

2002 ENGINE

Engine Mechanical System V6 3.5L - XG 350

GENERAL

SPECIFICATIONS

General Specifications (1 Of 4)

Description	Specification	Limit
General		
Type	V-type, DOHC	
Number of cylinders	6	
Bore	93.0 mm (3.661 in.)	
Stroke	85.8 mm (3.3779 in.)	
Total displacement	3497 cc	
Compression ratio	10.0	
Firing order	1 - 2 - 3 - 4 - 5 - 6	
Valve timing		
Intake valve		
Opens (BTDC)	11.5°	
Closes (ABDC)	60.5°	
Exhaust valve		
Opens (BBDC)	43.5°	
Closes (ATDC)	20.5°	
Valve overlap	32°	
Intake valve duration	252°	
Exhaust valve duration	244°	
Camshaft		
Drive mechanism	Cogged type belt	
Cam height intake	35.098 - 35.298 mm (1.3818 - 1.3897 in.)	
Cam height exhaust	34.81 - 35.01 mm (1.3705 - 1.3783 in.)	
Journal diameter	25.951 - 25.970 mm (1.0220 - 1.0224 in.)	
Bearing oil clearance	0.05 - 0.09 mm (0.0007 - 0.0024 in.)	
End play	0.1 - 0.15 mm (0.0039 - 0.0059 in.)	
Cylinder head		
Flatness of gasket surface	Max. 0.03 mm (0.0012 in.)	0.05 mm
Flatness of maunting Surface		
Intake	Max. 0.10 mm (0.0039 in.)	0.10 mm
Exhaust	Max. 0.15 mm (0.0059 in.)	0.15 mm
Valve guide hole diameter		
0.05 (0.002) O.S.	12.05 - 12.068 mm (0.474 - 0.475 in.)	

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0.25 (0.010) O.S.	12.05 - 12.268 mm (0.482 - 0.483 in.)	
0.50 (0.20) O.S.	12.50 - 12.518 mm (0.492 - 0.493 in.)	
Intake valve seat ring hole diameter		
0.3 (0.012) O.S.	36.30 - 36.325 mm (1.429 - 1.430 in.)	
0.6 (0.024) O.S.	36.60 - 36.625 mm (1.441 - 1.442 in.)	
Exhaust valve seat ring hole diameter		
0.3 (0.012) O.S.	33.30 - 33.325 mm (1.311 - 1.312 in.)	
0.6 (0.024) O.S.	33.60 - 33.625 mm (1.323 - 1.324 in.)	

General Specifications (2 Of 4)

Description	Specification	Limit
Valve		
Overall length		
Intake	106.28 mm (4.184 in.)	
Exhaust	105.4 mm (4.150 in.)	
Stem diameter		
Intake	6.565 - 6.580 mm (0.258 - 0.259 in.)	
Exhaust	6.530 - 6.550 mm (0.257 - 0.258 in.)	
Face angle	45° - 45.5°	
Margin	1.0 mm (0.0394 in.)	
Intake	1.5 mm (0.059 in.)	
Exhaust		
Clearance (stem-to - guide)	0.02 - 0.05 mm (0.0009 - 0.0020 in.)	
Intake	0.05 - 0.085 mm (0.0020 - 0.0033 in.)	
Exhaust		
Valve spring		
Free height	46.4 mm (1.8268 in.)	41.5 mm (1.6339 in.)
Lode	24.0 kg / 37.9 mm (53 lb / 1.492 in.)	55.8 kg / 28.9 mm (123 lb / 1.378 in.)
Out of squareness	Max 2°	
Valve guide		
Length		
Intake	45.5 mm (1.7913 in.)	
Exhaust	50.5 mm (1.9882 in.)	
Service oversize	0.05, 0.25, 0.50	
Valve seat contact width		
Intake	0.9 - 1.3 mm (0.035 - 0.051 in.)	
Exhaust	0.9 - 1.3 mm (0.035 - 0.051 in.)	
Service oversize	0.30, 0.60	
Seat angle		

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Intake	20°	
Exhaust	45°	
Piston		
Diameter (Standard)	92.96 - 92.99 mm (3.659 - 3.661 in.)	
Clearance (Piston-to-cylinder)	0.03 - 0.05 mm (0.0012 - 0.0020 in.)	
Ring groove width		
No. 1	1.503 - 1.505 mm (0.0592 - 0.05925 in.)	
No. 2	1.501 - 1.503 mm (0.0591 - 0.0592 in.)	
Oil	3.010 - 3.035 mm (0.1185 - 0.132 in.)	
Piston for service	0.25 mm (0.010 in.), 0.50 mm (0.020 in.)	0.75 mm (0.030 in.), 1.00 mm (0.040 in.) Oversize

General Specifications (3 Of 4)

Description	Specification	Limit
Piston ring		
Number of rings per piston	3	
Compression ring type	2	
Oil ring	1	
Compression ring type		
No. 1	Barrel type, steel	
No. 2	Taper type, special cast iron	
Oil ring type	3-piece type	
Ring end gap		
No. 1	0.30 - 0.45 mm (0.0118 - 0.0177 in.)	
No. 2	0.45 - 0.60 mm (0.0177 - 0.0236 in.)	
Oil ring side rail	0.2 - 0.7 mm (0.0079 - 0.0276 in.)	
Ring side clearance		
No. 1	0.04 - 0.08 mm (0.0016 - 0.0031 in.)	
No. 2	0.02 - 0.06 mm (0.0008 - 0.0024 in.)	
Ring for service	0.25 mm (0.010 in.), 0.50 mm (0.020 in.) 0.75 mm (0.030 in.), 1.00 (0.039 in.), Oversize	
Connecting rod		
Piston pin press - in load	7500 - 17,500 N (750 - 1,750 kg, 1,653 - 3,858 lb)	
Side clearance (Big end)	0.10 - 0.25 mm (0.0039 - 0.0098 in.)	
Bend	0.05 mm or less/100 mm (0.0020 in. or less/3.937 in.)	
Twist	0.1 mm or less/100 mm (0.0039 in. or less/3.937 in.)	

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Bearing		
Oil clearance	0.022 - 0.048 mm (0.0009 - 0.002 in.)	0.1 mm (0.004 in.)
Pin diameter	21.974 - 21.985 mm (0.8651 - 0.8655 in.)	
Crankshaft		
Journal O.D.	63.982 - 64.00 mm (2.519 - 2.5197 in.)	
Pin O.D.	54.982 - 55.00 mm (2.165 - 2.1653 in.)	
Out - of - roundness of journal and pin	Max. 0.03 mm (0.0012 in.)	
Taper of journal and pin	Max. 0.005 mm (0.0002 in.)	
End play	0.05 - 0.25 mm (0.002 - 0.0098 in.)	0.3 mm (0.012 in.)
Main bearing		
Oil clearance	0.018 - 0.036 mm (0.0007 - 0.0014 in.)	
Cylinder block		
Cylinder bore	93 mm (3.661 in.)	
Flatness of gasket surface	Max. 0.05 mm (0.002 in.)	
Out - of - roundness and taper	Max. 0.02 mm (0.0008 in.)	0.05 mm (0.002 in.)
Oil pump		
Side clearance		
Body clearance	0.100 - 0.181 mm (0.0039 - 0.0071 in.)	
Side clearance	0.040 - 0.095 mm (0.0016 - 0.0037 in.)	
Tip clearance	0.06 - 0.018 mm (0.0024 - 0.0071 in.)	
Relief spring		
Free length	46.3 mm (1.823 in.)	
Load	3.4 kg/39.1 mm (7.5 lb. 1.54 in.)	
Oil filter		
Type	Cartridge, full flow	
Engine oil pressure	80 kPa (11.4 psi) or more [Conditions : Oil temperature is 75 to 90°C (167 to 194°F)]	

General Specifications (4 Of 4)

Description	Specification	Limit
Cooling method	Engine coolant cooling, forced circulation with electric fan	
Cooling system Quantity	8.2 lit (8.61 U.S.qts., 7.2 Imp.qts)	
Thermostat		
Type	Wax pellet type with jiggle valve	
Normal opening temperature	82°C (179.6°F)	
Opening temperature range	80°C -84°C (176 - 183.2°F)	
Wide open temperature	95°C (203°F)	
Radiator cap	86.1 - 124.5 kPa	

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Main valve opening pressure	(0.98 - 1.27 kg/cm ² , 13.94 - 18.06 psi)	
Main valve closing pressure	83.4 kPa (0.85 kg/cm ² , 12.1 psi)	
Vacuum valve opening pressure	- 6.86 kPa (- 0.07 kg/cm ² , - 1.00 psi)	
Air cleaner		
Type	Dry type	
Element	Unwoven cloth type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	

SERVICE STANDARD

Standard value

Coolant concentration

Tropical area: 40%

Other area: 50%

LUBRICANT

Engine coolant - Ethylene glycol base for aluminum radiator

SEALANT

Engine coolant temperature sensor	Three bond No.2310 or equivalent
	LOCTITE 962T or equivalent

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Fig. 1: Sealant

Courtesy of HYUNDAI MOTOR CO.

TORQUE SPECIFICATIONS

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

TORQUE SPECIFICATIONS

Application	Ft. Lbs (N.m)
Air Intake Tank-To-Manifold Fasteners	11-15 (15-20)
Auto Tensioner Fixed Bolt	15-20 (20-27)

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Camshaft Bearing Cap	
Inner	(1)
Outer	14-15 (19-20)
Camshaft Sprocket Bolt	66-81 (90-110)
Connecting Rod Nut	
Step 1	26 (35)
Step 2	Tighten An Additional 90 Degrees
Coolant Inlet Fitting Bolt	13-15 (17-20)
Coolant Pump Bolt (Bolt Head Mark "7")	11-16 (15-22)
Coolant Temperature Sensor	15-30 (20-40)
Crankshaft Bolt	133-140 (180-190)
Crankshaft Pulley Bolt	133-140 (180-190)
Cylinder Head Bolt (Cold) ⁽²⁾	77-85 (105-115)
Drive Belt Tensioner Bolt	33-37 (45-50)
Drive Plate & Adapter Plate Bolt	54-57 (73-77)
Drive Belt Pulley Bolt	26-41 (35-55)
Engine Hanger Bracket Bolt	15-20 (20-27)
Engine Mounting Fasteners	
Engine Mounting Bracket Bolt	44-59 (60-80)
Engine Mounting Bracket Nut	44-59 (60-80)
Engine Mounting Insulator Bolt	66-81 (90-110)
Front Roll Stopper Bracket-To-Transaxle Bolt	44-59 (60-80)
Front Roll Stopper Insulator Fasteners	44-59 (60-80)
Front Roll Stopper Bracket-To-Subframe Bolt	44-59 (60-80)
Rear Roll Stopper Bracket-To-Subframe Bolts	44-59 (60-80)
Rear Roll Stopper Bracket-To-Transaxle Bolts	37-44 (50-60)
Rear Roll Stopper Insulator Bolt	44-59 (60-80)
Exhaust Components	
Catalytic Converter-To-Center Exhaust Pipe Nut	22-30 (30-40)
Exhaust Manifold-To-Engine Bolt	20-24 (27-33)
Front Exhaust Pipe-To-Catalytic Converter Bolt	30-44 (40-60)
Front Exhaust Pipe-To-Exhaust Manifold Bolt	22-30 (30-40)
Exhaust Manifold-To-Cylinder Head Nut	18-22 (25-30)
Generator Mounting Bracket Bolt (All)	15-22 (20-30)
Main Bearing Bolt	66-74 (90-100)
Oil Drain Plug	26-33 (35-45)
Oil Filter	13-18 (17-25)
Oil Pump Relief Valve Plug	30-37 (40-50)
Oil Screen Bolt	11-16 (15-22)
Oxygen Sensor	30-37 (40-50)

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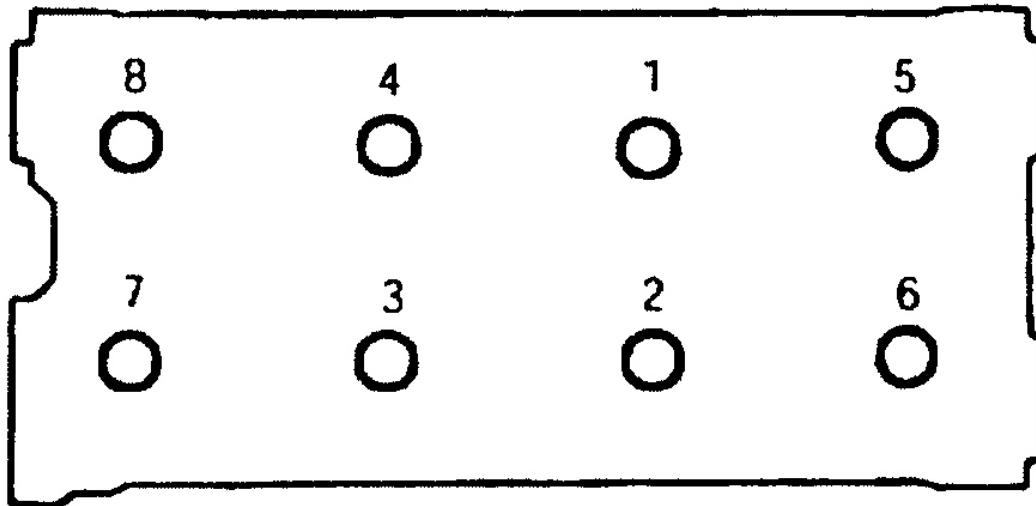
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Power Steering Bracket-To-Cylinder Head Bolt	13-15 (17-26)
Power Steering Pump-To-Bracket bolt	13-15 (17-26)
Starter-To-Engine Bolt	20-25 (27-34)
Starter-To-Engine Nut	
Surge Tank Stay Bolt	11-15 (15-20)
Transaxle Mounting Fasteners	
Transaxle Mounting Bracket Bolts	44-59 (60-80)
Transaxle Mounting Sub Bracket Nut	44-59 (60-80)
Transaxle Mounting Insulator Bolt	48-59 (90-110)
Timing Belt Cover Bolt (8 mm)	15-20 (20-27)
Timing Belt Idler Pulley Bolt	37-44 (50-60)
Timing Belt Tensioner Arm Fixed Bolt	26-41 (35-55)
Timing Belt Tensioner Bolt	15-20 (20-27)
Timing Belt Tensioner Pulley Bolt	32-41 (43-55)
Upper Oil Pan Bolt	
10x380 mm	22-31 (30-42)
8x22 mm	22-31 (19-28)
171.5 mm	(3)
152.5 mm	(3)
Water Outlet Fitting Bolt	13-15 (17-20)
INCH Lbs. (N.m)	
Air Cleaner Body Installation Bolt	71-106 (8-12)
Air Cleaner Mounting Bolt	71-106 (8-12)
Crankshaft Position Sensor Wheel Screw	97-106 (11-12)
Cylinder Head Cover Bolt	44-53 (5-6)
Delivery Pipe Installation Bolt	89-133 (10-15)
Distributor Adaptor Assembly-To-Engine	106-133 (12-15)
Fuel Hose Clamp-To-Engine Bolt	106-133 (12-15)
Generator Inlet Pipe Bolt	106-133 (12-15)
Heat Protector-To-Exhaust Manifold	106-133 (12-15)
Intake Manifold-To-Engine	106-133 (12-15)
Lower Oil Pan Bolt	89-106 (10-12)
Main Muffler Hanger Support Bracket Bolt	89-133 (10-15)
Oil Level Guide-To-Engine	106-133 (12-15)
Oil Pressure Switch	71-106 (8-12)
Oil Pump Case Bolt	106-133 (12-15)
Oil Pump Cover Screw	106-133 (8-15)
Oil Seal Case	89-106 (10-12)
Rear Plate	71-89 (8-10)
Throttle Body-To-Surge Tank Bolt	89-113 (12-15)
Timing Belt Cover Bolt (6 mm)	89-106 (10-12)

Transaxle Mounting Plate

89-106 (10-12)

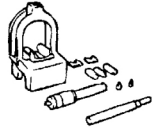
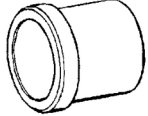
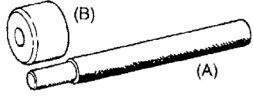
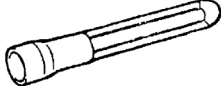
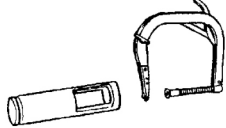
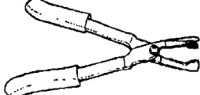
- (1) Tighten to 89-106 INCH Lbs. (10-12).
- (2) Tighten cylinder head bolts in sequence. See **Fig. 2**.
- (3) Tighten to 44-62 INCH Lbs. (5-7 N.m).



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Fig. 2: Identifying Cylinder Head Tightening Sequence
Courtesy of HYUNDAI MOTOR CO.

SPECIAL TOOLS

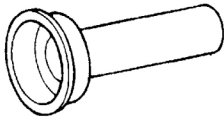
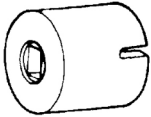
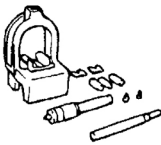
Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-33000)		Installation of the crankshaft front oil seal
Camshaft oil seal installer (09221-21000)		Installation of the camshaft oil seal
Valve guide installer (09222-22000 (B)) (09221-29000 (A))		Removal and installation of the valve guide
Valve stem oil seal installer (09222-22001)		Installation of the valve stem oil seal
Valve spring compressor (09222-28000)		Removal and installation of the intake or exhaust valve
Valve stem oil seal remover (09222-29000)		Removal of the valve stem oil seal

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Fig. 3: Identifying Special Tools (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

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Tool (Number and name)	Illustration	Use
Crankshaft rear oil seal installer (09231-33000)		Installation of the crankshaft rear oil seal
Crankshaft wrench (09231-33100)		Used if the crankshaft needs to be rotated to attach the timing belt, etc.
Piston pin remover and installer (09234-33001) Fork insert (09234-33003)		Removal and installation of the piston pin

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

TROUBLESHOOTING

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Symptom	Probable cause	Remedy
Knocking of crankshaft and bearing	Worn main bearing Seized bearing Bent crankshaft Excessive crankshaft end play	Replace Replace Replace Replace thrust bearing
Piston and connecting rod knock	Worn bearing Seized bearing Worn piston pin Worn piston in cylinder Broken piston ring Improper connecting rod alignment	Replace Replace Replace piston and pin or connecting rod Recondition cylinder Repair or replace Replace
Noisy valves	Faulty auto-lash adjuster Thin or diluted engine oil (low oil pressure) Worn or damaged valve stem or valve guide	Replace Change Replace
Excessively worn cylinder and piston	Shortage of engine oil Dirty engine oil Poor quality of engine oil Improperly assembled piston and connecting rod Improper piston ring end clearance Dirty air cleaner	Add or replace Check oil level on daily basis Replace Use proper oil Repair or replace Replace Clean air cleaner assembly and replace the air filter
Connecting rod and main bearing noise	Insufficient oil supply Thin or diluted engine oil Excessive bearing clearance	Check engine oil level Change and determine cause Replace
Damaged crankshaft bearing	Shortage of engine oil Low oil pressure Poor quality of engine oil Worn or out-of-round of crankshaft journal Restricted oil passage in crankshaft Worn bearing Bearing improperly installed Non-concentric crankshaft or bearing	Add or replace Check oil level on daily basis Adjust or repair Use proper engine oil Replace Clean Replace bearing and check engine oil and lubrication system Replace Replace
Timing belt noise	Incorrect belt tension	Replace
Low compression	Blown cylinder head gasket Worn or damaged piston rings Worn piston or cylinder Worn or damaged valve seat	Replace gasket Replace rings Repair or replace piston and/or cylinder block Repair or replace valve and/or seat ring
Oil pressure drop	Low engine oil level Faulty oil pressure switch Clogged oil filter Worn oil pump gears or cover Thin or diluted engine oil Oil relief valve stuck (open) Excessive bearing clearance	Check engine oil level Replace Replace Replace Change and determine cause Repair Replace
High oil pressure	Oil relief valve stuck (closed)	Repair

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Fig. 5: Troubleshooting chart (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

Symptom	Probable cause	Remedy
Excessive engine rolling and vibration	Loose engine roll stopper (front, rear) Loose transaxle mount bracket Loose engine mount bracket Loose center member Broken transaxle mount insulator Broken engine mount insulator Broken engine roll stopper insulator	Re-tighten Re-tighten Re-tighten Re-tighten Replace Replace Replace
Low coolant level	Leakage of coolant Damaged radiator core joint Corroded or cracked hoses (Radiator hose, heater hose, etc) Faulty radiator cap valve or setting of spring Faulty thermostat Faulty engine coolant pump	Replace Replace Replace Replace Replace
Clogged radiator	Foreign material in coolant	Replace
Abnormally high coolant temperature	Faulty thermostat Faulty radiator cap Restriction of flow in cooling system Loose or missing drive belt Faulty engine coolant pump Faulty temperature gauge or wiring Faulty electric fan Faulty thermo-sensor on radiator Insufficient coolant	Replace parts Replace Replace Adjust or replace Replace Repair or replace Repair or replace Replace Refill coolant
Abnormally low coolant temperature	Faulty thermostat Faulty temperature gauge or wiring	Replace Repair or replace
Leakage from oil cooling system	Loose hose and pipe connection Blocked or collapsed hose and pipe	Replace Repair or replace
Inoperative electrical cooling fan	Damaged	Replace or repair
Exhaust gas leakage	Loose connections Broken pipe or muffler	Re-tighten Repair or replace
Abnormal noise	Detached baffle plate in muffler Broken rubber hanger Pipe or muffler contacting vehicle body Broken pipe or muffler	Replace Replace Correct Repair or replace

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Fig. 6: Troubleshooting chart (2 Of 2)

Courtesy of HYUNDAI MOTOR CO.

CHECKING ENGINE OIL

1. Position a vehicle on a level surface.
2. Turn off the engine.

NOTE: In the case of a vehicle that has not been used for a prolonged period, run the engine for several minutes. Turn off the engine and wait for 5 minutes at least, then check the oil level.

3. 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.

NOTE: When refilling, use the proper grade of engine oil.

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

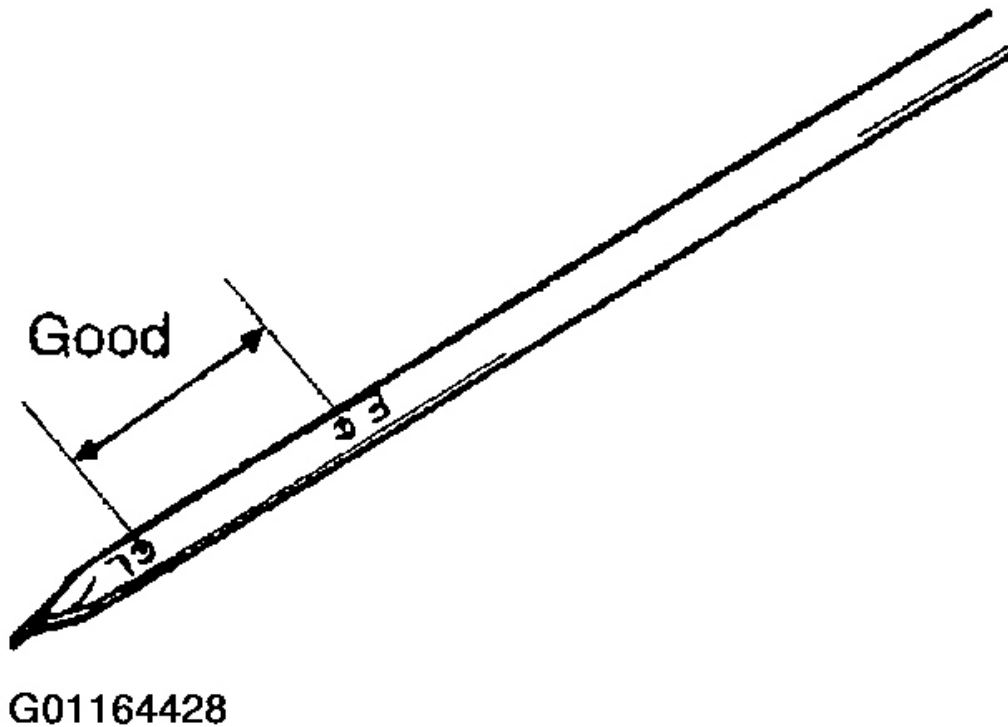
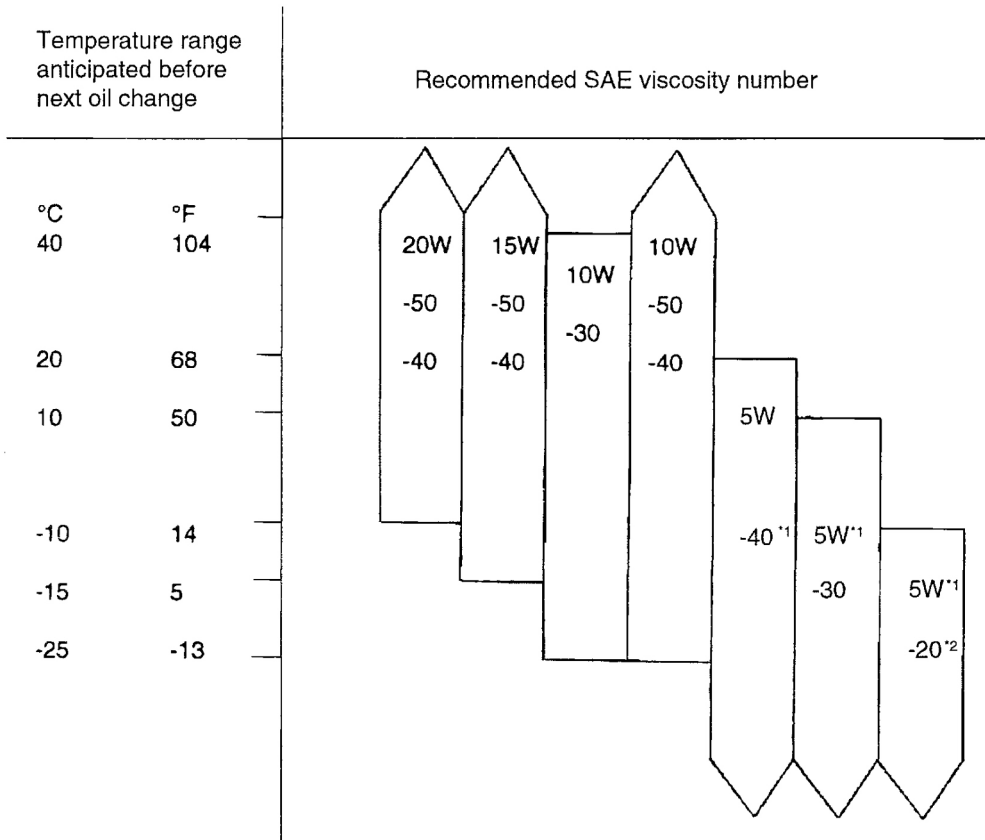


Fig. 7: Locating Engine Oil Indicator Range On Dipstick
Courtesy of HYUNDAI MOTOR CO.

SELECTION OF ENGINE OIL

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

Recommended SAE viscosity grades:



*1 Restricted by driving condition and environment.

*2 Not recommended for sustained high speed vehicle operation

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Fig. 8: Recommended SAE Viscosity Grades
Courtesy of HYUNDAI MOTOR CO.

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

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

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

CHANGE ENGINE OIL

1. Run the engine until it reaches normal operating temperature.
2. Turn off the engine.
3. Remove the oil filler cap and oil filter and then drain plug.

Drain the engine oil.

4. Tighten the drain plug to the specified torque.

Tightening torque

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

NOTE: Whenever tightening the oil drain plug, use a new drain plug gasket.

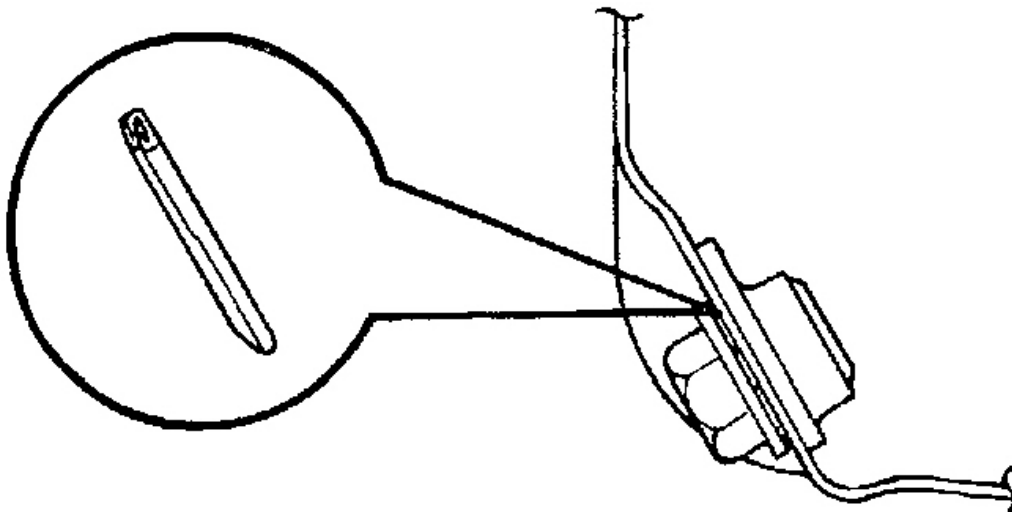
5. Fill the new engine oil through the oil filler cap.

Drain and Refill

Oil quantity: 4.3 lit (4.5 U.S. qts., 3.8 Imp. qts.)

NOTE: Do not over fill. 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.



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Fig. 9: Identifying Oil Filler Cap

Courtesy of HYUNDAI MOTOR CO.

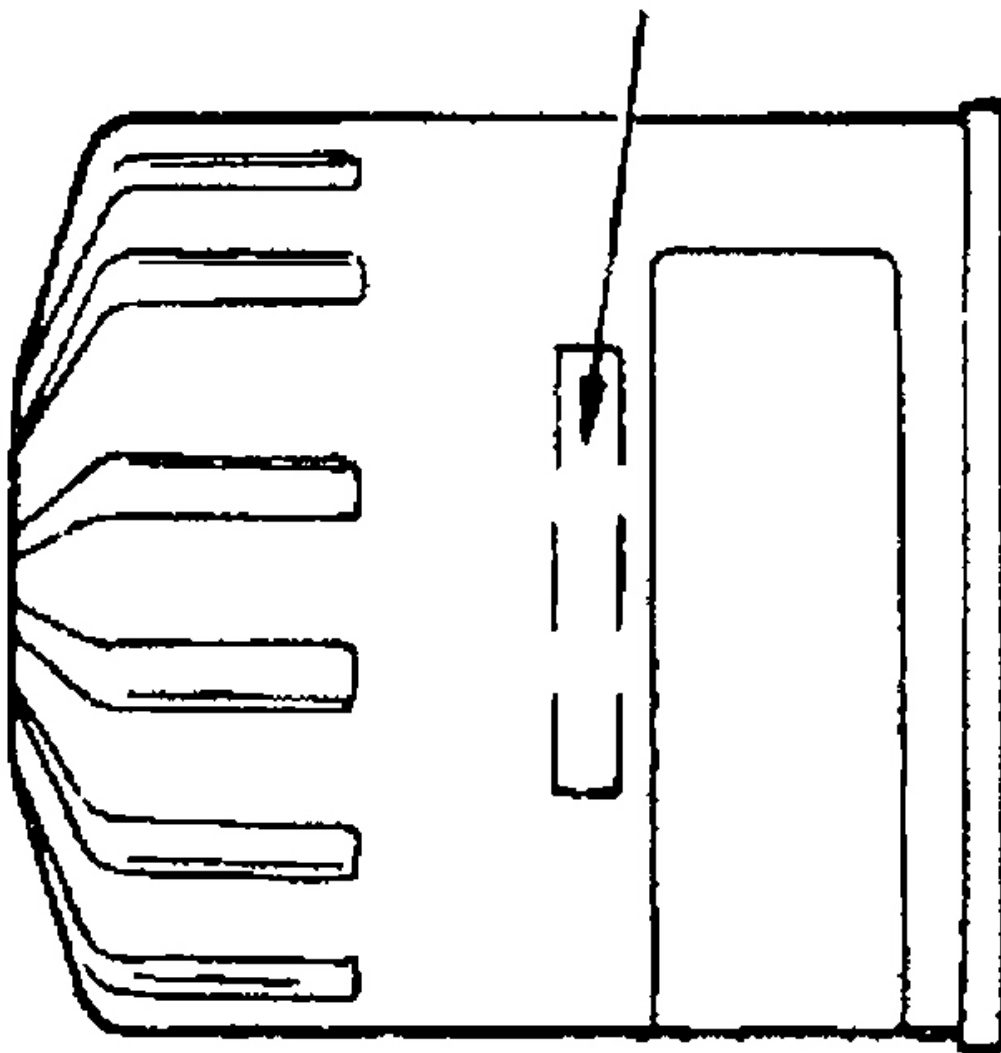
REPLACEMENT OIL FILTER

FILTER SELECTION

All Hyundai Motor Company engines are equipped with a high quality, disposable oil filter. This filter is recommended as a replacement filter for all vehicles. The quality of after market replacement filters is various considerably.

High quality of replacement 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 a new filter.

Part number



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

PROCEDURE FOR REPLACING OIL FILTER

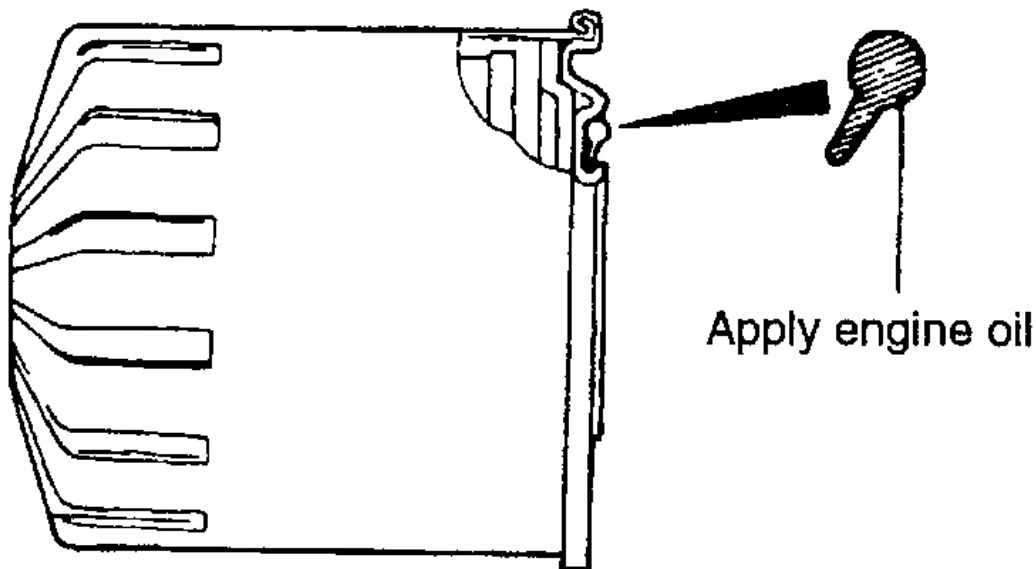
1. Use a filter wrench to remove the oil filter.

2. Before installing a new oil filter on the engine, apply clean engine oil to the surface of the rubber gasket.
3. Tighten the oil filter of the specified torque.

Tightening torque

Oil filter: 17 - 25 Nm (170 - 250 kg.cm, 12 - 18 lb.ft)

4. Start and run the engine and check engine oil leaks.
5. After stopping the engine, check the oil level and add oil as necessary.



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Fig. 11: Applying Clean Engine Oil To Oil Filter Rubber Gasket
Courtesy of HYUNDAI MOTOR CO.

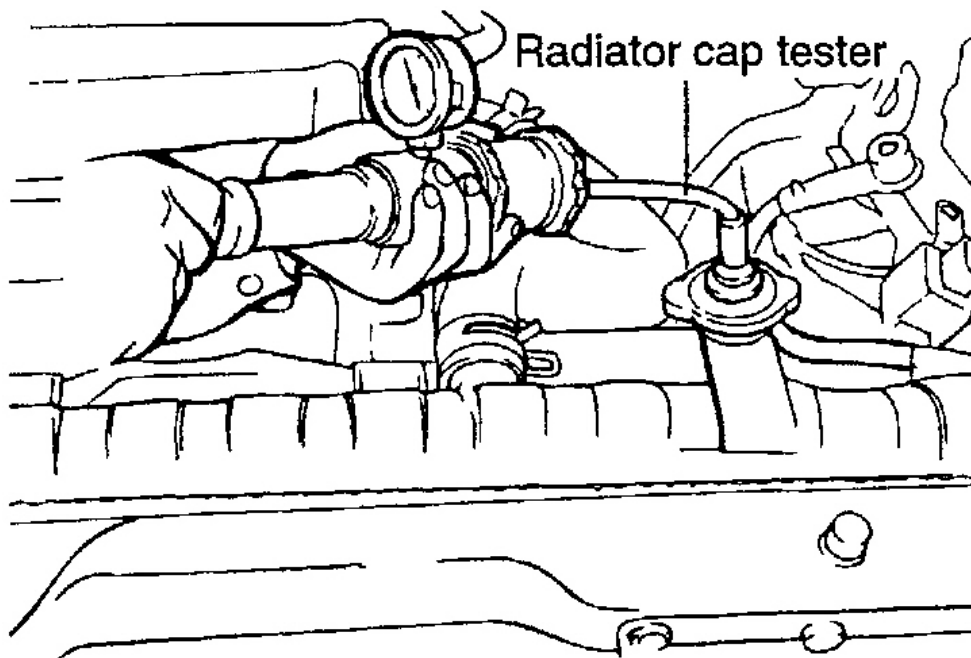
CHECKING COOLANT LEAK CHECK

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 150 KPa (21psi, 1.53 kg/cm²) pressure. Hold for two minutes, then check for leakage from the radiator, hoses or connections.

CAUTION: 1. Radiator coolant may be extremely hot. Do not open the system while hot, or scalding engine coolant could gush out, causing

personal injury. Allow the vehicle to cool before servicing this system.

2. When the tester is removed, be careful not to spill any coolant from it.
 3. Be sure to clean away completely any coolant from the area.
 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.



G01164433

Fig. 12: 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 indicator of the gauge stops moving.

Main valve opening pressure:

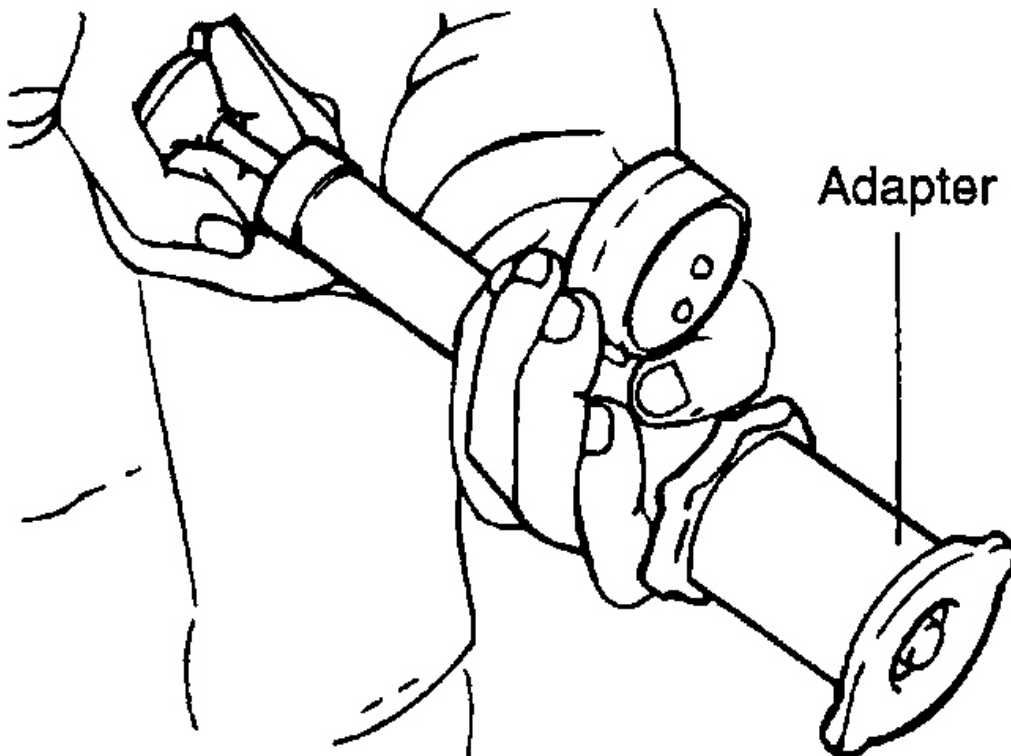
107.9 +/- 14.7 kPa (1.1 +/- 0.15 kg/cm² , 15.64 +/- 2.13 psi)

Main valve closing pressure:

83.4 kPa (0.85 kg/cm² , 12.1 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.

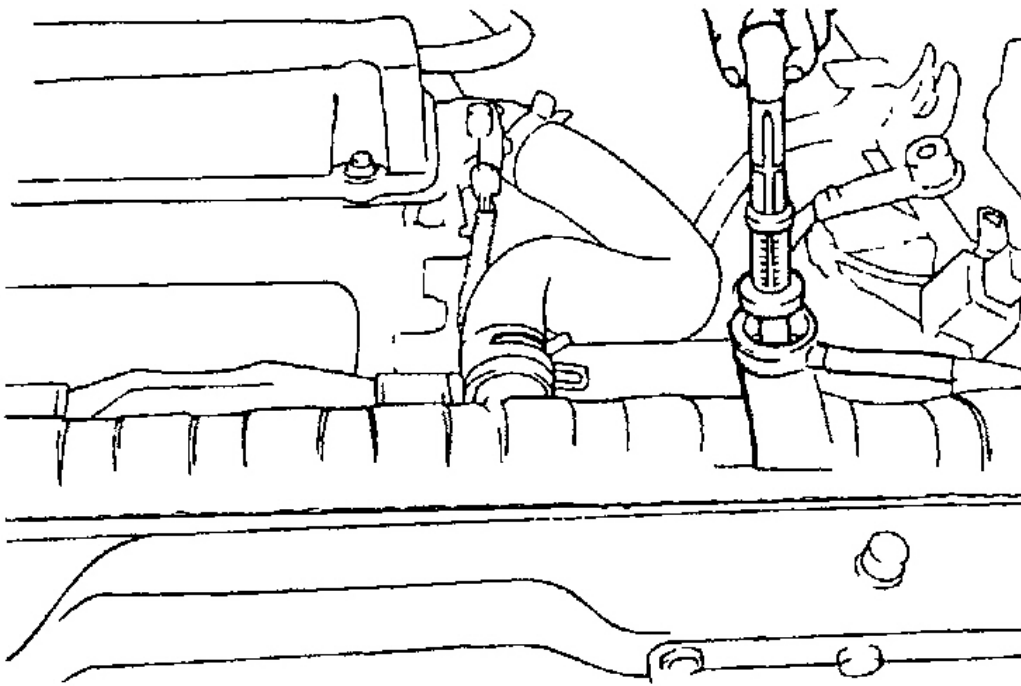


G01164434

Fig. 13: Using Adapter To Attach Radiator Cap To Tester
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. Use the following table for reference.



G01164435

Fig. 14: Measuring Specific Gravity Of Coolant
Courtesy of HYUNDAI MOTOR CO.

RELATION BETWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY

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

G01164436

Fig. 15: Relation Between Coolant Concentration And 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 property will be adversely affected.
- If the concentration is above 60%, the 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 mix types of anti - freeze.

RECOMMENDED COOLANT

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

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Fig. 16: Recommended Coolant
 Courtesy of HYUNDAI MOTOR CO.

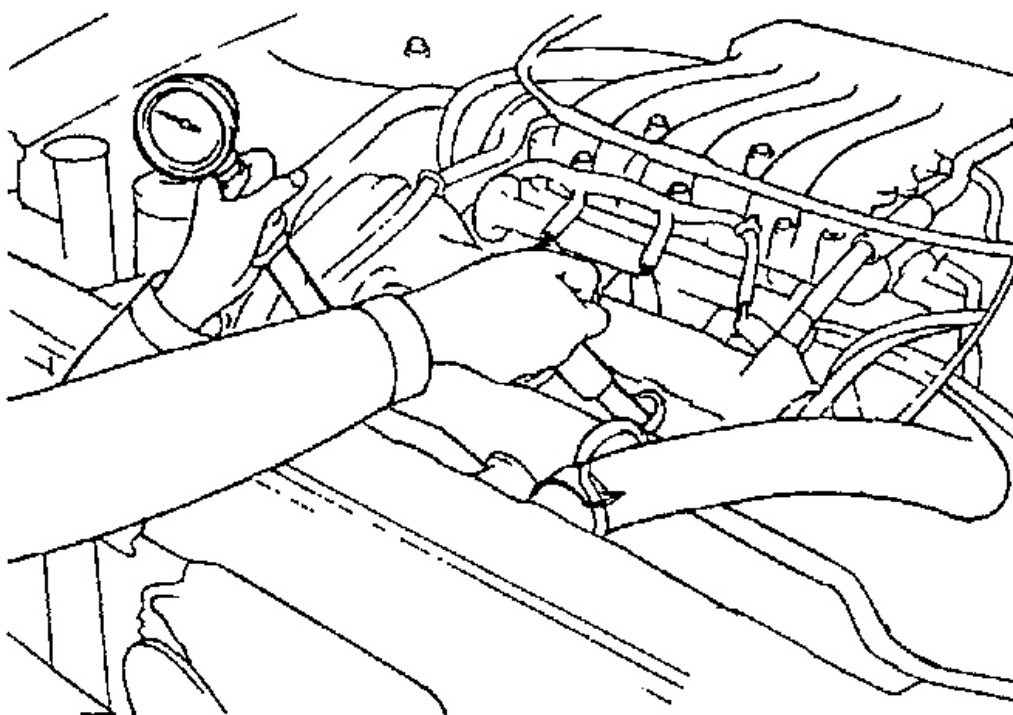
CHECKING COMPRESSION PRESSURE

1. Before checking the 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 the engine coolant temperature reaches 80-95°C (176~205°F).
3. Stop the 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: 1,200kpa(12.2 kg/cm² , 170psi)

Limit: 1,050kpa(10.7kg/cm² , 149psi)



G01164438

Fig. 17: Removing Spark Plugs
Courtesy of HYUNDAI MOTOR CO.

9. Repeat steps 6 to 8 for all cylinders, making sure that the pressure difference for each of the cylinders is within the specified limit.

Limit:

Max. 100kpa (1.0 kg/cm² , 14psi) 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 causes the compression to rise, it is possible that the piston ring is be worn.
 2. If the compression remains the same, valve seizure, poor valve seating or a compression leak in the cylinder head gasket are all possible causes.

Tightening torque

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

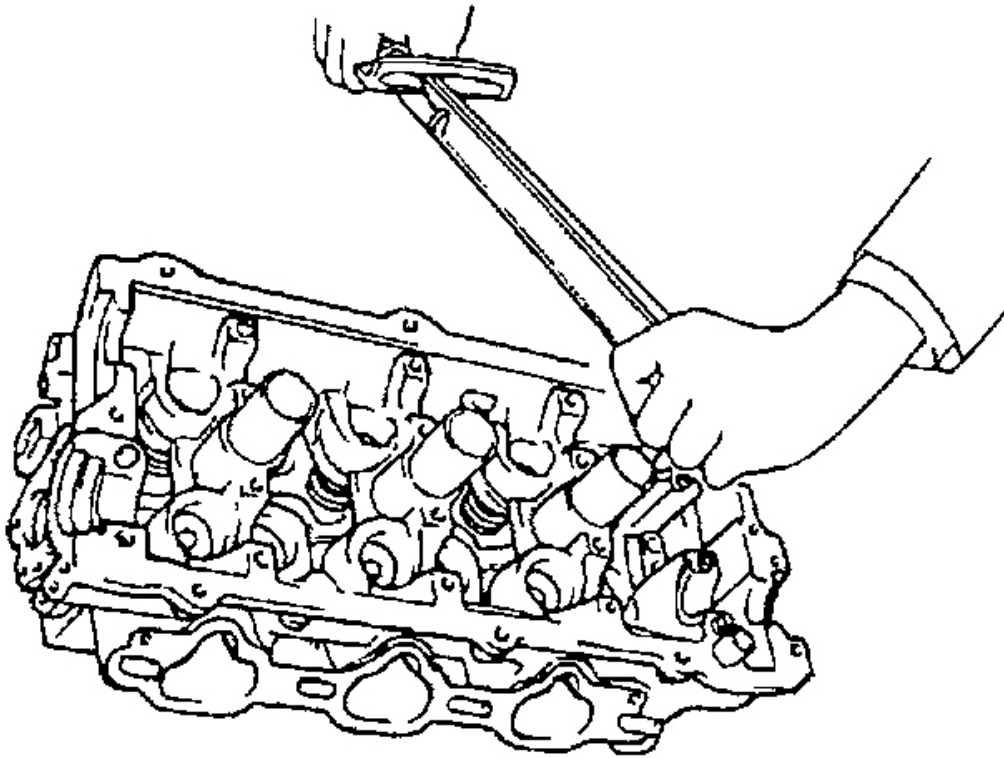
TIGHTENING CYLINDER HEAD BOLTS

1. First loosen slightly and then tighten to the specified torque.

Tightening torque

Cylinder head bolts cold [Engine temperature approximately 20°C (68°F)]:

105 - 115 Nm (1050 - 1150 kg.cm, 75 - 82 lb ft.)

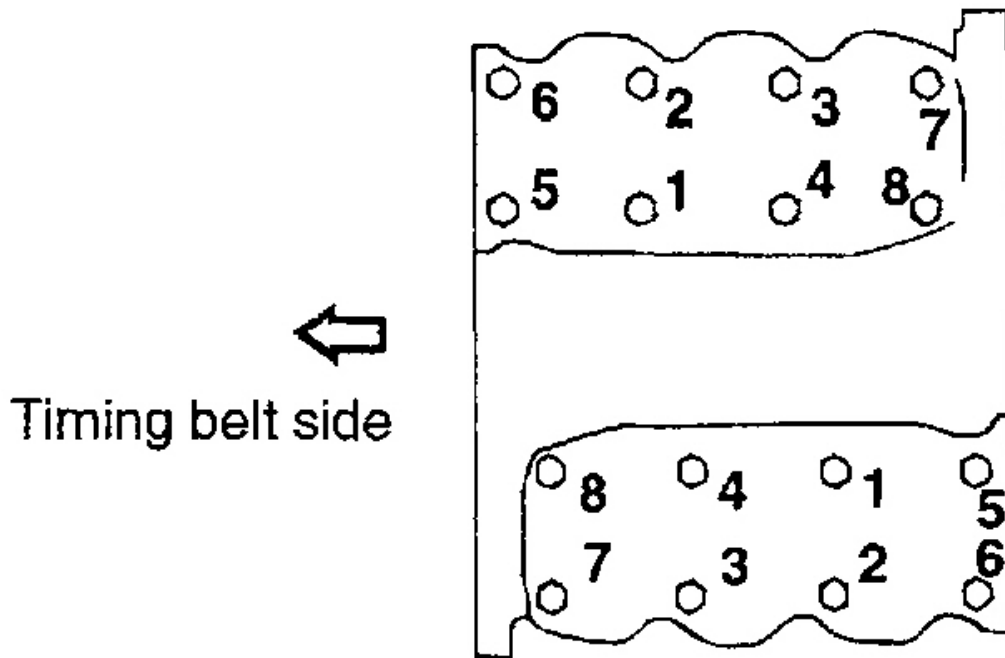


G01164439

Fig. 18: Tightening Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

2. Be sure to follow the specific torque sequence as shown in the illustration.

NOTE: Run the engine to normal operating temperature and let it cool, then re-torque the bolts to specifications.



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Fig. 19: Tightening Sequence Of Cylinder Head Bolts

Courtesy of HYUNDAI MOTOR CO.

ADJUSTING VALVE CLEARANCE

As the intake and exhaust valves are equipped with hydraulic lash adjusters, there is no need to adjust the valve clearance. The proper function of the hydraulic lash mechanism may be determined by checking for tappet noise. When there is a tappet noise or any unusual noise, check the hydraulic lash adjuster by removing and bleeding or replacing it.

ADJUSTING DRIVE BELT AND TENSIONER

1. Hang the belt on the pulley of the tensioner and install the tensioner.

(If the tensioner is already installed, loosen its mounting bolts to allow belt installation.)

Tightening torque

Tensioner assembly bolt:

45 - 50 Nm (450 - 500 kg.cm, 33 - 36 lb.ft)

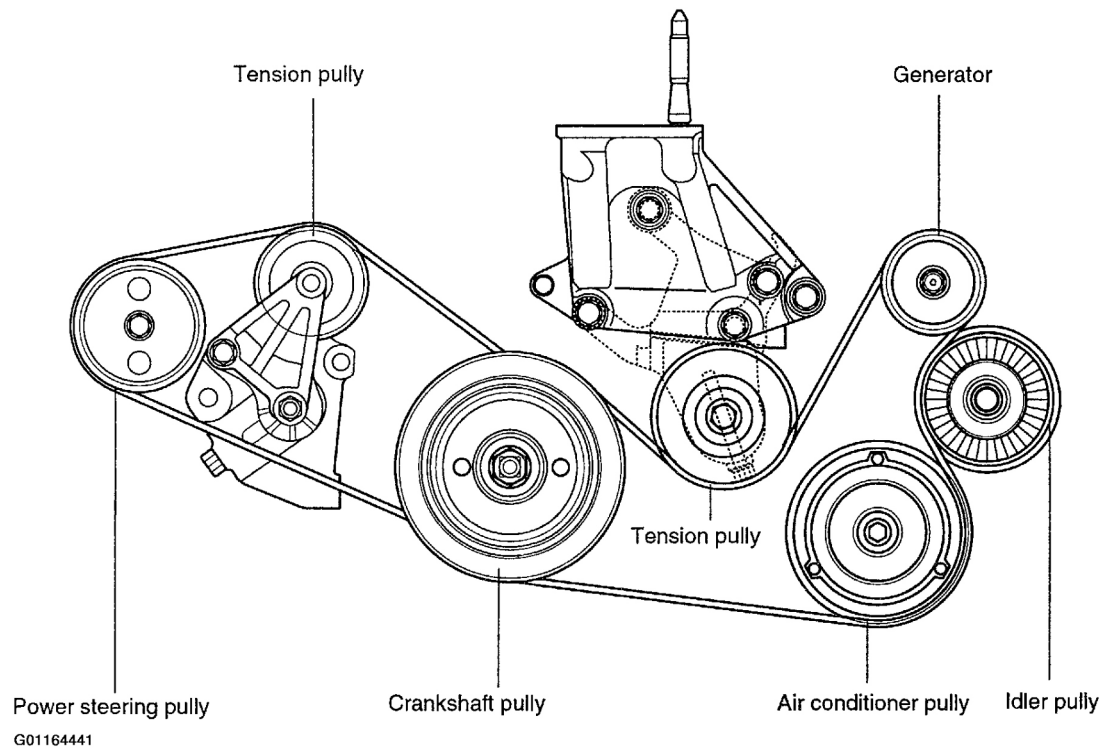
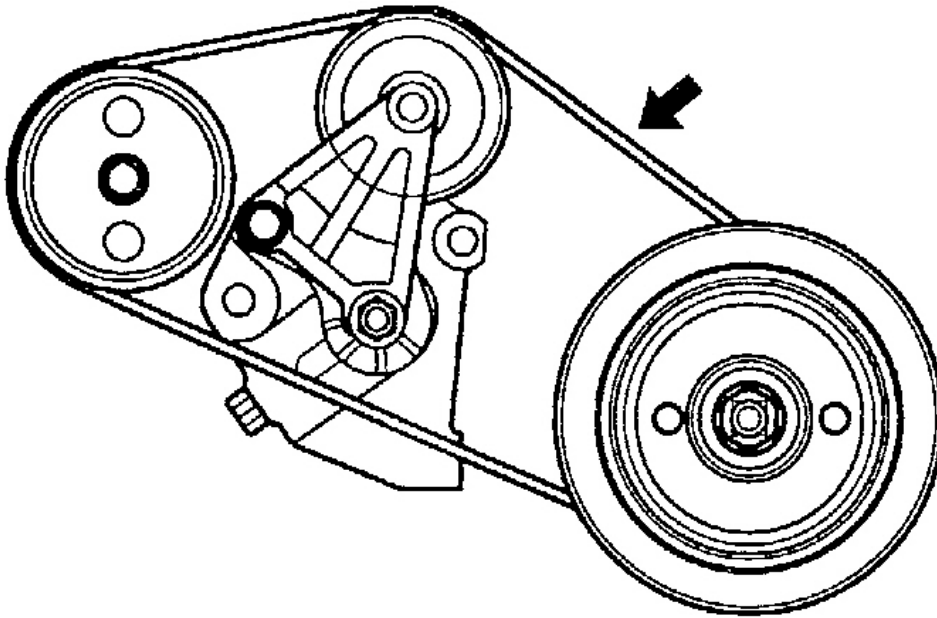


Fig. 20: Identifying Drive Belt & Tensioner
Courtesy of HYUNDAI MOTOR CO.

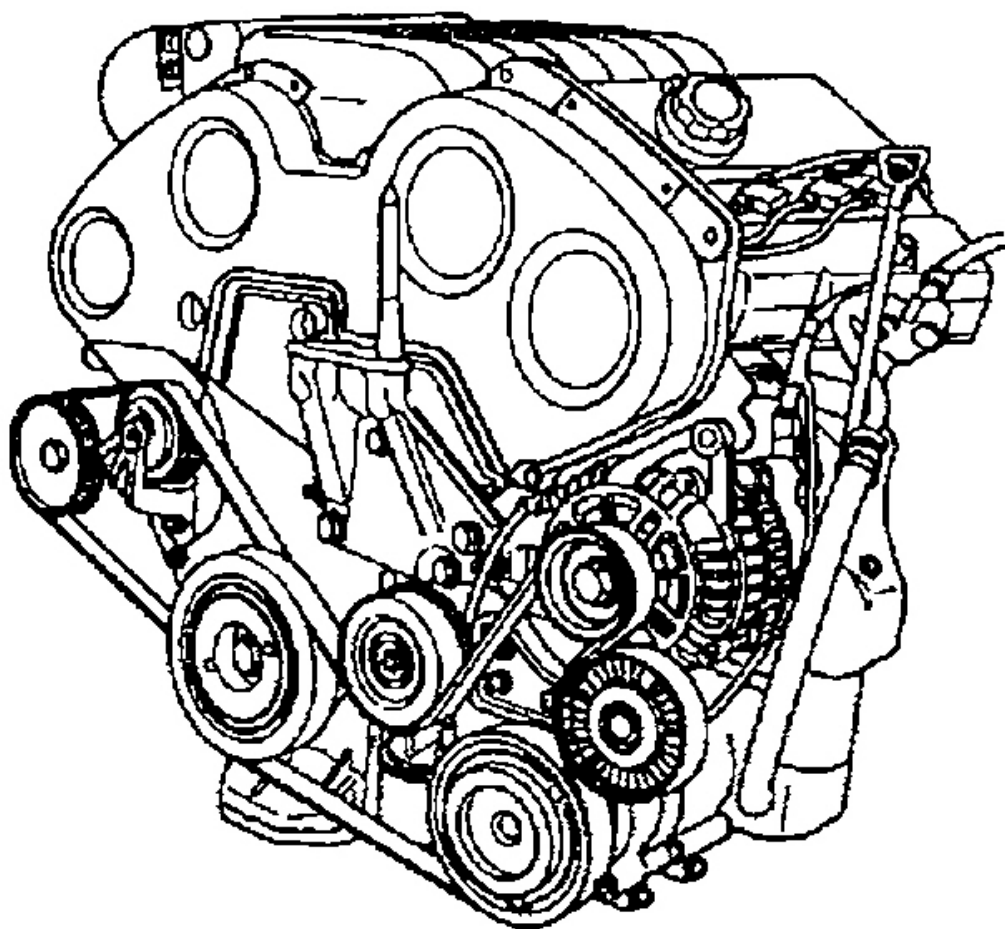
2. Install power steering belt.



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Fig. 21: Identifying Power Steering Belt
Courtesy of HYUNDAI MOTOR CO.

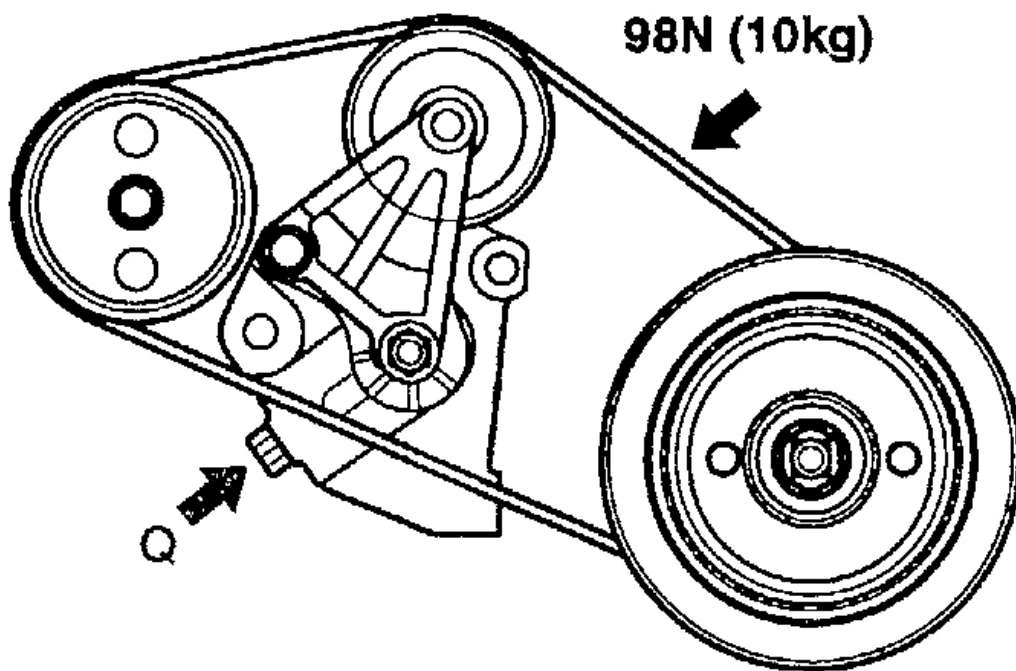
3. Install drive belt.



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Fig. 22: Identifying Drive Belt
Courtesy of HYUNDAI MOTOR CO.

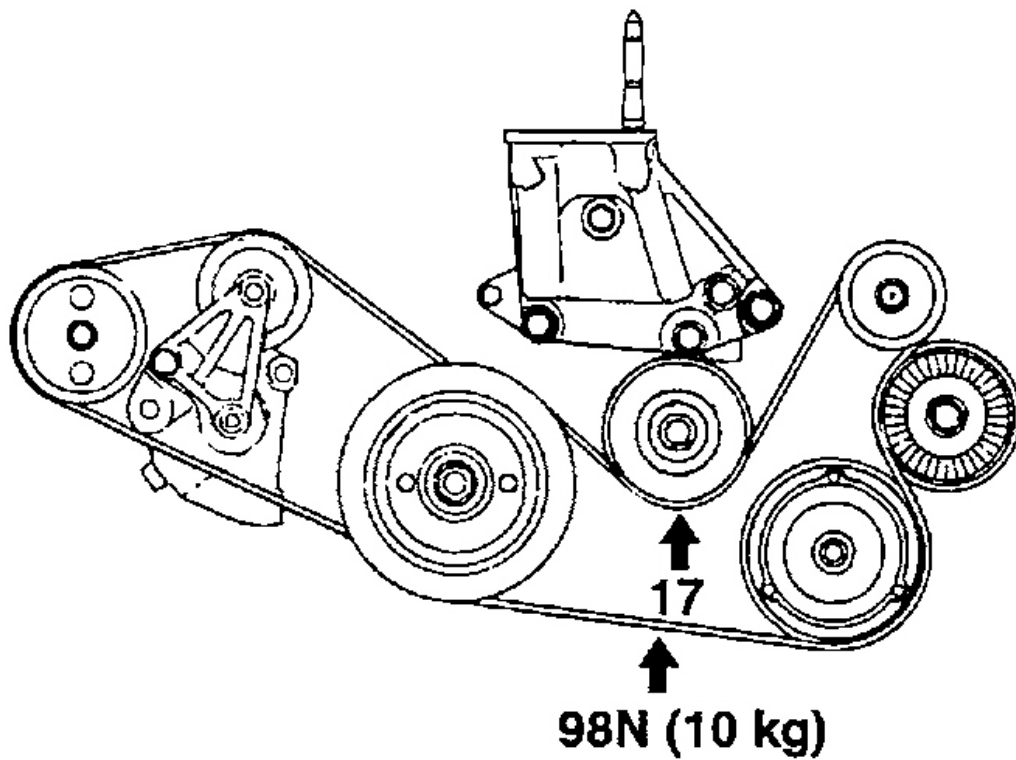
4. Adjust the power steering belt tension to specification by turning the adjusting bolt (Q) clockwise or counter-clockwise



G01164444

Fig. 23: Adjusting Power Steering Belt Tension
Courtesy of HYUNDAI MOTOR CO.

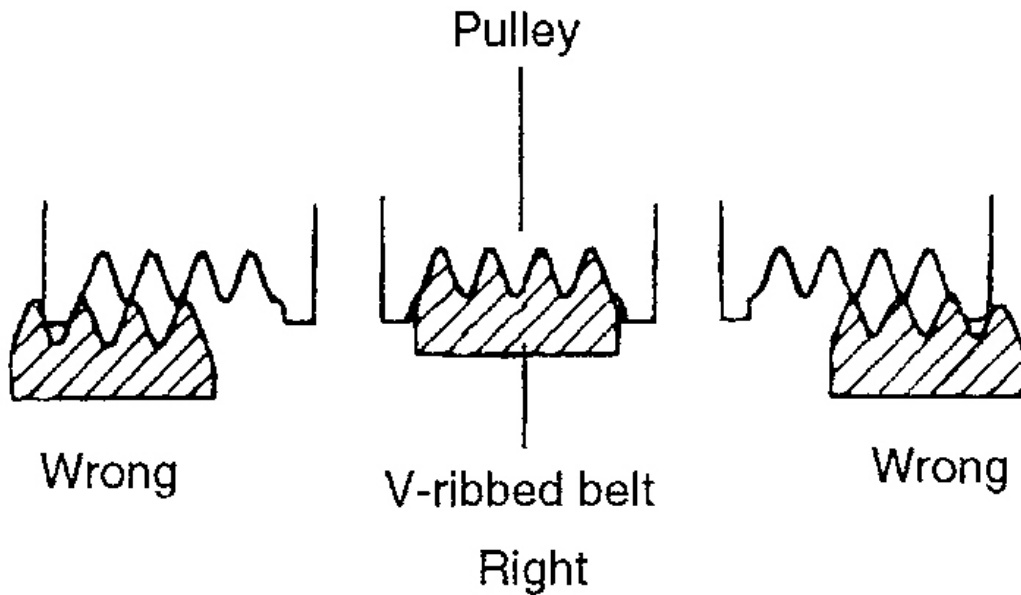
5. Adjust the drive belt tension to specification by turning the adjusting bolt (Q) clockwise or counterclockwise.



