

2002 Hyundai Sonata

2002 ENGINES 2.7L V6 - Sonata

2002 ENGINES**2.7L V6 - Sonata****GENERAL****SPECIFICATIONS****GENERAL SPECIFICATIONS**

Description	Specification	Limit
General		
Type	V-type, DOHC	
Number of cylinders	6	
Bore	86.7 mm (3.4133 in.)	
Stroke	75 mm (2.9528 in.)	
Total displacement	2,656 cc	
Compression ratio	10 : 1	
Firing order	1-2-3-4-5-6	
Valve timing		
Intake valve		
Opens (BTDC)	6°	
Closes (ABDC)	46	
Exhaust valve		
Opens (BBDC)	44°	
Closes (ATDC)	8°	
Camshaft		
Drive mechanism	Cogged type belt	
Cam height		
Intake	43.95-44.15 mm (1.7303-1.7382 in.)	43.45 mm (1.7106 in.)
Exhaust	43.95-44.15 mm (1.7303-1.7382 in.)	43.45 mm (1.7106 in.)
Journal diameter	25.964-25.980 mm (1.0222-1.0228 in.)	25.914 mm (1.0202 in.)
Bearing oil clearance	0.02-0.061 mm (0.0007-0.0024 in.)	0.1 (0.0039 in.)
End play	0.1-0.15 mm (0.0039-0.0059 in.)	
Cylinder head		
Flatness of cylinder head surface	Max. 0.03 mm (0.0012 in.)	0.05 mm (0.0020 in.)
Flatness of manifold mounting surface		
Intake	Max. 0.15 mm (0.0059 in.)	0.15 mm (0.0059 in.)
Exhaust	Max. 0.15 mm (0.0059 in.)	0.15 mm (0.0059 in.)
Valve guide hole diameter		

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0.05 (0.002) O.S.	11.05-11.068 mm (0.435-0.436 in.)	
0.25 (0.010) O.S.	11.25-11.268 mm (0.443-0.444 in.)	
0.50 (0.020) O.S.	11.50-11.518 mm (0.453-0.453 in.)	
Intake valve seat ring hole diameter 0.3 (0.012) O.S.	33.300-33.325 mm (1.311-1.312 in.)	
Exhaust valve seat ring hole diameter 0.3 (0.012) O.S.	28.600-28.625 mm (1.126-1.127 in.)	
Valve		
Overall length		
Intake	96.1 mm (3.783 in.)	
Exhaust	97.15 mm (3.825 in.)	
Stem diameter		
Intake	5.965-5.98 mm (0.235-0.2354 in.)	
Exhaust	5.95-5.965 mm (0.234-0.235 in.)	
Face angle	45° -45.5°	
Margin		
Intake	1.0 mm (0.0394 in.)	0.5 mm (0.0197 in.)
Exhaust	1.3 mm (0.0512 in.)	0.8 mm (0.0315 in.)
Clearance (stem- to- guide)		
Intake	0.02-0.05 mm (0.0008-0.0020 in.)	0.10 mm (0.0039 in.)
Exhaust	0.035-0.065 mm (0.0014-0.0026 in.)	0.15 mm (0.0059 in.)
Valve spring		
Free height	42.5 mm (1.6732 in.)	41.5 mm (1.6339 in.)
Load	21.9 kg/ 35 mm (48.4 lb/1.3780 in.)	21.9 kg/ 34 mm (48.4 lb/1.3386 in.)
Out of squareness	Max 1.5°	Max 3°
Piston		
Diameter (Standard)	86.68-86.71 mm (3.413-3.414 in.)	
Clearance (Piston -to - cylinder)	0.01-0.03 mm (0.0004-0.0012 in.)	
Ring groove width		
No.1	1.230-1.250 mm (0.0484-0.0492 in.)	
No.2	1.220-1.240 mm (0.0480-0.0488 in.)	
Oil	2.515-2.535 mm (0.0990-0.0998 in.)	
Piston for service	0.25 mm (0.010 in.), 0.50 mm (0.020 in.)	
Piston ring		
Number of rings per piston	3	

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Compression ring	2	
Oil ring	1	
Compression ring type		
No.1	Inner bevel type.	
No.2	Under cut type	
Oil ring type	3-piece type	
Ring end gap		
No.1	0.20-0.35 mm (0.0079-0.0138 in.)	0.8 mm (0.031 in.)
No.2	0.37-0.52 mm (0.0146-0.0205 in.)	0.8 mm (0.031 in.)
Oil ring side rail	0.2-0.7 mm (0.0079-0.0276 in.)	1.0 mm (0.039 in.)
Ring side clearance		
No.1	0.04-0.08 mm (0.0016-0.0031 in.)	0.1 mm (0.004 in.)
No.2	0.03-0.07 mm (0.0012-0.0028 in.)	0.1 mm (0.004 in.)
Rings for service	0.25 mm (0.010 in.), 0.50 mm (0.020 in.)	
Connecting rod		
Piston pin installation force	2,450-12,255 N (250-1,250 kg, 551-2,755 lb)	
Side clearance (big end)	0.10-0.25 mm (0.0039-0.0098 in.)	0.4 mm (0.016 in.)
Bend	0.05 mm or less/100 mm (0.0020 in. or less/3.937 in.)	
Bearing oil clearance	0.018-0.036 mm(0.0007-0.0014 in.)	0.1 mm (0.004 in.)
Crankshaft		
Journal O.D.	61.982-62.000 mm (2.4402-2.4409 in.)	
Pin O.D.	47.982-48.000 mm (1.8891-1.8898 in.)	
Out-of-round of journal and pin	Max. 0.003 mm (0.00012 in.)	
Taper of journal and pin	Max. 0.005 mm (0.00020 in.)	
End play	0.070-0.250 mm (0.0028-0.0098 in.)	0.4 mm (0.016 in.)
Main bearing oil clearance	0.004-0.022 mm (0.0002-0.0009 in.)	0.1 mm (0.004 in.)
Cylinder block		
Cylinder bore	86.7 mm (3.4134 in.)	
Flatness of gasket surface	Max. 0.03 mm (0.0012 in.)	0.05 mm (0.002 in.)
Out-of-round of cylinder bore	Max. 0.02 mm (0.0008 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.)	

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Relief spring		
Free length	43.8 mm (1.724 in.)	
Load	4.6 kg/39.3 mm (10.lb/1.547 in.)	
Oil filter		
Type	Cartridge, full flow	
Engine oil pressure	50 kPa (7.3 psi) or more [Conditions: Oil temperature is 75 to 90°C (167 to 194°F)]	
Cooling method	Engine coolant cooling, forced circulation with electric fan	
Cooling system quantity	7.0 lit (7.4 U.S.qts., 6.1 Imp.qts.) [For V6]	
Thermostat		
Type	Wax pellet type with jiggle valve	
Normal opening temperature	82 ± 2.0°C (179.6 ± 35.6°F)	
Opening temperature range	80°C-84°C (176-183.2°F)	
Wide open temperature	95°C (203°F)	
Radiator cap		
Main valve opening pressure	107.9 ± 14.7 kPa (1.1 ± 0.15 kg/cm ² , 15.64 ± 2.13 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	
Element	Paper type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	

SERVICE STANDARD

Standard value	
Coolant concentration	
Tropical areas	40%
Other areas	50%

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Fig. 1: Service Standards Table
Courtesy of HYUNDAI MOTOR CO.

COOLANT

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Engine coolant

Ethylene glycol base for aluminum radiator

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Fig. 2: Coolant Specification Table
Courtesy of HYUNDAI MOTOR CO.

SEALANT

Engine coolant temperature sensor

LOCTITE 262 or equivalent, Three bond No. 1324 or equivalent

Oil pressure switch

3M ATD No. 8660 or Three bond No. 1141E

PCV valve

LOCTITE 242 or equivalent

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Fig. 3: Sealant Specification Table
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)
Alternator Mounting Bracket-To-Engine	15-20 (20-27)
Alternator Mounting Bolt	15-20 (20-27)
Alternator Mounting Nut	15-20 (20-27)
Air Intake Surge Tank	
Mounting Bolt/Nut	11-15 (15-20)
Surge Tank Stay	11-15 (15-20)
Auto Tensioner Arm Fixed Bolt	26-41 (35-55)
Camshaft Sprocket Bolt	66-81 (90-110)
Coolant Inlet Fitting Bolt	13-15 (17-20)
Coolant Pump-To-Engine Bolt	11-16 (15-22)
Coolant Temperature Sensor	15-30 (20-40)
Connecting Rod Cap Bolt	
Step 1	13 (18)
Step 2	Tighten An Additional 90 Degrees
Crankshaft	
Main Bearing Cap Bolt	

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M8 Bolt	
Step 1	12 (16)
Step 2	Tighten An Additional 90 Degrees
M10 Bolt	
Step 1	22 (30)
Step 2	Tighten An Additional 90 Degrees
Pulley Bolt	133-140 (180-190)
Cylinder Head Bolt ⁽¹⁾	
Step 1	18 (25)
Step 2	Tighten An Additional 60 Degrees
Step 3	Tighten An Additional 45 Degrees
Drive Belt Pulley Bolt	26-41 (35-55)
Drive Belt Tensioner Bolt	15-20 (20-27)
Drive Plate & Adaptor Bolt	54-57 (73-77)
Engine Mounts	
Engine Hanger Bracket-To-Engine	15-20 (20-27)
Engine Mounting Bracket Bolt	44-59 (60-80)
Engine Support Bracket Stud	22-30 (30-40)
Engine Mounting Bracket Nut	44-59 (60-80)
Engine Mounting Insulator Bolt	30-41 (40-55)
Front Roll Stopper Bracket-To-Subframe Bolt	30-41 (40-55)
Front Roll Stopper Insulator Bolt & Nut	37-48 (50-65)
Rear Roll Stopper Insulator Bolt & Nut	30-41 (40-55)
Transaxle Mount	
Bracket Bolt/Nut	30-41 (40-55)
Insulator Bolt	66-81 (90-110)
Exhaust Manifold-To-Cylinder Head Nut	18-22 (25-30)
Exhaust Pipe	
Catalytic Converter-To-Center Exhaust Pipe Nut	22-30 (30-40)
Center Exhaust Pipe-To-Main Muffler Nut	22-30 (30-40)
Pipe-To-Manifold Nut	22-30 (30-40)
Pipe-To-Catalytic Converter Bolt	30-44 (40-60)
Flywheel Bolt	54-57 (73-77)
Intake Manifold Mounting Bolt/Nut	14-15 (19-20)
Oil Filter	9-12 (12-16)
Oil Pan Bolt	
Lower Pan	89-106 INCH Lbs. (10-12)
Upper Pan	
10x38 mm	22-31 (30-42)

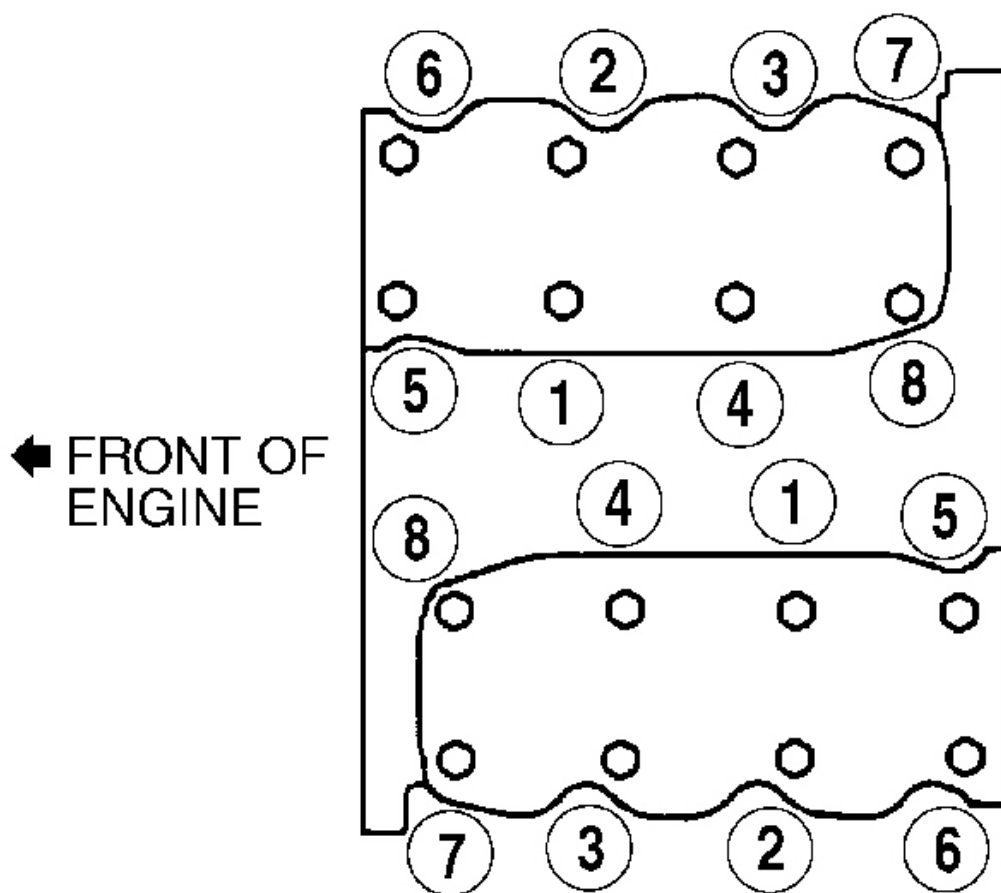
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8x22 mm	14-21 (19-28)
171.5 mm	44-62 INCH Lbs. (5-7)
152.5 mm	44-62 INCH Lbs. (5-7)
Oil Pan Drain Plug	26-33 (35-45)
Oil Pan Screen Bolt	11-16 (15-22)
Oil Pressure Switch	11-16 (15-22)
Oil Pump	
Driven Gear Bolt	25-29 (34-39)
Relief Valve Plug	30-37 (40-50)
Sprocket Nut	35-43 (48-58)
Oxygen Sensor	30-37 (40-50)
Power Steering Pump Bracket-To-Cylinder Head Bolt	13-19 (17-26)
Power Steering Pump-To-Bracket Bolt	13-19 (17-26)
Spark Plug	15-22 (20-30)
Starter	
Bolt	20-25 (27-34)
Nut	14-22 (19-30)
Thermostat Housing	13-15 (17-20)
Throttle Body-To-Surge Tank Bolt	11-15 (15-20)
Timing Belt Assembly	
Auto Tensioner Fixed Bolt	14-20 (19-27)
Auto Tensioner Pulley Bolt	32-41 (43-55)
Idler Pulley Bolt	37-44 (50-60)
Tensioner Arm Fixed Bolt	26-41 (35-55)
INCH Lbs. (N.m)	
Accelerator Bracket Bolt	35-53 (4-6)
Air Cleaner Body Bolt	71-106 (8-12)
Crank Position Sensor	44-53 (5-6)
Cylinder Head Cover Bolts	44-53 (5-6)
Delivery Pipe Installation Bolt	89-133 (10-15)
Exhaust Manifold Heat Shield Bolt	106-133 (12-15)
Fuel Hose Clamp-To-Cylinder Head Bolt	106-133 (12-15)
Main Muffler Hanger Support Bracket Bolt	89-133 (10-15)
Oil Level Gauge Guide Bolt	106-133 (12-15)
Oil Pump	
Case Bolt	106-133 (12-15)
Cover Screw	71-106 (8-12)
Oil Seal Case Bolt	89-106 (10-12)
Rear Plate	89-106 (10-12)
Transaxle Mounting Plate	89-106 (10-12)

Timing Belt Assembly Cover Bolt

89-106 (10-12)

(1) Tighten in sequence with engine cold. See **Fig. 4**.

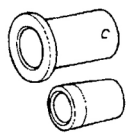
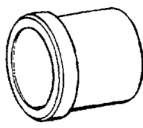
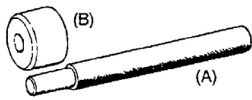
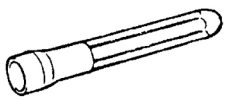
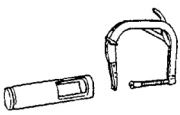
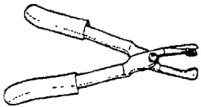
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Fig. 4: Cylinder Head Bolt Tightening Sequence
Courtesy of HYUNDAI MOTOR CO.

SPECIAL TOOLS

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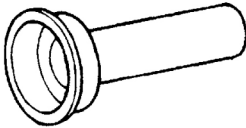
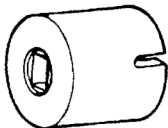
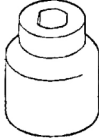
Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-33000)		Installation of the crankshaft front oil seal
Camshaft oil seal installer (09221-21000)		Installation of the camshaft oil seal
Valve guide installer (09222-22000 (B)) (09221-29000 (A))		Removal and installation of the valve guide
Valve stem oil seal installer (09222-22001)		Installation of the valve stem oil seal
Valve spring compressor (09222-28000) (09222-28100)		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. 5: Identifying Special Tools Table (1 Of 2)
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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)		Removal and installation of the piston pin
Cross member stud bolt socket (09234-33001)		Removal and installation of the cross member stud bolt.

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Fig. 6: Identifying Special Tools Table (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

TROUBLESHOOTING

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Symptom	Probable cause	Remedy
Crankshaft bearing knock	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 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 find out 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 Faulty oil pump Bearing improperly installed Non-concentric crankshaft or bearing	Add or replace Adjust or repair Use proper engine oil Repair or replace Clean Replace bearing and check engine oil and lubrication system Repair or replace Repair or replace Replace
Timing belt noise	Incorrect belt tension	Adjust belt tension
Low compression	Damaged 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 find out cause Repair Replace

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Fig. 7: Troubleshooting Table (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

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Symptom	Probable cause	Remedy
High oil pressure	Oil relief valve stuck (closed)	Repair or replace
Excessive engine rolling and vibration	Misfire 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	Correct Re-tighten Re-tighten Re-tighten Re-tighten Replace Replace Replace or 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	Correct 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 sender or wiring Faulty electric fan Faulty thermo-sensor on radiator Insufficient coolant	Replace parts Replace Clear restriction or replace parts 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 Loose wires or in operative sensor	Replace or repair Repair or replace
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. 8: Troubleshooting Table (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.

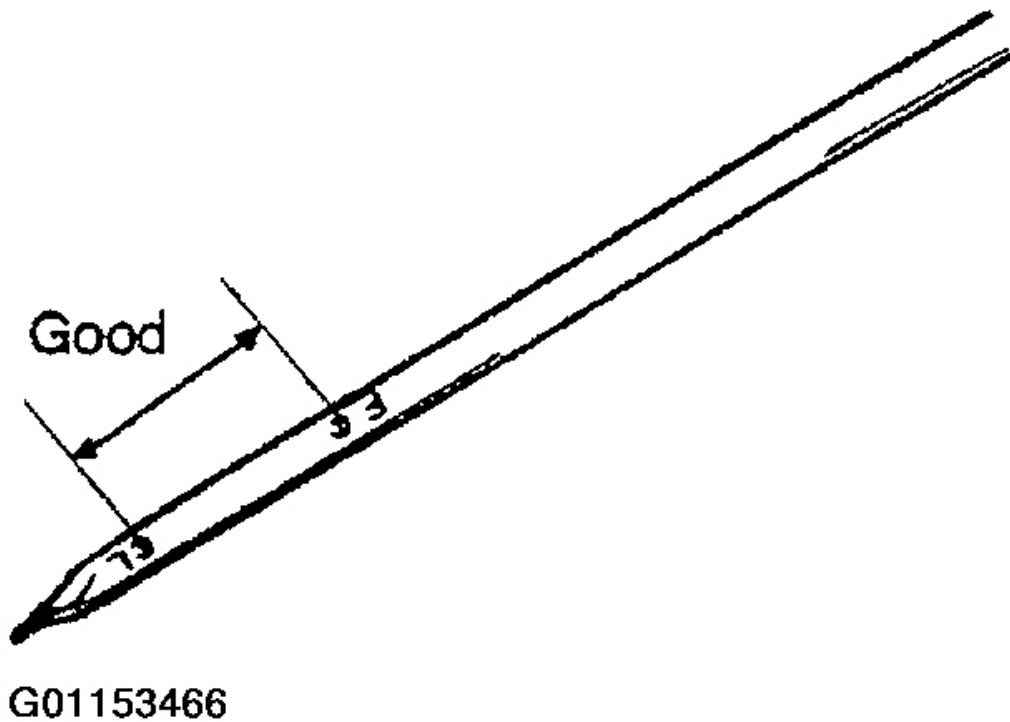


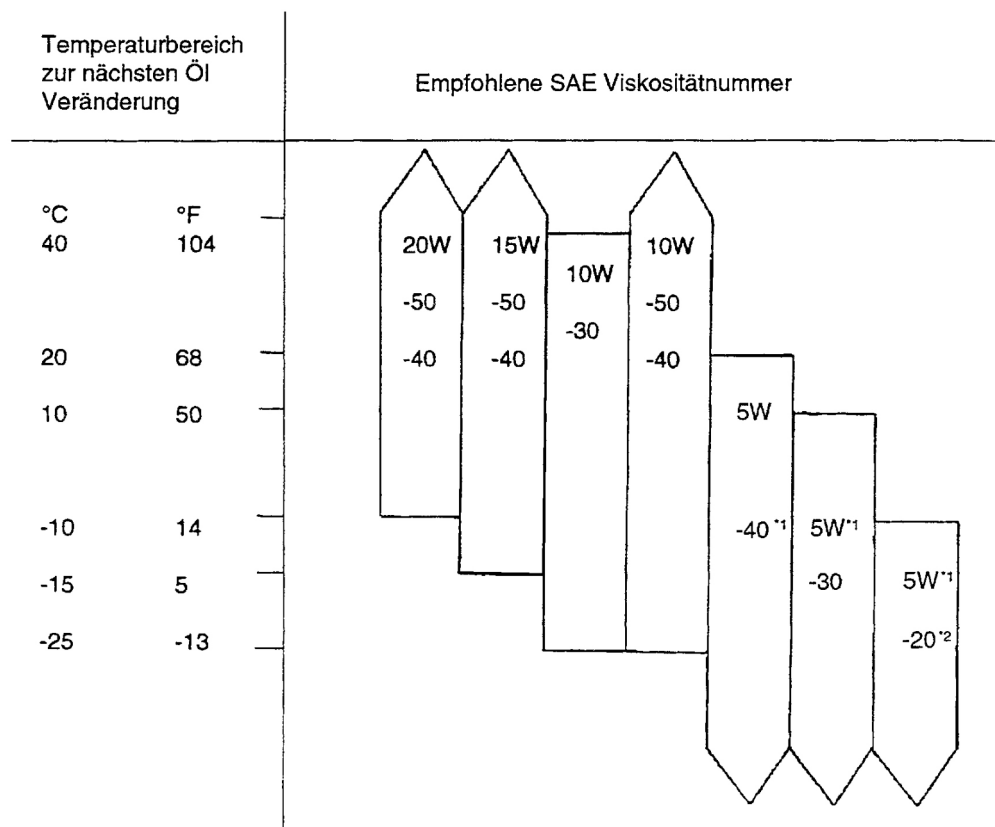
Fig. 9: Identifying Good Oil Level
Courtesy of HYUNDAI MOTOR CO.

SELECTION OF ENGINE OIL

Recommended API classification: SD OR ABOVE SE OR ABOVE [For EC.]

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*1 Verengte durch Fahr und Klimabedingung.

*2 Nicht verwendet für ein Betrieb des Fahrzeugs mit hoher Drehzahl.

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Fig. 10: 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 : 4.5 liters (4.74 U.S. qts., 3.95 imp. qts.)

NOTE: **Do not over fill. This will cause oil aeration and loss of oil pressure.**

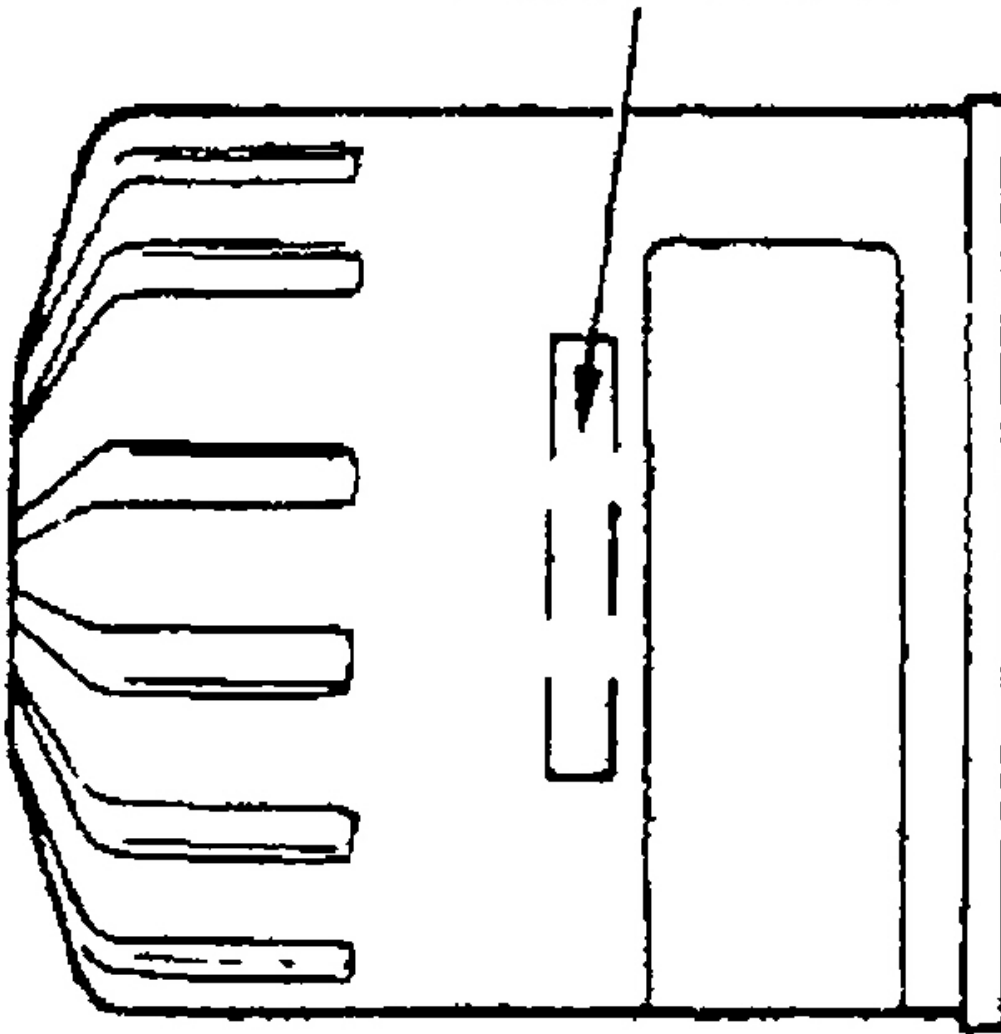
6. Install the oil filler cap.
7. Start and run the engine.
8. Turn off the engine and then check the oil level. Add oil if necessary.

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 vary 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. 11: Identifying Oil Filter Part Number
Courtesy of HYUNDAI MOTOR CO.

PROCEDURE FOR REPLACING OIL FILTER

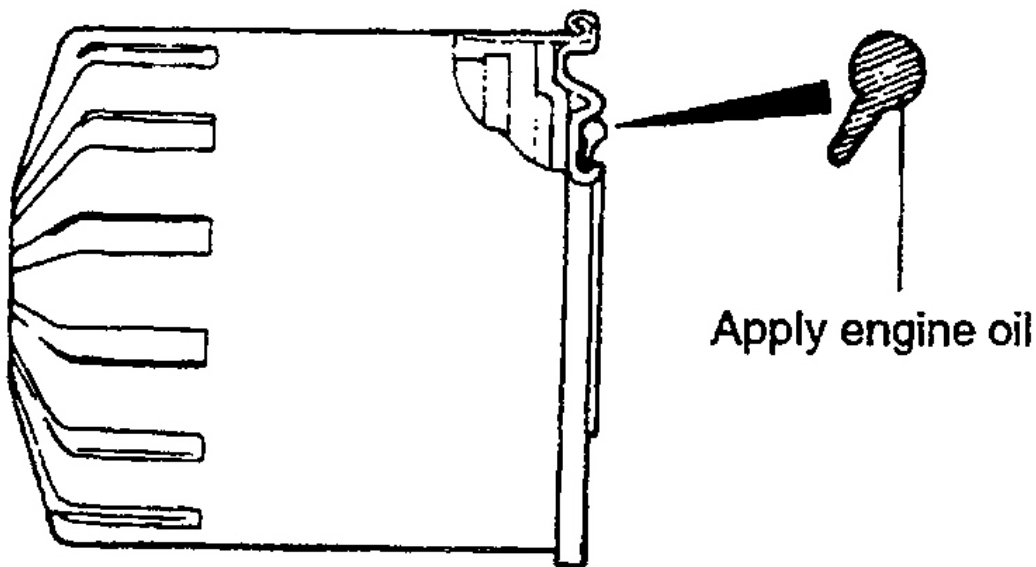
1. Use a filter wrench to remove the oil filter.
2. Before installing a new oil filter on the engine, apply clean engine oil to the surface of the rubber gasket.

3. Tighten the oil filter of the specified torque.

Tightening torque

Oil filter : 12-16 Nm (120-160 kg.cm, 9-12 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. 12: Lubricating Oil Filter Rubber Gasket
Courtesy of HYUNDAI MOTOR CO.

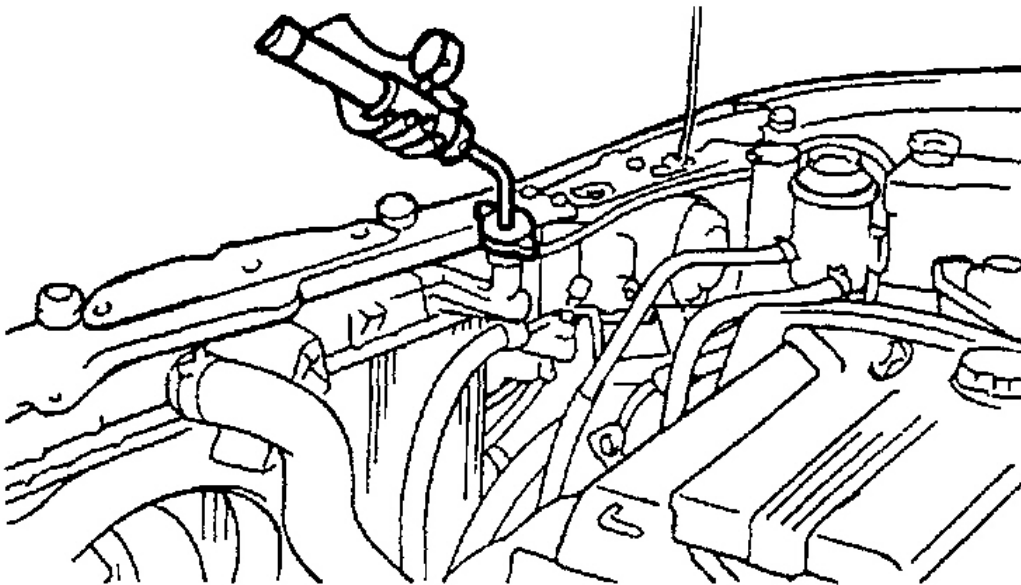
CHECKING COOLANT LEAK CHECK

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 (21 psi, 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.



G01153471

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

RADIATOR CAP PRESSURE TEST

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

Main valve opening pressure:

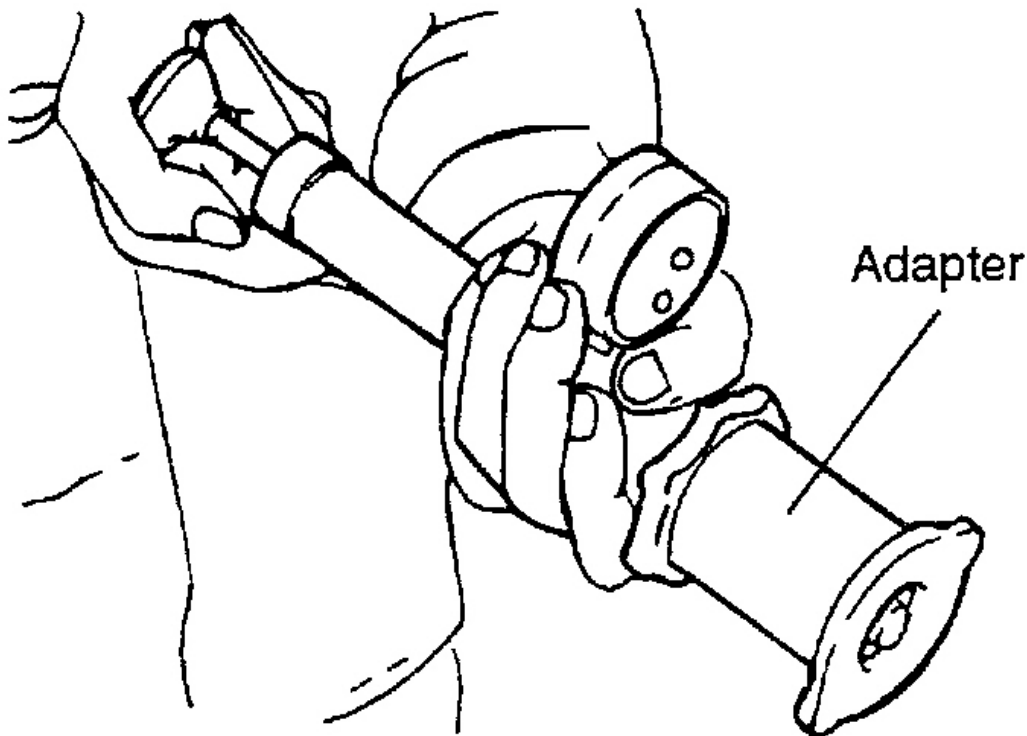
107.9 +/- 14.7 kPa (1.1 +/- 0.15 kg/cm² , 15.64 +/- 2.13 psi)

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.

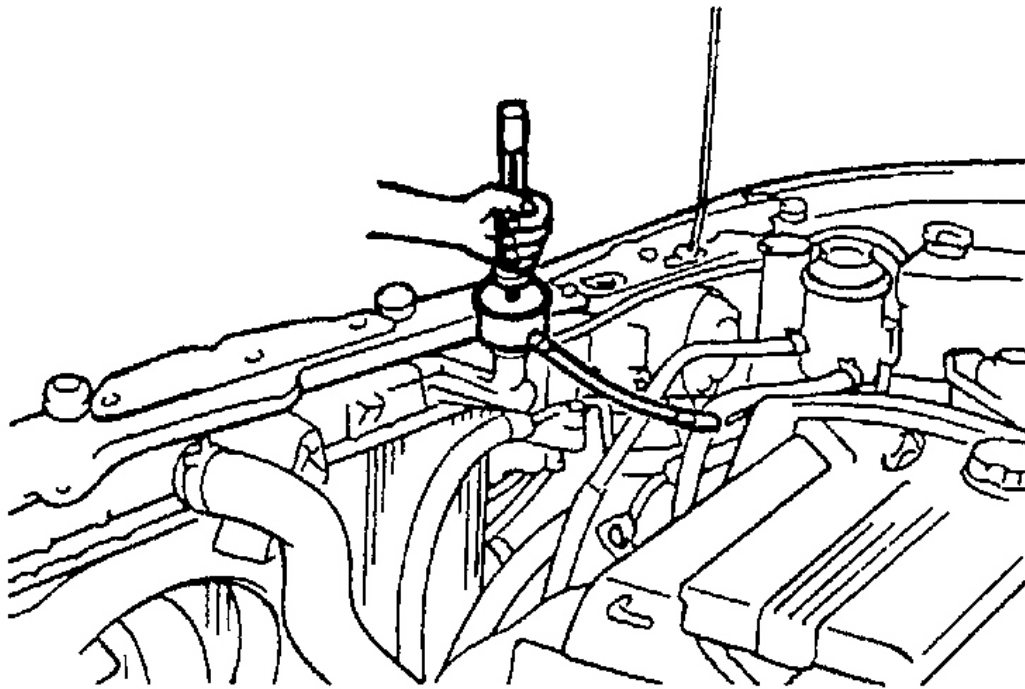


G01153472

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

SPECIFIC GRAVITY TEST

1. Measure the specific gravity of the coolant with a hydrometer.
2. Measure the coolant temperature and calculate the concentration from the relation between the specific gravity and temperature. Use the following table for reference. See **Fig. 16**.



G01153473

Fig. 15: Checking Coolant With Hydrometer
 Courtesy of HYUNDAI MOTOR CO.

RELATION BETWEEN COOLANT CONCENTRATION & 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%

G01153474

Fig. 16: Relationship Between Coolant Concentration & Specific Gravity
 Courtesy of HYUNDAI MOTOR CO.

Example

The safe operating temperature is -15°C (5°F) when the measure 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 reason, 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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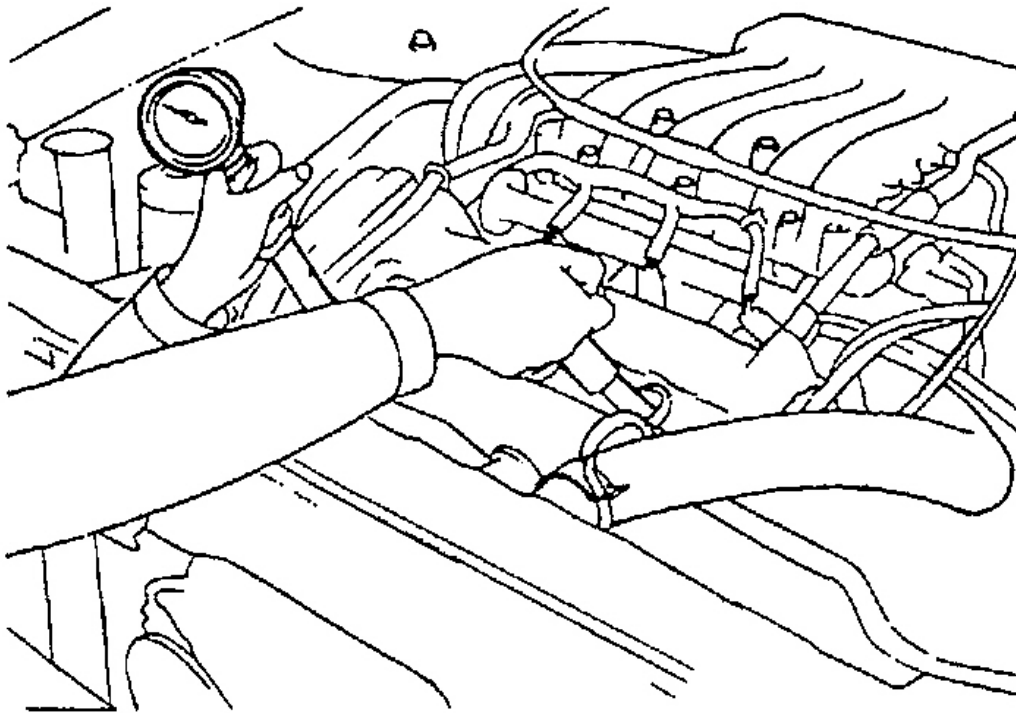
Fig. 17: Recommended Coolant
Courtesy of HYUNDAI MOTOR CO.

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 $80-95^{\circ}\text{C}$ ($176-205^{\circ}\text{F}$).
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 : 1,200 kPa (12.2 kg/cm^2 , 170 psi)

Limit: 1,050 kPa (10.7 kg/cm^2 , 149 psi)



G01153476

Fig. 18: Checking Compression Gauge
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. 100 kPa (1.0 kg/cm² , 14 psi) between cylinders

10. If a cylinder's compression or pressure differential is outside the specification, add a small amount of oil through the spark plug hole, and repeat steps 6 to 9.
 1. If the addition of oil causes the compression to rise, it is possible that the piston ring is 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)

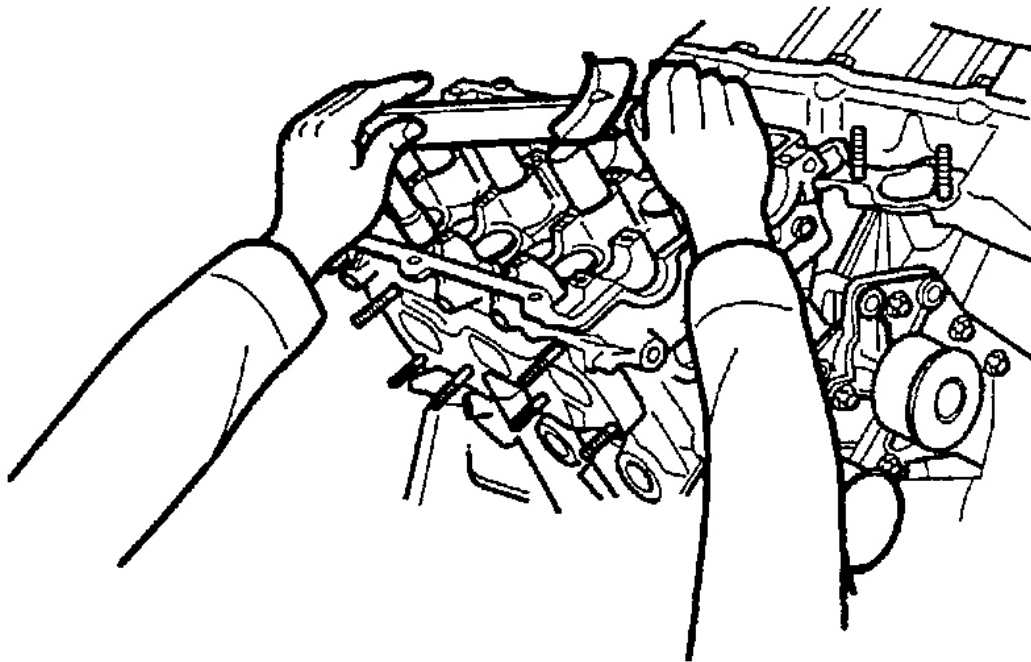
TIGHTENING CYLINDER HEAD BOLTS

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

Tightening torque

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

25 Nm (250 kg.cm, 18 lb ft) + (58°-62°) + (43°-47°)

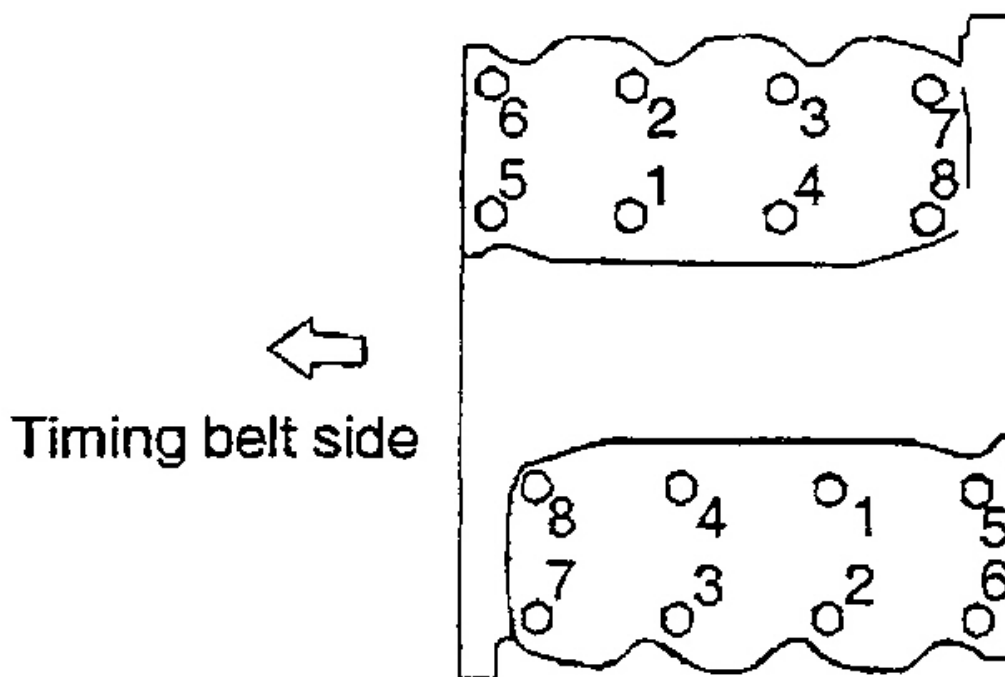


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Fig. 19: Tightening Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

2. Use the torque - angle method to torque the head bolts.
3. 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. 20: Cylinder Head Tightening Sequence
 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 & 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: 20-27 Nm (200-270 kg.cm, 14-20 lb.ft)

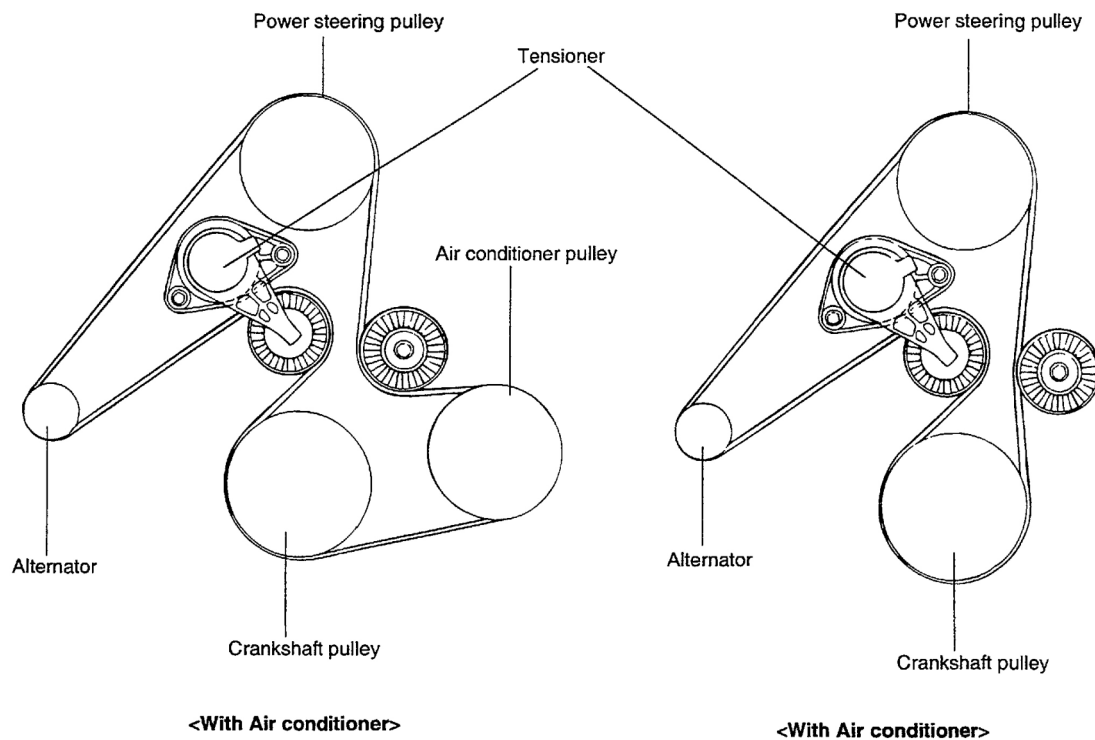
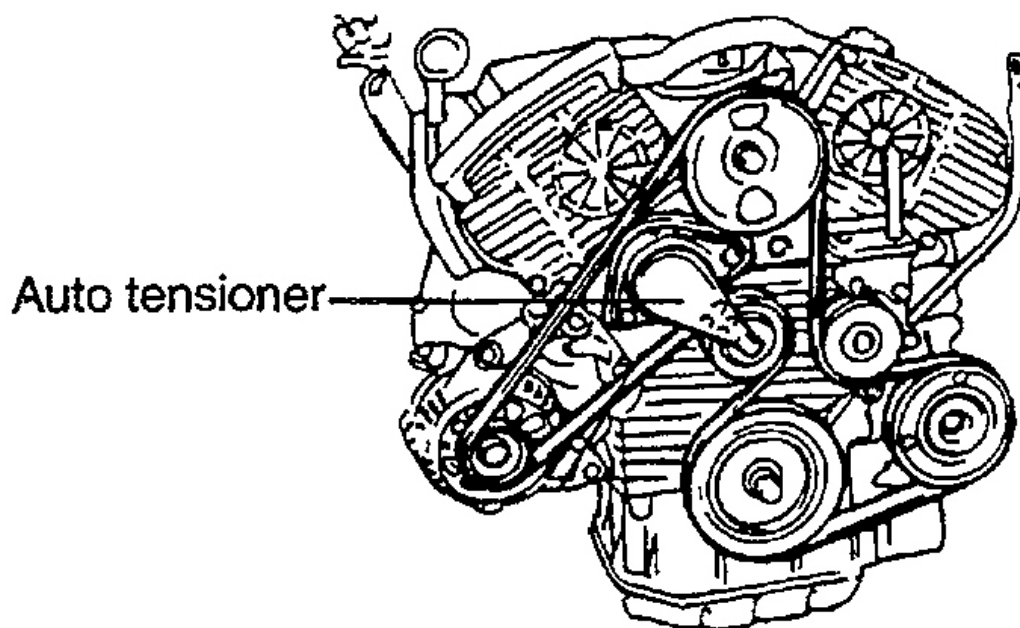


Fig. 21: Identifying Belt & Pulleys
Courtesy of HYUNDAI MOTOR CO.

2. Install the belt in the following order.

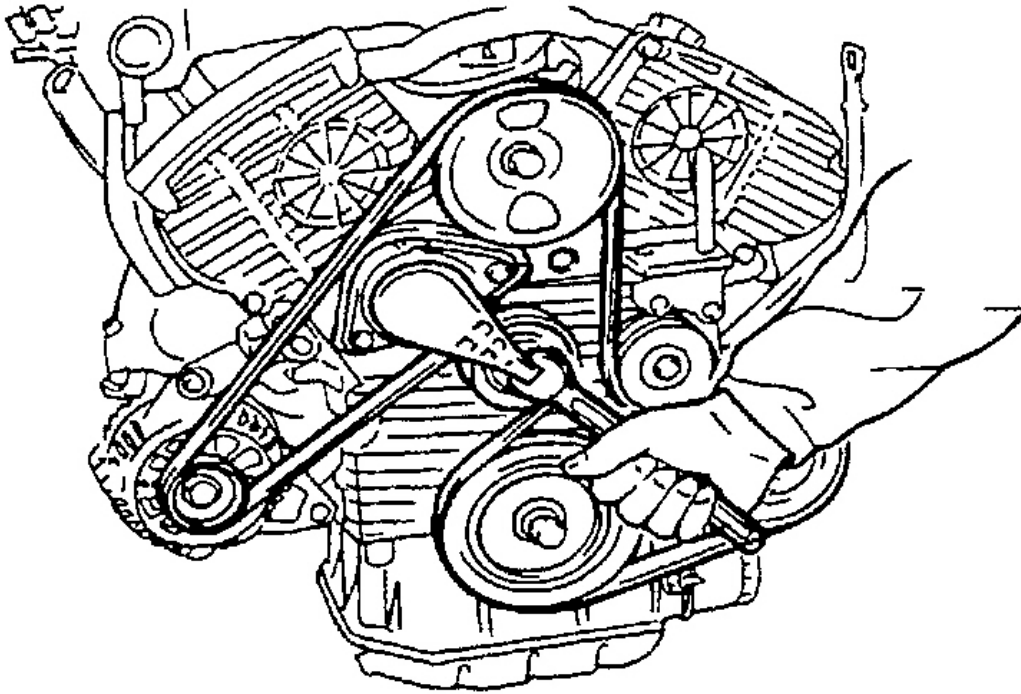
[Alternator --> Power steering --> Crankshaft pulley --> Air conditioner pulley.]



G01153480

Fig. 22: Identifying Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.

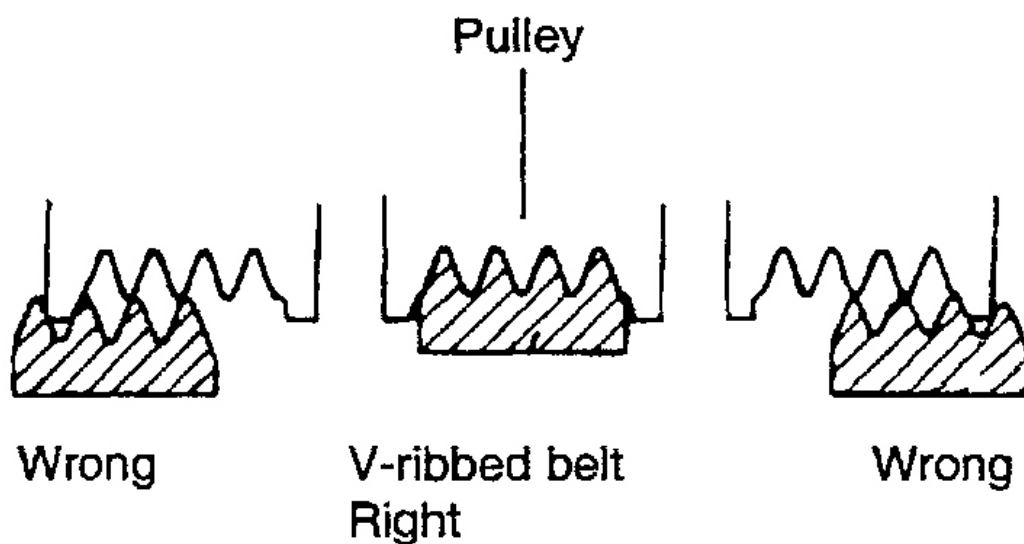
3. Rotate the tensioner arm clockwise (about 14°) with a spanner (16 mm) and fit the belt to the idler pulley.



G01153481

Fig. 23: Rotating Tensioner
Courtesy of HYUNDAI MOTOR CO.

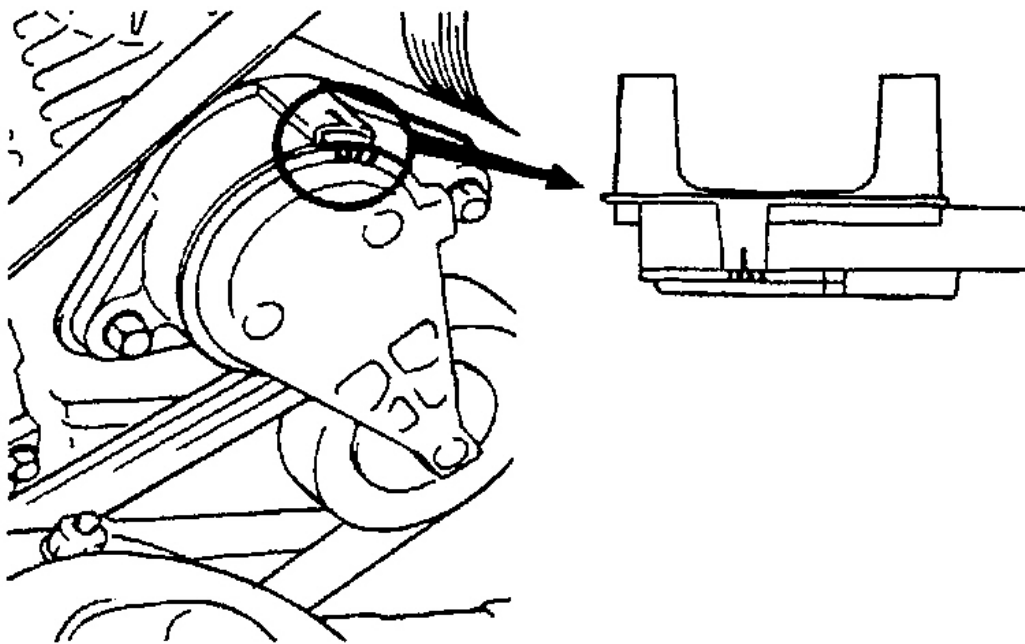
4. When installing the belt on the pulley, make sure it is centered on the pulley.



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Fig. 24: Locating Belt On Pulley
Courtesy of HYUNDAI MOTOR CO.

5. The tensioner mark should be between the "MIN" and "MAX" position. If not, replace the belt.



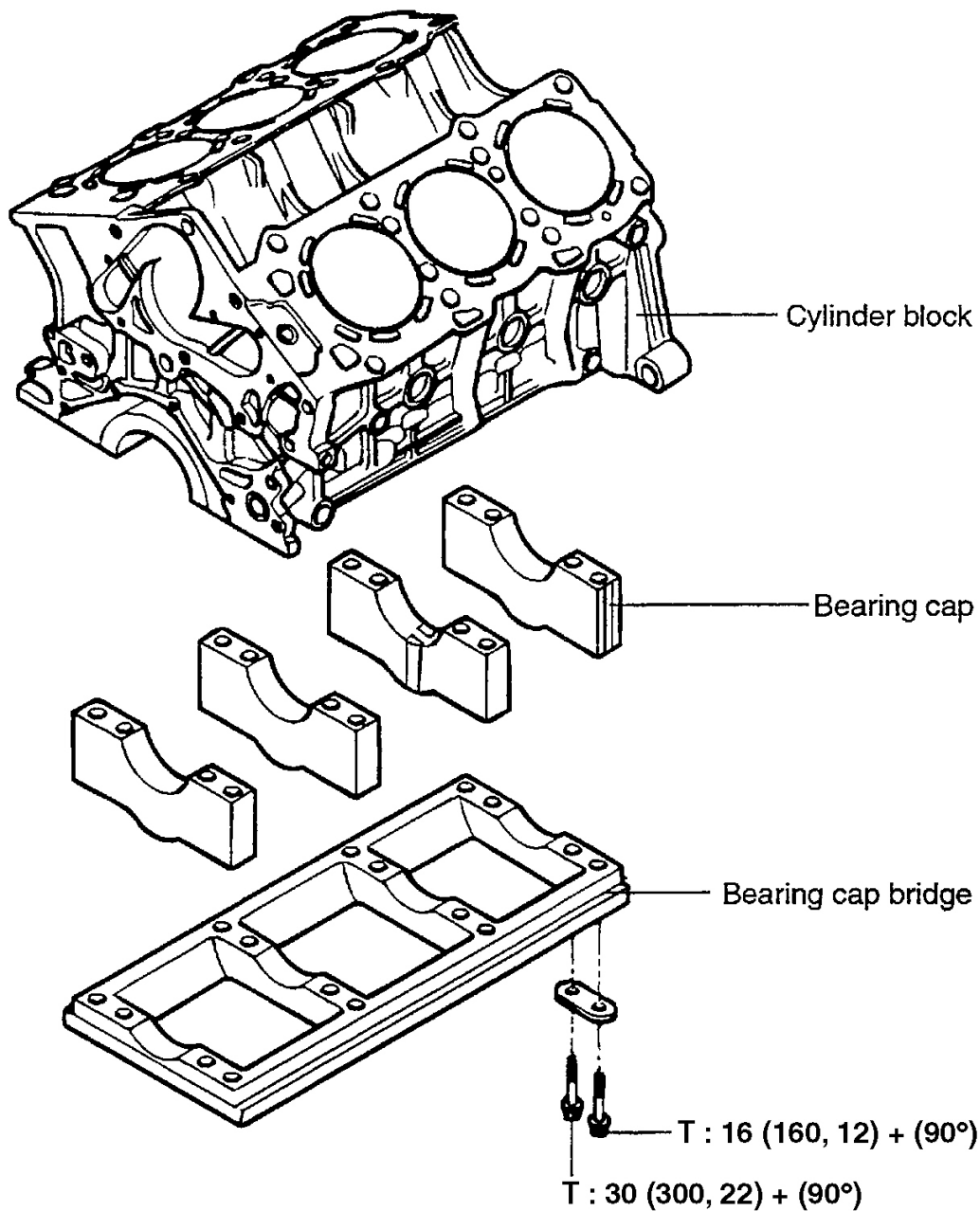
G01153483

Fig. 25: Identifying Min-Max On Tensioner
Courtesy of HYUNDAI MOTOR CO.

ENGINE BLOCK

ENGINE BLOCK

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

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Fig. 26: Engine Block Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

Remove the following:

- Timing belt. See **TIMING BELT**.
- Cylinder head assembly. See **CYLINDER HEAD**.
- Drive plate.
- Transaxle mounting plate.
- Oil pan.
- Oil pump case.

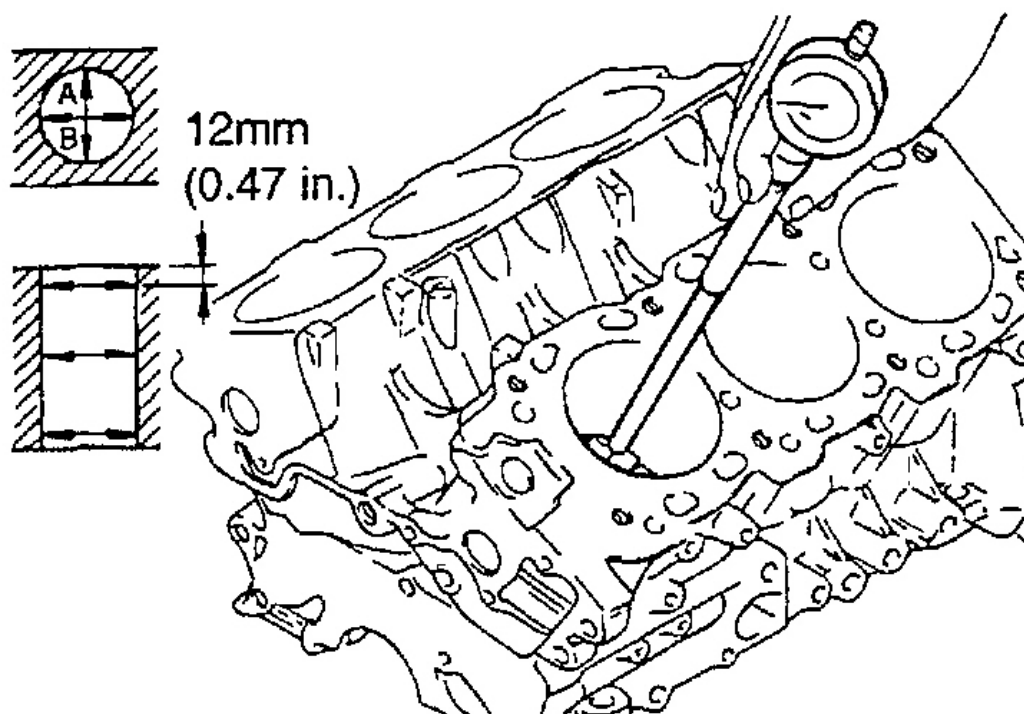
INSPECTION**CYLINDER BLOCK**

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 direction A and B.

Level 1 : No. 1 piston ring position at TDC

Level 2: Center of cylinder

Level 3 : Bottom of cylinder



G01153485

Fig. 27: Measuring Cylinder Bore
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 : 86-7 mm (3.41 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 two sizes.

Piston service size and mark mm (in.)

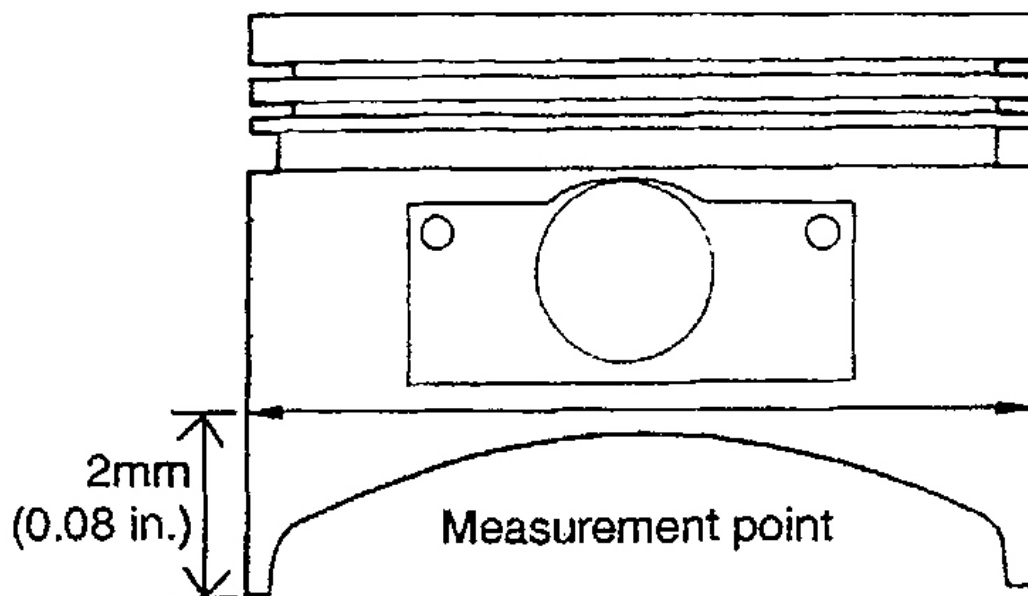
0.25 (0.010) O.S. : 0.25

0.50 (0.020) O.S. : 0.50

6. To rebores 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 12 mm (0.47 in.) above the bottom of the piston skirt and across the thrust faces.

Piston-to-cylinder clearance:

0.01-0.03 mm (0.0004-0.00012 in.)



G01153486

Fig. 28: Measuring Point On Piston Skirt
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 limits, grind to the minimum limit or replace.

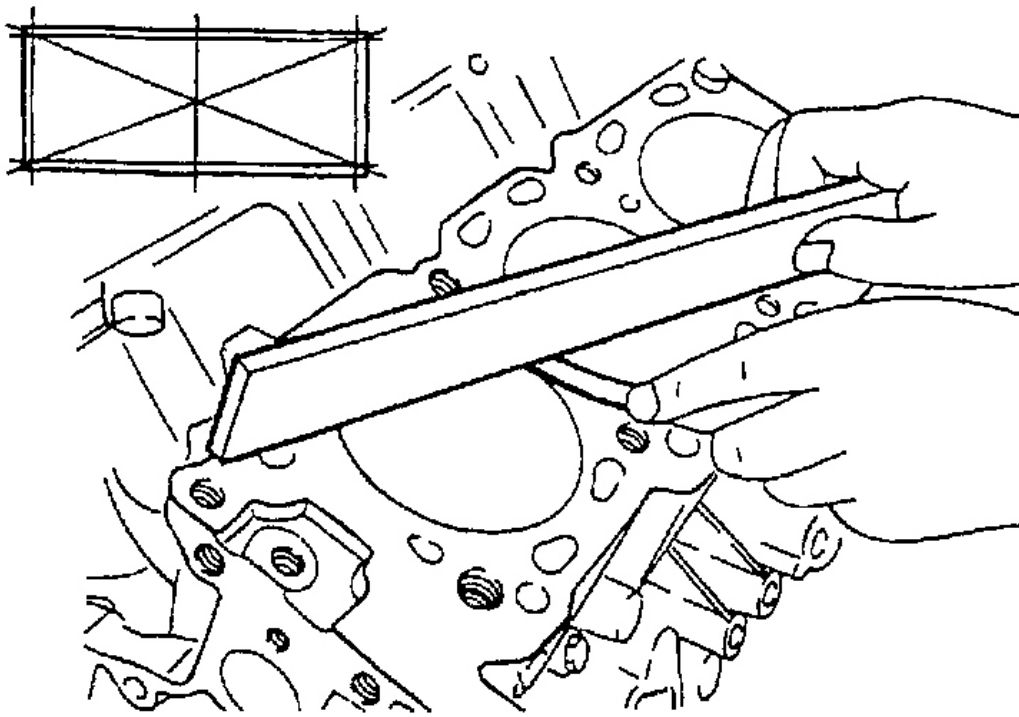
Standard value

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.



