2005 ENGINE

Engine Mechanical System (G4ED-GSL 1.6L) - Accent

GENERAL

SPECIFICATION

GENERAL SPECIFICATION

GENERAL SPECIFICATION

Description	Specification	Limit
General		
Type	In-line, Double Over Head Camshaft	
Number of cylinders	4	
Bore	76.5mm (3.0118 in)	
Stroke	87mm (3.4252 in)	
Total displacement	1599 cc (97.54 cu.in)	
Compression ratio	10	
Firing order	1-3-4-2	
Valve timing		
Intake valve		
Opens (BTDC)	5°	
Closes (ABDC)	35°	
Exhaust valve		
Opens (BBDC)	43°	
Closes (ATDC)	5°	
Valve overlap	10°	
Cylinder head		
Flatness of cylinder head surface	Max. 0.03mm (0.0012 in.)	0.1 mm (0.0039in.)
Flatness of manifold mounting surface	0.15mm (0.0059 in.)	0.2mm (0.008in.)
Oversize rework dimension of valve seat hole		
Intake		
0.3mm (0.012 in.) O.S.	30.7 ~ 30.721 mm (1.2087 ~ 1.2095 in.)	
0.6mm (0.024 in.) O.S.	31.0 ~ 31.021 mm (1.2205 ~ 1.2213 in.)	
Exhaust		
0.3mm (0.012 in.) O.S.	27.3 ~ 27.321mm (1.0748 ~ 1.0756 in.)	

0.6mm (0.024 in.) O.S	27.6 ~ 27.621mm (1.0866 ~ 1.0874 in.)	
Oversize rework dimensions of valve		
Guide hole		
0.05mm (0.002 in.) O.S.	11.05 ~ 11.068mm (0.435 ~ 0.4357 in.)	
0.25mm (0.010 in.) O.S.	11.25 ~ 11.268mm (0.443 ~ 0.4436 in.)	
0.50mm (0.020 in.) O.S.	11.50 ~ 11.518mm (0.453 ~ 0.4535 in.)	
Camshaft		
Cam lobe height		
Intake	43.4484mm (1.7106 in.)	42.9484mm (1.6909in.)
Exhaust	43.8489mm (1.7263 in.)	43.3489mm (1.7.66in.)
Journal O.D	Diameter 27mm (1.0630 in.)	
Bearing oil clearance	0.035 ~ 0.072mm (0.0014 ~ 0.0028 in.)	
End play	0.1 ~ 0.2mm (0.004 ~ 0.008 in.)	
Valve		
Valve length		
Intake	91.7mm (3.6102 in.)	
Exhaust	92.3mm (3.6339 in.)	
Stem O.D.		
Intake	5.955 ~ 5.97mm (0.2344 ~ 0.2350 in.)	
Exhaust	5.935 ~ 5.95mm (0.2337 ~ 0.2343 in.)	
Face angle thickness of valve head (Margin)		
Intake	1.1mm (0.0433 in.)	0.8mm (0.031 in.)
Exhaust	1.3mm (0.0512 in.)	1.0mm (0.039in.)
Valve stem to valve guide clearance		
Intake	0.03 ~ 0.06mm (0.0012 ~ 0.0024 in.)	0.10mm (0.0039in.)
Exhaust	0.05 ~ 0.08mm (0.0020 ~ 0.0031 in.)	0.15mm (0.0059in.)
Valve guide		
Installed dimension O.D.		
Intake	12.8mm (0.504 in.)	
Exhaust	12.8mm (0.504 in.)	
Service size	0.05, 0.25, 0.50mm	
(0.002, 0.010, 0.020 in.) oversize		

Valve seat		
Width of seat contact		
Intake	0.8 ~ 1.2mm (0.031 ~ 0.047 in.)	
Exhaust	1.3 ~ 1.7mm (0.051 ~ 0.066 in.)	
Seat angle	45°	
Oversize	0.3, 0.6mm (0.012, 0.024 in.) oversize	
Valve spring		
Free length	44.00mm (1.7323 in.)	
Load	21.6kg/35mm (47.6lb/1.3780 in.)	
45.1kg/27.2mm (99.4lb/1.071 in.)		
Squareness	1.5° or less	
Cylinder block		
Cylinder bore	76.50 ~ 76.53mm (3.0118 ~ 3.0130 in.)	
Out-of-round and taper of cylinder bore	Less than 0.01mm (0.0004 in.)	
Clearance with piston		
0.025 ~ 0.045mm (0.0009 ~ 0.0017 in.)		
Piston		
O.D.	76.465 ~ 76.495mm (3.0104 ~ 3.0116 in.)	
Service size	0.25 mm (0.010 in.) oversize	
Piston ring		
Side clearance		
No. 1	0.04 ~ 0.085 mm (0.0015 ~ 0.0033 in.)	0.1 mm (0.004 in.)
No. 2	0.04 ~ 0.085 mm (0.0015 ~ 0.0033 in.)	0.1 mm (0.004 in.)
Endgap		
No. 1	0.15 ~ 0.30 mm (0.0059 ~ 0.012 in.)	1.0 mm (0.039 in.)
No. 2	0.30 ~ 0.45 mm (0.012 ~ 0.0177 in.)	1.0 mm (0.039 in.)
Oil ring side rail	0.2 ~ 0.7 mm (0.0078 ~ 0.0275 in.)	1.0 mm (0.039 in.)
Service size	0.25 mm (0.010 in.) oversize	
Connecting rod		
Bend	0.05mm (0.0020 in.) or less	
Twist	0.1mm (0.0039 in.) or less	
Connecting rod big end to crankshaft side clearance	0.100-0.250mm (0.0039-0.0098 in.)	0.4mm (0.0157in.)

Connecting rod bearing oil clearance	0.018-0.036mm (0.0007-0.0014 in.)	
Undersize	0.25, 0.50, 0.75mm	
(0.010, 0.020, 0.030 in.)		
Crankshaft		
Pin O.D.	45 mm (1.77 in.)	
Journal O.D.	50 mm (1.97 in.)	
Bend	0.03 mm (0.0012 in.) or less	
Out-of-round, taper of journal and pin	0.005 mm (0.0002 in.) or less	
End play	0.05- 0.175 mm (0.0019- 0.0068 in.)	
Undersize rework dimension of pin		
0.25mm (0.010 in.)	44.725 ~ 44.74mm (1.7608 ~ 1.7614 in.)	
0.50mm (0.020 in.)	44.475 ~ 44.49mm (1.7509 ~ 1.7516 in.)	
0.75mm (0.030 in.)	44.225 ~ 44.24mm (1.7411 ~ 1.7417 in.)	
Undersize rework dimension of journal		
0.25mm (0.010 in.)	49.727 ~ 49.742mm (1.9577 ~ 1.9583 in.)	
0.50mm (0.020 in.)	49.477 ~ 49.492mm (1.9479 ~ 1.9485 in.)	
0.75mm (0.030 in.)	49.227 ~ 49.242mm (1.9380 ~ 1.9386 in.)	
Flywheel		
Runout	0.1mm (0.0039 in.)	0.13mm (0.0051 in.)
Oil pump		
Clearance between outer circumference and front case (body clearance)	0.12 ~ 0.18mm (0.0047 ~ 0.0070 in.)	
Front case tip clearance	0.025 ~ 0.069mm (0.001 ~ 0.0027 in.)	
Side clearance		
Inner gear	0.04 ~ 0.085mm (0.0016 ~ 0.0033 in.)	
Outer gear	0.04 ~ 0.09mm (0.0016 ~ 0.0035 in.)	
Engine oil pressure		
Engine at idle [Oil temperature is 90 to 100°C (194 to 215°F)]	147KPa (1.5 kg/cm^2 , 21.33psi)	
Relief spring		

Free height	46.6mm (1.8346 in.)	
Load	6.1kg at 40.1mm (13.42lb/1.578 in.)	
Cooling method	Water-cooled, pressurized, forced circulation with electrical fan	
Coolant		
Quantity	6.5 liter	
Radiator		
Type	Pressurized corrugated fin type	
Radiator cap		
Main valve opening pressure	81.4 ~ 108 kpa (11.8 ~ 15.6 psi., 0.83 ~ 1.1 kg/cm^2)	
Vacuum valve opening pressure	-6.86 kpa (-1.00 psi, -0.07 kg/cm^2 or less	
Coolant pump	Centrifugal type impeller	
Thermostat		
Type	Wax pellet type with jiggle valve	
Valve opening temperature	82°C (180°F)	
Full-opening temperature	95°C (203°F)	
Engine coolant temperature sensor		
Type	Heat-sensitive thermistor type	
Resistance	2.31 ~ 2.59k ohm at 20°C (68°F)	
146.9 ~ 147.3 ohm at 110°C (230° F)		
Air cleaner		
Type	Dry type	
Element	Unwoven cloth type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	
O.D. = Outer Diameter I.D. = Inner Diameter O.S. = Oversize Diameter U.S. = Undersize Diameter		

TIGHTENING TORQUE

TIGHTENING TORQUE

Item	Nm	Kg.cm	lb.ft
Cylinder Block			
Front engine support bracket bolt and nut	45 ~ 55	450 ~ 550	33 ~ 41

Engine support bracket stay bolt	45 ~ 55	450 ~ 550	33 ~ 41
Oil pressure switch	13 ~ 15	130 ~ 150	10 ~ 11
Cylinder head			
Cylinder head bolt	30+ (90°)+Release all bolts+30+ (90°)	300+ (90°)+Release all bolts+300+ (90°)	22+ (90°)+Release all bolts+22+ (90°)
Intake manifold bolts or nuts	15 ~ 20	150 ~ 200	11 ~ 15
Exhaust manifold nut	25 ~ 30	250 ~ 300	18 ~ 22
Cylinder head cover bolt	8 ~ 10	80 ~ 100	6 ~ 7
Camshaft bearing cap bolt	12 ~ 14	120 ~ 140	9 ~ 10
Rear plate bolt	32 ~ 35	320 ~ 350	24 ~ 26
Main Moving system			
Connecting rod cap nut	32 ~ 35	320 ~ 350	24 ~ 26
Crankshaft bearing cap bolt	55 ~ 60	550 ~ 600	41 ~ 44
Fly wheel M/T bolt	120 ~ 130	1200 ~ 1300	89 ~ 96
Drive plate A/T bolt	120 ~ 130	1200 ~ 1300	89 ~ 96
Timing system			
Crankshaft pulley bolt	140 ~ 150	1400 ~ 1500	103 ~ 111
Camshaft sprocket bolt	80 ~ 100	800 ~ 1000	59 ~ 74
Timing belt tensioner bolt	20 ~ 27	200 ~ 270	15 ~ 20
Timing belt idle bolt	43 ~ 55	430 ~ 550	32 ~ 41
Timing belt cover bolt	8 ~ 10	80 ~ 100	6 ~ 7
Front case bolt	20 ~ 27	200 ~ 270	15 ~ 20
Engine Mounting			
Right mounting insulator (large) bolt	90 ~ 110	900 ~ 1100	66 ~ 81
Right mounting insulator (small) nut	50 ~ 65	500 ~ 650	37 ~ 48
Transmission mount insulator bolt	90 ~ 110	900 ~ 1100	66 ~ 81
Transmission insulator bracket to side member bolts	30 ~ 40	300 ~ 400	22 ~ 30
Front roll stopper insulator bolt	45 ~ 60	450 ~ 600	33 ~ 44
Front roll stopper bracket to sub frame bolt	30 ~ 40	300 ~ 400	22 ~ 30
Rear roll stopper insulator bolt	45 ~ 60	450 ~ 600	33 ~ 44
Rear roll stopper bracket	30 ~ 40	300 ~ 400	22 ~ 30

to sub frame bolt			
Oil filter	12 ~ 16	120 ~ 160	9 ~ 12
Oil pan bolts	10 ~ 12	100 ~ 120	7 ~ 9
Oil pan drain plug	40 ~ 45	400 ~ 450	30 ~ 33
Oil screen bolts	15 ~ 22	150 ~ 220	11 ~ 16
Alternator support bolt and nut	20 ~ 25	200 ~ 250	15 ~ 18
Alternator lock bolt	12 ~ 15	120 ~ 150	9 ~ 11
Alternator brace mounting bolt	20 ~ 27	200 ~ 270	15 ~ 20
Coolant pump pulley	8 ~ 10	80 ~ 100	6 ~ 7
Coolant pump bolt	12 ~ 15	120 ~ 150	9 ~ 11
Coolant temperature sensor	25 ~ 30	250 ~ 300	18 ~ 22
Coolant inlet fitting bolt	17 ~ 20	170 ~ 200	13 ~ 14
Thermostat housing bolt	15 ~ 20	150 ~ 200	11 ~ 14
Air cleaner body mounting bolts	8 ~ 10	80 ~ 100	6 ~ 7
Resonator mounting bolts	4 ~ 6	40 ~ 60	3 ~ 4
Intake manifold to cylinder head nuts and bolts	15 ~ 20	150 ~ 200	11 ~ 14
Surge tank stay to cylinder block bolts	18 ~ 25	180 ~ 250	13 ~ 18
Throttle body to surge tank bolts	15 ~ 20	150 ~ 200	11 ~ 14
Exhaust manifold to cylinder head nuts	25 ~ 30	250 ~ 300	18 ~ 22
Exhaust manifold cover to exhaust manifold bolts	15 ~ 20	150 ~ 200	11 ~ 14
Oxygen sensor to exhaust manifold	50 ~ 60	500 ~ 600	37 ~ 44
Front exhaust pipe to exhaust manifold nuts	30 ~ 40	300 ~ 400	22 ~ 30
Front exhaust pipe bracket bolts	30 ~ 40	300 ~ 400	22 ~ 30
Front exhaust pipe to catalytic converter bolts	40 ~ 60	400 ~ 600	30 ~ 44

SERVICE STANDARD

SERVICE STANDARD

Standard value	
Antifreeze	Mixture ratio of anti-freeze in coolant

ETHYLENE GLYCOL BASE FOR ALUMINUM	50%

MAINTENANCE

CHECKING ENGINE OIL

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

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

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

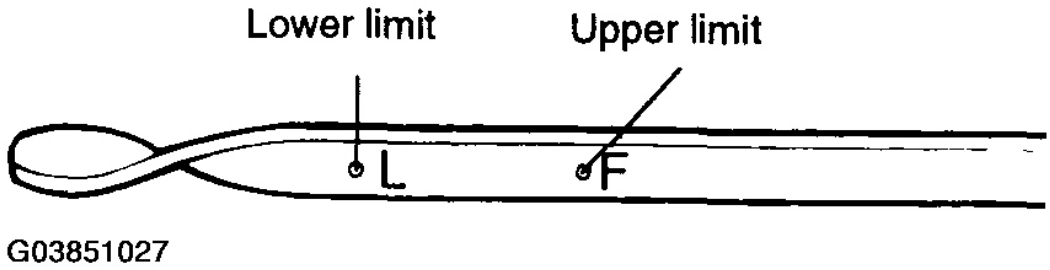


Fig. 1: Identifying Engine Oil Level
Courtesy of HYUNDAI MOTOR CO.

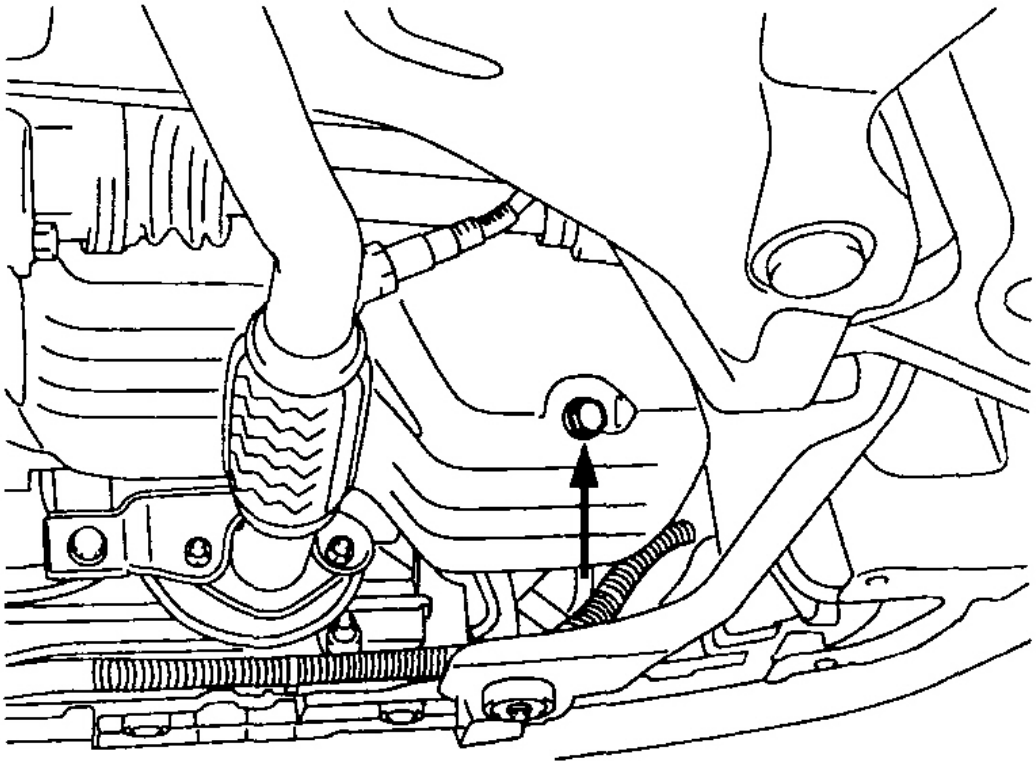
NOTE: When refilling, use the same type of engine oil.

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

CHANGING ENGINE OIL

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

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



G03851028

Fig. 2: Removing Drain Plug
Courtesy of HYUNDAI MOTOR CO.

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

   Tightening torque

   Drain plug: 40 ~ 45 Nm (400 ~ 450 kg.cm, 30 ~ 33 lb.ft)

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

   Drain and Refill Without oil filter:

   3.0 liter (3.17 U.S.qts, 2.64 Imp. qts)

   Draining and Refill With oil filter:

   3.3 liter (3.48 U.S.qts, 2.64 Imp. qts)

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

FILTER SELECTION

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

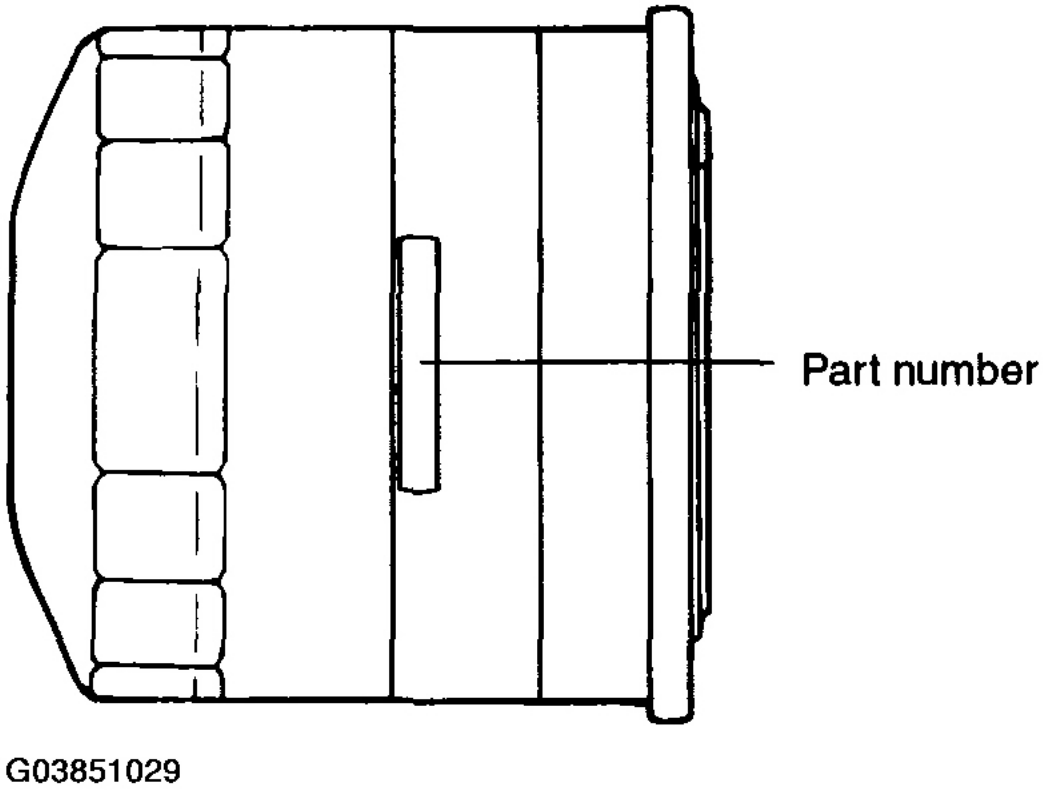


Fig. 3: Identifying Oil Filter Part Number
Courtesy of HYUNDAI MOTOR CO.

PROCEDURE FOR REPLACING THE OIL FILTER

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

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

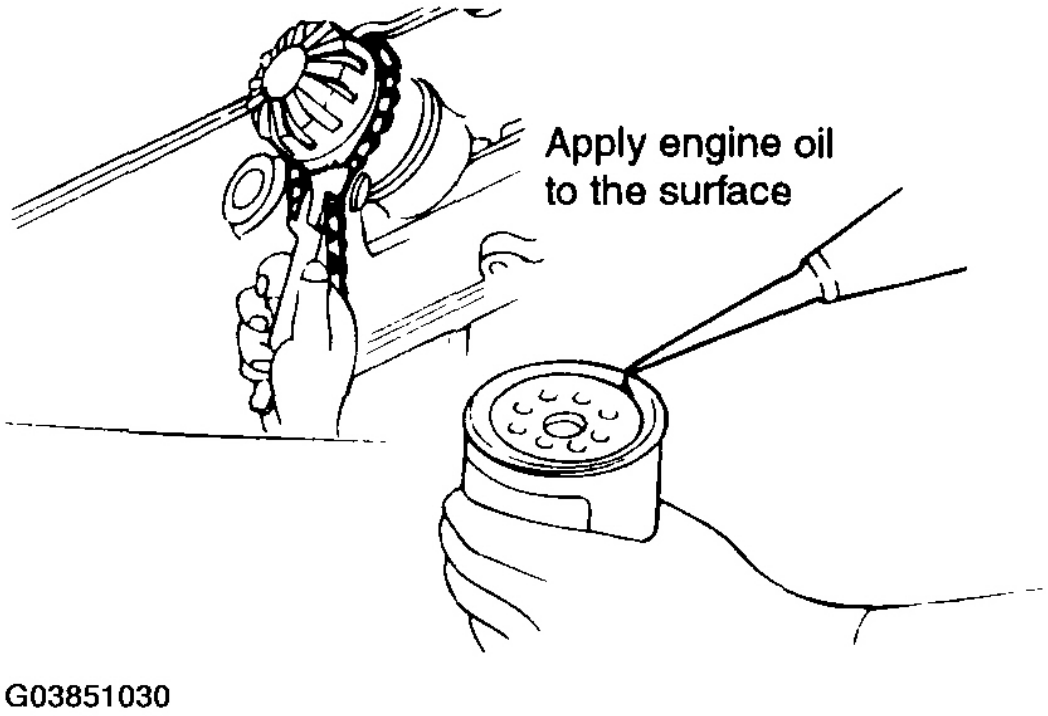
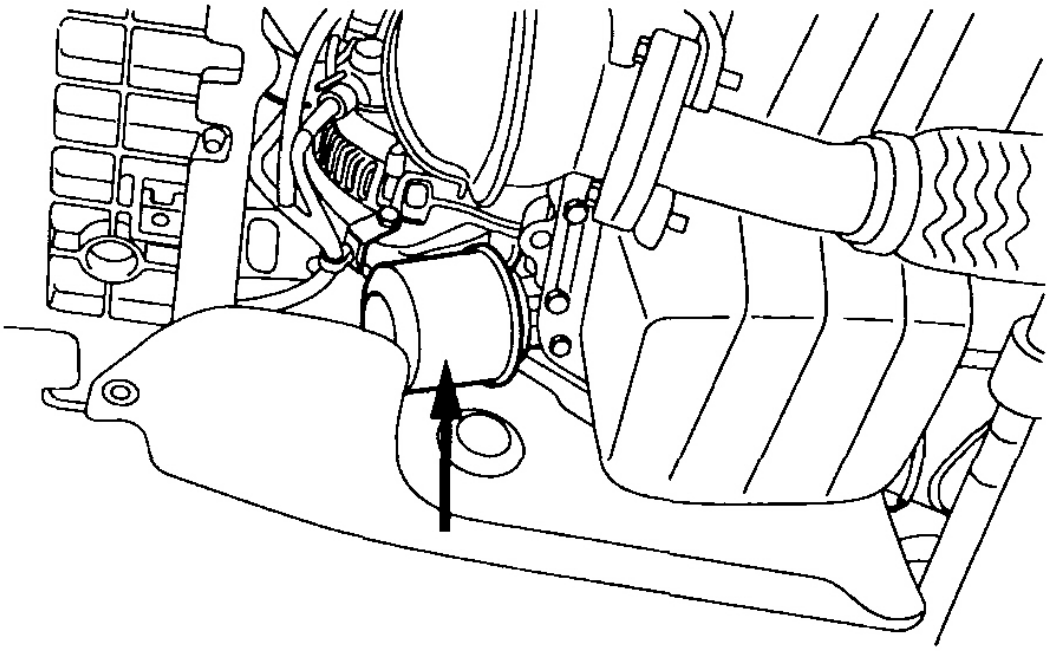


Fig. 4: Applying Clean Engine Oil To Surface Of Rubber Gasket
Courtesy of HYUNDAI MOTOR CO.

3. Tighten the oil filter to the specified torque.



G03851031

Fig. 5: Tightening Oil Filter To Specified Torque
Courtesy of HYUNDAI MOTOR CO.

Tightening torque

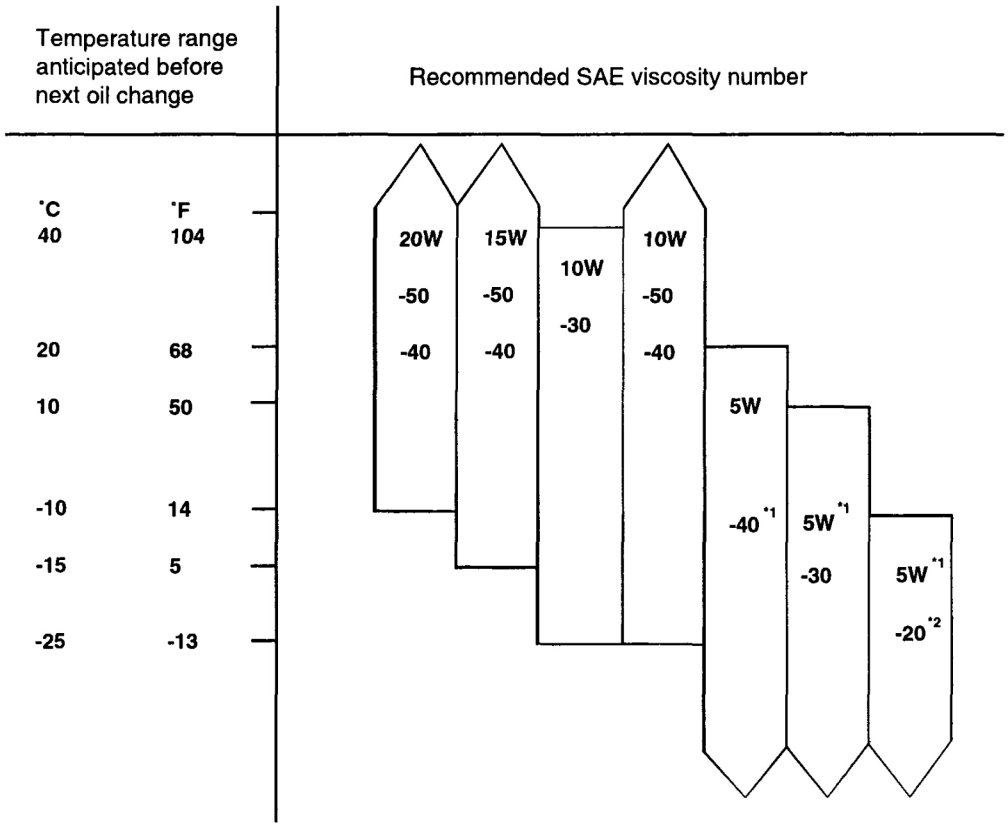
Oil filter: 12 ~ 16 Nm (120 ~ 160 kg.cm, 9 ~ 12 lb.ft)

4. Run the engine to check for engine oil leaks.
5. After turning off the engine, check the oil level and add oil as necessary.

SELECTION OF ENGINE OIL

Recommended API classification: SH OR ABOVE

Recommended SAE viscosity grades:



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

G03851032

Fig. 6: Engine Oil SAE Viscosity Number
Courtesy of HYUNDAI MOTOR CO.

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

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

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

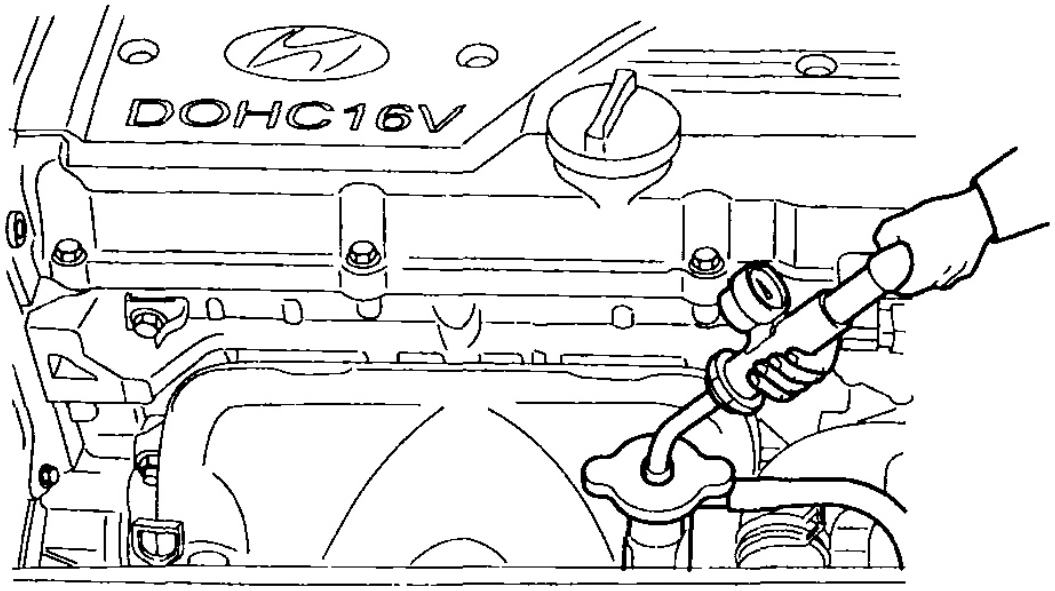
CHECKING COOLANT LEAK

1. Wait until the engine is cool, then carefully remove the radiator cap.
2. Confirm that the coolant level is up to the filler neck.
3. Install a radiator cap tester to the radiator filler neck and apply 140 kPa (1.4 kg/cm^2 , 20 psi) pressure.

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

NOTE:

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



G03851033

Fig. 7: Installing & Removing Tester
Courtesy of HYUNDAI MOTOR CO.

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

RADIATOR CAP PRESSURE TEST

1. Remove the radiator cap, wet its seal with engine coolant, then install it on the tester.
2. Increase the pressure until the gauge stops moving.

Main valve opening pressure:

83 ~ 110 kPa (0.83 ~ 1.1 kg/cm^2 , 12 ~ 16 psi)

Vacuum valve opening pressure:

-7 kPa (-0.07 kg/cm^2 , -1.0 psi)

3. Check that the pressure level is maintained at or above the limit.
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.

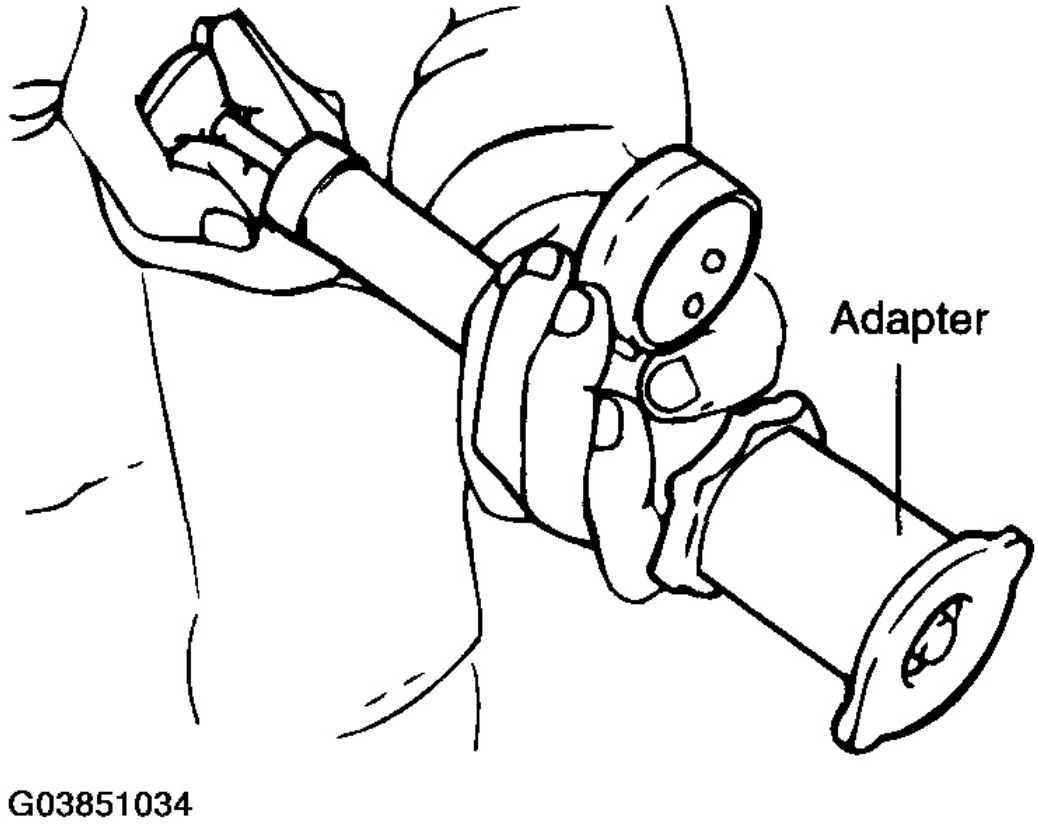
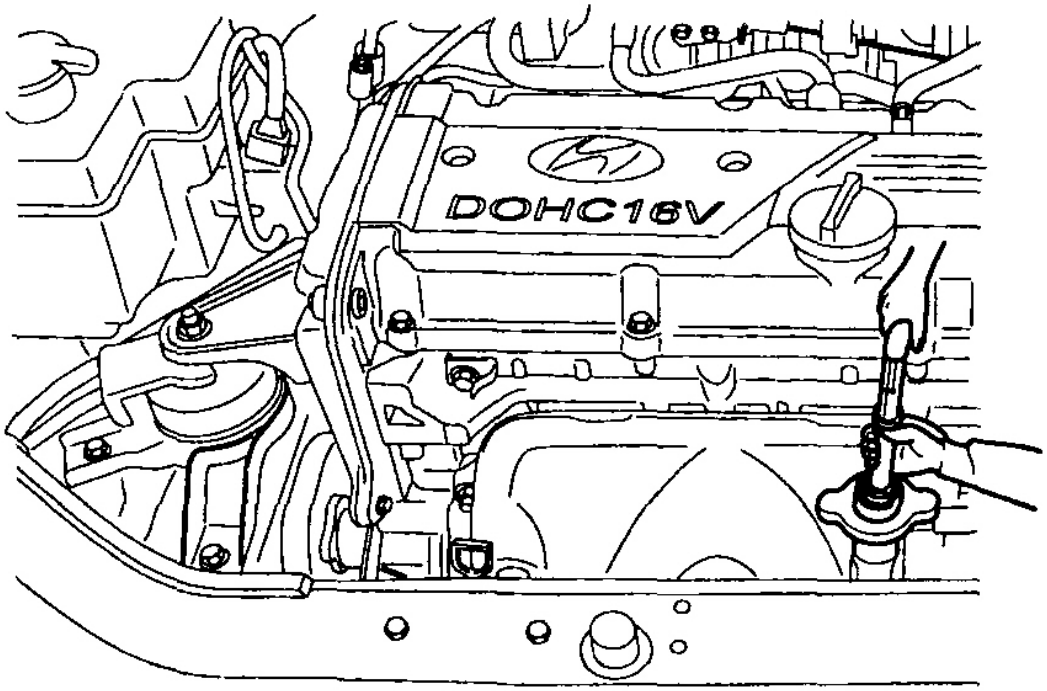


Fig. 8: Identifying Radiator Cap Pressure Test
Courtesy of HYUNDAI MOTOR CO.

SPECIFIC GRAVITY TEST

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

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



G03851035

Fig. 9: Specific Gravity Of The Coolant With A Hydrometer
Courtesy of HYUNDAI MOTOR CO.

RELATION BETWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY

COOLANT SPECIFICATION

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

Example

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

CAUTION:

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

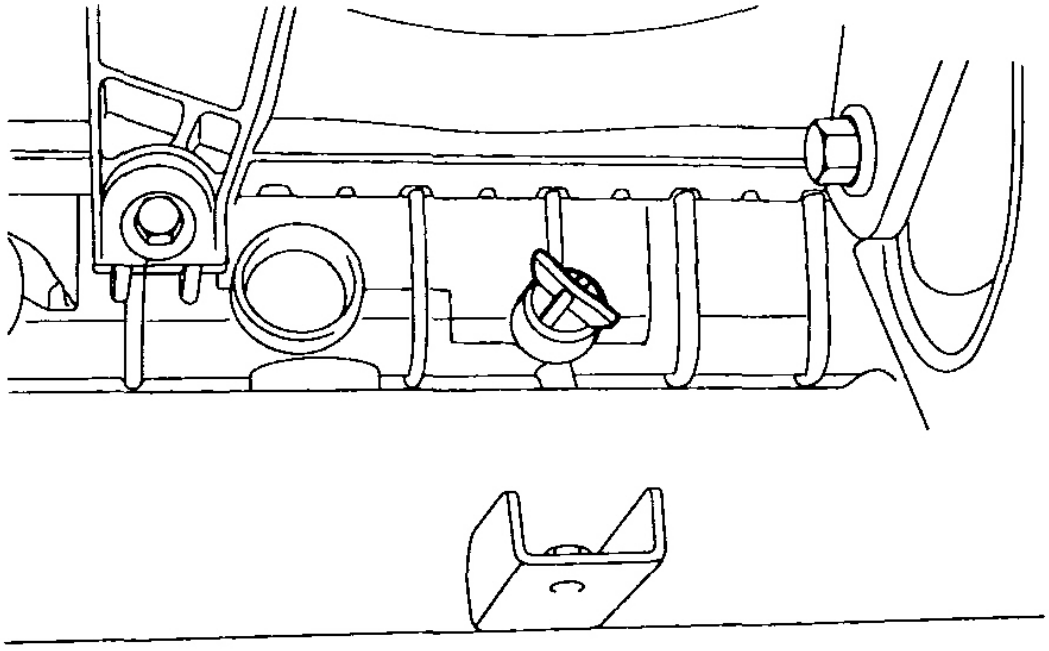
RECOMMENDED COOLANT CHART

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

CHANGING ENGINE COOLANT

CAUTION: When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on electrical parts or the paint. If any coolant spills, rinse it off immediately.

1. Slide the heater temperature control lever to maximum heat. Make sure the engine and radiator are cool to the touch.
2. Remove the radiator cap.
3. Loosen the drain plug, and drain the coolant.



G03851036

Fig. 10: Loosening Drain Plug
Courtesy of HYUNDAI MOTOR CO.

4. Tighten the radiator drain plug securely.
5. Remove, drain and reinstall the reservoir. Fill the tank halfway to the MAX mark with water, then up to the MAX mark with antifreeze.
6. Pour coolant into the radiator up to the base of the filler neck, and install the radiator cap loosely.
7. Start the engine and let it run until it warms up (the radiator fan comes on at least twice).
8. Turn off the engine.

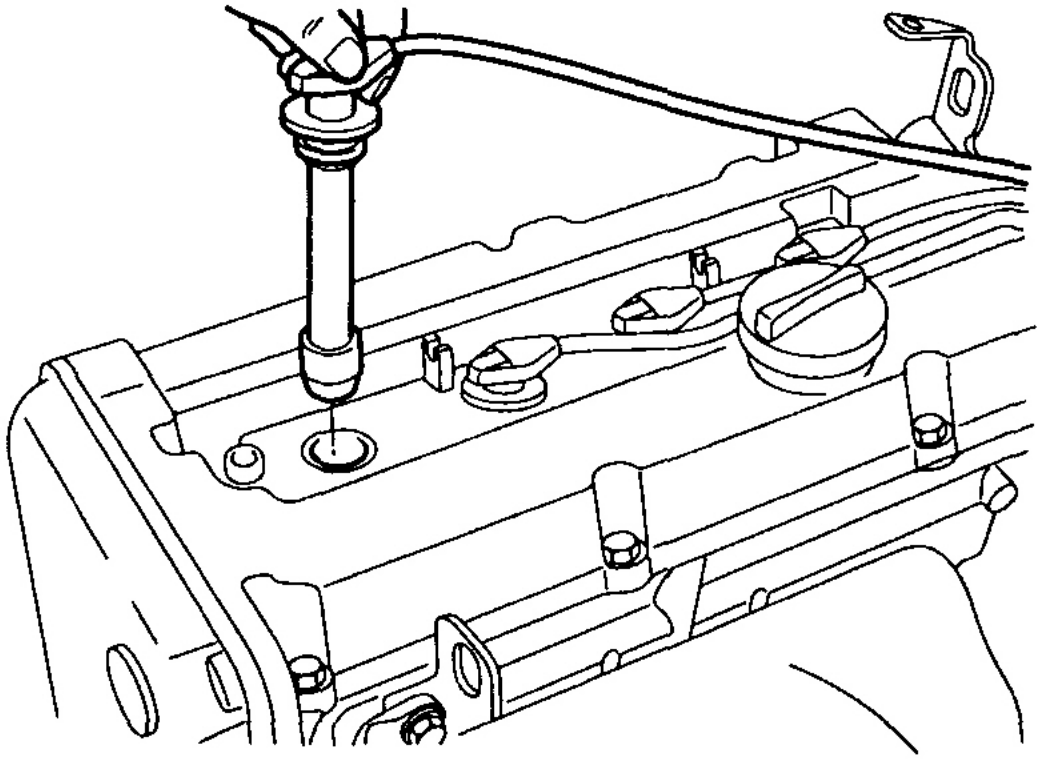
   Check the level in the radiator, add coolant if needed.

9. Put the radiator cap on tightly, then run the engine again and check for leaks.

CHECKING COMPRESSION PRESSURE

1. Before checking engine compression, check the engine oil level. Also check that the starter motor and battery are all in normal operating condition.
2. Check the DTC and note it. Use the scan tool to clear the ECM'S memory.
3. Start the engine and wait until engine coolant temperature reaches 80 ~ 95°C (176 ~ 205°F).
4. Disconnect the fuel pump connector.

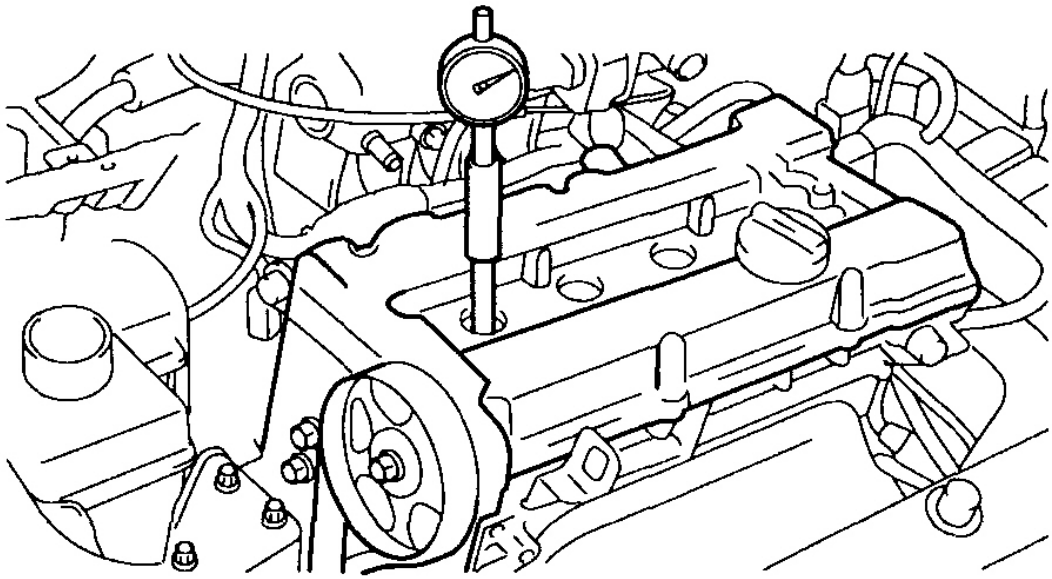
5. Turn off engine and disconnect the spark plug cables.



G03851037

Fig. 11: Disconnecting Spark Plug Cables
Courtesy of HYUNDAI MOTOR CO.

6. Remove the spark plugs.
7. Disconnect the I.G. connector.
8. Crank the engine to remove any foreign material in the cylinders.
9. Insert the compression gauge into the spark plug hole.



G03851038

Fig. 12: Inserting Compression Gauge Into Spark Plug Hole
Courtesy of HYUNDAI MOTOR CO.

10. Depress the accelerator pedal to open the throttle fully.
11. Crank the engine and read the gauge.

    Standard value: 1500 kpa (15 kg/cm^2 , 218 psi)

    Limit: 1400kpa (14 kg/cm^2 , 203 psi)

12. Repeat steps 9 to 11 over all cylinders, ensuring that the pressure differential for each of the cylinders is within the specified limit.

    Limit

    Max 100 kpa (1.0 kg/cm^2 , 14 psi) between cylinders

13. 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 9 to 12 .
    1. If the addition of oil makes the compression to rise, it is likely that there may be wear between the piston ring and cylinder wall.
    2. If compression remains the same, valve seizure, poor valve seating or a compression leak from the cylinder head gasket are all possible causes.

Tightening torque

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

ADJUSTING TIMING BELT TENSION

1. Rotate the steering wheel counter-clockwise thoroughly.

NOTE: Do watch not to over load.

2. Lift the vehicle by using of jack.

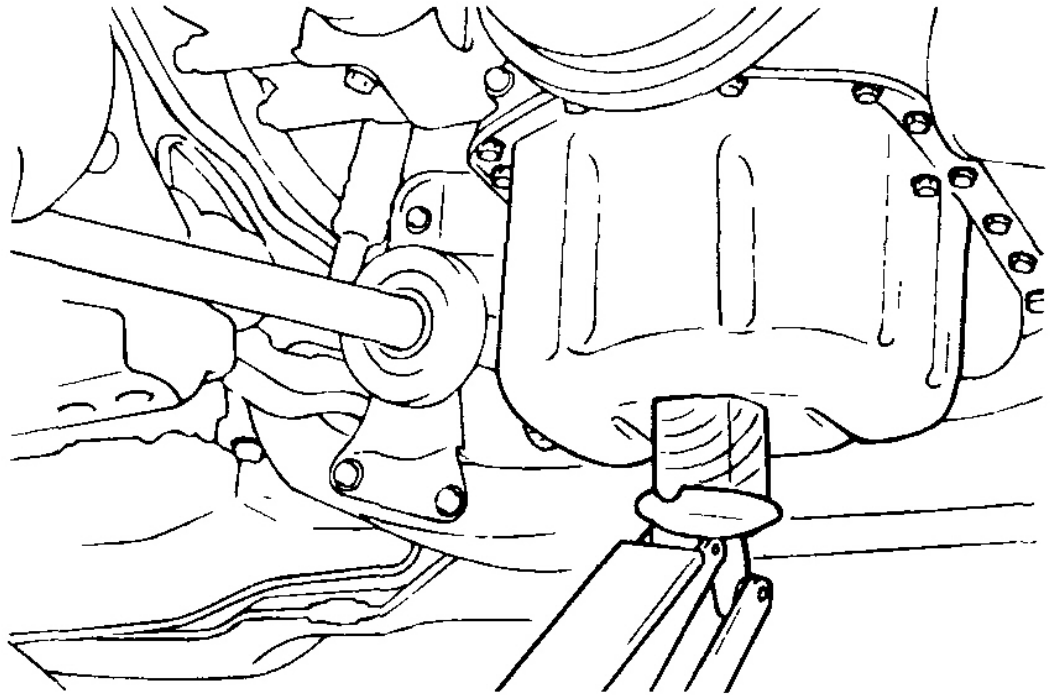


Fig. 13: Lifting Vehicle By Using Of Jack
Courtesy of HYUNDAI MOTOR CO.

3. Remove the engine support bracket. (14 mm bolt and 2 nuts, 17 mm bolt)

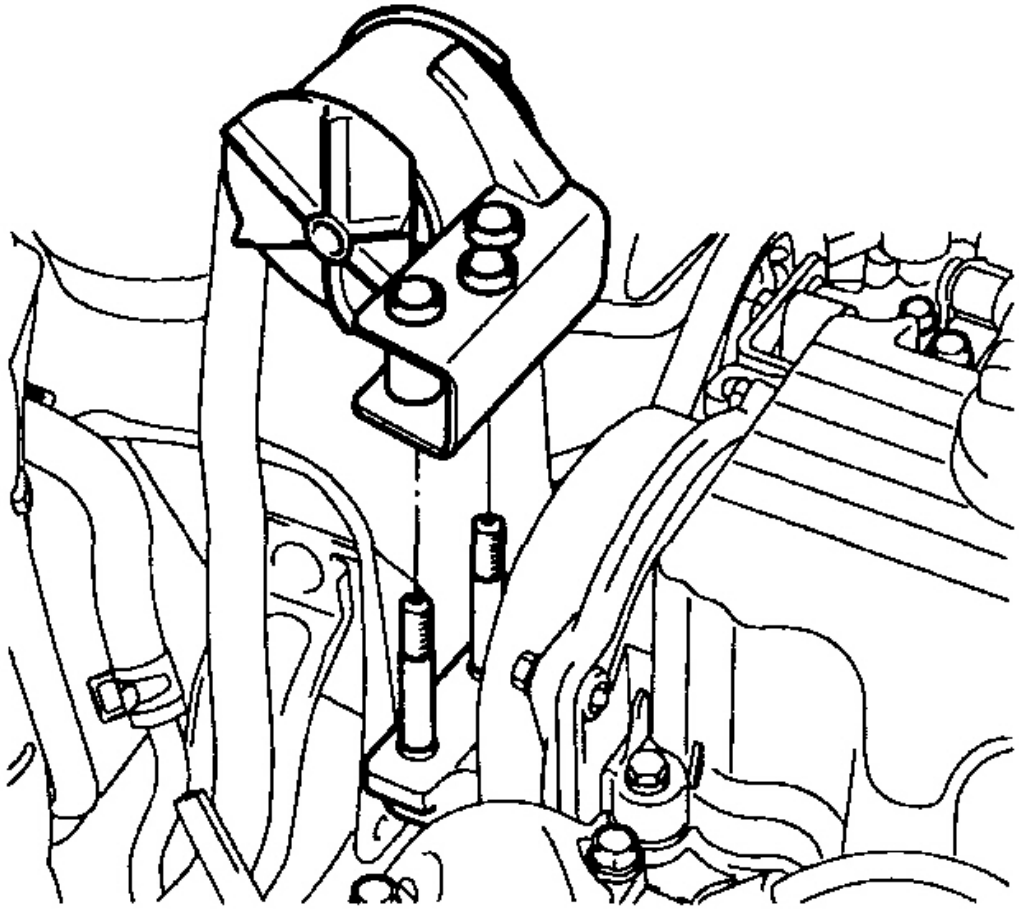
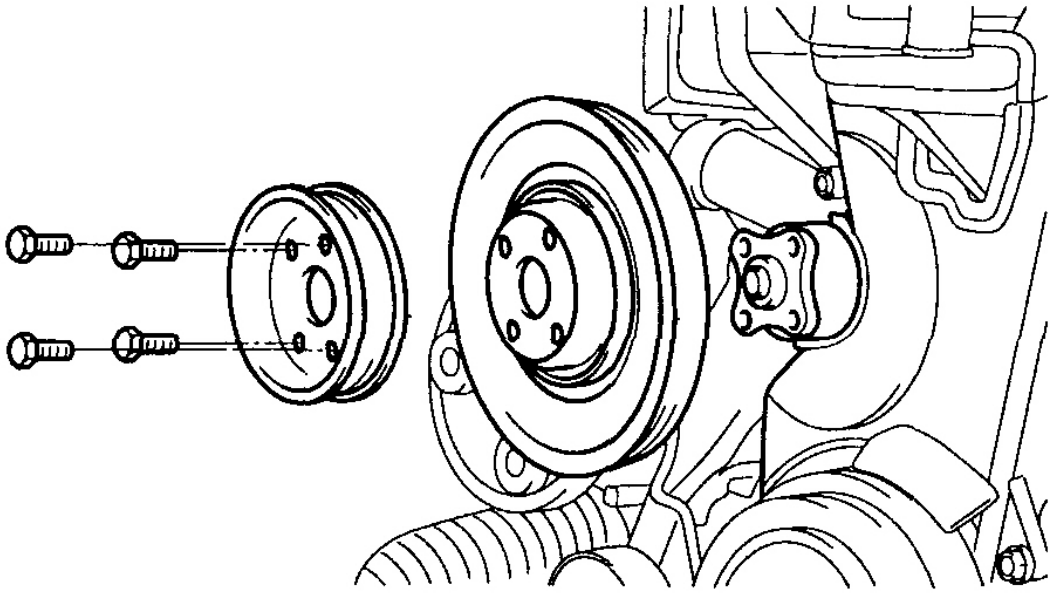


Fig. 14: Removing Engine Support Bracket
Courtesy of HYUNDAI MOTOR CO.

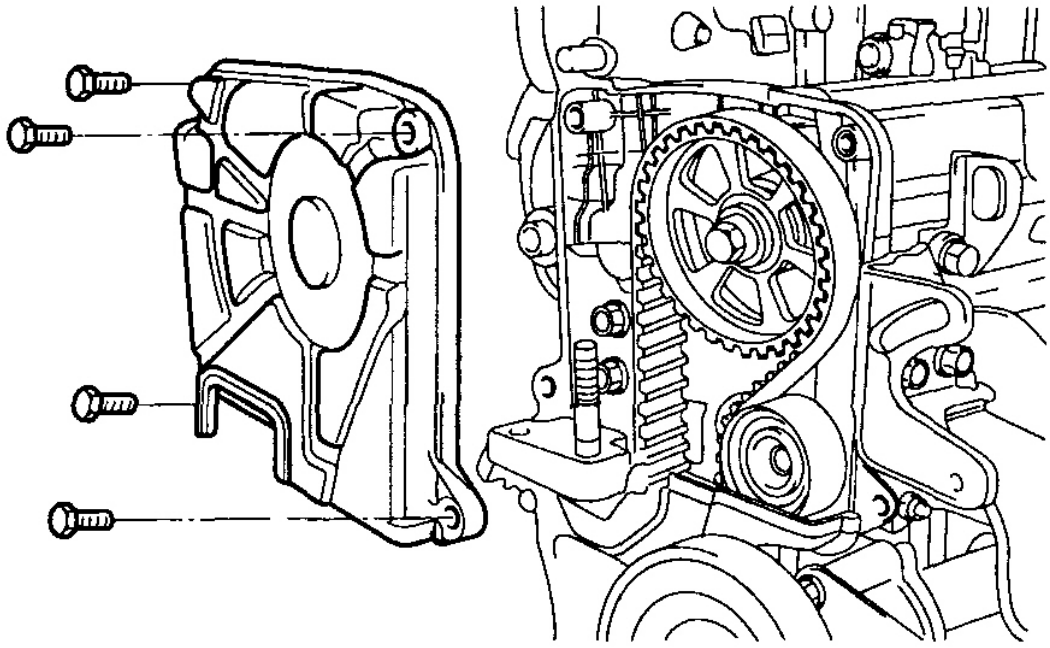
4. Remove the drive belts and the water pump pulley. (10 mm 4 bolts)



G03851041

Fig. 15: Removing Water Pump Pulley
Courtesy of HYUNDAI MOTOR CO.

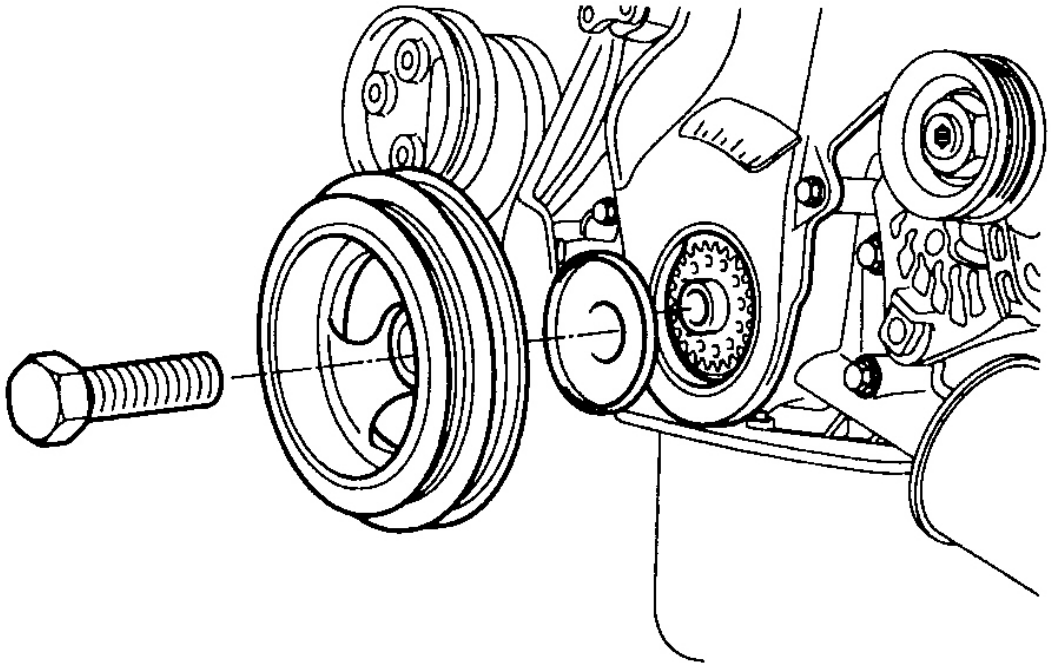
5. Remove the timing belt upper cover. (10 mm 4 bolts)



G03851042

Fig. 16: Removing Timing Belt Upper Cover
Courtesy of HYUNDAI MOTOR CO.

6. Remove the crankshaft pulley.



G03851043

Fig. 17: Removing Crankshaft Pulley
Courtesy of HYUNDAI MOTOR CO.

7. Remove the timing belt lower cover.
8. Place the piston of No. 1 cylinder to TDC of the compression stroke by rotating the crankshaft clockwise.

NOTE: Crankshaft is to be rotated clockwise otherwise, the tension is inadequately adjusted.

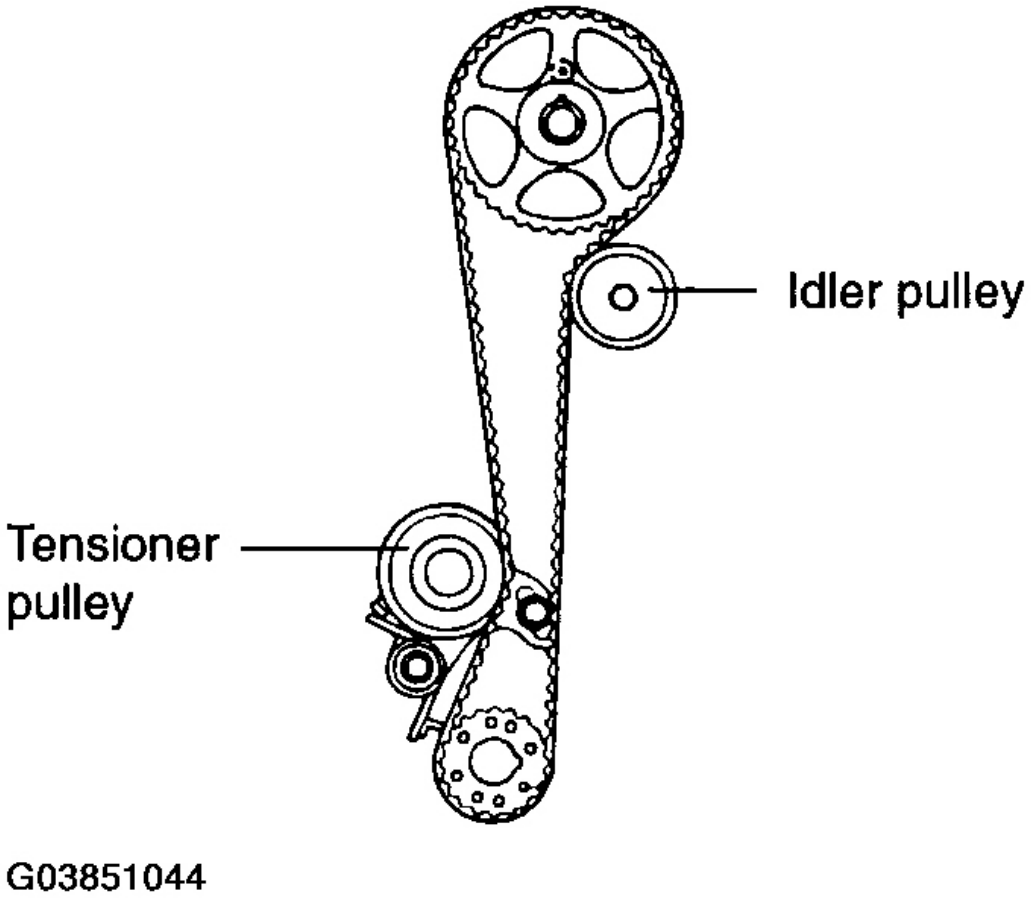
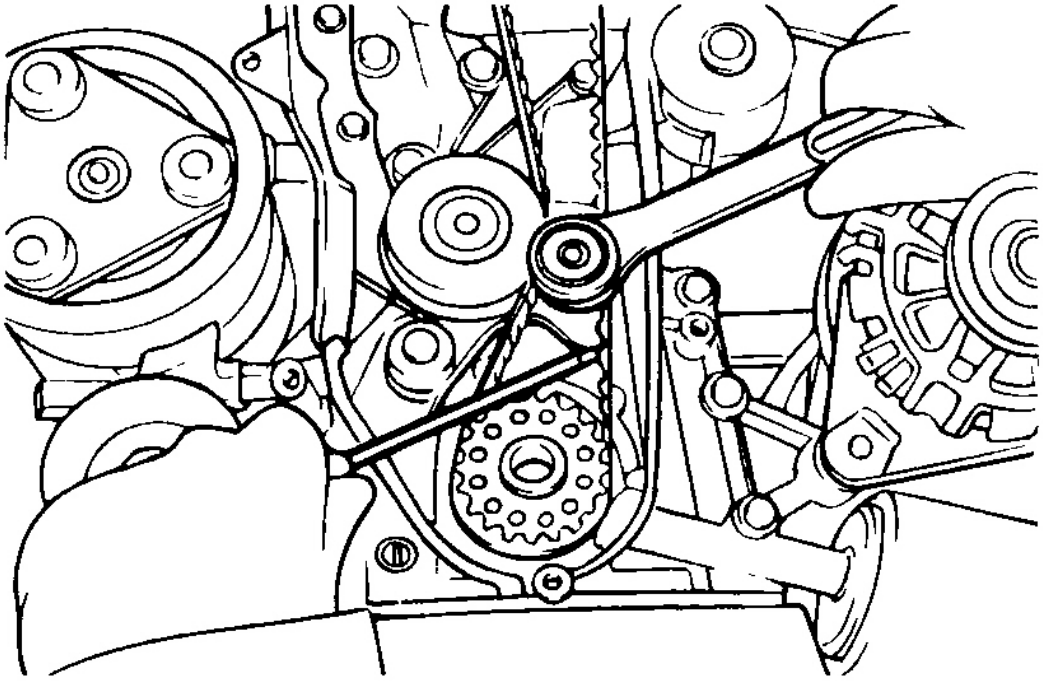


Fig. 18: View Of Pulley & Belt
Courtesy of HYUNDAI MOTOR CO.

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



G03851045

Fig. 19: Loosening Tensioner Bolt
Courtesy of HYUNDAI MOTOR CO.

10. Rotate the crankshaft clockwise as many as 2 teeth of camshaft sprocket.
11. Check that the teeth of the sprocket and belt coincide with each other.
12. Tighten the slot side bolt first and then tighten the bolt of pivot side.
13. Check the tension of the timing belt.

    When the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49N (11 lb)], the timing belt log end is approx. half of the tensioner mounting bolt head radius (cross flats) away from the bolt head center.

G03851046

Fig. 20: Checking Tension Of Timing Belt
Courtesy of HYUNDAI MOTOR CO.

14. Rotate the crankshaft pulley two turns clockwise so that the timing belt positions on the pulleys.
15. Install the timing belt lower cover.
16. Install the crankshaft pulley.
17. Install the timing belt upper cover.
18. Install the water pump pulley and engine support bracket.

ADJUSTING DRIVE BELT TENSION

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

CAUTION: **1. When installing the V-ribbed belt, check that the V-ribs are prope aligned.**

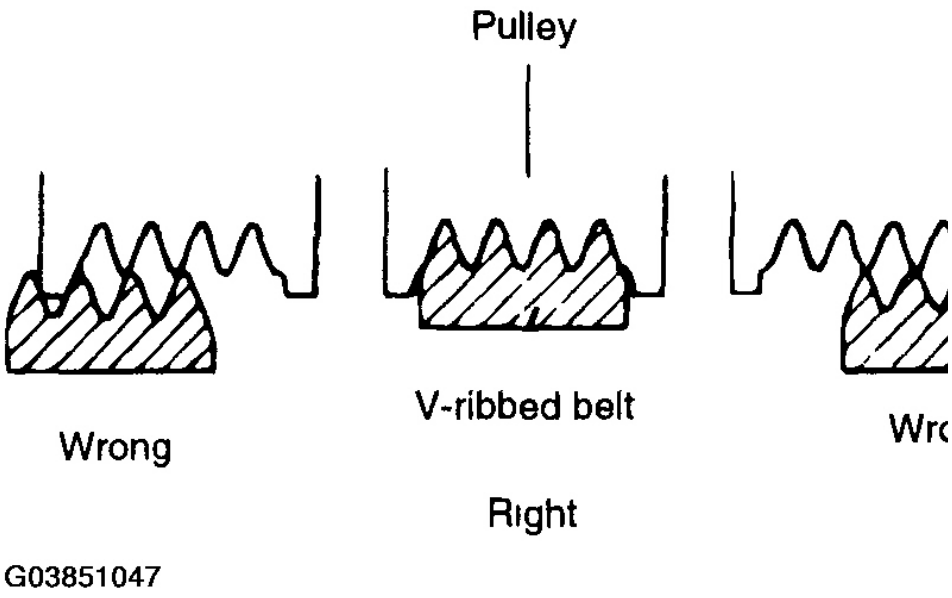


Fig. 21: Identifying V-Ribs Are Properly Aligned
Courtesy of HYUNDAI MOTOR CO.

2. **If noise or slippage is detected, check the belt for wear, damage, breakage on the pulley contact surface, and check the pulley for Also check the amount that the belt is deflected.**

STANDARD VALUE:

DIAGNOSIS PROCEDURE

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

NOTE:

1. **The belt tension must be measured half - way between the specified pulleys.**
2. **When a new belt is installed, adjust the tension to the central value of the**

standard range indicated under "New" in the above table. Let the engine idle for 5 minutes or more, and check the standard value indicated under "Inspection."

3. **When adjusting a belt which has been used, or newly installed, after 5 minutes or more of operation, refer to the standard value indicated under "Used" in the above table.**
4. **Refer to the standard value indicated under "Inspection" for periodic inspections.**

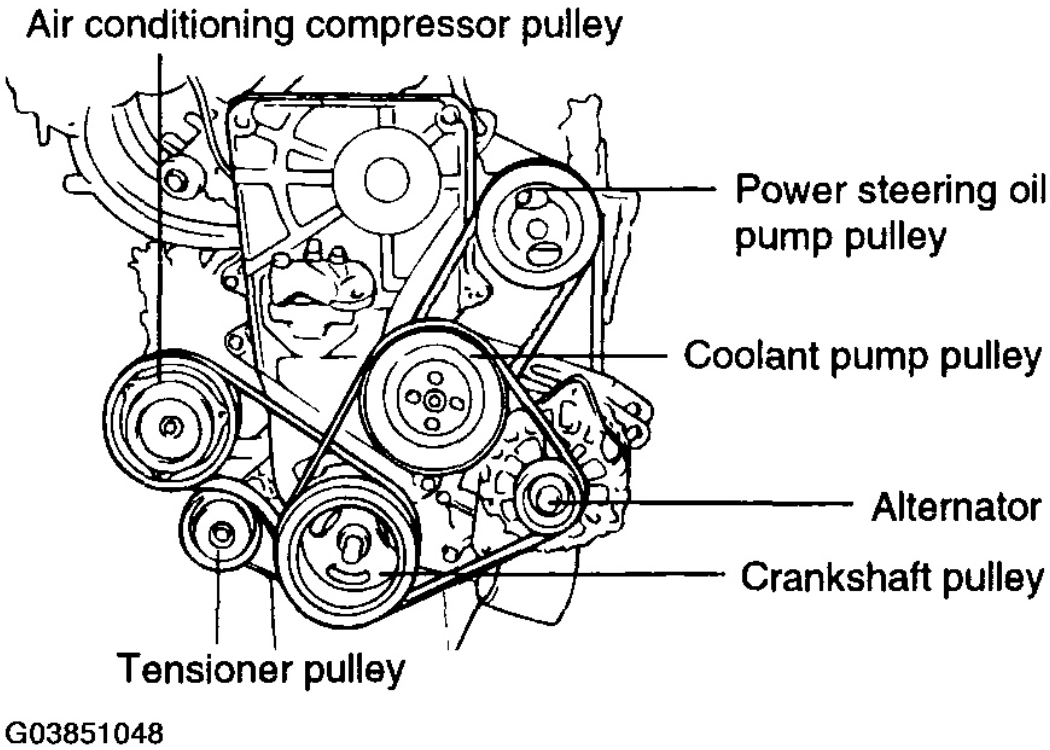


Fig. 22: View Of Pulley & Belt
Courtesy of HYUNDAI MOTOR CO.