G01164445

Fig. 24: Adjusting Drive Belt Tension
Courtesy of HYUNDAI MOTOR CO.

6. When installing the belt on the pulley, make sure it is centered on the pulley.



G01164446

Fig. 25: Verifying Proper Installation Of Drive Belt
Courtesy of HYUNDAI MOTOR CO.

ENGINE BLOCK

CYLINDER BLOCK

REMOVAL

Remove the timing belt, cylinder head assembly, drive plate, transaxle mounting plate, oil pan and oil pump case.

INSPECTION

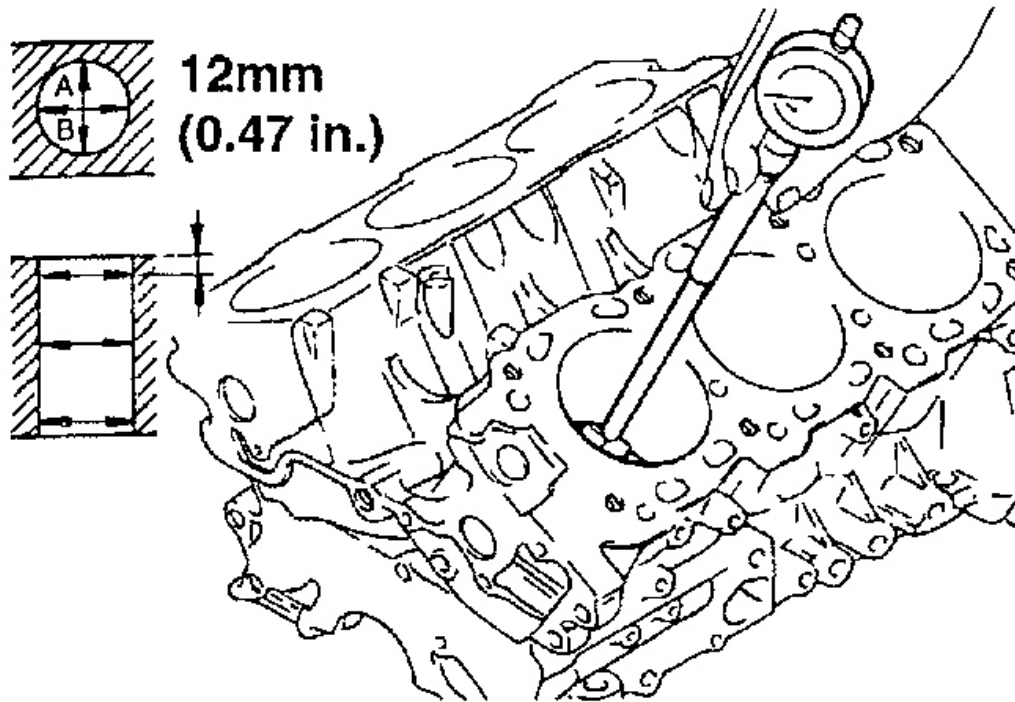
CYLINDER BLOCK

1. Check the cylinder block for scores, rust and corrosion. Also check for cracks or any other defects. Replace the block if defective.
2. Measure the cylinder bore with a cylinder gauge at the three levels indicated, in the directions A and B.

Level 1: No. 1 piston ring position at TDC

Level 2: Center of cylinder

Level 3: Bottom of cylinder



G01164447

Fig. 26: Measuring Cylinder Bore Diameter
Courtesy of HYUNDAI MOTOR CO.

3. 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. New oversize pistons and rings should be installed.

Standard value

Cylinder bore: 93 - 93.03 mm (3.661 - 3.6625 in.)

Out-of-round and taper of cylinder bore:

Max. 0.02 mm (0.0008 in.)

4. If a ridge exists at the top of the cylinder, cut it off 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

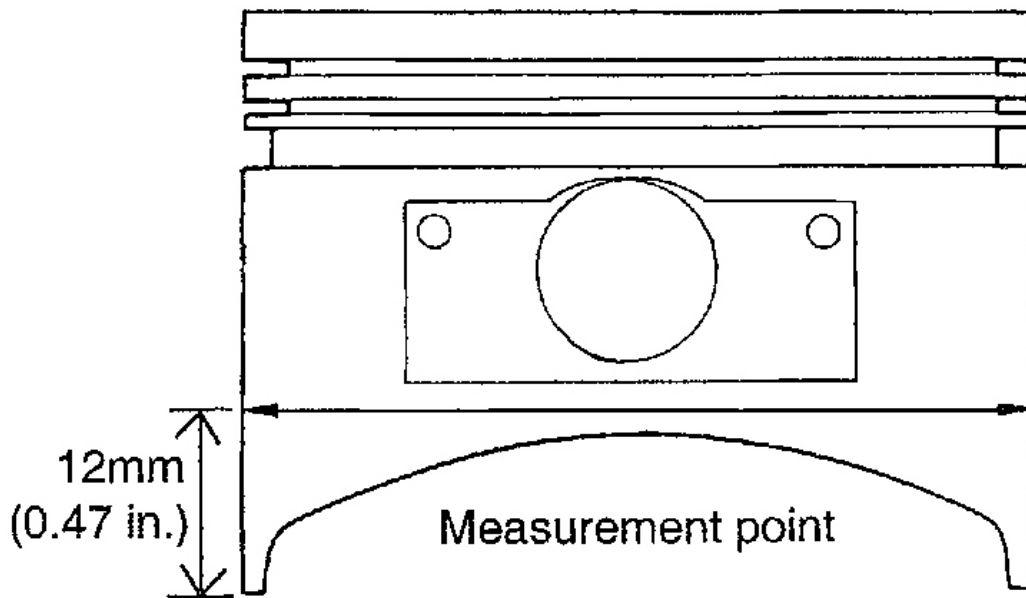
0.75 (0.030) O.S: 0.75

1.00 (0.040) O.S: 1.00

6. To rebore the cylinder bore to the oversize, maintain the specified clearance between the oversize piston and the bore and make sure that all used pistons are the same oversize. The standard measurement of the piston outside diameter is taken at a level of 12mm (0.47 in.) above the bottom of the piston skirt and across the thrust faces.

Piston-to-cylinder clearance:

0.03 - 0.05 mm (0.0012 - 0.0020 in.)



G01164448

Fig. 27: Measuring Piston To Cylinder Clearance
Courtesy of HYUNDAI MOTOR CO.

7. Check for damage or cracks in the cylinders.

8. Check the top surface of the cylinder block for flatness. If the top surface exceeds the limit, grind to the minimum limit or replace.

Standard value

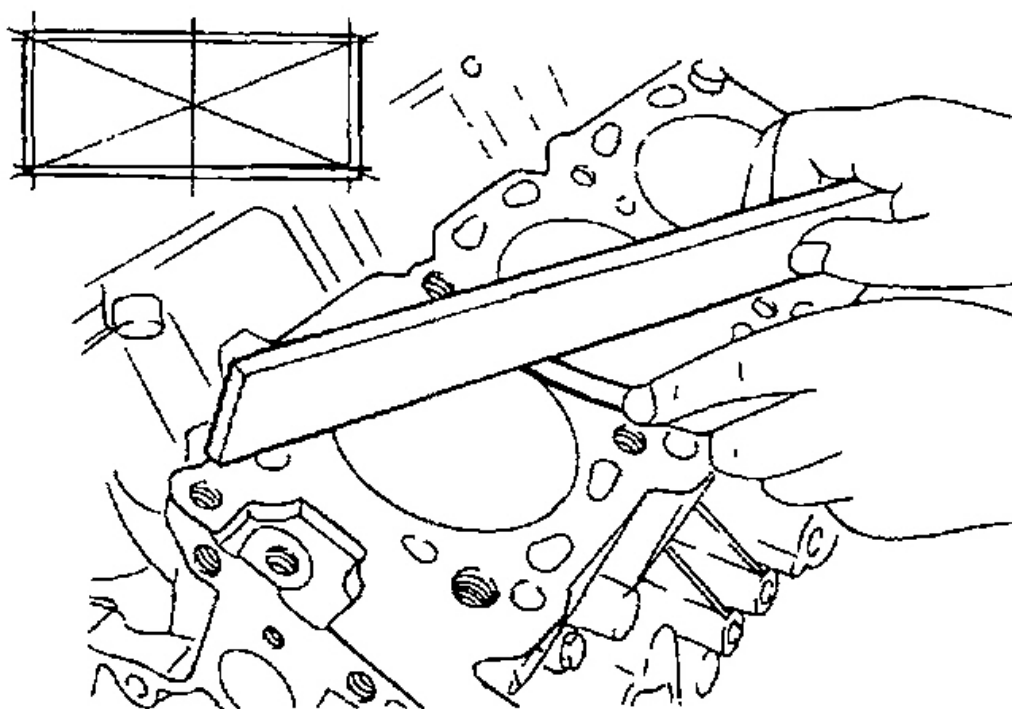
Flatness of gasket surface:

Max. 0.03 mm (0.0012 in.)

Service limit

Flatness of gasket surface: 0.05 mm (0.0020 in.)

CAUTION: When the cylinder head is assembled, grinding less than 0.2mm (0.008in.) is permissible.



G01164449

Fig. 28: Checking Top Surface Of Cylinder Block For Flatness
Courtesy of HYUNDAI MOTOR CO.

BORING CYLINDER

1. Oversize pistons should be selected according to the largest bore cylinder.

Identification Mark	Size
0.25	0.25 mm (0.010 in.)
0.50	0.50 mm (0.020 in.)
0.75	0.75 mm (0.030 in.)
1.00	1.00 mm (0.040 in.)

G01164450

Fig. 29: Selecting Oversize Pistons
Courtesy of HYUNDAI MOTOR CO.

NOTE: The size of piston is stamped on top of the piston.

2. Measure the outside diameter of the piston to be used.
3. According to the measured O.D., calculate the new bore size.

New bore size = Piston O.D + 0.01 to 0.03 mm (0.0004 to 0.0012 in.) (clearance between piston and cylinder) - 0.01 mm (0.0004 in.) (honing margin.)

4. Bore each of the cylinders to the calculated size.

CAUTION: To prevent distortion that may result from temperature rise during honing, bore the cylinder holes in the firing order.

5. Hone the cylinders, finishing them to the proper dimension (piston outside diameter + gap with cylinder).
6. Check the clearance between the piston and cylinder.

Standard: 0.03 - 0.05 mm (0.0012 - 0.0020 in.)

NOTE: When boring the cylinders, finish all of the cylinders to the same oversize. Do not bore only one cylinder to the oversize.

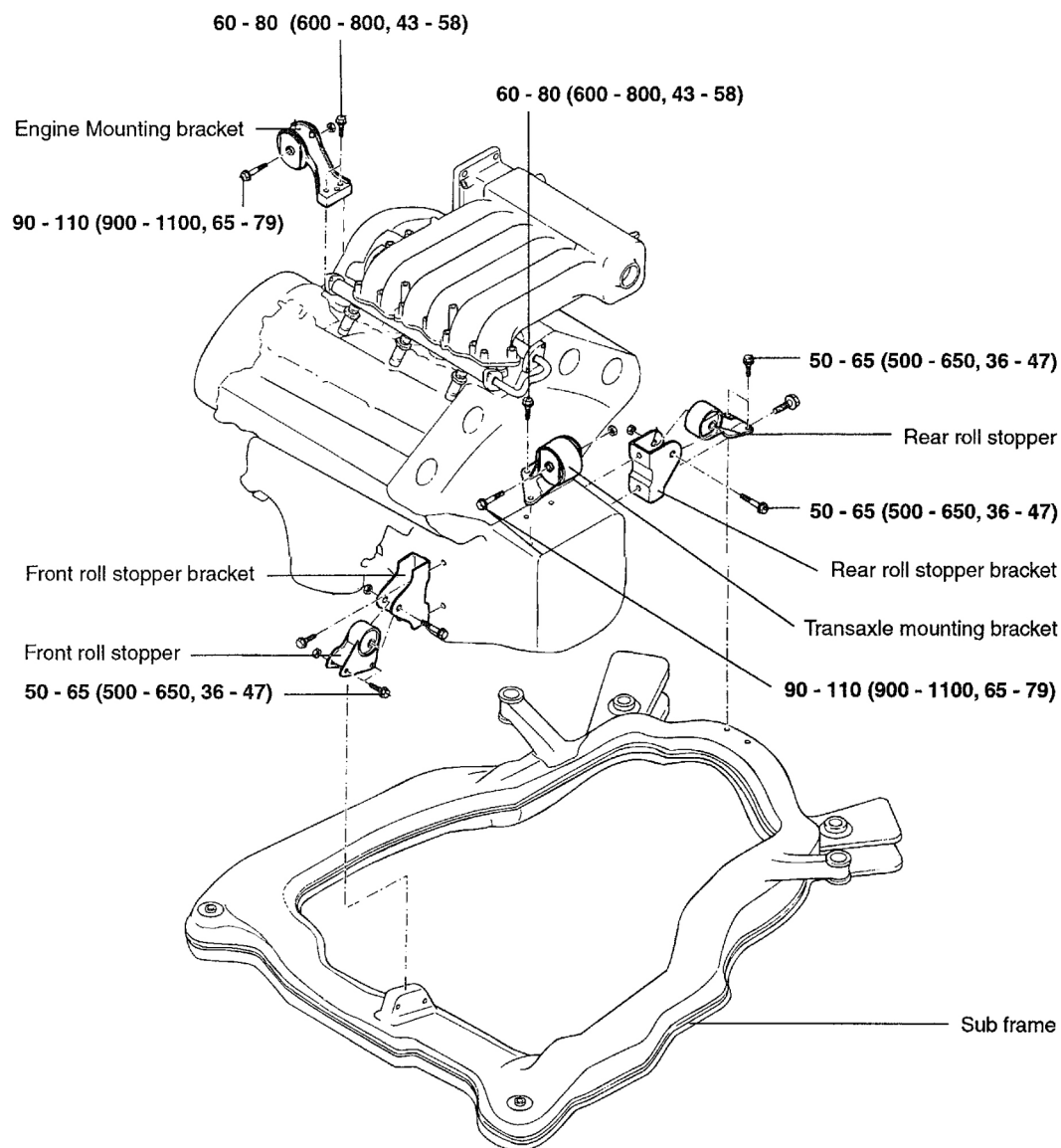
REASSEMBLY

Install the following parts by referring to their respective sections.

1. Crankshaft
2. Drive plate
3. Piston
4. Cylinder head
5. Timing belt
6. Oil pump case

ENGINE MOUNTS

COMPONENTS



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

G01164451

Fig. 30: Engine Mounts Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

Attach a cable or chain to the engine hooks, and then lift enough so that there is no pressure on the insulators.

ENGINE MOUNT

1. Remove the engine mount insulator bolts.

2. Remove the engine mount bracket from the engine.

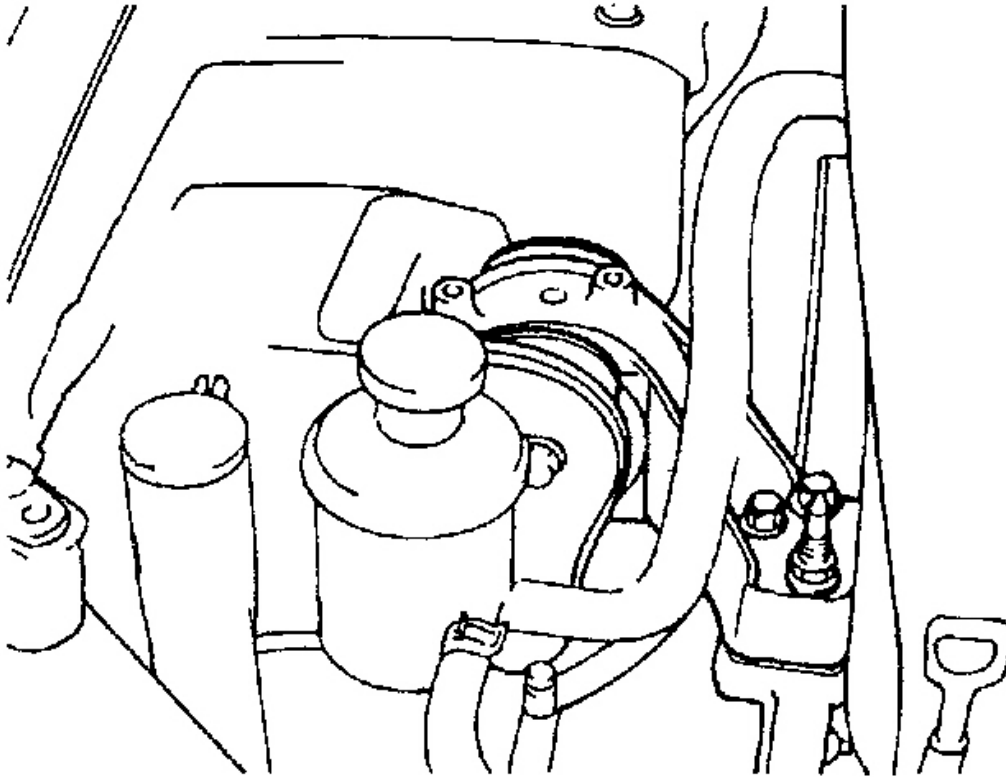
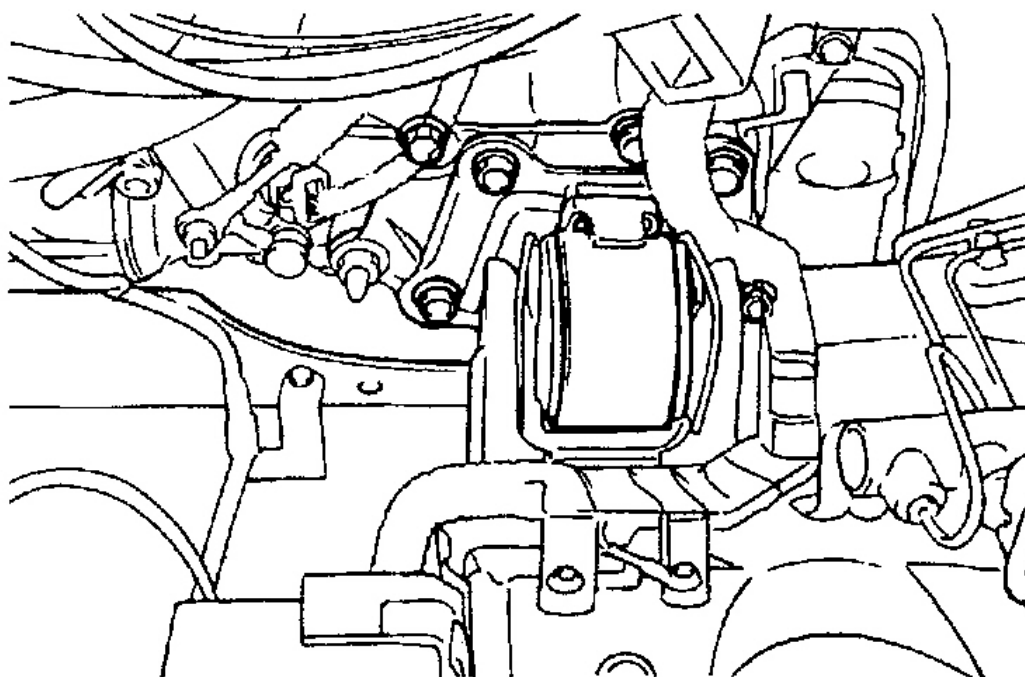
**G01164452**

Fig. 31: Identifying Engine Mount Bracket From Engine
Courtesy of HYUNDAI MOTOR CO.

TRANSAXLE MOUNTING

1. Remove the transaxle mounting bolt.
2. Remove the transaxle bracket.

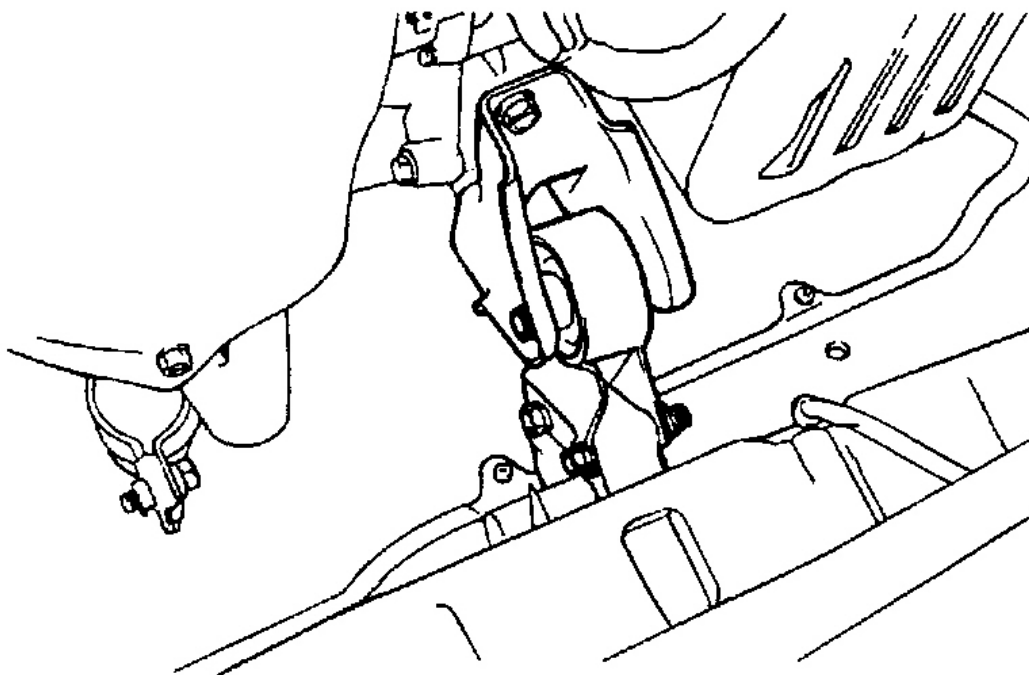


G01164453

Fig. 32: Identifying Transaxle Bracket
Courtesy of HYUNDAI MOTOR CO.

FRONT ROLL STOPPER

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

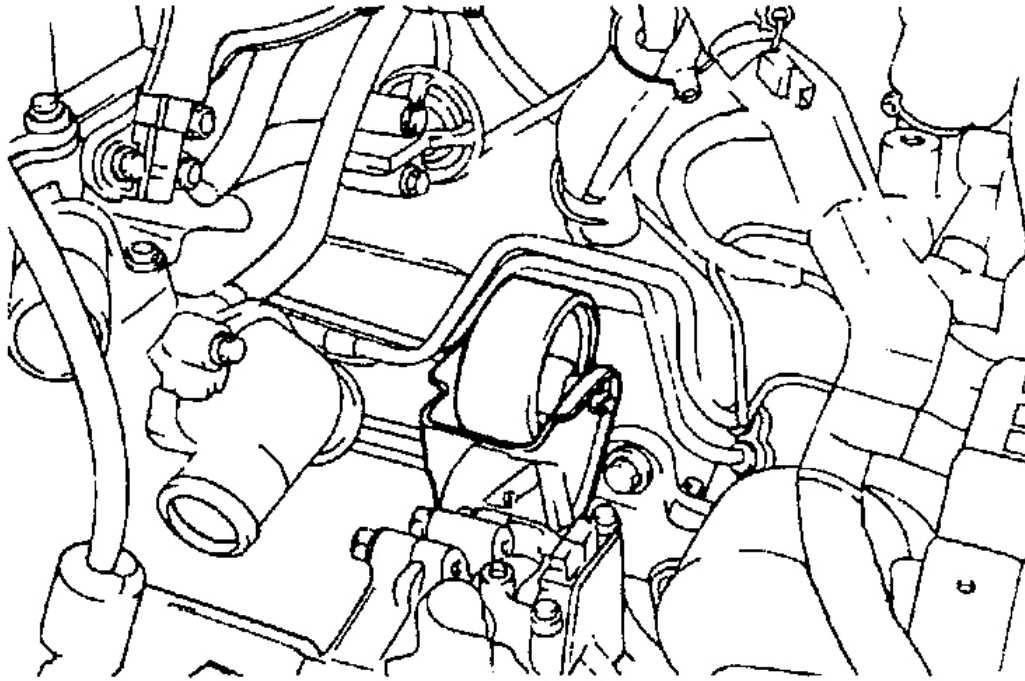


G01164454

Fig. 33: Identifying Front Roll Rod Assembly
Courtesy of HYUNDAI MOTOR CO.

REAR ROLL STOPPER

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

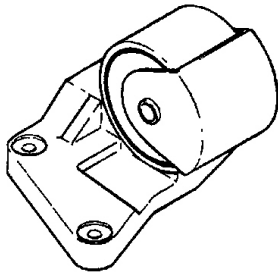


G01164455

Fig. 34: Identifying Rear Roll Stopper From Sub - Frame
Courtesy of HYUNDAI MOTOR CO.

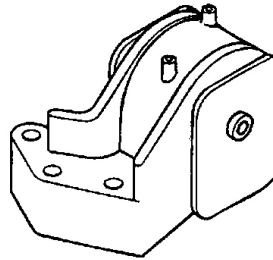
INSPECTION ITEMS

Transaxle mounting

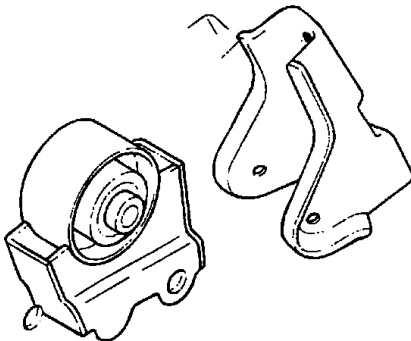


<5A/T>

Engine mounting



Front roll stopper assembly



G01164456

Rear roll stopper assembly

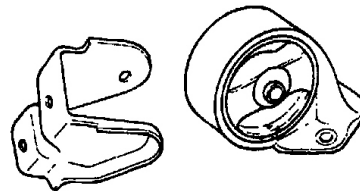
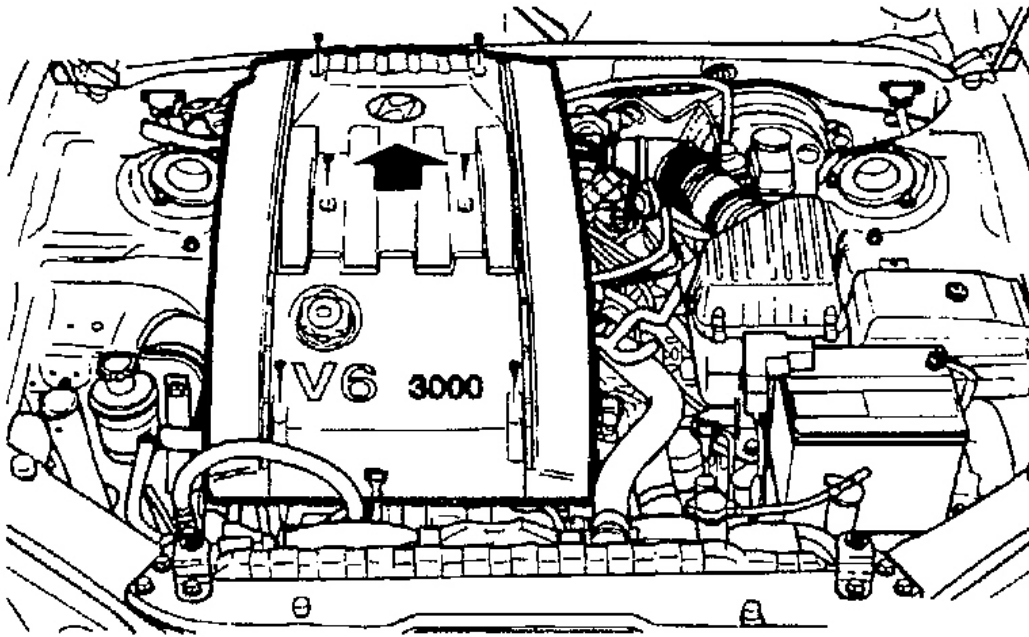


Fig. 35: Identifying Inspection Items
Courtesy of HYUNDAI MOTOR CO.

ENGINE AND TRANSAXLE ASSEMBLY

REMOVAL

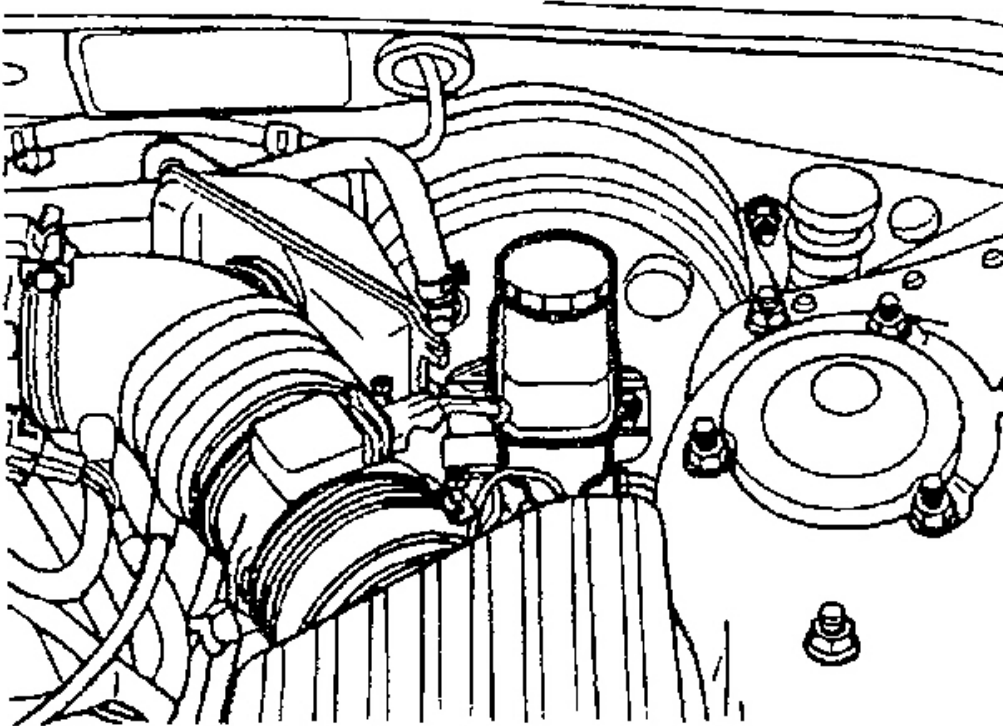
1. Remove the battery and engine cover.



G01164457

Fig. 36: Removing Battery & Engine Cover
Courtesy of HYUNDAI MOTOR CO.

2. Detach the air cleaner.



G01164458

Fig. 37: Detaching Air Cleaner
Courtesy of HYUNDAI MOTOR CO.

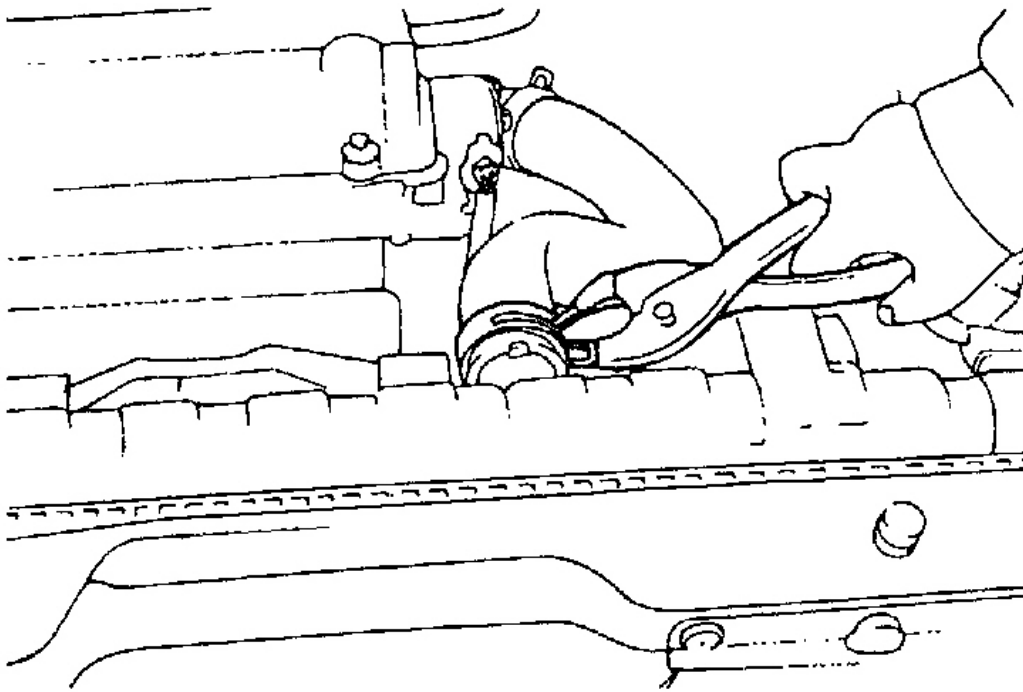
3. Disconnect the connectors from the engine harness.
 1. Alternator, starter
 2. Power steering switch connector, oil pressure gauge connector
 3. TPS connector
 4. Back up lamp switch connector
 5. A/T solenoid, inhibitor switch connector
 6. Coolant temperature
 7. Ignition coils, power TR connector
 8. Idle speed control valve (ISC) connector
 9. MAP and ATS connectors
 10. Oxygen sensor connector etc.
4. Drain the engine coolant.

5. Disconnect the transaxle oil cooler hoses (A/T).

NOTE: When disconnecting hoses, make identification marks to avoid making any mistake when installing them again.

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

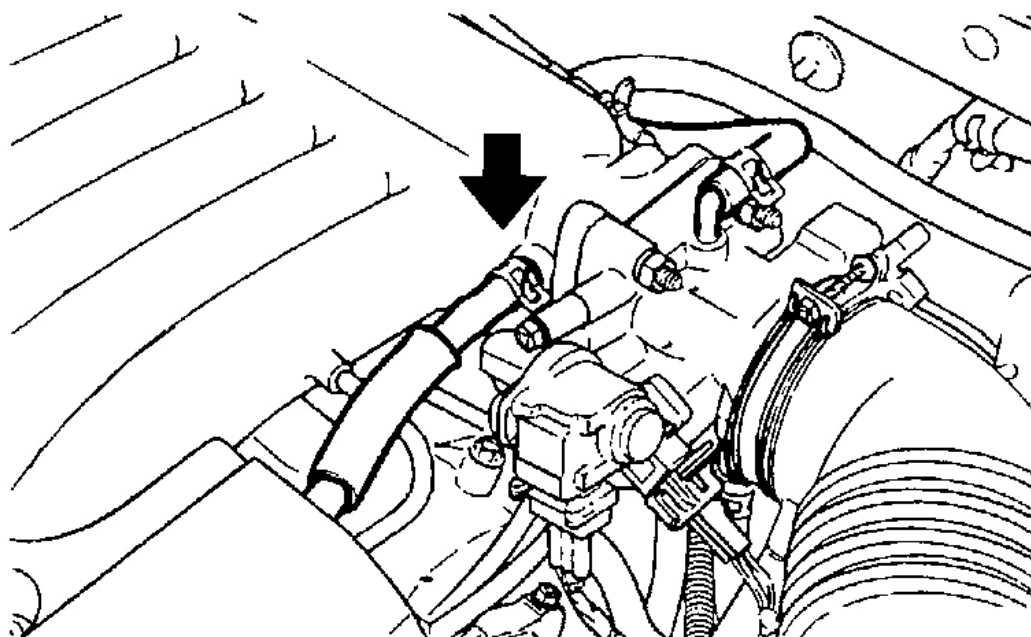
6. Disconnect the radiator upper and lower hoses on the engine side then remove the radiator assembly.



G01164459

Fig. 38: Disconnecting Radiator Upper & Lower Hoses
Courtesy of HYUNDAI MOTOR CO.

7. Disconnect the engine ground.
8. Disconnect the brake booster vacuum hose.



G01164460

Fig. 39: Disconnecting Brake Booster Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

9. Disconnect the heater hoses (inlet and outlet) on the engine side.

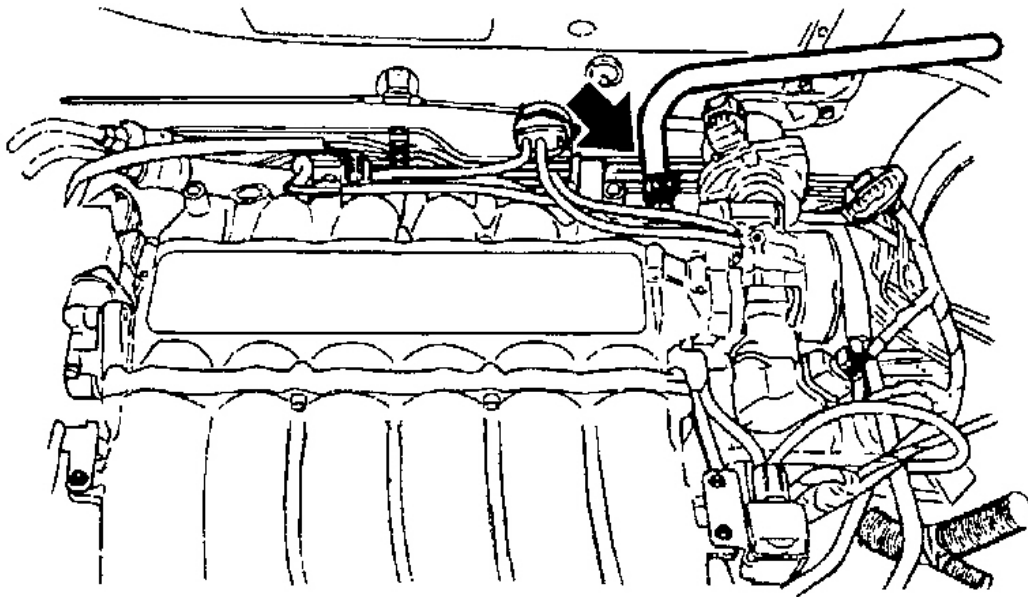
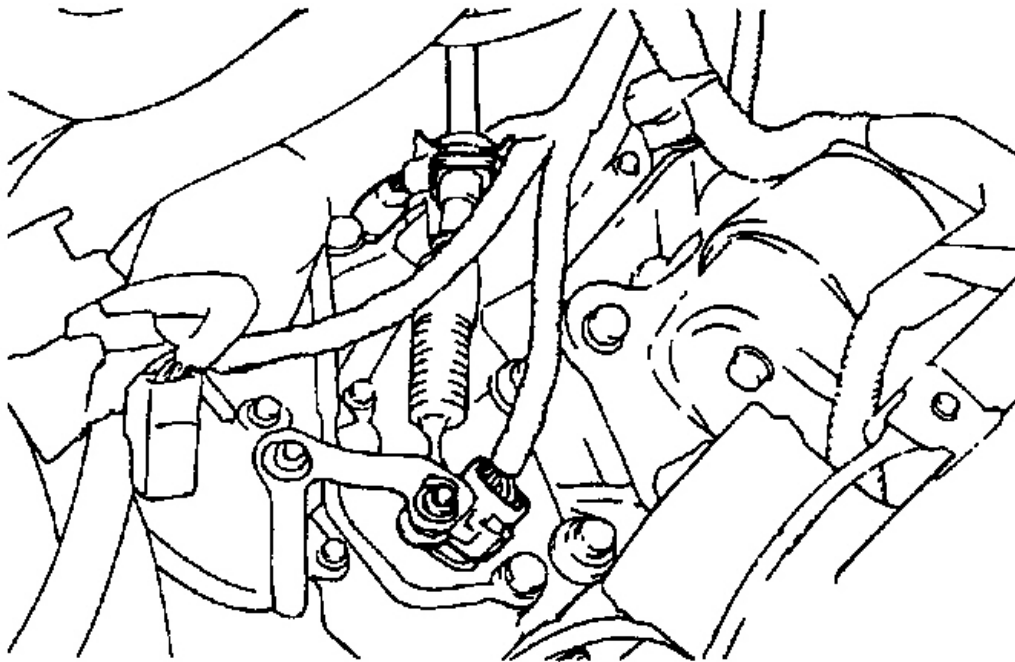
**G01164461**

Fig. 40: Disconnecting Vacuum Hose Connections
Courtesy of HYUNDAI MOTOR CO.

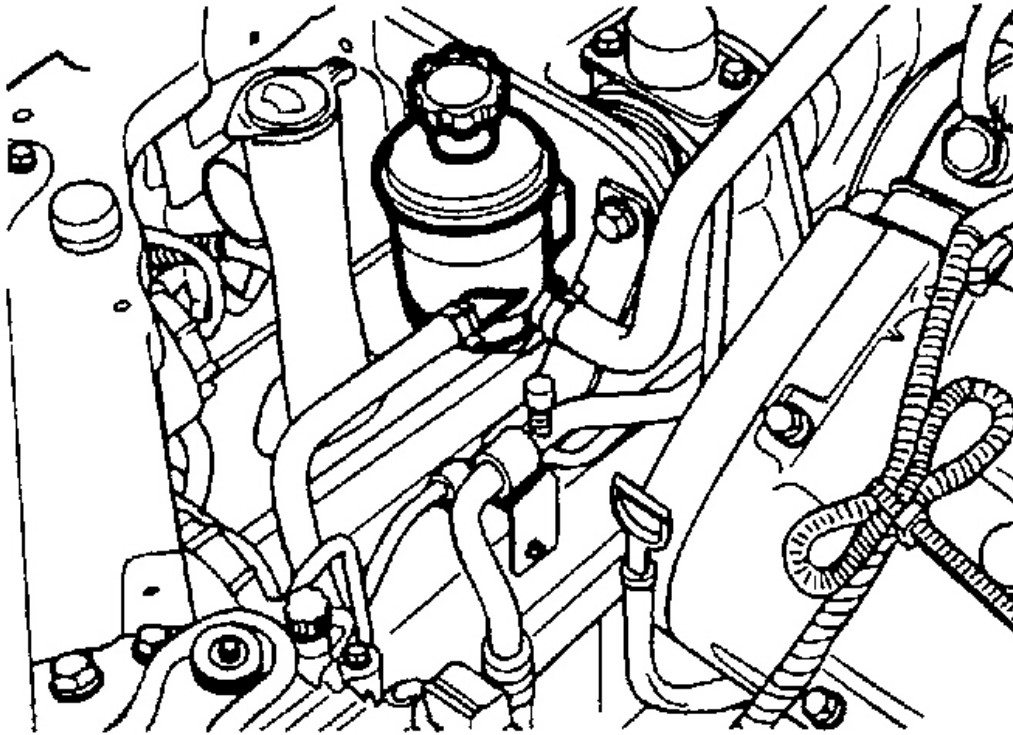
10. Disconnect the accelerator cable and cruise control cable at the engine side.
11. Using a special tool, remove the main fuel line (supply and return) at the delivery pipe.
12. Disconnect the speedometer cable from the transaxle.
13. Disconnect the clutch cable or control cable from the transaxle.



G01164462

Fig. 41: Disconnecting Clutch Cable Or Control Cable From Transaxle
Courtesy of HYUNDAI MOTOR CO.

14. Remove the power steering hose from the oil pump.



G01164463

Fig. 42: Removing Power Steering Hose From Oil Pump

Courtesy of HYUNDAI MOTOR CO.

15. Detach the steering dust cover in the engine compartment and then disconnect the gear box universal joint bolt.

NOTE: Make sure to make identification marks between the universal joint and the gear box for reassembly.

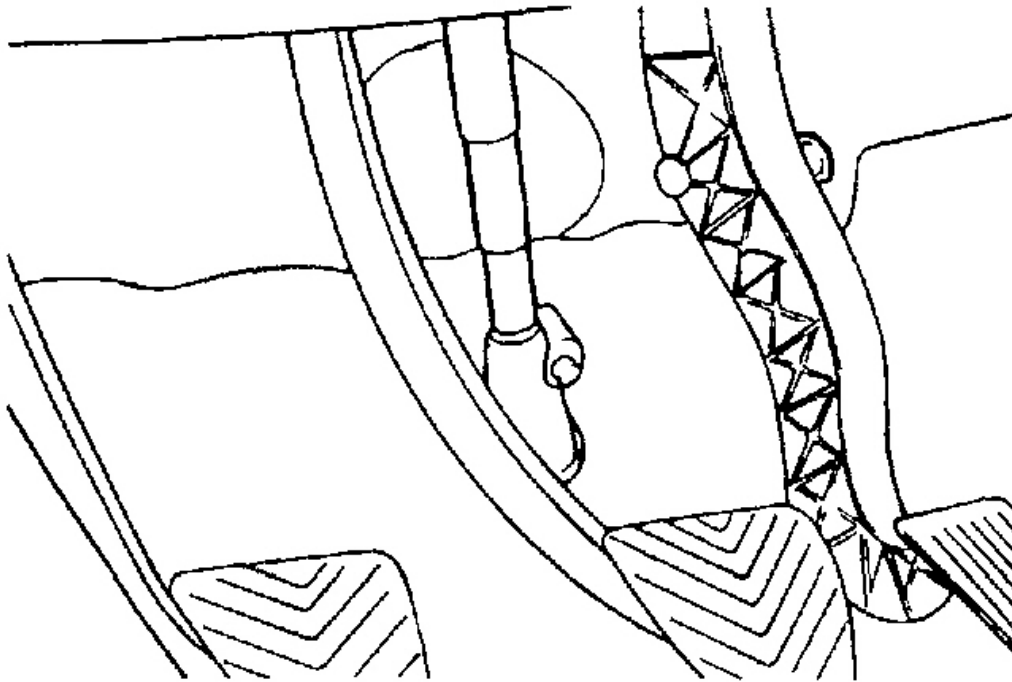
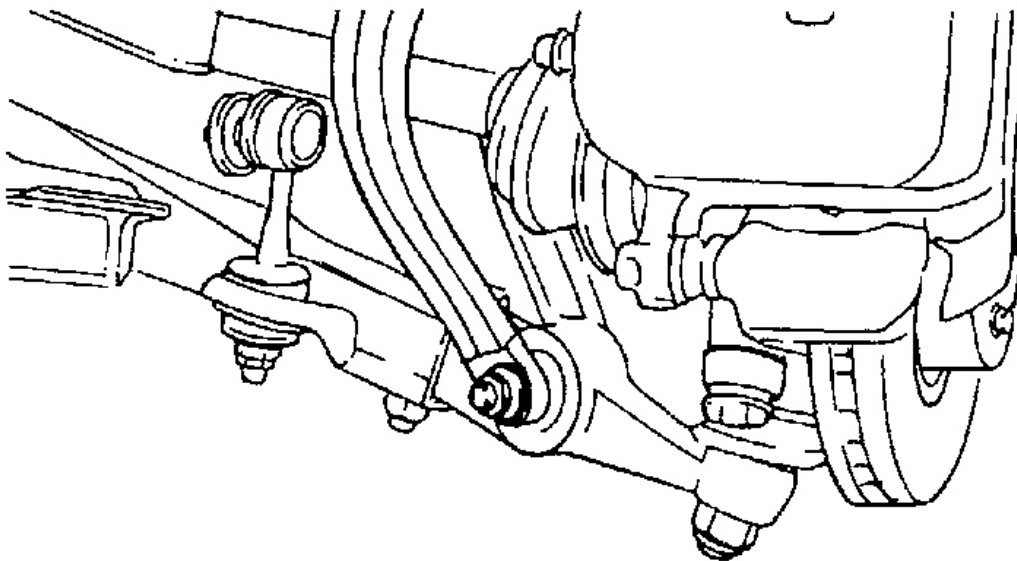
**G01164464**

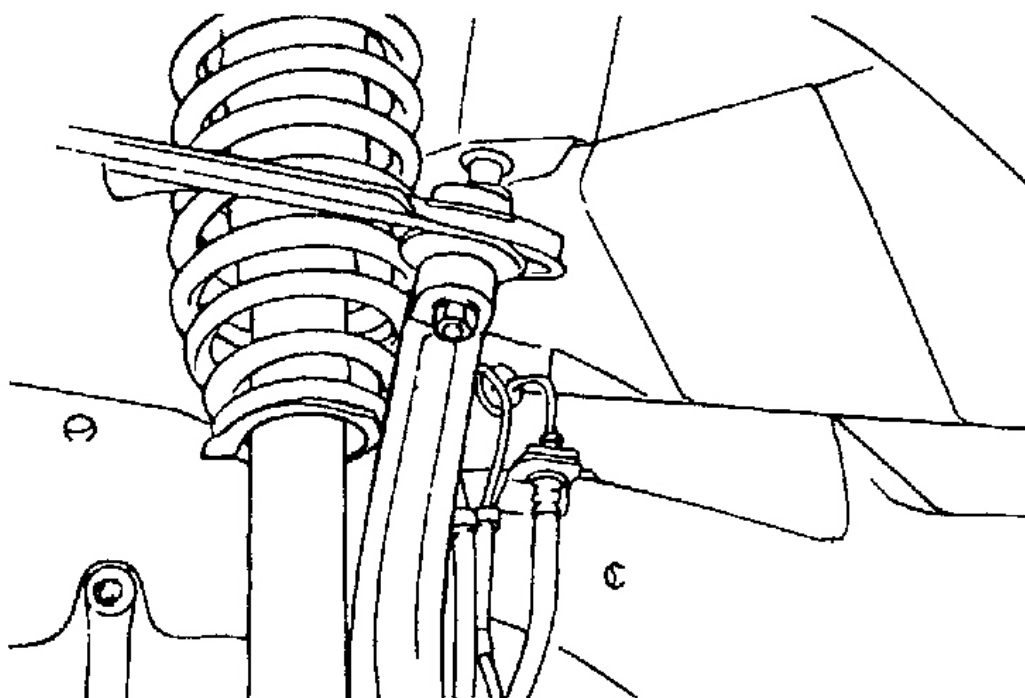
Fig. 43: Identifying Steering Dust Cover
Courtesy of HYUNDAI MOTOR CO.

16. Raise the vehicle and then remove the front tire.
17. Remove the lower arm ball joint bolts and upper arm bolt from the knuckle.



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Fig. 44: Removing Lower Arm Ball Joint Bolts
Courtesy of HYUNDAI MOTOR CO.

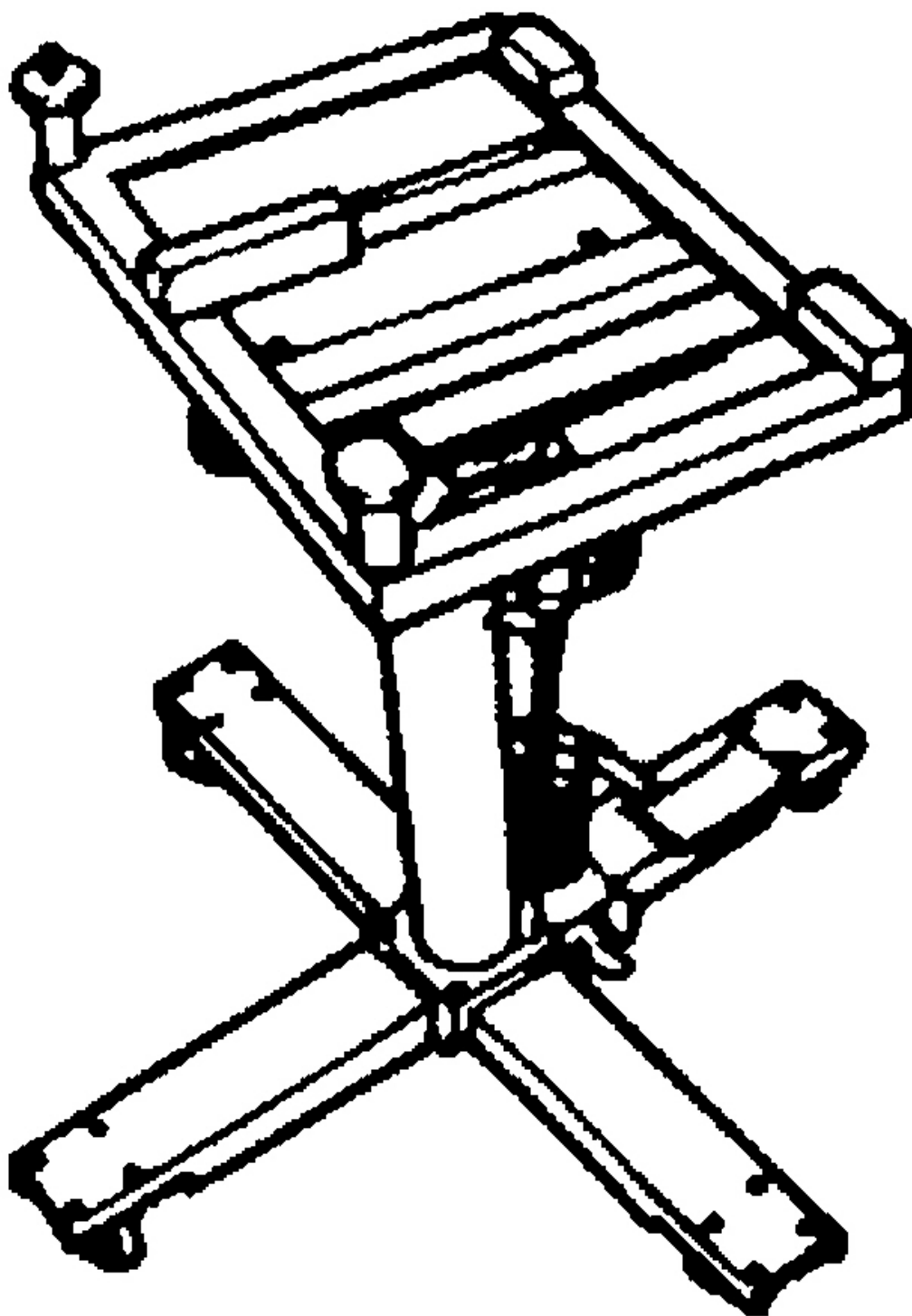


G01164466

Fig. 45: Removing Upper Arm Bolt From Knuckle
Courtesy of HYUNDAI MOTOR CO.

18. Drain the transaxle oil.
19. Remove the front muffler bolts.
20. Put the special fixture on the T/M jack and then adjust it to the sub - frame.

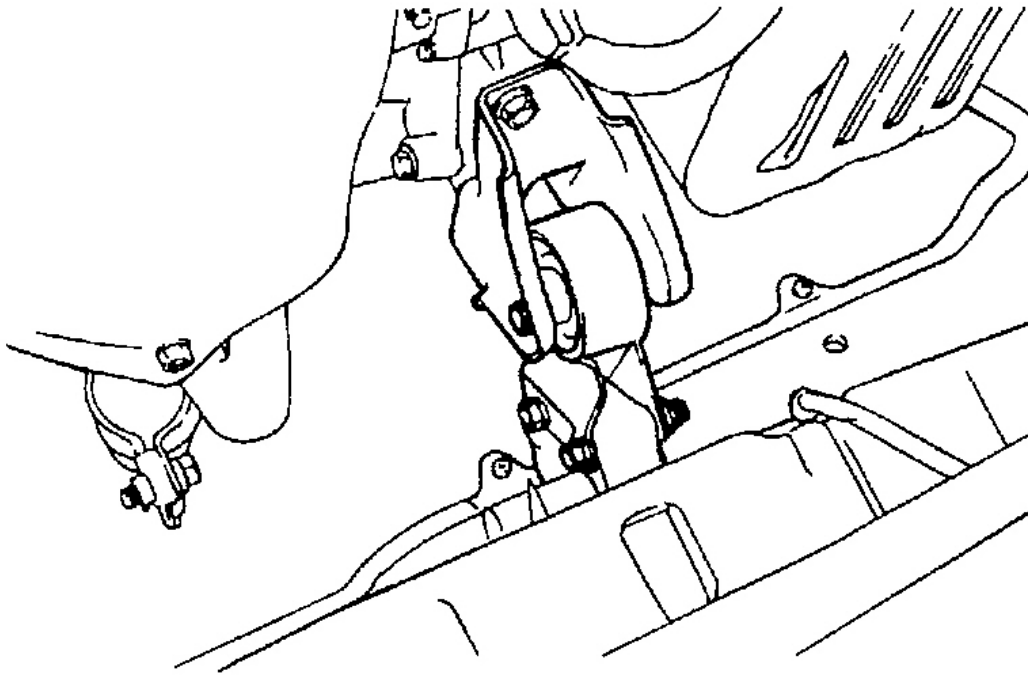
NOTE: Check that all the cables, harness connector and hoses are disconnected from the engine and transaxle assembly.



G01164467

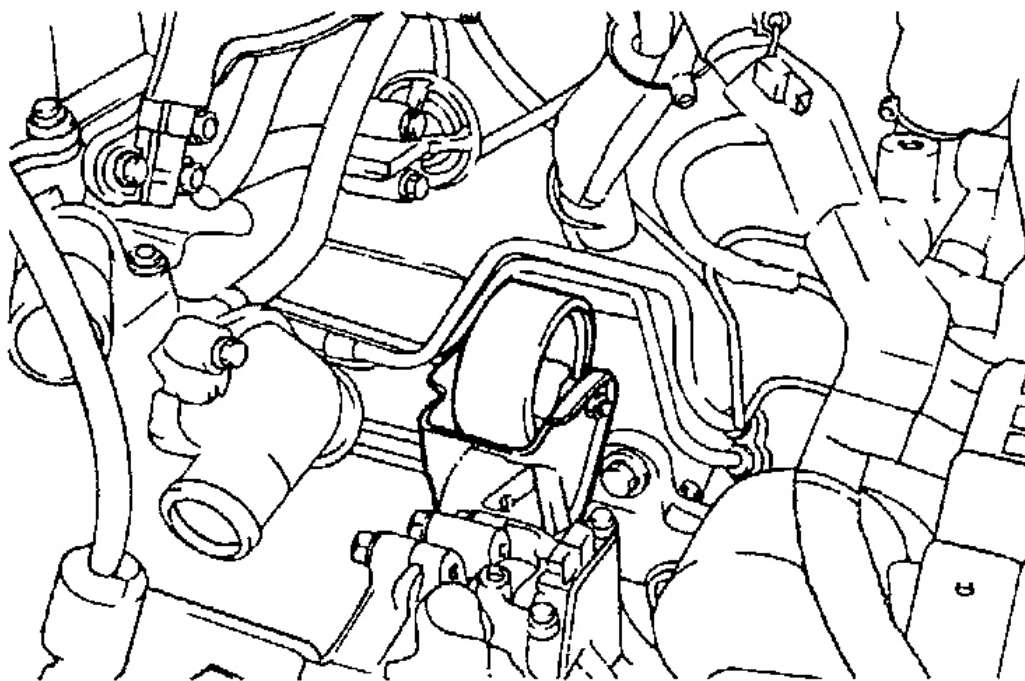
Fig. 46: Putting Special Fixture On T/M Jack
Courtesy of HYUNDAI MOTOR CO.

21. Remove the front roll stopper.
22. Remove the rear roll stopper.
23. Disconnect the connector of starter motor harness.



G01164468

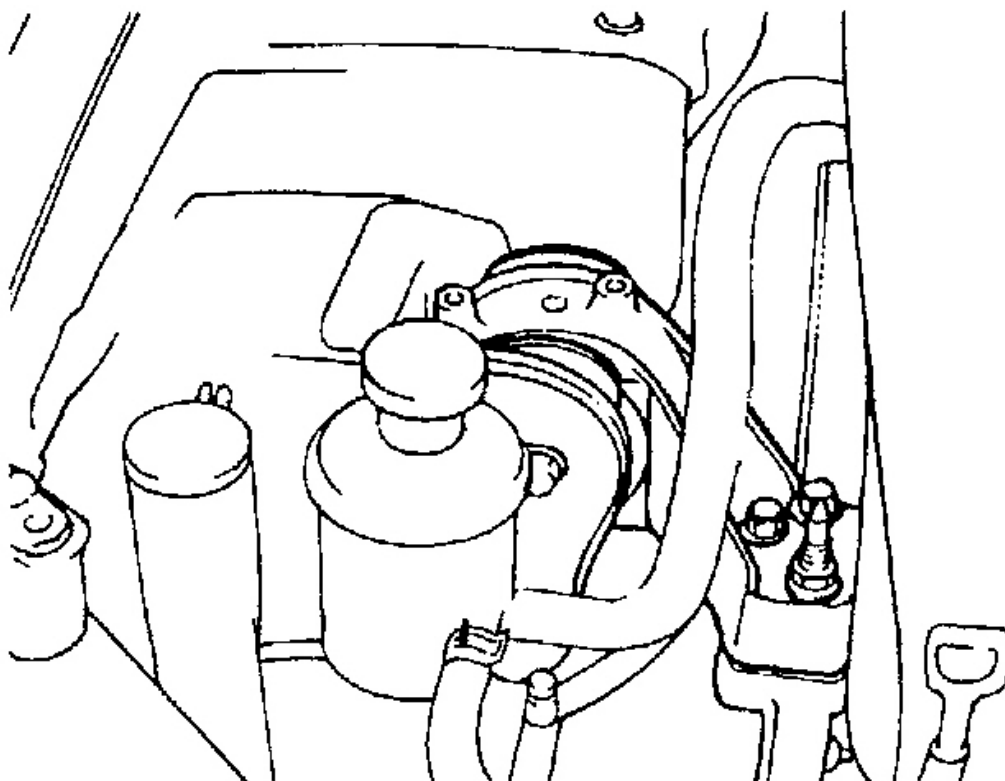
Fig. 47: Removing Engine Mount Bolts (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



G01164469

Fig. 48: Removing Engine Mount Bolts (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

24. Remove the engine mount bolts.
25. Remove the bolts and nuts that fasten the engine mount bracket to the body.



G01164470

Fig. 49: Removing Bolts & Nuts That Fasten Engine Mount Bracket To Body
Courtesy of HYUNDAI MOTOR CO.

26. Slowly raise the engine and transaxle and temporarily hold it in the raised condition.

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

27. Remove the transaxle mounting bracket bolts.

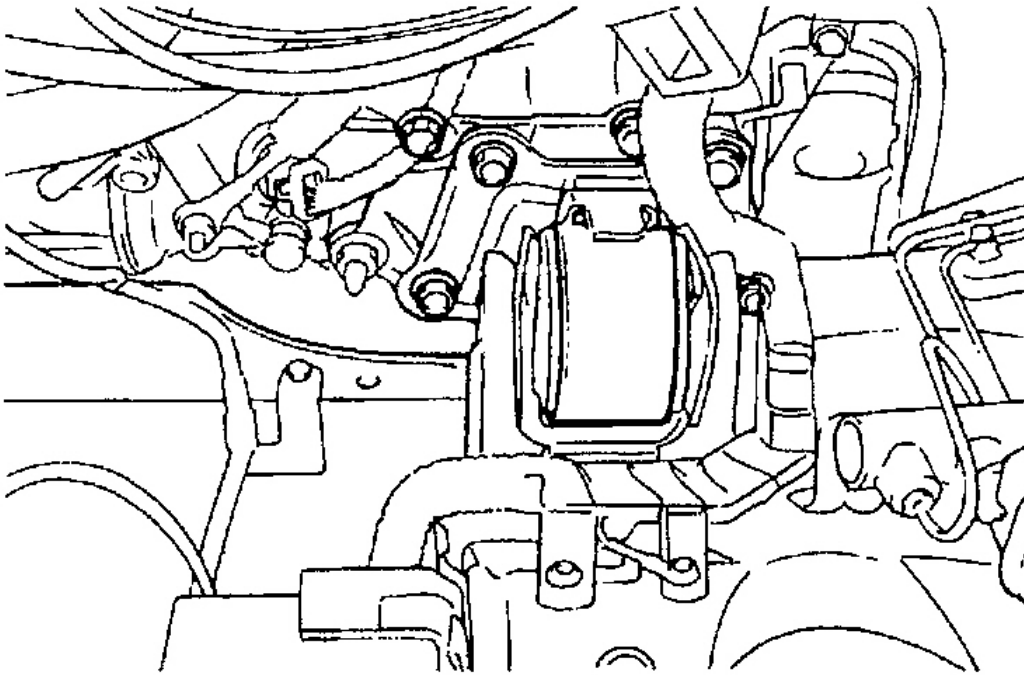
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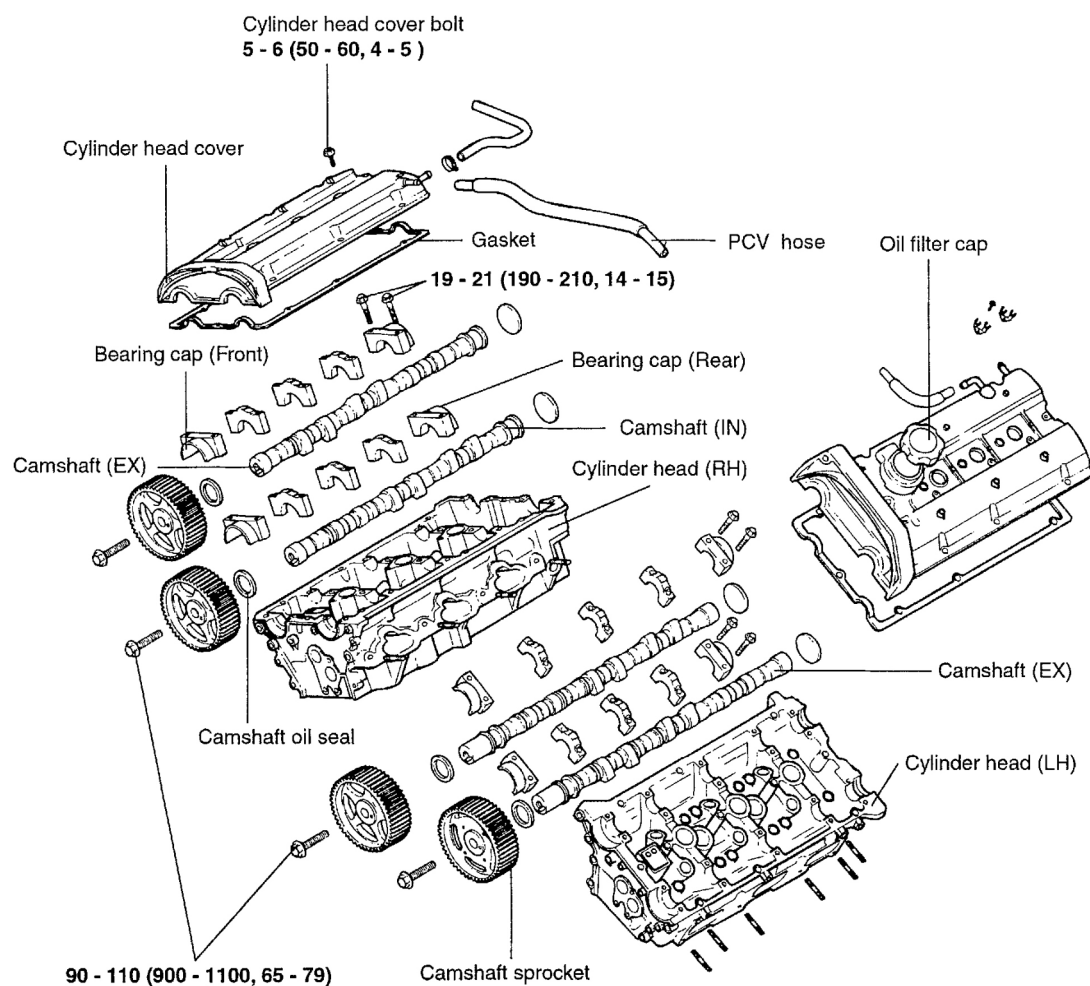
Fig. 50: Removing Transaxle Mounting Bracket Bolts
Courtesy of HYUNDAI MOTOR CO.