G01153487

Fig. 29: Checking Top Surface Of Cylinder Block
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.)

G01153488

Fig. 30: Piston Identification Table
Courtesy of HYUNDAI MOTOR CO.

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

- Measure the outside diameter of the piston to be used.
- 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 0.00012 in.) (clearance between piston and cylinder) - 0.01 mm (0.0004 in.) (honing margin.)

- 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.

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

Standard : 0.01-0.03 mm (0.0004-0.0012 in.)

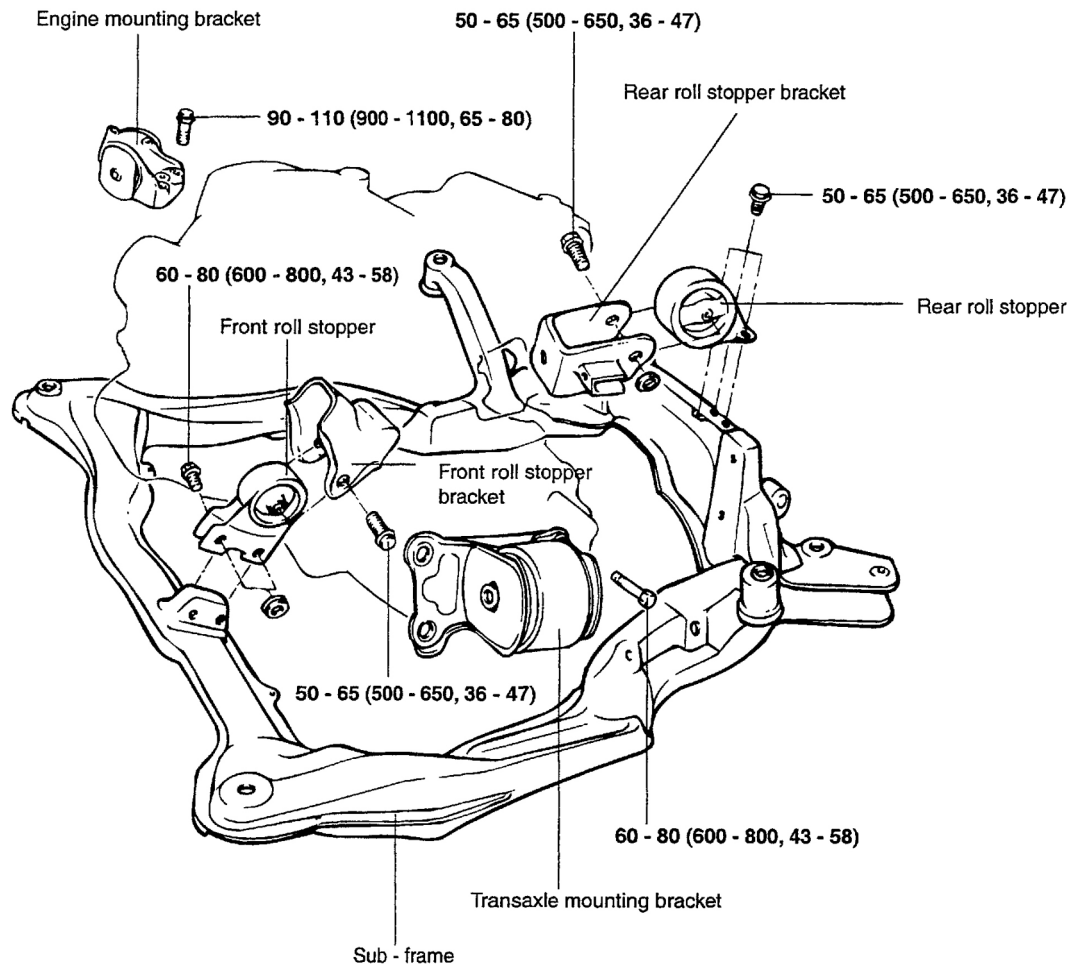
NOTE: When boring the cylinders, finish all of the cylinders to the same oversize. Do not bore only one cylinder to the oversize.

REASSEMBLY

Install the following parts by referring to their respective sections.

- Crankshaft. See **CRANK SHAFT**.
- Drive plate.
- Piston.
- Cylinder head. See **CYLINDER HEAD**.
- Timing belt. See **TIMING BELT**.

6. Oil pump case.

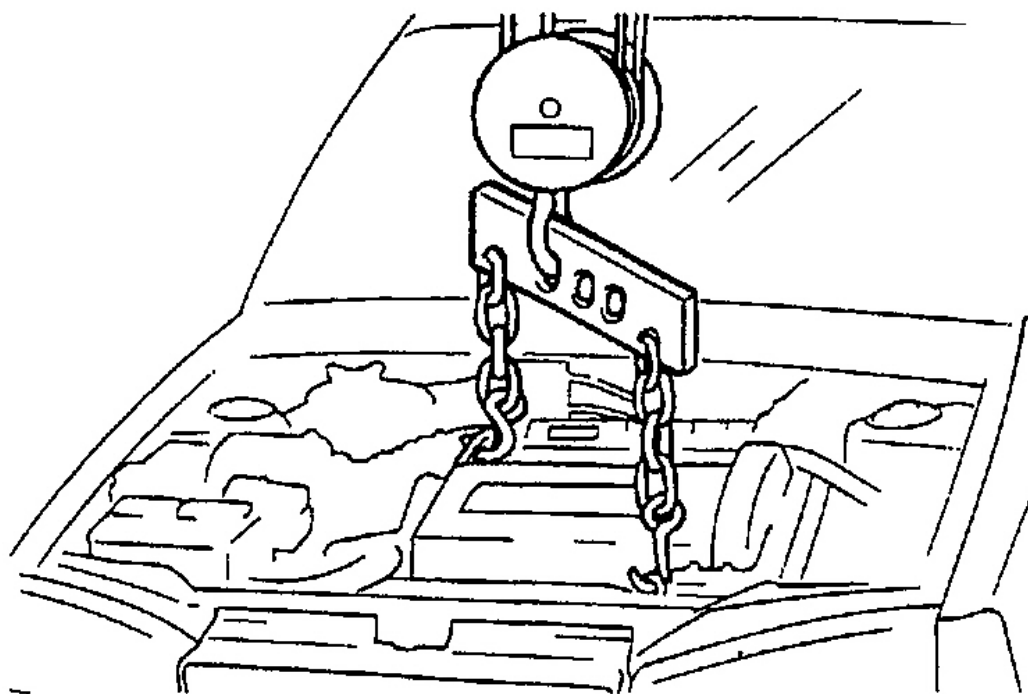
ENGINE MOUNTS**COMPONENTS****TORQUE : Nm (kg.cm, lb-ft)**

G01153489

Fig. 31: Engine Mount Components
 Courtesy of HYUNDAI MOTOR CO.

REMOVAL

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



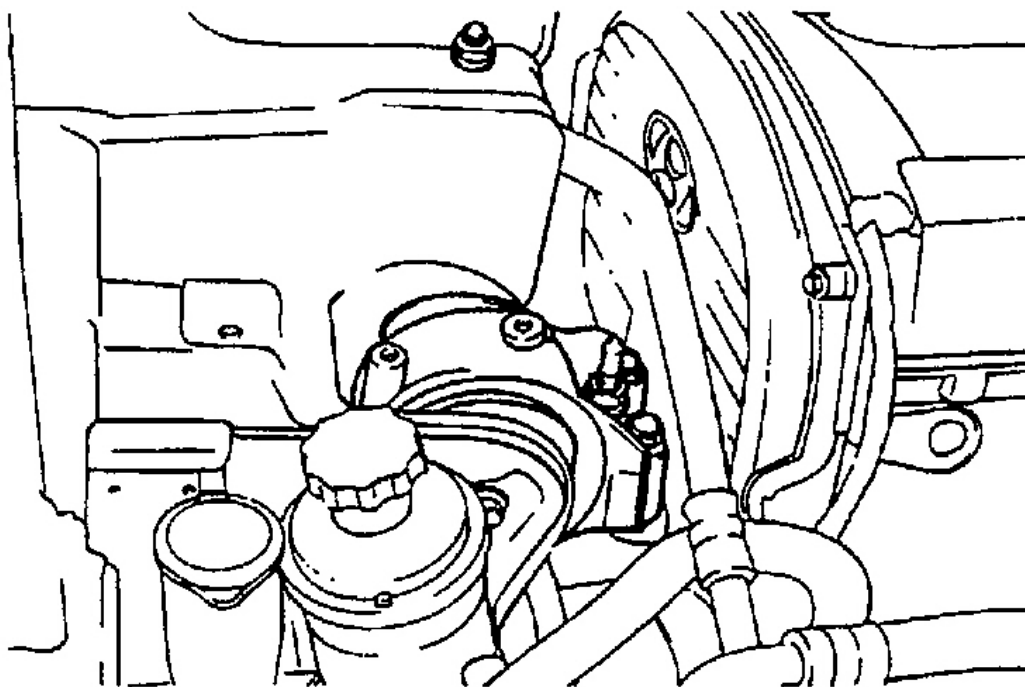
G01153490

Fig. 32: Lifting Engine

Courtesy of HYUNDAI MOTOR CO.

ENGINE MOUNTING

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

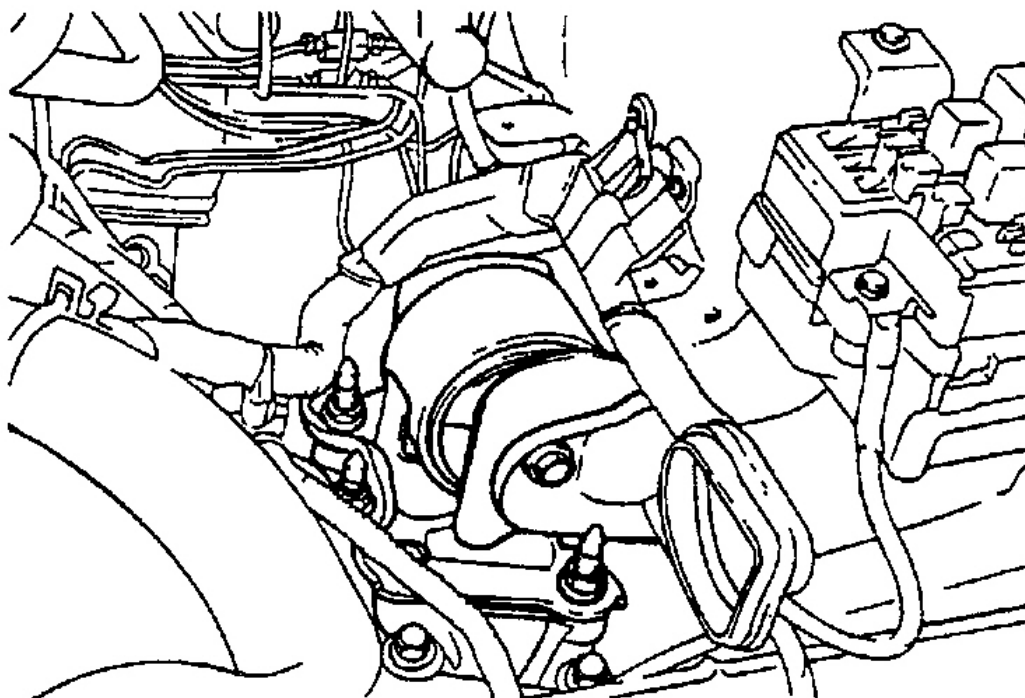


G01153491

Fig. 33: Identifying Engine Mounting Bracket
Courtesy of HYUNDAI MOTOR CO.

TRANSAXLE MOUNTING

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

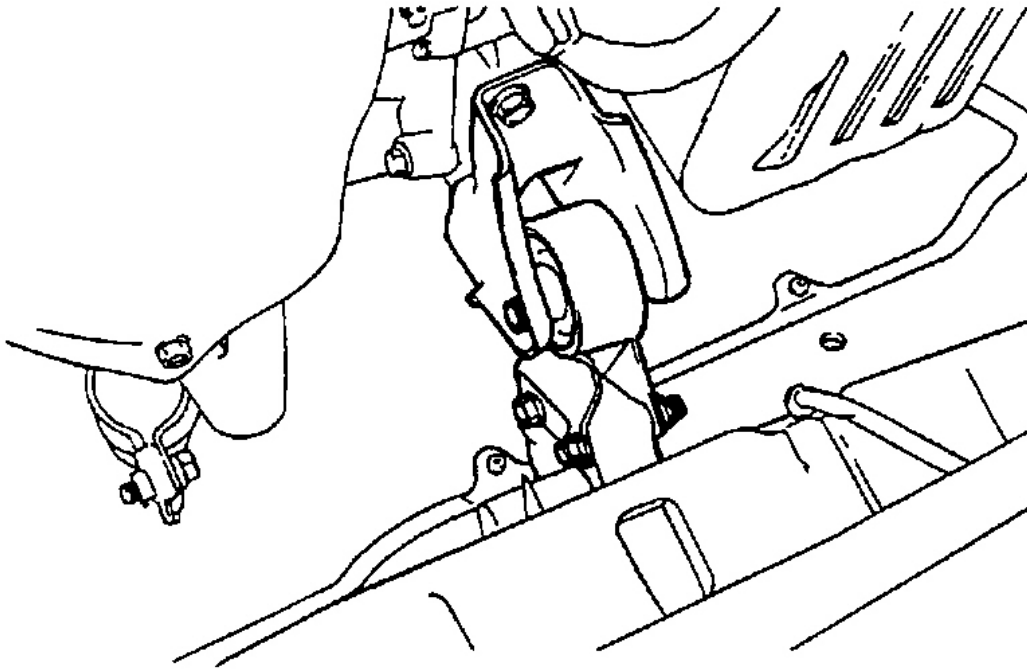


G01153492

Fig. 34: Identifying Transaxle Bracket
Courtesy of HYUNDAI MOTOR CO.

FRONT ROLL STOPPER

Remove the front roll stopper bracket from the sub-frame.

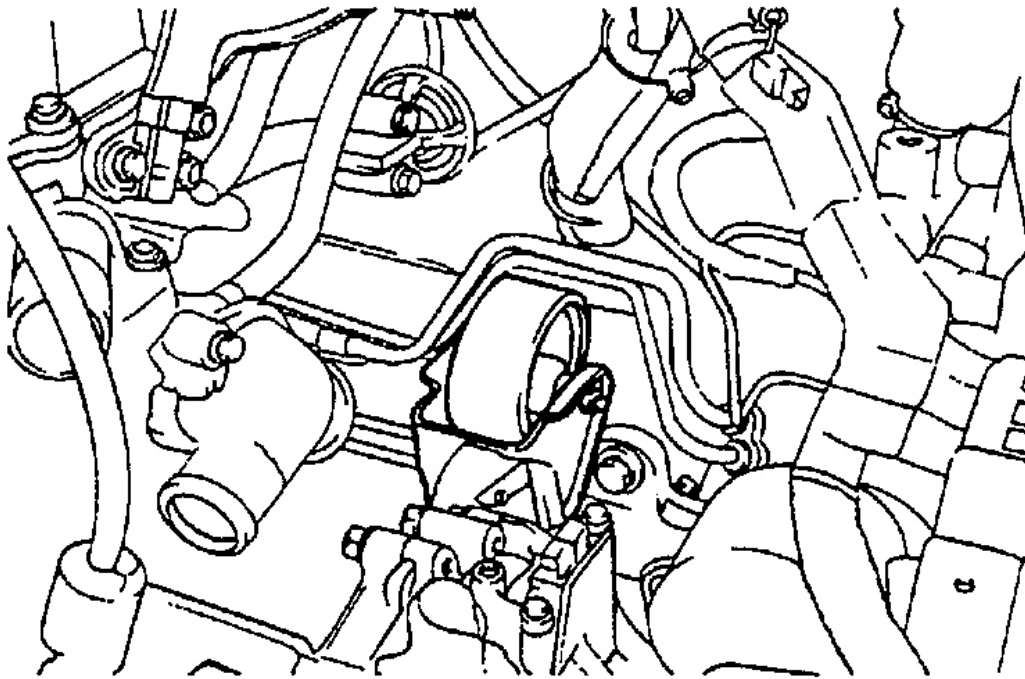


G01153493

Fig. 35: Identifying Front Roller Stopper Bracket
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 subframe.

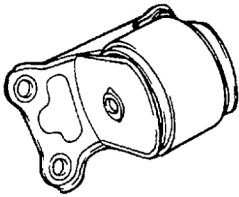


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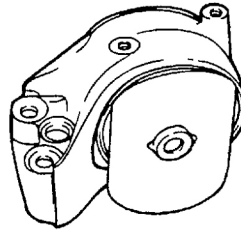
Fig. 36: Identifying Rear Roller Stopper Bracket
Courtesy of HYUNDAI MOTOR CO.

INSPECTION ITEMS

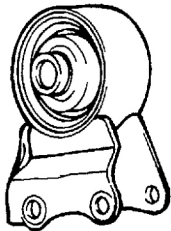
Transaxle mounting



Engine mounting



Front roll stopper assembly



G01153495

Rear roll stopper assembly

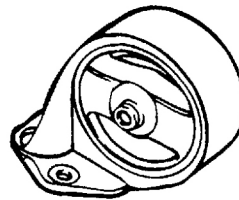


Fig. 37: Inspection Items
Courtesy of HYUNDAI MOTOR CO.

ENGINE & TRANSAXLE ASSEMBLY

REMOVAL

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

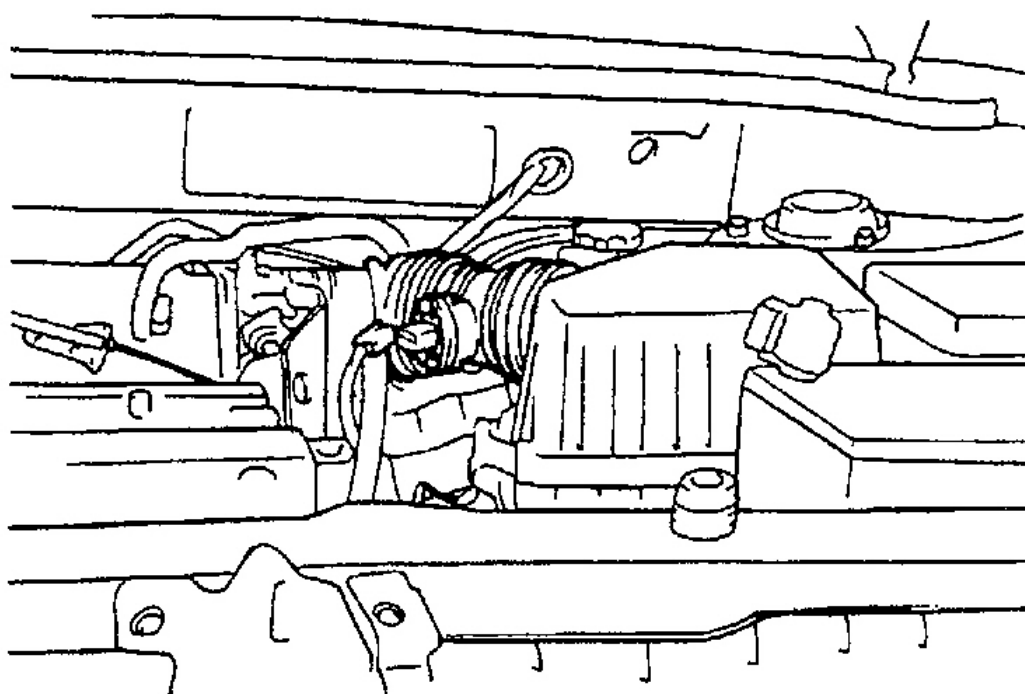
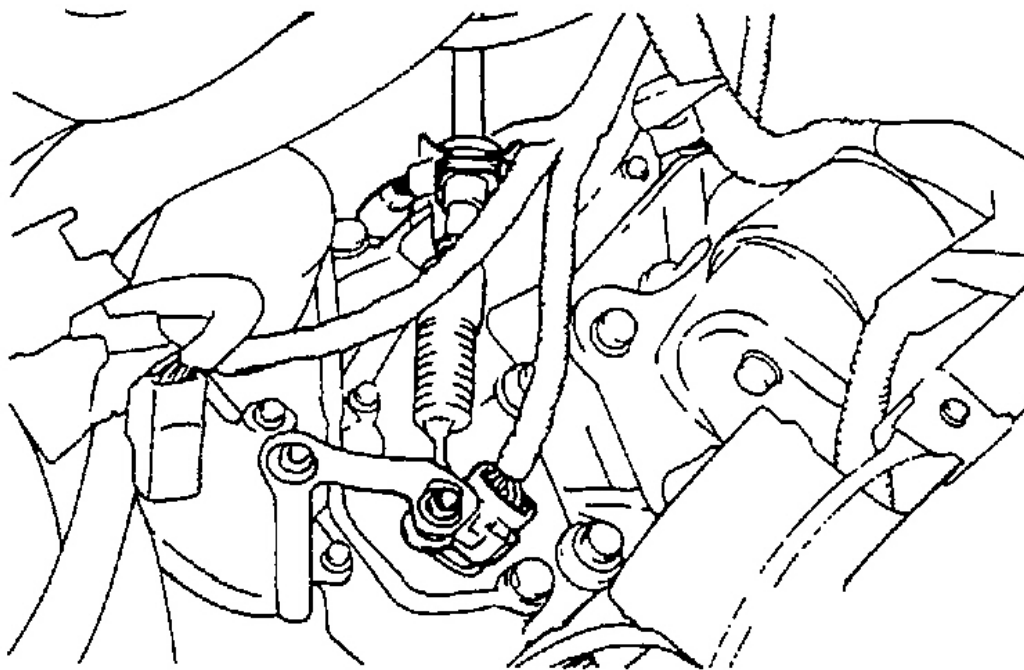
**G01153496**

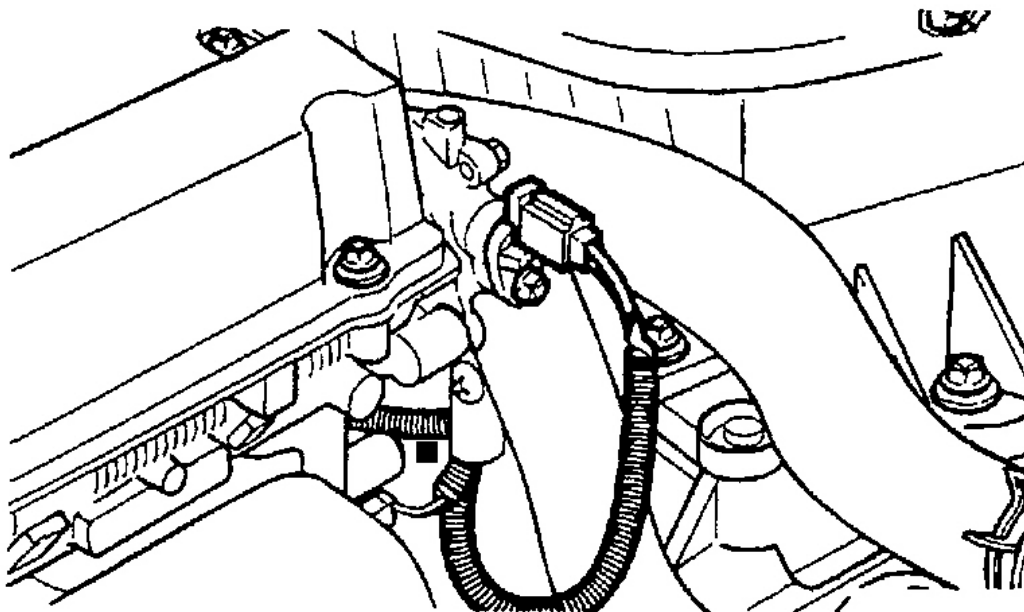
Fig. 38: Identifying Air Cleaner
Courtesy of HYUNDAI MOTOR CO.

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



G01153497

Fig. 39: View Transmission Range Sensor
Courtesy of HYUNDAI MOTOR CO.



G01153498

Fig. 40: View Engine Coolant Temperature Sensor
Courtesy of HYUNDAI MOTOR CO.

4. Drain the engine coolant.
5. For a vehicle with automatic transaxles, disconnect the transaxle oil cooler hoses.

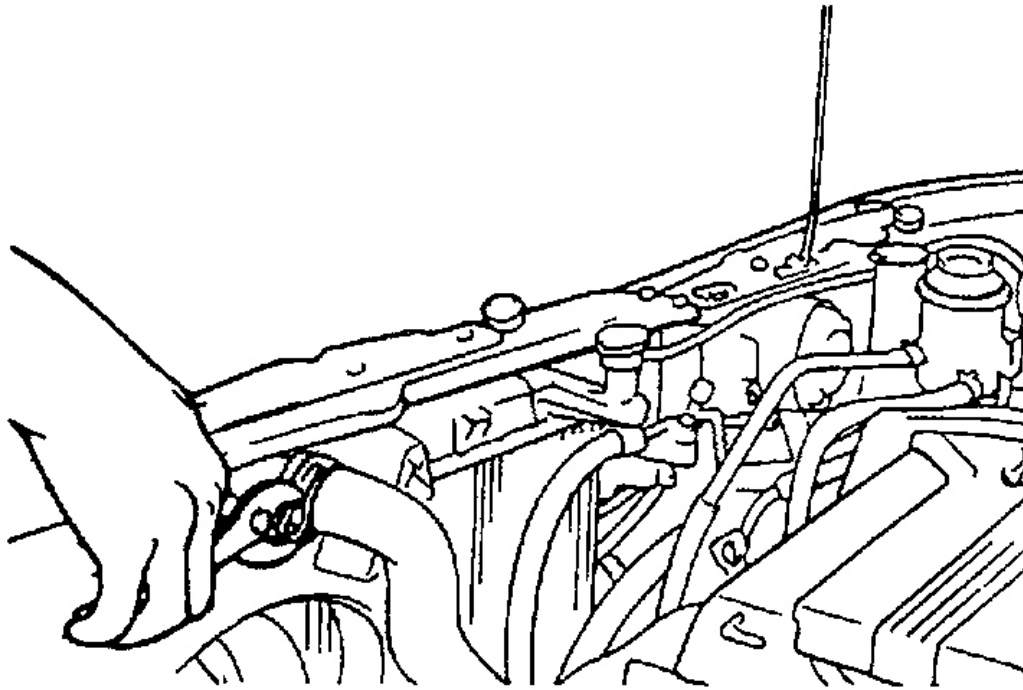
NOTE:

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

CAUTION:

- Be careful not to spill any of oil or fluid out of the hoses. Plug the opening to prevent the entry of foreign material.

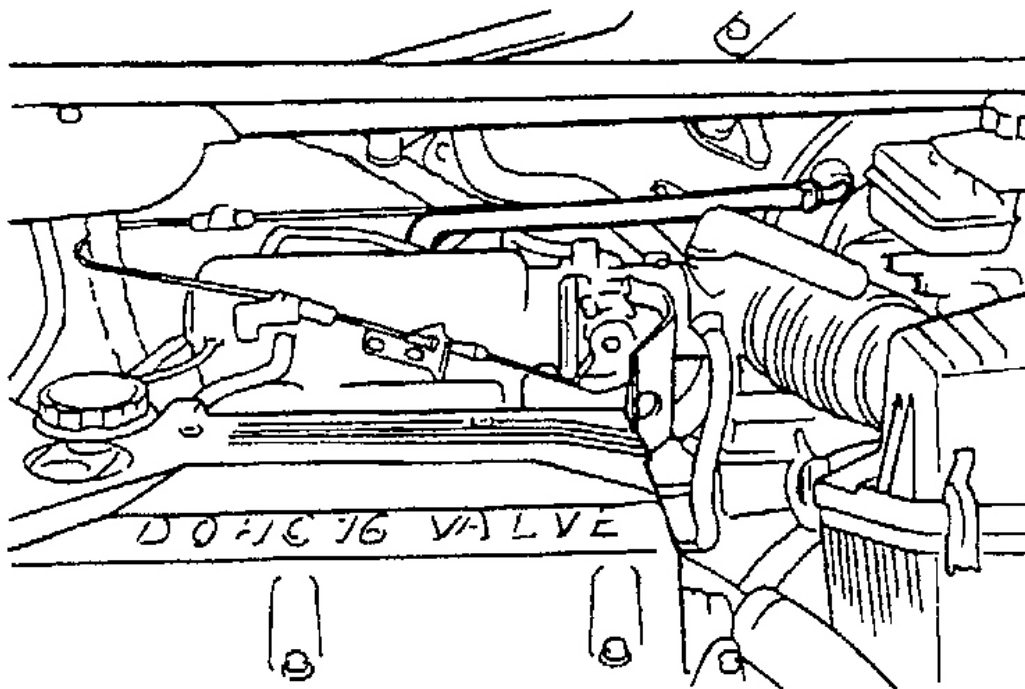
6. Disconnect the radiator upper and lower hoses on the engine side then remove the radiator assembly.



G01153499

Fig. 41: Removing Upper Radiator Hose
Courtesy of HYUNDAI MOTOR CO.

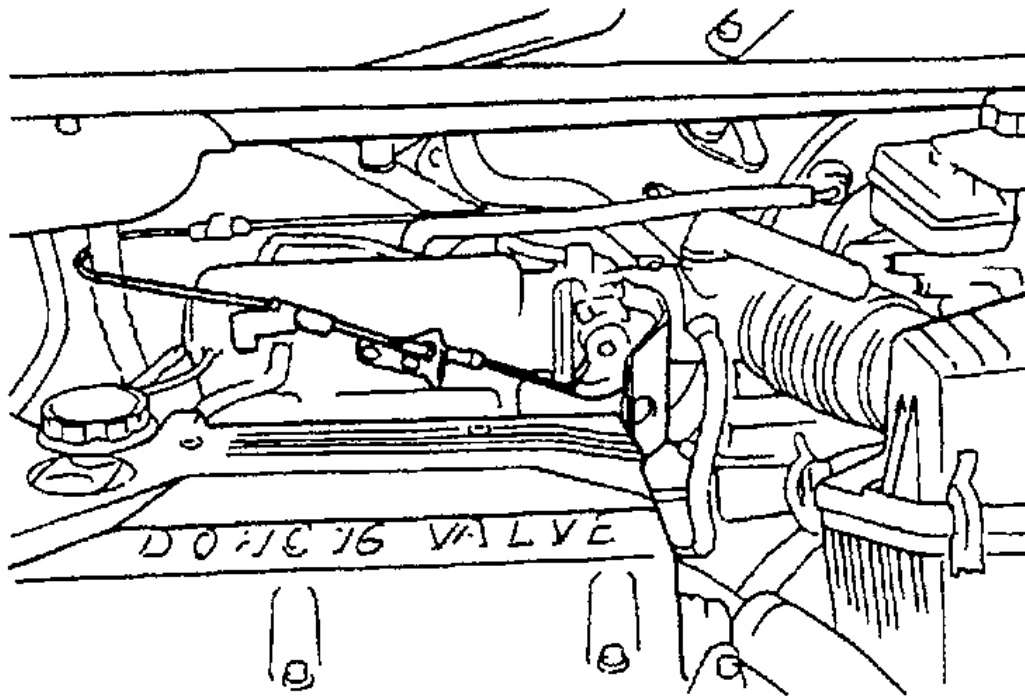
7. Disconnect the engine ground.
8. Disconnect the brake booster vacuum hose.



G01153500

Fig. 42: Identifying Brake Booster Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

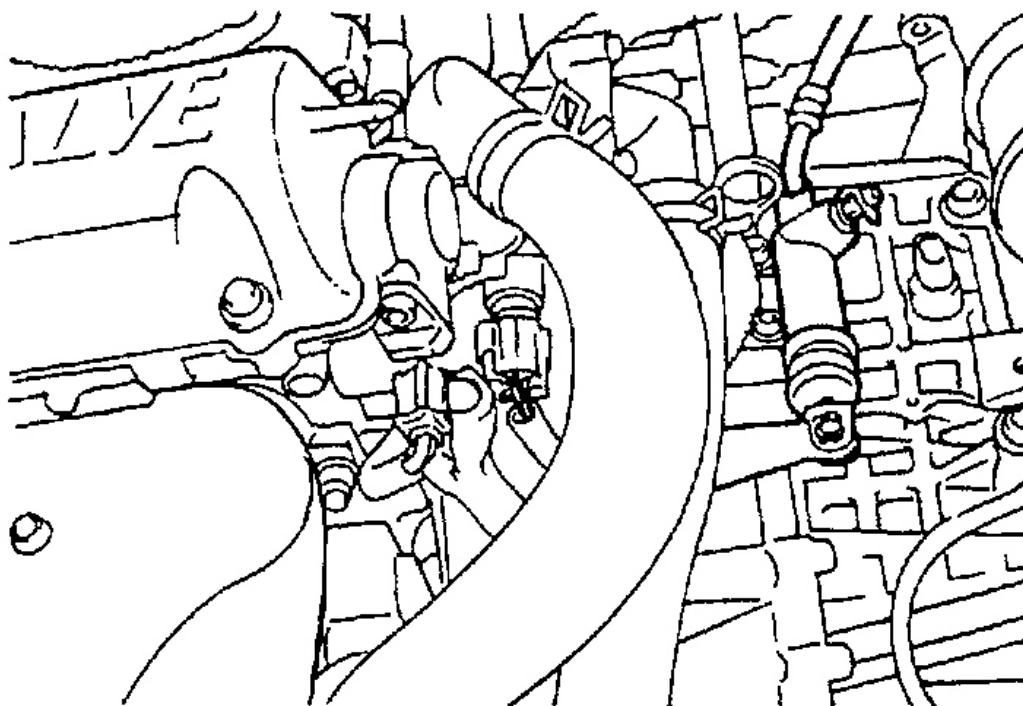
9. Disconnect the heater hoses (inlet and outlet) on the engine side.
10. Disconnect the accelerator cable at the engine side.



G01153501

Fig. 43: Identifying Accelerator Cable
Courtesy of HYUNDAI MOTOR CO.

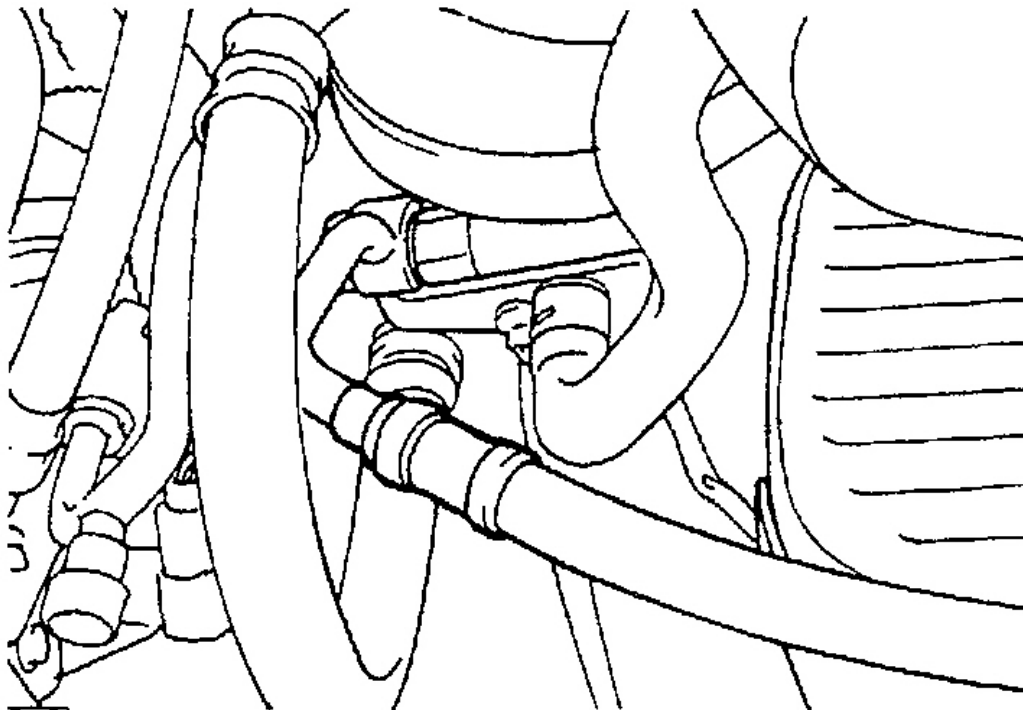
11. Using a special tool, remove the main fuel line at the delivery pipe (supply/return).
12. Disconnect the speedometer cable from the transaxle.
13. Disconnect the clutch cable or control cable from the transaxle.



G01153502

Fig. 44: Identifying Clutch Cable Or Control Cable
Courtesy of HYUNDAI MOTOR CO.

14. Disconnect the power steering hose and return hose from the pump.

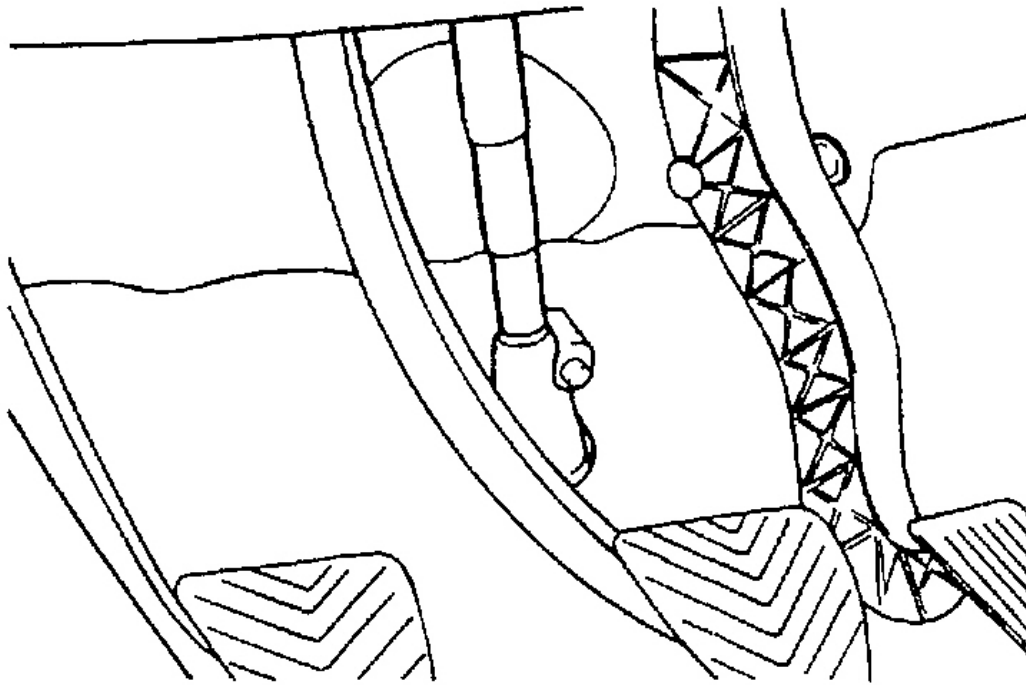


G01153503

Fig. 45: Identifying Power Steering Hoses
Courtesy of HYUNDAI MOTOR CO.

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

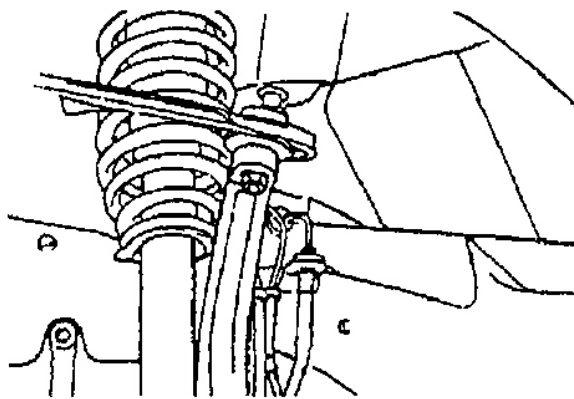
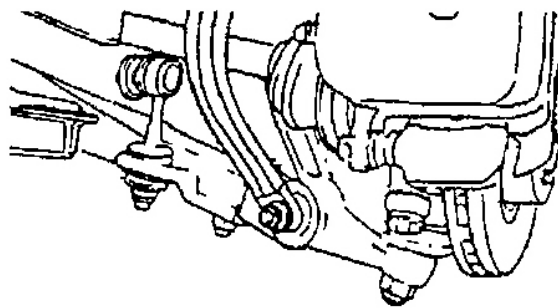
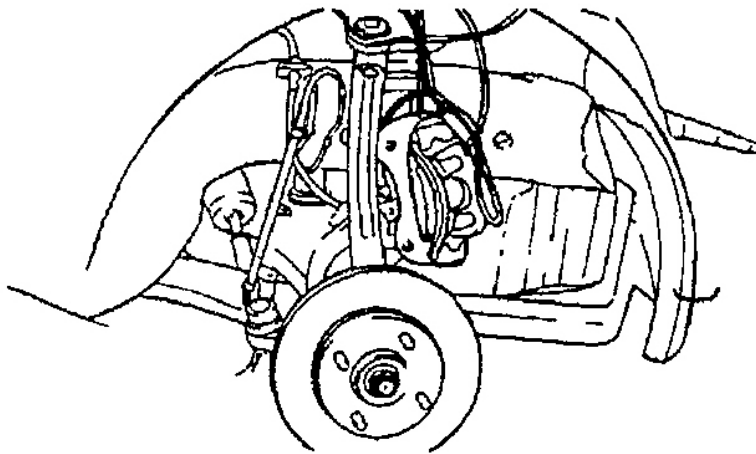
NOTE: **Make sure to make identification marks between the universal joint and the gear box for reassembly.**



G01153504

Fig. 46: Identifying Steering Column Through Floor Board Location
Courtesy of HYUNDAI MOTOR CO.

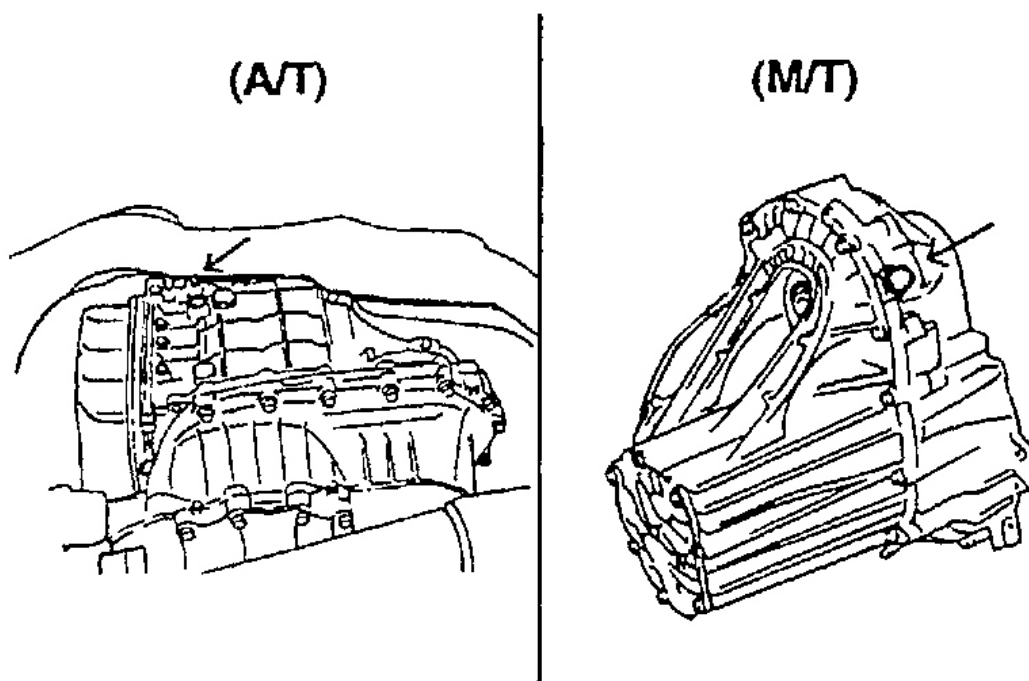
16. Raise the vehicle and then remove the front tire.
17. Attaching the wheel speed sensor and caliper to the body, disconnect the lower arm and the fork, and then separate the upper arm and knuckle.



G01153505

Fig. 47: Securing Brake Caliper & Identifying Wheel Knuckle Bolts
Courtesy of HYUNDAI MOTOR CO.

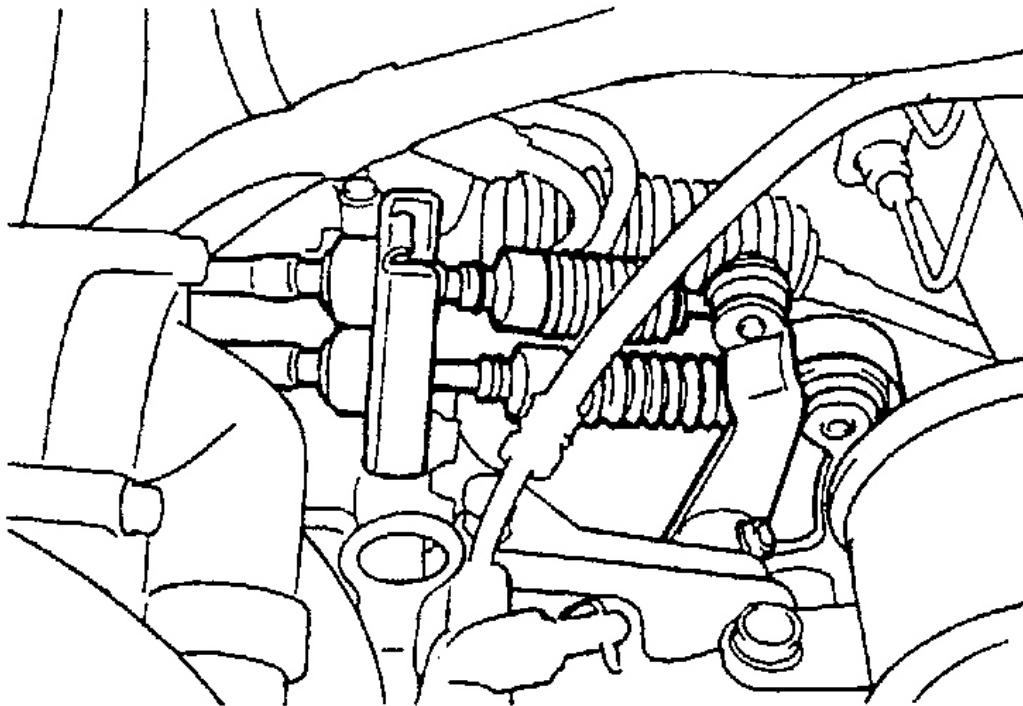
18. Drain the transaxle oil.



G01153506

Fig. 48: Identifying Transaxles Drain Plugs
Courtesy of HYUNDAI MOTOR CO.

19. Remove the front muffler bolts.
20. Remove the transaxle control rod and extension rod (M/T only).

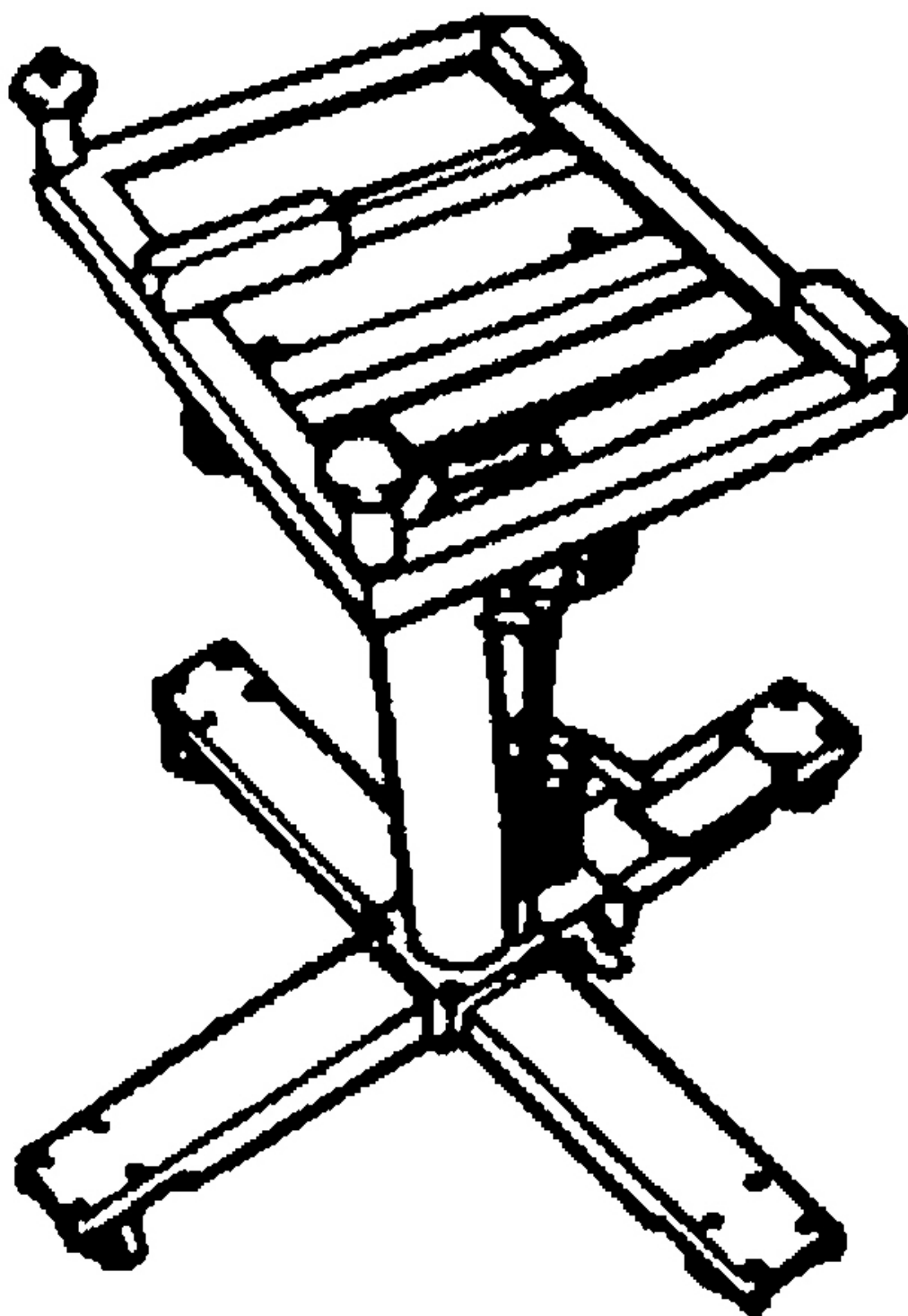


G01153507

Fig. 49: Identifying Transaxle Control Rod & Extension Rod
Courtesy of HYUNDAI MOTOR CO.

21. Put the special fixture on the T/M jack and then adjust it to the sub-frame.

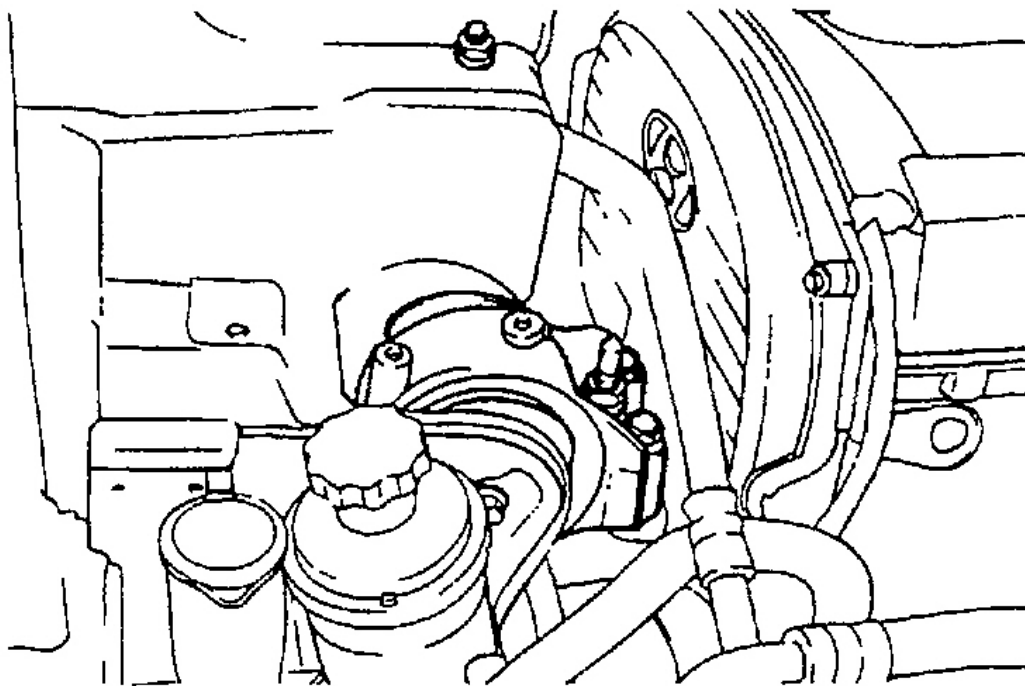
NOTE: Check that all the cables, harness connector and hose are disconnected from the engine and transaxle assembly.



G01153508

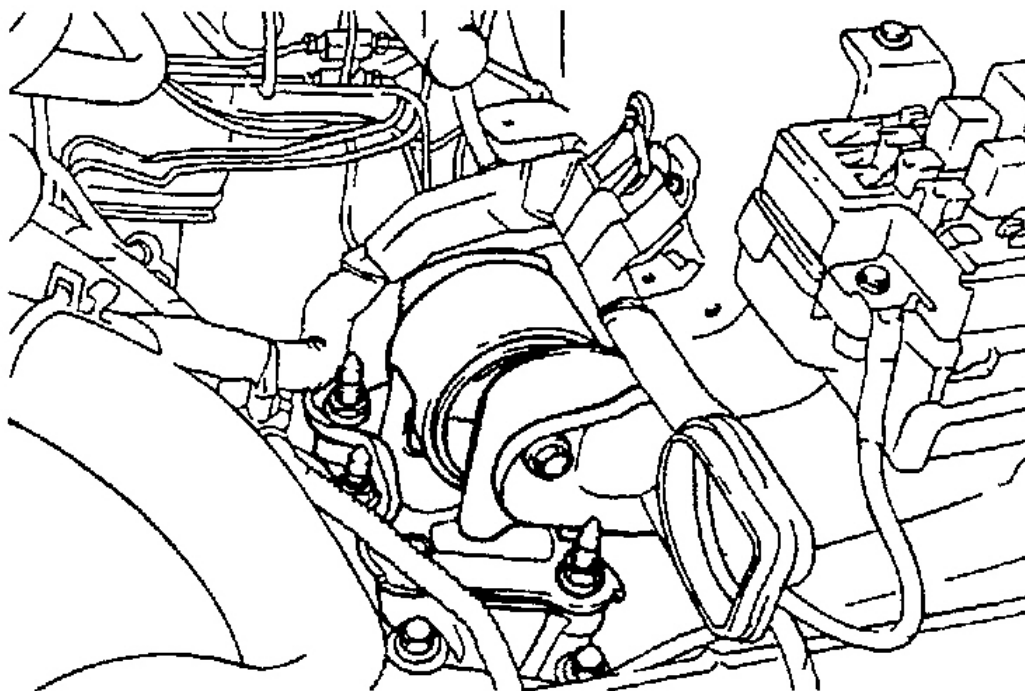
Fig. 50: Identifying T/M Jack
Courtesy of HYUNDAI MOTOR CO.

22. Remove the engine mounting bracket and the transaxle mounting bracket.



G01153509

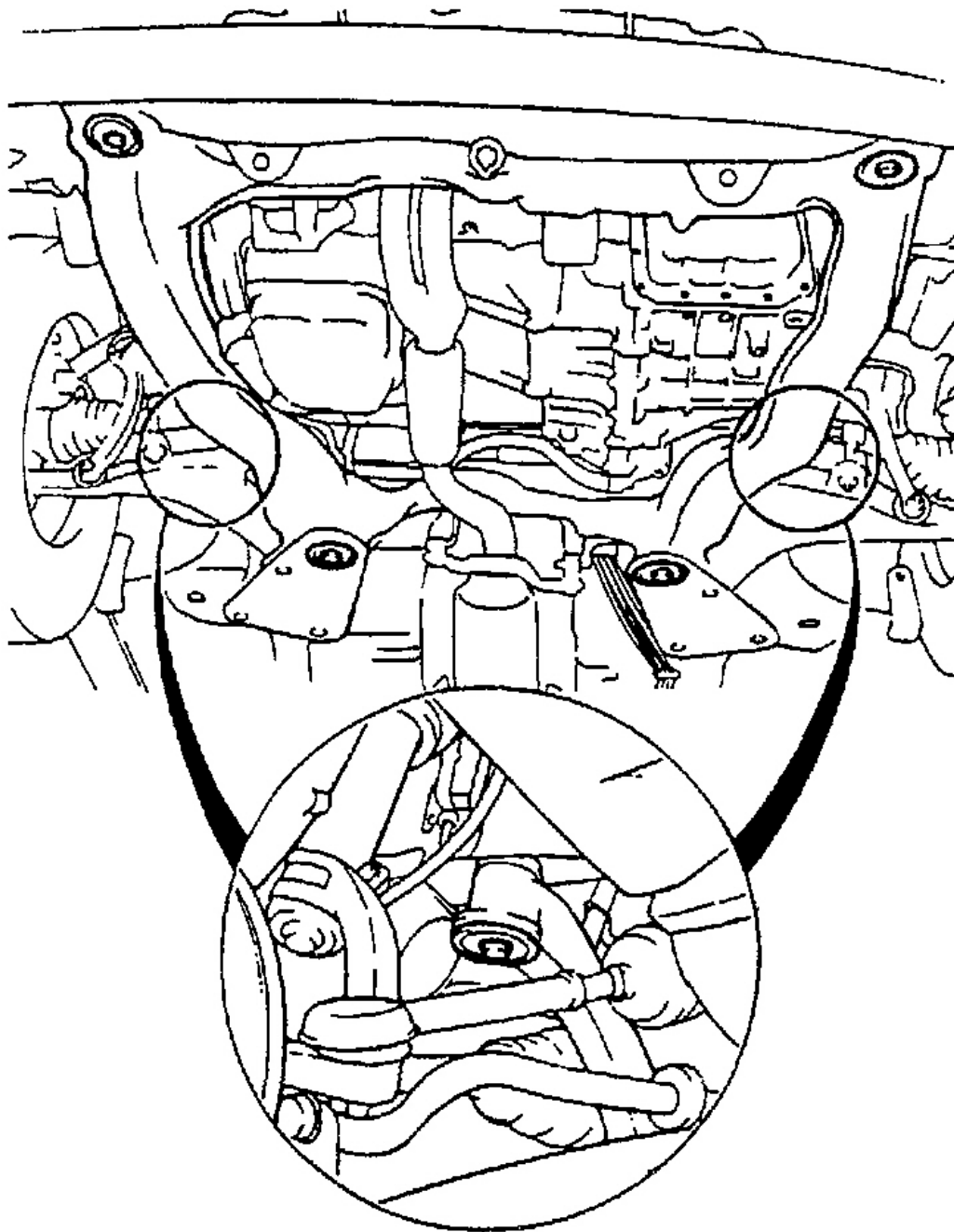
Fig. 51: Identifying Engine Mounting Bracket
Courtesy of HYUNDAI MOTOR CO.



G01153510

Fig. 52: Identifying Transaxle Mounting Bracket
Courtesy of HYUNDAI MOTOR CO.

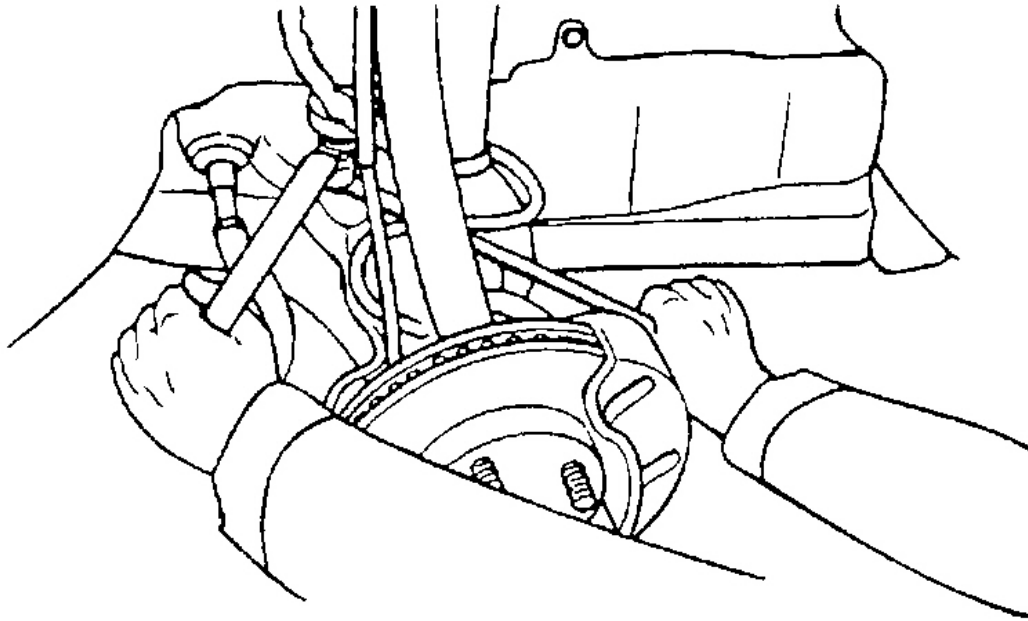
23. Remove the sub-frame installation bolts.



G01153511

Fig. 53: Identifying Sub-Frame Bolts
Courtesy of HYUNDAI MOTOR CO.

24. Using the special tool 09624 - 38100, remove the cross member stub bolt.

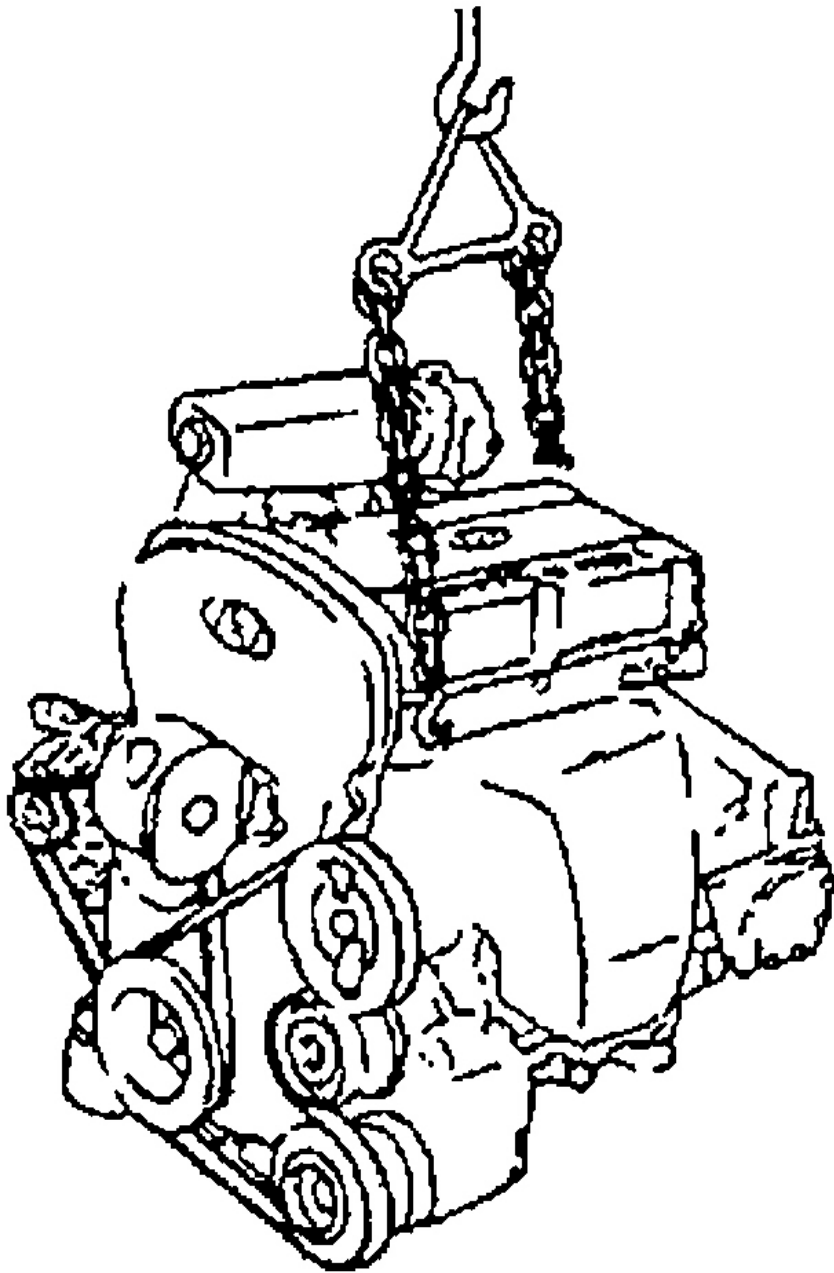


G01153512

Fig. 54: Removing Cross Member Stub Bolt
Courtesy of HYUNDAI MOTOR CO.

With holding the stud bolt using a special tool in order not to loosen the stud bolt, remove the lock nut using a ring wrench.

25. After removing the drive shaft, lower the engine and transaxle assembly on the jack then, remove the front roll stopper and the rear roll stopper.



G01153513

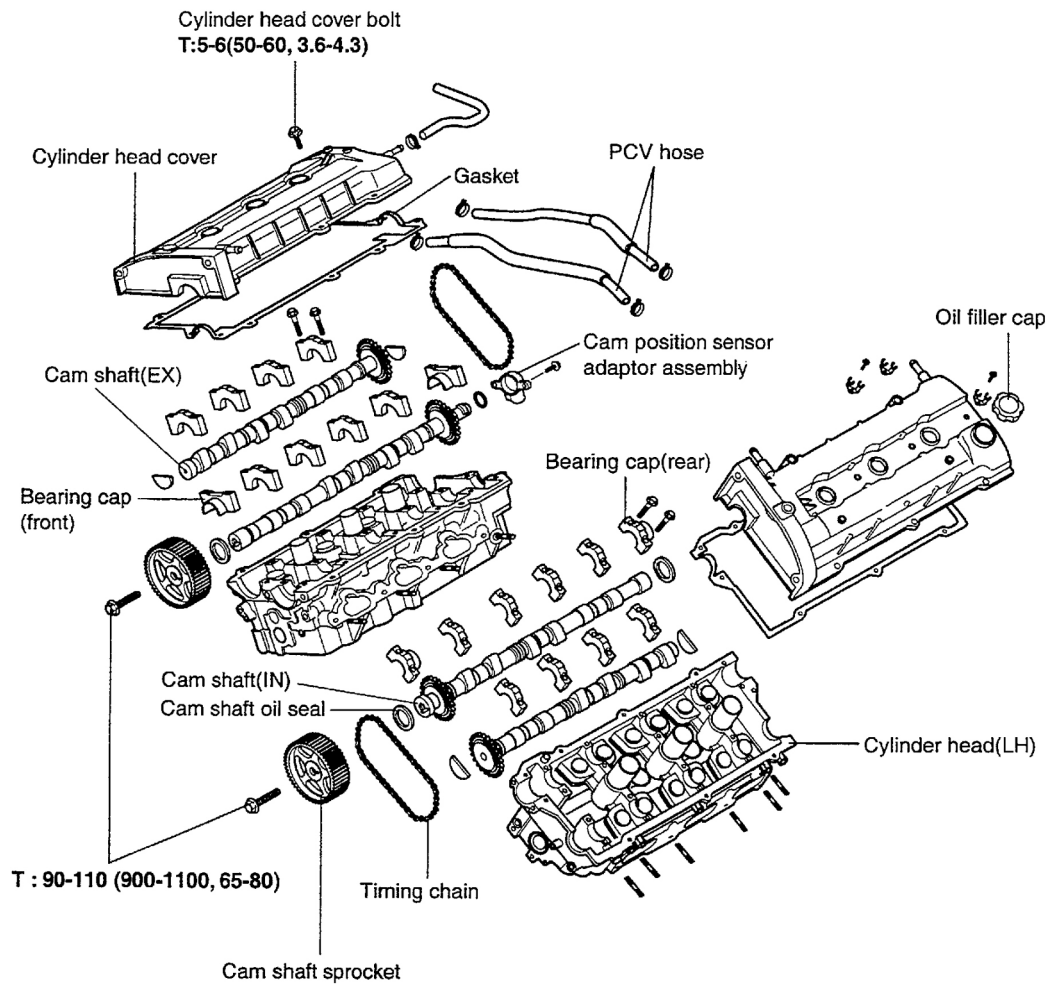
Fig. 55: Removing Engine
Courtesy of HYUNDAI MOTOR CO.