TYPE A TENSION GAUGE

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

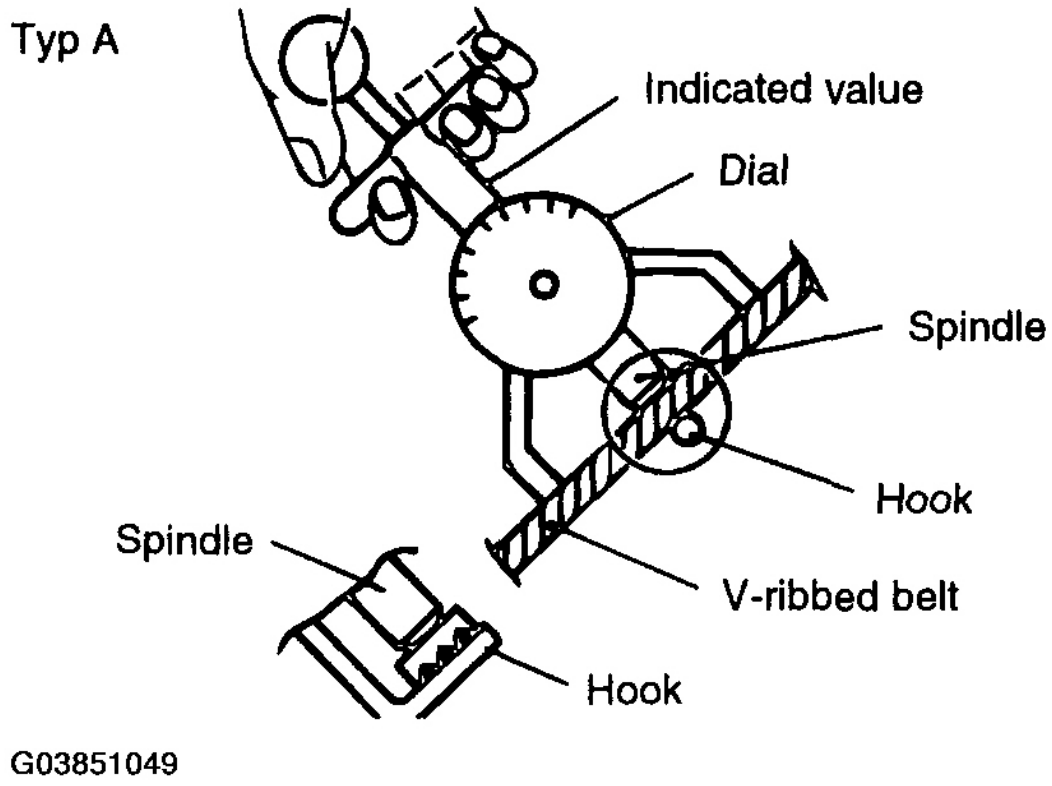


Fig. 23: Measure Belt Tension With Type A Tension Gauge
Courtesy of HYUNDAI MOTOR CO.

TYPE B TENSION GAUGE

1. When measuring, turn the reset button in the direction of the arrow and set the gauge needle to the RESET position.
2. If the tension gauge is removed from the belt, the needle will still indicate the tension. Read the tension value after removing the gauge.

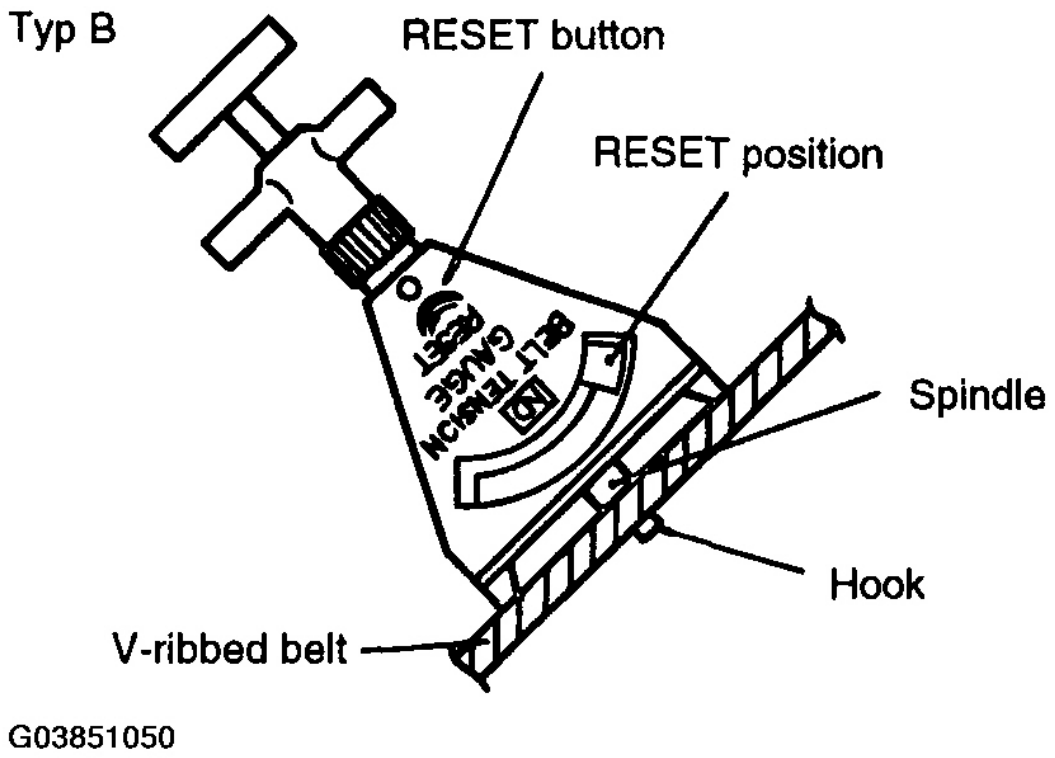


Fig. 24: Measuring Belt Tension With Type B Tension Gauge
Courtesy of HYUNDAI MOTOR CO.

ADJUSTING THE ALTERNATOR BELT

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

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

Tightening torque

Alternator support bolt and nut:

20 ~ 25 Nm (200 ~ 250 kg.cm, 14 ~ 18 lb.ft)

Alternator lock bolt B:

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

Alternator brace mounting bolt:

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

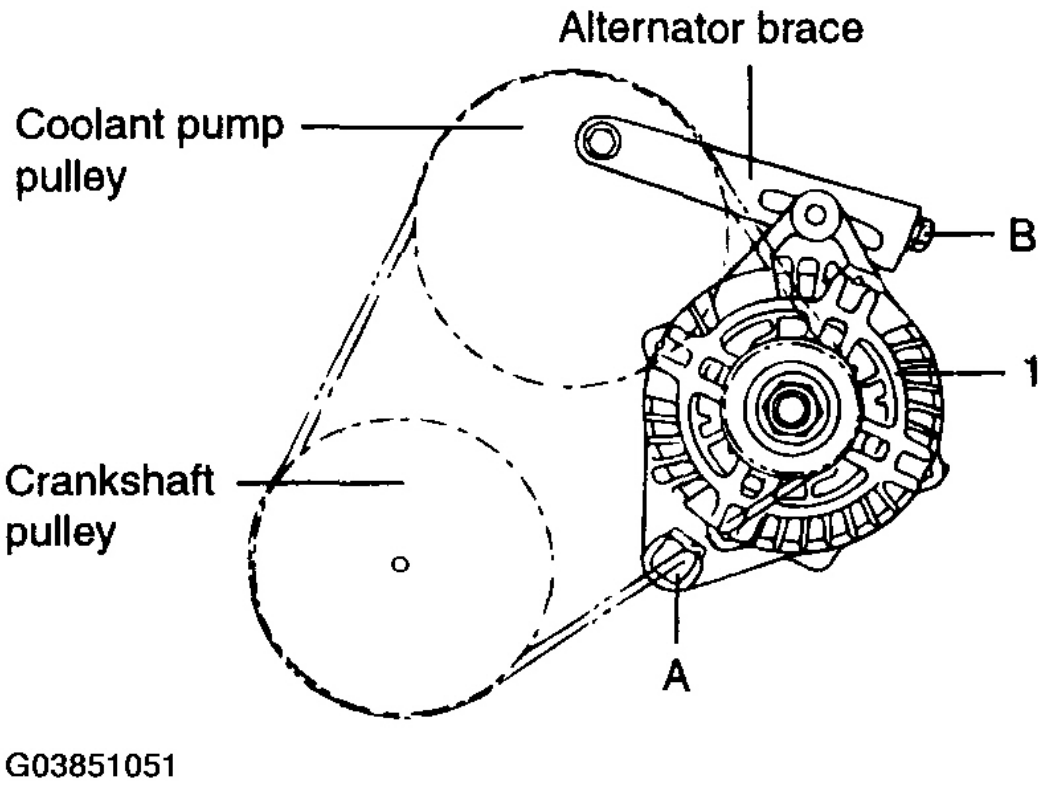
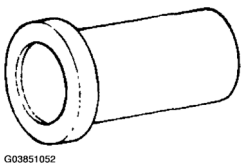
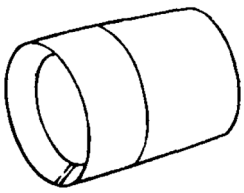
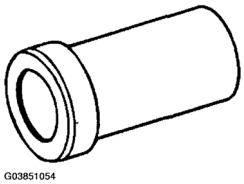
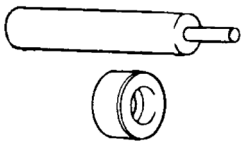
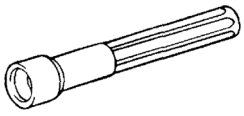
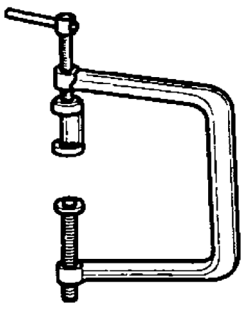


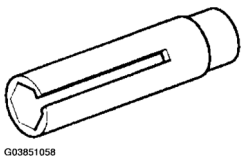
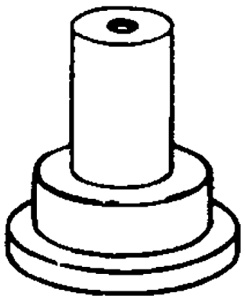
Fig. 25: Adjusting Alternator Belt
Courtesy of HYUNDAI MOTOR CO.

SPECIAL TOOLS

SPECIAL TOOLS CHART

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09231 - 22000)		Installation of the front oil seal

	 G03851052	
Crankshaft front oil seal guide (09231 - 22100)	 G03851053	Guide of oil seal
Camshaft oil seal installer (09221 - 21000)	 G03851054	Installation of the camshaft oil seal
Valve guide installer (09221 - 3F100 A/B)	 G03851055	Removal and installation of valve guides
Valve stem oil seal installer (09222 - 22001)	 G03851056	Installation of valve stem oil seals
Valve spring compressor (09222 - 28000) Valve spring compressor holder (09222 - 28100)	 G03851057	Removal and installation of intake and exhaust valves

Water temperature sensor socket wrench (09221 - 25100)	 G03851058	Removal and installation of the water temperature sensor
Crankshaft rear oil seal installer (09231 - 21000)	 G03851059	Installation of engine real oil seal and crankshaft rear oil seal

TROUBLESHOOTING

TROUBLESHOOTING CHART

Symptom	Probable cause	Remedy
Low compression	Blown cylinder head gasket	Replace gasket
	Worn or damaged piston rings	Replace rings
	Worn piston or cylinder	Repair or replace piston and/or cylinder block
	Worn or damaged valve seat	Repair or replace valve and/or seat ring
Low oil pressure	Low engine oil level	Check engine oil level
	Faulty oil pressure switch	Replace
	Clogged oil filter	Replace
	Worn oil pump gears or cover	Replace
	Thin or diluted engine oil	Change and determine cause
	Oil relief valve stuck (open)	Repair
	Excessive bearing clearance	Replace
High oil pressure	Oil relief valve stuck (closed)	Repair
Excessive engine vibration	Loose engine roll stopper (front, rear)	Re-tighten
	Loose transaxle mount bracket	Re-tighten
	Loose engine mount bracket	Re-tighten
	Loose center member	Re-tighten
	Broken transaxle mount insulator	Replace
	Broken engine mount insulator	Replace

	Broken engine roll stopper insulator	Replace
Noisy valves	Thin or diluted engine oil (low oil pressure)	Change
	Worn or damaged valve stem or valve guide	Replace
	HLA abnormal operation	Speed the engine up (for venting) or Replace the HLA
Connecting rod and/or main bearing noise	Insufficient oil supply	Check engine oil level
	Thin or diluted engine oil	Change and determine cause
	Excessive bearing clearance	Replace
Timing belt noise	Incorrect belt tension	Adjust belt tension
Low coolant level	Leakage of coolant	
	1. Heater or radiator hose	Repair or replace parts
	2. Faulty radiator cap	Tighten or replace clamps
	3. Thermostat housing	Replace gasket or housing
	4. Radiator	Repair or replace
	5. Engine coolant pump	Replace parts
Clogged radiator	Foreign material in coolant	Replace coolant
Abnormally high coolant temperature	Faulty thermostat	Replace parts
	Faulty radiator cap	Replace parts
	Restricted flow in cooling system	Clear restriction or replace parts
	Loose or missing drive belt	Adjust or replace
	Faulty water pump	Replace
	Faulty electric fan	Repair or replace
	Insufficient coolant	Refill coolant
Abnormally low coolant temperature	Faulty thermostat	Replace
	Faulty temperature sensor wiring	Repair or replace
Inoperative electrical cooling fan	Damaged thermo sensor, electrical motor, radiator fan relay and wiring, fuse	Replace or repair
Exhaust gas leakage	Loose connections	Retighten
	Broken pipe or muffler	Repair or replace
Abnormal noise	Detached baffle plate in muffler	Replace
	Broken rubber hanger	Replace
	Pipe or muffler contacting vehicle body	Correct
	Broken pipe or muffler	Repair or replace

ENGINE AND TRANSAXLE ASSEMBLY

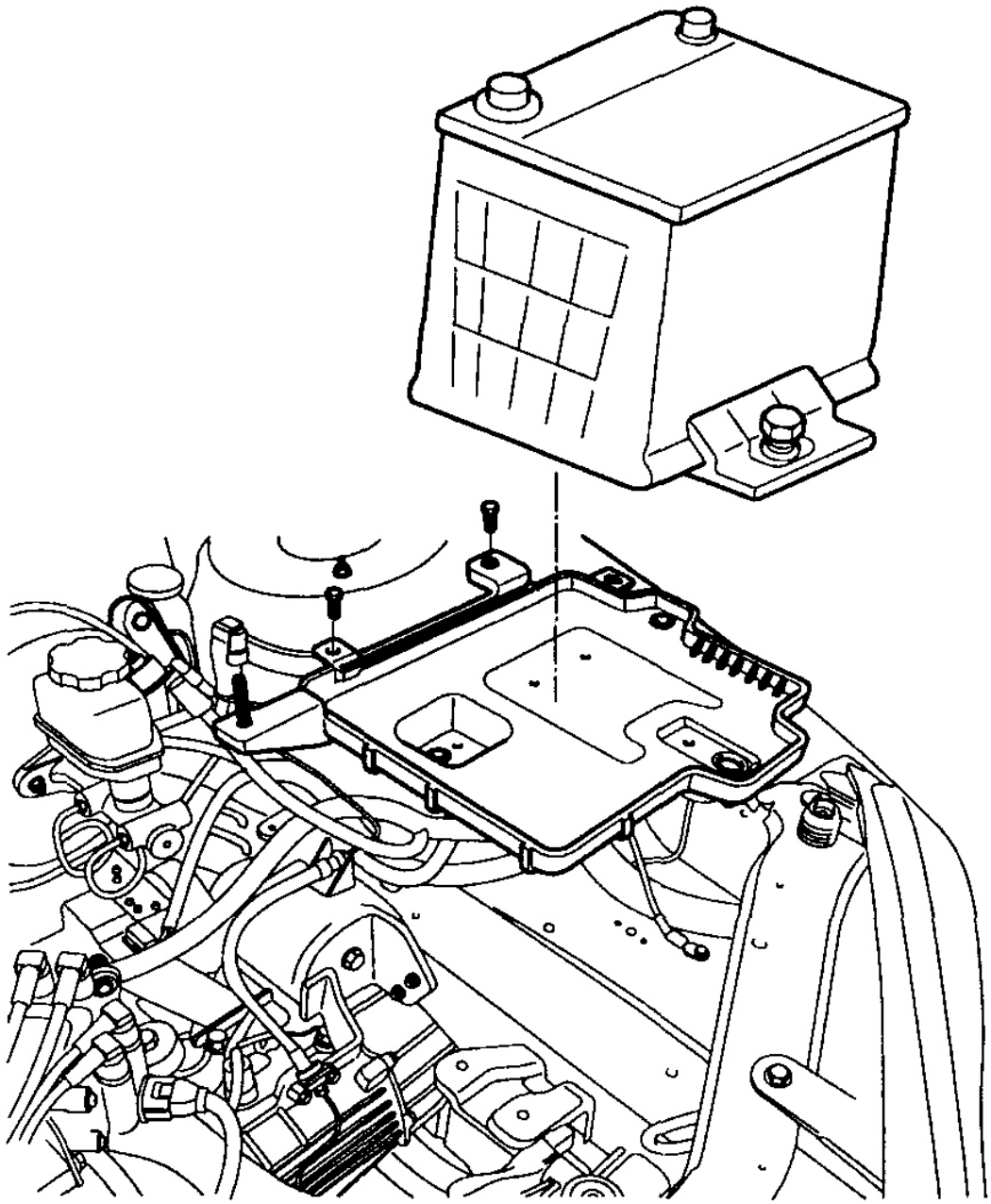
REMOVAL

WARNING:

- **Make sure jacks and safety stands are placed properly and hoist brackets are attached to the correct position on the engine.**
- **Make sure the vehicle will not roll off stands and fall while you are working under it.**

CAUTION: Use fender covers to avoid damaging painted surface.

1. Remove the battery.



G03851060

Fig. 26: Removing Battery
Courtesy of HYUNDAI MOTOR CO.

2. Detach the air cleaner.

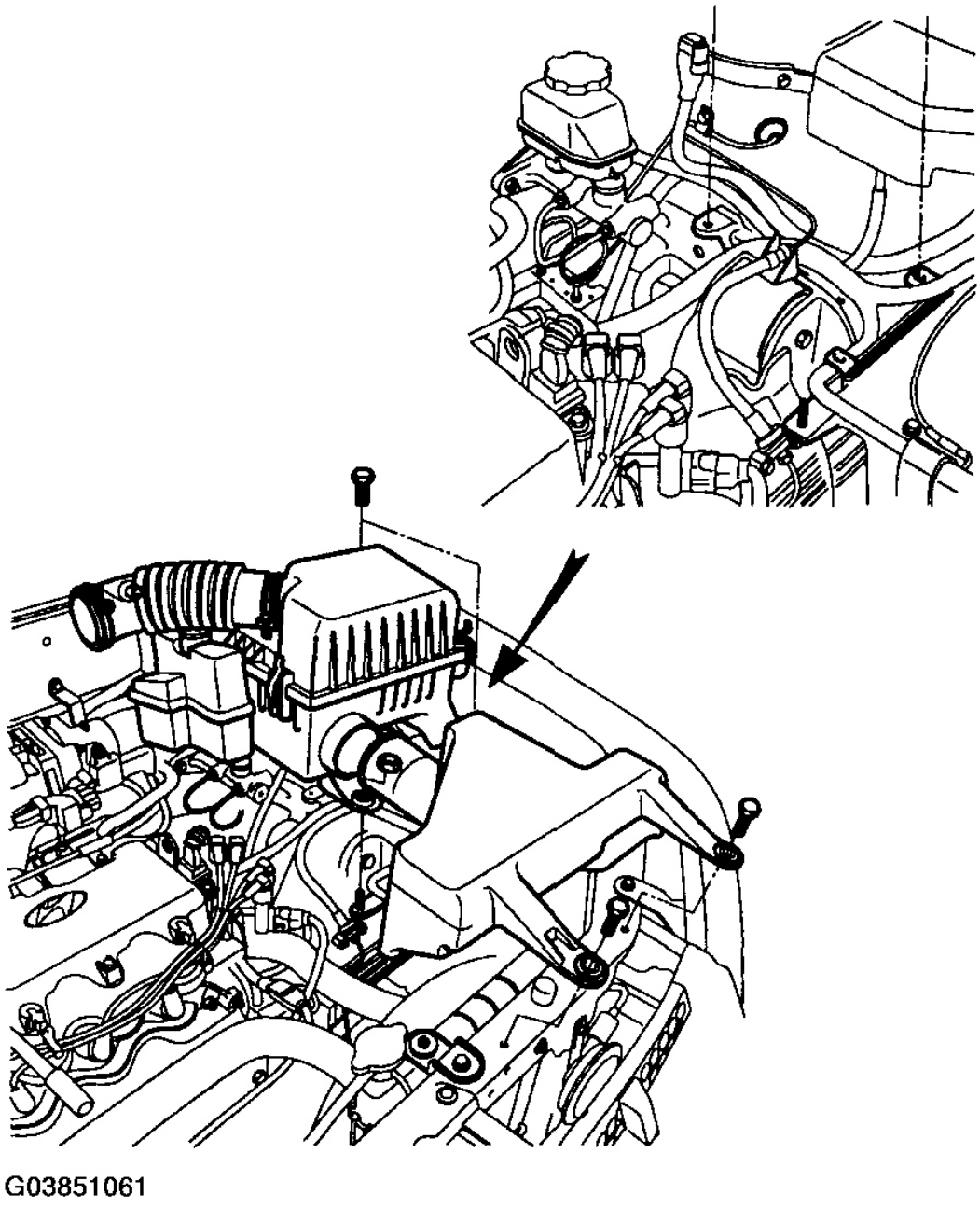
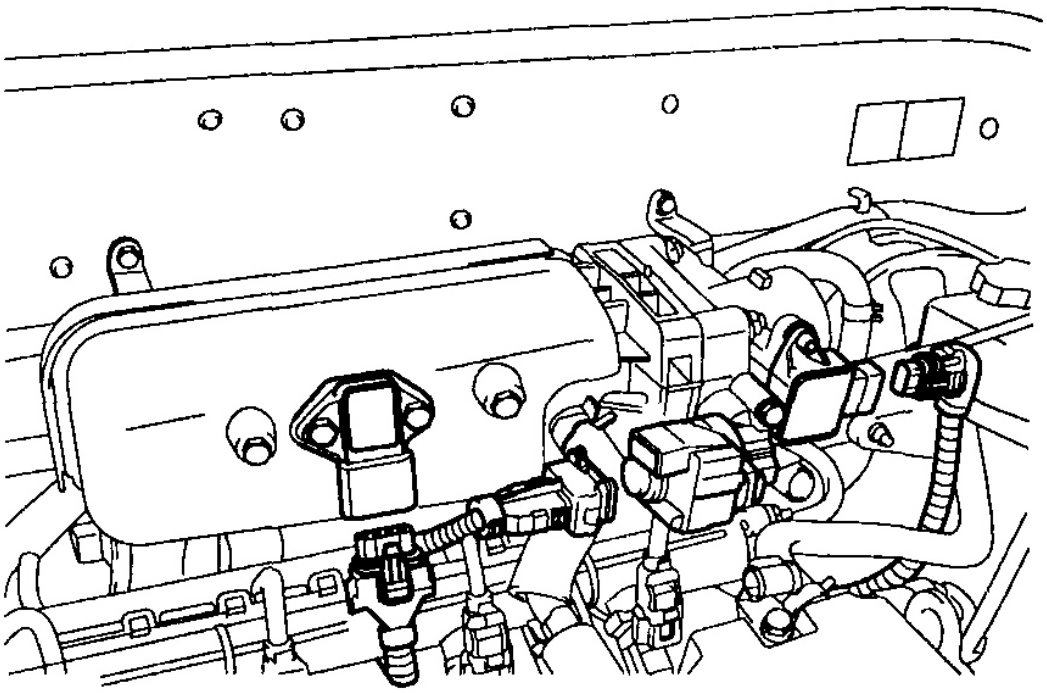


Fig. 27: Removing Air Cleaner
Courtesy of HYUNDAI MOTOR CO.

3. Disconnect the connectors for engine harness.



G03851062

Fig. 28: Disconnecting Connectors For Engine Harness (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

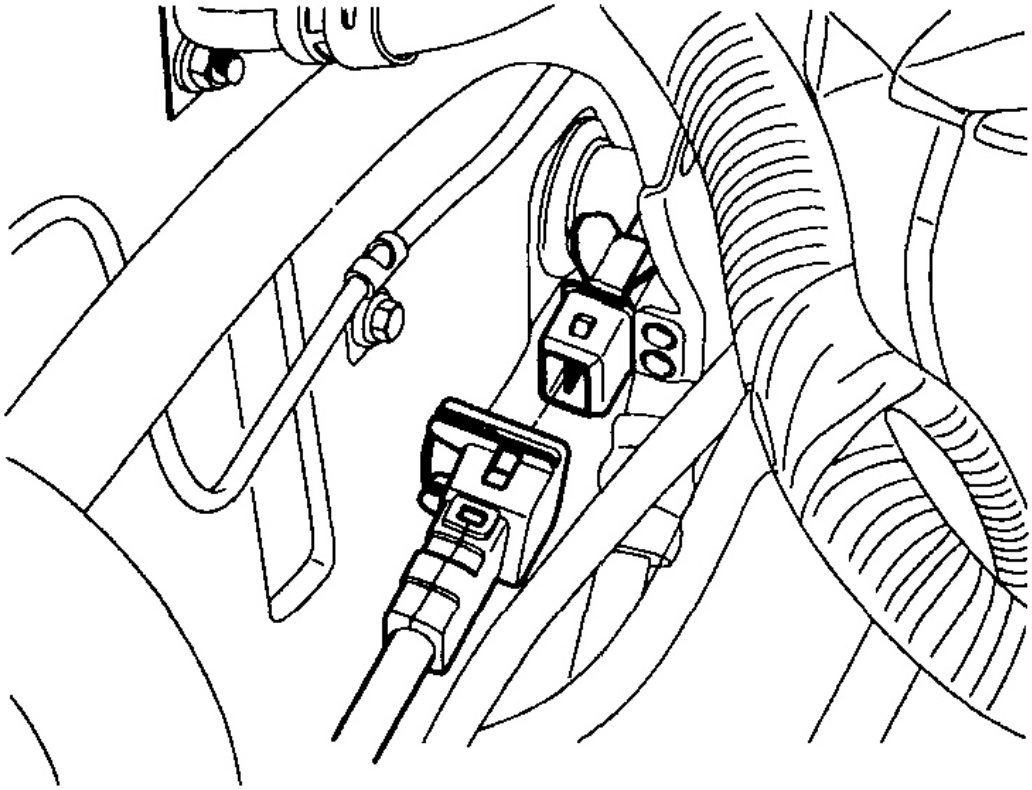
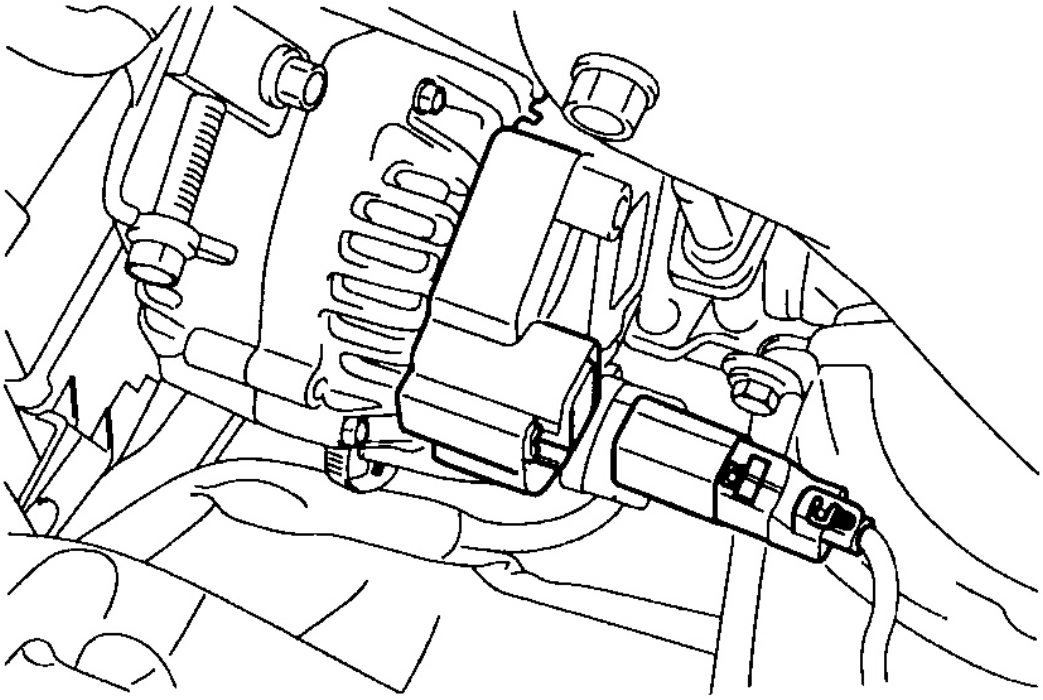


Fig. 29: Disconnecting Connectors For Engine Harness (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

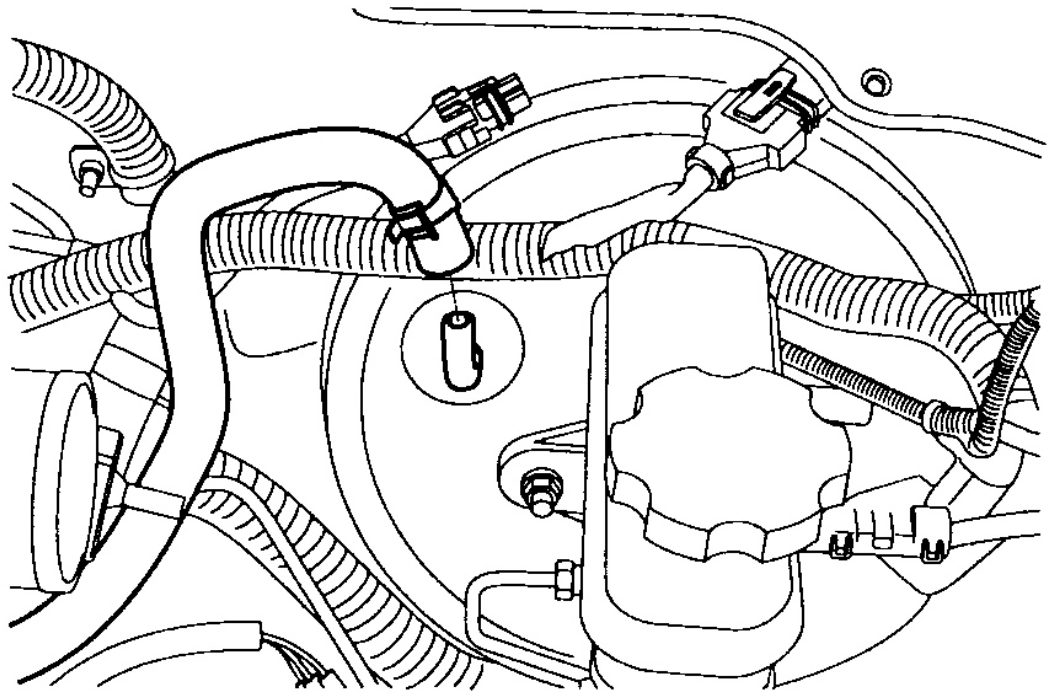
4. Disconnect the engine ground.
5. Disconnect the connectors for the alternator harness and the oil pressure gauge wiring.



G03851064

Fig. 30: Disconnecting Connectors For Alternator Harness
Courtesy of HYUNDAI MOTOR CO.

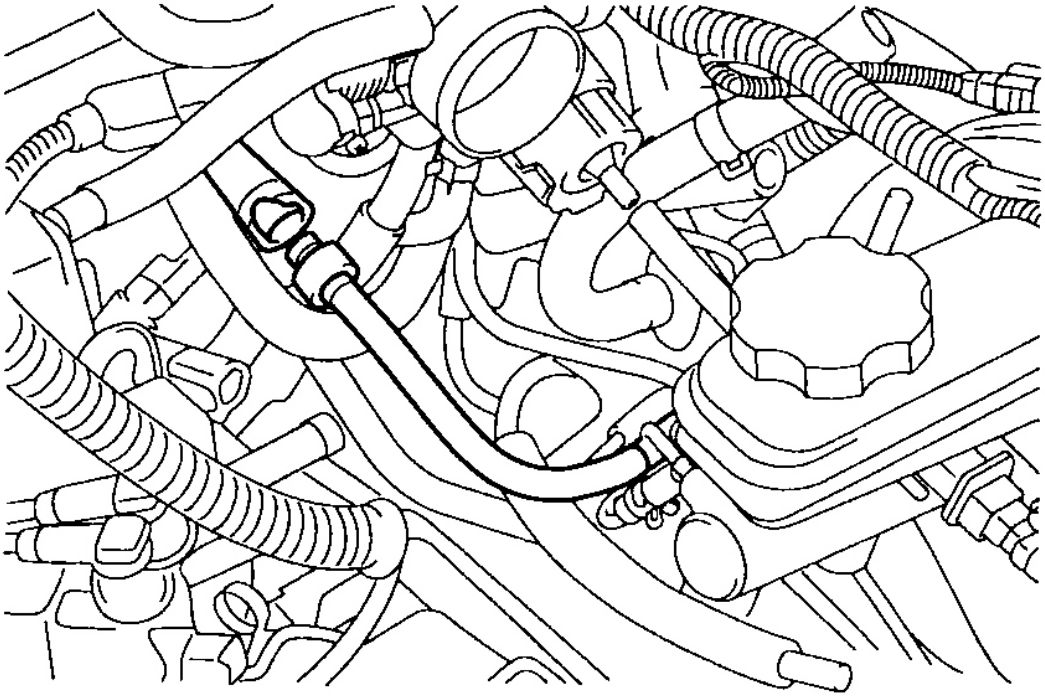
6. Disconnect the brake booster vacuum hose.



G03851065

Fig. 31: Disconnecting Brake Booster Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

7. Remove the main fuel line, the return and vapor hoses from the engine side.



G03851066

Fig. 32: Removing Main Fuel Line
Courtesy of HYUNDAI MOTOR CO.

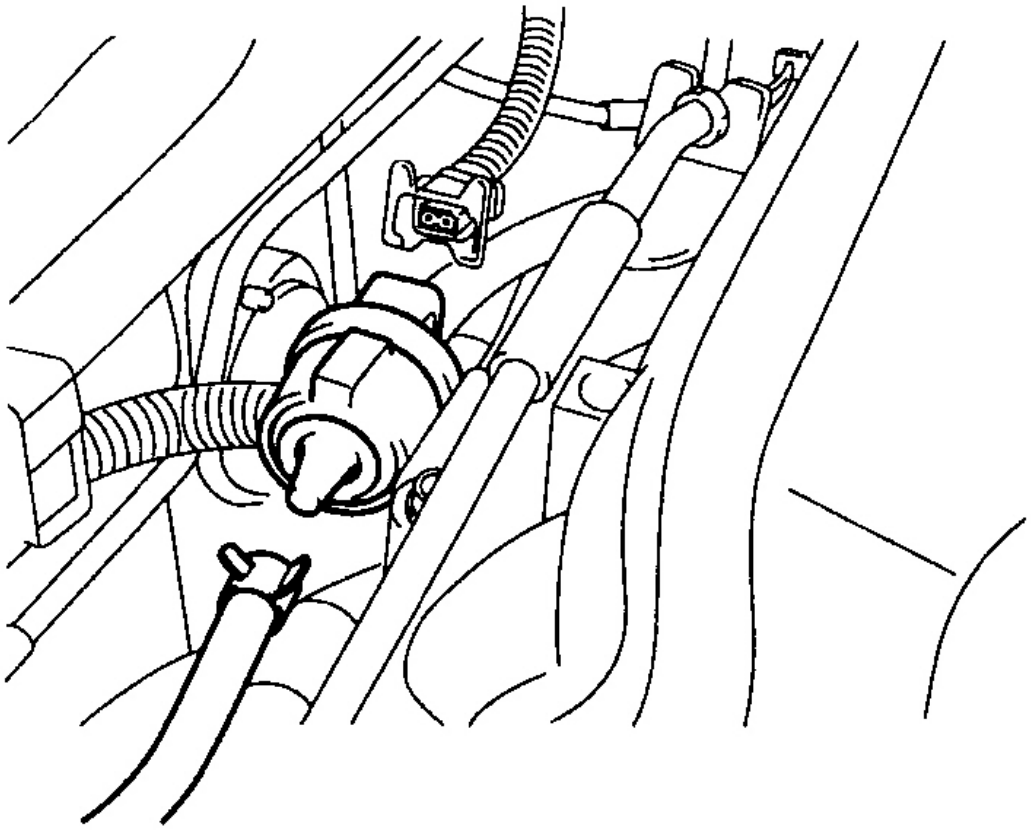
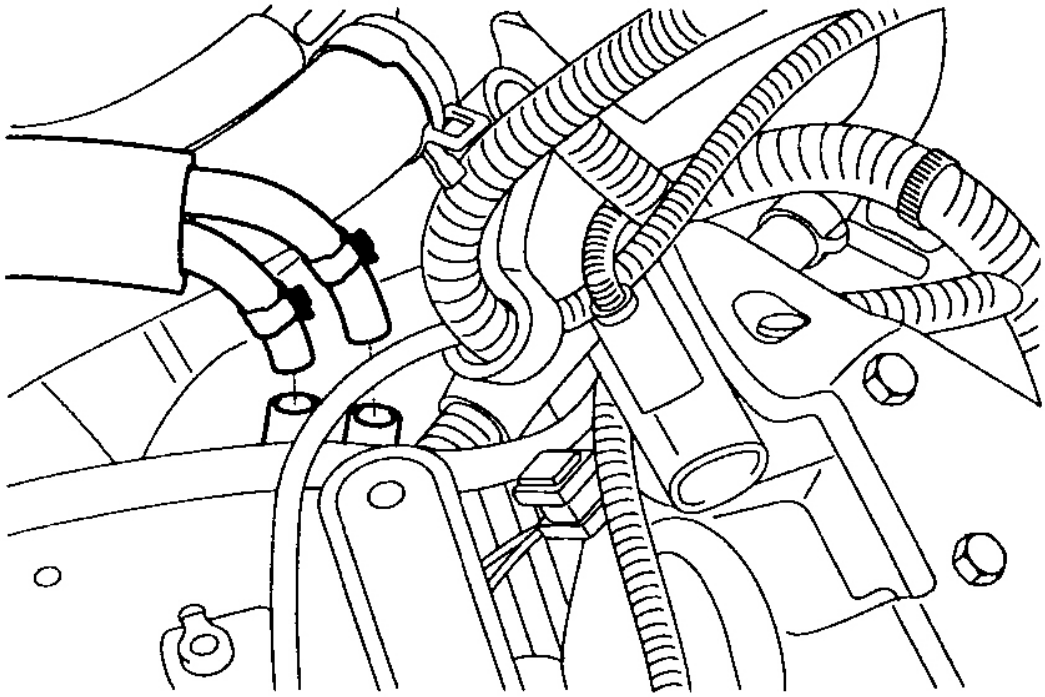


Fig. 33: Removing Vapor Hoses
Courtesy of HYUNDAI MOTOR CO.

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



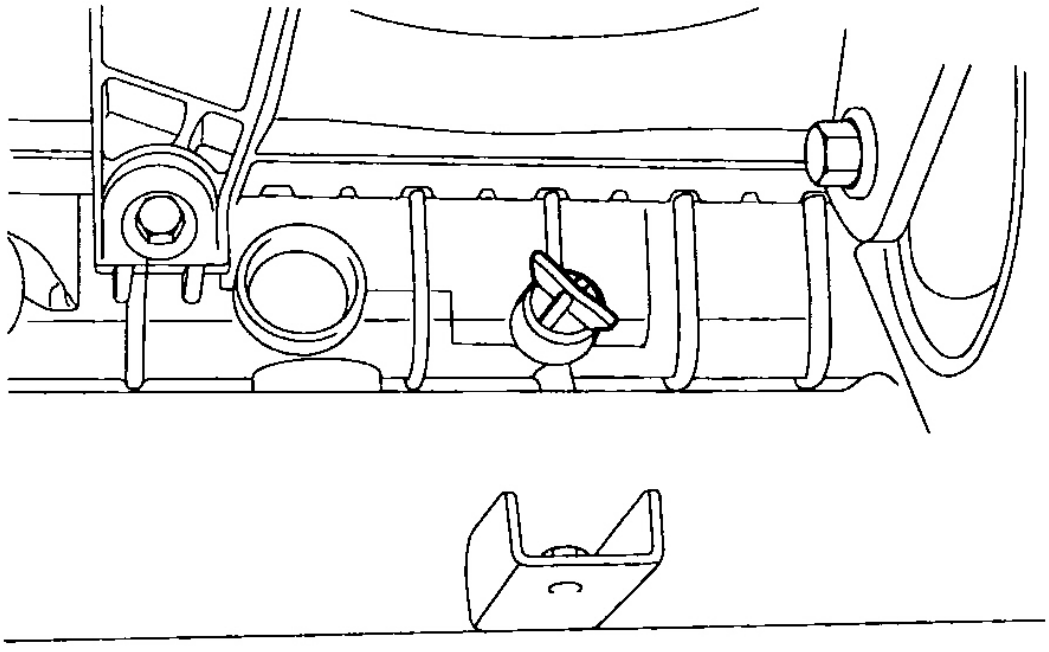
G03851068

Fig. 34: Disconnecting Transaxle Oil Cooler Hoses
Courtesy of HYUNDAI MOTOR CO.

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

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

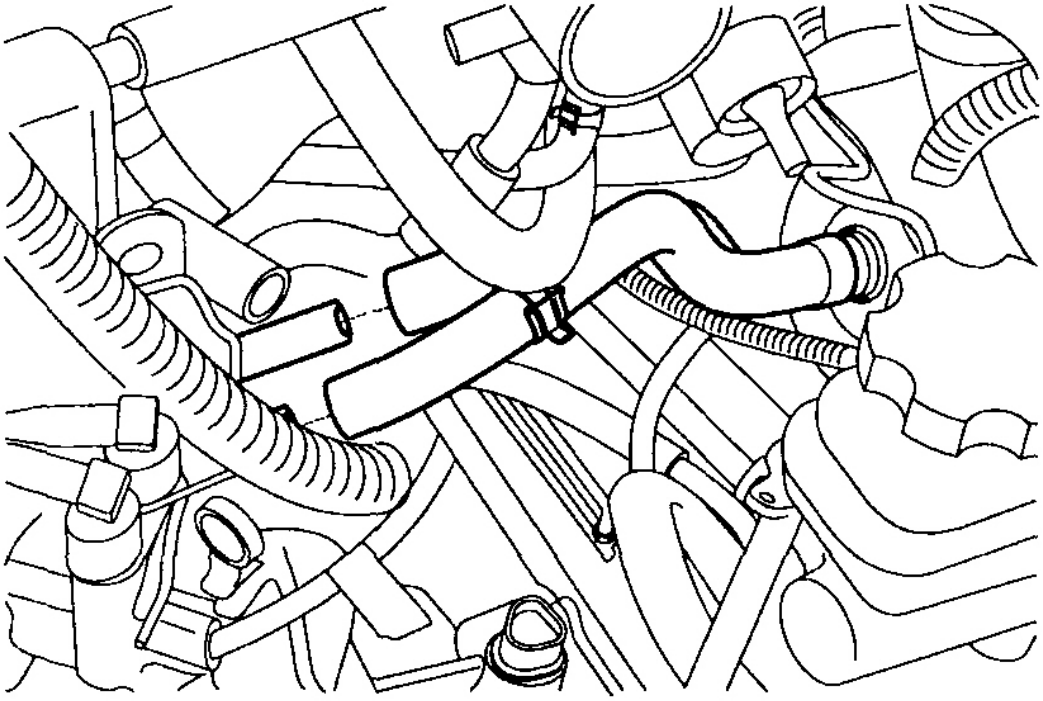
9. Drain the engine coolant.



G03851069

Fig. 35: Identifying Engine Coolant Drain Plug
Courtesy of HYUNDAI MOTOR CO.

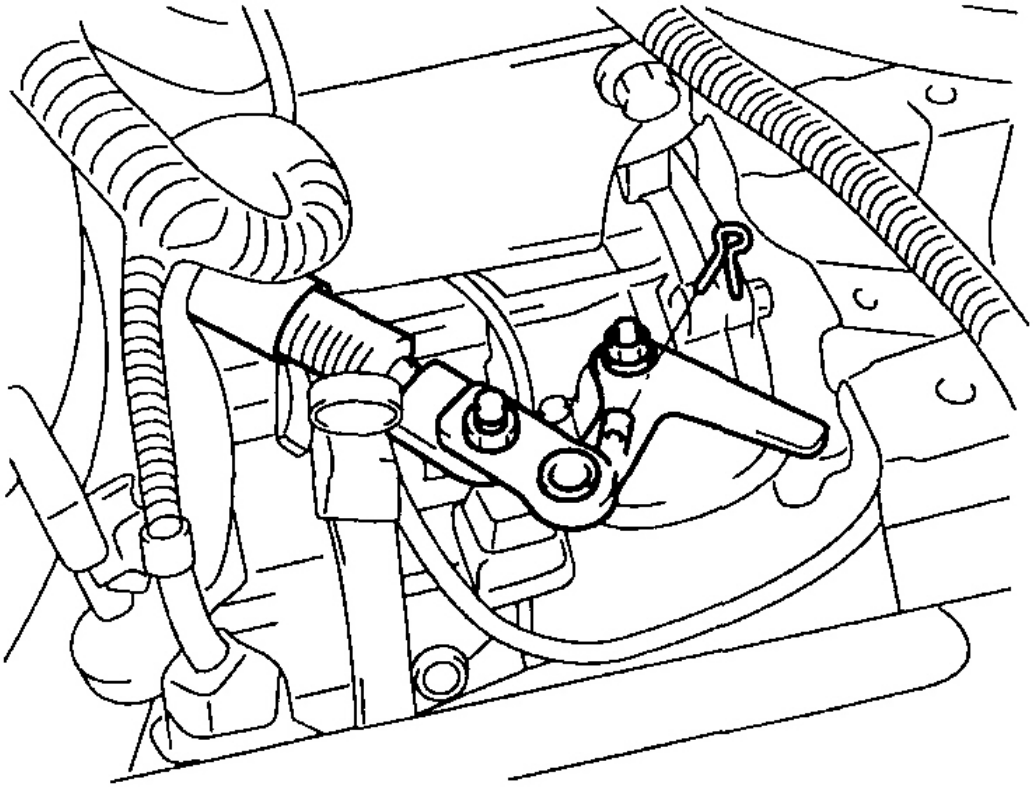
10. Disconnect the radiator upper and lower hoses on the engine side, then remove the radiator assembly.
11. Disconnect the heater hoses (inlet and outlet) on the engine side.



G03851070

Fig. 36: Disconnecting Heater Hoses
Courtesy of HYUNDAI MOTOR CO.

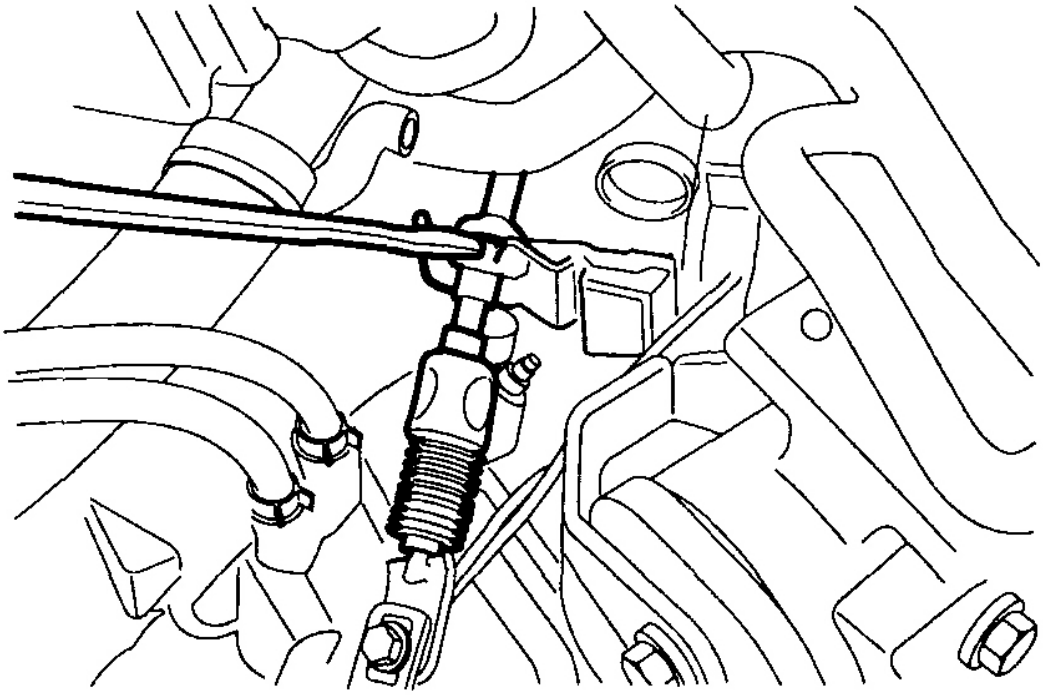
12. Disconnect the accelerator cable at the engine side.



G03851071

Fig. 37: Disconnecting Accelerator Cable
Courtesy of HYUNDAI MOTOR CO.

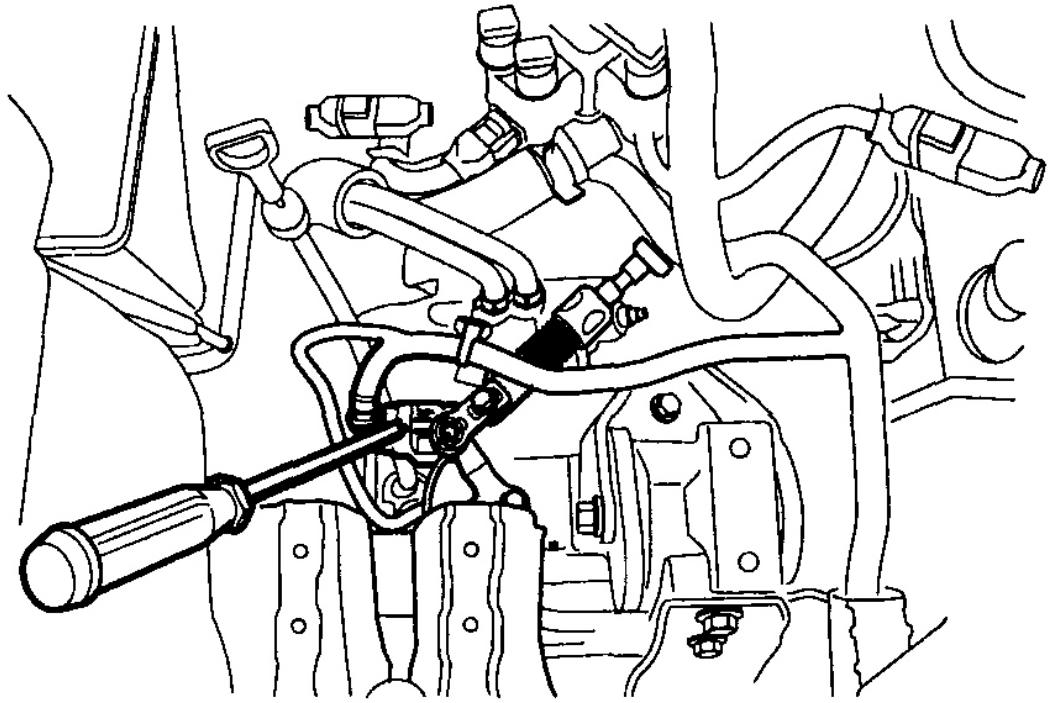
13. For vehicles with automatic transmission, remove the control cable from the transmission.



G03851072

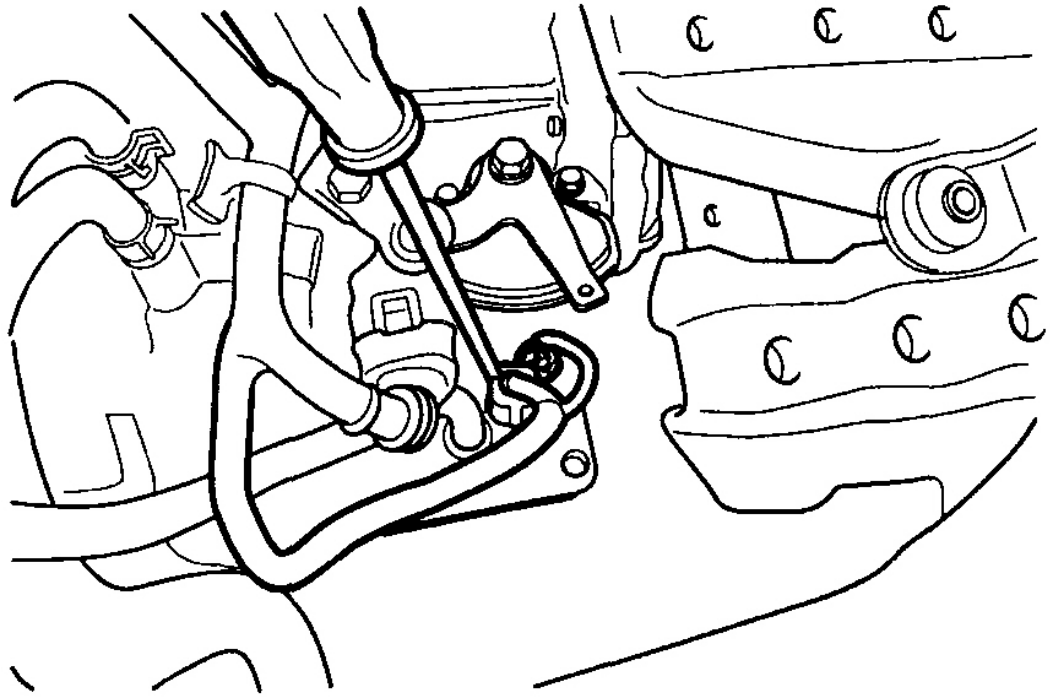
Fig. 38: Disconnecting Control Cable
Courtesy of HYUNDAI MOTOR CO.

14. Disconnect the inhibitor switch and solenoid valve connector.



G03851073

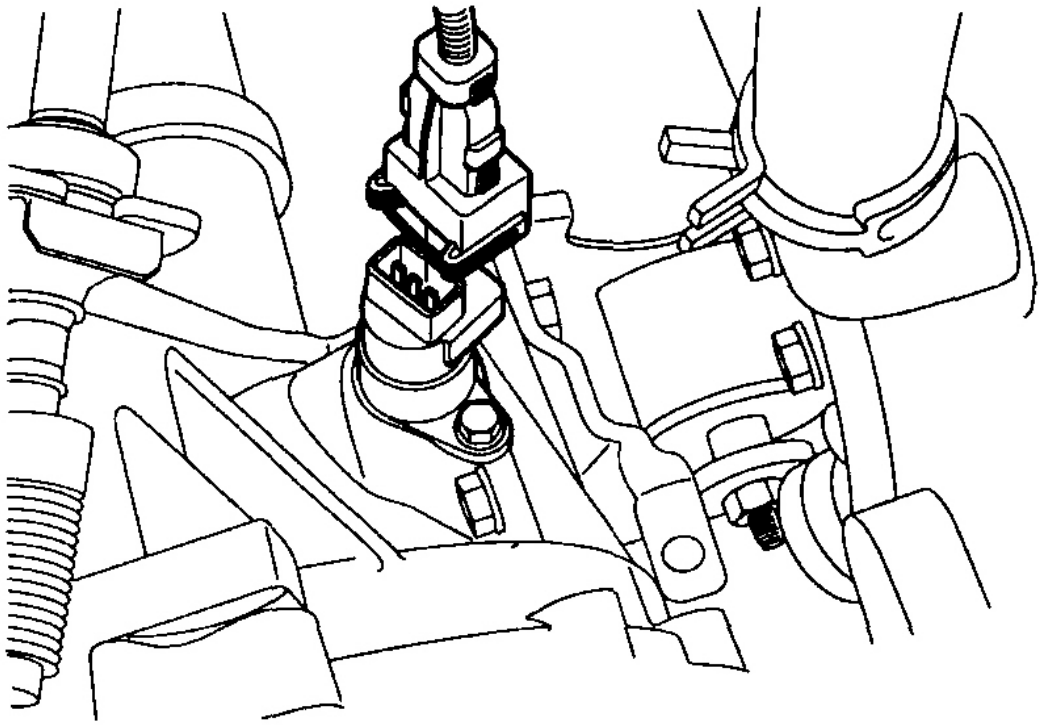
Fig. 39: Disconnecting Inhibitor Switch
Courtesy of HYUNDAI MOTOR CO.



G03851074

Fig. 40: Disconnecting Solenoid Valve Connector
Courtesy of HYUNDAI MOTOR CO.

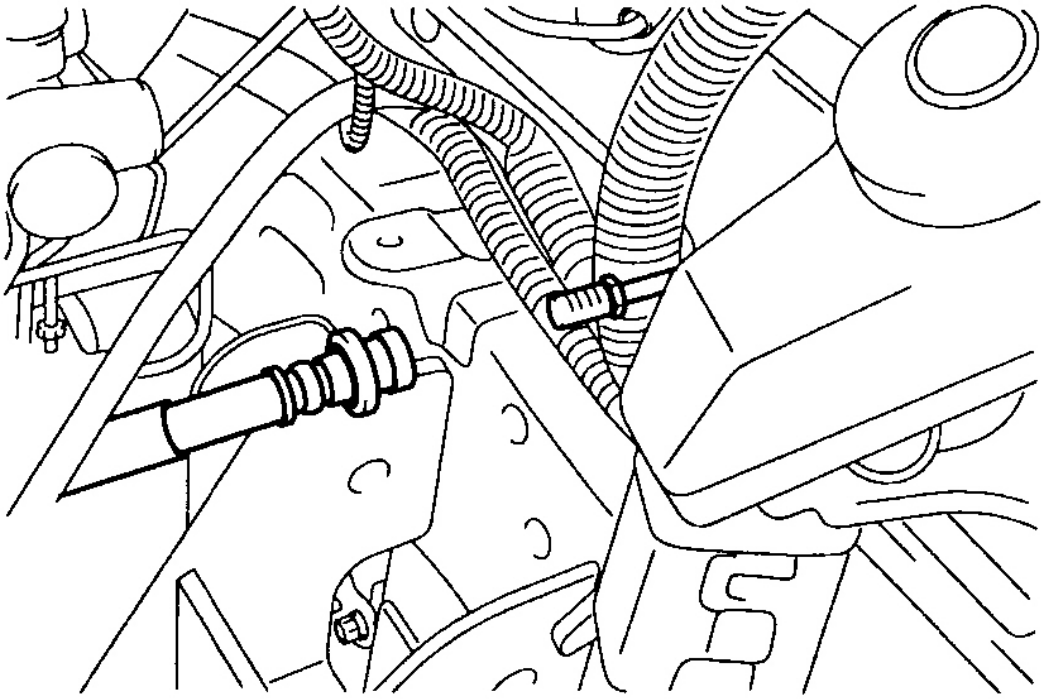
15. Disconnect the vehicle speed sensor connector.



G03851075

Fig. 41: Disconnecting Vehicle Speed Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

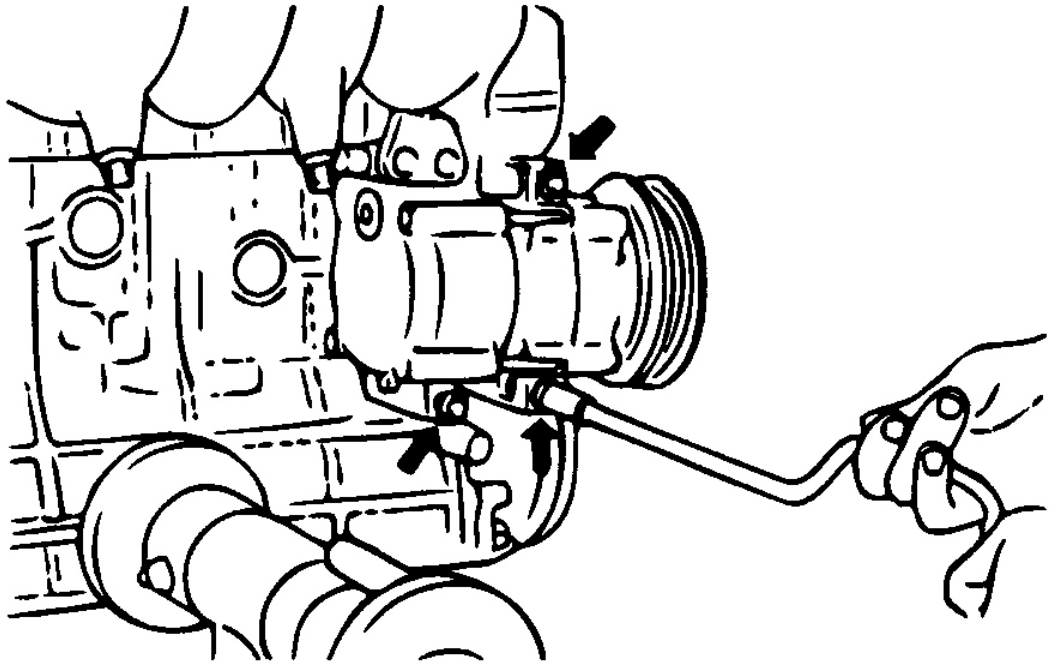
16. Disconnect the clutch tube.



G03851076

Fig. 42: Disconnecting Clutch Tube
Courtesy of HYUNDAI MOTOR CO.

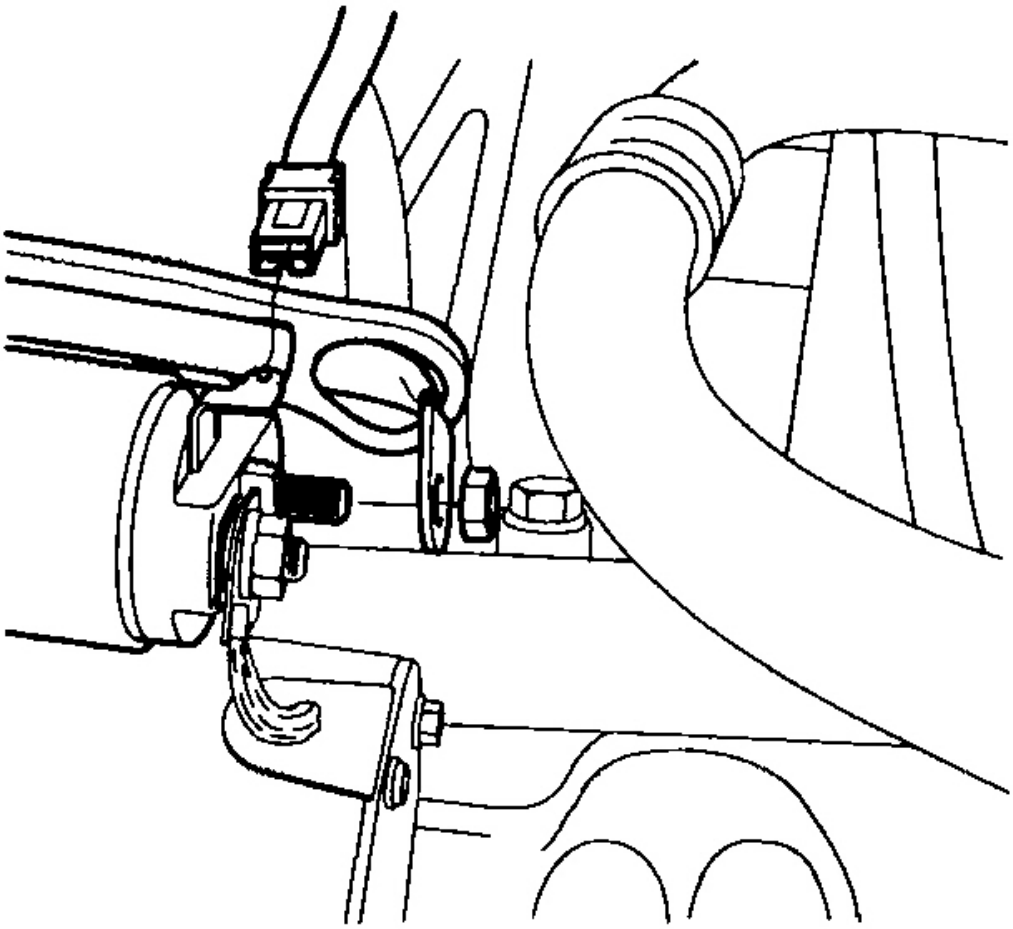
17. Disconnect the air conditioner compressor from the mounting bracket.



G03851077

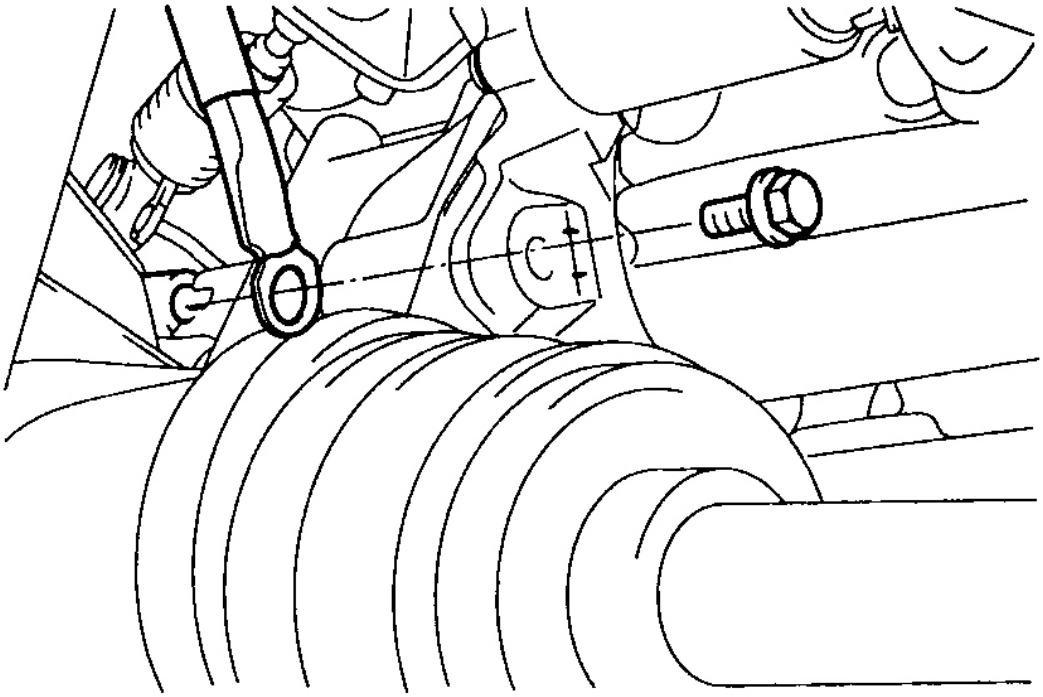
Fig. 43: Disconnecting Air Conditioner Compressor
Courtesy of HYUNDAI MOTOR CO.

18. Jack up the vehicle.
19. Disconnect the start motor connector and ground.



G03851078

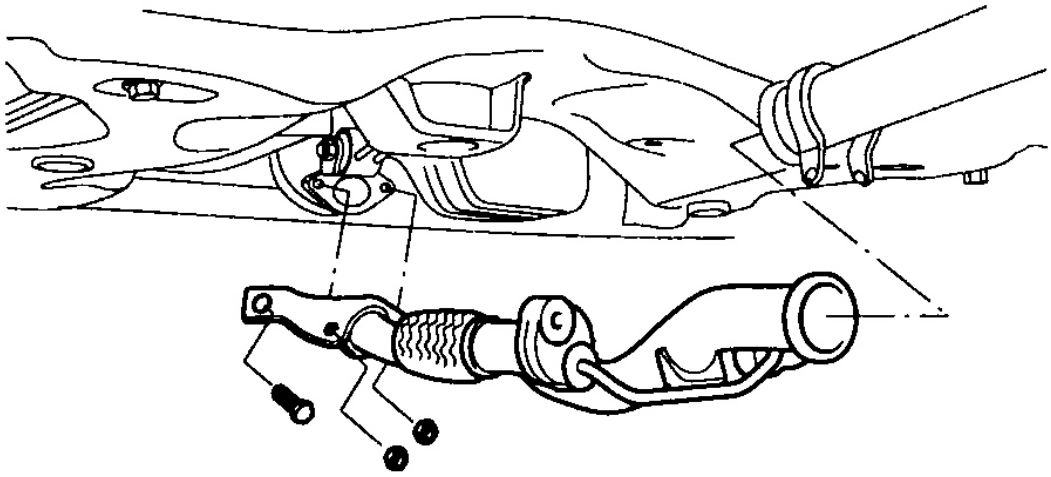
Fig. 44: Disconnecting Start Motor Connector
Courtesy of HYUNDAI MOTOR CO.



G03851079

Fig. 45: Disconnecting Start Motor Ground
Courtesy of HYUNDAI MOTOR CO.

20. Disconnect the front exhaust pipe from the manifold.

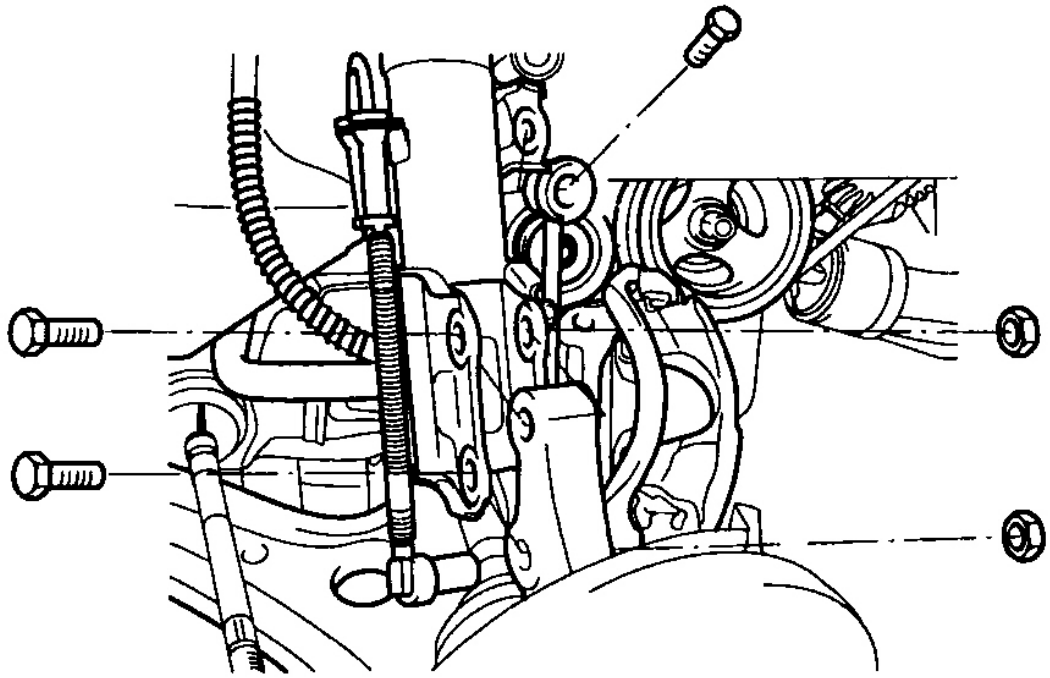


G03851080

Fig. 46: Disconnecting Front Exhaust Pipe From Manifold
Courtesy of HYUNDAI MOTOR CO.

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

21. Remove the knuckle form the front damper.



G03851081

Fig. 47: Removing Knuckle Form Front Damper
Courtesy of HYUNDAI MOTOR CO.

