2002 ENGINE

Engine Mechanical System (SOHC 1.5L) - Accent

GENERAL

SPECIFICATIONS

SPECIFICATIONS 1 Of 4

Description	Specification	Limit
General		
Type	In-line 12 valve OHO	
Number of cylinders	4	
Bore	75.5 mm (2.97 in.)	
Stroke	83.5 mm (3.29 in.)	
Total displacement	1.5L Eng, 1495 CC	
Compression ratio	10.0	
Firing order'	1 - 3 - 4 - 2	
Idle R.P.M	800+/- 100	
Ignition timing at idling speed	BTDC 9° +/-5° at 800 rpm	
Valve timing		
Intake valve		
Opens (BTDC)	12°	
Closes (ABDC)	52°	
Exhaust valve		
Opens (BBDC)	52°	
Closes (ATDC)	12°	
Cylinder head		
Flatness of gasket surface	Max. 0.03 mm (0.0012 in.)	0.08 mm (0.0031 in.)
Flatness of manifold mounting surface	Max. 0.15 mm (0.0059 in.)	0.3 mm (0.0118 in.)
Oversize rework dimensions of valve		
seat hole		
Intake	0.3 mm (0.012 in.) O.S.	
	28.8-28.821 mm (1.134-1.135 in.)	
	0.6mm (0.024 in.) O.S	
	29.1-29.121 mm (1.146-1.1467in.)	
Exhaust	0.3mm (0.012 in.) O.S.	
	34.3-34.325 mm (1.350-1.351 in.)	
	0.6mm (0.024 in.) O.S.	
	34.6-34.625 mm (1.362-1.363 in.)	
Oversize rework dimensions of valve guide		

hole (both intake and exhaust)		
0.05mm (0.002 in.) O.S.	11.05-11.068 mm (0.435-0.4357 in.)	
0.25mm (0.010 in.) O.S.	11.25-11.268 mm (0.443-0.4436 in.)	
0.50mm (0.020 in.) O.S.	11.50-11.518 mm (0.453-0.4535 in.)	
Camshaft		
Cam height		
Intake	42.8575 mm (1.6873 in.)	42.3575 mm (1.6676 in.)
Exhaust	42.7354 mm (1.6825 in.)	42.2624 mm (1.6628 in.)
Journal O.D.	30 mm (1.181 in.)	
Bearing oil clearance	0.045-0.085 mm (0.0020.0.0035 in.)	
End play	0.07-0.28 mm (0.003-0.011 in.)	
Valve		
Stem O.D.		
Intake	5.97-5.955 mm (0.235-0.234 in.)	
Exhaust	5.965-5.95 mm (0.235-0.234 in.)	
Face angle	45-45.3°	

SPECIFICATIONS 2 of 4

Description	Specification	Limit
Thickness of valve head (margin)		
Intake	1.1 mm (0.043 in.)	0.8 rnm (0.031 in.)
Exhaust	1.4 mm (0.055 in.)	1.0 mm (0.039 in.)
Valve stem to valve guide clearance		
Intake	0.03-0.06 mm (0.0012-0.0024 in.)	0.10 mm (0.0039 in.)
Exhaust	0.035-0.065 mm (0.0014-0.0026 in.)	0.5 mm (0.019 in.)
Valve guide		
Installed dimension O.D		
Intake	10.05 mm (0.3957 in.)	
Exhaust	11 mm (0.4331 in.)	
Service size	0.05, 0.25, 0.50 mm, (0.002, 0.010, 0.020 in.) oversize	
Valve seat insert		
Width of seat contact		
Intake	0.8-1.2 mm (0.031-0.047 in.)	
Exhaust	1.5-1.9 mm (0.059-0.075 in.)	
Seat angle	45°	
Oversize	0.3 mm (0.012 in.), 0.6 mm (0.024 in.)	
Valve spring		
Free length	42.03 mm (1.655 in.)	
Load		
	24.7±1.2 kg/ 34. mm at height	

	54.6± 2.7kg/ 25.9 mm at height	
Installed height	34.5 mm (1.358 in.)	
Squareness	1.5° or less	
Cylinder block		
Cylinder bore	75.50-75.53 mm (2.9724-2.9736 in.)	
Out-of-roundness and taper of cylinder bore	Less than 0.01 mm (0.0004 in.)	
Clearance with piston	0.02-0.04 mm (0.0008-0.0016 in.)	
Piston		
O.D.	75.47-75.50 mm (2.9713-2.9724 in.)	
Service size	0.25, 0.50, 0.75, 1.00 mm (0.010, 0.020, 0.030, 0.039 in.) oversize	
Piston ring		
Side clearance		
No. 1, No. 2	0.04-0.085 mm (0.0016-0.0033 in.)	0.1 mm (0.004 in.}
End gap (1.5 L Eng.)		
No. 1	0.20-0.35 mm (0.0079-0.0138 in.)	1 mm (0.0394 in.)
No. 2	0.37-0.52 mm (0.015-0.02 in.)	1 mm (0.0394 in.)
Oil ring side rail	0.20-0.70 mm (0.0078-0.0275 in.)	1 mm (0.0394 in.)
Service size	025, 0.50, 0. 75, 1.00 mm (0.010,	
	0.020, 0:030, 0.039 .in.)-	
Connecting rod		
Bend	0.05 mm (0.0019 in.) or less	
Twist	0.1 mm (0.0394 in.) or less	0.4mm (0.0157 in.)
Connecting rod big end to crankshaft side clearance	0.10-0.25mm(0:0039-0.0098 in.)	
Connecting rod bearing		
Oil clearance	0.018-0.036 mm (0.0007-0.0014 in.)	
Undersize	0.25 mm, 0.50 mm, 0.75 mm (0.01 in., 0.02in., .0.03 in.)	

SPECIFICATIONS 3 of 4

Description	Specification	Limit
Crankshaft		
Pin O.D.	45 mm (1.7717 in.)	
Journal O.D.	50 mm (1.9685 in.)	
Bend	0.03 mm or less	
Out-of-roundness, taper of journal and pin	0.005 mm (0.0004 in.) or less	
End play	0.05.0.175 mm (0.0020-0.0069 in.)	
Undersize rework dimension of pin		
0.25 mm (0.010 in.)	44.704- 44.722 mm (1.7600- 1.7607	

	in.)	
0.50 mm (0.020 in.)	44.454- 44.472mm (1.7502-1.7509 in.)	
0.75 mm (0.030 in.)	44.204- 44.222 mm (1.7403- 1.7410 in.)	
Undersizd rewodk dimension of journal		
0.25 mm (0.010 in.)	49.700-49.718 mm (1.9567-1.9574 in.)	
0.50 mm (0.020 in.)	49.450- 49.468 mm (1.9469-1.9476 in.)	
0.75 mm (0.030 in.)	49.200- 49.218 mm (1.9370- 1.9377 in.)	
Flywheel		
Runout	0.1 mm (0.0039 in.)	0.13 mm (0.0051 in.)
Oil pump		
Clearance between outer circumference	0.12-0.18 mm (0.0047-0.0070 in.)	
and front case.		
Clearance between roter axial side	0.04-0.065 mm (0.0016-0.0026 in.)	
and front case		
Tip clearance between outer and inner roter	0.0025-0.069 mm (0.0010-0.0027 in.)	
Engine oil pressure		
Engine at idle speed	147 KPa (1.5 kg/cm2, 21.33 psi)	
Relief spring		
Free height	46.6 mm (1.8346 in.)	
Load	6.1 kg at 40.1 mm (13.42 lb at 1.578 in.)	
Cooling method	Water-cooled, Pressurized, Forced circulation with electrical fan	
Coolant		
Quantity	6 lit (7 U.S qts., 6.9 Imp. qts.)	
Radiator		
Type	Pressurized corrugated fin type	
Performance	38000 K Cal/h	
Radiator cap		
Main valve opening pressure	81.4-108 kpa (11.8-15.6 psi., 0.83-	
	1.1 kg/cm2)	
Vacuum valve opening pressure	-6.86 kpa (-1.00 psi, -0.07 kg/cm2 or less	
Coolant pump	Centrifugal type impeller	
Thermostat		

Type	Wax pellet type with jiggle valve	
Valve opening temperature	88°C (190°F)	
Full-opening temperature	100°C (212°F)	
Valve lift, when fully open	8 mm (0.32 in) or more at 100°C (212°F)	
Identification mark	88 (Stamped on flange)	
Drive belt		
Type	V-ribbed belt	
Engine coolant temperature gauge unit		
Type	Thermistor type	
Resistance	42.4-54.4 ohms at 85°C (185°F)	
	22.1-26.2 ohms at 110°C (230°F)	

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Description	Specification	Limit
Engine coolant temperature sensor		
Type	Thermistor type	
Resistance	2.31-2.59 k/ohms at 20°C (68°F)	
Switching temperature	146.9-147.3 ohms at 110° C (230° F)	
Automatic transaxte	Performance	1,200 Kcal/h
Air cleaner		
Type	Dry type	
Element	Unwoven cloth type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	

TIGHTENING TORQUE

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

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Bolt	22-30 (30-40)
Camshaft Sprocket Bolt	59-74 (80-100)
Catalytic Converter-To-Main Muffler Nuts	22-30 (30-40)
Connecting Rod Cap Nut	24-26 (33-35)
Coolant Outlet Fitting Bolt	13-15 (18-20)

Coolant Temperature Sensor	11-15 (15-20)
Crankshaft Sprocket Bolt	103-111 (140-150)
Cylinder Head Bolt (1)	
Step 1	18 (25)
Step 2	Tighten An Additional 60 Degrees
Step 3	Tighten An Additional 60 Degrees
Drive Plate-To-Crankshaft Bolt	96-103 (130-140)
Engine Mount	
Front Support Bracket Fasteners	22-32 (30-42)
Through-Bolt (Insulator - Large)	66-81 (90-110)
Left Support Bracket Fasteners	22-32 (30-42)
Mounting Bolt (Insulator - Small)	37-48 (50-65)
Right Mounting Bracket-To-Engine Bolt/Nut	37-48 (50-65)
Exhaust Manifold Cover-To-Manifold Bolt	11-15 (15-20)
Exhaust Manifold-To-Engine Bolt	11-15 (15-20)
Exhaust Pipe-To-Catalytic Converter	30-44 (40-60)
Exhaust Pipe-To-Manifold Bolt	22-30 (30-40)
Exhaust Pipe Bracket Bolts	22-30 (30-40)
Flywheel-To-Crankshaft Bolt	96-103 (130-140)
Front Cover Bolt	9-11 (12-15)
Front Roll Stopper	22-30 (30-40)
Front Roll Stopper Insulator Nut	33-44 (45-60)
Generator Brace Mounting Bolt	15-21 (20-28)
Generator Lock Bolt	11-16 (15-22)
Generator Support & Nut	15-18 (20-25)
Intake Manifold Bolt	11-15 (15-20)
Intake Manifold Brace Bolt	13-18 (18-25)
Main Bearing Cap Bolt	41-44 (55-60)
Oil Drain Plug	26-33 (35-45)
Oil Filter	9-12 (12-16)
Oil Pressure Switch	10-11 (14-15)
Oil Pump Relief Valve Plug Cap	30-37 (40-50)
Oil Screen Bolt	11-16 (15-22)
Oxygen Sensor	37-44 (50-60)
Rear Roll Stopper Nut	33-44 (45-60)
Roll Stopper Bracket-To-Subframe Bolts	22-40 (30-40)
Rear Roll Stopper Insulator Nut	33-44 (45-60)
Rocker Arm Shaft Assembly Retaining Bolt	15-18 (20-25)
Surge Tank-To-Inlet Manifold Bolt	11-15 (15-20)
Throttle Body-To-Intake Manifold Bolt	11-15 (15-20)
Timing Belt Tensioner Bolt	15-20 (20-27)
Transaxle Mount	

Mounting Bolt	22-30 (30-40)
Through-Bolt	66-81 (90-110)
	INCH Lbs. (N.m)
Coolant Pump Pulley Bolt	106-133 (12-15)
Coolant Temperature Sender	89-106 (10-12)
Crankshaft Pulley-To-Sprocket Bolt	108-120 (12-14)
Oil Pan Bolt	71-89 (8-10)
Oil Pump Cover Bolt	71-106 (8-12)
Rear Plate Bolt	71-89 (8-10)
Resonator Mounting Bolt	35-53 (4-6)
Timing Belt Cover Bolt	89-106 (10-12)
Torque Converter-To-Drive Plate Bolt	80-124 (9-14)
Valve Cover Bolt	71-89 (8-10)
(1) Tighten in sequence. See **Fig. 1**.	

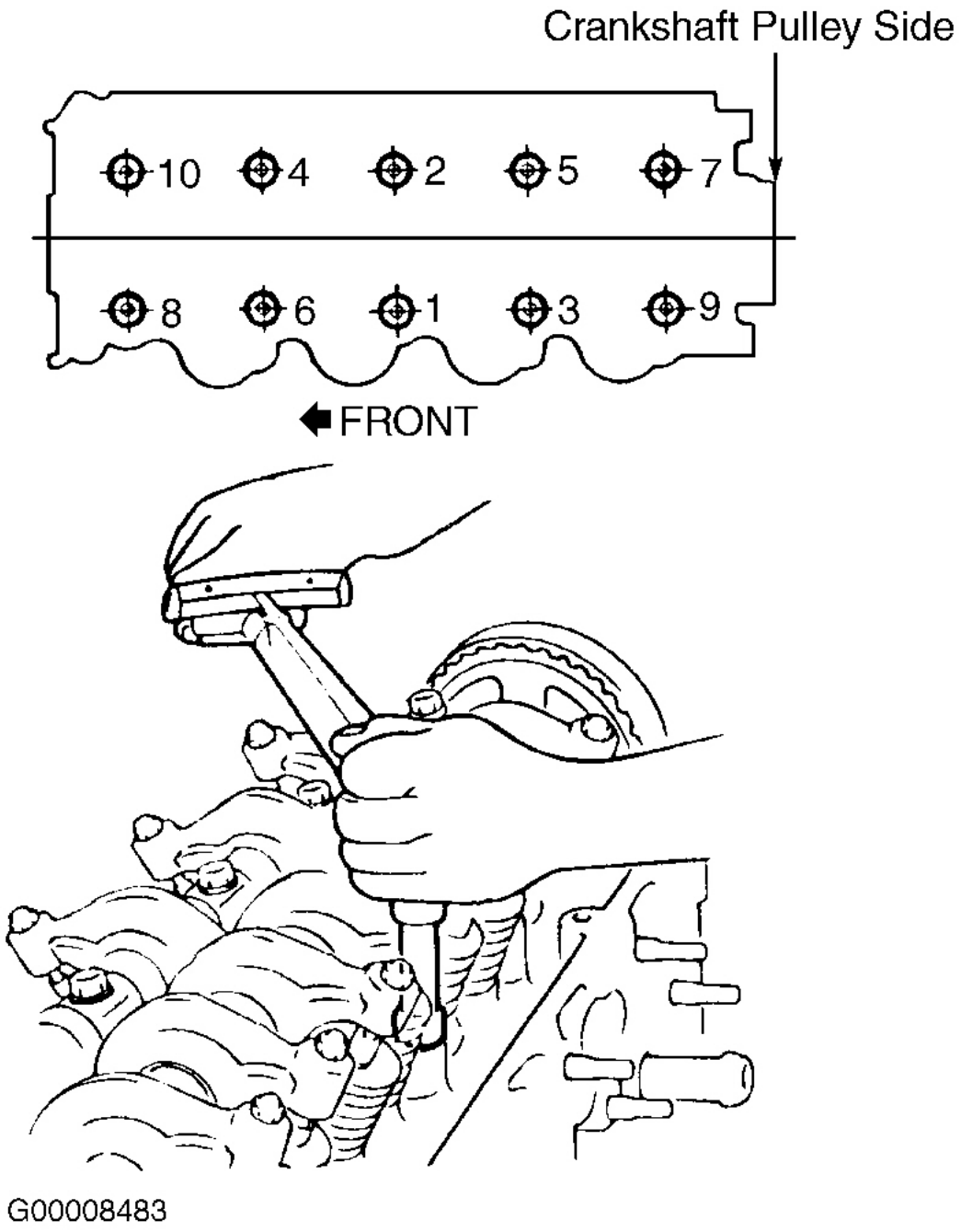

Fig. 1: Tightening Sequence For Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

SERVICE STANDARD

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

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Fig. 2: Service Standard
Courtesy of HYUNDAI MOTOR CO.

SPECIAL TOOLS

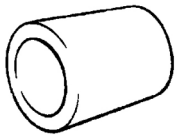
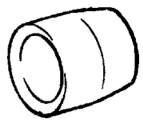
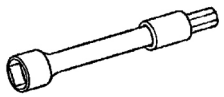
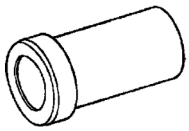
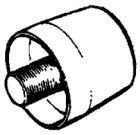
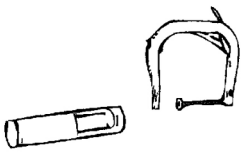
Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer 09231-22000		Installation of the crankshaft front oil seal (use with 09231-22100)
Crankshaft front oil seal guide 09231-22100		Installation of the crankshaft front oil seal (use with 09214-22000)
Cylinder head bolt wrench 09221-11000		Removal and tightening of the cylinder head bolt
Camshaft oil seal installer 09221-21000		Installation of the camshaft oil seal (use with 09221-21100)
Camshaft oil seal guide 09221-21100		Used as a guide when pressing in the camshaft oil seal (use with 09221-21000)
Valve spring remover and installer 09222-22100		Removal and installation of the inlet or exhaust valve

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Fig. 3: Special Tools (1 Of 3)
Courtesy of HYUNDAI MOTOR CO.

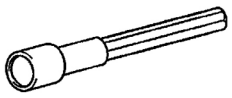
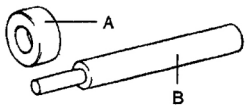
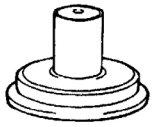
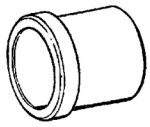
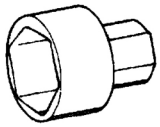
Tool (Number and name)	Illustration	Use
Valve stem oil seal installer 09222-22001		Installation of the vale stem oil seal
Valve guide installer 09221-22000 A/B		Removal and installation of the valve guide
Crankshaft rear oil seal installer 09231-21000		1) Installation of the engine rear oil seal 2) Installation of the crankshaft rear oil seal
Piston pin setting tool insert 09235-22000		Removal and installation of the piston pin (use with 09234-33001)
Oil pressure switch wrench 09260-32000		Removal and installation of the oil pressure switch

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Fig. 4: Special Tools (2 Of 3)
Courtesy of HYUNDAI MOTOR CO.

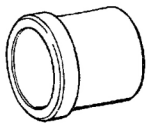
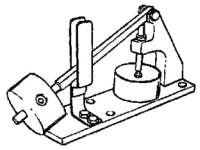
Tool (Number and name)	Illustration	Use
Mounting bushing remover and installer 09216-22000		Removal and installation of engine mounting bushing (Use with 09216-22100)
Leak down tester 09246-32000		Leak down test of auto lash adjuster

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Fig. 5: Special Tools (3 Of 3)
Courtesy of HYUNDAI MOTOR CO.

TROUBLESHOOTING

Symptom	Probable cause	Remedy
Low compression	Blown cylinder head gasket Worn or damaged piston rings Worn piston or cylinder Worn or damaged valve seat	Replace gasket Replace rings Repair or replace piston and/or cylinder block Repair or replace valve and/or seat ring
Low oil pressure	Low engine oil level Faulty oil pressure switch Clogged oil filter Worn oil pump gears or cover Thin or diluted engine oil Oil relief valve stuck (open) Excessive bearing clearance	Check engine oil level Replace Replace Replace Change and determine cause Repair Replace
High oil pressure	Oil relief valve stuck (closed)	Repair
Excessive engine rolling and vibration	Loose engine roll stopper (front, rear) Loose transaxle mount bracket Loose engine mount bracket Loose center member Broken transaxle mount insulator Broken engine mount insulator Broken engine roll stopper insulator	Re-tighten Re-tighten Re-tighten Re-tighten Replace Replace Replace
Noisy valves	Thin or diluted engine oil (low oil pressure) Worn or damaged valve stem or valve guide HLA abnormal operation	Change Replace In erease engine spred up (for venting) or Replace the HLA
Connecting rod and/main bearing noise	Insufficient oil supply Thin or diluted engine oil Excessive bearing clearance	Check engine oil level Change and determine cause Replace
Timing belt noise	Incorrect belt tension	Adjust belt tension
Low coolant level	Leakage of coolant from 1.Heater or radiator hose 2.Faulty radiator cap 3.Thermostat housing 4.Radiator 5.Engine coolant pump	 Repair or replace parts Tighten or replace clamps Replace gasket or housing Repair or replace Replace parts
Clogged radiator	Foreign material in coolant	Replace coolant
Abnormally high coolant temperature	Faulty thermostat Faulty radiator cap Restriction to flow in cooling system Loose or missing drive belt Faulty Engine coolant pump Faulty temperature sender or wiring Faulty electric fan Insufficient coolant	Replace parts Replace parts Clear restriction or replace parts Adjust or replace Replace Repair or replace Repair or replace Refill coolant
Abnormally low coolant temperature	Faulty thermostat Faulty temperature sender or wiring	Replace Repair or replace

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Fig. 6: Troubleshooting Table (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

Symptom	Probable cause	Remedy
Leakage from oil cooling system	Loose connections	Retighten
	Cracked or damaged ; hoses, pipes or oil cooler	Replace or repair
Inoperative electrical cooling fan	Damaged:Thermo sensor, Electrical motor, Radiator fan relay,Wiring	Replace or repair
Exhaust gas leakage	Loose connections Broken pipe or muffler	Re-tighten Repair or replace
Abnormal noise	Detached baffle plate in muffler Broken rubber hanger Pipe or muffler contacting vehicle body Broken pipe or muffler	Replace Replace Correct Repair or replace

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Fig. 7: Troubleshooting Table (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

MAINTENANCE

CHECKING ENGINE OIL

1. Position the vehicle on a level surface.

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

2. Warm up the engine.
3. Turn off the engine, and wait 2 or 3 minutes, then check the oil level.

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

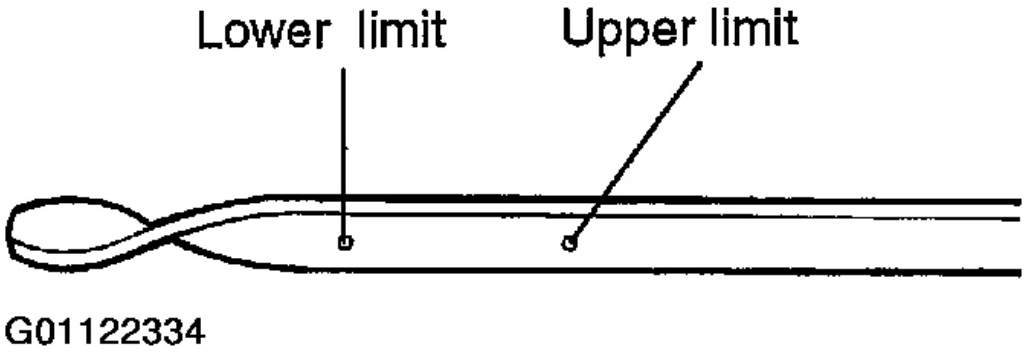

Fig. 8: Locating Dipstick Level Indicator Marks

Courtesy of HYUNDAI MOTOR CO.

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.
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.

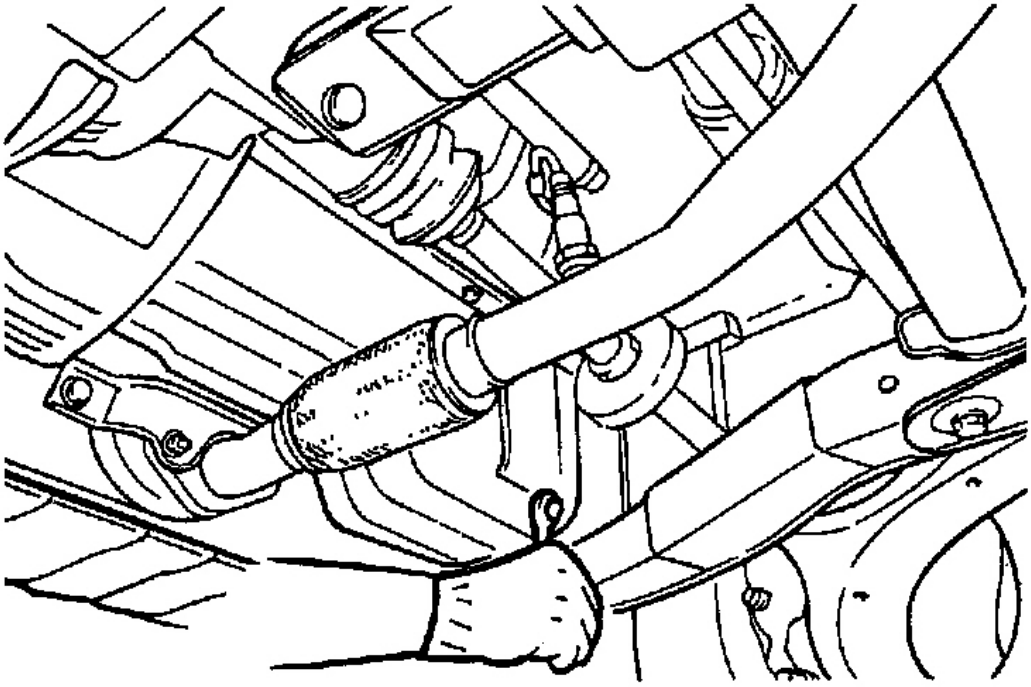

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Fig. 9: Removing Drain Plug
Courtesy of HYUNDAI MOTOR CO.

4. Install and tighten the drain plug to the specified torque.

   Tightening torque

   Drain plug: 35 - 45Nm (350 - 450kg.cm, 24 - 33lb.ft)

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

   Drain and Refill Without oil filter: 3.0liter (3.17U.S.qts, 2.64 lmp.qts.)

   Drain and Refill With oil filter: 3.3liter (3.48U.S.qts., 2.90 lmp.qts.)

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.

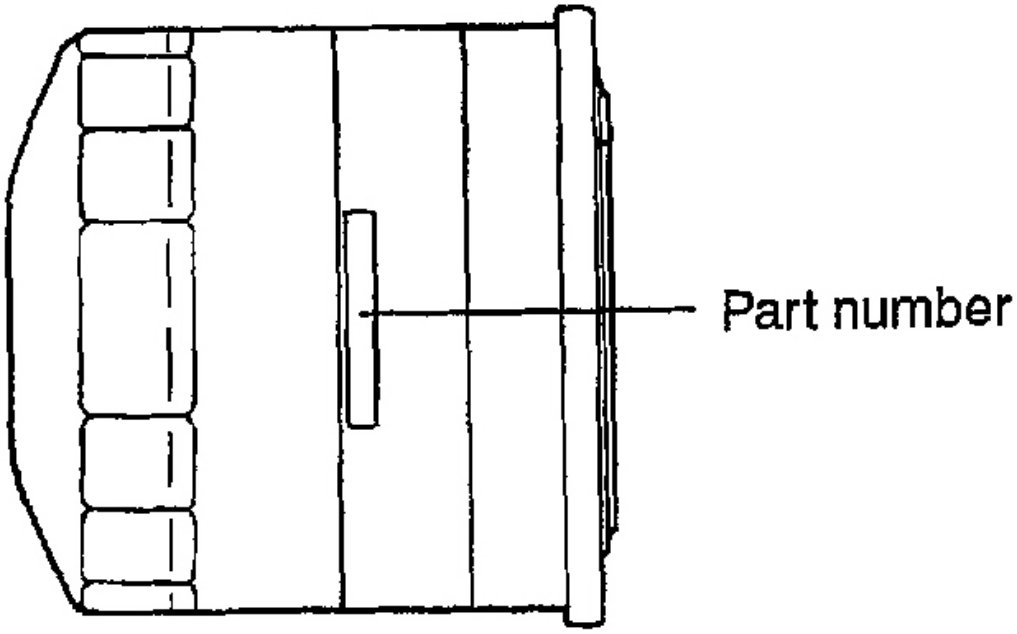

Fig. 10: Identifying Oil Filter Part Number
Courtesy of HYUNDAI MOTOR CO.

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.

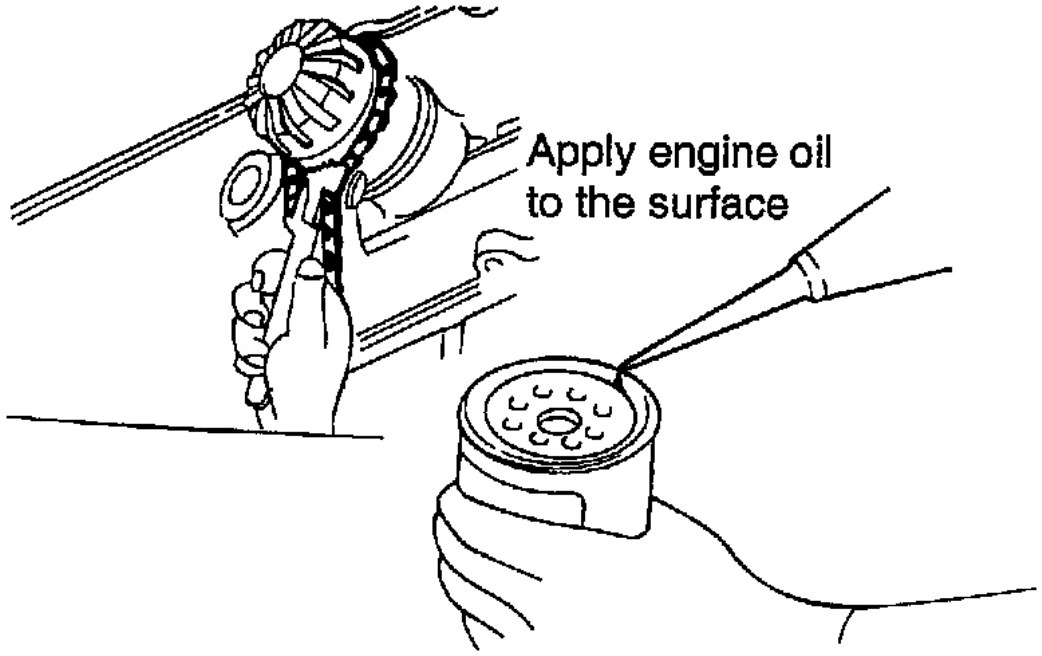

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Fig. 11: Installing Oil Filter
Courtesy of HYUNDAI MOTOR CO.

3. Tighten the oil filter to the specified torque.

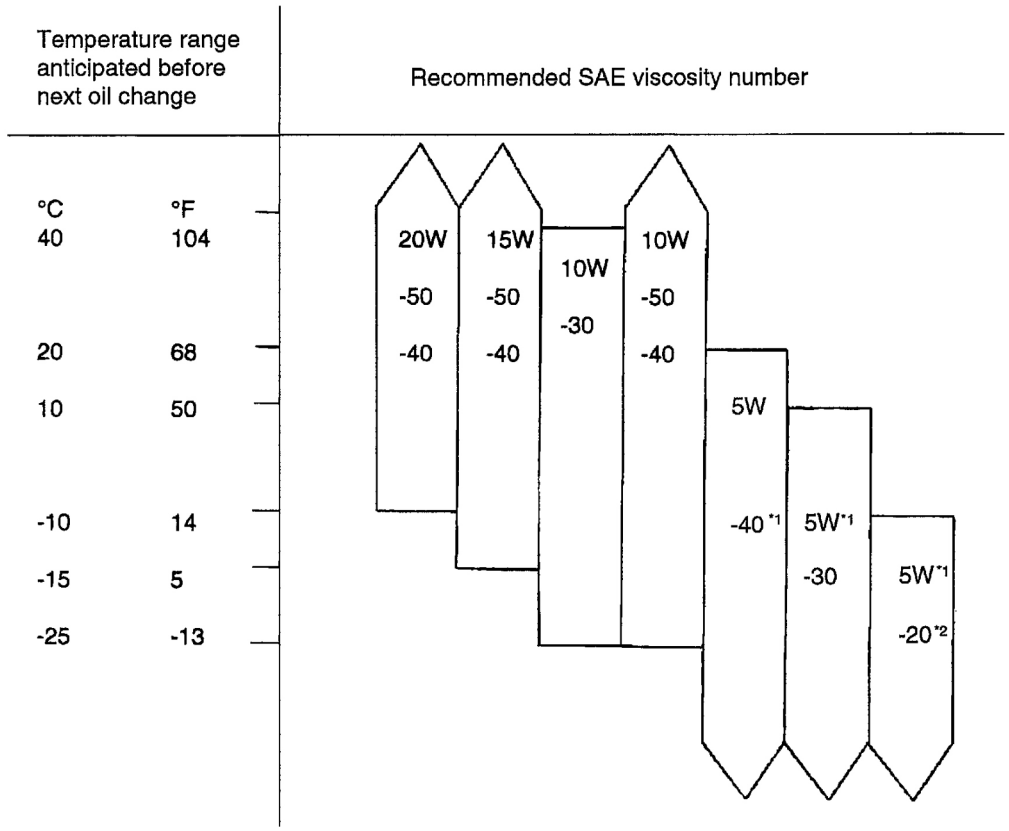
   Tightening torque

   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.]



***1 Restricted by driving condition and environment.**
***2 Not recommended for sustained high speed vehicle operation**

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Fig. 12: Recommended SAE Viscosity Grades
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.**

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

CHECKING COOLANT LEAK

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.**

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^{2,} 20psi) pressure. Hold it for two minutes in that condition, while checking for leakage from the radiator, hoses or connections.
4. If there is leakage, repair or replace with the appropriate part.

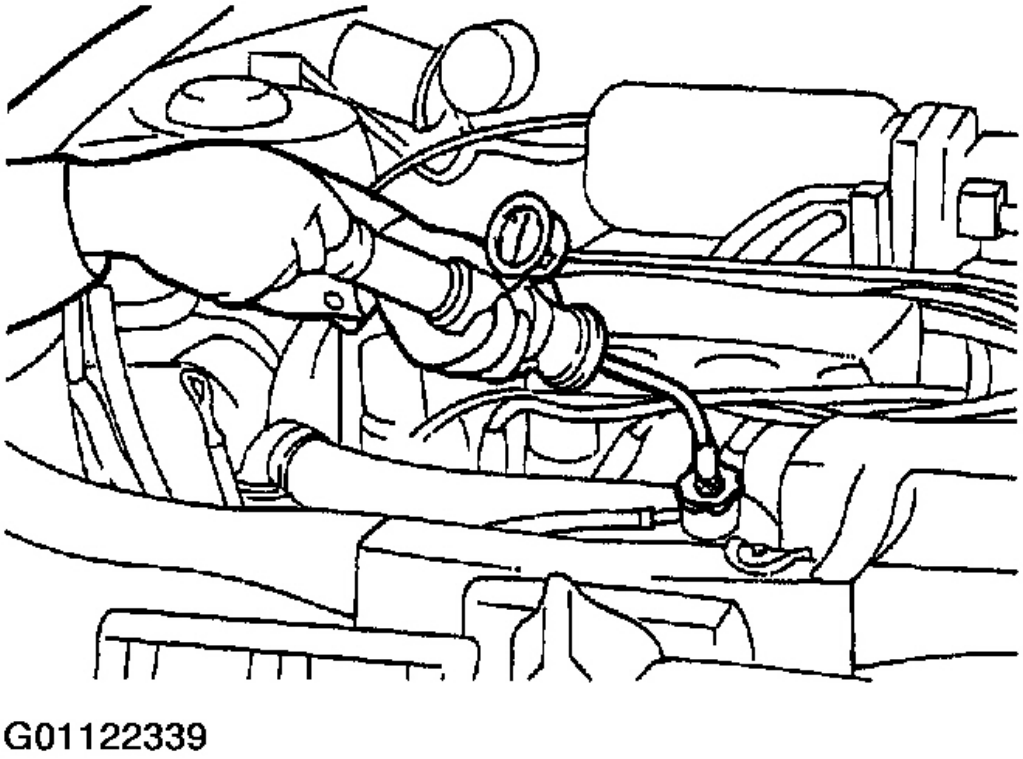

Fig. 13: Pressure Testing Cooling System
Courtesy of HYUNDAI MOTOR CO.

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^{2,} 12-16 psi)

   Vacuum valve opening pressure: -7 kPa (-0.07 kg/cm^{2,} -1.0 psi)

3. Check that the pressure level is maintained 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.

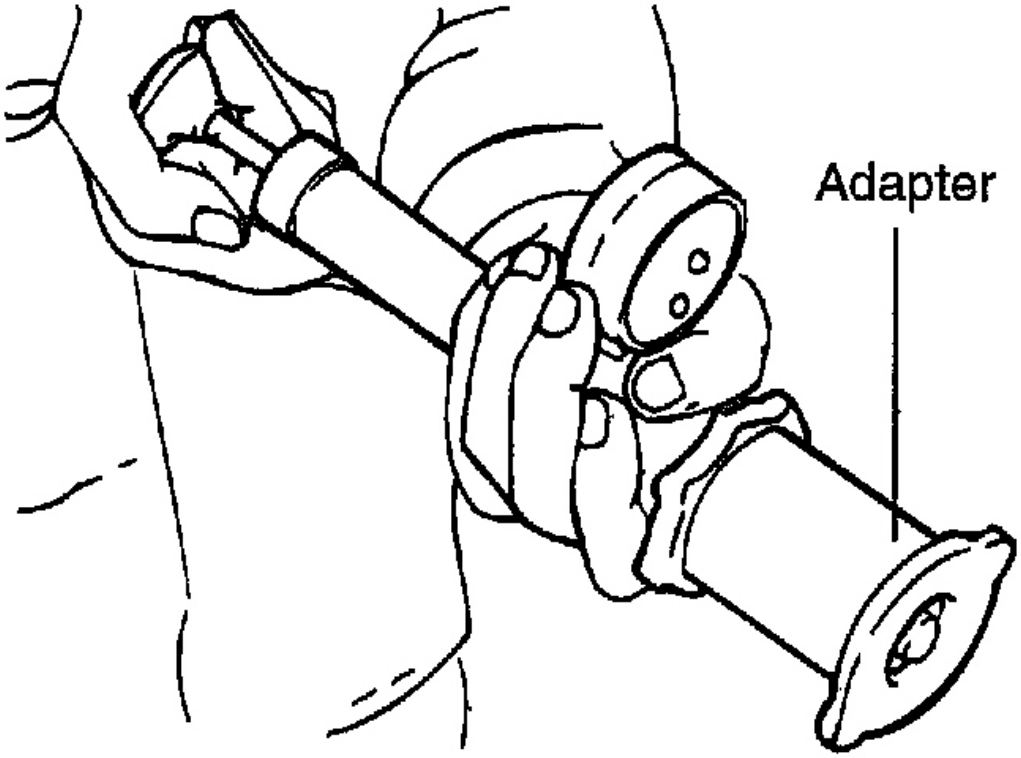

Fig. 14: Testing Radiator Cap
Courtesy of HYUNDAI MOTOR CO.

4. Replace the radiator cap if the reading does not remain at or above the limit.

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 **Fig. 16**.

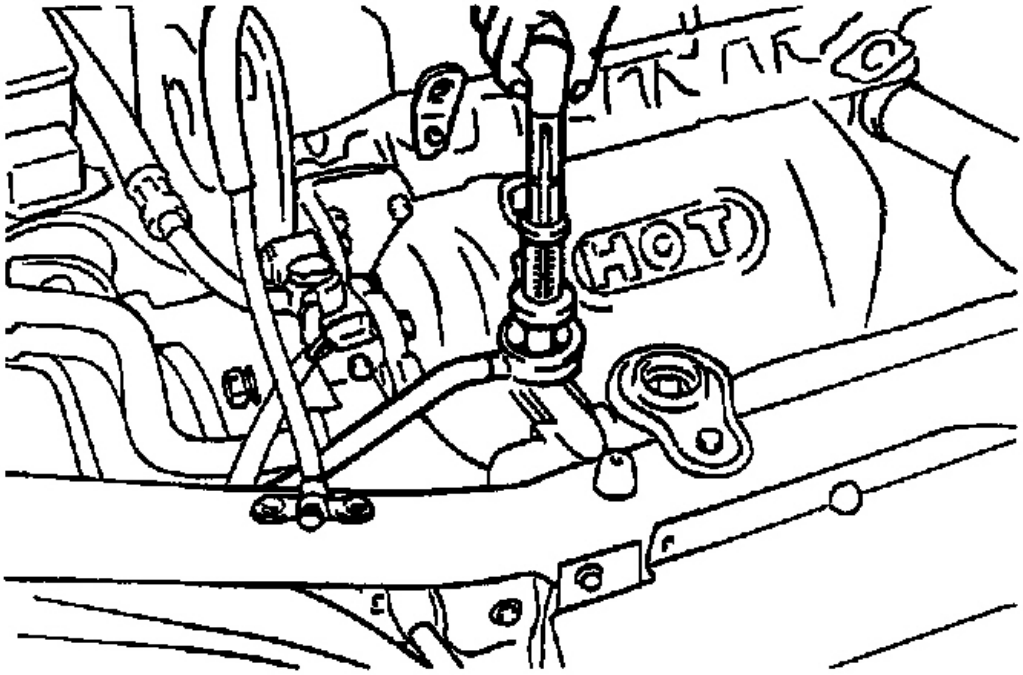

Fig. 15: Measuring Specific Gravity Of Coolant
Courtesy of HYUNDAI MOTOR CO.

RELATION BETWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY

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. 16: Relation Between Coolant Concentration & 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

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: 1500kpa (15Kg/$cm^{2,}$ 218 psi)

   Limit: 1400kpa (14Kg/$cm^{2,}$ 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/$cm^{2,}$ 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)

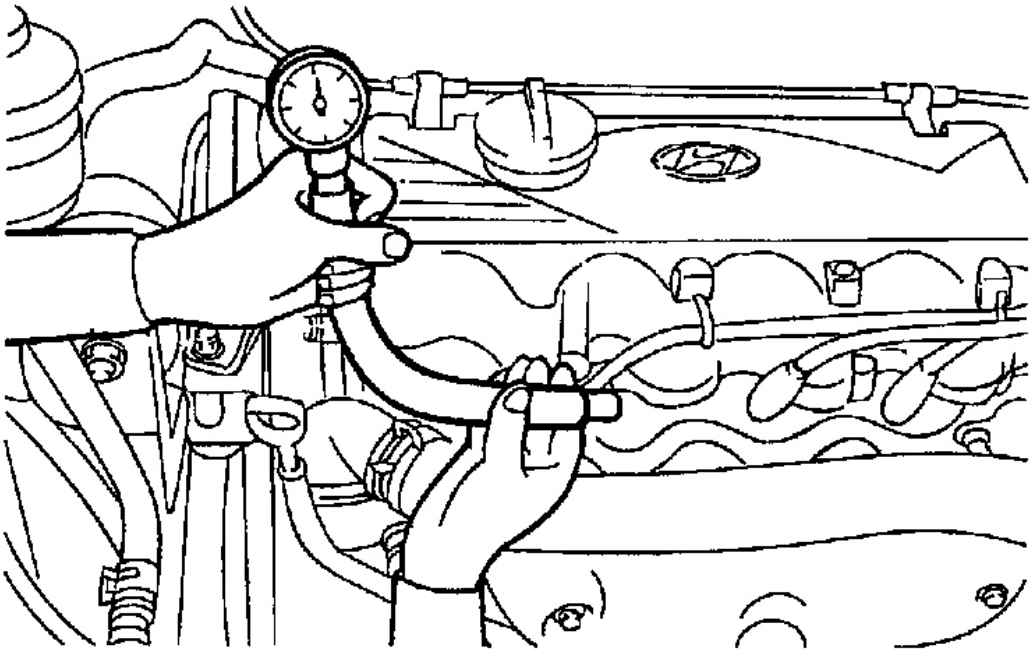

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Fig. 17: Checking Compression Pressure
Courtesy of HYUNDAI MOTOR CO.

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.

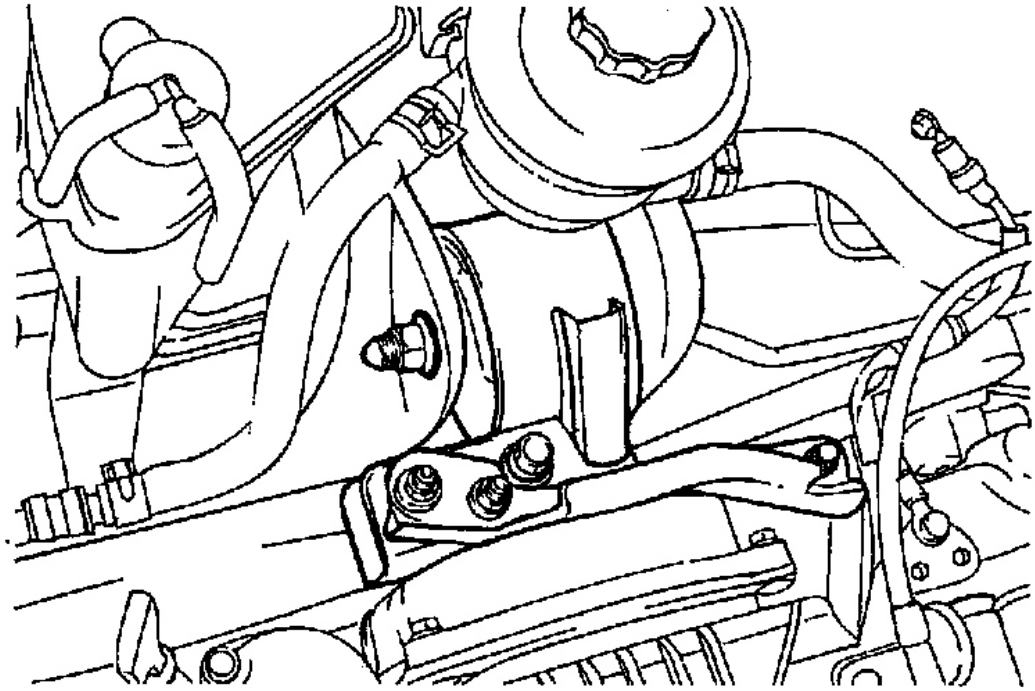

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Fig. 18: Identifying Engine Support Bracket
Courtesy of HYUNDAI MOTOR CO.

4. Remove the water pump pulley.
5. Remove the timing belt upper cover.

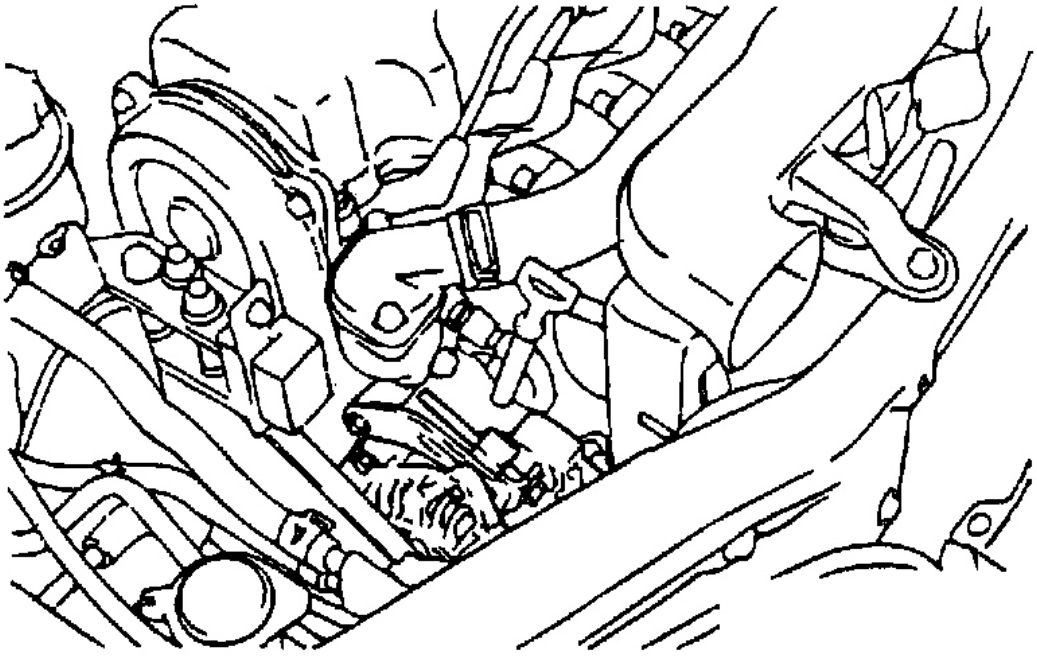

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Fig. 19: Identifying Timing Belt Upper Cover
Courtesy of HYUNDAI MOTOR CO.

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.

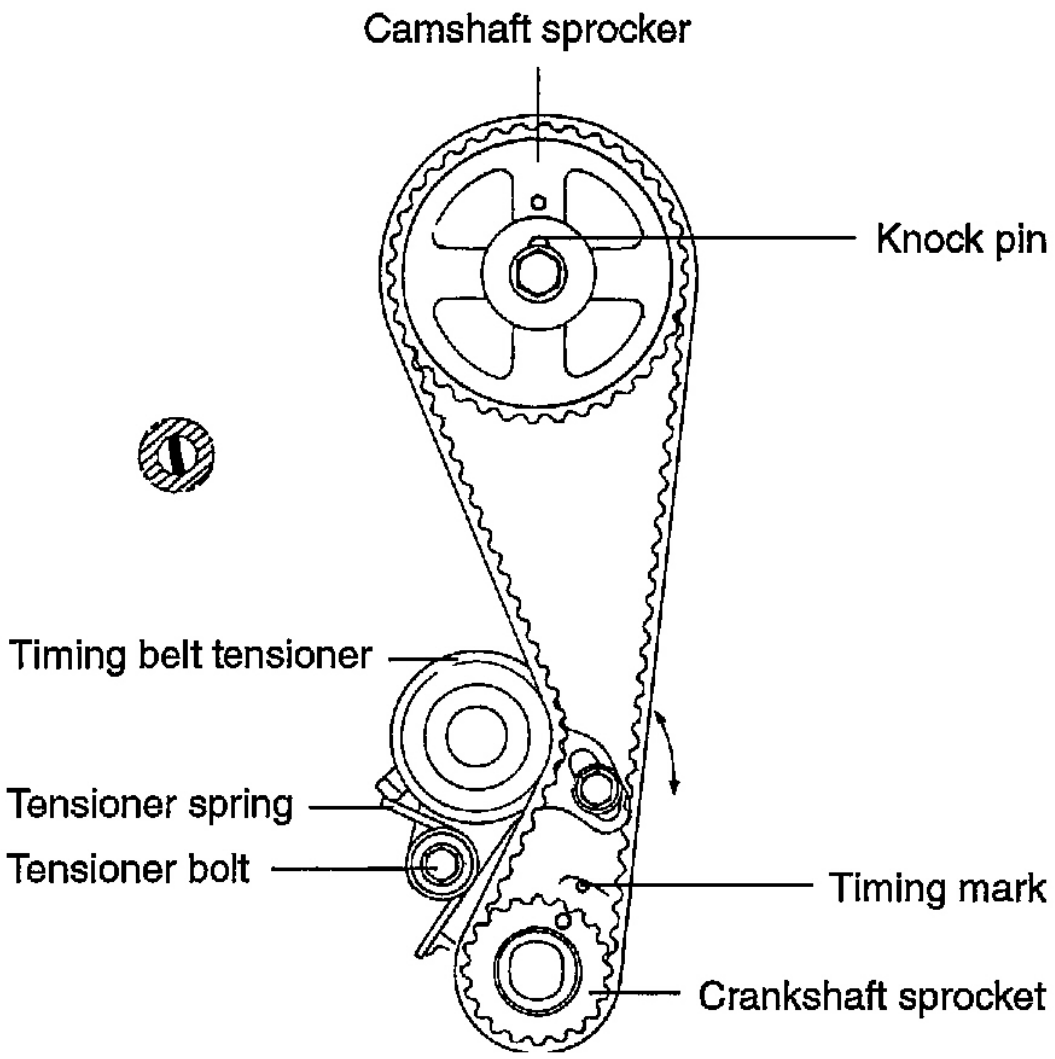

Fig. 20: Identifying Timing Belt Tensioner Components
Courtesy of HYUNDAI MOTOR CO.

8. Loosen the tensioner bolt of pivot side and slot side.

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

9. Rotate the crankshaft clockwise as many as 2 teeth of sprocket.
10. Check that the teeth of sprocket and belt coincide with each other.
11. Tighten the bolt of slot side of 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.

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 amount that the belt is deflected.**

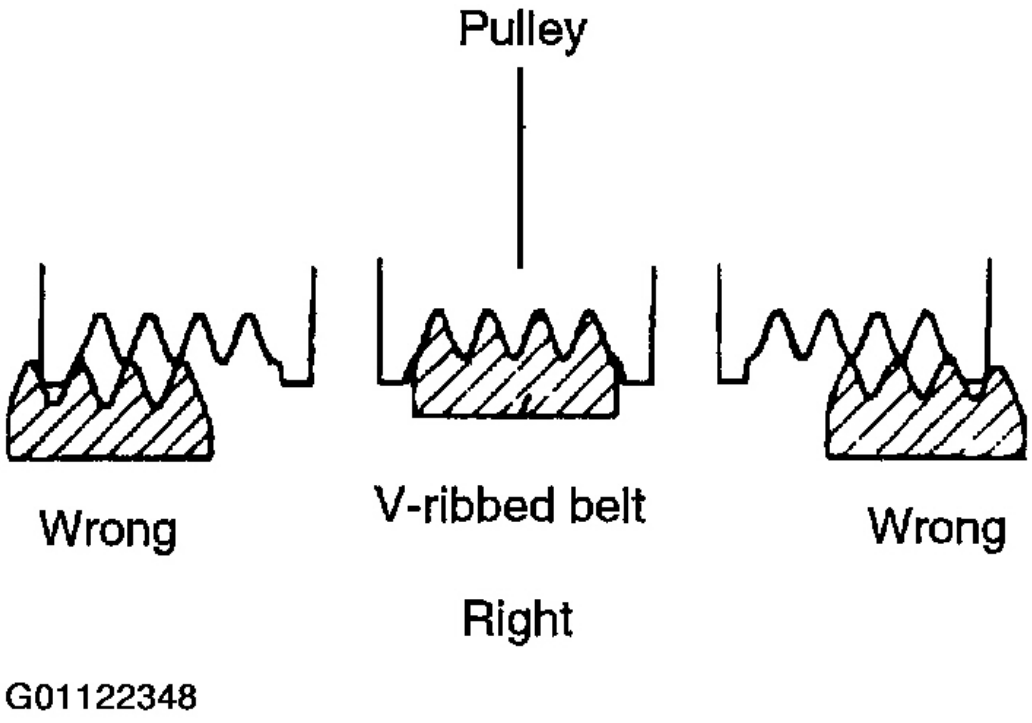

Fig. 21: Identifying Proper Installation Of Belt
Courtesy of HYUNDAI MOTOR CO.

STANDARD VALUE:

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

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Fig. 22: 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 the above table. 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 newly installed, after 5 minutes or more of operation, refer to Fig. 22 under "Used".**
4. **Refer to Fig. 22 under "Inspection" for periodic inspections.**

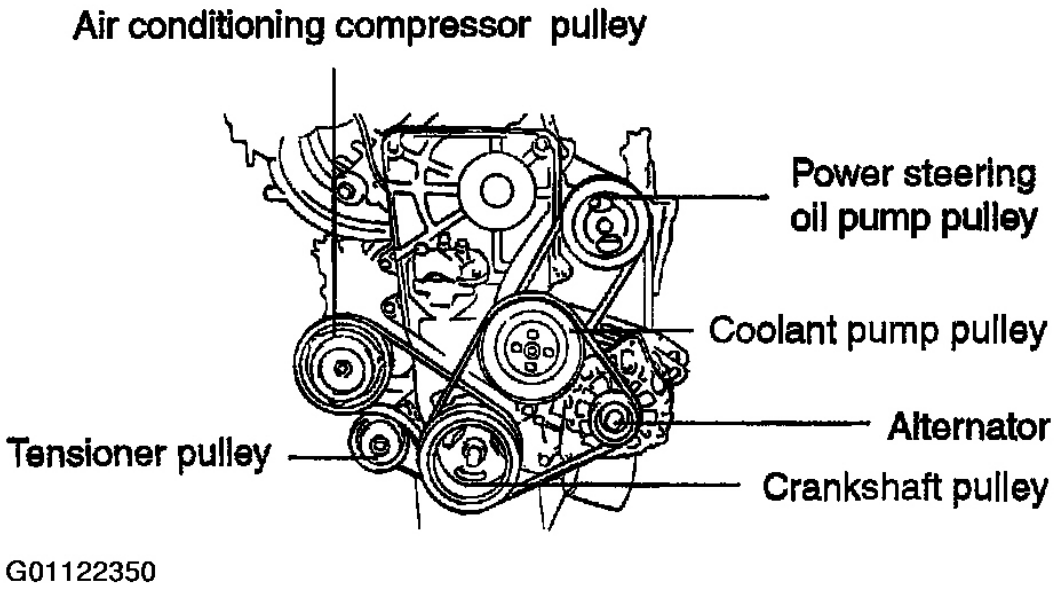

Fig. 23: Locating Engine Pulleys
Courtesy of HYUNDAI MOTOR CO.

TYPE A TENSION GAUGE

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

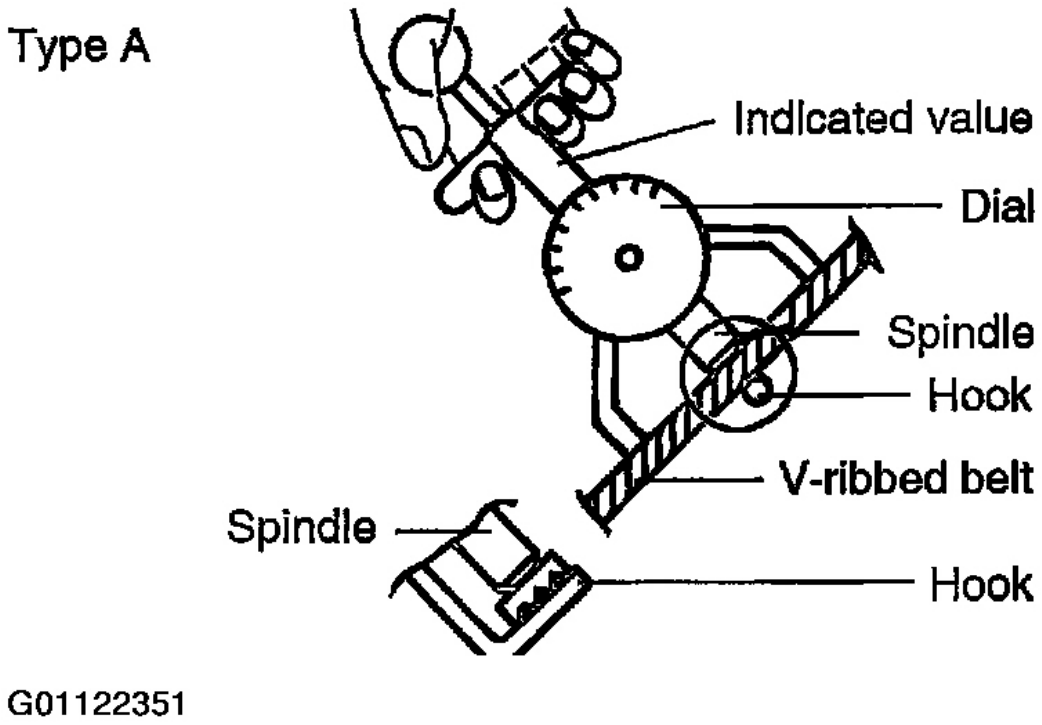

Fig. 24: Identifying Type A Tension Gauge
Courtesy of HYUNDAI MOTOR CO.

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.

