft end play: 0.1-0.2 mm (0.004-0.008 in.)

**CAMSHAFT OIL SEAL**

1. Check the lips for wear. If the lip threads are worn, replace.
2. Check the oil seal lip contacting surface of the camshaft. If it is worn, replace the camshaft.

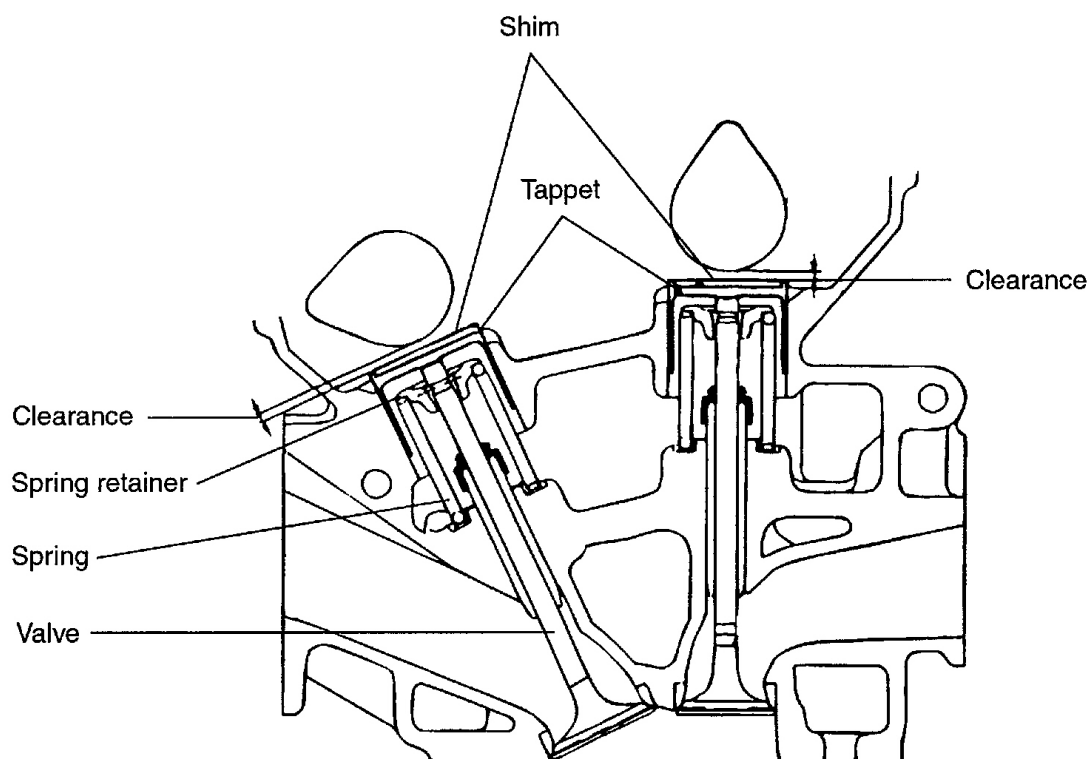
**MLA (MECHANICAL LASH ADJUSTER)**



G01277548

**Fig. 62: Identifying Camshaft Oil Seal**  
Courtesy of HYUNDAI MOTOR CO.

**VALVE CLEARANCE INSPECTION AND ADJUSTMENT**

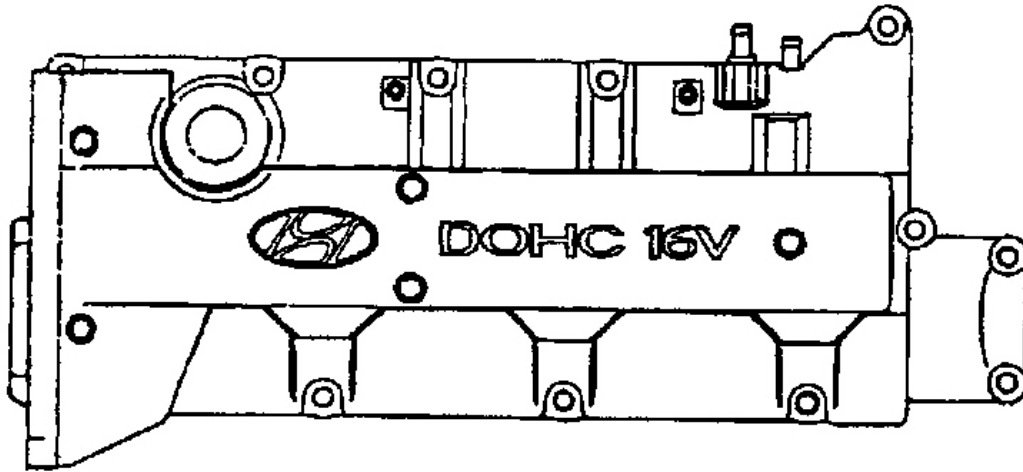


G01277549

**Fig. 63: Identifying Valve Clearance**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE:** Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature: 20°C) and cylinder head is installed on the cylinder block.

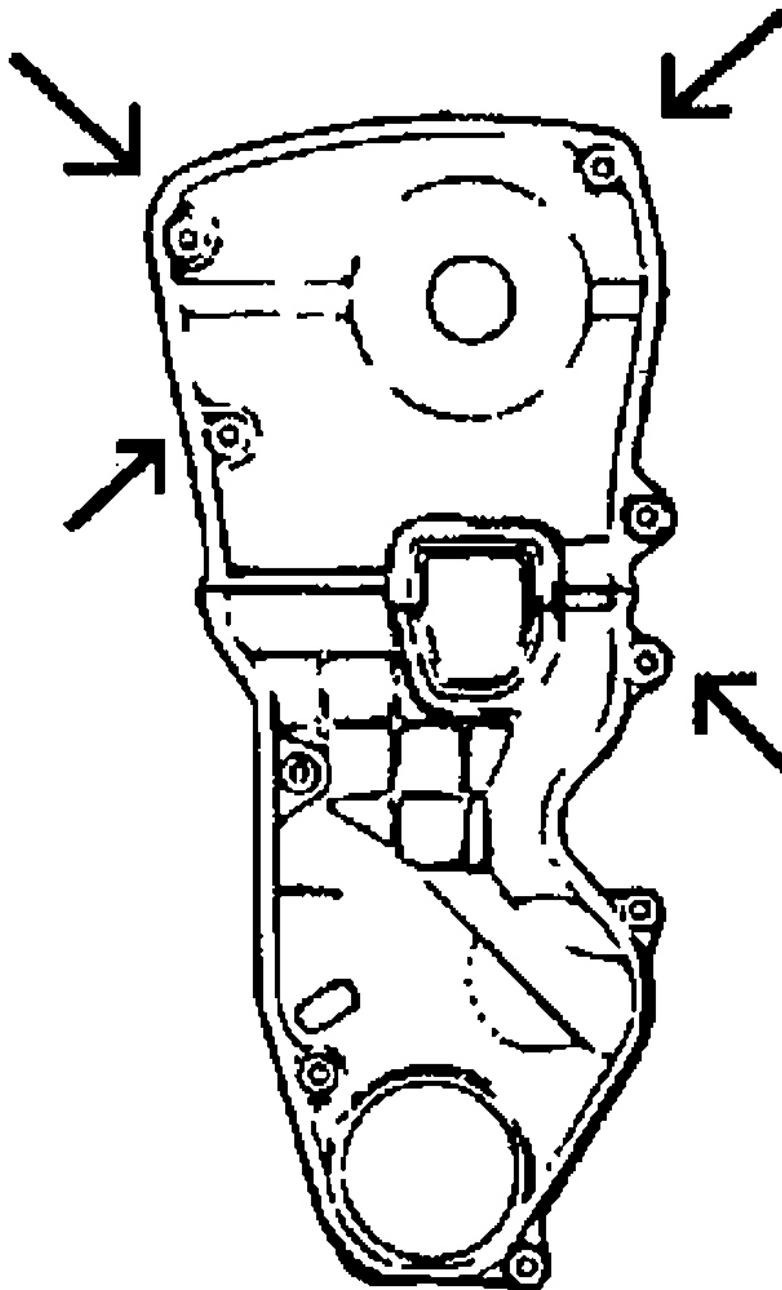
1. Remove the engine cover.
2. Remove oil filler cap.
3. Remove the center cover bolts and then remove the center cover.



G01277550

**Fig. 64: View Of Cylinder Head Cover**  
Courtesy of HYUNDAI MOTOR CO.

4. Remove the upper timing belt cover



G01277551

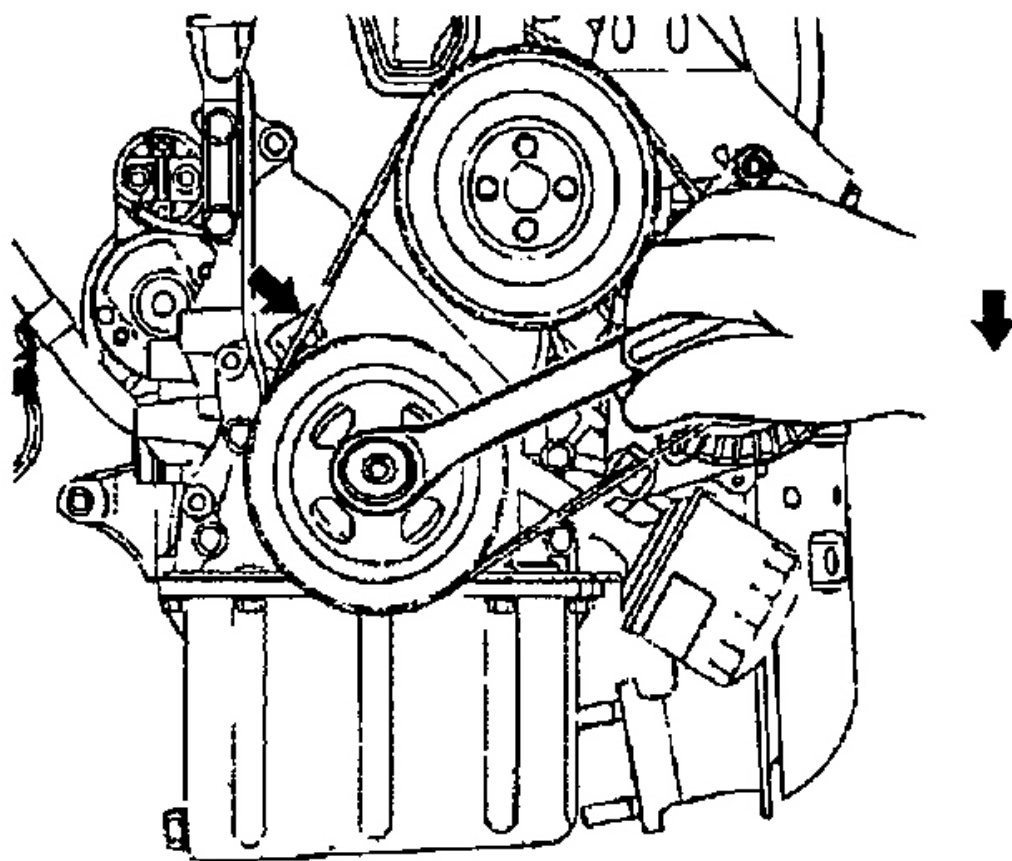
**Fig. 65: Identifying Upper Timing Cover**  
Courtesy of HYUNDAI MOTOR CO.

- a. Loosen the upper timing belt cover bolts and then remove the cover.

5. Remove the cylinder head cover.
  - a. Disconnect the spark plug cables and do not pull on the spark plug cables by force.

**NOTE:** Pulling on or bending the cables may damage the conductor inside.

- b. Disconnect the P.C.V. hose and the breather hose from the cylinder head cover.
  - c. Disconnect the accelerator cable from the cylinder head cover.
  - d. Loosen the cylinder head cover bolts and then remove the cover and gasket.
6. Set No.1 cylinder to TDC/ compression.
  - a. Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing belt cover.

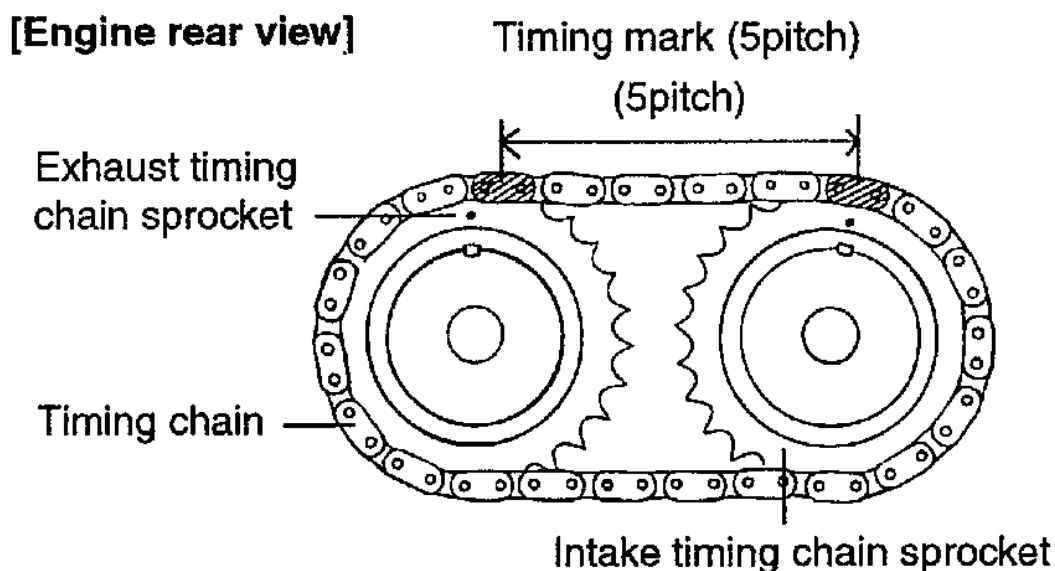


G01277552

**Fig. 66: Turning Crankshaft Pulley**

Courtesy of HYUNDAI MOTOR CO.

- b. Check that the hole of the camshaft timing pulley is aligned with the timing mark of the bearing cap. If not, turn the crankshaft one revolution (360°)



G01277553

**Fig. 67: Identifying Timing Marks On Sprockets & Chain**

Courtesy of HYUNDAI MOTOR CO.

7. Inspect the valve clearance.
  - a. Check only the valves indicated as shown. [No.1 cylinder: TDC/Compression] measure the valve clearance
    - Using a thickness gauge, measure the clearance between the tappet shim and the base circle of camshaft.
    - Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

Valve clearance (Engine coolant temperature: 20°C)

[Specification]

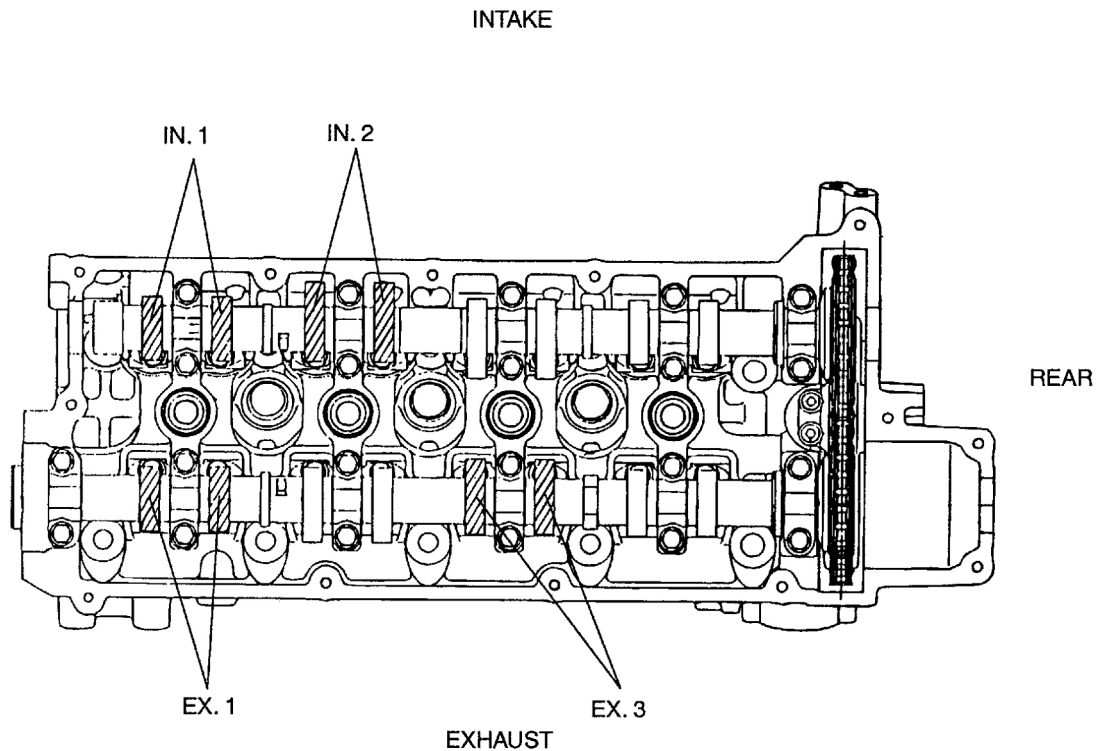
Intake: 0.20 mm (0.0079 in.)

Exhaust: 0.28 mm (0.0110 in.)

[Limit]

Intake: 0.12-0.28 mm (0.0047-0.0110 in.)

Exhaust: 0.20-0.36 mm (0.0079-0.0142 in.)

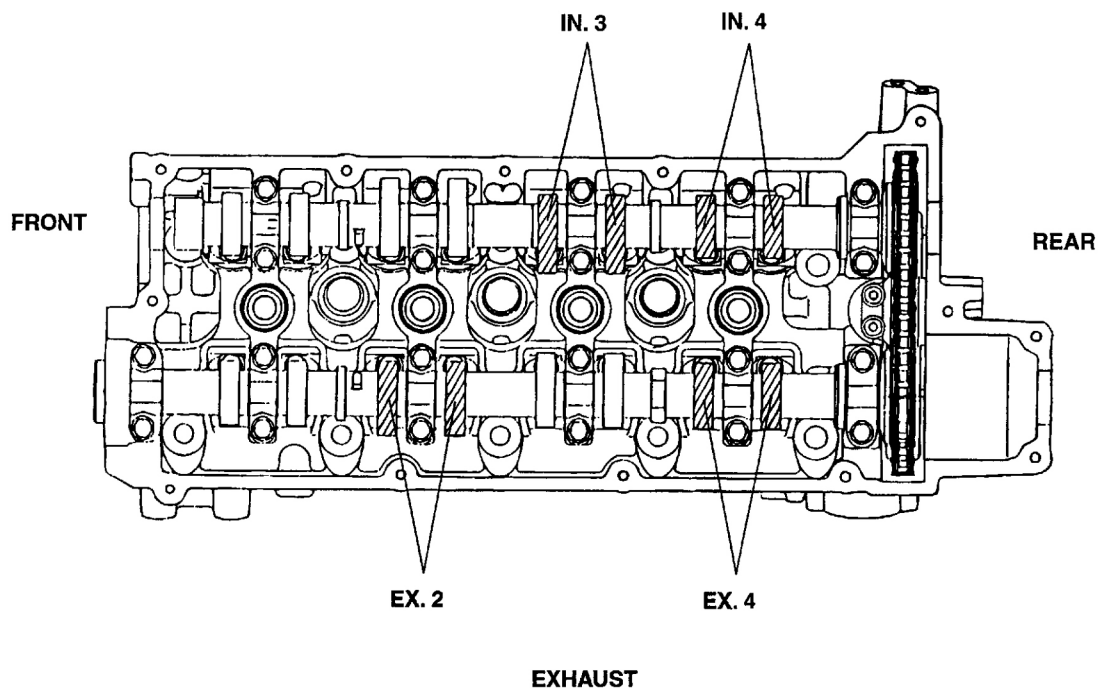


ADJUSTING VALVE AT NO. 1 TOP DEAD CENTER

G01277554

**Fig. 68: Adjusting Valve At No. 1 Top Dead Center**  
Courtesy of HYUNDAI MOTOR CO.

- b. Turn the crankshaft pulley one revolution (360°) and align the groove with timing mark "T" of the lower timing belt cover.
- c. Check only the valves indicated as shown. [No. 4 cylinder: TDC/compression]. Measure the valve clearance.

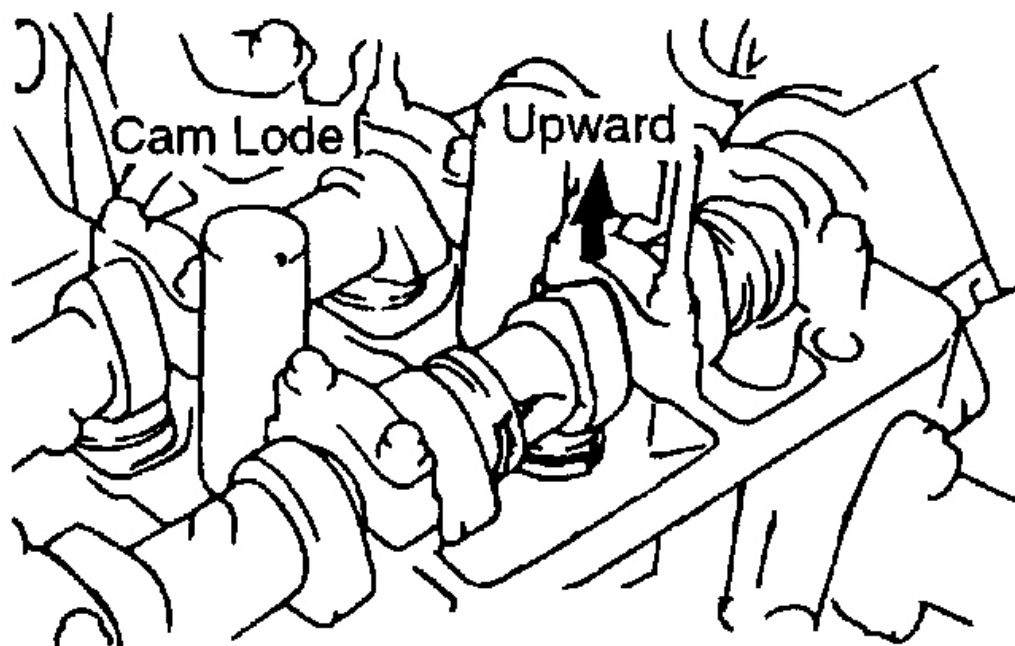


ADJUSTING VALVE AT NO. 4 TOP DEAD CENTER

G01277555

**Fig. 69: Adjusting Valve At No. 4 Top Dead Center**  
Courtesy of HYUNDAI MOTOR CO.

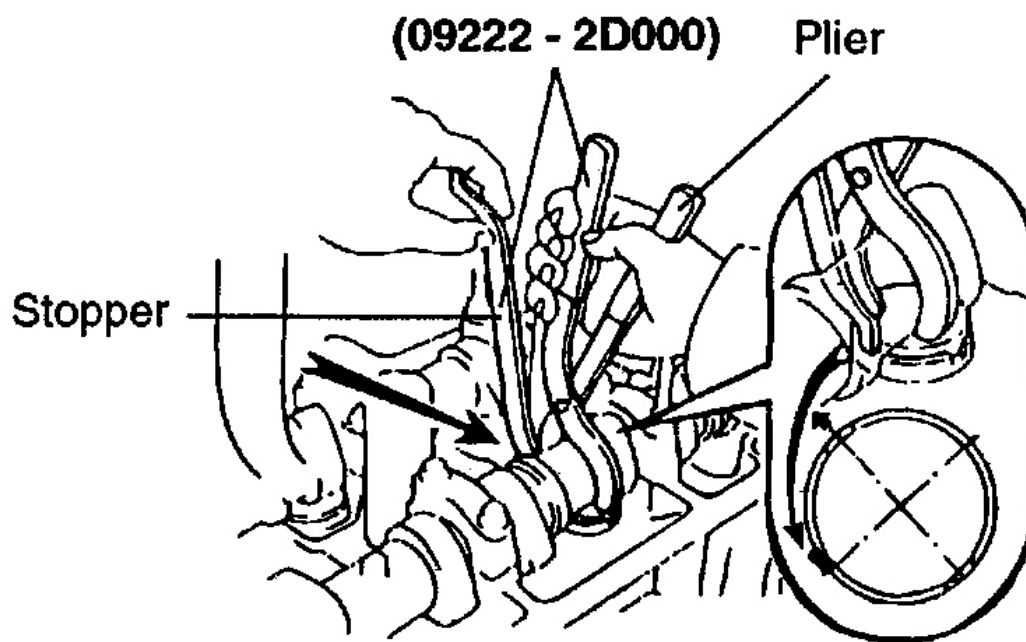
8. Adjust the intake and exhaust valve clearance.
  - a. Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve is upward.



G01277556

**Fig. 70: Identifying Cam Lobe Facing Upward**  
Courtesy of HYUNDAI MOTOR CO.

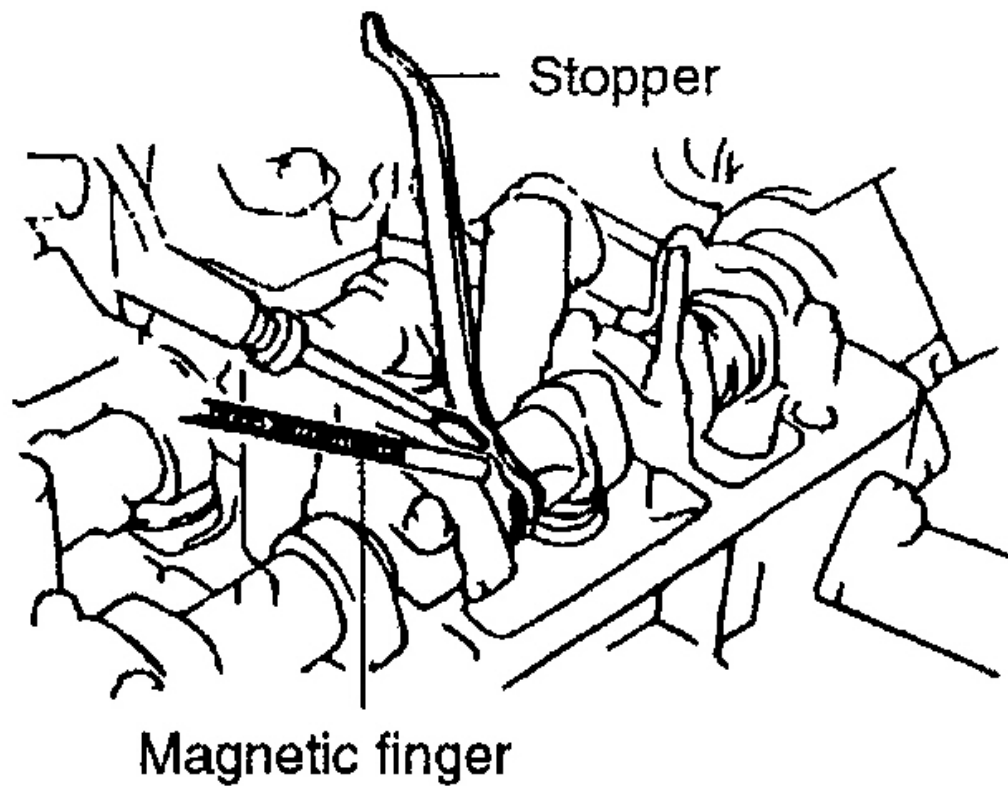
- b. Using the special tool (09220-2D000), press down the valve lifter and place the stopper between the camshaft and valve lifter and remove the special tool.



G01277557

**Fig. 71: Placing Stopper Between Camshaft & Valve Lifter**  
Courtesy of HYUNDAI MOTOR CO.

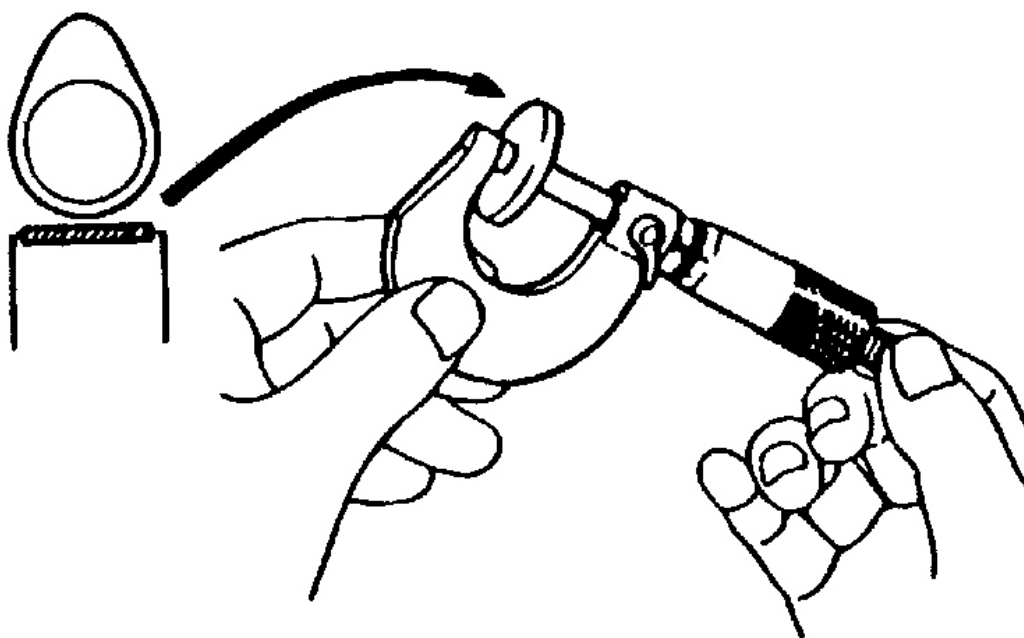
- c. Remove the adjusting shim with a small screw driver and magnet.



G01277558

**Fig. 72: Removing Adjusting Shim**  
Courtesy of HYUNDAI MOTOR CO.

- d. Measure the thickness of the removed shim using a micrometer.



G01277559

**Fig. 73: Measuring Shim**

Courtesy of HYUNDAI MOTOR CO.

- e. Calculate the thickness of a new shim so that the valve clearance comes within the specified value.

Valve clearance (Engine coolant temperature: 20°C)

**T:** Thickness of removed shim

**A:** Measured valve clearance

**N:** Thickness of new shim

**Intake:**  $N = T + [A - 0.20 \text{ mm (0.0079 in.)}]$

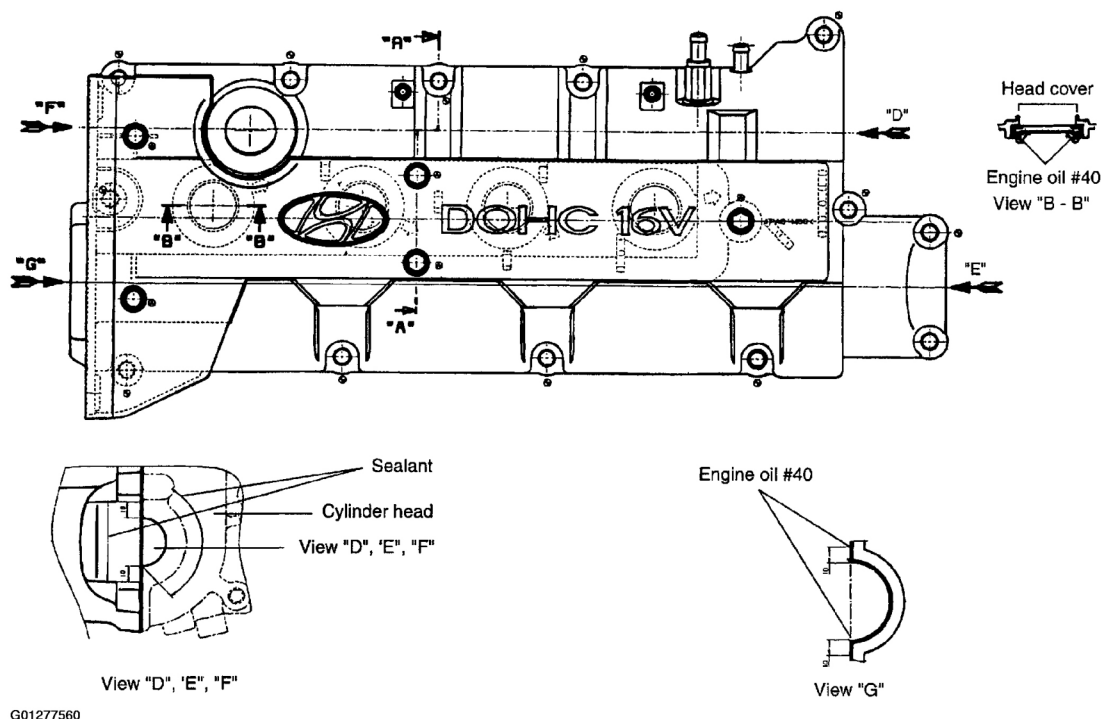
**Exhaust:**  $N = T + [A - 0.28 \text{ mm (0.0110 in.)}]$

- f. Select a new shim with a thickness as close as possible to the calculated value. Refer to **Fig. 74** or **Fig. 75**.

**NOTE:** Shims are available in 20 size increments of 0.04 mm (0.0016 in.) from 2.00 mm (0.079 in.) to 2.76 mm (0.1087 in.)







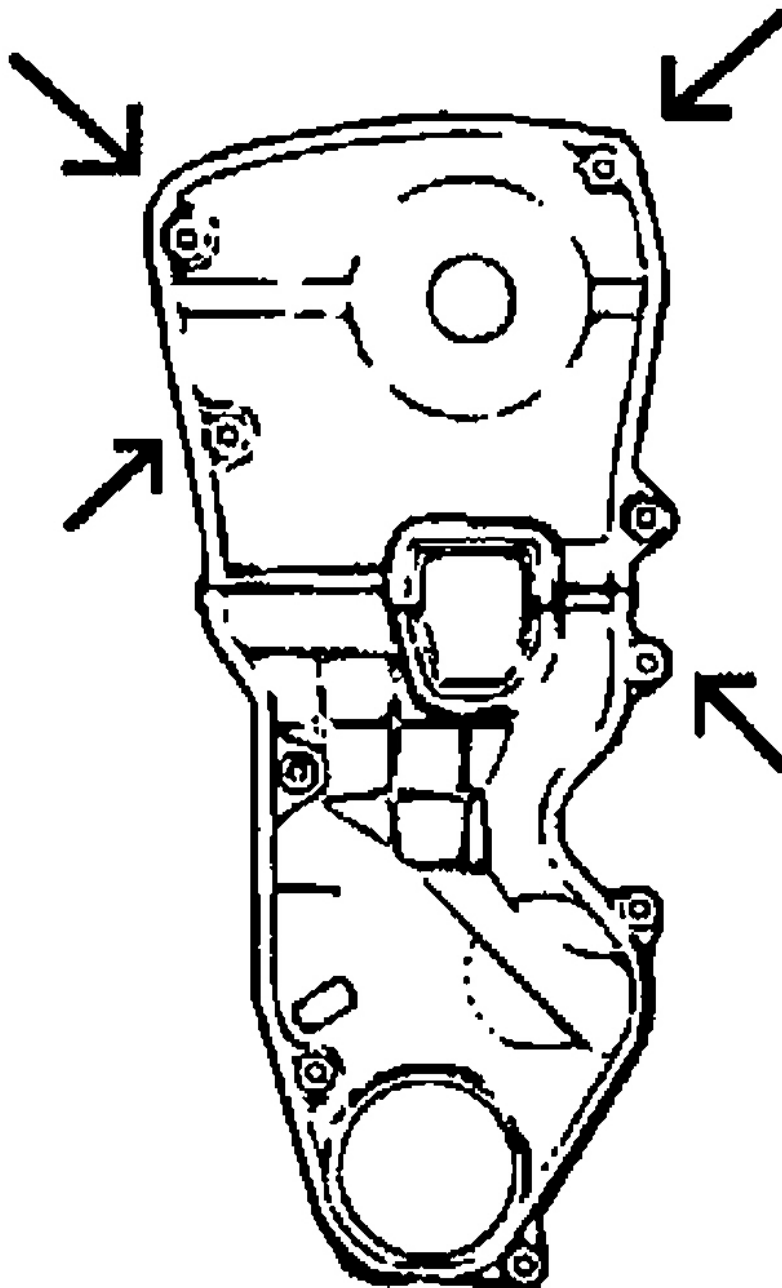
**Fig. 76: Installing Cylinder Head Cover**  
 Courtesy of HYUNDAI MOTOR CO.

3. Install the cylinder head cover.

Cylinder head cover:

8-10 Nm (80-100 kg.cm, 6-7 lb.ft)

4. Connect the accelerator cable.
5. Connect the PCV hose and the breather hose to the cylinder head cover.
6. Connect the spark plug cables to the spark plugs.
7. Install the upper timing belt cover with the four bolts.



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**Fig. 77: Identifying Upper Timing Belt Cover**  
Courtesy of HYUNDAI MOTOR CO.

8. Install the center cover with the five bolts.

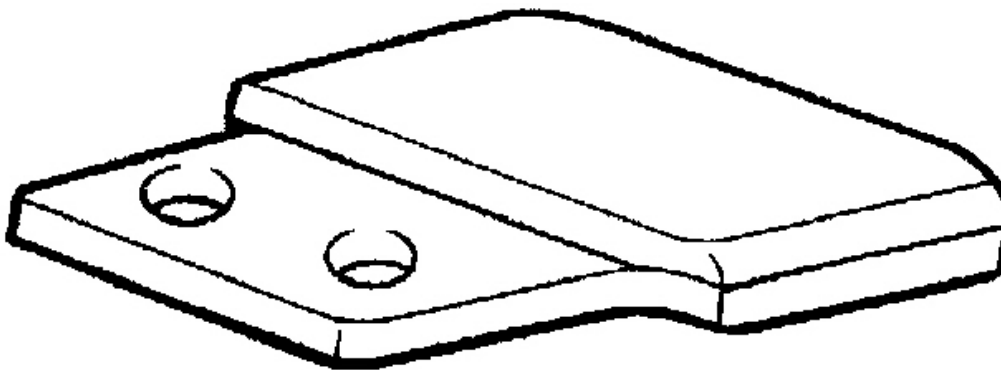
Center cover: 2.5-3.5 Nm (25-35 kg.cm, 2-3 lb.ft)

9. Install the oil filler cap.
10. Install the engine cover.

#### CHAIN GUIDE

1. Check the chain guide for bend, crack or damage, Replace if necessary.
2. Check the rubber part of chain guide for abnormal wear.

Replace if necessary.

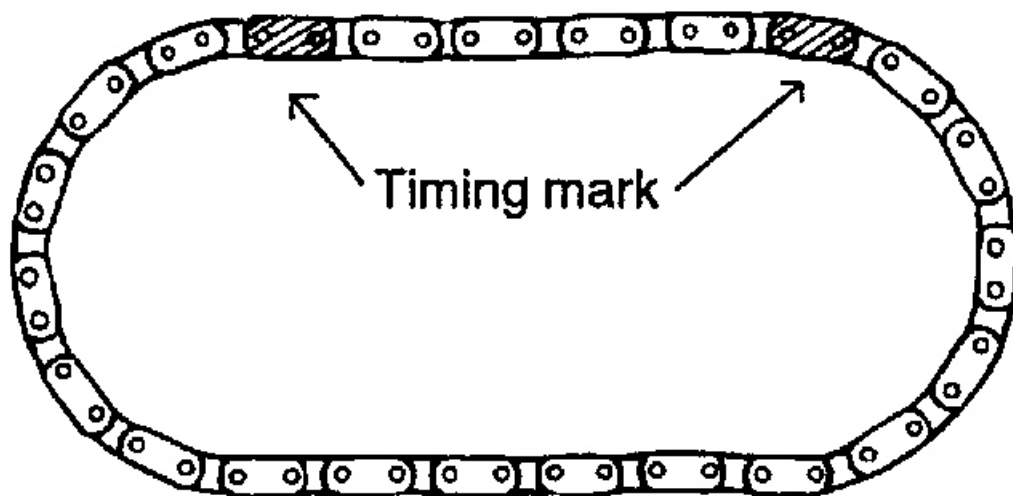


**G01277563**

**Fig. 78: Identifying Chain Guide**  
Courtesy of HYUNDAI MOTOR CO.

#### TIMING CHAIN

Check the bushing and plate of the timing chain for wear. Replace if it is worn severely.



