

2003 Hyundai Elantra GT

2003 ENGINE 2.0L 4 Cylinder DOHC - Elantra

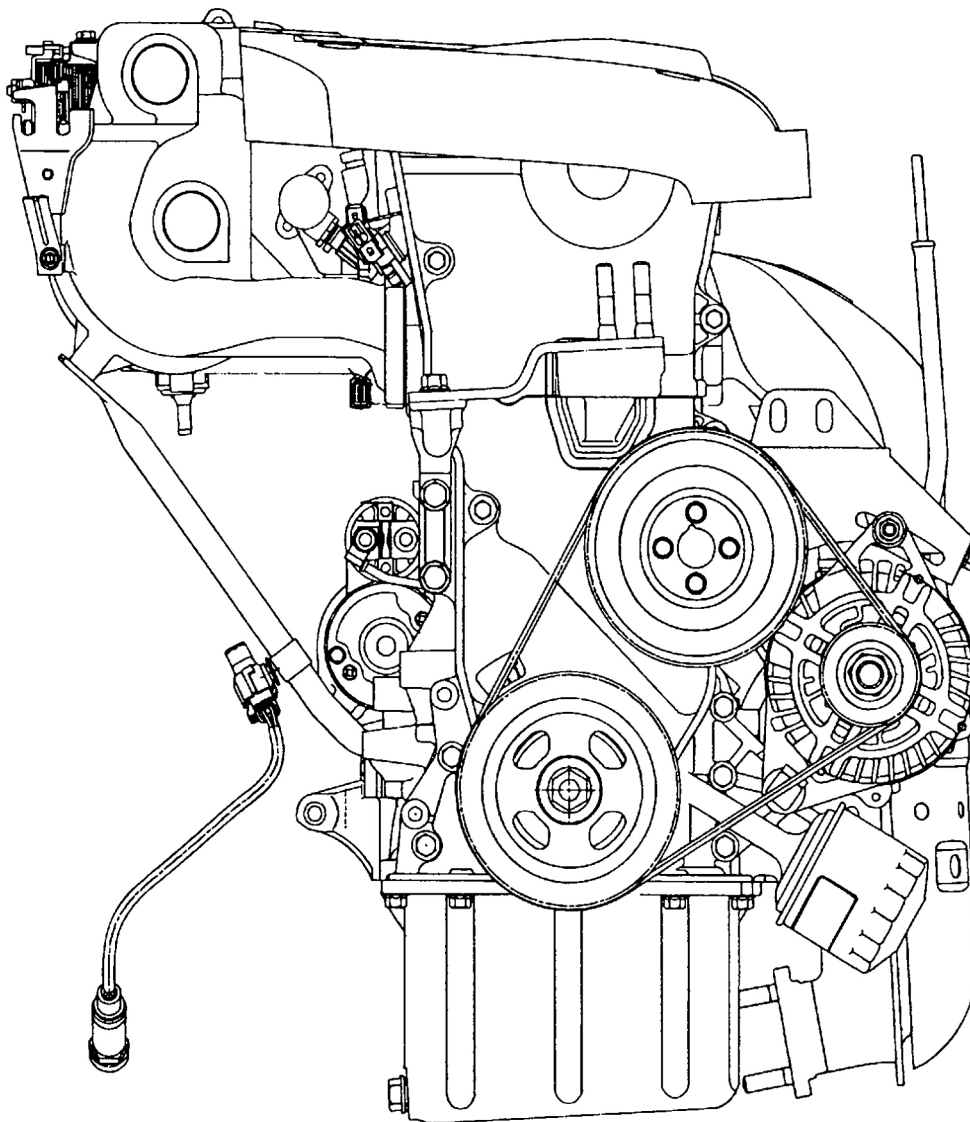
2003 ENGINE

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GENERAL

BETA ENGINE APPEARANCE

FRONT VIEW

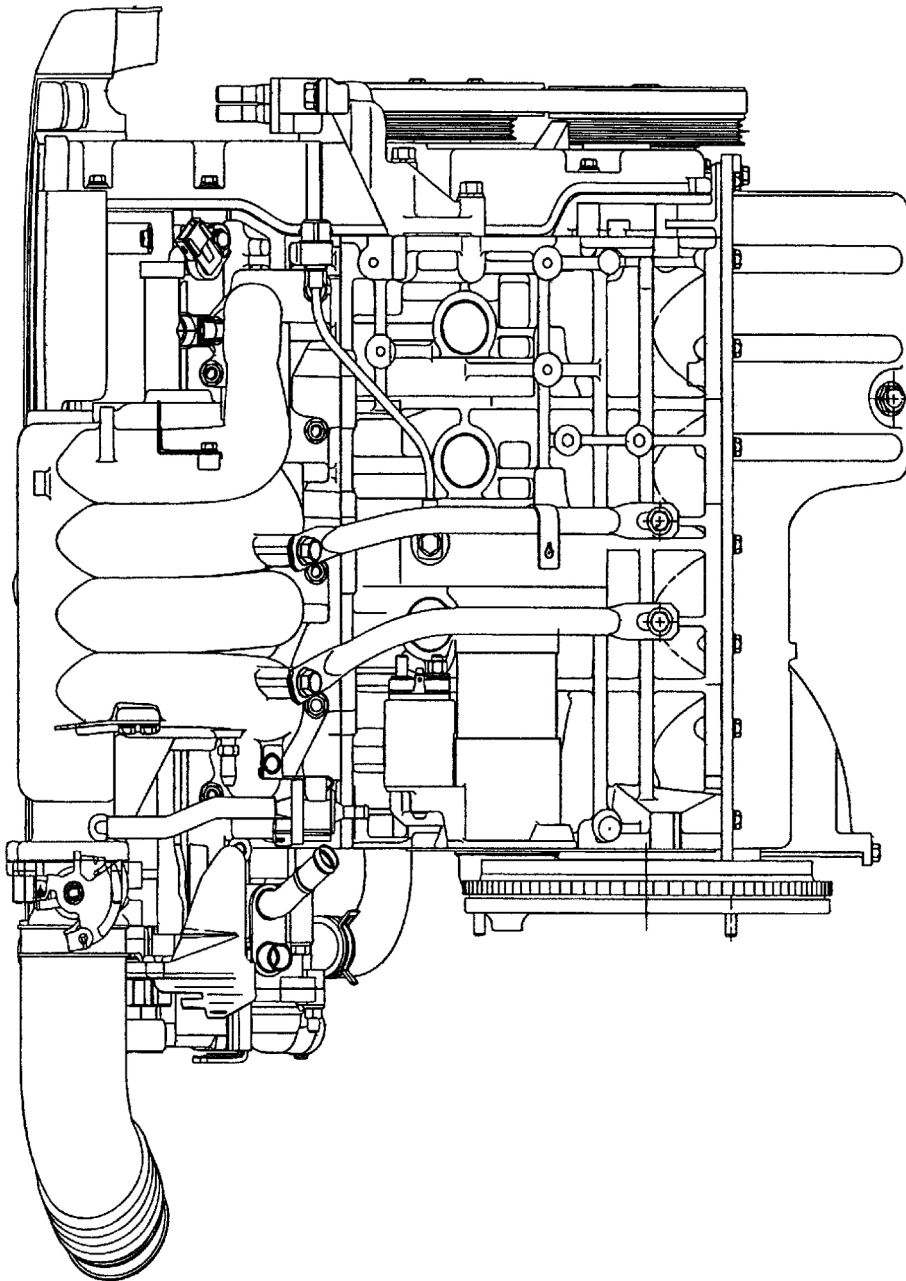


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Fig. 1: Front View Of Engine

Courtesy of HYUNDAI MOTOR CO.

RIGHT VIEW

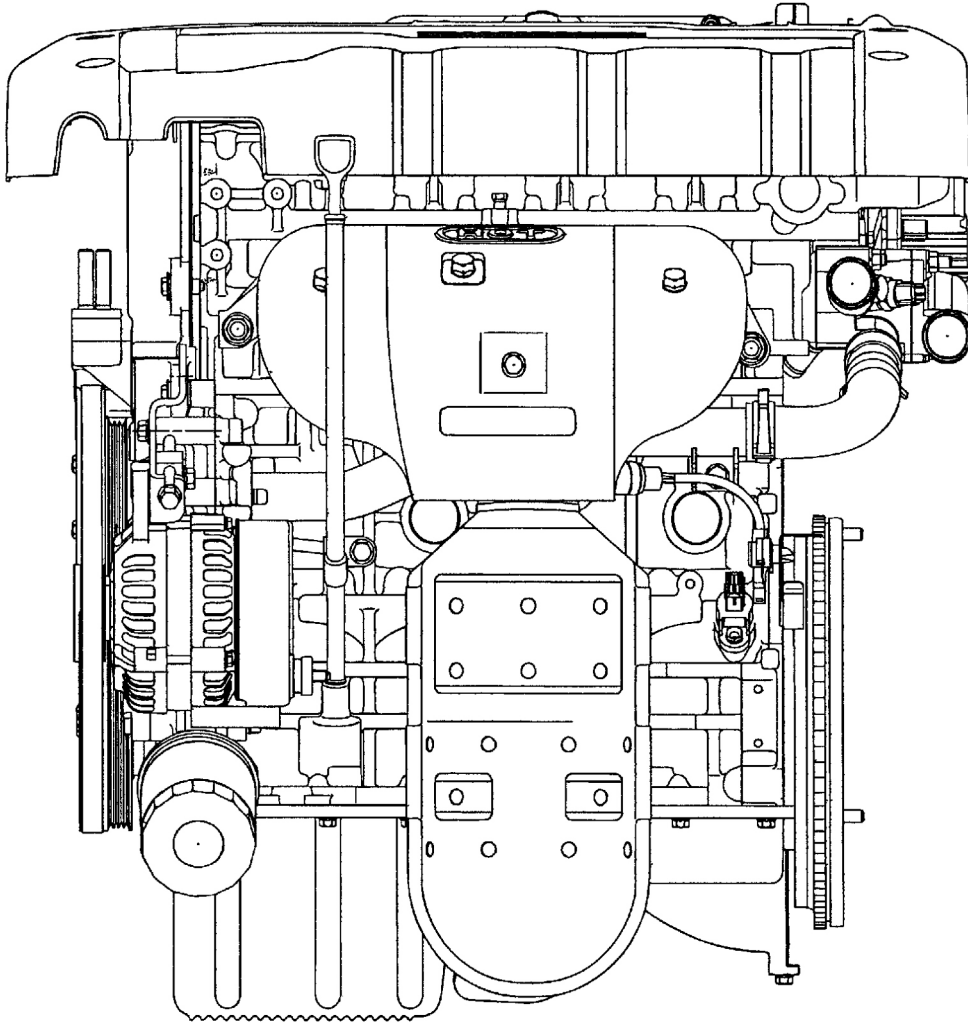


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Fig. 2: Right View Of Engine

Courtesy of HYUNDAI MOTOR CO.

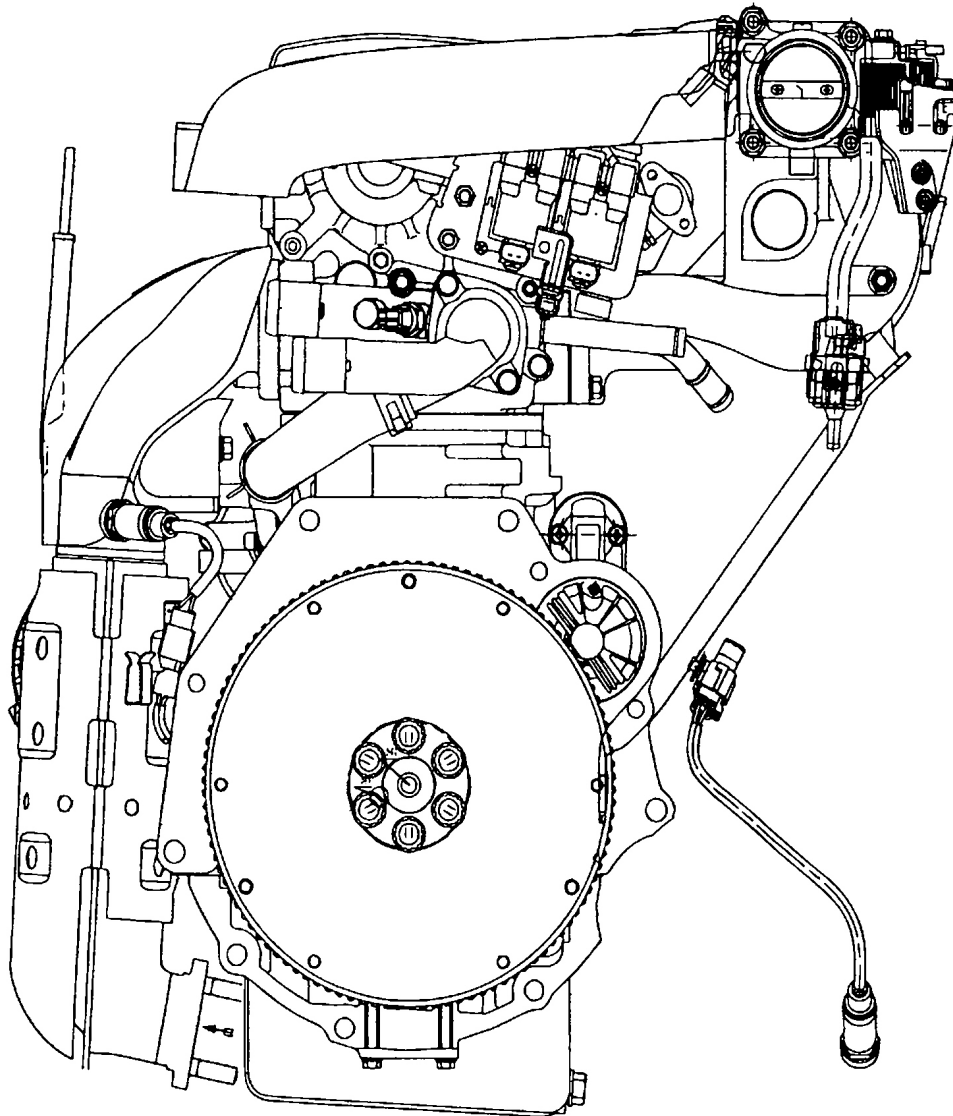
LEFT VIEW



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

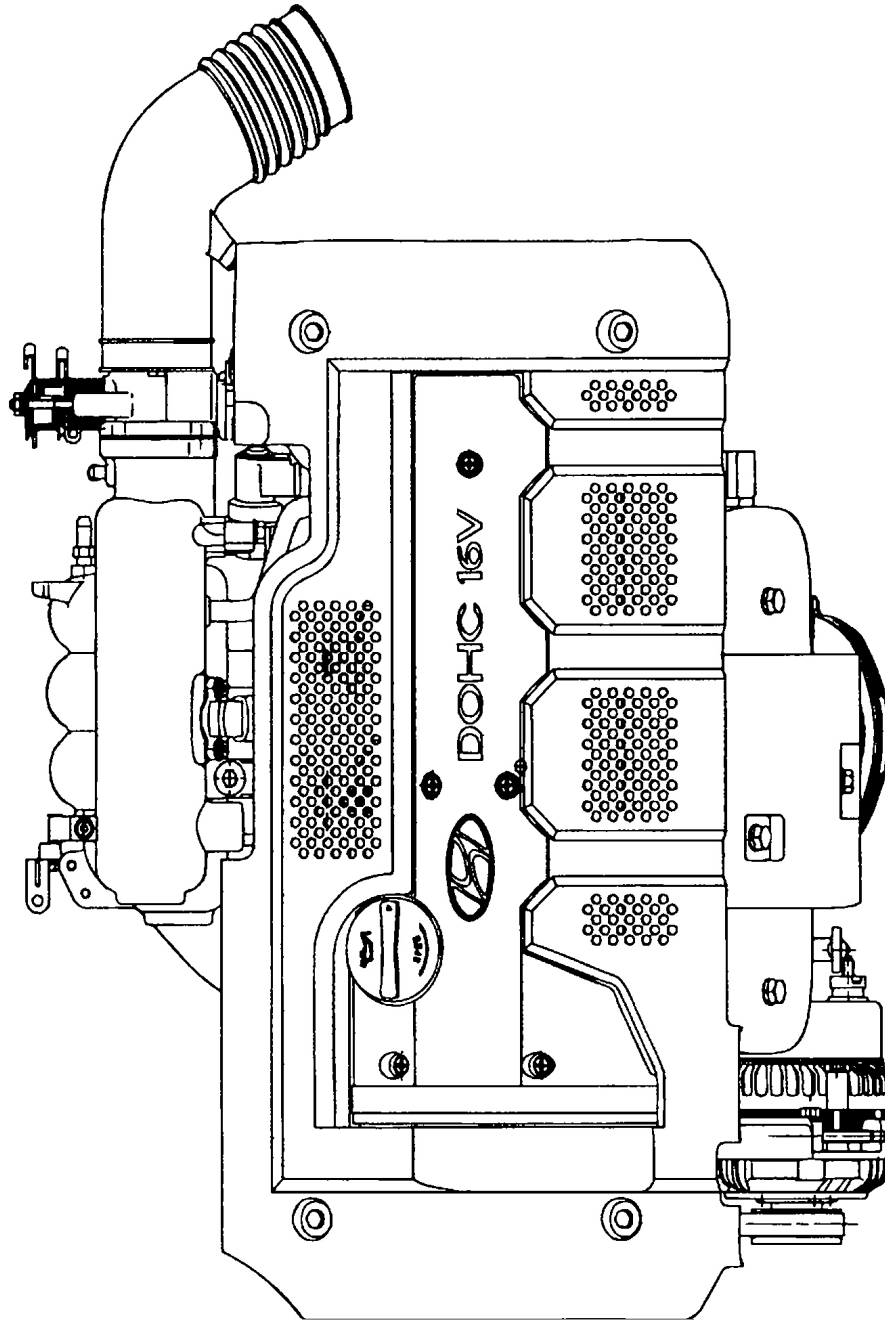
REAR VIEW



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

TOP VIEW



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

SPECIFICATIONS

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General Engine Specifications

Description		Specification	Limit
General			
Type		In-line, Double Overhead Camshaft	
Number of cylinder		4	
Bore		82 mm (3.228 in.)	
Stroke		93.5 mm (3.681 in.)	
Total displacement		1975 cc (120.52 cu.in.)	
Compression ratio		10.1	
Firing order		1-3-4-2	
Valve timing			
Intake valve			
	Opens (BTDC)	9°	
	Closes (ABDC)	43°	
Exhaust valve			
	Opens (BBDC)	50°	
	Closes (ATDC)	6°	
Cylinder block			
Cylinder bore		82.00 - 82.03 mm (3.2283 - 3.2295 in.)	
Out-of-round and taper of cylinder bore		Less than 0.01 mm (0.0004 in.)	
Clearance with piston (To set limits to new parts)		0.02 - 0.04 mm (0.0008 - 0.0016 in.)	
Piston			
O.D. (To set limits to new parts)		81.97 - 82.00 mm (3.2271 - 3.2283 in.)	
Service oversize		0.25, 0.50, 0.75, 1.00 mm (0.010, 0.020, 0.030, 0.039 in.) oversize	
Piston ring			
Side clearance			
	No. 1	0.04-0.08 mm (0.0015-0.0031 in.)	0.1 mm (0.004 in.)
	No. 2	0.03-0.07 mm (0.0012-0.0027 in.)	
End gap			
	No. 1	0.23-0.38 mm (0.0090-0.0149 in.)	1 mm (0.039 in.)
	No. 2	0.33-0.48 mm (0.0130-0.0189 in.)	1 mm (0.039 in.)

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

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Undersize rework dimension of journal		(1.7411 - 1.7417 in.)
	0.25 mm (0.010 in.)	56.727 - 56.742 mm (2.2333 - 2.2339 in.)
	0.50 mm (0.020 in.)	56.477 - 56.492 mm (2.2235 - 2.2240 in.)
	0.75 mm (0.030 in.)	56.227 - 56.242 mm (2.2136 - 2.2142 in.)
Flywheel Runout		0.1 mm (0.0039 in.) 0.13 mm (0.0051 in.)
Cooling method	Water-cooled, pressurized, Forced circulation with electrical fan	
Coolant Quantity	6 liter (6.3 U.S qts., 5.2 Imp. qts.)	
Radiator Type	Pressurized corrugated fin type	
Radiator cap Main valve opening pressure	83-110 kpa(12-16 psi, 0.83-1.1 kg/cm ²)	
Vacuum valve opening pressure	- 7 kpa(-1.00 psi, - 0.07 kg/cm ²) or less	
Thermostat Type	Wax pellet type with jiggle valve	
Valve opening temperature	82°C (177°F)	
Full-opening temperature	95°C (201°F)	
Coolant pump	Centrifugal type impeller	
Drive belt Type	V-ribbed belt	
Engine coolant temperature sensor Type	Heat-sensitive thermistor type	
Resistance	2.31-2.59Kohms at 20°C (68°F)	
Oil pump Clearance between outer circumference and front case.	0.120-0.185 mm (0.0047-0.0073 in.)	
Front case tip clearance Side clearance	0.025-0.069 mm (0.0009-0.0027 in.)	

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	Inner gear	0.04-0.085 mm (0.0016-0.0033 in.)	
	Outer gear	0.04-0.09 mm (0.0016-0.0035 in.)	
Engine oil pressure at idle [Oil temperature is 90 to 100°C (194 to 215°F)]		166 KPa (1.7 kg/cm ² , 24.2 psi)	
Relief spring			
Free height		43.8 mm (1.724 in.)	
Load		3.7kg at 40.1 mm (3.15 lb/1.578 in.)	
Air cleaner			
Type		Dry type	
Element		Unwoven cloth type	
Exhaust pipe			
Muffler		Expansion resonance type	
Suspension system		Rubber hangers	
Valve			
Valve length	Intake	114.34 mm (4.5016 in.)	
	Exhaust	116.8 mm (4.5984 in.)	
Stem O.D.	Intake	5.965-5.98 mm (0.2348-0.2354 in.)	
	Exhaust	5.950-5.965 mm (0.2343-0.2348 in.)	
Face angle thickness of valve head (Margin)			
Intake		1.15 mm (0.0452 in.)	0.8 mm (0.031 in.)
Exhaust		1.35 mm (0.0531 in.)	1.0 mm (0.039 in.)
Valve stem to valve guide clearance			
Intake		0.02-0.05 mm (0.0008-0.0019 in.)	0.10 mm (0.0039 in.)
Exhaust		0.035-0.065 mm (0.0014-0.0026 in.)	0.13 mm (0.0051 in.)
Valve guide			
Installed dimension O.D.	Intake	46 mm (1.811 in.)	
	Exhaust	54.5 mm (2.146 in.)	
Service oversize		0.05, 0.25, 0.50 mm (0.002, 0.010, 0.020	

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		in.) oversize	
Valve seat			
Width of seat contact	Intake	1.1-1.5 mm (0.043-0.059 in.)	
	Exhaust	1.3-1.7 mm (0.051-0.066 in.)	
Seat angle		45°	
Oversize		0.3, 0.6 mm (0.012, 0.024 in.) oversize	
Valve spring			
Free length		48.86 mm (1.9236 in.)	
Load		18.3 kg / 39 mm, 40.0 kg / 30.5 mm	
Installed height		39 mm (1.5354 in.)	
Squareness		1.5° or less	
Valve clearance (cold)			
Intake		0.20 mm (0.0079 in.)	0.12-0.28 mm (0.0047-0.0110 in.)
Exhaust		0.28 mm (0.0110 in.)	0.20-0.36 mm (0.0079-0.0142 in.)
Valve clearance (warm)			
Intake		0.29 mm (0.0114 in.)	
Exhaust		0.34 mm (0.0134 in.)	
Cylinder head			
Flatness of gasket surface		Max. 0.03 mm (0.0012 in.)	0.06 mm (0.0024 in.)
Flatness of manifold mounting surface		Max. 0.15 mm (0.0059 in.)	Max. 0.03 mm (0.0118 in.)
Oversize rework dimensions of valve seat hole			
Intake			
	0.3 mm (0.012 in.) O.S.	33.300-33.325 mm (1.3110-1.3120 in.)	
	0.6 mm (0.024 in.) O.S.	33.600-33.625 mm (1.3228-1.3238 in.)	
Exhaust			
	0.3 mm (0.012 in.) O.S.	28.800-28.821 mm (1.1338-1.1346 in.)	
	0.6 mm (0.024 in.) O.S.	29.100-29.121 mm (1.1456-1.1465 in.)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)			

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	0.05 mm (0.002 in.) O.S.	11.05-11.068 mm (0.435-0.4357 in.)	
	0.25 mm (0.010 in.) O.S.	11.25-11.268 mm (0.443-0.4436 in.)	
	0.50 mm (0.020 in.) O.S.	11.50-11.518 mm (0.453-0.4535 in.)	

SERVICE STANDARDS

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

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Fig. 6: Service Standards Table
Courtesy of HYUNDAI MOTOR CO.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Alternator Brace Bolt	15-20 (20-27)
Alternator Support Bolt	14-18 (20-25)
Camshaft Bearing Cap Bolt	10-11 (14-15)
Camshaft Sprocket Bolt	74-89 (100-120)
Connecting Rod Cap Nut	37-39 (50-53)
Coolant Inlet Fitting Nuts	11-15 (15-20)
Coolant Pump Bolt	15-20 (20-27)
Coolant Temperature Sensor	15-30 (20-40)
Crankshaft Bearing Cap Bolt	
Step 1	20-24 (27-33)
Step 2	Tighten An Additional 60-65 Degrees
Crankshaft Pulley Bolt	125-133 (170-180)
Cylinder Head Bolt ⁽¹⁾	
M10	
Step 1	18 (25)
Step 2	Tighten An Additional 60-65 Degrees
Step 3	Tighten An Additional 60-65 Degrees
M12	
Step 1	22 (30)

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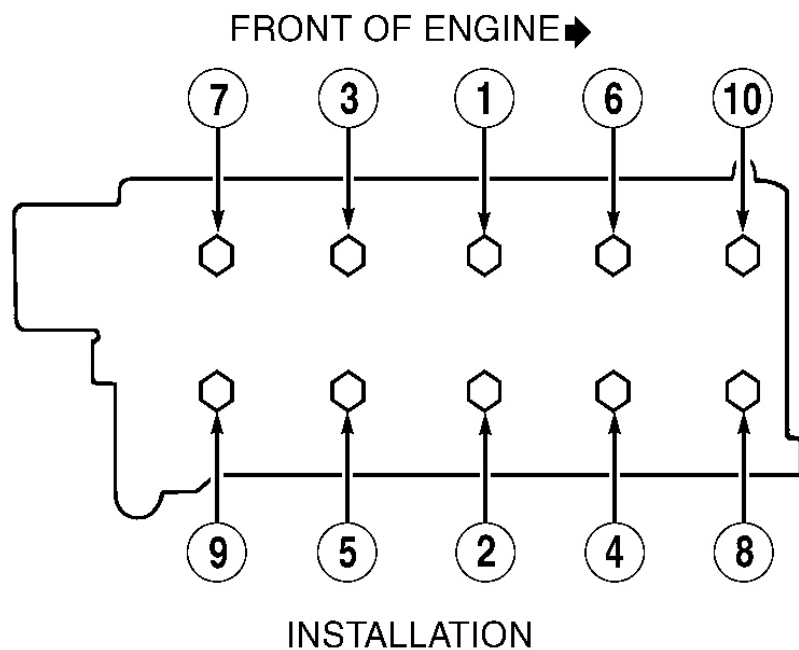
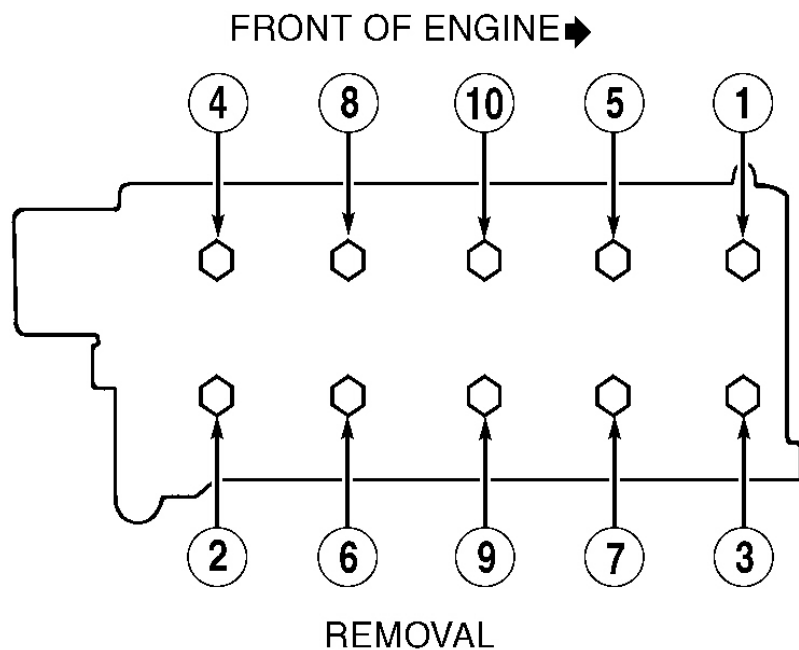
Step 2	Tighten An Additional 60-65 Degrees
Step 3	Tighten An Additional 60-65 Degrees
Engine Mounts	
Front Engine Support Bracket Retainers	25-37 (35-50)
Front Roll Stopper Bracket Bolt	51-66 (70-90)
Front Roll Stopper Bracket-To-Center Member Bolts	30-37 (40-50)
Front Roll Stopper Insulator Nut	37-48 (50-65)
Rear Engine Stopper Bracket Bolt	25-37 (35-50)
Rear Roll Stopper Bracket Bolt	51-66 (70-90)
Rear Roll Stopper Bracket-To-Center Member Bolt	30-37 (40-50)
Rear Roll Stopper Insulator Nut	37-48 (50-65)
Right Mounting Bracket-To-Engine Nuts & Bolts	37-48 (50-65)
Right Mounting Insulator Nut (Large)	66-81 (90-110)
Right Mounting Insulator Nut (Small)	33-44 (45-60)
Transaxle Insulator Bracket-To-Side Member Bolts	30-37 (40-50)
Transaxle Mount Insulator Nut	66-81 (90-110)
Exhaust Components	
Exhaust Manifold Cover-To-Exhaust Manifold Bolts	11-14 (15-20)
Exhaust Manifold-To-Cylinder Head Nut	32-40 (43-55)
Exhaust Pipe-To-Manifold Nut	22-30 (30-40)
Front Exhaust Pipe Bracket Bolts	22-30 (30-40)
Front Exhaust Pipe-To-Catalytic Converter Bolts	29-43 (40-60)
Main Muffler Hanger Support Bracket Bolts	89-133 INCH Lbs. (10-15)
Flexplate-To-Crankshaft Bolt	89-95 (120-129)
Flywheel-To-Crankshaft Bolt	89-95 (120-129)
Front Case Bolts	14-20 (19-27)
Heat Protector Bolts	11-15 (15-20)
Intake Manifold Bracket Bolts	13-18 (18-25)
Intake Manifold Nuts	12-17 (16-23)
Intake Manifold-To-Cylinder Head Bolts	12-17 (16-23)
Oil Drain Plug	25-33 (35-45)
Oil Filter	9-12 (12-16)
Oil Pump Relief Valve	30-37 (40-50)
Oil Screen Bolt	11-16 (15-22)
Oxygen Sensors	36-43 (50-60)
Starter Bolt	20-25 (27-34)
Thermostat Housing	11-15 (15-20)
Throttle Body-To-Intake Manifold Bolt	11-15 (15-20)
Throttle Body-To-Surge Tank Bolts	11-15 (15-20)

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Timing Belt Idler Bolt	31-40 (43-55)
Timing Belt Tensioner Bolt	31-40 (43-55)
Torque Converter-To-Drive Plate Bolt	33-38 (45-52)
INCH Lbs. (N.m)	
Air Cleaner Body Mounting Bolts	71-89 (8-10)
Alternator Lock Bolt	106-133 (12-15)
Chain Guide	71-89 (8-10)
Coolant Pump Pulley Bolts	71-89 (8-10)
Cylinder Head Cover Bolts	71-89 (8-10)
Engine Cover	27-35 (4-6)
Oil Pan Bolt	89-106 (10-12)
Oil Pressure Switch	115-133 (13-15)
Oil Pump Cover	53-80 (6-9)
Rear Oil Seal Case Bolt	89-106 (10-12)
Rear Plate Bolts	71-89 (8-10)
Resonator Mounting Bolts	27-35 (4-6)
Rocker Cover Bolt	71-89 (8-10)
Timing Belt Cover Bolt	71-89 (8-10)
Water Pump Pulley Bolt	71-89 (8-10)

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



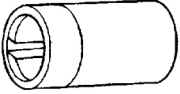
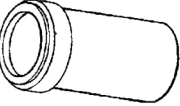
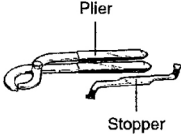
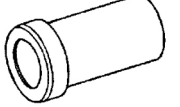
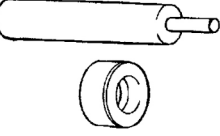
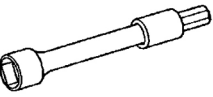
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Fig. 7: Cylinder Head Bolt Removal & Installation Sequence
Courtesy of HYUNDAI MOTOR CO.

SPECIAL TOOLS

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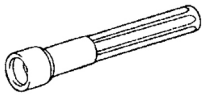
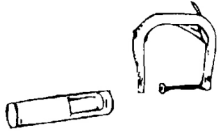
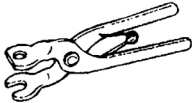
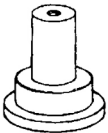
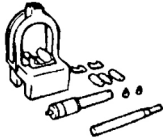
Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-32000)		Installation of the front oil seal
Crankshaft front oil seal guide (09214-32100)		Installation of the front oil seal
Valve clearance adjust tool set (09220-2D000)		Removal and installation of the tappet shim
Camshaft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

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

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Tool (Number and name)	Illustration	Use
Valve stem oil seal installer (09222-22001)		Installation of the valve stem oil seal
Valve spring compressor & adaptor (09222-28000, 09222-28100)		Removal and installation of the intake or exhaust valve
Valve stem seal remover (09222-29000)		Removal of the valve stem seal
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 remover and installer kit (09234-33001)		Removal and installation of the piston pin (Use with 09234-33003)
Piston pin setting tool insert (09234-33002)		Removal and installation of the piston pin (Use with 09234-33001)

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

TROUBLESHOOTING

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

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

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

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

MAINTENANCE

CHECKING ENGINE OIL

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

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

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

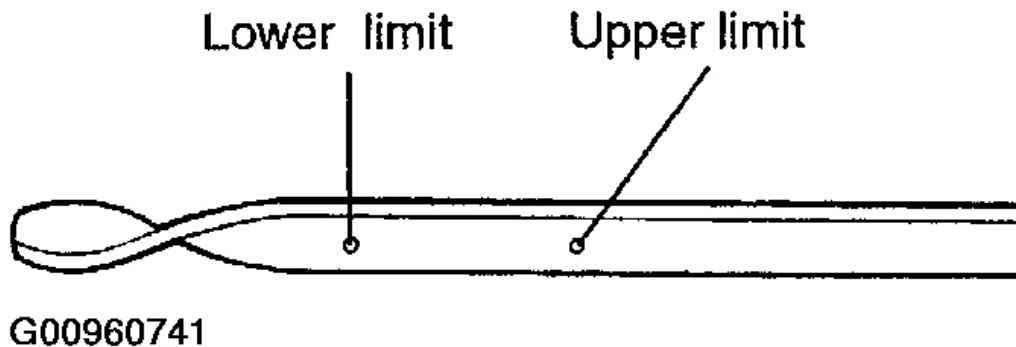


Fig. 12: Identifying Engine Oil Level Range On Dipstick
Courtesy of HYUNDAI MOTOR CO.

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

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

CHANGING ENGINE OIL

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

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

Tightening torque

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

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

Capacity

Drain and refill

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

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

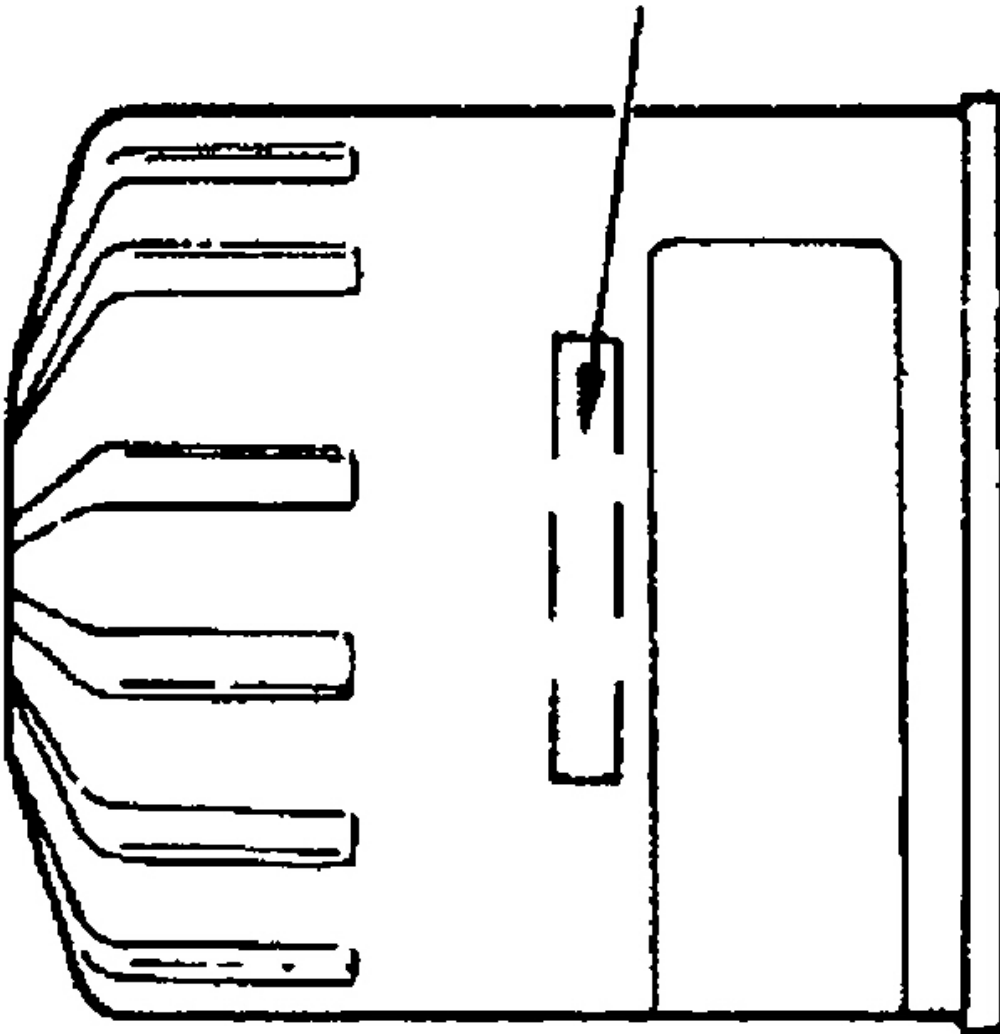
CAUTION: Do not overfill the crankcase. This will cause oil aeration and loss of oil pressure.

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

FILTER SELECTION

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

Part number



G00960742

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

PROCEDURE FOR REPLACING THE OIL FILTER

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

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

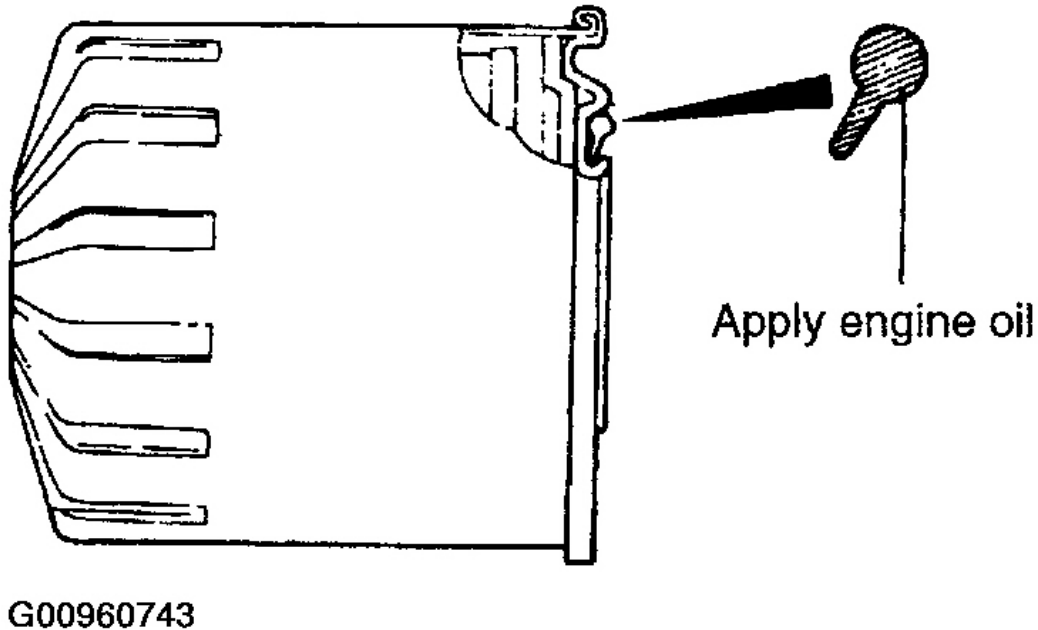


Fig. 14: Identifying Oil Application On New Oil Filter Gasket
Courtesy of HYUNDAI MOTOR CO.

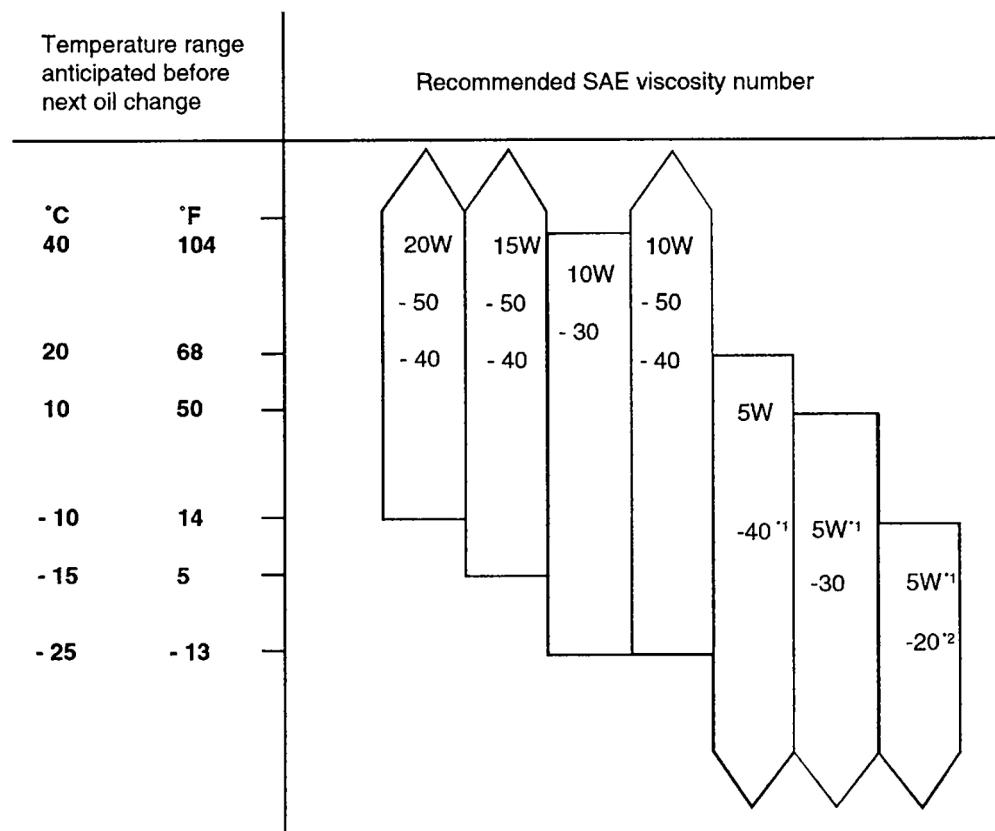
3. Tighten the oil filter to the specified torque.
Tightening torque
Oil filter: 12-16 Nm (120-160 kg.cm, 9-12 lb.ft)
4. Run the engine to check for engine oil leaks.
5. After turning off the engine, check the oil level and add oil as necessary.

SELECTION OF ENGINE OIL

Recommended API classification: SH OR ABOVE [For EC.]

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2003 ENGINE 2.0L 4 Cylinder DOHC - Elantra



*1 Restricted by driving condition and environment.

*2 Not recommended for sustained high speed vehicle operation

G00960744

Fig. 15: Recommended SAE Viscosity Grades Chart

Courtesy of HYUNDAI MOTOR CO.

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

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

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

CHECKING COOLANT LEAK

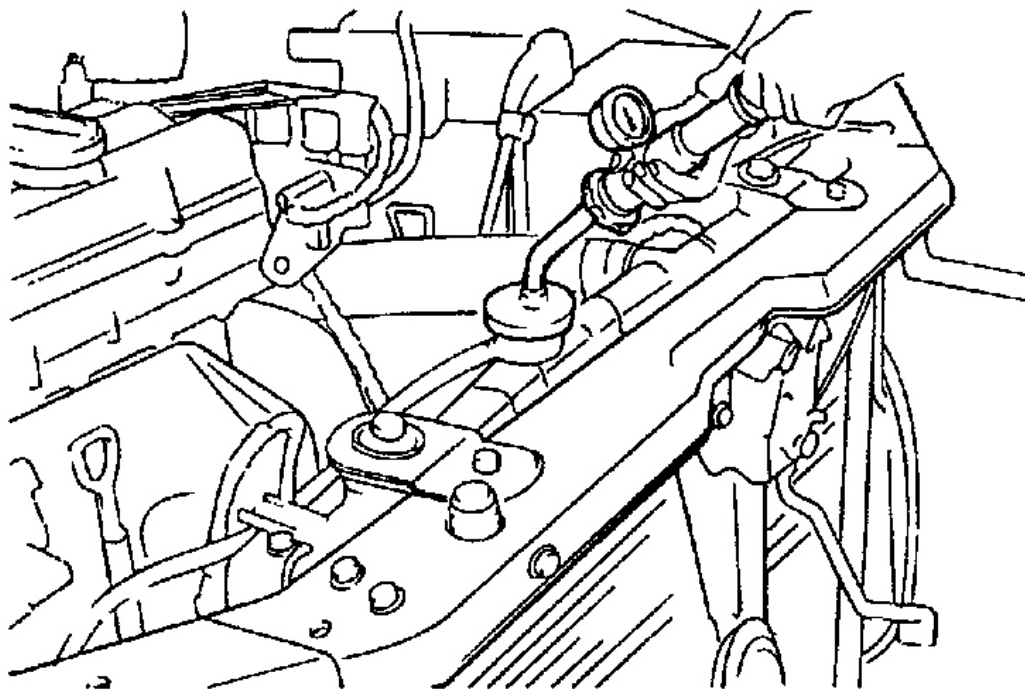
1. Loosen the radiator cap.
2. Confirm that the coolant level is up to the filler neck.
3. Install a radiator cap tester to the radiator filler neck and apply 140 kPa (1.4 kg/cm², 20 psi) pressure.

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

NOTE:

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

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



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

RADIATOR CAP PRESSURE TEST

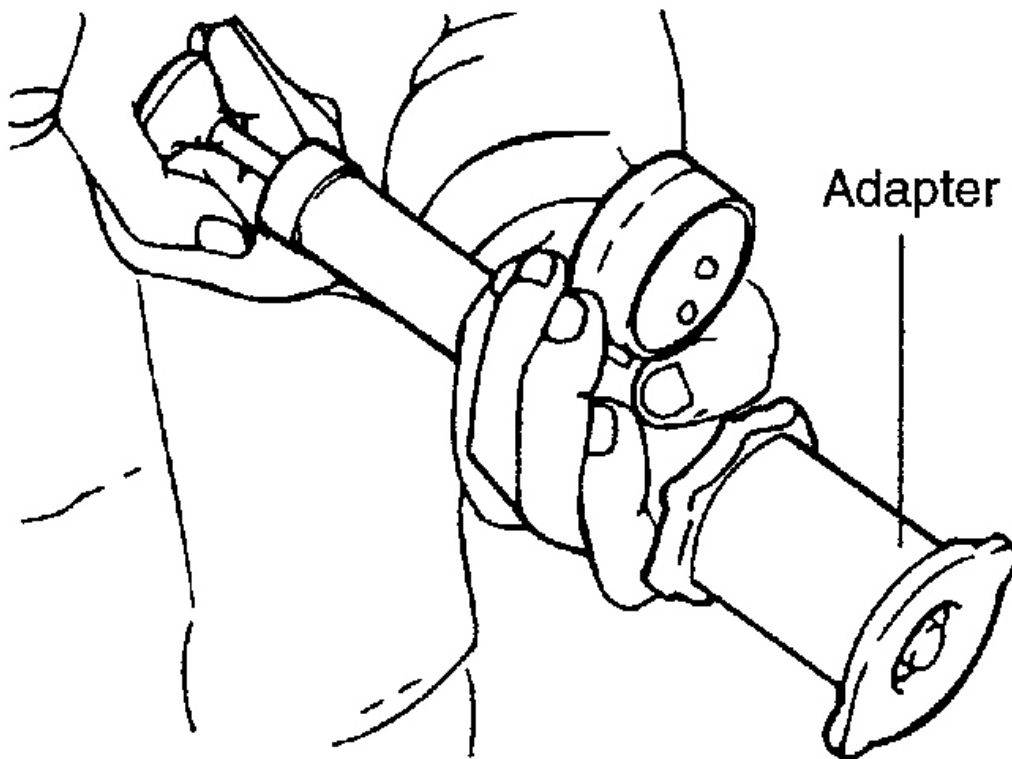
1. Use an adapter to attach the cap to the tester.
2. Increase the pressure until the gauge stops moving.

Main valve opening pressure: 83-110 kPa (0.83-1.1 kg/cm² , 12-16 psi)

Vacuum valve opening pressure: -7 kPa (-0.07 kg/cm² , -1.0 psi)

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

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



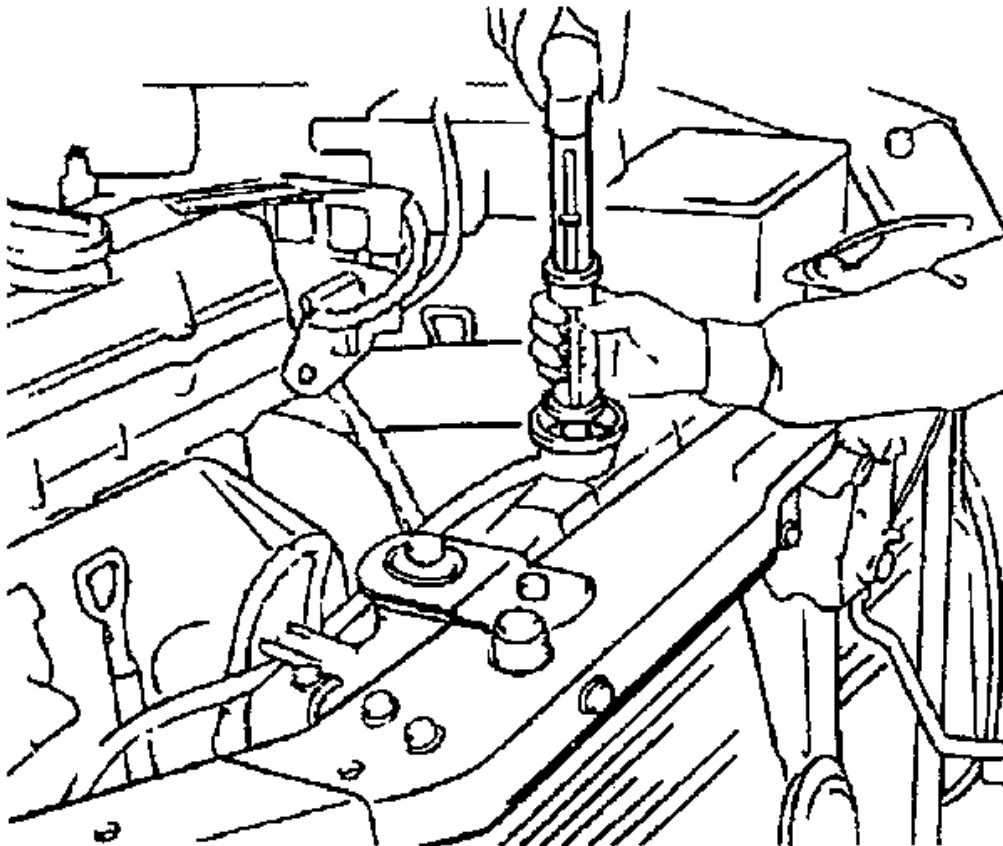
G00960746

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

SPECIFIC GRAVITY TEST

1. Measure the specific gravity of the coolant with a hydrometer.

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



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

RELATION BETWEEN COOLANT CONCENTRATION & SPECIFIC GRAVITY

2003 Hyundai Elantra GT

2003 ENGINE 2.0L 4 Cylinder DOHC - Elantra

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

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

Example

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

CAUTION:

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

RECOMMENDED COOLANT

Antifreeze	Mixture ratio of anti freeze in coolant
ETHYLENE GLYCOL BASE FOR ALUMINUM	50% [Except tropical areas] 40% [Tropical areas]

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Fig. 20: Coolant Specification
Courtesy of HYUNDAI MOTOR CO.

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 (15 kg/cm² , 218 psi)

Limit: 1400kpa (14 kg/cm² , 203 psi)

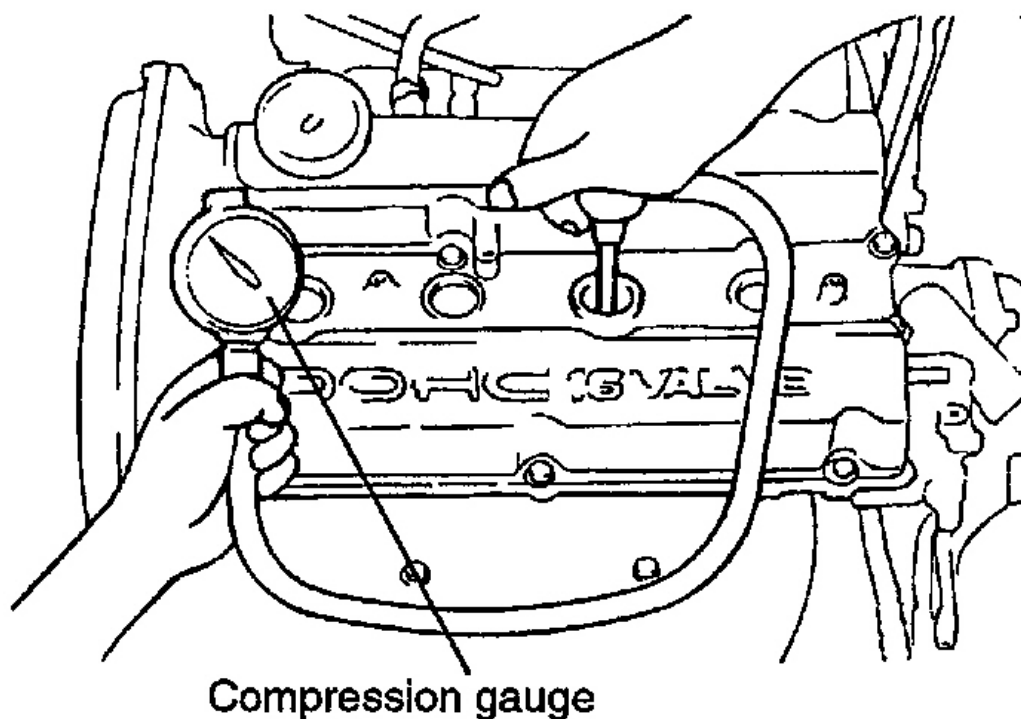
9. Repeat steps 6 to 8 over all cylinders, ensuring that the pressure differential for each of the cylinders is within the specified limit.

Limit: Max. 100 kPa (1.0 kg/cm² , 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)



G00960750

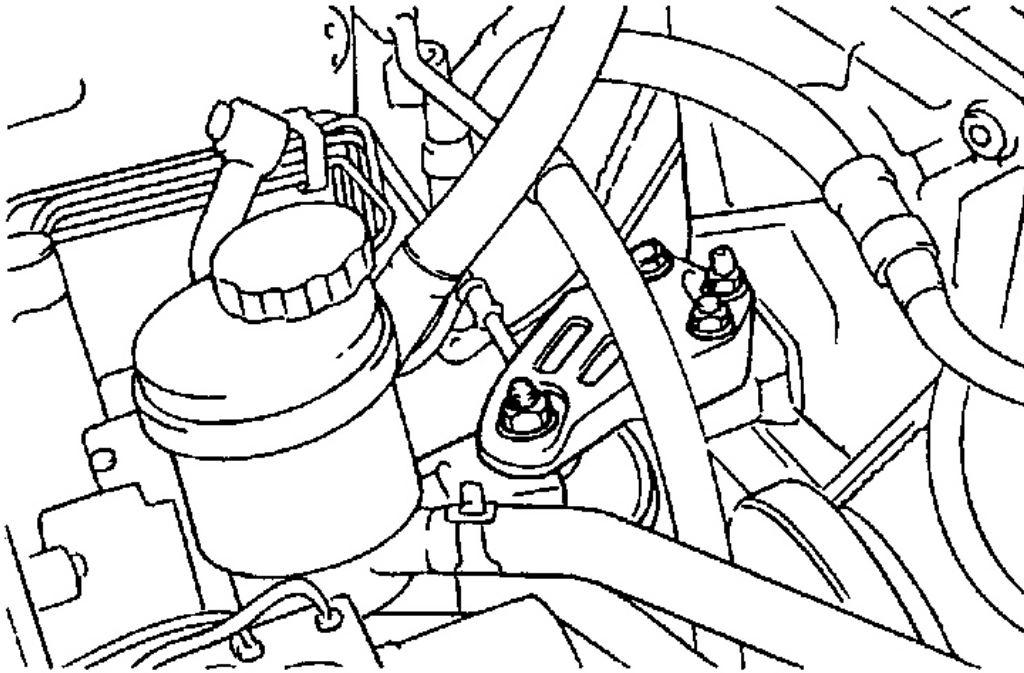
Fig. 21: Checking Cylinder Compression
Courtesy of HYUNDAI MOTOR CO.

ADJUSTING TIMING BELT TENSION

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

NOTE: Do watch not to over load.

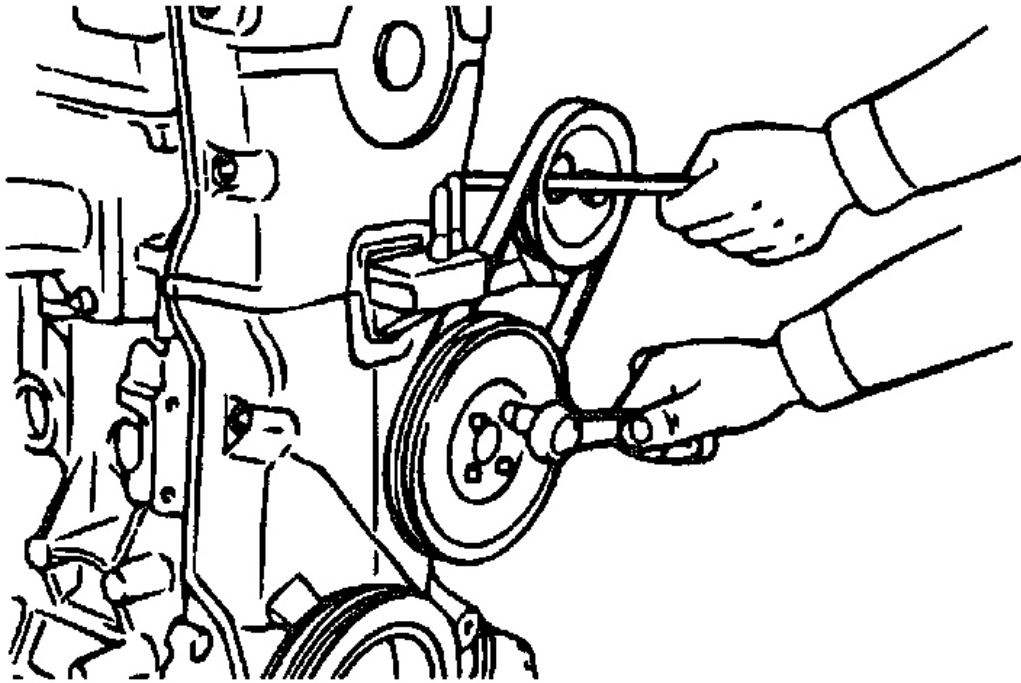
3. Remove the engine support bracket.



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Fig. 22: Identifying Engine Support Bracket Nuts
Courtesy of HYUNDAI MOTOR CO.

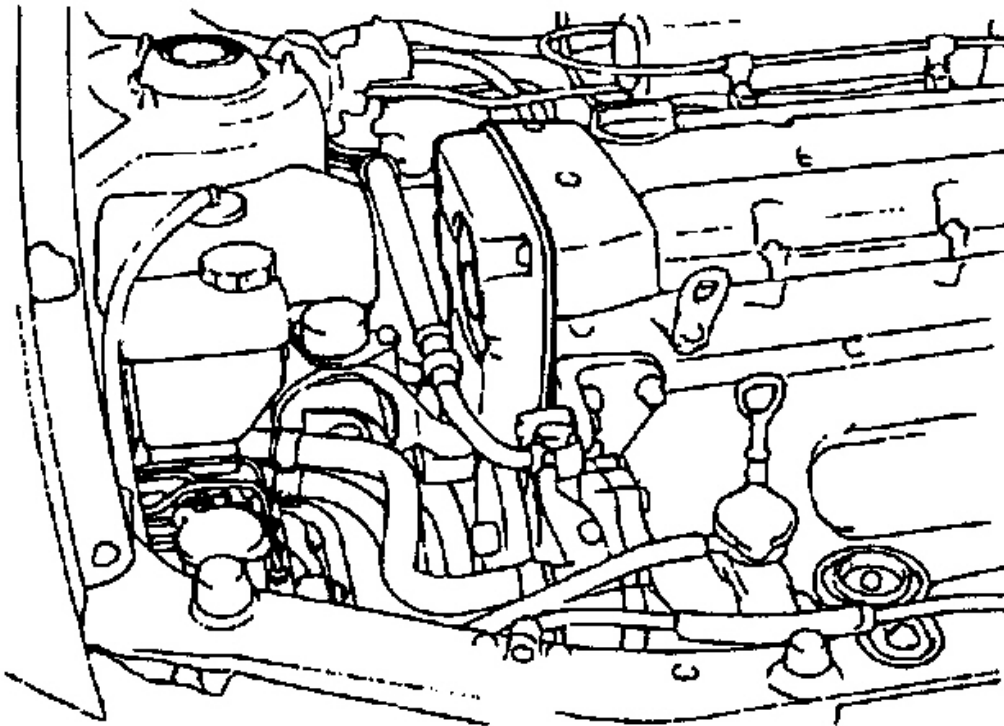
4. Remove the water pump pulley.