22. Remove the caliper from the knuckle and hang the caliper from the front damper with wire.

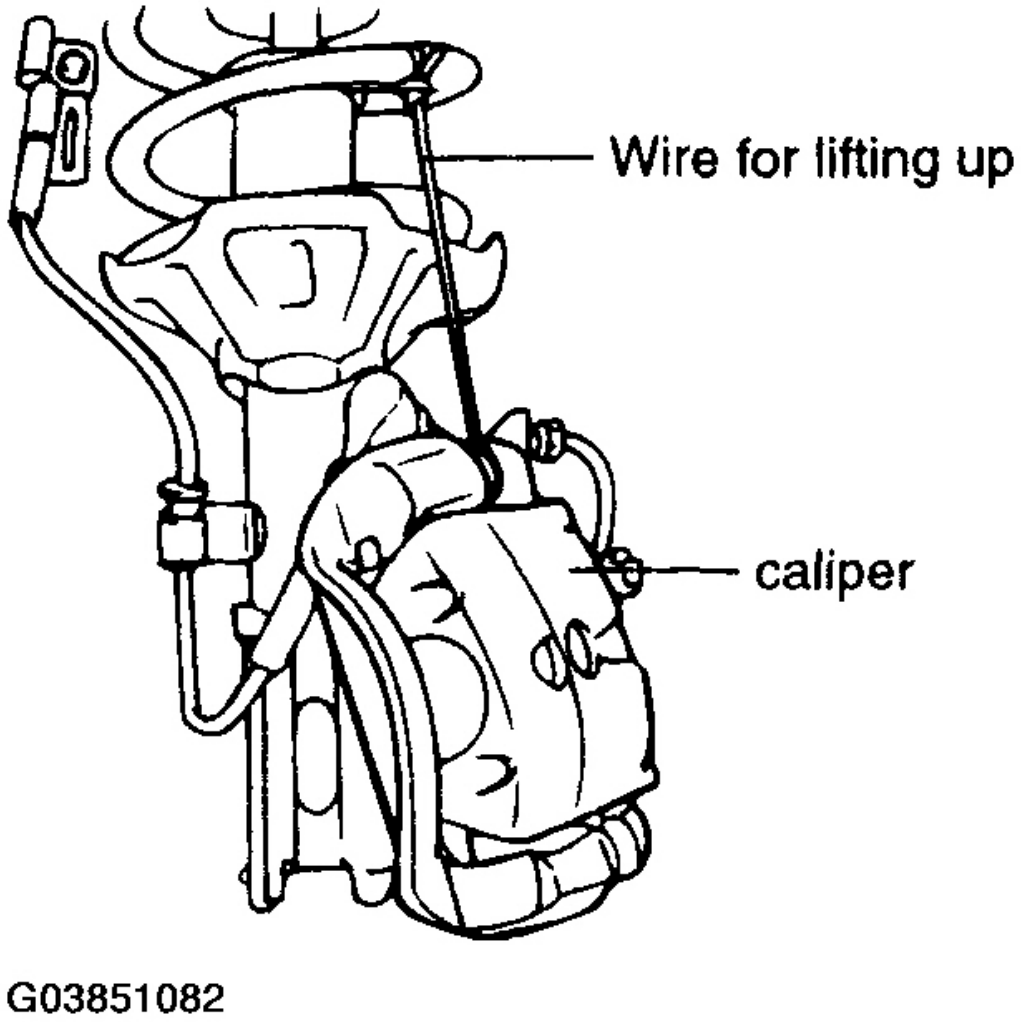
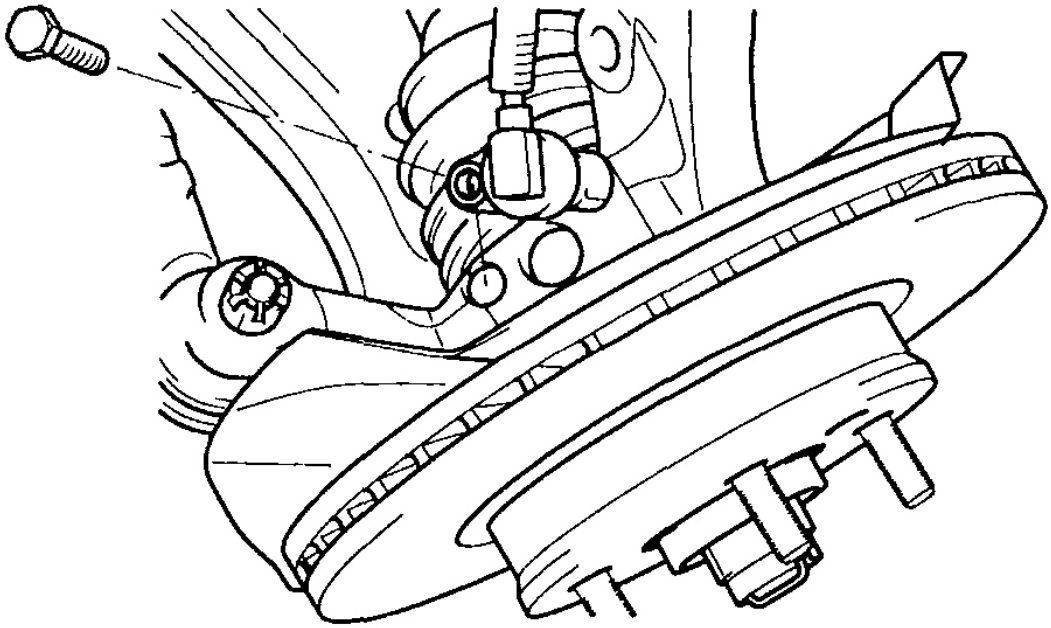


Fig. 48: Removing Caliper From Knuckle & Hanging Caliper From The Front Damper With Wire
Courtesy of HYUNDAI MOTOR CO.

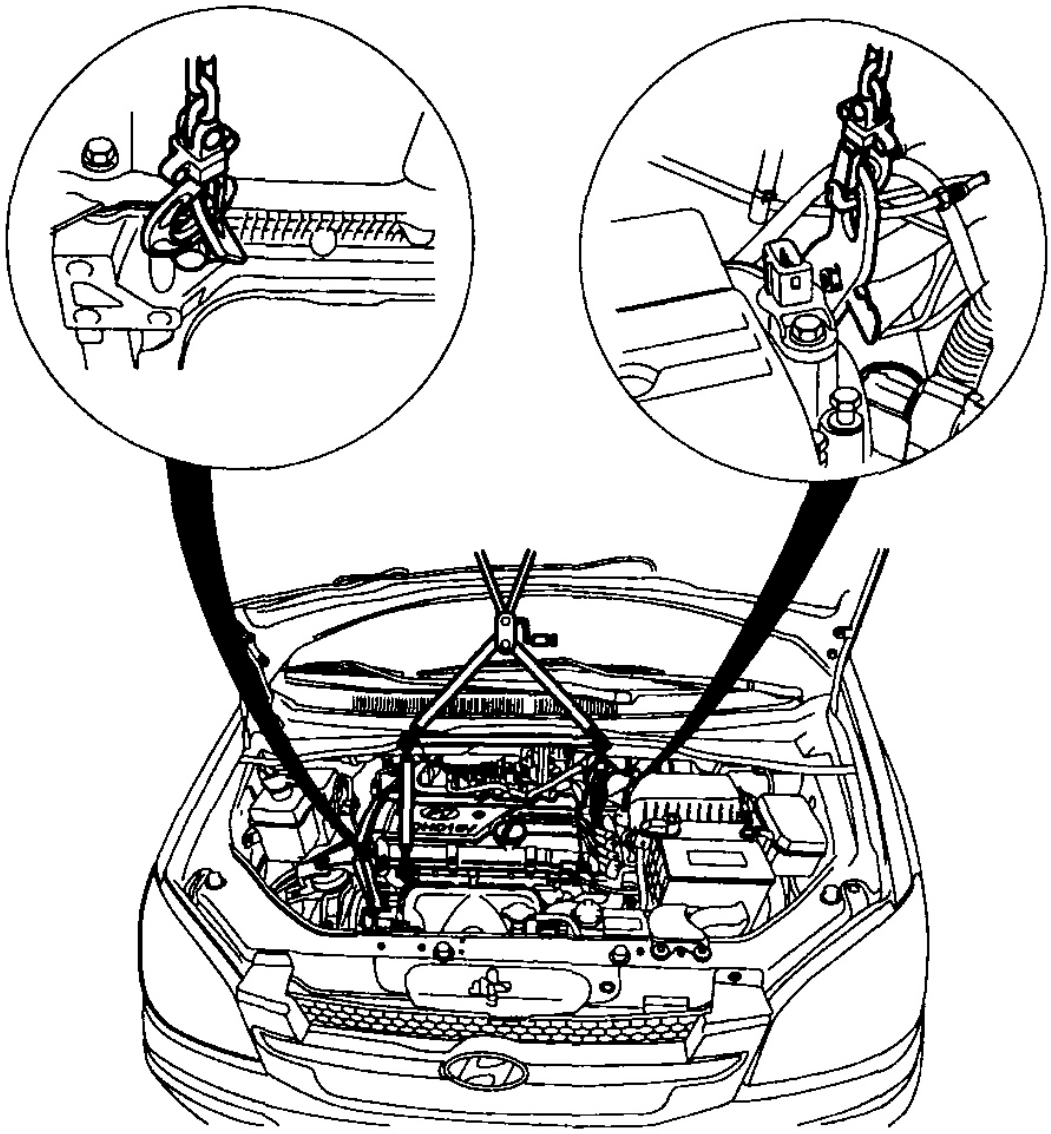
23. Remove the wheel speed sensor form the knuckle (with ABS).



G03851083

Fig. 49: Removing Wheel Speed Sensor Form Knuckle
Courtesy of HYUNDAI MOTOR CO.

24. Attach a chains or cables to the engine. Use an engine hoist or a chain hoist to slightly raise the engine (enough to support the engine's weight while processing with the following steps).



G03851084

Fig. 50: Attaching Chains Or Cables To Engine
Courtesy of HYUNDAI MOTOR CO.

25. Remove the steering joint bolt.

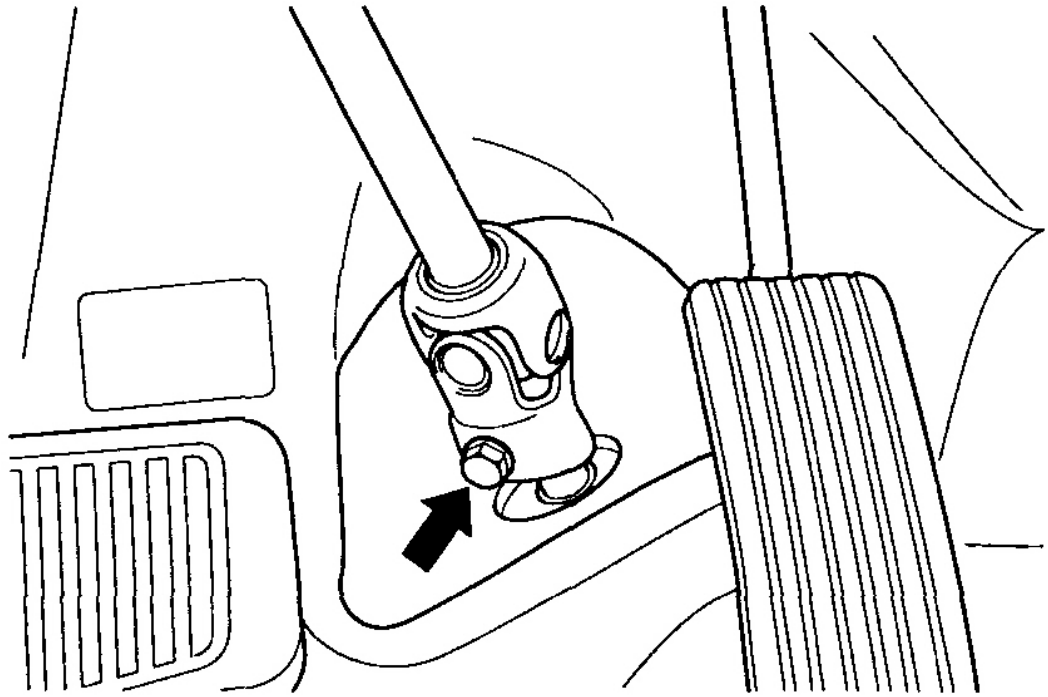
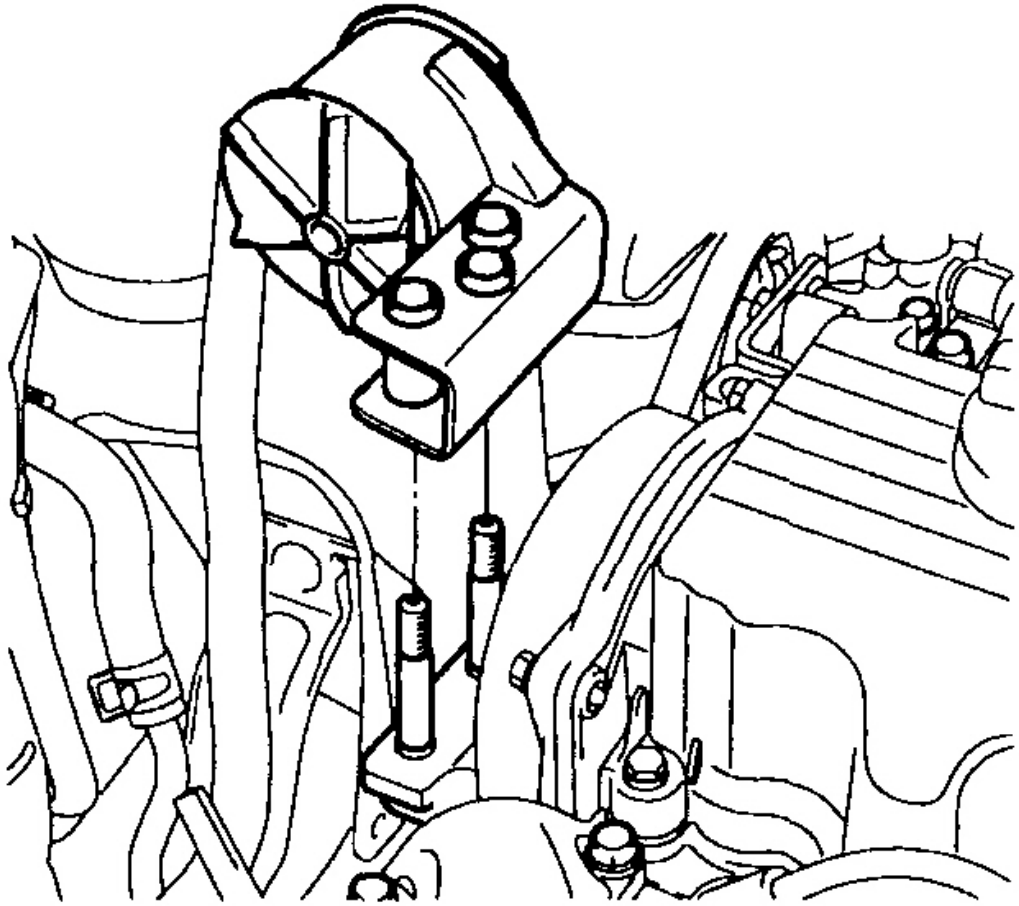


Fig. 51: Removing Steering Joint Bolt
Courtesy of HYUNDAI MOTOR CO.

26. Remove the engine mounting bracket from the engine.



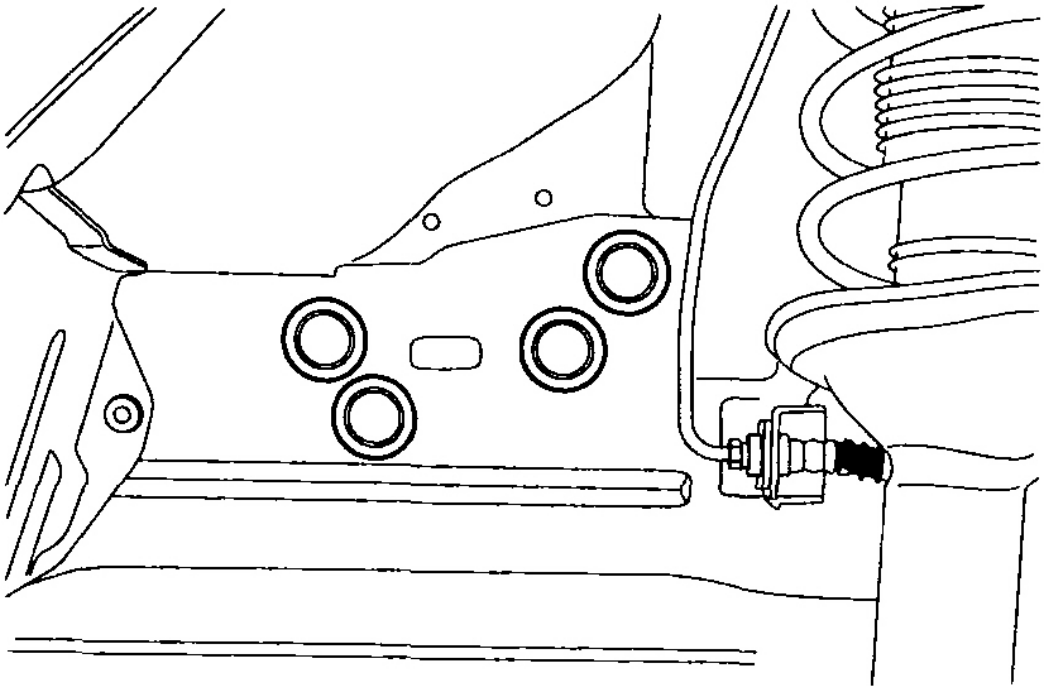
G03851086

Fig. 52: Removing Engine Mounting Bracket From Engine
Courtesy of HYUNDAI MOTOR CO.

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

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

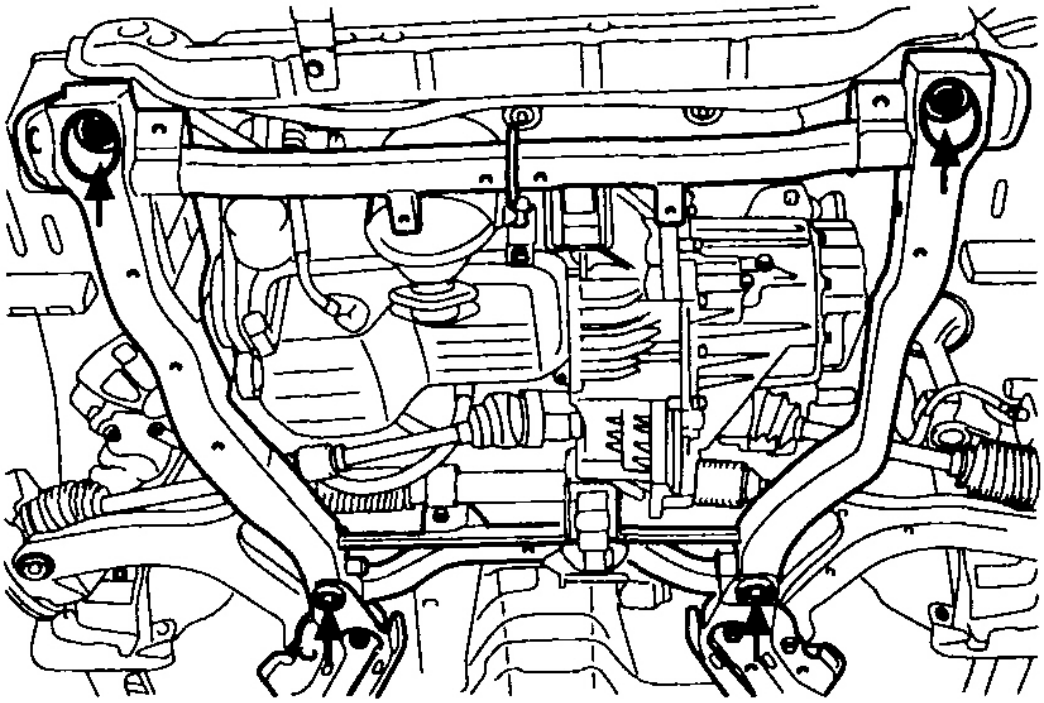
28. Remove the caps from the inside of the right fender shield and remove the transaxle mount bracket bolts.



G03851087

Fig. 53: Removing Transaxle Mount Bracket Bolts
Courtesy of HYUNDAI MOTOR CO.

29. Remove the sub frame fixing bolts and nuts.



G03851088

Fig. 54: Removing Sub Frame Fixing Bolts & Nuts
Courtesy of HYUNDAI MOTOR CO.

30. While directing the transmission side downward, lift the engine and transmission assembly down and out of the vehicles.

TIMING SYSTEM

TIMING BELT

COMPONENTS

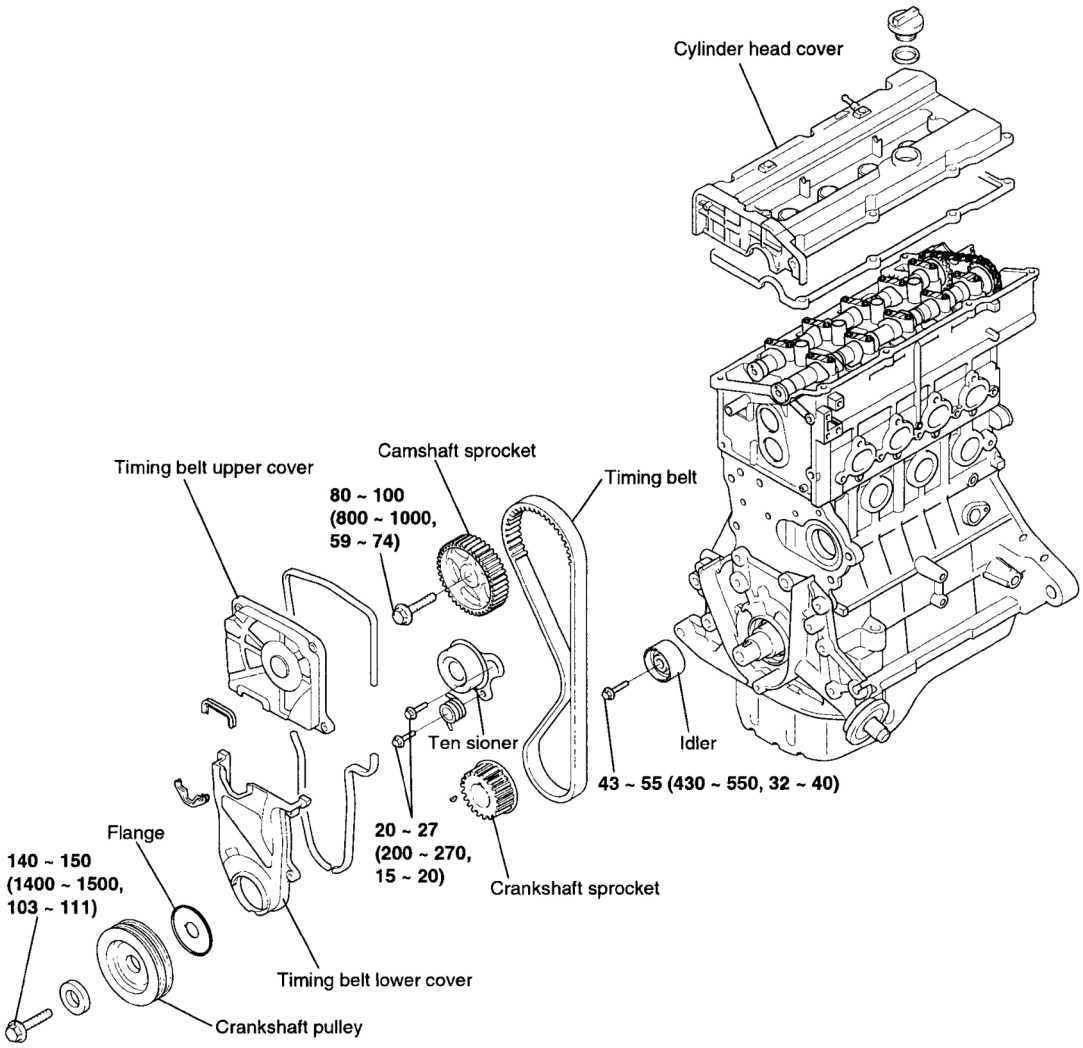
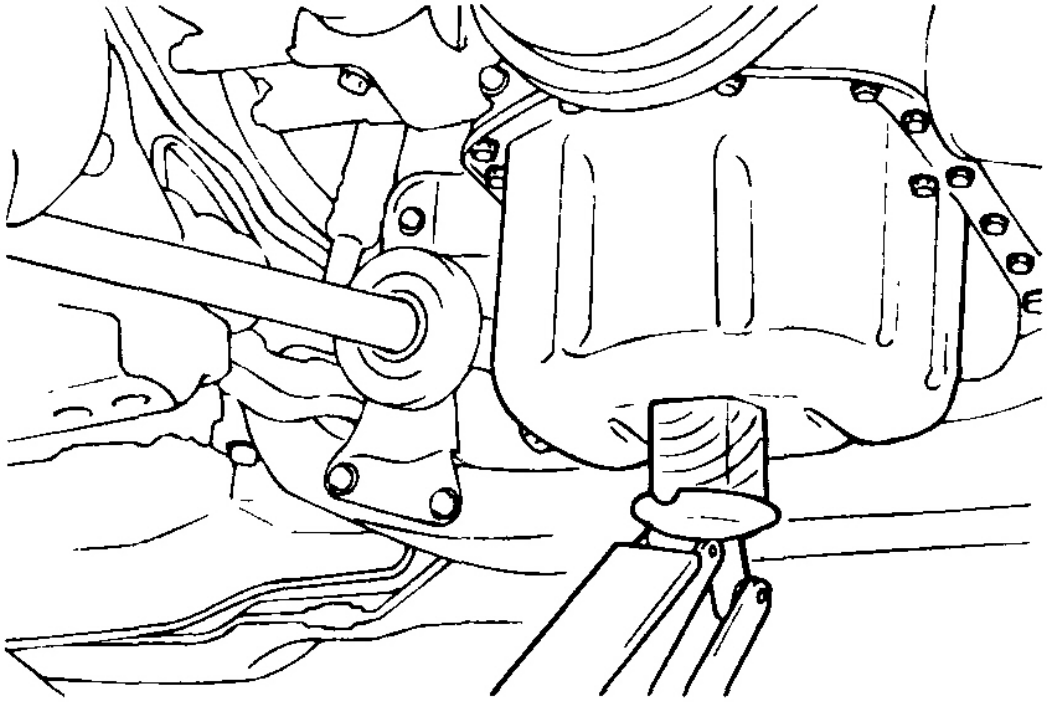


Fig. 55: Exploded View Of Timing Belt Components & Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

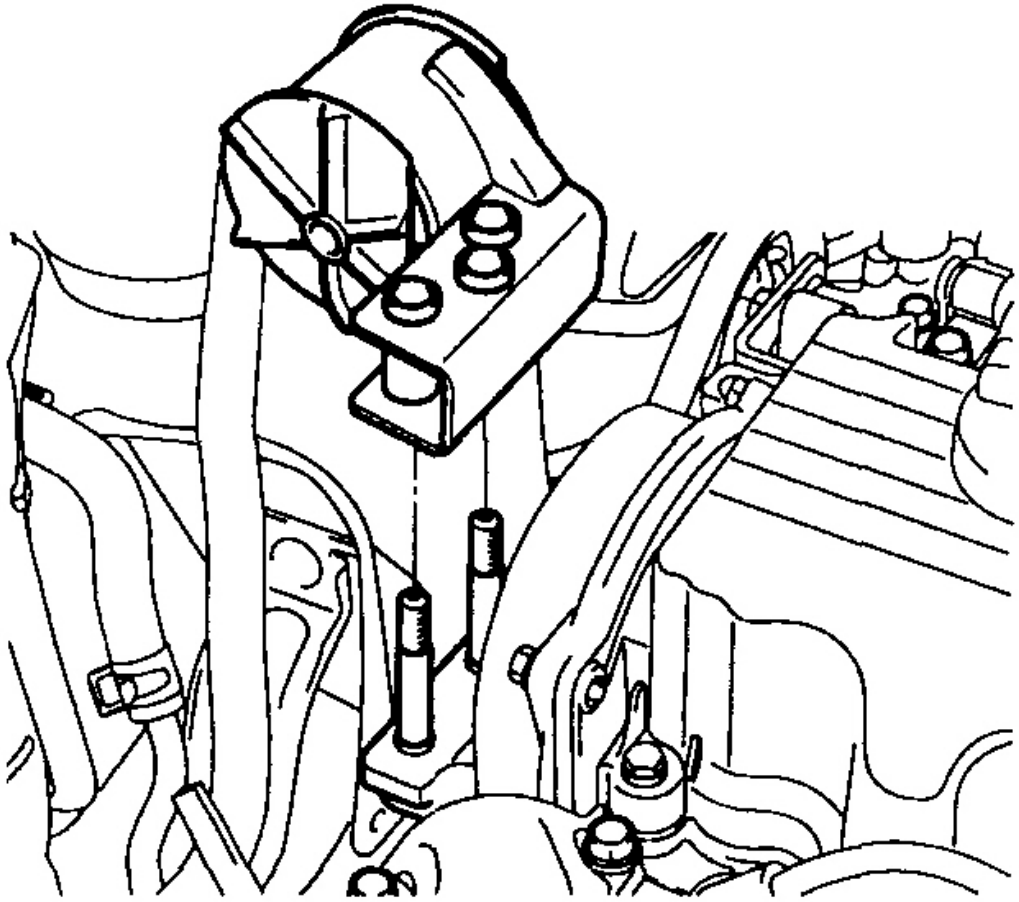
1. Lift the vehicle by using of jack.



G03851090

Fig. 56: Lifting Vehicle By Using Of Jack
Courtesy of HYUNDAI MOTOR CO.

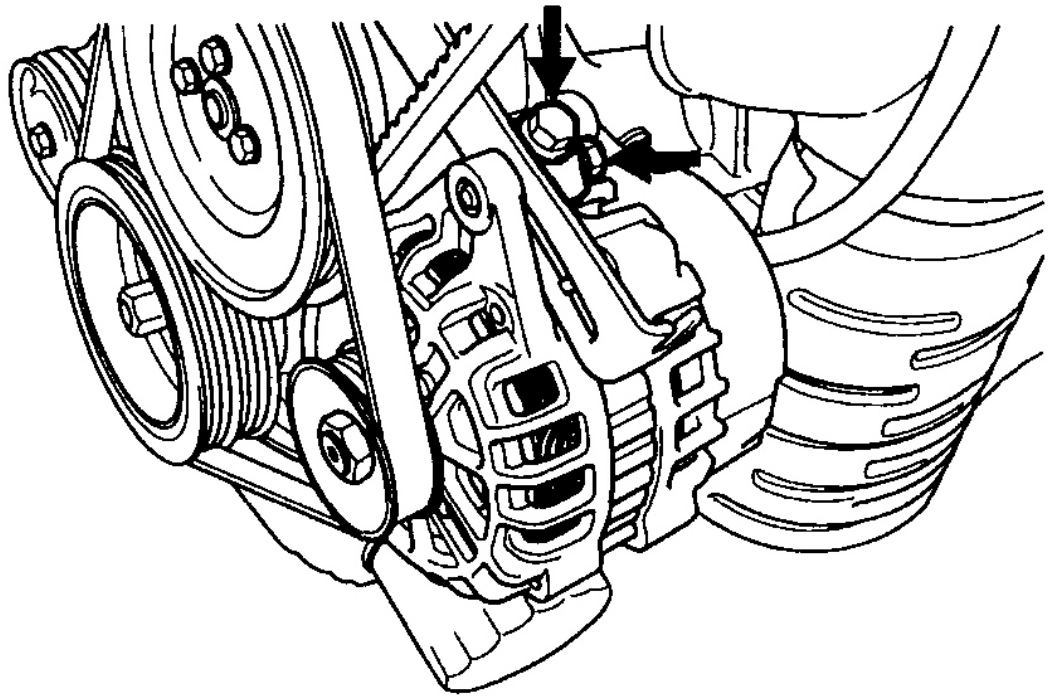
2. Remove the engine support bracket. (14 mm bolt and 2 nuts, 17 mm bolt)



G03851091

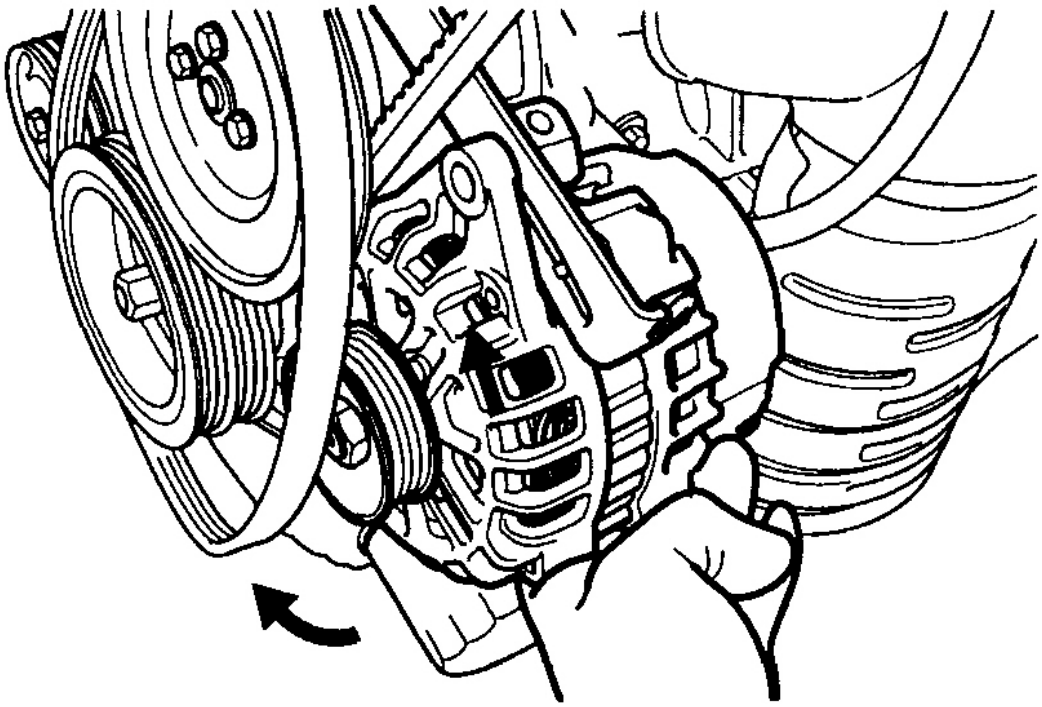
Fig. 57: Removing Engine Support Bracket
Courtesy of HYUNDAI MOTOR CO.

3. Remove the power steering belt.
4. Remove the air conditioning compressor belt.
5. Remove the alternator belt.



G03851092

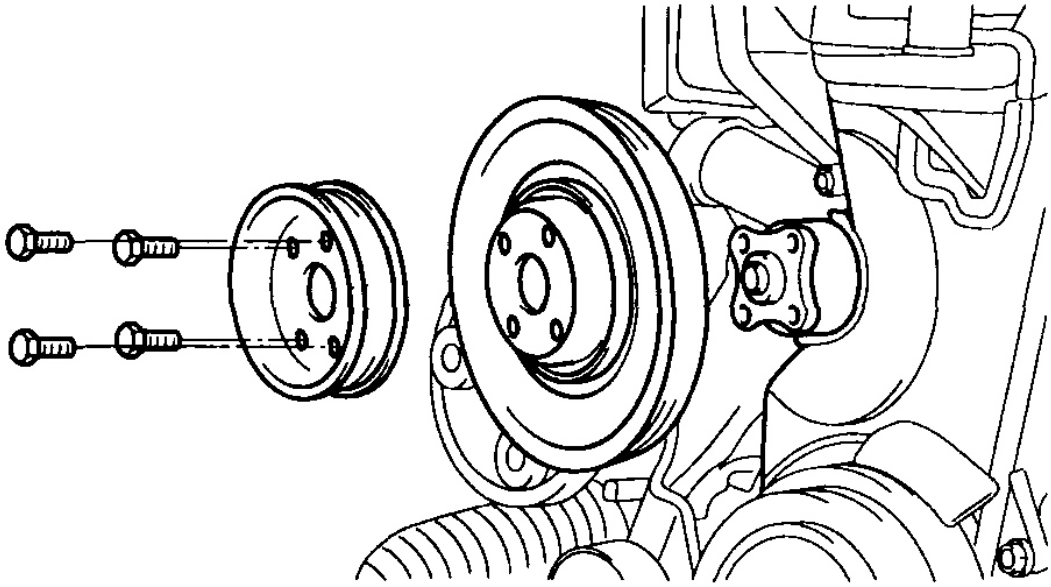
Fig. 58: Removing Alternator Bolt
Courtesy of HYUNDAI MOTOR CO.



G03851093

Fig. 59: Removing Alternator Belt
Courtesy of HYUNDAI MOTOR CO.

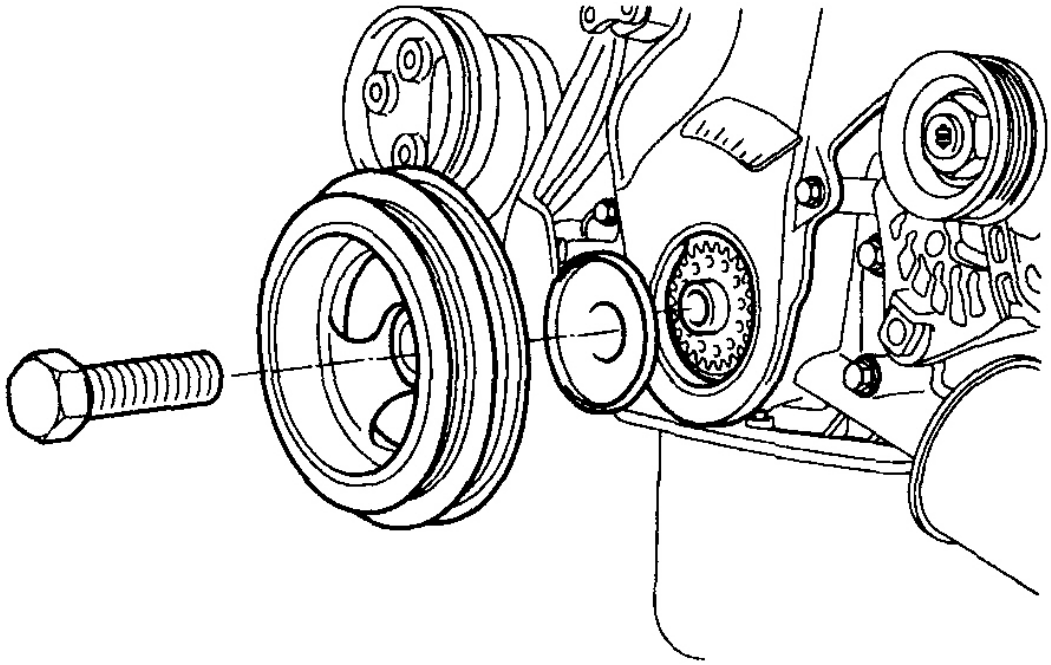
6. Remove the coolant pump pulley.



G03851094

Fig. 60: Removing Coolant Pump Pulley
Courtesy of HYUNDAI MOTOR CO.

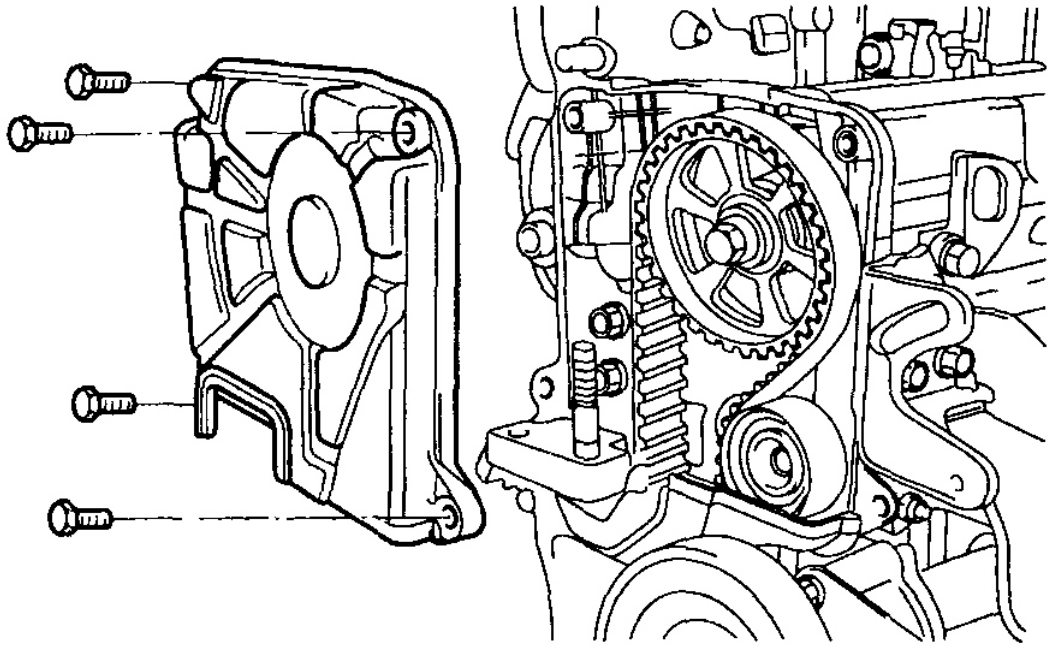
7. Remove the crankshaft pulley.



G03851095

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

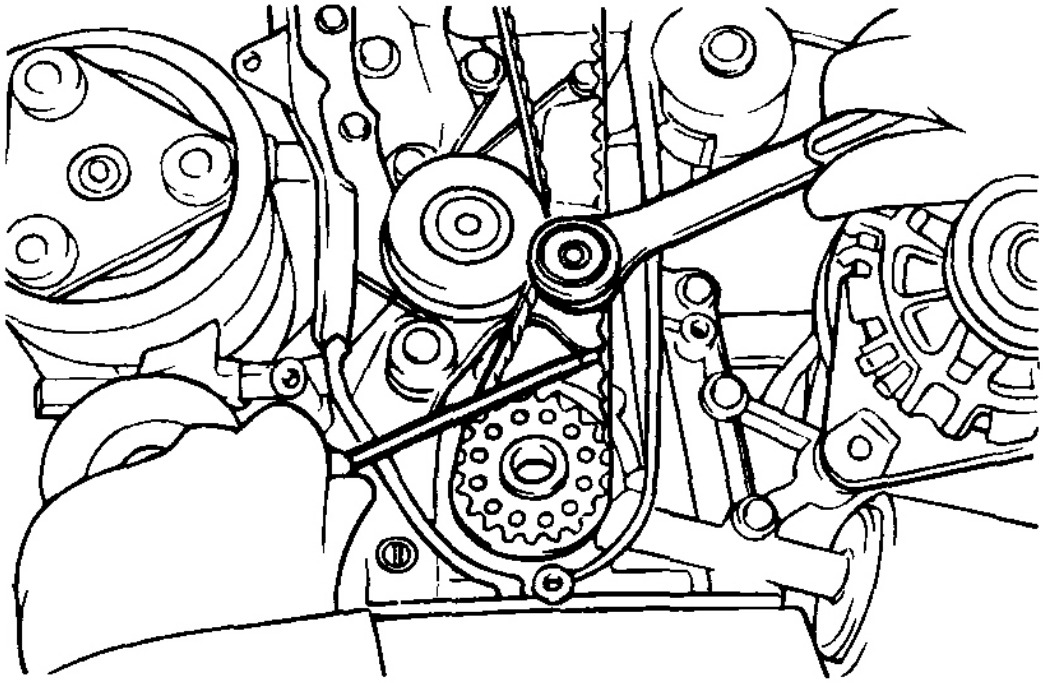
8. Remove the timing belt cover.



G03851096

Fig. 62: Removing Timing Belt Cover
Courtesy of HYUNDAI MOTOR CO.

9. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.

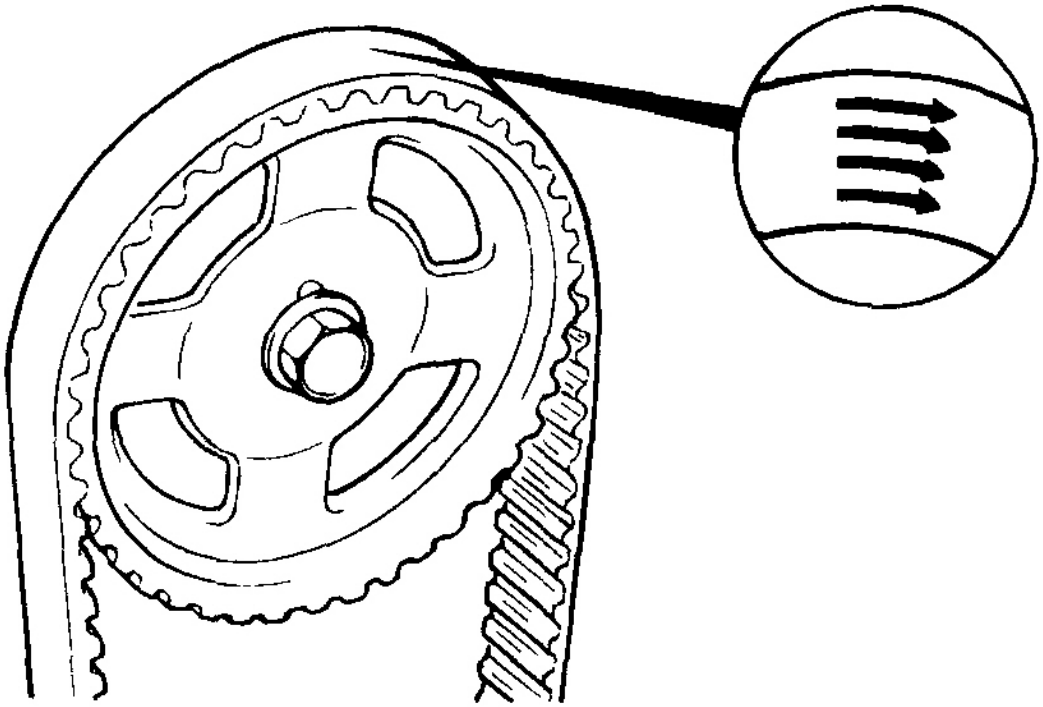


G03851097

Fig. 63: Moving Timing Belt Tensioner Pulley
Courtesy of HYUNDAI MOTOR CO.

10. Remove the timing belt.

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



G03851098

Fig. 64: Identifying Timing Belt Mark
Courtesy of HYUNDAI MOTOR CO.

11. Remove the camshaft from the camshaft sprocket.
12. Remove the crankshaft sprocket and flange.
13. Remove the timing belt idler.
14. Remove the timing belt tensioner.

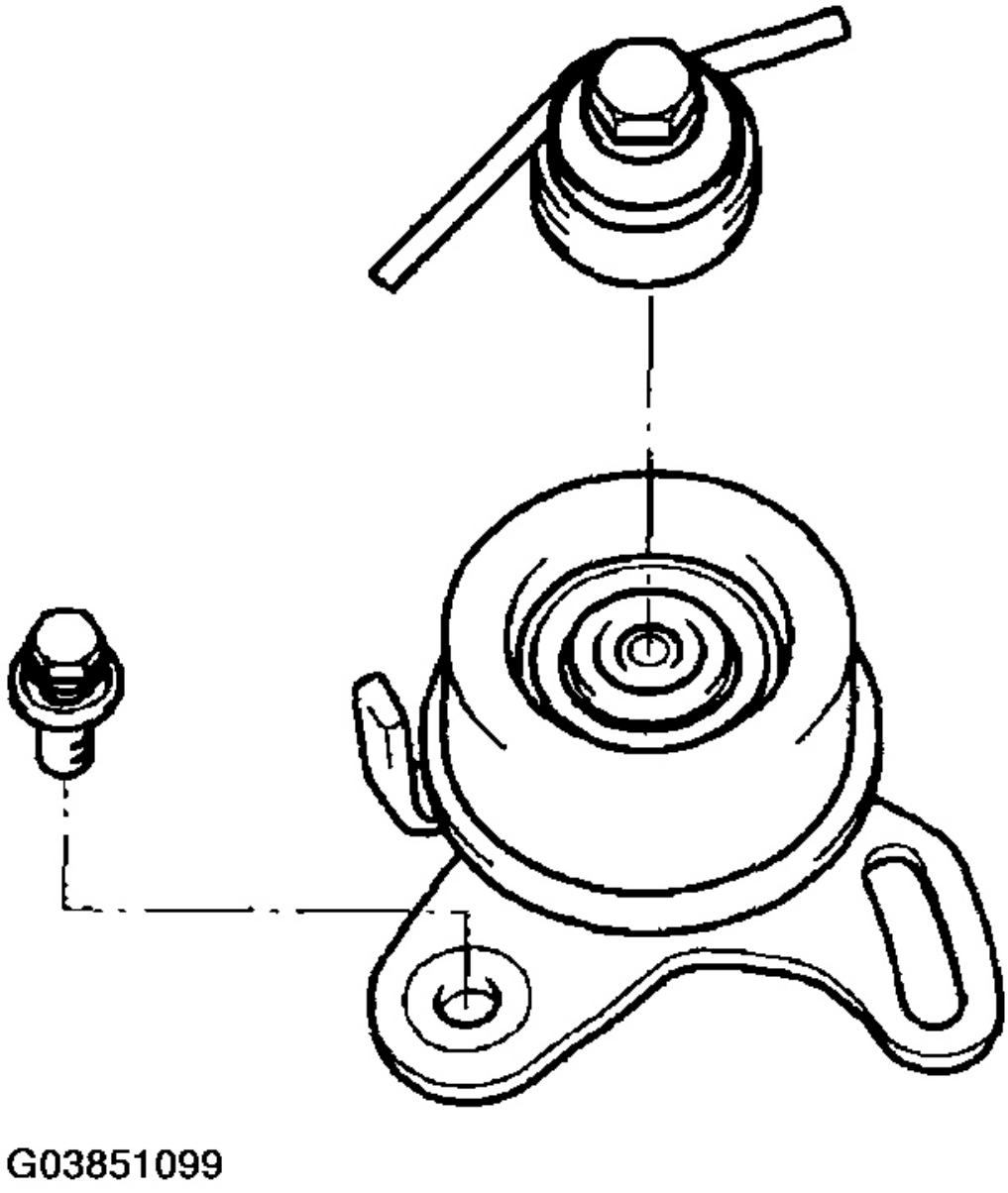


Fig. 65: Removing Timing Belt Tensioner
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

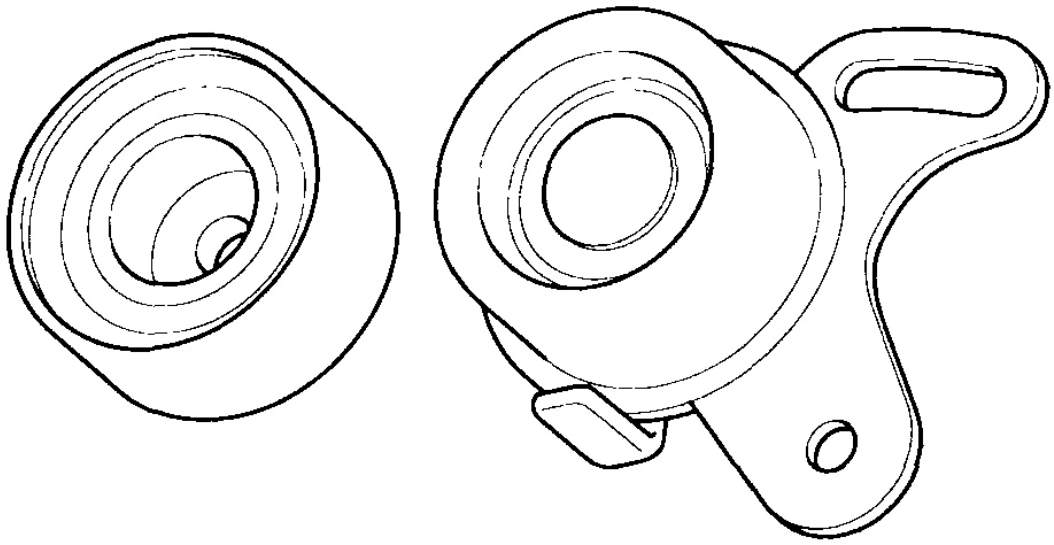
SPROCKETS TENSIONER PULLEY, AND IDLER PULLEY

1. Check the camshaft sprocket, crankshaft sprocket, tensioner pulley, and idler pulley for abnormal wear,

cracks, or damage.

Replace as necessary.

2. Inspect the tensioner pulley and the idler pulley for easy and smooth rotation and check for play or noise. Replace as necessary.



G03851100

Fig. 66: Inspecting Tensioner Pulley & Idler Pulley
Courtesy of HYUNDAI MOTOR CO.

3. Replace the pulley if there is a grease leak from its bearing.

TIMING BELT

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

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

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

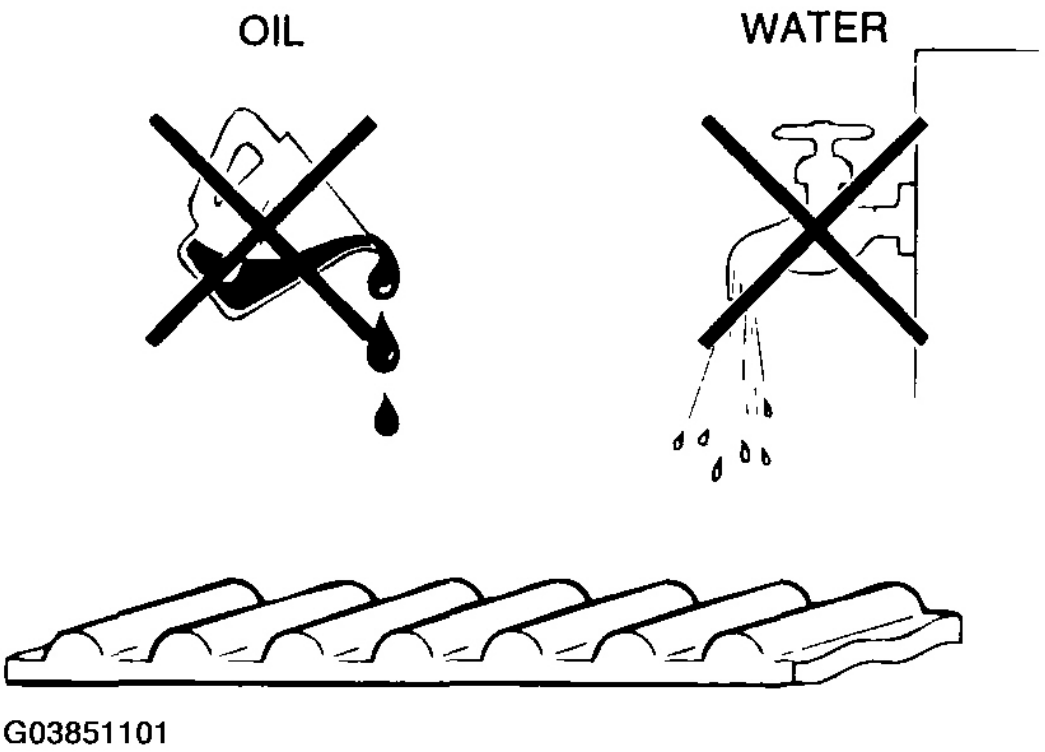
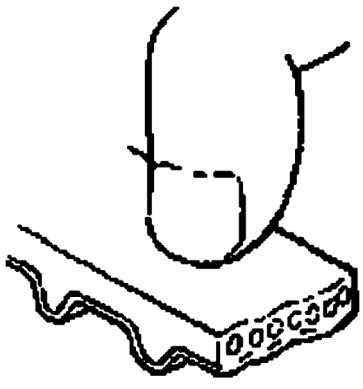
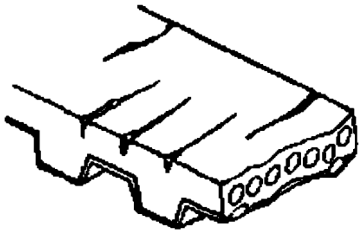


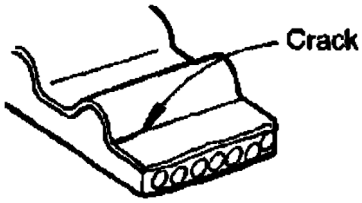
Fig. 67: Safety Precaution Of Timing Belt
Courtesy of HYUNDAI MOTOR CO.

TIMING BELT FLAW CONDITIONS

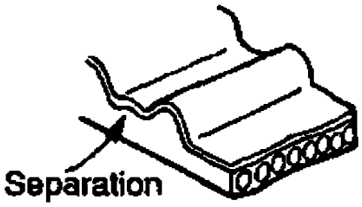
Description	Flaw conditions
1. Hardened back surface • Back surface is glossy, non-elastic and so hard that when your fingernail is pressed into it. No mark is produced.	
2. Cracked back surface rubber	


G03851103

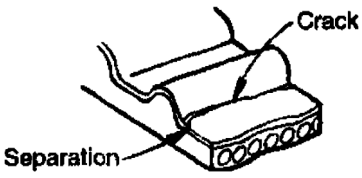
3. Cracked or separating canvas



G03851104



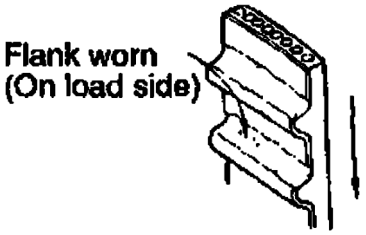
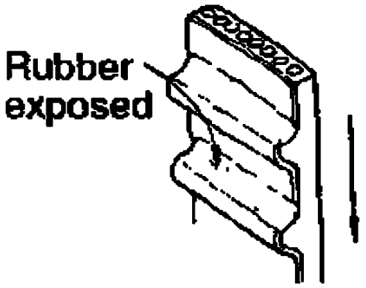
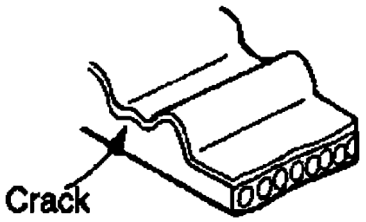
G03851105



G03851106

4. Badly worn teeth (initial stages)

- Canvas on load side of tooth flank worn (Fluffy canvas fibers, rubber gone and color changed to white, and unclear canvas texture)

	 G03851107
5. Badly worn teeth (last stage) • Canvas on load side of tooth flank worn down and rubber exposed (tooth width reduced)	 G03851108
6. Cracked tooth bottom	 G03851109
7. Missing tooth	 G03851110
8. Side of belt badly worn	

NOTE: **Normal belt should have precisely cut sides as if cut by a sharp knife.**	
9. Side of belt cracked	

REASSEMBLY

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

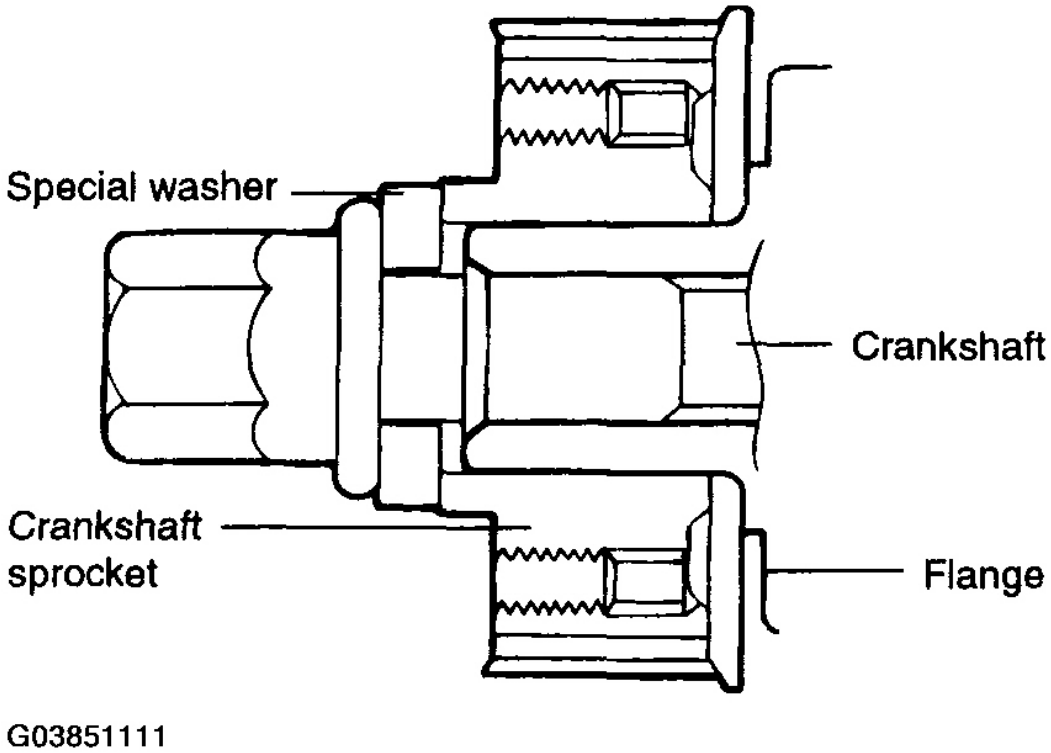


Fig. 68: Installing Flange & Crankshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

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

   Tightening torque

   Camshaft sprocket bolt:

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

3. Install the idler and tighten the idler bolt to the specified torque.

Tightening torque

Idler bolt: 43 ~ 55 Nm (430 ~ 550 kg.cm, 32 ~ 41 lb.ft)

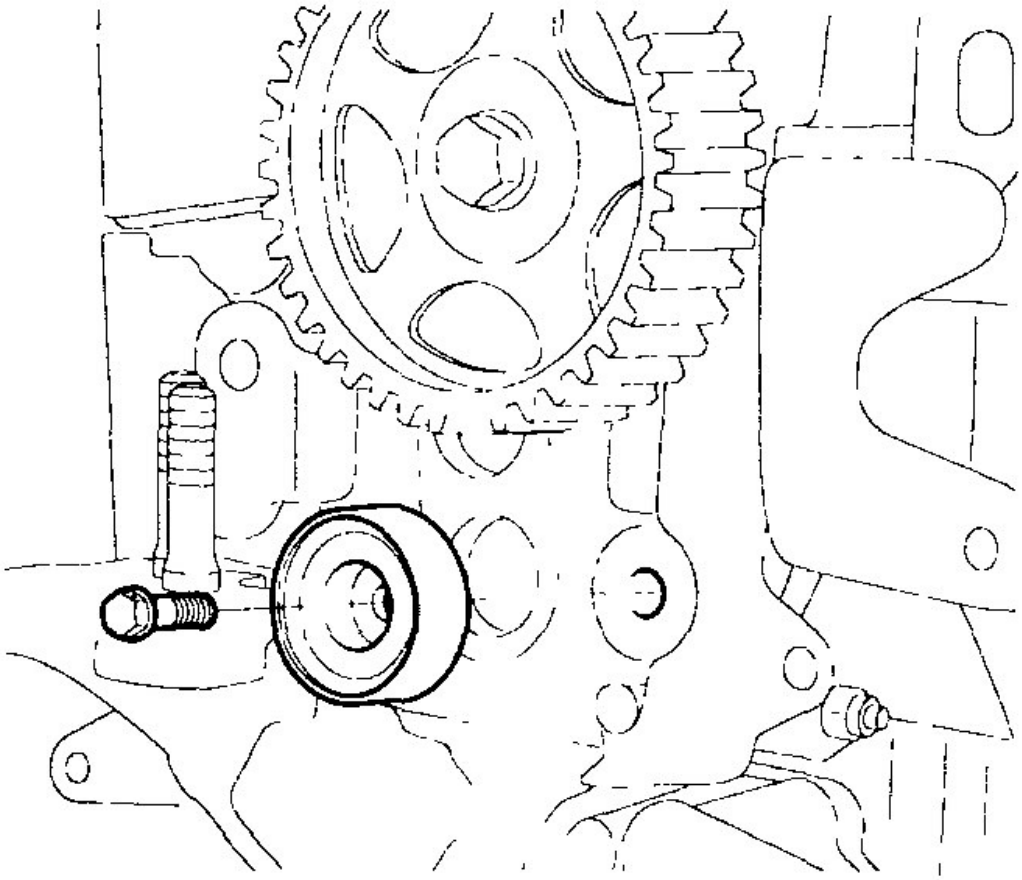


Fig. 69: Installing Idler & Tightening Idler Bolt
Courtesy of HYUNDAI MOTOR CO.

4. Align the timing marks of the camshaft sprocket (A) and camshaft bearing cap (B).

   Then align the timing marks of crankshaft sprocket and front case with the No.1 piston placed at top dead center on its compression stroke as shown in the illustration.

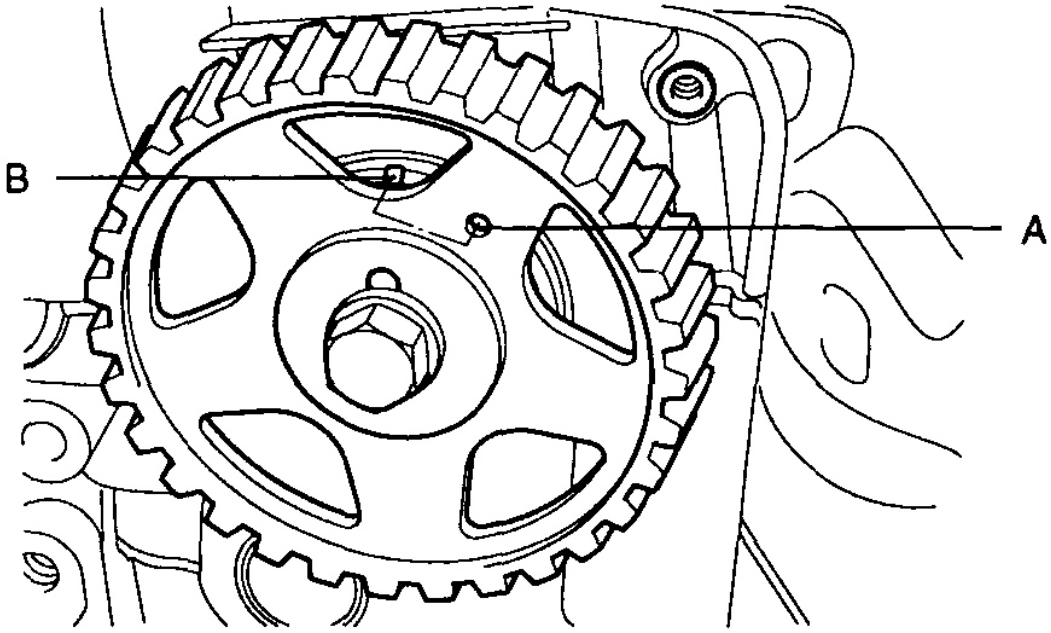
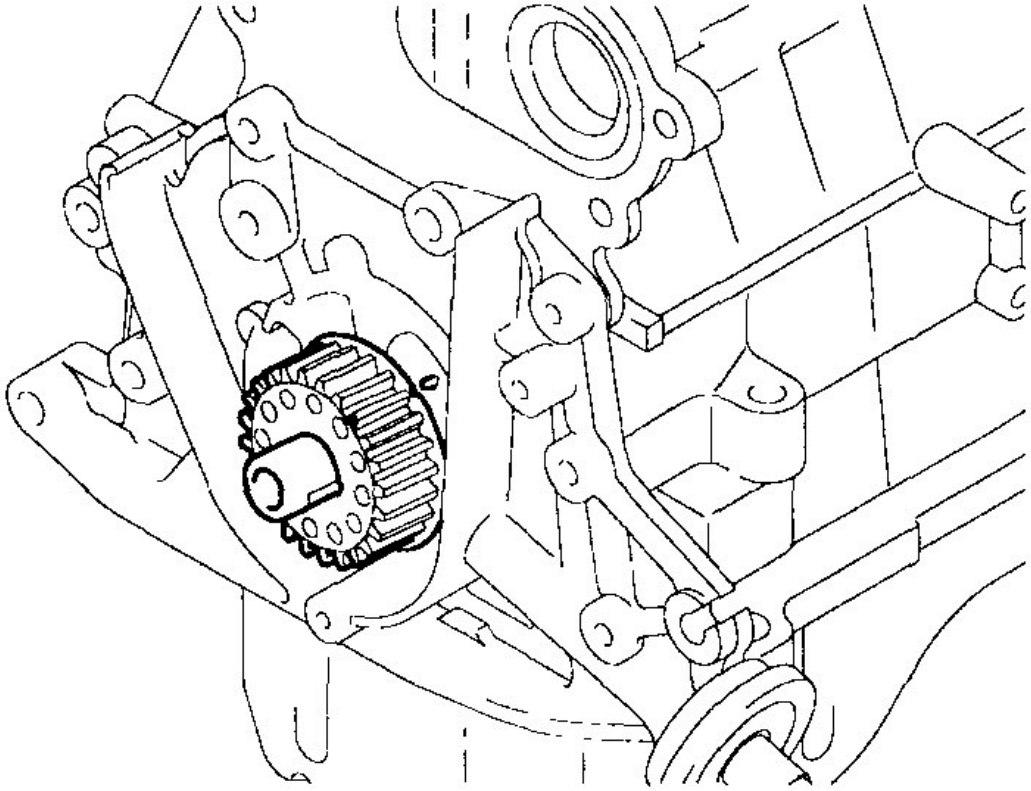


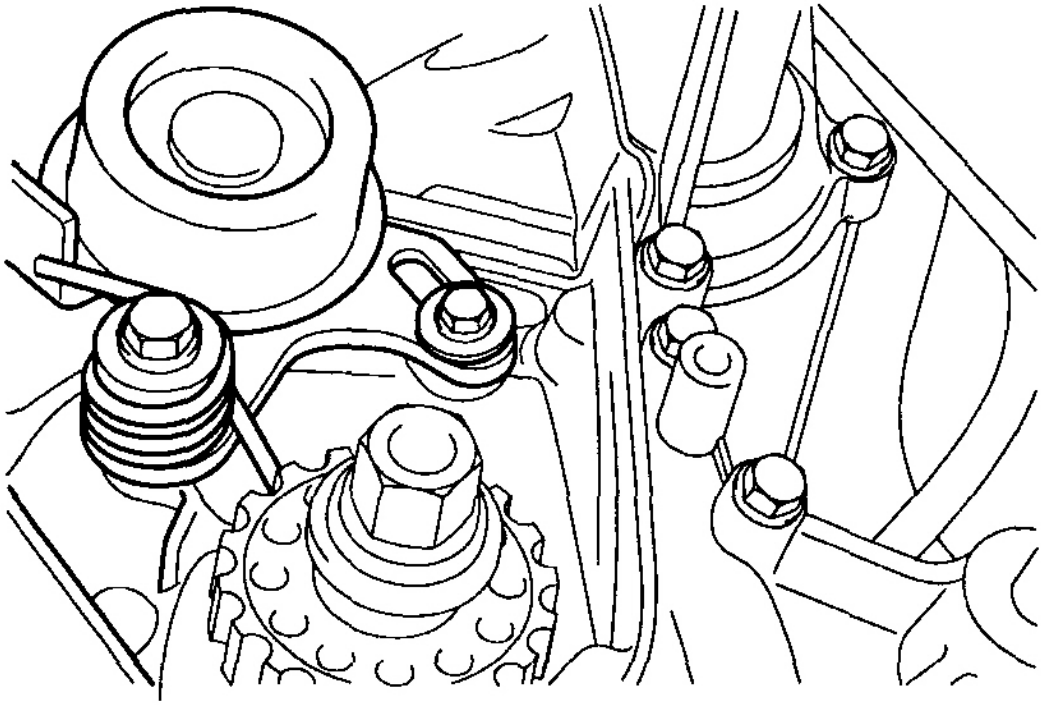
Fig. 70: Aligning Timing Marks Of Camshaft Sprocket & Camshaft Bearing Cap
Courtesy of HYUNDAI MOTOR CO.