26. Remove the engine and transaxle assembly as a unit.

MAIN MOVING SYSTEM

CAMSHAFT

COMPONENTS



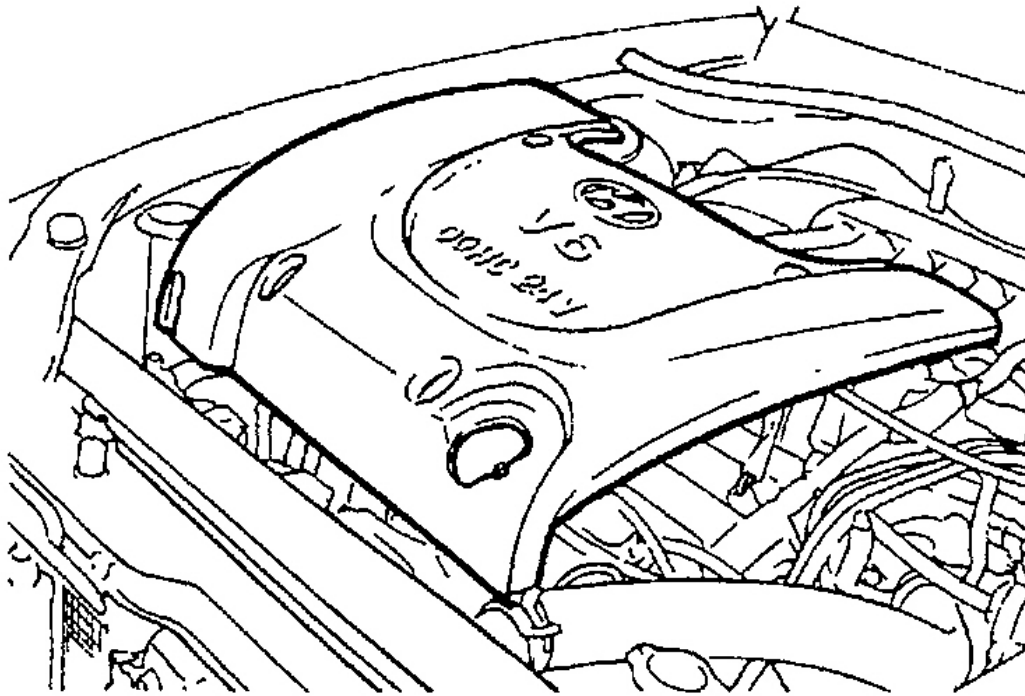
TORQUE : Nm (kg·cm, lb·ft)

G01153514

Fig. 56: Camshaft Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

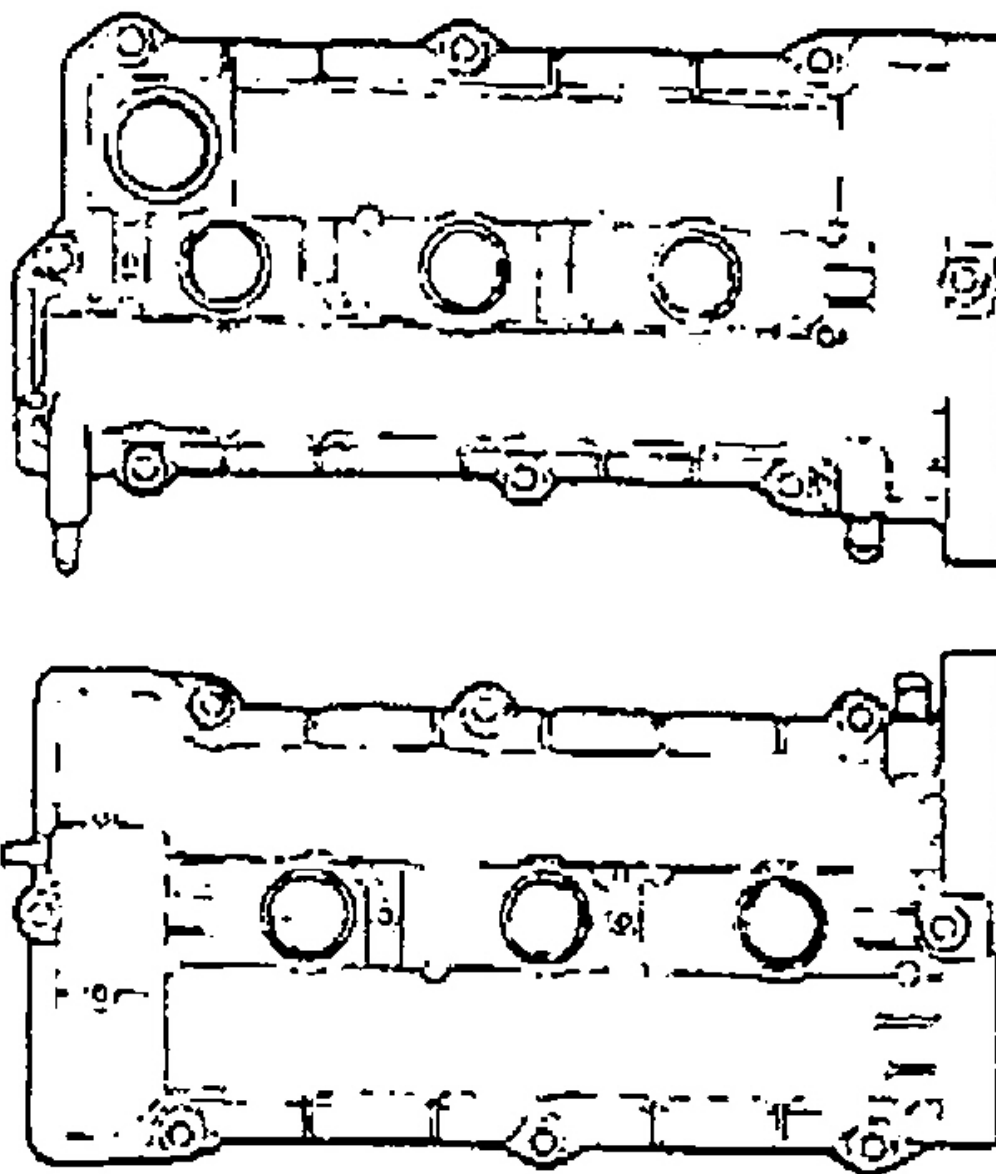
1. Remove the engine cover and intake manifold.



G01153515

Fig. 57: Identifying Engine Cover
Courtesy of HYUNDAI MOTOR CO.

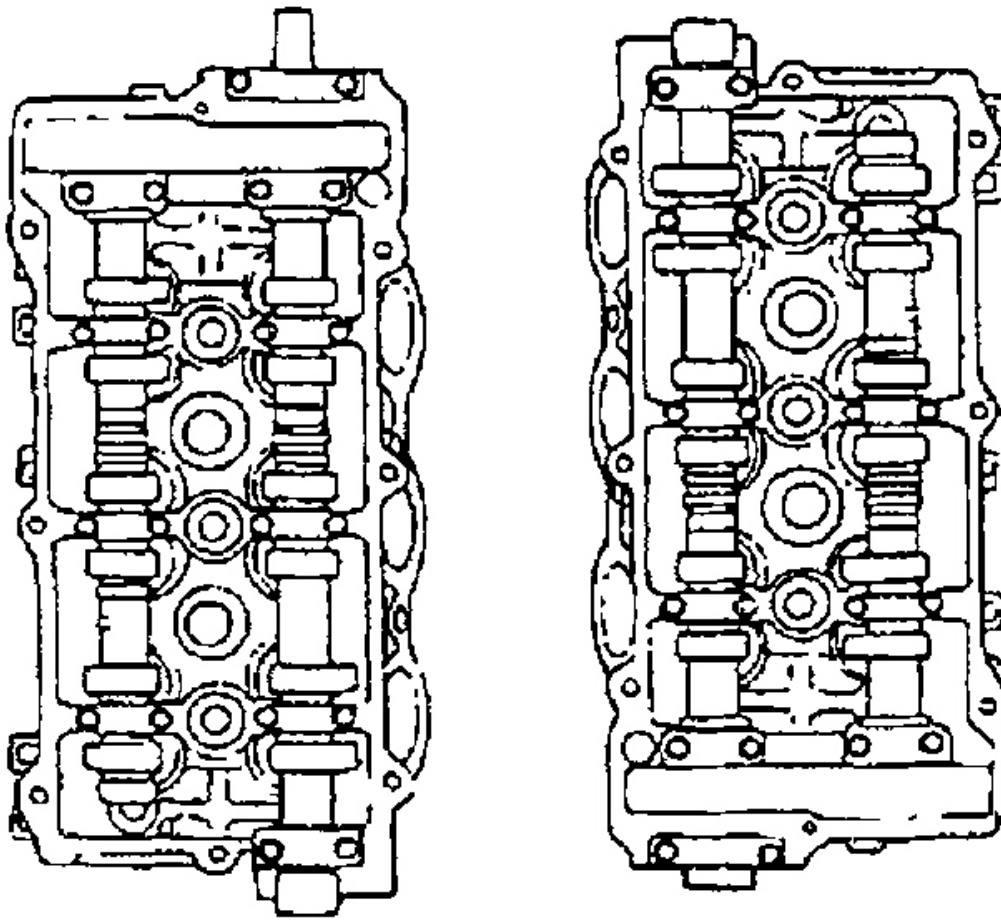
2. Disconnect the breather hose and the engine harness.
3. Remove the power steering pulley, air conditioner pulley, crankshaft pulley, idler pulley and tensioner pulley.
4. Remove the timing belt cover.
5. Loosen the auto tensioner.
6. Remove the timing belt from the camshaft sprocket.
7. Remove the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



G01153516

Fig. 58: Identifying Cylinder Head Covers
Courtesy of HYUNDAI MOTOR CO.

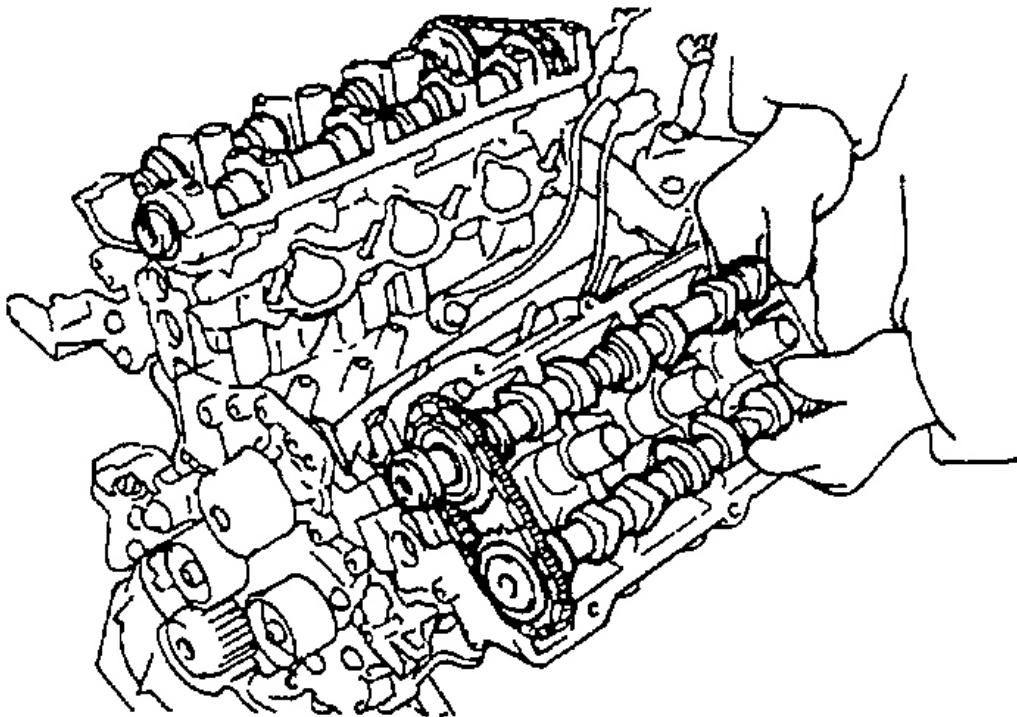
9. Remove the camshaft sprockets.
10. Remove the camshaft bearing caps.



G01153517

Fig. 59: View Of Camshafts In Cylinder Heads
Courtesy of HYUNDAI MOTOR CO.

11. Remove the camshafts.



G01153518

Fig. 60: Removing Camshafts
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

CAMSHAFTS

1. Check the camshaft journal 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

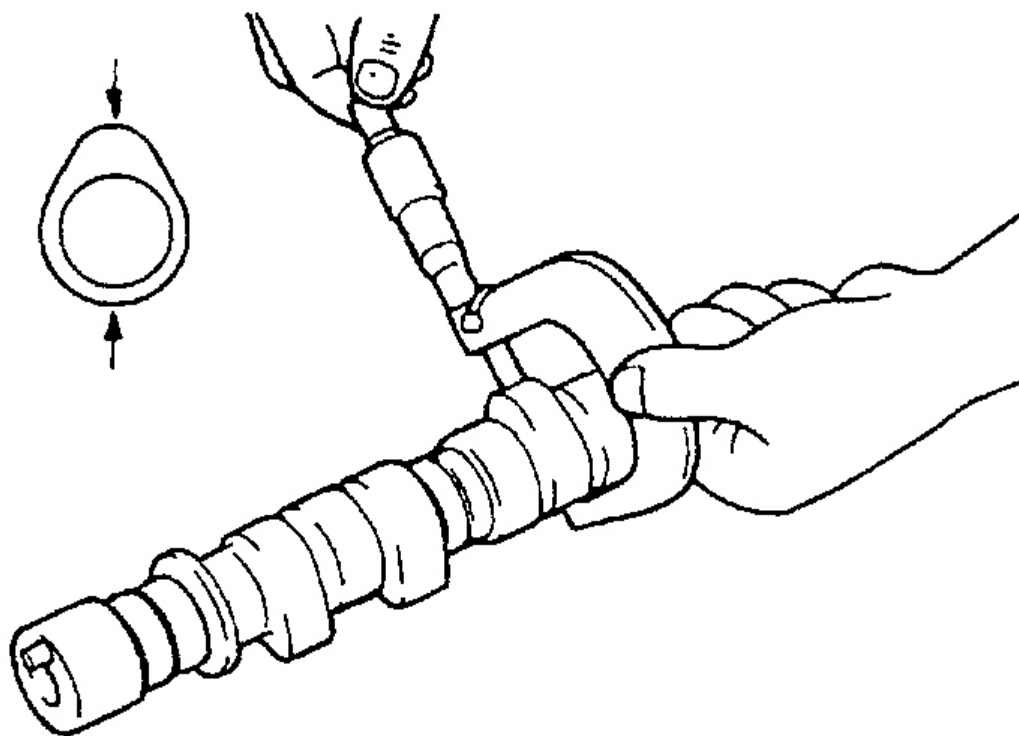
[Standard]

Intake: 43.95-44.15 mm (1.7303-1.7382 in.)

Exhaust: 43.95-44.15mm (1.7303-1.7382 in.)

[Limit]

Intake/Exhaust: 43.45 mm (1.7106 in.)



G01153519

Fig. 61: Measuring Cam Lobes
Courtesy of HYUNDAI MOTOR CO.

3. Check the arm 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.

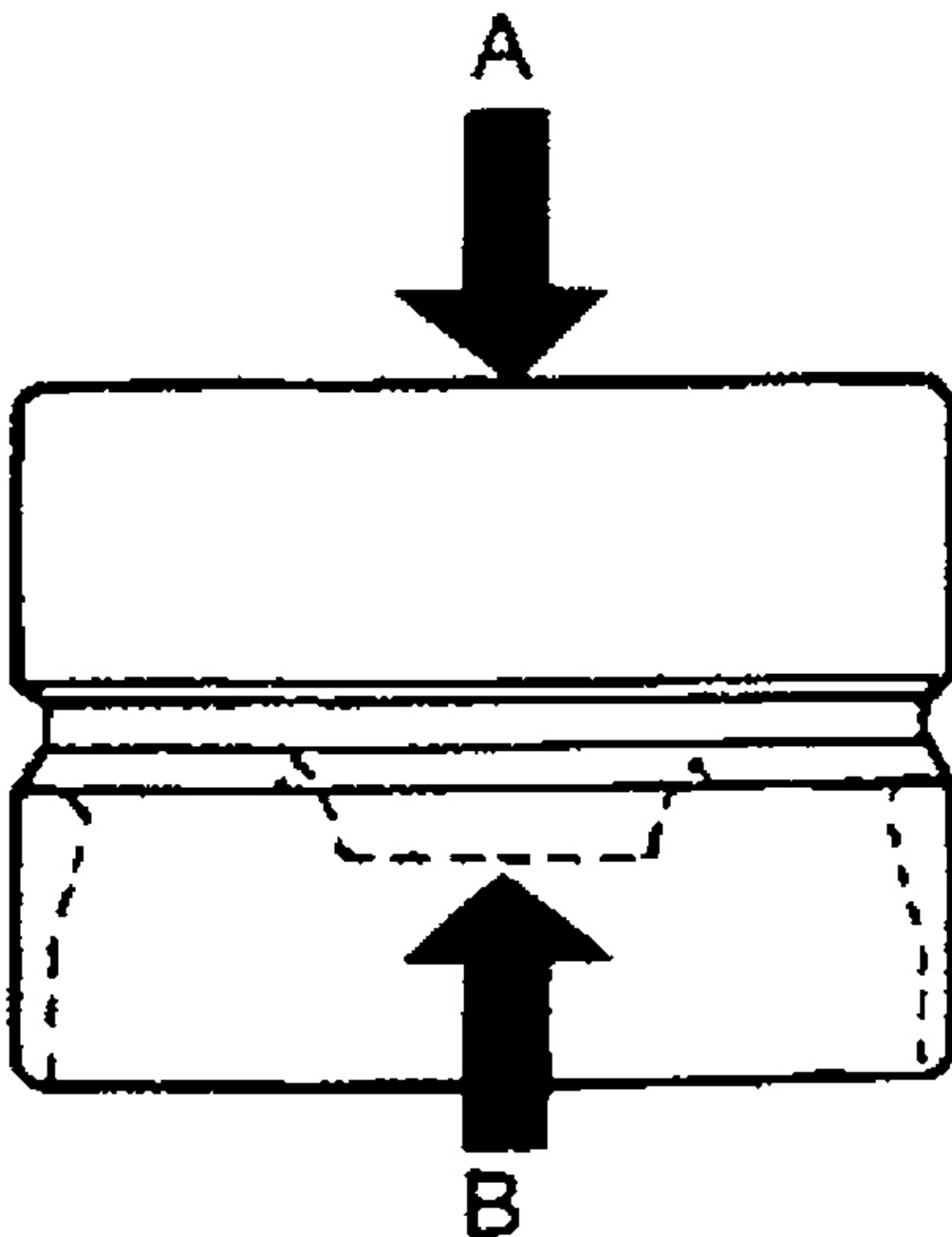
Camshaft end play: 0.1-0.15 mm (0.0039-0.0059 in.)

OIL SEAL (CAMSHAFT FRONT)

1. Check the lips for wear. If lip threads are worn out, replace the oil sea 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.



G01153520

Fig. 62: Checking Hydraulic Lash Adjuster
Courtesy of HYUNDAI MOTOR CO.

2002 Hyundai Sonata

2002 ENGINES 2.7L V6 - Sonata

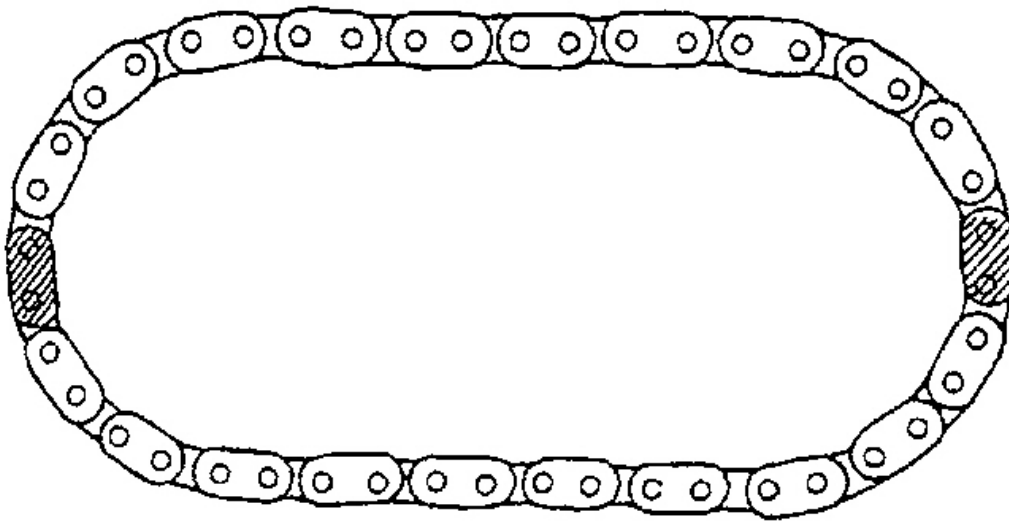
Problem	Possible cause	Action
1. Temporary noise when starting a cold engine	Normal	This noise will disappear after the oil in the engine reaches the normal pressure.
2. Continuous noise when the engine is started after parking more than 48 hours.	Oil leakage of the high pressure chamber on the HLA, 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 <i>Do not run engine at a speed higher than 3000 rpm, as this may damage the HLA.</i>
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 <i>Be careful with the hot HLAS.</i>

G01153521

Fig. 63: Engine Noise Symptom Chart
 Courtesy of HYUNDAI MOTOR CO.

TIMING CHAIN

Check the bushing and plate of timing chain for wear. Replace if there is severe wear.

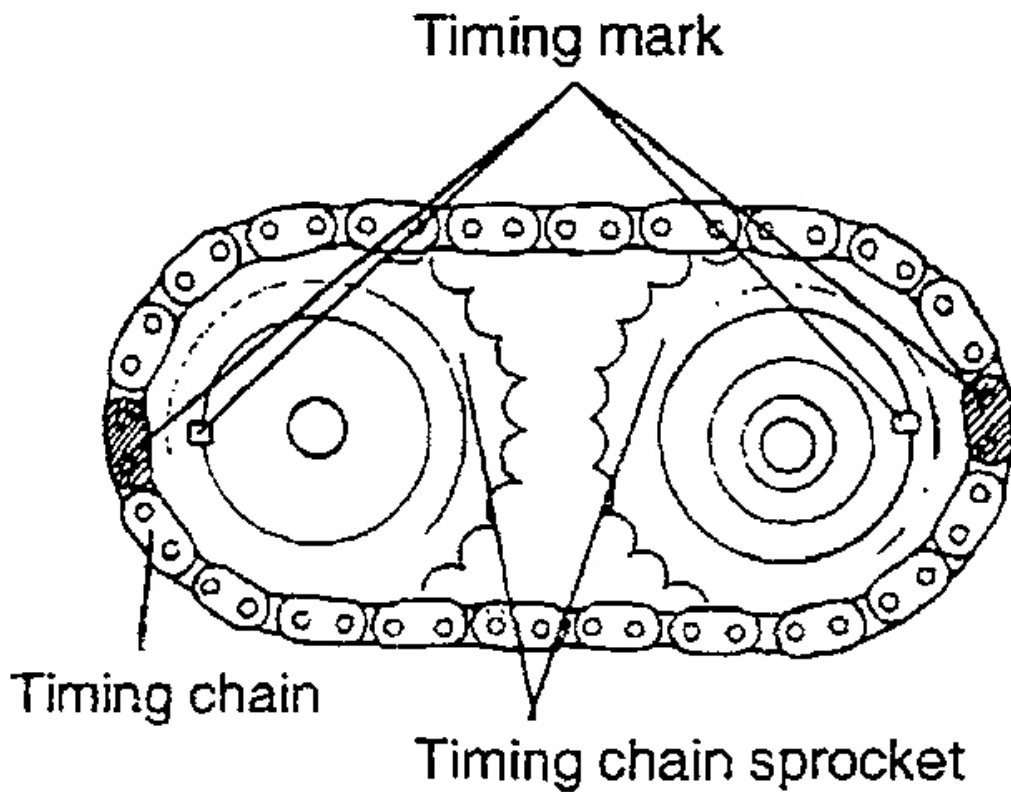


G01153522

Fig. 64: View Of Timing Chain
Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

1. Install the HLA.
2. Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown in the illustration.



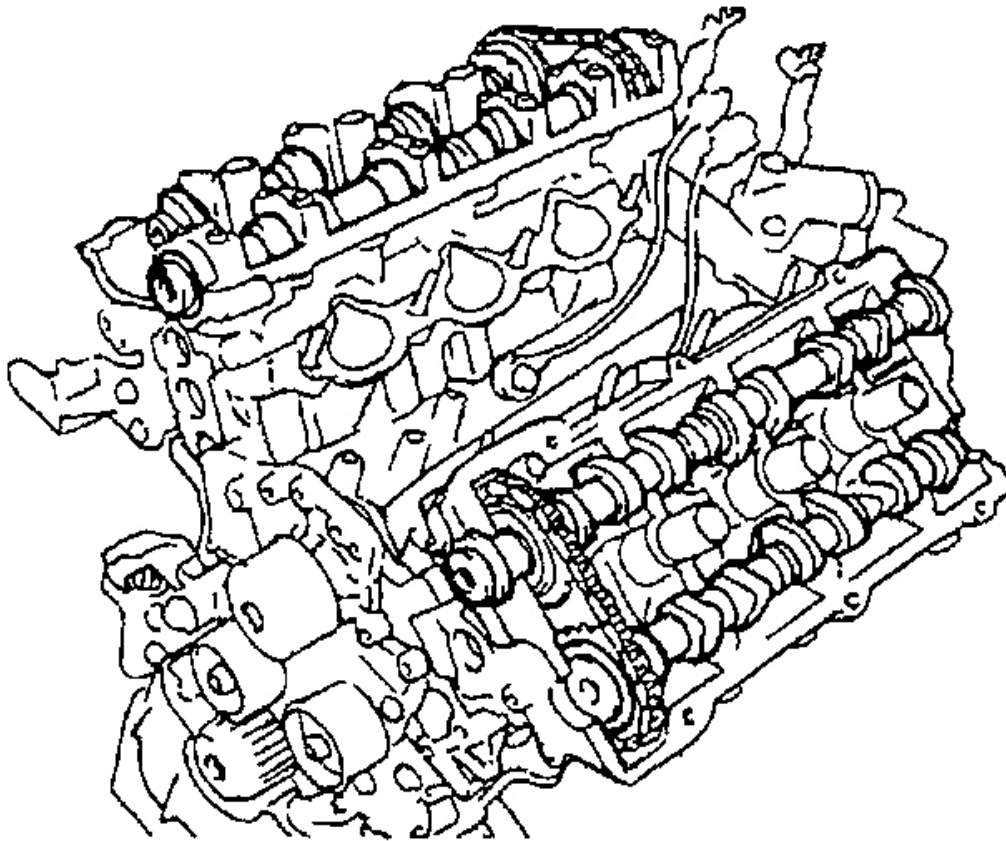
G01153523

Fig. 65: Identifying Timing Marks On Chain & Sprockets

Courtesy of HYUNDAI MOTOR CO.

3. Install the camshafts after lubricating the journals of the camshaft with engine oil.

NOTE: To check the press fit, the camshaft (IN) and timing chain sprocket should be separable by a force greater than 100 kg (MIN.) at room temperature.



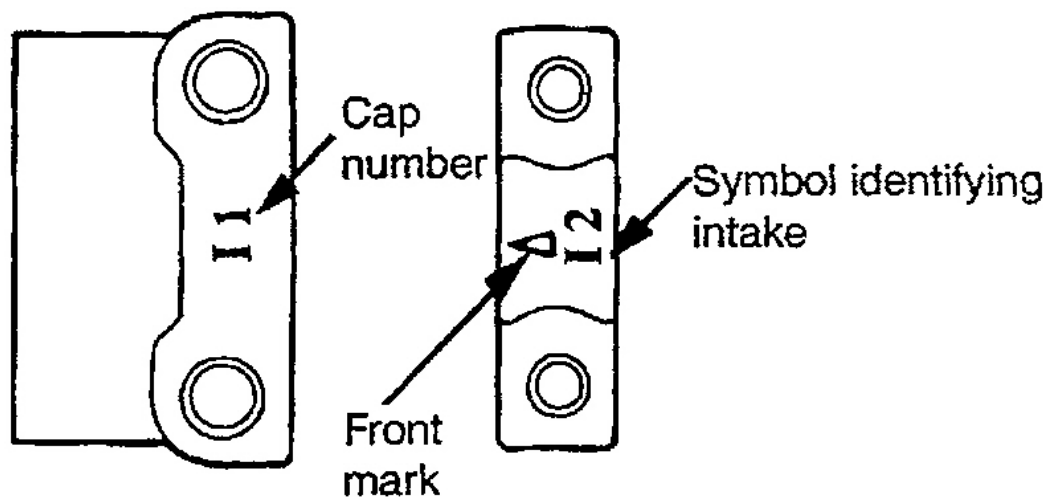
G01153524

Fig. 66: View Of Camshafts In Cylinder Heads
Courtesy of HYUNDAI MOTOR CO.

4. Install the bearing caps. Check the markings on the caps for intake/exhaust identification symbol.

I: Intake camshaft

E: Exhaust camshaft



G01153525

Fig. 67: Bearing Cap Identification Marks
Courtesy of HYUNDAI MOTOR CO.

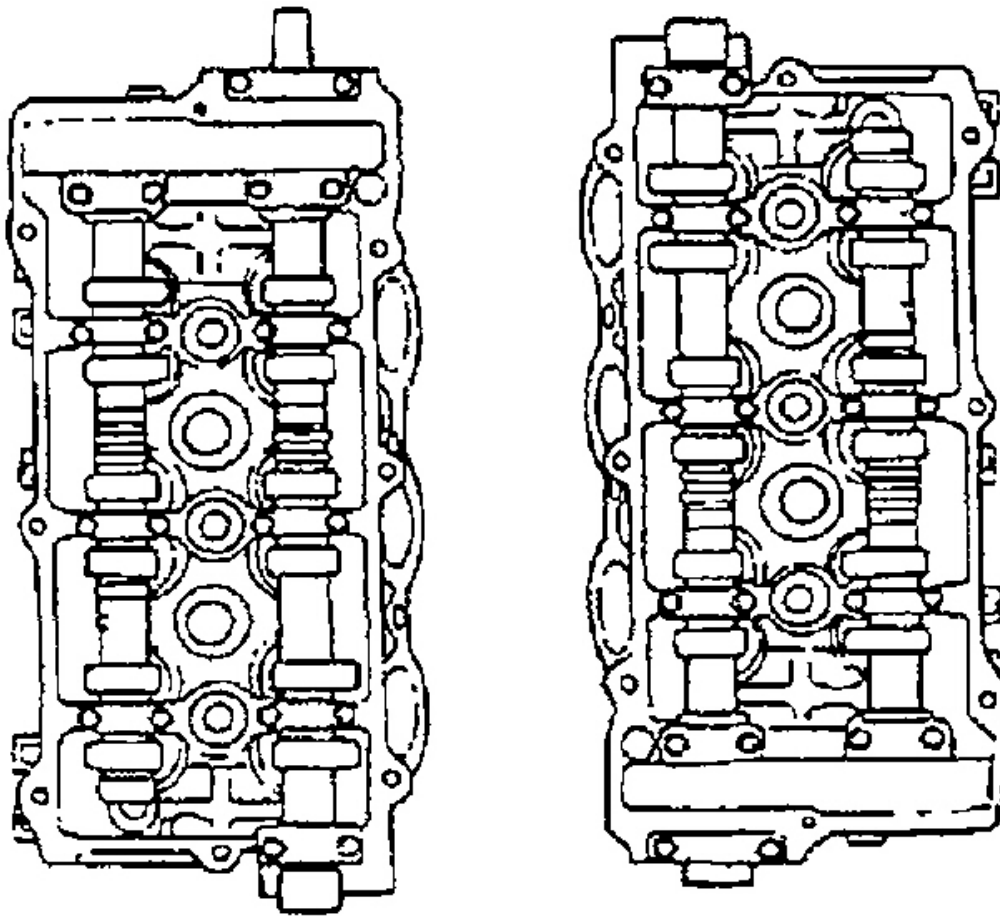
5. Tighten the bearing caps to the specified torque in two or three increments as shown.

Tightening torque

Bearing cap bolt

M 10: 14-16 Nm (140-160 kg.cm, 10-12 lb.ft)

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

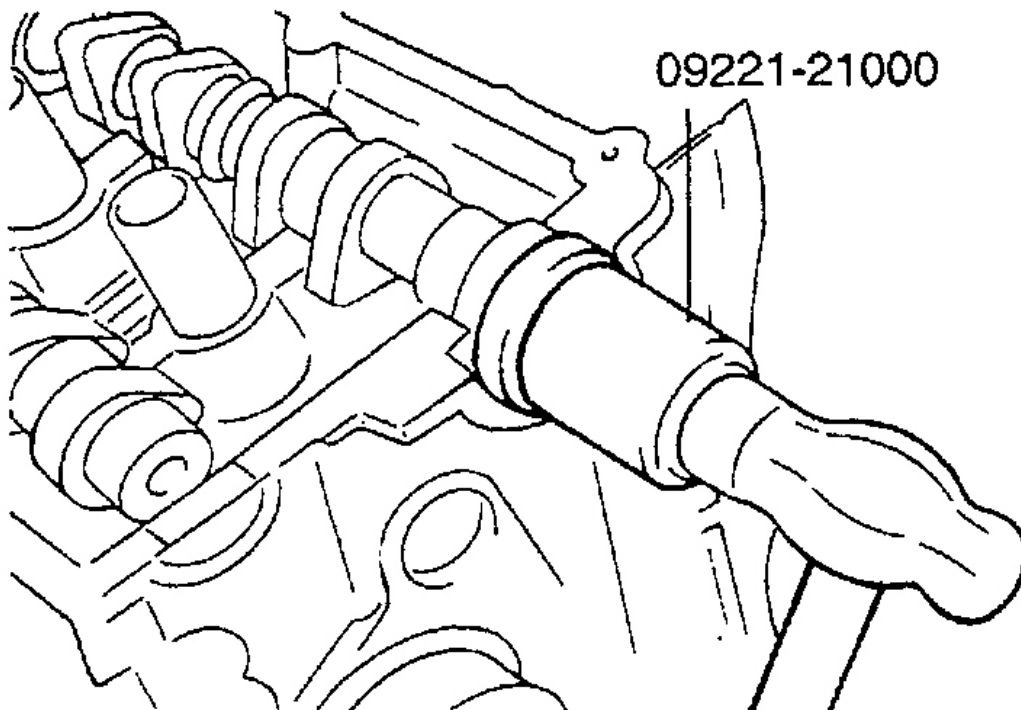


G01153526

Fig. 68: View Of Camshafts In Cylinder Head
Courtesy of HYUNDAI MOTOR CO.

6. Using the special tool, the camshaft oil seal installer (09221-21000), install the camshaft oil seal. Be sure to apply engine oil to the external surface of the oil seal.

Insert the oil seal along the camshaft front end and install it with a hammer until it is seated.



G01153527

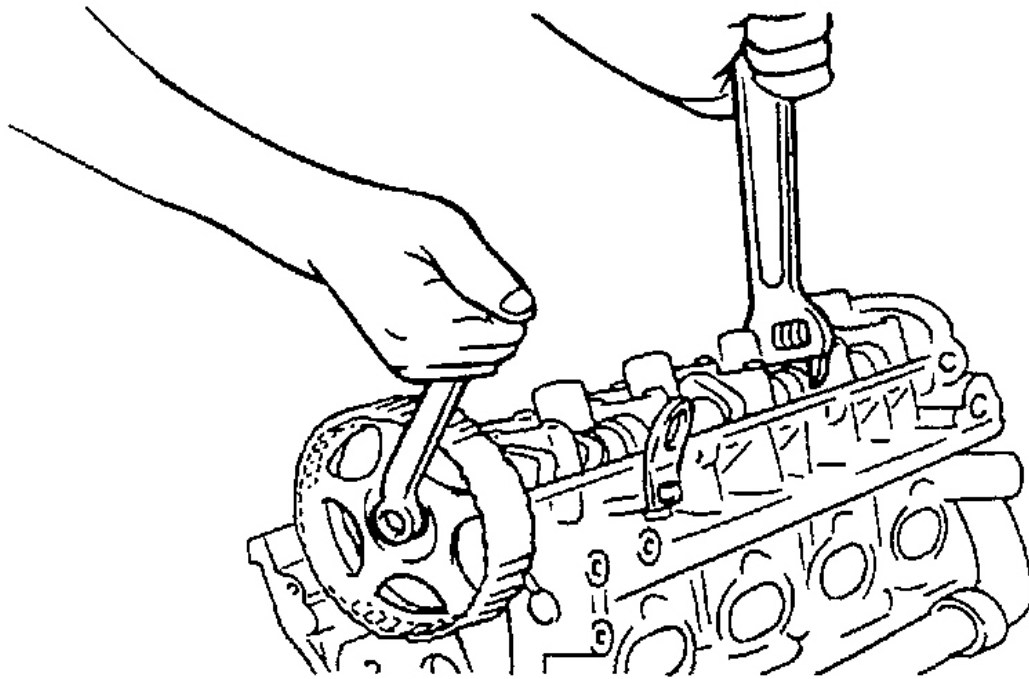
Fig. 69: Installing Camshaft Oil Seal
Courtesy of HYUNDAI MOTOR CO.

7. Install the camshaft sprocket to the specified torque.

Tightening torque

Camshaft sprocket bolt:

90-110 Nm (900-1100 kg.cm, 65-80 lb.ft)



G01153528

Fig. 70: Installing Camshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

8. Install the cylinder head cover.

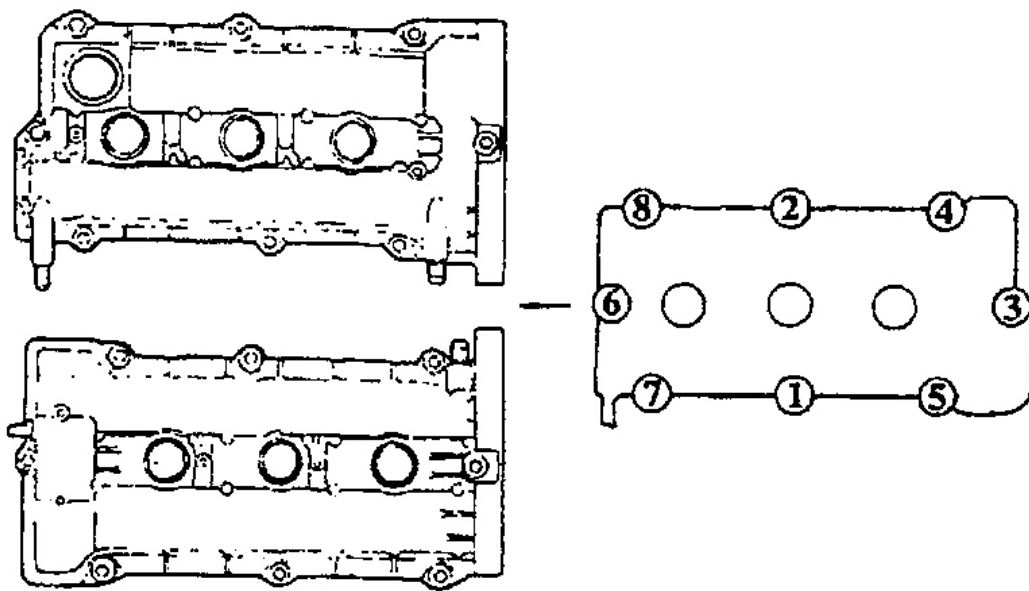
Tightening torque

Cylinder head cover bolts:

5-6 Nm (50-60 kg.cm, 3.6-4.4 lb.ft)

TIGHTENING PROCEDURE

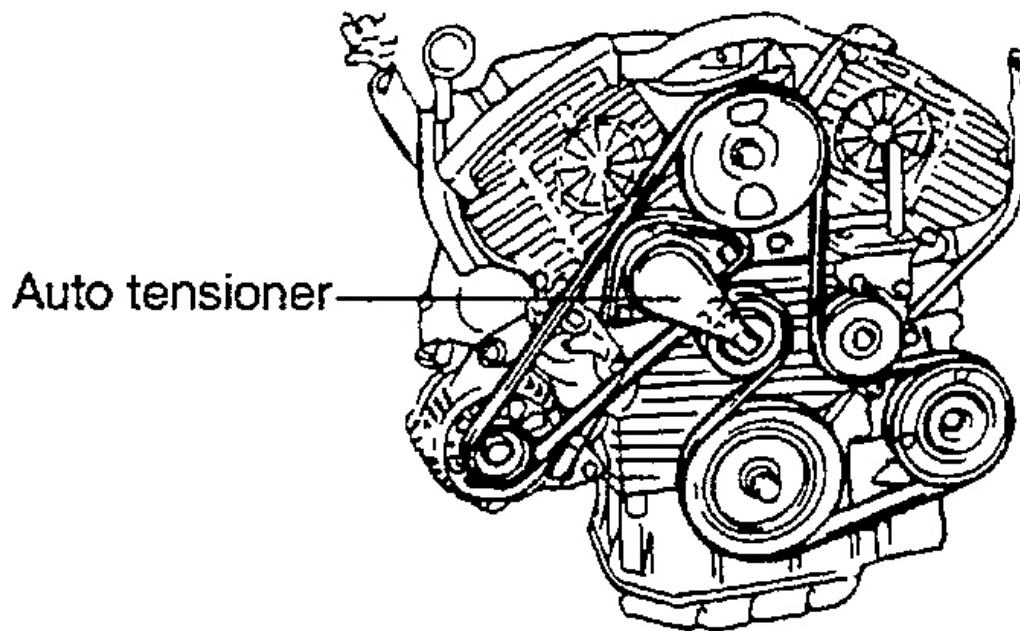
1. Tighten all bolts temporarily to half of the specified torque in the sequence 1.2.3.4.5.6.7.8
2. Retighten all bolts to the specified torque.



G01153529

Fig. 71: Cylinder Head Cover Bolt Tightening Sequence
Courtesy of HYUNDAI MOTOR CO.

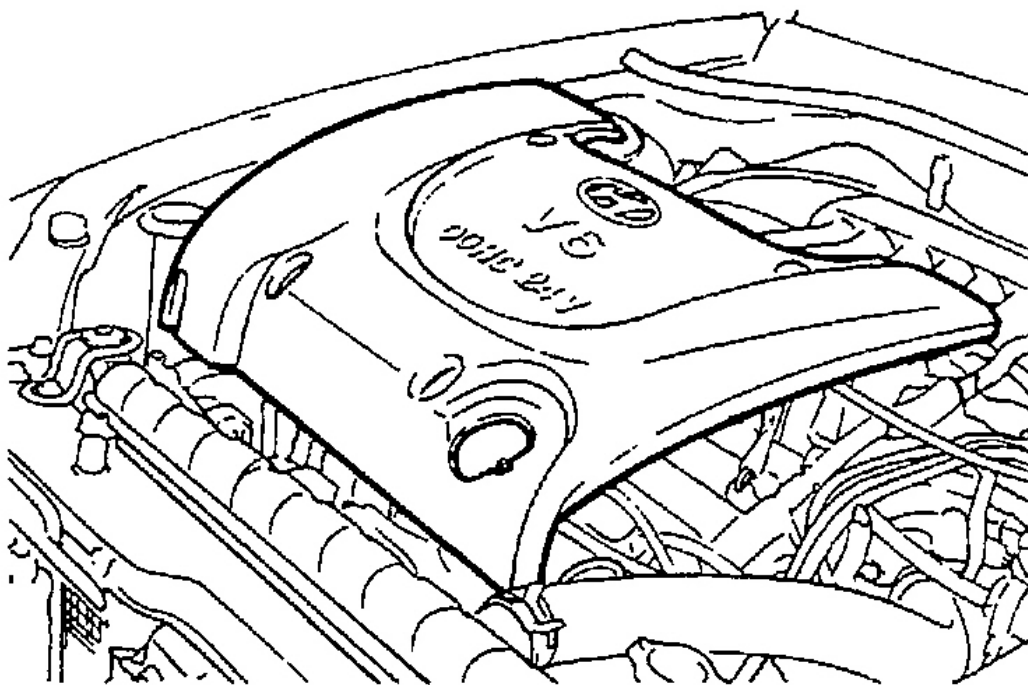
3. Install the park plug cables and, center cover.
4. Install the timing belt and then tighten the auto tensioner pulley.
5. Install the timing belt cover.
6. Install the power steering pulley, air conditioner pulley, crankshaft pulley and tensioner pulley.



G01153530

Fig. 72: Identifying Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.

7. Connect the breather hose and engine harness.



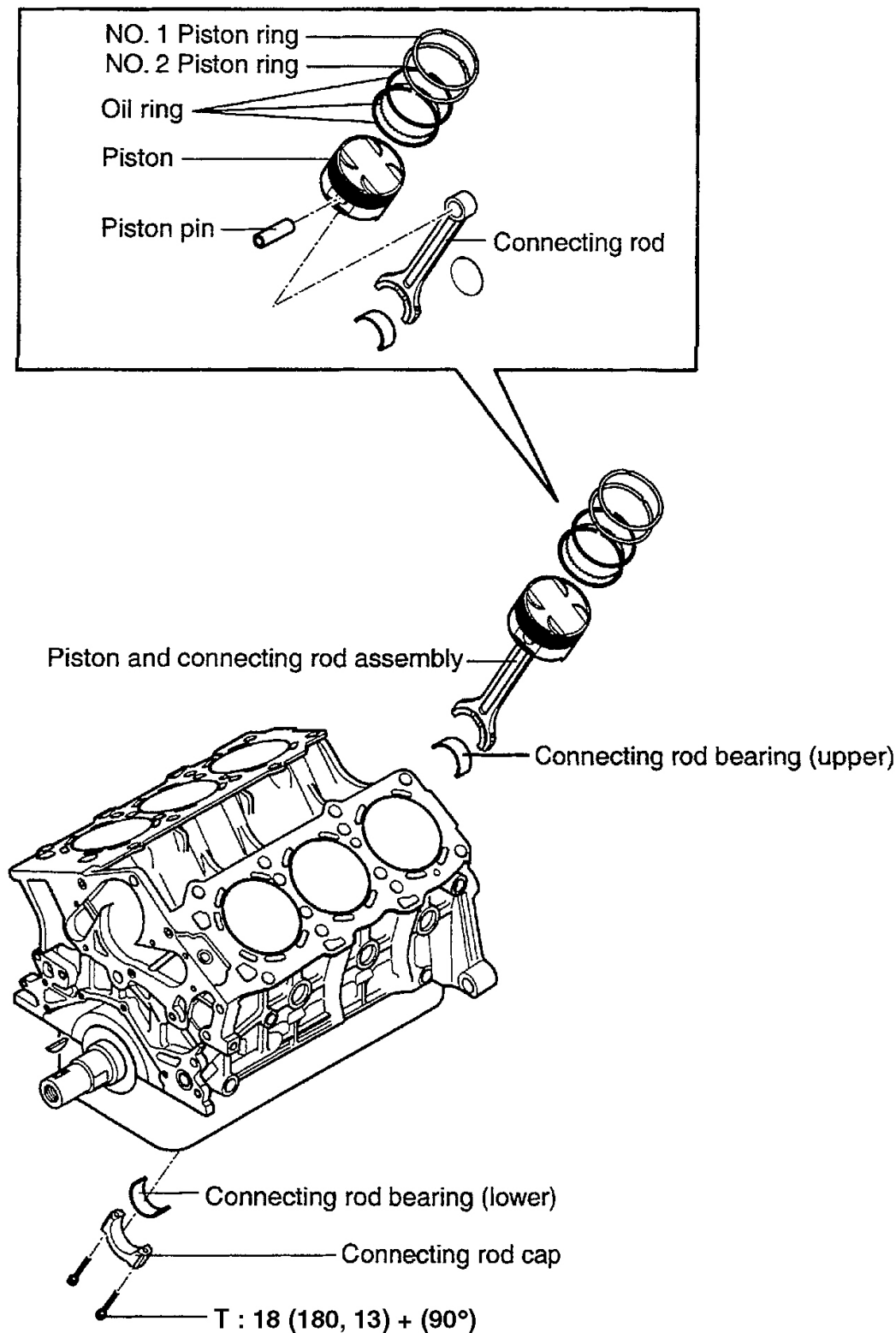
G01153531

Fig. 73: Identifying Engine Cover
Courtesy of HYUNDAI MOTOR CO.

8. Install the intake manifold and engine cover.

CONNECTING ROD

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

G01153532

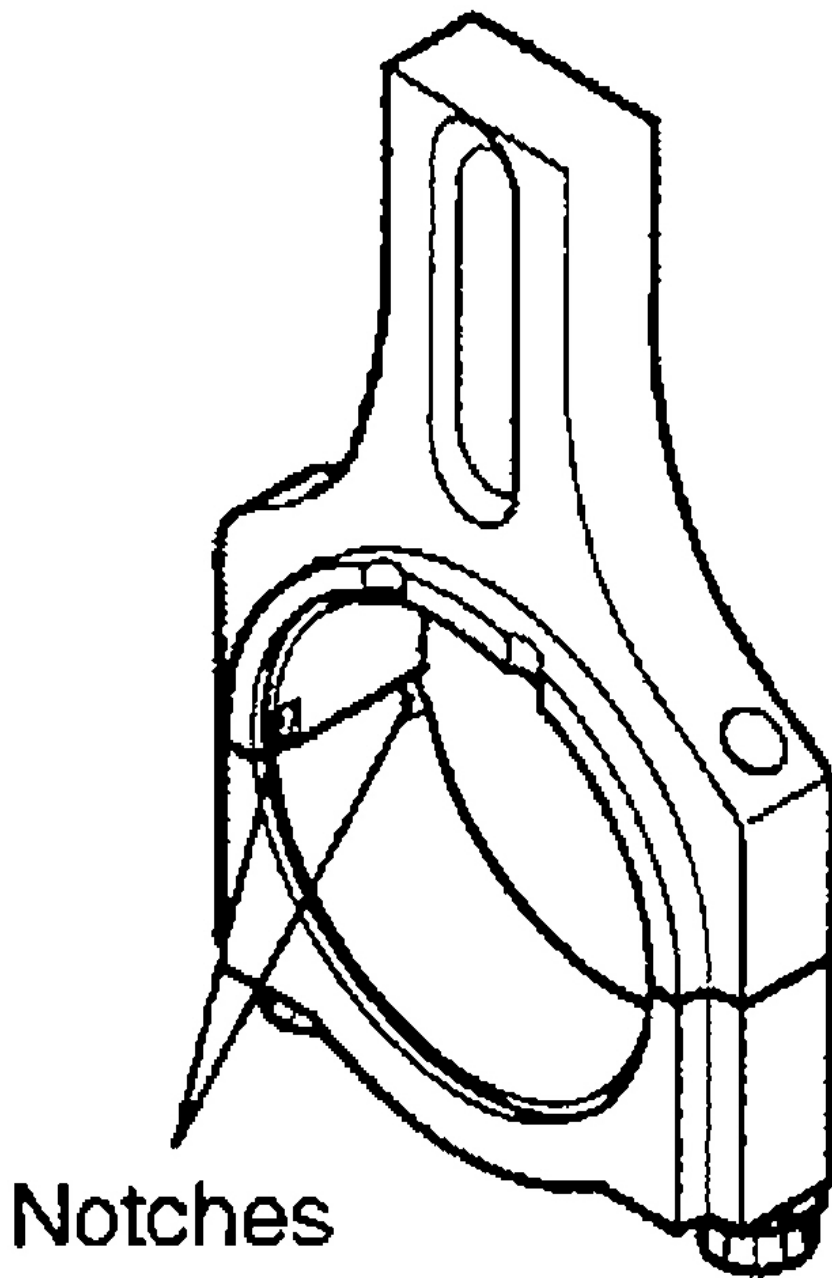
Fig. 74: Connecting Rod Components
Courtesy of HYUNDAI MOTOR CO.

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 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.

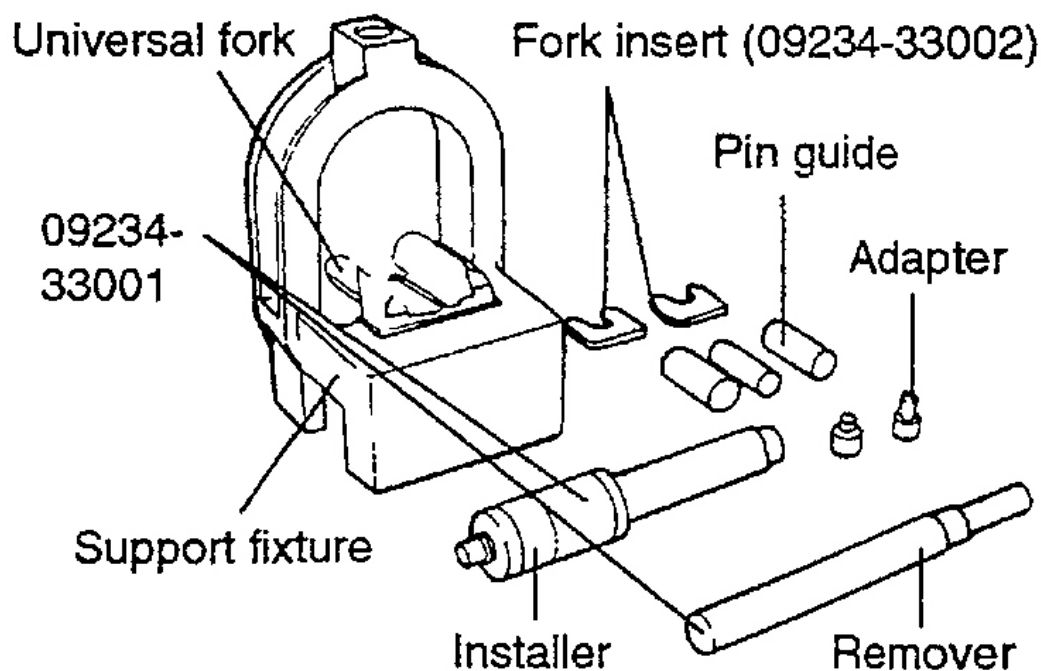


G01153533

Fig. 75: Identifying Connecting Rod Bearing Notches
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY & REASSEMBLY OF THE PISTON PIN

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

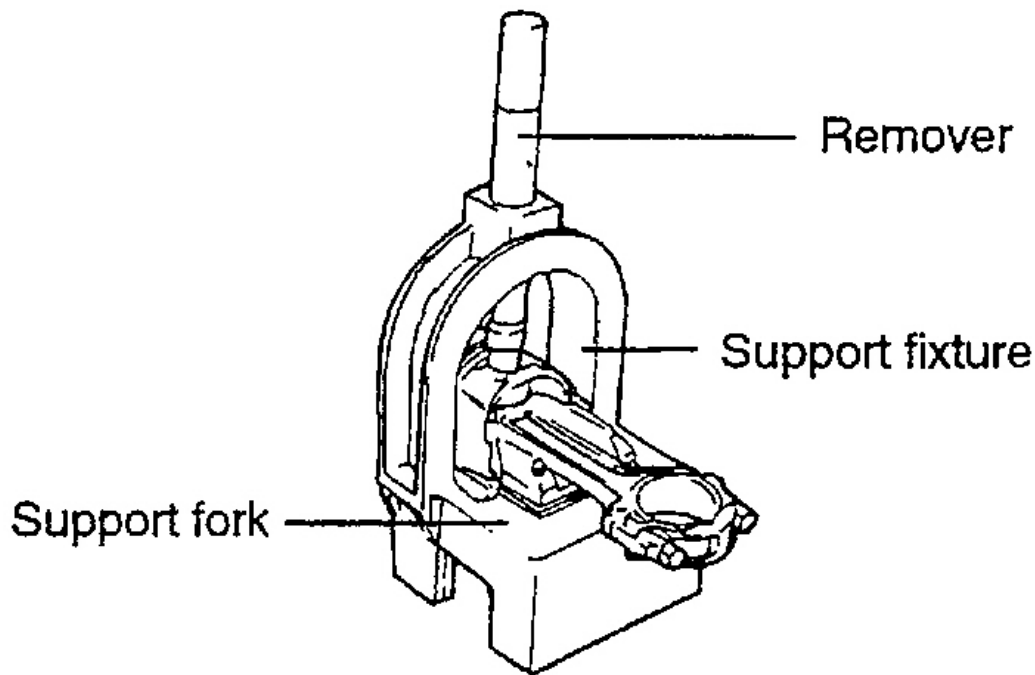


G01153534

Fig. 76: identifying Special Tools

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 at 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 picture and use it to press out the pin.



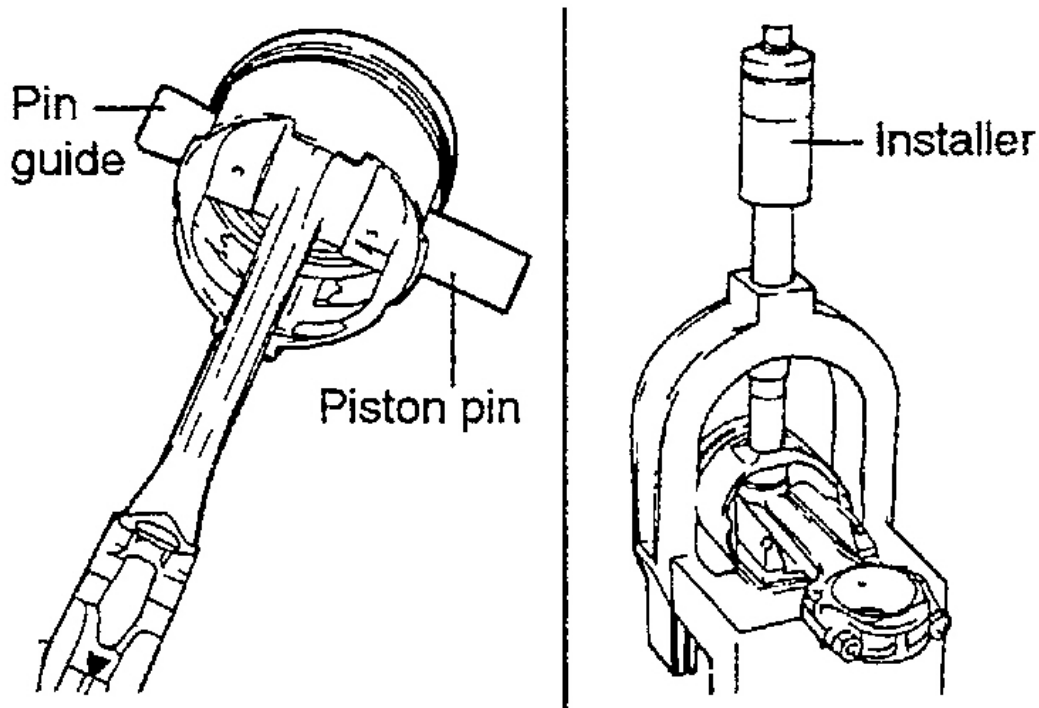
G01153535

Fig. 77: Removing Piston Pin

Courtesy of HYUNDAI MOTOR CO.

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

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



G01153536

Fig. 78: Installing Piston Pin

Courtesy of HYUNDAI MOTOR CO.

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

CAUTION: Do not exceed 1250 +/- 500 kg (2765 +/- 1100 lb) of force when the installing tool seats against the top of the arch.

INSPECTION

PISTONS & PISTON PINS

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

PISTON RINGS

1. Measure the piston rings 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 (0.0031 in.)

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

[Limit]

No. 1 : 0.1 mm (0.004 in.)

No. 2 : 0.1 mm (0.004 in.)

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

Piston ring end gap

[Standard dimensions]

No. 1 : 0.20-0.35 mm (0.0097-0.0138 in.)

No. 2 : 0.37-0.52 mm (0.0146-0.0205 in.)

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

[Limit]

No. 1, No. 2 : 0.8 mm (0.0079-0.0138 in.)

Oil ring side rail: 1.0 mm (0.039 in)

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

PISTON RING SERVICE SIZE & MARK

2002 Hyundai Sonata

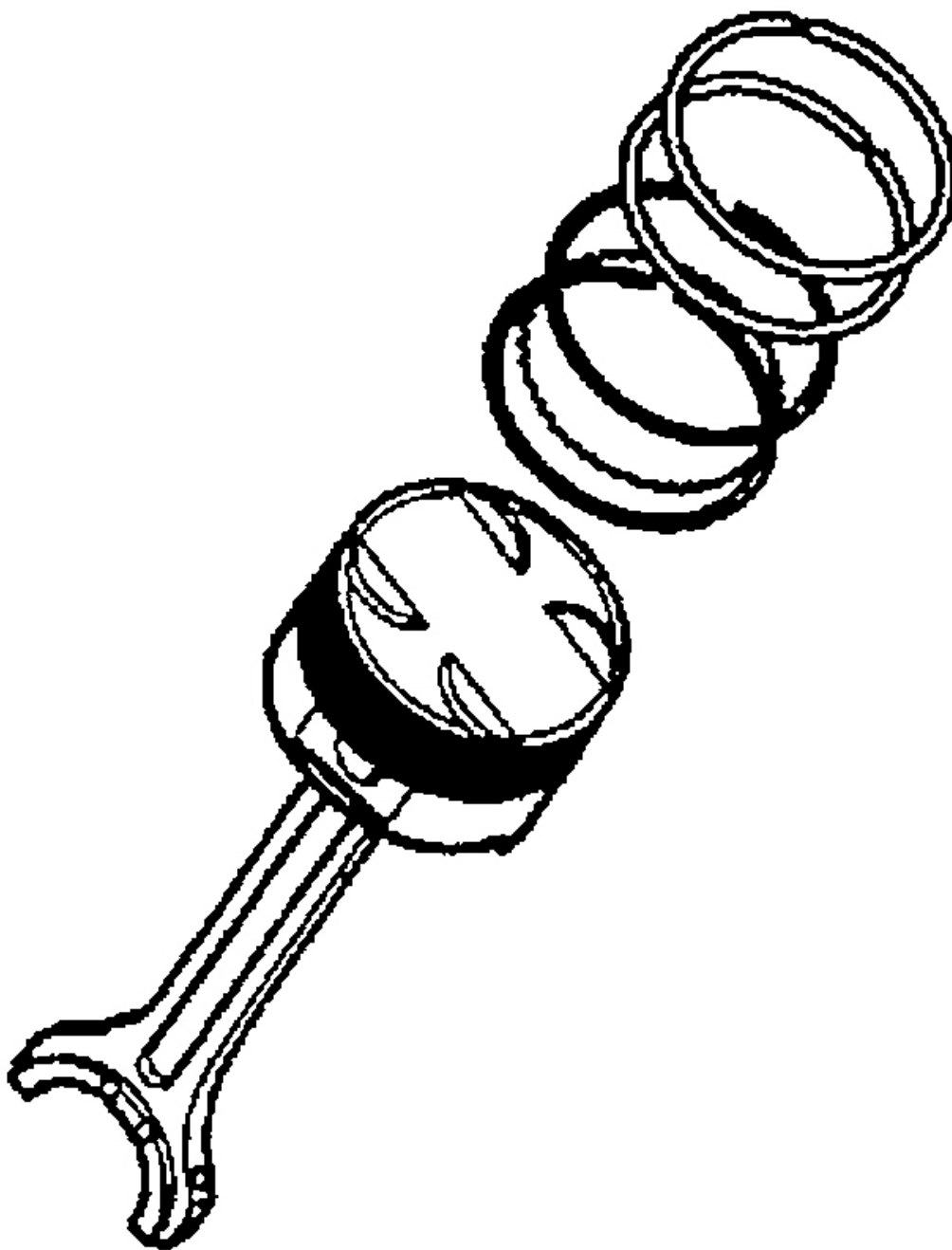
2002 ENGINES 2.7L V6 - Sonata

Standard	None
0.25mm (0.010 in.) O.S	25
0.50mm (0.020 in.) O.S	50

G01153537

Fig. 79: Piston Ring Service Size Table
Courtesy of HYUNDAI MOTOR CO.

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

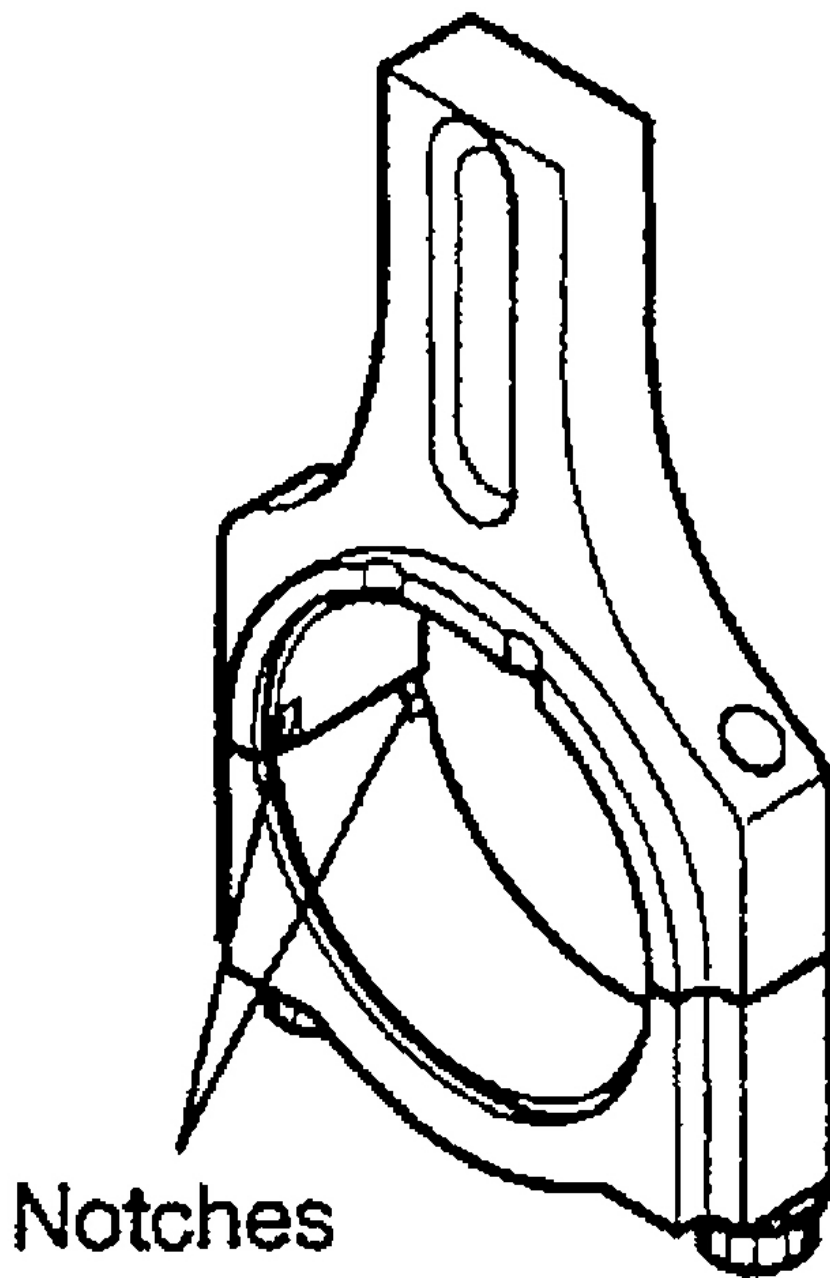


G01153538

Fig. 80: View Of Piston & Rings
Courtesy of HYUNDAI MOTOR CO.