28. Remove the left mount insulator bolt.
29. While directing the transaxle side downward, lift the engine and transaxle assembly up and out of the vehicle.

MAIN MOVING SYSTEM

CAM SHAFT

COMPONENTS



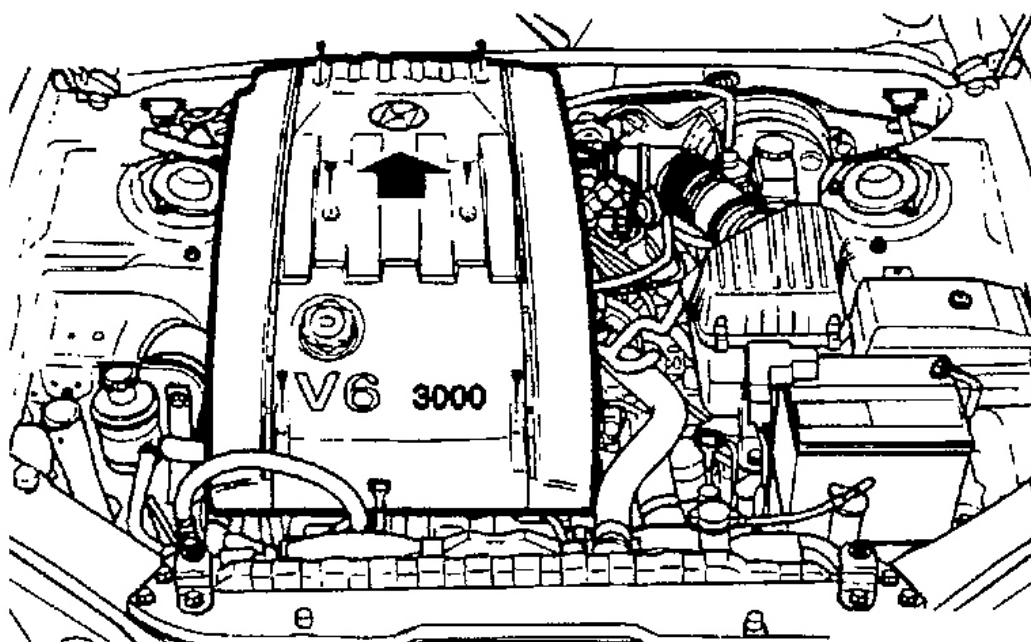
TORQUE : Nm (kg.cm, lb.ft)

G01164472

Fig. 51: Cam Shaft Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

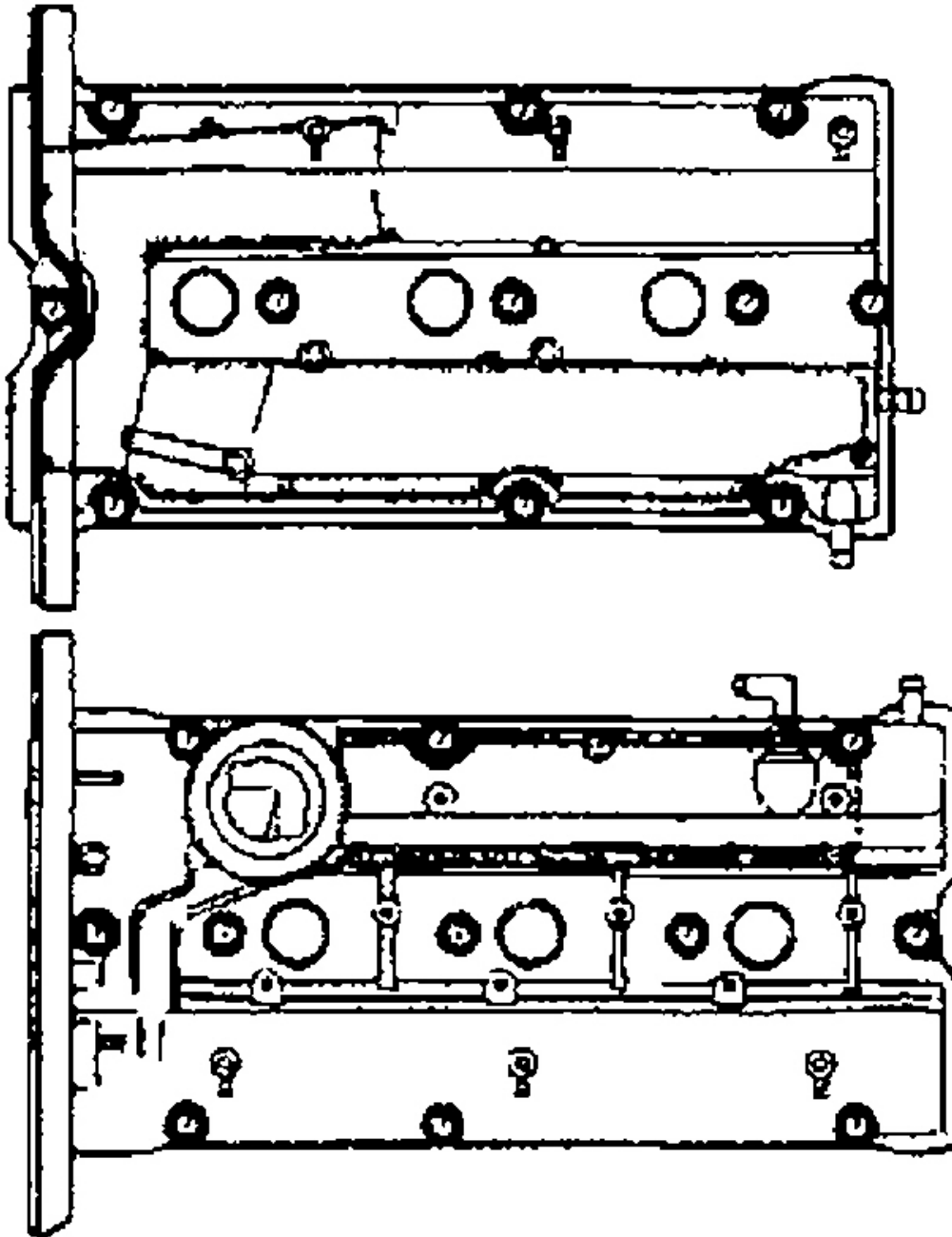
1. Remove the engine cover and intake manifold.



G01164473

Fig. 52: Removing Engine Cover
Courtesy of HYUNDAI MOTOR CO.

2. Disconnect the breather hose and the engine harness.
3. Remove the power steering pulley, air conditioner pulley, crankshaft pulley, idler pulley and tensioner pulley.
4. Remove the timing belt cover.
5. Loosen the auto tensioner.
6. Remove the timing belt from the camshaft sprocket.
7. Remove the spark plug cables.
8. Loosen the cylinder head cover bolts and then remove it.



G01164474

Fig. 53: View Of Cylinder Head Covers
Courtesy of HYUNDAI MOTOR CO.

9. Remove the camshaft sprockets.
10. Remove the camshaft bearing caps.

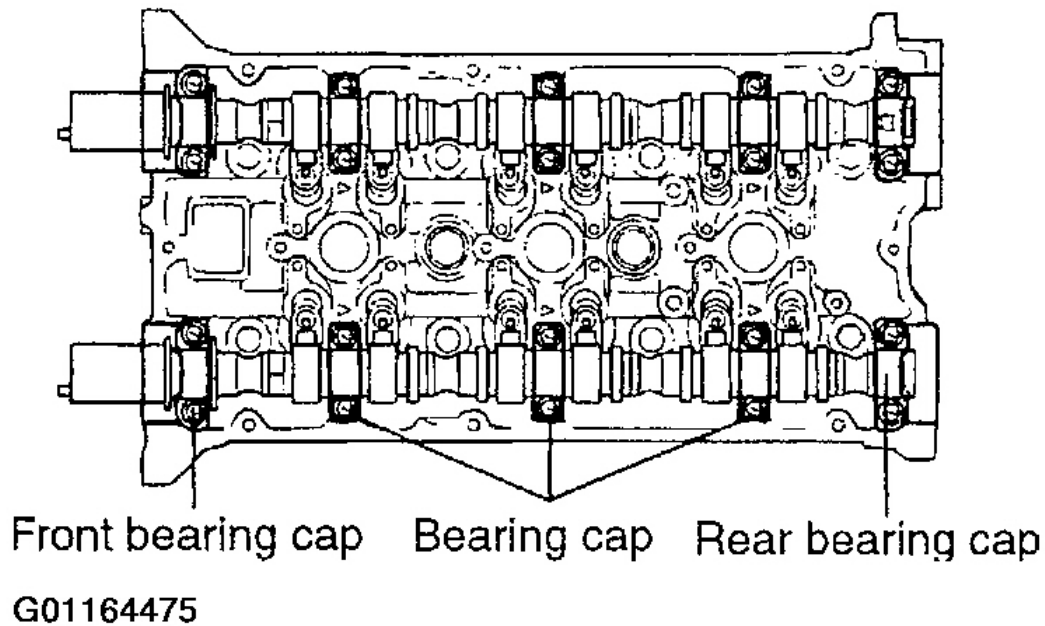
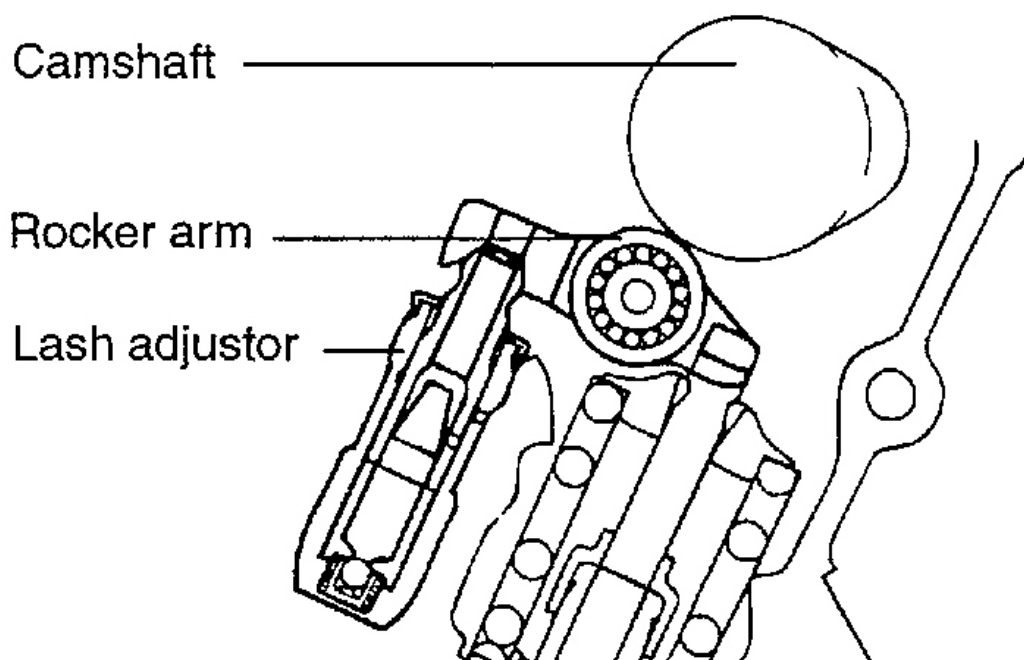


Fig. 54: Removing Camshaft Bearing Caps
Courtesy of HYUNDAI MOTOR CO.

11. Remove the camshafts.



G01164476

Fig. 55: Identifying Rocker Arm & Lash Adjuster
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

CAMSHAFTS

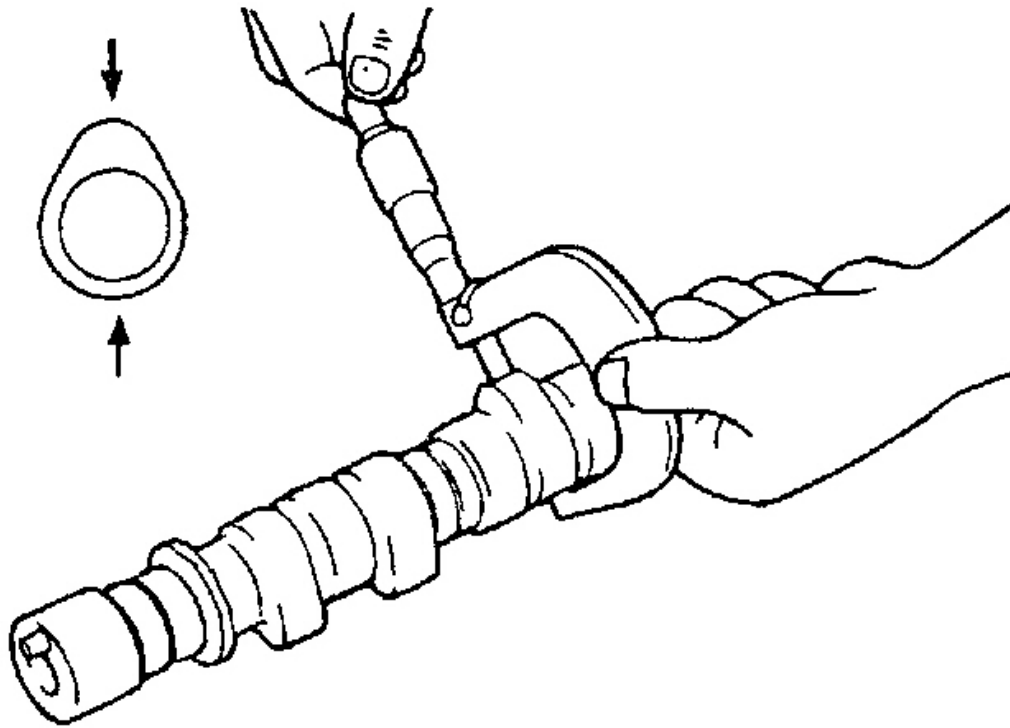
1. Check the camshaft journals for wear. If the journals are badly worn out, replace the camshaft.
2. Check the cam lobes for damage. If the lobe is damaged or excessively worn out, replace the camshaft.

Cam height

Standard

Intake: 35.098 - 35.298 mm (1.3818 - 1.3897 in.)

Exhaust: 34.81 - 35.01 mm (1.3705 - 1.3783 in.)



G01164477

Fig. 56: Measuring Cam Lobes
Courtesy of HYUNDAI MOTOR CO.

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

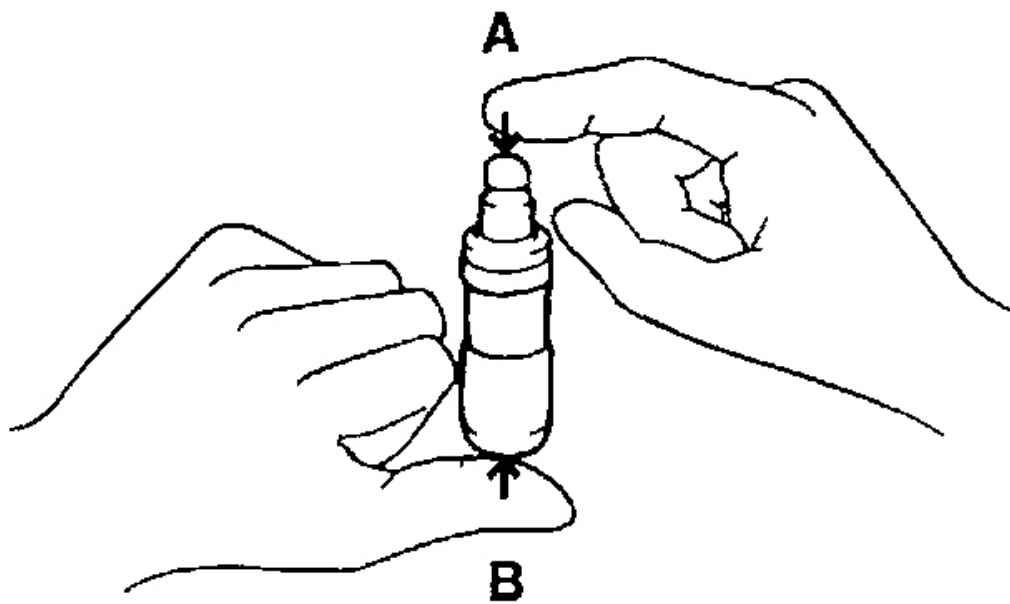
Camshaft end play: 0.1-0.15mm(0.0039-0.0059 in.)

OIL SEAL (CAMSHAFT FRONT)

1. Check the lips for wear. If lip threads are worn out, replace the oil seal with new one.
2. Check a contact surface of oil seal lip on camshaft. If there stratified wear, replace the camshaft.

HLA (HYDRAULIC LASH ADJUSTER)

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



G01164478

Fig. 57: Inspecting Hydraulic Lash Adjuster
Courtesy of HYUNDAI MOTOR CO.

2002 Hyundai XG350

2002 ENGINE Engine Mechanical System V6 3.5L - XG 350

Problem	Possible cause	Action
1. Temporary noise when starting a cold engine	Normal	This noise will disappear after the oil in the engine reaches the normal pressure.
2. Continuous noise when the engine is started after parking more than 48 hours.	Oil leakage of the high pressure chamber on the HLA, allowing air to get in.	Noise will disappear within 15 minutes when engine runs at 2000-3000 rpm. If it doesn't disappear, refer to step 7 below.
3. Continuous noise when the engine is first started after rebuilding cylinder head.	Insufficient oil in cylinder head oil gallery.	
4. Continuous noise when the engine is started after excessively cranking the engine by the starter motor or band.	Oil leakage of the high-pressure chamber in the HLA, allowing air to get in. Insufficient oil in the HLA.	
5. Continuous noise when the engine is running after changing the HLA.		 CAUTION Do not run engine at a speed higher than 3000 rpm, as this may damage the HLA.
6. Continuous noise during idle after high engine speed.	Engine oil level too high or too low.	Check oil level. Drain or add oil as necessary.
	Excessive amount of air in the oil at high engine speed.	Check oil supply system.
	Deteriorated oil.	Check oil quality. If deteriorated, replace with specified type.
7. Noise continues for more than 15 minutes.	Low oil pressure.	Check oil pressure and oil supply system of each part of engine.
	Faulty HLA.	Remove the cylinder head cover and press HLA down by hand. If it moves, replace the HLA.  WARNING Be careful with the hot HLAS.

G01164479

Fig. 58: Hydraulic Lash Adjuster Troubleshooting Table
Courtesy of HYUNDAI MOTOR CO.

AUTO LASH ADJUSTER

1. Check auto lash adjusters for free play by inserting a small wire through the air bleed hole in the rocker arm and push the auto lash adjuster check ball down very lightly.
2. While lightly holding the check ball down move the rocker arm up and down to check for free play. If there is no play replace the auto - lash adjuster.

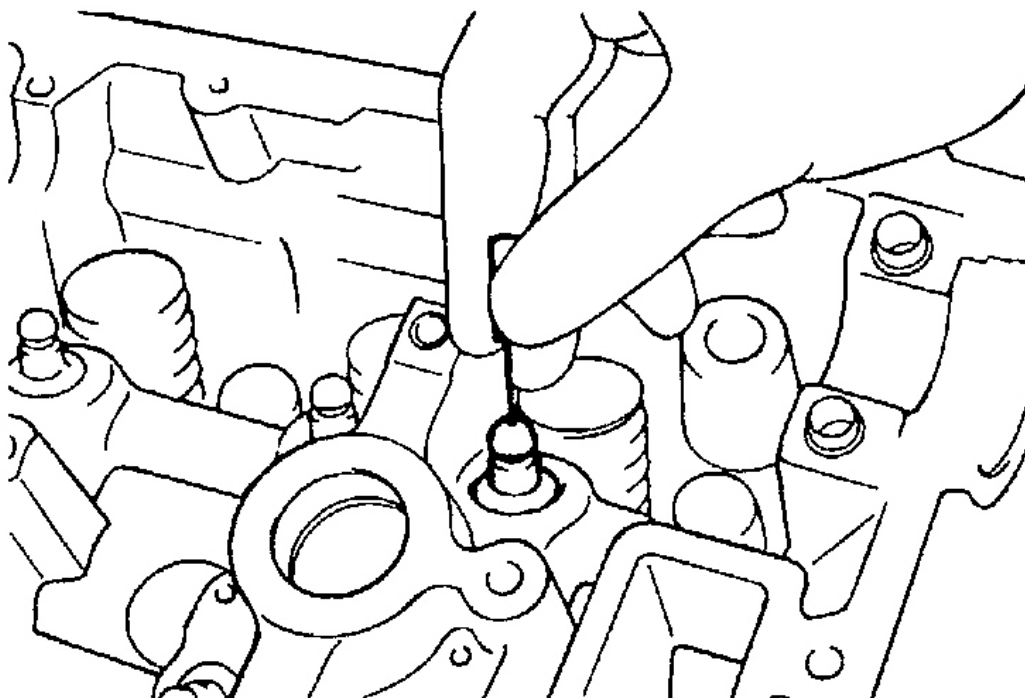
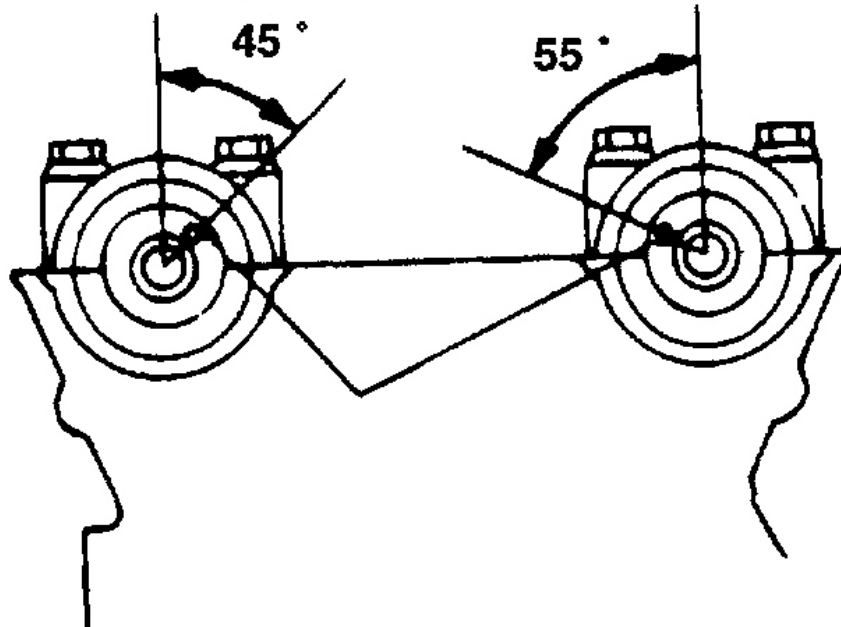
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Fig. 59: Checking Rocker Arm Free Play
Courtesy of HYUNDAI MOTOR CO.

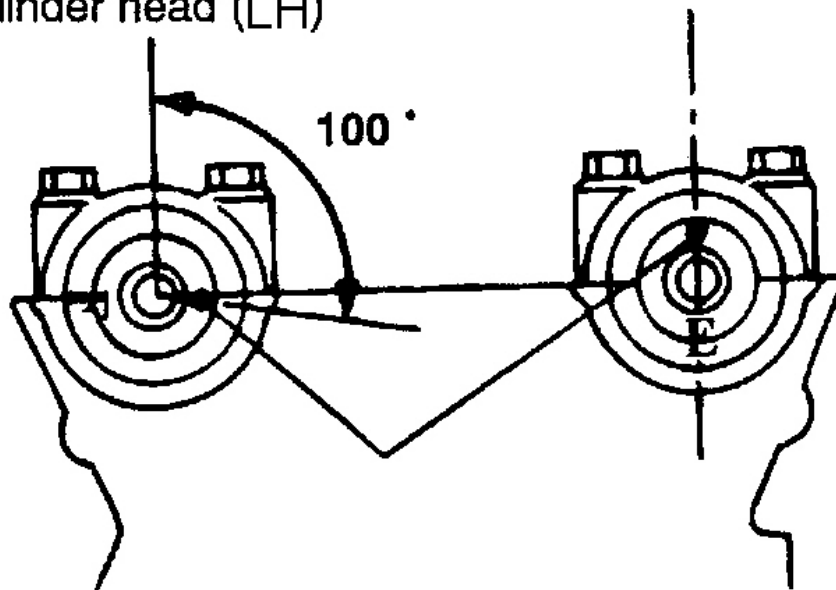
REASSEMBLY**CAMSHAFT AND BEARING CAP**

1. Rotate the crankshaft and No. 1 cylinder is in TDC (Compression stroke)
2. Check the position of the rocker arm whether it is exactly installed on the lash adjuster and valve or not.
3. Install the camshaft dowel pin as illustration.

Cylinder head (RH)



Cylinder head (LH)



G01164481

Fig. 60: Installing Camshaft Dowel Pin
Courtesy of HYUNDAI MOTOR CO.

4. The left and right banks of the camshafts are different and you should be careful not to confuse them.

Identification signal

Left bank

Intake (IN): F

Exhaust (Ex): E

Right bank

Intake (IN): G

Exhaust (Ex): H



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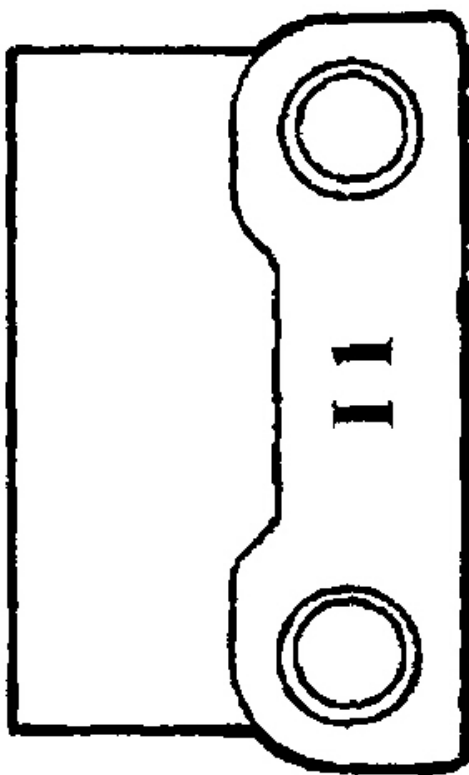
Fig. 61: Identifying Camshafts
Courtesy of HYUNDAI MOTOR CO.

5. Confirm the identification mark and the number. Bearing caps of New No.4, and No.5 have the front mark and arrange the front mark upon the cylinder head while installing the bearing caps.

Identification mark

Intake: I

Exhaust: E



G01164483

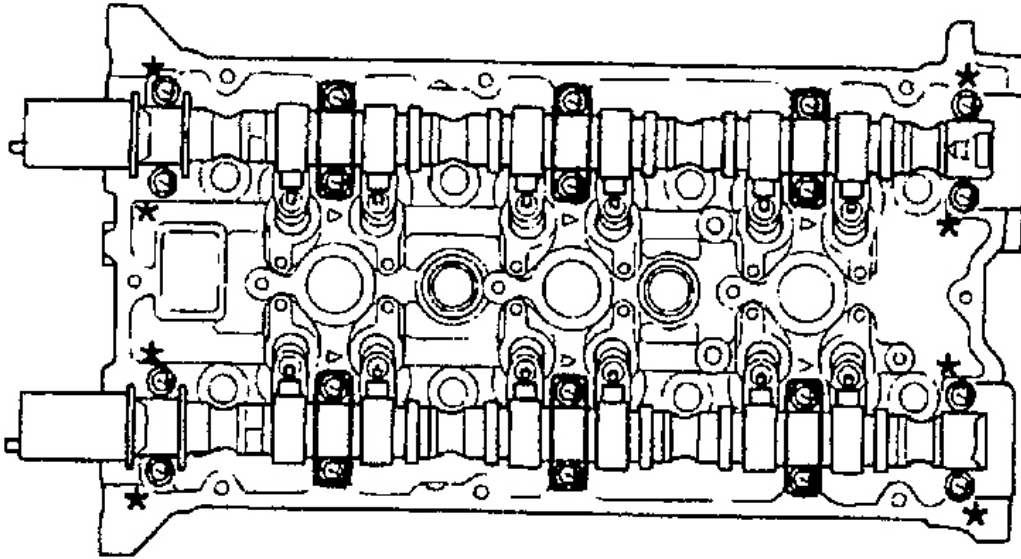
Fig. 62: Confirming Bearing Cap Identification Mark & Number
Courtesy of HYUNDAI MOTOR CO.

6. Tighten the bearing cap by 2 or 3 steps

Tightening Torque

Outer (*) 16 EA: 1.9-2.1 kg.m

Inner 24 EA: 1.0-1.2 kg.m

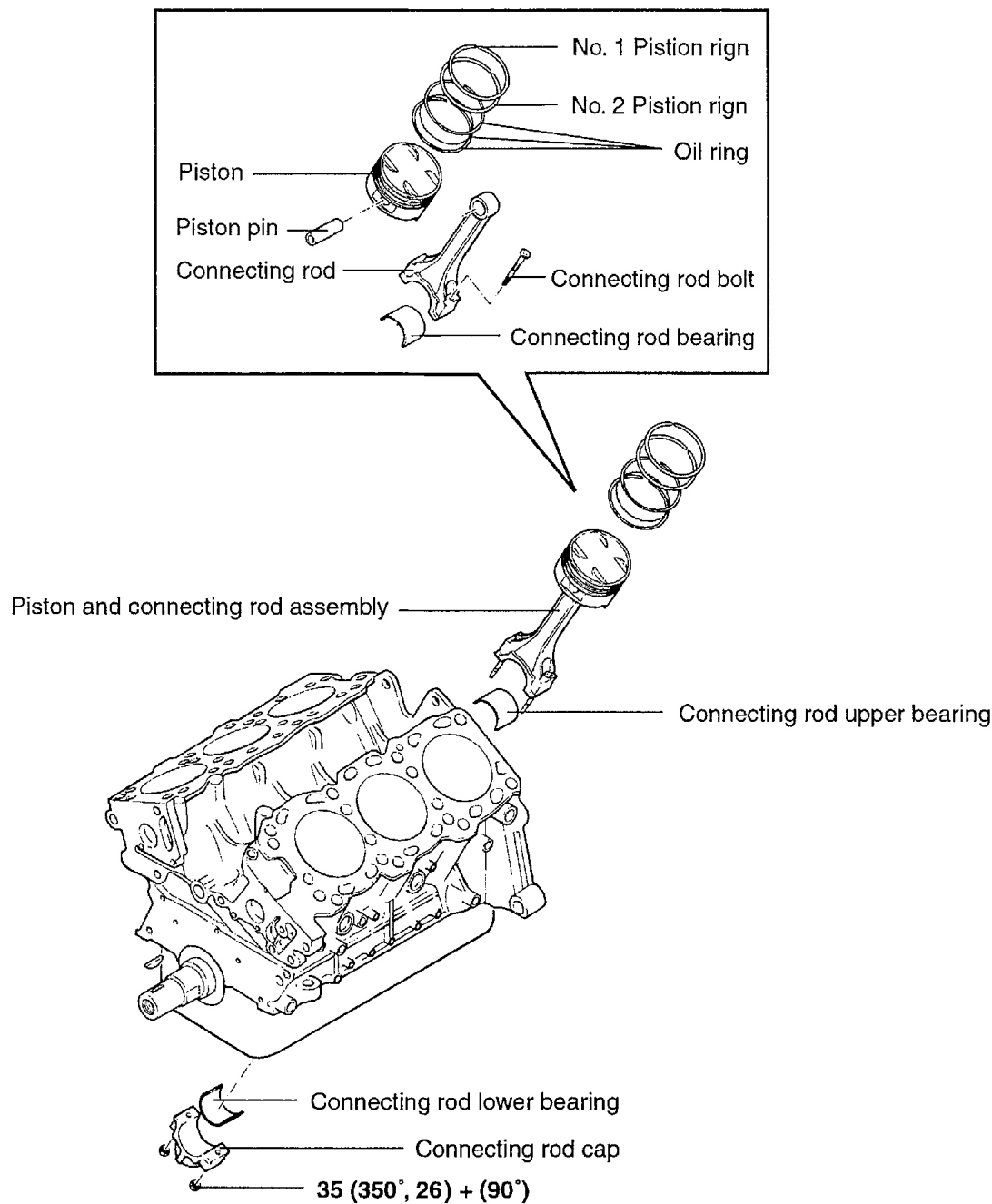


G01164484

Fig. 63: Tightening Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

CONNECTING ROD

COMPONENTS



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

G01164485

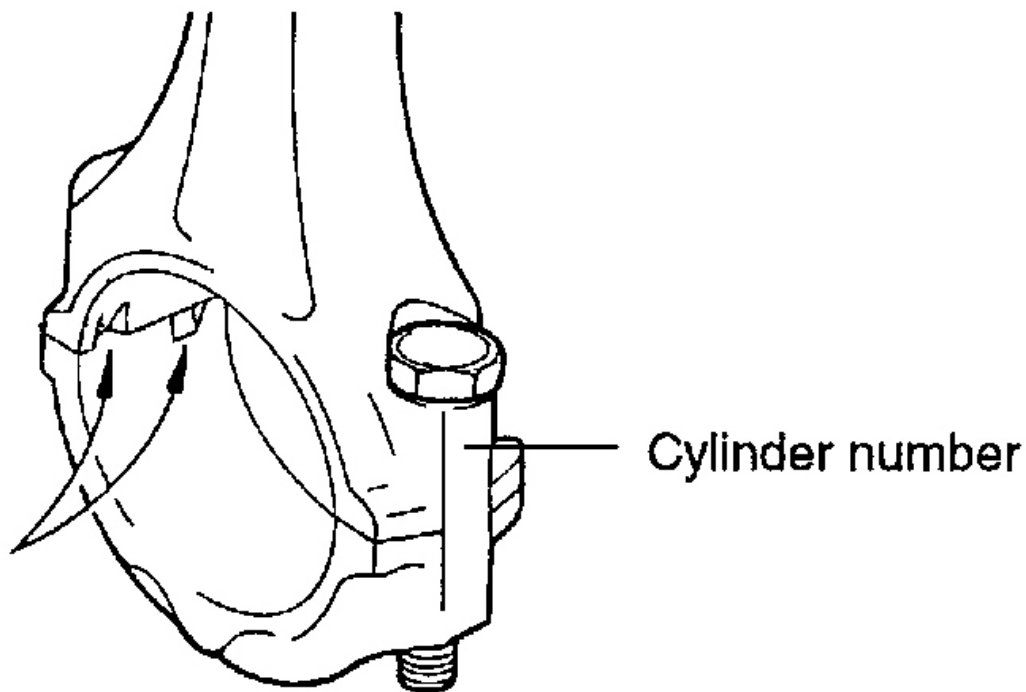
Fig. 64: Connecting Rod Components
Courtesy of HYUNDAI MOTOR CO.

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 mark for reassembly.
2. Push each piston connecting rod assembly toward the top of the cylinder.

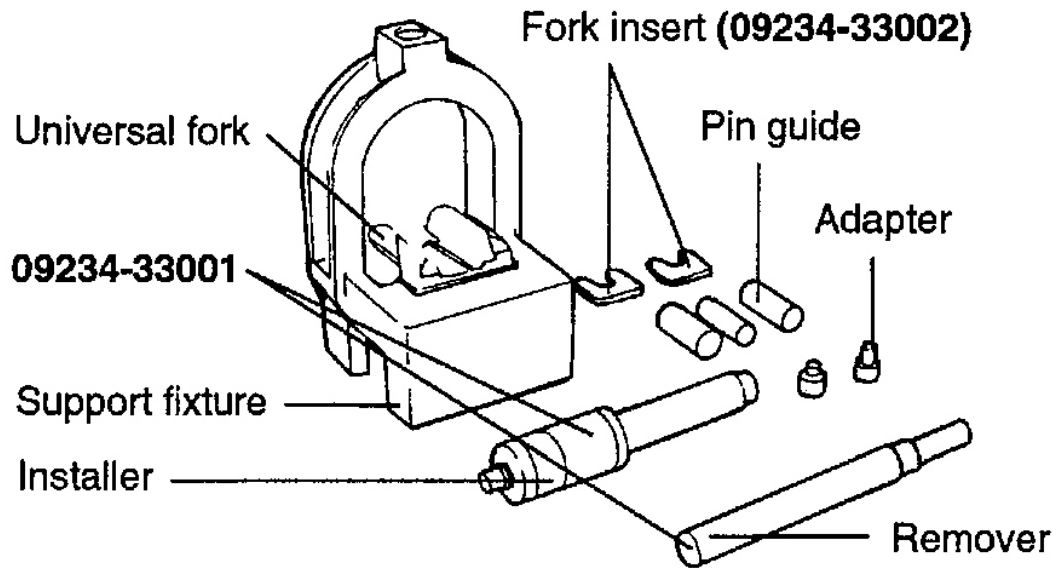


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Fig. 65: Locating Cylinder Number On Connecting Rod
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY AND REASSEMBLY OF THE PISTON PIN

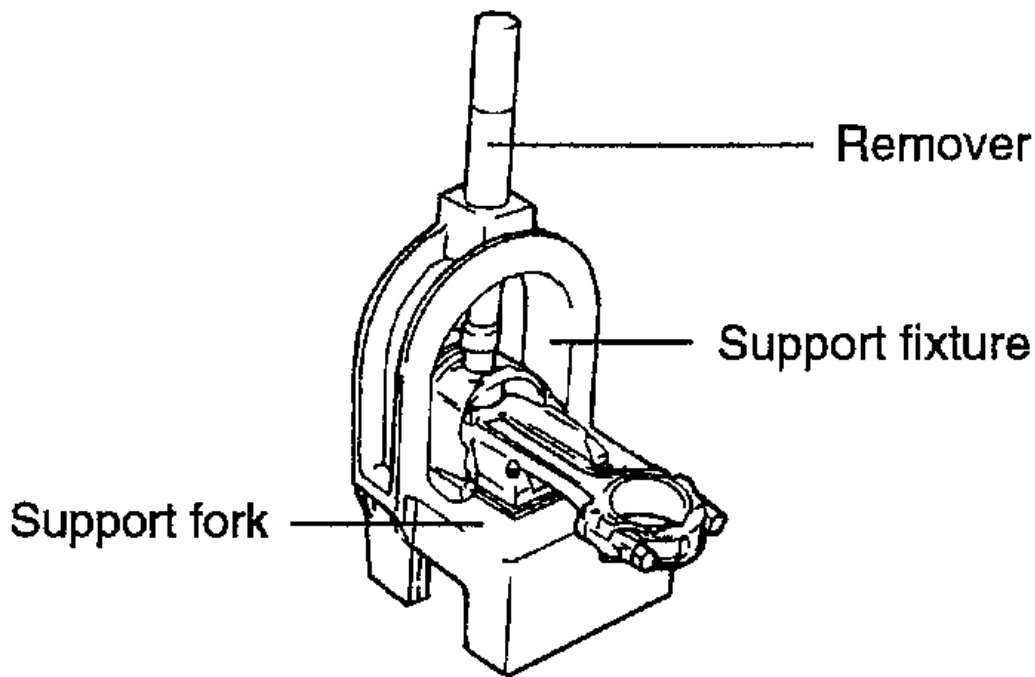
1. Using the special tools 09234-33001 and 09234-3002, disassemble and reassemble the piston and connecting rod.



G01164487

Fig. 66: Identifying Special Tool For Piston Pin Disassembly
Courtesy of HYUNDAI MOTOR CO.

2. The piston pin is a press fit in 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 remover tool through the top of the support fixture and use it to press out the pin.



G01164488

Fig. 67: Removing Pin From Piston
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 up with the support fixture.

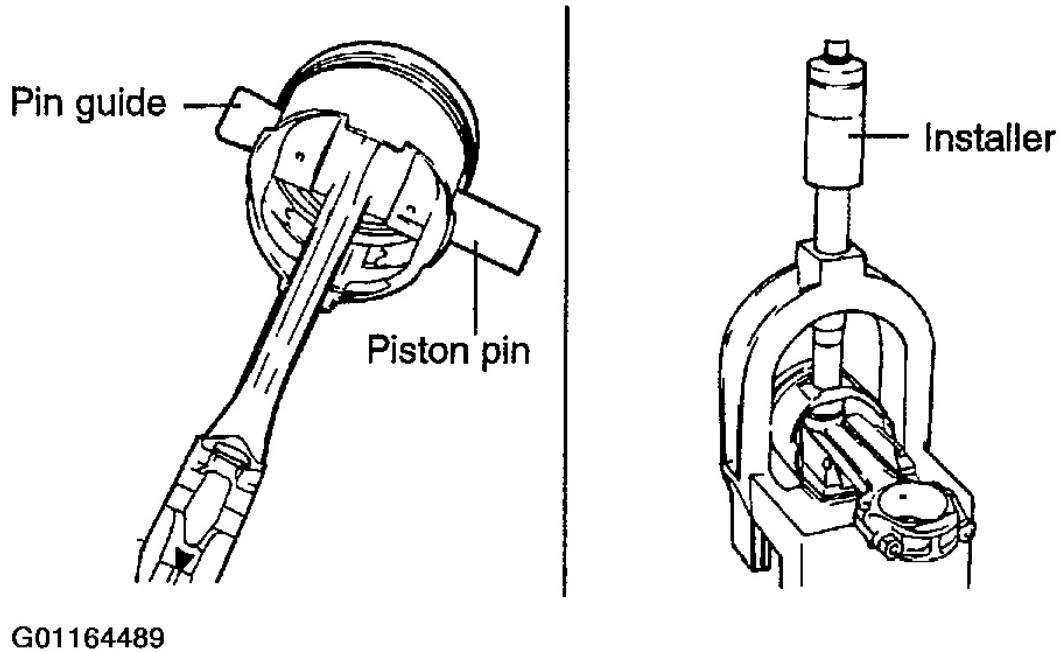


Fig. 68: Installing Removing Pin In Piston
 Courtesy of HYUNDAI MOTOR CO.

7. Insert the installer tool through the hole in the arch of the support fixture and use an 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 750+/-1,750 kg (1,653+/-3,858 lb) of force when the installing tool seats against the top of the arch.

INSPECTION

PISTONS AND PISTON PINS

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

PISTON RINGS

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

Piston ring side clearance

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

No.2: 0.02-0.06 mm (0.0008-0.0024 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 dimensions

No.1: 0.30-0.45 mm (0.012-0.018 in.)

No.2: 0.45-0.60 mm (0.0018-0.024 in.)

Oil ring side rail: 0.2-0.7 mm (0.0079-0.0276)

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

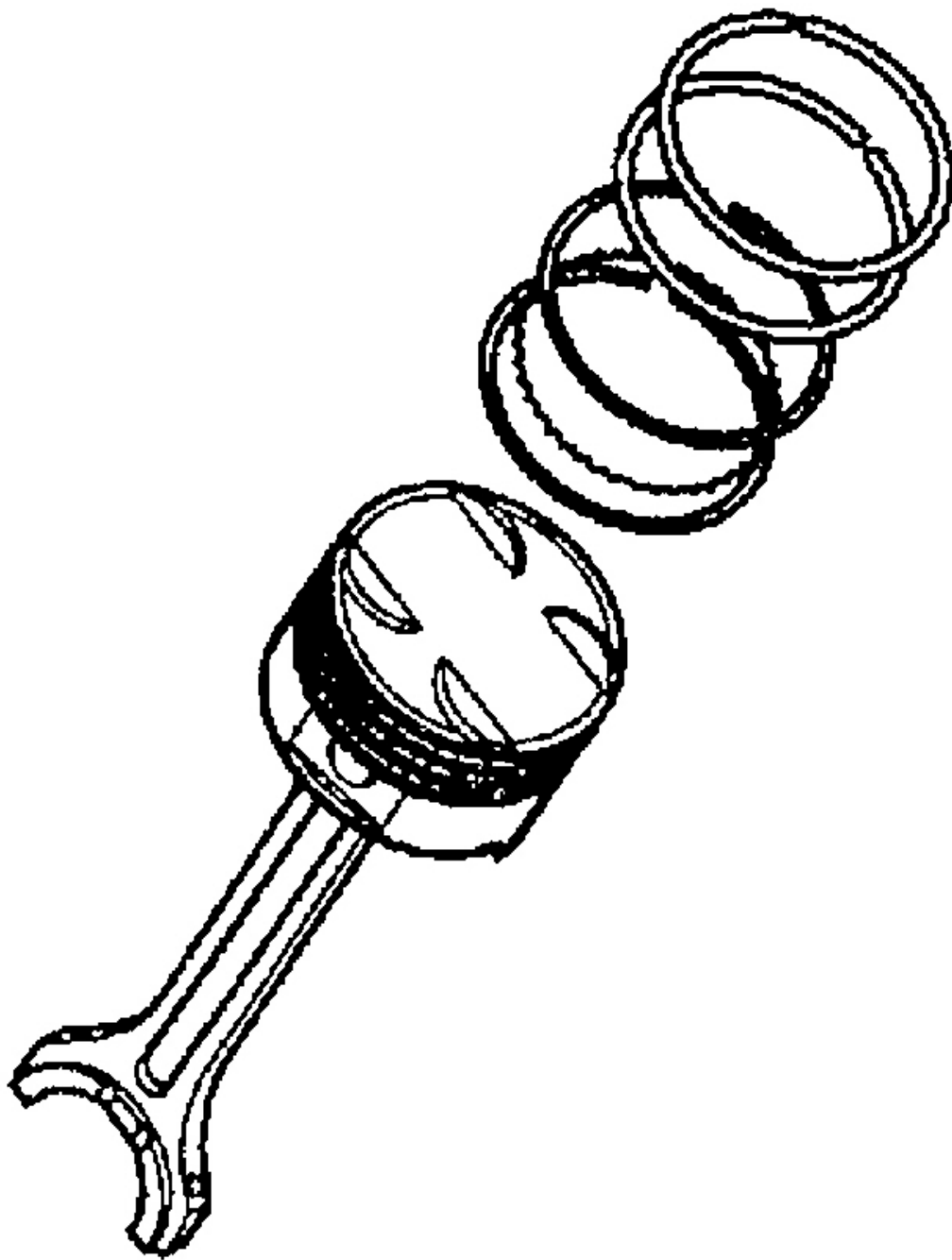
PISTON RING SERVICE SIZE AND MARK

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 (0.040 in.) O.S	100

G01164490

Fig. 69: Piston Ring Service Size & Mark Specification Table
Courtesy of HYUNDAI MOTOR CO.

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



G01164491

Fig. 70: Identifying Piston Rings
Courtesy of HYUNDAI MOTOR CO.

CONNECTING RODS

1. When the connecting rod cap is installed, make sure that the cylinder numbers, marked on rod end cap at disassembly, match. 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 trust faces. If it has a stratified wear, or if the surface of the inside diameter of the small end is severely rough, replace the rod.

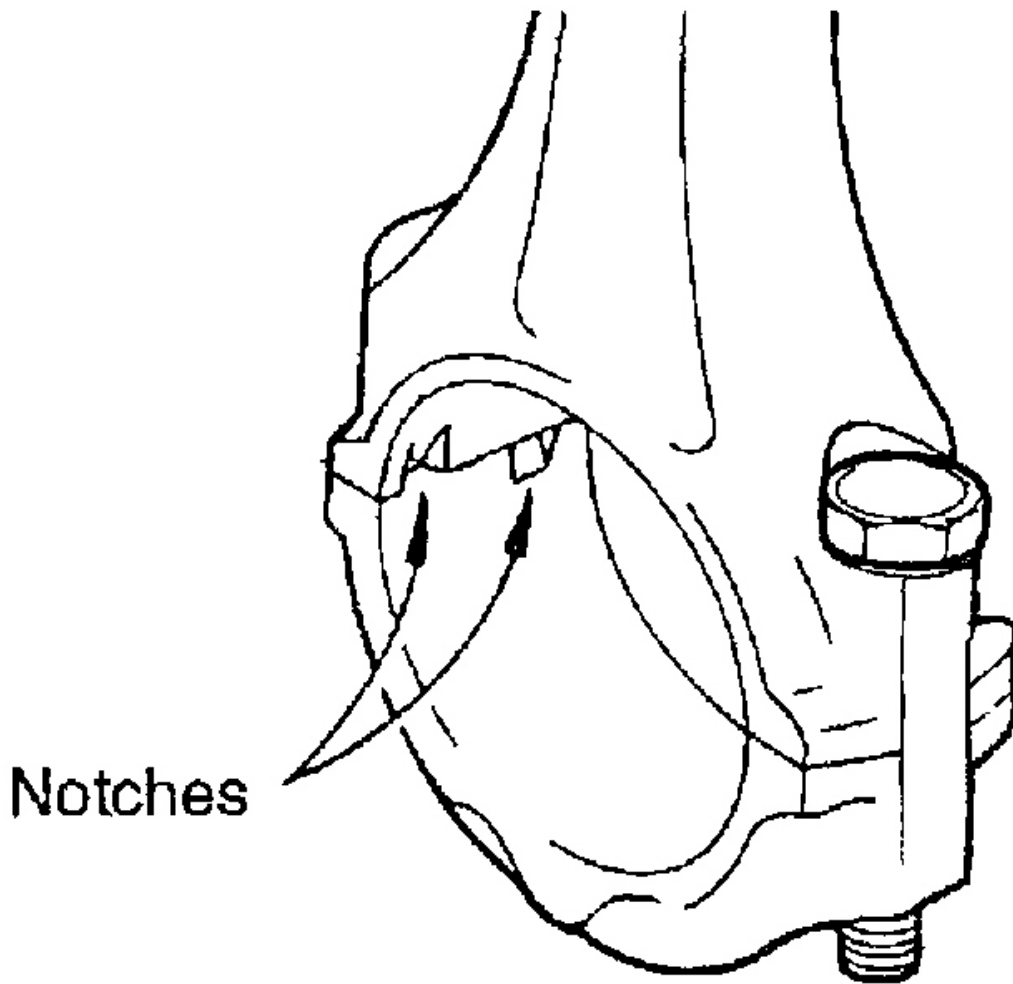
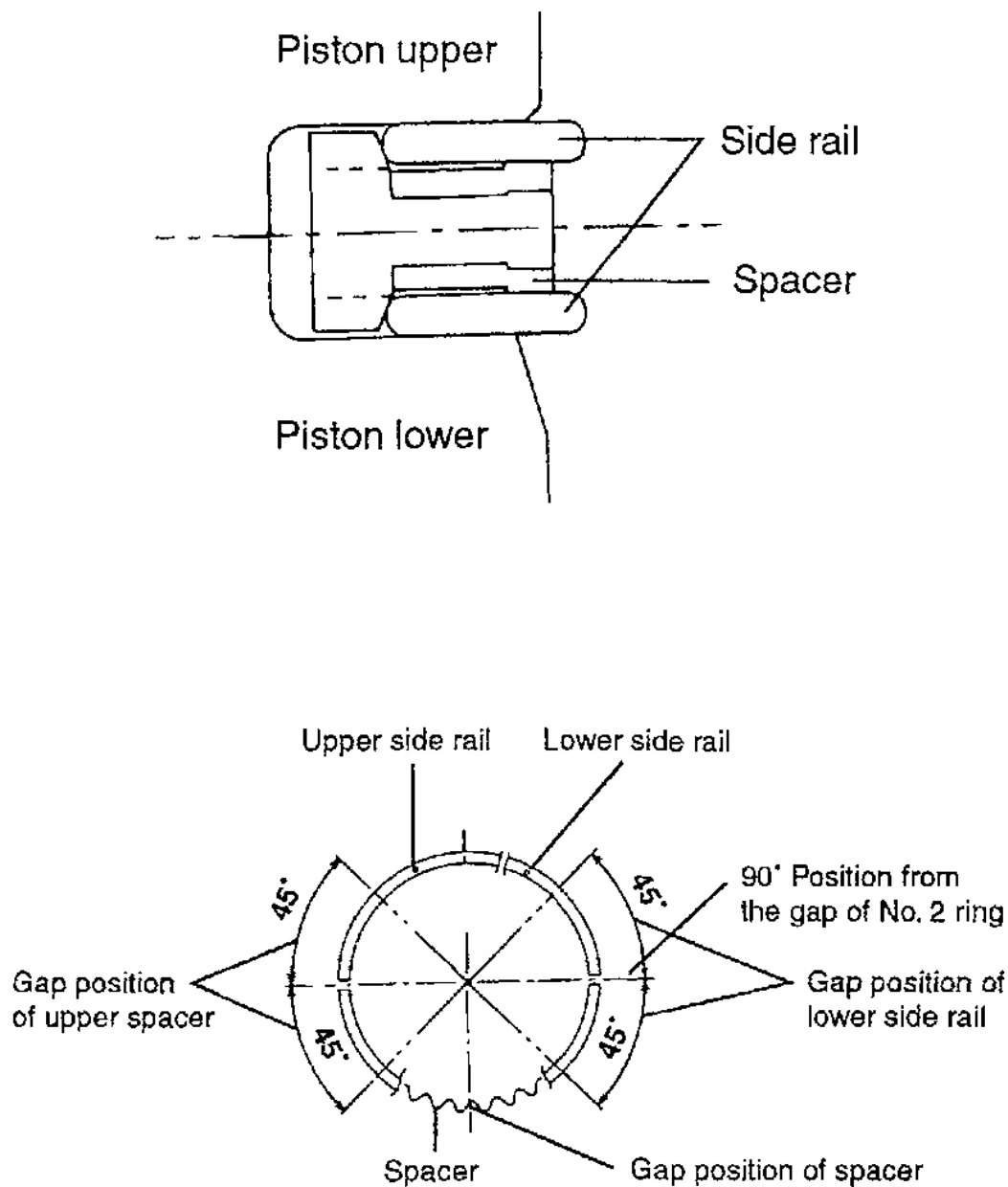
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Fig. 71: Locating Proper Notches Position
Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

1. Install the spacer.



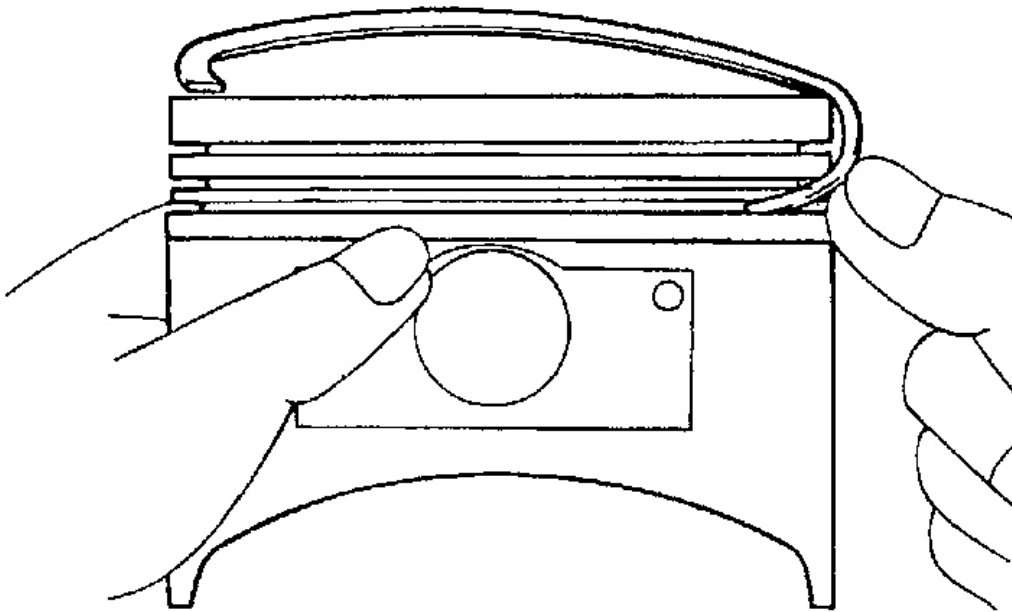
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Fig. 72: Installing Spacer
Courtesy of HYUNDAI MOTOR CO.

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 finger on the portion to be inserted into the groove (as illustrated).

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

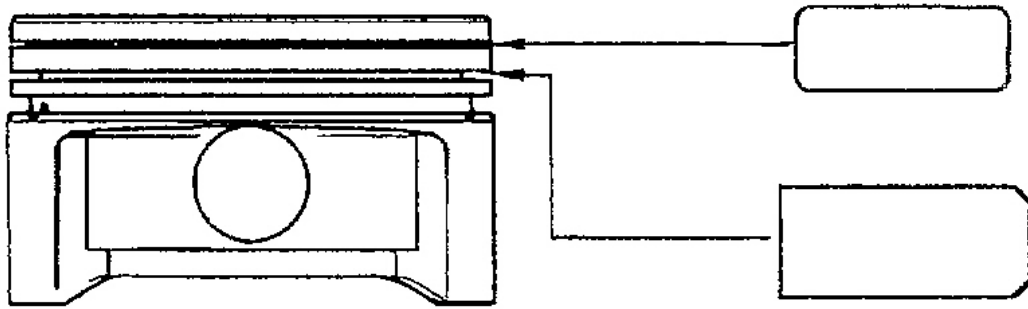
3. Install the lower side rail by the same procedure described in Step 2.



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Fig. 73: Installing Lower Side Rail
Courtesy of HYUNDAI MOTOR CO.

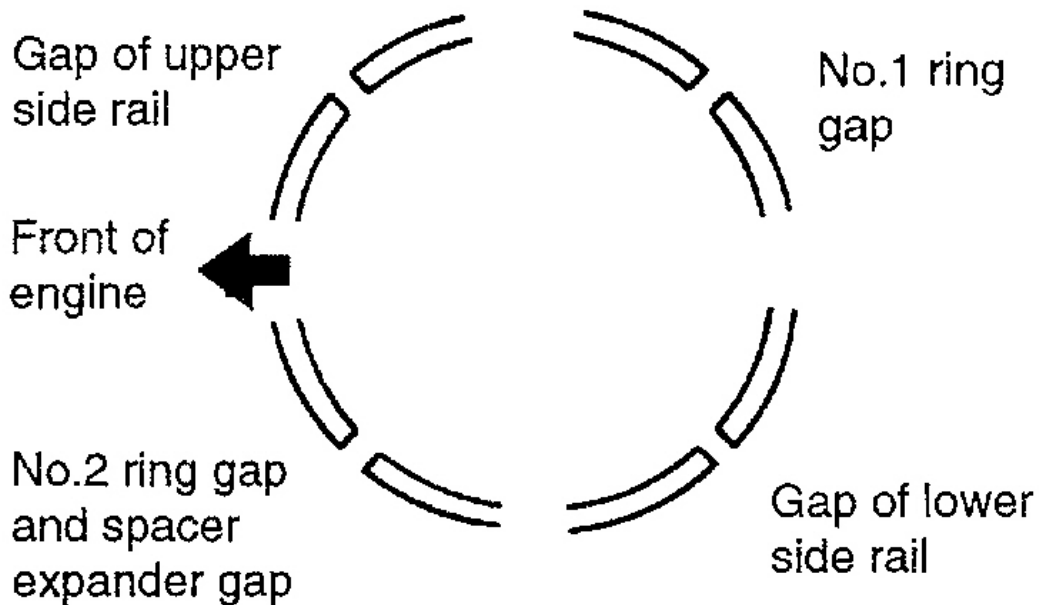
4. Apply engine oil around the piston and piston grooves.
5. Using a piston ring expander, install the No.2 piston ring.
6. Install the No. 1 piston ring.



G01164495

Fig. 74: Identifying Proper Piston Ring Location
 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.

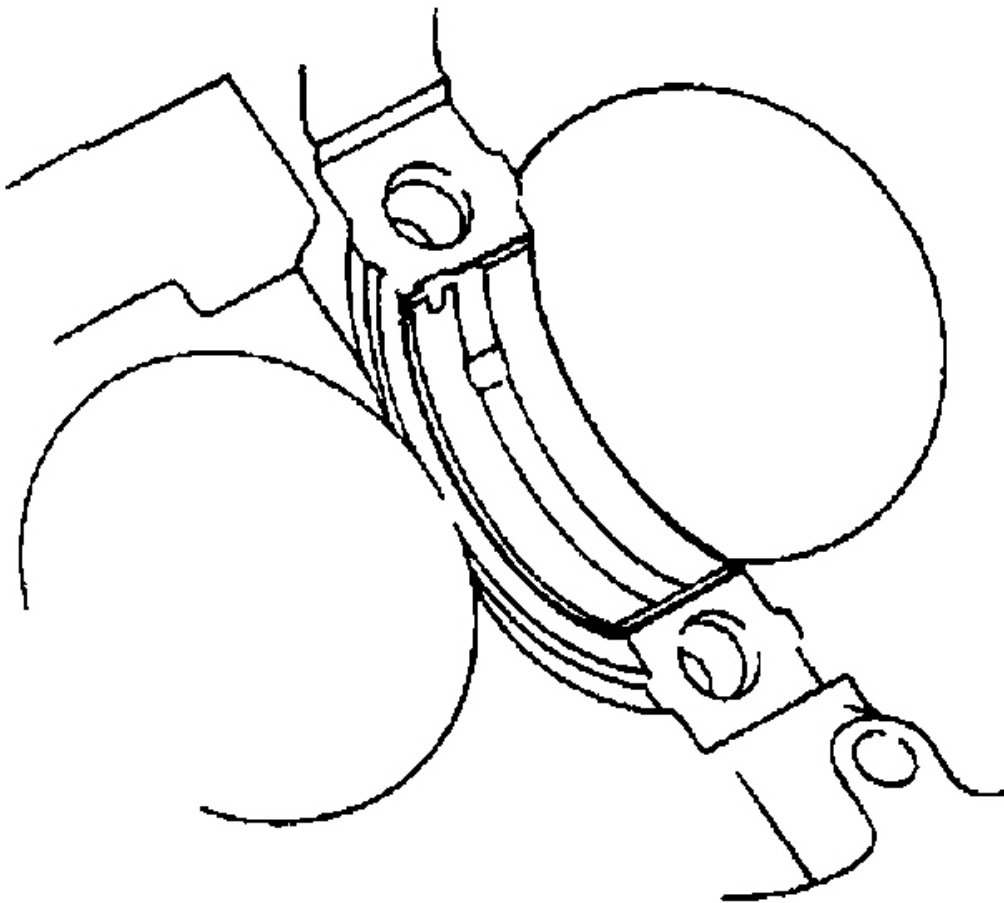


G01164496

Fig. 75: Identifying Proper Position Ring End Gap Positioning
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.

CAUTION: Install the bearing so it matches the oil hole in the block.



G01164497

Fig. 76: Installing Lower Main Bearing
Courtesy of HYUNDAI MOTOR CO.

11. Install the thrust washers in the No. 3 main bearing cap with the oil grooves facing outward.

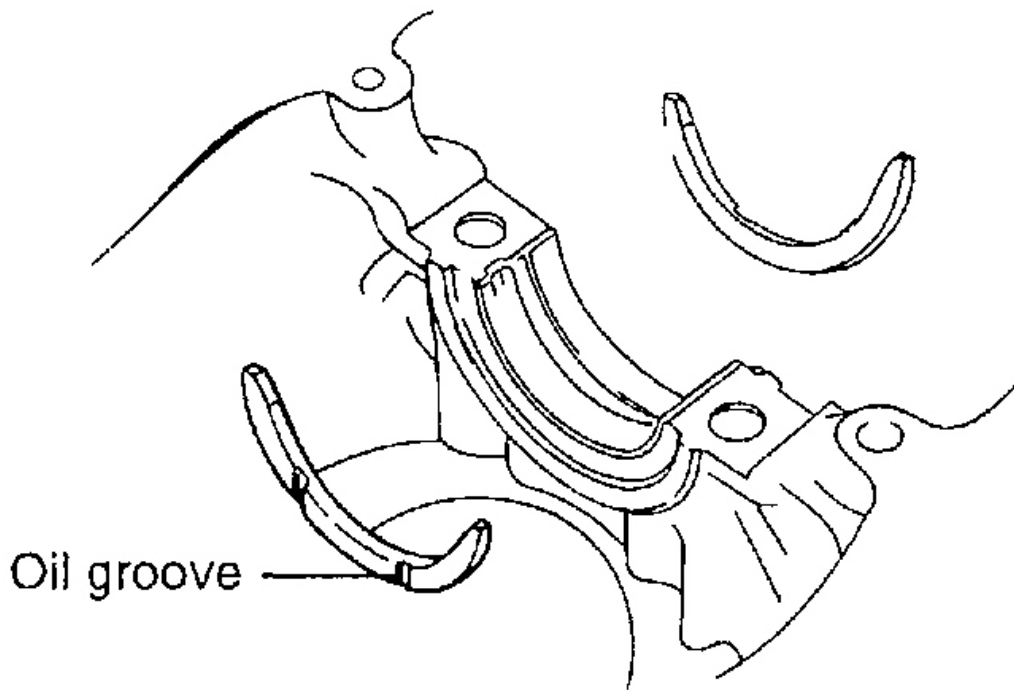
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Fig. 77: Installing Thrust Washers
Courtesy of HYUNDAI MOTOR CO.