G03851114

Fig. 71: Aligning Timing Marks Of Crankshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

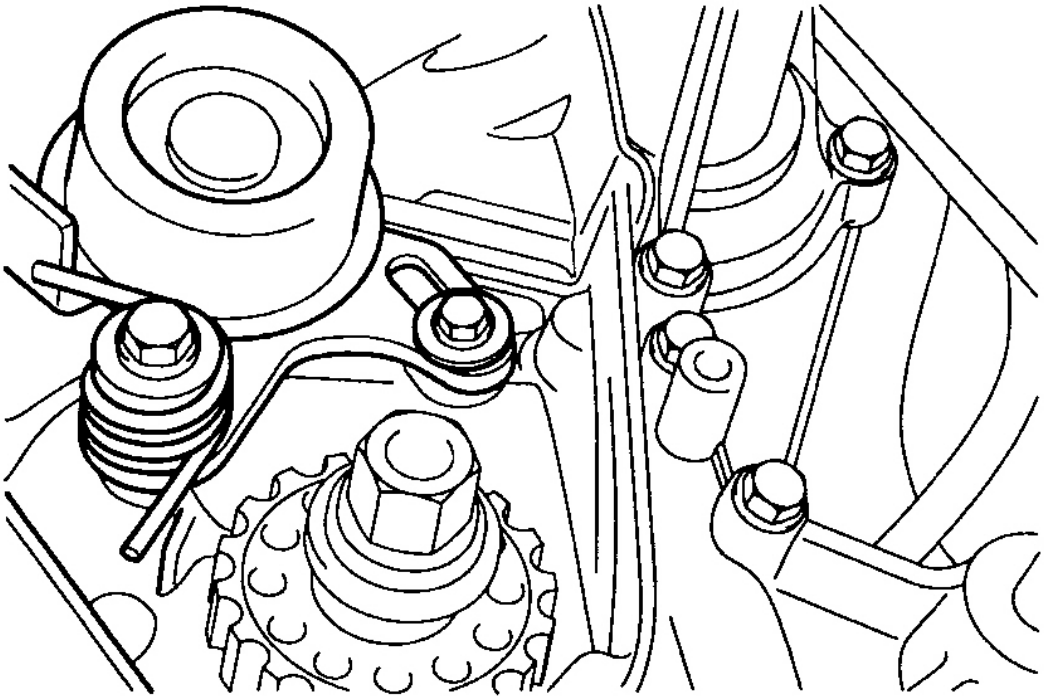
5. To install the timing belt tensioner, first mount the tensioner, spring, and spacer. Temporarily tighten the bolts. Next, temporarily tighten the tensioner long hole side washer and bolts. Install the bottom end of the spring against the front case as shown in the illustration.



G03851115

Fig. 72: Installing Timing Belt Tensioner
Courtesy of HYUNDAI MOTOR CO.

6. Secure the tensioner, positioned towards the water pump.



G03851116

Fig. 73: Securing Tensioner, Positioned Towards Water Pump
Courtesy of HYUNDAI MOTOR CO.

7. Install the timing belt on the crankshaft sprocket.

(1) Crankshaft sprocket → (2) Timing belt idler → (3) Camshaft sprocket → (4) Timing belt tensioner.

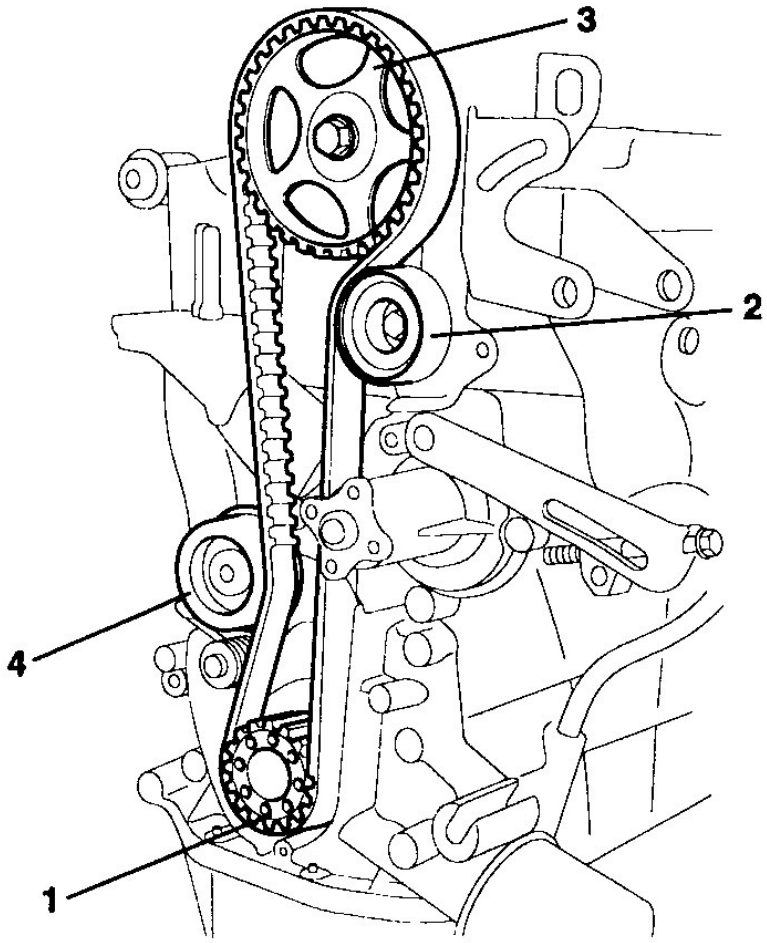


Fig. 74: Installing Timing Belt On Crankshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

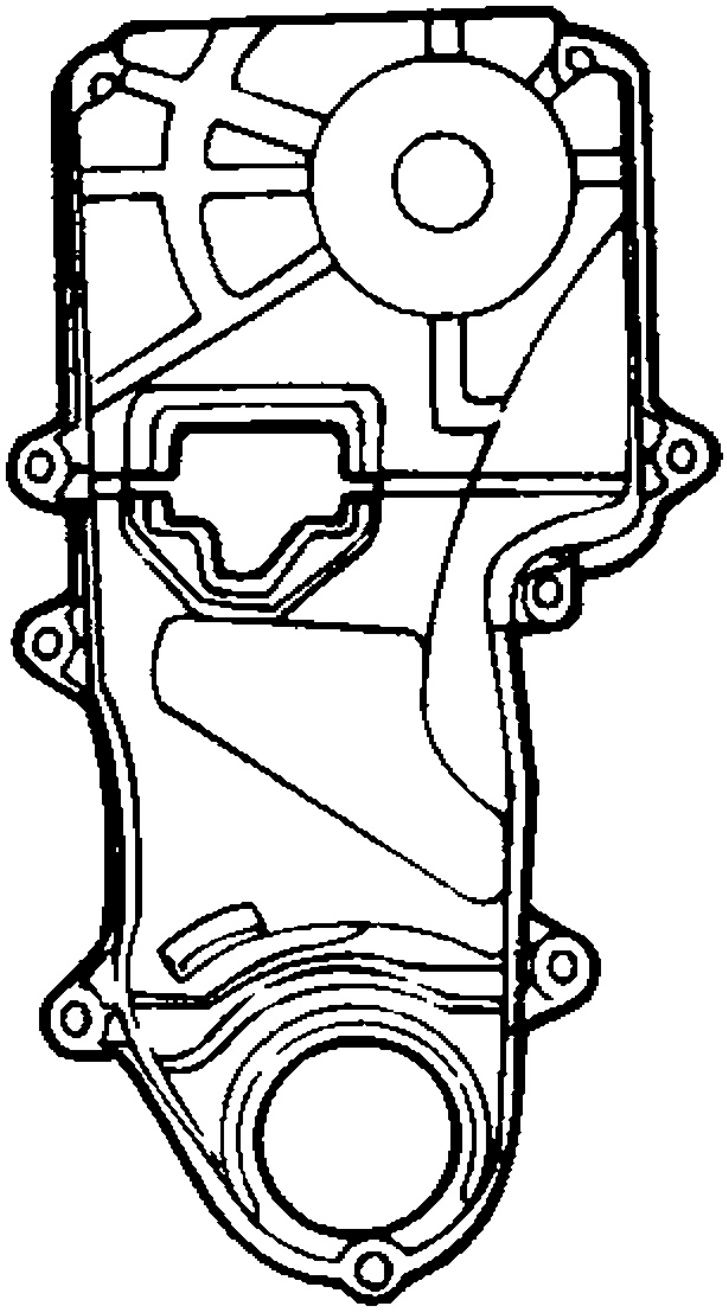
Tensioner attaching bolt:

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

10. Turn the crankshaft two turns in its operating direction (clock-wise) and realign the camshaft sprocket timing mark with the top dead center position.
11. Then recheck the belt tension. Verify that when the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49N (11lb)], the timing belt cog end is approx. 1/2 of the tensioner mounting bolt head radius (across flats) away from the bolt head center.

Fig. 75: Checking Belt Tension
Courtesy of HYUNDAI MOTOR CO.

12. Install the timing belt cover.



G03851119

Fig. 76: Installing Timing Belt Cover
Courtesy of HYUNDAI MOTOR CO.

Tightening torque

Timing belt cover bolt:

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

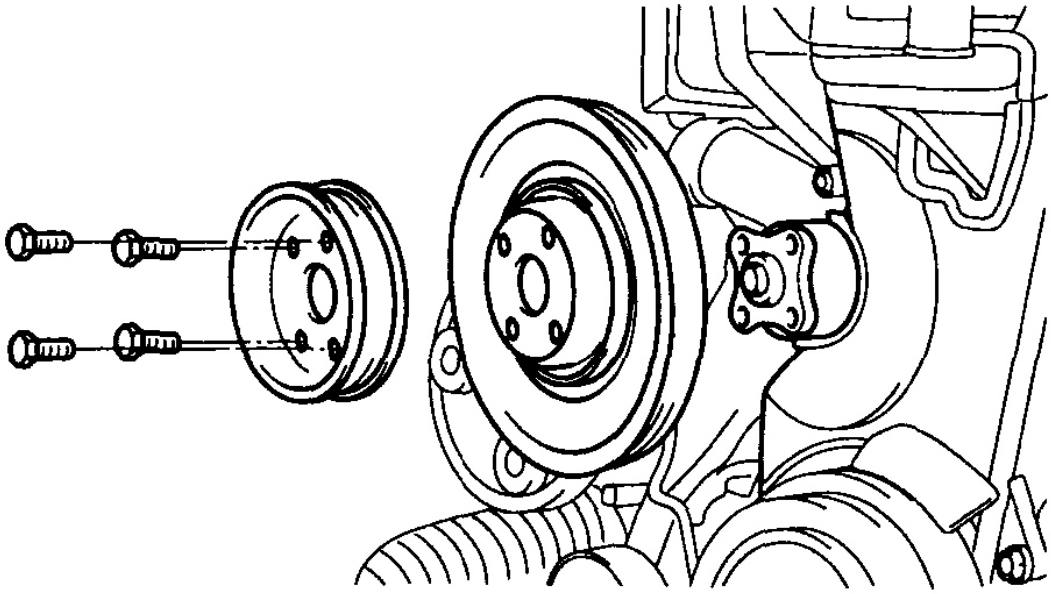
13. Install the crankshaft pulley. Make sure that the crankshaft sprocket pin fits the small hole in the pulley.

    Tightening torque

    Crankshaft pulley bolt:

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

14. Install the water pump pulley.



G03851120

Fig. 77: Installing Water Pump Pulley
Courtesy of HYUNDAI MOTOR CO.

15. Install the alternator belt and adjust the belt tension.
16. Install the air conditioning compressor belt and adjust the belt tension.
17. Install the power steering belt and adjust the belt tension.

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

COMPONENTS

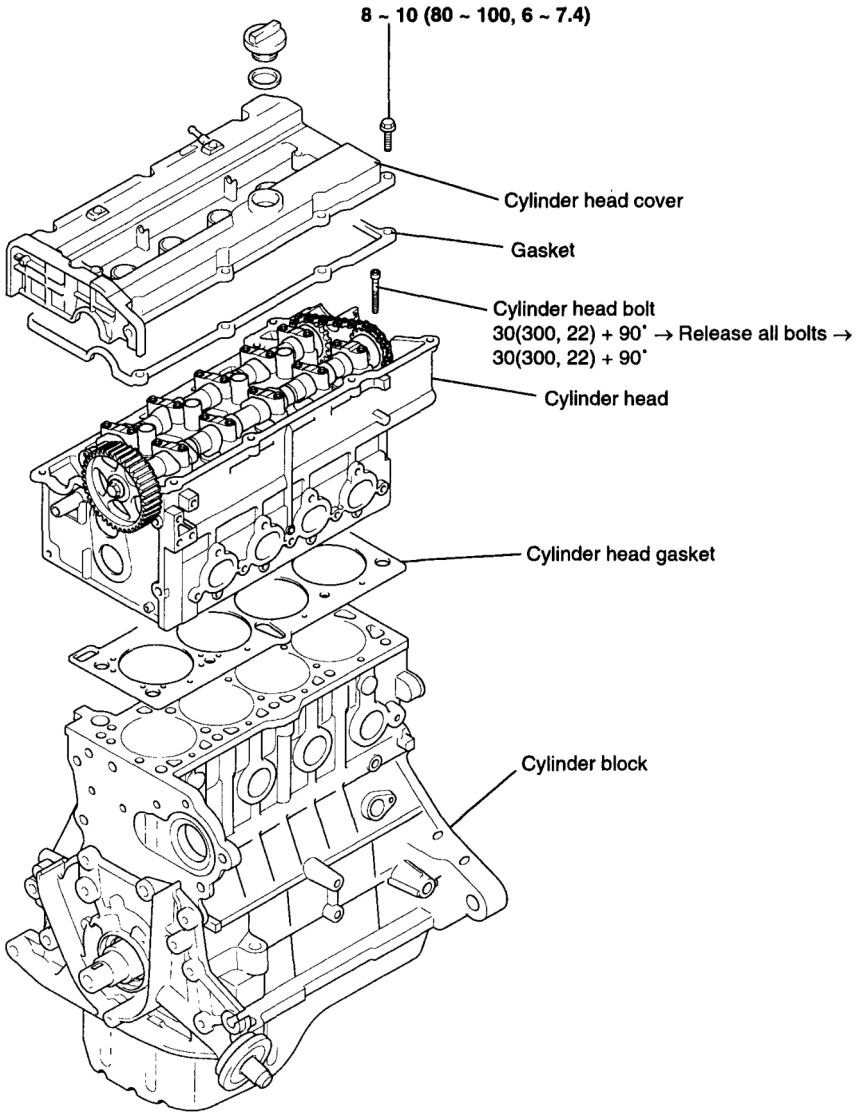


Fig. 78: Exploded View Of Cylinder Head Assembly & Torque Specifications (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

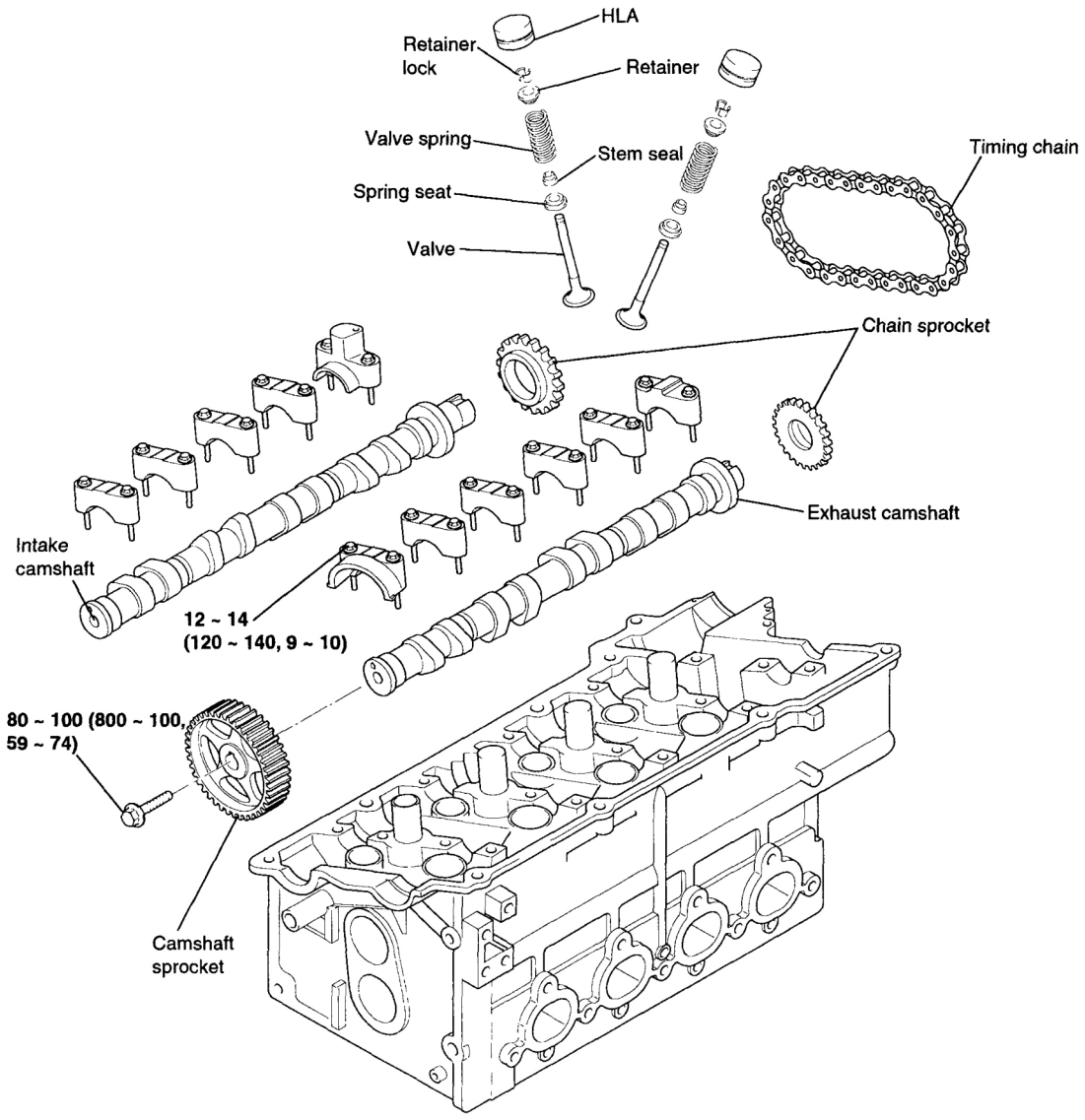


Fig. 79: Exploded View Of Cylinder Head Assembly & Torque Specifications (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Using a tool remove the cylinder head bolts in the order shown in the illustration.

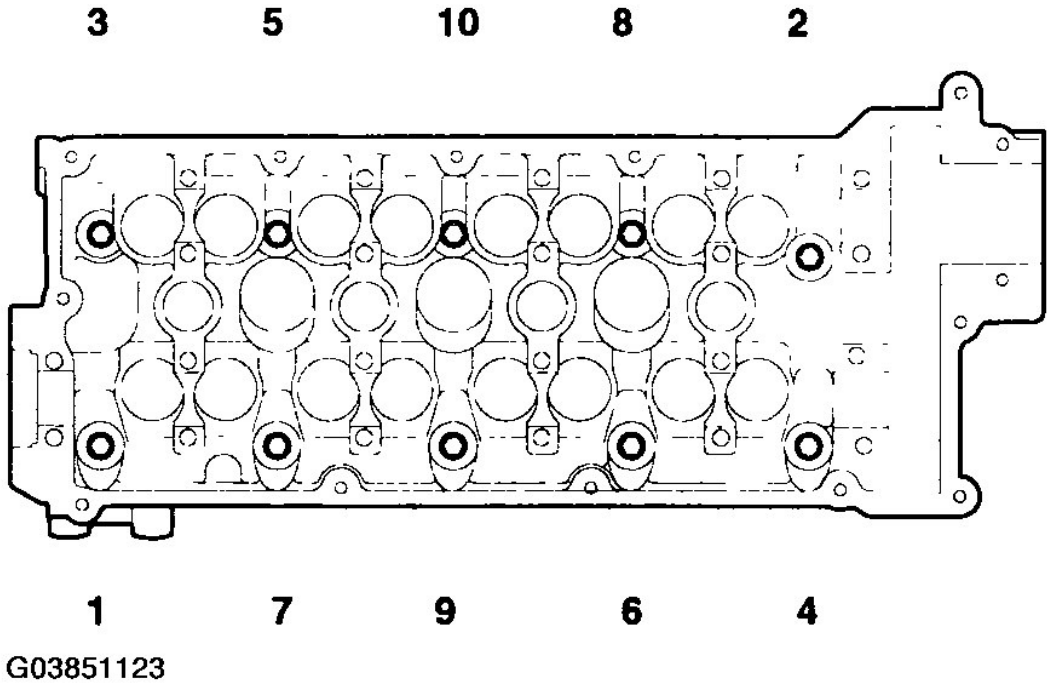


Fig. 80: Removing Cylinder Head Bolts In Sequence
Courtesy of HYUNDAI MOTOR CO.

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

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

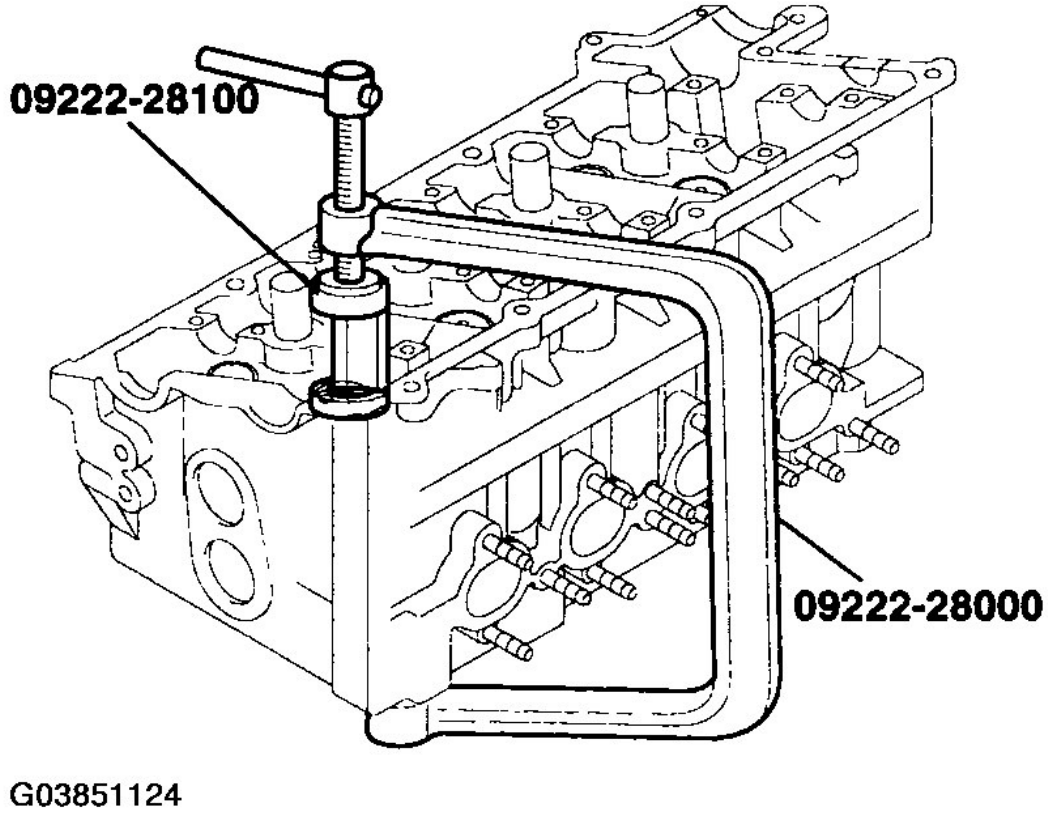


Fig. 81: Removing Spring Retainer, Valve Spring, Spring Seat & Valve Using Special Tool
Courtesy of HYUNDAI MOTOR CO.

3. Remove the valve stem seals with pliers.

NOTE: Do not reuse the valve stem seals.

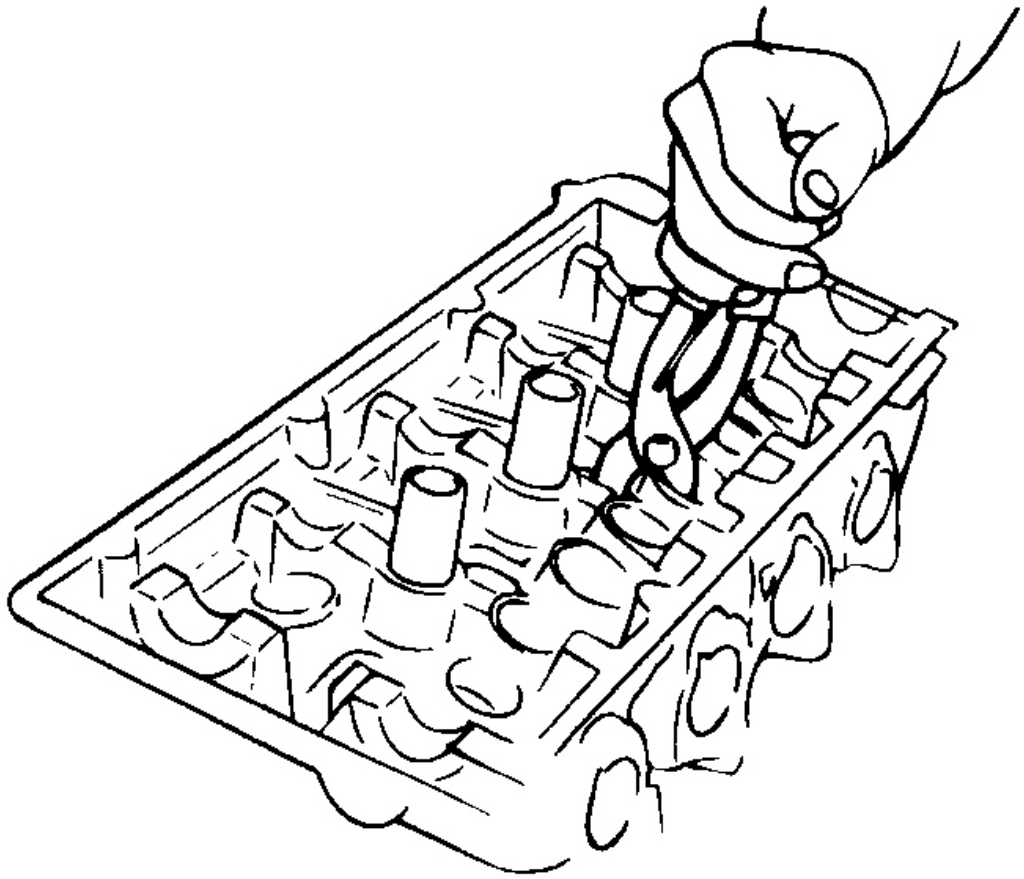
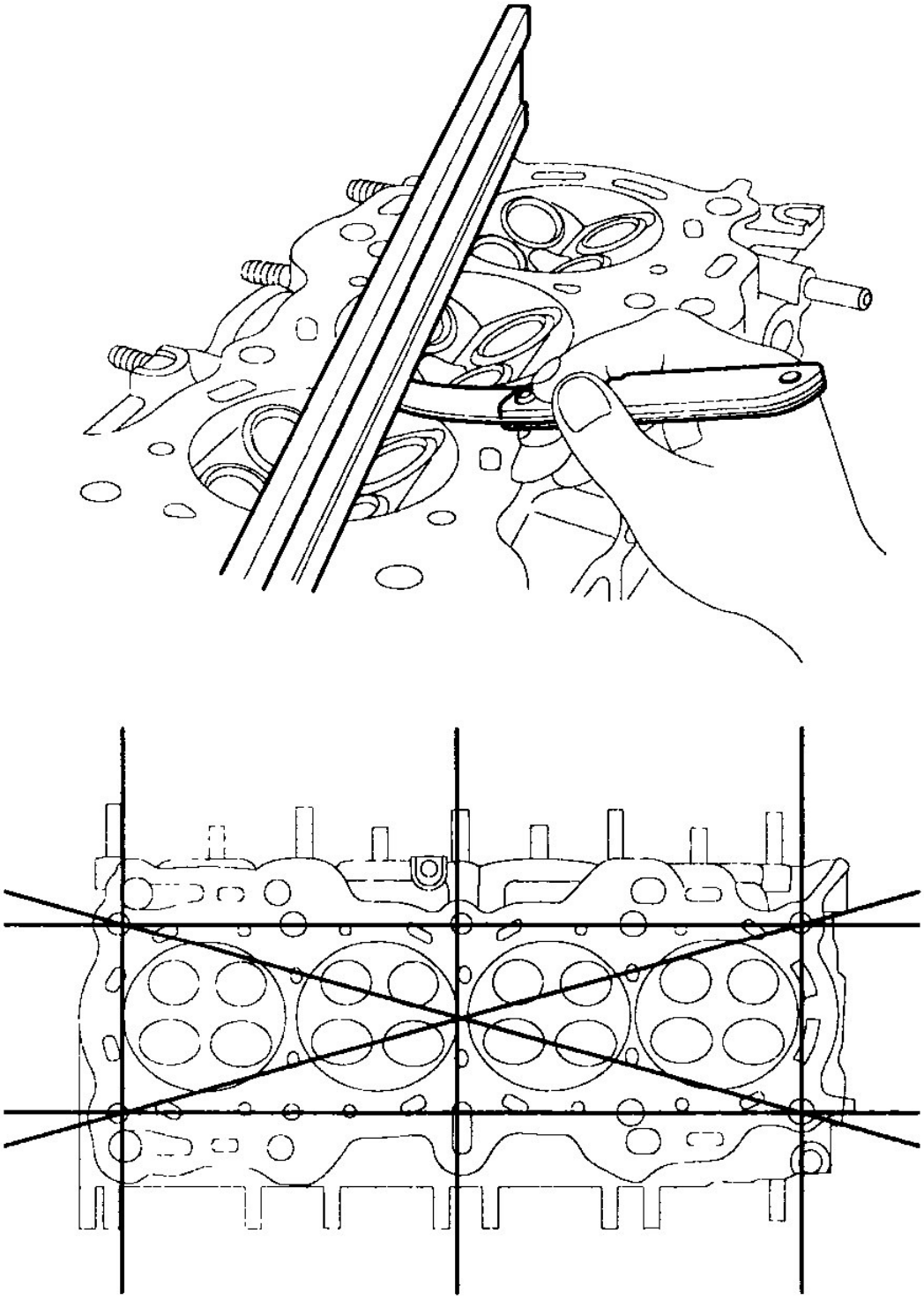


Fig. 82: Removing Valve Stem Seals With Pliers
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

CYLINDER HEAD

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



G03851126

Fig. 83: Checking Cylinder Head
Courtesy of HYUNDAI MOTOR CO.

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

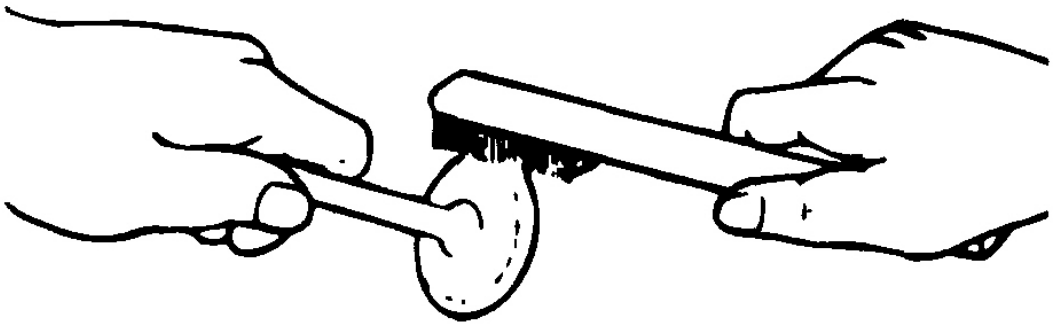
   Flatness of cylinder head gasket surface

   Standard: Less than 0.03 mm (0.0012 in.)

   Limit: 0.05 mm (0.002 in.)

VALVES

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



G03851127

Fig. 84: Cleaning Valve With Wire Brush
Courtesy of HYUNDAI MOTOR CO.

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

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

   Margin

   [Standard]

   Intake: 1.1 mm (0.043 in.)

Exhaust: 1.3 mm (0.051 in.)

[Limit]

Intake: 0.8 mm (0.028 in.)

Exhaust: 1.0 mm (0.040 in.)

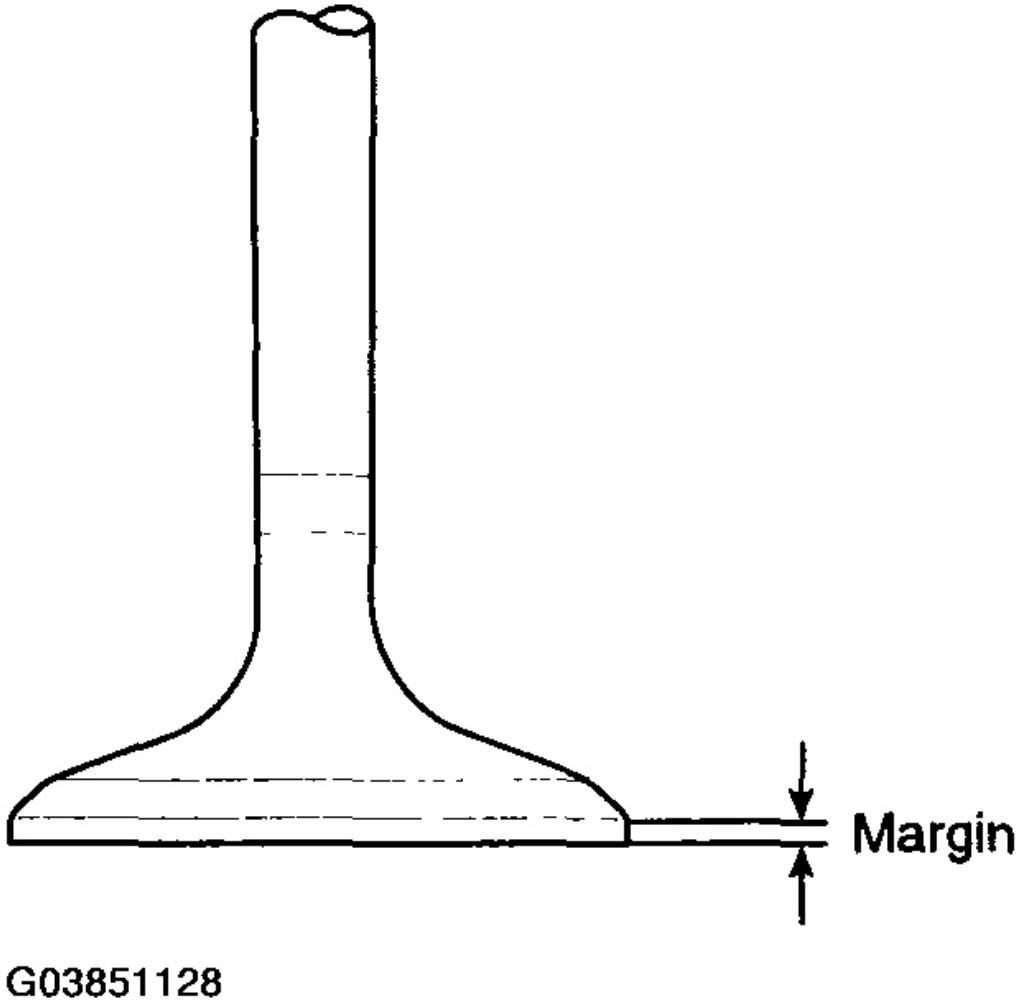


Fig. 85: Identifying Valve Margin Clearance
Courtesy of HYUNDAI MOTOR CO.

VALVE SPRINGS

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

Valve spring

[Standard]

Free height: 44 mm (1.7323 in.)

Load:

21.6 kg/35 mm (47.6 lb/1.3780 in.)

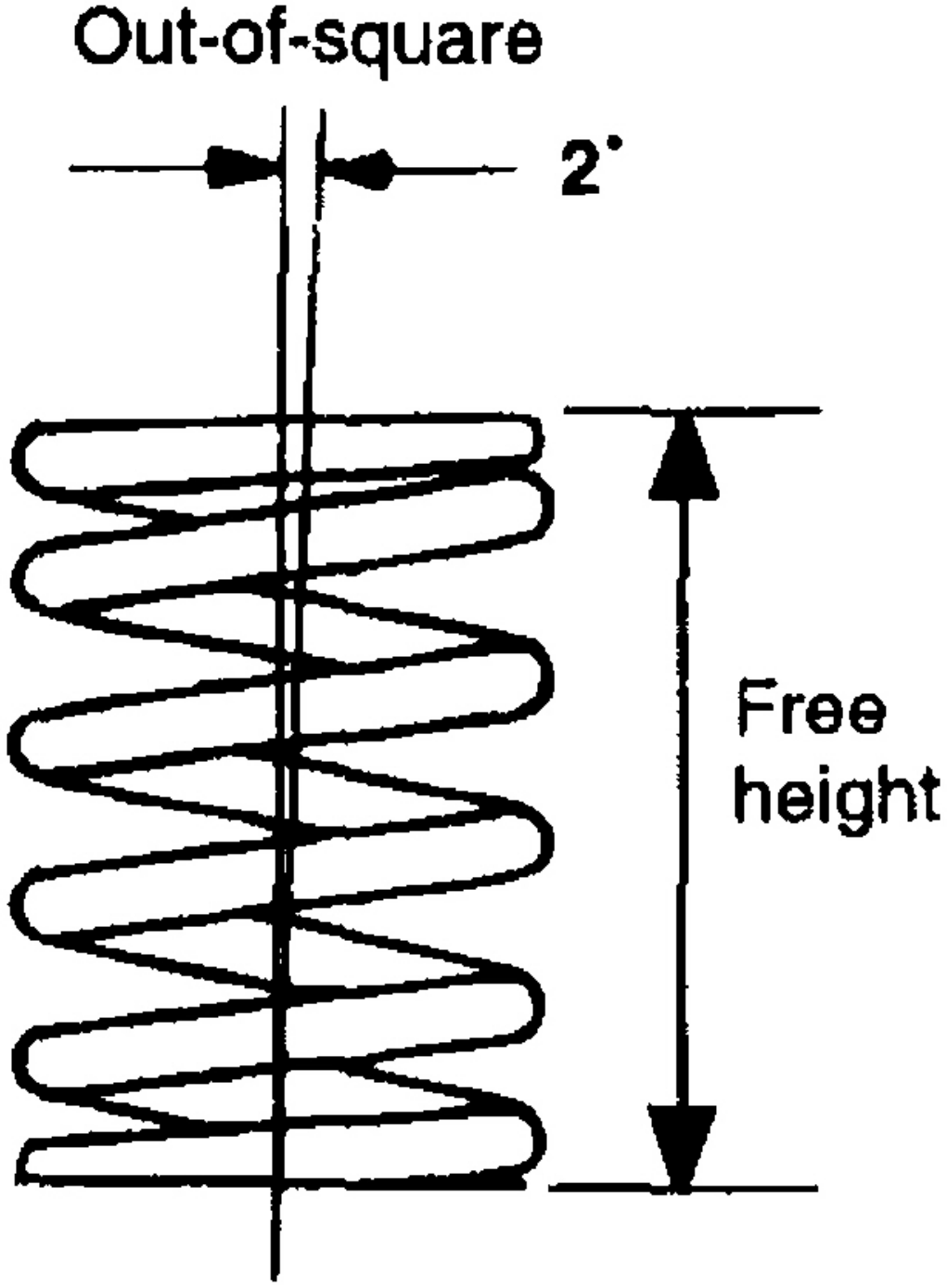
45.1 kg/27.2 mm (99.4 lb/1.0709 in.)

Out of square: 1.5°

[Limit]

Free height: - 1.0 mm (- 0.039 in.)

Out of square: 3°



G03851129

Fig. 86: Identifying Valve Spring Free Height
Courtesy of HYUNDAI MOTOR CO.

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

Valve stem-to-clearance

[Standard]

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

Exhaust: 0.05 ~ 0.08 mm (0.0020 ~ 0.0031 in.)

[Limit]

Intake: 0.1 mm (0.0040 in.)

Exhaust: 0.15 mm (0.0059 in.)

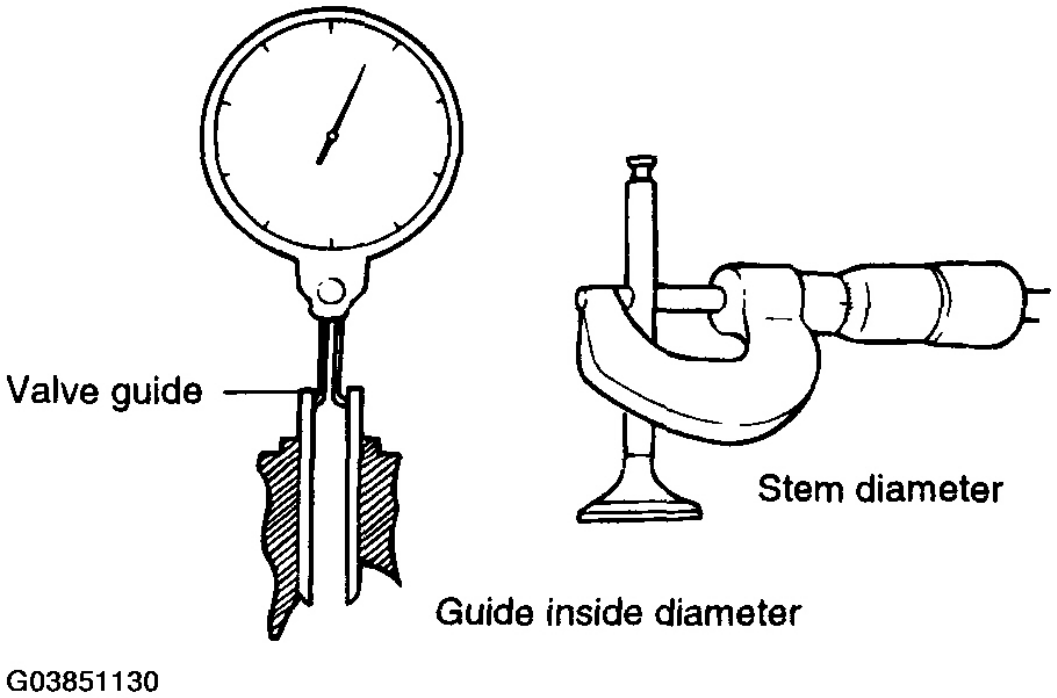


Fig. 87: Checking Valve Stem-To-Guide Clearance
Courtesy of HYUNDAI MOTOR CO.

REPLACING THE VALVE SEAT RING

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

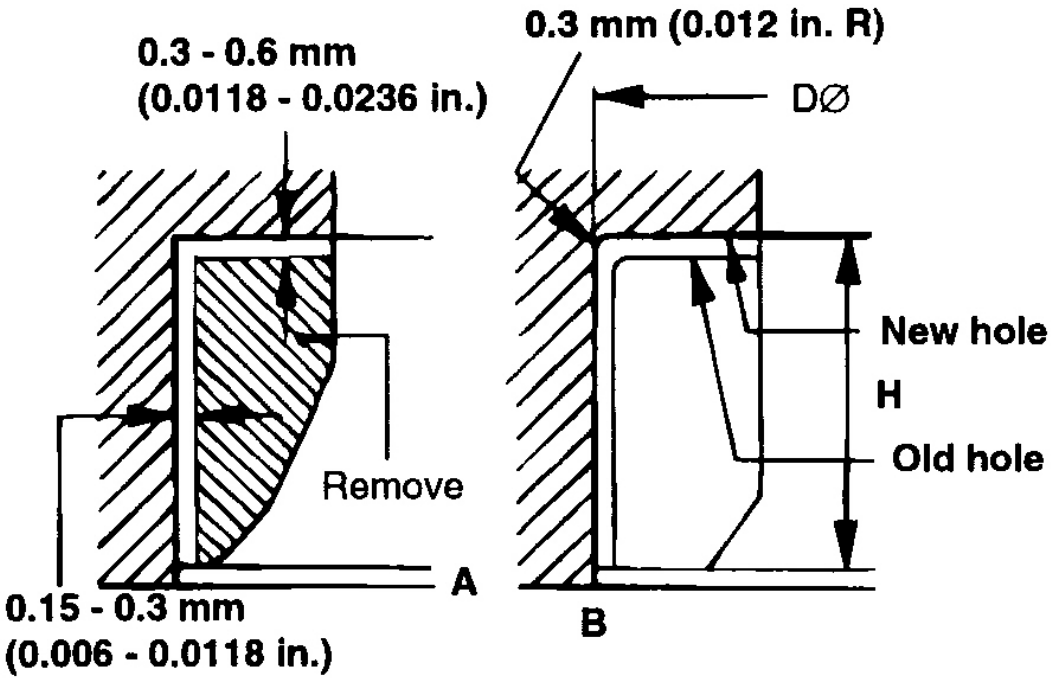


Fig. 88: Identifying Inner Face Of Valve Seat
Courtesy of HYUNDAI MOTOR CO.

2. Enlarge the diameter of the valve seat so that it matches the specified oversize hole diameter of the new valve seat ring.
3. Heat the cylinder head to about 250°C (480°F) and press - fit an oversize seat ring for the bore in the cylinder head.
4. Using lapping compound, lap the valve to the new seat.

Valve seat contact width

Intake: 0.8 ~ 1.2 mm (0.0315 ~ 0.0472 in.)

Exhaust: 1.3 ~ 1.7 mm (0.0512 ~ 0.0670 in.)

OVERSIZE VALVE SEAT SPECIFICATIONS

Description	Size mm (in.)	Size mark	Seat ring height H mm (in.)	Oversize hole diameter I.D. mm (in.)

Intake valve Seat ring	0.3 (0.012) O.S.	30	5.1~5.3 (0.2008~0.2087)	30.7~30.721 (1.2087~1.2095
	0.6 (0.024) O.S.	60	5.4~5.6 (0.2126~0.2205)	31.0~31.021 (1.2205~1.2213)
Exhaust valve Seat ring	0.3 (0.012) O.S.	30	6.2~6.4 (0.2441~0.2520)	27.3~27.321 (1.0748~1.0756)
	0.6 (0.024) O.S.	60	6.5~6.7 (0.2560~0.2638)	27.6~27.621 (1.0866~1.0874)

REPLACING VALVE GUIDE

1. Using the special tool (09221-3F100 A/B), withdraw the old valve guide toward the bottom of cylinder head.

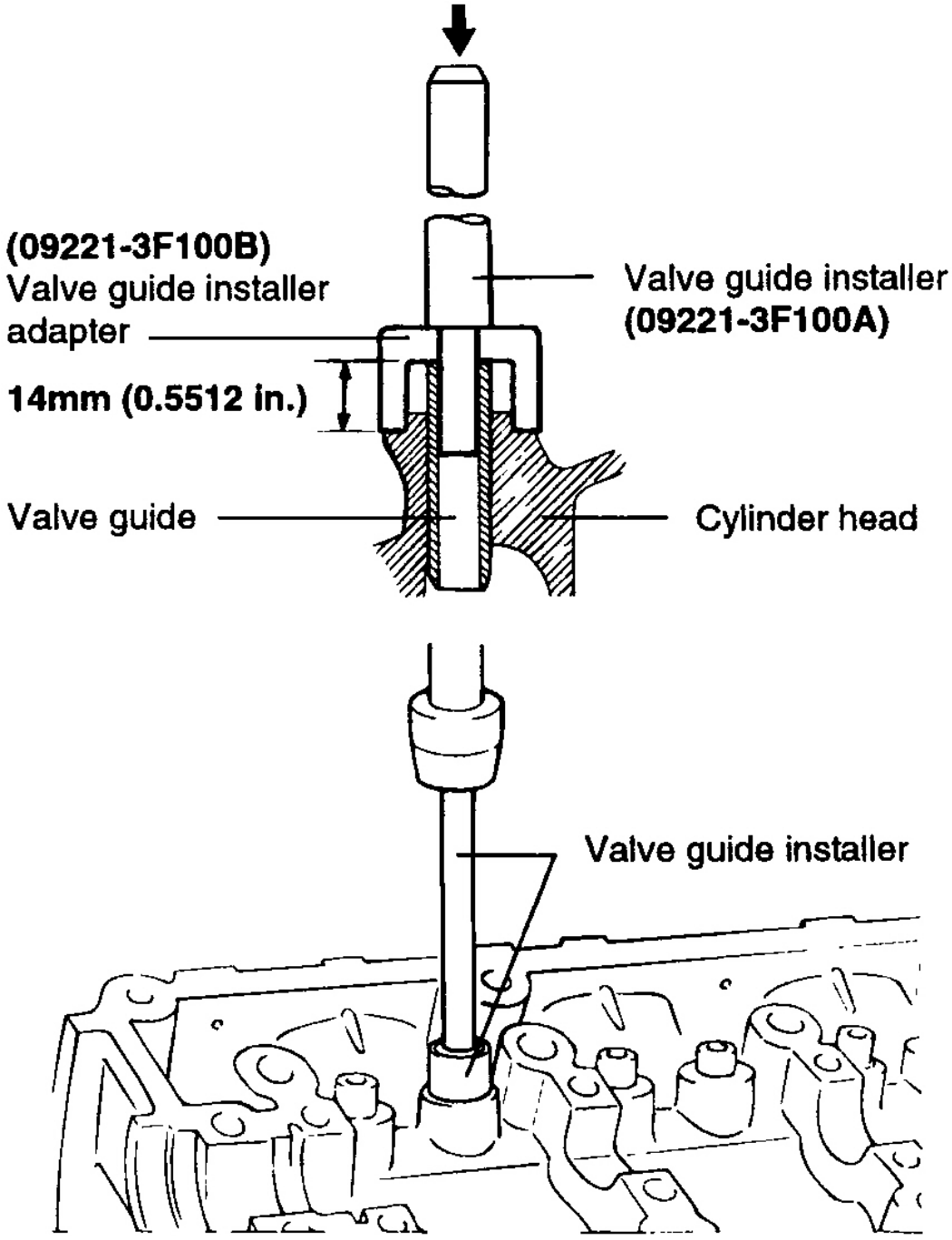


Fig. 89: Removing Valve Guide Using Special Tool
Courtesy of HYUNDAI MOTOR CO.

2. Recondition the valve guide hole so that it can match the newly press-fitted oversize valve guide.
3. Using the special tool (09221-3F100 A/B), press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head.
4. After the valve guide is press-fitted, insert a new valve and check for proper the clearance
5. After the valve guide is replaced, check that the valve is seated properly. Recondition the valve seats as necessary.

OVERSIZE VALVE GUIDE SPECIFICATIONS

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

REASSEMBLY

NOTE:

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

1. Install the spring seats.

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

NOTE:

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

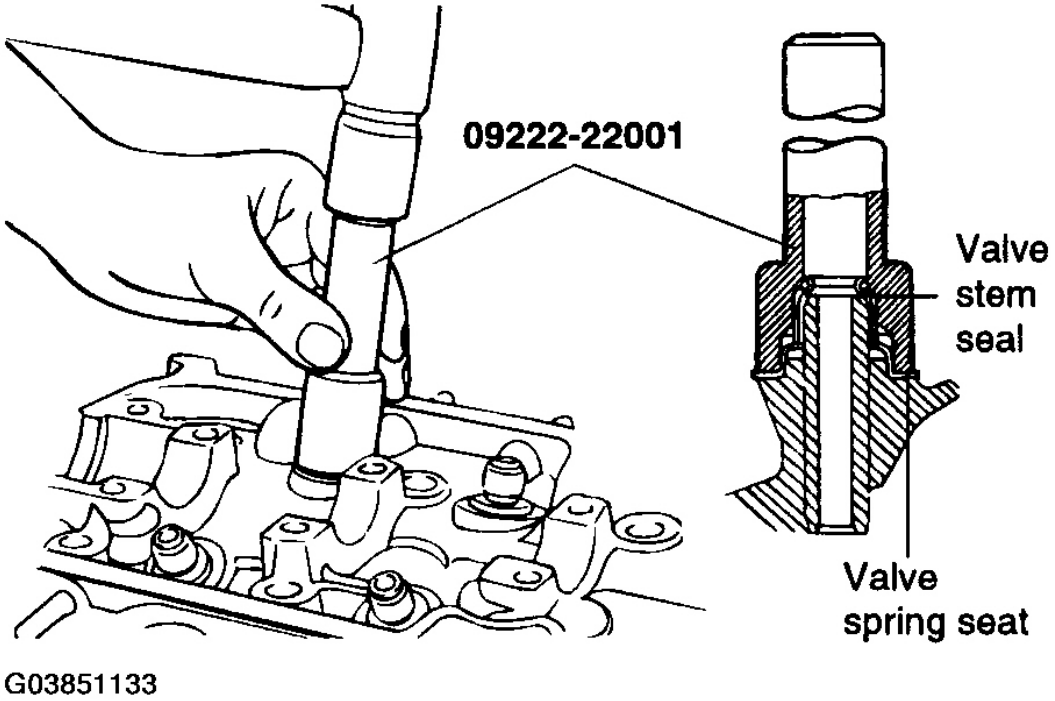


Fig. 90: Tapping Seal In Position Lightly Using Special Tool
Courtesy of HYUNDAI MOTOR CO.

2. Apply engine oil to each valve. Insert the valve into the valve guide.

   Avoid pushing the valve into the seal by force. After inserting the valve, check that it moves smoothly.

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

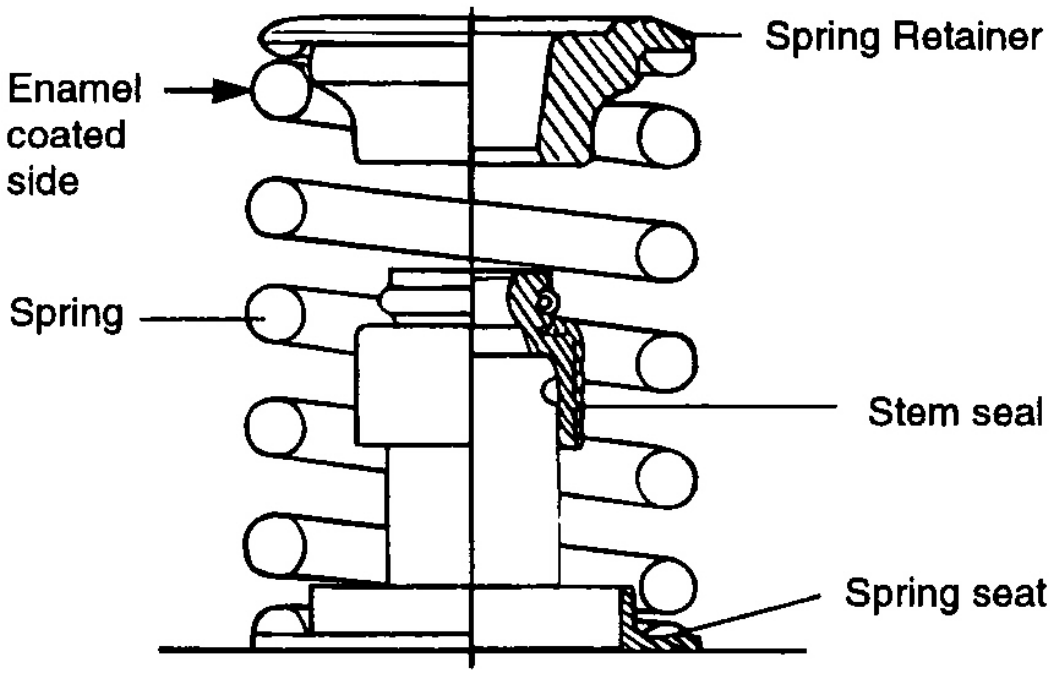


Fig. 91: Installing Valve Springs
Courtesy of HYUNDAI MOTOR CO.

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

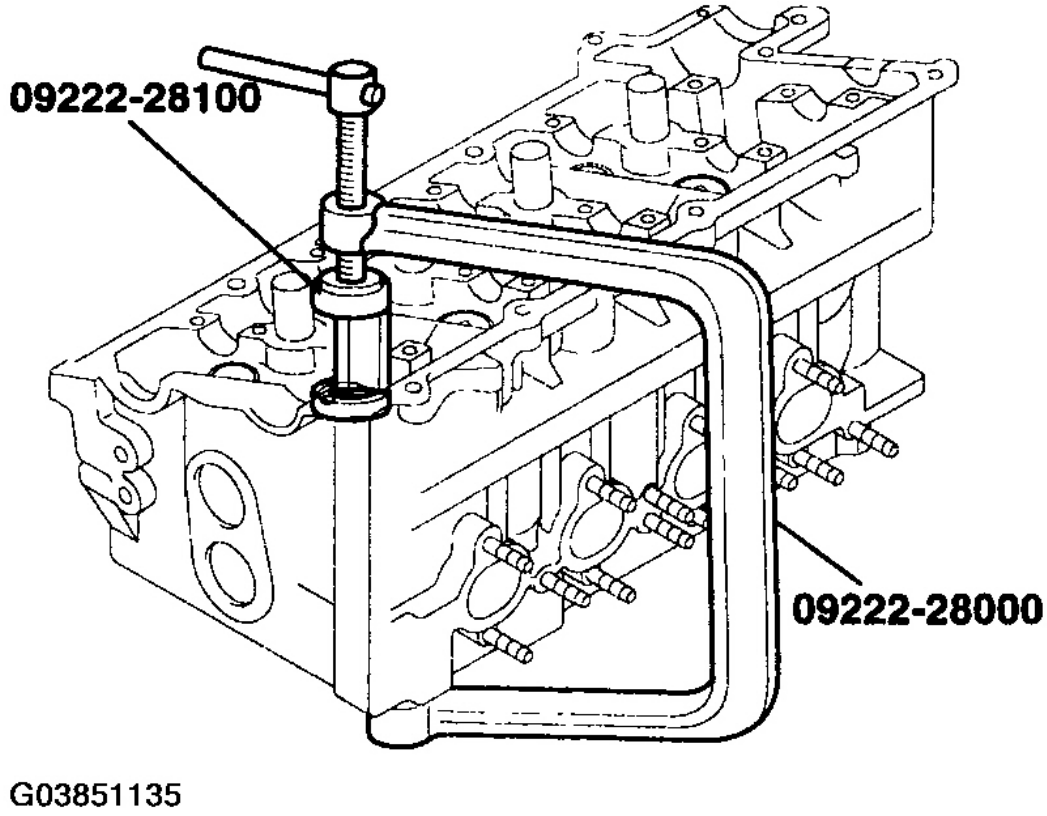


Fig. 92: Compressing Spring & Installing Retainer Locks Using Special Tool
Courtesy of HYUNDAI MOTOR CO.

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

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

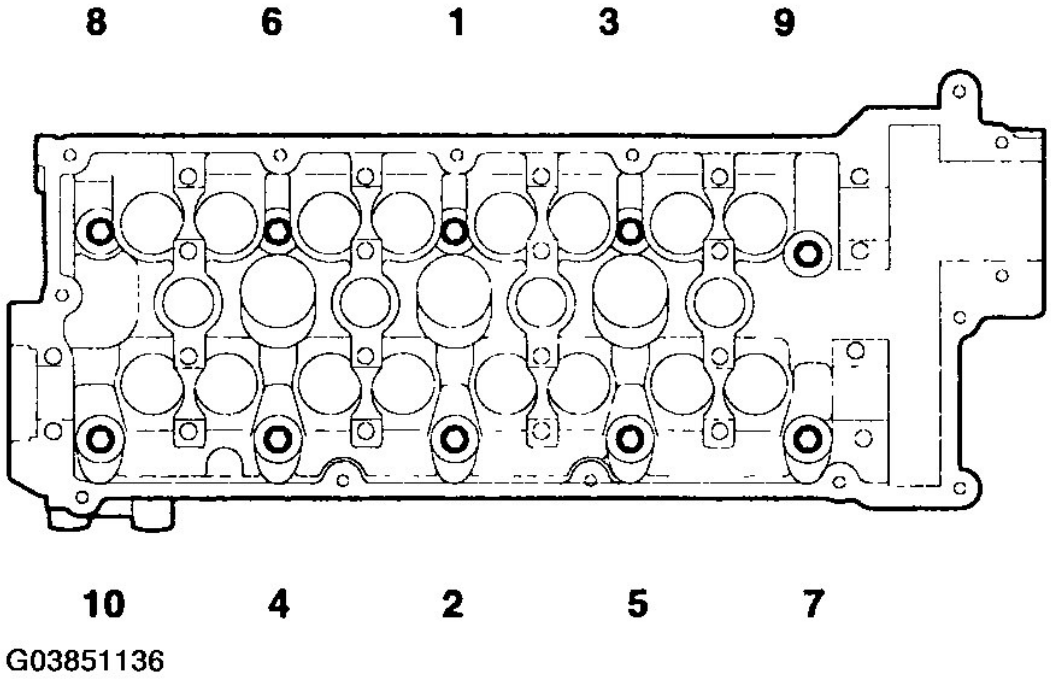


Fig. 93: Tightening Cylinder Head Bolts In Sequence
Courtesy of HYUNDAI MOTOR CO.

Cylinder head bolt

30 Nm (300 kg.cm, 22 lb.ft)+ 90° + Release all bolts

+ 30 Nm (300kg.cm, 22 lb.ft) + 90°

CAMSHAFT, CRANKSHAFT, FLYWHEEL AND PISTON

CAM SHAFT

COMPONENTS

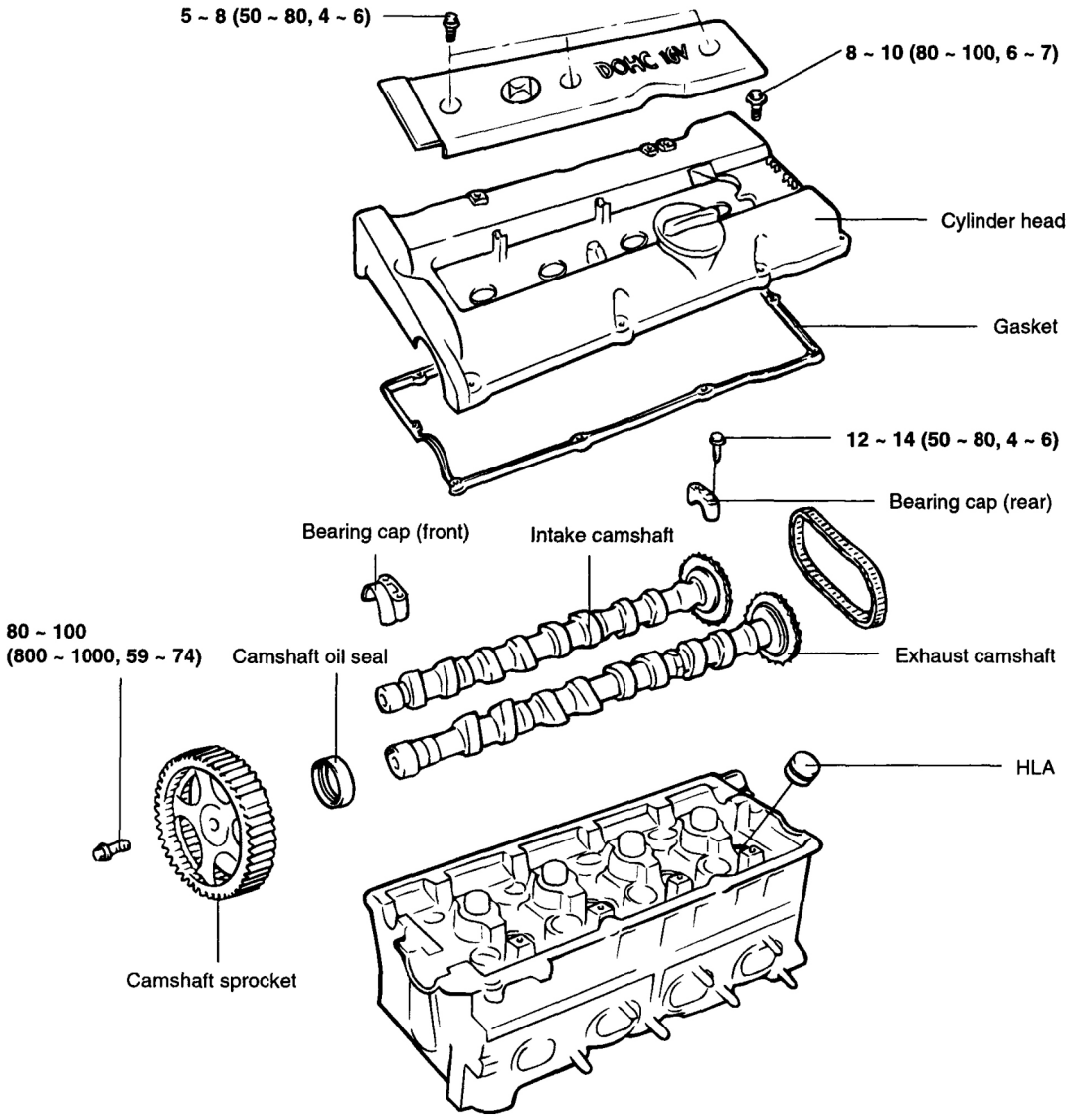
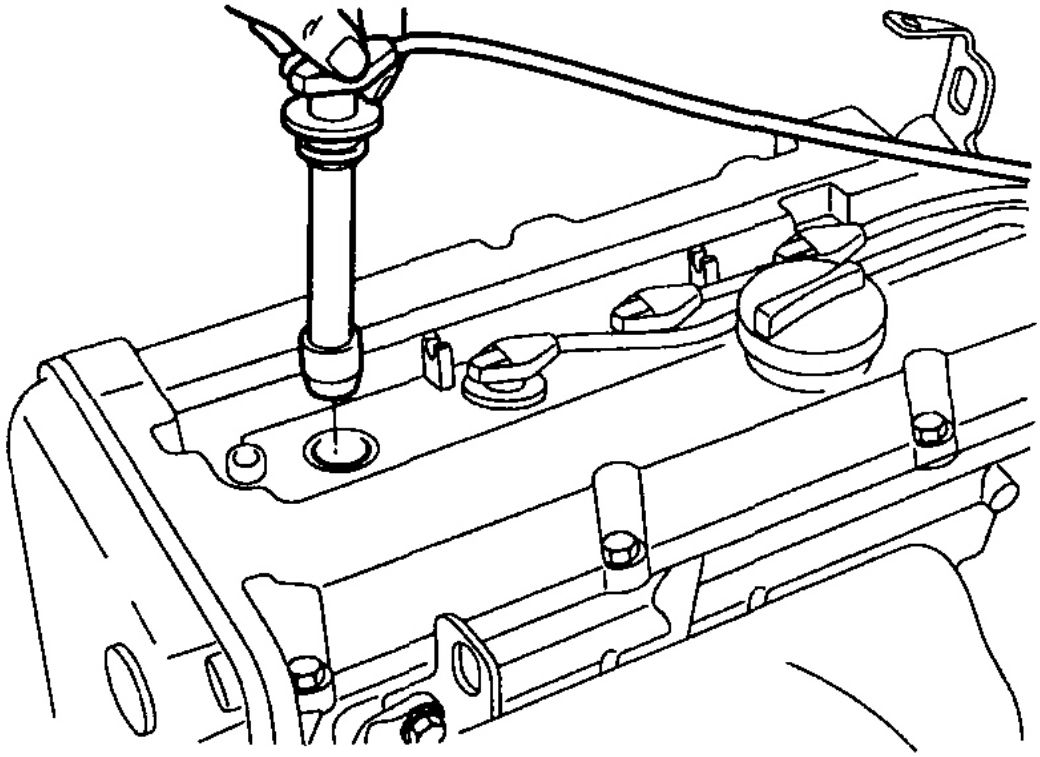


Fig. 94: Identifying Cam Shaft Components & Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

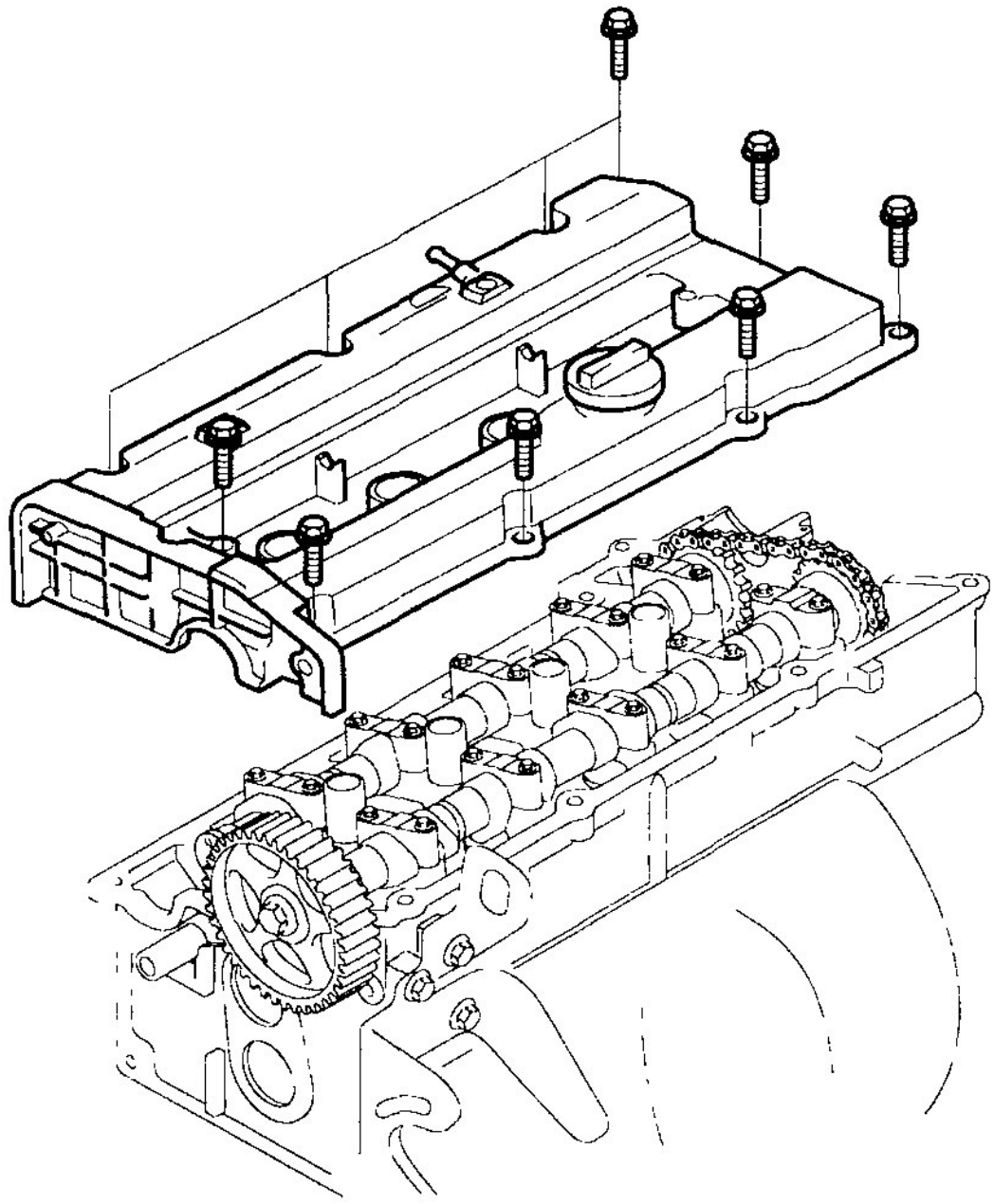
1. Disconnect the breather hose and the PCV hose.
2. Loosen the center cover bolts and then remove the center cover.
3. Remove the ignition coil assembly and the spark plug cables.



G03851138

Fig. 95: Removing Spark Plug Cables
Courtesy of HYUNDAI MOTOR CO.