CONNECTING RODS

1. When the connecting rod cap is installed, make sure that the cylinder numbers, 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 thrust 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.

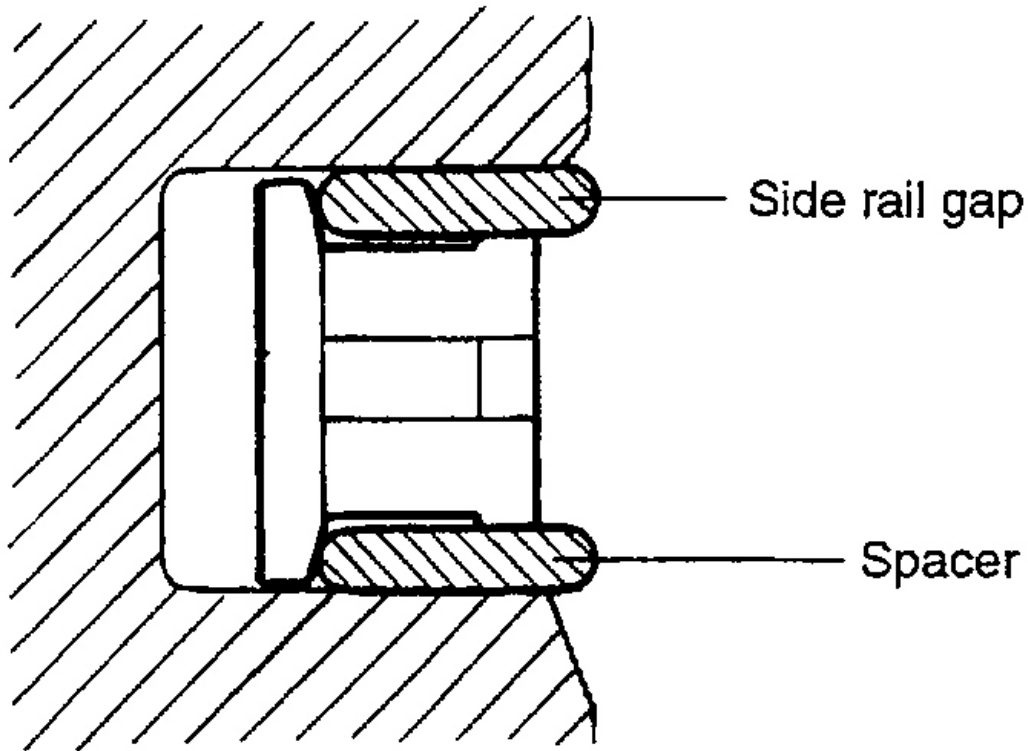


G01153539

Fig. 81: Identifying Connecting Rod Bearing Notches
Courtesy of HYUNDAI MOTOR CO.

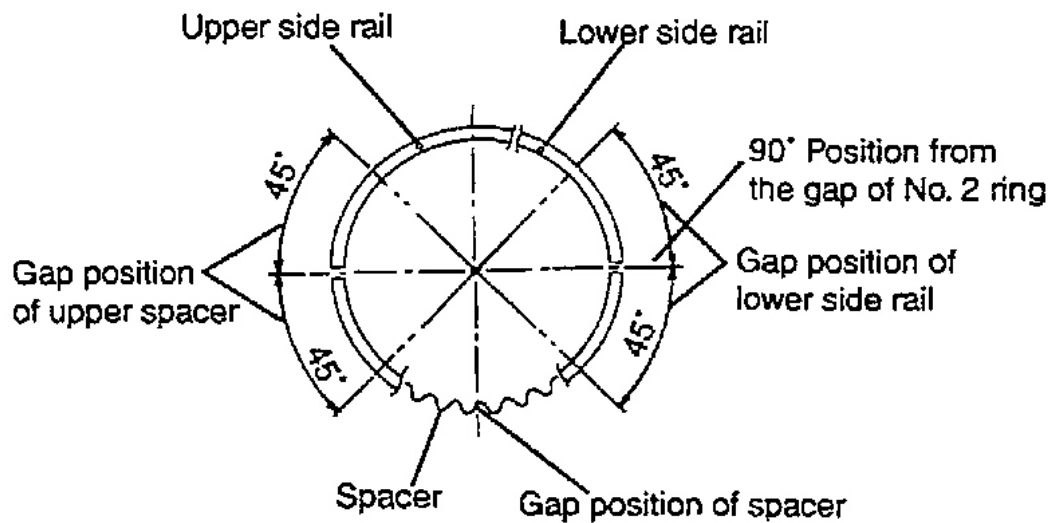
REASSEMBLY

1. Install the spacer.



G01153540

Fig. 82: Identifying Spacer Installation (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



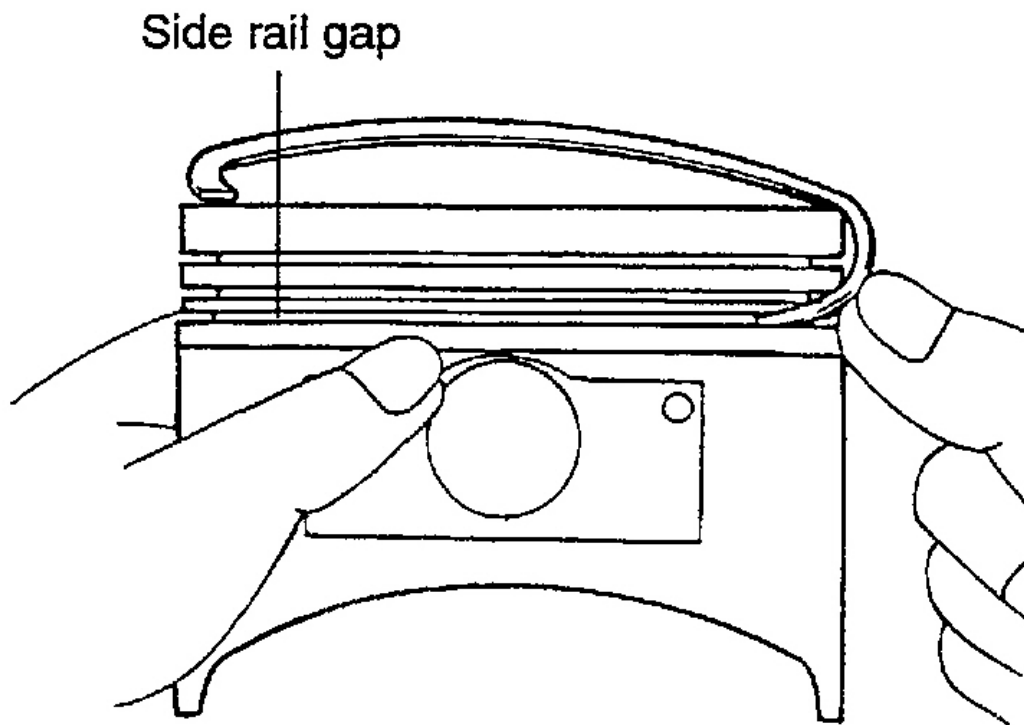
G01153541

Fig. 83: Identifying Spacer Installation (2 Of 2)
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 expander when installing the side rail.

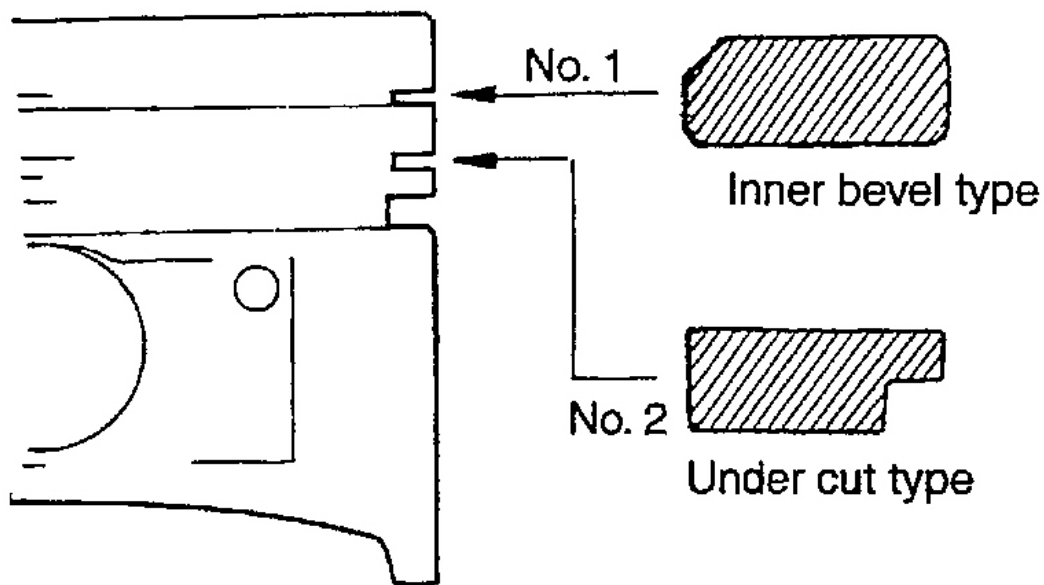
3. Install the lower side rail by the same procedure described in Step 2.



G01153542

Fig. 84: Installing 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.



G01153543

Fig. 85: Identifying Piston Rings

Courtesy of HYUNDAI MOTOR CO.

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

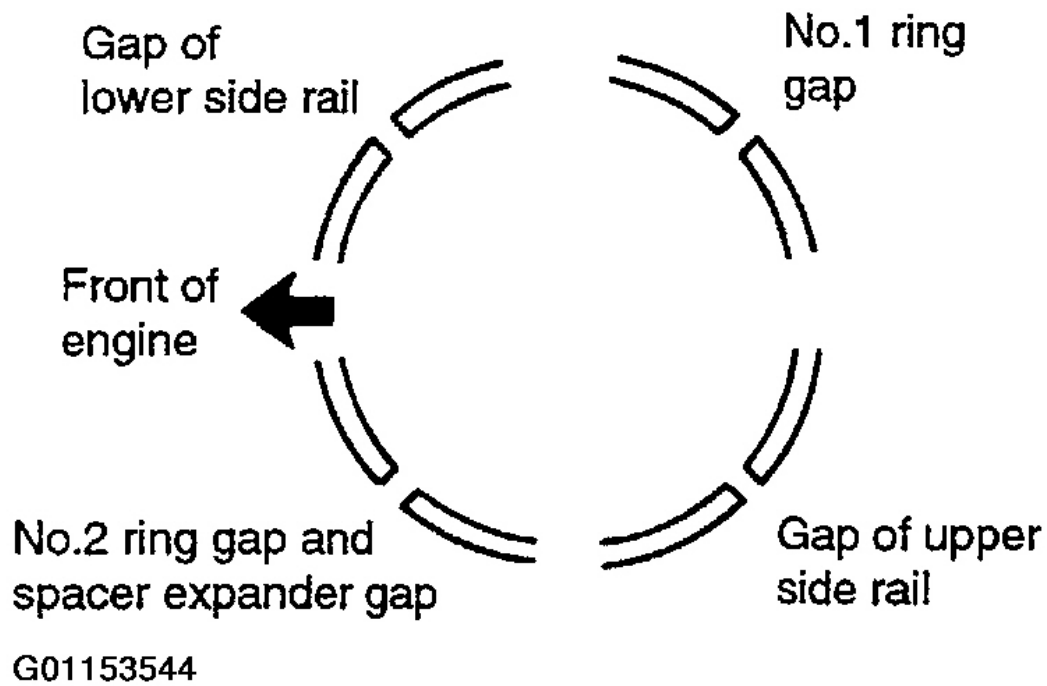
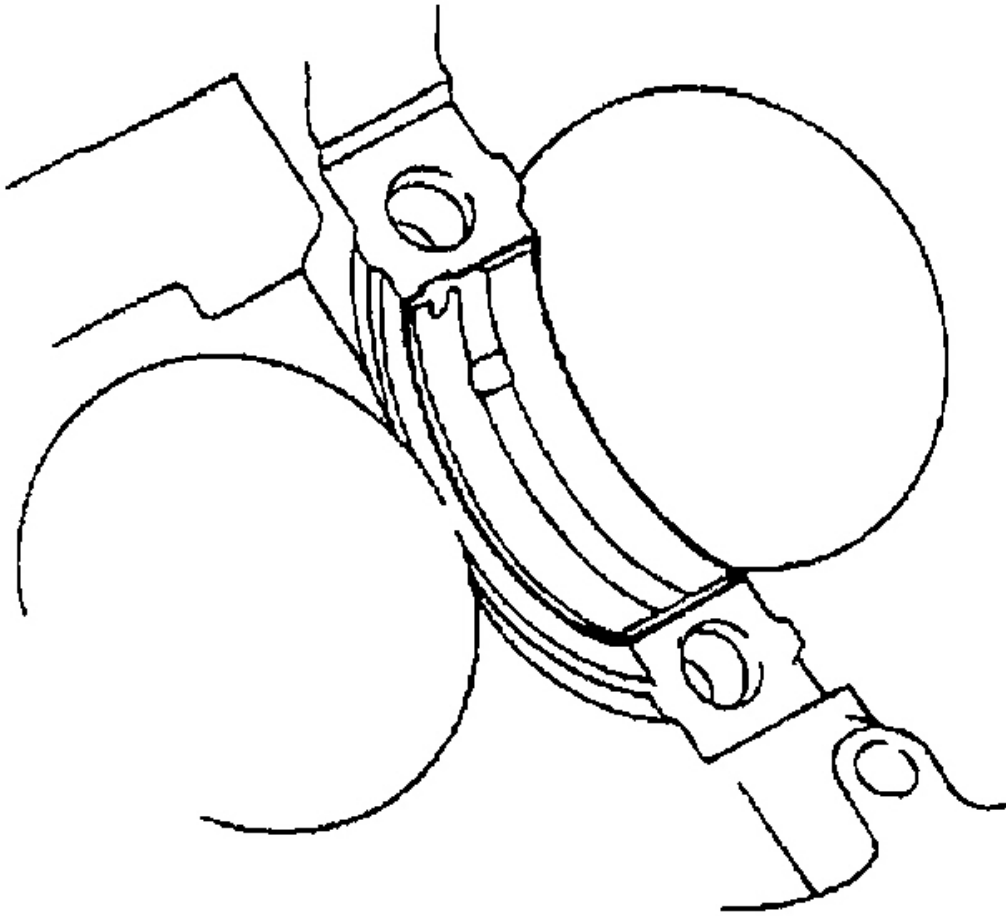


Fig. 86: Identifying Piston Installation
Courtesy of HYUNDAI MOTOR CO.

9. Install the upper main bearing in the cylinder block.
10. Install the lower main bearing in the main bearing caps.

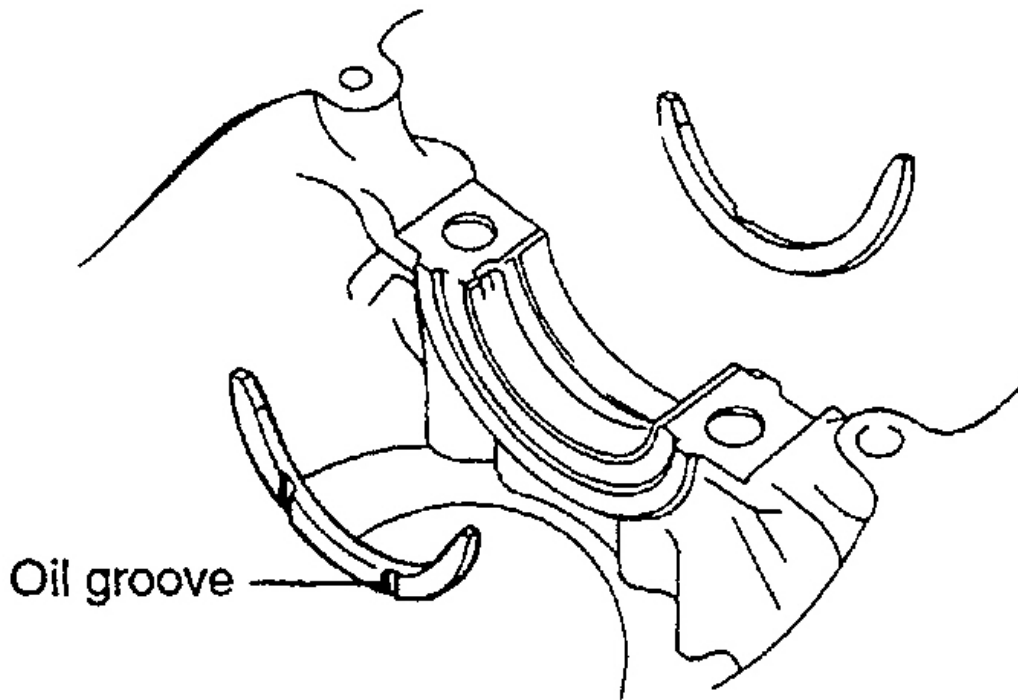
CAUTION: Install the bearing so it matches the oil in the block.



G01153545

Fig. 87: 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.



G01153546

Fig. 88: Installing Crankshaft Thrust Washers
Courtesy of HYUNDAI MOTOR CO.

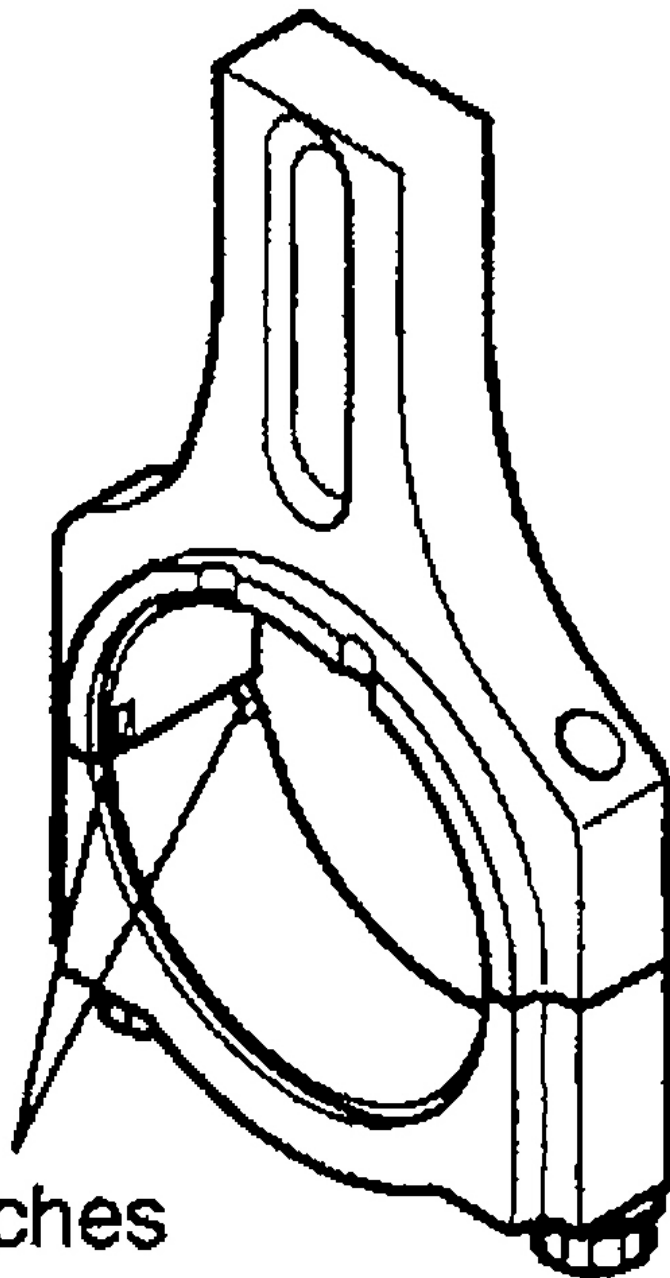
12. Make sure that the front mark of the piston and the front mark (identification mark) of the connecting rod are directed toward the from of the engine.
13. When the connecting rod cap is installed, make sure that any cylinder numbers placed on the rod and cap at disassembly match.
14. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
15. When assembling, bolts could 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:

18 Nm (180 kg.cm, 13 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.



Notches

G01153547

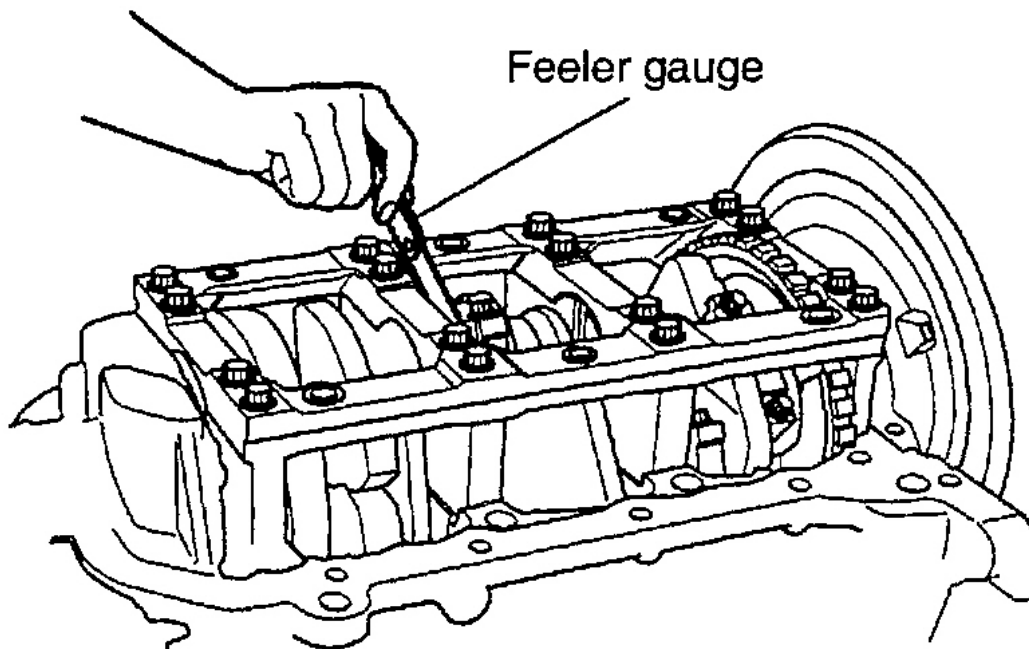
Fig. 89: Identifying Connecting Rod Bearing Notches
Courtesy of HYUNDAI MOTOR CO.

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.)

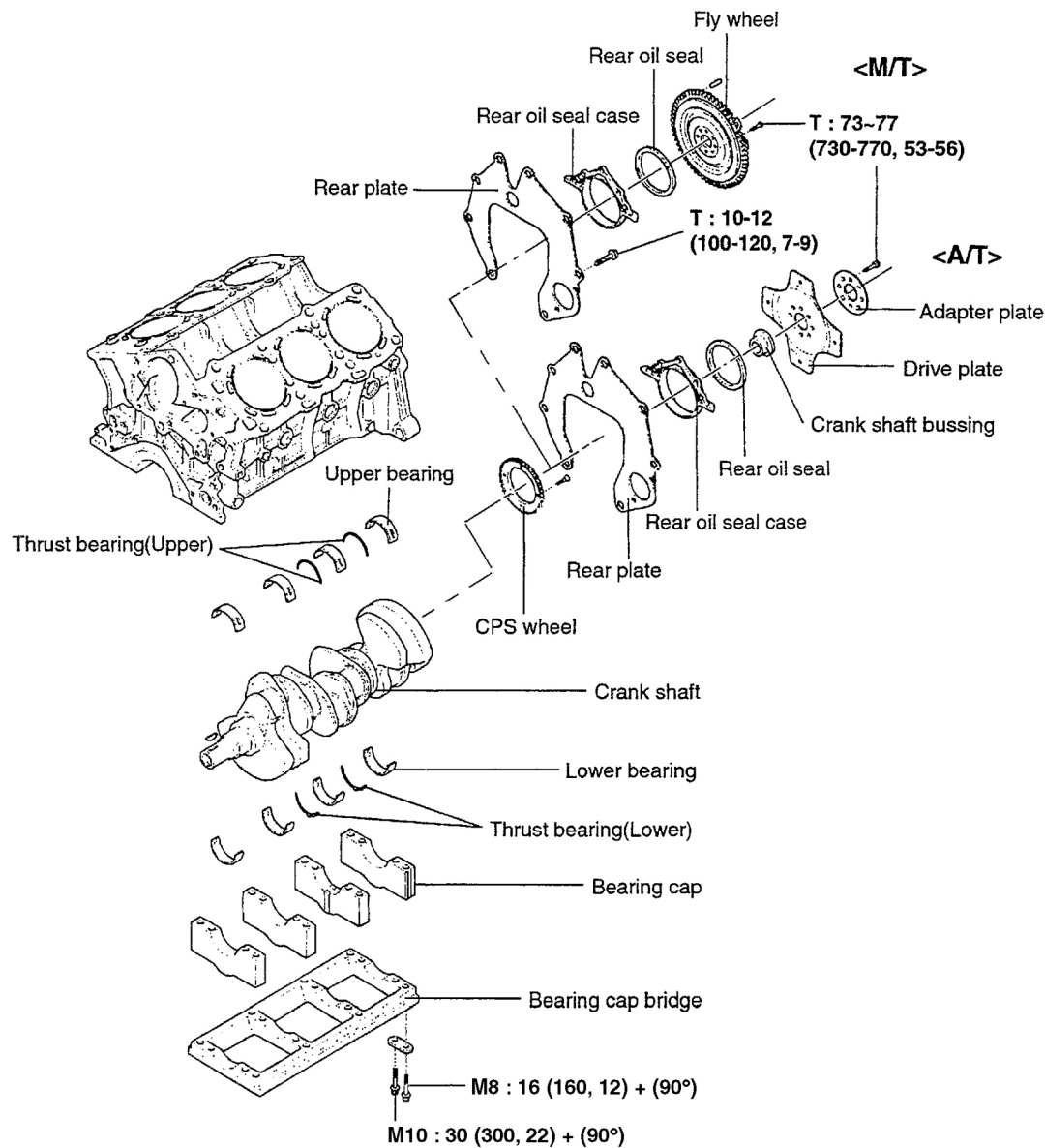


G01153548

Fig. 90: Checking Connecting Rod Side Clearance
Courtesy of HYUNDAI MOTOR CO.

CRANKSHAFT

COMPONENTS



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

G01153549

Fig. 91: Crankshaft Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Remove the following:
 - Timing belt. See **TIMING BELT**.
 - Front case.
 - Flywheel.

- Cylinder head assembly. See **CYLINDER HEAD**.
 - 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 bearing 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-round and taper.

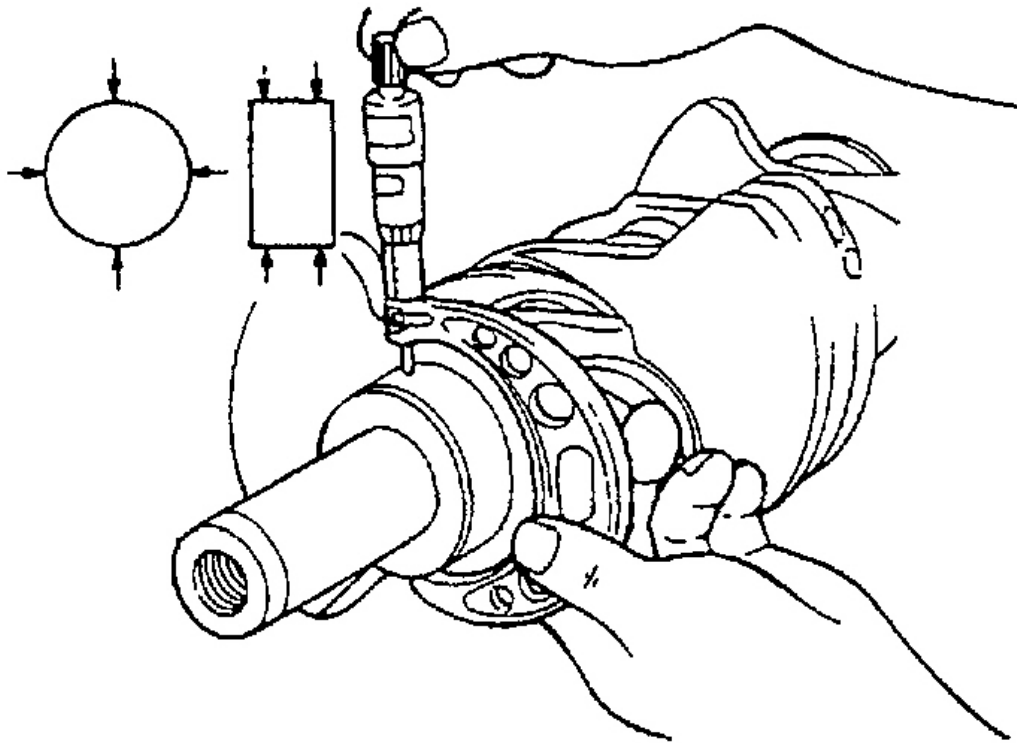
Standard value

Crankshaft journal O.D:

61.982-62.000 mm (2.4402-2.4409 in.)

Crankshaft pin O.D:

47.982-48.0000 mm (1.8890-1.8898 in.)



G01153550

Fig. 92: Checking Crankshaft Journal
Courtesy of HYUNDAI MOTOR CO.

MAIN BEARINGS & 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

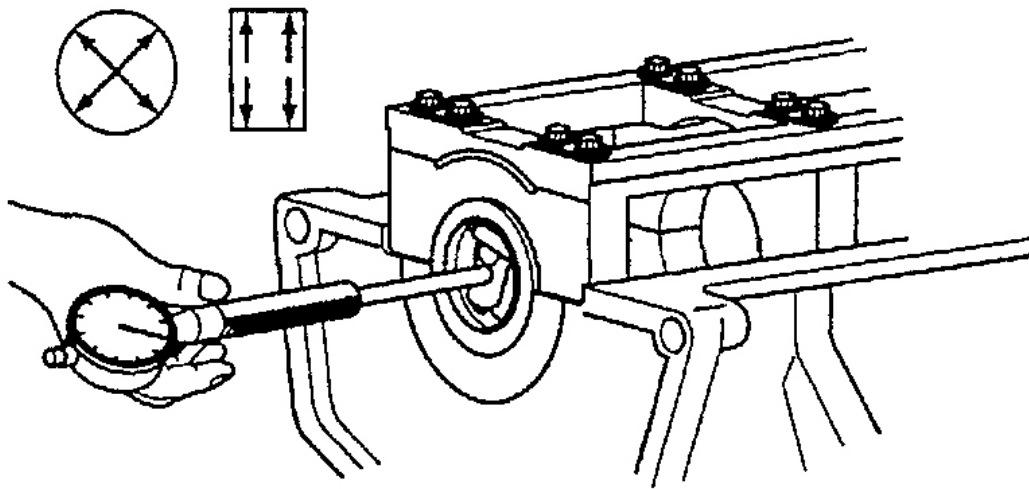
Crankshaft main bearing:

0.004-0.022 mm (0.00015-0.00087 in.)

Connecting rod bearing:

0.018-0.036 mm (0.00071-0.000141 in.)

Limit: 0.1mm (0.004 in.)



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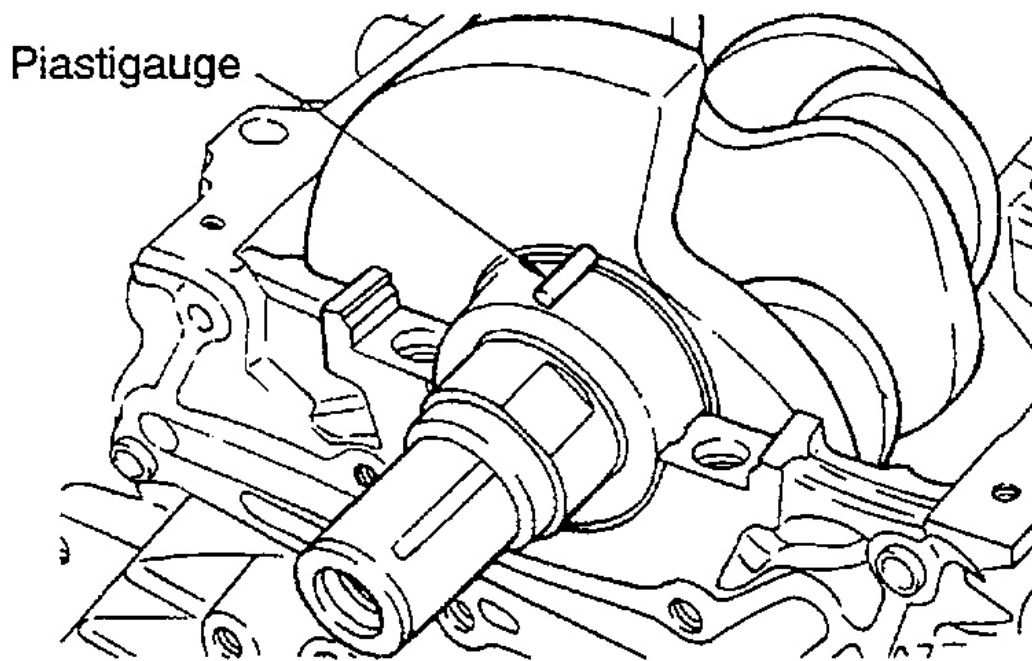
Fig. 93: Measuring Outside Diameter Of Crankshaft Journal
Courtesy of HYUNDAI MOTOR CO.

PLASTIC GAUGE METHOD

Plastic gauge may be used to measure the clearance.

1. Remove oil, grease and any other dirt from the bearings and journals.
2. Cut the plastic gauge 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.



G01153552

Fig. 94: Measuring Bearing 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.

FLYWHEEL (M/T)

Replace distorted or damaged flywheel.

REASSEMBLY

MAIN BEARING

1. Install a grooved main bearing (upper bearing) on the cylinder block side.
2. Install 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

M8 (9-16): 16 Nm (160 kg.cm, 12 lb.ft) + (90°)

M10 (1-8): 30 Nm (300 kg.cm, 22 lb.ft) + (90°)

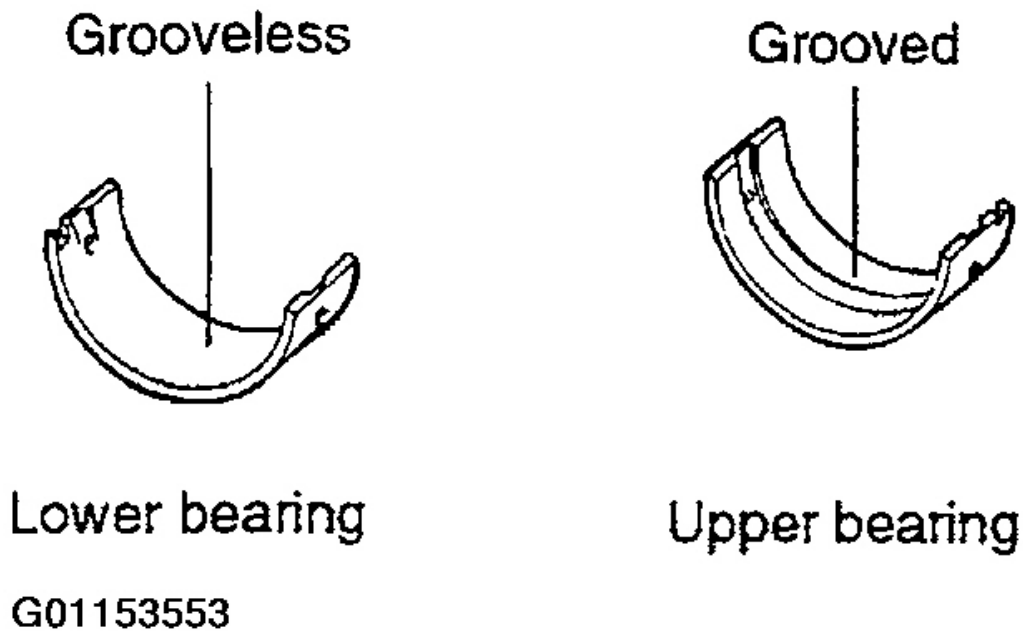
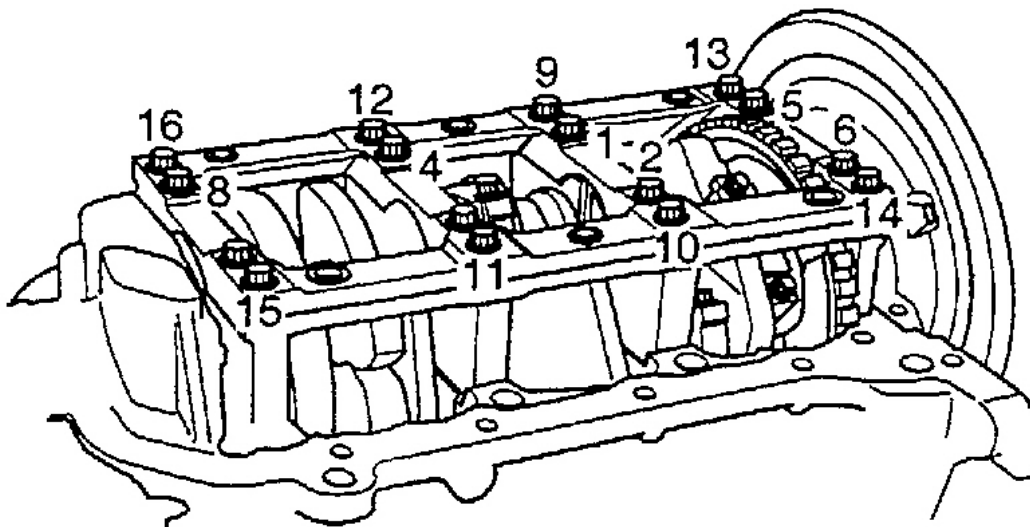


Fig. 95: Identifying Main Bearings
Courtesy of HYUNDAI MOTOR CO.



G01153554

Fig. 96: Identifying Main Bearing Caps & Bolt Torque Sequence

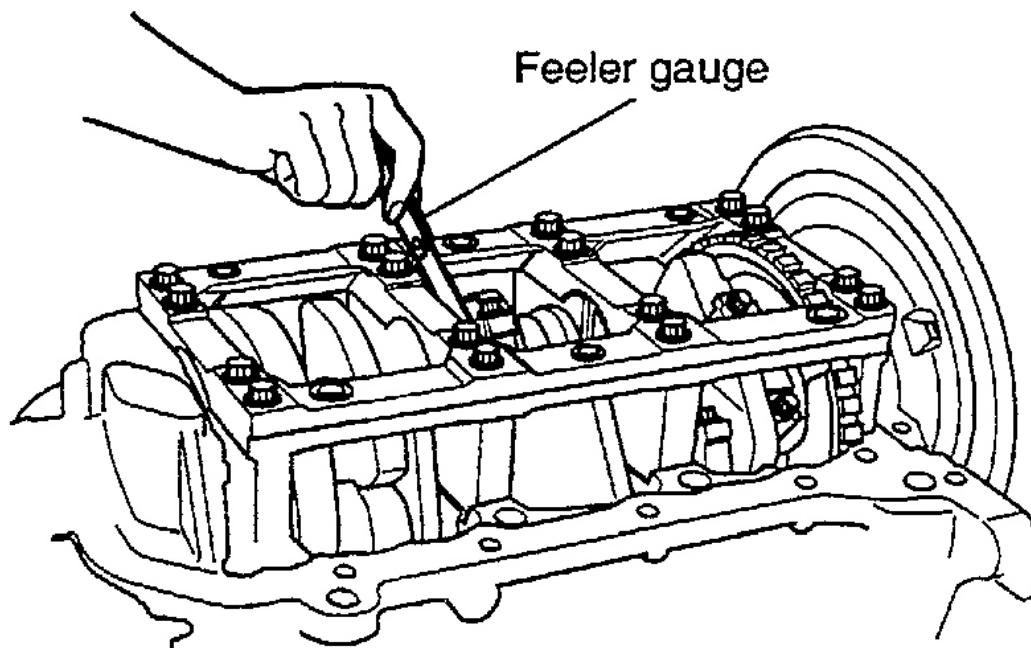
Courtesy of HYUNDAI MOTOR CO.

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

Limit: 0.4 mm (0.016 in.)



G01153555

Fig. 97: Checking Crankshaft 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:

010-12 Nm (100-120 kg.cm, 7-9 lb.ft)

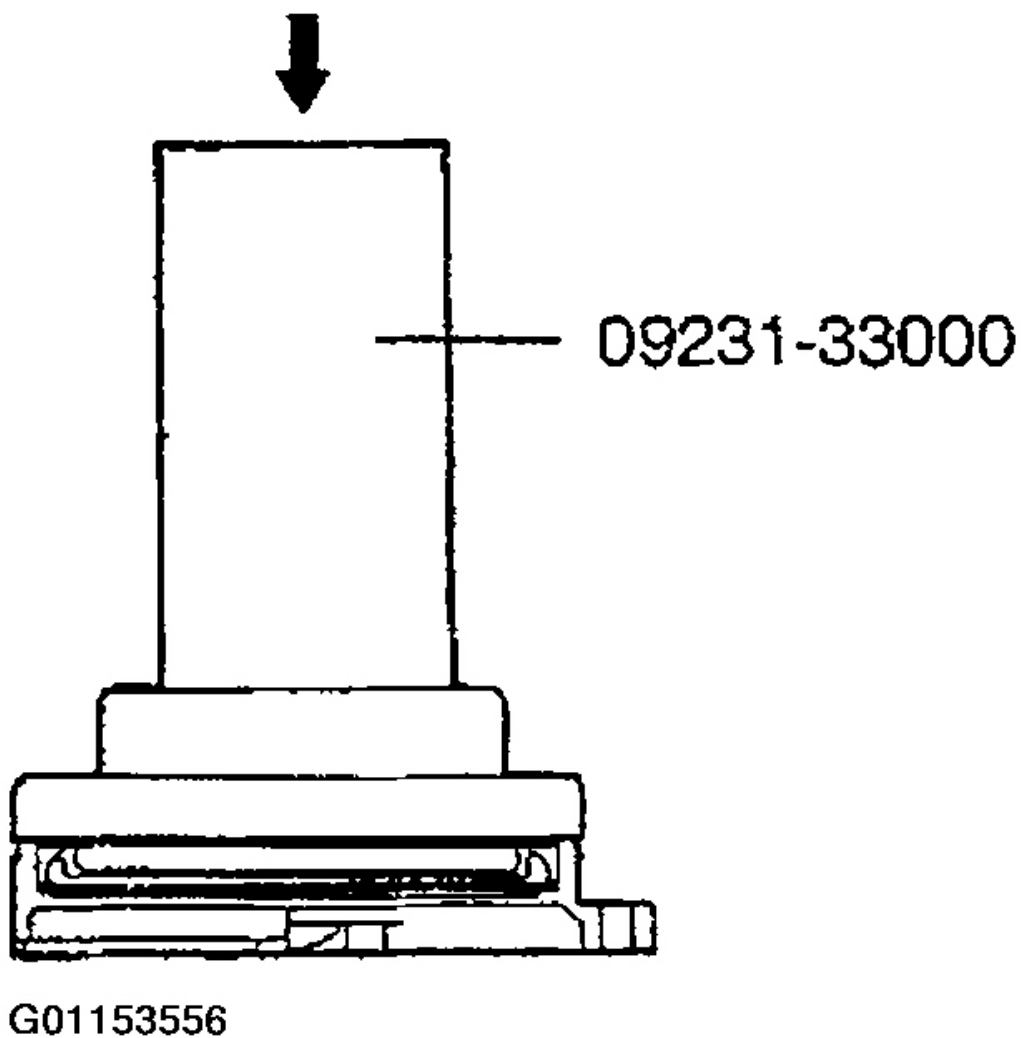
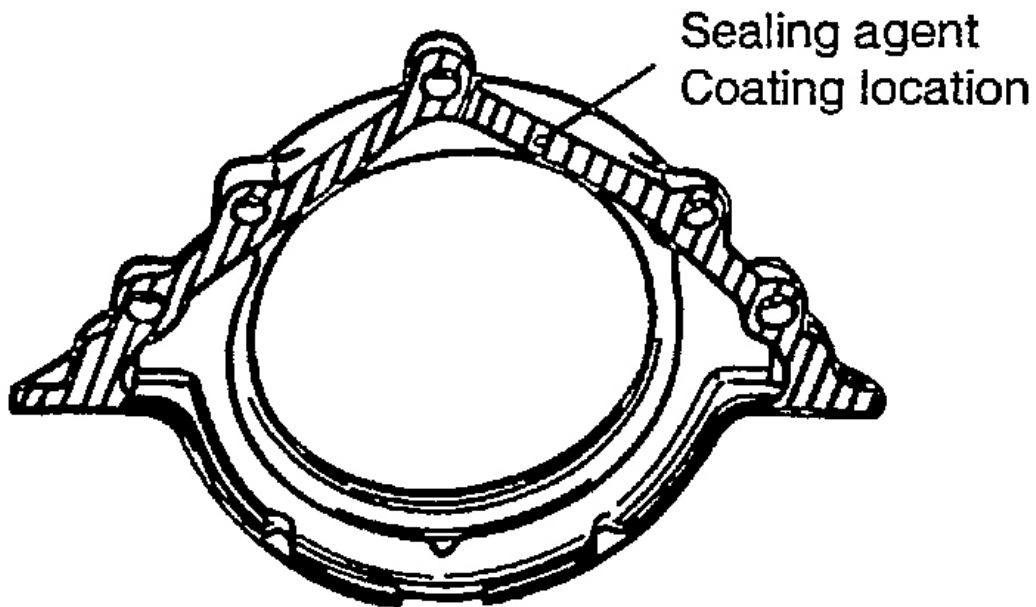


Fig. 98: Installing Rear Oil Seal In Oil Seal Case
Courtesy of HYUNDAI MOTOR CO.



G01153557

Fig. 99: Sealant Coating Location
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)

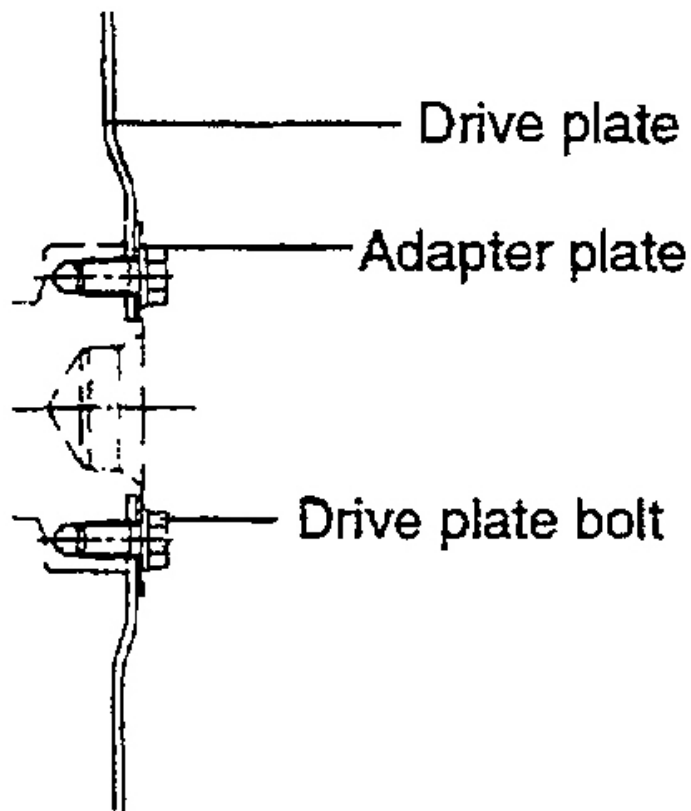
(A/T)**G01153558**

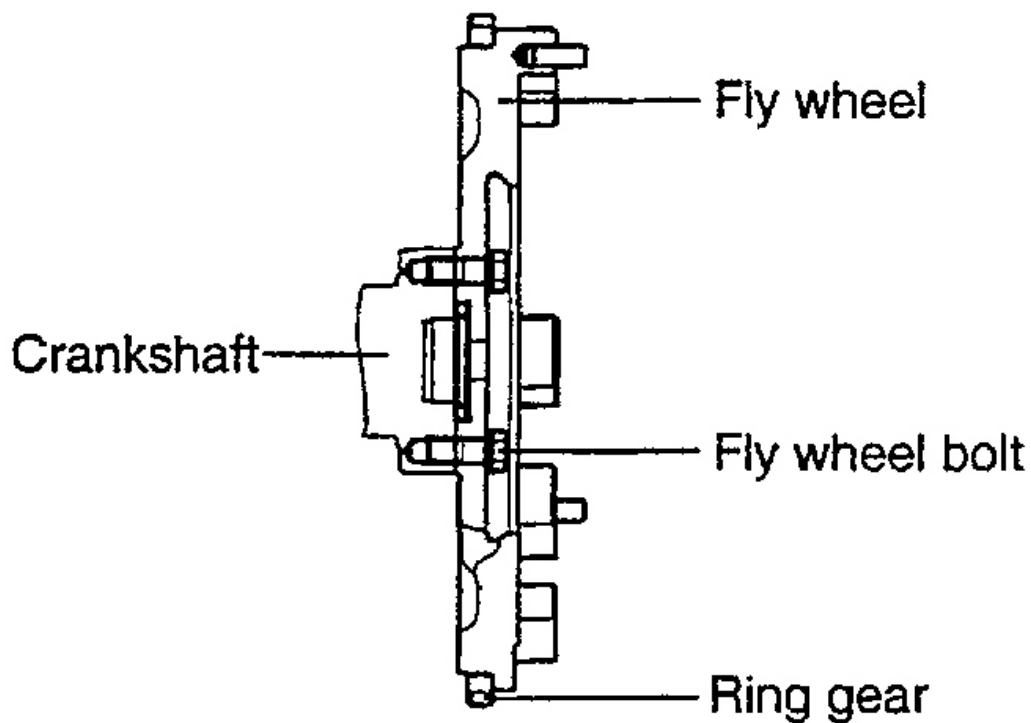
Fig. 100: Identifying Drive Plate & Adapter Plate
Courtesy of HYUNDAI MOTOR CO.

12. Tighten the fly wheel (M/T).

Tightening torque

Fly wheel installed bolt:

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



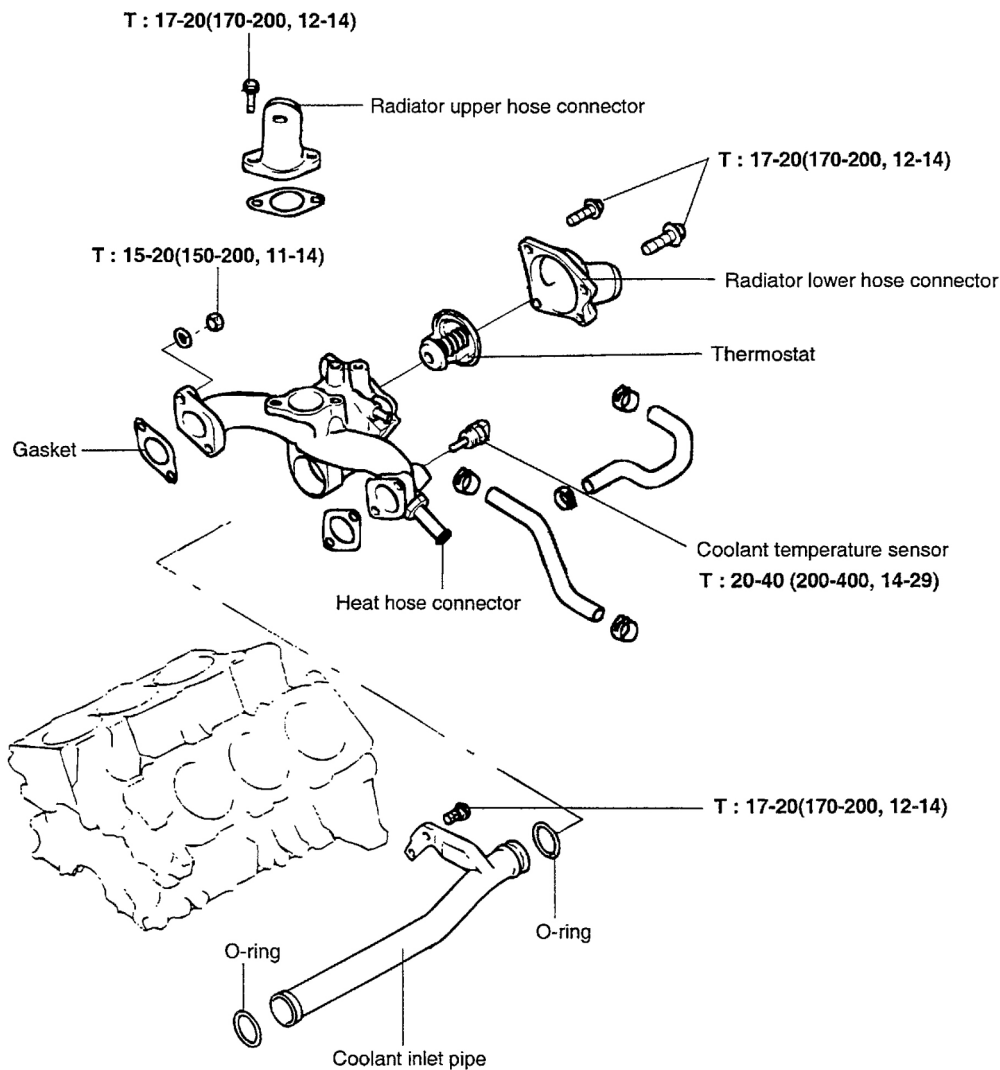
G01153559

Fig. 101: Identifying Flywheel Bolt Installation
Courtesy of HYUNDAI MOTOR CO.

COOLING SYSTEM

ENGINE COOLANT HOSE/PIPES

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

G01153560

Fig. 102: Engine Coolant Hose/Pipes Components
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

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

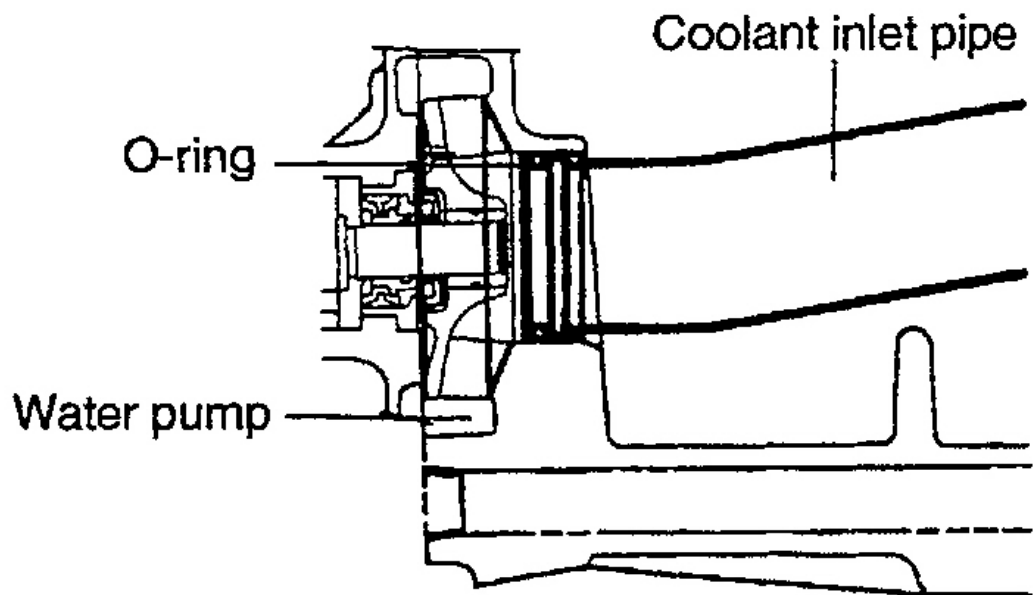
REASSEMBLY

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.

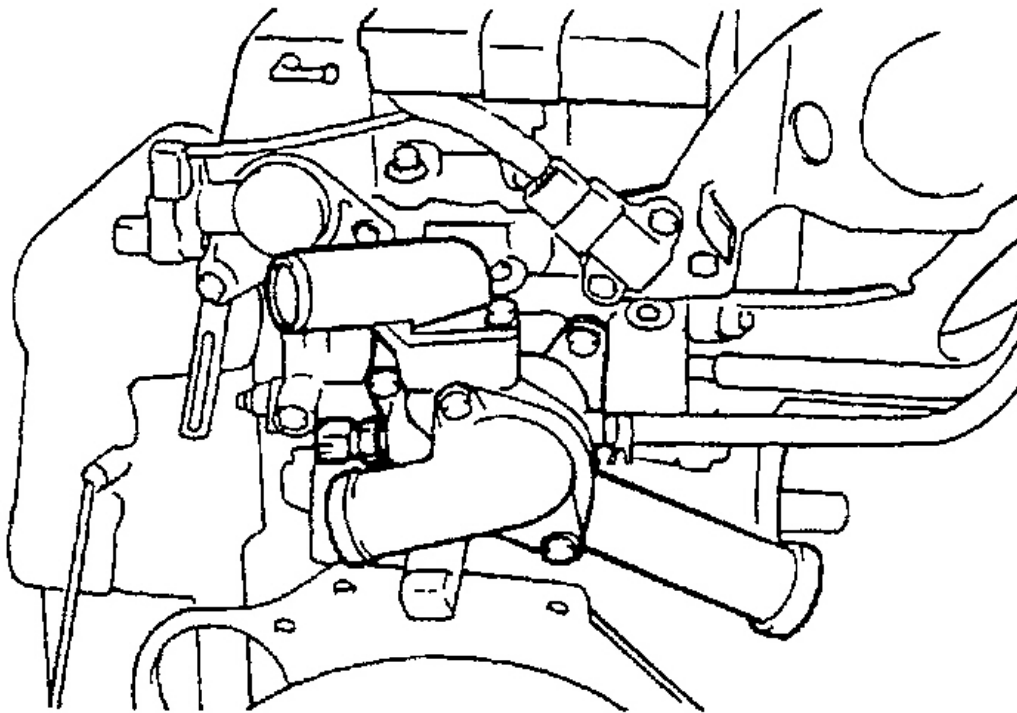


G01153561

Fig. 103: Identifying Coolant Inlet Pipe & Water Pump
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.



G01153562

Fig. 104: Identifying Engine Coolant Temperature 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. 1324 or LOCTITE 262

Tightening torque

The coolant sensor:

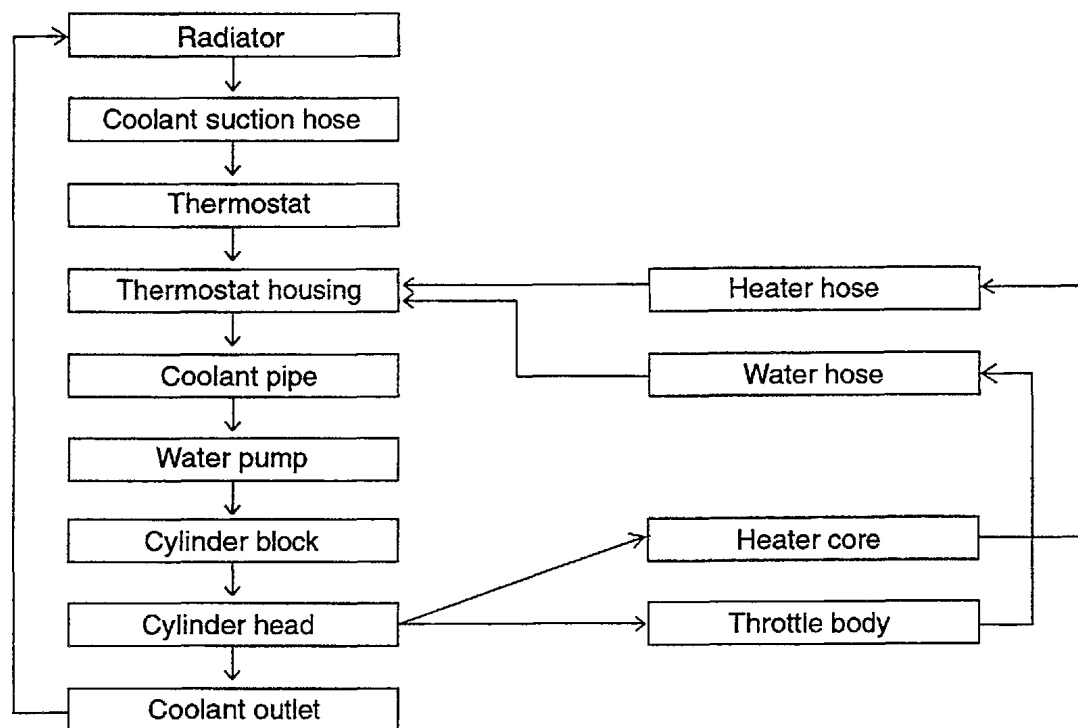
20-40 Nm (200-400 kg.cm, 14-29 lb.ft)

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

4. Refill radiator with the coolant.

COOLING SYSTEM

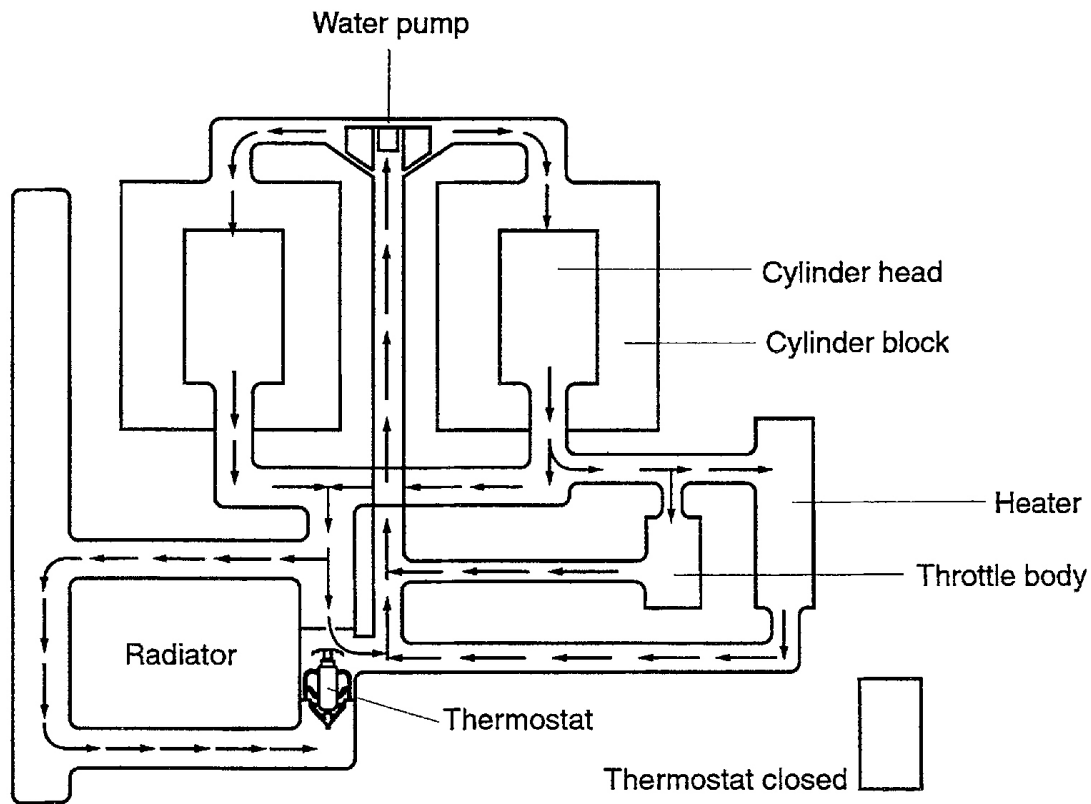
INLET CONTROL



G01153563

Fig. 105: Inlet Control Flow
 Courtesy of HYUNDAI MOTOR CO.

FLOW CHART

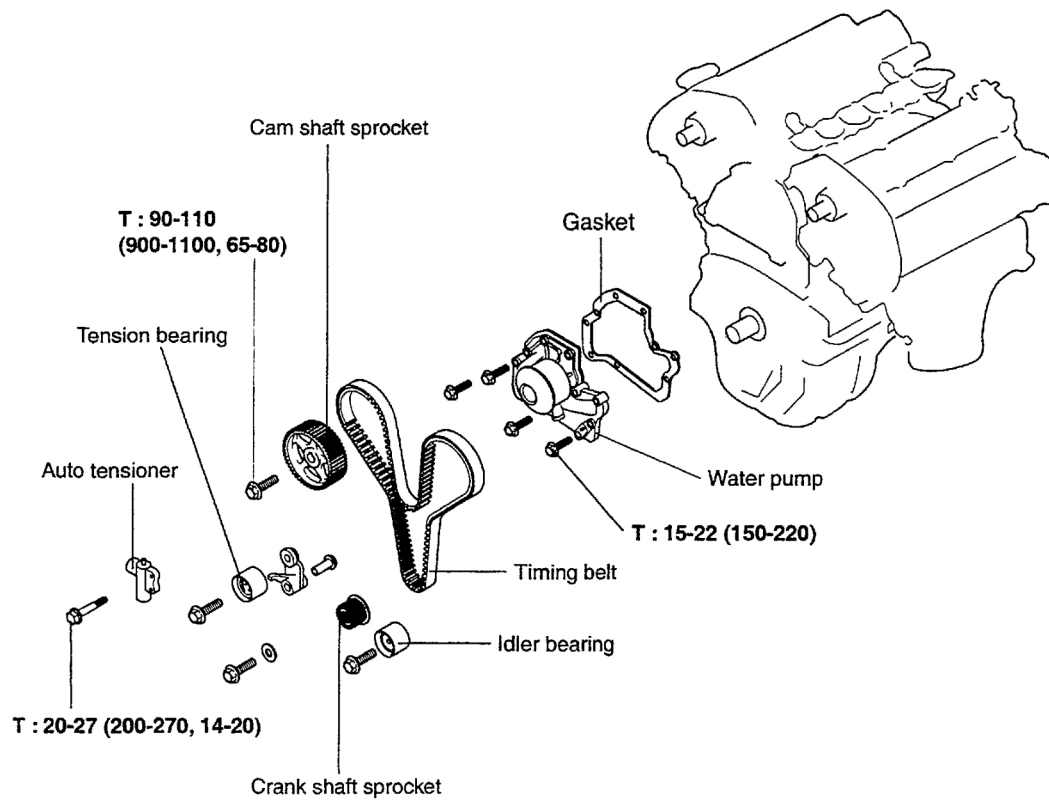


G01153564

Fig. 106: Flow Chart
Courtesy of HYUNDAI MOTOR CO.