G01277564

**Fig. 79: Identifying Timing Marks On Chain**  
Courtesy of HYUNDAI MOTOR CO.

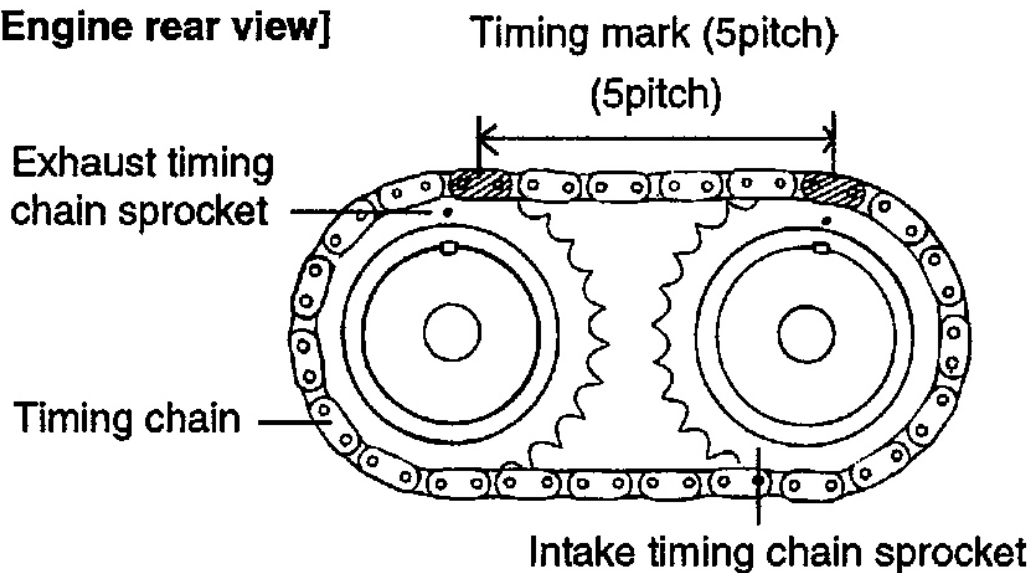
**REASSEMBLY**

1. Install the mechanical tappets and shims.

**NOTE:**        **The mechanical tappets and shims must be reinstalled in their original position.**

2. Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.

[Engine rear view]



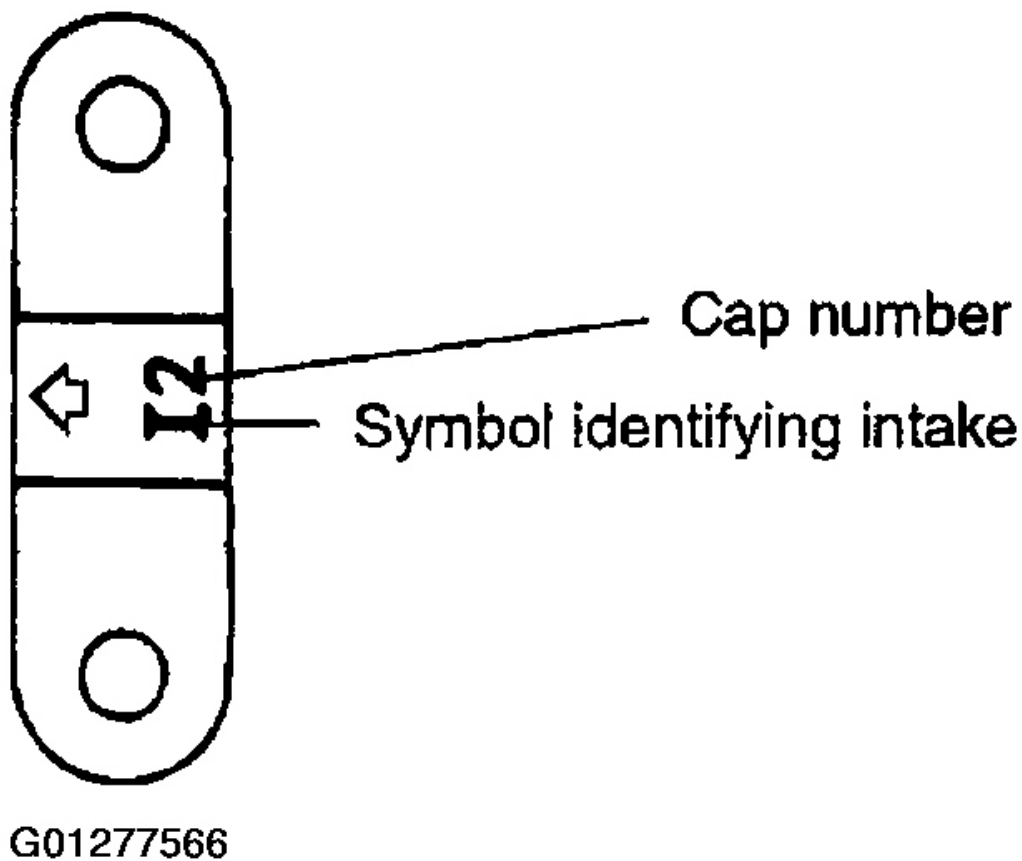
G01277565

**Fig. 80: Identifying Timing Marks On Sprockets & Chain**  
Courtesy of HYUNDAI MOTOR CO.

3. Install the camshaft after lubricating the camshaft journal with engine oil.
4. Install the bearing caps. The markings on the caps are for intake/exhaust identification.

I: Intake camshaft

E: Exhaust camshaft



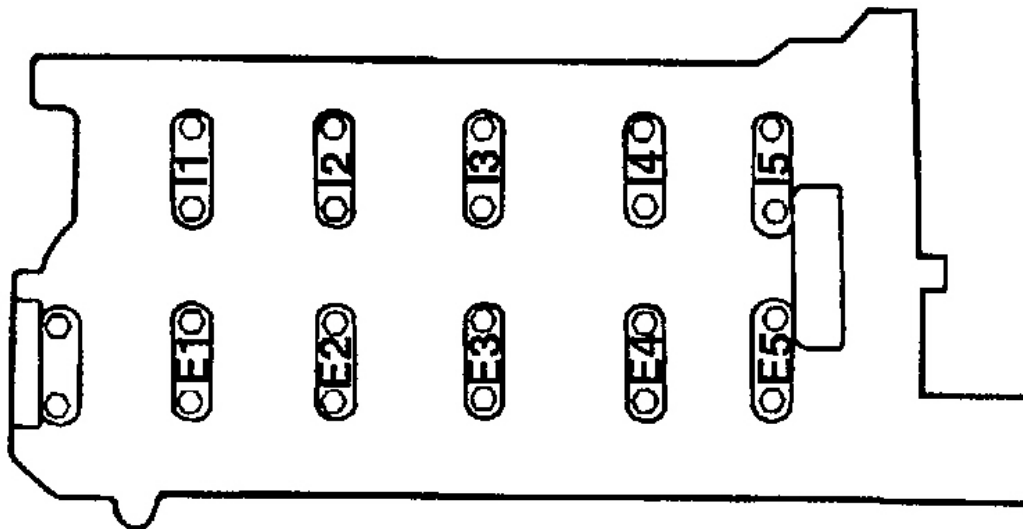
**Fig. 81: Identifying Camshaft Bearing Cap**  
Courtesy of HYUNDAI MOTOR CO.

5. Tighten the bearing caps to the specified torque in two or three steps as shown.

**Tightening torque**

Bearing cap bolt:

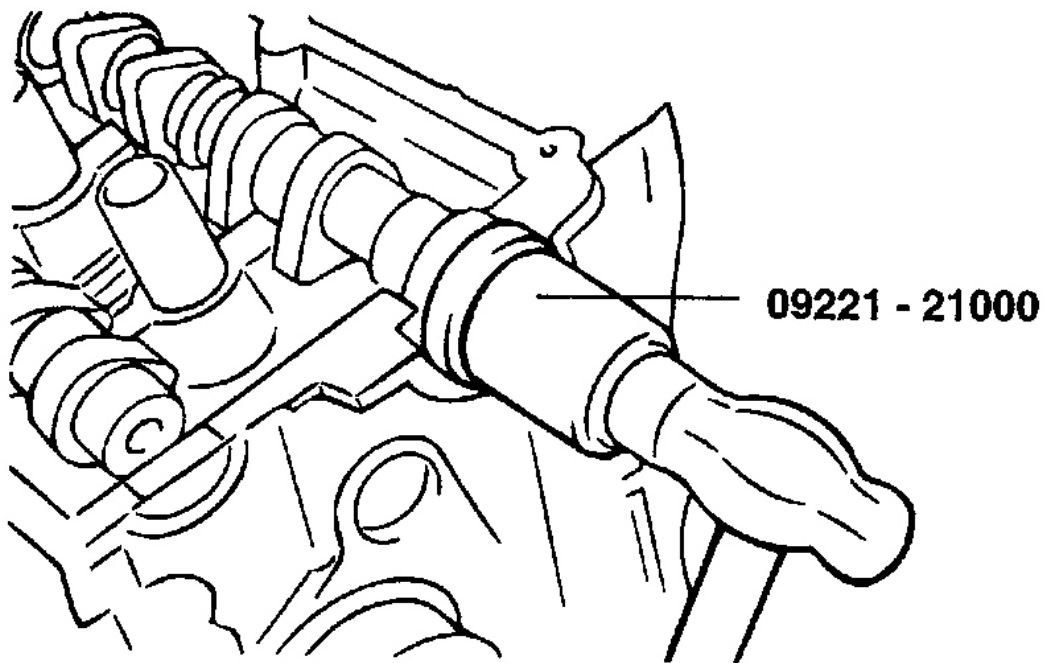
14-15 Nm (140-150 kg.cm, 10-11 lb.ft)



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**Fig. 82: Identifying Camshaft Bearing Cap Positions**  
Courtesy of HYUNDAI MOTOR CO.

6. Using the special tool, camshaft oil seal installer (09221-21000), press the camshaft oil seal. Be sure to apply engine oil to the oil seal lips. Insert the oil seal along the camshaft front end and install by driving the installer with a hammer to 8.5 mm (0.3346 in.) depth from the front end face of the camshaft.



G01277568

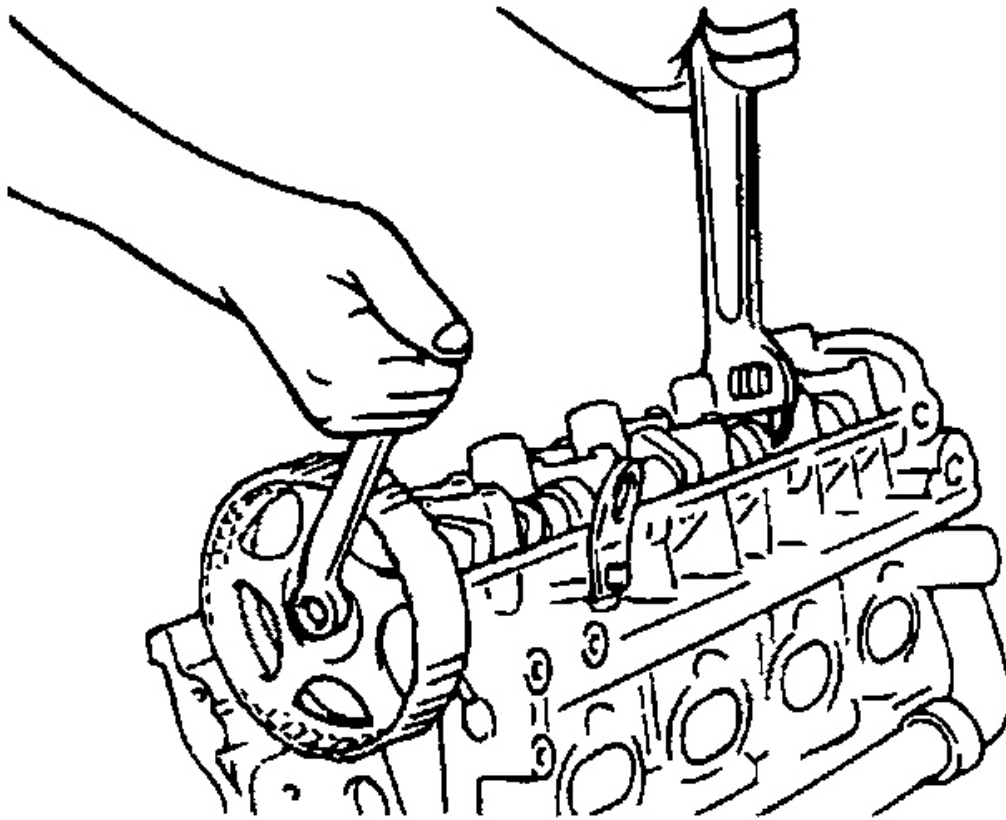
**Fig. 83: Installing Camshaft Oil Seal**  
Courtesy of HYUNDAI MOTOR CO.

7. Install the camshaft sprocket to the specified torque.

**Tightening torque**

Camshaft sprocket bolt:

100-120 Nm (1000-1200 kg.cm, 74-89 lb.ft)



G01277569

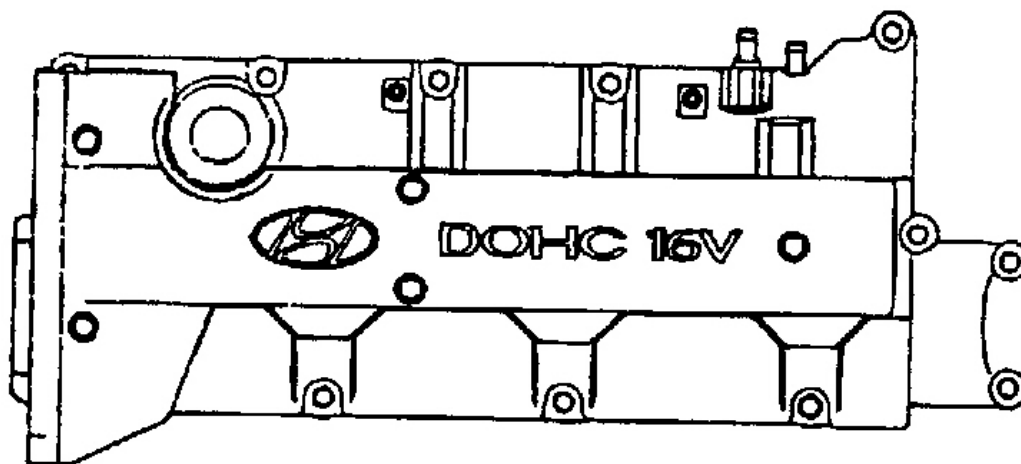
**Fig. 84: Installing Camshaft Sprocket**  
Courtesy of HYUNDAI MOTOR CO.

8. Align the camshaft sprocket and crankshaft sprocket timing marks. Place the piston of the No. 1 cylinder to top dead center on the compression stroke.
9. Install the cylinder head cover.

**Tightening torque**

Cylinder head cover bolts:

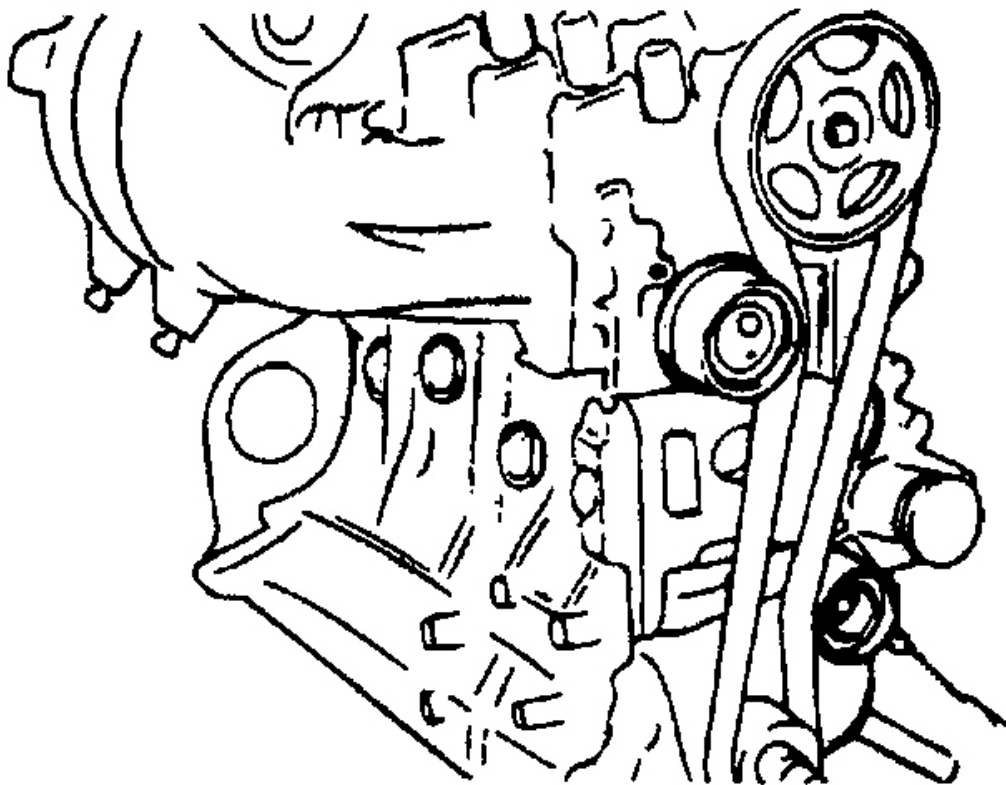
8-10 Nm (80-100 kg.cm, 6-7 lb.ft)



G01277570

**Fig. 85: View Of Cylinder Head Cover**  
**Courtesy of HYUNDAI MOTOR CO.**

10. Install the spark plug cables, ignition coil assembly and cylinder head center cover.
11. Install the timing belt and then tighten the timing belt tensioner pulley.



G01277571

**Fig. 86: View Of Timing Belt Installed**  
Courtesy of HYUNDAI MOTOR CO.

12. Install the timing belt cover.

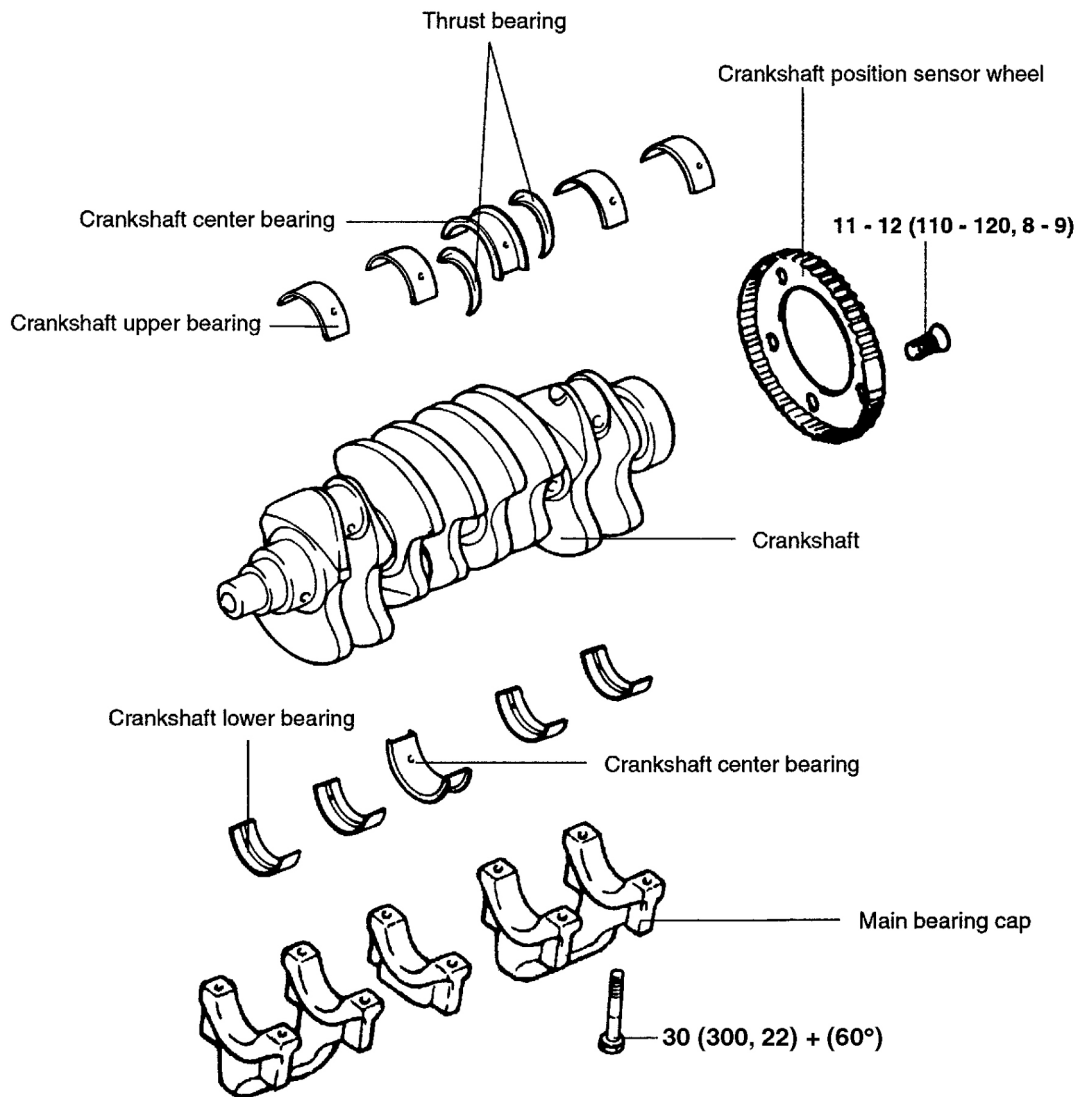
Timing belt cover:

8-10 Nm (80-100 kg.cm, 6-7 lb.ft)

13. Install the coolant pump pulley and crankshaft pulley.

## CRANKSHAFT

### COMPONENTS



**TORQUE : Nm (kg.cm, lb.ft)**

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**Fig. 87: Crankshaft Components**  
Courtesy of HYUNDAI MOTOR CO.

### DISASSEMBLY

1. Remove the timing belt, front case, flywheel, cylinder head assembly and oil pan.
2. Remove the rear plate and the rear oil seal.
3. Remove the connecting rod caps.

**NOTE:** Put the main bearing caps in order of their original position and direction for easier reassembly.

4. Remove the main bearing caps and remove crankshaft crankshaft. Keep the bearings in order by cap number.
5. Remove the crankshaft position sensor wheel.

**INSPECTION****CRANKSHAFT**

1. Check the crankshaft journals and pins for damage, uneven wear and crack. Also check oil holes for clogging. Correct or replace any defective part.
2. Inspect the crankshaft journal for taper and out-of-round.

**Standard value**

Crankshaft journal O.D.: 57 mm (2.2440 in.)

Crankshaft pin O.D.: 45 mm (1.7717 in.)

Crankshaft journal, pin out-of-round and taper

0.01 mm: (0.0004 in.) or less

**MAIN BEARINGS AND CONNECTING ROD BEARINGS**

Visually inspect each bearing for peeling, melting, seizure and improper contact. Replace the defective bearings.

**OIL CLEARANCE MEASUREMENT**

1. Measure the diameter of crankshaft journal and pin.
2. Measure the diameter of crankshaft bore and connecting rod bore.
3. Measure the thickness of crankshaft bearing and connecting rod bearing.
4. Measure the clearance by the value that subtract the diameter of journal and pin and the thickness of bearing from the diameter of bore.

Main bearing oil clearance:

0.028-0.048 mm (0.0011-0.0019 in.)

Connecting rod bearing oil clearance:

(To set limits to new parts)

0.024-0.044 mm (0.0009-0.0017 in.)

**OIL SEAL**

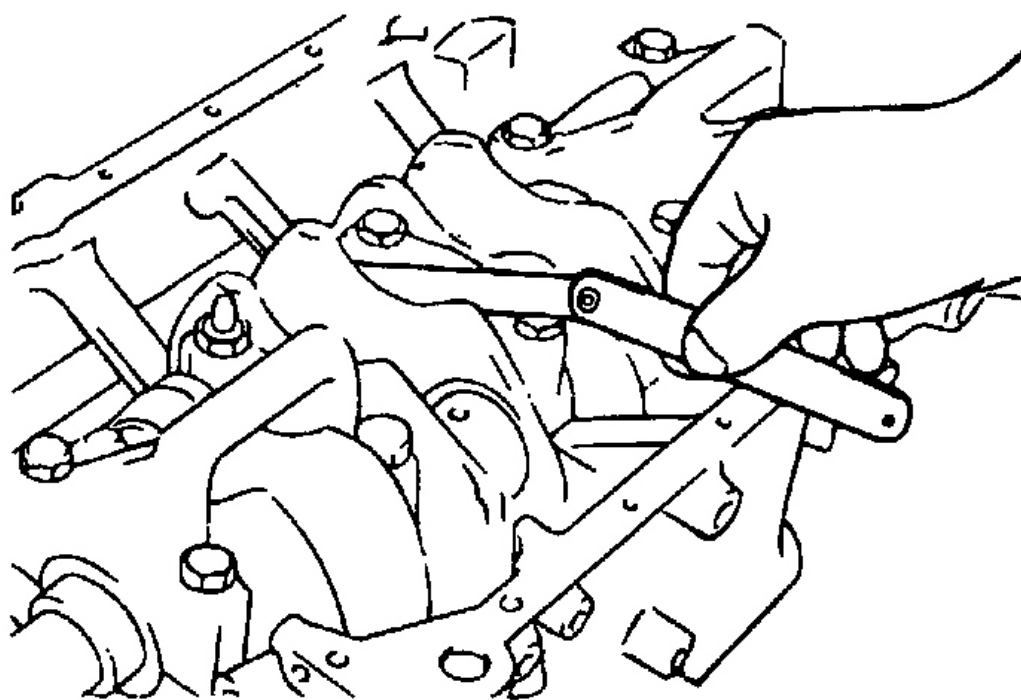
Check front and rear oil seals for damage or worn lips. Replace any defective seal.

**BEARING CAPS**

After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the service limit, replace the crankshaft bearing.

Standard value: 0.06-0.26 mm (0.0023-0.010 in.)

Limit: 0.30 mm (0.0118 in.)



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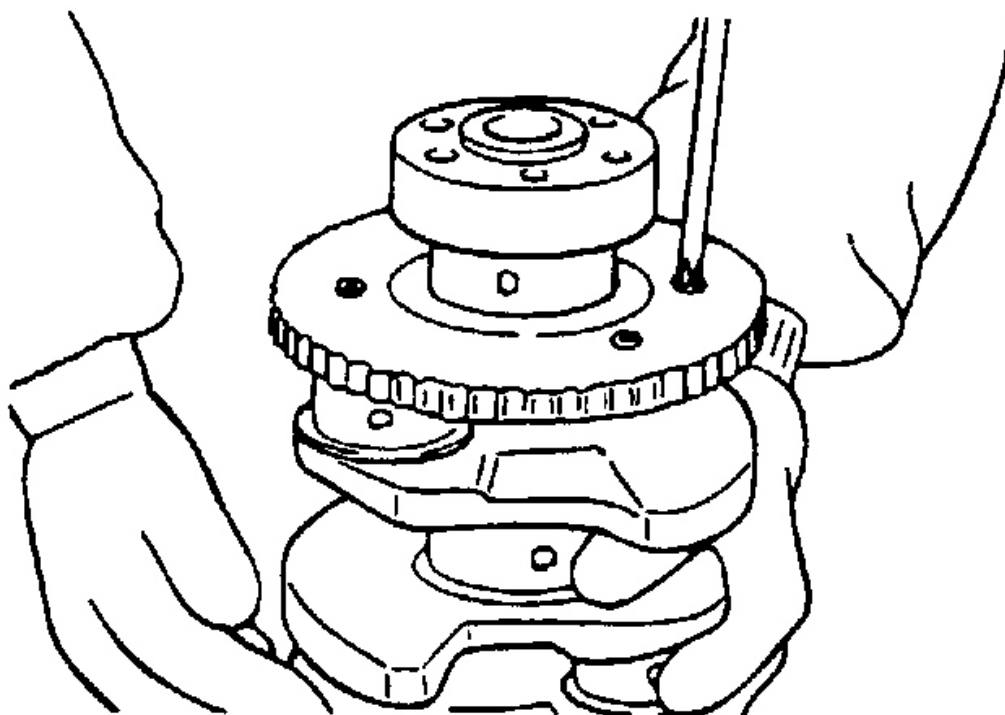
**Fig. 88: Measuring End Play**  
Courtesy of HYUNDAI MOTOR CO.

#### SENSOR WHEEL

1. Remove the crankshaft sensor wheel.
2. Check the crankshaft sensor wheel for damage, crack and wear. Replace if necessary.
3. Check the clearance between crankshaft sensor wheel and crank position sensor with a depth gauge.

#### Standard value

Clearance between crankshaft sensor wheel and crank position sensor:  
0.5-1.1 mm (0.020-0.043 in.)



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**Fig. 89: Measuring Depth Of Sensor Wheel Tooth And Cylinder Block Mounting Surface**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE:**

- Measure the depth of the top of the sensor wheel tooth and the cylinder block mounting surface.
- Measure the difference between sensor length and depth.
- Sensor length is the distance between the end of sensor and inner point of contacting face.

**REASSEMBLY**

1. Install the upper main bearing inserts in the cylinder block.

**When reusing the main bearings, remember to install them by referring to the location marks made when disassembling.**

2. Install the crankshaft. Apply engine oil to the journals.
3. Install bearing caps and tighten the cap bolts to the specified torque in the sequence of the center, No.2,

No.4 front and rear caps. Cap bolts should be tightened evenly in from 2 to 3 stages before they are tightened to the specified torque. The caps should be installed with the arrow mark directed toward the crank pulley side of engine. Cap numbers must be correct.

**Tightening torque**

Main bearing cap bolt:

30 Nm (22lb.ft) + (60°)

Connecting rod cap bolt:

50-53 Nm (37-39 lb.ft)

4. Make certain that the crankshaft turns freely and has the proper clearance between the center main bearing thrust flange and the connecting rod big end bearing.

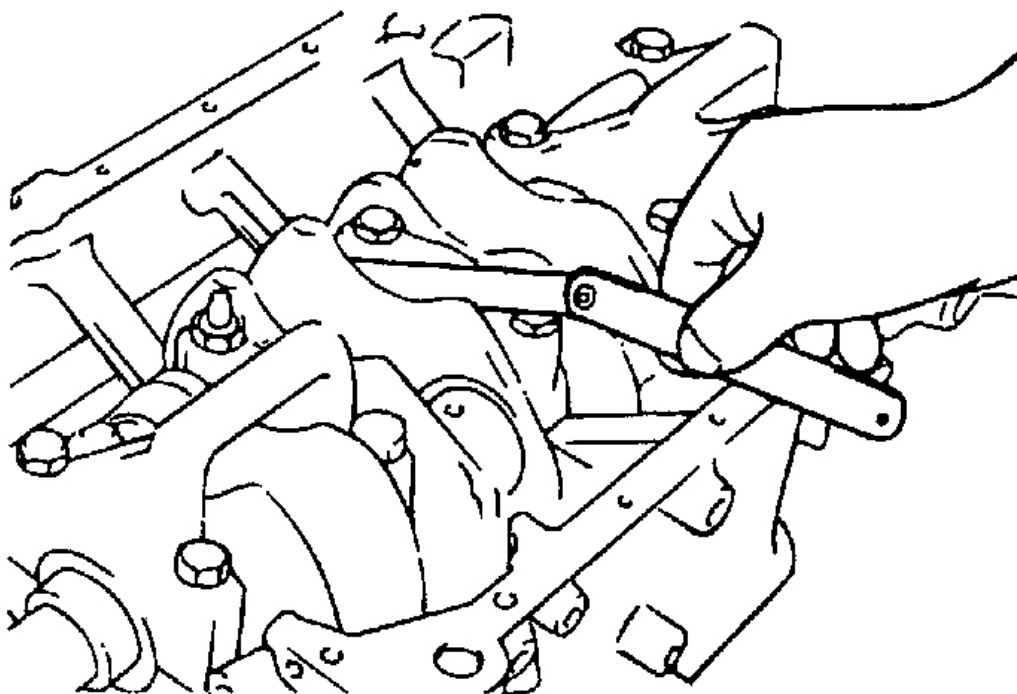
**Standard value**

Crankshaft end play:

0.06-0.260 mm (0.0024-0.0102)

Connecting rod end play:

0.10-0.25 mm (0.0039-0.0098 in.)

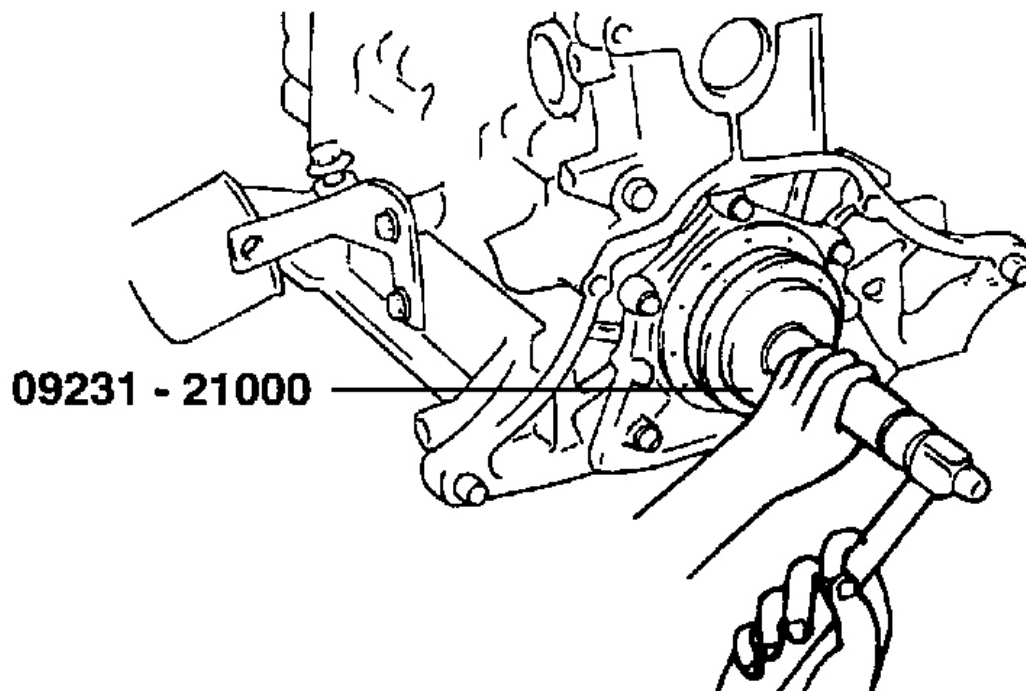


G01277575

**Fig. 90: Measuring End Play**

Courtesy of HYUNDAI MOTOR CO.

5. Using the special tool, crankshaft rear oil seal installer (09231-21000) as shown, install the oil seal in the crankshaft rear oil seal case. Press fit the oil seal being careful not to align it wrong.

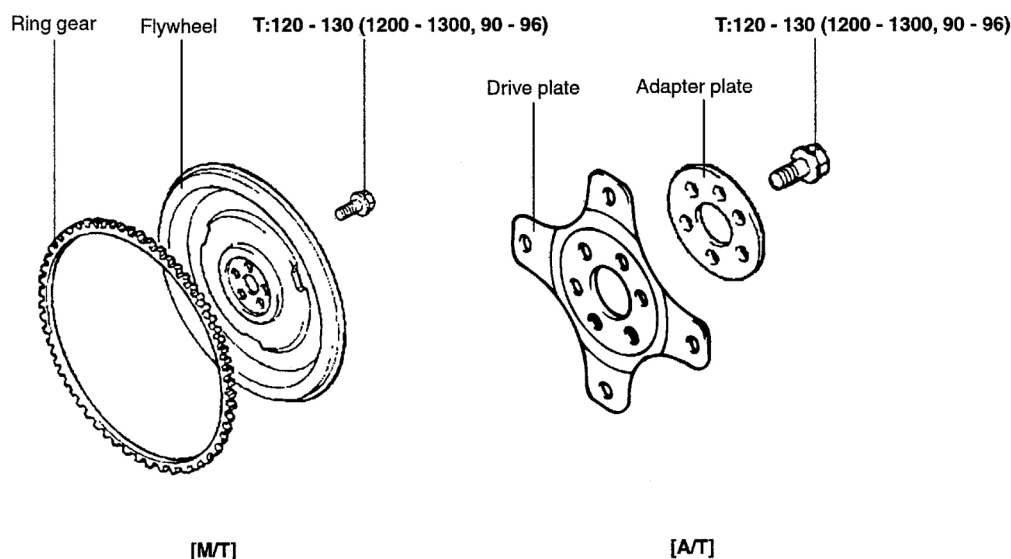
**G01277576**

**Fig. 91: Installing Crankshaft Rear Seal**  
Courtesy of HYUNDAI MOTOR CO.

6. Install the rear plate and tighten the bolts.
7. Install the connecting rod caps.
8. Install the flywheel, front case, oil pan and timing belt.

## **FLYWHEEL**

### **COMPONENTS**



#### TORQUE : Nm (kg.cm, lb.ft)

M/T : Manual Transmission Vehicles

A/T : Automatic Transmission Vehicles

G01277577

**Fig. 92: Flywheel Components**

Courtesy of HYUNDAI MOTOR CO.

#### DISASSEMBLY

1. Remove the transmission and clutch.
2. Remove the flywheel.

#### INSPECTION

1. Check the clutch disc contacting surface of the flywheel for damage and wear. Replace the flywheel if excessively damaged or worn.
2. Check the clutch disc contacting surface of the flywheel for runout.

#### Standard value

Flywheel run-out: 0.1 mm (0.004 in.)

3. Check the ring gear for damage, crack and wear, and replace if necessary.

#### REASSEMBLY

Install the flywheel assembly and tighten the bolts to the specified torque.