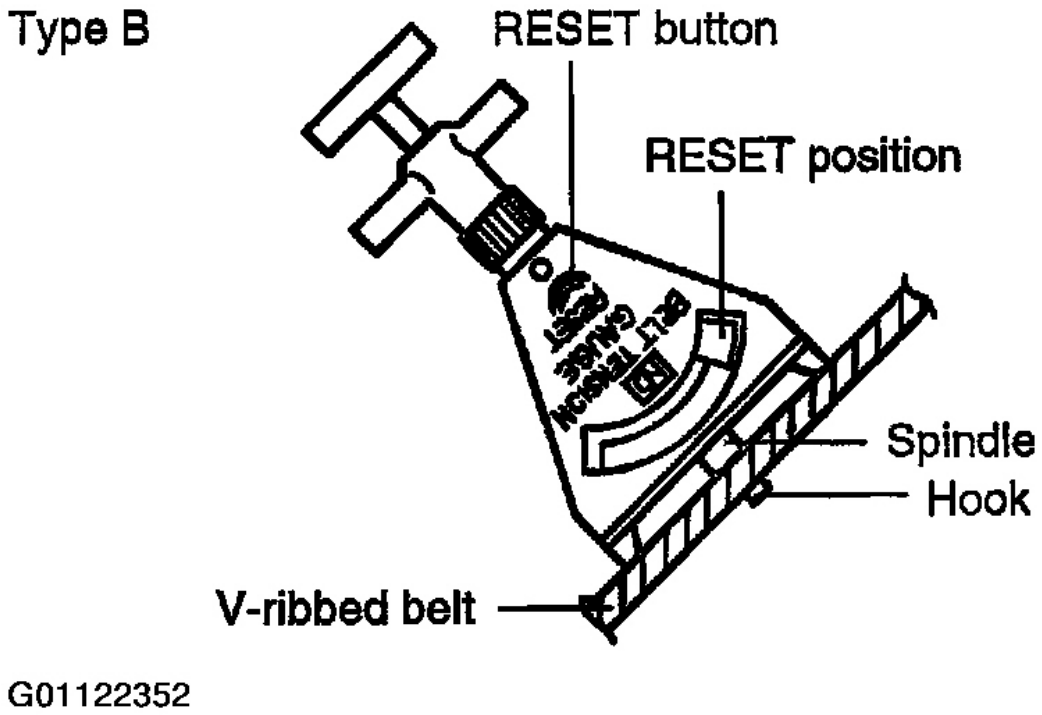

Fig. 25: Identifying Type B Tension Gauge
Courtesy of HYUNDAI MOTOR CO.

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, 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)

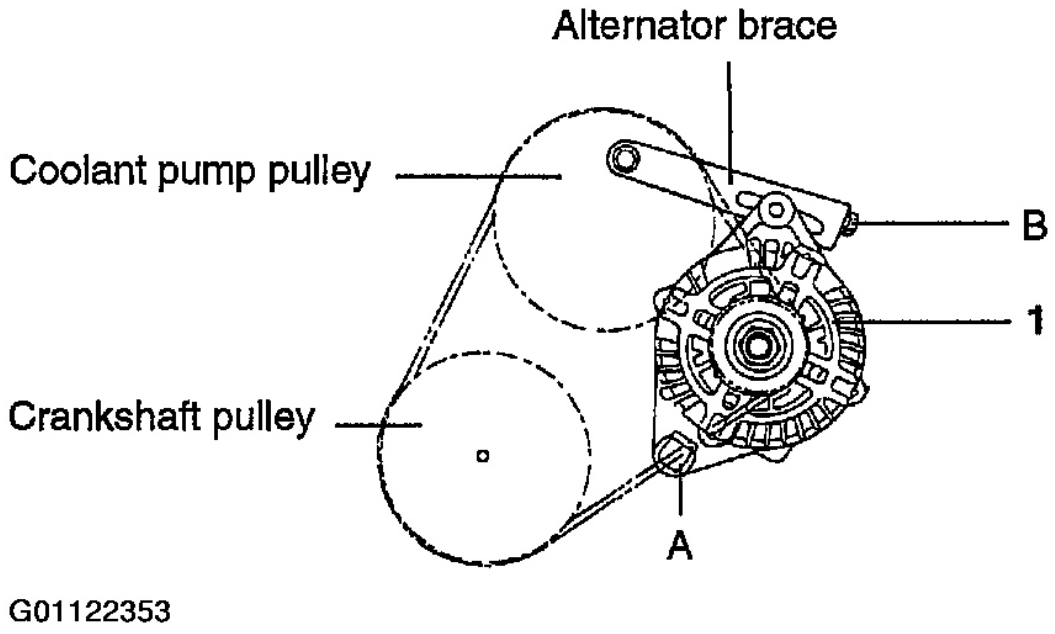

Fig. 26: Locating Adjuster Lock Bolt
Courtesy of HYUNDAI MOTOR CO.

ENGINE BLOCK

NEW ALPHA ENGINE APPEARANCE

FRONT VIEW

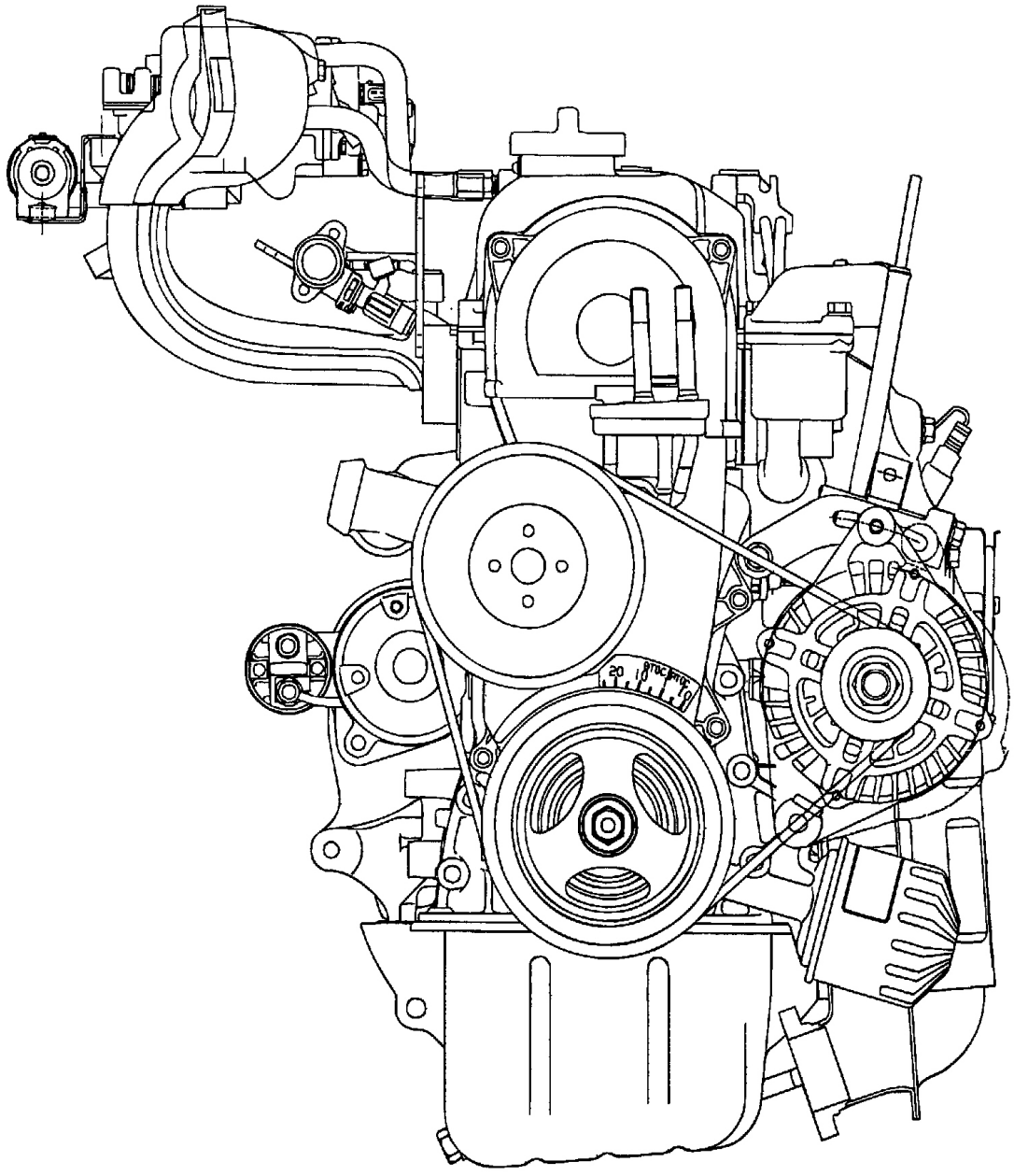

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Fig. 27: Engine Block Front View
Courtesy of HYUNDAI MOTOR CO.

RIGHT VIEW

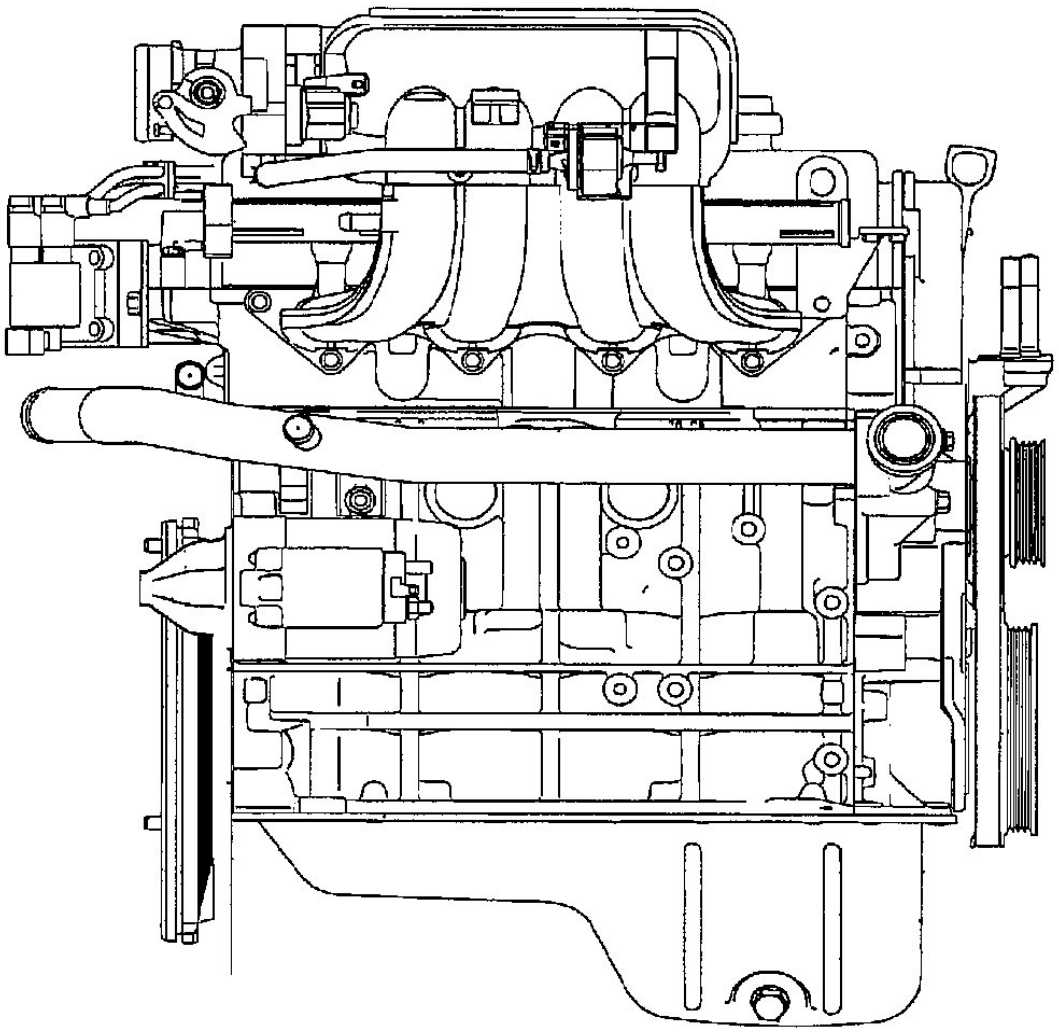

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Fig. 28: Engine Block Right View
Courtesy of HYUNDAI MOTOR CO.

LEFT VIEW

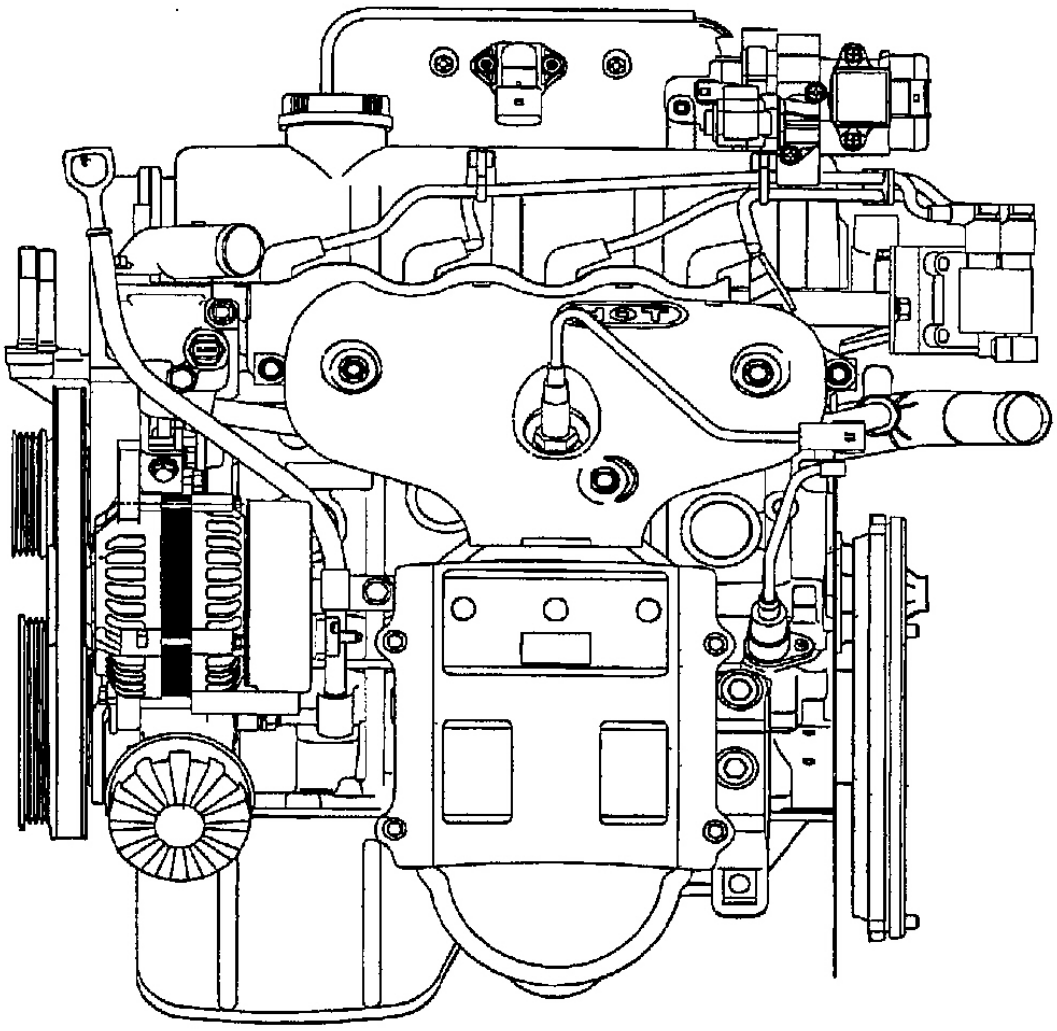

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Fig. 29: Engine Block Left View
Courtesy of HYUNDAI MOTOR CO.

REAR VIEW

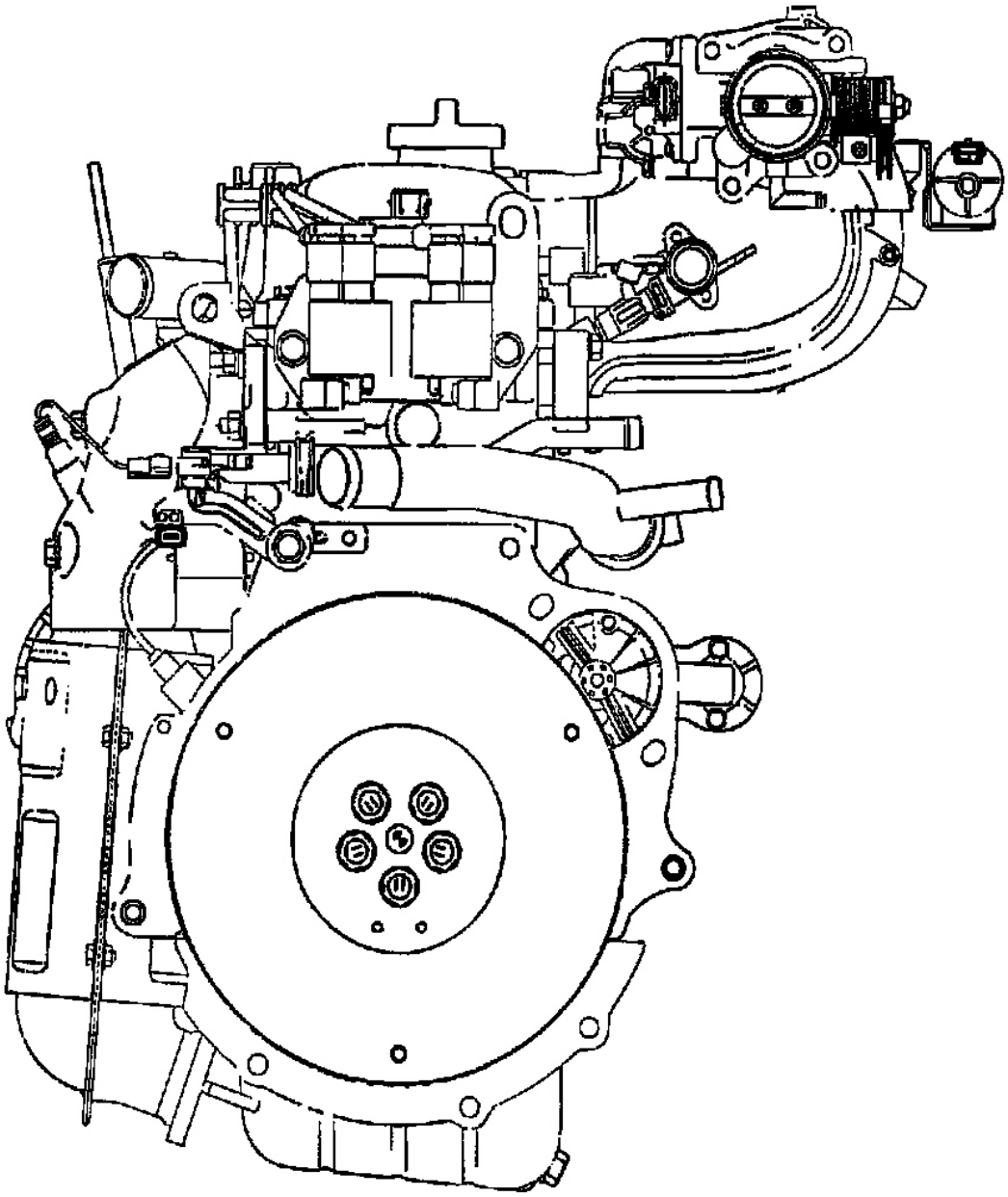

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Fig. 30: Engine Block Rear View
Courtesy of HYUNDAI MOTOR CO.

TOP VIEW

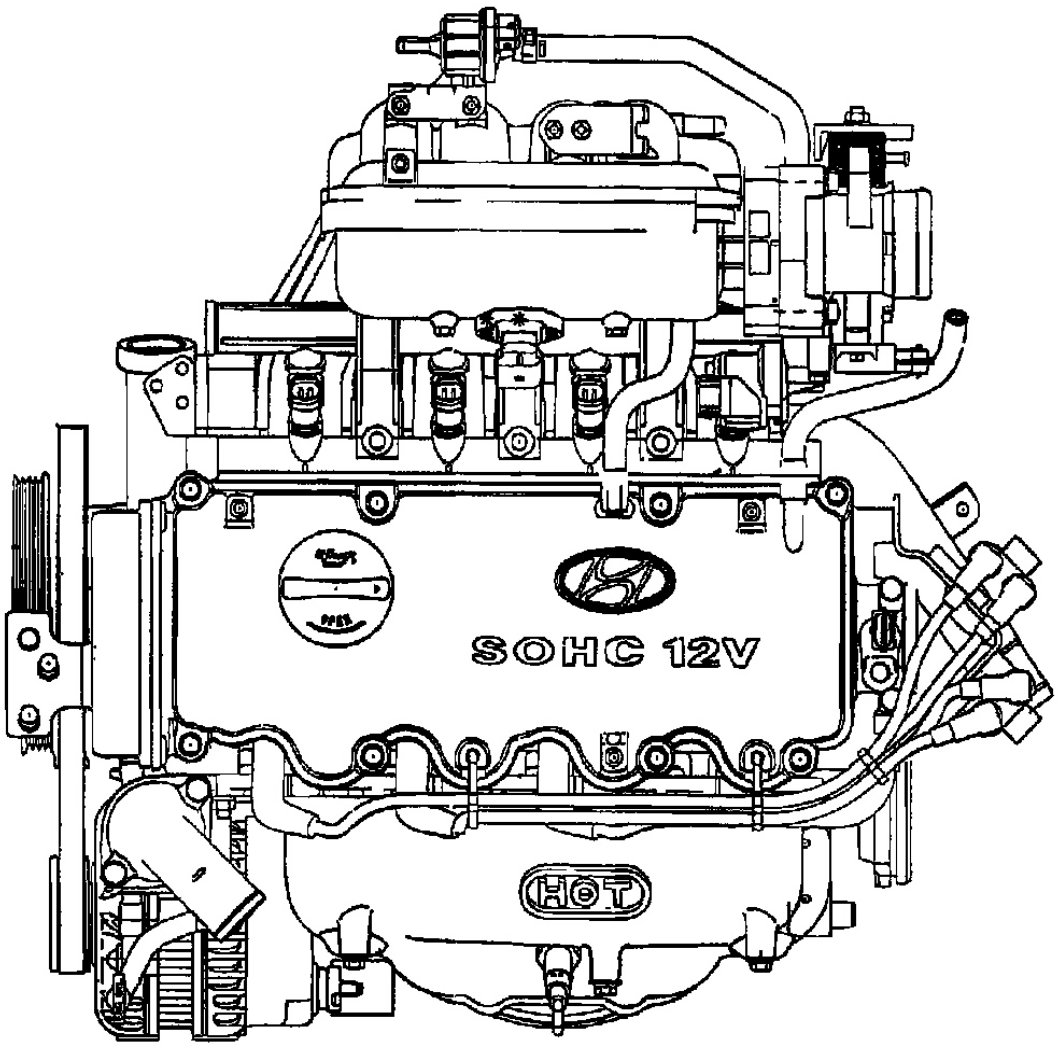

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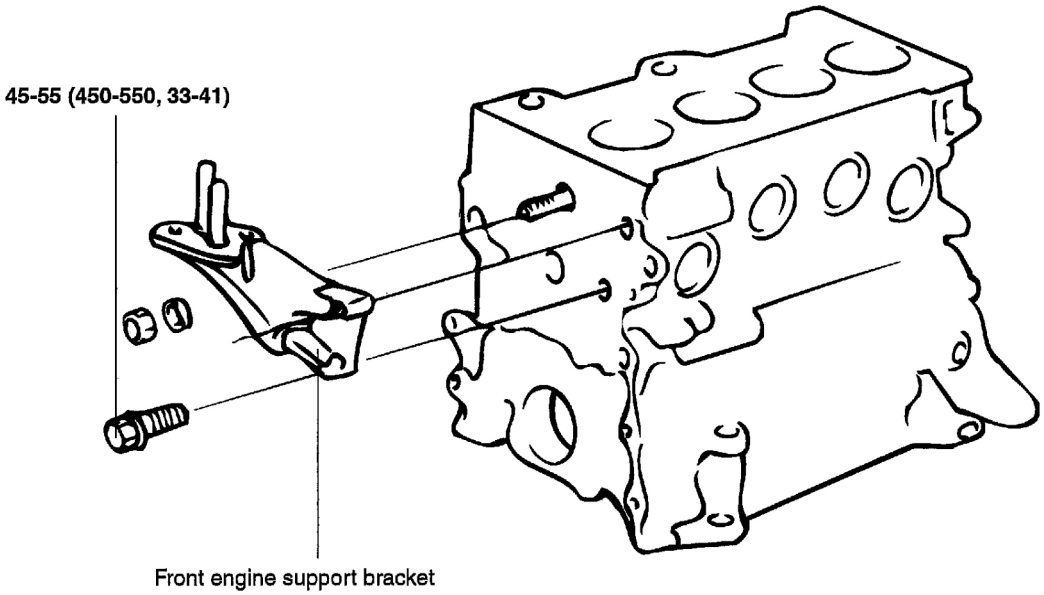
Fig. 31: Engine Block Top View
Courtesy of HYUNDAI MOTOR CO.

CYLINDER BLOCK

COMPONENTS



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

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Fig. 32: Cylinder Block Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Remove the cylinder head, timing belt, front case, fly-wheel, piston and crankshaft.
2. Using the special tool (09260-32000), remove the oil pressure switch

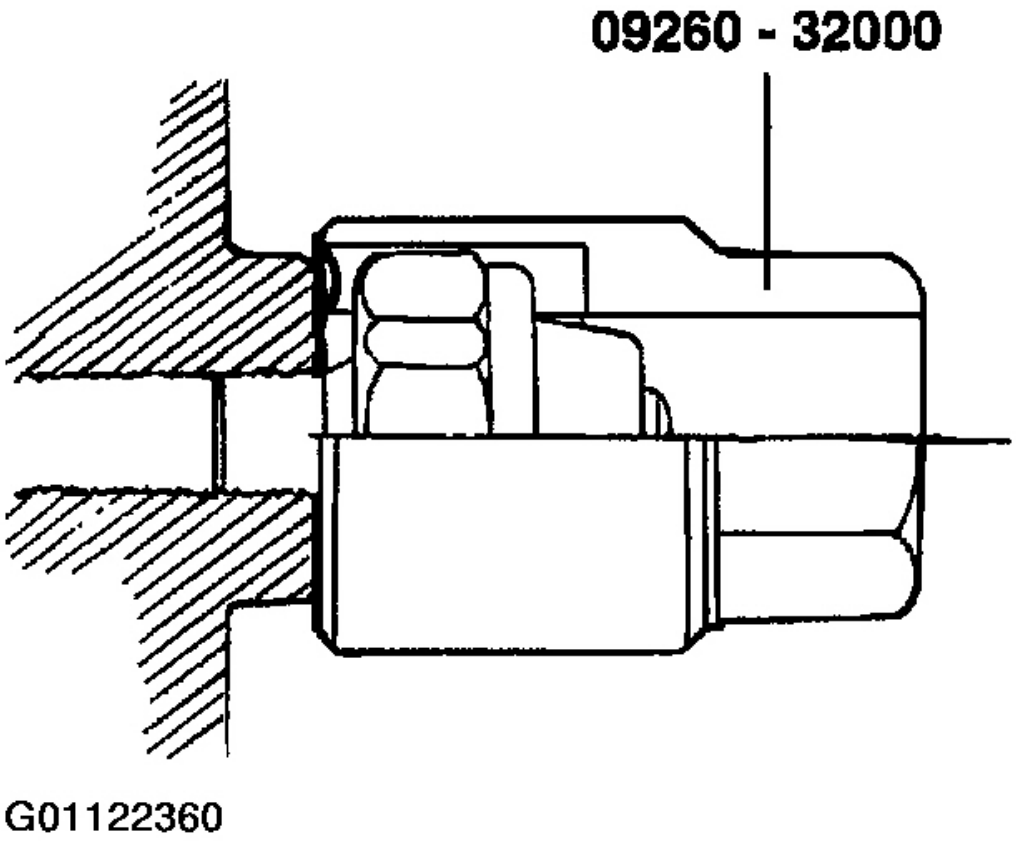

Fig. 33: Removing Oil Pressure Switch
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

CYLINDER BLOCK

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

   Standard: 0.05mm (0.0020 in.) or less

   Limit: 0.1mm (0.0039 in.)

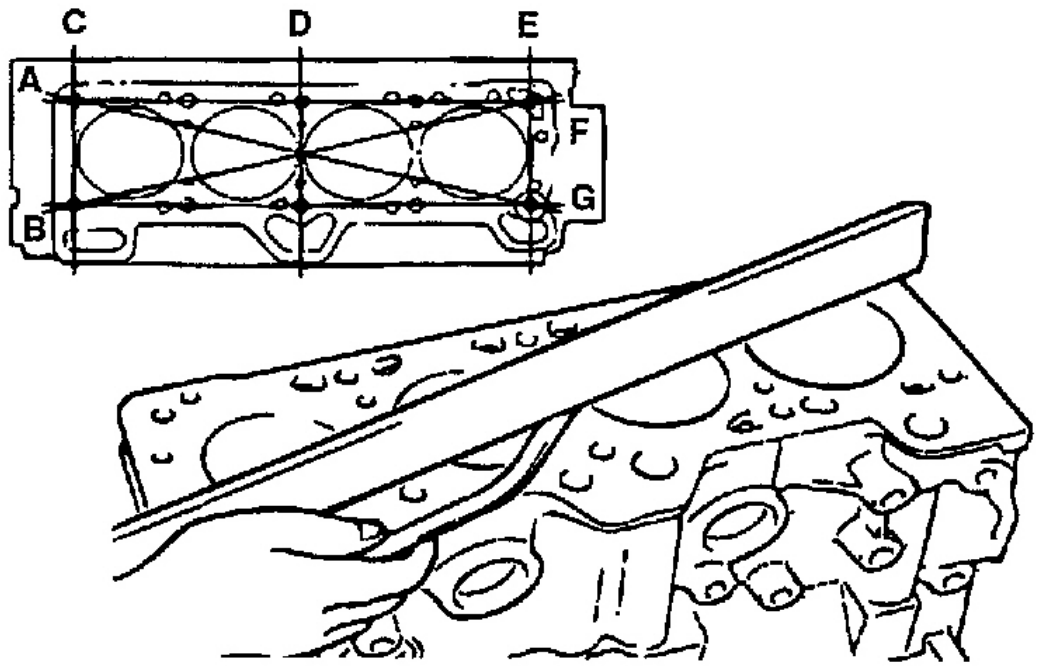

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Fig. 34: Checking Cylinder Block Top Surface For Warpage
Courtesy of HYUNDAI MOTOR CO.

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

   Cylinder I.D: 75.5mm (2.972 in.)

   Cylinder I.D. taper: 0.02mm (0.0008 in.) or less

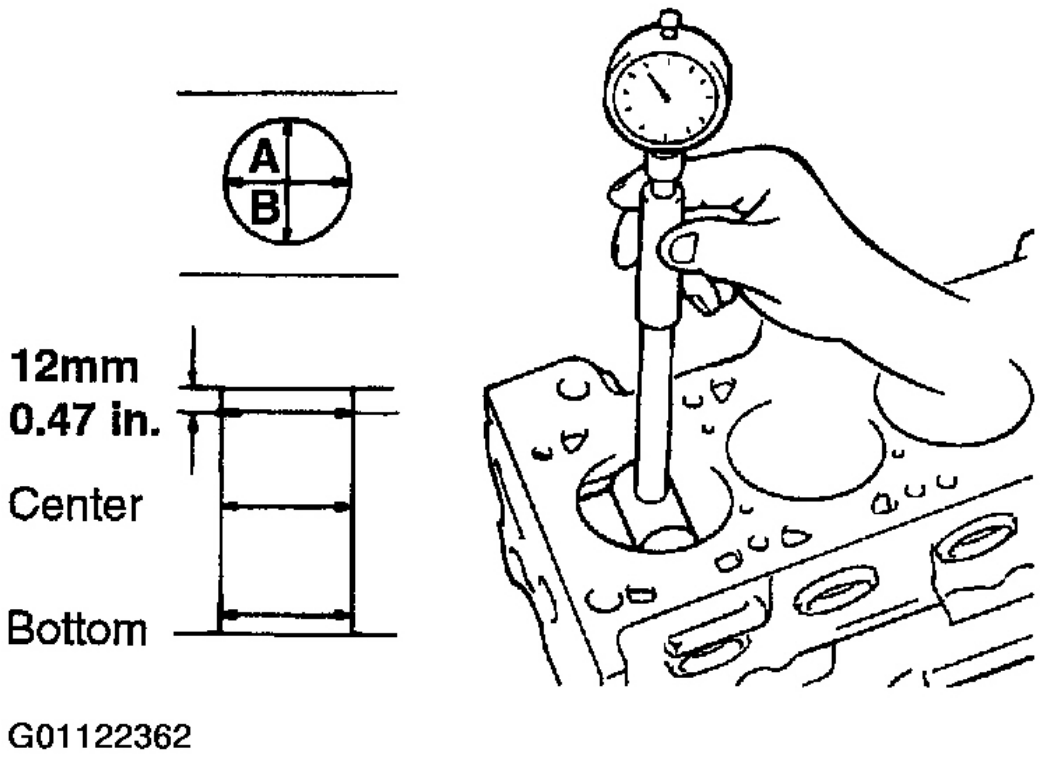

Fig. 35: Measuring Cylinder Bore Diameter
Courtesy of HYUNDAI MOTOR CO.

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 25

   0.50 (0.020) O.S 50

   0.75 (0.030) O.S 75

   1.00 (0.039) O.S 100

6. When boring the cylinder bore to oversize, keep the specified clearance between the oversize piston and the bore, and make sure that all pistons used are of the same oversize.

   The standard measurement of the piston outside diameter is taken at a level 12 mm (0.47 in.) above the bottom of the piston skirt and across the thrust faces.

Piston-to-cylinder wall clearance: 0.025-0.045 (0.0008-0.0016 in.)

ENGINE MOUNTS

COMPONENTS

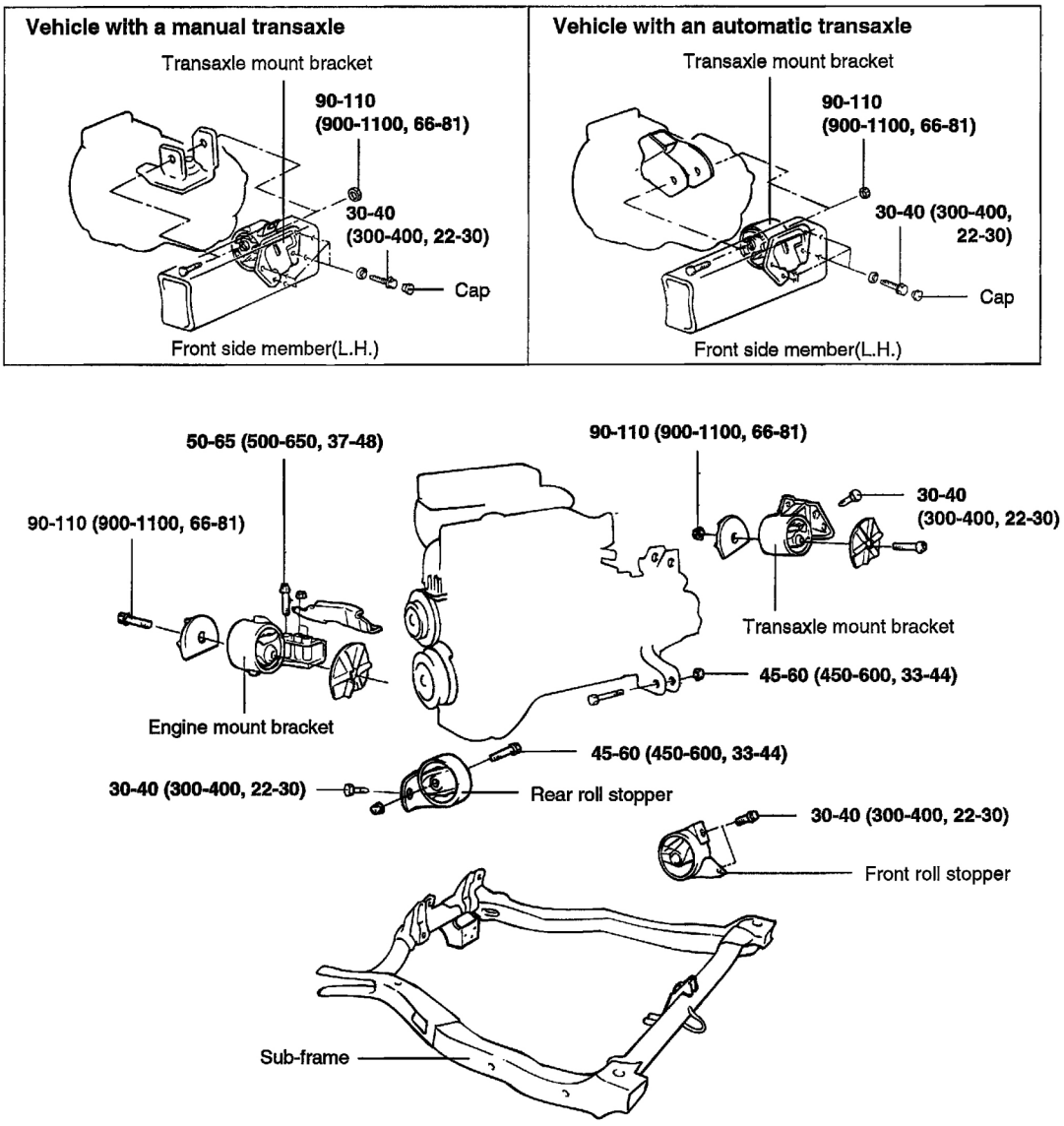

Fig. 36: Engine Mounts Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

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

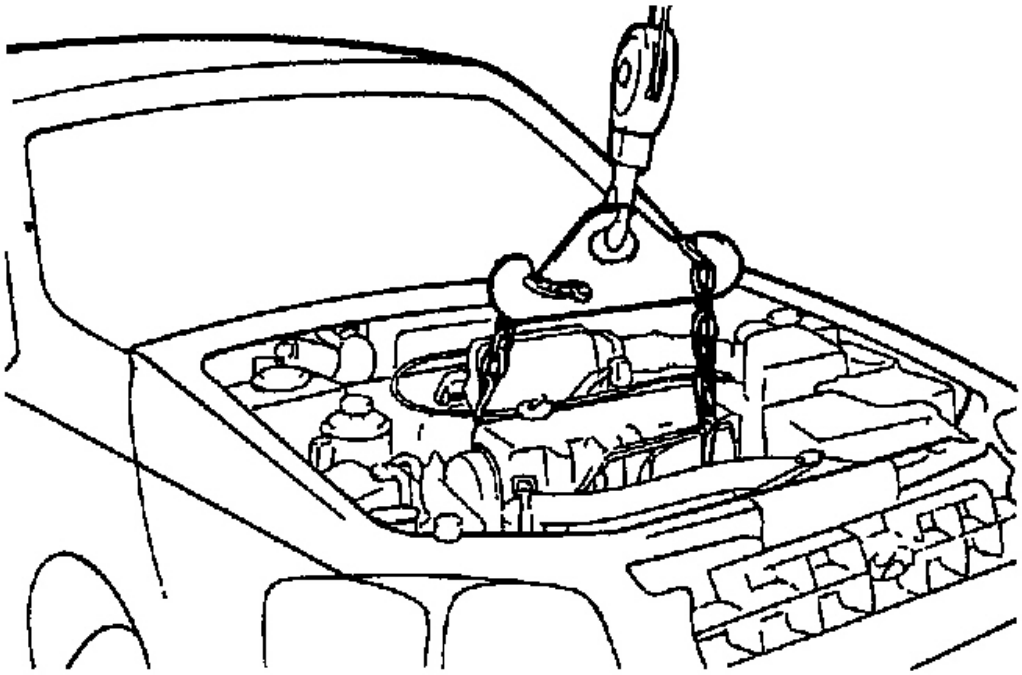

Fig. 37: Attaching Engine Hoist To Engine Hooks
Courtesy of HYUNDAI MOTOR CO.

ENGINE MOUNTING

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

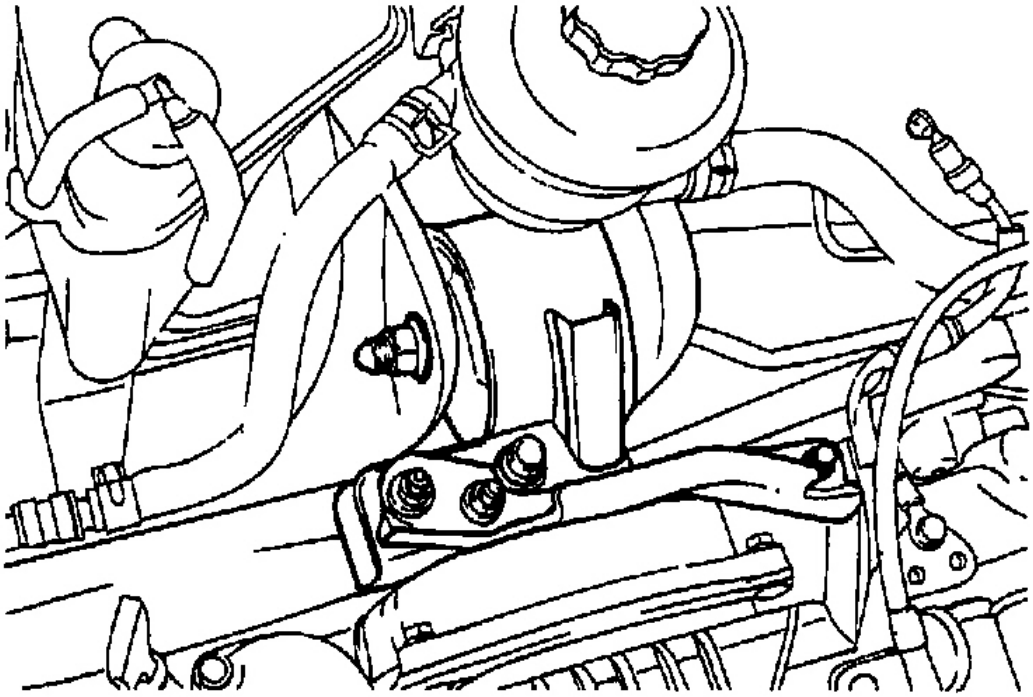

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Fig. 38: Removing Engine Mount Bracket From Engine
Courtesy of HYUNDAI MOTOR CO.

TRANSAXLE

1. For vehicles with a 5-speed manual transaxle, remove the shift lever.
2. Remove the transaxle mount bolt.

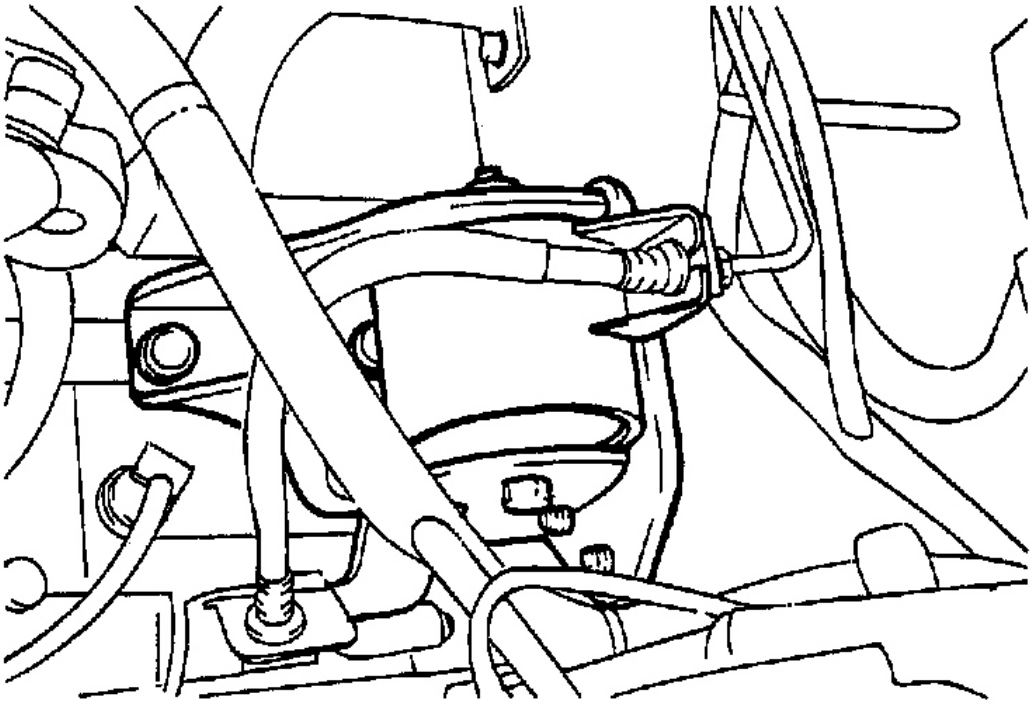
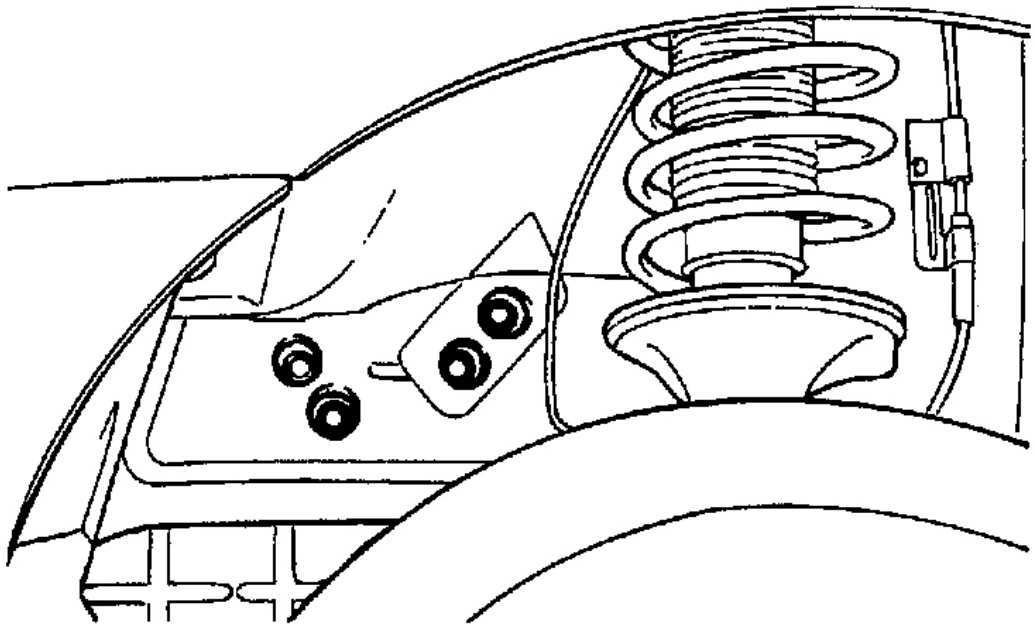


Fig. 39: Removing Transaxle Mount Bolt
Courtesy of HYUNDAI MOTOR CO.

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



G01122367

Fig. 40: Detaching Cap From Inside Right Fender Shield
Courtesy of HYUNDAI MOTOR CO.

FRONT ROLL STOPPER

1. Remove the upper and lower bolts of the front roll stopper.
2. Remove the front roll stopper assembly.

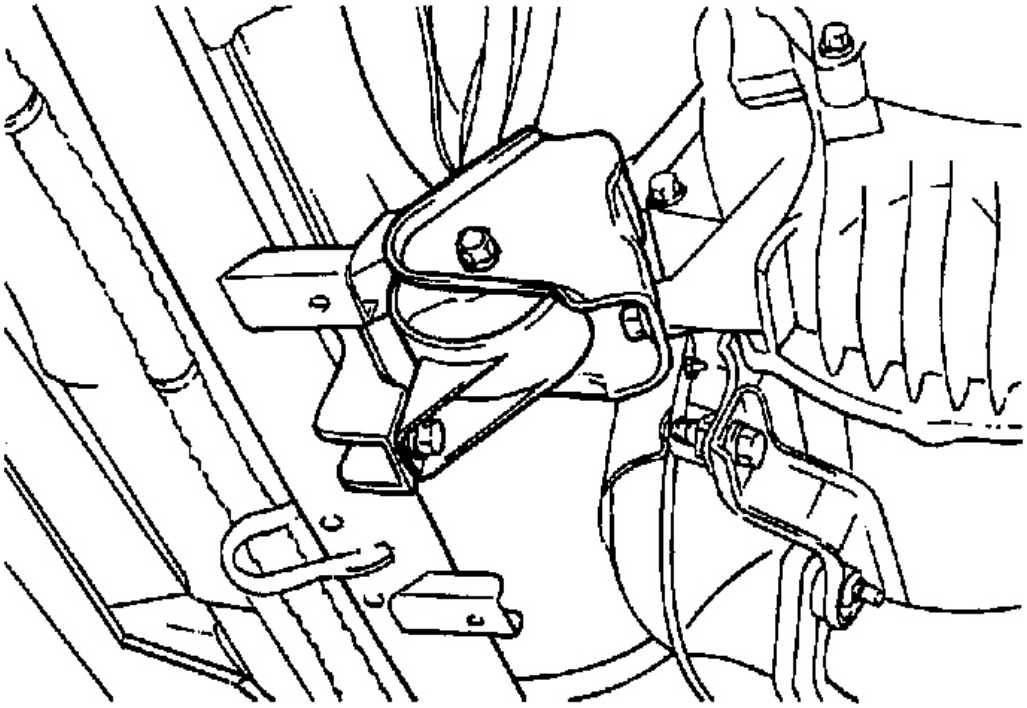


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Fig. 41: Removing Front Roll Stopper Assembly
Courtesy of HYUNDAI MOTOR CO.

REAR ROLL STOPPER

1. Remove the bolt of the rear roll stopper.
2. Remove the rear roll stopper from the sub-frame.

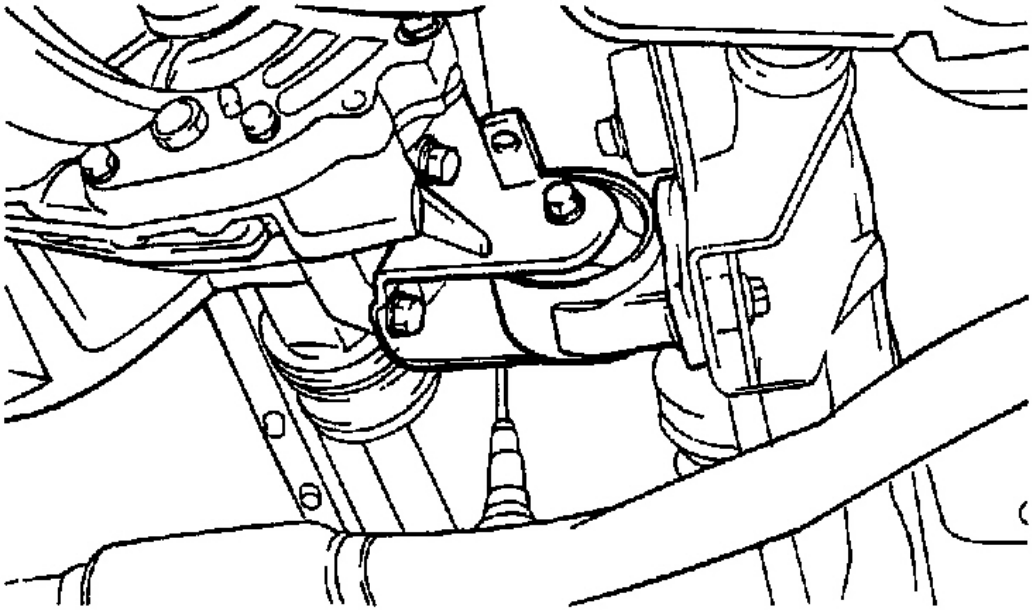

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Fig. 42: Removing Rear Roll Stopper From Sub-Frame
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

1. While checking the connections of the harnesses, pipes, hoses, etc., and making sure that none of them are caught, damaged, etc., install the engine and transaxle assembly.
2. When the engine and transaxle assembly is installed temporarily tighten the front roll stopper.

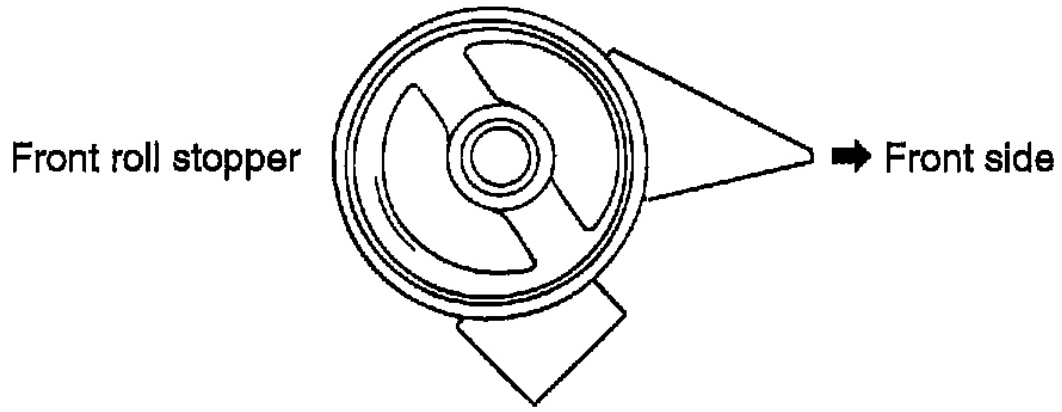


Fig. 43: Locating Front Roller Stopper Position
Courtesy of HYUNDAI MOTOR CO.

3. After the weight of the engine and transaxle assembly has been applied to each insulator, tighten to the specified torque.
4. Reassemble all of the components removed during disassembly. Be especially careful to properly secure all components, including fuel, electrical and fluid pipe connections.
5. Refill the coolant and check for leaks.
6. Refill the transaxle fluid, test its operation, and check for leaks.
7. Check the operation of the transaxle control cable and accelerator cable. Adjust as necessary.
8. Check for proper operation of each of the various gauges.

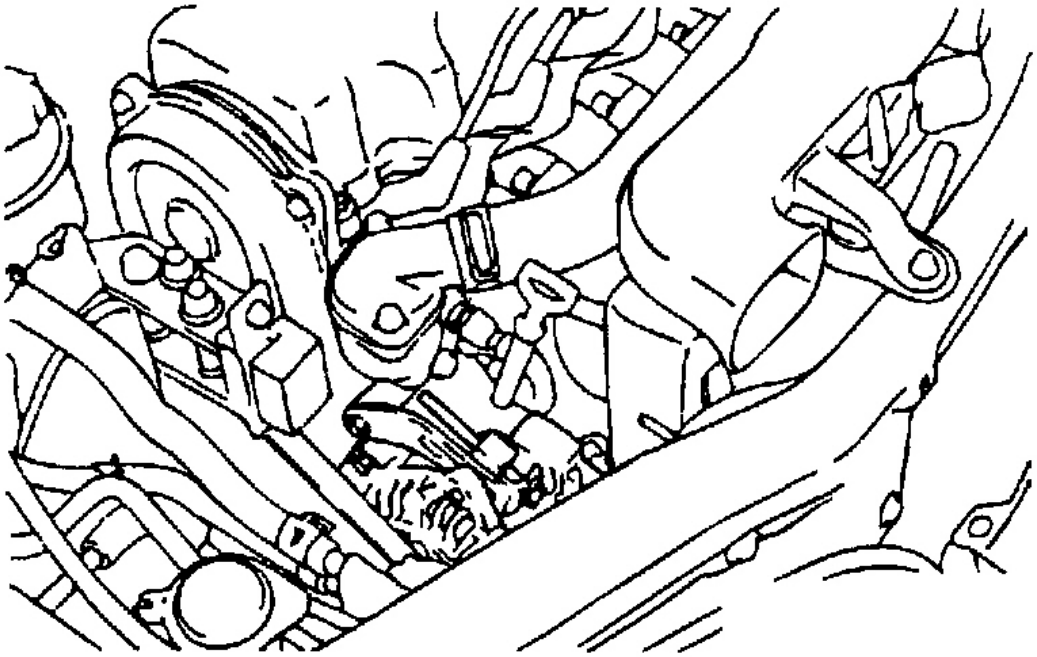
ENGINE AND TRANSAXLE ASSEMBLY

REMOVAL

1. Remove the battery.
2. Detach the air cleaner.
3. Disconnect the backup lamp and engine harness connectors.
4. For vehicles with 5-speed manual transaxles, disconnect the select control valve connector.
5. Disconnect the connectors for the generator harness and the oil pressure gauge wiring.
6. Drain the engine coolant from the radiator.
7. For vehicles with automatic transaxles, disconnect transaxle oil cooler hoses.

NOTE: When disconnecting the hoses, make identification marks to avoid making mistakes when reconnecting them.

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



G01122371

Fig. 44: Disconnecting Transaxle Oil Cooler Hoses
Courtesy of HYUNDAI MOTOR CO.

8. Disconnect the radiator upper and lower hoses on the engine side, then remove the radiator assembly.
9. Disconnect the engine ground.
10. Disconnect the brake booster vacuum hose.
11. Remove the main fuel line and the return and vapor hoses from the engine side.

CAUTION: To reduce the residual pressure in the hoses, refer to FUEL SYSTEM PRESSURE RELEASE

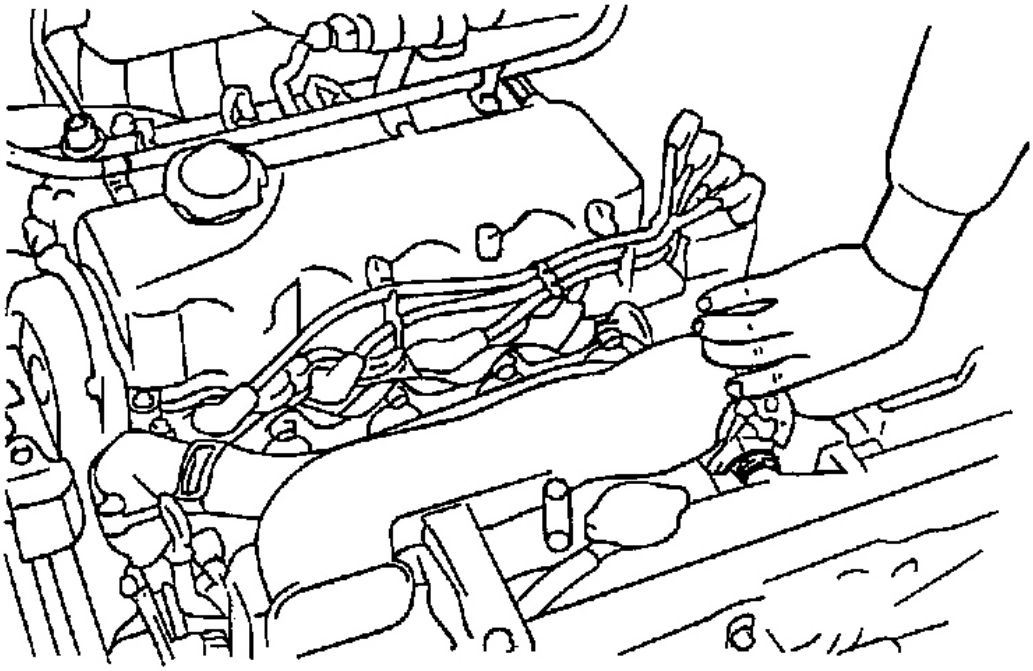


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Fig. 45: Removing Main Fuel Line & Vapor Return Hoses From Engine Side
Courtesy of HYUNDAI MOTOR CO.

12. Disconnect the heater hoses (inlet and outlet) on the engine side.
13. Disconnect the accelerator cable at the engine side.
14. For vehicles with manual transaxles, remove the clutch cable from the transaxle.
15. For vehicles with automatic transaxles, remove the control cable from the transaxle.
16. Disconnect the speedometer cable from the transaxle.