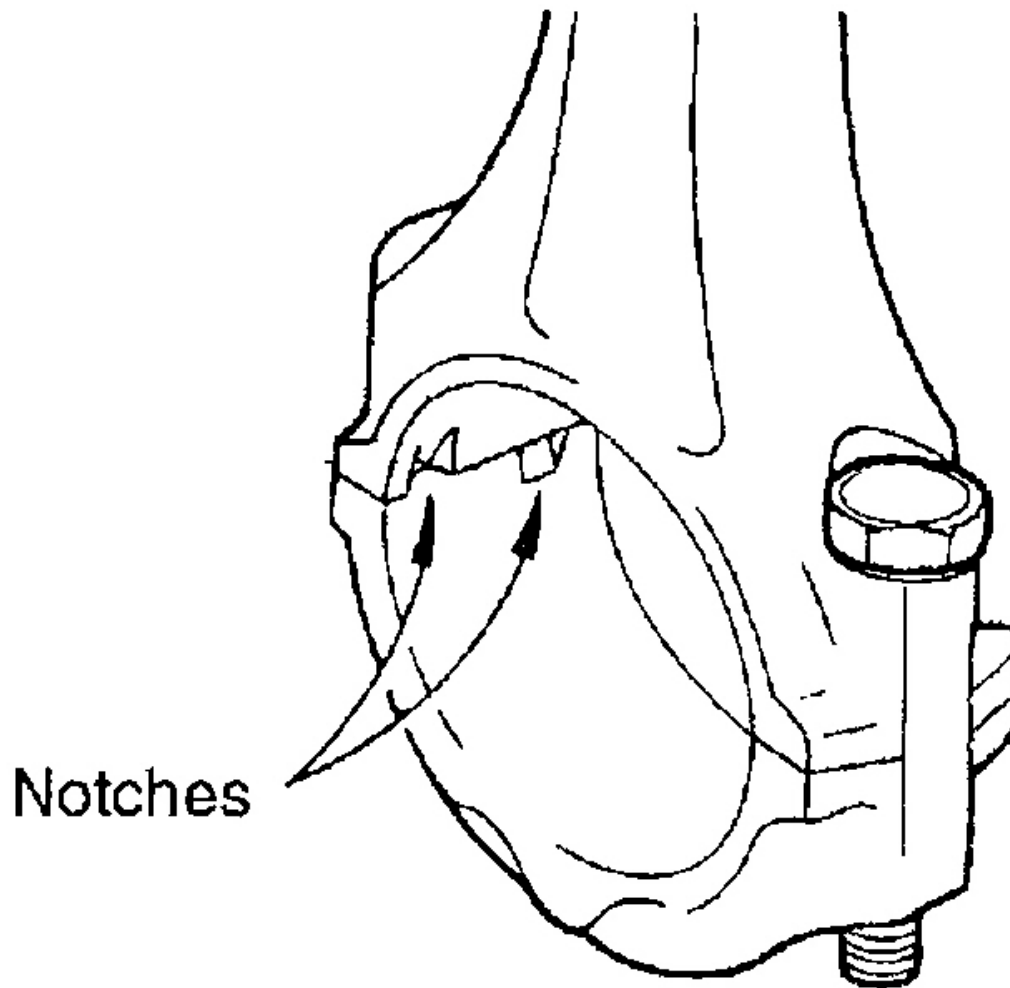
12. Make sure that the front mark of the piston and the front mark (identification mark) of the connecting rod are directed toward the front of the engine.
13. When the connecting rod cap is installed, make sure that any cylinder numbers placed on the rod and cap at disassembly match.
14. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
15. When assembling, bolts should be fastened using the plastic angle technique as follows.
 1. Apply oil to the threads and matching areas.
 2. Tighten the connecting rod bolt.

Tightening torque

Connecting rod bolt:

35 Nm (350 kg.cm, 26 lb.ft) + 90°

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.



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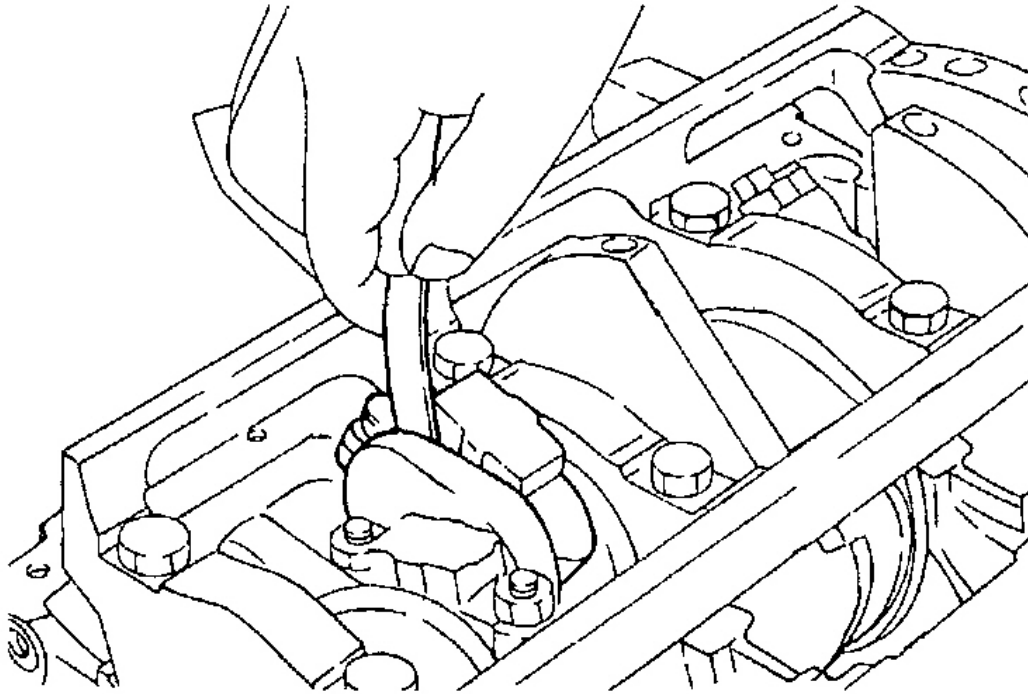
Fig. 78: Locating Proper Notches Positioning
Courtesy of HYUNDAI MOTOR CO.

16. 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.)

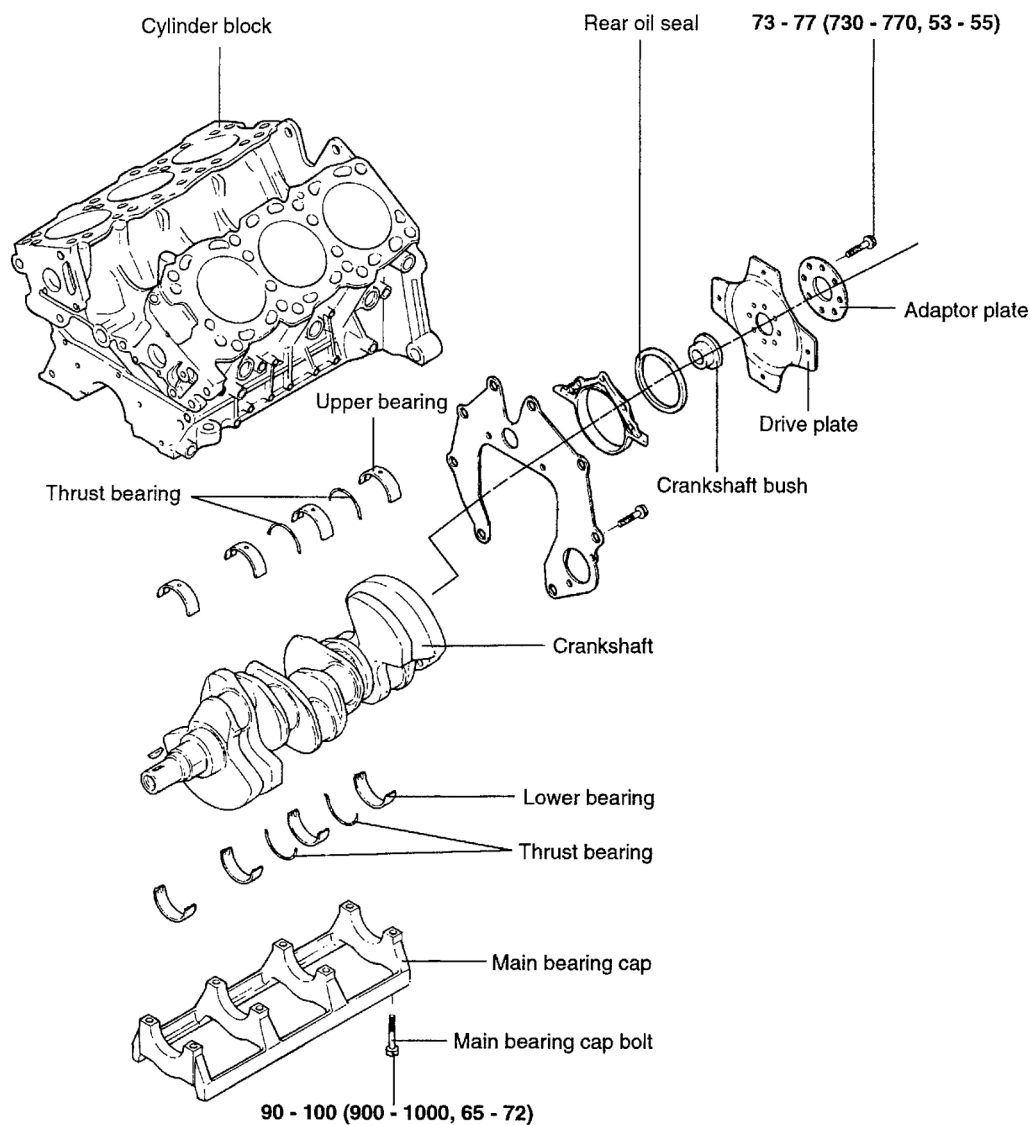


G01164500

Fig. 79: Checking Connecting Rod Side Clearance
Courtesy of HYUNDAI MOTOR CO.

CRANK SHAFT

COMPONENTS



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

G01164501

Fig. 80: Exploded View Of Cylinder Block & Crank Shaft
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

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

NOTE: **Mark the main bearing caps to be able to reassemble in the original position and direction.**

4. Remove the main bearing caps and remove the crankshaft. Keep the bearings in order according to the cap number.

INSPECTION

CRANKSHAFT

1. Check the crankshaft journals and pins for damage, uneven wear and cracks. Also check the oil holes for restrictions. Repair or replace any defective parts.
2. Inspect the crankshaft journal and pin for out-of-round and taper.

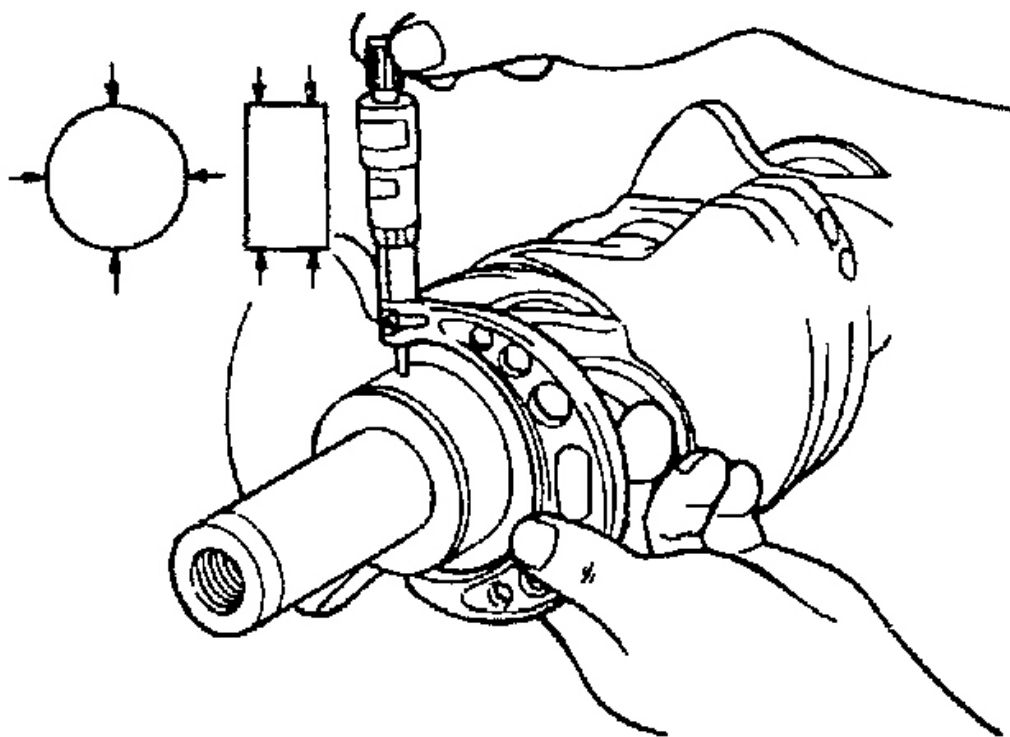
Standard value

Crankshaft journal O.D:

63.982-64.00 mm (2.519-2.5197 in.)

Crankshaft pin O.D:

54.982-55.00 mm (2.165-2.1653 in.)



G01164502

Fig. 81: Inspecting Crankshaft Journal & Pin For Out-Of-Round & Taper
Courtesy of HYUNDAI MOTOR CO.

MAIN BEARINGS AND CONNECTING ROD BEARINGS

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

MEASURING OIL CLEARANCE

Check for oil clearance by measuring the outside diameter of the crankshaft journal and the inside diameter of the bearing. The clearance can be obtained by calculating the difference between the measured outside diameters.

Standard value

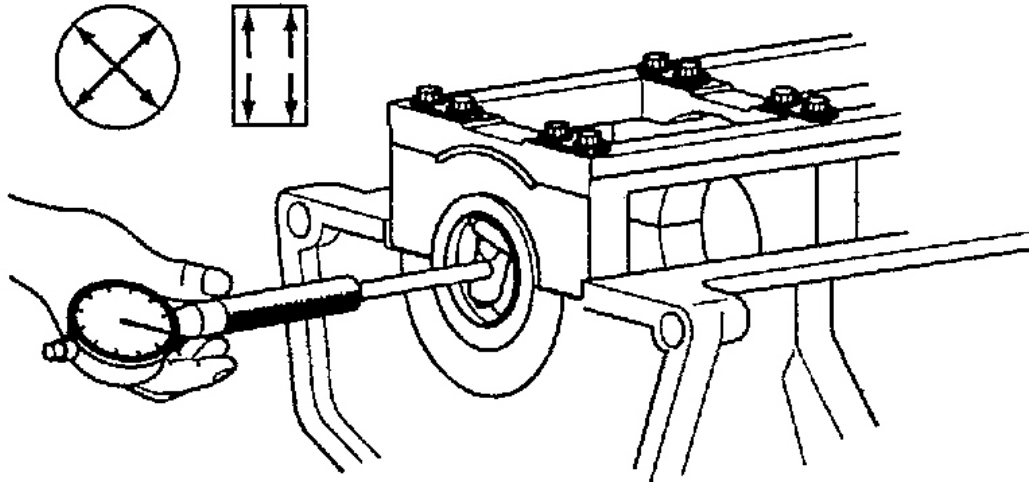
Oil clearance

Crankshaft main bearing:

0.018-0.036 mm (0.0007-0.0014 in.)

Connecting rod bearing:

0.022-0.048 mm (0.0009-0.002 in.)



G01164503

Fig. 82: Checking Inside Diameter Of Main Bearing
Courtesy of HYUNDAI MOTOR CO.

PLASTIGAGE METHOD

Plastigage may be used to measure the clearance.

1. Remove oil, grease and any other dirt from the bearings and journals.
2. Cut the plastigage the same length as the width of the bearing and place it in parallel with the journal, avoiding the oil holes.
3. Install the crankshaft, bearings and caps and tighten them to the specified torques. During this operation, do not turn the crankshaft. Remove the caps. Measure the width of the plastigage at the widest part by using the scale printed on the gauge package.

If the clearance exceeds the service limit, the bearing should be replaced or an undersize bearing should be used. When installing a new crankshaft, be sure to use standard size bearings.

If the standard clearance can not be obtained even after replacing the bearing, the journal and pin should be ground to the undersize and a bearing of the corresponding size should be installed.

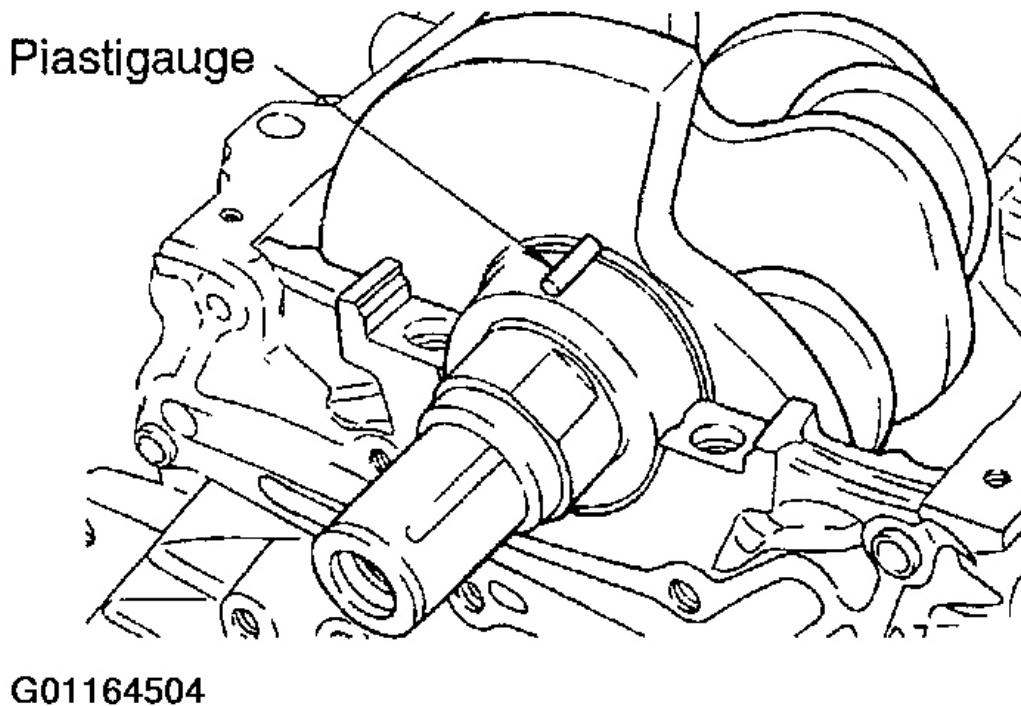


Fig. 83: Measuring Standard Clearance Using Plastigage
Courtesy of HYUNDAI MOTOR CO.

OIL SEAL

Check the front and rear oil seals for damage or worn surfaces. Replace any seal that is defective.

DRIVE PLATE (A/T)

Replace distorted, damaged, or cracked drive plates.

REASSEMBLY

MAIN BEARING

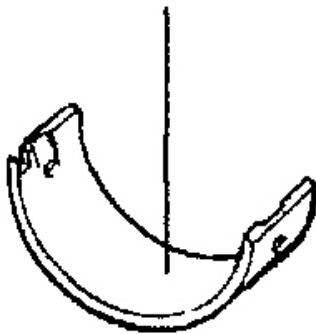
1. Install a grooved main bearing (upper bearing) on the cylinder block side.
2. Install a groove less main bearing (lower bearing) on the main bearing cap side.
3. Install the crankshaft. Apply engine oil to journal and pin.
4. Install the bearing caps with the arrow mark directed toward the front of the engine. Cap number must be correct.
5. Tighten the cap bolts to the specified torque.

Tightening torque

Main bearing cap bolts:

90-100 Nm (900-1000 kg.cm, 65-72 lb.ft)

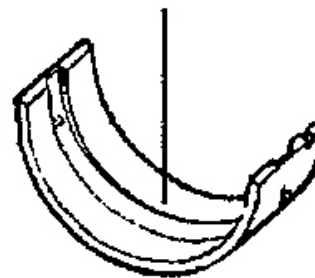
Grooveless



Lower bearing

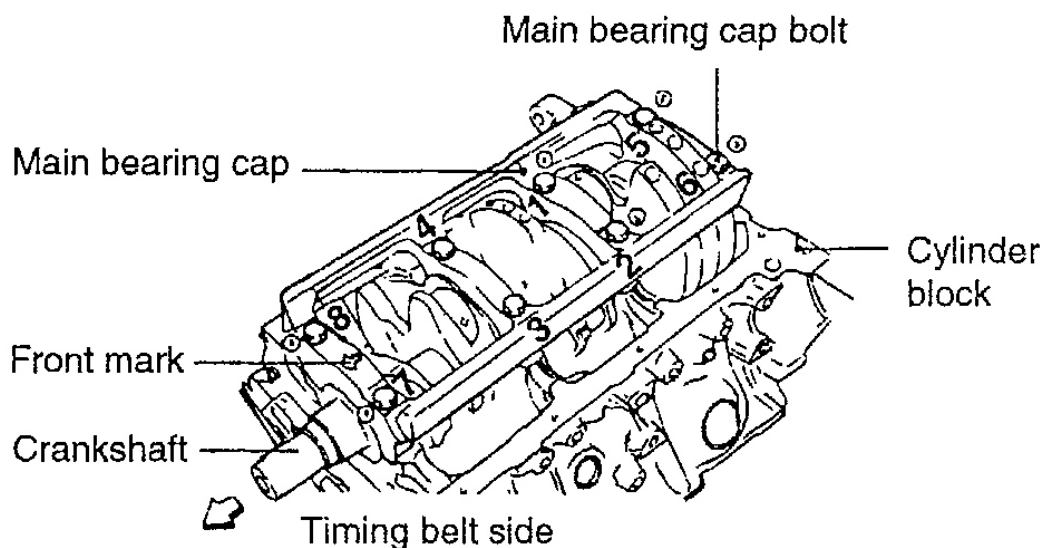
G01164505

Grooved



Upper bearing

Fig. 84: Identifying Upper & Lower Bearing
Courtesy of HYUNDAI MOTOR CO.



G01164506

Fig. 85: Tightening Cap Bolts

Courtesy of HYUNDAI MOTOR CO.

6. Cap bolts should be tightened evenly in stages 4 to 5 increments before they are tightened to the specified torque.
7. Make certain that crankshaft turns freely and check the end play of the crankshaft.

Crankshaft end play

Standard: 0.070-0.250mm (0.0028-0.0098 in.)

Limit: 0.35 mm (0.014 in.)

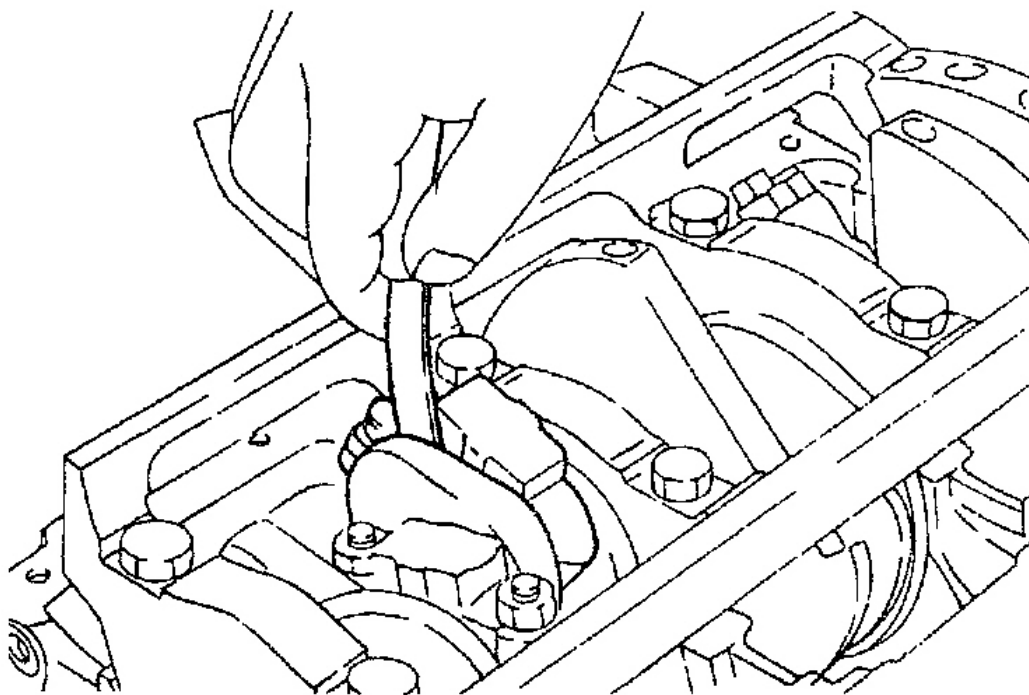
**G01164507**

Fig. 86: Measuring Crank Shaft End Play
Courtesy of HYUNDAI MOTOR CO.

8. Using special tool(09231-33000), install the rear oil seal in oil seal case.
9. Apply sealant to the area shown in the illustration. Install the oil seal case in the cylinder block.

Tightening torque

Oil seal case bolt:

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

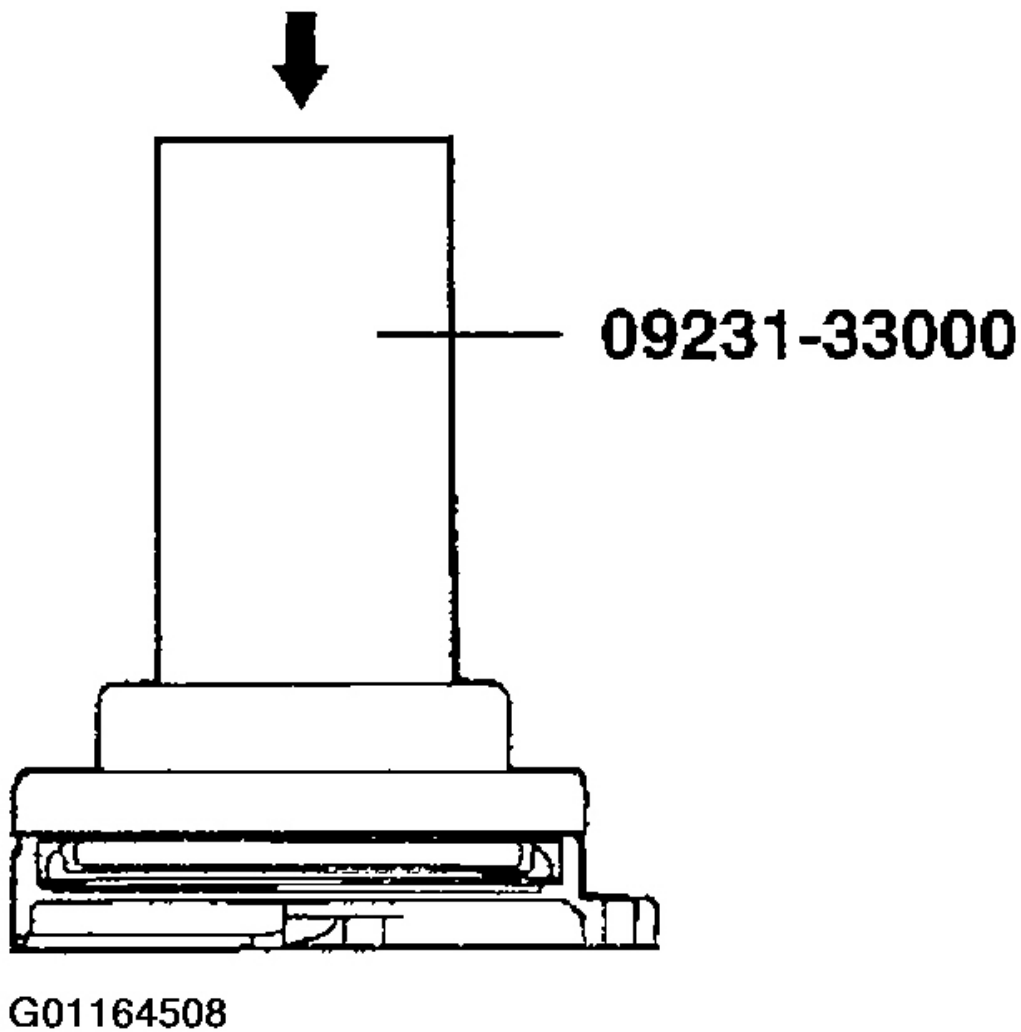
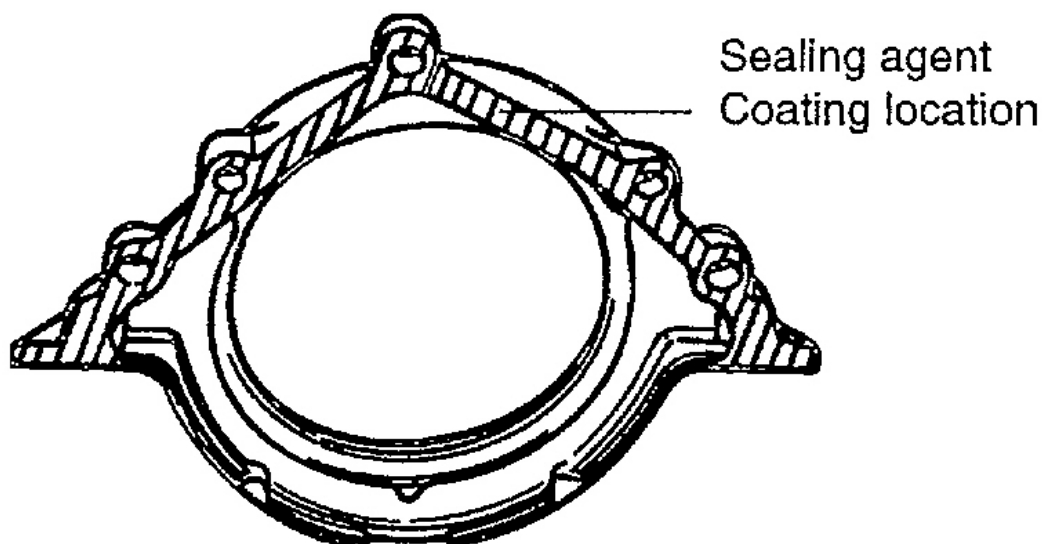


Fig. 87: Installing Oil Seal Case In Cylinder Block
Courtesy of HYUNDAI MOTOR CO.



G01164509

Fig. 88: Identifying Coating Location Of Sealing Agent
Courtesy of HYUNDAI MOTOR CO.

10. Tighten the rear plate to the specified torque.

Tightening torque

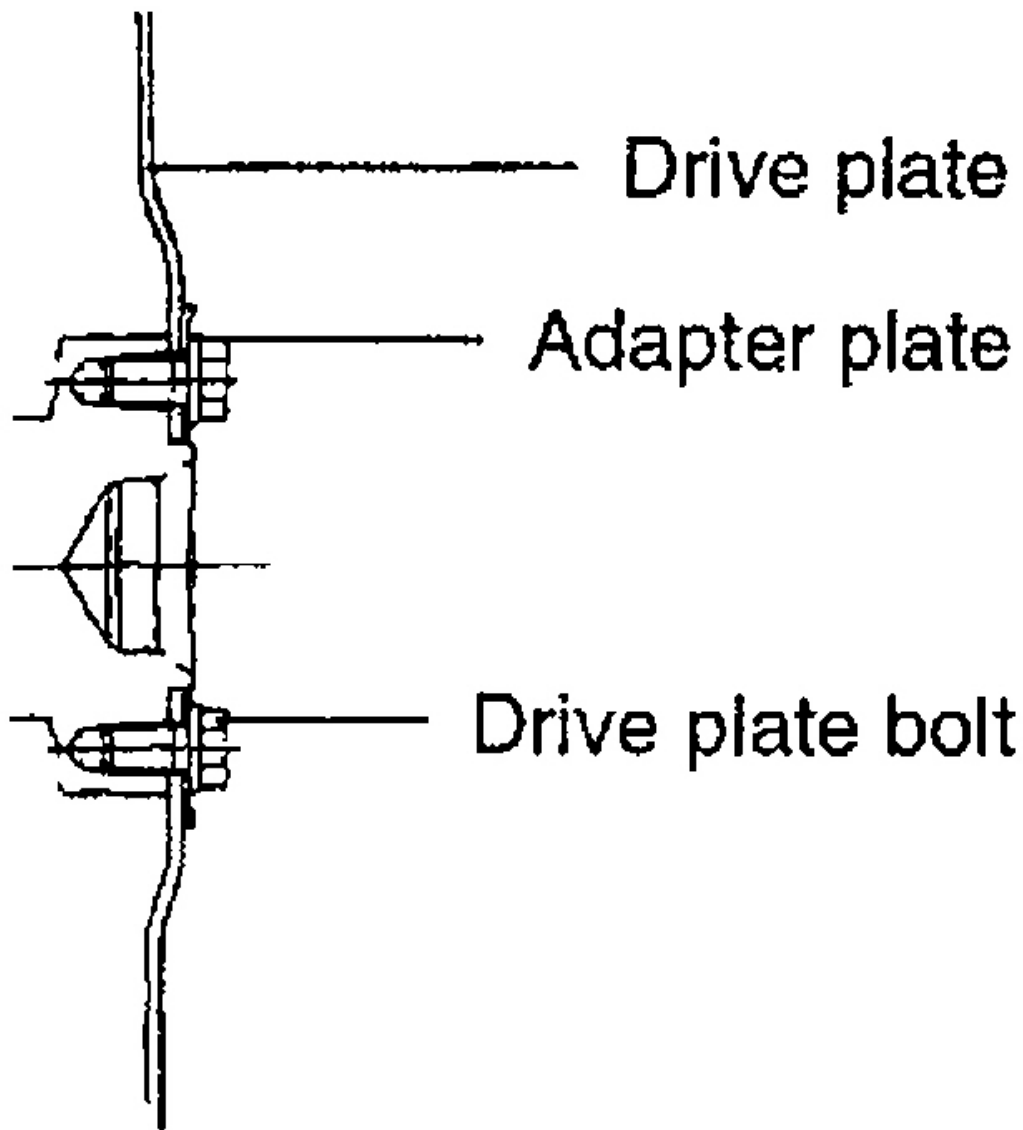
Rear plate: 10-12 Nm (100-120 kg.cm, 7-9 lb.ft)

11. Tighten the drive plate and the adapter plate (A/T).

Tightening torque

Drive plate and adapter plate bolt:

73-77 Nm (730-770 kg.cm, 53-56 lb.ft)



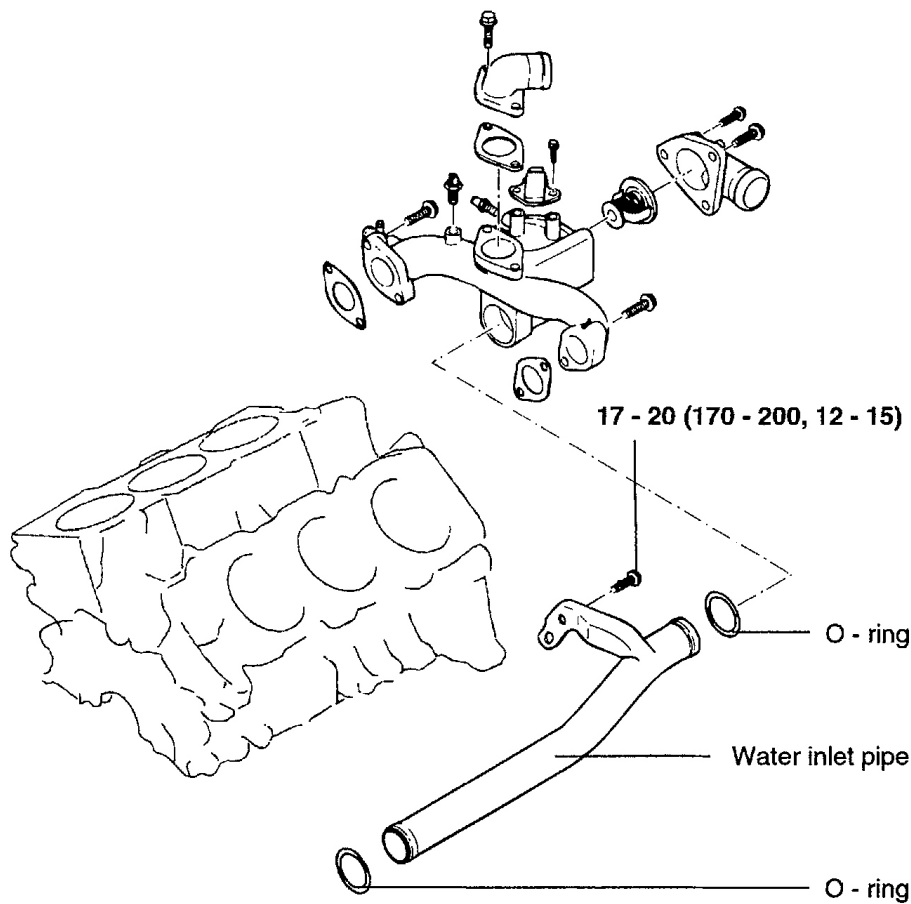
G01164510

Fig. 89: Tightening Drive Plate & Adapter Plate
Courtesy of HYUNDAI MOTOR CO.

COOLING SYSTEM

ENGINE COOLANT HOSE/PIPES

COMPONENTS



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

G01164511

Fig. 90: Disassembled View Of Engine Coolant Hose/Pipes
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

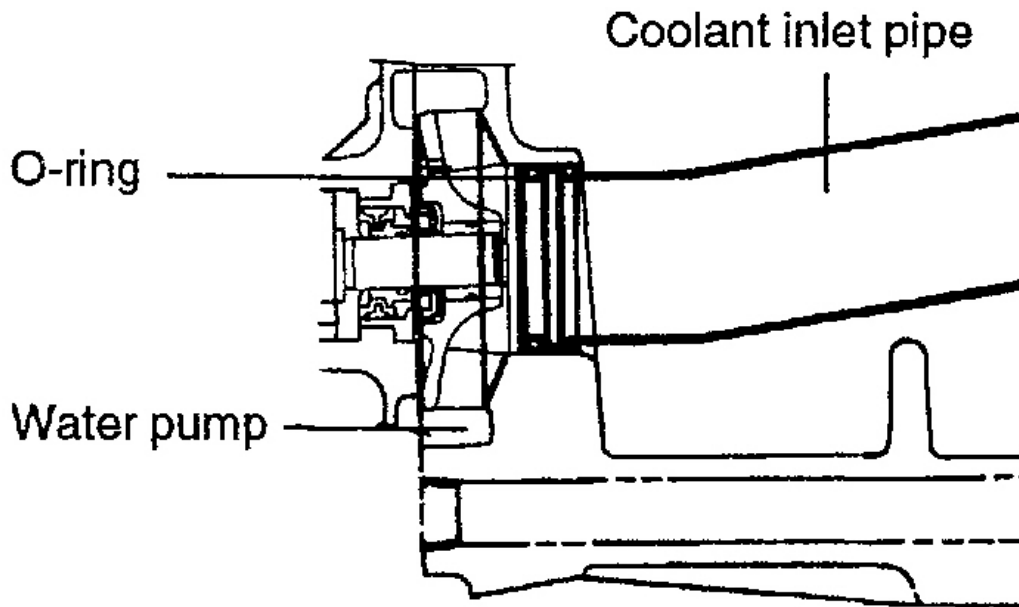
Check the engine coolant pipe and hose for cracks, damage and restrictions. Replace if necessary.

REASSEMBLY

Fit the O-ring in the groove of the engine coolant inlet pipe end. Wet the periphery of the O-ring with water and insert the engine coolant inlet pipe.

NOTE:

1. Do not apply oil or grease to the engine coolant pipe O-ring.
2. Keep the engine coolant pipe connections free of sand, dust, etc.
3. Insert the engine coolant pipe into the end of the engine coolant pump inlet.
4. Whenever installing the engine coolant inlet pipe, always replace the O-ring with a new one.



G01164512

Fig. 91: Fitting O-Ring In Groove Of Engine Coolant Inlet Pipe End
Courtesy of HYUNDAI MOTOR CO.

COOLANT TEMPERATURE SENSOR**REMOVAL**

1. Drain the engine coolant.
2. Remove the engine harness after disconnecting the ground cable of the battery.
3. Remove the engine coolant sensor.

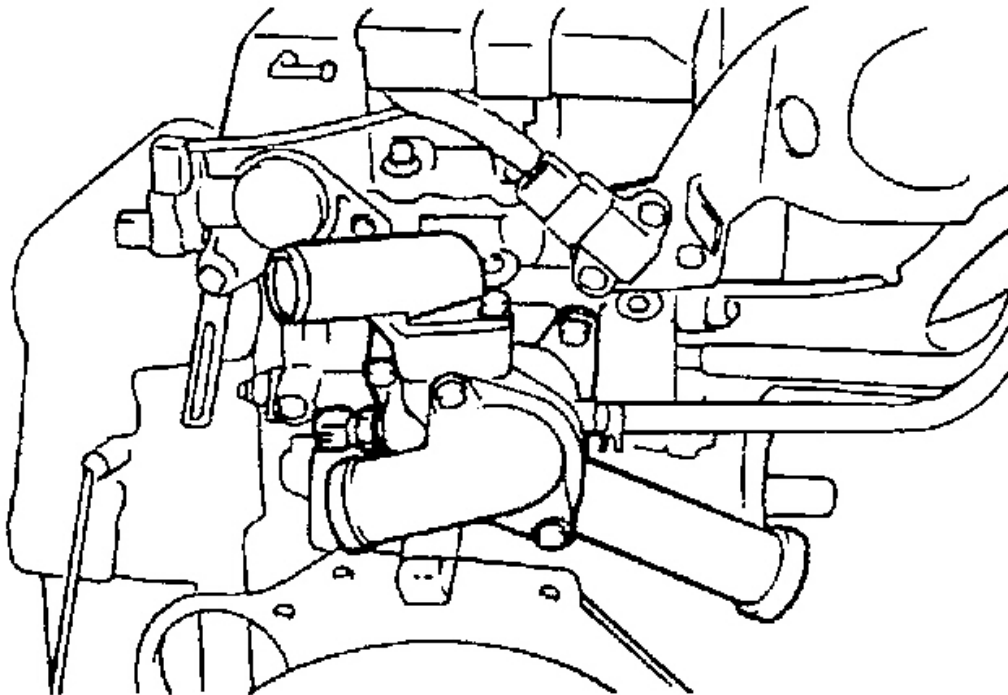
**G01164513**

Fig. 92: Removing Engine Coolant Sensor
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

1. Apply sealant to the sensor's threads. Tighten it to the specified torque.

Recommended sealant:

Three bond NO. 2310 or LOCTITE 962T

Tightening torque

The coolant sensor:

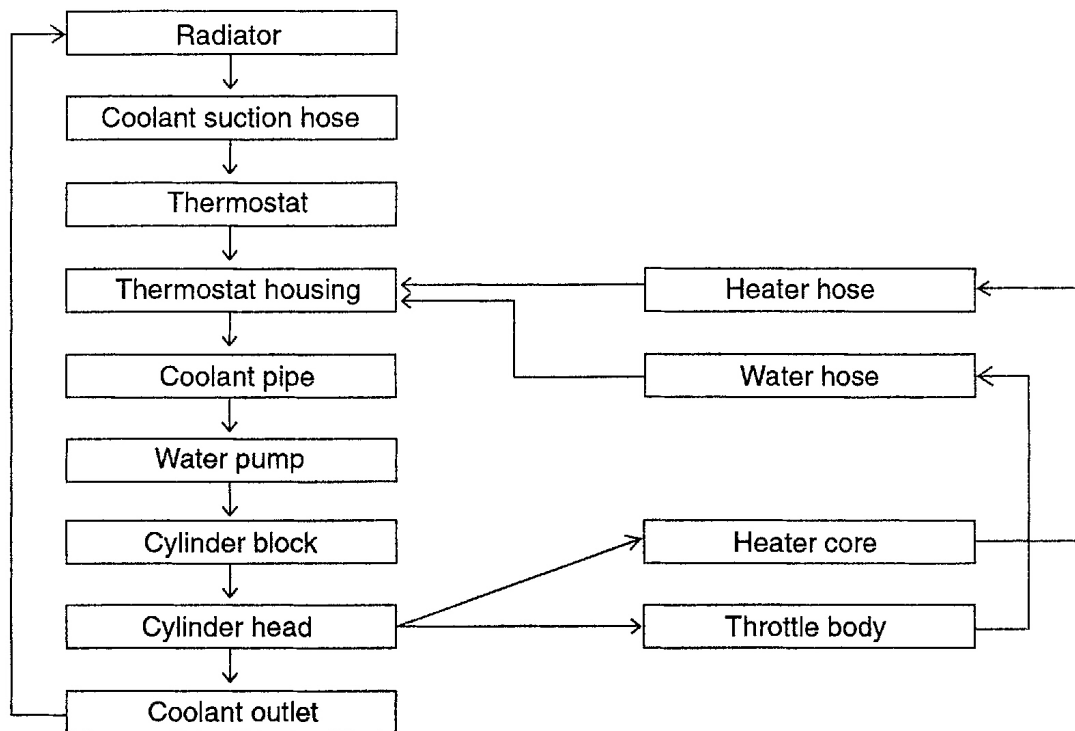
20-40Nm(200-400 kg.cm, 14-29 lb.ft)

2. Connect the coolant sensor to the harness.
3. Connect the ground cable of battery.

4. Refill the coolant.

SCHEMATIC DIAGRAM

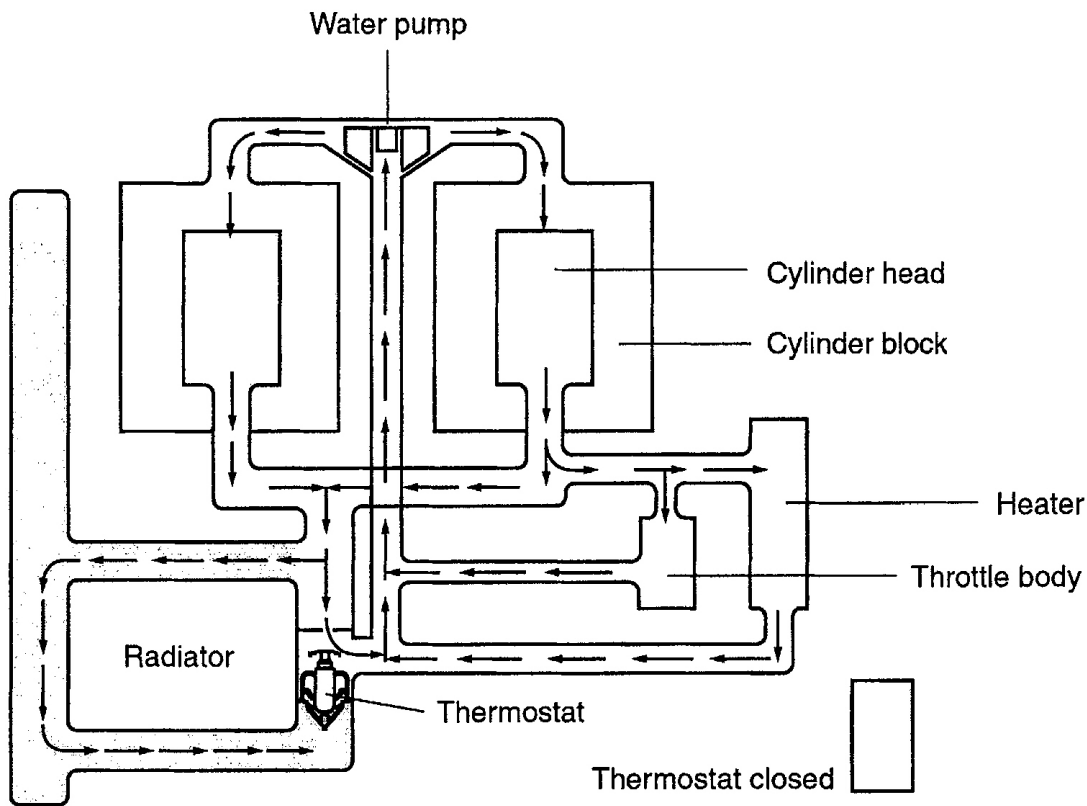
INLET CONTROL



G01164514

Fig. 93: Inlet Control Schematic Diagram
 Courtesy of HYUNDAI MOTOR CO.

FLOW CHART

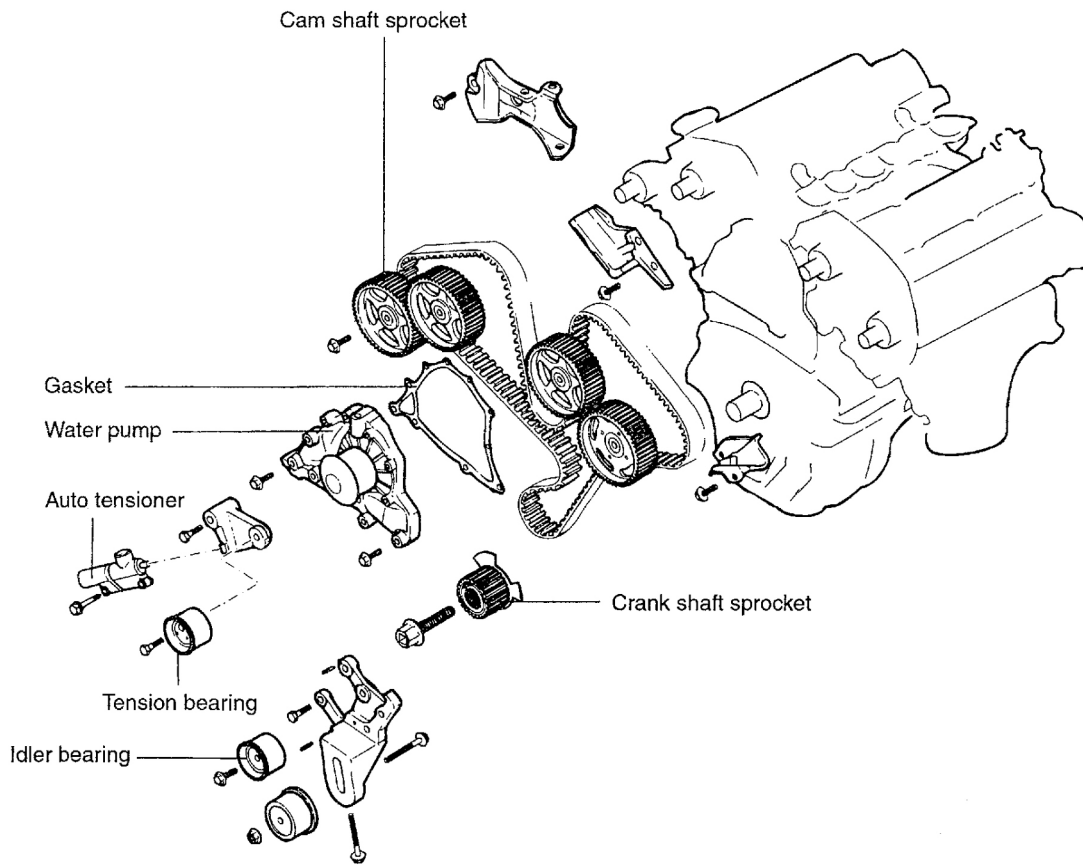


G01164515

Fig. 94: Engine Coolant Flow
Courtesy of HYUNDAI MOTOR CO.

ENGINE COOLANT PUMP

COMPONENTS

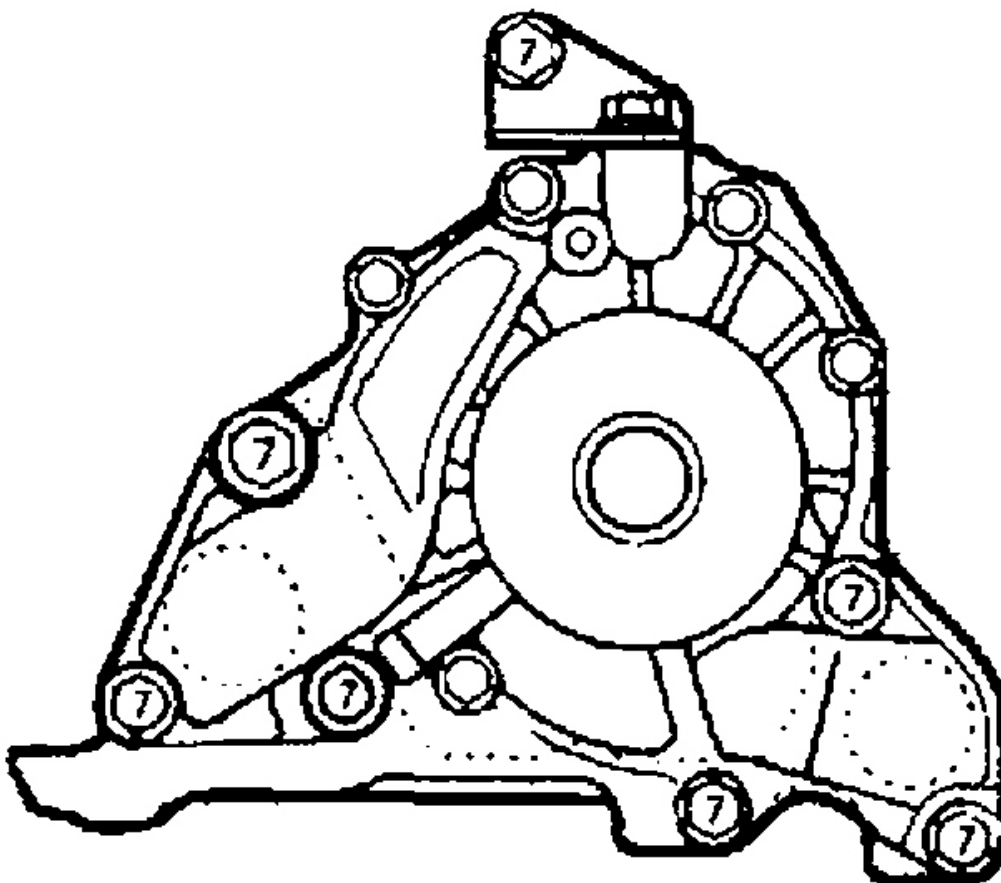


G01164516

Fig. 95: Exploded View Of Engine Coolant Pump & Components
 Courtesy of HYUNDAI MOTOR CO.

REMOVAL

1. Using the drain plug, drain the coolant.
2. Remove the drive belt and the engine coolant pump pulley.
3. Remove the timing belt cover, the auto tensioner and idler pulley.
4. Remove the engine coolant pump mounting bolts.
5. Remove the engine coolant pump assembly from the cylinder block.



G01164517

Fig. 96: Identifying Engine Coolant Pump

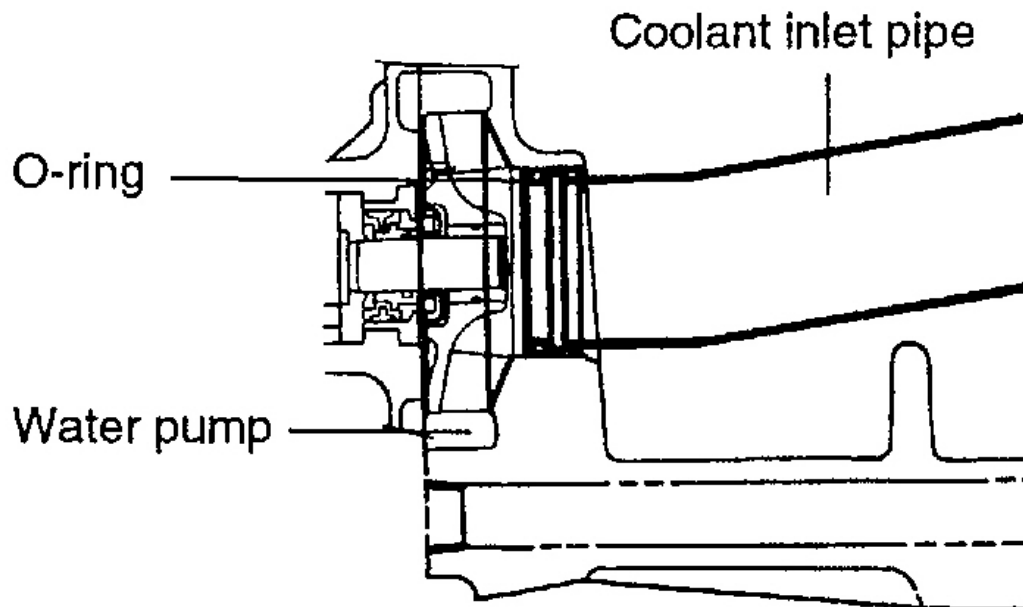
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

1. Check the engine coolant pump for cracks, damage or wear, and replace the pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation and replace the pump assembly if necessary.
3. Check the seal for leaks and replace the pump assembly if necessary.

INSTALLATION

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



G01164518

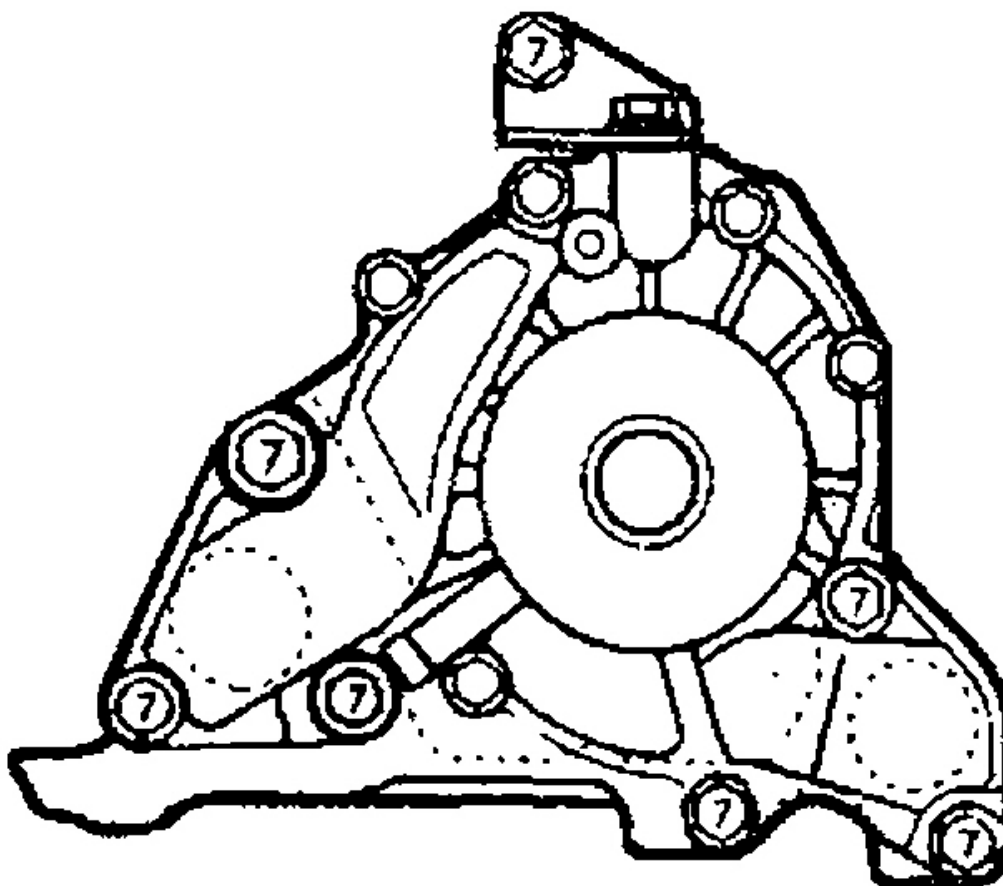
Fig. 97: Identifying Coolant Inlet Pipe-To-Pump
Courtesy of HYUNDAI MOTOR CO.

2. Install the new engine coolant pump gasket and pump assembly. Tighten the bolts to the specified torque.

Tightening torque

Engine coolant pump bolt:

Head mark "7": 15-22 (150-220, 11-16)



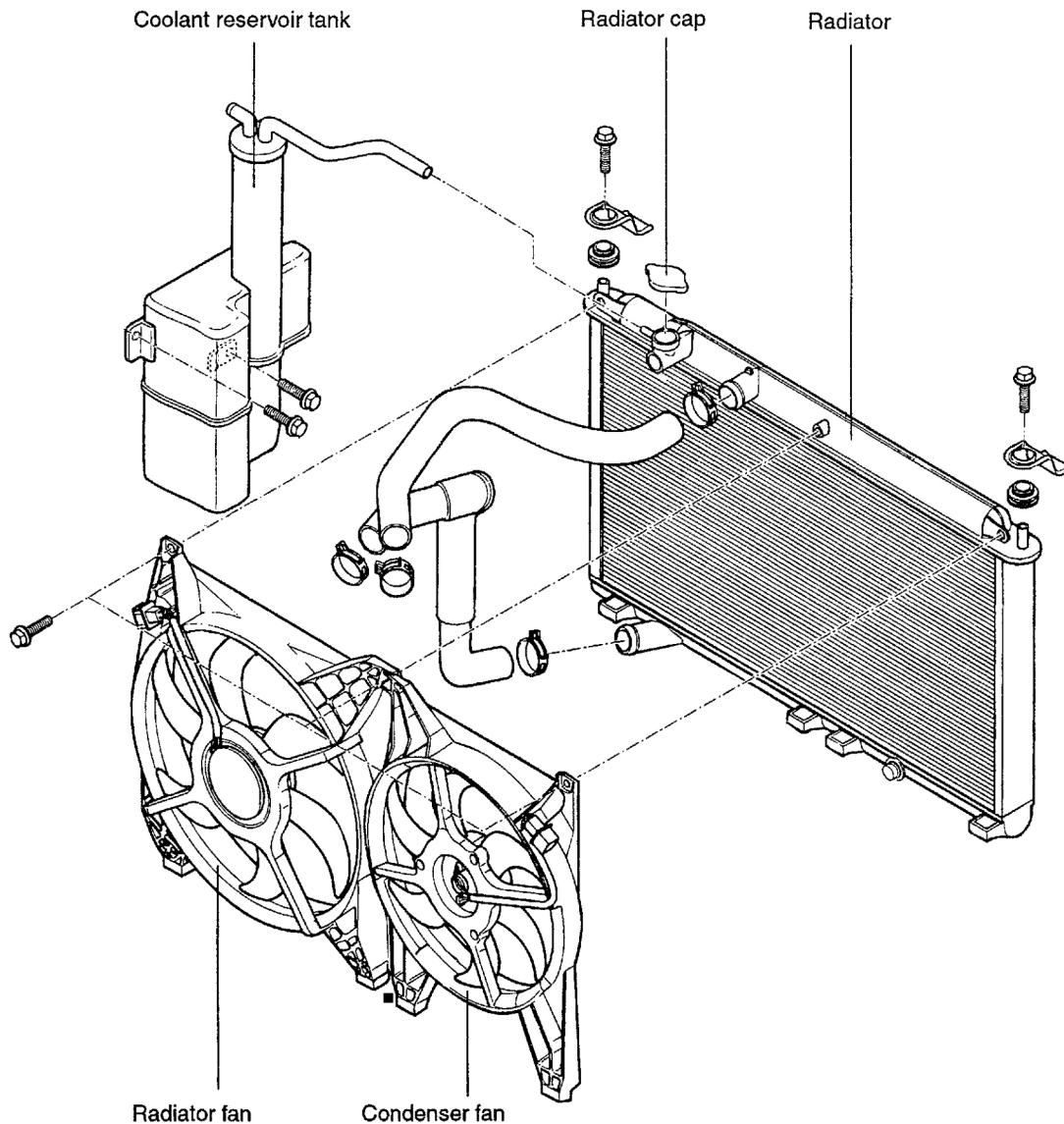
G01164519

Fig. 98: Identifying Engine Coolant Pump Assembly
Courtesy of HYUNDAI MOTOR CO.

3. Install the auto tensioner and timing belt. Adjust the timing belt tension, then install the timing belt cover.
4. Install the drive belt, coolant pump pulley and then adjust the auto tensioner.
5. Refill the coolant.
6. Run the engine and check for leaks.

RADIATOR

COMPONENTS

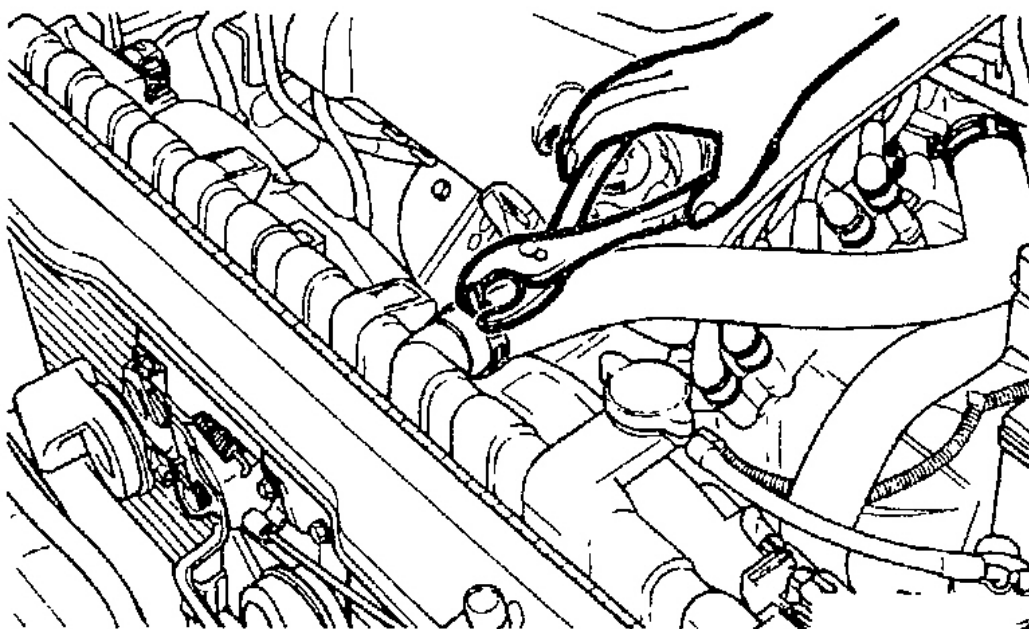


G01164520

Fig. 99: Radiator Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

1. Disconnect the ground cable from the battery terminal.
2. Disconnect the fan motor connector.
3. Loosen the radiator drain plug to drain the coolant.
4. Disconnect the upper and lower hoses and overflow tube after marking the radiator hose and the hose clamp the ease reassembly.



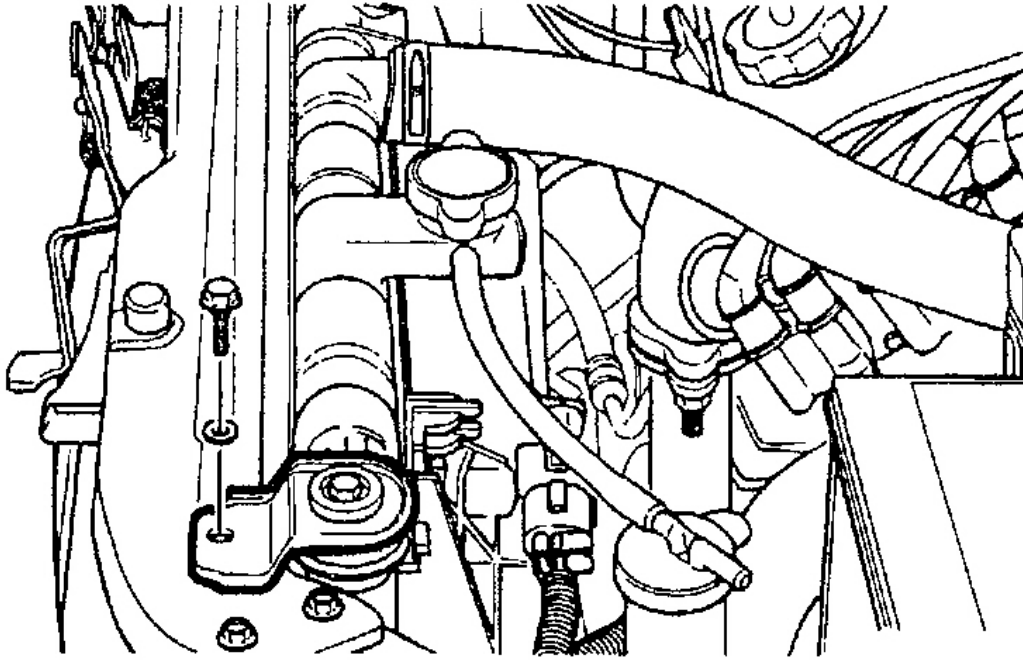
G01164521

Fig. 100: Disconnecting Upper Hose
Courtesy of HYUNDAI MOTOR CO.