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Fig. 23: Removing Water Pump Pulley
Courtesy of HYUNDAI MOTOR CO.

5. Remove the timing belt upper cover.

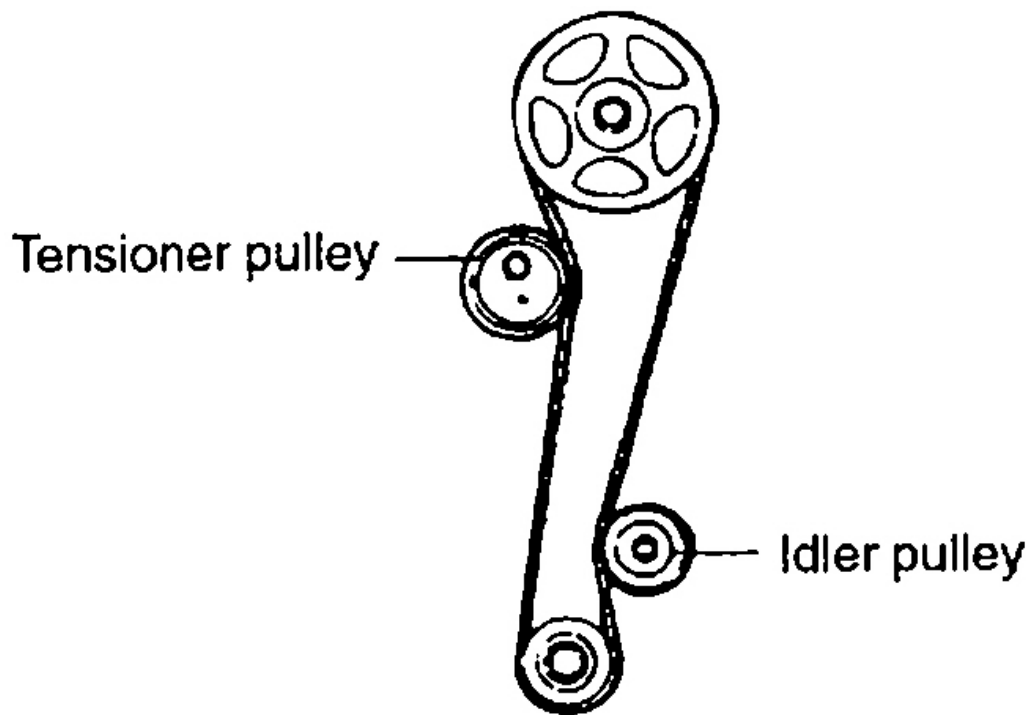


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Fig. 24: Identifying Timing Belt Upper Cover
Courtesy of HYUNDAI MOTOR CO.

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.



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Fig. 25: Identifying Tensioner Pulley & Idler Pulley
Courtesy of HYUNDAI MOTOR CO.

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

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

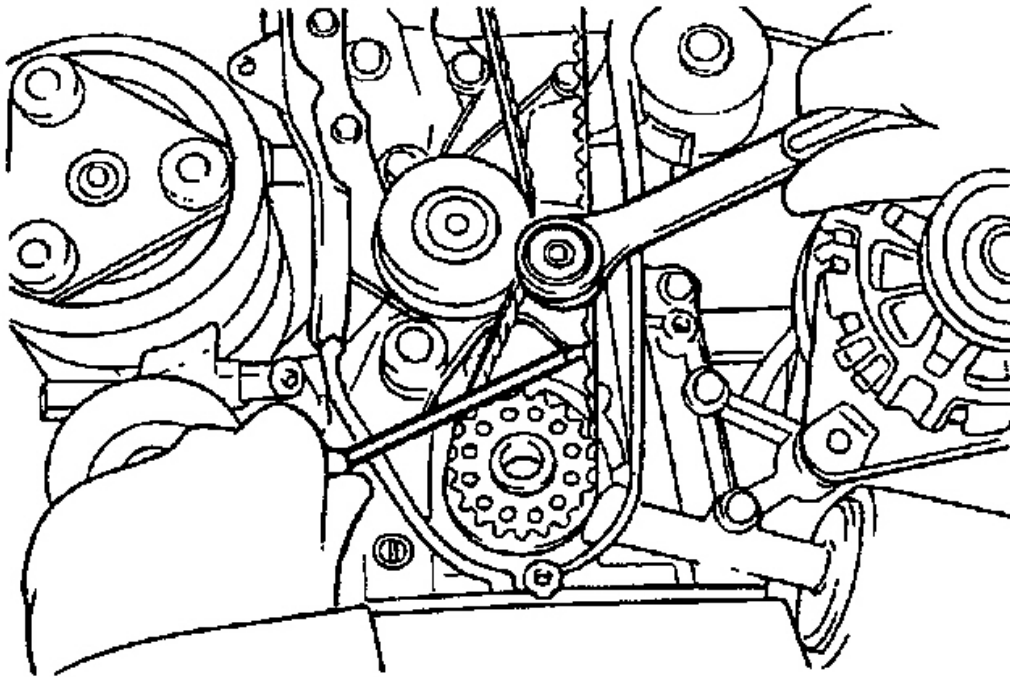
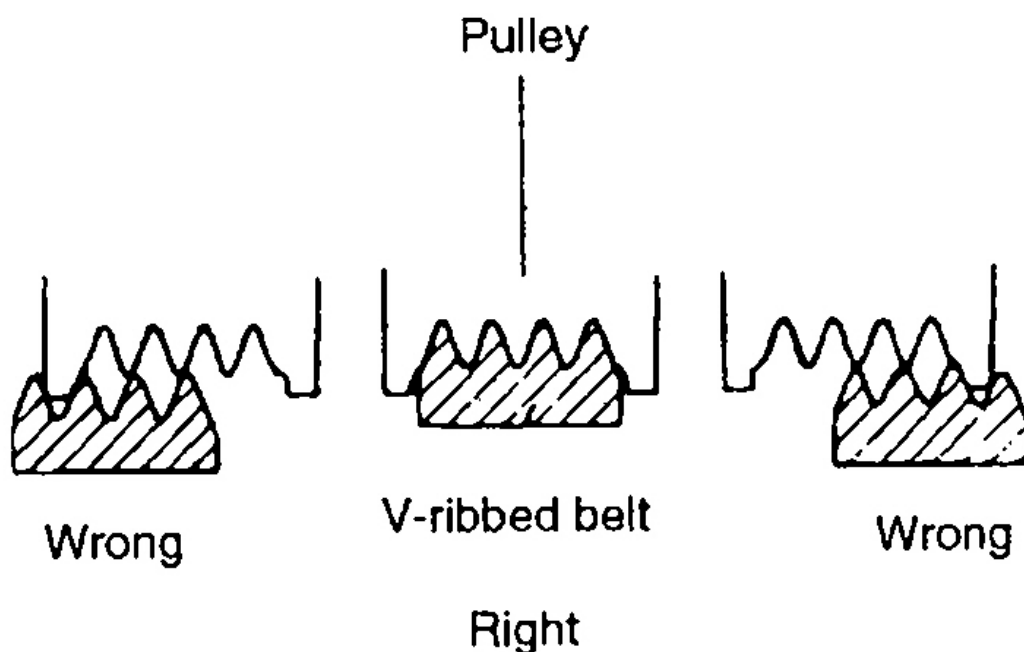
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Fig. 26: Loosening Tensioner Bolt
Courtesy of HYUNDAI MOTOR CO.

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

ADJUSTING DRIVE BELT TENSION

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



G00960756

Fig. 27: Identifying Popper Belt-To-Pulley Installation
Courtesy of HYUNDAI MOTOR CO.

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

STANDARD VALUE:

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2003 ENGINE 2.0L 4 Cylinder DOHC - Elantra

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)	-	-

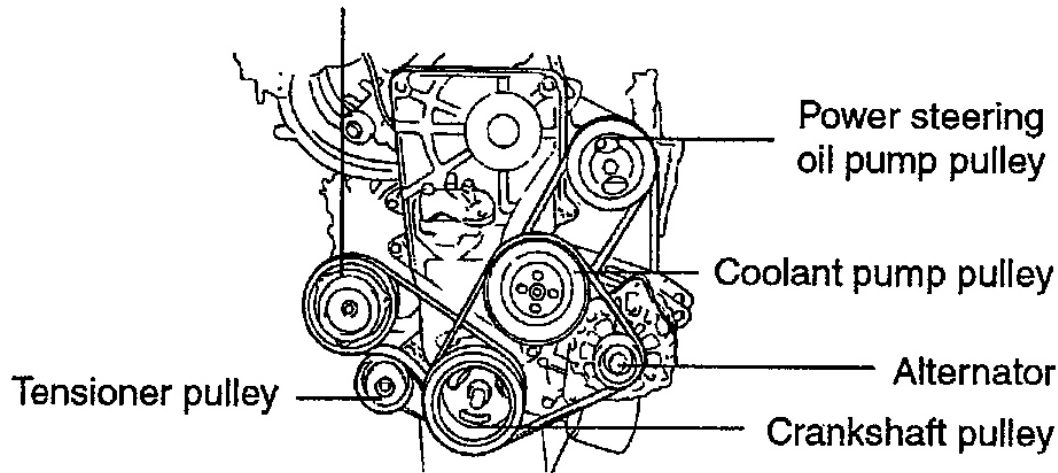
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Fig. 28: Drive Belt Standard Value Table
Courtesy of HYUNDAI MOTOR CO.

NOTE:

1. The belt tension must be measured half - way between the specified pulleys.
2. When a new belt is installed, adjust the tension to the central value of the standard range indicated under "New" in 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 a belt installed newly after 5 minutes or more of operation, refer to Fig. 28 indicated under "Used" in the above table.
4. Refer to Fig. 28 indicated under "Inspection" for periodic inspections.

Air conditioning compressor pulley



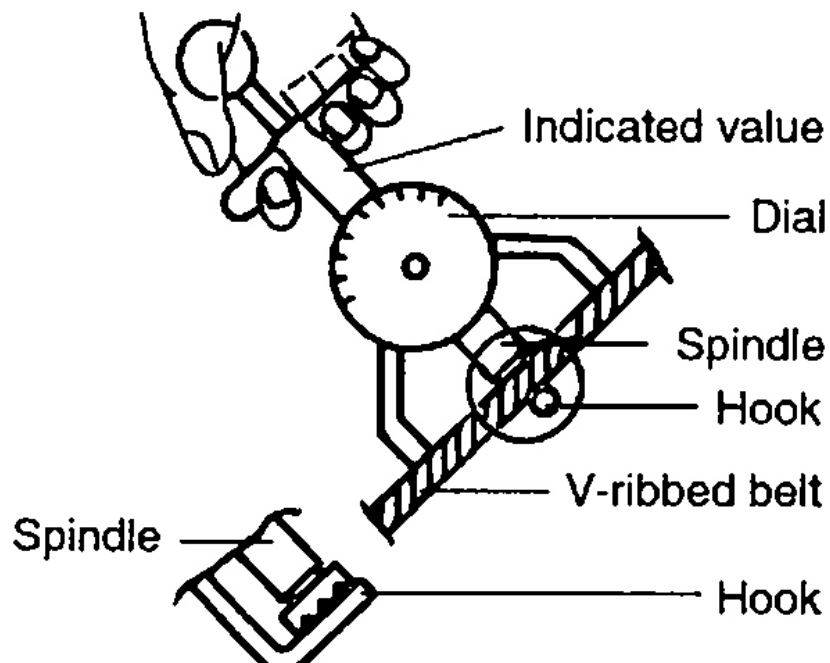
G00960758

Fig. 29: Identifying Drive Belt Pulleys
Courtesy of HYUNDAI MOTOR CO.

TYPE A TENSION GAUGE

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

Type A



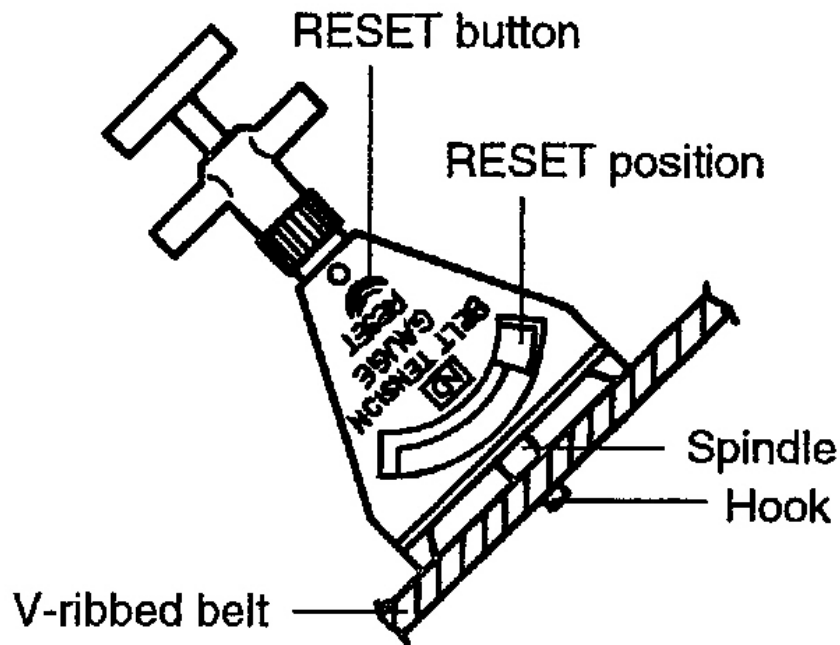
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Fig. 30: Identifying Type A Tension Gauge
Courtesy of HYUNDAI MOTOR CO.

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.

Type B



G00960760

Fig. 31: Identifying Type B Tension Gauge
 Courtesy of HYUNDAI MOTOR CO.

ADJUSTING THE ALTERNATOR BELT

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

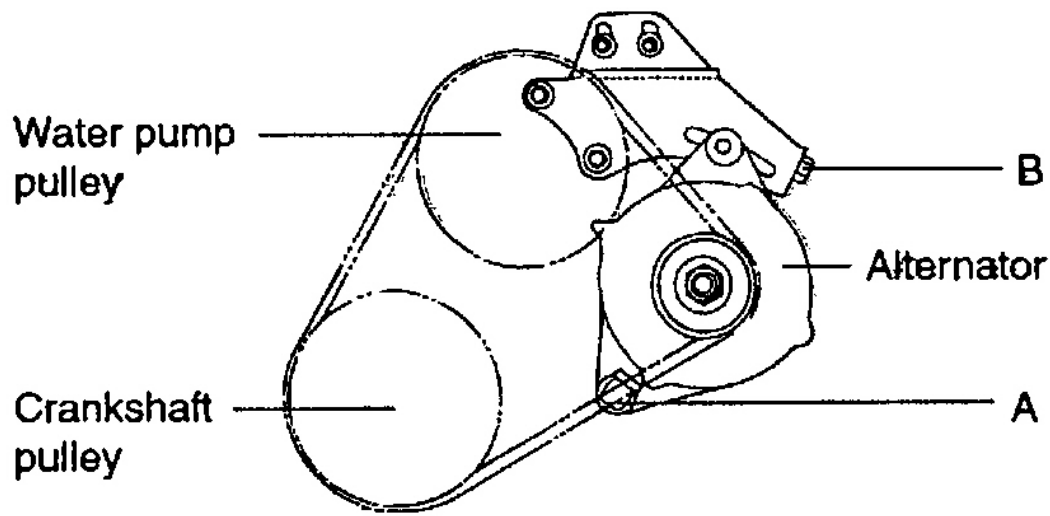
1. Loosen the alternator nut "A" and the tension adjuster lock bolt "B".
2. Using the tension adjuster bolt, adjust the belt tension to the specification.
3. Tighten the adjuster lock bolt "B".
4. Tighten the alternator nut "A".
5. Check the tension or the deflection of belt, and readjust if necessary.

Tightening torque

Alternator support bolt and nut: 20-25 Nm (200-250 kg.cm, 14-18 lb.ft)

Alternator lock bolt B: 12-15 Nm (120-150 kg.cm, 9-11 lb.ft)

Alternator brace mounting bolt: 20-27 Nm (200-270 kg.cm, 15-20 lb.ft)

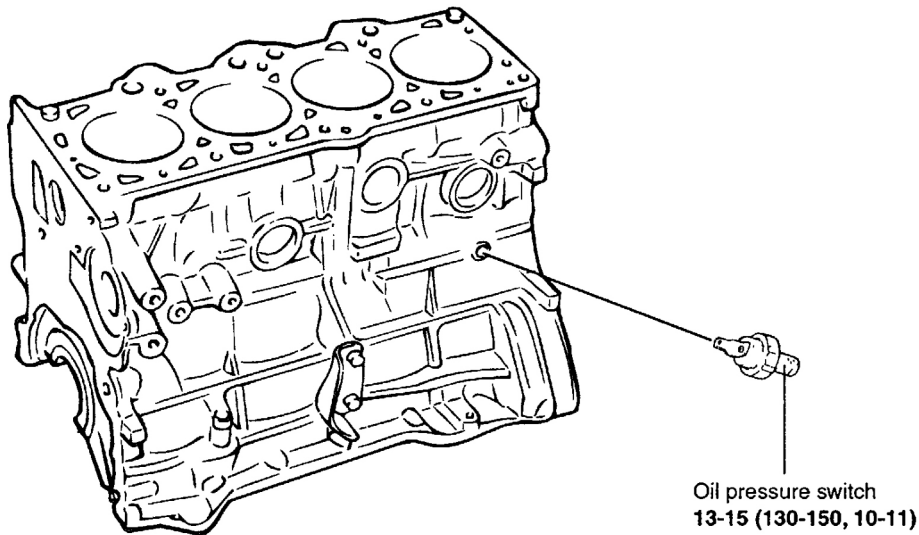


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Fig. 32: Identifying Alternator Belt Tensioner
Courtesy of HYUNDAI MOTOR CO.

ENGINE BLOCK

COMPONENTS



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

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Fig. 33: Engine Block Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

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

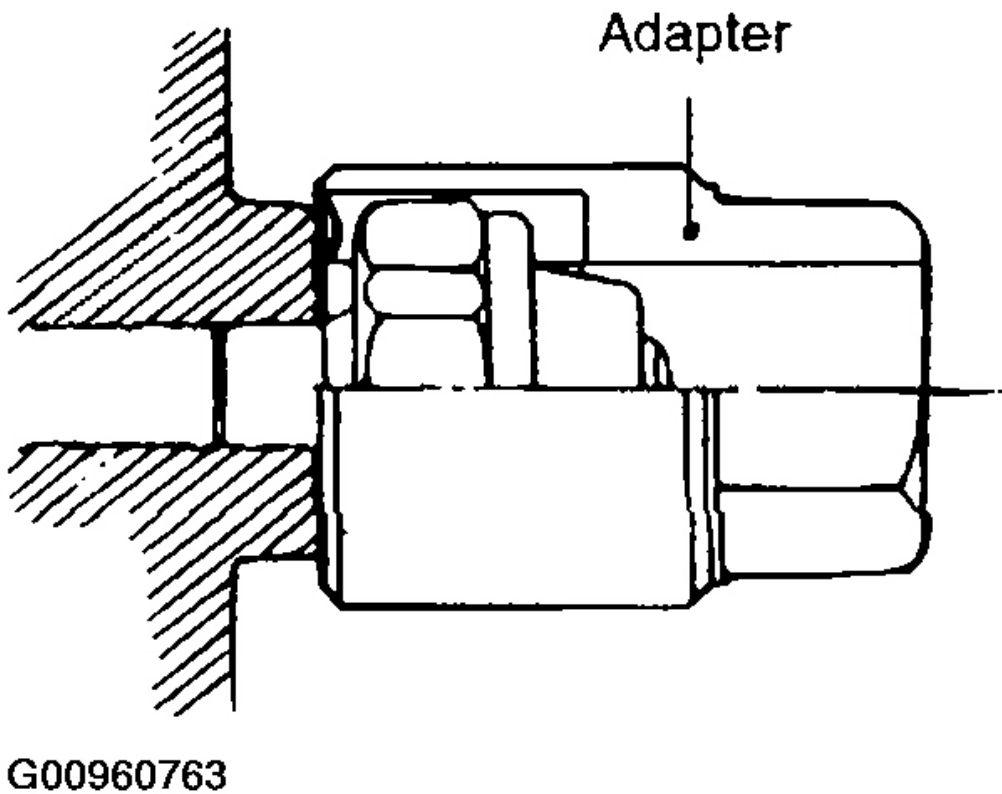


Fig. 34: Removing Oil Pressure Switch
Courtesy of HYUNDAI MOTOR CO.

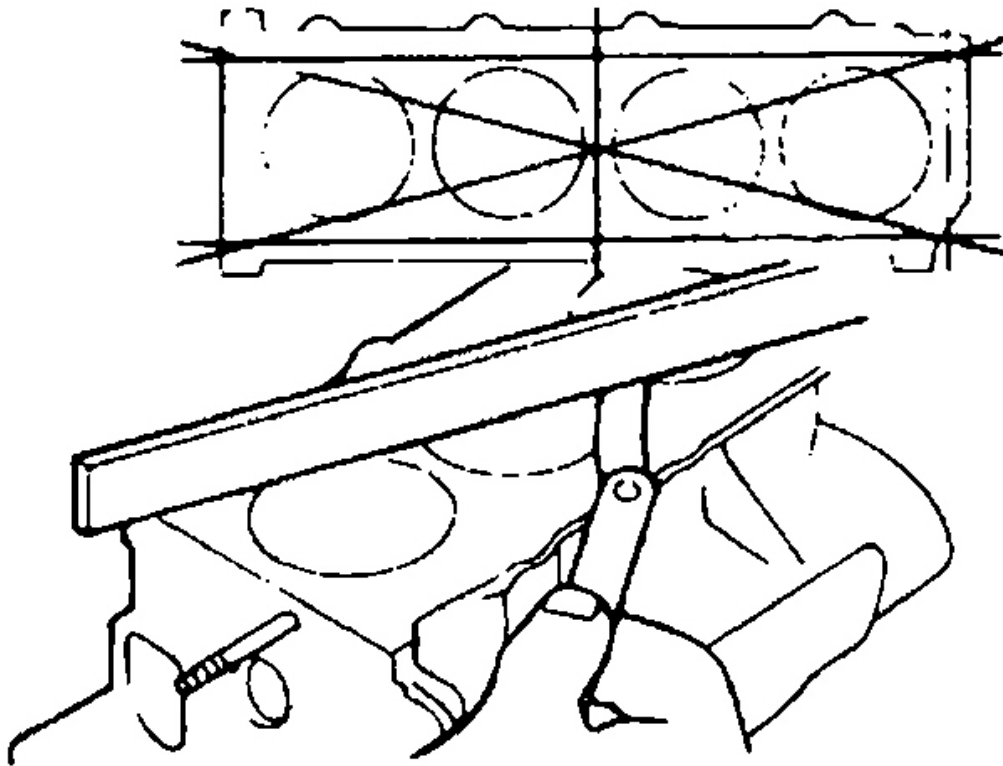
INSPECTION

CYLINDER BLOCK

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

Standard: 0.03 mm (0.0012 in.) or less

Limit: 0.1 mm (0.0039 in.) or less



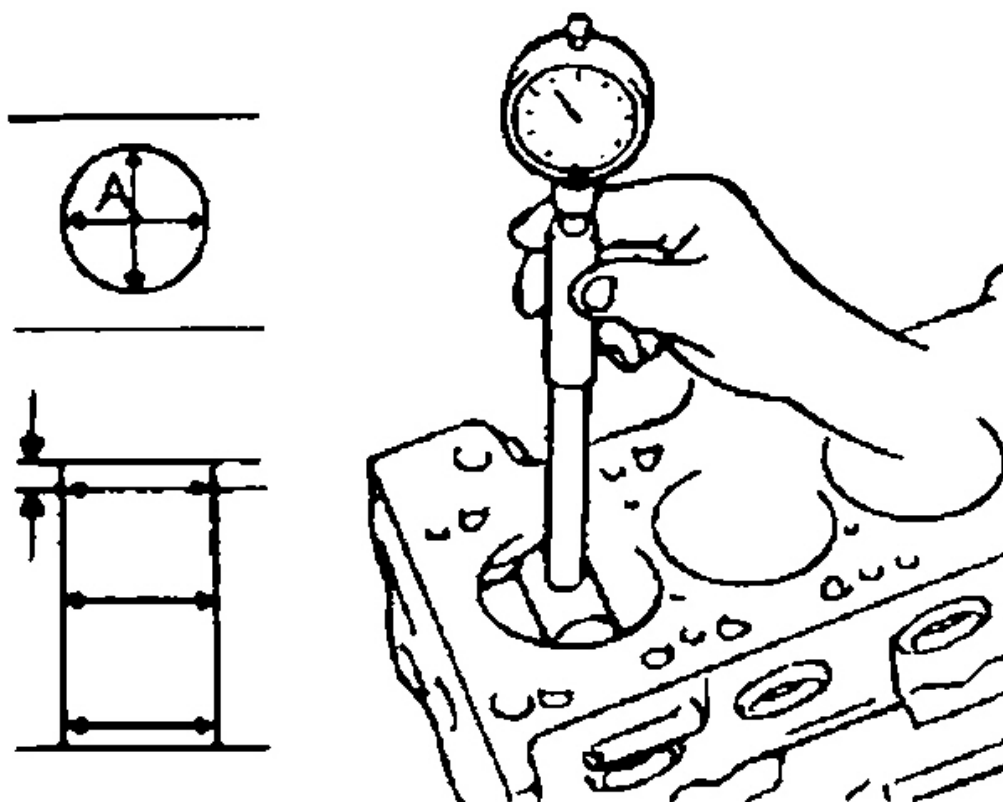
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Fig. 35: Checking Block Surface Flatness
Courtesy of HYUNDAI MOTOR CO.

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

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

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



G00960765

Fig. 36: Measuring Cylinder Bore
Courtesy of HYUNDAI MOTOR CO.

4. If a cylinder ridge exists, cut away with a ridge reamer.
5. Oversize pistons are available in four sizes.
Piston service size and mark mm (in.)
0.25 (0.010) O.S.: 0.25
0.50 (0.020) O.S.: 0.50
0.75 (0.030) O.S.: 0.75
1.00 (0.039) O.S.: 1.00
6. When boring the cylinder bore to the oversize, maintain the specified clearance between the oversize piston and the bore, and make sure that all pistons used are the same oversize.
7. The standard measurement of the piston outside diameter is taken 47 mm (1.85 in.) from the top land of the piston.

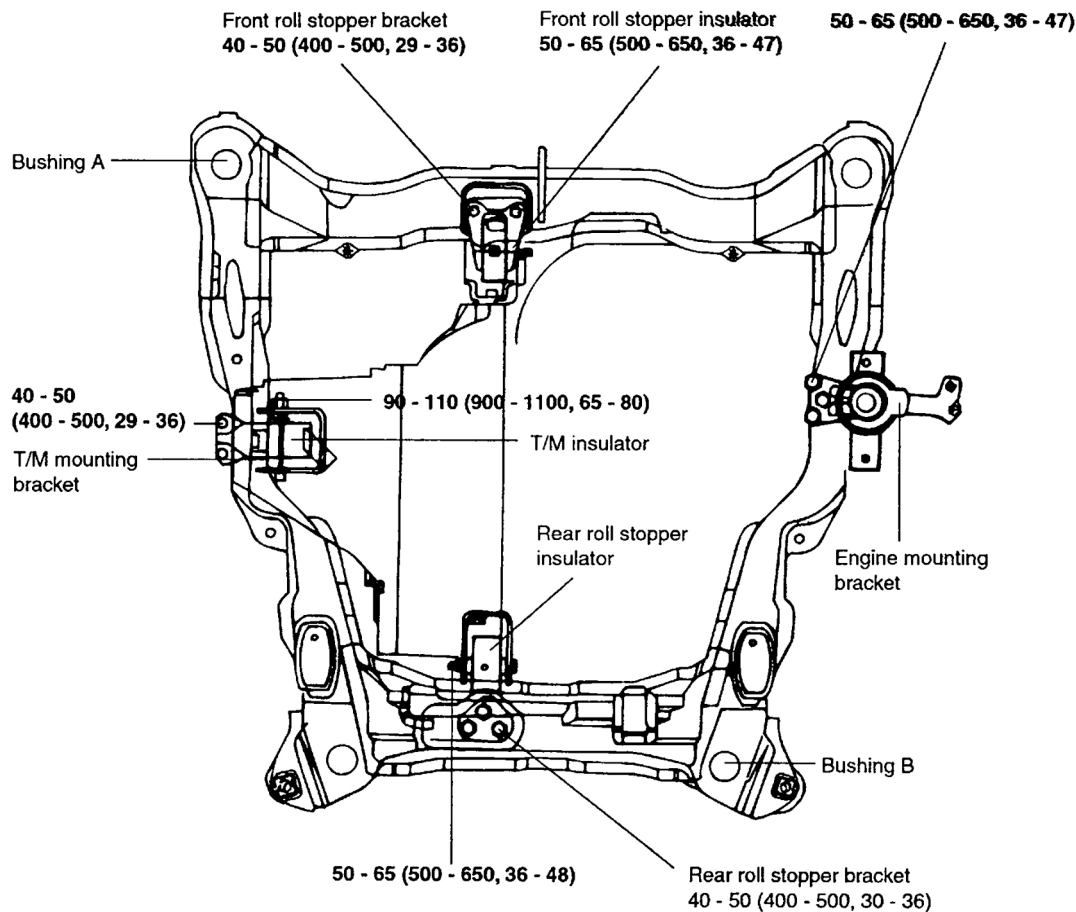
Piston-to-cylinder clearance (To set limits to new parts):

0.02-0.04 mm (0.0008-0.0016 in.)

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

ENGINE MOUNTS

ENGINE MOUNTING



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

G00960766

Fig. 37: Identifying Engine Mounts
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

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

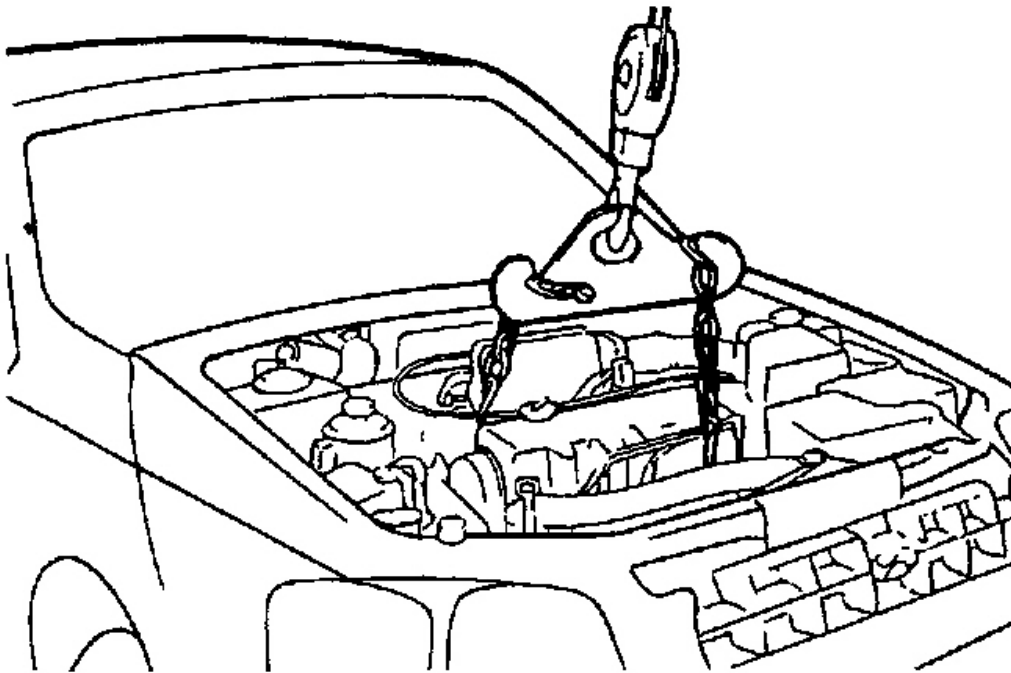
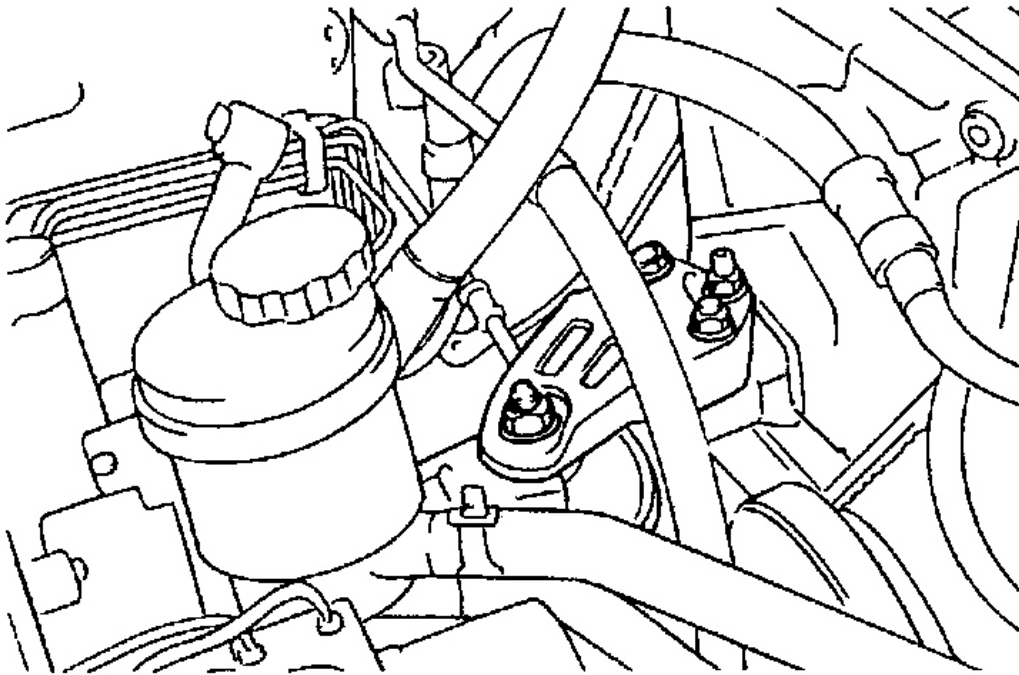
**G00960767**

Fig. 38: Attaching Engine Hoist
Courtesy of HYUNDAI MOTOR CO.

ENGINE MOUNTING

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

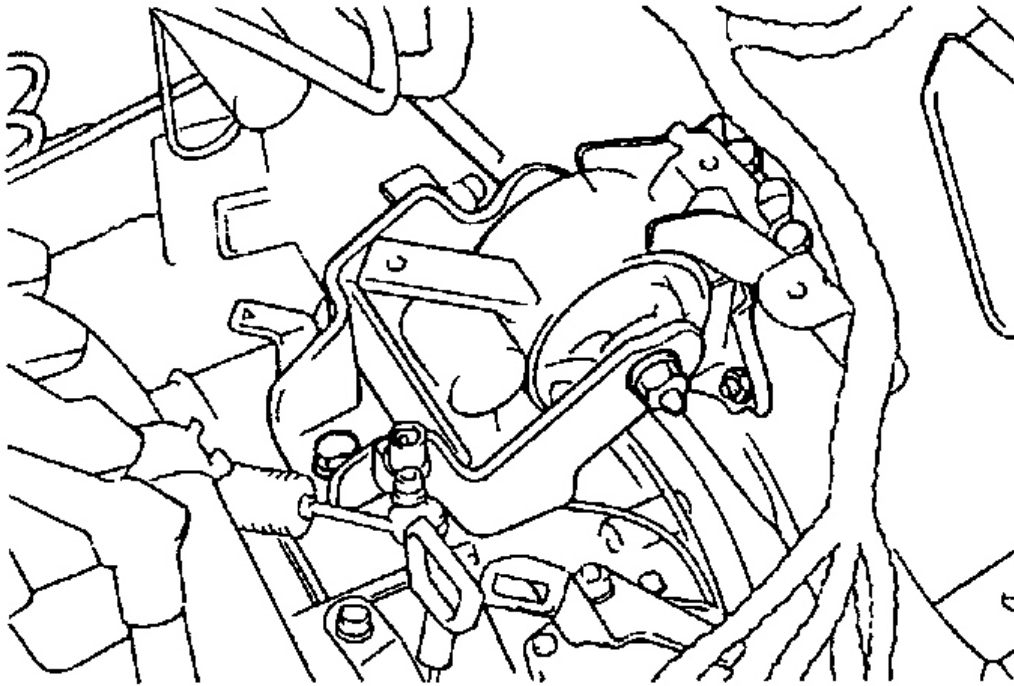


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Fig. 39: Identifying Engine Mounting Bracket Nuts
Courtesy of HYUNDAI MOTOR CO.

TRANSMISSION MOUNTING

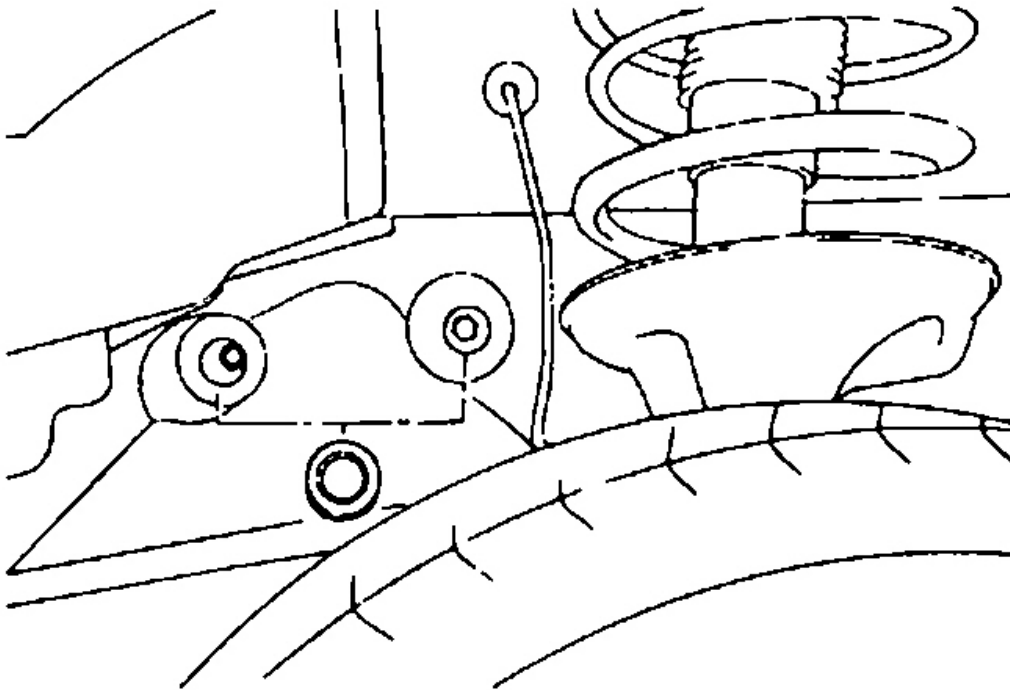
1. For vehicles with a 5-speed manual transmission, remove the select control valve.
2. Remove the transmission mounting bolt.



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Fig. 40: Identifying Transmission Mounting Bolt
Courtesy of HYUNDAI MOTOR CO.

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

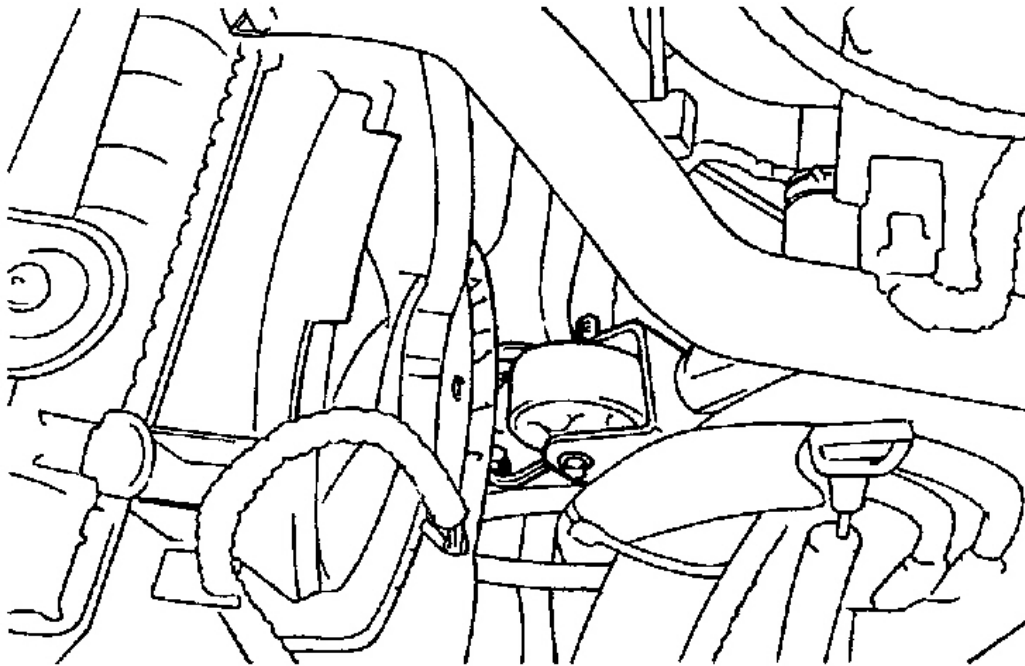


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Fig. 41: Identifying Transmission Bracket Bolts
Courtesy of HYUNDAI MOTOR CO.

FRONT ROLL STOPPER

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

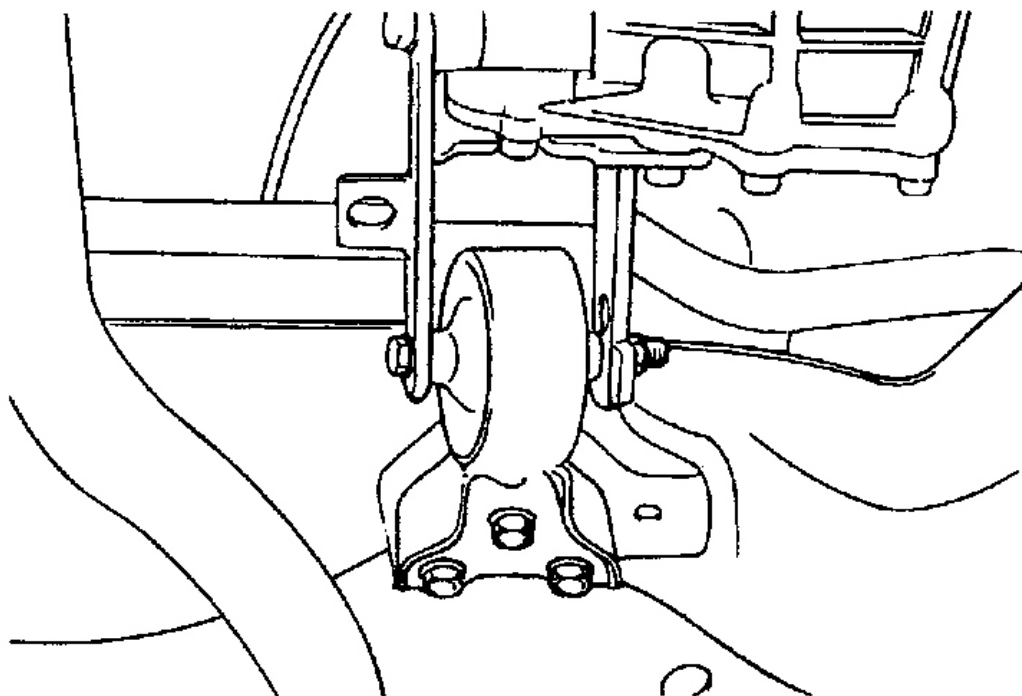


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Fig. 42: Identifying Front Roll Stopper
Courtesy of HYUNDAI MOTOR CO.

REAR ROLL STOPPER

1. Remove the rear roll stopper from the subframe.



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Fig. 43: Identifying Rear Roll Stopper
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

TRANSMISSION MOUNTING

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

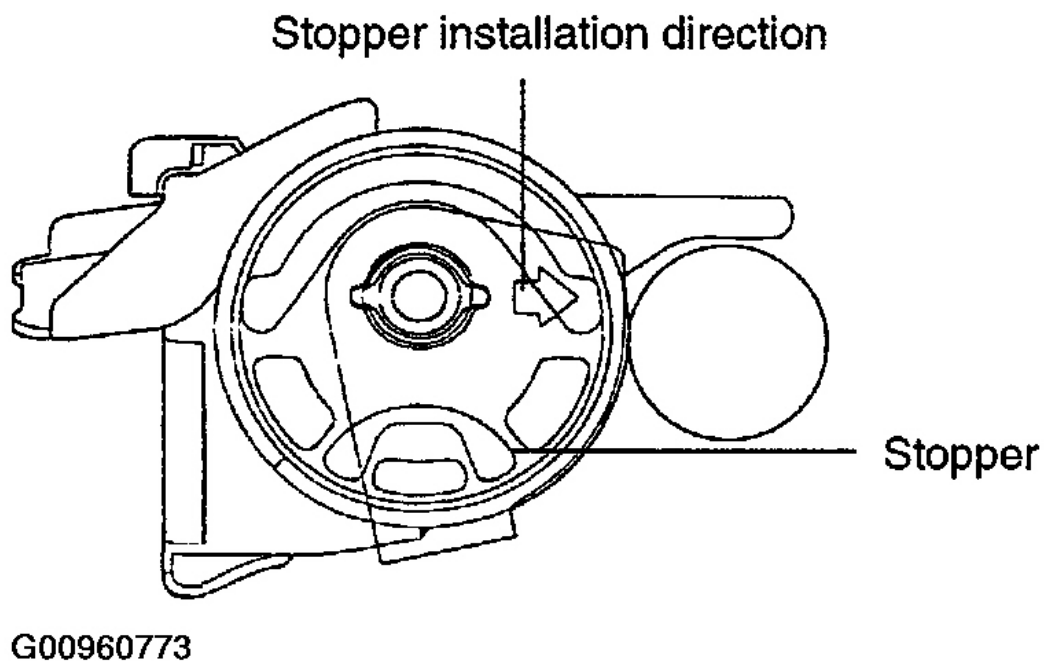
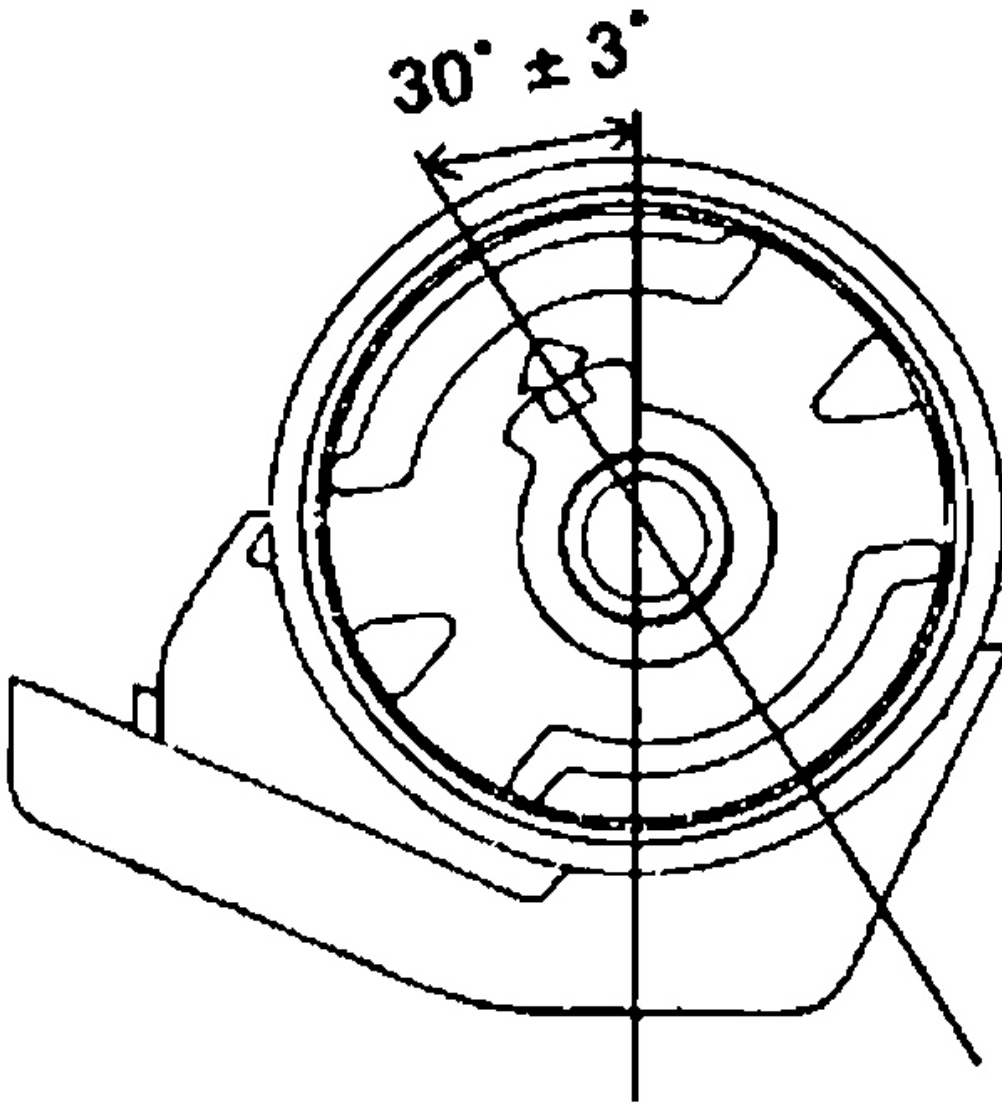


Fig. 44: Identifying Proper Stopper Installation
Courtesy of HYUNDAI MOTOR CO.

FRONT ROLL STOPPER

1. Install the insulator in the correct angle.
A/T : 30 +/- 3°
M/T : 14 +/- 3°



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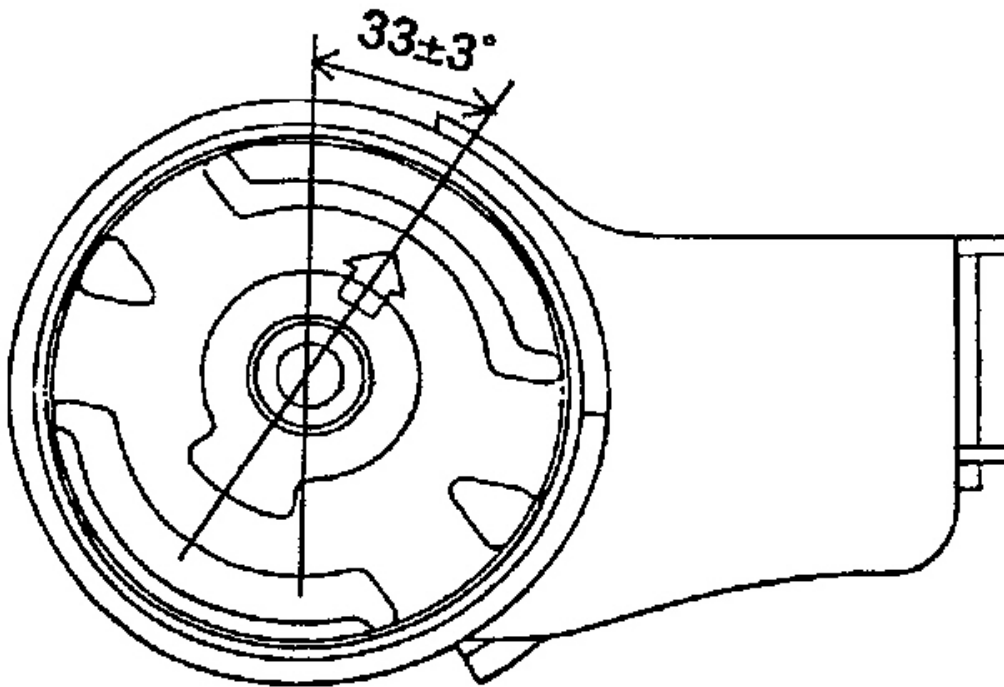
Fig. 45: Identifying Proper Front Roll Stopper Installation
Courtesy of HYUNDAI MOTOR CO.

REAR ROLL STOPPER

1. Install the insulator in the correct angle.

A/T : 33 +/- 3°

M/T : 20 +/- 3°



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Fig. 46: Identifying Proper Rear Roll Stopper Installation
Courtesy of HYUNDAI MOTOR CO.

MOUNTING BUSHING

NOTE:

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

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

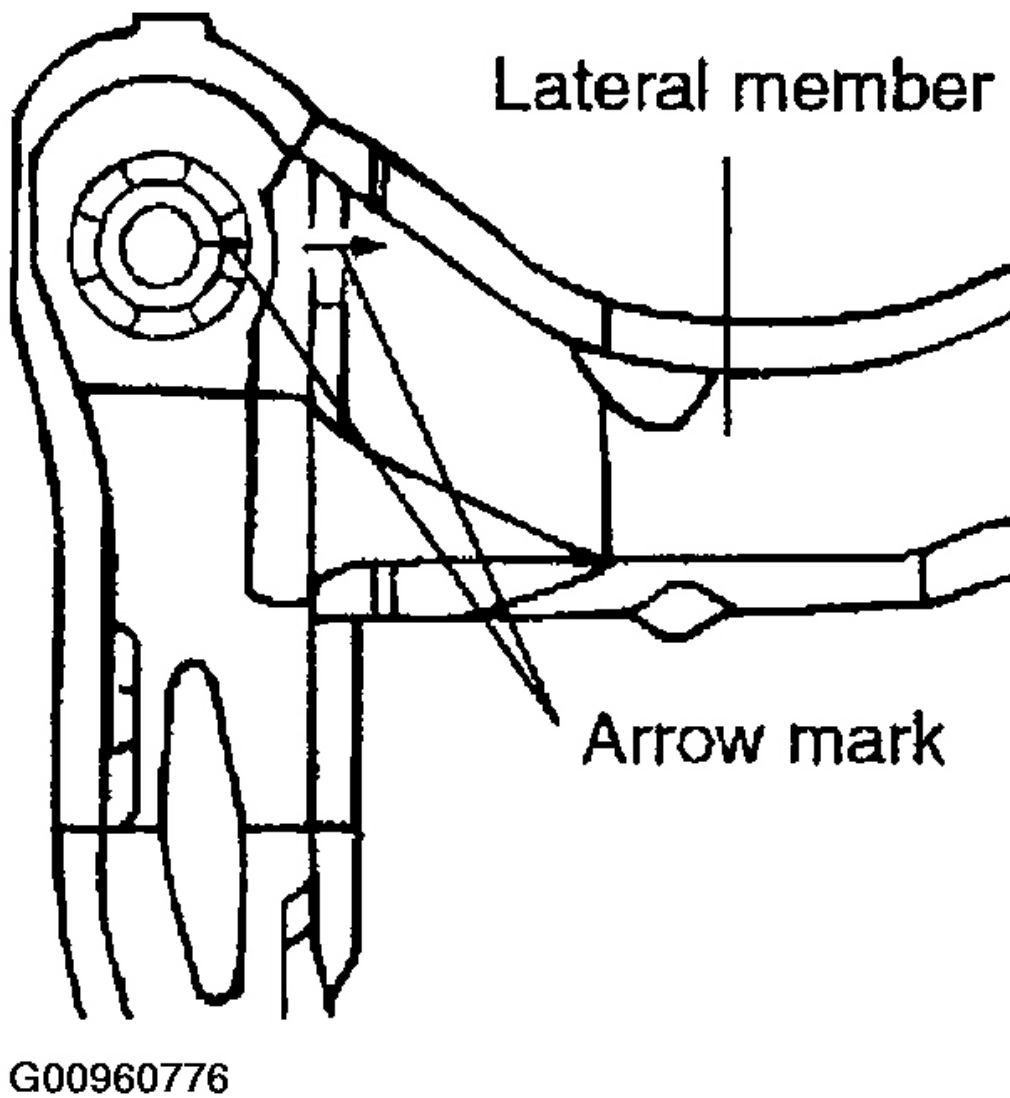
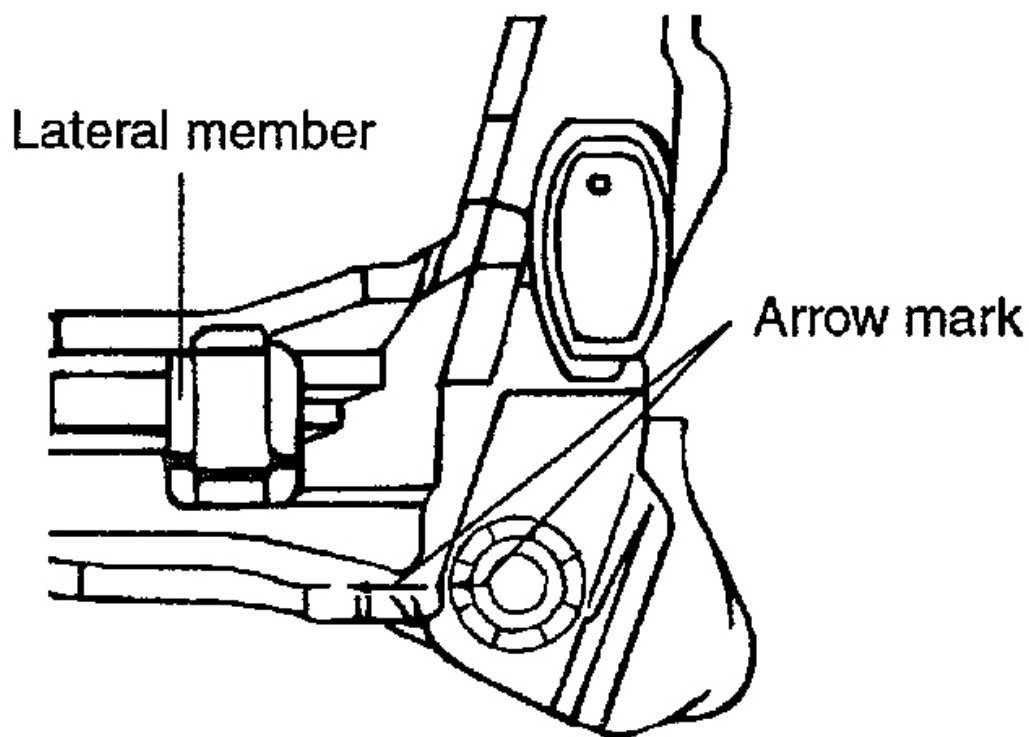


Fig. 47: Identifying Proper Bushing Installation
Courtesy of HYUNDAI MOTOR CO.



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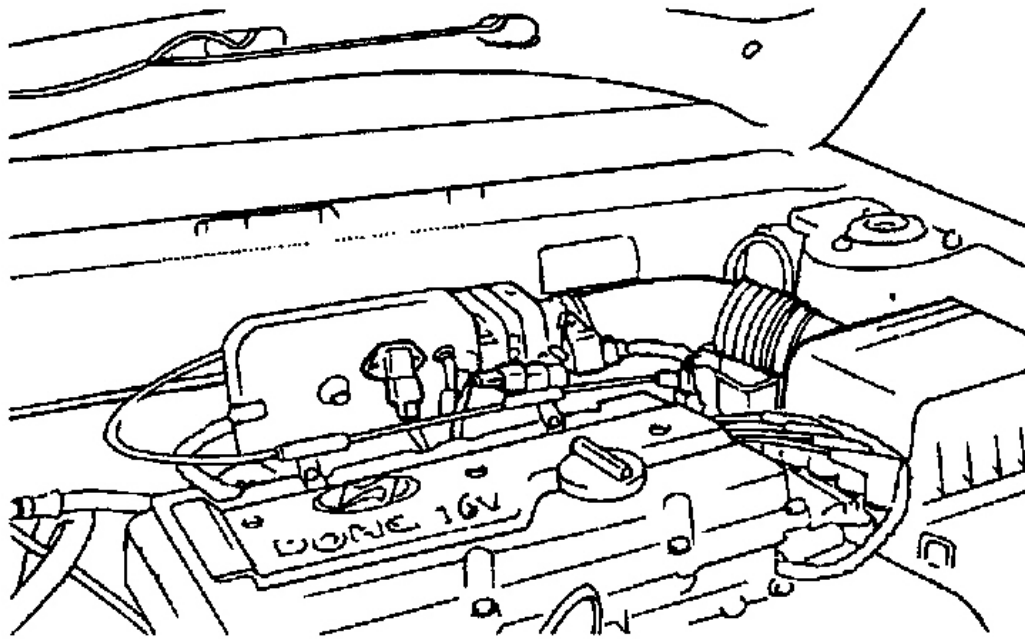
Fig. 48: Identifying Proper Bushing Installation
Courtesy of HYUNDAI MOTOR CO.