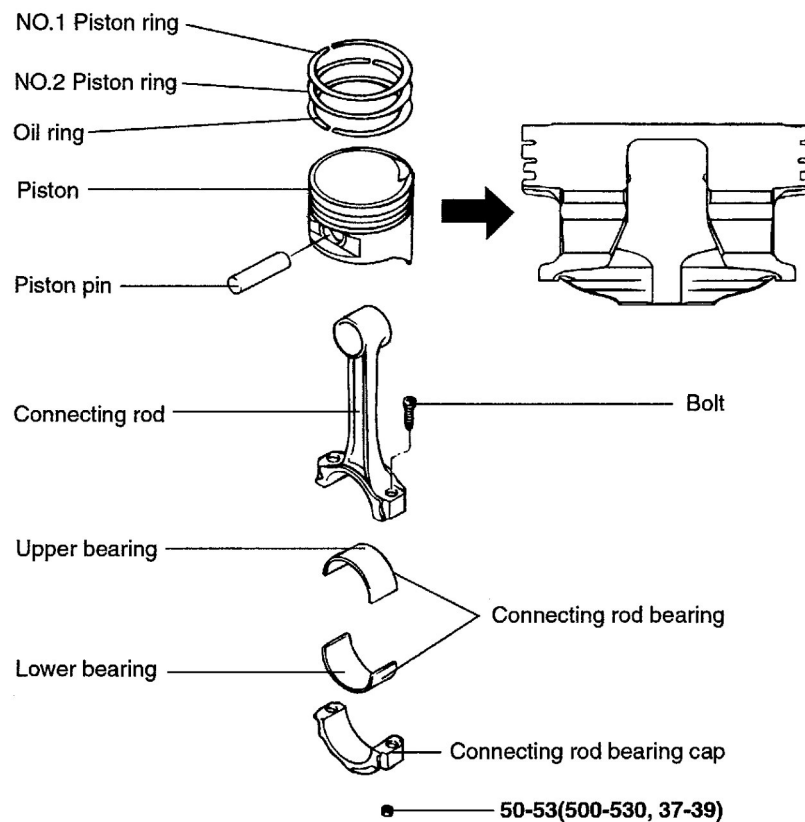
## Tightening torque

Flywheel bolt:

120-130 Nm (1200-1300 kg.cm, 90-96 lb.ft)

## PISTON

### COMPONENTS



**TORQUE : Nm (kg.cm, lb.ft)**

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**Fig. 93: Piston Components**

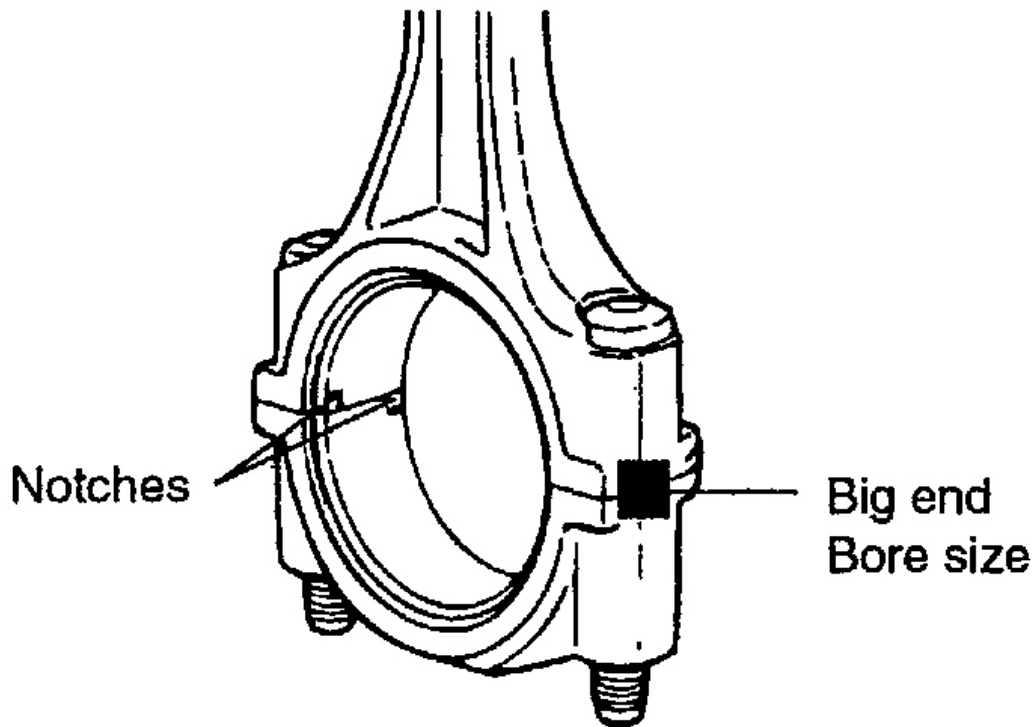
Courtesy of HYUNDAI MOTOR CO.

## DISASSEMBLY

### CONNECTING ROD CAP

**CAUTION:** Keep the bearings in order with their corresponding connecting rods (according to cylinder numbers) for proper reassembly.

1. Remove the connecting rod cap bolts, then remove the caps and the big end lower bearing.
2. Push each piston connecting rod assembly toward the top of the cylinder.

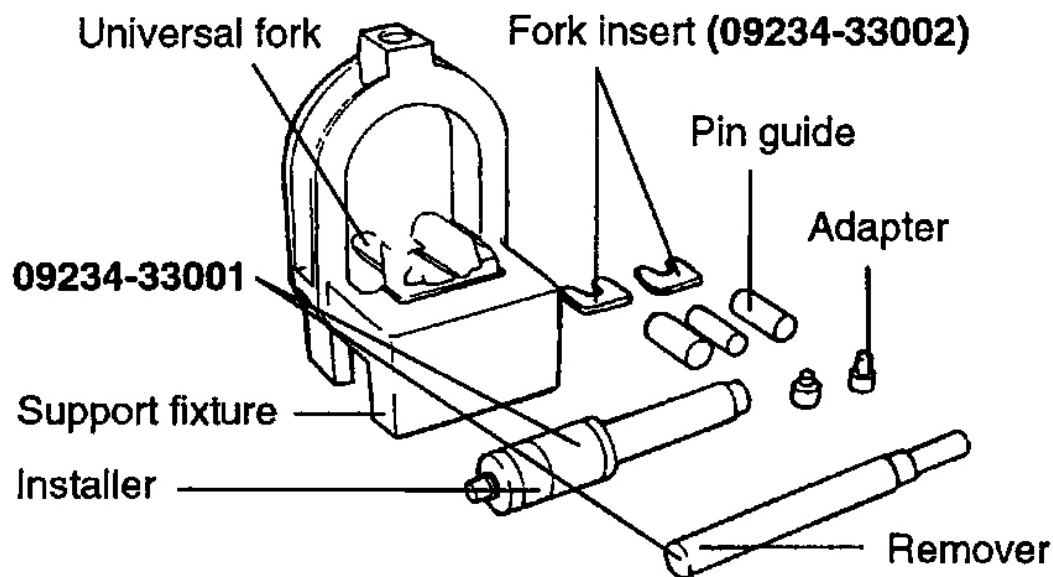


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**Fig. 94: Identifying Connecting Rod Bearing Notches**  
Courtesy of HYUNDAI MOTOR CO.

#### DISASSEMBLY AND REASSEMBLY OF THE PISTON PIN

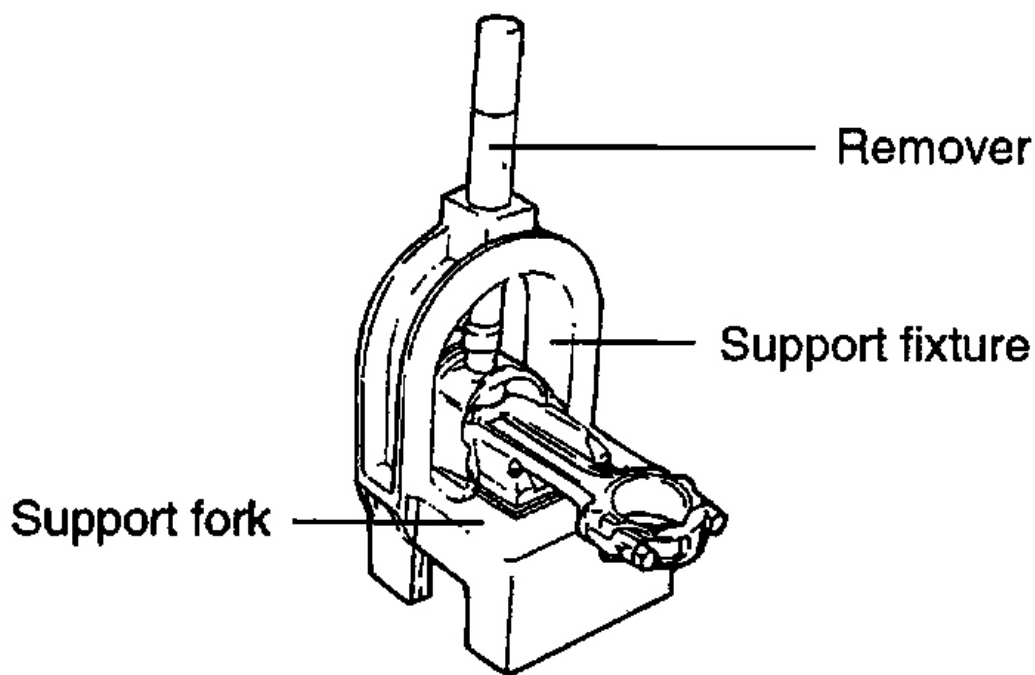
1. Using the special tools (09234-33001) and (09234-33002), disassemble and reassemble the piston and connecting rod.



G01277580

**Fig. 95: Identifying Special Tool**  
Courtesy of HYUNDAI MOTOR CO.

2. The piston pin is press fit into the rod little end, and the piston floats on the pin.
3. The tool consists of a support fixture with fork inserts, guides, adapters, an installer and a remover. The piston is supported in the support fixture while the pin is being installed or removed. Guides help position the pin as it is installed or removed, while the rod is supported by fork inserts.
4. To remove the pin from the piston, place the piston in the support fixture with the rod resting on the fork inserts. Pass the remove tool through the top of the support fixture and use it to press out the pin.



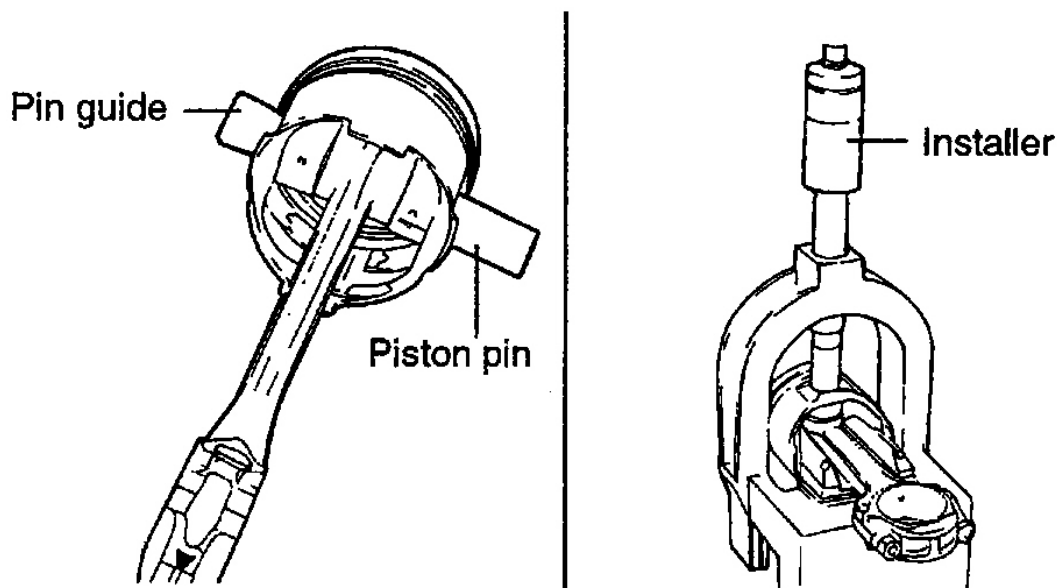
G01277581

**Fig. 96: Removing Piston Pin**

Courtesy of HYUNDAI MOTOR CO.

5. To install a new pin, the proper fork inserts must be in place to support the rod.
6. Position the rod inside the piston. Insert the proper pin guide through one side of the piston and through the rod. Hand tap the pin guide so it is held by the piston. Insert the new pin into the piston from the other side and set the assembly into the support fixture with the pin guide facing down.

**NOTE:** The pin guide should be centered on the connecting rod through the piston. If assembled correctly, the pin guide will sit exactly under the center of the hole in the tool's arch, and rest evenly on the fork inserts. If the wrong size pin guide is used, the piston and pin will not line up with the support fixture.



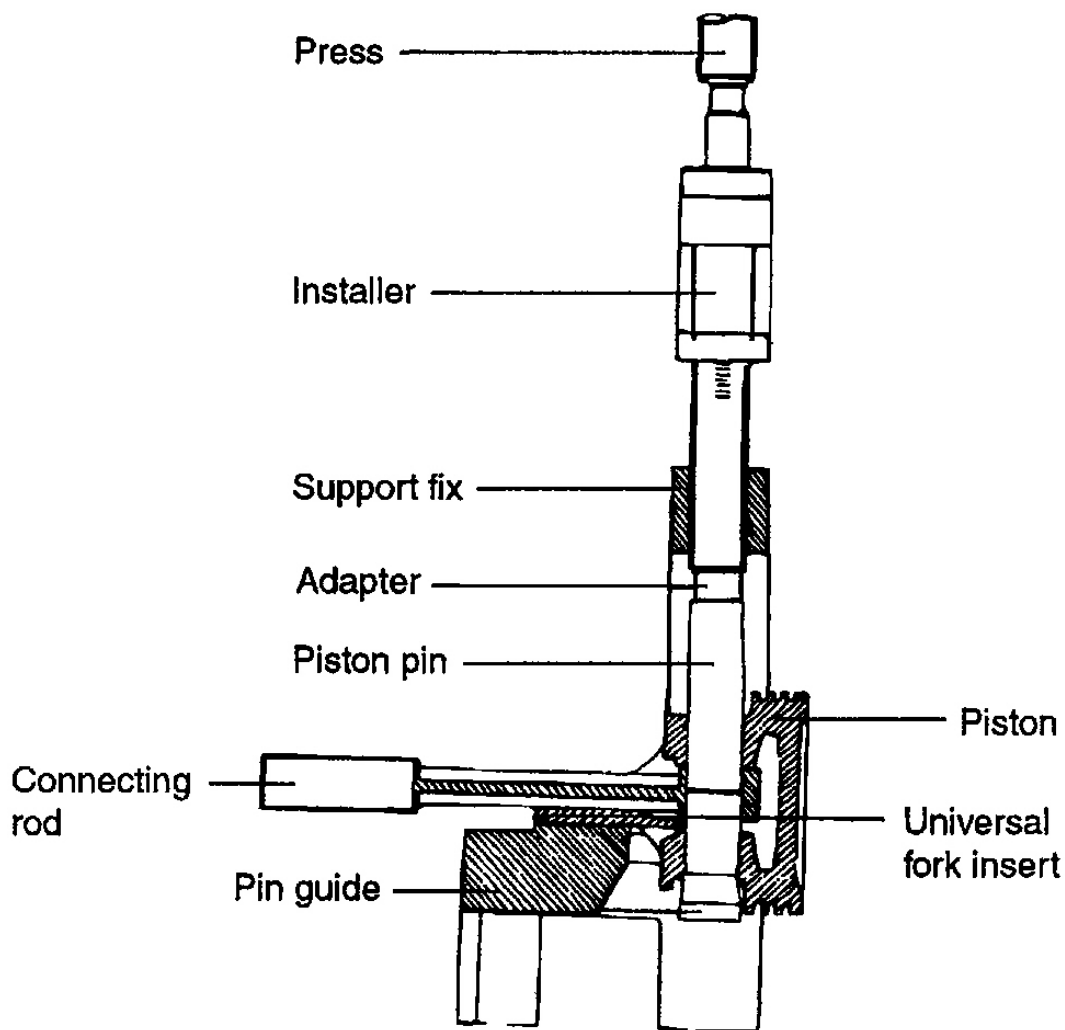
G01277582

**Fig. 97: Installing Piston Pin**

Courtesy of HYUNDAI MOTOR CO.

7. Insert the installer tool through the hole in the arch of the support fixture and use a hydraulic press to force the piston pin through the rod little end. Continue pressing until the pin guide falls free and the installer tool seats against the top of the arch.

**CAUTION: Do not exceed 350-1350 kgf of force when the installing tool seats against the top of the arch.**



G01277583

**Fig. 98: Using Hydraulic Press To Force Piston Pin Through Rod Little End**  
Courtesy of HYUNDAI MOTOR CO.

## INSPECTION

### PISTONS AND PISTON PINS

1. Check each piston for scuffing, scoring, wear and other defects. Replace any piston that is defective.
2. Check each piston ring for breakage, damage and abnormal wear. Replace the defective rings. When the piston requires replacement, its rings should also be replaced.
3. Check that the piston pin fits in the piston pin hole. Replace any piston and pin assembly that is defective. The piston pin must be smoothly pressed by hand into the pin hole (at room temperature)

**PISTONS RINGS**

1. Measure the piston ring side clearance. If the measured value exceeds the service limit, insert a new ring in the ring groove to measure the side clearance. If the clearance still exceeds the service limit, replace the piston and rings together. If it is less than the service limit, replace only the piston rings only.

**Piston ring side clearance**

No. 1: 0.04-0.08 mm (0.0016-0.0031 in.)

No. 2: 0.03-0.07 mm (0.0012-0.0028 in.)

**Limit**

No. 1: 0.1 mm (0.004 in.)

No. 2: 0.1 mm (0.004 in.)

2. To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston ring.

**Piston ring end gap****[Standard]**

No. 1: 0.23-0.38 mm (0.0091-0.0150 in.)

No. 2: 0.33-0.48 mm (0.0130-0.0189 in.)

Oil ring: 0.20-0.60 mm (0.0079-0.0236 in.)

**[Limit]**

No. 1, 2 oil ring: 1.0 mm (0.039 in.)

3. When replacing the ring without correcting the cylinder bore, check the gap with the ring situated at the low part of cylinder that is less worn out.

**PISTON RING SERVICE SIZE AND MARK**

| <b>Standard</b>          | <b>None</b> |
|--------------------------|-------------|
| 0.25 mm (0.010 in.) O.S. | 25          |
| 0.25 mm (0.010 in.) O.S. | 50          |
| 0.75 mm (0.030 in.) O.S. | 75          |
| 1.00 mm (0.039 in.) O.S. | 100         |

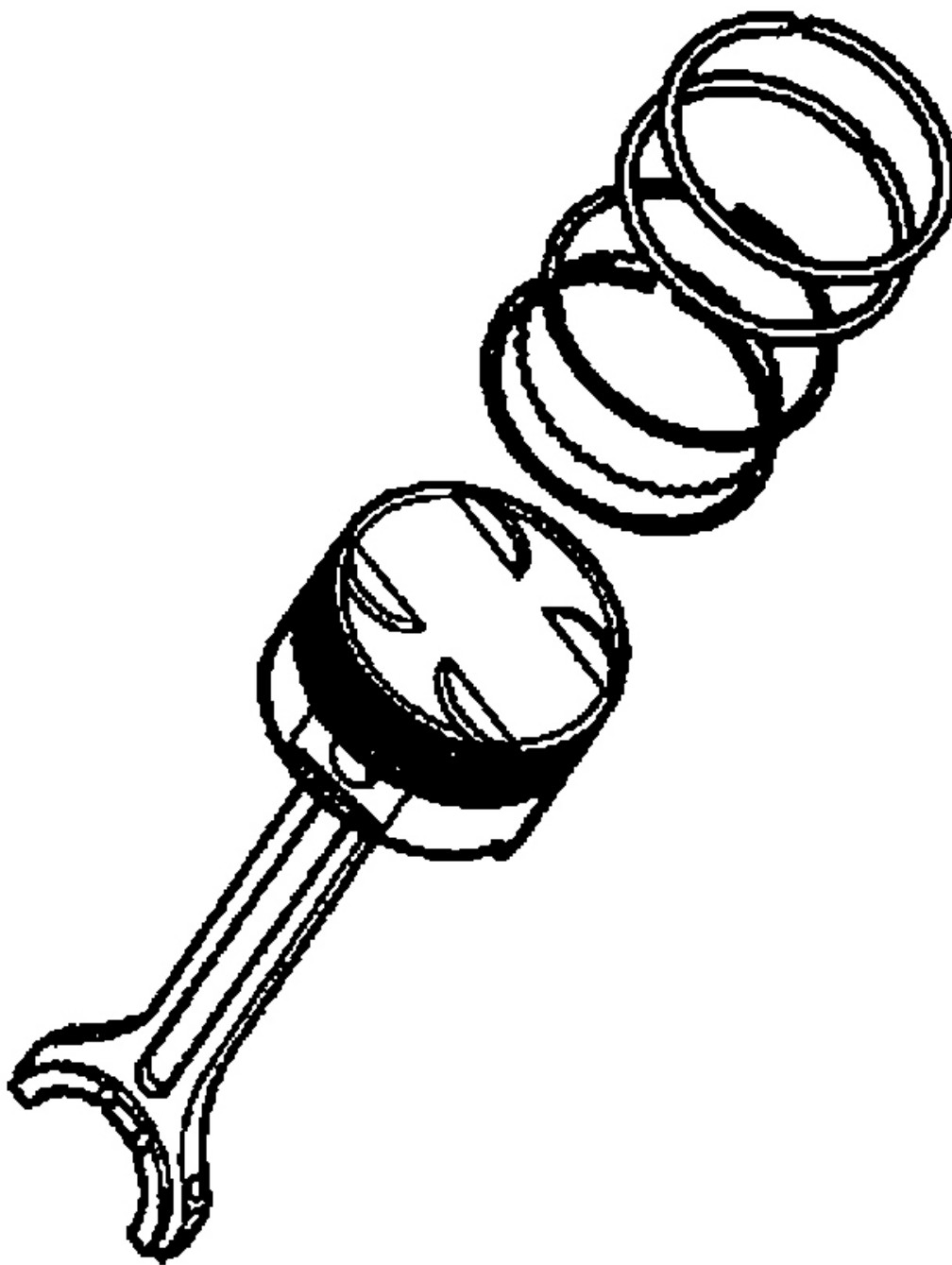
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|                                            |
|--------------------------------------------|
| <b>2002 Hyundai Elantra GLS</b>            |
| 2002 ENGINE 2.0L 4 Cylinder DOHC - Elantra |

**Fig. 99: Piston Ring Service Size & Mark Table**

Courtesy of HYUNDAI MOTOR CO.

**NOTE:**        The mark can be found on the upper side of the ring next to the end.

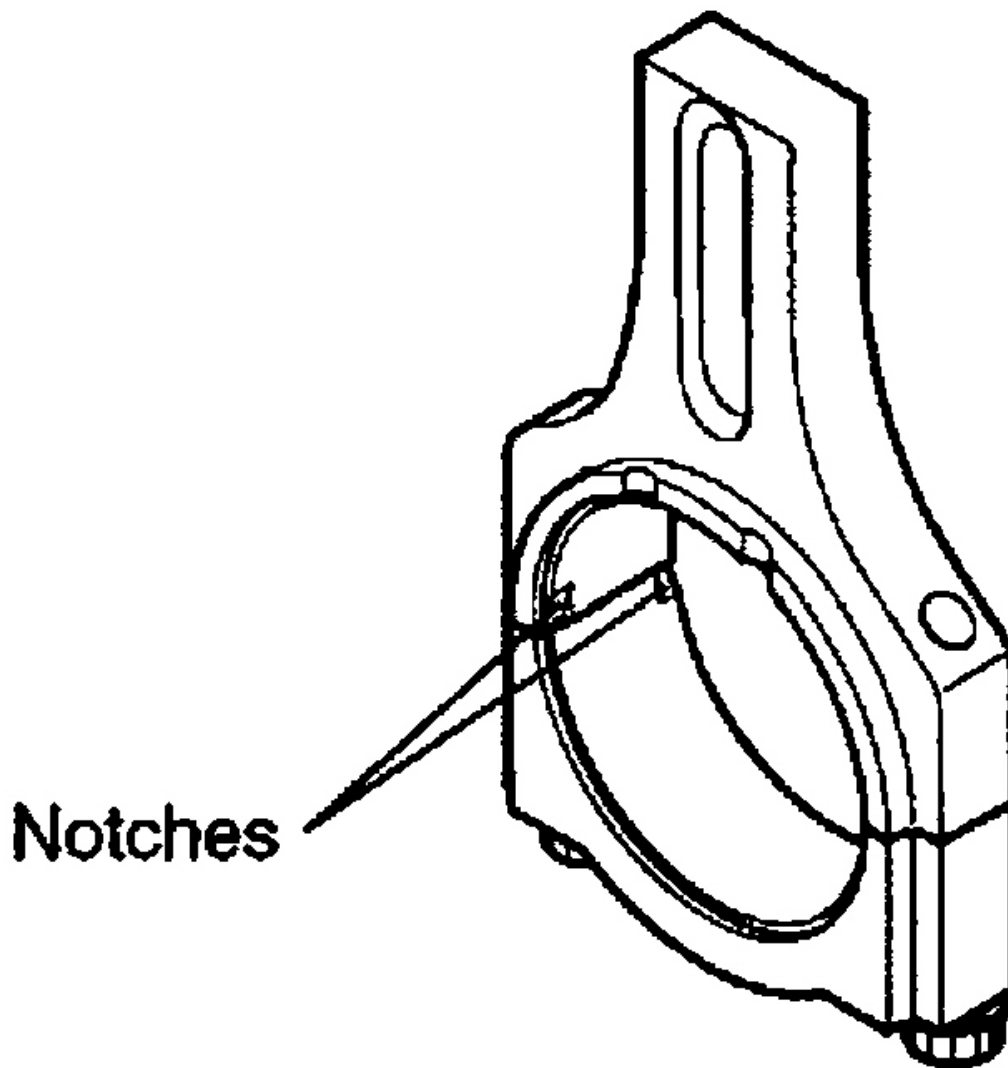


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**Fig. 100: View Of Piston & Rings**  
Courtesy of HYUNDAI MOTOR CO.

**CONNECTING RODS**

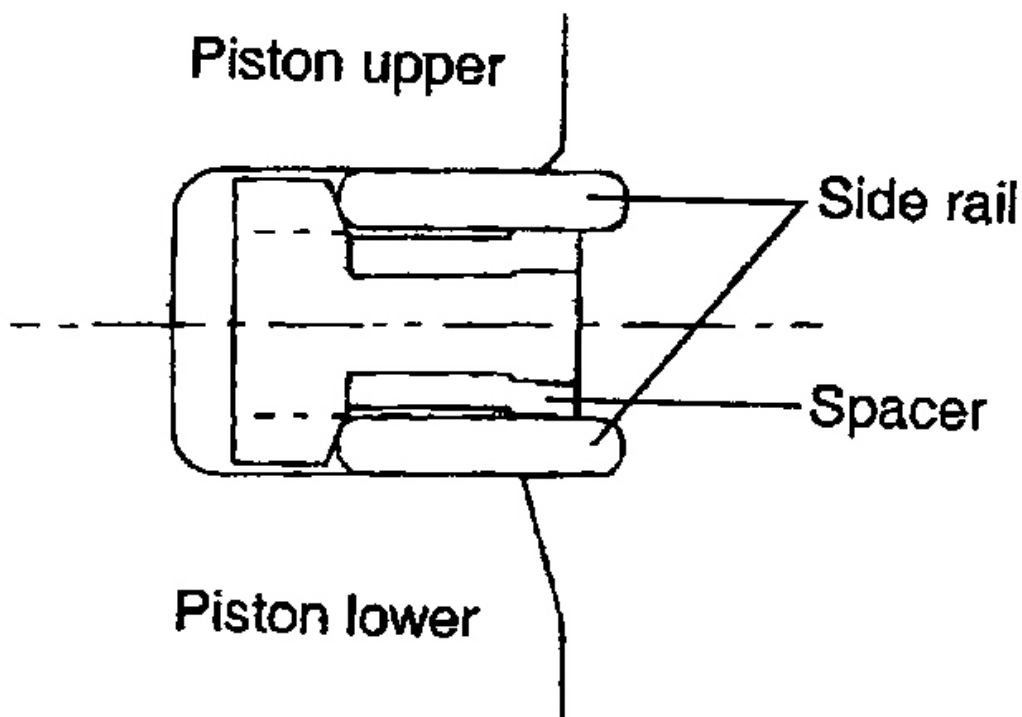
1. When the connecting rod cap is installed, make sure that the cylinder numbers match. (marked on rod end cap at disassembly) When a new connecting rod is installed, make sure that the notches holding the bearing in place are on the same side.
2. Replace the connecting rod if it is damaged at either end of the thrust faces. If it has a stratified wear in, or if the surface of the inside diameter of the small end is severely rough, replace the rod.

**G01277586****Fig. 101: Identifying Connecting Rod Bearing Notches**

Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

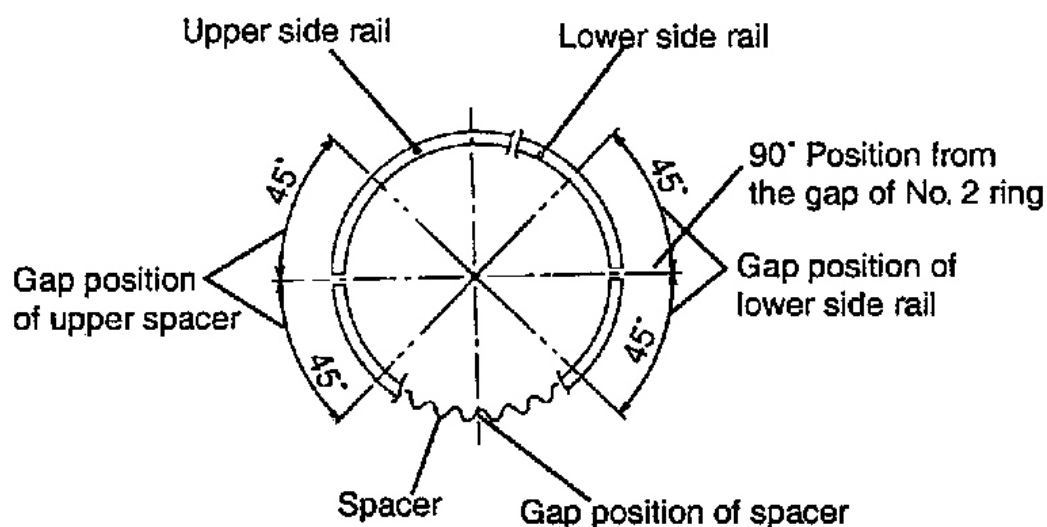
1. Install the spacer.



G01277587

**Fig. 102: Identifying Spacer**

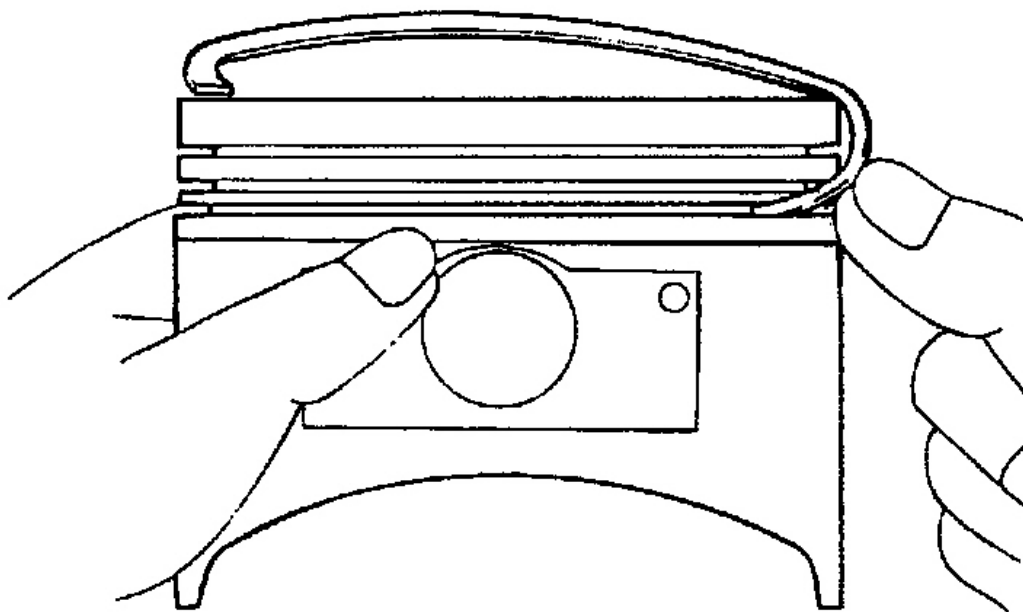
Courtesy of HYUNDAI MOTOR CO.



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**Fig. 103: Identifying Spacer Installation**  
Courtesy of HYUNDAI MOTOR CO.

2. Install the upper side rail. To install the side rail, first put one end of the side rail between the piston ring groove and spacer, hold it firmly, and press down with a finger on the portion to be inserted into the groove (as illustrated).



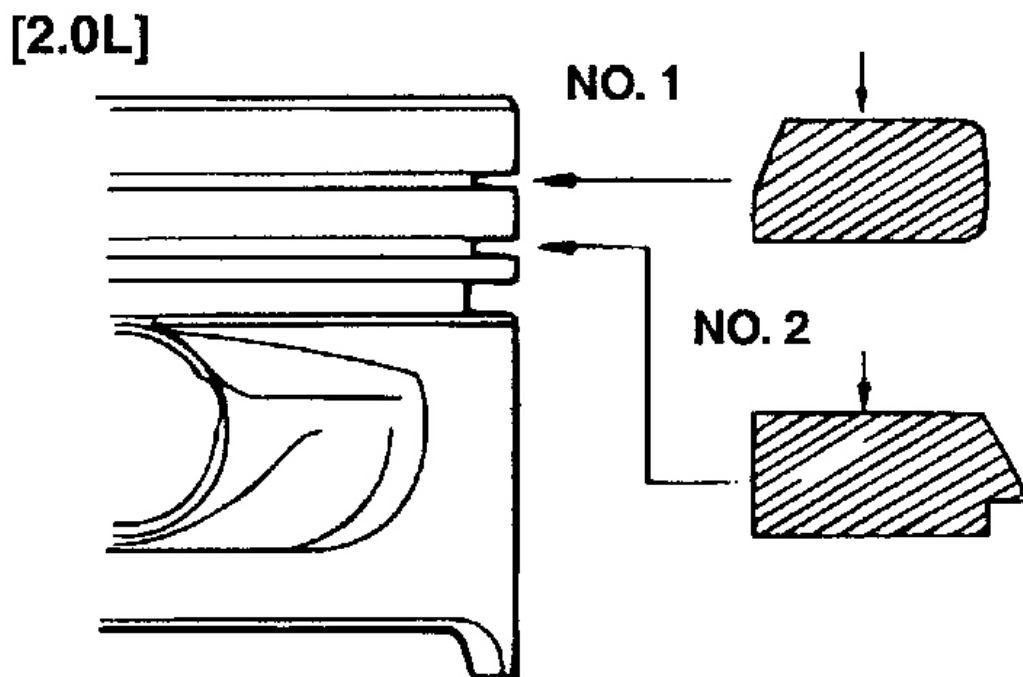
G01277589

**Fig. 104: Installing Side Rail**

Courtesy of HYUNDAI MOTOR CO.

**CAUTION:** Do not use a piston ring expander when installing side rail.

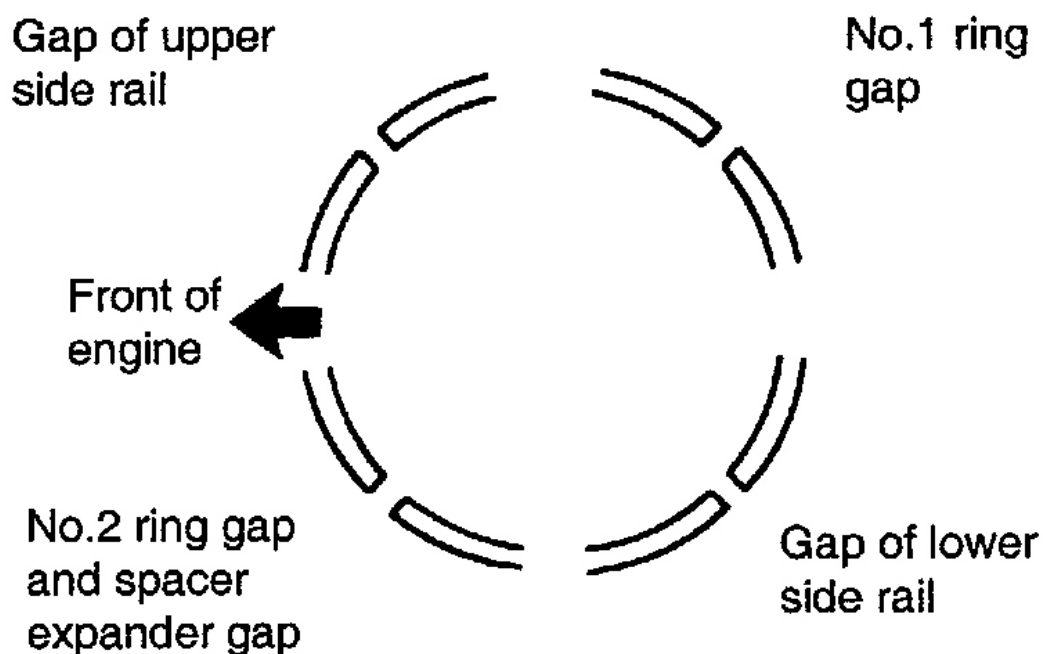
3. Install the lower side rail using the same procedure described in Step 2.
4. Apply engine oil around the piston and piston grooves.
5. Using a piston ring expander, install the No.2 piston ring.
6. Install the No. 1 piston ring.



G01277590

**Fig. 105: Identifying Piston Ring Installation**  
Courtesy of HYUNDAI MOTOR CO.

7. Position each piston ring end gap as far away from its neighboring gaps as possible. Make sure that the gaps are not positioned in the thrust and pin directions.
8. Hold the piston rings firmly with a piston ring compressor as they are inserted into cylinder.



G01277591

**Fig. 106: Identifying Piston Ring Gaps**  
Courtesy of HYUNDAI MOTOR CO.

9. Install the upper main bearings in the cylinder block.
10. Install the lower main bearings in the main bearing caps.
11. Make sure that the front mark of the piston and the front mark (identification mark) of the connecting rod are directed toward the front of the engine.
12. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
13. When assembling, bolts should be fastened by the angle-torque controlled method as the following.
  1. Apply oil to the thread of nuts and spot areas.
  2. Tighten the connecting rod bolt.

#### **Tightening torque**

Connecting rod cap nut:

50-53 Nm (500-530 kg.cm, 36-39 lb.ft)

**CAUTION: After removing the connecting rod bolt, do not use it again.  
When using a new bolt, do not tighten the bolt more than 3**

**times.**

14. Check the connecting rod side clearance.

**Connecting rod side clearance**

Standard: 0.10-0.25 mm (0.0039-0.0098 in.)

