

2002-04 ENGINES

2.7L V6 - Santa Fe

GENERAL

SPECIFICATIONS

General Specifications

Description	Specification	Limit
General		
Type	V-type, DOHC	
Number of cylinder	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		
Open (BTDC)	6°	
Close (ABDC)	46°	
Exhaust valve		
Open (BBDC)	44°	
Close (ATDC)	8°	
Camshaft		
Driver 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
Bearing oil clearance	0.02 ~ 0.061 mm (0.0007 ~ 0.0024 in.)	(1.0202 in.)
Endplay	0.1 ~ 0.15 mm (0.0039 ~ 0.0059 in.)	0.1 mm (0.0039 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.)

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe

Valve guide hole diameter		
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.	3.300 ~ 33.325 mm (1.311 ~ 1.312 in.)	
Exhaust valve seat ring hole diameter		
0.3 (0.012) O.S.	28.600 ~ 28.621 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 Piston	Max 1.5°	Max 3°
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.)	

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe

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	
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 Bend	0.10 ~ 0.25 mm (0.0039 ~ 0.0098 in.) 0.05 mm or less/100 mm	0.4 mm (0.016 in.)
Bearing oil clearance	(0.0020 in. or less/3.937 in.) 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 ~	0.1 mm (0.004 in.)

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe

	0.0009 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		
Body clearance	0.100 ~ 0.181 mm (0.0039 ~ 0.0071 in.)	
Side clearance	0.040 ~ 0.095 mm (0.0016 ~ 0.0037 in.)	
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 Engine oil pressure	Cartridge, full flow 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	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	

Service Standard

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe

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

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	15-22 (20-30)
Alternator Mounting Bolt	15-22 (20-30)
Alternator Mounting Nut	15-22 (20-30)
Air Intake Surge Tank	
Mounting Bolt/Nut	11-15 (15-20)
Surge Tank Stay	11-15 (15-20)

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe

Auto Tensioner Fixed Bolt	15-20 (20-27)
Camshaft Sprocket Bolt	66-81 (90-110)
Coolant Inlet Fitting Bolt	13-15 (17-20)
Coolant Pump-To-Engine Bolt (Head Marked "7" Bolt)	11-16 (15-22)
Coolant Temperature Sensor	15-30 (20-40)
Crankshaft	
Connecting Rod Cap Bolt	
Step 1	13 (18)
Step 2	Tighten An Additional 90 Degrees
Main Bearing Cap Bolt ⁽¹⁾	
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 ⁽²⁾	
Step 1	18 (25)
Step 2	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 Bracket-To-Crossmember Bolt	30-41 (40-55)
Rear Roll Stopper Insulator Bolt & Nut	37-48 (50-65)
Exhaust Manifold-To-Cylinder Head (Self-Locking Nut)	22-26 (30-35)
Exhaust Pipe	
Catalytic Converter-To-Center Exhaust	22-30 (30-40)

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe

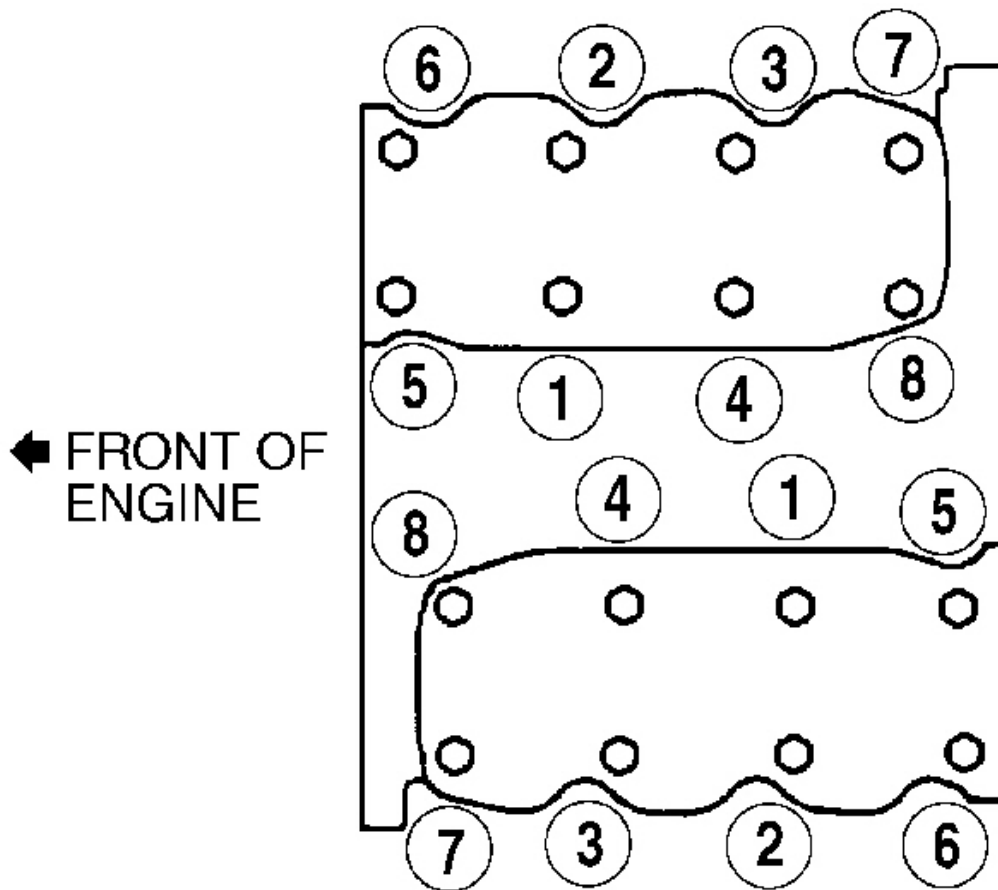
Pipe Nut	
Center Exhaust Pipe-To-Main Muffler Nut	22-30 (30-40)
Pipe-To-Manifold Nut	22-30 (30-40)
Pipe-To-Catalytic Converter Bolt	30-44 (40-60)
Flywheel Bolt	54-57 (73-77)
Intake Manifold-To-Cylinder Head ⁽³⁾	14-15 (19-20)
Oil Filter	9-12 (12-16)
Oil Pan Bolt	
Lower Pan ⁽⁴⁾	(5)
Upper Pan	(6)
Oil Pan Drain Plug	26-33 (35-45)
Oil Pan Screen Bolt	11-16 (15-22)
Oil Pressure Switch	11-16 (15-22)
Oil Relief Valve Plug	30-37 (40-50)
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	15-22 (20-30)
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)
Transaxle Mount	
Mounting Bracket Bolt	30-41 (40-55)
Insulator Bolt	66-81 (90-110)
Water Outlet Fitting Bolt	13-15 (17-20)
	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	71-88 (8-10)
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)

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe

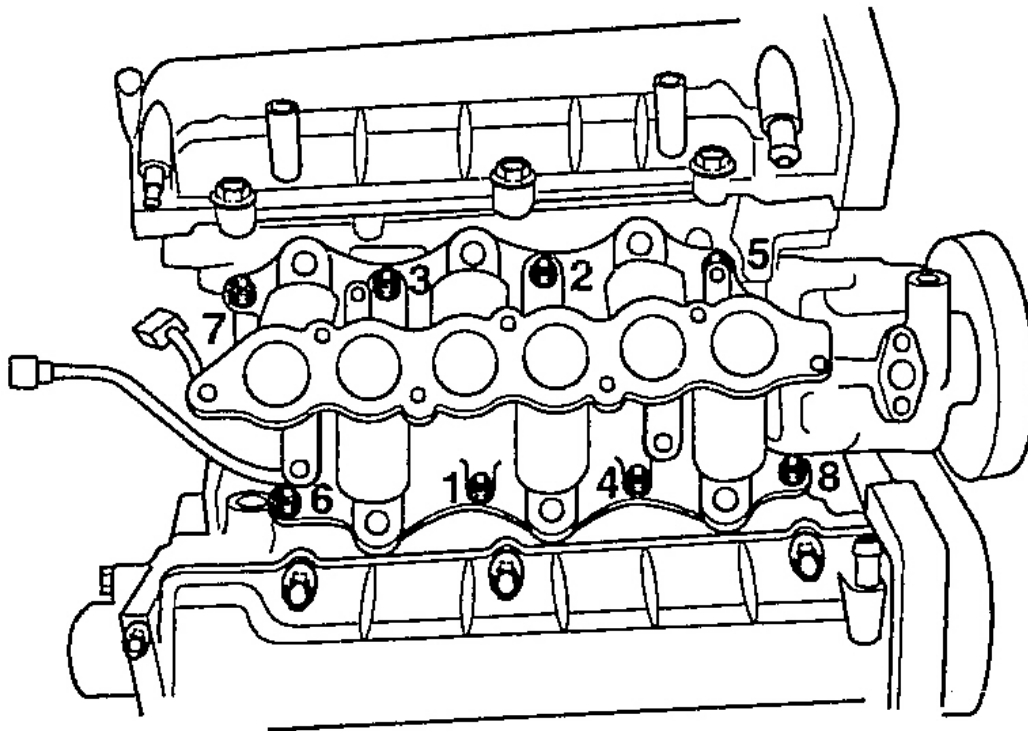
Oil Level Gauge Guide Bolt	106-133 (12-15)
Oil Pump	
Case Bolt	106-133 (12-15)
Cover Screw	71-106 (8-12)
Oil Seal Case Bolt	89-106 (10-12)
Rear Plate	89-106 (10-12)
Transaxle Mounting Plate	89-106 (10-12)
Timing Belt Assembly Cover Bolt	89-106 (10-12)

- (1) Tighten in sequence. See **Fig. 8**.
- (2) Tighten in sequence with engine cold. See **Fig. 4**.
- (3) Tighten in sequence. See **Fig. 5**.
- (4) Tighten in sequence. See **Fig. 6**.
- (5) Tighten to 88-106 INCH Lbs. (10-12 N.m).
- (6) Tighten in sequence. See **Fig. 7**.



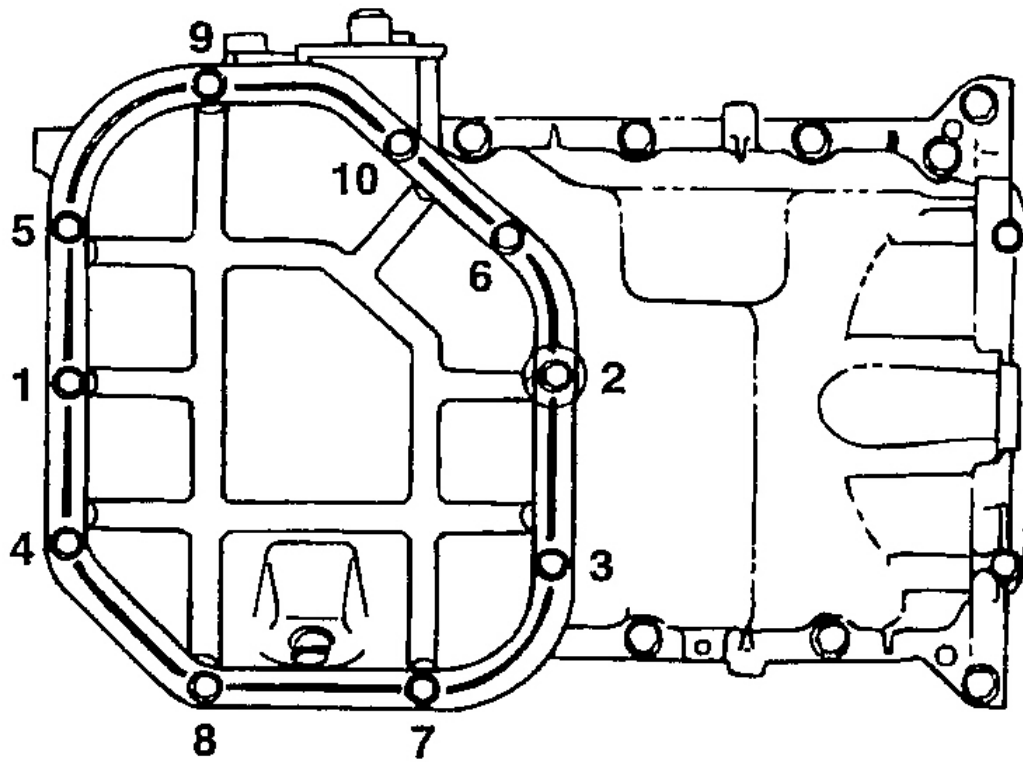
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Fig. 4: Cylinder Head Bolt Tightening Sequence
 Courtesy of HYUNDAI MOTOR CO.



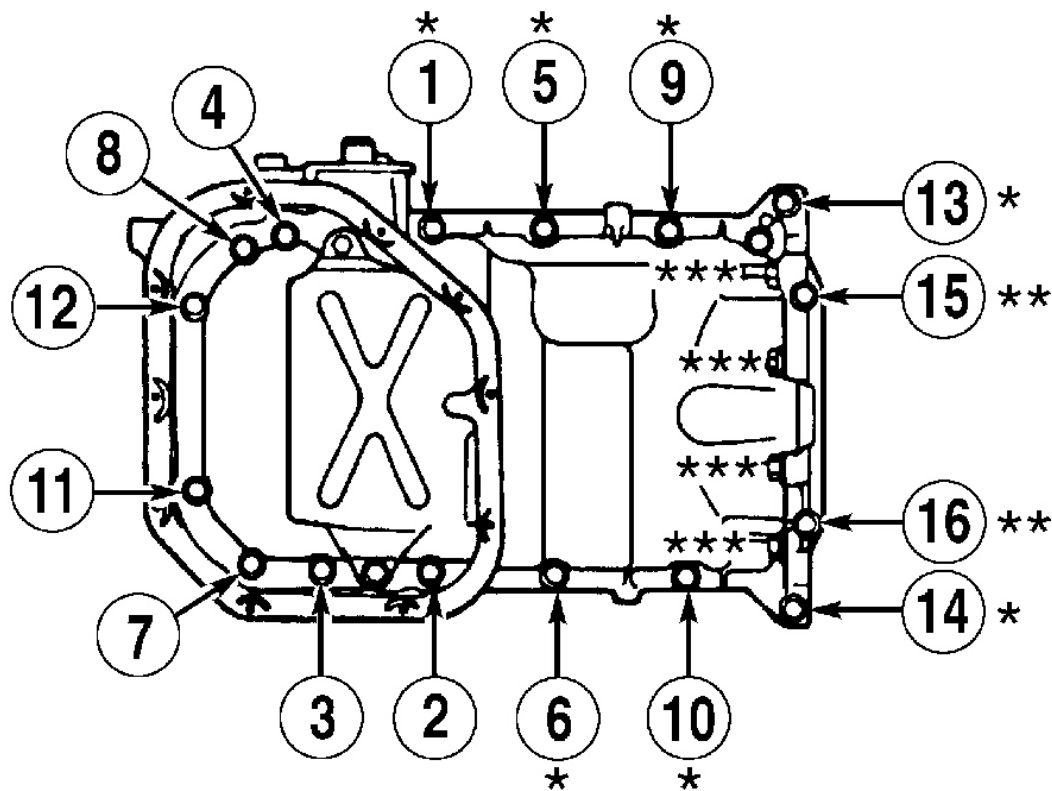
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Fig. 5: Intake Manifold Tightening Sequence
Courtesy of HYUNDAI MOTOR CO.



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Fig. 6: Lower Oil Pan Bolt Tightening Sequence
Courtesy of HYUNDAI MOTOR CO.



* 14-20 ft. lbs. (19-28 N.m)

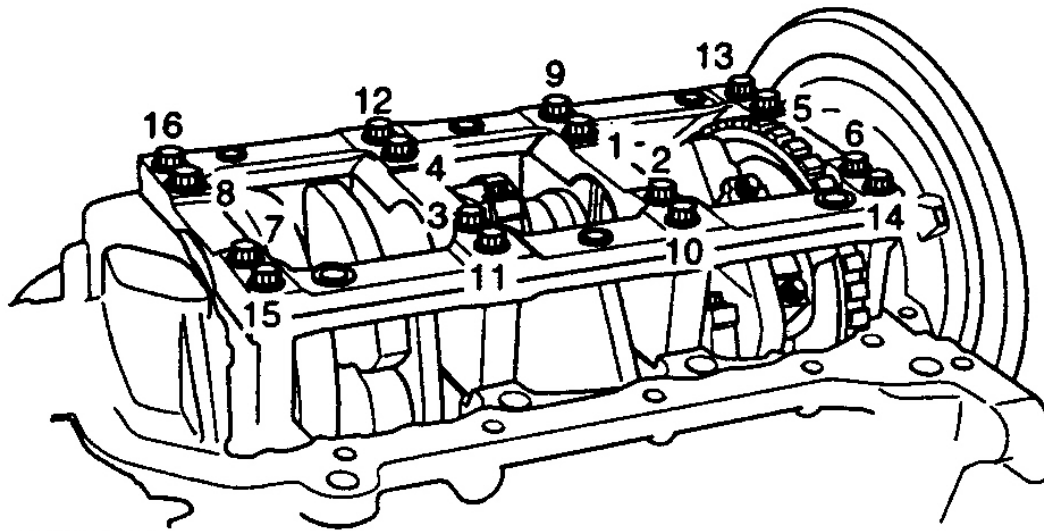
** 4-5 ft. lbs. (5-7 N.m)

*** 22-30 ft. lbs. (30-42 N.m)

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Fig. 7: Upper Oil Pan Bolt Tightening Sequence

Courtesy of KIA MOTORS AMERICA, INC.



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Fig. 8: Identifying Main Bearing Cap Tightening Sequence
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.

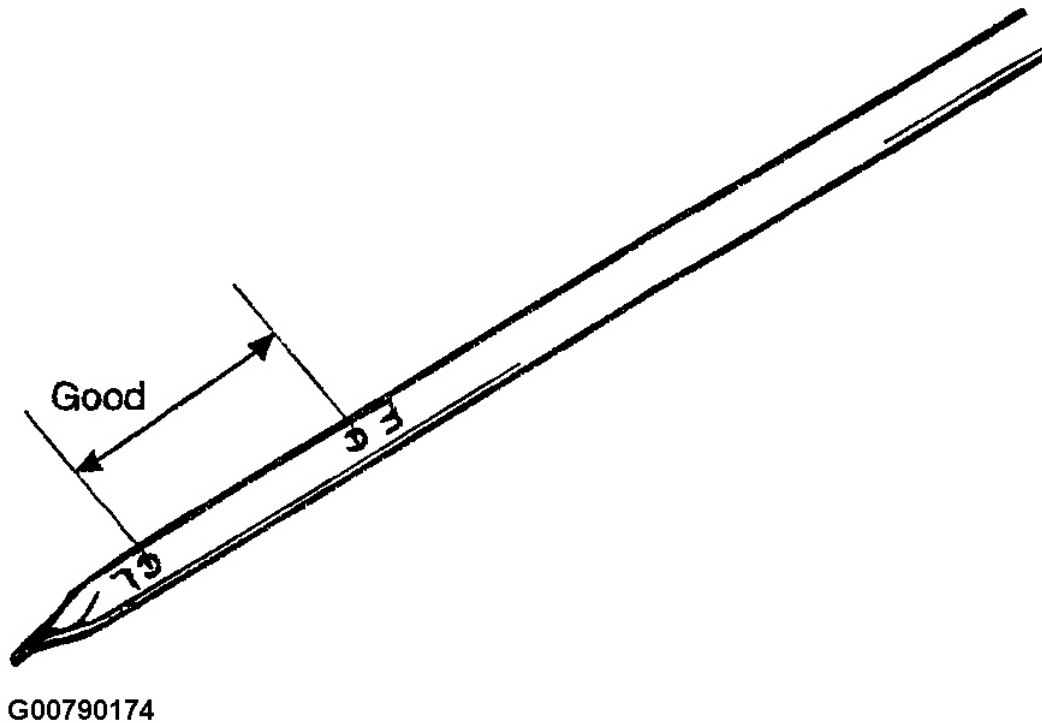


Fig. 9: Identifying Good Oil Level
Courtesy of HYUNDAI MOTOR CO.

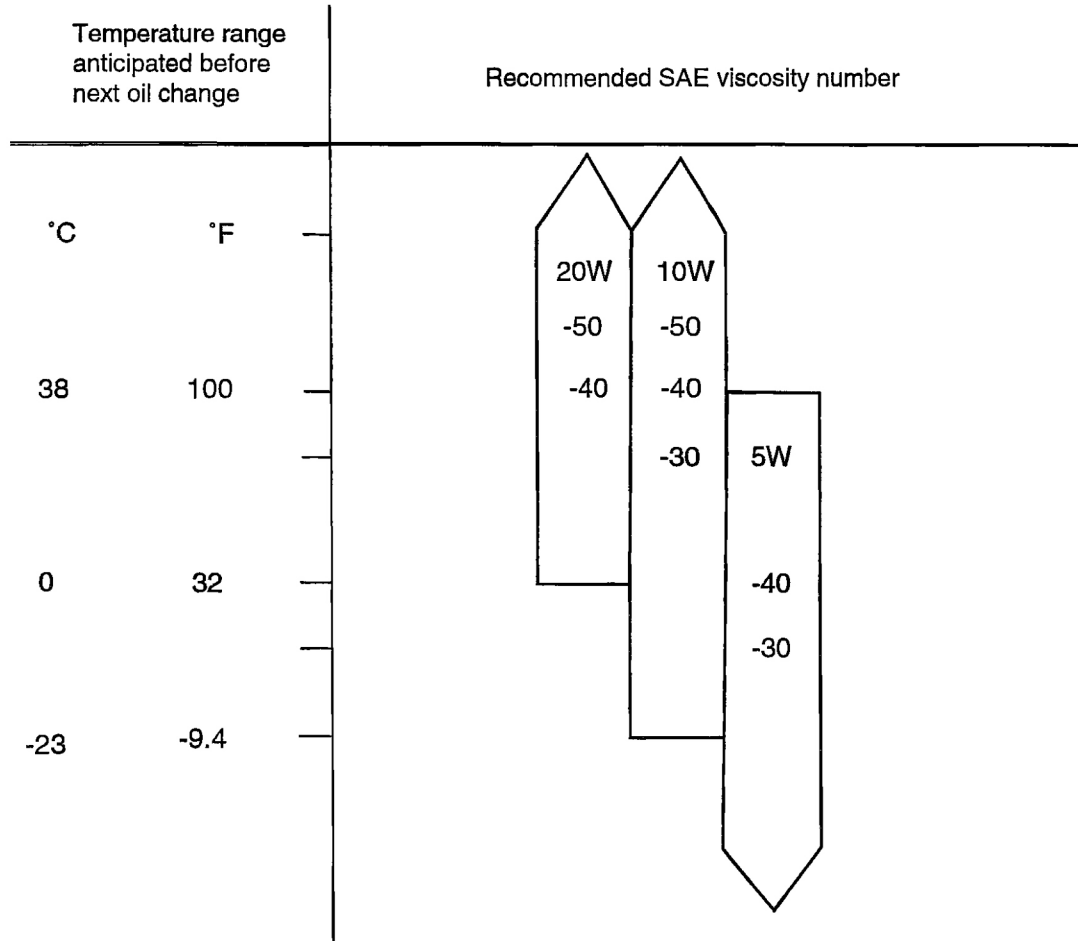
Selection Of Engine Oil

Recommended API classification: SH OR ABOVE

Recommended SAE Viscosity Grades :

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe



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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

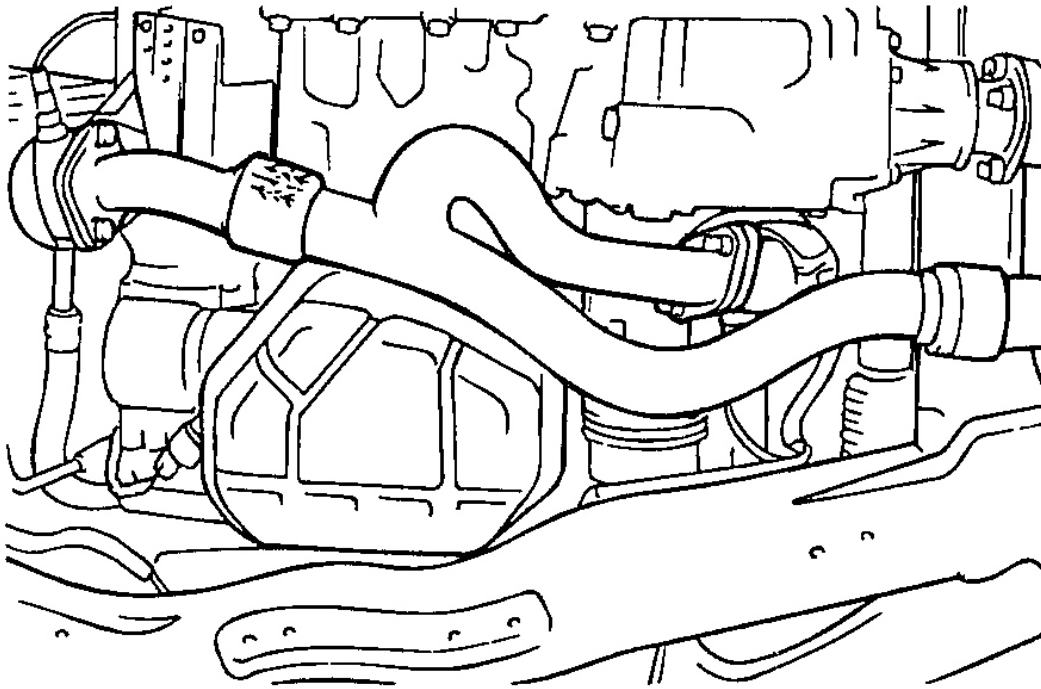
1. Run the engine until it reaches normal operating temperature.

2. Turn off the engine.
3. Remove the oil filler cap and oil filter and then drain plug.
4. Drain the engine oil.
5. 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)



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Fig. 11: View Of Oil Pan

Courtesy of HYUNDAI MOTOR CO.

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

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

Drain and Refill

Oil quantity : 4.5 lit (4.74 U.S.qts., 3.95 Imp.qts.)

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

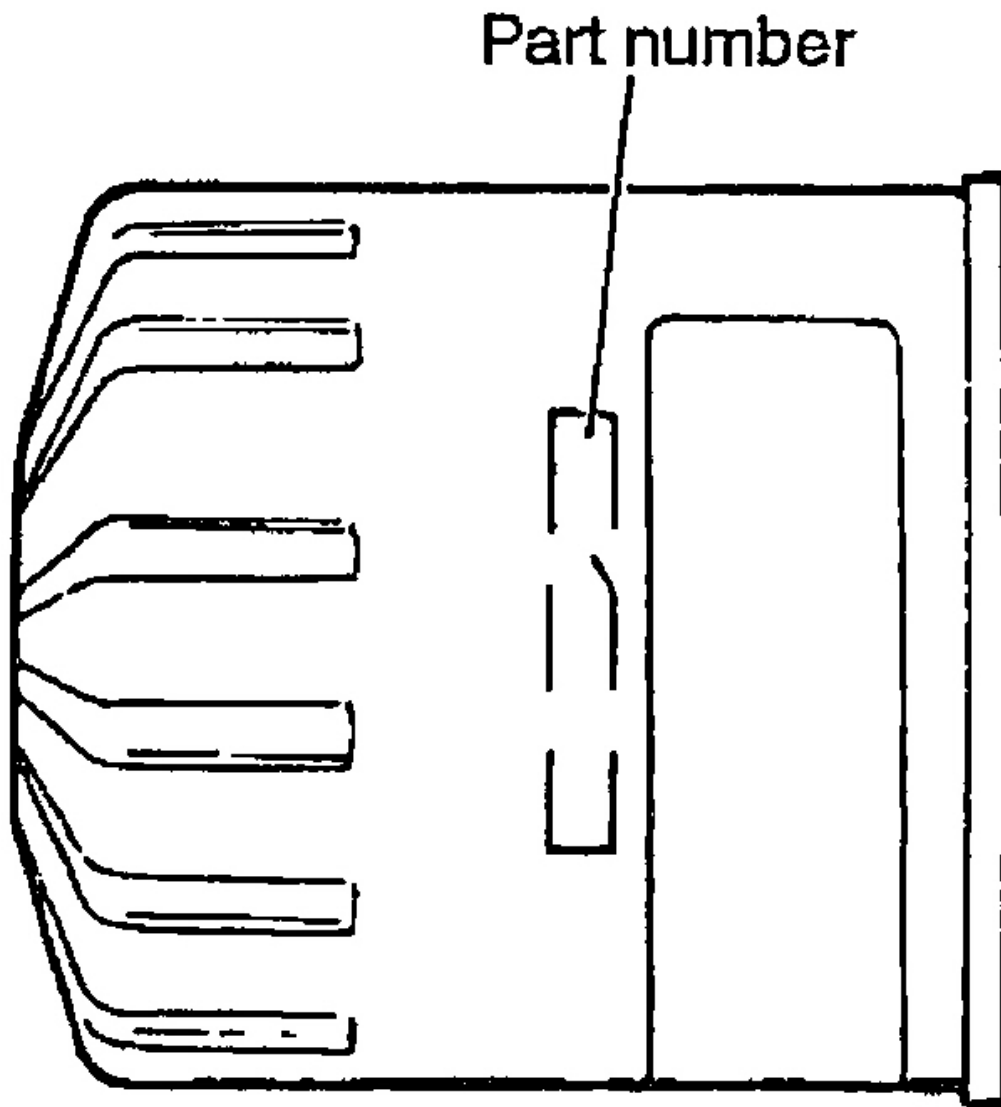
7. Install the oil filler cap.
8. Start and run the engine.
9. Turn off the engine and then check the oil level. Add oil if necessary.

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.



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Fig. 12: Identifying Oil Filter Part Number
Courtesy of HYUNDAI MOTOR CO.

Procedure For Replacing Oil Filter

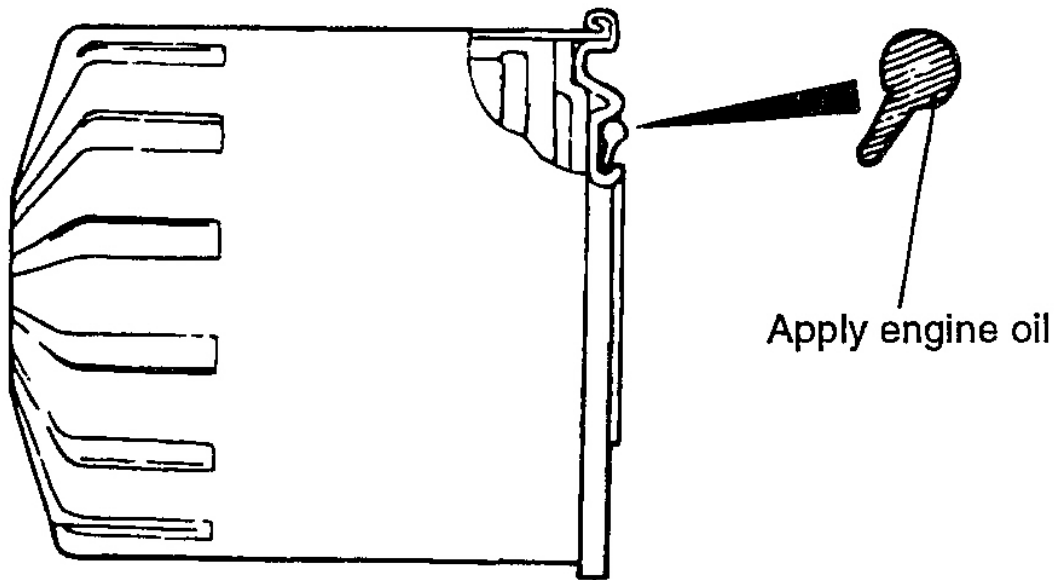
1. Use a filter wrench to remove the oil filter.
2. Before installing a new oil filter on the engine, apply clean engine oil to the surface of the rubber gasket.

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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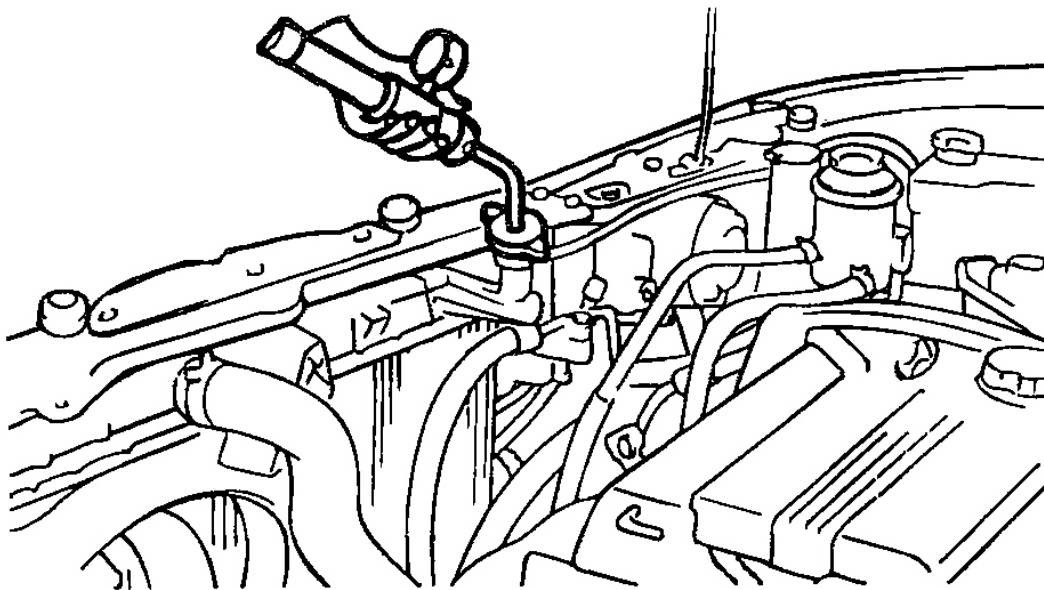
Fig. 13: Lubricating Oil Filter Rubber Gasket
Courtesy of HYUNDAI MOTOR CO.

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.



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Fig. 14: Pressure Testing Cooling System
Courtesy of HYUNDAI MOTOR CO.

Radiator Cap Pressure Test

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

Main valve opening pressure :

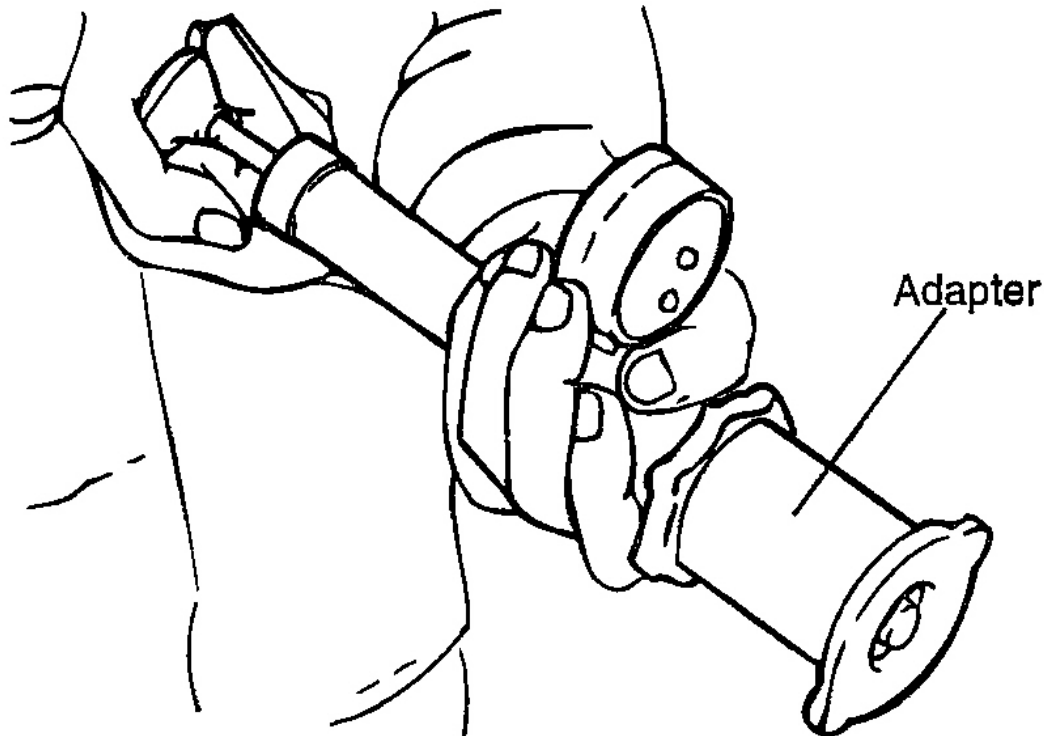
107.9 +/- 14.7 kPa (1.1 +/- 0.15 kg/cm² , 15.64 +/- 2.13 psi)

Main valve closing pressure:

83.4 kPa (0.85 kg/cm² , 12.1 psi)

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

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

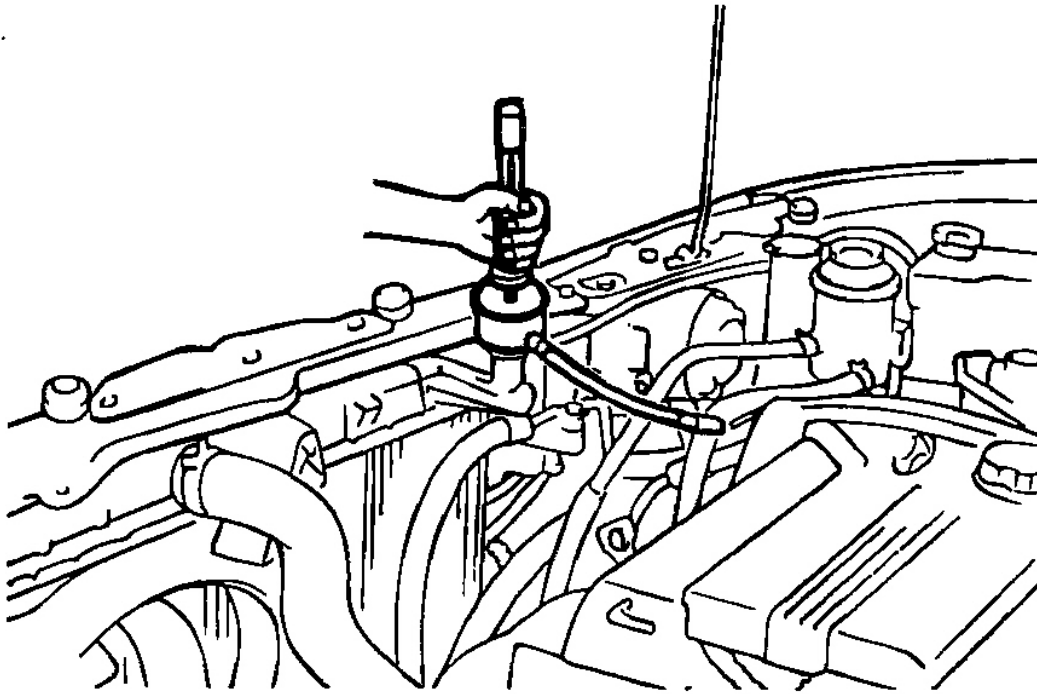


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Fig. 15: Pressure Testing Radiator Cap
Courtesy of HYUNDAI MOTOR CO.

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.



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Fig. 16: Checking Coolant With Hydrometer
Courtesy of HYUNDAI MOTOR CO.

Coolant temperature °C(°F) and specific gravity					Freezing temperature °C(°F)	Sage Operating tempera- ture °C (°F)	Coolant Contraction (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	-15 (5)	-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	4.084	1.077	1.070	-42 (-44)	-37 (-35)	55%
1.103	1.098	1.092	1.084	1.076	-50 (-58)	-45 (-49)	60%

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Fig. 17: Relationship Between Coolant Concentration & Specific Gravity
Courtesy of HYUNDAI MOTOR CO.

Example

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

CAUTION:

- If the concentration of the coolant is below 30%, its anti-corrosion property will be adversely affected.
- If the concentration is above 60%, the engine cooling property will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.
- Do not mix types of anti-freeze.

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

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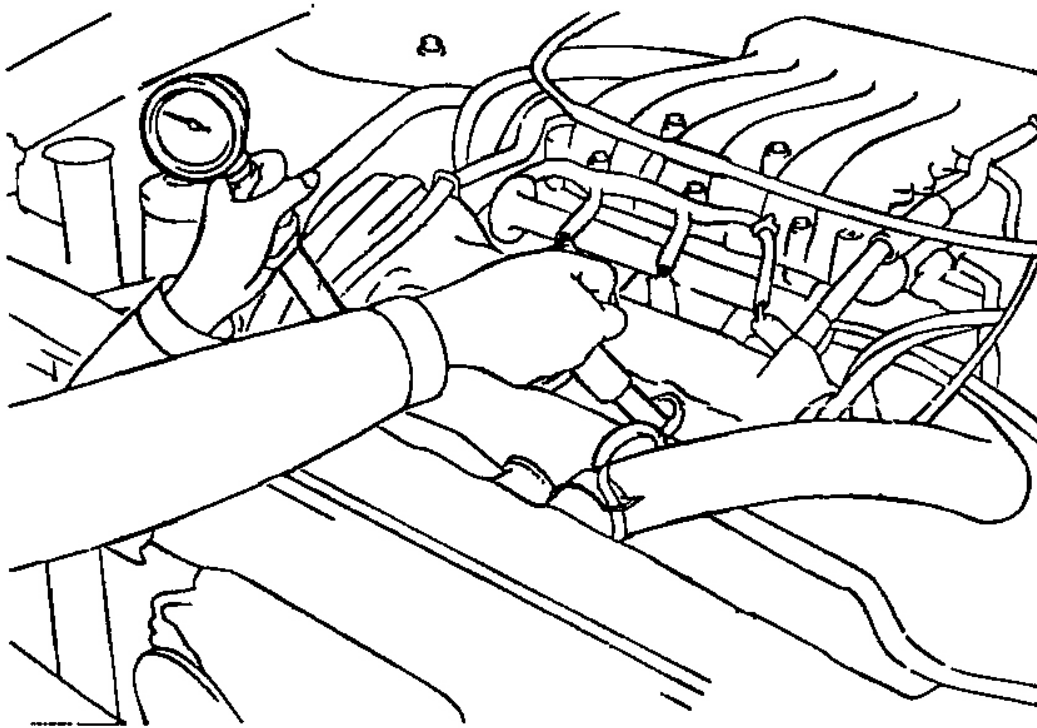
Fig. 18: Recommended Coolant
Courtesy of HYUNDAI MOTOR CO.

Checking Compression Pressure

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

Standard value : 1,200 kpa (12.2 kg / cm² , 170 psi)

Limit : 1,050 kpa (10.7kg / cm² , 149psi)



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Fig. 19: 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. 100kpa (1.0 kg / cm² , 14psi) between cylinders

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

Tightening torque

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

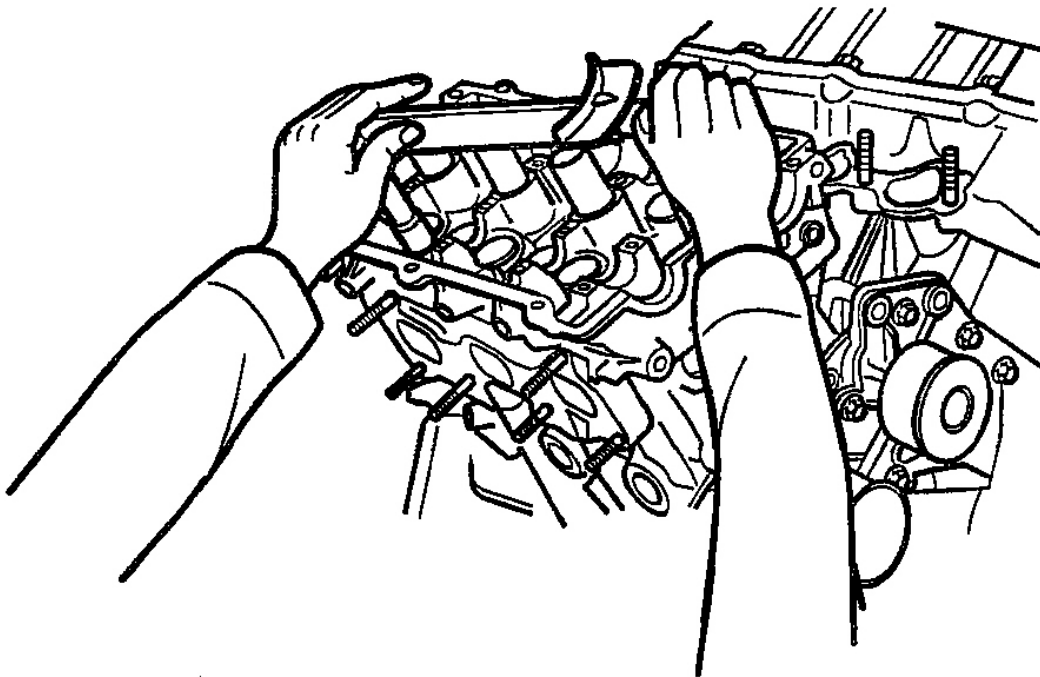
Tightening Cylinder Head Bolts

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

Tightening torque

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

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

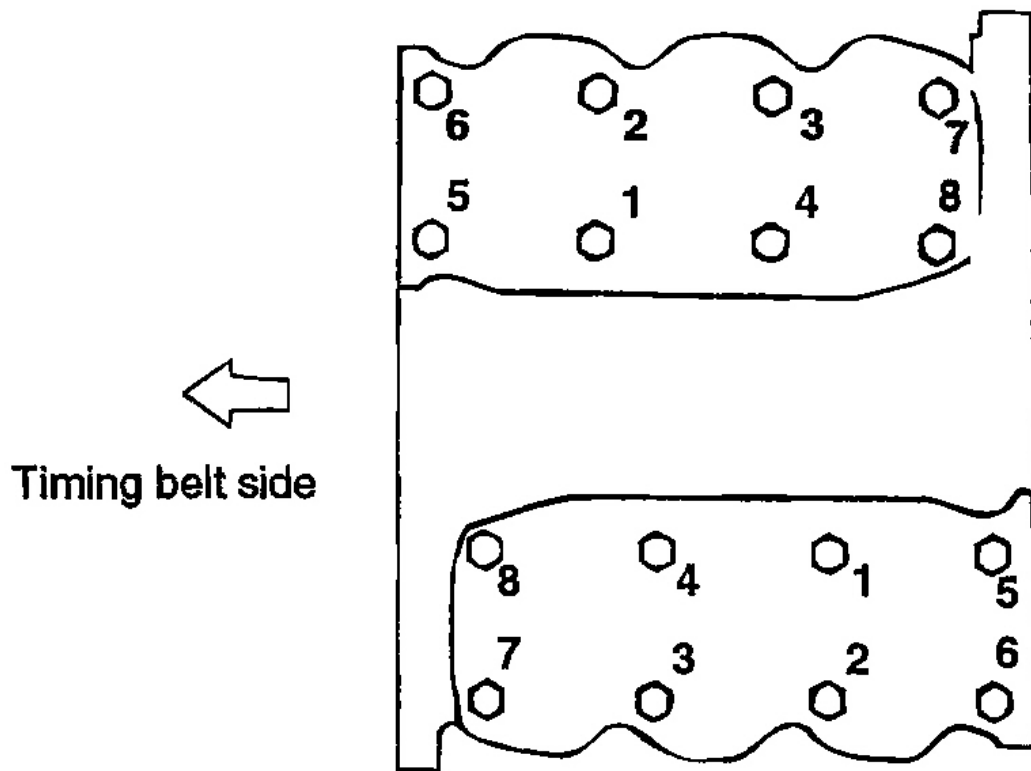


G00790185

Fig. 20: 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. 21: 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.

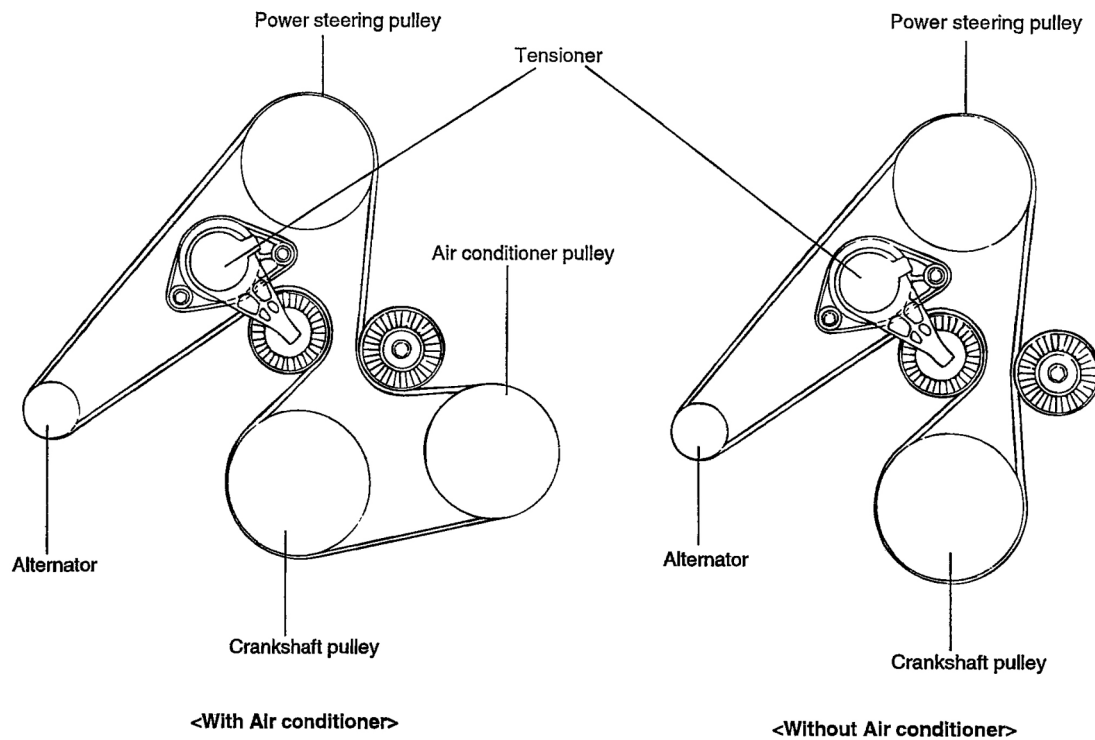
Adjusting Drive Belt & Tensioner

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)

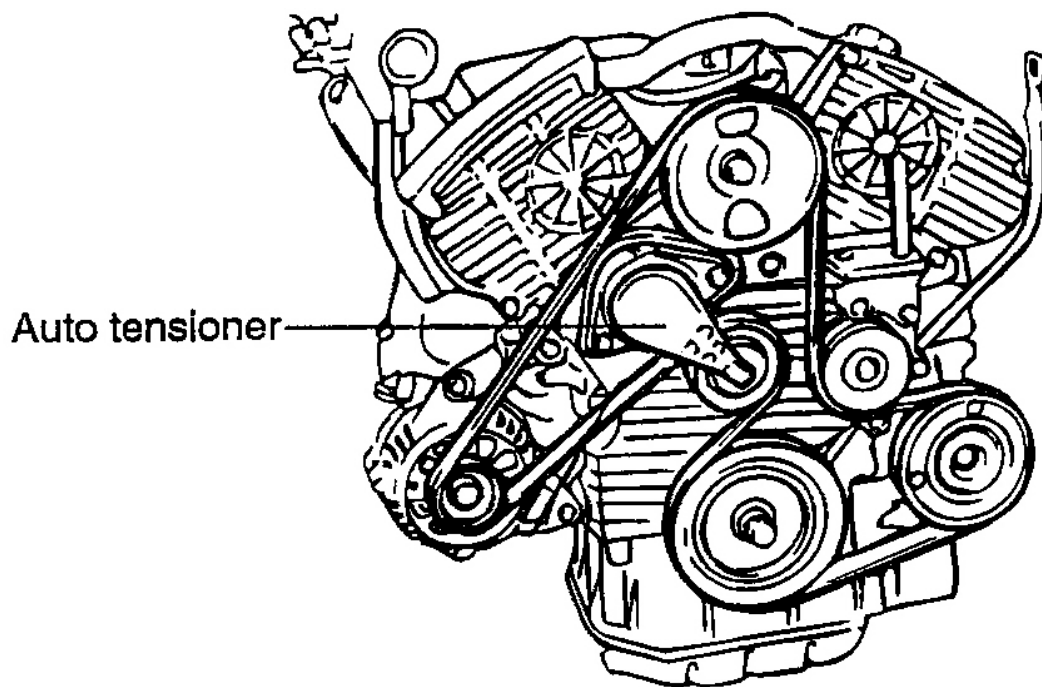


G00790187

Fig. 22: Identifying Belt & Pulleys
Courtesy of HYUNDAI MOTOR CO.

2. Install the belt in the following order.

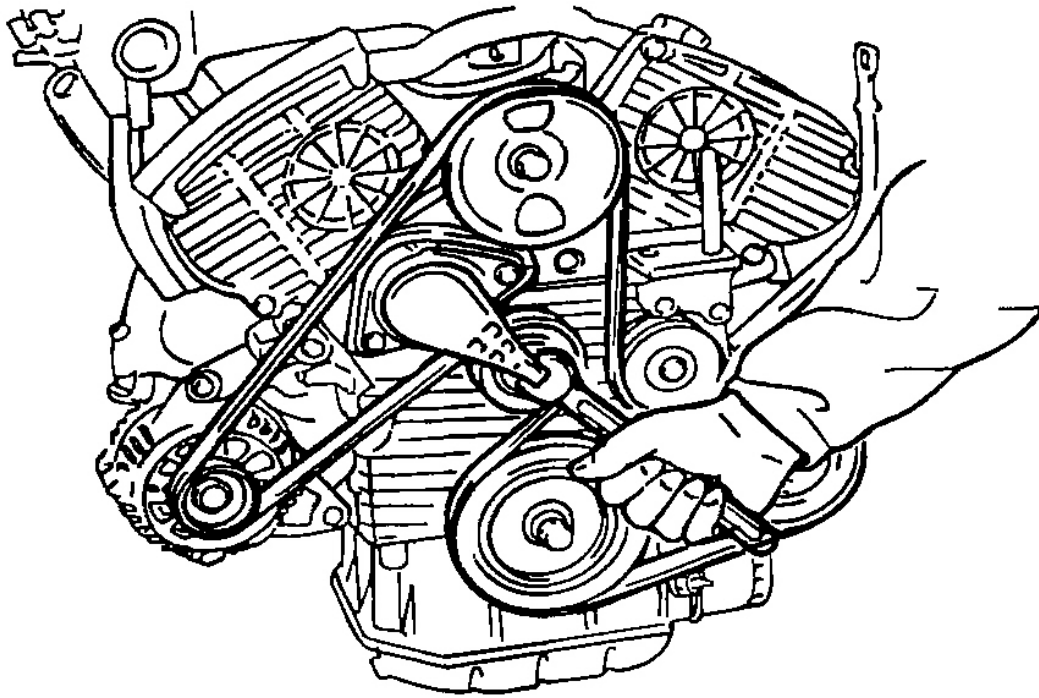
Alternator, Power steering, Air conditioner pulley and then Crankshaft pulley.



G00790188

Fig. 23: Identifying Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.

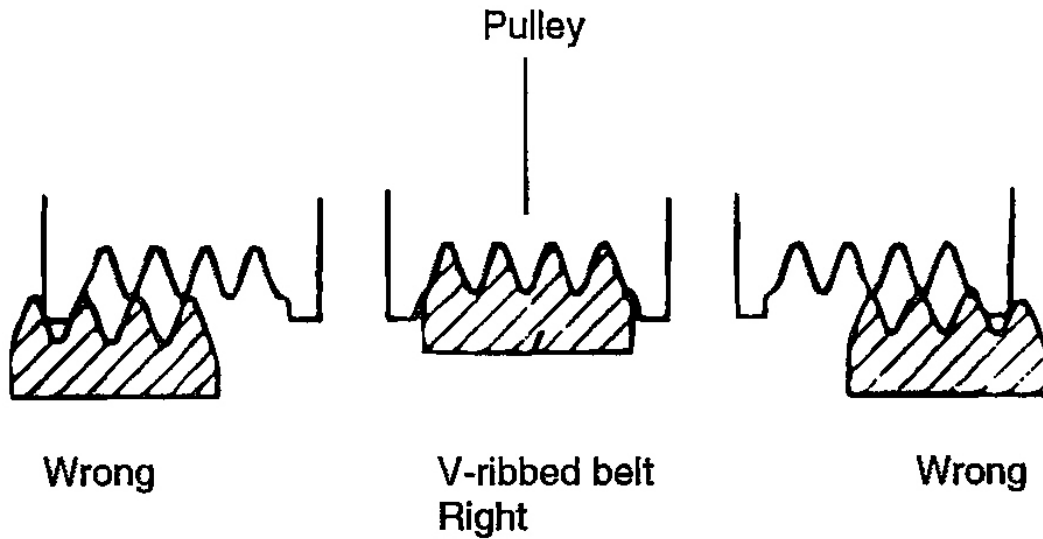
3. Rotate the tensioner arm clockwise (about 14°) with a spanner (16 mm) and fit the belt to the idler pulley.



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Fig. 24: Rotating Tensioner
Courtesy of HYUNDAI MOTOR CO.

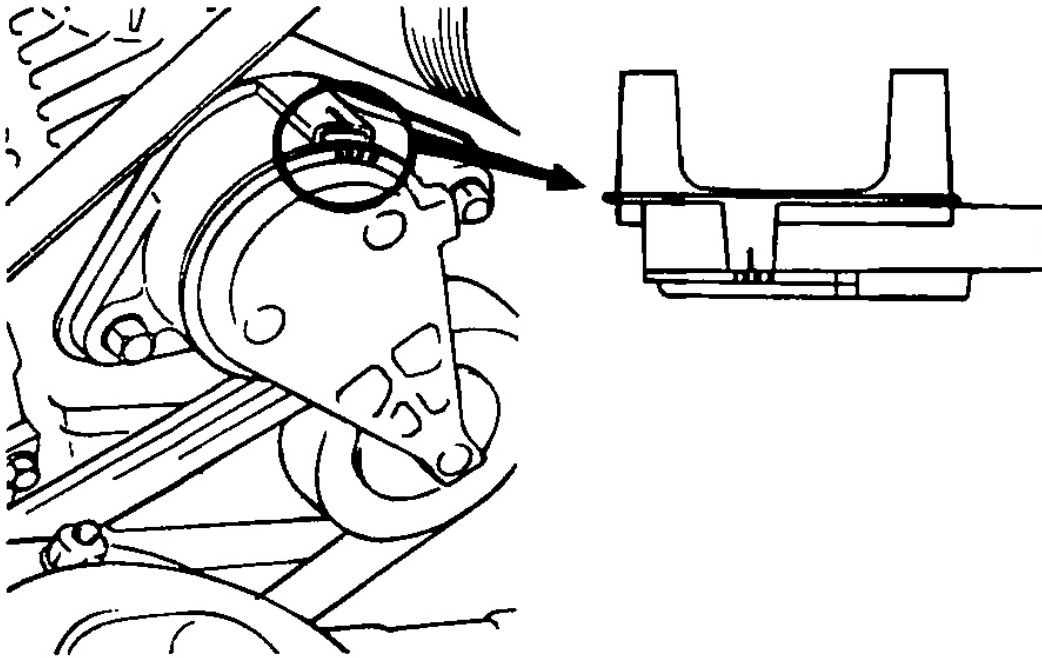
4. When installing the belt on the pulley, make sure it is centered on the pulley.



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Fig. 25: 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.



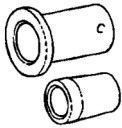
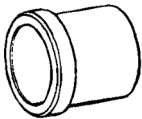
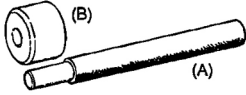
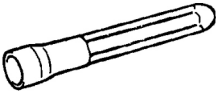
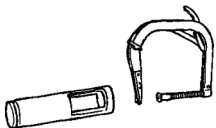
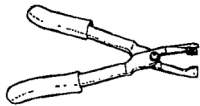
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Fig. 26: Identifying Min-Max On Tensioner
Courtesy of HYUNDAI MOTOR CO.

SPECIAL TOOLS

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe

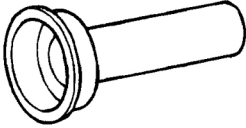
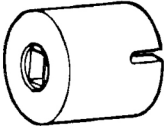
Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-33000)		Installation of the crankshaft front oil seal
Camshaft oil seal installer (09221-21000)		Installation of the camshaft oil seal
Valve guide installer (09221-3F100 A/B)		Removal and installation of the valve guide
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. 27: Identifying Special Tools Table (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe

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.