ENGINE COOLANT PUMP

COMPONENTS

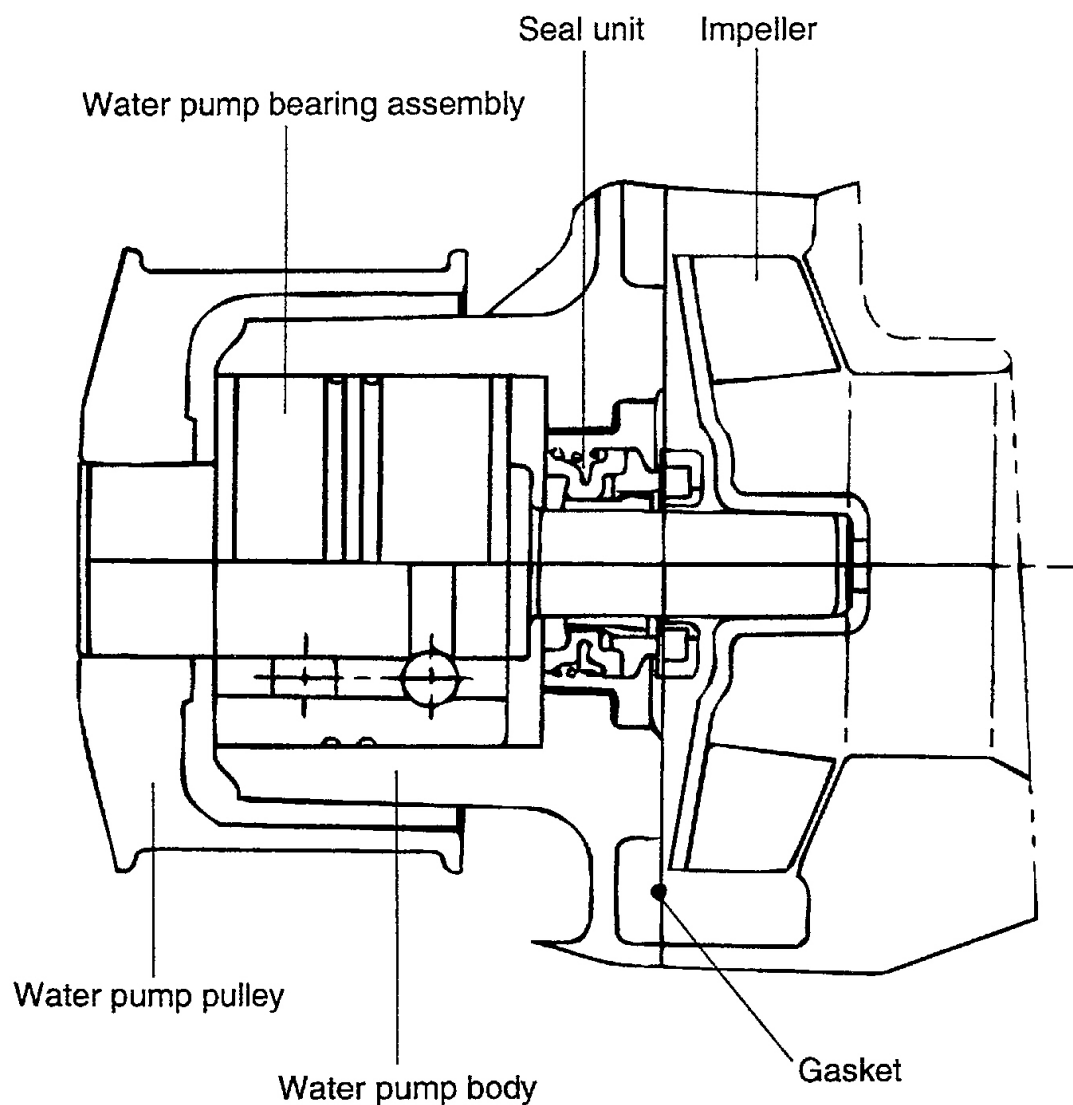


TORQUE : Nm (kg·cm, lb·ft)

G01153565

Fig. 107: Engine Coolant Pump Components
Courtesy of HYUNDAI MOTOR CO.

ENGINE COOLANT PUMP



G01153566

Fig. 108: Coolant Pump Internal Diagram
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

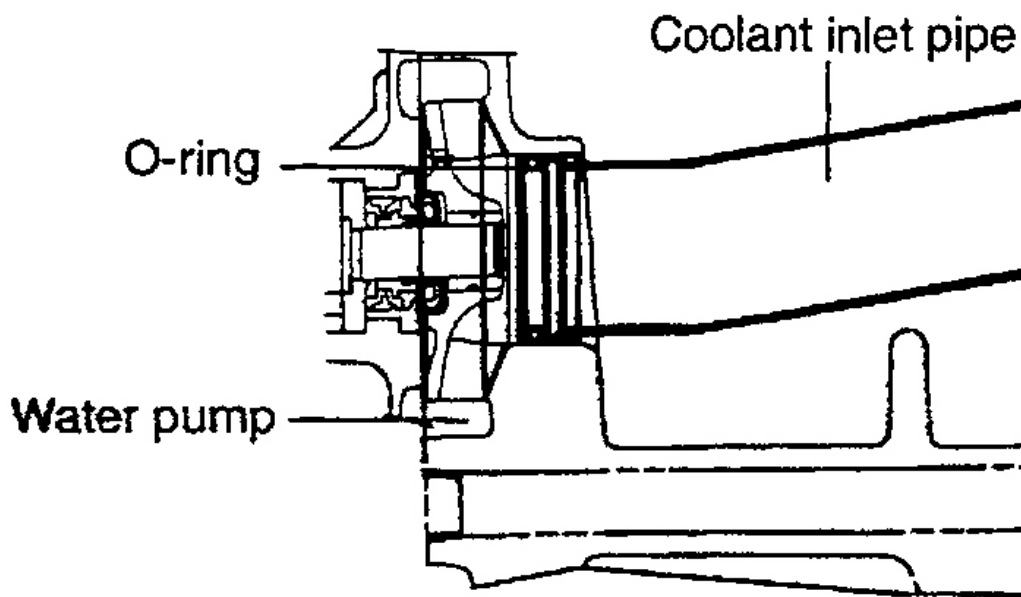
1. Using the drain plug, drain the coolant.
2. Remove the drive belt and the engine coolant pump pulley.
3. Remove the timing belt cover, the auto tensioner and idler pulley.
4. Remove the engine coolant pump mounting bolts.
5. Remove the engine coolant pump assembly from the cylinder block.

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 surface of the engine coolant pump body and cylinder block.



G01153567

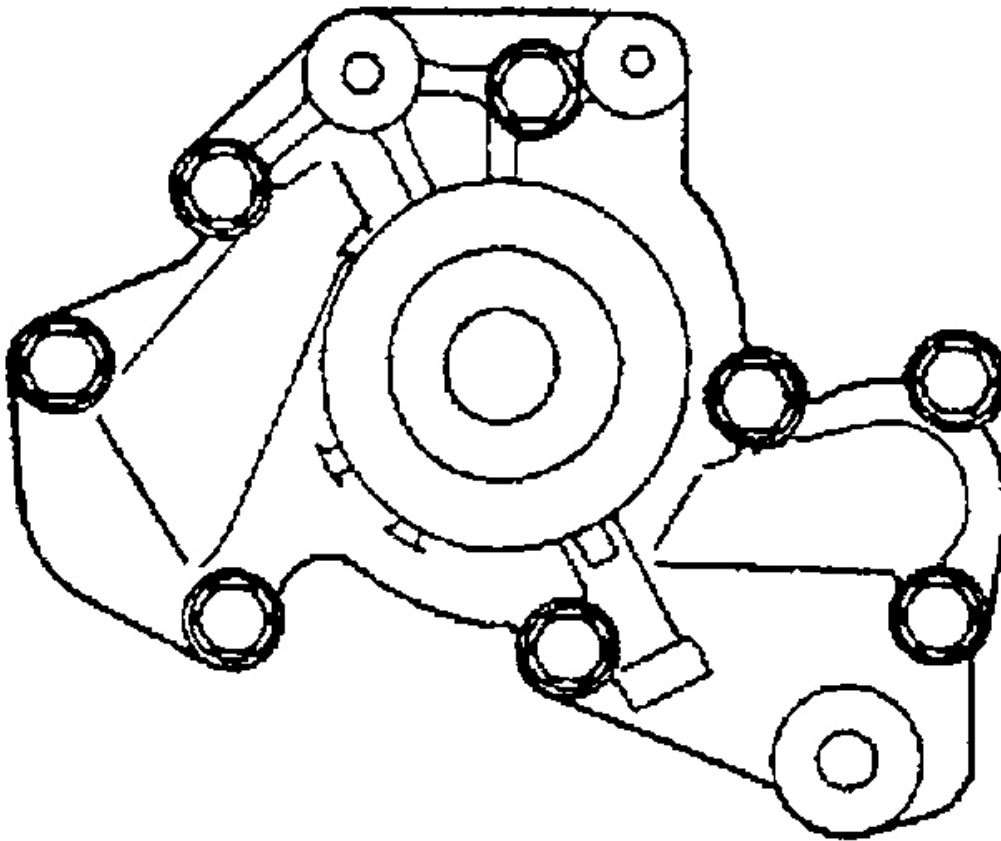
Fig. 109: Identifying Coolant Pipe To Coolant Pump O-Ring
Courtesy of HYUNDAI MOTOR CO.

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 Nm (150-220 kg.cm, 11-16 lb.ft)



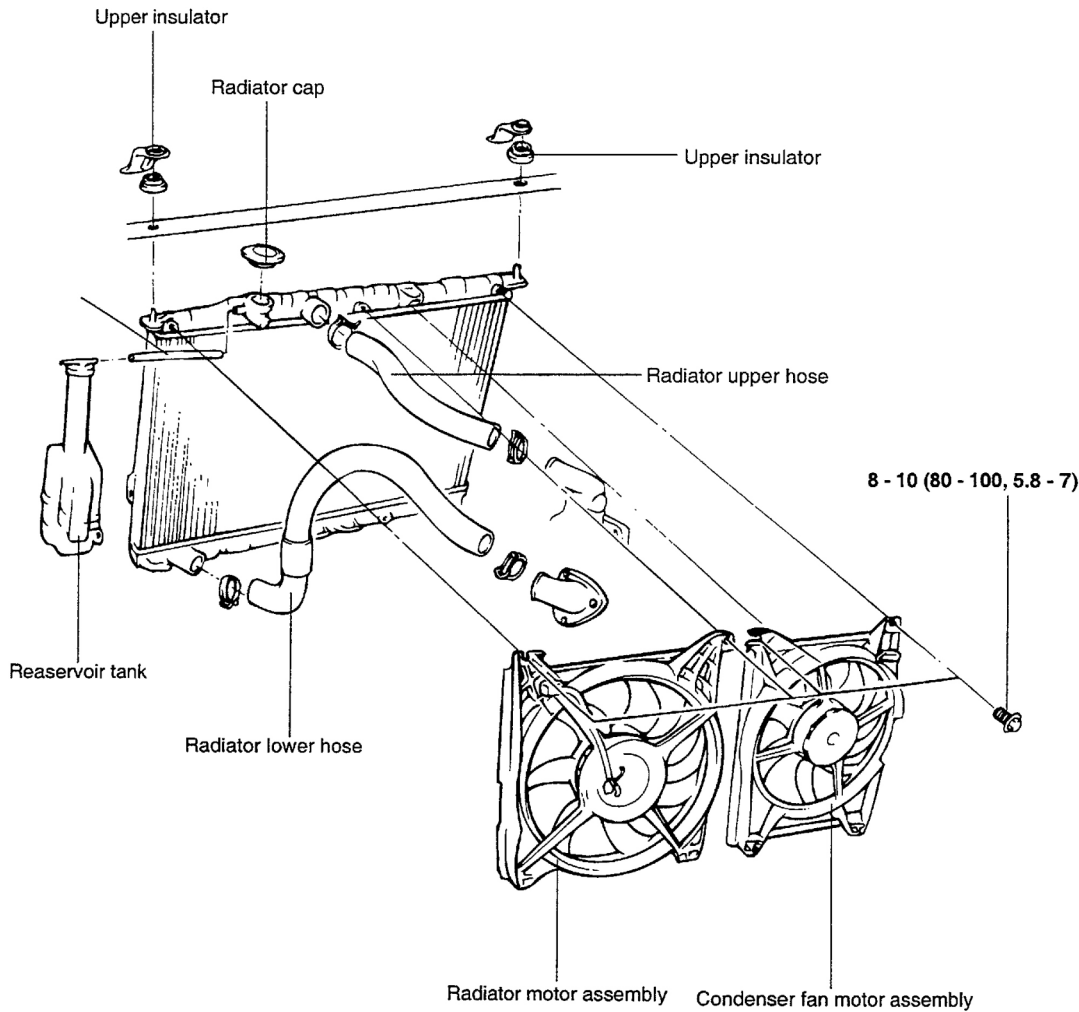
G01153568

Fig. 110: Identifying Coolant Pump Bolts
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 radiator with coolant.
6. Run the engine and check for leaks.

RADIATOR

COMPONENTS



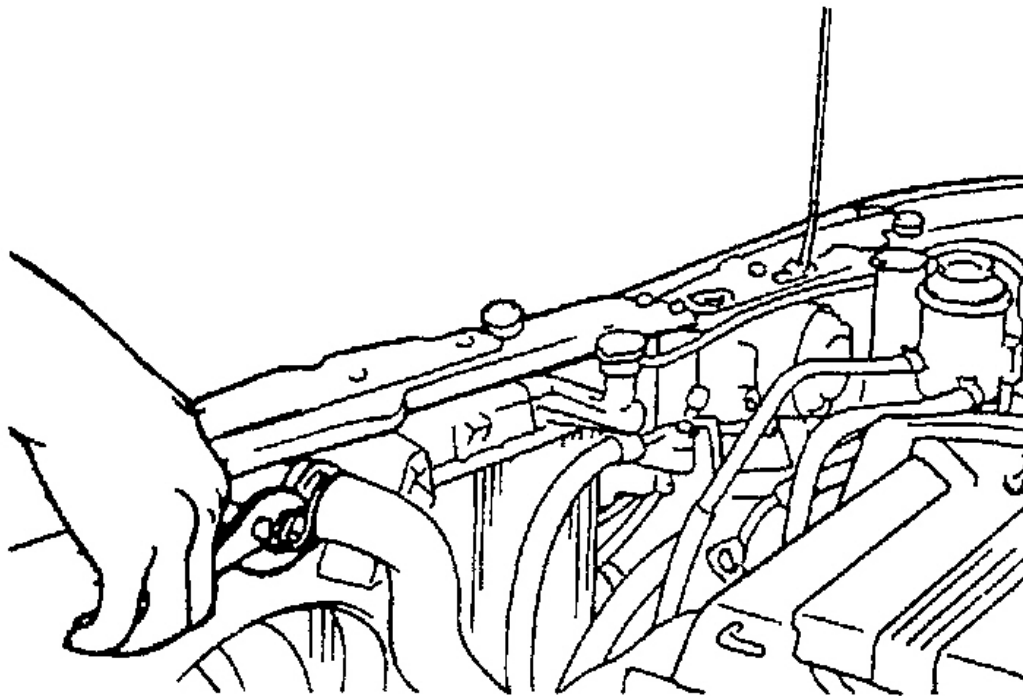
TORQUE : Nm (kg-cm, lb-ft)

G01153569

Fig. 111: 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 making marks on the radiator hose and the hose clamp.



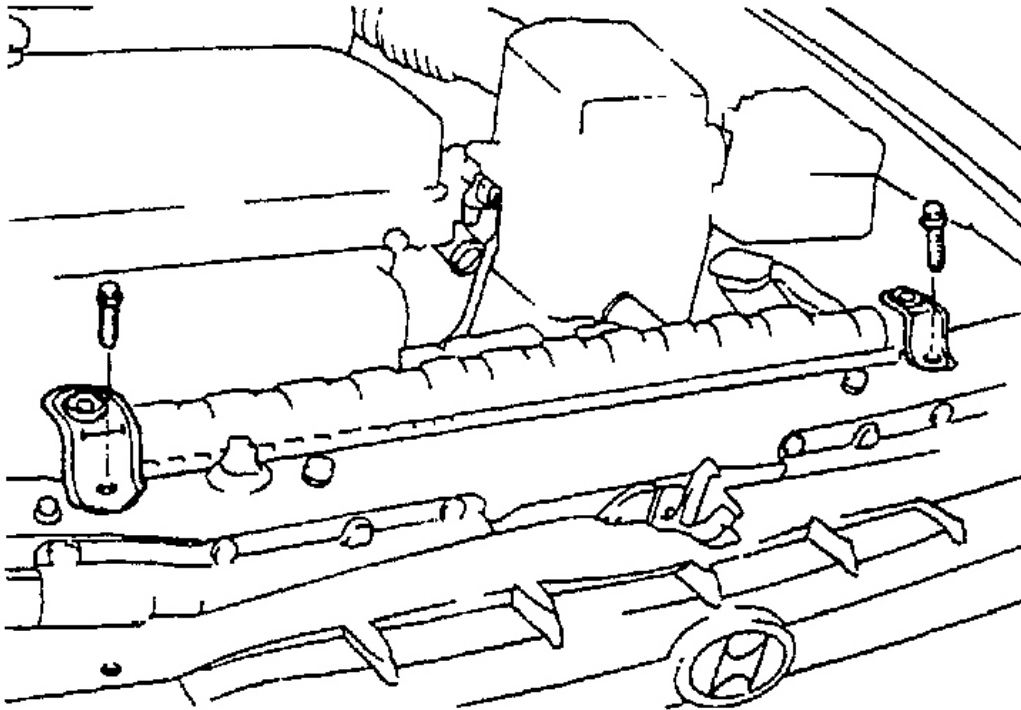
G01153570

Fig. 112: Removing Upper Radiator 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 materials can not enter after the hose is disconnected from the radiator.

6. Remove the radiator upper mounting bolt.



G01153571

Fig. 113: Identifying Radiator Upper Mount & Bolts
Courtesy of HYUNDAI MOTOR CO.

7. Remove the radiator together with 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).

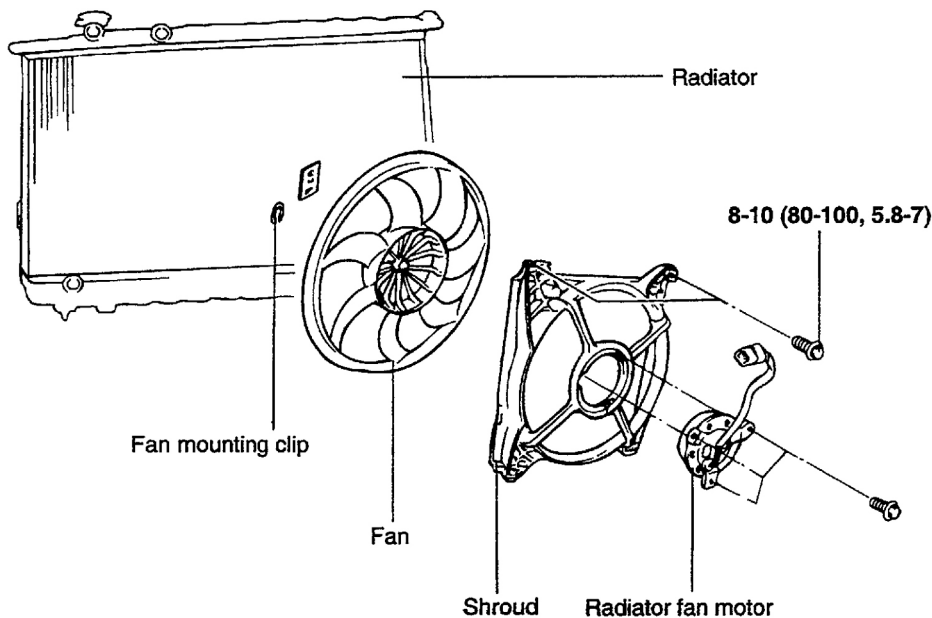
INSTALLATION

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



TORQUE : Nm (kg·cm, lb·ft)

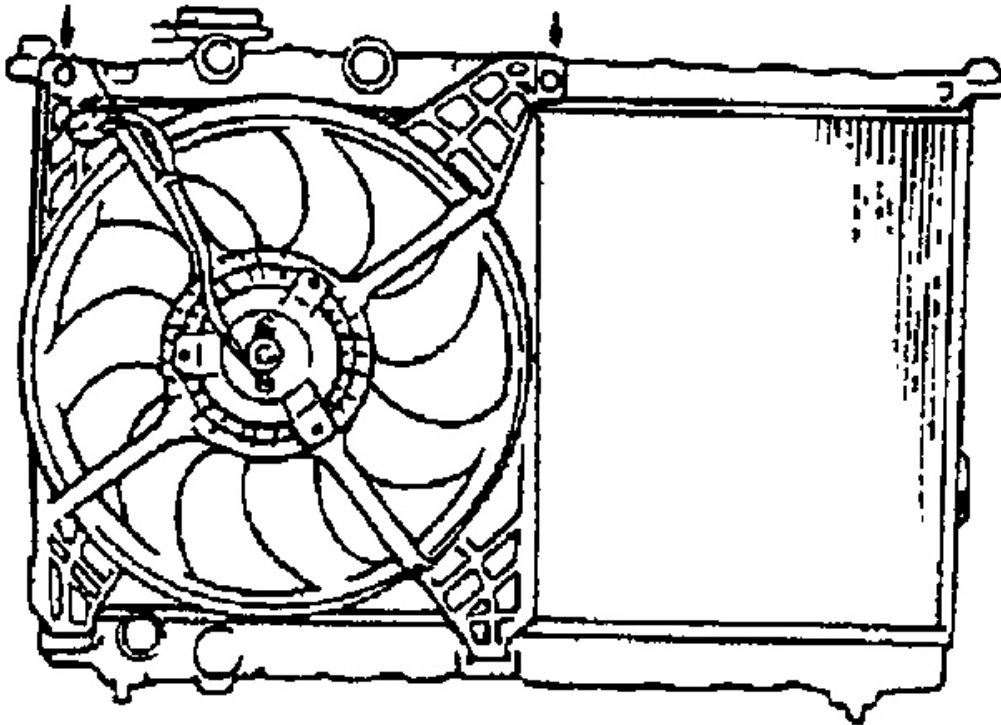
G01153572

Fig. 114: Radiator Fan 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.



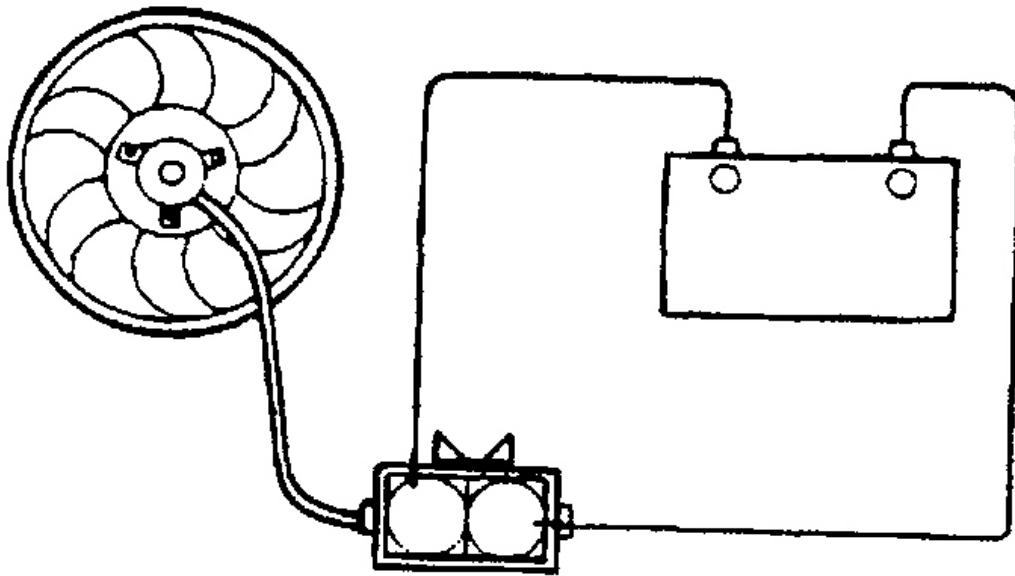
G01153573

Fig. 115: View Of Radiator Fan
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

RADIATOR FAN MOTOR & 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.

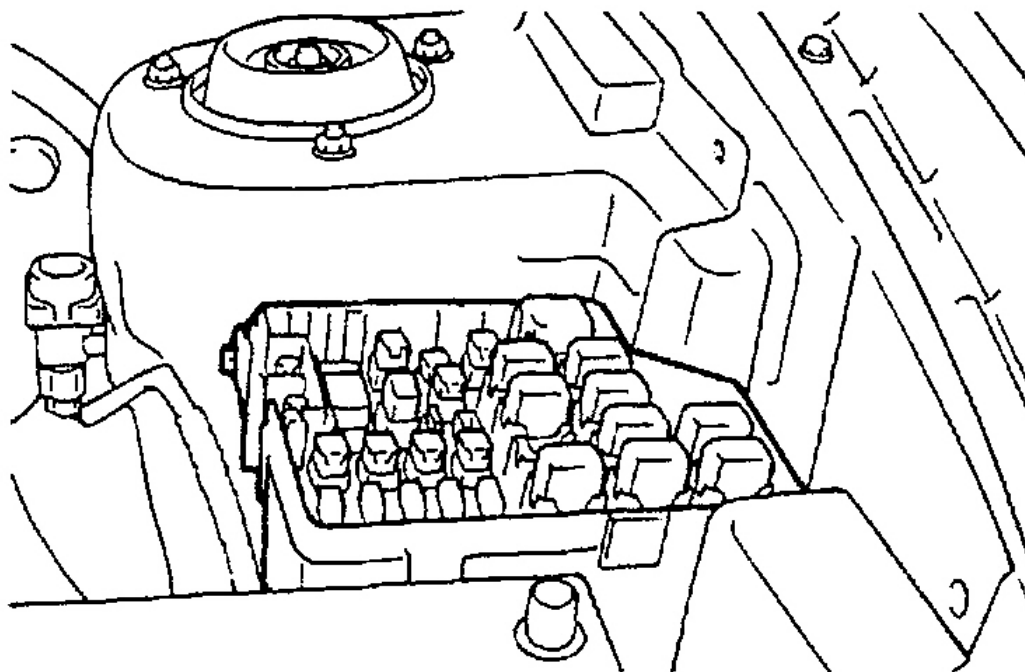


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Fig. 116: Checking Fan Motor
Courtesy of HYUNDAI MOTOR CO.

RADIATOR FAN MOTOR RELAY

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



G01153575

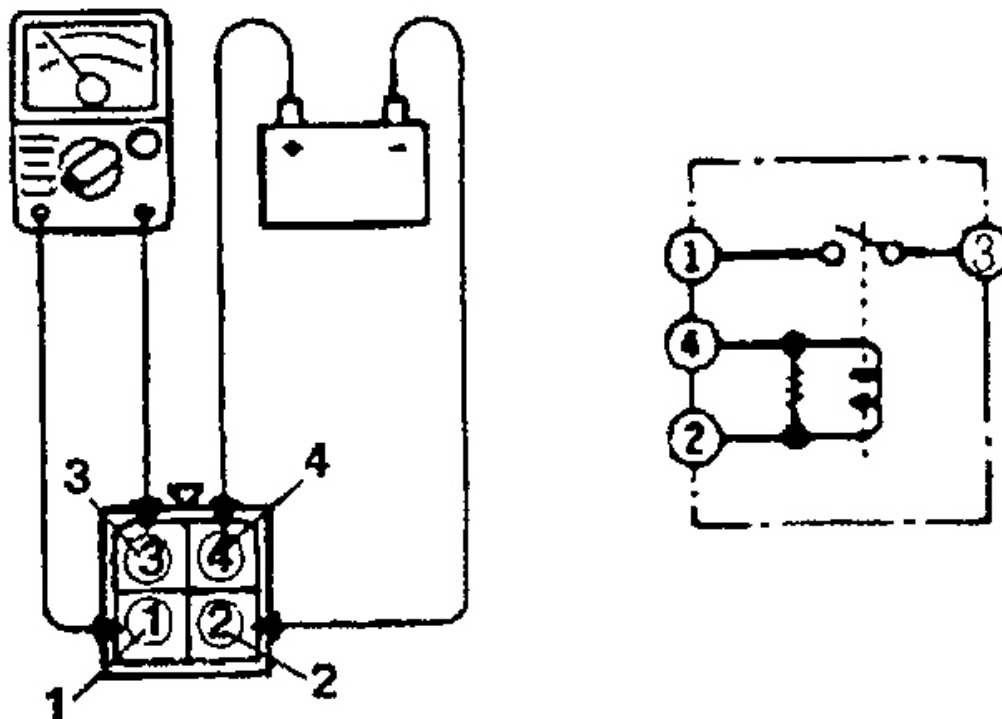
Fig. 117: View Of Relay Box
 Courtesy of HYUNDAI MOTOR CO.

2. Check the continuity of the terminals.

Current	Terminal No.	Yes or No
ON	Terminal 1-3	Continuity
OFF	Terminal 1-3	Non continuity
	Terminal 2-4	Continuity

G01153576

Fig. 118: Fan Motor Relay Continuity Table
 Courtesy of HYUNDAI MOTOR CO.



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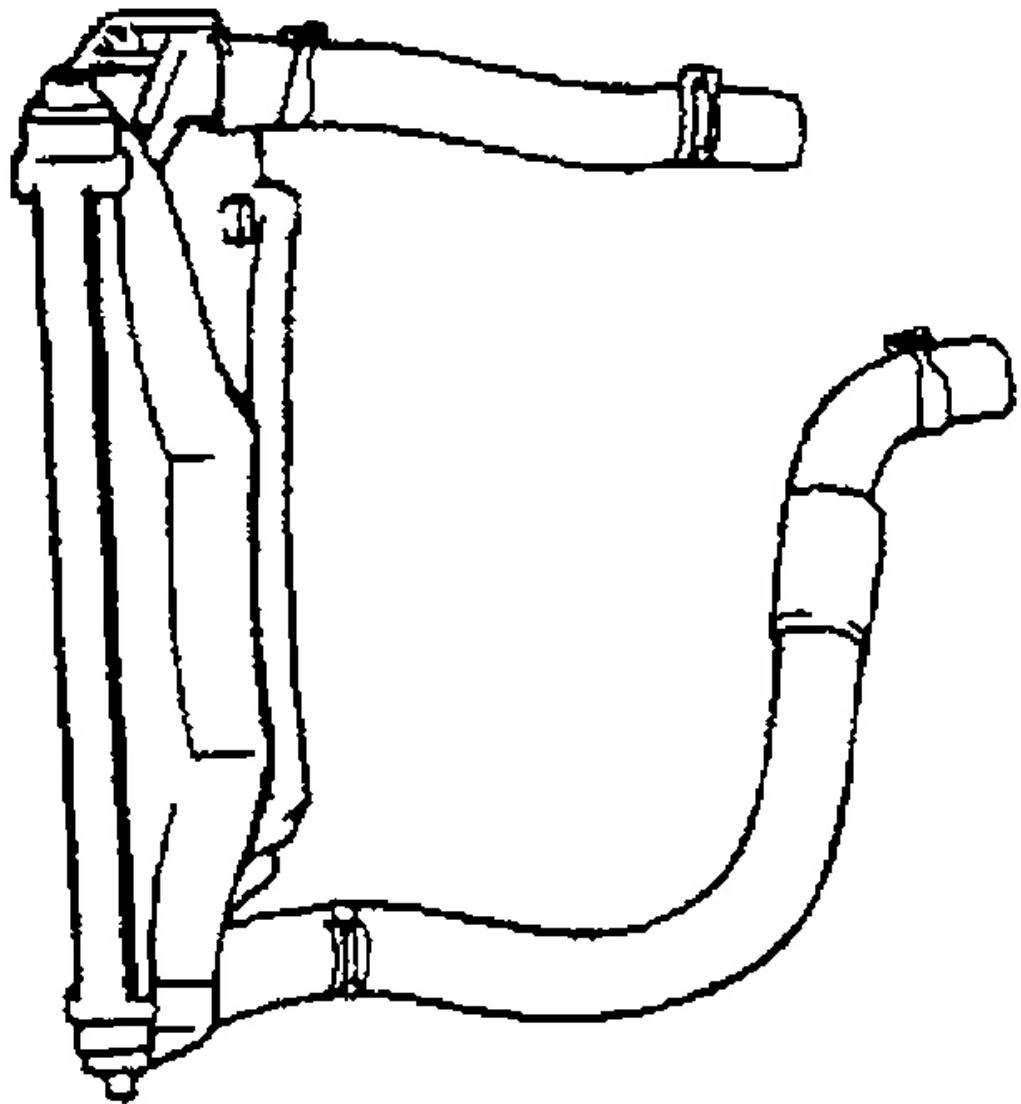
Fig. 119: Checking Fan Motor Relay
Courtesy of HYUNDAI MOTOR CO.

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.

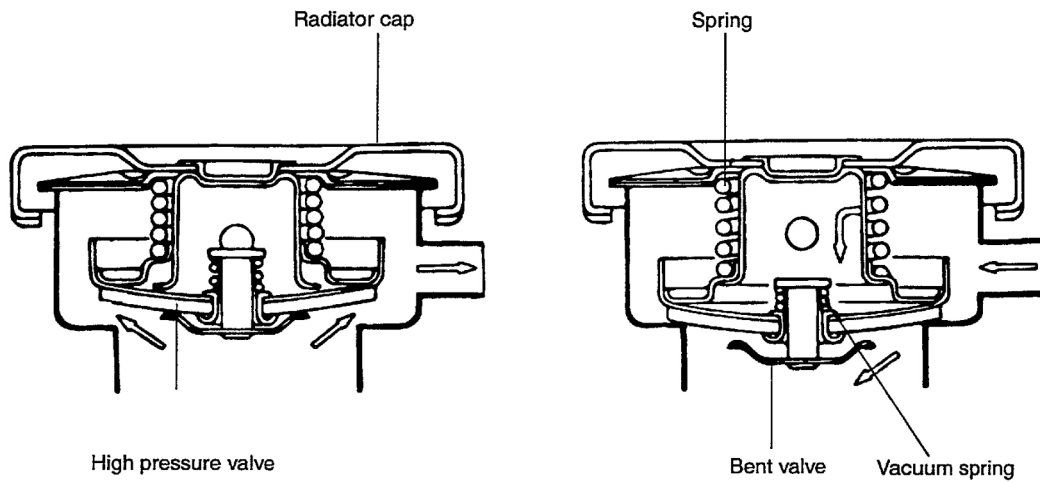


G01153578

Fig. 120: View Of Radiator Fan & Hoses
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)

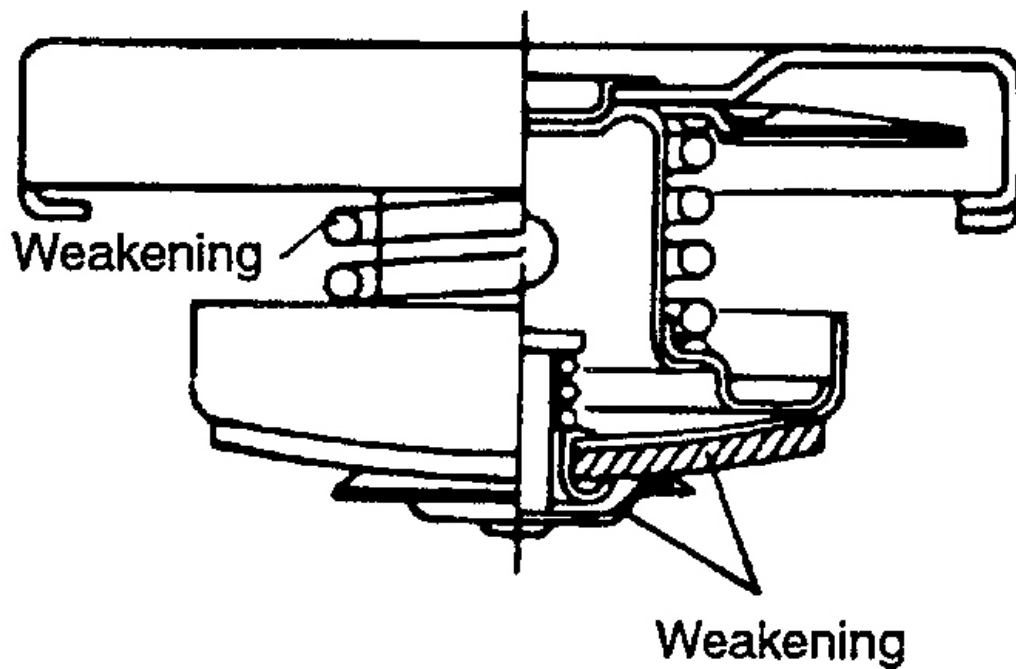
PRESSURE : Kpa (kg/cm², psi)

G01153579

Fig. 121: Radiator Cap Components
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

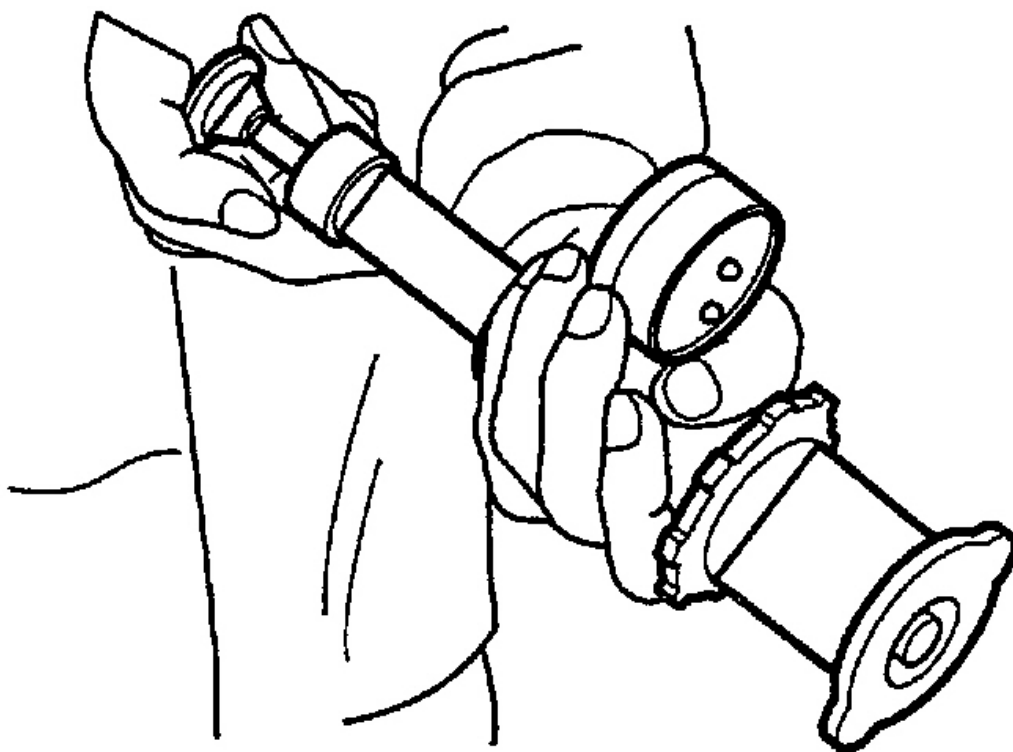
1. Check the radiator cap for damage, cracks or weakening.



G01153580

Fig. 122: Inspecting Radiator Cap
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.

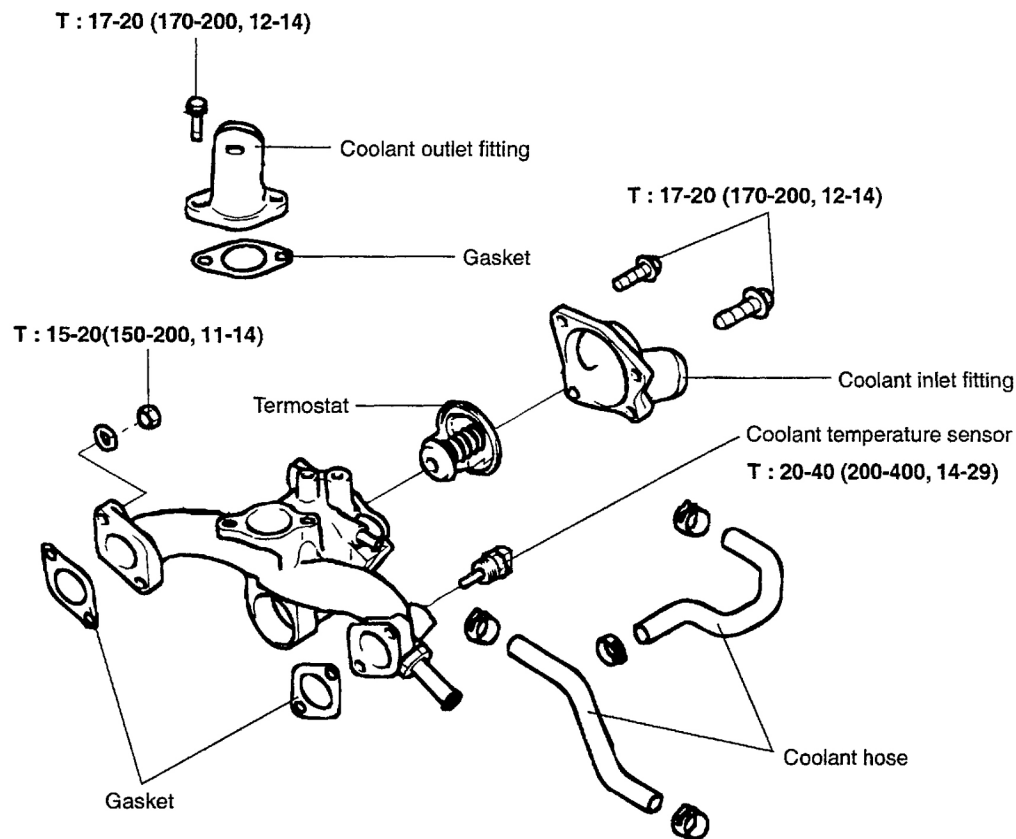


G01153581

Fig. 123: Pressure Testing Radiator Cap
Courtesy of HYUNDAI MOTOR CO.

THERMOSTAT

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

G01153582

Fig. 124: Thermostat Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

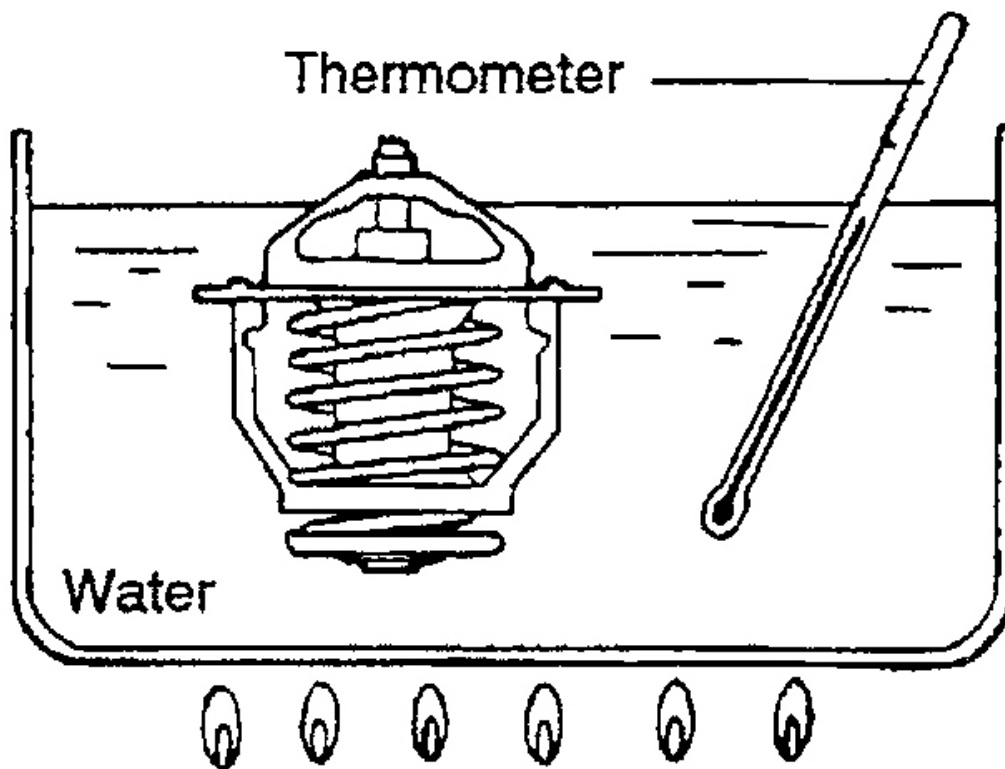
1. Drain the coolant to thermostat level or below.
2. Remove the inlet fitting and gasket.
3. Remove the thermostat.

INSPECTION

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

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

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



G01153583

Fig. 125: Checking Thermostat Operation
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

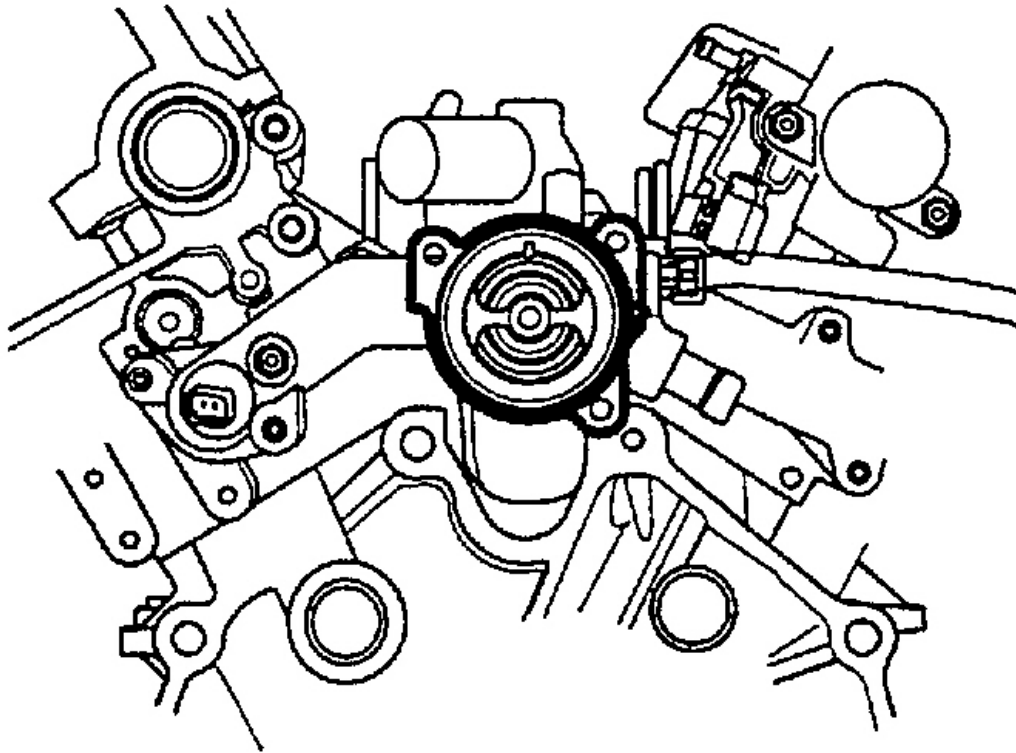
1. Check that the flange of the thermostat is correctly placed in the socket of the thermostat housing.
2. Install the inlet fitting.

Tightening torque

Engine coolant inlet fitting bolt:

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

3. Refill the coolant.



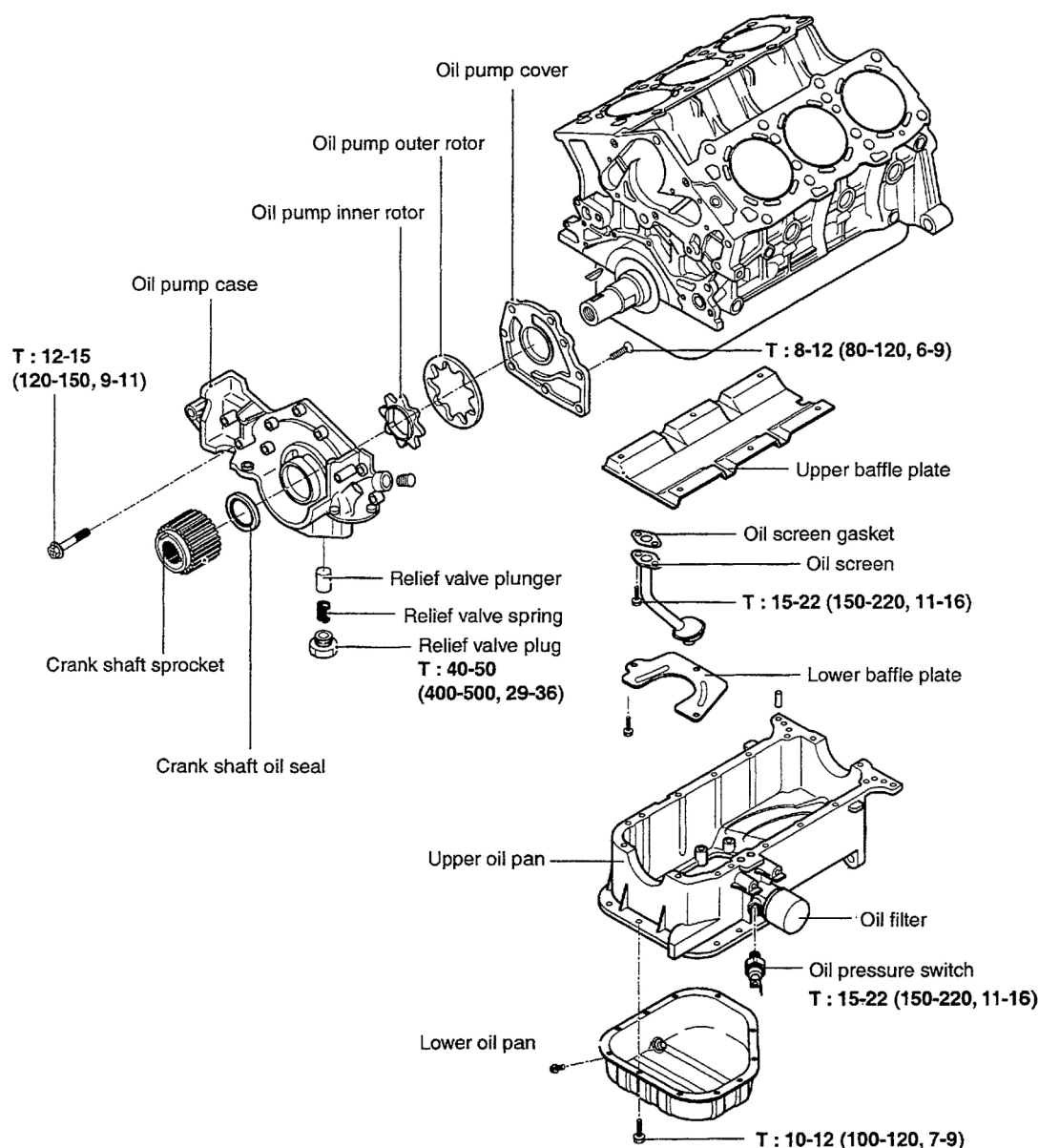
G01153584

Fig. 126: Installing Thermostat
Courtesy of HYUNDAI MOTOR CO.

LUBRICATION SYSTEM

OIL PUMP

COMPONENTS



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

G01153585

Fig. 127: Oil Pump Components
Courtesy of HYUNDAI MOTOR CO.

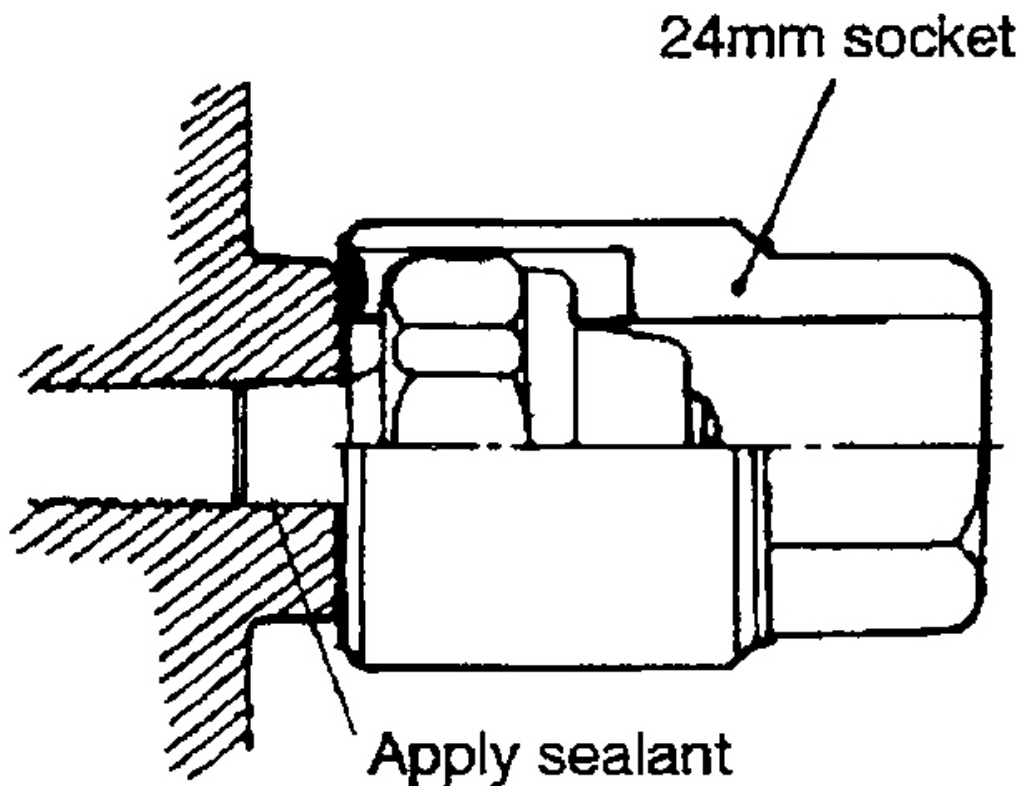
DISASSEMBLY

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.



G01153586

Fig. 128: 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.

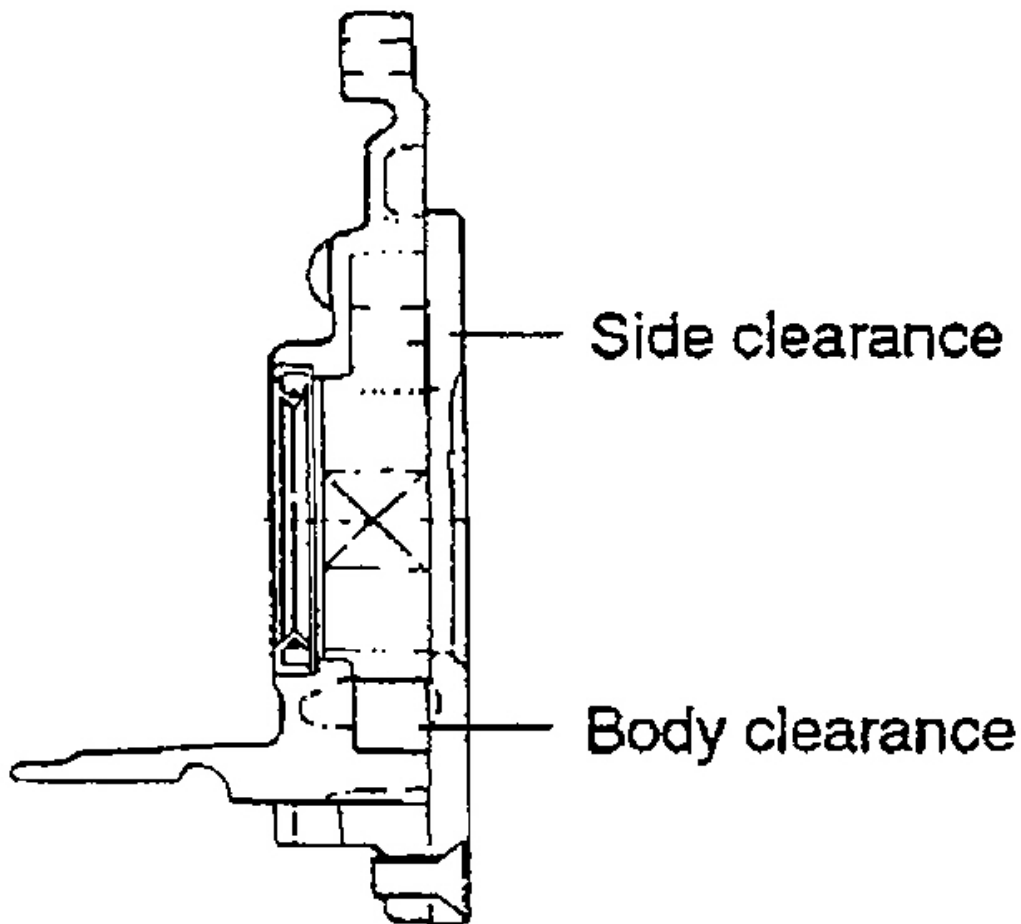
2. Assemble the rotor on the oil pump and then check the clearance with a thickness gauge.

Oil pump side clearance

Standard value

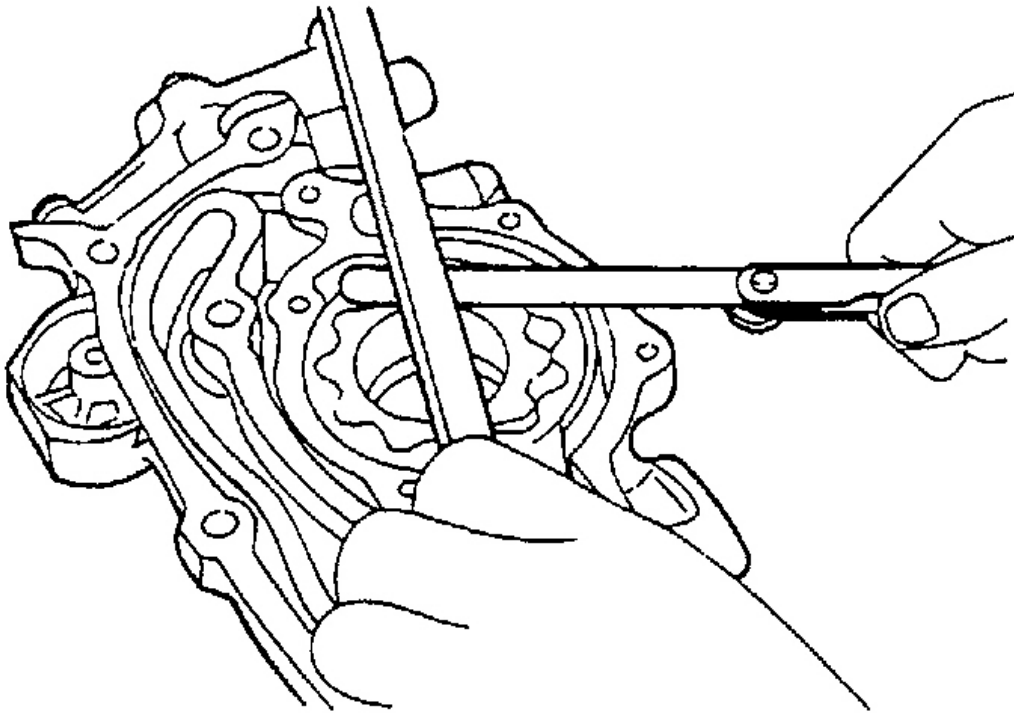
Body clearance: 0.100-0.181 mm (0.0039-0.0071 in.)

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



G01153587

Fig. 129: Identifying Side Clearance & Body Clearance
Courtesy of HYUNDAI MOTOR CO.



G01153588

Fig. 130: Checking Clearance
Courtesy of HYUNDAI MOTOR CO.

RELIEF PLUNGER & SPRING

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

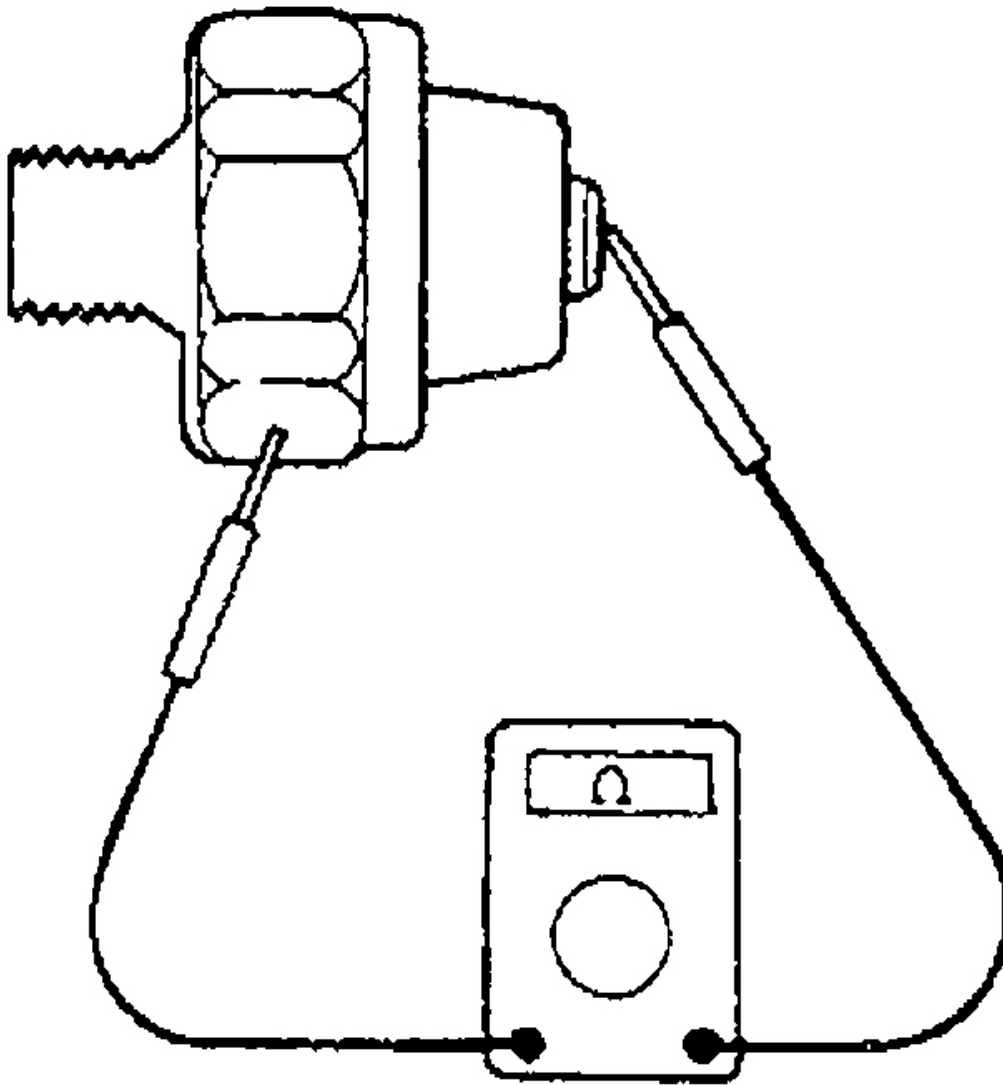
OIL FILTER BRACKET

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.

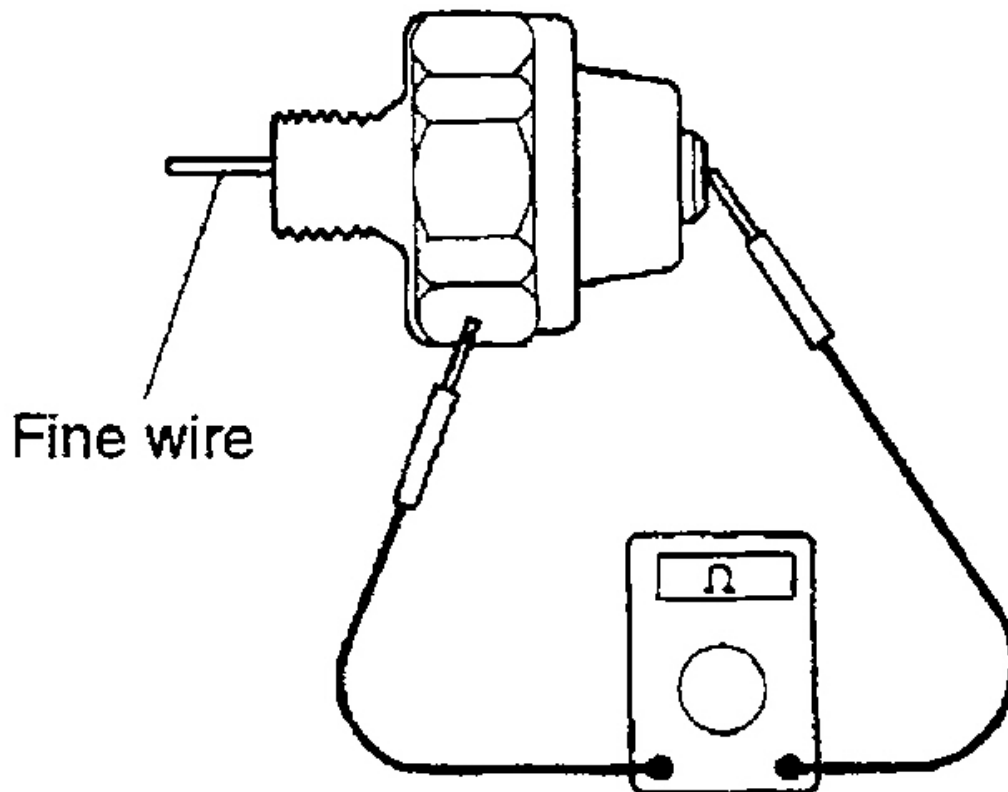


G01153589

Fig. 131: Checking Oil Pressure Switch Continuity
Courtesy of HYUNDAI MOTOR CO.

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

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



G01153590

Fig. 132: Checking Oil Pressure Switch Continuity With Fine Wire
Courtesy of HYUNDAI MOTOR CO.