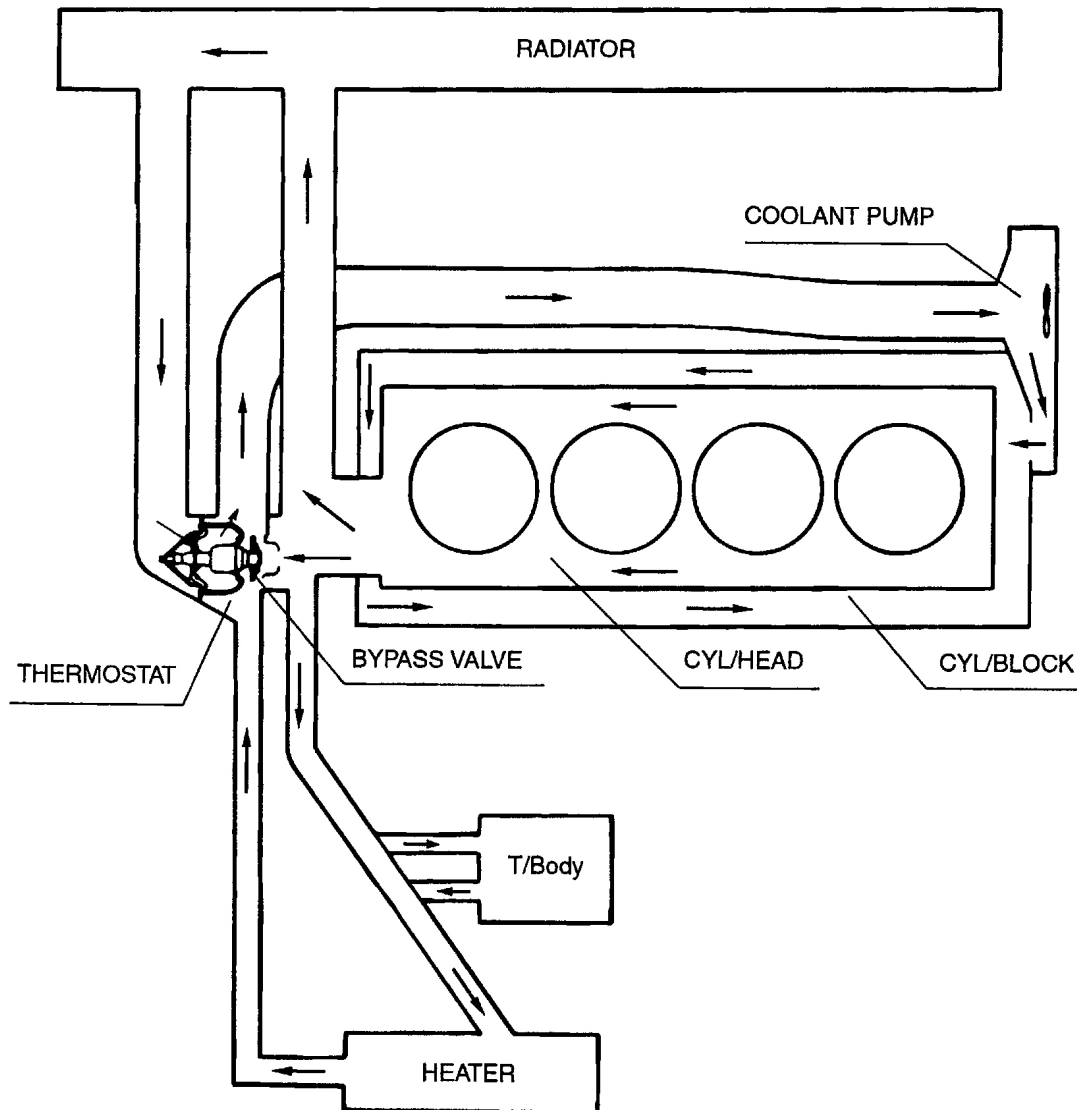
Limit: 0.4 mm (0.0157 in.)

15. Install the oil screen.
16. Install the oil pan.
17. Install the cylinder head.

## **COOLING SYSTEM**

### **ENGINE COOLANT HOSE/PIPES**

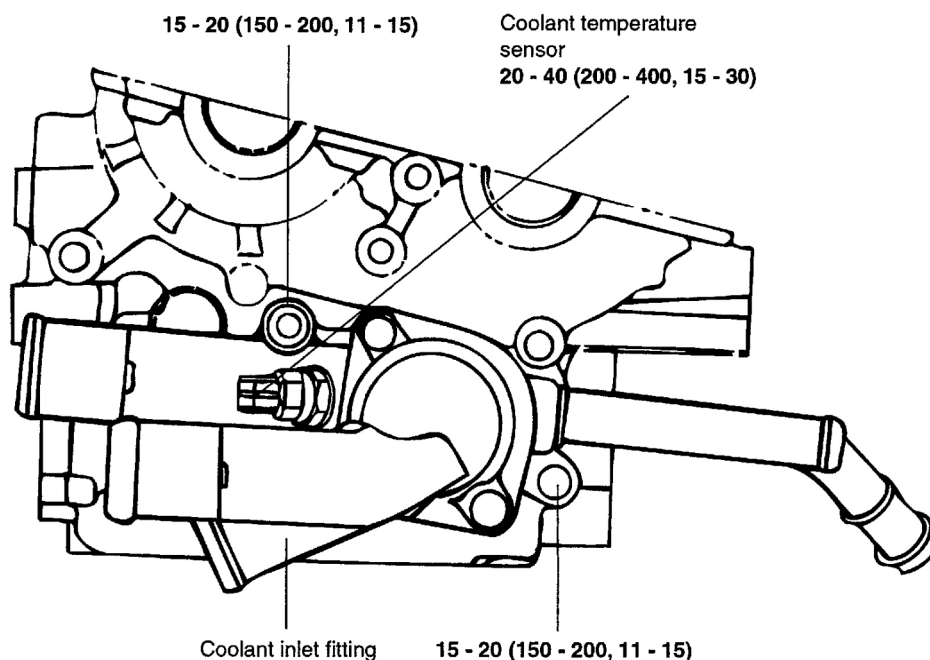
### **COOLING SYSTEM DIAGRAM**



G01277592

**Fig. 107: Engine Cooling System Diagram**  
Courtesy of HYUNDAI MOTOR CO.

COOLANT HOSE AND PIPE

**COMPONENTS****TORQUE : Nm (kg.cm, lb.ft)**

G01277593

**Fig. 108: Coolant Hose & Pipe Components**  
Courtesy of HYUNDAI MOTOR CO.

**INSPECTION**

Check the coolant pipe and hoses for cracks, damage, or restrictions.

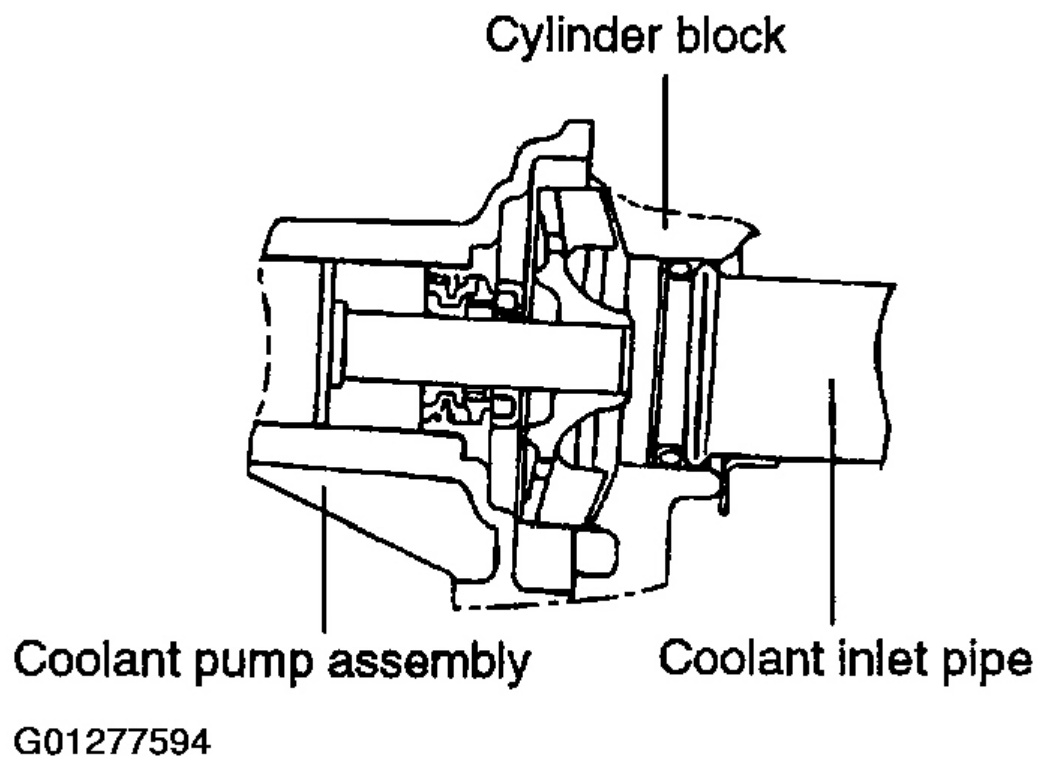
Replace if necessary.

**REASSEMBLY**

Fit an O - ring in the groove provided at the coolant inlet pipe end, wet the O - ring with coolant and insert the coolant inlet pipe.

**NOTE:**

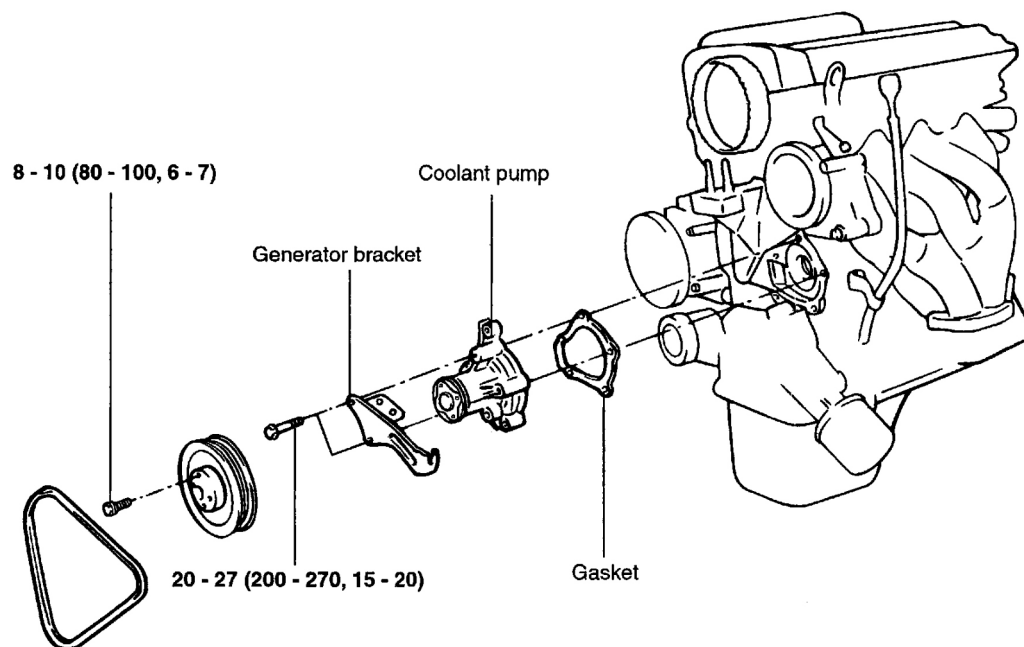
- Do not apply oil or grease to the coolant pipe O - ring.
- Keep the coolant pipe connections free from sand, dust, etc.
- Insert the coolant pipe fully into the coolant pump.
- Do not reuse O - ring. Replace it with a new one.



**Fig. 109: Identifying Thermostat**  
Courtesy of HYUNDAI MOTOR CO.

## ENGINE COOLANT PUMP

### COMPONENTS



# TORQUE : Nm (kg.cm, lb.ft)

G01277595

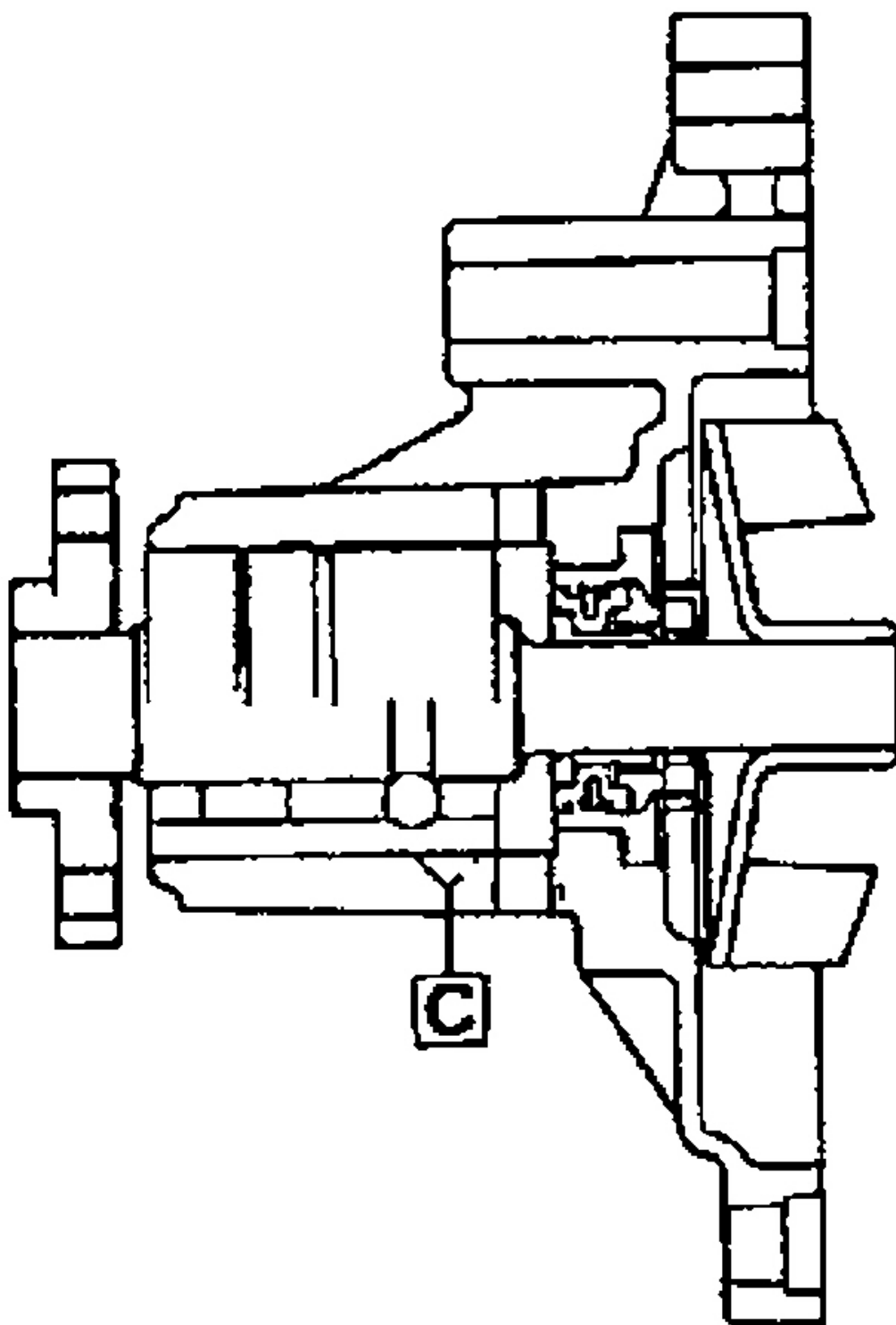
**Fig. 110: Engine Coolant Pump Components**  
Courtesy of HYUNDAI MOTOR CO.

## DISASSEMBLY

1. Drain the coolant and disconnect the coolant inlet pipe connection hose from the coolant pump.
2. Remove the drive belt and engine coolant pump pulley.
3. Remove the timing belt covers and the timing belt idler.
4. Remove the coolant pump mounting bolts, then remove the alternator brace.
5. Remove the coolant pump assembly from the cylinder block.

## INSPECTION

1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.
3. Check for coolant leakage. If coolant leaks the seal is defective. Replace the coolant pump assembly.



G01277596

**Fig. 111: View Of Coolant Pump**  
**Courtesy of HYUNDAI MOTOR CO.**

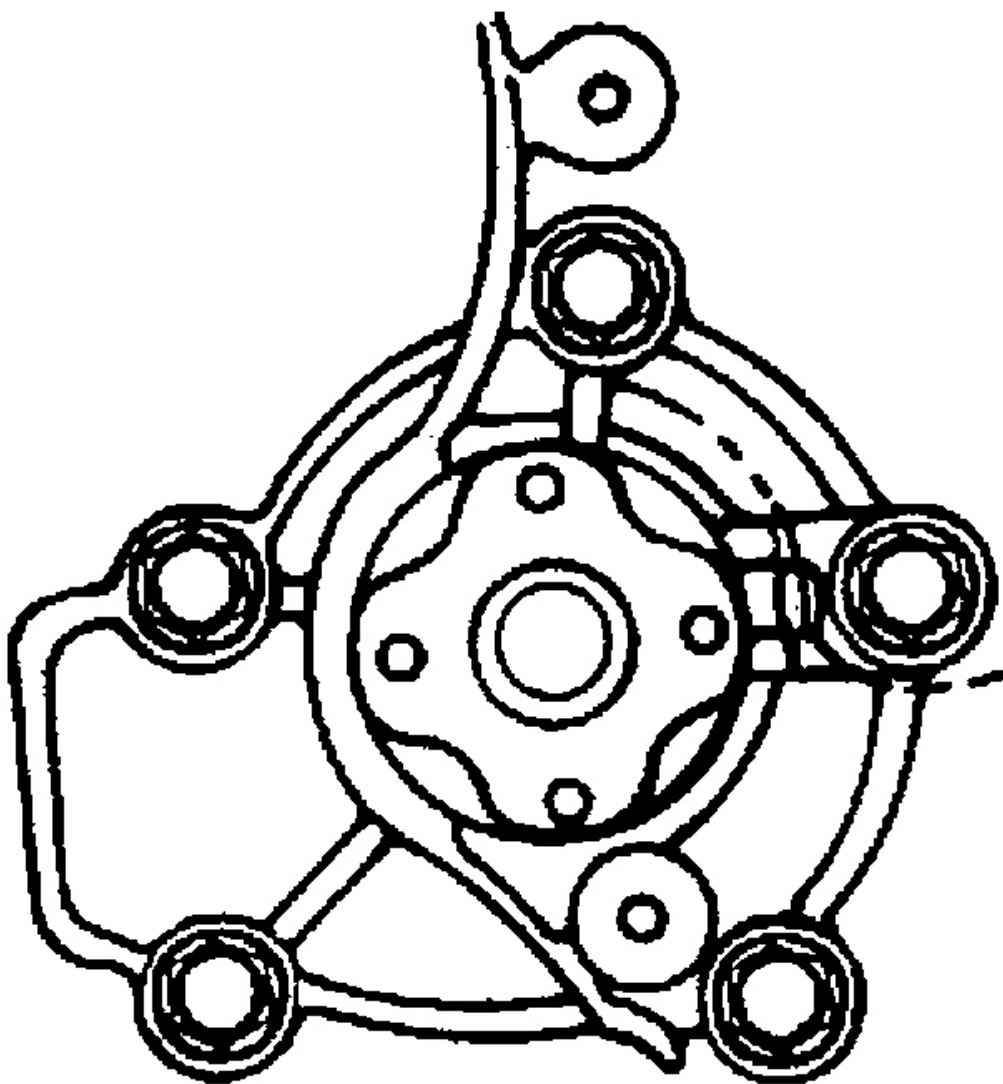
**REASSEMBLY**

1. Clean the gasket surfaces of the coolant pump body and the cylinder block.
2. Install a new coolant pump gasket to the coolant pump and tighten the bolts to the specified torque.

**Tightening torque**

Coolant pump to cylinder block:

20-27 Nm (200-270 kg.cm, 15-20 lb.ft)



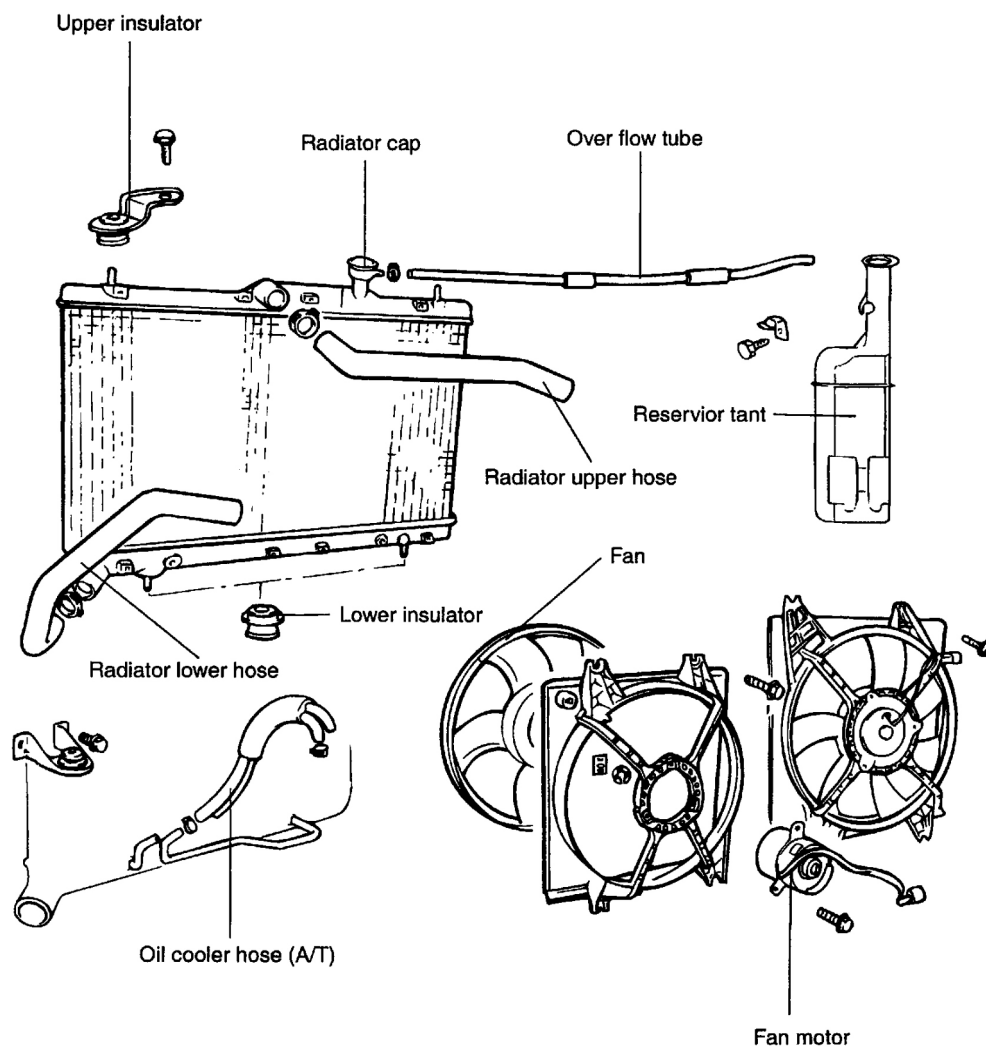
G01277597

**Fig. 112: Identifying Coolant Pump Bolts**  
Courtesy of HYUNDAI MOTOR CO.

3. Install the timing tensioner and timing belt. Adjust the timing belt tension.
4. Install the timing belt covers.
5. Install the coolant pump pulley and drive belt, and then adjust the belt tension.
6. Refill the system with clean coolant.
7. Run the engine and check for leaks.

## RADIATOR

### COMPONENTS



TORQUE : Nm (kg.cm, lb.ft)

G01277598

**Fig. 113: Radiator Components**  
Courtesy of HYUNDAI MOTOR CO.

### DISASSEMBLY

1. Disconnect the radiator fan motor connector.

2. Set the temperature control switch to the hot position.
3. Loosen the radiator drain plug to drain coolant.
4. Disconnect the upper and lower hose and overflow tube.
5. For vehicles with automatic transmission, disconnect the oil cooler hoses from the automatic transmission.

**CAUTION: Plug the ends of the oil cooler hoses and the automatic transmission fittings to prevent transmission fluid from spilling out and foreign material from entering.**

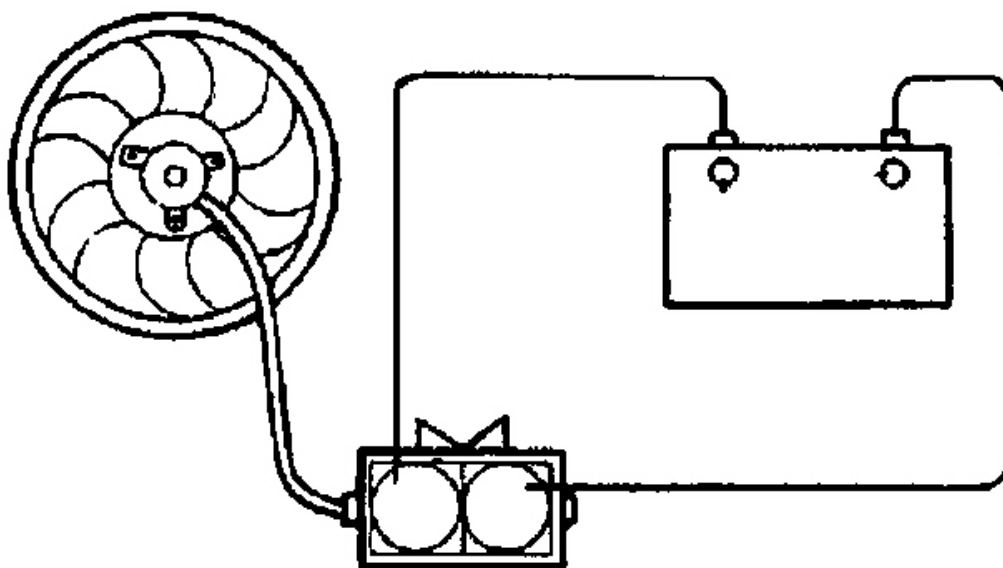
6. Remove the radiator mounting bolts.
7. Remove the radiator and the fan motor together.
8. Remove the fan motor from the radiator.

#### **INSPECTION**

1. Check the radiator for bent, broken or plugged fins.
2. Check the radiator for corrosion, damage, rust or scale.
3. Check the radiator hoses for crack, damage or deterioration.
4. Check the reservoir tank for damage.
5. Check the radiator cap spring for damage.
6. Test the pressure of the cap using a machine for checking a cooling system.
7. Check the radiator cap seal for crack or damage.

#### **RADIATOR FAN MOTOR**

1. Check that the radiator fan rotates when battery voltage is applied to the terminals.



G01277599

**Fig. 114: Checking Radiator Fan Operation**  
Courtesy of HYUNDAI MOTOR CO.

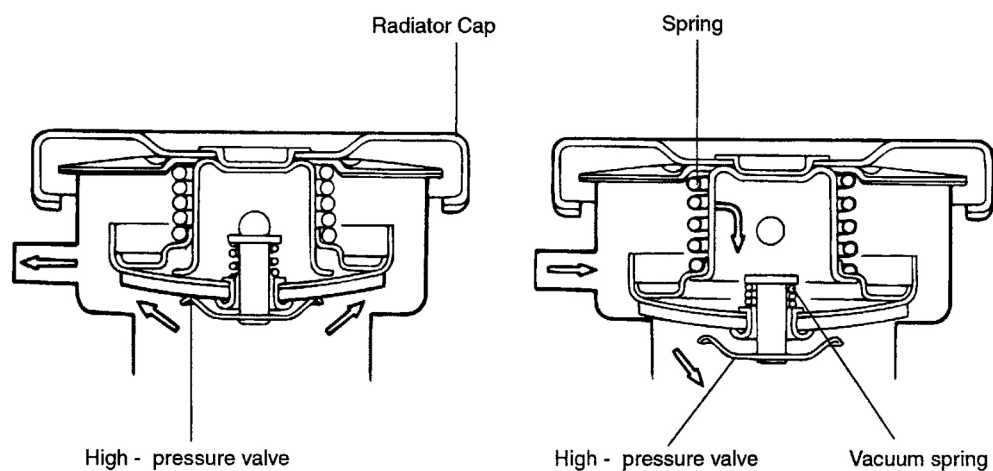
2. Check that abnormal noises are not produced while the motor is turning.

#### REASSEMBLY

1. Fill the radiator and reservoir tank with clean coolant mixture.
2. Run the engine until the thermostat opens, and then stop the engine.
3. Remove the radiator cap, and add coolant up to the filler neck of the radiator, and then fill the reservoir tank to the upper level. Replace the radiator cap.
4. Check that there are no leaks from the radiator, hoses or connections.

#### RADIATOR CAP

#### COMPONENTS



When the pressure is peduced to the specified level  
[81.4 - 1.8 Kpa (0.83 - 1.1 kg/cm, 11.8 - 15.6 psi)]

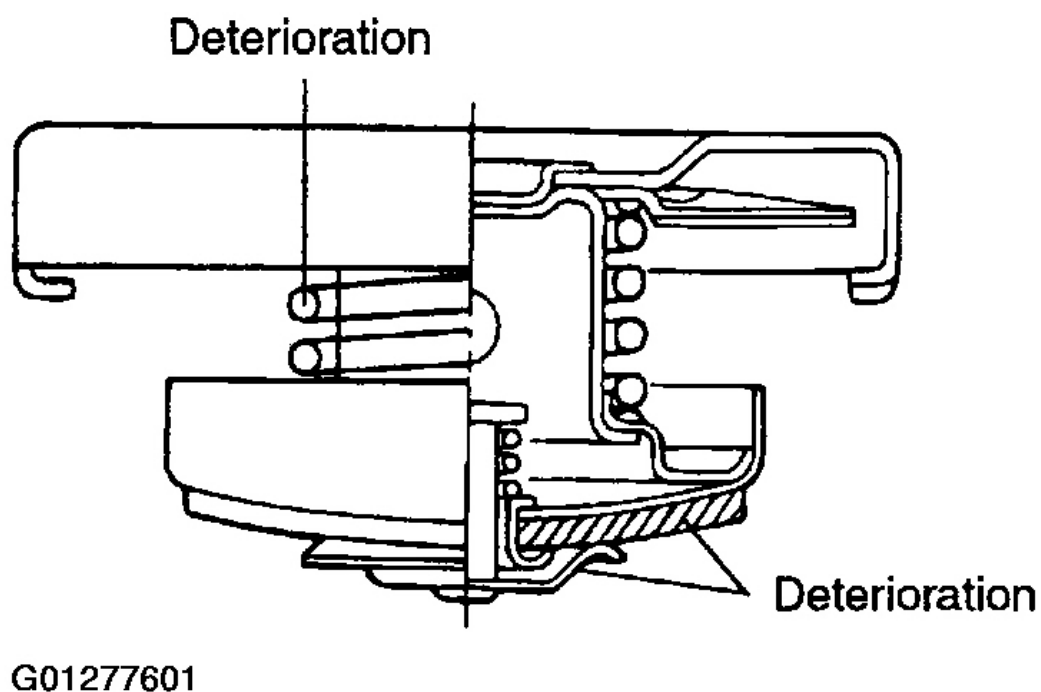
G01277600

When the pressure is peduced to the specified level  
[-6.86 Kpa (- 0.07 kg/cm, -1.00 psi)]

**Fig. 115: Radiator Cap Components**  
Courtesy of HYUNDAI MOTOR CO.

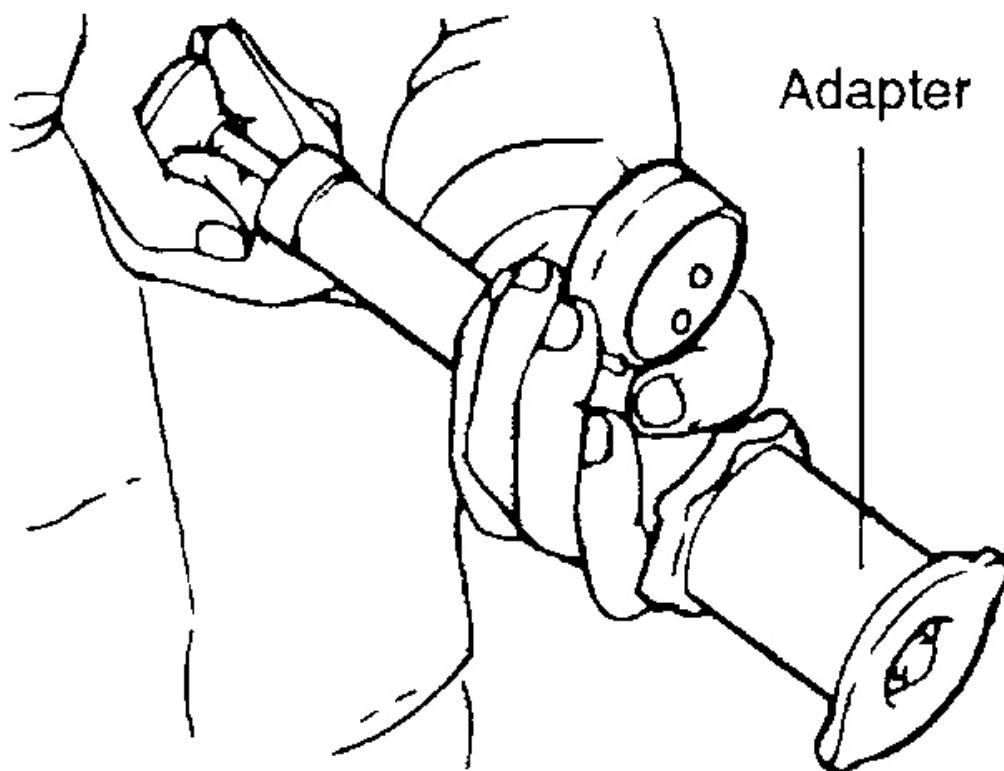
#### INSPECTION

1. Check the radiator cap for damage, cracks and deterioration.



**Fig. 116: Checking Radiator Cap**  
Courtesy of HYUNDAI MOTOR CO.

2. Attach a radiator cap tester to the radiator.
3. Pump the tester until the pointer stabilizes.
4. If the pointer stays constant for 10 sec. at a point exceeding the service limit, the radiator cap is good.

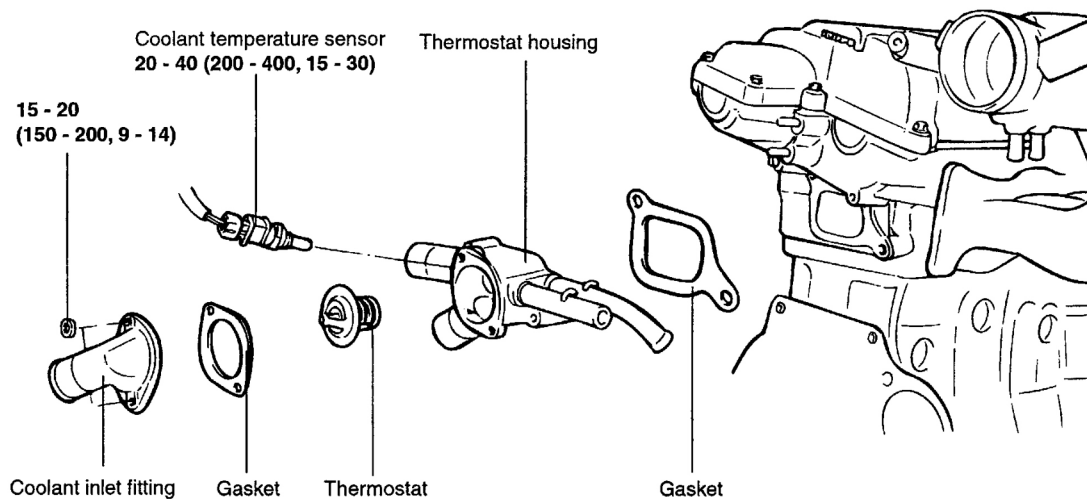


G01277602

**Fig. 117: Pressure Testing Radiator Cap**  
Courtesy of HYUNDAI MOTOR CO.

## THERMOSTAT

### COMPONENTS



**TORQUE : Nm (kg.cm, lb.ft)**

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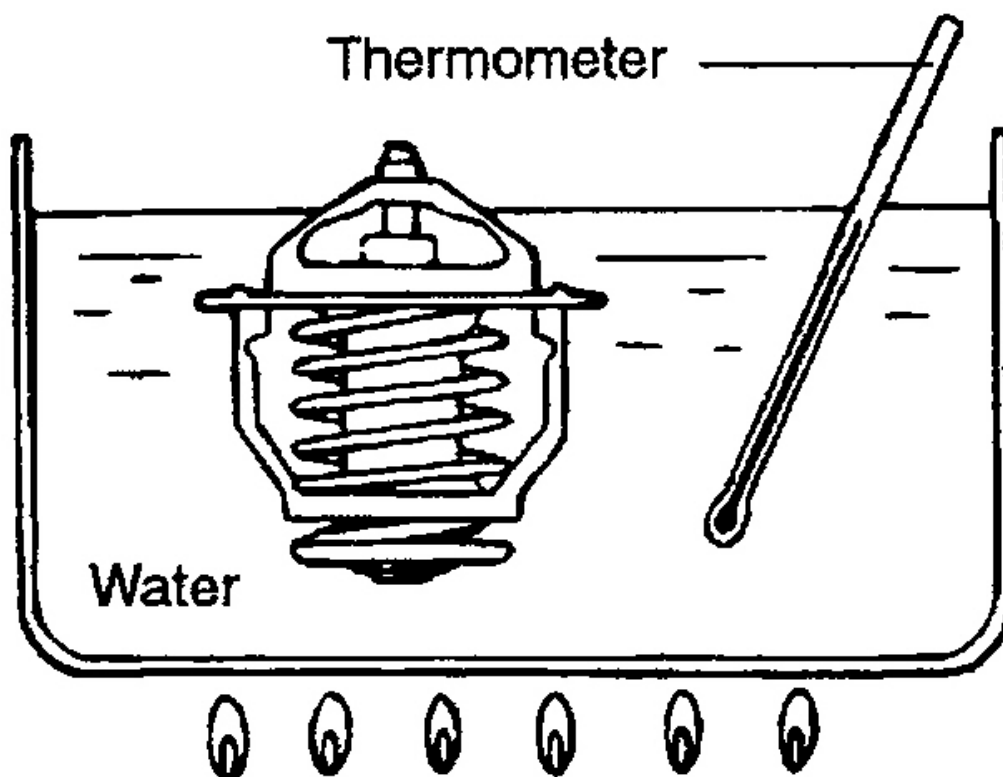
**Fig. 118: Thermostat Components**  
Courtesy of HYUNDAI MOTOR CO.

#### DISASSEMBLY AND INSPECTION

1. Drain the coolant so its level is below thermostat.
2. Remove the inlet fitting and gasket.
3. Remove the thermostat.
4. Immerse thermostat in hot coolant to check proper valve opening temperature. Replace if necessary.

Valve opening temperature: 82 °C(177 °F)

Full opening temperature: 95 °C(205 °F)



G01277604

**Fig. 119: Checking Thermostat Operation**  
Courtesy of HYUNDAI MOTOR CO.

#### COOLANT TEMPERATURE SENSOR

1. Heat the sensor by submerging it in hot engine coolant.
2. Check that the resistance is within the specified range.

#### Resistance

At: 20 °C(68 °F): 2.31-2.59 k $\Omega$

#### REASSEMBLY

1. Check that the flange of the thermostat is correctly seated in the socket of the thermostat housing.
2. Install a new gasket and the coolant inlet fitting.