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Fig. 28: Identifying Special Tools Table (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

TROUBLESHOOTING

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe

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 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	Add or replace Adjust or repair Use proper engine oil 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 Replace or replace valve and/or seat ring

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Fig. 29: Troubleshooting Table (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe

Symptom	Probable cause	Remedy
Oil pressure drop	Low engine oil level Faulty oil pressure switch Clogged oil filter Worn oil pump gear 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 clearance Repair Replace
High oil pressure	Oil relief 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 Repair 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 thermo-sensor or radiator Insufficient coolant	Replace parts Replace Clear restriction or replace parts 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	Repair or replace 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

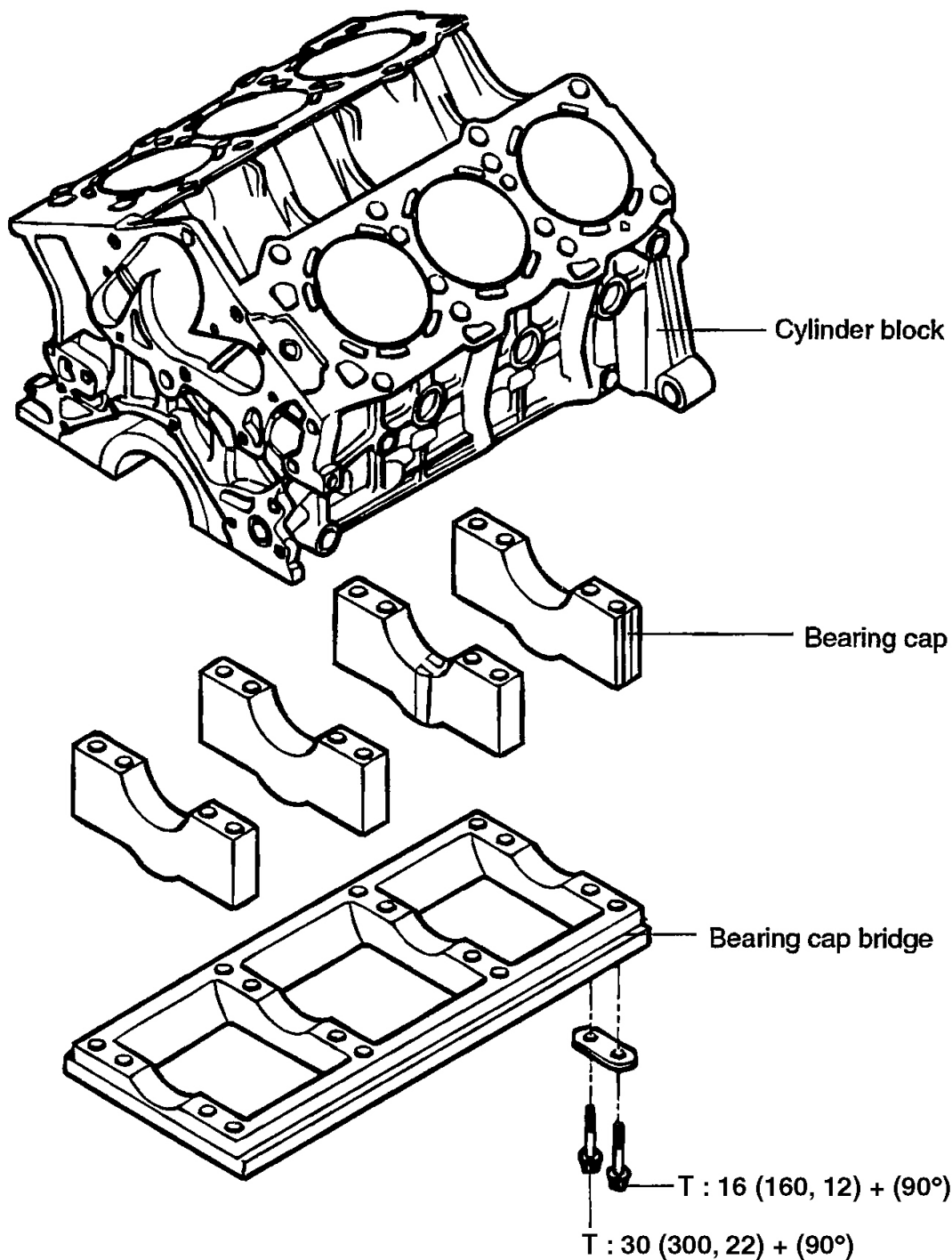
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Fig. 30: Troubleshooting Table (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

ENGINE BLOCK

ENGINE BLOCK

Components



TORQUE : Nm (kg·cm, lb·ft)

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Fig. 31: 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 and oil pump case.

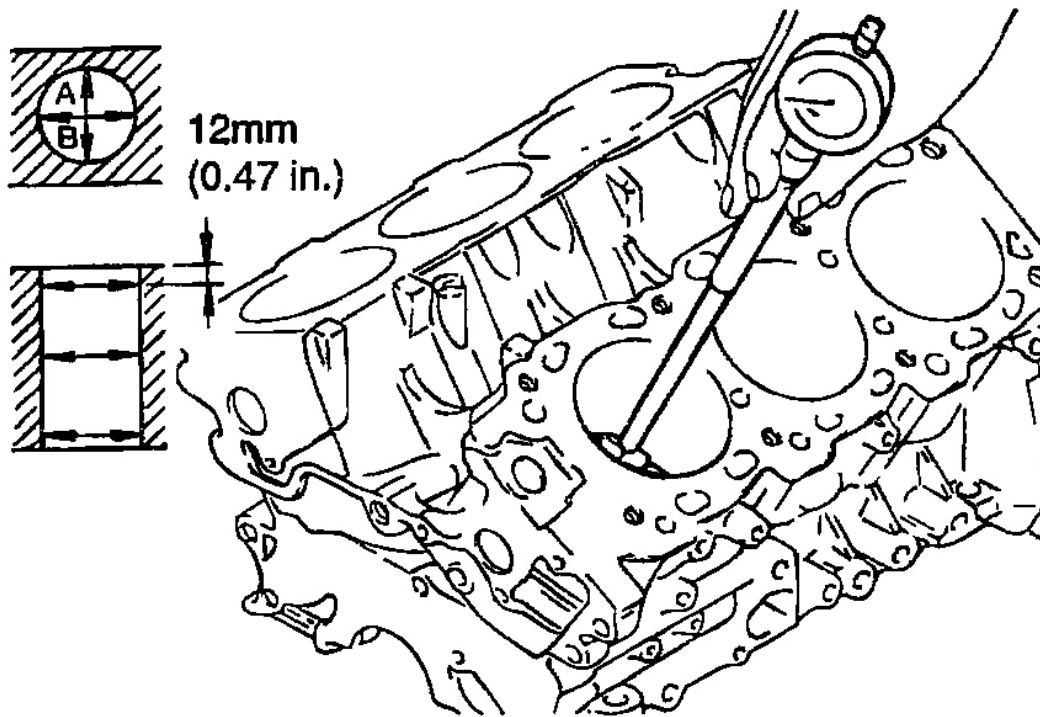
Inspection**Cylinder Block**

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

Level 1 : No.1 piston ring position at TDC

Level 2: Center of cylinder

Level 3 : Bottom of cylinder



G00790197

Fig. 32: 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 15.5mm (0.61 in.) above the bottom of the piston skirt and across the thrust faces.

Piston-to-cylinder clearance

0.01 ~ 0.03 mm (0.0004 ~ 0.0012 in.)

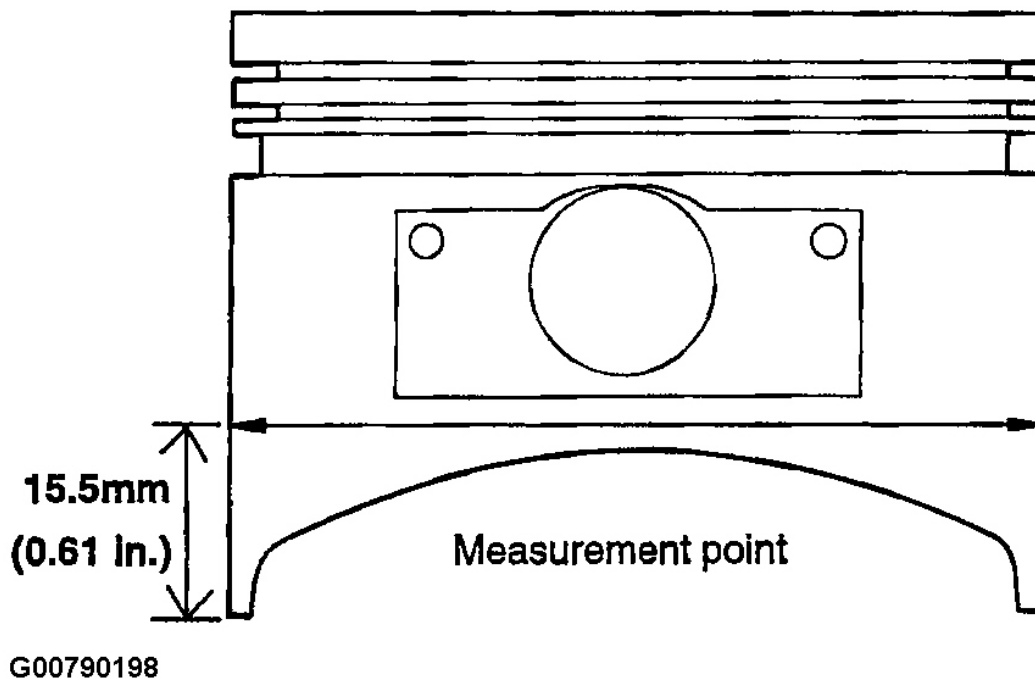


Fig. 33: Measuring Point On Piston Skirt
Courtesy of HYUNDAI MOTOR CO.

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 limit, grind to the minimum limit or replace.

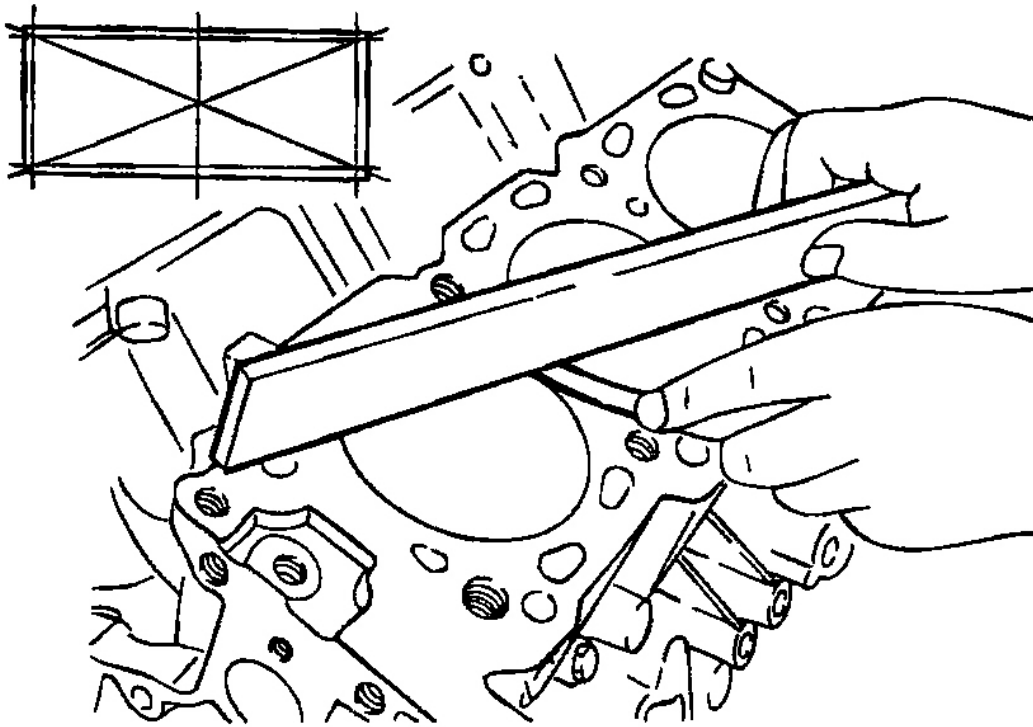
Standard value

Flatness of gasket surface : Max. 0.03 mm (0.0012 in.)

Service limit

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

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



G00790199

Fig. 34: 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.)

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Fig. 35: Piston Identification Table
 Courtesy of HYUNDAI MOTOR CO.

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

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

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

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

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

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

Standard : 0.01 ~ 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

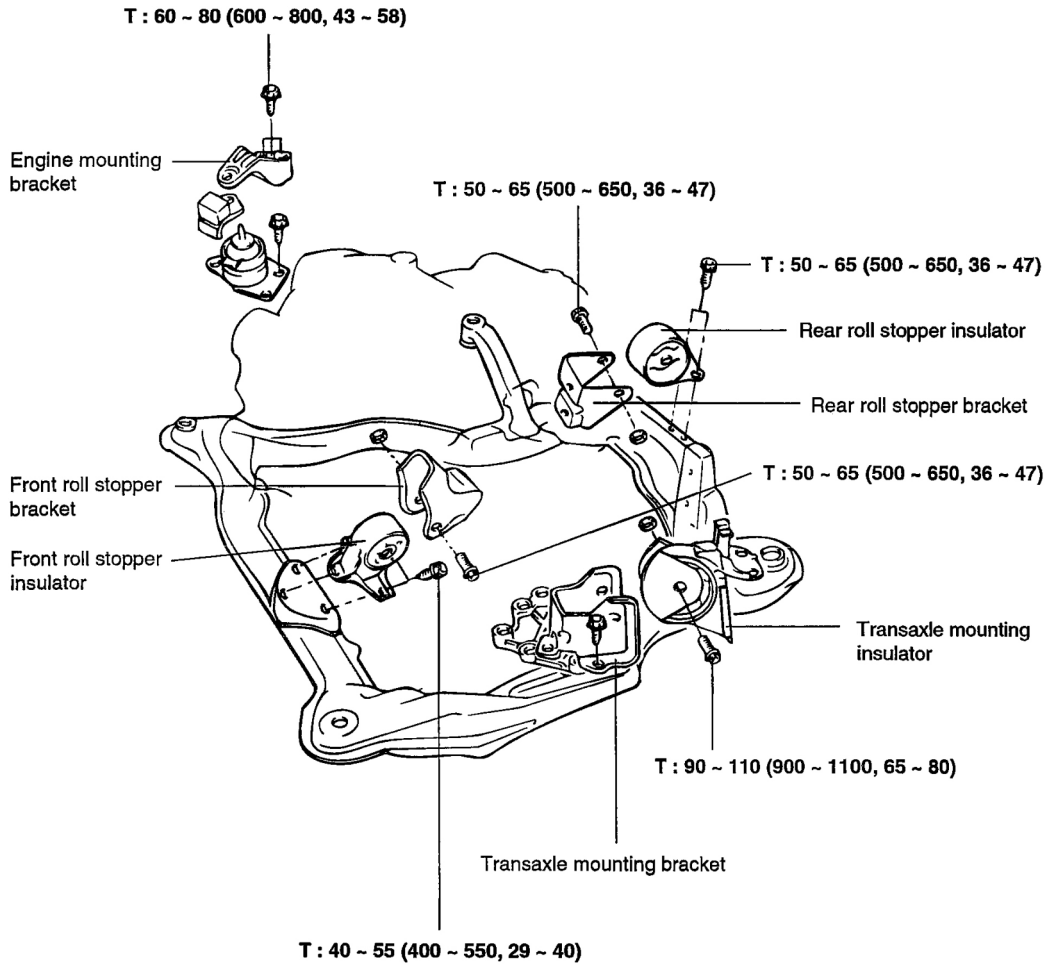
Install the following parts by referring to their respective sections.

1. Crankshaft
2. Drive plate
3. Piston
4. Cylinder head
5. Timing belt

6. Oil pump case

ENGINE MOUNTS

Components



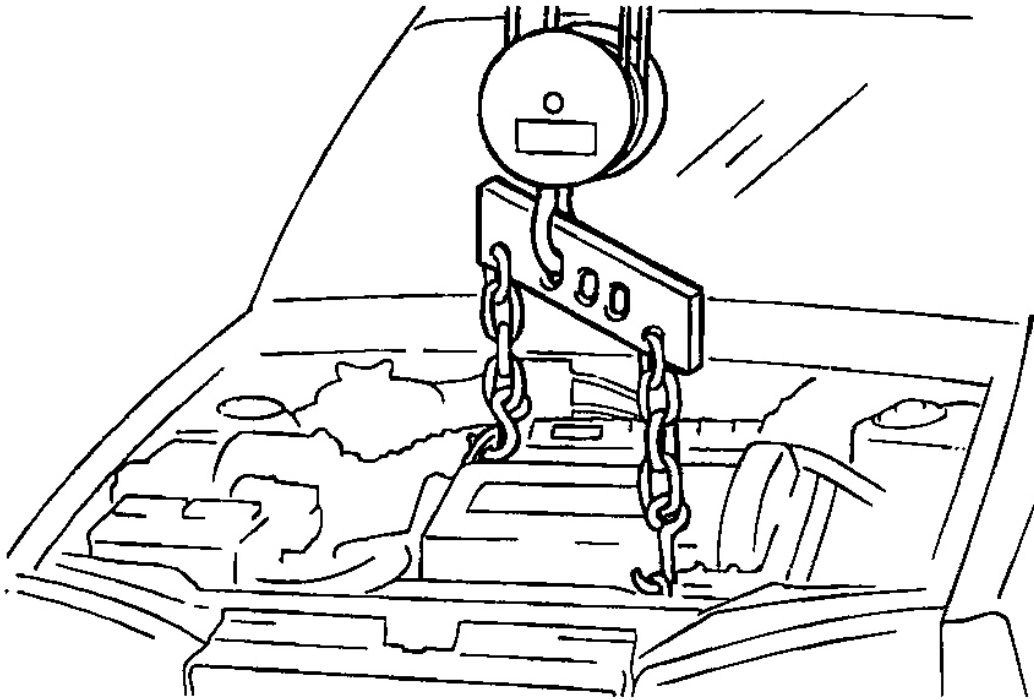
TORQUE : Nm (kg·cm, lb·ft)

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Fig. 36: 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.

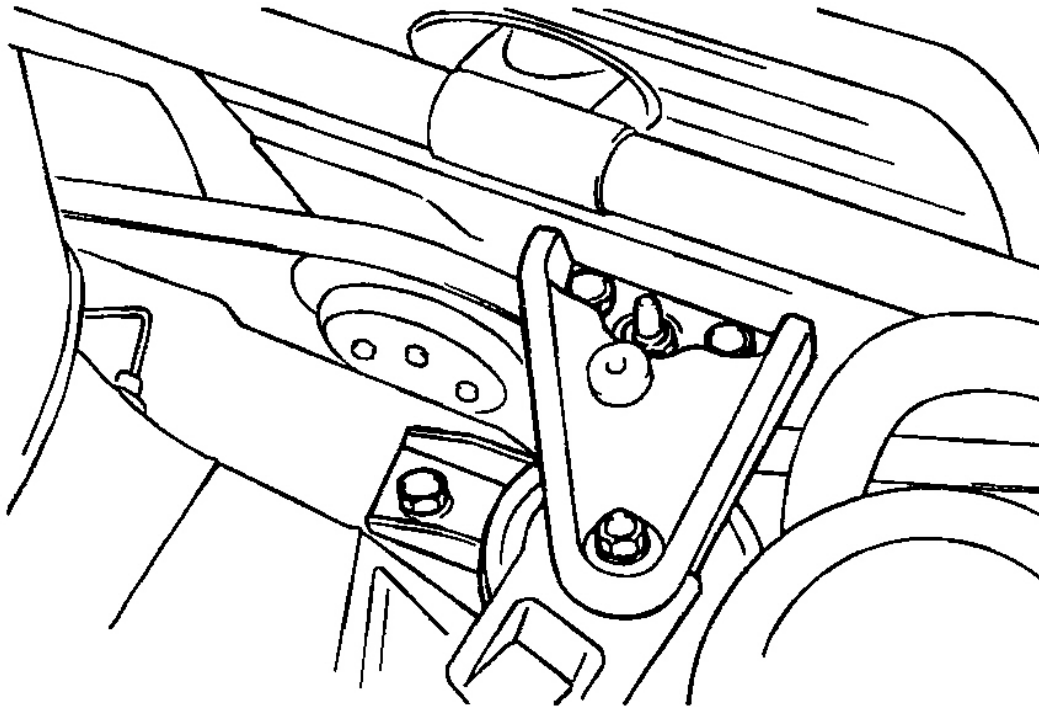


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Fig. 37: Lifting Engine
Courtesy of HYUNDAI MOTOR CO.

Engine Mounting

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

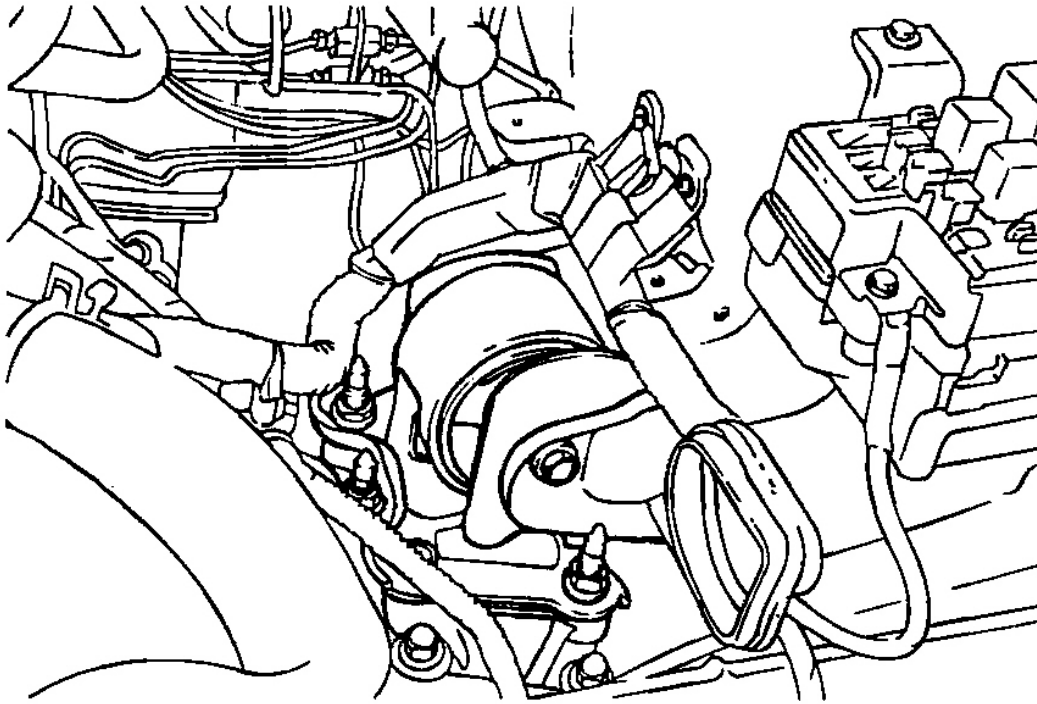


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Fig. 38: Identifying Engine Mounting Bracket
Courtesy of HYUNDAI MOTOR CO.

Transaxle Mounting

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

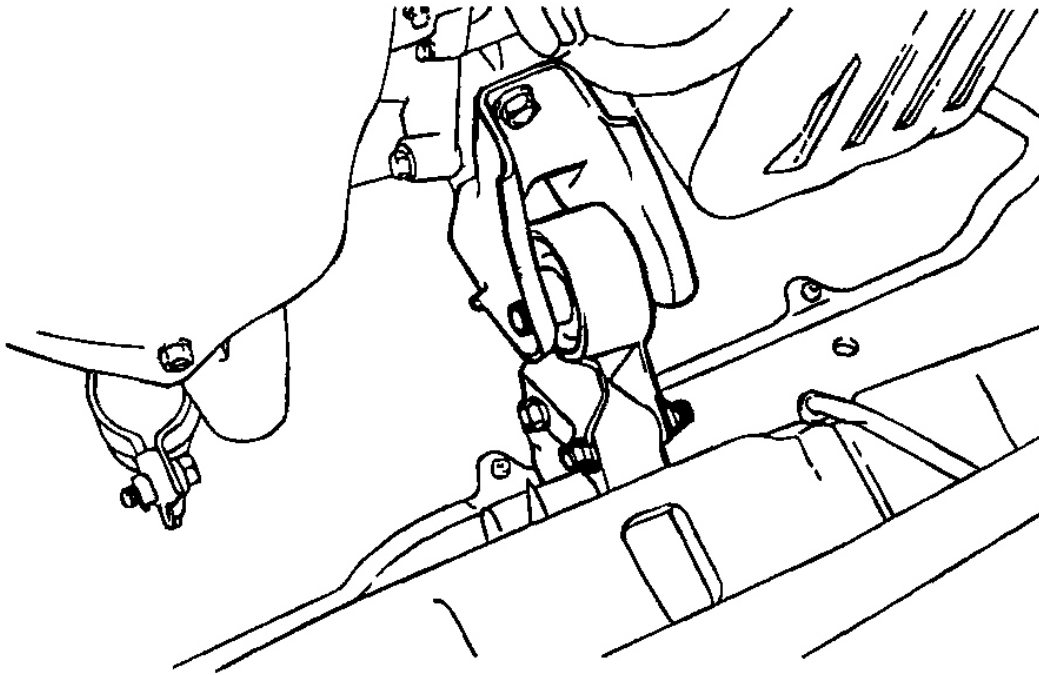


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Fig. 39: Identifying Transaxle Bracket
Courtesy of HYUNDAI MOTOR CO.

Front Roll Stopper

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

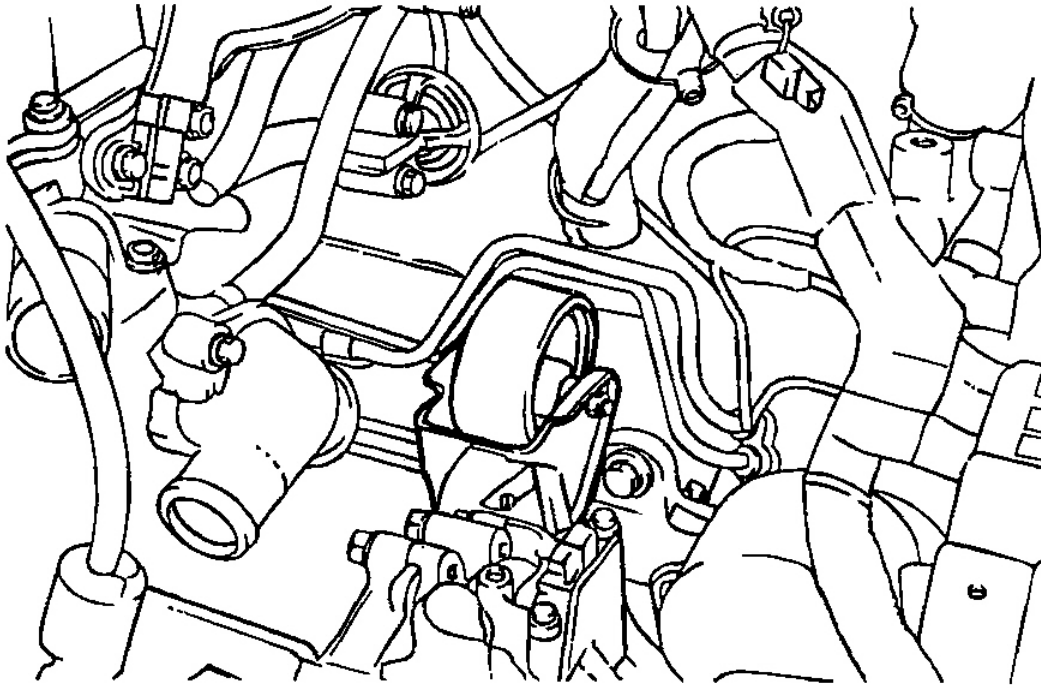


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Fig. 40: Identifying Front Roller Stopper Bracket
Courtesy of HYUNDAI MOTOR CO.

Rear Roll Stopper

1. Remove the bolt from the rear roll stopper.
2. Remove the rear roll stopper from the subframe.

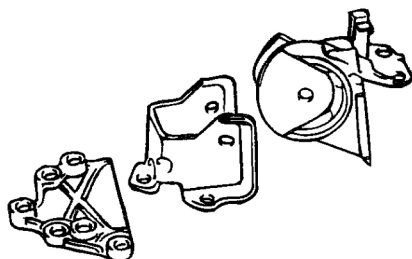


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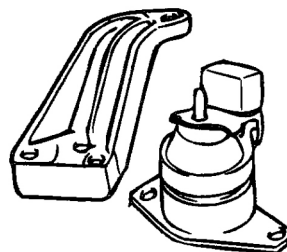
Fig. 41: Identifying Rear Roller Stopper Bracket
Courtesy of HYUNDAI MOTOR CO.

Inspection Items

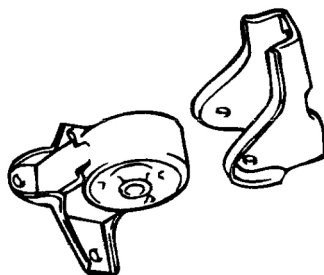
Transaxle mount



Engine mount



Front roll stopper assembly



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Rear roll stopper assembly

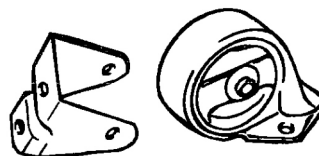


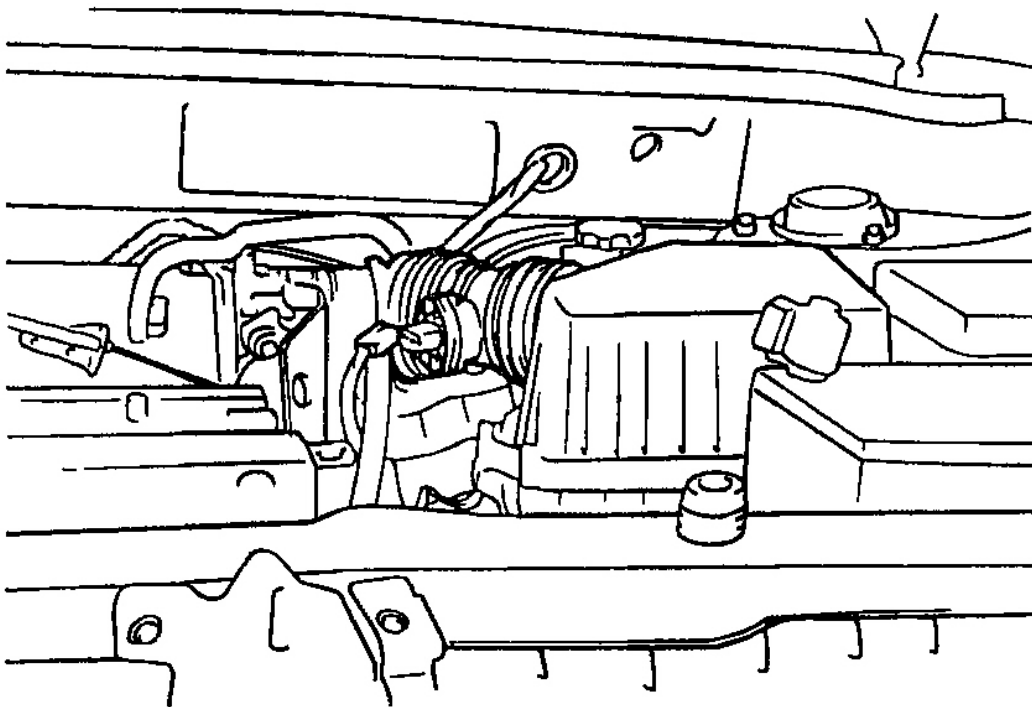
Fig. 42: Inspection Items

Courtesy of HYUNDAI MOTOR CO.

ENGINE AND TRANSAXLE ASSEMBLY

Removal

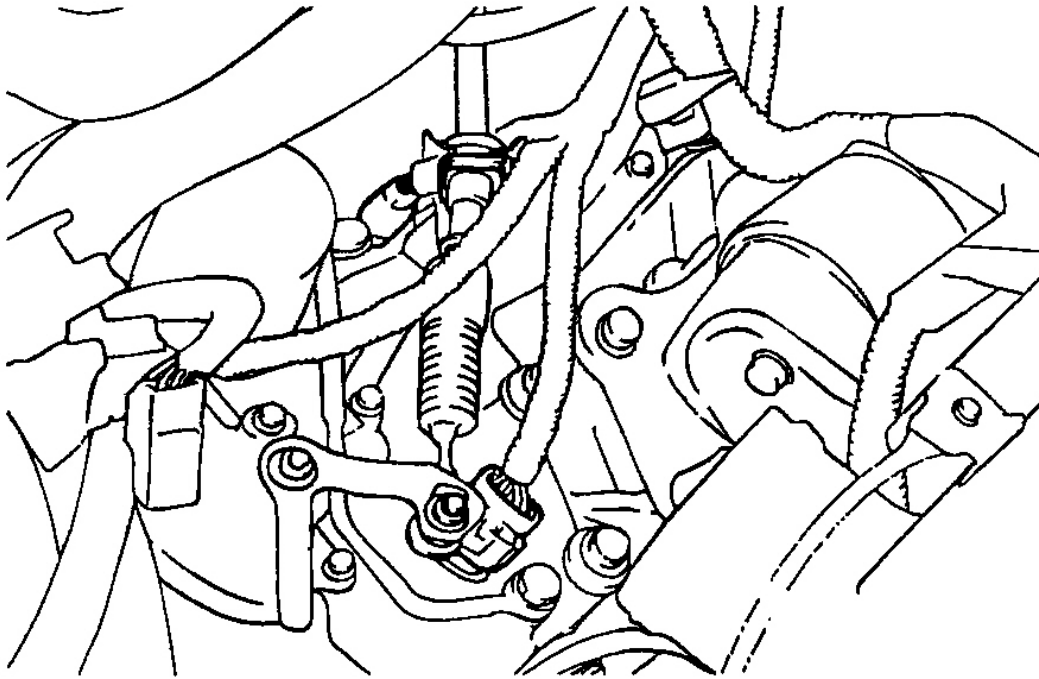
1. Remove the battery.
2. Detach the air cleaner.



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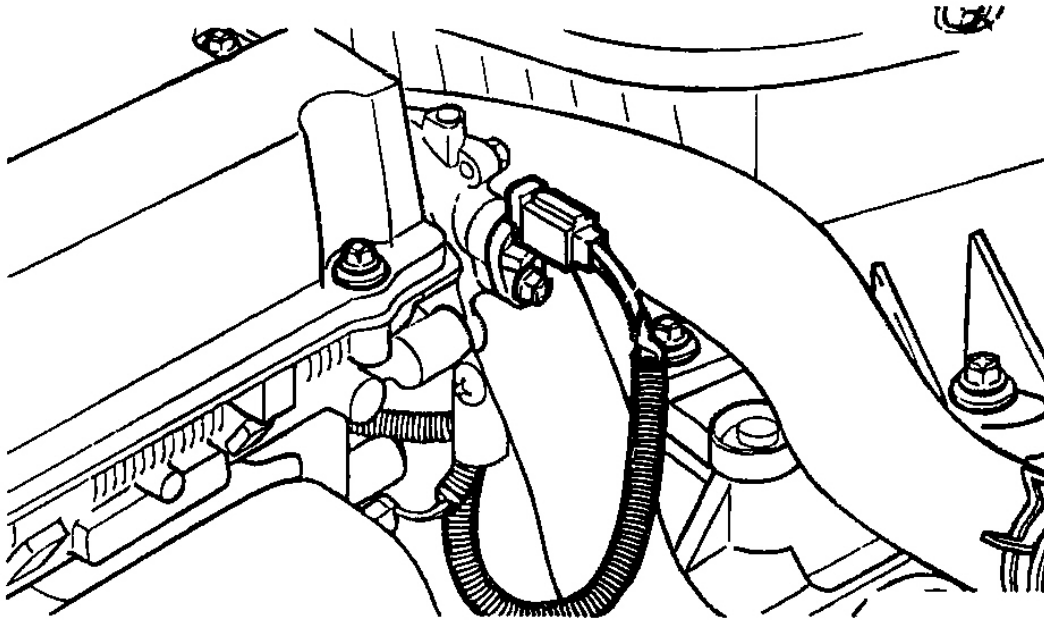
Fig. 43: Identifying Air Cleaner
Courtesy of HYUNDAI MOTOR CO.

3. Disconnect the engine harness connectors.
 1. Engine wiring connectors (alternator, starter, etc.)
 2. TPS connector
 3. 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.



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Fig. 44: View Transmission Range Sensor
Courtesy of HYUNDAI MOTOR CO.



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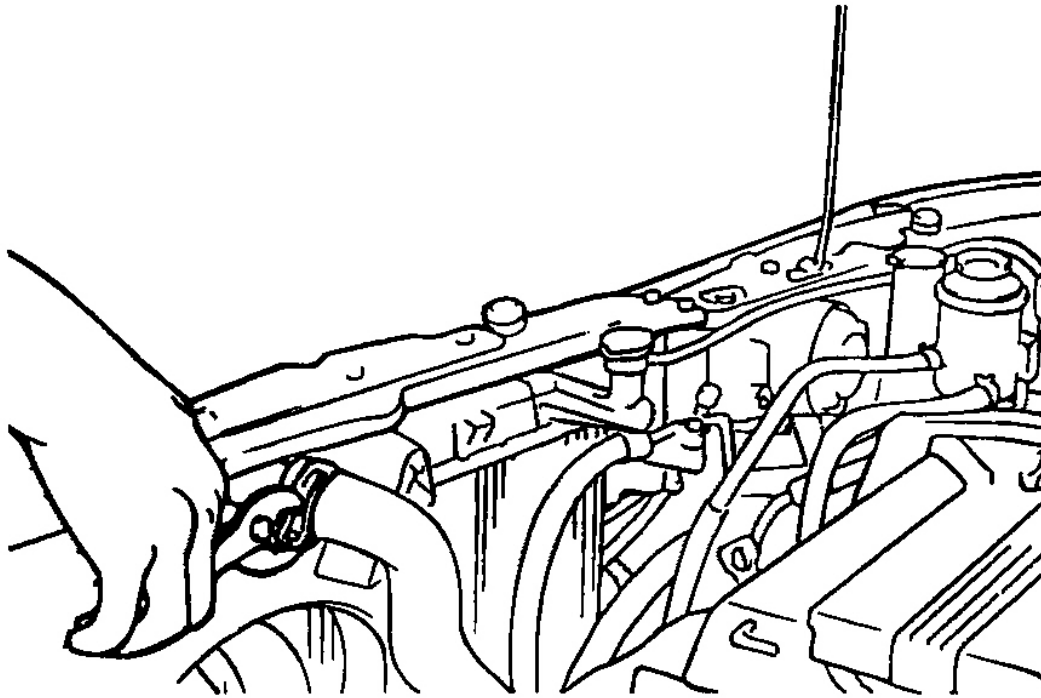
Fig. 45: View Engine Coolant Temperature Sensor
Courtesy of HYUNDAI MOTOR CO.

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 openings to prevent the entry of foreign material.

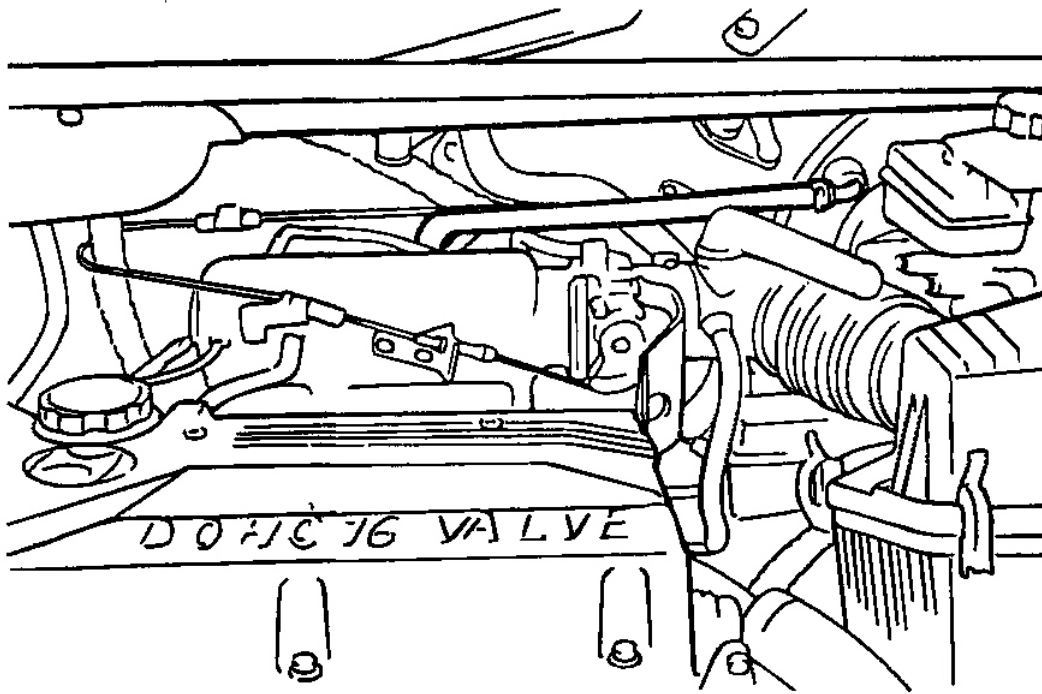
6. Disconnect the radiator upper and lower hoses on the engine side then remove the radiator assembly.



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Fig. 46: Removing Upper Radiator Hose
Courtesy of HYUNDAI MOTOR CO.

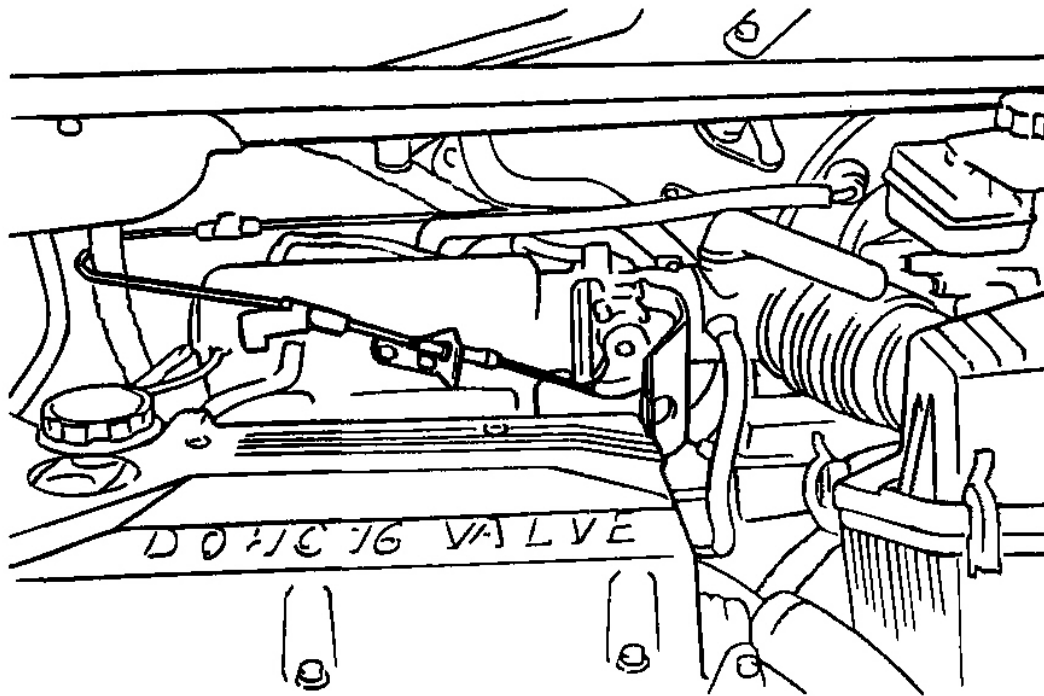
7. Disconnect the engine ground.
8. Disconnect the brake booster vacuum hose.



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Fig. 47: Identifying Brake Booster Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

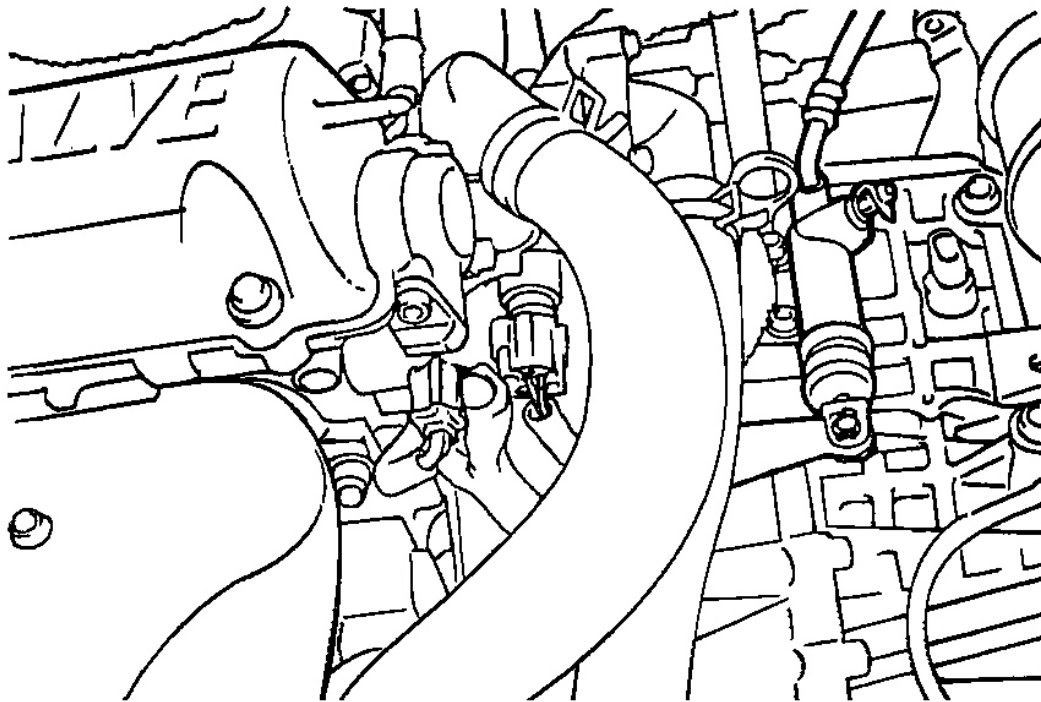
9. Disconnect the heater hoses (inlet and outlet) on the engine side.
10. Disconnect the accelerator cable at the engine side.



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Fig. 48: Identifying Accelerator Cable
Courtesy of HYUNDAI MOTOR CO.

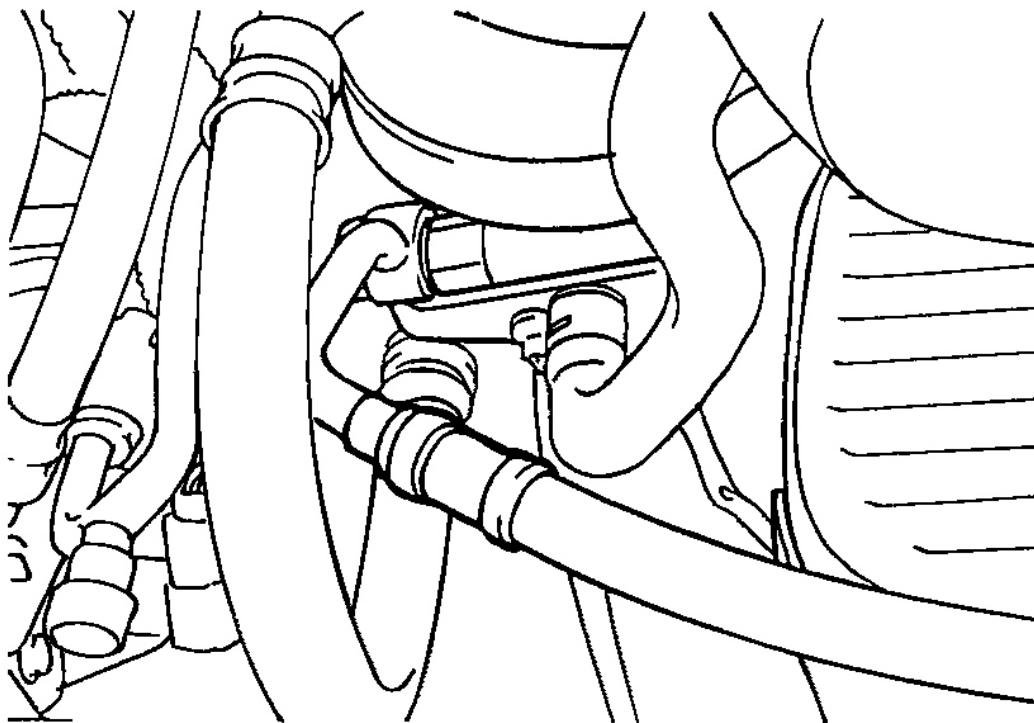
11. Using a special tool, remove the main fuel line at the delivery pipe (supply/return).
12. Disconnect the speedometer cable from the transaxle.
13. Disconnect the clutch cable or control cable from the transaxle.



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Fig. 49: Identifying Clutch Cable Or Control Cable
Courtesy of HYUNDAI MOTOR CO.

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

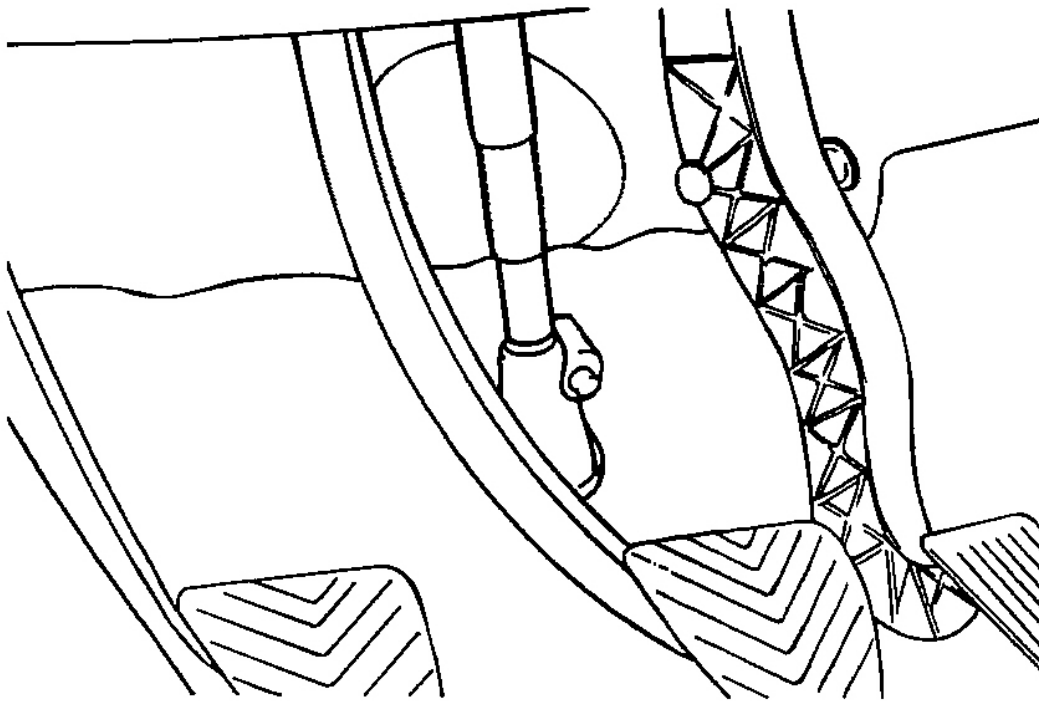


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Fig. 50: Identifying Power Steering Hoses
Courtesy of HYUNDAI MOTOR CO.

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

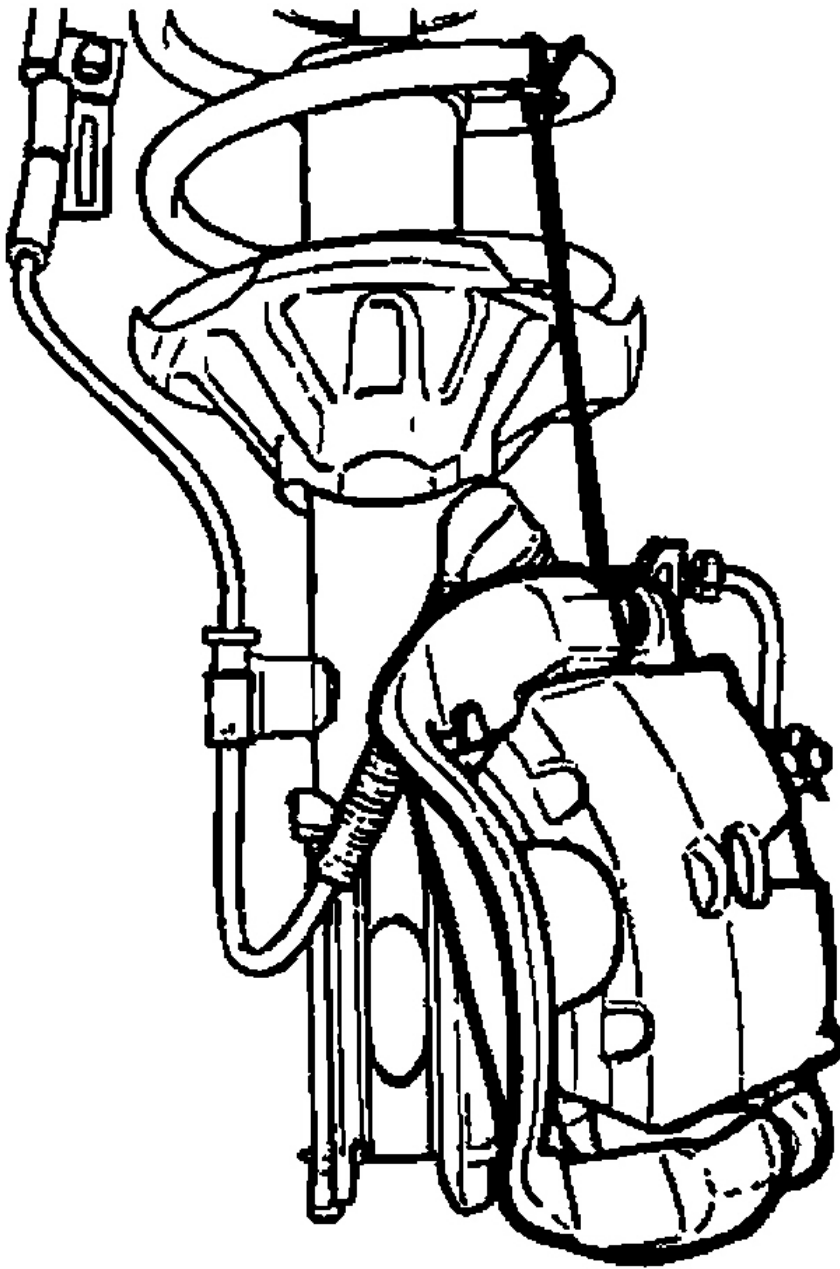
NOTE: Make sure to make identification marks between the universal joint and the gear box for reassembly.



G00790216

Fig. 51: Identifying Steering Column Through Floor Board Location
Courtesy of HYUNDAI MOTOR CO.

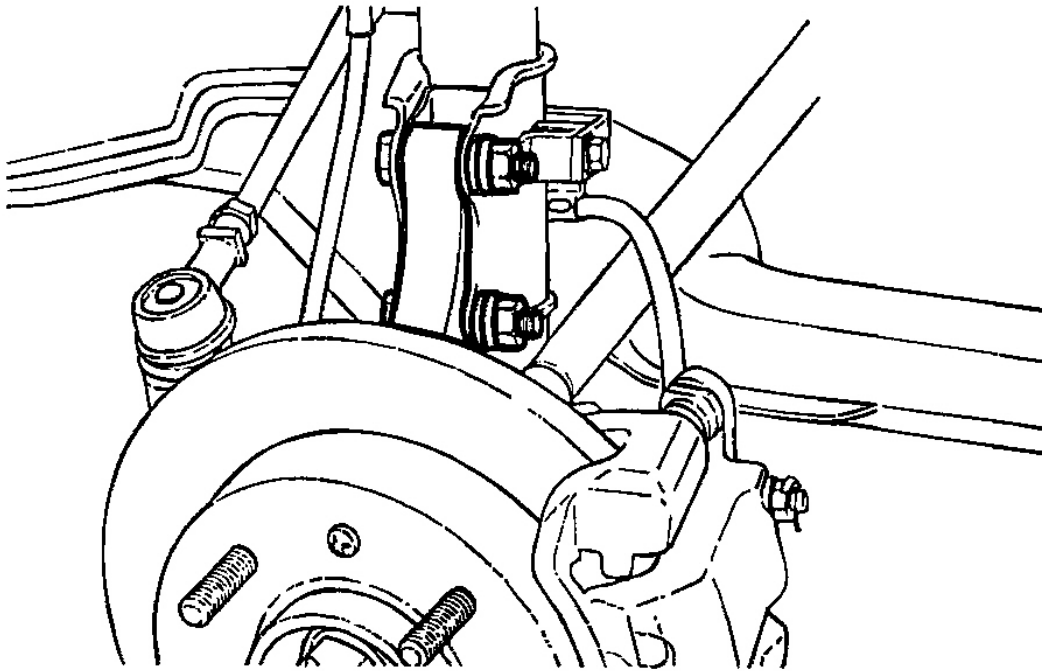
16. Raise the vehicle and then remove the front tire.
17. Remove the calliper assembly from the knuckle. Using wire, hang it from the suspension.



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Fig. 52: Identifying Caliper Location After Removal
Courtesy of HYUNDAI MOTOR CO.

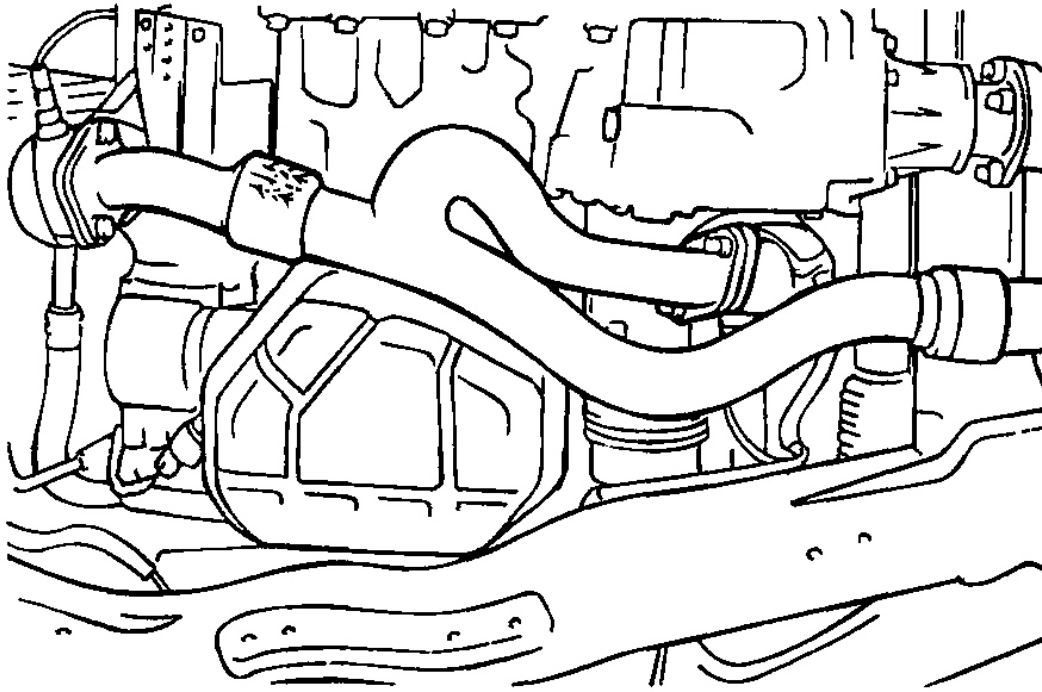
18. Loosen the strut lower bolts and then remove it.



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Fig. 53: Removing Knuckle From Strut
Courtesy of HYUNDAI MOTOR CO.