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

ENGINE & TRANSAXLE ASSEMBLY

REMOVAL

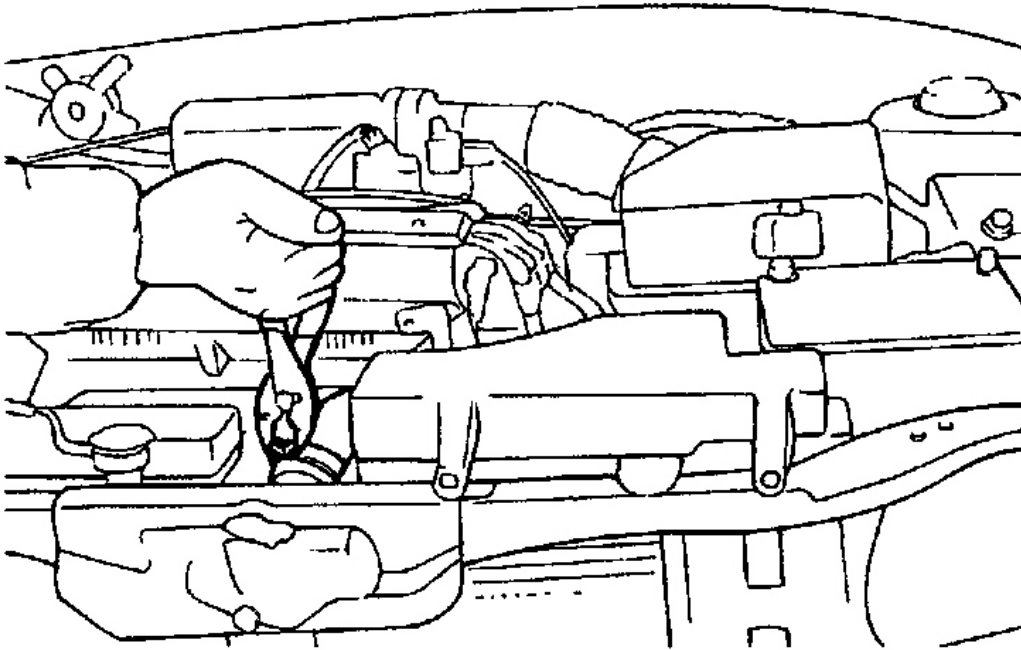
1. Remove the battery.
2. Detach the air cleaner.



G00960778

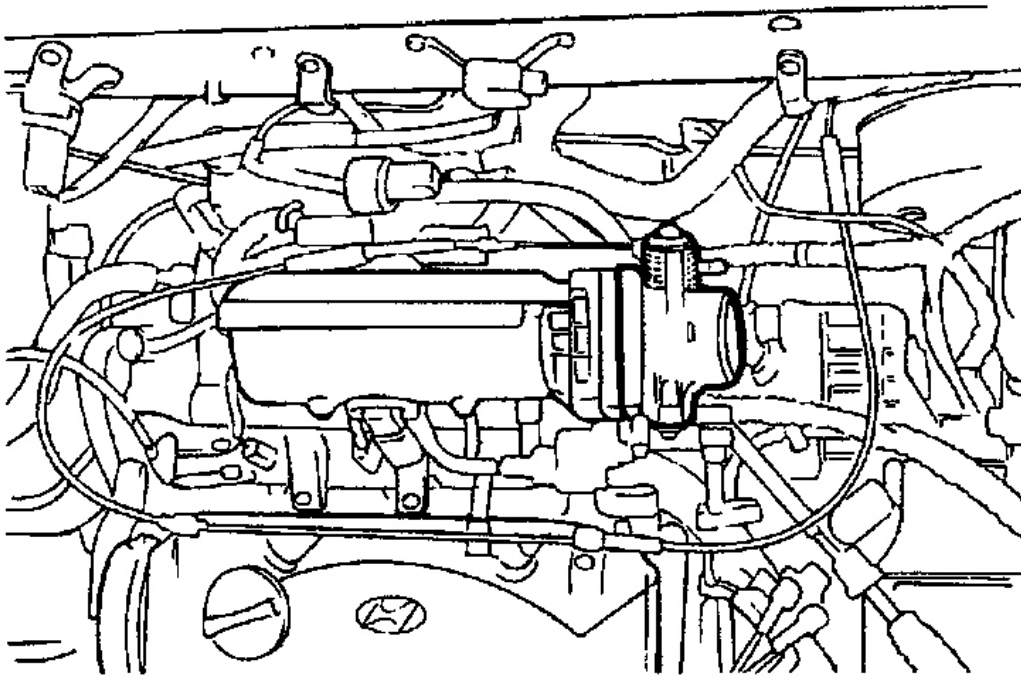
Fig. 49: Identifying Air Cleaner
Courtesy of HYUNDAI MOTOR CO.

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



G00960779

Fig. 50: Removing Radiator Hose
Courtesy of HYUNDAI MOTOR CO.



G00960780

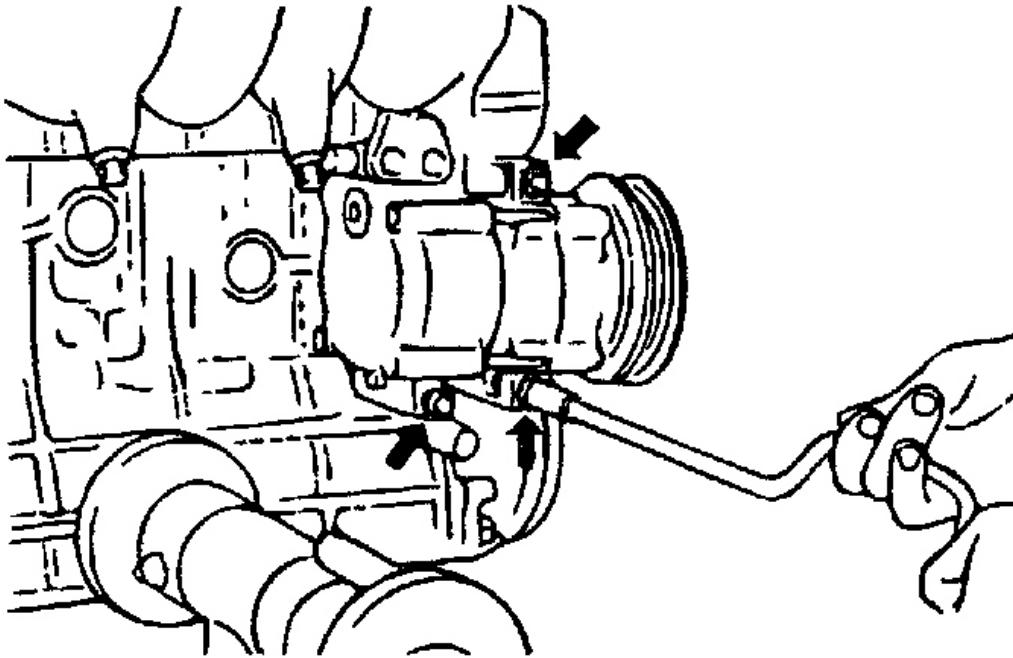
Fig. 51: Identifying Accelerator Cable
Courtesy of HYUNDAI MOTOR CO.

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

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

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

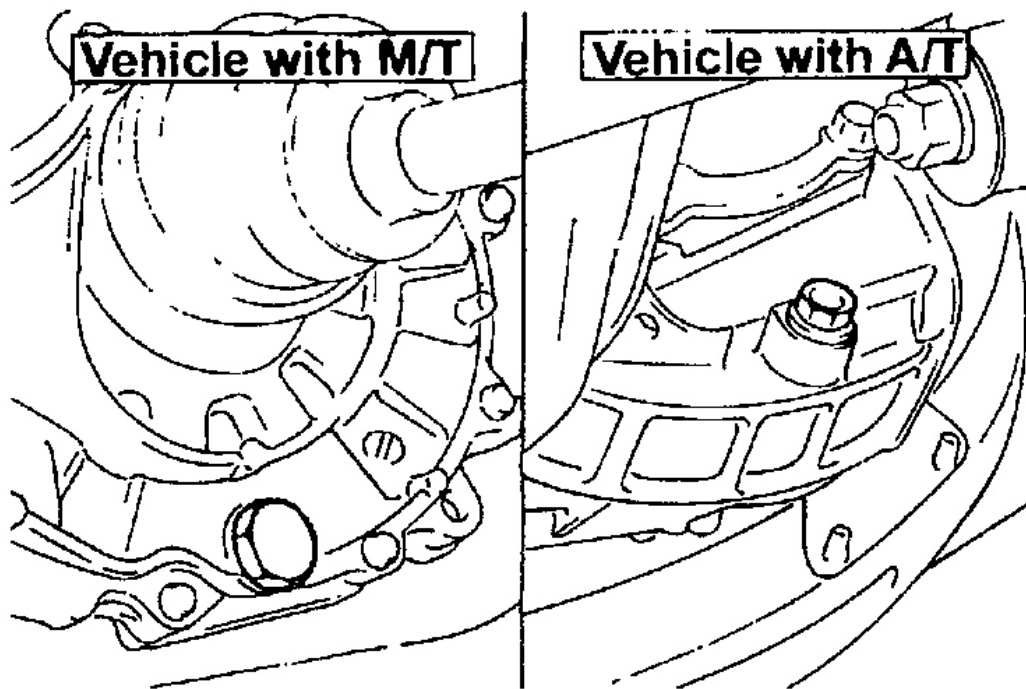
16. Disconnect the air conditioner compressor from the mounting bracket.



G00960781

Fig. 52: Removing Air Conditioner Compressor
Courtesy of HYUNDAI MOTOR CO.

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



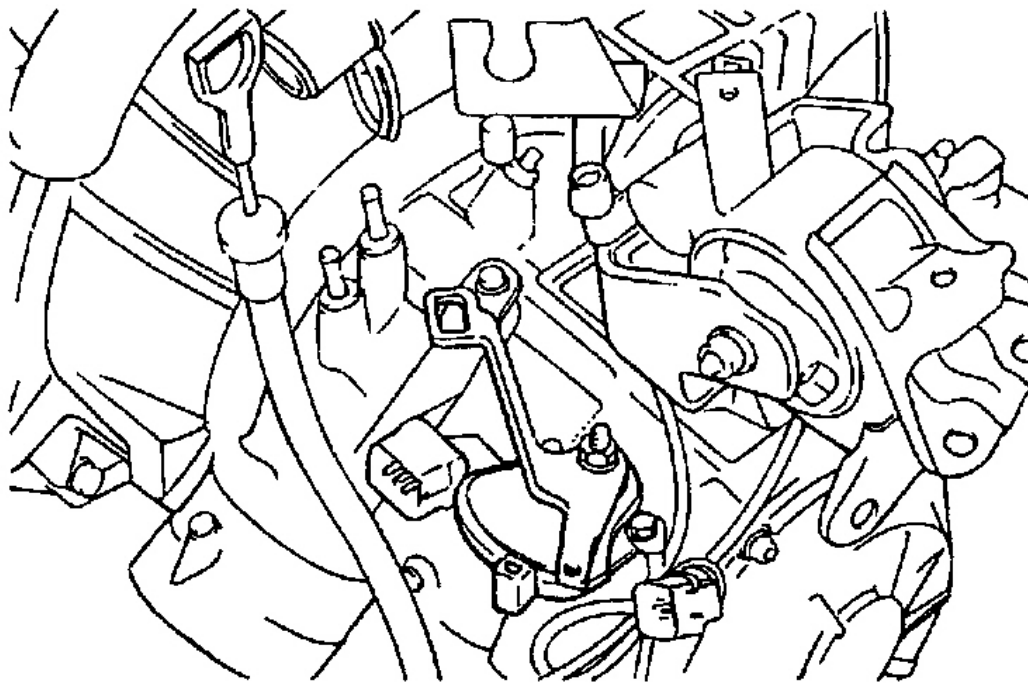
G00960782

Fig. 53: Identifying Transmission Drain Plug
Courtesy of HYUNDAI MOTOR CO.

19. Disconnect the front exhaust pipe from the manifold.

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

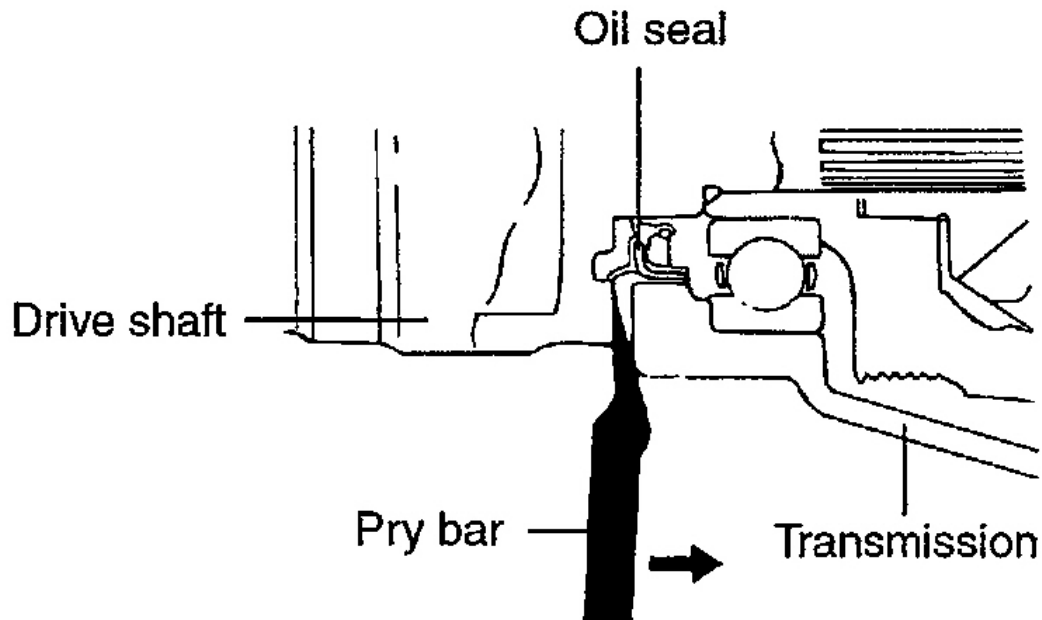
20. For vehicles with manual transmission, remove the shift control rod and extension rod.



G00960783

Fig. 54: Identifying Shift Control Rod & Extension
Courtesy of HYUNDAI MOTOR CO.

21. Remove the lower arm ball joint bolts and the stabilizer bar at the point where it is mounted to the lower arm.
22. Remove the drive shafts from the transmission case.



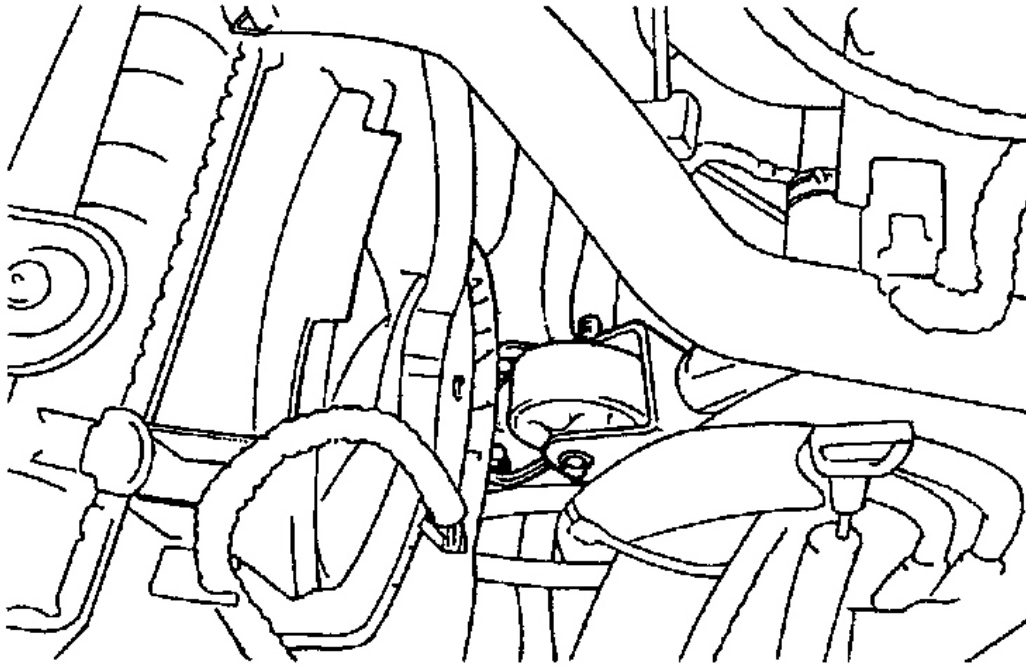
G00960784

Fig. 55: Removing Drive Shaft From Transmission
Courtesy of HYUNDAI MOTOR CO.

CAUTION:

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

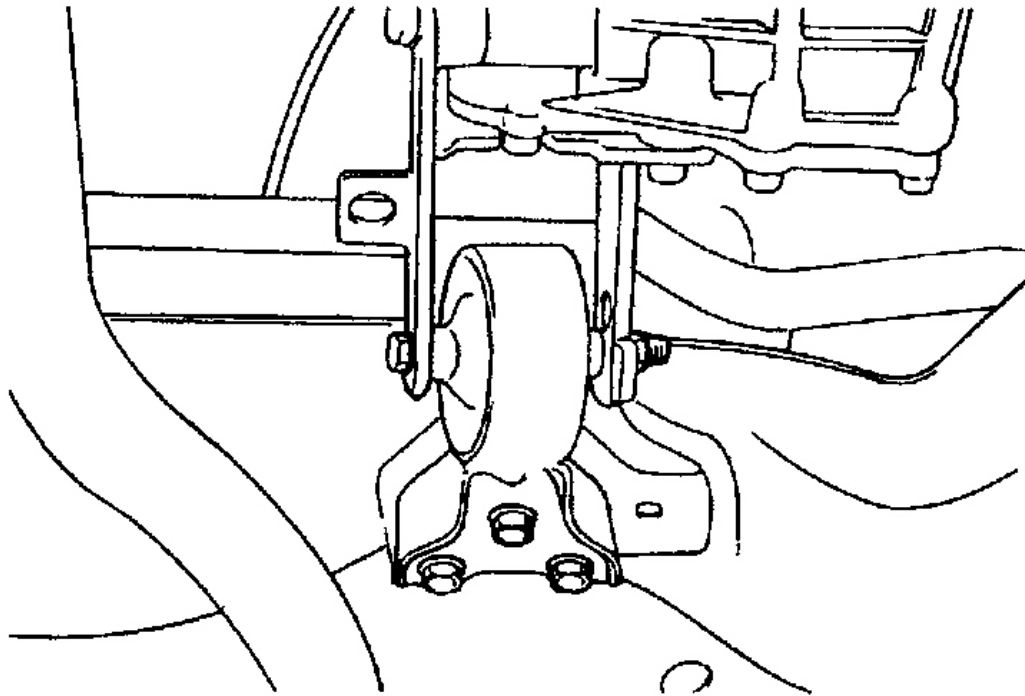
23. Hang the lower arm and drive shaft from the body with wire.
24. Attach a chains or cables to the engine. Use an engine hoist or a chain hoist to slightly raise the engine (enough to support the engine's weight while processing with the following steps).
25. Remove the front roll stopper.



G00960785

Fig. 56: Identifying Front Roll Stopper
Courtesy of HYUNDAI MOTOR CO.

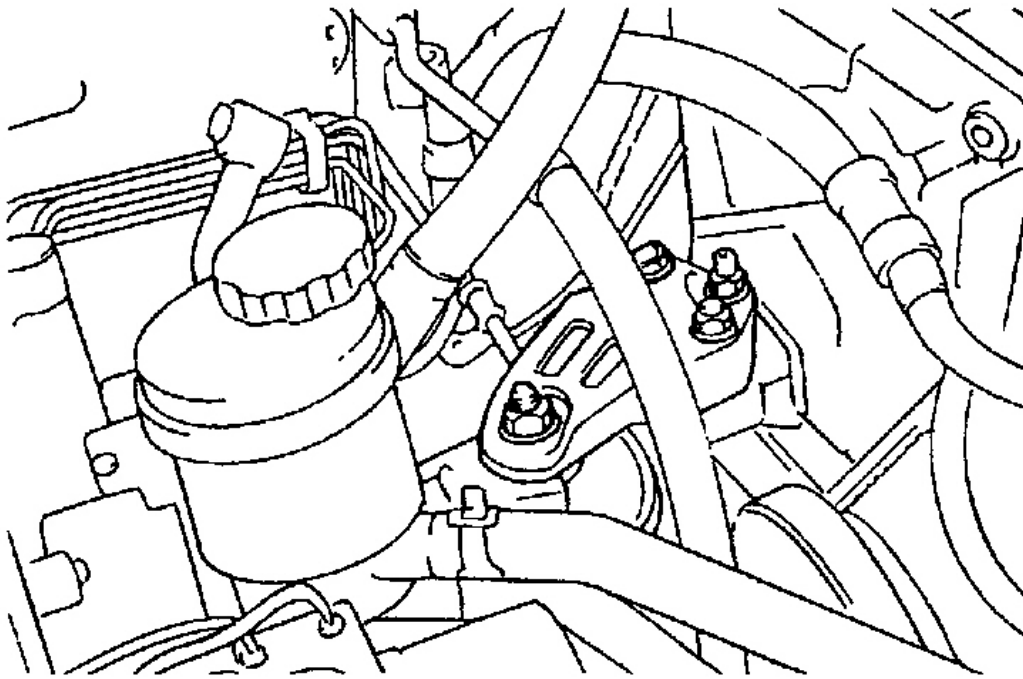
26. Separate the rear roll stopper.



G00960786

Fig. 57: Identifying Rear Roll Stopper
Courtesy of HYUNDAI MOTOR CO.

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



G00960787

Fig. 58: Identifying Engine Mounting Bracket Nuts

Courtesy of HYUNDAI MOTOR CO.

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

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

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

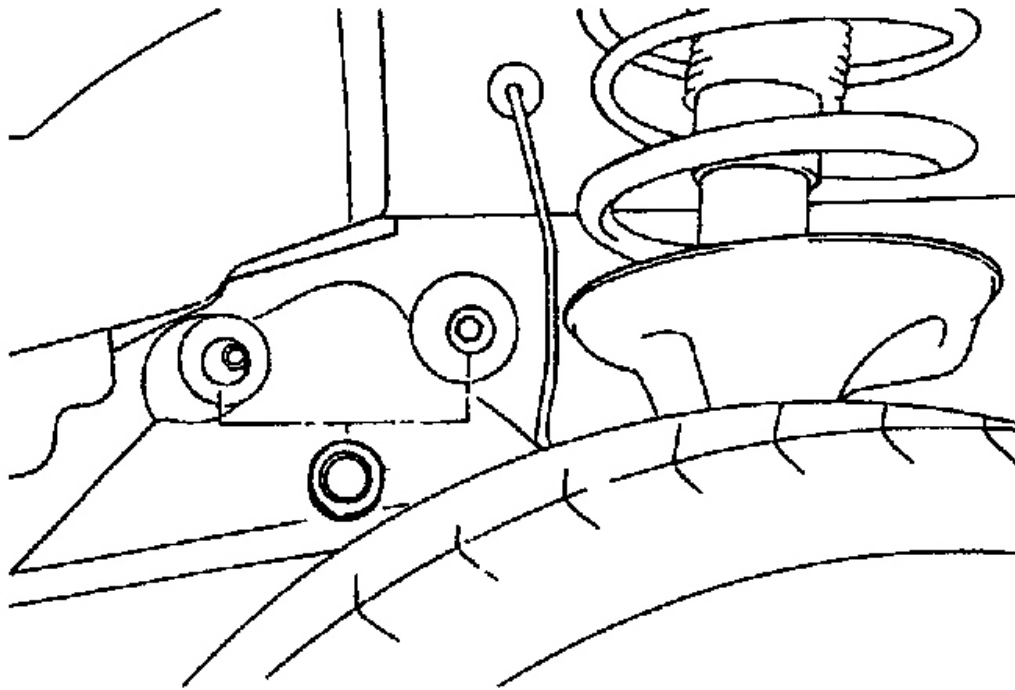
**G00960788**

Fig. 59: Identifying Transaxle Mount Bracket Bolts
Courtesy of HYUNDAI MOTOR CO.

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

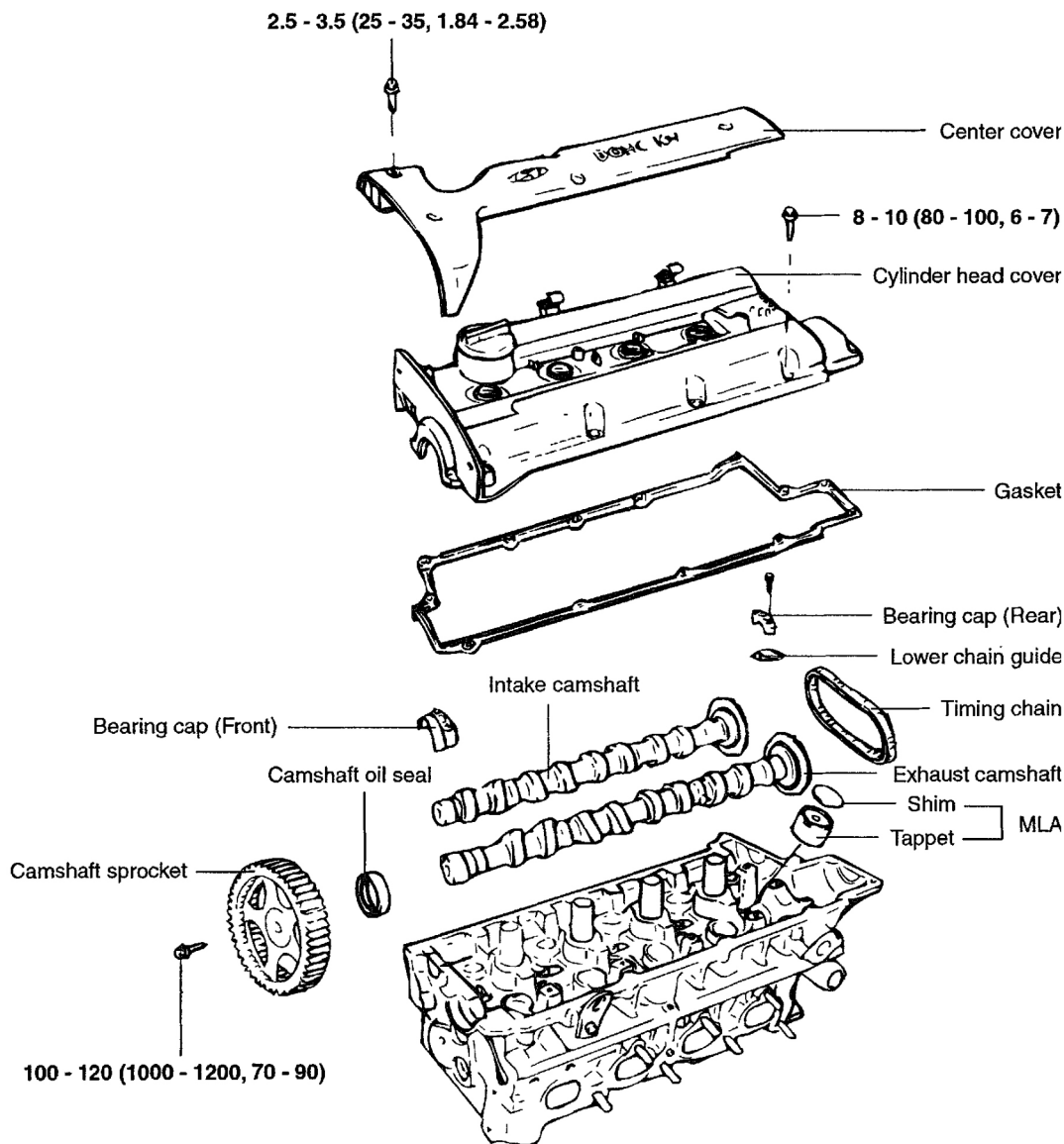
MAIN MOVING SYSTEM

CAM SHAFT

COMPONENTS

2003 Hyundai Elantra GT

2003 ENGINE 2.0L 4 Cylinder DOHC - Elantra



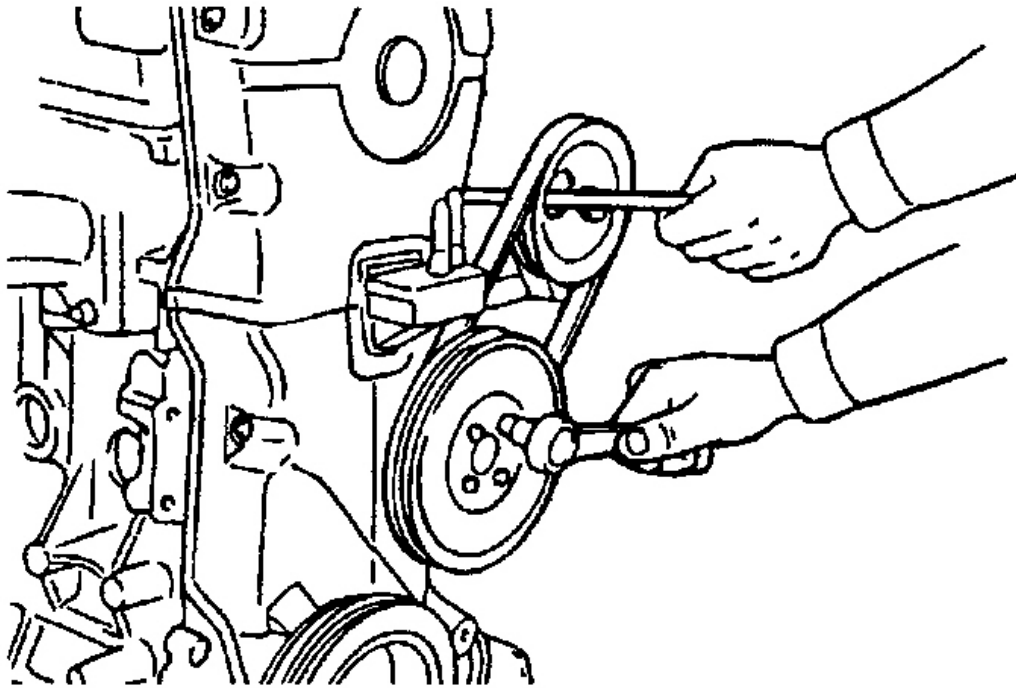
TORQUE : Nm (kg.cm, lb.ft)

G00960789

Fig. 60: Cam Shaft Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

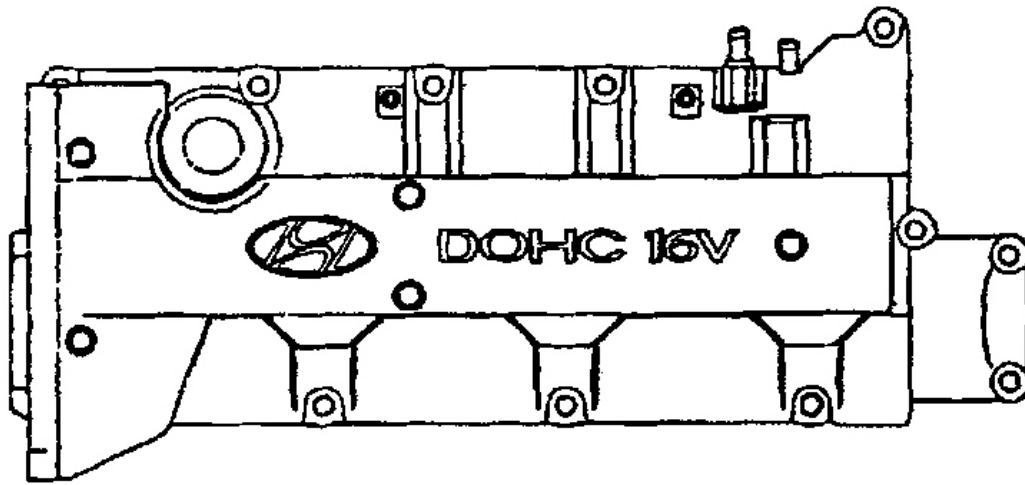
1. Disconnect the breather hose and the P.C.V. hose.
2. Remove the coolant pump pulley and crankshaft pulley.



G00960790

Fig. 61: Removing Water Pump Pulley & Crankshaft Pulley
Courtesy of HYUNDAI MOTOR CO.

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

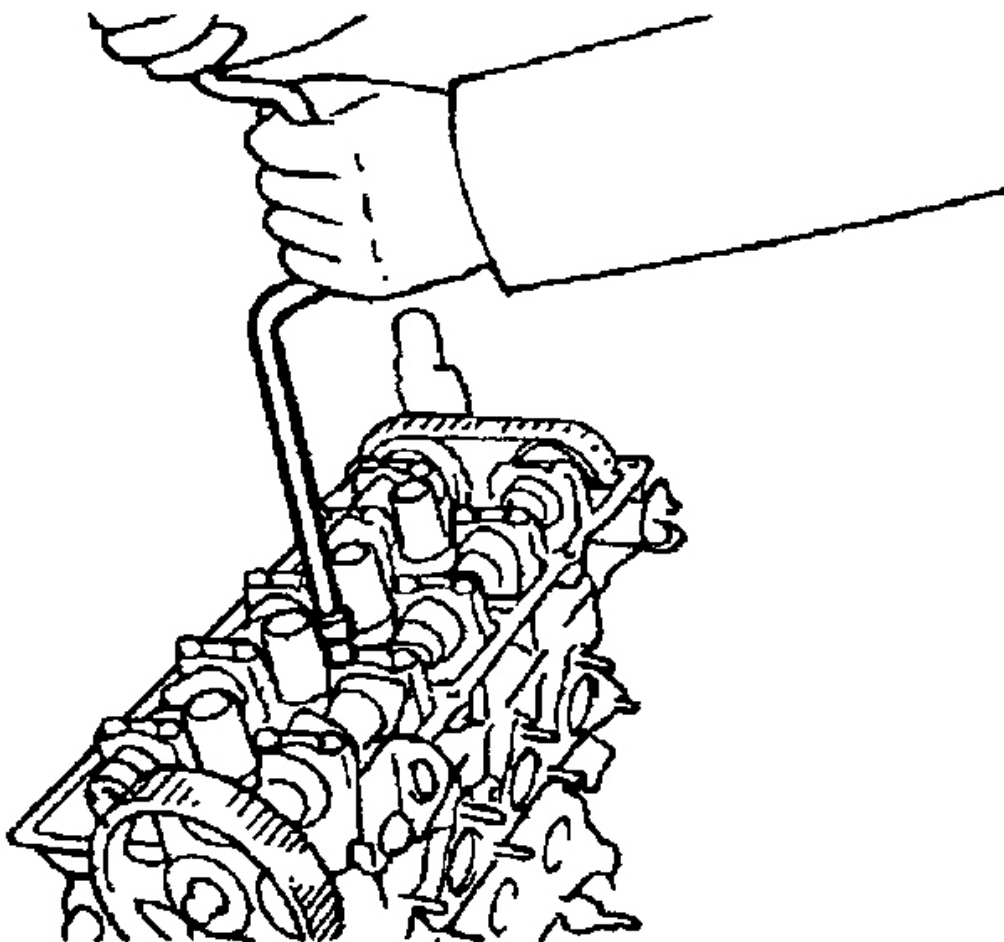


G00960791

Fig. 62: Identifying Cylinder Head Cover

Courtesy of HYUNDAI MOTOR CO.

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



G00960792

Fig. 63: Identifying Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

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

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

INSPECTION

CAMSHAFT

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

Cam height

[Standard value]

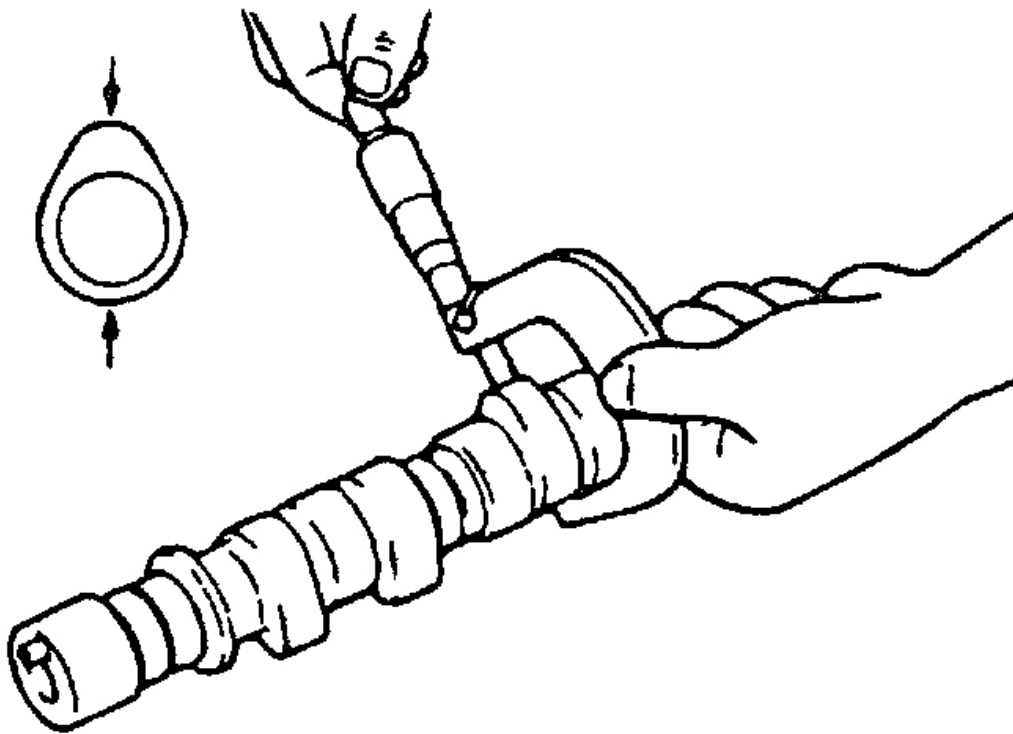
Intake: 44.820 mm (1.7646 in.)

Exhaust: 44.720 mm (1.7606 in.)

[Limit]

Intake : 44.720 mm (1.7606 in.)

Exhaust : 44.620 mm (1.7567 in.)



G00960793

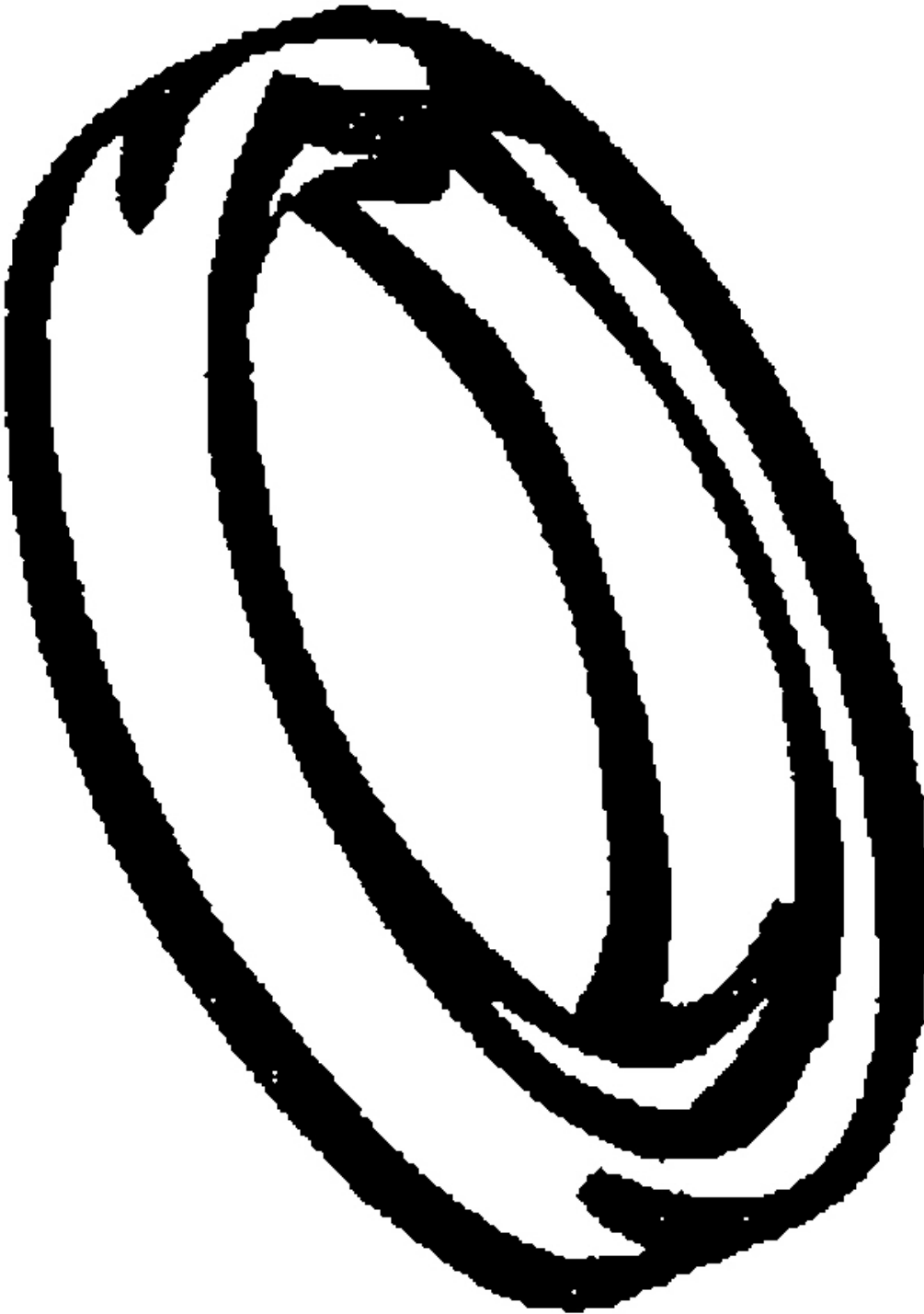
Fig. 64: Measuring Camshaft Lobe
Courtesy of HYUNDAI MOTOR CO.

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

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

CAMSHAFT OIL SEAL

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

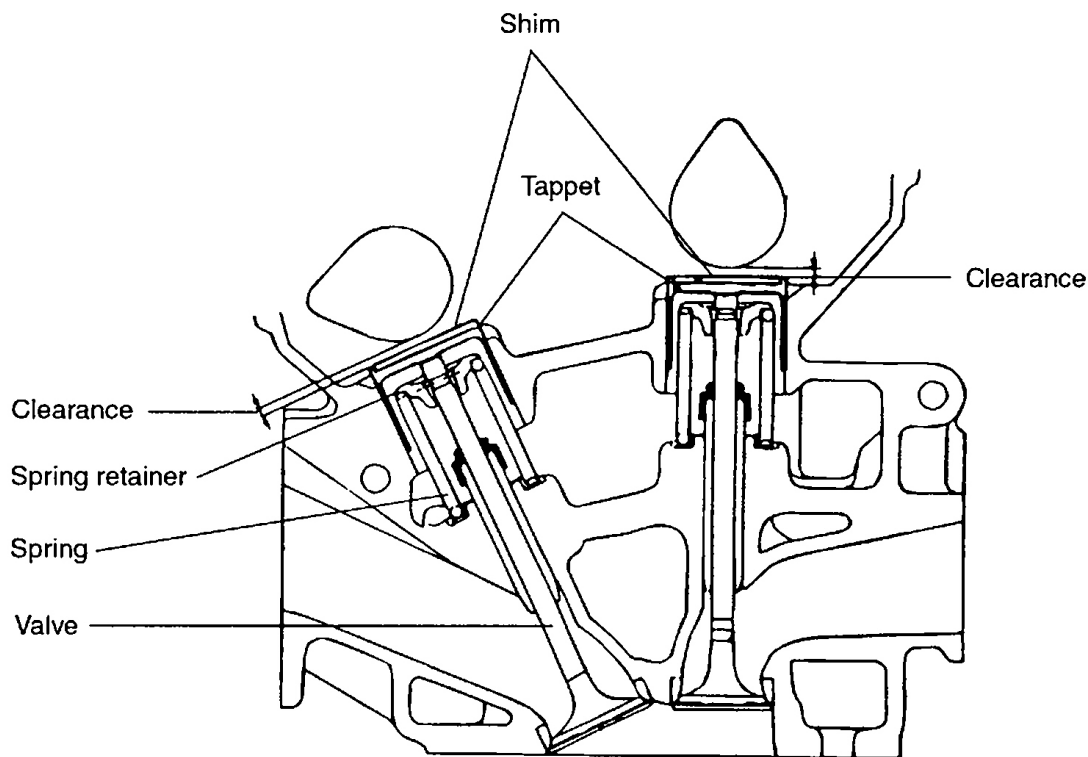


G00960794

Fig. 65: Identifying Camshaft Oil Seal
Courtesy of HYUNDAI MOTOR CO.

VALVE CLEARANCE INSPECTION & ADJUSTMENT

MLA (MECHANICAL LASH ADJUSTER)

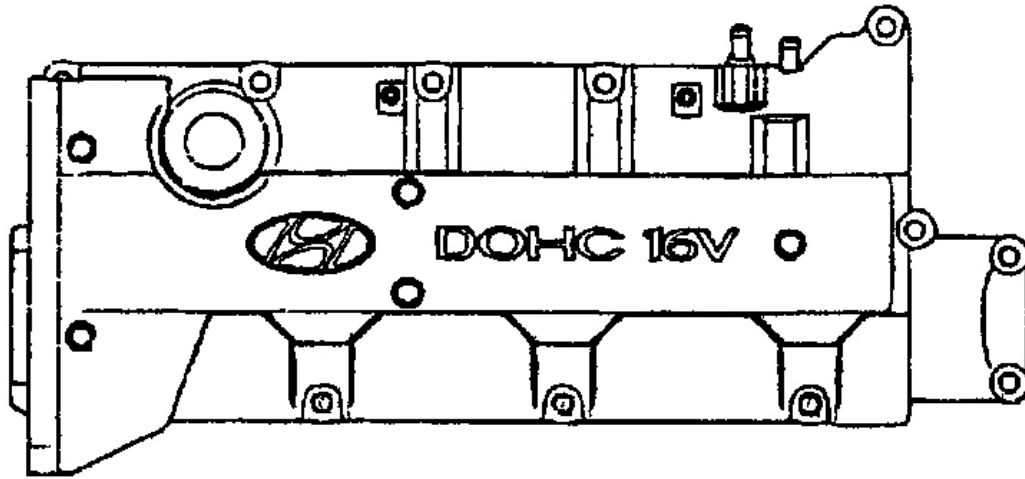


G00960795

Fig. 66: Identifying Valve Clearance
Courtesy of HYUNDAI MOTOR CO.

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

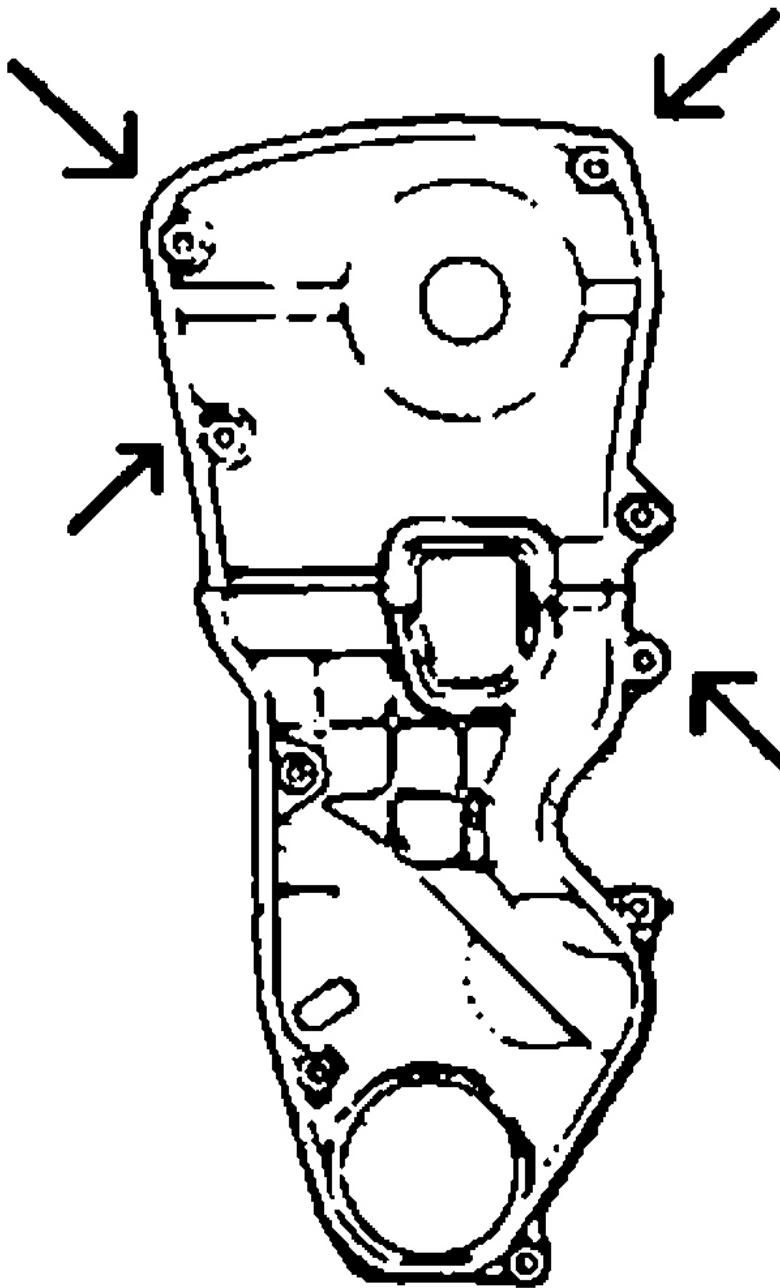
1. Remove the engine cover.
2. Remove oil filler cap.
3. Remove the center cover bolts and then remove the center cover.



G00960796

Fig. 67: View Of Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

4. Remove the upper timing belt cover



G00960797

Fig. 68: Identifying Upper Timing Cover
Courtesy of HYUNDAI MOTOR CO.

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

5. Remove the cylinder head cover.

- a. Disconnect the spark plug cables and do not pull on the spark plug cables by force.

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

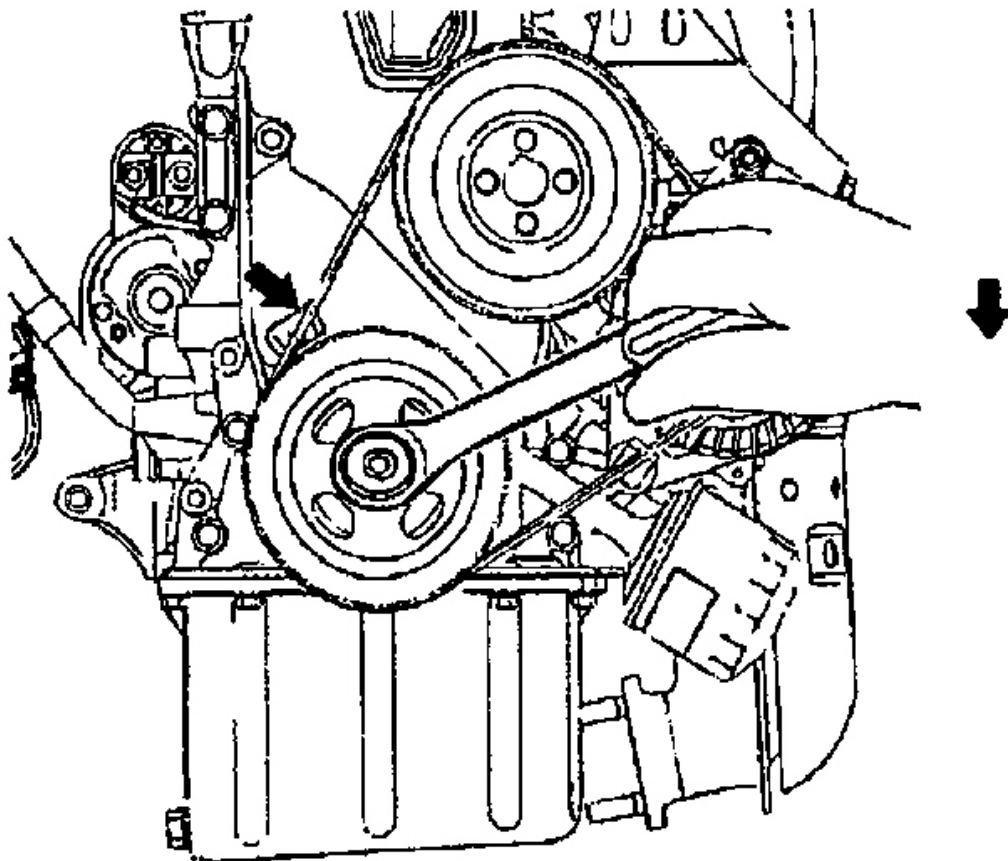
- b. Disconnect the P.C.V. hose and the breather hose from the cylinder head cover.

- c. Disconnect the accelerator cable from the cylinder head cover.

- d. Loosen the cylinder head cover bolts and then remove the cover and gasket.

6. Set No. 1 cylinder to TDC/compression.

- a. Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing belt cover.



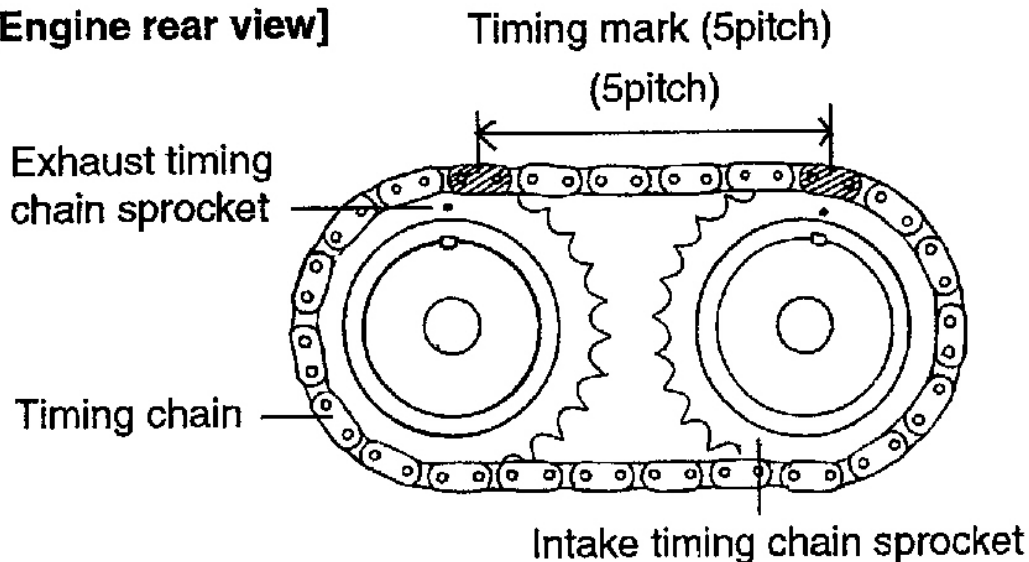
G00960798

Fig. 69: Turning Crankshaft Pulley

Courtesy of HYUNDAI MOTOR CO.

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

[Engine rear view]



G00960799

Fig. 70: Identifying Timing Marks On Sprockets & Chain
Courtesy of HYUNDAI MOTOR CO.

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

Valve clearance (Engine coolant temperature: 20°C)

[Specification]

Intake : 0.20mm (0.0079 in.)

Exhaust : 0.28mm (0.0110 in.)

Engine coolant temperature : 80°C

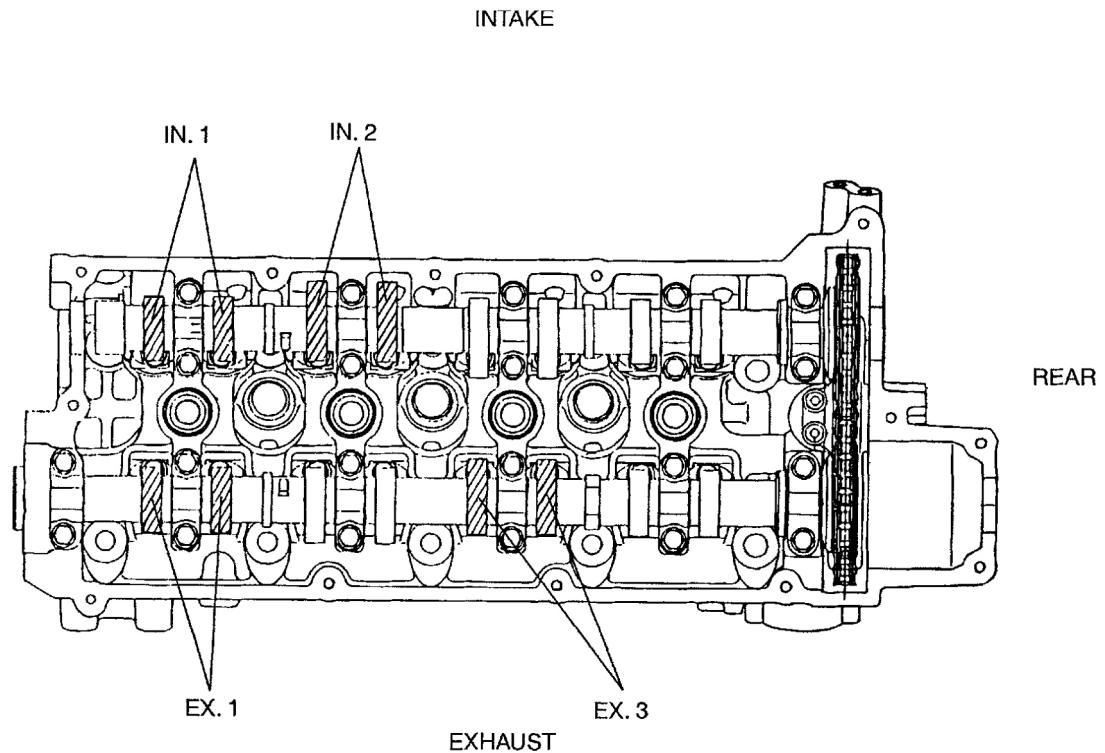
Intake : 0.29 mm (0.0114 in.)

Exhaust : 0.34 mm (0.0134 in.)

[Limit]

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

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



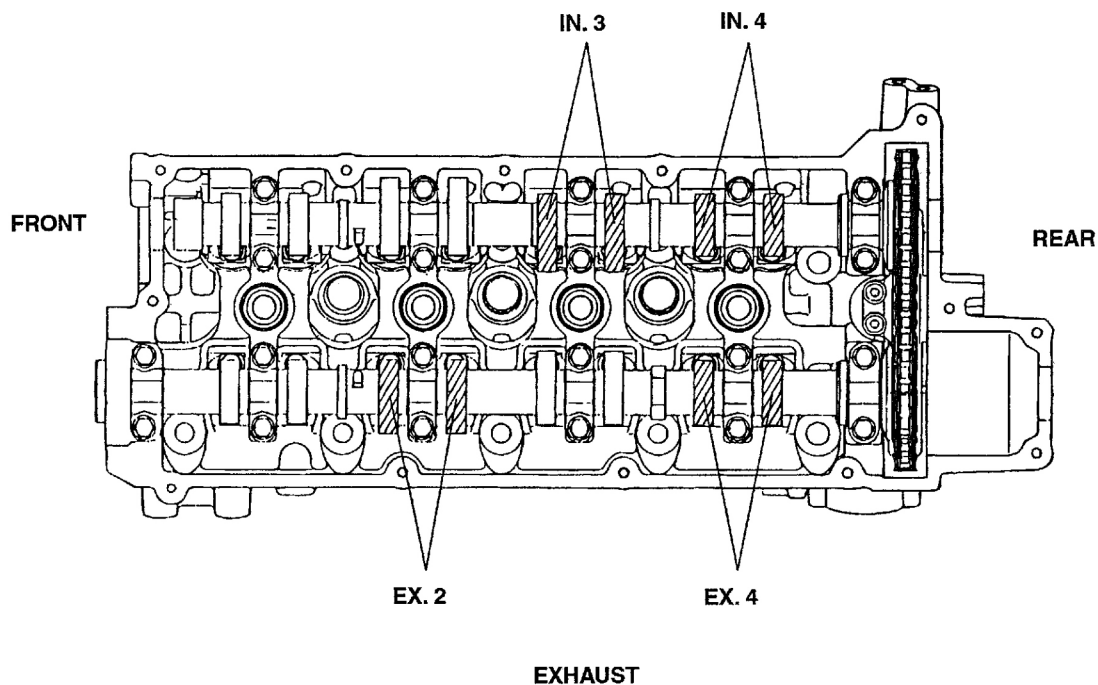
ADJUSTING VALVE AT NO. 1 TOP DEAD CENTER

G00960800

Fig. 71: Adjusting Valve At No. 1 Top Dead Center
Courtesy of HYUNDAI MOTOR CO.

Turn the crankshaft pulley one revolution (360°) and align the groove with timing mark "T" of the lower timing belt cover.

Check only the valves indicated as shown. [No. 4 cylinder: TDC/compression]. Measure the valve clearance.

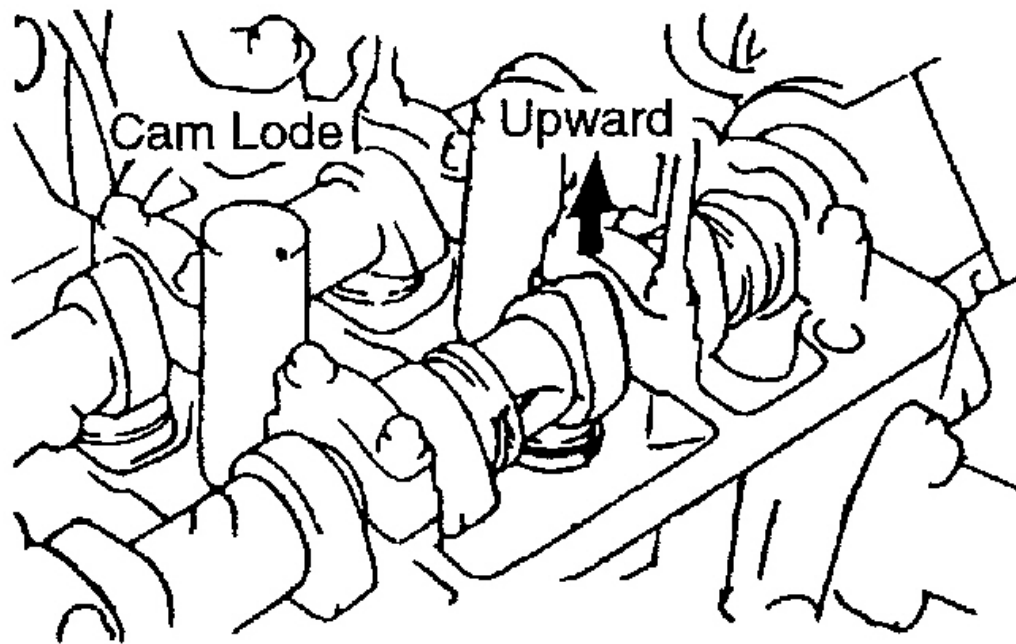


ADJUSTING VALVE AT NO. 4 TOP DEAD CENTER

G00960801

Fig. 72: Adjusting Valve At No. 4 Top Dead Center
Courtesy of HYUNDAI MOTOR CO.