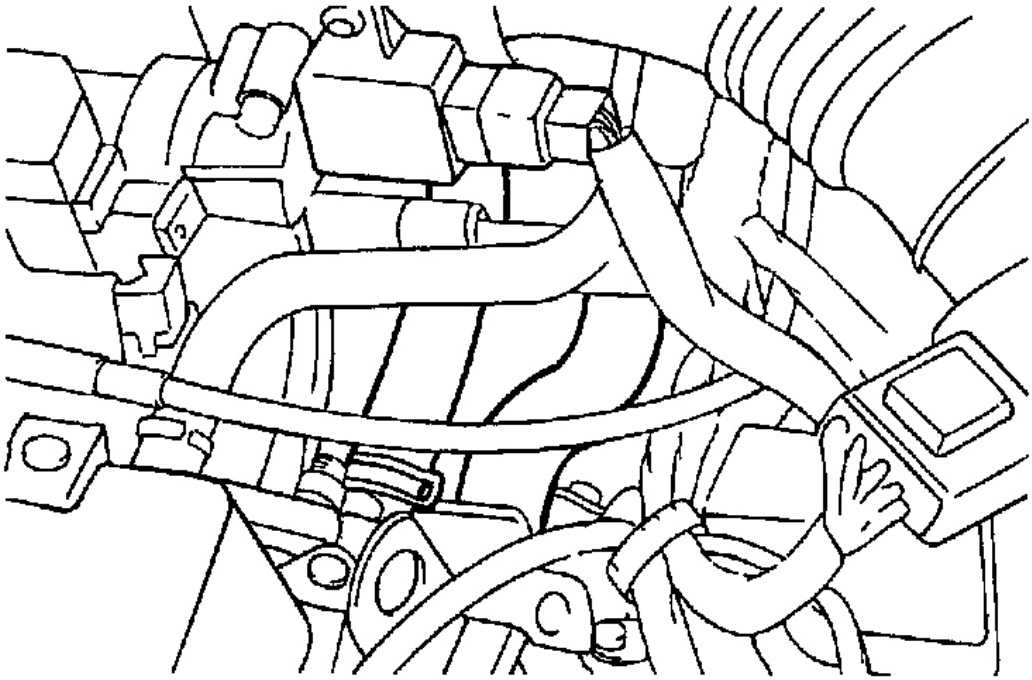

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Fig. 46: Disconnecting Speedometer Cable From Transaxle
Courtesy of HYUNDAI MOTOR CO.

17. Disconnect the air conditioning compressor from the mounting bracket.

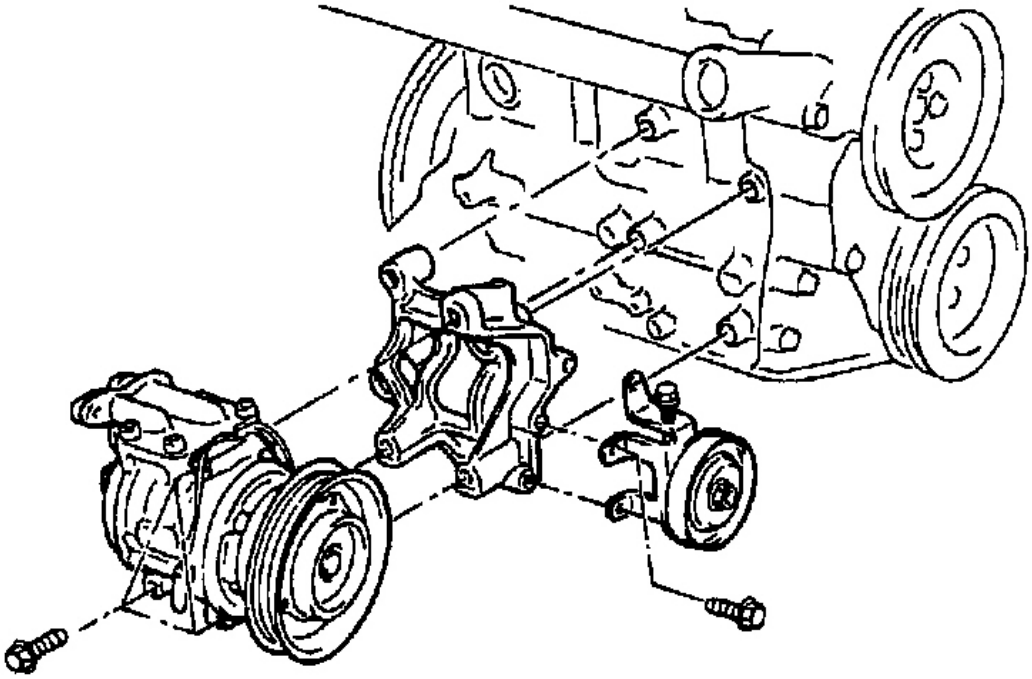

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Fig. 47: Disconnecting Air Conditioning Compressor From Mounting Bracket
Courtesy of HYUNDAI MOTOR CO.

18. Jack up the vehicle.
19. Drain the transaxle oil (or fluid).
20. Disconnect the front exhaust pipe from the manifold.

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

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

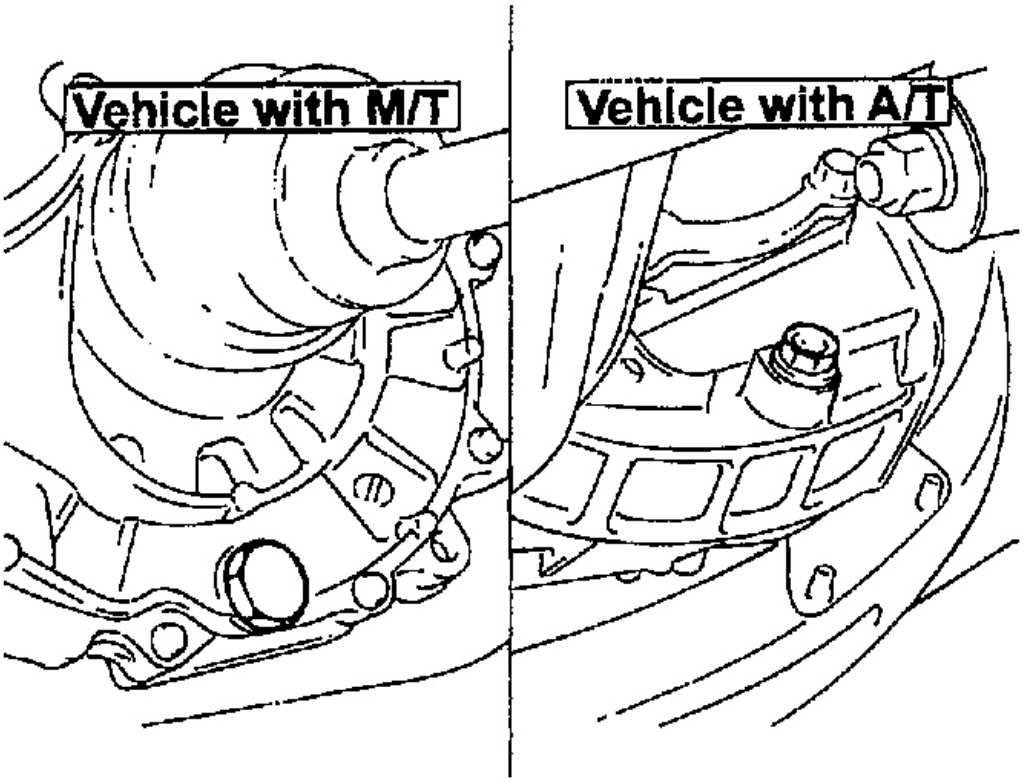

Fig. 48: Removing Drain Plug
Courtesy of HYUNDAI MOTOR CO.

23. Remove the drive shafts from the transaxle case.

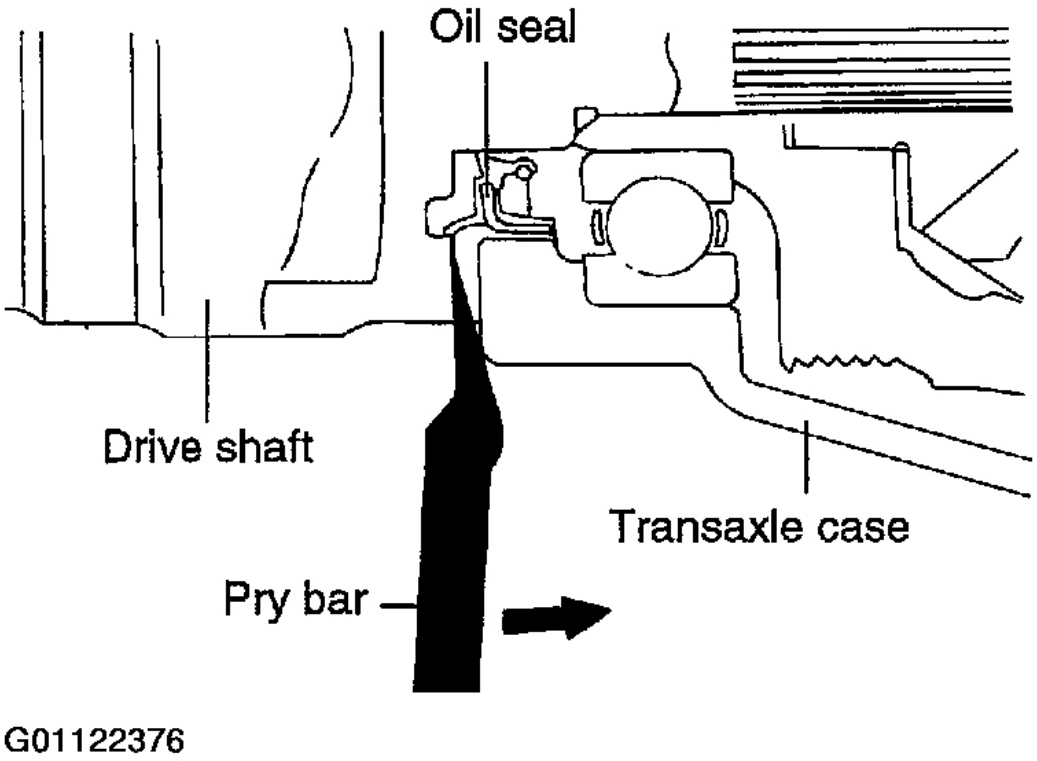

Fig. 49: Removing Drive Shafts Oil Seal
Courtesy of HYUNDAI MOTOR CO.

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

24. Hang the lower arm and drive shaft from the body with a string.
25. Attach a cable to the engine, and use a chain hoist to lift the engine just enough so that the cable becomes tight.
26. Remove the front roll stopper.
27. Separate the rear roll stopper.
28. For vehicles with a manual transaxle, remove the roll rod.
29. Remove the engine mounting insulator bolts.

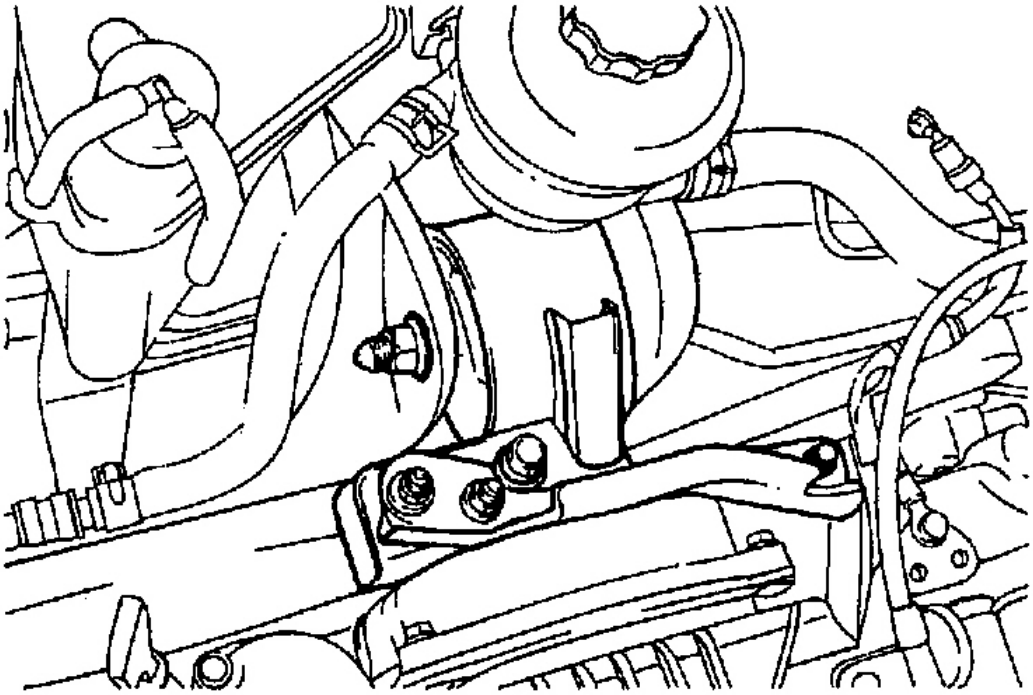

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Fig. 50: Removing Engine Mounting Insulator Bolts
Courtesy of HYUNDAI MOTOR CO.

30. Remove the engine mounting bracket from the engine.
31. Slowly raise the engine (to the extent that the weight of the engine and transaxle 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.

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

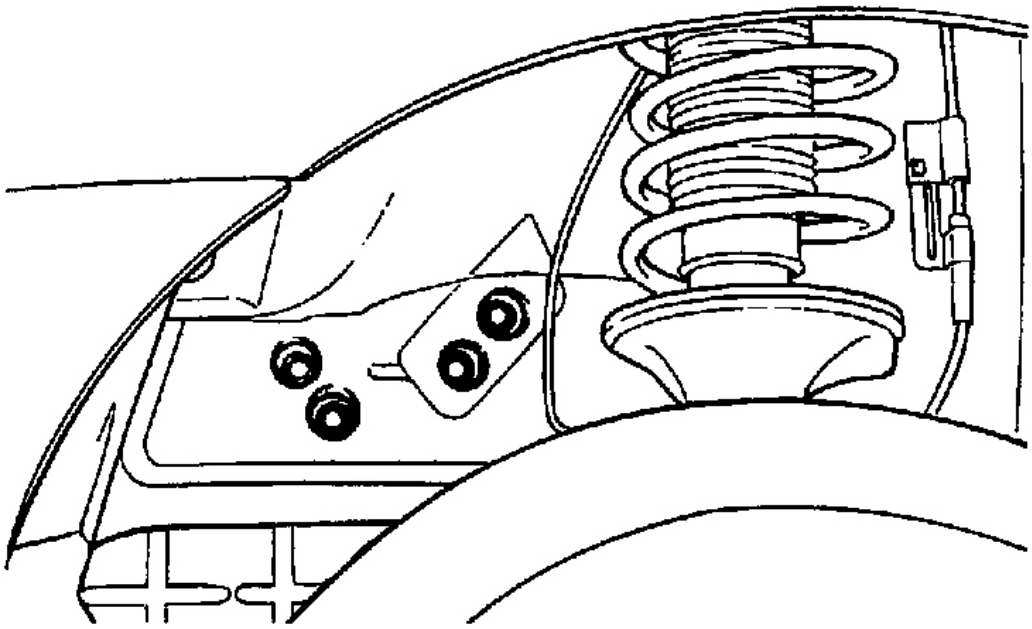

Fig. 51: Removing Transaxle Mount Bracket Bolts
Courtesy of HYUNDAI MOTOR CO.

33. Remove the left mount insulator bolt.
34. While directing the transaxle side downward, lift the engine and transaxle assembly up and out of the vehicles.

MAIN MOVING SYSTEM

CAM SHAFT

COMPONENTS

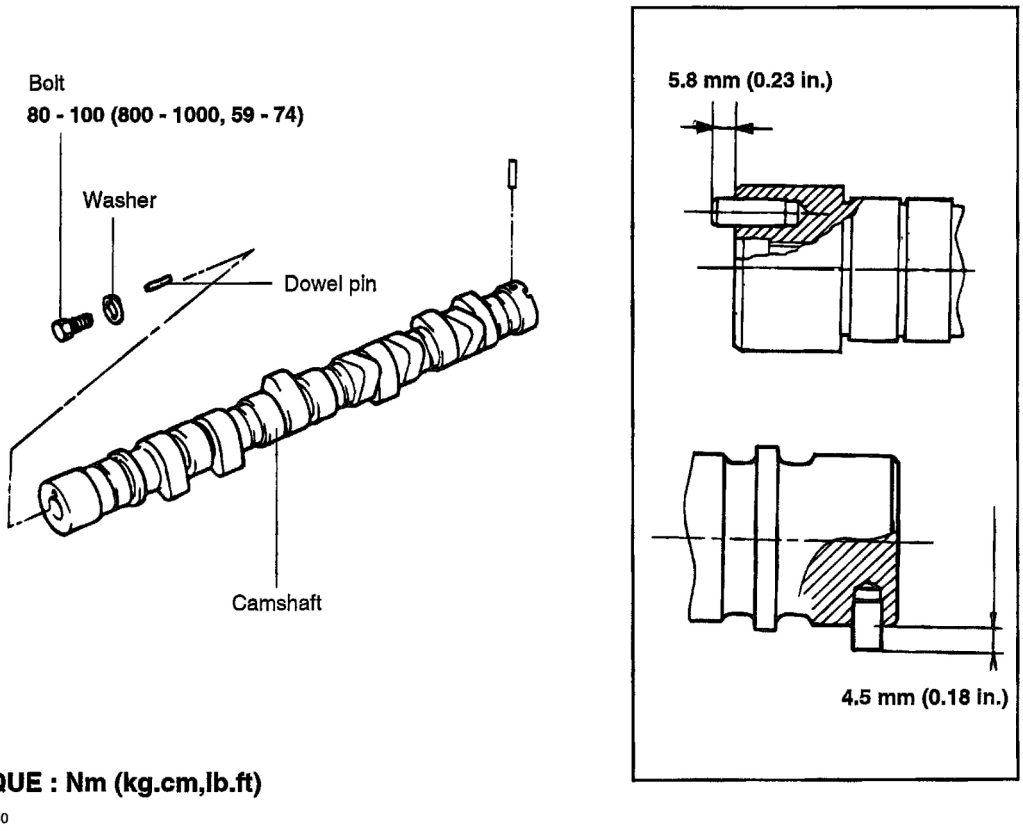

Fig. 52: Cam Shaft Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Disconnect the breather hose and the PCV hose.
2. Remove the coolant pump pulley and crankshaft pulley.
3. Remove the timing belt cover.
4. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.
5. Remove the timing belt from the camshaft sprocket.
6. Remove the camshaft sprocket.
7. Remove the ignition coil assembly
8. Remove the rocker cover.
9. Remove the rocker arm shaft assembly, Refer to **ROCKER ARM**.
10. Remove the camshaft bearing caps.
11. Remove the camshaft.

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: 42.8575mm (1.6873 in.)

   Exhaust: 42.7354mm (1.6825 in.)

   Limit

   Intake: 42.3575mm (1.6676 in.)

   Exhaust: 42.2353mm (1.6628 in.)

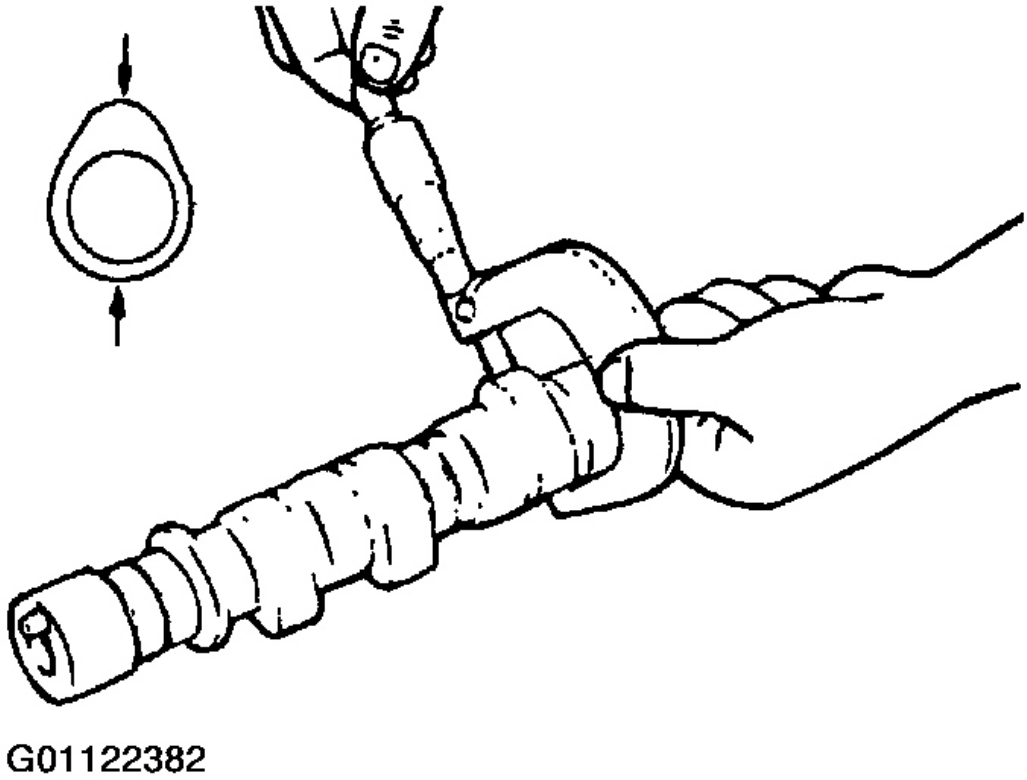

Fig. 53: Measuring Cam Lobes
Courtesy of HYUNDAI MOTOR CO.

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.

OIL SEAL (CAMSHAFT FRONT)

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

Camshaft end play: 0.07-0.28mm (0.0003-0.0011 in.)

REASSEMBLY

1. Install the camshaft after lubricating the journal of the camshaft with engine oil.

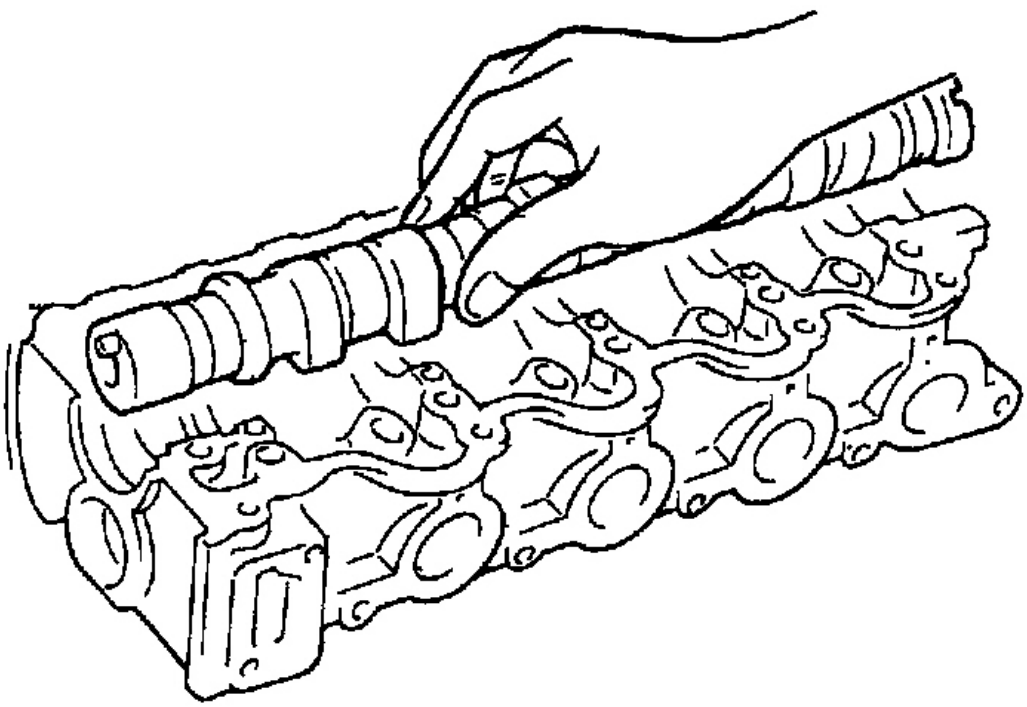

Fig. 54: Installing Camshaft
Courtesy of HYUNDAI MOTOR CO.

2. Install the camshaft bearing caps.

3. Install the ignition coil.

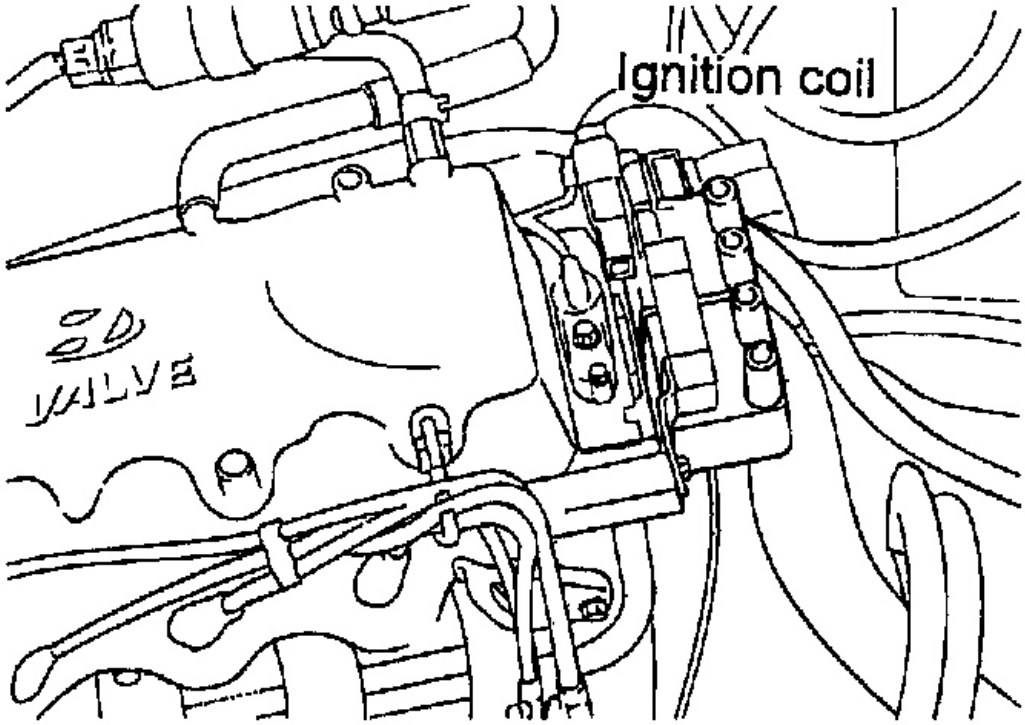

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Fig. 55: Installing Ignition Coil
Courtesy of HYUNDAI MOTOR CO.

4. Install the rocker arm and rocker arm shaft. Refer to **ROCKER ARM**.
5. Using the Special Tools, Camshaft Oil Seal Installer (09221-21000), press and fit the camshaft oil seal. Be sure to apply engine oil to the external surface of the oil seal.

   Insert the oil seal along the camshaft front end and install by driving the installer with a hammer until the oil seal is fully seated.

6. Install the camshaft sprocket and tighten the bolts to the specified torque.

   Tightening torque

   Camshaft sprocket bolt: 80-100Nm (800-1000kg.cm, 59-74lb.ft)

7. Align the camshaft sprocket and crankshaft sprocket timing marks. The piston in the No. 1 cylinder will

then be at top dead center on the compression stroke.

8. Install a gasket in the rocker cover groove.
9. Temporarily install the rocker cover.
10. Start the engine and run at idle.
11. Install the rocker cover and tighten the bolts to the specified torque.

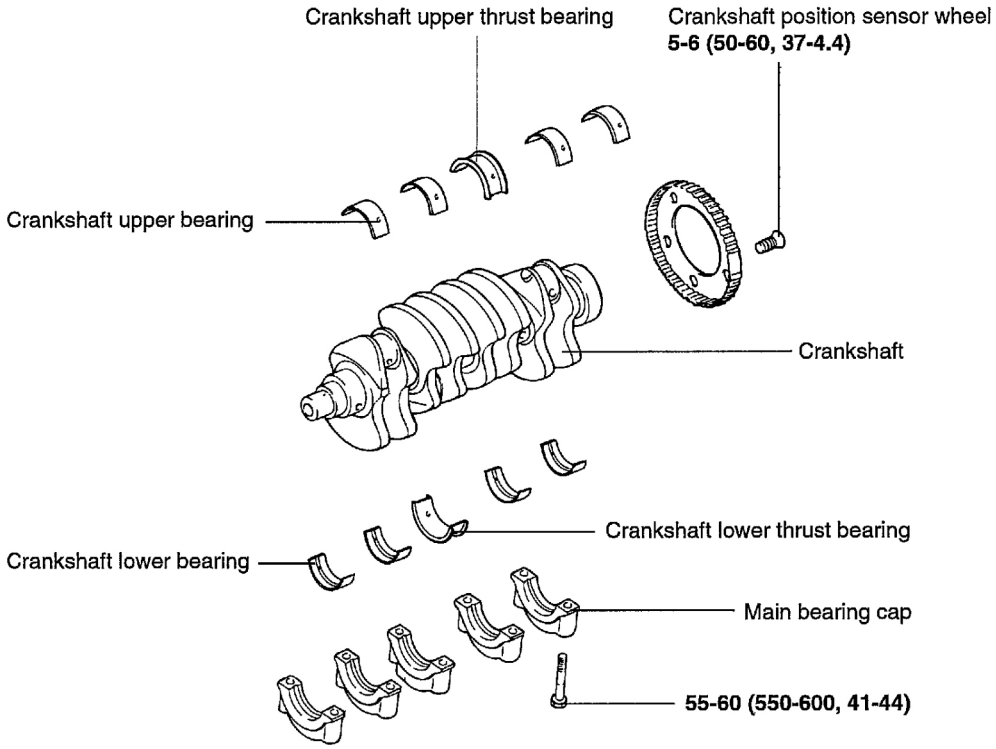
Tightening torque

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

12. Install the timing belt cover.
13. Install the coolant pump pulley and crank shaft pulley.

CRANK SHAFT

COMPONENTS



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

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Fig. 56: Crank Shaft Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Remove the timing belt train, 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.
4. Remove the main bearing caps and remove the crankshaft. Keep the bearings in order according to the cap number.
5. Remove the crankshaft position sensor wheel.

CAUTION: Mark the main bearing caps to permit reassembly in the original position and direction.

INSPECTION

CRANKSHAFT

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

Standard value

Crankshaft journal O.D: 50mm (1.9685 in.)

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

Crankshaft journal, pin out-of-roundness and taper: 0.01mm (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

To check the oil clearance, measure outside diameter of the crankshaft journal and the crank pin and inside diameter of the bearing. The clearance measurement is the difference between the measured outside and inside diameters.

Standard value

Journal oil clearance NO. 1,2,4,5: 0.028 - 0.046 mm (0.0011 - 0.0018 in.)

Journal oil clearance NO. 3 (center): 0.034 - 0.52 mm (0.0013 - 0.002 in.)

Pin oil clearance: 0.024 - 0.042 mm (0.0009 - 0.0017 in.)

PLASTIC GAUGE METHOD

A plastic gauge may be used to measure the clearance.

1. Remove oil, grease and any other dirt from bearings and journals.
2. Cut plastic gauge to the same length as the width of the bearing and place it parallel with the journal, off from the oil holes.

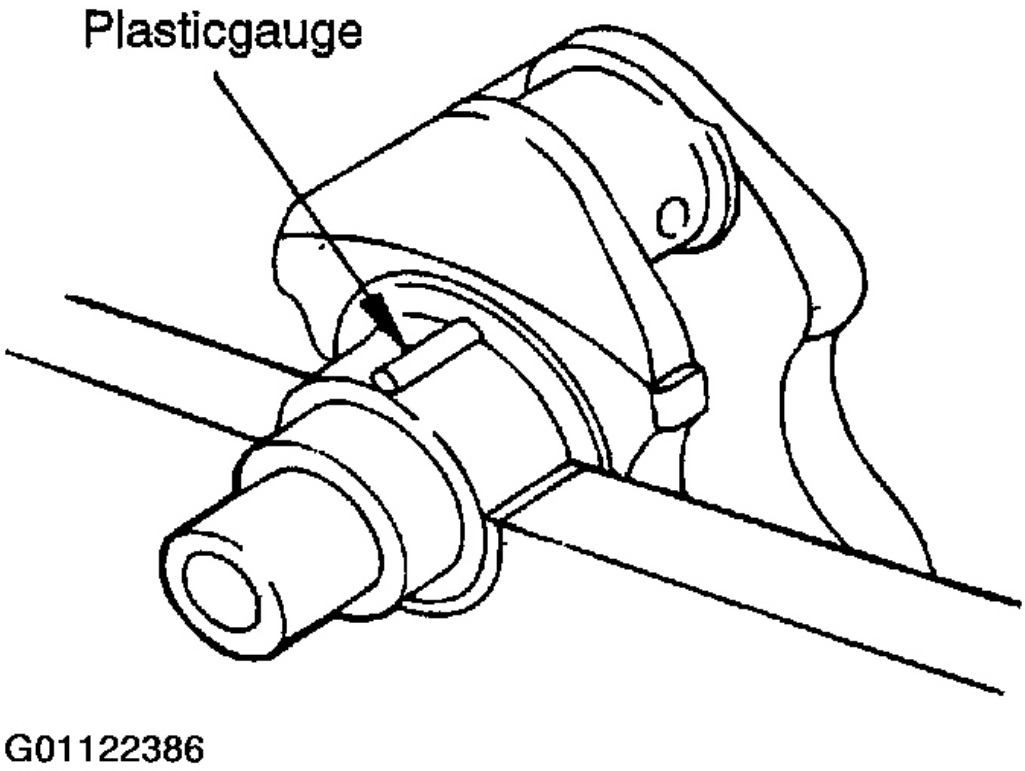

Fig. 57: Measuring Oil Clearance By Using Plastic Gauge
Courtesy of HYUNDAI MOTOR CO.

3. Install the crankshaft, bearings, and caps. Tighten them to the specified torques. During this operation, do not turn the crankshaft. Remove the caps. Measure the width of the plastic gauge at the widest point using the scale printed on the gauge package. If the clearance exceeds the repair limit, replace the bearing.

   Should the standard clearance not be obtained even after bearing replacement, the journal should be

ground to a recommended undersize, and a bearing of the same size should be installed.

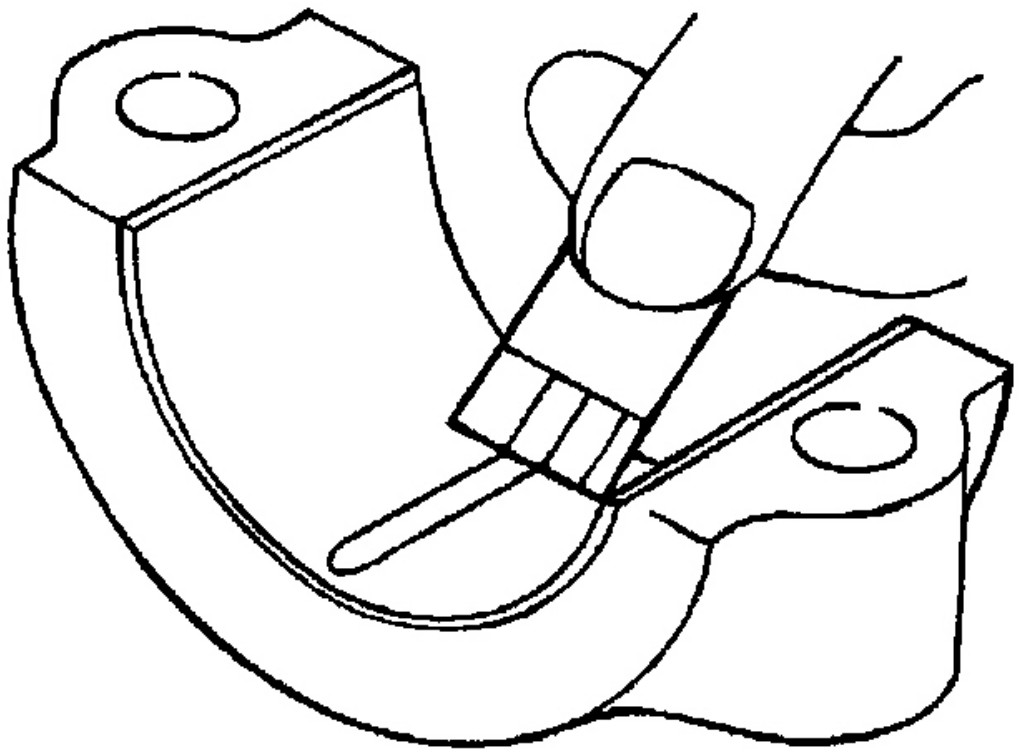

Fig. 58: Measuring Plastic Gauge On Connecting Rod Cap
Courtesy of HYUNDAI MOTOR CO.

OIL SEAL

Check front and rear oil seals for damage or worn lips. Replace any seat that is defective.

CRANKSHAFT POSITION SENSOR WHEEL

1. Remove the crankshaft position sensor wheel
2. Check the crankshaft position sensor wheel for damage, cracks and wear, and replace if necessary.
3. Check the clearance between the crankshaft position sensor wheel and the crankshaft position sensor with a depth gage.

   Standard value:

Clearance between the crankshaft position sensor wheel and crankshaft position sensor: 0.5 - 1.5 mm (0.020 - 0.059 in.)

NOTE:

1. **Measure the depth of the top of the crankshaft position sensor wheel teeth and the outside of transaxle housing.**
2. **Measure the difference between the crankshaft position sensor length and depth.**
3. **The crankshaft position sensor length is the distance between the end of crankshaft position sensor and inner point of contacting face.**

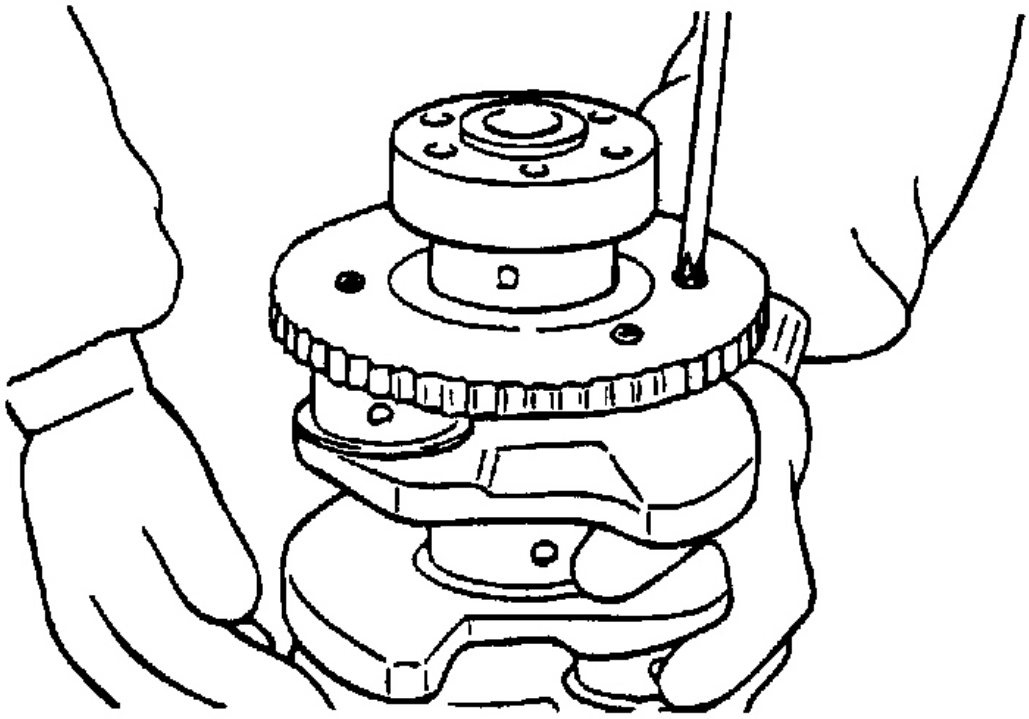

Fig. 59: Checking Clearance Between Crankshaft Position Sensor Wheel & Crankshaft Position Sensor
Courtesy of HYUNDAI MOTOR CO.

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

at the time of disassembly.

2. Install the crankshaft. Apply engine oil to the journals.
3. Install bearing caps and tighten 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 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: 55 - 60 Nm (550 - 600 kg.cm, 41 - 44 lb.ft)

   Connecting rod cap bolt: 32 - 35 Nm (320 - 350 kg.cm, 24 - 26 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: 0.05 - 0.175 mm (0.002 - 0.005 in.)

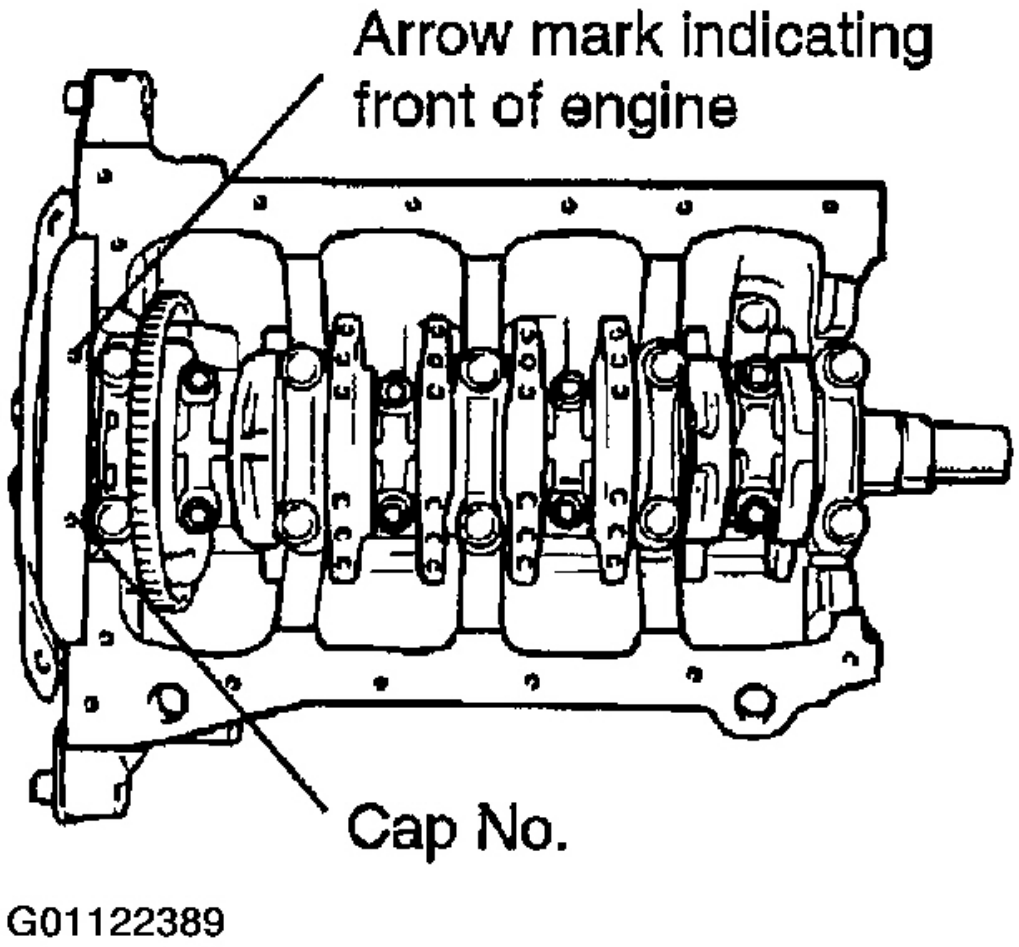

Fig. 60: Locating Arrow Mark Indicating Front Of Engine
Courtesy of HYUNDAI MOTOR CO.

5. Install the oil seal in the crankshaft rear oil seal case. Use the Special Tool, Crankshaft Rear Oil Seal Installer (09231-21000) as shown. Press and fit the oil seal in all the way, being careful not to misalign it.

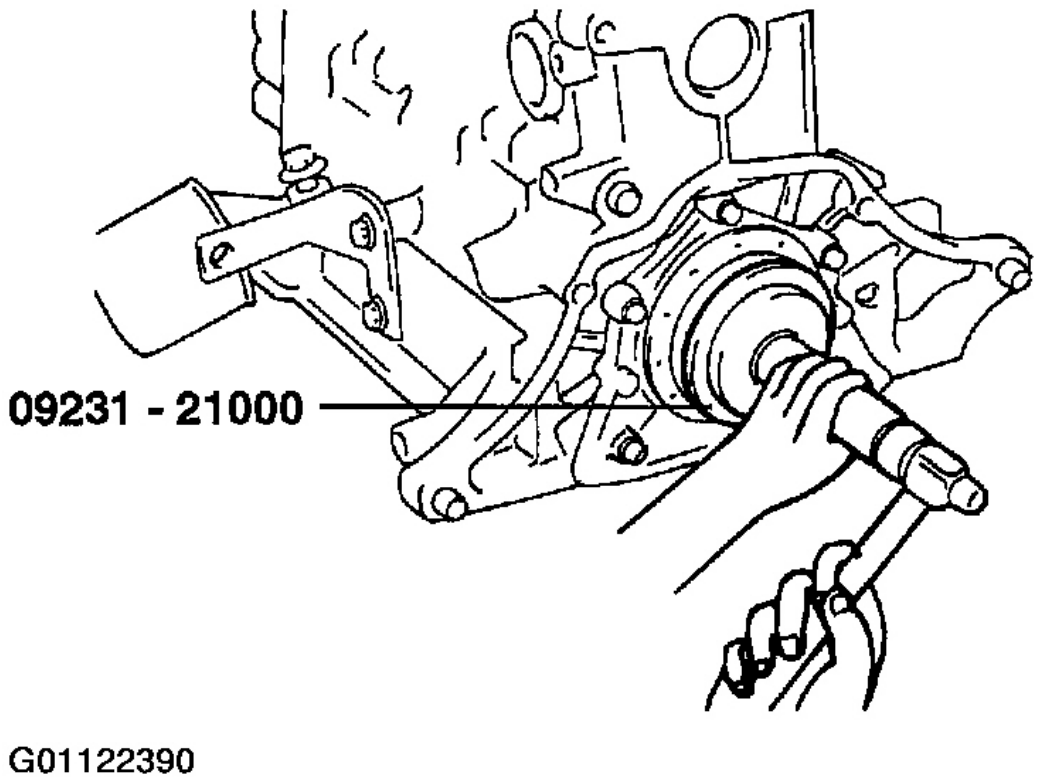

Fig. 61: Installing Oil Seal
Courtesy of HYUNDAI MOTOR CO.

6. Install the rear oil seal case and gasket. Tighten the five bolts.

   Apply engine oil to the oil seal lips and crankshaft at the time of installation.

7. Install the rear plate and tighten the bolts.
8. Install the connecting rod caps. Refer to **PISTON**.
9. Install the flywheel, front case, oil pan and timing belt.

FLY WHEEL

COMPONENTS

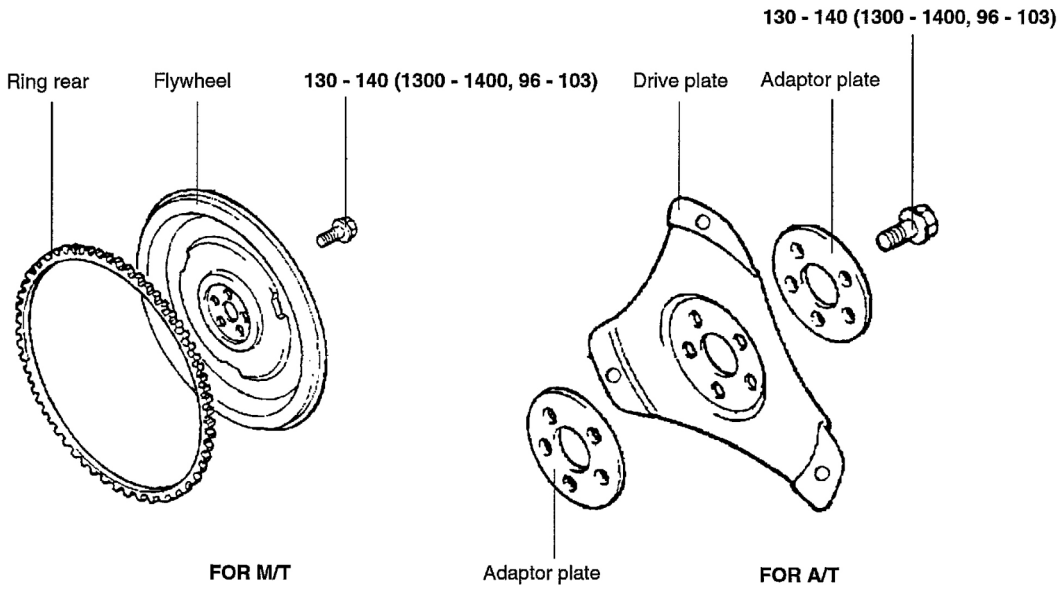

Fig. 62: Fly Wheel Components
Courtesy of HYUNDAI MOTOR CO.

M/T: Manual Transaxle Vehicles

A/T: Automatic Transaxle Vehicles

DISASSEMBLY

1. Remove the transaxle 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: 0.1mm (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: 130 - 140 Nm (1300 - 1400kg.cm, 96 - 103 lb.ft)

PISTON

COMPONENTS

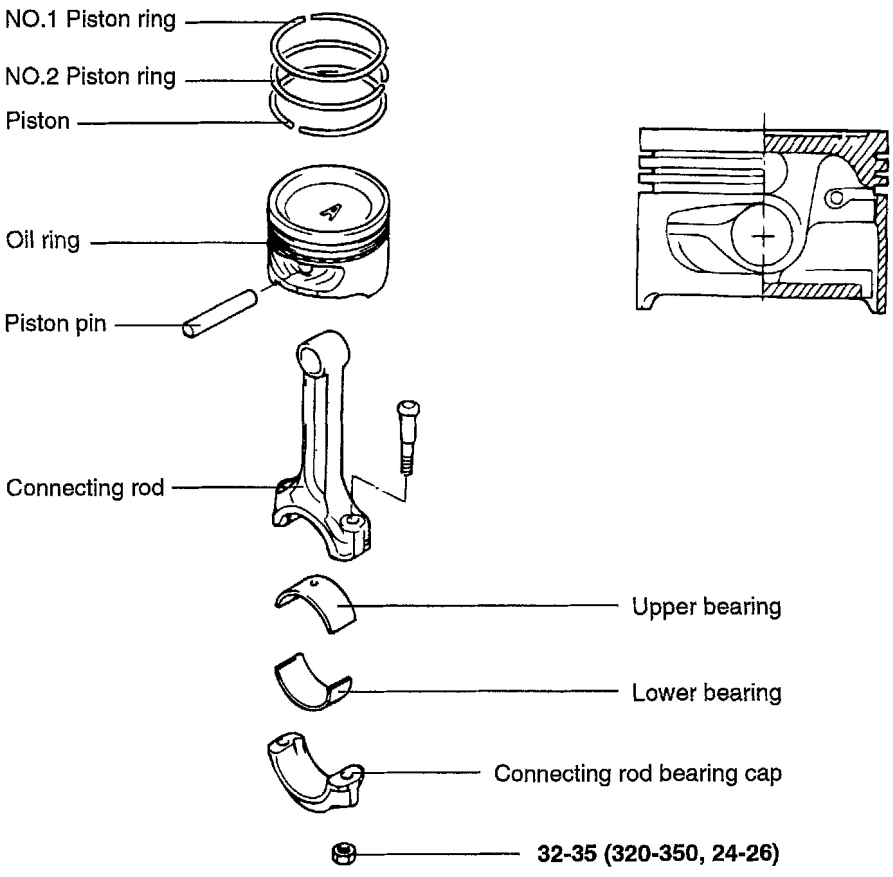

Fig. 63: Piston Components
Courtesy of HYUNDAI MOTOR CO.

PISTON PIN REMOVAL & INSTALLATION PROCEDURE

DISASSEMBLY

1. Use the Special Tools (09234-33001) to disassemble and reassemble the piston and connecting rod.

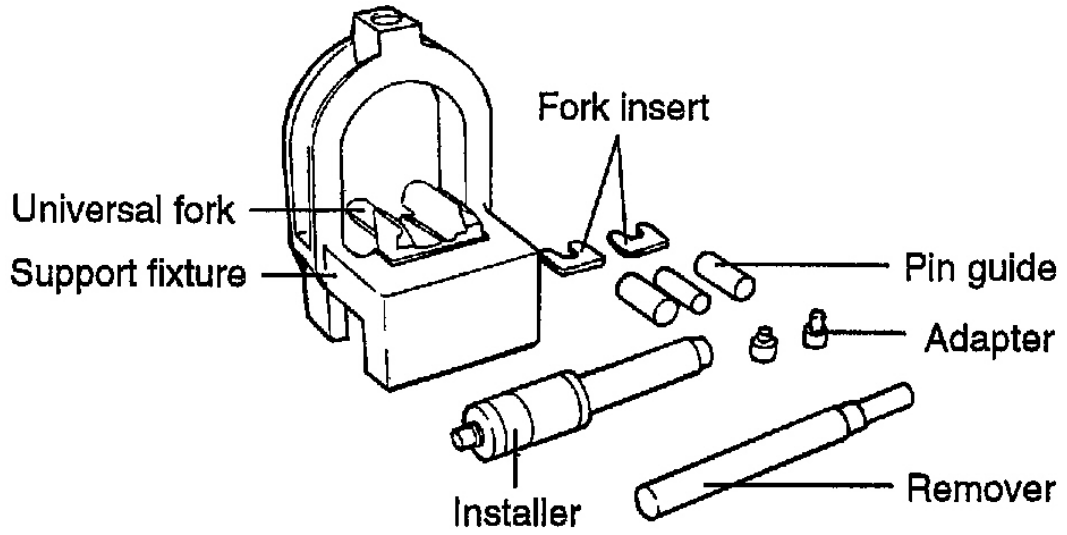

Fig. 64: Identifying Special Tools
Courtesy of HYUNDAI MOTOR CO.

2. Place the proper fork inserts in the fork of the tool. Between the connecting rod and the piston.
3. Insert the proper removal tool through the hole in the arch of the tool.

NOTE: Center the piston, rod and pin assembly with the removal arbor.

4. Press the piston pin out of the connecting rod.

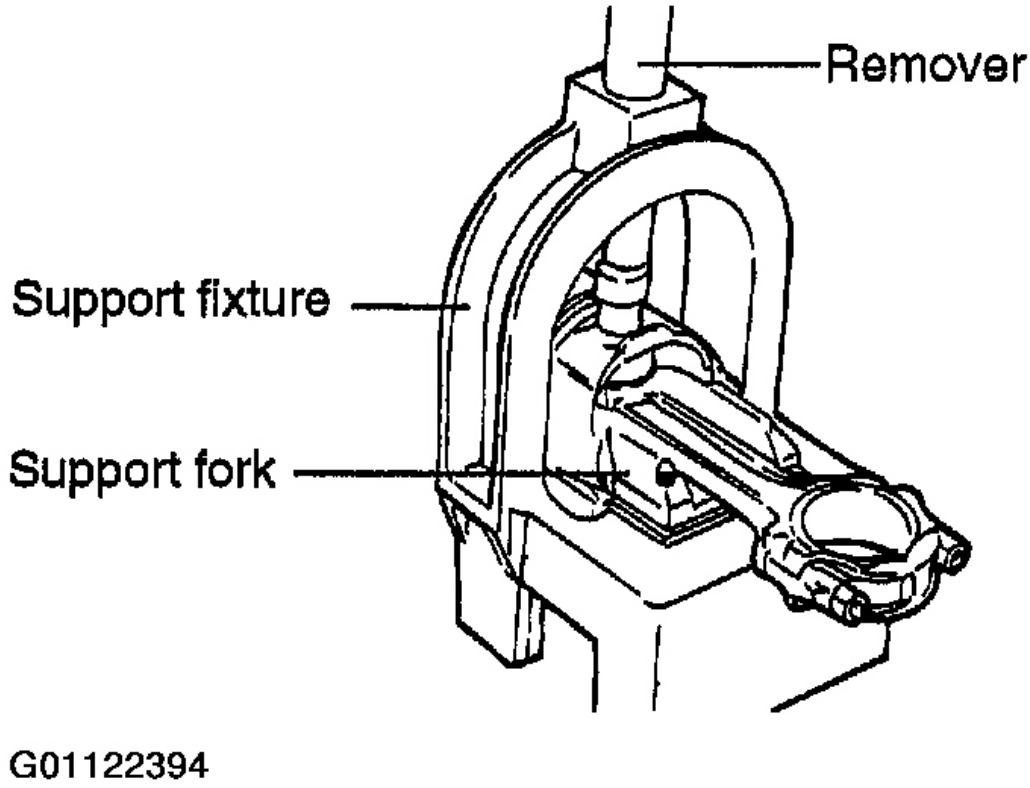

Fig. 65: Pressing Piston Pin Out Of Connecting Rod
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

1. Install proper pin guide through piston and into connecting rod. Hand tap pin guide into piston for proper retention. Drop piston pin into the other side of the piston.

NOTE: The pin guide centers the connecting rod in the piston. When the piston, connecting rod, piston pin and pin guide assembly are positioned on the fork of the tool, the pin guide will also center this assembly in the tool. If too small a pin guide is used, the piston assembly will not be located centrally in the tool, and damage may occur to the fork and/or insert of the tool.

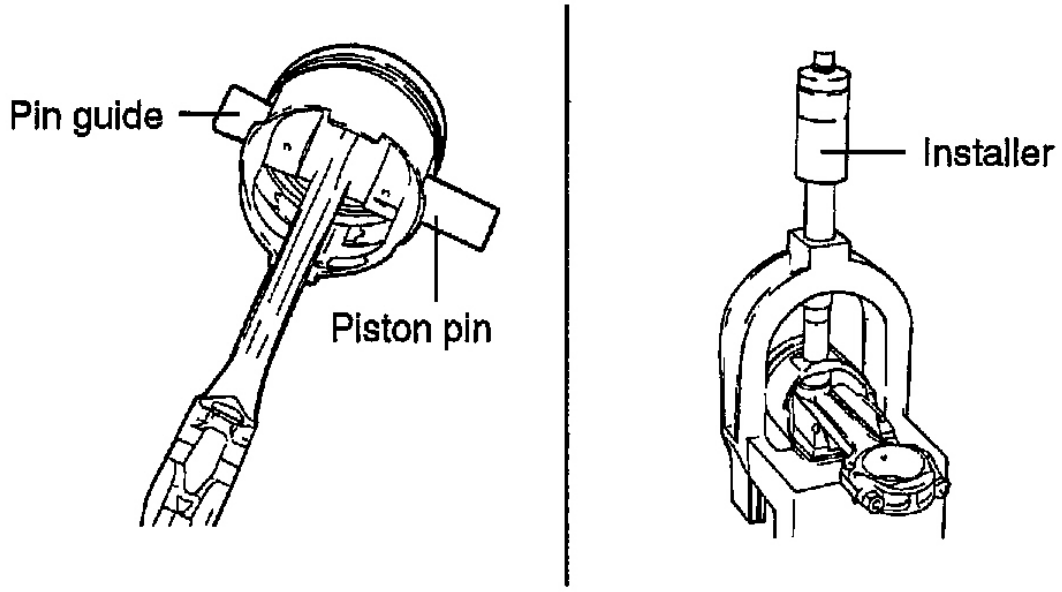

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Fig. 66: Installing Piston Pin
Courtesy of HYUNDAI MOTOR CO.

2. Install piston assembly onto fork assembly of tool. Tool will support connecting rod at the piston pin. Be sure to slide the piston assembly onto the fork until the pin guide contacts the fork insert.
3. Adjust the installing arbor to the proper length by turning the numbered sleeve on the lettered shaft until the specified alpha-numeric setting from the application chart is obtained. Turn knurled nut to lock numbered sleeve on shaft.
4. Insert the installing arbor through the hole in the arch of the tool. Press piston pin into the connecting rod until the sleeve on the installing arbor contacts the top of the tool arch. The pin guide will fall out of the connecting rod as the piston pin is pressed in.