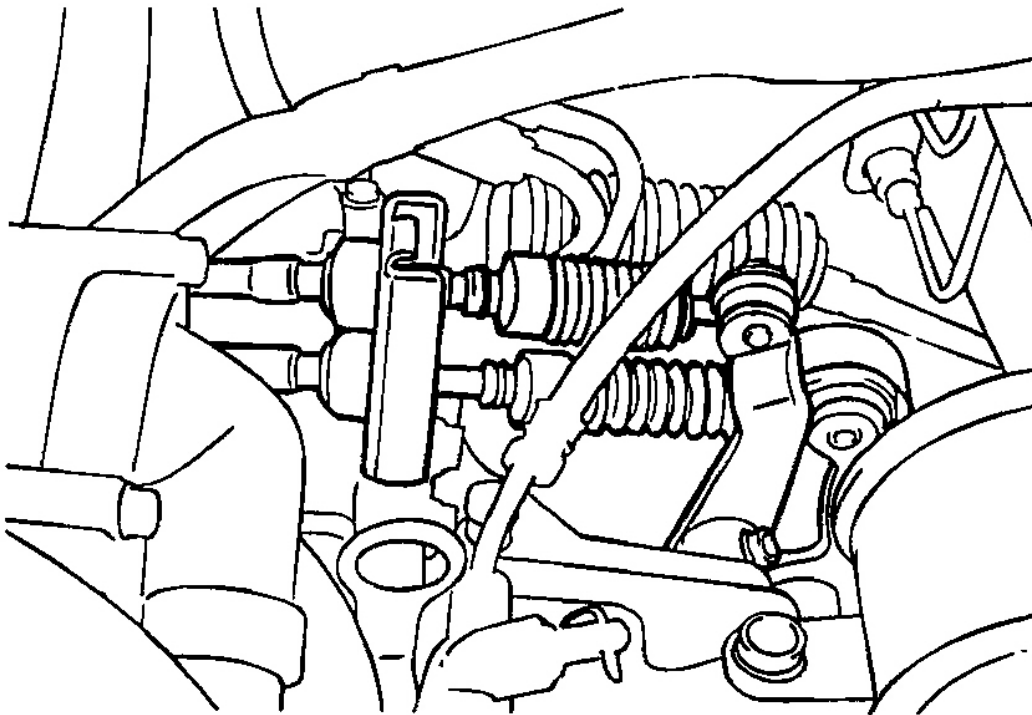
19. Remove the front muffler bolts.



G00790219

Fig. 54: Identifying Front Muffler Bolts
Courtesy of HYUNDAI MOTOR CO.

20. Remove the transaxle control rod and extension rod (M/T only).

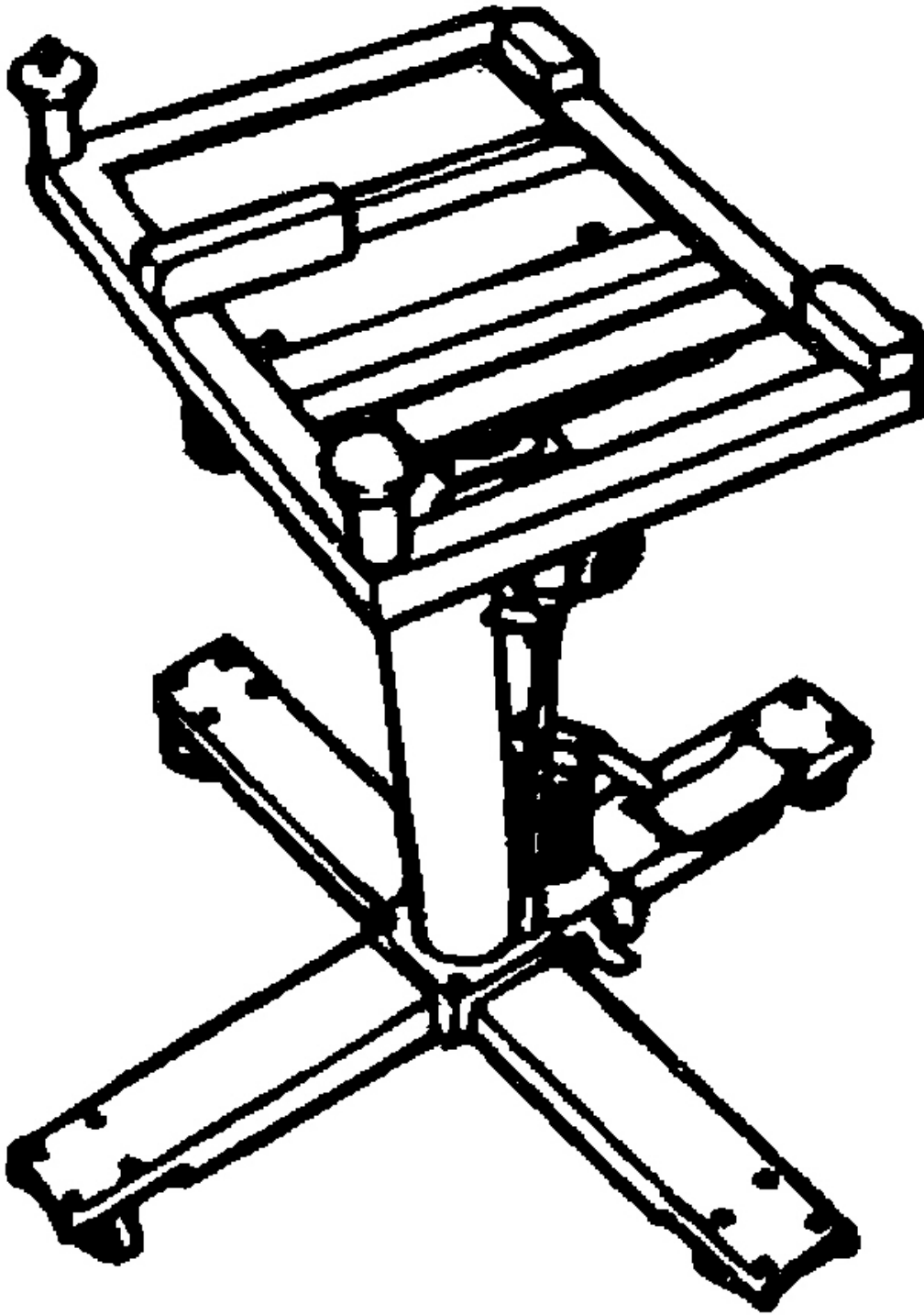


G00790220

Fig. 55: 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.

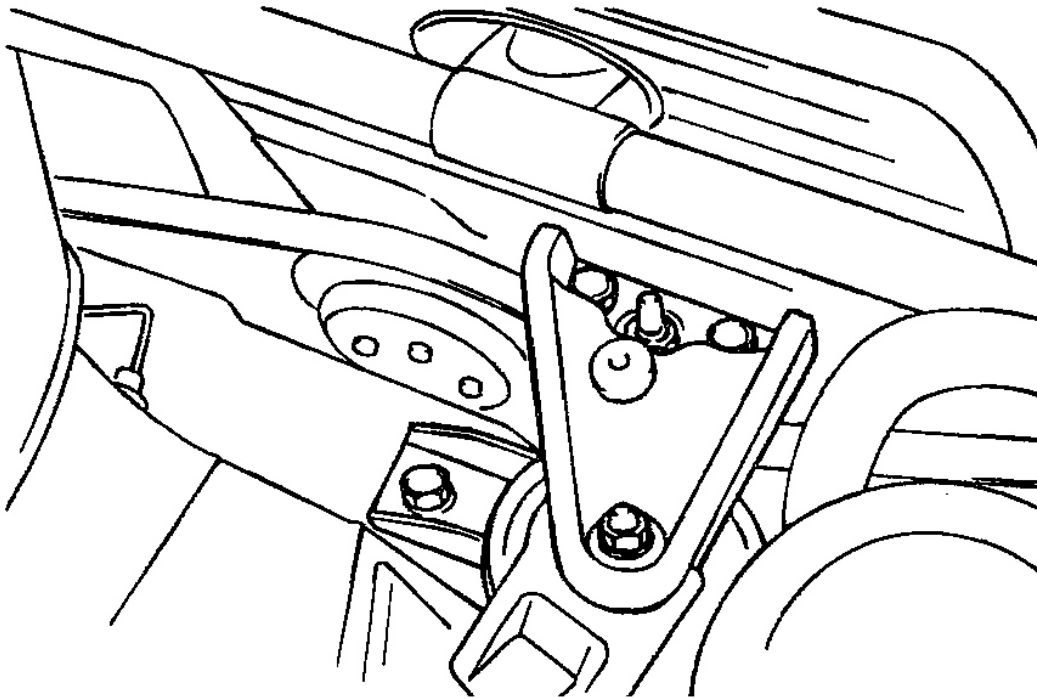
NOTE: Check that all the cables, harness connector and hose are disconnected from the engine and transaxle assembly.



G00790221

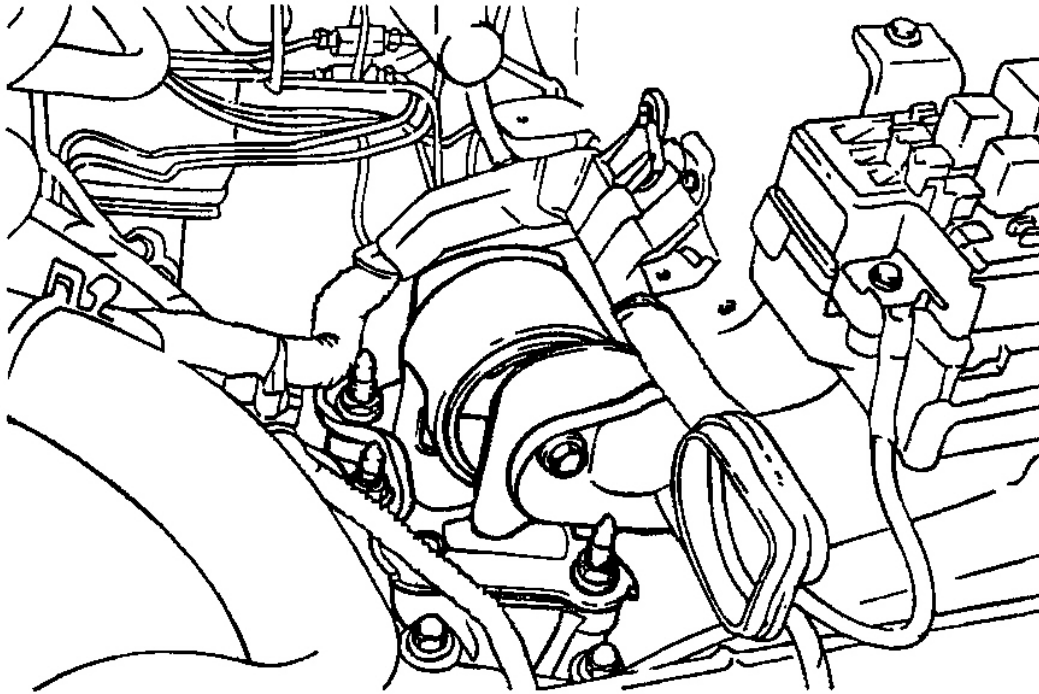
Fig. 56: Identifying T/M Jack
Courtesy of HYUNDAI MOTOR CO.

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



G00790222

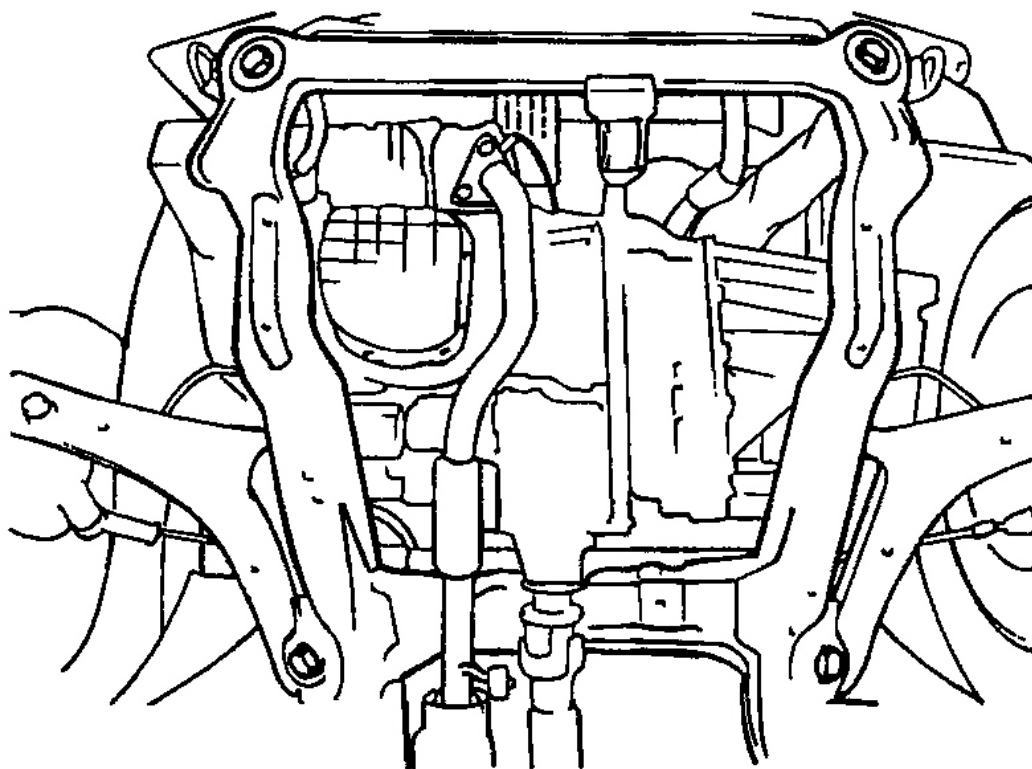
Fig. 57: Identifying Engine Mount Bracket
Courtesy of HYUNDAI MOTOR CO.



G00790223

Fig. 58: Identifying Transaxle Mounting Bracket
Courtesy of HYUNDAI MOTOR CO.

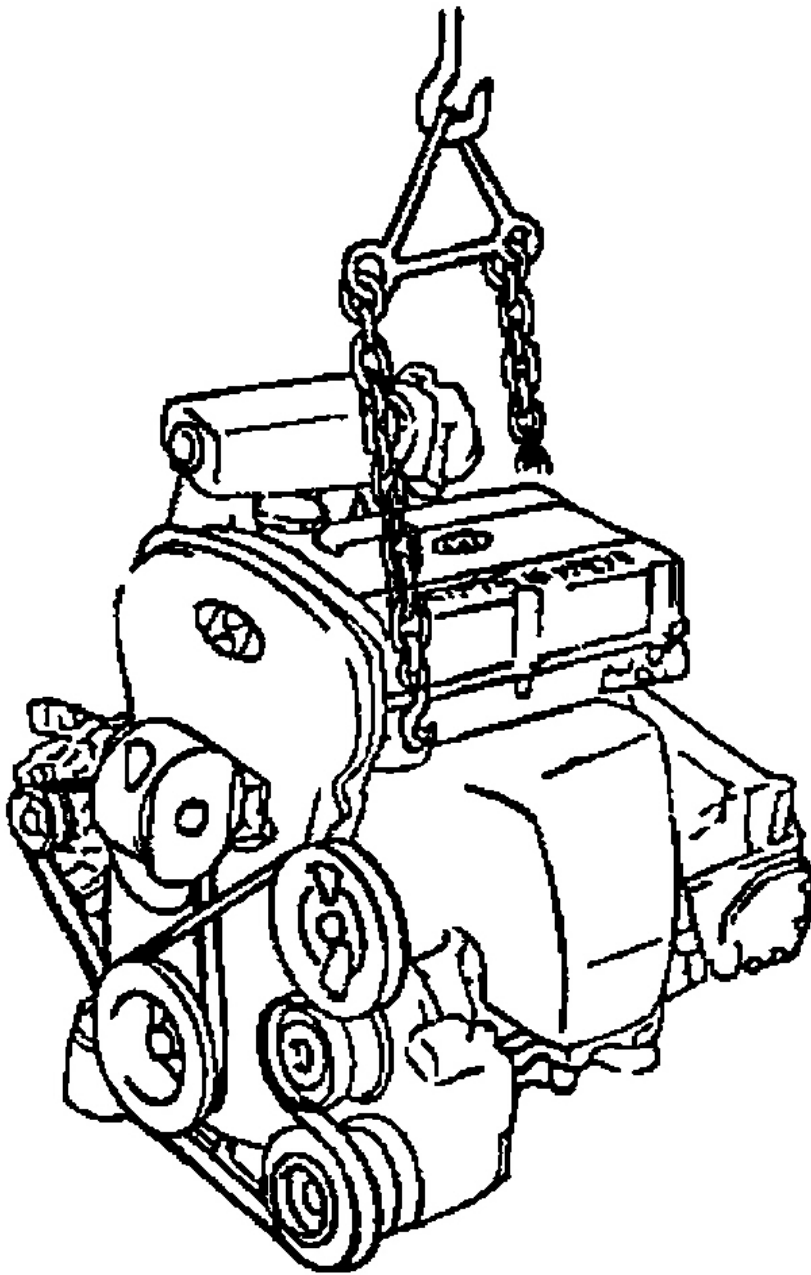
23. Remove the sub-frame installation bolts.



G00790224

Fig. 59: Identifying Sub-Frame Bolts
Courtesy of HYUNDAI MOTOR CO.

24. Lower the engine and transaxle assembly on the jack then, remove the front roll stopper and the rear roll stopper.
25. Remove the engine and transaxle assembly as a unit.



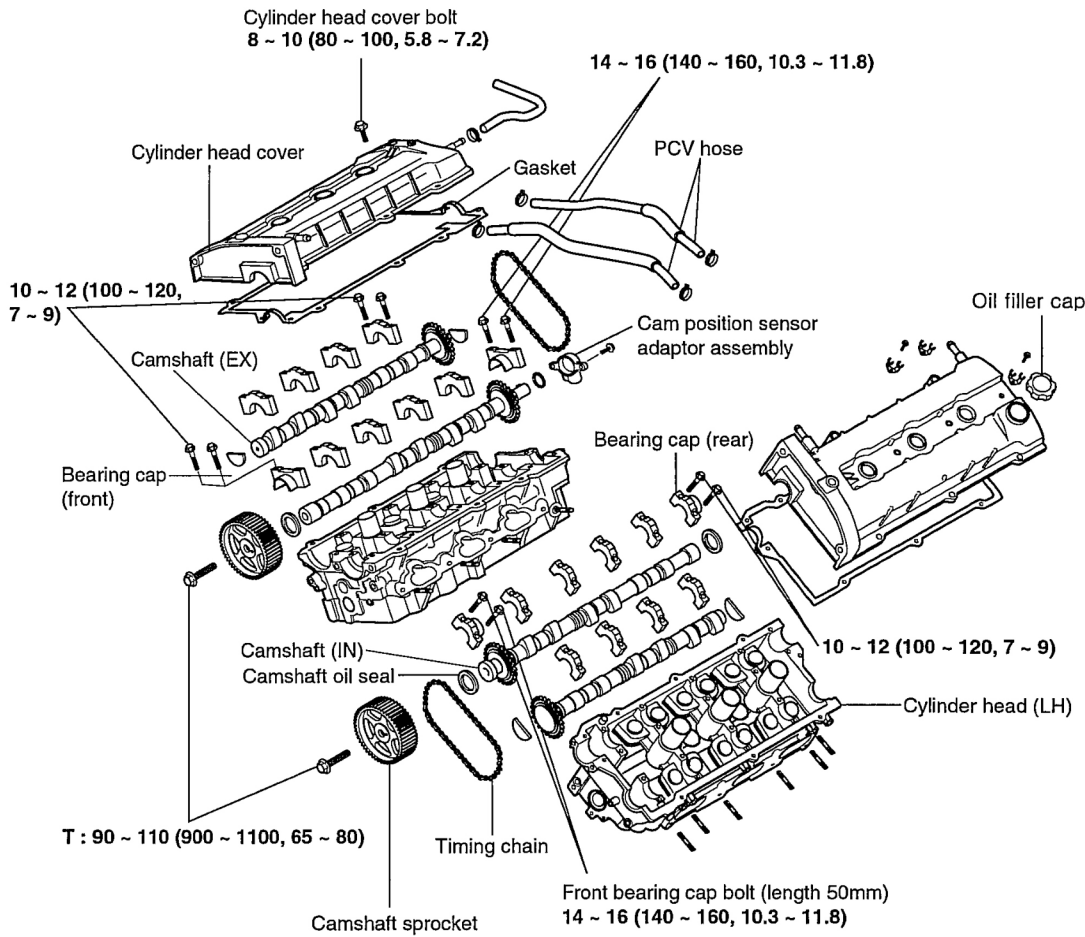
G00790225

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

MAIN MOVING SYSTEM

CAMSHAFT

Components



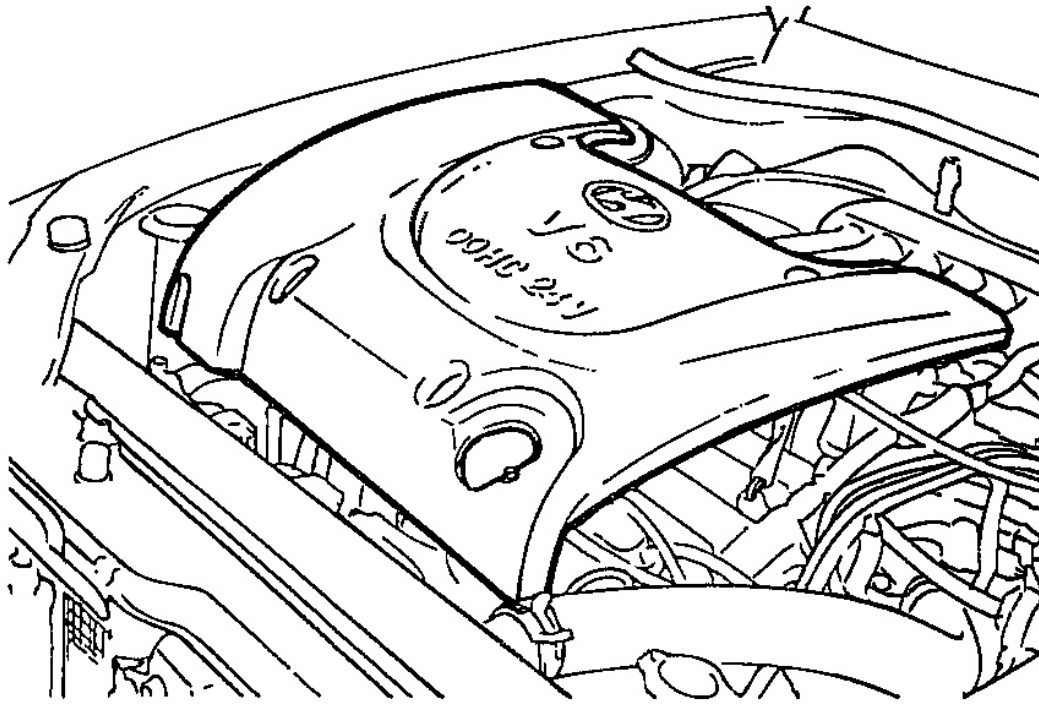
TORQUE : Nm (kg.cm, lb.ft)

G00790226

Fig. 61: Camshaft Components
Courtesy of HYUNDAI MOTOR CO.

Disassembly

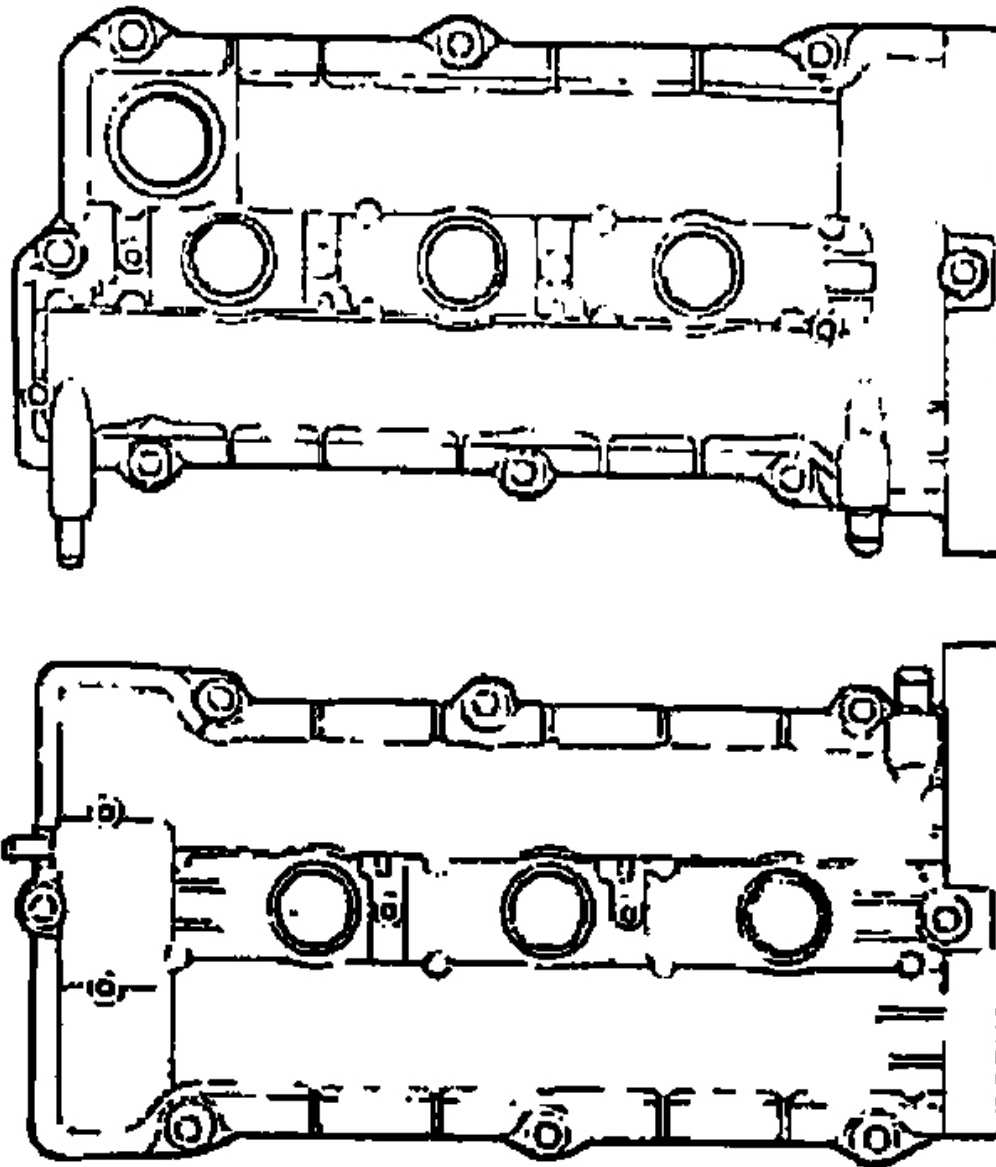
1. Remove the engine cover and intake manifold.



G00790227

Fig. 62: Identifying Engine Cover
Courtesy of HYUNDAI MOTOR CO.

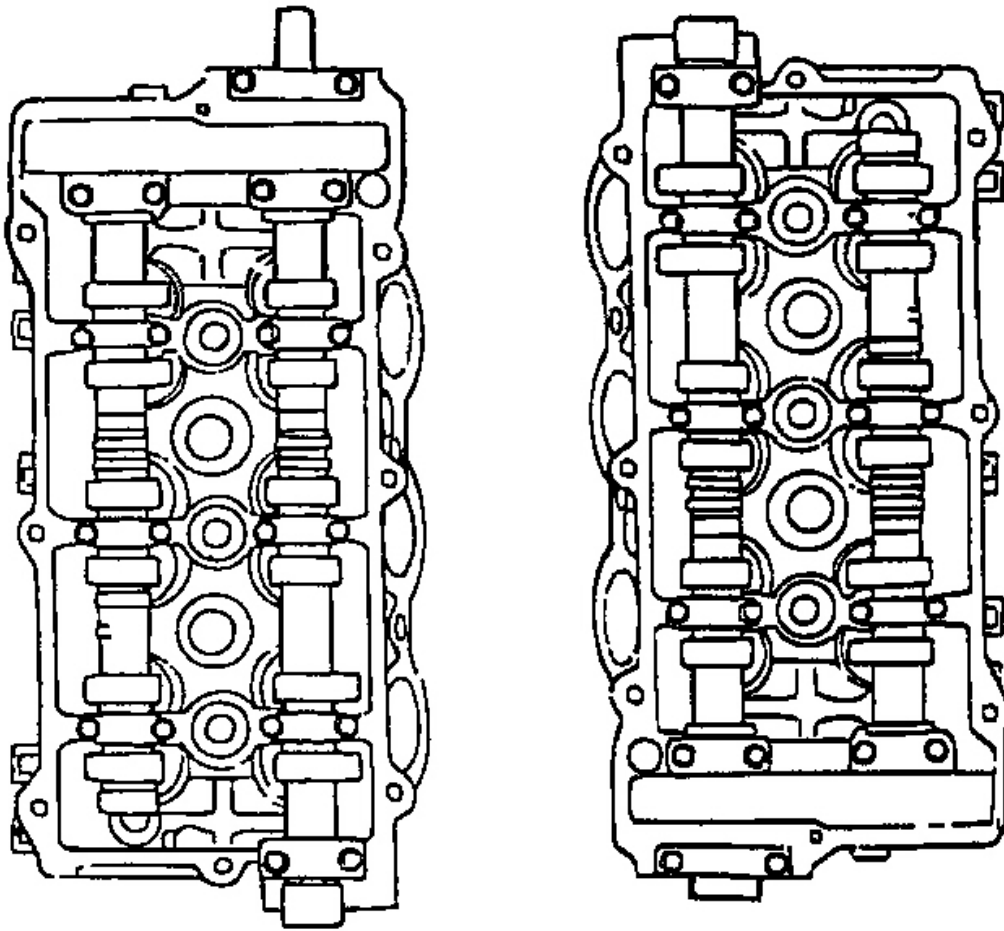
2. Disconnect the breather hose and the engine harness.
3. Remove the power steering pulley, air conditioner pulley, crankshaft pulley, idler pulley and tensioner pulley.
4. Remove the timing belt cover.
5. Loosen the auto tensioner.
6. Remove the timing belt from the camshaft sprocket.
7. Remove the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



G00790228

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

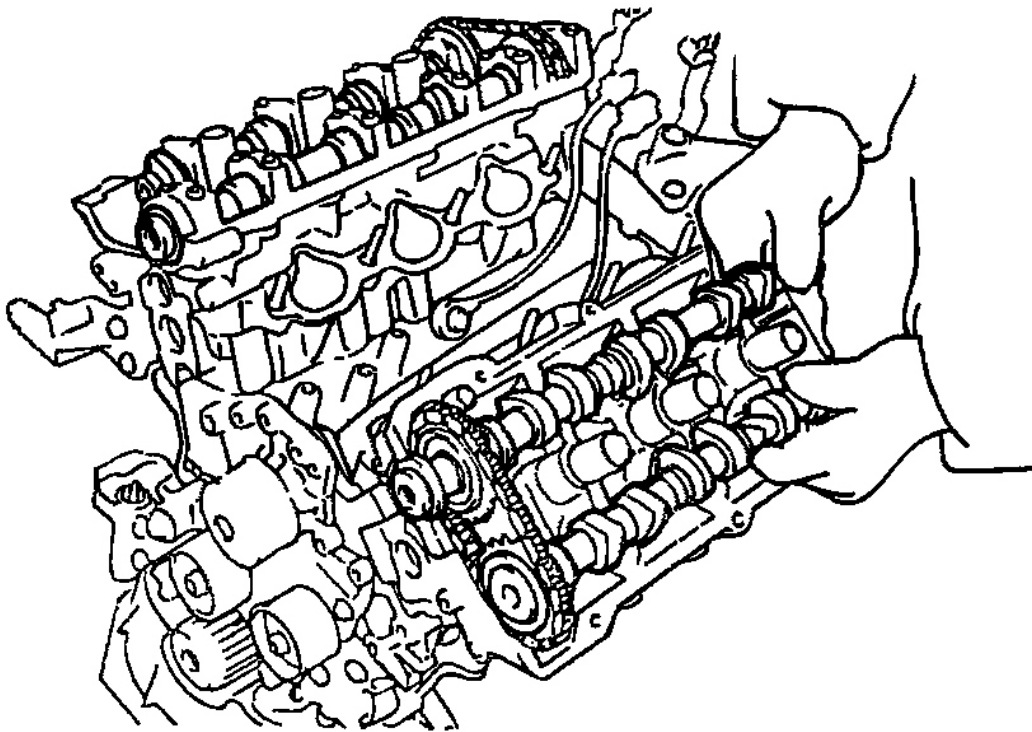
9. Remove the camshaft sprockets.
10. Remove the camshaft bearing caps.



G00790229

Fig. 64: View Of Camshafts In Cylinder Heads
Courtesy of HYUNDAI MOTOR CO.

11. Remove the camshafts.



G00790230

Fig. 65: Removing Camshafts
Courtesy of HYUNDAI MOTOR CO.

Inspection

Camshafts

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

Cam height

[Standard]

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

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

[Limit]

Intake / Exhaust : 43.45 mm (1.7106 in.)

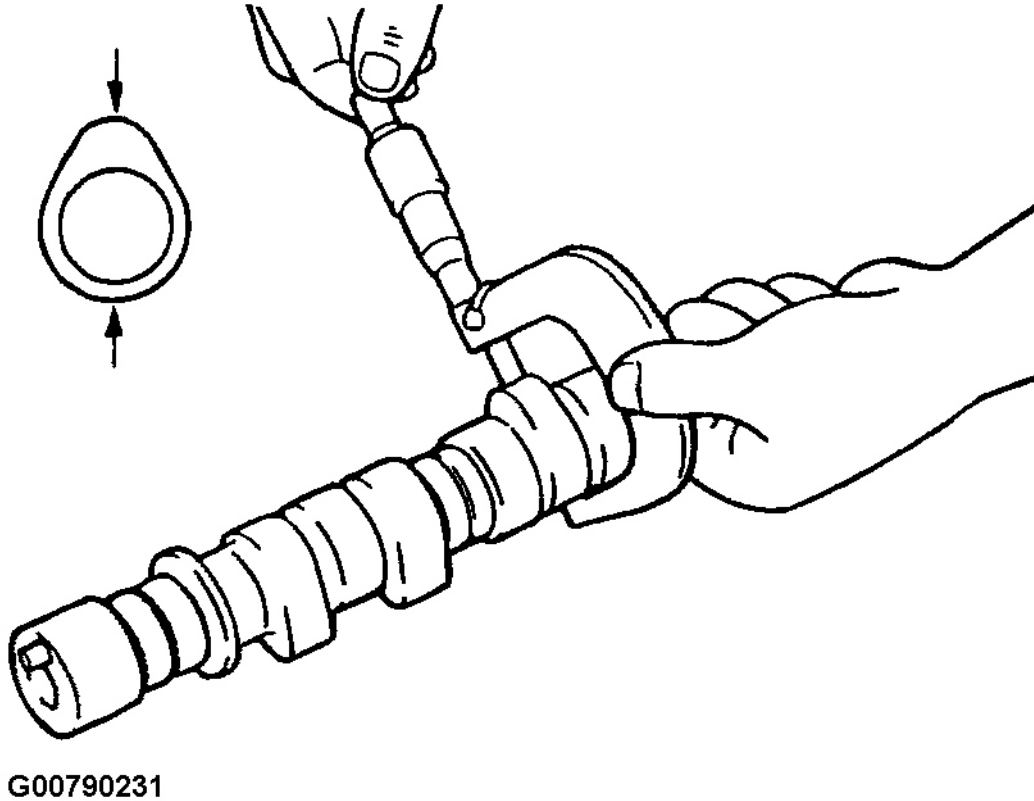


Fig. 66: Measuring Cam Lobes
Courtesy of HYUNDAI MOTOR CO.

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

Camshaft end play

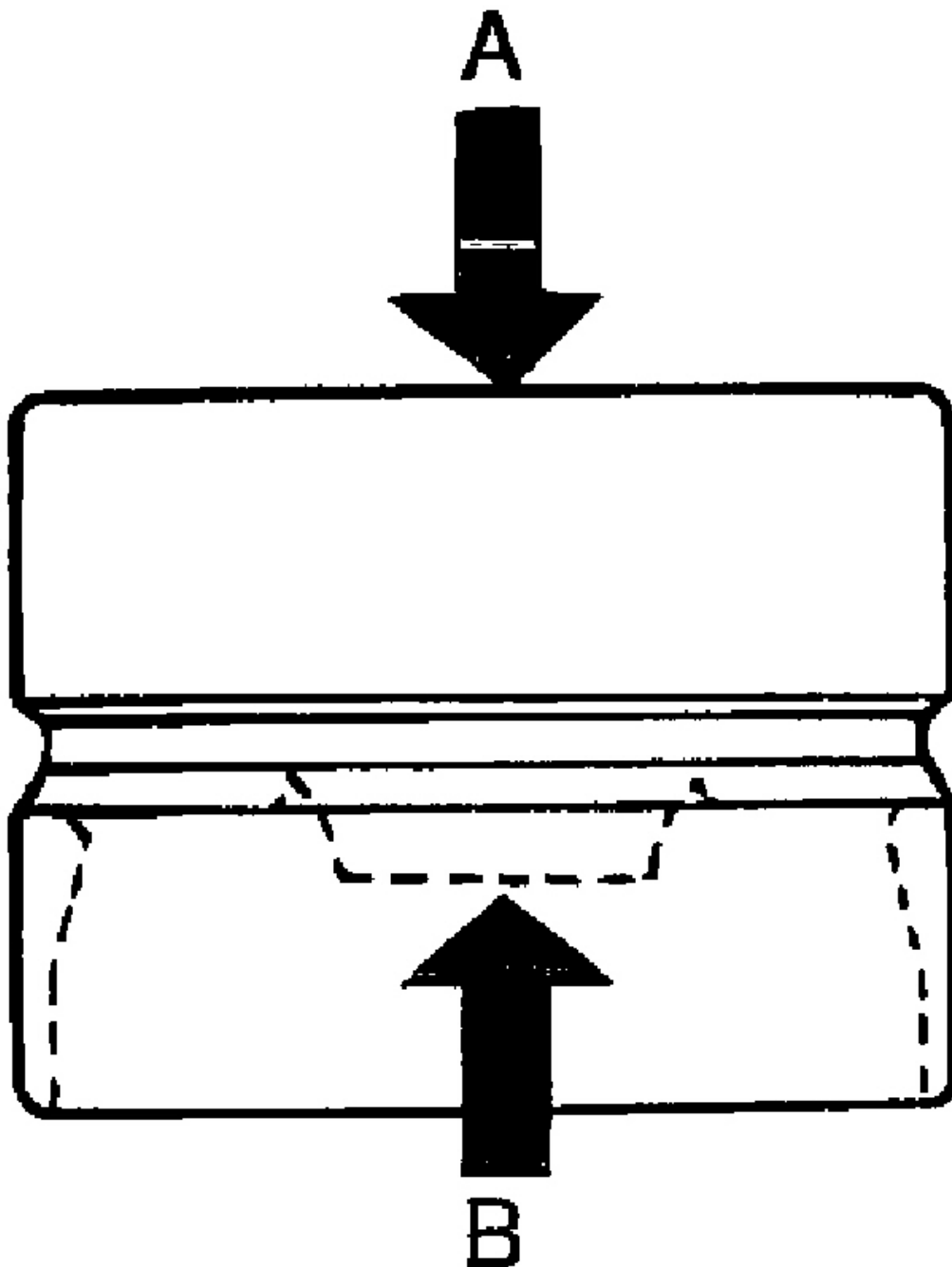
0.1 ~ 0.15 mm (0.0039 ~ 0.0059 in.)

Oil Seal (Camshaft Front)

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

Hla (Hydraulic Lash Adjuster)

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



G00790232

Fig. 67: Checking Hydraulic Lash Adjuster
Courtesy of HYUNDAI MOTOR CO.

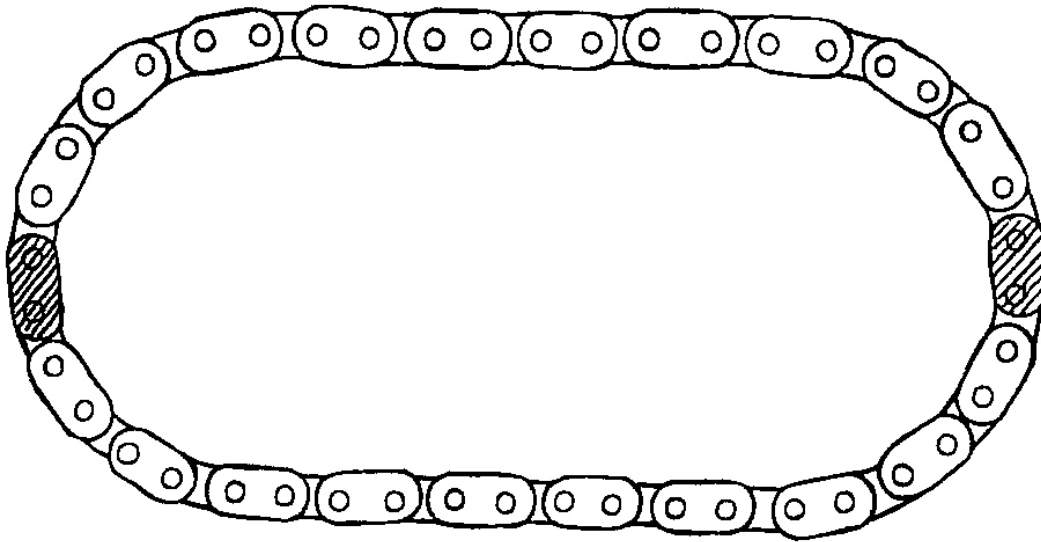
Problem	Possible	Action
1. Temporary noise when starting a cold engine	Noermal	This noise will disappear after the oil in the engine reaches the normal pressure.
2. Continuous noise when the engine is started after parking more than 48 hours.	Oil leakage of the high pressure chamber on the HLA, allowing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

G00790233

Fig. 68: 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.



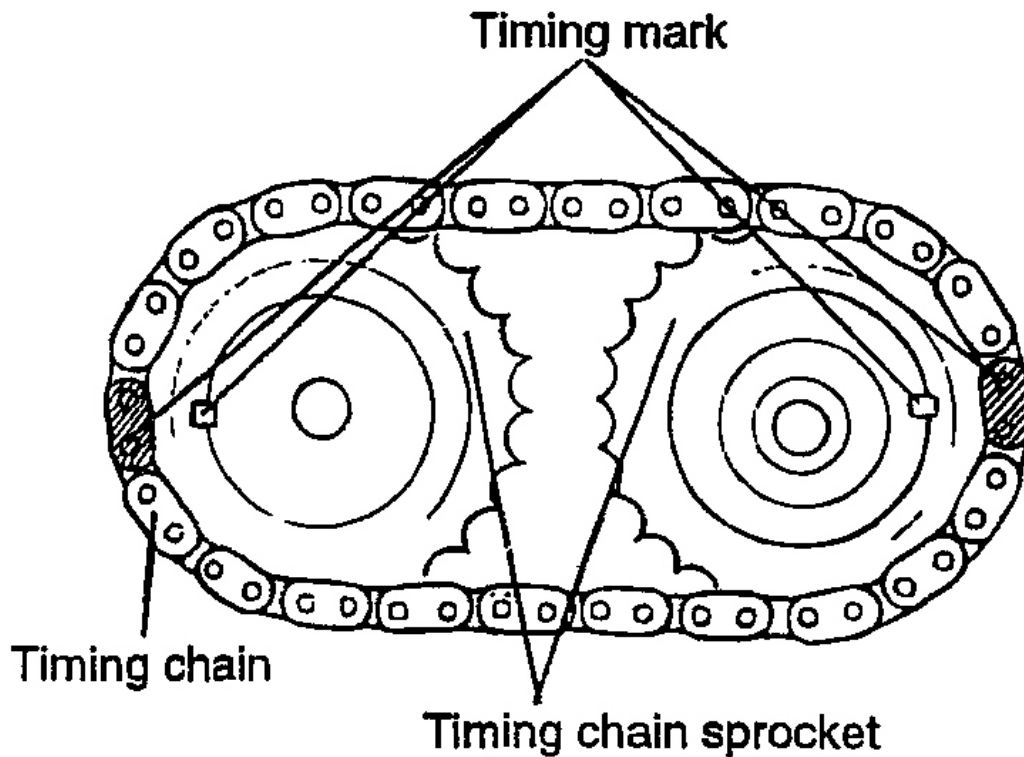
G00790234

Fig. 69: 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.

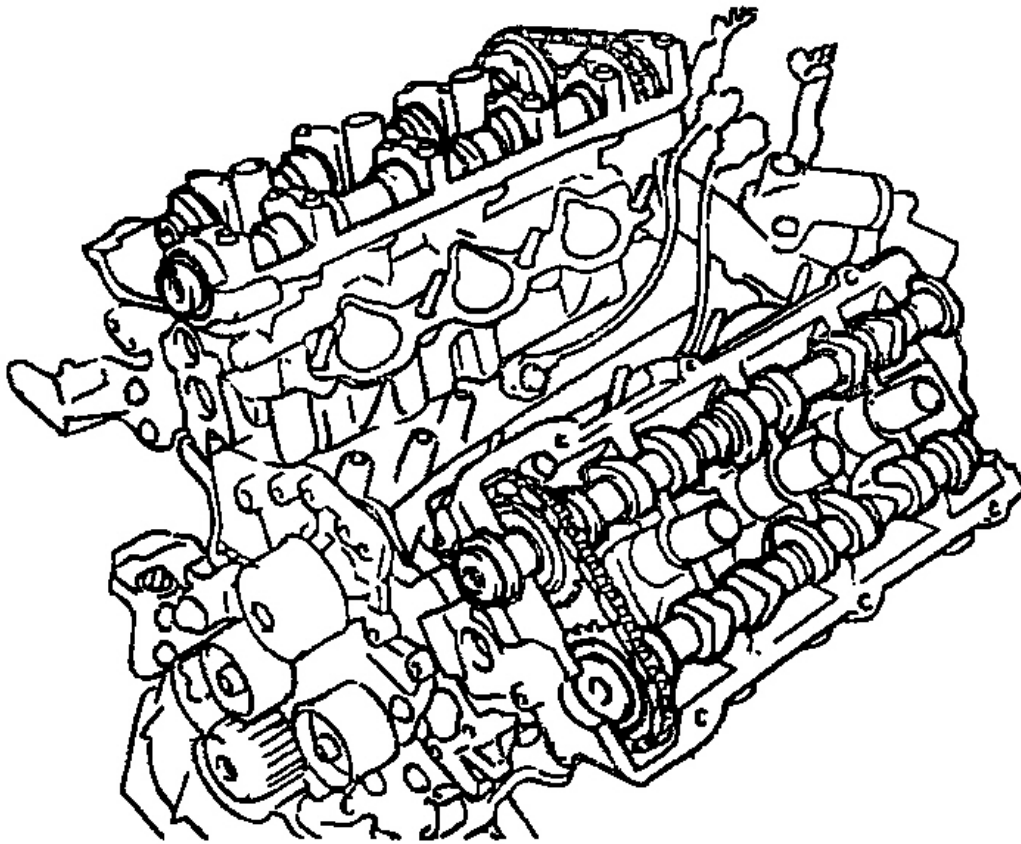


G00790235

Fig. 70: 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 1000kg (MIN.) at room temperature.



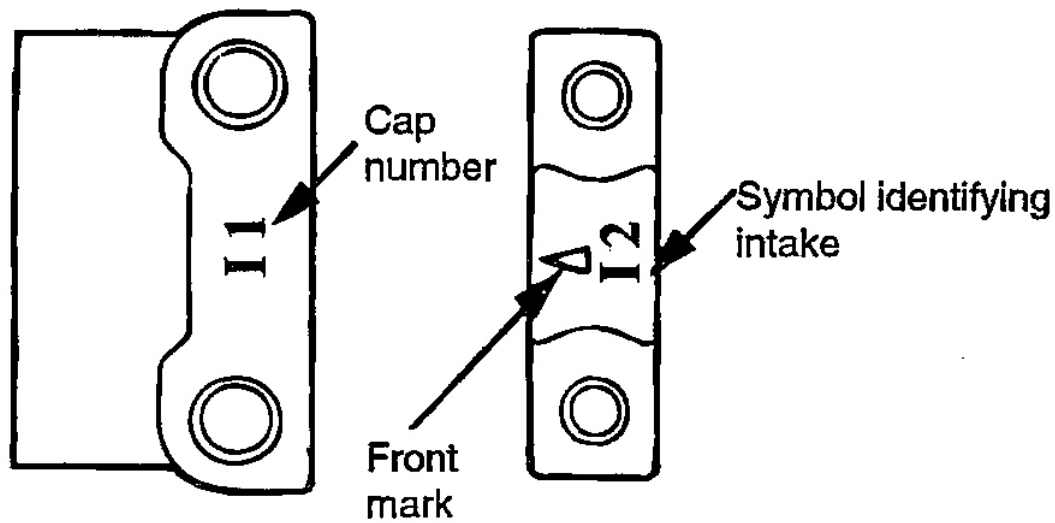
G00790236

Fig. 71: 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



G00790237

Fig. 72: Bearing Cap Identification Marks
Courtesy of HYUNDAI MOTOR CO.

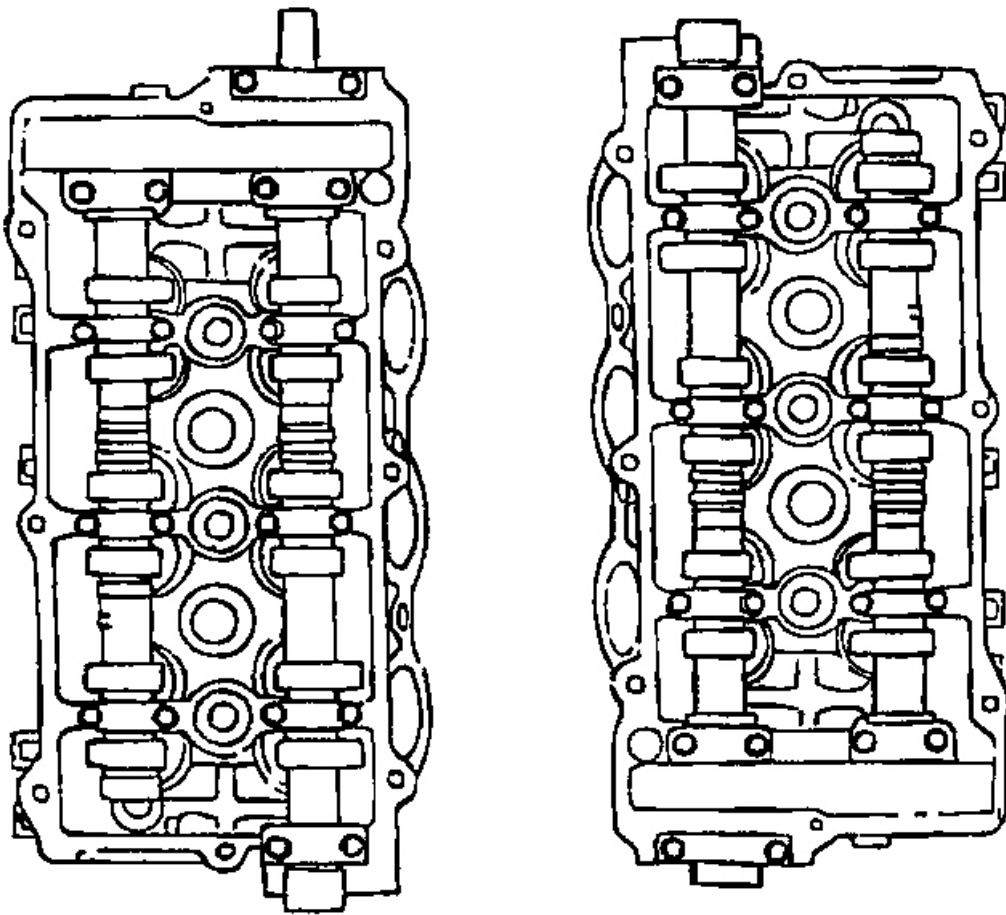
5. Tighten the bearing caps to the specified torque in two or three increments as shown.

Tightening torque

Bearing cap bolt

M6 (38 mm) : 10 ~ 12Nm (100 ~ 120kg.cm, 7 ~ 9lb.ft)

M6 (50 mm) : 14 ~ 16Nm (140 ~ 160kg.cm, 10 ~ 12lb.ft)



G00790238

Fig. 73: 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.

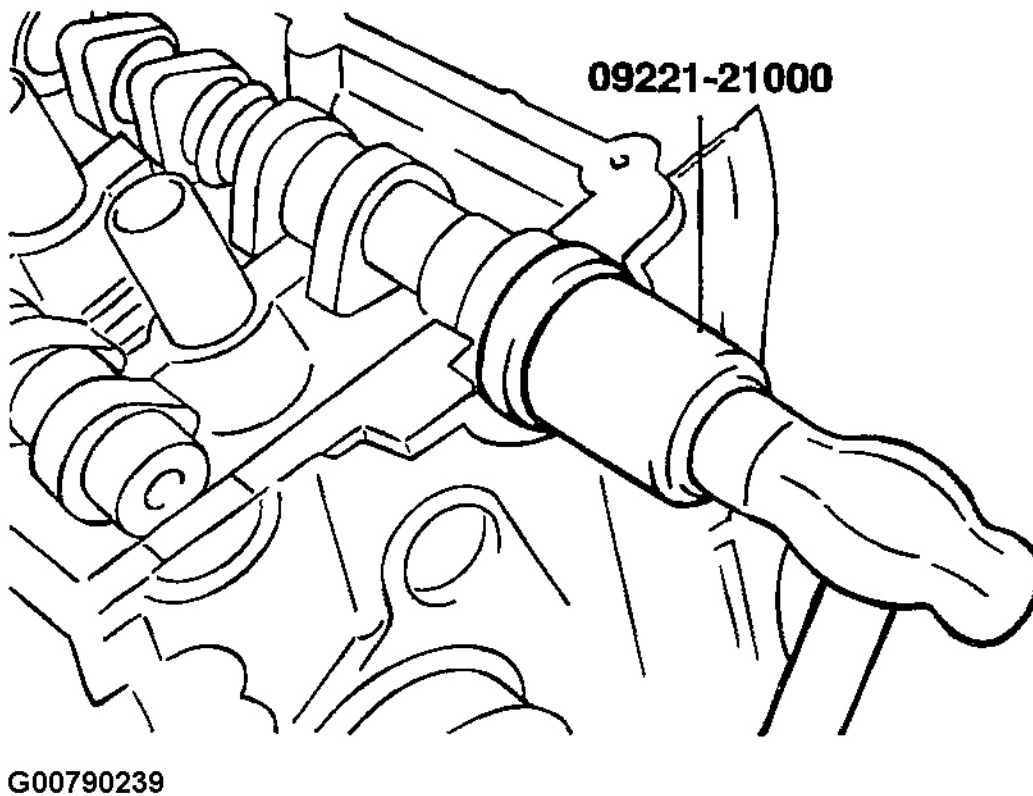


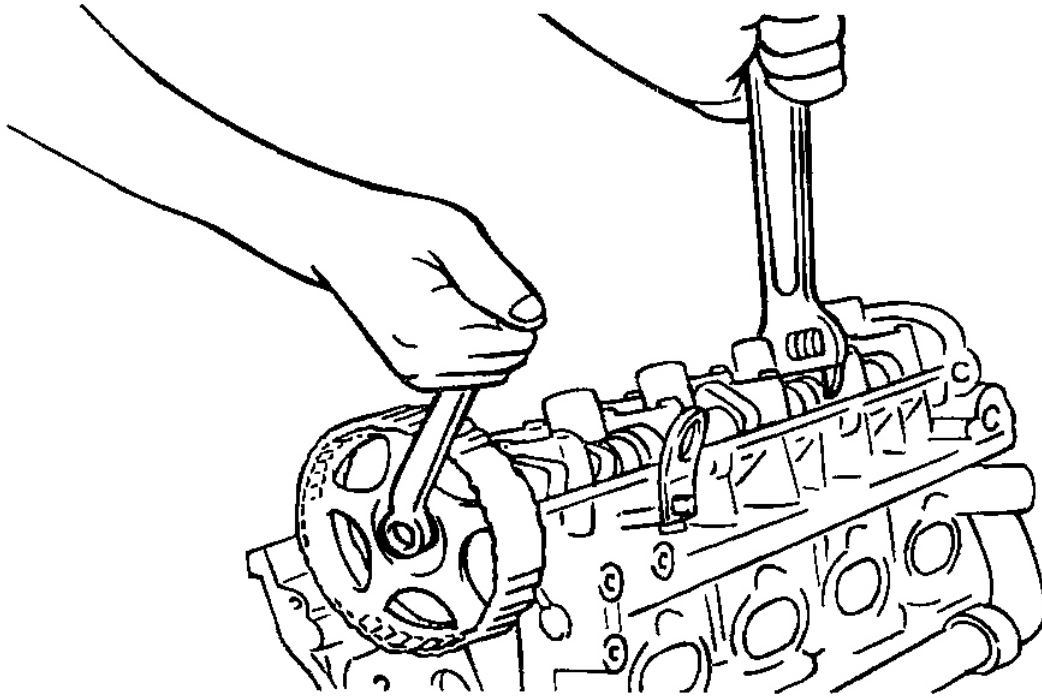
Fig. 74: Installing Camshaft Oil Seal
Courtesy of HYUNDAI MOTOR CO.

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)



G00790240

Fig. 75: Installing Camshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

8. Install the cylinder head cover.

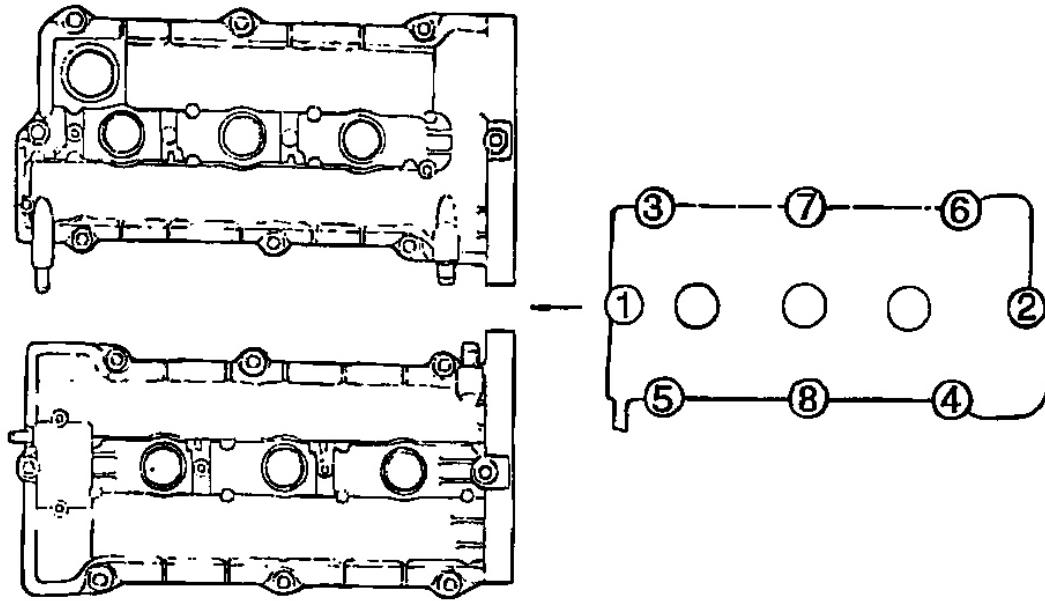
Tightening torque

Cylinder head cover bolts:

8 ~ 10 Nm (80 ~ 100 kg.cm, 5.8 ~ 7.2 lb.ft)

(Tightening procedure)

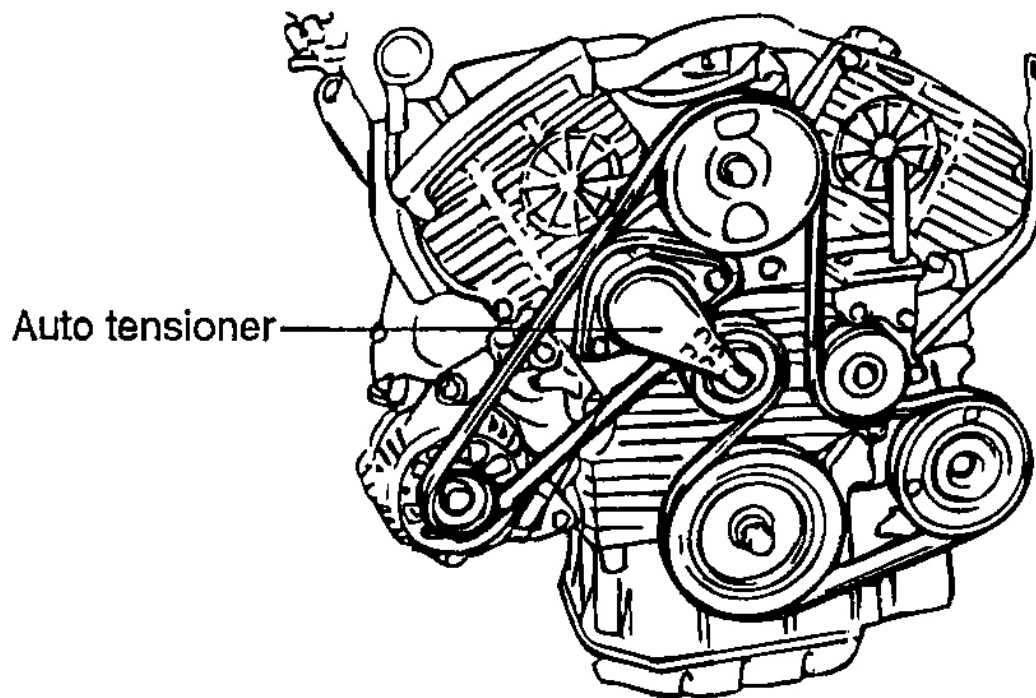
1. Tighten all bolts temporarily to half of the specified torque in the sequence 1.2.3.4.5.6.7.8.
2. Retighten all bolts to the specified torque.