Operation Pressure

Oil pressure switch:

20-40 kPa (0.2-0.4 kg/cm² , 2.9-5.8 psi)

REASSEMBLY

1. Install the oil pump case with the gasket.

Tightening torque

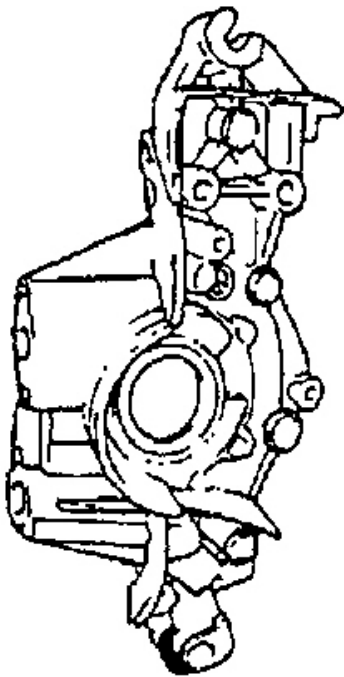
Oil pump case bolt:

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

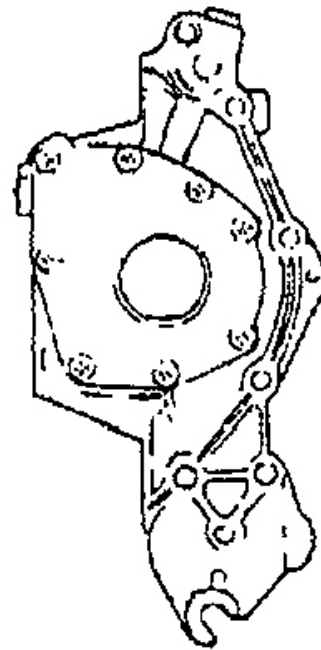
Oil pump cover screw:

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

<Front view>



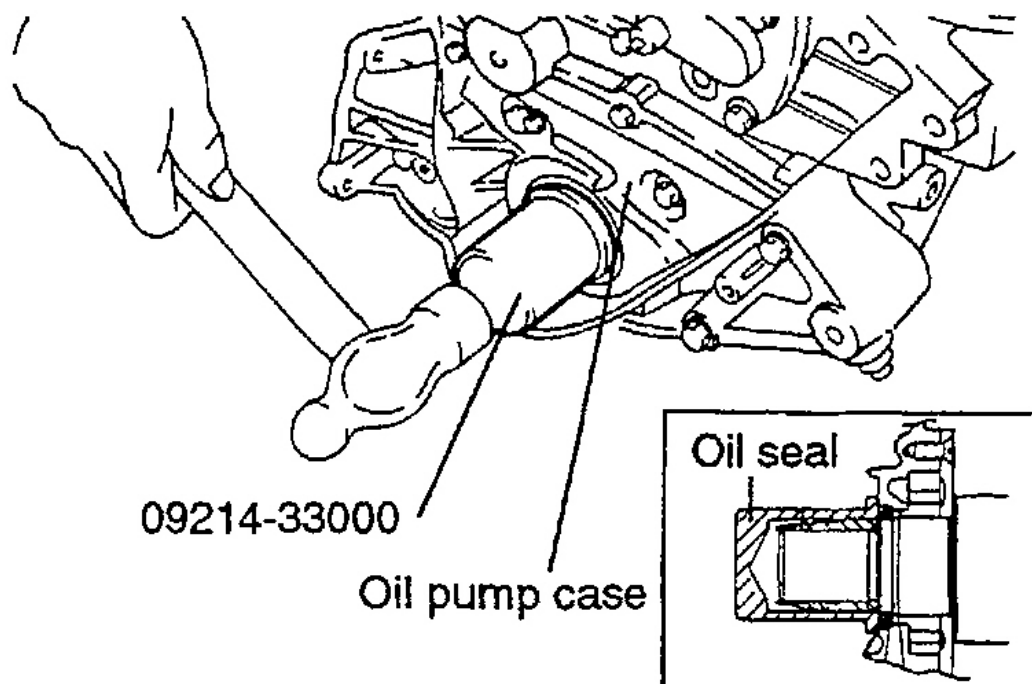
<Rear view>



G01153591

Fig. 133: Identifying Oil Pump Case
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).



G01153592

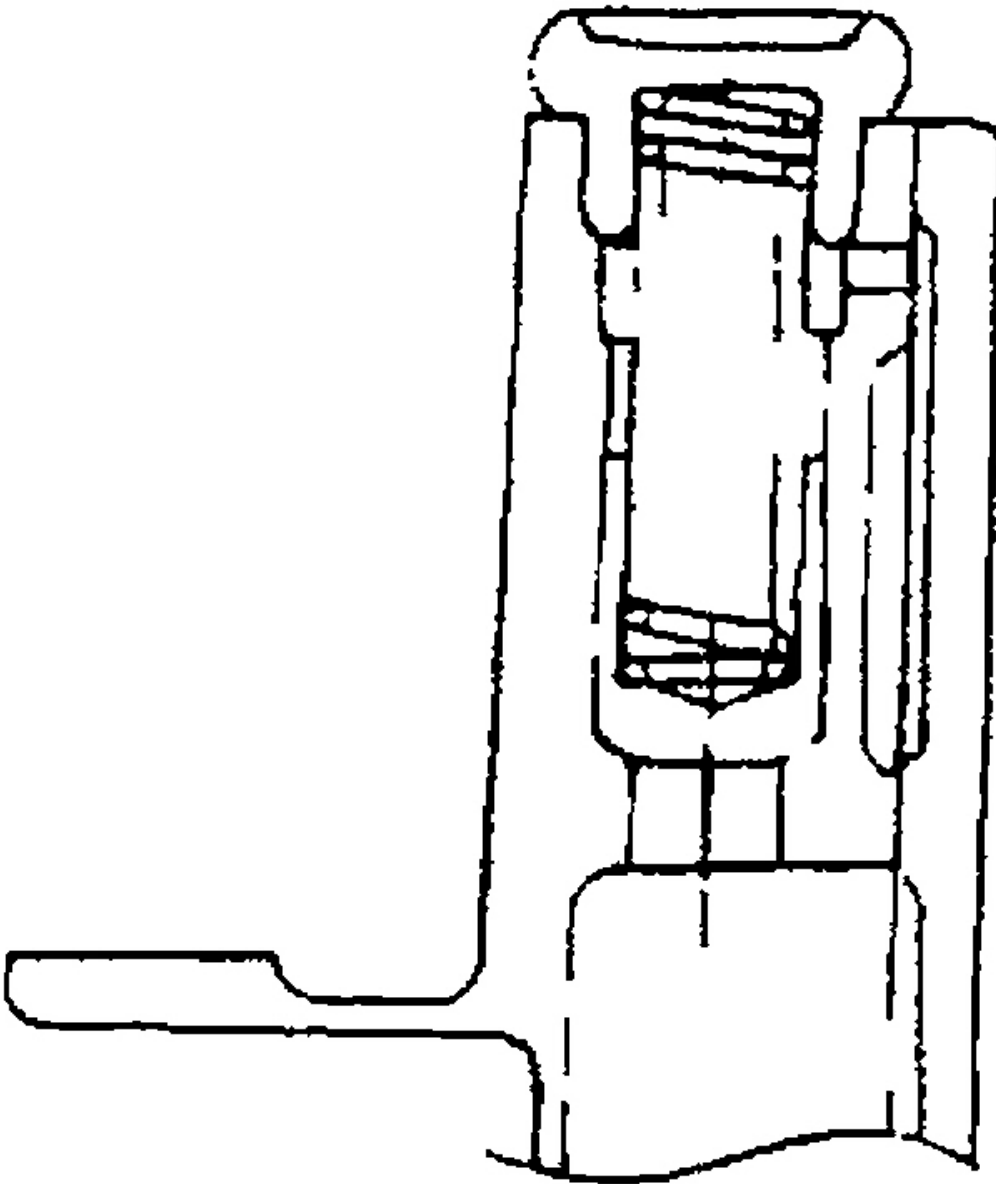
Fig. 134: Installing Oil Seal Into Pump Case
Courtesy of HYUNDAI MOTOR CO.

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)



G01153593

Fig. 135: Identifying 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 pa 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.

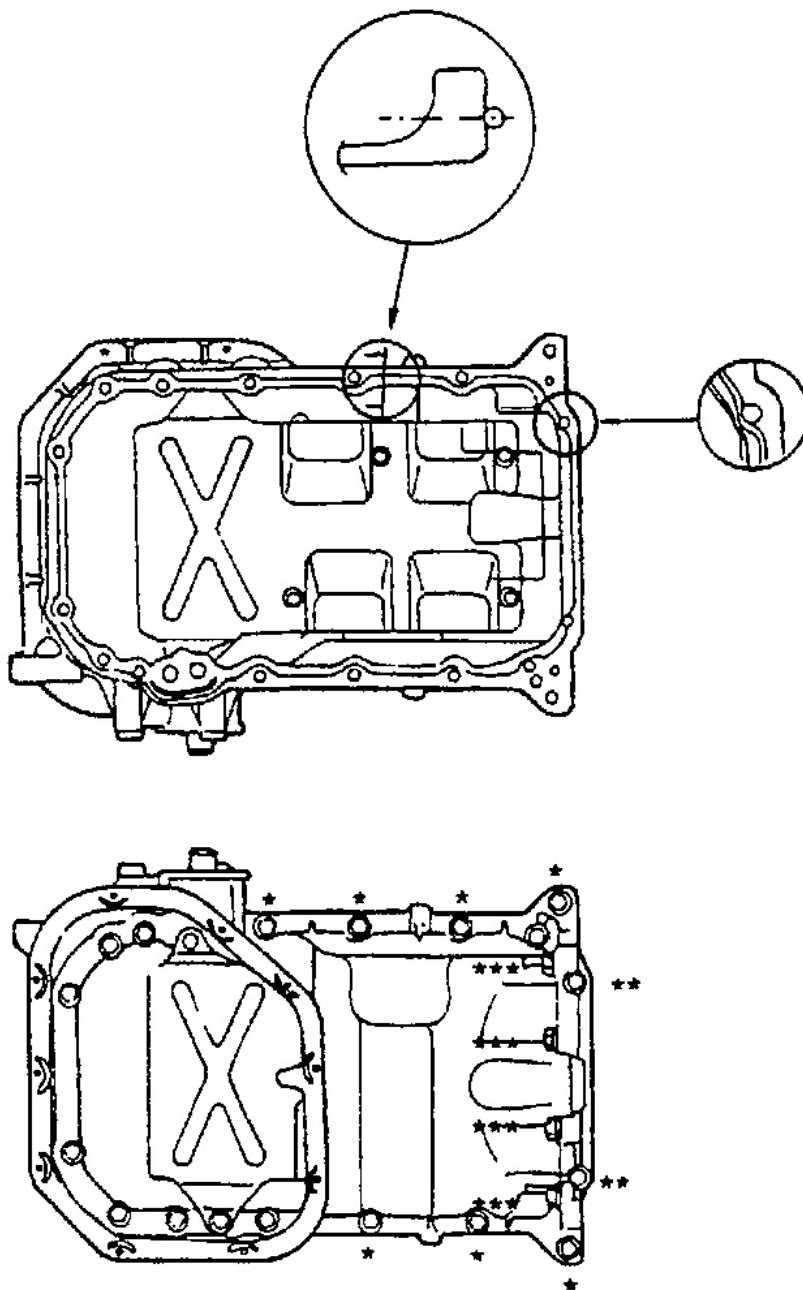
Tightening torque

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)

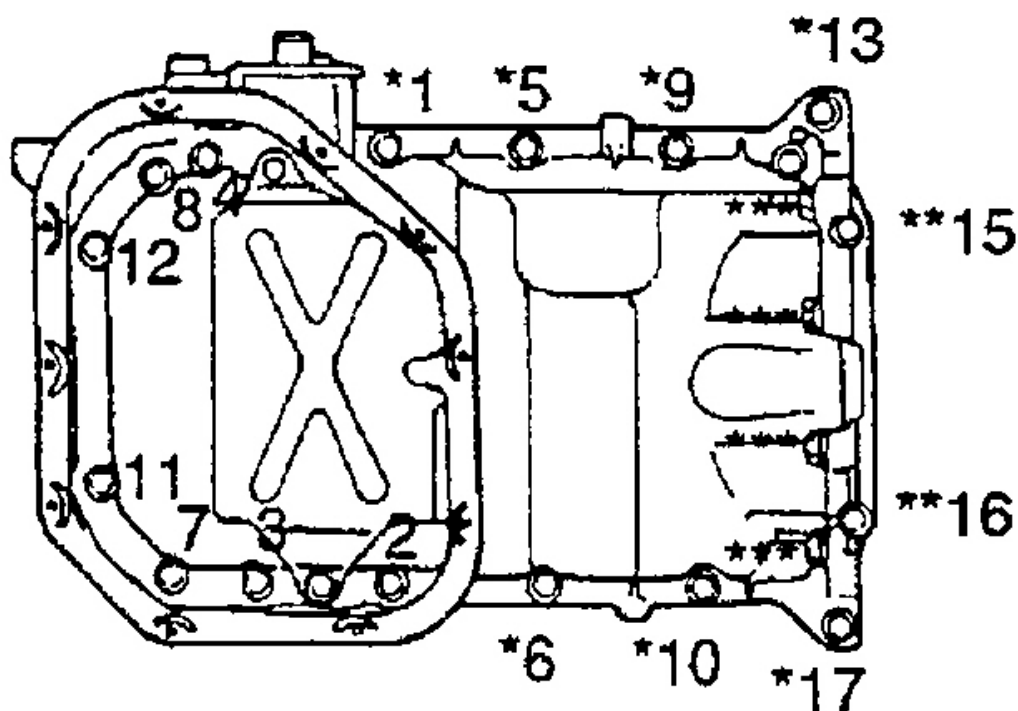
*** 30-42 Nm (300-420 kg.cm, 22-30 lb.ft)



G01153594

Fig. 136: Identifying Oil Pan
Courtesy of HYUNDAI MOTOR CO.

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



G01153595

Fig. 137: Identifying Oil Pan Bolt Torque Sequence
 Courtesy of HYUNDAI MOTOR CO.

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

Sealant:

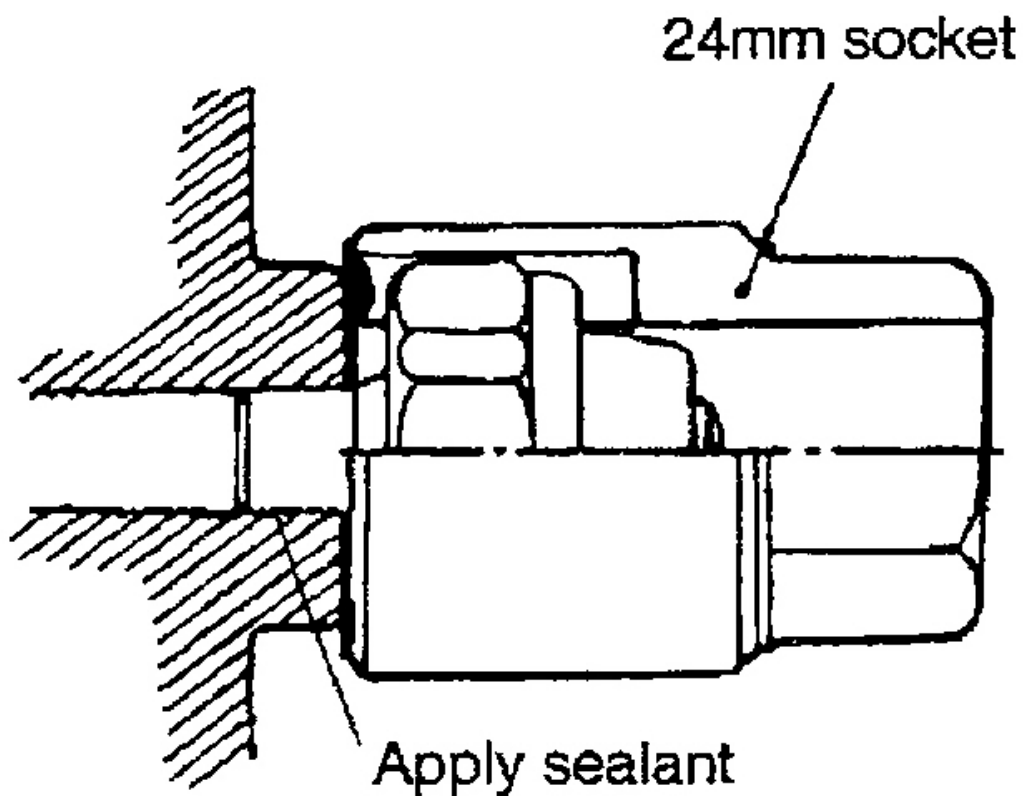
Three bond No. 11471E or 3M ATD No. 8660 or equivalent

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

Tightening torque

Oil pressure switch:

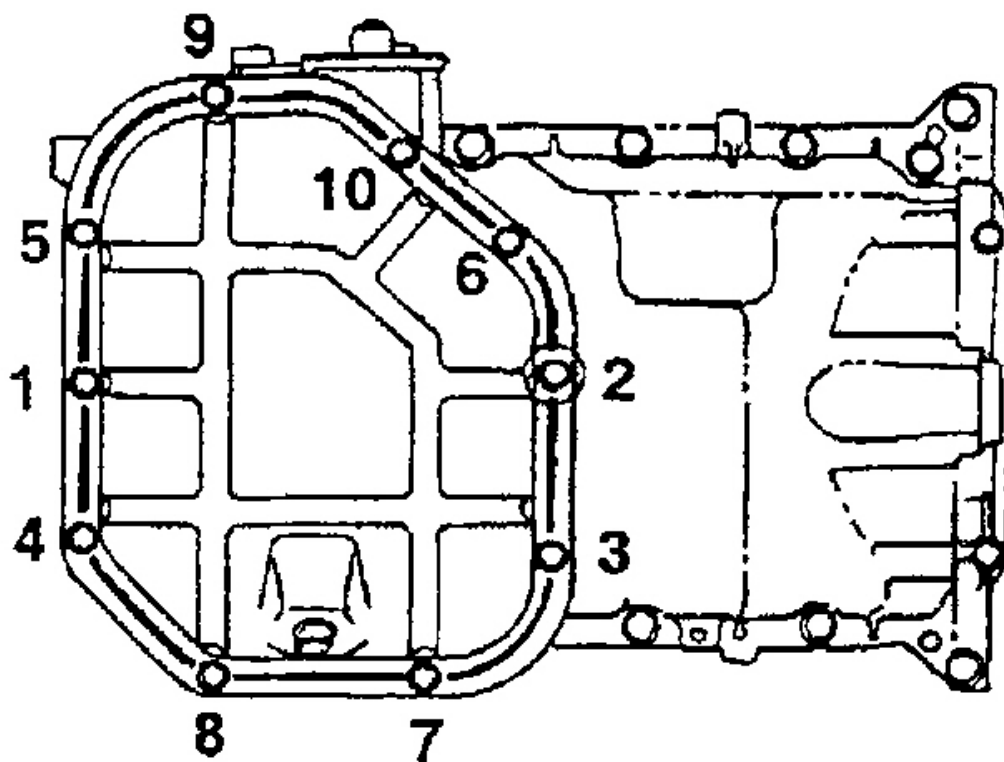
15-22 Nm (150-220 kg.cm, 11-16 lb.ft)



G01153596

Fig. 138: Installing Oil Pressure Switch
Courtesy of HYUNDAI MOTOR CO.

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



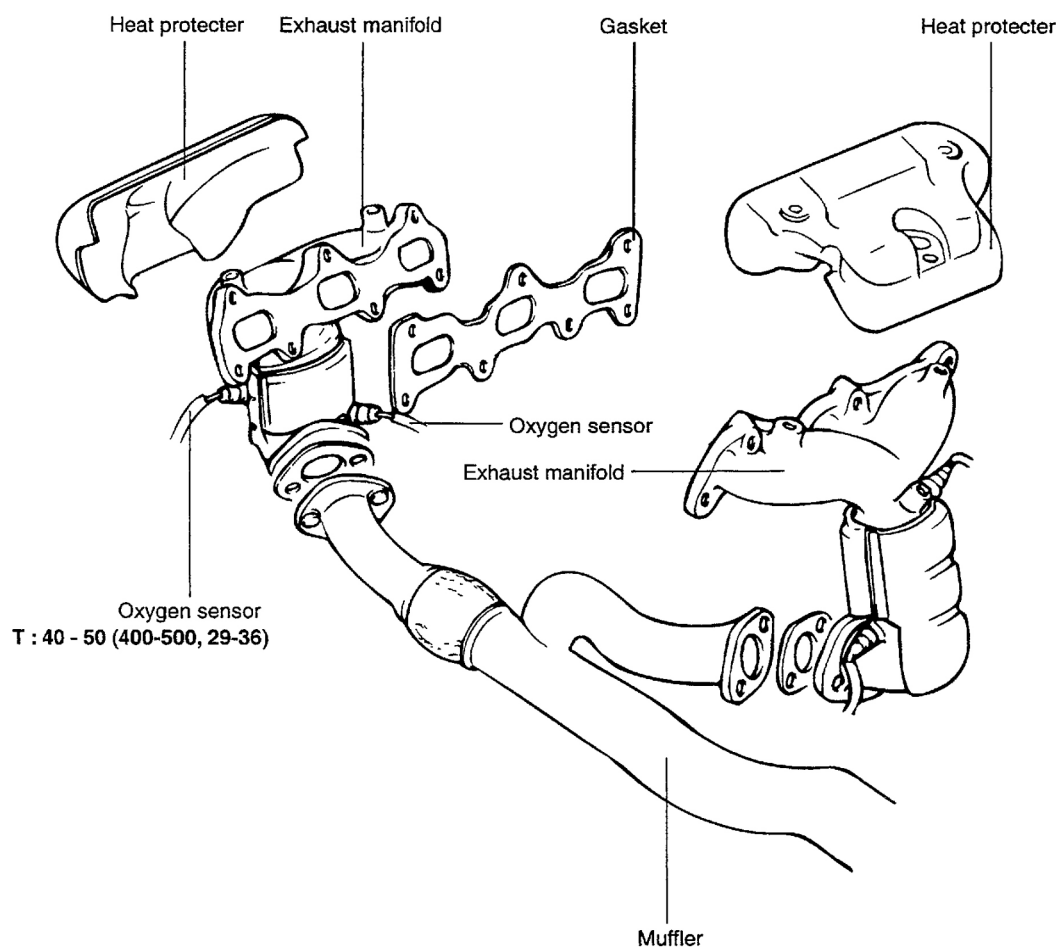
G01153597

Fig. 139: Lower Oil Pan Bolt Torque Sequence
Courtesy of HYUNDAI MOTOR CO.

INTAKE & EXHAUST SYSTEM

EXHAUST MANIFOLD

COMPONENTS



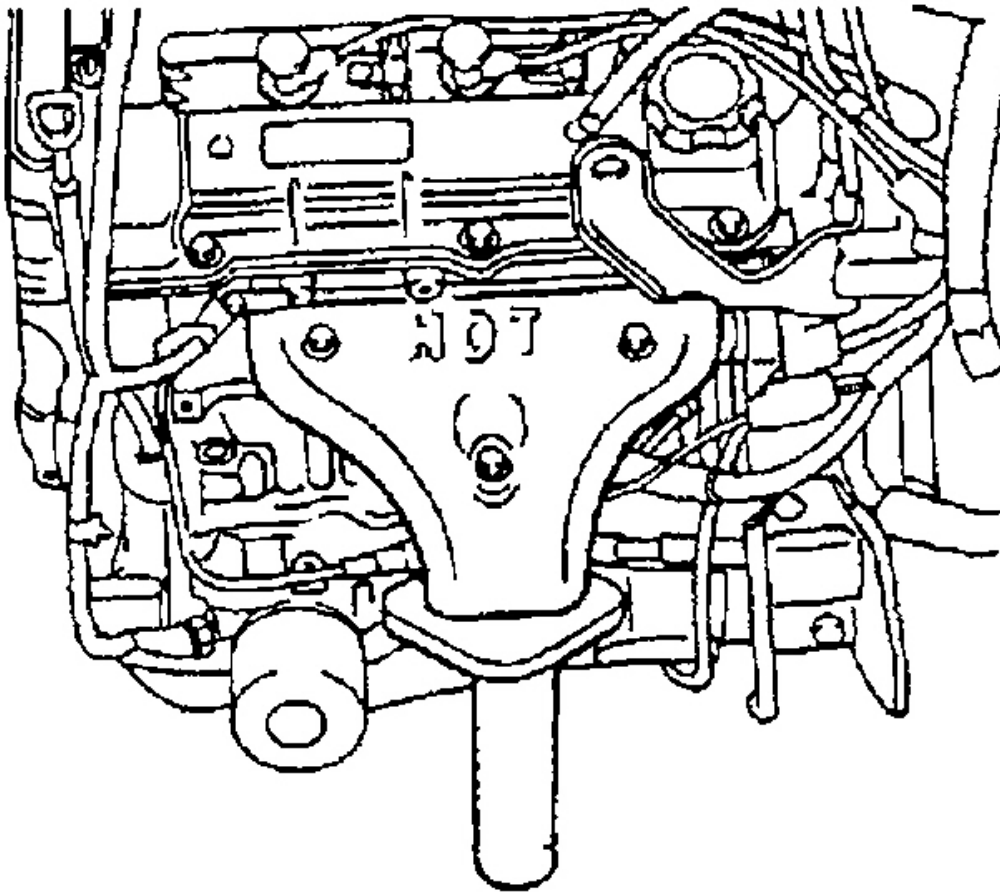
TORQUE : Nm (kg·cm, lb.ft)

G01153598

Fig. 140: Exhaust Manifold Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

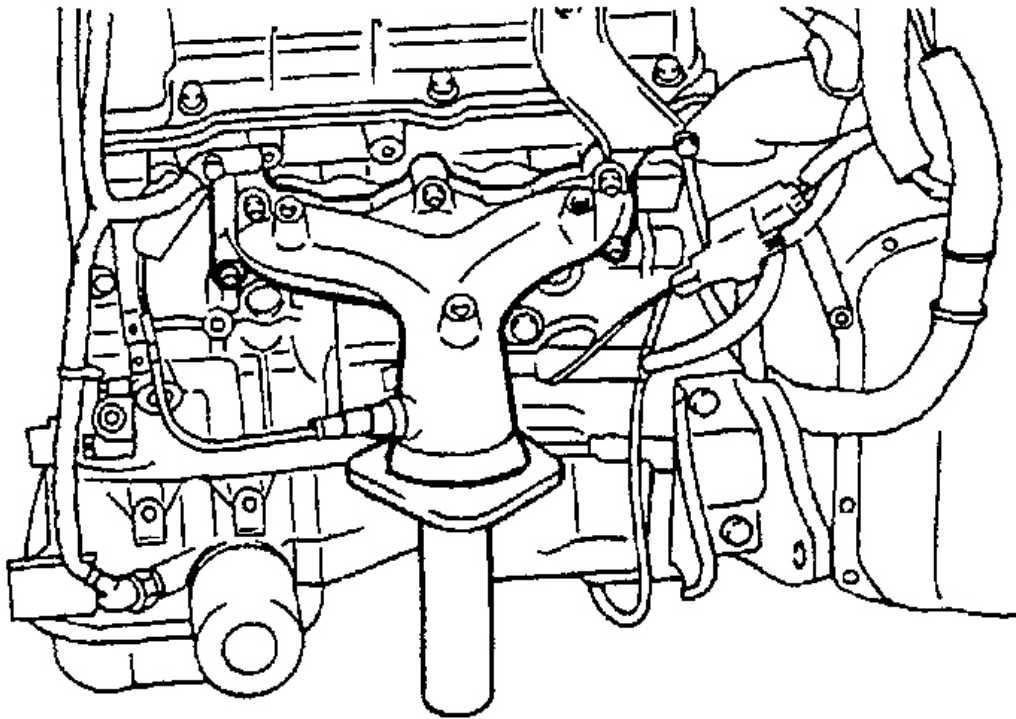
1. Remove the heat protector.



G01153599

Fig. 141: Identifying Heat Protector
Courtesy of HYUNDAI MOTOR CO.

2. Remove the exhaust manifold.



G01153600

Fig. 142: Identifying Exhaust Manifold
Courtesy of HYUNDAI MOTOR CO.

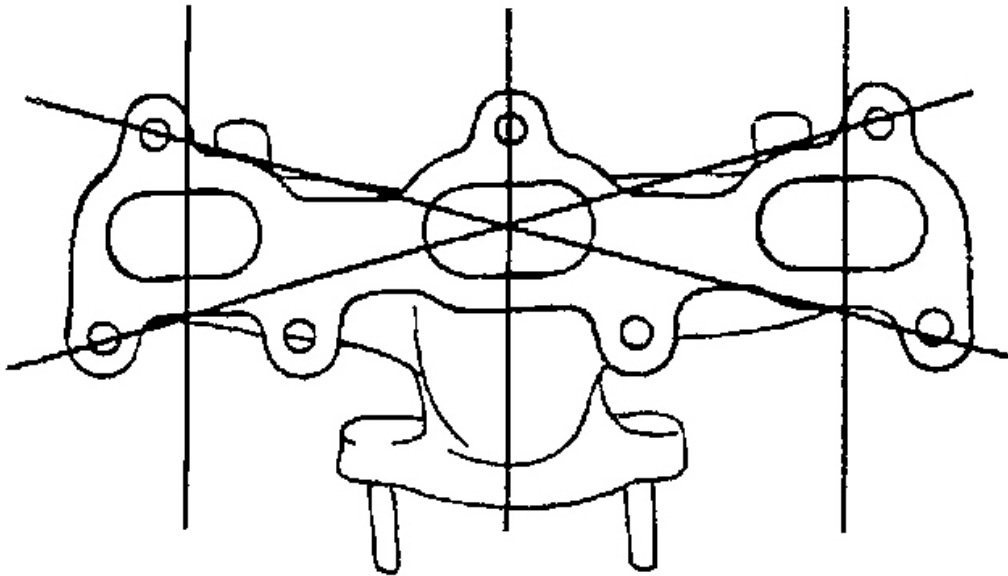
3. Remove the exhaust manifold gasket.

INSPECTION

1. Check for damage or cracks.
2. Using a straight edge and feels 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



G01153601

Fig. 143: Checking Exhaust Manifold Flange
Courtesy of HYUNDAI MOTOR CO.

3. Check the exhaust manifold for damage and cracks.

INSTALLATION

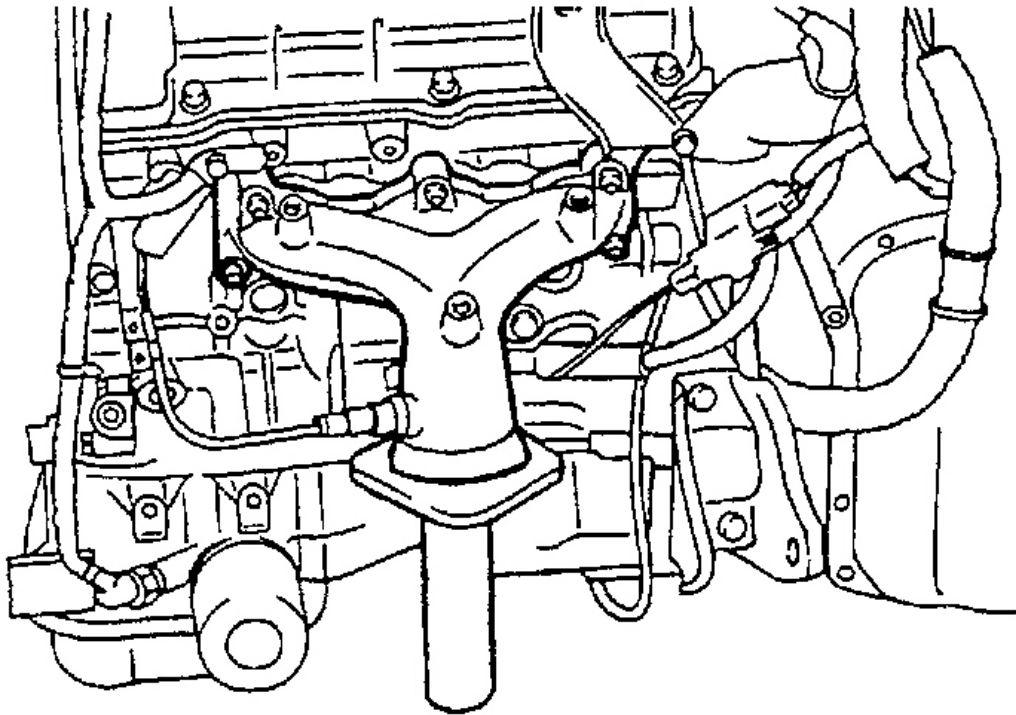
1. Install the exhaust manifold with gasket.

Tightening torque

Exhaust manifold:

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

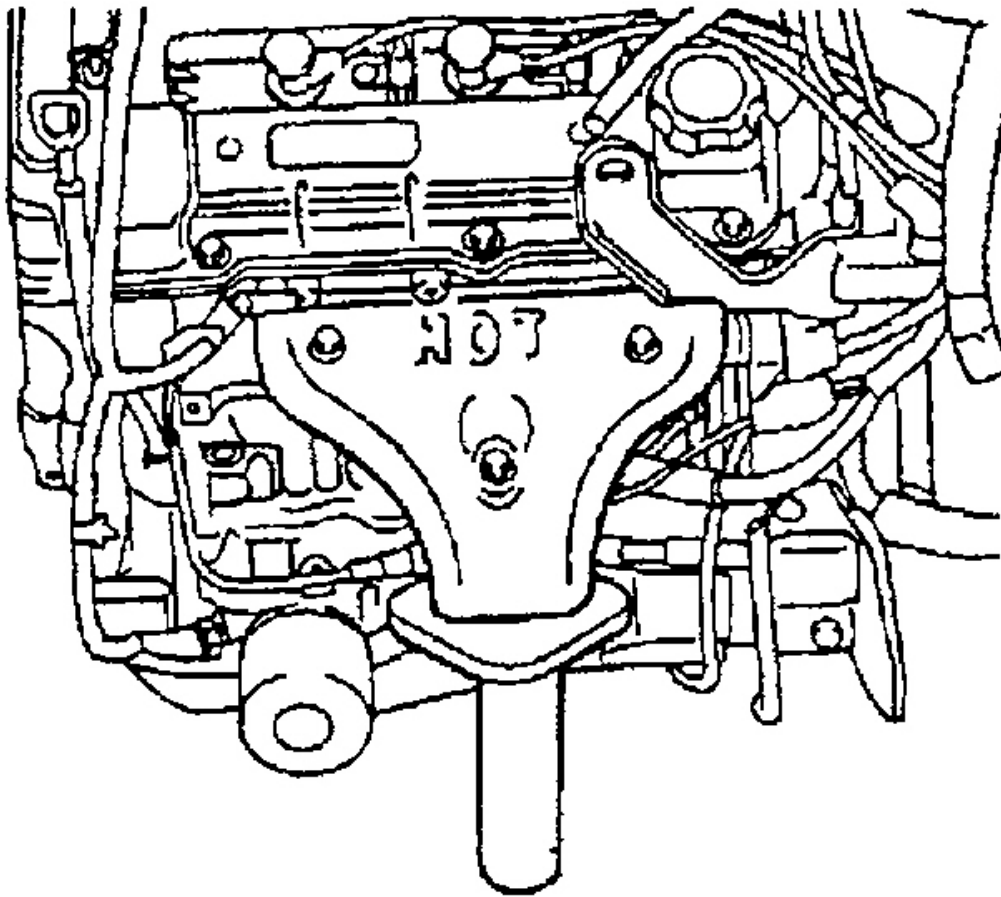
NOTE: Do not re-use an exhaust manifold gasket.



G01153602

Fig. 144: Installing Exhaust Manifold
Courtesy of HYUNDAI MOTOR CO.

2. Install the heat protector.

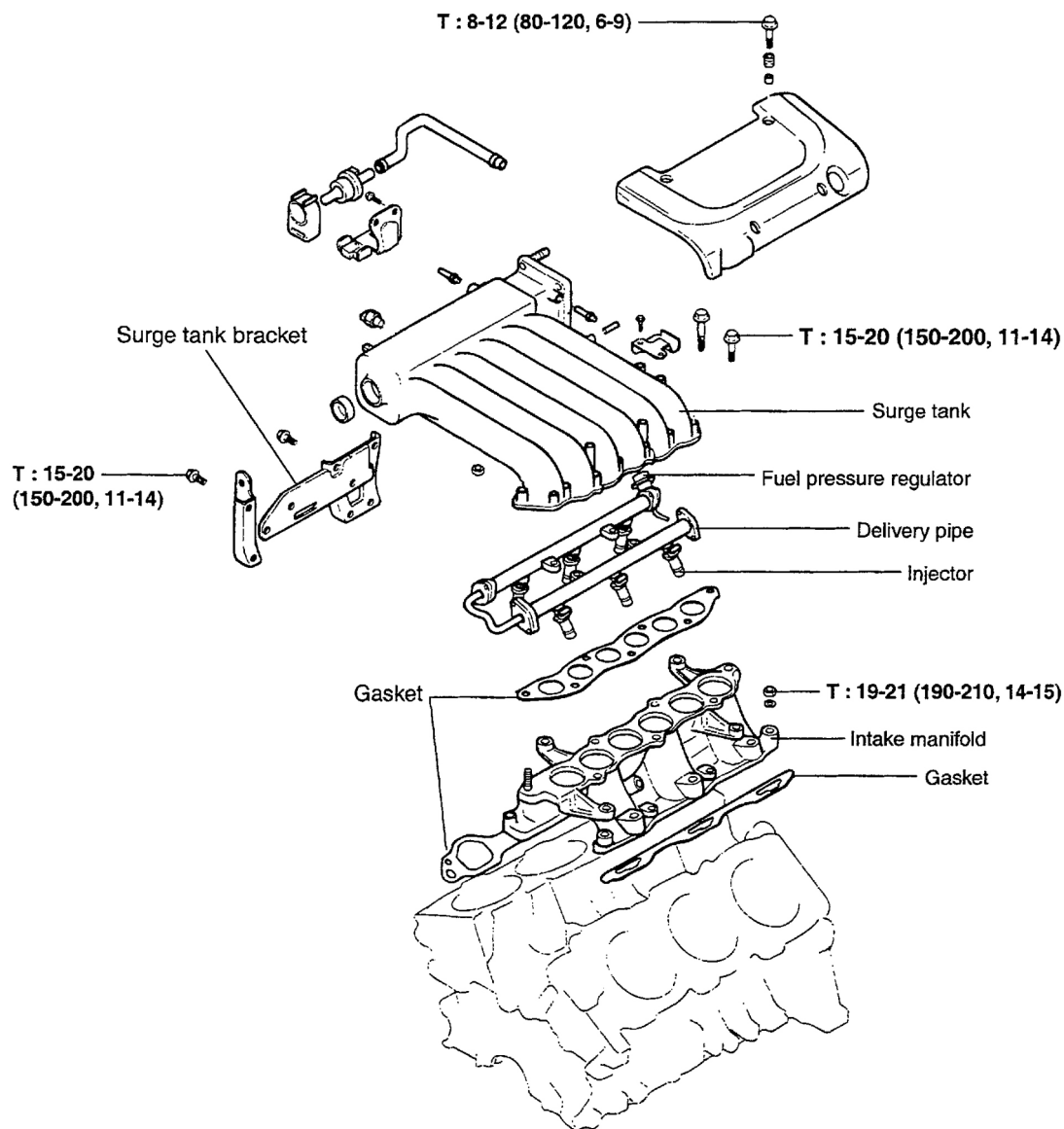


G01153603

Fig. 145: Identifying Heat Protector
Courtesy of HYUNDAI MOTOR CO.

INTAKE MANIFOLD

COMPONENTS



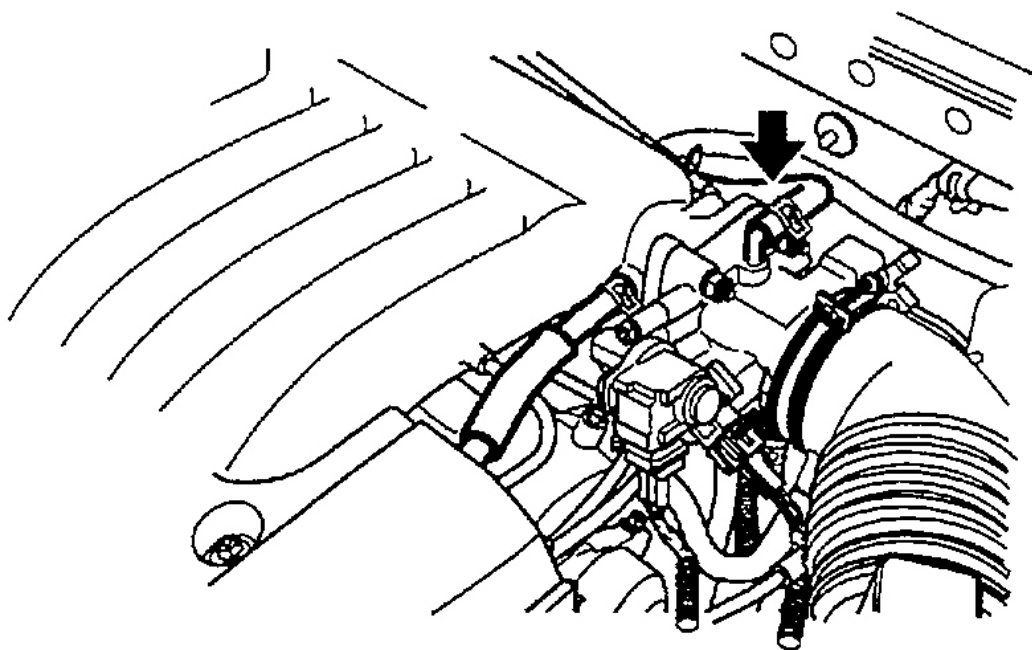
TORQUE : Nm (kg·cm, lb·ft)

G01153604

Fig. 146: Intake Manifold Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

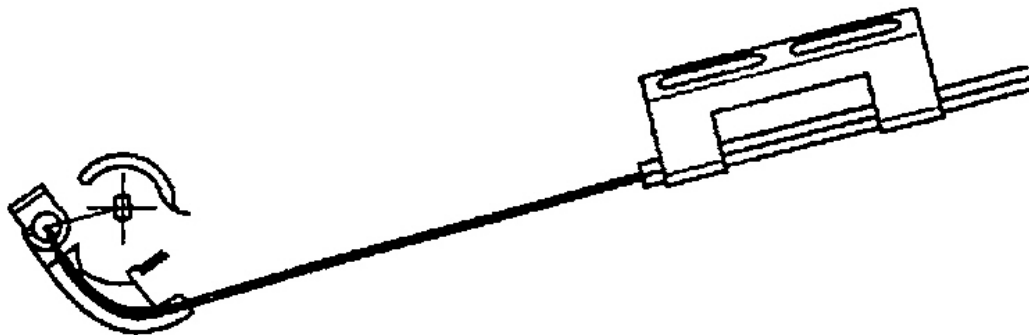
1. Remove the air intake hose connected to the throttle body.



G01153605

Fig. 147: Identifying Air Intake Hose & Throttle Body
Courtesy of HYUNDAI MOTOR CO.

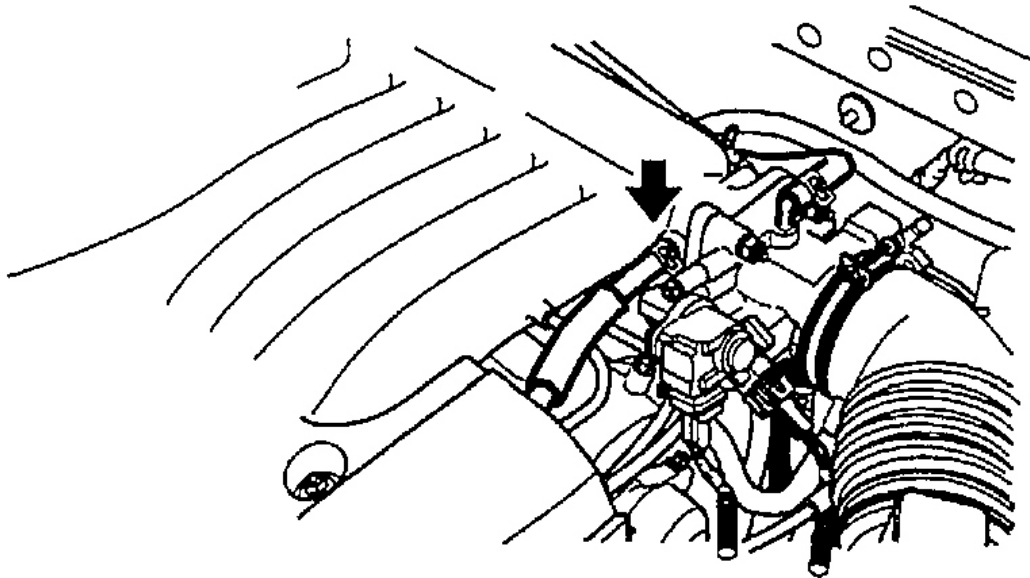
2. Remove the accelerator and cruise control cables.
3. Remove the engine coolant hose and throttle body.



G01153606

Fig. 148: Identifying Accelerator & Cruise Control Cables
Courtesy of HYUNDAI MOTOR CO.

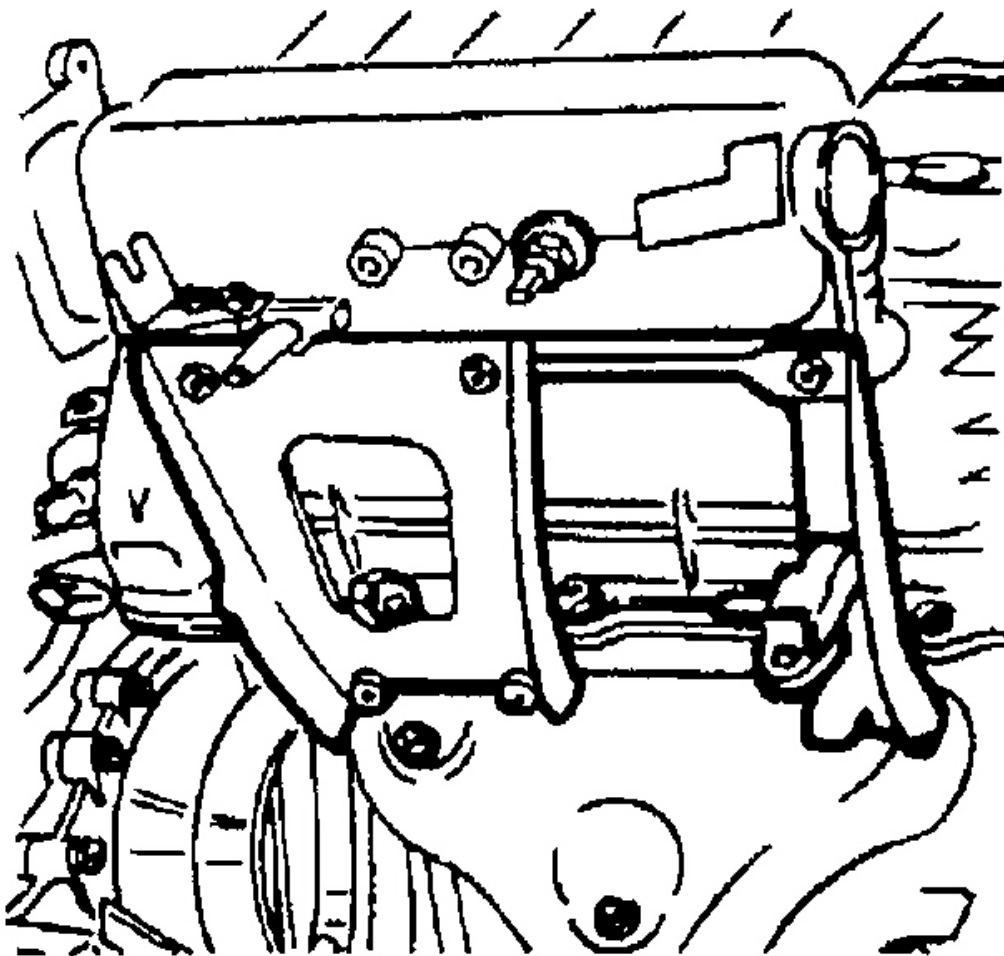
4. Remove the P.C.V. hose and brake booster vacuum hoses.
5. Disconnect the vacuum hose connections.



G01153607

Fig. 149: Identifying Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

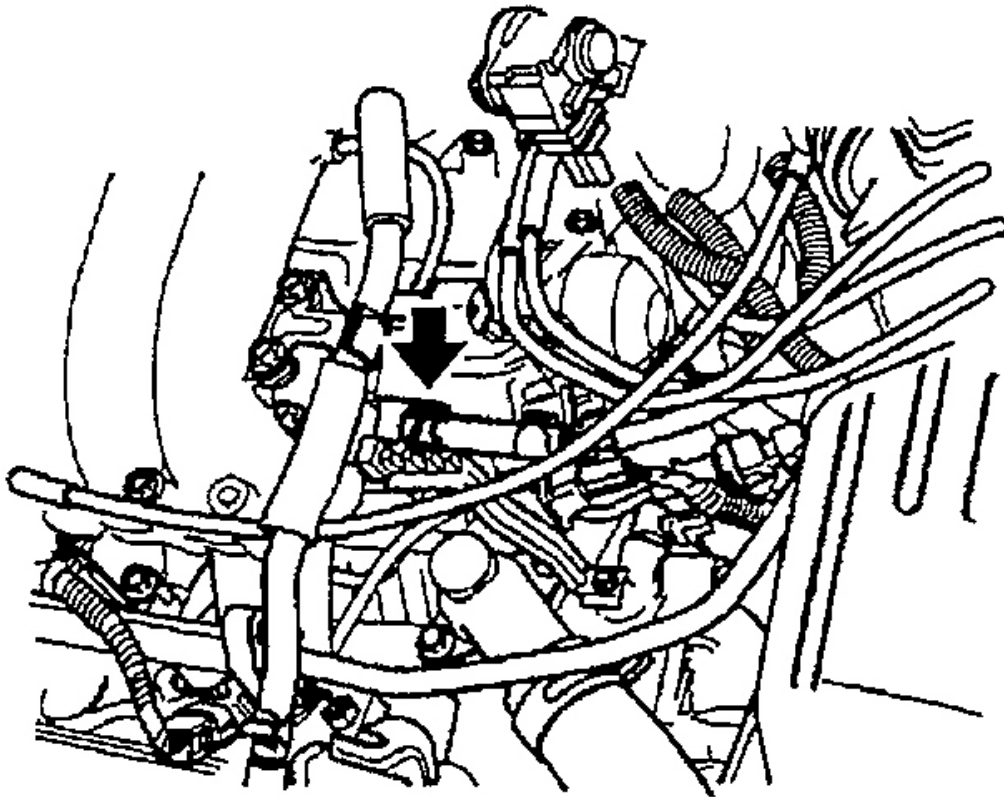
6. Remove the surge tank stay.



G01153608

Fig. 150: View Of Air Intake Surge Tank
Courtesy of HYUNDAI MOTOR CO.

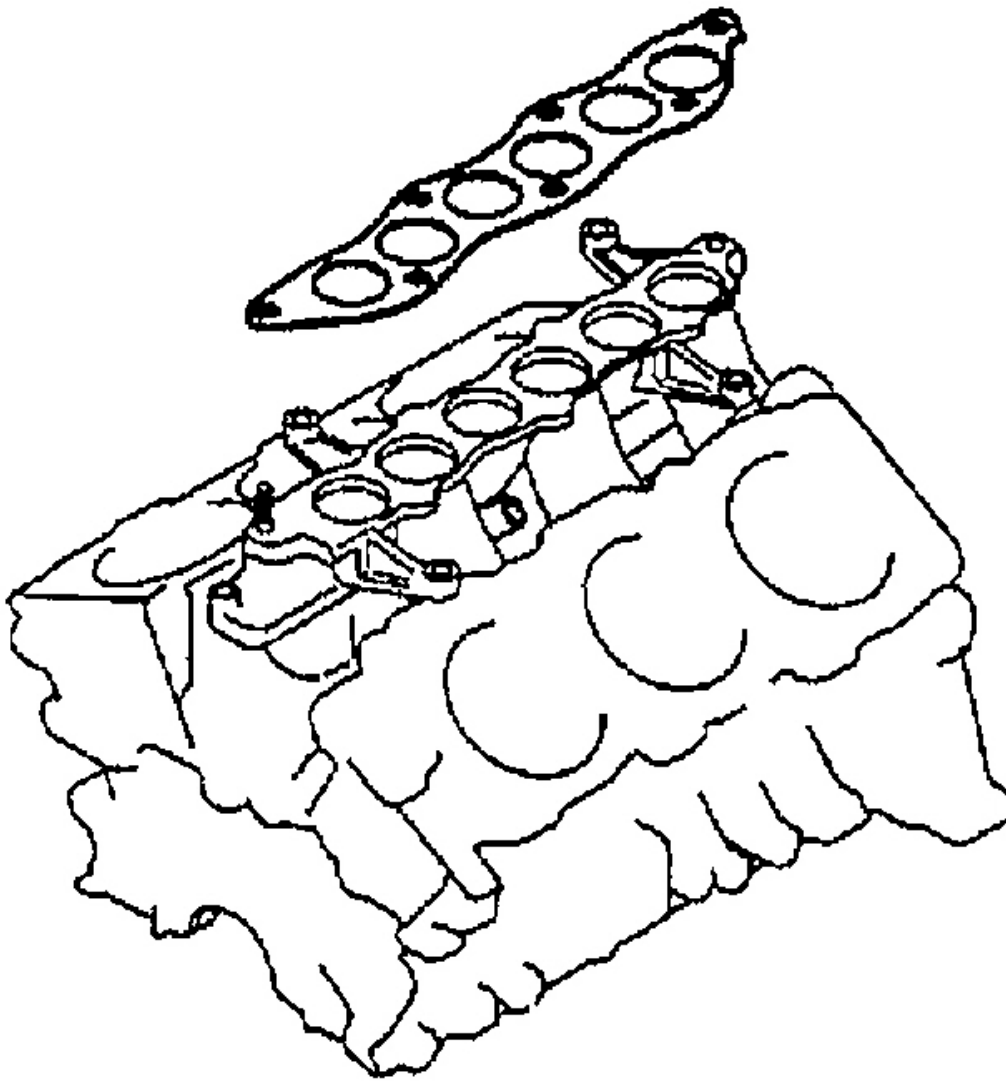
7. Bleed off the pressure in the fuel pipe line to prevent the fuel from spilling.
8. Disconnect the connector from high pressure hose.



G01153609

Fig. 151: Identifying High Pressure Hose Connector
Courtesy of HYUNDAI MOTOR CO.

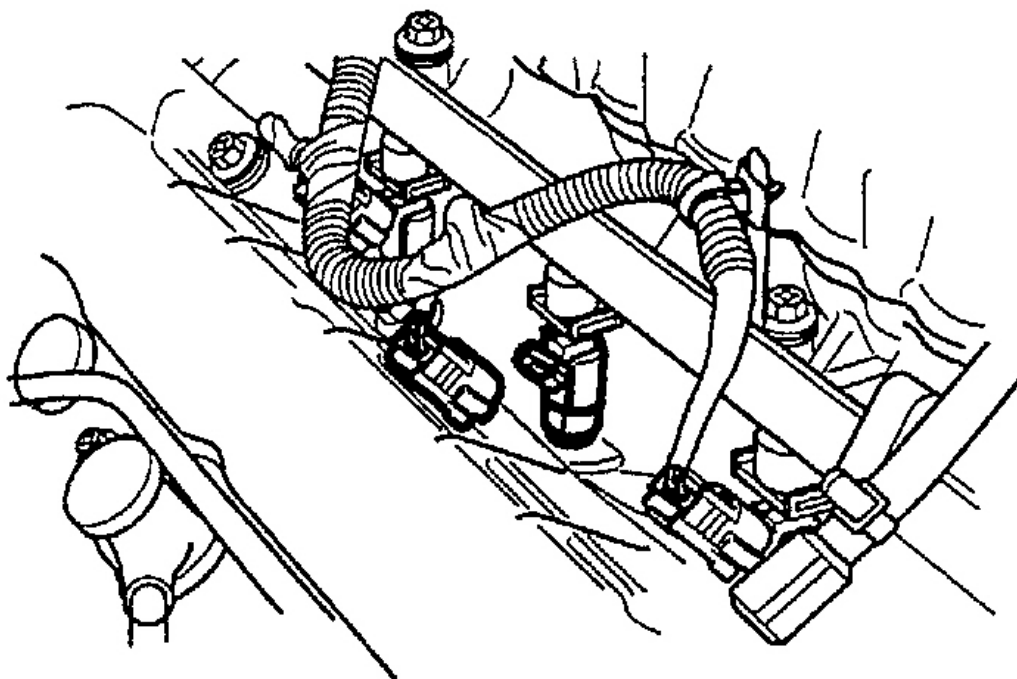
9. Remove the surge tank and gasket.



G01153610

Fig. 152: View Of Air Intake Surge Tank Gasket
Courtesy of HYUNDAI MOTOR CO.

10. Disconnect the fuel injector harness connector.

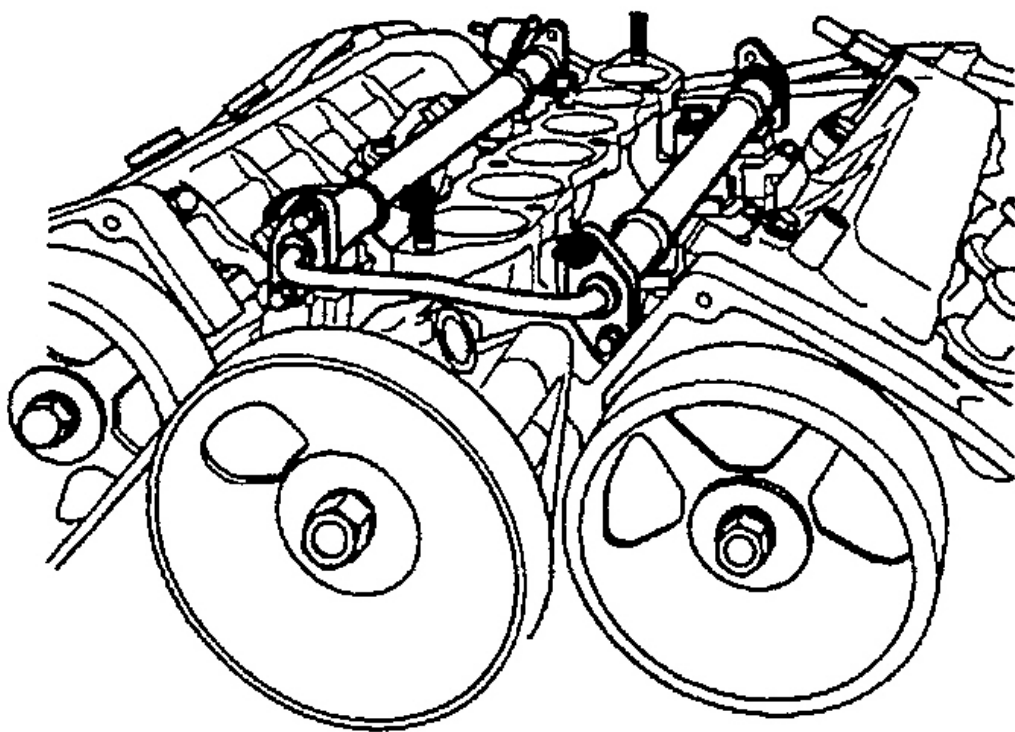


G01153611

Fig. 153: View Of Fuel Injector Harness
Courtesy of HYUNDAI MOTOR CO.

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

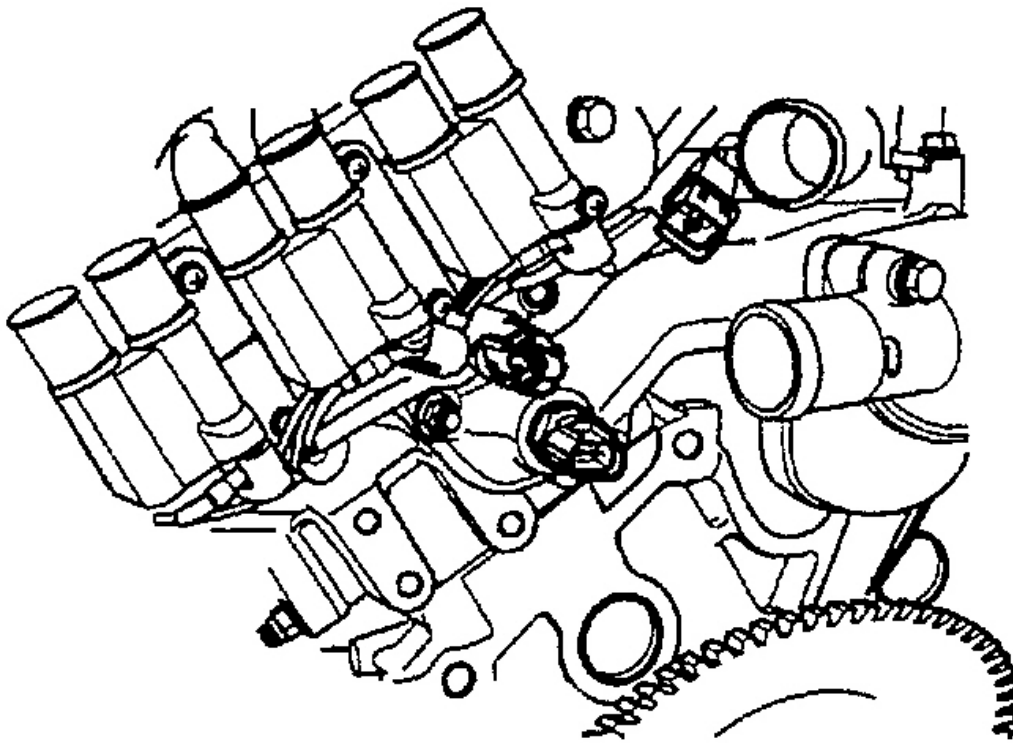
NOTE: When the delivery pipe is remove, be careful not to drop an injector.



G01153612

Fig. 154: View Of Fuel Injector Delivery Pipe
Courtesy of HYUNDAI MOTOR CO.

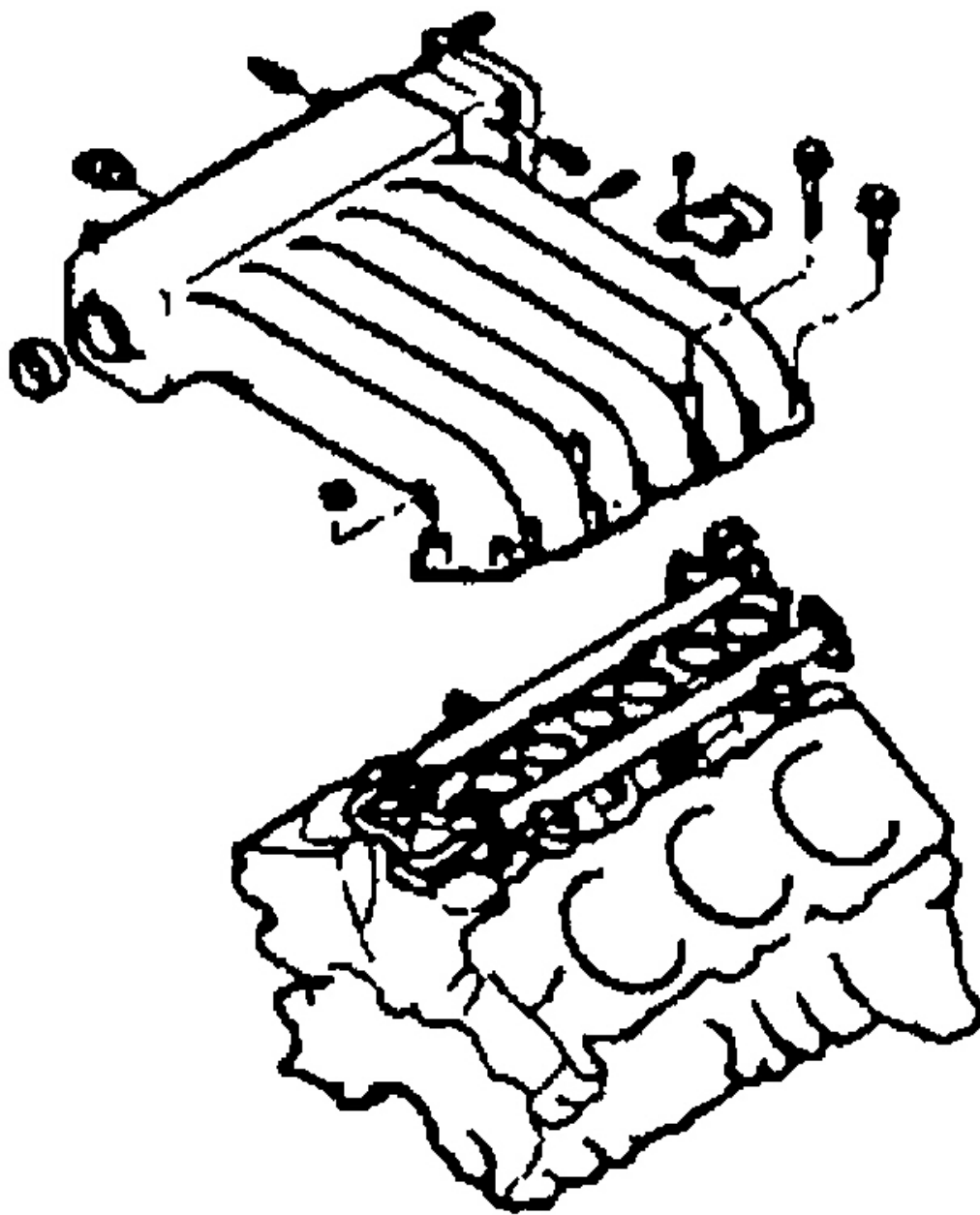
12. Disconnect the wiring harness of the coolant sensor assembly.



G01153613

Fig. 155: View Of Coolant Sensor
Courtesy of HYUNDAI MOTOR CO.

13. Remove the surge tank.



G01153615

Fig. 156: Removing Surge Tank
Courtesy of HYUNDAI MOTOR CO.

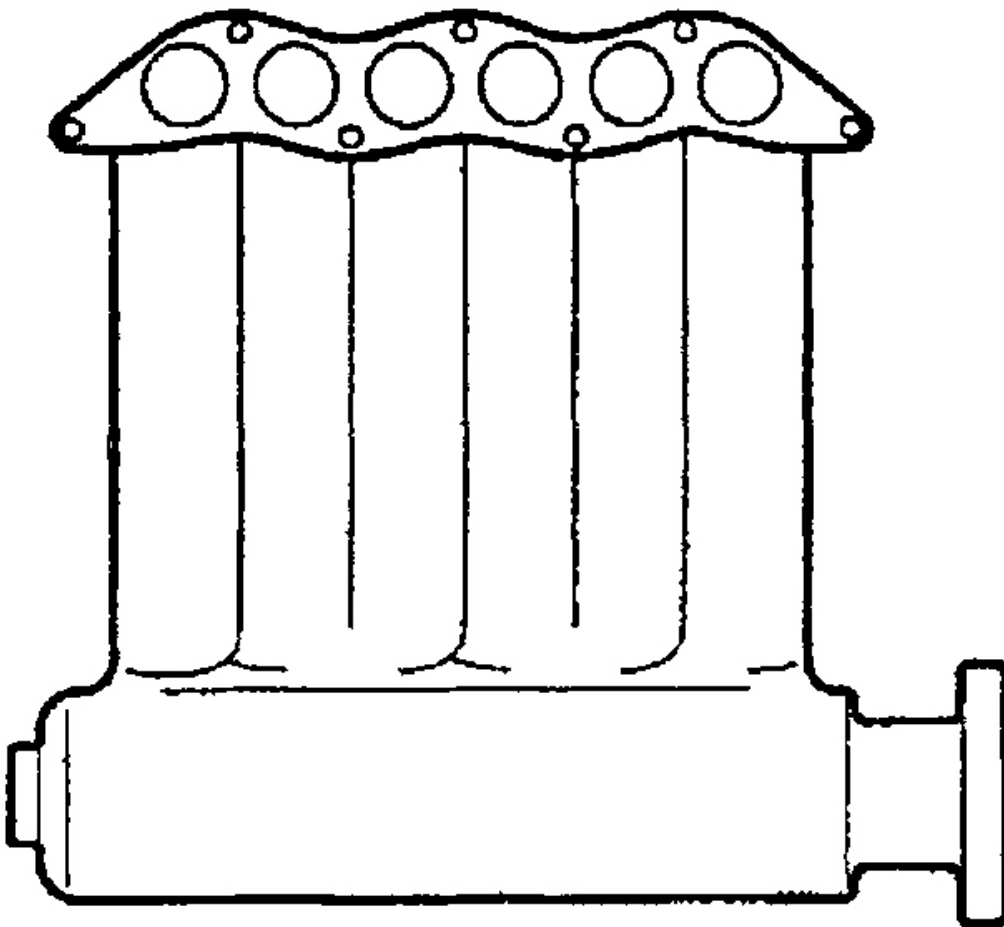
INSPECTION

SURGE TANK & 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.)