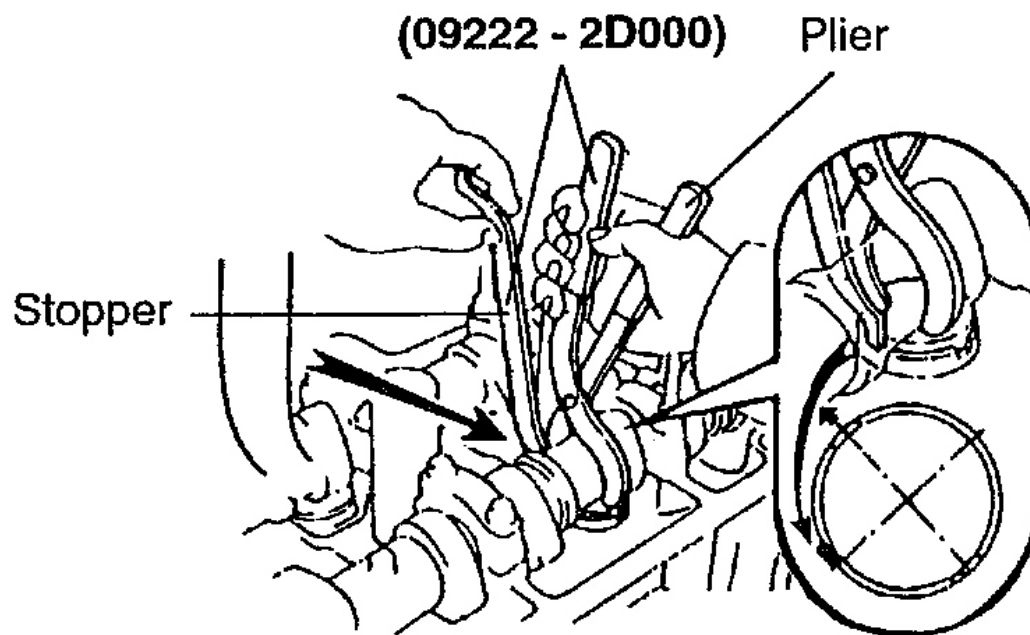
8. Adjust the intake and exhaust valve clearance.
 - a. Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve is upward.



G00960802

Fig. 73: Identifying Cam Lobe Facing Upward
Courtesy of HYUNDAI MOTOR CO.

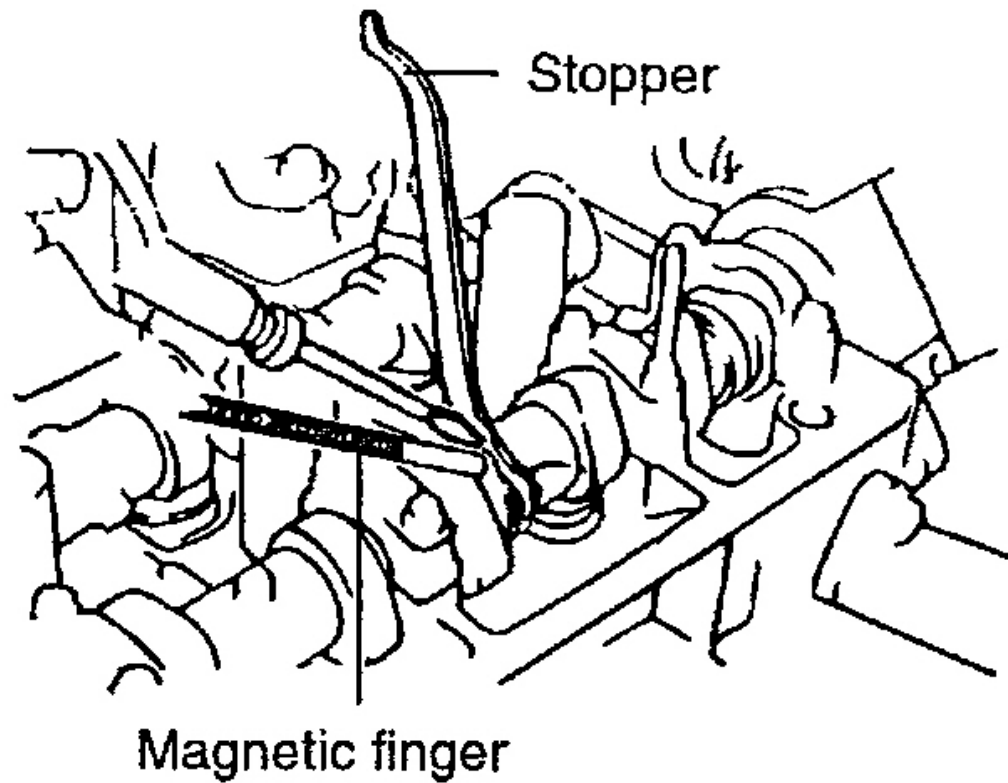
- b. Using the special tool (09220 - 2D000), press down the valve lifter and place the stopper between the camshaft and valve lifter and remove the special tool.



G00960803

Fig. 74: Placing Stopper Between Camshaft & Valve Lifter
Courtesy of HYUNDAI MOTOR CO.

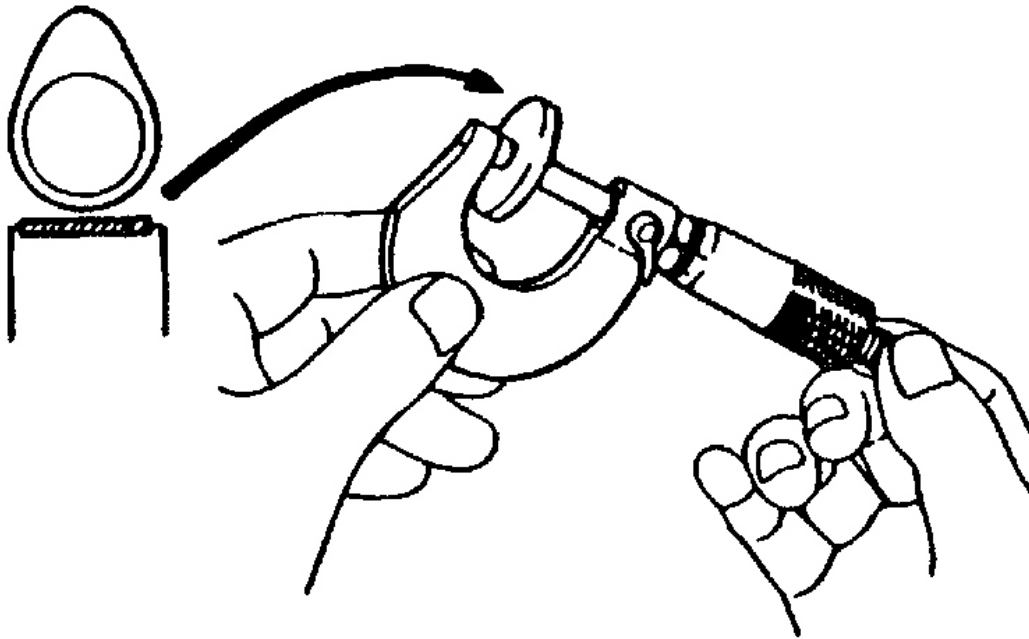
- c. Remove the adjusting shim with a small screw driver and magnet.



G00960804

Fig. 75: Removing Adjusting Shim
Courtesy of HYUNDAI MOTOR CO.

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



G00960805

Fig. 76: Measuring Shim

Courtesy of HYUNDAI MOTOR CO.

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

Valve clearance (Engine coolant temperature: 20°C)

T : Thickness of removed shim

A : Measured valve clearance

N : Thickness of new shim

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

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

- f. Select a new shim with a thickness as close as possible to the calculated value. Refer to **Fig. 77** or **Fig. 78**.

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

- g. Place a new adjusting shim on the valve lifter.
 h. Using the special tool (09220 - 2D000), press down the valve lifter and remove the stopper.
 i. Recheck the valve clearance.

2003 Hyundai Elantra GT

2003 ENGINE 2.0L 4 Cylinder DOHC - Elantra

Valve clearance (Engine coolant temperature : 20°C)

[Specification]

Intake : 0.20 mm (0.0079 in.)

Exhaust : 0.28 mm (0.0110 in.)

[Limit] (After adjusting valve clearance)

Intake : 0.17-0.23 mm (0.0067-0.0091 in.)

Exhaust : 0.25-0.31 mm (0.0098-0.0122 in.)

Installed shim thickness mm (in.)	Measured clearance mm (in.)	Shim No.	Thickness	Shim No.	Thickness		
0.000 (0.0000)	0.0000 - 0.0001	1	2.00	0.0787	11	2.40	0.0945
0.001 (0.0001)	0.0001 - 0.0002	2	2.04	0.0803	12	2.44	0.0961
0.002 (0.0002)	0.0002 - 0.0003	3	2.08	0.0819	13	2.48	0.0976
0.003 (0.0003)	0.0003 - 0.0004	4	2.12	0.0835	14	2.52	0.0992
0.004 (0.0004)	0.0004 - 0.0005	5	2.16	0.0850	15	2.56	0.1008
0.005 (0.0005)	0.0005 - 0.0006	6	2.20	0.0866	16	2.60	0.1024
0.006 (0.0006)	0.0006 - 0.0007	7	2.24	0.0882	17	2.64	0.1039
0.007 (0.0007)	0.0007 - 0.0008	8	2.28	0.0898	18	2.68	0.1055
0.008 (0.0008)	0.0008 - 0.0009	9	2.32	0.0913	19	2.72	0.1071
0.009 (0.0009)	0.0009 - 0.0010	10	2.36	0.0929	20	2.76	0.1087
0.010 (0.0010)	0.0010 - 0.0011						
0.011 (0.0011)	0.0011 - 0.0012						
0.012 (0.0012)	0.0012 - 0.0013						
0.013 (0.0013)	0.0013 - 0.0014						
0.014 (0.0014)	0.0014 - 0.0015						
0.015 (0.0015)	0.0015 - 0.0016						
0.016 (0.0016)	0.0016 - 0.0017						
0.017 (0.0017)	0.0017 - 0.0018						
0.018 (0.0018)	0.0018 - 0.0019						
0.019 (0.0019)	0.0019 - 0.0020						
0.020 (0.0020)	0.0020 - 0.0021						
0.021 (0.0021)	0.0021 - 0.0022						
0.022 (0.0022)	0.0022 - 0.0023						
0.023 (0.0023)	0.0023 - 0.0024						
0.024 (0.0024)	0.0024 - 0.0025						
0.025 (0.0025)	0.0025 - 0.0026						
0.026 (0.0026)	0.0026 - 0.0027						
0.027 (0.0027)	0.0027 - 0.0028						
0.028 (0.0028)	0.0028 - 0.0029						
0.029 (0.0029)	0.0029 - 0.0030						
0.030 (0.0030)	0.0030 - 0.0031						
0.031 (0.0031)	0.0031 - 0.0032						
0.032 (0.0032)	0.0032 - 0.0033						
0.033 (0.0033)	0.0033 - 0.0034						
0.034 (0.0034)	0.0034 - 0.0035						
0.035 (0.0035)	0.0035 - 0.0036						
0.036 (0.0036)	0.0036 - 0.0037						
0.037 (0.0037)	0.0037 - 0.0038						
0.038 (0.0038)	0.0038 - 0.0039						
0.039 (0.0039)	0.0039 - 0.0040						
0.040 (0.0040)	0.0040 - 0.0041						
0.041 (0.0041)	0.0041 - 0.0042						
0.042 (0.0042)	0.0042 - 0.0043						
0.043 (0.0043)	0.0043 - 0.0044						
0.044 (0.0044)	0.0044 - 0.0045						
0.045 (0.0045)	0.0045 - 0.0046						
0.046 (0.0046)	0.0046 - 0.0047						
0.047 (0.0047)	0.0047 - 0.0048						
0.048 (0.0048)	0.0048 - 0.0049						
0.049 (0.0049)	0.0049 - 0.0050						
0.050 (0.0050)	0.0050 - 0.0051						
0.051 (0.0051)	0.0051 - 0.0052						
0.052 (0.0052)	0.0052 - 0.0053						
0.053 (0.0053)	0.0053 - 0.0054						
0.054 (0.0054)	0.0054 - 0.0055						
0.055 (0.0055)	0.0055 - 0.0056						
0.056 (0.0056)	0.0056 - 0.0057						
0.057 (0.0057)	0.0057 - 0.0058						
0.058 (0.0058)	0.0058 - 0.0059						
0.059 (0.0059)	0.0059 - 0.0060						
0.060 (0.0060)	0.0060 - 0.0061						
0.061 (0.0061)	0.0061 - 0.0062						
0.062 (0.0062)	0.0062 - 0.0063						
0.063 (0.0063)	0.0063 - 0.0064						
0.064 (0.0064)	0.0064 - 0.0065						
0.065 (0.0065)	0.0065 - 0.0066						
0.066 (0.0066)	0.0066 - 0.0067						
0.067 (0.0067)	0.0067 - 0.0068						
0.068 (0.0068)	0.0068 - 0.0069						
0.069 (0.0069)	0.0069 - 0.0070						
0.070 (0.0070)	0.0070 - 0.0071						
0.071 (0.0071)	0.0071 - 0.0072						
0.072 (0.0072)	0.0072 - 0.0073						
0.073 (0.0073)	0.0073 - 0.0074						
0.074 (0.0074)	0.0074 - 0.0075						
0.075 (0.0075)	0.0075 - 0.0076						
0.076 (0.0076)	0.0076 - 0.0077						
0.077 (0.0077)	0.0077 - 0.0078						
0.078 (0.0078)	0.0078 - 0.0079						
0.079 (0.0079)	0.0079 - 0.0080						
0.080 (0.0080)	0.0080 - 0.0081						
0.081 (0.0081)	0.0081 - 0.0082						
0.082 (0.0082)	0.0082 - 0.0083						
0.083 (0.0083)	0.0083 - 0.0084						
0.084 (0.0084)	0.0084 - 0.0085						
0.085 (0.0085)	0.0085 - 0.0086						
0.086 (0.0086)	0.0086 - 0.0087						
0.087 (0.0087)	0.0087 - 0.0088						
0.088 (0.0088)	0.0088 - 0.0089						
0.089 (0.0089)	0.0089 - 0.0090						
0.090 (0.0090)	0.0090 - 0.0091						
0.091 (0.0091)	0.0091 - 0.0092						
0.092 (0.0092)	0.0092 - 0.0093						
0.093 (0.0093)	0.0093 - 0.0094						
0.094 (0.0094)	0.0094 - 0.0095						
0.095 (0.0095)	0.0095 - 0.0096						
0.096 (0.0096)	0.0096 - 0.0097						
0.097 (0.0097)	0.0097 - 0.0098						
0.098 (0.0098)	0.0098 - 0.0099						
0.099 (0.0099)	0.0099 - 0.0100						
0.100 (0.0100)	0.0100 - 0.0101						
0.101 (0.0101)	0.0101 - 0.0102						
0.102 (0.0102)	0.0102 - 0.0103						
0.103 (0.0103)	0.0103 - 0.0104						
0.104 (0.0104)	0.0104 - 0.0105						
0.105 (0.0105)	0.0105 - 0.0106						
0.106 (0.0106)	0.0106 - 0.0107						
0.107 (0.0107)	0.0107 - 0.0108						
0.108 (0.0108)	0.0108 - 0.0109						
0.109 (0.0109)	0.0109 - 0.0110						
0.110 (0.0110)	0.0110 - 0.0111						
0.111 (0.0111)	0.0111 - 0.0112						
0.112 (0.0112)	0.0112 - 0.0113						
0.113 (0.0113)	0.0113 - 0.0114						
0.114 (0.0114)	0.0114 - 0.0115						
0.115 (0.0115)	0.0115 - 0.0116						
0.116 (0.0116)	0.0116 - 0.0117						
0.117 (0.0117)	0.0117 - 0.0118						
0.118 (0.0118)	0.0118 - 0.0119						
0.119 (0.0119)	0.0119 - 0.0120						
0.120 (0.0120)	0.0120 - 0.0121						
0.121 (0.0121)	0.0121 - 0.0122						
0.122 (0.0122)	0.0122 - 0.0123						
0.123 (0.0123)	0.0123 - 0.0124						
0.124 (0.0124)	0.0124 - 0.0125						
0.125 (0.0125)	0.0125 - 0.0126						
0.126 (0.0126)	0.0126 - 0.0127						
0.127 (0.0127)	0.0127 - 0.0128						
0.128 (0.0128)	0.0128 - 0.0129						
0.129 (0.0129)	0.0129 - 0.0130						
0.130 (0.0130)	0.0130 - 0.0131						
0.131 (0.0131)	0.0131 - 0.0132						
0.132 (0.0132)	0.0132 - 0.0133						
0.133 (0.0133)	0.0133 - 0.0134						
0.134 (0.0134)	0.0134 - 0.0135						
0.135 (0.0135)	0.0135 - 0.0136						
0.136 (0.0136)	0.0136 - 0.0137						
0.137 (0.0137)	0.0137 - 0.0138						
0.138 (0.0138)	0.0138 - 0.0139						
0.139 (0.0139)	0.0139 - 0.0140						
0.140 (0.0140)	0.0140 - 0.0141						
0.141 (0.0141)	0.0141 - 0.0142						
0.142 (0.0142)	0.0142 - 0.0143						
0.143 (0.0143)	0.0143 - 0.0144						
0.144 (0.0144)	0.0144 - 0.0145						
0.145 (0.0145)	0.0145 - 0.0146						
0.146 (0.0146)	0.0146 - 0.0147						
0.147 (0.0147)	0.0147 - 0.0148						
0.148 (0.0148)	0.0148 - 0.0149						
0.149 (0.0149)	0.0149 - 0.0150						
0.150 (0.0150)	0.0150 - 0.0151						
0.151 (0.0151)	0.0151 - 0.0152						
0.152 (0.0152)	0.0152 - 0.0153						
0.153 (0.0153)	0.0153 - 0.0154						
0.154 (0.0154)	0.0154 - 0.0155						
0.155 (0.0155)	0.0155 - 0.0156						
0.156 (0.0156)	0.0156 - 0.0157						
0.157 (0.0157)	0.0157 - 0.0158						
0.158 (0.0158)	0.0158 - 0.0159						
0.159 (0.0159)	0.0159 - 0.0160						
0.160 (0.0160)	0.0160 - 0.0161						
0.161 (0.0161)	0.0161 - 0.0162						
0.162 (0.0162)	0.0162 - 0.0163						
0.163 (0.0163)	0.0163 - 0.0164						
0.164 (0.0164)	0.0164 - 0.0165						
0.165 (0.0165)	0.0165 - 0.0166						
0.166 (0.0166)	0.0166 - 0.0167						
0.167 (0.0167)	0.0167 - 0.0168						
0.168 (0.0168)	0.0168 - 0.0169						
0.169 (0.0169)	0.0169 - 0.0170						
0.170 (0.0170)	0.0170 - 0.0171						
0.171 (0.0171)	0.0171 - 0.0172						
0.172 (0.0172)	0.0172 - 0.0173						
0.173 (0.0173)	0.0173 - 0.0174						
0.174 (0.0174)	0.0174 - 0.0175						
0.175 (0.0175)	0.0175 - 0.0176						
0.176 (0.0176)	0.0176 - 0.0177						
0.177 (0.0177)	0.0177 - 0.0178						
0.178 (0.0178)	0.0178 - 0.0179						
0.179 (0.0179)	0.0179 - 0.0180						
0.180 (0.0180)	0.0180 - 0.0181						

2003 Hyundai Elantra GT

2003 ENGINE 2.0L 4 Cylinder DOHC - Elantra

Installed shim thickness mm (in.)	0.80 (0.0315)	0.85 (0.0335)	0.90 (0.0354)	0.95 (0.0374)	1.00 (0.0394)	1.05 (0.0413)	1.10 (0.0433)	1.15 (0.0453)	1.20 (0.0472)	1.25 (0.0492)	1.30 (0.0512)	1.35 (0.0531)	1.40 (0.0551)	1.45 (0.0571)	1.50 (0.0590)	1.55 (0.0610)	1.60 (0.0630)	1.65 (0.0649)	1.70 (0.0669)	1.75 (0.0689)	1.80 (0.0708)	1.85 (0.0728)	1.90 (0.0748)	1.95 (0.0768)	2.00 (0.0787)	2.05 (0.0807)	2.10 (0.0827)	2.15 (0.0847)	2.20 (0.0867)	2.25 (0.0887)	2.30 (0.0906)	2.35 (0.0926)	2.40 (0.0946)	2.45 (0.0966)	2.50 (0.0986)	2.55 (0.1006)	2.60 (0.1026)	2.65 (0.1046)	2.70 (0.1066)	2.75 (0.1086)	2.80 (0.1106)	2.85 (0.1126)	2.90 (0.1146)	2.95 (0.1166)	3.00 (0.1186)	3.05 (0.1206)	3.10 (0.1226)	3.15 (0.1246)	3.20 (0.1266)	3.25 (0.1286)	3.30 (0.1306)	3.35 (0.1326)	3.40 (0.1346)	3.45 (0.1366)	3.50 (0.1386)	3.55 (0.1406)	3.60 (0.1426)	3.65 (0.1446)	3.70 (0.1466)	3.75 (0.1486)	3.80 (0.1506)	3.85 (0.1526)	3.90 (0.1546)	3.95 (0.1566)	4.00 (0.1586)	4.05 (0.1606)	4.10 (0.1626)	4.15 (0.1646)	4.20 (0.1666)	4.25 (0.1686)	4.30 (0.1706)	4.35 (0.1726)	4.40 (0.1746)	4.45 (0.1766)	4.50 (0.1786)	4.55 (0.1806)	4.60 (0.1826)	4.65 (0.1846)	4.70 (0.1866)	4.75 (0.1886)	4.80 (0.1906)	4.85 (0.1926)	4.90 (0.1946)	4.95 (0.1966)	5.00 (0.1986)	5.05 (0.2006)	5.10 (0.2026)	5.15 (0.2046)	5.20 (0.2066)	5.25 (0.2086)	5.30 (0.2106)	5.35 (0.2126)	5.40 (0.2146)	5.45 (0.2166)	5.50 (0.2186)	5.55 (0.2206)	5.60 (0.2226)	5.65 (0.2246)	5.70 (0.2266)	5.75 (0.2286)	5.80 (0.2306)	5.85 (0.2326)	5.90 (0.2346)	5.95 (0.2366)	6.00 (0.2386)	6.05 (0.2406)	6.10 (0.2426)	6.15 (0.2446)	6.20 (0.2466)	6.25 (0.2486)	6.30 (0.2506)	6.35 (0.2526)	6.40 (0.2546)	6.45 (0.2566)	6.50 (0.2586)	6.55 (0.2606)	6.60 (0.2626)	6.65 (0.2646)	6.70 (0.2666)	6.75 (0.2686)	6.80 (0.2706)	6.85 (0.2726)	6.90 (0.2746)	6.95 (0.2766)	7.00 (0.2786)	7.05 (0.2806)	7.10 (0.2826)	7.15 (0.2846)	7.20 (0.2866)	7.25 (0.2886)	7.30 (0.2906)	7.35 (0.2926)	7.40 (0.2946)	7.45 (0.2966)	7.50 (0.2986)	7.55 (0.3006)	7.60 (0.3026)	7.65 (0.3046)	7.70 (0.3066)	7.75 (0.3086)	7.80 (0.3106)	7.85 (0.3126)	7.90 (0.3146)	7.95 (0.3166)	8.00 (0.3186)	8.05 (0.3206)	8.10 (0.3226)	8.15 (0.3246)	8.20 (0.3266)	8.25 (0.3286)	8.30 (0.3306)	8.35 (0.3326)	8.40 (0.3346)	8.45 (0.3366)	8.50 (0.3386)	8.55 (0.3406)	8.60 (0.3426)	8.65 (0.3446)	8.70 (0.3466)	8.75 (0.3486)	8.80 (0.3506)	8.85 (0.3526)	8.90 (0.3546)	8.95 (0.3566)	9.00 (0.3586)	9.05 (0.3606)	9.10 (0.3626)	9.15 (0.3646)	9.20 (0.3666)	9.25 (0.3686)	9.30 (0.3706)	9.35 (0.3726)	9.40 (0.3746)	9.45 (0.3766)	9.50 (0.3786)	9.55 (0.3806)	9.60 (0.3826)	9.65 (0.3846)	9.70 (0.3866)	9.75 (0.3886)	9.80 (0.3906)	9.85 (0.3926)	9.90 (0.3946)	9.95 (0.3966)	10.00 (0.3986)	10.05 (0.4006)	10.10 (0.4026)	10.15 (0.4046)	10.20 (0.4066)	10.25 (0.4086)	10.30 (0.4106)	10.35 (0.4126)	10.40 (0.4146)	10.45 (0.4166)	10.50 (0.4186)	10.55 (0.4206)	10.60 (0.4226)	10.65 (0.4246)	10.70 (0.4266)	10.75 (0.4286)	10.80 (0.4306)	10.85 (0.4326)	10.90 (0.4346)	10.95 (0.4366)	11.00 (0.4386)	11.05 (0.4406)	11.10 (0.4426)	11.15 (0.4446)	11.20 (0.4466)	11.25 (0.4486)	11.30 (0.4506)	11.35 (0.4526)	11.40 (0.4546)	11.45 (0.4566)	11.50 (0.4586)	11.55 (0.4606)	11.60 (0.4626)	11.65 (0.4646)	11.70 (0.4666)	11.75 (0.4686)	11.80 (0.4706)	11.85 (0.4726)	11.90 (0.4746)	11.95 (0.4766)	12.00 (0.4786)	12.05 (0.4806)	12.10 (0.4826)	12.15 (0.4846)	12.20 (0.4866)	12.25 (0.4886)	12.30 (0.4906)	12.35 (0.4926)	12.40 (0.4946)	12.45 (0.4966)	12.50 (0.4986)	12.55 (0.5006)	12.60 (0.5026)	12.65 (0.5046)	12.70 (0.5066)	12.75 (0.5086)	12.80 (0.5106)	12.85 (0.5126)	12.90 (0.5146)	12.95 (0.5166)	13.00 (0.5186)	13.05 (0.5206)	13.10 (0.5226)	13.15 (0.5246)	13.20 (0.5266)	13.25 (0.5286)	13.30 (0.5306)	13.35 (0.5326)	13.40 (0.5346)	13.45 (0.5366)	13.50 (0.5386)	13.55 (0.5406)	13.60 (0.5426)	13.65 (0.5446)	13.70 (0.5466)	13.75 (0.5486)	13.80 (0.5506)	13.85 (0.5526)	13.90 (0.5546)	13.95 (0.5566)	14.00 (0.5586)	14.05 (0.5606)	14.10 (0.5626)	14.15 (0.5646)	14.20 (0.5666)	14.25 (0.5686)	14.30 (0.5706)	14.35 (0.5726)	14.40 (0.5746)	14.45 (0.5766)	14.50 (0.5786)	14.55 (0.5806)	14.60 (0.5826)	14.65 (0.5846)	14.70 (0.5866)	14.75 (0.5886)	14.80 (0.5906)	14.85 (0.5926)	14.90 (0.5946)	14.95 (0.5966)	15.00 (0.5986)	15.05 (0.6006)	15.10 (0.6026)	15.15 (0.6046)	15.20 (0.6066)	15.25 (0.6086)	15.30 (0.6106)	15.35 (0.6126)	15.40 (0.6146)	15.45 (0.6166)	15.50 (0.6186)	15.55 (0.6206)	15.60 (0.6226)	15.65 (0.6246)	15.70 (0.6266)	15.75 (0.6286)	15.80 (0.6306)	15.85 (0.6326)	15.90 (0.6346)	15.95 (0.6366)	16.00 (0.6386)	16.05 (0.6406)	16.10 (0.6426)	16.15 (0.6446)	16.20 (0.6466)	16.25 (0.6486)	16.30 (0.6506)	16.35 (0.6526)	16.40 (0.6546)	16.45 (0.6566)	16.50 (0.6586)	16.55 (0.6606)	16.60 (0.6626)	16.65 (0.6646)	16.70 (0.6666)	16.75 (0.6686)	16.80 (0.6706)	16.85 (0.6726)	16.90 (0.6746)	16.95 (0.6766)	17.00 (0.6786)	17.05 (0.6806)	17.10 (0.6826)	17.15 (0.6846)	17.20 (0.6866)	17.25 (0.6886)	17.30 (0.6906)	17.35 (0.6926)	17.40 (0.6946)	17.45 (0.6966)	17.50 (0.6986)	17.55 (0.7006)	17.60 (0.7026)	17.65 (0.7046)	17.70 (0.7066)	17.75 (0.7086)	17.80 (0.7106)	17.85 (0.7126)	17.90 (0.7146)	17.95 (0.7166)	18.00 (0.7186)	18.05 (0.7206)	18.10 (0.7226)	18.15 (0.7246)	18.20 (0.7266)	18.25 (0.7286)	18.30 (0.7306)	18.35 (0.7326)	18.40 (0.7346)	18.45 (0.7366)	18.50 (0.7386)	18.55 (0.7406)	18.60 (0.7426)	18.65 (0.7446)	18.70 (0.7466)	18.75 (0.7486)	18.80 (0.7506)	18.85 (0.7526)	18.90 (0.7546)	18.95 (0.7566)	19.00 (0.7586)	19.05 (0.7606)	19.10 (0.7626)	19.15 (0.7646)	19.20 (0.7666)	19.25 (0.7686)	19.30 (0.7706)	19.35 (0.7726)	19.40 (0.7746)	19.45 (0.7766)	19.50 (0.7786)	19.55 (0.7806)	19.60 (0.7826)	19.65 (0.7846)	19.70 (0.7866)	19.75 (0.7886)	19.80 (0.7906)	19.85 (0.7926)	19.90 (0.7946)	19.95 (0.7966)	20.00 (0.7986)	20.05 (0.8006)	20.10 (0.8026)	20.15 (0.8046)	20.20 (0.8066)	20.25 (0.8086)	20.30 (0.8106)	20.35 (0.8126)	20.40 (0.8146)	20.45 (0.8166)	20.50 (0.8186)	20.55 (0.8206)	20.60 (0.8226)	20.65 (0.8246)	20.70 (0.8266)	20.75 (0.8286)	20.80 (0.8306)	20.85 (0.8326)	20.90 (0.8346)	20.95 (0.8366)	21.00 (0.8386)	21.05 (0.8406)	21.10 (0.8426)	21.15 (0.8446)	21.20 (0.8466)	21.25 (0.8486)	21.30 (0.8506)	21.35 (0.8526)	21.40 (0.8546)	21.45 (0.8566)	21.50 (0.8586)	21.55 (0.8606)	21.60 (0.8626)	21.65 (0.8646)	21.70 (0.8666)	21.75 (0.8686)	21.80 (0.8706)	21.85 (0.8726)	21.90 (0.8746)	21.95 (0.8766)	22.00 (0.8786)	22.05 (0.8806)	22.10 (0.8826)	22.15 (0.8846)	22.20 (0.8866)	22.25 (0.8886)	22.30 (0.8906)	22.35 (0.8926)	22.40 (0.8946)	22.45 (0.8966)	22.50 (0.8986)	22.55 (0.9006)	22.60 (0.9026)	22.65 (0.9046)	22.70 (0.9066)	22.75 (0.9086)	22.80 (0.9106)	22.85 (0.9126)	22.90 (0.9146)	22.95 (0.9166)	23.00 (0.9186)	23.05 (0.9206)	23.10 (0.9226)	23.15 (0.9246)	23.20 (0.9266)	23.25 (0.9286)	23.30 (0.9306)	23.35 (0.9326)	23.40 (0.9346)	23.45 (0.9366)	23.50 (0.9386)	23.55 (0.9406)	23.60 (0.9426)	23.65 (0.9446)	23.70 (0.9466)	23.75 (0.9486)	23.80 (0.9506)	23.85 (0.9526)	23.90 (0.9546)	23.95 (0.9566)	24.00 (0.9586)	24.05 (0.9606)	24.10 (0.9626)	24.15 (0.9646)	24.20 (0.9666)	24.25 (0.9686)	24.30 (0.9706)	24.35 (0.9726)	24.40 (0.9746)	24.45 (0.9766)	24.50 (0.9786)	24.55 (0.9806)	24.60 (0.9826)	24.65 (0.9846)	24.70 (0.9866)	24.75 (0.9886)	24.80 (0.9906)	24.85 (0.9926)	24.90 (0.9946)	24.95 (0.9966)	25.00 (0.9986)	25.05 (1.0006)	25.10 (1.0026)	25.15 (1.0046)	25.20 (1.0066)	25.25 (1.0086)	25.30 (1.0106)	25.35 (1.0126)	25.40 (1.0146)	25.45 (1.0166)	25.50 (1.0186)	25.55 (1.0206)	25.60 (1.0226)	25.65 (1.0246)	25.70 (1.0266)	25.75 (1.0286)	25.80 (1.0306)	25.85 (1.0326)	25.90 (1.0346)	25.95 (1.0366)	26.00 (1.0386)	26.05 (1.0406)	26.10 (1.0426)	26.15 (1.0446)	26.20 (1.0466)	26.25 (1.0486)	26.30 (1.0506)	26.35 (1.0526)	26.40 (1.0546)	26.45 (1.0566)	26.50 (1.0586)	26.55 (1.0606)	26.60 (1.0626)	26.65 (1.0646)	26.70 (1.0666)	26.75 (1.0686)	26.80 (1.0706)	26.85 (1.0726)	26.90 (1.0746)	26.95 (1.0766)	27.00 (1.0786)	27.05 (1.0806)	27.10 (1.0826)	27.15 (1.0846)	27.20 (1.0866)	27.25 (1.0886)	27.30 (1.0906)	27.35 (1.0926)	27.40 (1.0946)	27.45 (1.0966)	27.50 (1.0986)	27.55 (1.1006)	27.60 (1.1026)	27.65 (1.1046)	27.70 (1.1066)	27.75 (1.1086)	27.80 (1.1106)	27.85 (1.1126)	27.90 (1.1146)	27.95 (1.1166)	28.00 (1.1186)	28.05 (1.1206)	28.10 (1.1226)	28.15 (1.1246)	28.20 (1.1266)	28.25 (1.1286)	28.30 (1.1306)	28.35 (1.1326)	28.40 (1.1346)	28.45 (1.1366)	28.50 (1.1386)	28.55 (1.1406)	28.60 (1.1426)	28.65 (1.1446)	28.70 (1.1466)	28.75 (1.1486)	28.80 (1.1506)	28.85 (1.1526)	28.90 (1.1546)	28.95 (1.1566)	29.00 (1.1586)	29.05 (1.1606)	29.10 (1.1626)	29.15 (1.1646)	29.20 (1.1666)	29.25 (1.1686)	29.30 (1.1706)	29.35 (1.1726)	29.40 (1.1746)	29.45 (1.1766)	29.50 (1.1786)	29.55 (1.1806)	29.60 (1.1826)	29.65 (1.1846)	29.70 (1.1866)	29.75 (1.1886)	29.80 (1.1906)	29.85 (1.1926)	29.90 (1.1946)	29.95 (1.1966)	30.00 (1.1986)	30.05 (1.2006)	30.10 (1.2026)	30.15 (1.2046)	30.20 (1.2066)	30.25 (1.2086)	30.30 (1.2106)	30.35 (1.2126)	30.40 (1.2146)	30.45 (1.2166)	30.50 (1.2186)	30.55 (1.2206)	30.60 (1.2226)	30.65 (1.2246)	30.70 (1.2266)	30.75 (1.2286)	30.80 (1.2306)	30.85 (1.2326)	30.90 (1.2346)	30.95 (1.2366)	31.00 (1.2386)	31.05 (1.2406)	31.10 (1.2426)	31.15 (1.2446)	31.20 (1.2466)	31.25 (1.2486)	31.30 (1.2506)	31.35 (1.2526)	31.40 (1.2546)	31.45 (1.2566)	31.50 (1.2586)	31.55 (1.2606)	31.60 (1.2626)	31.65 (1.2646)	31.70 (1.2666)	31.75 (1.2686)	31.80 (1.2706)	31.85 (1.2726)	31.90 (1.2746)	31.95 (1.2766)	32.00 (1.2786)	32.05 (1.2806)	32.10 (1.2826)	32.15 (1.2846)	32.20 (1.2866)	32.25 (1.2886)	32.30 (1.2906)	32.35 (1.2926)	32.40 (1.2946)	32.45 (1.2966)	32.50 (1.2986)	32.55 (1.3006)	32.60 (1.3026)	32.65 (1.3046)	32.70 (1.3066)	32.75 (1.3086)	32.80 (1.3106)	32.85 (1.3126)	32.90 (1.3146)	32.95 (1.3166)	33.00 (1.3186)	33.05 (1.3206)	33.10 (1.3226)	33.15 (1.3246)	33.20 (1.3266)	33.25 (1.3286)	33.30 (1.3306)	33.35 (1.3326)	33.40 (1.3346)	33.45 (1.3366)	33.50 (1.3386)	33.55 (1.3406)	33.60 (1.3426)	33.65 (1.3446)	33.70 (1.3466)	33.75 (1.3486)	33.80 (1.3506)	33.85 (1.3526)	33.90 (1.3546)	33.95 (1.3566)	34.00 (1.3586)	34.05 (1.3606)	34.10 (1.3626)	34.15 (1.3646)	34.20 (1.3666)	34.25 (1.3686)	34.30 (1.3706)	34.35 (1.3726)	34.40 (1.3746)	34.45 (1.3766)	34.50 (1.3786)	34.55 (1.3806)	34.60 (1.3826)	34.65 (1.3846)	34.70 (1.3866)	34.75 (1.3886)	34.80 (1.3906)	34.85 (1.3926)	34.90 (1.3946)	34.95 (1.3966)	35.00 (1.3986)	35.05 (1.4006)	35.10 (1.4026)	35.15 (1.4046)	35.20 (1.4066)	35.25 (1.4086)	35.30 (1.4106)	35.35 (1.4126)	35.40 (1.4146)	35.45 (1.4166)	35.50 (1.4186)	35.55 (1.4206)	35.60 (1.4226)	35.65 (1.4246)	35.70 (1.4266)	35.75 (1.4286)	35.80 (1.4306)	35.85 (1.4326)	35.90 (1.4346)	35.95 (1.4366)	36.00 (1.4386)	36.05 (1.4406)	36.10 (1.4426)	36.15 (1.4446)	36.20 (1.4466)	36.25 (1.4486)	36.30 (1.4506)	36.35 (1.4526)	36.40 (1.4546)	36.45 (1.4566)	36.50 (1.4586)	36.55 (1.4606)	36.60 (1.4626)	36.65 (1.4646)	36.70 (1.4666)	36.75 (1.4686)	36.80 (1.4706)	36.85 (1.4726)	36.90 (1.4746)	36.95 (1.4766)	37.00 (1.4786)	37.05 (1.4806)	37.10 (1.4826)	37.15 (1.4846)	37.20 (1.4866)	37.25 (1.4886)	37.30 (1.
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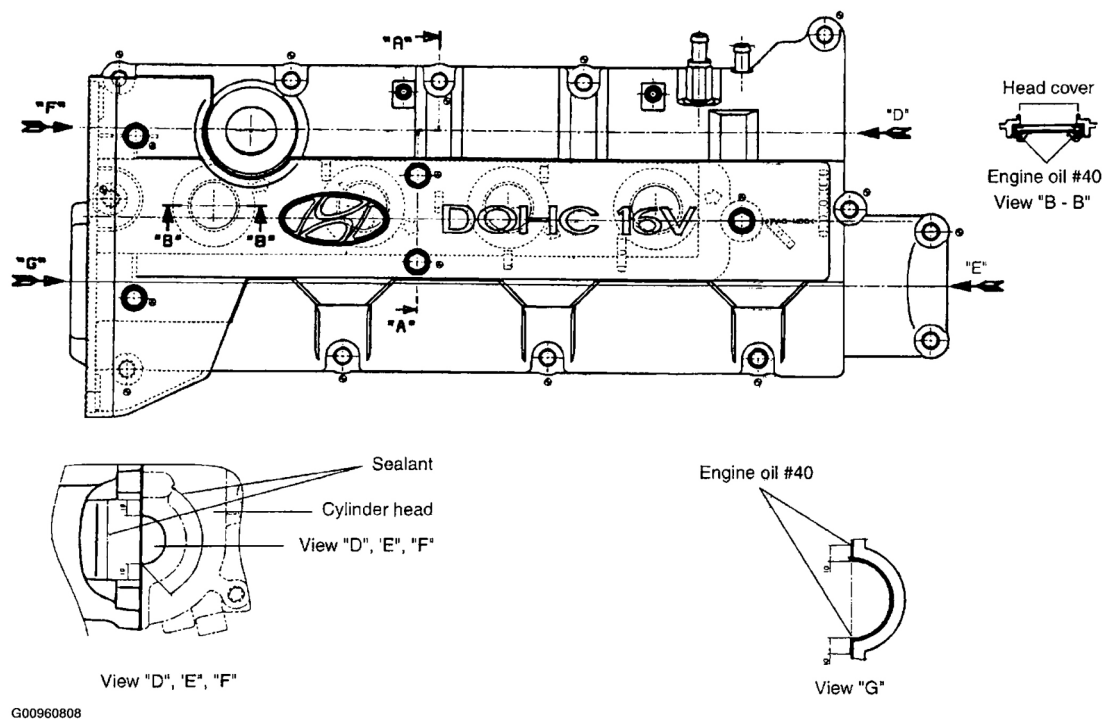
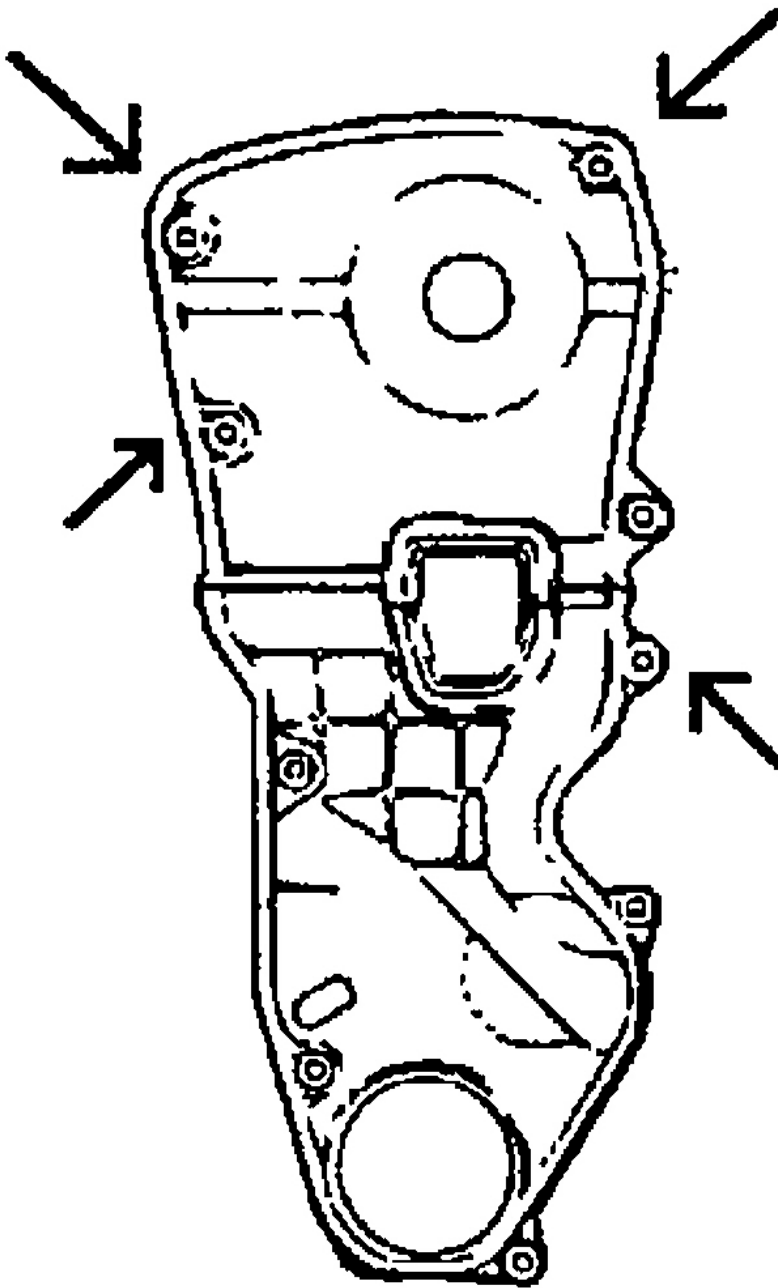


Fig. 79: Installing Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

3. Install the cylinder head cover.
Cylinder head cover: 8-10 Nm (80 - 100 kg.cm, 6-7 lb.ft)
4. Connect the accelerator cable.
5. Connect the PCV hose and the breather hose to the cylinder head cover.
6. Connect the spark plug cables to the spark plugs.
7. Install the upper timing belt cover with the four bolts.



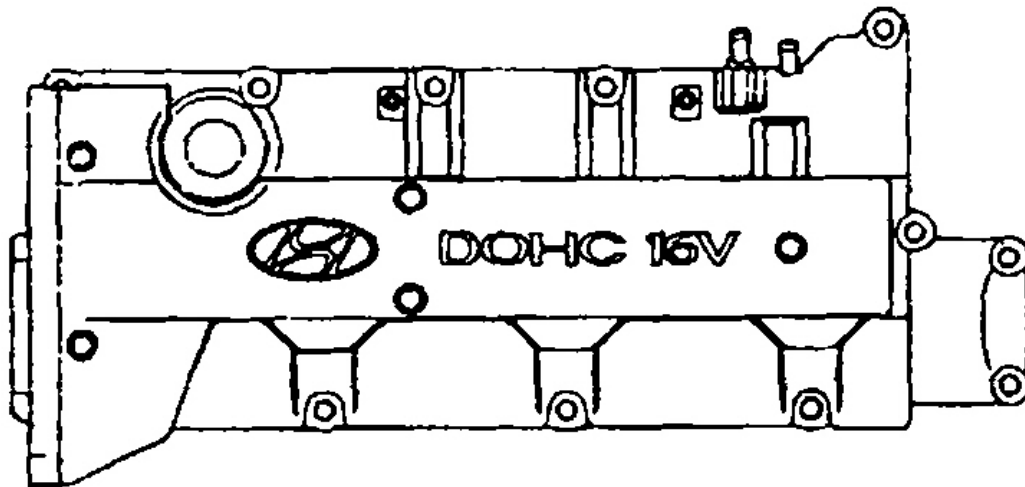
G00960809

Fig. 80: Identifying Upper Timing Belt Cover
Courtesy of HYUNDAI MOTOR CO.

8. Install the center cover with the five bolts.

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

9. Install the oil filler cap.



G00960810

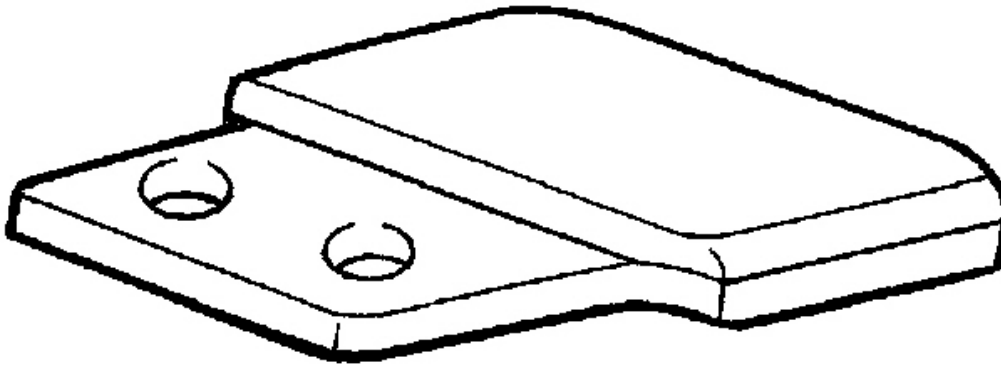
Fig. 81: Identifying Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

10. Install the engine cover.

CHAIN GUIDE

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

Replace if necessary.



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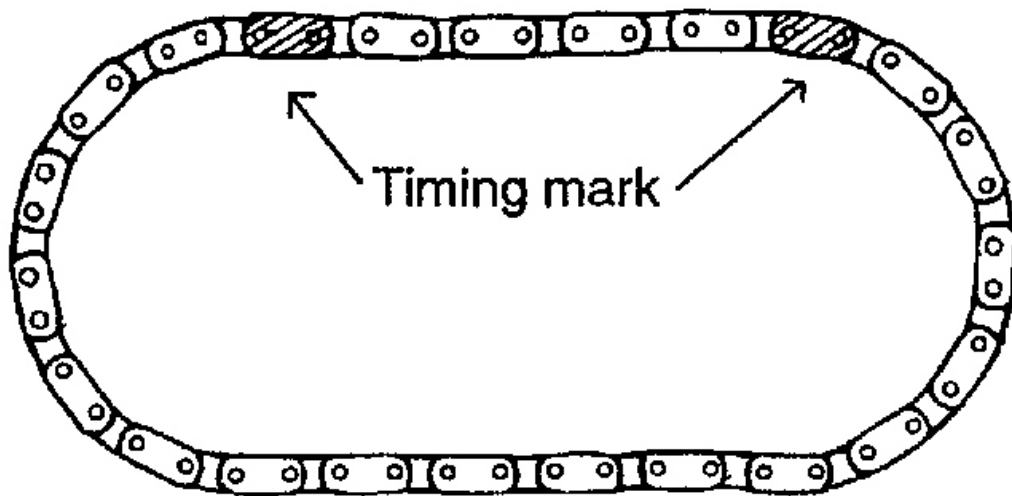
Fig. 82: Identifying Chain Guide

Courtesy of HYUNDAI MOTOR CO.

TIMING CHAIN

Check the bushing and plate of the timing chain for wear.

Replace if it is worn severely.



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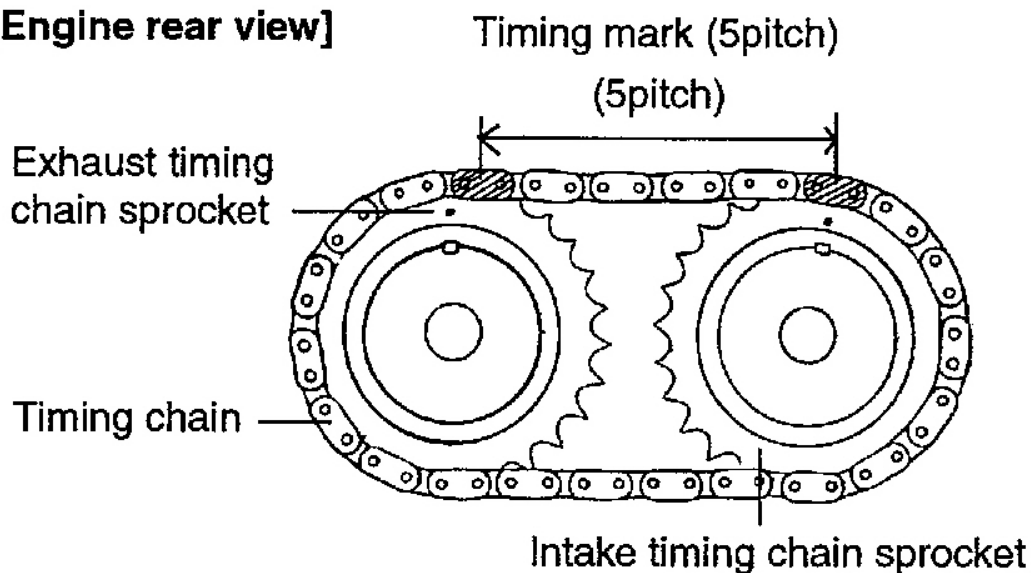
Fig. 83: Identifying Timing Marks On Chain
Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

1. Install the mechanical tappets and shims.

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

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

[Engine rear view]

G00960813

Fig. 84: Identifying Timing Marks On Sprockets & Chain
Courtesy of HYUNDAI MOTOR CO.

3. Install the camshaft after lubricating the camshaft journal with engine oil.
4. Install the bearing caps. The markings on the caps are for intake/exhaust identification.
 - I: Intake camshaft
 - E: Exhaust camshaft

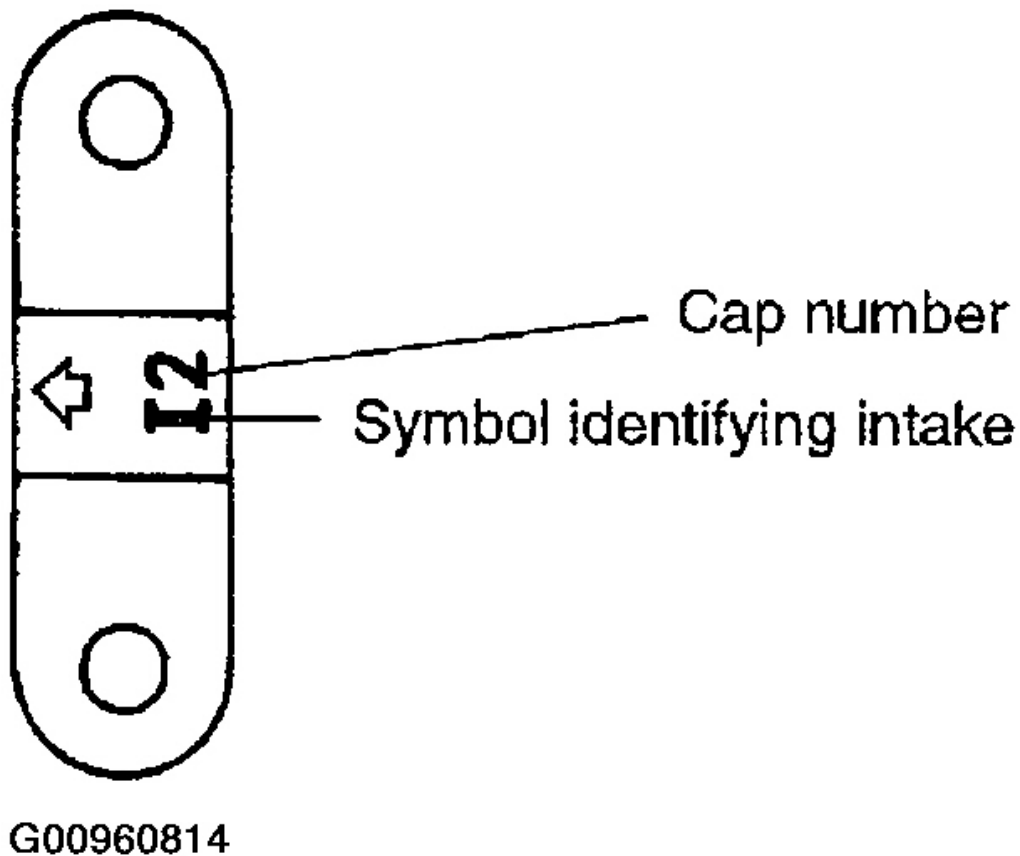
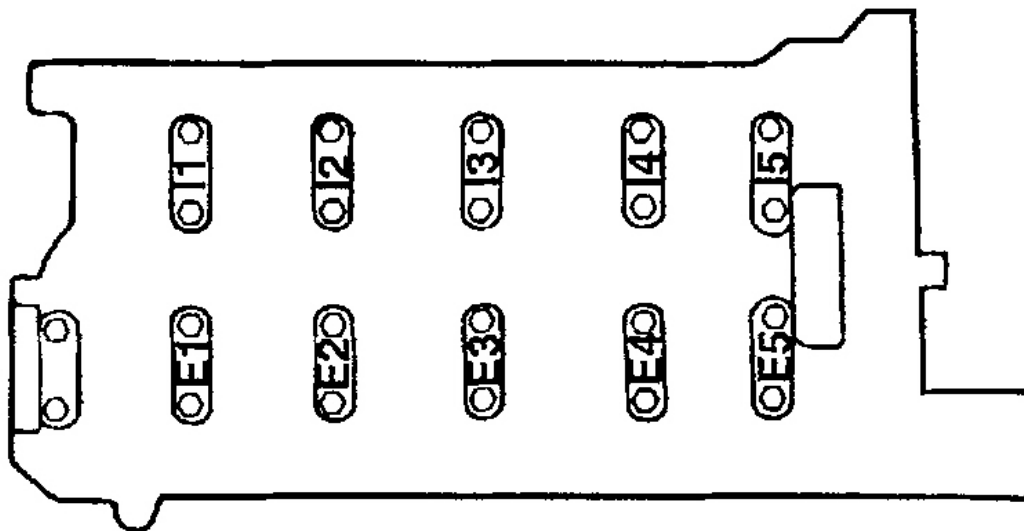


Fig. 85: Identifying Camshaft Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

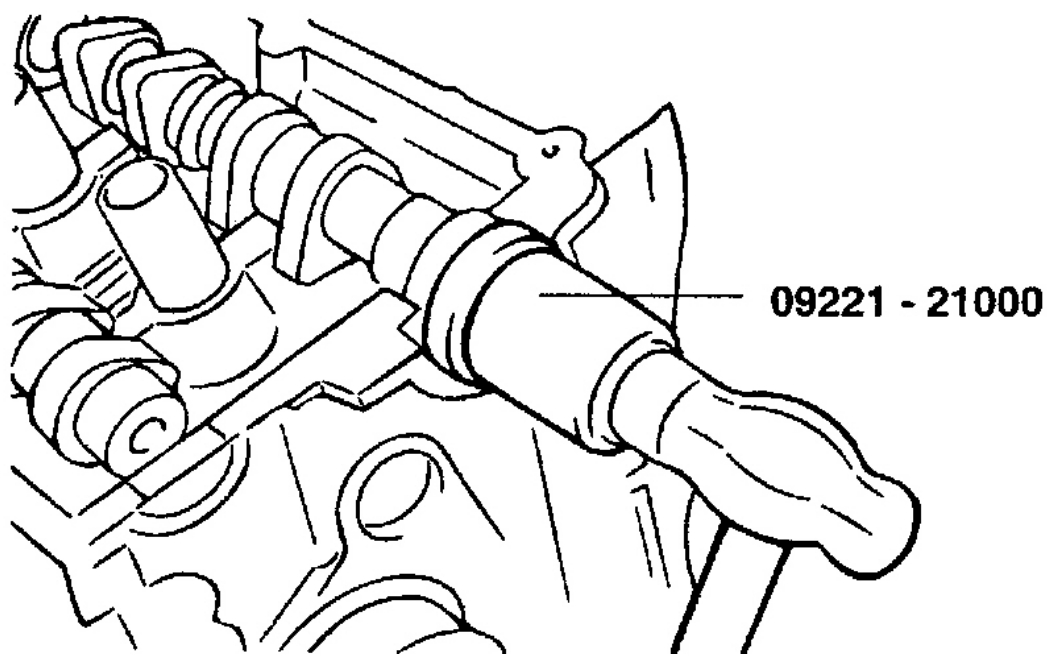
Bearing cap bolt: 14-15 Nm (140-150 kg.cm, 10-11 lb.ft)



G00960815

Fig. 86: Identifying Camshaft Bearing Cap Positions
Courtesy of HYUNDAI MOTOR CO.

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



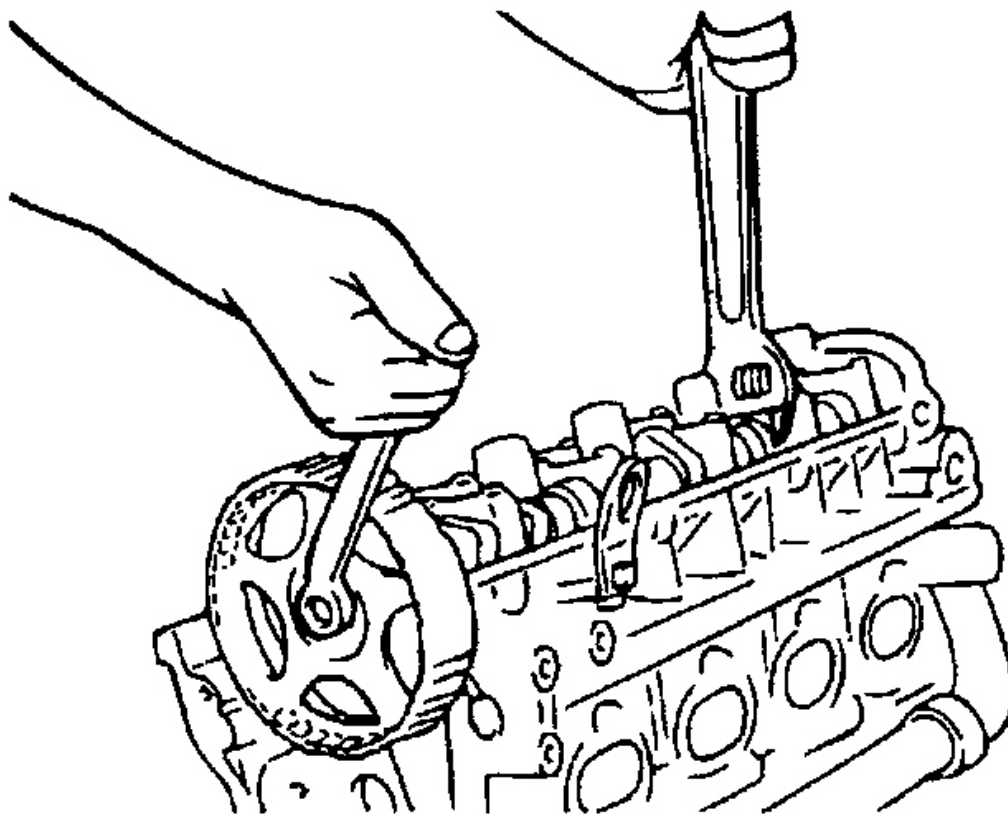
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Fig. 87: Installing Camshaft Oil Seal
Courtesy of HYUNDAI MOTOR CO.