CAUTION: Do not exceed 5000 pounds of force when stopping the installing arbor sleeve against the arch.

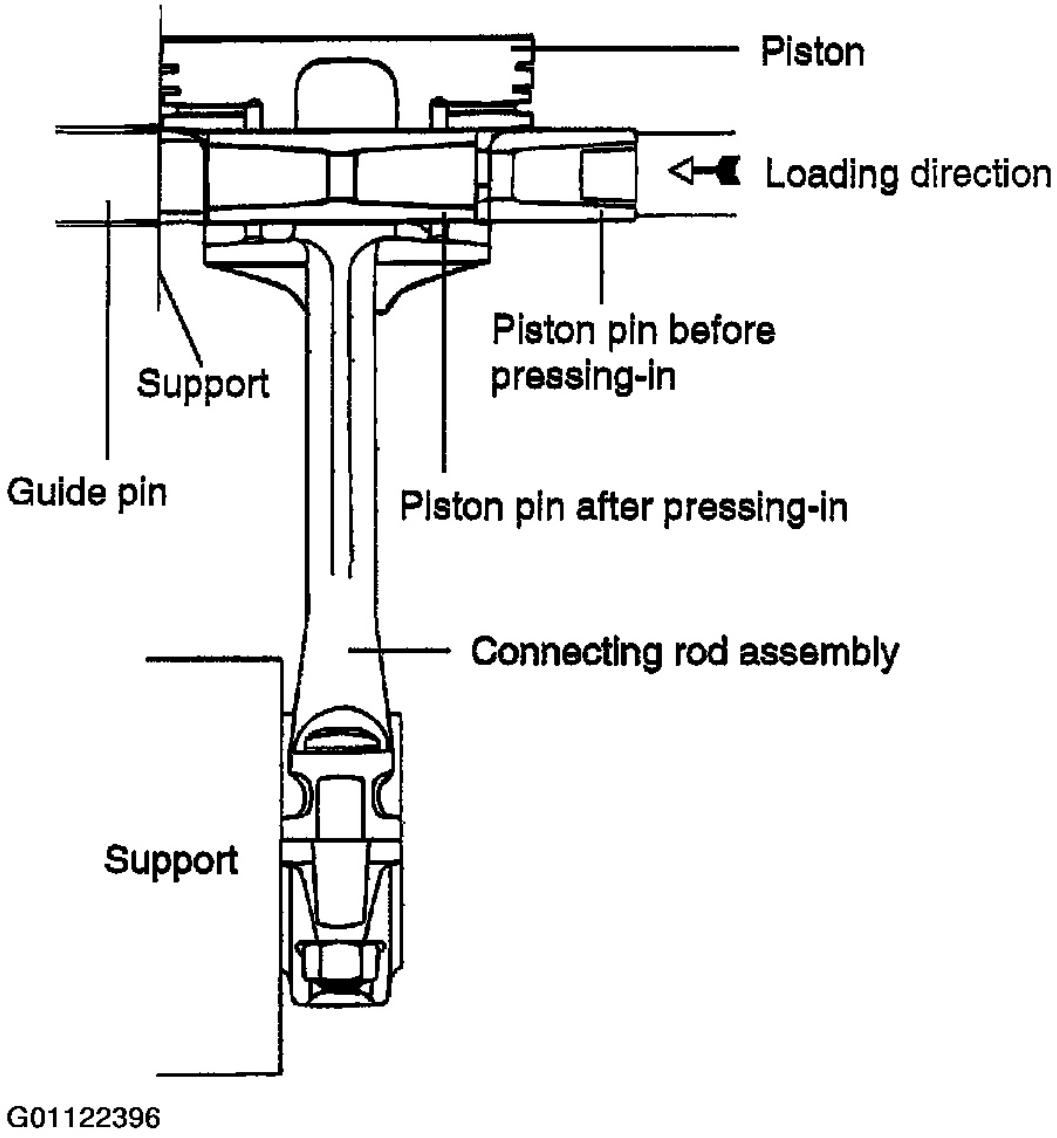


Fig. 67: Identifying Piston Pin Installation
Courtesy of HYUNDAI MOTOR CO.

Standard value

Bowl depth: 0.3-0.5mm (0.012-0.02 in.)

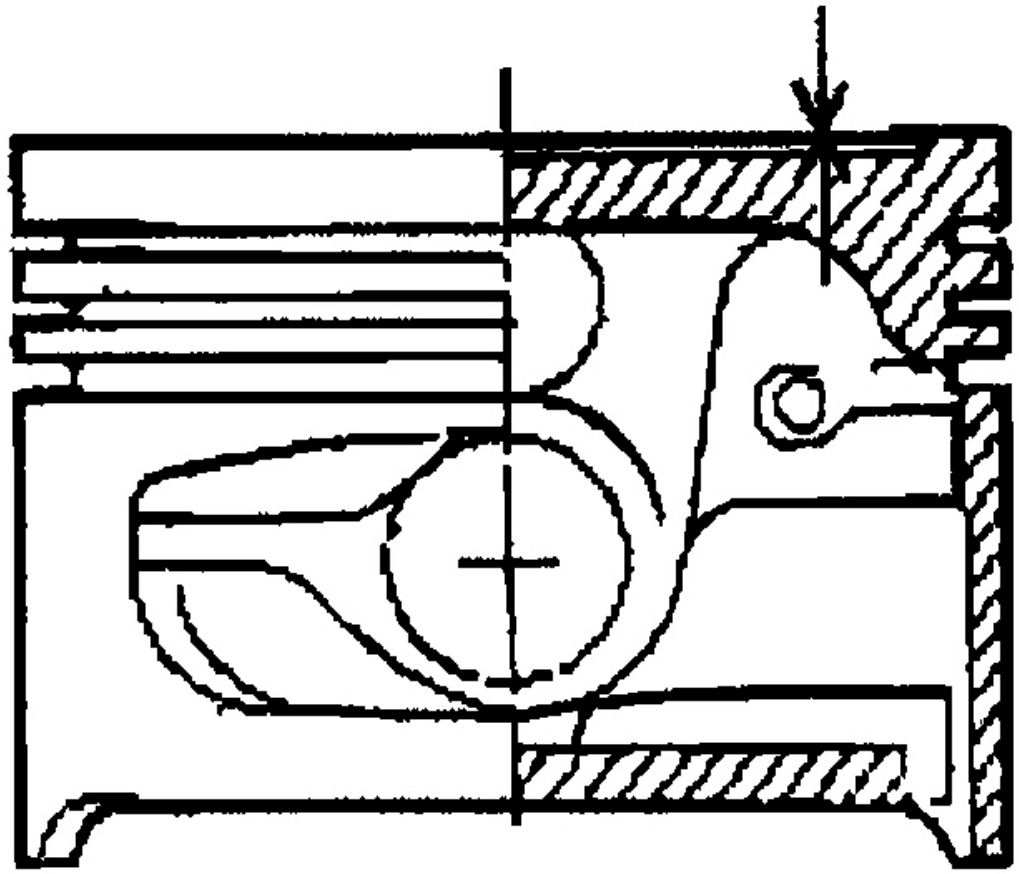


Fig. 68: Identifying Bowl Depth
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

PISTON 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, also replace the rings
3. Check the piston pin fit in the piston pin hole. Replace any defective piston and pin assembly that is defective. The piston pin must be smoothly pressed by hand into the pin hole (at room temperature).

PISTON RINGS

1. Measure the piston ring side clearance. if the measured value exceeds the service limit, insert a new ring in a 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.

   PISTON RING SIDE CLEARANCE

   Standard value

   No. 1: 0.04-0.085mm (0.0016-0.0031 in.)

   No.2: 0.04-0.085mm (0.0016-0.0031 in.)

   Limit

   No.1: 0.1mm (0.004 in.)

   No.2: 0.1mm (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.

Item	Standard - mm (in.)	Limit - mm (in.)
Piston ring end gap No. 1	0.15-0.30 (0.0059-0.0118)	1 (0.039)
Piston ring end gap No. 2	0.25-0.40 (0.008-0.014)	1 (0.039)
Oil ring side rail end gap	0.20-0.70 (0.078-0.0275)	1 (0.039)

G01122398

Fig. 69: Piston Ring End Gap Specification Table
Courtesy of HYUNDAI MOTOR CO.

When replacing the ring without correcting the cylinder bore, check the gap with the ring positioned at the bottom of the ring travel.

When replacing a ring, use a ring of the same size.

PISTON RING SERVICE SIZE AND MARK

STD: None

0.25mm (0.010 in.) O.S: 25

0.50mm (0.020 in.) O.S: 50

0.75mm (0.030 in.) O.S: 75

1.00mm (0.039 in.) O.S: 100

NOTE: The mark can be found on the upper side of the ring.

REASSEMBLY

1. Install the spacer.

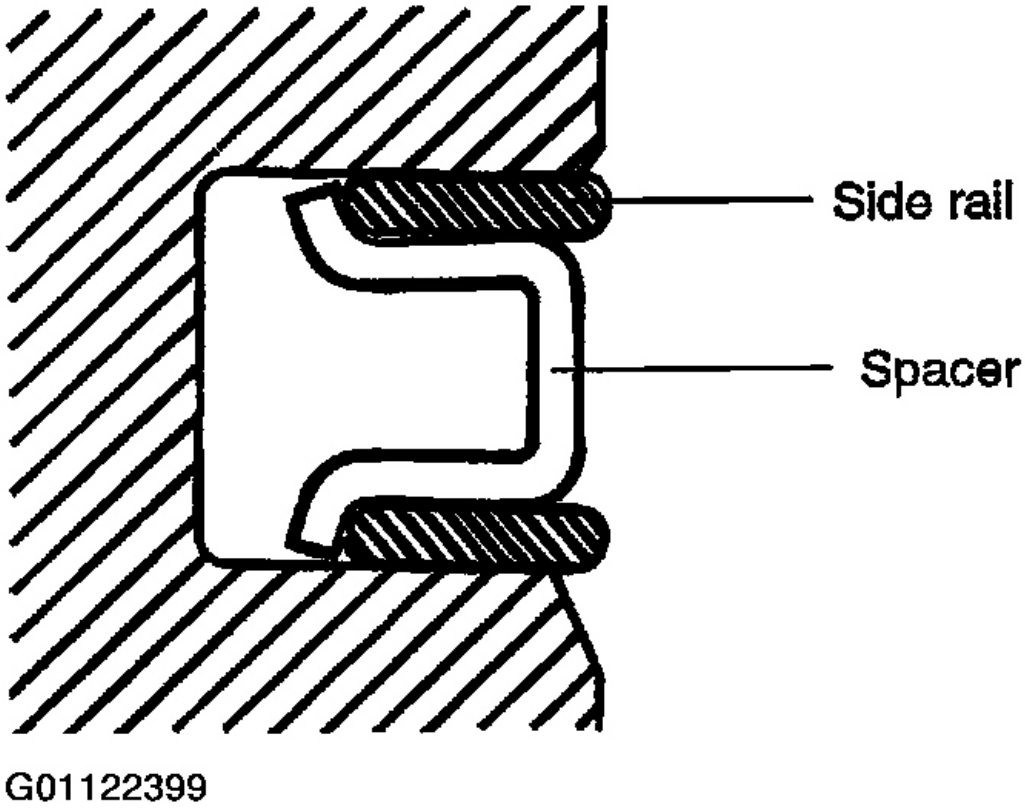


Fig. 70: Installing Spacer
Courtesy of HYUNDAI MOTOR CO.

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

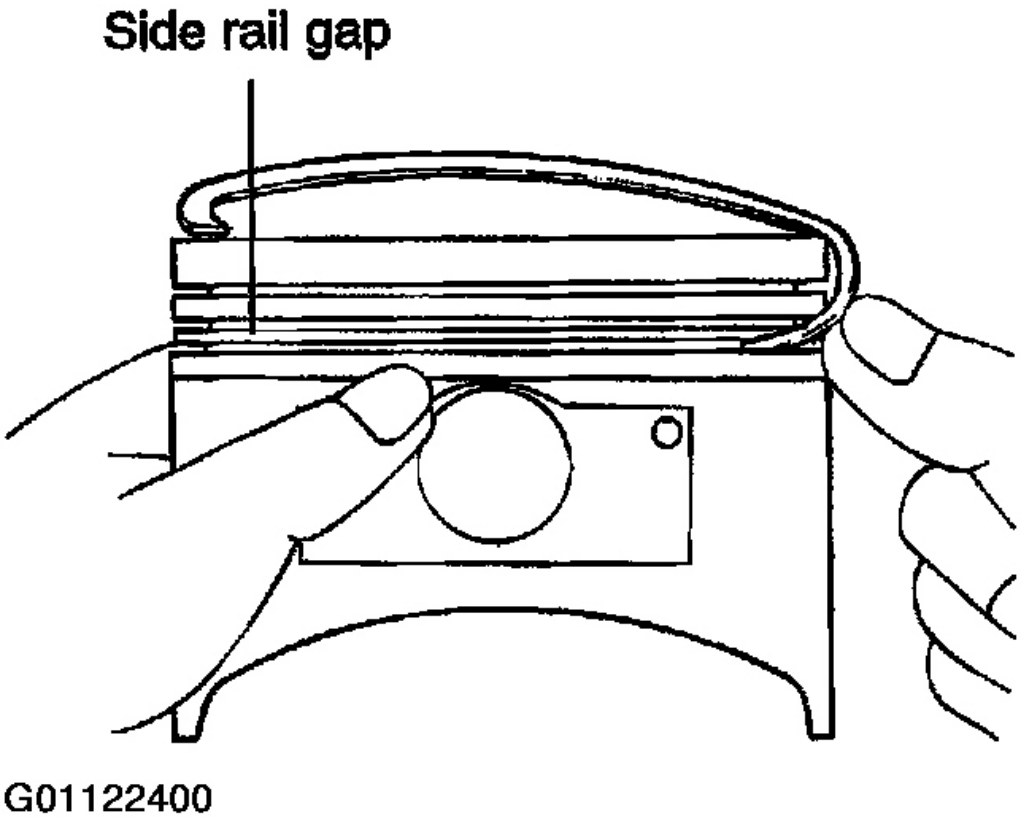


Fig. 71: Identifying Side Rail Gap
Courtesy of HYUNDAI MOTOR CO.

NOTE: Do not use piston ring expander when installing side rail.

3. Install lower side rail using same procedure as Step 2.
4. Using piston ring expander, install No.2 piston ring.
5. Install No. 1 piston ring.

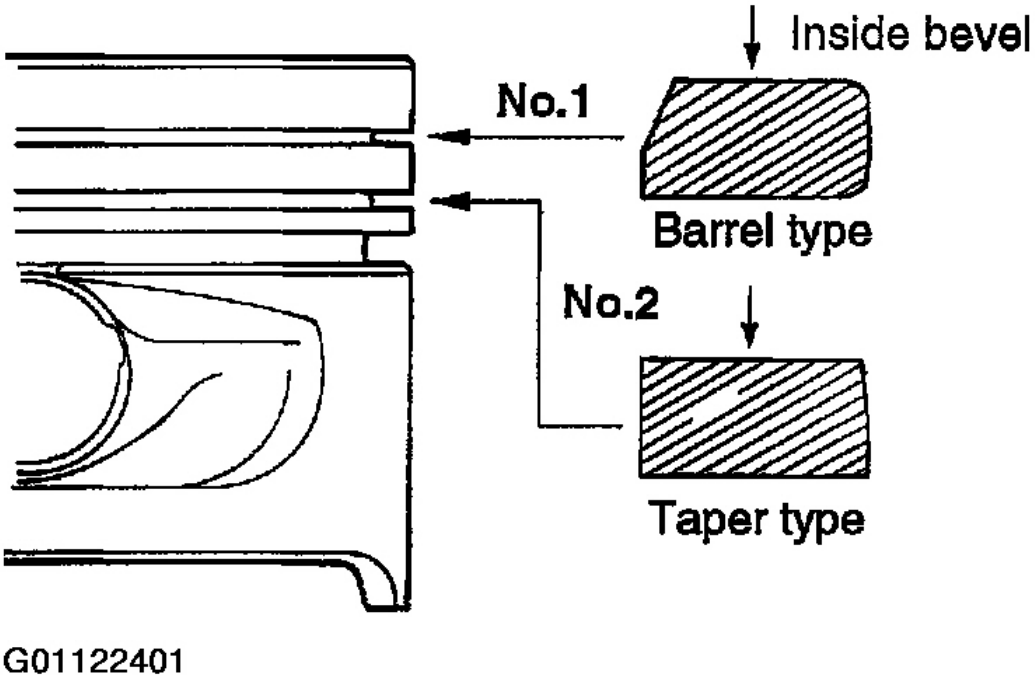


Fig. 72: Installing Piston Ring No.1 & No. 2
Courtesy of HYUNDAI MOTOR CO.

6. Apply engine oil around piston and piston rings.
7. Position each piston ring end gap as far apart from neighboring gaps as possible. Make sure that gaps are not positioned in side rail thrust and pin directions.
8. Hold piston rings firmly in a piston ring compressor as you insert them into cylinder.

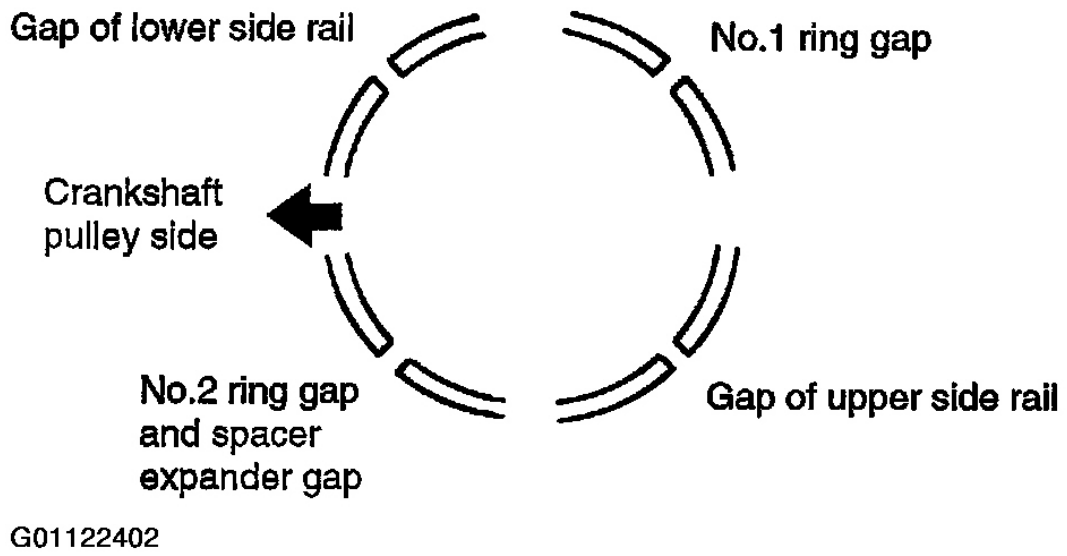


Fig. 73: Positioning Piston Ring End Gaps
Courtesy of HYUNDAI MOTOR CO.

9. Make sure that the front mark of piston and the front mark (identification mark) of connecting rod are directed toward front of engine.
10. When connecting rod cap is installed, make sure that cylinder numbers put on rod and cap at disassembly match each other.
11. When new connecting rod is installed, make sure that notches for holding bearing in place are on same side.
12. Tighten the connecting rod cap nuts.

Tightening torque

Connecting rod cap nuts: 32-35Nm (320-350kg.cm, 24-26lb.ft)

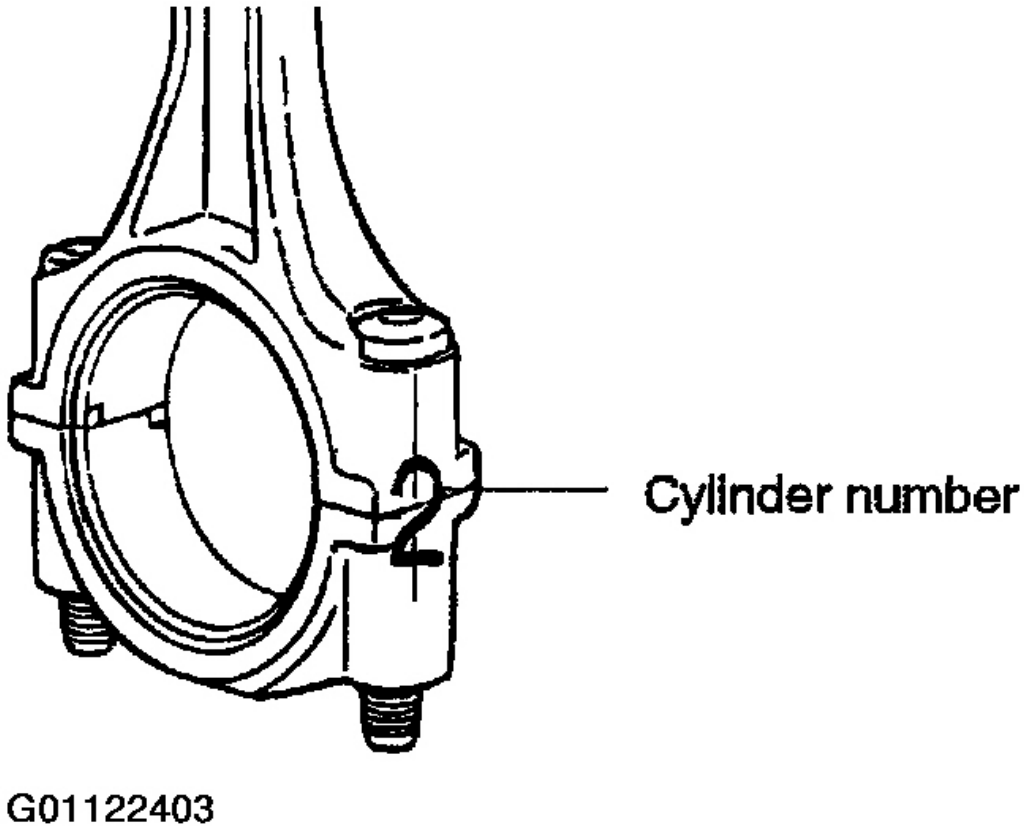


Fig. 74: Identifying Cylinder Number Mark On Connecting Rod
Courtesy of HYUNDAI MOTOR CO.

13. Check connecting rod side clearance.

    Connecting rod side clearance

    Standard value: 0.10-0.25mm (0.004-0.0098 in.)

    Limit: 0.4mm (0.0157 in.)

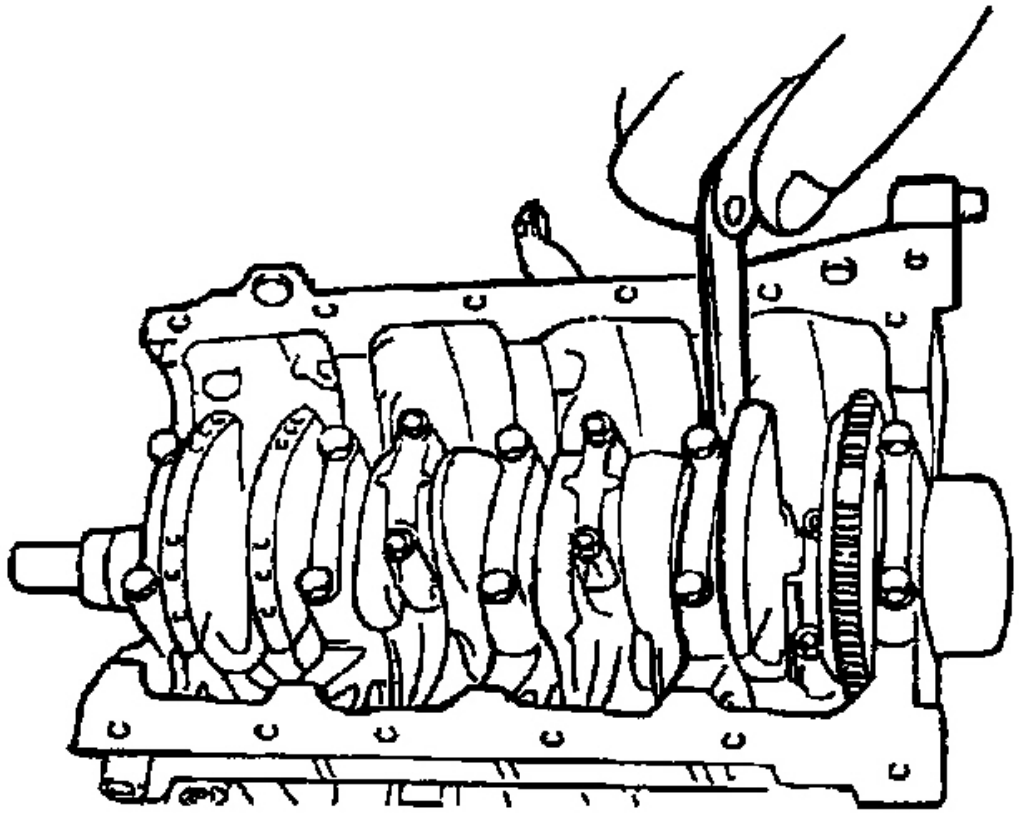
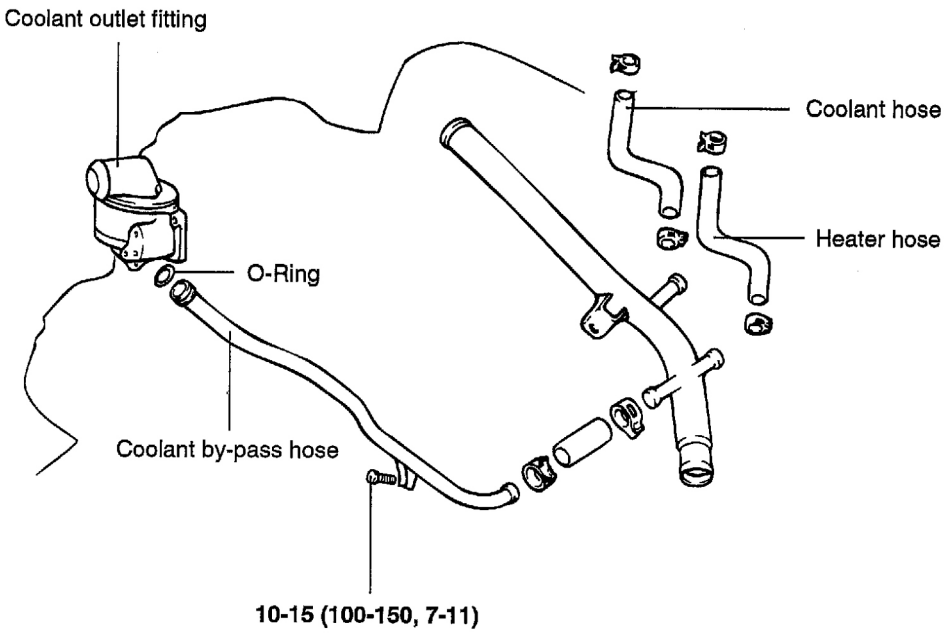


Fig. 75: Checking Connecting Rod Side Clearance
Courtesy of HYUNDAI MOTOR CO.

COOLING SYSTEM

ENGINE COOLANT HOSE/PIPES

COMPONENTS



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

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Fig. 76: Engine Coolant Hose/Pipes
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

1. Check the coolant pipes and hoses for cracks, damage, or restrictions.
2. Replace if necessary.

REASSEMBLY

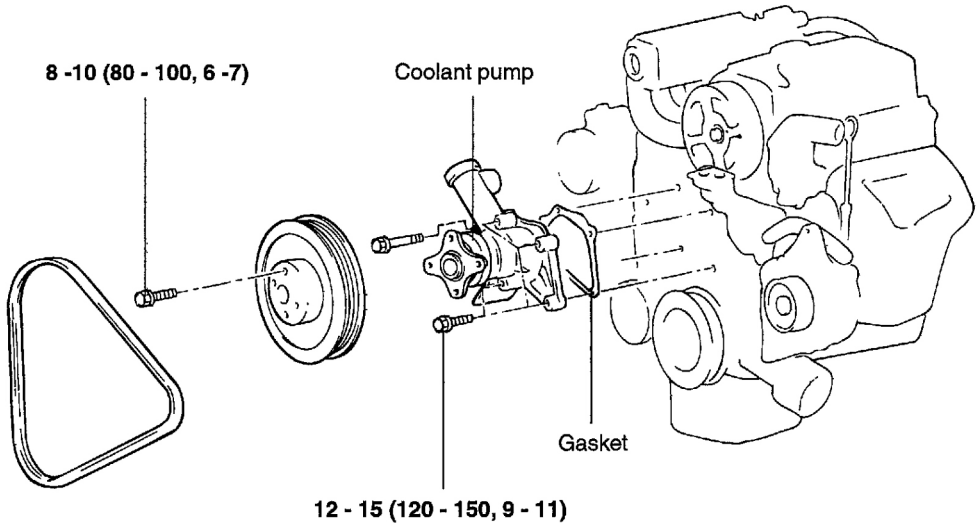
1. Fit the O-ring in the groove provided at the coolant inlet pipe ends, wet the O-ring with coolant and insert into the coolant inlet pipe.
2. Make sure that there is a yellow mark on the inlet coolant hose and while keeping the yellow mark toward of the coolant inlet pipe, fit the hose to the pipe to the end of the yellow mark.

NOTE:

1. **Do not apply oil or grease to the coolant pipe O-ring.**
2. **Keep the coolant pipe connections free of sand, dust, etc.**
3. **Insert the coolant pipe fully into the coolant pump.**
4. **Do not reuse the o-ring but replace it with a new one.**

ENGINE COOLANT PUMP

COMPONENTS



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

G01122406

Fig. 77: Engine Coolant Pump Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Drain the coolant and disconnect the coolant outlet 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 generator 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 from hole "A", the seal is defective. Replace the coolant pump assembly.

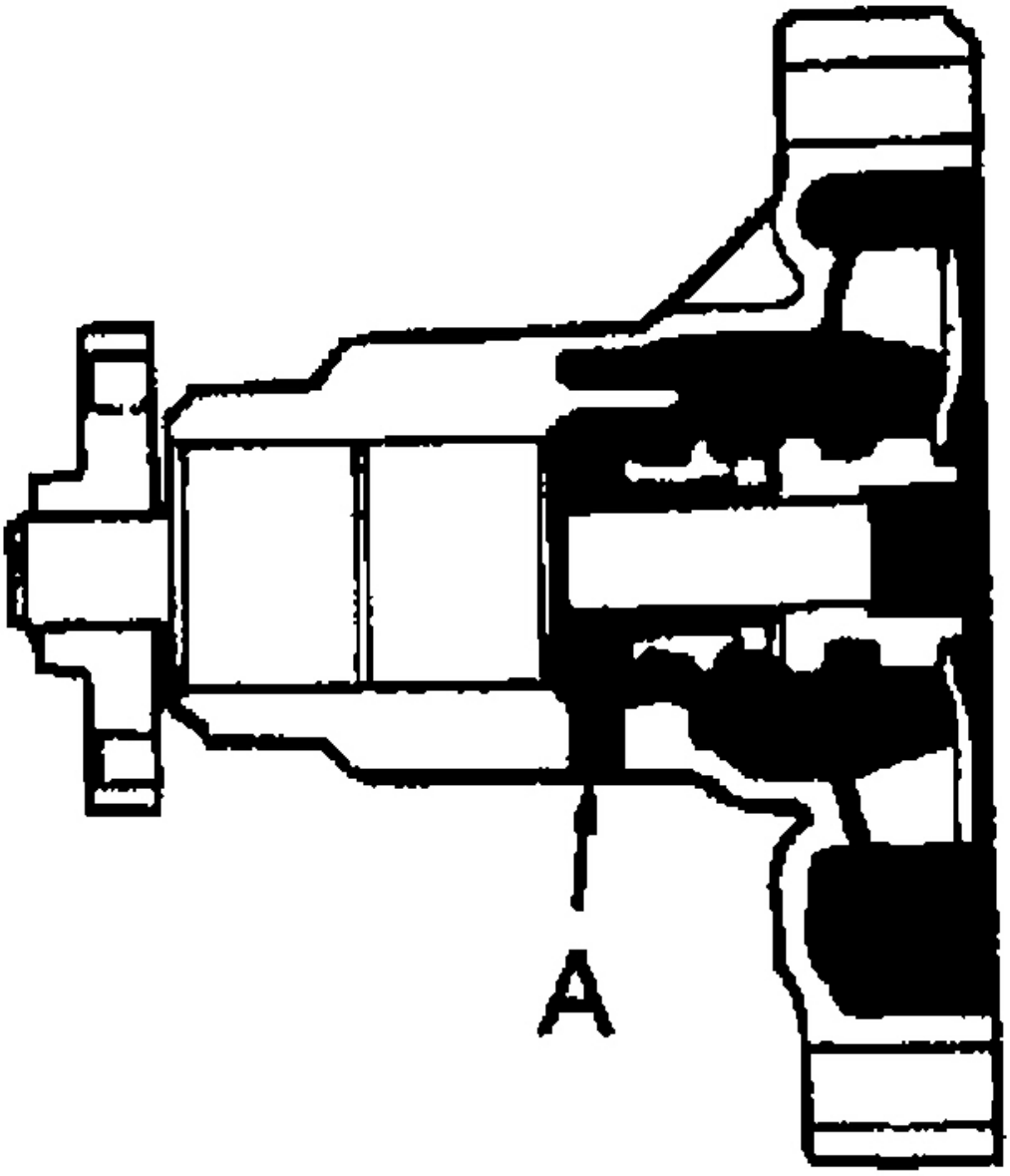


Fig. 78: Inspecting Coolant Leakage From Seal
Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

1. Clean the gasket surfaces of the coolant pump body and the cylinder block.

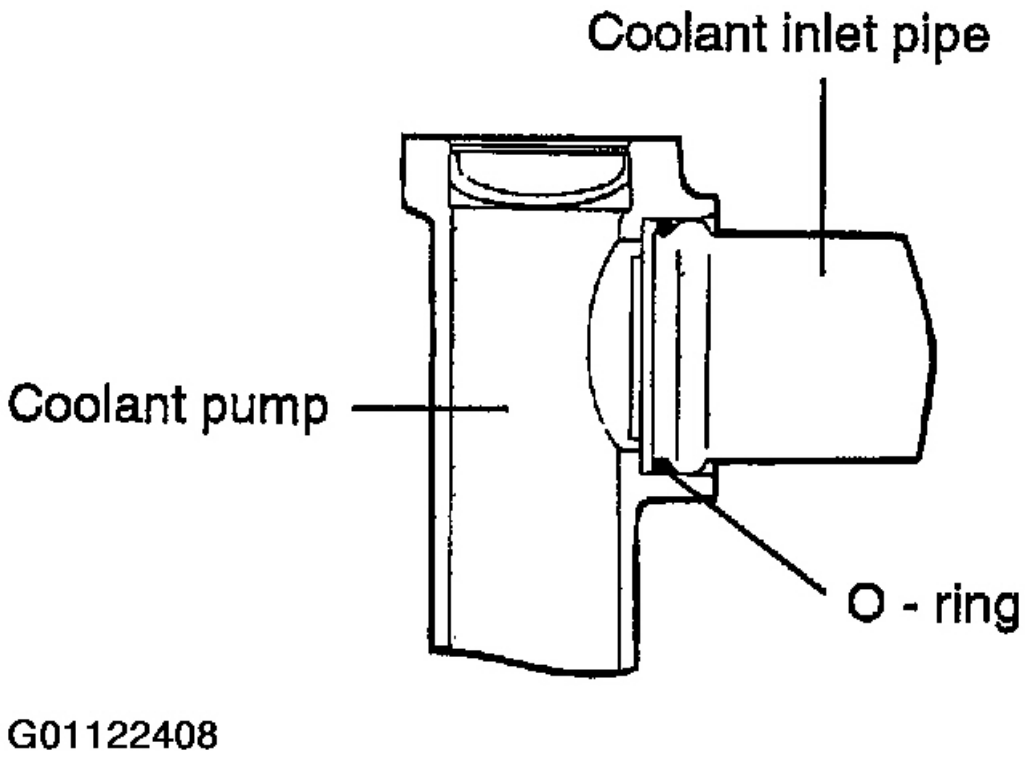


Fig. 79: Locating Coolant Pump O-Ring
Courtesy of HYUNDAI MOTOR CO.

2. Install a new coolant pump gasket to the coolant pump and tighten the bolts to the specified torque.

   Tightening torque

   Coolant pump bolt to cylinder block:

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

3. Install the timing belt idler and timing belt. Adjust the timing belt tension. Refer to **TIMING SYSTEM**.
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.

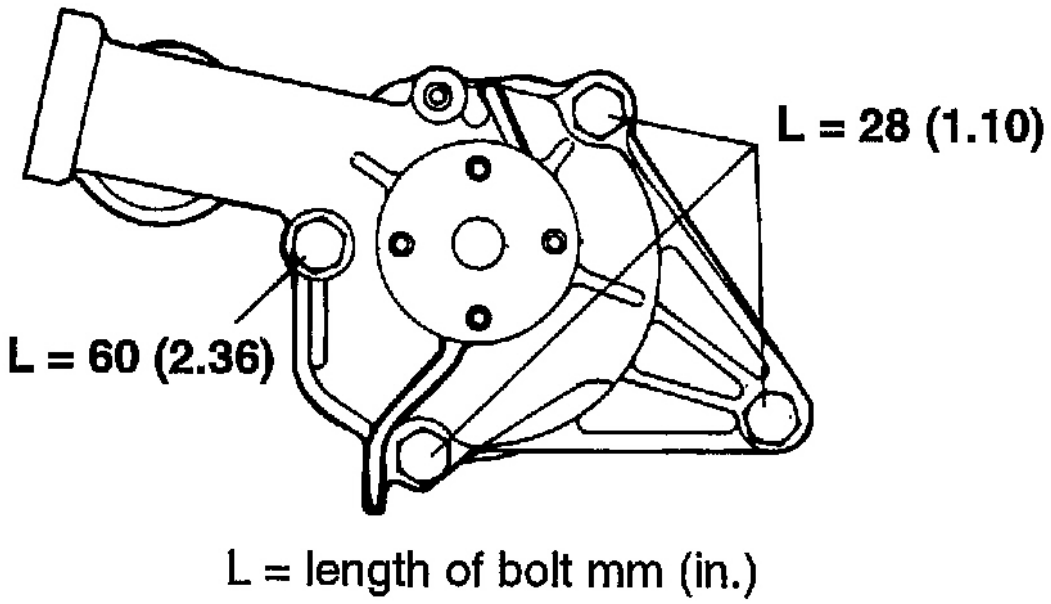


Fig. 80: Locating Coolant Pump Bolts
Courtesy of HYUNDAI MOTOR CO.

RADIATOR

COMPONENTS

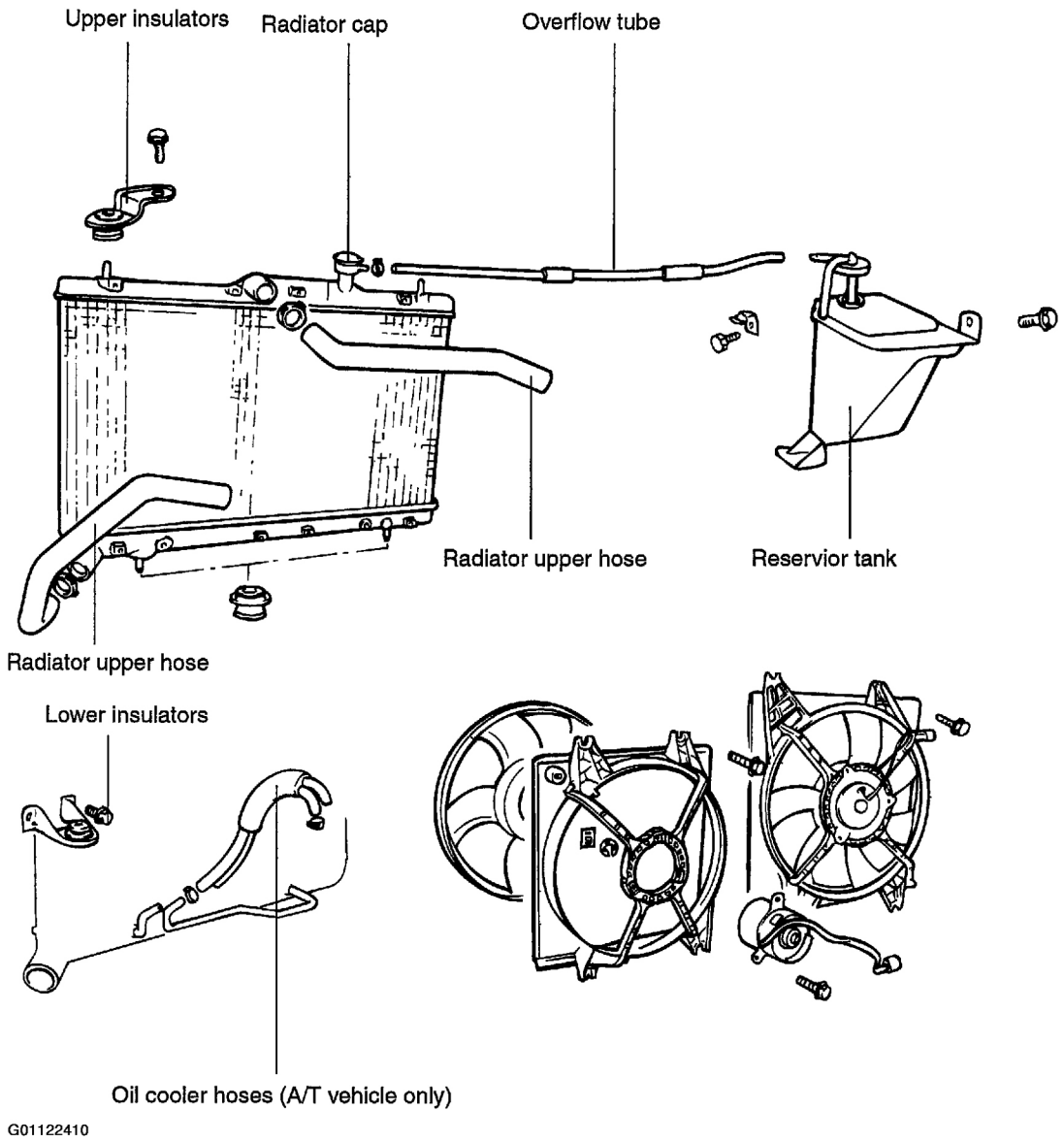


Fig. 81: Radiator Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Disconnect the radiator fan motor connector.
2. Set the temperature of the heater control 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 transaxles, disconnect the oil cooler hoses from the automatic transaxle.

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

6. Remove the radiator mounting bolts.
7. Remove the radiator together with the fan motor.
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 cracks, 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 cooling system checker
7. Check the radiator cap seal for cracks or damage.

RADIATOR FAN MOTOR

1. Check that the radiator fan rotates when battery voltage is applied to the terminals (as shown in figure).

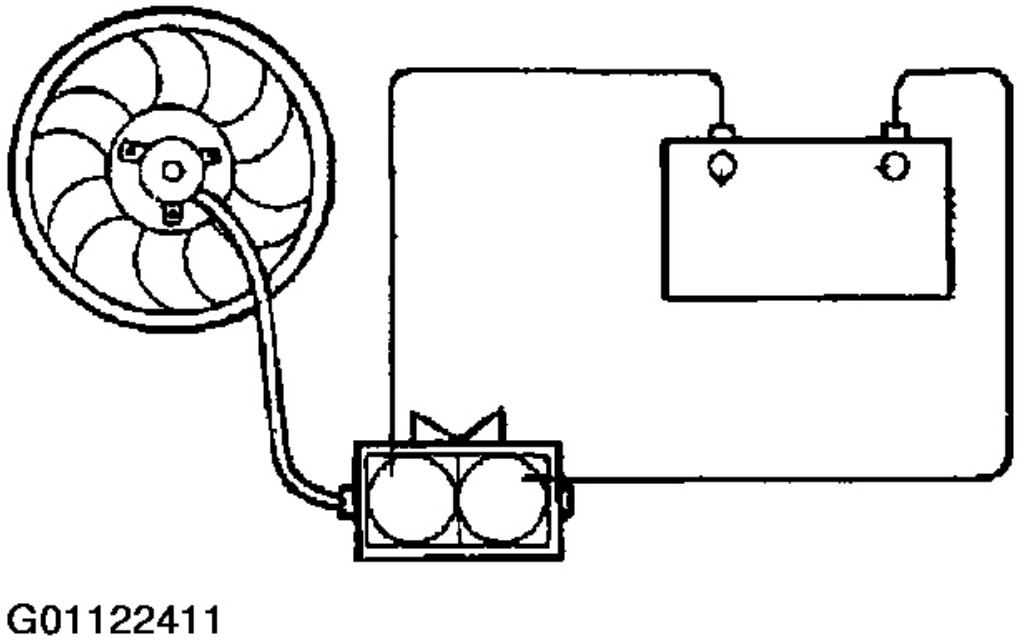


Fig. 82: Checking Radiator Fan Operation
Courtesy of HYUNDAI MOTOR CO.

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.
4. Check that there is no leakage from the radiator, hoses or connections.

RADIATOR CAP

COMPONENTS

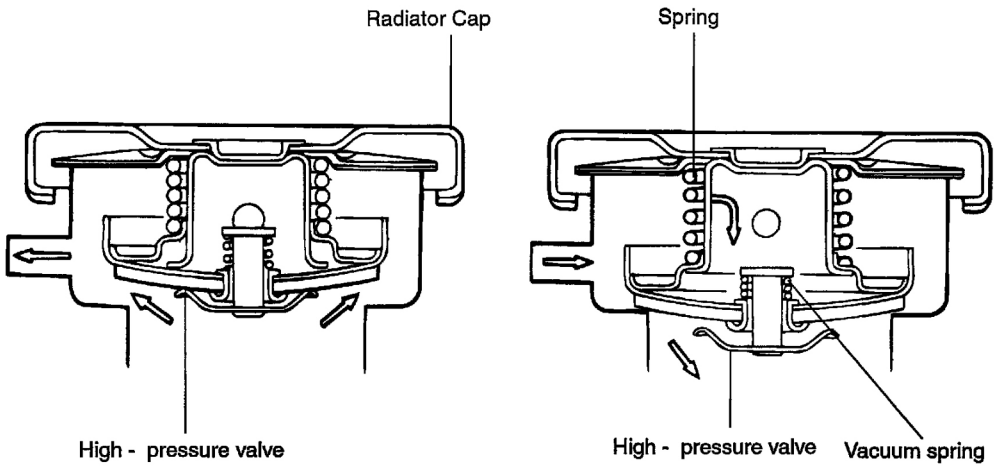


Fig. 83: Radiator Cap Components
Courtesy of HYUNDAI MOTOR CO.

RADIATOR CAP PRESSURE TEST

1. Use an adapter to attach the cap to the tester.

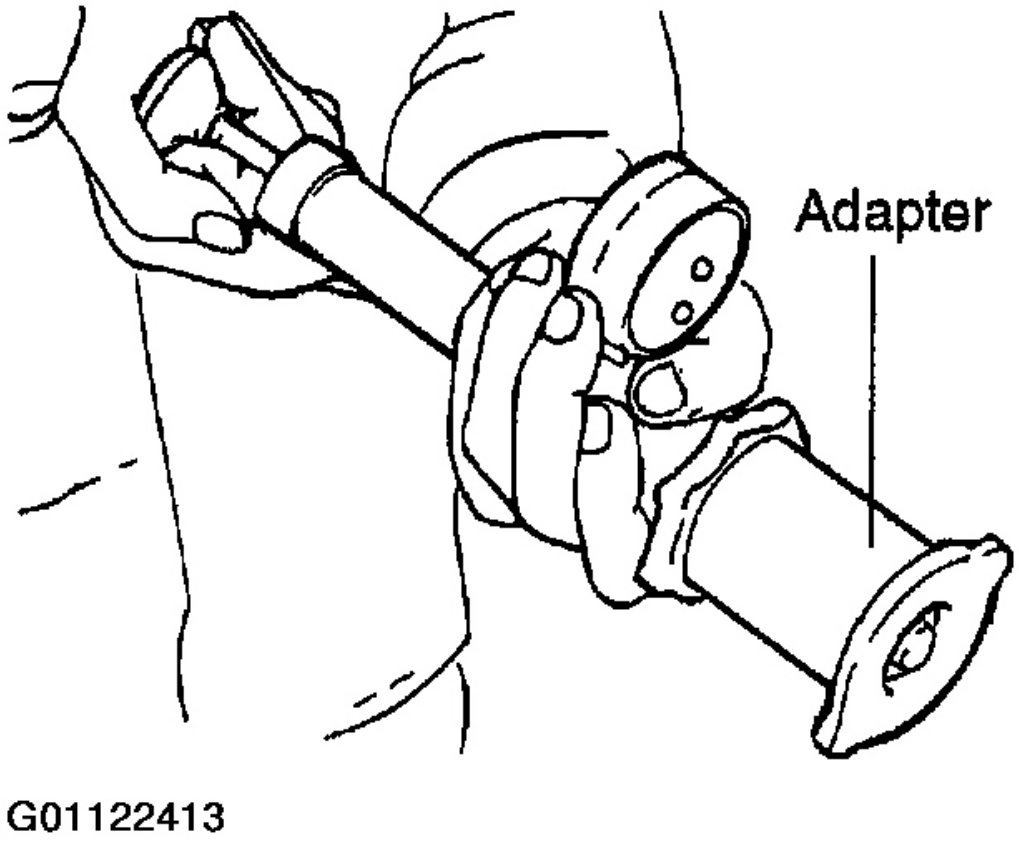


Fig. 84: Testing Radiator Cap
Courtesy of HYUNDAI MOTOR CO.

2. Increase the pressure until the gauge stops moving.

   Main valve opening pressure:

   81.4-108kPa (0.83-1.1 kg/cm^2 , 11.8-15.6psi)

   Limit: 65kPa (0.65kg/cm^2 , 9.2psi)

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

INSPECTION

RADIATOR CAP

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

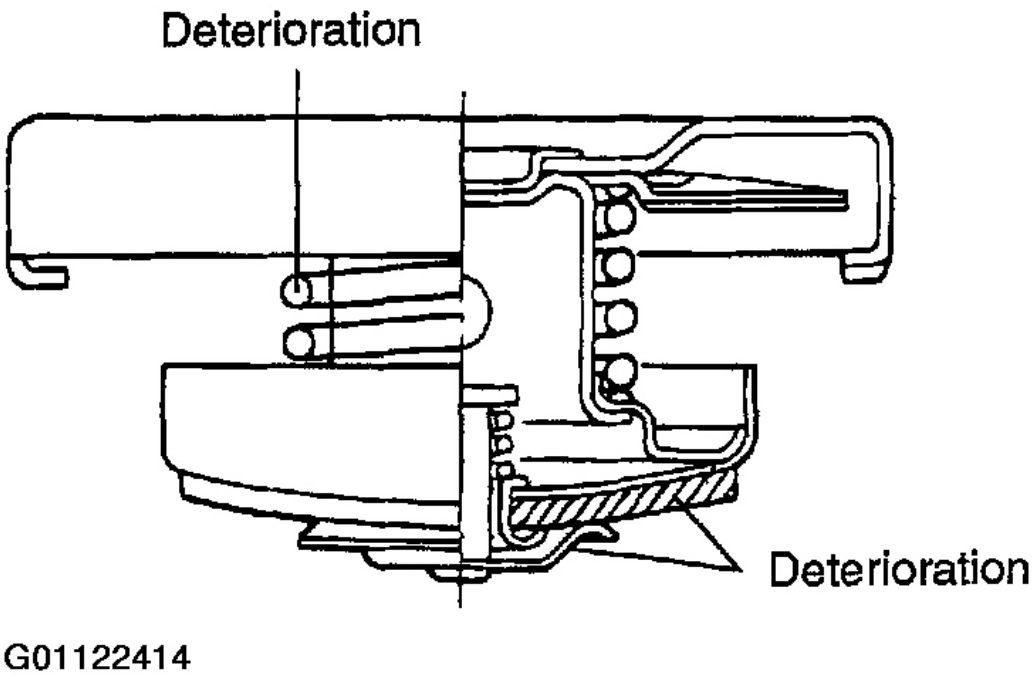


Fig. 85: Checking Radiator Cap Deterioration
Courtesy of HYUNDAI MOTOR CO.

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.

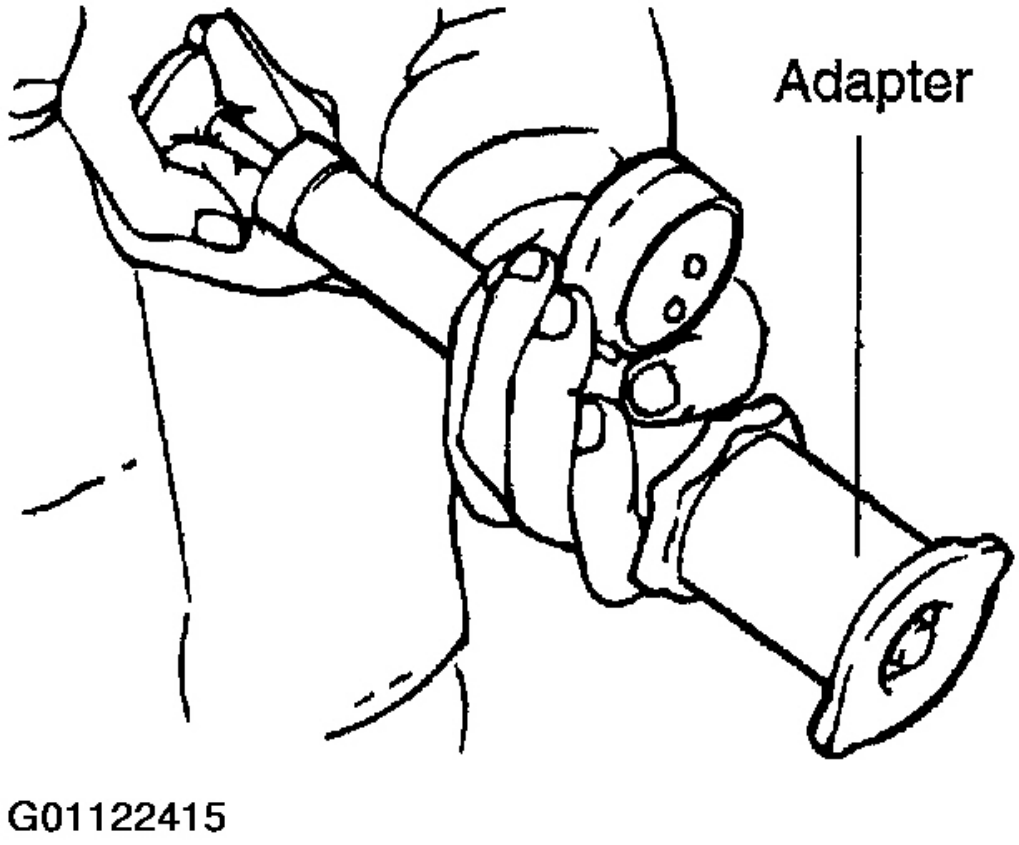
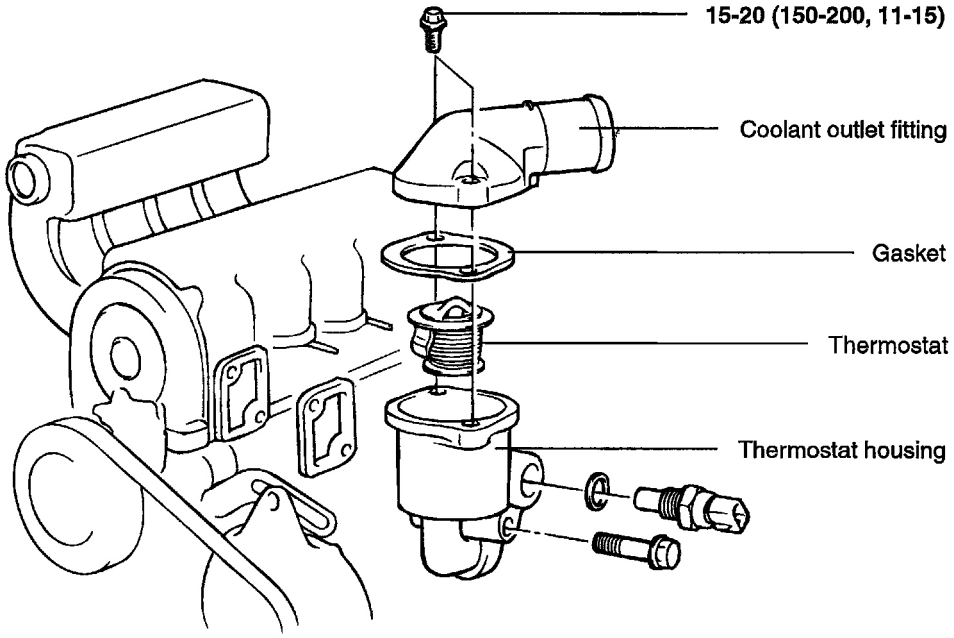


Fig. 86: Testing Radiator Cap
Courtesy of HYUNDAI MOTOR CO.

THERMOSTAT

COMPONENTS



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

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Fig. 87: Thermostat Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY AND INSPECTION

1. Drain the coolant down to thermostat level or below.
2. Remove the coolant outlet fitting and gasket.
3. Remove the thermostat.
4. Immerse the 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)

   Valve lift (at full open): 8mm (0.32 in.) or more

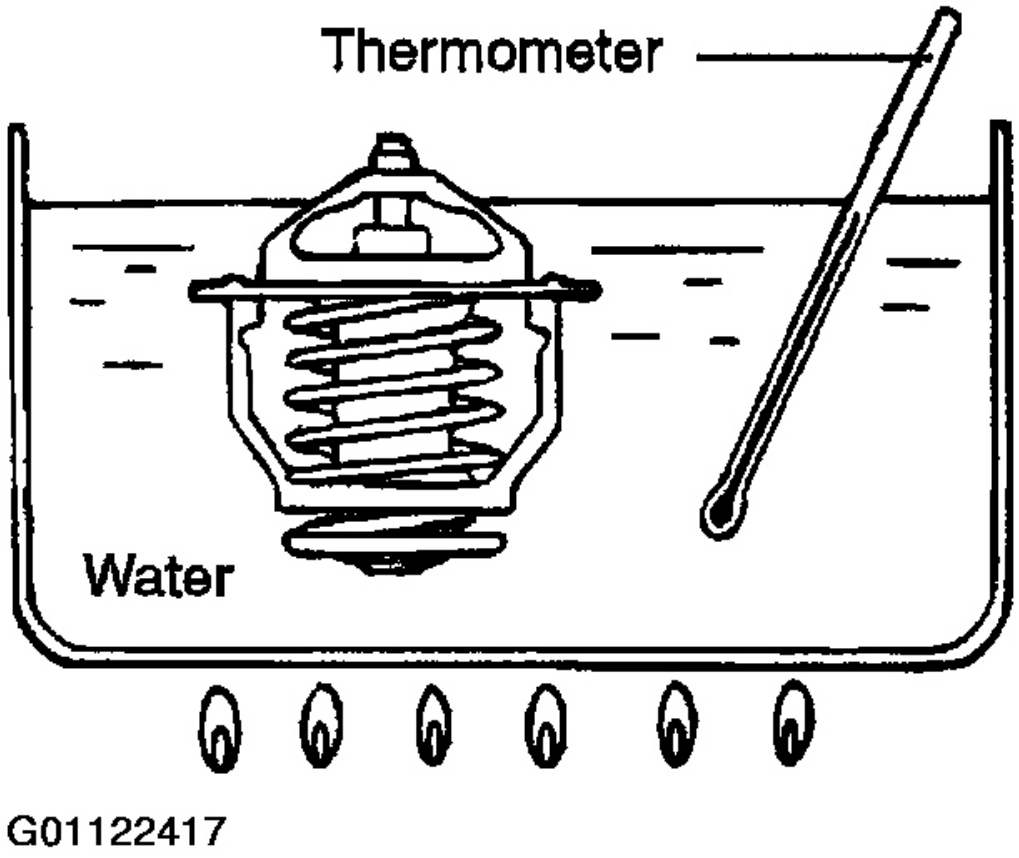


Fig. 88: Inspecting Thermostat Valve Opening Temperature
Courtesy of HYUNDAI MOTOR CO.