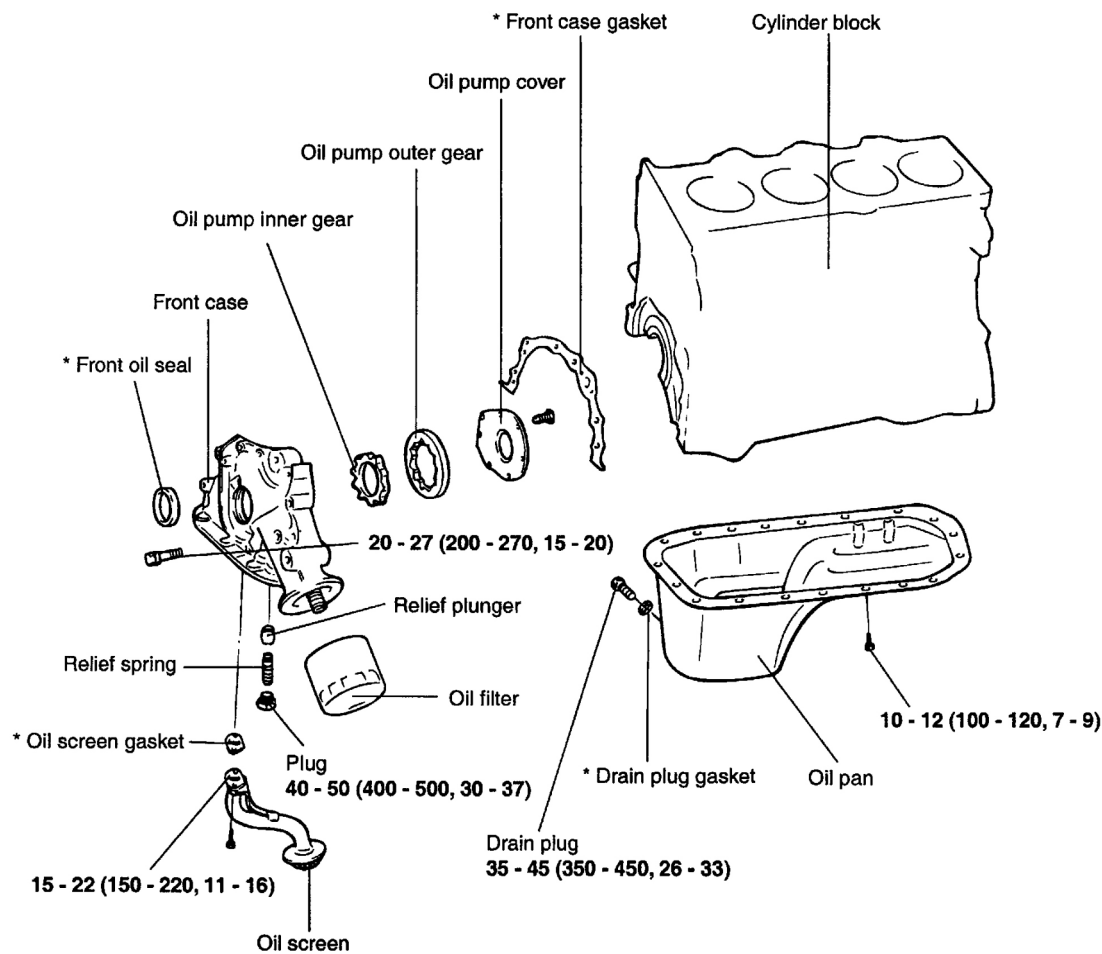
3. Refill the system with clean coolant.

**Tightening torque**

Coolant temperature sensor:

20-40 Nm (200-400 kg.cm, 15-30 lb.ft)

**LUBRICATION SYSTEM****OIL PUMP****OIL PUMP, FRONT CASE**



\* Replace the gasket and seal with new ones after removal.

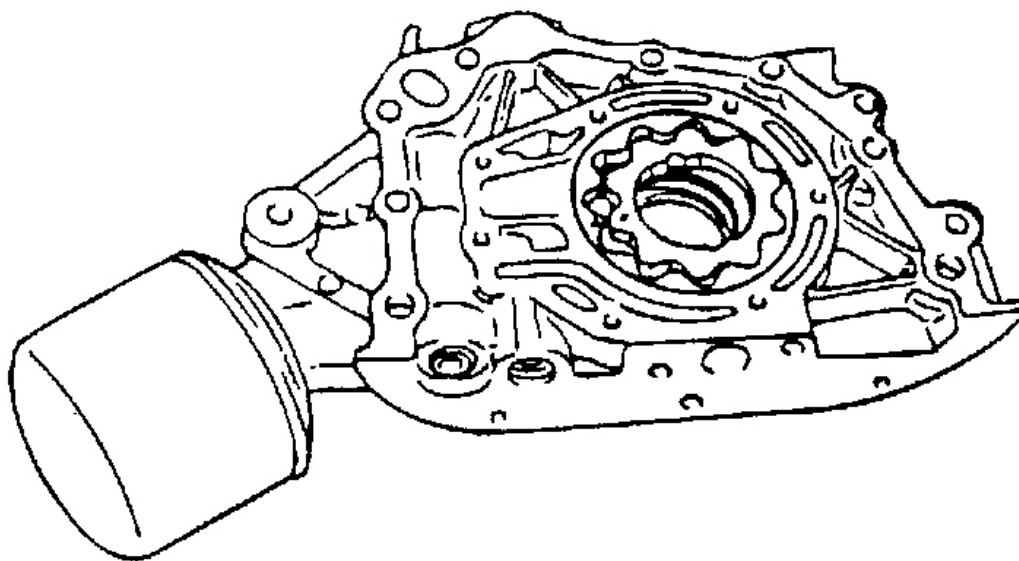
**TORQUE : Nm (kg.cm, lb.ft)**

G01277605

**Fig. 120: Lubrication System Components**  
Courtesy of HYUNDAI MOTOR CO.

### DISASSEMBLY

1. Remove the timing belt.
2. Remove all the oil pan bolts.
3. Remove the oil pan.
4. Remove the oil screen.
5. Remove the front case assembly.

**G01277606**

**Fig. 121: Identifying Front Case Assembly**  
Courtesy of HYUNDAI MOTOR CO.

6. Remove the oil pump cover.
7. Remove the inner and outer gears from the front case. The matching marks on the inner and outer gears indicate the direction of installation.
8. Remove all the oil pan bolts.

## **INSPECTION**

### **FRONT CASE**

1. Check the front case for cracks or damage. Replace as necessary.
2. Check the front oil seal for worn or damaged lips. Replace if defective.

### **OIL PAN AND OIL SCREEN**

1. Check the oil pan for failure, damage or cracks. Replace if defective.
2. Check the oil screen for failure, damage and cracks and replace if defective.

### **FRONT CASE AND OIL PUMP COVER**

Check the surfaces contacting gears for damage or worn.

**OIL PUMP GEARS**

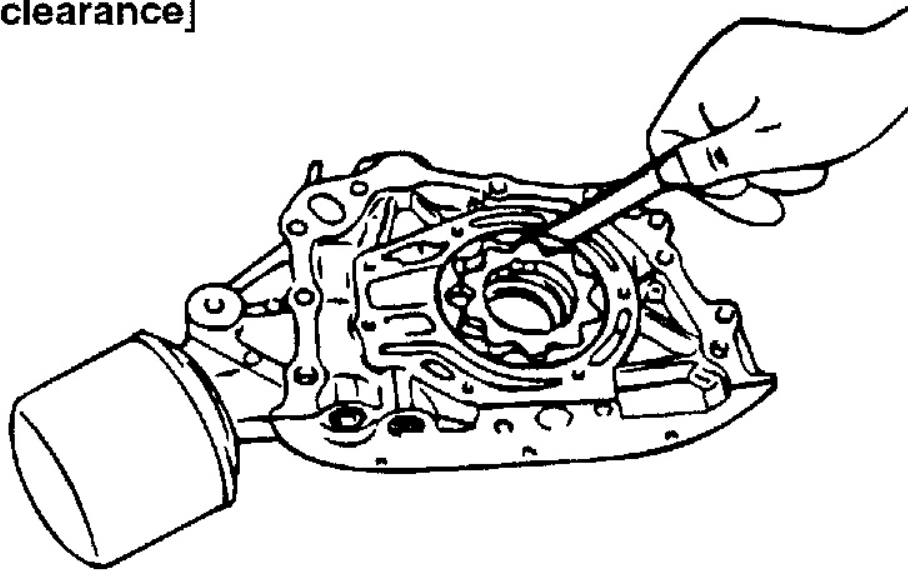
1. Check the gear tooth surfaces for wear or damage.
2. Measure the clearance between the outer gear and the front case.

|                        |            |                                          |
|------------------------|------------|------------------------------------------|
| Body clearance         |            | 0.12 - 0.185 mm<br>(0.0047- 0.0073 in.)  |
| Tip clearance          |            | 0.025 - 0.069 mm<br>(0.0010- 0.0027 in.) |
| Side<br>clear-<br>ance | Outer gear | 0.04 - 0.09 mm<br>(0.0016- 0.0035 in.)   |
|                        | Inner gear | 0.04 - 0.085 mm<br>(0.0016- 0.0033 in.)  |

G01277607

**Fig. 122: Outer Gear Clearance Specification Table**  
 Courtesy of HYUNDAI MOTOR CO.

**[Body clearance]**

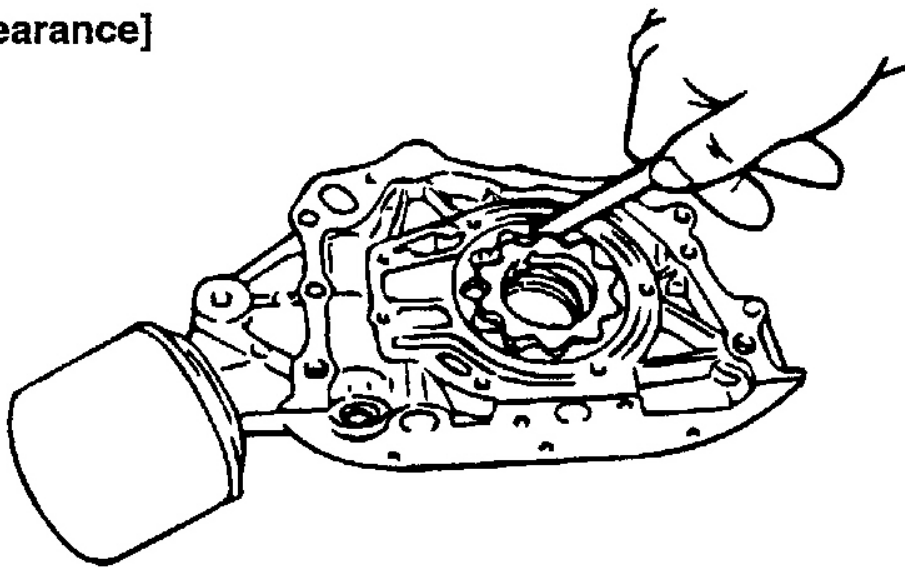


G01277608

**Fig. 123: Checking Body Clearance**  
Courtesy of HYUNDAI MOTOR CO.

3. Check the tip clearance on the pump rotor.

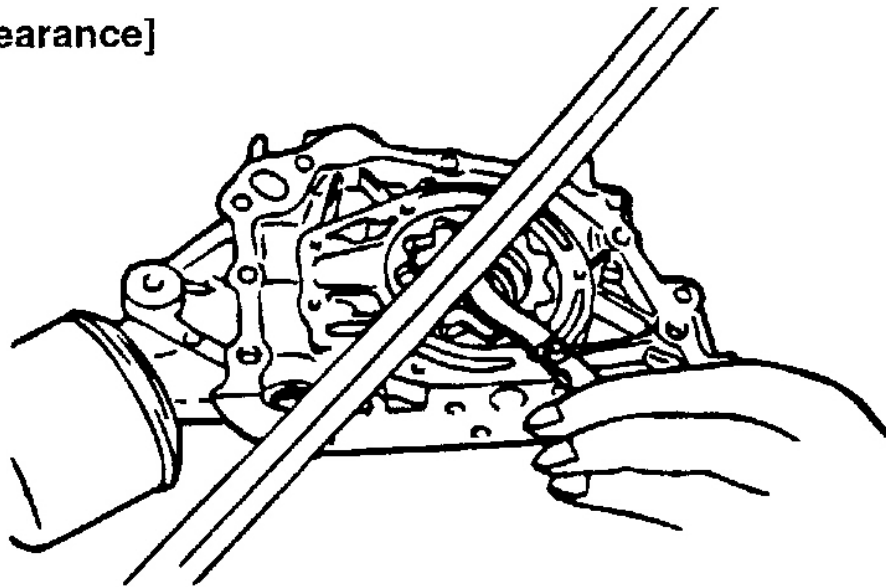
[Tip clearance]



G01277609

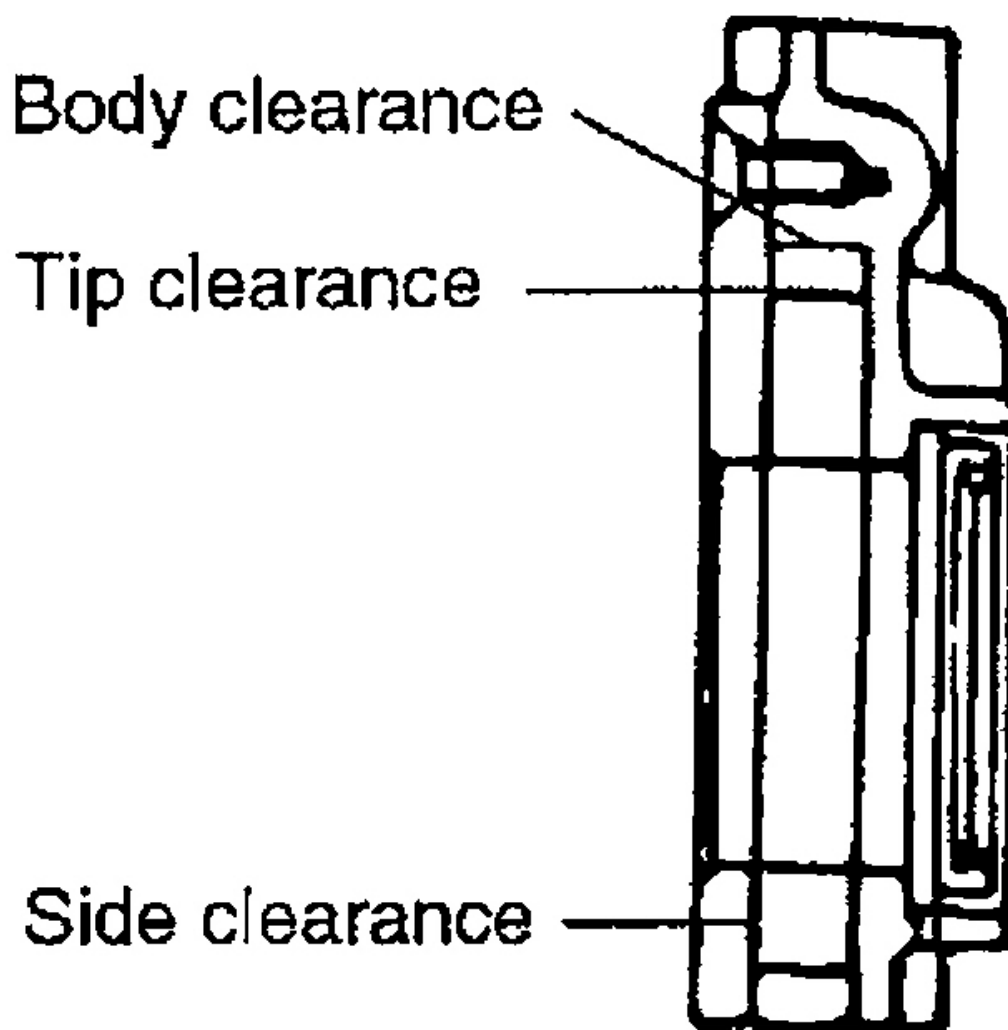
**Fig. 124: Checking Tip Clearance**  
Courtesy of HYUNDAI MOTOR CO.

[Side clearance]



G01277610

**Fig. 125: Checking Side Clearance**  
Courtesy of HYUNDAI MOTOR CO.



G01277611

**Fig. 126: Identifying Body, Tip & Side Clearances Of Outer Gear**  
Courtesy of HYUNDAI MOTOR CO.

#### RELIEF VALVE AND SPRING

1. Check sliding condition of the relief valve inserted in the front case.
2. Inspect for a distorted or broken relief valve spring.

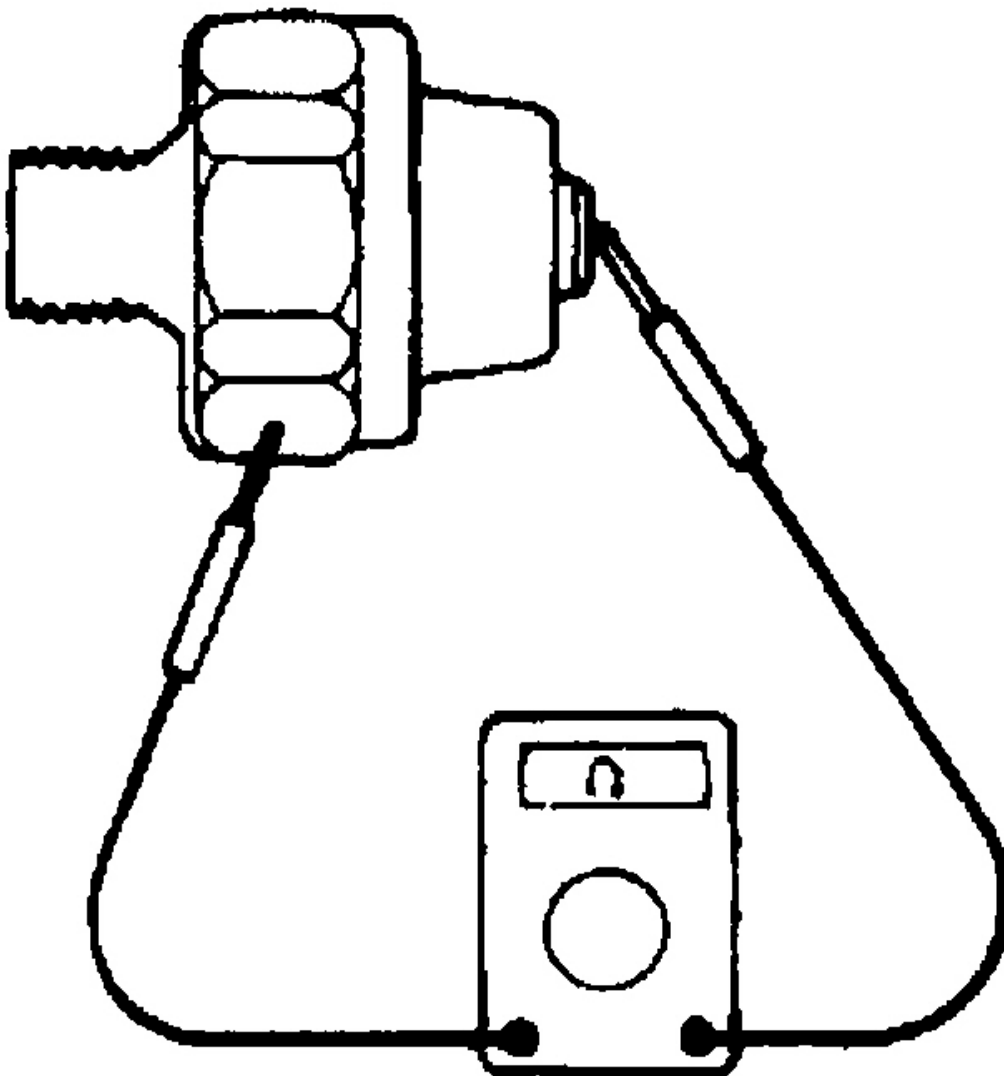
#### Standard value

Free height: 43.8 mm (1.724 in.)

Load: 3.7 kg/40.1 mm (8.14 lb/1.579 in.)

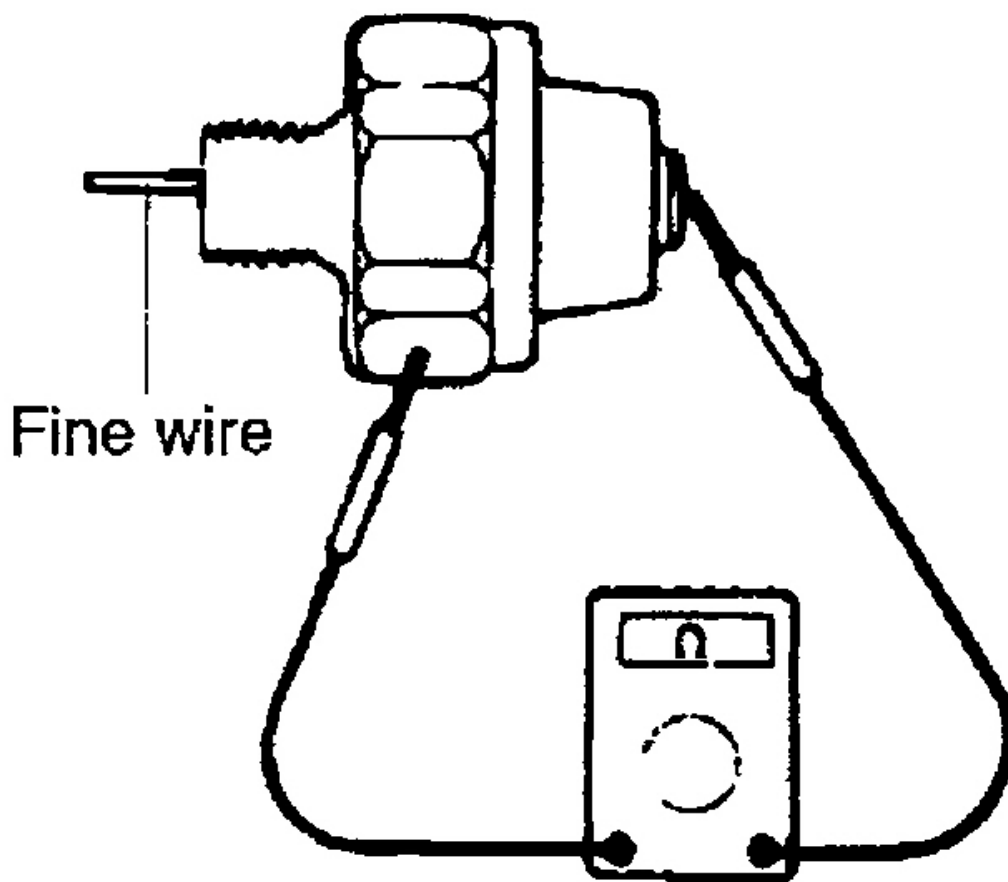
**OIL PRESSURE SWITCH**

1. Use an ohmmeter to check the continuity between the terminal and the body. If there is no continuity, replace the oil pressure switch.

**G01277612**

**Fig. 127: Checking Oil Pressure Switch Continuity**  
Courtesy of HYUNDAI MOTOR CO.

2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.
3. If there is no continuity when a 50 kPa (7 psi) vacuum is applied through the oil hole, the switch is operating properly.



G01277613

**Fig. 128: Checking Oil Pressure Switch Continuity With Wire Installed**  
Courtesy of HYUNDAI MOTOR CO.

4. Check for an air leaks, the diaphragm is broken. Replace the switch.

#### REASSEMBLY

**OIL PUMP**

1. Install the outer and inner gears into the front case. Make sure that the inner and outer gears are installed in the same direction as shown.
2. Install the oil pump cover and tighten the bolts to the specified torque. After the bolts have been tightened, check to ensure that the gear turns smoothly.

**Tightening torque**

Oil pump cover bolt: 6-9 Nm (60-90 kg.cm, 4-7 lb.ft)

3. Install the relief valve and spring. Tighten the plug to the specified torque. Apply engine oil to the relief valve.

**Tightening torque**

Relief valve plug: (400-500 kg.cm, 30-37 lb.ft)

**FRONT CASE**

1. Install the front case assembly with a new gasket, and tighten the bolts to the specified torque.

Length

A: 25 mm (0.98 in.)

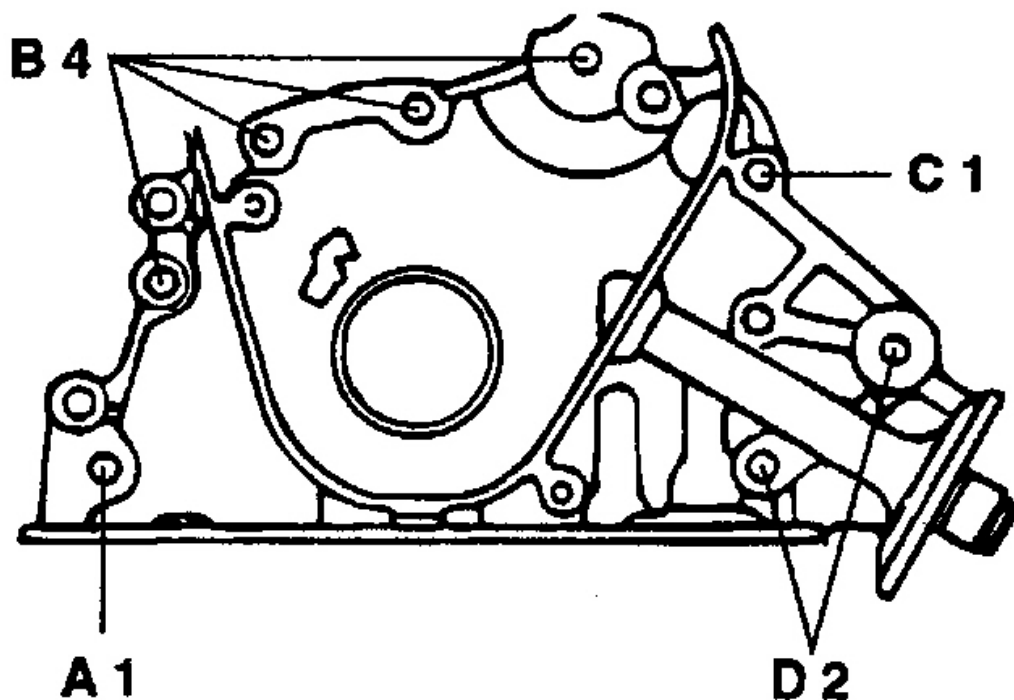
B: 20 mm (0.79 in.)

C: 45 mm (1.77 in.)

D: 38 mm (1.50 in.)

**Tightening torque:**

20-27 Nm (200-270 kg.cm, 15-20 lb.ft)



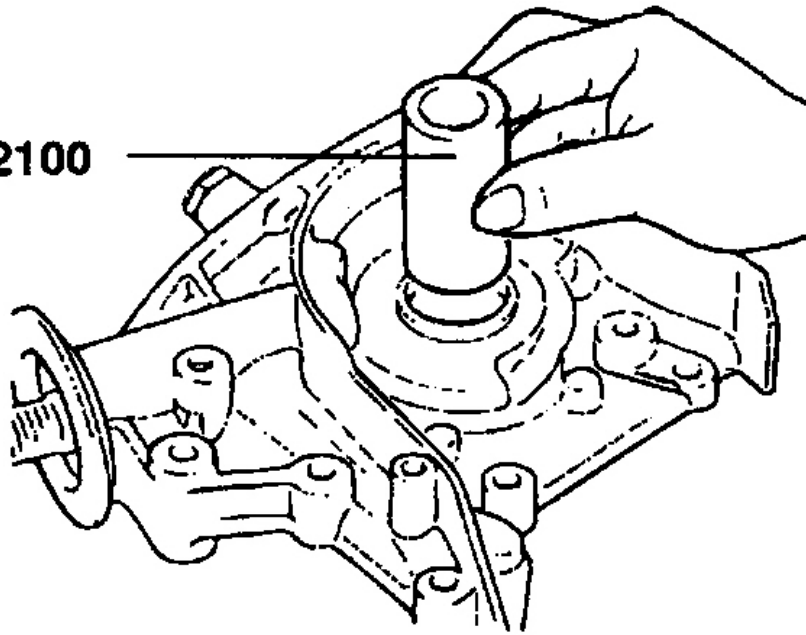
G01277615

**Fig. 129: Identifying Front Case Torque Specifications**  
Courtesy of HYUNDAI MOTOR CO.

#### OIL SEAL

1. Using the special tool, Crankshaft oil seal guide (09214-32100), install the oil seal.

**09214 - 32100**

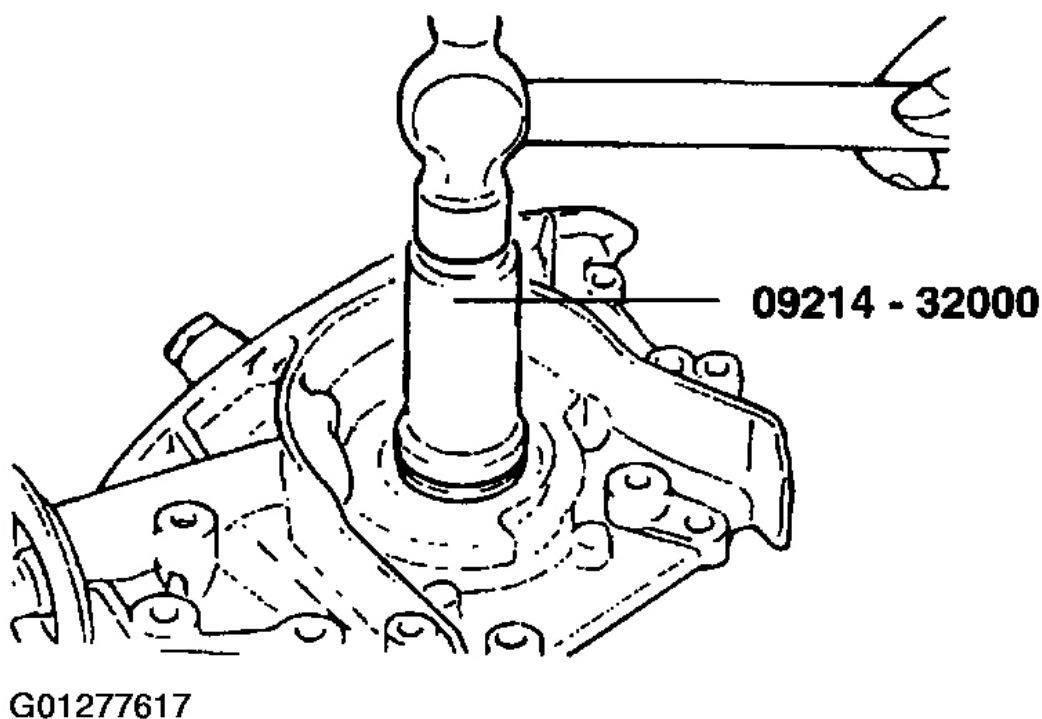


**G01277616**

**Fig. 130: Installing Oil Seal**

Courtesy of HYUNDAI MOTOR CO.

2. Using the special tool, Crankshaft front oil seal installer (09214-32000), install the oil seal.

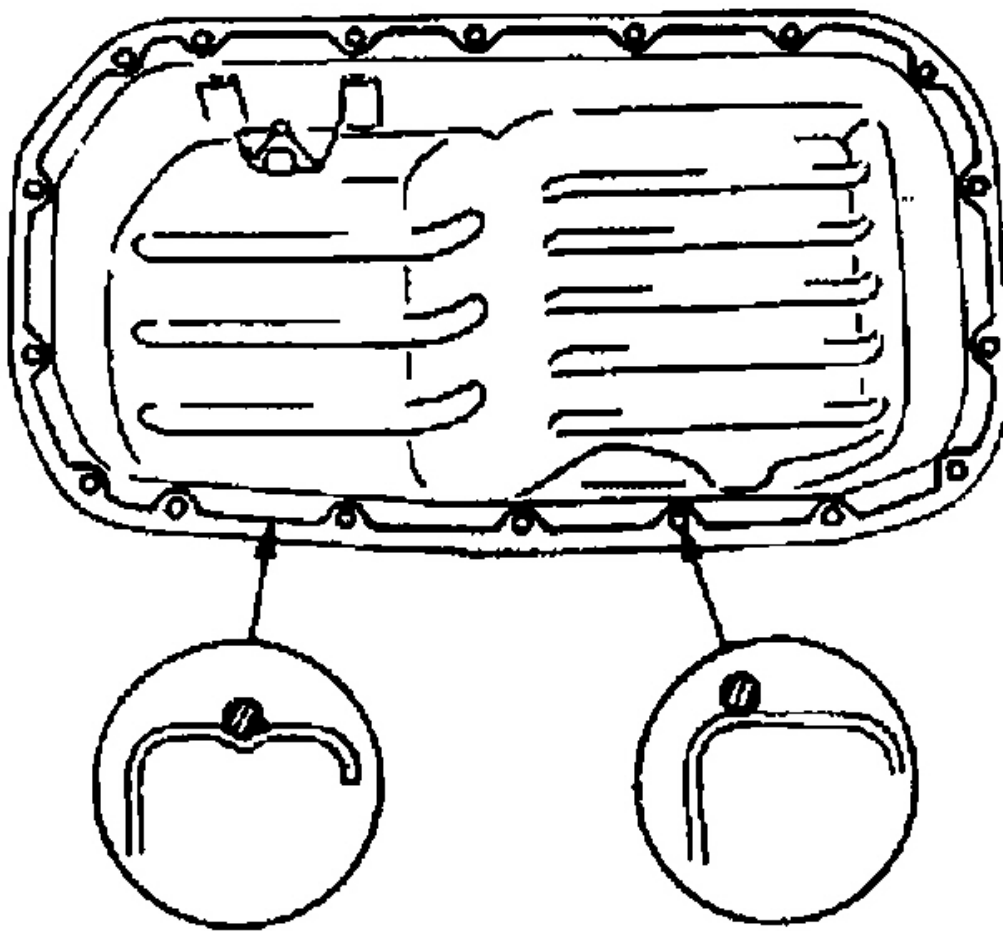


**Fig. 131: Installing Crankshaft Oil Seal**  
Courtesy of HYUNDAI MOTOR CO.

3. Install the oil screen.
4. Clean both gasket surfaces of the oil pan and the cylinder block.
5. Apply sealant into the groove of the oil pan flange as shown.

**CAUTION:**

- Apply sealant approx. 4mm (0.16 in.) in thickness.
- After application of sealant, do not exceed 15 minutes before installing the oil pan.



G01277618

**Fig. 132: Identifying Oil Pan Sealant Application**  
Courtesy of HYUNDAI MOTOR CO.

6. Install the oil pan and tighten the bolts to the specified torque.

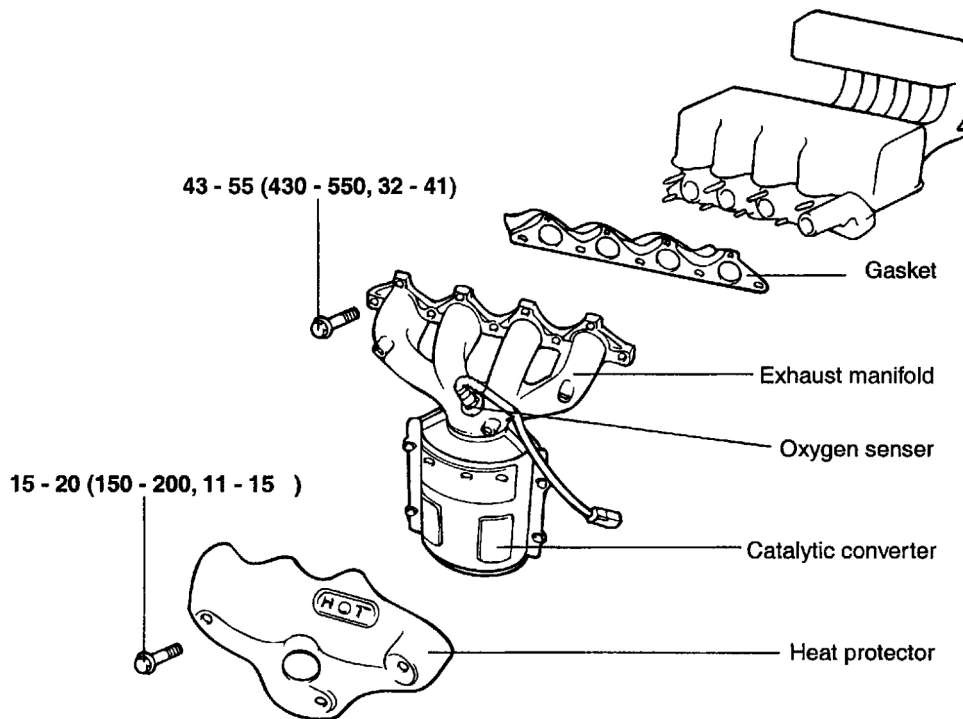
#### **Tightening torque**

Oil pan bolt: 10-12 Nm (100-120 kg.cm, 7-9 lb.ft)

## **INTAKE AND EXHAUST SYSTEM**

### **EXHAUST MANIFOLD**

## COMPONENTS



\* Replace the lock nuts with new ones after removal.

## TORQUE : Nm (kg.cm, lb.ft)

G01277619

**Fig. 133: Exhaust Manifold Components**  
Courtesy of HYUNDAI MOTOR CO.

## DISASSEMBLY

1. Remove the exhaust manifold heat protector.
2. Remove the exhaust manifold assembly from the cylinder head.
3. Remove the exhaust manifold gasket.

## INSPECTION

### EXHAUST MANIFOLD

1. Check for damage or cracking.
2. Check for damage or cracking of welding between exhaust manifold and converter.

## REASSEMBLY

## 2002 Hyundai Elantra GLS

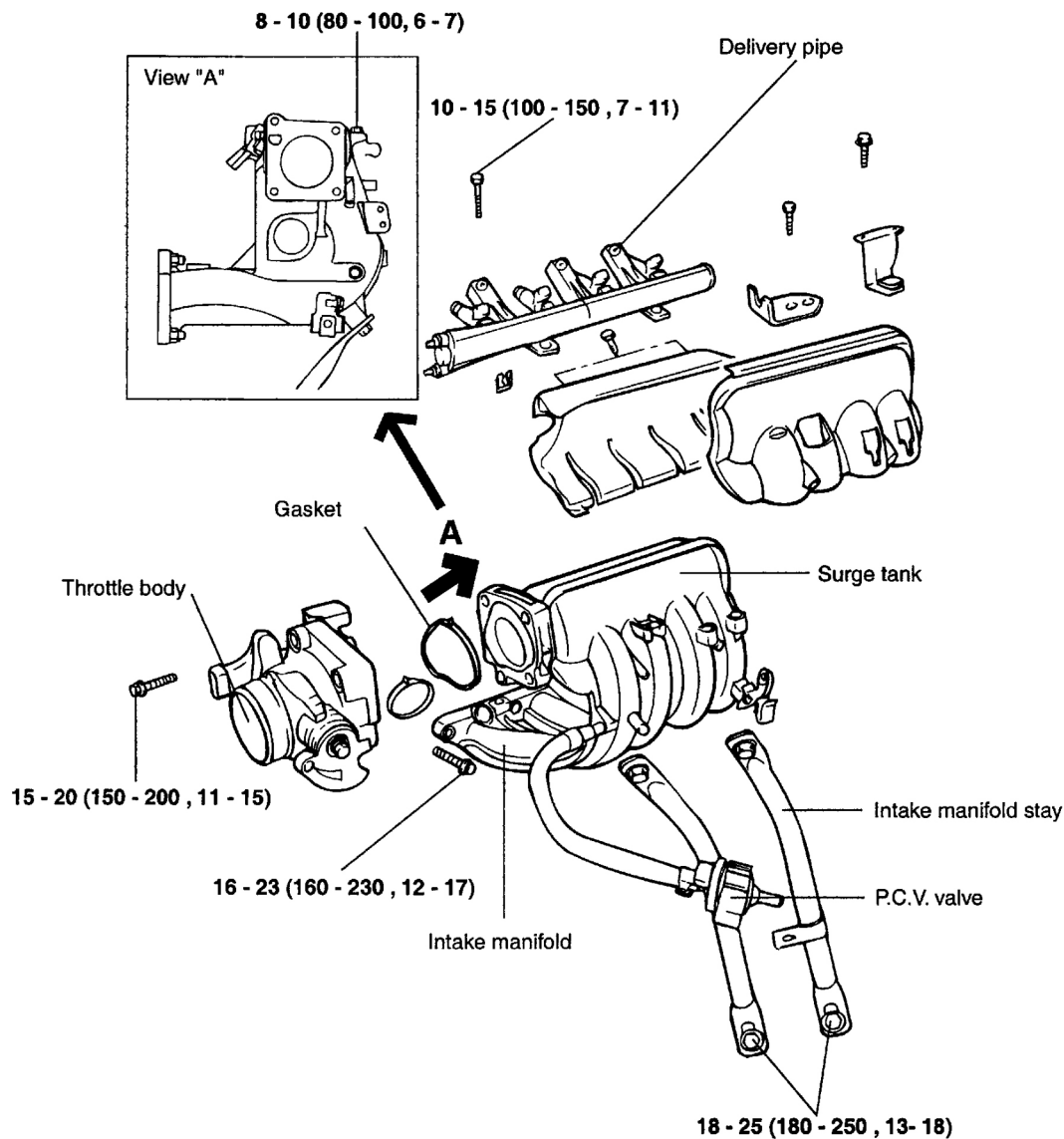
2002 ENGINE 2.0L 4 Cylinder DOHC - Elantra

Install the exhaust manifold in the reverse order of removal.