G00790241

Fig. 76: Cylinder Head Cover Bolt Tightening Sequence
 Courtesy of HYUNDAI MOTOR CO.

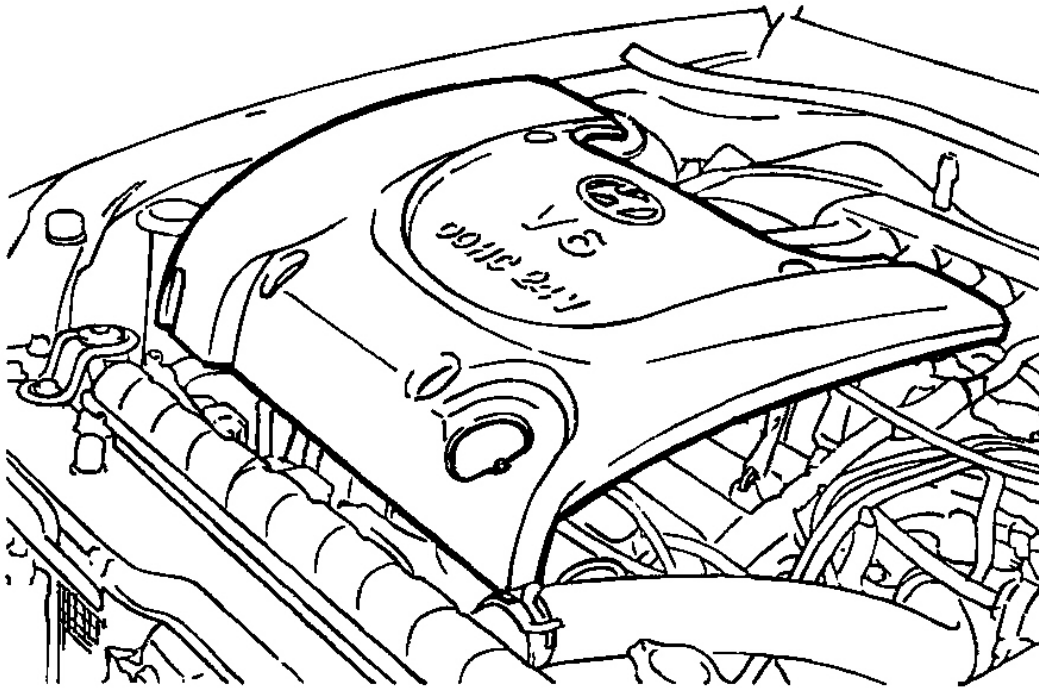
9. Install the spark plug cables and, center cover.
10. Install the timing belt and then tighten the auto tensioner pulley.
11. Install the timing belt cover.
12. Install the power steering pulley, air conditioner pulley, crankshaft pulley and tensioner pulley.



G00790242

Fig. 77: Identifying Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.

13. Connect the breather hose and engine harness.
14. Install the intake manifold and engine cover.

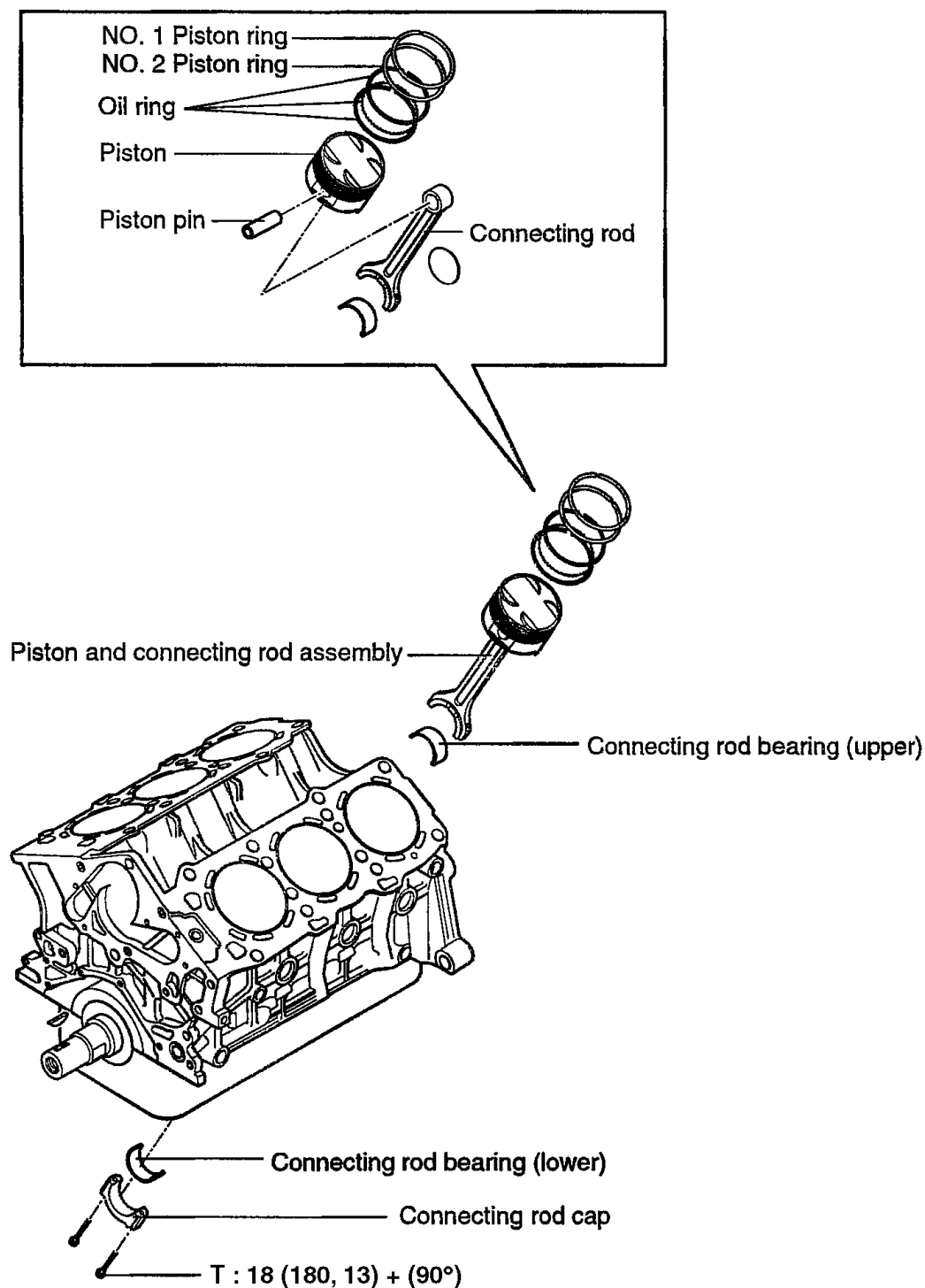


G00790243

Fig. 78: Identifying Engine Cover
Courtesy of HYUNDAI MOTOR CO.

PISTON

Components



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

G00790244

Fig. 79: Piston Components

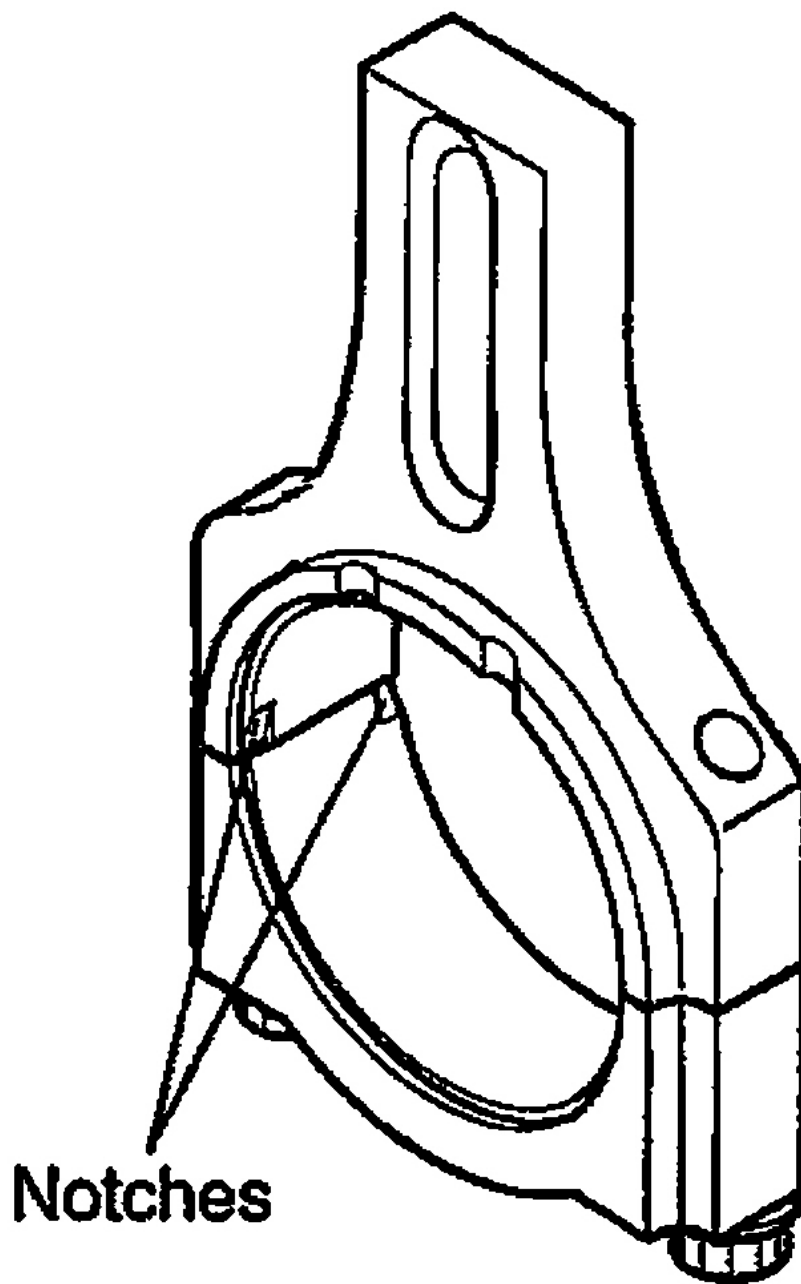
Courtesy of HYUNDAI MOTOR CO.

Disassembly

Connecting Rod Cap

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

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



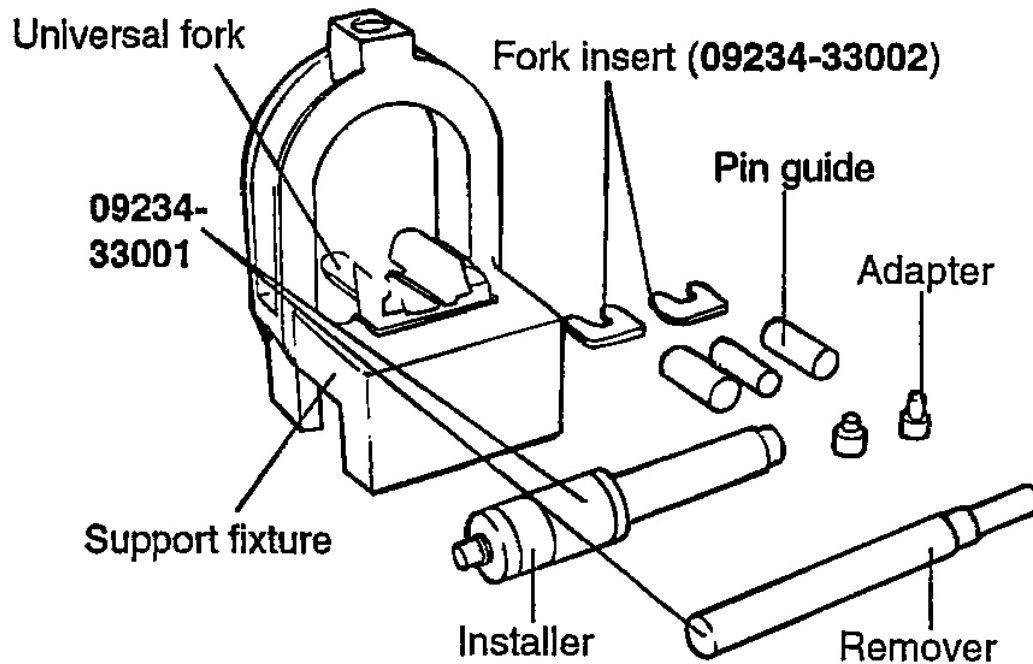
Notches

G00790245

Fig. 80: Identifying Connecting Rod Bearing Notches
Courtesy of HYUNDAI MOTOR CO.

Disassembly & Reassembly Of Piston Pin

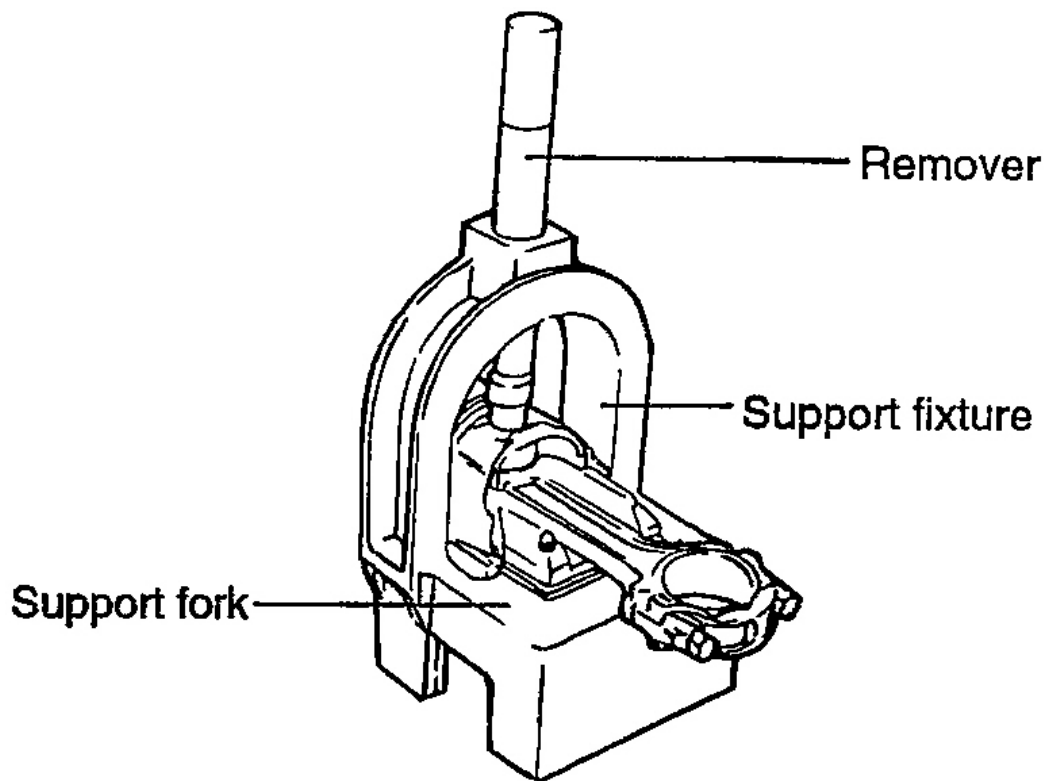
1. Using the special tools 09234 - 33001 and 09234 - 3002, disassemble and reassemble the piston and connecting rod.



G00790246

Fig. 81: 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 as it is installed or removed, while the rod is supported by fork inserts.
4. To remove the pin from the piston, place the piston in the support fixture with the rod resting on the fork inserts. Pass the remover tool through the top of the support fixture and use it to press out the pin.



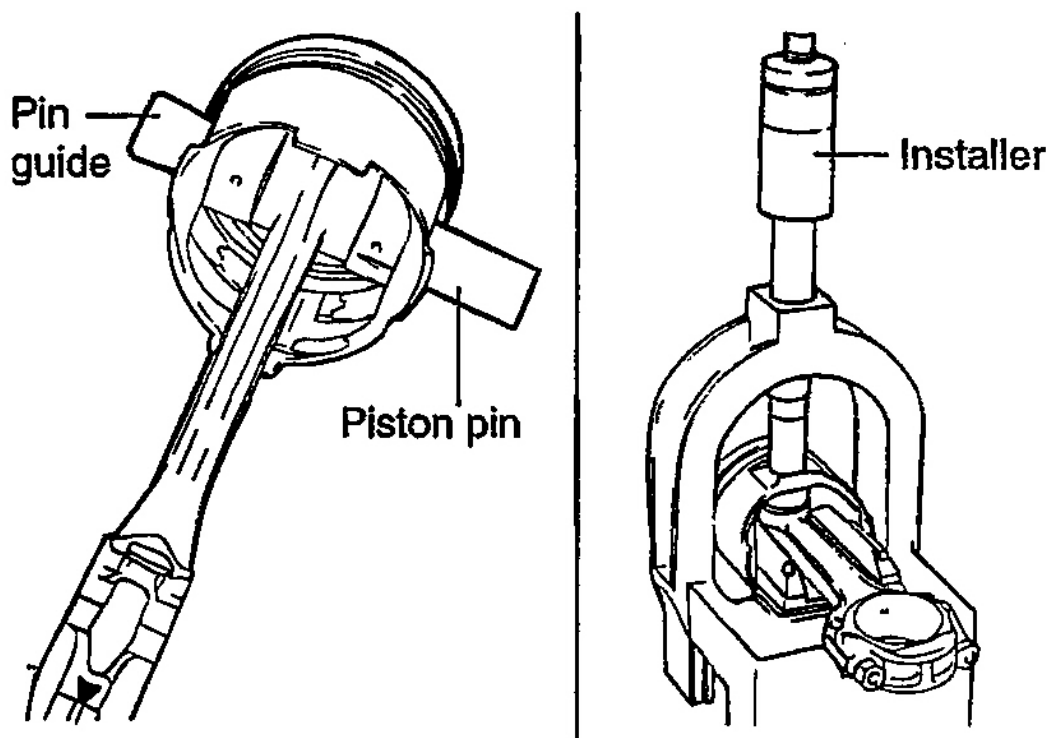
G00790247

Fig. 82: 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 up with the support fixture.



G00790248

Fig. 83: Installing Piston Pin

Courtesy of HYUNDAI MOTOR CO.

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

CAUTION: Do not exceed 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 ring side clearance. If the measured value exceeds the service limit, insert a new ring in the ring groove to measure the side clearance. If the clearance still exceeds the service limit, replace the piston and rings together. If it is less than the service limit, replace only the piston rings.

Piston ring side clearance

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

No.2 : 0.03 ~ 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 (0.0079 ~ 0.0138 in.)

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

[Limit]

No.1, No.2 : 0.8 mm (0.031 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 part of cylinder that is less worn out.

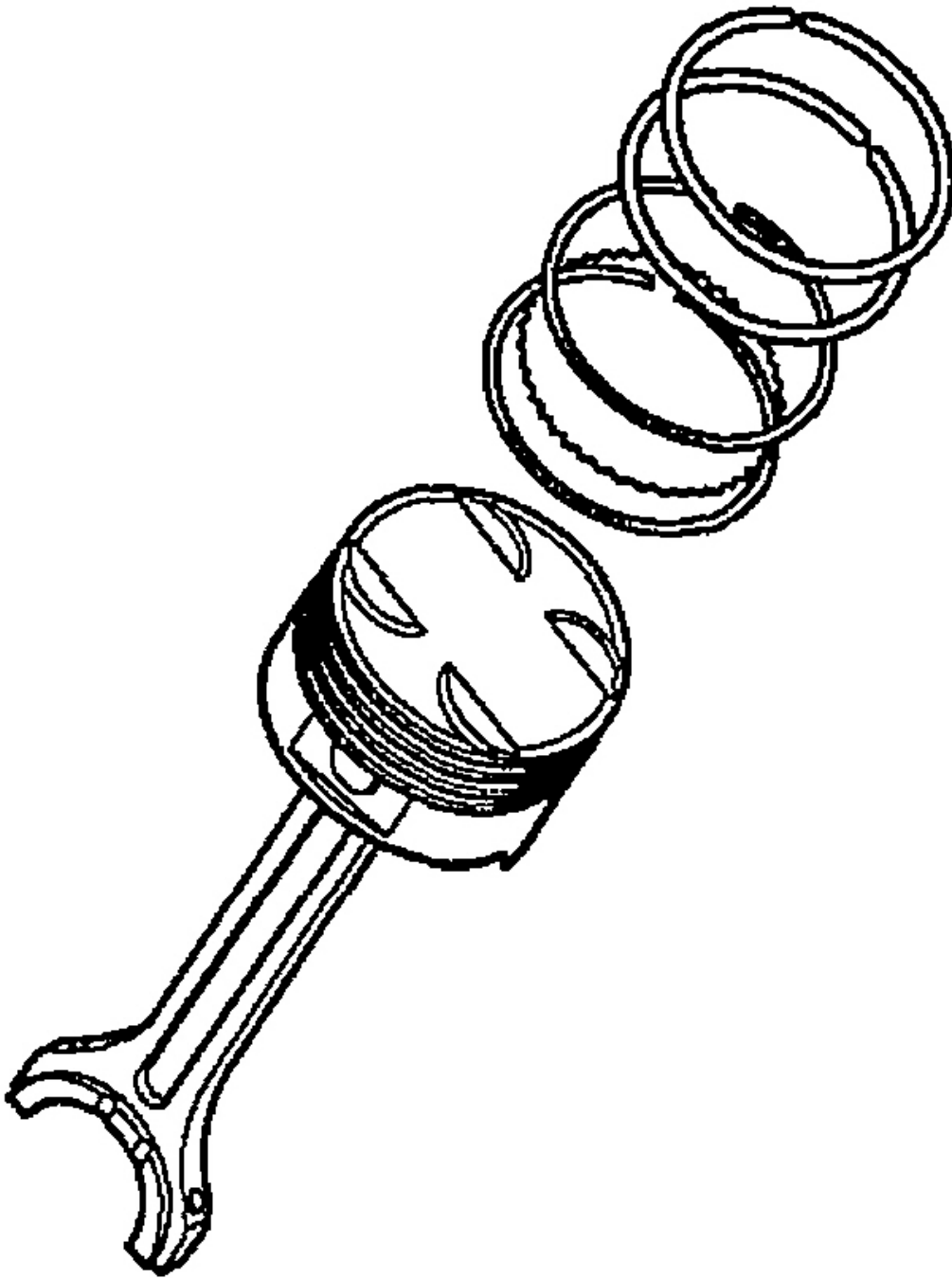
Piston Ring Service Size & Mark

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

G00790249

Fig. 84: 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.



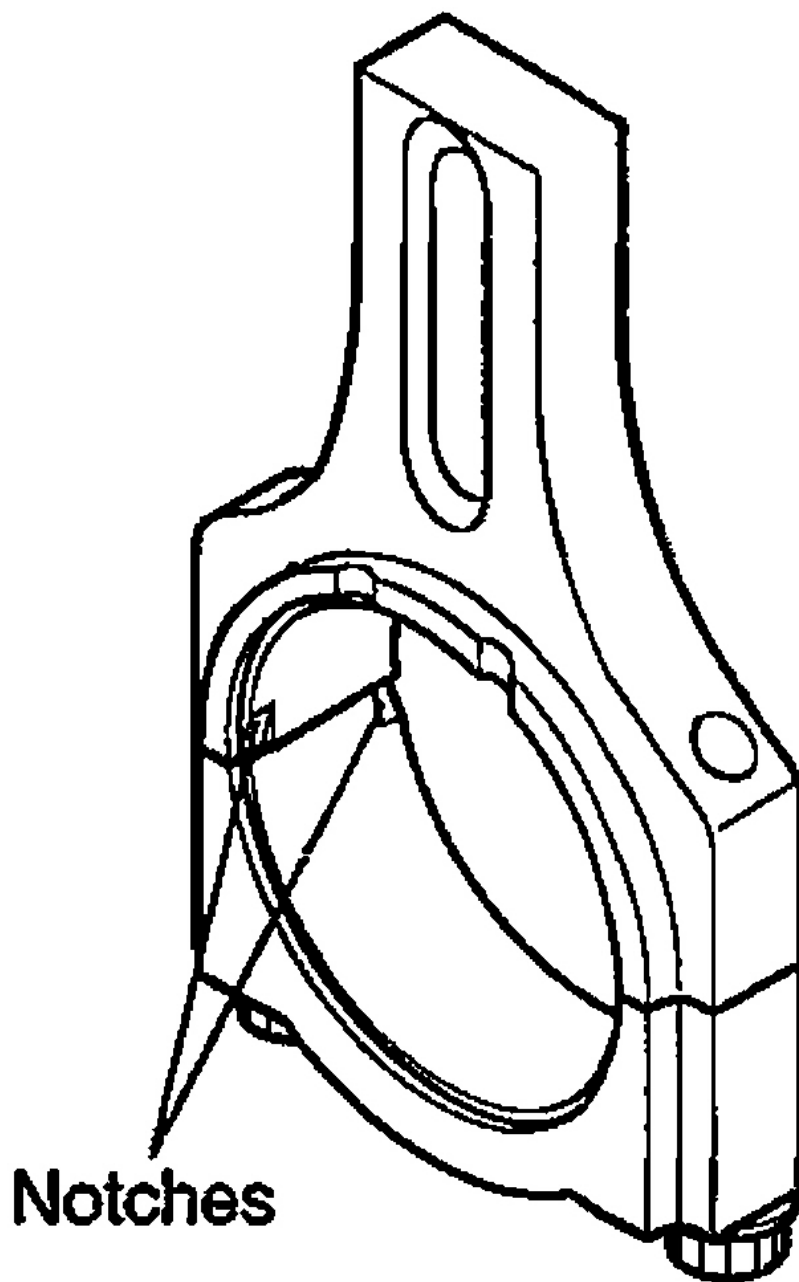
G00790250

Fig. 85: 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.

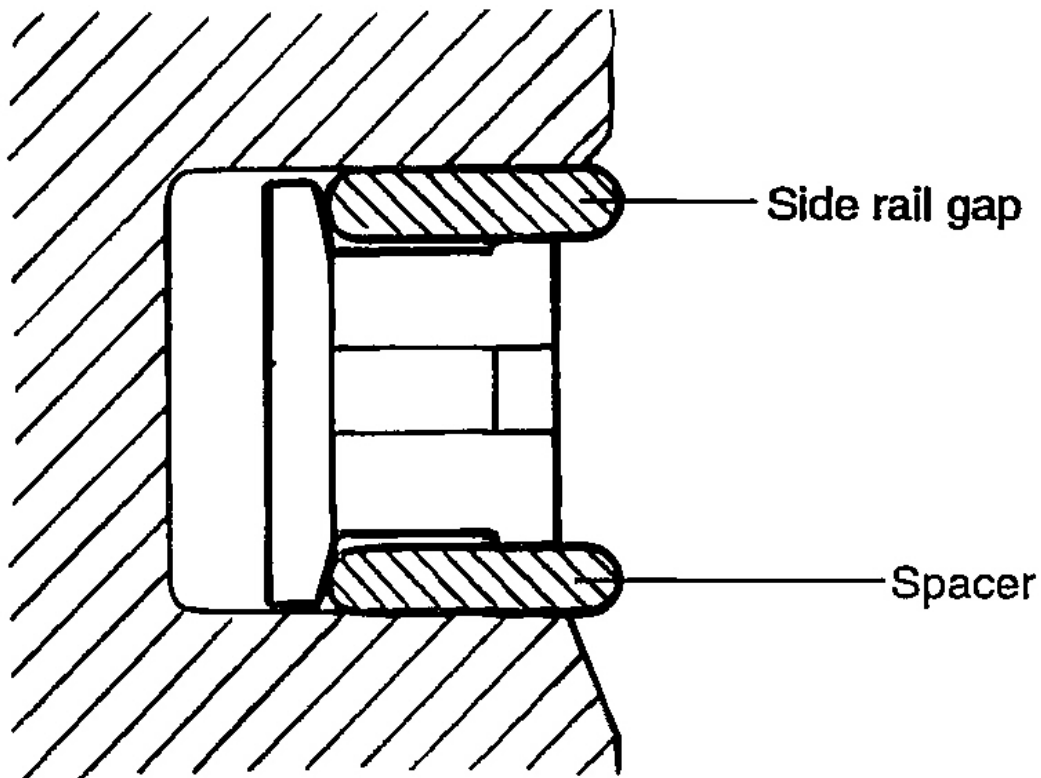


G00790251

Fig. 86: Identifying Connecting Rod Bearing Notches
Courtesy of HYUNDAI MOTOR CO.

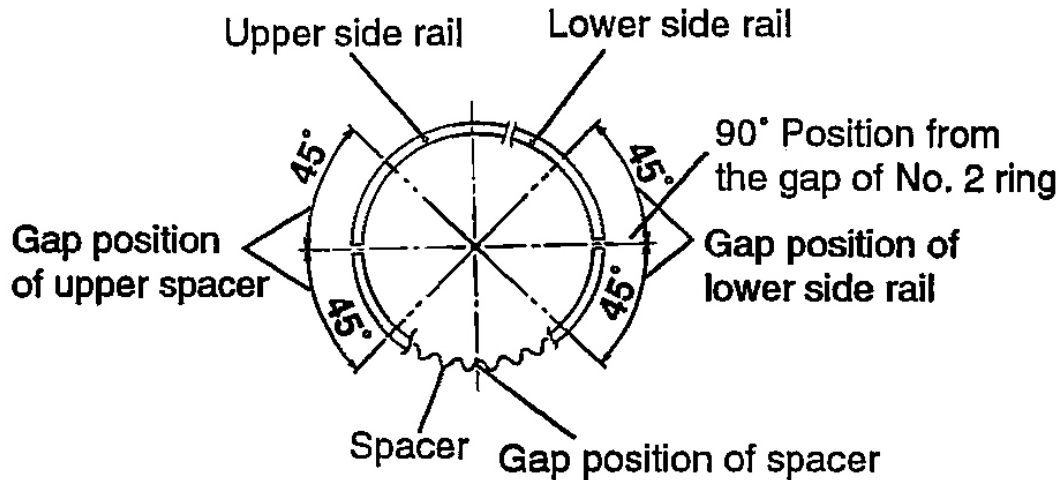
Reassembly

1. Install the spacer.



G00790252

Fig. 87: Identifying Spacer Installation (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



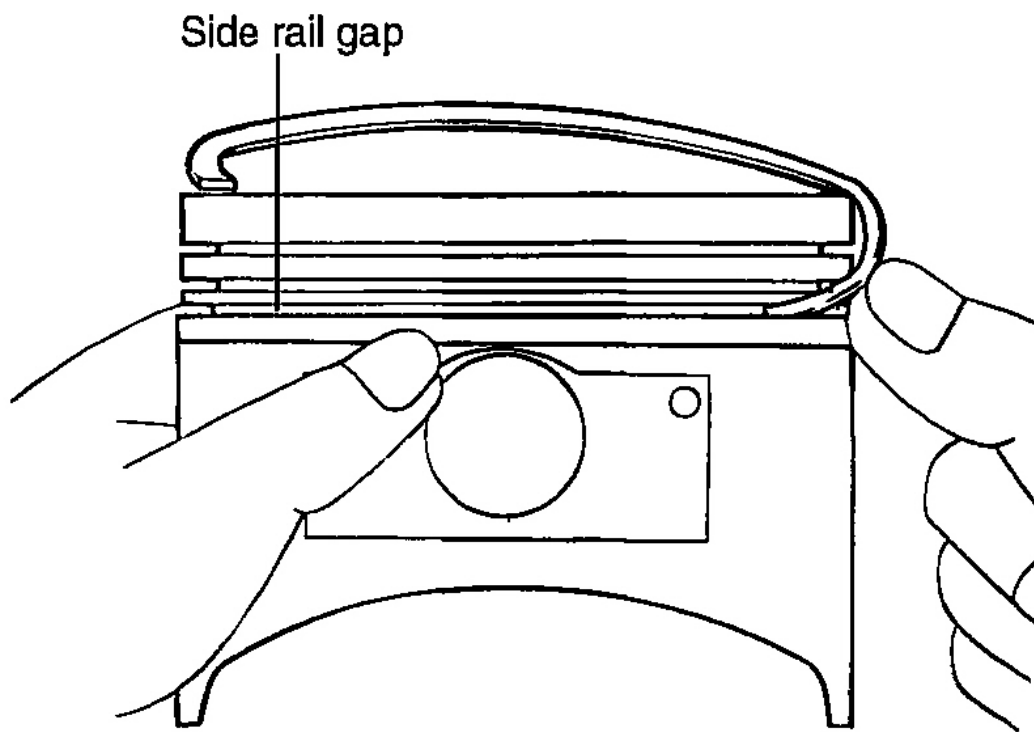
G00790253

Fig. 88: 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 ring expander when installing the side rail.

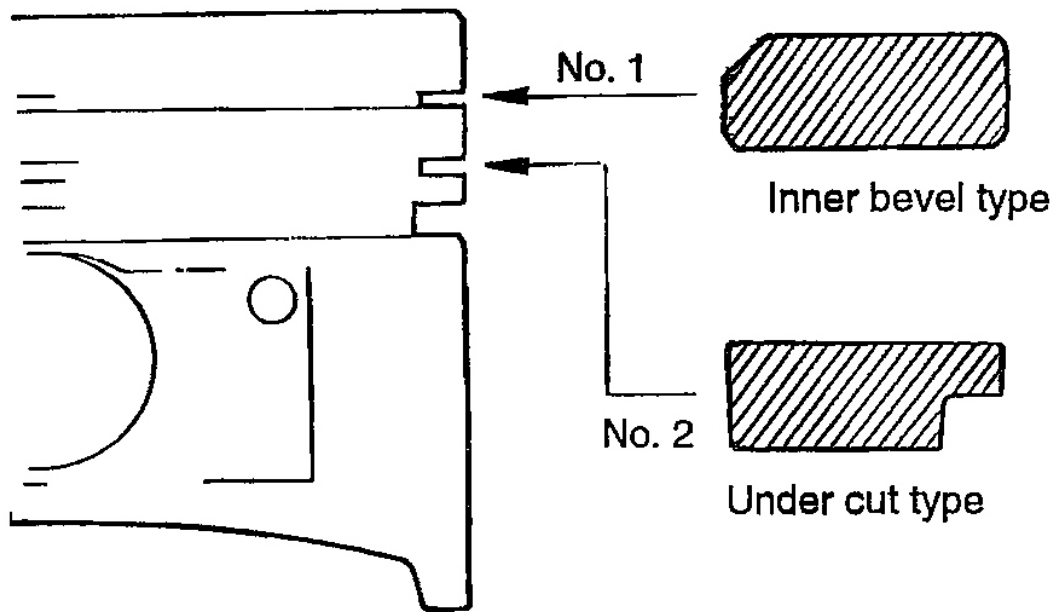
3. Install the lower side rail by the same procedure described in Step 2.



G00790254

Fig. 89: 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.



G00790255

Fig. 90: 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.

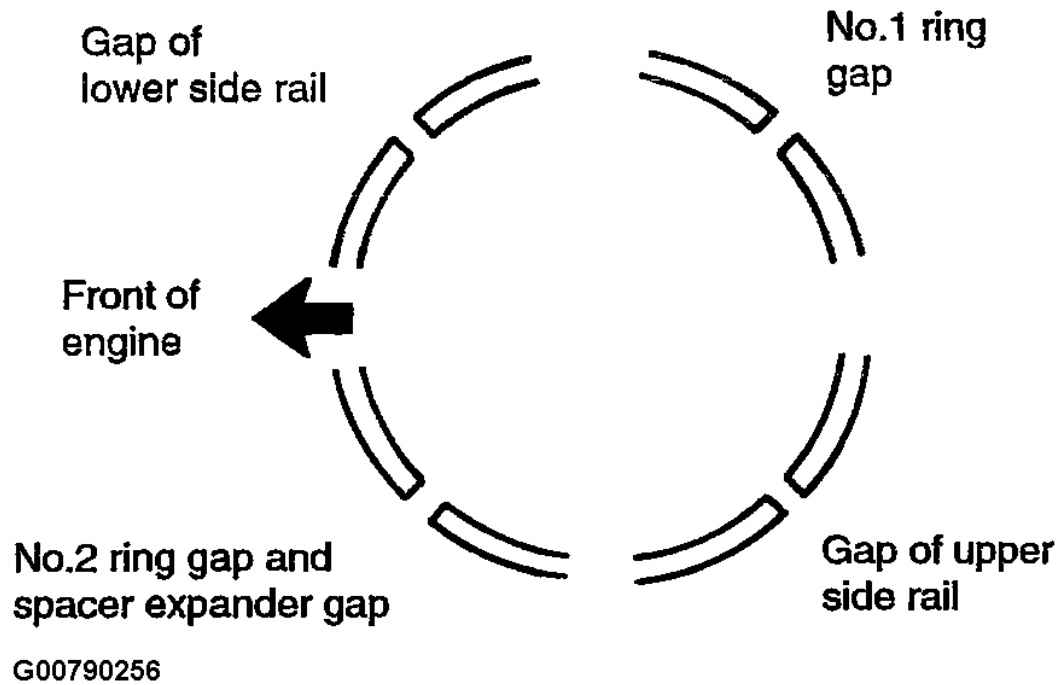
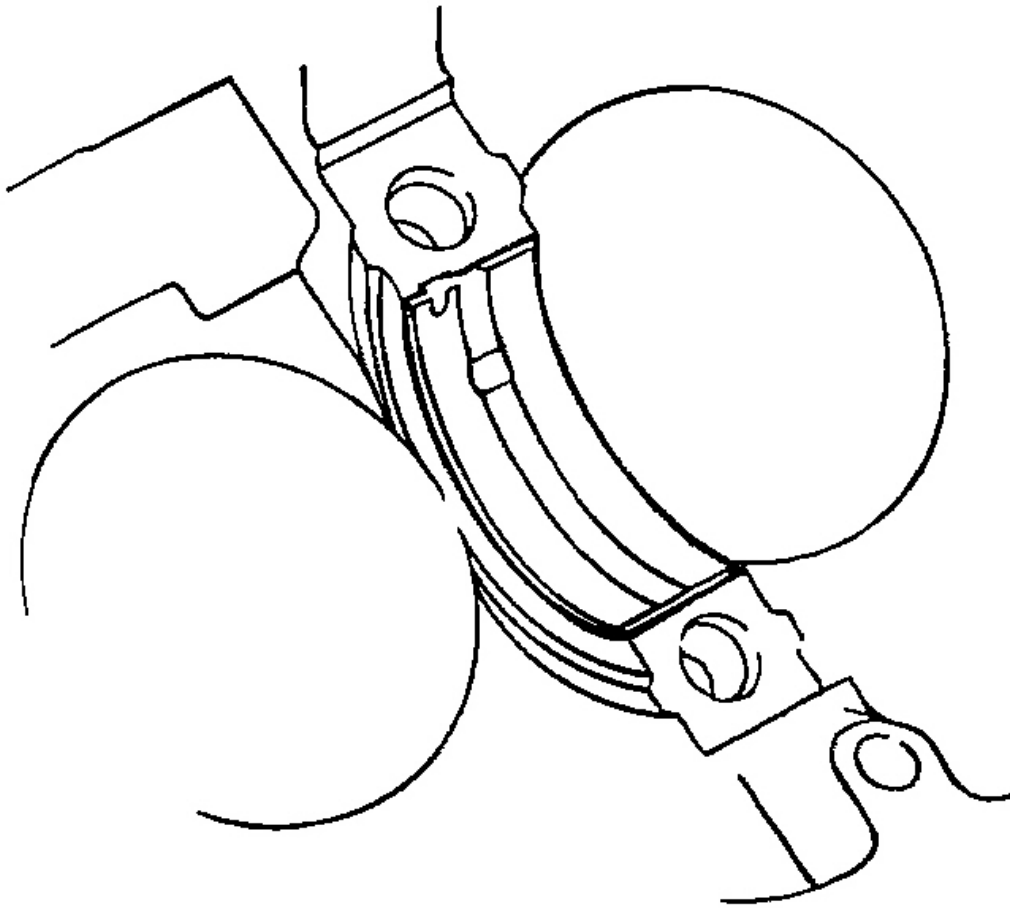


Fig. 91: Identifying Piston Installation
Courtesy of HYUNDAI MOTOR CO.

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

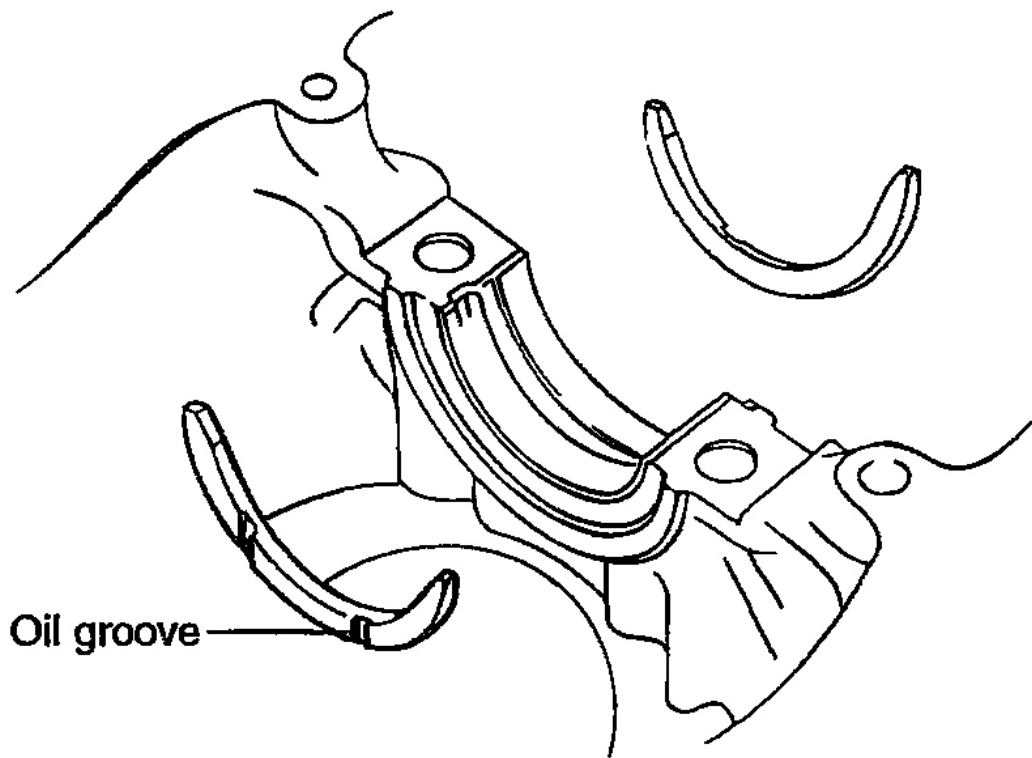
CAUTION: Install the bearing so it matches the oil hole in the block.



G00790257

Fig. 92: 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.



G00790258

Fig. 93: Installing Crankshaft Thrust Washers
Courtesy of HYUNDAI MOTOR CO.

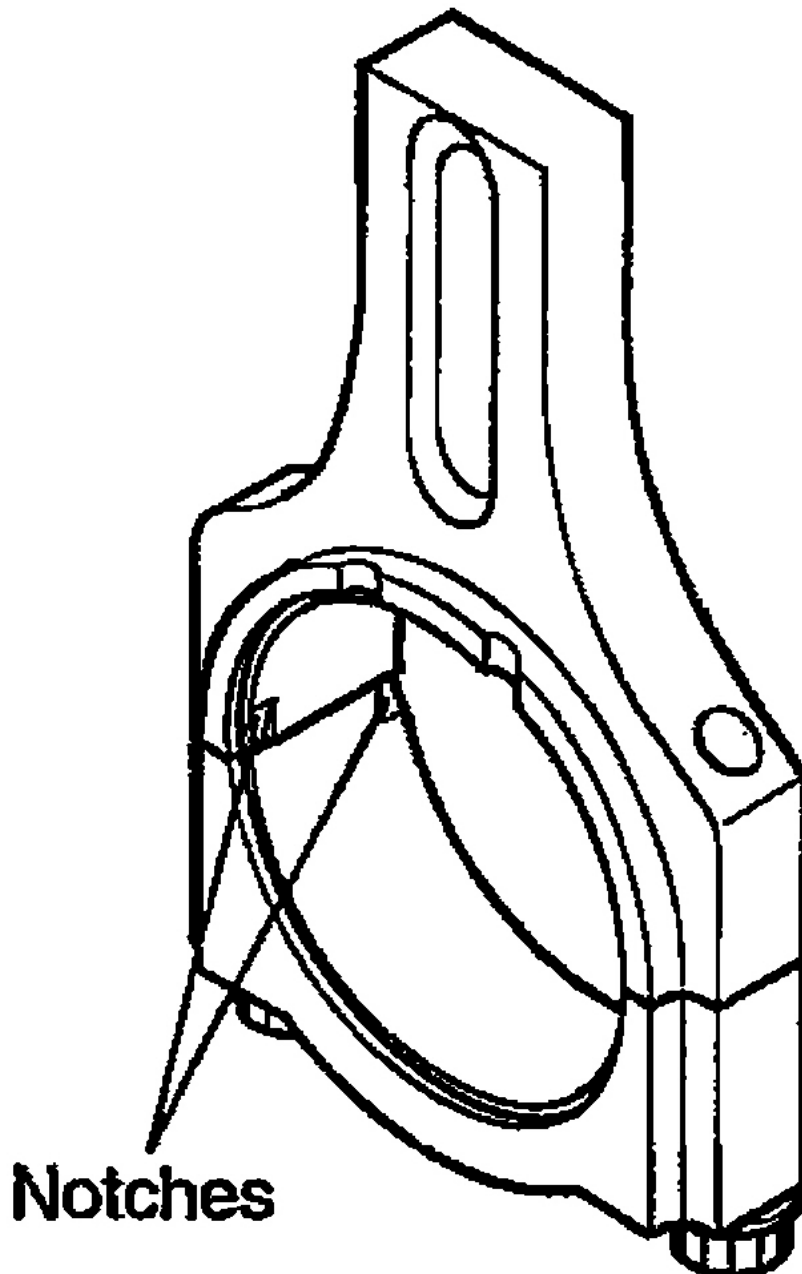
12. Make sure that the front mark of the piston and the front mark (identification mark) of the connecting rod are directed toward the front of the engine.
13. When the connecting rod cap is installed, make sure that any cylinder numbers placed on the rod and cap at disassembly match.
14. When a new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

Tightening torque

Connecting rod bolt :

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.



G00790259

Fig. 94: Identifying Connecting Rod Bearing Notches

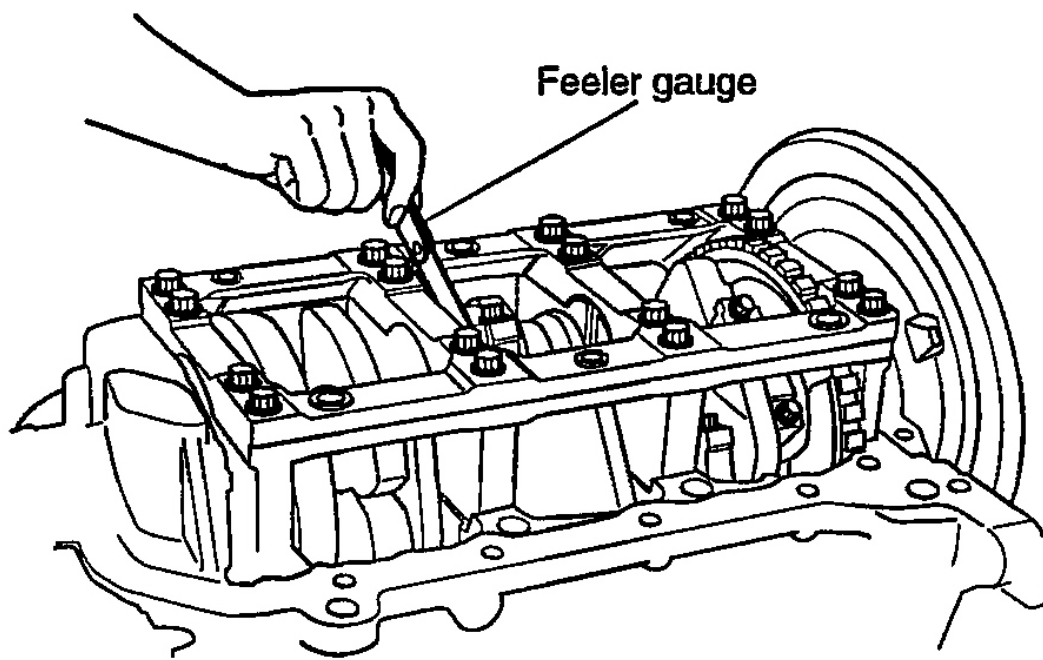
Courtesy of HYUNDAI MOTOR CO.

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.)

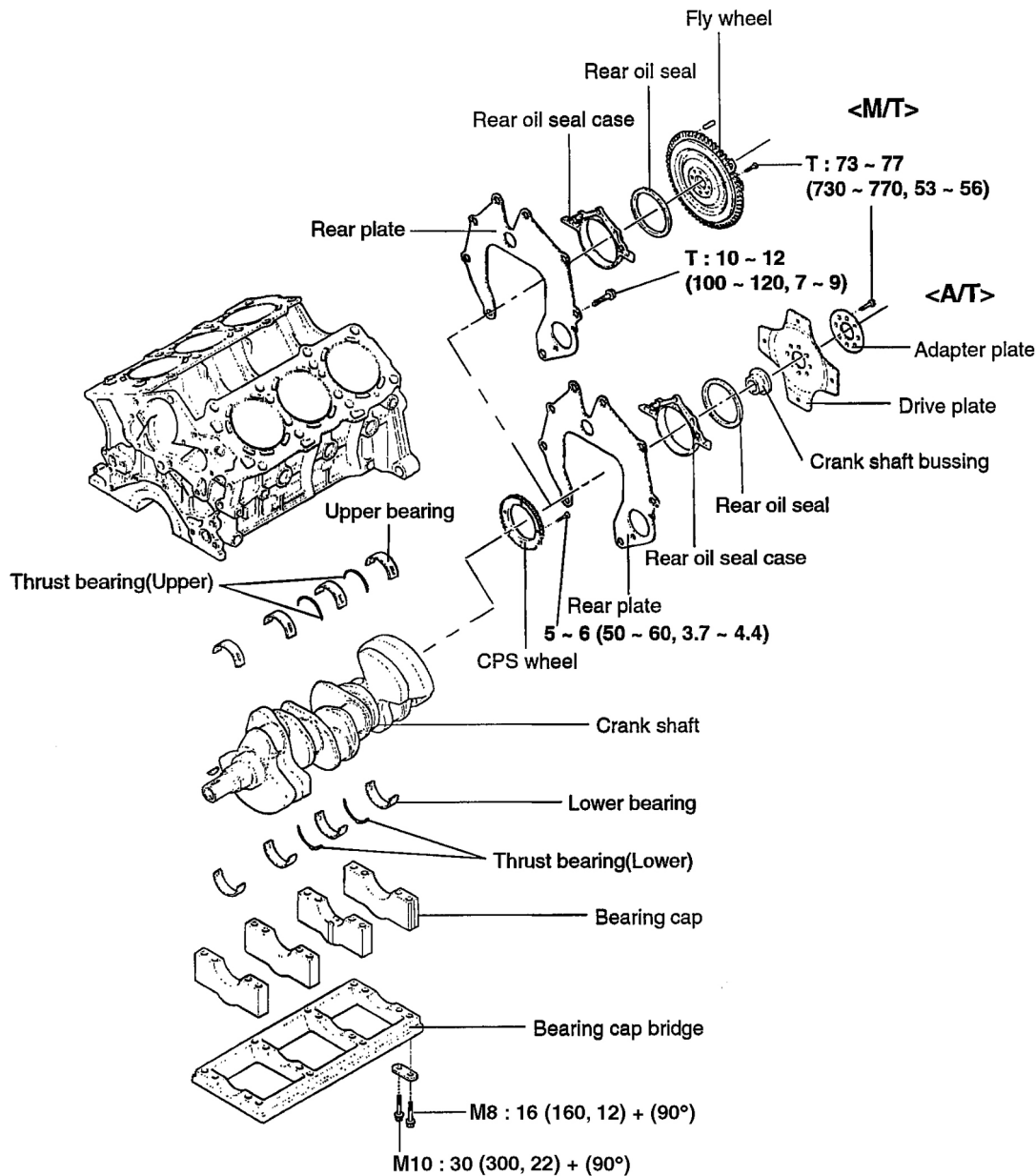


G00790260

Fig. 95: Checking Connecting Rod Side Clearance
Courtesy of HYUNDAI MOTOR CO.

CRANKSHAFT

Components



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

G00790261

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

Disassembly

1. Remove the following components :
 - Timing belt train.
 - 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 bearings in order according to the cap number.

Inspection

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

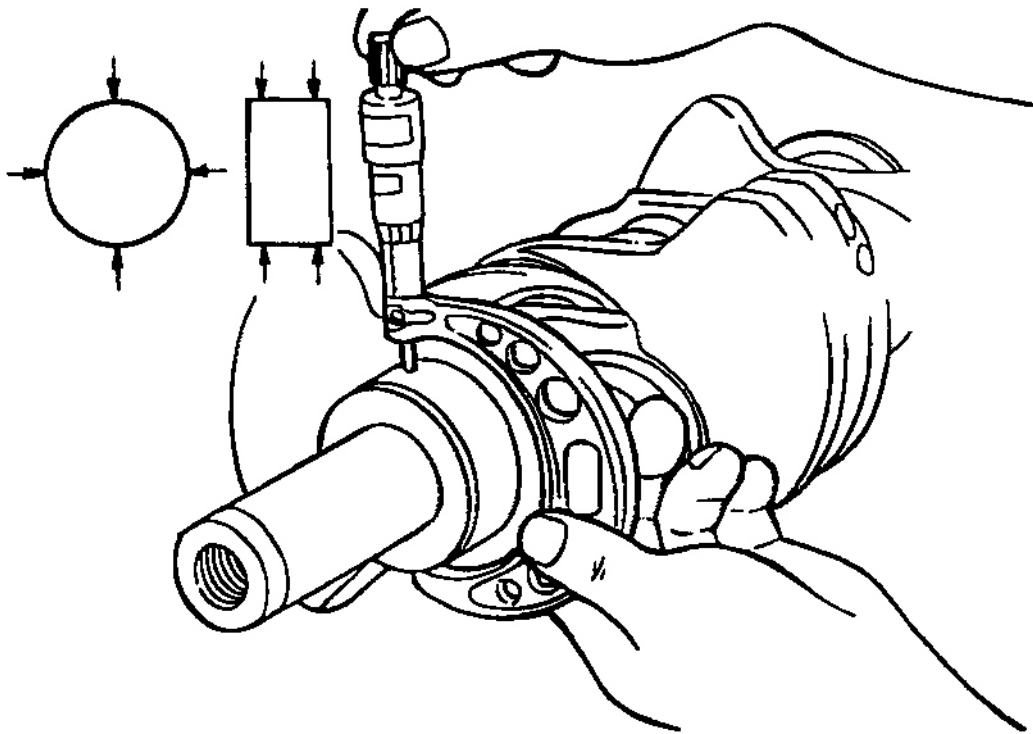
Standard value

Crankshaft journal O.D :

61.982 ~ 62.000 mm (2.4402 ~ 2.4409 in.)

Crankshaft pin O.D :

47.982 ~ 48.000 mm (1.8890 ~ 1.8898 in.)



G00790262

Fig. 97: 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

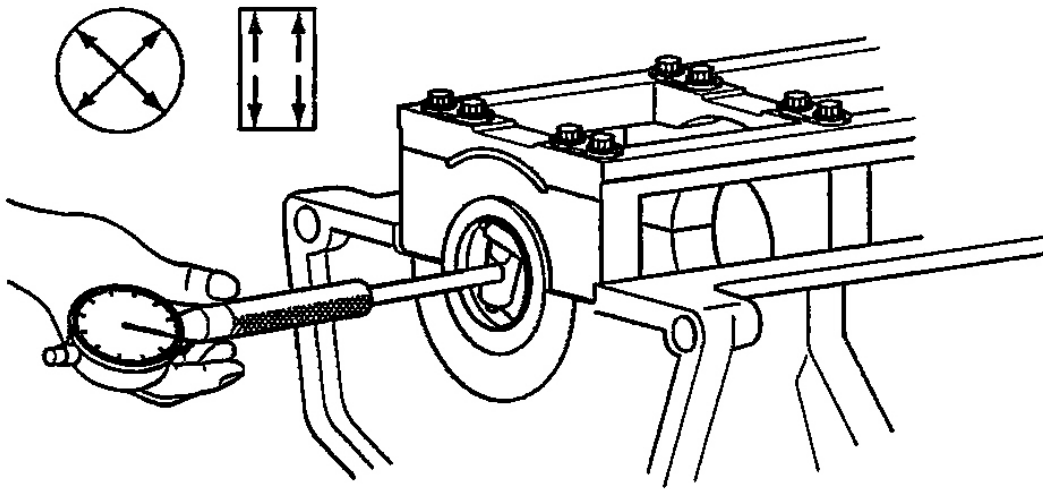
Crankshaft main bearing :

0.004 ~ 0.022 mm (0.00015 ~ 0.00087 in.)

Connecting rod bearing :

0.018 - 0.036 mm (0.00071 - 0.00141 in.)

Limit : 0.1 mm (0.004in.)



G00790263

Fig. 98: Measuring Outside Diameter Of Crankshaft Journal
Courtesy of HYUNDAI MOTOR CO.

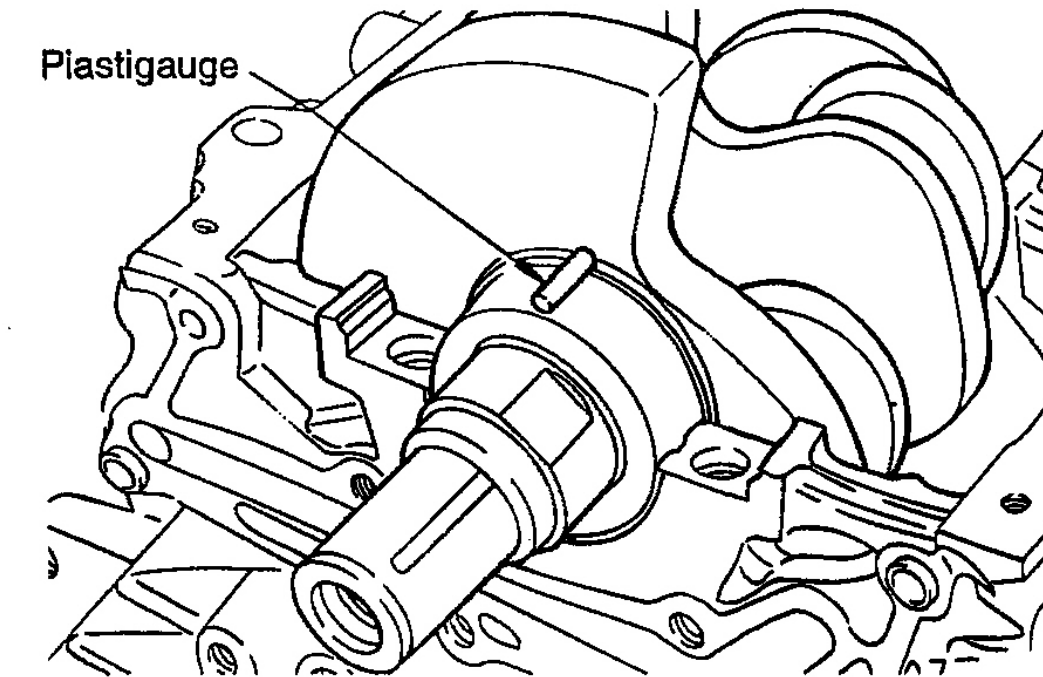
Plastic Gauge Method

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.