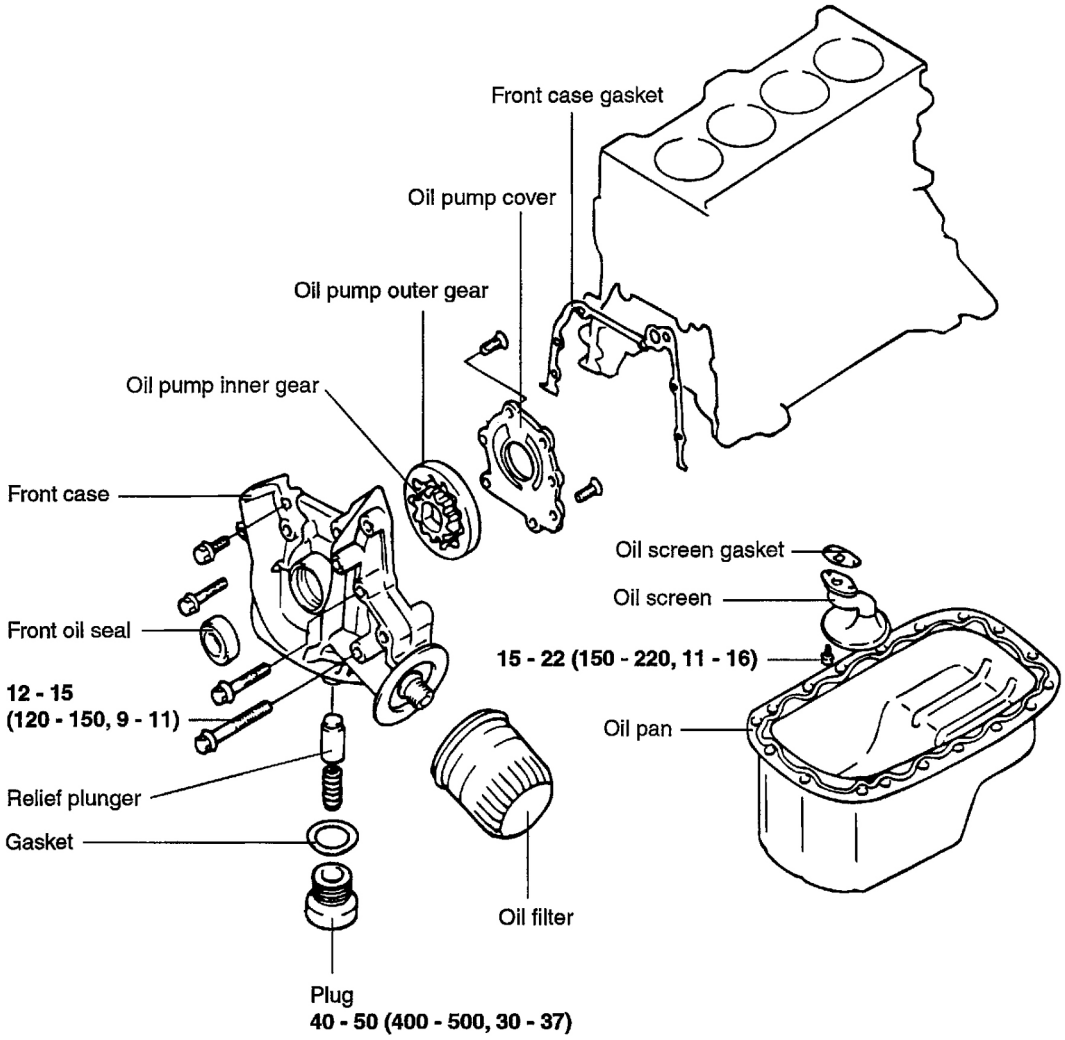
REASSEMBLY

1. Check that the flange of the thermostat is correctly seated in the socket of the thermostat housing. If the thermostat is installed in the wrong direction, the bottom of the thermostat will touch the rib inside the intake manifold, making it impossible for the thermostat to operate properly.
2. Install a new gasket and the coolant outlet fitting.
3. Refill the system with clean coolant.

LUBRICATION SYSTEM

OIL PUMP

COMPONENTS



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

G01122418

Fig. 89: Oil Pump Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Remove the timing belt. Refer to **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.

6. Remove the oil pump cover.
7. Remove the inner and outer gears from the front case. The mating marks on the inner and outer gears indicate the direction of installation. Make sure that the inner and outer gears are installed as shown.

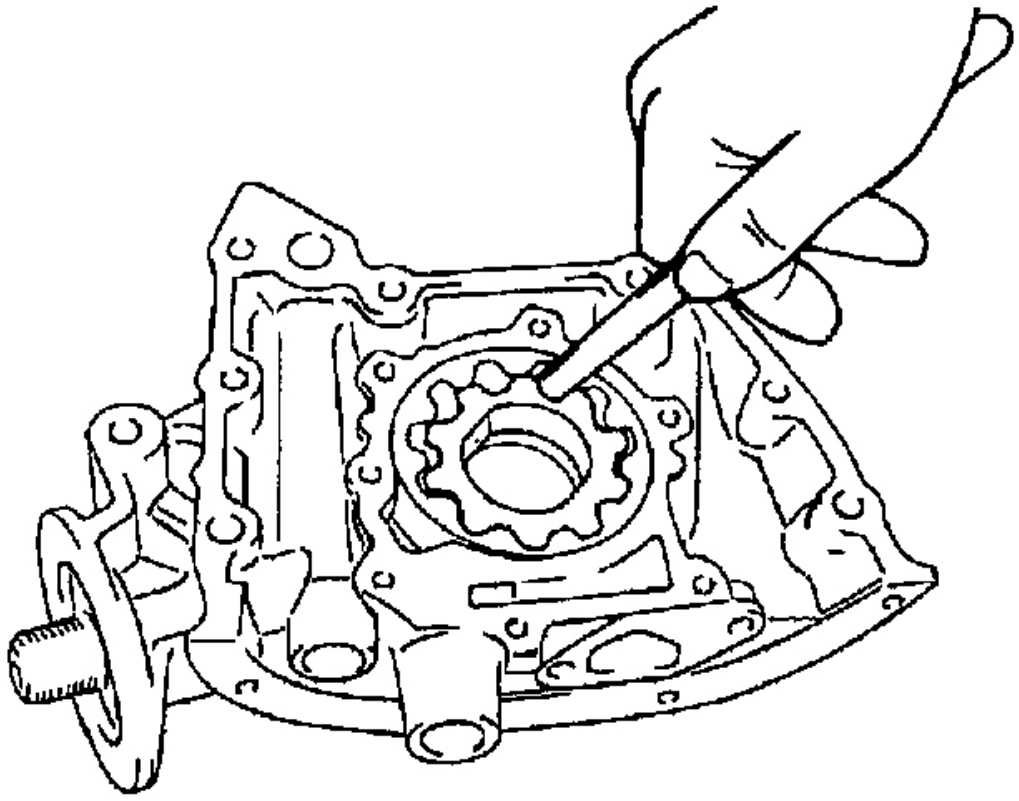


Fig. 90: Removing Inner & Outer Gears From Front Case
Courtesy of HYUNDAI MOTOR CO.

8. Remove the plug and remove the relief spring and relief plunger.

INSPECTION

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 for worn (especially stepped) or damaged surfaces contacting gears.

OIL PUMP GEARS

1. Check for worn or damaged gear teeth surfaces.
2. Check for clearance between outer gear and front case.

   Outer gear

   Clearance between outer circumference and front case:

   0.12 - 0.18 mm (0.005 - 0.007 in.)

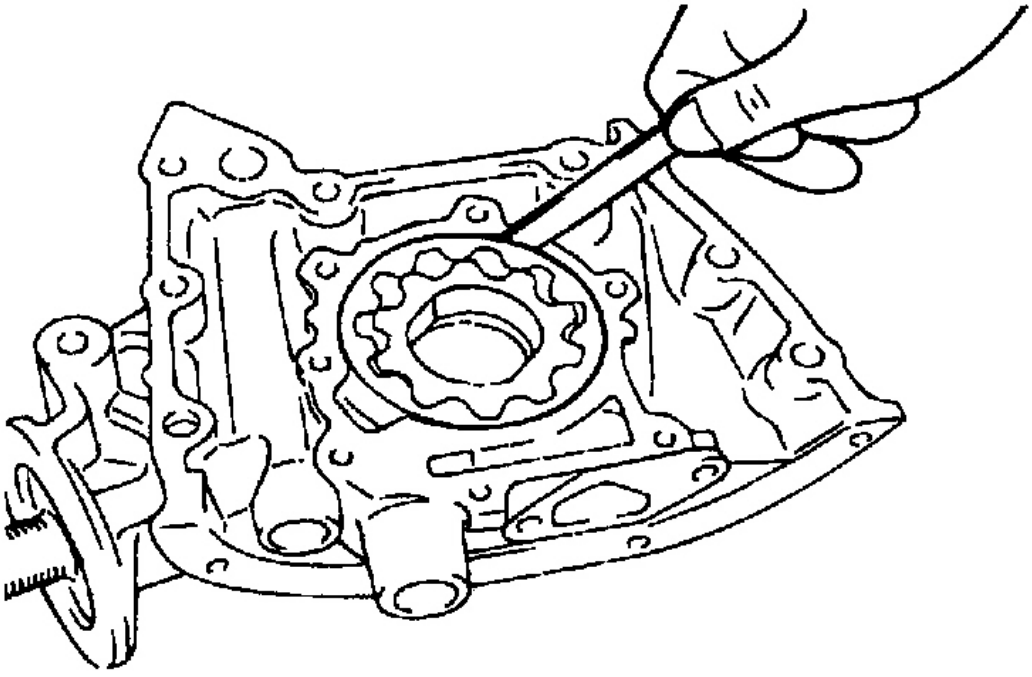
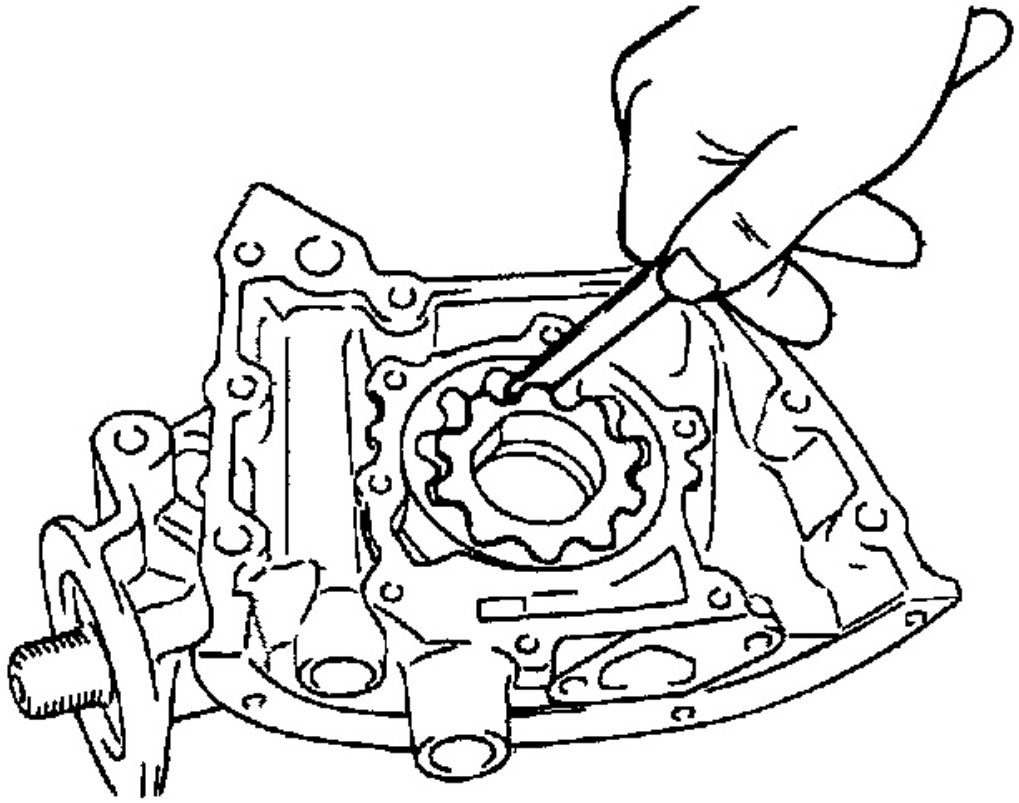


Fig. 91: Checking Clearance Between Outer Gear & Front Case
Courtesy of HYUNDAI MOTOR CO.

3. Check the tip clearance on the pump rotor.

   Standard value: 0.025-0.069 mm (0.001-0.003 in.)



G01122421

Fig. 92: Checking Tip Clearance On Pump Rotor
Courtesy of HYUNDAI MOTOR CO.

4. Check the axial clearance on the outer pump rotor

Standard value: 0.04-0.087mm (0.0016-0.0034 in.)

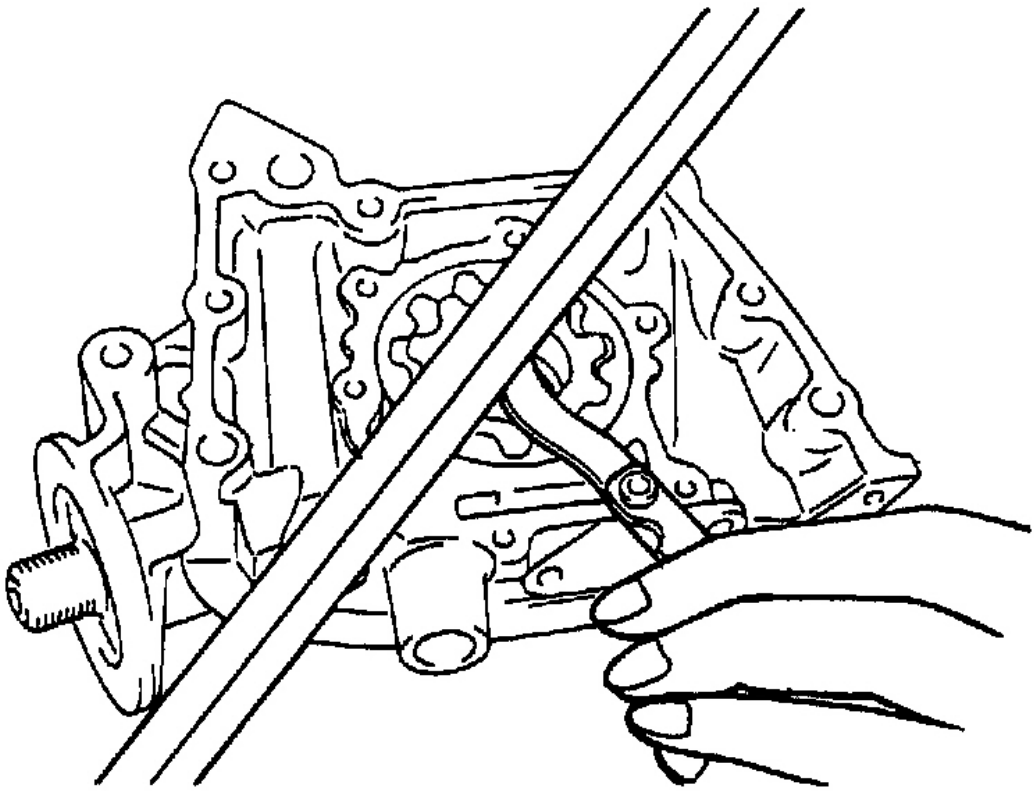


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Fig. 93: Checking Axial Clearance On Outer Pump Rotor
Courtesy of HYUNDAI MOTOR CO.

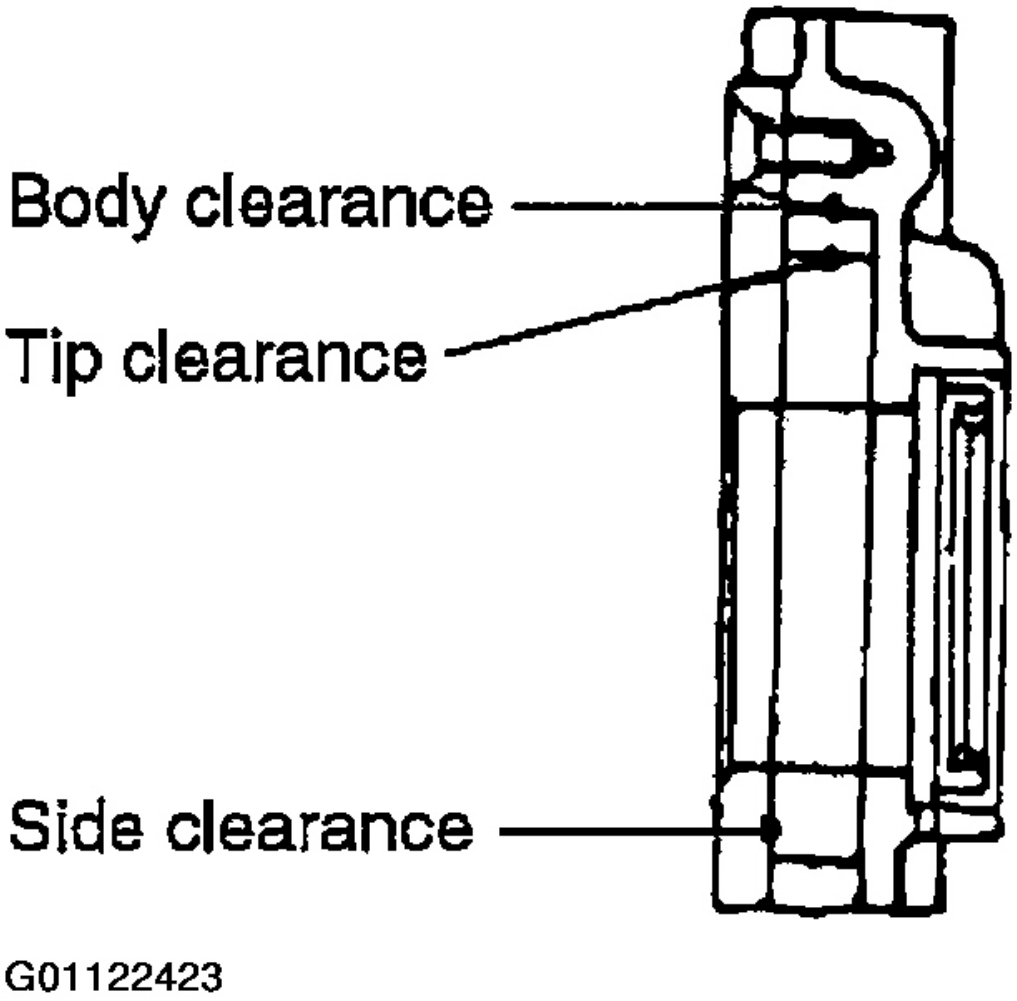


Fig. 94: Locating Body Clearance
Courtesy of HYUNDAI MOTOR CO.

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.

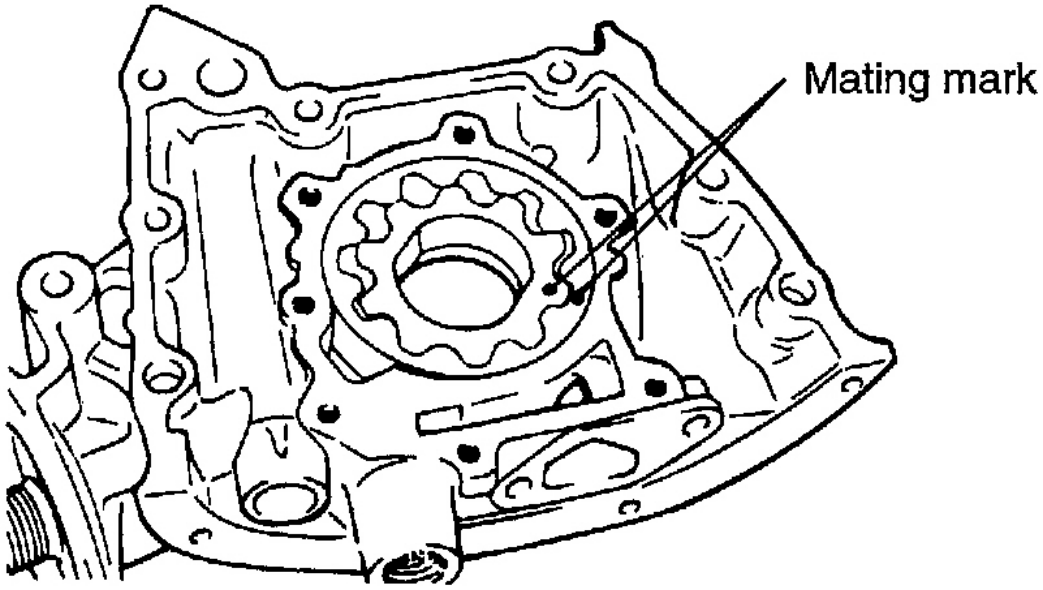


Fig. 95: Locating Inner & Outer Gears Mating Marks
Courtesy of HYUNDAI MOTOR CO.

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:

   8 - 12 Nm (80 - 120 kg.cm, 6 - 8.8lb.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:

   40 - 50 Nm (400 - 500 kg.cm, 30 - 37 lb.ft)

OIL SEAL

1. Inspect for worn, distorted or damaged lips.

2. Check for elongated spring ring.
3. Install the Special Tool, Crankshaft Front Oil Seal Guide (09231-22100), to the front end of the crankshaft. Apply engine oil to the outer surface of the oil seal guide, and install the new oil seal along the guide by hand, until it touches front case. Always use a new oil seal when reassembling.

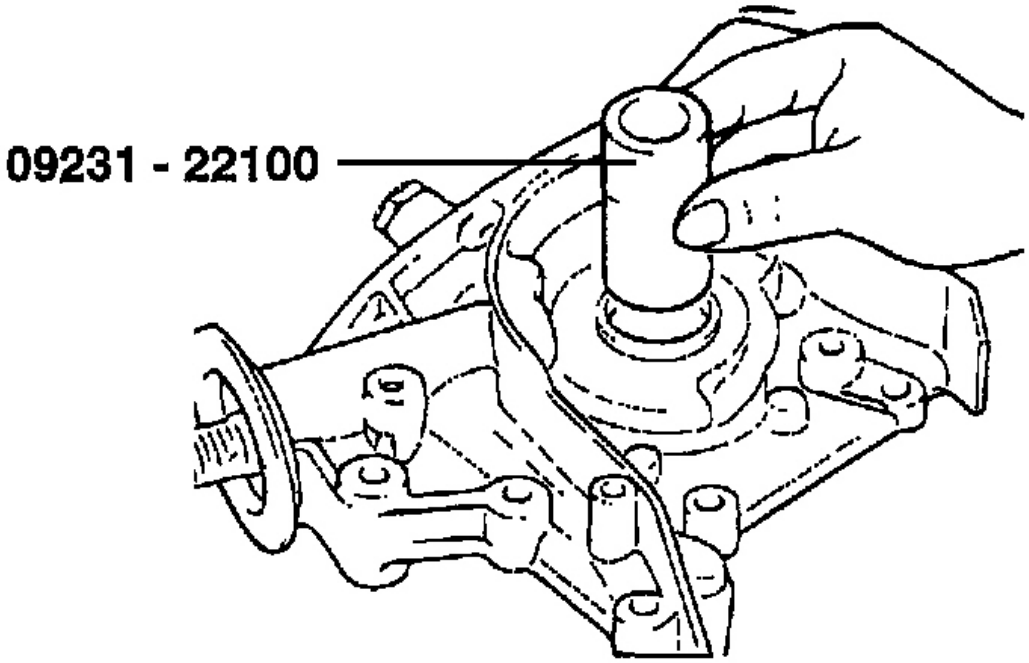


Fig. 96: Fitting Oil Seal
Courtesy of HYUNDAI MOTOR CO.

4. Use the Special Tool, Crankshaft Front Oil Seal Installer (09231-22000), to install the oil seal.

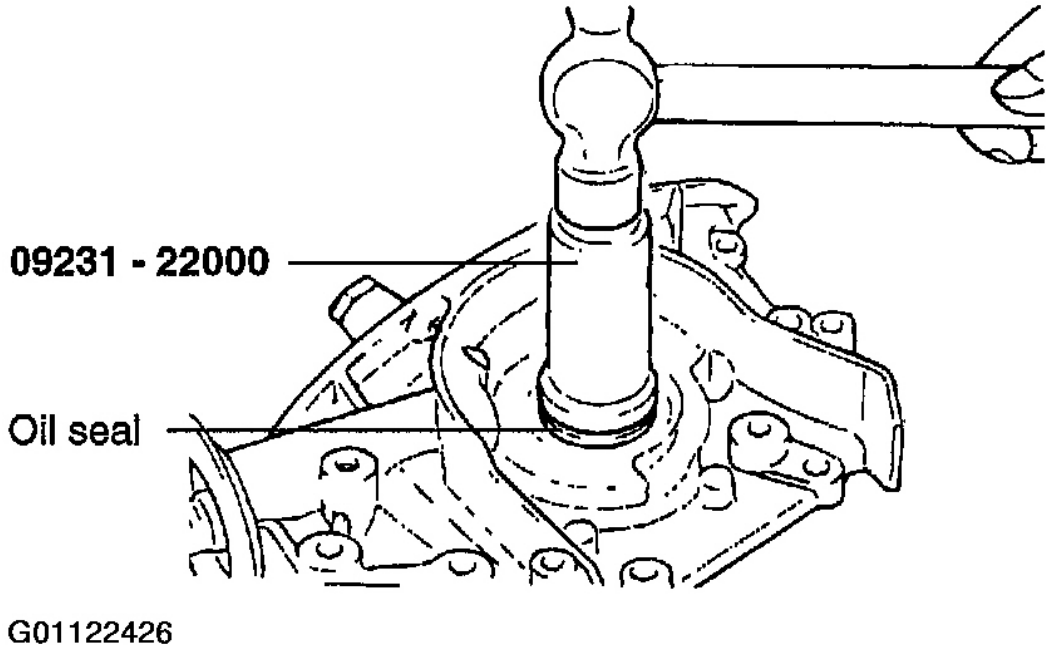


Fig. 97: Installing Oil Seal
Courtesy of HYUNDAI MOTOR CO.

5. Install the crankshaft sprocket, timing belt and crankshaft pulley. Refer to **TIMING BELT**.
6. Install the oil screen.
7. Clean both gasket surfaces of the oil pan and the cylinder block.
8. Apply sealant into the groove of the oil pan flange as shown.

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

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

Tightening torque

Oil pan bolt: 6 - 8 Nm (60 - 80 kg.cm, 4 - 6lb.ft)

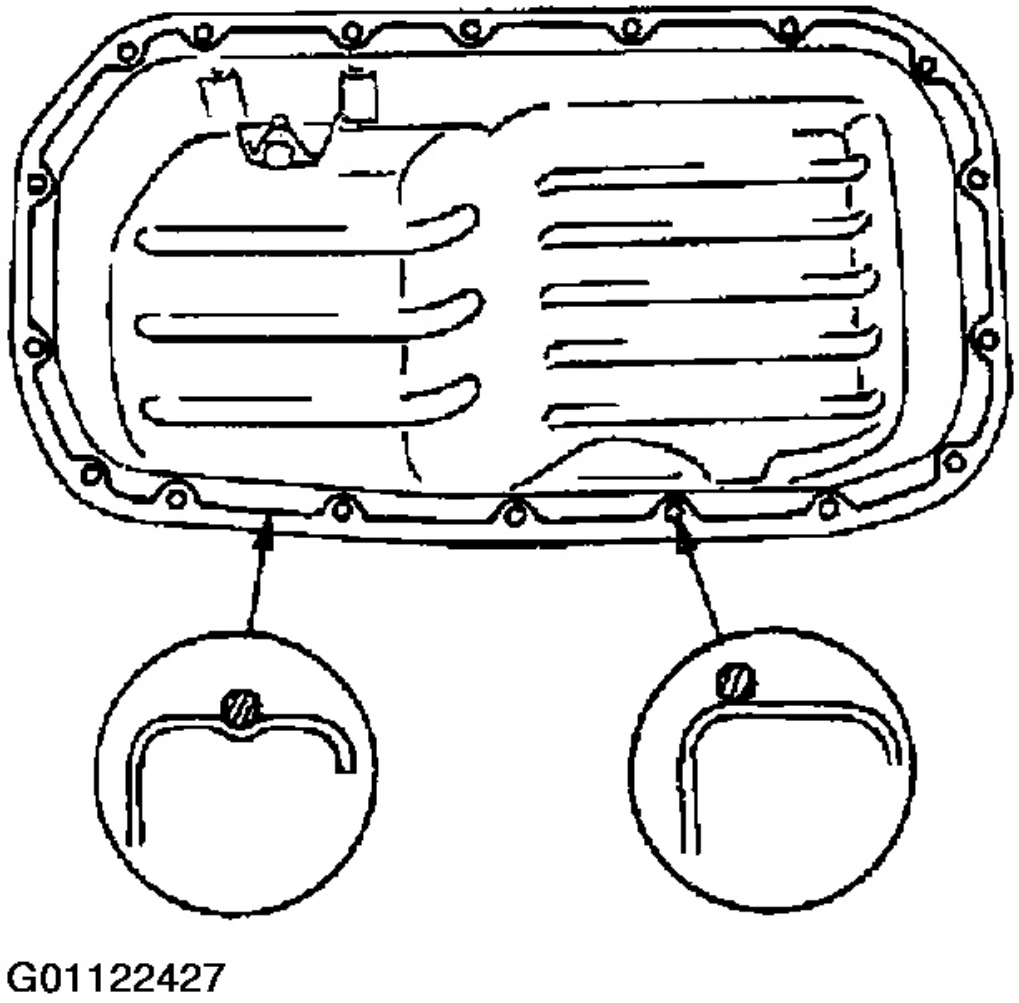


Fig. 98: Identifying Areas For Sealant Application
Courtesy of HYUNDAI MOTOR CO.

OIL PRESSURE SWITCH

1. Check the continuity between the terminal and the body with an ohmmeter.

   If there is no continuity, replace the oil pressure switch.

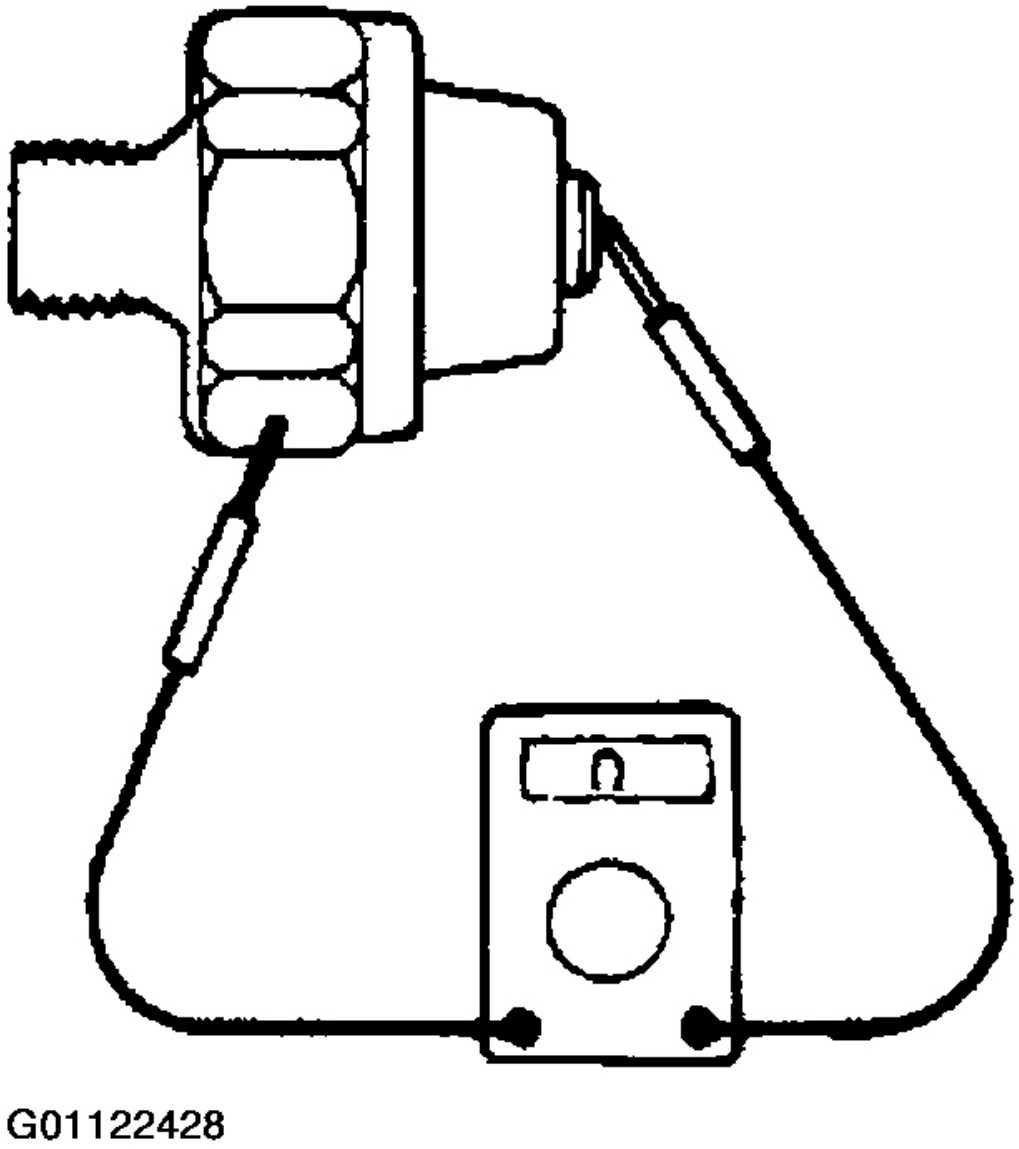


Fig. 99: Checking Continuity Between Oil Pressure Switch Terminal & Body
Courtesy of HYUNDAI MOTOR CO.

2. Check the continuity between the terminal and the body when the fine wedge is pushed. If there is continuity even when the fine wedge is pushed, replace it.
3. However, if there is non continuity when a 50 KPa (70 psi) vacuum is applied through the oil hole, the switch is operating properly. Check to see that air doesn't leak. If air leaks, the diaphragm is broken. Replace the switch.

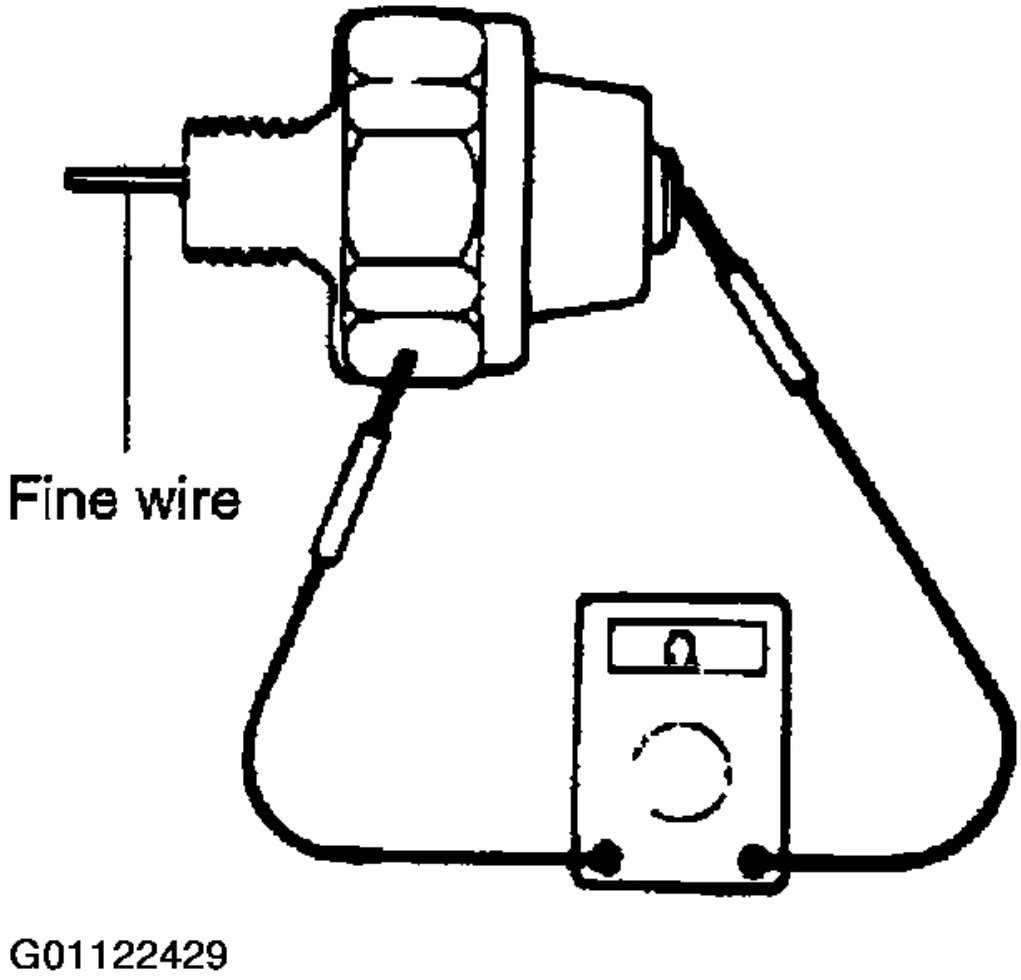


Fig. 100: Checking Continuity Between Oil Pressure Switch Terminal & Body With Fine Wire Pushed
Courtesy of HYUNDAI MOTOR CO.

INTAKE AND EXHAUST SYSTEM

EXHAUST MANIFOLD

COMPONENTS

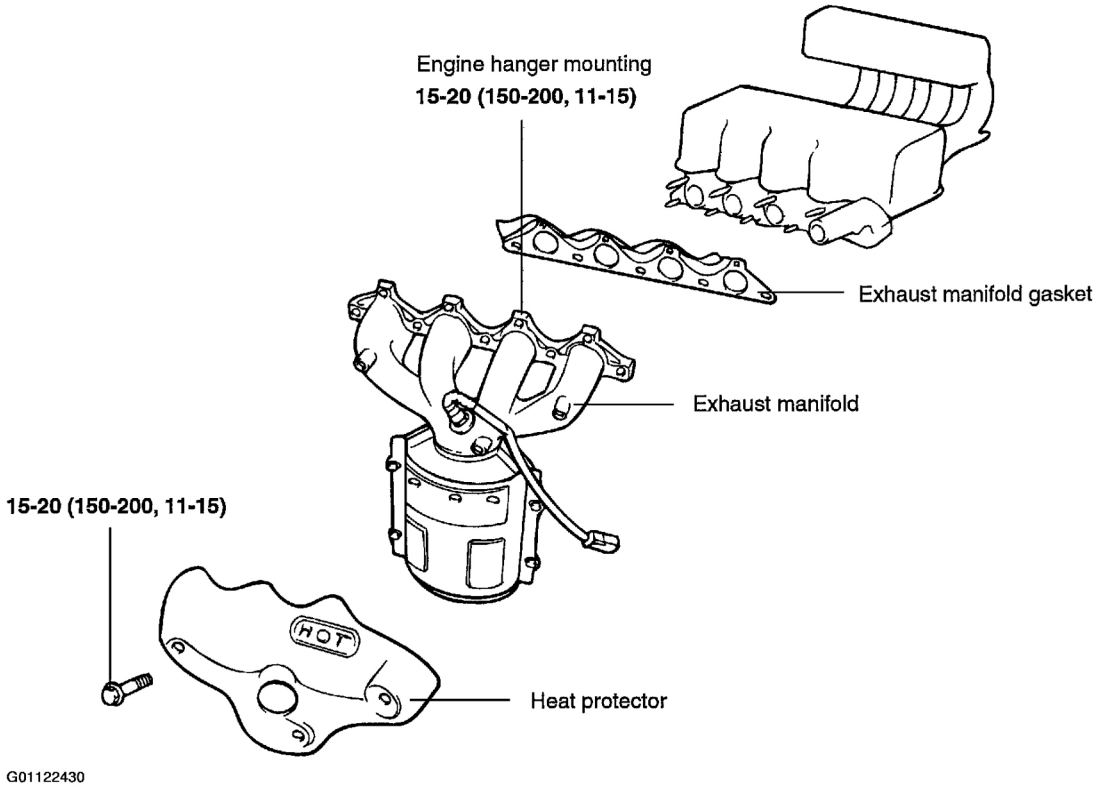


Fig. 101: Exhaust Manifold Components
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

EXHAUST MANIFOLD

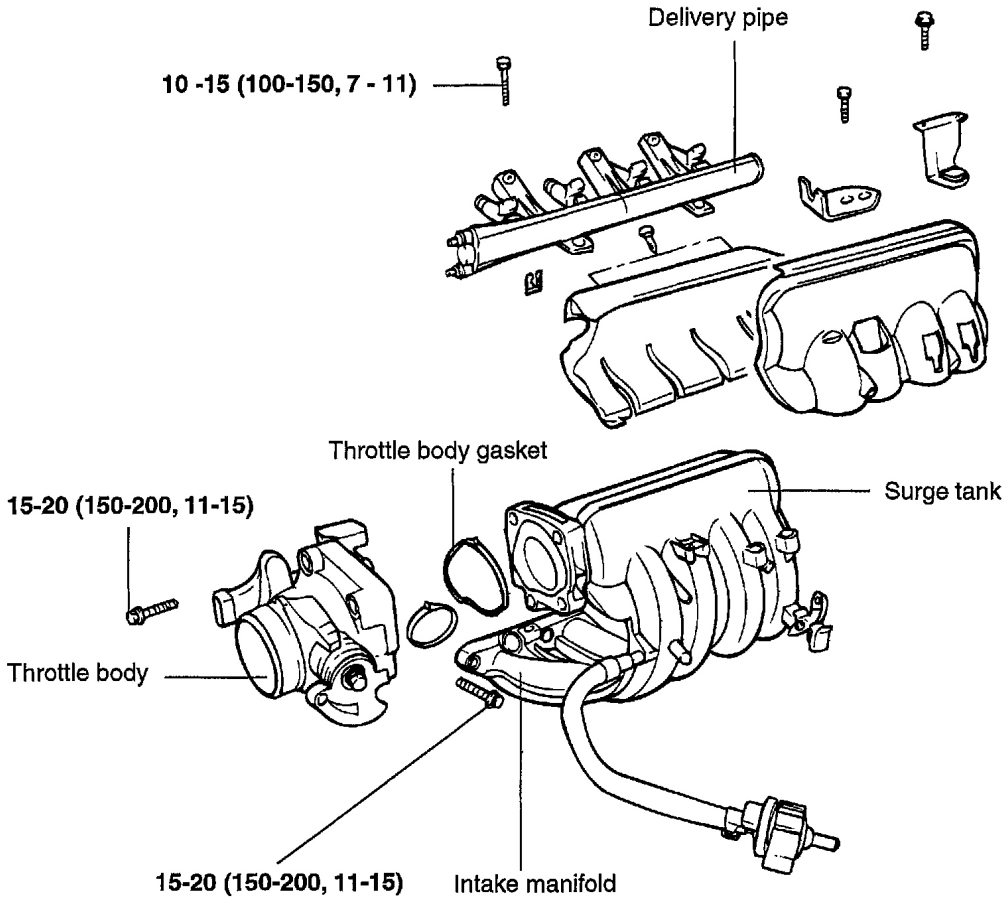
Check for damage or cracking.

EXHAUST MANIFOLD GASKET

Check for flaking or damage of the gasket.

INTAKE MANIFOLD

COMPONENTS



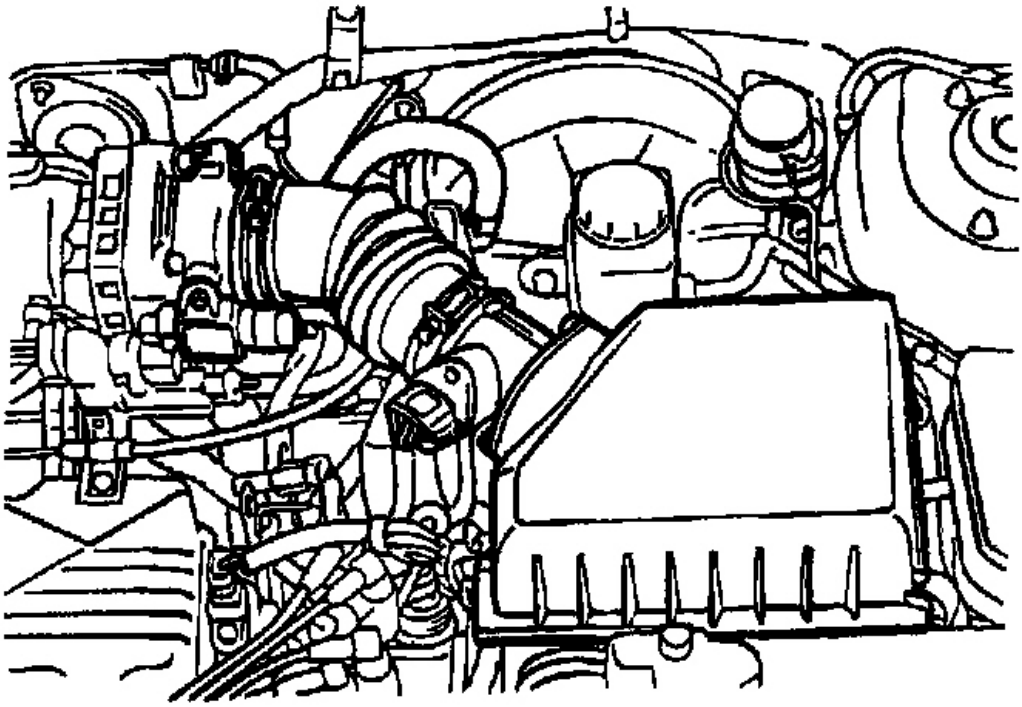
TORQUE : Nm (kg.cm, lb.ft)

G01122431

Fig. 102: Intake Manifold Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

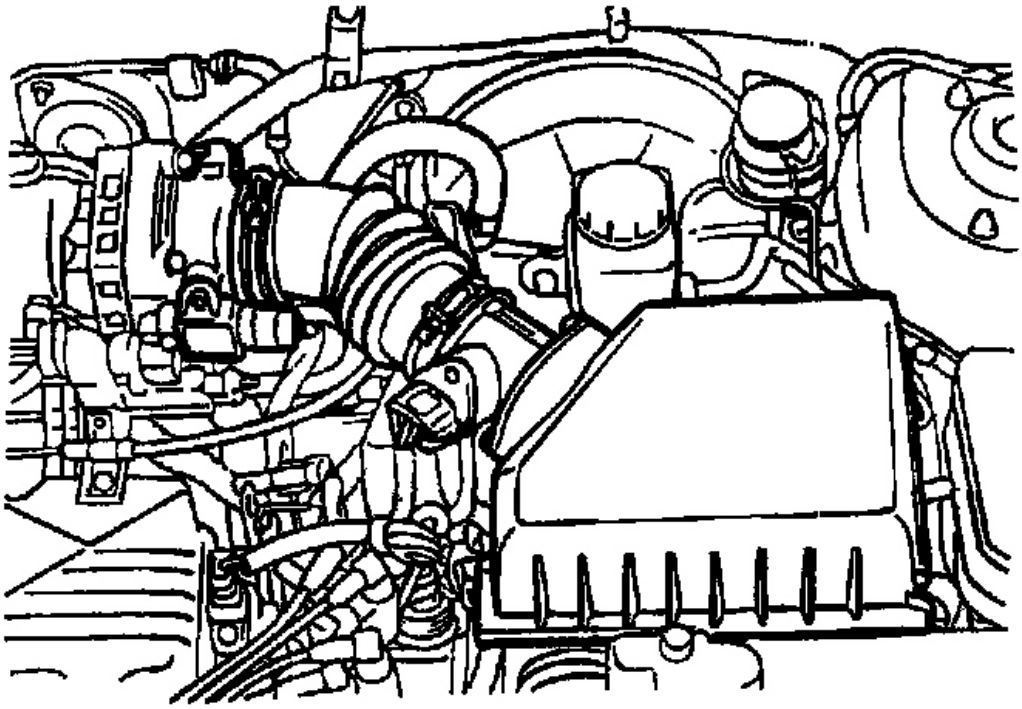
1. Disconnect the connectors of MAP sensor, TPS and ISA.



G01122432

Fig. 103: Disconnecting MAP Sensor & TPS Sensor
Courtesy of HYUNDAI MOTOR CO.

2. Remove the Intake air hose connected to the throttle body.

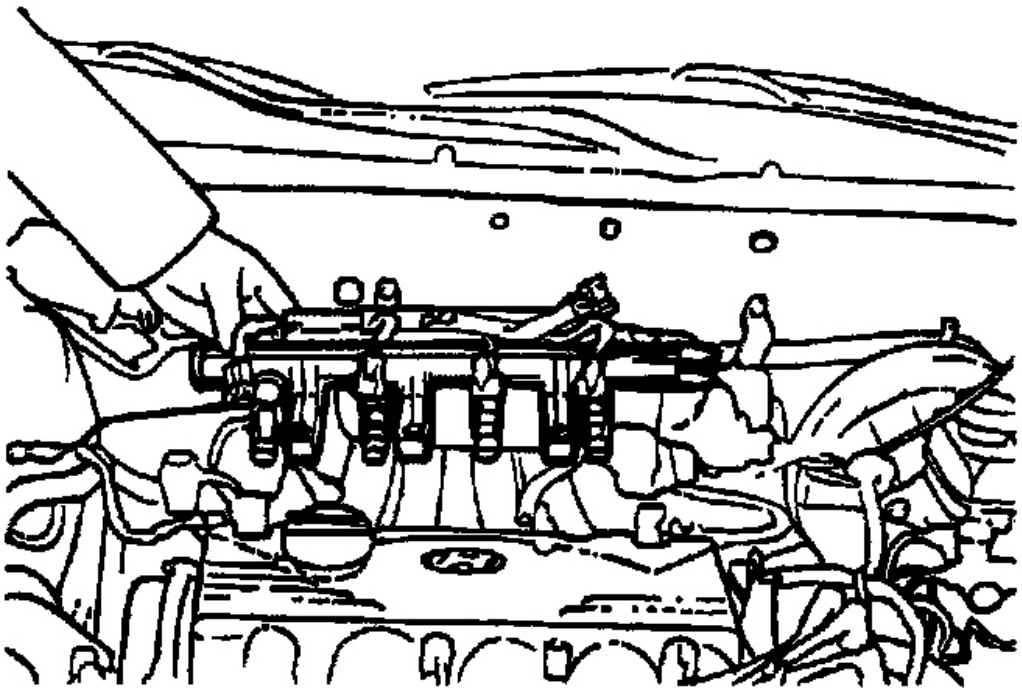


G01122433

Fig. 104: Removing Intake Air Hose Connected To Throttle Body
Courtesy of HYUNDAI MOTOR CO.

3. Remove the accelerator cable.
4. Remove the P.C.V. hose and brake booster vacuum hoses.
5. Disconnect the vacuum hose connections.
6. Remove the surge tank stay.
7. Remove the surge tank assembly and gasket.
8. Disconnect the fuel injector harness connector.
9. Remove the delivery pipe with the fuel injectors attached.

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



G01122434

Fig. 105: Removing Delivery Pipe With Fuel Injectors Attached
Courtesy of HYUNDAI MOTOR CO.

10. Remove the insulator from the intake manifold and disconnect the heater hose.
11. Remove the intake manifold.

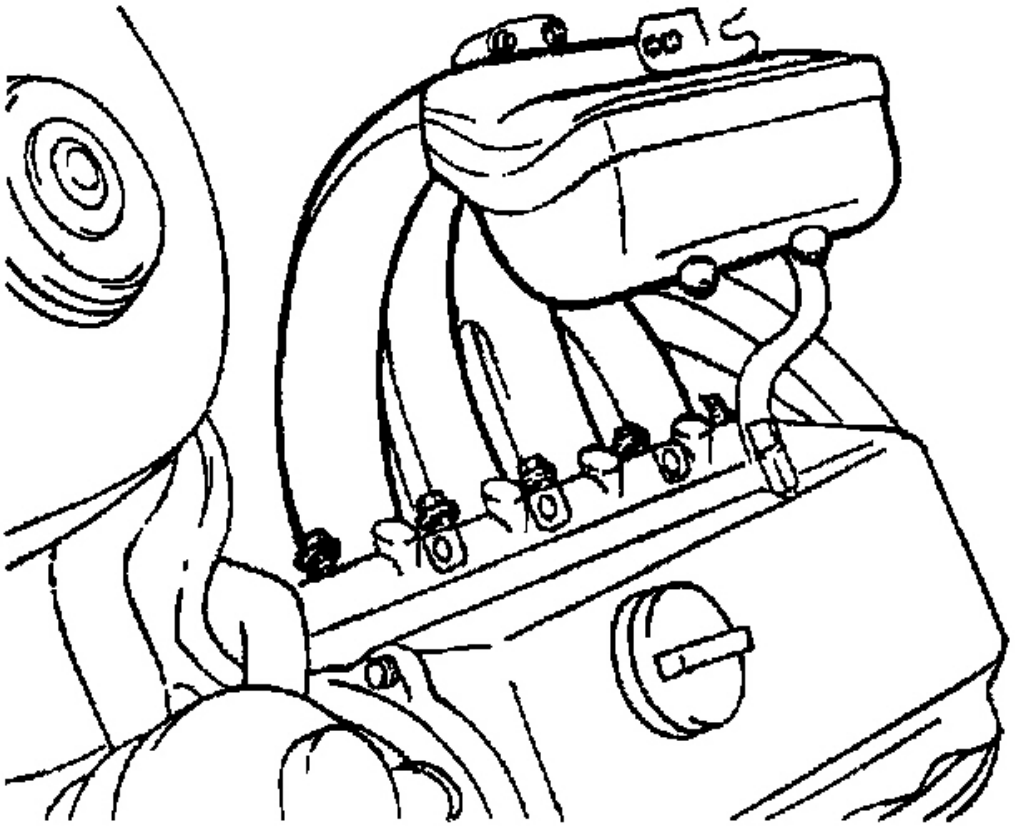


Fig. 106: Removing Intake Manifold
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

SURGE TANK

Check the surge tank for defects or cracks. Replace if necessary.

INTAKE MANIFOLD

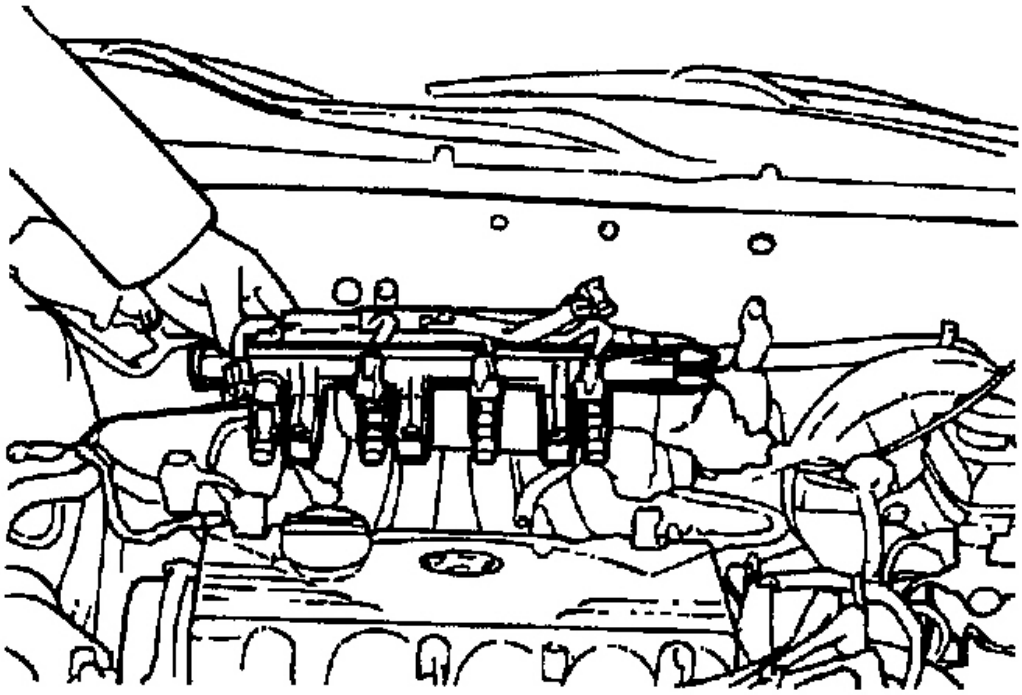
Check for damage or cracking of any part.

AIR HOSE

Check for damage or cracking or any part.

INSTALLATION

1. Install the delivery pipe with the fuel injectors attached.



G01122436

Fig. 107: Installing Delivery Pipe With Fuel Injectors Attached
Courtesy of HYUNDAI MOTOR CO.

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

2. Ensure that insulators are correctly inserted into the delivery pipe hole.

MUFFLER

COMPONENTS

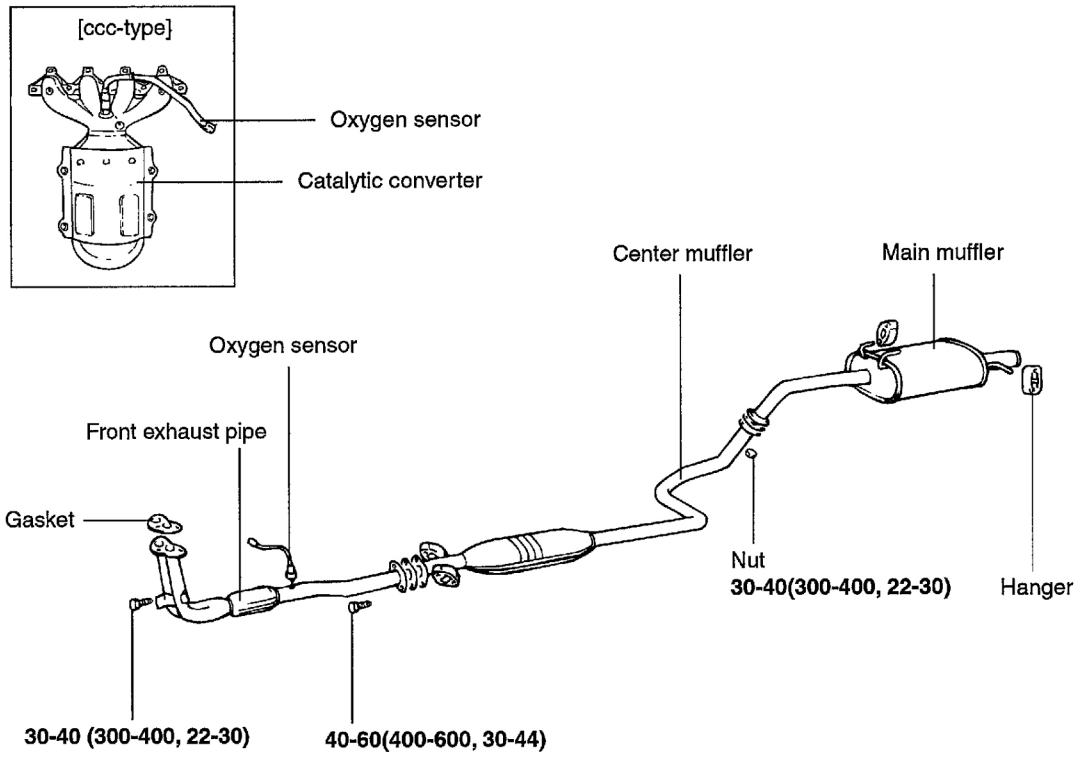


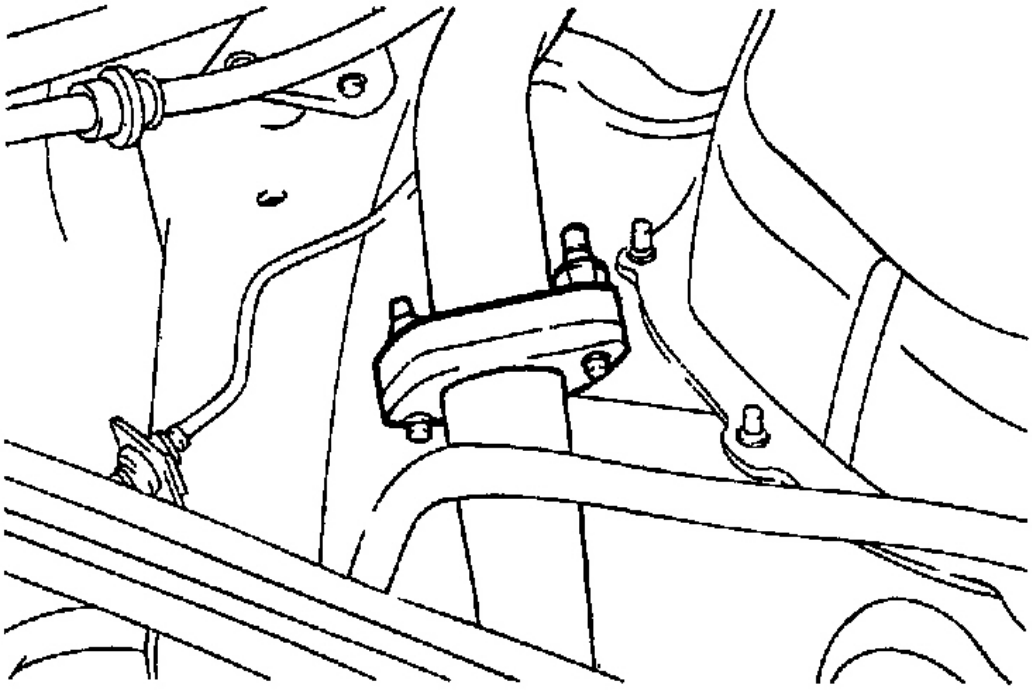
Fig. 108: Muffler Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

MUFFLER

CAUTION: Before removing or inspecting the exhaust system, ensure that it has cooled sufficiently.