**CAUTION:** Replace the exhaust manifold gasket and lock nut when reassembling.

### INTAKE MANIFOLD

#### COMPONENTS



**TORQUE : Nm (kg.cm, lb.ft)**

G01277620

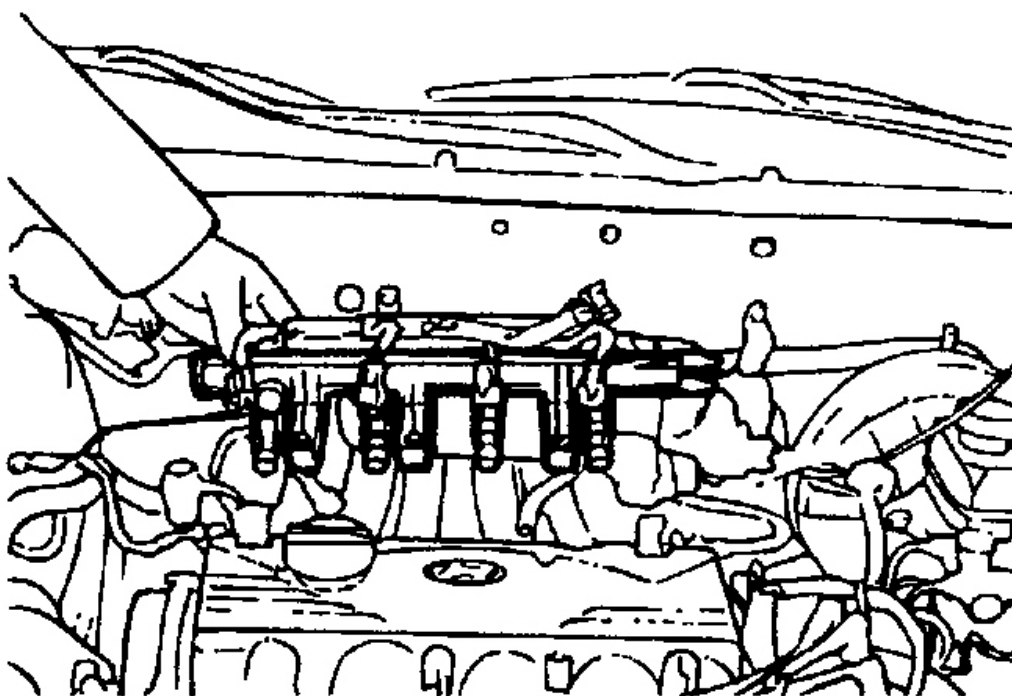
**Fig. 134: Intake Manifold Components**  
Courtesy of HYUNDAI MOTOR CO.

### REMOVAL

1. Remove the engine cover.
2. Remove the intake air hose connected to the throttle body.
3. Remove the accelerator cable.

4. Remove the P.C.V. hose and brake booster vacuum hoses.
5. Disconnect the vacuum hose connections, ISA and TPS connector.
6. Disconnect the high pressure fuel hose connection after relieving pressure in the fuel rail to prevent fuel from spilling.
7. Remove the intake manifold.
8. Remove the intake manifold assembly and gasket.
9. Disconnect the fuel injector harness connector.
10. Remove the delivery pipe with the fuel injectors.

**CAUTION:** Be careful not to drop the injectors when removing the delivery pipe.



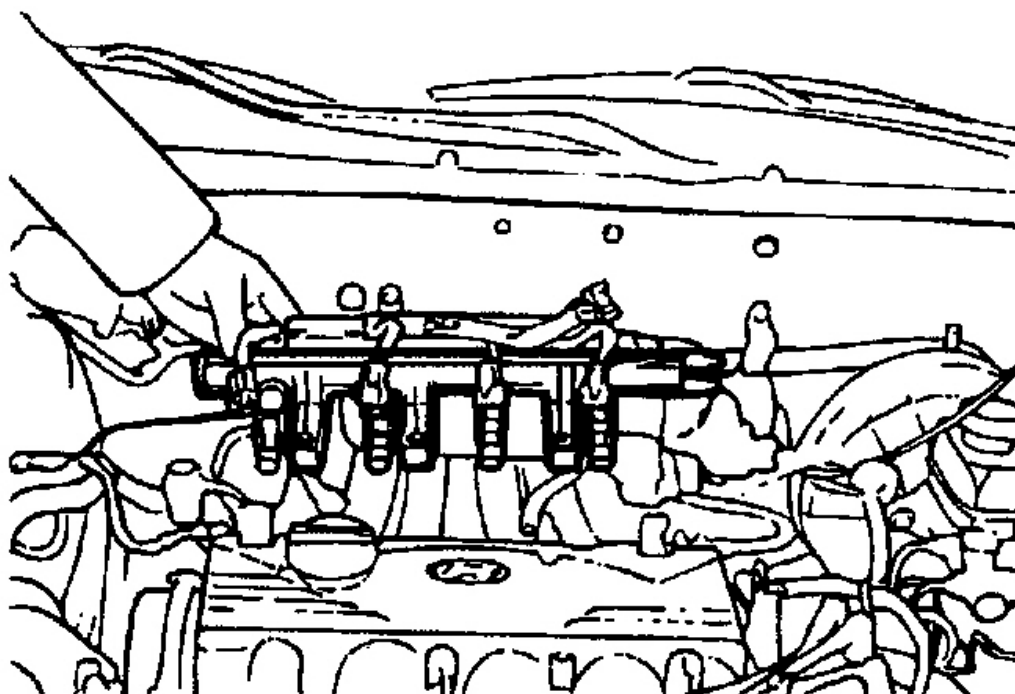
G01277623

**Fig. 135: Removing Fuel Delivery Pipe**  
Courtesy of HYUNDAI MOTOR CO.

#### INSTALLATION

1. Replace the intake manifold gasket and install the intake manifold.

**CAUTION:** Be careful not to drop the injectors when removing the delivery pipe.



G01277624

**Fig. 136: Installing Fuel Delivery Pipe**  
Courtesy of HYUNDAI MOTOR CO.

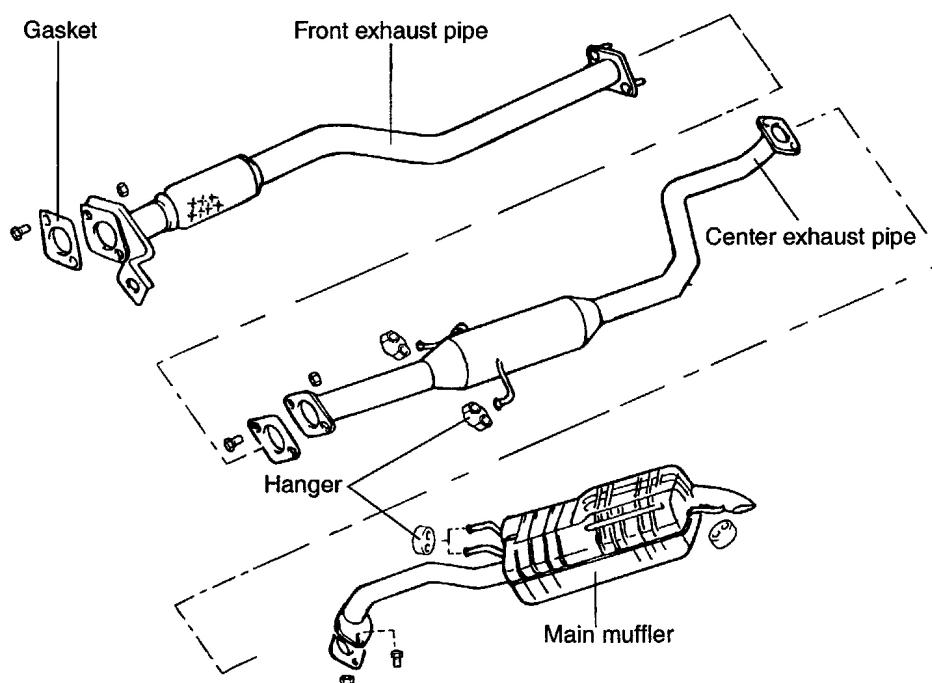
2. Install the delivery pipe with the fuel injectors.
3. Connect the fuel injector harness connector.
4. Install the intake manifold stay.
5. Connect the high pressure fuel hose connection.
6. Install the P.C.V hose and brake booster vacuum hose.
7. Install the intake air hose to the throttle body.
8. Install the accelerator cable.
9. Connect the ISA and TPS wire harness connector.

**INSPECTION****INTAKE MANIFOLD**

Check the parts for damage or cracking.

**AIR HOSE**

Check for damage or cracking of any part.

**MUFFLER****MUFFLER****COMPONENTS**

**TORQUE : Nm (kg.cm, lb.ft)**

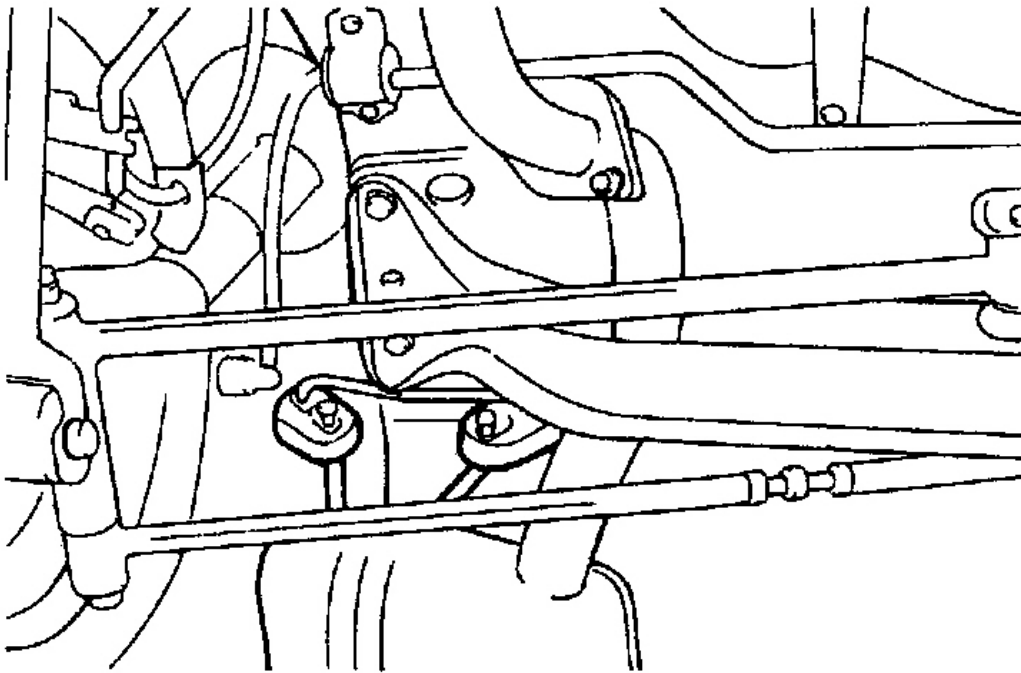
G01277625

**Fig. 137: Muffler Components**  
Courtesy of HYUNDAI MOTOR CO.

**REMOVAL****MAIN MUFFLER**

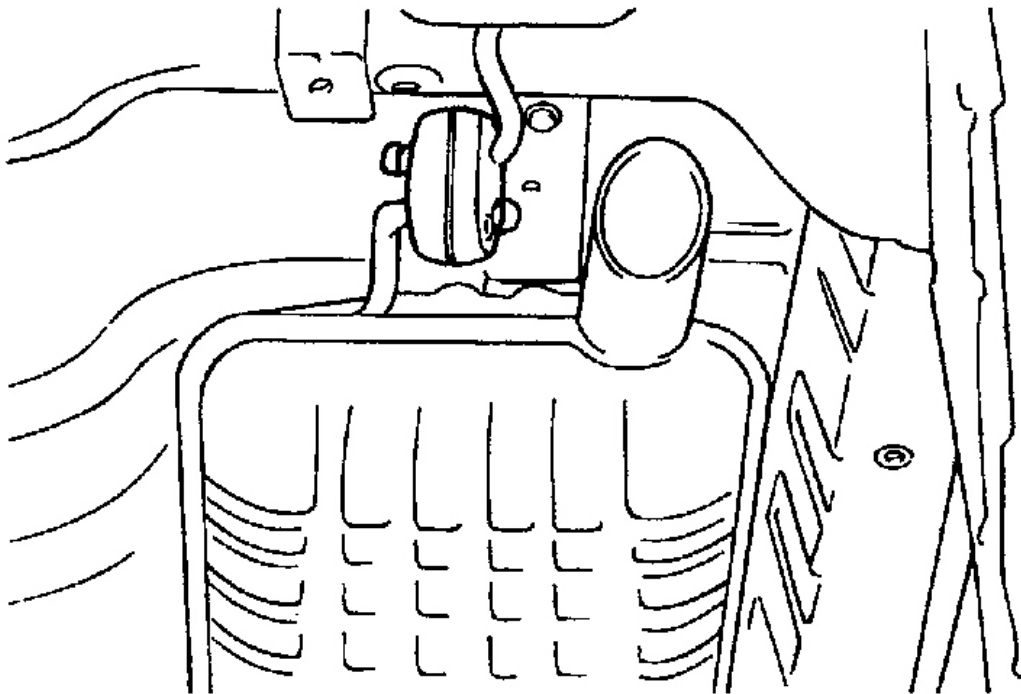
**CAUTION:** Before removing or inspecting the exhaust system, ensure that the exhaust system is cool.

1. Disconnect the main muffler from the center muffler.
2. Remove the rubber hangers and remove the main muffler.



G01277627

**Fig. 138: Identifying Rubber Hangers**  
Courtesy of HYUNDAI MOTOR CO.

**G01277628**

**Fig. 139: Identifying Rubber Hangers**

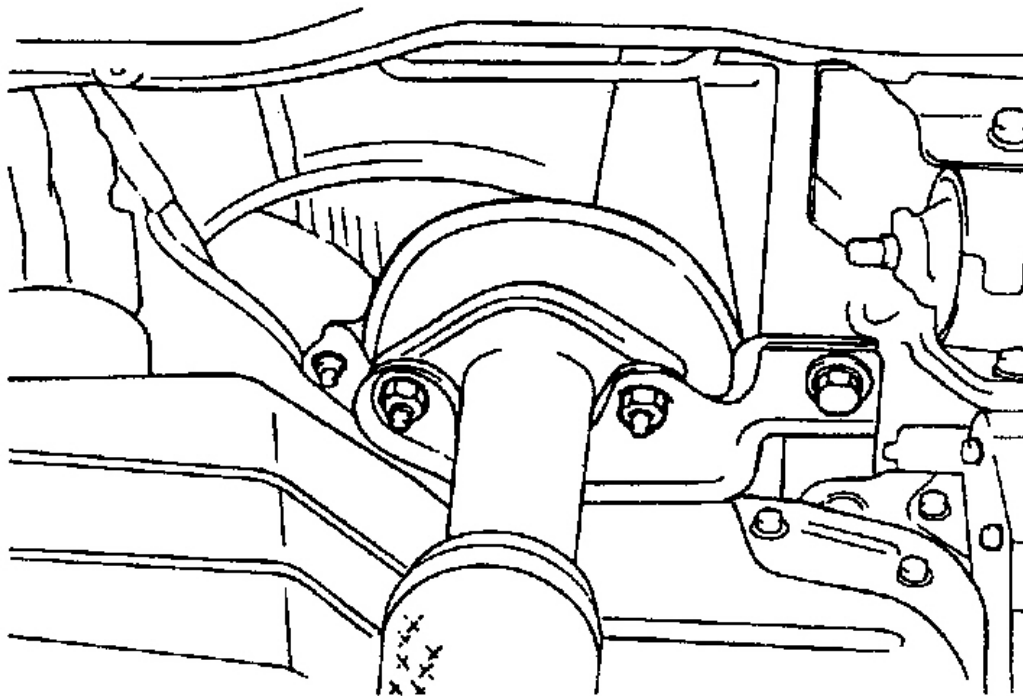
Courtesy of HYUNDAI MOTOR CO.

#### **CENTER MUFFLER**

1. Remove the center muffler assembly from the main muffler and front exhaust pipe.
2. Remove the rubber hanger, then remove the center muffler.

#### **FRONT EXHAUST PIPE**

1. Remove the front exhaust pipe clamp bolts, and remove the front exhaust pipe nuts from the catalytic converter.
2. Remove the front exhaust pipe and center muffler bolt.



G01277630

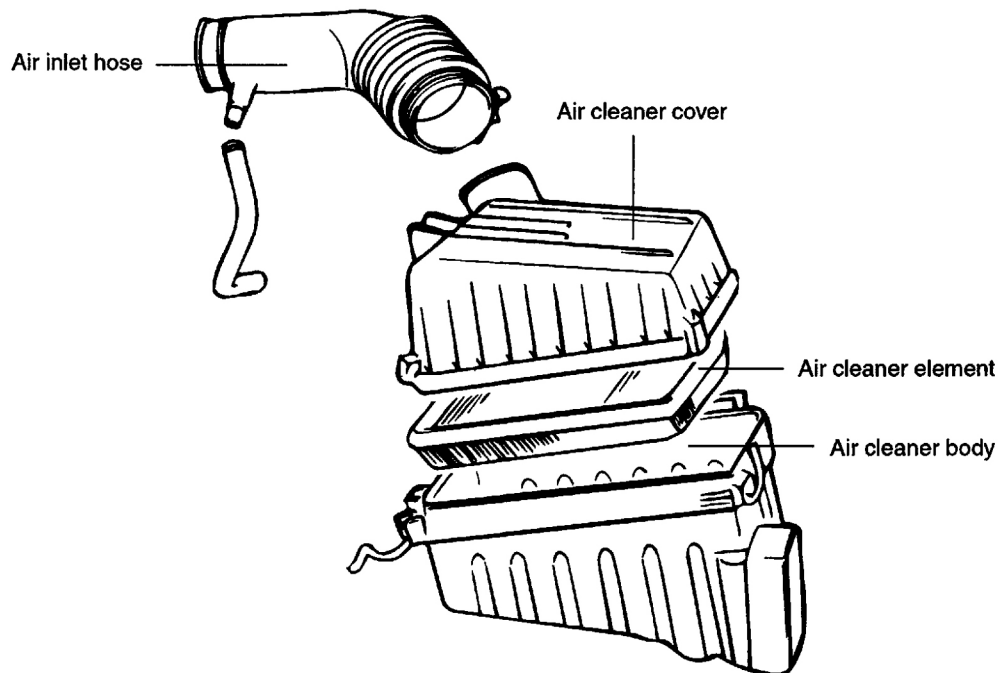
**Fig. 140: Identifying Front Exhaust Pipe**  
Courtesy of HYUNDAI MOTOR CO.

#### INSTALLATION

1. Temporarily install the front exhaust pipe, the center exhaust pipe, and the main muffler, in that order.
2. Tighten the parts securely. Make sure there is no interference with any body components.

#### AIR CLEANER (ACL)

#### COMPONENTS



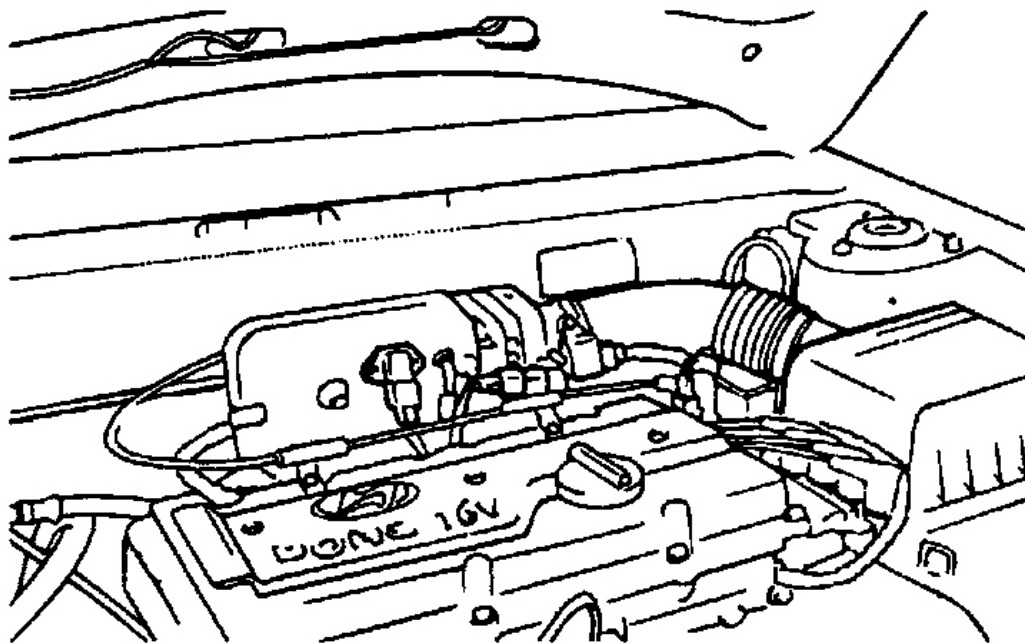
**TORQUE : Nm (kg.cm, lb.ft)**

G01277631

**Fig. 141: Air Cleaner Components**  
Courtesy of HYUNDAI MOTOR CO.

#### REMOVAL

1. Remove the air duct connected to the air cleaner.
2. Disconnect the intake air temperature sensor harness.
3. Remove the air intake hose at the air cleaner side.
4. Remove the air cleaner cover and filter.
5. Remove the air cleaner mounting bolts and remove the air cleaner.

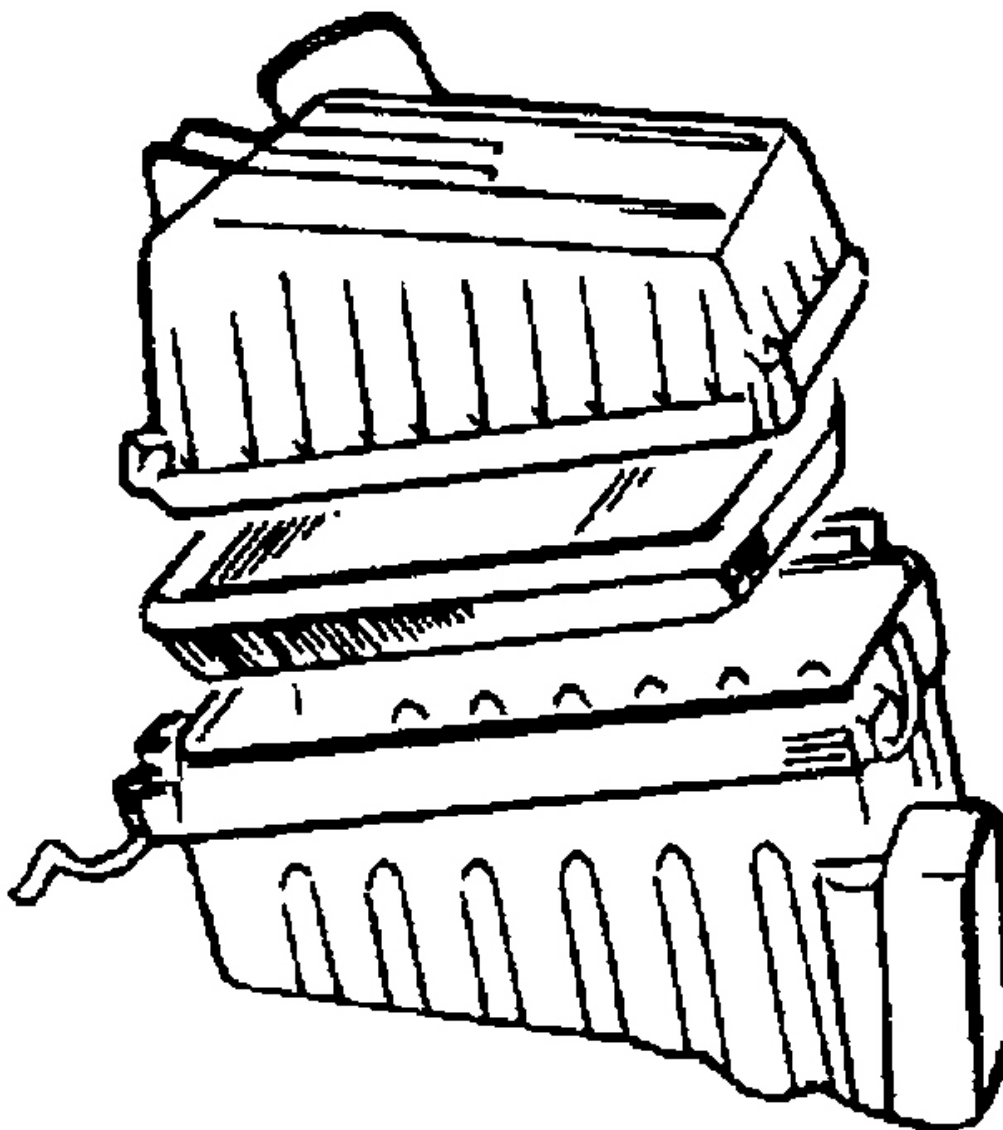


G01277632

**Fig. 142: View Of Air Cleaner**  
Courtesy of HYUNDAI MOTOR CO.

#### INSPECTION

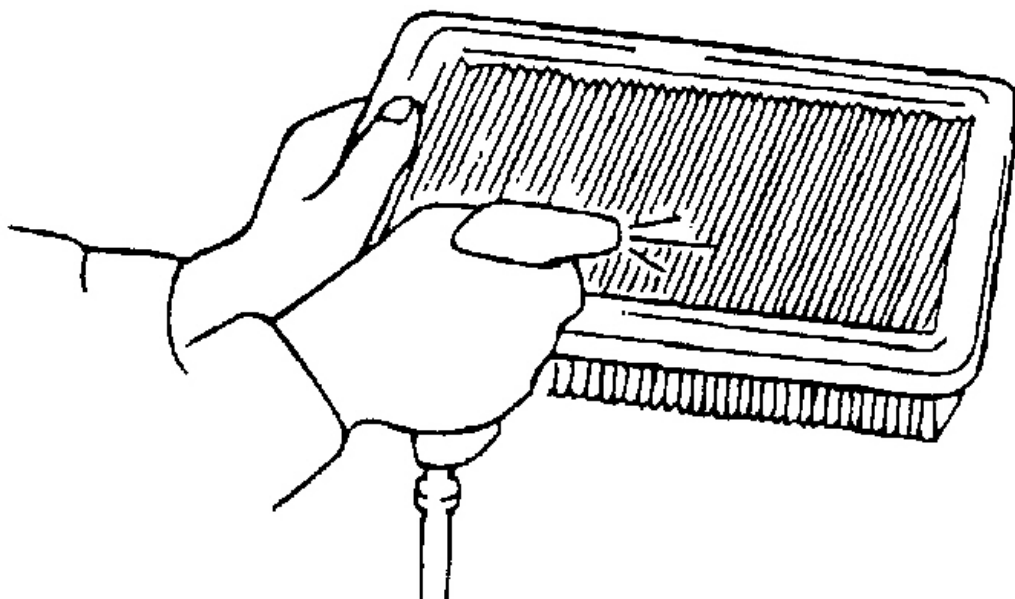
1. Check the air cleaner body, cover, or filter for distortion, corrosion or damage.
2. Check the air duct for damage.
3. Check the resonator for distortion or damage.



G01277633

**Fig. 143: Checking Resonator**  
Courtesy of HYUNDAI MOTOR CO.

4. Check the air cleaner filter for restriction, contamination or damage. If the filter is slightly restricted, remove the dust and other contaminants by blowing compressed air from the upper side through the filter.



G01277634

**Fig. 144: Cleaning Air Filter**  
Courtesy of HYUNDAI MOTOR CO.

5. Check the air cleaner housing for restrictions, contamination or damage.

## INSTALLATION

Install the air cleaner assembly following the reverse order of removal.

## CYLINDER HEAD ASSEMBLY

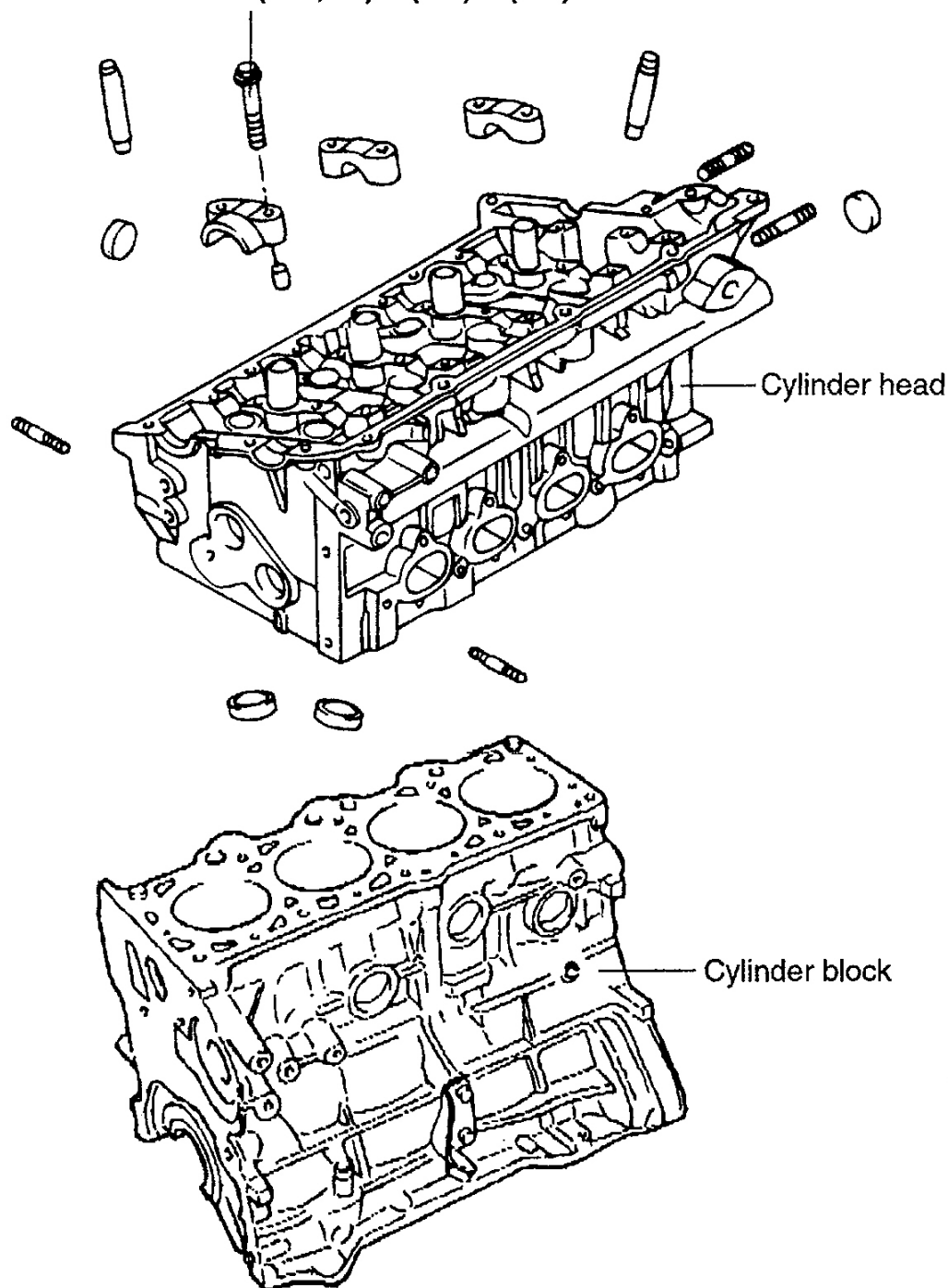
### CYLINDER HEAD

#### COMPONENTS

Cylinder head bolt

M 10 : 25 (250, 18) + (60°) + (60°)

M 12 : 30 (300, 22) + (60°) + (60°)



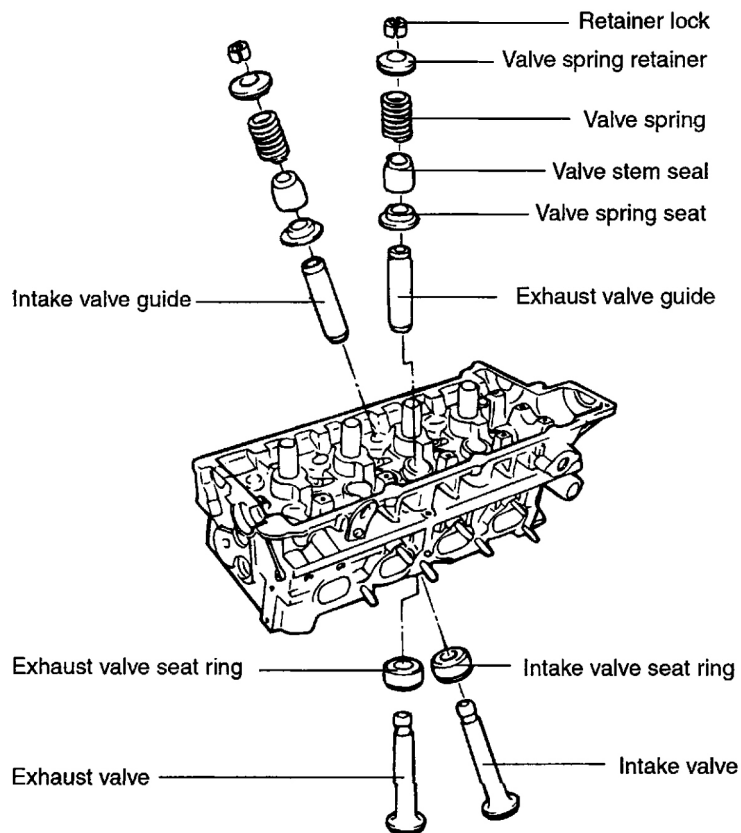
**TORQUE : Nm (kg.cm, lb.ft)**

G01277635

**Fig. 145: Cylinder Head Components**  
Courtesy of HYUNDAI MOTOR CO.

## VALVES

### COMPONENTS



**TORQUE : Nm (kg.cm, lb.ft)**

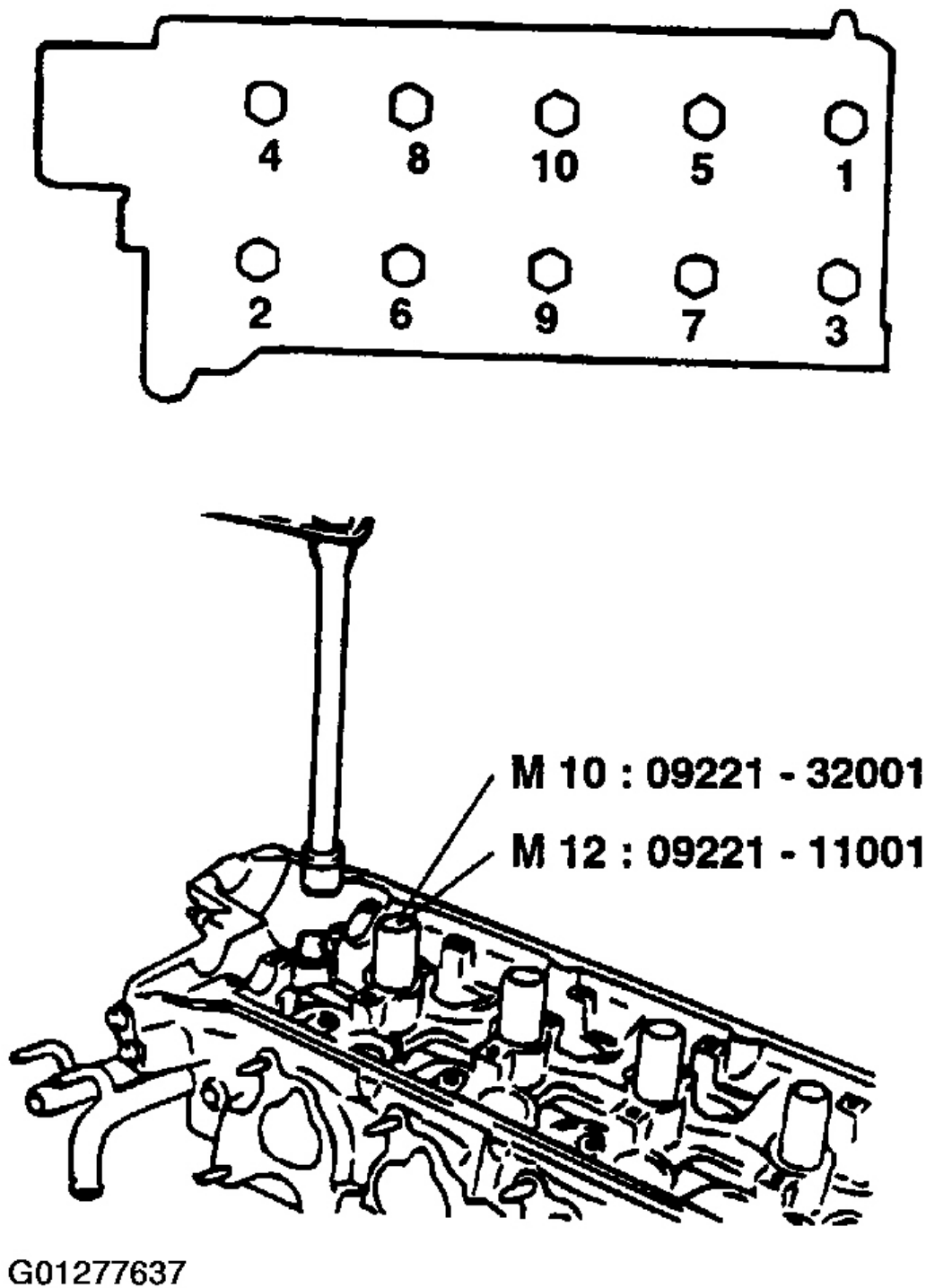
G01277636

**\*Replace the seal with new one after removal**

**Fig. 146: Valves Components**  
Courtesy of HYUNDAI MOTOR CO.

### DISASSEMBLY

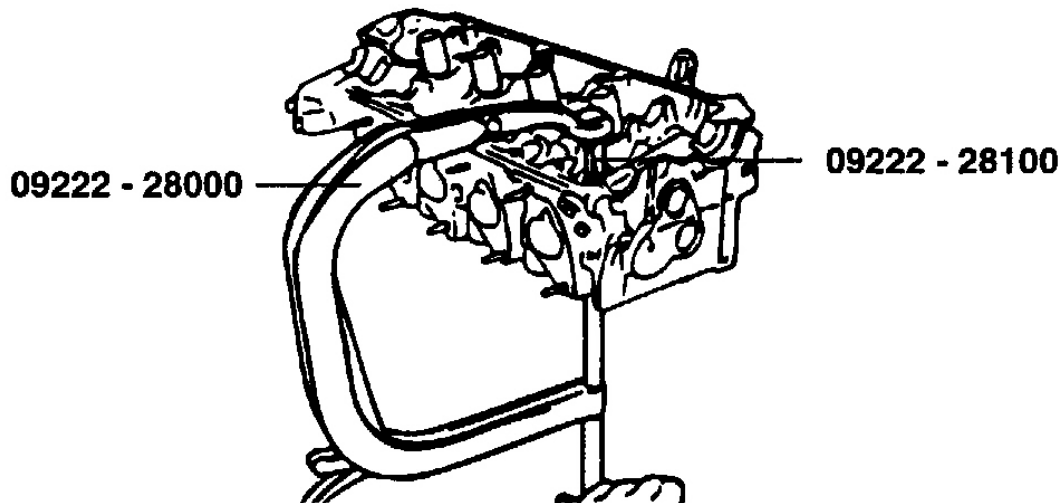
1. Using a special tool (09221-32001, 09221-11000), remove the cylinder head bolts in the order shown in the illustration.