G00790264

Fig. 99: 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 seat 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 a grooveless 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

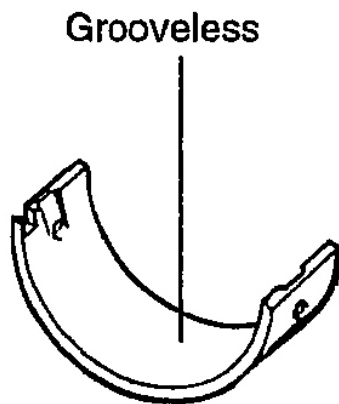
Main bearing cap bolts

M8 (9 ~ 15):

16 Nm (160 kg.cm, 12 lb.ft) + (90°)

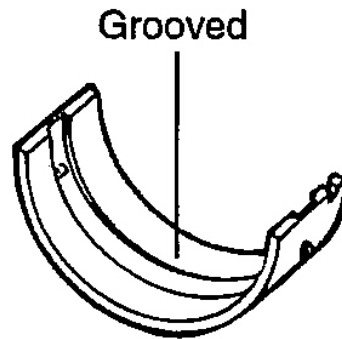
M10 (1 ~ 8):

30 Nm (300 kg.cm, 22 lb.ft) + (90°)



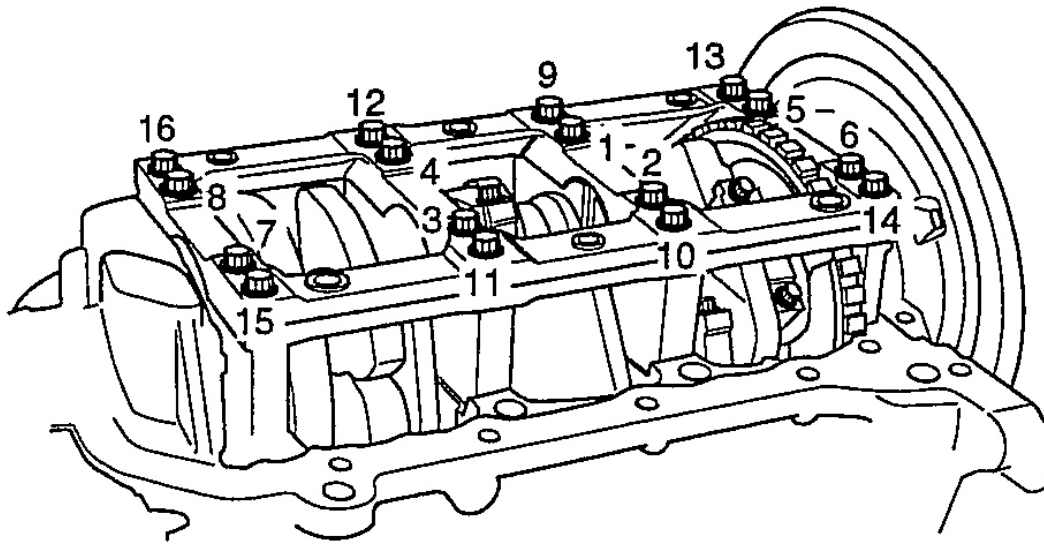
Lower bearing

G00790265



Upper bearing

Fig. 100: Identifying Main Bearings
Courtesy of HYUNDAI MOTOR CO.



G00790266

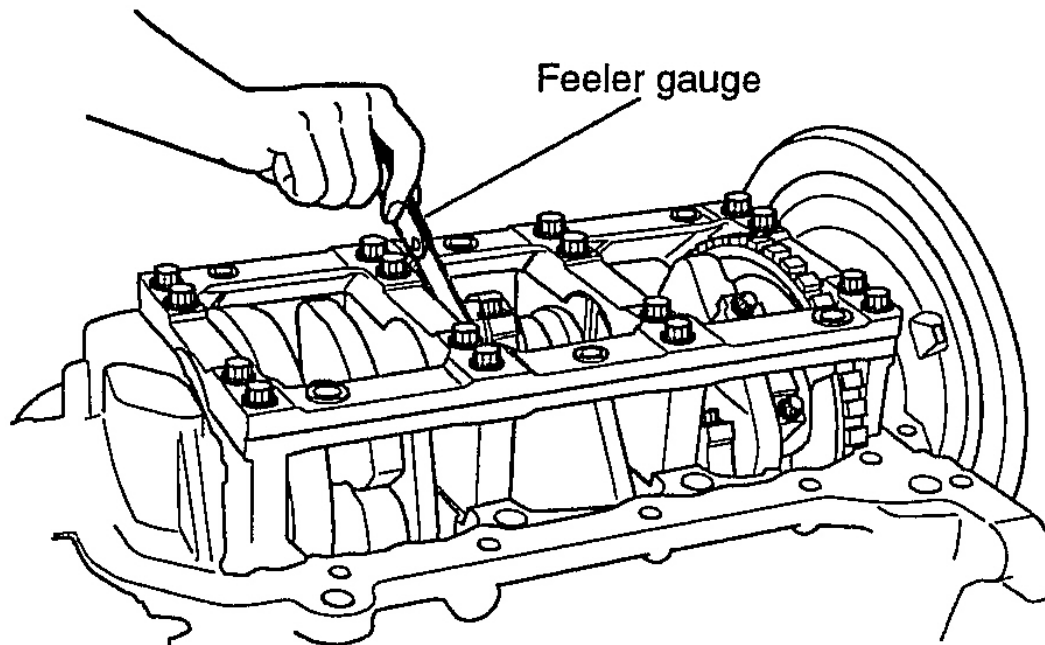
Fig. 101: Identifying Main Bearing Caps & Bolt Torque Sequence
 Courtesy of HYUNDAI MOTOR CO.

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.)



G00790267

Fig. 102: 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 :

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

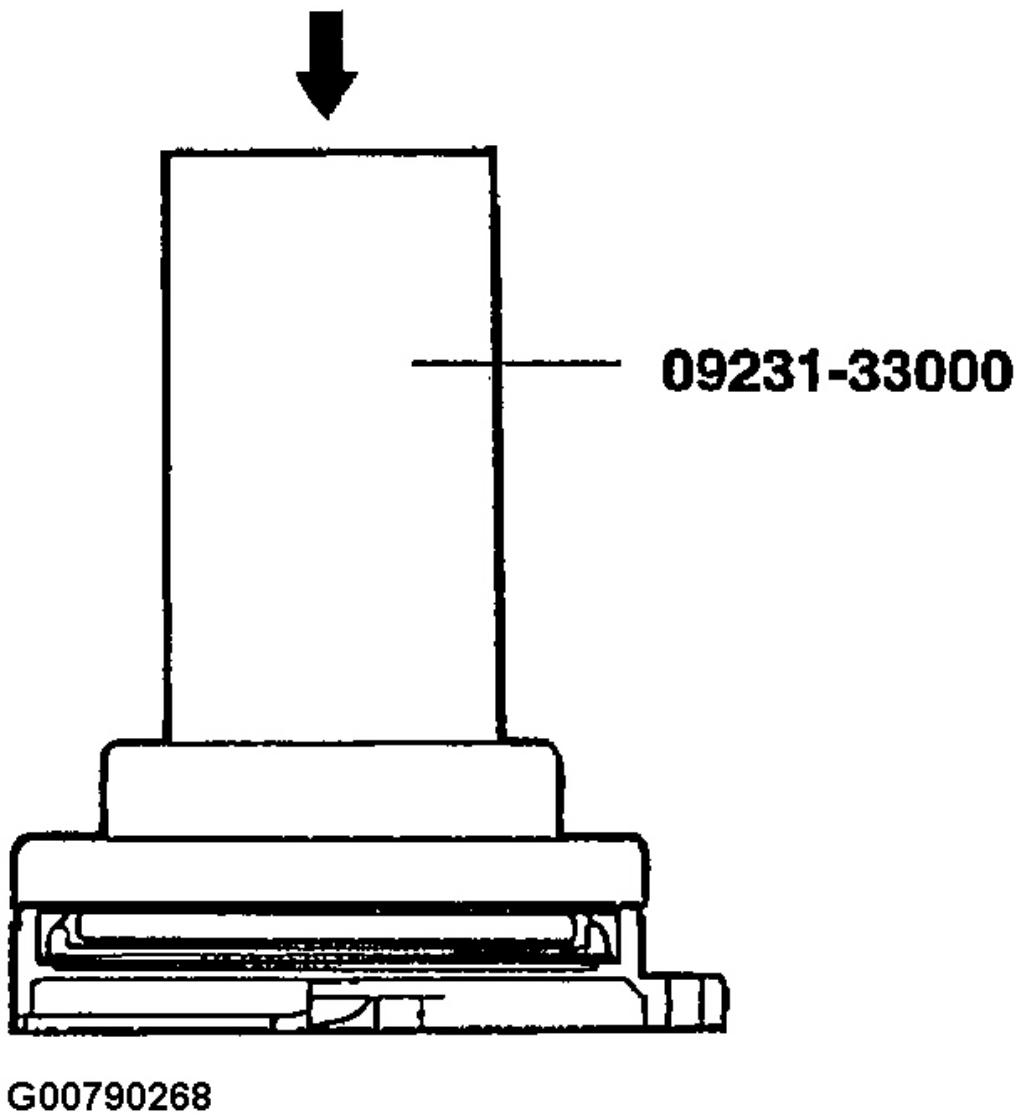
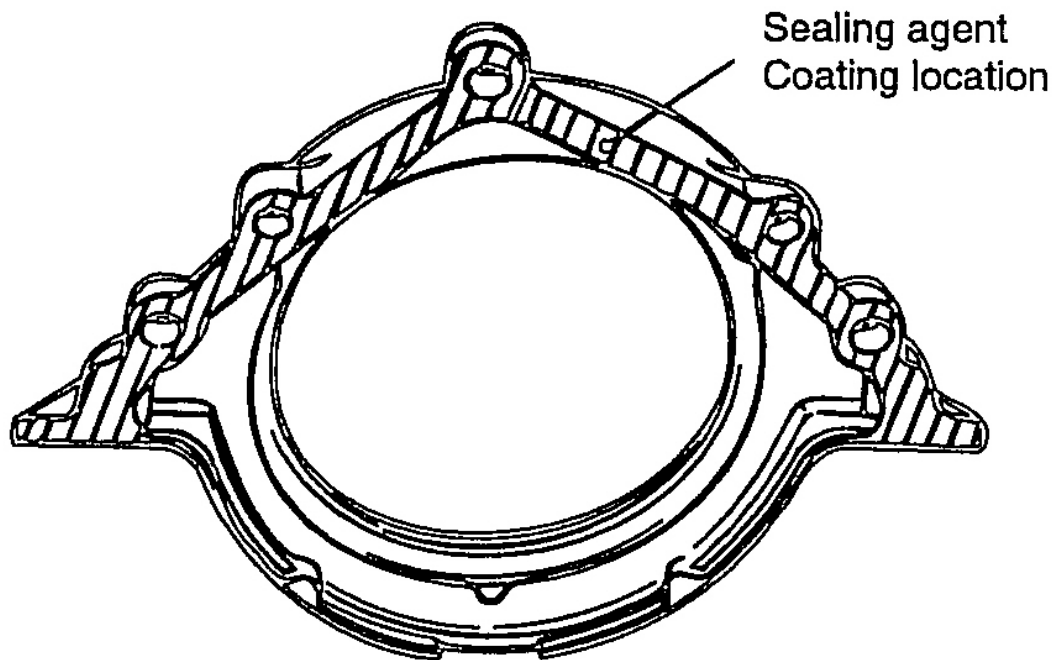


Fig. 103: Installing Rear Oil Seal In Oil Seal Case
Courtesy of HYUNDAI MOTOR CO.



G00790269

Fig. 104: 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)

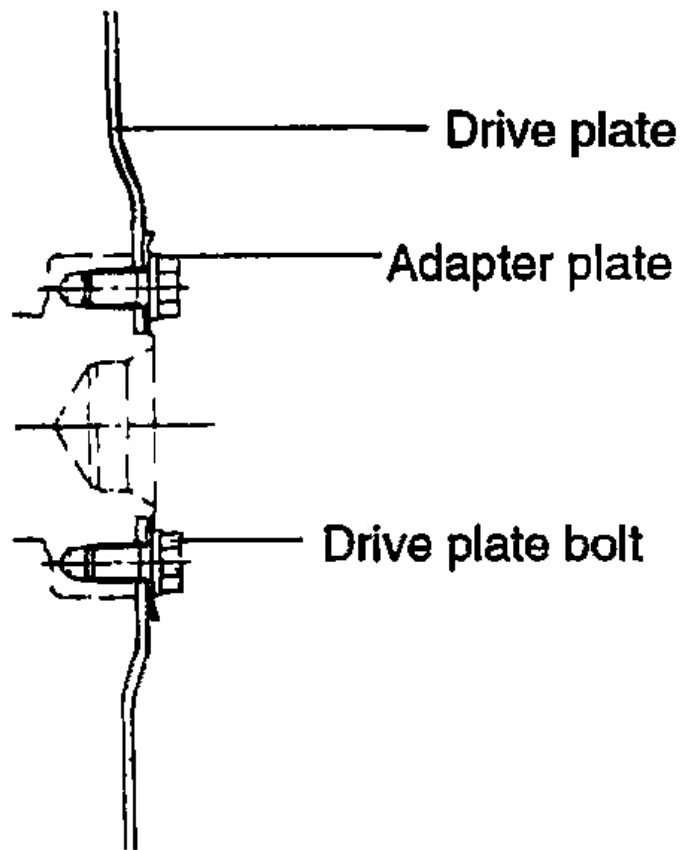
11. Tighten the drive plate and the adapter plate (A/T).

Tightening torque

Drive plate and adapter plate bolt:

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

(A/T)



G00790270

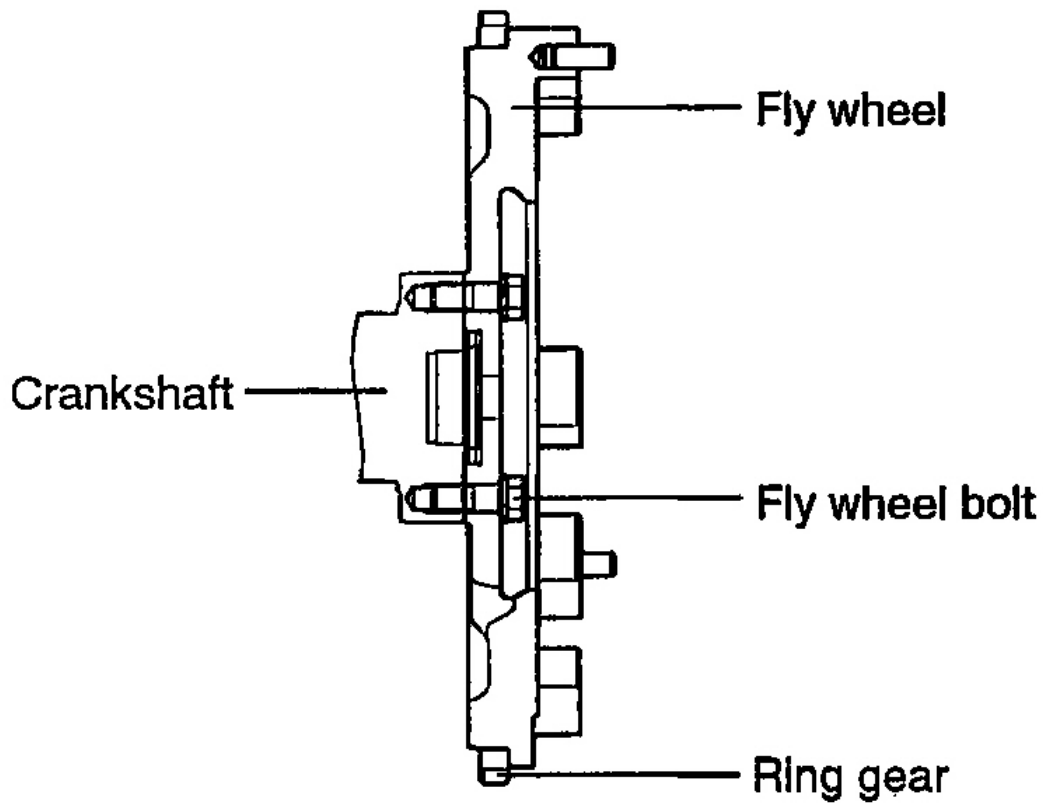
Fig. 105: Identifying Drive Plate & Adapter Plate
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

Flywheel installation bolt:

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



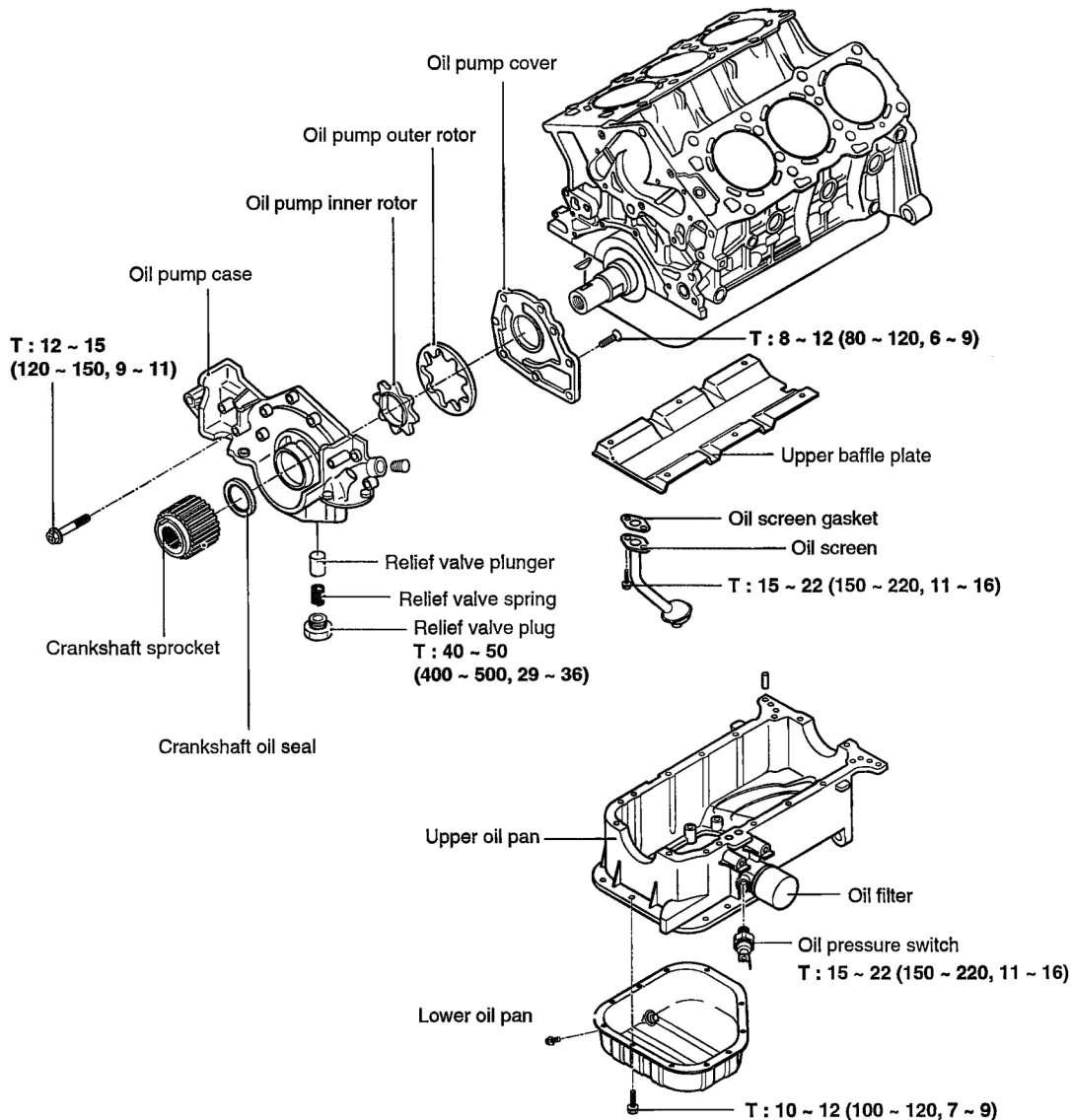
G00790271

Fig. 106: Identifying Flywheel Bolt Installation
Courtesy of HYUNDAI MOTOR CO.

LUBRICATION SYSTEM

OIL PUMP

Components



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

G00790289

Fig. 107: 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.

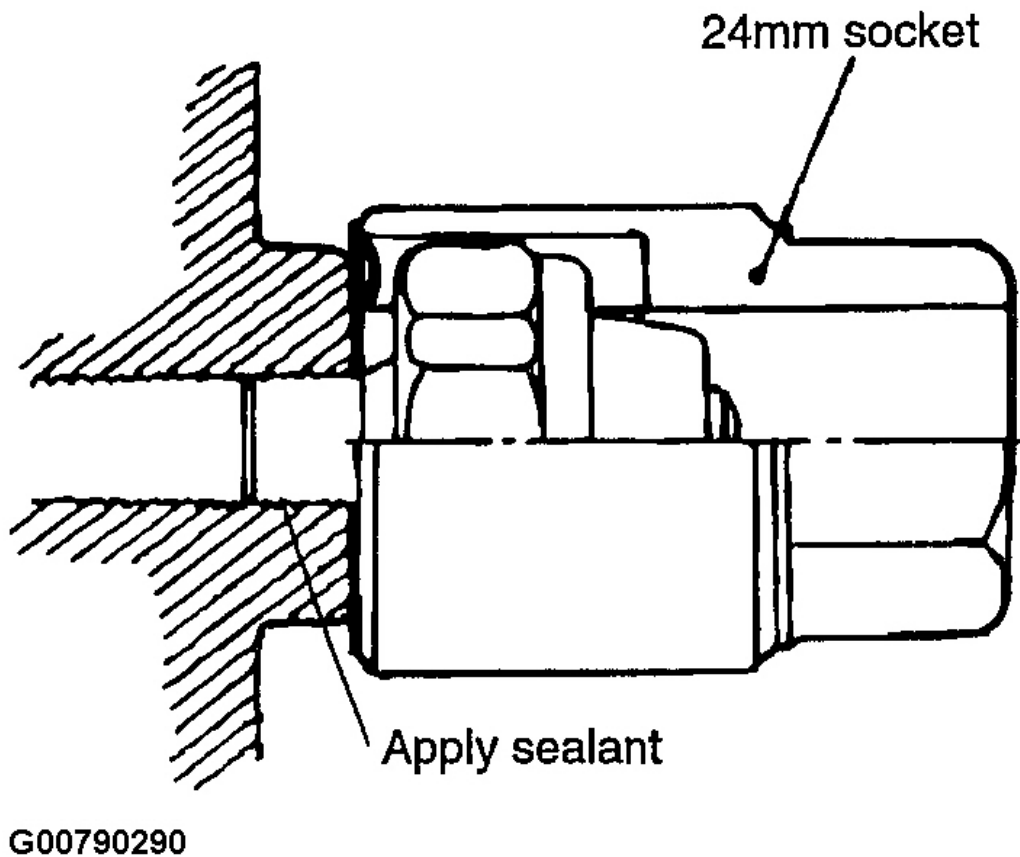


Fig. 108: Removing Oil Pressure Switch
Courtesy of HYUNDAI MOTOR CO.

Inspection

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

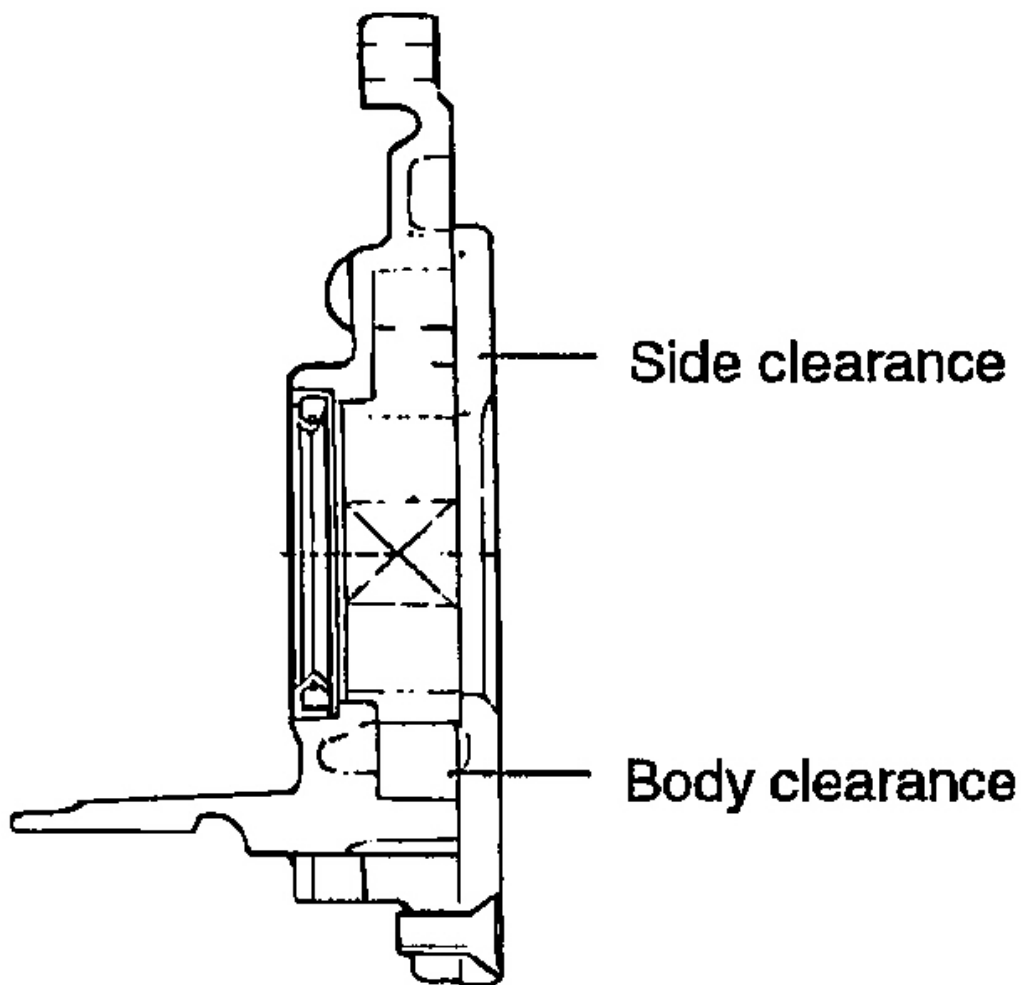
Standard value

Body clearance :

0.100 ~ 0.181 mm (0.0039 ~ 0.0071 in.)

Side clearance :

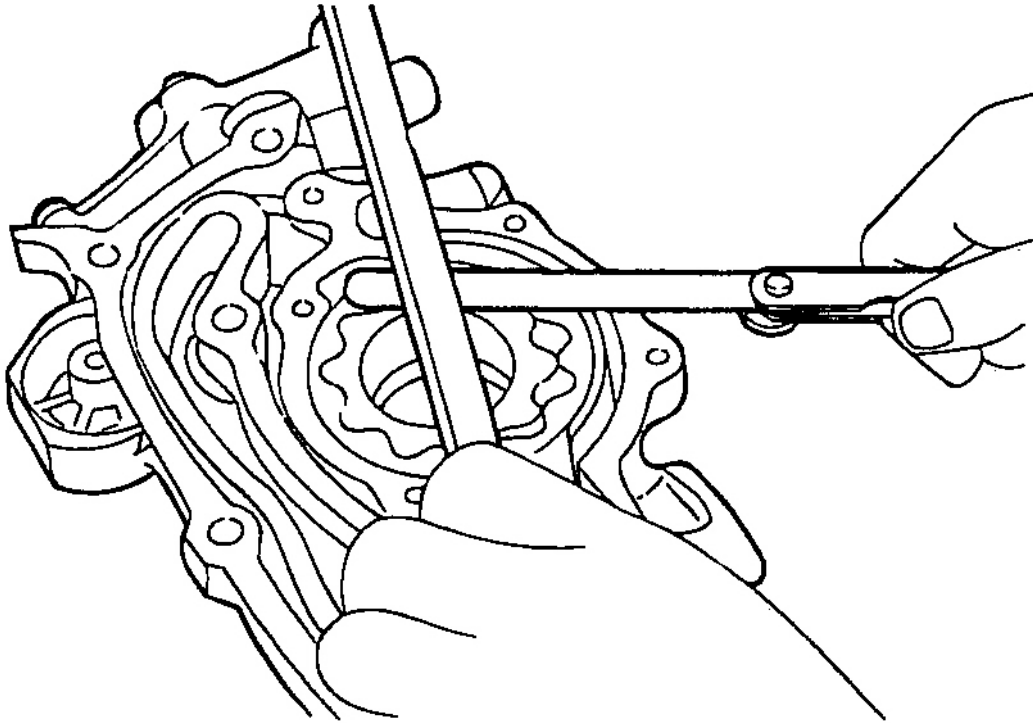
0.040 ~ 0.095 mm (0.0016 ~ 0.0037 in.)



G00790291

Fig. 109: Identifying Side Clearance & Body Clearance

Courtesy of HYUNDAI MOTOR CO.



G00790292

Fig. 110: 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.

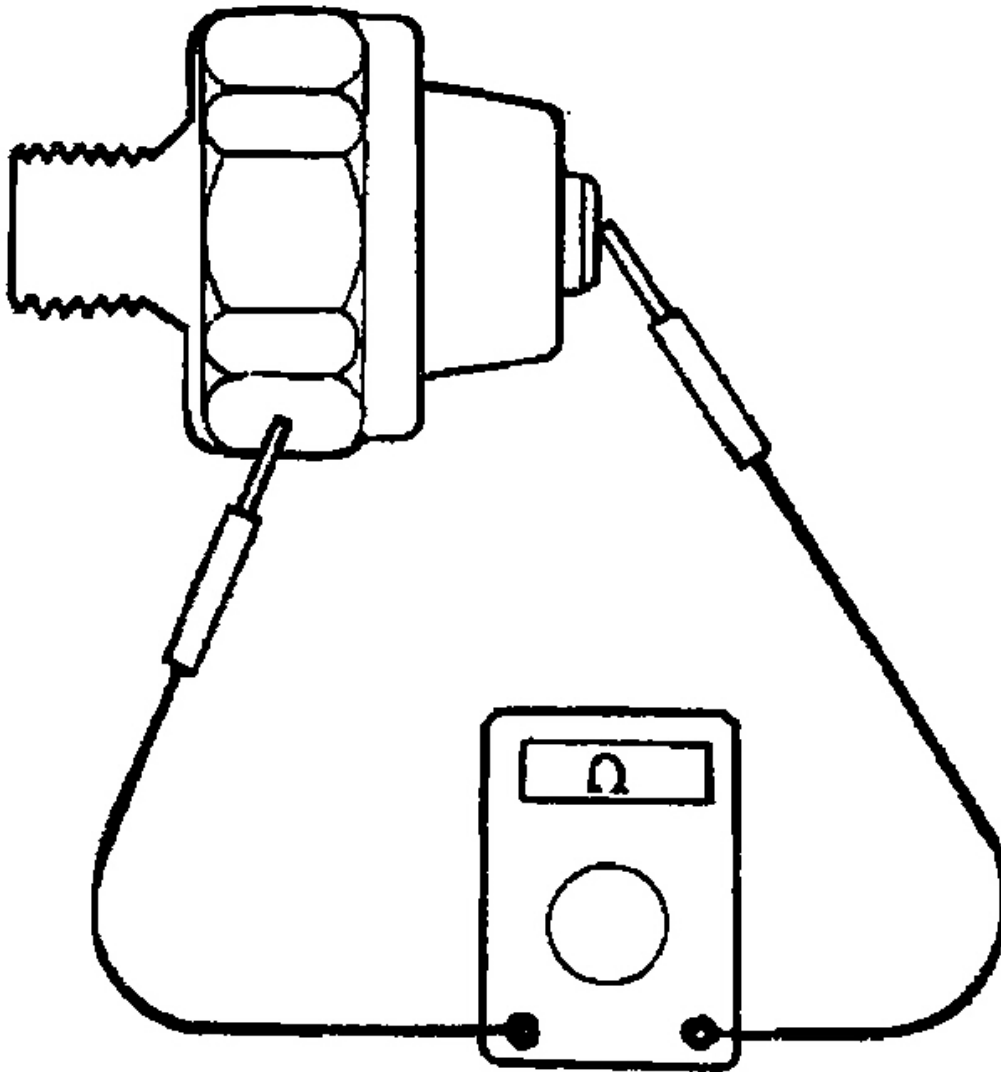
Oil Filter Bracket

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.



G00790293

Fig. 111: Checking Oil Pressure Switch Continuity
Courtesy of HYUNDAI MOTOR CO.

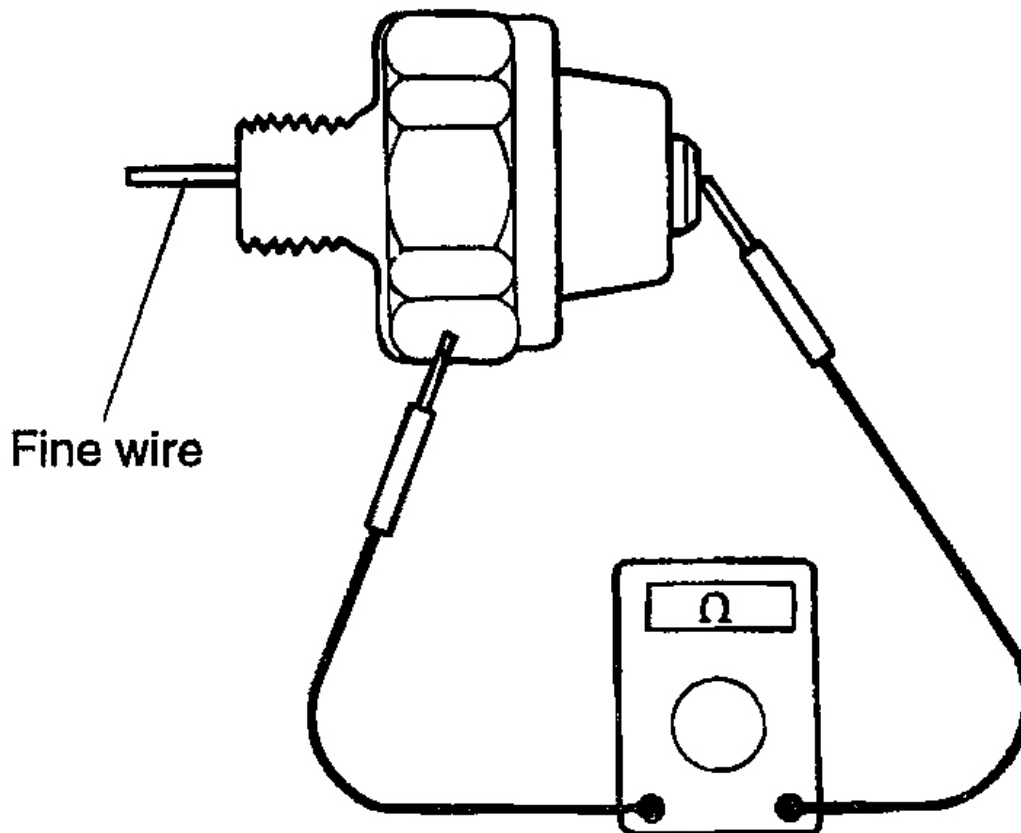
2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.
3. If there is no continuity when a 50 kpa (7 psi) vacuum is applied through the oil hole, the switch is operating properly.

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

Operation Pressure

Oil pressure switch :

20 ~ 40 kpa (0.2 ~ 0.4 kg/cm² . 2.9 ~ 5.8 psi)



G00790294

Fig. 112: Checking Oil Pressure Switch Continuity With Fine Wire
Courtesy of HYUNDAI MOTOR CO.

Reassembly

1. Install the oil pump case with the gasket.

Tightening torque

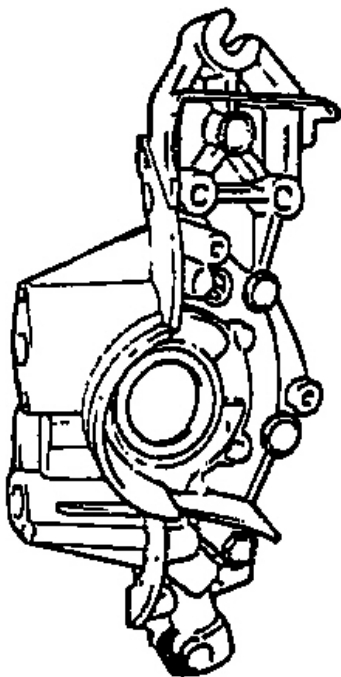
Oil pump case bolt :

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

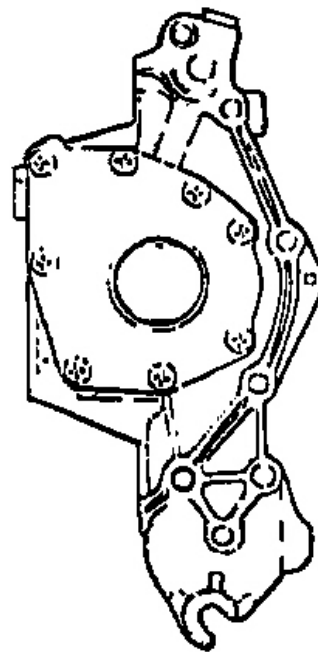
Oil pump cover screw :

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

<Front view>



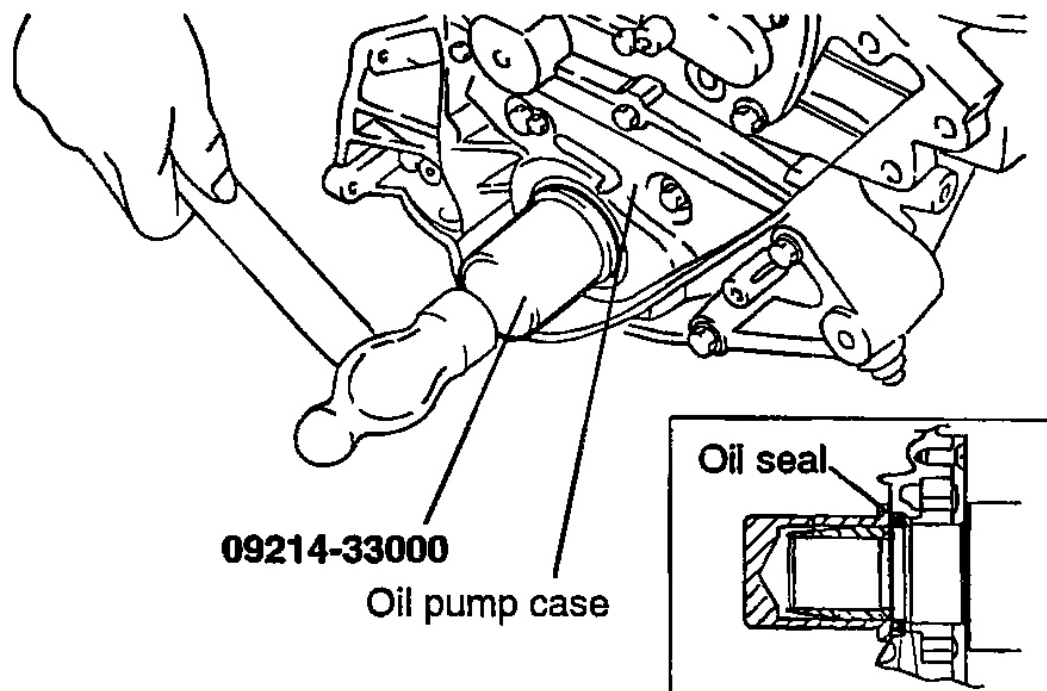
<Rear view>



G00790295

Fig. 113: 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).



G00790296

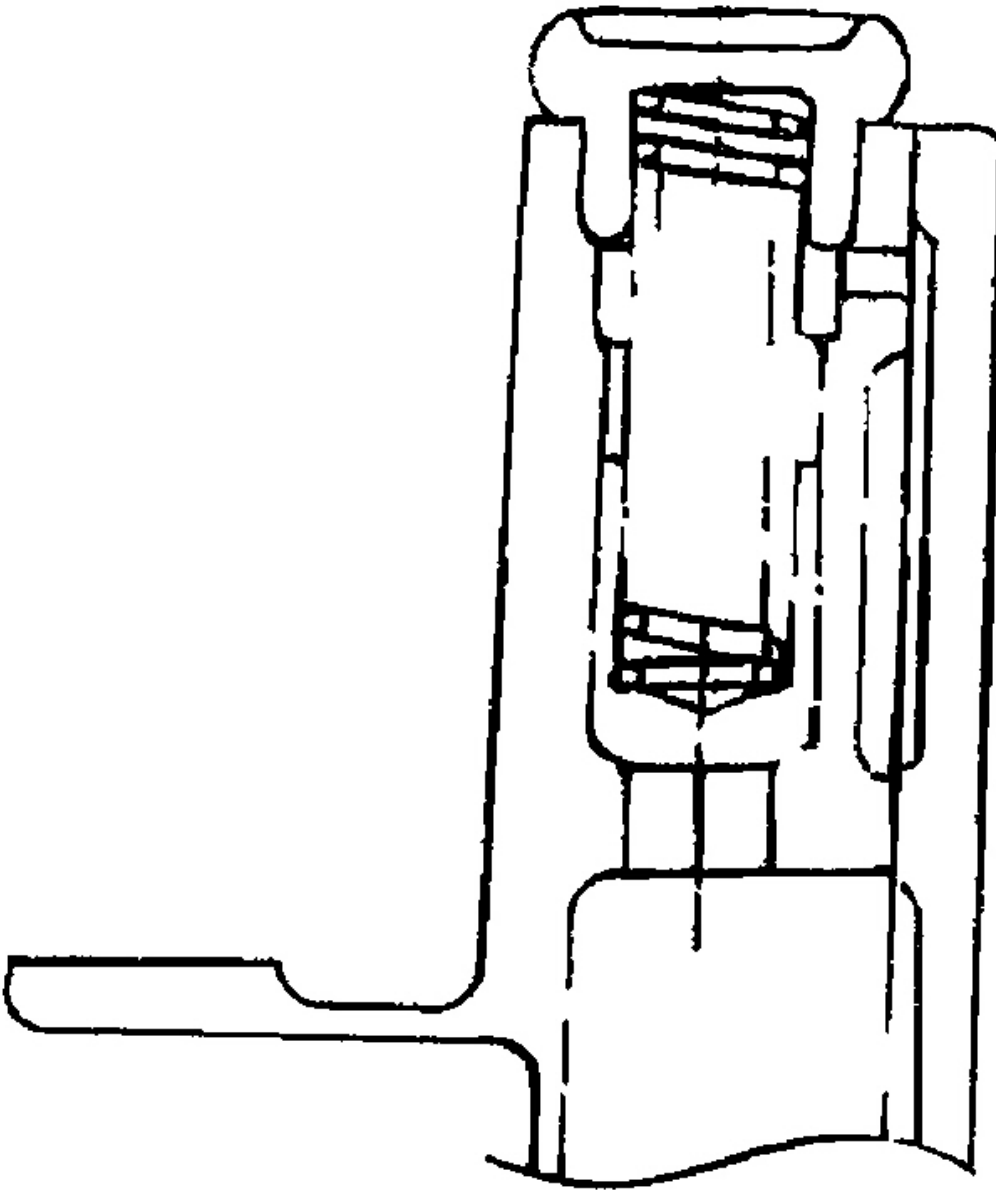
Fig. 114: Installing Oil Seal Into Pump Case
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

Oil relief valve plug

10 ~ 50 Nm (400 ~ 500 kg.cm, 29 ~ 36 lb.ft)



G00790297

Fig. 115: 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 pan flange.

NOTE:

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

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

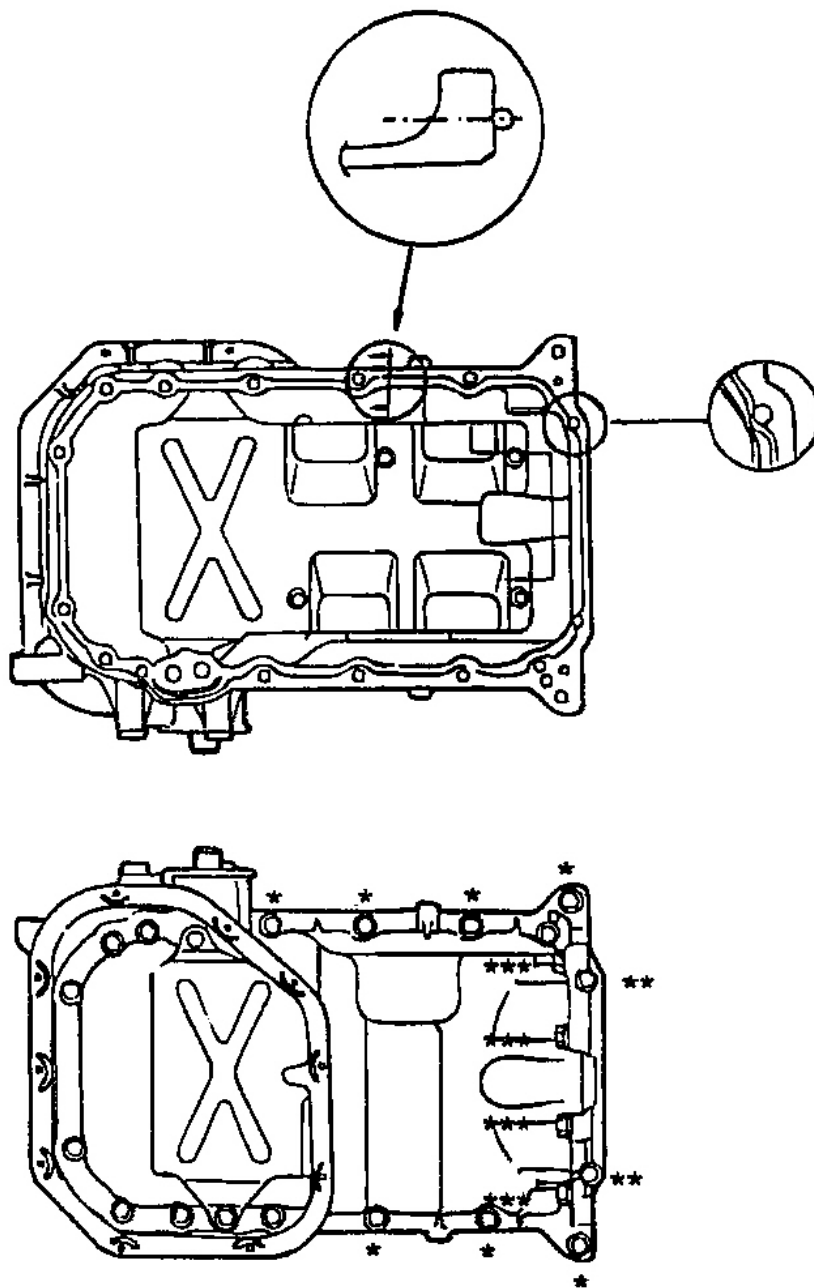
Tightening torque

Oil pan bolt

* : 19 ~ 28 Nm (190 ~ 280 kg.cm, 14 ~ 20 lb.ft)

** : 5 ~ 7 Nm (50 ~ 70 kg.cm, 4 ~ 5 lb.ft)

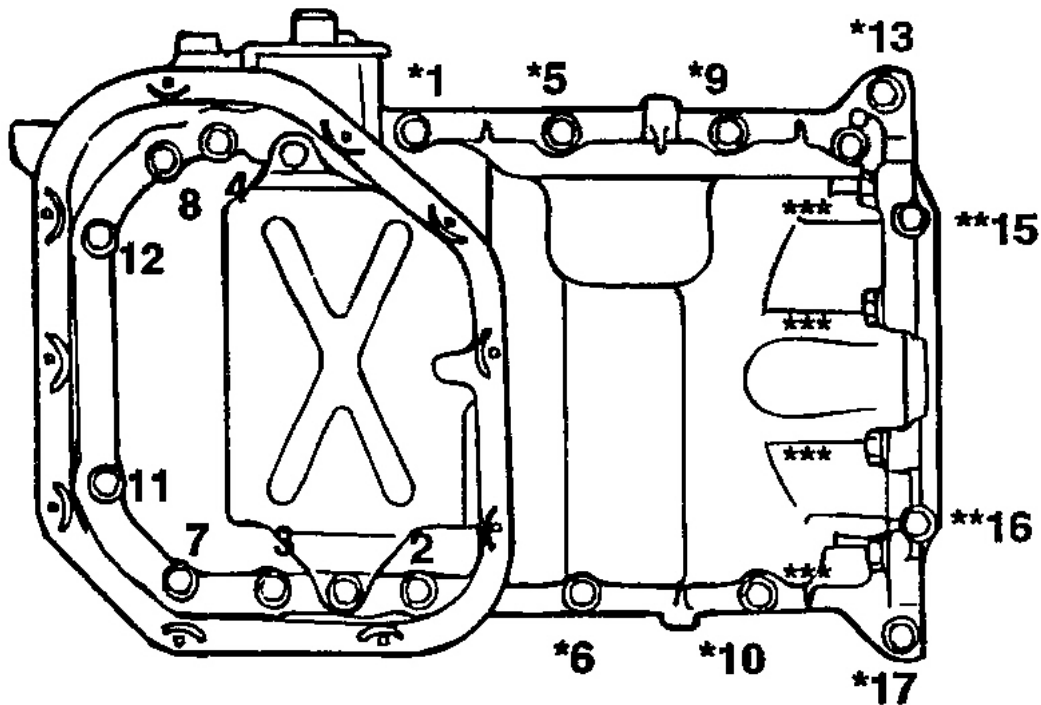
*** : 30 ~ 42 Nm (300 ~ 420 kg.cm, 22 ~ 30 lb.ft)



G00790298

Fig. 116: Identifying Oil Pan
Courtesy of HYUNDAI MOTOR CO.

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



G00790299

Fig. 117: 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 area.

Sealant : Three bond No.1141E 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)

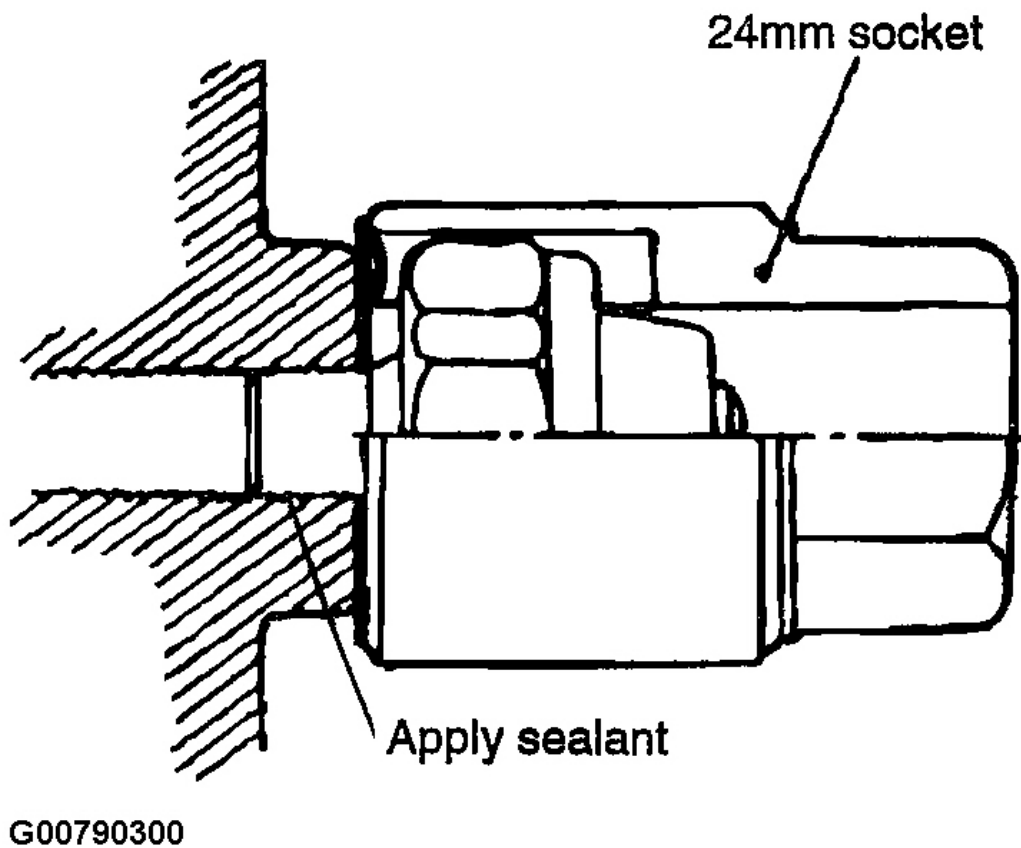
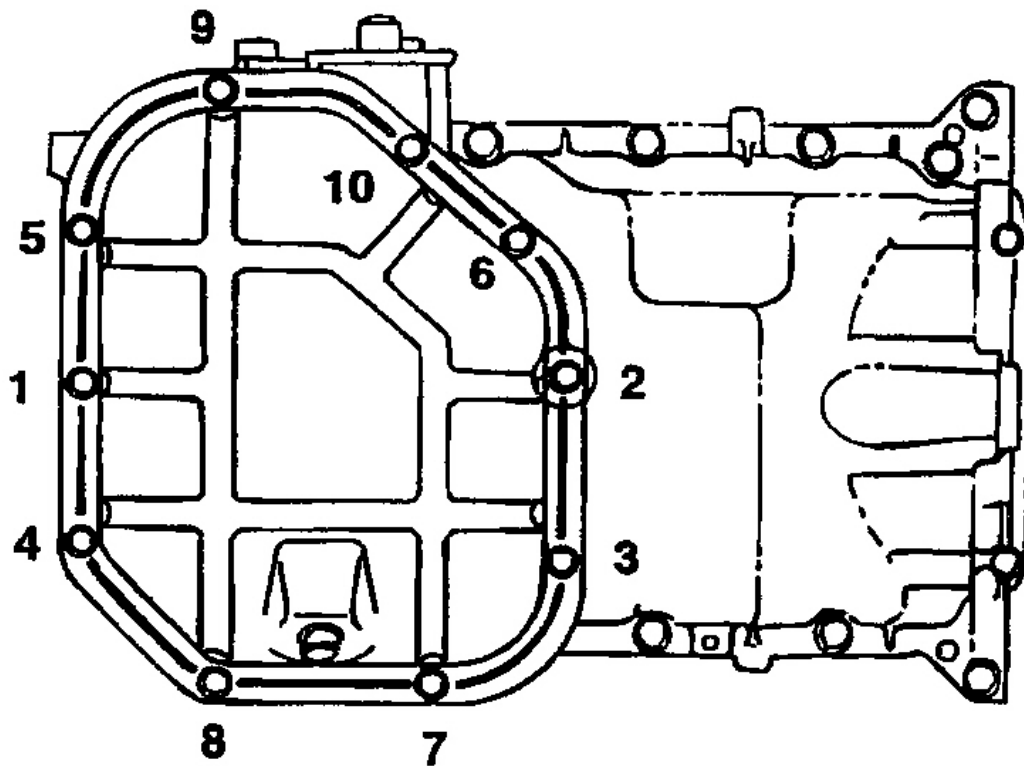


Fig. 118: Installing Oil Pressure Switch
Courtesy of HYUNDAI MOTOR CO.

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



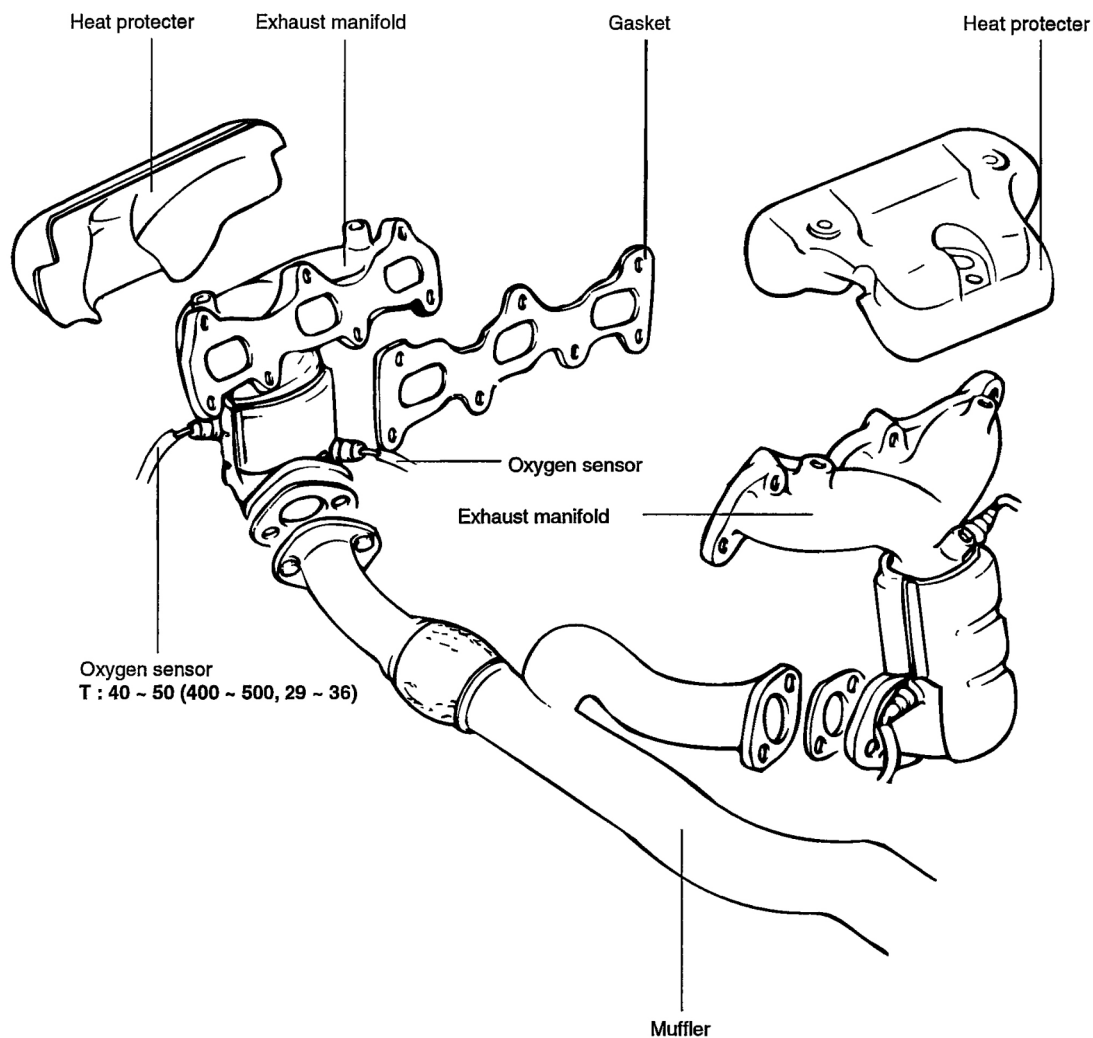
G00790301

Fig. 119: Lower Oil Pan Bolt Torque Sequence
Courtesy of HYUNDAI MOTOR CO.

INTAKE AND EXHAUST SYSTEM

EXHAUST MANIFOLD

Components



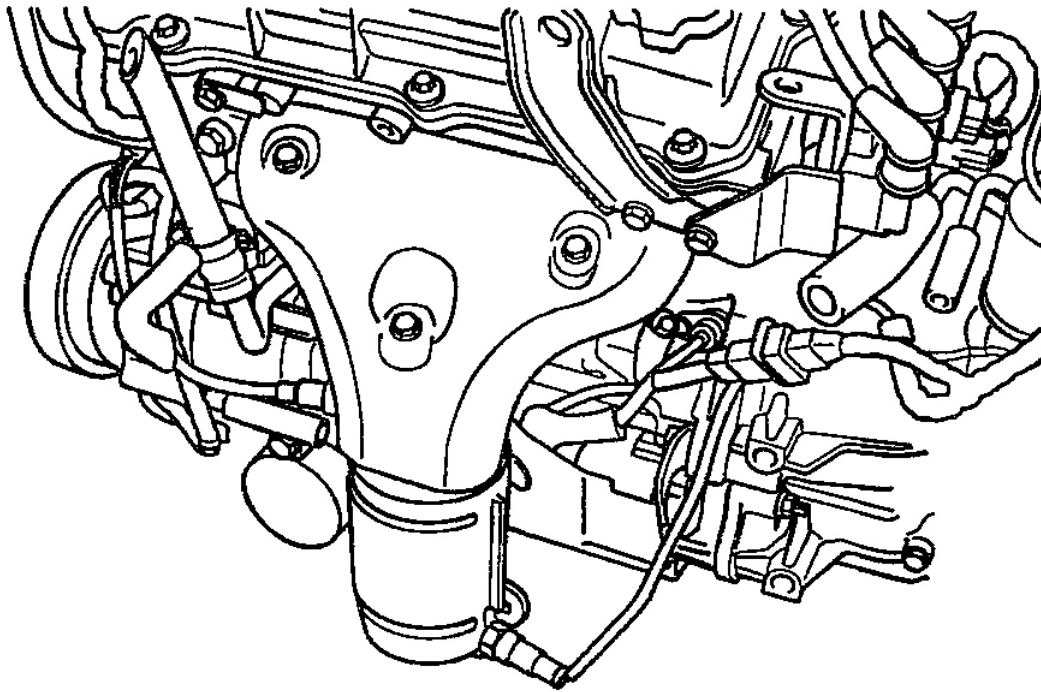
TORQUE : Nm (kg-cm, lb.ft)

G00790302

Fig. 120: Exhaust Manifold Components
Courtesy of HYUNDAI MOTOR CO.