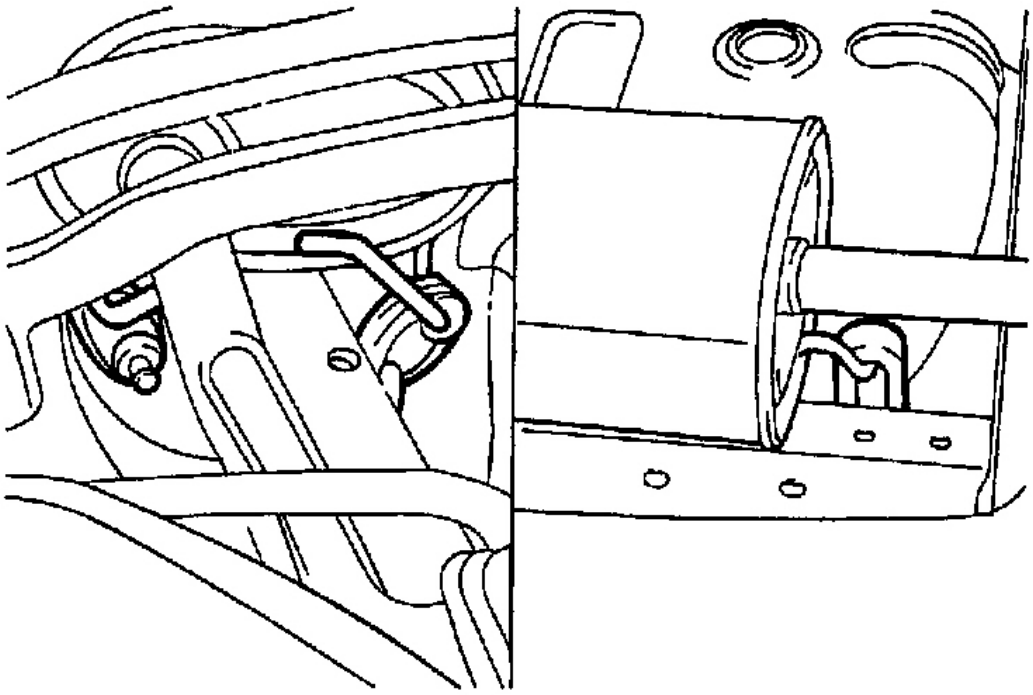
1. Disconnect the muffler from the center pipe.



G01122438

Fig. 109: Disconnecting Muffler From Center Pipe
Courtesy of HYUNDAI MOTOR CO.

2. Remove the rubber hangers and take out the main muffler.



G01122439

Fig. 110: Removing Main Muffler From Rubber Hangers
Courtesy of HYUNDAI MOTOR CO.

CENTER PIPE

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

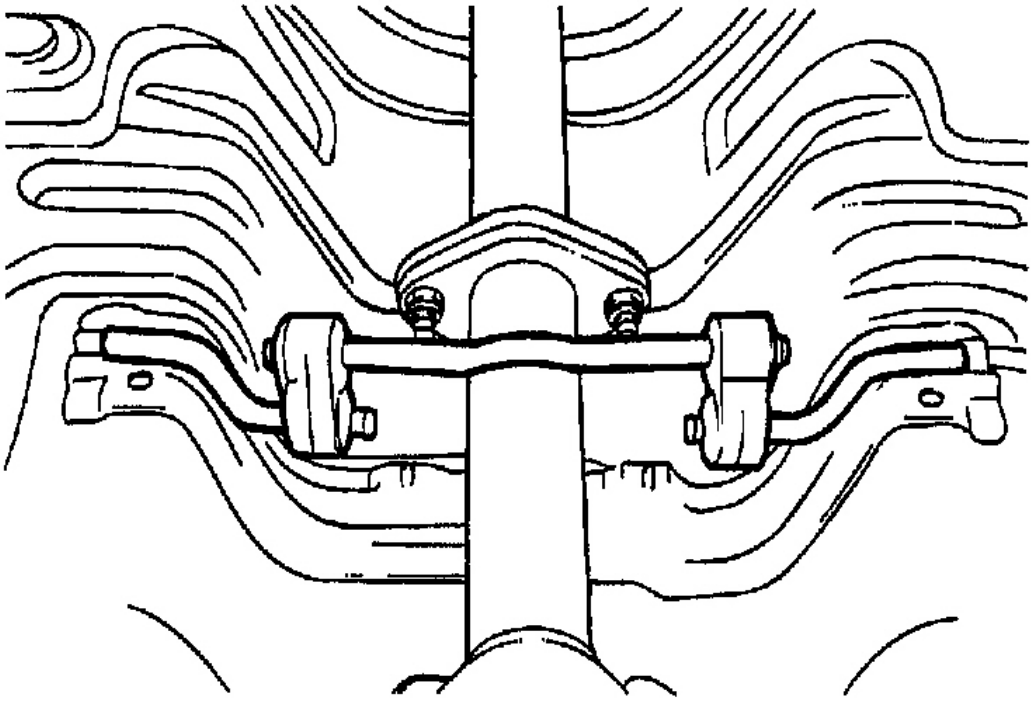
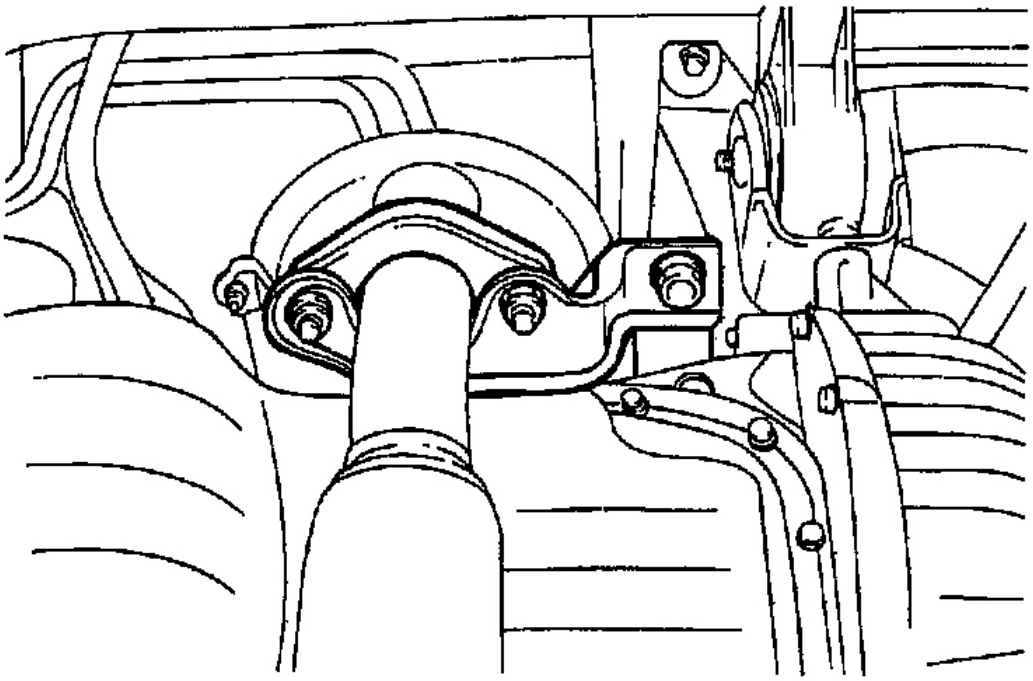


Fig. 111: Removing Center Muffler
Courtesy of HYUNDAI MOTOR CO.

CATALYTIC CONVERTER

1. Remove the catalytic converter from the front exhaust.
2. Remove the catalytic converter from the cylinder head.

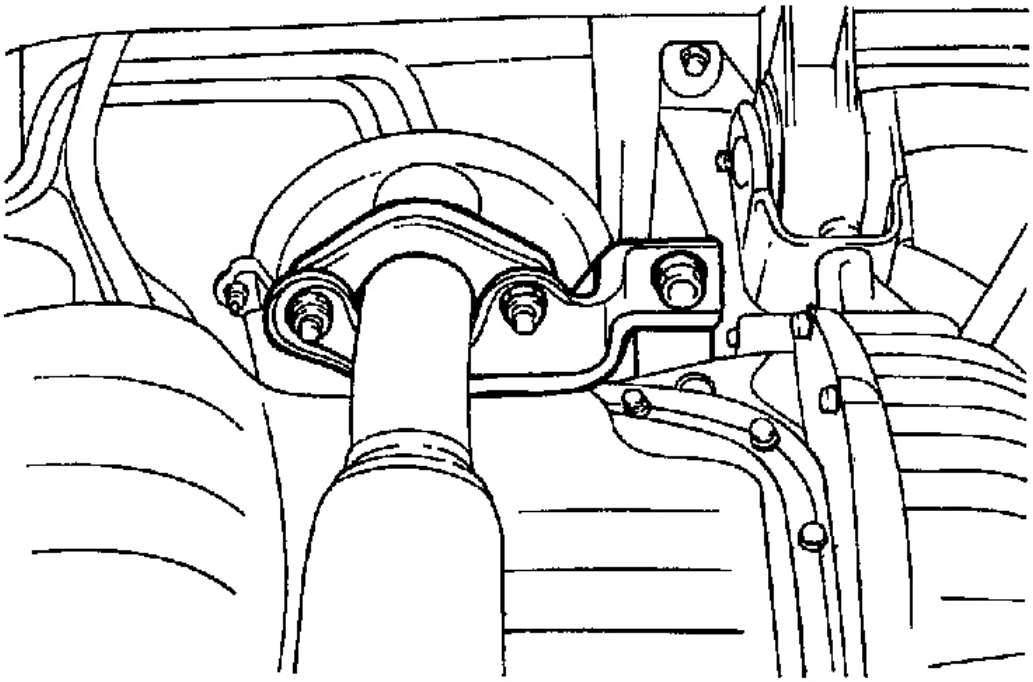


G01122441

Fig. 112: Removing Catalytic Converter From Cylinder Head
Courtesy of HYUNDAI MOTOR CO.

FRONT EXHAUST PIPE

1. Remove the O^2 sensor connector. (EC only)
2. Remove the front exhaust pipe from the catalytic converter (unleaded vehicle) or exhaust manifold (leaded vehicle).
3. Remove the front exhaust pipe clamp bolt and remove the center muffler mounting nut.



G01122442

Fig. 113: Removing Center Muffler Mounting Nut
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

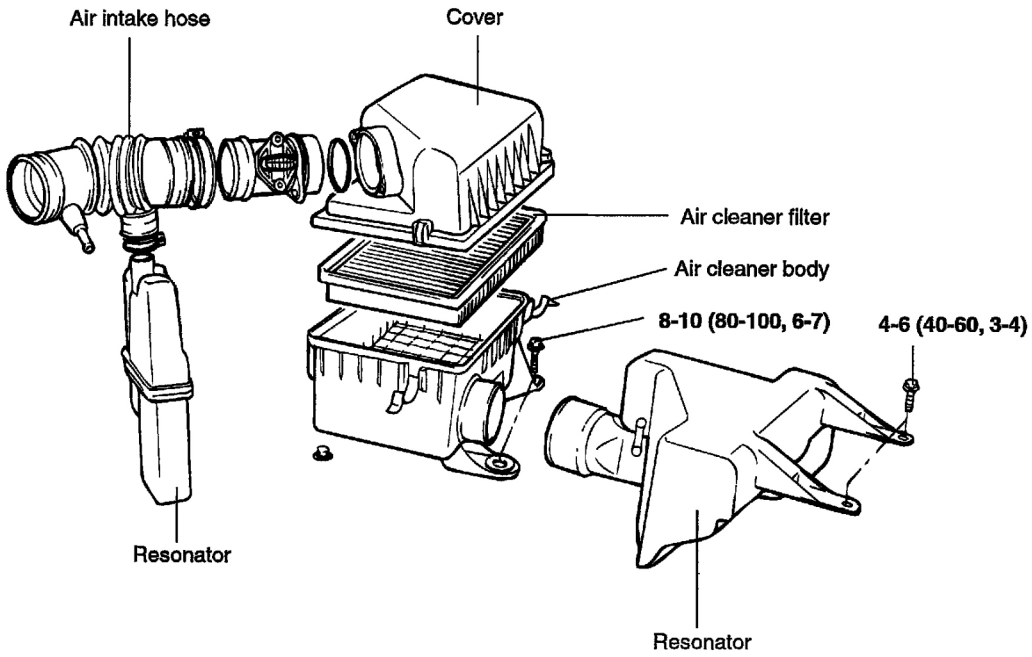
1. Check the mufflers and pipes for corrosion and damage.
2. Check the rubber hanger and bands for deterioration and cracks.

INSTALLATION

1. Temporarily install the catalytic converter assembly 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



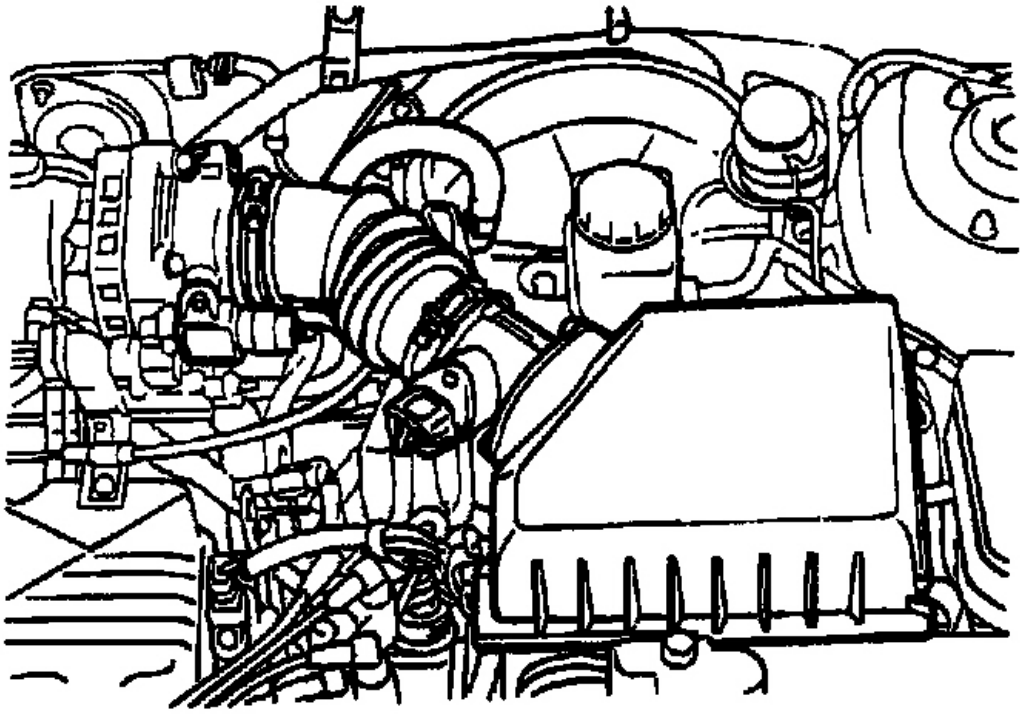
TORQUE : Nm (kg.cm, lb.ft)

G01122443

Fig. 114: Air Cleaner Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

1. Remove the air duct connected to the air cleaner.
2. Remove the air intake hose from the air cleaner side.
3. Remove the air cleaner cover and filter.
4. Remove the air cleaner mounting bolts and remove the air cleaner.



G01122444

Fig. 115: Locating Air Duct Connected To Air Cleaner
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

1. Check the air cleaner body, cover, or filter for distortion, corrosion or damage.

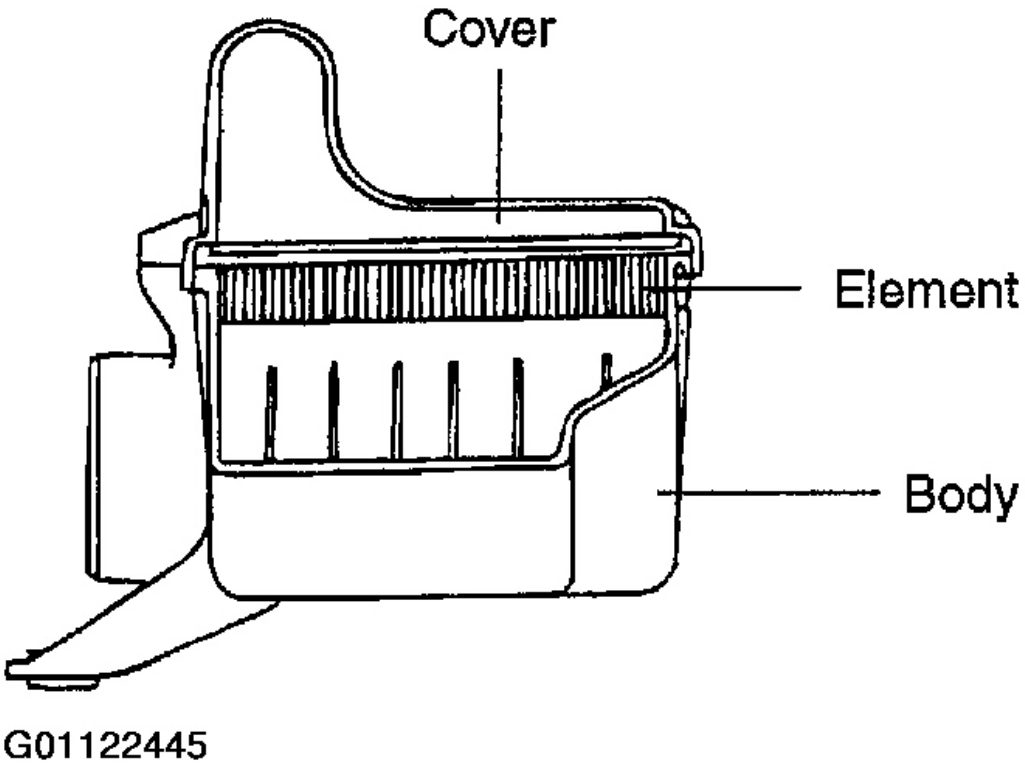


Fig. 116: Checking Air Cleaner Body, Cover & Filter
Courtesy of HYUNDAI MOTOR CO.

2. Check the air duct for damage.
3. Check the resonator for distortion or damage.
4. Check the air cleaner filter for restrictions, contamination or damage.

   If the filter is slightly restricted, remove dust and other contaminants by blowing air from the upper side through the filter.

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

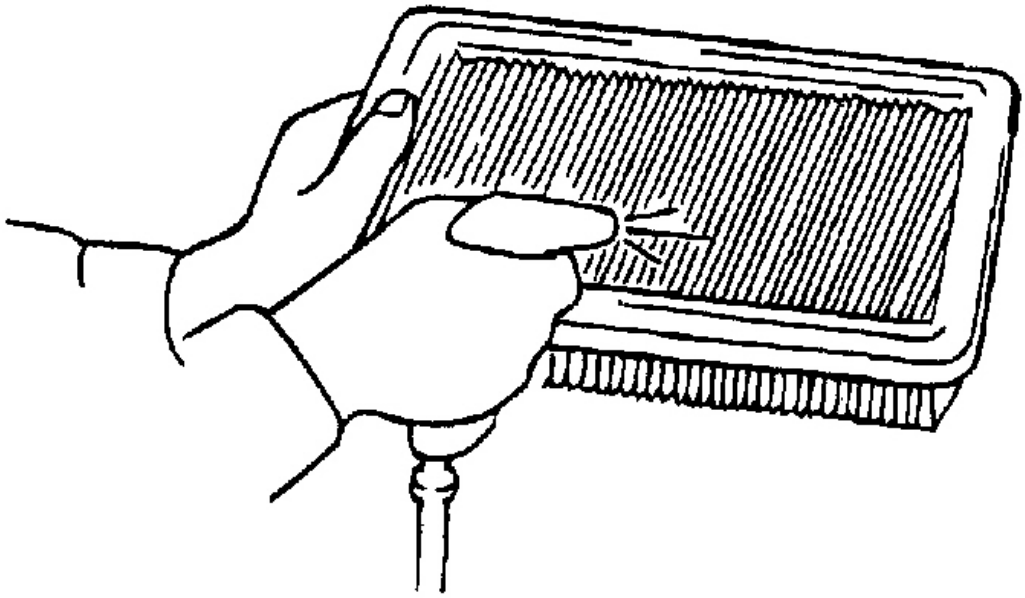


Fig. 117: Cleaning Air Filter
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

Installation is the reverse order of removal.

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

COMPONENTS

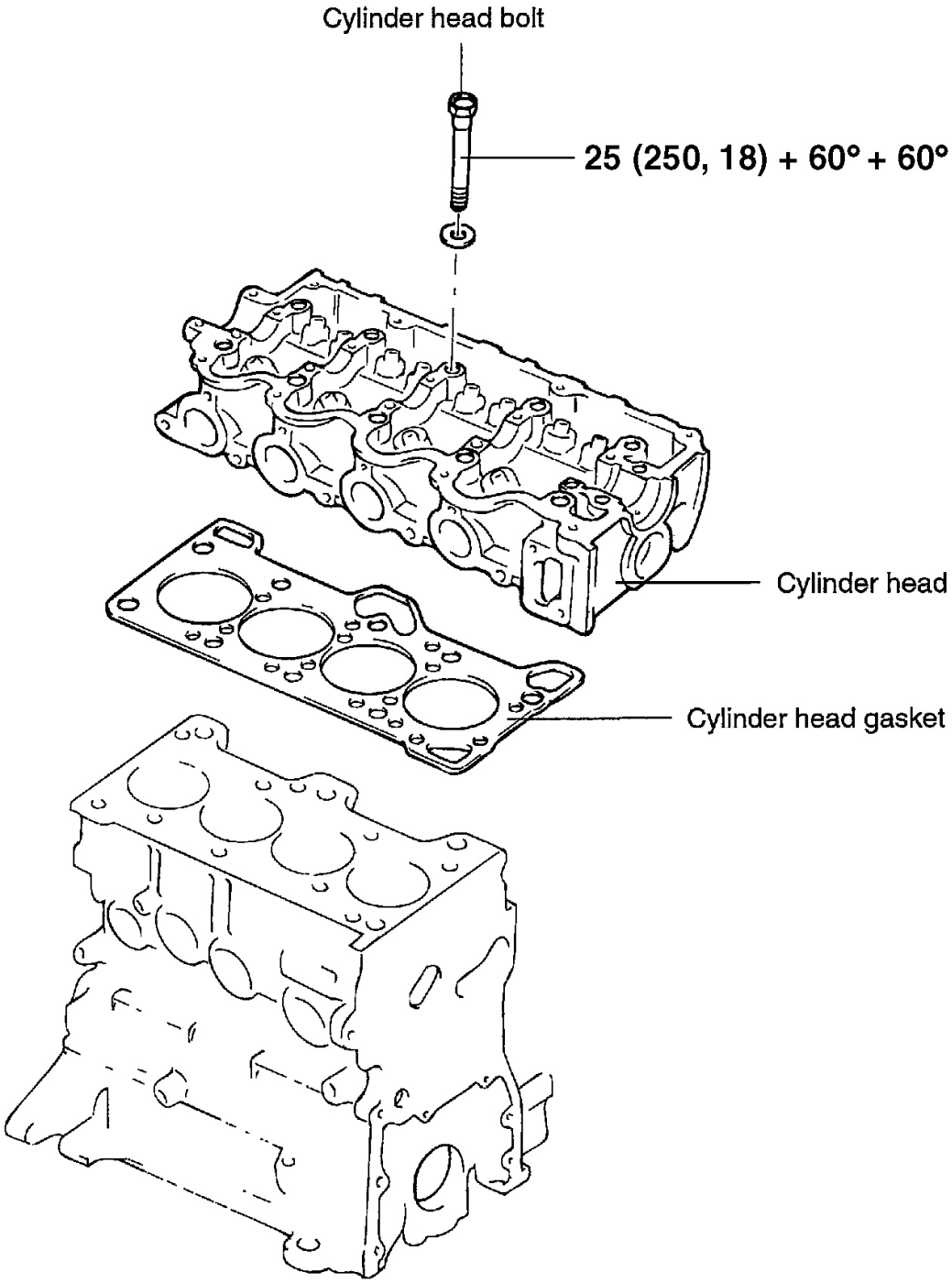
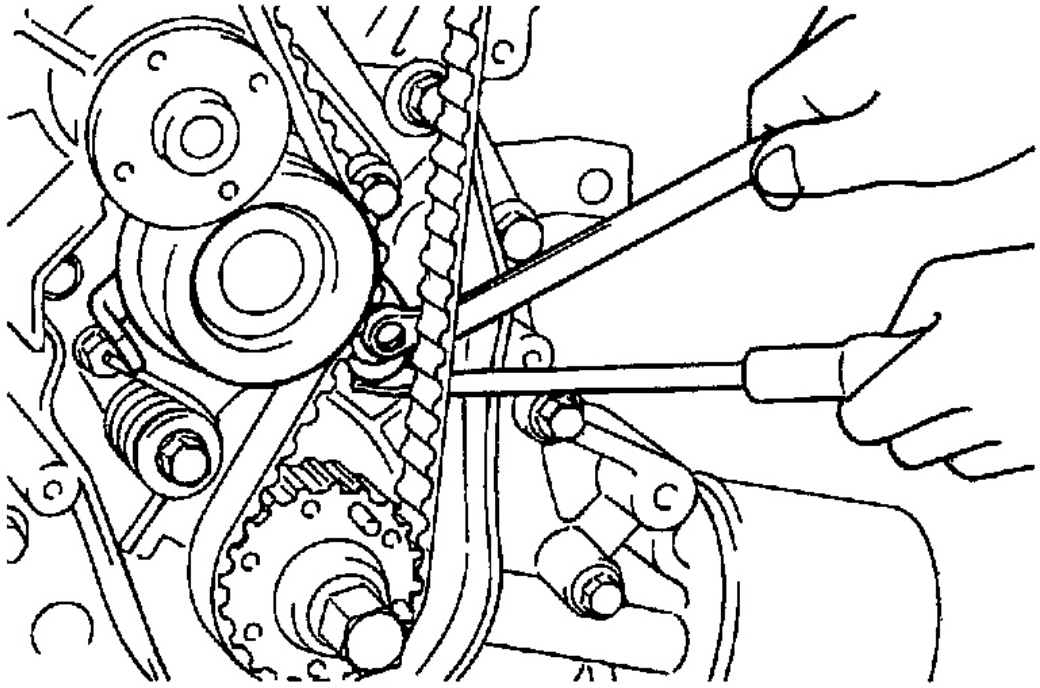


Fig. 118: Cylinder Head Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Drain the coolant and disconnect the upper radiator hose.
2. Remove the breather hose (between the air cleaner and the rocker cover).
3. Remove the air-intake hose.
4. Remove the vacuum hose, fuel hose and coolant hose.
5. Remove the cables from the spark plugs. The cables should be removed by holding the boot portion.
6. Remove the ignition coil.
7. Remove the surge tank.
8. Remove the intake manifold.
9. Remove the heat protector and exhaust manifold assembly.
10. Remove the coolant pump pulley and the crankshaft pulley.
11. Remove the timing belt cover.
12. Move the timing belt, tensioner pulley toward the coolant pump and temporarily secure it.
13. Remove the timing belt.



G01122448

Fig. 119: Removing Timing Belt
Courtesy of HYUNDAI MOTOR CO.

14. Remove the rocker cover.
15. Remove the cylinder head assembly. The cylinder head bolts should be removed using Special Tool, Cylinder Head Bolt Wrench (09221-21000), in the sequence as shown in the illustration.

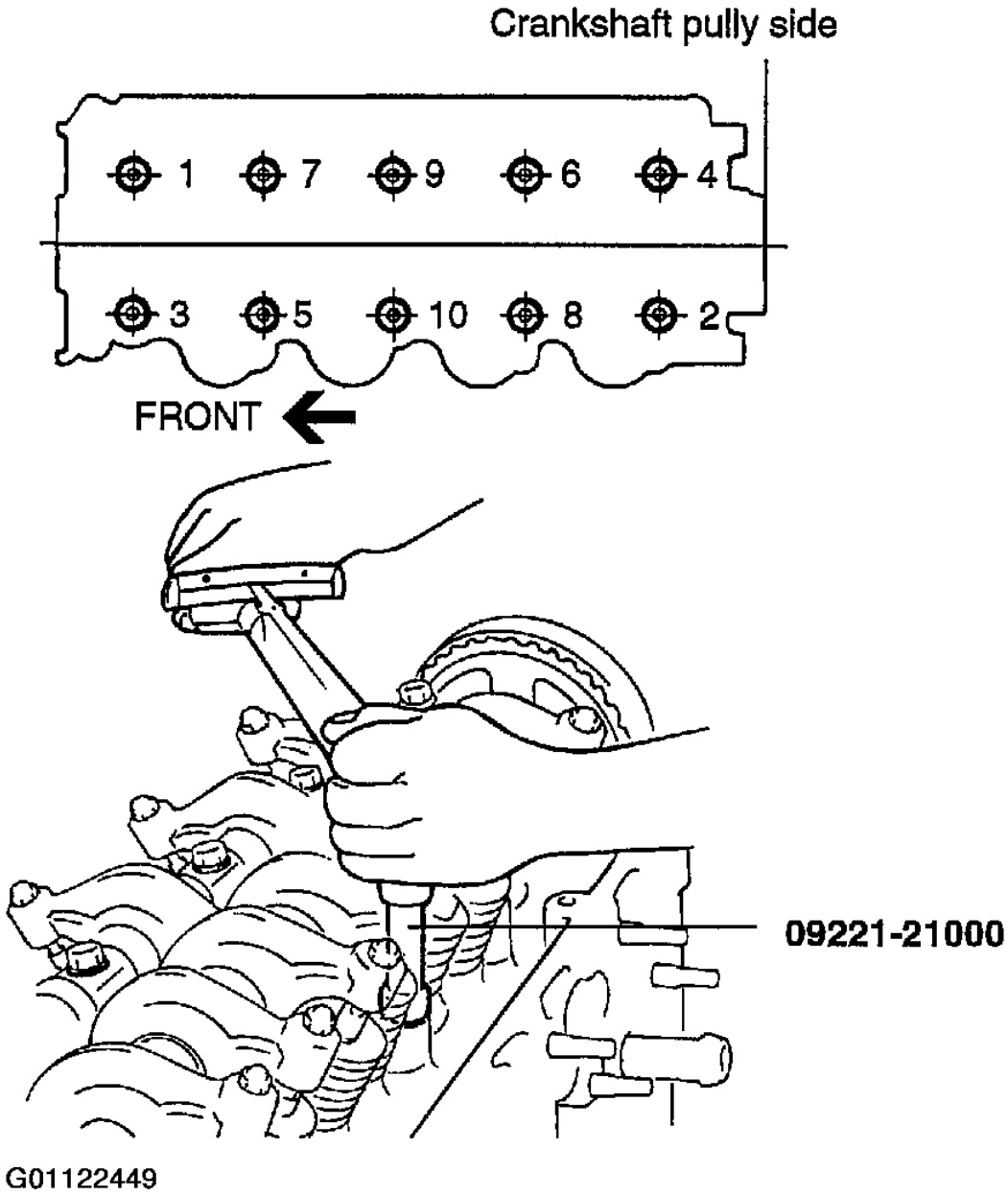


Fig. 120: Removal Sequence Of Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

16. Remove the gasket pieces from the cylinder block top surface and cylinder head bottom surface.

NOTE: **1. Make sure that the gasket pieces do not fall in to the engine.**

INSPECTION

1. Check the cylinder head for cracks, damage and coolant leakage.
2. Remove scale, sealing compound and carbon deposits completely. After cleaning oil passages, apply compressed air to make certain that the passages are not clogged.
3. Check the cylinder head surface for flatness using a straight edge in the direction of A, B, C, D & E as shown.

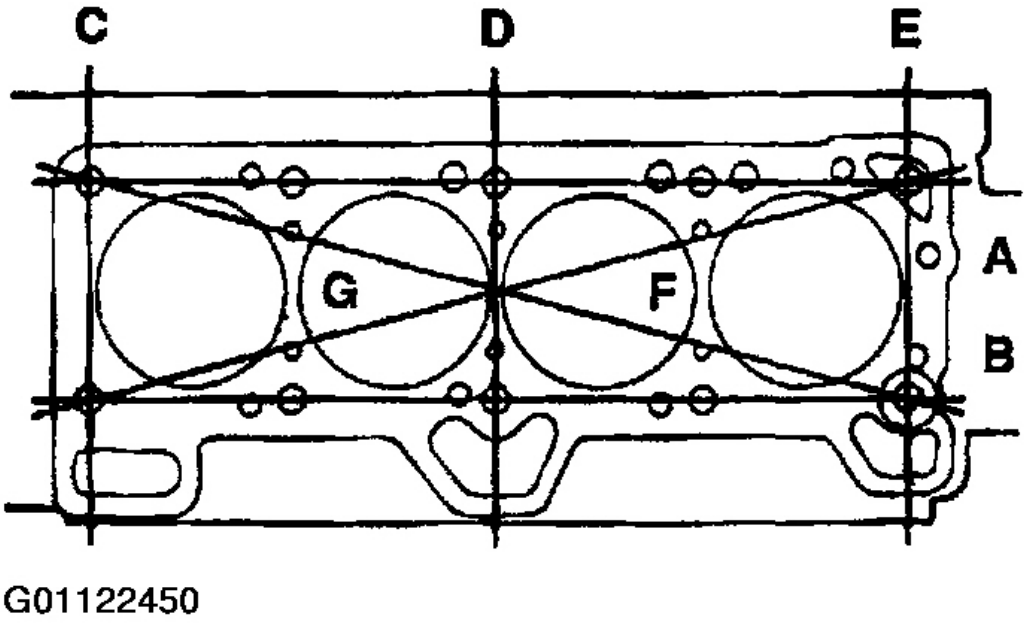


Fig. 121: Inspecting Cylinder Head
Courtesy of HYUNDAI MOTOR CO.

If flatness exceeds service limit in any direction, replace the cylinder head, or lightly machine the cylinder head surface.

Cylinder head flatness

Standard value: Less than 0.03 mm (0.0012 in.)

Limit: 0.08mm (0.0031 in.)

REASSEMBLY

1. Clean all gasket surfaces of the cylinder block and the cylinder head.
2. Install a new cylinder head gasket onto the cylinder head assembly. do not apply sealant to the gasket and do not reuse the old cylinder head gasket.
3. Install the cylinder head bolts. Starting at top center, tighten all cylinder head bolts in sequence as shown in illustration, using the Cylinder Head Bolt Wrench (09221-21000). Repeat the procedure, retightening all cylinder head bolt to the specified torque.

CYLINDER HEAD FLATNESS

Tightening torque:

25Nm (250kg.cm, 18lb.ft) + 60° + 60°

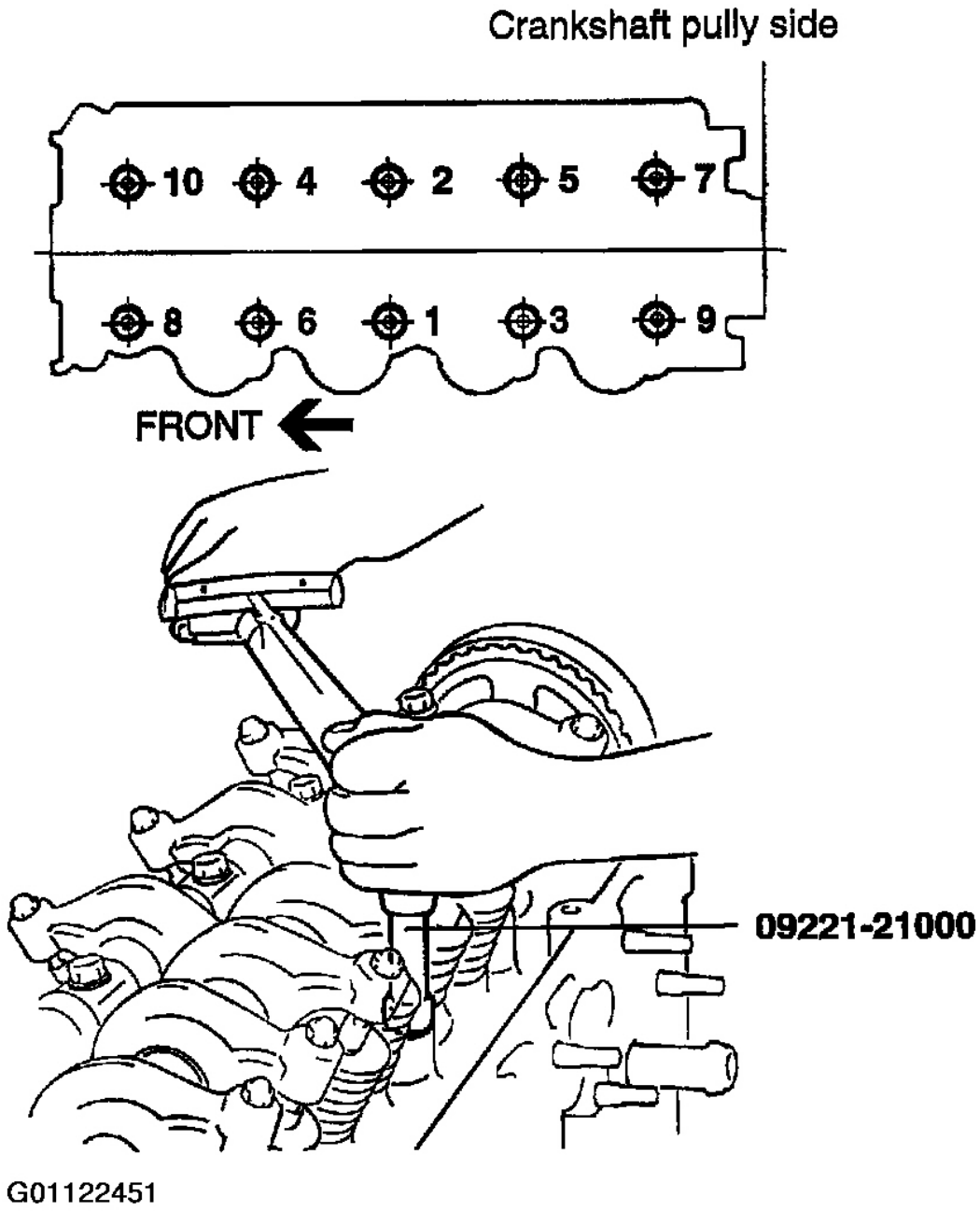


Fig. 122: Installation Sequence Of Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

4. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.
5. Install the timing belt on the camshaft sprocket, making sure that the tension side is tightened by turning the camshaft sprocket in reverse. Make sure all timing marks are in alignment.

6. Adjust the timing according to the "Timing Belt" section.
7. Install the rocker cover and tighten the bolts to the specified torque.

   Tightening torque

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

8. Install the timing belt cover.
9. Install the new intake manifold gasket and the intake manifold. Tighten the nuts and bolts to the specified torque.

   Tightening torque

   Manifold nuts and bolts (both intake and exhaust):

   15-20Nm (150-200kg.cm, 11-15 lb.ft)

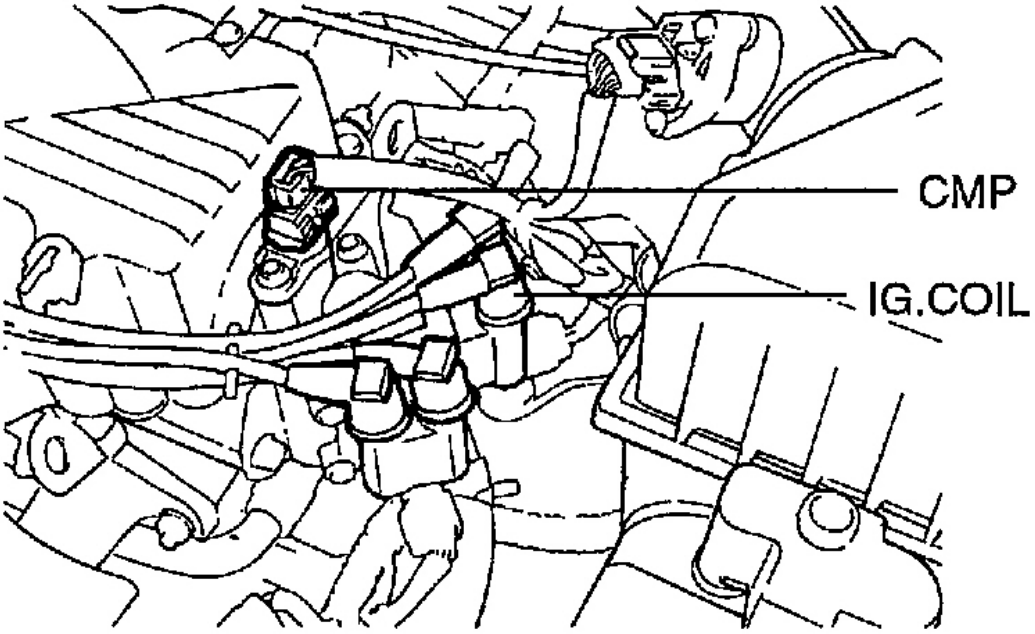
10. Install the new exhaust manifold gasket and the exhaust manifold. Tighten the exhaust manifold attaching nuts to the specified torque.
11. Install the surge tank and tighten the nuts and bolts to the specified torque.

    Tightening torque

    Surge tank to inlet manifold nuts and bolts:

    15-20Nm (150-200kg.cm, 11-15 lb.ft)

12. Install the ignition coil.



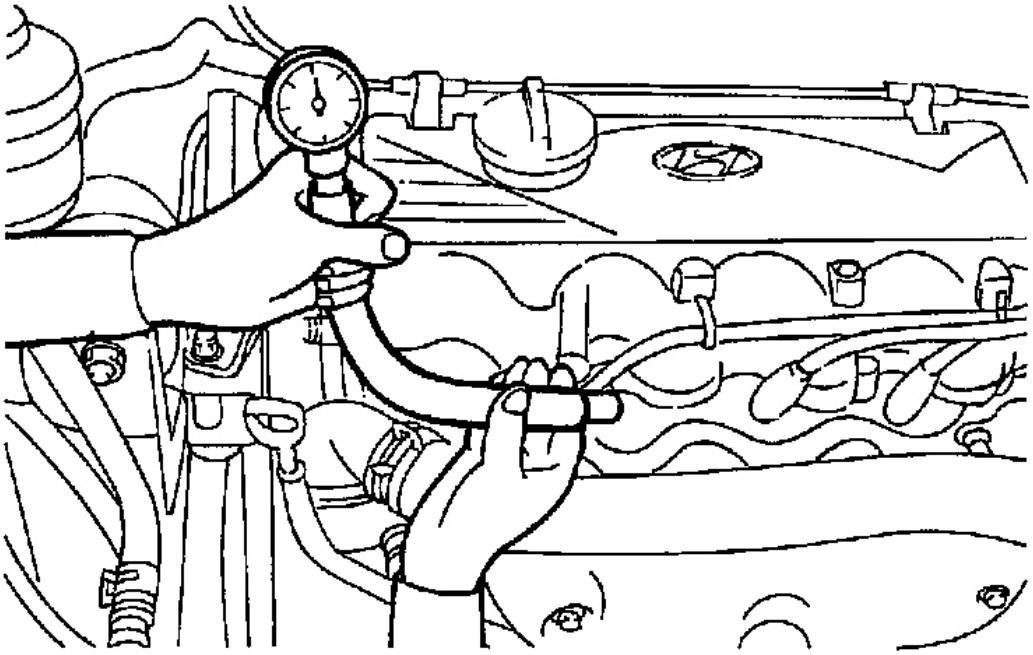
G01122452

Fig. 123: Installing Ignition Coil
Courtesy of HYUNDAI MOTOR CO.

13. Install the air intake hose.
14. Connect the vacuum hose, fuel hose and coolant hose.
15. Install breather hose.

CHECKING COMPRESSION PRESSURE

1. Before checking compression, check the engine oil level. Make sure the starter motor and battery are in normal operating condition.
2. Start the engine and wait until engine coolant temperature reaches 80-95°C (176-205°F)
3. Stop the engine and disconnect all spark plug cables.
4. Remove the spark plug.
5. Crank the engine to remove any foreign objects in the cylinders.
6. Screw the compression gauge into the spark plug hole.



G01122453

Fig. 124: Checking Engine Compression
Courtesy of HYUNDAI MOTOR CO.

7. Fully open the throttle.
8. Crank the engine (approximately 4 revolutions) and read the gauge.

   Standard value [at 250 - 400 rpm]:

   16.5kg/cm^2 (1.62Mpa 234Psi)

   Limit: 15.5kg/cm^2 (1.52 Mpa, 220Psi)

9. Repeat steps 6 through 8 on all cylinders, making sure that the pressure differential for each of the cylinders is within the specified limit.
10. If a cylinder's compression or pressure differential is below the specification, add a small amount of oil through the spark plug hole and repeat steps 6 through 9.
    1. If the addition of oil brings the compression up, it is possible that there is 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 possible causes.

3. Reinstall the spark plug cables.

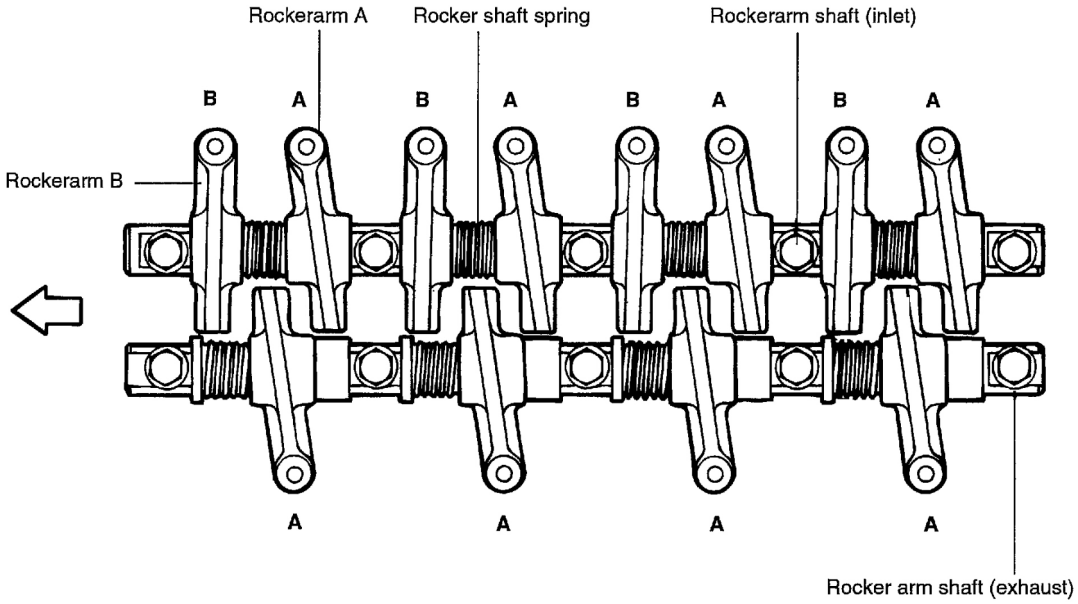
Tightening torque

Spark plug:

20.4 - 30.6Nm (204 - 306 kg.cm, 15-21 lb.ft)

ROCKER ARM

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

G01122454

Fig. 125: Rocker Arm Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Remove the breather hose and PCV valve.
2. Remove the timing belt cover.
3. Remove the rocker cover.
4. Loosen the flange bolts and remove the rocker arm shaft, rocker arms and rocker arm shaft springs as an assembly.
5. Remove the bolts, the rocker arms and arm shaft springs from the rocker arm shaft.

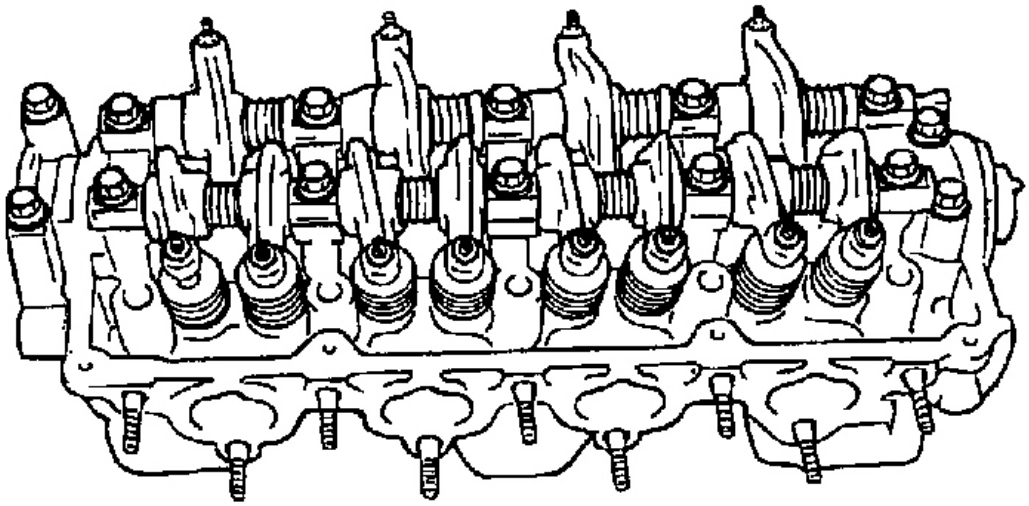


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Fig. 126: View Of Cylinder Head
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

ROCKER ARM

1. Check the rotation of roller. Replace it if not rough or worn.
2. Check the rocker face. Replace it if damaged or pressed.
3. Check hydraulic lash adjust (HLA) face that contact the valve stem.

If badly worn or damaged, replace the HLA.

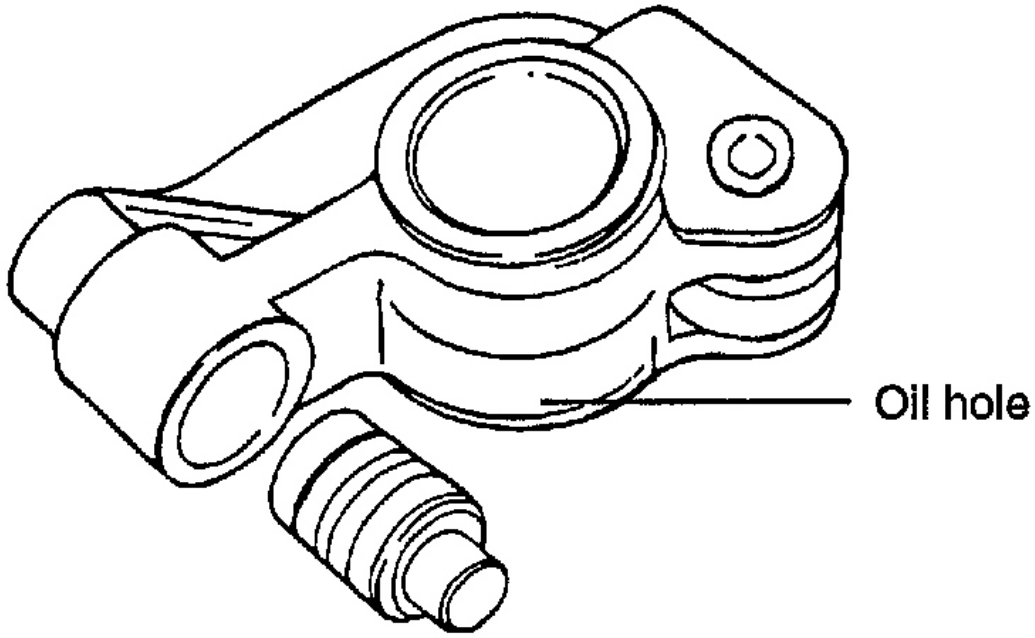


Fig. 127: Locating Hydraulic Lash Adjust Oil Hole
Courtesy of HYUNDAI MOTOR CO.

ROCKER ARM SHAFT

1. Check the rocker arm shafts for damage. Replace as necessary.
2. Check the oil hole for foreign matter.

REASSEMBLY

1. Install the rocker arms and rocker arm shaft springs to the rocker arm shafts, Install the rocker arm shaft to the cylinder head.

   Tighten the rocker arm shaft mounting bolts to the specified torque.

   Tightening torque

   Rocker arm shaft mounting bolt:

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

2. When installing the rocker arms, shafts, and springs, note the difference between the A and B type rocker

arms, and exhaust side needs only A type rocker arms.

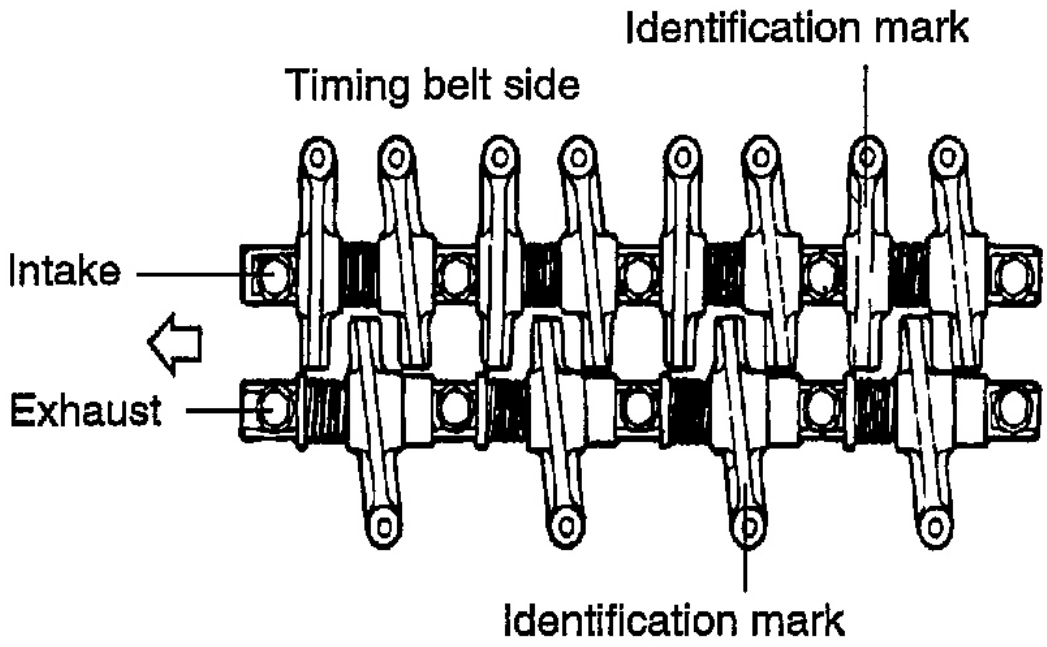
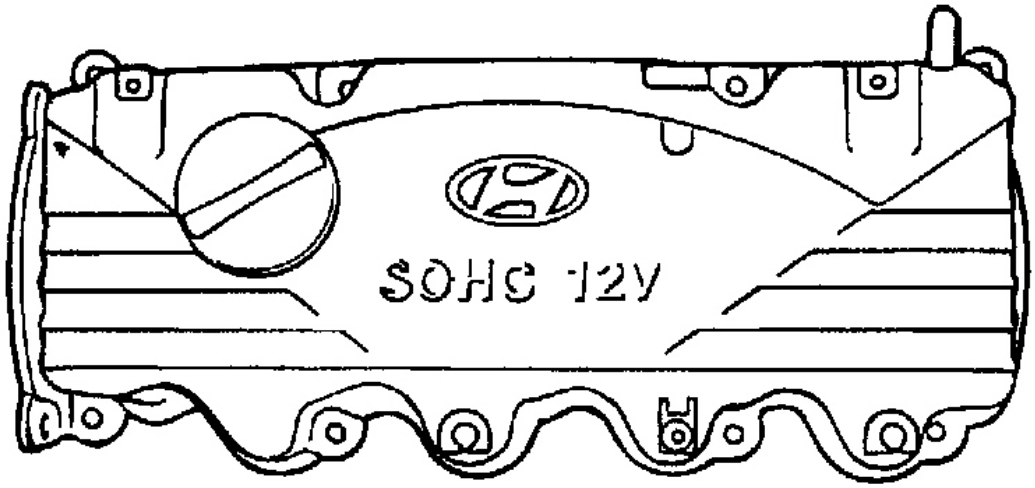


Fig. 128: Locating Rocker Arm Identification Marks
Courtesy of HYUNDAI MOTOR CO.

3. Install the rocker cover and tighten the bolts to the specified torque.

Tightening torque

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



G01122458

Fig. 129: Identifying Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

CAUTION:

1. **Sealant must be applied to top surface of cylinder head and cam cap and area of application is shown in figure.**
2. **The proper amount of sealant must be used to prevent the sealant from pushing excessive amounts.**
3. **use sealant of specified brands or equivalent.**
4. **Sealant (Three bond No. 1212D aluminum color or equivalent) application place (4 place).**

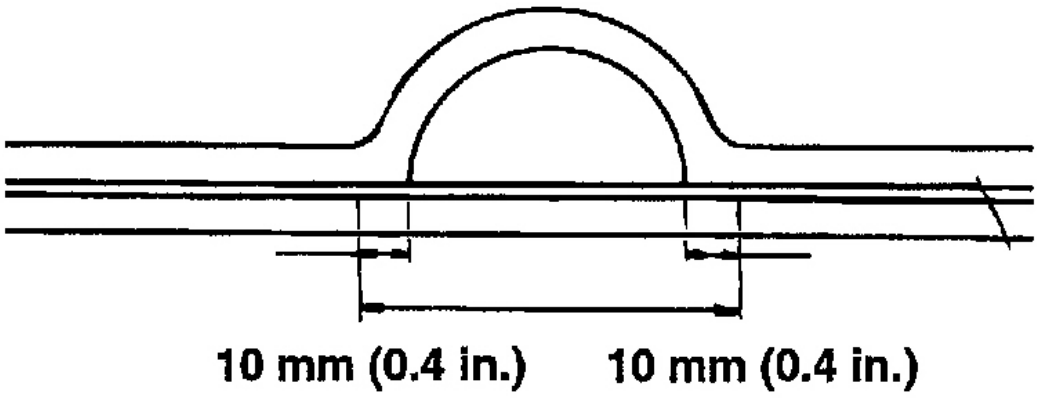


Fig. 130: Identifying Sealant Application
Courtesy of HYUNDAI MOTOR CO.