**Fig. 147: Cylinder Head Removal Sequence**  
Courtesy of HYUNDAI MOTOR CO.

2. Using the special tool (09222-28000, 09222-28100), remove the valve spring retainer lock. Next remove the spring retainer, valve spring, spring seat and valve.

**NOTE:**        **Arrange these parts so that they can be reinstalled in their original positions.**

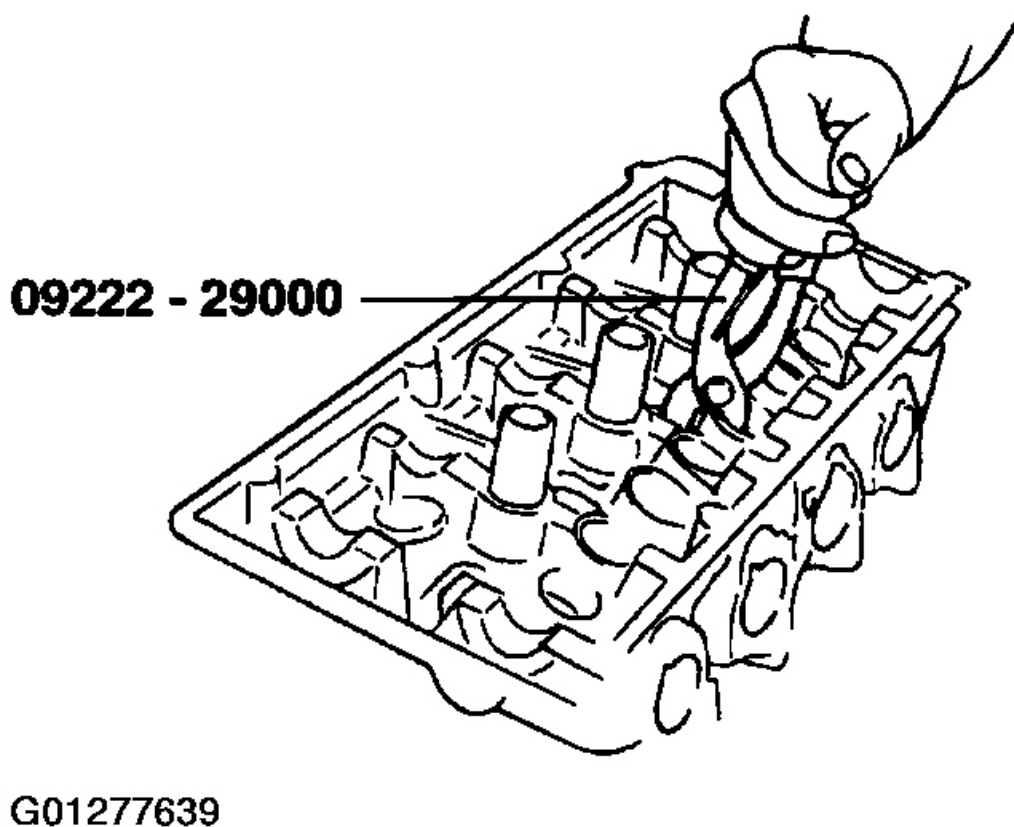


G01277638

**Fig. 148: Removing Valve Spring Retainer Locks**  
Courtesy of HYUNDAI MOTOR CO.

3. Remove the valve stem seals with pliers (09222-29000).

**NOTE:**        **Do not reuse the valve stem seals.**

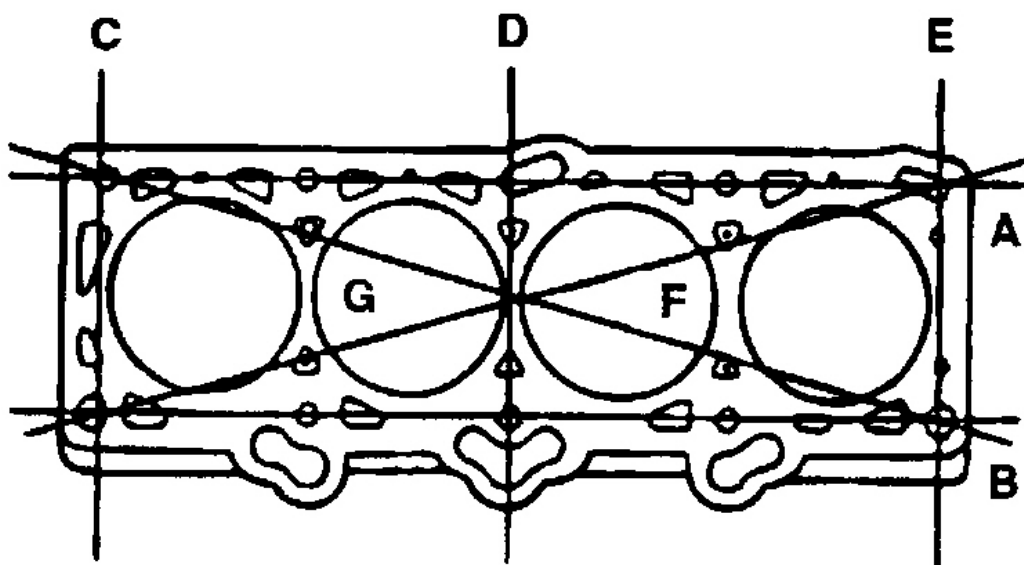


**Fig. 149: Removing Valve Stem Seals**  
Courtesy of HYUNDAI MOTOR CO.

#### **INSPECTION**

##### **CYLINDER HEAD**

1. Check the cylinder head for crack, damage and coolant leakage. If cracked, replace the cylinder head.
2. Remove scale, sealing compound and carbon deposits completely. After cleaning the oil passages, apply compressed air to verify that the passages are not clogged.



G01277640

**Fig. 150: Checking Cylinder Head Surface**  
Courtesy of HYUNDAI MOTOR CO.

3. Check the cylinder head surface for flatness in the direction as shown in the illustration. If flatness exceeds the service limit in any direction, either replace the cylinder head or machine the cylinder head matching surface lightly.

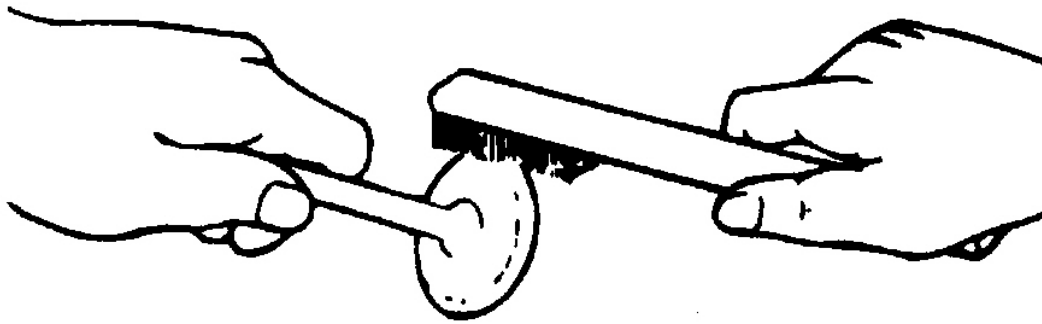
Flatness of cylinder head gasket surface

Standard: Less than 0.03mm (0.0012 in.)

Limit: 0.06 mm (0.0024 in.)

#### VALVES

1. Using a wire brush, clean the valve thoroughly.



G01277641

**Fig. 151: Cleaning Valve**

Courtesy of HYUNDAI MOTOR CO.

2. Check each valve for wear, damage and distortion of the head and the stem at B Position. Replace if necessary. If stem end, A, is hollowed out or worn, resurface as necessary. This correction must be limited to a minimum. Also resurface the valve face.

Replace the valve if the margin has decreased to less than the service limit.

**Margin****[Standard]**

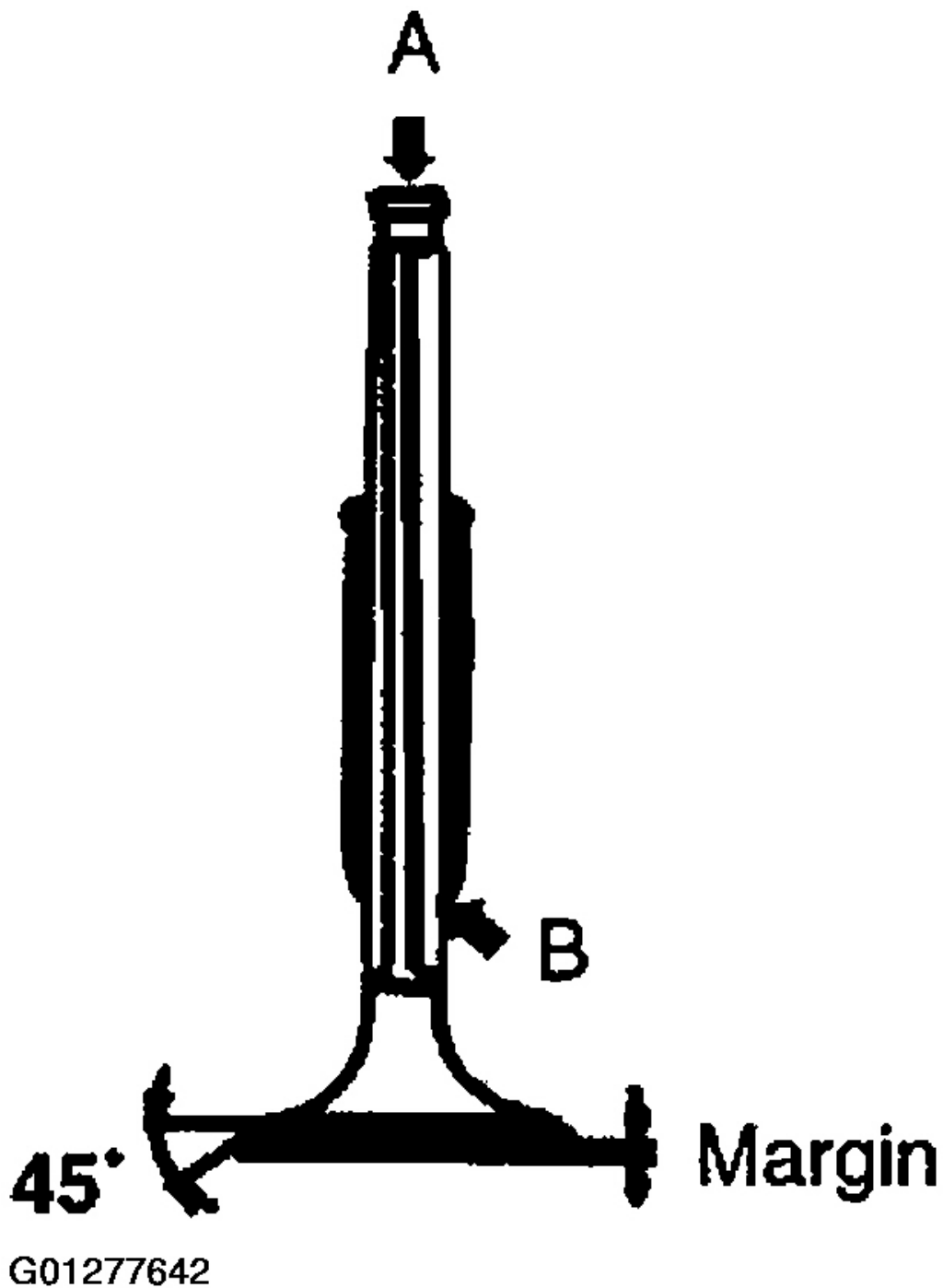
Intake: 1.15 mm (0.0453 in.)

Exhaust: 1.35 mm (0.0531 in.)

**[Limit]**

Intake: 0.8 mm (0.0315 in.)

Exhaust: 1.0 mm (0.040 in.)



**Fig. 152: Identifying Valve Margin**  
Courtesy of HYUNDAI MOTOR CO.

**VALVE SPRINGS**

1. Check the free height of each valve spring. If they exceed the service limit, replace the springs.
2. Using a square, test the squareness of each spring. If a spring is excessively out-of-square, replace it.

**Valve spring****[Standard]**

Free height: 48.86 mm(1.9236 in.)

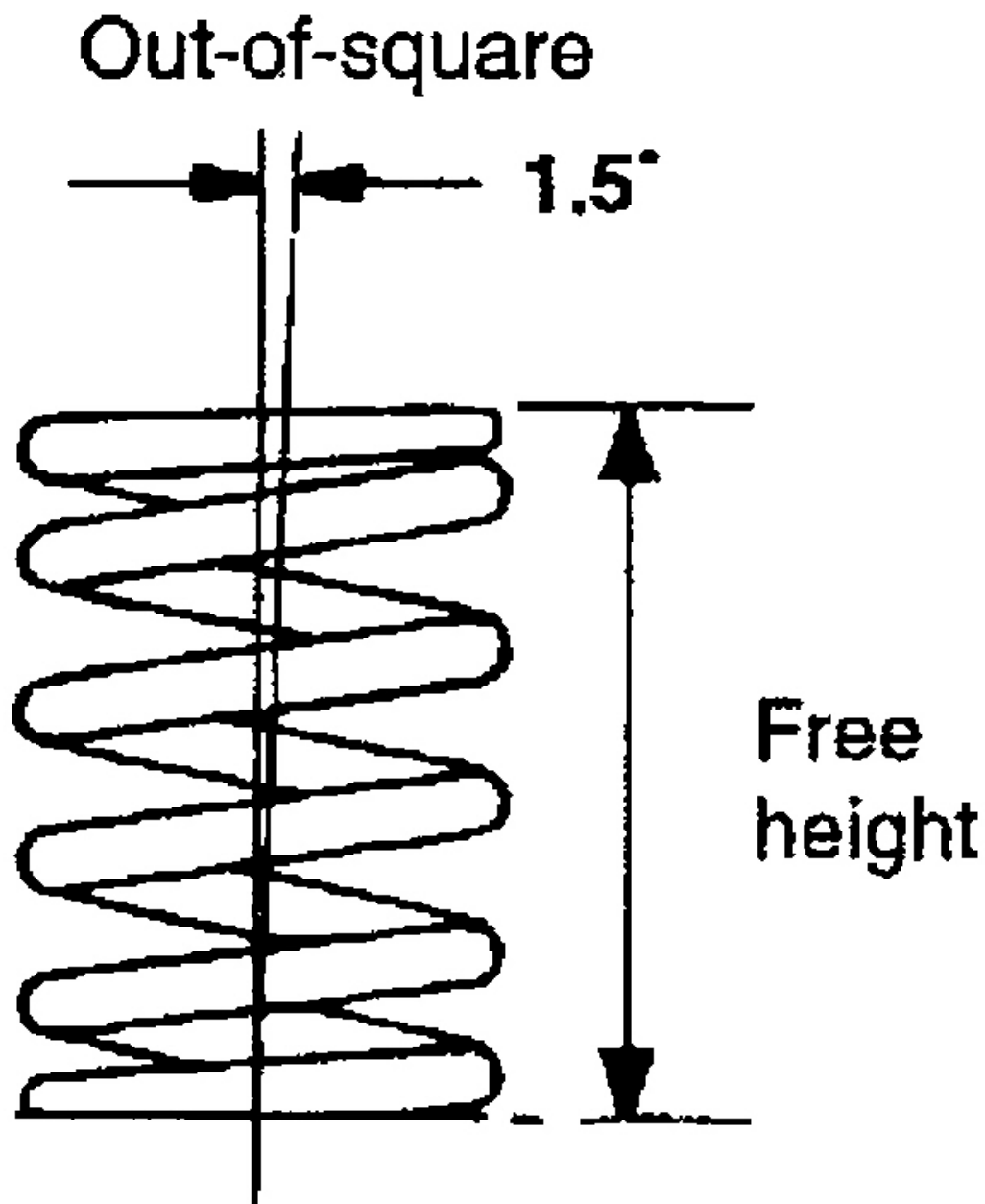
Load: 18.3kg / 39 mm (40.0 kg / 30.5mm)

Out - of - square: 1.5° or less

**[Limit]**

Free height: - 1.0 mm (- 0.0394 in.)

Out-of-square: 3°



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**Fig. 153: Identifying Valve Spring Free Height**  
Courtesy of HYUNDAI MOTOR CO.

#### VALVE GUIDES

Check the valve stem-to-guide clearance. If the clearance exceeds the service limit, replace the valve guide.

### Valve stem-to-guide clearance

[Standard]

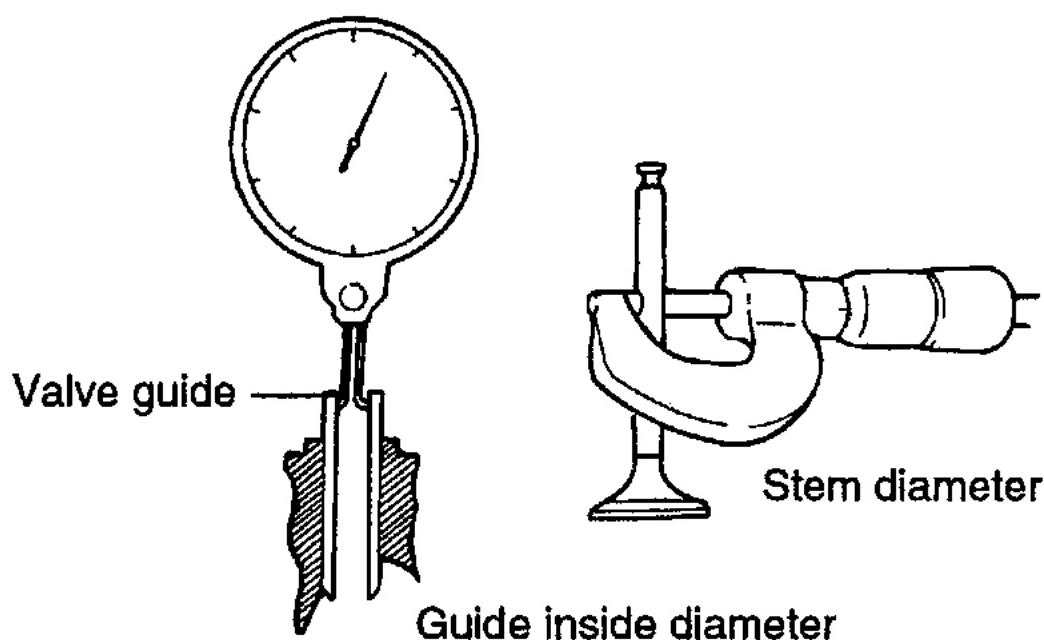
Intake: 0.02-0.05 mm (0.0008-0.0020 in.)

Exhaust: 0.035-0.065mm (0.0014 - 0.0026 in.)

[Limit]

Intake: 0.1 mm (0.0040 in)

Exhaust: 0.13 mm (0.0051 in.)



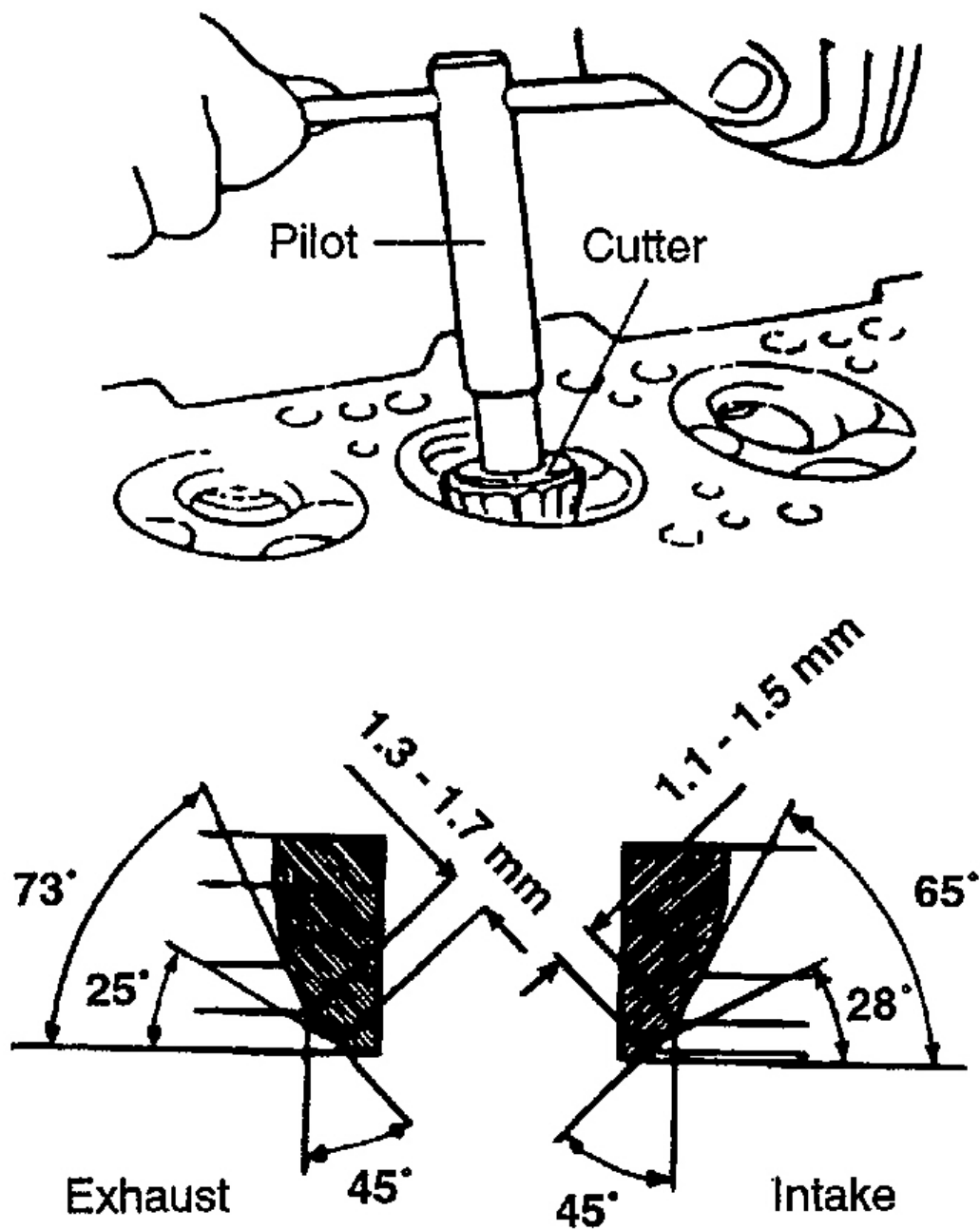
G01277644

**Fig. 154: Measuring Valve Stem-To-Guide Clearance**

Courtesy of HYUNDAI MOTOR CO.

### RECONDITIONING VALVE SEAT

Check the valve seat for overheating and unequal contact with the valve face. Recondition or replace the seat if necessary. Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it and then recondition the seat. Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face. After reconditioning, the valve and valve seat should be lapped lightly with a lapping compound.

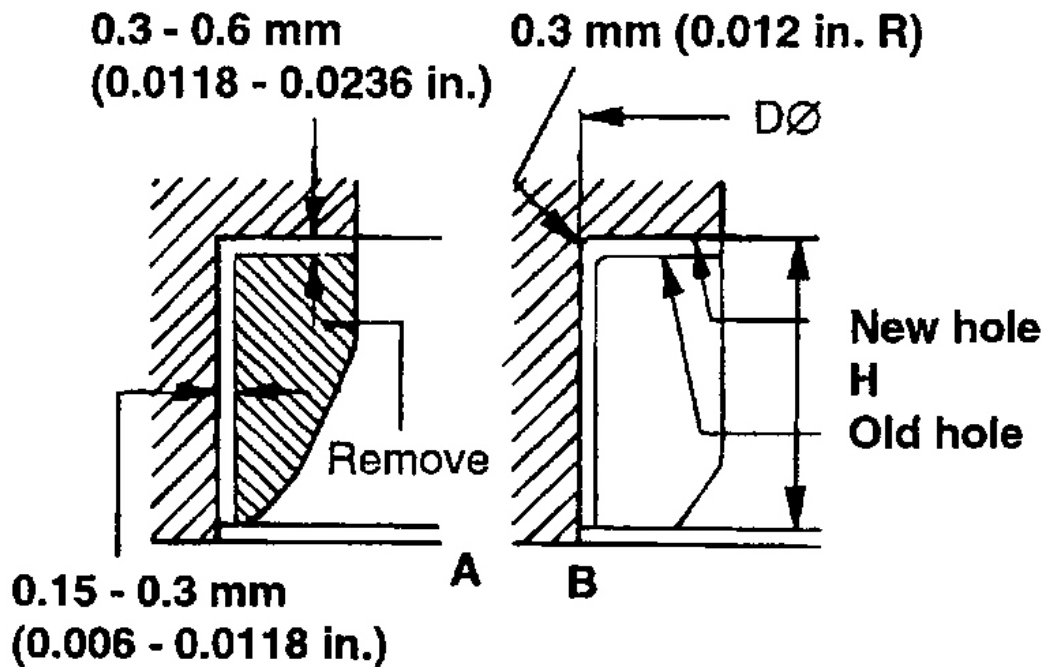


G01277645

**Fig. 155: Reconditioning Valve Seat**  
Courtesy of HYUNDAI MOTOR CO.

#### REPLACING THE VALVE SEAT RING

1. Cut away the inner face of the valve seat to reduce the wall thickness.



G01277646

**Fig. 156: Cutting Away Inner Face Of Valve Seat**  
 Courtesy of HYUNDAI MOTOR CO.

2. Enlarge the diameter of the valve seat so that it matches the specified oversize hole diameter of the new valve seat ring.
3. Heat the cylinder head to about 250°C (480°F) and press - fit an oversize seat ring for the bore in the cylinder head.
4. Using lapping compound, lap the valve to the new seat.

Valve seat contact width

Intake: 1.1-1.5 mm (0.0433-0.0590 in.)

Exhaust: 1.3-1.7 mm (0.0512-0.0670 in.)

#### VALVE SEAT INSERT OVERSIZES

## 2002 Hyundai Elantra GLS

2002 ENGINE 2.0L 4 Cylinder DOHC - Elantra

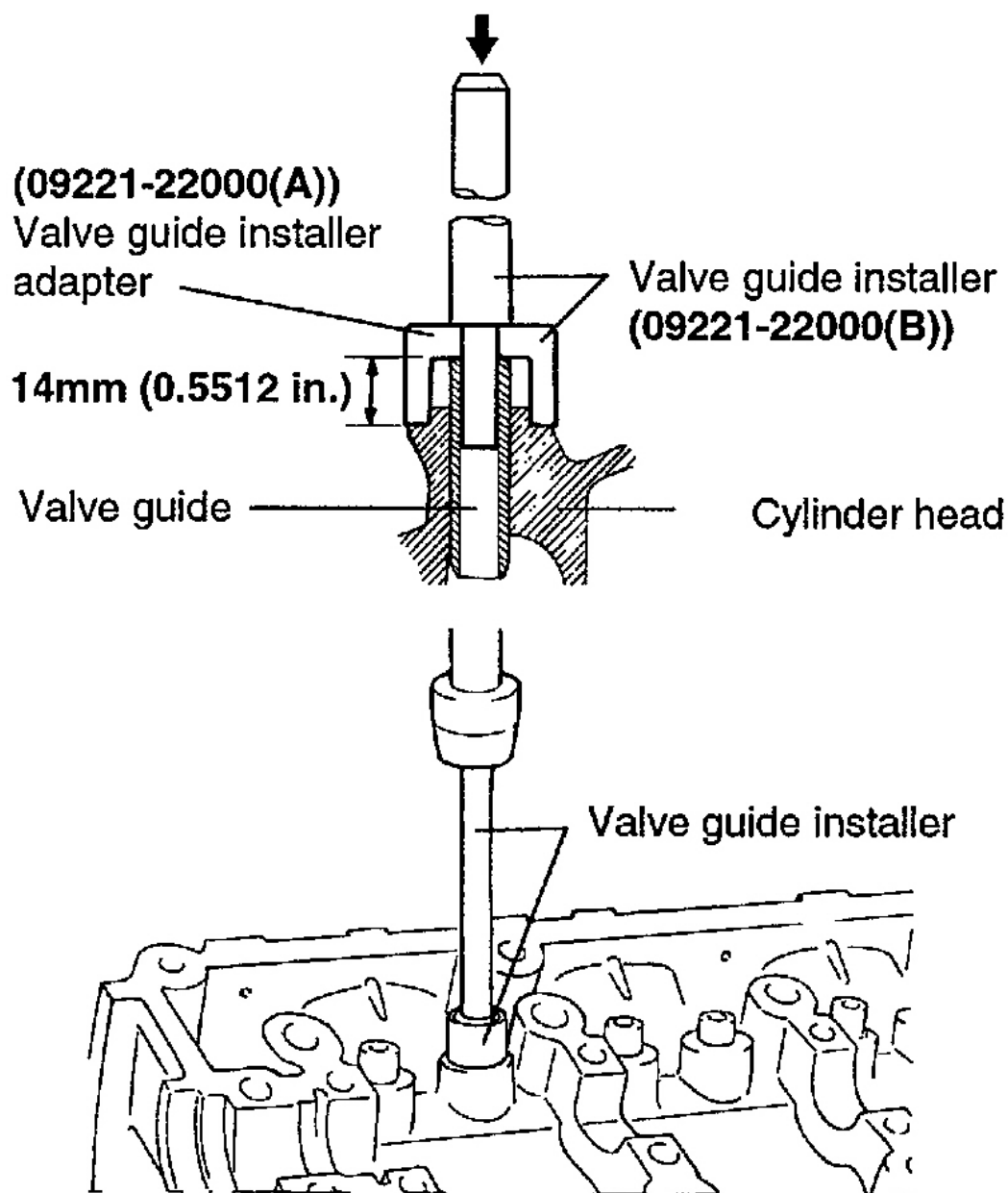
| Description   | Size mm (in.)    | Size mark | Seat ring height H mm(in.) | Oversize hole diameter I.D. mm(in.)  |
|---------------|------------------|-----------|----------------------------|--------------------------------------|
| Intake valve  | 0.3 (0.012) O.S. | 30        | 7.5-7.7 (0.295-0.303)      | 33.300 - 33.325<br>(1.3110 - 1.3120) |
| Seat ring     | 0.6 (0.024) O.S. | 60        | 7.8-8.0 (0.307-0.315)      | 33.600 - 33.625<br>(1.3228 - 1.3238) |
| Exhaust valve | 0.3 (0.012) O.S. | 30        | 7.9-8.1 (0.311-0.319)      | 28.800 - 28.821<br>(1.1339 - 1.1347) |
| Seat ring     | 0.6 (0.024) O.S. | 60        | 8.2-8.4 (0.323-0.331)      | 29.100 - 29.121<br>(1.1457 - 1.1465) |

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**Fig. 157: Valve Seat Insert Oversize Table**  
**Courtesy of HYUNDAI MOTOR CO.**

### REPLACING VALVE GUIDE

1. Using the special tool (09221-22000 A/B), withdraw the old valve guide toward the bottom of cylinder head.
2. Recondition the valve guide hole so that it can match the newly press-fitted oversize valve guide.



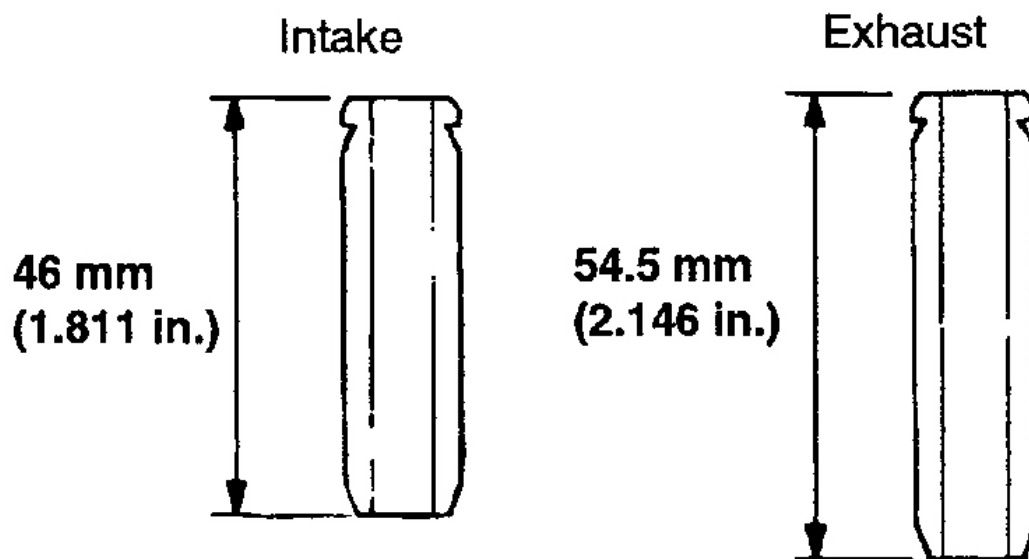
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**Fig. 158: Installing Valve Guide**

Courtesy of HYUNDAI MOTOR CO.

3. Using the special tool (09221-22000 A/B), press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head. Keep in mind that the intake and exhaust valve guides are different in length.

**NOTE:** Do not install a valve guide unless it is oversize.



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**Fig. 159: Identifying Intake & Exhaust Valve Guide Differences**  
Courtesy of HYUNDAI MOTOR CO.

4. After the valve guide is press-fitted, insert a new valve and check for proper stem-to-guide clearance.
5. After the valve guide is replaced, check that the valve is seated properly. Recondition the valve seats as necessary.

#### VALVE GUIDE OVERSIZES

| Over size mm (in.) | Size mark | Oversize valve guide hole size mm (in.) |
|--------------------|-----------|-----------------------------------------|
| 0.05(0.002)        | 5         | 11.05-11.068<br>(0.4350-0.4357)         |
| 0.25 (0.010)       | 25        | 11.25-11.268<br>(0.4429-0.4436)         |
| 0.50 (0.020)       | 50        | 11.50-11.518<br>(0.4528-0.4535)         |

G01277650

**Fig. 160: Valve Guide Oversize Specification Table**  
 Courtesy of HYUNDAI MOTOR CO.

#### REASSEMBLY

**NOTE:**

1. Clean each part before assembly.
2. Apply engine oil to the sliding and rotating parts.

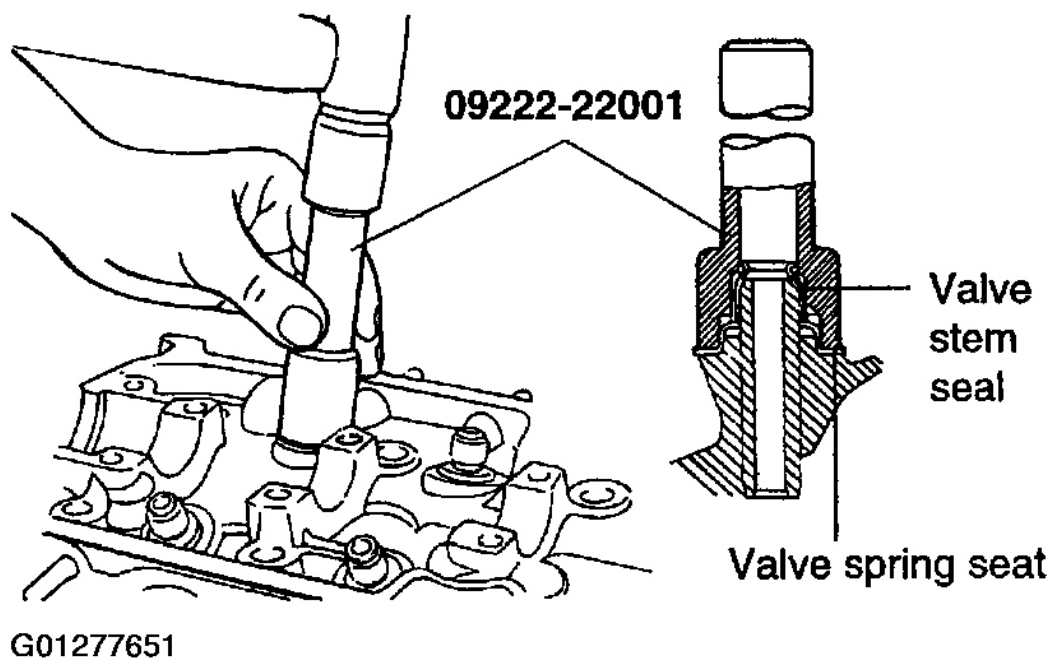
1. Install the spring seats.

Using a special tool (09222-22001), tap the seal in position lightly.

**NOTE:**

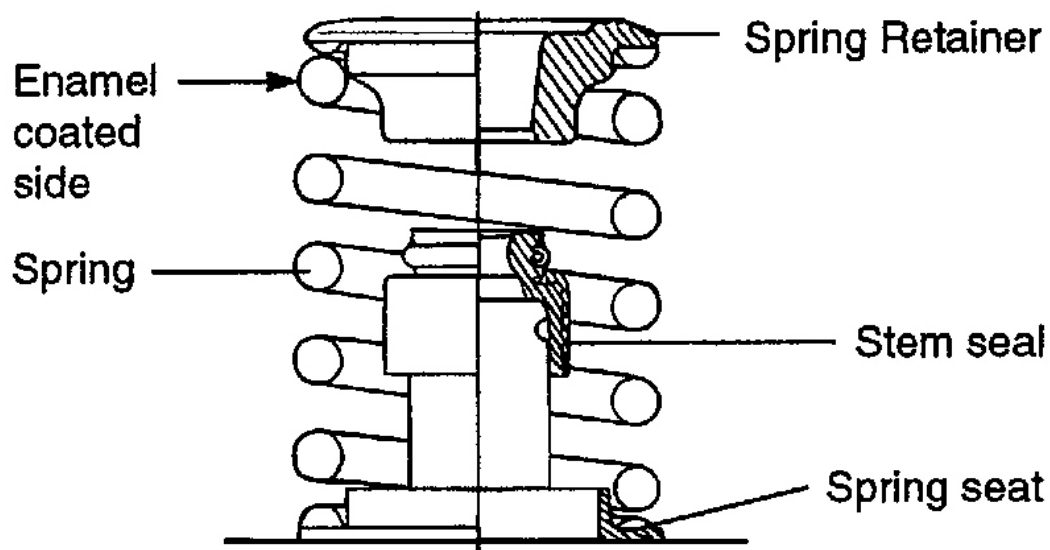
- Do not reuse old valve stem seals.
- Incorrect installation of the seal could result in oil leakage past the valve guides.

2. Apply engine oil to each valve. Insert the valve into the valve guide. Avoid pushing the valve into the seal by force. After inserting the valve, check that it moves smoothly.