Removal

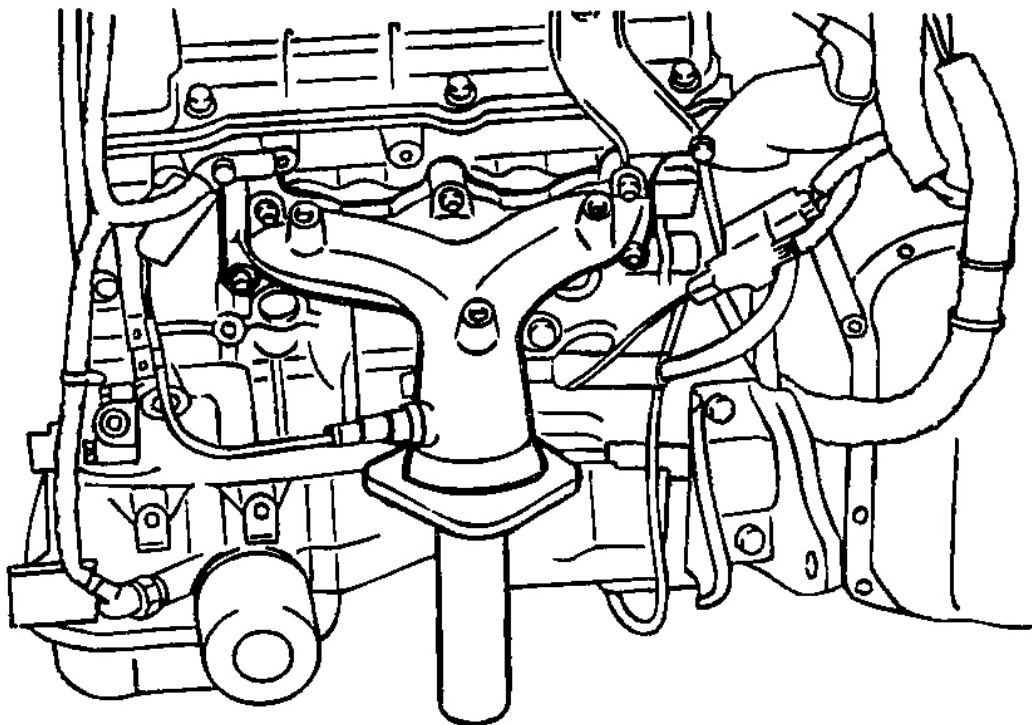
1. Remove the heat protector.



G00790303

Fig. 121: Identifying Heat Protector
Courtesy of HYUNDAI MOTOR CO.

2. Remove the exhaust manifold.



G00790304

Fig. 122: Identifying Exhaust Manifold
Courtesy of HYUNDAI MOTOR CO.

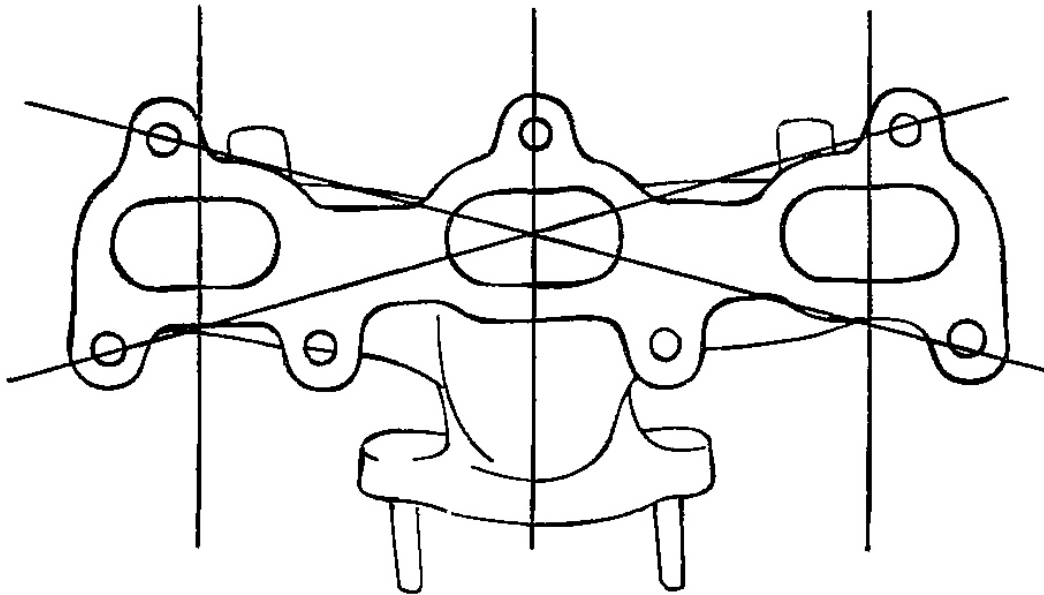
3. Remove the exhaust manifold gasket.

Inspection

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

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

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



G00790305

Fig. 123: Checking Exhaust Manifold Flange
Courtesy of HYUNDAI MOTOR CO.

3. Check the exhaust manifold for damage and cracks.

Installation

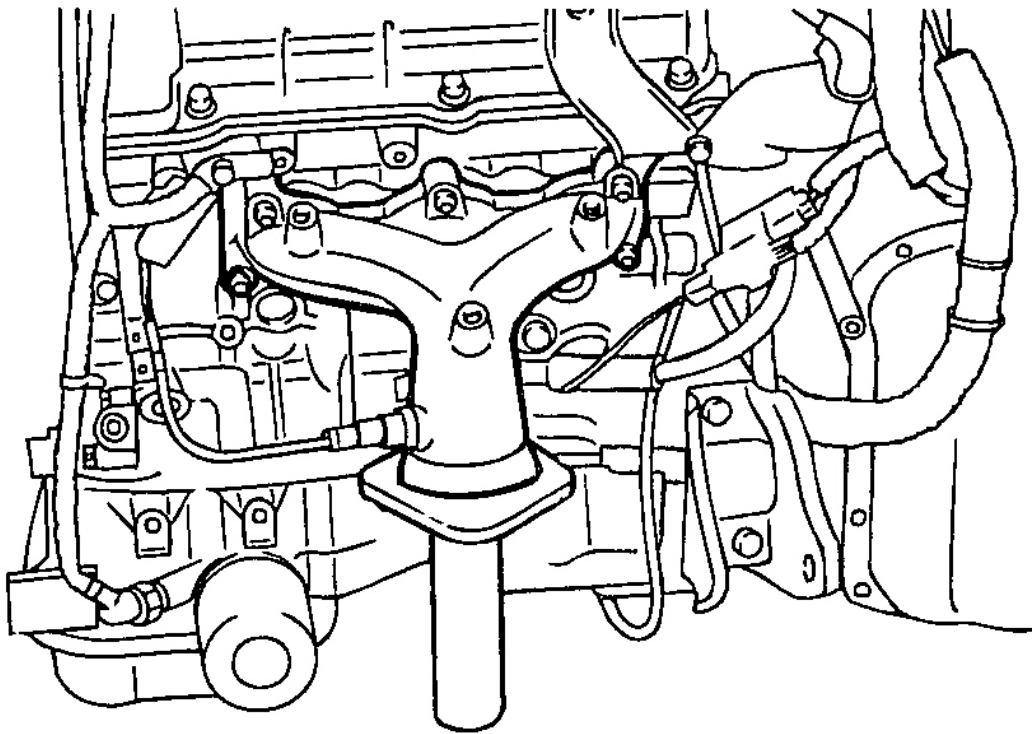
1. Install the exhaust manifold with gasket.

Tightening torque

Exhaust manifold :

30 ~ 35 Nm (300 ~ 350 kg.cm, 22 ~ 26 lb.ft)

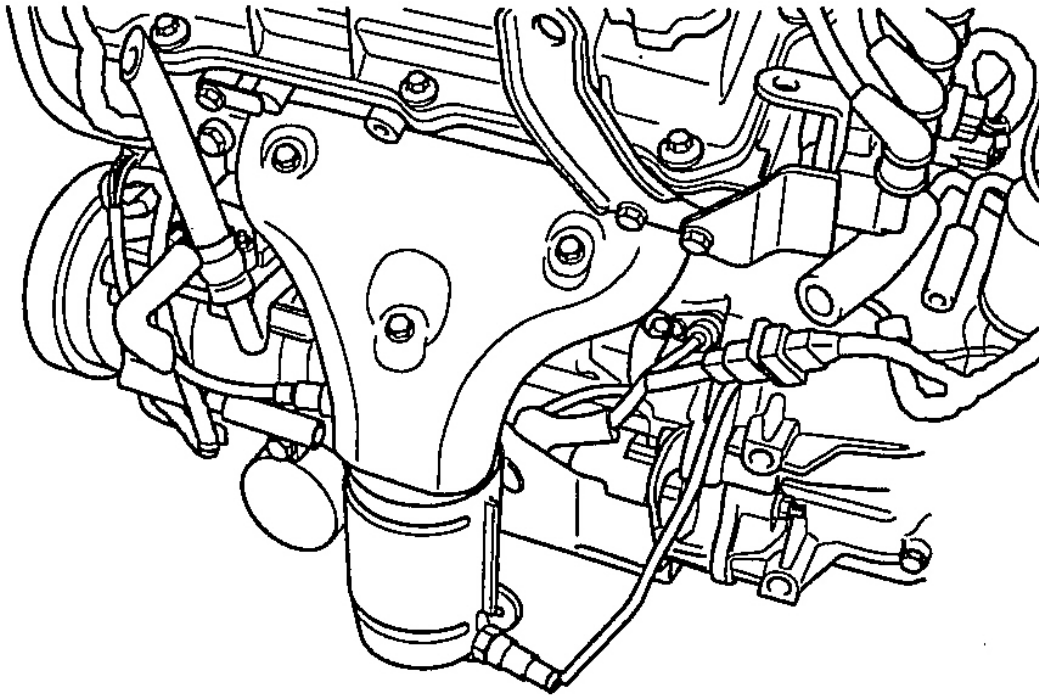
NOTE: **Do not re - use an exhaust manifold gasket.**



G00790306

Fig. 124: Installing Exhaust Manifold
Courtesy of HYUNDAI MOTOR CO.

2. Install the heat protector.

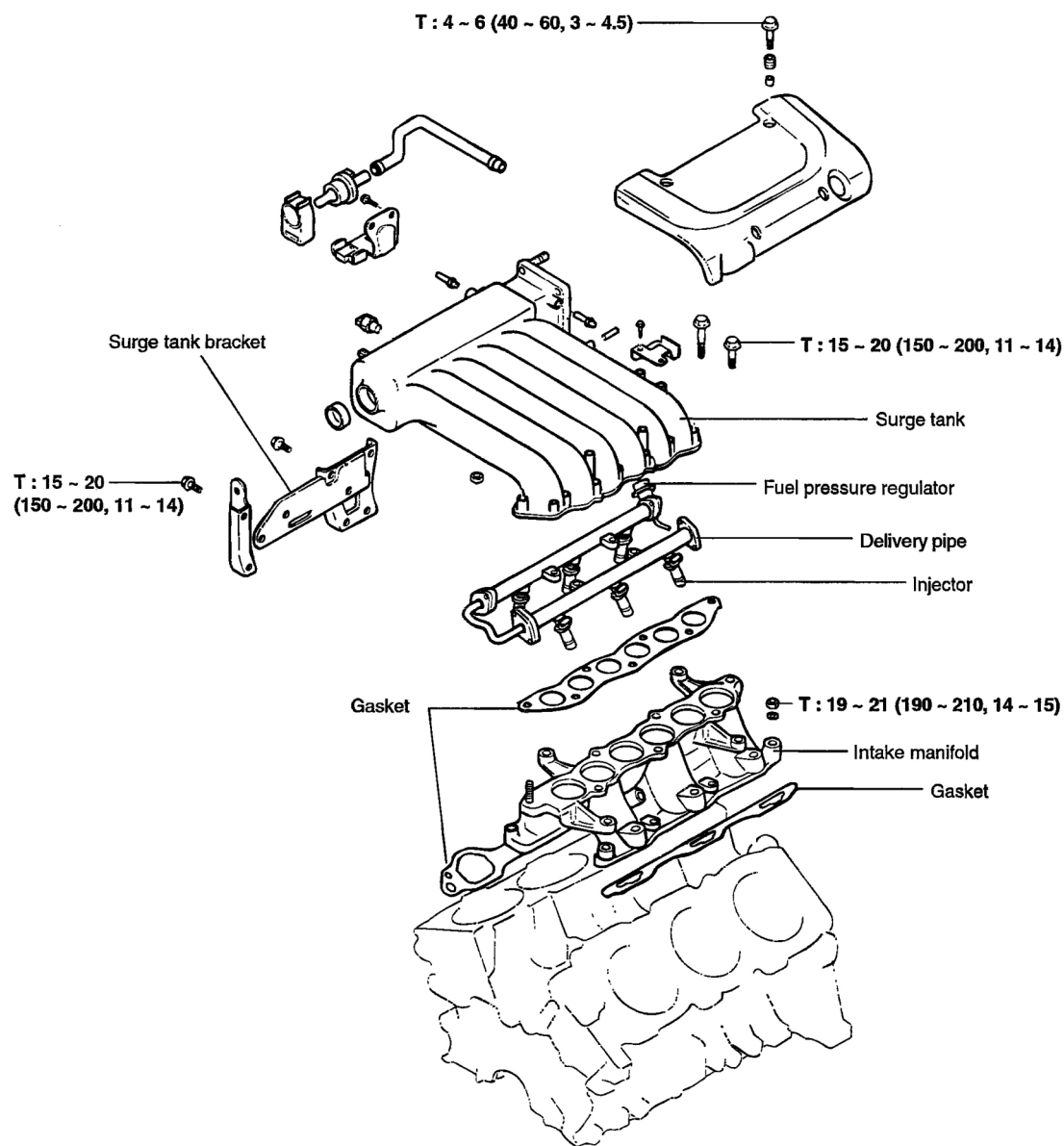


G00790307

Fig. 125: Identifying Heat Protector
Courtesy of HYUNDAI MOTOR CO.

INTAKE MANIFOLD

Components



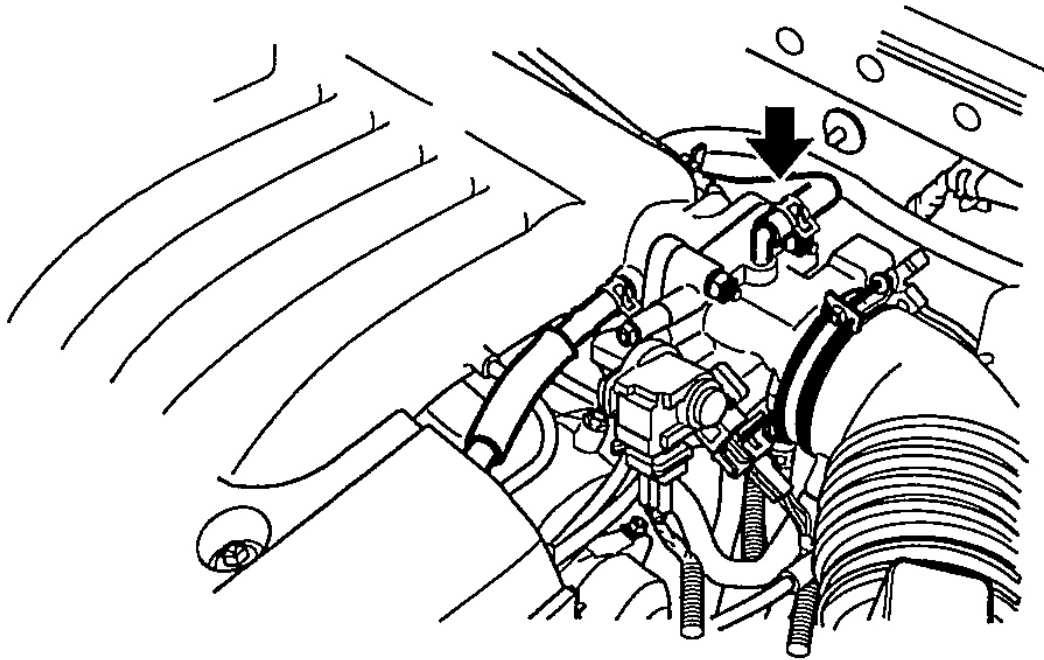
TORQUE : Nm (kg-cm, lb-ft)

G00790308

Fig. 126: Intake Manifold Components
Courtesy of HYUNDAI MOTOR CO.

Removal

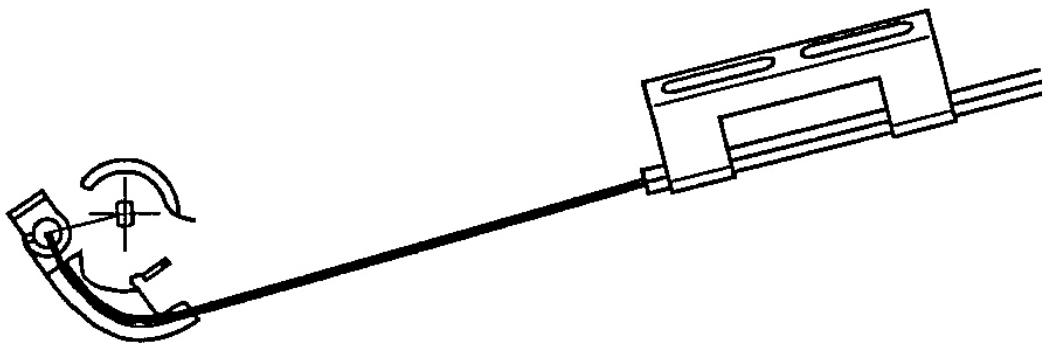
1. Remove the air intake hose connected to the throttle body.



G00790309

Fig. 127: Identifying Air Intake Hose & Throttle Body
Courtesy of HYUNDAI MOTOR CO.

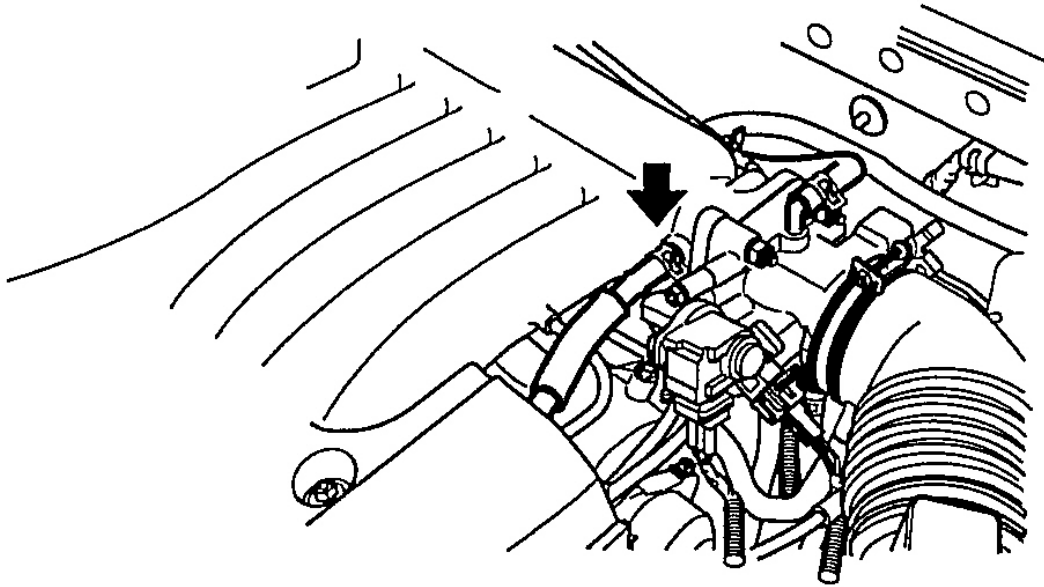
2. Remove the accelerator and cruise control cables.



G00790310

Fig. 128: Identifying Accelerator & Cruise Control Cables
Courtesy of HYUNDAI MOTOR CO.

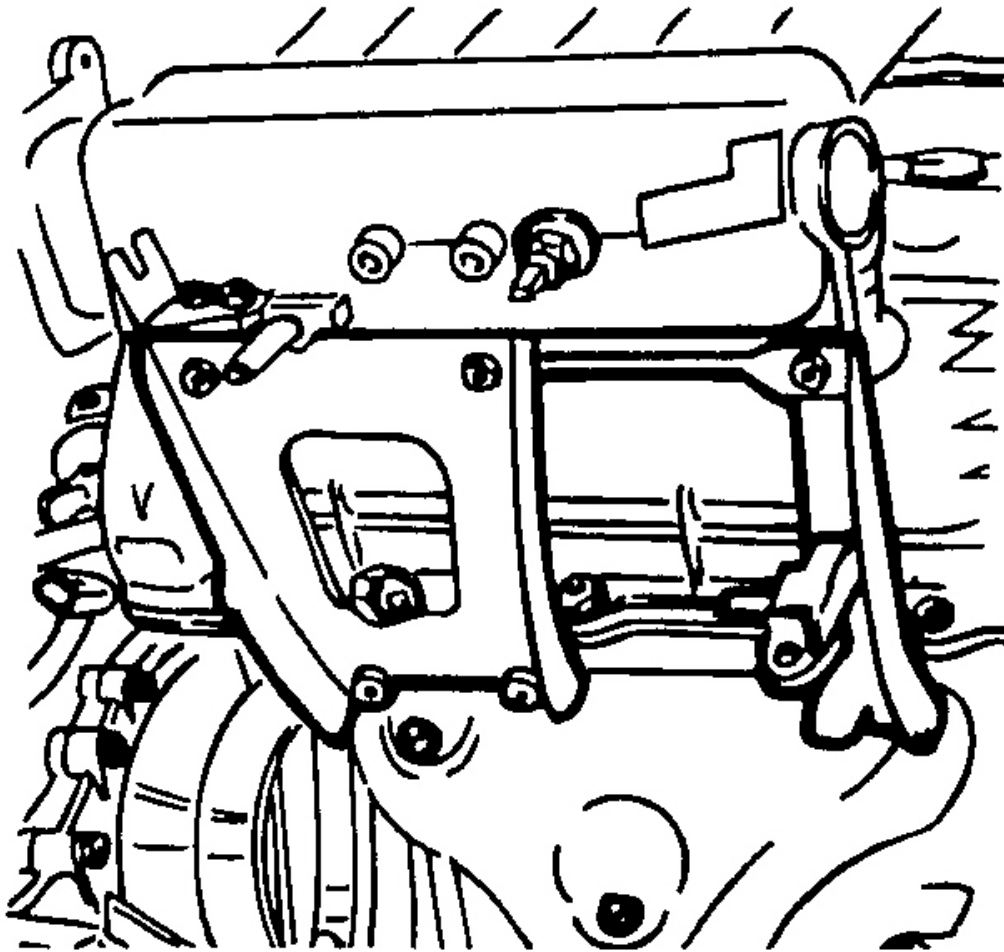
3. Remove the engine coolant hose and throttle body.
4. Remove the P.C.V. hose and brake booster vacuum hoses.
5. Disconnect the vacuum hose connections.



G00790311

Fig. 129: Identifying Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

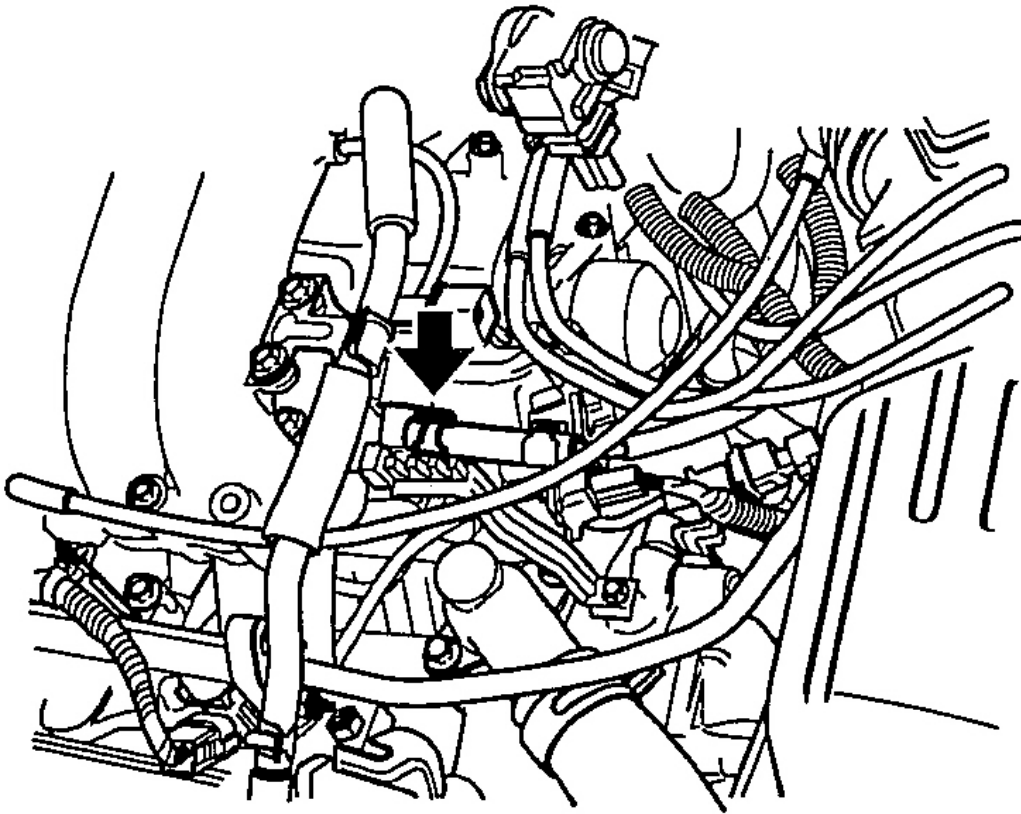
6. Remove the air intake surge tank stay.



G00790312

Fig. 130: View Of Air Intake Surge Tank
Courtesy of HYUNDAI MOTOR CO.

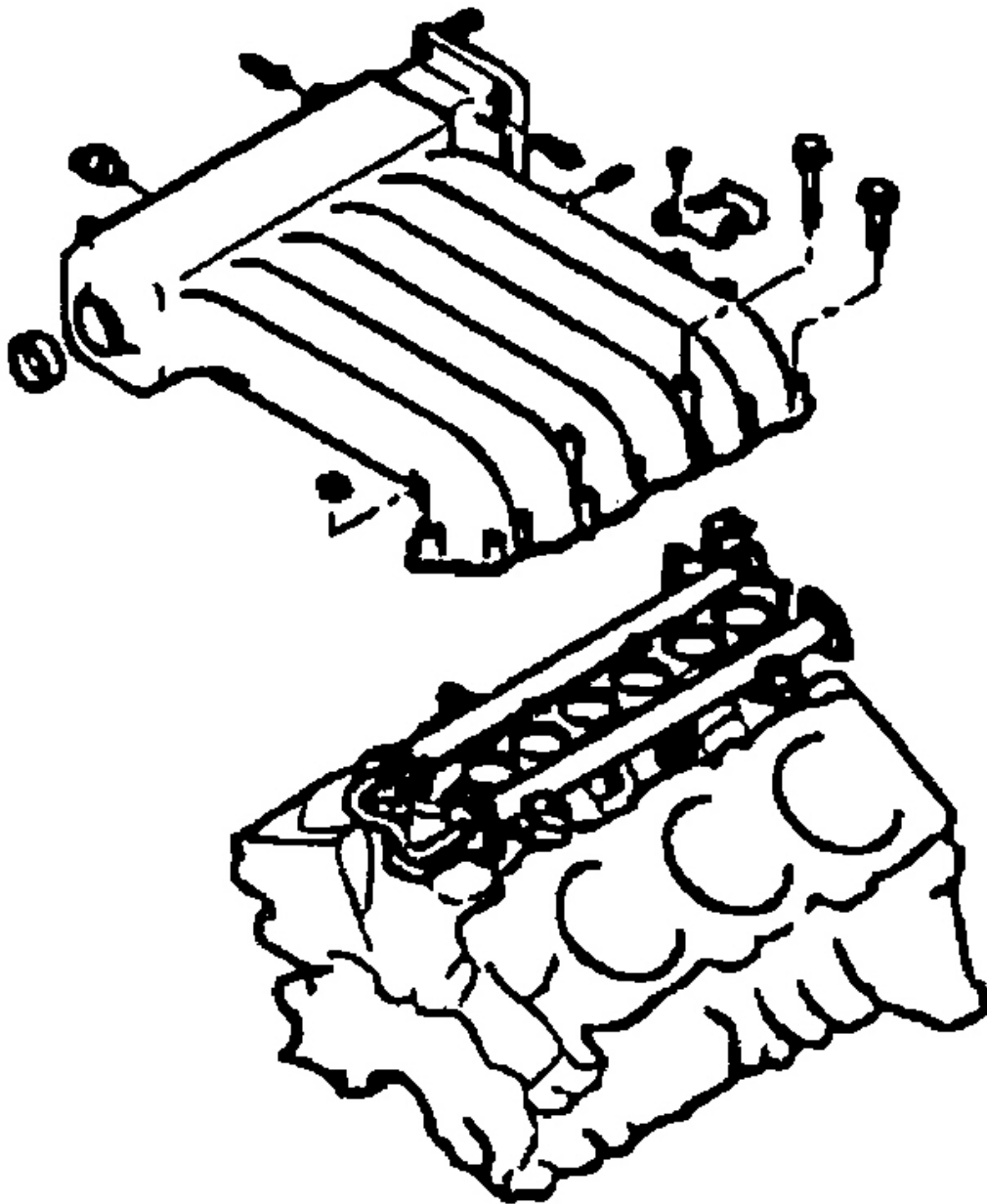
7. Bleed off the pressure in the fuel pipe line to prevent the fuel from spilling.
8. Disconnect the connector from high pressure hose.



G00790313

Fig. 131: Identifying High Pressure Hose Connector
Courtesy of HYUNDAI MOTOR CO.

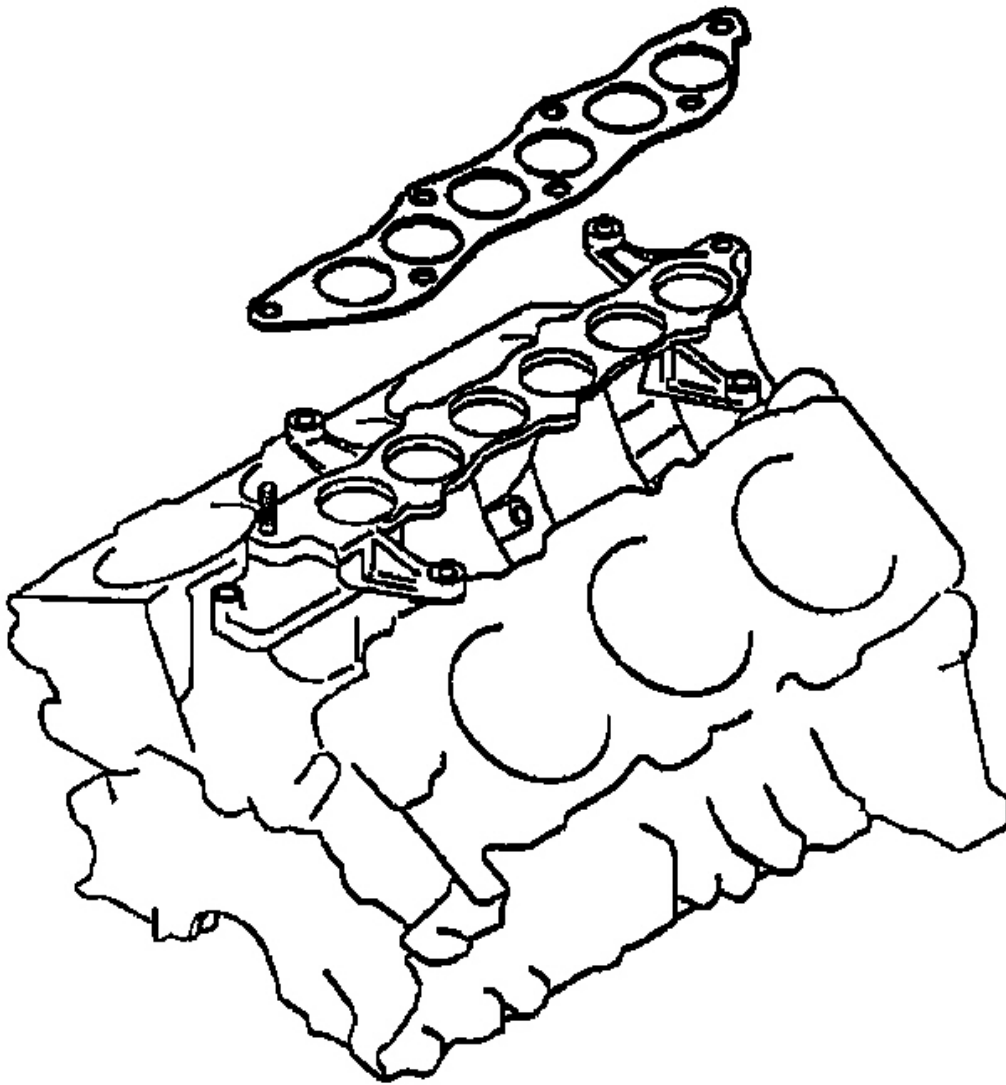
9. Remove the air intake surge tank.



G00790314

Fig. 132: Removing Air Intake Surge Tank
Courtesy of HYUNDAI MOTOR CO.

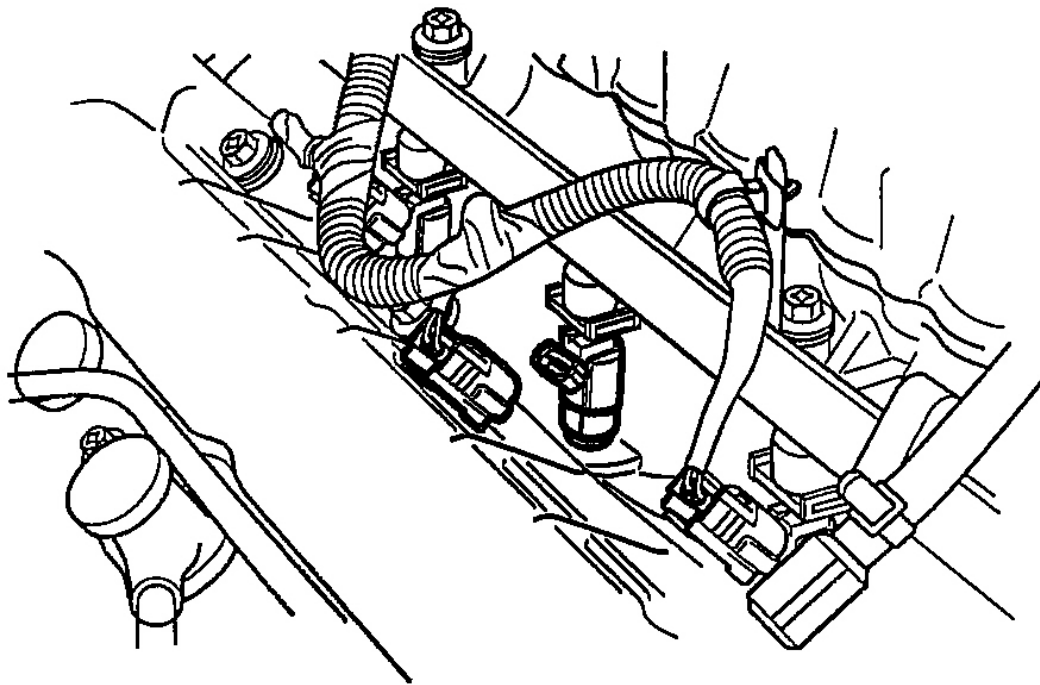
10. Remove the air intake surge tank and gasket.



G00790315

Fig. 133: View Of Air Intake Surge Tank Gasket
Courtesy of HYUNDAI MOTOR CO.

11. Disconnect the fuel injector harness connector.

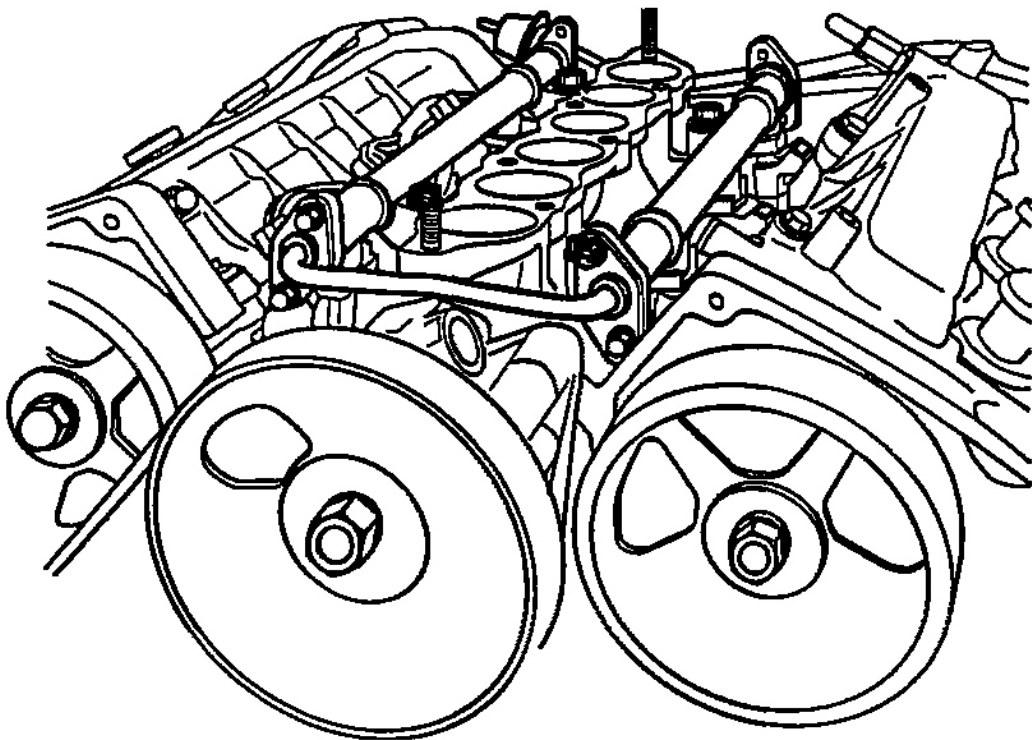


G00790316

Fig. 134: View Of Fuel Injector Harness
Courtesy of HYUNDAI MOTOR CO.

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

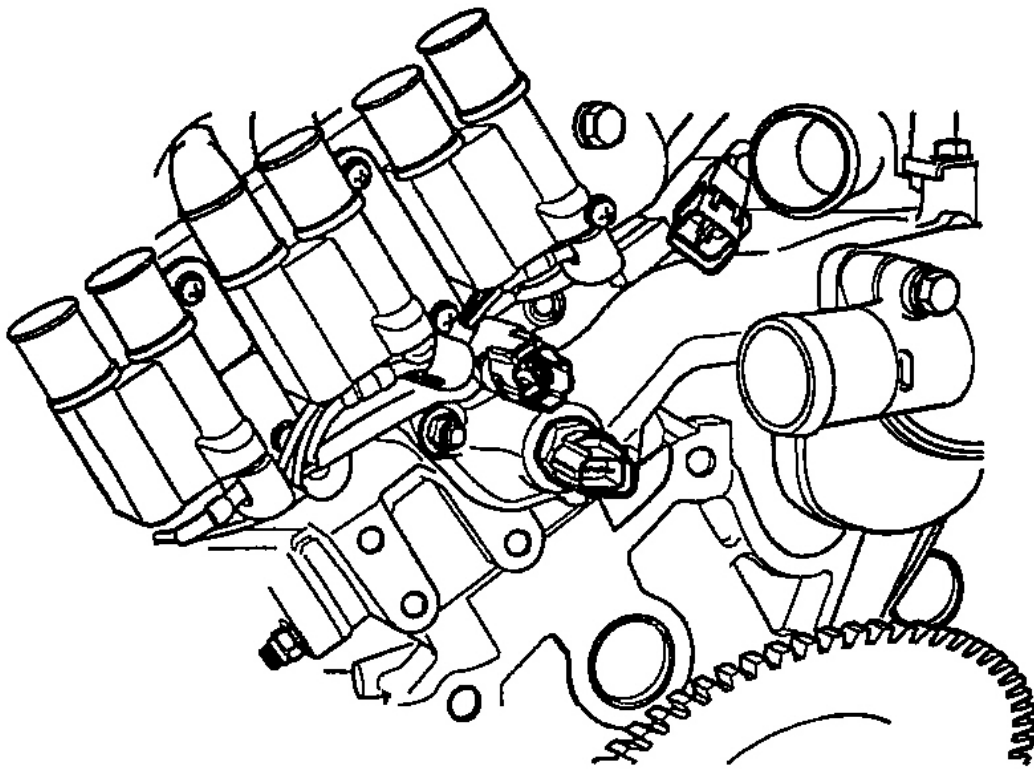
NOTE: When the delivery pipe is removed, be careful not to drop an injector.



G00790317

Fig. 135: View Of Fuel Injector Delivery Pipe
Courtesy of HYUNDAI MOTOR CO.

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



G00790318

Fig. 136: View Of Coolant Sensor
Courtesy of HYUNDAI MOTOR CO.

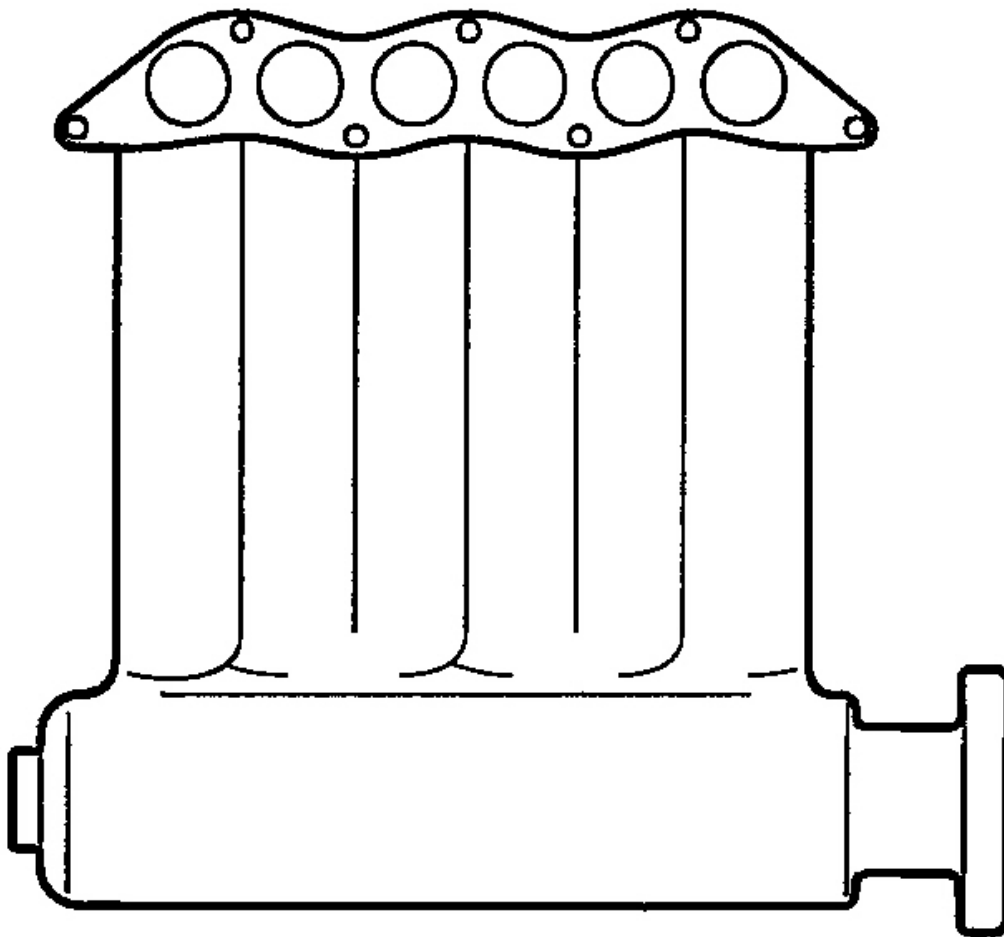
Inspection

Air Intake Surge Tank & Intake Manifold

1. Check the air intake 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.)



G00790319

Fig. 137: Identifying Air Intake Surge Tank Surface For Inspection
Courtesy of HYUNDAI MOTOR CO.

Installation

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

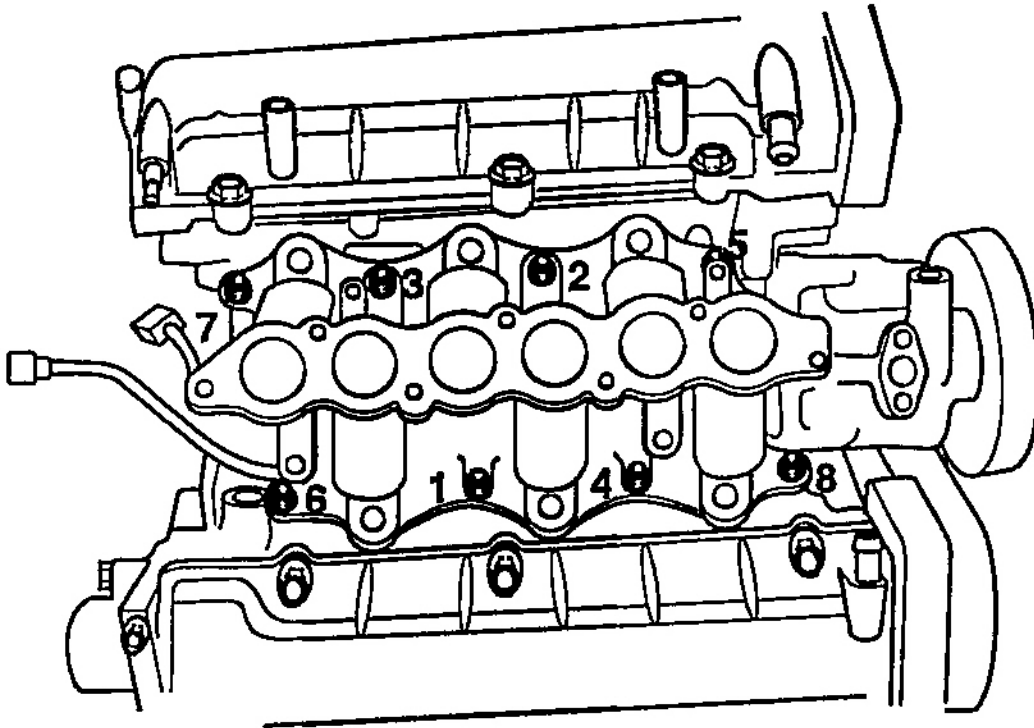
Tightening torque

Intake manifold :

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

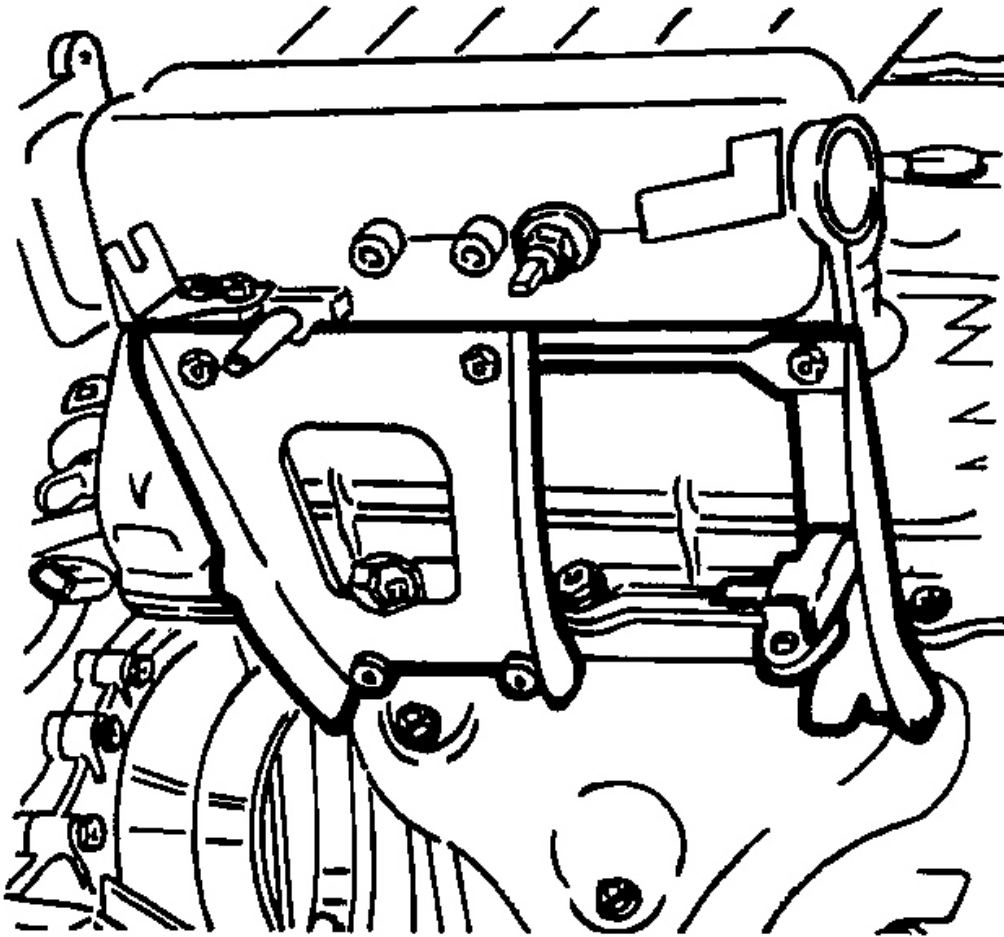
Air intake surge tank :

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



G00790320

Fig. 138: Identifying Intake Manifold Bolt Torque Sequence
Courtesy of HYUNDAI MOTOR CO.

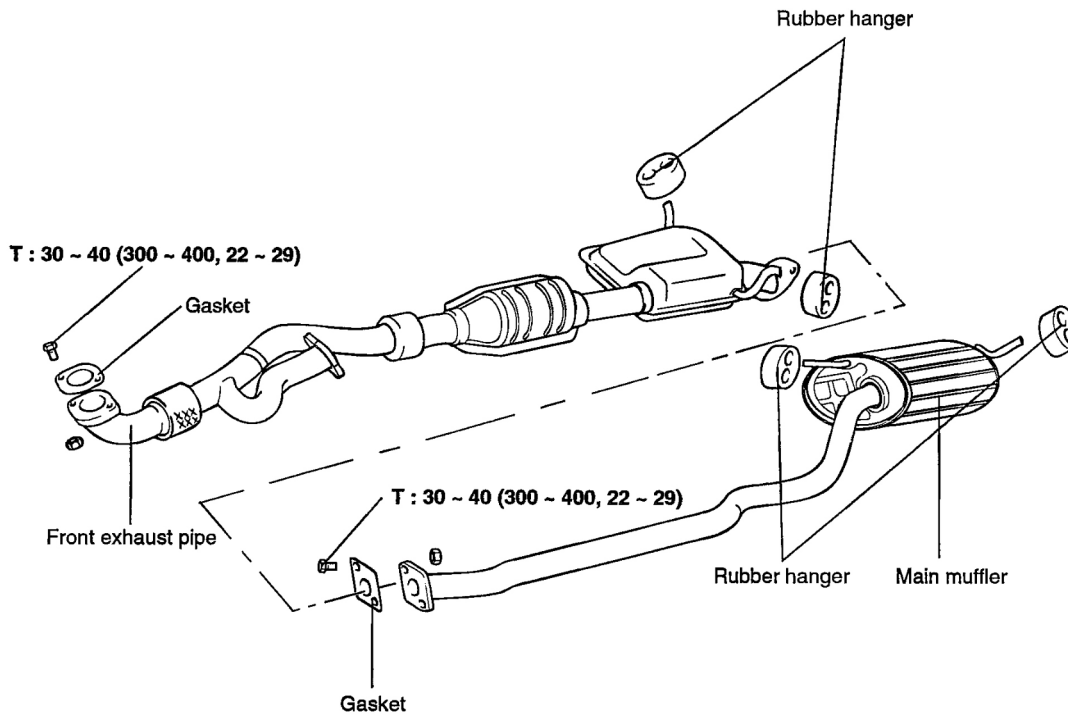


G00790321

Fig. 139: View Of Air Intake Surge Tank
Courtesy of HYUNDAI MOTOR CO.

MUFFLER

Components



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

G00790322

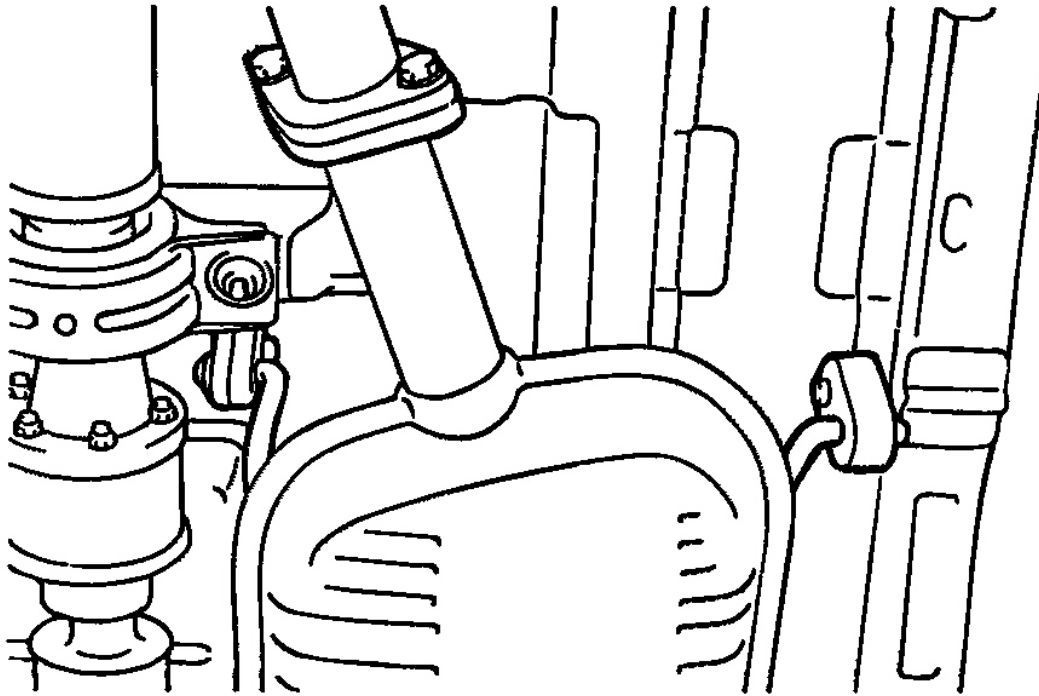
Fig. 140: Muffler Components
Courtesy of HYUNDAI MOTOR CO.

Removal

Main Muffler

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

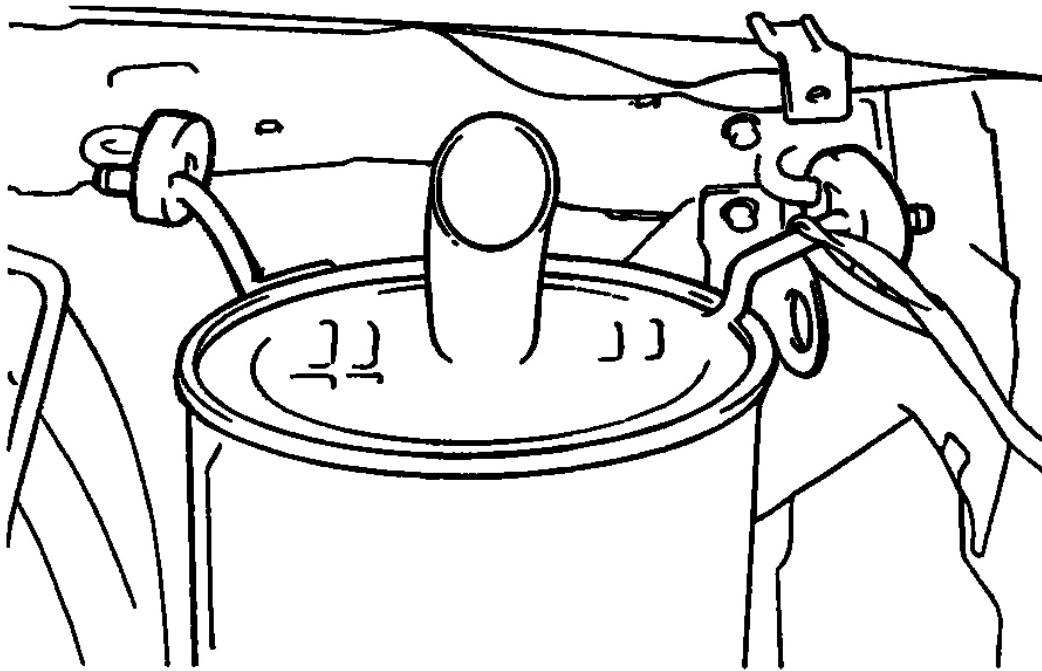
1. Disconnect the main muffler from the center exhaust pipe.



G00790323

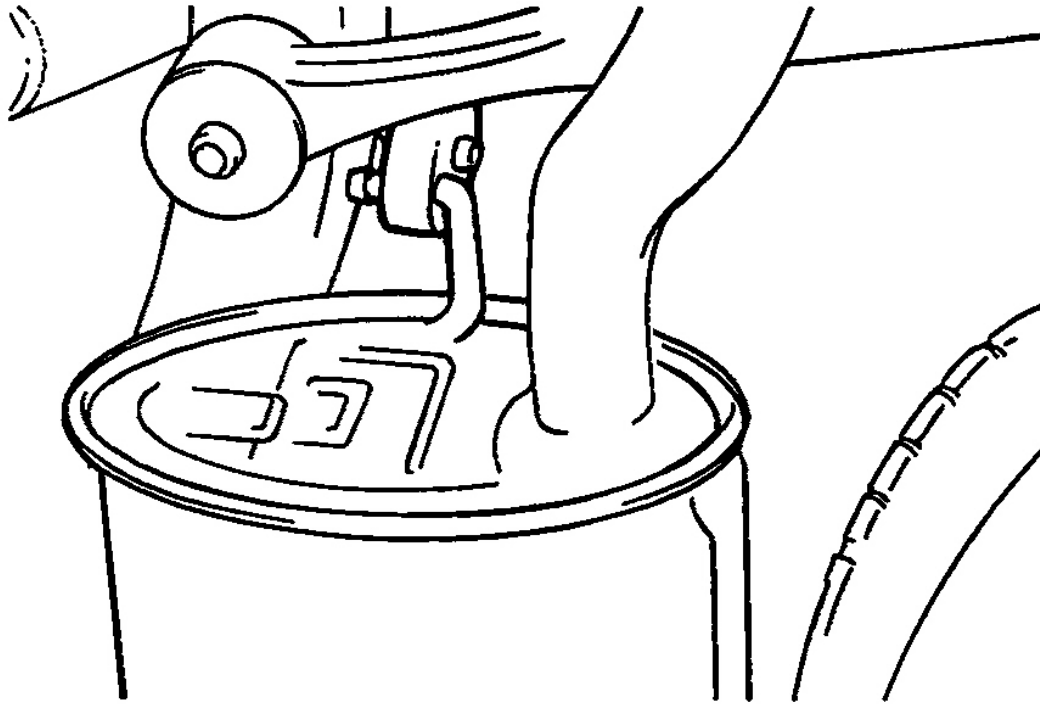
Fig. 141: View Of Exhaust Muffler
Courtesy of HYUNDAI MOTOR CO.

2. Remove the rubber hangers and the main muffler.



G00790324

Fig. 142: View Of Muffler Hangers
Courtesy of HYUNDAI MOTOR CO.