4. Install the timing belt cover.

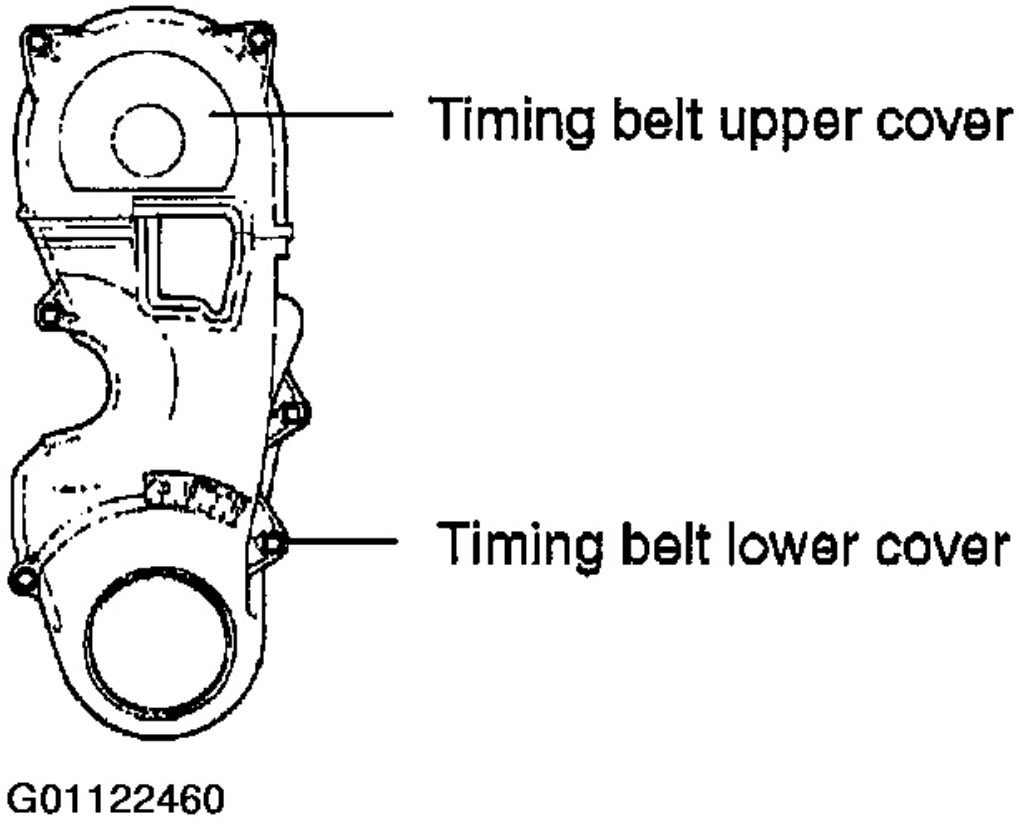


Fig. 131: Locating Timing Belt Cover
Courtesy of HYUNDAI MOTOR CO.

Tightening torque

Timing belt cover bolt:

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

5. Install the air cleaner.
6. Install the breather hose and PCV hose.

HLA

With the HLA filled with engine oil, hold A and press B by hand. If B moves, Replace the HLA.

For other specific troubleshooting regarding HLA, refer to **Fig. 133**.

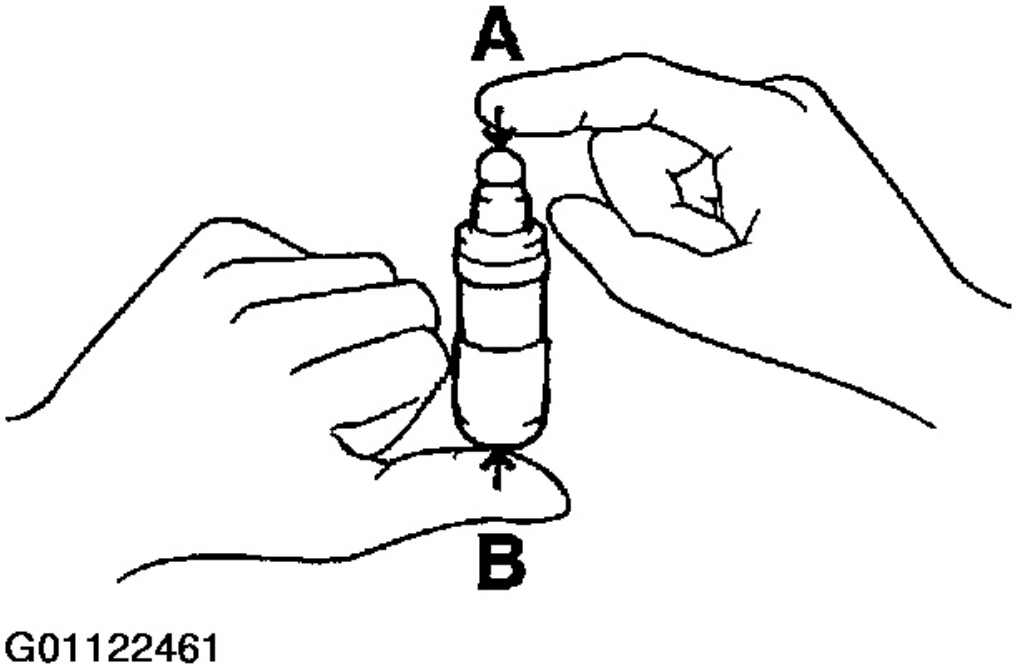


Fig. 132: Inspecting Hydraulic Lash Adjust
Courtesy of HYUNDAI MOTOR CO.

Problem	Possible cause	Action
• Temporary noise on starting a cold engine	Normal	This noise will disappear after the oil in the engine has reached normal pressure.
• Continuous noise when engine is started after loger than 48 hours parking.	Oil drain out of the high pressure chamber on HLA, allowing air to get in.	Noise will disappear within 15 minutes when engine run at 2000-3000 rpm If not disappear,refer to item 7 below
• Continuous noise when engine is first started after rebuilding cylinder head.	Insufficient oil in cylinder head oil gallery.	
• Continuous noise when engine is after excessive craking the engine by starter motor or band.	Oil drain out of the hig-pressure chamber in HLA, allowing air to get in. Insufficient oil in HLA,	
• Continuous noise when engine is after changing HLA.		⚠ ***CAUTION*** ***Do not run engine all a speed higher than 3000 rpm as this may damage HLA.***
• Continuous noise during idle after high speed running.	Engine oil level too high or too low.	Check oil level. Drain or add oil as necessary.
	Excessive amount of air in the oil at high engine speed.	Check oil supply system
	Deteriorated oil	Check oil quality. If deteriorated, replace with specified type and amount of oil.
• Noise cotinues more than 15 minutes.	Low oil pressure	Check oil pressure and oil supply system of each part of engine.
	Faulty HLA.	Remove the cylinder head over and press down HLA by band. If it moves, replace HLA. ⚠ ***CAUTION*** ***Be careful of hot HLA.***

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Fig. 133: Troubleshooting Symptom Table
Courtesy of HYUNDAI MOTOR CO.

VALVE SEAT INSERT REPLACEMENT PROCEDURE.

1. Any valve seat insert that has been worn over the service limit should be removed at normal temperature after cutting away most of the insert wall, using valve seat cutters, as shown in Fig A.
2. After removing the seat insert, machine the seat insert bore using a reamer or a cutter. Cut to the size shown in the table.
3. Heat the cylinder head to about 250°C (480°F) and press in the oversize seat insert. The oversize seat insert should be at normal room temperature for installation. After installing a new valve seat insert, resurface the valve seat using the same procedure described in the first paragraph of "Valve Seat Insert" (above).

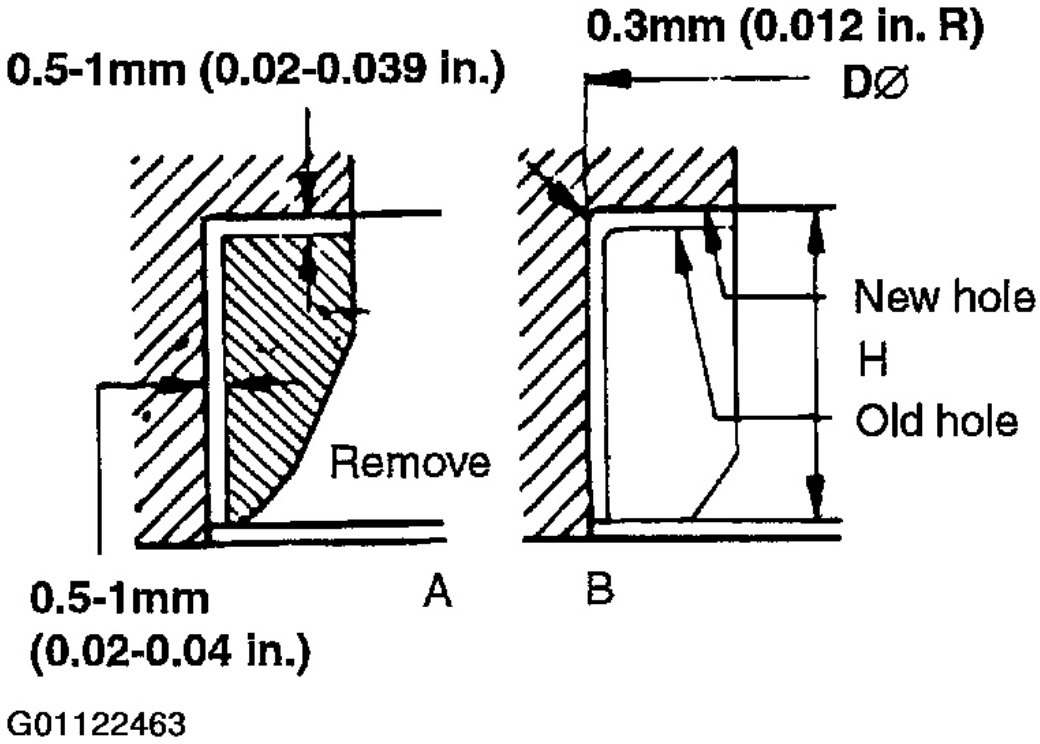

Fig. 134: Identifying Seat Insert Bore
Courtesy of HYUNDAI MOTOR CO.

VALVE SEAT INSERT OVERSIZE

Description	Size mm (in.)	Size mark	Seat insert height H mm (in.)	Cylinder head I.D. mm (in.)
Intake valve seat insert	0.3 (0.012) O.S.	30	5.1-5.3 (0.201-0.209)	28.80-28.821(1.134-1.135)
	0.6 (0.024) O.S.	60	5.4-5.6 (0.213-0.220)	29.10-29.121(1.146-1.147)
Exhaust valve seat	0.3 (0.012) O.S.	30	5.9-6.1 (0.232-0.240)	34.30-34.325(1.350-1.351)
	0.6 (0.024) O.S	60	6.2-6.4 (0.244-0.252)	34.60-34.625(1.362-1.363)

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Fig. 135: Valve Seat Insert Oversize Table
Courtesy of HYUNDAI MOTOR CO.

VALVE GUIDE REPLACEMENT PROCEDURES

The valve guide is installed using a press fit. Using a Valve Guide Installer (09221-22000) or suitable tool, replace the valve guide described in the following procedure.

1. Using the Valve Guide installer push rod, push the valve guide out toward the cylinder block with a press.

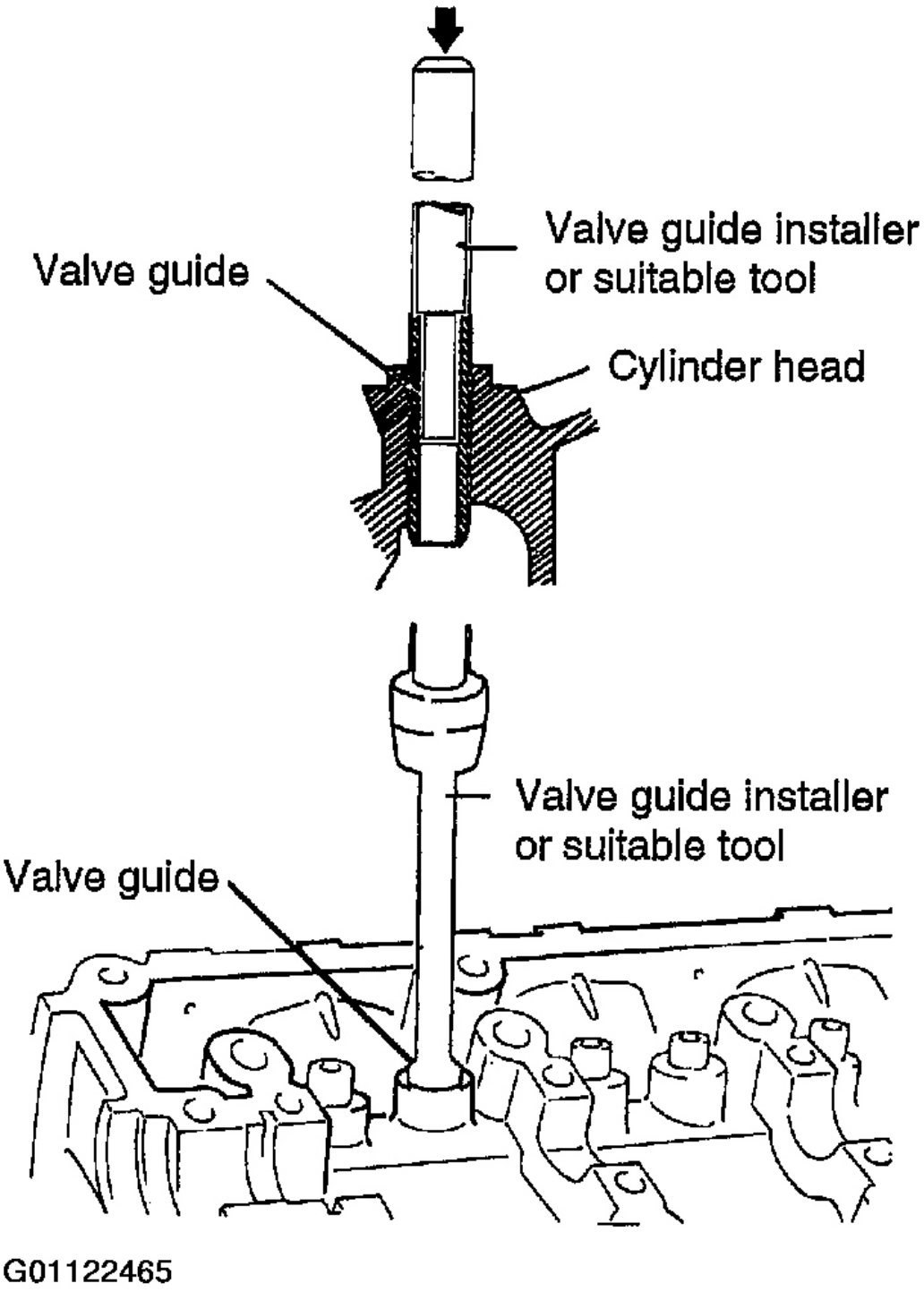

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Fig. 136: Pushing Valve Guide Out Toward Cylinder Block
Courtesy of HYUNDAI MOTOR CO.

2. Machine the valve guide insert hole in the cylinder head to the specified oversize of the new valve guide.
3. Using the Valve Guide Installer or suitable tool, press fit the valve guide. Using the valve guide installer makes it possible to press fit the valve guide to a predetermined height. Install the valve guide from the top of the cylinder head. Note that intake and exhaust valve guides differ in length (42.7 mm [1.68 in] for intake and 39.1 mm [1.54 in.] for exhaust).
4. After installing the valve guides, insert new valves and check the clearance.

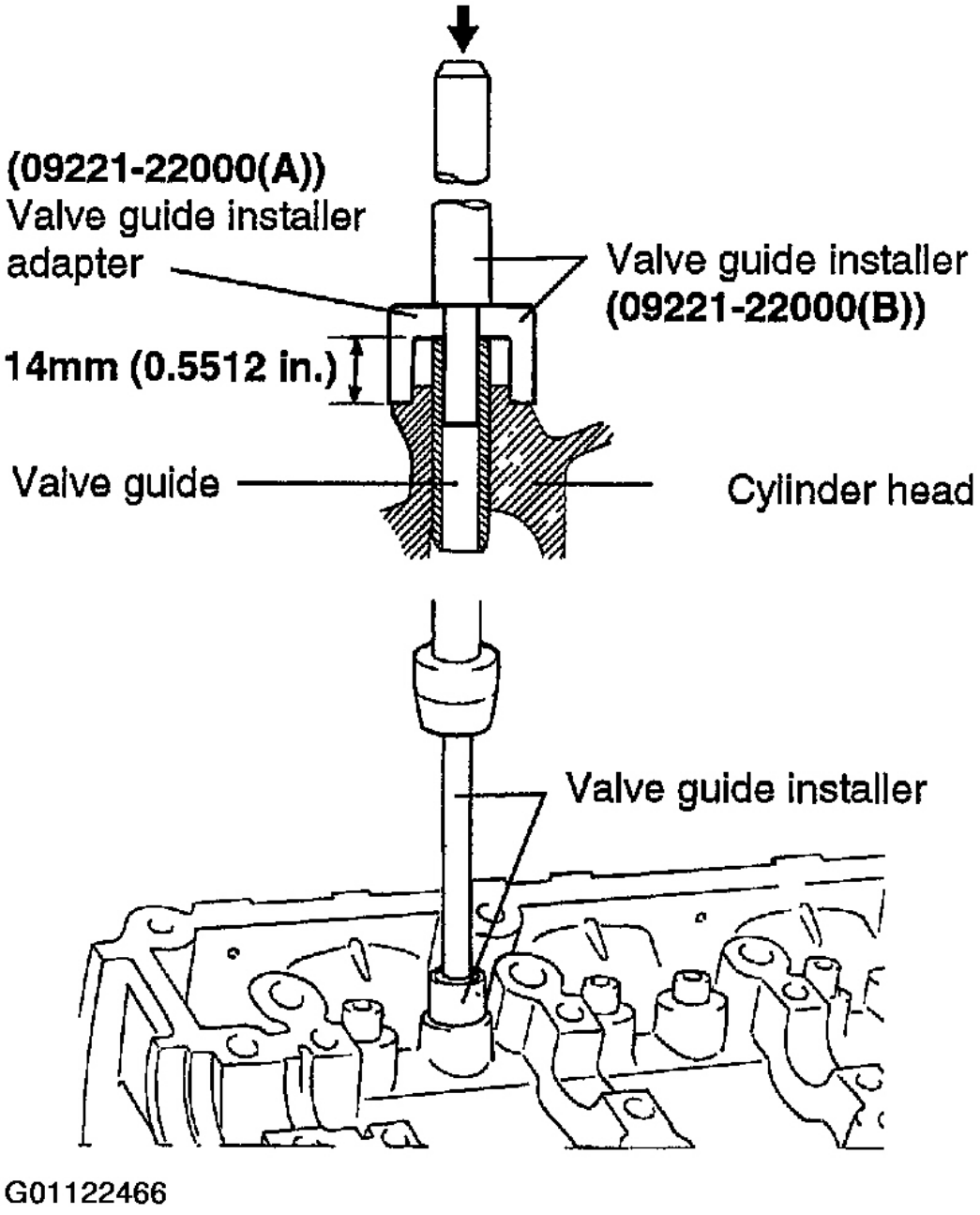

Fig. 137: Pressing Fitting Valve Guide
Courtesy of HYUNDAI MOTOR CO.

5. Whenever valve guides are replaced, check for valve-to-seat contact, and recondition the valve seats as necessary.

VALVES

COMPONENT

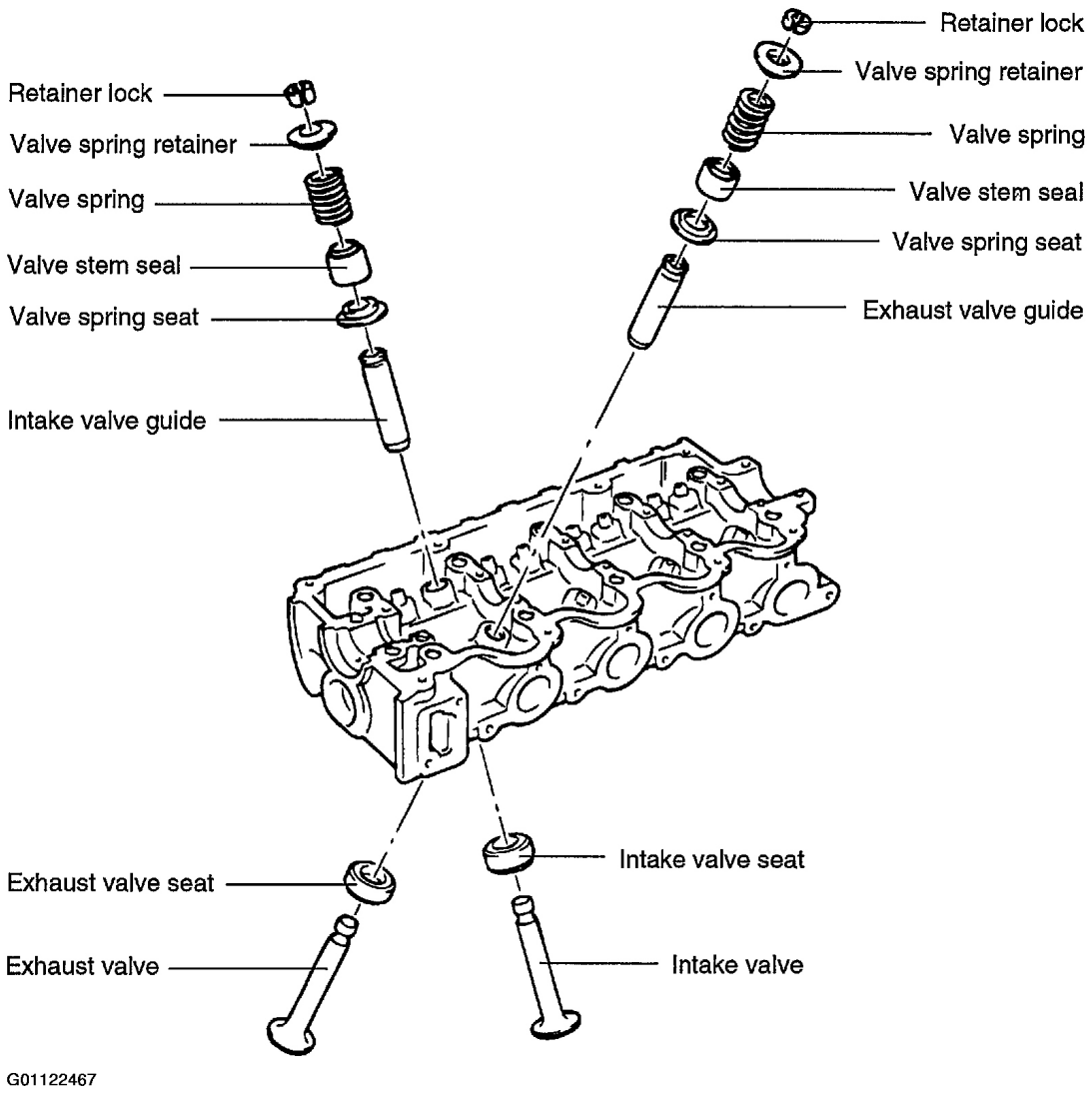

Fig. 138: Valve Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Using the special tool, Valve Spring Remover and Installer, remove the retainer lock. Next, remove the spring retainer, valve spring, spring seat and valve.

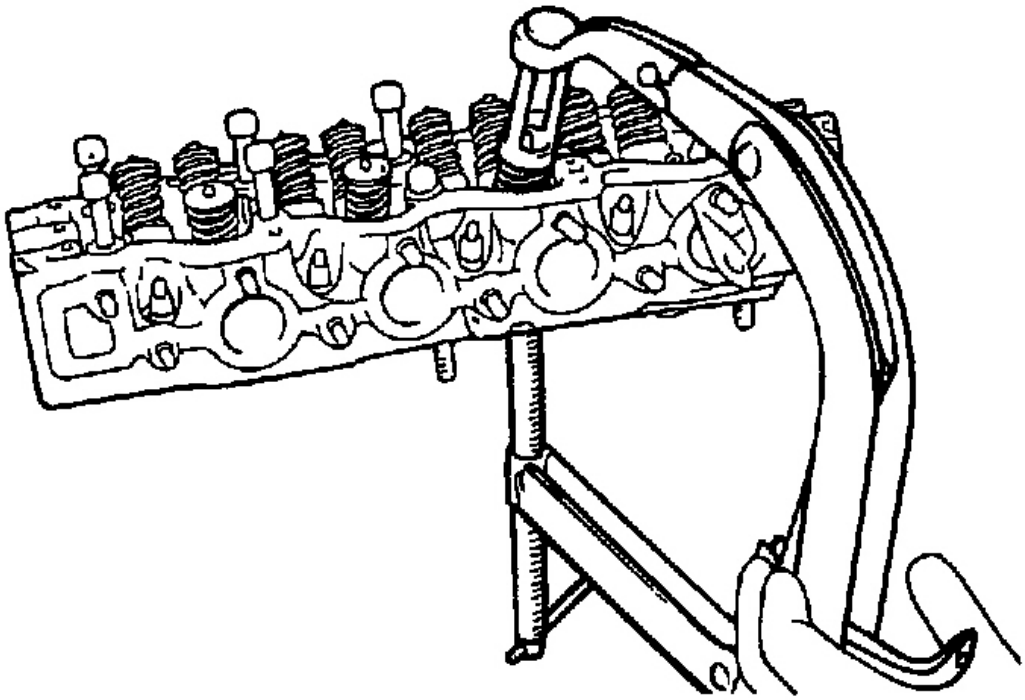

Fig. 139: Removing Valve Retainer Lock
Courtesy of HYUNDAI MOTOR CO.

NOTE: Keep these parts in order so that they can be reinstalled in their original positions.

2. Remove the valve stem seals with pliers, and discard them.

NOTE: Do not reuse the valve stem seals.

INSPECTION

VALVE SPRING

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

VALVE GUIDE OVERSIZE

VALVE SPRING

Standard value

Free height: 42.03mm (1.655 in.)

Load: 24.7kg at 34.5mm

Out of square: 1.5ohms or less

VALVE GUIDES

Check the valve stem-to-guide clearance. If the clearance exceeds the service limit, replace the valve guide with the next oversize part.

VALVE STEM-TO-GUIDE CLEARANCE:

Standard value

Intake: 0.03-0.06mm (0.0012-0.0024 in.)

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

Limit

Intake: 0.1mm (0.004 in.)

Exhaust: 0.15mm (0.006 in.)

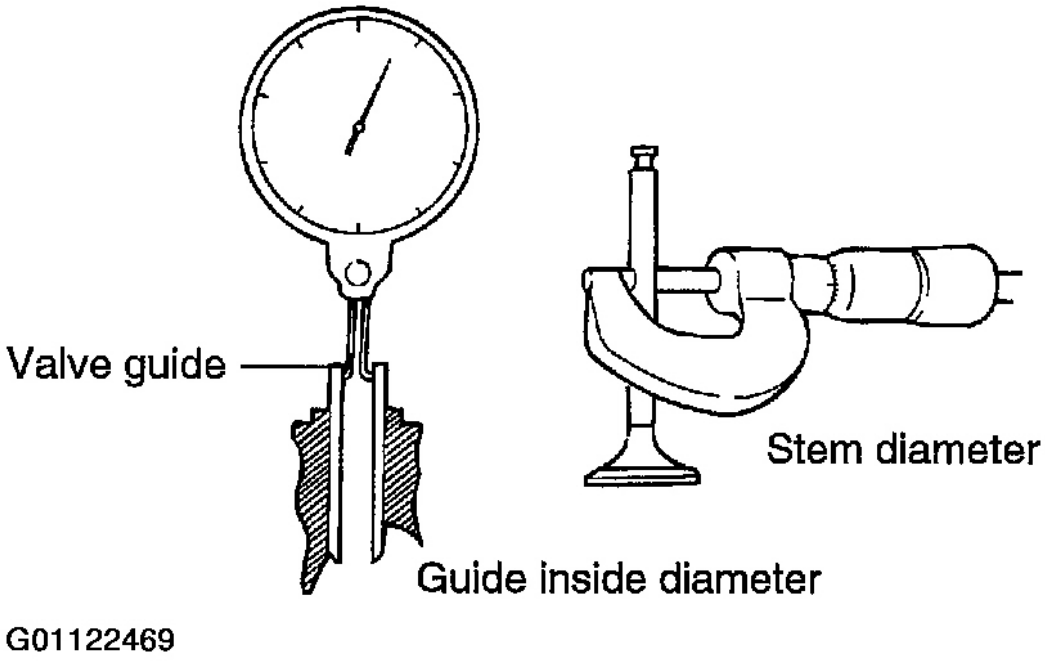

Fig. 140: Measuring Valve Stem Diameter
Courtesy of HYUNDAI MOTOR CO.

Size mm (in.)	Size mark	Cylinder head hole size mm (in.)
0.05 (0.002) O.S.	5	11.05-11.058 (0.435-0.4354)
0.25 (0.010) O.S.	25	11.25-11.258 (0.429-0.4432)
0.50 (0.020) O.S.	50	11.50-11.508 (0.4528-0.4531)

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Fig. 141: Valve Guide Oversize Table
Courtesy of HYUNDAI MOTOR CO.

VALVE SEAT INSERT

Check the valve seat for evidence of overheating and improper 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, 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.

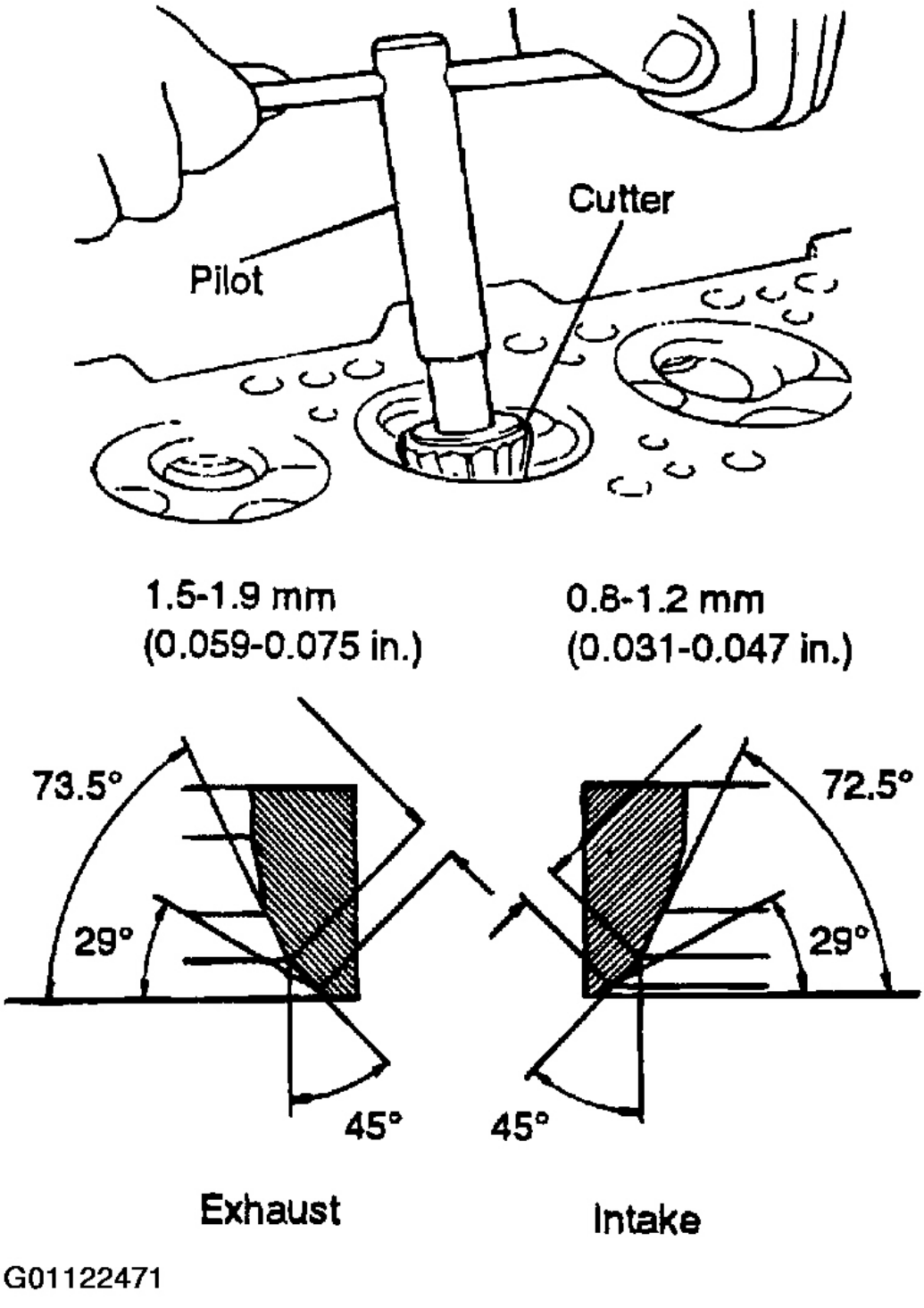

Fig. 142: Reconditioning Valve Seat
Courtesy of HYUNDAI MOTOR CO.

VALVES

Check each valve for wear, damage and distortion of head and stem at B. Repair or correct, if necessary. If stem end A is pitted 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.

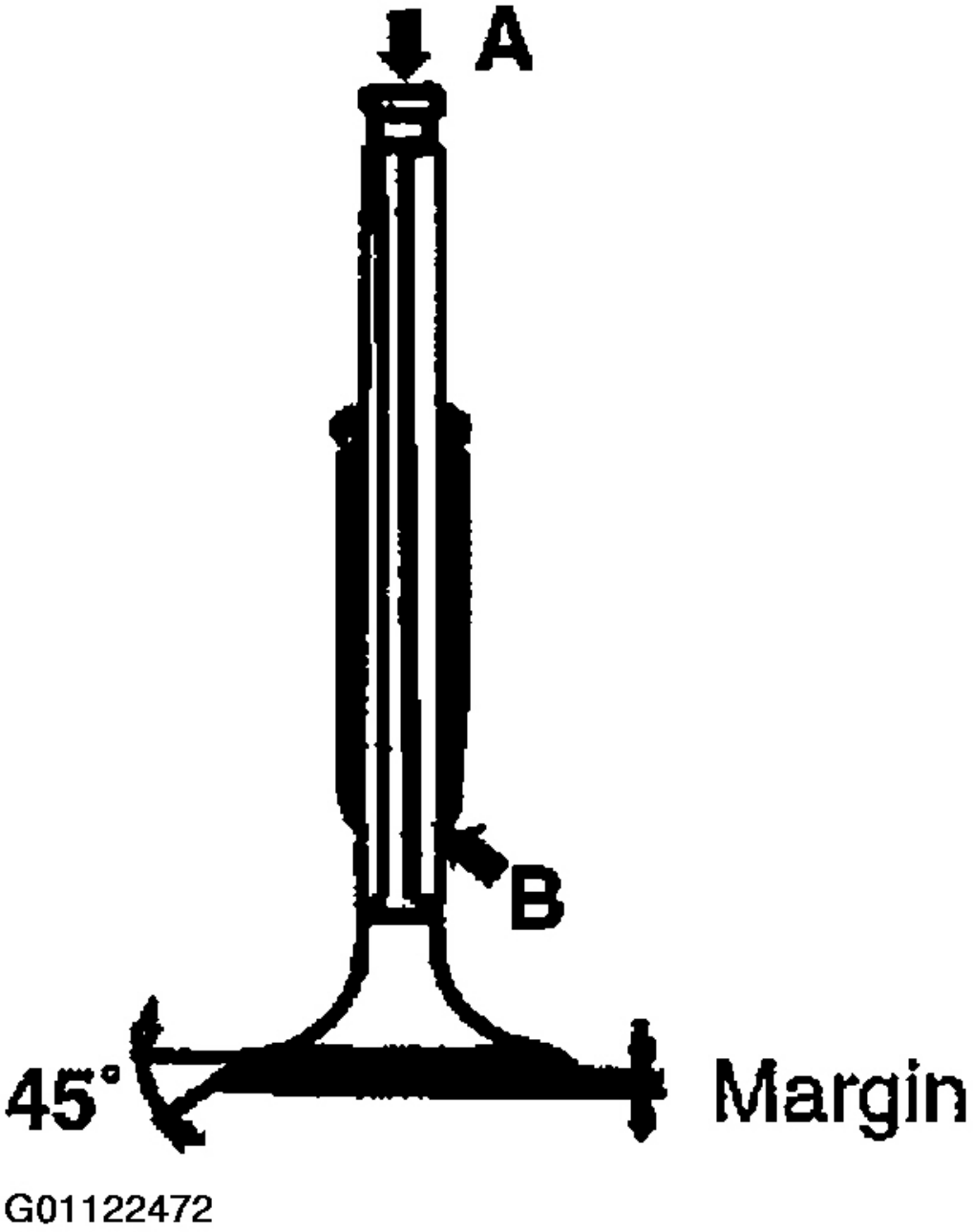

Fig. 143: Checking Valve For Wear, Damage & Distortion
Courtesy of HYUNDAI MOTOR CO.

VALVE STEM-TO-GUIDE CLEARANCE:

Standard value

Intake: 1.1mm (0.043 in.)

Exhaust: 1.4mm (0.055 in.)

Limit

Intake: 0.8mm (0.031 in.)

Exhaust: 1.1mm (0.043 in.)

REASSEMBLY

NOTE:

1. **Thoroughly clean each part before assembly.**
2. **Apply engine oil to sliding and rotating parts.**

1. After installing the spring seat, fit the stem seal onto the valve guide.

   To install, fit the seal in by lightly tapping the Special Tool, Valve Stem Oil Seal installer (09222-22001)

   The seal is installed in the specified position by means of the special tool. Incorrect installation of the seal will adversely affect the lip I.D. and eccentricity, resulting in oil leaking down the valve guides. Therefore, when installing, be careful not to twist the seal. Do not reuse old stem seals.

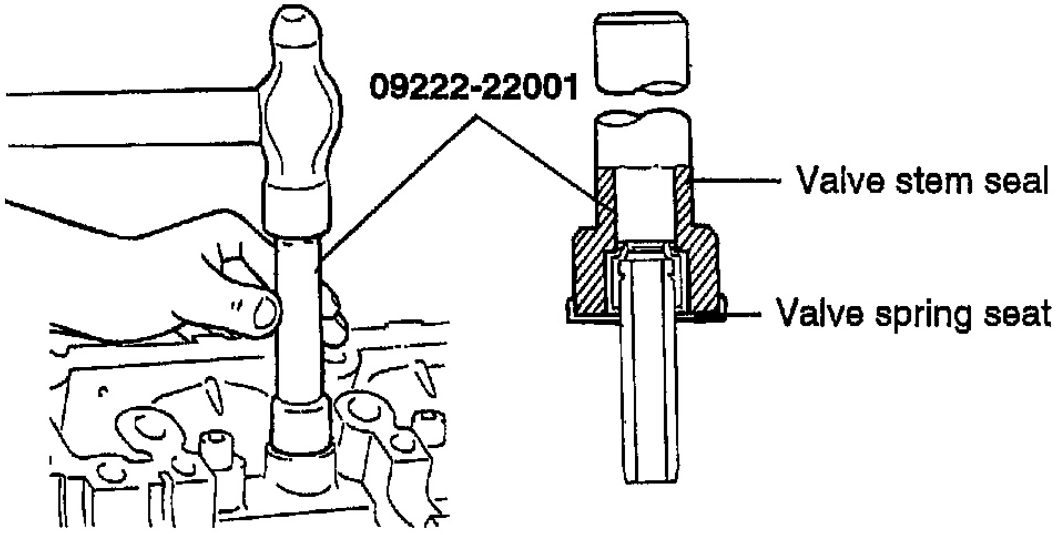

Fig. 144: Installing Valve Seal

Courtesy of HYUNDAI MOTOR CO.

2. Apply engine oil to each valve. Insert the valves into the valve guides. Avoid using force when inserting the valve into the seal. After insertion, check to see if the valve moves smoothly.
3. Install springs and spring retainers. Valve springs should be installed with the enamel coated side toward the valve spring retainer.

   Valve springs should be installed with the enamel coated side toward the valve spring retainer.

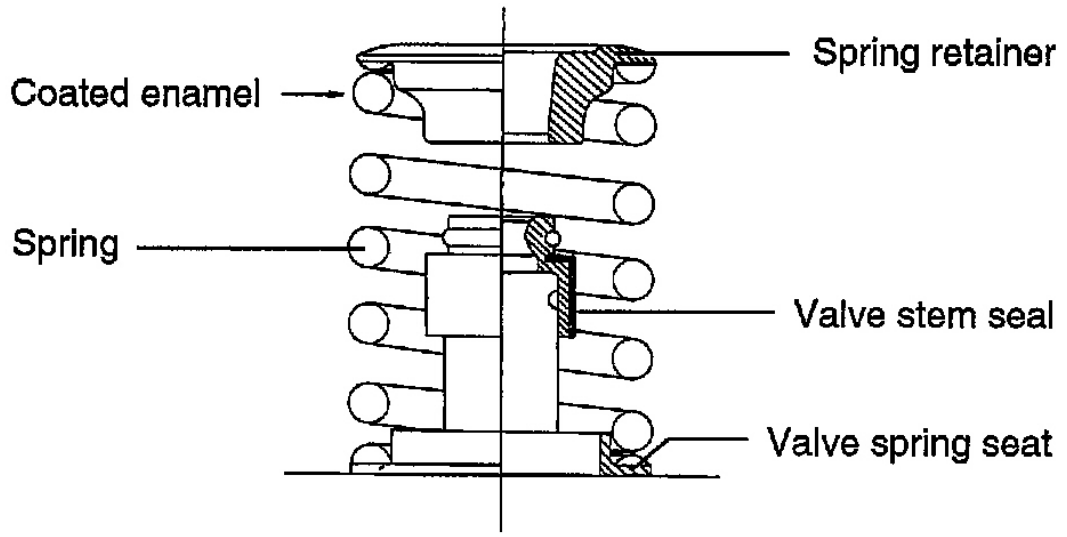

Fig. 145: Locating Springs & Spring Retainers
Courtesy of HYUNDAI MOTOR CO.

4. Using special tool, Valve Spring Remover and Installer, compress the spring. Be careful that the valve stem seal is not distorted by the bottom of the retainer. Then install the retainer locks. After installation of the valves, make certain that the retainer locks are properly installed.

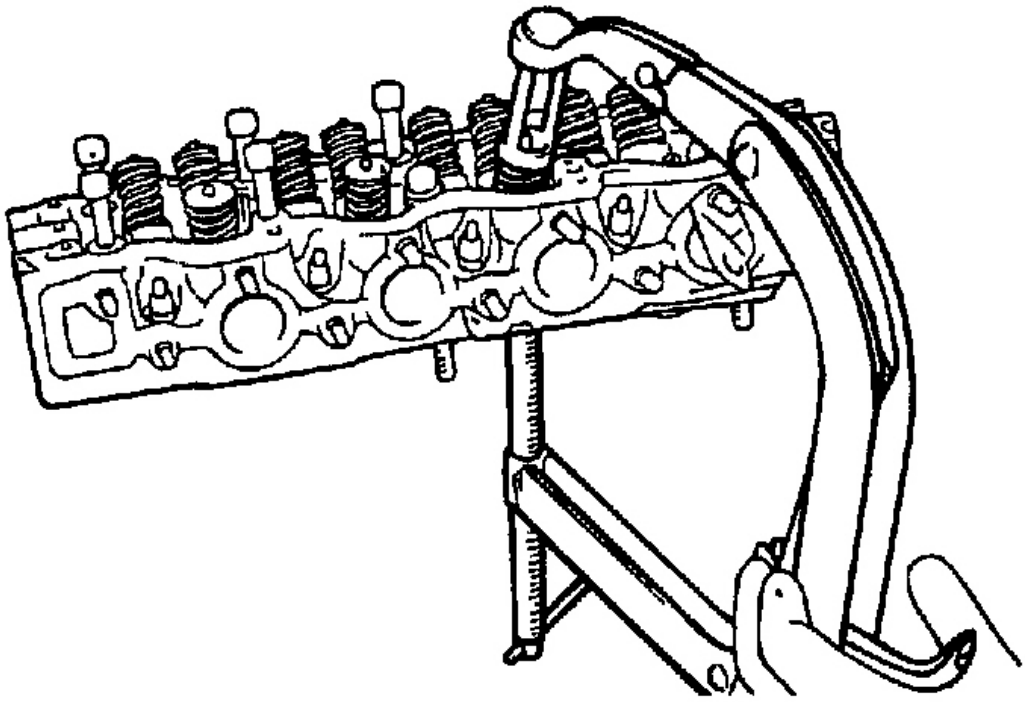

Fig. 146: Installing Valve Spring Retainer
Courtesy of HYUNDAI MOTOR CO.

5. Install the cylinder head. Refer to **CYLINDER HEAD**.

TIMING SYSTEM

TIMING BELT

COMPONENTS

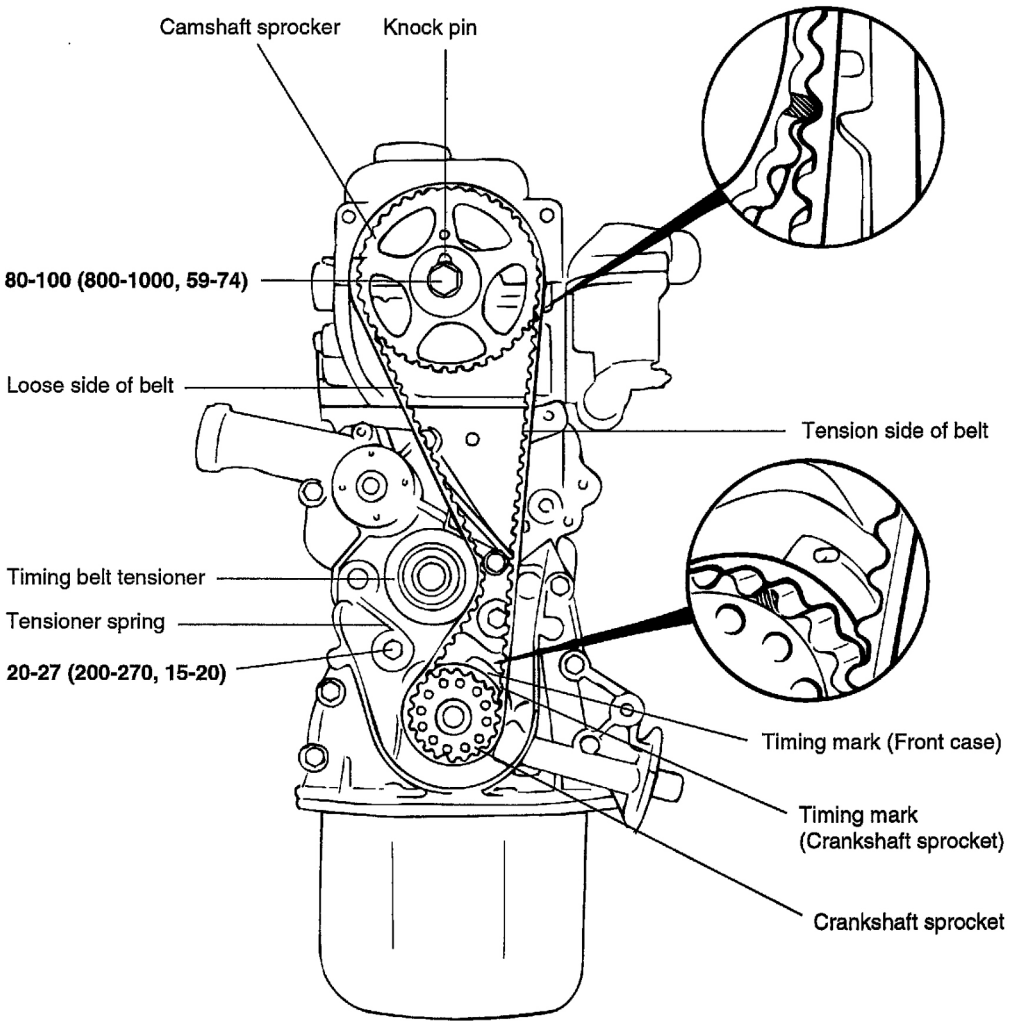

Fig. 147: Timing Belt Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Loosen the coolant pump pulley bolt.
2. Loosen the generator bolt.
3. Remove the coolant pump pulley and belt.
4. Remove the crankshaft pulley.
5. Remove the timing belt cover.

6. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.
7. Remove the camshaft from the camshaft sprocket.
8. Remove the camshaft sprocket.
9. Remove the timing belt.

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

10. Remove the crankshaft sprocket bolts. Remove the crankshaft sprocket and flange.
11. Remove the timing belt tensioner.

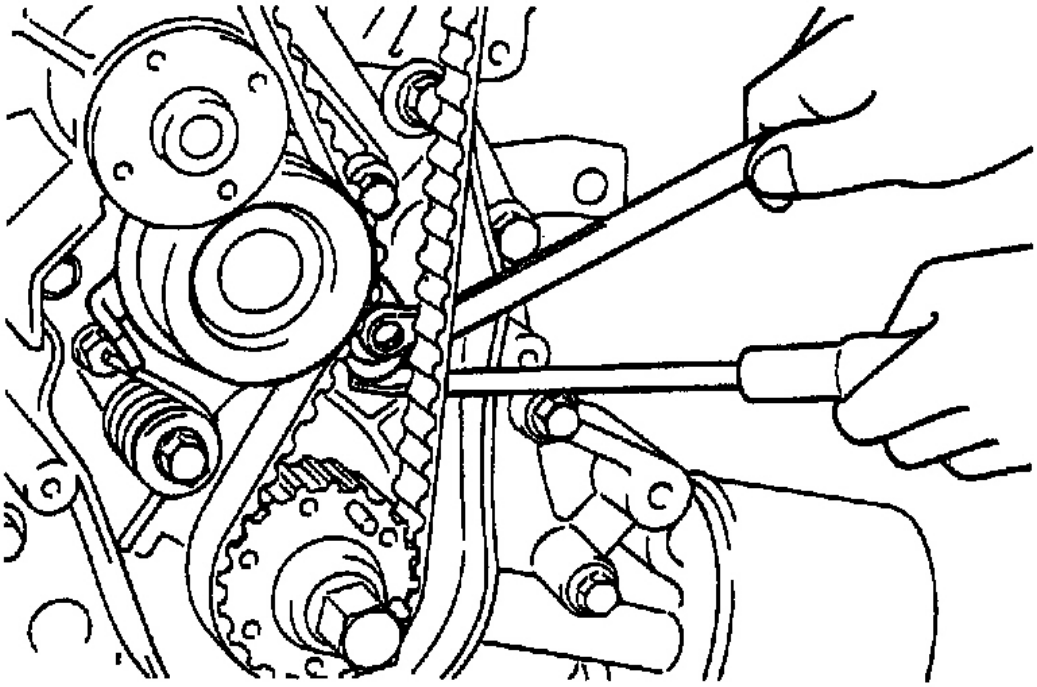

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Fig. 148: Removing Timing Belt Tensioner
Courtesy of HYUNDAI MOTOR CO.

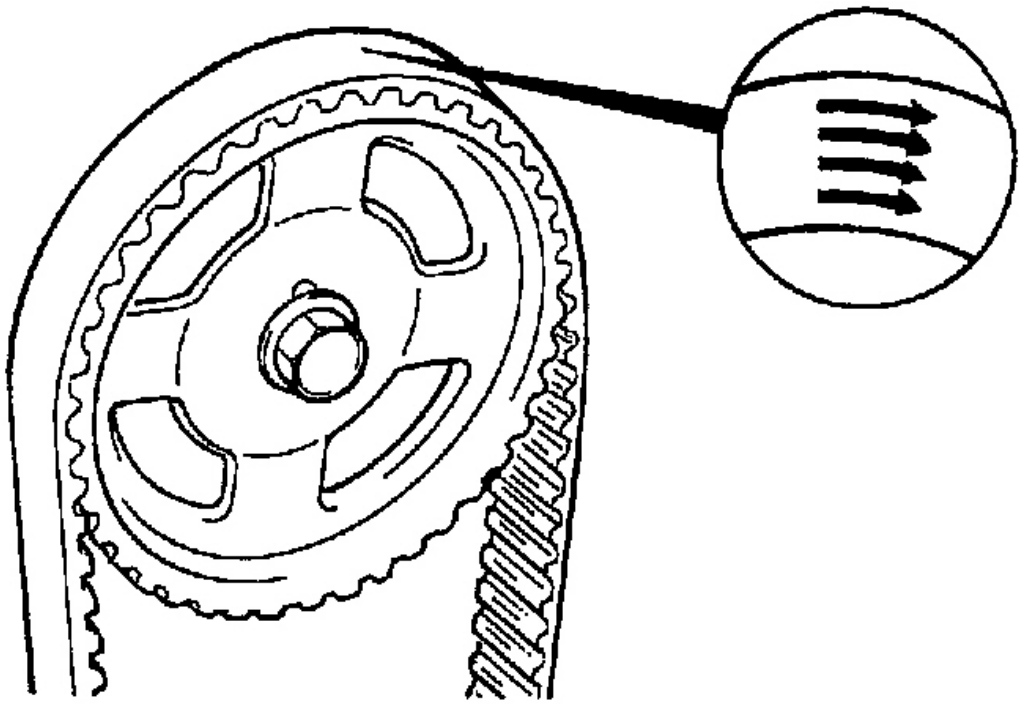

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Fig. 149: Locating Timing Belt Installation Direction
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

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.

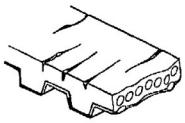
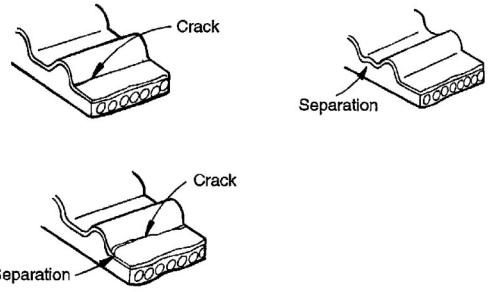
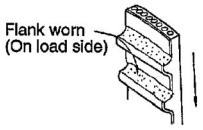
Description	Flaw conditions
1. Hardened back surface Back surface glossy. Non-elastic and so hard that when your fingernail is pressed into it, no mark is produced.	
2. Cracked back surface rubber	
3. Cracked or separating canvas	
4. Badly worn teeth (initial stage) Canvas on load side tooth flank worn (Fluffy canvas fibers, rubber gone and color changed to white, and unclear canvas texture)	

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Fig. 150: Timing Belt Flaw Conditions (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

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

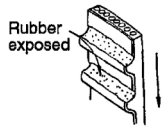
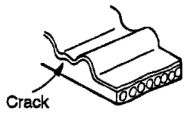
Description	Flaw conditions
5. Badly worn teeth (last stage) Canvas on load side tooth flank worn down and rubber exposed (tooth width reduced)	
6. Cracked tooth bottom	
7. Missing tooth	
8. Side of belt badly worn **NOTE : A normal belt should have precisely cut sides as if cut by a sharp knife.**	
9. Side of belt cracked	

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Fig. 151: Timing Belt Flaw Conditions (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

SPROCKETS AND TENSIONER

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 pulley rotation and check for play or noise. Replace as necessary.

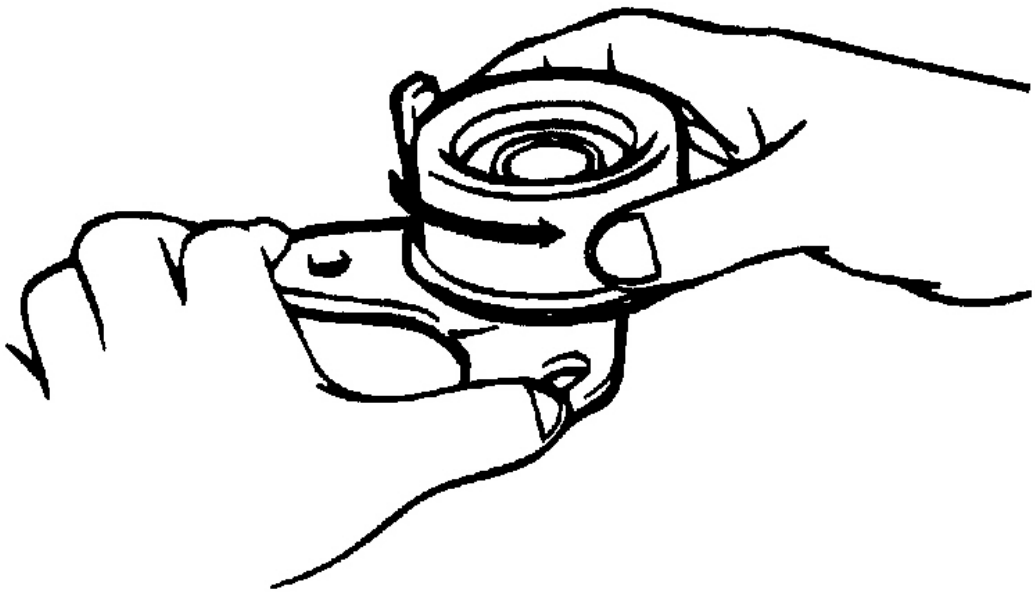

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Fig. 152: Inspecting Tensioner Pulley
Courtesy of HYUNDAI MOTOR CO.

TENSIONER INSTALLATION PROCEDURE

1. Temporarily fasten timing belt tensioner in such a position as to place it's pulley nearest to the coolant pump (pulley may touch coolant pump body)

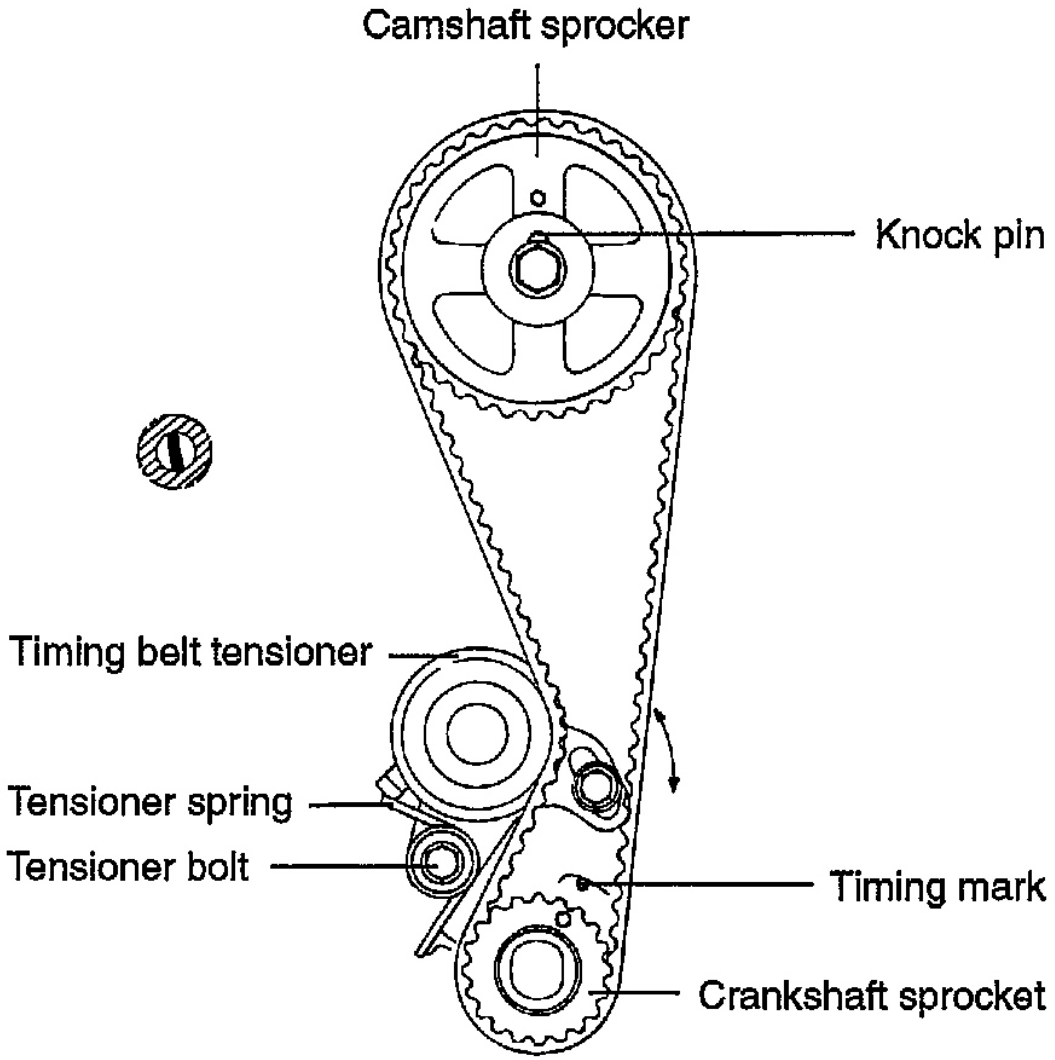

Fig. 153: Identifying Tensioner Components
Courtesy of HYUNDAI MOTOR CO.