5. For vehicles with automatic transaxles, disconnect the oil cooler hoses from the automatic transaxle.

CAUTION: Cover or plug the hose and inlets of the radiator so that dust and other foreign material etc. can not enter after the hose is disconnected from the radiator.

6. Remove the radiator mounting bolt.



G01164522

Fig. 101: Removing Radiator Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

7. Remove the radiator and the fan motor.
8. Remove the radiator fan motor and condenser fan motor from the radiator.

INSPECTION

1. Check for foreign material between the radiator fins.
2. Check the radiator fins for damage and straighten if necessary.
3. Check the radiator for corrosion, damage, rust or scale.
4. Check the radiator hoses for cracks, damage or deterioration.
5. Check the reservoir tank for damage.
6. Check the automatic transaxle oil cooler hoses for cracking, damage or deterioration (only A/T).

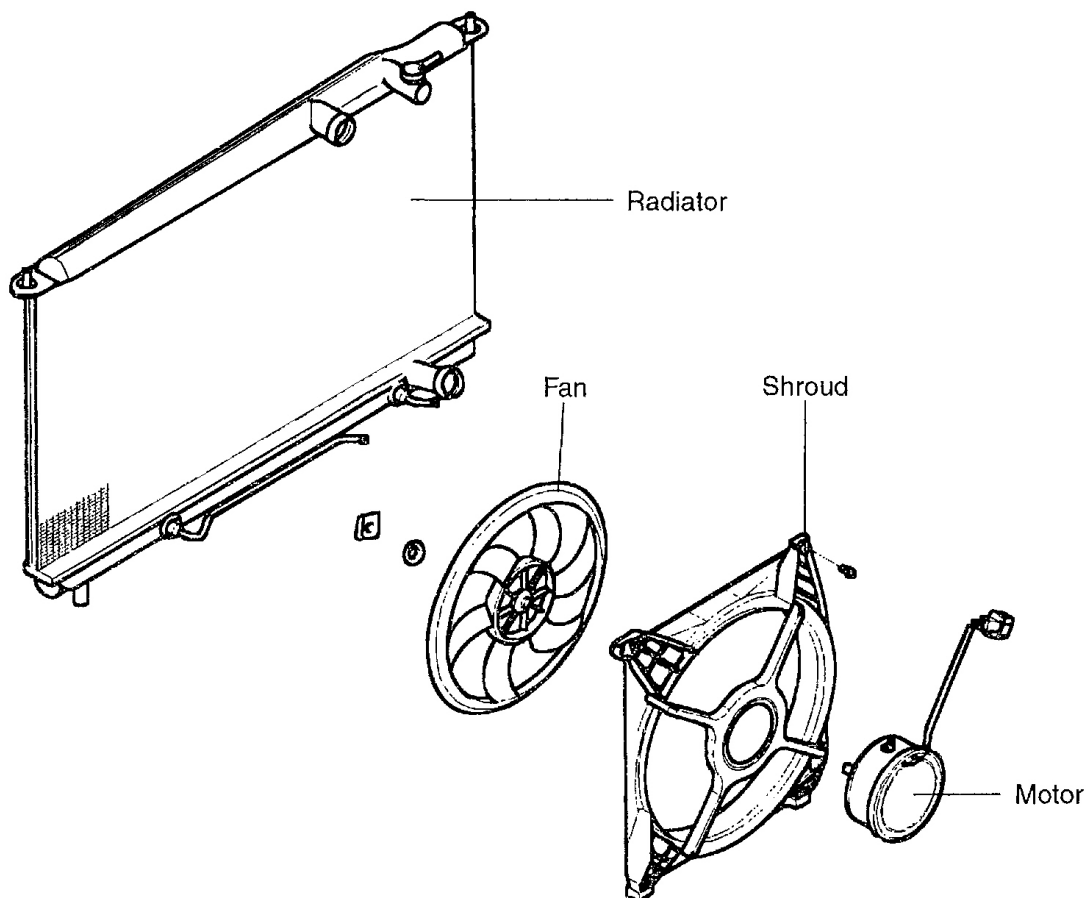
INSTALLATION

1. Fill the radiator and reservoir tank with a clean coolant mixture.
2. Run the engine until the coolant warms up enough so that the thermostat valve opens and then turn off the engine.

3. Remove the radiator cap and pour the coolant up to the filler neck of the radiator. Fill the reservoir tank to the upper level.
4. Check that there are no leaks from the radiator, hoses or connections.

RADIATOR FAN MOTOR

COMPONENTS



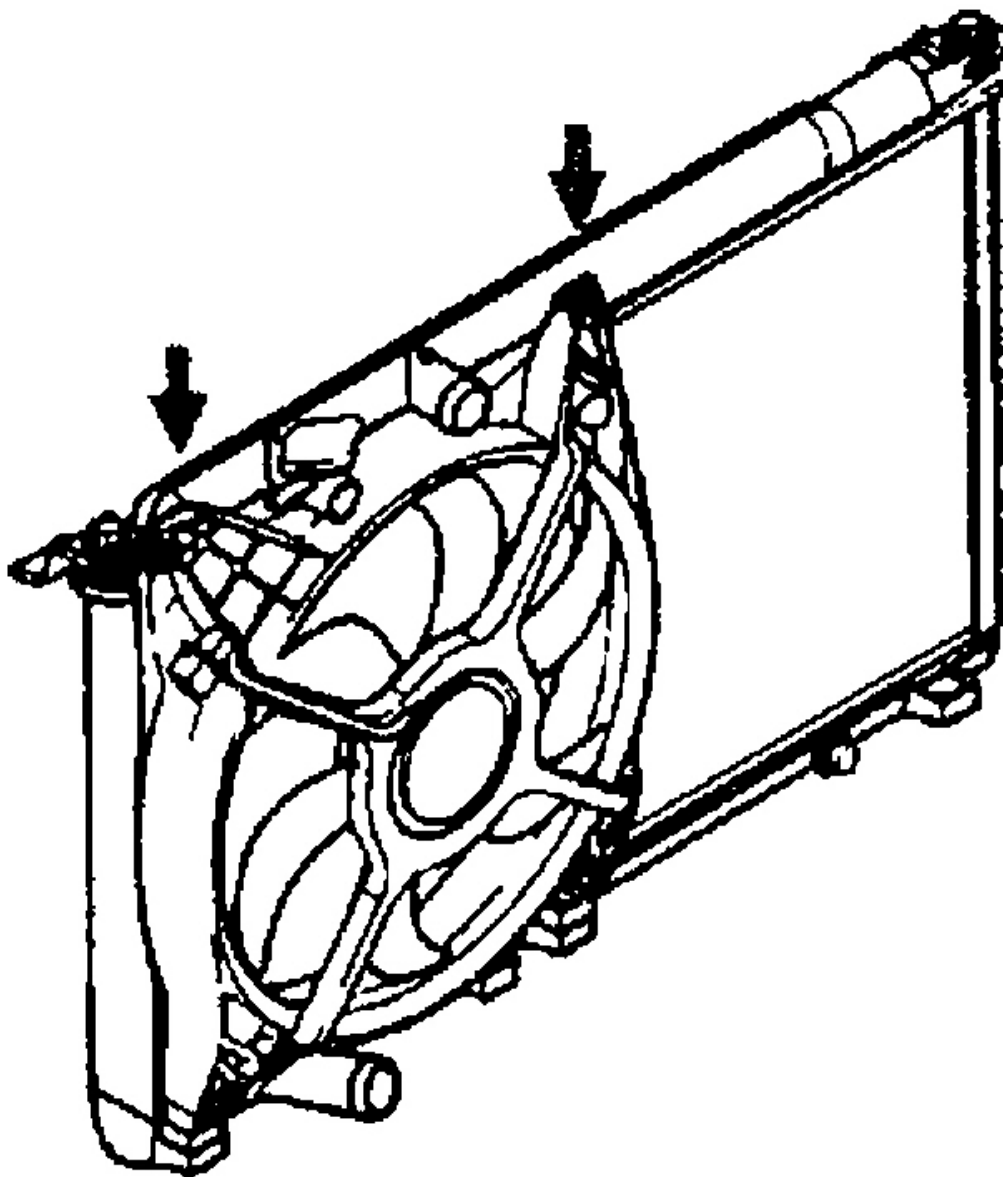
G01164523

Fig. 102: Radiator Fan Motor Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

1. Disconnect the ground cable from the battery cable.
2. Disconnect the connectors from the fan motor and the harness from the shroud.
3. For vehicles with automatic transaxles, remove the oil cooler hose from the shroud.
4. Remove the four bolts holding the shroud.

5. Remove the shroud with the fan motor.
6. Remove the fan mounting clip and detach the fan from the fan motor.
7. Remove the three screws and detach the fan motor.



G01164524

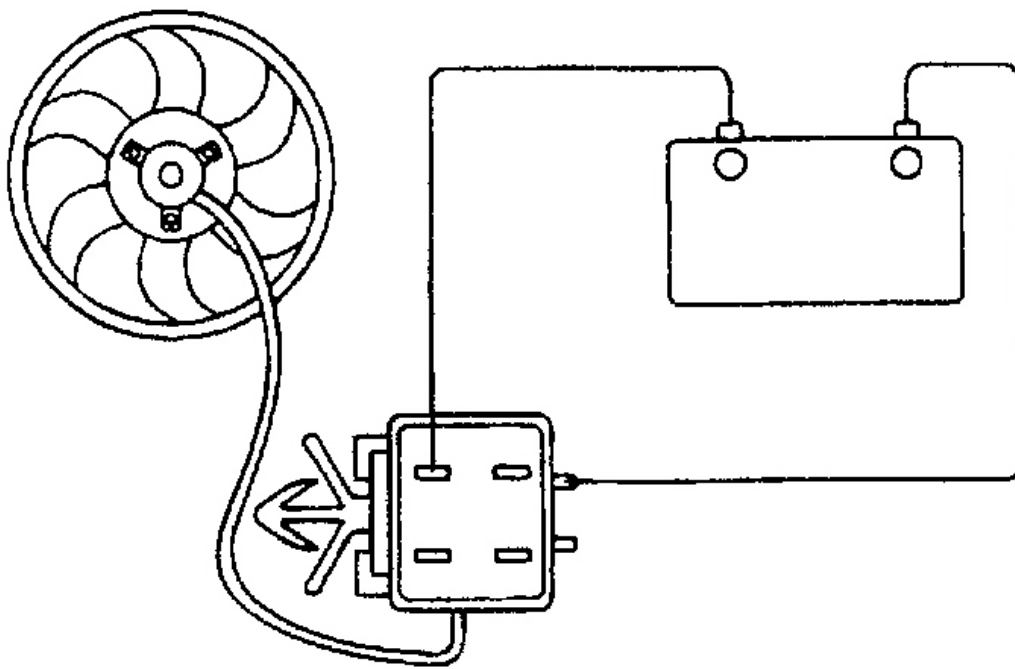
Fig. 103: Identifying Radiator Fan Motor Bolts

Courtesy of HYUNDAI MOTOR CO.

INSPECTION

RADIATOR FAN MOTOR AND CONDENSER FAN MOTOR

1. Check that the radiator fan rotates when battery voltage is applied between the terminals.
2. Check that there are no abnormal noises while the motor is running.

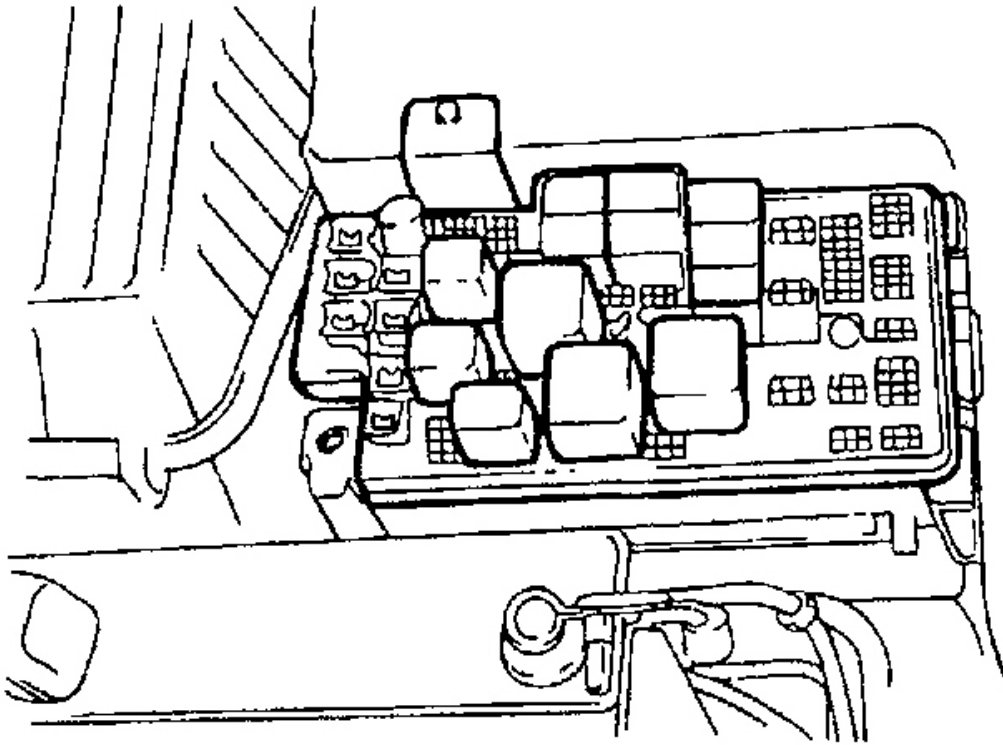


G01164525

Fig. 104: Inspecting Radiator Fan Motor
Courtesy of HYUNDAI MOTOR CO.

RADIATOR FAN MOTOR RELAY

1. Remove the radiator fan motor relay (High and Low) from the relay box in the engine room.

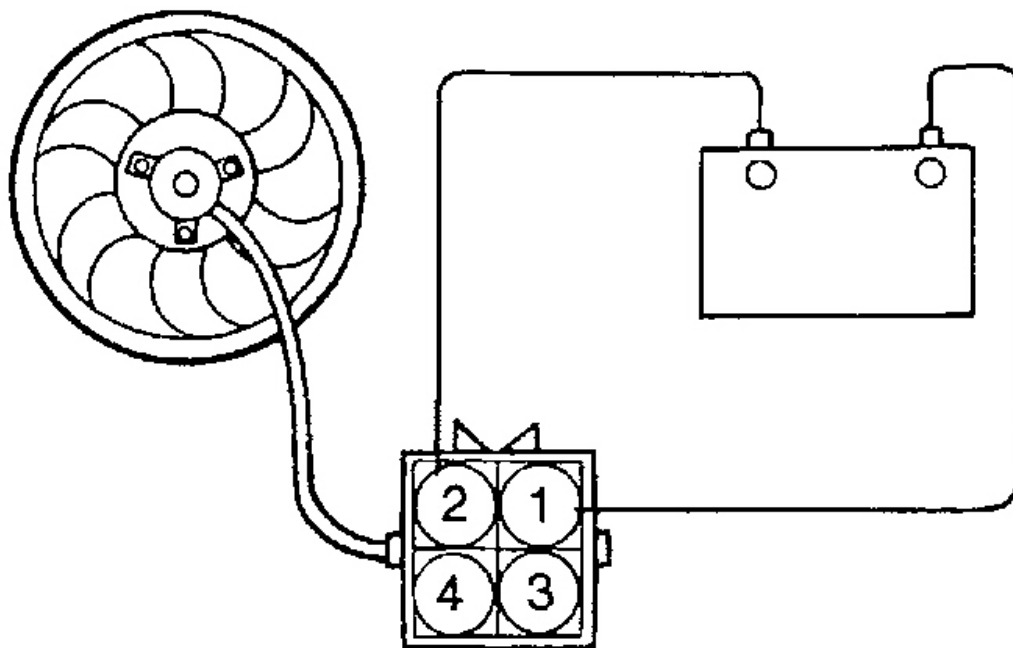


G01164526

Fig. 105: View Of Relay Box

Courtesy of HYUNDAI MOTOR CO.

2. Check to be sure that the radiator fan rotates when battery voltage is applied between the terminals (as shown table below).
3. Check to see that abnormal noises are not produced while the motor is turning.



G01164527

Fig. 106: Inspecting Radiator Fan Motor Operation
Courtesy of HYUNDAI MOTOR CO.

Terminal Item	1	2	3	4	MOTOR SPEED
RADIATOR FAN MOTOR	⊕		⊖		LOW
	⊕	⊕		⊖	MIDDLE
	⊕	⊕	⊖	⊖	HIGH
CONDENSER FAN MOTOR		⊕	⊖		LOW
	⊕	⊕		⊖	MIDDLE
	⊕	⊕	⊖	⊖	HIGH

G01164528

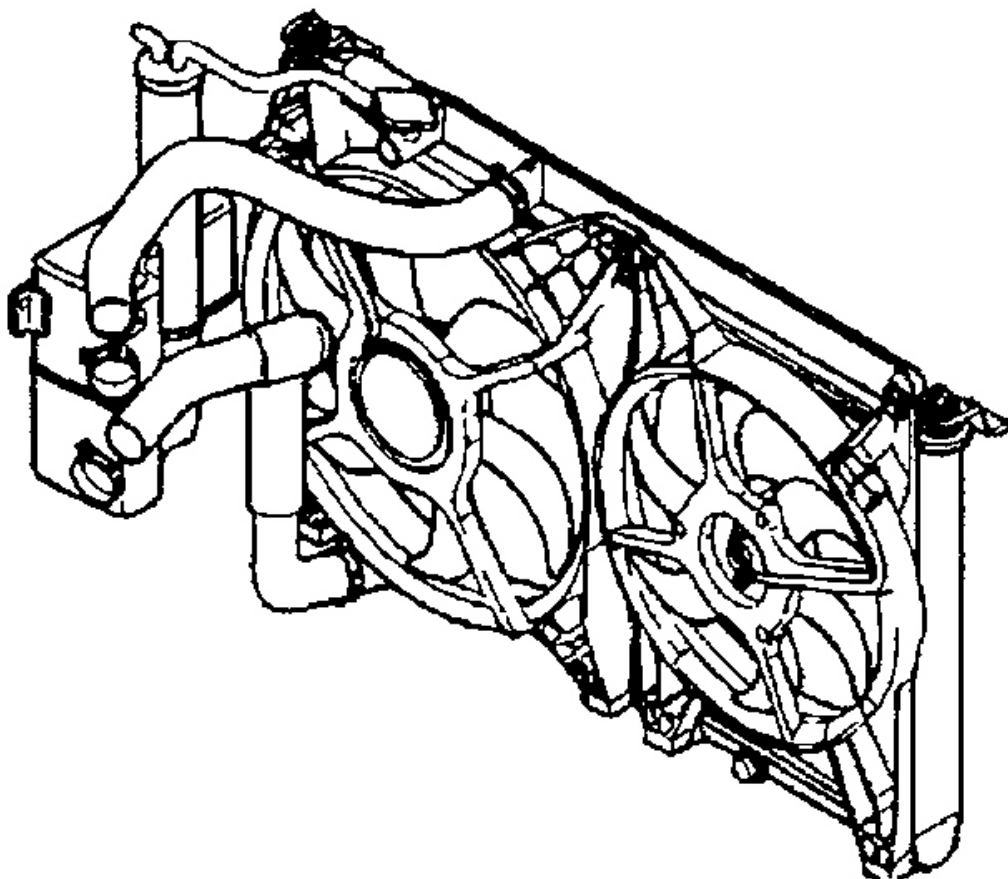
Fig. 107: Radiator Fan Operational Check Table
 Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

Installation is the reverse of removal.

NOTE:

1. Make sure the cooling fan does not come into contact with the shroud when installed.
2. After installation, make sure there is no unusual noise or vibration when the fan is rotating.

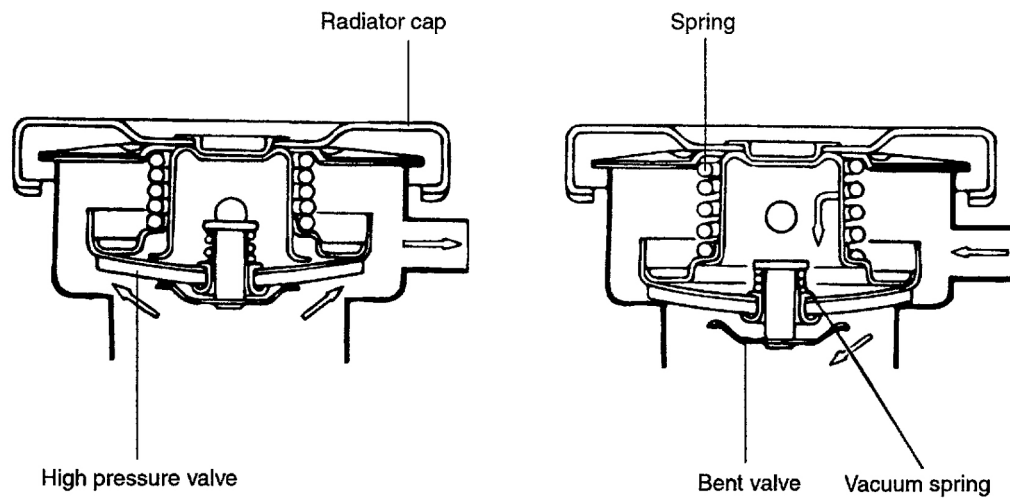


G01164529

Fig. 108: View Of Radiator Fan
Courtesy of HYUNDAI MOTOR CO.

RADIATOR CAP

COMPONENTS



Pressure : 107.9±14.7 (1.1±0.15, 15.64±2.13)

Pressure : 83.4 (0.85, 12.1)

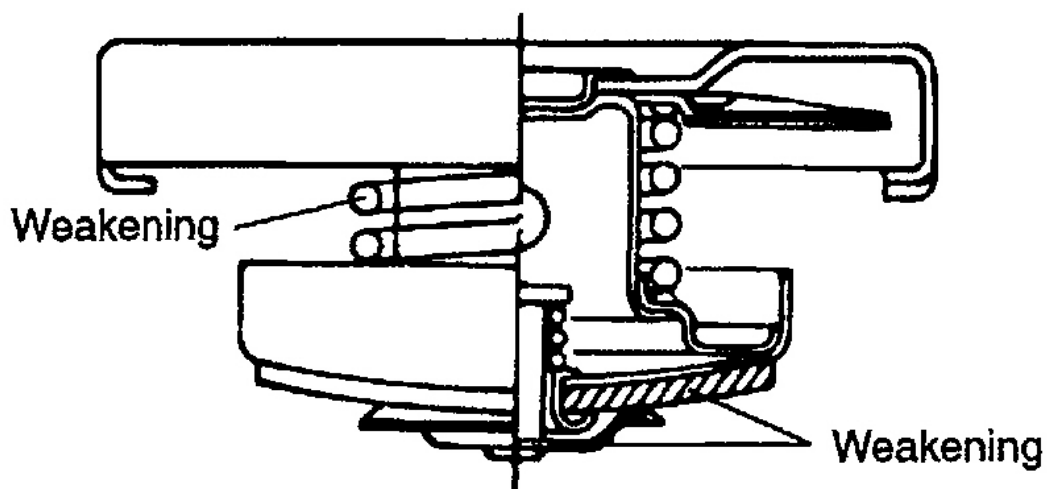
PRESSURE : Kpa (kg/cm², psi)

G01164530

Fig. 109: Radiator Cap Component
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

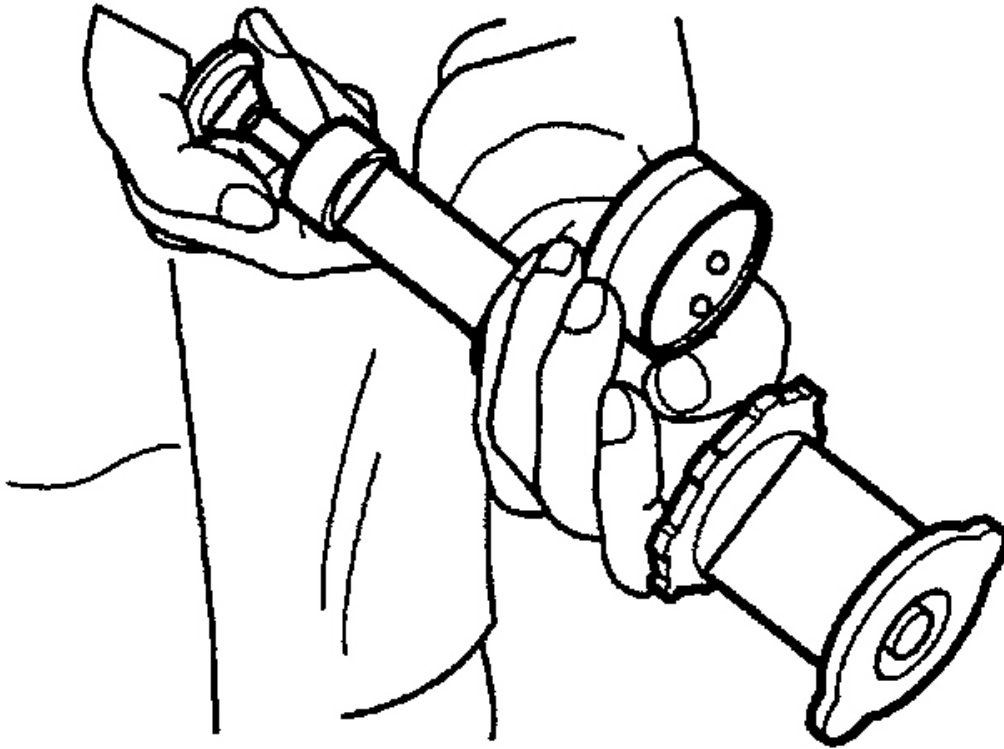
1. Check the radiator cap for damage, cracks or weakening.



G01164531

Fig. 110: Checking Radiator Cap For Damage, Cracks Or Weakening
Courtesy of HYUNDAI MOTOR CO.

2. Connect the tester to the radiator cap.
3. Increase the pressure until the indicator of the gauge stops moving.
4. Replace the radiator cap if the reading does not hold steady for about 10 seconds.

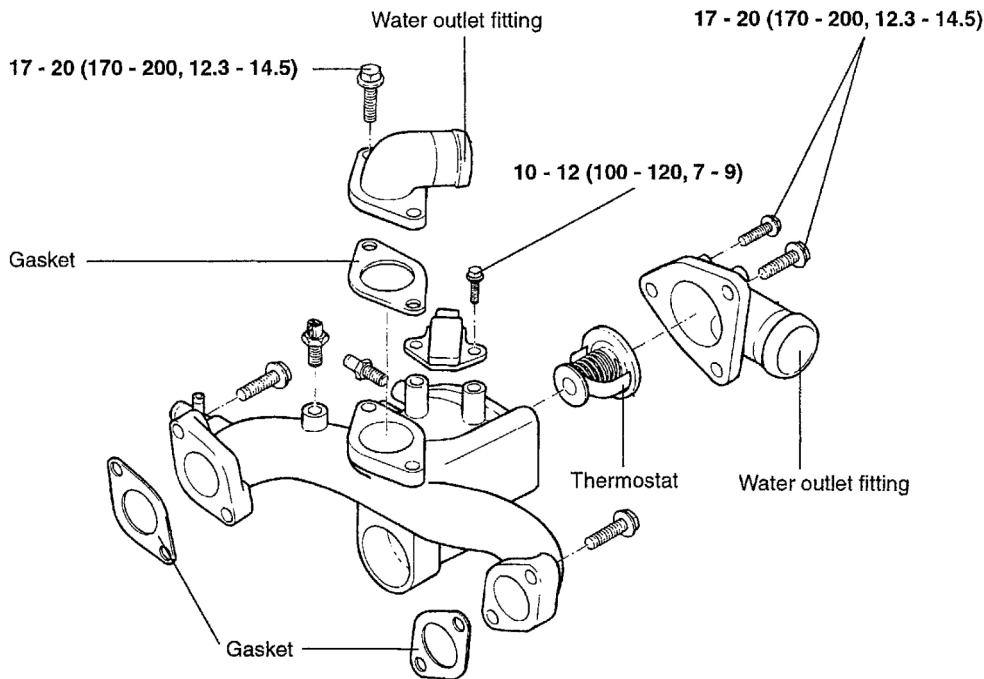


G01164532

Fig. 111: Connecting Tester To Radiator Cap
Courtesy of HYUNDAI MOTOR CO.

THERMOSTAT

COMPONENTS



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

G01164533

Fig. 112: Thermostat Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

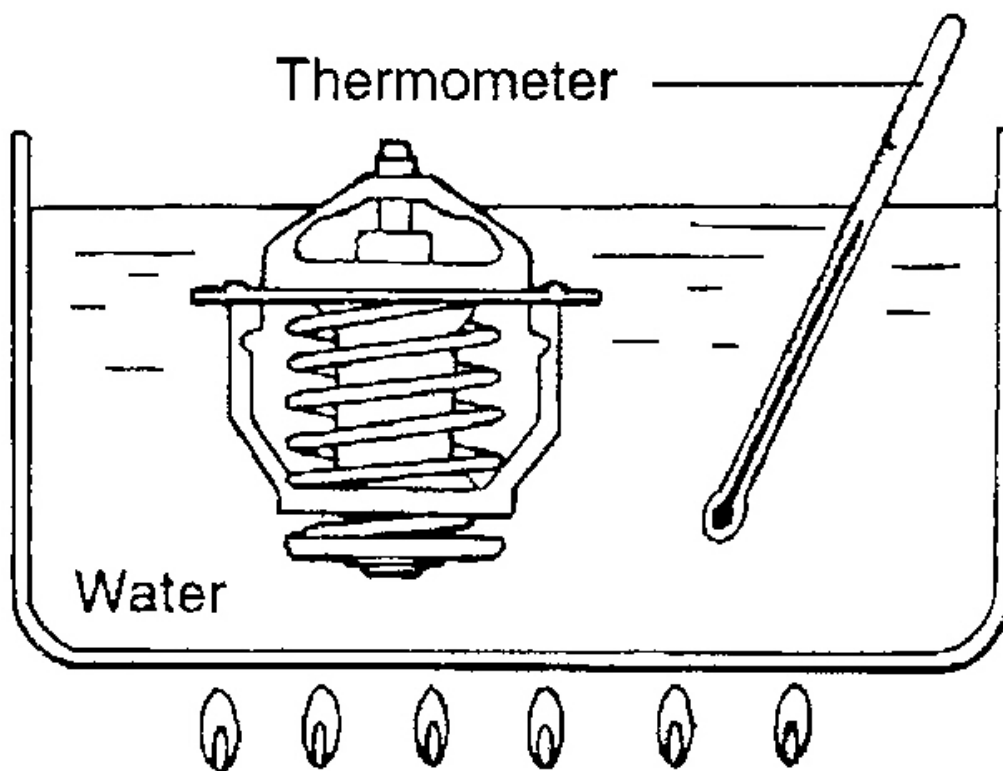
1. Drain the coolant to thermostat level or below.
2. Remove the inlet fitting and gasket.
3. Remove the thermostat.

INSPECTION

1. Heat the thermostat as shown in the illustration.
2. Check that the valve operates properly.
3. Verify the temperature at which the valve begins to open.

Valve opening temperature: 80 - 84°C (176-183.2°F)

Full opening temperature: 95°C (203°C)



G01164534

Fig. 113: Checking Thermostat Operation
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

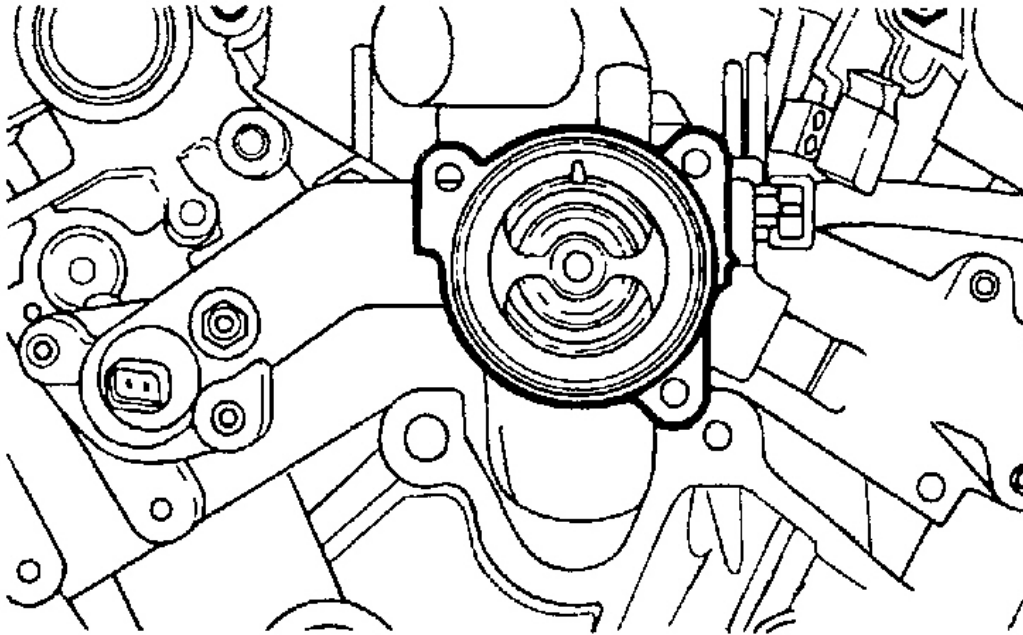
1. Check that the flange of the thermostat is correctly placed in the socket of the thermostat housing.
2. Install the inlet fitting.

Tightening torque

Engine coolant inlet fitting bolt:

17-20 Nm (170-200 kg.cm, 12-14 lb.ft)

3. Refill the coolant.



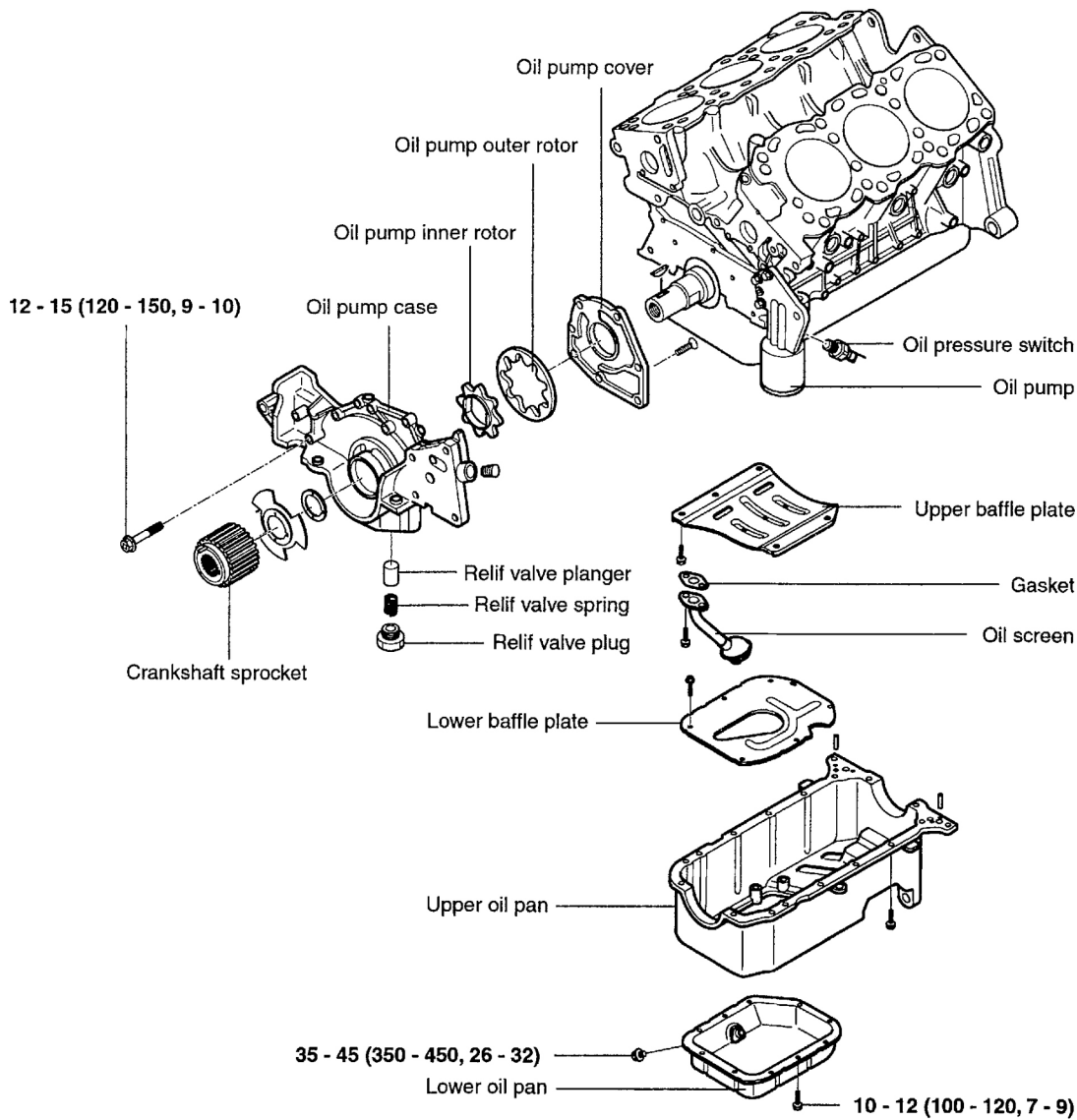
G01164535

Fig. 114: Properly Installing Thermostat
Courtesy of HYUNDAI MOTOR CO.

LUBRICATION SYSTEM

OIL PUMP

COMPONENTS



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

G01164536

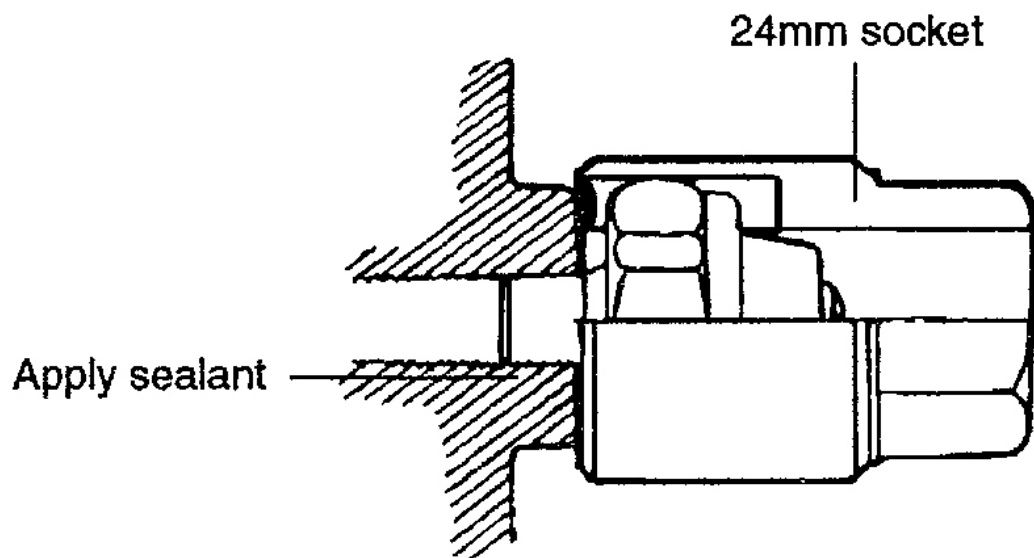
Fig. 115: Oil Pump Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Remove the oil pressure switch, using 24 mm deep socket.

NOTE: Since a sealant is used on the threaded area, be careful not to damage the oil pressure switch.

2. Remove the oil filter and the oil pan.
3. Remove the oil screen and gasket.
4. Remove the three bracket securing bolts and remove the oil filter bracket and gasket.
5. Remove the oil relief valve plug from the oil pump case.
6. Remove the oil pump case.



G01164537

Fig. 116: Removing Oil Pressure Switch
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

OIL PUMP

1. Visually check the parts of the oil pump case for cracks and damage.
2. Assemble the rotor on the oil pump and then check the clearance with a thickness gauge.

Oil pump side clearance

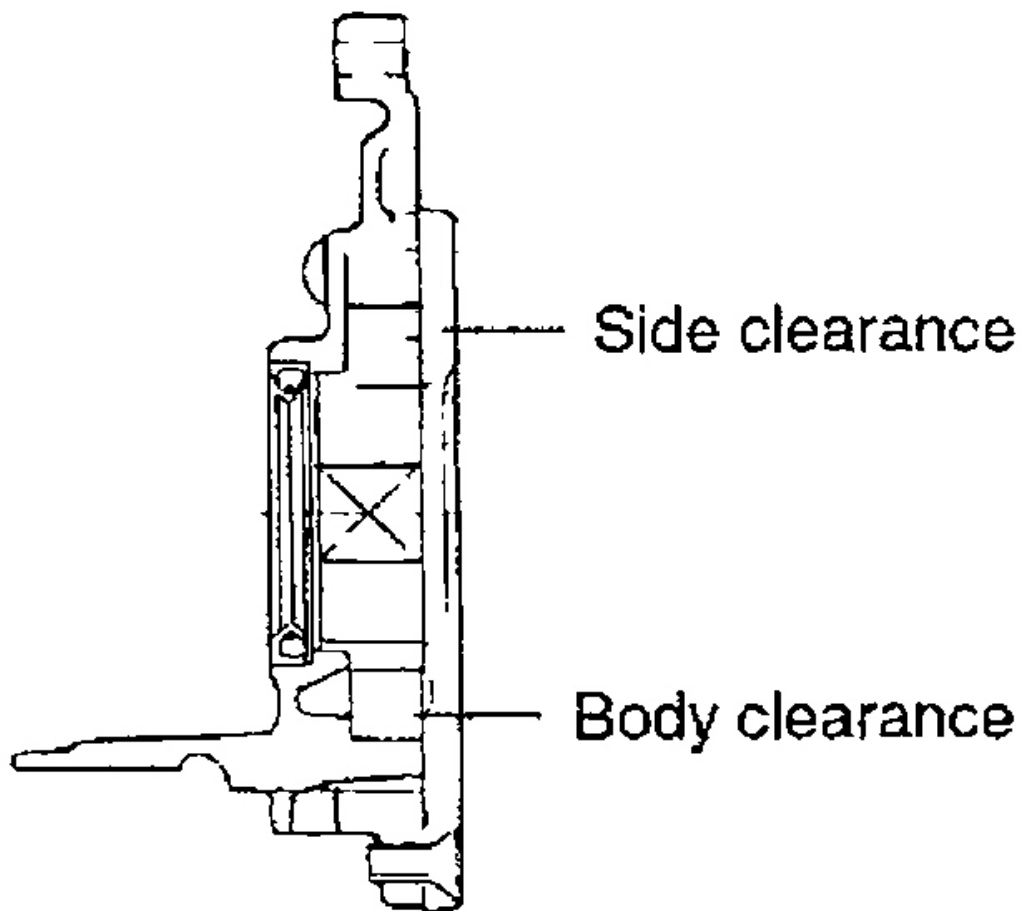
Standard value

Body clearance: 0.100-0.181mm (0.0039-0.0071 in.)

Side clearance: 0.040-0.095mm (0.0016-0.0037 in.)

Oil pump Tip clearance:

0.06 - 0.18 mm (0.0024 - 0.0071 in.)



G01164538

Fig. 117: Side View Of Oil Pump
Courtesy of HYUNDAI MOTOR CO.

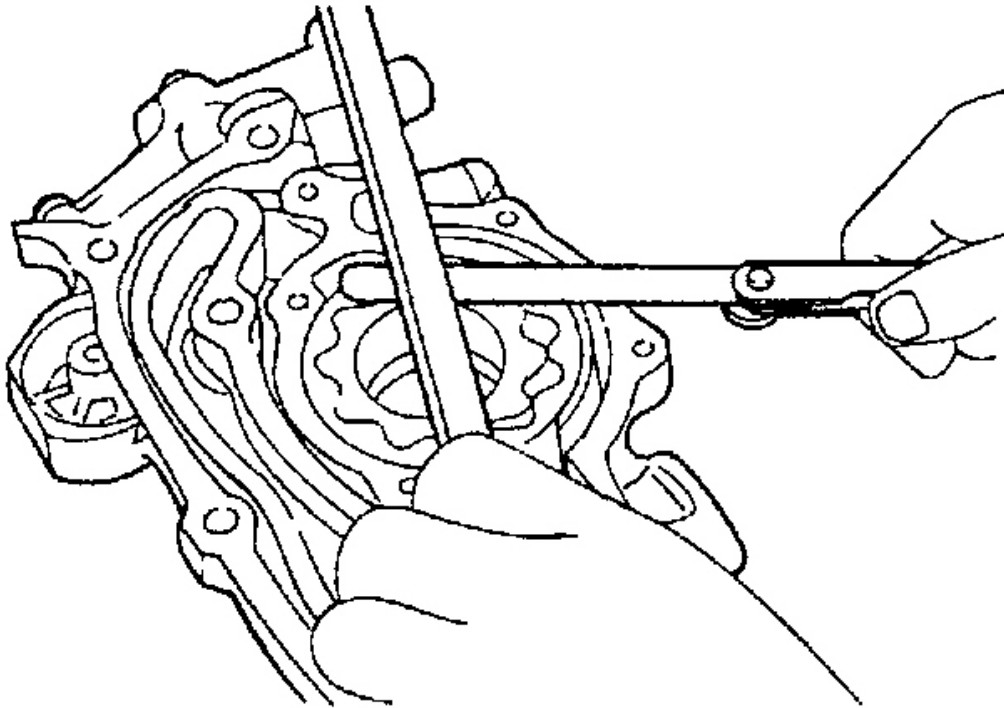
**G01164539**

Fig. 118: Checking Clearance With Thickness Gauge
Courtesy of HYUNDAI MOTOR CO.

RELIEF PLUNGER AND SPRING

1. Check the relief plunger for smooth operation.
2. Check the relief spring for deformation or breaks.

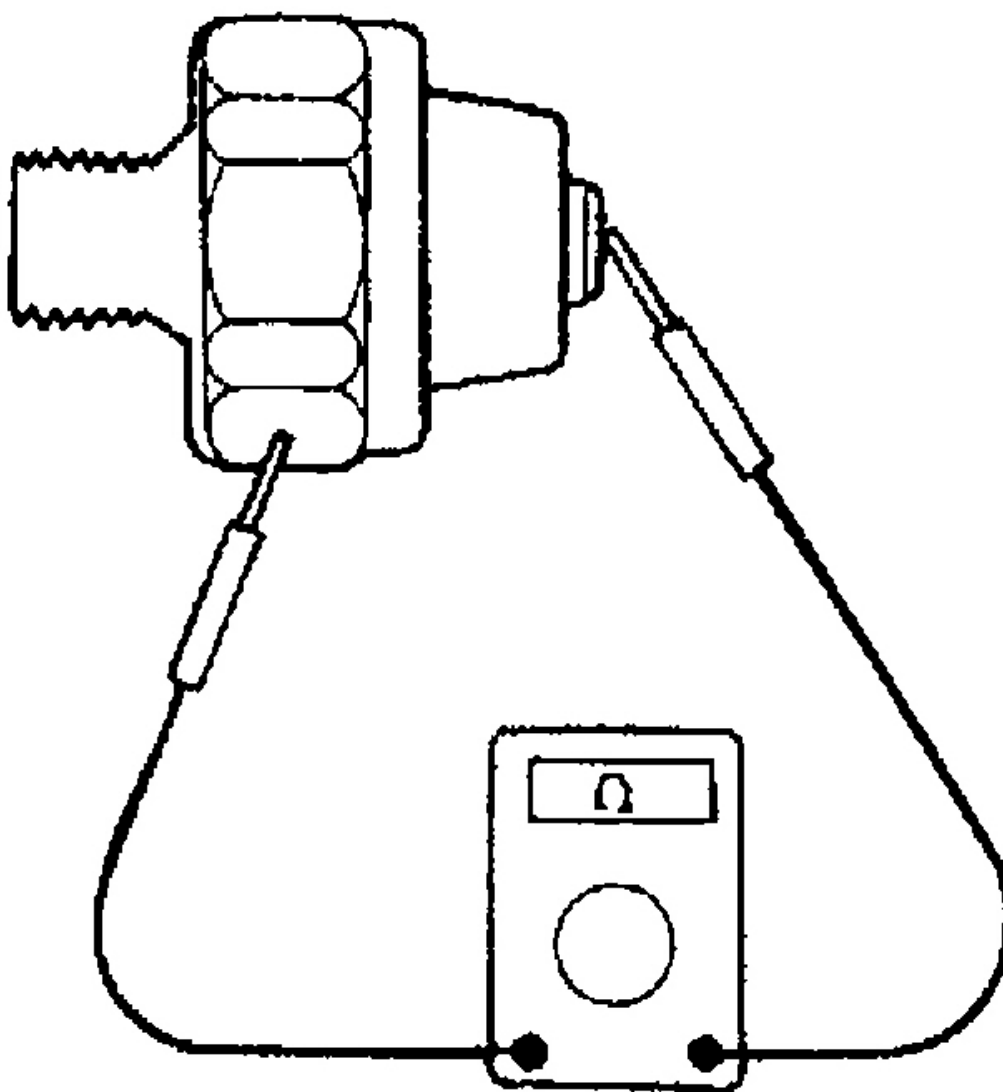
OIL FILTER BRACKET

1. Make sure that there is no damage on the surface that mates with the oil filter.
2. Check the oil filter bracket for oil leaks or cracks.

OIL PRESSURE SWITCH

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

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



G01164540

Fig. 119: Checking Continuity Between Terminal & Body With Ohmmeter
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.

Check for air leakage. If air leaks, the diaphragm is broken Replace it.

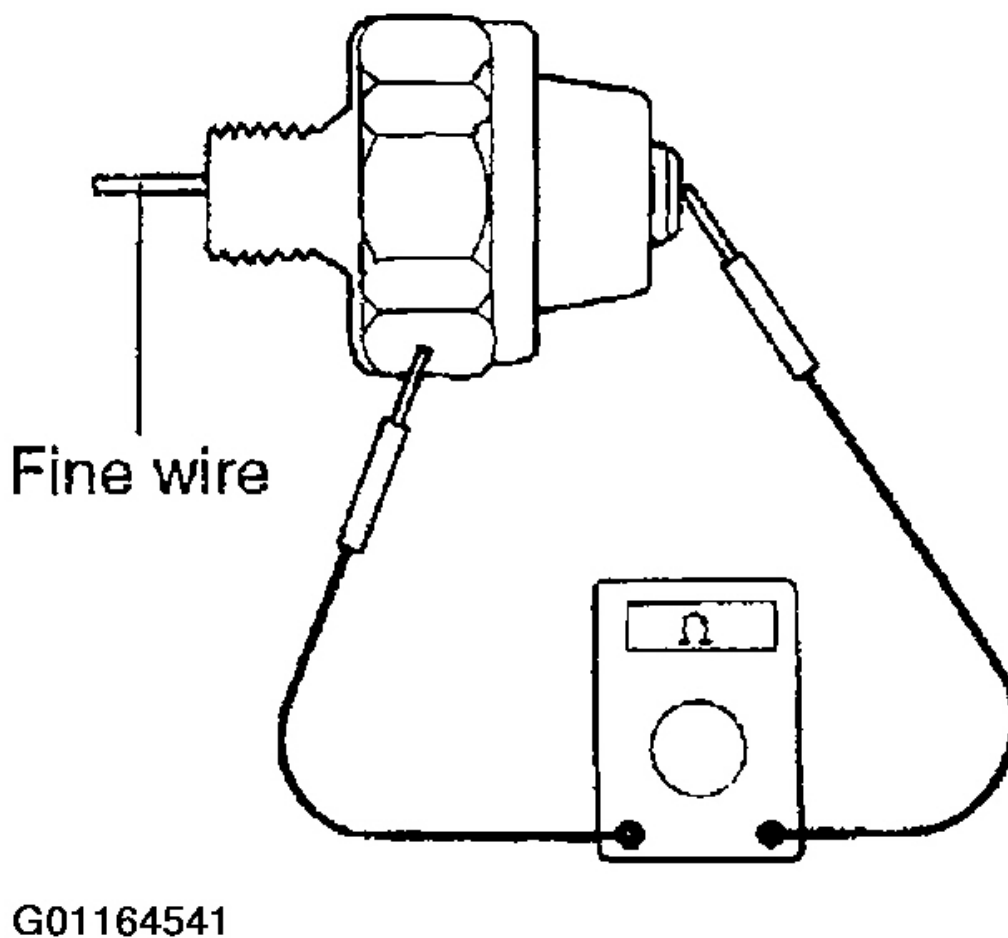


Fig. 120: Checking Continuity Between Terminal & Body When Fine Wire Is Pushed
Courtesy of HYUNDAI MOTOR CO.

Operation Pressure

Oil pressure switch:

80 kpa (0.8 kg/cm² . 11.4 psi) or more

REASSEMBLY

1. Install the oil pump case with the gasket.

Tightening torque

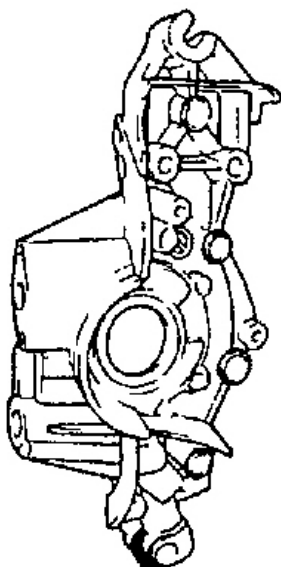
Oil pump case bolt:

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

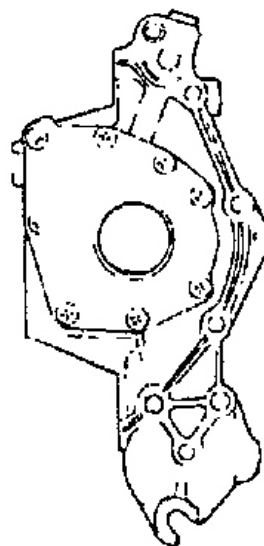
Oil pump cover screw:

8-12 Nm (80-120 kg.cm, 6-9 lb.ft)

<Front view>



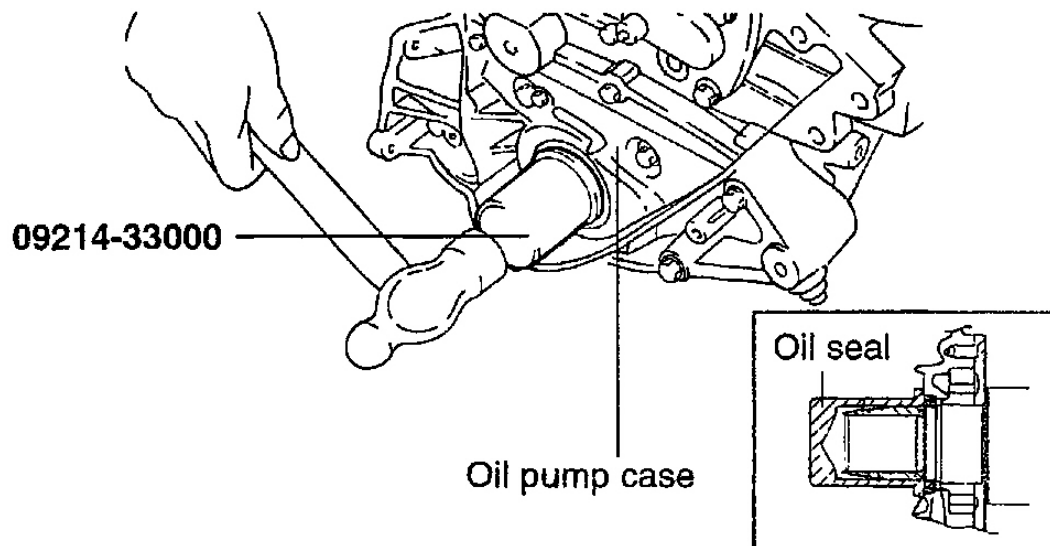
<Rear view>



G01164542

Fig. 121: Pump Case Front & Rear View
Courtesy of HYUNDAI MOTOR CO.

2. Install the oil seal into the oil pump case as tightly as possible, using the special tool (09214-33000).



G01164543

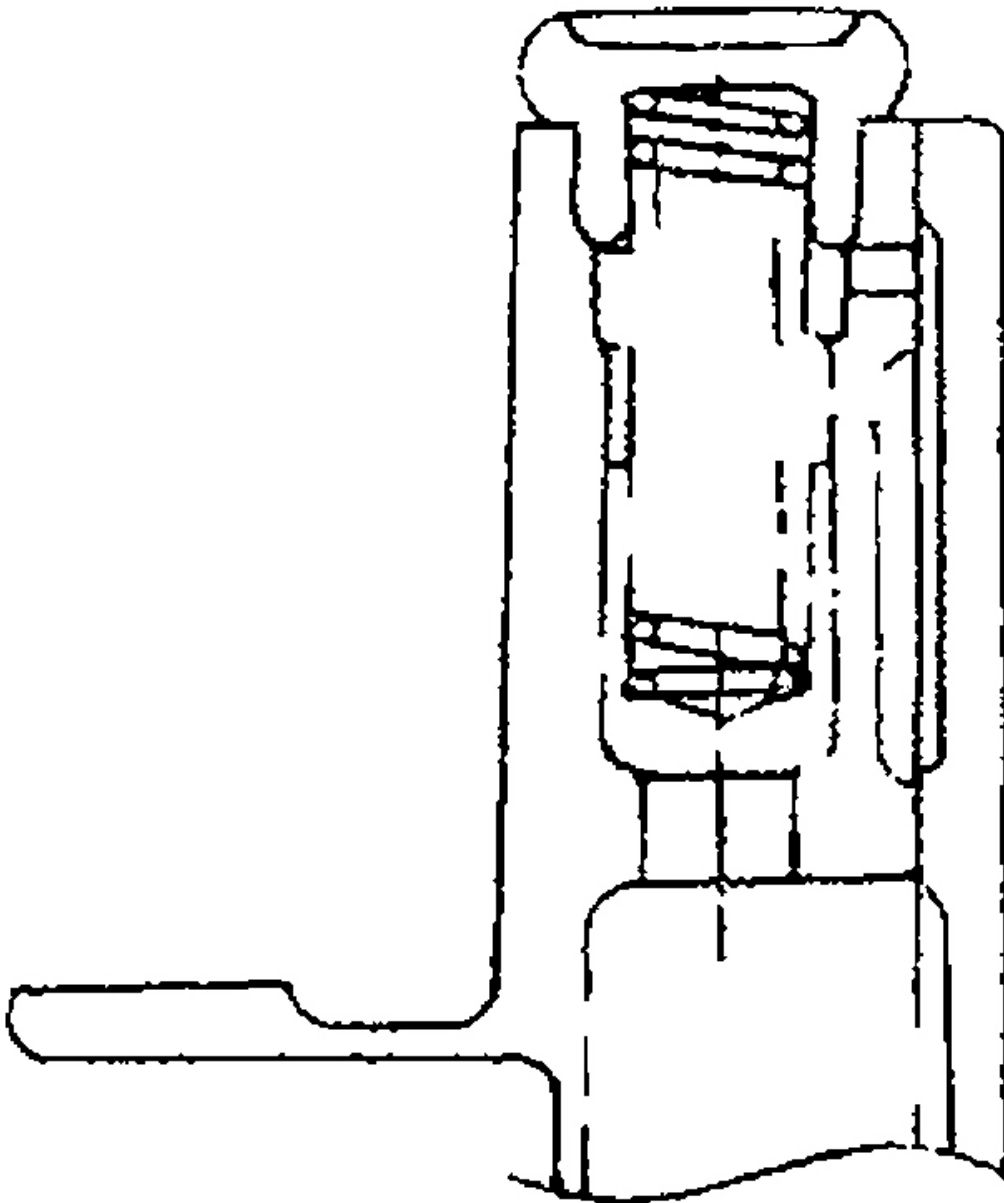
Fig. 122: Installing Oil Seal Into Oil Pump
 Courtesy of HYUNDAI MOTOR CO.

3. Install the relief plunger and spring, and tighten the oil relief valve plug to the specified torque.

Tightening torque

Oil relief valve plug:

40-50 Nm (400-500 kg.cm, 29-36 lb.ft)



G01164544

Fig. 123: Installing Relief Plunger & Spring
Courtesy of HYUNDAI MOTOR CO.

4. Install the oil screen and a new gasket.

Tightening torque**Oil screen bolt:****15-22 Nm (150-220 kg.cm, 11-15 lb.ft)**

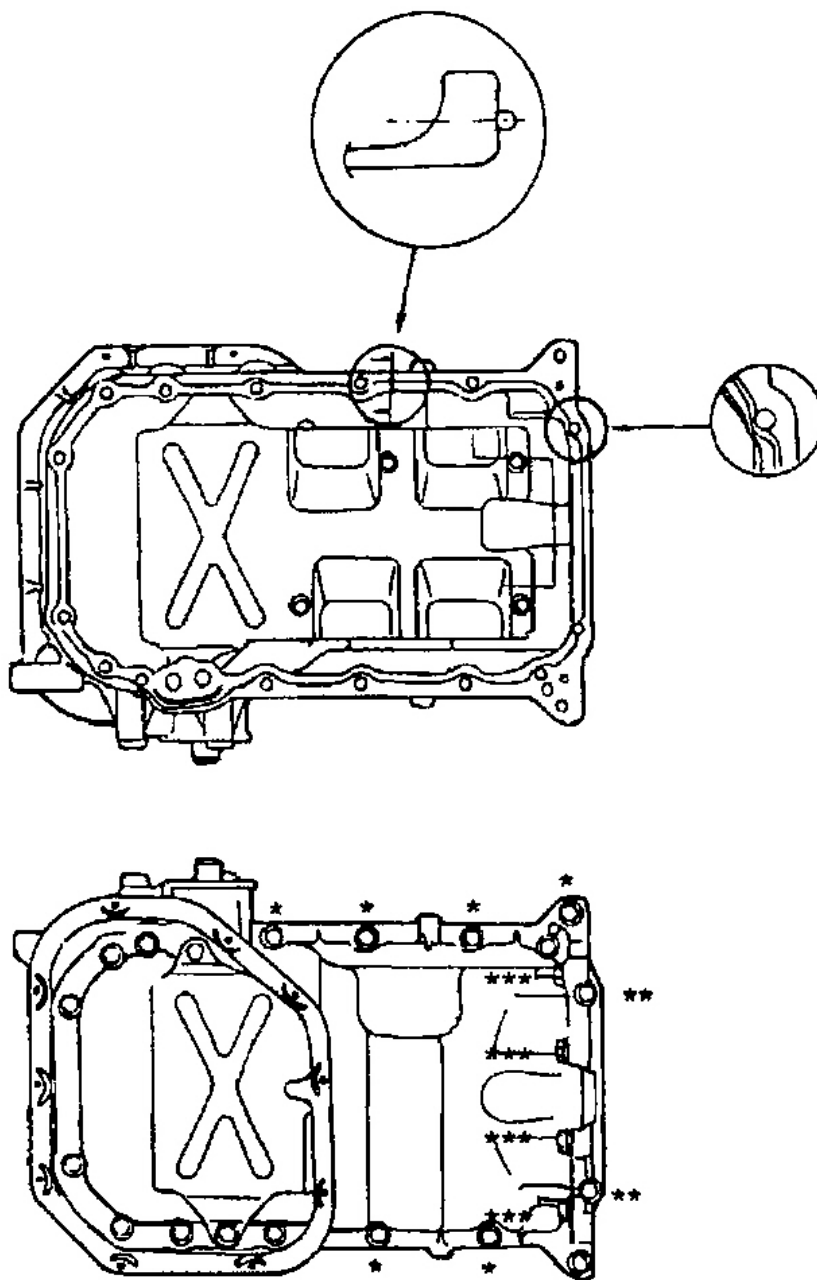
5. Clean the gasket surfaces of the cylinder block and the oil pan.
6. Apply sealant to the groove of the oil pan flange.

NOTE:

- 1. Make the first cut approx. 4 mm from the end of the nozzle furnished with the sealant. After application of the sealant, do not exceed 15 minutes before installing the oil pan.**
- 2. Make sure that the sealant doesn't enter the inside of the oil pan.**

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

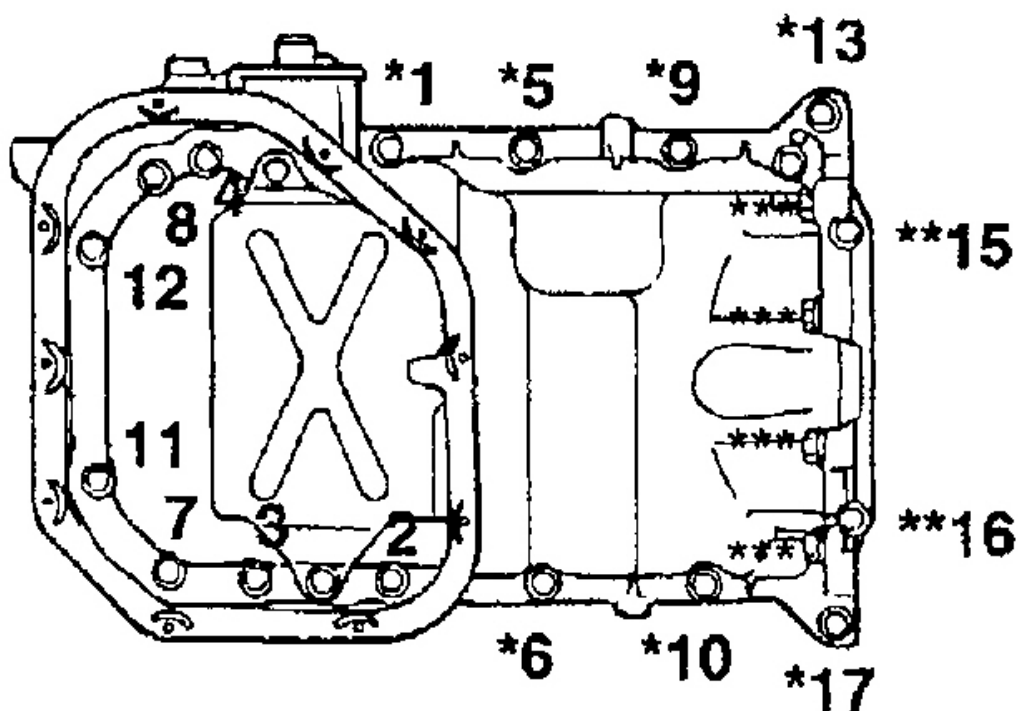
Tightening torque**Oil pan bolt:*****: 19-28 Nm (190-280 kg.cm, 14-20 lb.ft)****** : 5-7 Nm (50-70 kg.cm, 4-5 lb.ft)*******: 30-42 Nm (300-420 kg.cm, 22-30 lb.ft)**



G01164545

Fig. 124: Installing Oil Pan
Courtesy of HYUNDAI MOTOR CO.