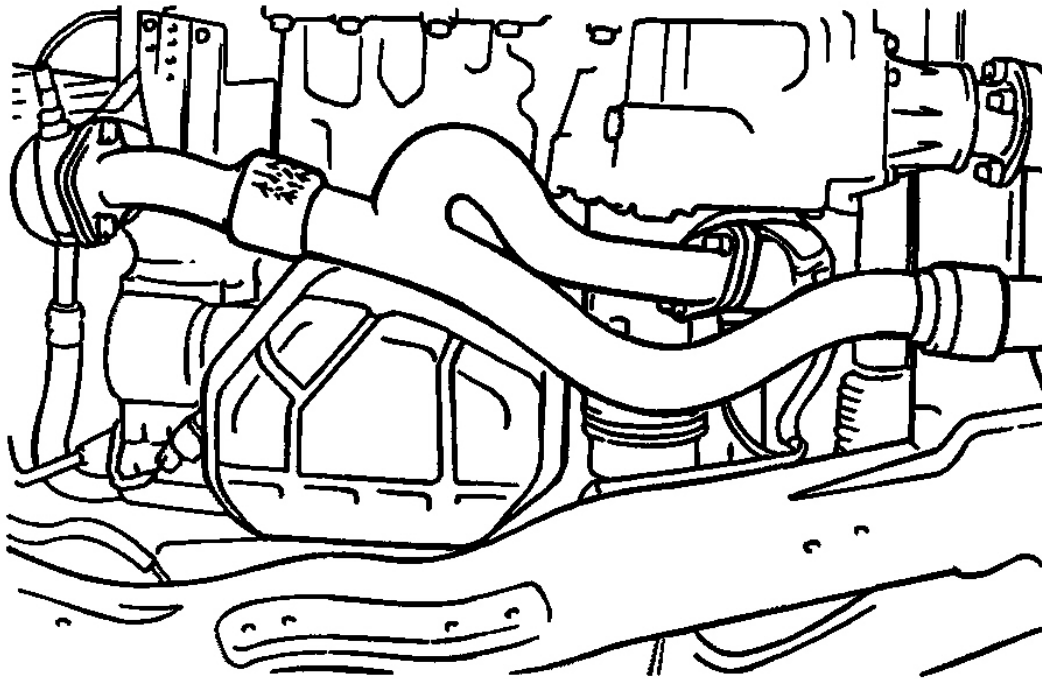


G00790325

Fig. 143: View Of Muffler Hangers
Courtesy of HYUNDAI MOTOR CO.

Front Exhaust Pipe (Including Catalytic Converter)

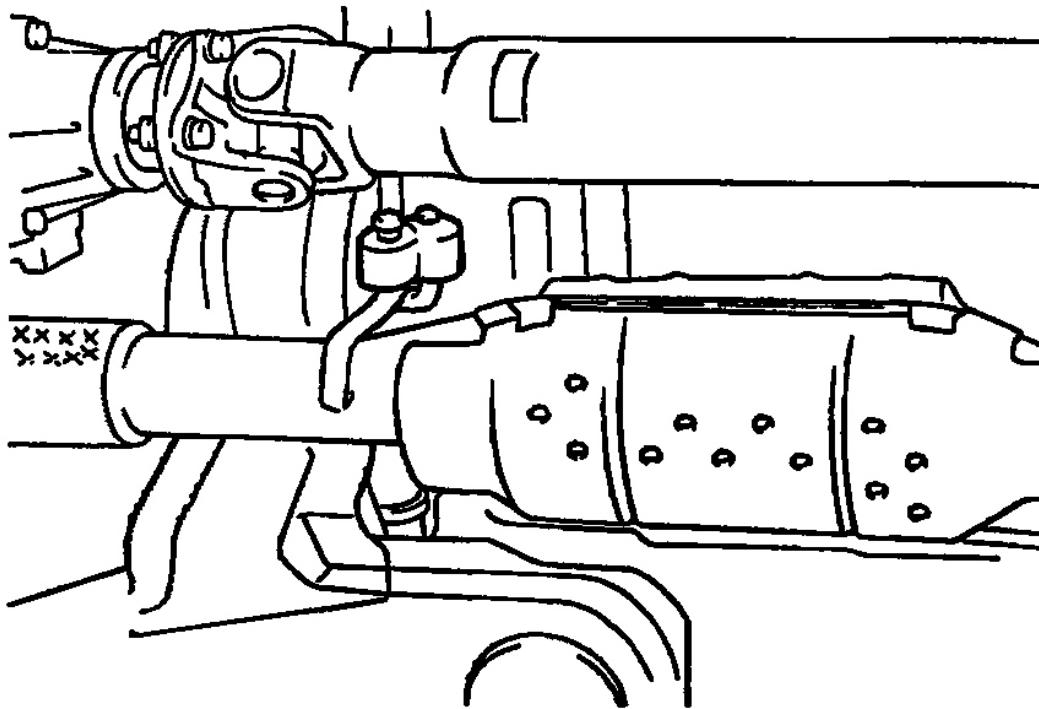
1. Remove the front exhaust pipe from the center exhaust pipe.
2. Remove the front exhaust pipe bolt and the exhaust manifold pipe mounting nuts.



G00790326

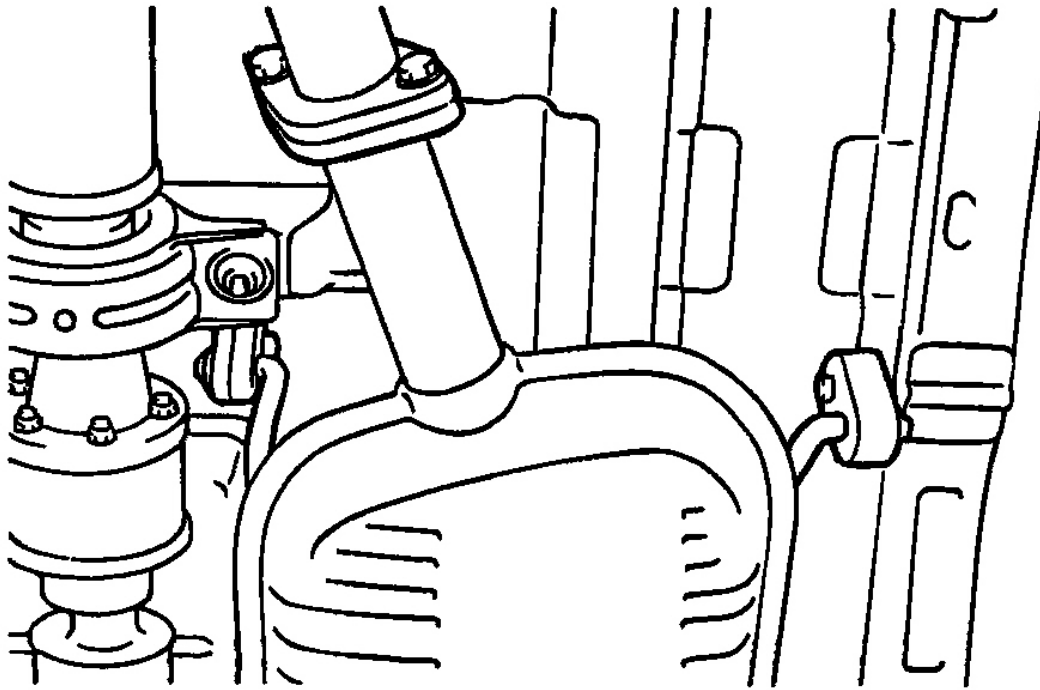
Fig. 144: View Of Exhaust Pipe
Courtesy of HYUNDAI MOTOR CO.

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



G00790327

Fig. 145: View Of Front Exhaust Pipe & Rubber Hanger
Courtesy of HYUNDAI MOTOR CO.



G00790328

Fig. 146: View Of Front Exhaust Pipe & Rubber Hangers
Courtesy of HYUNDAI MOTOR CO.

Inspection

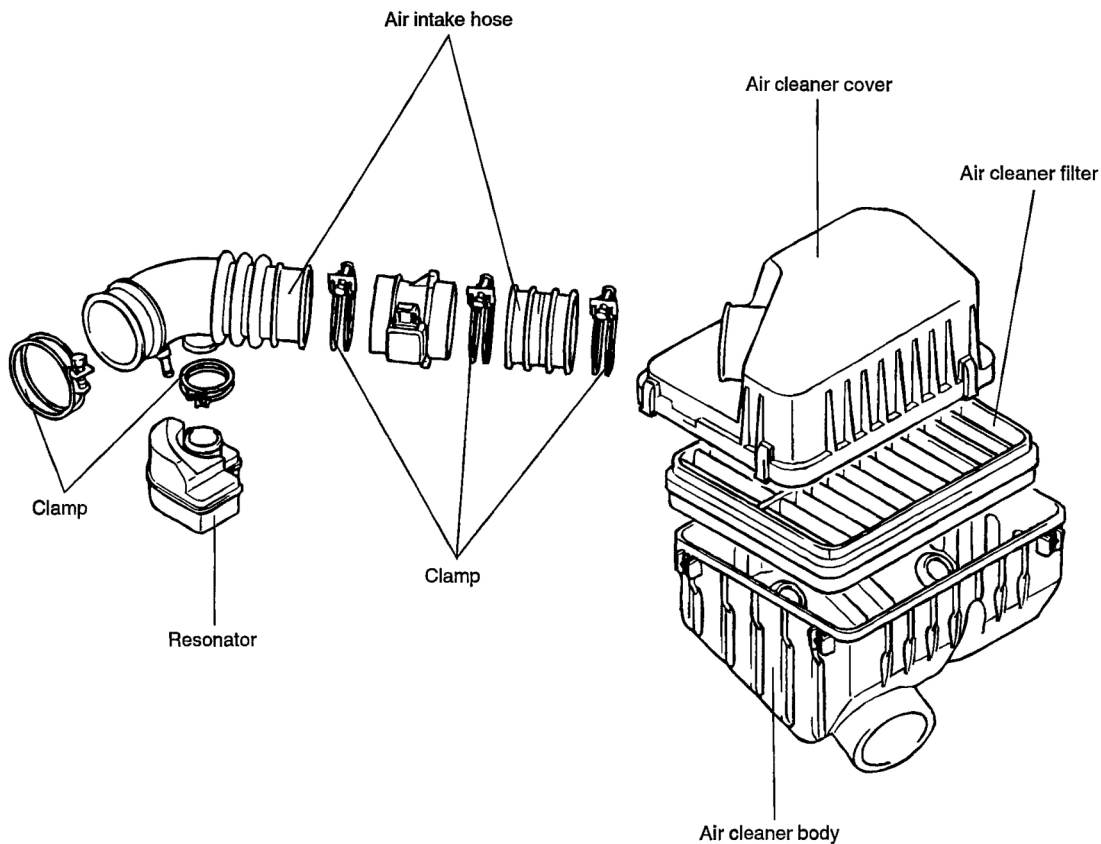
1. Check the mufflers and pipes for leaks, corrosion and damage.
2. Check the rubber hangers for deterioration and cracks.

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

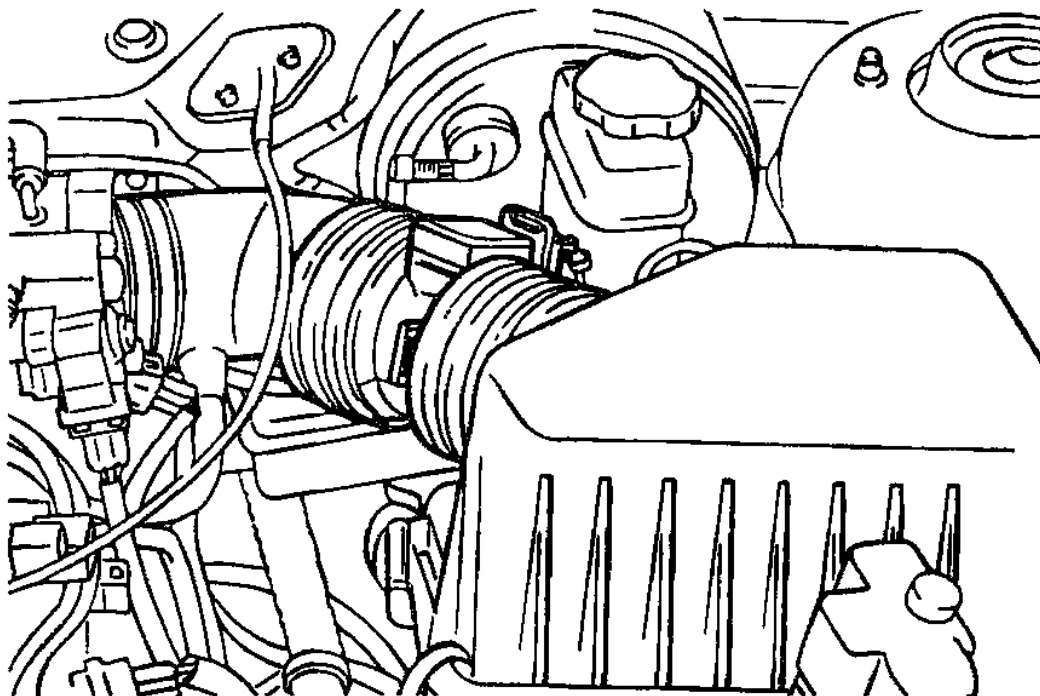


G00790329

Fig. 147: 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.



G00790330

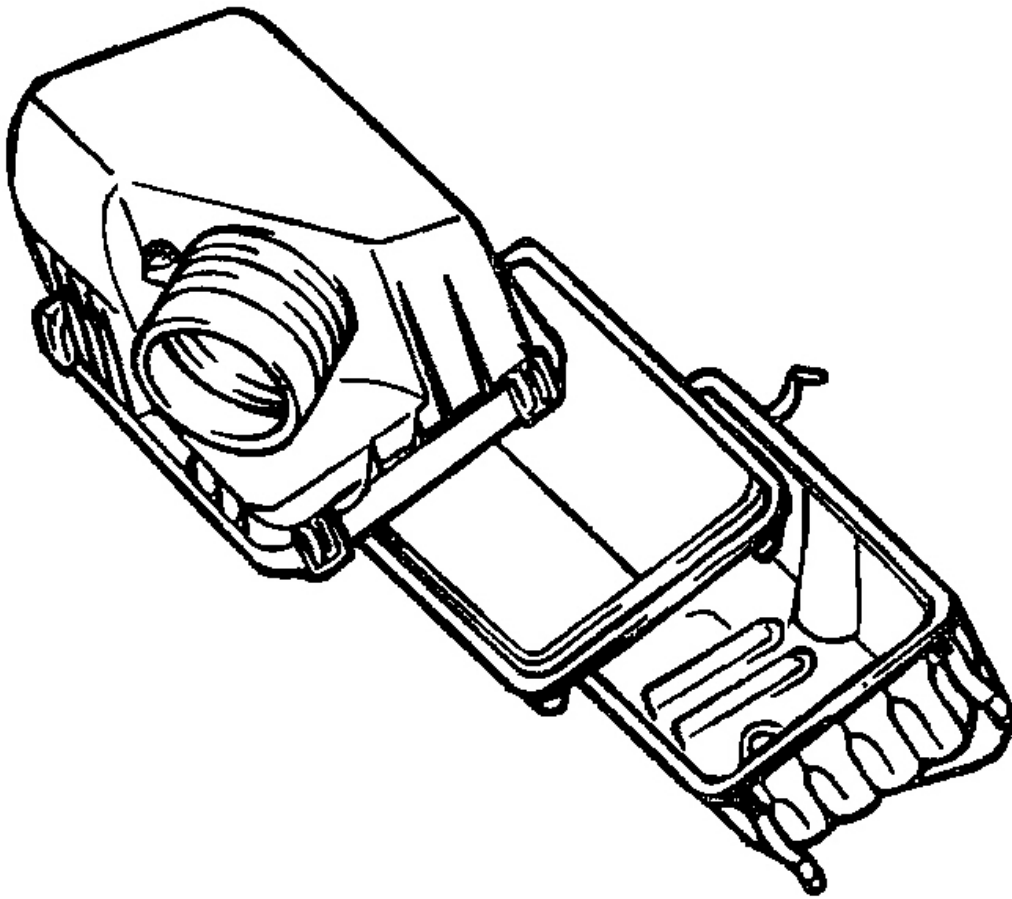
Fig. 148: View Of Air Cleaner
Courtesy of HYUNDAI MOTOR CO.

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.

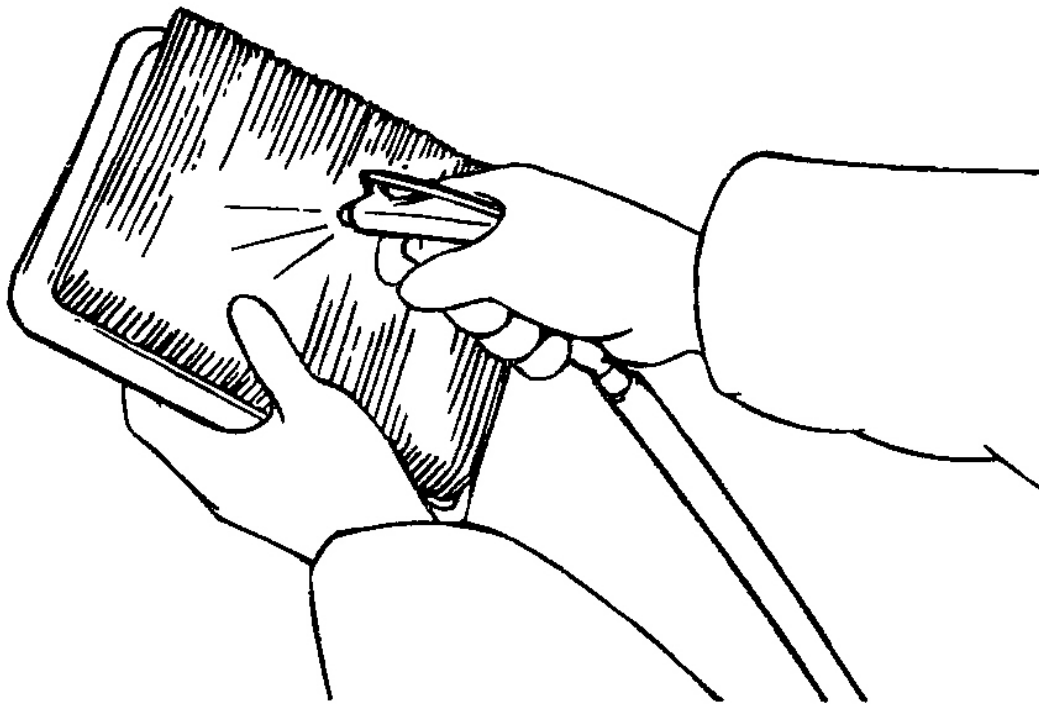


G00790331

Fig. 149: 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.



G00790332

Fig. 150: Cleaning Air Filter

Courtesy of HYUNDAI MOTOR CO.

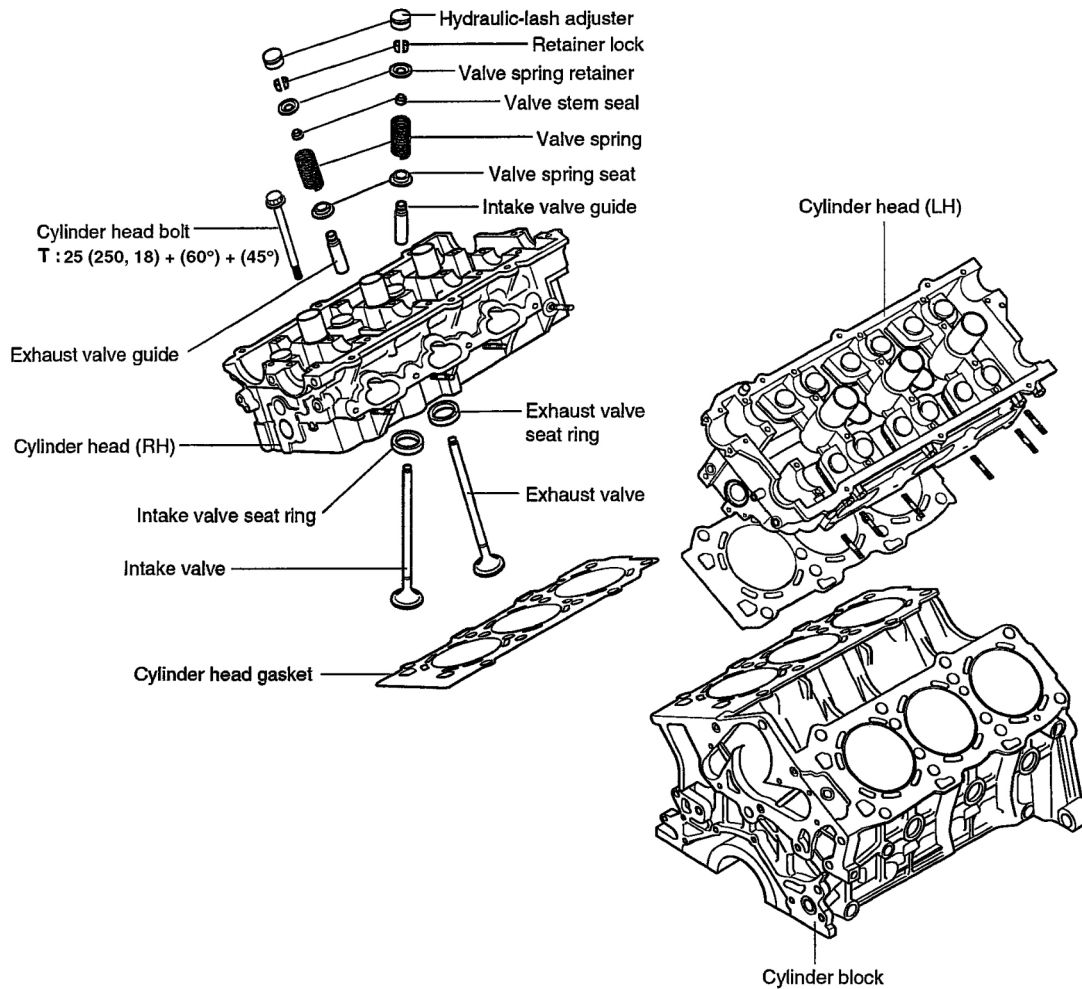
Installation

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

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

Components



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

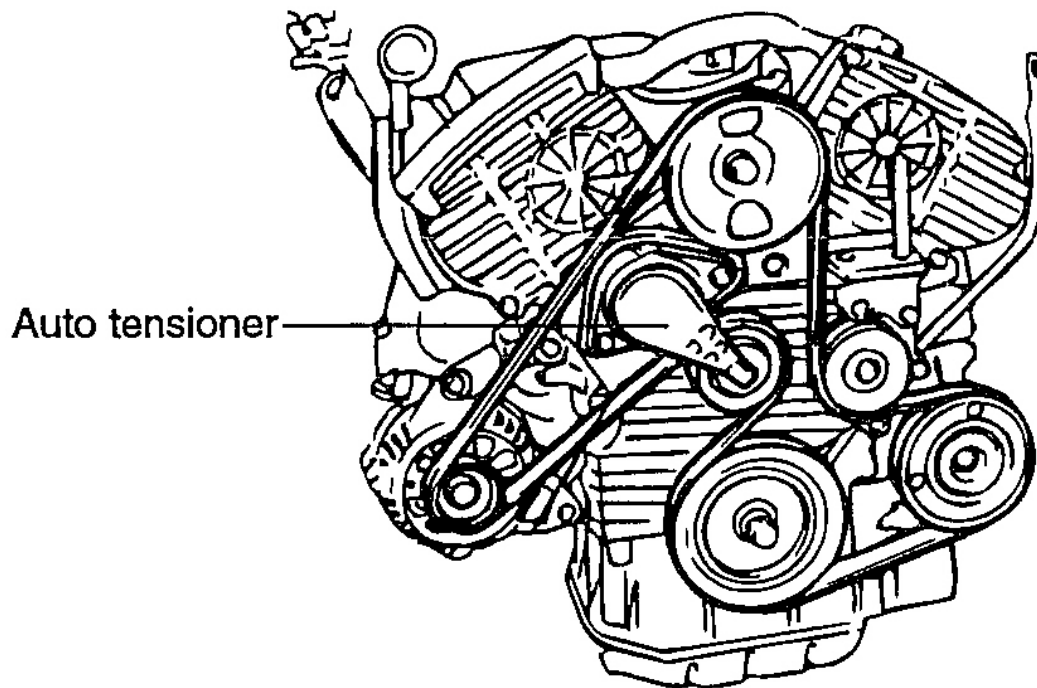
G00790333

Fig. 151: Cylinder Head Components
Courtesy of HYUNDAI MOTOR CO.

Disassembly

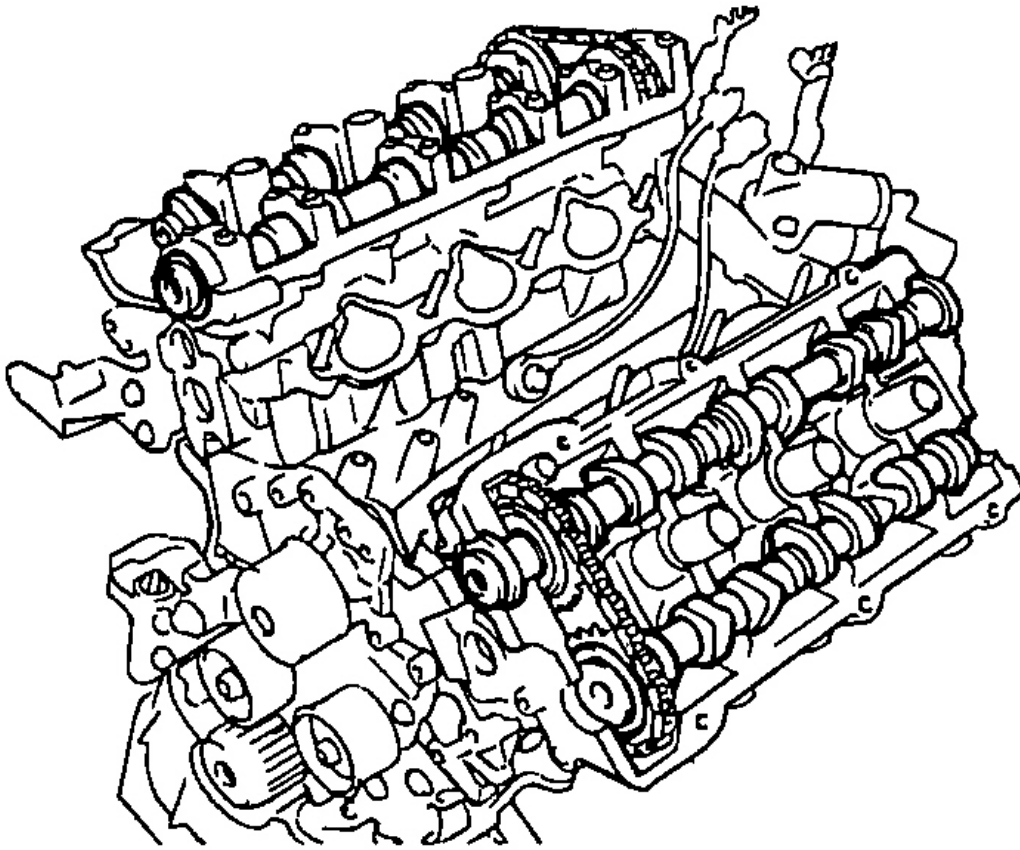
1. Drain the coolant and disconnect the upper radiator hose.
2. Remove the breather hose and air-intake hose.
3. Remove the vacuum hose, fuel hose and coolant hose.
4. Remove the intake manifold.
5. Remove the cables from the spark plugs. The cables should be removed by holding the boot portion.
6. Remove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



G00790334

Fig. 152: Identifying Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.

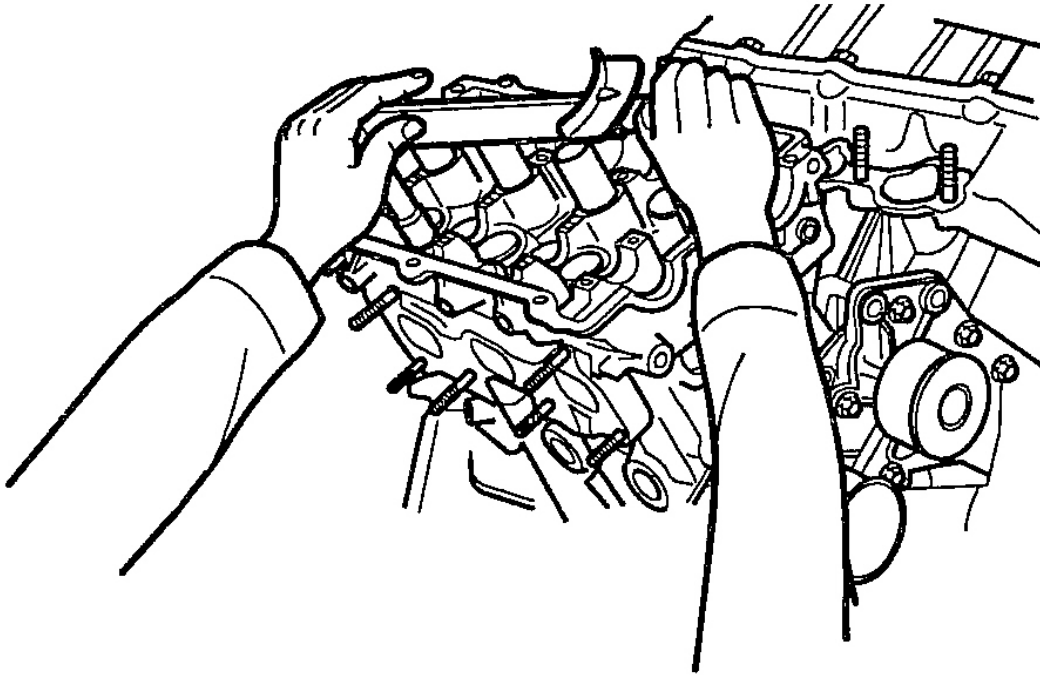


G00790335

Fig. 153: 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.**



G00790336

Fig. 154: Removing Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

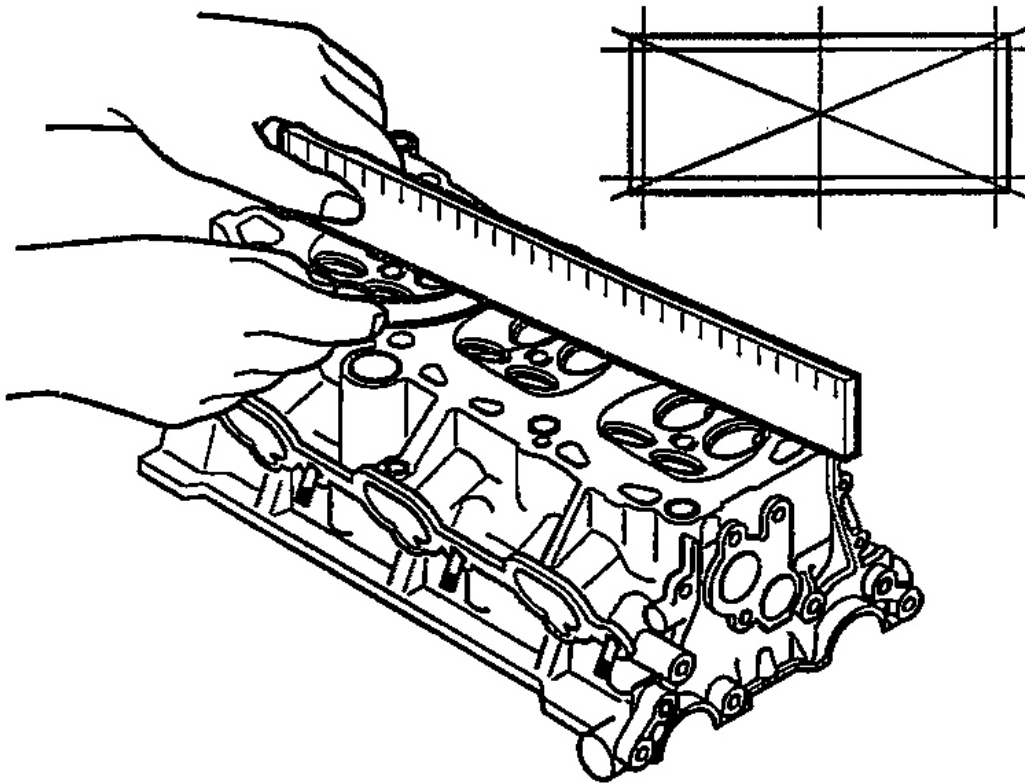
Inspection

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.)



G00790337

Fig. 155: 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

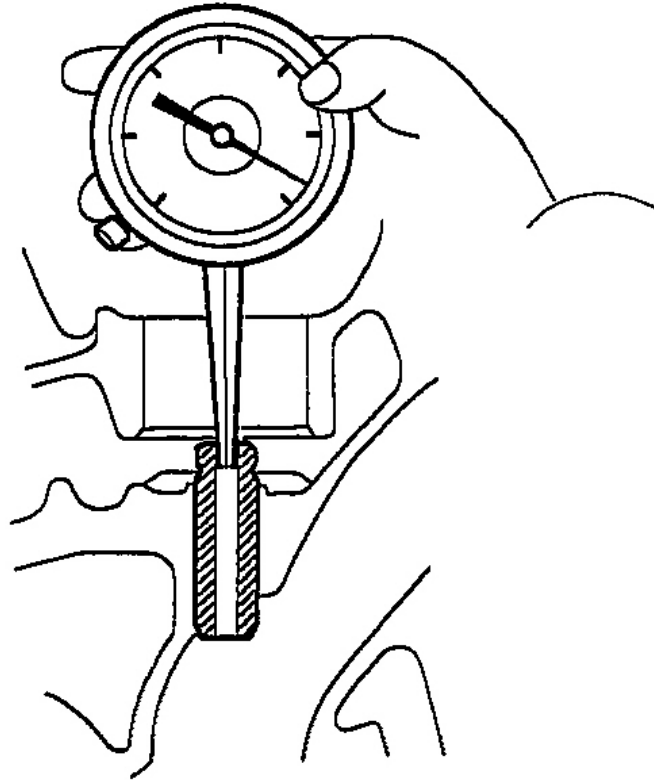
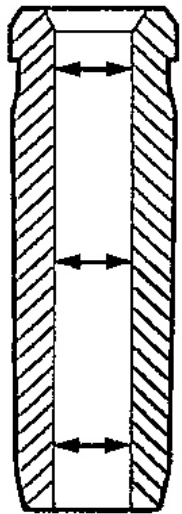
Intake : 0.02 ~ 0.05 mm (0.0009 ~ 0.0020 in.)

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

Service limit

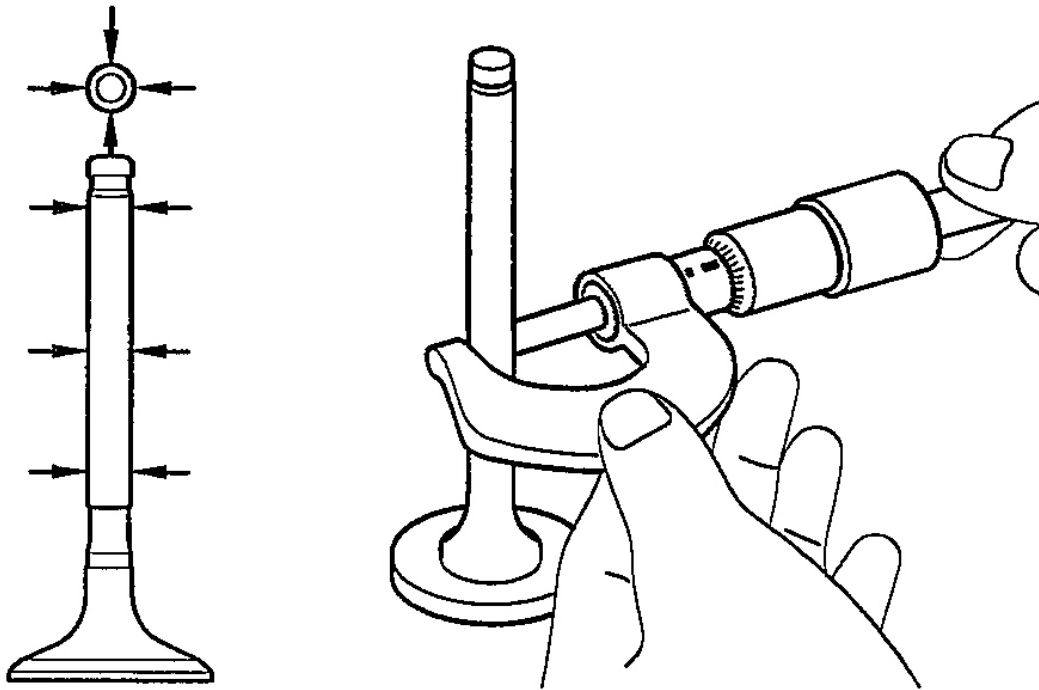
Intake : 0.10 mm (0.0039 in.)

Exhaust : 0.15 mm (0.0059 in.)



G00790338

Fig. 156: Checking Valve Guides
Courtesy of HYUNDAI MOTOR CO.



G00790339

Fig. 157: Measuring Valve Stems
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

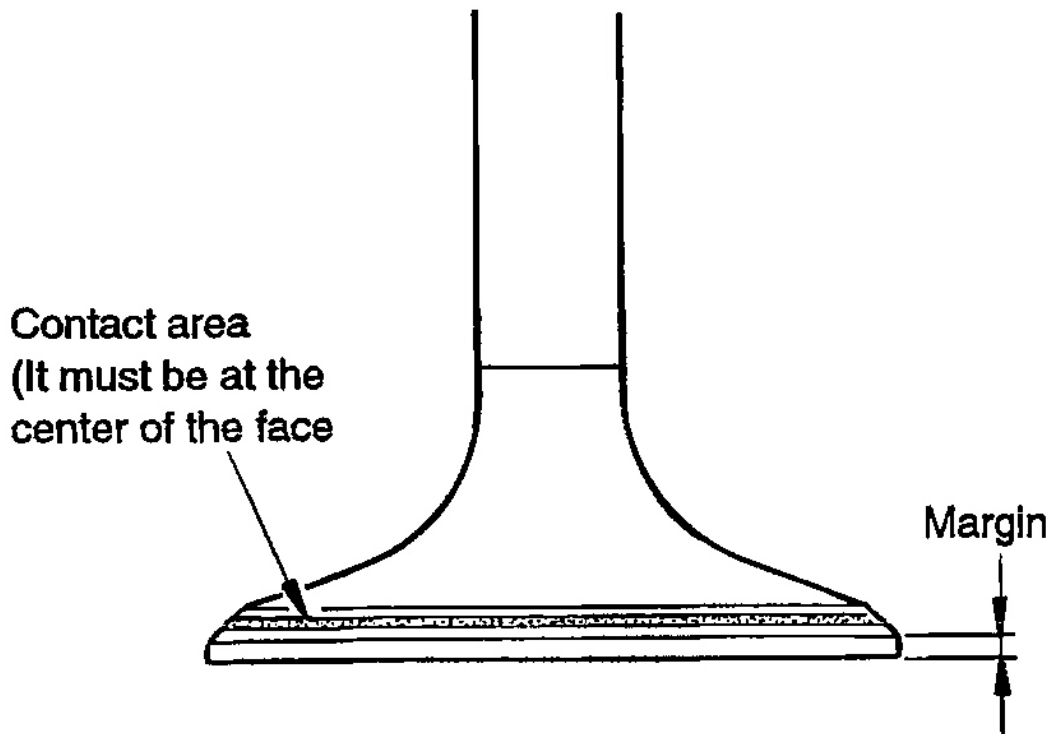
Intake : 1.0mm (0.0397 in.)

Exhaust : 1.3 mm (0.0512 in.)

Service limit

Intake : 0.5mm (0.0197 in.)

Exhaust : 0.8 mm (0.0315 in.)



G00790340

Fig. 158: 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

Free height : 42.5 mm (1.6732 in.)

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

2003 Hyundai Santa Fe

2002-04 ENGINES 2.7L V6 - Santa Fe

Out of squareness : Max. 1.5°

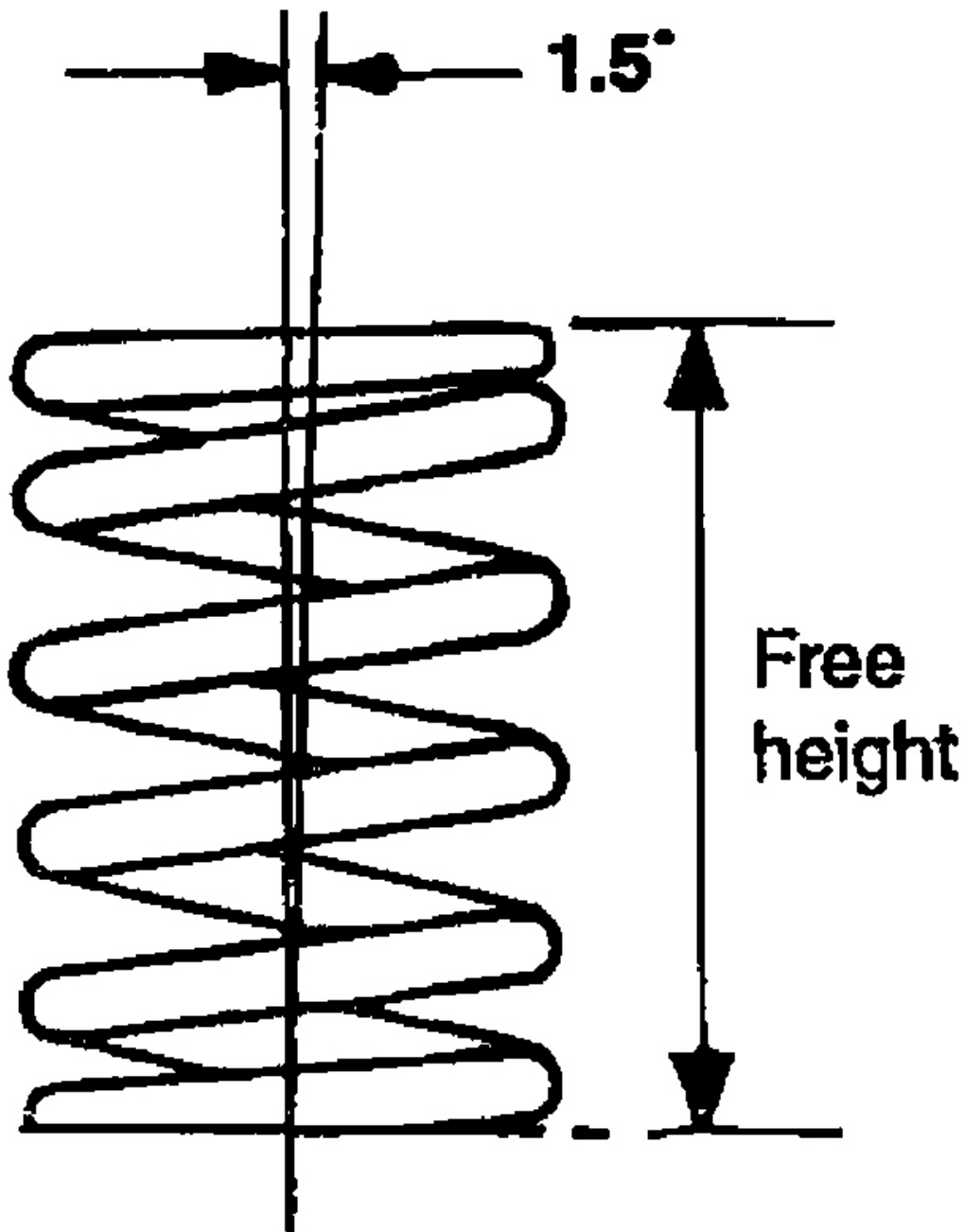
Service limit

Free height : 41.5 mm (1.6339 in.)

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

Out of squareness : Max. 3°

Out-of-square



G00790341

Fig. 159: Checking Valve Spring

Courtesy of HYUNDAI MOTOR CO.

Replacing Valve Guide

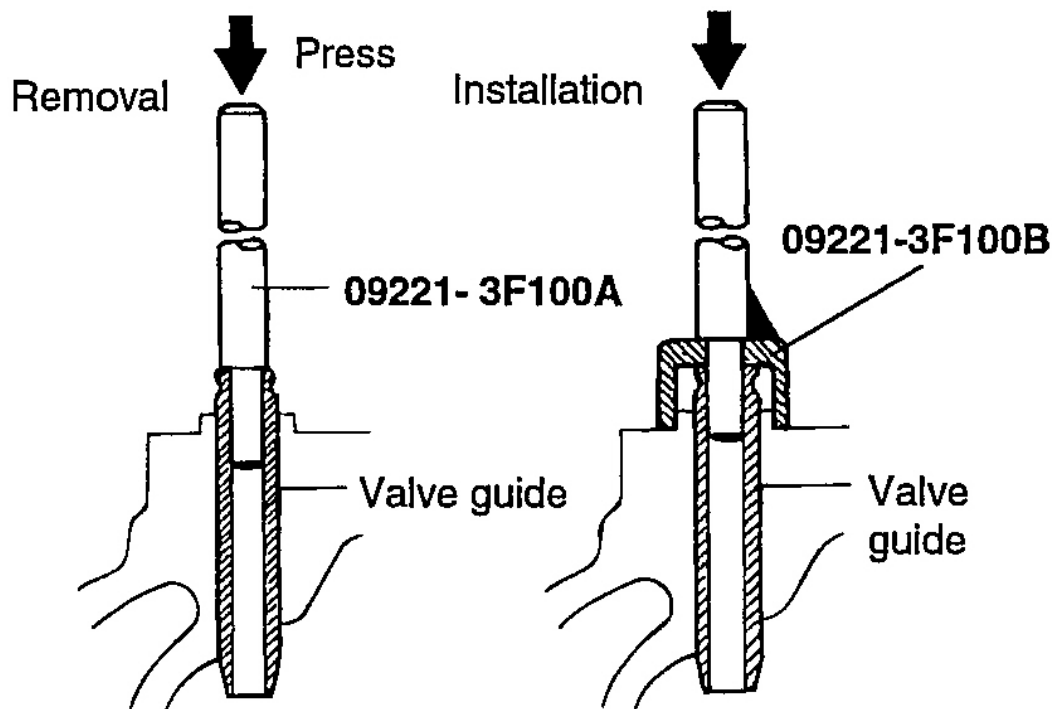
1. Using the special tool (09221-3F100 A/B), withdraw the old valve guide out the bottom of the cylinder head.
2. Recondition the valve guide hole so that it can receive the newly press-fitted oversize valve guide.

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 ~ 0.04436)
0.50 (0.020) O.S	50	11.500 ~ 11.518 (0.453 ~ 0.4535)

G00790342

Fig. 160: Valve Guide Oversizes

Courtesy of HYUNDAI MOTOR CO.



G00790343

Fig. 161: Press Fit Valve Guide

Courtesy of HYUNDAI MOTOR CO.

3. Using the special tool (09221-3F100(A), 09221-3F100(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.

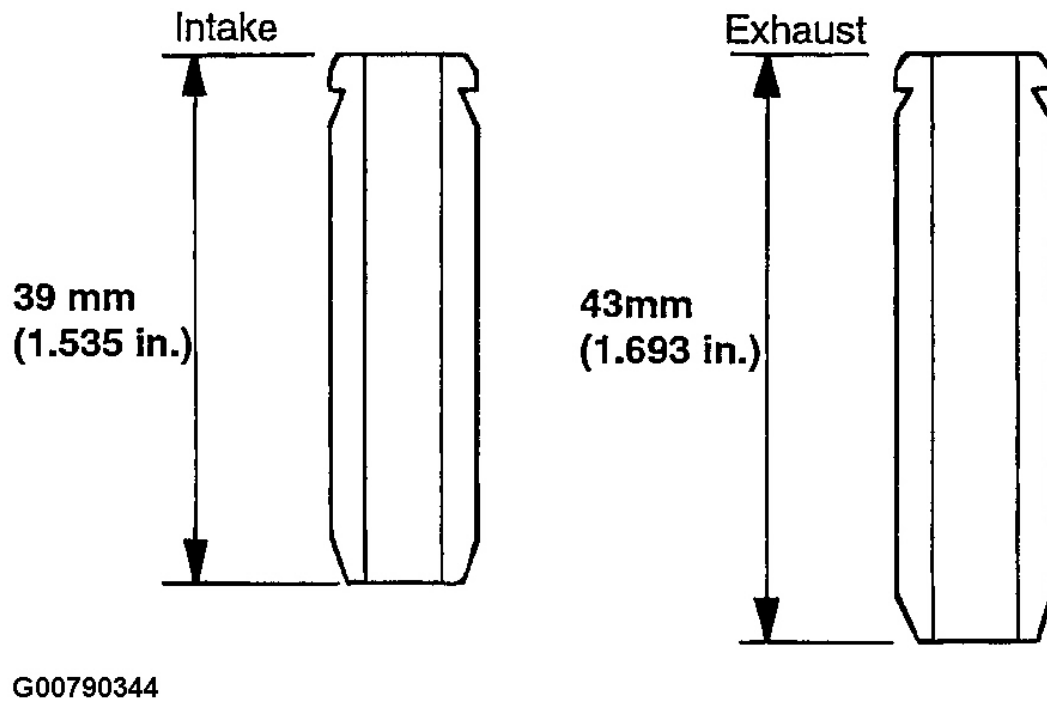
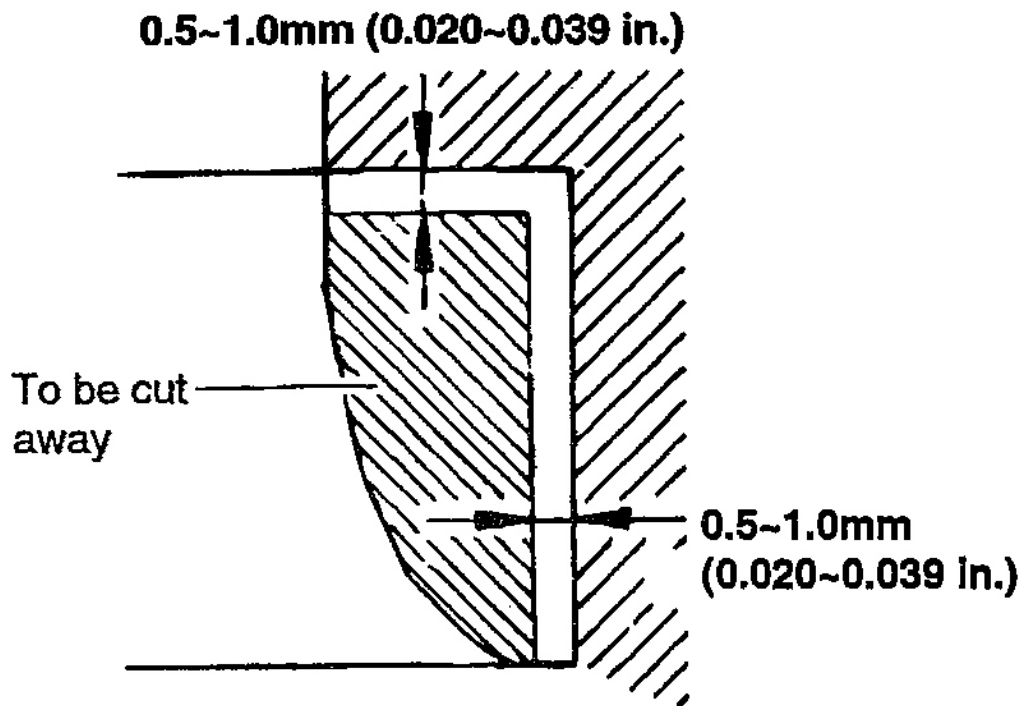


Fig. 162: Checking If Valve Is Fully Seated
Courtesy of HYUNDAI MOTOR CO.

Replacing Valve Seat Ring

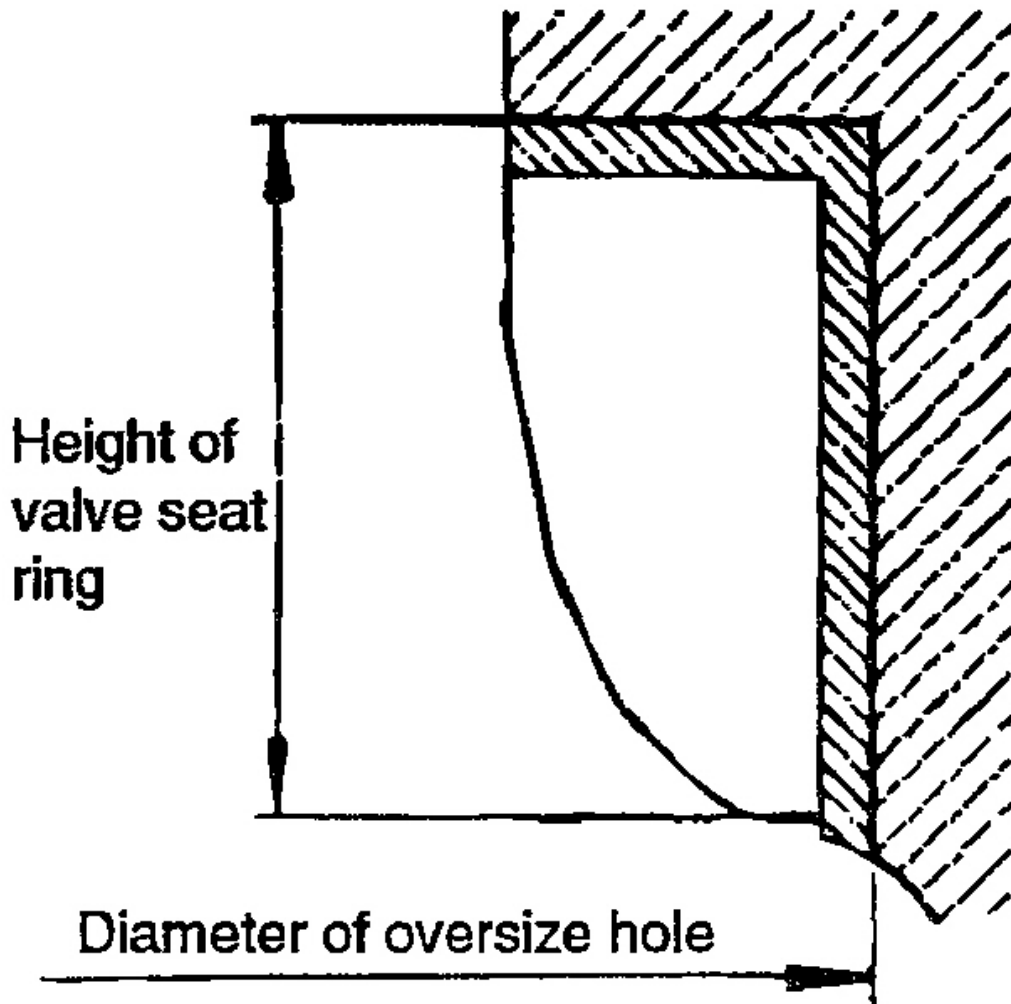
1. Cut away the inner face of the valve seat to reduce the wall thickness.



G00790345

Fig. 163: 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.



G00790346

Fig. 164: Enlarging Diameter Of The Valve Seat
 Courtesy of HYUNDAI MOTOR CO.

Description	Size mm(in.)	Size Mark	Seat ring height H mm(in.)	Oversize hole 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)

G00790347

Fig. 165: 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.)

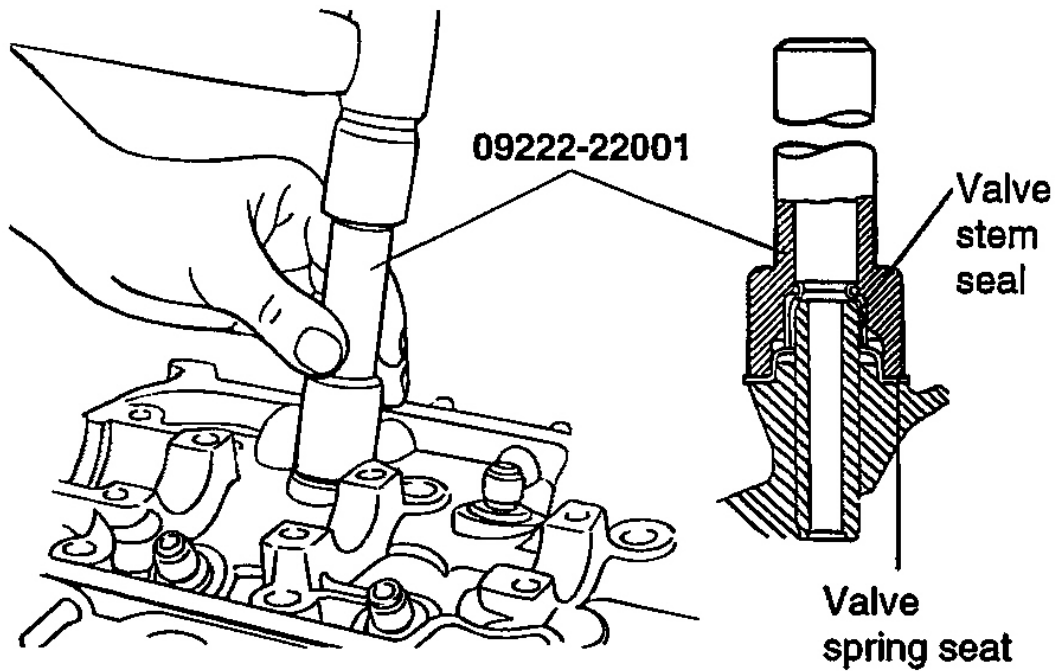
Exhaust : 1.3 ~ 1.7 mm (0.051 ~ 0.067 in.)

Reassembly

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

NOTE:

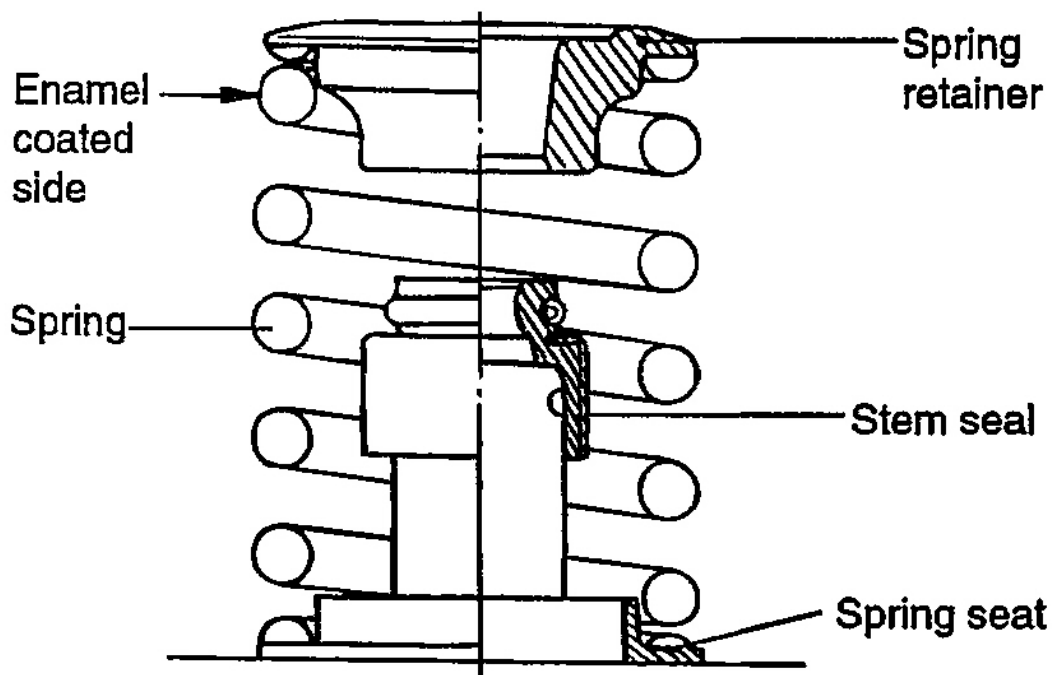
- **Do not reuse old valve stem seals.**
- **Incorrect installation of the seal could result in oil leakage of from the valve guides.**



G00790348

Fig. 166: 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.