7. Install the camshaft sprocket to the specified torque.

Tightening torque

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



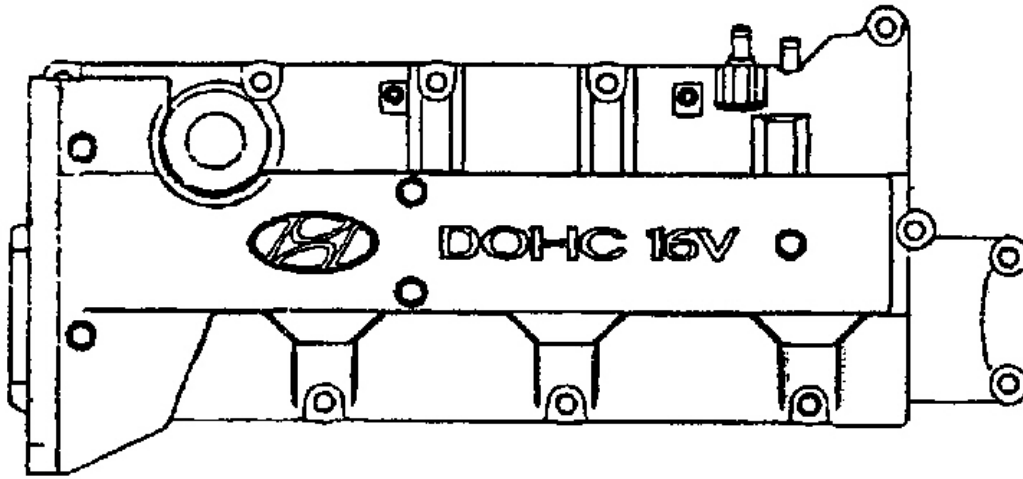
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Fig. 88: Installing Camshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

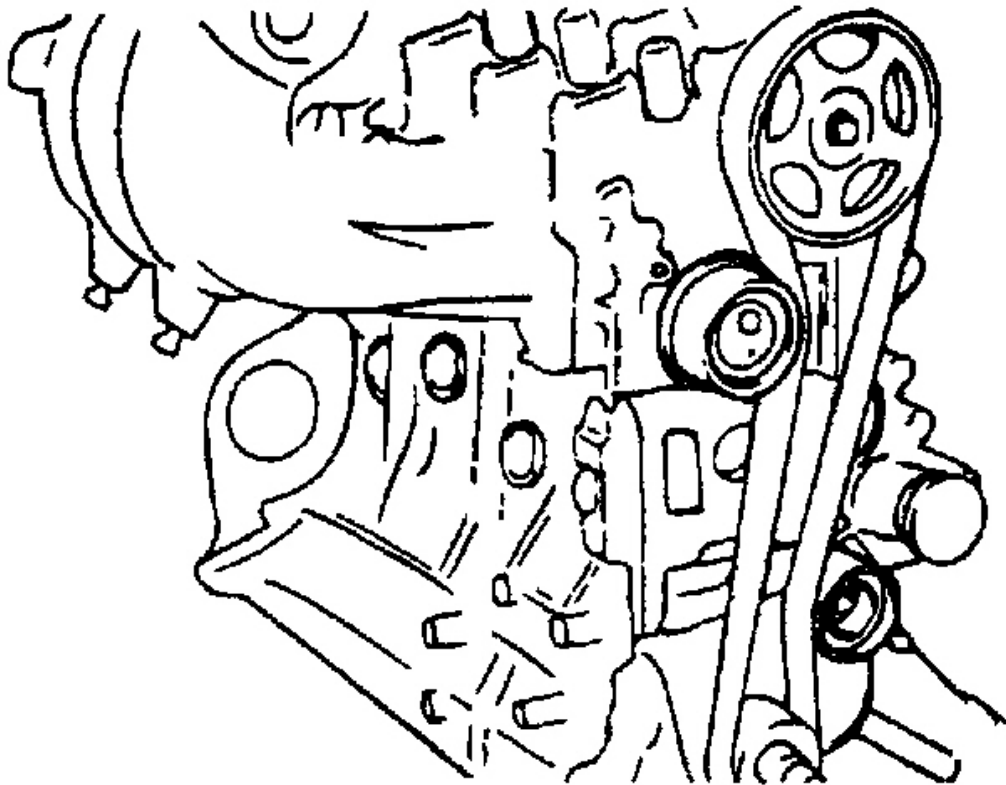
Cylinder head cover bolts: 8-10 Nm (80-100 kg.cm, 6-7 lb.ft)



G00960818

Fig. 89: View Of Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

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



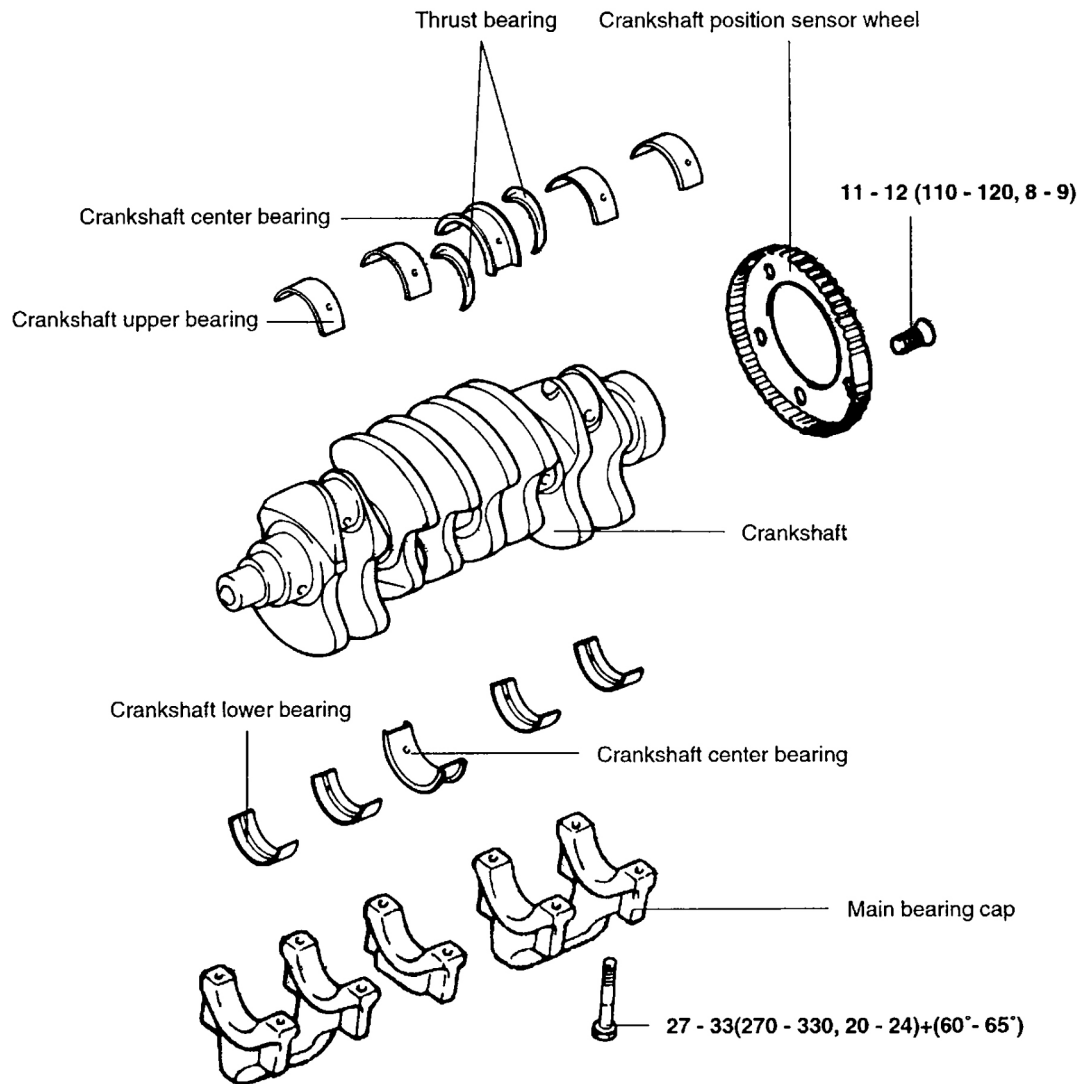
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Fig. 90: View Of Timing Belt Installed
Courtesy of HYUNDAI MOTOR CO.

12. Install the timing belt cover.
Timing belt cover: 8-10 Nm (80-100 kg.cm, 6-7 lb.ft)
13. Install the coolant pump pulley and crankshaft pulley.

CRANK SHAFT

COMPONENTS



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

G00960820

Fig. 91: Crank Shaft Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

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

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

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

INSPECTION

CRANKSHAFT

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

Standard value

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

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

Crankshaft journal, pin out-of-round and taper 0.01 mm: (0.0004 in.) or less

MAIN BEARINGS & CONNECTING ROD BEARINGS

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

OIL CLEARANCE MEASUREMENT

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

Main bearing oil clearance: 0.028-0.048 mm (0.0011-0.0019 in.)

Connecting rod bearing oil clearance:

(To set limits to new parts) 0.024-0.044 mm (0.0009-0.0017 in.)

OIL SEAL

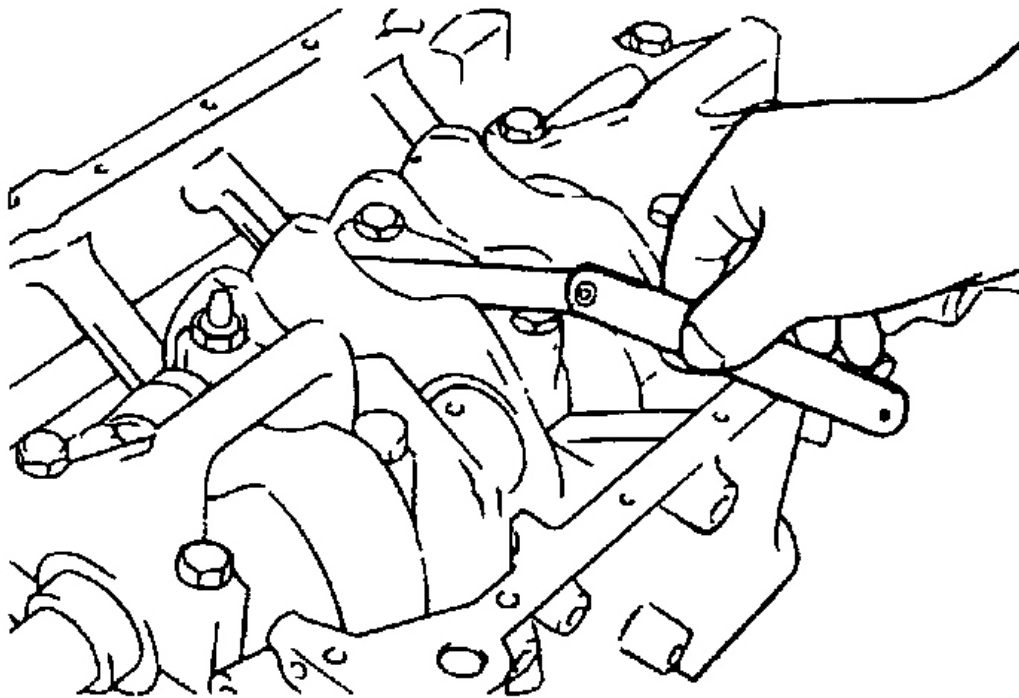
Check front and rear oil seals for damage or worn lips. Replace any defective seal.

BEARING CAPS

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

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

Limit: 0.30 mm (0.0118 in.)



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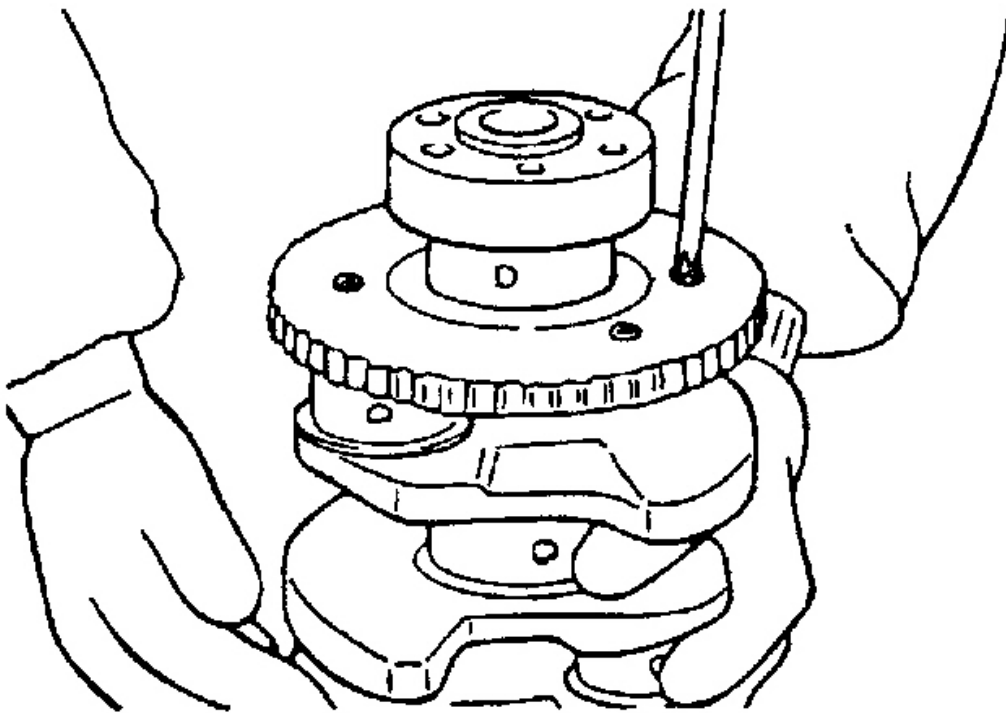
Fig. 92: Measuring End Play
Courtesy of HYUNDAI MOTOR CO.

SENSOR WHEEL

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

Standard value

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



G00960822

Fig. 93: Measuring Depth Of Sensor Wheel Tooth And Cylinder Block Mounting Surface
Courtesy of HYUNDAI MOTOR CO.

NOTE:

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

REASSEMBLY

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

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

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

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

Tightening torque

Main bearing cap bolt: 27-33 Nm (270-330 kg.cm, 20 - 24lb.ft) + (60°-65°)

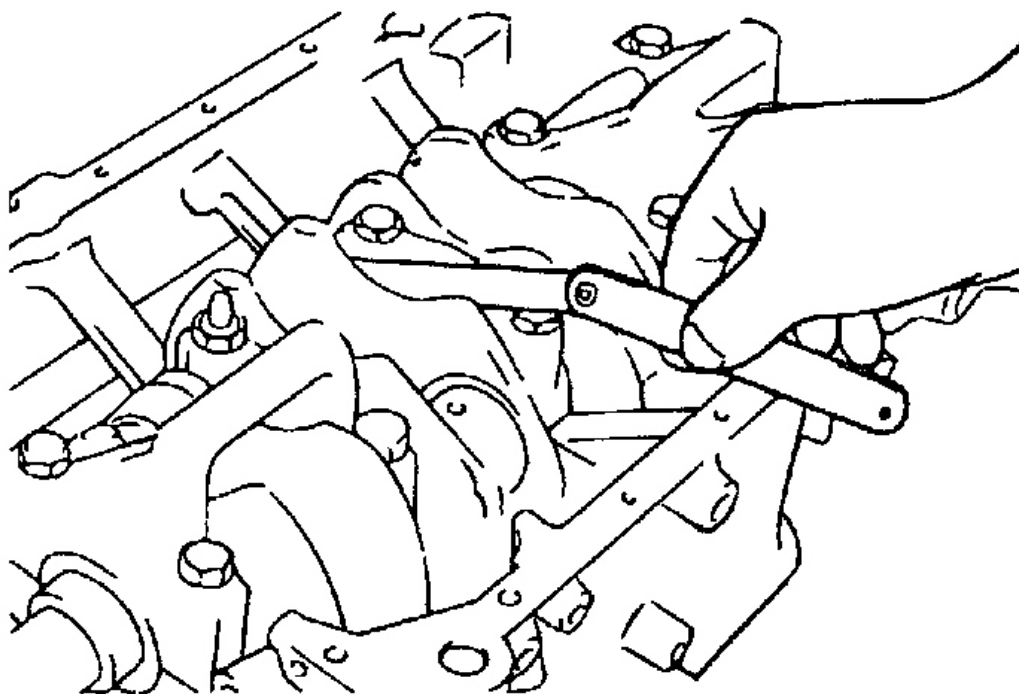
Connecting rod cap bolt: 50-53 Nm (500-530 kg.cm, 37-39 lb.ft)

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

Standard value

Crankshaft end play: 0.06-0.260 mm (0.0024-0.0102)

Connecting rod end play: 0.10-0.25 mm (0.0039-0.0098 in.)

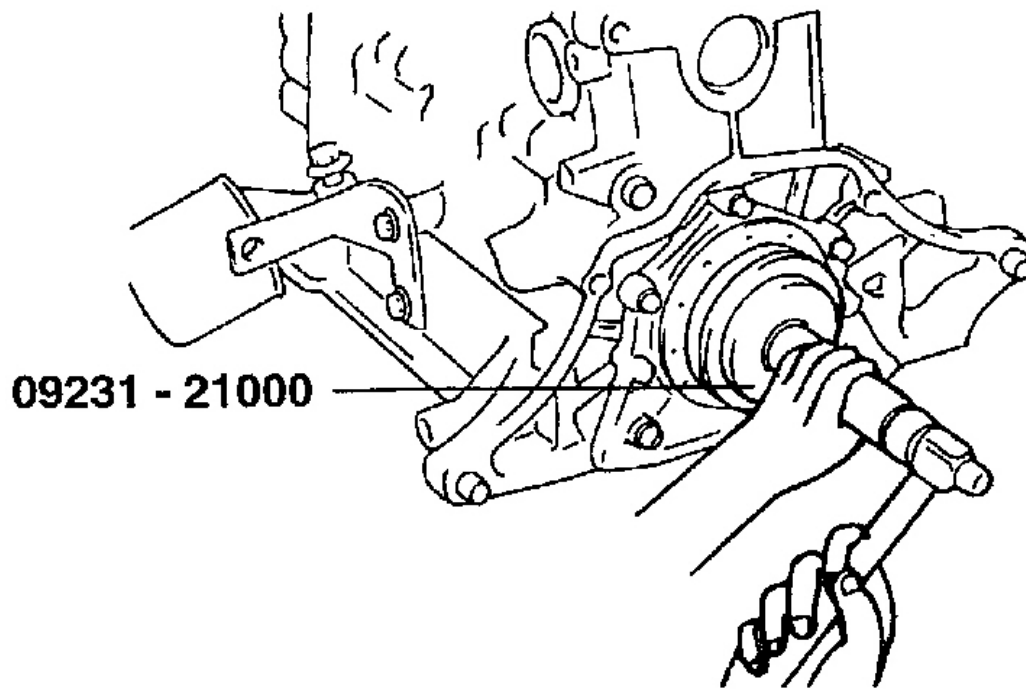


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Fig. 94: Measuring End Play

Courtesy of HYUNDAI MOTOR CO.

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



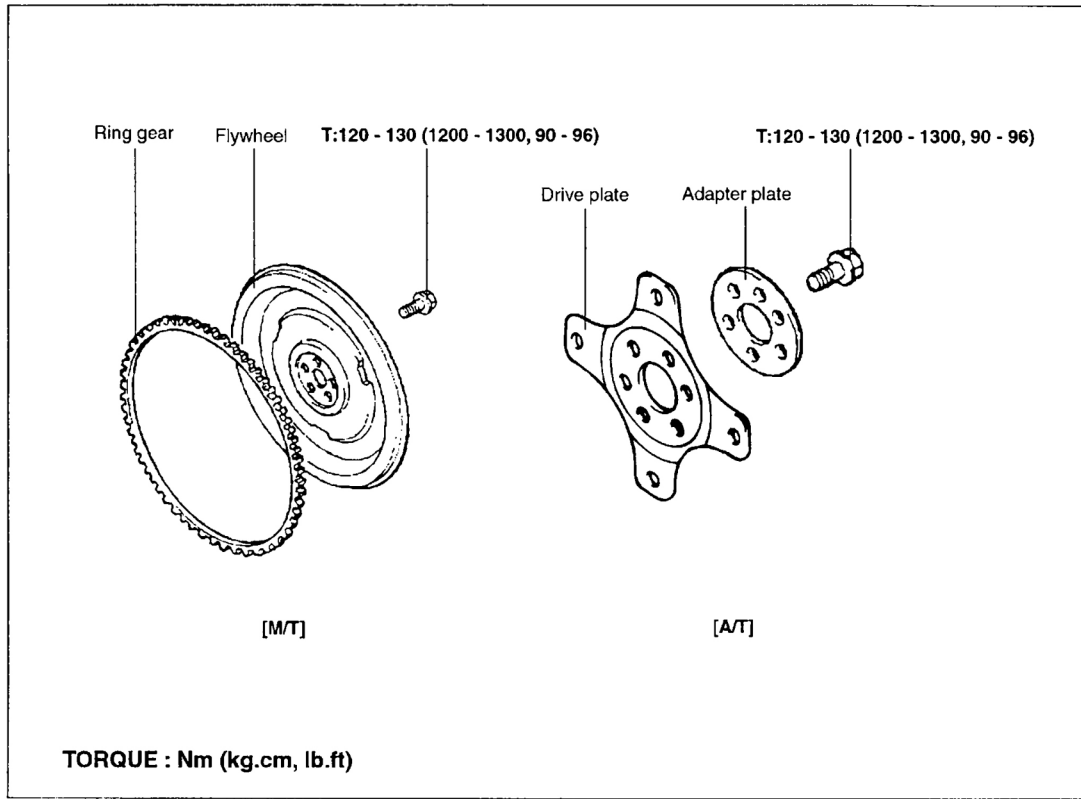
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Fig. 95: Installing Crankshaft Rear Seal
Courtesy of HYUNDAI MOTOR CO.

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

FLYWHEEL

COMPONENTS



M/T : Manual Transmission Vehicles
 A/T : Automatic Transmission Vehicles
 G00960825

Fig. 96: Flywheel Components
 Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

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

INSPECTION

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

Standard value

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

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

REASSEMBLY

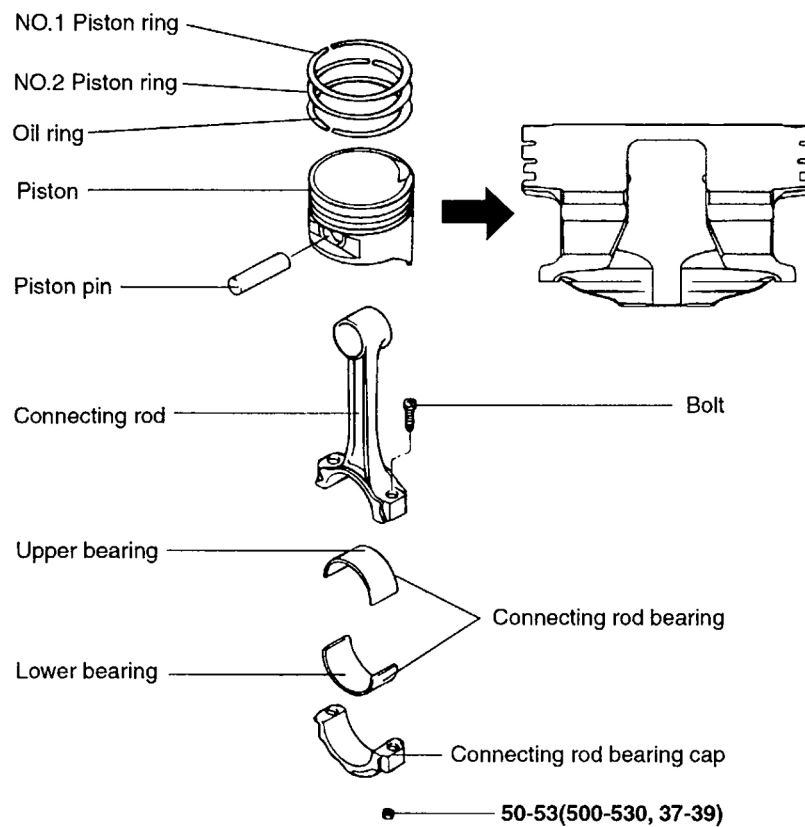
Install the flywheel assembly and tighten the bolts to the specified torque.

Tightening torque

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

PISTON

COMPONENTS



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

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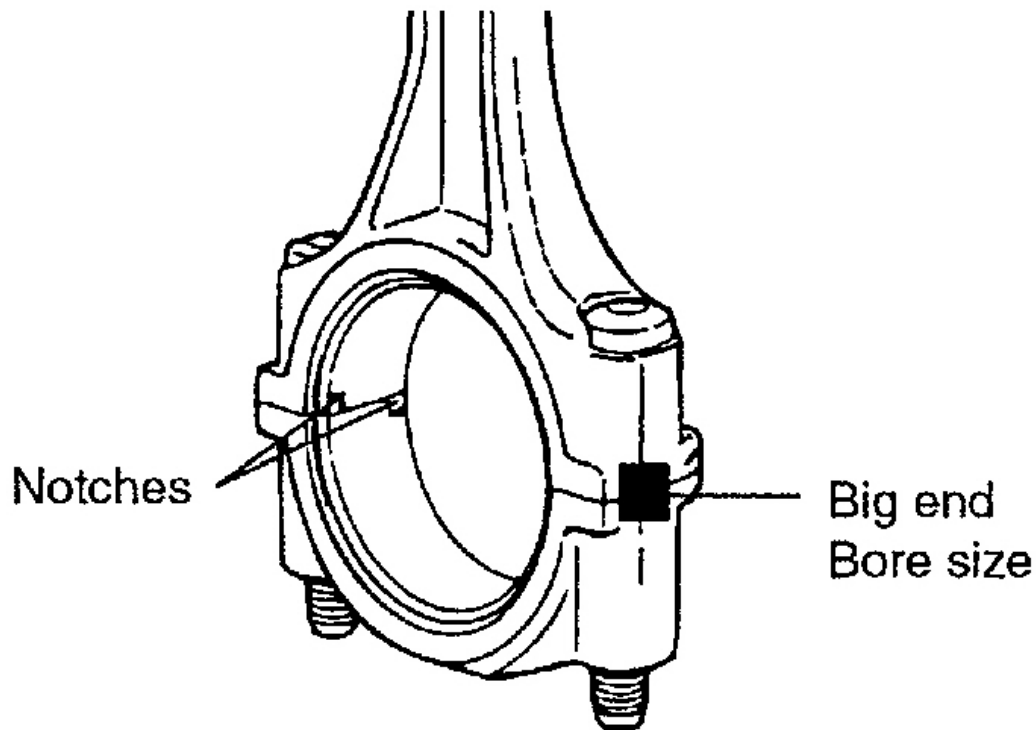
Fig. 97: Piston Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

CONNECTING ROD CAP

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

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

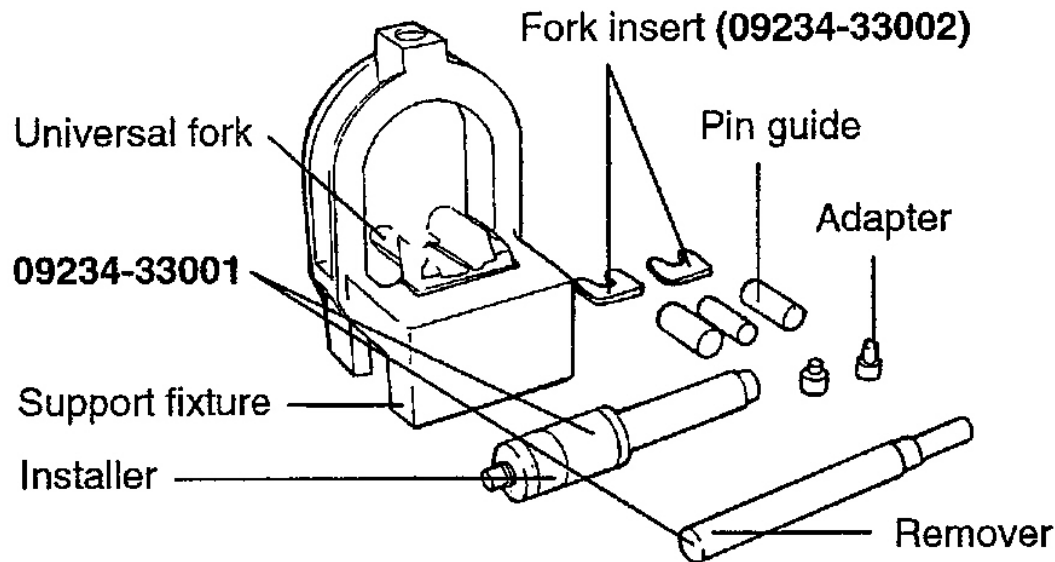


G00960827

Fig. 98: Identifying Connecting Rod Bearing Notches
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY & REASSEMBLY OF THE PISTON PIN

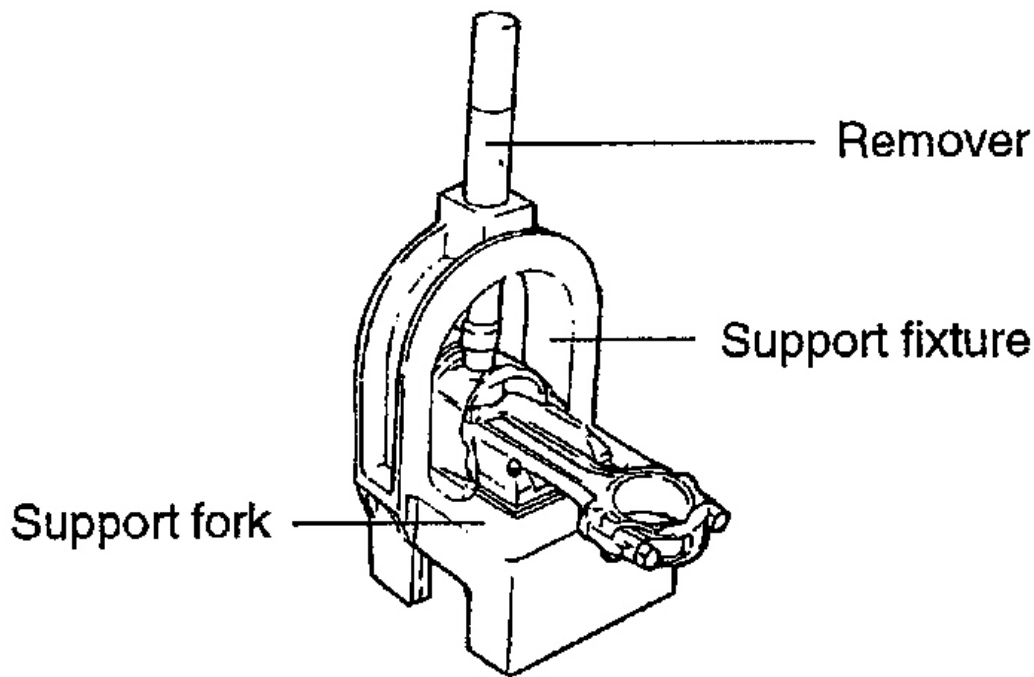
1. Using the special tools (09234-33001) and (09234-33002), disassemble and reassemble the piston and connecting rod.



G00960828

Fig. 99: Identifying Special Tool
Courtesy of HYUNDAI MOTOR CO.

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



G00960829

Fig. 100: Removing Piston Pin
Courtesy of HYUNDAI MOTOR CO.

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

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

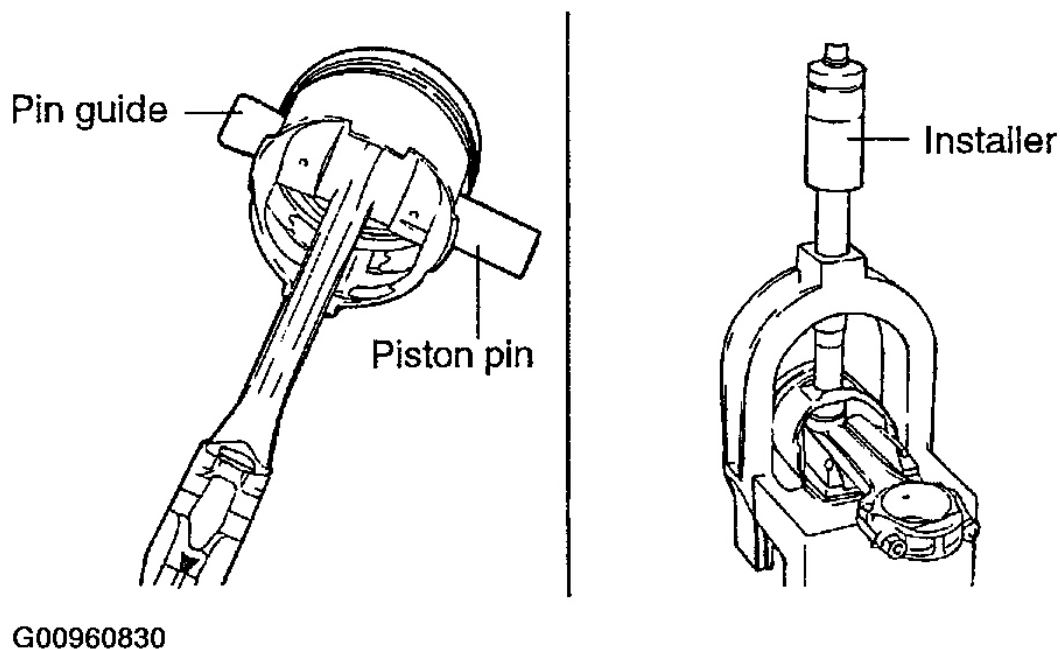
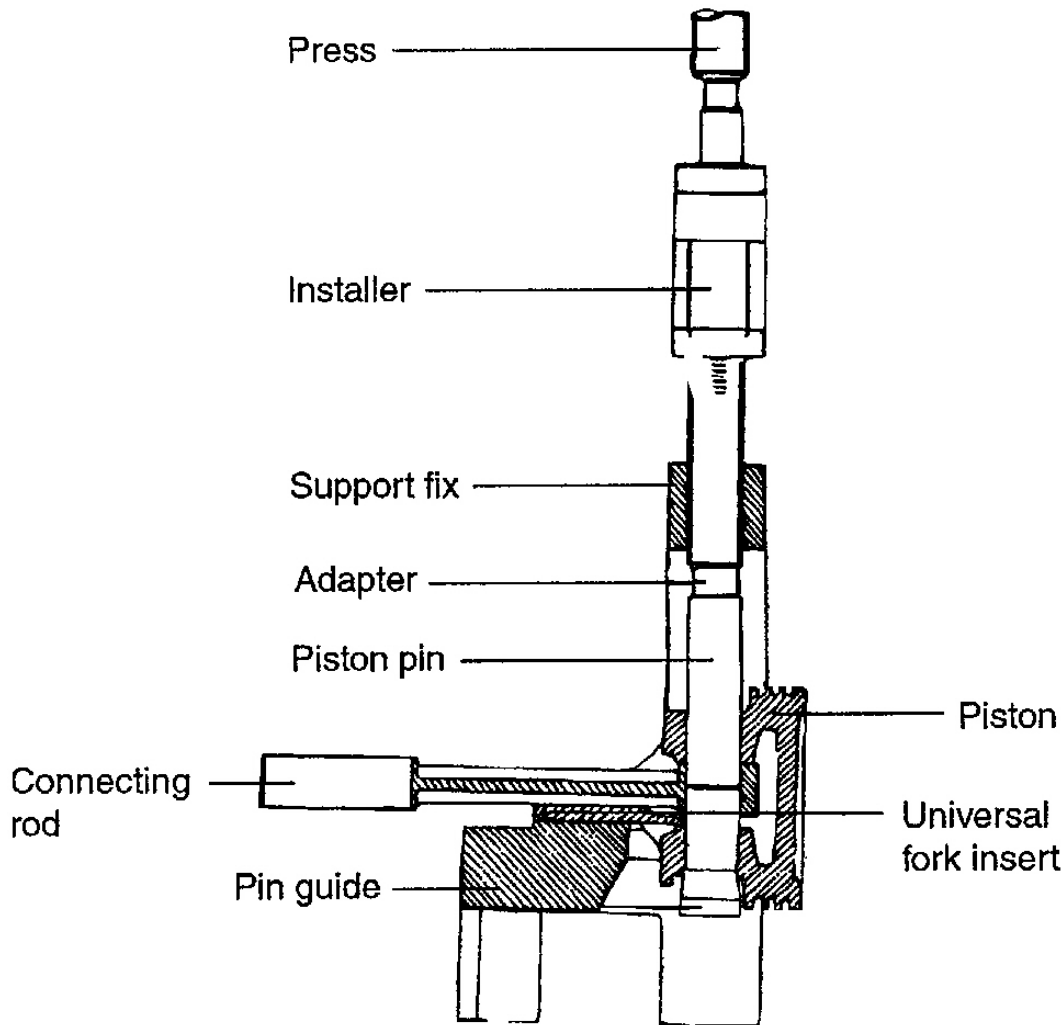


Fig. 101: Installing Piston Pin

Courtesy of HYUNDAI MOTOR CO.

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

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



G00960831

Fig. 102: Using Hydraulic Press To Force Piston Pin Through Rod Little End
 Courtesy of HYUNDAI MOTOR CO.

INSPECTION

PISTONS & PISTON PINS

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

PISTONS RINGS

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

Piston ring side clearance

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

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

Limit

No. 1: 0.1 mm (0.004 in.)

No. 2: 0.1 mm (0.004 in.)

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

Piston ring end gap

[Standard]

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

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

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

[Limit]

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

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

PISTON RING SERVICE SIZE & MARK

Standard	None
0.25 mm (0.010 in.) O.S.	25
0.50 mm (0.020 in.) O.S.	50
0.75 mm (0.030 in.) O.S.	75
1.00 mm (0.039 in.) O.S.	100

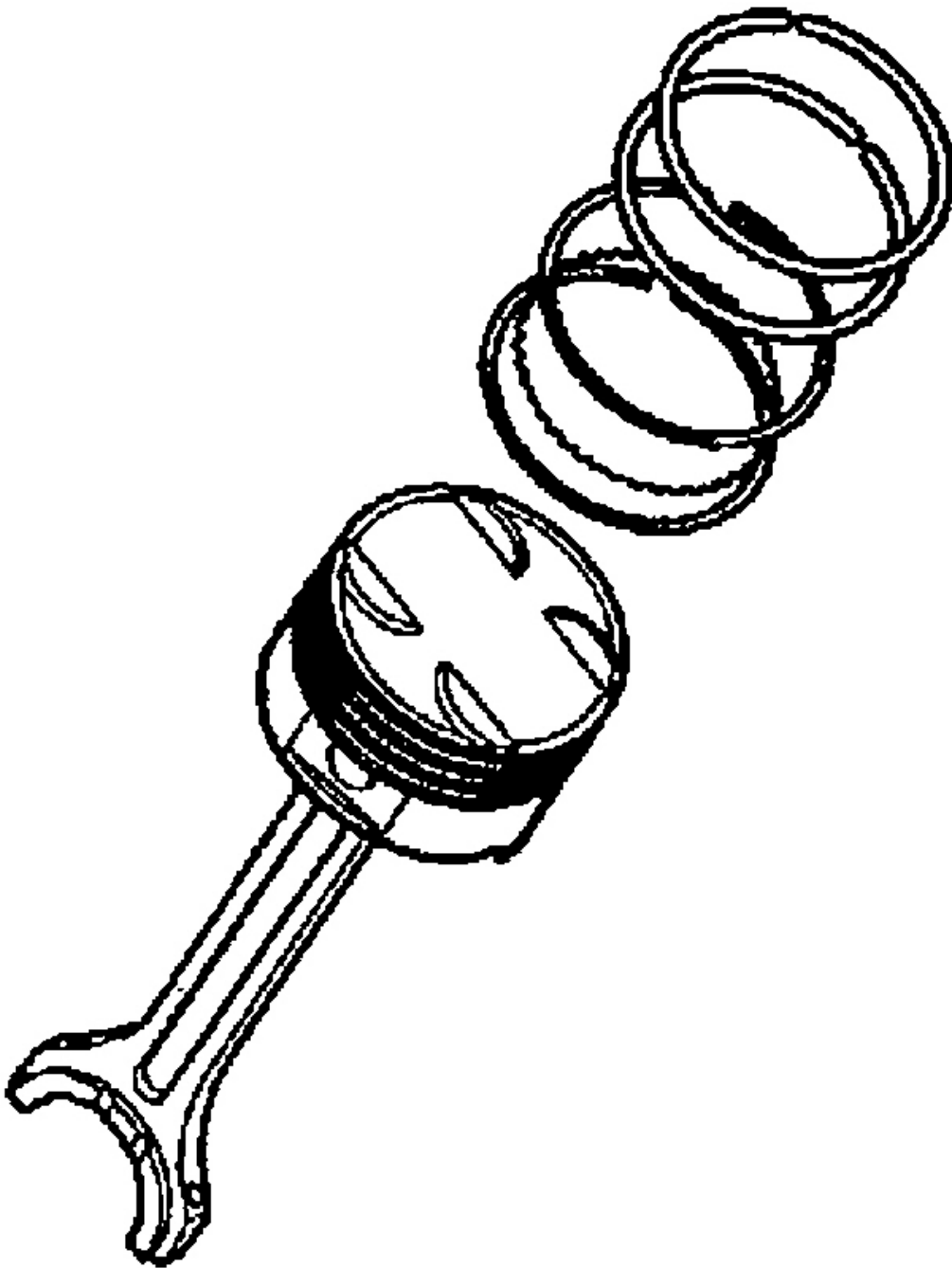
G00960832

Fig. 103: Piston Ring Service Size & Mark Table
 Courtesy of HYUNDAI MOTOR CO.

2003 Hyundai Elantra GT

2003 ENGINE 2.0L 4 Cylinder DOHC - Elantra

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



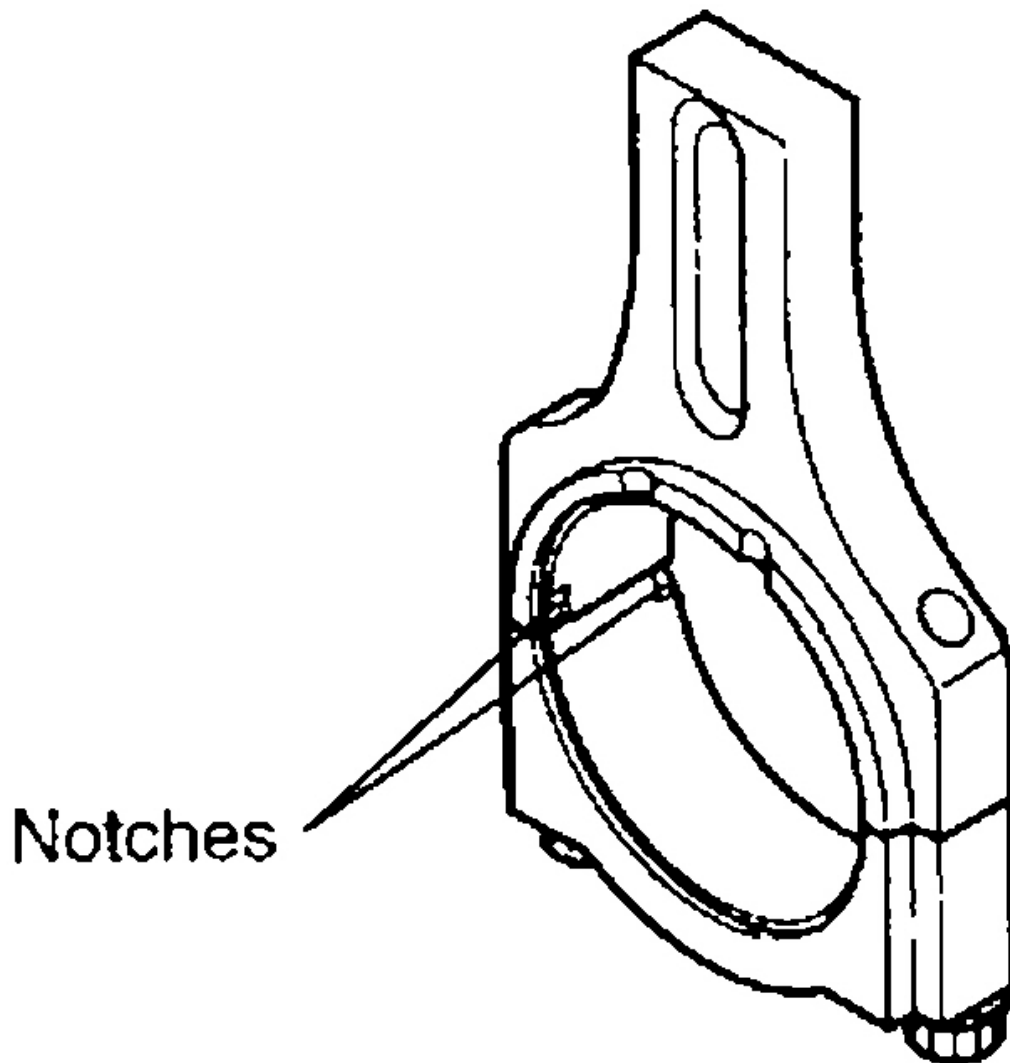
G00960833

Fig. 104: View Of Piston & Rings

Courtesy of HYUNDAI MOTOR CO.

CONNECTING RODS

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

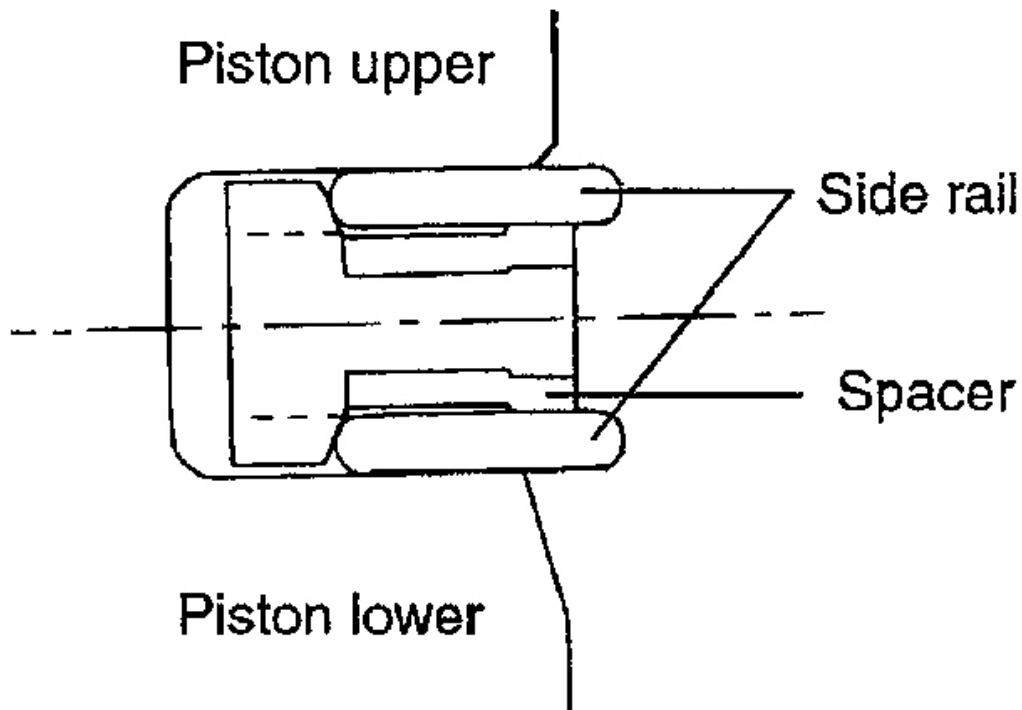


G00960834

Fig. 105: Identifying Connecting Rod Bearing Notches
Courtesy of HYUNDAI MOTOR CO.

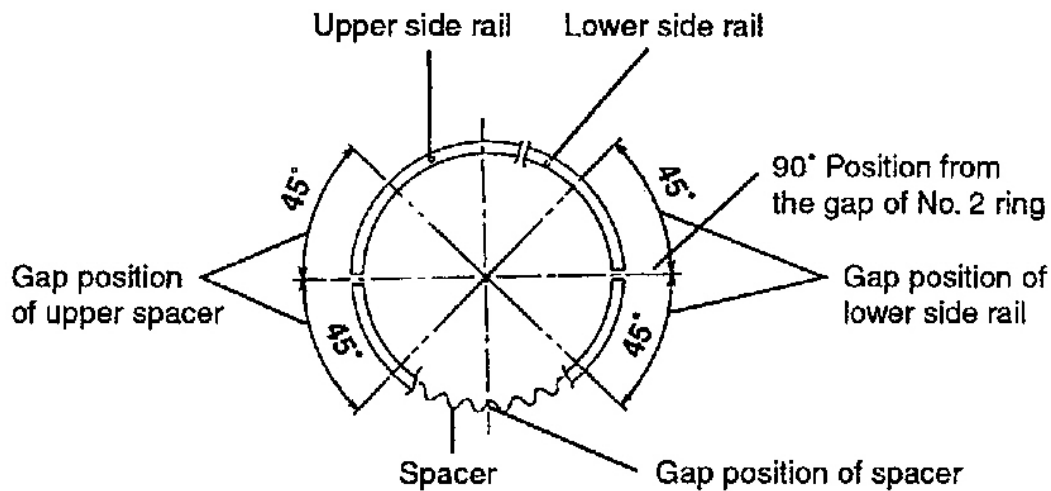
REASSEMBLY

1. Install the spacer.



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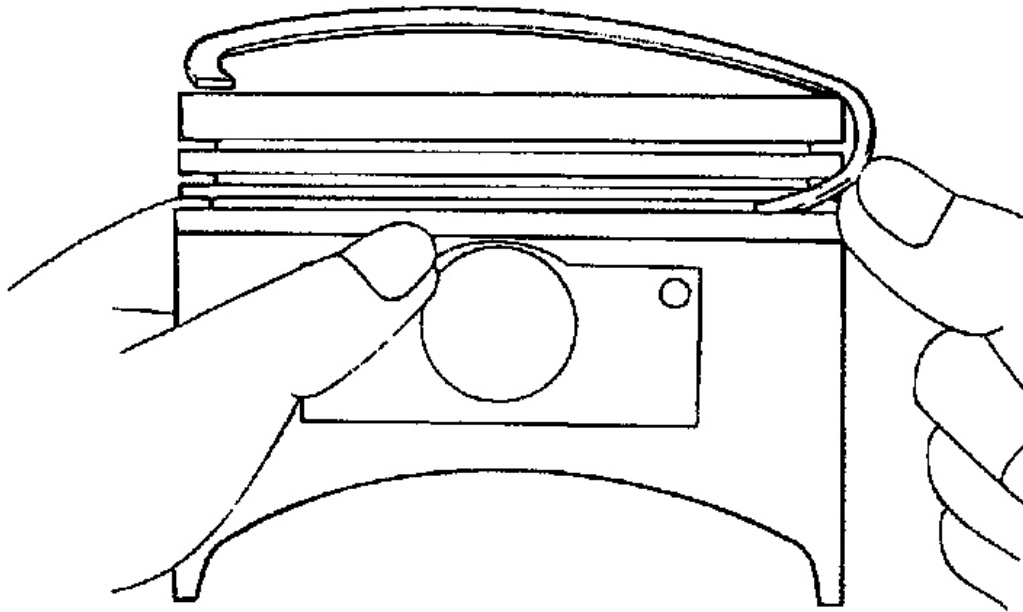
Fig. 106: Identifying Spacer
Courtesy of HYUNDAI MOTOR CO.



G00960836

Fig. 107: Identifying Spacer Installation
Courtesy of HYUNDAI MOTOR CO.

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

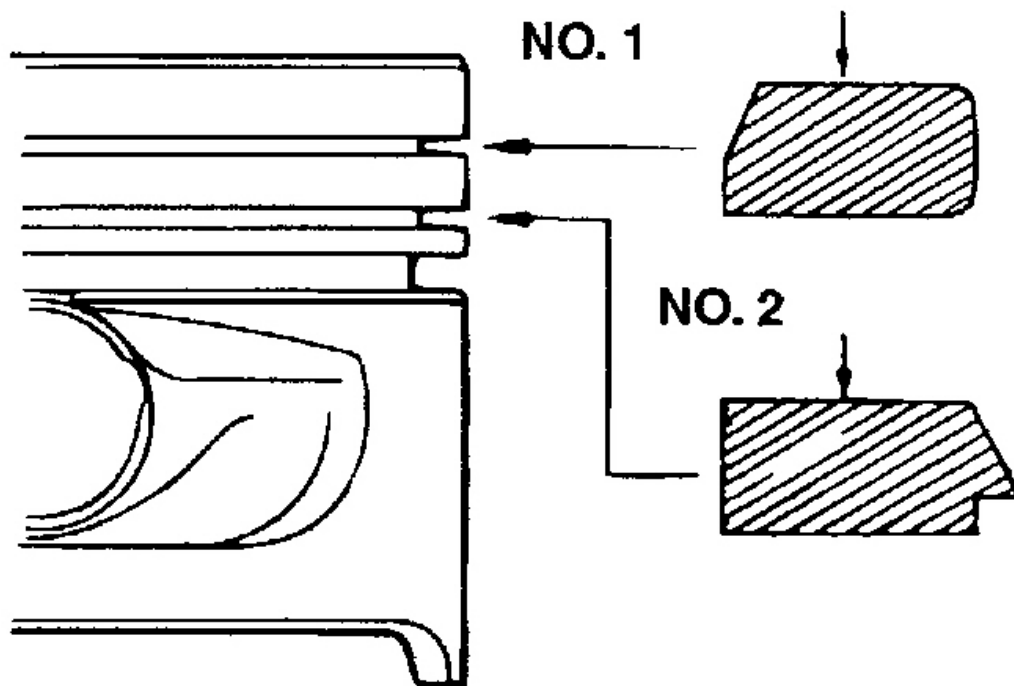


G00960837

Fig. 108: Installing Side Rail
Courtesy of HYUNDAI MOTOR CO.

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

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



G00960838

Fig. 109: Identifying Piston Ring Installation
Courtesy of HYUNDAI MOTOR CO.

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

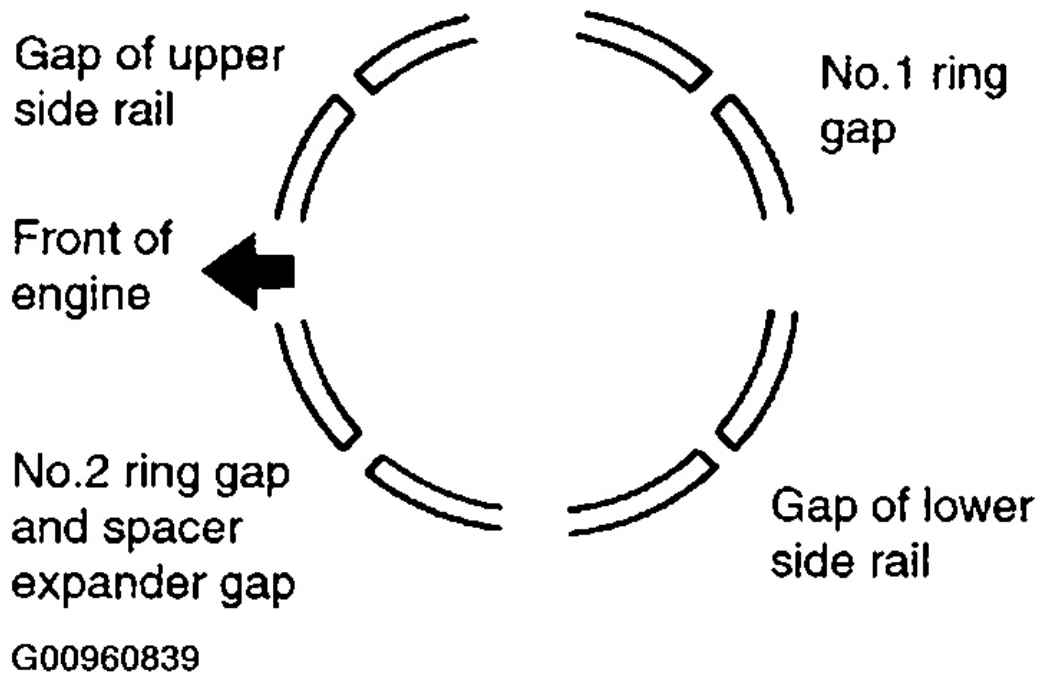


Fig. 110: Identifying Piston Ring Gaps
 Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

Connecting rod cap nut: 50-53 Nm (500-530 kg.cm, 36-39 lb.ft)

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

14. Check the connecting rod side clearance.

Connecting rod side clearance

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

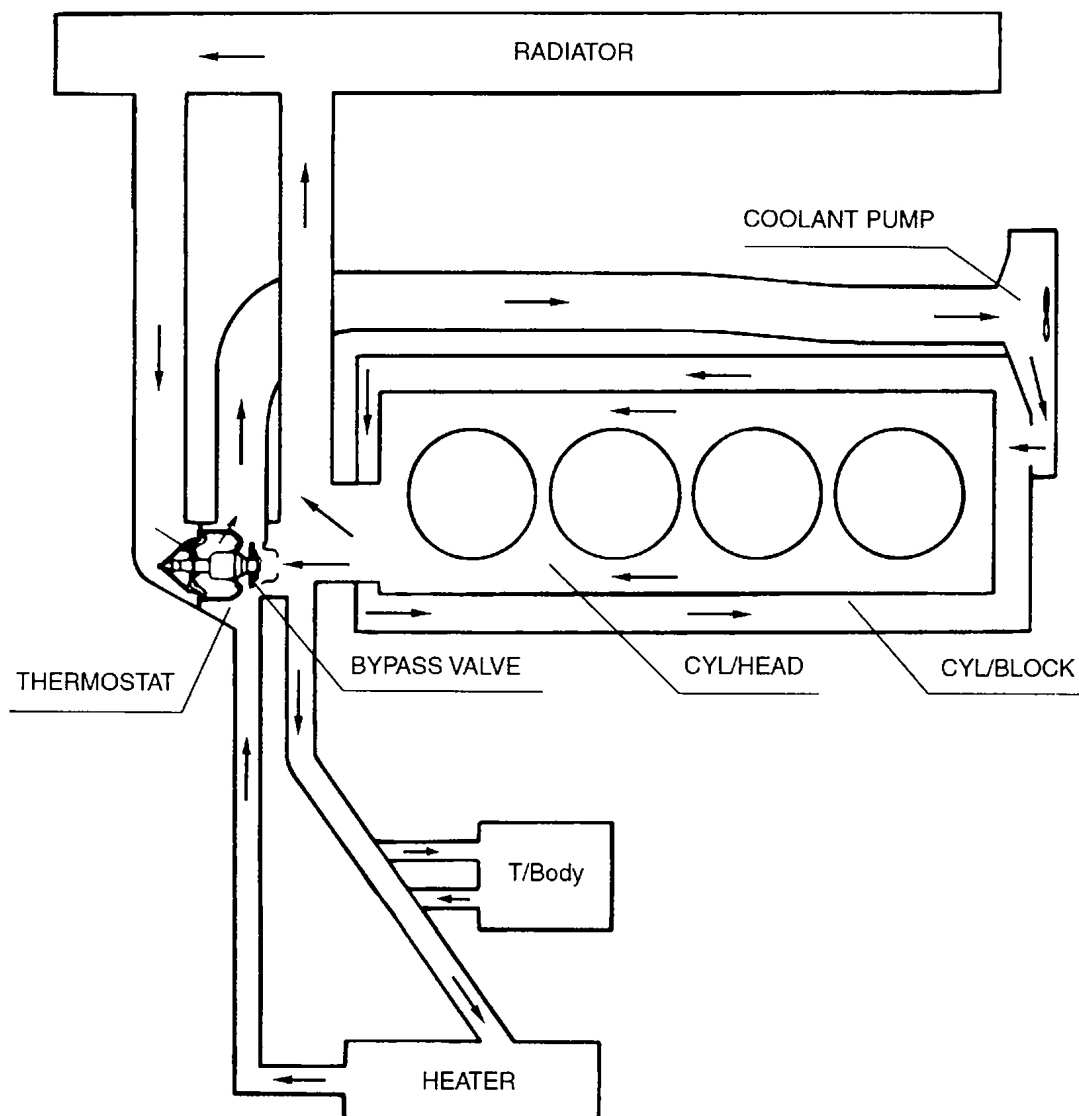
Limit : 0.4 mm (0.0157 in.)

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

COOLING SYSTEM

ENGINE COOLANT HOSE/PIPES

COOLING SYSTEM DIAGRAM

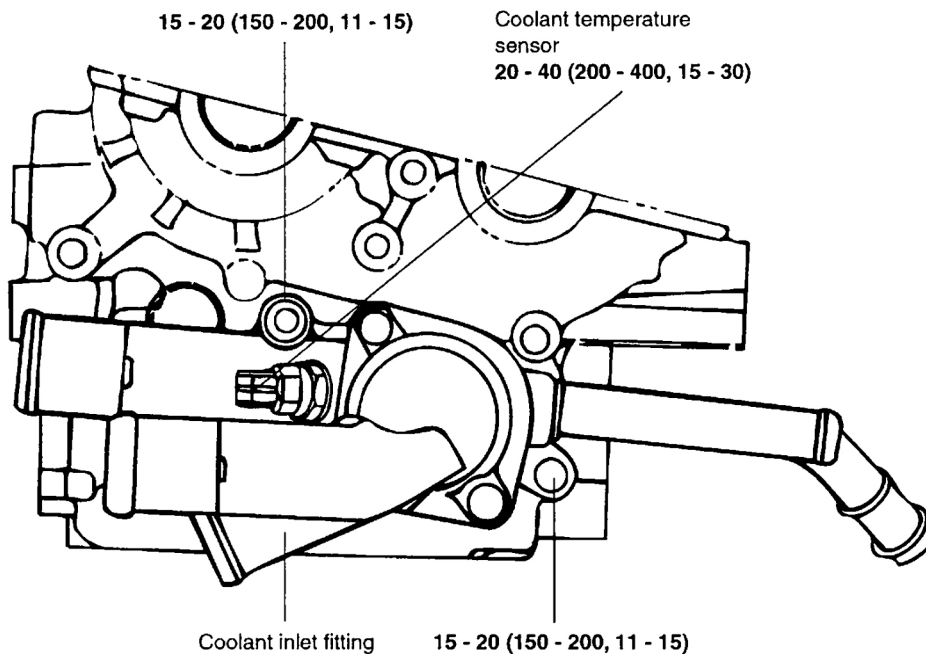


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Fig. 111: Engine Cooling System Diagram
Courtesy of HYUNDAI MOTOR CO.

COOLANT HOSE & PIPE

COMPONENTS



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

G00960841

Fig. 112: Coolant Hose & Pipe Components
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

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

Replace if necessary.