**Fig. 161: Installing Valve**  
Courtesy of HYUNDAI MOTOR CO.

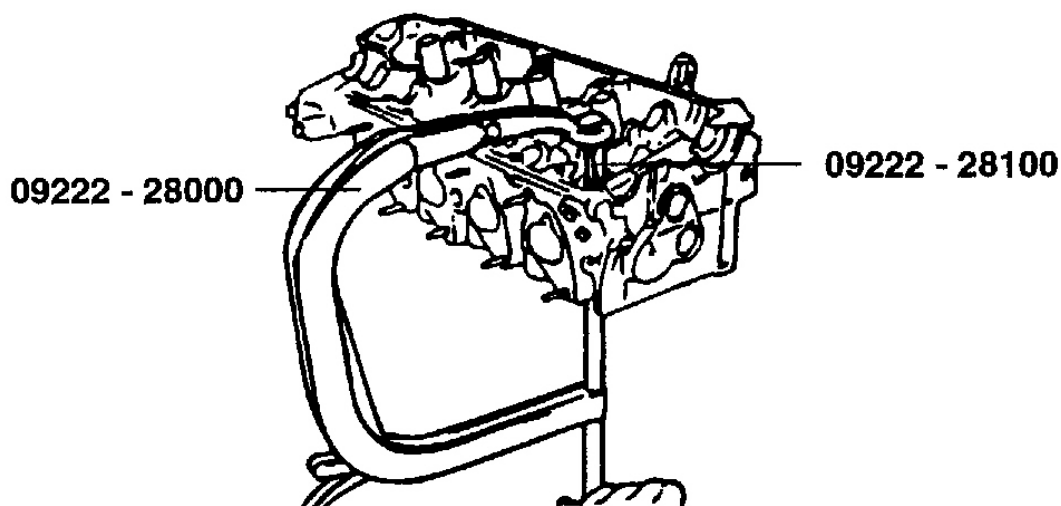
3. Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then install the retainer.



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**Fig. 162: Identifying Proper Valve Spring Installation**  
Courtesy of HYUNDAI MOTOR CO.

4. Using the special tool (09222-28000, 09222-28100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.

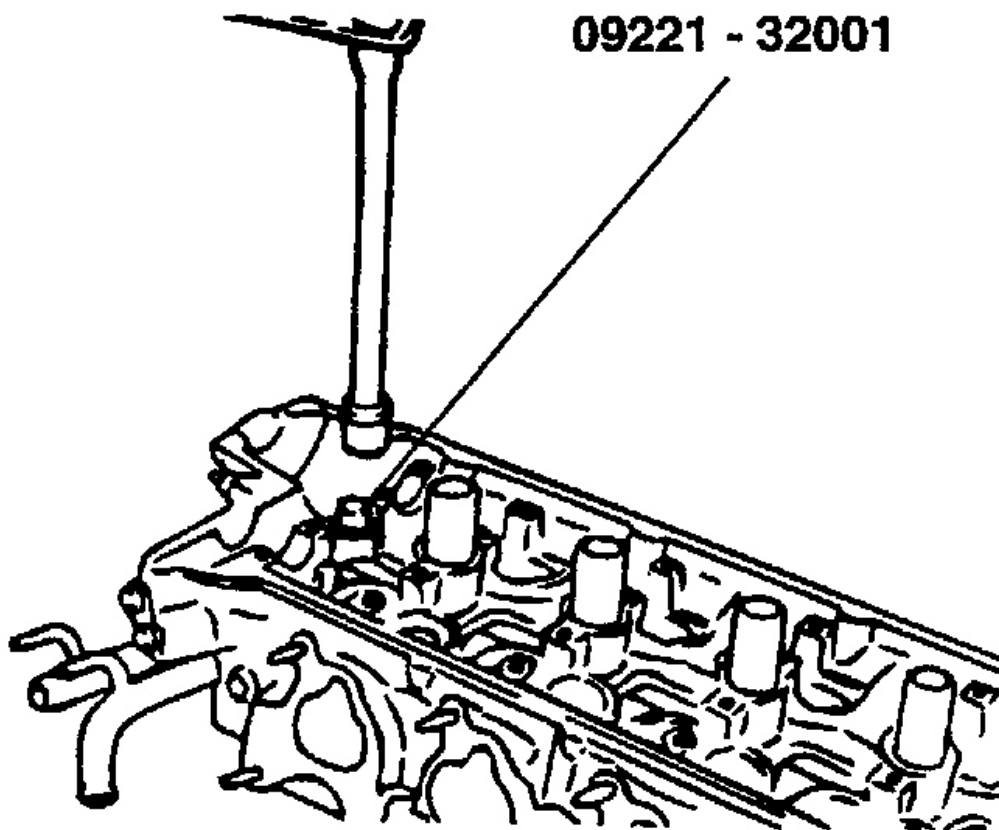
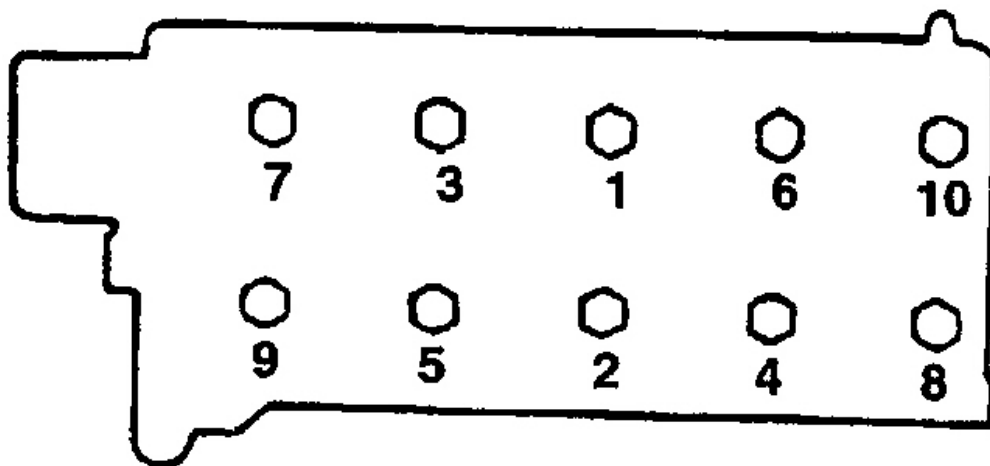


G01277653

**Fig. 163: Installing Valve Spring Retainer Locks**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE:** When the spring is compressed, Check that the valve stem seal is not pressed against the bottom of the retainer.

5. Clean both gasket surfaces of the cylinder block and cylinder head.
6. Verify the identification marks on the cylinder head gasket.
7. Install the gasket so that the surface with the identification mark faces toward the cylinder head.
8. Tighten the bolts to the specified torque in the sequence shown below.



G01277654

**Fig. 164: Identifying Cylinder Head Torque Sequence**  
**Courtesy of HYUNDAI MOTOR CO.**

**Cylinder head bolt**

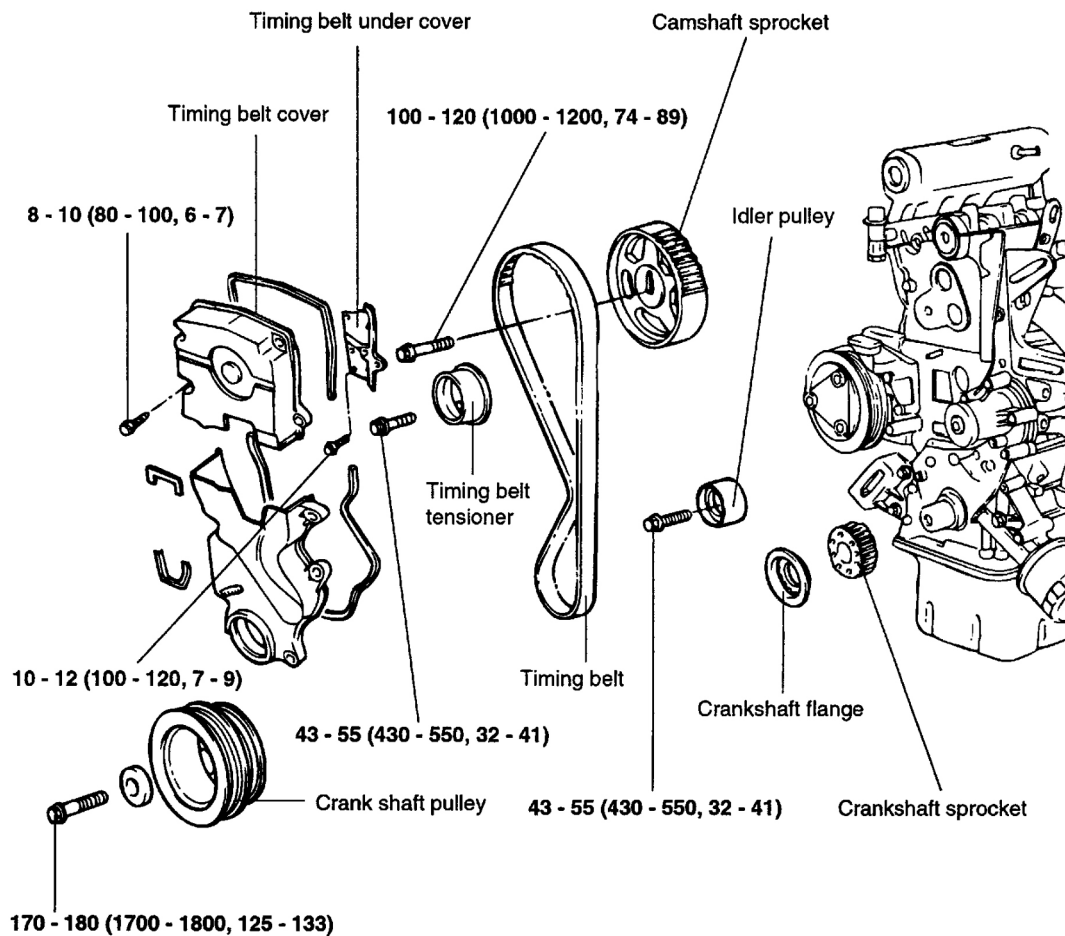
M10: 25 Nm (250kg.cm, 18lb.ft) + (60°) + (60°)

M12: 30 Nm (300kg.cm, 22 lb.ft) + (60°) + (60°)

## **TIMING SYSTEM**

### **TIMING BELT**

#### **COMPONENTS**



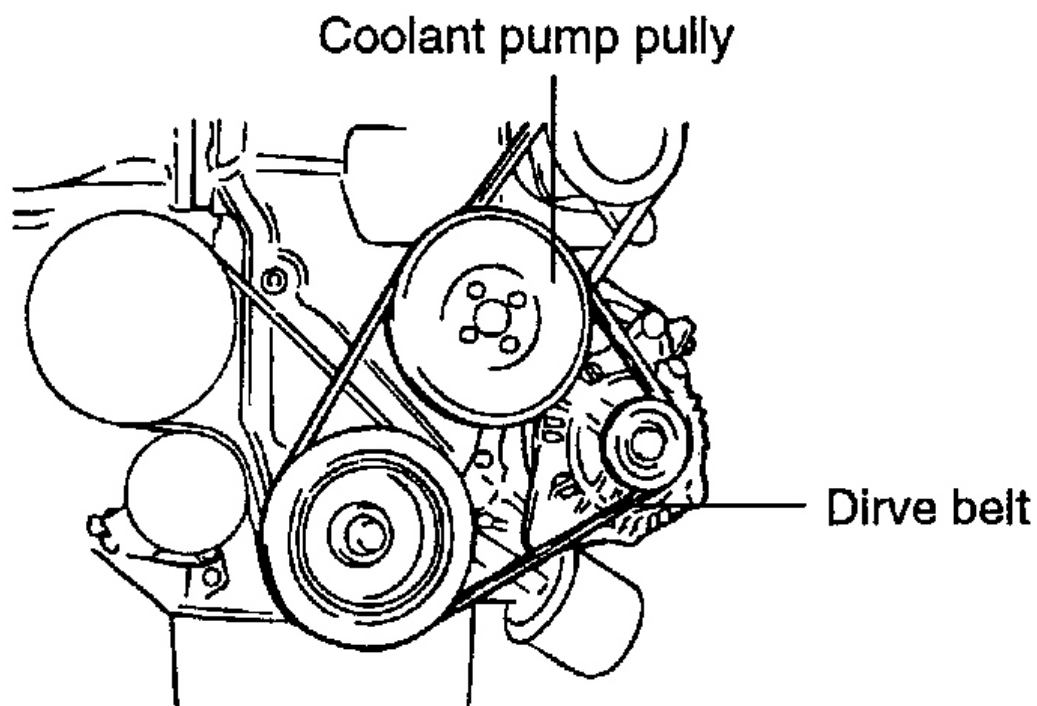
**TORQUE : Nm (kg.cm, lb.ft)**

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**Fig. 165: Timing Belt Components**  
Courtesy of HYUNDAI MOTOR CO.

### DISASSEMBLY

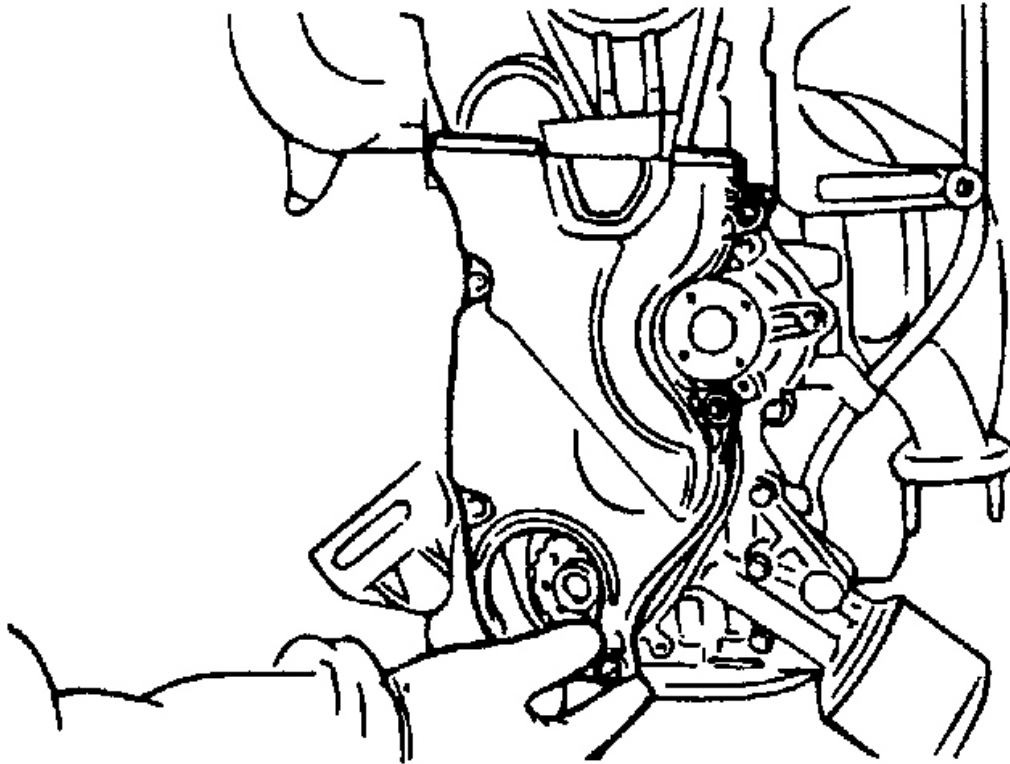
1. Remove the crankshaft pulley, coolant pump pulley and drive belt.
2. Remove the alternator bolt.
3. Remove the coolant pump pulley and belt.



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**Fig. 166: Removing Water Pump Pulley & Belt**  
Courtesy of HYUNDAI MOTOR CO.

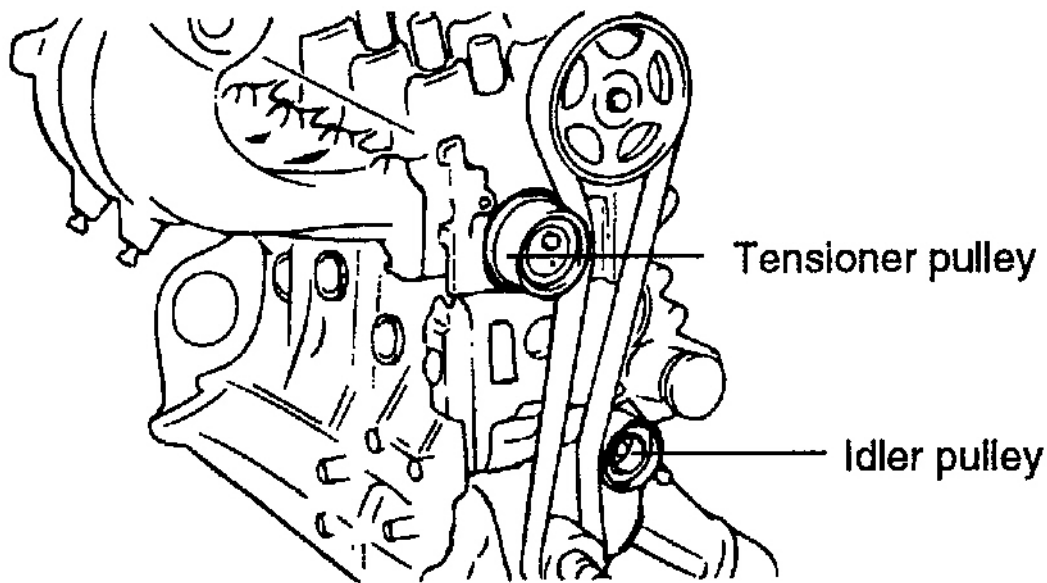
4. Remove the crankshaft pulley.
5. Remove the timing belt cover.



G01277657

**Fig. 167: Removing Timing Cover**  
Courtesy of HYUNDAI MOTOR CO.

6. Remove the timing belt tensioner pulley.

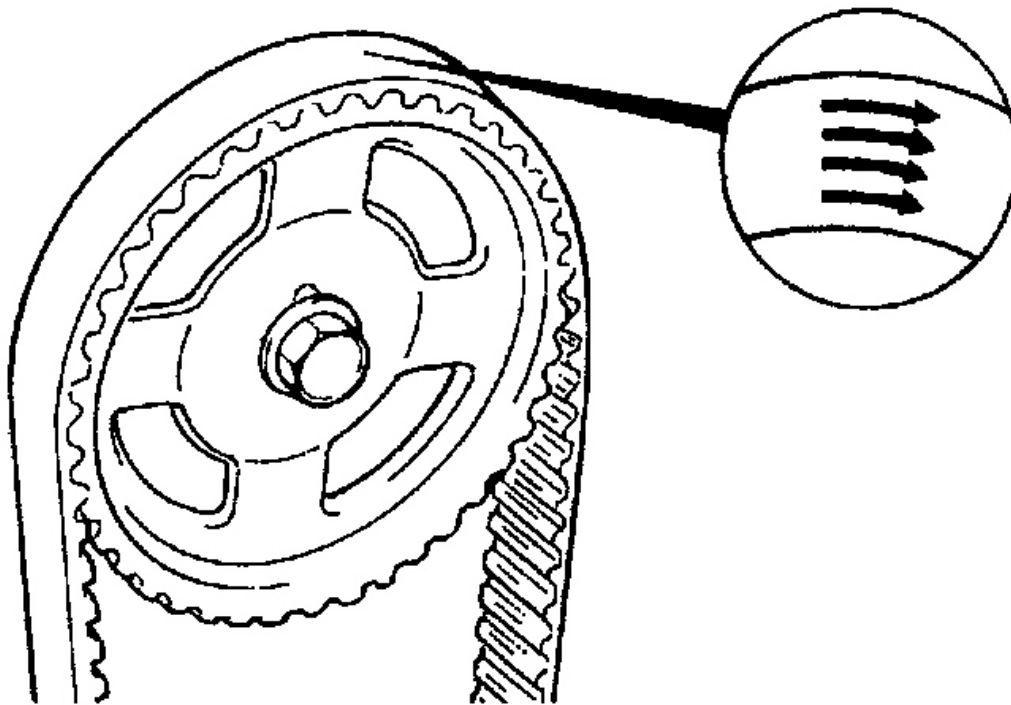


G01277658

**Fig. 168: Identifying Tensioner & Idler Pulley**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE:** If the timing belt is reused, make an arrow indicating the turning direction (or the front of the engine) to make sure that the belt is reinstalled in the same direction as before.

7. Remove the timing belt.



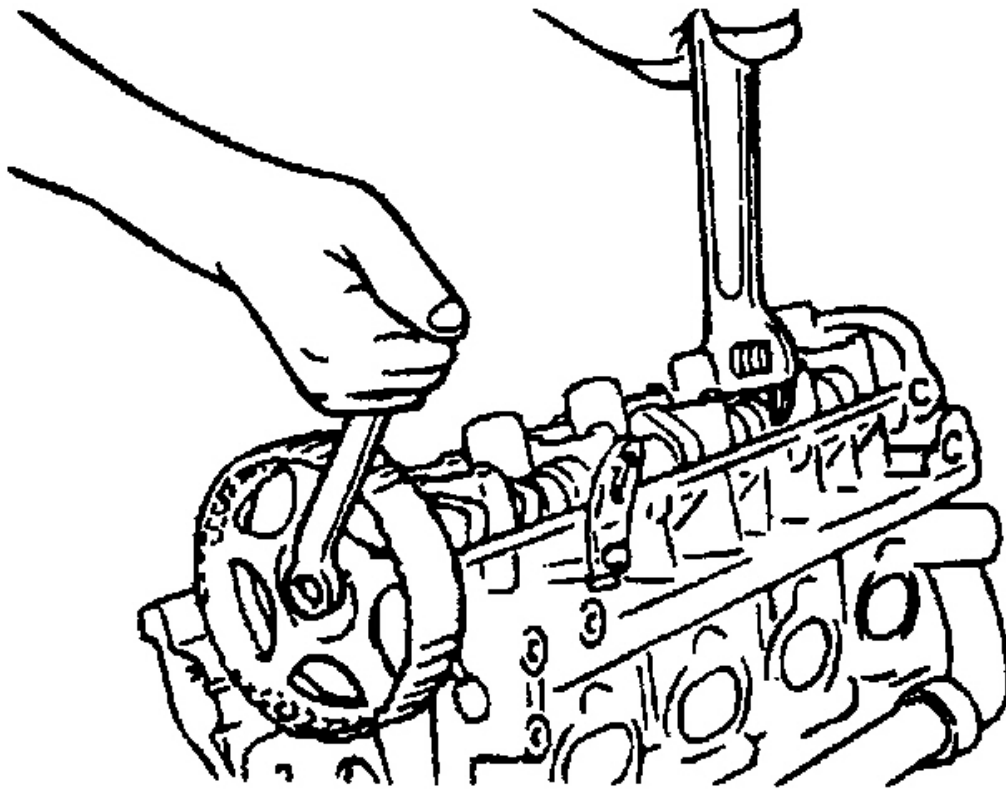
G01277659

**Fig. 169: Removing Timing Belt**  
Courtesy of HYUNDAI MOTOR CO.

8. Remove the idler pulley.
9. Remove the camshaft sprocket.

**NOTE:** Be careful not to damage the cylinder head with the wrench.

10. Remove the crankshaft sprocket from crankshaft.



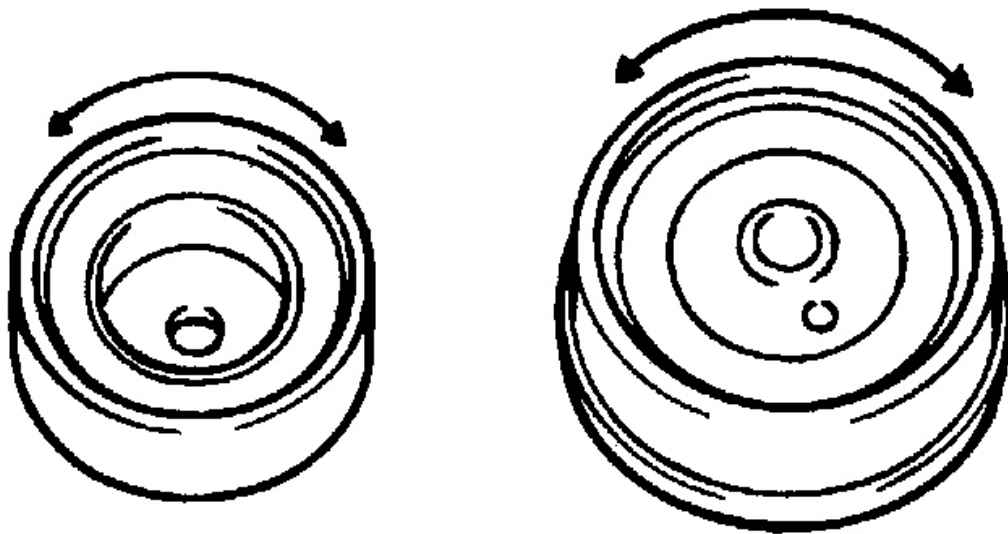
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**Fig. 170: Removing Crankshaft Sprocket**  
Courtesy of HYUNDAI MOTOR CO.

#### INSPECTION

##### SPROCKETS, TENSIONER PULLEY, AND IDLER PULLEY.

1. Check the camshaft sprocket, crankshaft sprocket, tensioner pulley, and idler pulley for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner pulley and the idler pulley for easy and smooth rotation and check for play or noise. Replace as necessary.
3. Replace the pulley if there is a grease leak from its bearing.



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**Fig. 171: Inspecting Pulleys**

Courtesy of HYUNDAI MOTOR CO.

#### **TIMING BELT**

1. Check the belt for oil or dust deposits. Replace, if necessary.

Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.

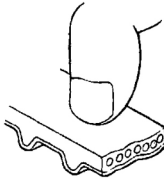
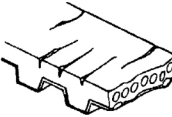
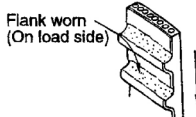
2. When the engine is overhauled or belt tension adjusted, check the belt carefully. If any of the following flaws are evident, replace the belt.

**NOTE:**

- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water and steam.

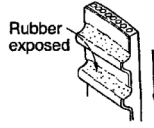
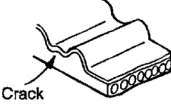
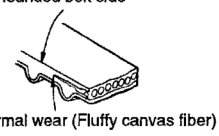
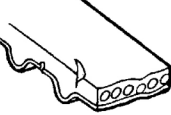
## 2002 Hyundai Elantra GLS

2002 ENGINE 2.0L 4 Cylinder DOHC - Elantra

| Description                         | Flaw conditions                                                                                                                                                                                                                                                                                         |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Hardened back surface of rubber  | <p>Back surface is glossy, non-elastic and so hard that, when your fingernail is pressed into it, no mark is produced.</p>                                                                                            |
| 2. Cracked back surface of rubber   |                                                                                                                                                                                                                       |
| 3. Cracked or separating canvas     |  <p>Crack</p>  <p>Crack</p>  <p>Separation</p> |
| 4. Badly worn teeth (initial stage) | <p>Tooth flank shows canvas on the load side (Fluffy canvas fibers, rubber changed into white color and unclear canvas texture)</p>  <p>Flank worn (On load side)</p>                                               |
| 5. Badly worn teeth (last stage)    | <p>Tooth flank worn and rubber exposed on load side (tooth width reduced)</p>                                                                                                                                                                                                                           |

G01277663

**Fig. 172: Inspecting Timing Belt (1 Of 2)**  
 Courtesy of HYUNDAI MOTOR CO.

| Description                | Flaw conditions                                                                                                                                      |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            |  <p>Rubber exposed</p>                                             |
| 6. Cracked tooth bottom    |  <p>Crack</p>                                                      |
| 7. Missing tooth           |  <p>Tooth missing and canvas fiber exposed</p>                     |
| 8. Badly worn side of belt |  <p>Rounded belt side<br/>Abnormal wear (Fluffy canvas fiber)</p> |
| 9. Cracked side of belt    |                                                                  |

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**Fig. 173: Inspecting Timing Belt (2 Of 2)**  
 Courtesy of HYUNDAI MOTOR CO.

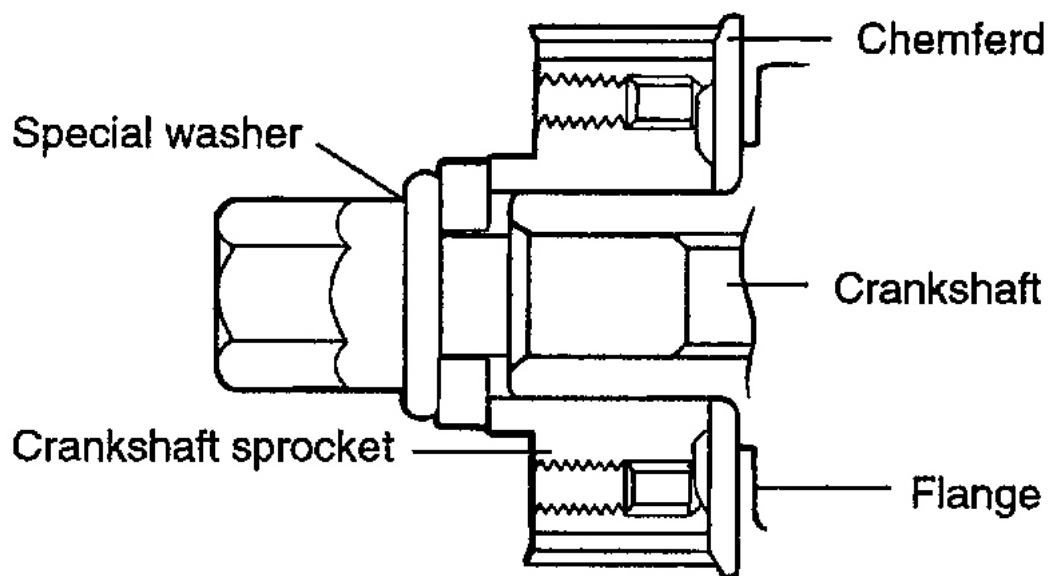
## REASSEMBLY

1. Install damper pulley flange and crankshaft sprocket as shown. Pay close attention to their mounting direction.

## Tightening Torque

Camshaft sprocket bolt:

170-180 Nm (1700-1800 kg.cm, 125-133 lb.ft)



G01277665

**Fig. 174: Identifying Crankshaft Sprocket Installation**  
Courtesy of HYUNDAI MOTOR CO.

2. Install the camshaft sprocket and tighten the bolt to the specified torque.

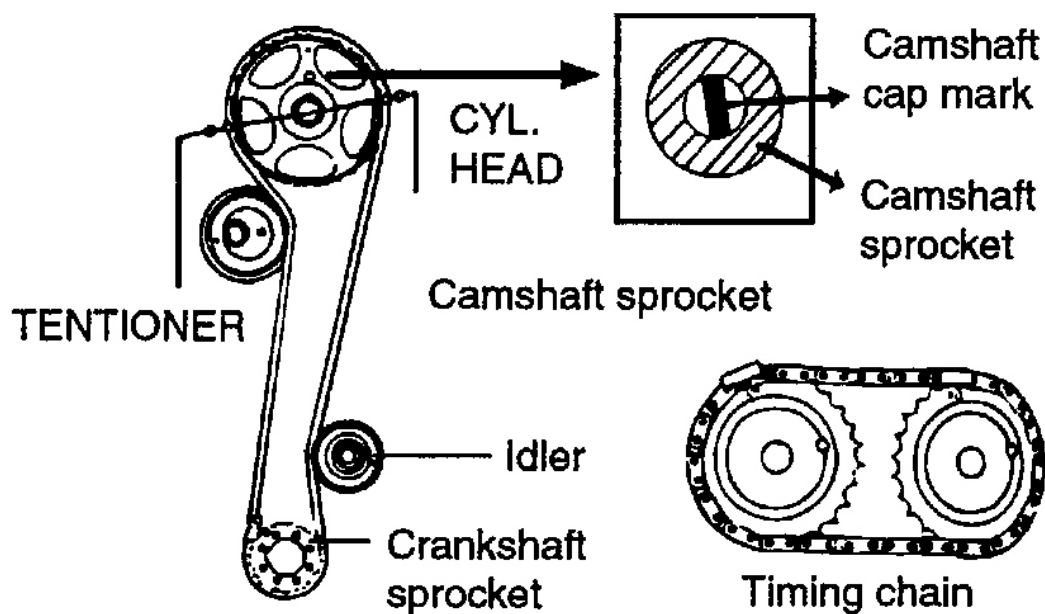
#### **Tightening torque**

Camshaft sprocket bolt:

100-120 Nm (1000-1200 kg.cm, 74-89 lb.ft)

3. Align the timing marks of the camshaft sprocket and crankshaft sprocket with the No. 1 piston placed at top dead center and its compression stroke.
4. Install the timing belt tensioner and idler pulley.
5. Install the timing belt on the camshaft.

**NOTE:** When the timing belt is installed on the camshaft sprocket, make sure that the tension side is tightened by pushing the timing belt tensioner pulley toward the water pump.



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**Fig. 175: Identifying Timing Chain & Belt Installation**

Courtesy of HYUNDAI MOTOR CO.

6. Turn the crankshaft one turn in the operating direction (clockwise) and realign crankshaft sprocket timing mark.

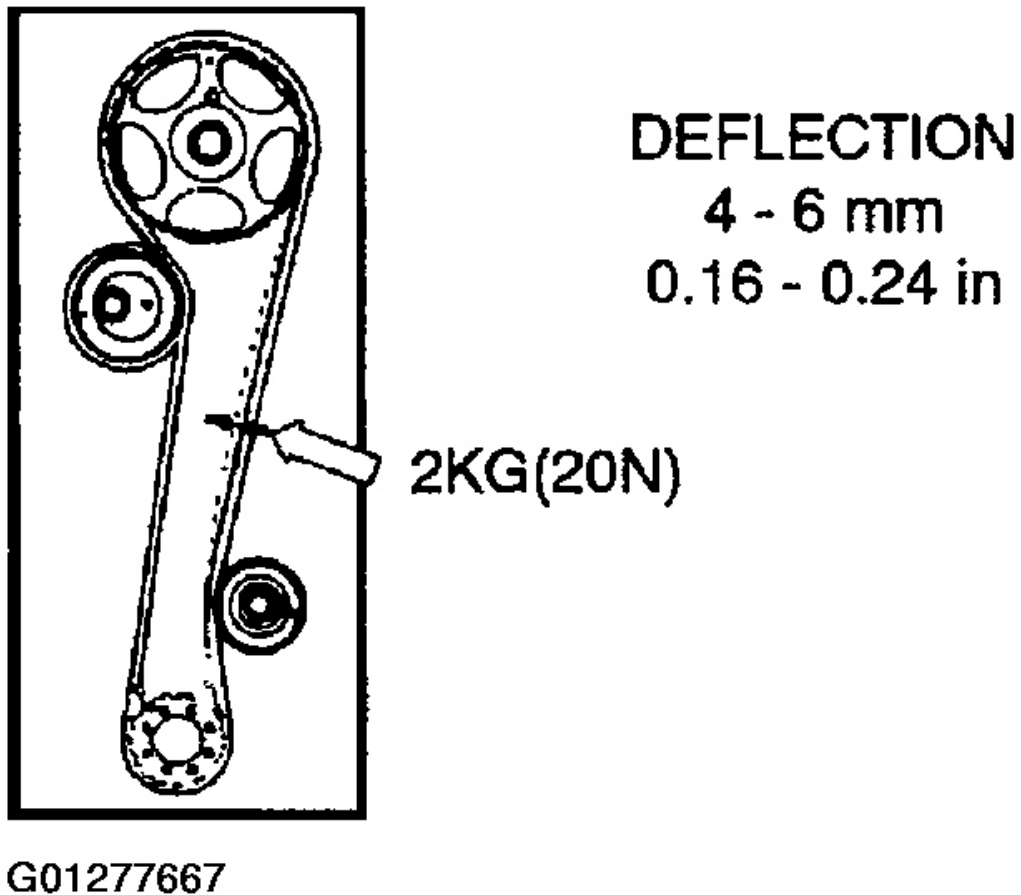
**CAUTION:** Do not turn the crankshaft in a counterclockwise direction. The crankshaft should be turned smoothly.

### Tightening torque

Tensioner and idler pulley installing bolt:

43-55 Nm (430-550 kg.cm, 32-41 lb.ft)

7. Recheck the belt tension. When the tension side of timing belt is pushed horizontally with a moderate force [approx. 2kg (20N, 5lb)], the timing belt cog end sags in approx. 4-6 mm (0.16-0.24 in.)



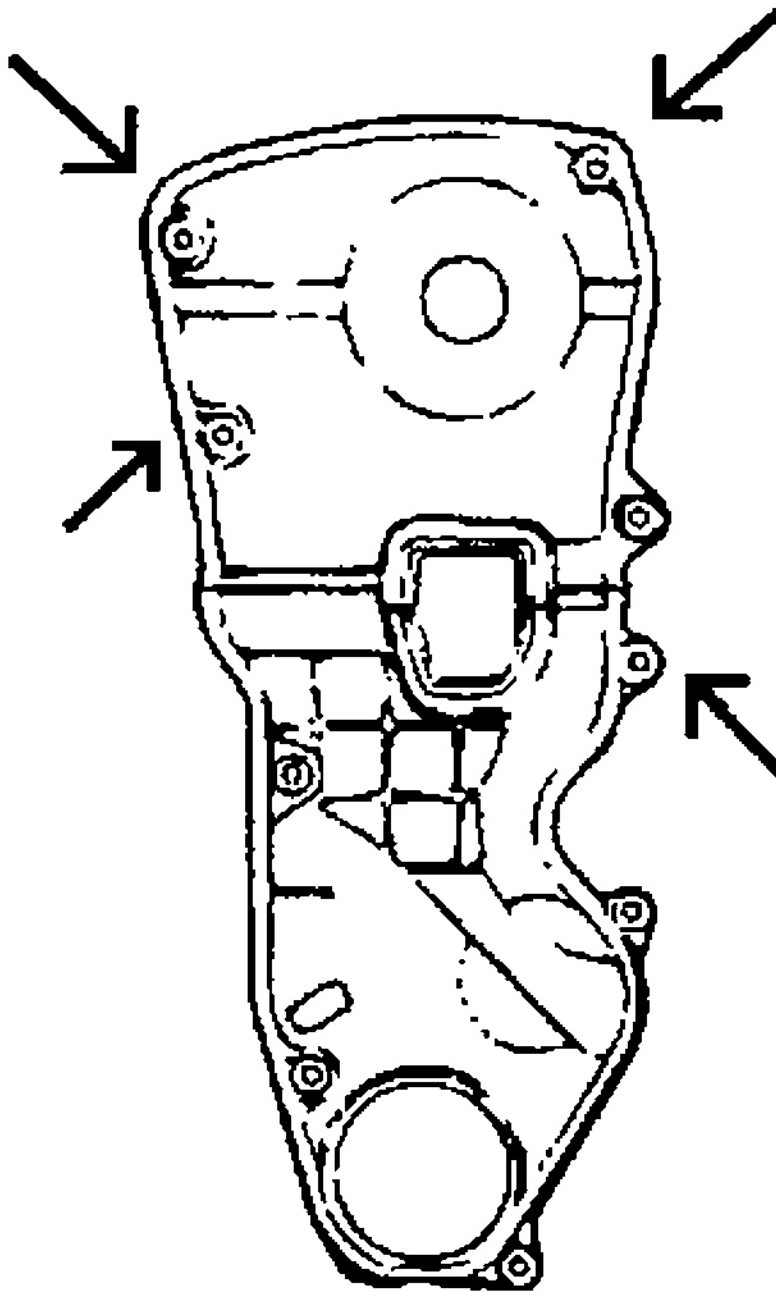
**Fig. 176: Checking Timing Belt Tension**  
Courtesy of HYUNDAI MOTOR CO.

8. Install the timing belt cover.

**Tightening torque**

Timing belt cover bolt:

8-10 Nm (80-100 kg.cm, 6-7 lb.ft)



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**Fig. 177: View Of Timing Belt Cover**  
Courtesy of HYUNDAI MOTOR CO.

9. Install the crankshaft pulley. Make sure that the crankshaft sprocket pin fits the small hole in the pulley.
10. Install the coolant pump pulley.

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11. Install the drive belt and adjust the belt tension.