8. Tighten the oil pan bolts as shown in the illustration.



G01164546

Fig. 125: Tightening Oil Pan Bolts In proper Sequence
 Courtesy of HYUNDAI MOTOR CO.

9. Using a 24 mm deep socket, install the oil pressure switch after applying sealant to the threaded area.

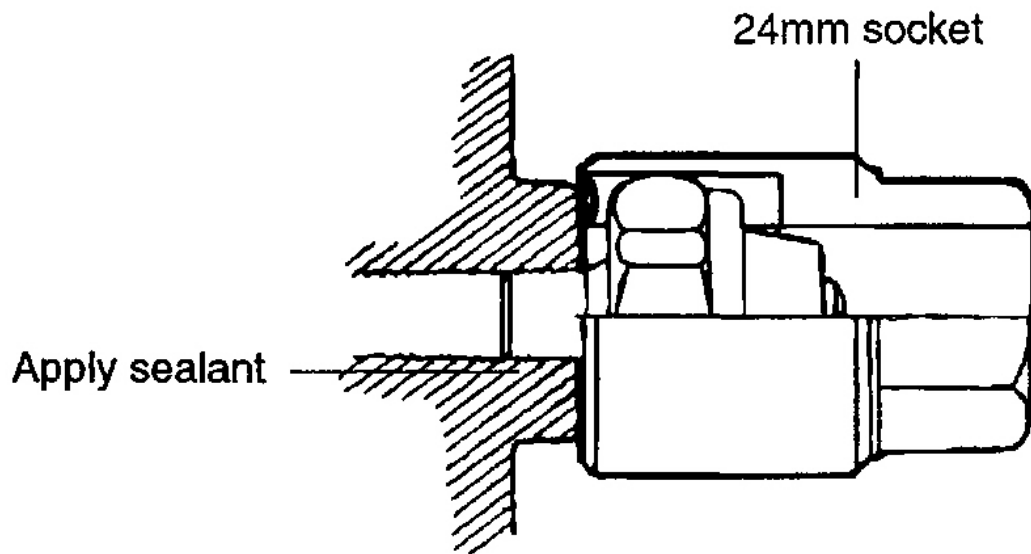
Sealant: Three bond No. 1104E or equivalent

NOTE: Do not torque the oil pressure switch too much.

Tightening torque

Oil pressure switch:

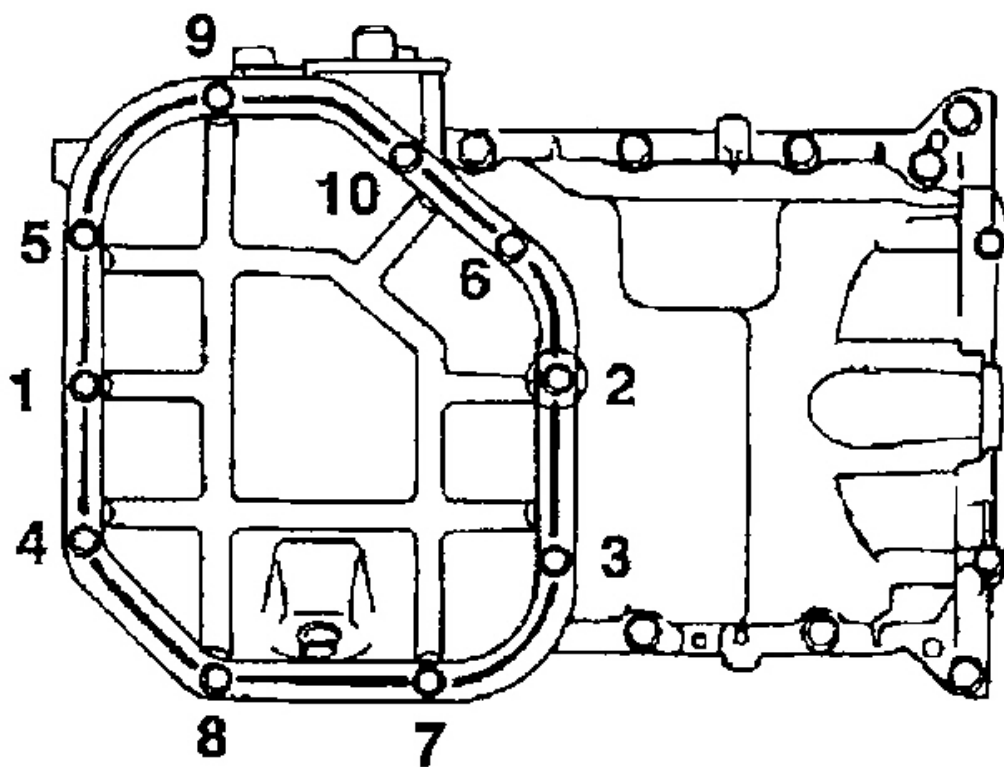
8 - 12 Nm (80 - 120 kg.cm, 6 - 9 lb.ft)



G01164547

Fig. 126: Installing Oil Pressure Switch
Courtesy of HYUNDAI MOTOR CO.

10. Tighten the lower oil pan bolts as shown in figure.



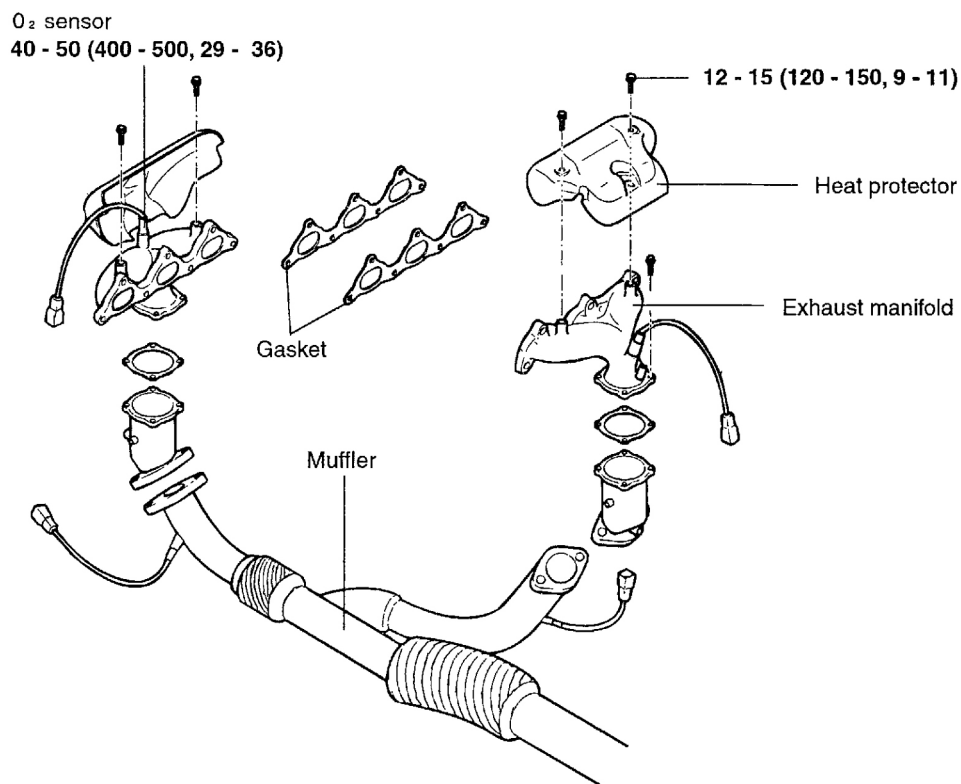
G01164548

Fig. 127: Tightening Lower Oil Pan Bolts In Proper Sequence
Courtesy of HYUNDAI MOTOR CO.

INTAKE AND EXHAUST SYSTEM

EXHAUST MANIFOLD

COMPONENTS



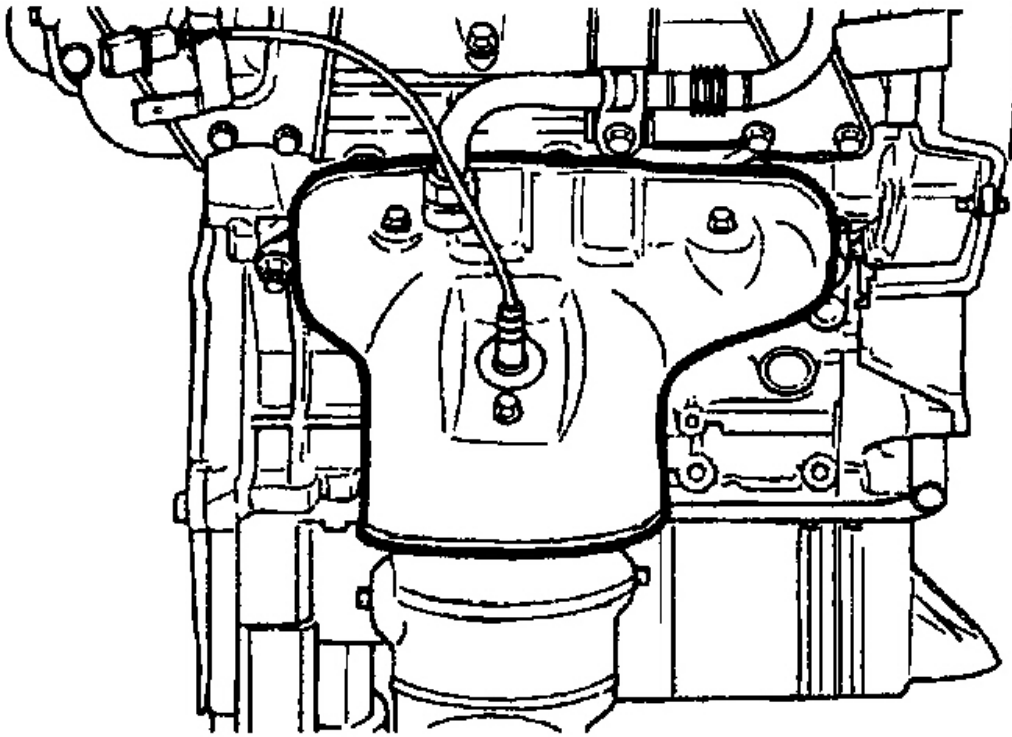
TORQUE : Nm (kg.cm, lb.ft)

G01164549

Fig. 128: Exhaust Manifold Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

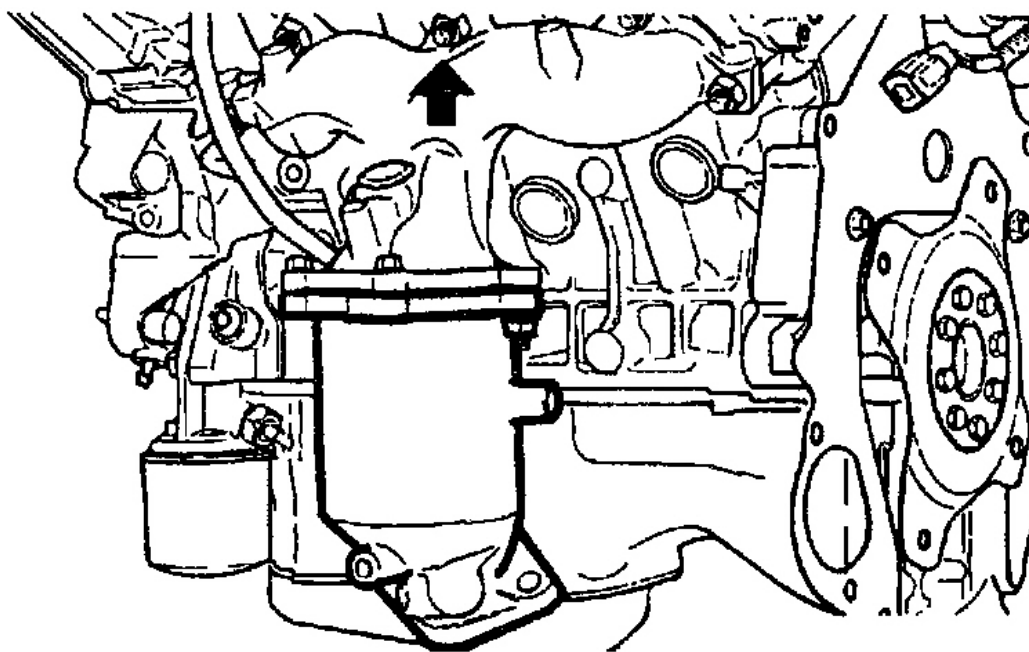
1. Remove the heat protector.



G01164550

Fig. 129: Removing Heat Protector
Courtesy of HYUNDAI MOTOR CO.

2. Remove the exhaust manifold.



G01164551

Fig. 130: Removing Exhaust Manifold
Courtesy of HYUNDAI MOTOR CO.

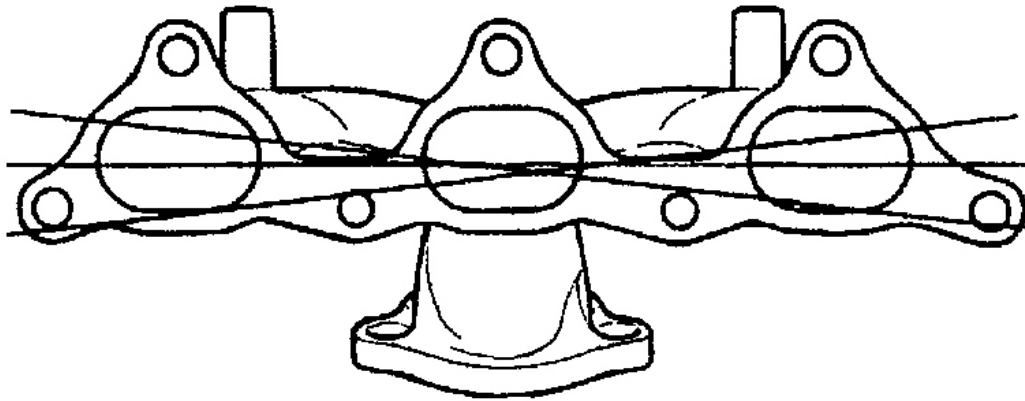
3. Remove the exhaust manifold gasket.

INSPECTION

1. Check for damage or cracks.
2. Using a straight edge and feeler gauge, check for distortion on the cylinder head matching surface.

Standard value: 0.15 mm (0.006 in.) or less

Service limit: 0.3 mm (0.012 in.) or less



G01164552

Fig. 131: Checking Manifold For Distortion
Courtesy of HYUNDAI MOTOR CO.

3. Check the exhaust manifold for damage and cracks.

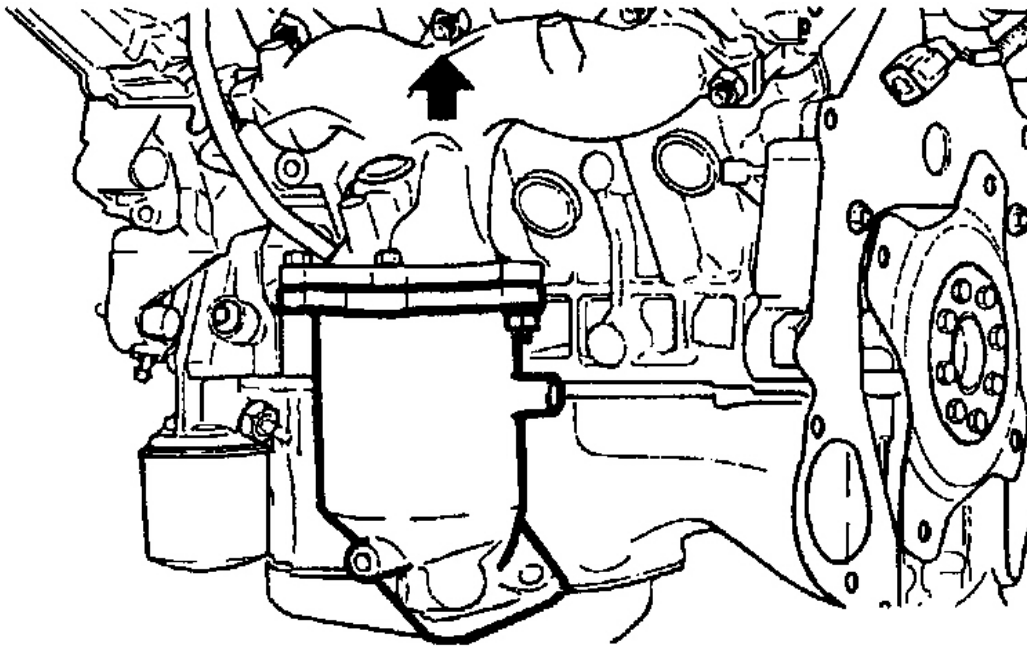
INSTALLATION

1. Install the exhaust manifold with gasket.

Tightening torque

Exhaust manifold: 25-30N.m (250-300 kg.cm, 18-22 lb.ft)

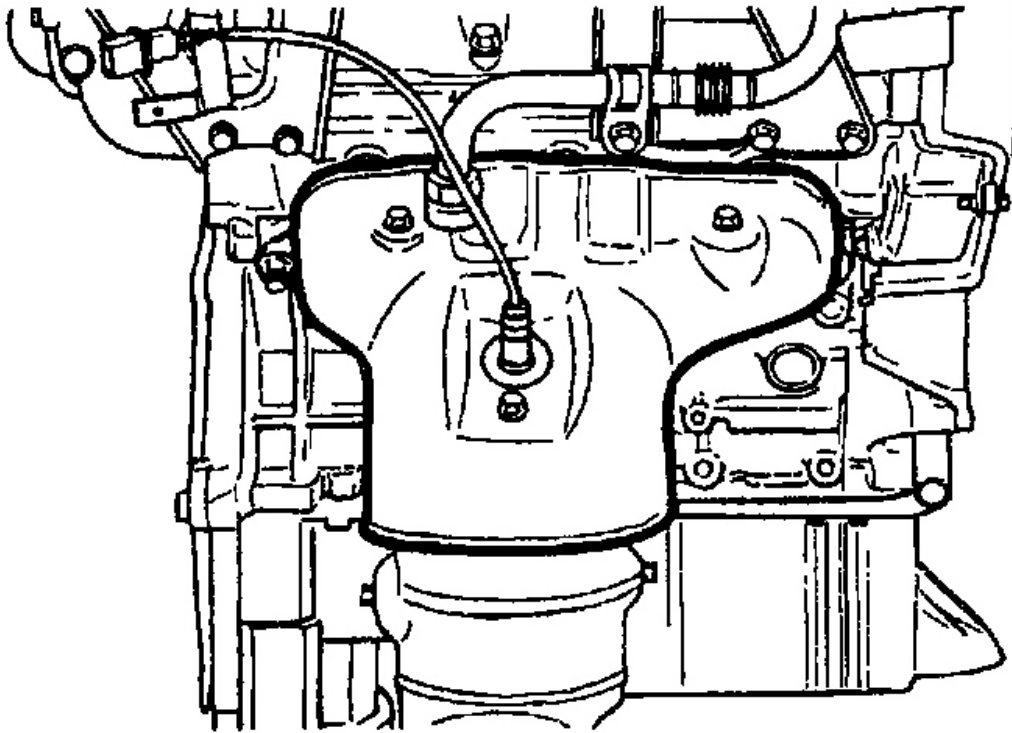
NOTE: Do not re - use an exhaust manifold gasket.



G01164553

Fig. 132: Installing Exhaust Manifold With Gasket
Courtesy of HYUNDAI MOTOR CO.

2. Install the heat protector.

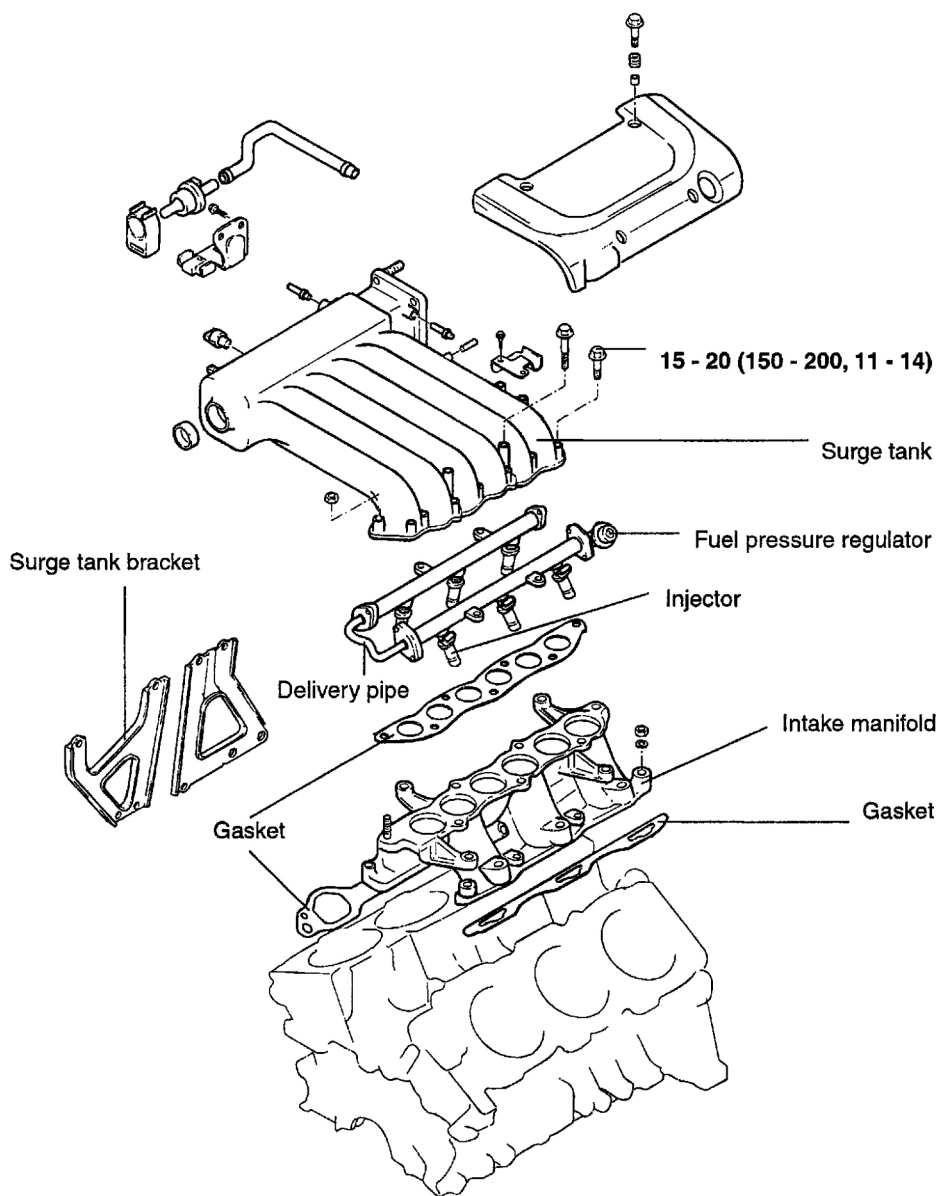


G01164554

Fig. 133: Installing Heat Protector
Courtesy of HYUNDAI MOTOR CO.

INTAKE MANIFOLD

COMPONENTS



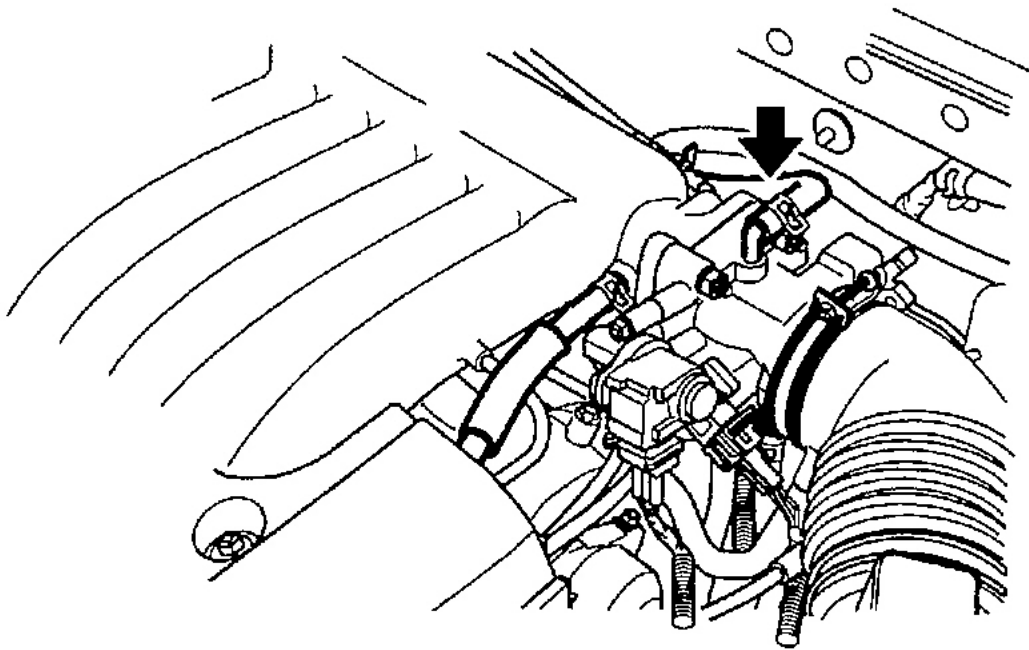
TORQUE : Nm (kg.cm, lb.ft)

G01164555

Fig. 134: Exploded View Of Intake Manifold & Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

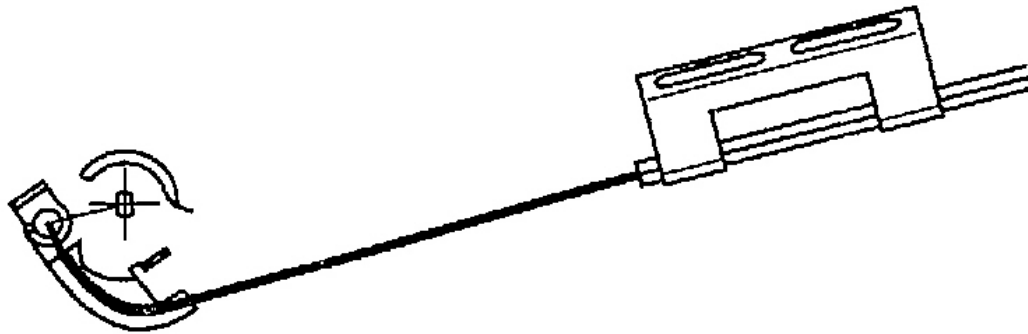
1. Remove the air intake hose connected to the throttle body.



G01164556

Fig. 135: Removing Air Intake Hose Connected To Throttle Body
Courtesy of HYUNDAI MOTOR CO.

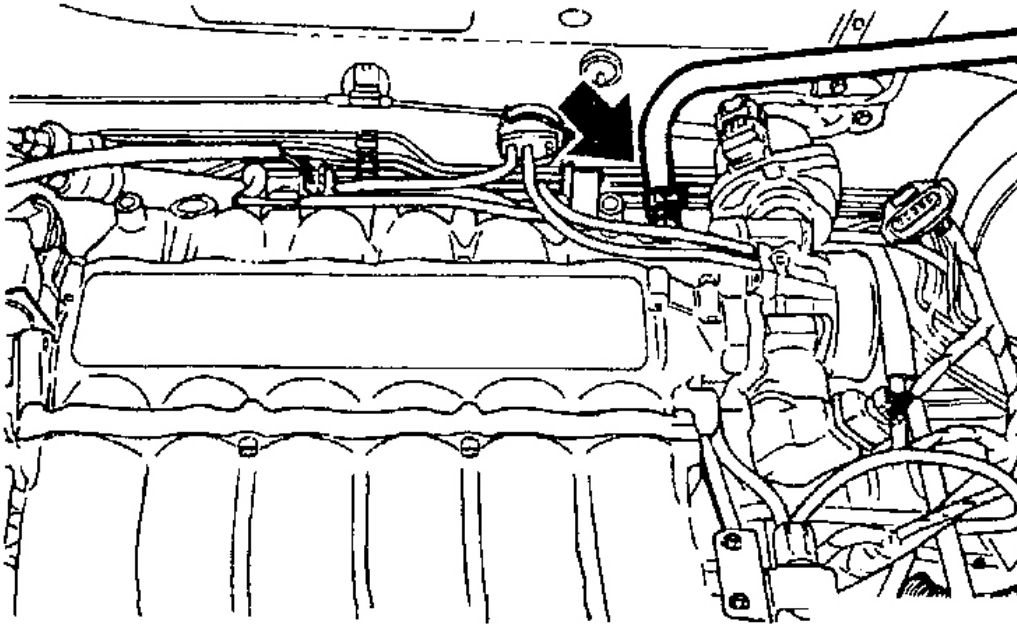
2. Remove the accelerator and cruise control cables.
3. Remove the engine coolant hose and throttle body.



G01164557

Fig. 136: Removing Accelerator & Cruise Control Cables
Courtesy of HYUNDAI MOTOR CO.

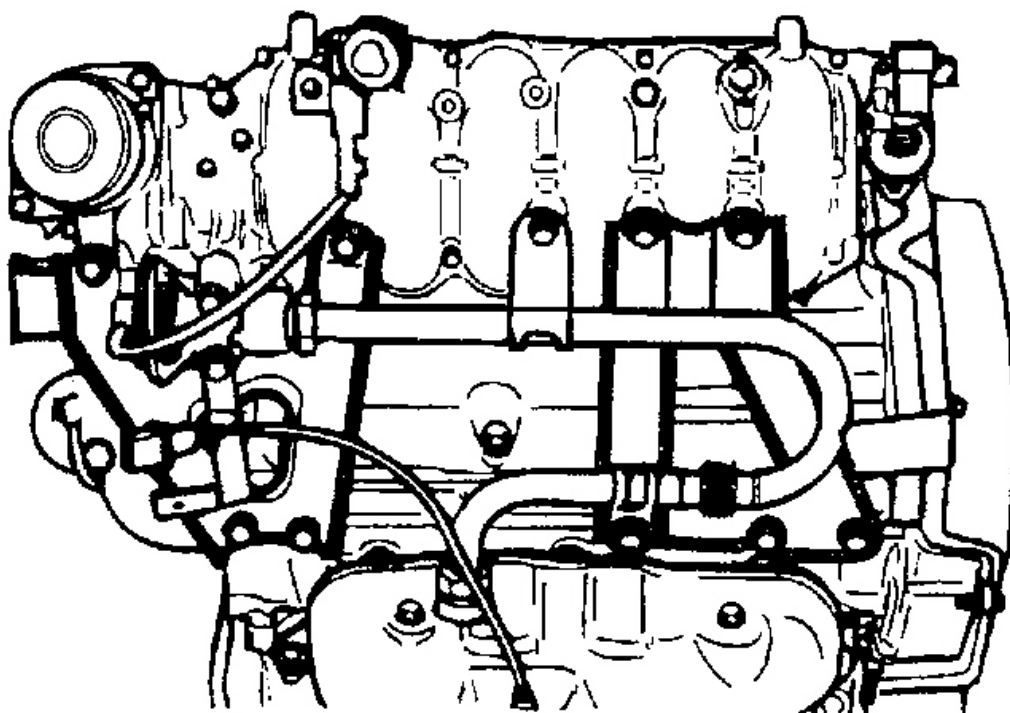
4. Remove the P.C.V. hose and brake booster vacuum hoses.
5. Disconnect the vacuum hose connections.



G01164558

Fig. 137: Disconnecting Vacuum Hose Connections
Courtesy of HYUNDAI MOTOR CO.

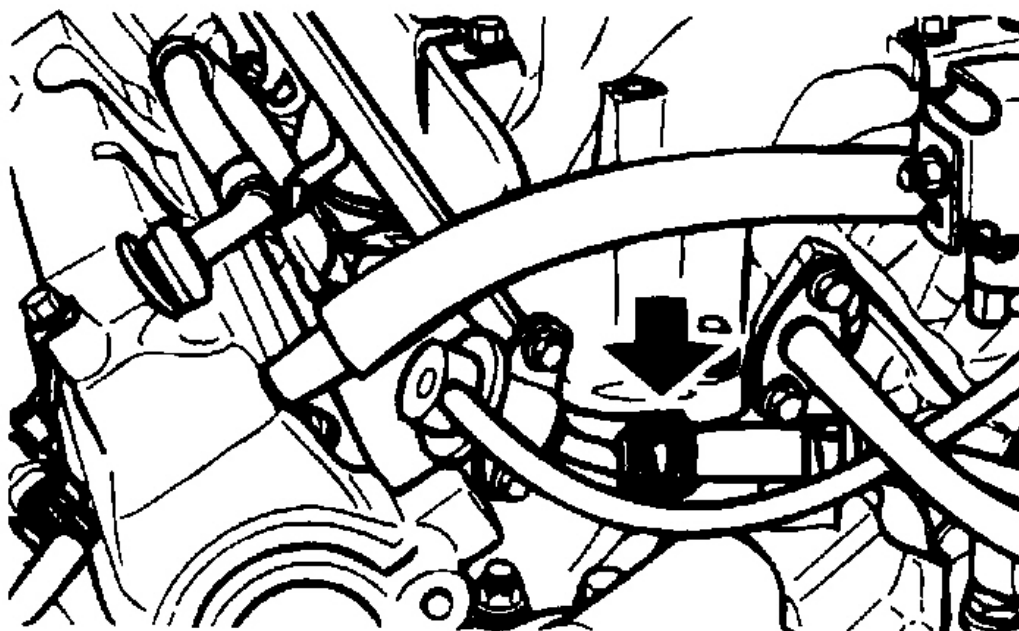
6. Remove the surge tank stay.



G01164559

Fig. 138: Removing Surge Tank Stay
Courtesy of HYUNDAI MOTOR CO.

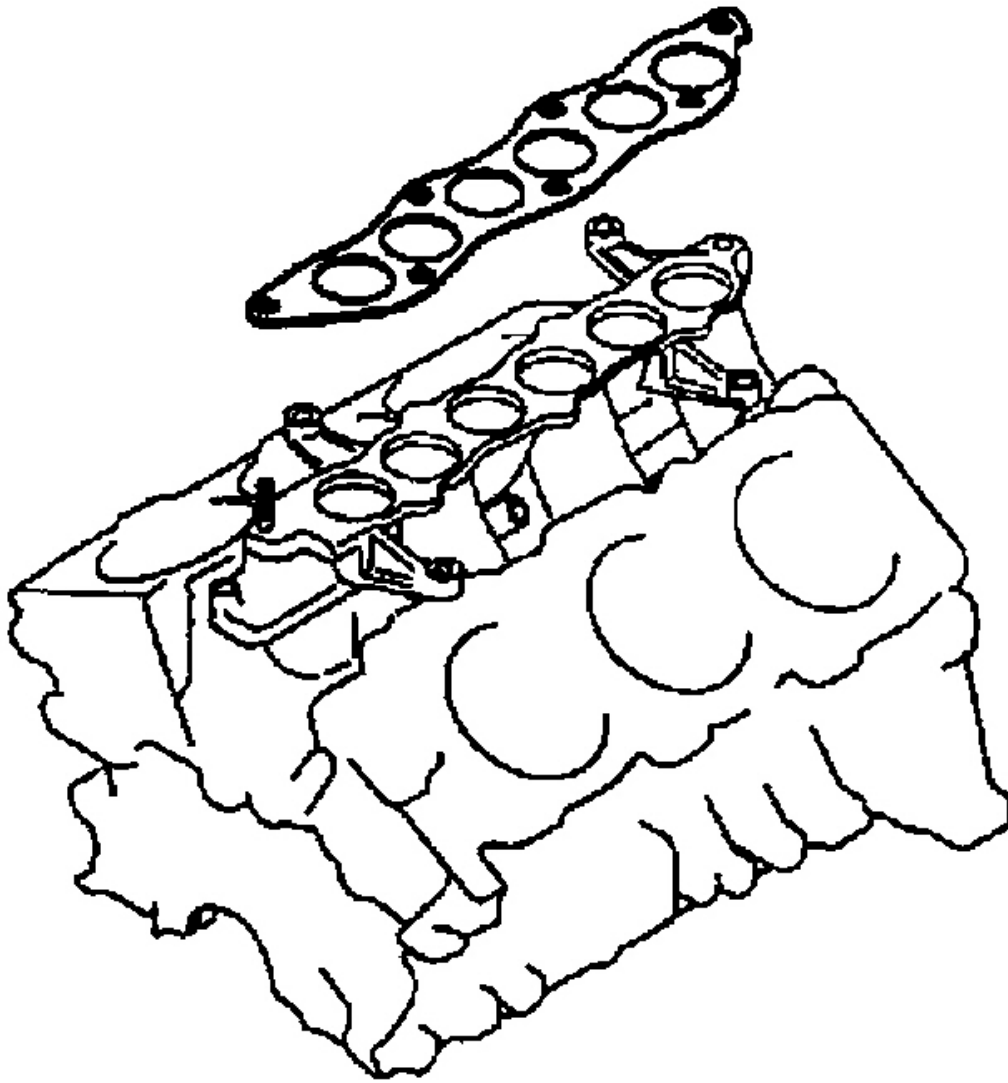
7. Bleed off the pressure in the fuel pipe line to prevent the fuel from spilling.
8. Disconnect the connector from high pressure hose.



G01164560

Fig. 139: Disconnecting Connector From High Pressure Hose
Courtesy of HYUNDAI MOTOR CO.

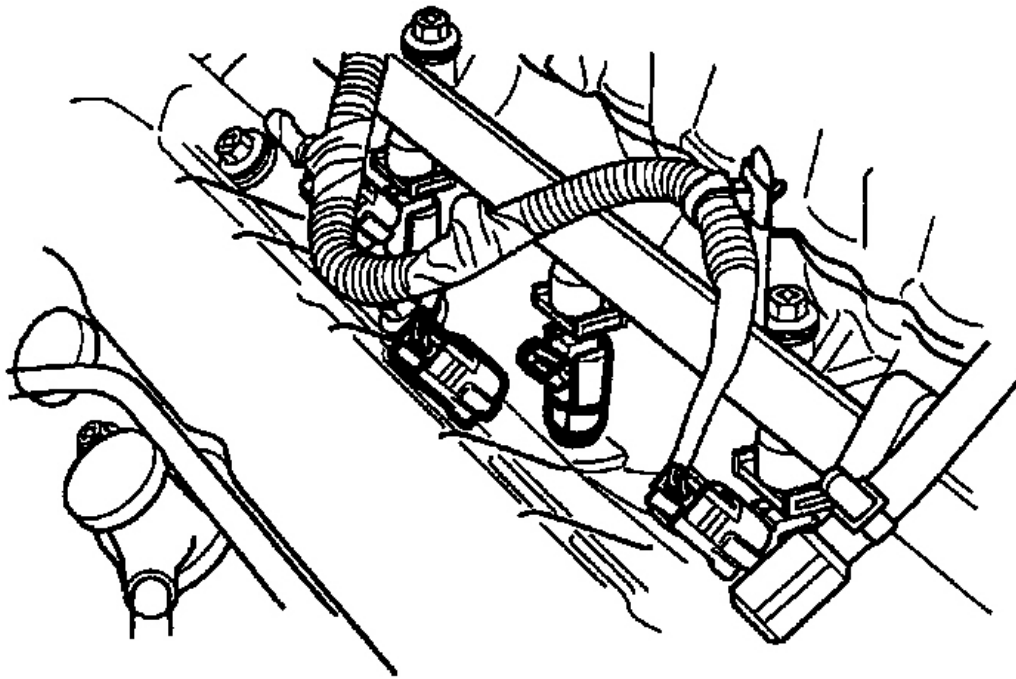
9. Remove the surge tank and gasket.



G01164561

Fig. 140: Removing Surge Tank And Gasket
Courtesy of HYUNDAI MOTOR CO.

10. Disconnect the fuel injector harness connector.

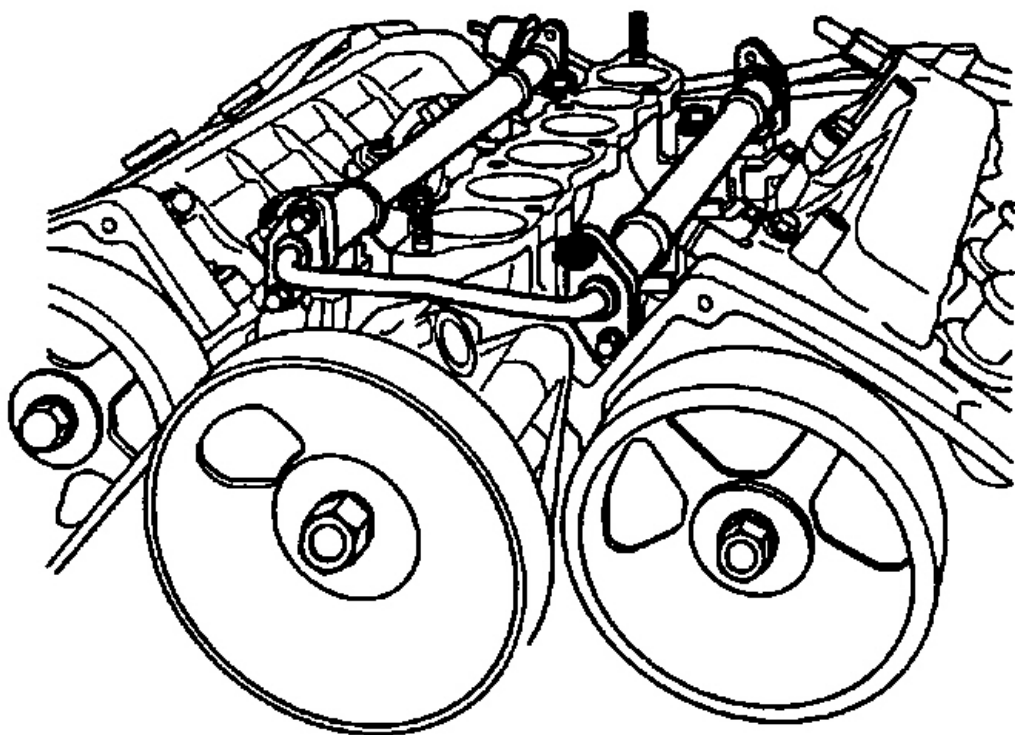


G01164562

Fig. 141: Disconnecting Fuel Injector Harness Connector
Courtesy of HYUNDAI MOTOR CO.

11. Remove the delivery pipe with the fuel injector and the pressure regulator.

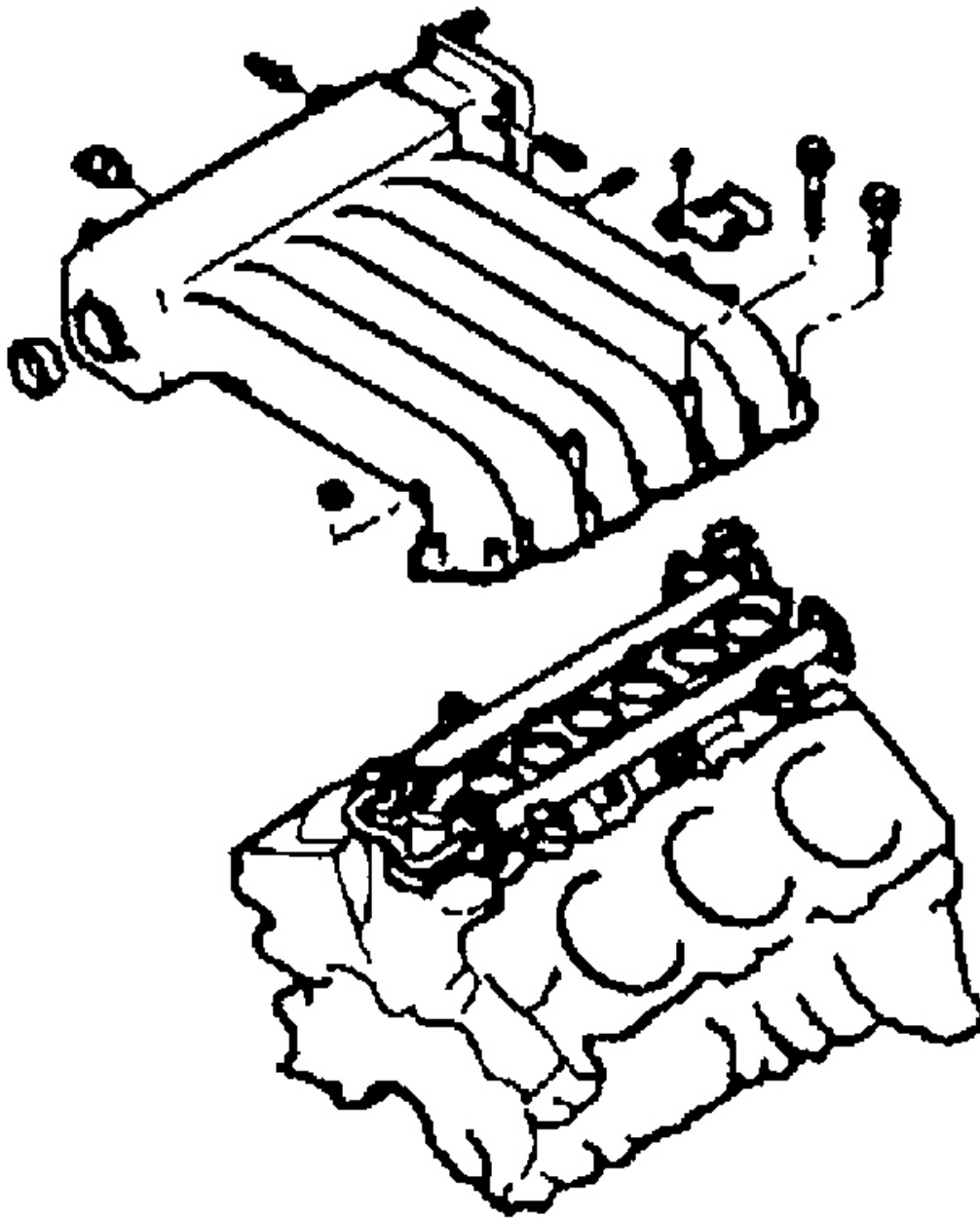
NOTE: When the delivery pipe is removed, be careful not to drop an injector.



G01164563

Fig. 142: Removing Delivery Pipe With Fuel Injector & Pressure Regulator
Courtesy of HYUNDAI MOTOR CO.

12. Disconnect the wiring harness of the coolant sensor assembly.
13. Remove the surge tank.



G01164564

Fig. 143: Removing Surge Tank
Courtesy of HYUNDAI MOTOR CO.

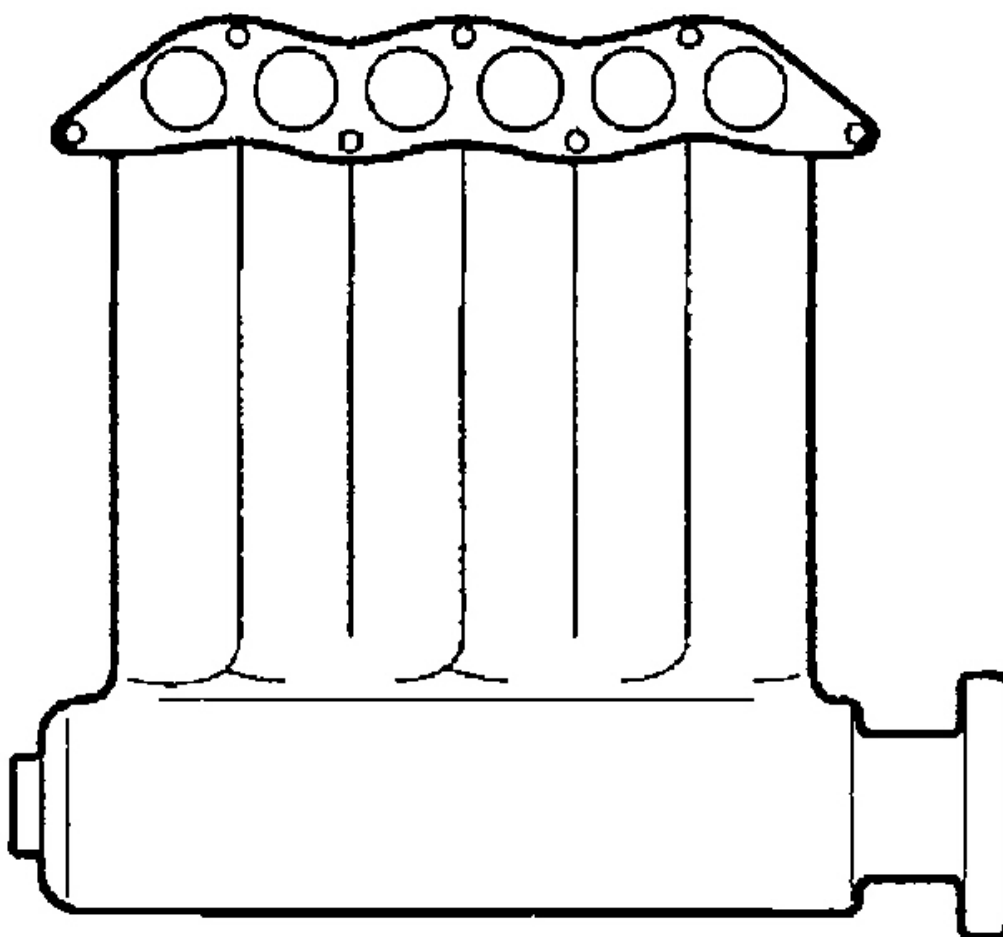
INSPECTION

SURGE TANK AND INTAKE MANIFOLD

1. Check the surge tank and intake manifold for damage, cracking or restriction of the vacuum outlet port, water or gas passages.
2. Check for distortion on the surface using a straight edge and feeler gauge.

Standard value: 0.15 mm (0.006 in.) or less

Service limit: 0.2 mm (0.0078 in.)



G01164565

Fig. 144: View Of Surge Tank
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

1. Install the intake manifold and delivery pipe reversing the order of the removal procedure.

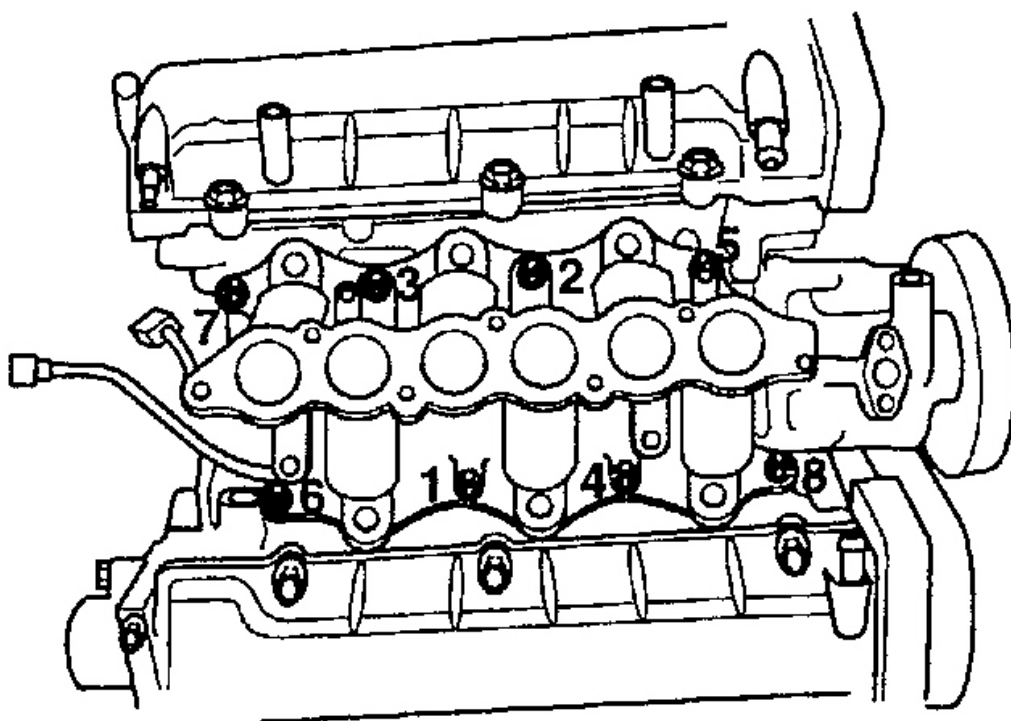
Tightening torque

Intake manifold:

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

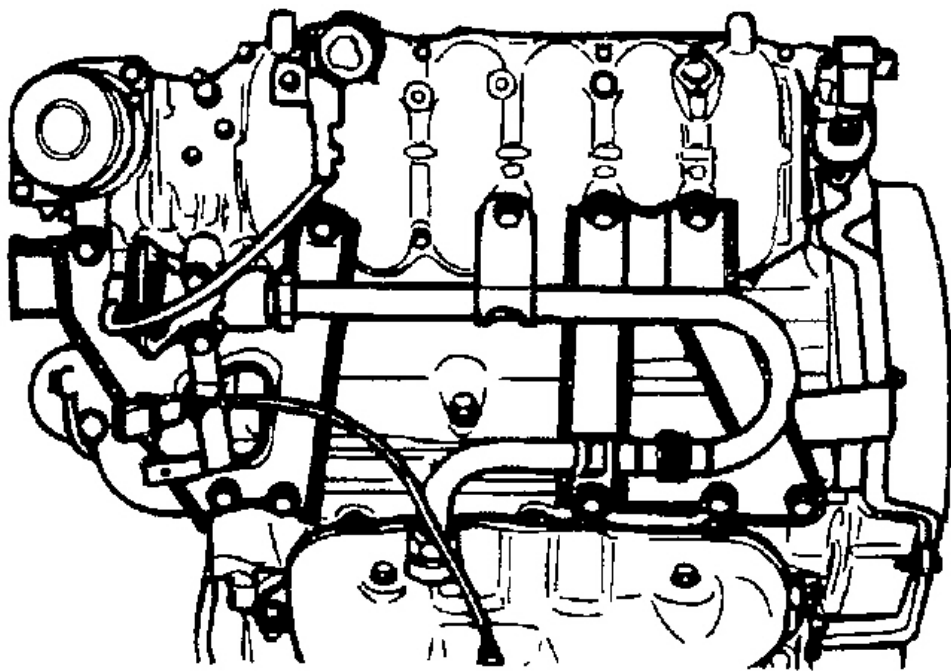
Surge tank stay:

15-20 N.m (150-200 kg.cm, 11-14lb.ft)



G01164566

Fig. 145: Installing Intake Manifold
Courtesy of HYUNDAI MOTOR CO.

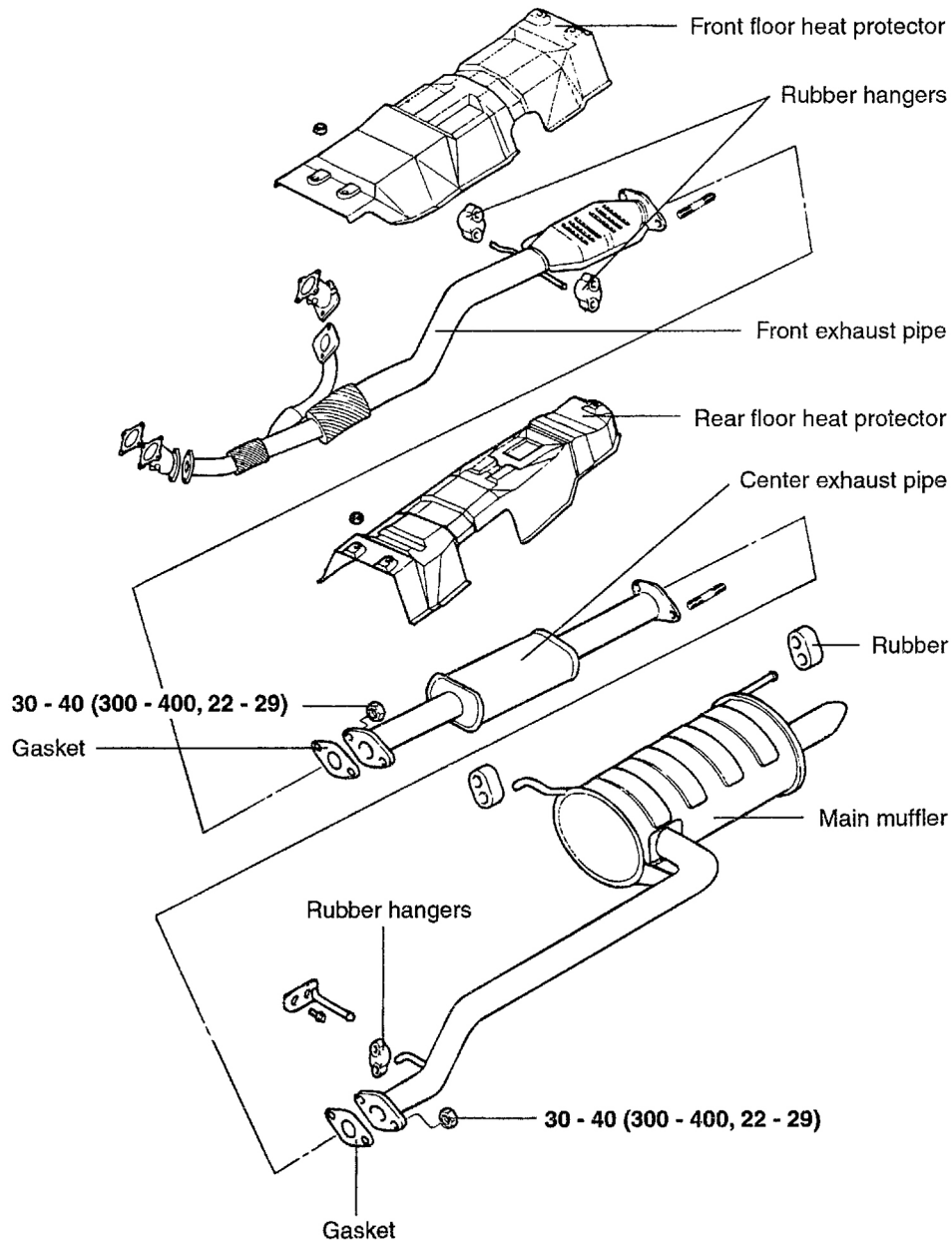


G01164567

Fig. 146: Installing Delivery Pipe
Courtesy of HYUNDAI MOTOR CO.

MUFFLER

COMPONENTS



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

G01164568

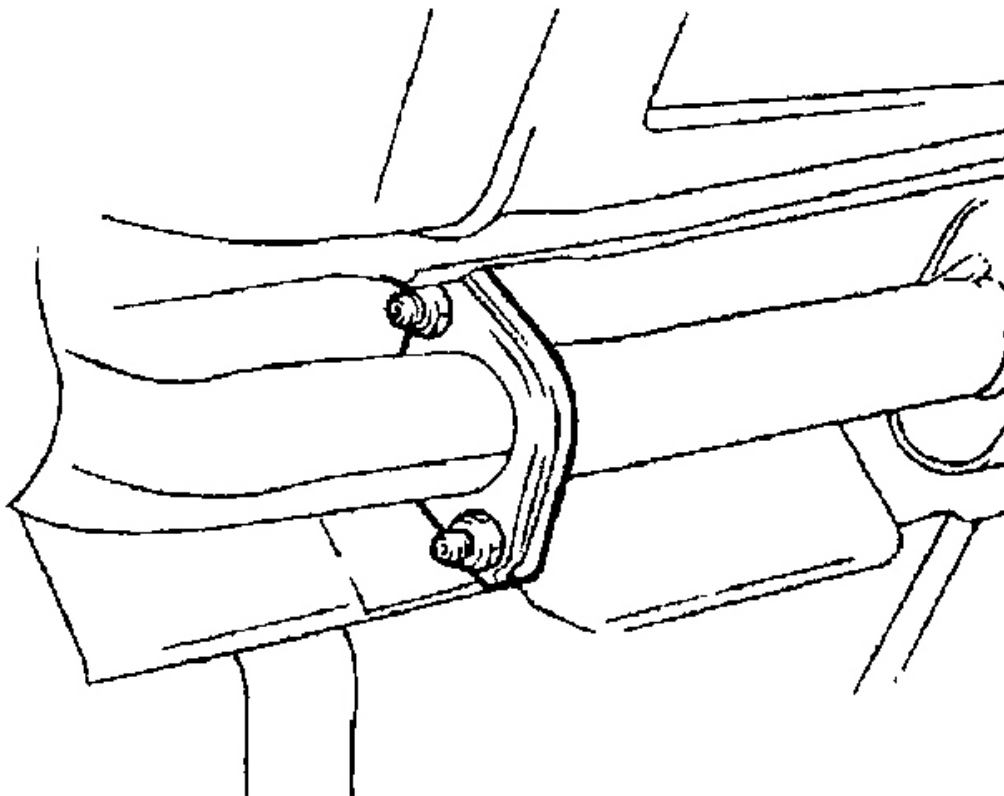
Fig. 147: Muffler Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

MAIN MUFFLER

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

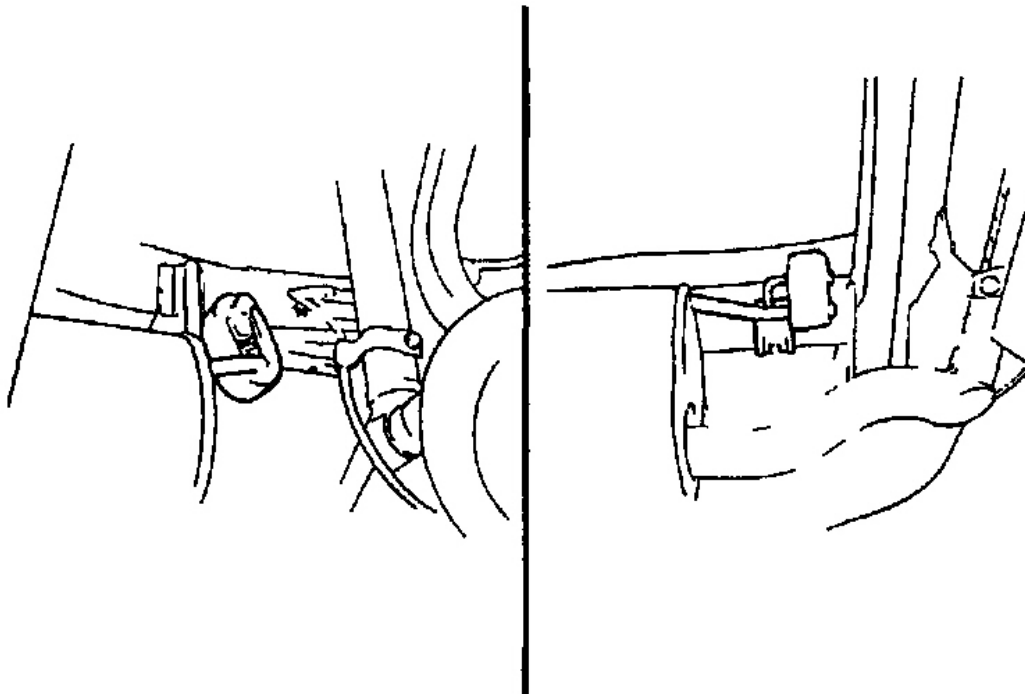
1. Disconnect the main muffler from the center exhaust pipe.



G01164569

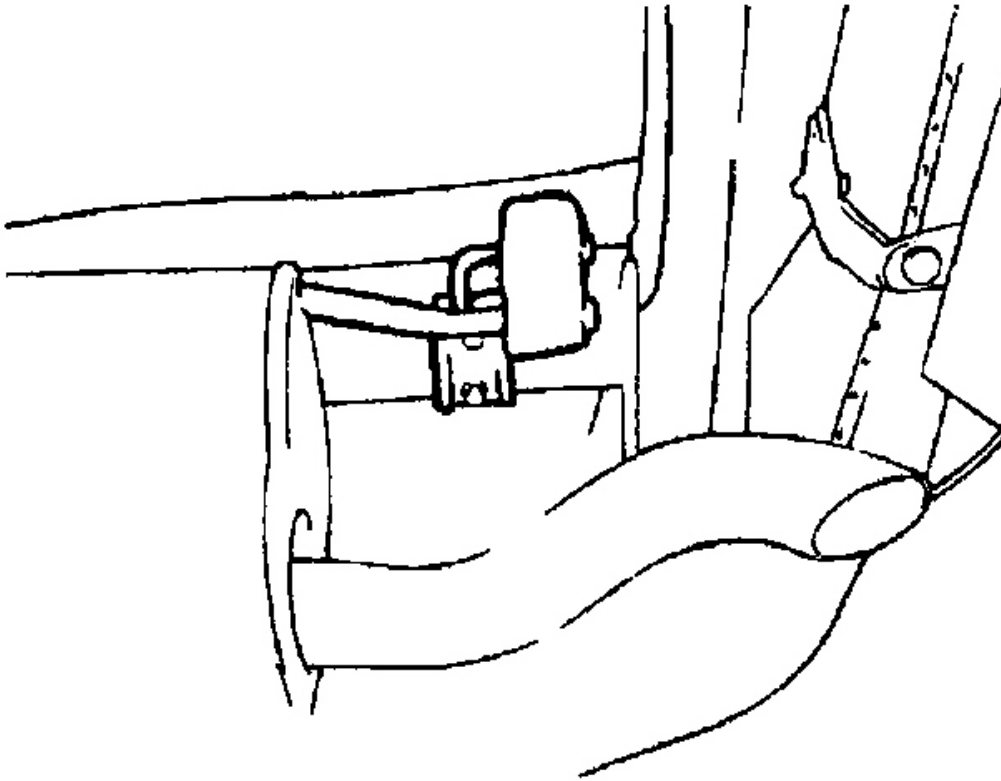
Fig. 148: Disconnecting Main Muffler From Center Exhaust Pipe
Courtesy of HYUNDAI MOTOR CO.