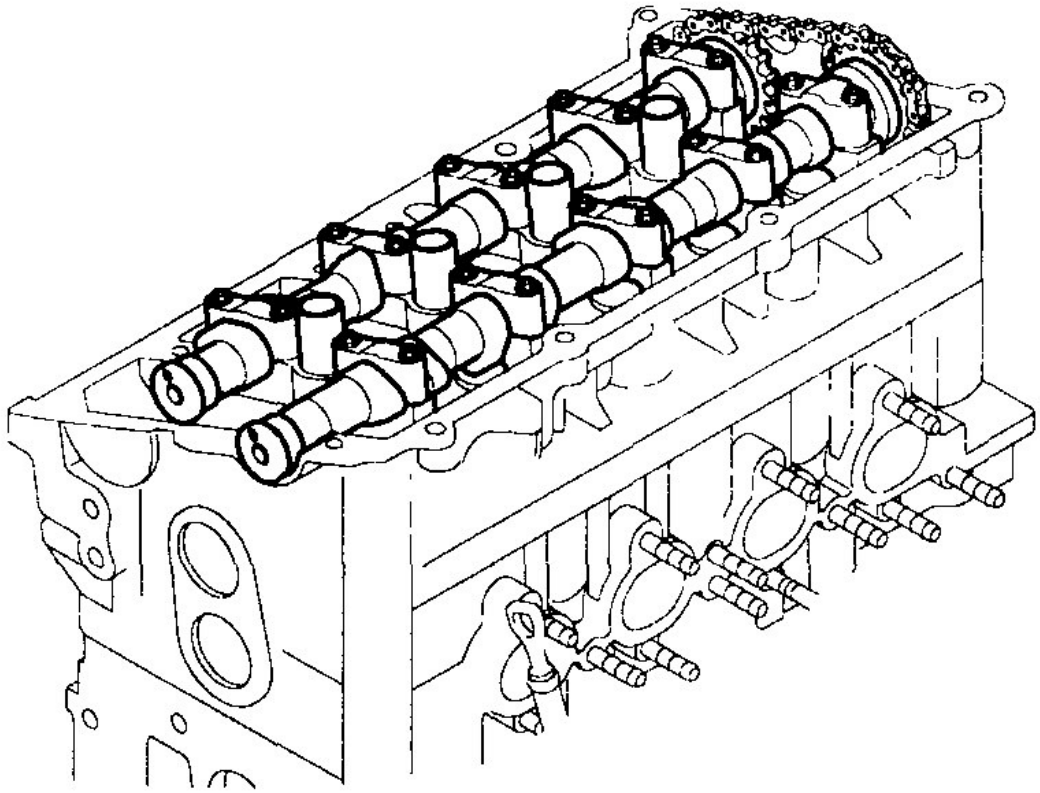
4. Loosen the cylinder head cover bolts and then remove the cylinder head cover.



G03851139

Fig. 96: Removing Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

5. Remove the camshaft sprocket.
6. Remove the camshaft bearing caps and timing chain.



G03851140

Fig. 97: Removing Camshaft Bearing Caps
Courtesy of HYUNDAI MOTOR CO.

7. Remove the camshaft.
8. Remove the HLA.

INSPECTION

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

Standard value

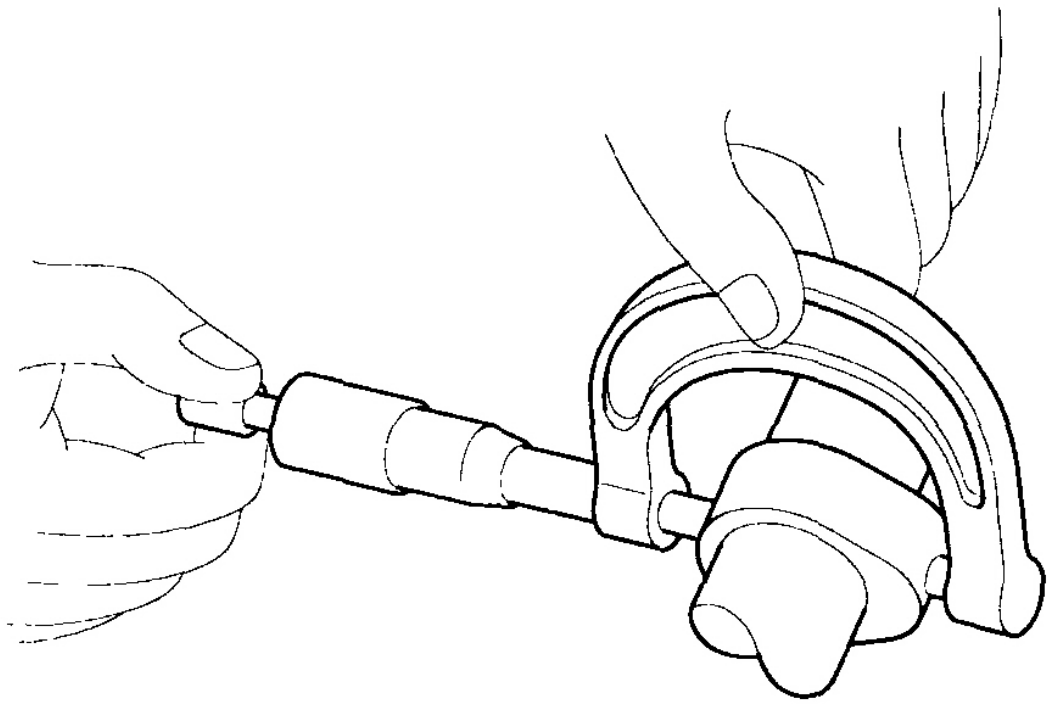
Intake: 43.4484 mm (1.7106 in.)

Exhaust: 43.8489 mm (1.7263 in.)

Limit

Intake: 42.9484 mm (1.6909 in.)

Exhaust: 43.3489 mm (1.7066 in.)



G03851141

Fig. 98: Checking Camshaft Journals
Courtesy of HYUNDAI MOTOR CO.

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

Camshaft end play: 0.1 - 0.2 mm (0.0039 - 0.0079 in.)

OIL SEAL

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

HLA (HYDRAULIC LASH ADJUSTER)

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

For other specific troubleshooting regarding HLA, refer to the **DIAGNOSIS PROCEDURE** below.

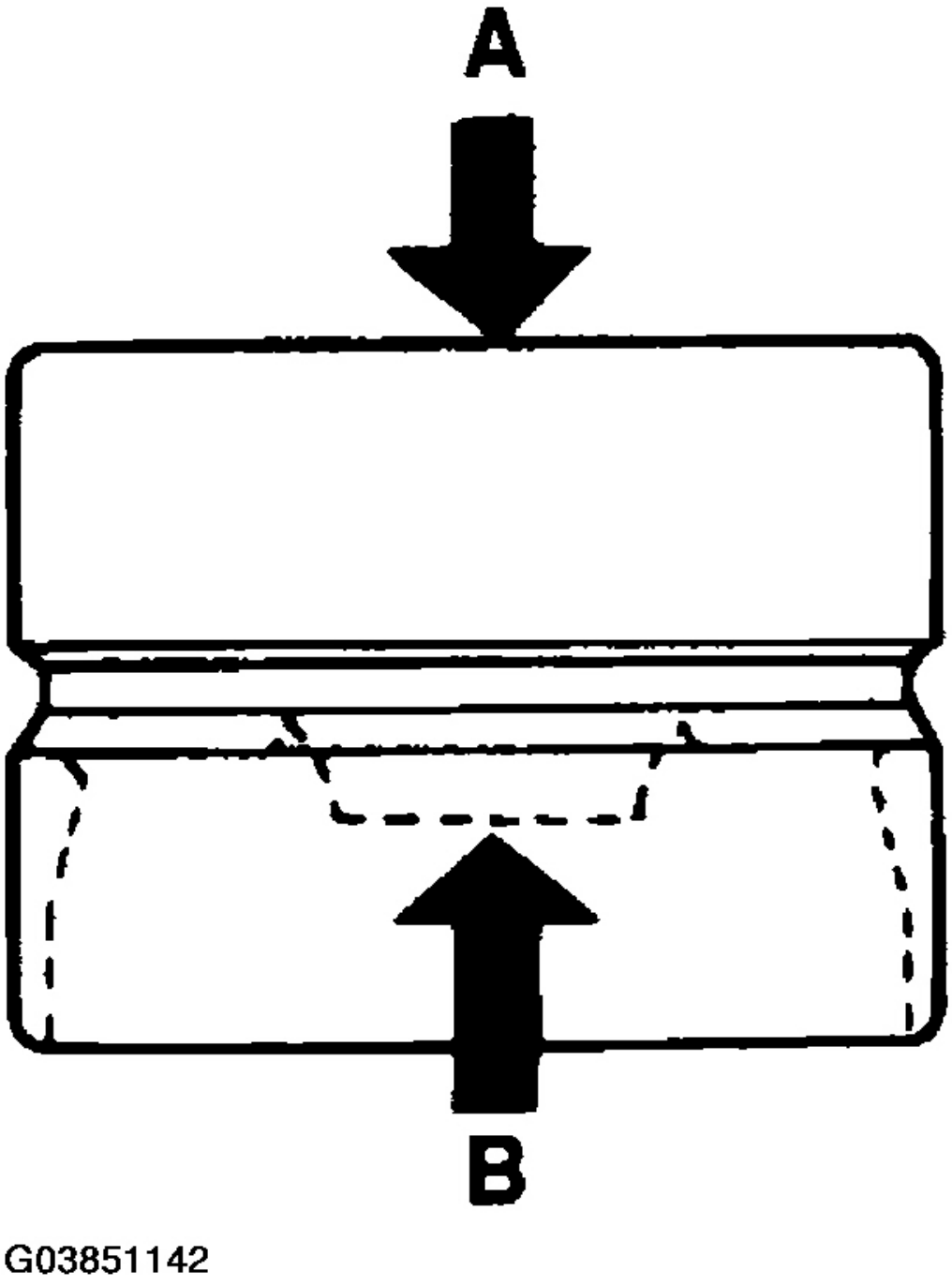


Fig. 99: Inspecting Hydraulic Lash Adjuster

Courtesy of HYUNDAI MOTOR CO.

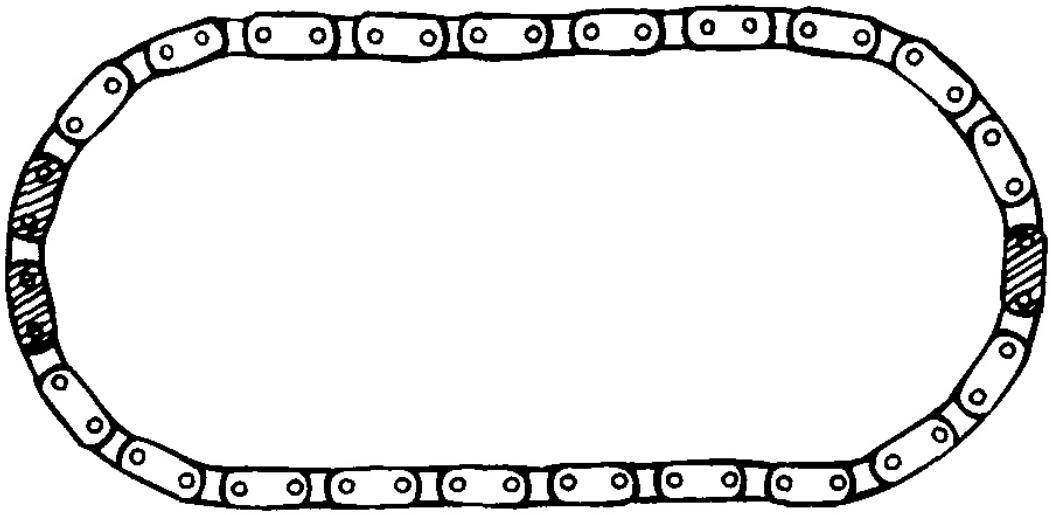
DIAGNOSIS PROCEDURE

Problem	Possible cause	Action
Temporary noise on starting a cold engine.	Normal	This noise will disappear after the oil in the engine has reached normal pressure.
Continuous noise when engine is running after sitting more than 48 hours.	Oil leakage of the high pressure chamber on 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 "Noise continuous for more than 15 minutes" at bottom of this table.
Continuous noise when engine is first started after rebuilding cylinder head.	Insufficient oil in cylinder head oil gallery.	
Continuous noise when engine is running after excessive cranking.	Oil drain out of the high-pressure chamber in HLA, allowing air to get in. Insufficient oil in HLA.	
Continuous noise when engine is running after changing HLA.		**CAUTION:** **Do not run engine at a speed higher than 3000 RPM as this may damage HLA.**
Continuous noise during idle after high speed running.	Engine oil level too high or too low.	Check oil level. Drain or add oil as necessary.
	Excessive amount of air in the oil at high engine speed.	Check oil supply system
	Deteriorated oil	Check oil quality.
Noise continuous 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 down on the HLA by hand. If it move, replace HLA. **CAUTION:** **Be careful of hot HLA.**

NOTE: HLA noise could occur to your engine due to malfunction of HLA if you use additives besides engine oil regulated to HMC.

TIMING CHAIN

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



G03851143

Fig. 100: Inspecting Bushing & Plate Of Timing Chain For Wear
Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

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

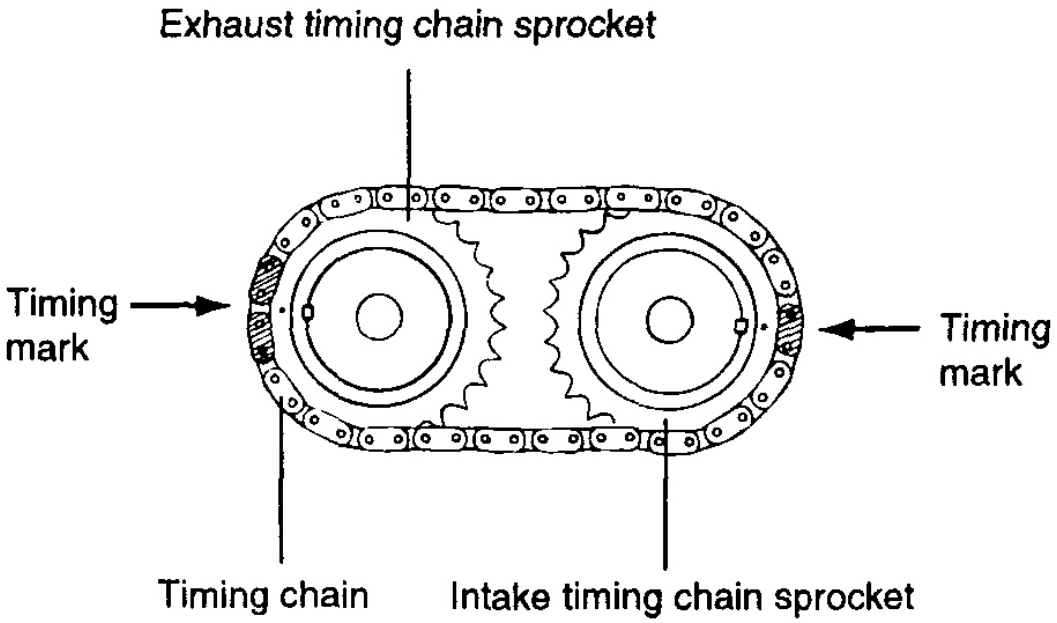
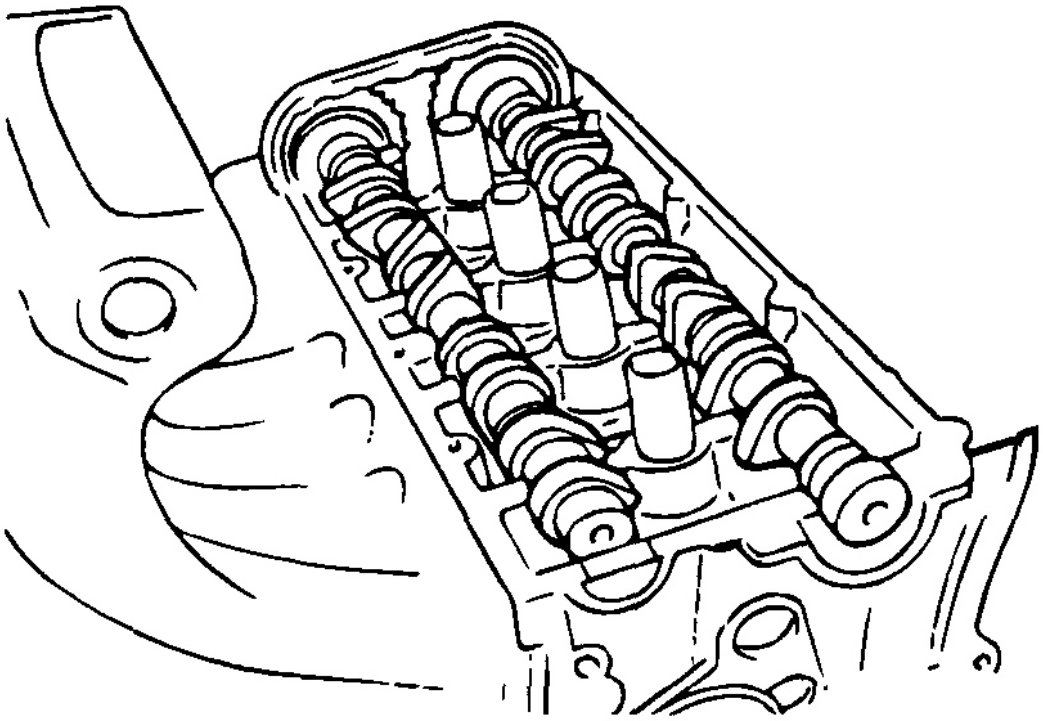


Fig. 101: Aligning Camshaft Timing Chain With Intake Timing Chain Sprocket & Exhaust Timing Chain Sprocket
Courtesy of HYUNDAI MOTOR CO.

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



G03851145

Fig. 102: Installing Camshaft
Courtesy of HYUNDAI MOTOR CO.

4. Install the bearing caps. The markings on the caps are for intake/exhaust identification.

   I: Intake camshaft

   E: Exhaust camshaft

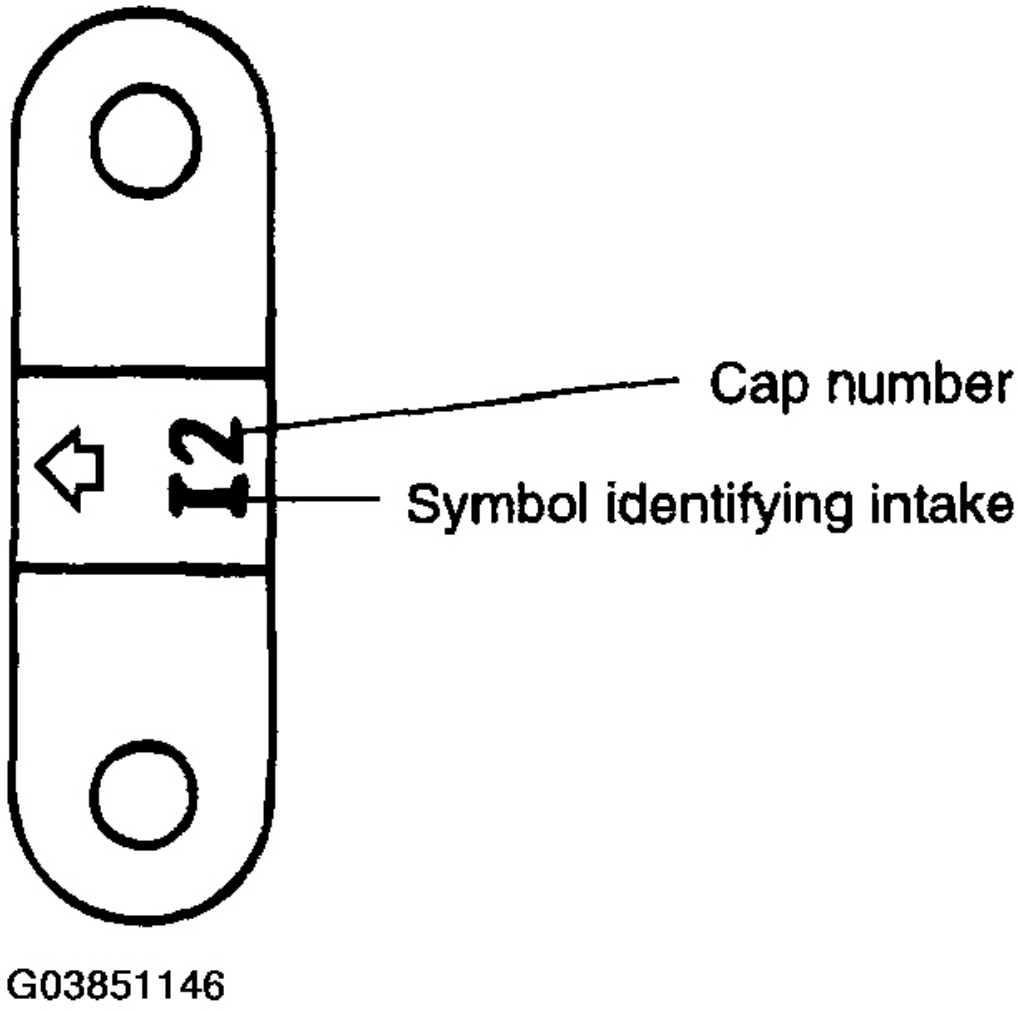


Fig. 103: Locating Identification Mark On Bearing Caps
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

Bearing cap bolt:

12 ~ 14 Nm (120 ~ 140 kg.cm, 9 ~ 10 lb.ft)

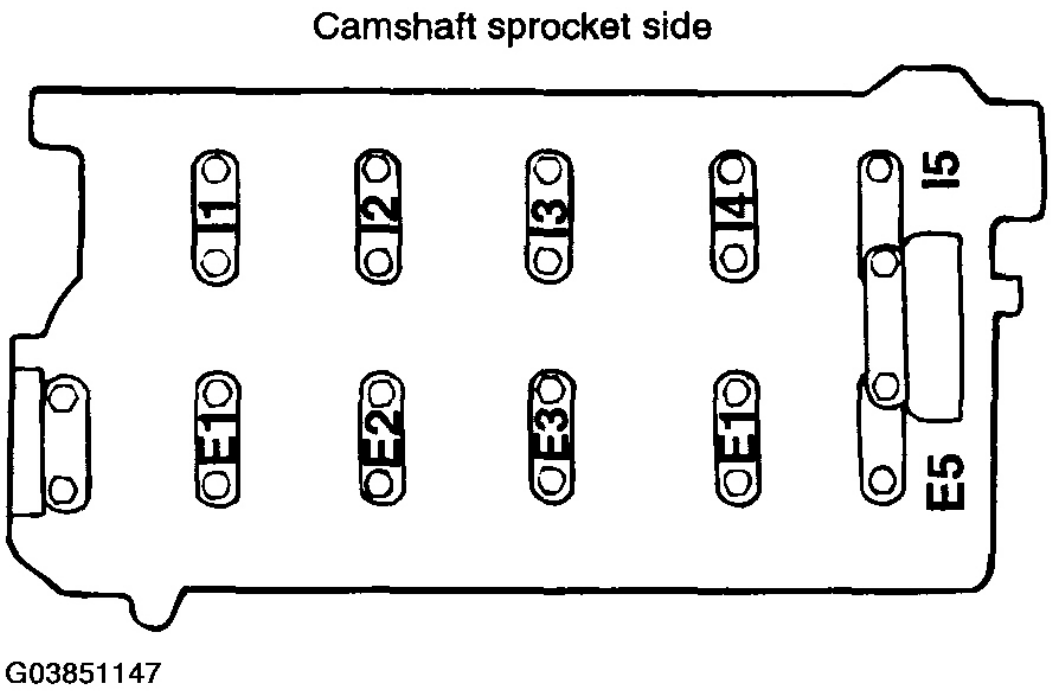


Fig. 104: Tightening Bearing Cap Bolt
Courtesy of HYUNDAI MOTOR CO.

6. Using the special tool, camshaft oil seal installer (09221 - 21000), press fit the camshaft oil seal. Be sure to apply engine oil to the oil seal lip. Insert the oil seal along the camshaft front end and install by driving the installer with a hammer until the oil seal is fully seated.

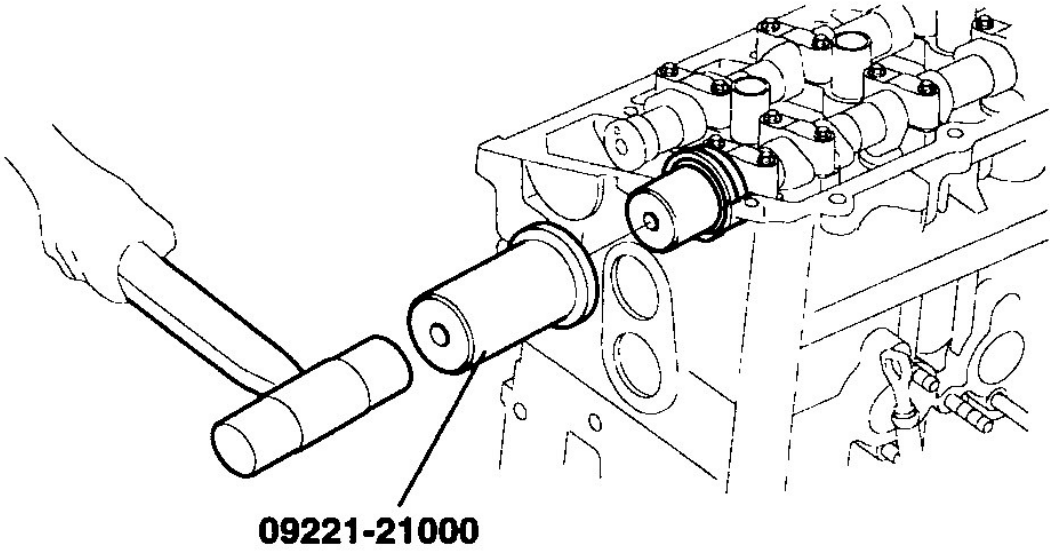


Fig. 105: Installing Camshaft Oil Seal
Courtesy of HYUNDAI MOTOR CO.

7. Install the camshaft sprocket bolts to the specified torque.

   Tightening torque

   Camshaft sprocket bolt:

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

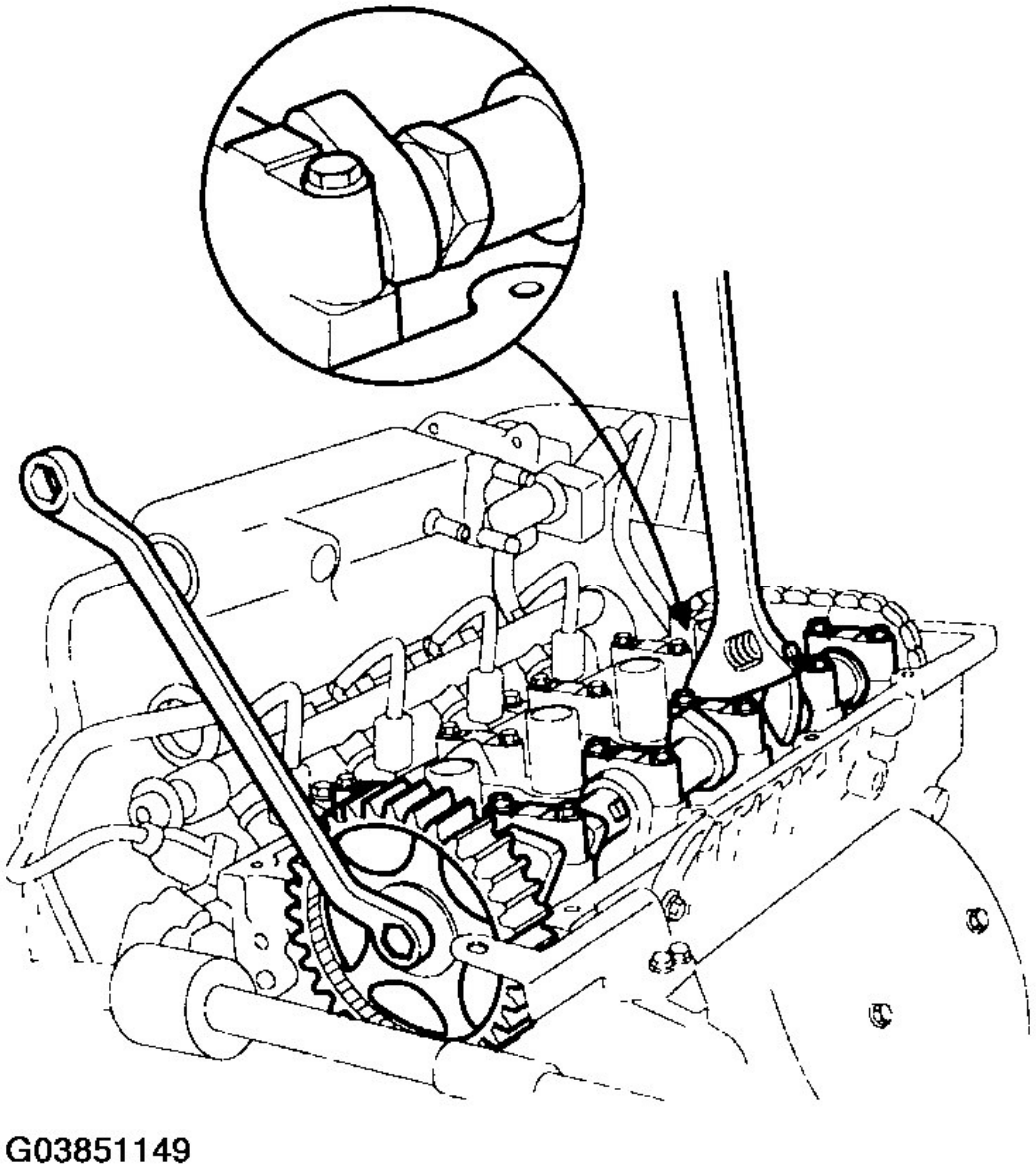


Fig. 106: Installing Camshaft Sprocket Bolts
Courtesy of HYUNDAI MOTOR CO.

8. Align the camshaft sprocket and crankshaft sprocket timing marks. Place the piston in the No.1 cylinder to top dead center on the compression stroke. (Refer to the **TIMING BELT**)
9. Install the cylinder head cover.

Tightening torque

Cylinder head cover bolts:

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

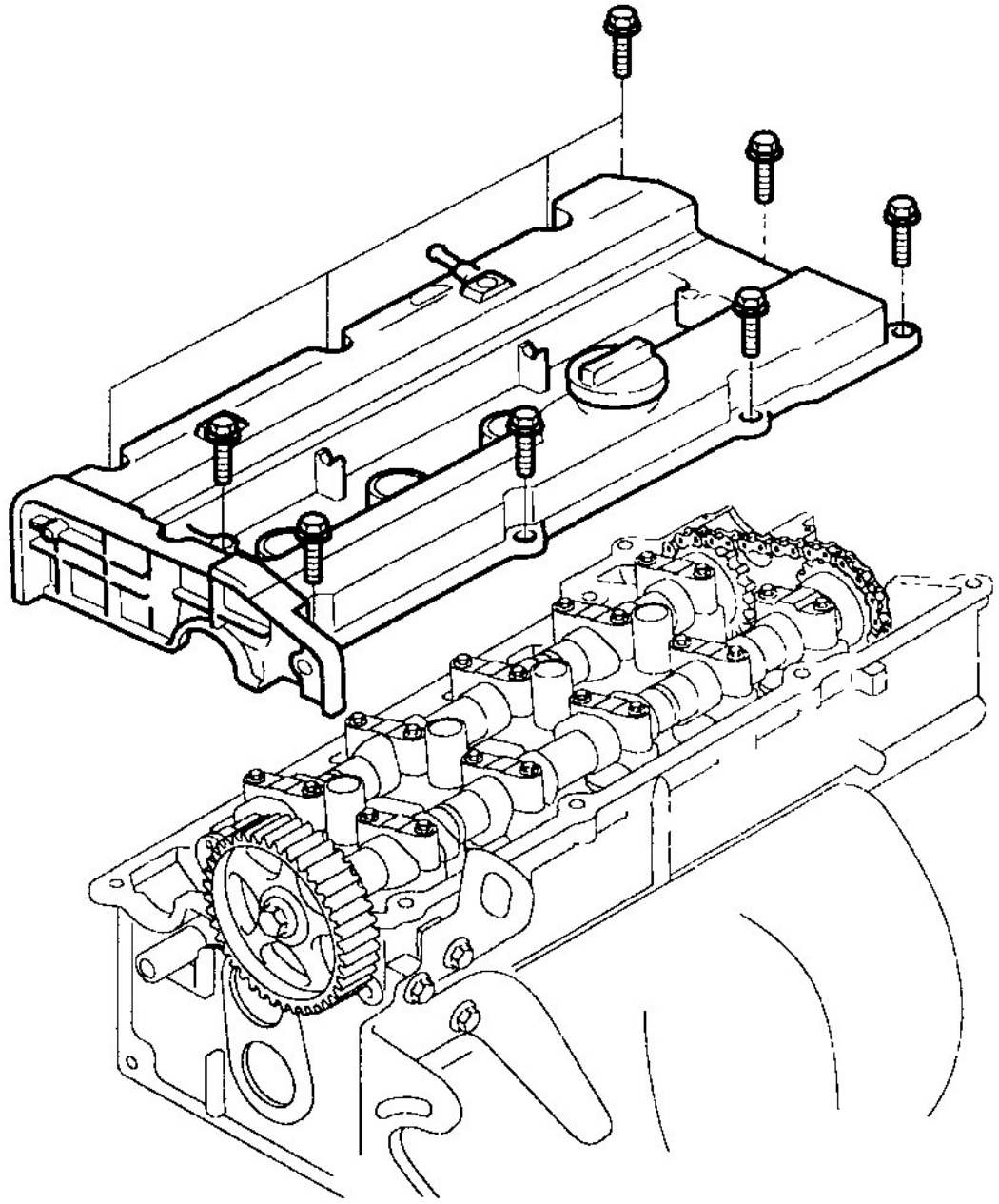


Fig. 107: Installing Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

Timing belt cover: 8 ~ 10 Nm (80 ~ 100 kg.cm, 6 ~ 7 lb.ft)

CRANK SHAFT

COMPONENTS

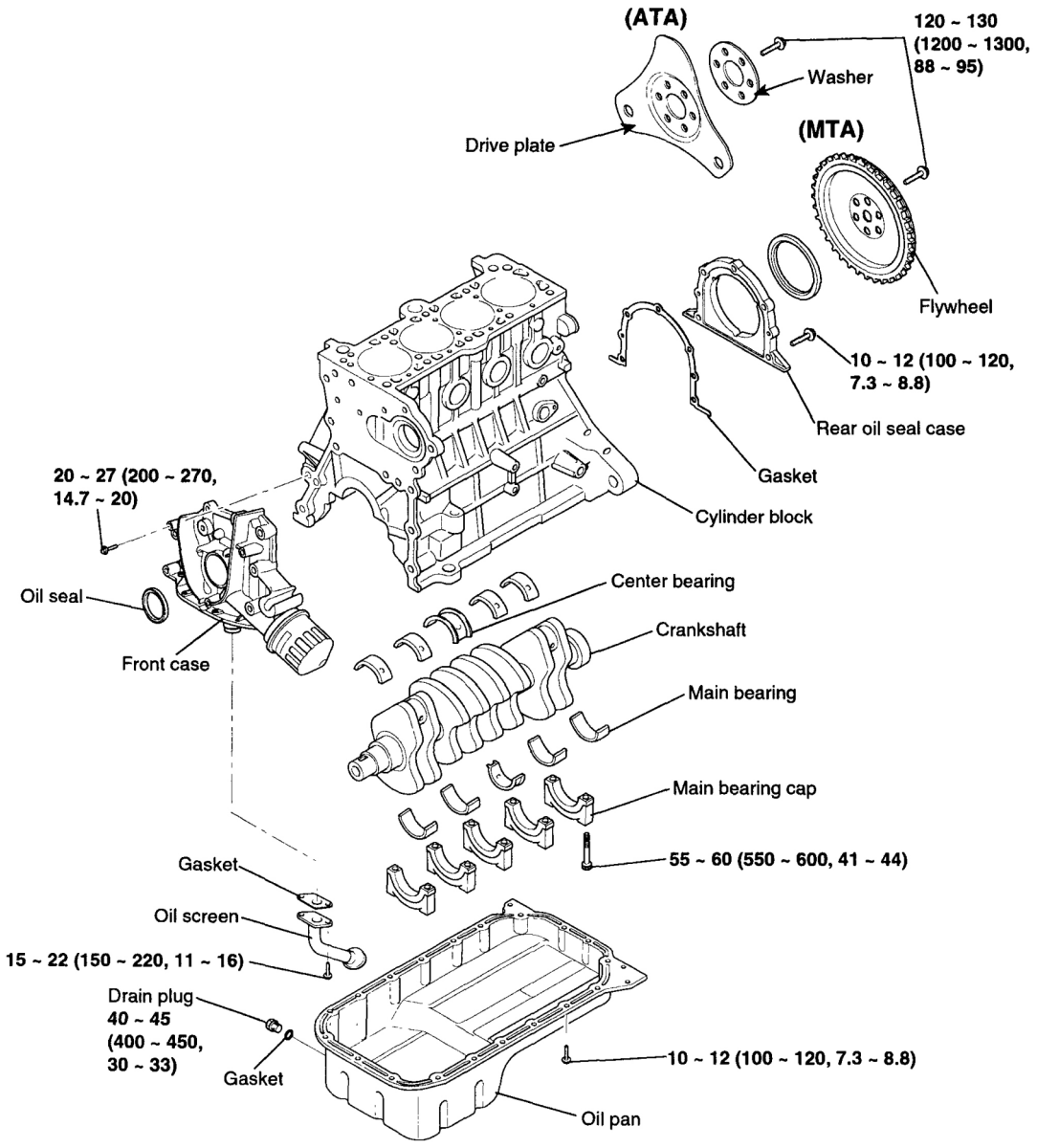


Fig. 108: Identifying Crank Shaft Components & Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

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

4. Remove the main bearing caps and remove the crankshaft.
5. Remove the crankshaft position sensor wheel.

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

INSPECTION

CRANKSHAFT

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

Standard value

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

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

Crankshaft journal, pin out-of-roundness and taper: 0.005 mm (0.0002 in.) or less

MAIN BEARINGS AND CONNECTING ROD BEARINGS

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

OIL CLEARANCE MEASUREMENT

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

Connecting rod bearing oil clearance:

0.018 ~ 0.036 mm (0.0007 ~ 0.0014 in.)

Crankshaft main bearing oil clearance

NO. 1, 2, 4, 5: 0.022 ~ 0.040 mm (0.0009 ~ 0.0018 in.)

NO.3: 0.028 ~ 0.046 mm (0.0011 ~ 0.0018 in.)

OIL SEAL

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

CRANKSHAFT SENSOR WHEEL

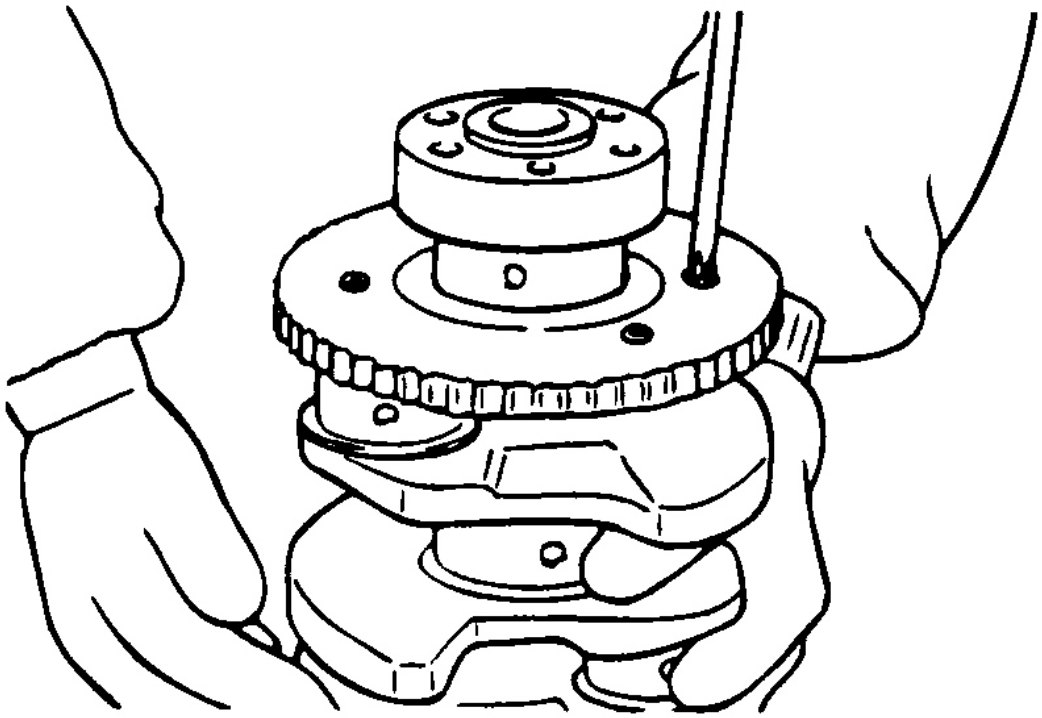
1. Remove the sensor wheel.
2. Check the sensor wheel for damage, cracks and wear, and replace if necessary.
3. Check the clearance between the sensor wheel and the crank position sensor with a depth gage.

   Standard value

   Clearance between sensor wheel and crank

   Position sensor:

   0.5 ~ 1.1 mm (0.020 ~ 0.043 in.)



G03851152

Fig. 109: Checking Clearance Between Sensor Wheel & Crank Position Sensor
Courtesy of HYUNDAI MOTOR CO.

NOTE:

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

REPLACEMENT

1. Check the cylinder block crankshaft bore size code.

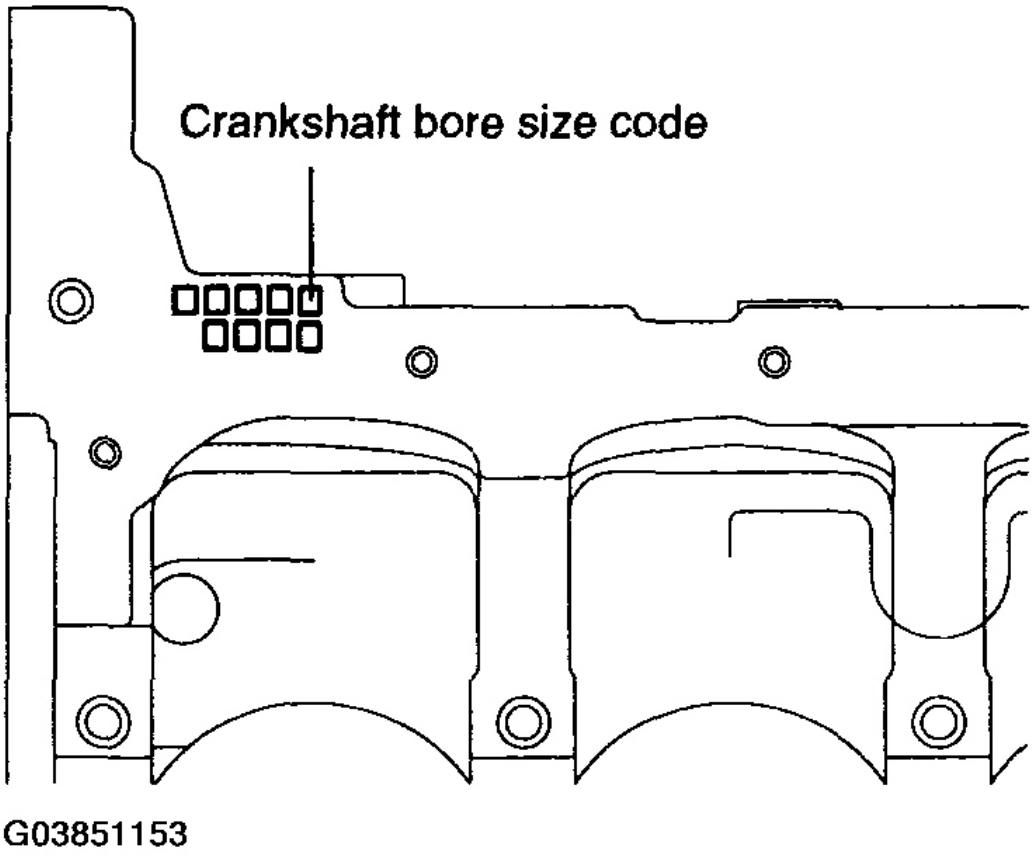


Fig. 110: Identifying Cylinder Block Crankshaft Bore Size Code
Courtesy of HYUNDAI MOTOR CO.

NOTE: **Record the cylinder block crankshaft bore size code letters on cylinder block as shown.**
Reading order is from left to right with front crankshaft bore size code shown first.

CRANKSHAFT BORE DIAMETER CHART

Class	Crankshaft bore diameter	Size code
a	54~54.006 mm (2.1259~2.1262 in.)	A
b	54.006~54.012 mm (2.1262~2.1264 in.)	B
c	54.012~54.016 mm (2.1264~2.1266 in.)	C

2. Check the crankshaft main journal size code.

NOTE: Record the main journal size code letters on the crankshaft balance weight.
Reading order is from left to right as shown, with No. 1 main journal size code shown first.

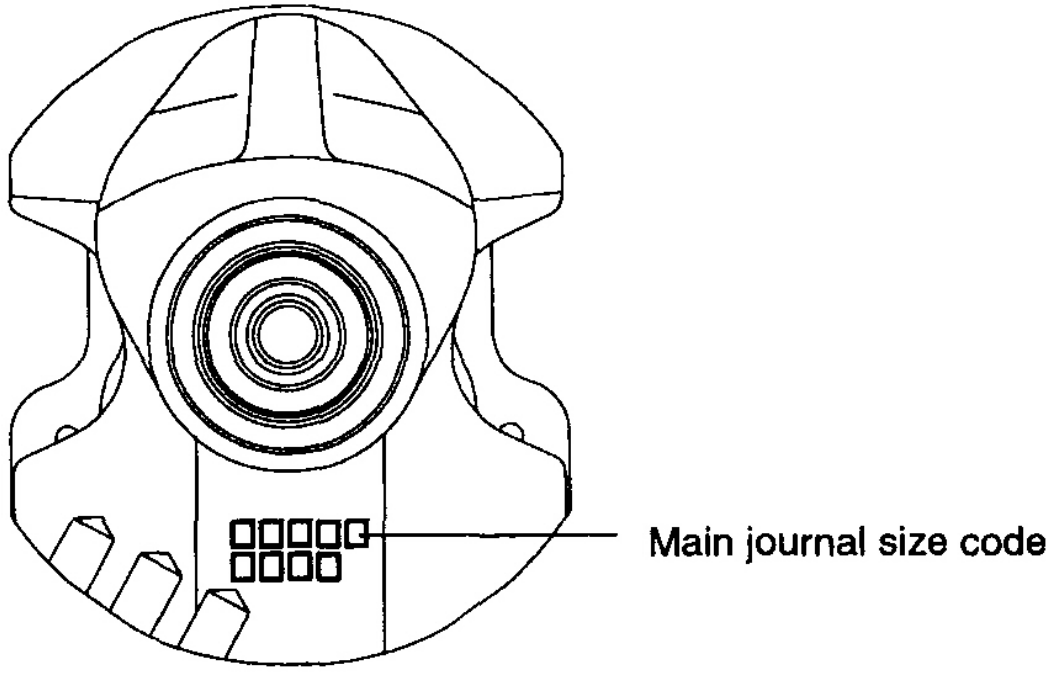


Fig. 111: Identifying Crankshaft Main Journal Size Code
Courtesy of HYUNDAI MOTOR CO.

CRANKSHAFT MAIN JOURNAL DIAMETER

CRANKSHAFT MAIN JOURNAL DIAMETER

Class	Main journal diameter	Size code
I	49.968 ~ 49.962 mm (1.9672 ~ 1.9670 in.)	A
II	49.962 ~ 49.956 mm (1.9670 ~ 1.9667 in.)	b
III	49.956 ~ 49.950 mm (1.9667 ~ 1.9665 in.)	c

MAIN JOURNAL BEARING THICKNESS

No. 1, 2, 4, 5 (MAIN BEARING)

MAIN JOURNAL BEARING THICKNESS (NO. 1, 2, 4, 5 MAIN BEARING)

Color	Main journal bearing thickness
Yellow	2.002 ~ 2.005 mm (0.0788 ~ 0.0789 in.)
Green	2.005 ~ 2.008 mm (0.0789 ~ 0.0790 in.)
No color	2.008 ~ 2.011 mm (0.0790 ~ 0.0791 in.)
Black	2.011 ~ 2.014 mm (0.0791 ~ 0.0793 in.)
Blue	2.014 ~ 2.017 mm (0.0793 ~ 0.0794 in.)

No.3 (CENTER BEARING)

MAIN JOURNAL BEARING THICKNESS (NO. 3 CENTER BEARING)

Color	Main journal bearing thickness
Yellow	1.999 ~ 2.002 mm (0.0787 ~ 0.0788 in.)
Green	2.002 ~ 2.005 mm (0.0788 ~ 0.0789 in.)
No color	2.005 ~ 2.008 mm (0.0788 ~ 0.0790 in.)
Black	2.008 ~ 2.011 mm (0.0790 ~ 0.0791 in.)
Blue	2.011 ~ 2.014 mm (0.0791 ~ 0.0793 in.)

3. Choose proper main journal bearing in table. Refer to **MAIN JOURNAL BEARING THICKNESS (NO. 1, 2, 4, 5 MAIN BEARING)** table or **MAIN JOURNAL BEARING THICKNESS (NO. 3**

CENTER BEARING) table.

REASSEMBLY

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

   When reusing the main bearings, remember to install them by referring to the location marks made at the time of disassembly.

2. Install the crankshaft. Apply engine oil to the journals.
3. Install bearing caps and tighten cap bolts to the specified torque in the following sequence; center, No.2, No.4, front, and rear caps.

   Cap bolts should be tightened evenly in 2 to 3 stages before they are tightened to the specified torque. The caps should be installed with the arrow mark directed toward the crank pulley side of engine. Cap numbers must be correct.

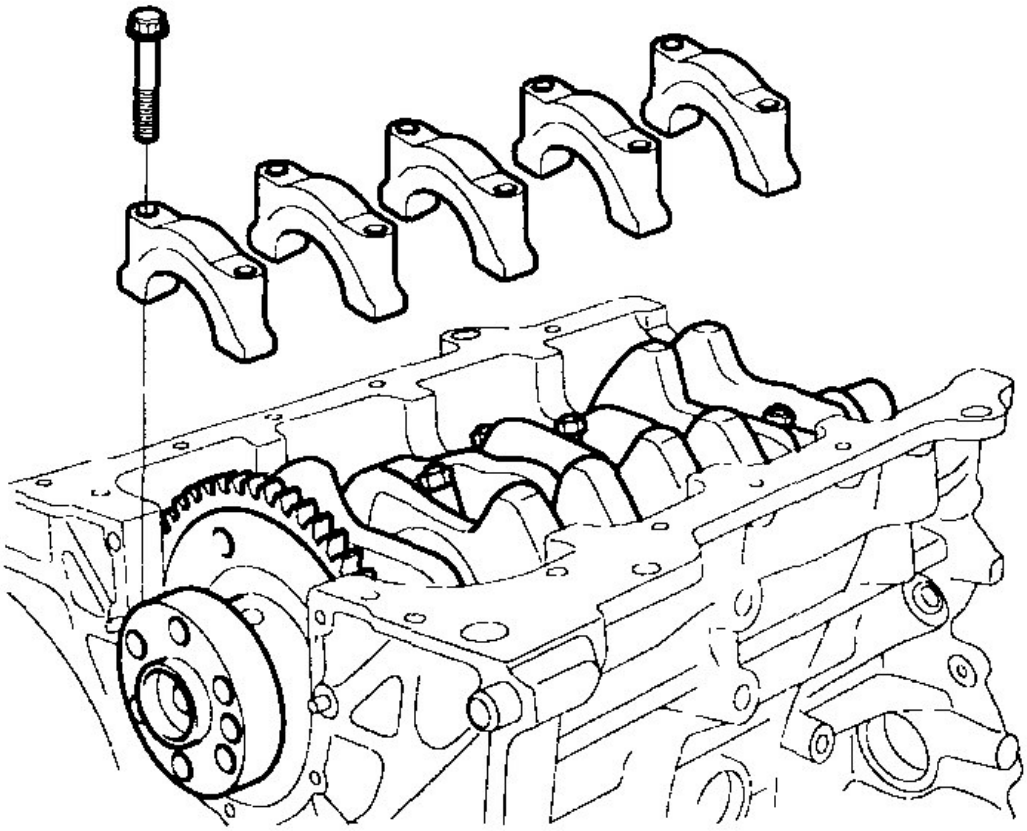
   Tightening torque

   Main bearing cap bolt:

   55 ~ 60 Nm (550 ~ 600 kg.cm, 41 ~ 44 lb.ft)

   Connecting rod cap bolt:

   32 ~ 35 Nm (320 ~ 350 kg.cm, 24 ~ 26 lb.ft)



G03851155

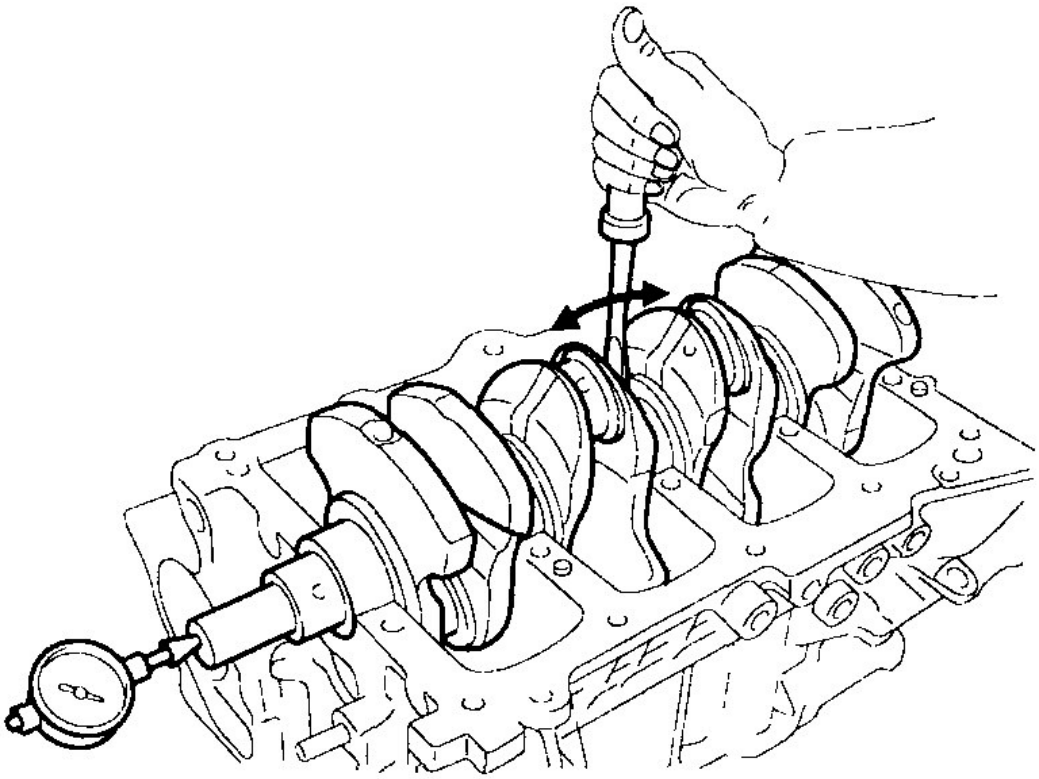
Fig. 112: Installing Bearing Caps Bolt
Courtesy of HYUNDAI MOTOR CO.

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

   Standard value

   Crankshaft end play:

   0.05 ~ 0.175 mm (0.0019 ~ 0.0068 in.)



G03851156

Fig. 113: Checking Crankshaft End Play
Courtesy of HYUNDAI MOTOR CO.

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

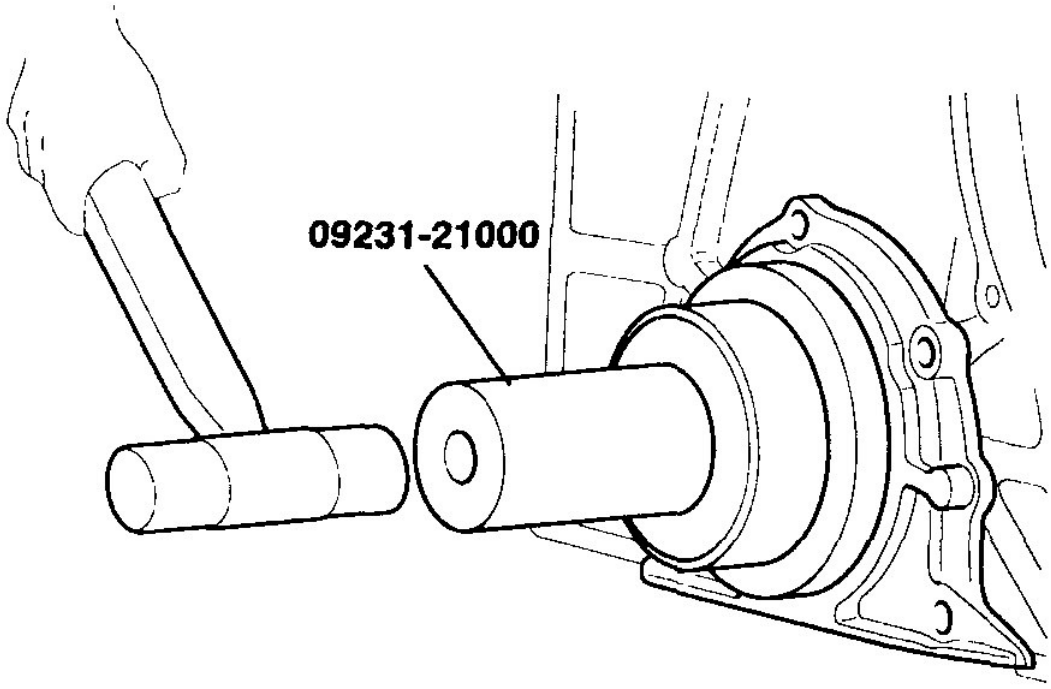
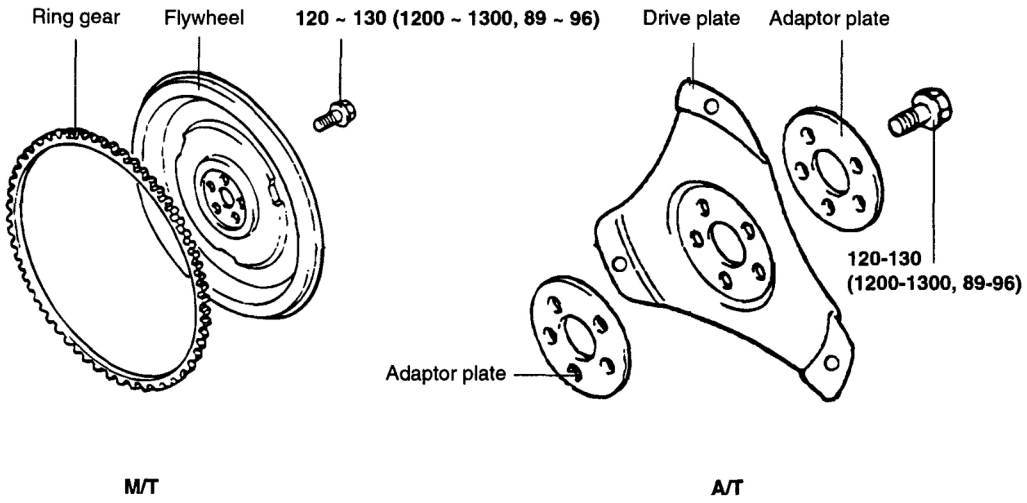


Fig. 114: Installing Crankshaft Rear Oil Seal Using Special Tool
Courtesy of HYUNDAI MOTOR CO.

6. Install the rear plate and tighten the bolts.
7. Install the connecting rod caps.
8. Install the flywheel, front case, oil pan and timing belt. For further details, refer to the respective chapters.

FLYWHEEL

COMPONENTS



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

M/T : Manual Transmission Vehicles
A/T : Automatic Transmission Vehicles
G03851158

Fig. 115: Identifying Flywheel Components Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

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

INSPECTION

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

   Standard value

   Flywheel run - out: 0.1 mm (0.0039 in.)

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

REASSEMBLY

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

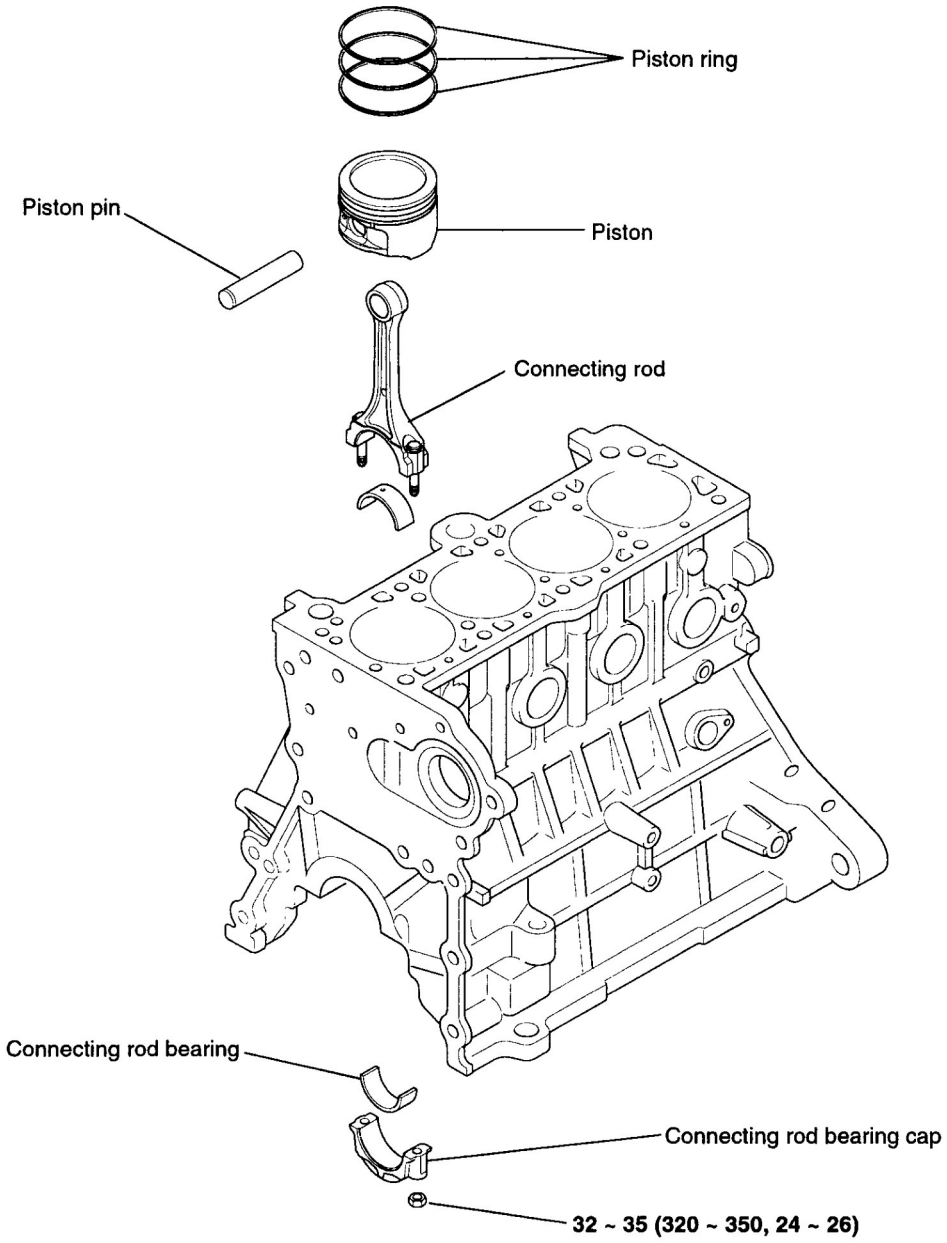
Tightening torque

Flywheel bolt:

120 ~ 130 Nm (1200 ~ 1300 kg.cm, 89 ~ 96 lb.ft)

PISTON

COMPONENTS



TORQUE : Nm (kgf.cm, lbf.ft)

G03851159

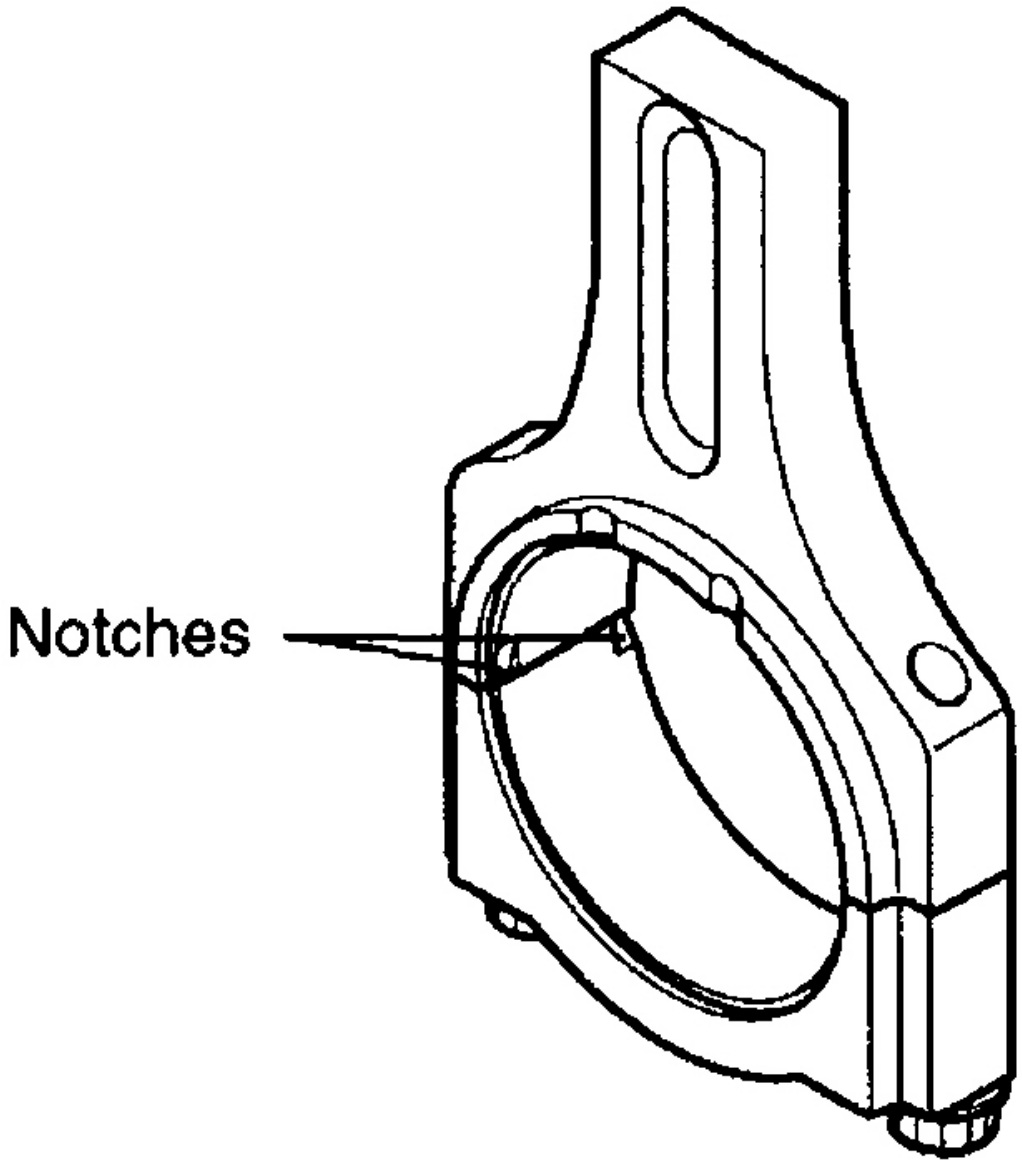
Fig. 116: Identifying Piston Components & Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

CONNECTING ROD CAP

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

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



G03851160

Fig. 117: Identifying Piston Connecting Rod Notches
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY AND REASSEMBLY OF THE PISTON PIN

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

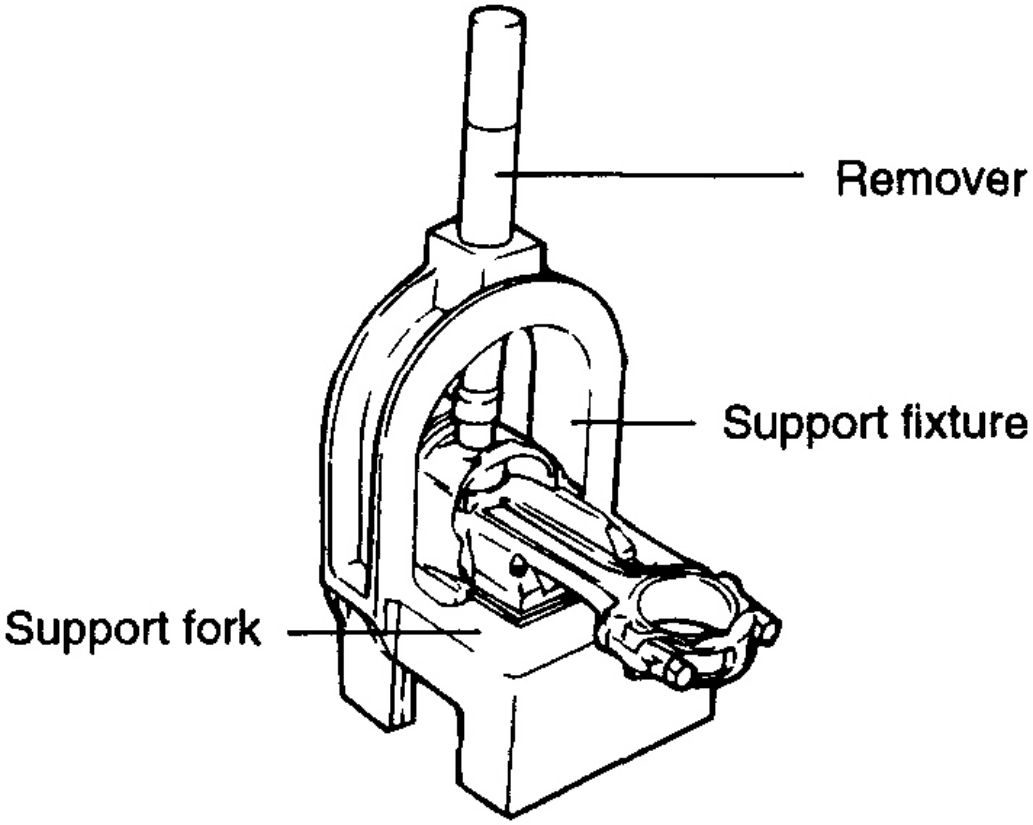


Fig. 118: Removing Pin From Piston Using Remove Tool & Support Fixture
Courtesy of HYUNDAI MOTOR CO.

5. To install a new pin, the proper fork inserts must be in place to support the rod.
6. Position the rod inside the piston. Insert the proper pin guide through one side of the piston and through the rod.

   Hand tap the pin guide so it is held by the piston. Insert the new pin into the piston from the other side and set the assembly into the support fixture with the pin guide facing down.