G01153616

Fig. 157: Inspecting Air Intake Surge Tank Surface
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

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

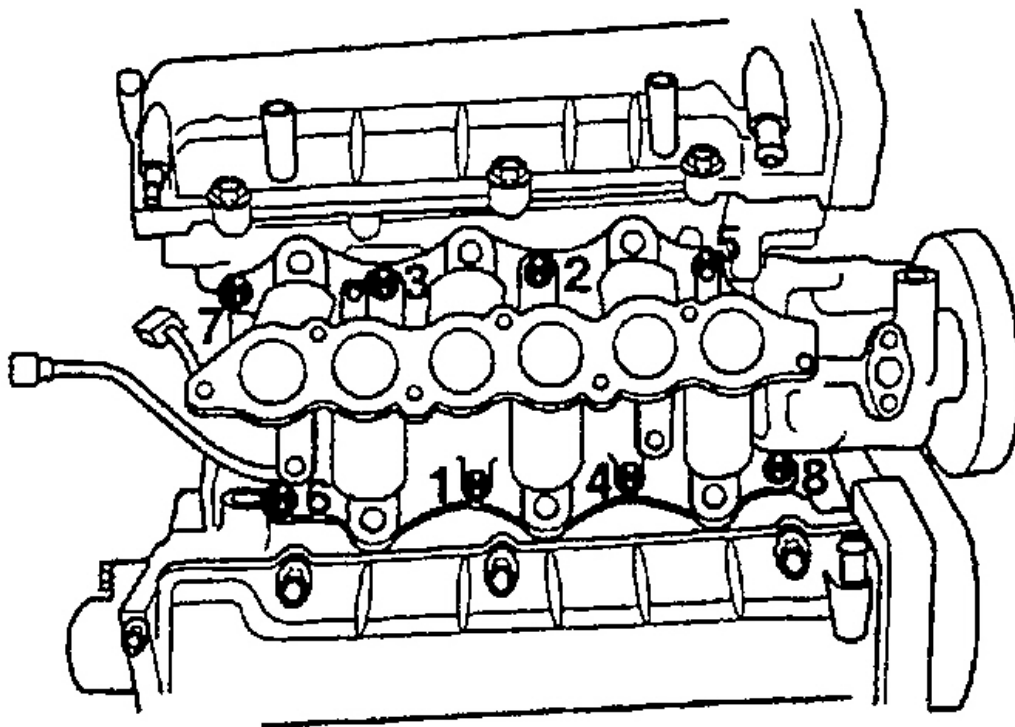
Tightening torque

Intake manifold:

19-21 Nm (190-210 kg.cm, 14-15 lb.ft)

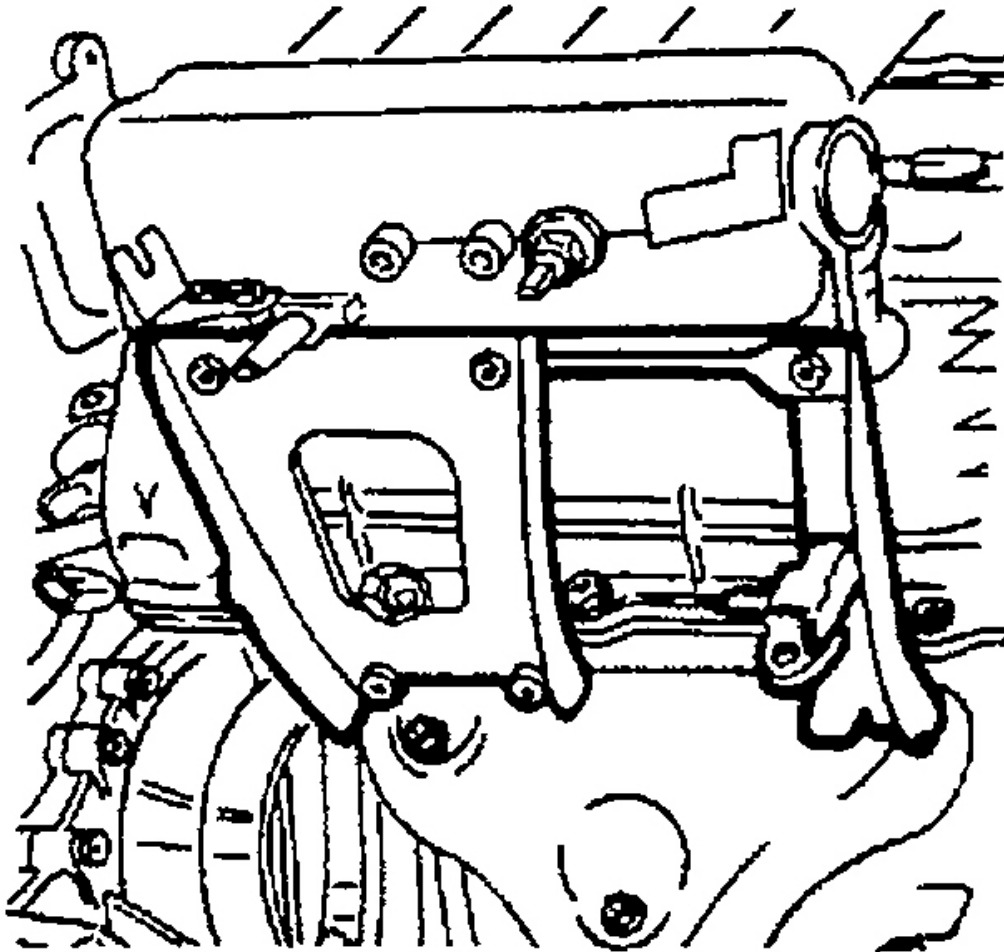
Surge tank:

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



G01153617

Fig. 158: Identifying Intake Manifold Bolt Torque Sequence
Courtesy of HYUNDAI MOTOR CO.

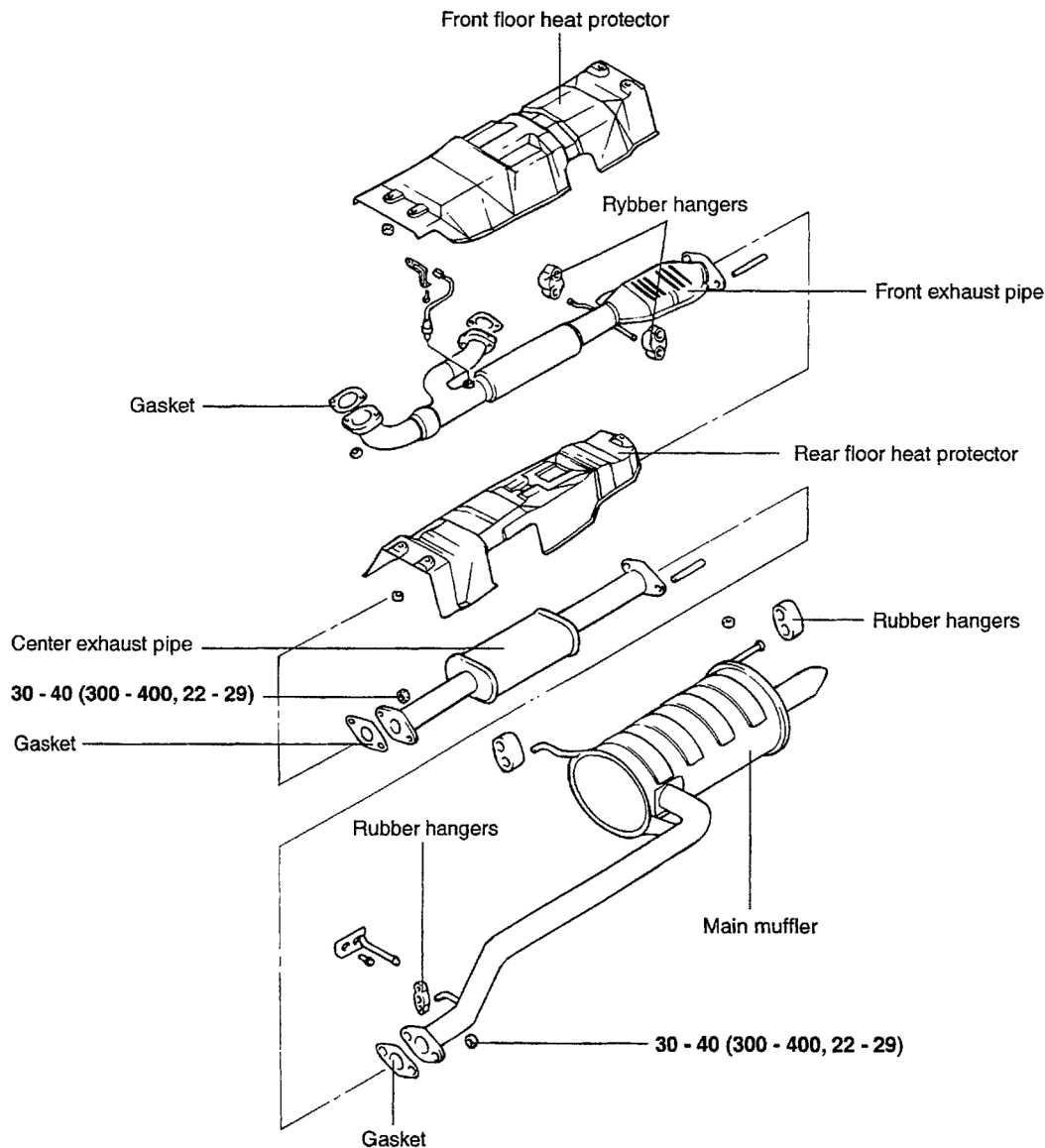


G01153618

Fig. 159: View Of Air Intake Surge Tank
Courtesy of HYUNDAI MOTOR CO.

MUFFLER

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

G01153619

Fig. 160: Muffler Components
Courtesy of HYUNDAI MOTOR CO.

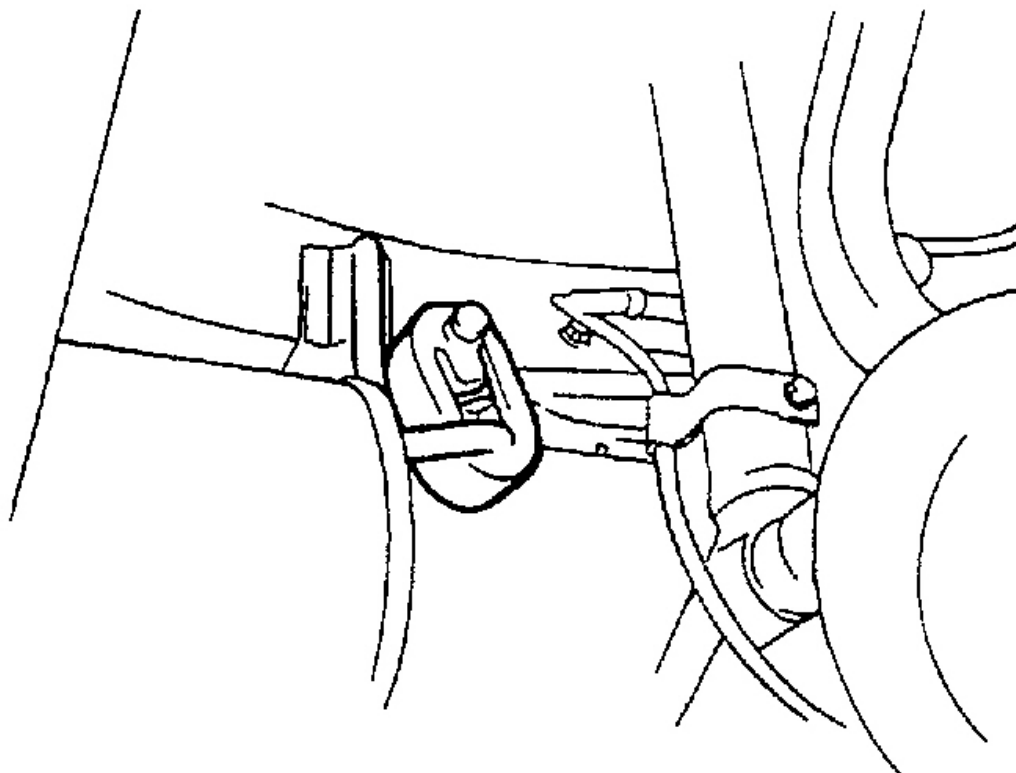
REMOVAL

MAIN MUFFLER

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

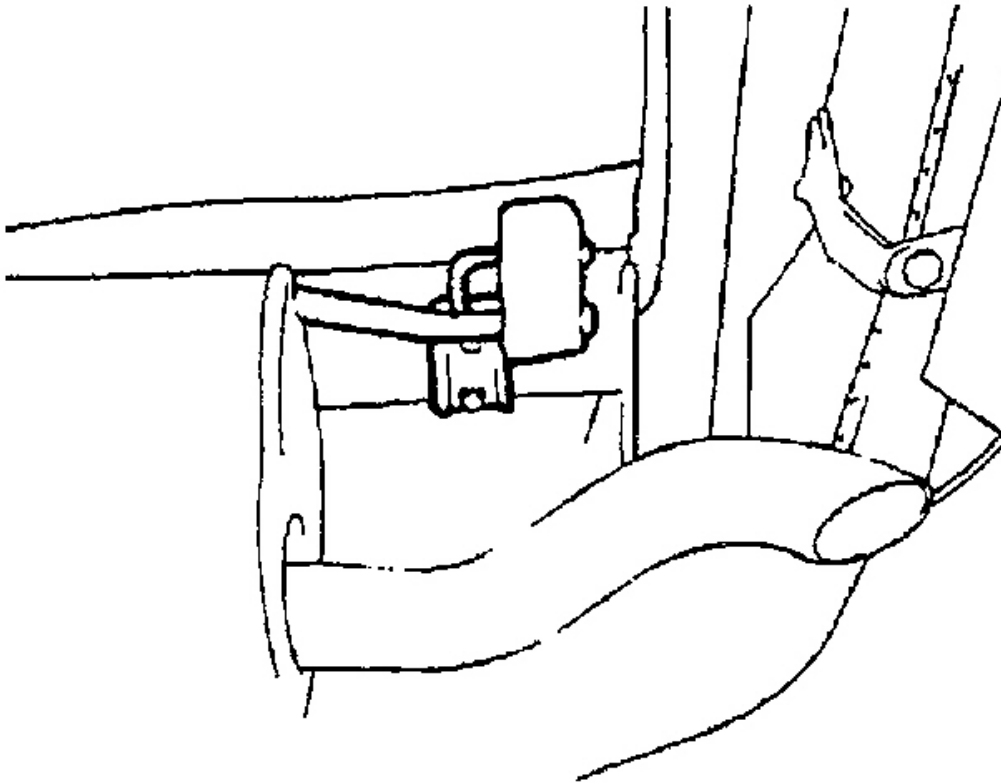
exhaust system is cool.

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



G01153620

Fig. 161: View Of Muffler Hanger
Courtesy of HYUNDAI MOTOR CO.



G01153621

Fig. 162: View Of Muffler Hanger
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.
3. Remove the front exhaust pipe from the rubber hanger.

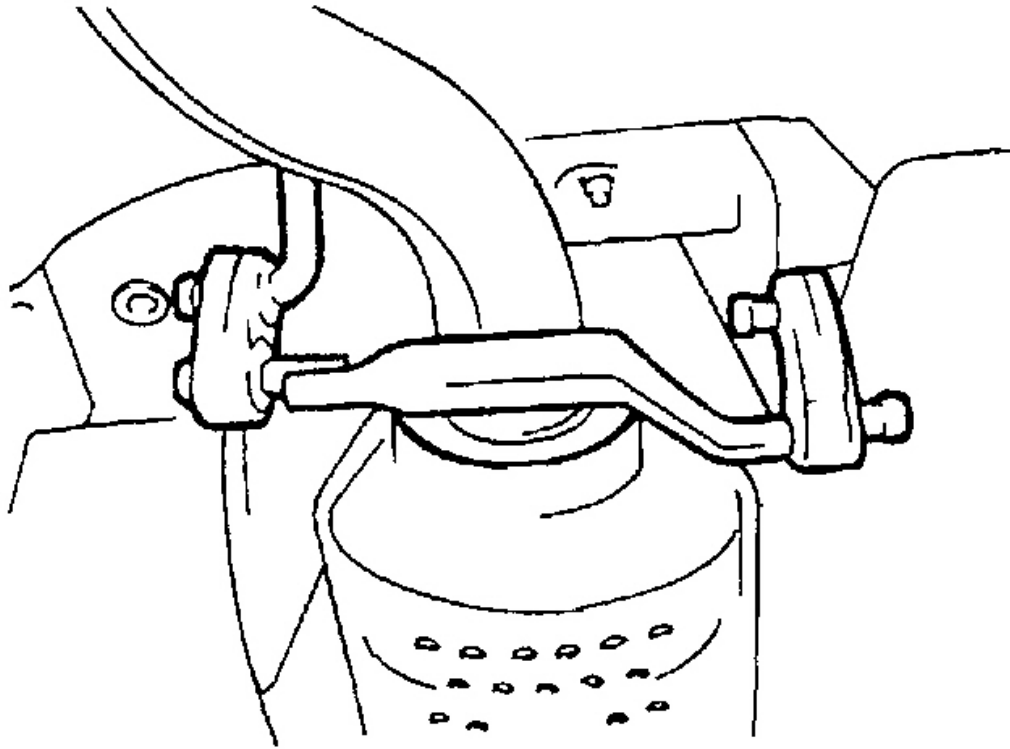
**G01153623**

Fig. 163: View Of Front Exhaust Pipe & Rubber Hangers
Courtesy of HYUNDAI MOTOR CO.

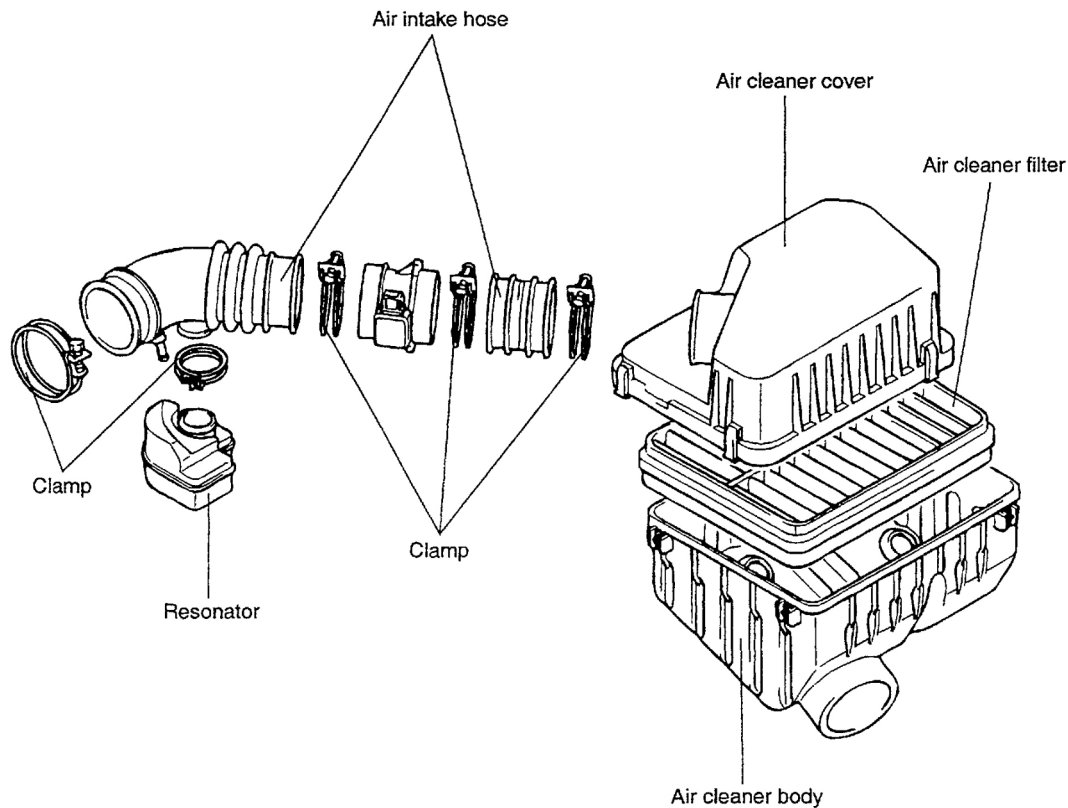
INSPECTION

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**



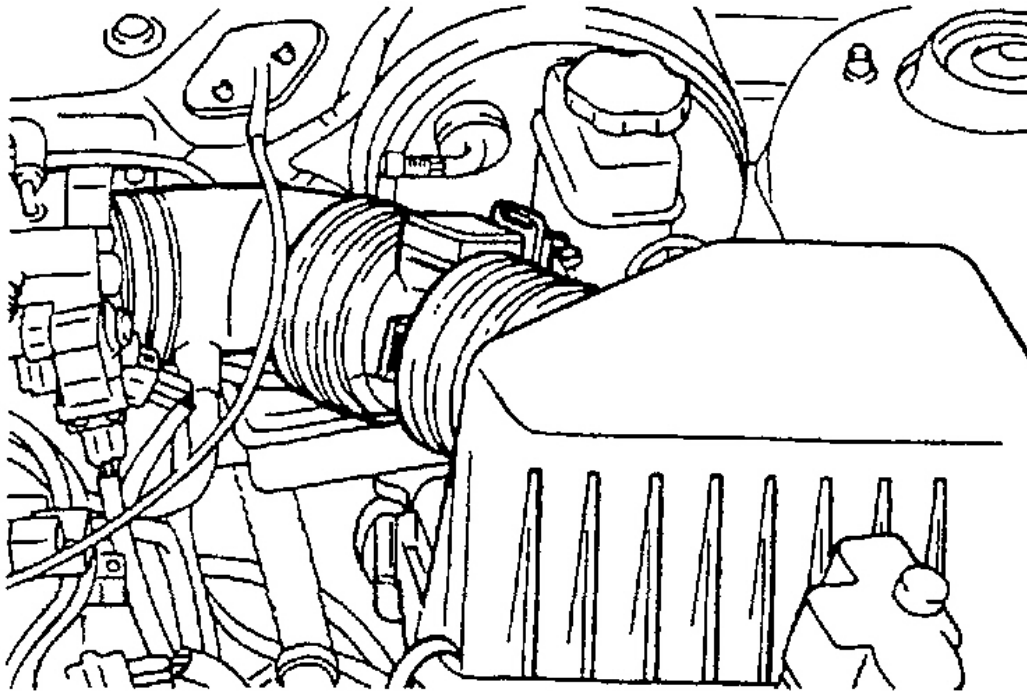
TORQUE : Nm (kg·cm, lb·ft)

G01153624

Fig. 164: 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.



G01153625

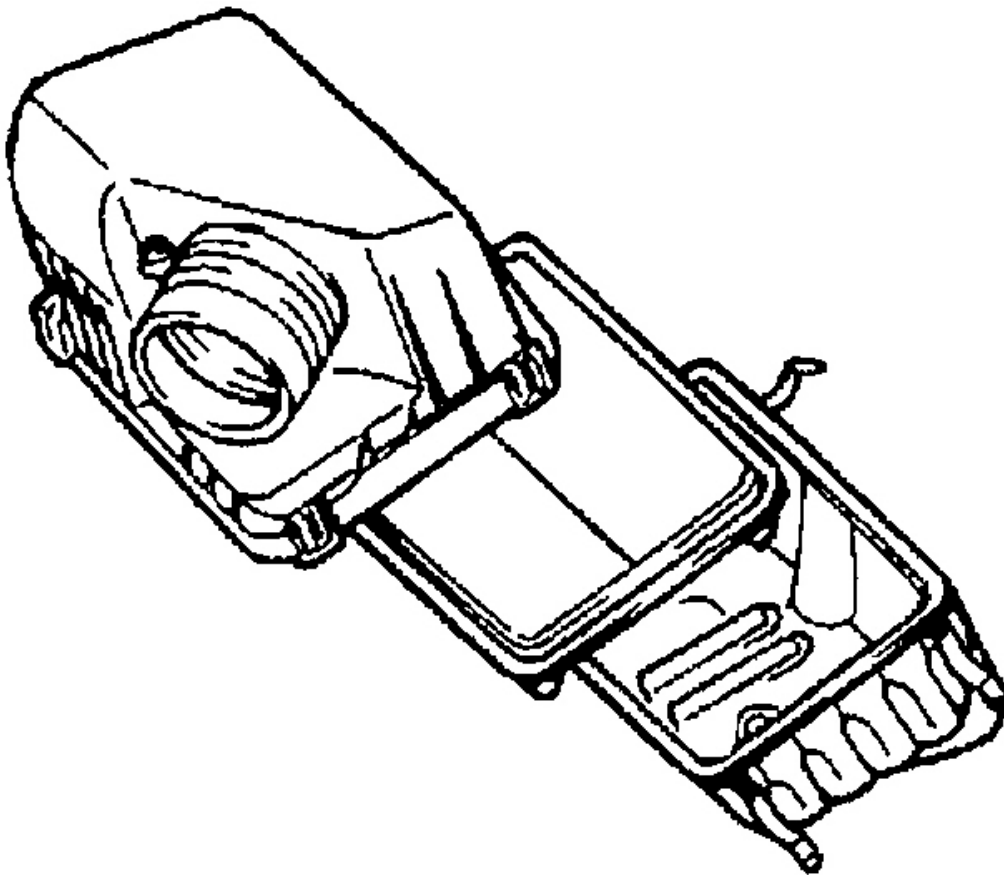
Fig. 165: View Of Air Cleaner
Courtesy of HYUNDAI MOTOR CO.

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.

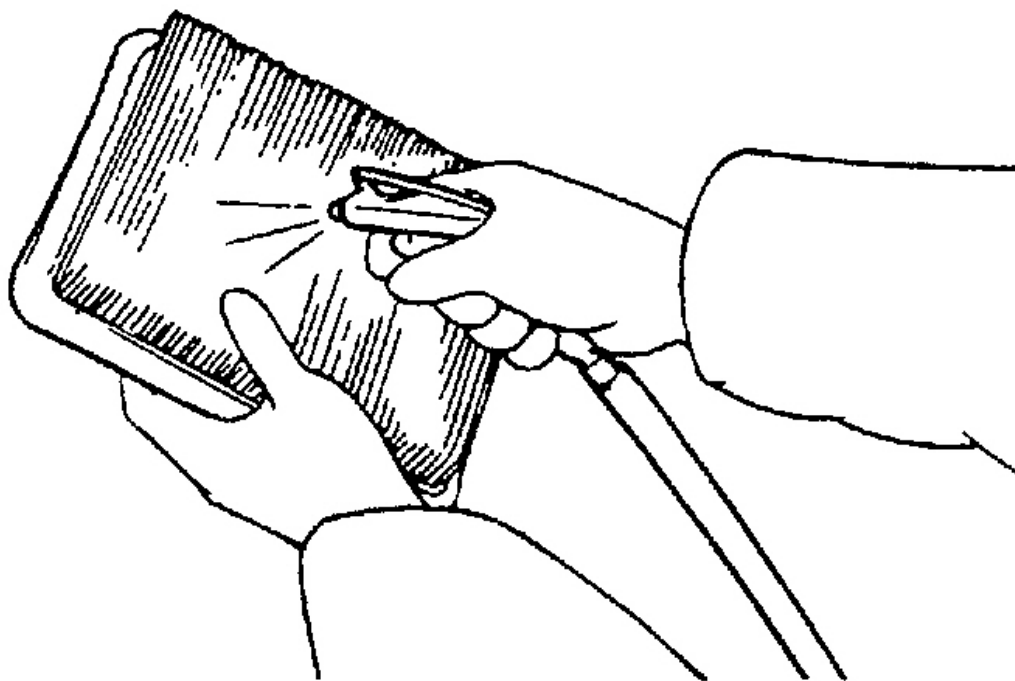


G01153626

Fig. 166: Identifying Air Cleaner Cover Assembly
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.



G01153627

Fig. 167: Cleaning Air Filter
Courtesy of HYUNDAI MOTOR CO.

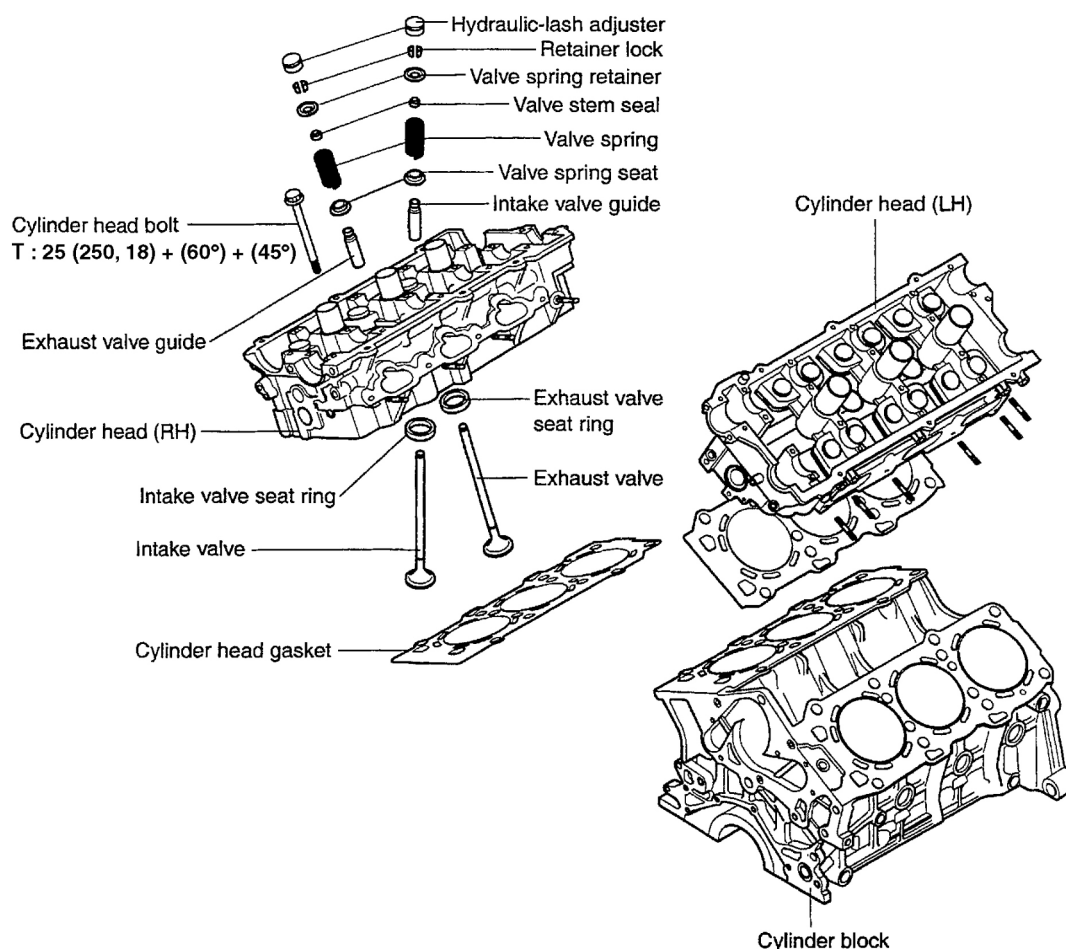
INSTALLATION

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

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

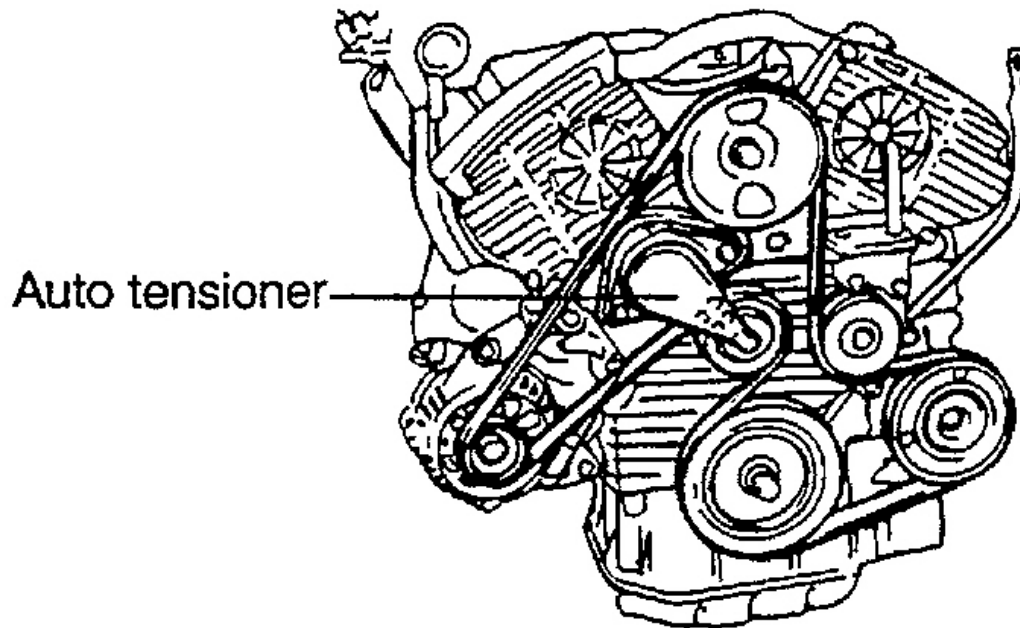
G01153628

Fig. 168: Cylinder Head Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

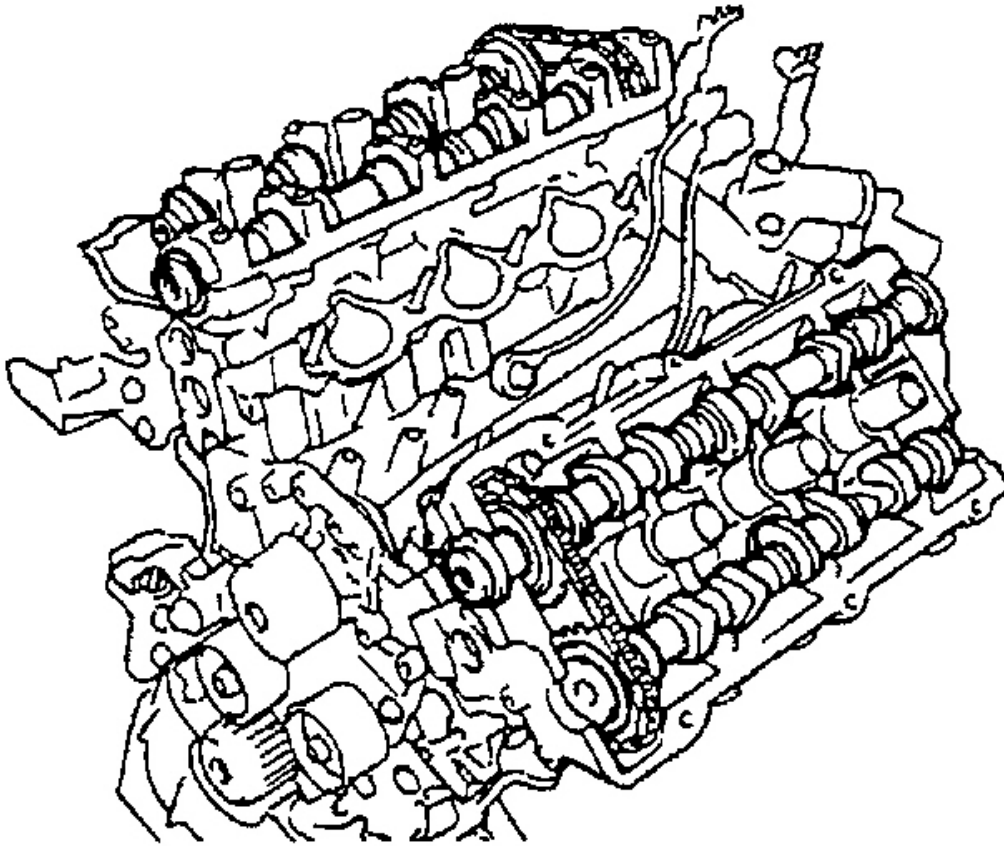
1. Drain the coolant and disconnect the upper radiator hose.
2. Remove the breather hose and air-intake hose.
3. Remove the vacuum hose, fuel hose and coolant hose.
4. Remove the intake manifold.
5. Remove the cables from the spark plugs. The cables should be removed by holding the boot portion.
6. Remove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



G01153629

Fig. 169: Identifying Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.

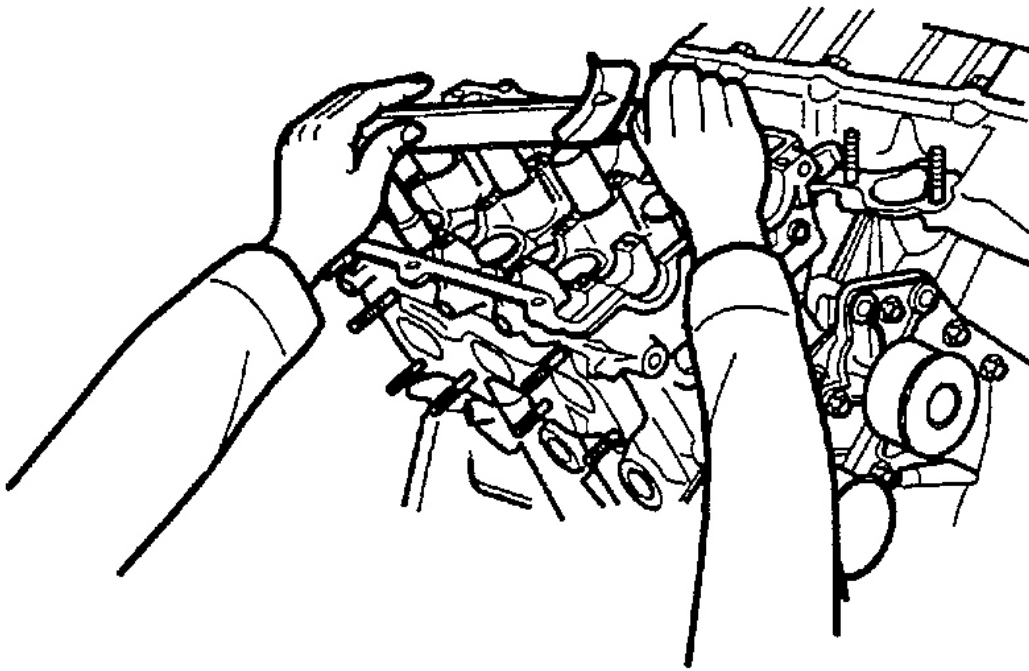


G01153630

Fig. 170: View Of Cylinder Heads
Courtesy of HYUNDAI MOTOR CO.

12. Remove the cylinder head assembly. The cylinder head bolts should be removed using the S12 mm socket, in two or three steps.
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.**



G01153631

Fig. 171: Removing Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

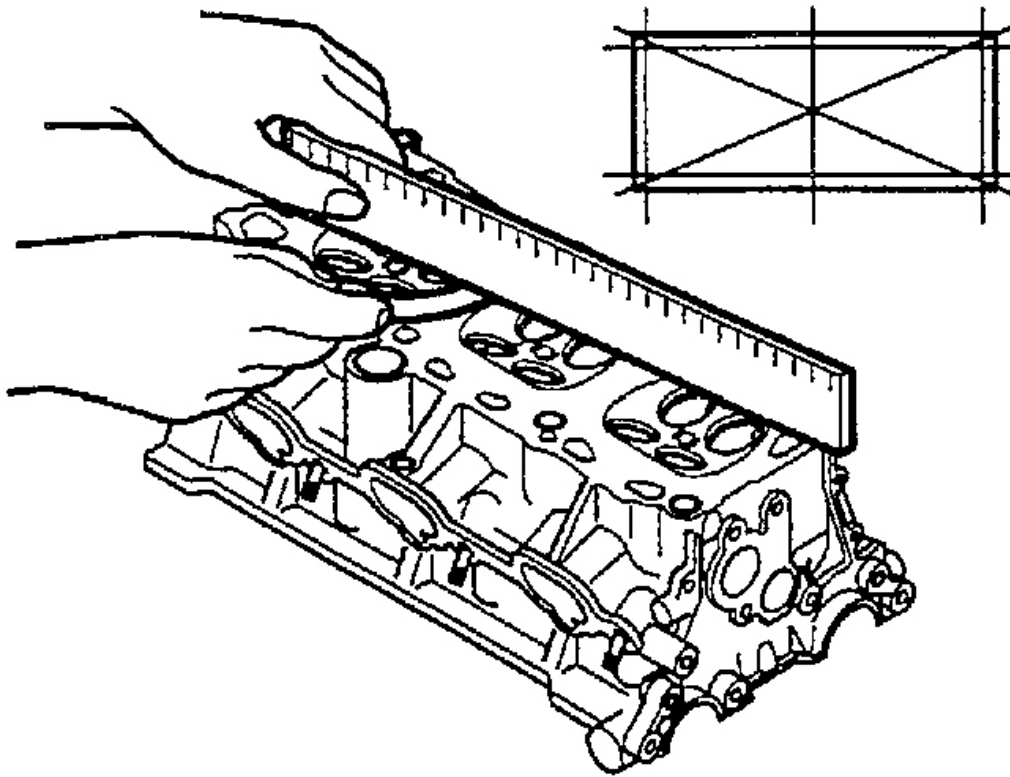
CYLINDER HEAD

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. 0.03 mm (0.0059 in.)

Service limit : 0.05 mm (0.0020 in.)



G01153632

Fig. 172: Checking Cylinder Head 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

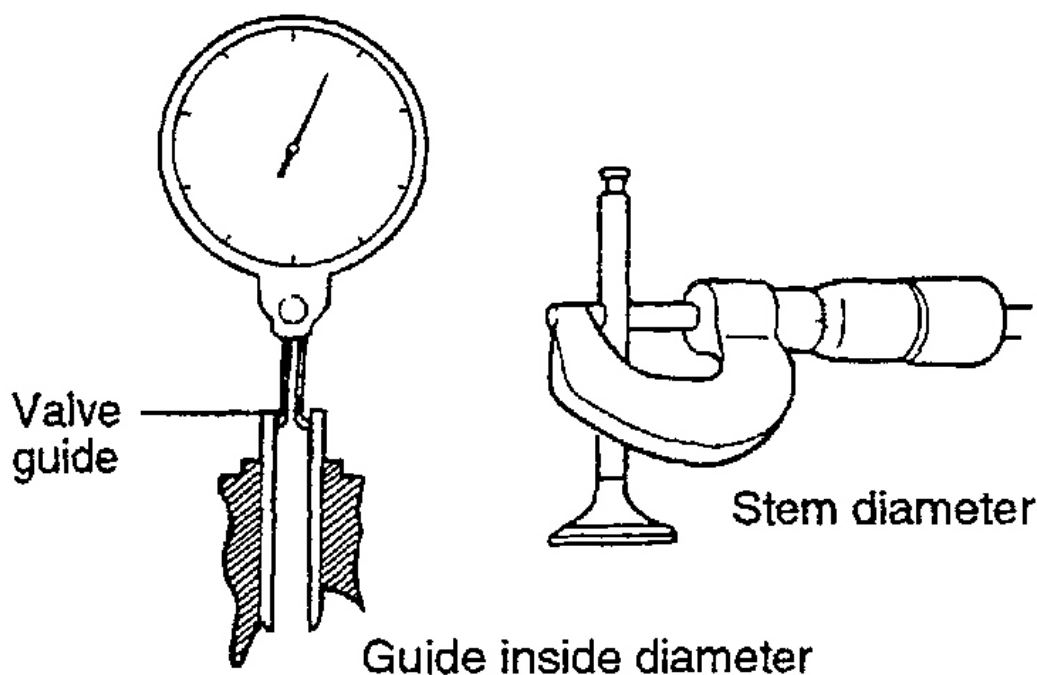
Intake : 0.02-0.05 mm (0.0009-0.0020 in.)

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

Service limit

Intake: 0.10 mm (0.0039 in.)

Exhaust : 0.15 mm (0.0059 in.)



G01153633

Fig. 173: Measuring 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.
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

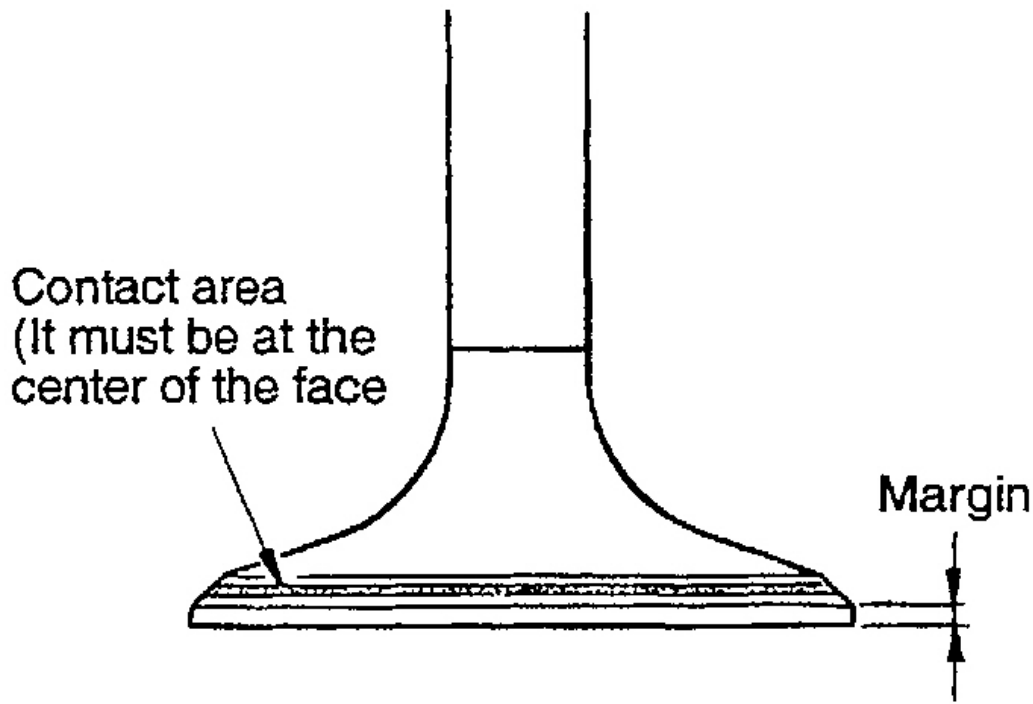
Intake: 1.0 mm (0.0394 in.)

Exhaust: 1.3 mm (0.0512 in.)

Service limit

Intake: 0.5 mm (0.0197 in.)

Exhaust: 0.8 mm (0.0315 in.)



G01153635

Fig. 174: Identifying Valve Margin
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

2002 Hyundai Sonata

2002 ENGINES 2.7L V6 - Sonata

Free height: 42.5 mm (1.6732 in.)

Load: 21.9kg/35 mm (48.4 lb/1.3780 in.)

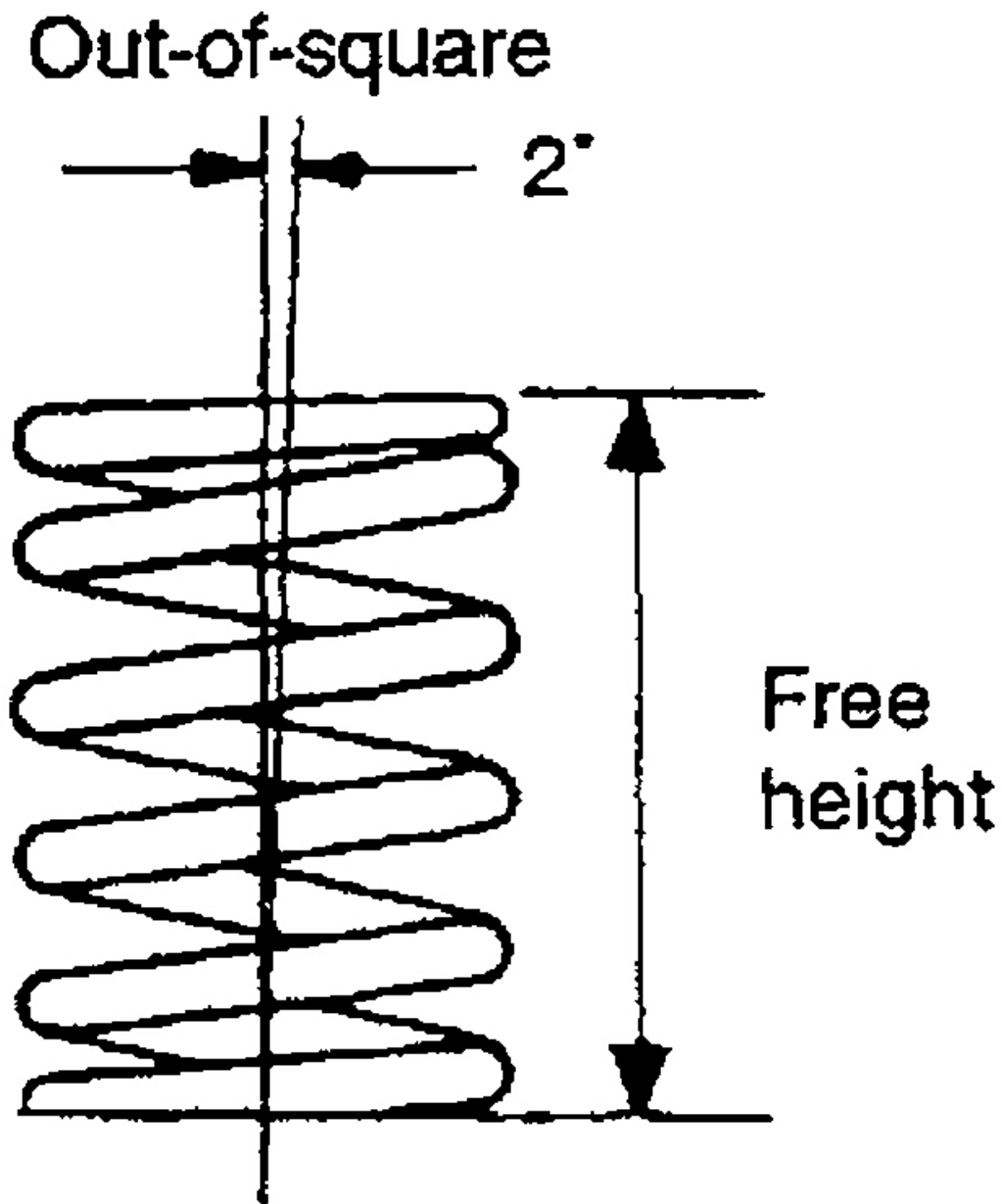
Out of squareness : Max. 1.5°

Service limit

Free height : 41.5 mm (1.6339 in.)

Load : 21.9kg/34 mm (48.4 lb/1.3386 in.)

Out of squareness : Max. 3°

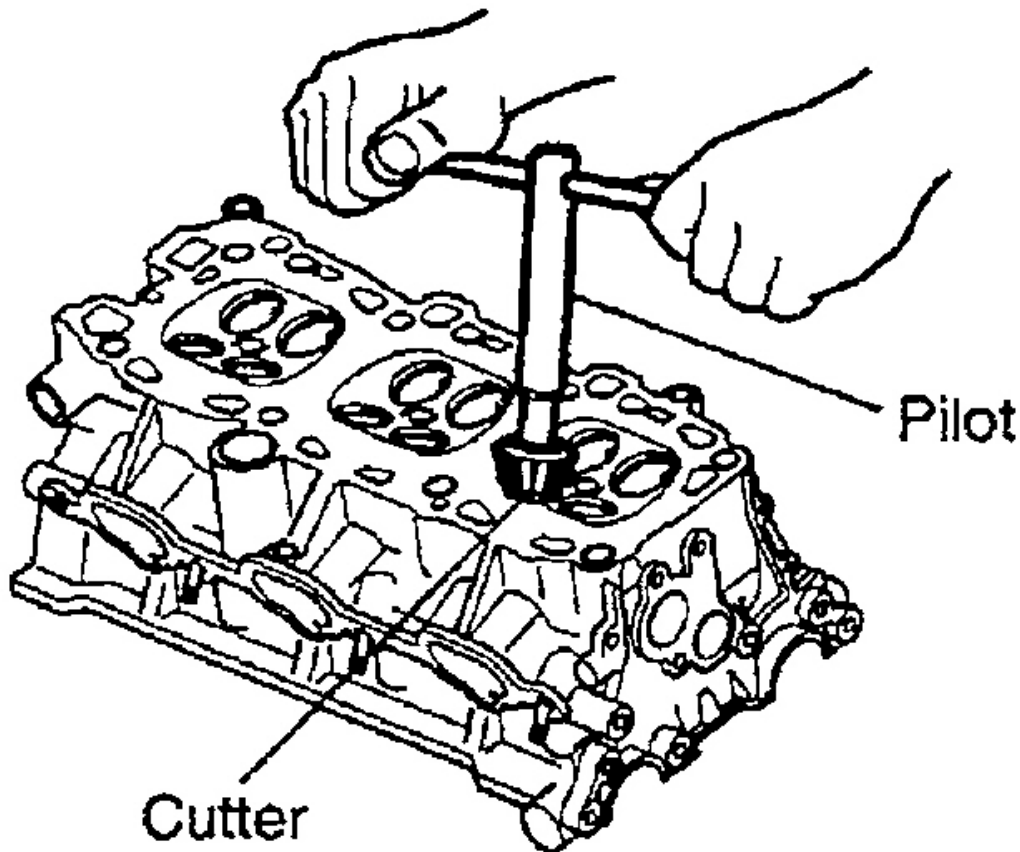


G01153636

Fig. 175: Checking Valve Spring
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.



G01153637

Fig. 176: Reconditioning Valve Seat
Courtesy of HYUNDAI MOTOR CO.

REPLACING VALVE GUIDE

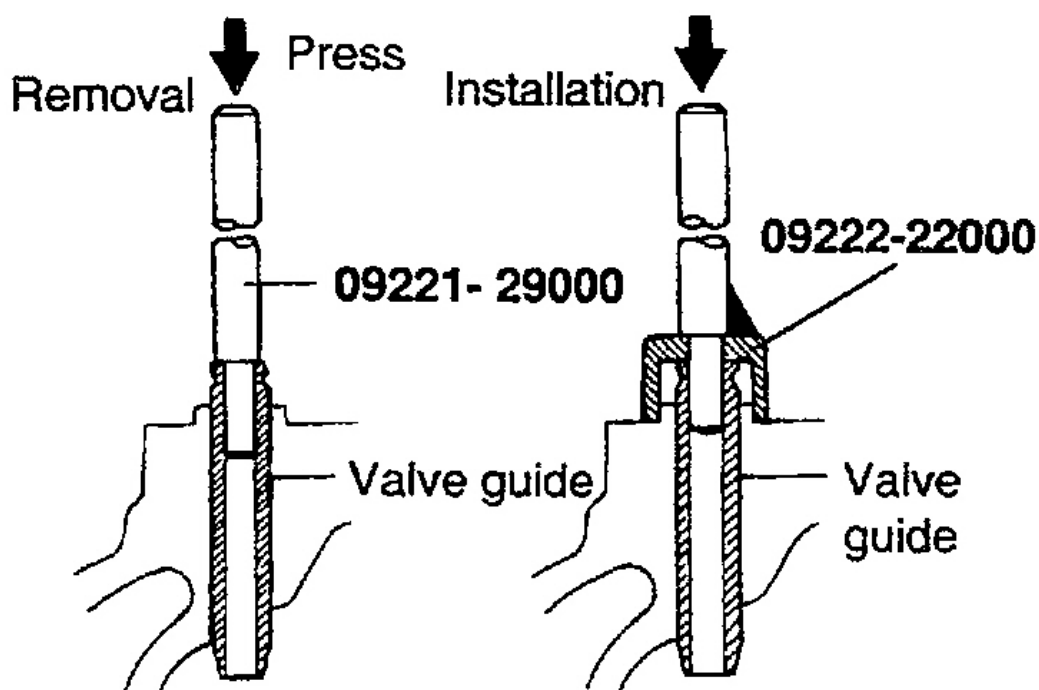
1. Using the special tool (09221-29000), withdraw the old valve guide out the bottom of the cylinder head.
2. Recondition the valve guide hole so that it can receive the newly press-fitted oversize valve guide.

VALVE GUIDE OVERSIZES

Size mm (in.)	Size Mark	Oversize valve guide hole size mm (in.)
0.05 (0.002) O.S.	5	11.050-11.068 (0.435-0.4357)
0.25 (0.010) O.S.	25	11.250-11.268 (0.443-0.4436)
0.50 (0.020) O.S.	50	11.500-11.518 (0.453-0.4535)

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Fig. 177: Valve Guide Oversizes
 Courtesy of HYUNDAI MOTOR CO.



G01153639

Fig. 178: Press Fit 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.

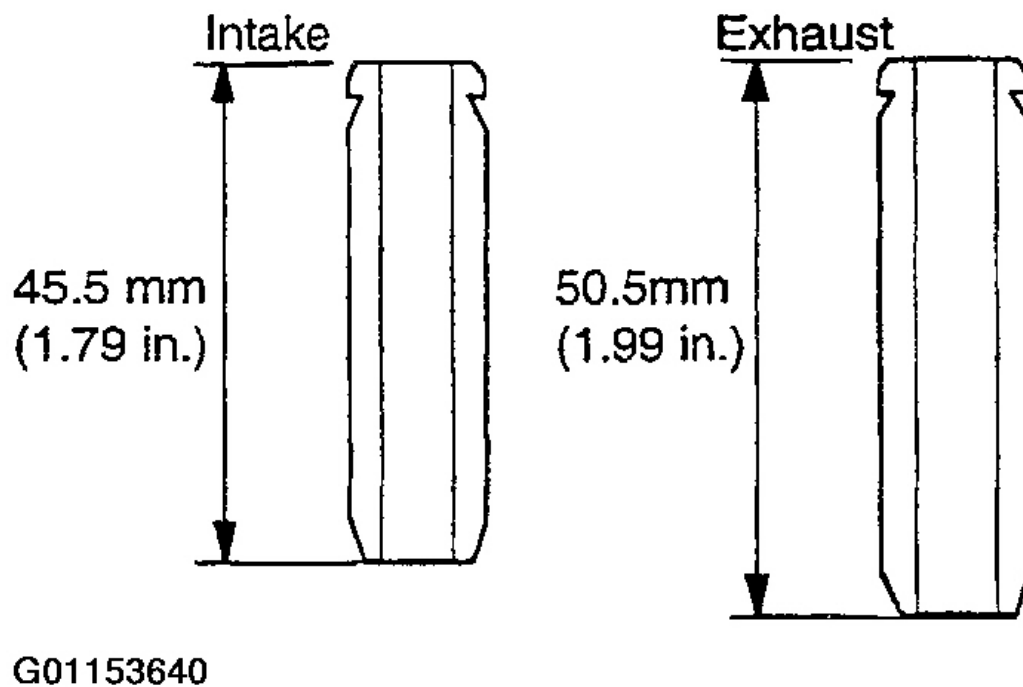
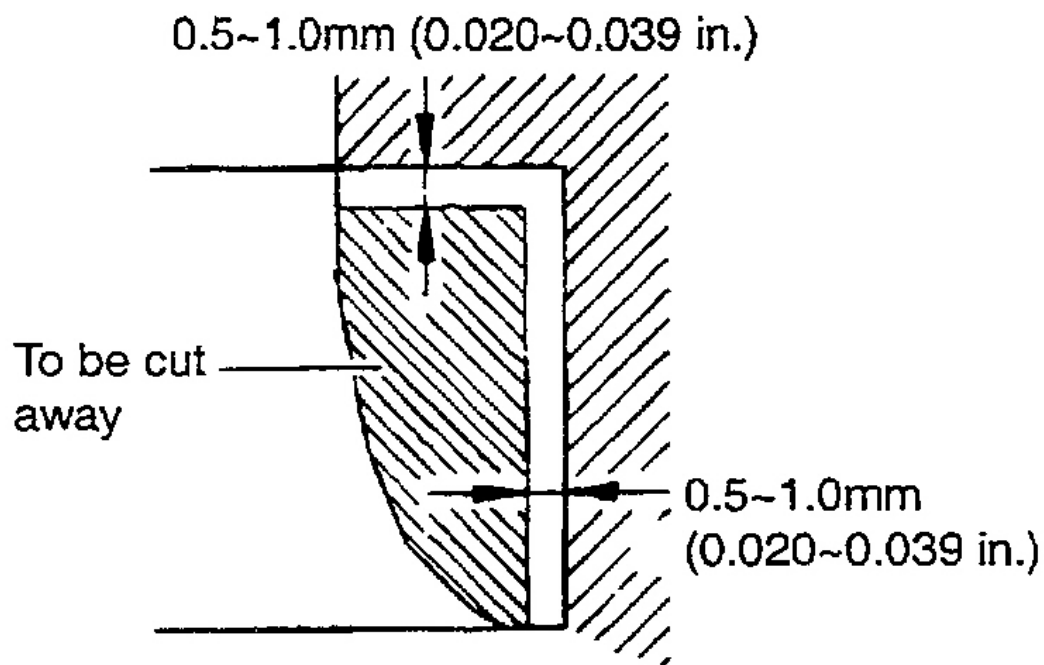


Fig. 179: Checking If Valve Guide Is Fully Seated
Courtesy of HYUNDAI MOTOR CO.

REPLACING VALVE SEAT RING

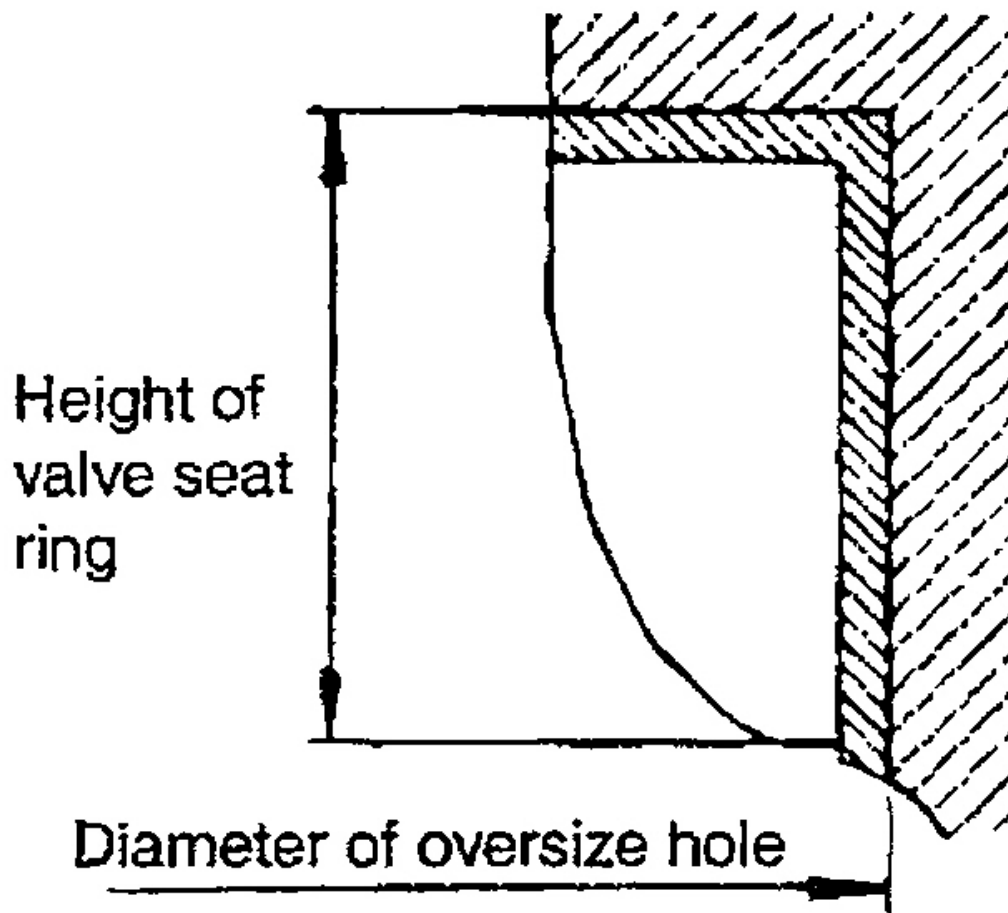
1. Cut away the inner face of the valve seat to reduce the wall thickness.



G01153641

Fig. 180: Identifying Inner Face Of Valve Seat
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.



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Fig. 181: Enlarging Diameter Of 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)	33.300-33.325 (1.311-1.312)
Exhaust valve seat ring	0.3 (0.012) O.S.	30	7.9-8.1 (0.311-0.319)	28.600-28.625 (1.126-1.127)

G01153643

Fig. 182: Valve Seat Ring Oversizes
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: 1.1-1.5 mm (0.043-0.059 in.)

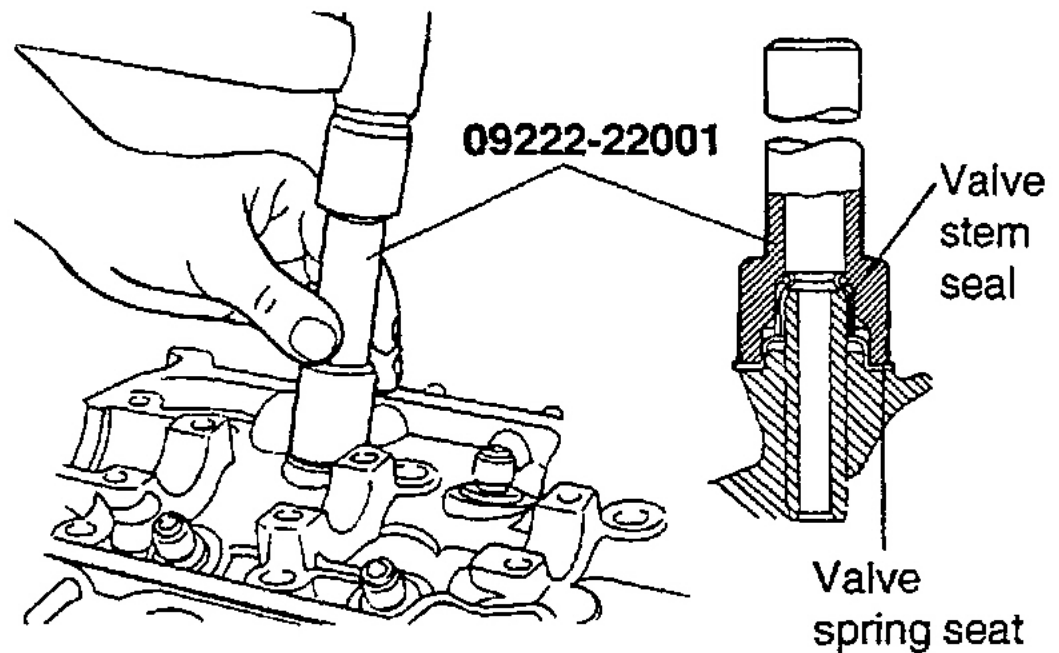
Exhaust: 1.3-1.7 mm (0.051-0.068 in.)