REASSEMBLY

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

NOTE:

- Do not apply oil or grease to the coolant pipe O - ring.

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

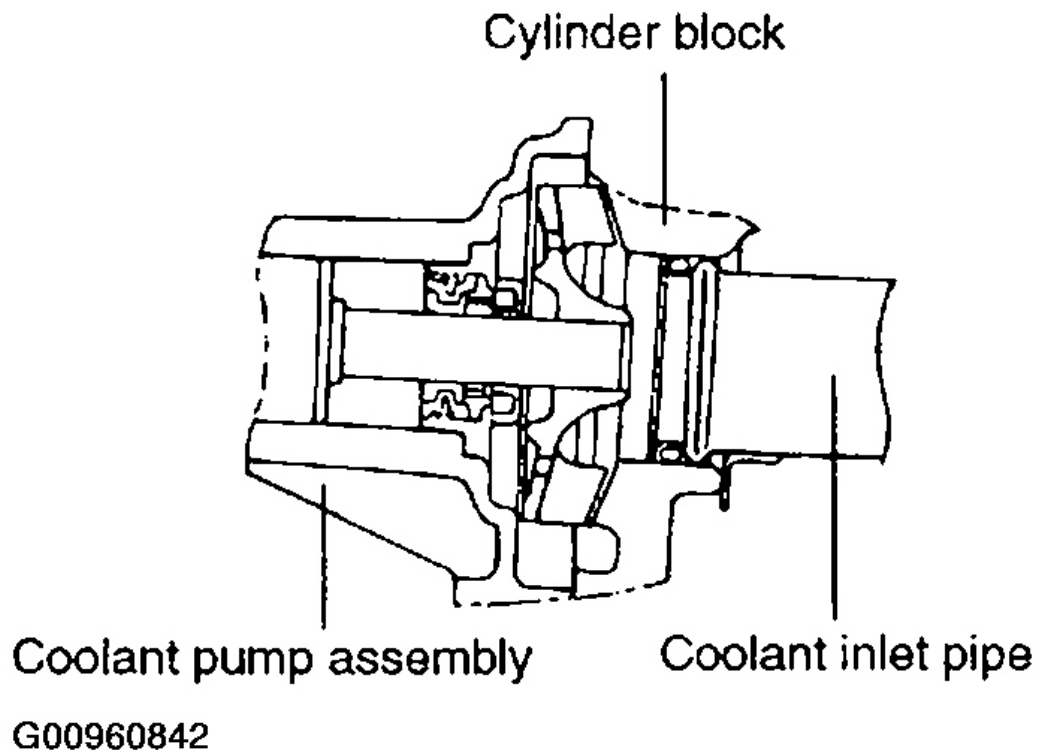
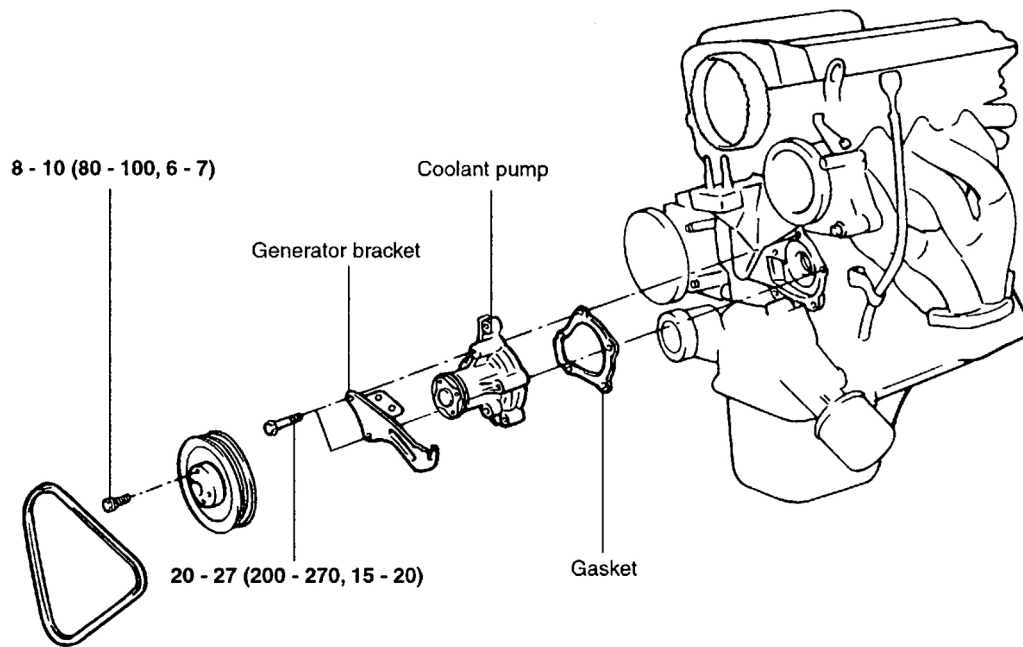


Fig. 113: Identifying Coolant Inlet Pipe-To-Pump Assembly
Courtesy of HYUNDAI MOTOR CO.

ENGINE COOLANT PUMP

COMPONENTS



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

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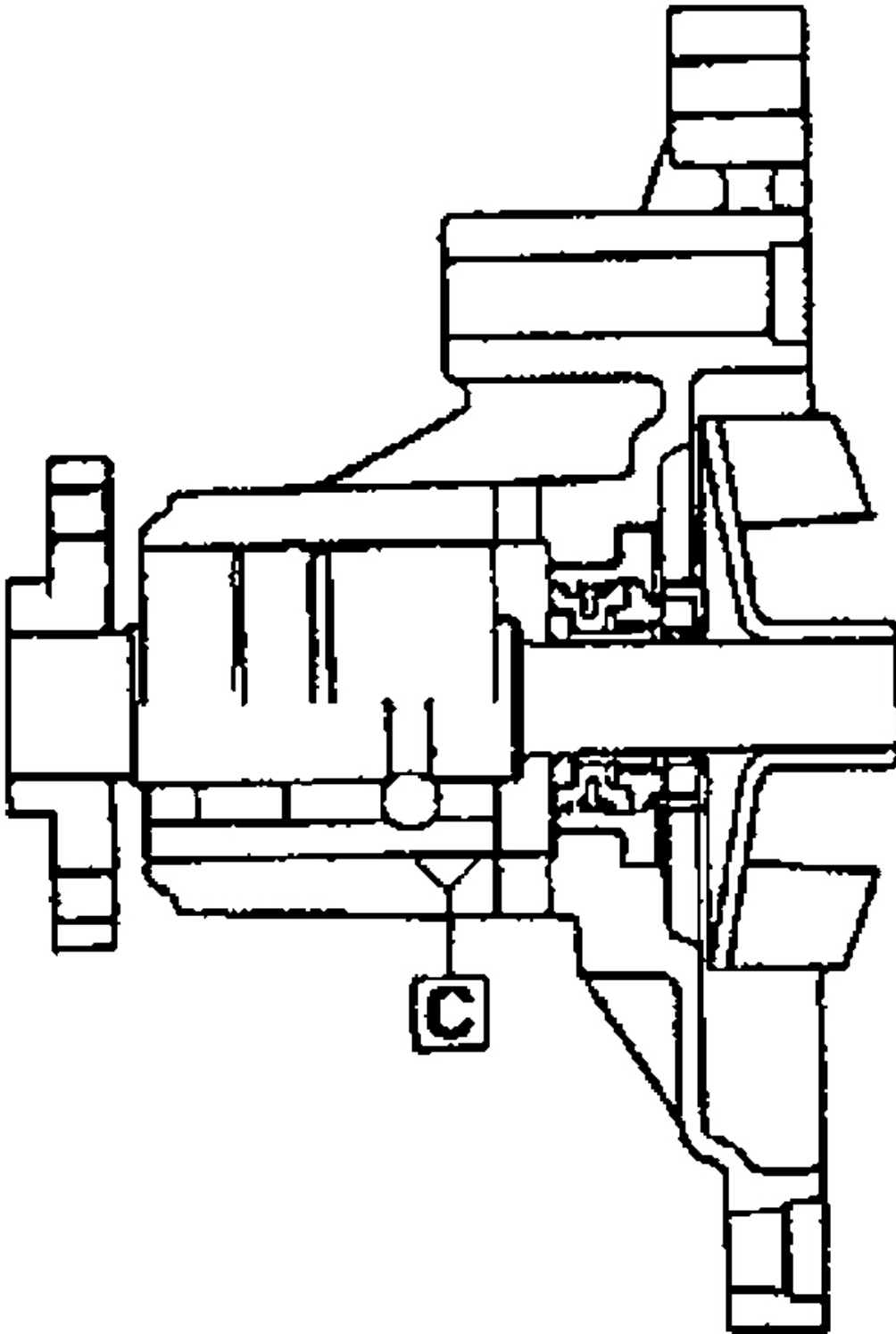
Fig. 114: Engine Coolant Pump Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

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

INSPECTION

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



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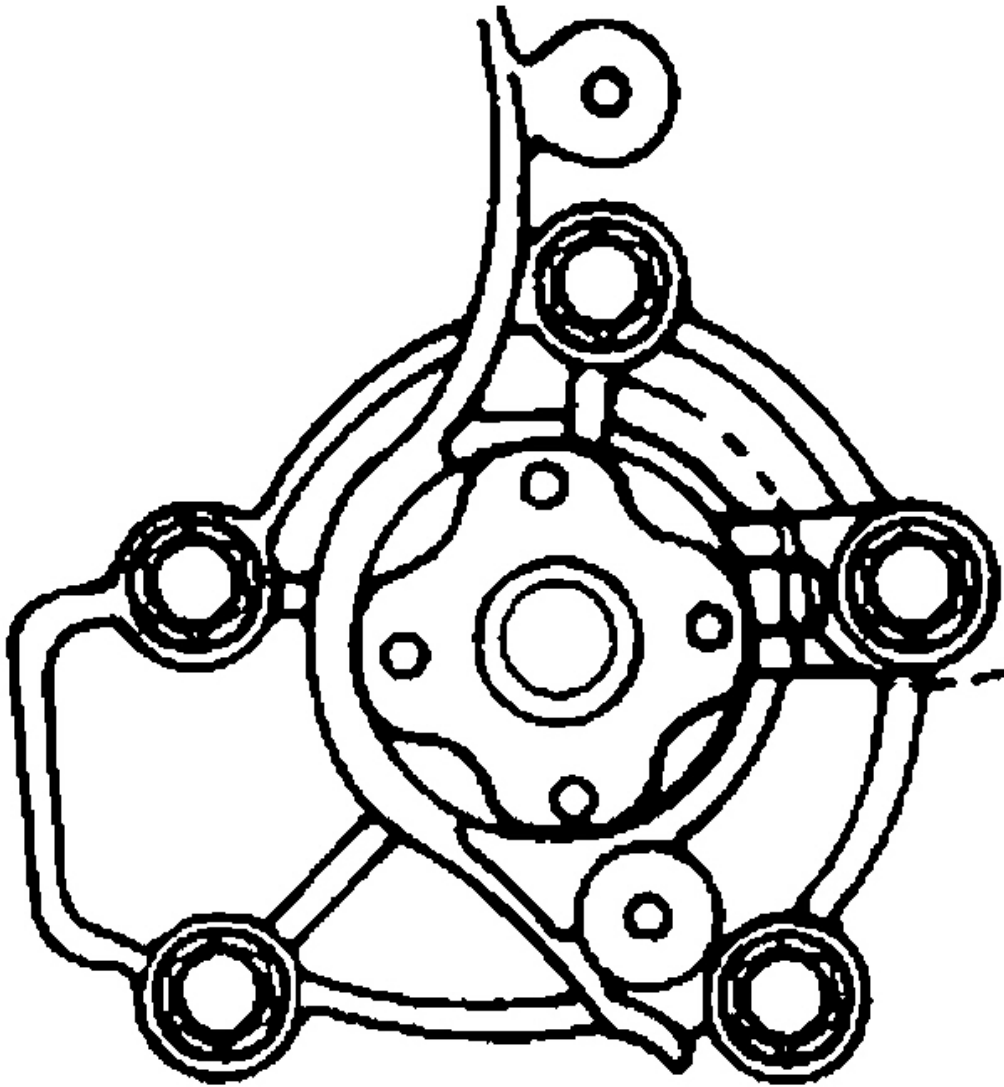
Fig. 115: View Of Coolant Pump
Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

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

Tightening torque

Coolant pump to cylinder block: 20-27 Nm (200-270 kg.cm, 15-20 lb.ft)



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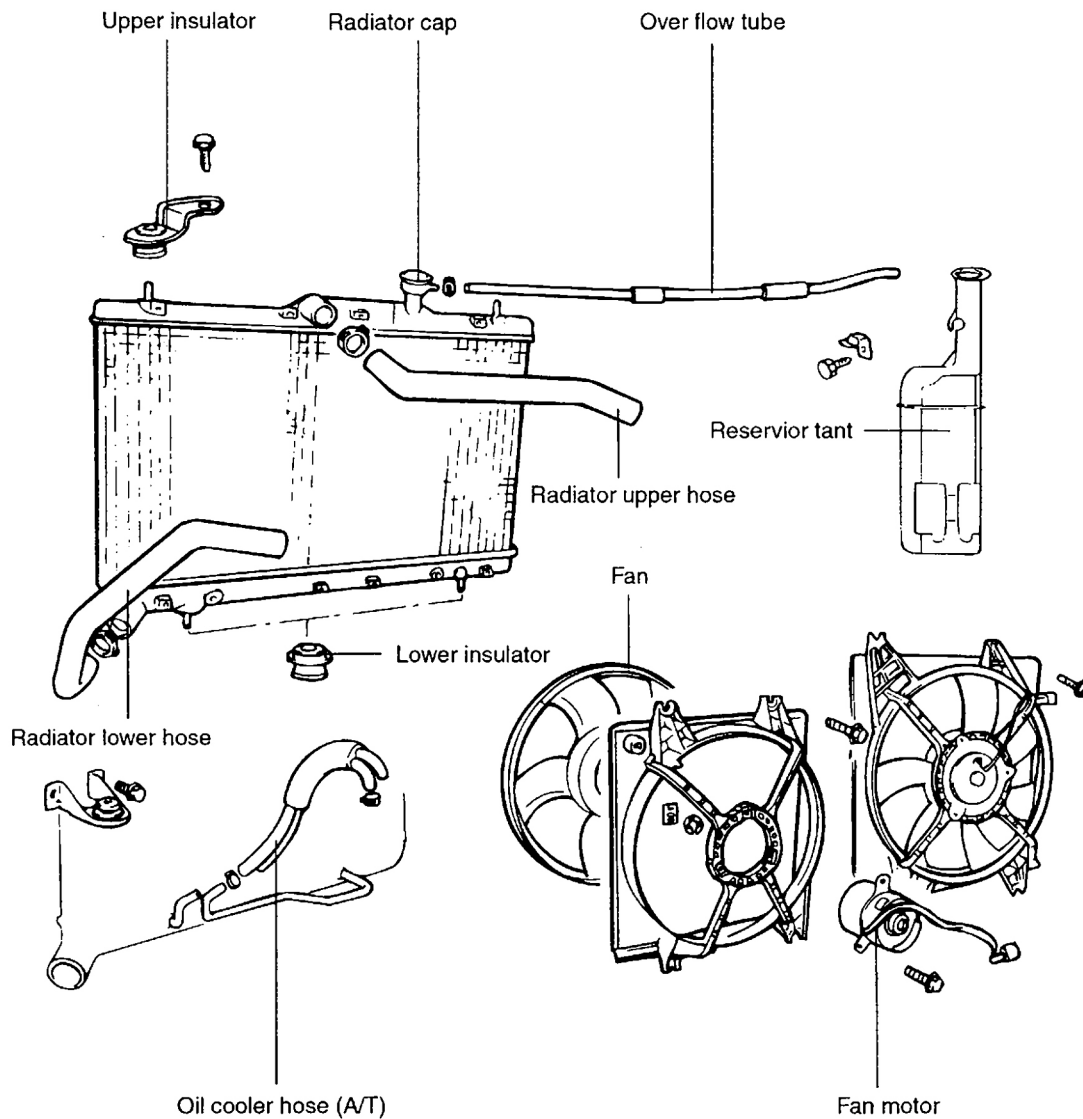
Fig. 116: Identifying Coolant Pump Bolts
Courtesy of HYUNDAI MOTOR CO.

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

- Run the engine and check for leaks.

RADIATOR

COMPONENTS



G00960846

Fig. 117: Radiator Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

- Disconnect the radiator fan motor connector.
- Set the temperature control switch to the hot position.

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

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

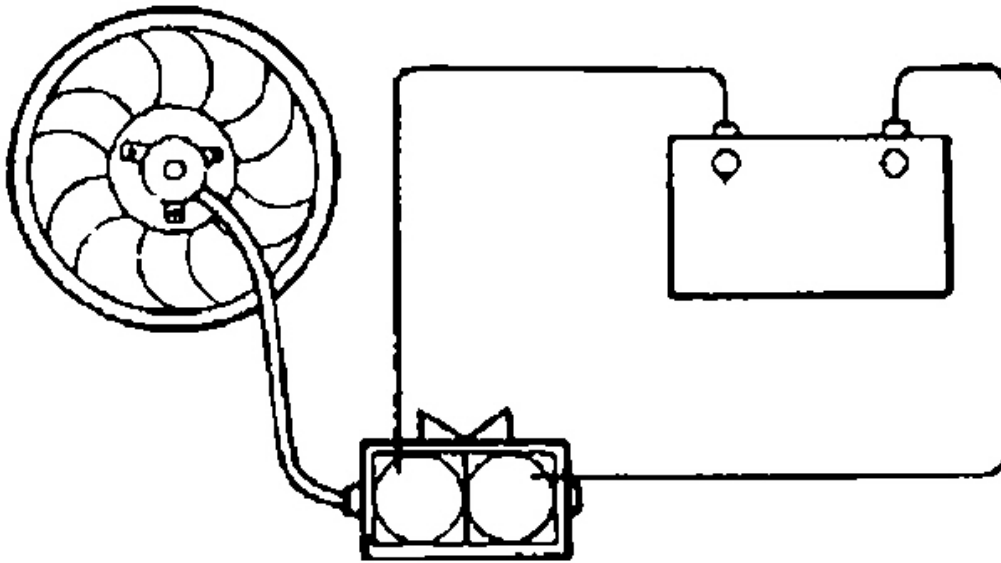
6. Remove the radiator mounting bolts.
7. Remove the radiator and the fan motor together.
8. Remove the fan motor from the radiator.

INSPECTION

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

RADIATOR FAN MOTOR

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



G00960847

Fig. 118: Checking Radiator Fan Operation
Courtesy of HYUNDAI MOTOR CO.

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

REASSEMBLY

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

RADIATOR CAP

COMPONENTS

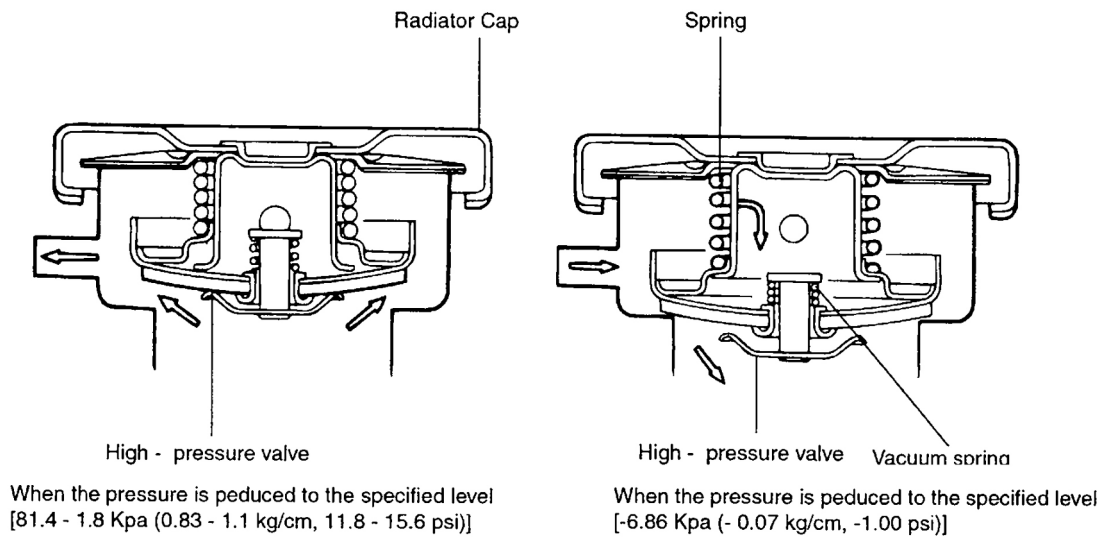


Fig. 119: Radiator Cap Components
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

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

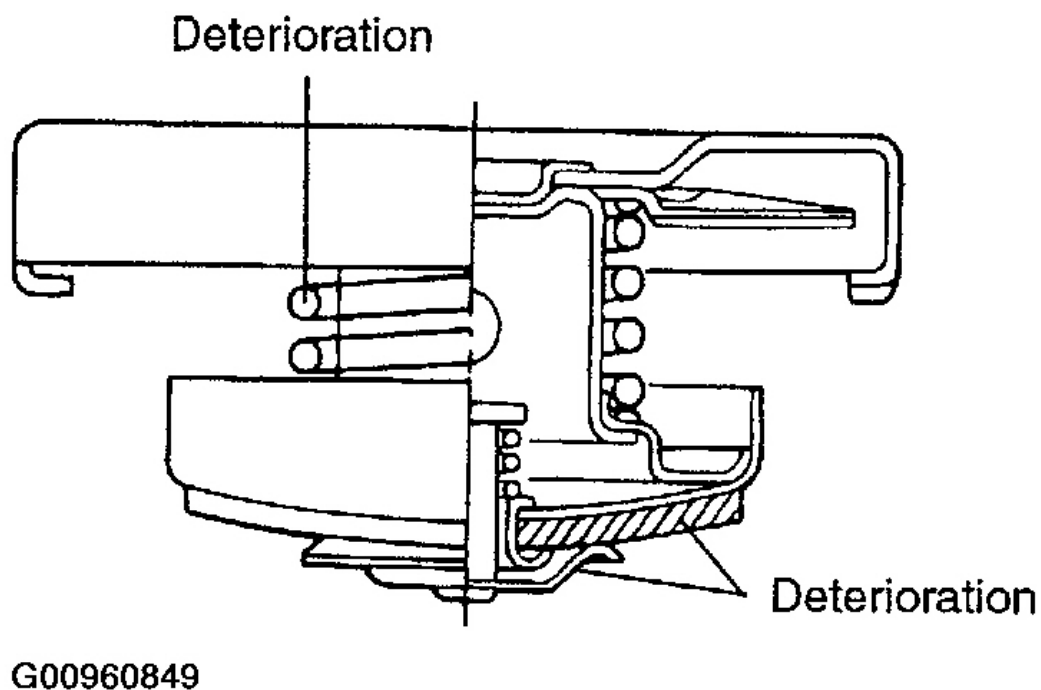
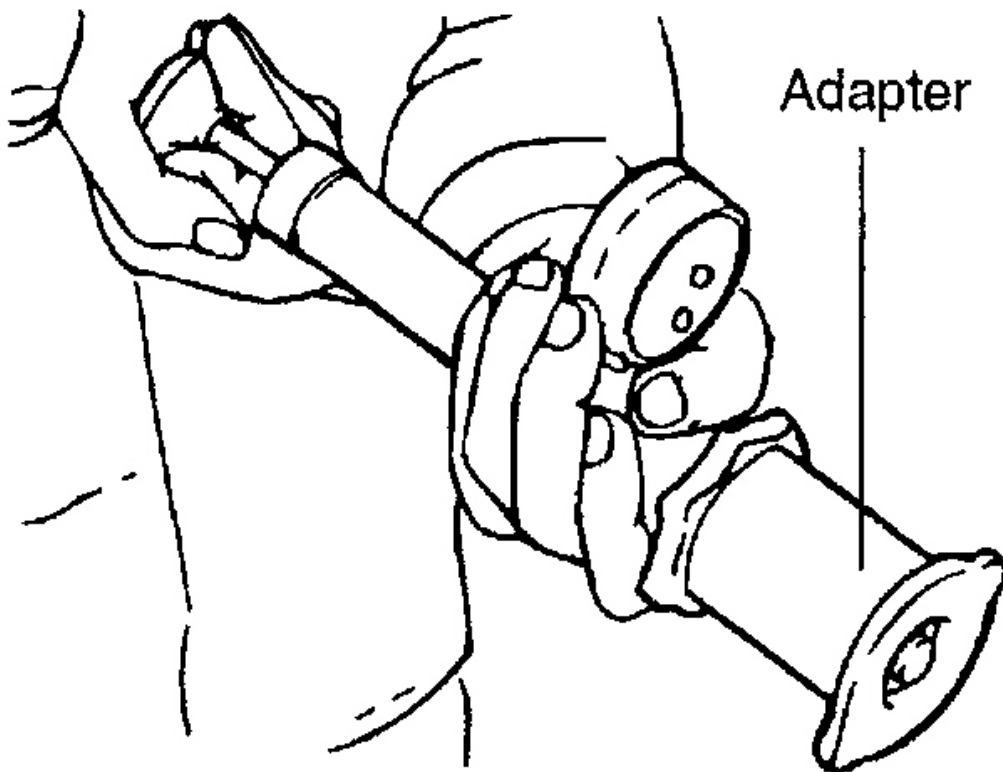


Fig. 120: Checking Radiator Cap
Courtesy of HYUNDAI MOTOR CO.

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

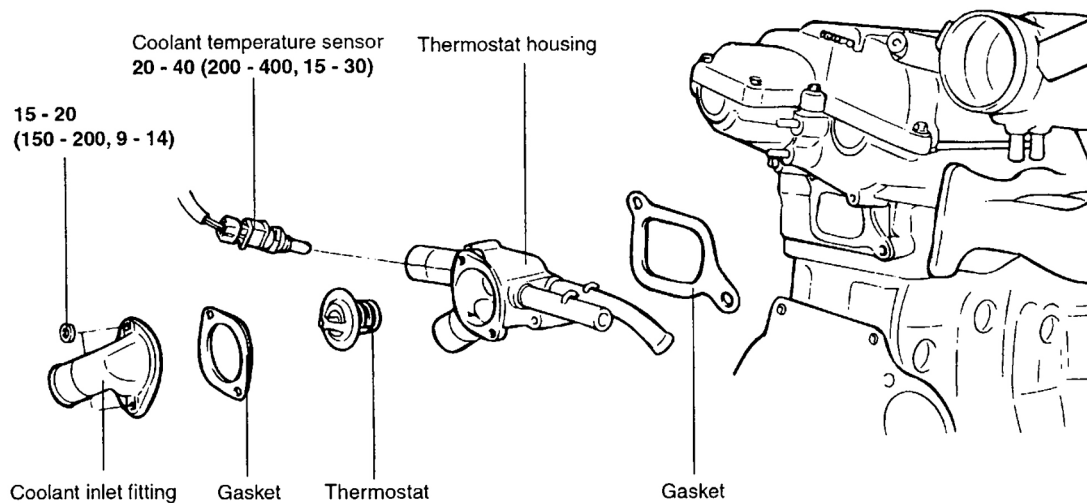


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Fig. 121: Pressure Testing Radiator Cap
Courtesy of HYUNDAI MOTOR CO.

THERMOSTAT

COMPONENTS



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

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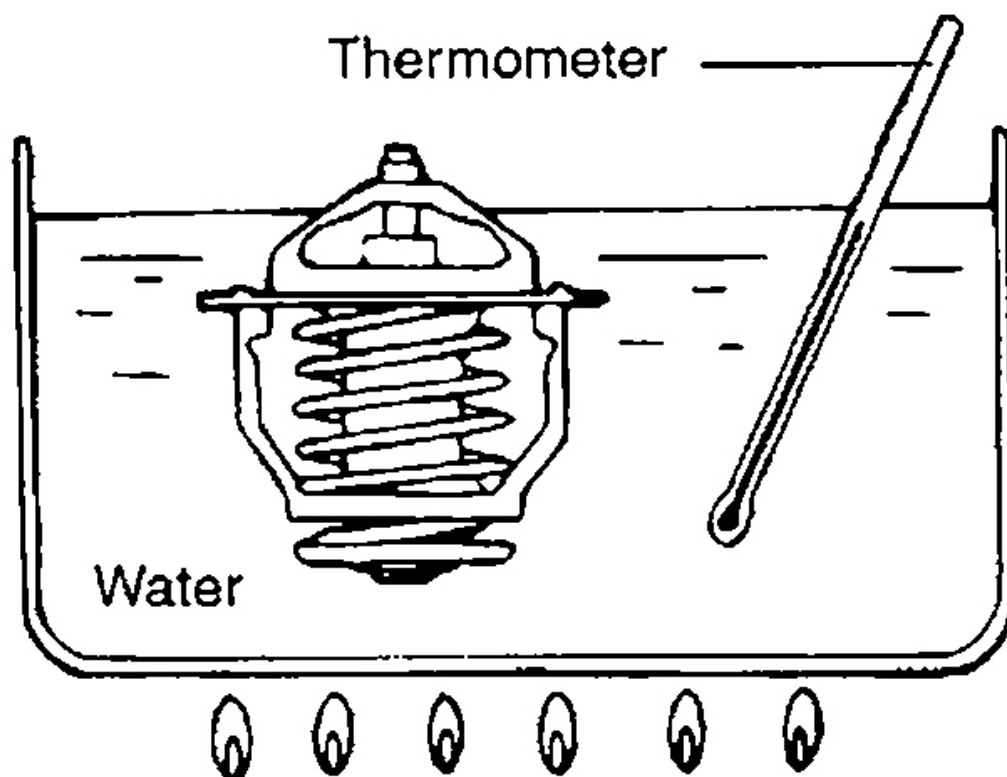
Fig. 122: Thermostat Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY & INSPECTION

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

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

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



G00960852

Fig. 123: Checking Thermostat Operation
Courtesy of HYUNDAI MOTOR CO.

COOLANT TEMPERATURE SENSOR

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

Resistance

At: 20°C (68°F) : 2.31-2.59 kΩ

REASSEMBLY

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

Tightening torque

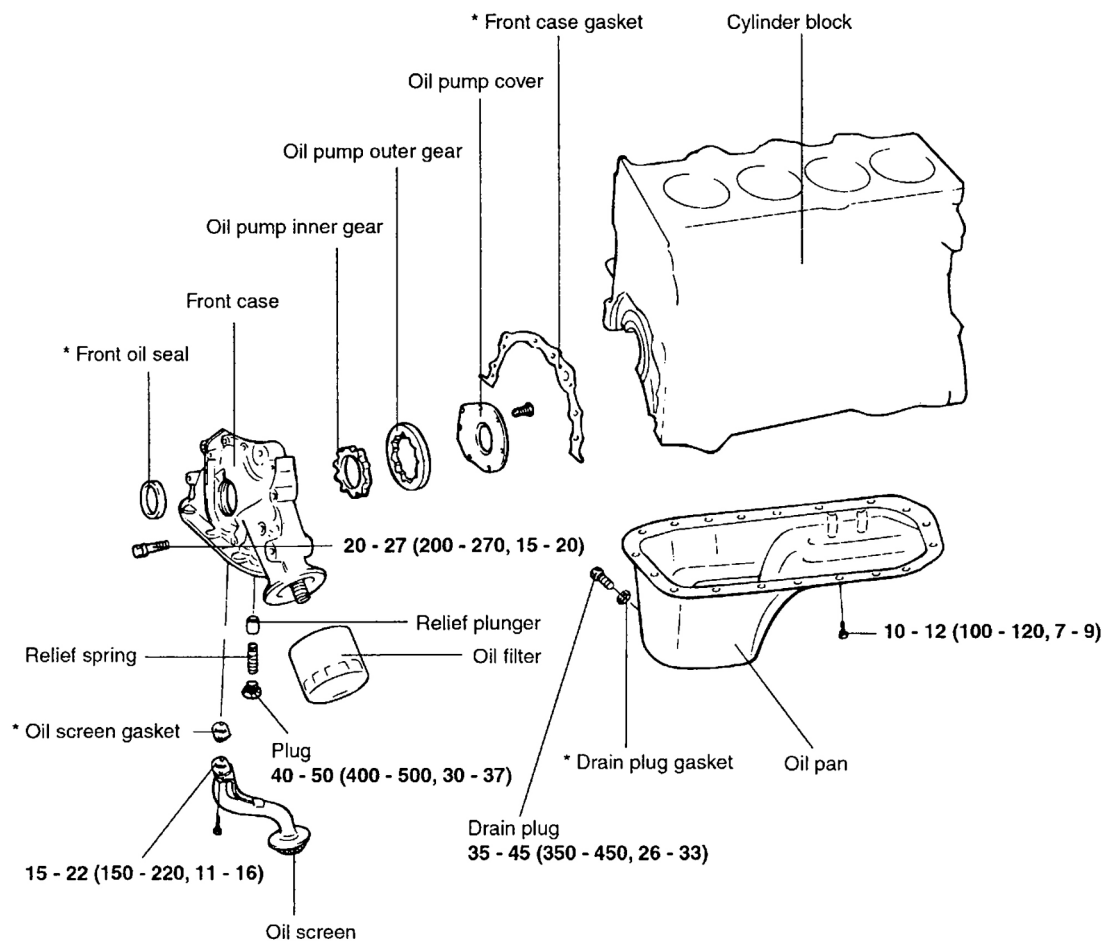
Coolant temperature sensor:

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

LUBRICATION SYSTEM

OIL PUMP

OIL PUMP, FRONT CASE



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

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

G00960853

Fig. 124: Lubrication System Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

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

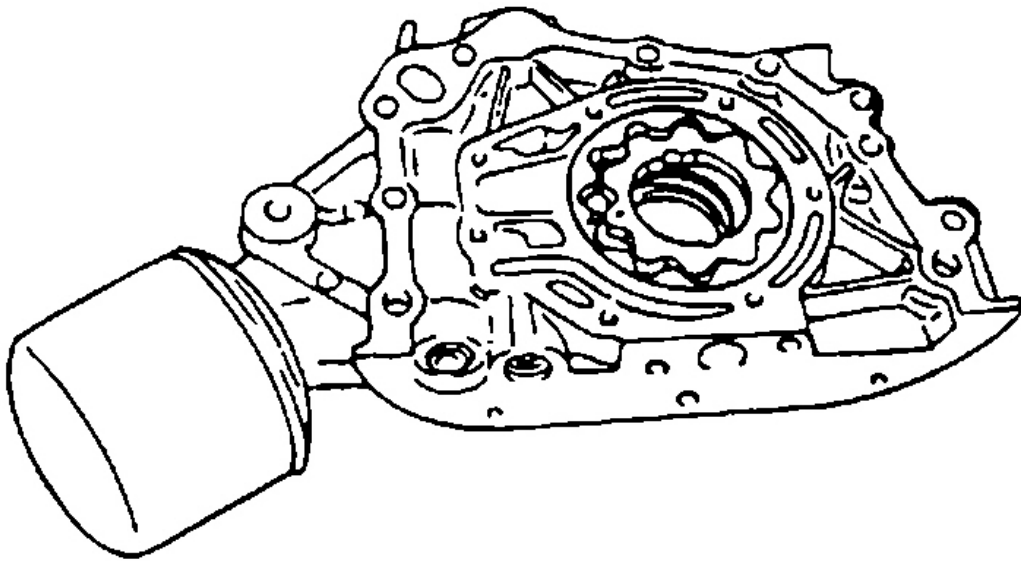
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Fig. 125: Identifying Front Case Assembly
Courtesy of HYUNDAI MOTOR CO.

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

INSPECTION**FRONT CASE**

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

OIL PAN & 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 & OIL PUMP COVER

Check the surfaces contacting gears for damage or worn.

OIL PUMP GEARS

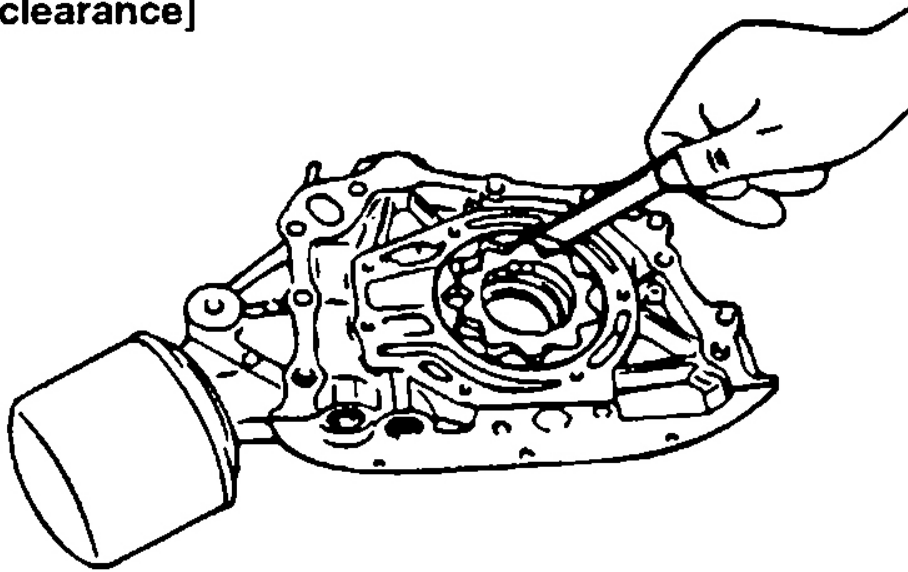
1. Check the gear tooth surfaces for wear or damage.
2. Measure the clearance between the outer gear and the front case.

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

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Fig. 126: Outer Gear Clearance Specification Table
 Courtesy of HYUNDAI MOTOR CO.

[Body clearance]

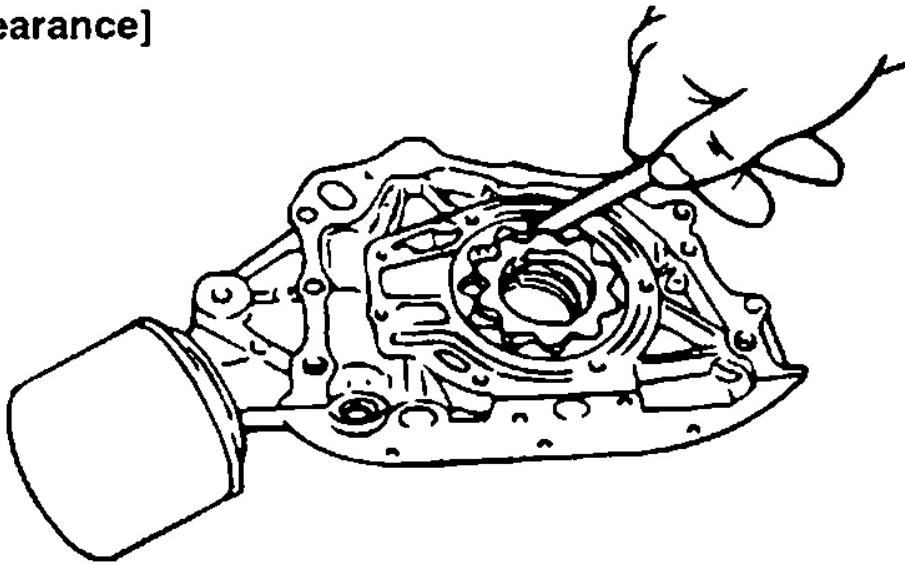


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Fig. 127: Checking Body Clearance
Courtesy of HYUNDAI MOTOR CO.

3. Check the tip clearance on the pump rotor.

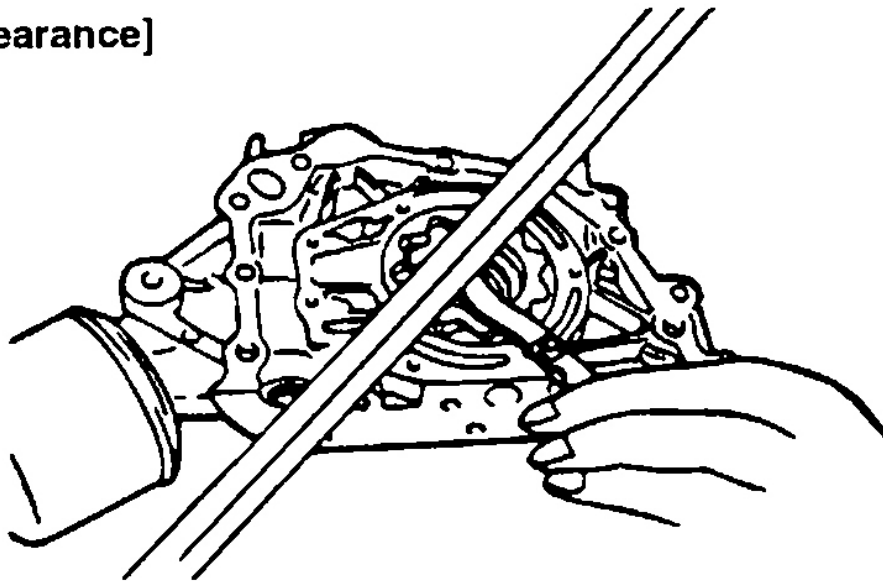
[Tip clearance]



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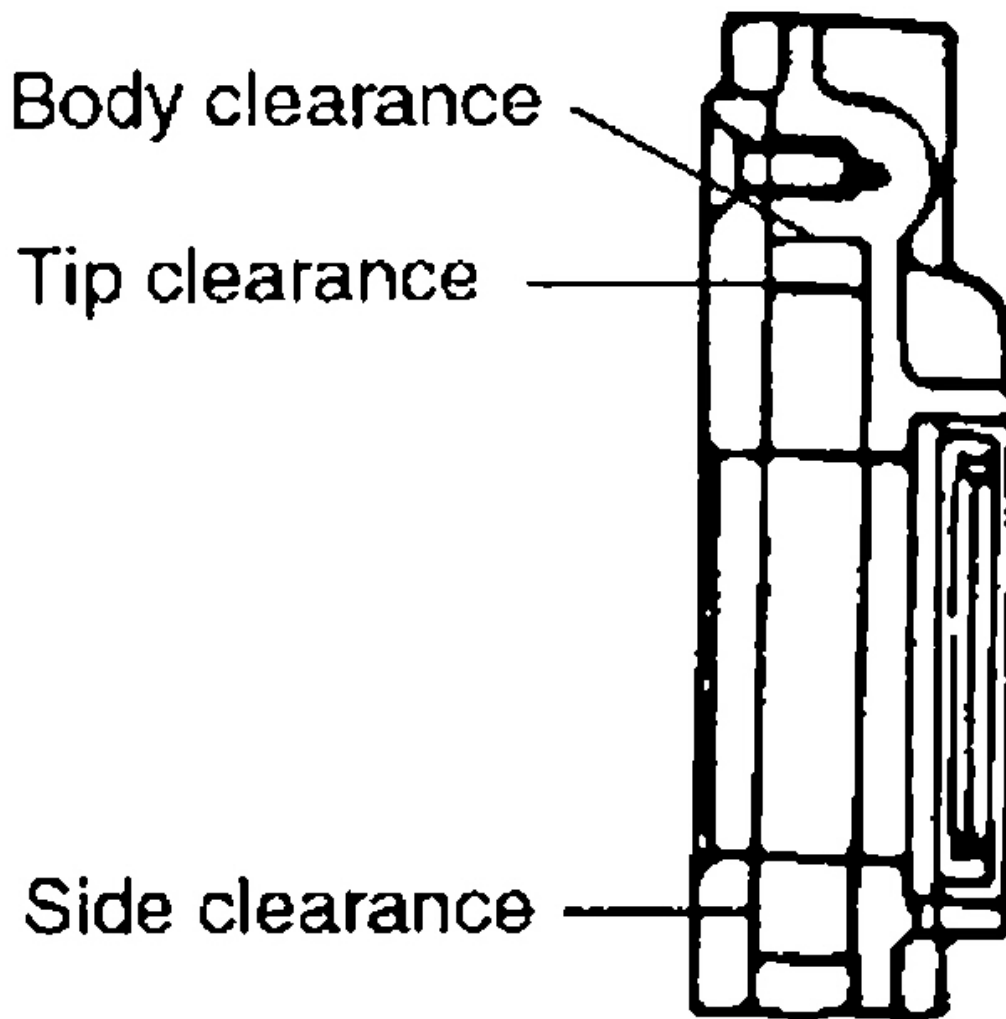
Fig. 128: Checking Tip Clearance
Courtesy of HYUNDAI MOTOR CO.

[Side clearance]



G00960858

Fig. 129: Checking Side Clearance
Courtesy of HYUNDAI MOTOR CO.



G00960859

Fig. 130: Identifying Body, Tip & Side Clearances Of Outer Gear
Courtesy of HYUNDAI MOTOR CO.

RELIEF VALVE & SPRING

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

Standard value

Free height: 43.8 mm (1.724 in.)

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

OIL PRESSURE SWITCH

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

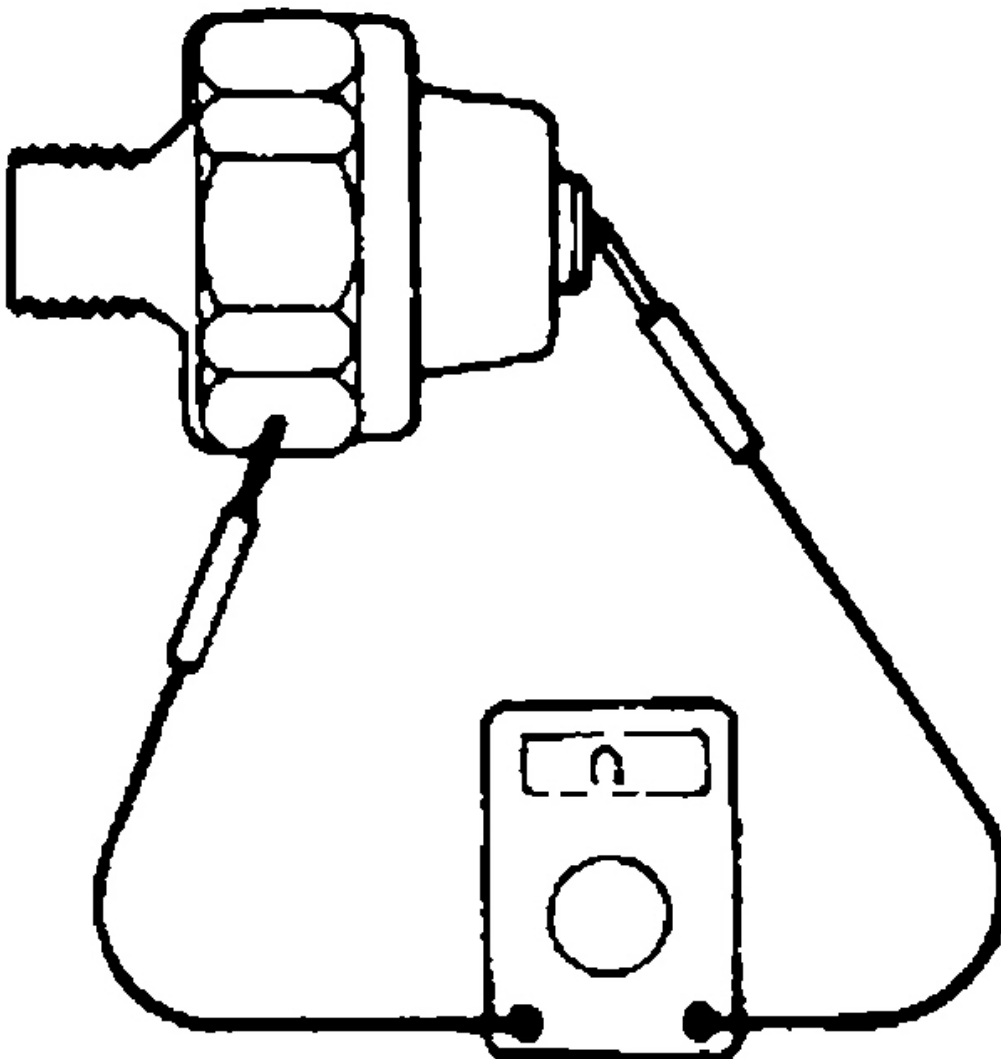
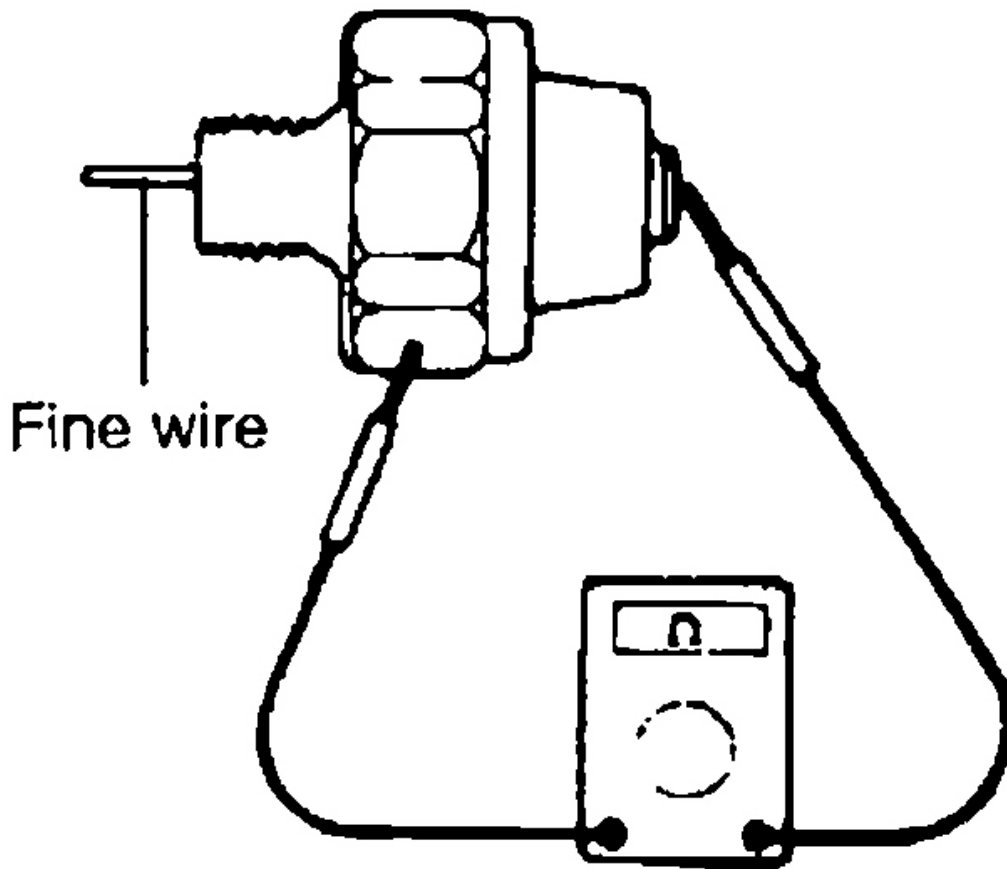
**G00960860**

Fig. 131: Checking Oil Pressure Switch Continuity

Courtesy of HYUNDAI MOTOR CO.

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



G00960861

Fig. 132: Checking Oil Pressure Switch Continuity With Wire Installed

Courtesy of HYUNDAI MOTOR CO.

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

REASSEMBLY

OIL PUMP

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

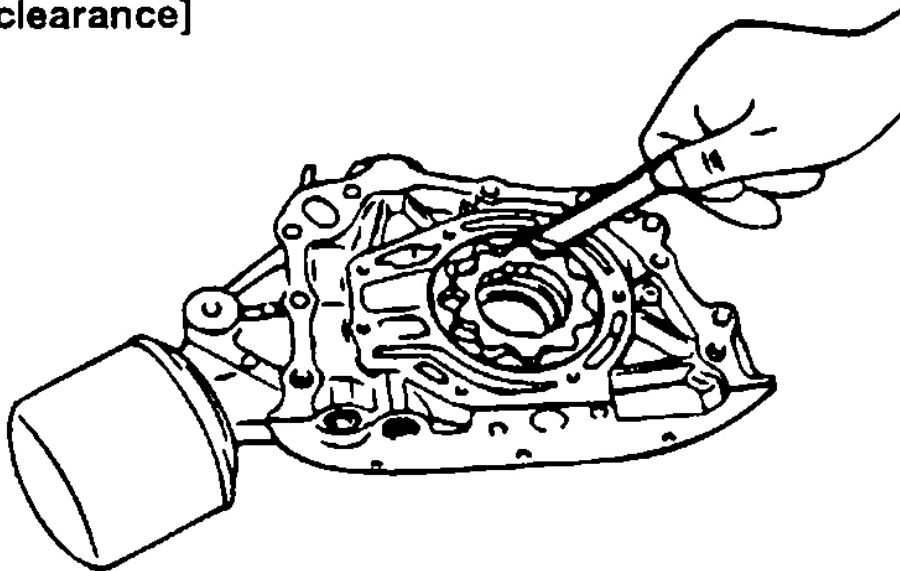
Tightening torque

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

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

Tightening torque

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

[Body clearance]

G00960862

Fig. 133: Identifying Front Case Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

FRONT CASE

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

Length

A : 25 mm (0.98 in.)

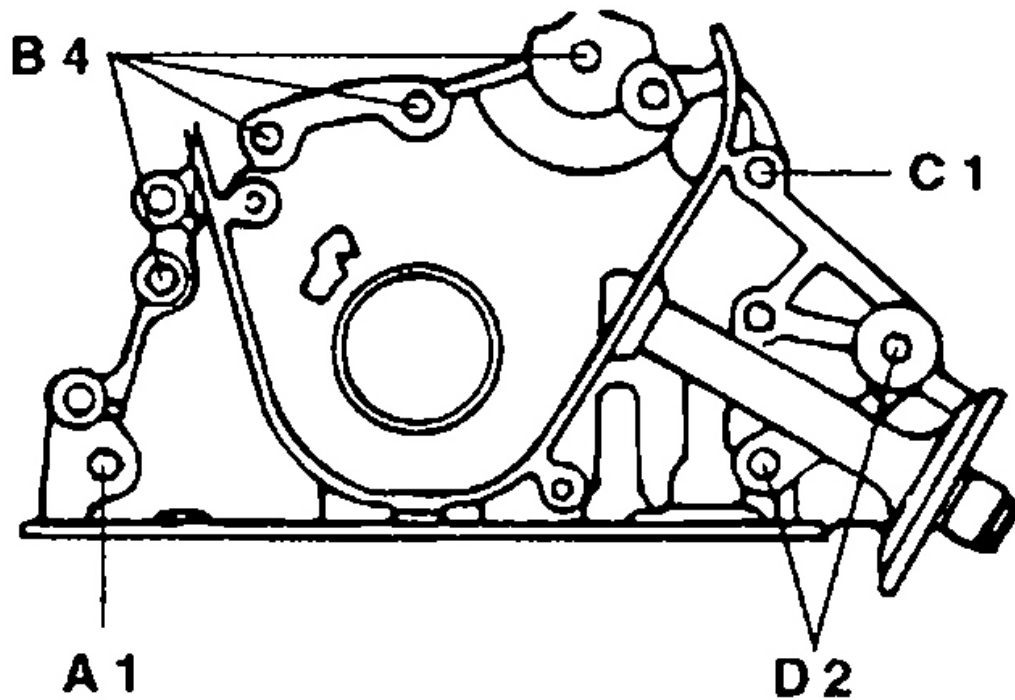
B : 20 mm (0.79 in.)

C : 45 mm (1.77 in.)

D : 38 mm (1.50 in.)

Tightening torque:

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



G00960863

Fig. 134: Identifying Front Case Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

OIL SEAL

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

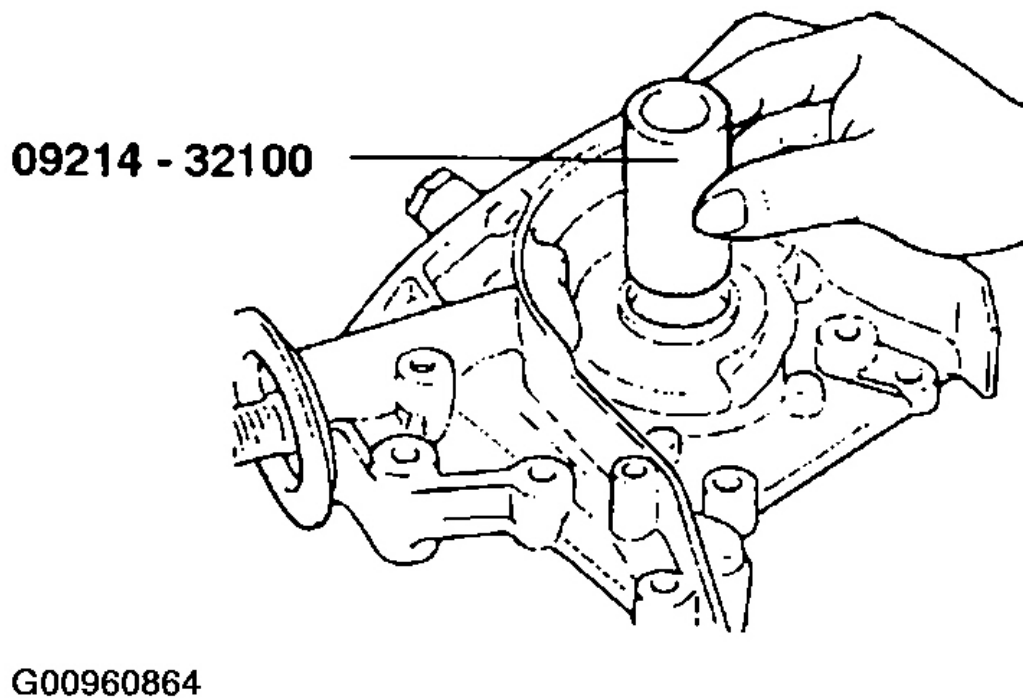


Fig. 135: Installing Oil Seal
Courtesy of HYUNDAI MOTOR CO.

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

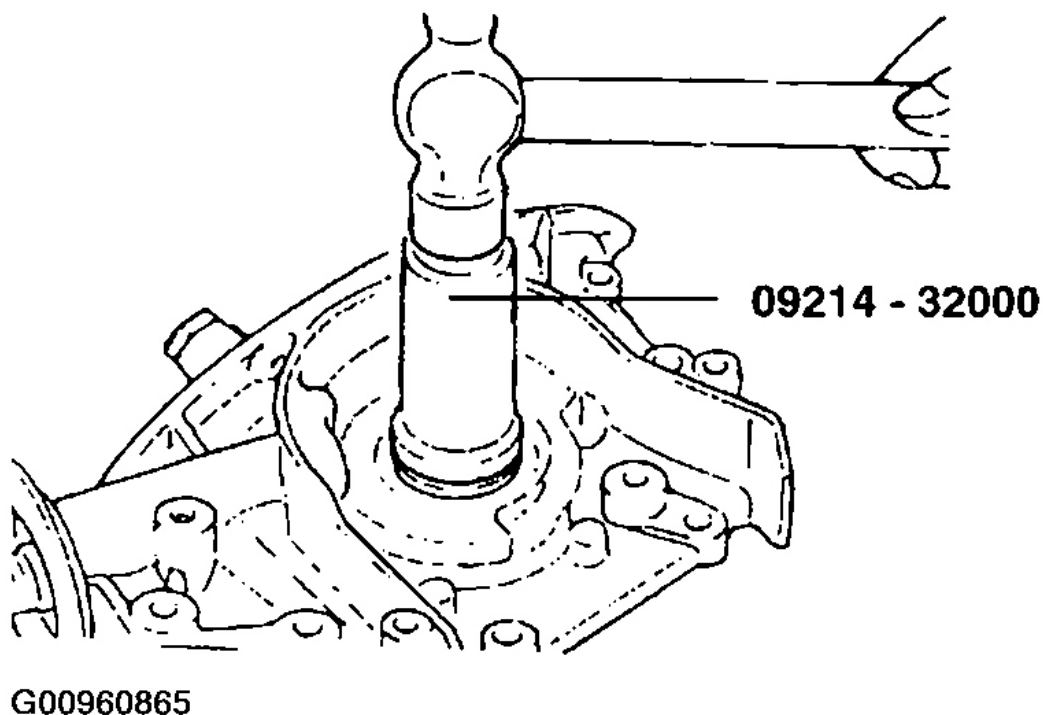


Fig. 136: Installing Crankshaft Oil Seal
Courtesy of HYUNDAI MOTOR CO.

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

CAUTION:

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

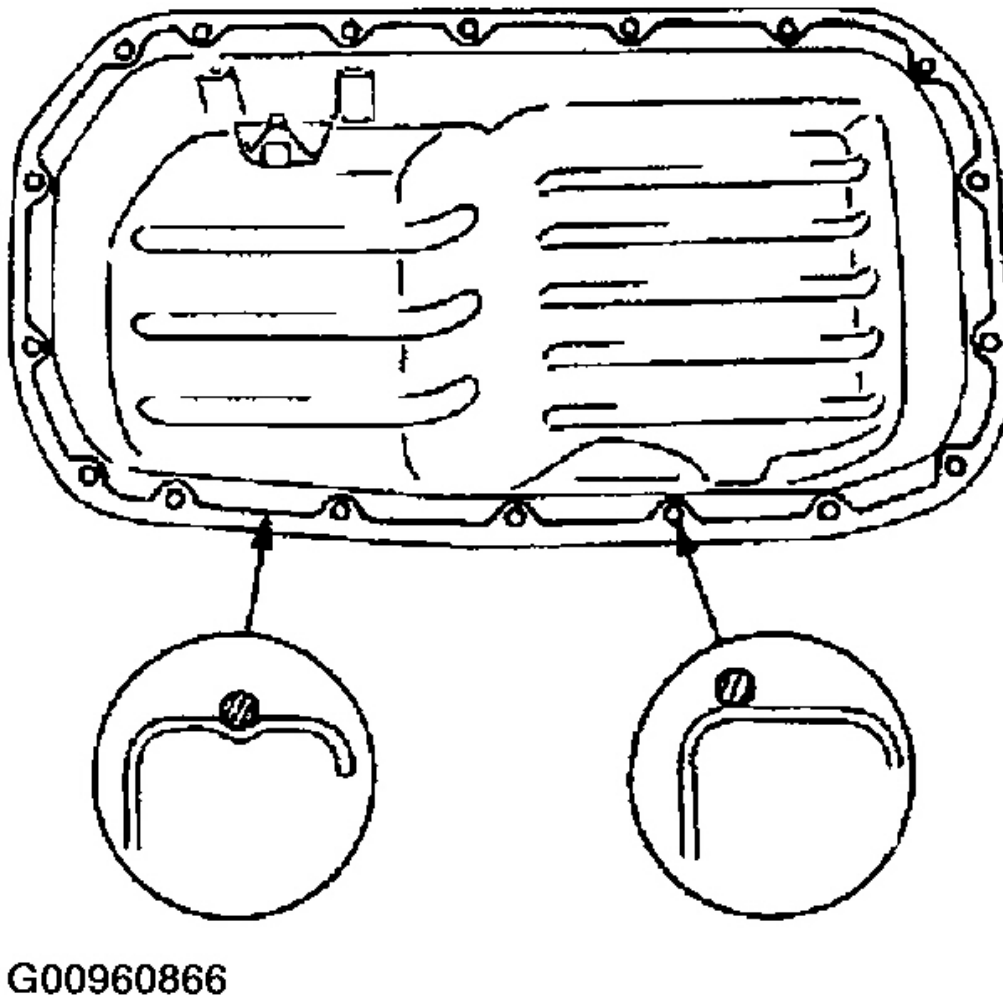


Fig. 137: Identifying Oil Pan Sealant Application
Courtesy of HYUNDAI MOTOR CO.