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

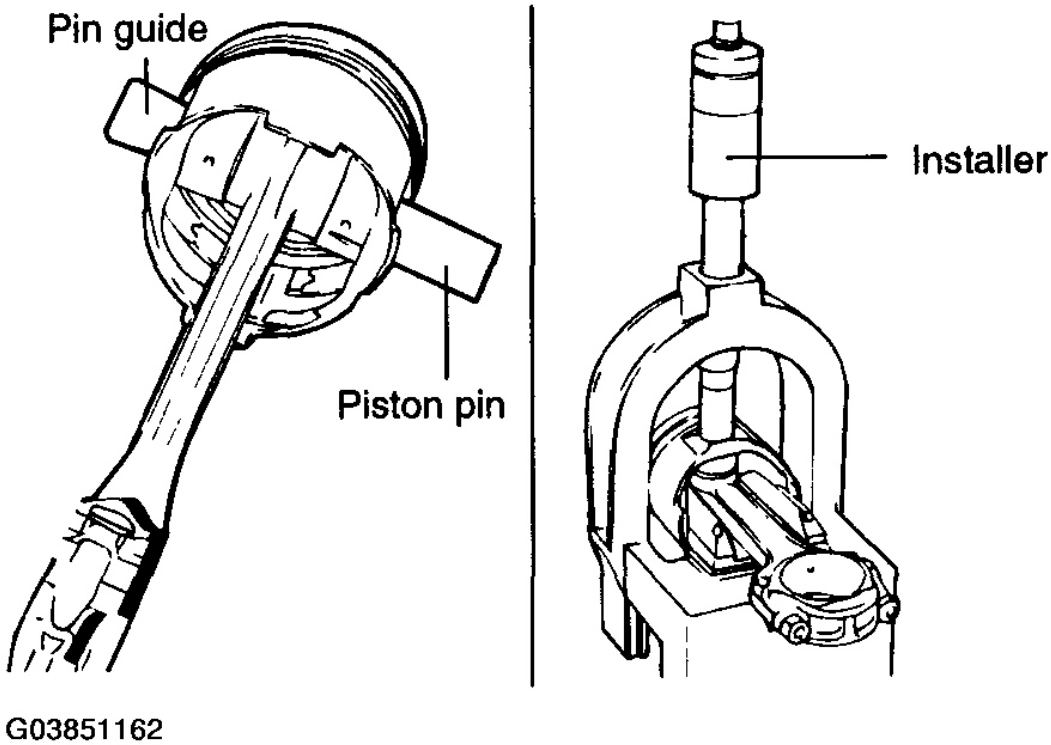


Fig. 119: Installing Pin Guide On The Connecting Rod Through The Piston
Courtesy of HYUNDAI MOTOR CO.

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

CAUTION: Do not exceed 1250 +/- 500 kg (2765 +/- 1102 lb) of force when the

installing tool seats against the top of the arch.

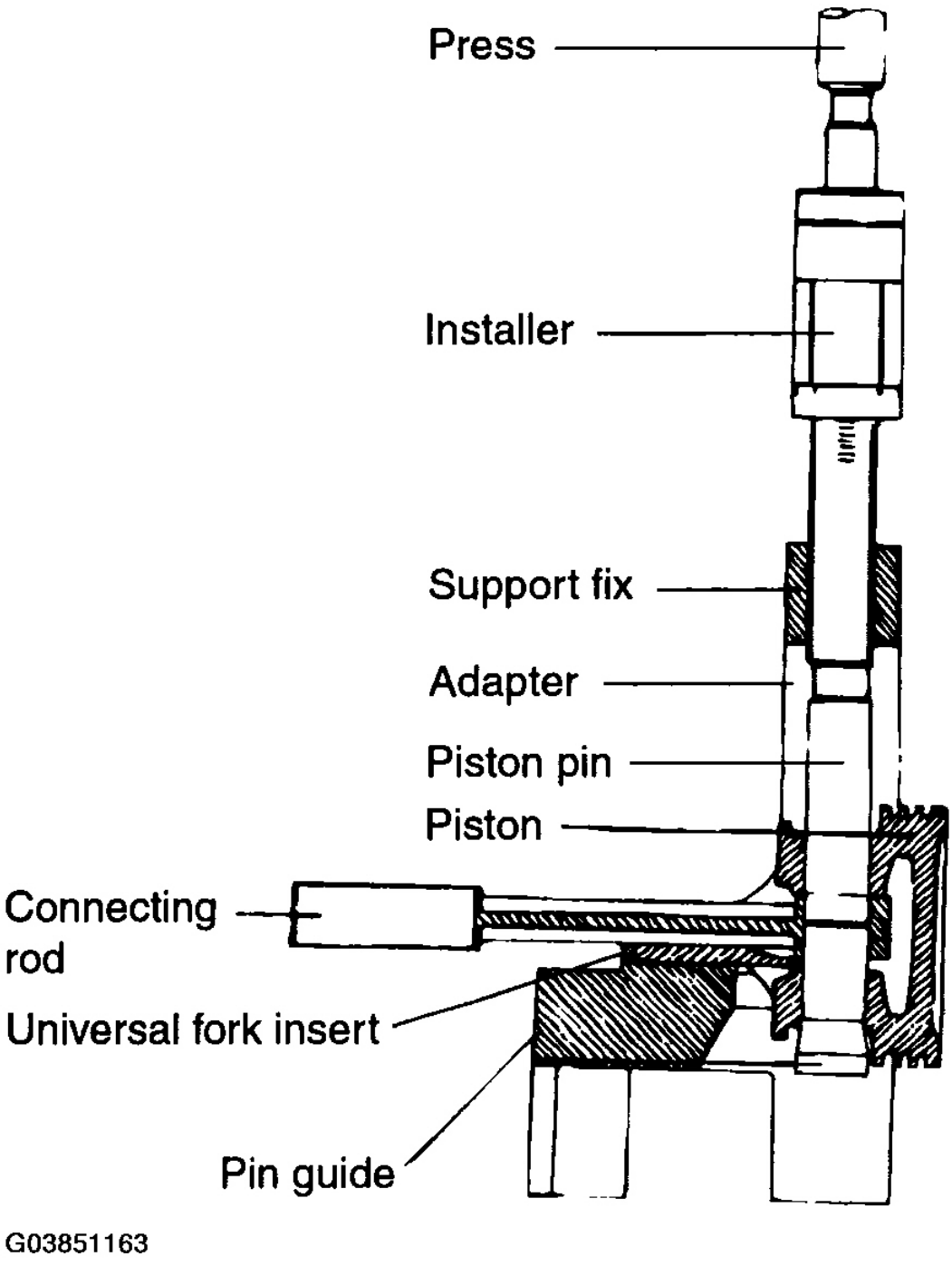


Fig. 120: Inserting Installer Tool Through Hole In Arch Of Support Fixture & Using Hydraulic Press To Force Piston Pin Through The Rod Little End

Courtesy of HYUNDAI MOTOR CO.

INSPECTION

PISTONS AND PISTON PINS

1. Check each piston for scuffing, scoring, wear and other defects. Replace any piston that is defective.
2. Check each piston ring for breakage, damage and abnormal wear. Replace the defective rings.

   When the piston requires replacement, its rings should also be replaced.

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

PISTON RINGS

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

   Piston ring side clearance

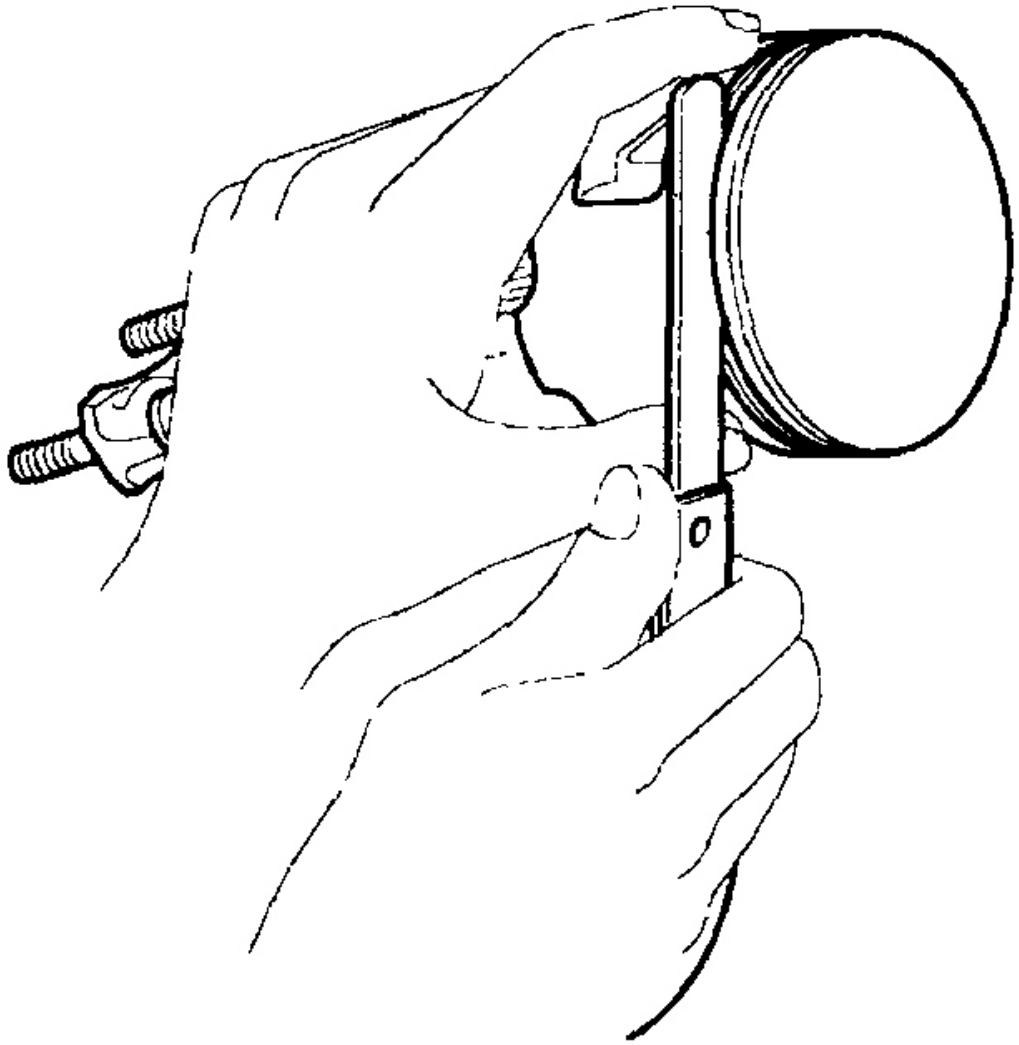
   No.1: 0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)

   No. 2: 0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)

   Limit

   No. 1: 0.1 mm (0.004 in.)

   No. 2: 0.1 mm (0.004 in.)



G03851164

Fig. 121: Measuring Piston Ring Side Clearance
Courtesy of HYUNDAI MOTOR CO.

2. To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles in 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: 0.15 ~ 0.30 mm (0.0059 ~ 0.012 in.)

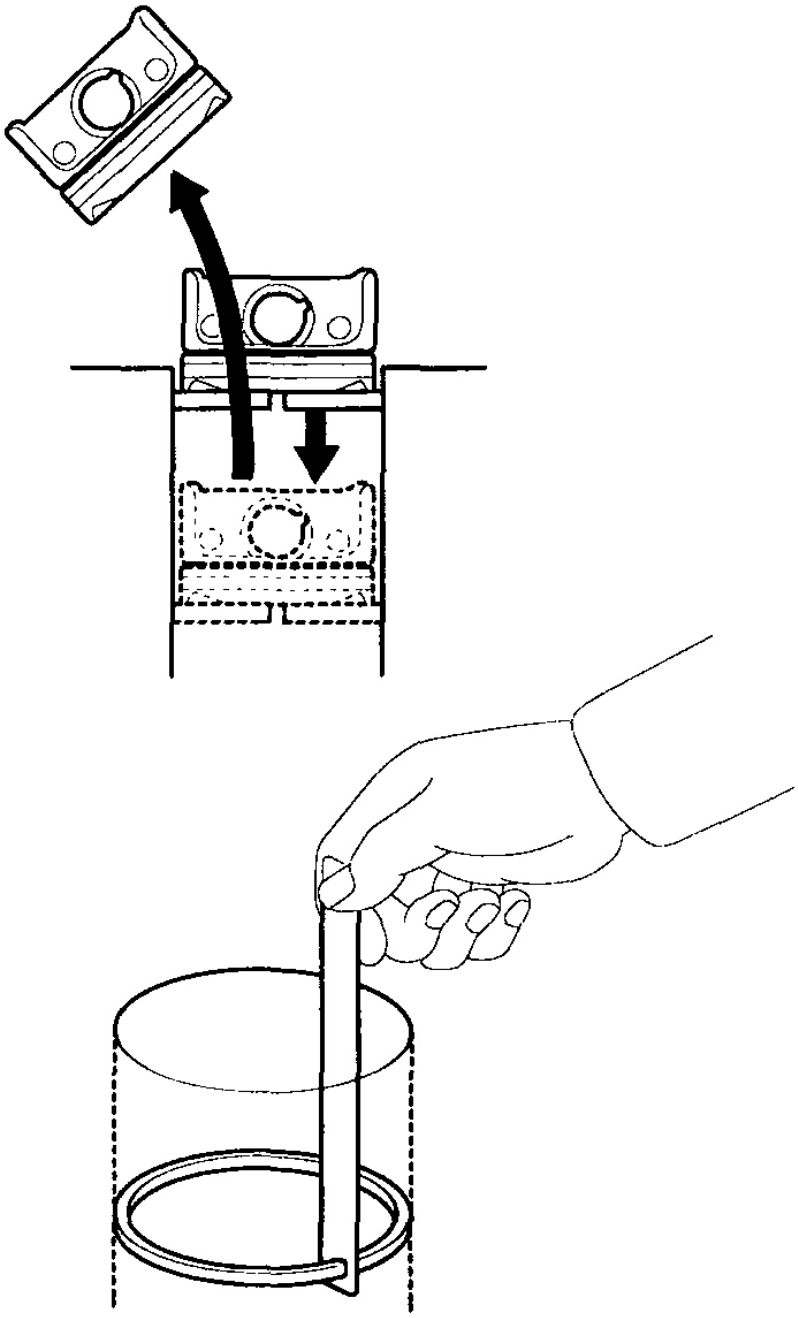
No. 2: 0.30 ~ 0.45 mm (0.012 ~ 0.018 in.)

Oil ring side rail: 0.2 ~ 0.7 mm (0.0079 ~ 0.0276 in.)

[Limit]

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

Oil ring side rail: 1.0 mm (0.0.39 in.)



G03851165

Fig. 122: Measuring Piston Ring End Gap
Courtesy of HYUNDAI MOTOR CO.

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

PISTON RING SERVICE SIZE AND MARK

PISTON RING SERVICE SIZE AND MARK

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

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

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 in, or if the surface of the inside diameter of the small end is severely rough, replace the rod.

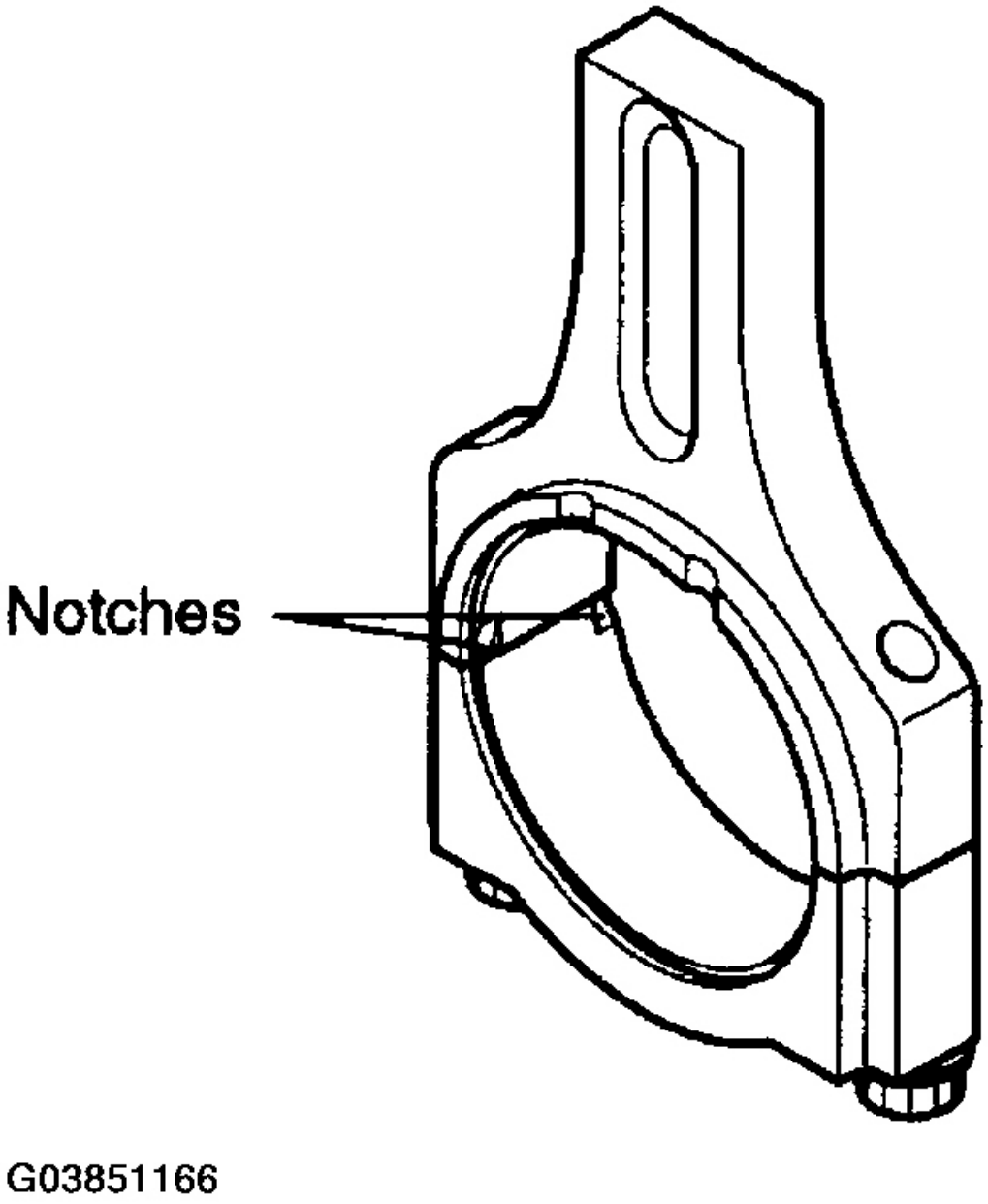


Fig. 123: Identifying Connecting Rods Notches
Courtesy of HYUNDAI MOTOR CO.

REPLACEMENT

1. Check the cylinder bore size code on the cylinder block bottom face.

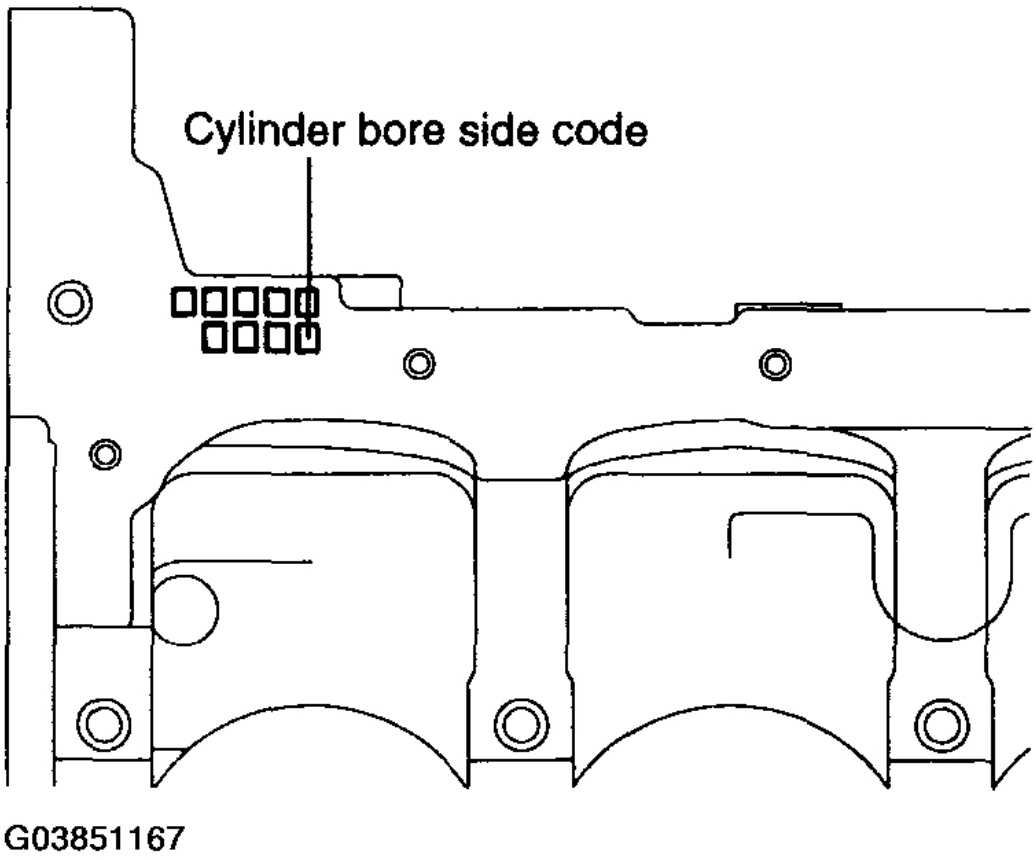


Fig. 124: Checking Cylinder Bore Size Code On The Cylinder Block Bottom Face
Courtesy of HYUNDAI MOTOR CO.

CYLINDER BORE CHART (1.6L)

Class	Cylinder bore inner diameter	Size code
A	76.5~76.51 mm (3.0118~3.0121 in.)	A
B	76.51~76.52mm (3.0121~3.0126in.)	B
C	76.52~76.53mm (3.0126~3.0129in.)	C

2. Check the piston size code on the piston top face.

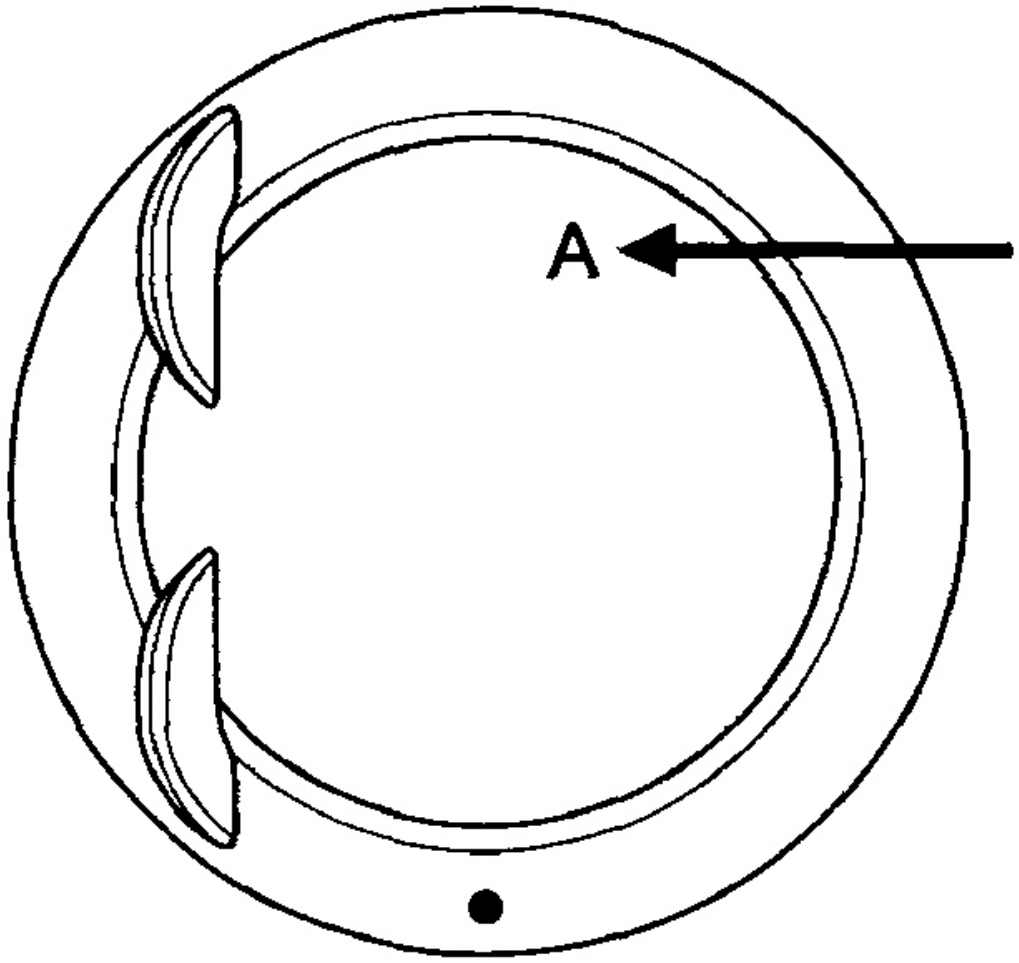


Fig. 125: Checking Piston Size Code On Piston Top Face
Courtesy of HYUNDAI MOTOR CO.

NOTE: Stamp the grade mark of basic diameter with rubber stamp.

PISTON OUTER DIAMETER (1.6L)

Class	Piston outer diameter	Size code
A	76.465~76.475mm (3.0104~3.0108in.)	A
B	76.475~76.485mm	B

	(3.0108~3.0112in.)	
C	76.485~76.495mm (3.0112~3.0116in.)	C

3. Select the piston related to cylinder bore class.

Oil clearance

0.025 ~ 0.045mm (0.00098 ~ 0.00177in.)

REASSEMBLY

1. Install the spacer.

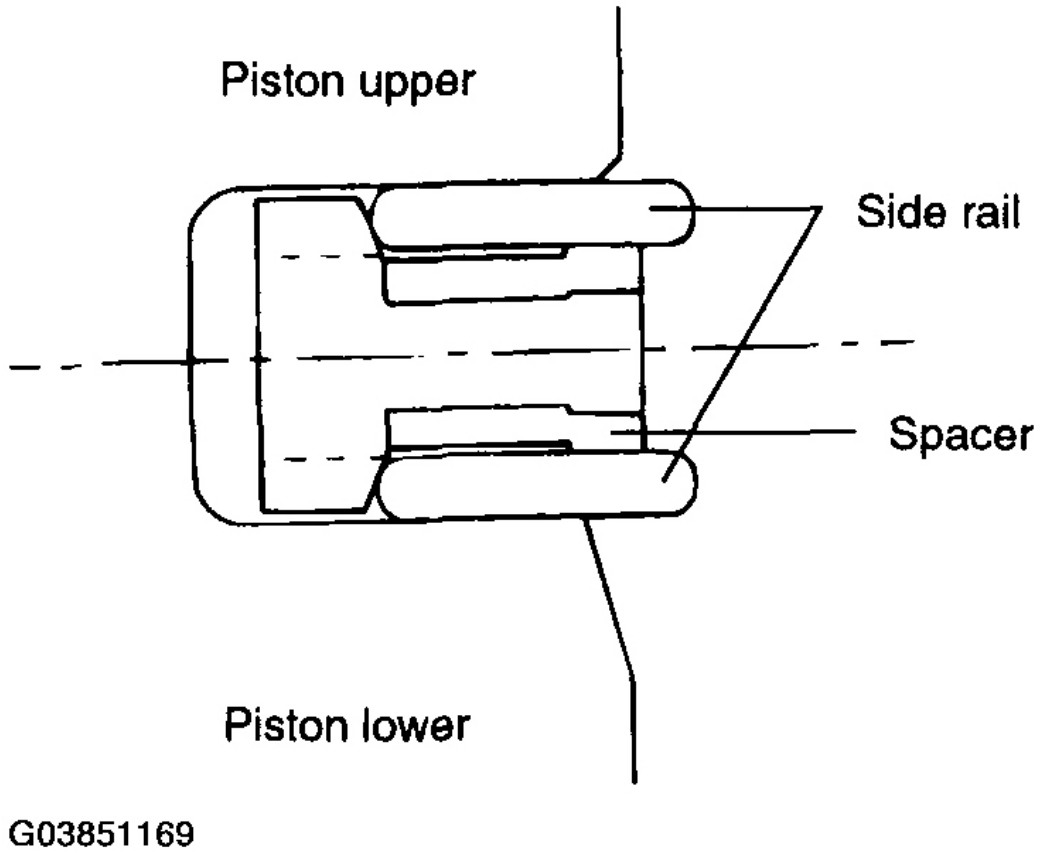


Fig. 126: Installing Spacer
Courtesy of HYUNDAI MOTOR CO.

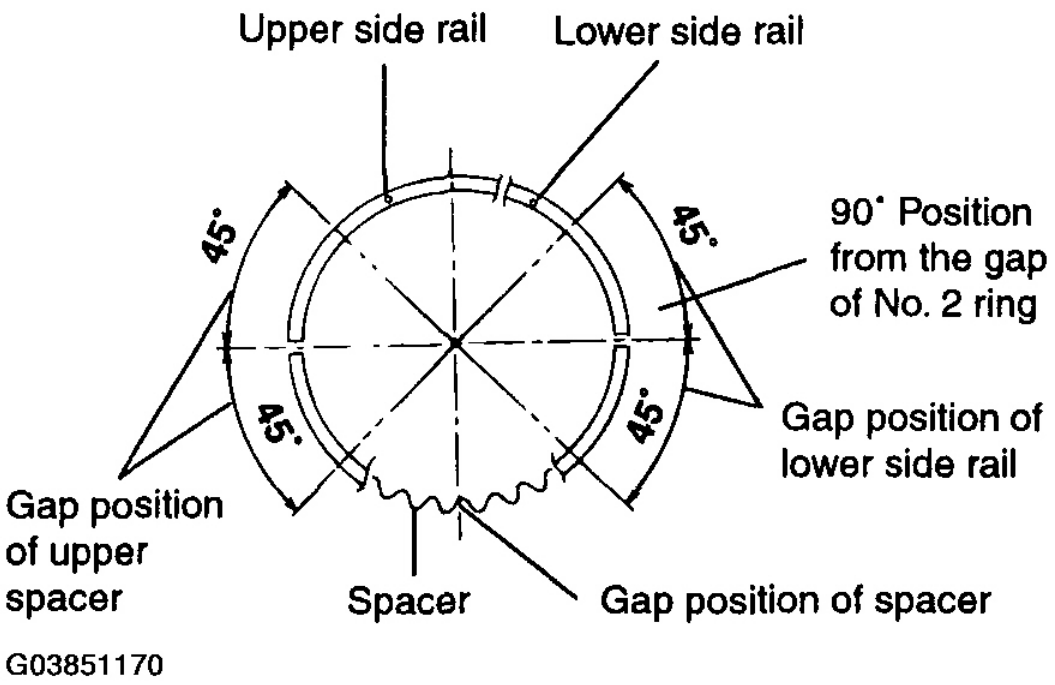


Fig. 127: Positioning Spacer
Courtesy of HYUNDAI MOTOR CO.

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

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

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

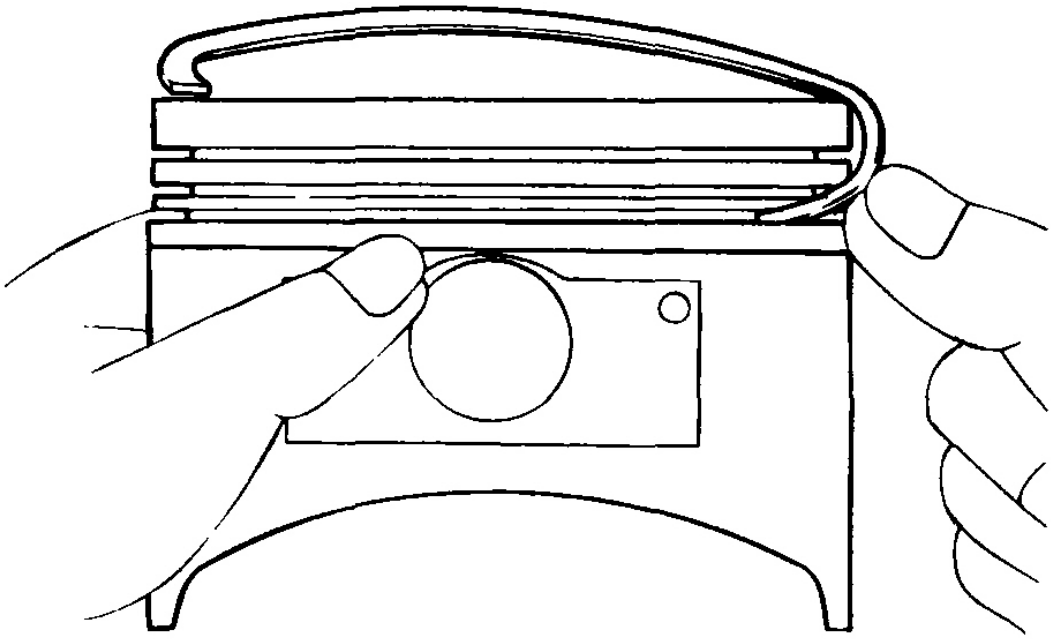


Fig. 128: Installing Lower Side Rail
Courtesy of HYUNDAI MOTOR CO.

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

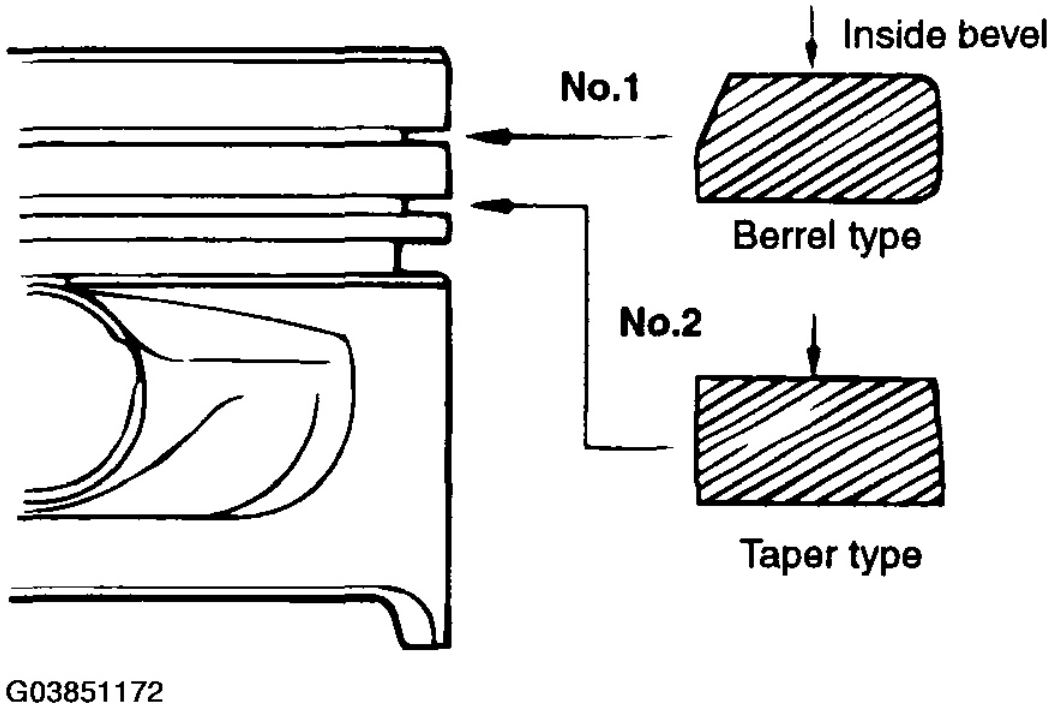


Fig. 129: Installing No. 1 & No. 2 Piston Ring
Courtesy of HYUNDAI MOTOR CO.

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.

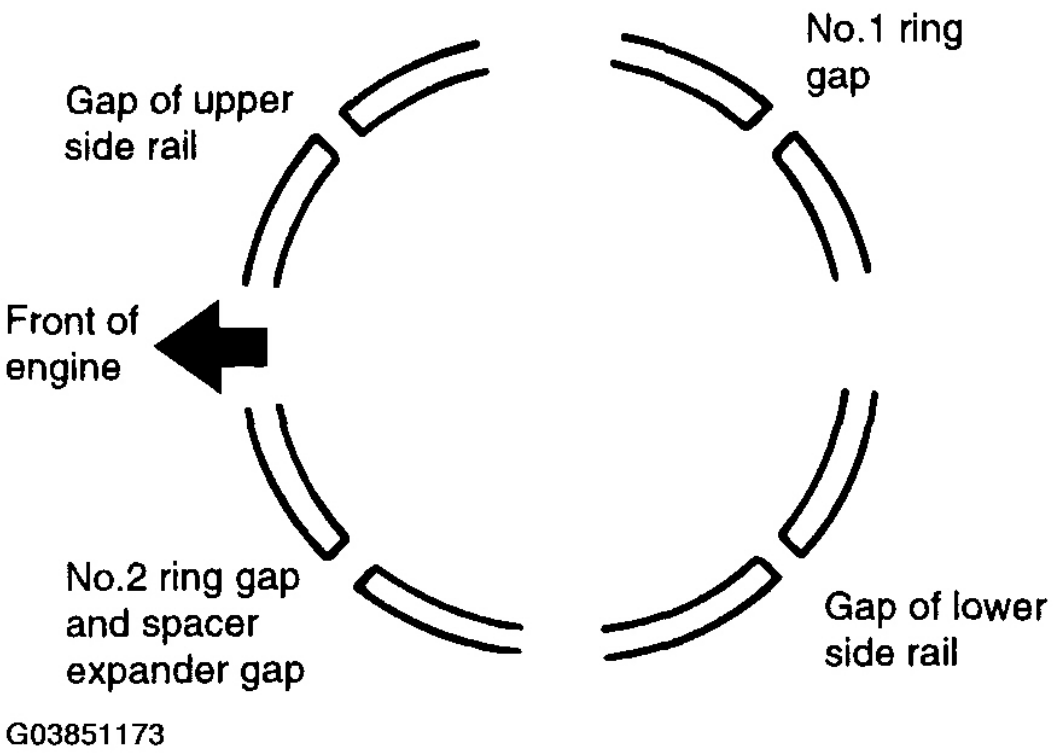


Fig. 130: Positioning Piston Rings Gap
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

Connecting rod cap nut:

32 ~ 35 Nm (320 ~ 350 kg.cm, 24 ~ 26 lb.ft)

CAUTION: After removing the connecting rod bolt, do not use if again.

When using a new bolt, do not tighten the bolt more than 3 times.

14. Check the connecting rod side clearance.

    Connecting rod side clearance

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

    Limit: 0.4 mm (0.0157 in.)

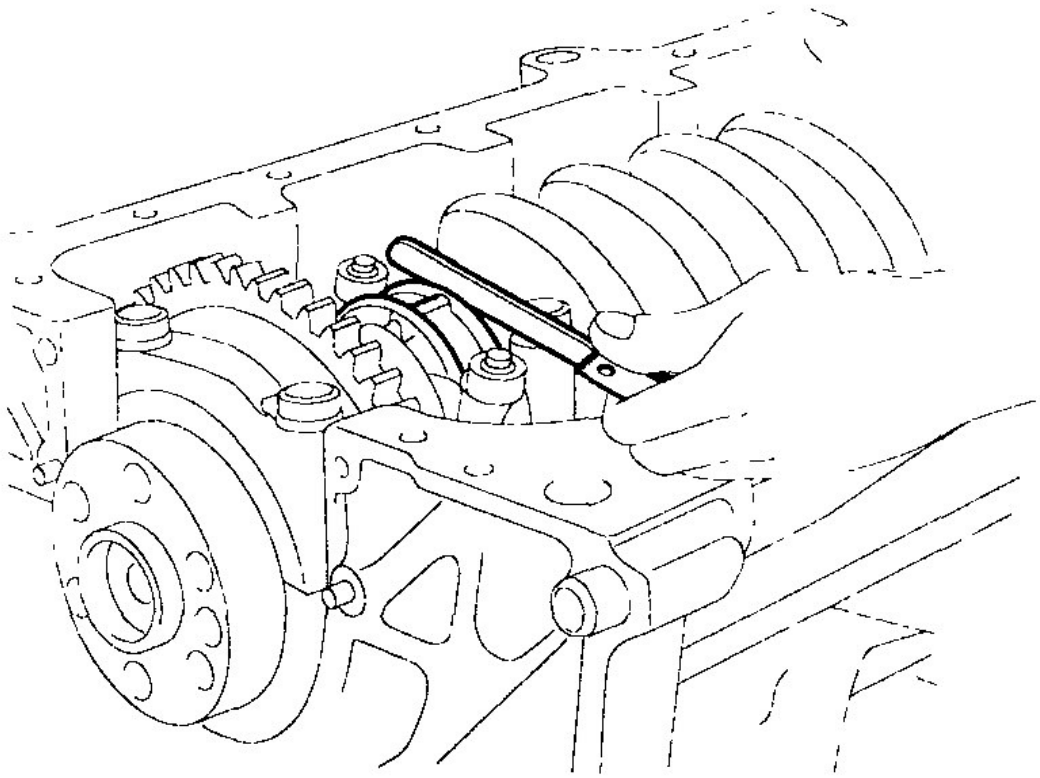


Fig. 131: Checking Connecting Rod Side Clearance
Courtesy of HYUNDAI MOTOR CO.

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

COOLING SYSTEM

ENGINE COOLANT HOSE/PIPES

COMPONENTS

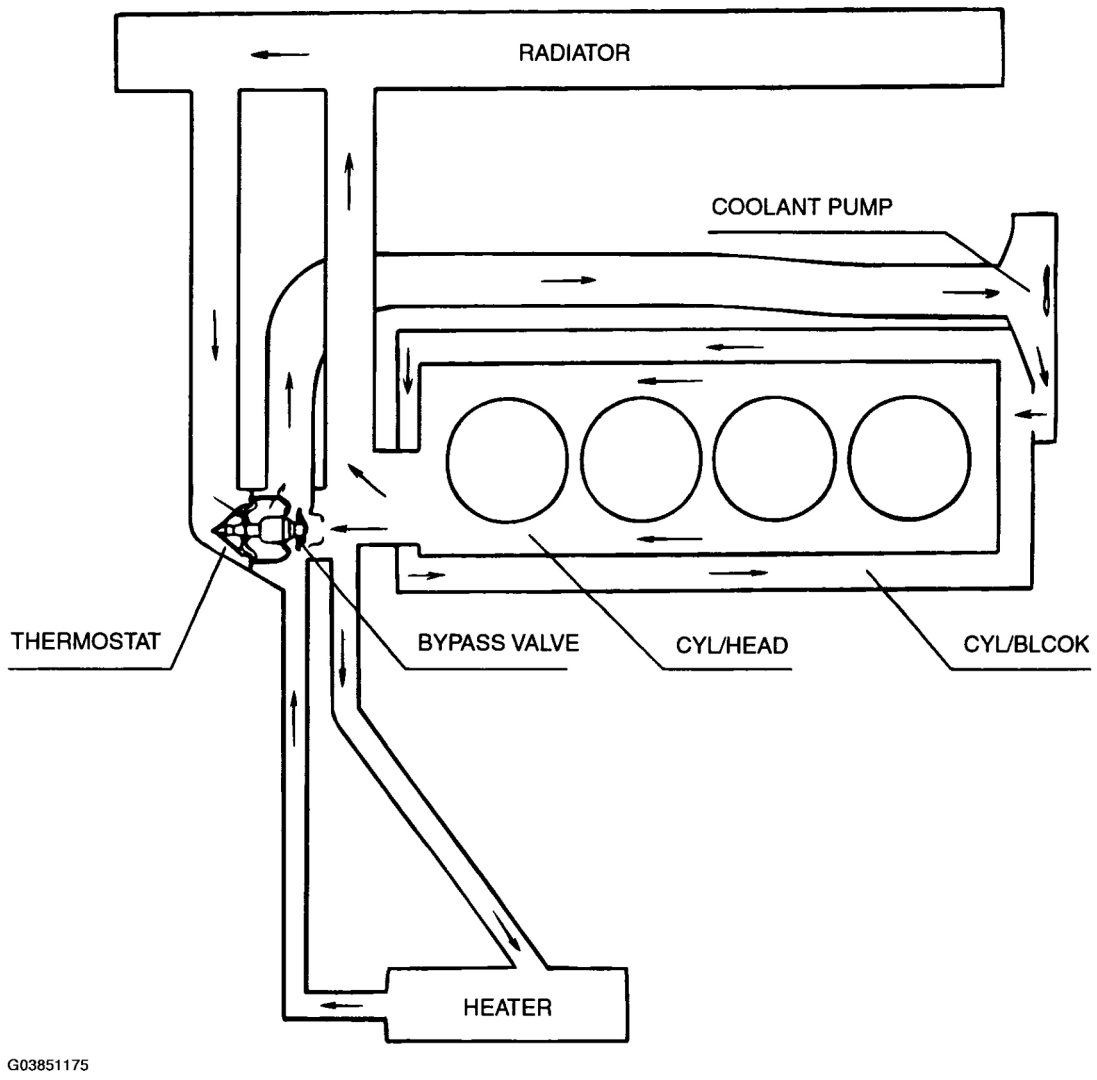


Fig. 132: Identifying Engine Coolant Hose/Pipes Components (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

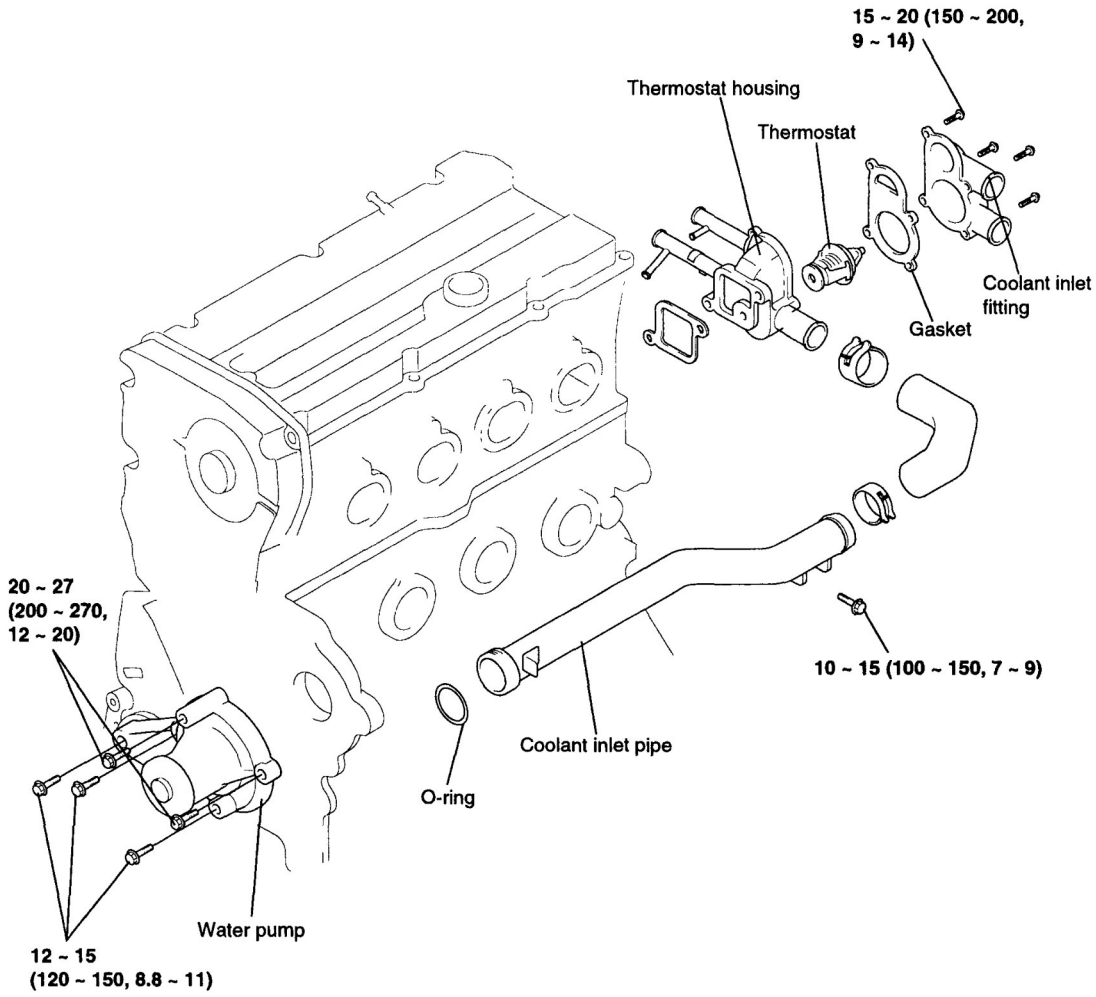


Fig. 133: Identifying Engine Coolant Hose/Pipes Components (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

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

Replace if necessary.

REASSEMBLY

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

coolant inlet pipe.

NOTE:

1. **Do not apply oil or grease to the coolant pipe O-ring.**
2. **Keep the coolant pipe connections free of sand, dust, etc.**
3. **Insert the coolant pipe fully into the cylinder block.**
4. **Do not reuse the O-ring. Replace it with a new part.**

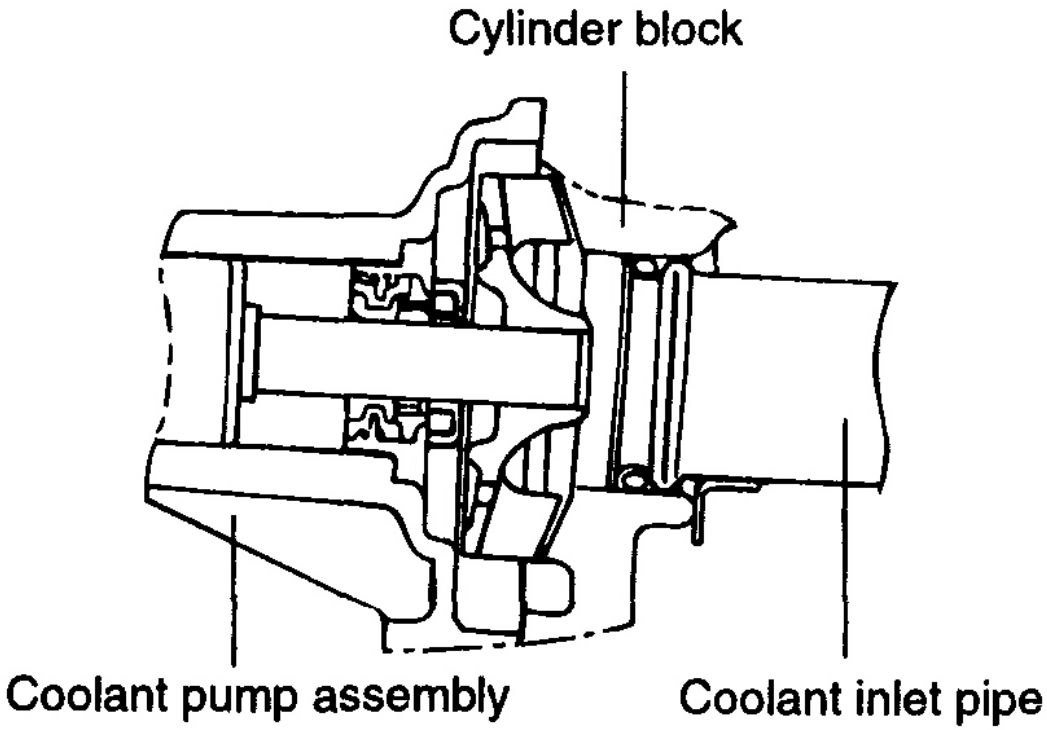


Fig. 134: Identifying Coolant Pipe Connections
Courtesy of HYUNDAI MOTOR CO.

ENGINE COOLANT PUMP

COMPONENTS

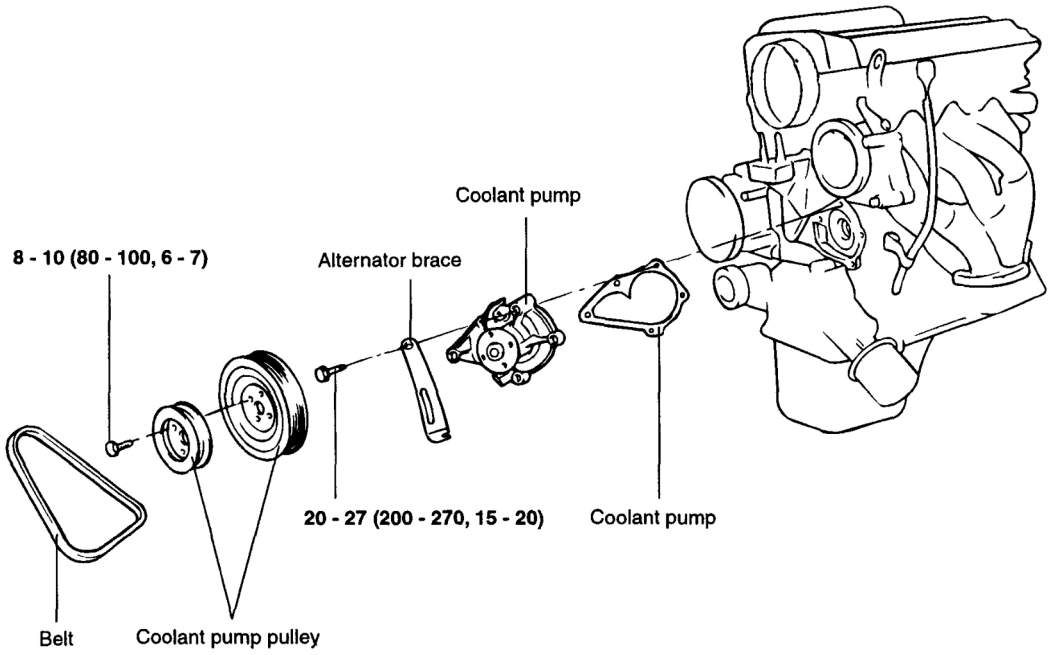


Fig. 135: Identifying Engine Coolant Pump Components & Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

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

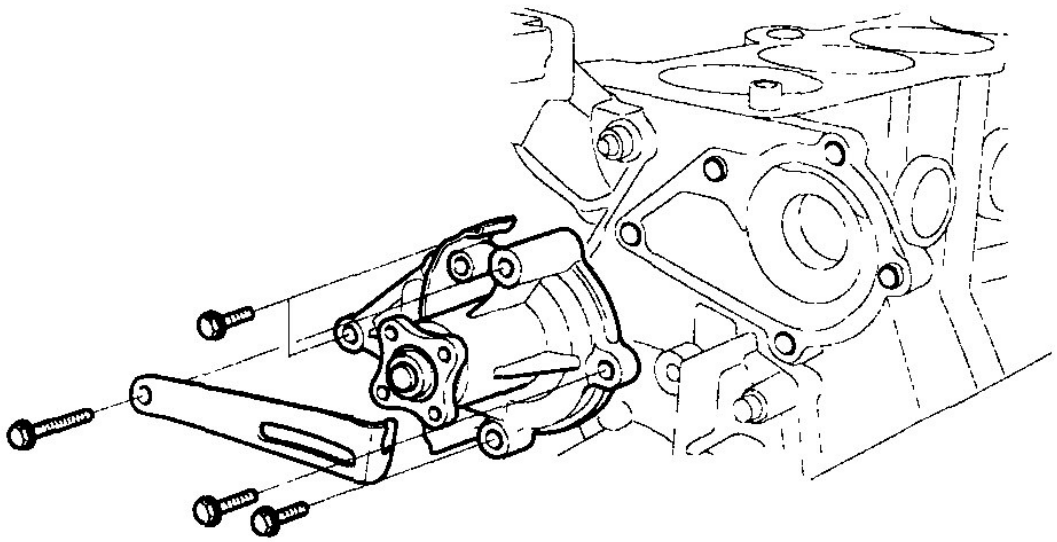
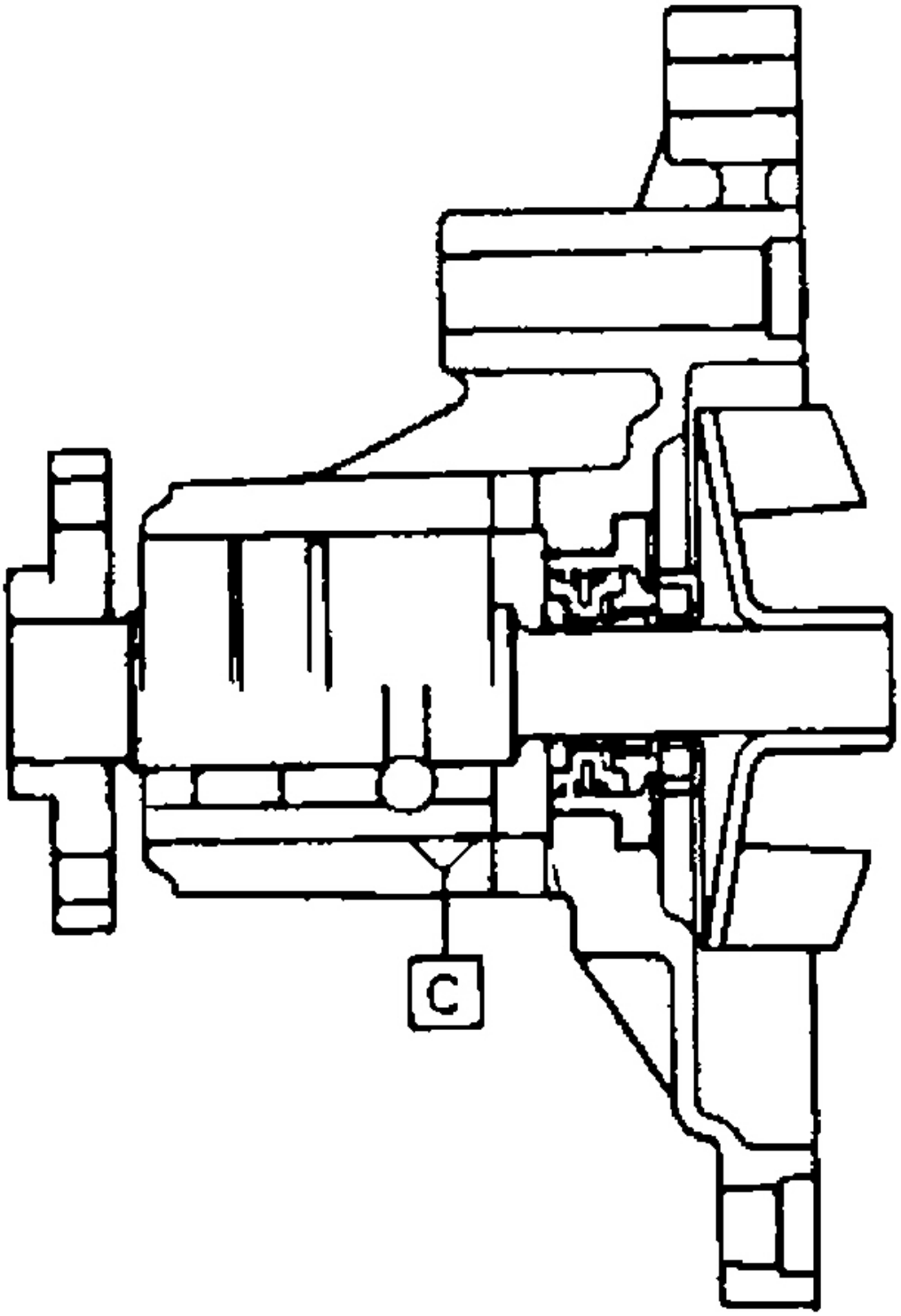


Fig. 136: Removing Coolant Pump Mounting Bolts & Alternator Brace
Courtesy of HYUNDAI MOTOR CO.

5. Remove the coolant pump assembly from the cylinder block.

INSPECTION

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



G03851180

Fig. 137: Identifying Coolant Pump Assembly
Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

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

Tightening torque

Coolant pump to cylinder block:

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

B: 20 ~ 27 Nm (200 ~ 270 kg.cm, 15 ~ 20 lb.ft)

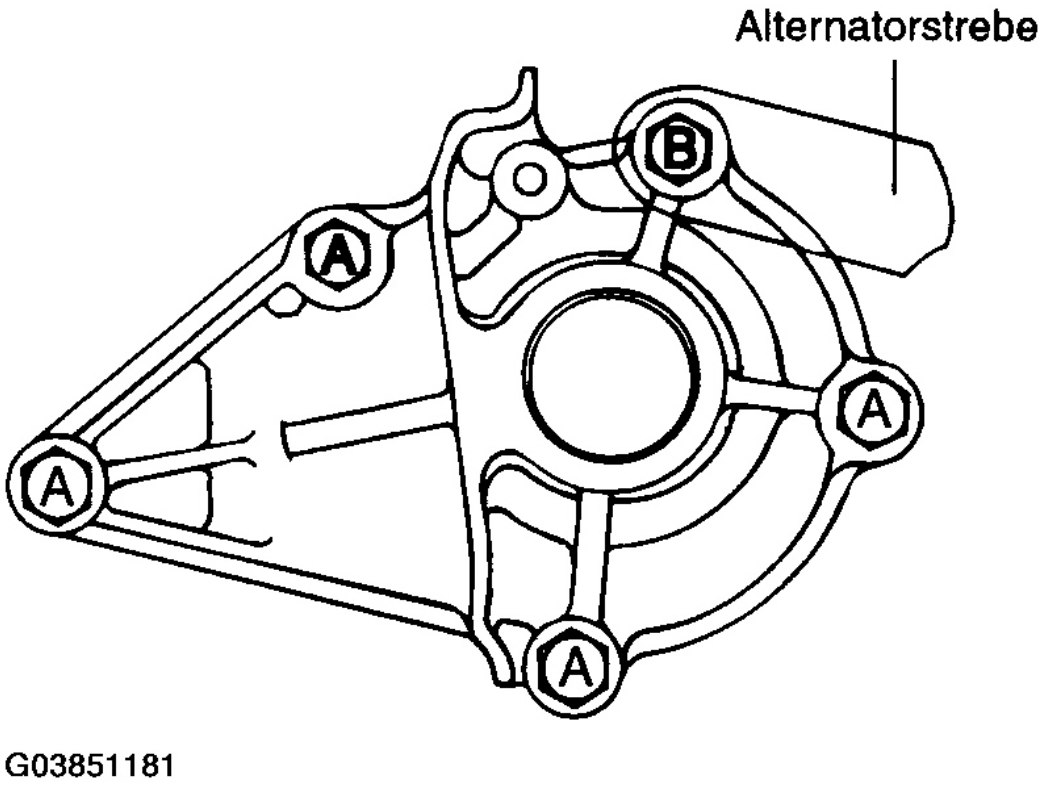


Fig. 138: Tightening Coolant Pump Bolts
Courtesy of HYUNDAI MOTOR CO.

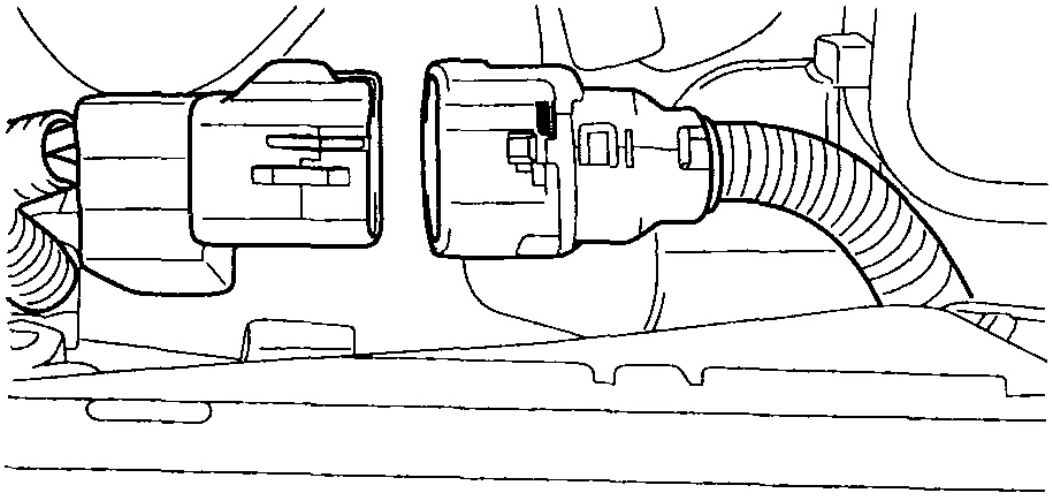
3. Install the timing tensioner and timing belt. Adjust the timing belt tension.

4. Install the timing belt covers.
5. Install the coolant pump pulley and drive belt, and then adjust the belt tension.
6. Refill the system with clean coolant.
7. Run the engine and check for leaks.

RADIATOR

DISASSEMBLY

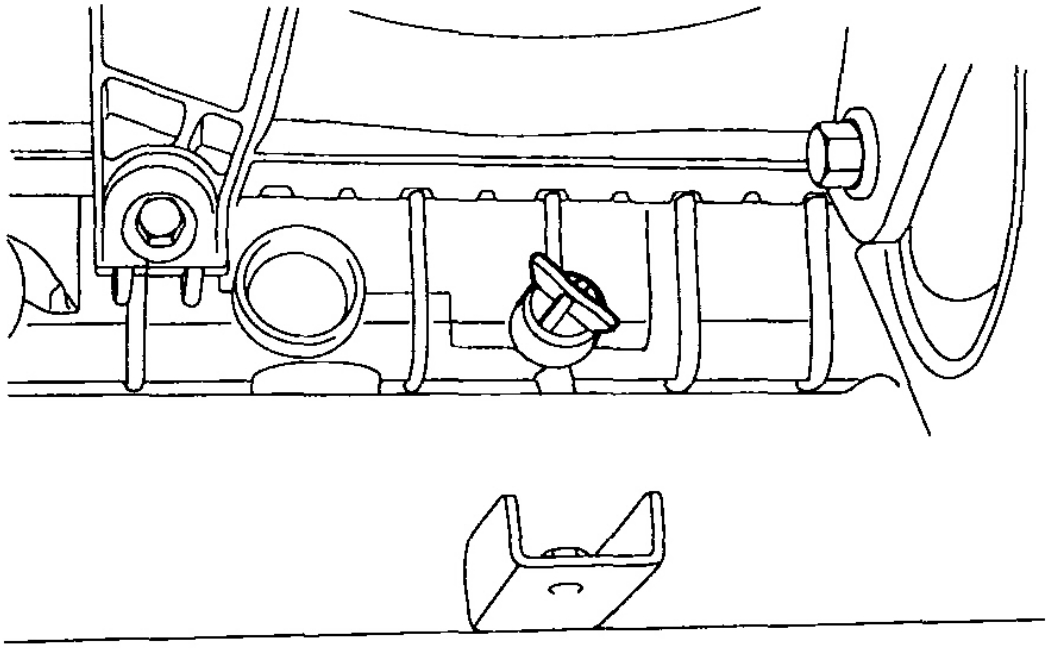
1. Disconnect the radiator fan motor connector.



G03851182

Fig. 139: Disconnecting Radiator Fan Motor Connector
Courtesy of HYUNDAI MOTOR CO.

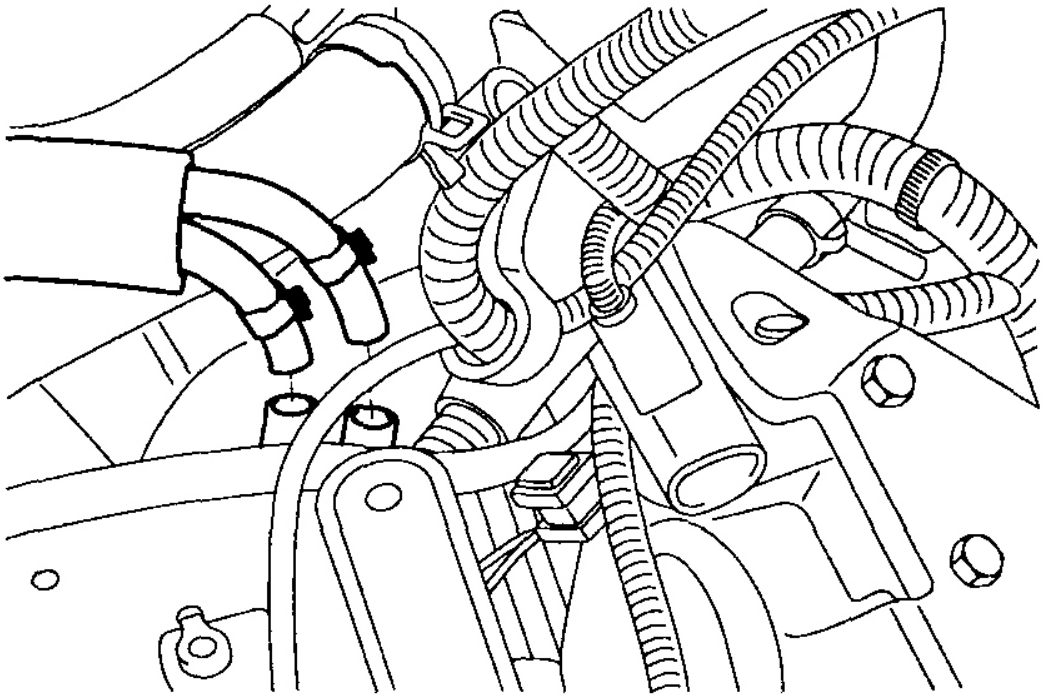
2. Set the temperature of the heater control to the hot position.
3. Loosen the radiator drain plug to drain coolant.



G03851183

Fig. 140: Loosening Radiator Drain Plug
Courtesy of HYUNDAI MOTOR CO.

4. Disconnect the upper and lower hose and overflow tube.
5. For vehicles with automatic transmission, disconnect the oil cooler hoses from the automatic transmission.

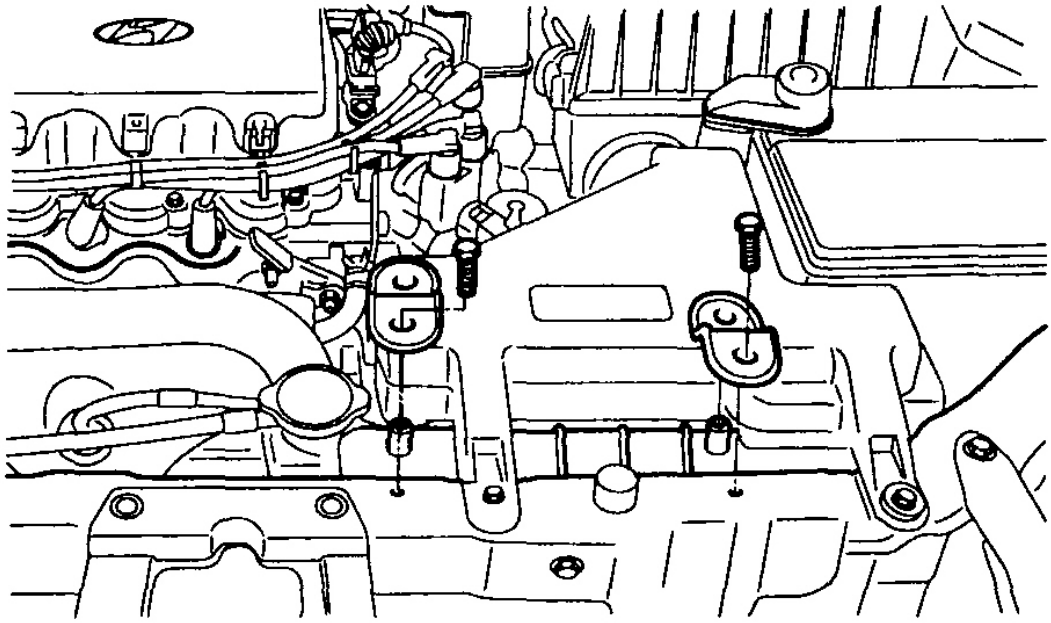


G03851184

Fig. 141: Disconnecting Oil Cooler Hoses From Automatic Transmission
Courtesy of HYUNDAI MOTOR CO.