REASSEMBLY

1. Install the spring seats.
2. Using special tool (09222-22001), lightly tap the seal in position.

NOTE:

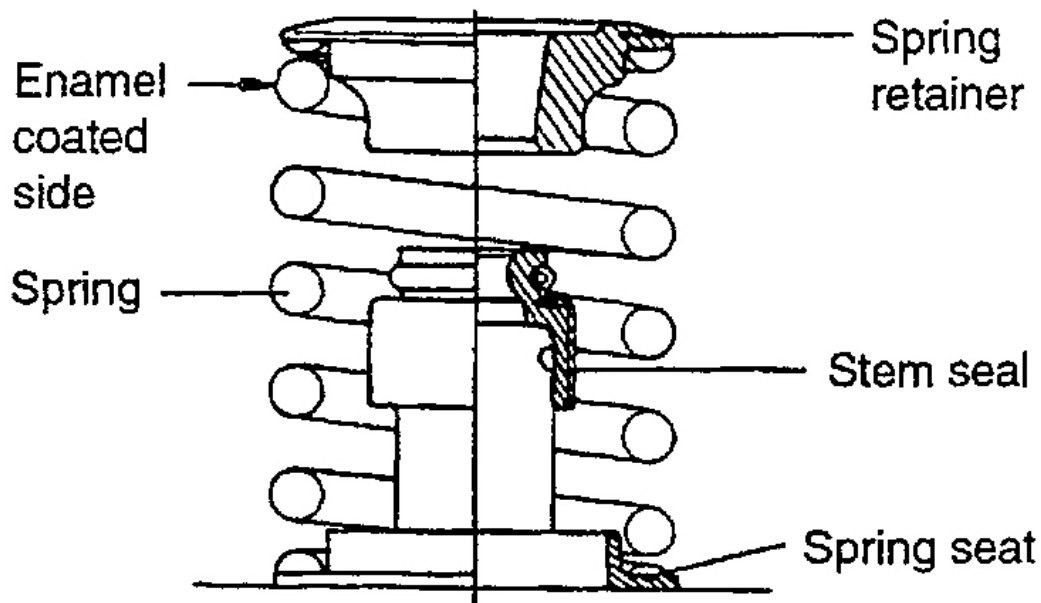
- **Do not reuse old valve stem seals.**
- **Incorrect installation of the seal could result in oil leakage of from the valve guides.**



G01153644

Fig. 183: Installing Valve Stem Seal
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.

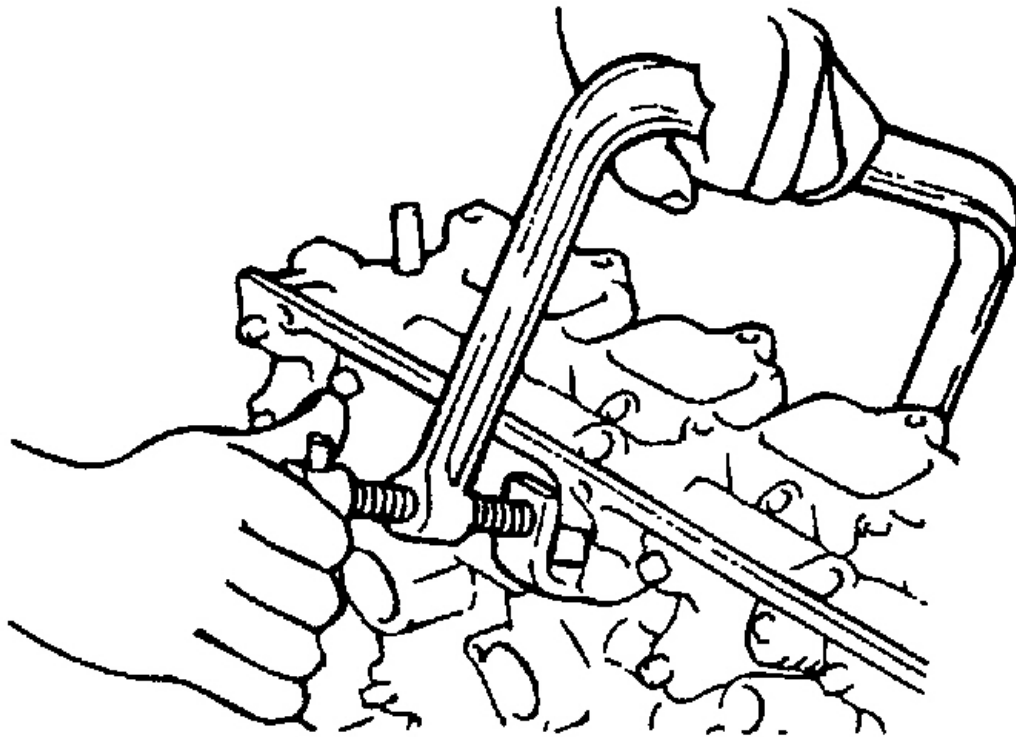


G01153645

Fig. 184: Identifying Valve Spring 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.



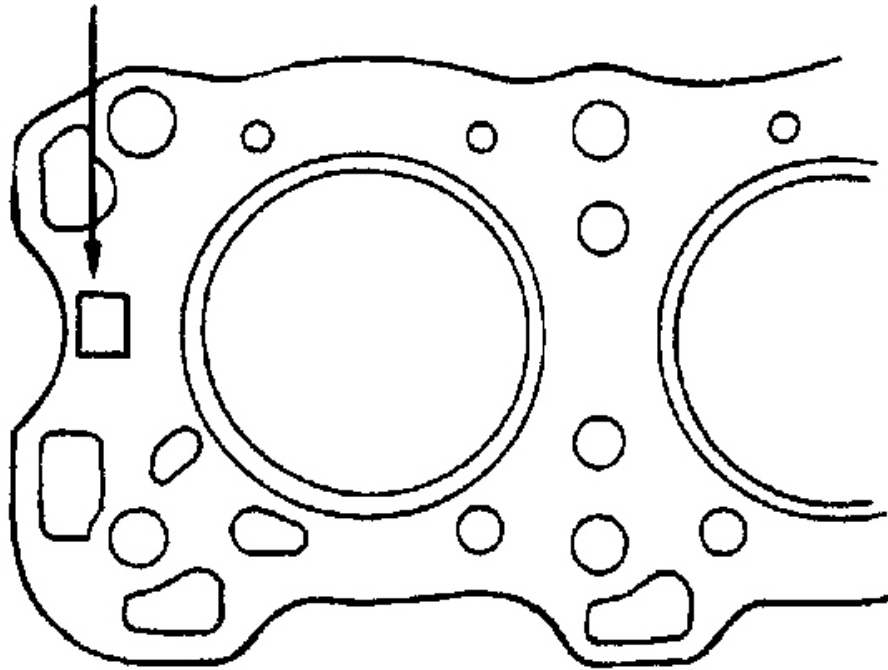
G01153646

Fig. 185: 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.**

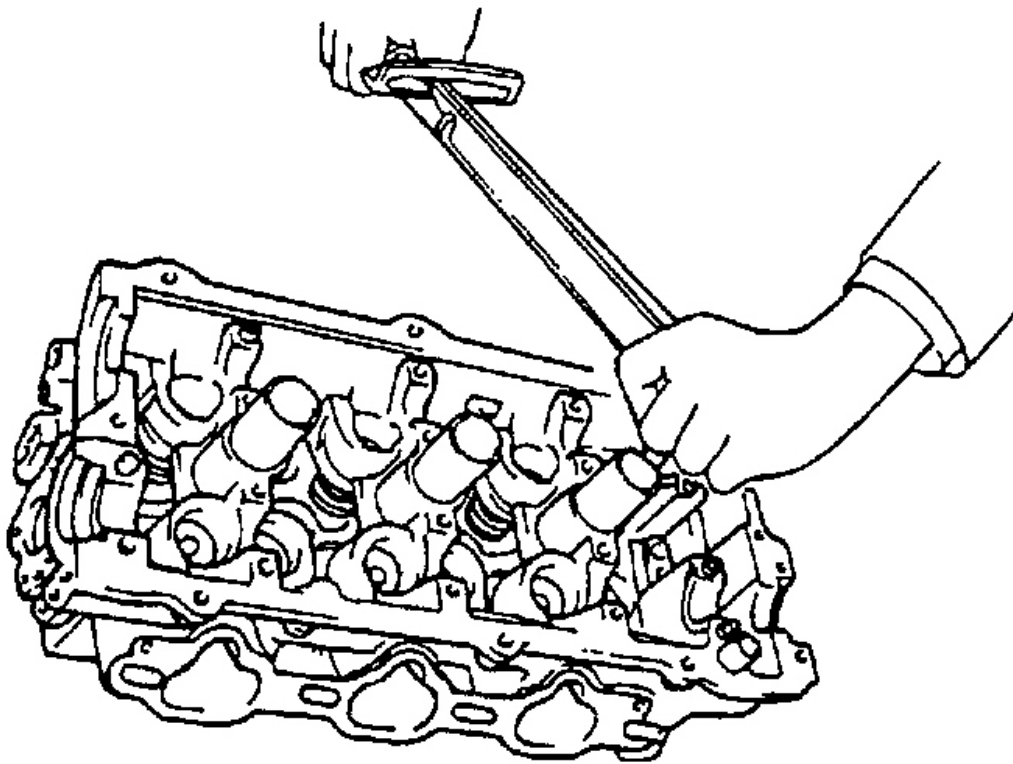
Identification mark



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Fig. 186: Identifying 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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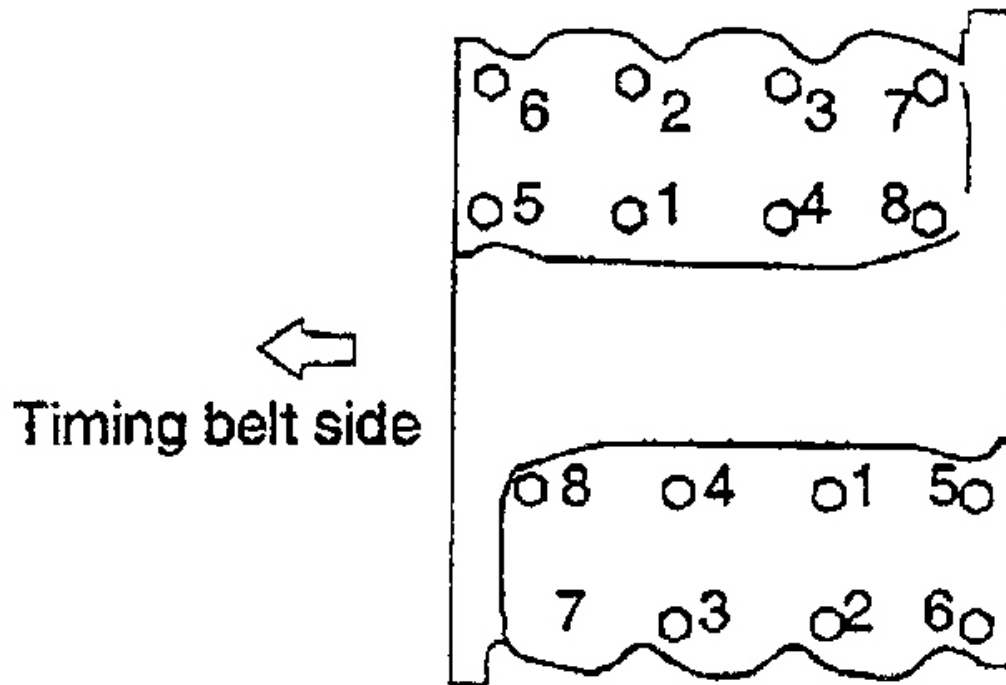
Fig. 187: Tightening Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

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

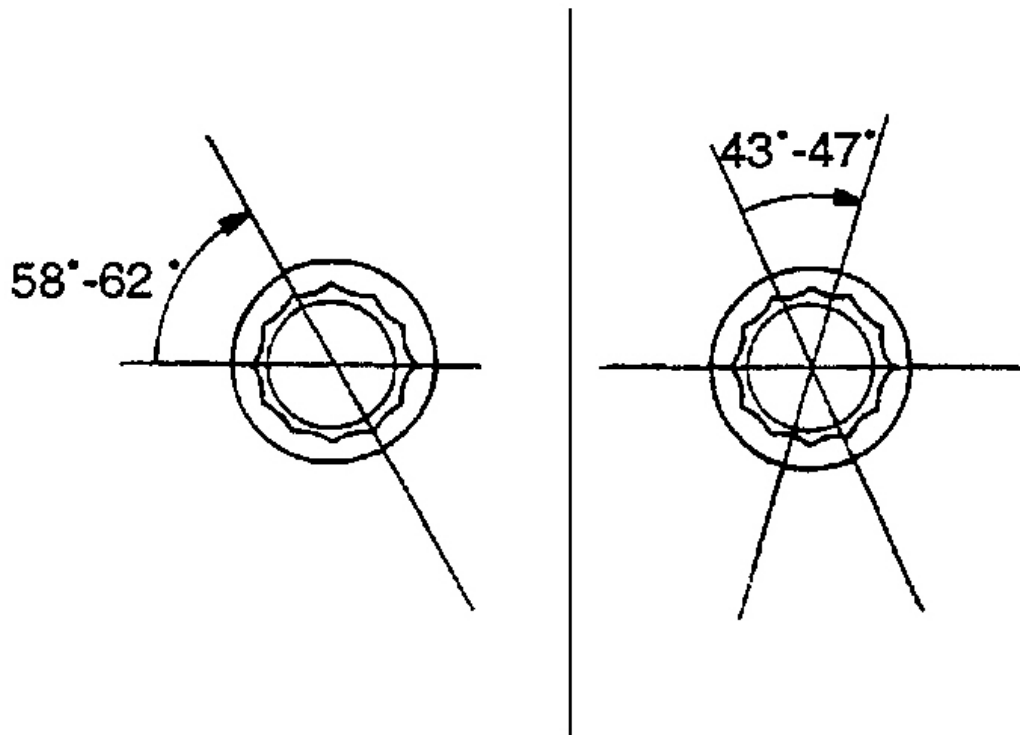
Cylinder head bolt:

25 Nm (250 kg.cm, 18 lb.ft) + (60°) + (45°)



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Fig. 188: Cylinder Head Bolt Tightening Sequence
 Courtesy of HYUNDAI MOTOR CO.



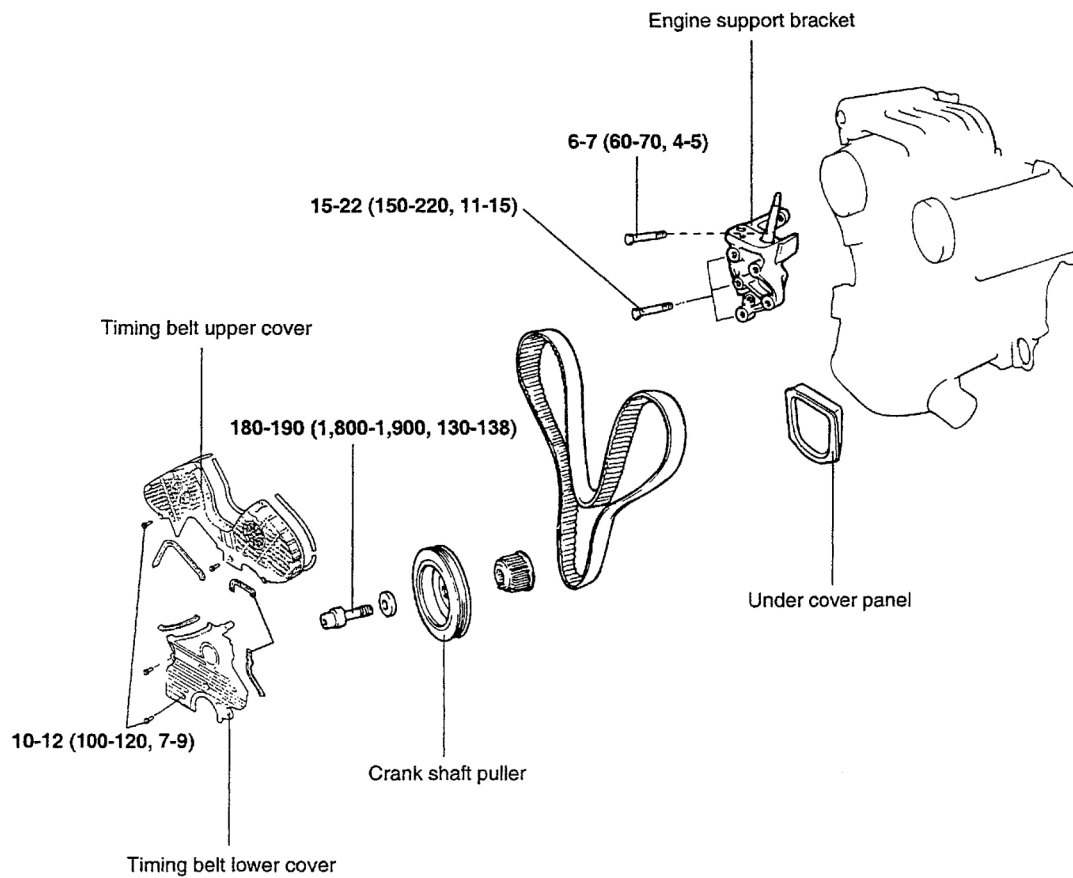
G01153650

Fig. 189: Identifying Cylinder Head Bolt Tightening Degrees
Courtesy of HYUNDAI MOTOR CO.

TIMING SYSTEM

TIMING BELT

COMPONENTS



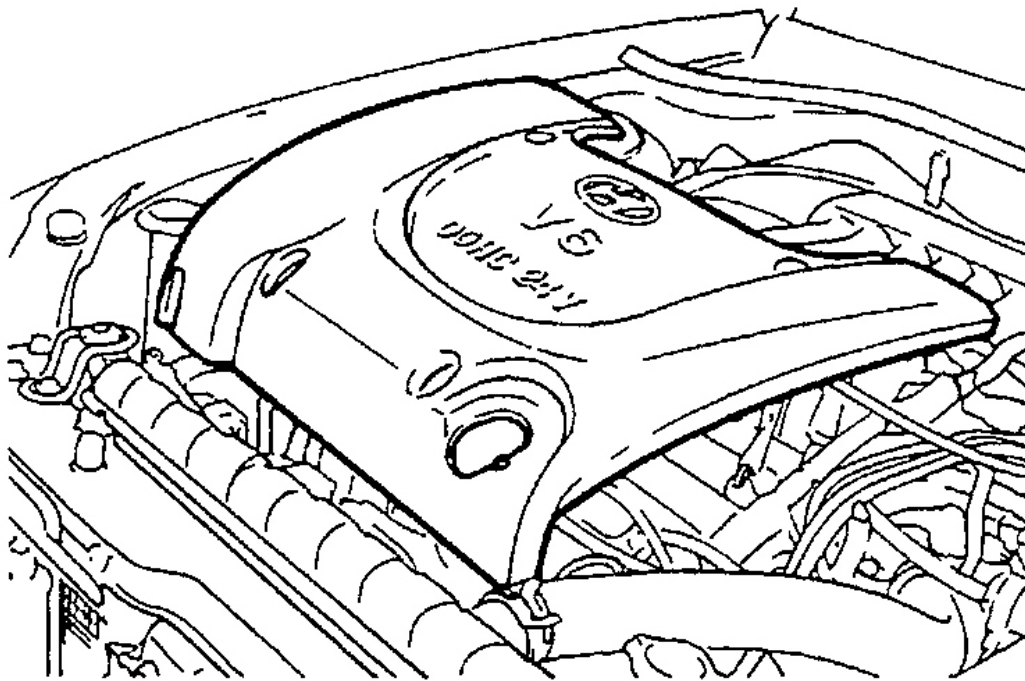
TORQUE : Nm (kg.cm, lb.ft)

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Fig. 190: Timing System Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

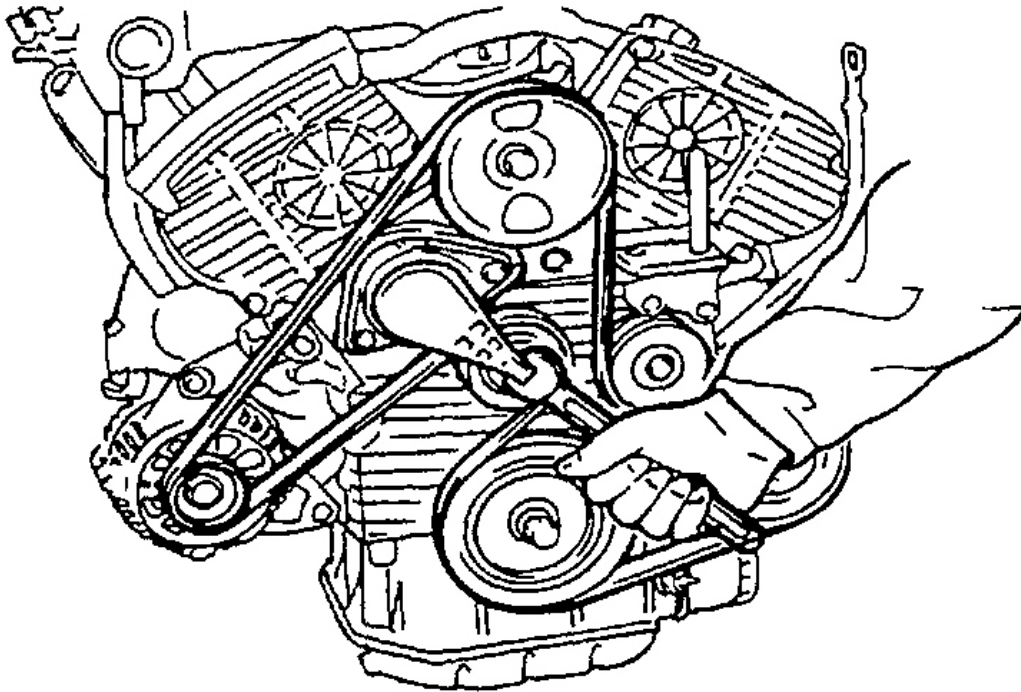
1. Remove the engine cover.



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Fig. 191: Identifying Engine Cover
Courtesy of HYUNDAI MOTOR CO.

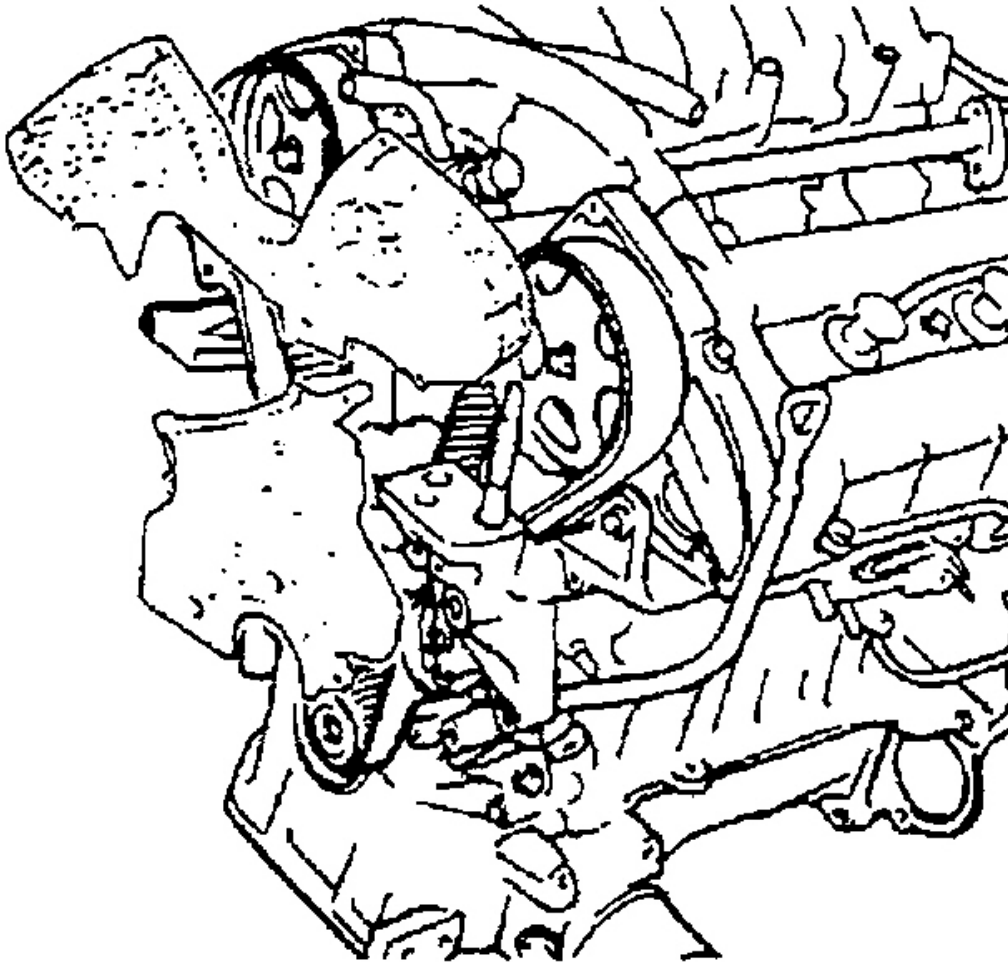
2. Using a [16 mm], rotate the tensioner arm clockwise (about 14°) and remove the belt from the pulley.
3. Remove the power steering pump pulley, idler pulley, tensioner pulley and crankshaft pulley.



G01153653

Fig. 192: Removing Belt From Pulleys
Courtesy of HYUNDAI MOTOR CO.

4. Remove the upper and lower timing belt covers.

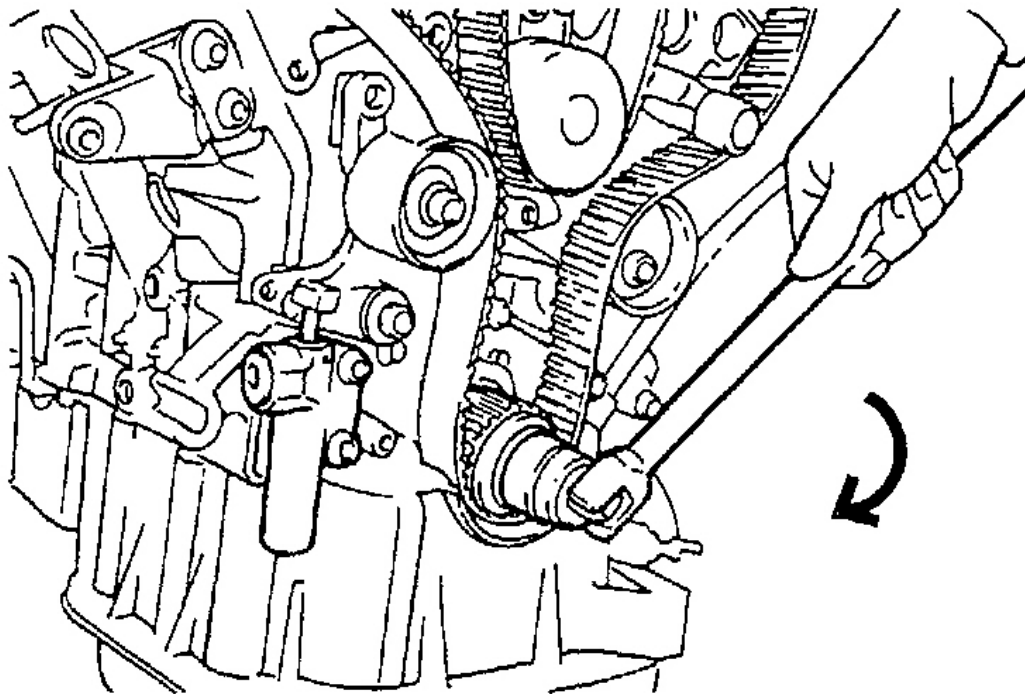


G01153654

Fig. 193: Identifying Upper & Lower Timing Belt Covers
Courtesy of HYUNDAI MOTOR CO.

5. Remove the auto tensioner

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.

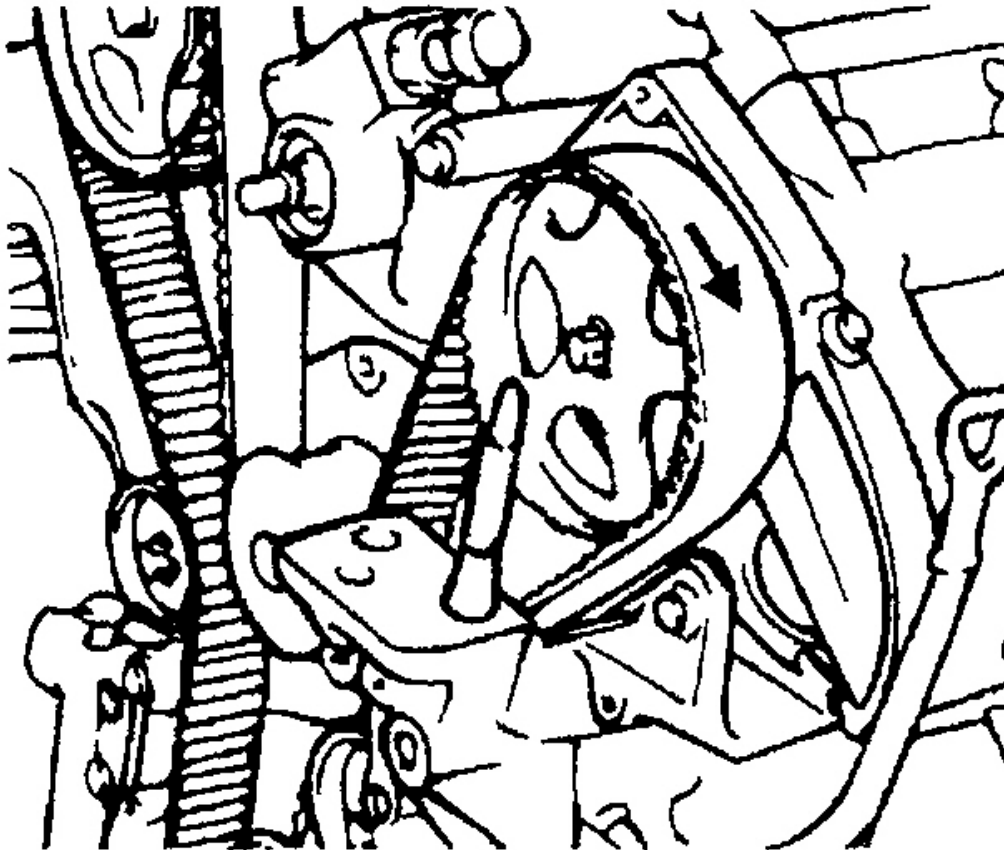


G01153655

Fig. 194: Rotating Crankshaft
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.

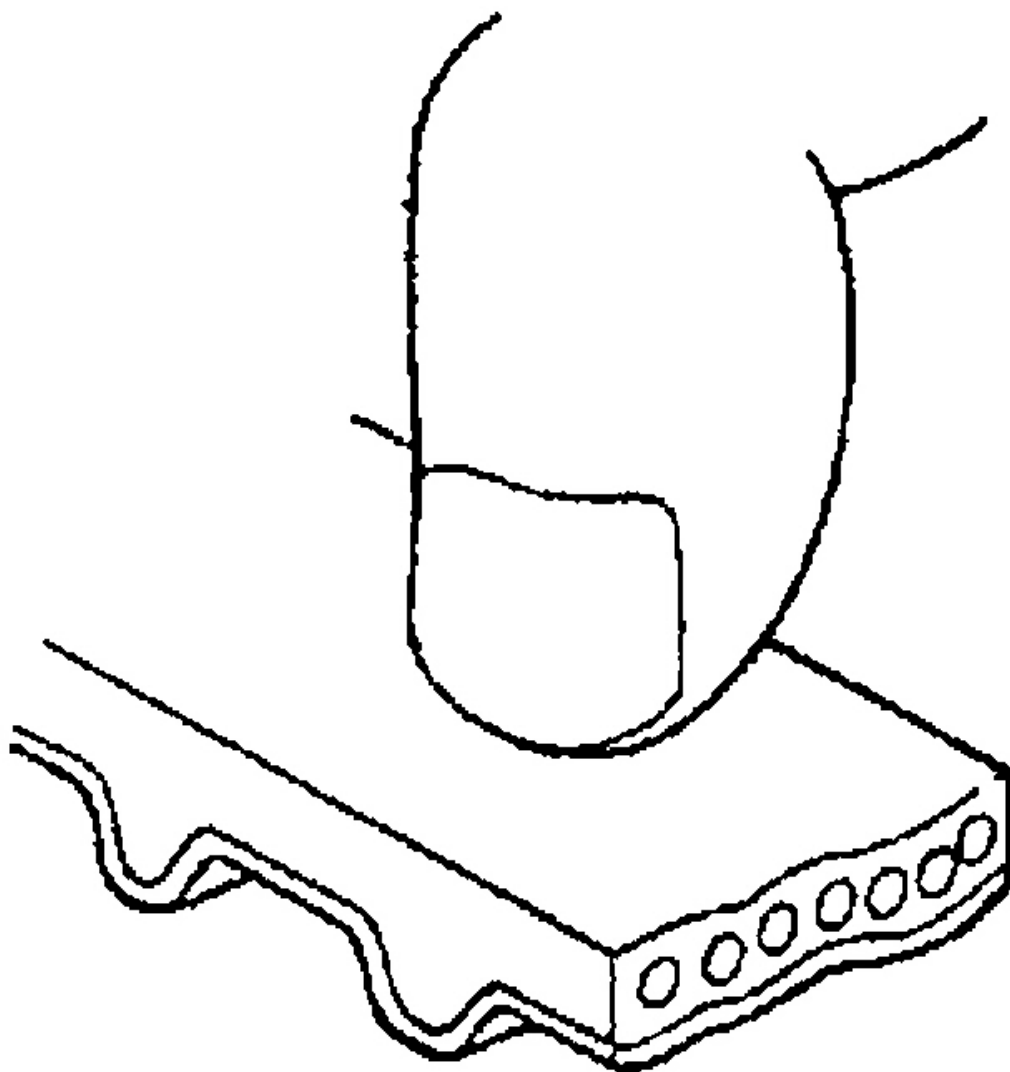


G01153656

Fig. 195: View Of Timing Belt
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

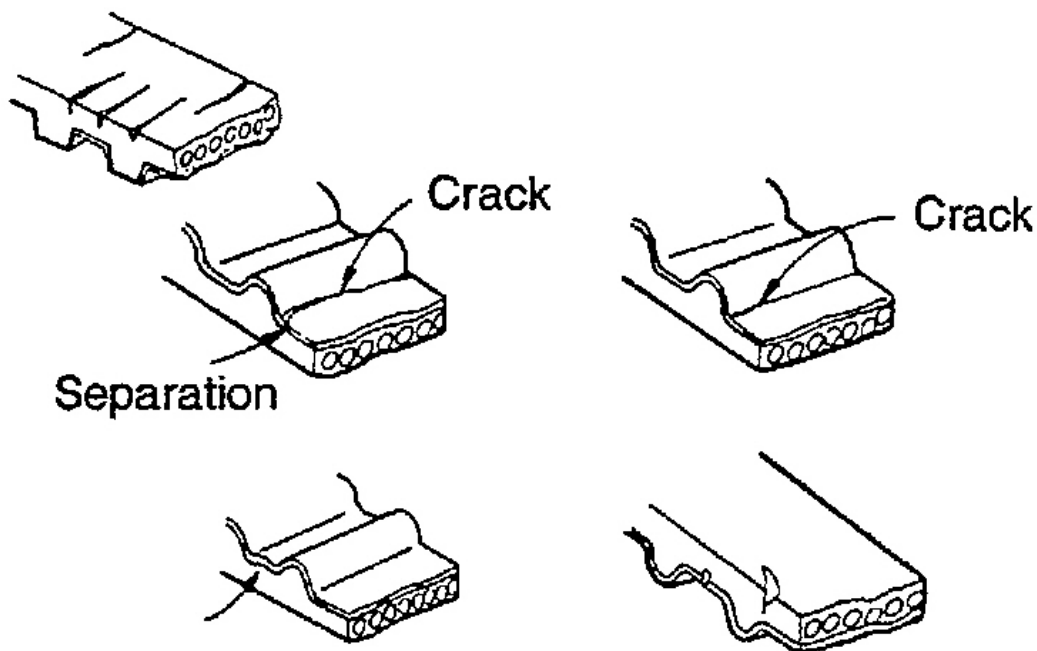
1. Inspect the belt closely. If the following problems are evident, replace the belt with a new one.
 1. Hardened back surface of rubber Back surface is glossy, non-elastic and so hard that when the nail of your finger is pressed into it, no mark is produced.



G01153657

Fig. 196: Checking Belt Surface With Finger Nail
Courtesy of HYUNDAI MOTOR CO.

2. Cracked back surface of rubber.

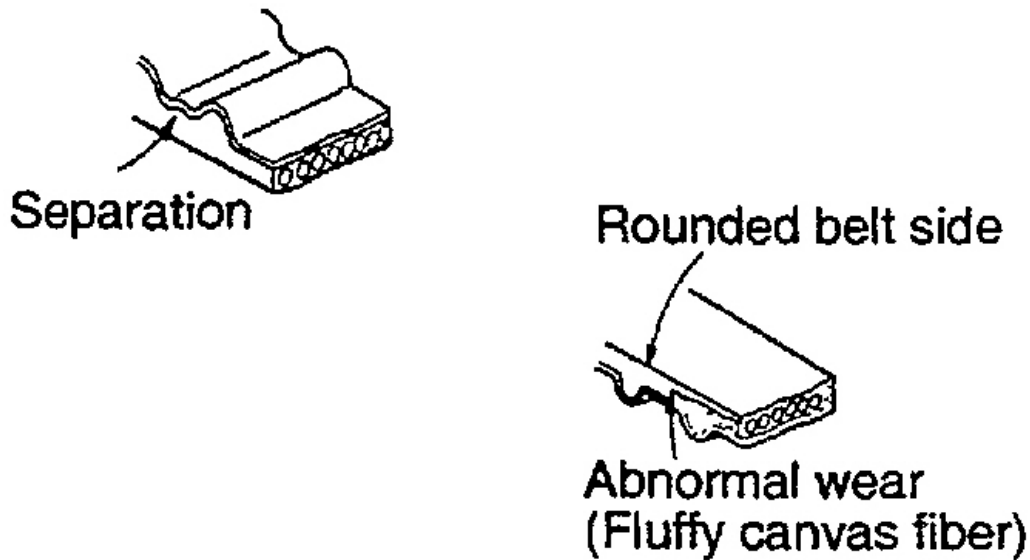


G01153658

Fig. 197: Identifying Cracked Belt
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.



G01153659

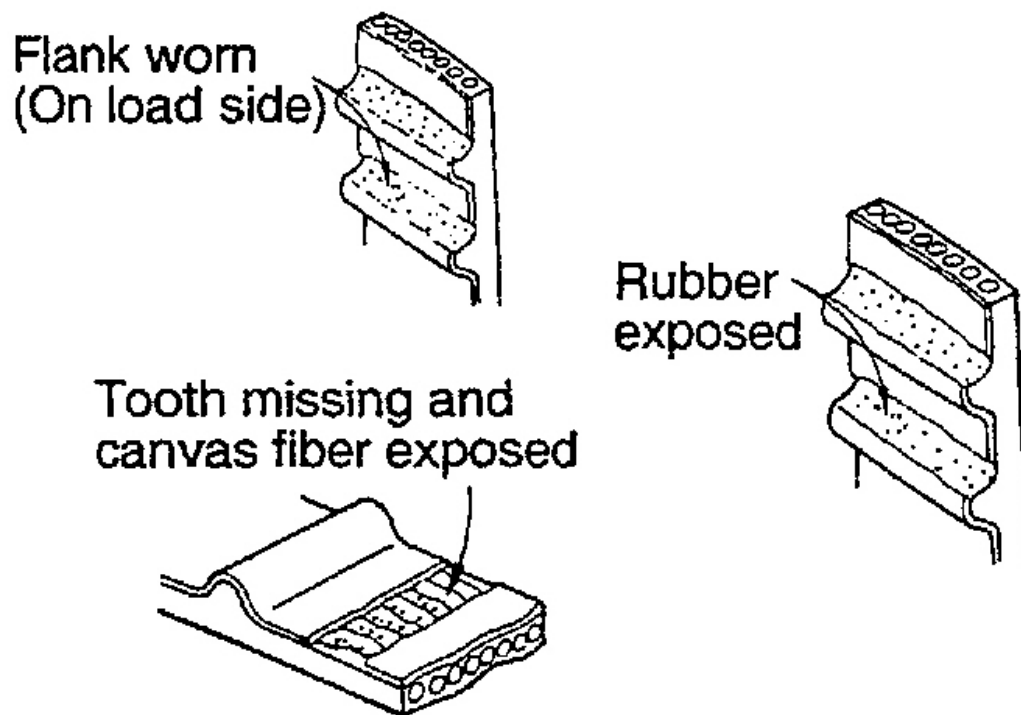
Fig. 198: Identifying Separating Or Rounded Belt
Courtesy of HYUNDAI MOTOR CO.

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 white, and unclear canvas texture)

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

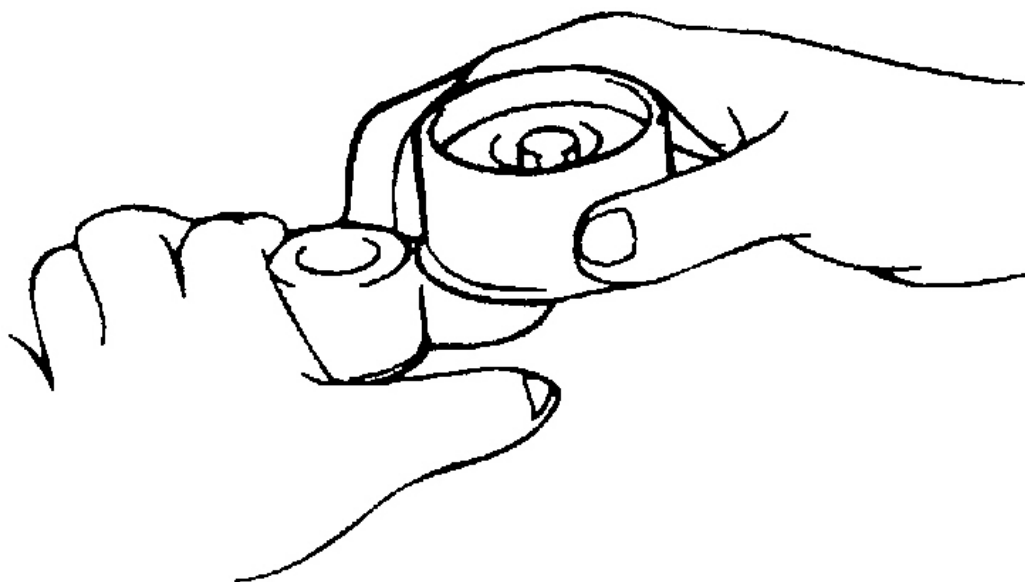
5. Missing tooth



G01153660

Fig. 199: Checking Timing Belt For Flaws
Courtesy of HYUNDAI MOTOR CO.

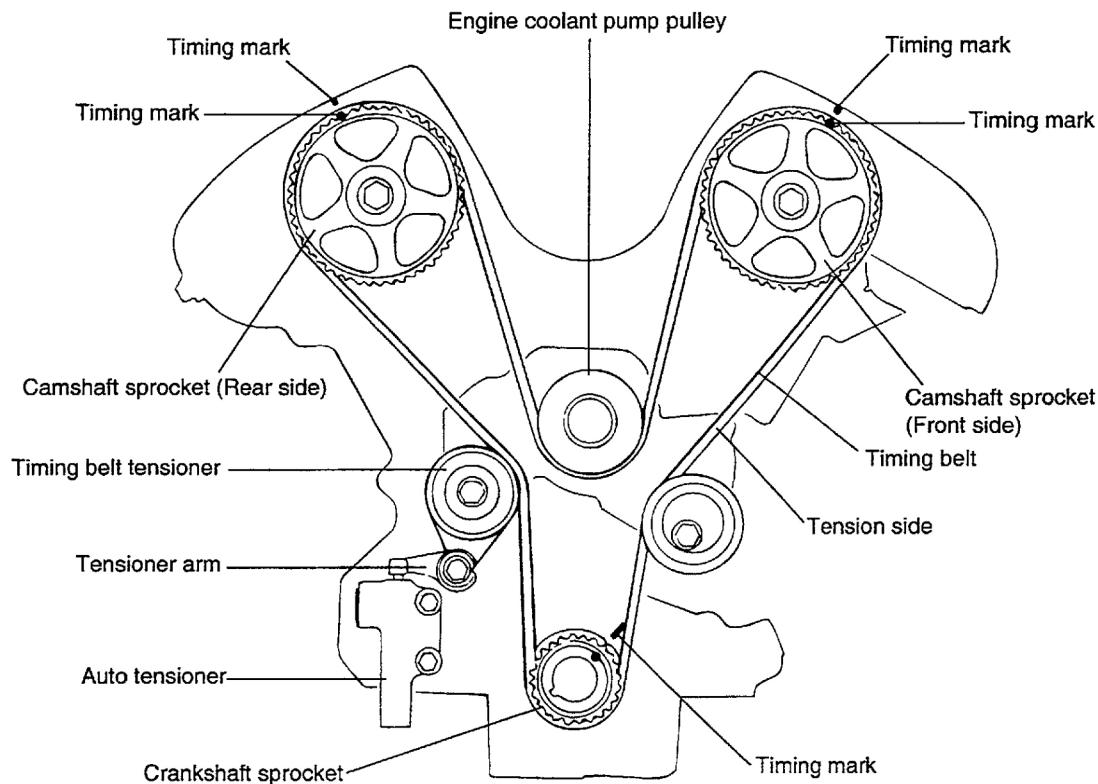
2. If backlash or an irregular noise is observed when rotating the pulley, replace the timing belt tensioner and idler pulley.



G01153661

Fig. 200: Checking Timing Belt Tensioner
Courtesy of HYUNDAI MOTOR CO.

TIMING BELT



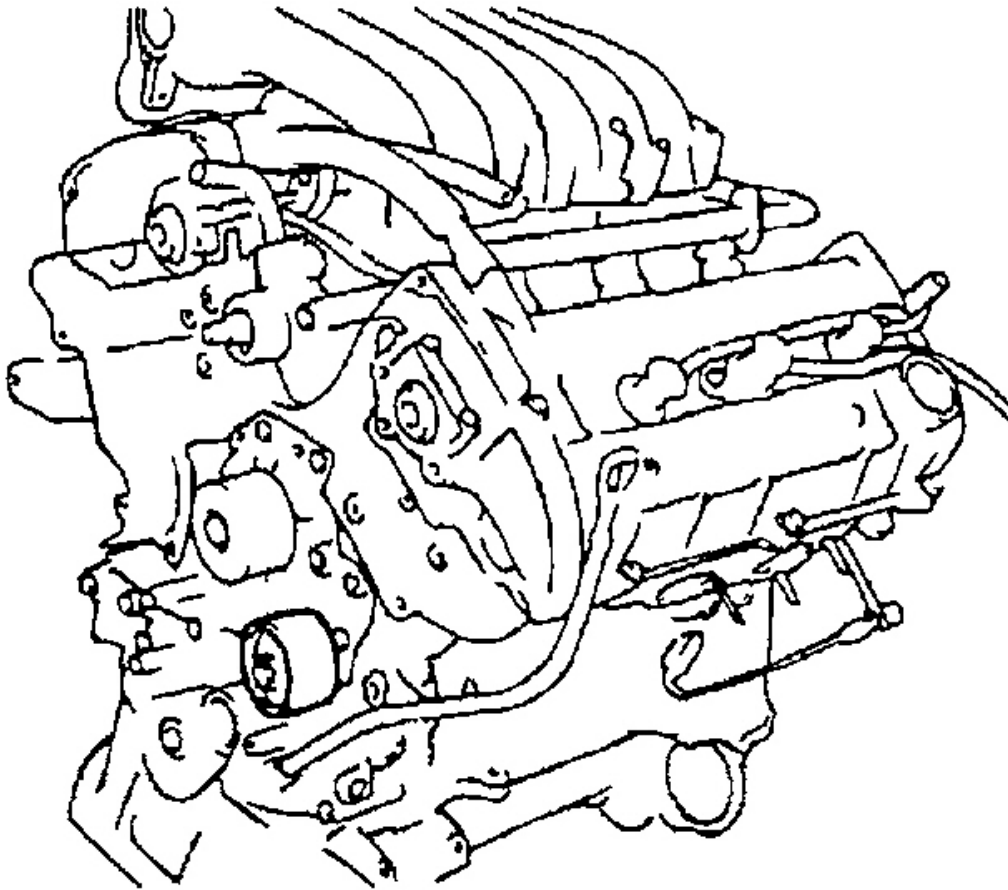
G01153662

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

INSTALLATION

1. Install the idler pulley to water pump boss.

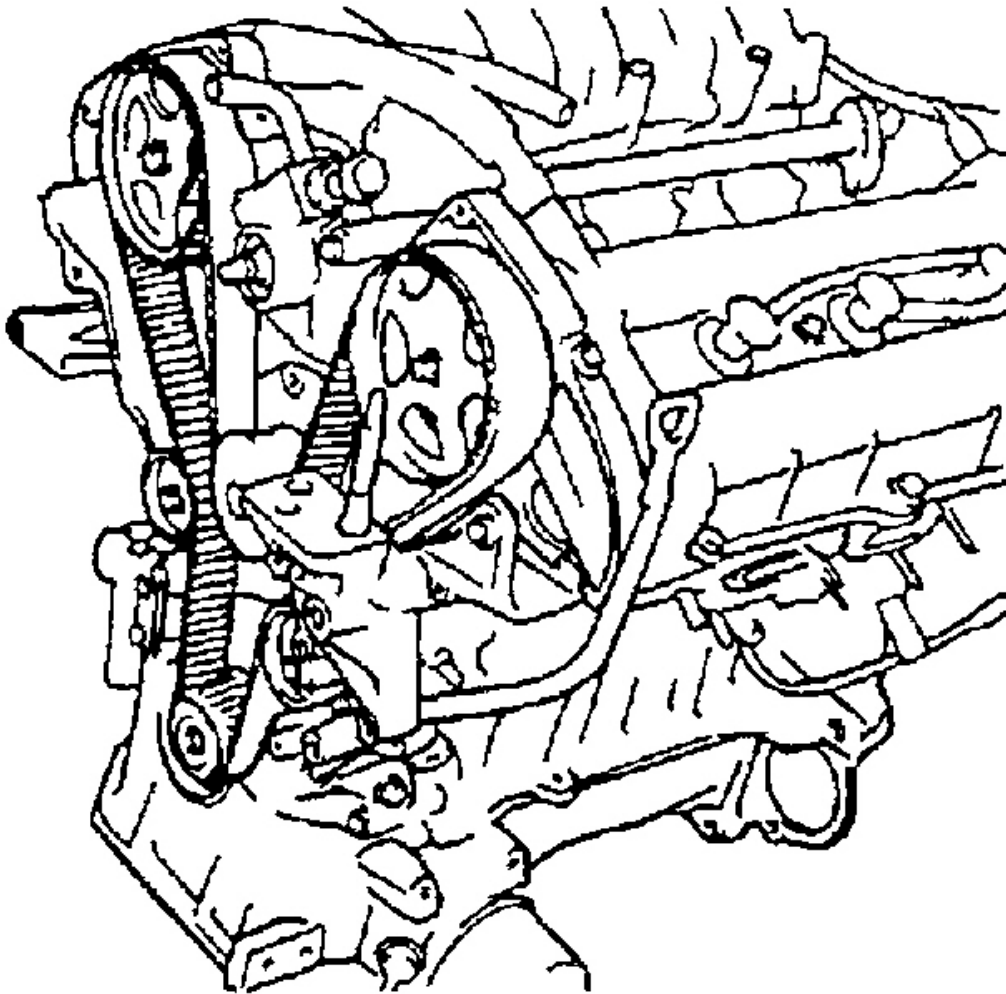
NOTE: Insert and install the idler pulley to the roll pin that is pressed in the water pump boss.



G01153663

Fig. 202: Identifying Idler Pulley
Courtesy of HYUNDAI MOTOR CO.

2. Install the tensioner arm and plain washer to the cylinder block.
3. Install the tensioner pulley to the tensioner arm.
4. Install the camshaft sprockets and align the timing marks.



G01153664

Fig. 203: View Of Timing Belt Assembly
Courtesy of HYUNDAI MOTOR CO.

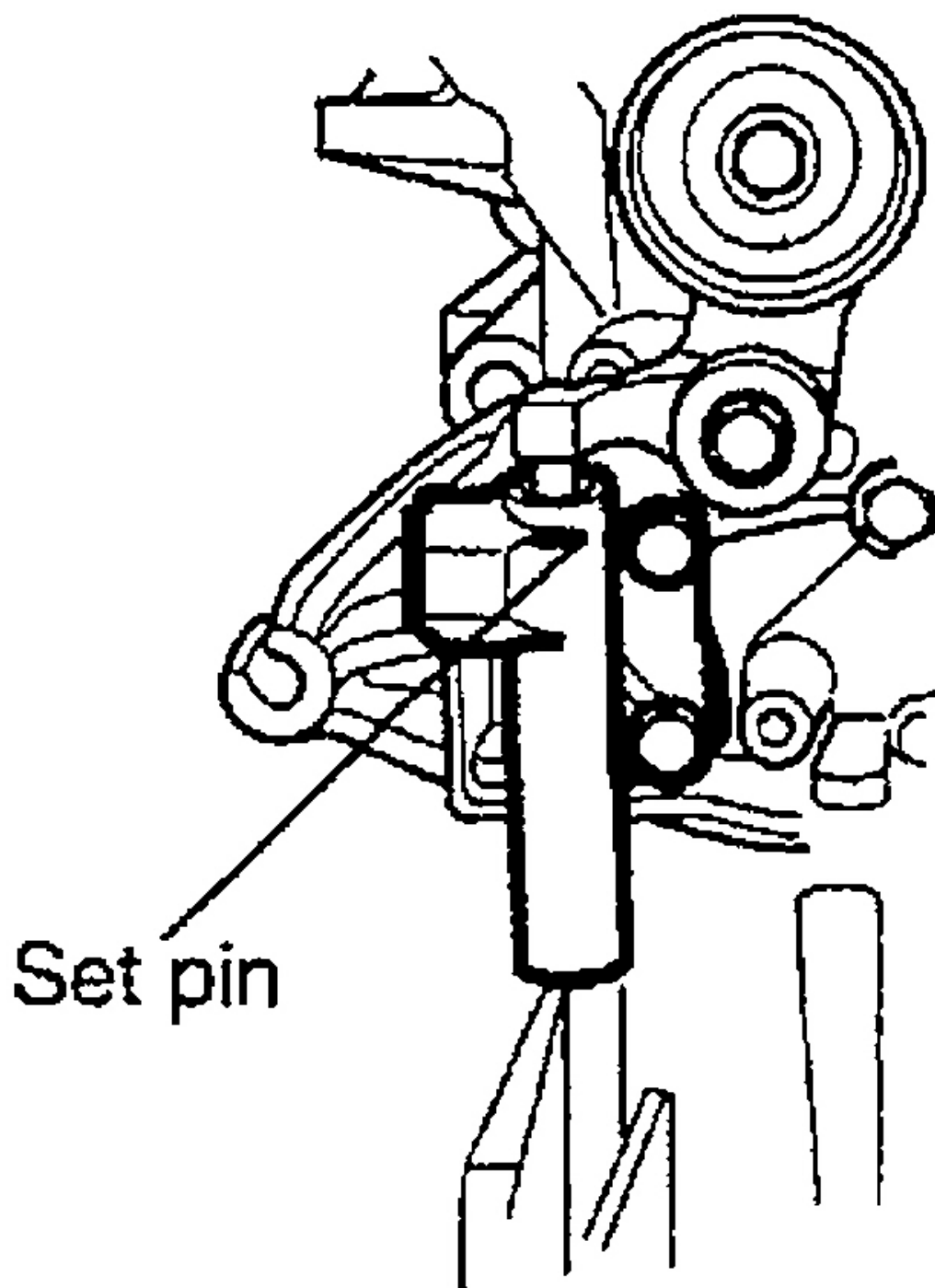
NOTE:

- When installing the camshaft sprockets, fasten them tightly while holding the hexagonal part of the camshaft.
- Before installing the timing belt, if the timing marks of the cam sprocket and the cylinder head cover do not coincide, do not rotate the cam sprocket more than 3 teeth in either direction.
- Rotating the sprocket more than 3 teeth may allow the valve and piston to touch each other.

- If the cam sprocket is rotated more than 3 teeth unavoidably, rotate the crankshaft counter - clock wise a bit before rotating the cam sprocket.

5. Install the auto tensioner to the front case.

NOTE: At this time auto tensioner's set pin should be compressed and secured with set pin.



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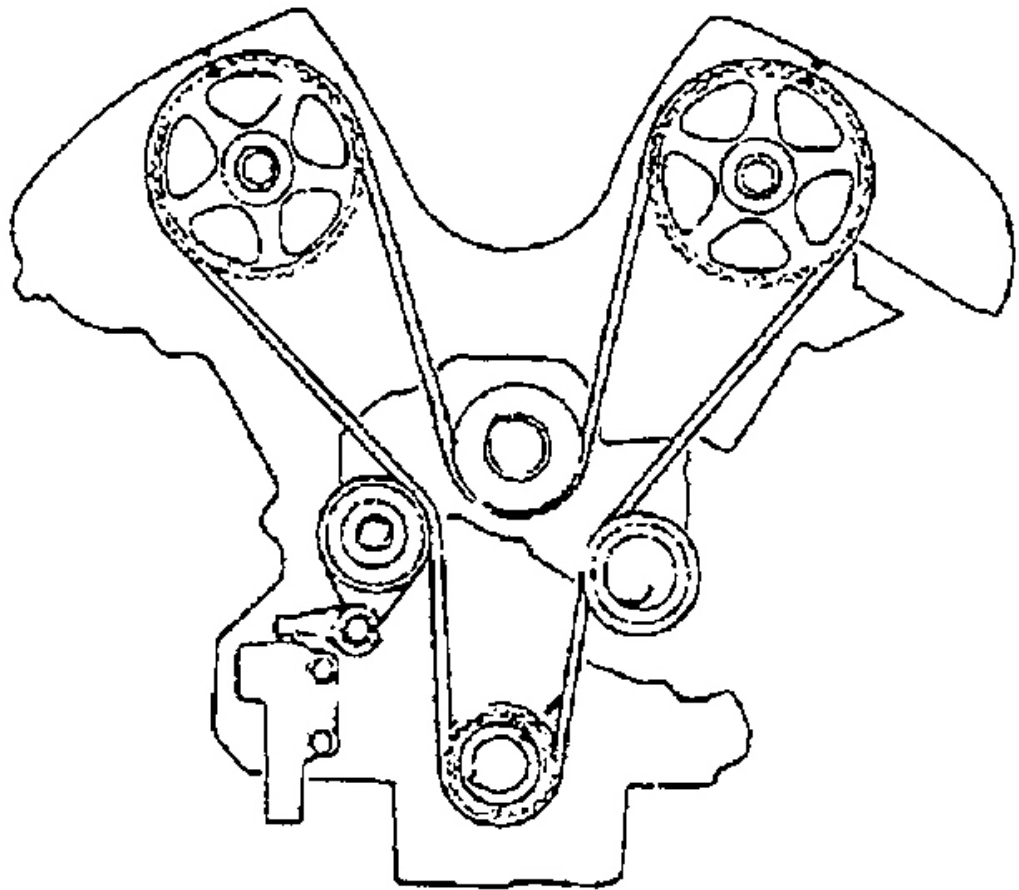
Fig. 204: Installing Auto Tensioner & Identifying Set Pin
Courtesy of HYUNDAI MOTOR CO.

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

Crankshaft sprocket --> Idler pulley --> camshaft sprocket (LH side) --> Water pump pulley --> camshaft --> sprocket (RH side) --> Tensioner pulley.

NOTE:

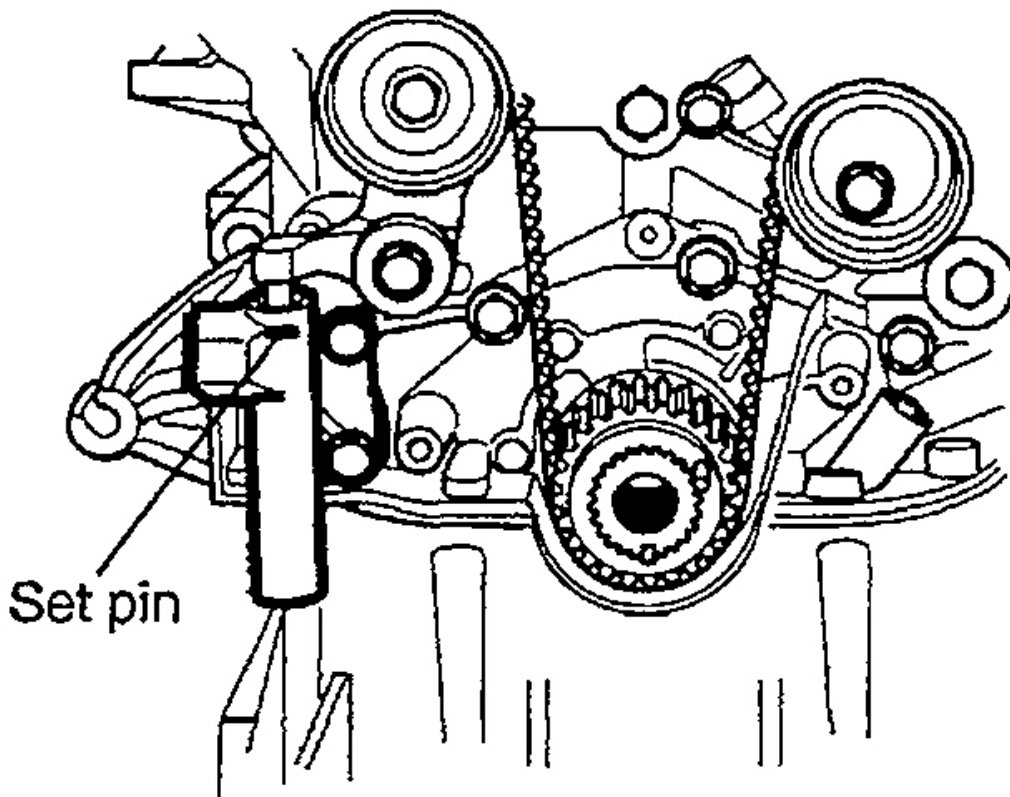
- In this step, No. 1 cylinder is in the TDC (Compression stroke).
- Be very careful if you use your fingers.



G01153666

Fig. 205: Identifying Timing Marks
Courtesy of HYUNDAI MOTOR CO.

7. Pull out the set pin of the auto tensioner.



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Fig. 206: Removing Set Pin

Courtesy of HYUNDAI MOTOR CO.

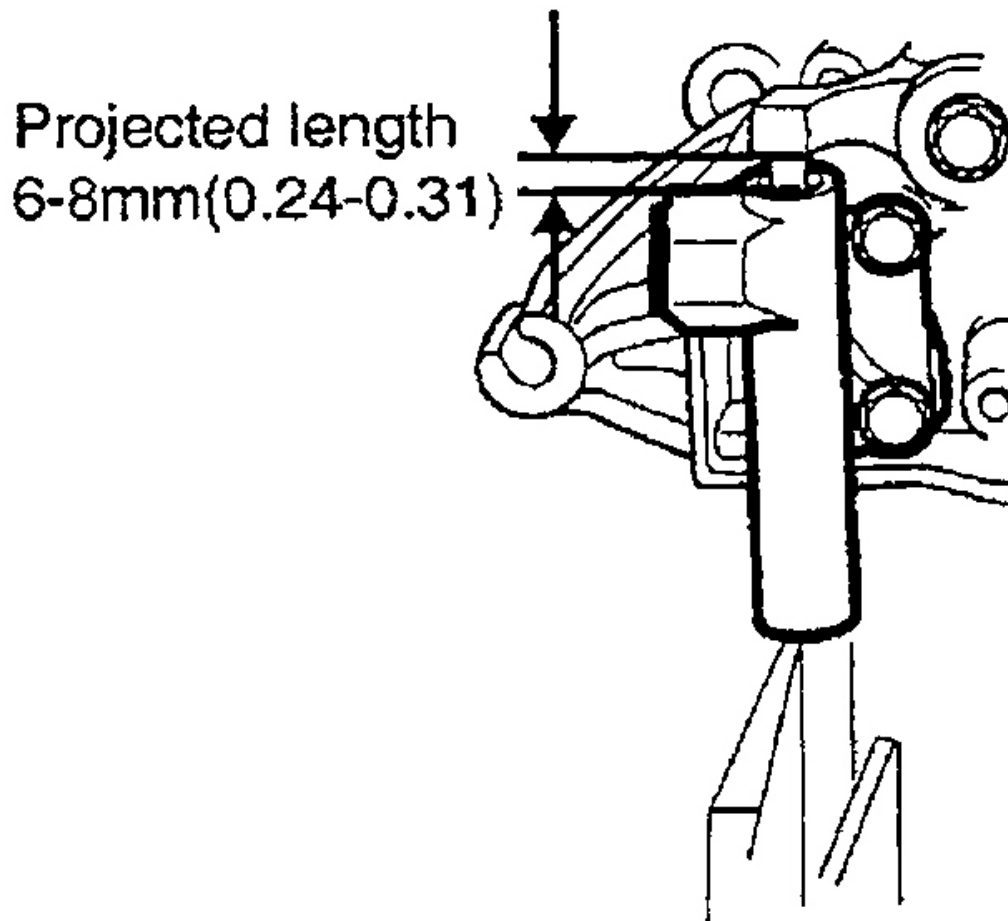
8. Install the upper and lower timing belt covers.
9. Install the power steering pump pulley, idler pulley, tensioner pulley and crankshaft pulley.
10. Using the wrench [16mm], rotate the tensioner arm clockwise (about 14°) and install the belt to the pulley.
11. Install the engine cover.

HOW TO ADJUST THE TENSION OF THE TIMING BELT

1. Rotate the crankshaft 2 turns clockwise and measure the projected length of the auto tensioner at TDC (#1 Compression stroke) after 5 minutes.

2. The projected length should be 6-8 mm.
3. Verify that the timing marks of each sprocket are in their specified position.

NOTE: If the timing marks are not in their specified position, repeat from 6 above.



G01153668

Fig. 207: Identifying Projected Length Of Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.