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

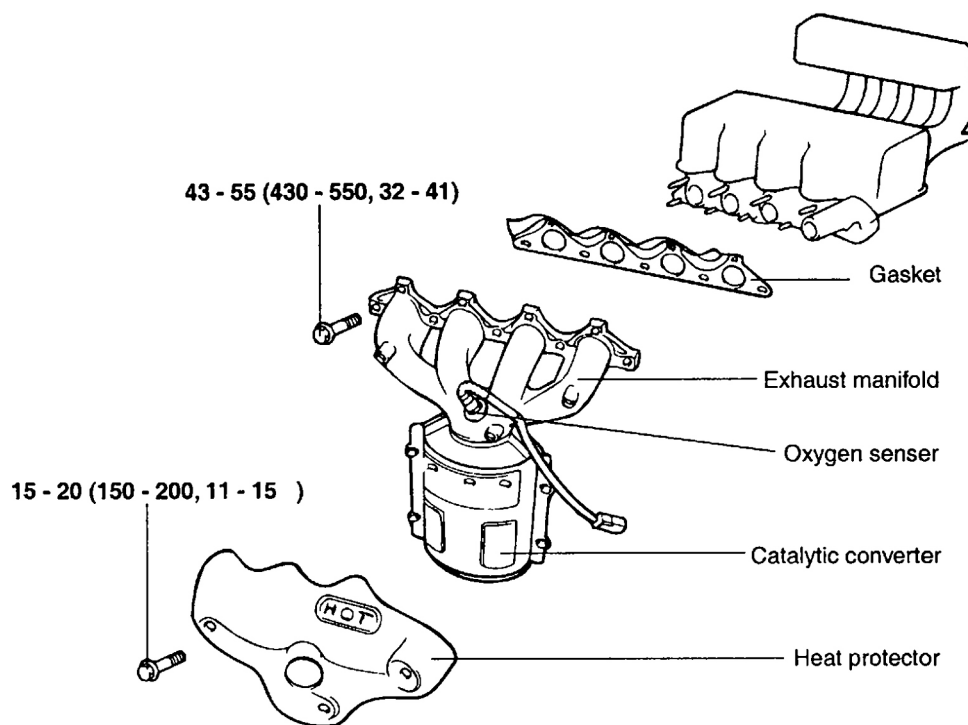
Tightening torque

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

INTAKE & EXHAUST SYSTEM

EXHAUST MANIFOLD

COMPONENTS



* Replace the lock nuts with new ones after removal.

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

G00960867

Fig. 138: Exhaust Manifold Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

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

INSPECTION

EXHAUST MANIFOLD

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

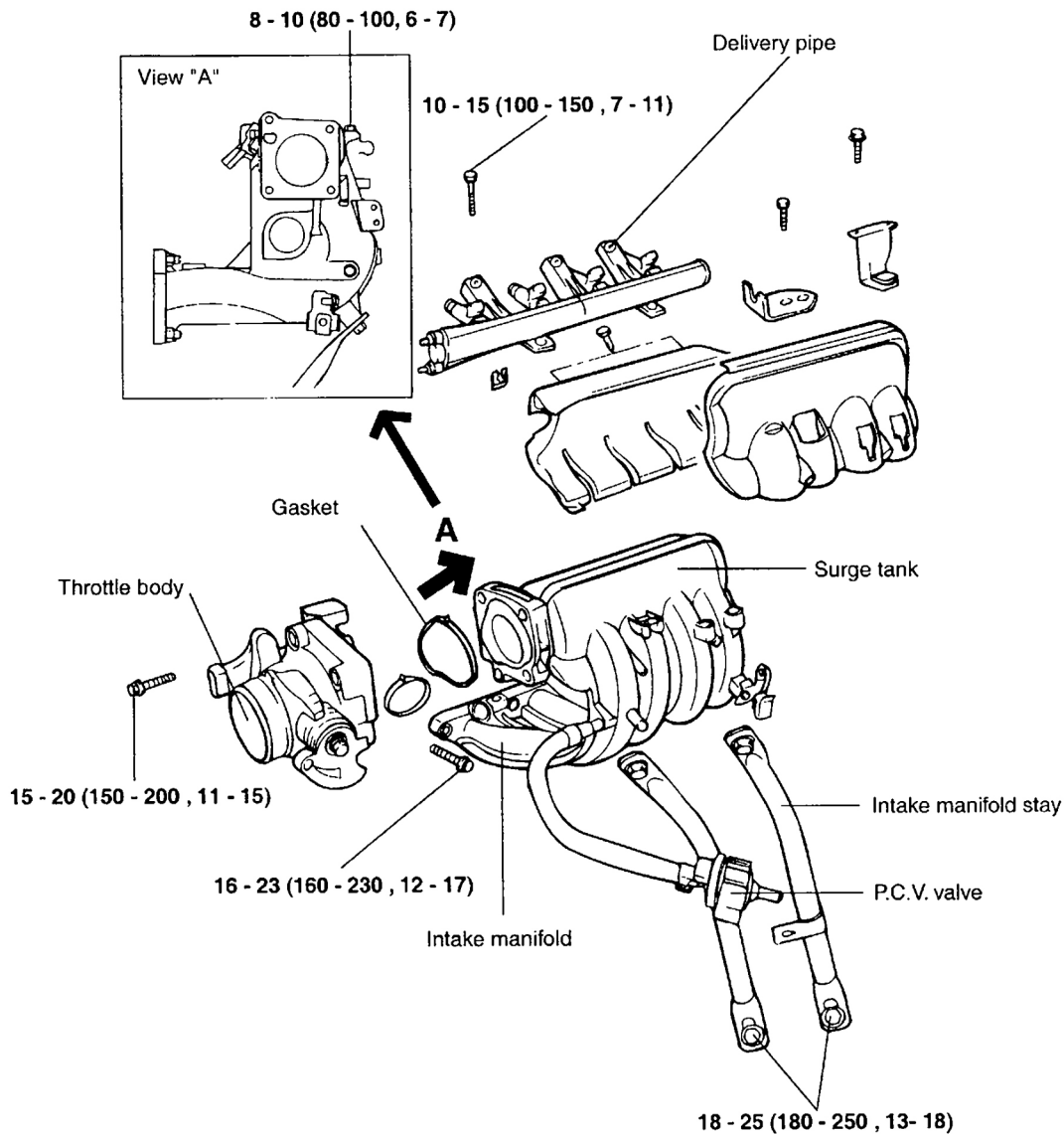
REASSEMBLY

Install the exhaust manifold in the reverse order of removal.

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

INTAKE MANIFOLD

COMPONENTS



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

G00960868

Fig. 139: Intake Manifold Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

1. Remove the engine cover.
2. Remove the intake air hose connected to the throttle body.
3. Remove the accelerator cable.
4. Remove the P.C.V. hose and brake booster vacuum hoses.
5. Disconnect the vacuum hose connections, ISA and TPS connector.

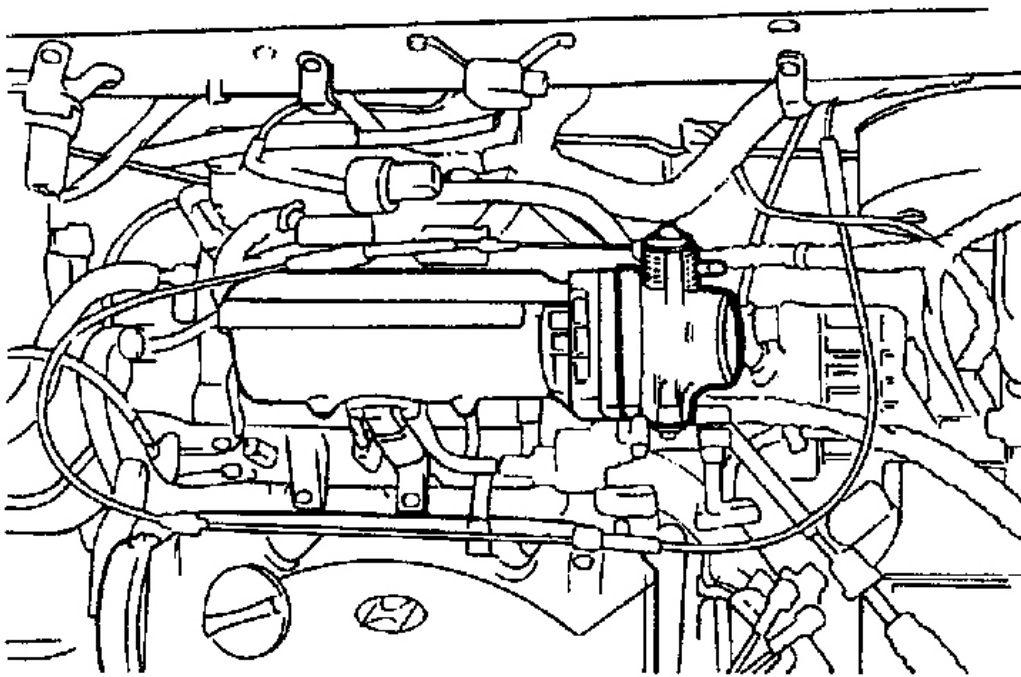
**G00960870**

Fig. 140: Identifying Throttle Body Assembly
Courtesy of HYUNDAI MOTOR CO.

6. Disconnect the high pressure fuel hose connection after relieving pressure in the fuel rail to prevent fuel from spilling.
7. Remove the intake manifold.
8. Remove the intake manifold assembly and gasket.
9. Disconnect the fuel injector harness connector.
10. Remove the delivery pipe with the fuel injectors.

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

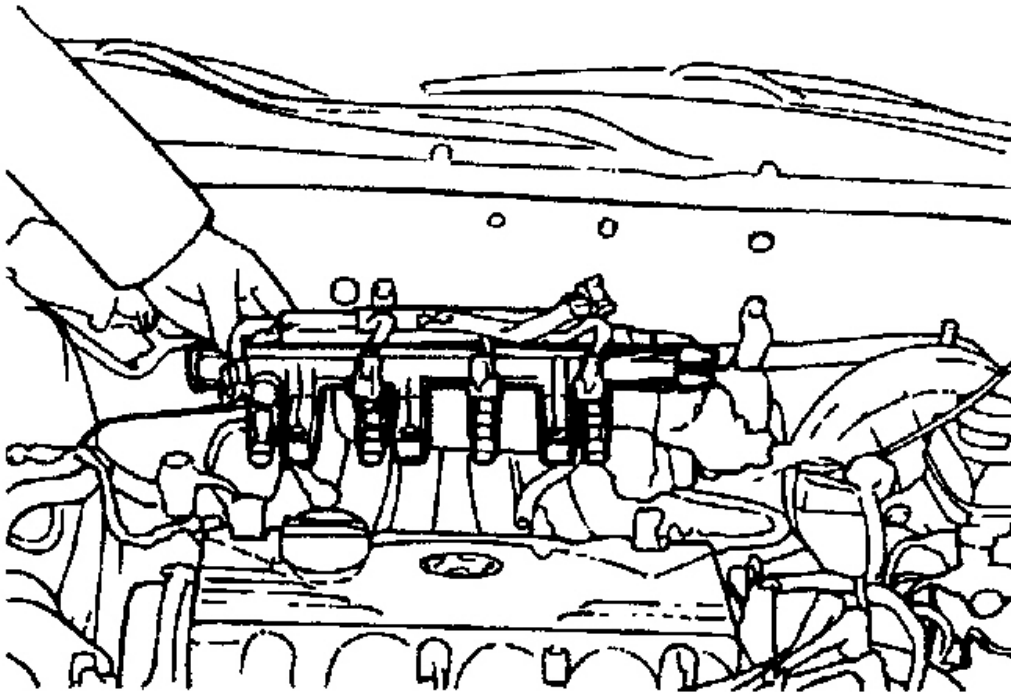


Fig. 141: Identifying Fuel Delivery Pipe Assembly
Courtesy of HYUNDAI MOTOR CO.

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

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

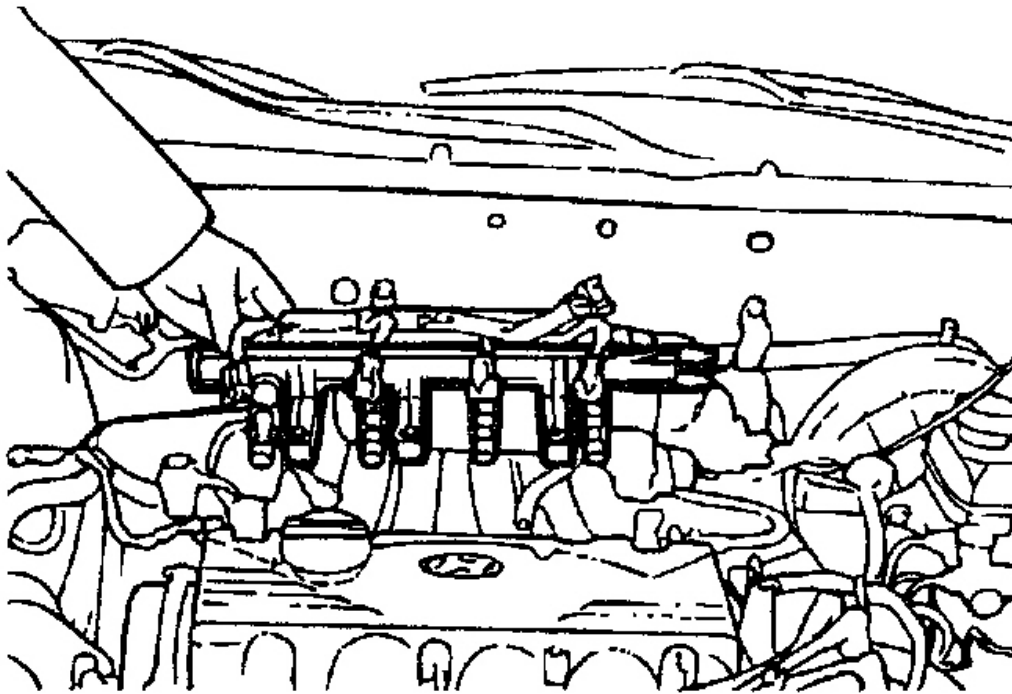
**G00960872**

Fig. 142: Identifying Fuel Delivery Pipe Assembly
Courtesy of HYUNDAI MOTOR CO.

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

INSPECTION

INTAKE MANIFOLD

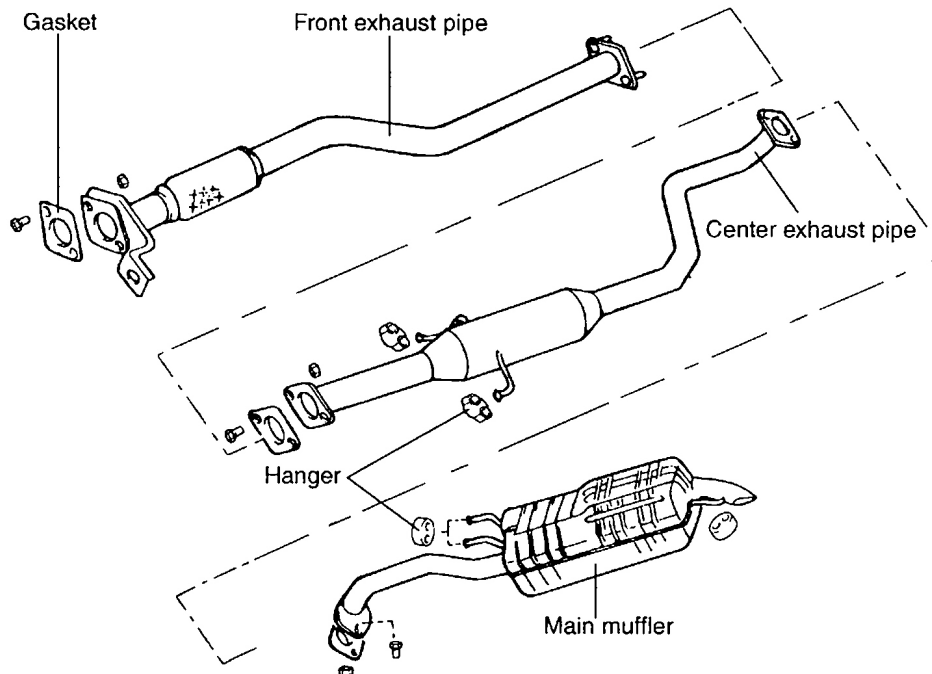
Check the parts for damage or cracking.

AIR HOSE

Check for damage or cracking of any part.

MUFFLER

COMPONENTS



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

G00960873

Fig. 143: Muffler Components

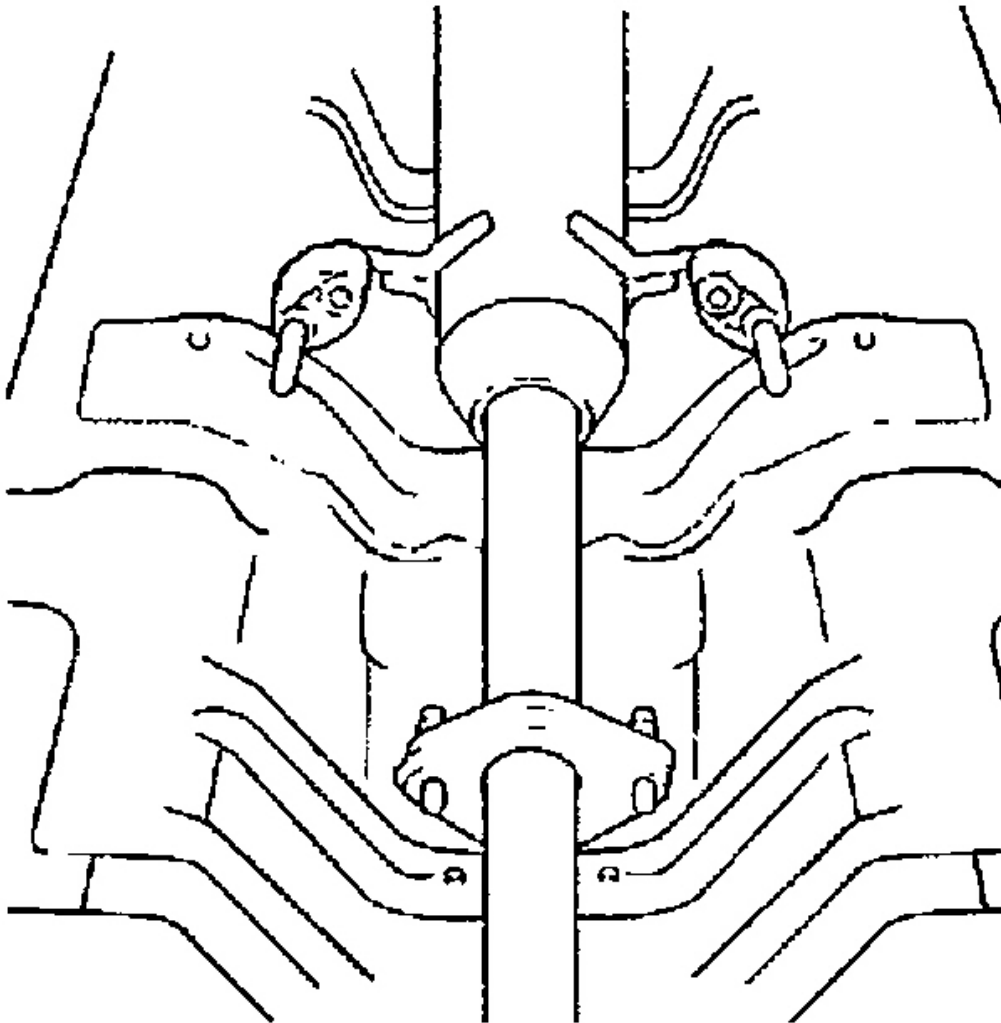
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

MAIN MUFFLER

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

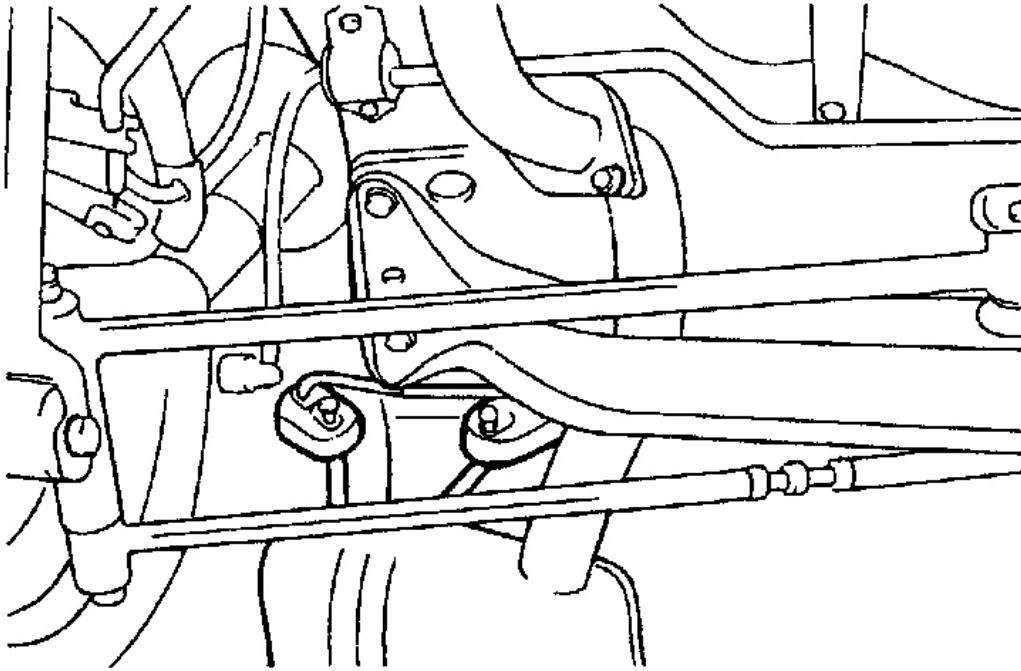
1. Disconnect the main muffler from the center muffler.



G00960874

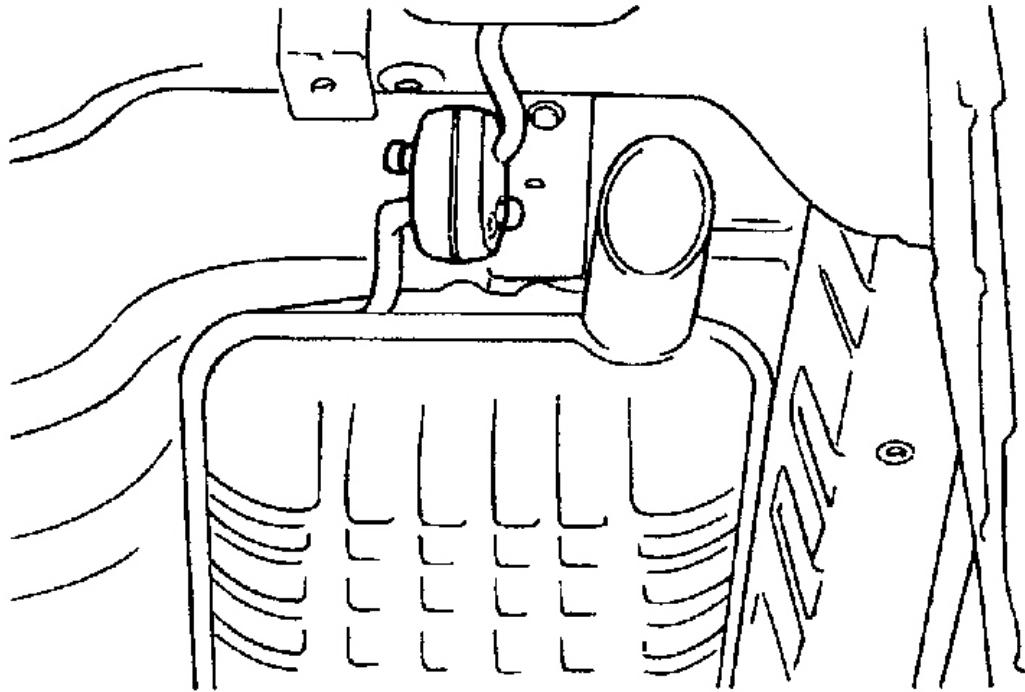
Fig. 144: Identifying Main Muffler-To-Center Muffler
Courtesy of HYUNDAI MOTOR CO.

2. Remove the rubber hangers and remove the main muffler.



G00960875

Fig. 145: Identifying Main Muffler Rubber Hangers
Courtesy of HYUNDAI MOTOR CO.



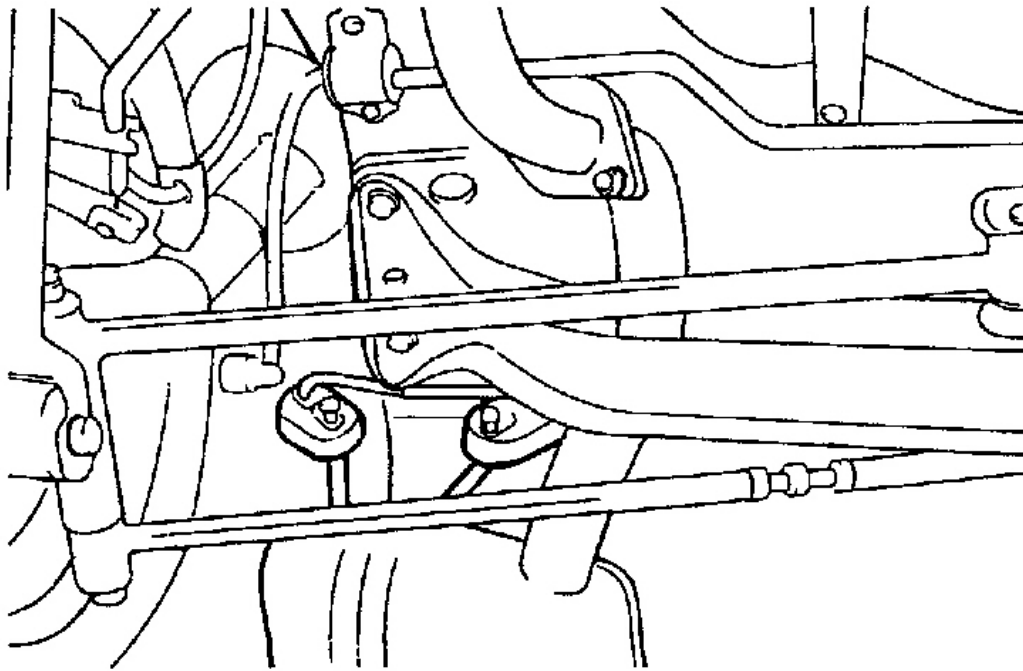
G00960876

Fig. 146: Identifying Main Muffler Rubber Hangers

Courtesy of HYUNDAI MOTOR CO.

CENTER MUFFLER

1. Remove the center muffler assembly from the main muffler and front exhaust pipe.



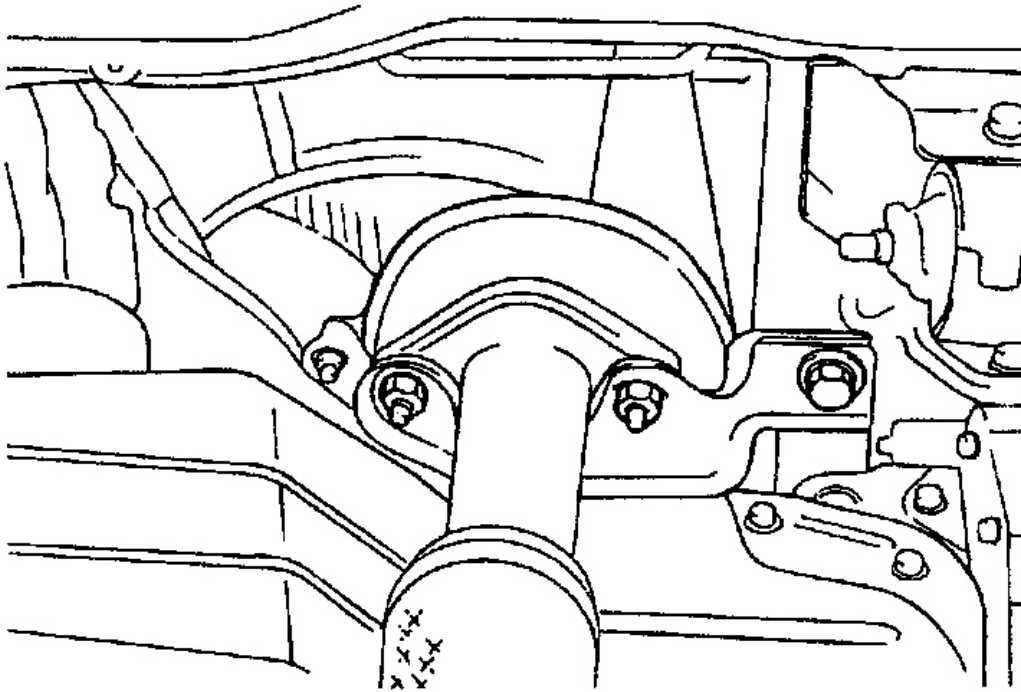
G00960877

Fig. 147: Identifying Center Muffler-To-Main Muffler & Front Exhaust Pipe
Courtesy of HYUNDAI MOTOR CO.

2. Remove the rubber hanger, then remove the center muffler.

FRONT EXHAUST PIPE

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



G00960878

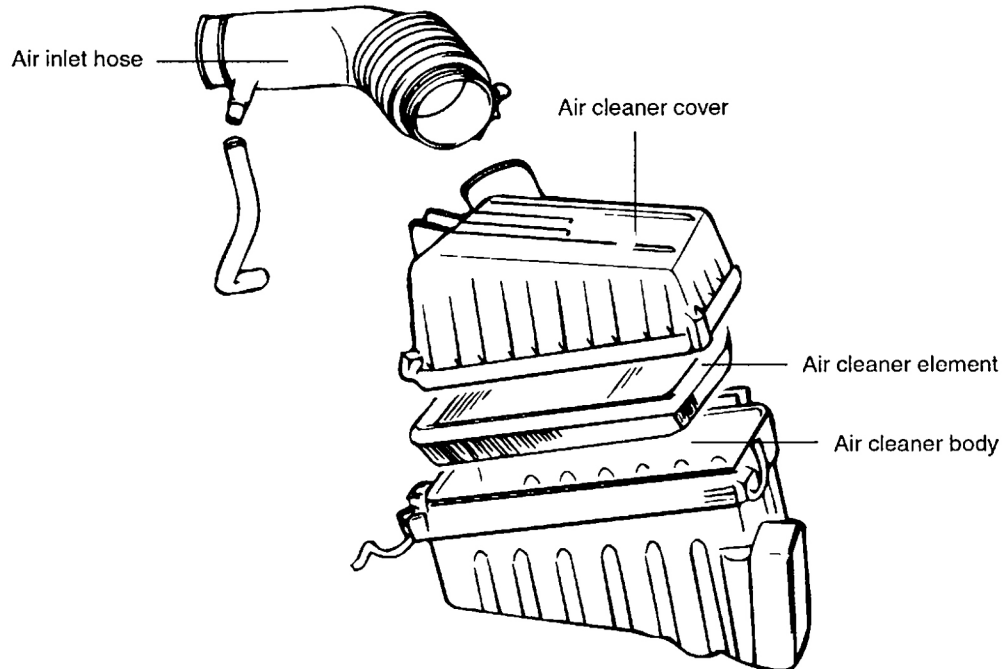
Fig. 148: View Of Front Exhaust Pipe & Center Muffler Bolt
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

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

AIR CLEANER (ACL)

COMPONENTS



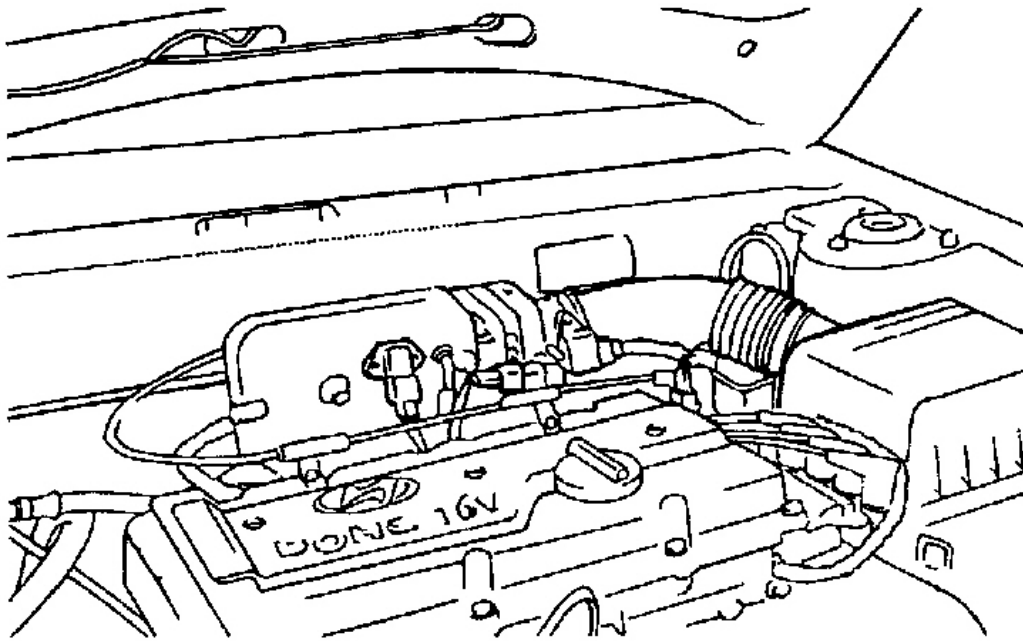
TORQUE : Nm (kg.cm, lb.ft)

G00960879

Fig. 149: Air Cleaner Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

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

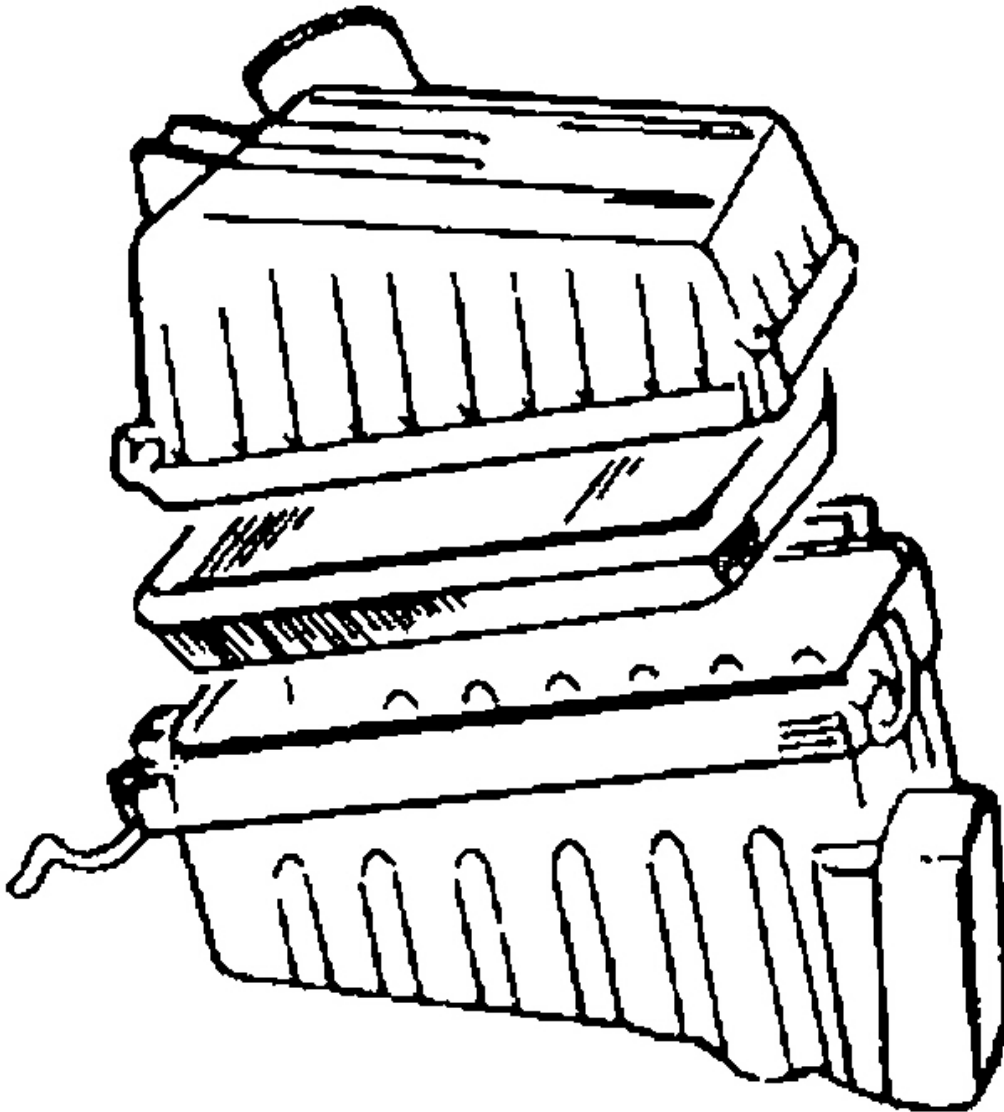


G00960880

Fig. 150: View Of Air Cleaner
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

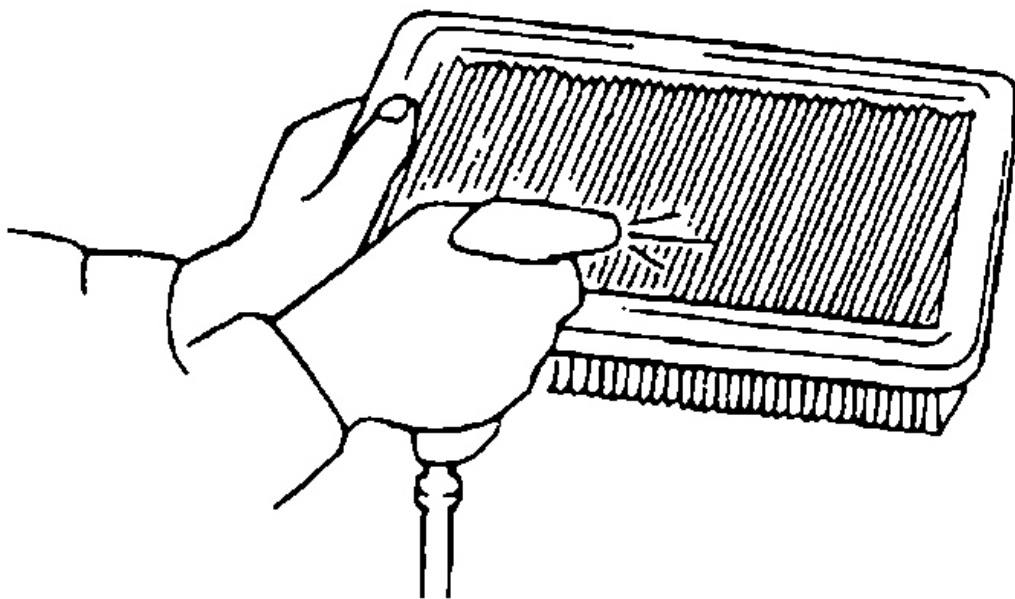
1. Check the air cleaner body, cover, or filter for distortion, corrosion or damage.
2. Check the air duct for damage.
3. Check the resonator for distortion or damage.



G00960881

Fig. 151: Checking Resonator
Courtesy of HYUNDAI MOTOR CO.

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



G00960882

Fig. 152: Cleaning Air Filter

Courtesy of HYUNDAI MOTOR CO.

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

INSTALLATION

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

CYLINDER HEAD ASSEMBLY

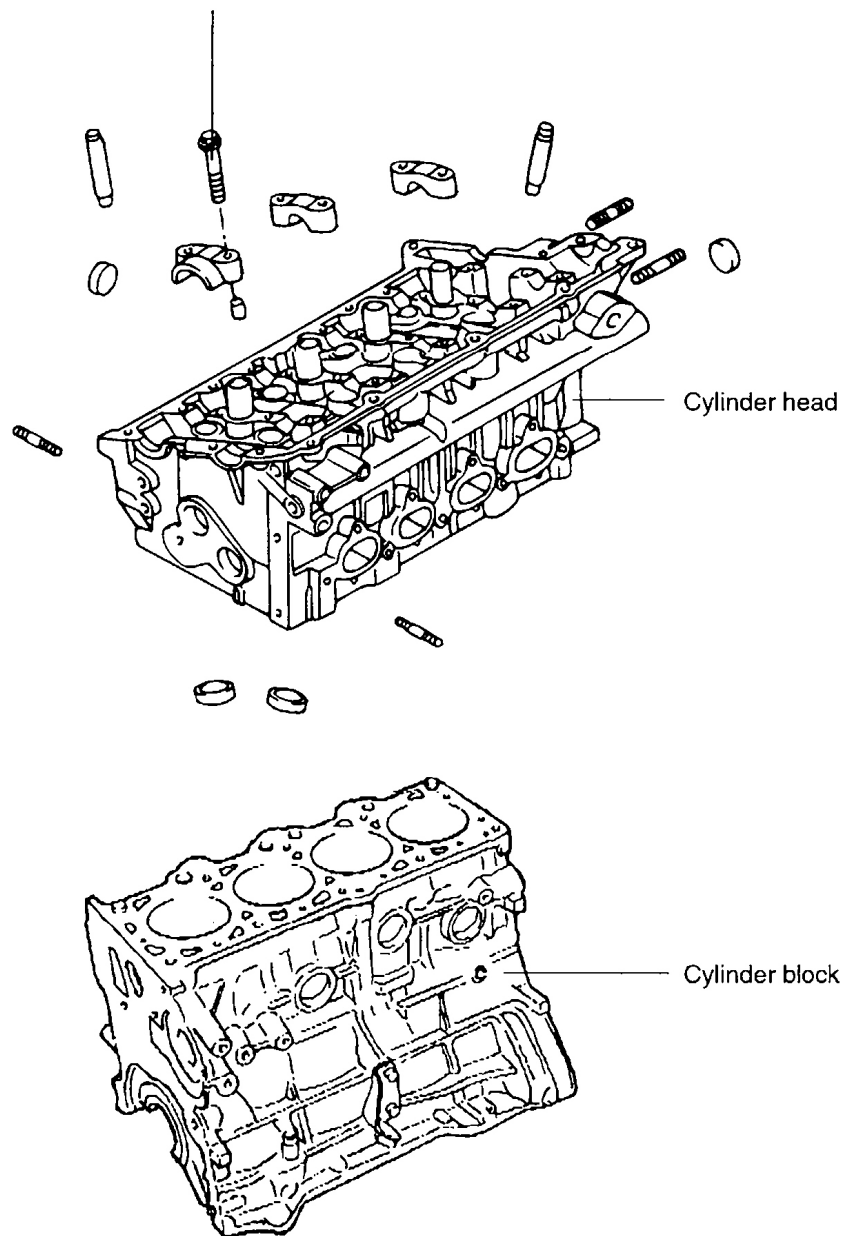
CYLINDER HEAD

COMPONENTS

Cylinder head bolt

M 10 : 25 (250, 18) + (60° - 65°) + (60° - 65°)

M 12 : 30 (300, 22) + (60° - 65°) + (60° - 65°)



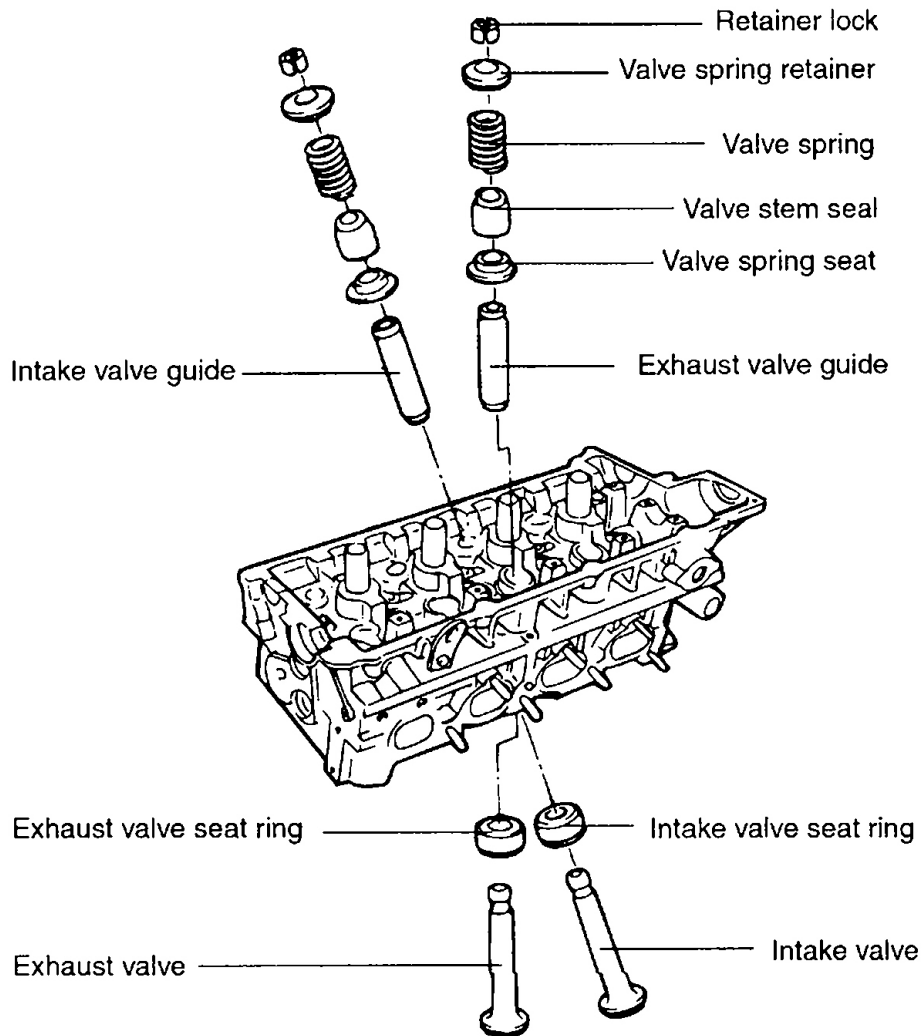
TORQUE : Nm (kg.cm, lb.ft)

G00960883

Fig. 153: Cylinder Head Components
Courtesy of HYUNDAI MOTOR CO.

VALVES

COMPONENTS



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

G00960884

Fig. 154: Valves Components

Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

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

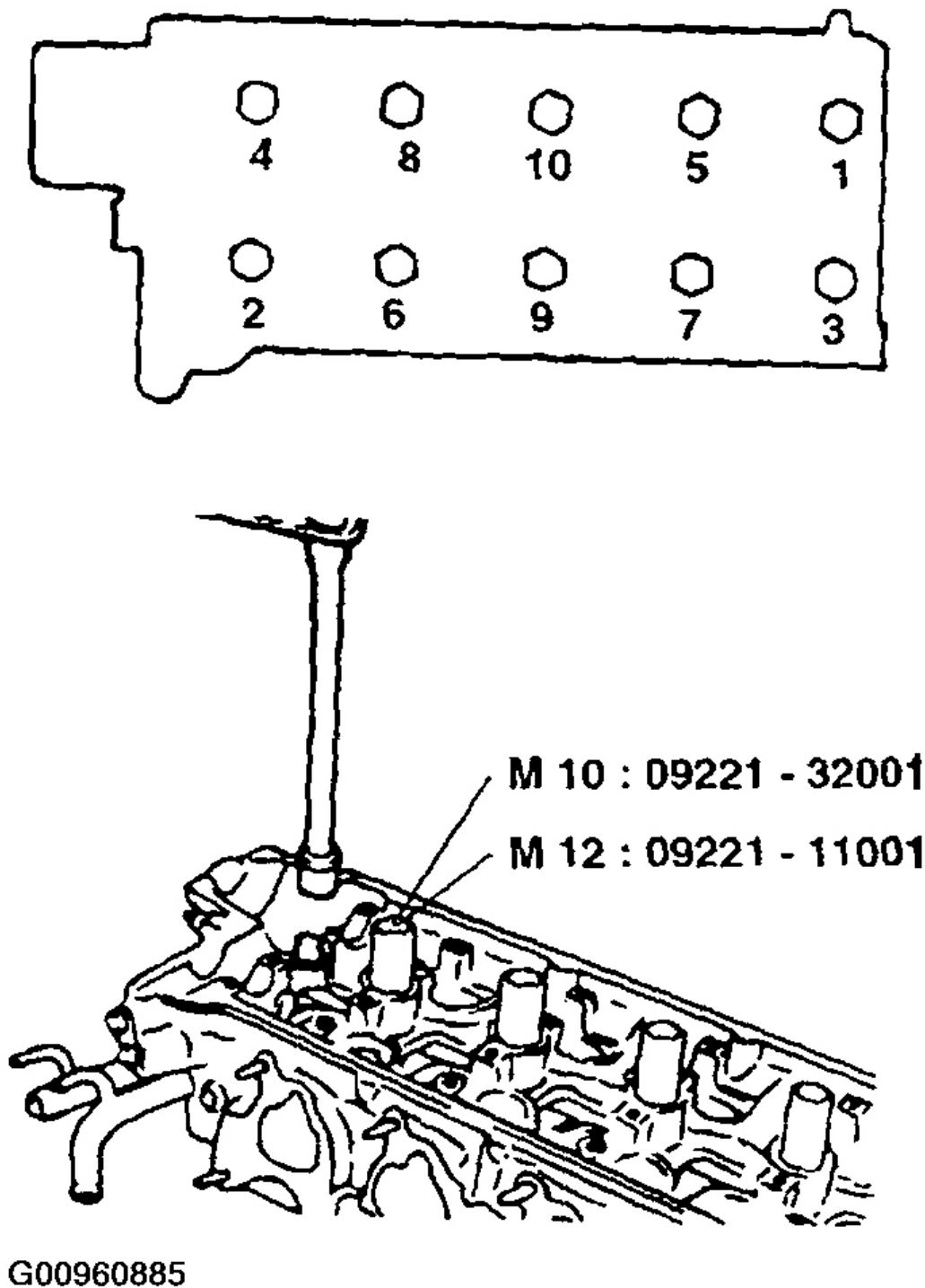
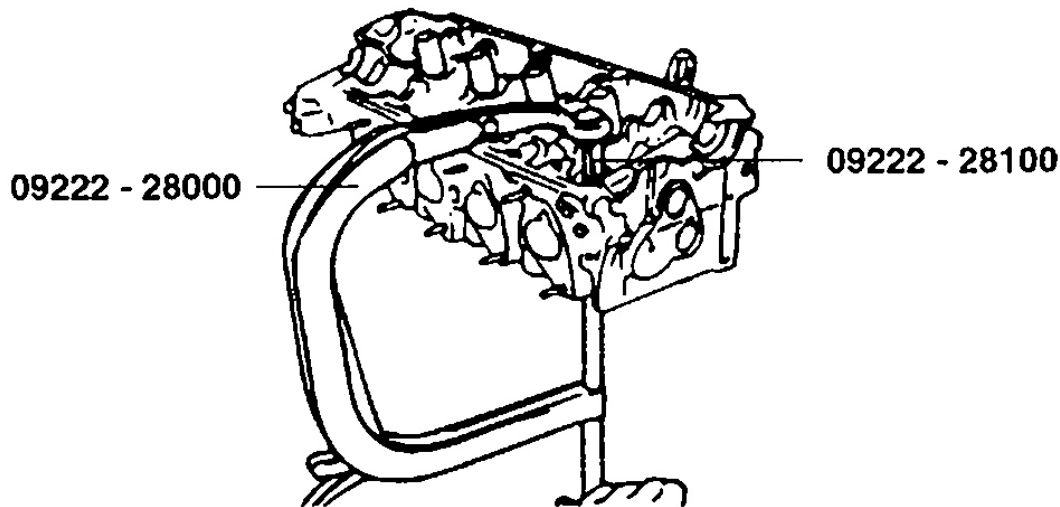


Fig. 155: Cylinder Head Removal Sequence
Courtesy of HYUNDAI MOTOR CO.

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

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



G00960886

Fig. 156: Removing Valve Spring Retainer Locks
Courtesy of HYUNDAI MOTOR CO.

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

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

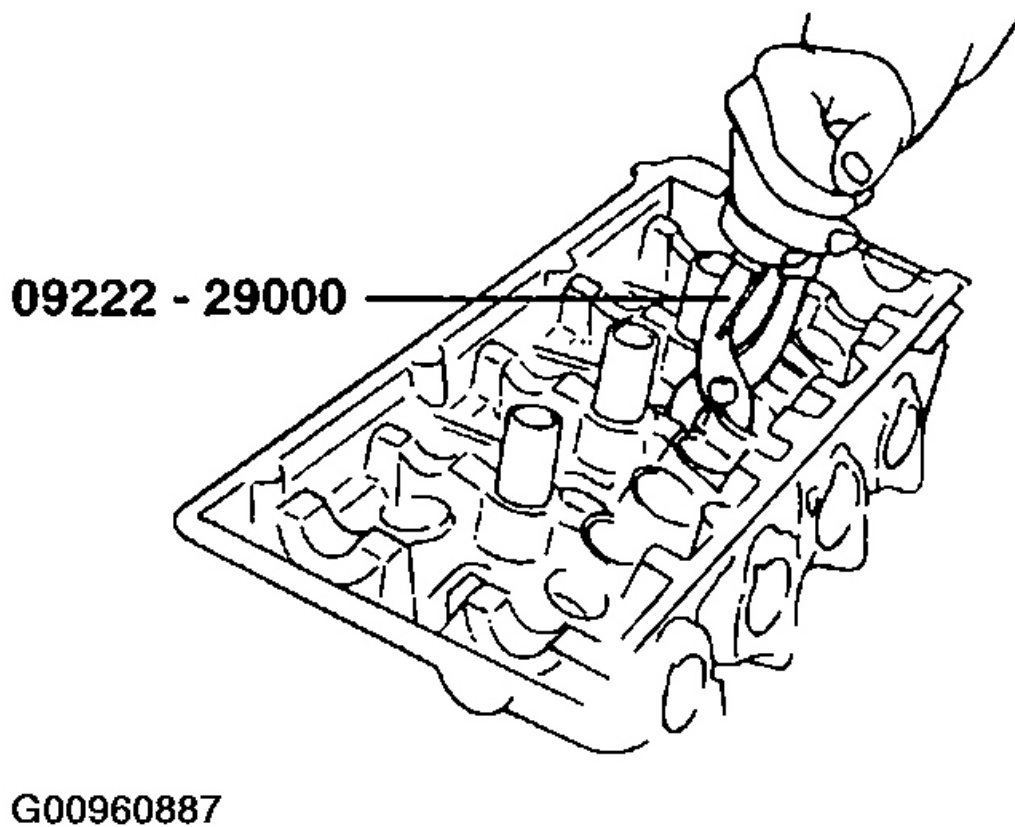
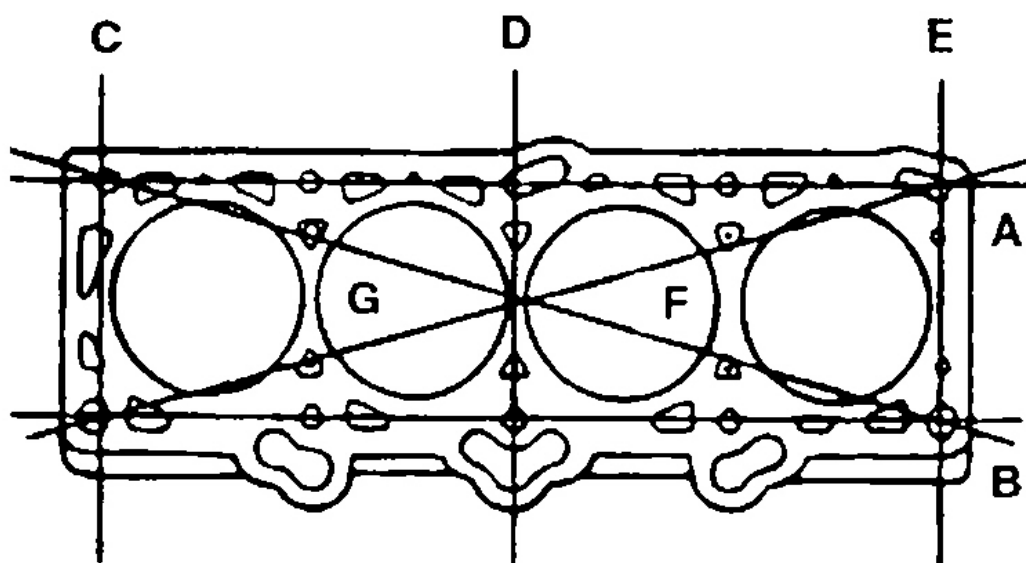


Fig. 157: Removing Valve Stem Seals
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

CYLINDER HEAD

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



G00960888

Fig. 158: Checking Cylinder Head Surface
Courtesy of HYUNDAI MOTOR CO.

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

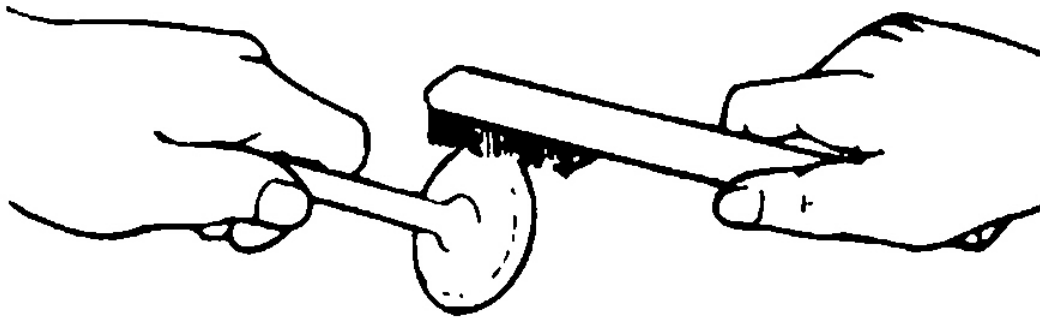
Flatness of cylinder head gasket surface

Standard : Less than 0.03 mm (0.0012 in.)

Limit : 0.06 mm (0.0024 in.)

VALVES

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



G00960889

Fig. 159: Cleaning Valve

Courtesy of HYUNDAI MOTOR CO.

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

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

Margin

[Standard]

Intake : 1.15 mm (0.0453 in.)

Exhaust : 1.35 mm (0.0531 in.)

[Limit]

Intake : 0.8 mm (0.0315 in.)

Exhaust : 1.0 mm (0.040 in.)

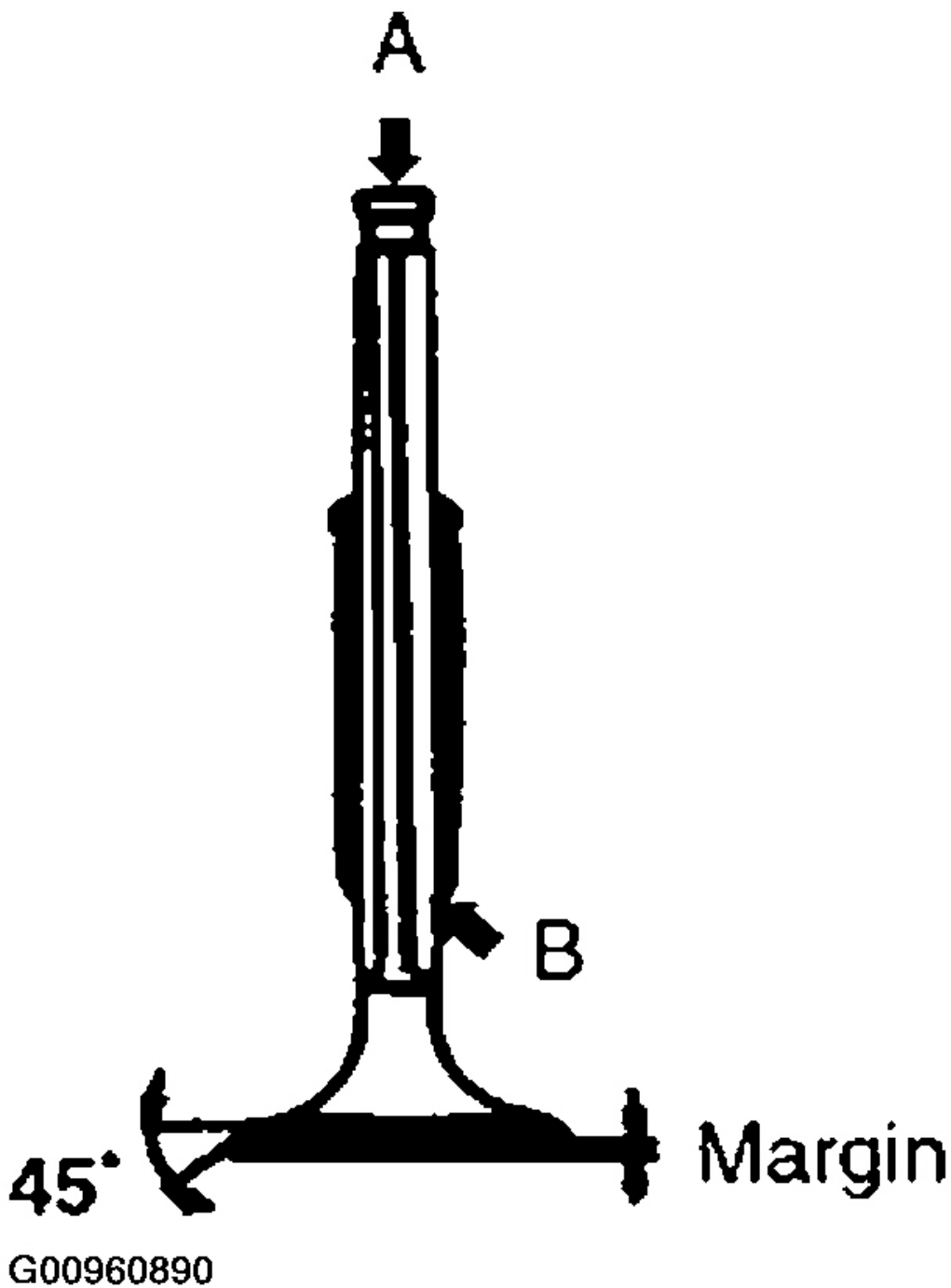


Fig. 160: Identifying Valve Margin
Courtesy of HYUNDAI MOTOR CO.