2. Remove the rubber hangers and the main muffler.



G01164570

Fig. 149: Removing Rubber Hangers & Main Muffler (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

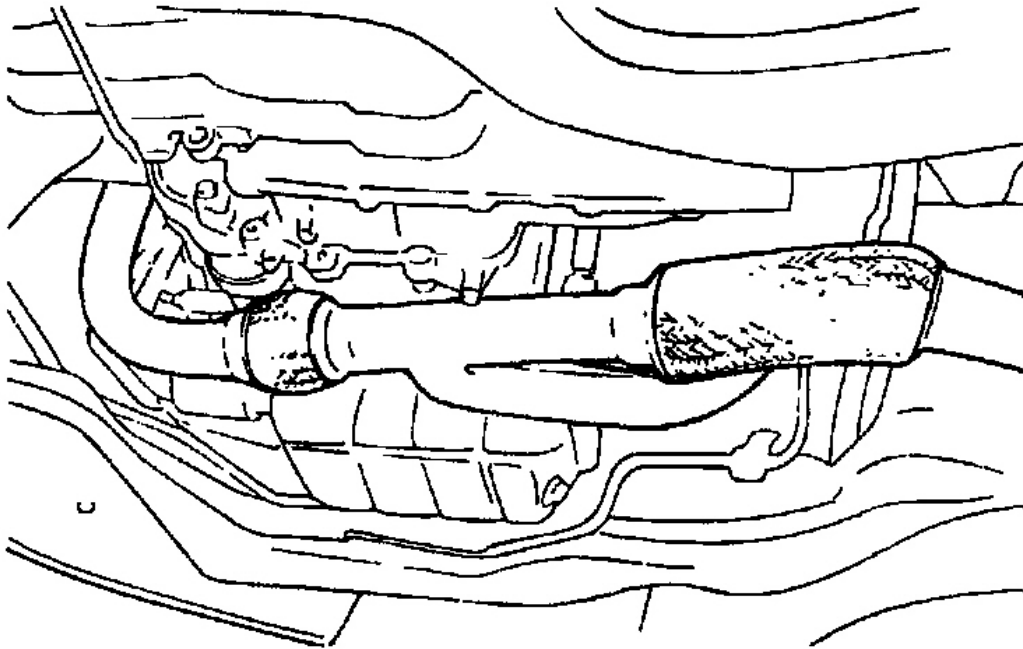


G01164571

Fig. 150: Removing Rubber Hangers & Main Muffler (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

FRONT EXHAUST PIPE (INCLUDING CATALYTIC CONVERTER)

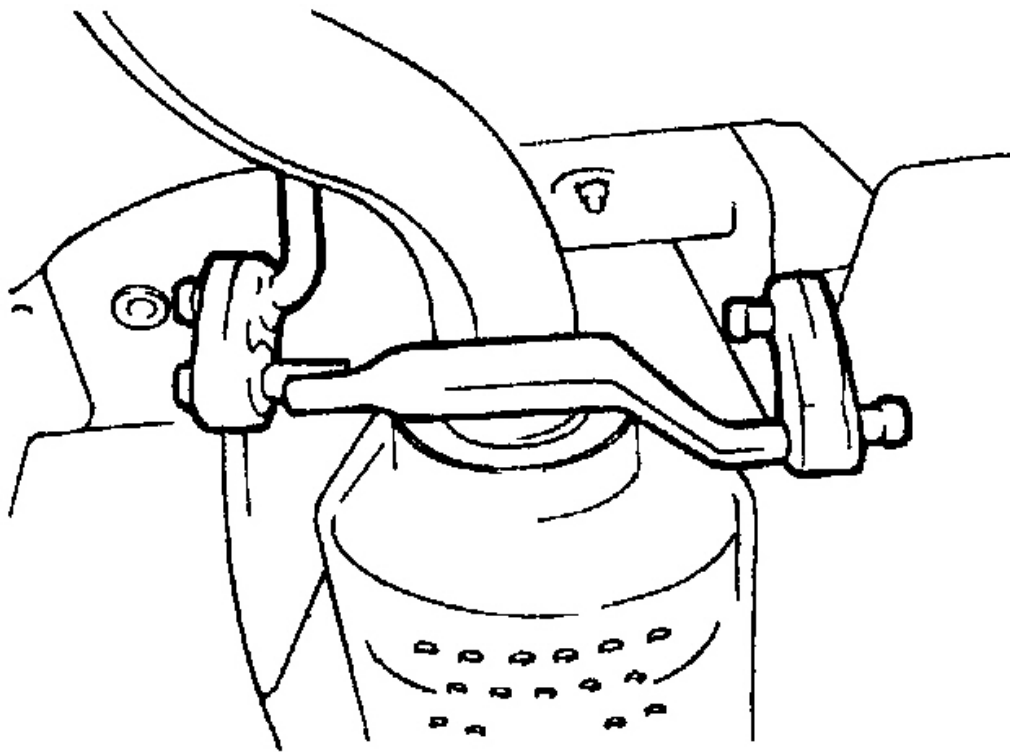
1. Remove the front exhaust pipe from the center exhaust pipe.
2. Remove the front exhaust pipe bolt and the exhaust manifold pipe mounting nuts.



G01164572

Fig. 151: Removing Front Exhaust Pipe From Center Exhaust Pipe
Courtesy of HYUNDAI MOTOR CO.

3. Remove the front exhaust pipe from the rubber hanger.



G01164573

Fig. 152: Removing Front Exhaust Pipe From Rubber Hanger (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

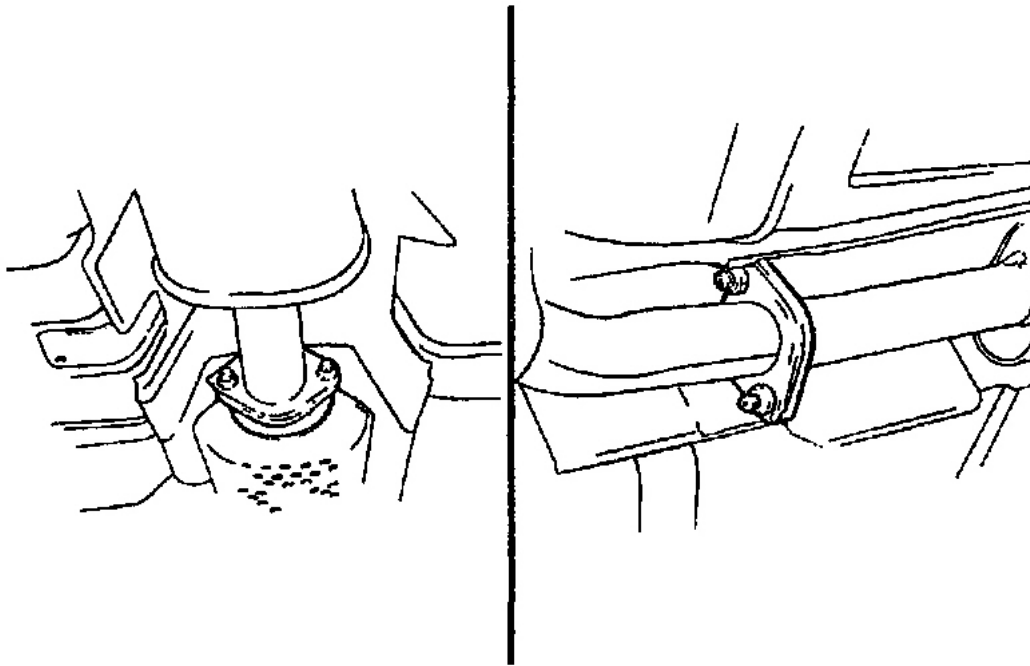
**G01164574**

Fig. 153: Removing Front Exhaust Pipe From Rubber Hanger (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

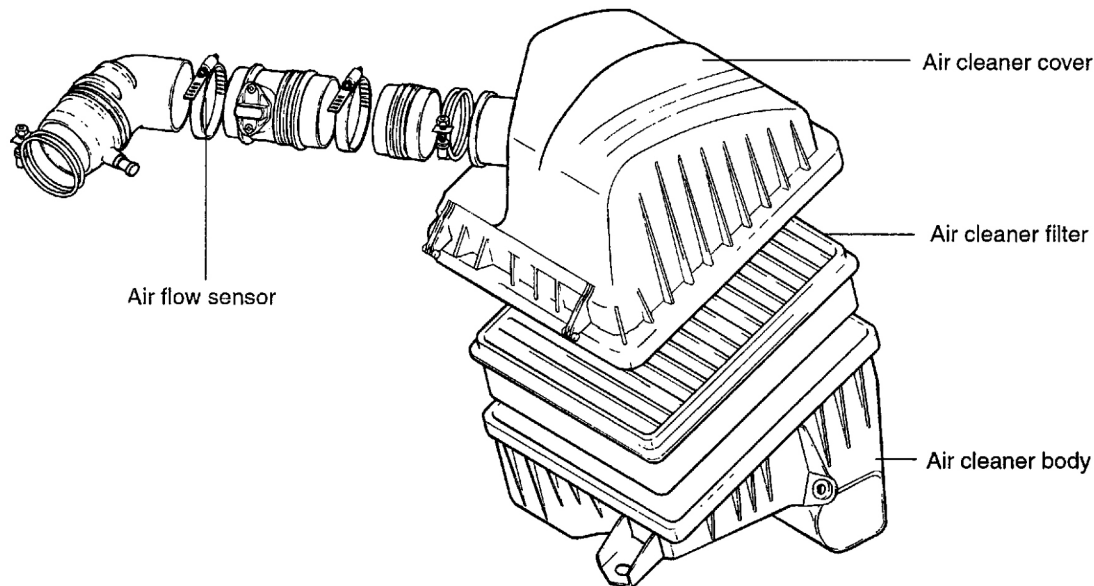
INSPECTION

1. Check the mufflers and pipes for leaks, corrosion and damage.
2. Check the rubber hangers for deterioration and cracks.

INSTALLATION

1. Temporarily install the front exhaust pipe, the catalytic converter assembly, the center exhaust pipe and the main muffler, in this order.
2. Install the rubber hangers so that they hang equally left and right.
3. Tighten the parts securely and then confirm that there is no interference with any components.

AIR CLEANER (ACL)**COMPONENTS**

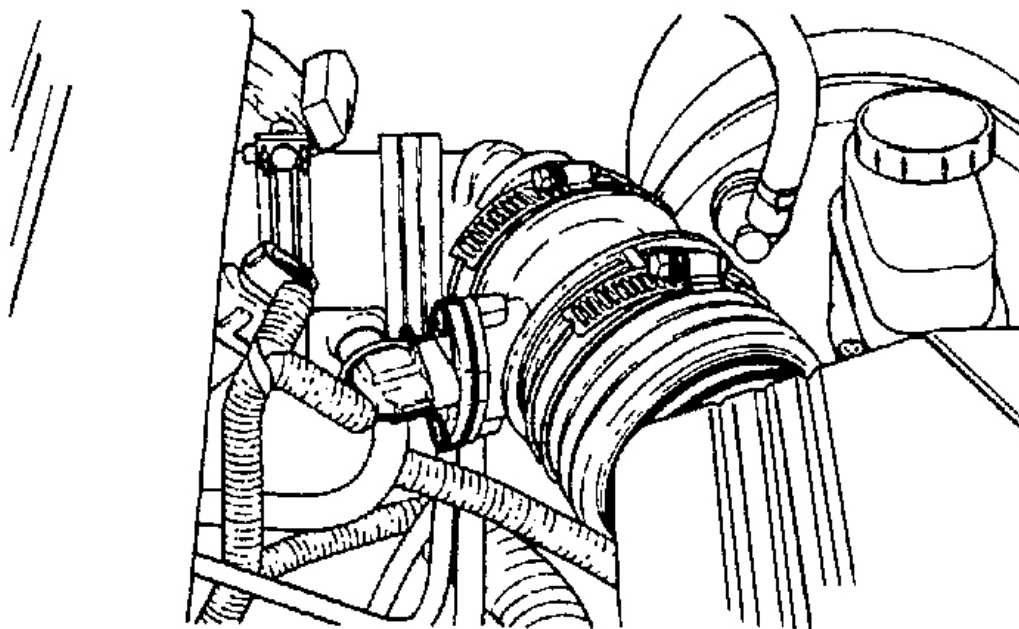


G01164575

Fig. 154: Air Cleaner Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

1. Disconnect the air flow sensor connector.
2. Remove the air intake hose and air duct connected to the air cleaner.
3. Remove the three bolts attaching the air cleaner mounting brackets.
4. Detach the air cleaner.



G01164576

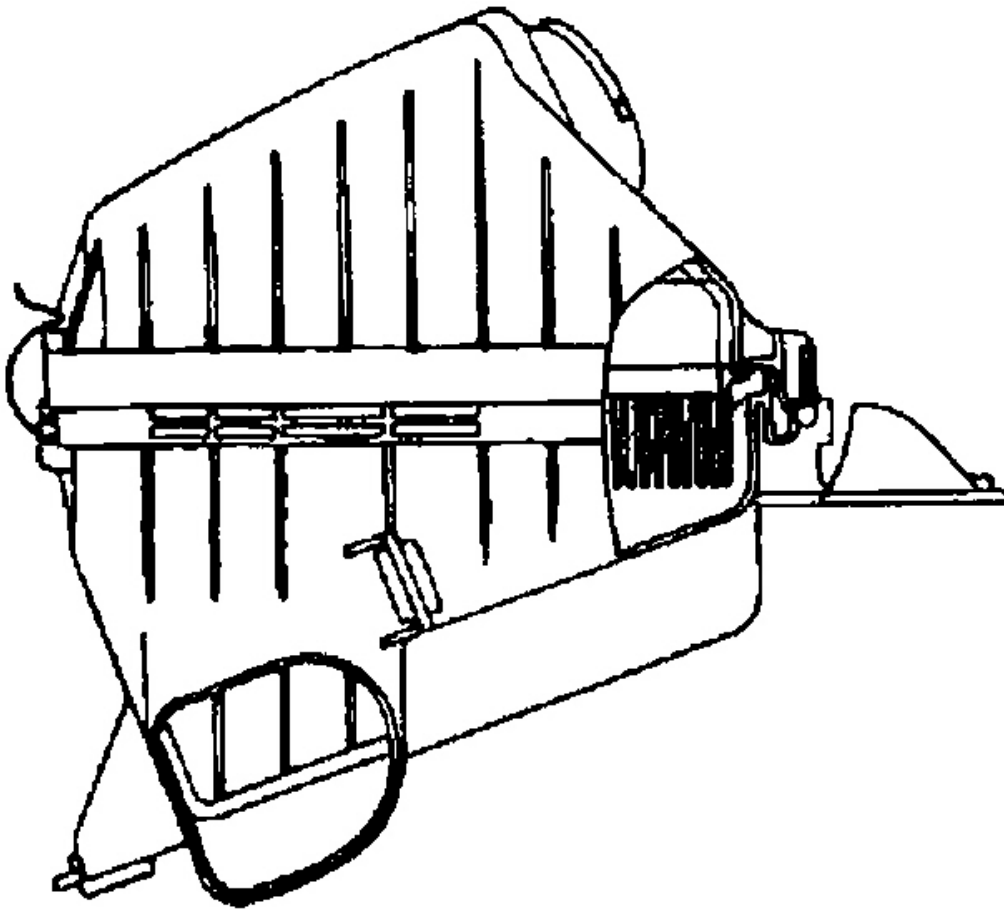
Fig. 155: Removing Air Intake Hose & Air Duct Connected To Air Cleaner
Courtesy of HYUNDAI MOTOR CO.

5. Remove the air flow sensor from the air intake hose.

CAUTION: Do not pull on the air flow sensor wires.

INSPECTION

1. Check the air intake hose, air cleaner cover for damage.
2. Check the air duct for damage.

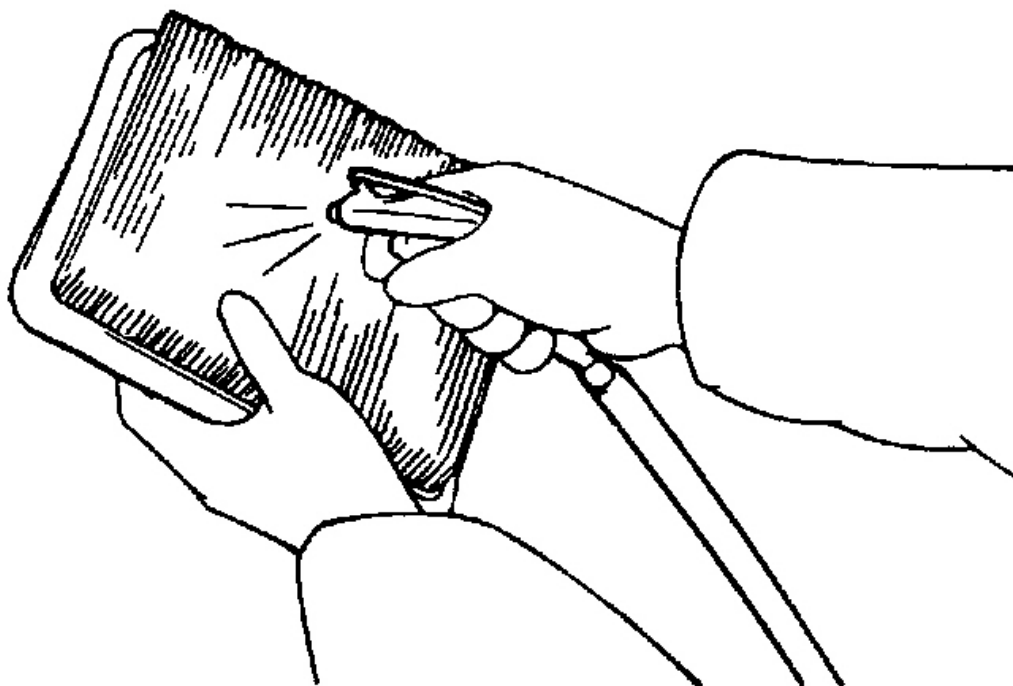


G01164577

Fig. 156: Checking Air Duct For Damage
Courtesy of HYUNDAI MOTOR CO.

3. Check the air cleaner element for restriction, contamination or damage.

If the element is slightly restricted, remove dust and debris by blowing compressed air from the inside of the element. Replace the element if it cannot be cleaned.



G01164578

Fig. 157: Removing Dust & Debris From Air Filter
Courtesy of HYUNDAI MOTOR CO.

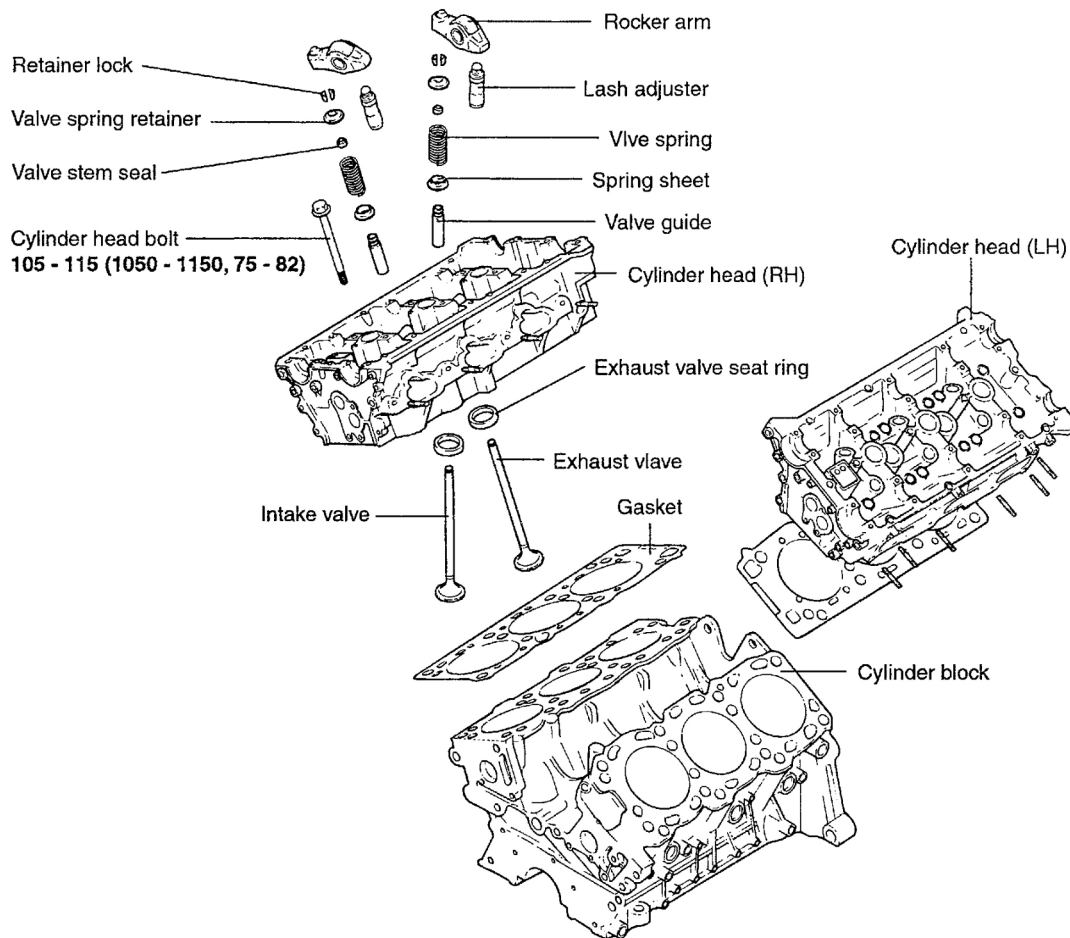
INSTALLATION

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

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

COMPONENTS



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

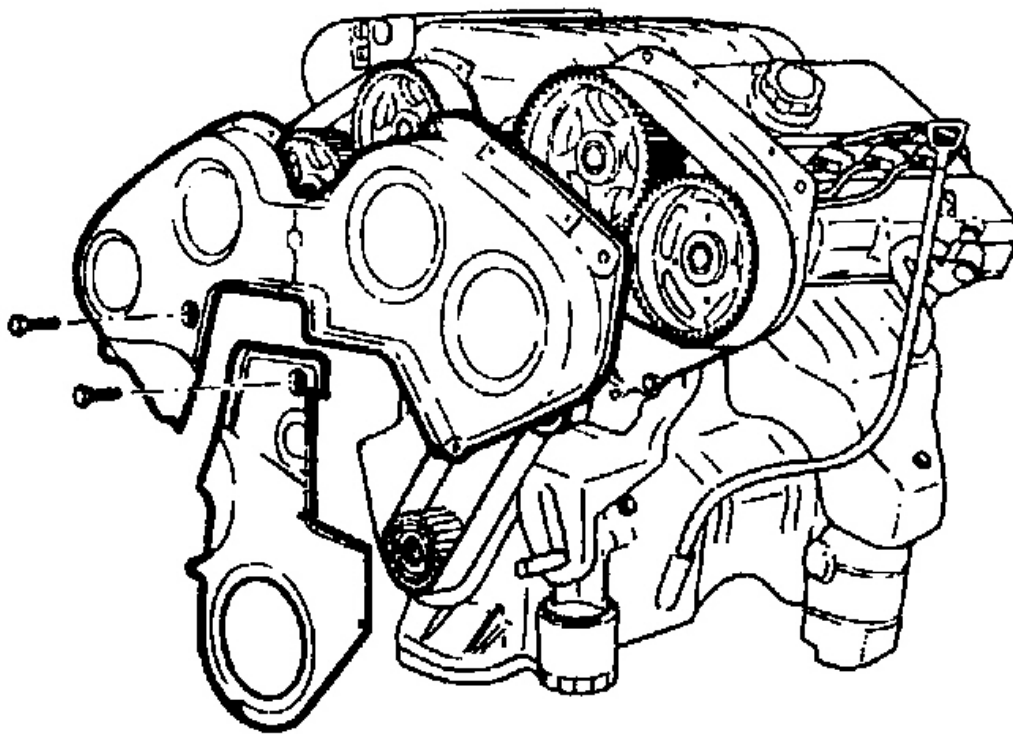
G01164579

Fig. 158: Exploded View Of Cylinder Head & Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Drain the coolant and disconnect the upper radiator hose.
2. Remove the breather hose and air-intake hose.
3. Remove the vacuum hose, fuel hose and coolant hose.
4. Remove the intake manifold.
5. Remove the cables from the spark plugs. The cables should be removed by holding the boot portion.
6. Remove the ignition coil.

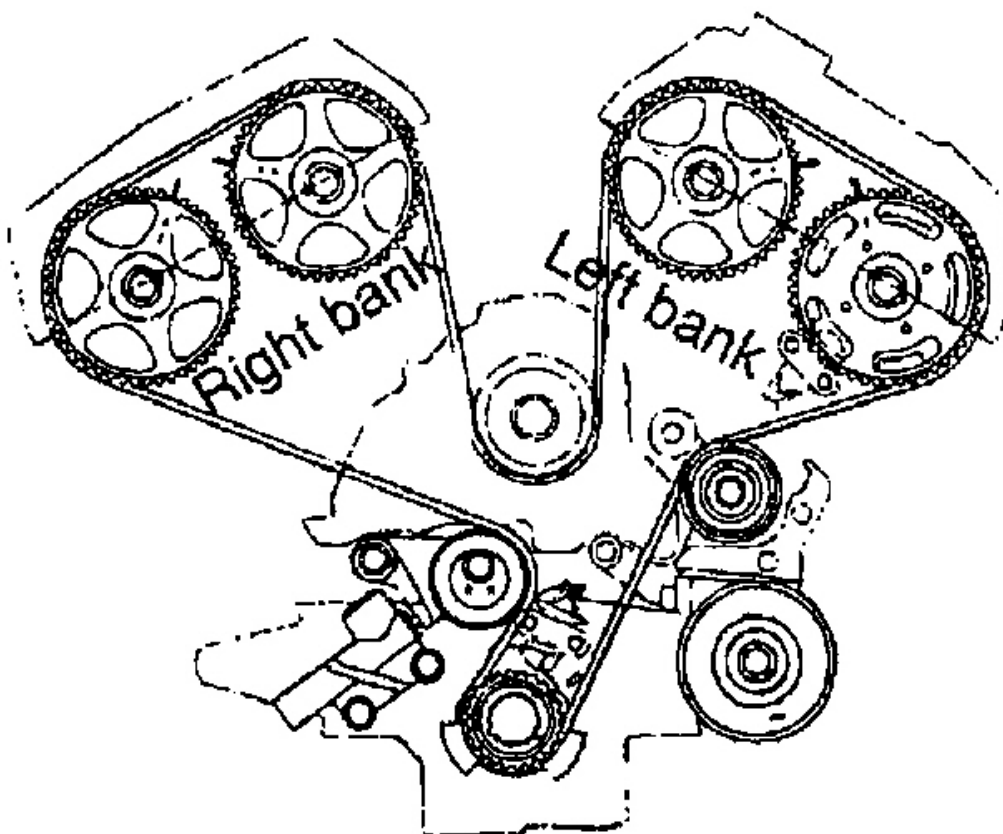
7. Remove the upper and lower timing belt cover.



G01164580

Fig. 159: Removing Upper & Lower Timing Belt Cover
Courtesy of HYUNDAI MOTOR CO.

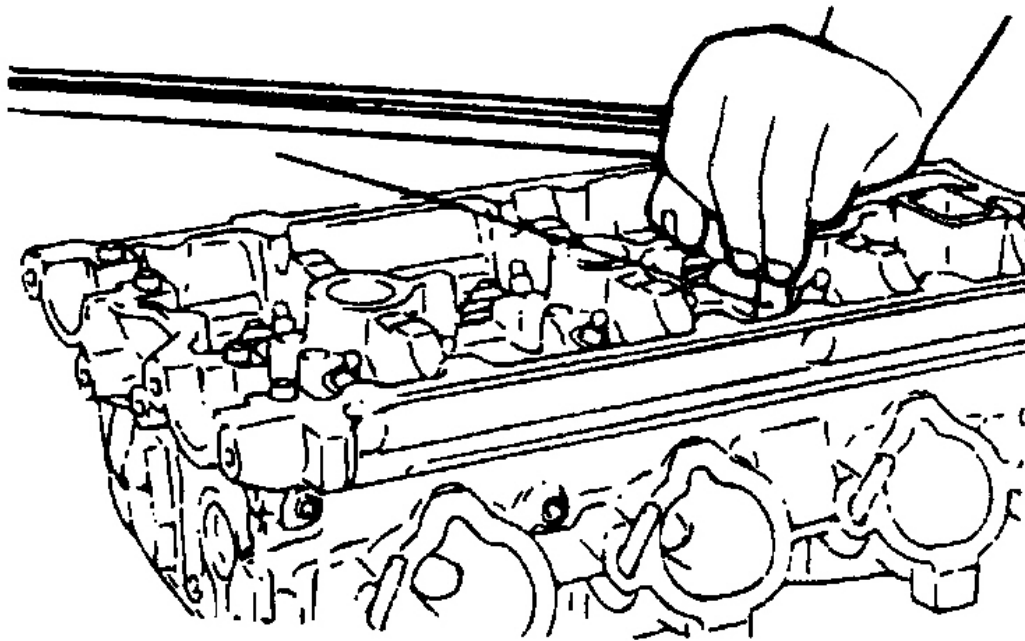
8. Remove the timing belt and camshaft sprockets.



G01164581

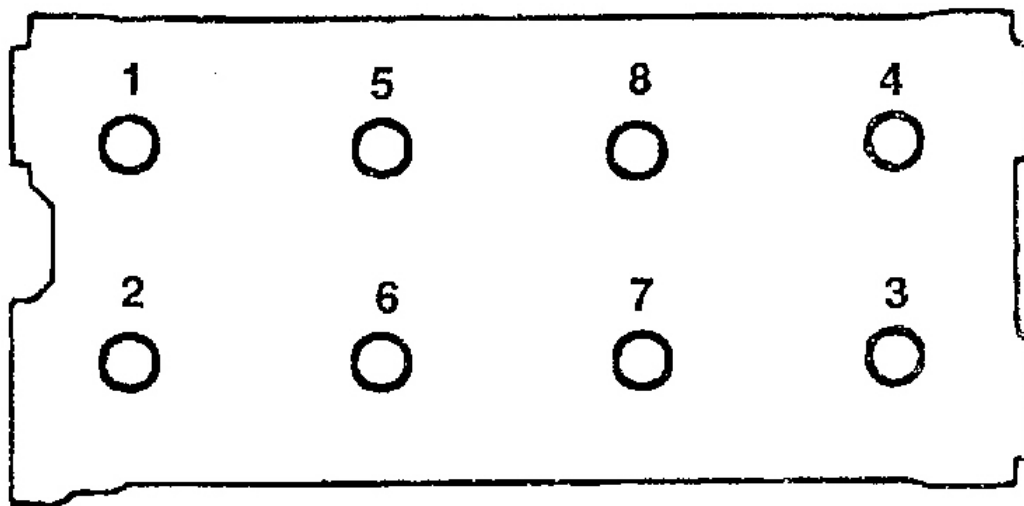
Fig. 160: Identifying Timing Belt System
Courtesy of HYUNDAI MOTOR CO.

9. Remove the heat protector and exhaust manifold assembly.
10. Remove the coolant pump pulley and head cover.
11. Remove the intake and exhaust camshaft.
12. Remove the cylinder head assembly. The cylinder head bolts should be removed using the 12 mm socket, in two or three steps.



G01164582

Fig. 161: Removing Cylinder Head Assembly
Courtesy of HYUNDAI MOTOR CO.



G01164583

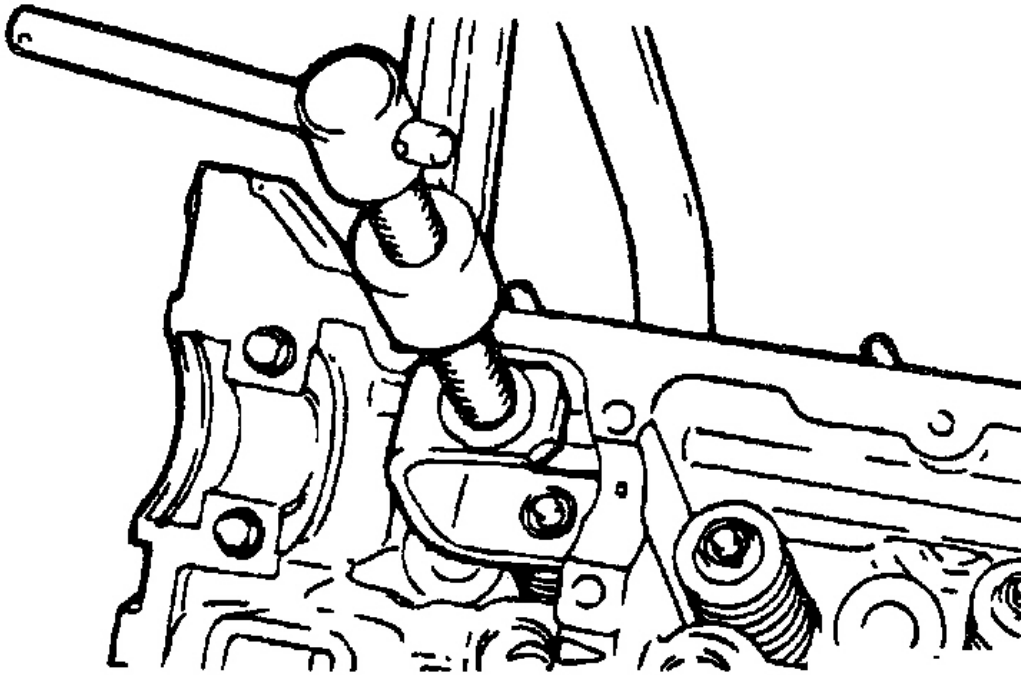
Fig. 162: Cylinder Head Bolt Removal Sequence
Courtesy of HYUNDAI MOTOR CO.

13. Clean the gasket pieces from the cylinder block top surface and cylinder head bottom surface.

NOTE: Make sure that fragments from the gasket do not fall in the engine.

RETAINER LOCK

1. Compress the valve spring using special tool. (09222 - 28000, 09222 - 28100)
2. Remove the retainer lock.



G01164584

Fig. 163: Removing Retainer Lock
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

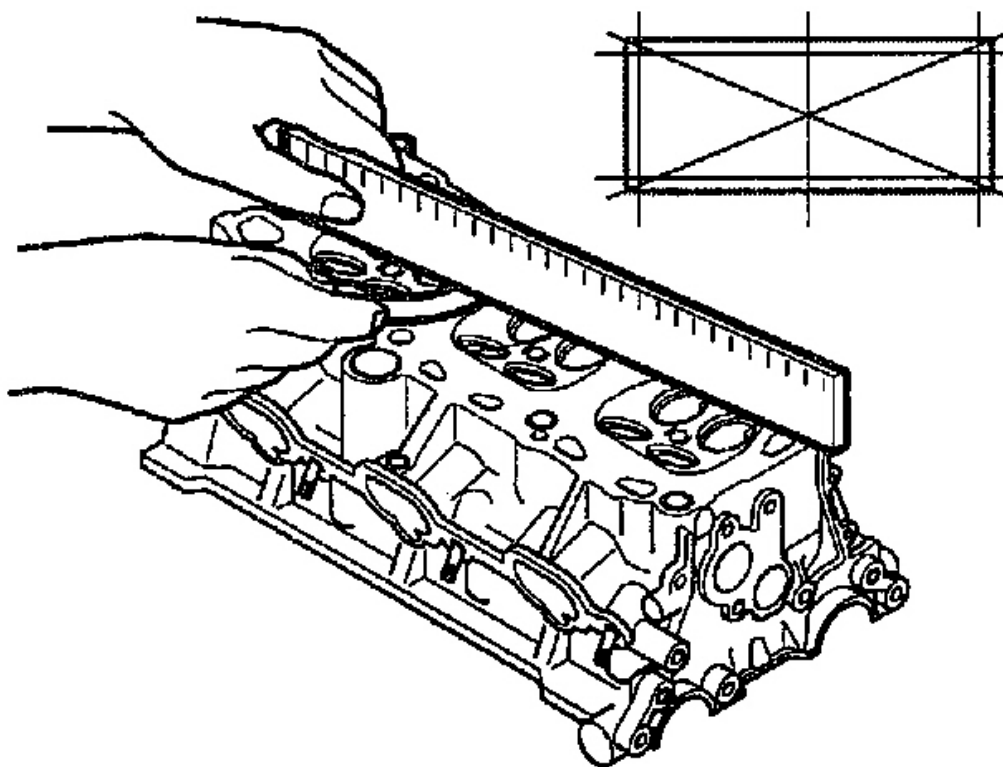
CYLINDER HEAD

1. Remove scale, sealing compound and carbon deposits. After cleaning oil passages, apply compressed air to make certain that the passages are not clogged.
2. Visually check the cylinder head for cracks, damage or water leakage.
3. Check the cylinder head surface for flatness with a straight edge and feeler gauge as shown in the illustration.

Cylinder head flatness

Standard dimensions: Max. 0.03mm(0.0059 in.)

Service limit: 0.05mm(0.0020 in.)



G01164585

Fig. 164: Checking Cylinder Head Surface For Flatness
Courtesy of HYUNDAI MOTOR CO.

VALVE GUIDES

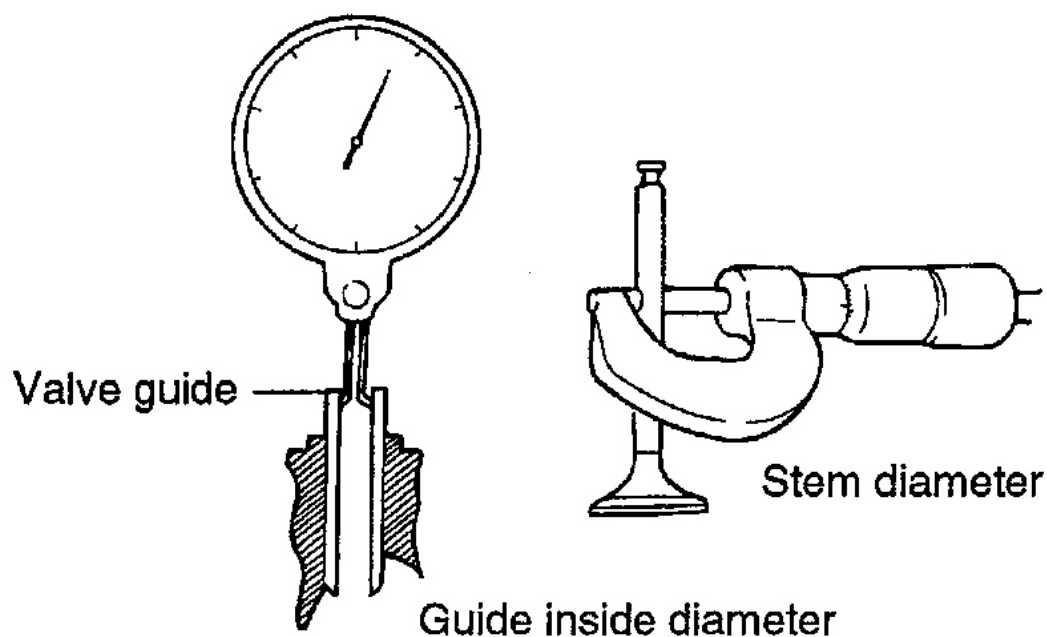
Check the valve stem-to-guide clearance. If the clearance exceeds the service limit, replace the valve guide with a new oversize guide.

Valve stem-to-guide clearance

Standard value

Intake: 0.02 - 0.05 mm (0.0009 - 0.0020 in.)

Exhaust: 0.050 - 0.085 mm (0.0020 - 0.0033 in.)



G01164586

Fig. 165: Checking Valve Stem-To-Guide Clearance
Courtesy of HYUNDAI MOTOR CO.

VALVE

1. Replace the valve if its stem is bent, worn or damaged. Also replace it if the stem end (the surface contacting the hydraulic-lash adjuster) is hollowed out.
2. Check the valve face contact area, and recondition or replace as necessary.

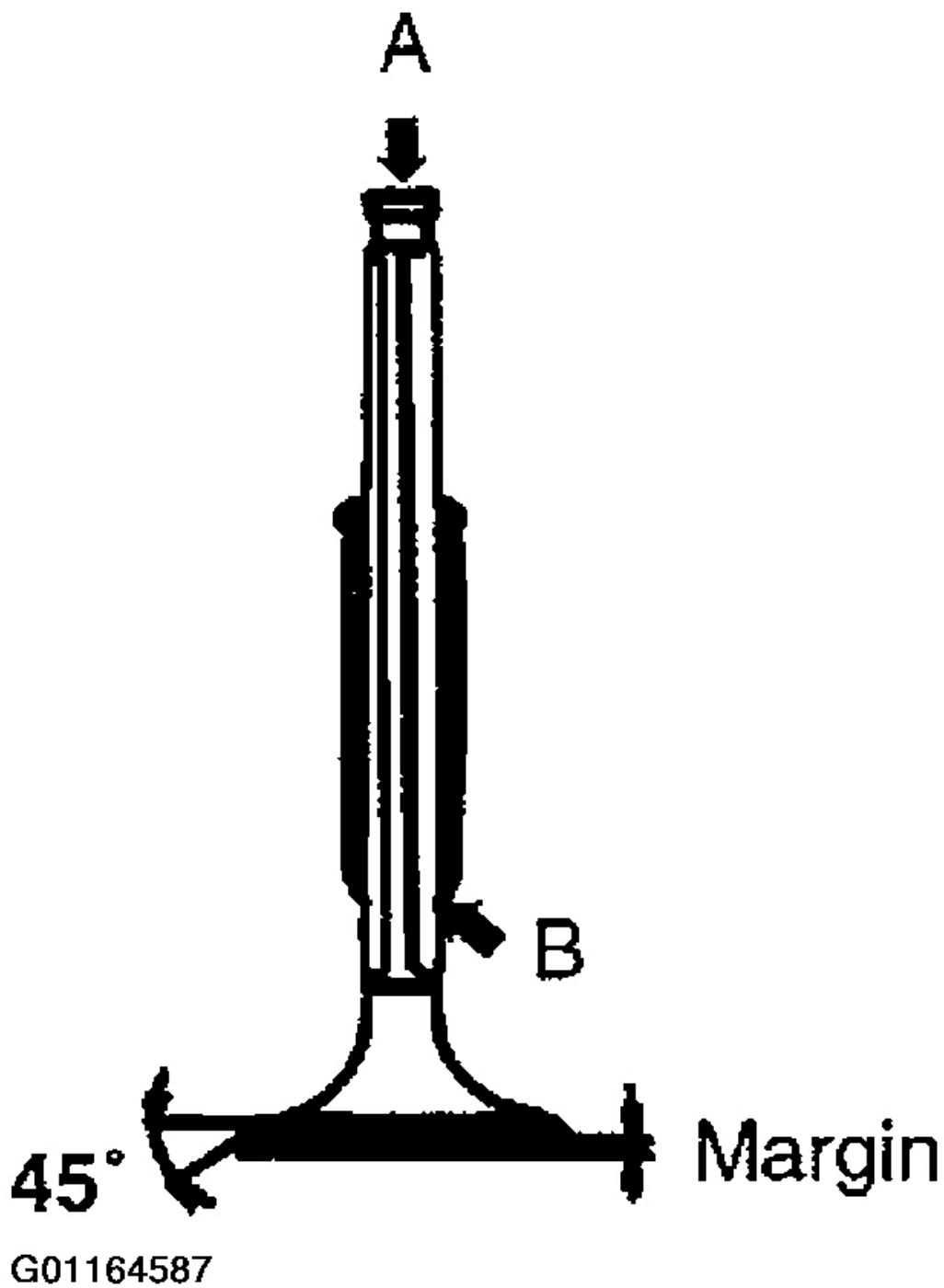


Fig. 166: Checking Valve Face Contact Area
Courtesy of HYUNDAI MOTOR CO.

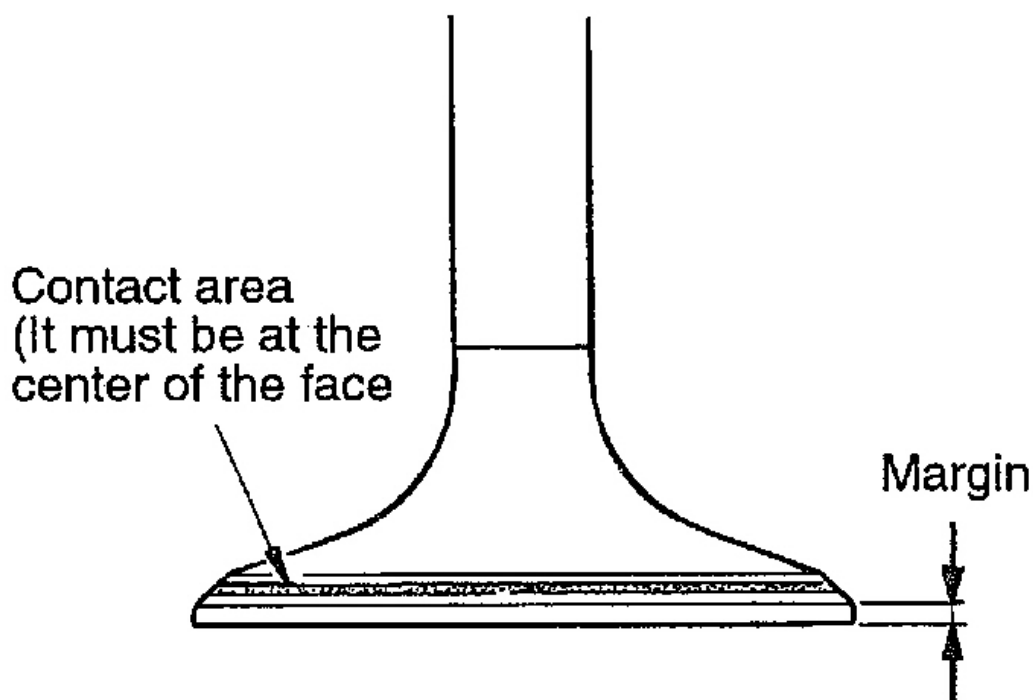
3. Replace the valve if the width of the margin (thickness of the valve head) is less than the minimum specified.

Valve margin

Standard value

Intake: 1.0mm(0.0394 in.)

Exhaust: 1.3mm(0.0512 in.)



G01164588

Fig. 167: Measuring Valve Face Thickness
Courtesy of HYUNDAI MOTOR CO.

VALVE SPRING

1. Check the free height of each valve spring and replace if necessary.
2. Using a square, test the squareness of each valve spring. If the spring is excessively out-of-square, replace it.

VALVE SPRING

Standard value

Free height: 46.4 mm (1.8268 in.)

Load: 24 kg / 37.9 mm (53 lb / 1.492 in.)

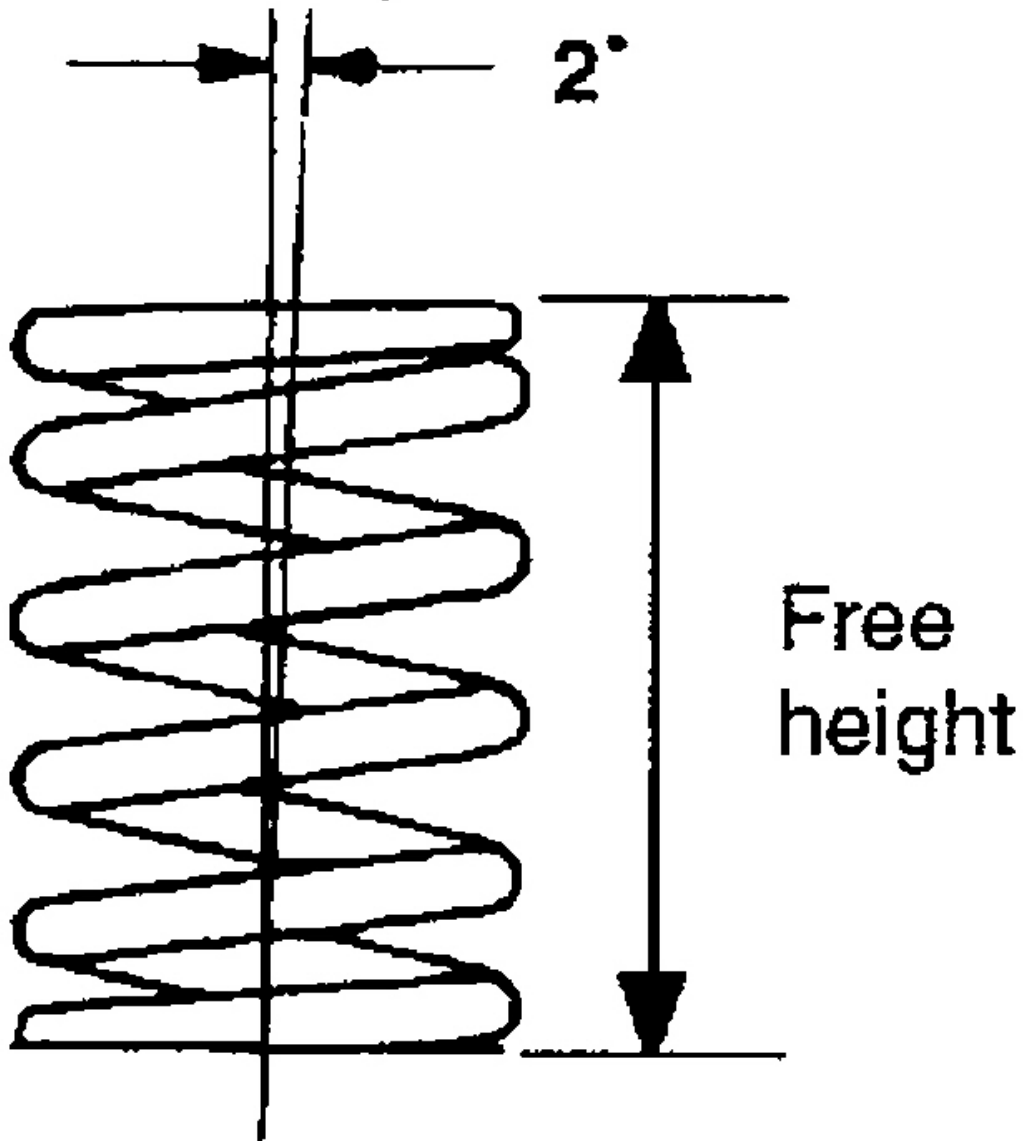
Out - of - square: Max. 2°

Service limit

Free height: 41.5 mm (1.6339 in.)

Load: 55.8 kg/28.9 mm (123 lb/1.1378 in.)

Out-of-square

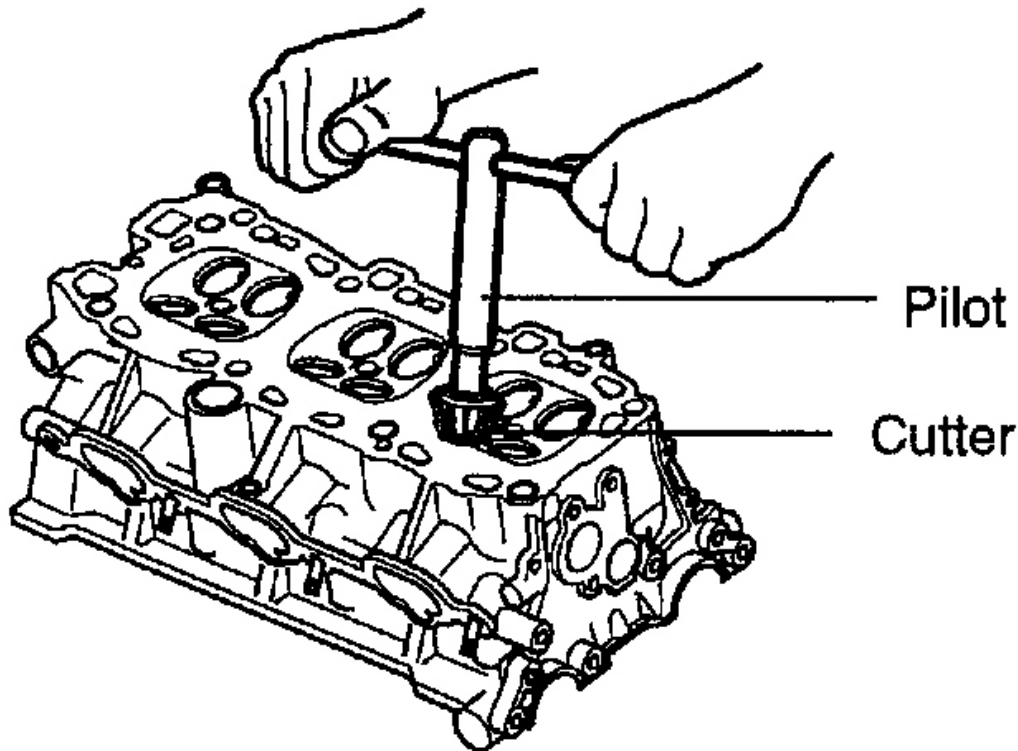


G01164589

Fig. 168: Checking Valve Spring Free Height
Courtesy of HYUNDAI MOTOR CO.

RECONDITIONING VALVE SEAT

1. Before reconditioning, check the valve guide for wear. Replace worn guides if necessary and then recondition the valve seats.
2. Recondition the valve seat using the Valve Seat Cutter and Pilot.
3. After reconditioning, the valve and valve seat should be lapped lightly with a lapping compound.



G01164590

Fig. 169: Reconditioning Valve Seat
Courtesy of HYUNDAI MOTOR CO.

REPLACING VALVE GUIDE

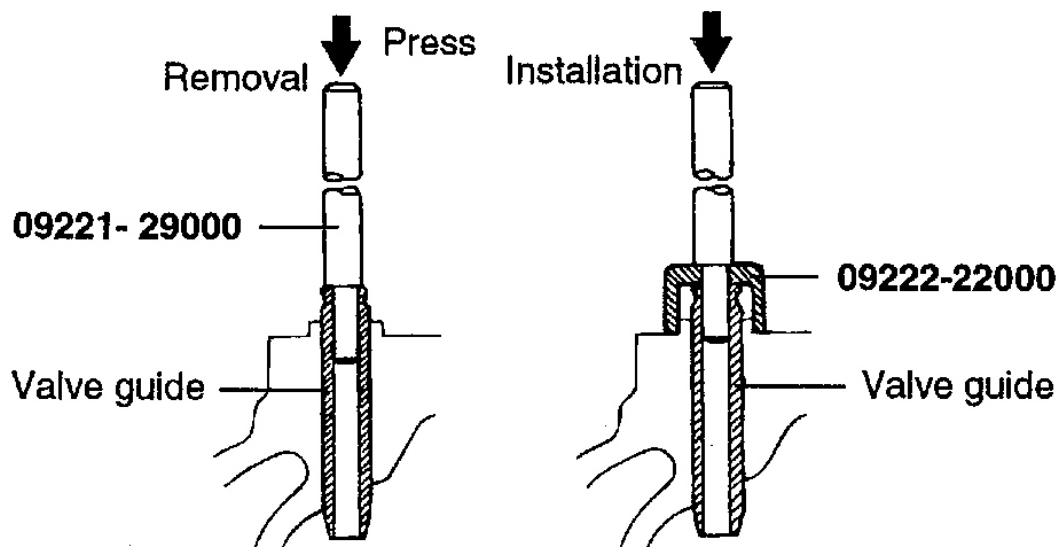
1. Using the special tool (09222-22000B), withdraw the old valve guide out the bottom of the cylinder head.
2. Recondition the valve guide hole so that it can receive the newly press-fitted oversize valve guide.

VALVE GUIDE OVERSIZES

Size mm (in.)	Size Mark	Oversize valve guide hole size mm (in.)
0.05 (0.002) O.S.	5	12.05 - 12.068 (0.474 - 0.475)
0.25 (0.010) O.S.	25	12.25 - 12.268 (0.482 - 0.483)
0.50 (0.020) O.S.	50	12.50 - 12.518 (0.492 - 0.493)

G01164591

Fig. 170: Valve Guide Oversizes Specification
 Courtesy of HYUNDAI MOTOR CO.



G01164592

Fig. 171: Press-fitting Valve Guide
 Courtesy of HYUNDAI MOTOR CO.

3. Using the special tool (09221-29000(A), 09222-22000(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.
4. After the valve guide is press-fitted, insert a new valve and check for proper clearance.
5. After the valve guide is replaced, check that the valve is fully seated. Recondition the valve seats as necessary.

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

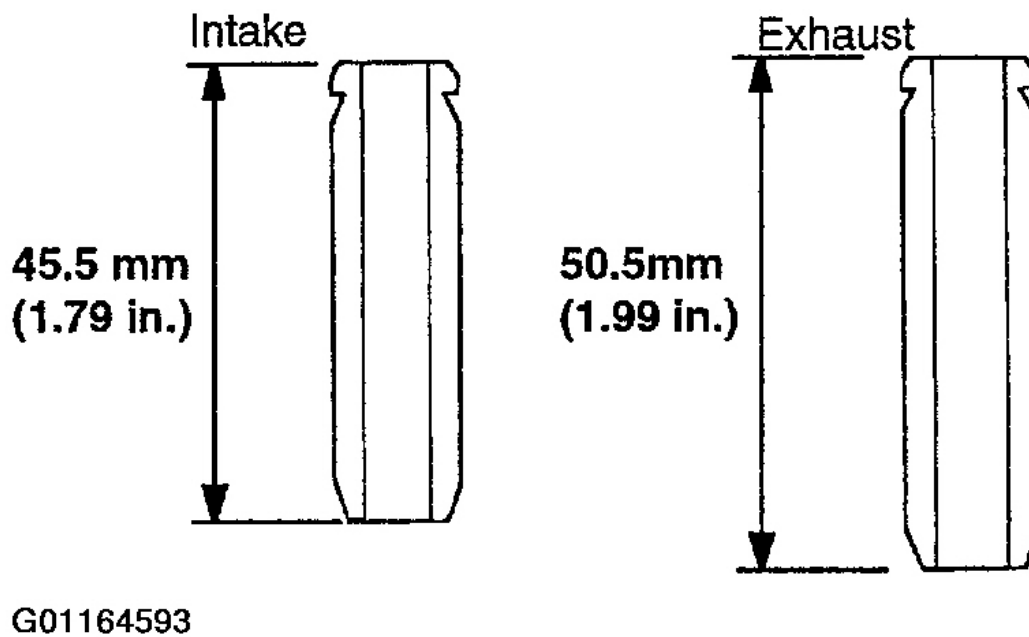
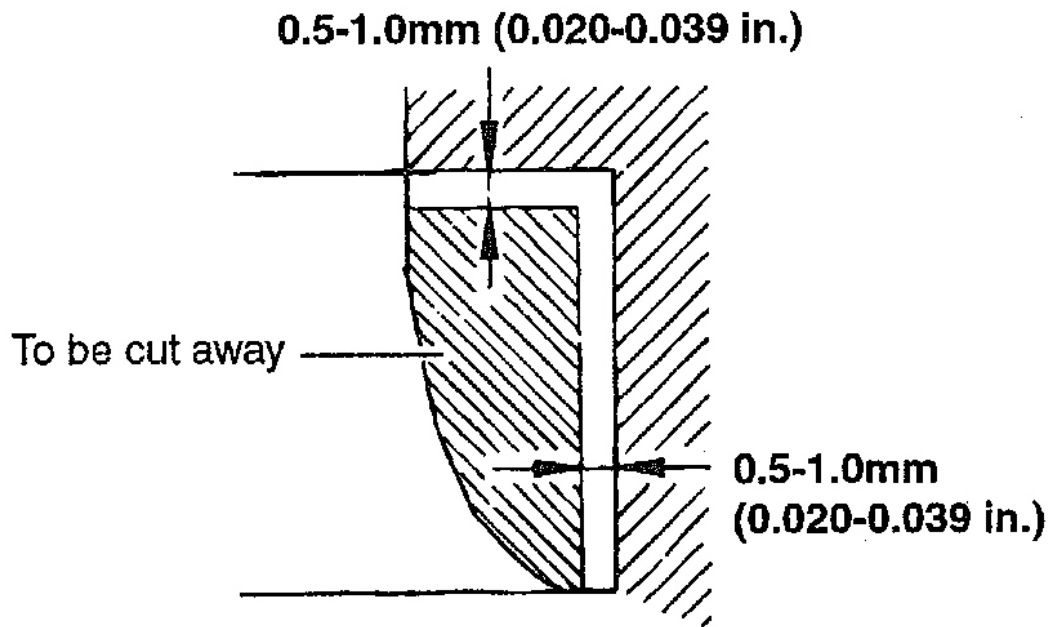


Fig. 172: Measuring Valve Stem Height
Courtesy of HYUNDAI MOTOR CO.

REPLACING VALVE SEAT RING

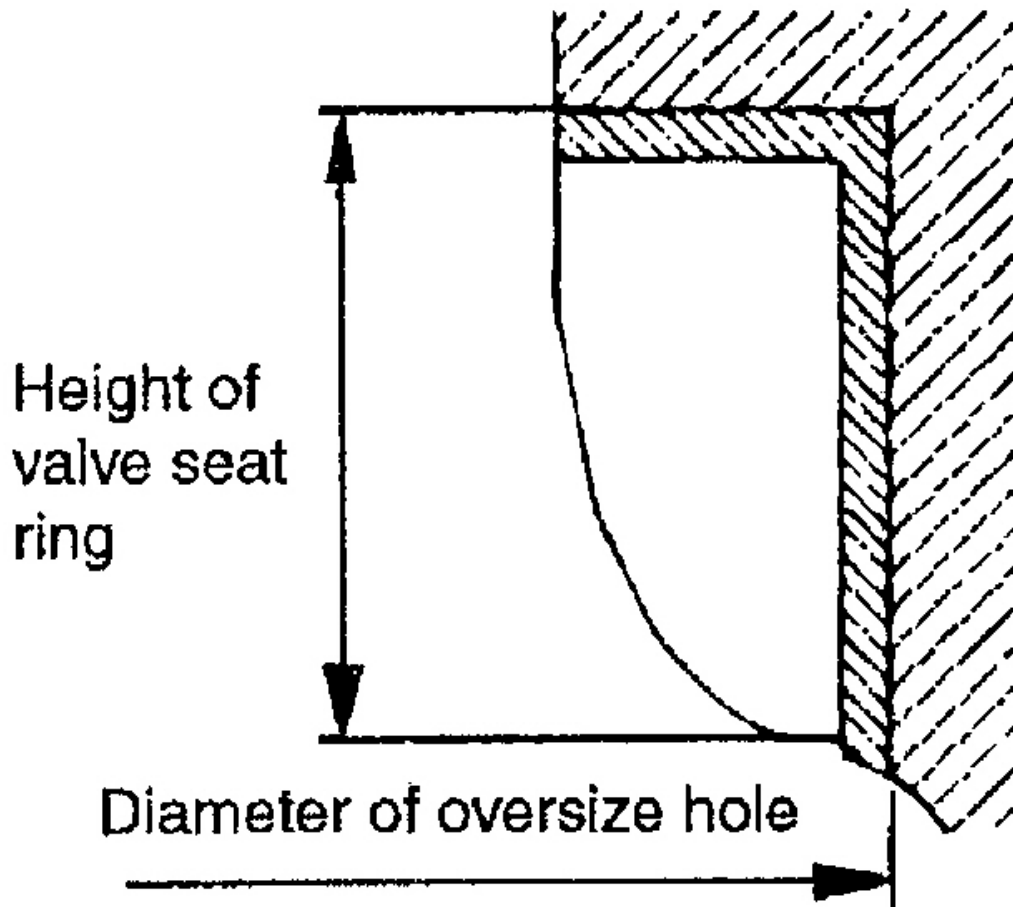
1. Cut away the inner face of the valve seat to reduce the wall thickness.



G01164595

Fig. 173: Identifying Inner Face Of Valve Seat To Be Cut Away
Courtesy of HYUNDAI MOTOR CO.

2. Enlarge the diameter of the valve seat so that it matches the specified hole diameter of the new valve seat ring.



G01164596

Fig. 174: Enlarging Valve Seat
 Courtesy of HYUNDAI MOTOR CO.

VALVE SEAT RING OVERSIZES

Description	Size mm (in.)	Size Mark	Seat ring height H mm (in.)	Oversize hole diameter I.D. mm (in.)
Intake valve seat ring	0.3 (0.012) O.S.	30	7.9 - 8.1 (0.311 - 0.319)	36.300 - 36.325 (1.429 - 1.430)
	0.6 (0.024) O.S.	60	8.2 - 8.4 (0.323 - 0.331)	36.600 - 36.625 (1.441 - 1.442)
Exhaust valve seat ring	0.3 (0.012) O.S.	30	7.9 - 8.1 (0.311 - 0.319)	33.30 - 33.325 (1.311 - 1.312)
	0.6 (0.024) O.S.	60	8.2 - 8.4 (0.323 - 0.331)	33.600 - 33.625 (1.323 - 1.324)

G01164594

Fig. 175: Valve Seat Ring Oversizes Table
Courtesy of HYUNDAI MOTOR CO.

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: 0.9 - 1.3 mm (0.035 - 0.051 in.)

Exhaust: 0.9 - 1.3 mm(0.035 - 0.051 in.)

REASSEMBLY

1. Install the spring seats.
2. Using special tool (09222-28200), lightly tap the seal in position.

NOTE:

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

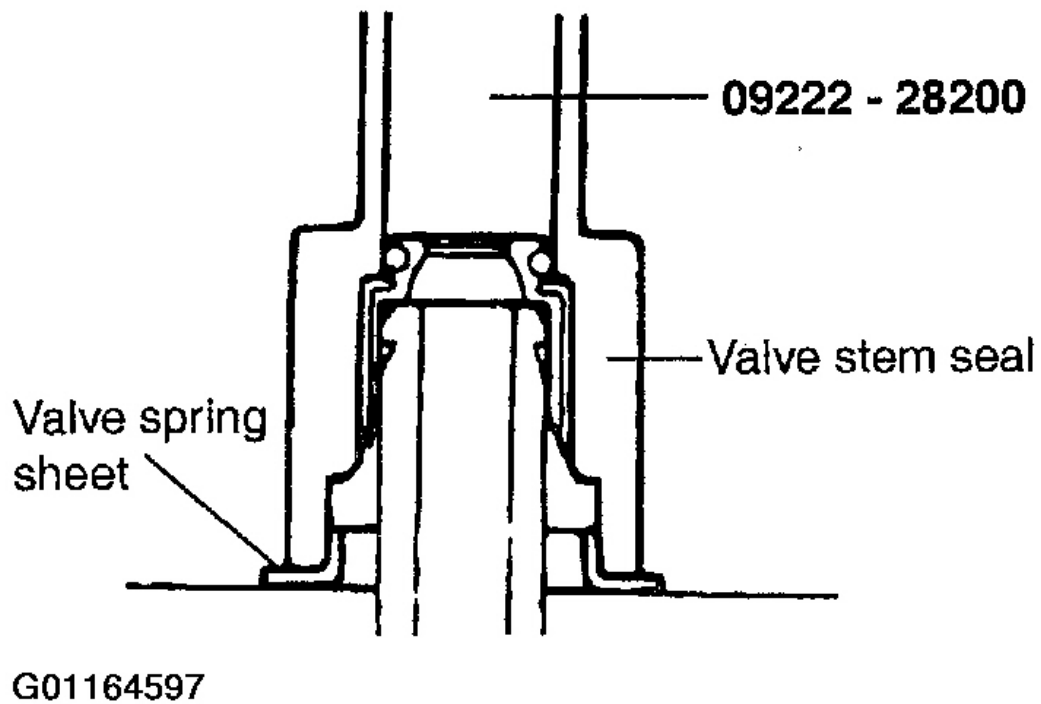
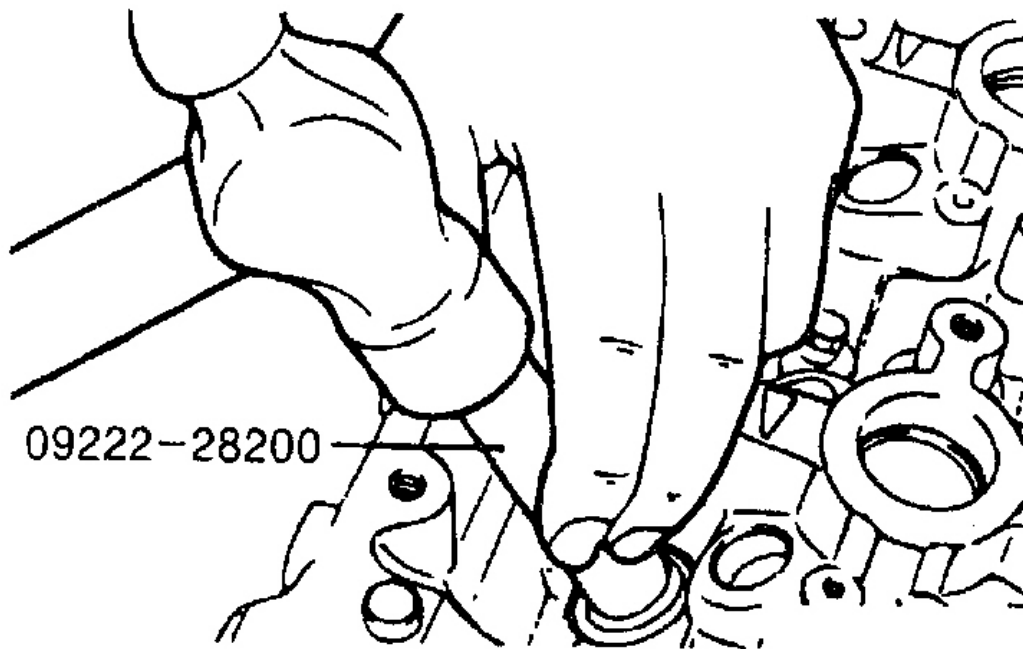


Fig. 176: Identifying Valve Spring Sheet, Stem Seal & Special Tool
Courtesy of HYUNDAI MOTOR CO.