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

6. Remove the radiator mounting bolts.



G03851185

Fig. 142: Removing Radiator Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

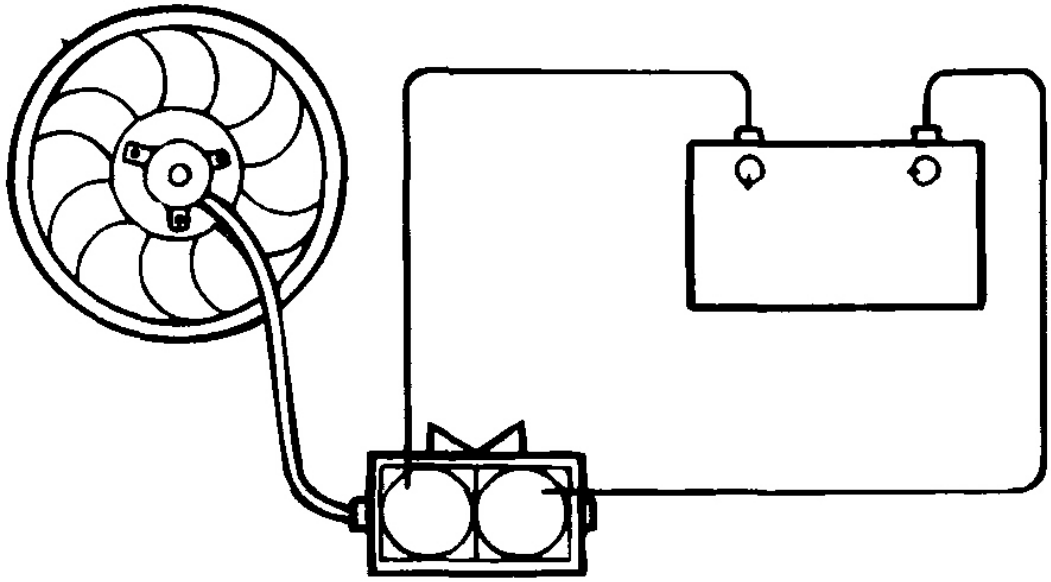
7. Remove the radiator together with the fan motor.
8. Remove the fan motor from the radiator.

INSPECTION

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

RADIATOR FAN MOTOR

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



G03851186

Fig. 143: Checking Radiator Fan Motor
Courtesy of HYUNDAI MOTOR CO.

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

REASSEMBLY

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

RADIATOR CAP

COMPONENTS

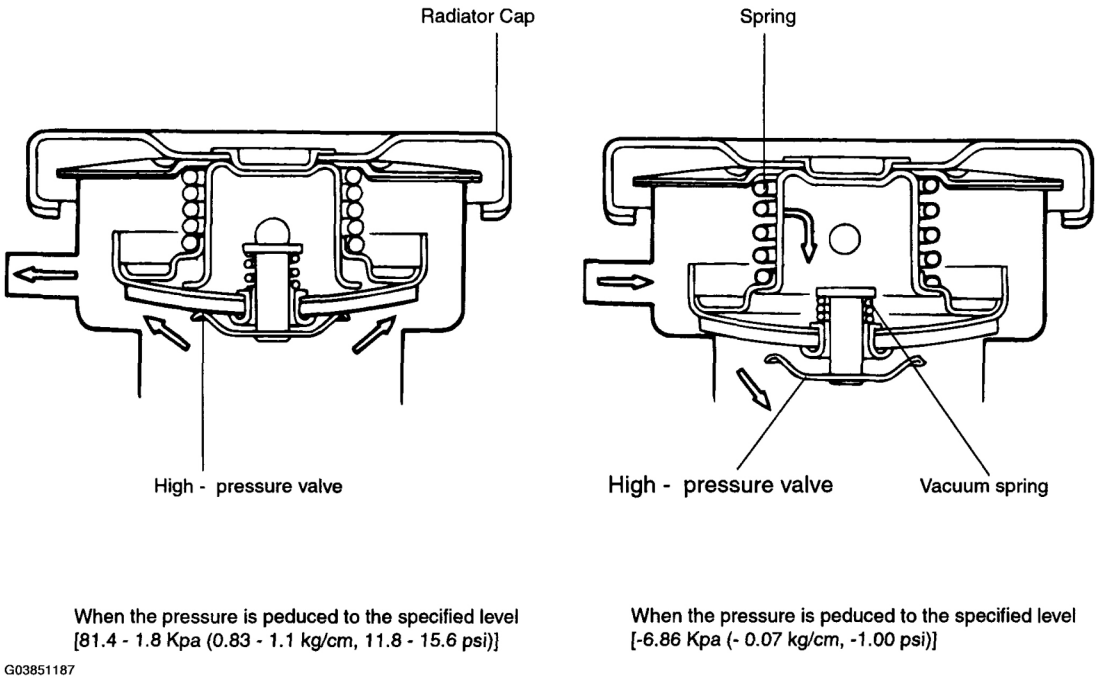


Fig. 144: Identifying Radiator Cap Components
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

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

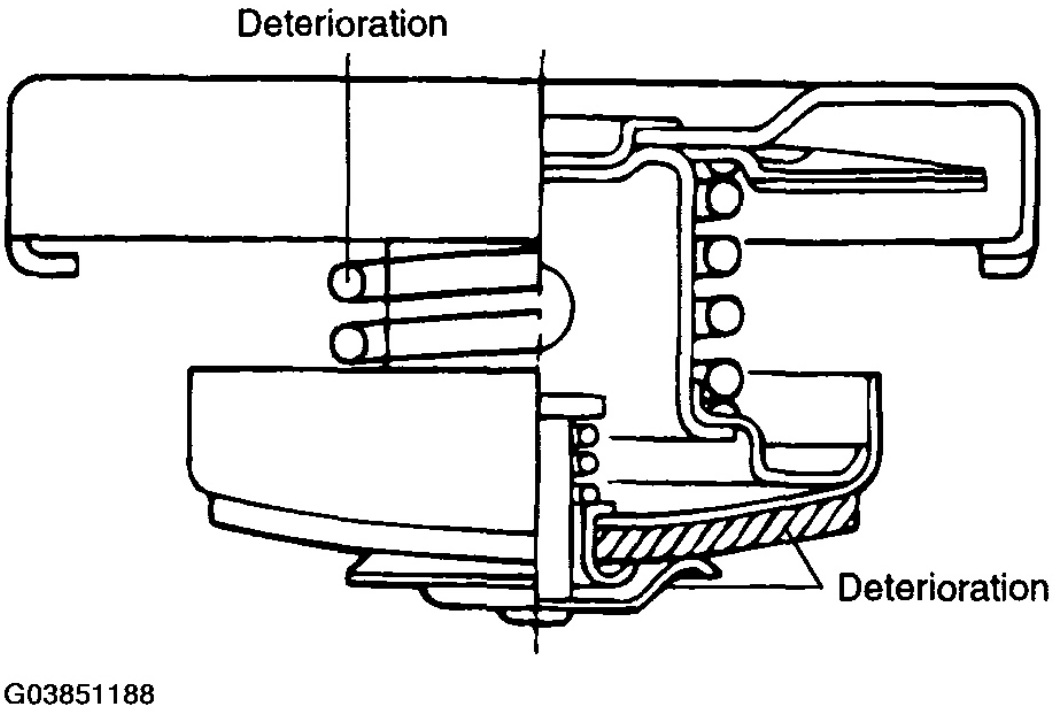


Fig. 145: Cut Section Of Radiator Cap
Courtesy of HYUNDAI MOTOR CO.

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

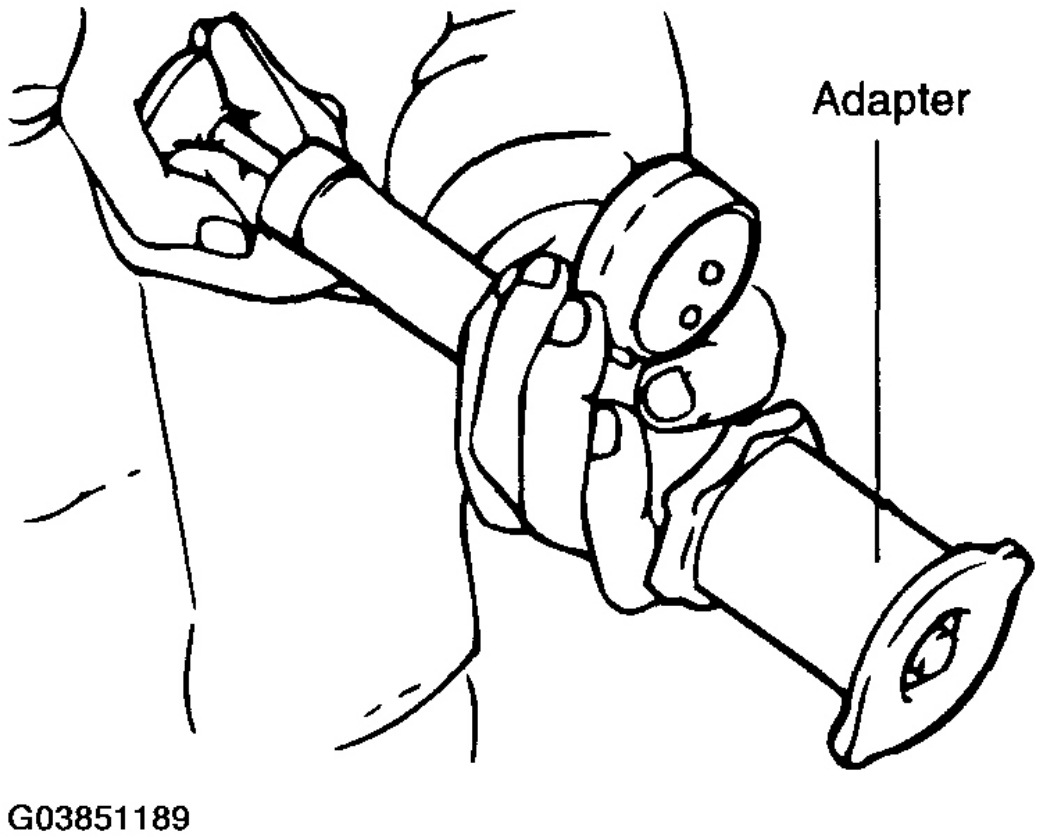
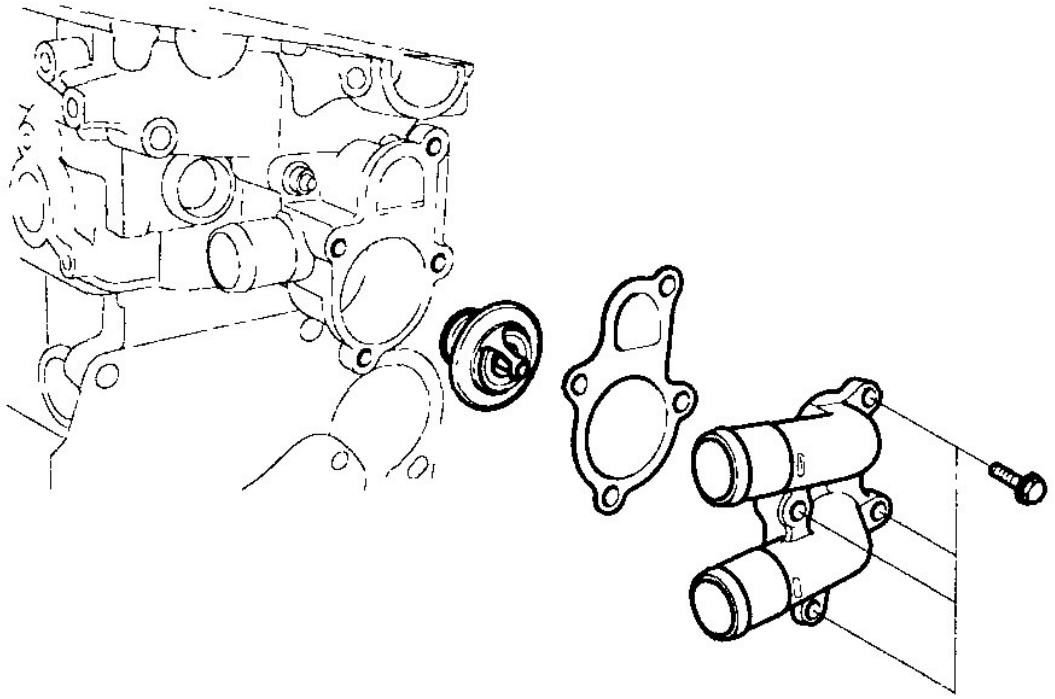


Fig. 146: Attaching Radiator Cap Tester To Radiator
Courtesy of HYUNDAI MOTOR CO.

THERMOSTAT

INSPECTION

1. Drain the coolant so its level is below thermostat.
2. Remove the inlet fitting and gasket.



G03851190

Fig. 147: Removing Inlet Fitting & Gasket
Courtesy of HYUNDAI MOTOR CO.

3. Remove the thermostat.
4. Immerse thermostat in hot coolant to check proper valve opening temperature. Replace if necessary.

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

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

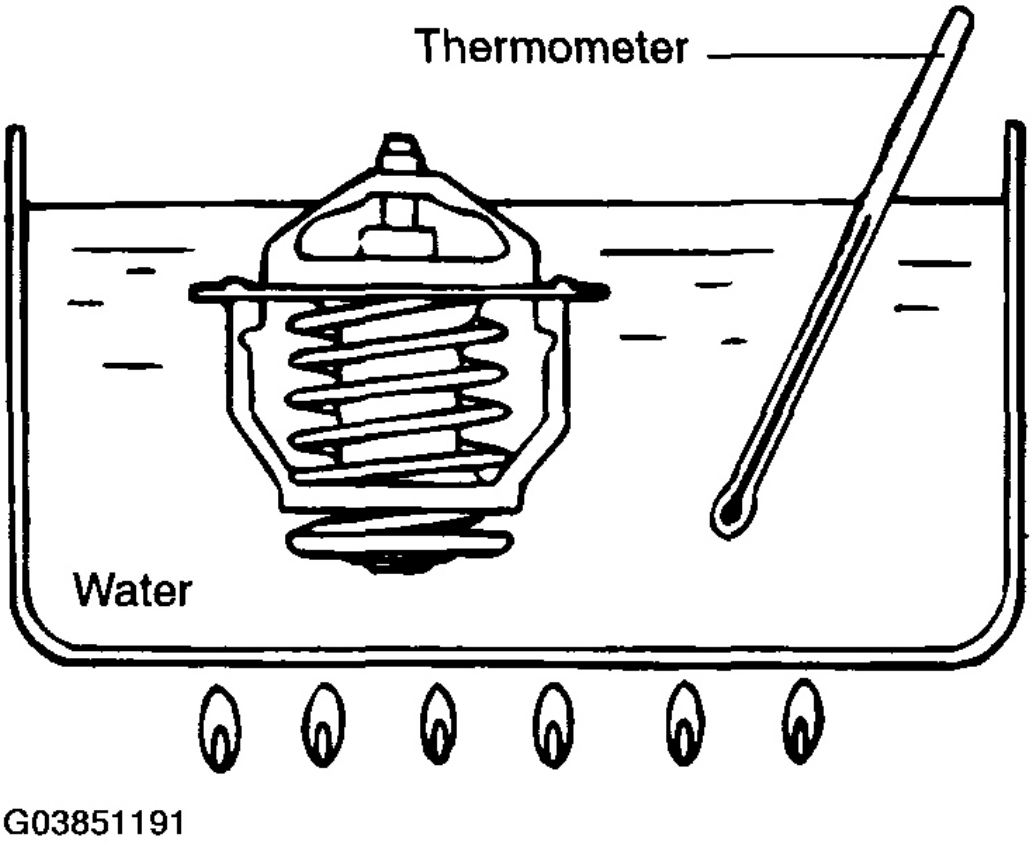


Fig. 148: Checking Proper Valve Opening Temperature
Courtesy of HYUNDAI MOTOR CO.

COOLANT TEMPERATURE SENSOR

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

Resistance

At: 20°C (68°F): 2.31 ~ 2.59 kohm

OVERHAUL AND REPAIR INSTRUCTIONS

REASSEMBLY

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

3. Refill the system with clean coolant.

Tightening torque

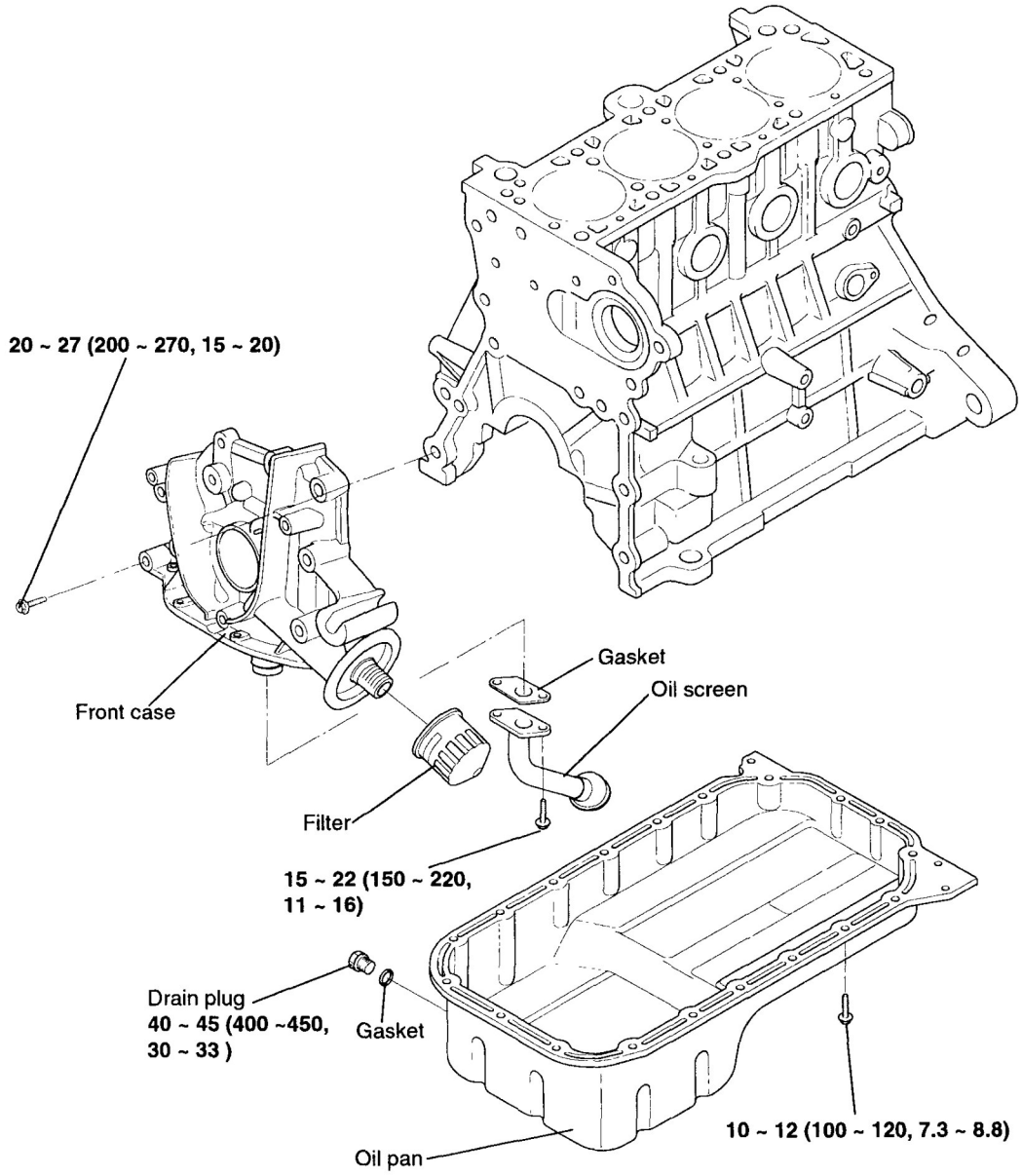
Coolant temperature sensor:

25 ~ 30 Nm (250 ~ 300 kg.cm, 18 ~ 22 lb.ft)

LUBRICATION SYSTEM

OIL PUMP

COMPONENTS



TORQUE : Nm (kgf.cm, lbf.ft)

G03851192

Fig. 149: Identifying Oil Pump Components & Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Remove the timing belt.

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

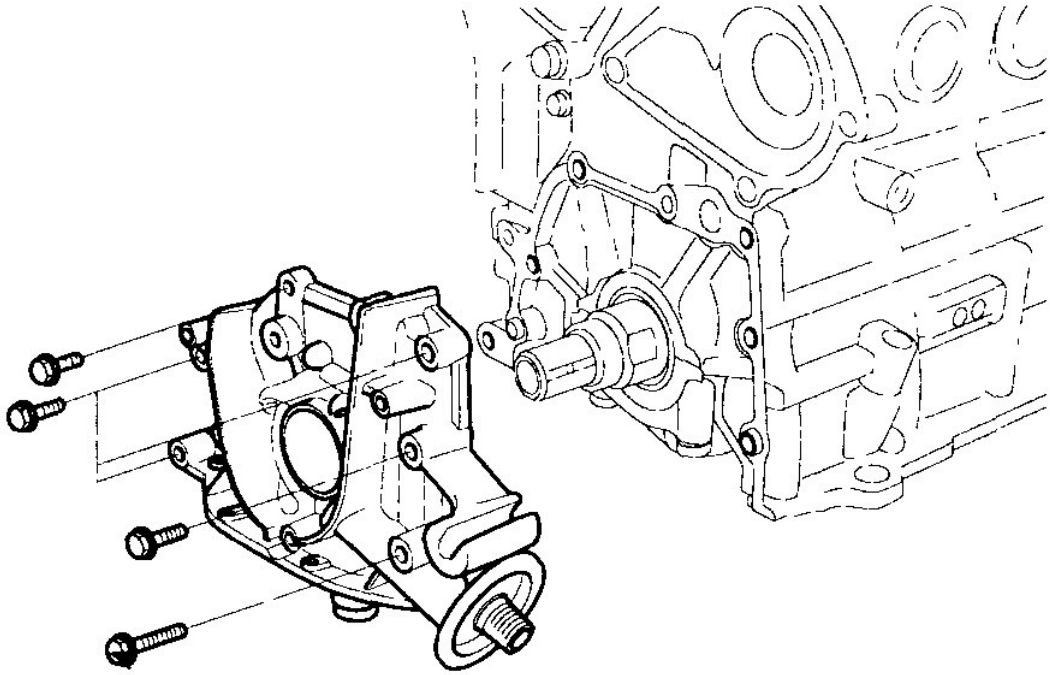
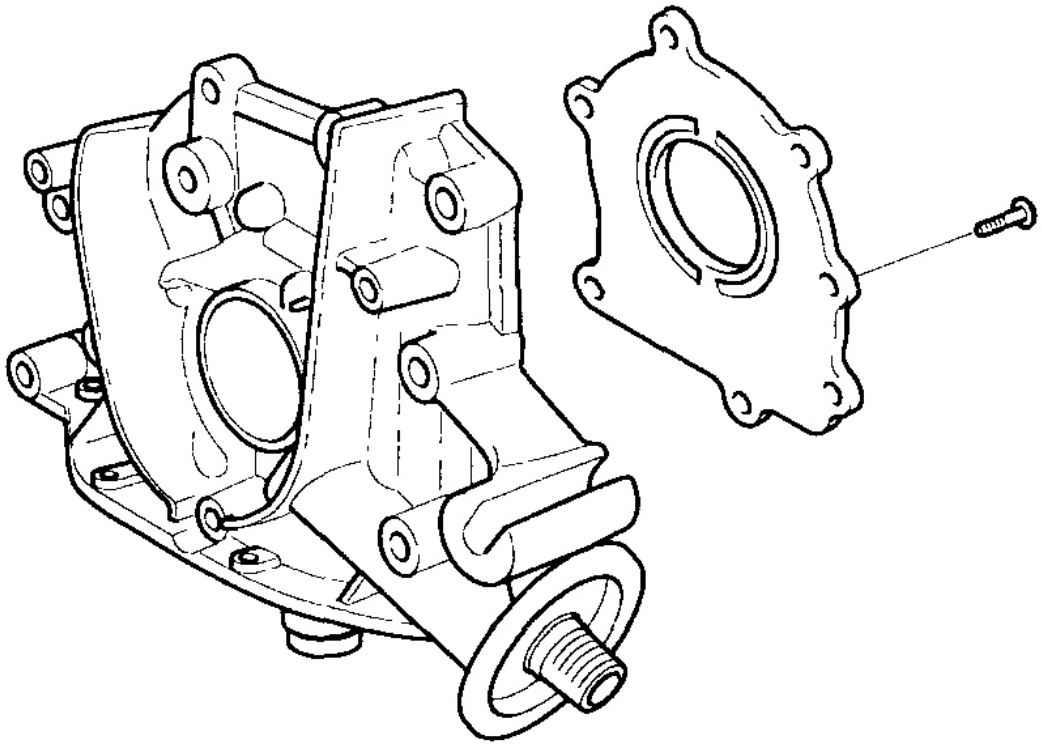


Fig. 150: Removing Front Case Assembly
Courtesy of HYUNDAI MOTOR CO.

6. Remove the oil pump cover.



G03851194

Fig. 151: Removing Oil Pump Cover
Courtesy of HYUNDAI MOTOR CO.

7. Remove the inner and outer gears from the front case. The matching marks on the inner and outer gears indicate the direction of installation.

INSPECTION

FRONT CASE

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

OIL PAN AND OIL SCREEN

1. Check the oil pan for failure, damage or cracks. Replace if defective.
2. Check the oil screen for failure, damage and cracks and replace if defective.

FRONT CASE AND OIL PUMP COVER

Check the surfaces contacting the gears for damage or wear.

OIL PUMP GEARS

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

   Body clearance: 0.12 ~ 0.185 mm (0.0047 ~ 0.0073 in.)

   Tip clearance: 0.025 ~ 0.069 mm (0.0010 ~ 0.0027 in.)

   Side clearance

   Inner gear: 0.06 ~ 0.11 mm (0.0023 ~ 0.0043 in.)

   Outer gear: 0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)

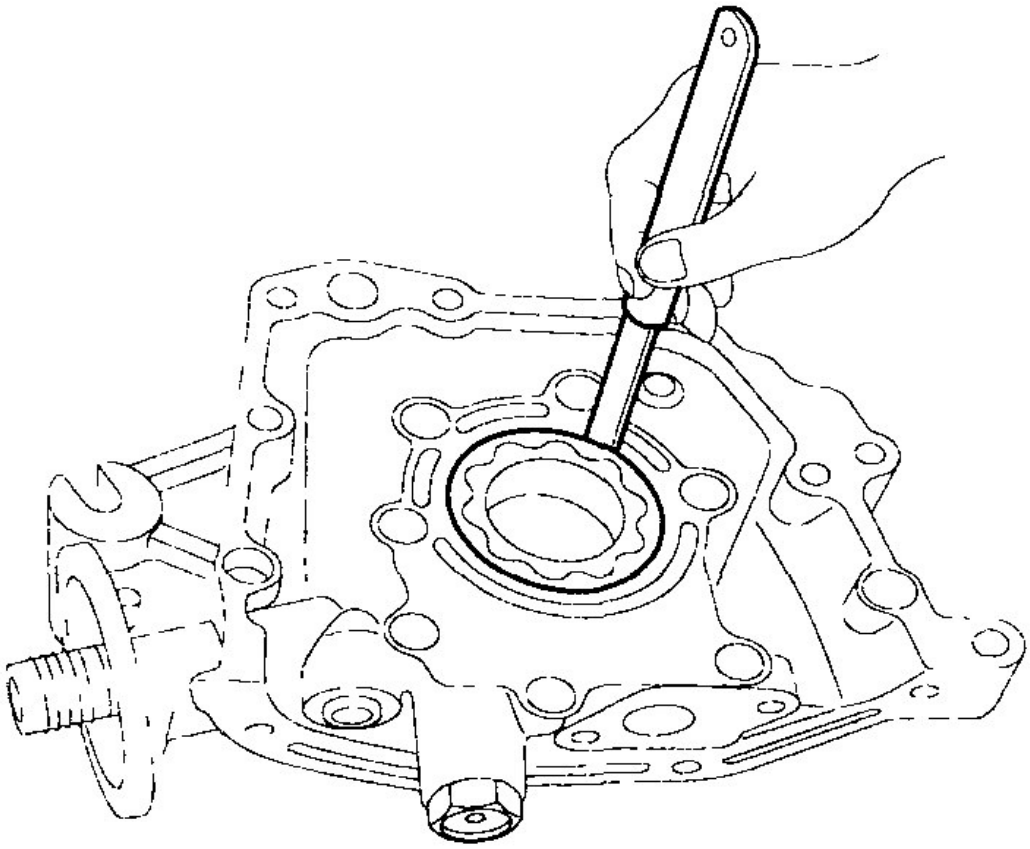
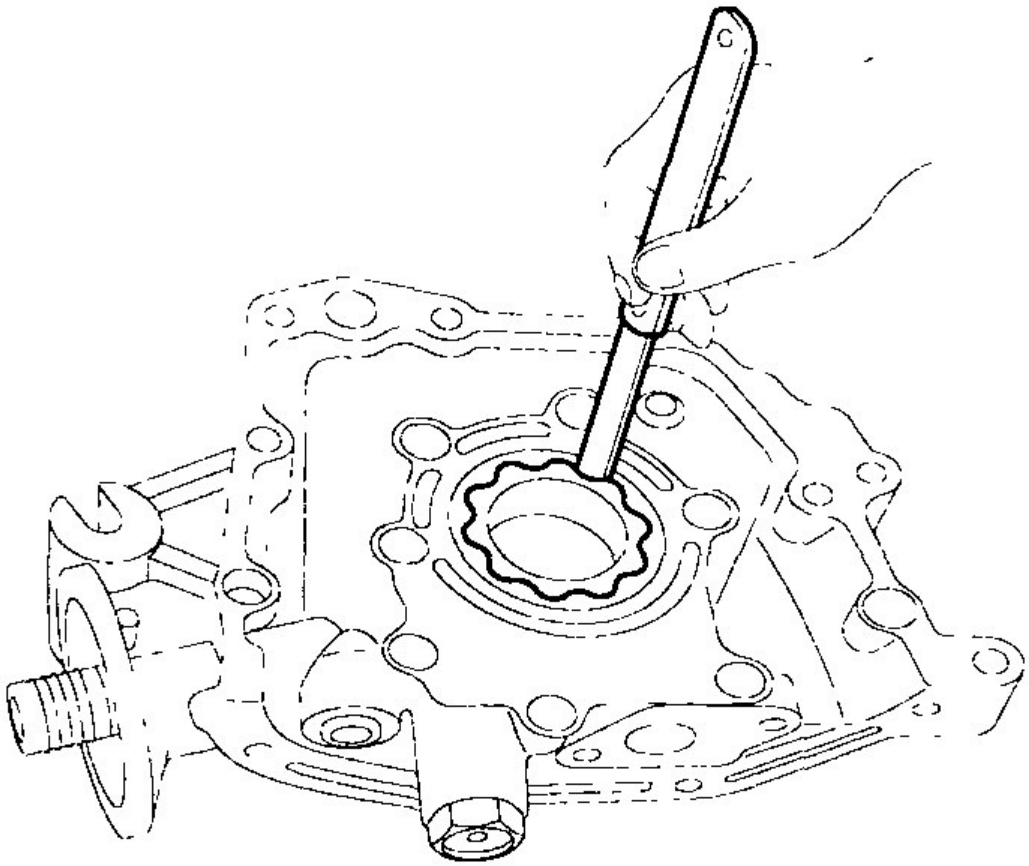


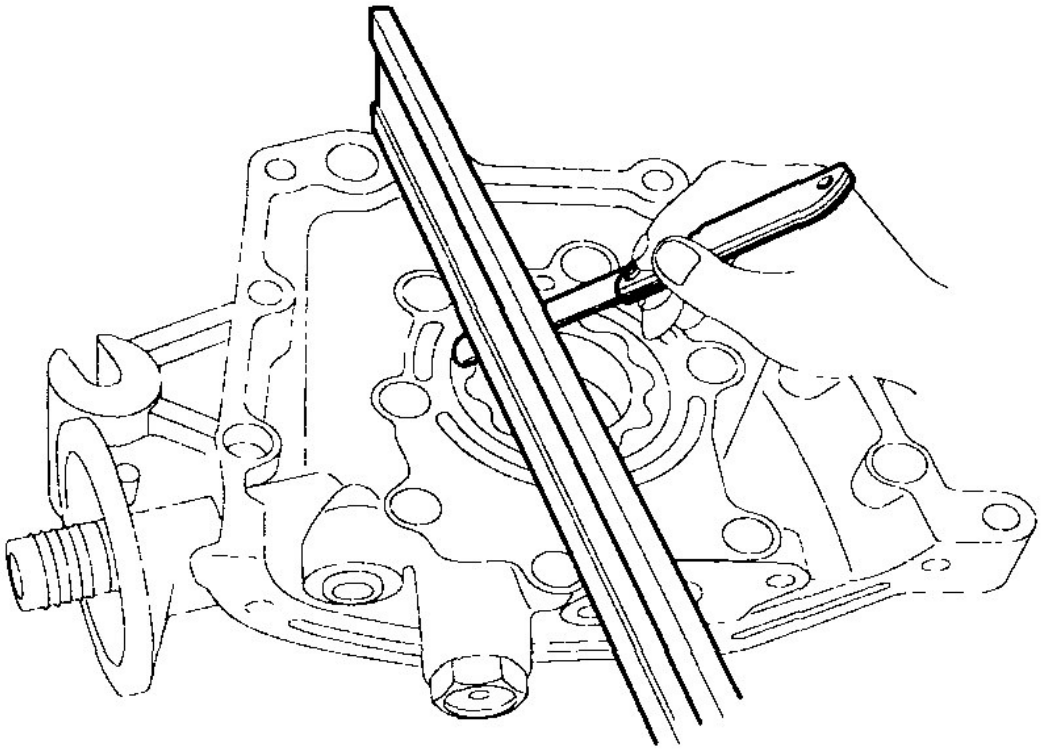
Fig. 152: Measuring Clearance Between Outer Gear & Front Case
Courtesy of HYUNDAI MOTOR CO.

3. Check the tip clearance on the pump rotor.



G03851196

Fig. 153: Checking Tip Clearance On Pump Rotor (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



G03851197

Fig. 154: Checking Tip Clearance On Pump Rotor (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

RELIEF VALVE AND SPRING

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

Standard value

Free height: 46.6 mm (1.8346 in.)

Load: 6.1 kg/40.1 mm (13.42 lb/1.578 in.)

OIL PRESSURE SWITCH

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

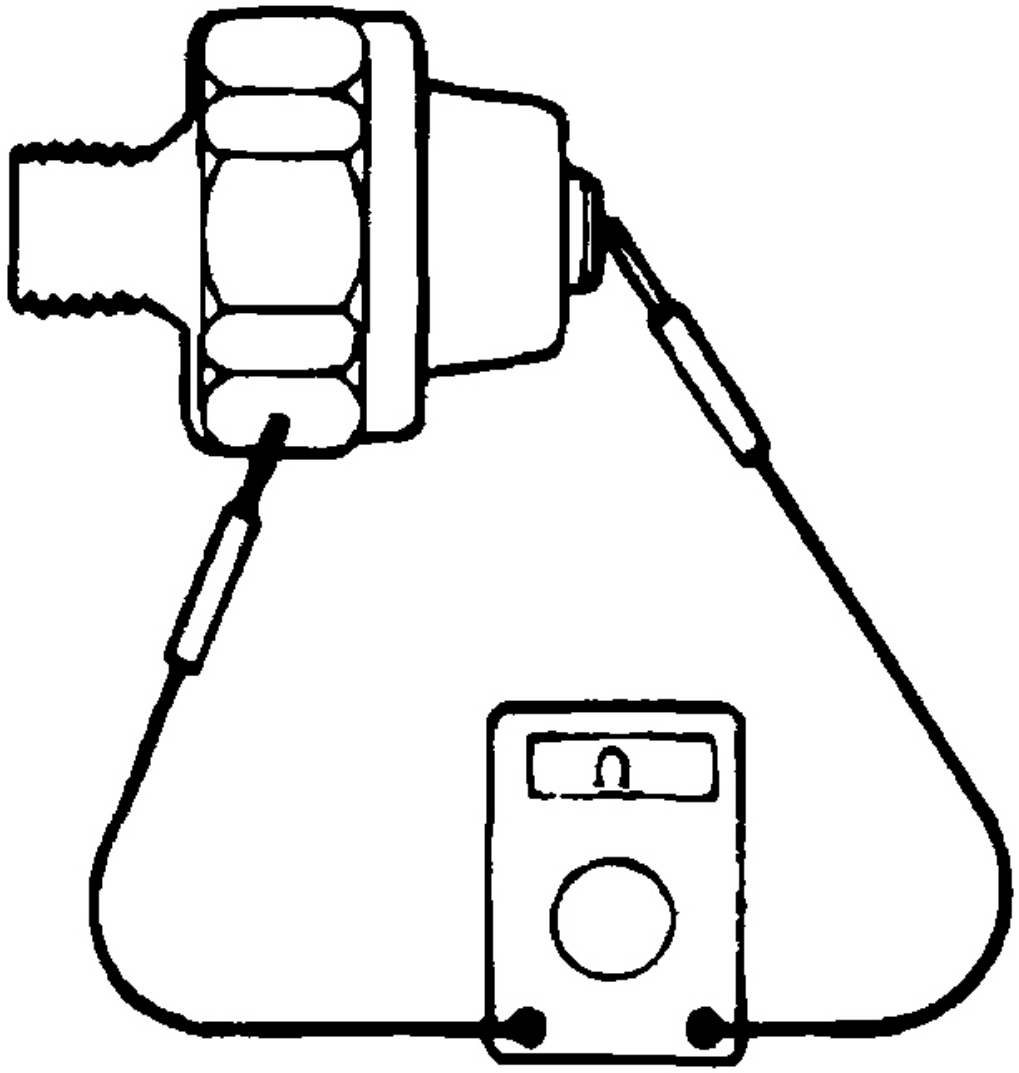


Fig. 155: Checking Continuity Between Terminal & Body Using Ohmmeter
Courtesy of HYUNDAI MOTOR CO.

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

   Check for air leaks. If air does leak, the diaphragm is broken. Replace the switch.

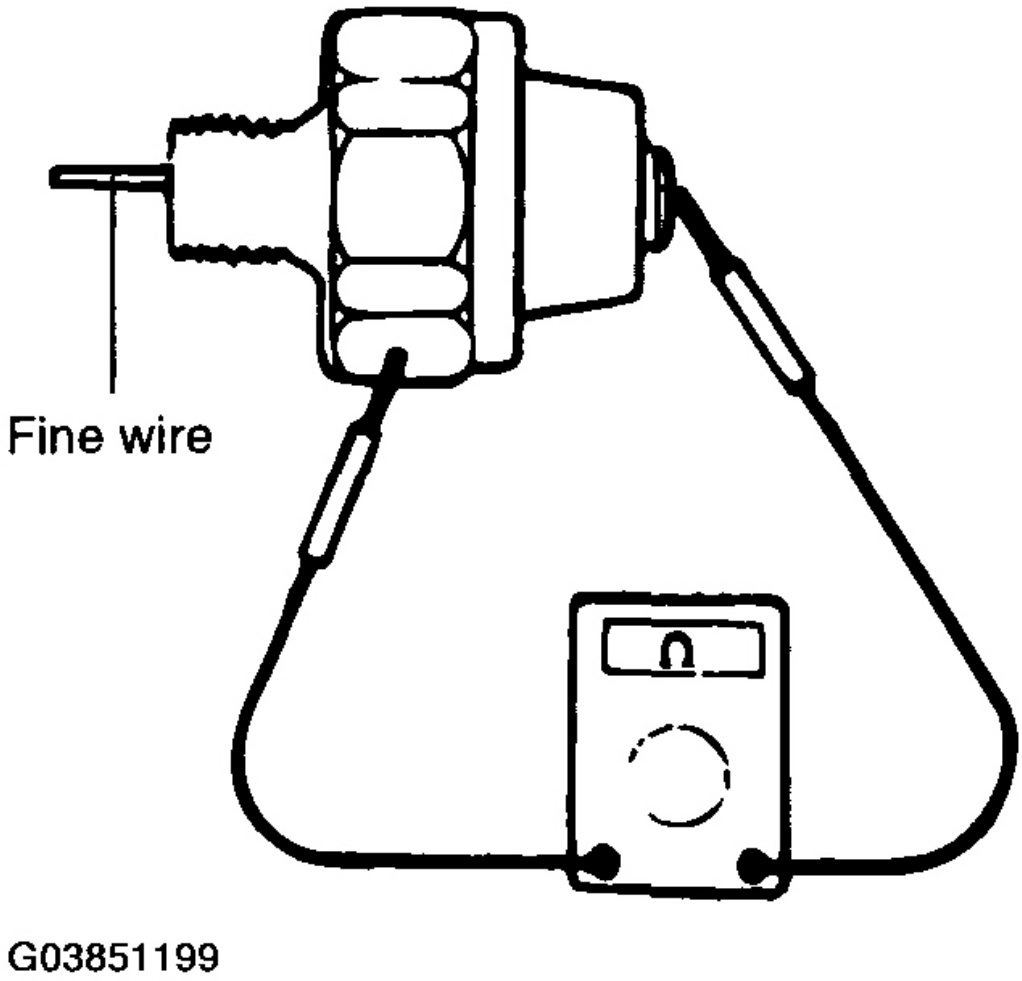


Fig. 156: Checking Continuity Between Terminal & Body When The Fine Wire Is Pushed
Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

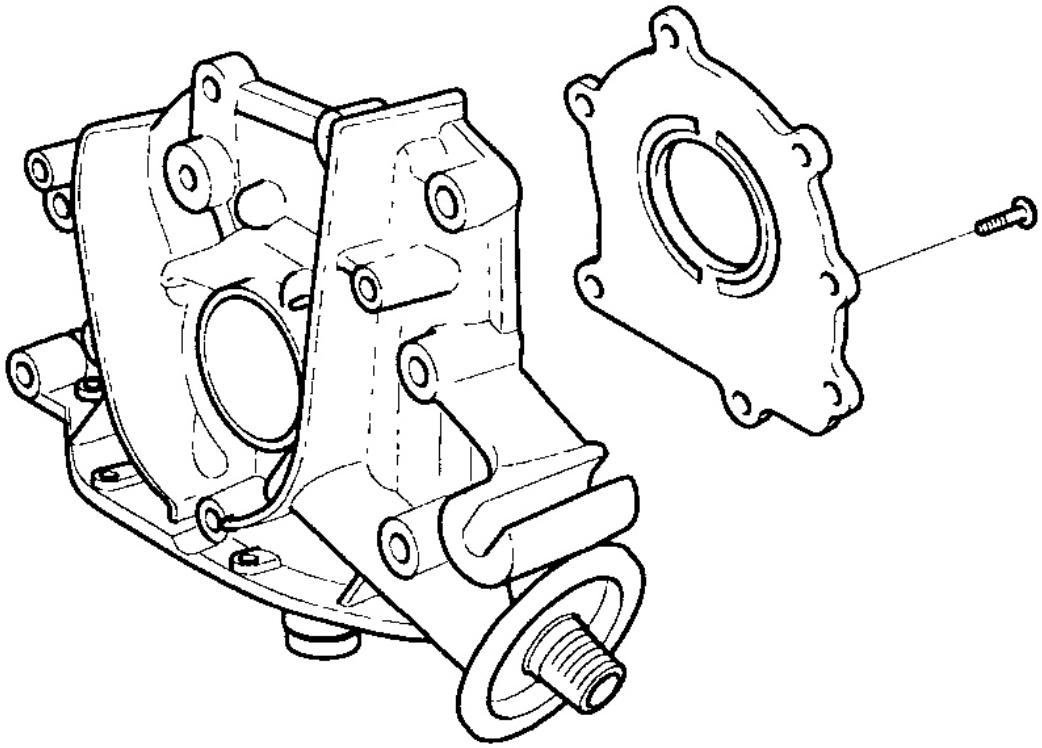
OIL PUMP

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

Tightening torque

Oil pump cover bolt:

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



G03851200

Fig. 157: Installing Oil Pump Cover & Tighten The Bolts To The Specified Torque
Courtesy of HYUNDAI MOTOR CO.

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

Relief valve plug

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

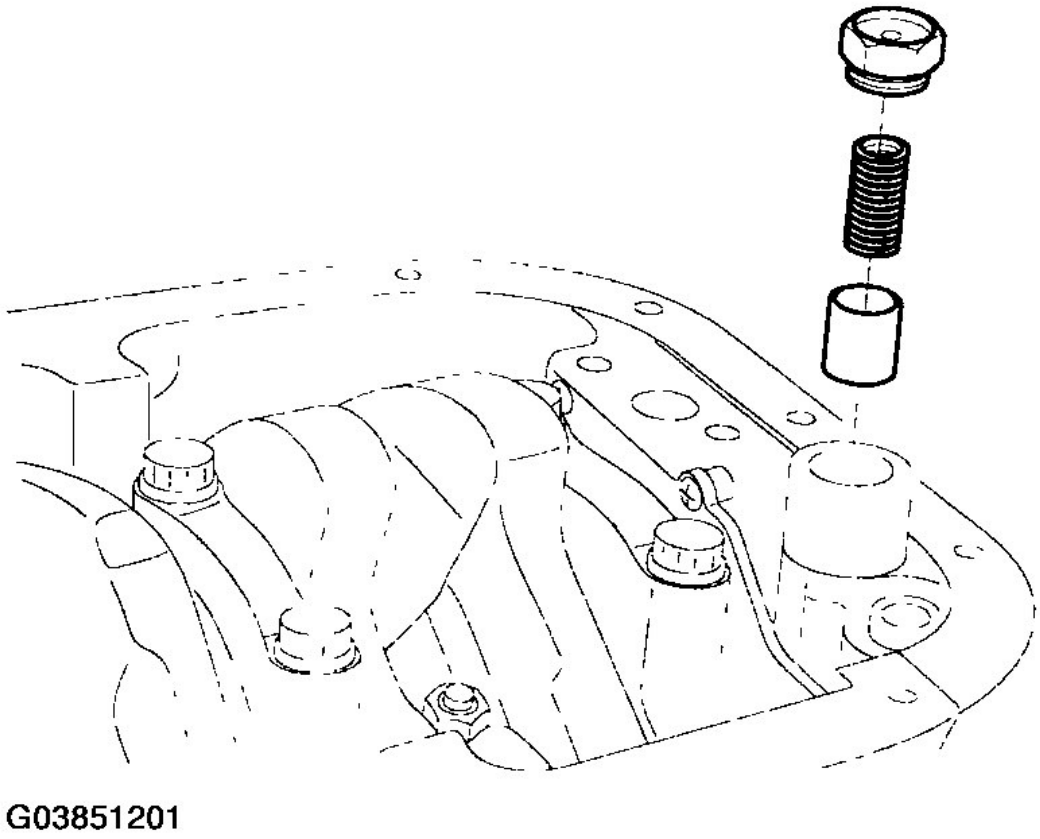


Fig. 158: Installing Relief Valve & Spring
Courtesy of HYUNDAI MOTOR CO.

FRONT CASE

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

   Tightening torque

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

   Length

   A: 30 mm (1.18 in.)

   B: 45 mm (1.77 in.)

   C: 60 mm (2.36 in.)

D: 22 mm (0.89 in.)

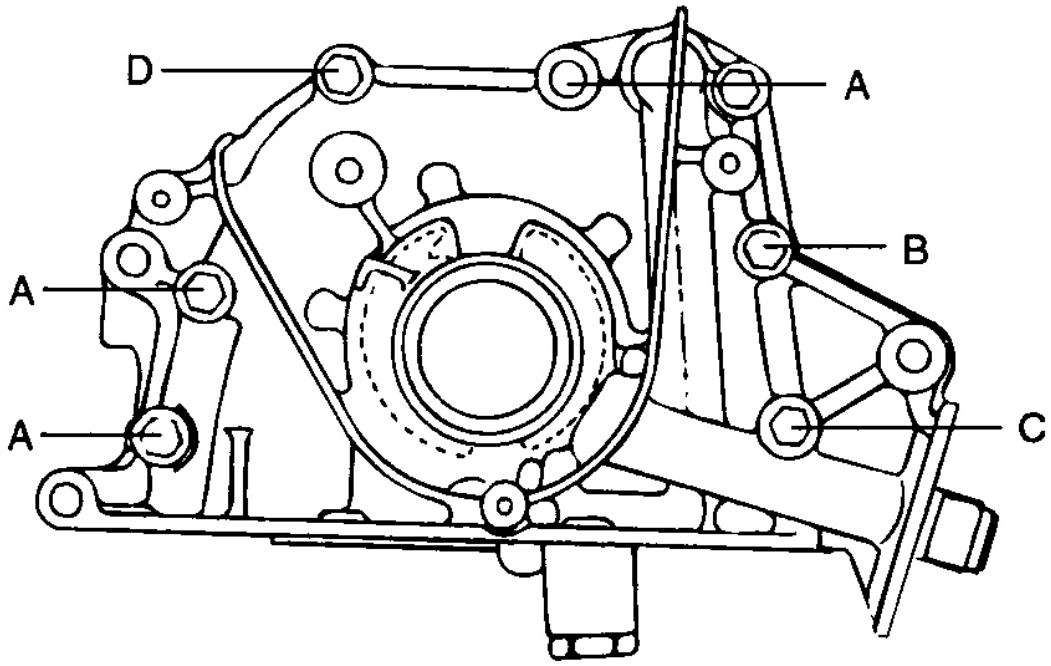


Fig. 159: Installing Front Case Assembly & Tightening Bolts To The Specified Torque
Courtesy of HYUNDAI MOTOR CO.

OIL SEAL

1. Using the special tool, Crankshaft oil seal guide (09231 - 22100), install the oil seal.
2. Using the special tool, Crankshaft front oil seal installer (09231-22000), install the oil seal.

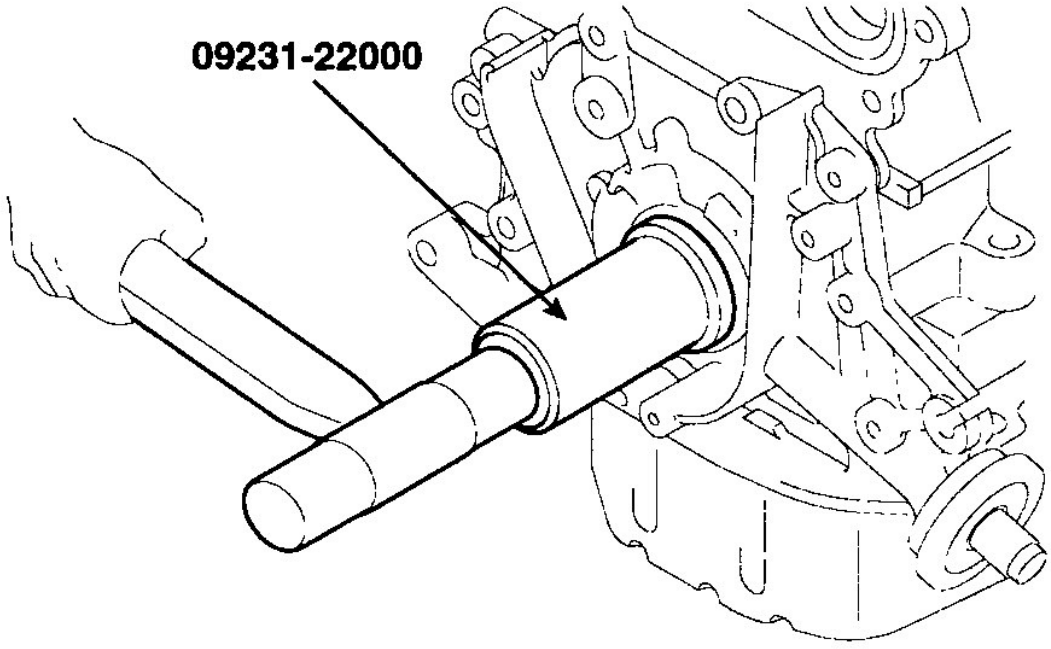


Fig. 160: Installing Crankshaft Front Oil Seal Using Special Tool
Courtesy of HYUNDAI MOTOR CO.

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

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

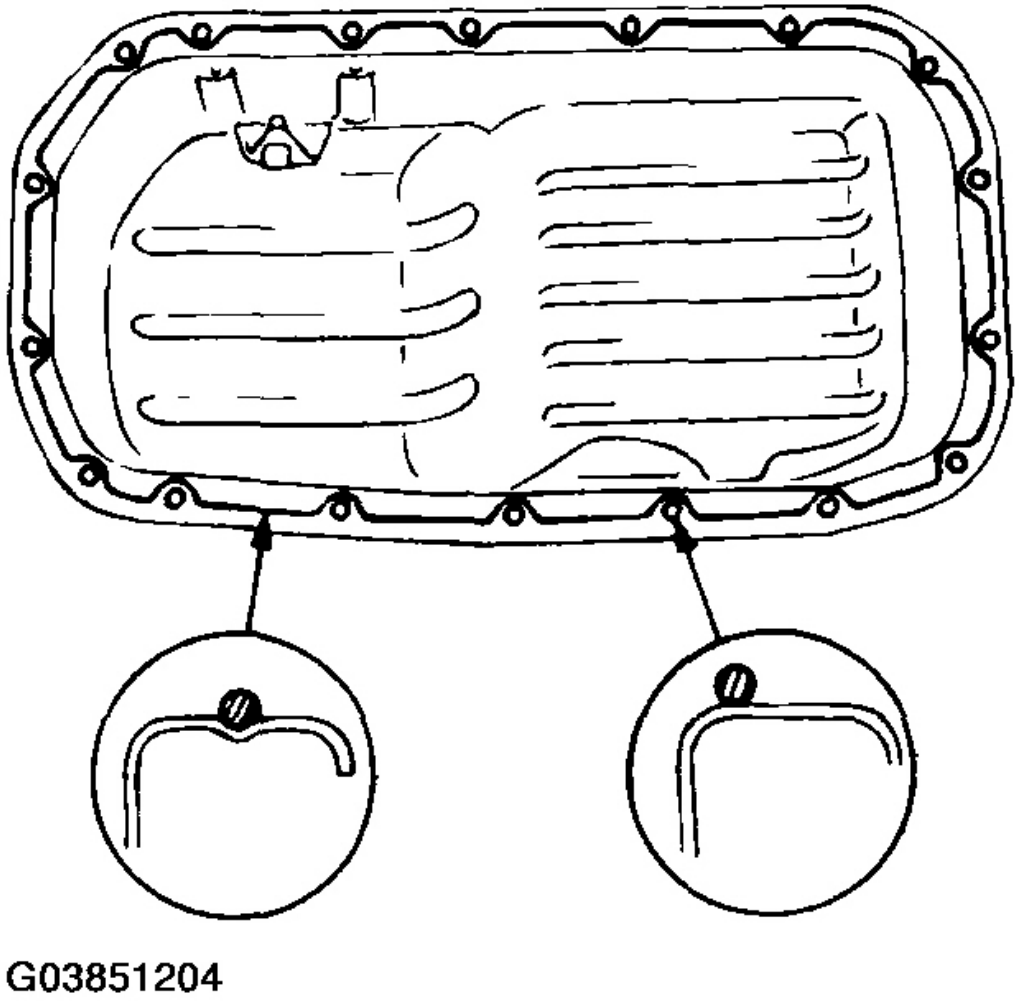


Fig. 161: Applying Sealant Into The Groove Of The Oil Pan Flange
Courtesy of HYUNDAI MOTOR CO.

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

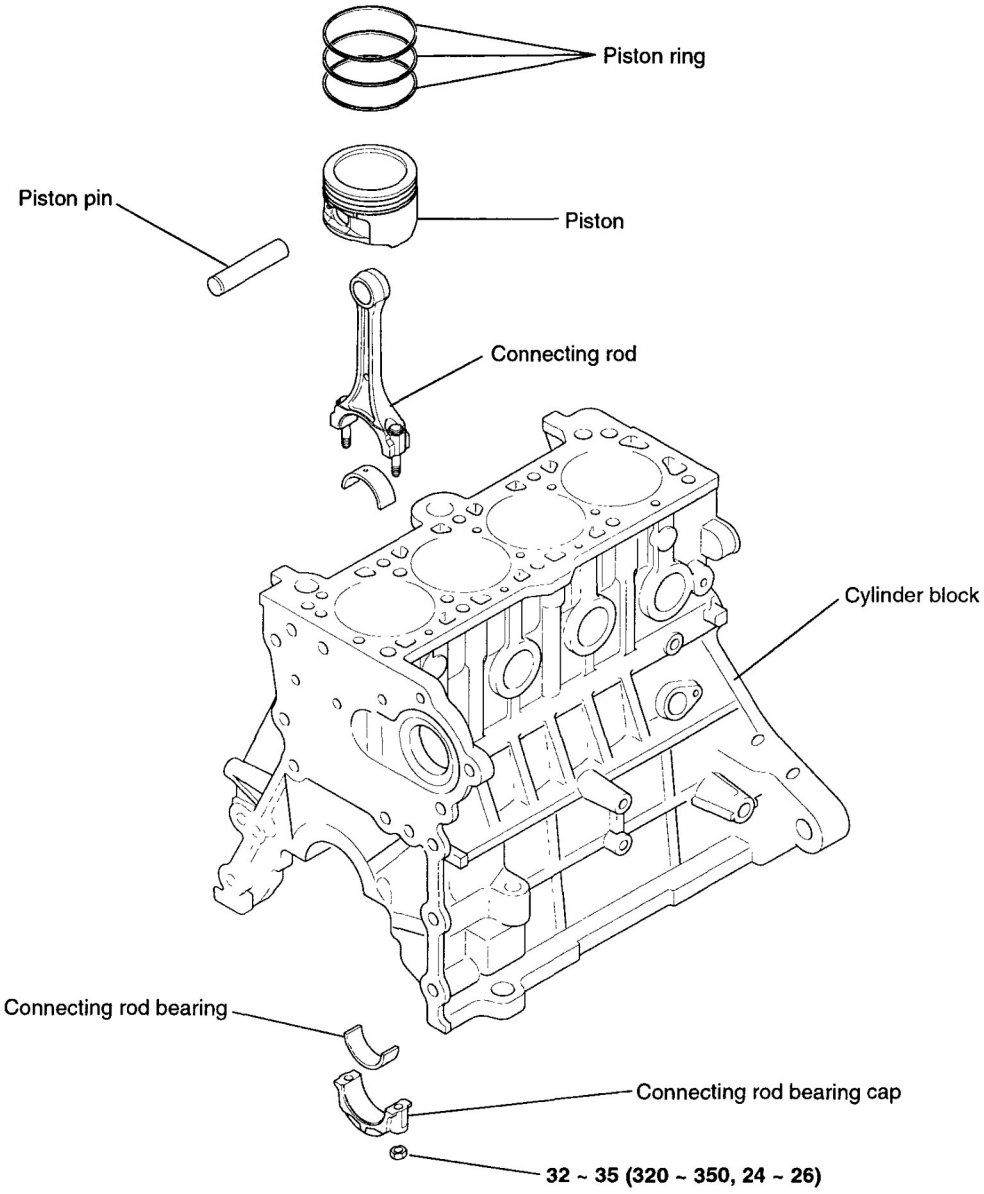
   Tightening torque

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

ENGINE BLOCK

ENGINE BLOCK

COMPONENTS



TORQUE : Nm (kgf.cm, lbf.ft)

G03851205

Fig. 162: Identifying Engine Block Components & Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Remove the timing belt, cylinder head, front case, flywheel, pistons and crankshaft.

2. Remove the oil pressure switch.

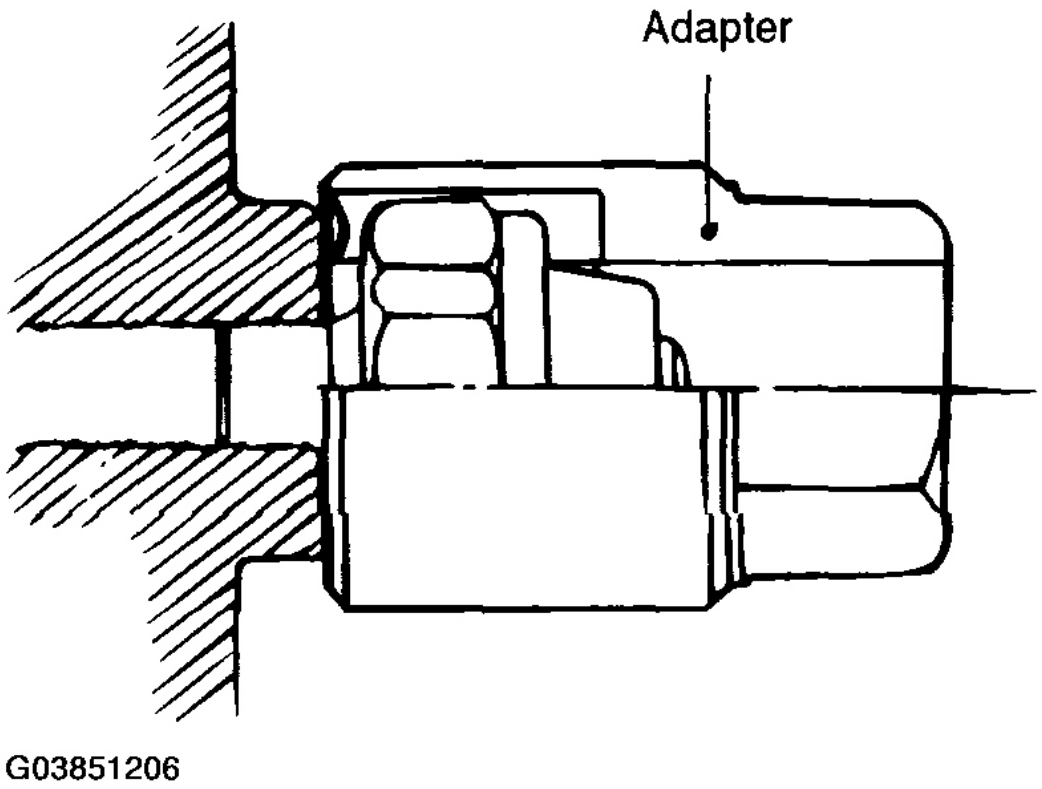


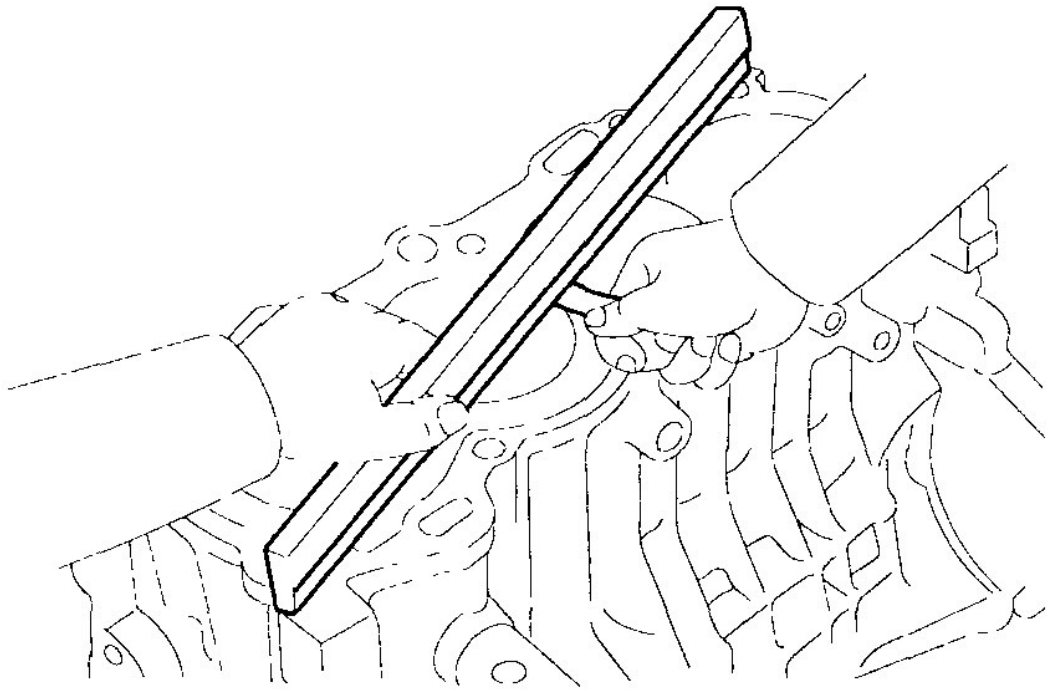
Fig. 163: Removing Oil Pressure Switch
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

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

   Standard: 0.03 mm (0.0012 in.) or less

   Limit: 0.06 mm (0.0024 in.) or less



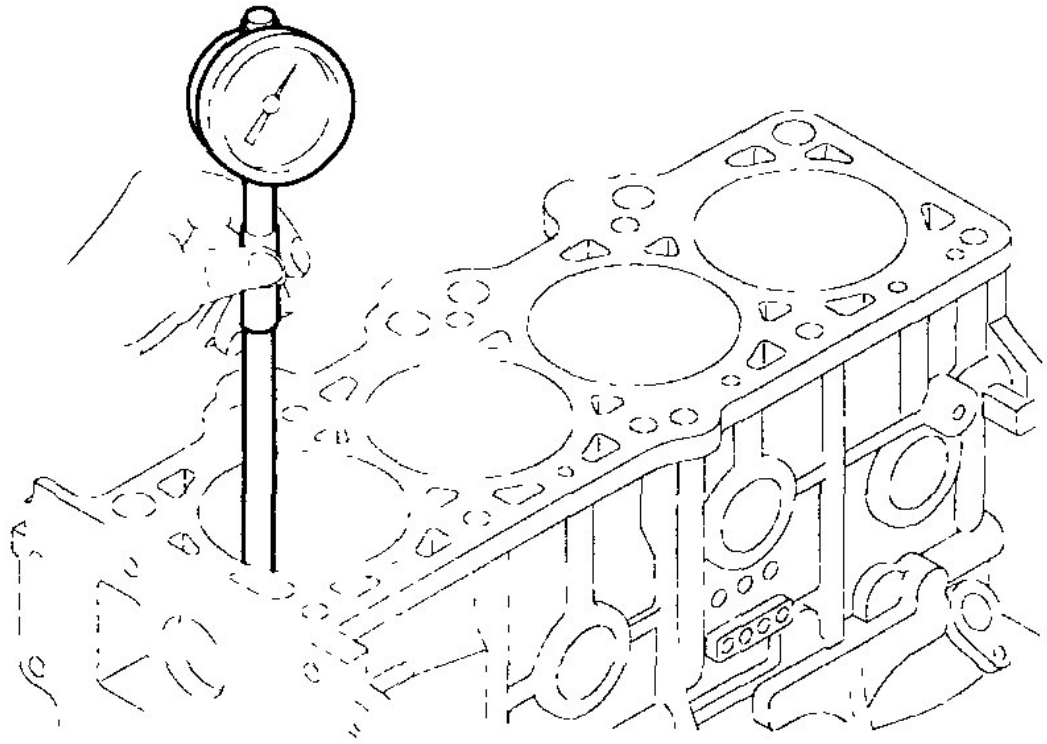
G03851207

Fig. 164: Checking Top Surface Of Block For Warpage Using A Straight Edge & Feeler Gauge
Courtesy of HYUNDAI MOTOR CO.

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

   Cylinder I.D: 76.5 ~ 76.53 mm (3.0118 ~ 3.0130 in.)

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



G03851208

Fig. 165: Measuring Cylinder Bore With A Cylinder Gauge
Courtesy of HYUNDAI MOTOR CO.

4. If a cylinder ridge exists, cut away with a ridge reamer.
5. Oversize pistons are available in four sizes.

Piston service size and mark mm (in.)

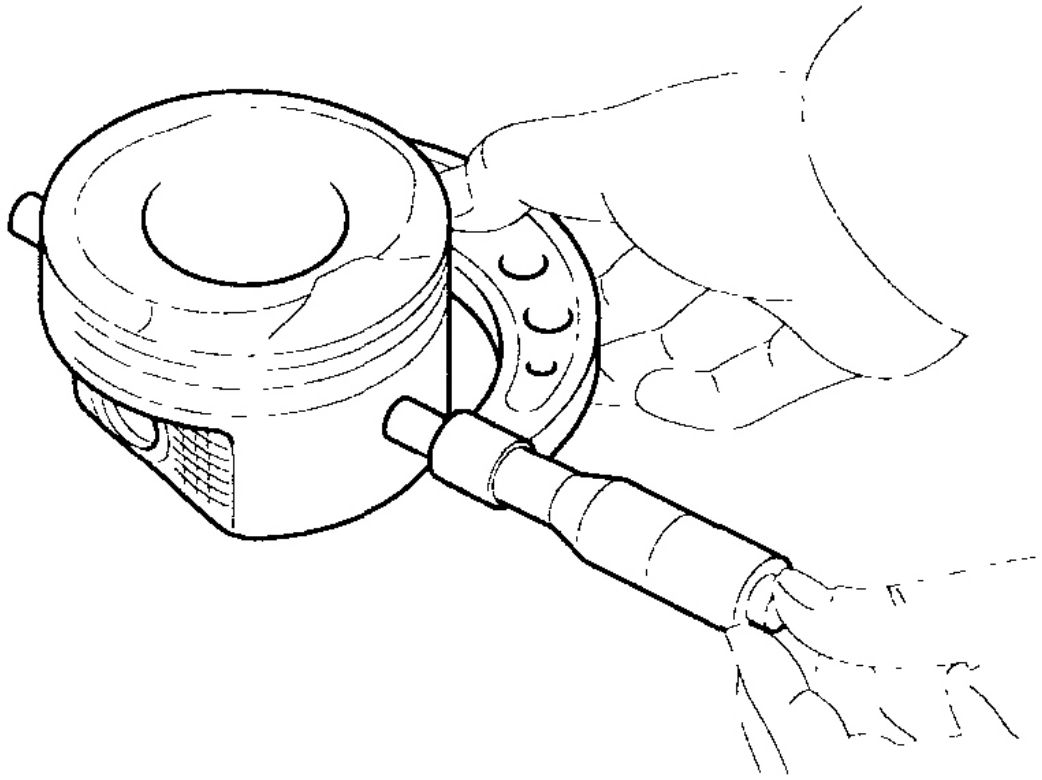
0.25 (0.010) O.S.: 0.25

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

The standard measurement of the piston's outside diameter is taken 39.35 mm (1.55 in.) from the top land of the piston.

Piston-to-cylinder clearance

0.025 ~ 0.045 mm (0.0010 ~ 0.0018 in.)



G03851209

Fig. 166: Measuring Piston Outside Diameter
Courtesy of HYUNDAI MOTOR CO.