2. After installing the tensioner, the crankshaft sprocket and the camshaft sprocket match the timing mark of each sprocket as shown in the illustration.

   Rotate the crankshaft until the No. 1 cylinder is at top dead center on the compression stroke.

CAUTION:
1. **Be sure to install the flange in the correct direction (Chamfered part shows front of engine).**
2. **When installing the camshaft sprocket, make sure that the pin**

on the camshaft fits the small hole in the pulley.

NOTE: Allow tensioner to remain in assemble state and must be installed temporarily as follows.
Then set extended end of tensioner spring at front case with drive etc.

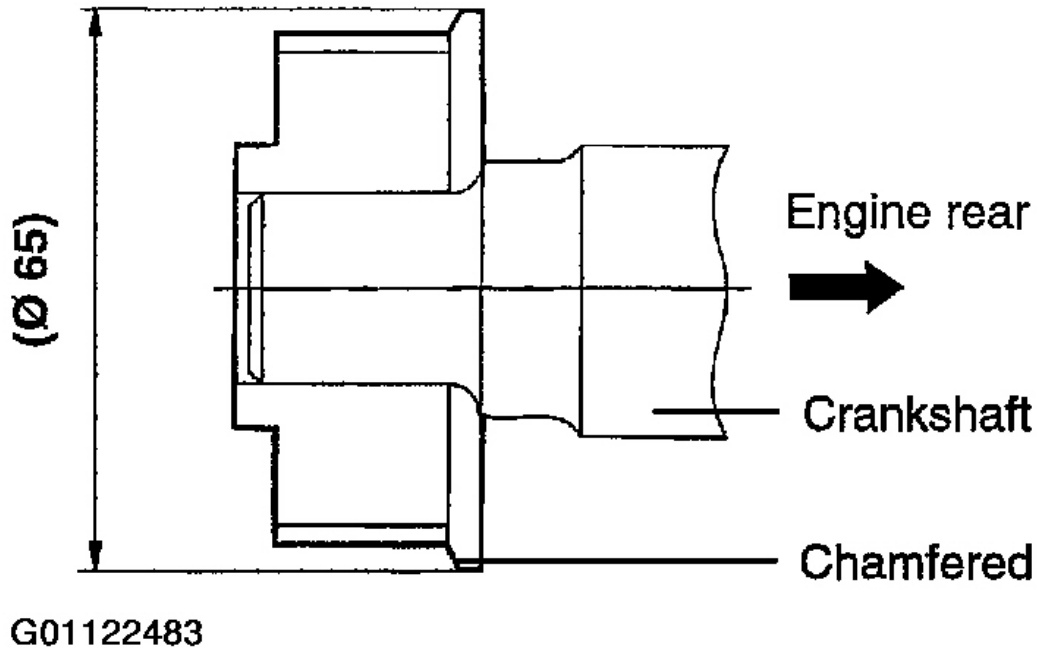

Fig. 154: Identifying Crankshaft Sprocket Installation
Courtesy of HYUNDAI MOTOR CO.

3. Install the timing belt so as not to allow slack to the tension side.

   Make sure that all timing marks are at their correct position with the tension side in a strained state by applying force to the camshaft sprocket in a counter clockwise direction.

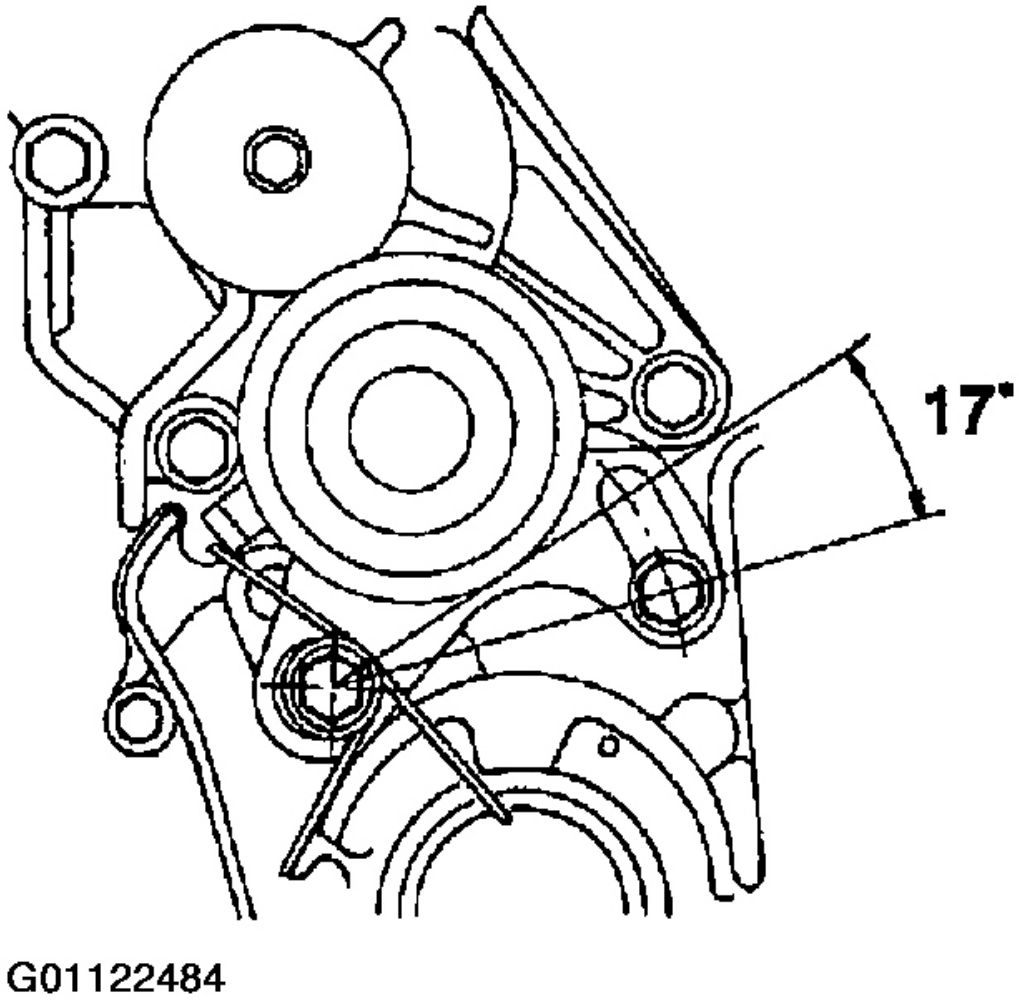

Fig. 155: Identifying Timing Belt Tensioner
Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

1. Install the flange and crankshaft sprocket as shown Pay close attention to their mounting directions.

   Tightening torque

   Crankshaft sprocket bolt:

   140-150Nm (1400-1500 kg.cm, 103-111 lb.ft)

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

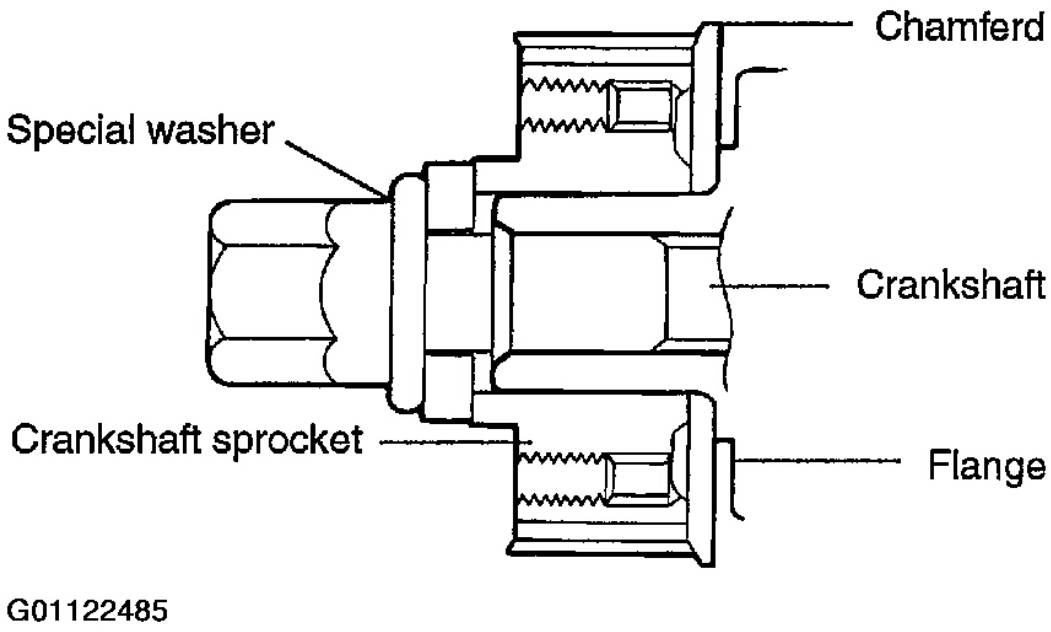

Fig. 156: Installing Flange & Crankshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

Tightening torque

Camshaft Sprocket bolt:

80-100Nm (800-1000 kg.cm, 59-74 lb.ft)

3. Align the timing marks of the camshaft sprocket and crank shaft sprocket, with the No.1 piston placed at top dead center on its compression stroke.

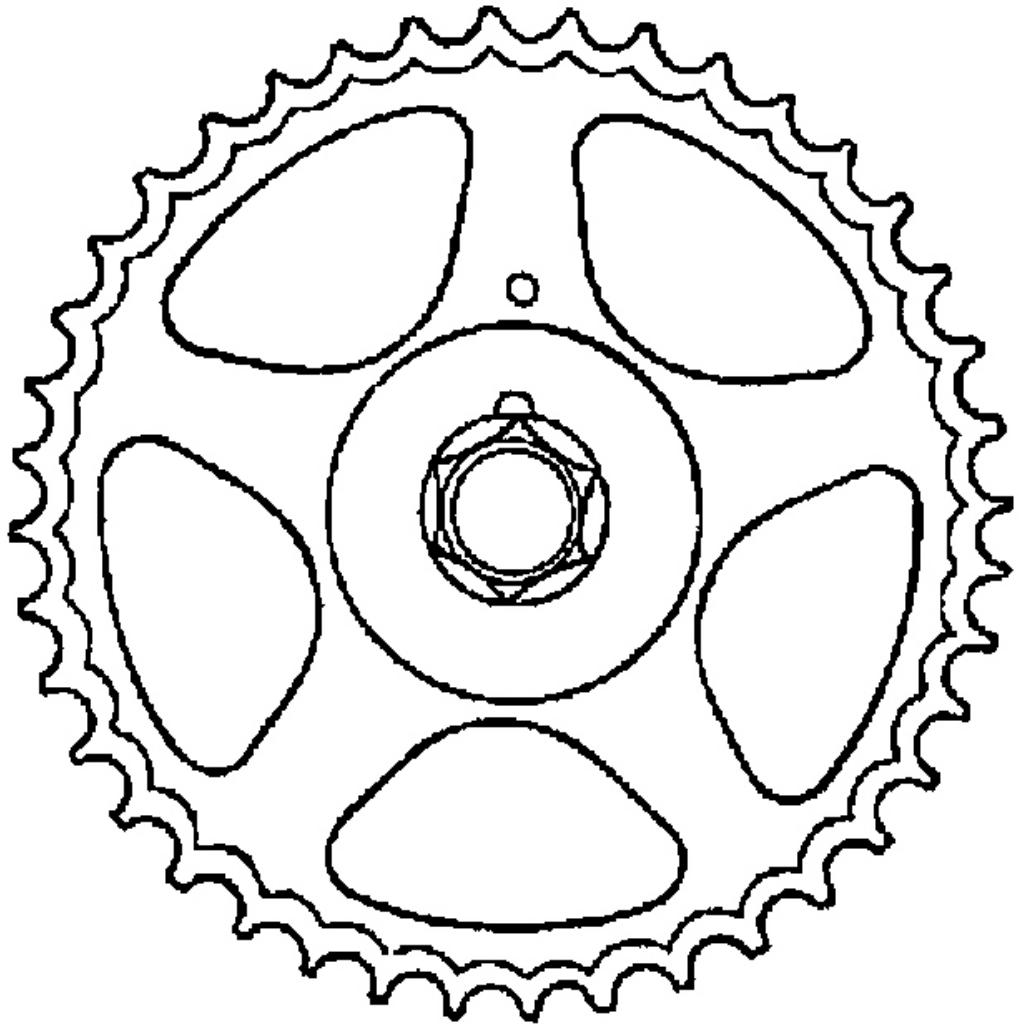

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Fig. 157: Identifying Timing Marks Of Camshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

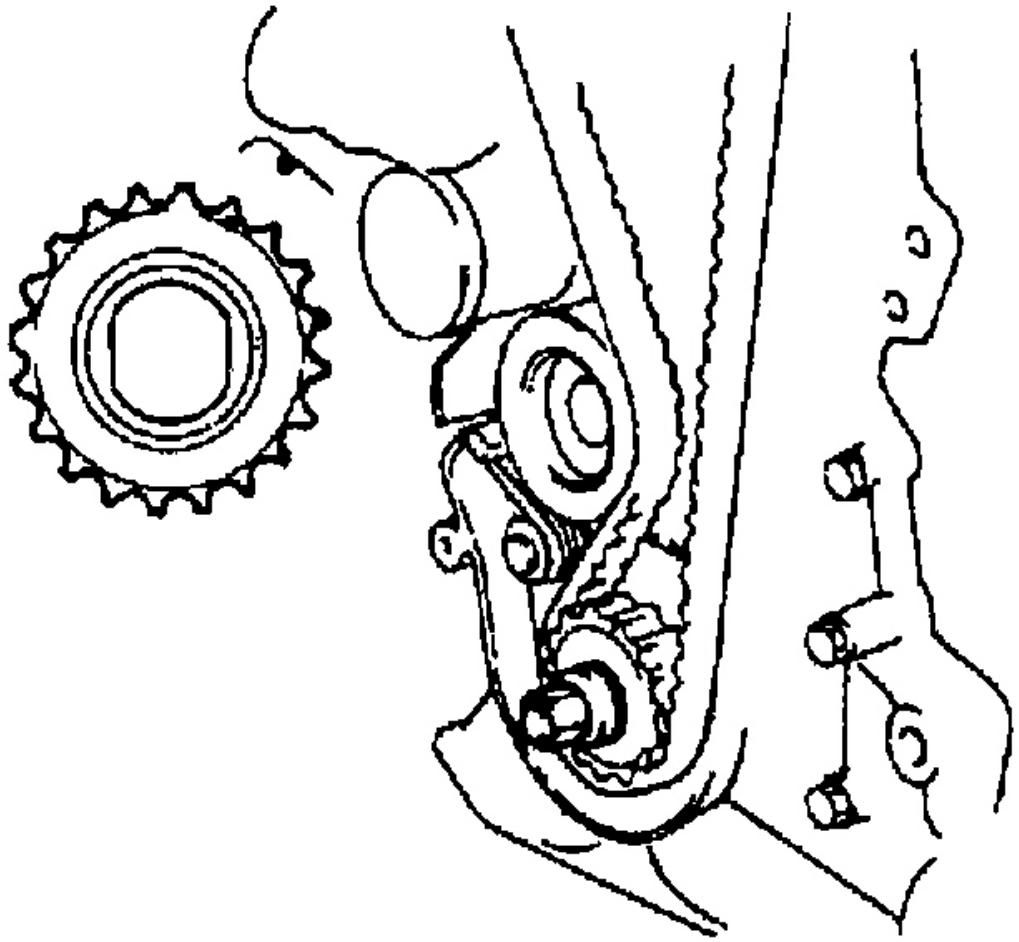

Fig. 158: Identifying Timing Marks Of Crank Shaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

4. To install the timing belt tensioner, first mount the tensioner, spring, and spacer. Temporarily tighten the bolts. Next, temporarily tighten the tensioner long hole side washer and bolts. Install the bottom end of the spring against the front case as shown in the illustration.
5. Secure the tensioner, postponed towards the coolant pump.
6. Install the timing belt on the crankshaft sprocket.

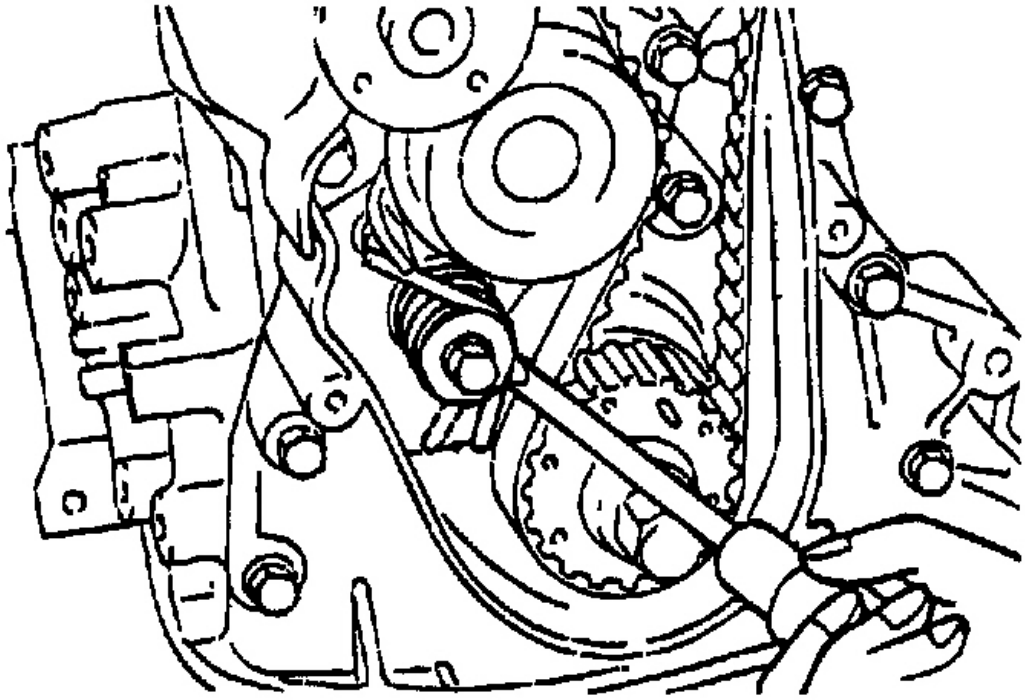

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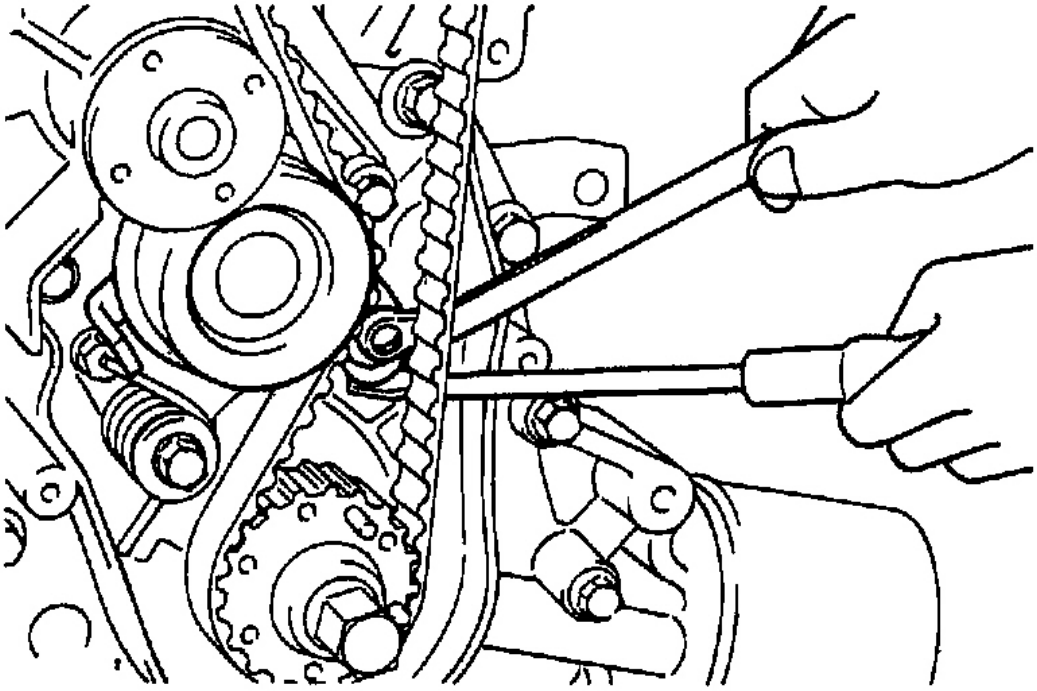
Fig. 159: Installing Timing Belt Tensioner
Courtesy of HYUNDAI MOTOR CO.

7. Install the timing belt on the camshaft sprocket. When the timing belt is installed on the camshaft sprocket, make sure that the tension side is tight. Then, check to ensure that when the tension side is tightened by turning the camshaft sprocket in a reverse direction, all timing marks are in line.



G01122489

Fig. 160: Tightening Timing Belt Tensioner Bolt
Courtesy of HYUNDAI MOTOR CO.

8. Loosen the tensioner mounting bolts 1 and 2 in that order as shown. This will apply spring tension to the timing belt only. Check the belt to ensure that it is not out of position.

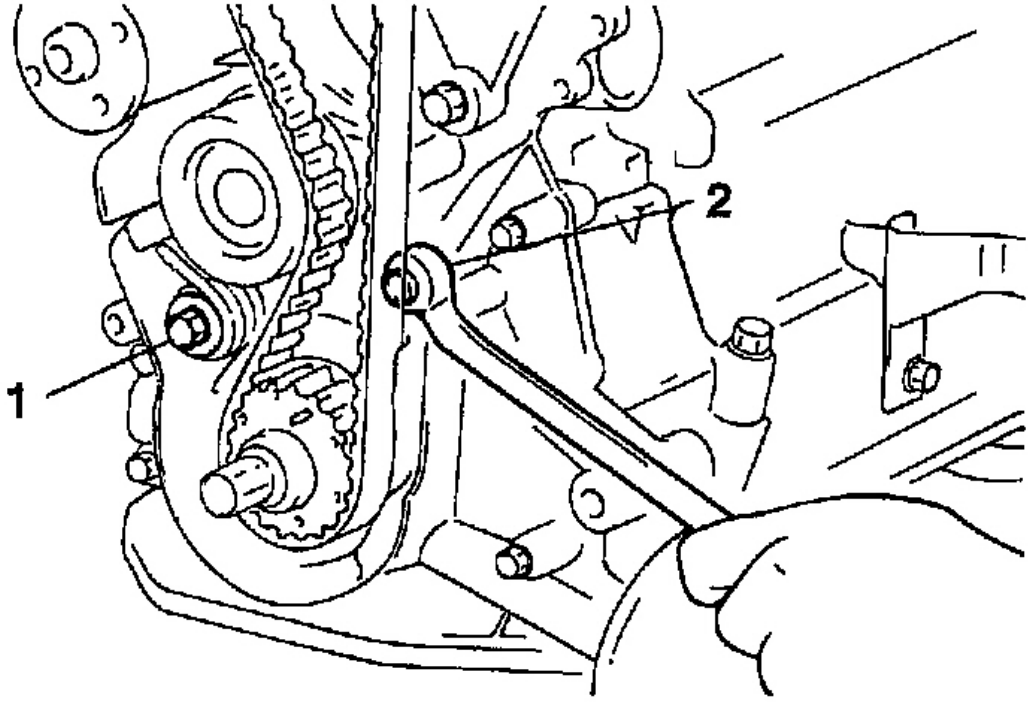


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Fig. 161: Loosening Tensioner Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

9. Tighten the tensioner tightening bolts 1 and 2 in that order. If the bolt 1 is tightened first, the tensioner will move with the belt in the direction that the belt is tightened.
10. Give the crankshaft one turn in operating direction (clock-wise) and realign crankshaft sprocket timing mark with the top dead center position.

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

11. Loosen the tensioner attaching bolt 1 and 2 in that order.
12. Tighten the tensioner attaching bolts 2 and 1 in that order to the specified torque.

Tightening torque

Tensioner attaching bolt:

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

13. Then recheck the belt tension. Verify that when the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49N (11lb)], the timing belt is offset from bolt head center by approximately bolt of the tensioner adjusting bolt head radius.

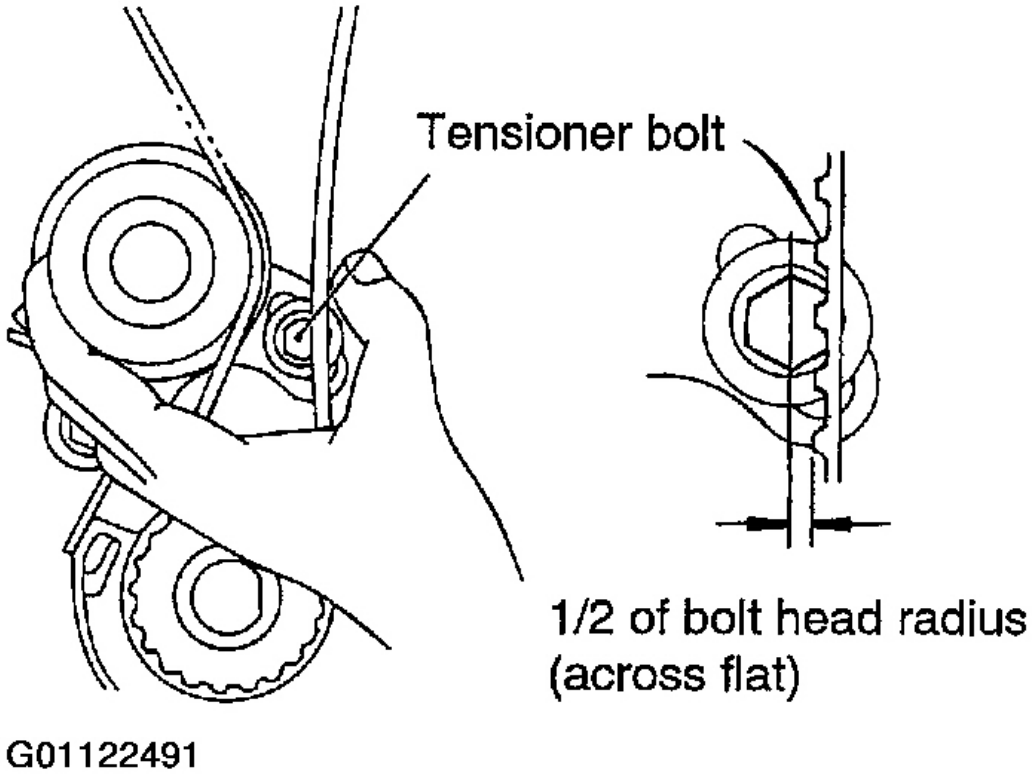

Fig. 162: Checking Timing Belt Tension
Courtesy of HYUNDAI MOTOR CO.

14. Install the timing belt cover.

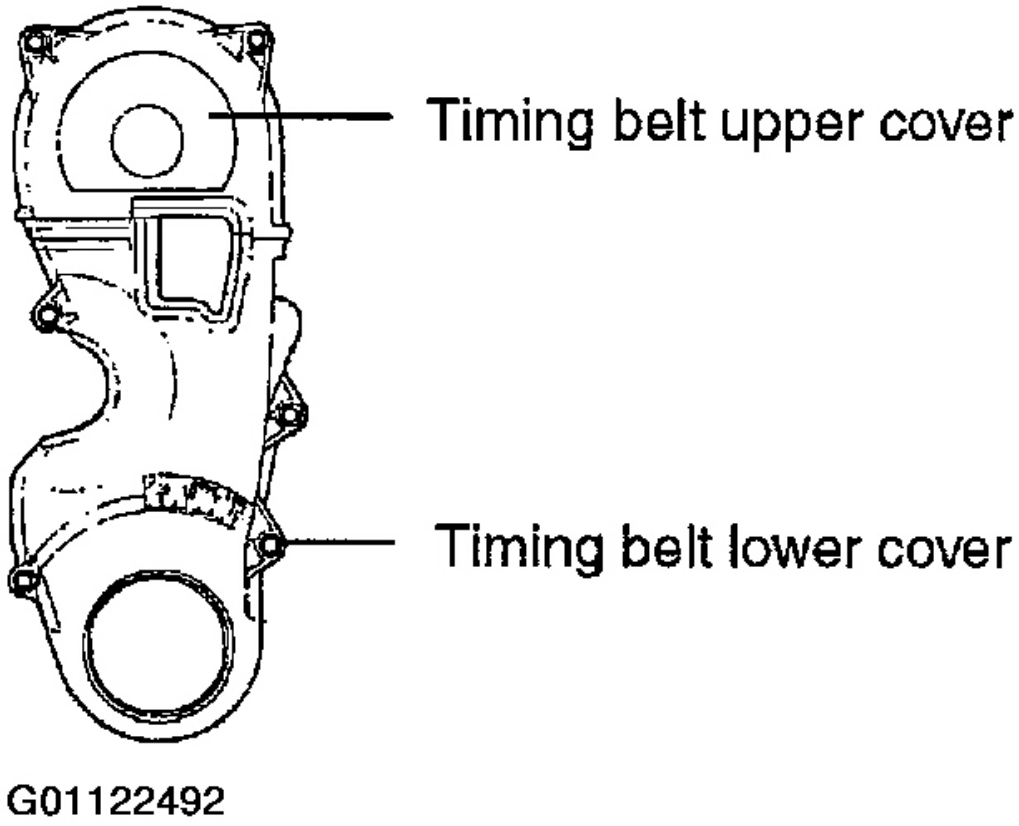

Fig. 163: Identifying Timing Belt Cover
Courtesy of HYUNDAI MOTOR CO.

Tightening torque

Timing belt cover bolt:

10-12 Nm (100-120 kg.cm, 7-6 lb.ft)

15. Install the crankshaft pulley. In this case, make sure that the crankshaft sprocket pin fits the small hole in the pulley.
16. Install the fan belt and adjust the belt tension.
17. Install the water pump pulley.
18. Install V-belt and adjust the belt tension.

TENSION MEASURING PROCEDURE

When using a tension gauge

1. Rotate the crankshaft in a counterclockwise direction to position of 90 degrees before top dead center as shown in the illustration.

NOTE: Make sure the valves are adjusted properly

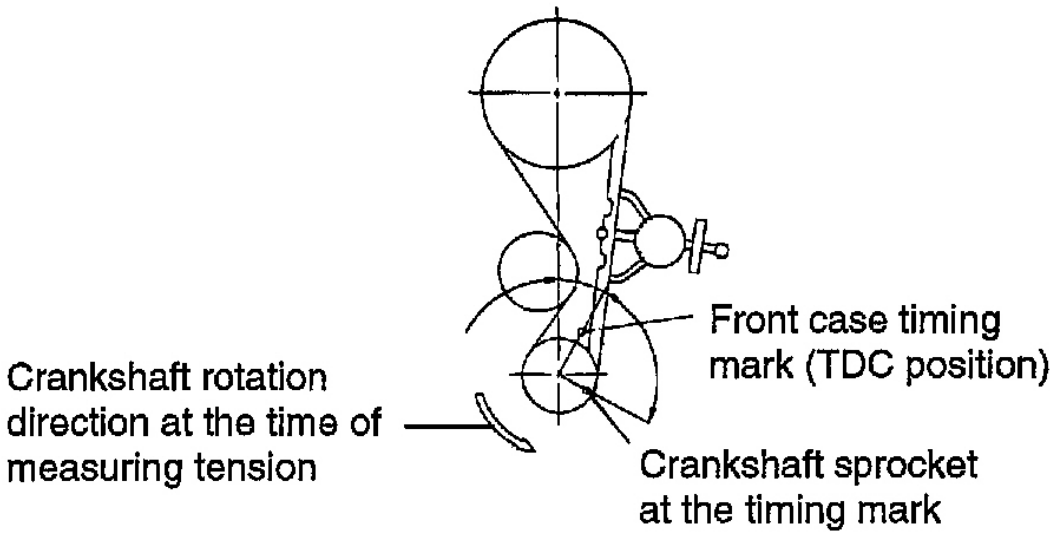

Fig. 164: Positioning Crankshaft 90° Before TDC
Courtesy of HYUNDAI MOTOR CO.

2. Measure the belt tension in the middle of the tension side of the belt using the tension gauge. (BOR-ROUGHS BT-33-73F TYPE)

Tightening torque

Timing belt tension (in cool condition):

9.5-16.5kg (20.9-36.4 lb)

CAUTION:
1. **Put arm on bottom of belt teeth. Put spindle on the middle of belt back surface.**
2. **Keep your hands off the indicator.**

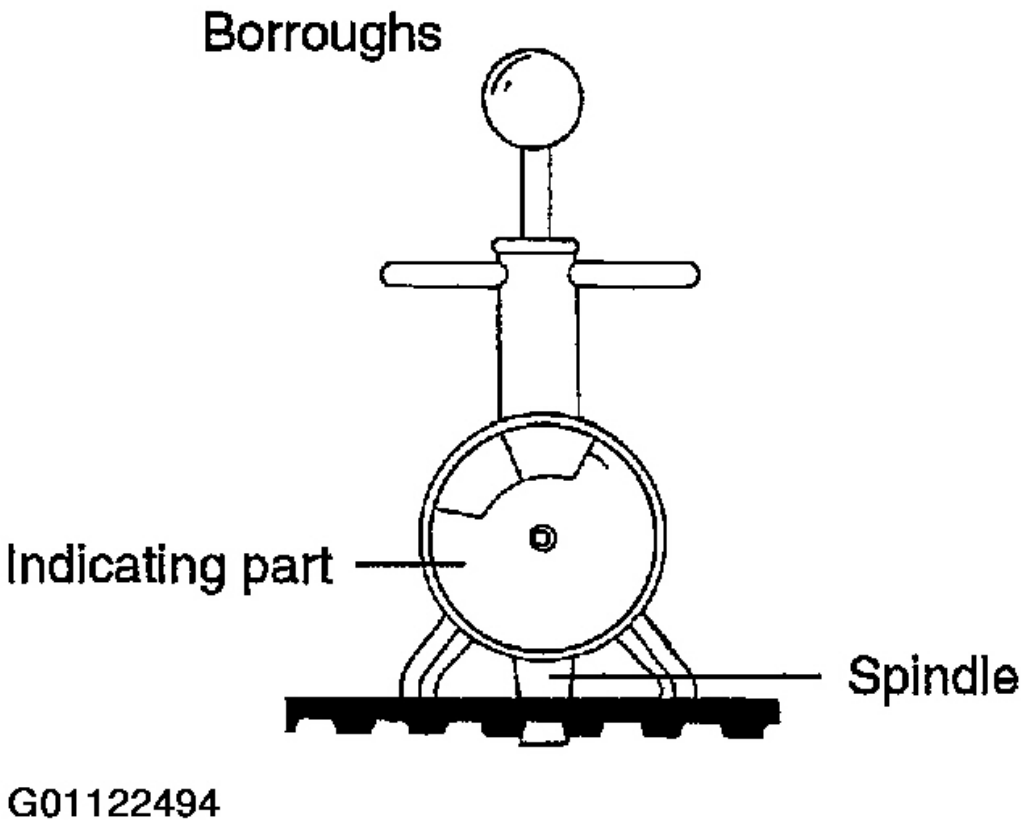

Fig. 165: Measuring Belt Tension
Courtesy of HYUNDAI MOTOR CO.

TIMING BELT TENSION ADJUSTMENT PROCEDURE

The timing belt has an automatic tension adjusting mechanism.

Adjustment can be made using the following procedure:

1. Turn the steering wheel fully counter-clockwise.
2. Apply a wood block under the engine oil pan and carefully raise the engine.

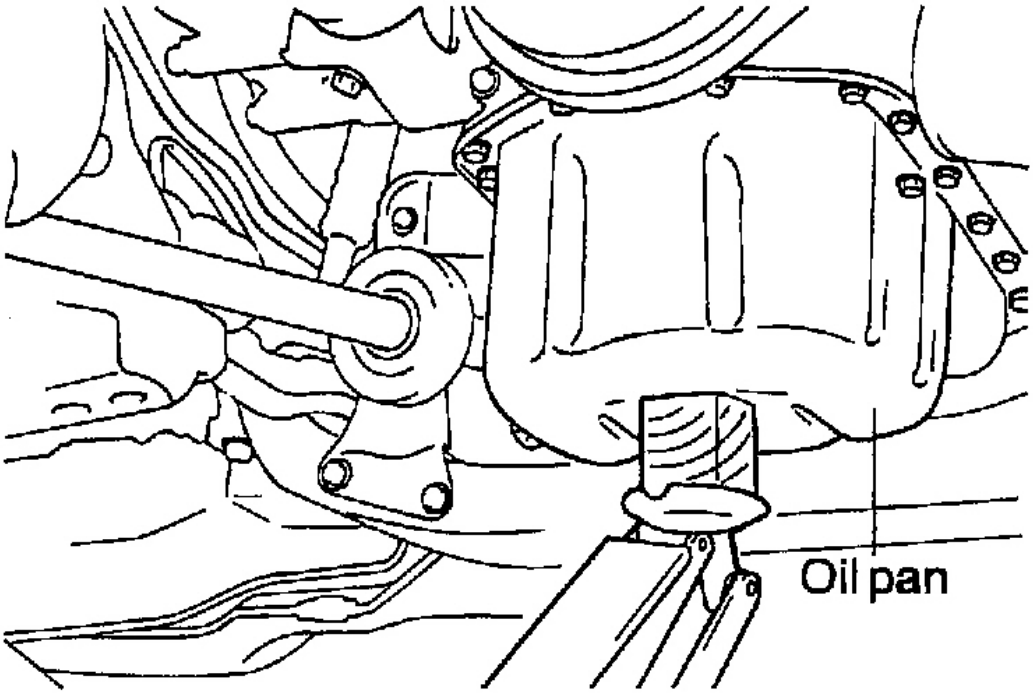

Fig. 166: Identifying Wood Block Under Engine Oil Pan
Courtesy of HYUNDAI MOTOR CO.

CAUTION: Jack up the vehicle only slightly to prevent engine damage.

3. Remove the left engine mount bracket.

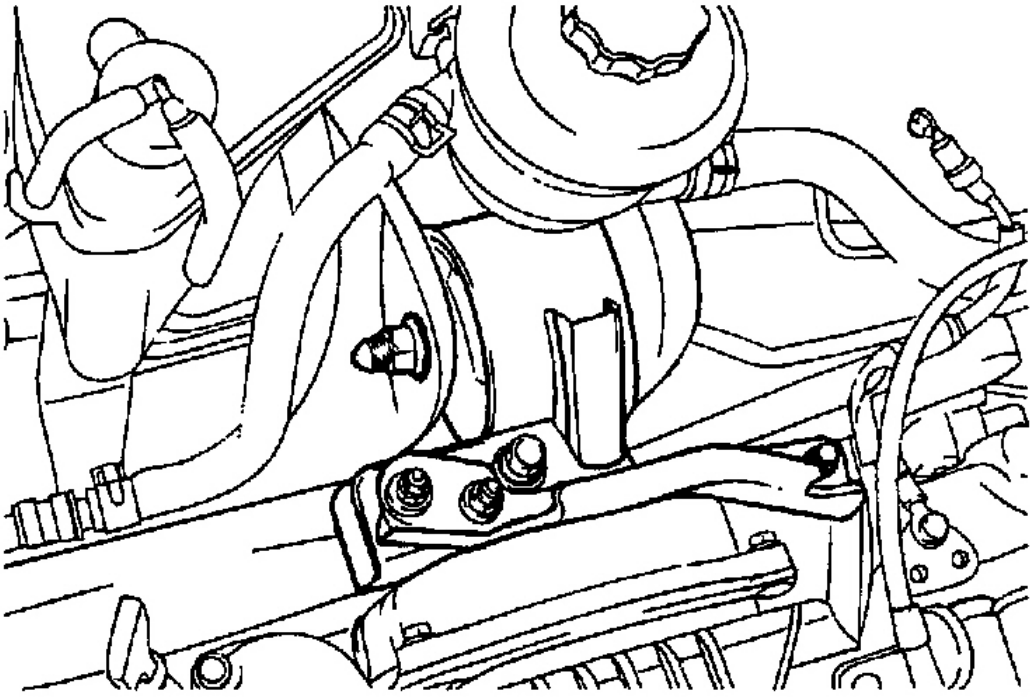

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Fig. 167: Removing Left Engine Mount Bracket
Courtesy of HYUNDAI MOTOR CO.

4. Remove the coolant pump pulley.
5. Remove the crankshaft pulley.

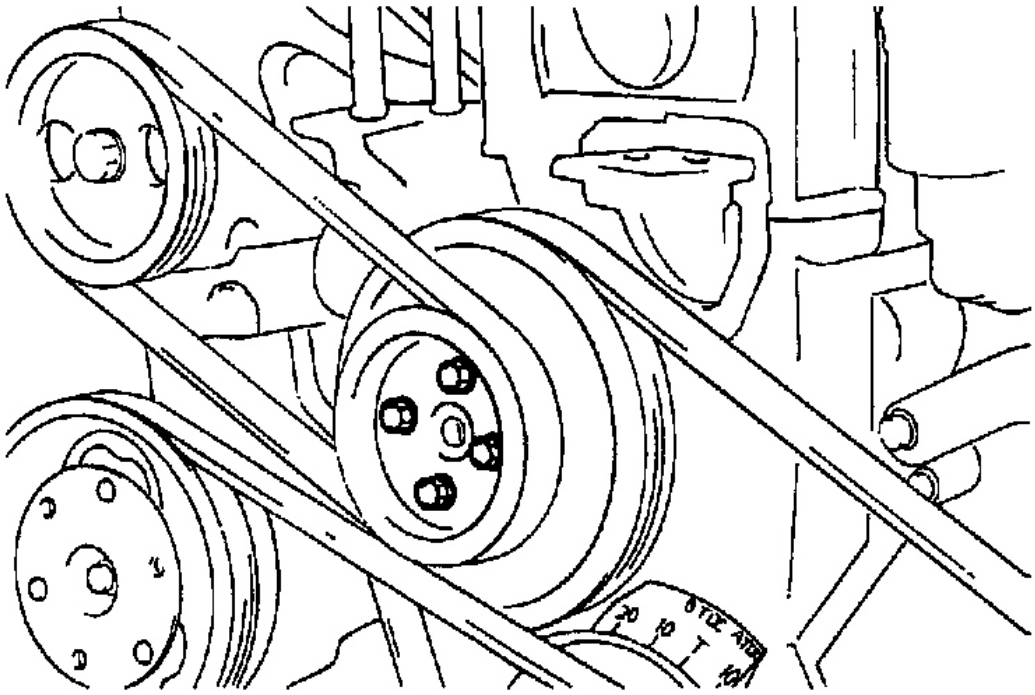

Fig. 168: Removing Crankshaft Pulley
Courtesy of HYUNDAI MOTOR CO.

6. Remove the timing belt upper cover.

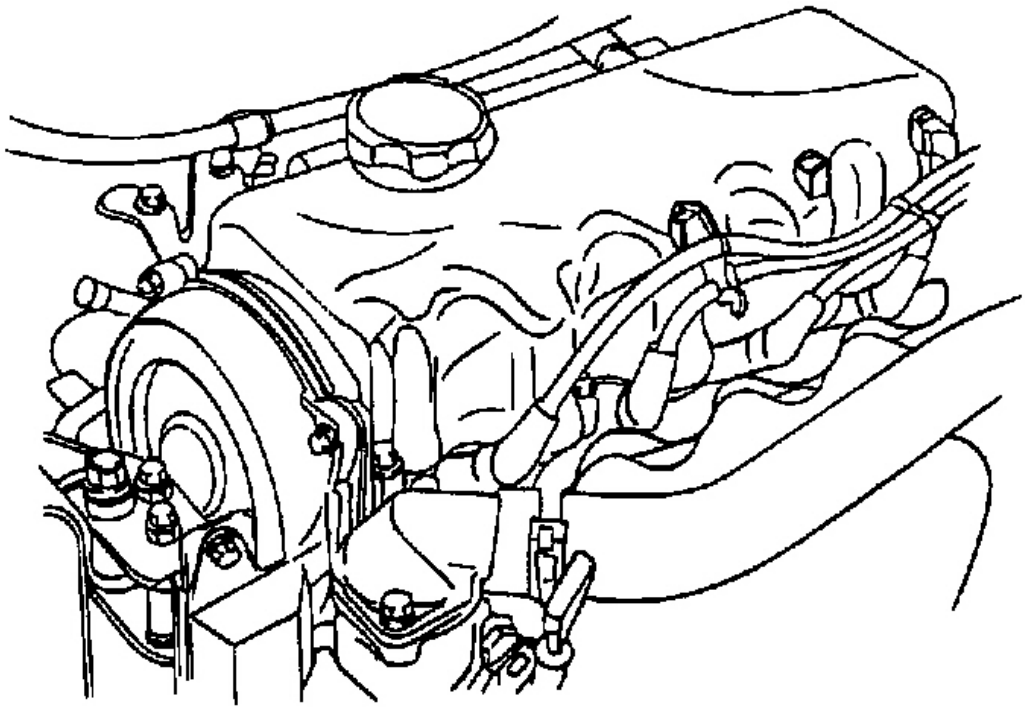

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Fig. 169: Removing Timing Belt Upper Cover
Courtesy of HYUNDAI MOTOR CO.

7. Check the belt for cracking, peeling or other damage. Be sure to carefully check the entire length of the belt.
8. Rotate the crankshaft so that the No. 1 piston is at top dead center of the compression stroke. In other words, align the timing mark on the camshaft sprocket with that on the cylinder head.

   Note that the crankshaft should be turned clockwise, not counterclockwise. Turning the crankshaft counter-clockwise will cause the tension to become improperly adjusted.

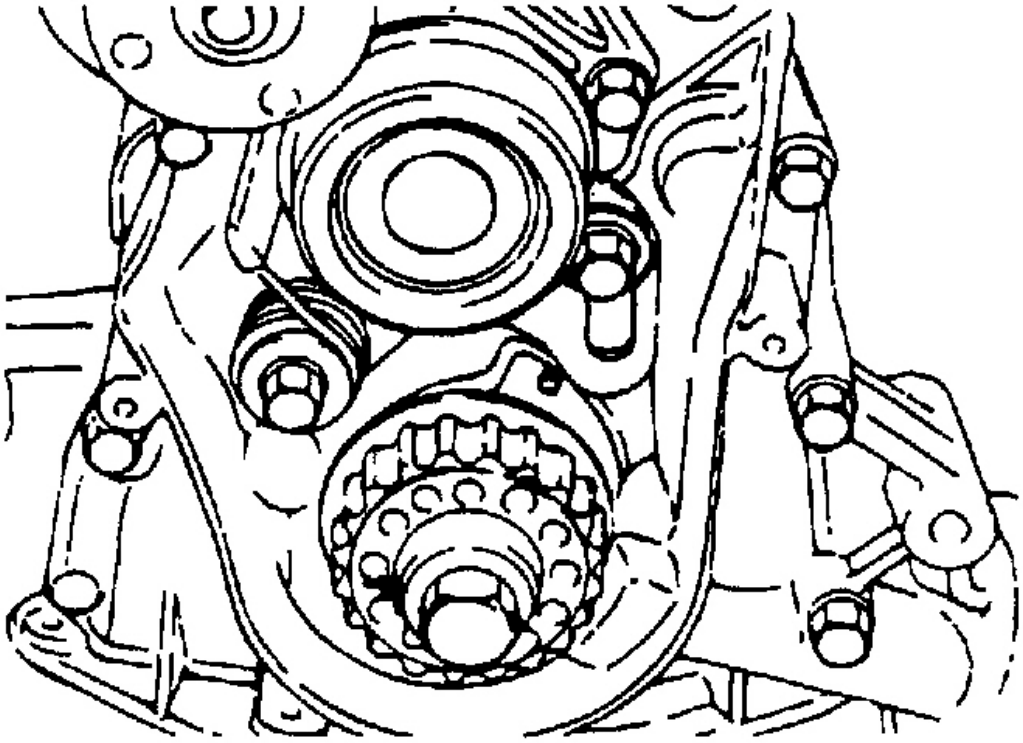

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Fig. 170: Placing No.1 Piston At TDC Of Compression Stoke
Courtesy of HYUNDAI MOTOR CO.

9. Remove the timing belt lower cover.
10. Loosen the tensioner mounting bolts 1 and 2 in that order as shown to give the timing belt spring tension.

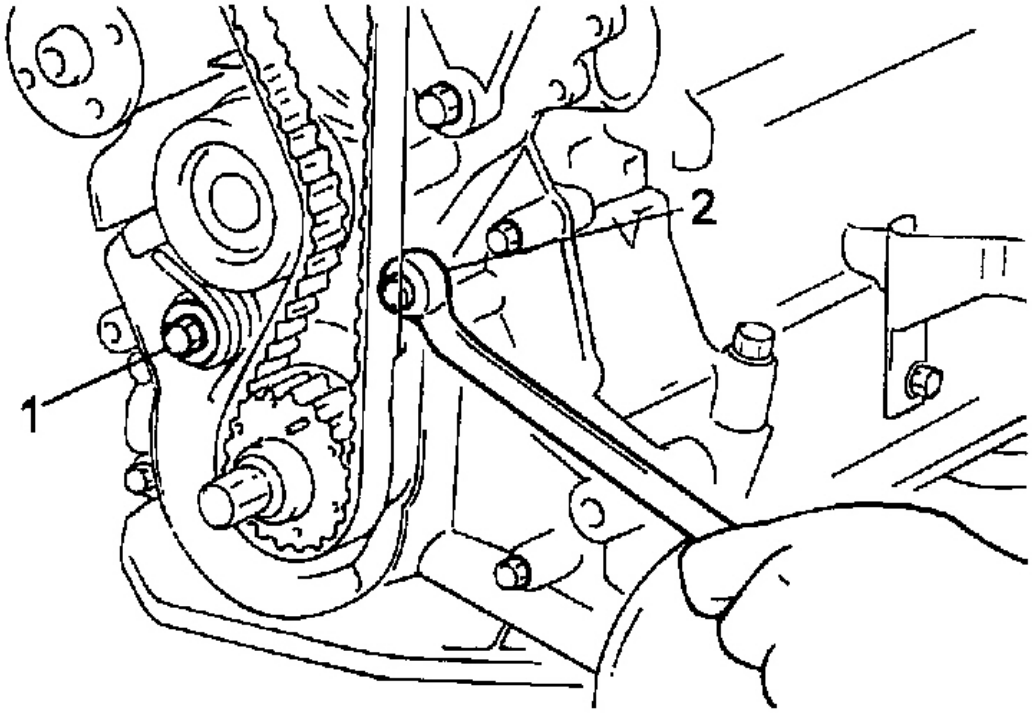

Fig. 171: Loosening Tensioner Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

11. Check the belt to ensure that it is not out of position.

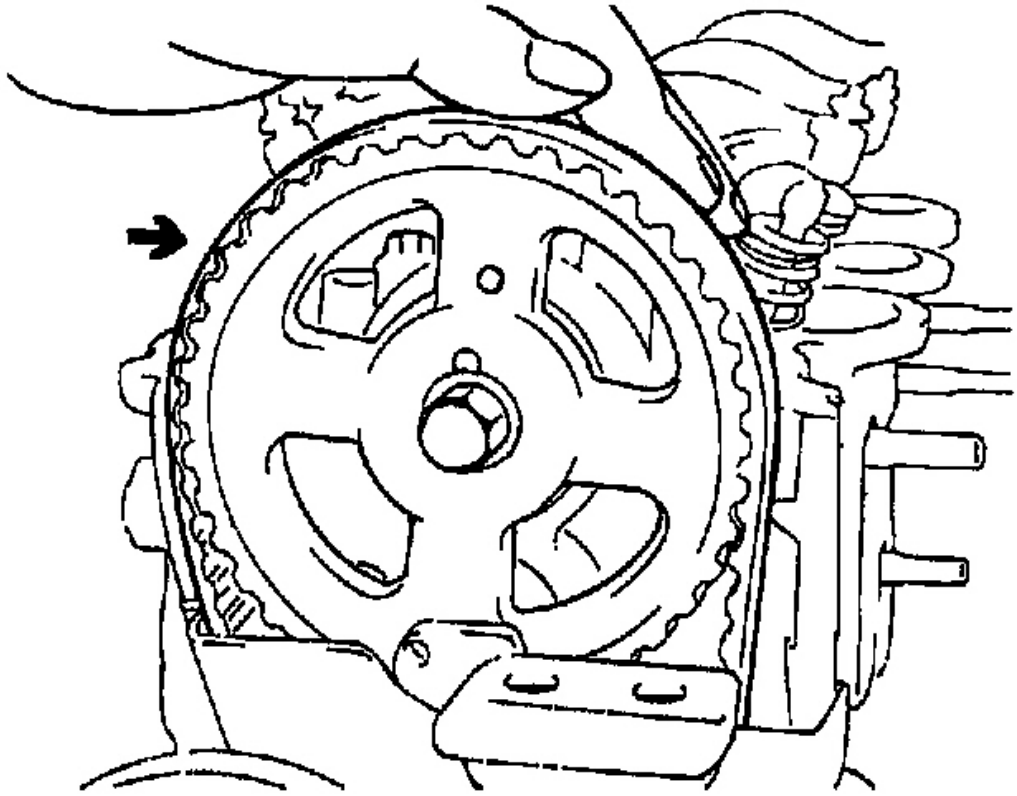

Fig. 172: Checking Belt Position
Courtesy of HYUNDAI MOTOR CO.

12. Tighten the tensioner attaching bolts 2 and 1 in that order as shown. If the bolt 1 is tightened first, the tensioner will move with the bolt and cause the belt to become overtightened.
13. Give the crankshaft one turn in the operating direction (clockwise) and realign crankshaft sprocket timing mark with the top dead center position.

CAUTION: Do not turn the crankshaft in a counterclockwise direction.

14. Loosen the tensioner attaching bolts 1 and 2 in that order as shown.
15. Retighten the tensioner attaching bolts 2 and 1 in that order as shown to the specified torque.

Tightening torque:

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

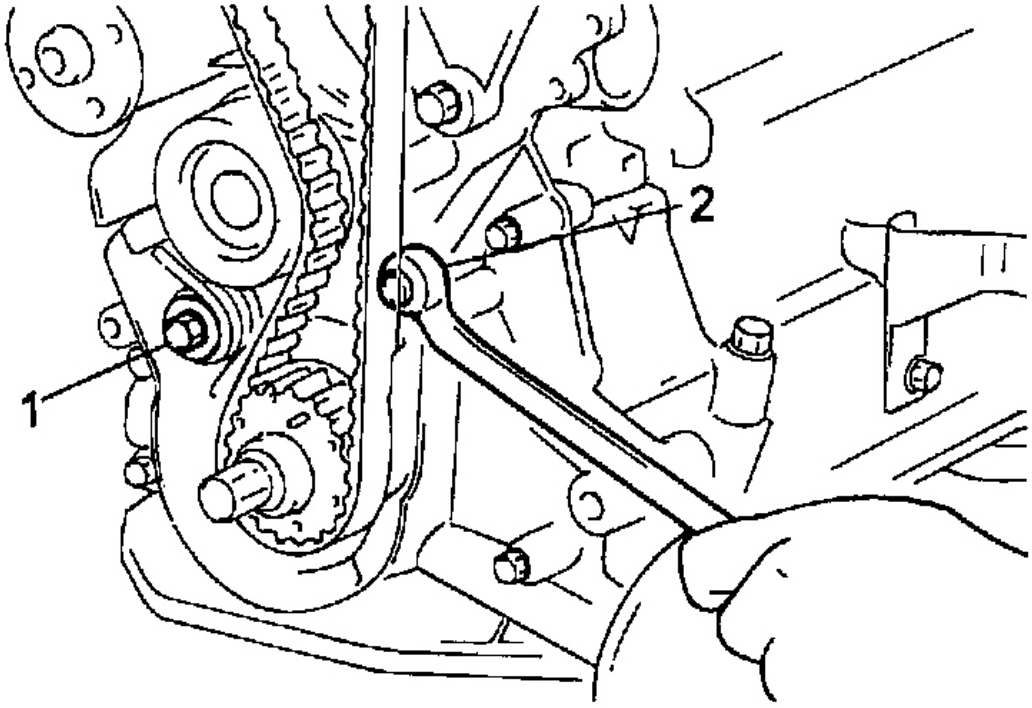

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Fig. 173: Tightening Tensioner Attaching Bolts
Courtesy of HYUNDAI MOTOR CO.

16. Recheck the belt tension. When the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49 N (11 lb)], the timing belt cog end is approx.

    half of the tensioner mounting bolt head radius (across flats) away from the bolt head center.

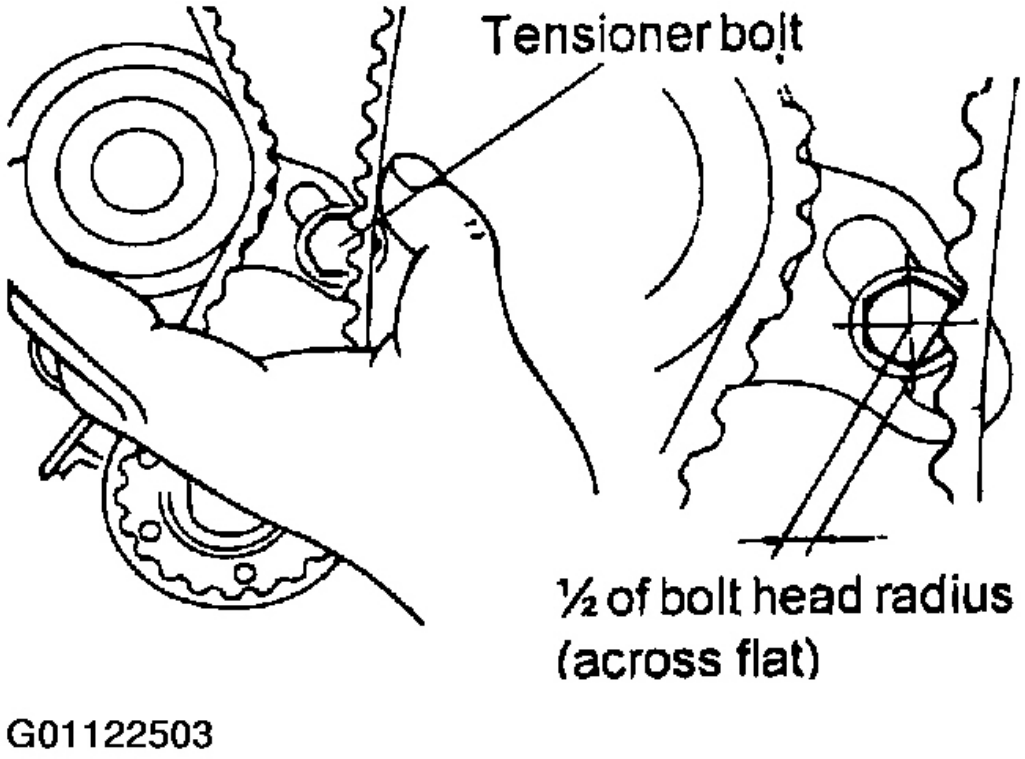

Fig. 174: Checking Belt Tension
Courtesy of HYUNDAI MOTOR CO.