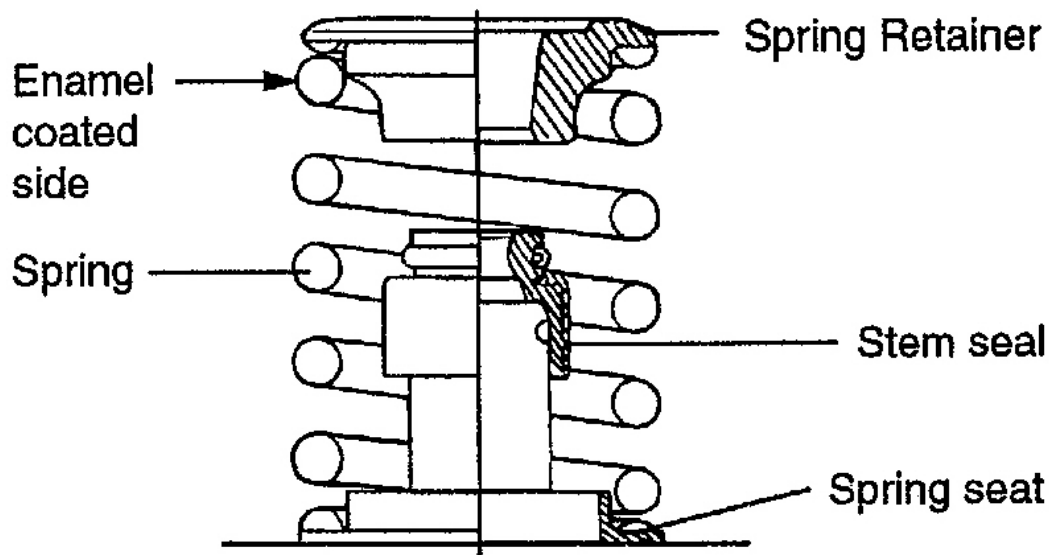


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Fig. 177: Installing Seals

Courtesy of HYUNDAI MOTOR CO.

3. Apply engine oil to each valve. Insert the valve into their guides. Avoid pushing the valve into the seal by force. After installing the valve, check that it moves smoothly.
4. Place valve springs so that the side coated with enamel faces toward the valve spring retainer.

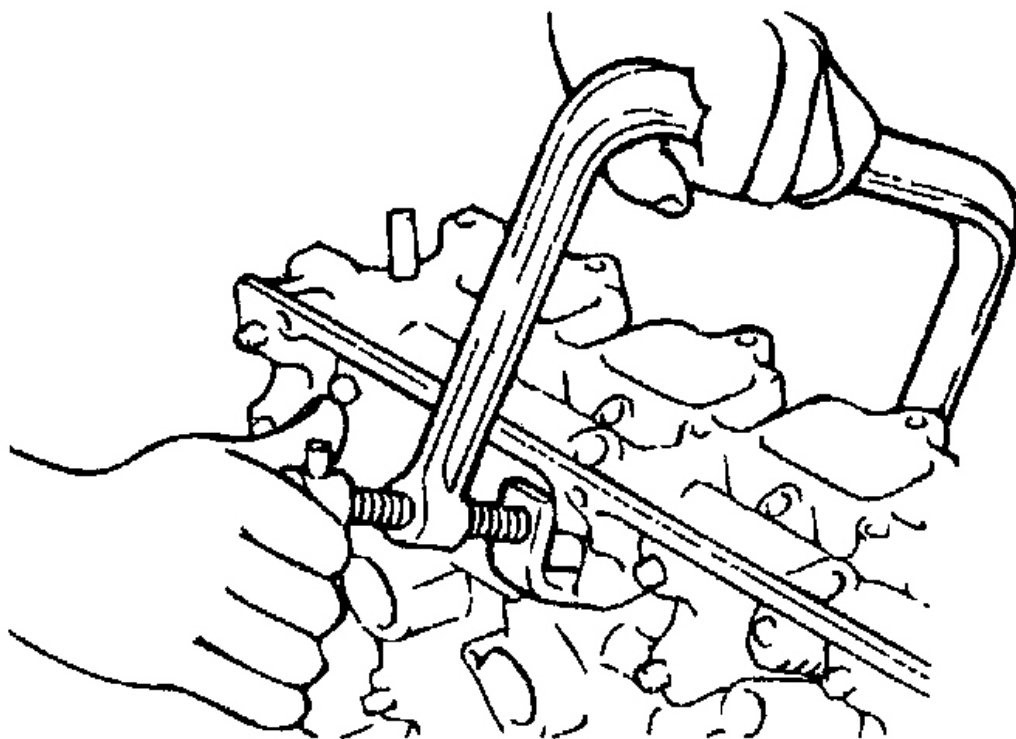


G01164599

Fig. 178: Identifying Proper Valve Springs Installation
Courtesy of HYUNDAI MOTOR CO.

5. 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.

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

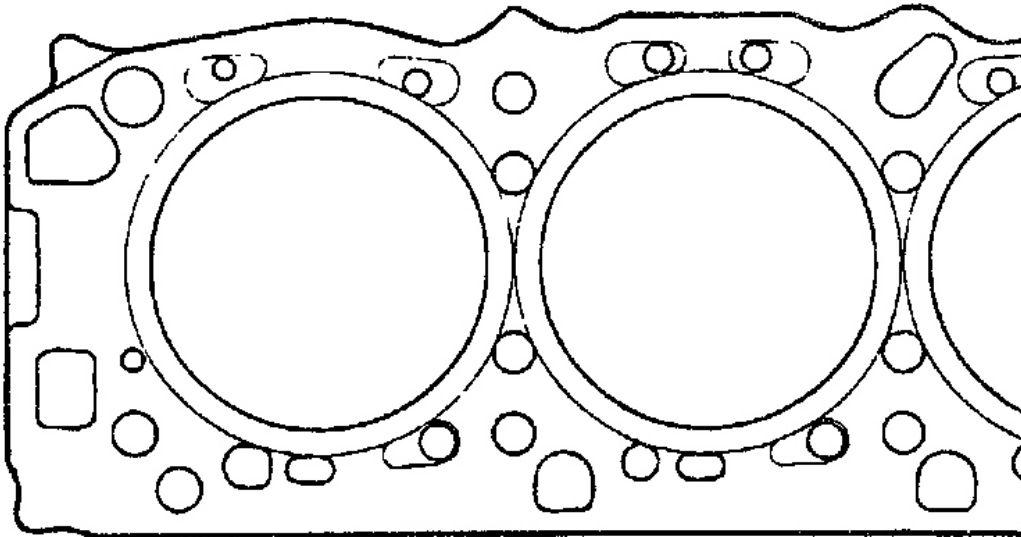


G01164600

Fig. 179: Installing Valve Spring Retainer Locks
Courtesy of HYUNDAI MOTOR CO.

6. Clean both gasket surfaces of the cylinder head and cylinder block.
7. Verify the identification marks on the cylinder head gasket.
8. Install the gasket so that the surface with the identification mark faces toward the cylinder head.

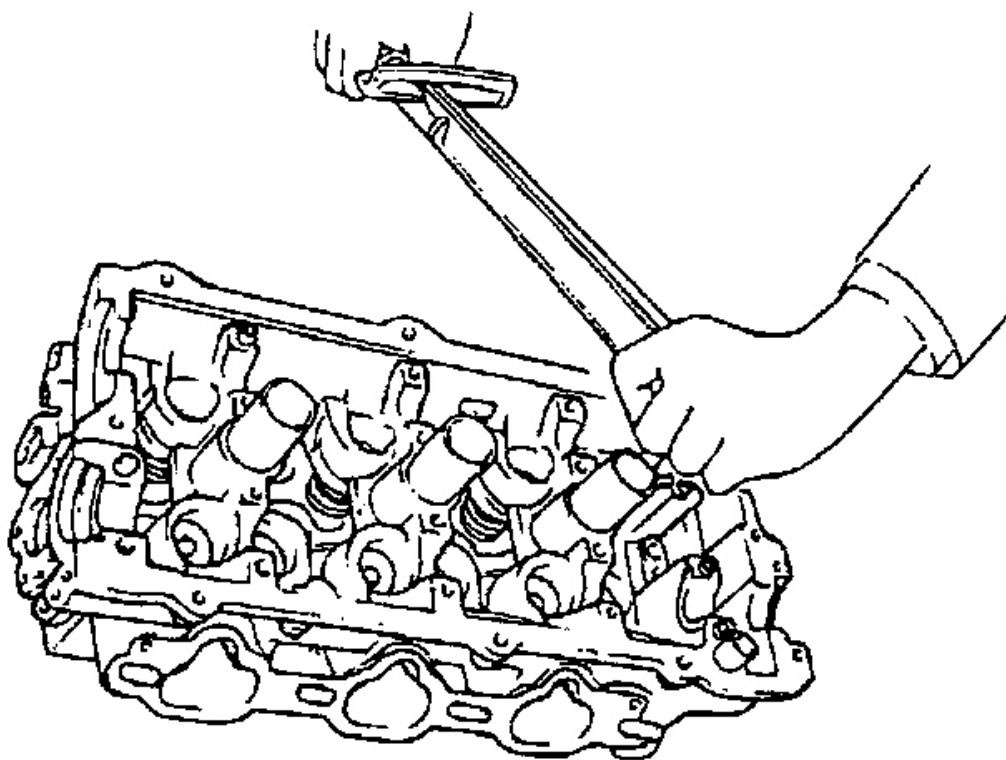
NOTE: **Do not apply sealant to these surfaces.**



G01164601

Fig. 180: Verifying Identification Marks On Cylinder Head Gasket
Courtesy of HYUNDAI MOTOR CO.

9. Tighten the cylinder head bolts in the sequence shown in the illustration with a torque wrench.



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Fig. 181: Tightening Cylinder Head Bolts

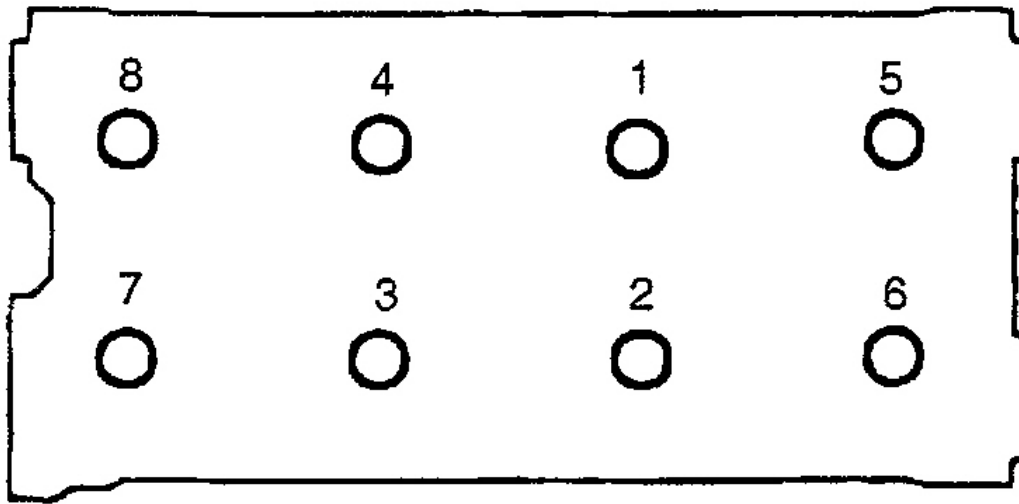
Courtesy of HYUNDAI MOTOR CO.

10. Tighten the cylinder head bolts using the torque-angle method. Starting at top center, tighten all cylinder head bolts in sequence as shown in the illustration, using the 12 mm socket.

Tightening procedure

Cylinder head bolt:

105 - 115 Nm (1050 - 1150 kg.cm, 75 - 82 lb.ft)



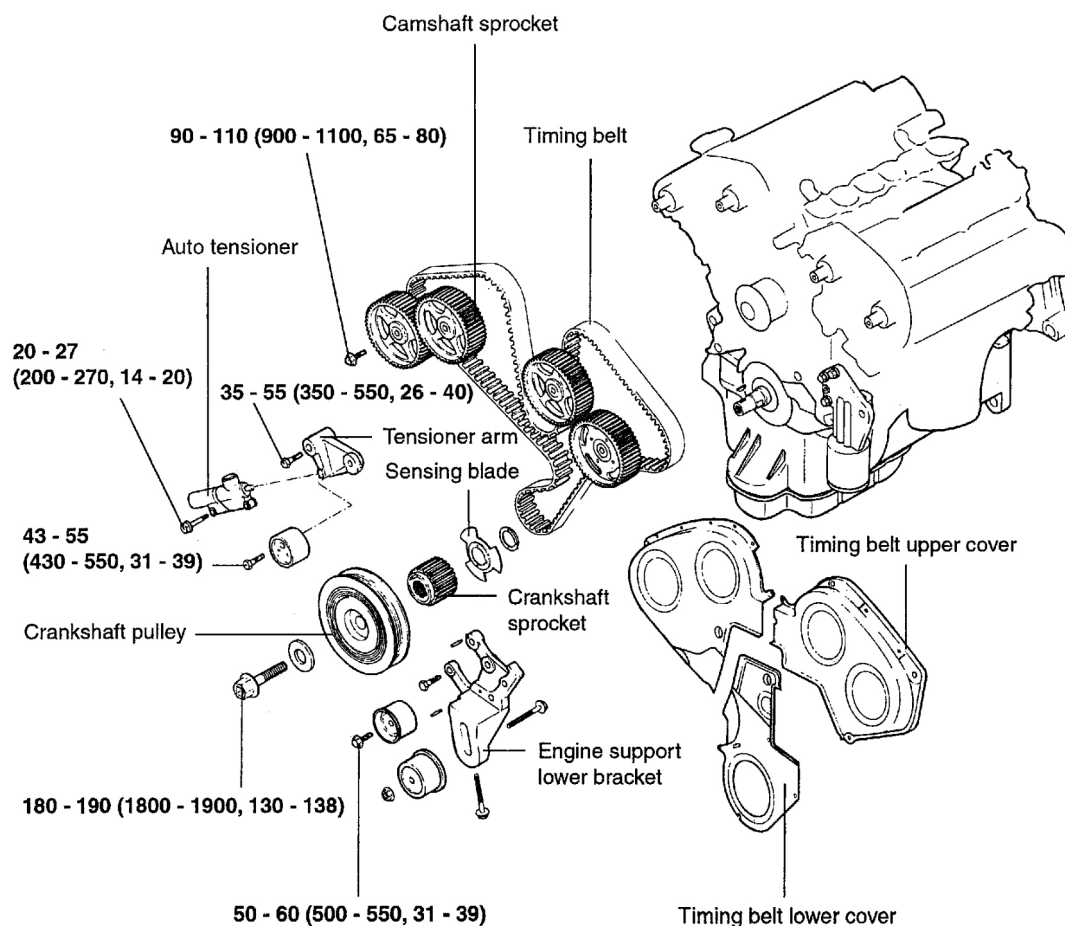
G01164603

Fig. 182: Cylinder Head Bolt Tightening Sequence
Courtesy of HYUNDAI MOTOR CO.

TIMING SYSTEM

TIMING BELT

COMPONENTS



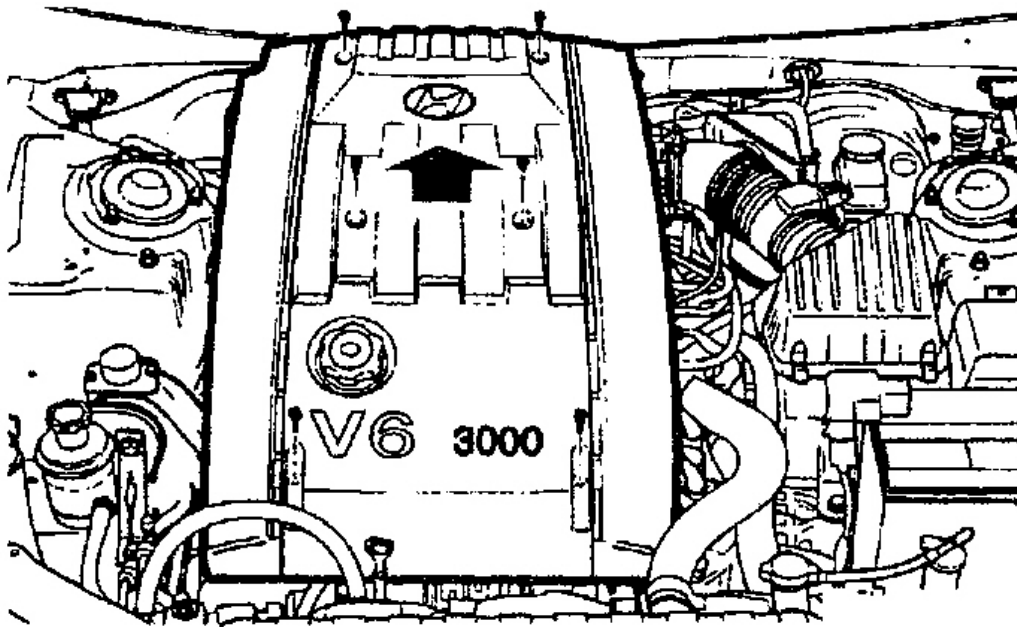
TORQUE : Nm (kg.cm, lb.ft)

G01164604

Fig. 183: Removing/Installing Timing Belt
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

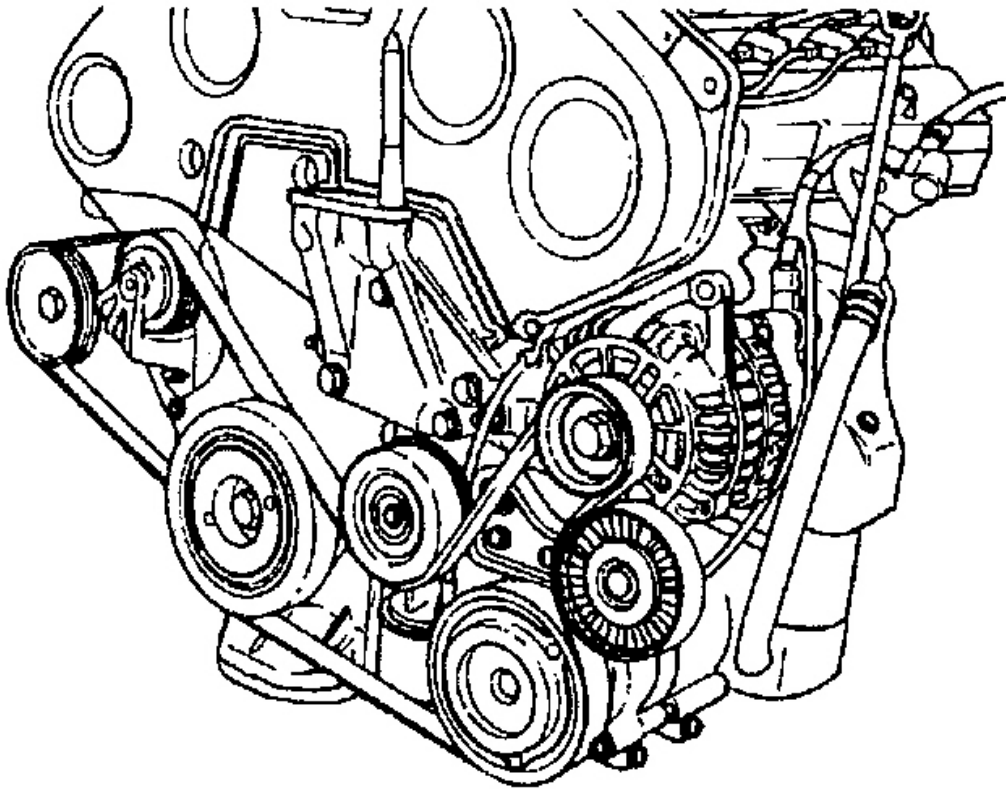
1. Remove the engine cover.



G01164605

Fig. 184: Removing Engine Cover
Courtesy of HYUNDAI MOTOR CO.

2. Using a [16 mm], rotate the tensioner arm clockwise (about 14°) and remove the belt from the pulley.
3. Remove the power steering pump pulley, idler pulley, tensioner pulley and crankshaft pulley.

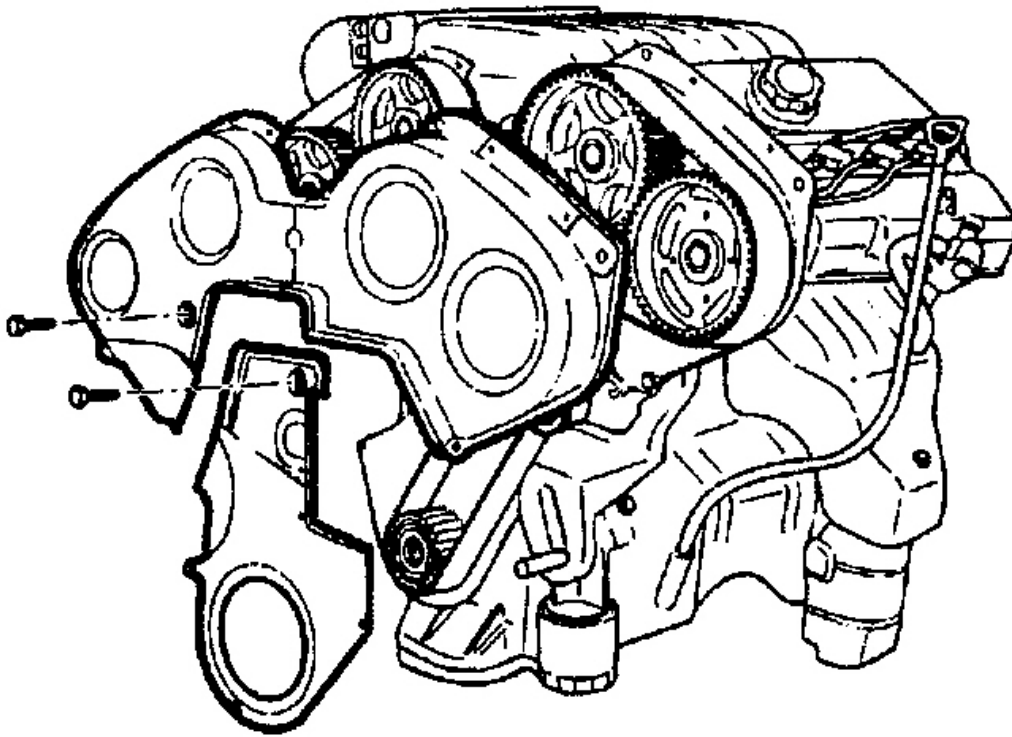


G01164606

Fig. 185: Identifying Power Steering Pump Pulley, Idler Pulley, Tensioner Pulley & Crankshaft Pulley

Courtesy of HYUNDAI MOTOR CO.

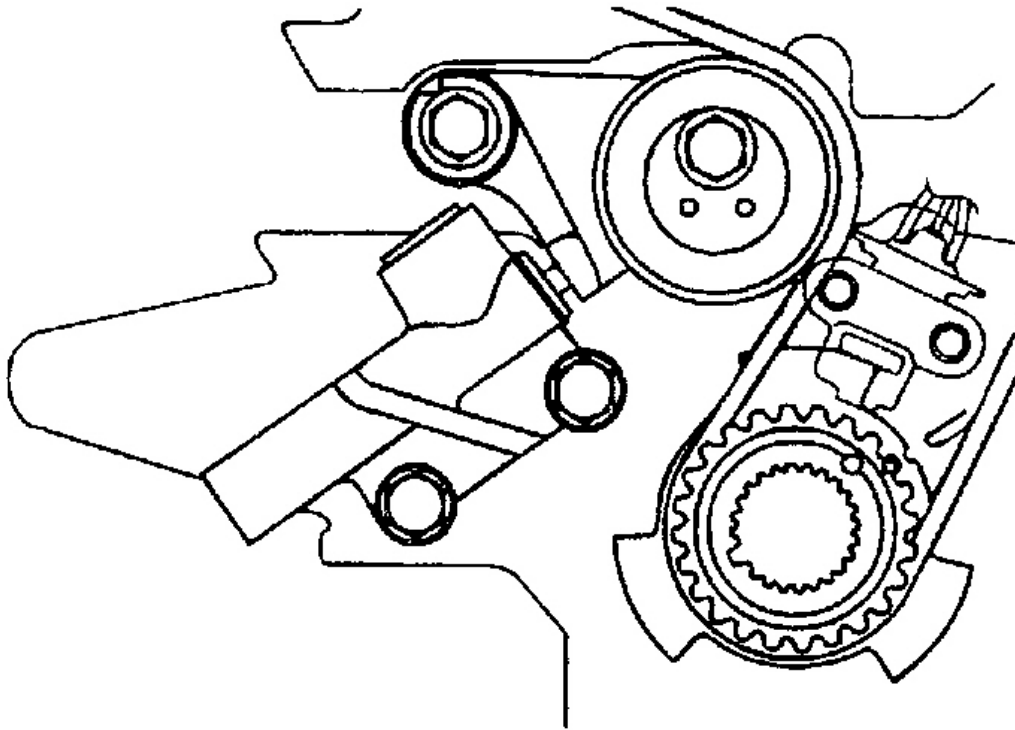
4. Remove the upper and lower timing belt covers.



G01164607

Fig. 186: Removing Upper & Lower Timing Belt Covers
Courtesy of HYUNDAI MOTOR CO.

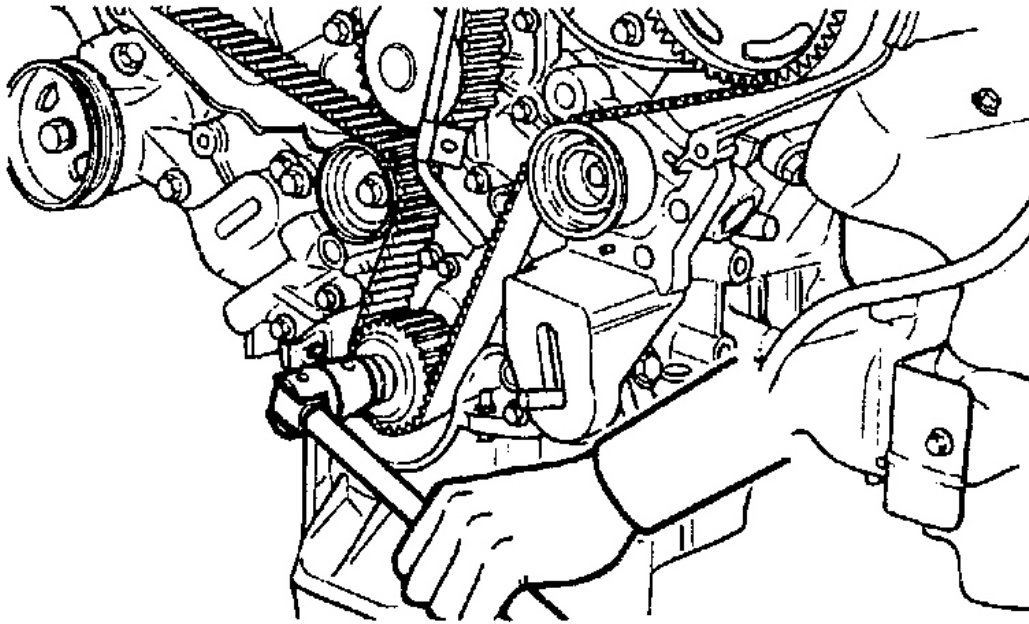
5. Remove the auto tensioner.



G01164608

Fig. 187: Identifying Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.

NOTE: Rotate the crankshaft clockwise and align the timing mark to set the No.1 cylinder's piston to TDC (compression stroke). At this time, the timing marks of the camshaft sprocket and cylinder head cover should coincide with each other.



G01164609

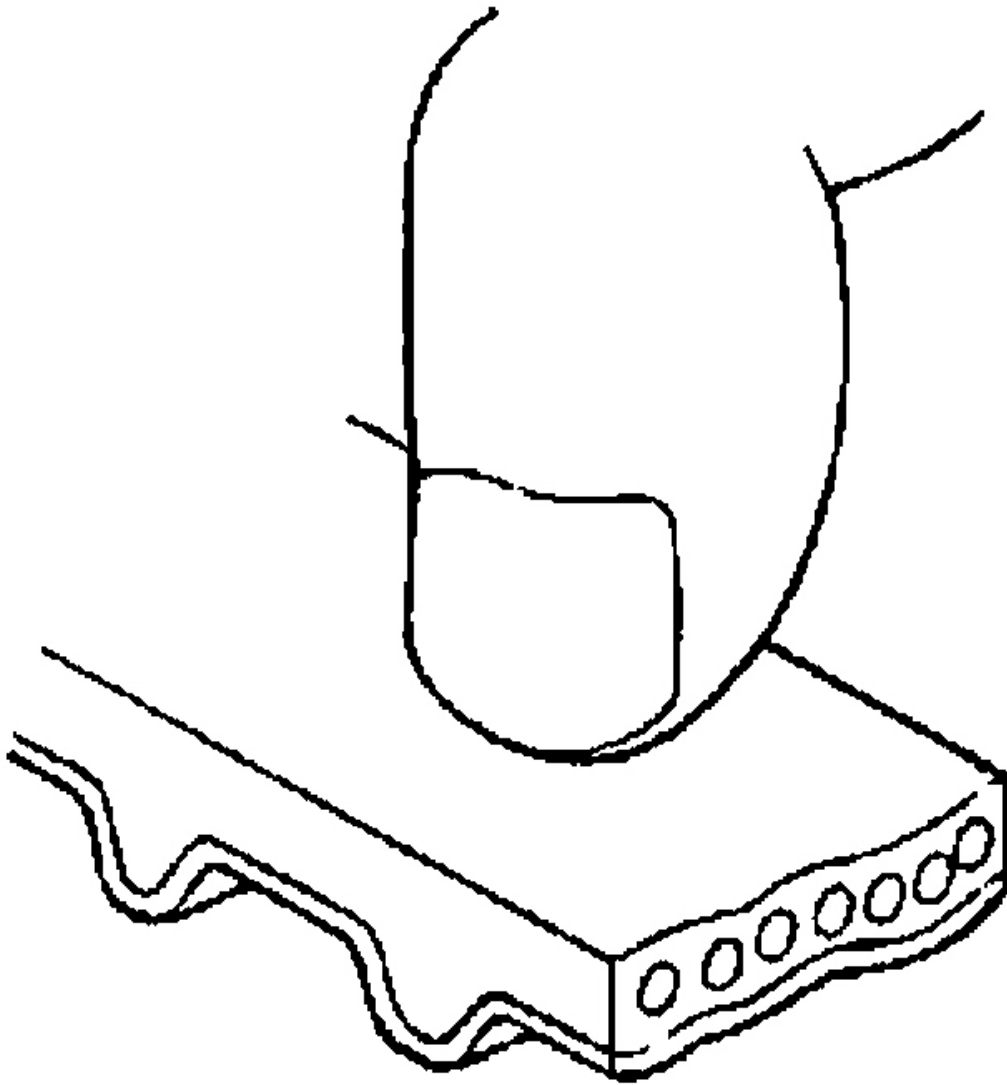
Fig. 188: Rotating Timing Belt
Courtesy of HYUNDAI MOTOR CO.

6. Unbolt the tensioner to remove the timing belt.

NOTE: If you plan to use the timing belt again, mark the rotation direction on the belt so you reinstall it correctly.

INSPECTION

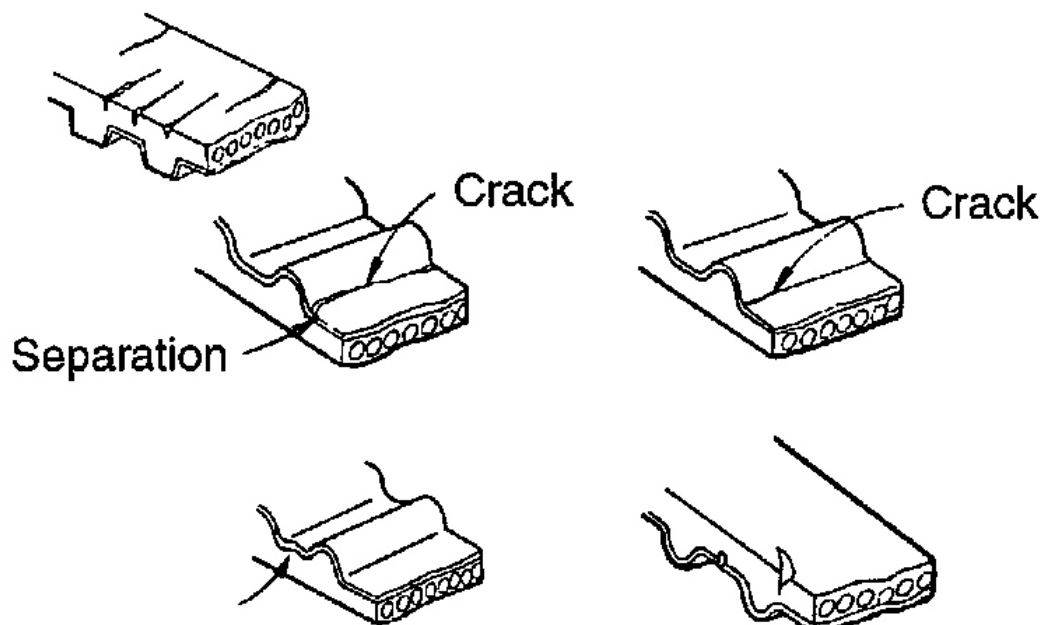
1. Inspect the belt closely. If the following problems are evident, replace the belt with a new one.
 1. Hardened back surface of rubber Back surface is glossy, non-elastic and so hard that when the nail of your finger is pressed into it, no mark is produced.



G01164610

Fig. 189: Identifying Hardened Back Surface Of Rubber Belt
Courtesy of HYUNDAI MOTOR CO.

2. Cracked back surface of rubber.

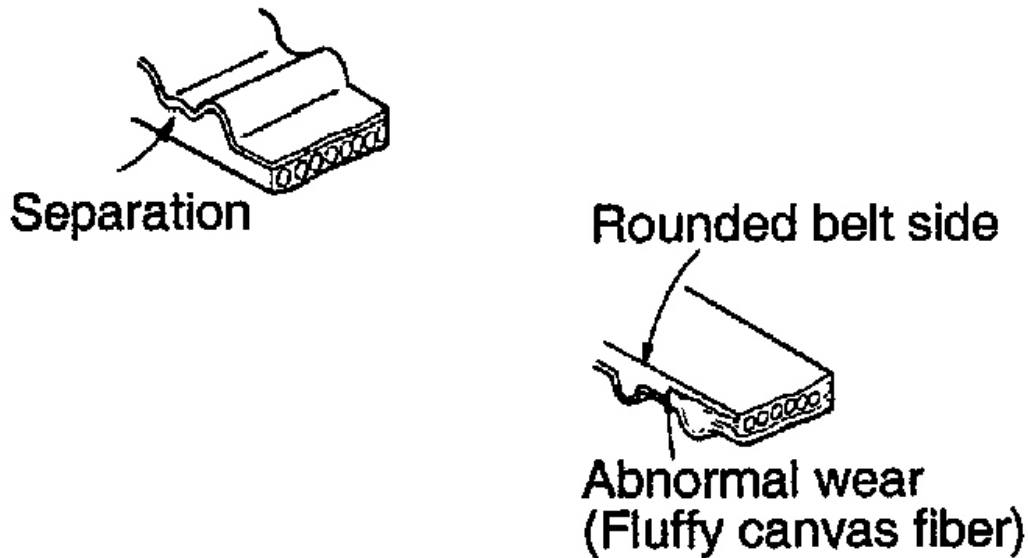


G01164611

Fig. 190: Identifying Cracked Back Surface Of Rubber
Courtesy of HYUNDAI MOTOR CO.

3. Side of belt is badly worn.

NOTE: A belt in good condition should have clear-cut sides as if it were cut with a sharp knife.



G01164612

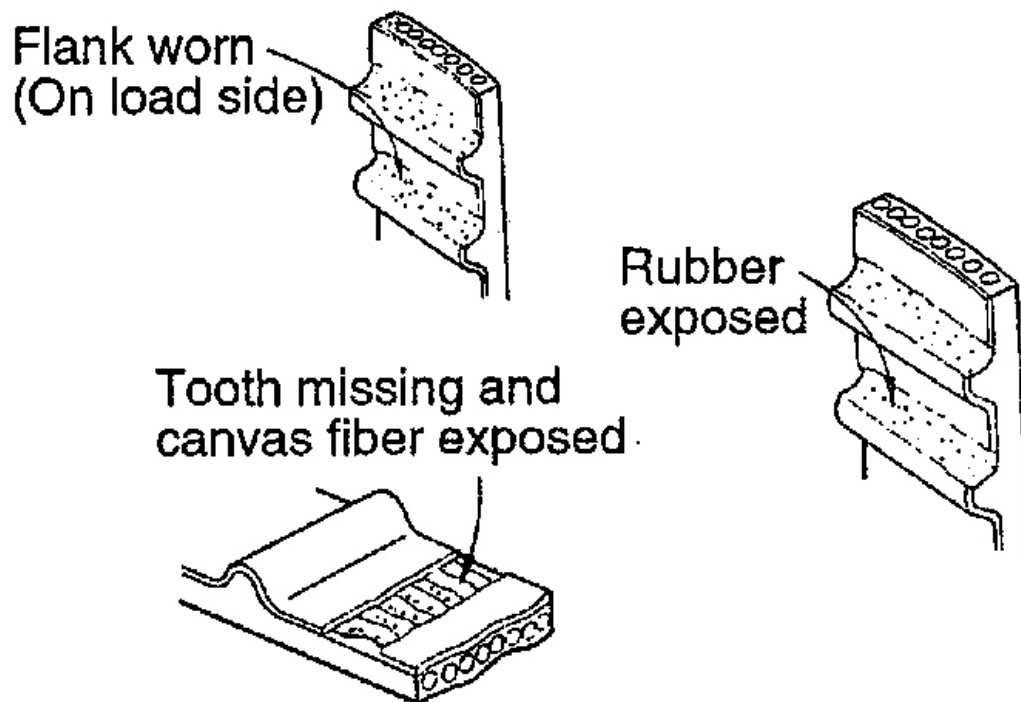
Fig. 191: Identifying Abnormal Wear Of Belt
Courtesy of HYUNDAI MOTOR CO.

4. Teeth are badly worn out.

Initial stage: Canvas on load side of the tooth flank worn (Fluffy canvas fibers, rubber gone, color changed to with, and unclear canvas texture)

Last stage: Canvas on the load side of the tooth flank worn down and rubber exposed (tooth width reduced).

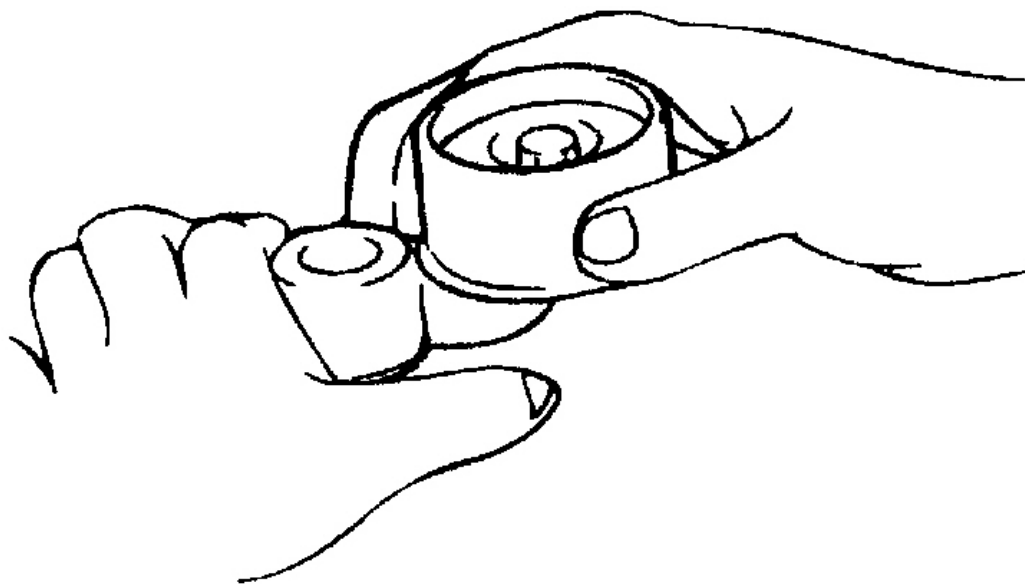
5. Missing tooth



G01164613

Fig. 192: Identifying Badly Worn Teeth Of Belt
Courtesy of HYUNDAI MOTOR CO.

2. If backlash or an irregular noise is observed when rotating the pulley, replace the timing belt tensioner and idler pulley.



G01164614

Fig. 193: Inspecting Timing Belt Tensioner & Idler Pulley
Courtesy of HYUNDAI MOTOR CO.

TIMING BELT

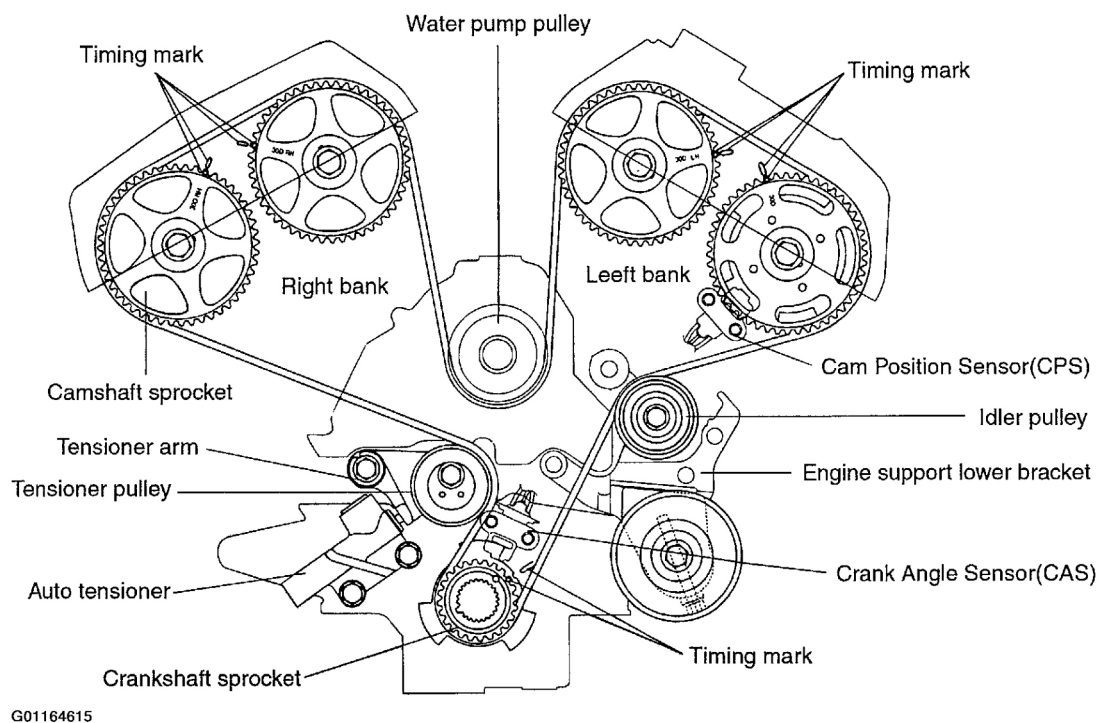
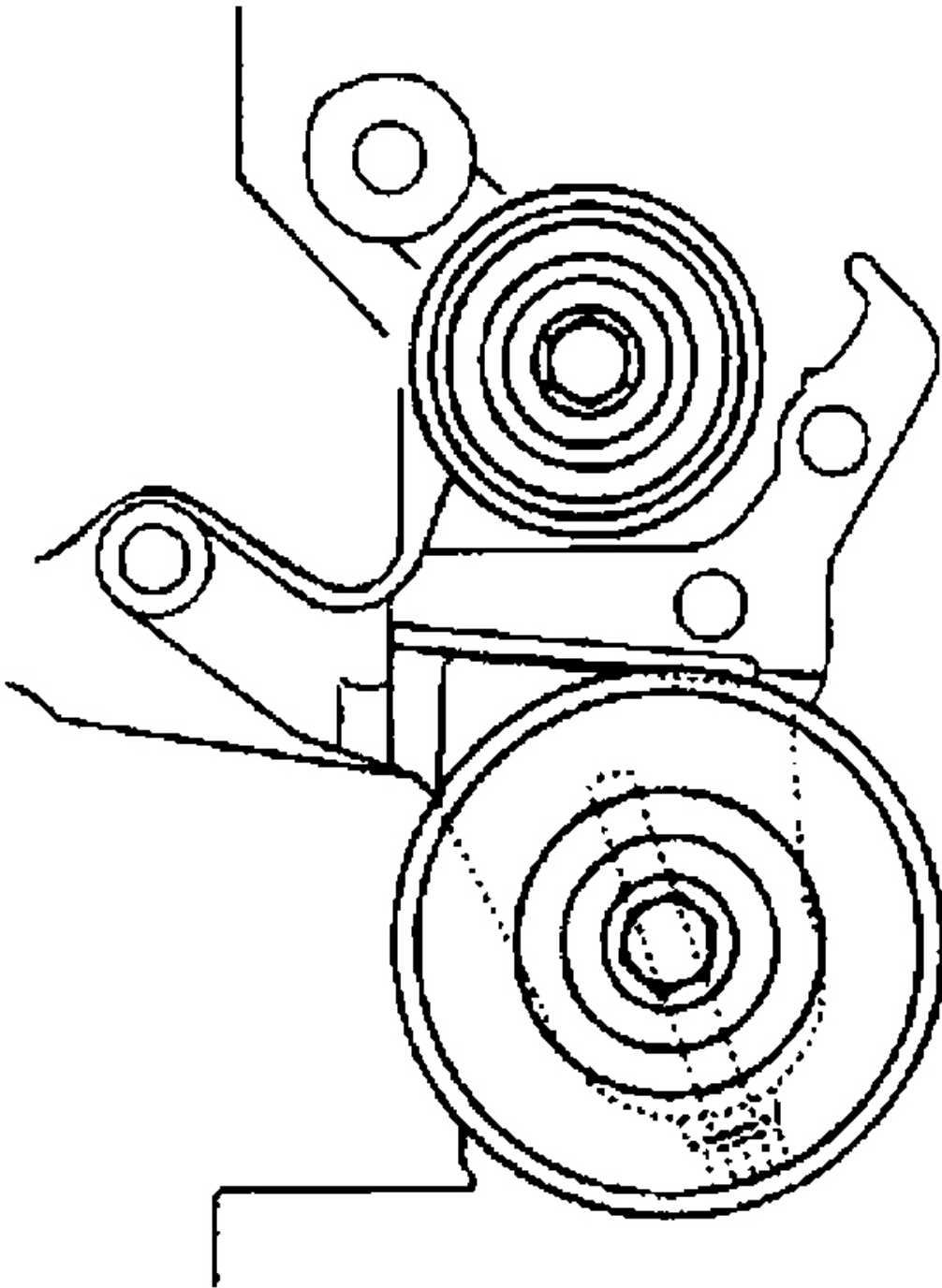


Fig. 194: Identifying Components Of Engine Timing System
 Courtesy of HYUNDAI MOTOR CO.

INSPECTION

THE METHOD OF INSTALLING TIMING BELT AND AUTO TENSIONER.

1. Install idler pulley to engine support lower bracket.

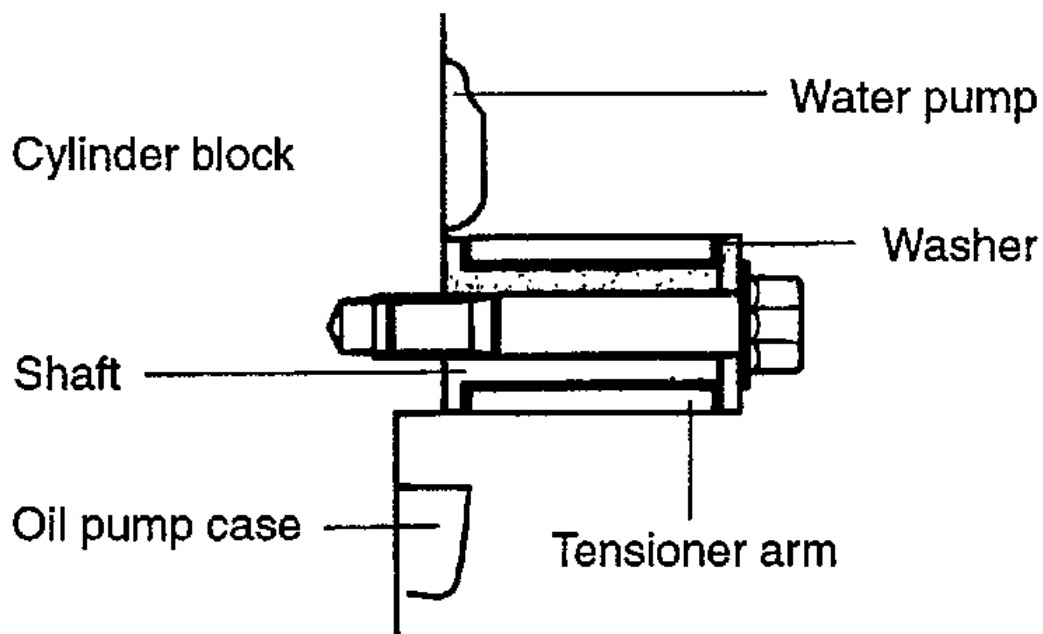


G01164616

Fig. 195: Installing Idler Pulley To Engine Support Lower Bracket
Courtesy of HYUNDAI MOTOR CO.

2. Install tensioner arm, shaft and plane washer to cylinder block.

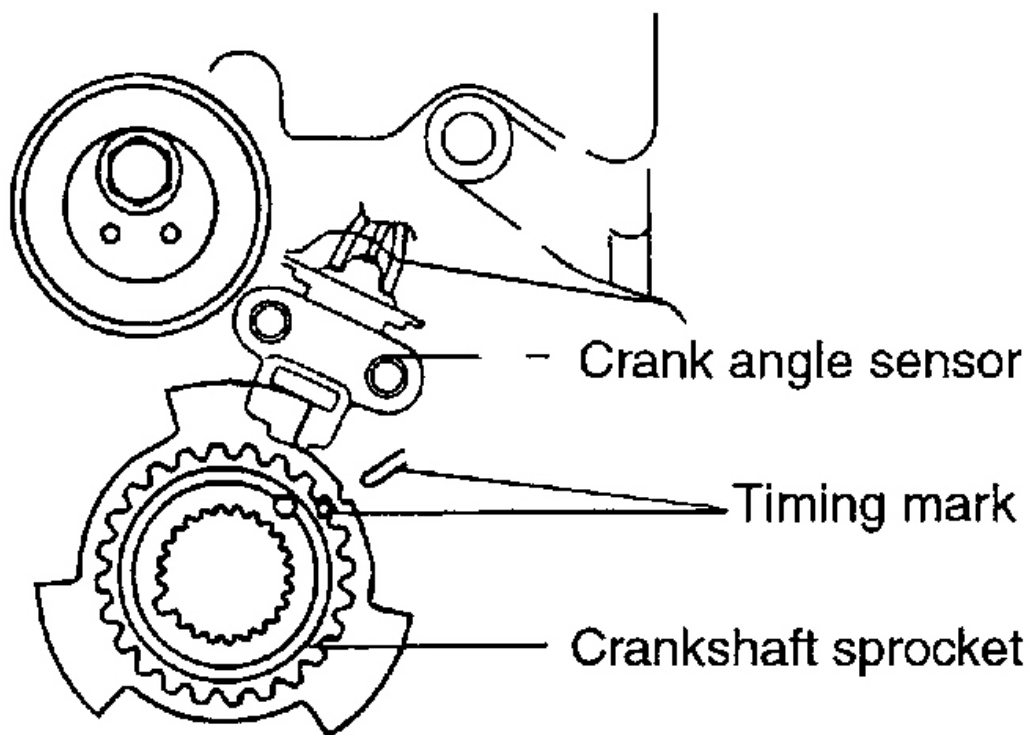
Tightening torque: 35 - 55 Nm (350 - 550 kg.cm)



G01164617

Fig. 196: Installing Tensioner Arm, Shaft & Plane Washer To Cylinder Block
Courtesy of HYUNDAI MOTOR CO.

3. Install crankshaft sprocket and align the timing mark.



G01164618

Fig. 197: Installing Crankshaft Sprocket & Aligning Timing Mark
Courtesy of HYUNDAI MOTOR CO.

CAUTION: Be careful not to bend crankshaft sensing blade.

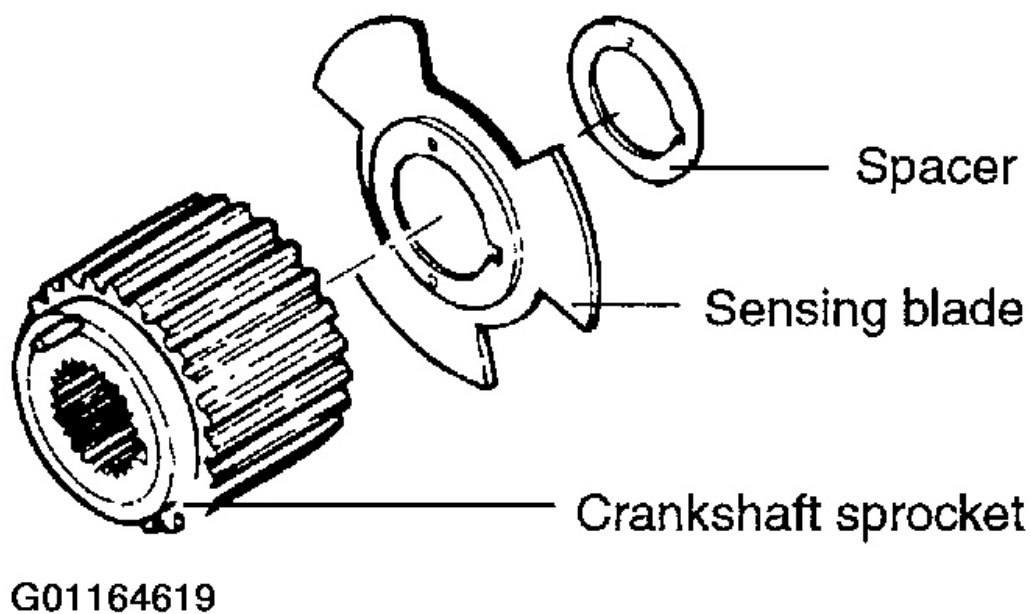


Fig. 198: Identifying Crankshaft Sprocket, Sensing Blade & Spacer
Courtesy of HYUNDAI MOTOR CO.

4. Install camshaft sprocket and adjust initial installation state as illustration.

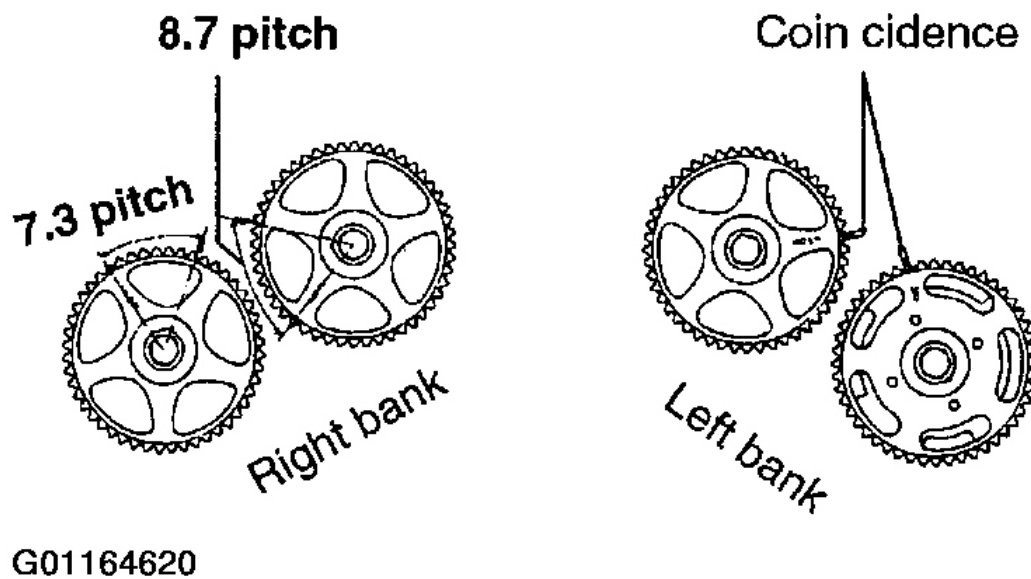
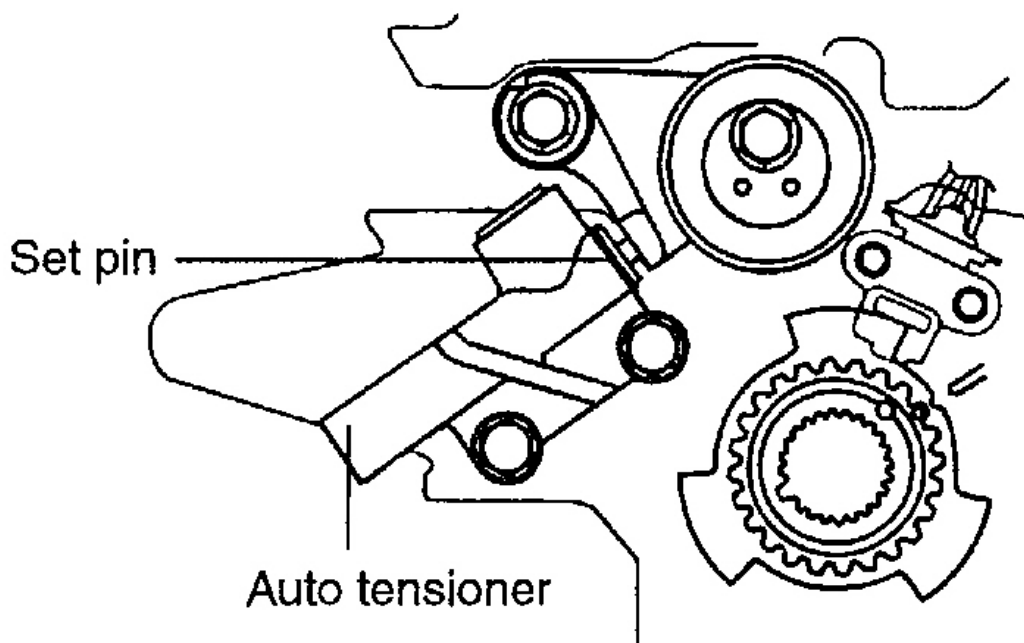


Fig. 199: Identifying Camshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

5. Install auto tensioner to oil pump case.

NOTE: At this time auto tensioner's set pin should be assembled completely.

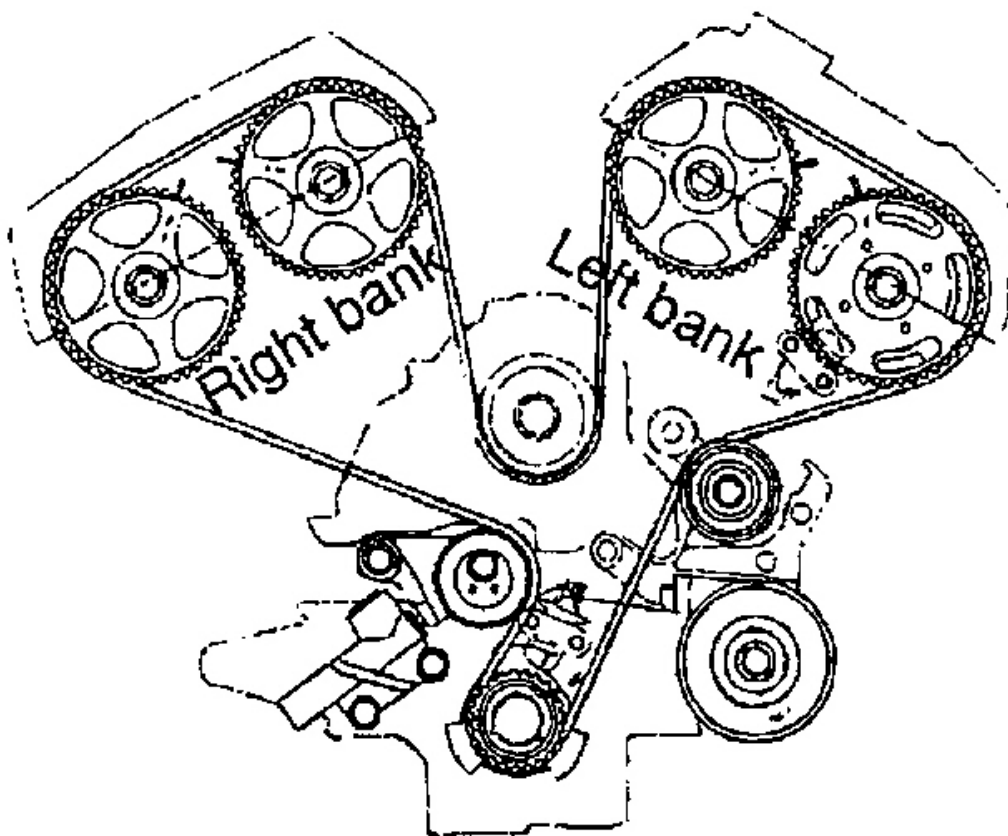


G01164621

Fig. 200: Identifying Auto Tensioner & Set Pin
Courtesy of HYUNDAI MOTOR CO.

6. Align the timing marks of each sprocket and install the timing belt in this order.

Crankshaft sprocket - Idler pulley - Exhaust camshaft sprocket (LH) - Intake camshaft sprocket (LH) -
Water pump pulley - Intake camshaft sprocket (RH) - Exhaust camshaft sprocket (RH) - Tensioner pulley

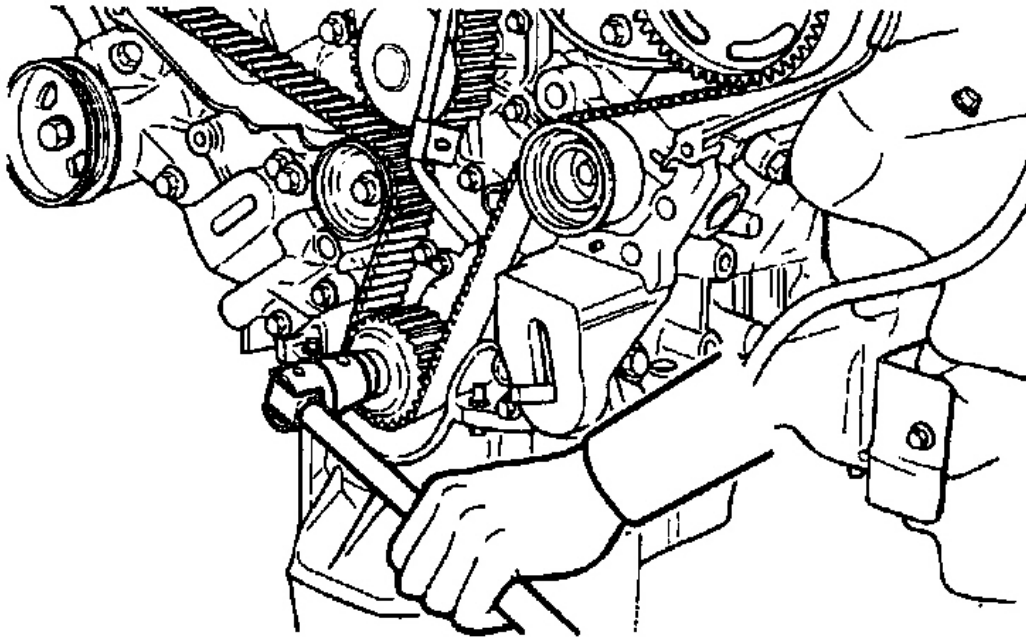


G01164622

Fig. 201: Installing Timing Belt
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- In this step, No. 1 is in TDC (Compression stroke)
- Do not insert fingers.



G01164623

Fig. 202: Rotating Crankshaft To Reconfirm Timing Marks
Courtesy of HYUNDAI MOTOR CO.

7. After installing the timing belt, reconfirm the timing mark.
8. Install the tensioner pulley.
9. Pull out the set pin of auto tensioner.

THE METHOD TO ADJUST THE TENSION OF TIMING BELT.

1. Rotate the crankshaft 2 rotation clockwise and measure the projected load of auto tensioner in the TDC (# 1 Compression stroke) after 5 minutes.
2. Check the projected length is 3.8 - 4.5 mm.
3. Check again if the timing marks of each sprocket is with in specified position.

NOTE: If not within specified position, do again from procedure 6 in the method of installing timing belt and auto tensioner.