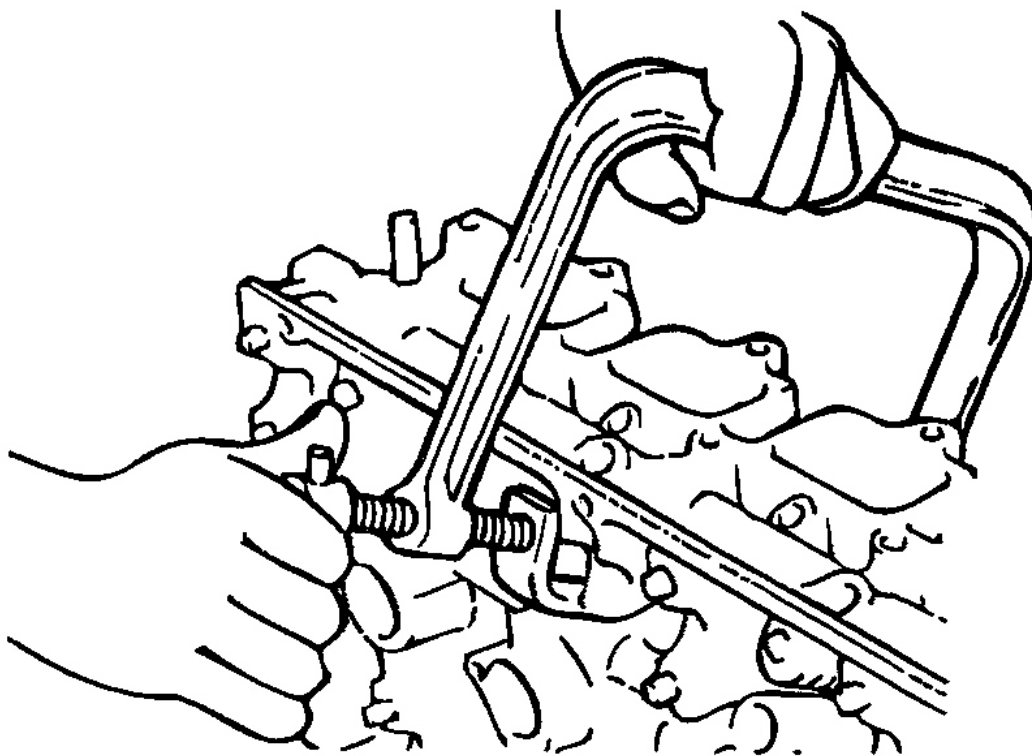


G00790349

Fig. 167: 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.



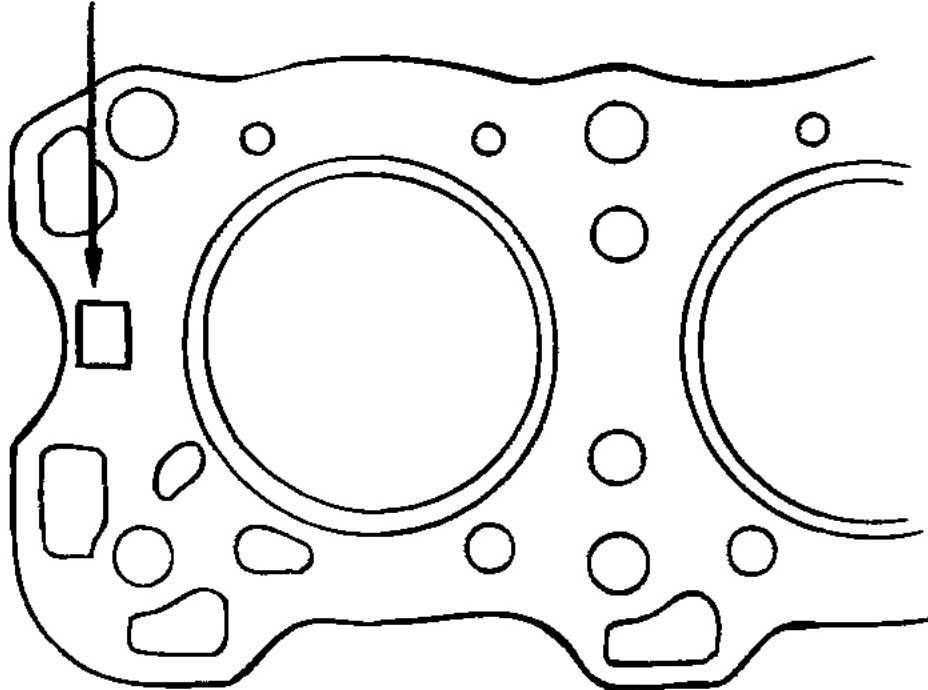
G00790350

Fig. 168: 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.**

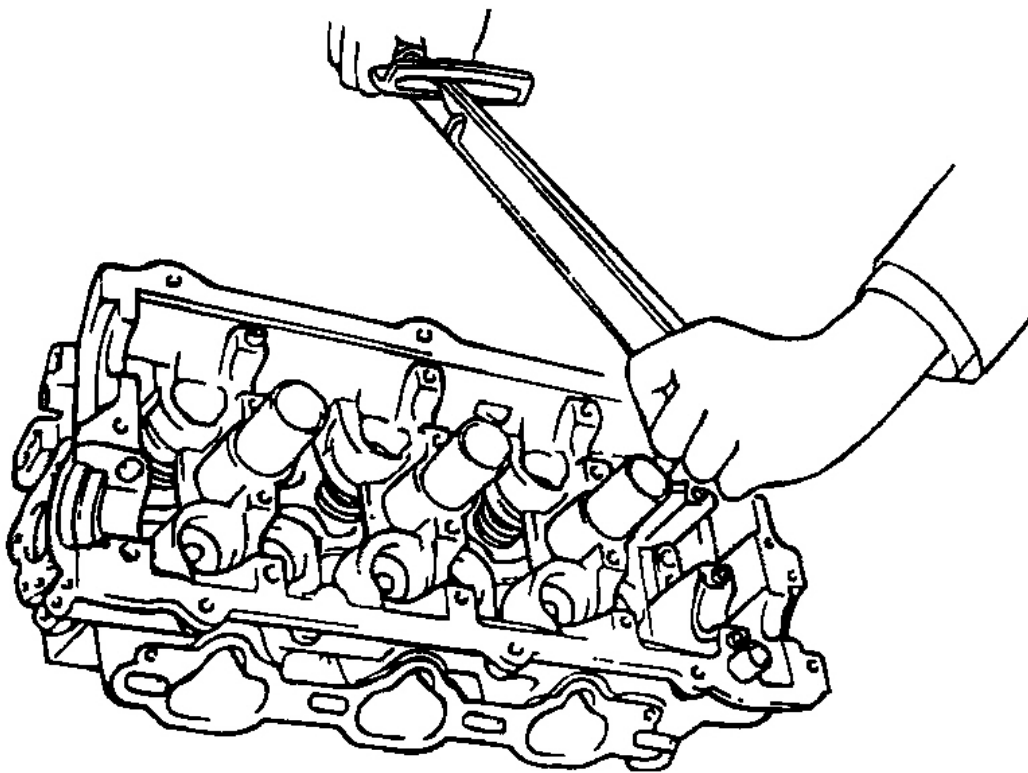
Identification mark



G00790351

Fig. 169: 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.



G00790352

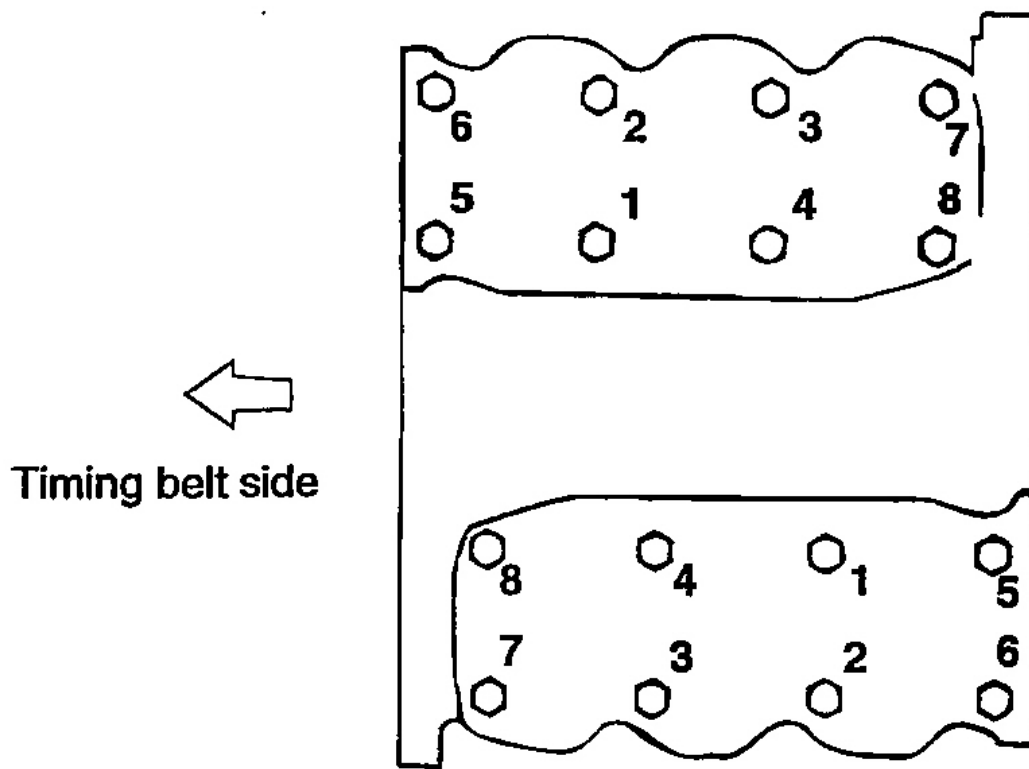
Fig. 170: Tightening Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

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

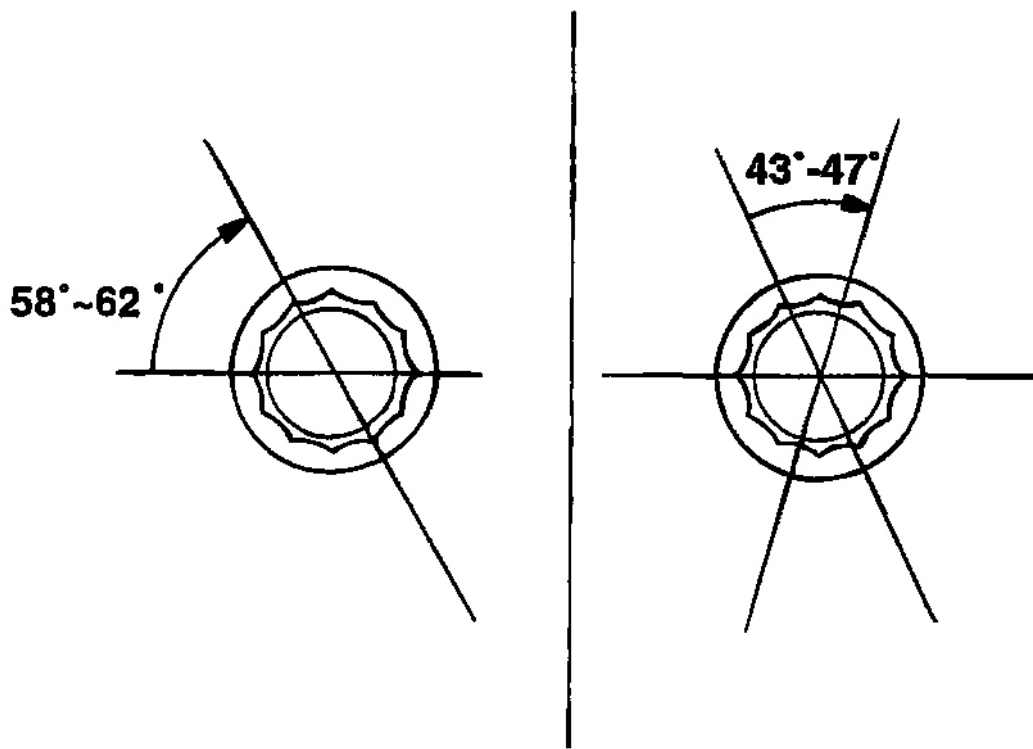
Cylinder head bolt :

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



G00790353

Fig. 171: Cylinder Head Bolt Tightening Sequence
 Courtesy of HYUNDAI MOTOR CO.



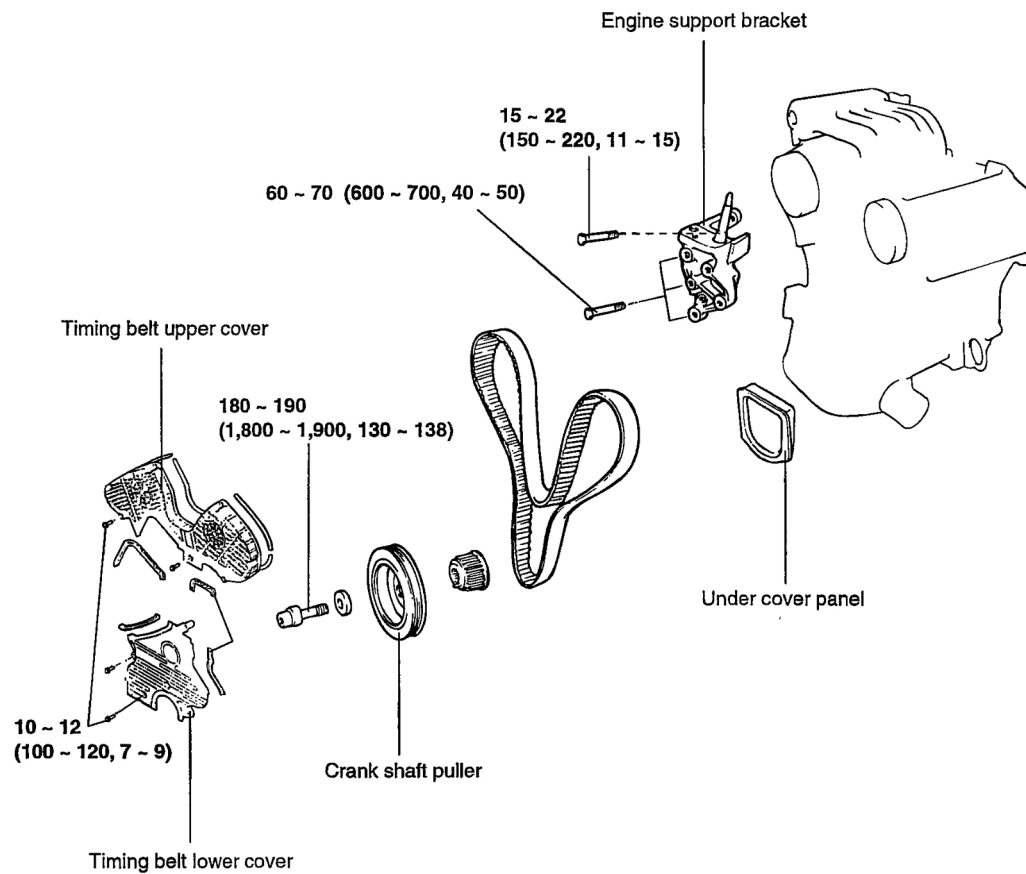
G00790354

Fig. 172: Identifying Cylinder Head Bolt Tightening Degrees
Courtesy of HYUNDAI MOTOR CO.

TIMING SYSTEM

TIMING BELT

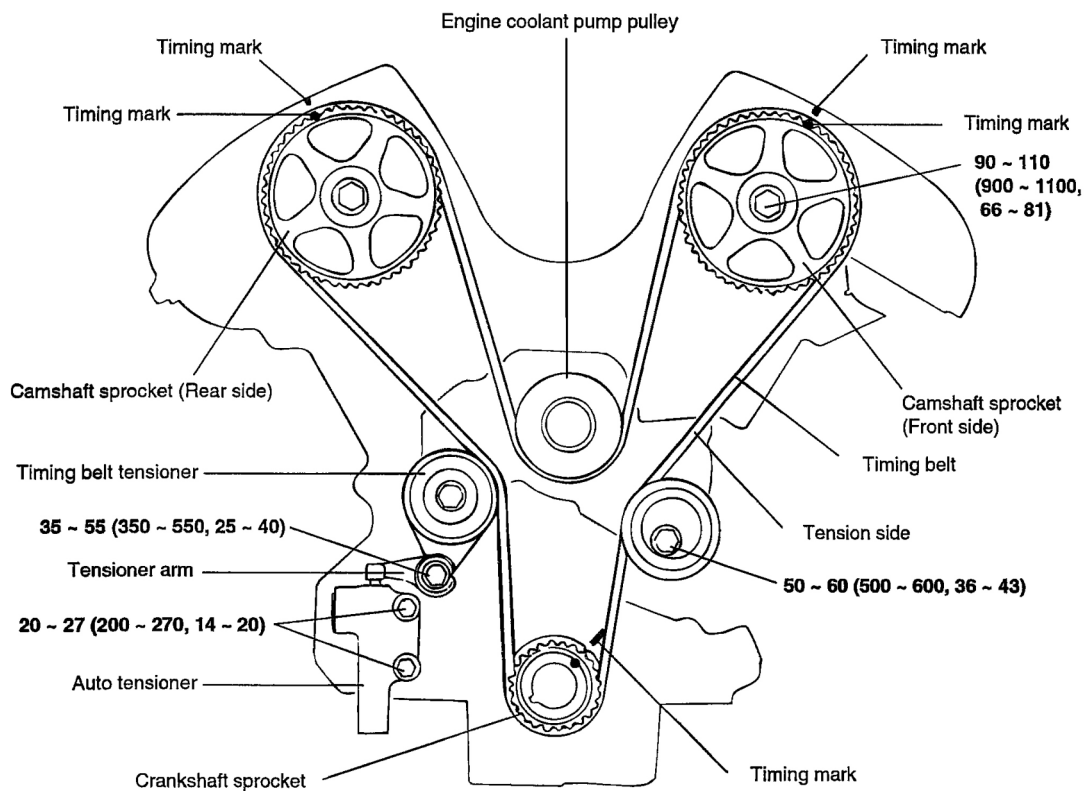
Components



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

G00790355

Fig. 173: Timing System Components (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



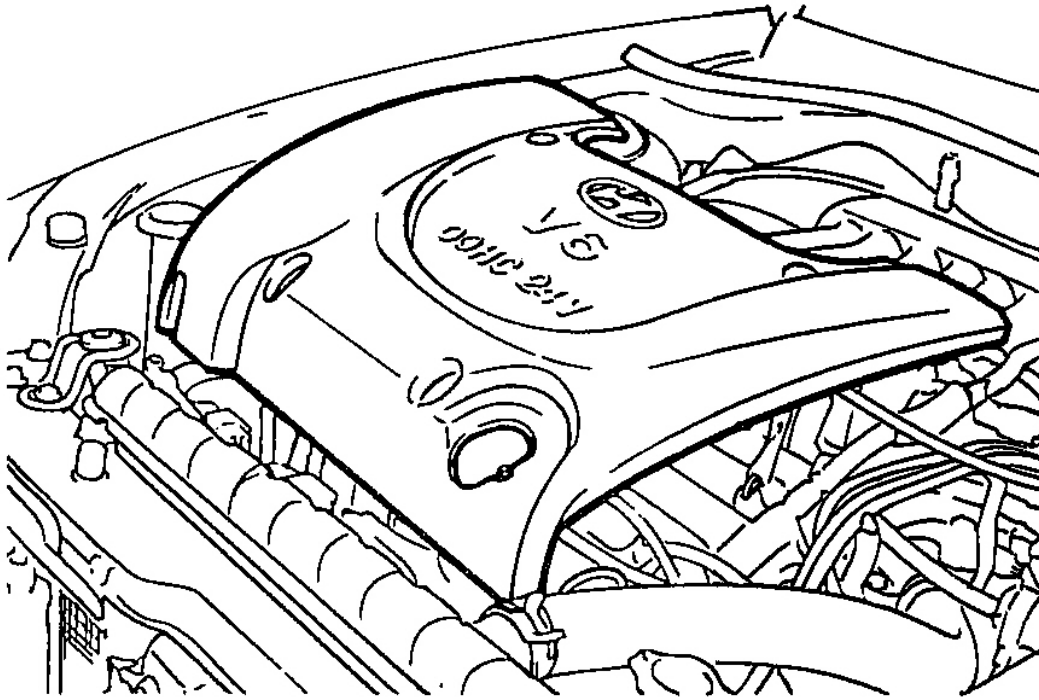
TORQUE : Nm (kg.cm, lb.ft)

G00790356

Fig. 174: Timing System Components (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

Removal

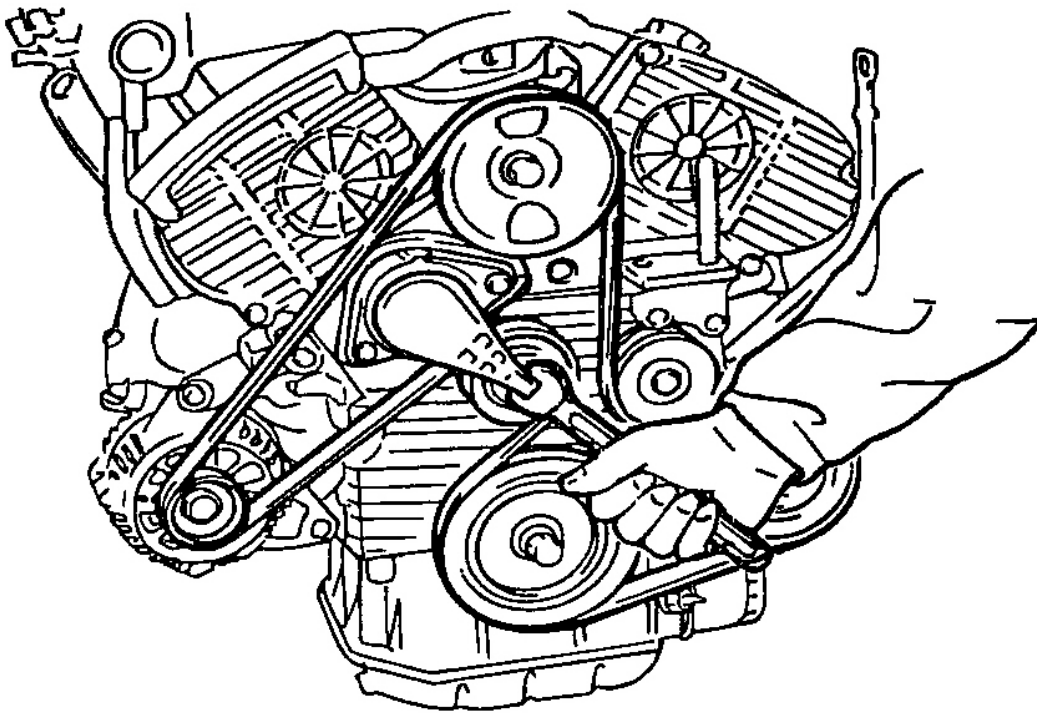
1. Remove the engine cover.



G00790357

Fig. 175: Identifying Engine Cover
Courtesy of HYUNDAI MOTOR CO.

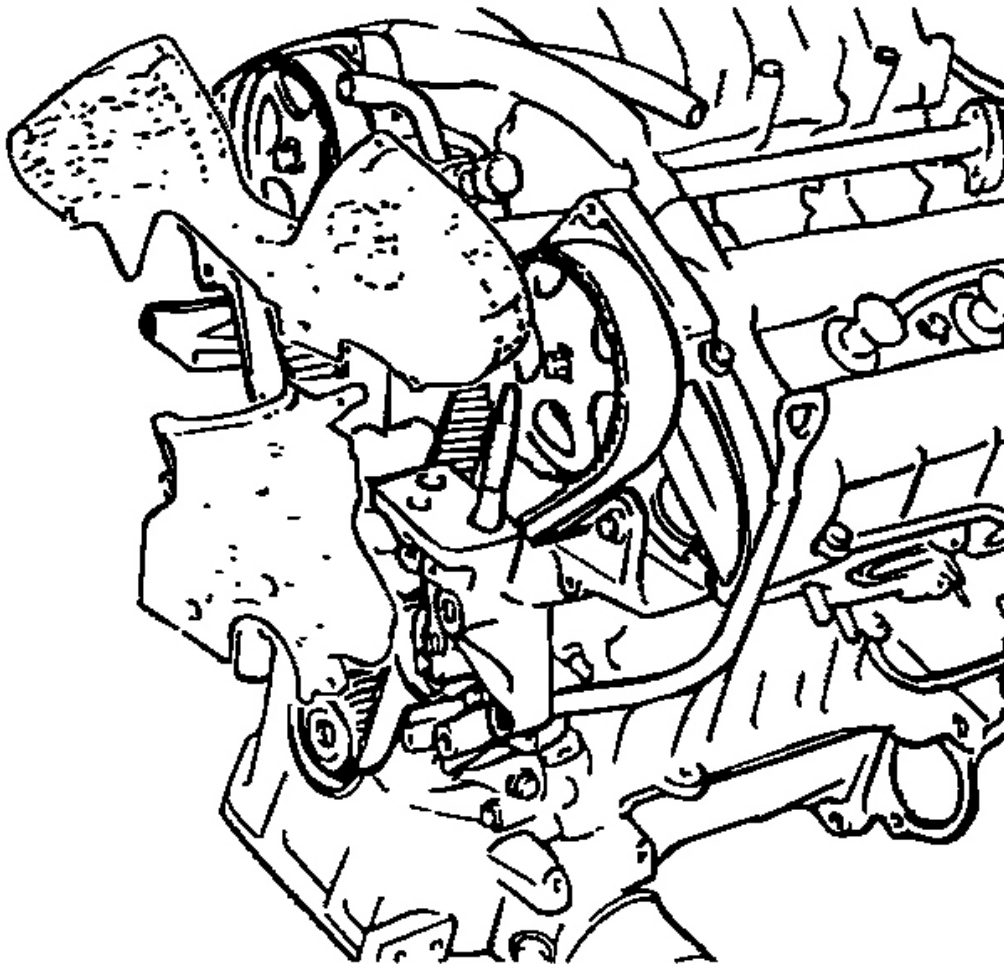
2. Using a [16 mm], rotate the tensioner arm clockwise (about 14°) and remove the belt from the pulley.
3. Remove the power steering pump pulley, idler pulley, tensioner pulley and crankshaft pulley.



G00790358

Fig. 176: Removing Belt From Pulleys
Courtesy of HYUNDAI MOTOR CO.

4. Remove the upper and lower timing belt covers.

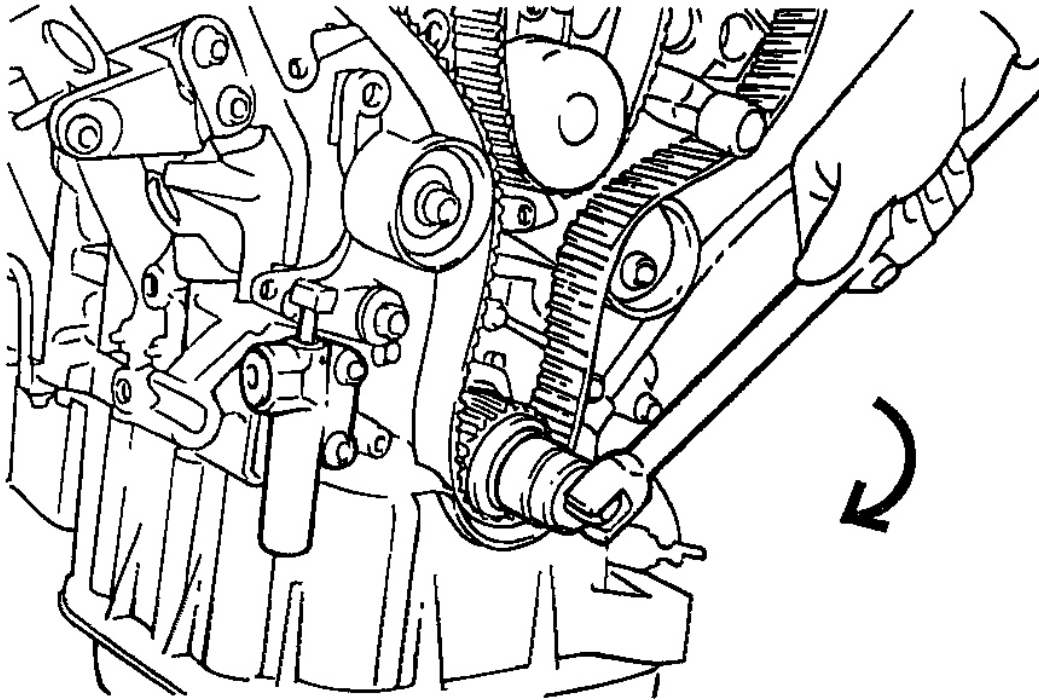


G00790359

Fig. 177: 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.

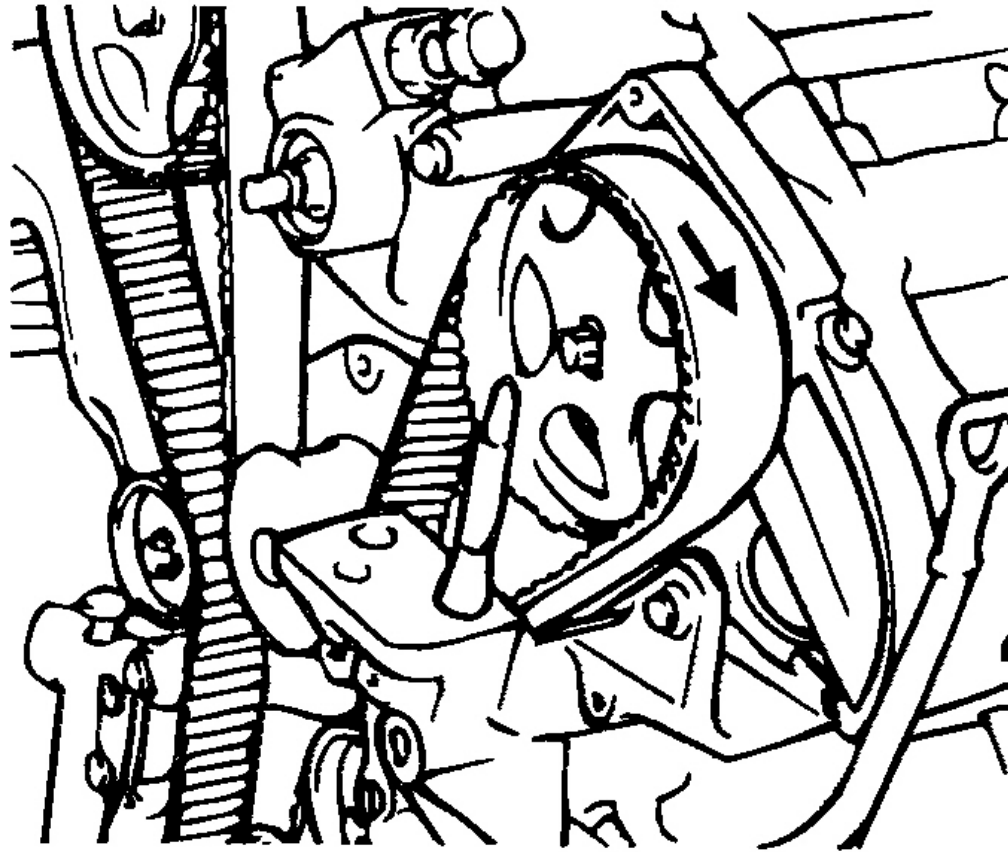


G00790360

Fig. 178: 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.



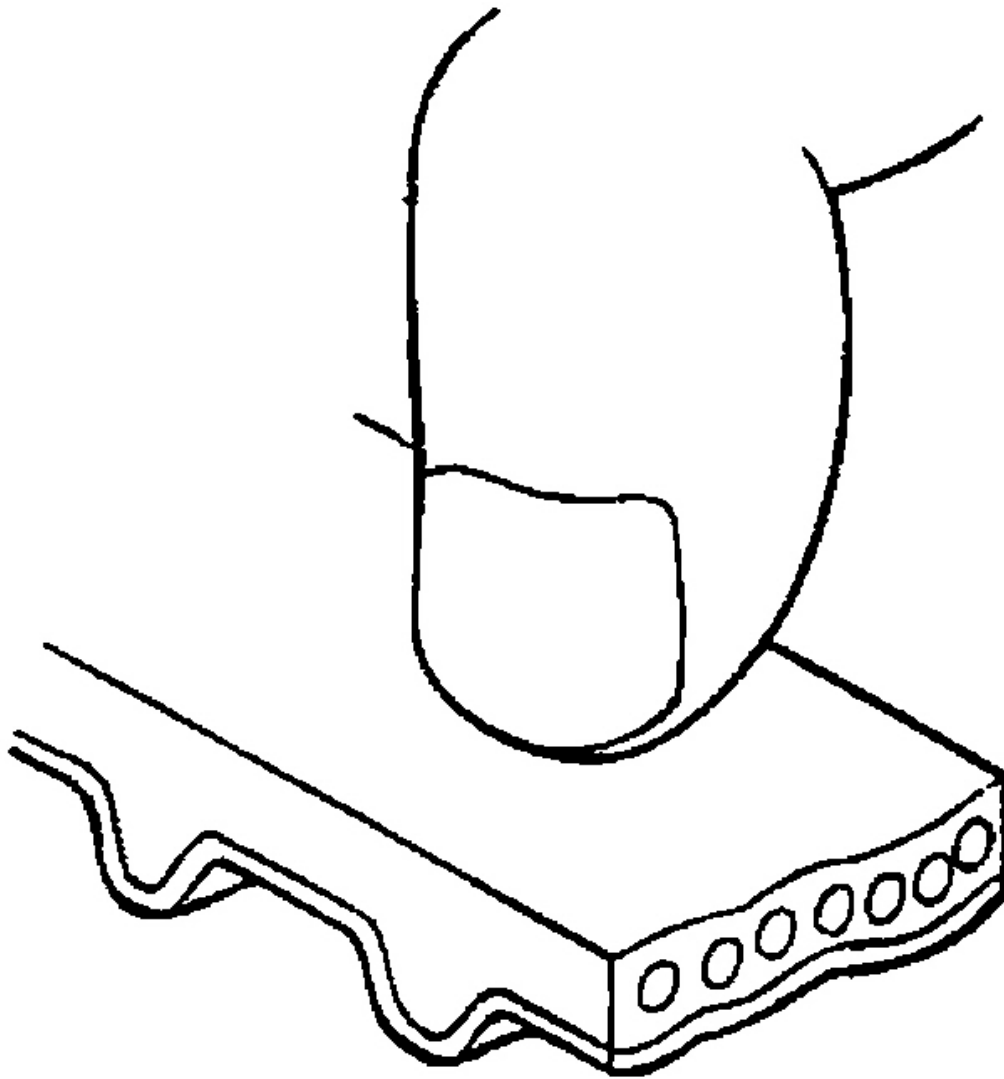
G00790361

Fig. 179: 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

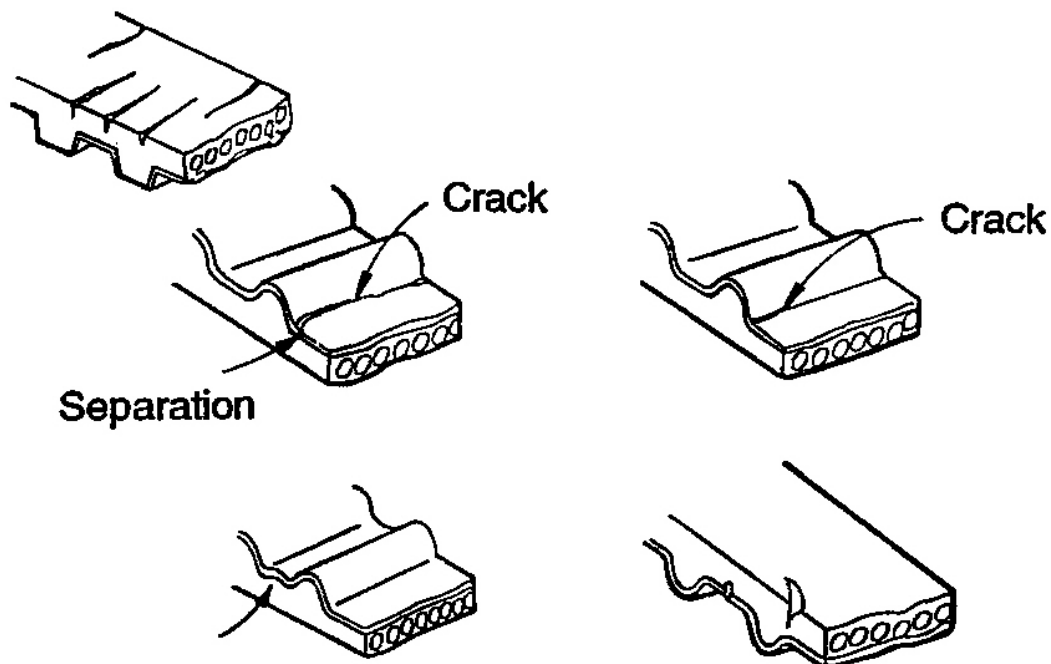
Back surface is glossy, non-elastic and so hard that when the nail of your finger is pressed into it, no mark is produced.



G00790362

Fig. 180: Checking Belt Surface With Finger Nail
Courtesy of HYUNDAI MOTOR CO.

2. Cracked back surface of rubber.

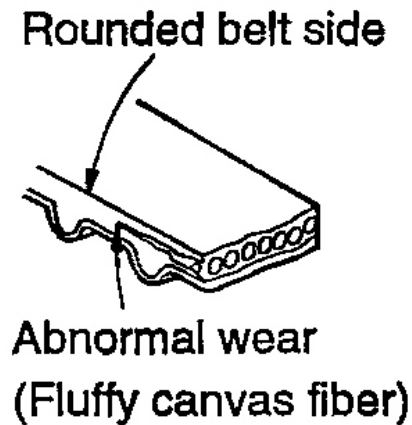
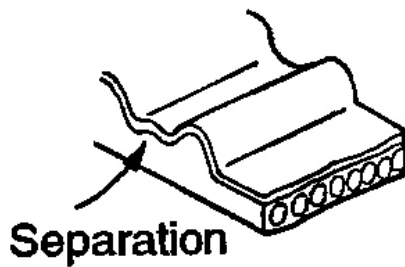


G00790363

Fig. 181: 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.



G00790364

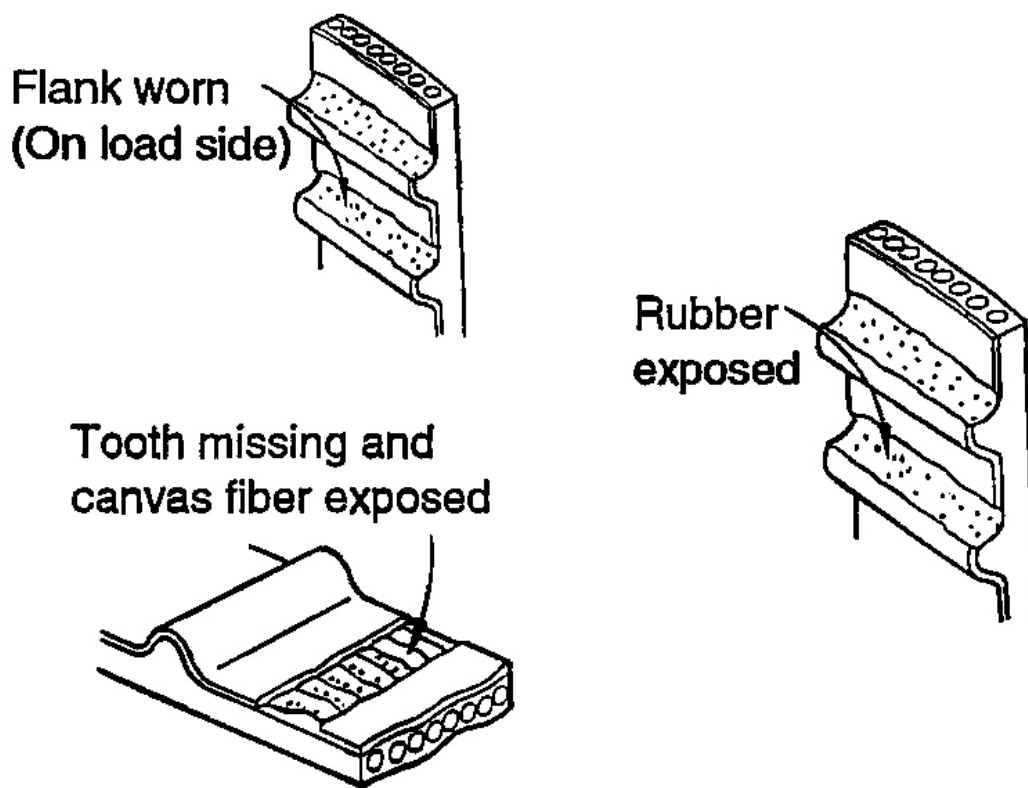
Fig. 182: Identifying Separating Or Rounded Belt
 Courtesy of HYUNDAI MOTOR CO.

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 down and rubber exposed (tooth width reduced).

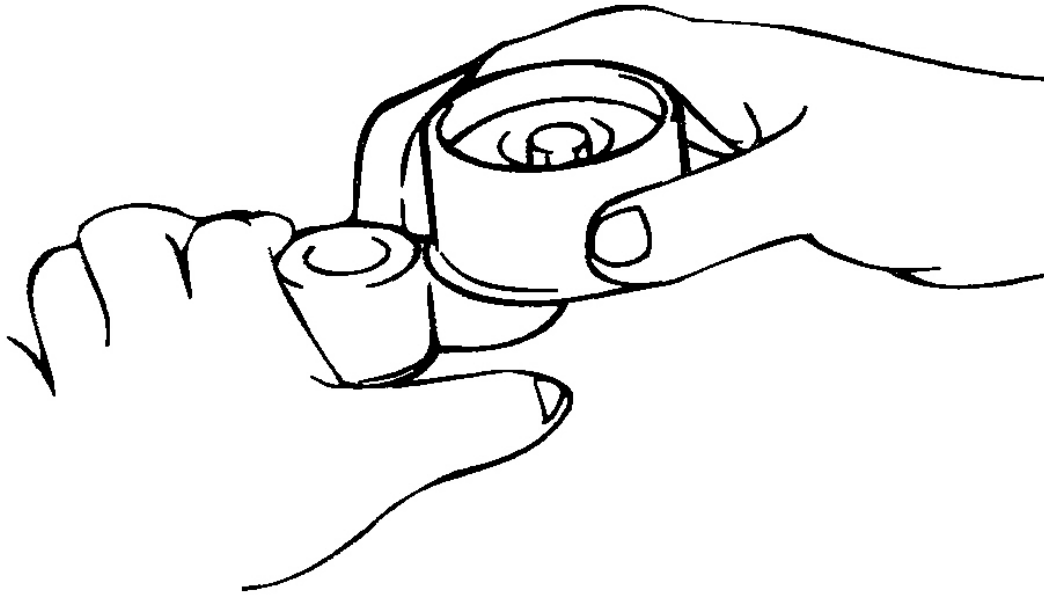
5. Missing tooth



G00790365

Fig. 183: Checking Timing Belt
Courtesy of HYUNDAI MOTOR CO.

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



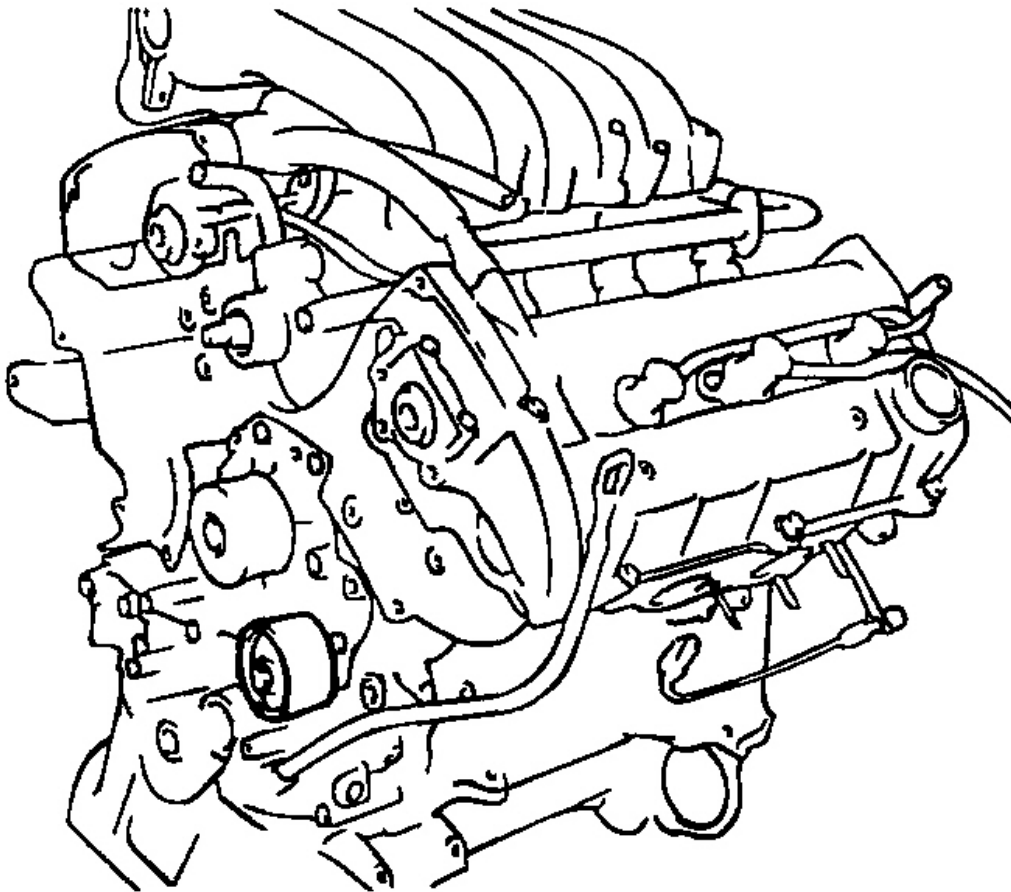
G00790366

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

Installation

1. Install the idler pulley to water pump boss.

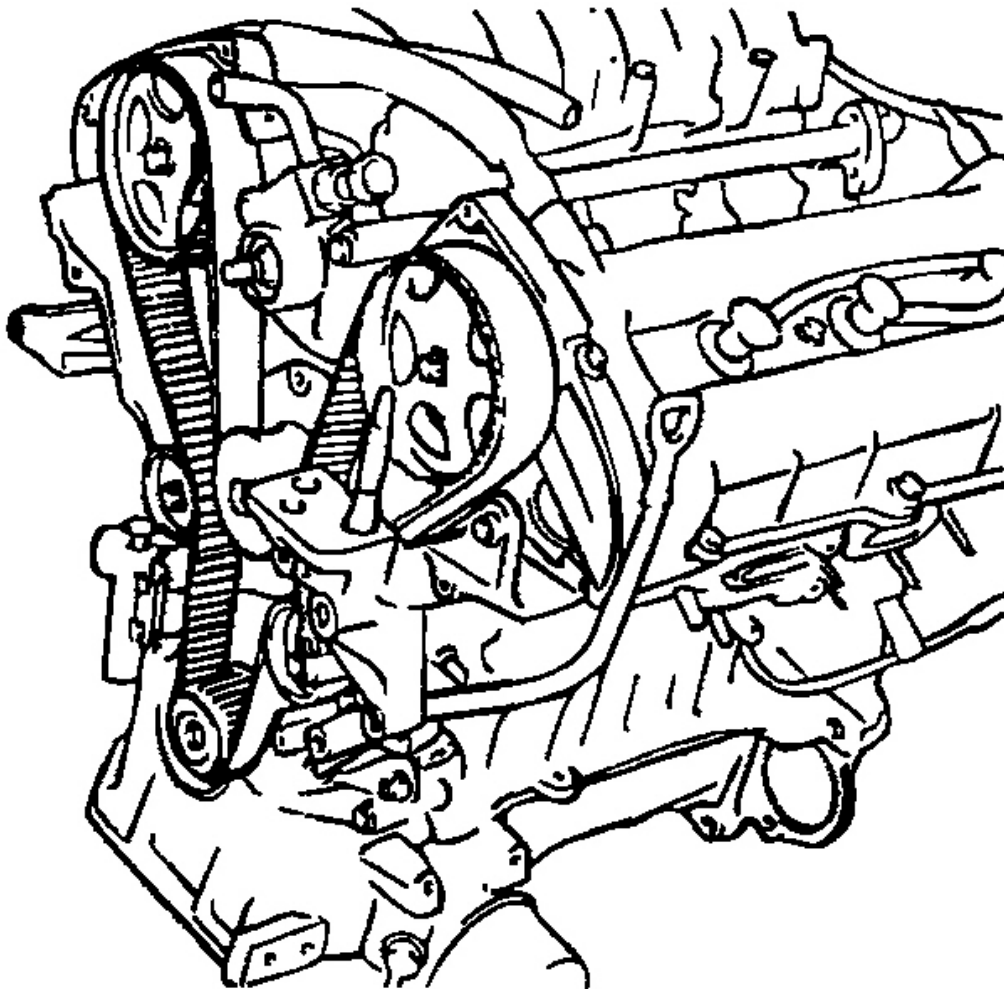
NOTE: Insert and install the idler pulley to the roll pin that is pressed in the water pump boss.



G00790367

Fig. 185: 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.



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Fig. 186: View Of Timing Belt
Courtesy of HYUNDAI MOTOR CO.

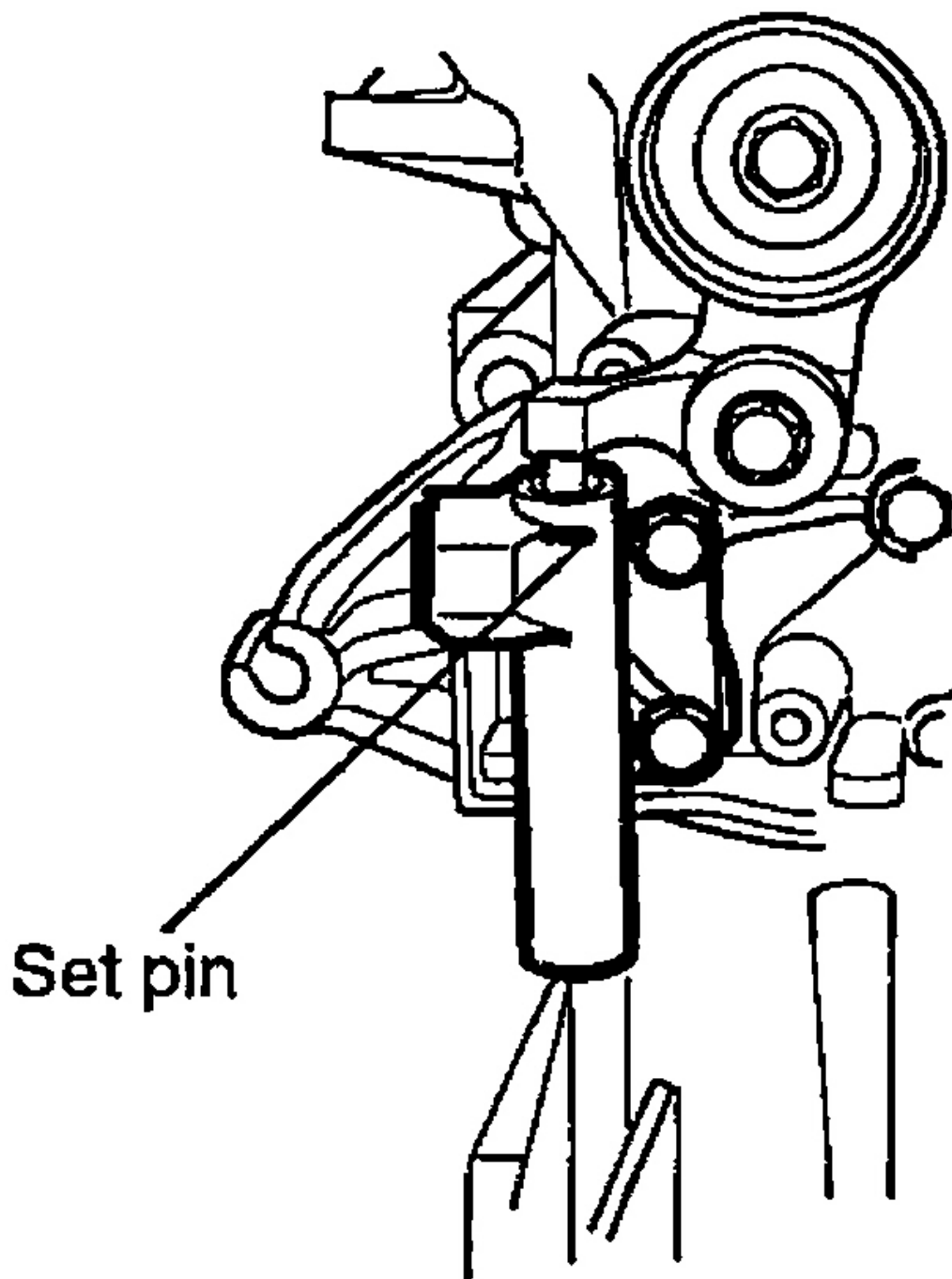
NOTE:

- 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. 187: Identifying Set Pin

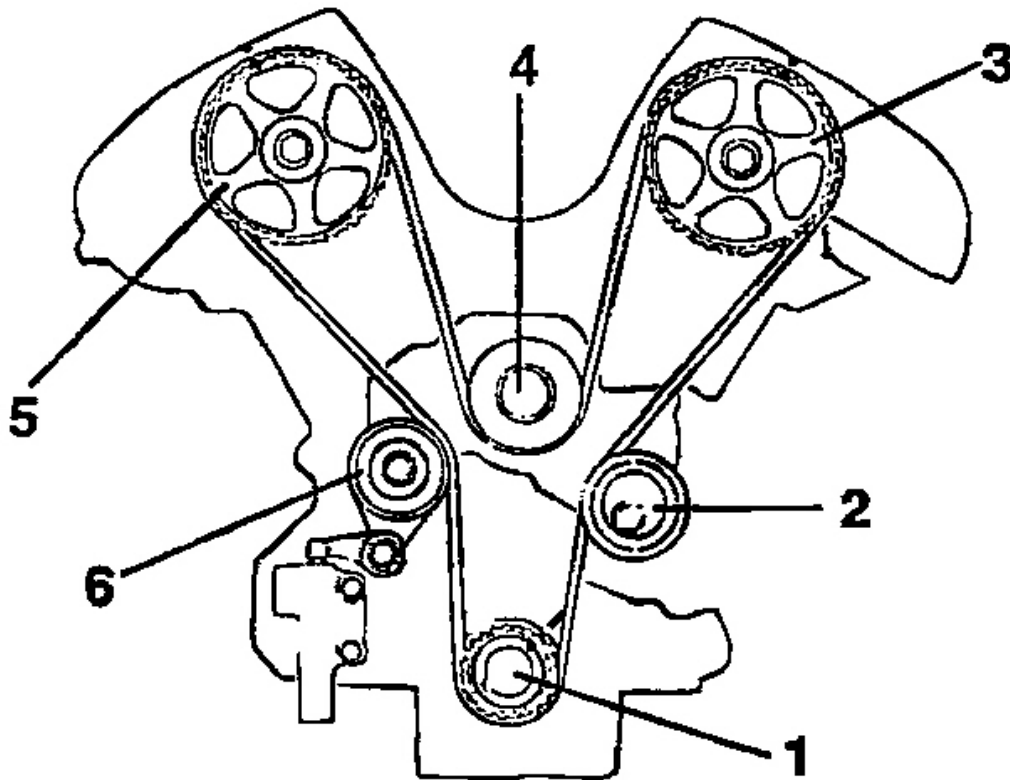
Courtesy of HYUNDAI MOTOR CO.

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

1. Crankshaft sprocket => 2. Idler pulley => 3. Camshaft sprocket (LH side) => 4. Water pump pulley => 5. Camshaft sprocket (RH side) => 6. Tensioner pulley.

NOTE:

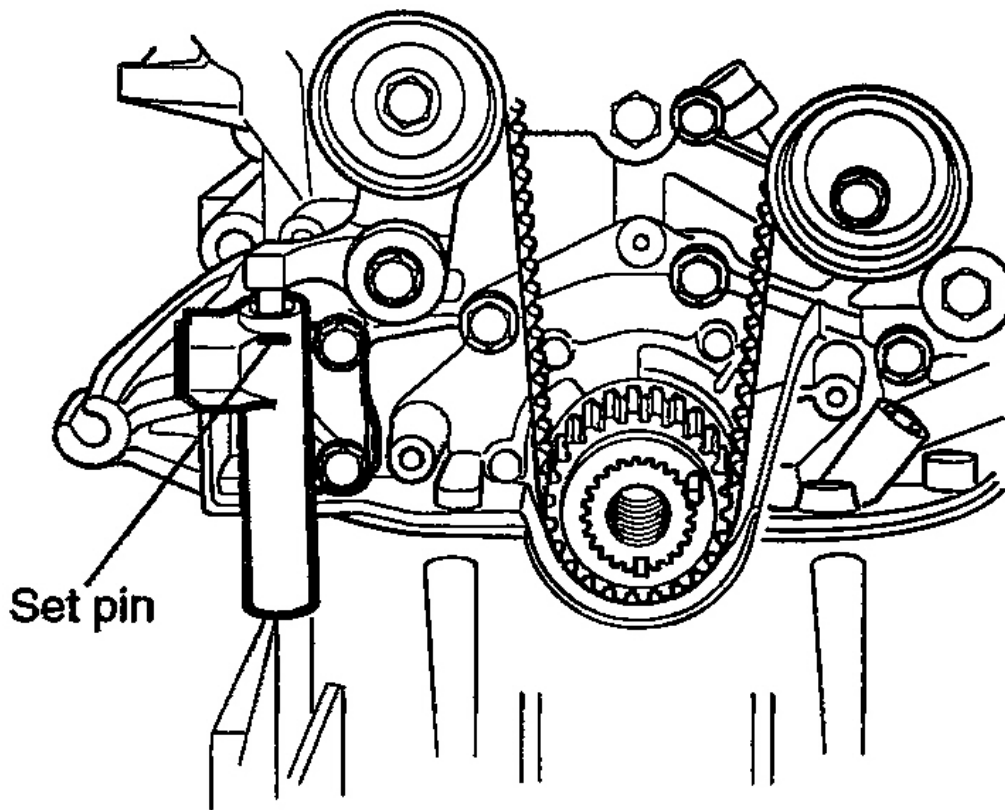
- In this step, No. 1 cylinder is in the TDC (Compression stroke).
- Be very careful if you use your fingers.



G00790370

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

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



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Fig. 189: Removing Set Pin

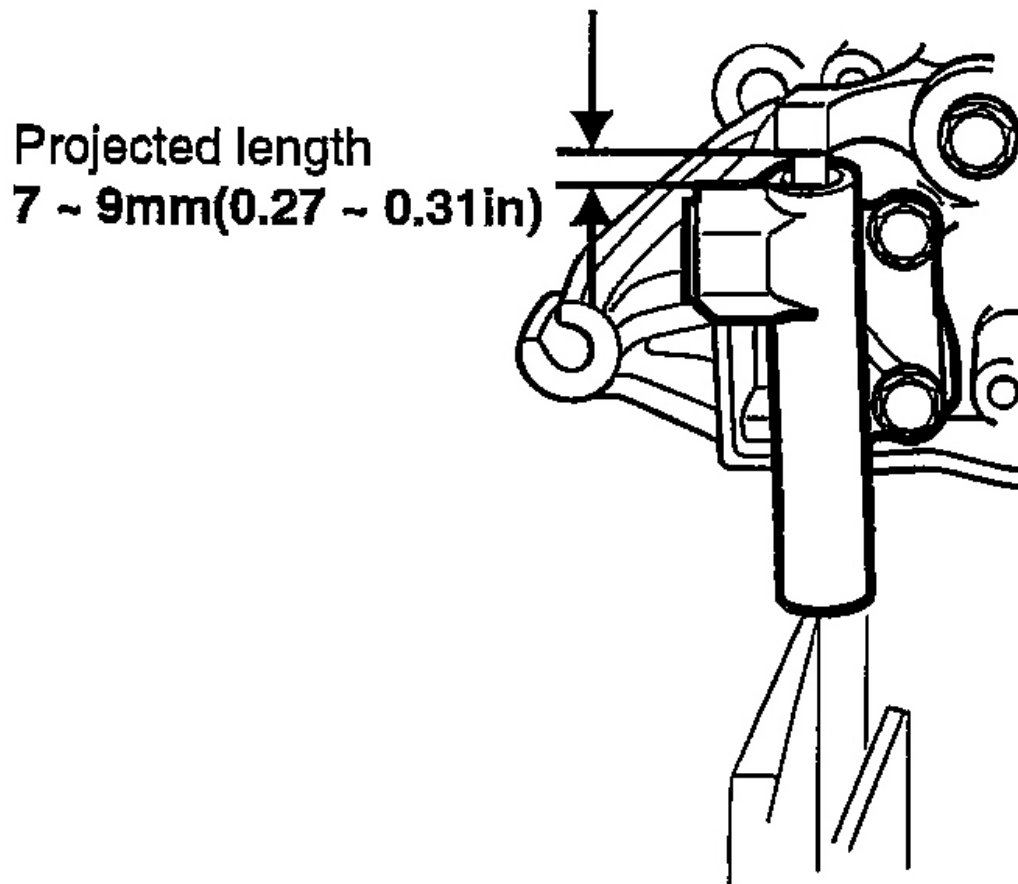
Courtesy of HYUNDAI MOTOR CO.

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 7 ~ 9 mm (0.27 ~ 0.31 in.).
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.



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Fig. 190: Identifying Projected Length
Courtesy of HYUNDAI MOTOR CO.