VALVE SPRINGS

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

Valve spring

[Standard]

Free height: 48.86 mm (1.9236 in.)

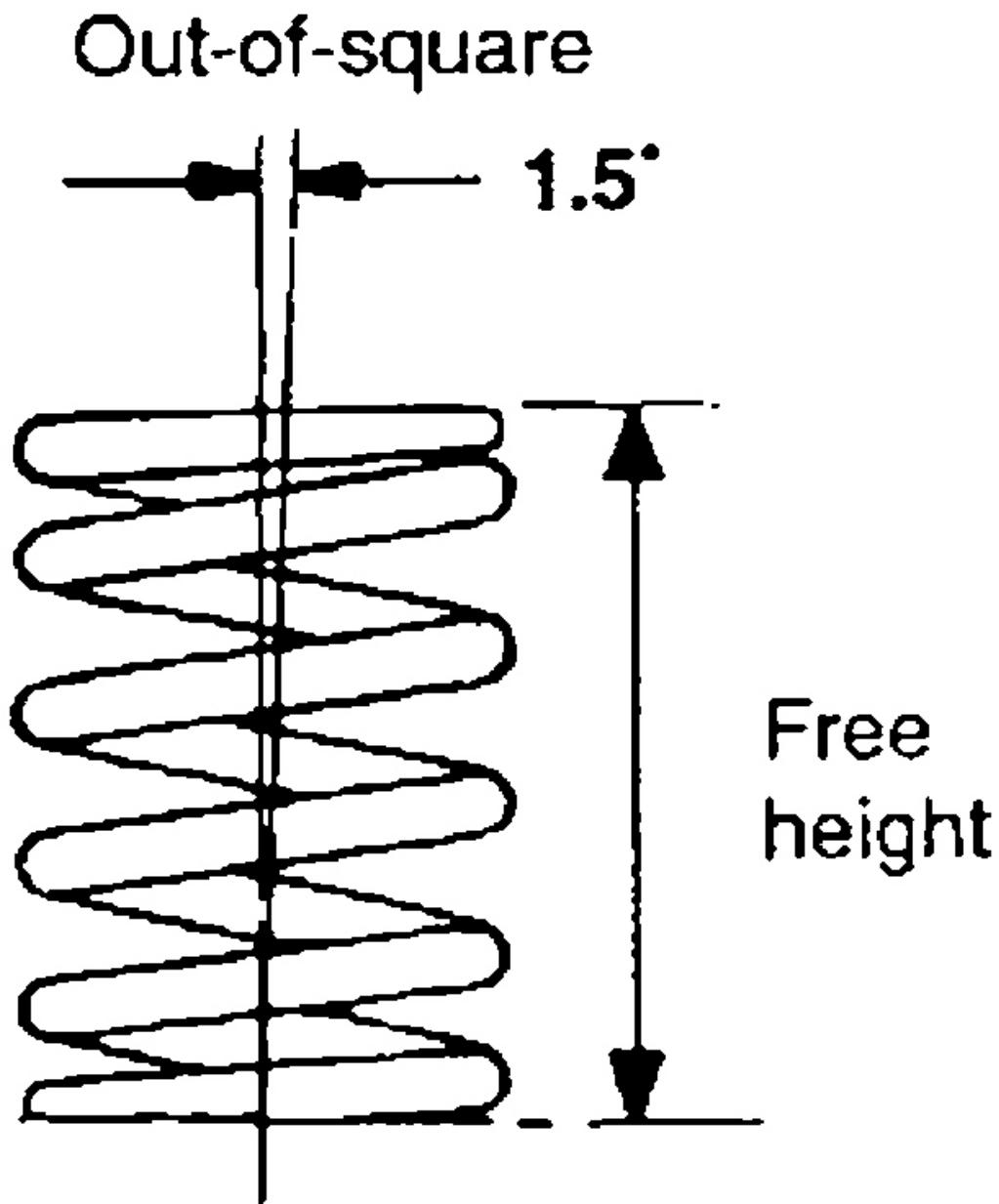
Load: 18.3kg/39 mm (40.0 kg/30.5mm)

Out-of-square: 1.5° or less

[Limit]

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

Out-of-square: 3°



G00960891

Fig. 161: Identifying Valve Spring Free Height
Courtesy of HYUNDAI MOTOR CO.

VALVE GUIDES

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

Valve stem-to-guide clearance

[Standard]

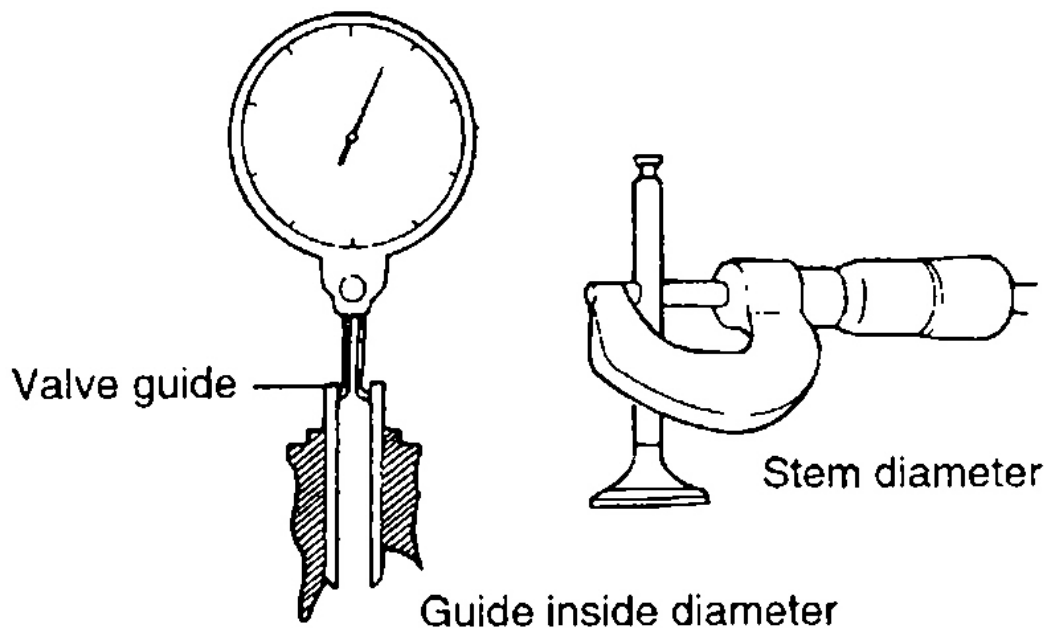
Intake: 0.02-0.05 mm (0.0008-0.0020 in.)

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

[Limit]

Intake: 0.1 mm (0.0040 in)

Exhaust: 0.13 mm (0.0051 in.)

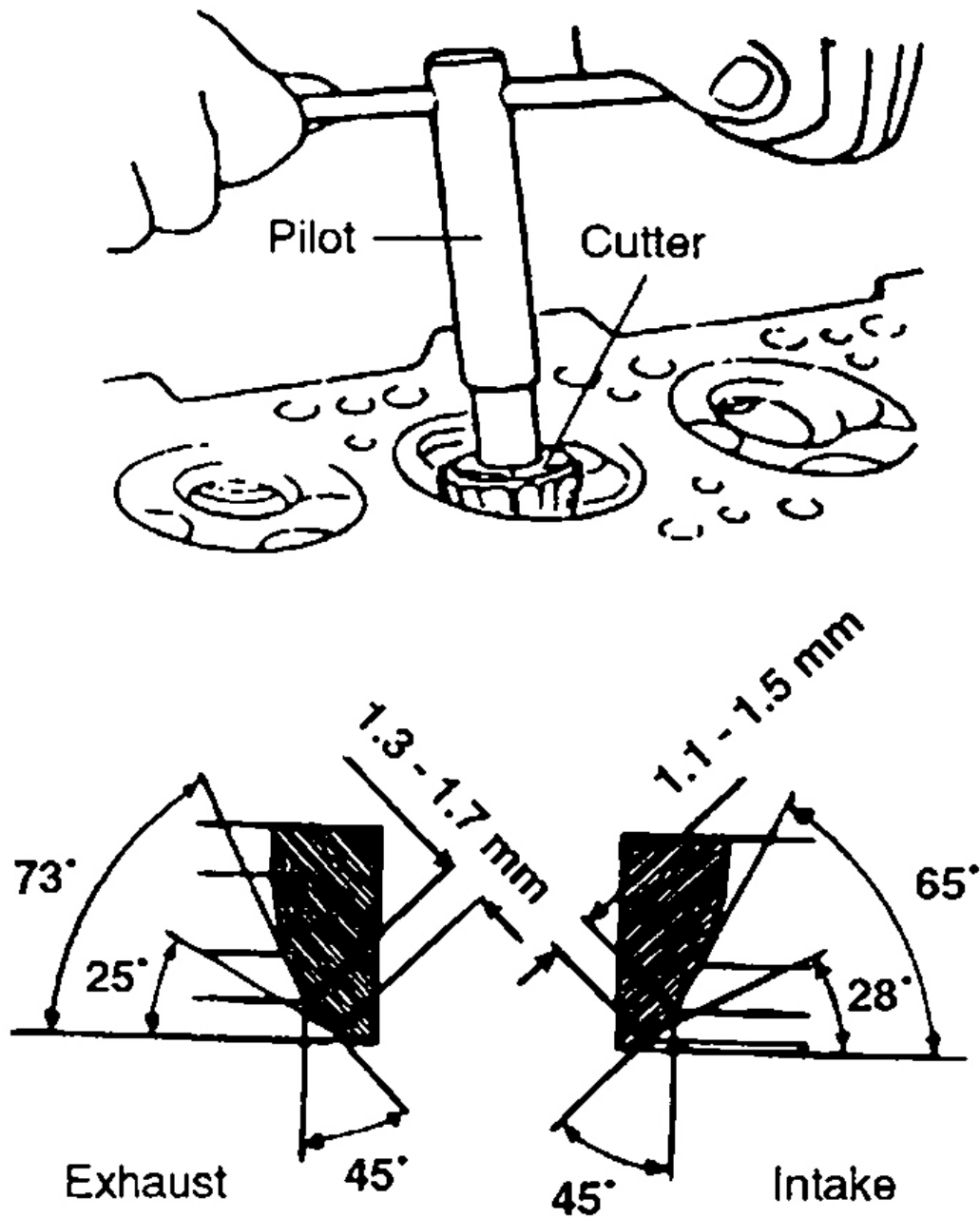


G00960892

Fig. 162: Measuring Valve Stem-To-Guide Clearance
Courtesy of HYUNDAI MOTOR CO.

RECONDITIONING VALVE SEAT

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



G00960893

Fig. 163: Reconditioning Valve Seat
Courtesy of HYUNDAI MOTOR CO.

REPLACING THE VALVE SEAT RING

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

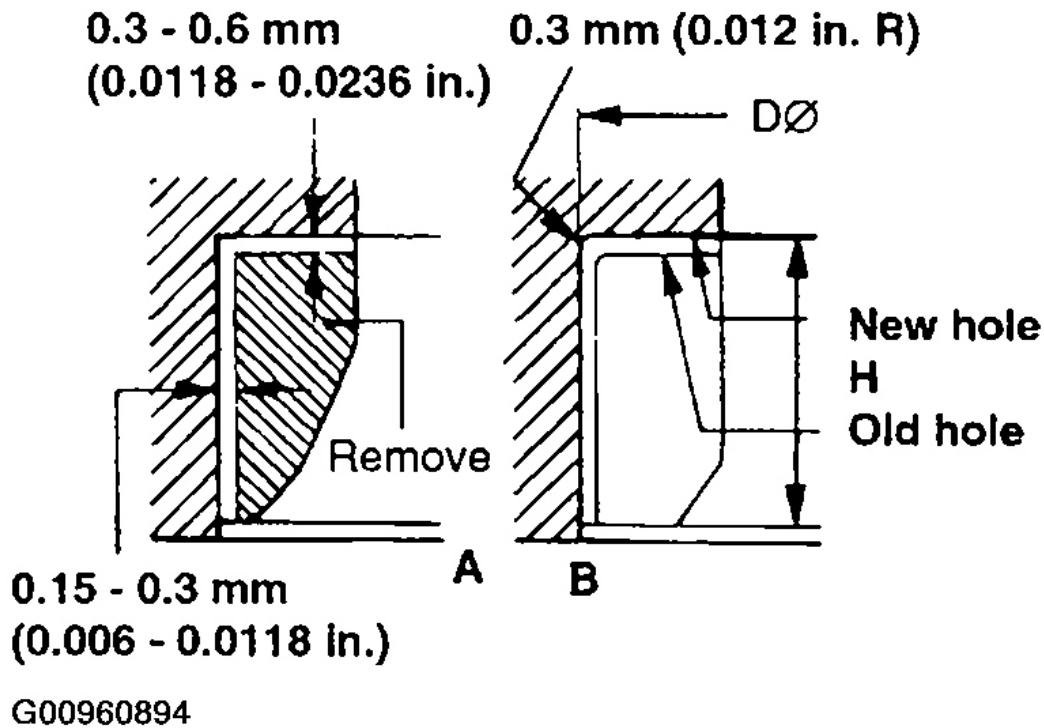


Fig. 164: Cutting Away Inner Face Of Valve Seat
Courtesy of HYUNDAI MOTOR CO.

2. Enlarge the diameter of the valve seat so that it matches the specified oversize hole diameter of the new valve seat ring.
3. Heat the cylinder head to about 250°C (480°F) and press-fit an oversize seat ring for the bore in the cylinder head.
4. Using lapping compound, lap the valve to the new seat.
Valve seat contact width
Intake: 1.1-1.5 mm (0.0433-0.0590 in.)
Exhaust: 1.3-1.7 mm (0.0512-0.0670 in.)

VALVE SEAT INSERT OVERSIZES

2003 Hyundai Elantra GT

2003 ENGINE 2.0L 4 Cylinder DOHC - Elantra

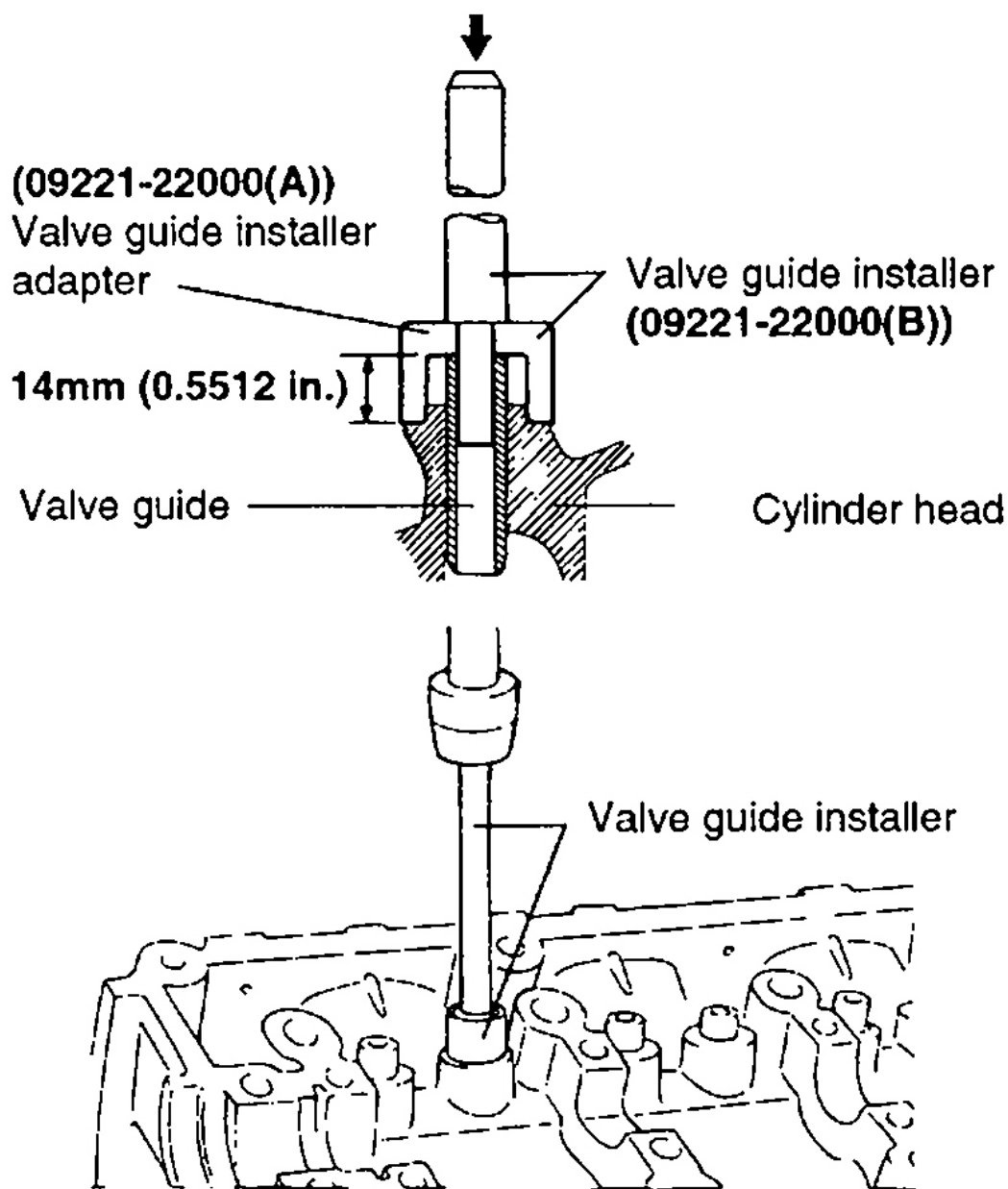
Description	Size mm (in.)	Size mark	Seat ring height H mm(in.)	Oversize hole diameter I.D. mm(in.)
Intake valve	0.3 (0.012) O.S.	30	7.5-7.7 (0.295-0.303)	33.300 - 33.325 (1.3110 - 1.3120)
Seat ring	0.6 (0.024) O.S.	60	7.8-8.0 (0.307-0.315)	33.600 - 33.625 (1.3228 - 1.3238)
Exhaust valve	0.3 (0.012) O.S.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

G00960895

Fig. 165: Valve Seat Insert Oversize Table
Courtesy of HYUNDAI MOTOR CO.

REPLACING VALVE GUIDE

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



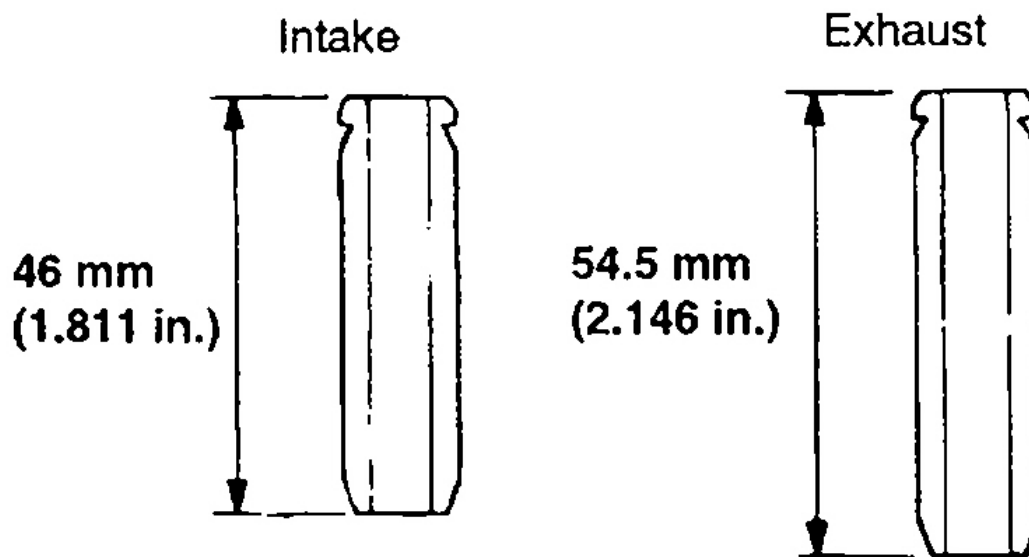
G00960896

Fig. 166: Installing Valve Guide

Courtesy of HYUNDAI MOTOR CO.

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

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



G00960897

Fig. 167: Identifying Intake & Exhaust Valve Guide Differences
Courtesy of HYUNDAI MOTOR CO.

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

VALVE GUIDE OVERSIZES

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

G00960898

Fig. 168: Valve Guide Oversize Specification Table
 Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

NOTE:

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

1. Install the spring seats.

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

NOTE:

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

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

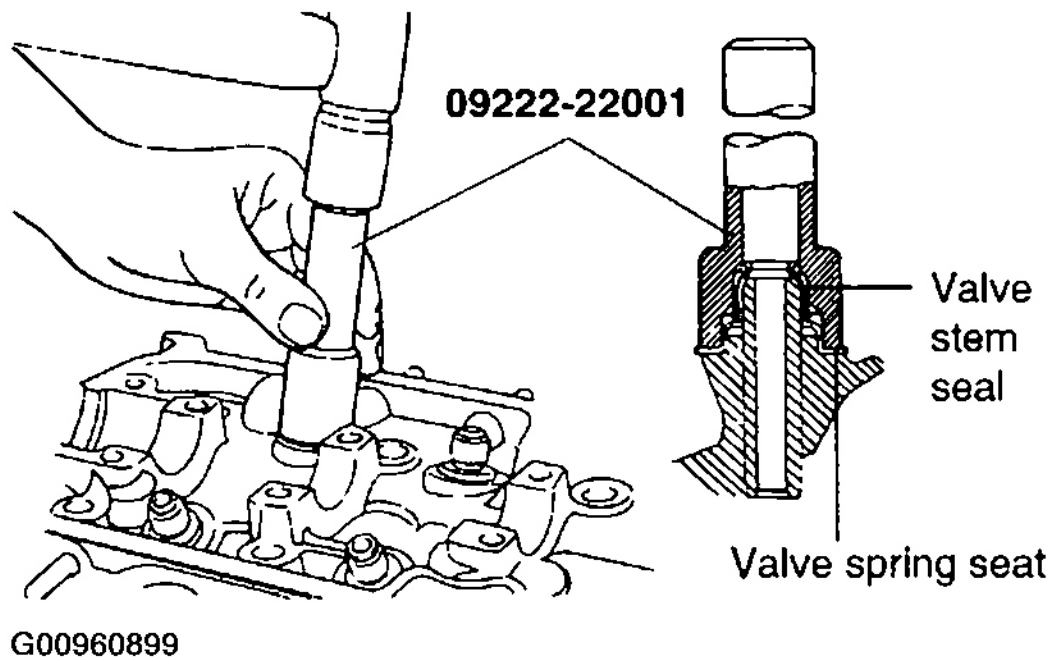
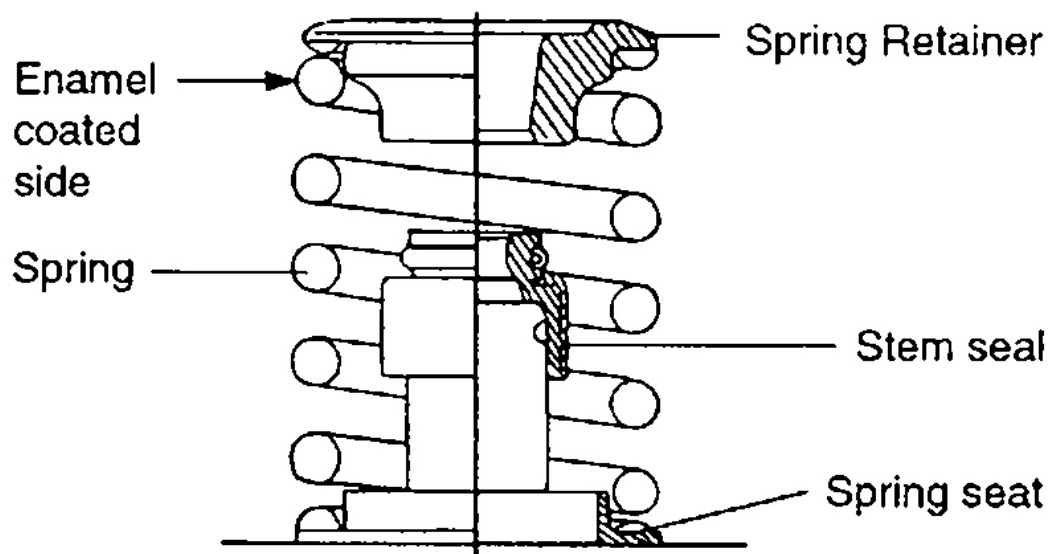


Fig. 169: Installing Valve

Courtesy of HYUNDAI MOTOR CO.

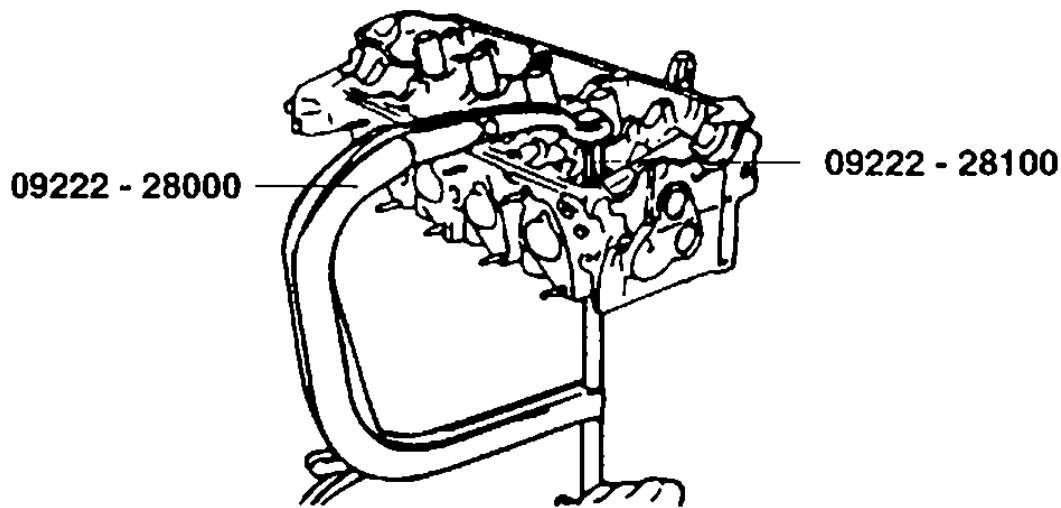
3. Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then install the retainer.



G00960900

Fig. 170: Identifying Proper Valve Spring Installation
Courtesy of HYUNDAI MOTOR CO.

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



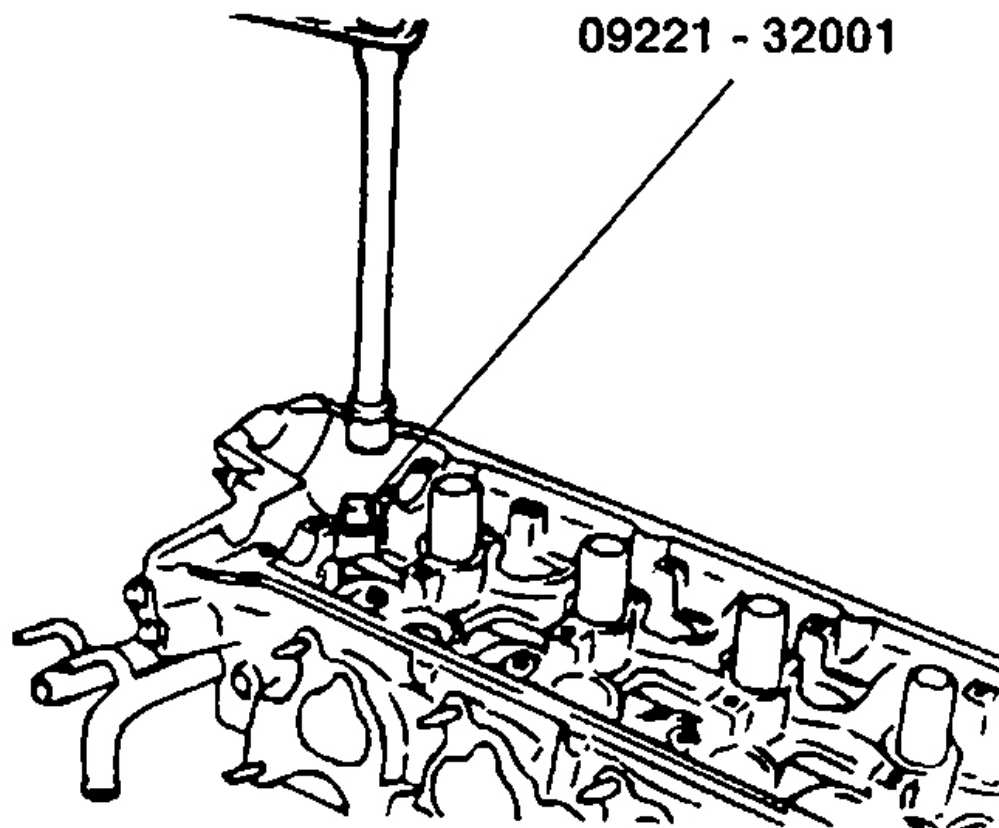
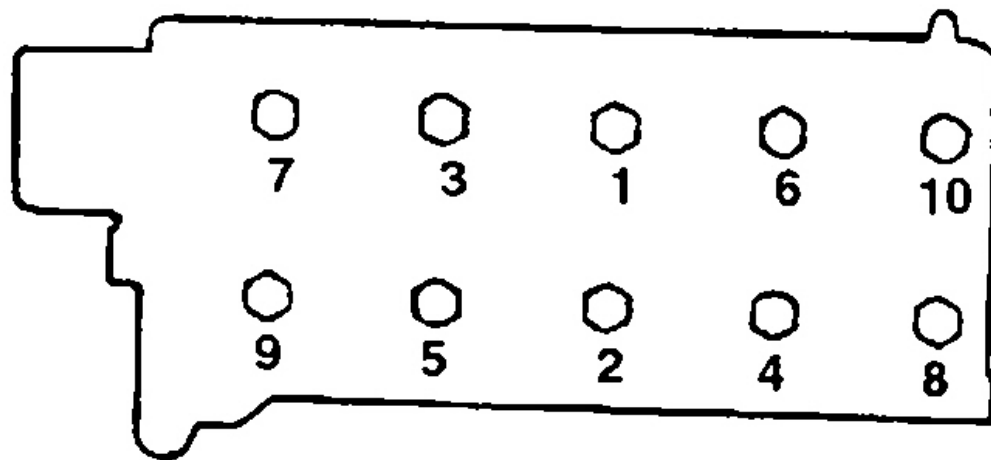
G00960901

Fig. 171: Installing Valve Spring Retainer Locks

Courtesy of HYUNDAI MOTOR CO.

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

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



G00960902

Fig. 172: Identifying Cylinder Head Torque Sequence
Courtesy of HYUNDAI MOTOR CO.

Cylinder head bolt

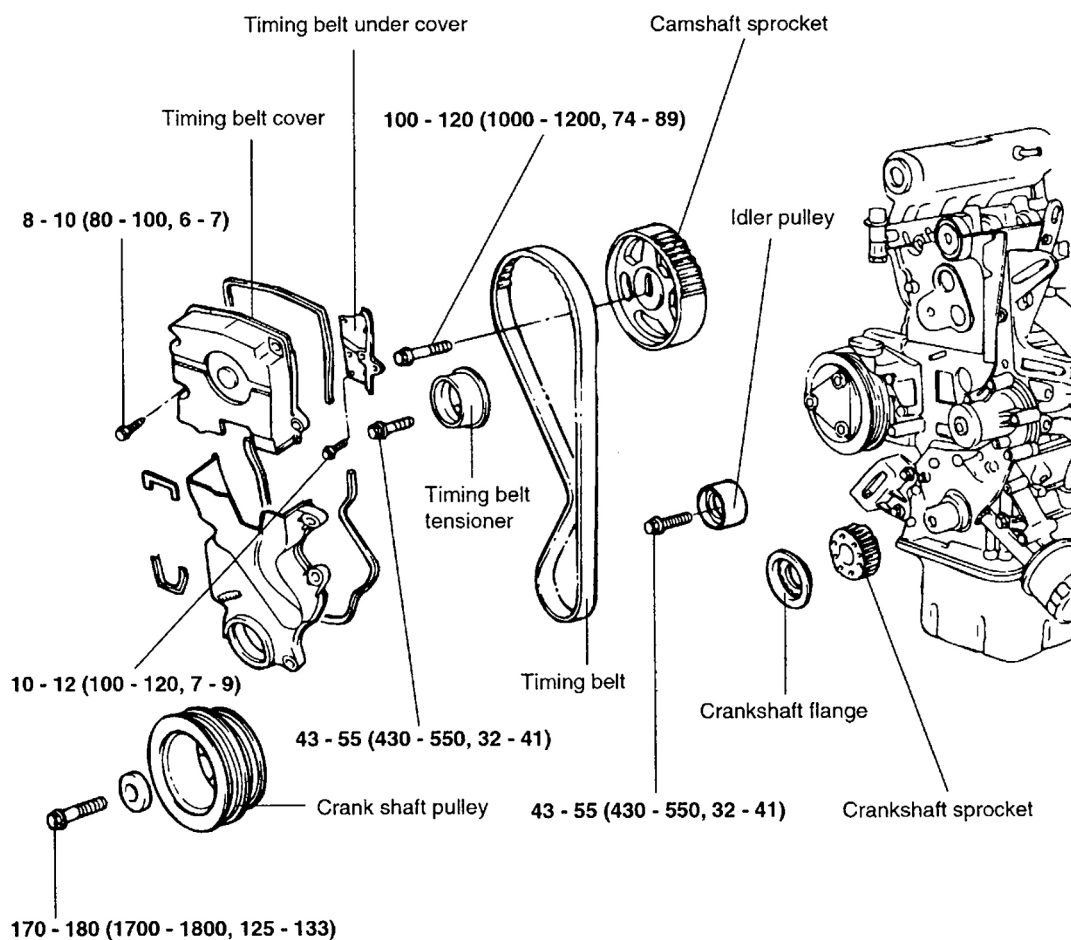
M10 : 25 Nm (250 kg.cm, 18 lb.ft) + (60°-65°) + (60°-65°)

M12 : 30 Nm (300 kg.cm, 22 lb.ft) + (60°-65°) + (60°-65°)

TIMING SYSTEM

TIMING BELT

COMPONENTS



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

G00960903

Fig. 173: Timing Belt Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

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

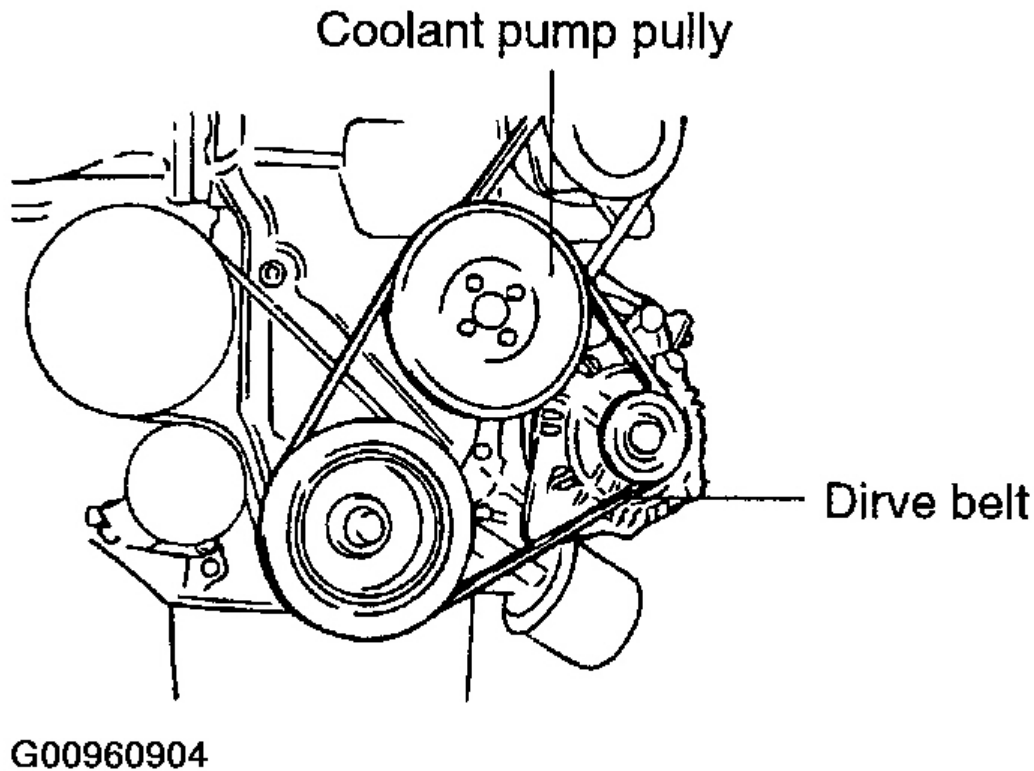
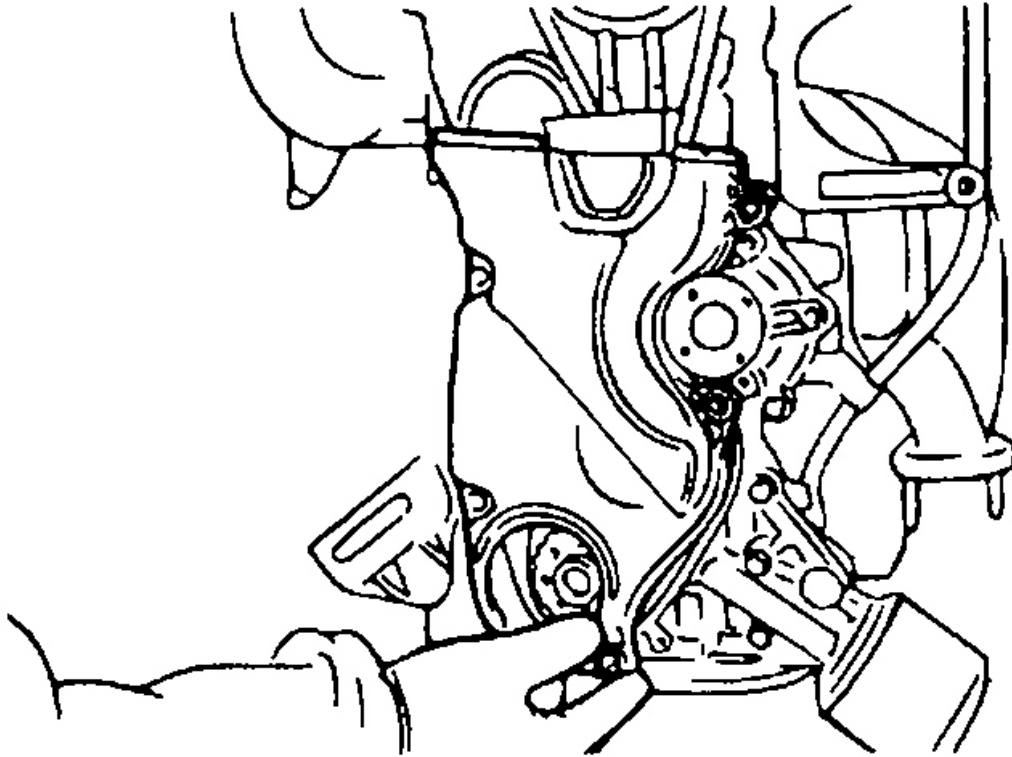


Fig. 174: Removing Water Pump Pulley & Belt
Courtesy of HYUNDAI MOTOR CO.

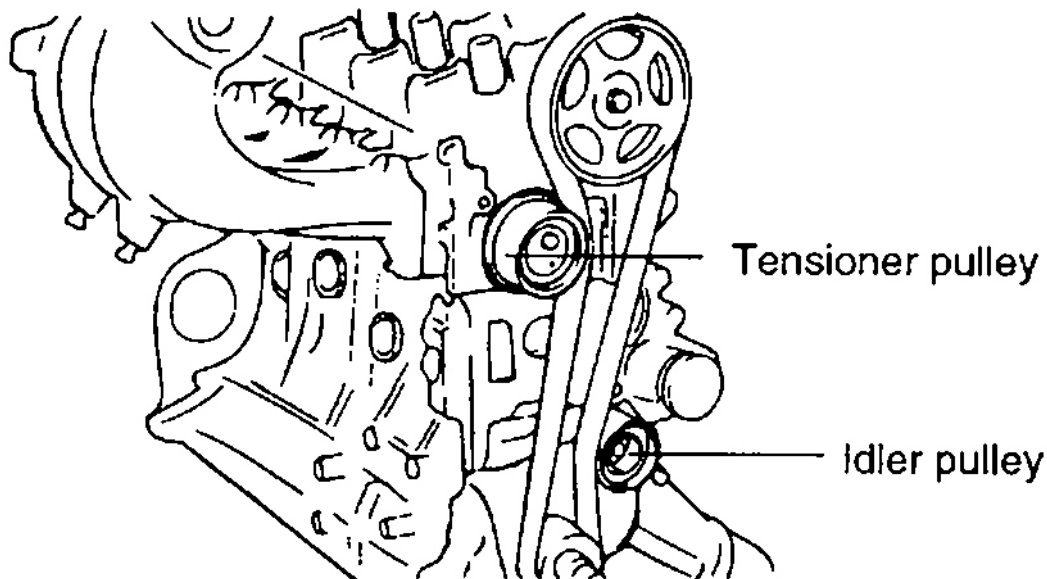
4. Remove the crankshaft pulley.
5. Remove the timing belt cover.



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Fig. 175: Removing Timing Cover
Courtesy of HYUNDAI MOTOR CO.

6. Remove the timing belt tensioner pulley.

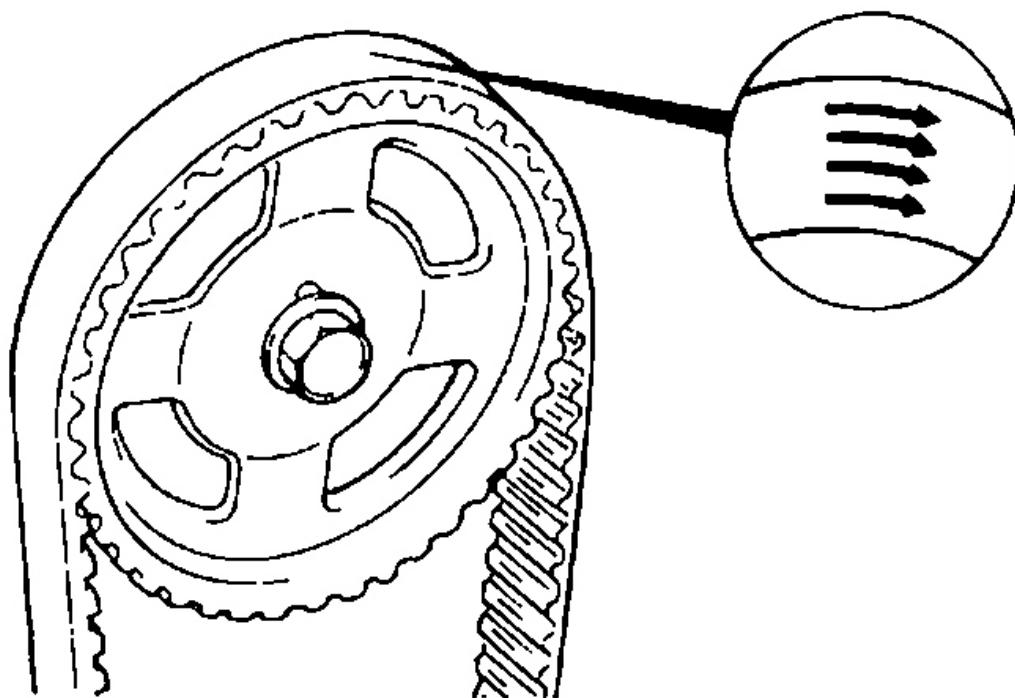


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Fig. 176: Identifying Tensioner & Idler Pulley
Courtesy of HYUNDAI MOTOR CO.

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

7. Remove the timing belt.



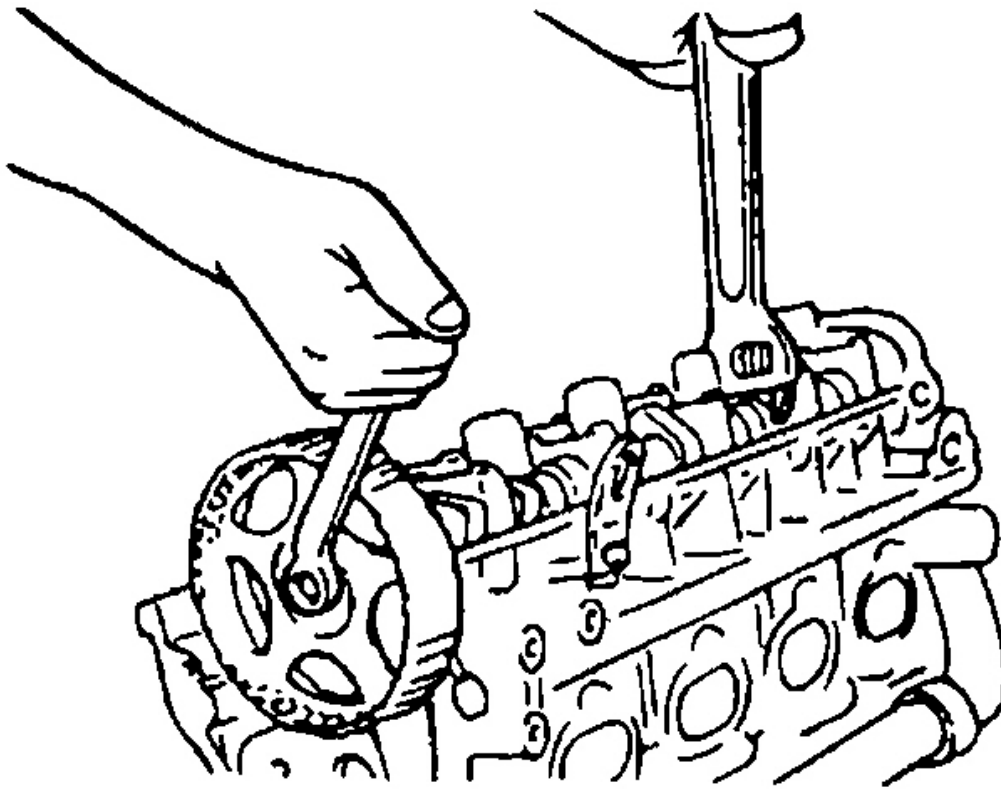
G00960907

Fig. 177: Removing Timing Belt
Courtesy of HYUNDAI MOTOR CO.

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

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

10. Remove the crankshaft sprocket from crankshaft.



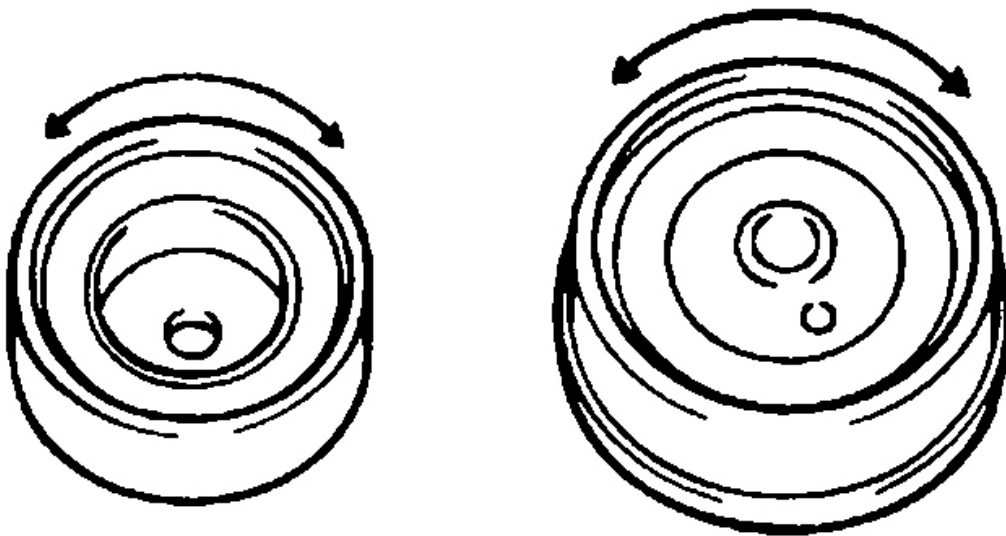
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Fig. 178: Removing Crankshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

SPROCKETS, TENSIONER PULLEY, & IDLER PULLEY.

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



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Fig. 179: Inspecting Pulleys
Courtesy of HYUNDAI MOTOR CO.

TIMING BELT

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

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

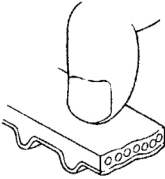
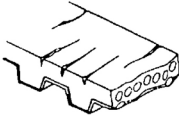
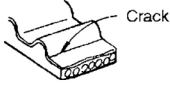
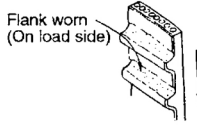
2. When the engine is overhauled or belt tension adjusted, check the belt carefully. If any of the following flaws are evident, replace the belt.

NOTE:

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

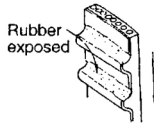
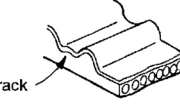
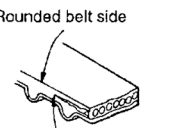
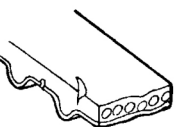
2003 Hyundai Elantra GT

2003 ENGINE 2.0L 4 Cylinder DOHC - Elantra

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

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Fig. 180: Inspecting Timing Belt (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

Description	Flaw conditions
6. Cracked tooth bottom	 Rubber exposed
7. Missing tooth	 Crack
8. Badly worn side of belt	 Tooth missing and canvas fiber exposed
NOTE Normal belt should have a precisely cut side as if cut by a sharp knife	 Rounded belt side Abnormal wear (Fluffy canvas fiber)
9. Cracked side of belt	

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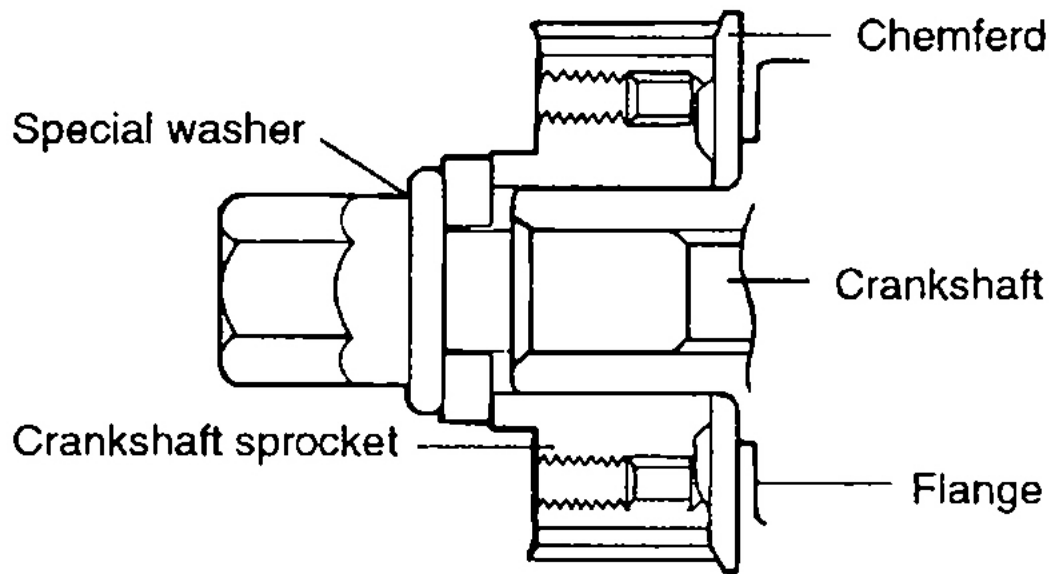
Fig. 181: Inspecting Timing Belt (2 Of 2)
 Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

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

Tightening Torque

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



G00960913

Fig. 182: Identifying Crankshaft Sprocket Installation
Courtesy of HYUNDAI MOTOR CO.

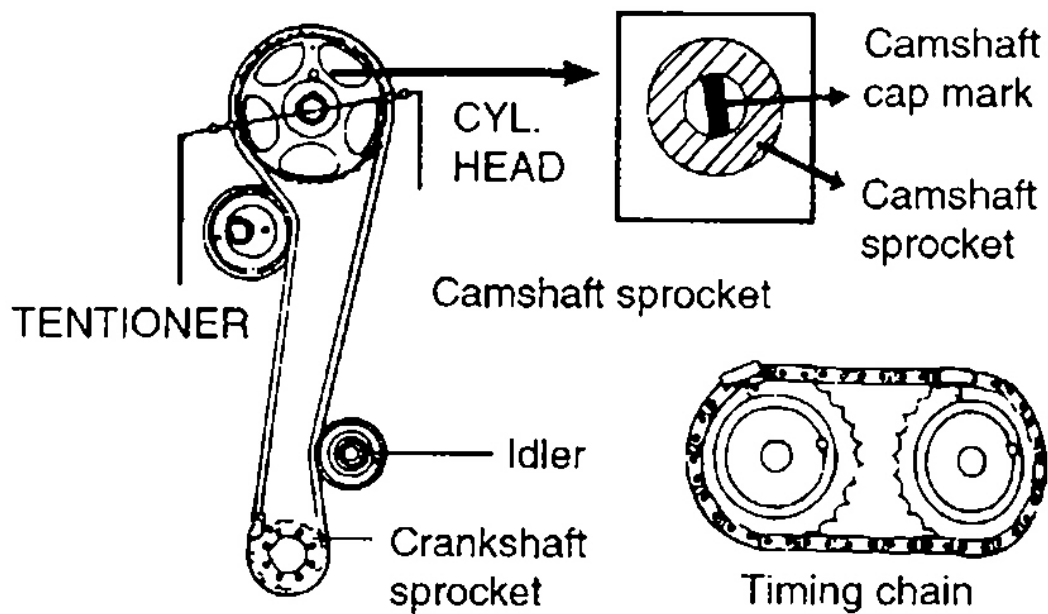
2. Install the camshaft sprocket and tighten the bolt to the specified torque.

Tightening torque

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

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

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



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Fig. 183: Identifying Timing Chain & Belt Installation
Courtesy of HYUNDAI MOTOR CO.

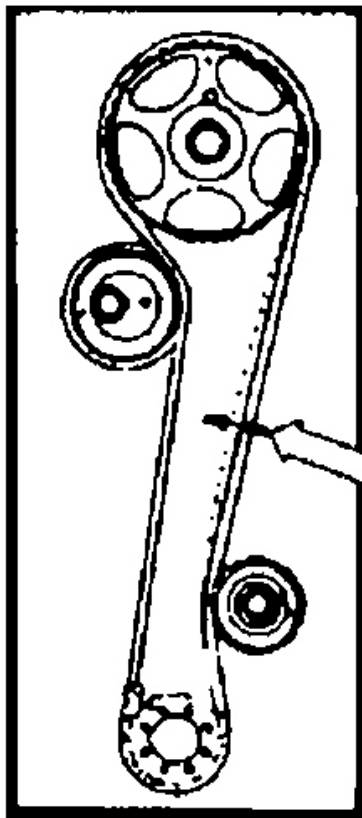
6. Turn the crankshaft one turn in the operating direction (clockwise) and realign crankshaft sprocket timing mark.

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

Tightening torque

Tensioner and idler pulley installing bolt: 43-55 Nm (430-550 kg.cm, 32-41 lb.ft)

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



DEFLECTION

4 - 6 mm

0.16 - 0.24 in

2KG(20N)

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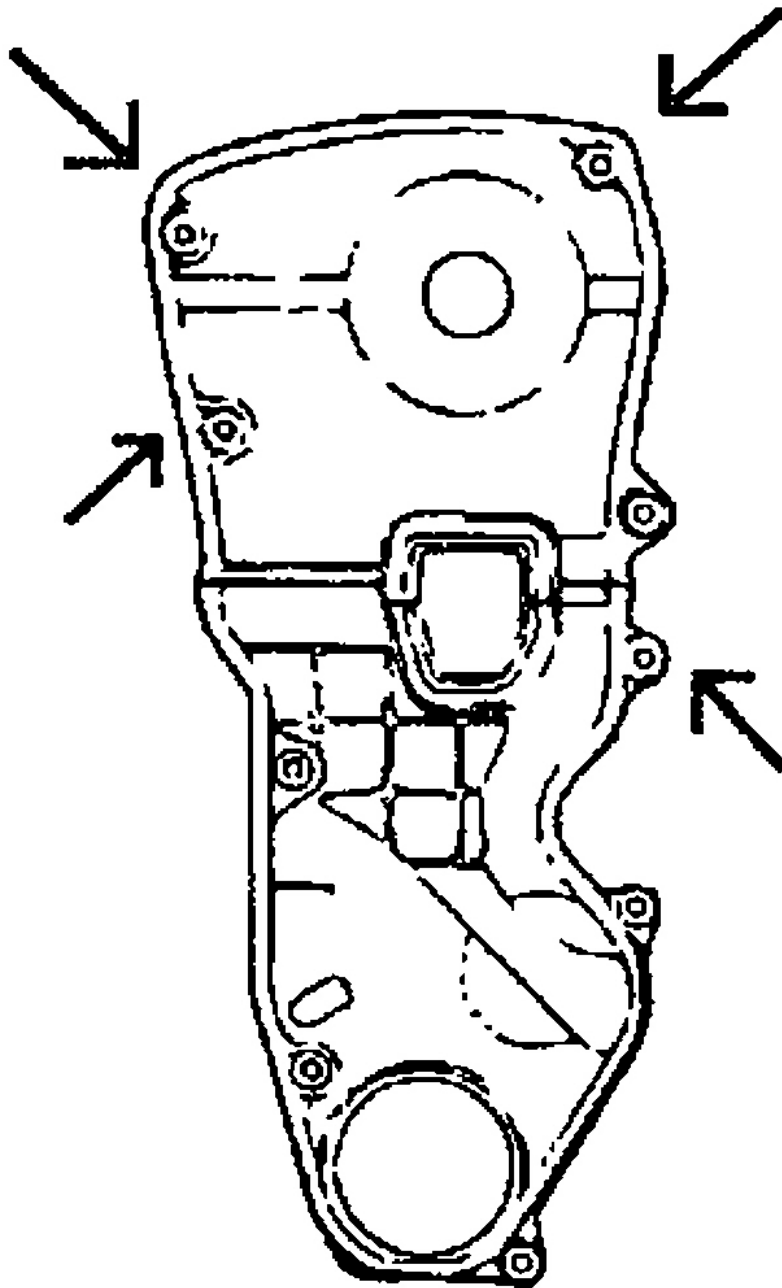
Fig. 184: Checking Timing Belt Tension
Courtesy of HYUNDAI MOTOR CO.

8. Install the timing belt cover.

Tightening torque

Timing belt cover bolt:

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

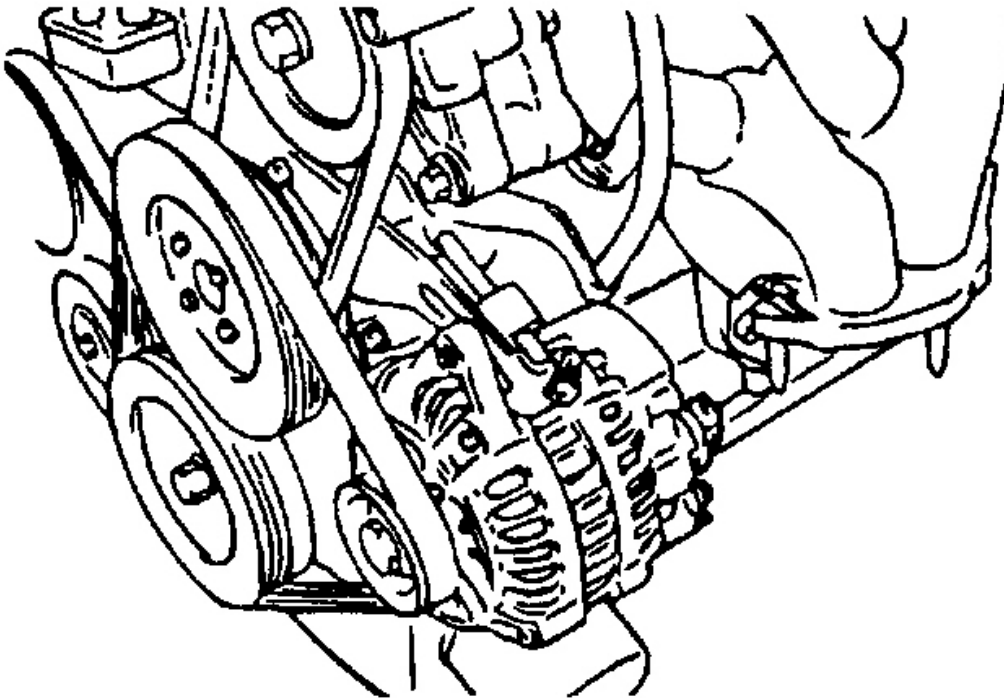


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Fig. 185: View Of Timing Belt Cover
Courtesy of HYUNDAI MOTOR CO.

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

10. Install the coolant pump pulley.



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Fig. 186: View Of Coolant Pump Pulley & Belt
Courtesy of HYUNDAI MOTOR CO.

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