ENGINE MOUNTS

COMPONENTS

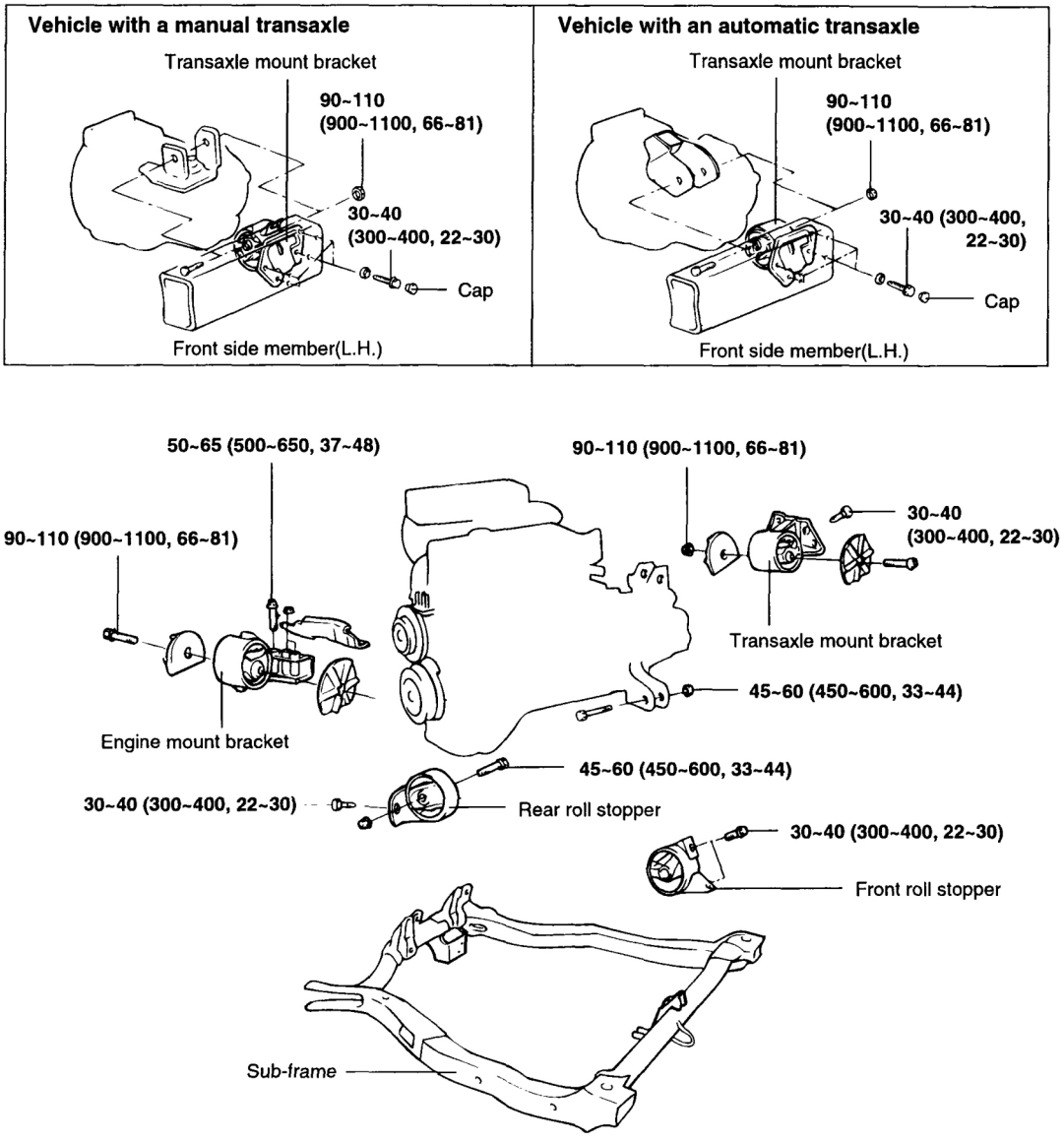
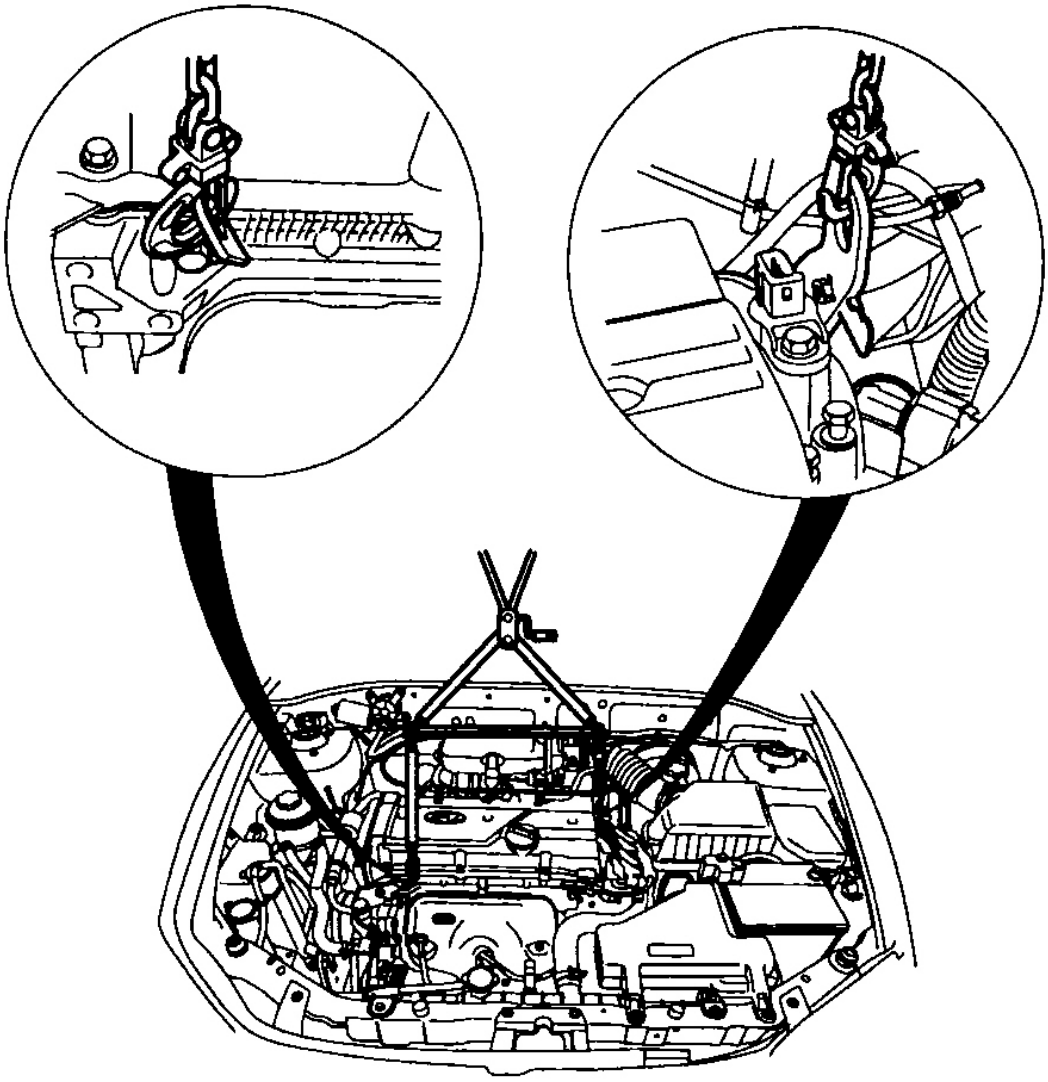


Fig. 167: Identifying Engine Mounts Components & Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

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



G03851211

Fig. 168: Attaching An Engine Hoist To Engine Hooks
Courtesy of HYUNDAI MOTOR CO.

ENGINE MOUNTING

Remove the engine mounting support bracket from the engine.

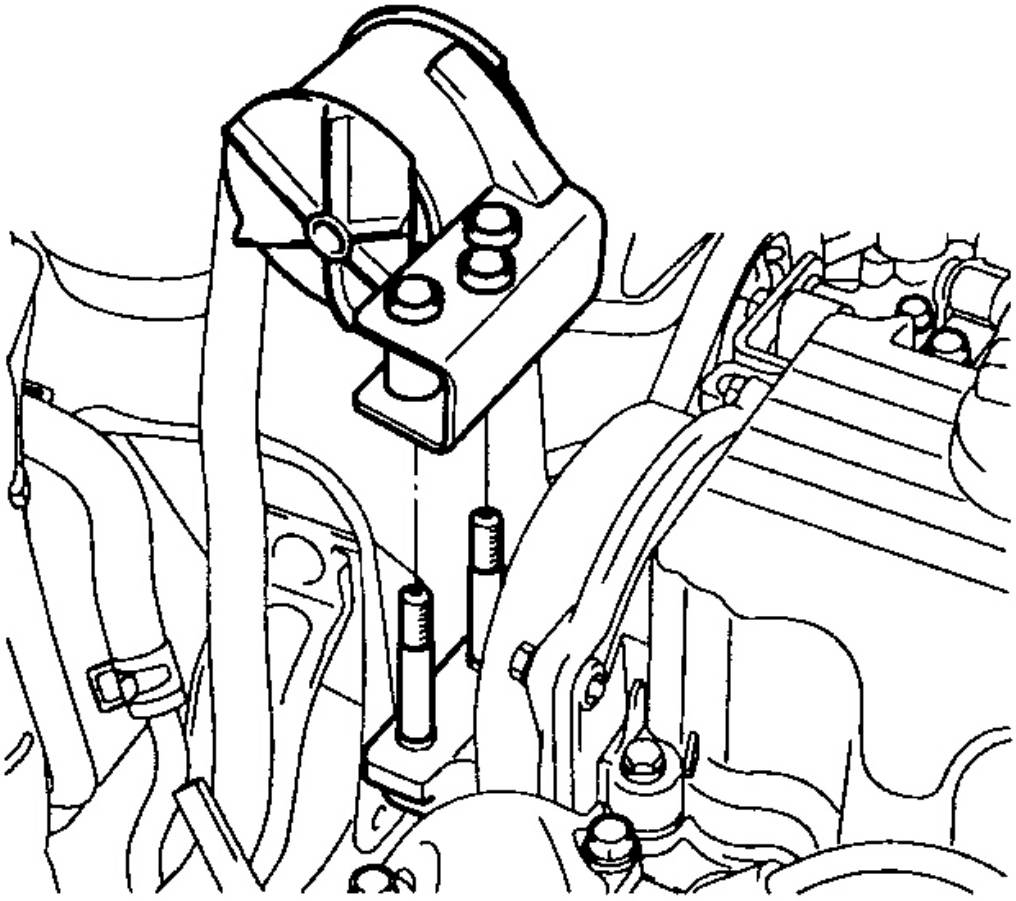
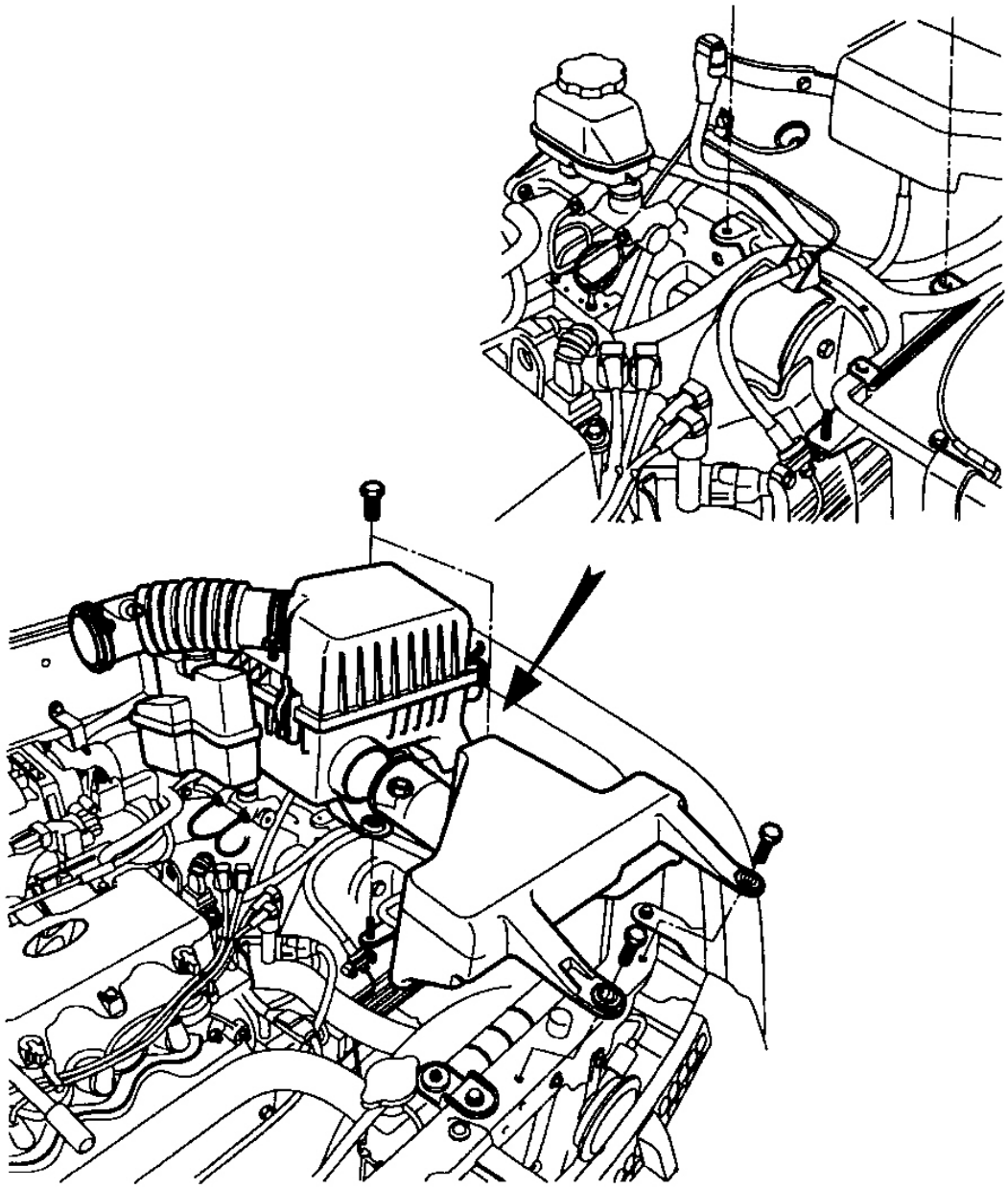


Fig. 169: Removing Engine Mounting Support Bracket
Courtesy of HYUNDAI MOTOR CO.

TRANSMISSION MOUNTING

1. Remove the air cleaner.



G03851213

Fig. 170: Removing Air Cleaner
Courtesy of HYUNDAI MOTOR CO.

2. Remove the transmission mounting bolt. (17 mm)

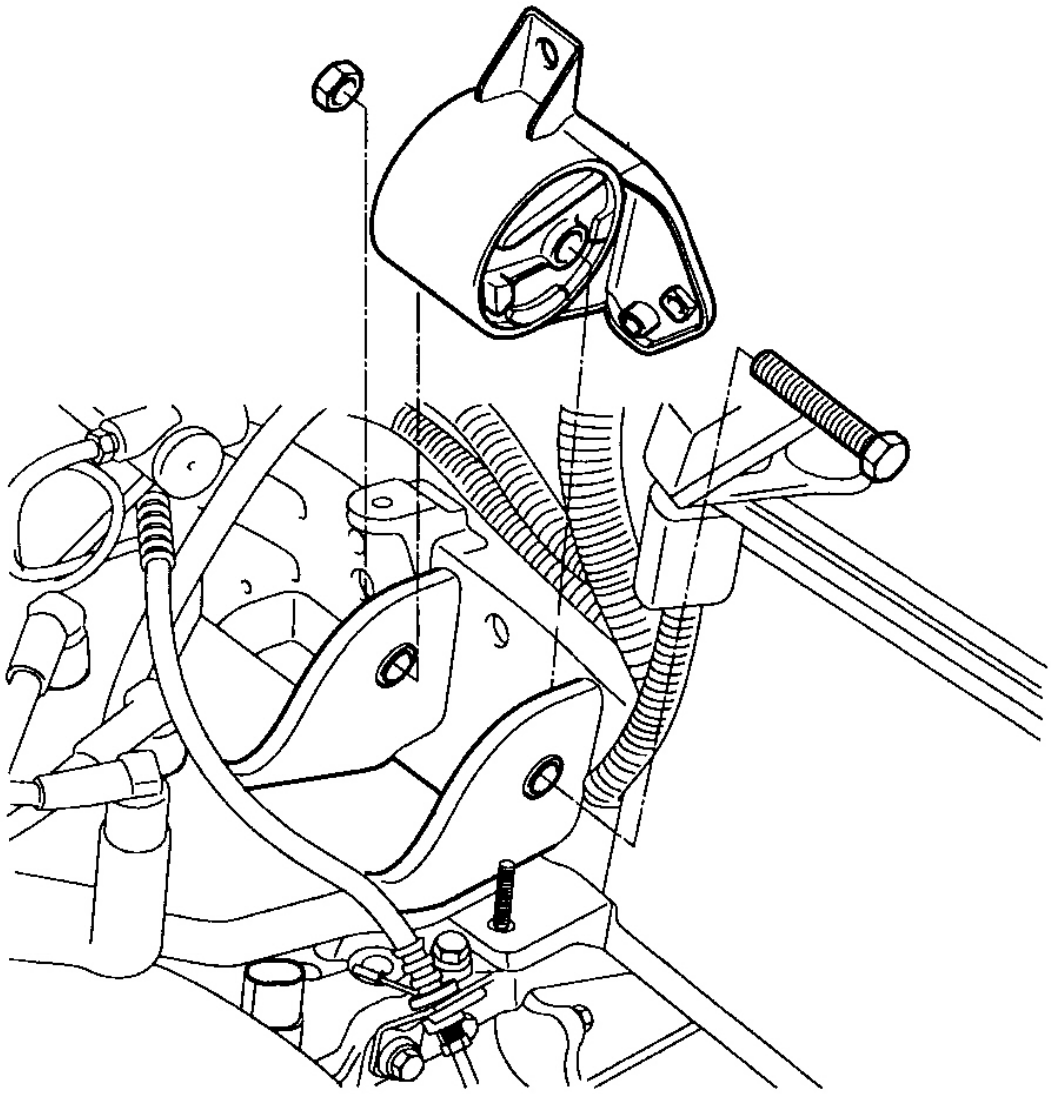
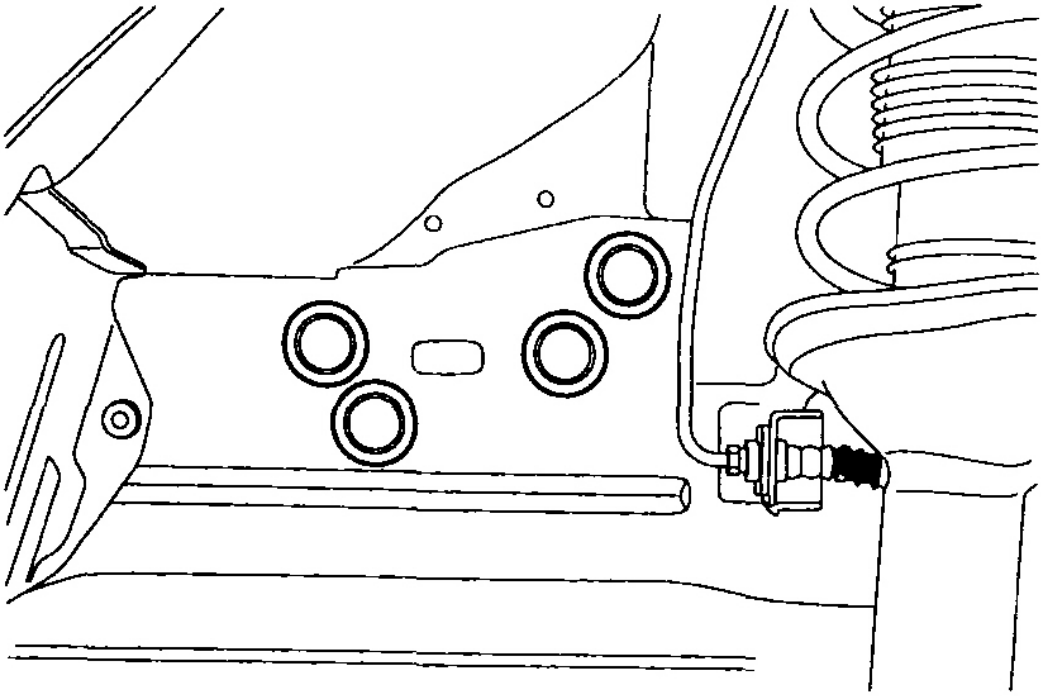


Fig. 171: Removing Transmission Mounting Bolt
Courtesy of HYUNDAI MOTOR CO.

3. Detach the cap from inside the right fender shield. Remove the transmission mounting bolts. (14 mm)



G03851215

Fig. 172: Removing Transmission Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

4. Remove the transmission bracket.

FRONT ROLL STOPPER BRACKET

Remove the roll rod bracket from the cross member.

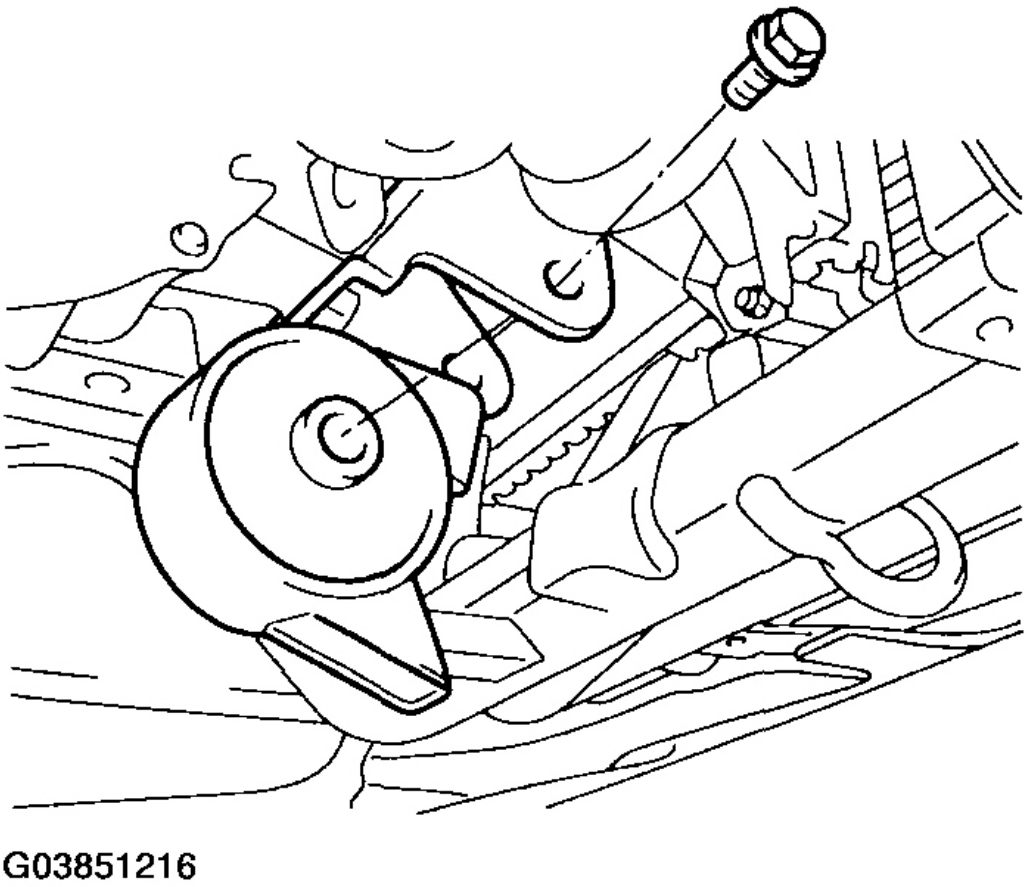
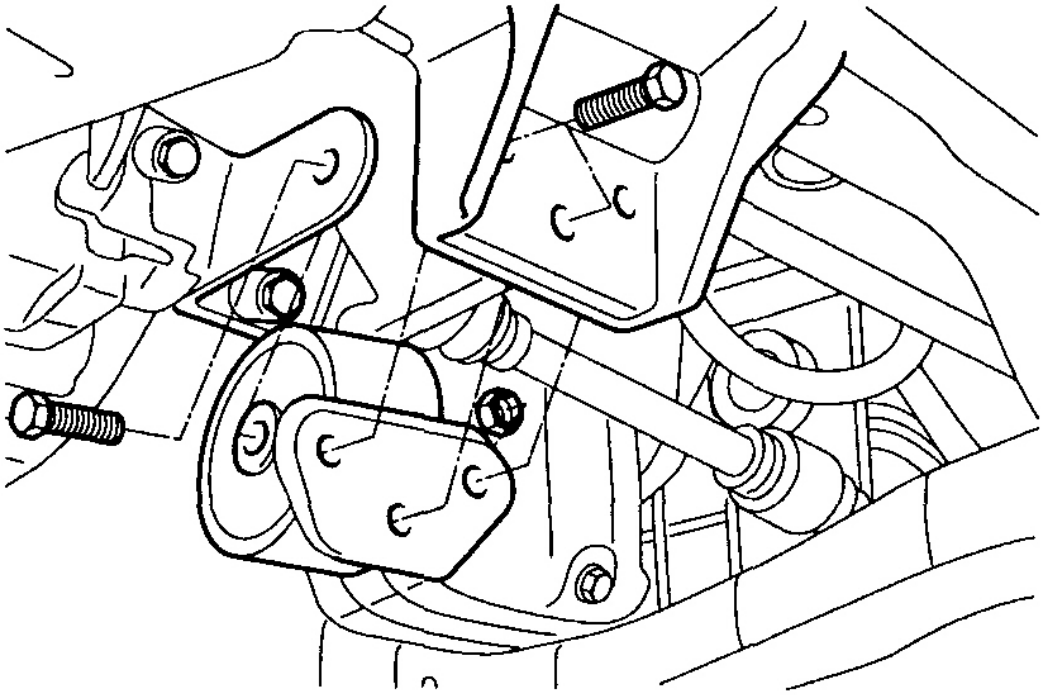


Fig. 173: Removing Roll Rod Bracket From Cross Member
Courtesy of HYUNDAI MOTOR CO.

REAR ROLL STOPPER BRACKET

Remove the rear roll stopper bracket from the sub frame.



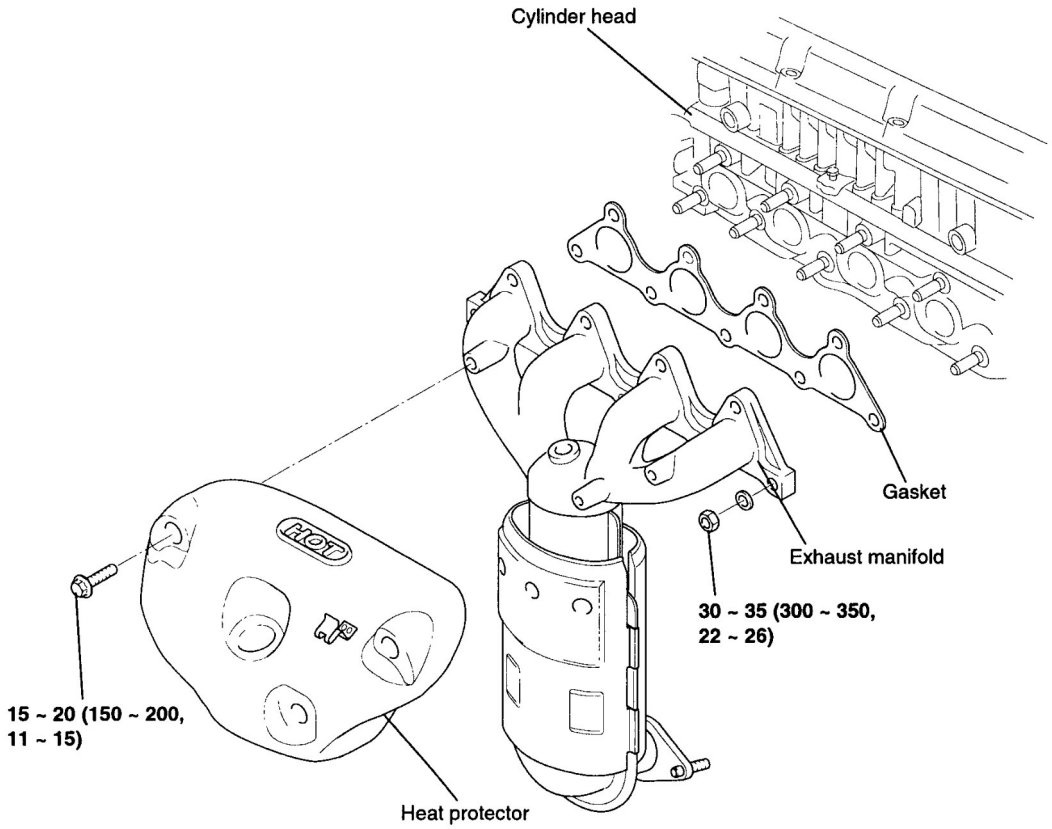
G03851217

Fig. 174: Removing Rear Roll Stopper Bracket From Sub Frame
Courtesy of HYUNDAI MOTOR CO.

INTAKE AND EXHAUST SYSTEM

EXHAUST MANIFOLD

COMPONENTS



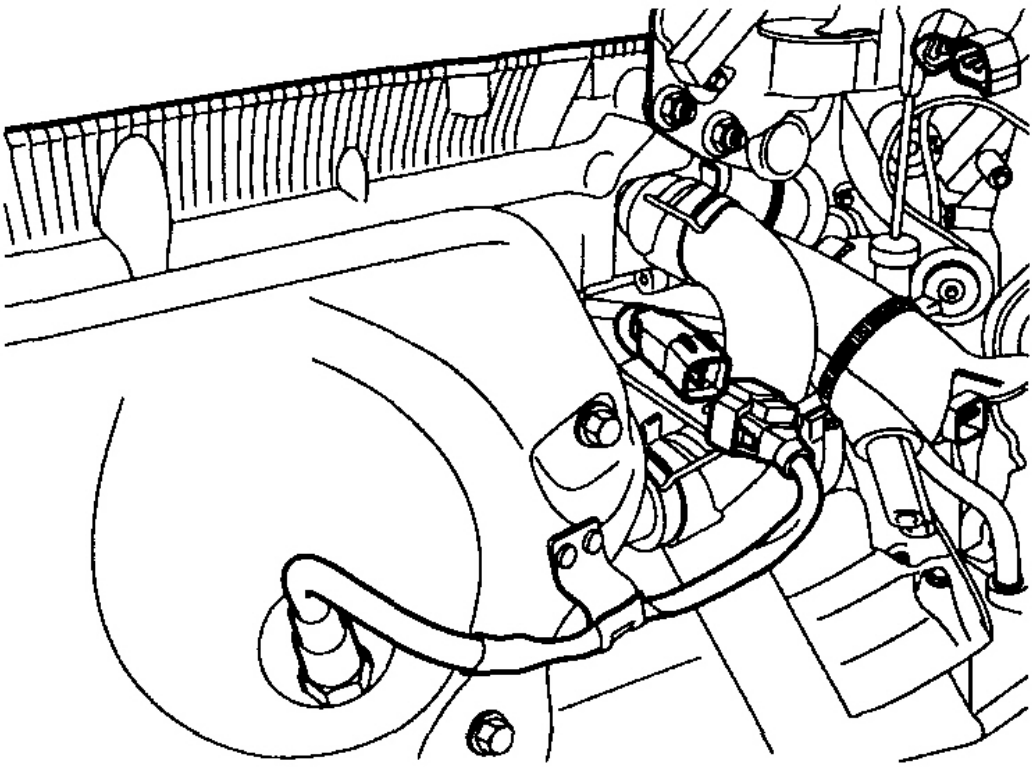
TORQUE : Nm (kgf.cm, lbf.ft)

G03851218

Fig. 175: Identifying Exhaust Manifold Components & Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Disconnect the oxygen sensor connect.



G03851219

Fig. 176: Disconnecting Oxygen Sensor Connect
Courtesy of HYUNDAI MOTOR CO.

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

INSPECTION

EXHAUST MANIFOLD

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

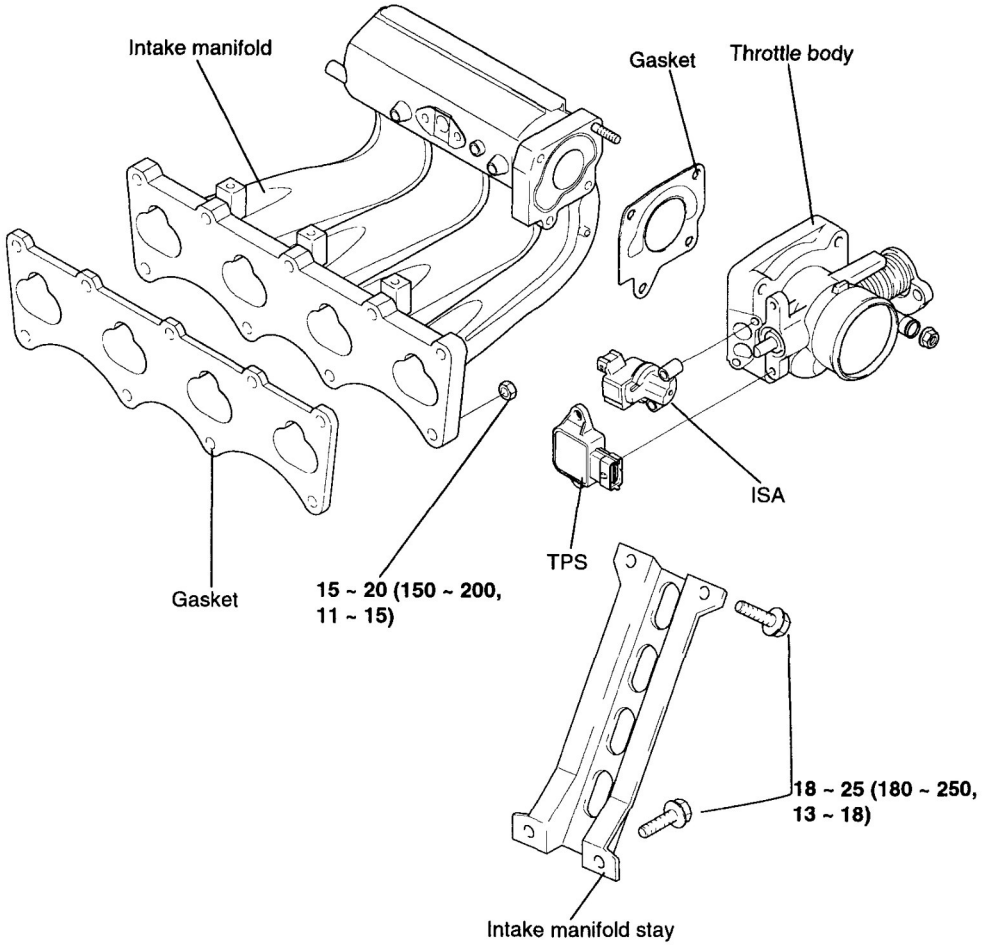
REASSEMBLY

Install the exhaust manifold in the reverse order of removal.

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

INTAKE MANIFOLD

COMPONENTS



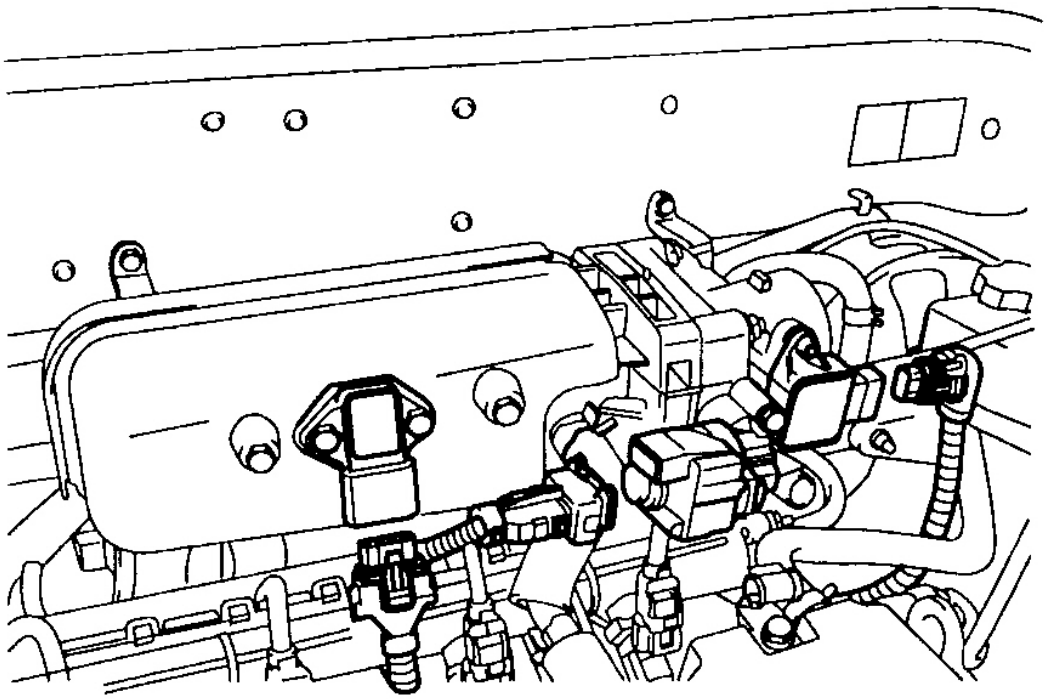
TORQUE : Nm (kg.cm, lb.ft)

G03851220

Fig. 177: Identifying Intake Manifold Components Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

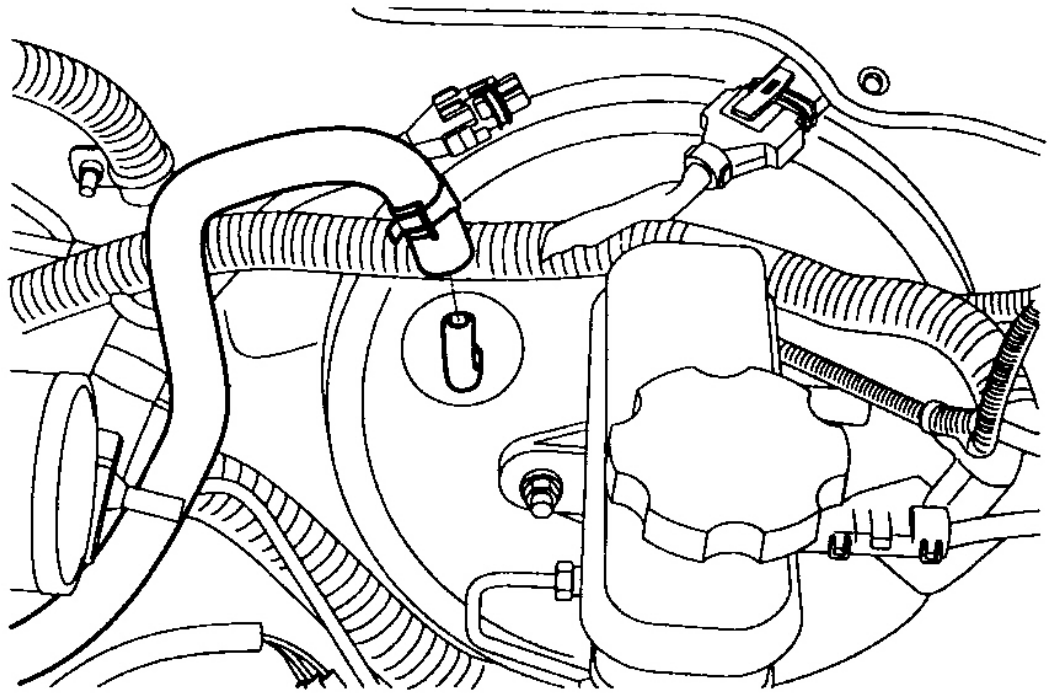
1. Disconnect the MAP, ISA and TPS connect.



G03851221

Fig. 178: Disconnecting MAP, ISA & TPS Connect
Courtesy of HYUNDAI MOTOR CO.

2. Remove the intake air hose connected to the throttle body.
3. Remove the accelerator cable.
4. Remove the PCV hose and brake booster vacuum hoses.



G03851222

Fig. 179: Removing PCV Hose & Brake Booster Vacuum Hoses
Courtesy of HYUNDAI MOTOR CO.

5. Disconnect the coolant hose connections front the throttle body.

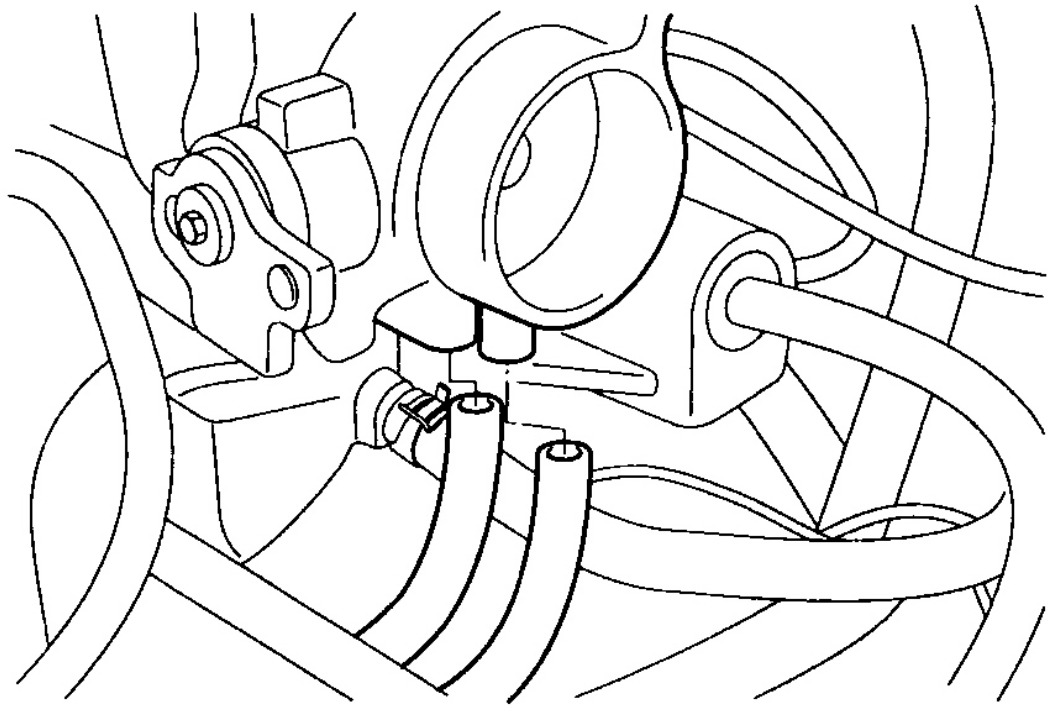
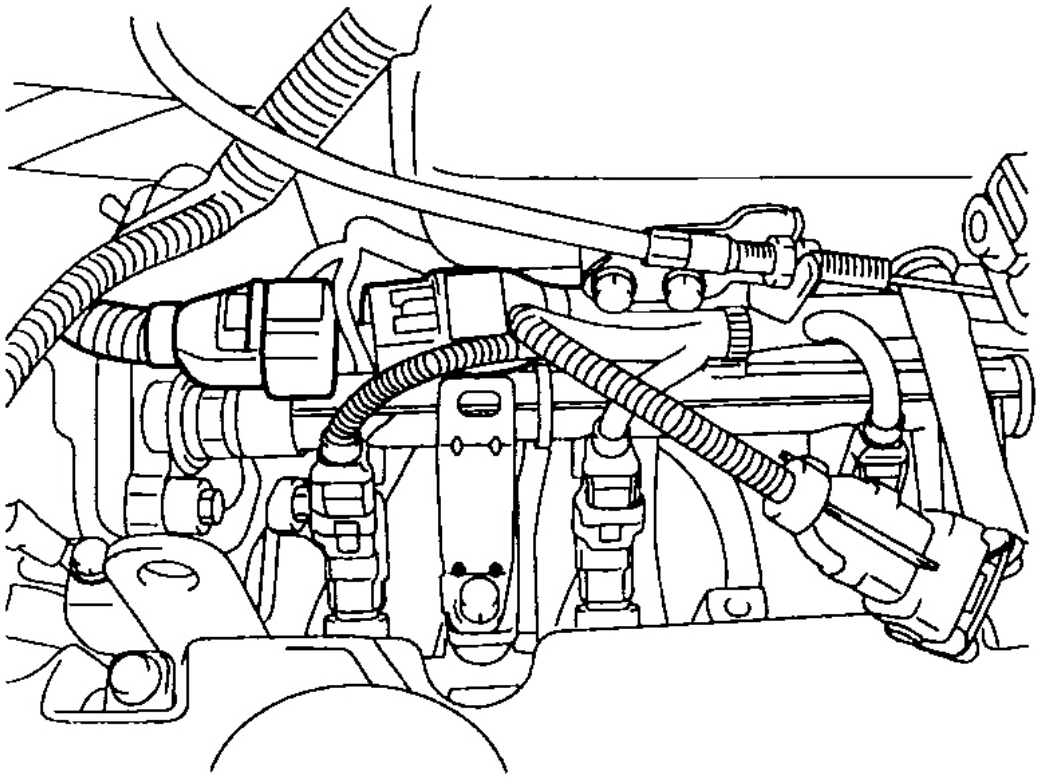


Fig. 180: Disconnecting Coolant Hose Connections Front Throttle Body
Courtesy of HYUNDAI MOTOR CO.

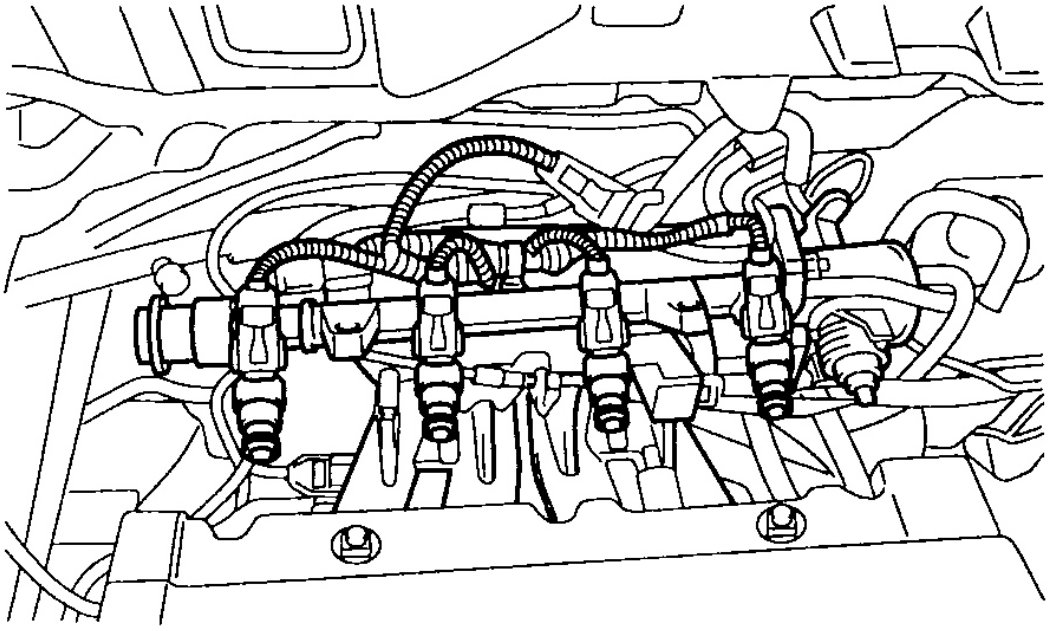
6. Disconnect the fuel injector harness connector.



G03851224

Fig. 181: Disconnecting Fuel Injector Harness Connector
Courtesy of HYUNDAI MOTOR CO.

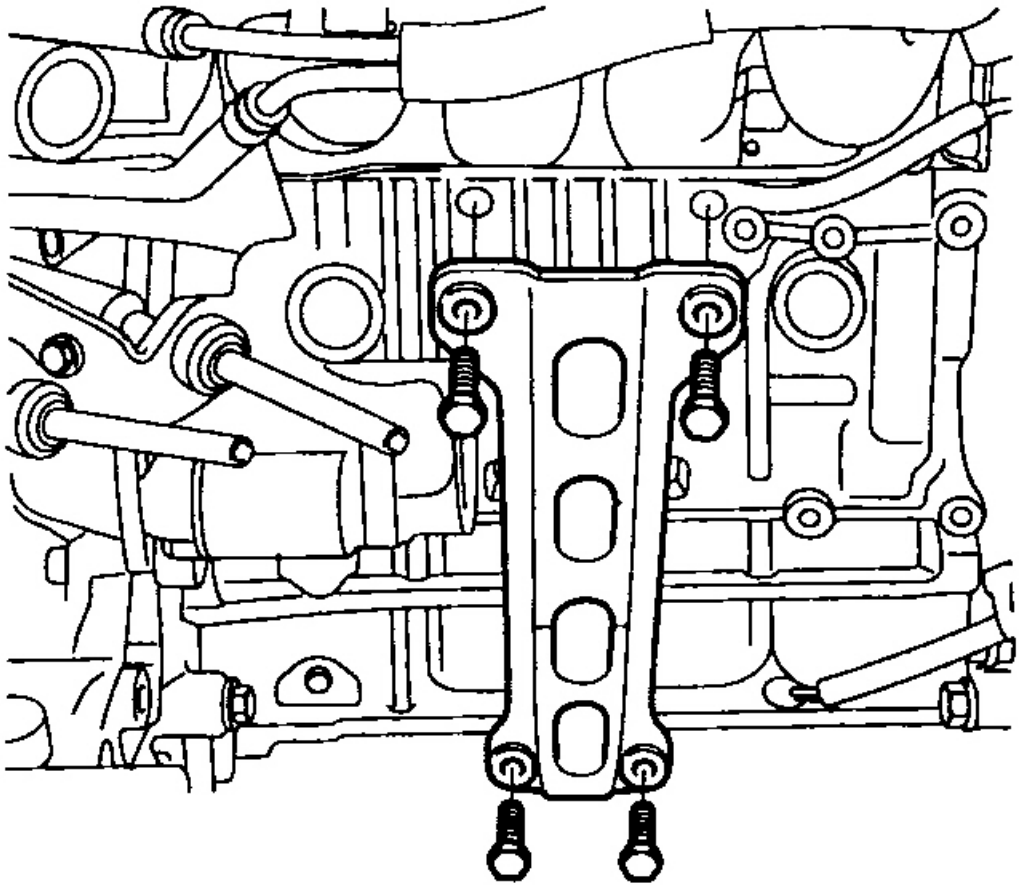
7. Remove the delivery pipe with the fuel injectors.



G03851225

Fig. 182: Removing Delivery Pipe With Fuel Injectors
Courtesy of HYUNDAI MOTOR CO.

8. Remove the intake manifold stay.



G03851226

Fig. 183: Removing Intake Manifold Stay
Courtesy of HYUNDAI MOTOR CO.

9. Remove the intake manifold.
10. Remove the intake manifold assembly and gasket.

INSPECTION

INTAKE MANIFOLD

Check the parts for damage or cracking.

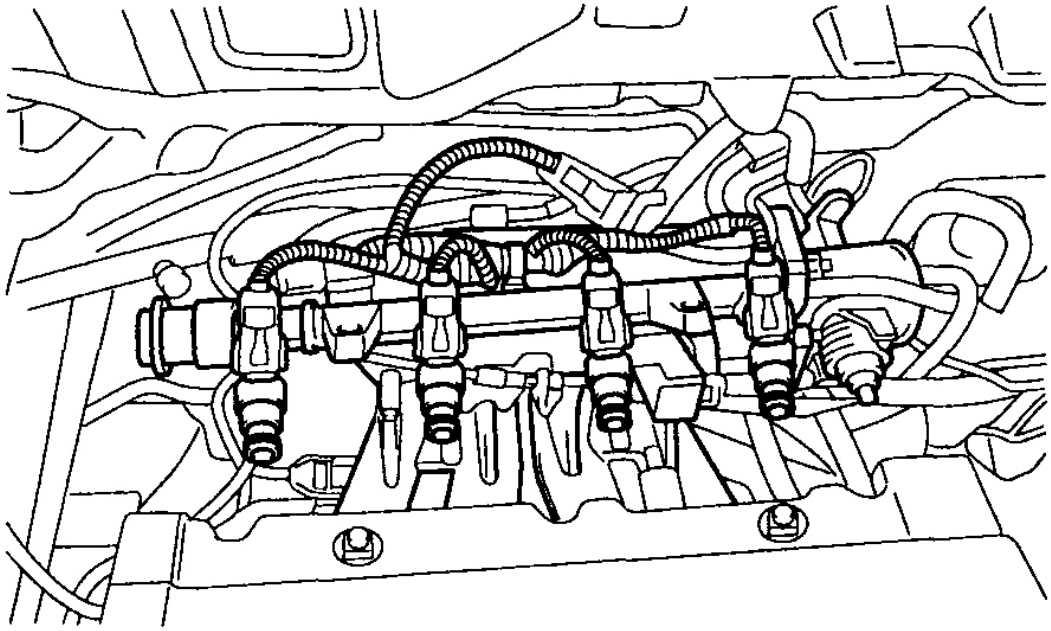
AIR HOSE

Check for damage or cracking of any part.

INSTALLATION

1. Replace the intake manifold gasket and install the intake manifold.
2. Install the intake manifold stay.
3. Install the delivery pipe with the fuel injectors.

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



G03851227

Fig. 184: Installing Delivery Pipe With Fuel Injectors
Courtesy of HYUNDAI MOTOR CO.

4. Connect the fuel injector harness connector.
5. Install the PCV hose and brake booster vacuum hose.
6. Install the intake air hose to the throttle body.
7. Install the accelerator cable.
8. Connect the ISA and TPS wire harness connector.

MUFFLER

COMPONENTS

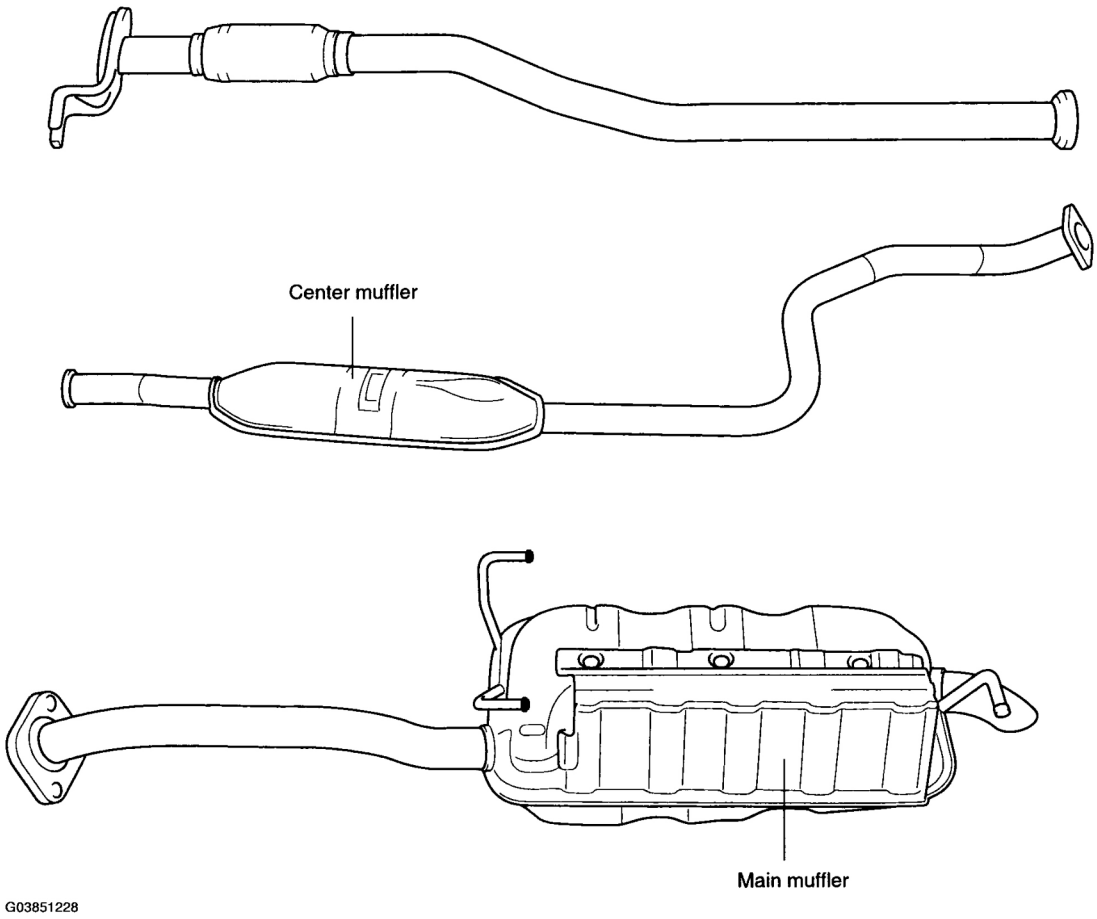


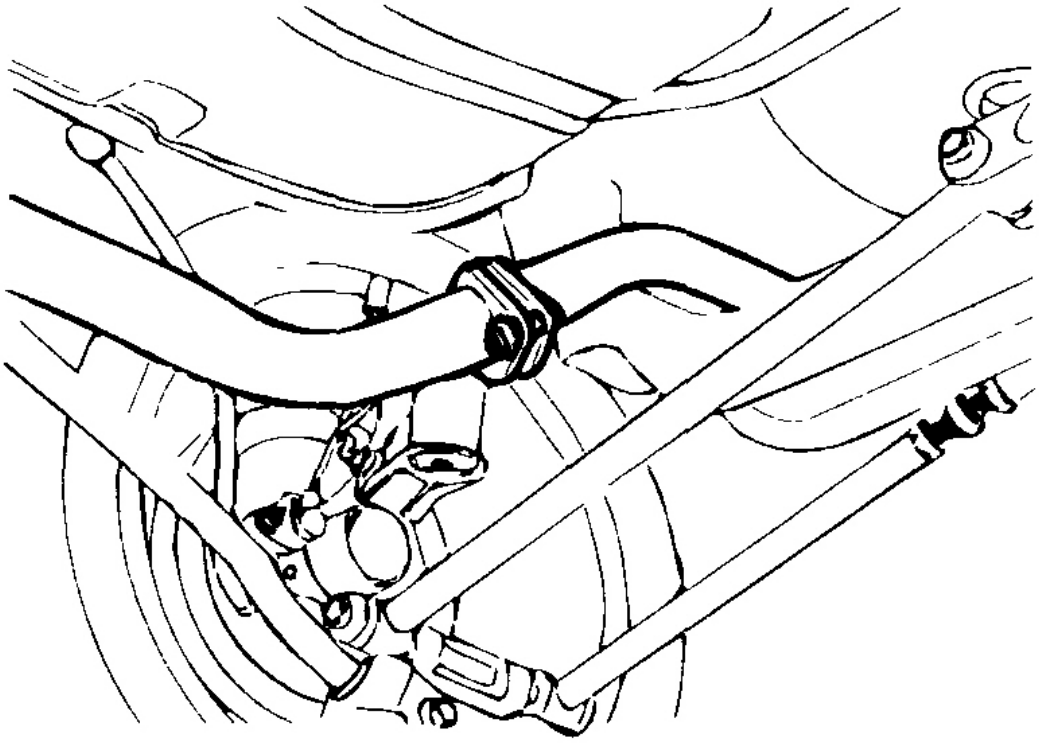
Fig. 185: Identifying Muffler Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

REAR MUFFLER

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

1. Disconnect the rear muffler from the center muffler.
2. Remove the rubber hangers and remove the rear muffler.

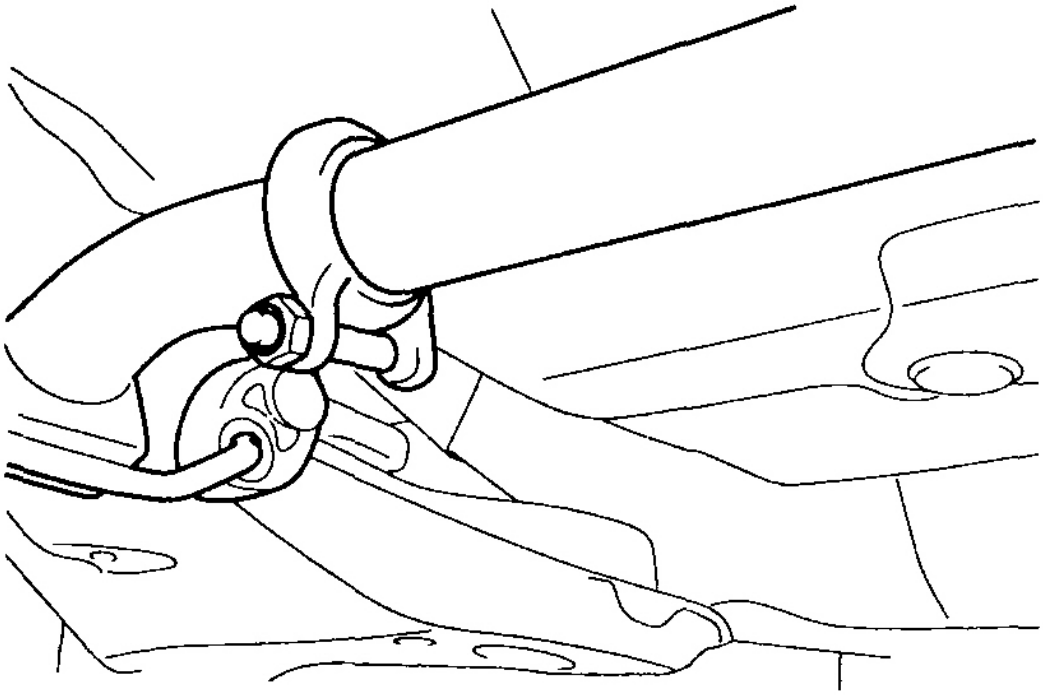


G03851229

Fig. 186: Removing Rear Muffler
Courtesy of HYUNDAI MOTOR CO.

CENTER MUFFLER

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



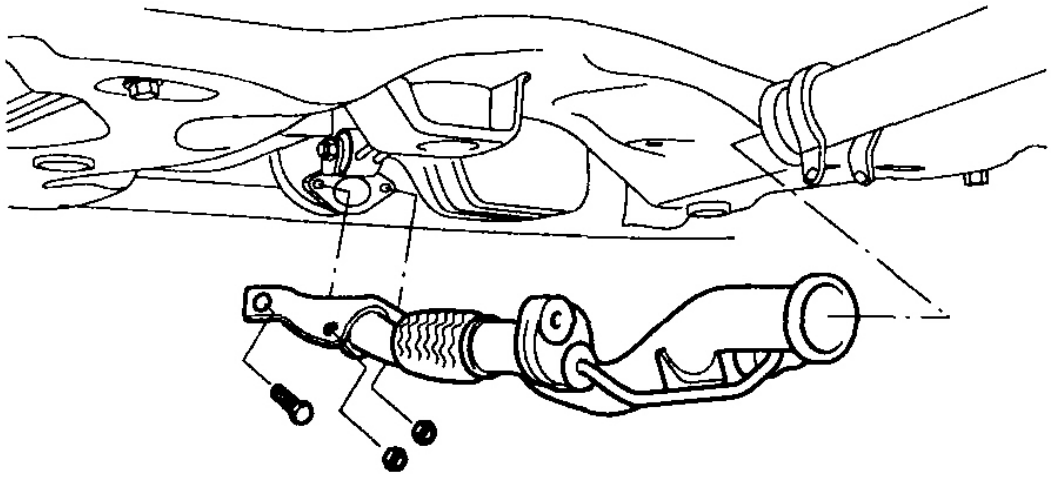
G03851230

Fig. 187: Removing Center Muffler Assembly From Rear Muffler & Front Exhaust Pipe
Courtesy of HYUNDAI MOTOR CO.

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

FRONT EXHAUST PIPE

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



G03851231

Fig. 188: Removing Front Exhaust Pipe & Center Muffler Bolt
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

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

AIR CLEANER (ACL)

COMPONENTS

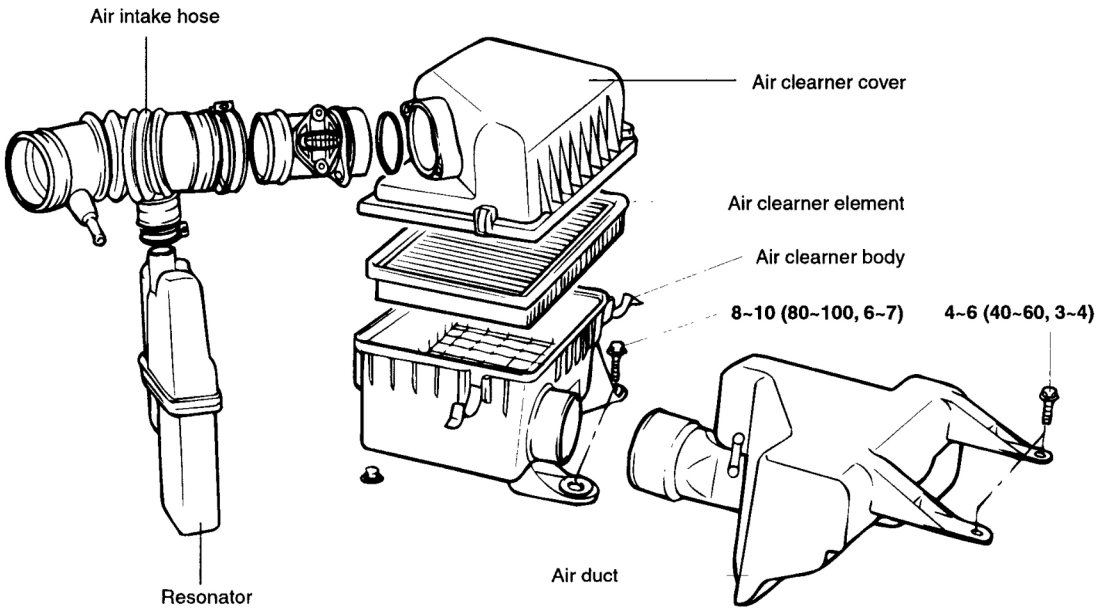
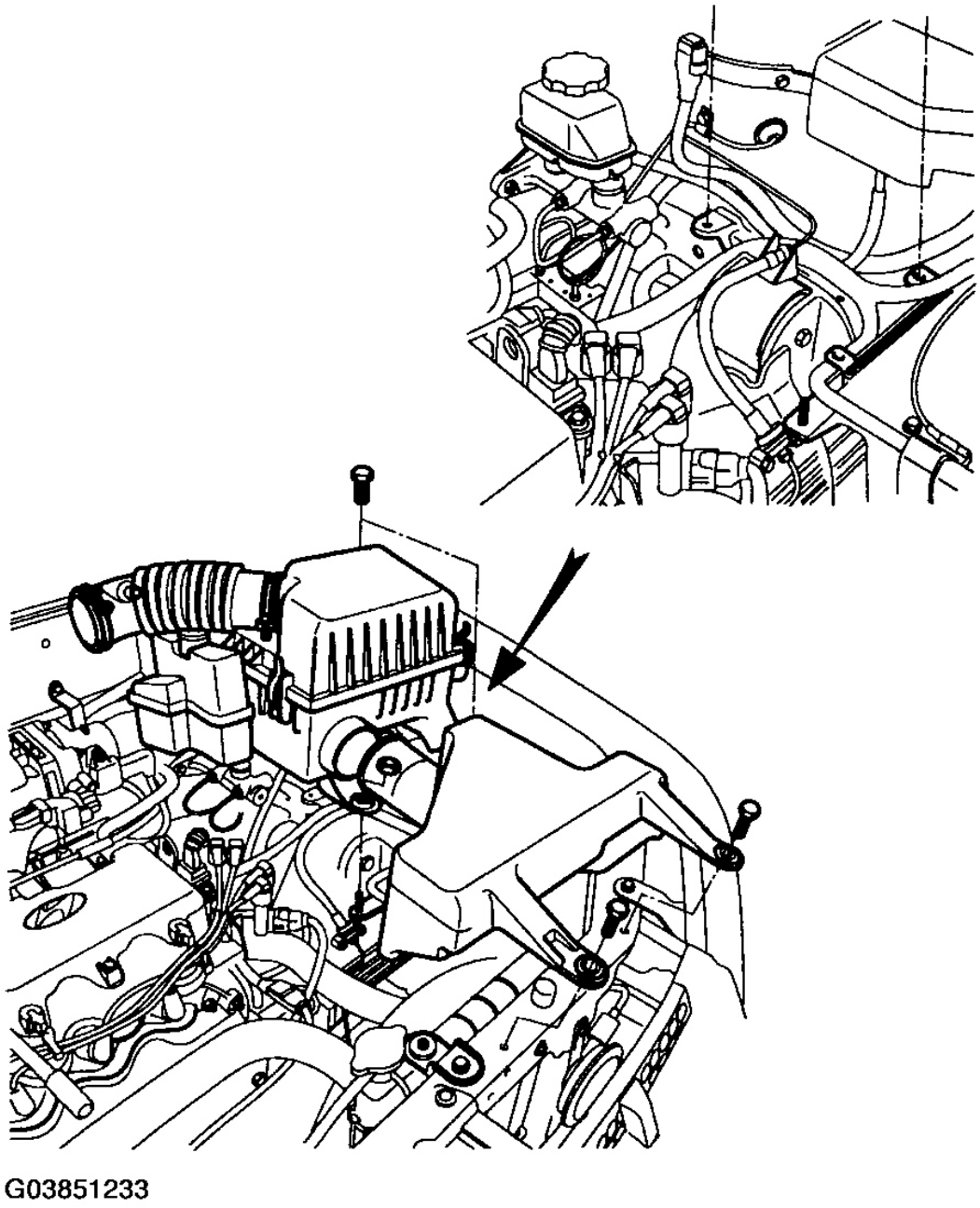


Fig. 189: Exploded View Of Air Cleaner (ACL) & Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

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



G03851233

Fig. 190: Removing Air Cleaner Mounting Bolts & Removing Air Cleaner
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

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

3. Check the resonator for distortion or damage.

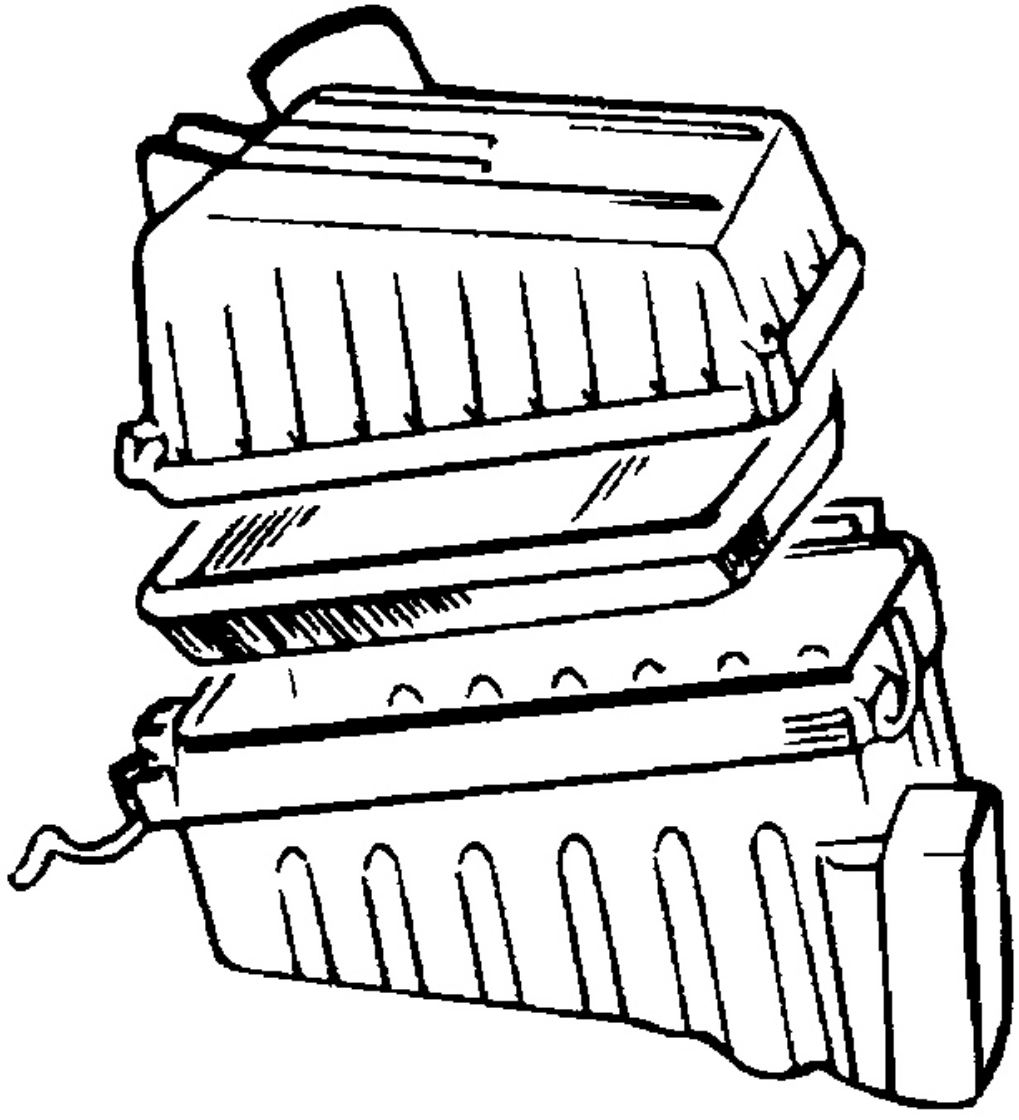
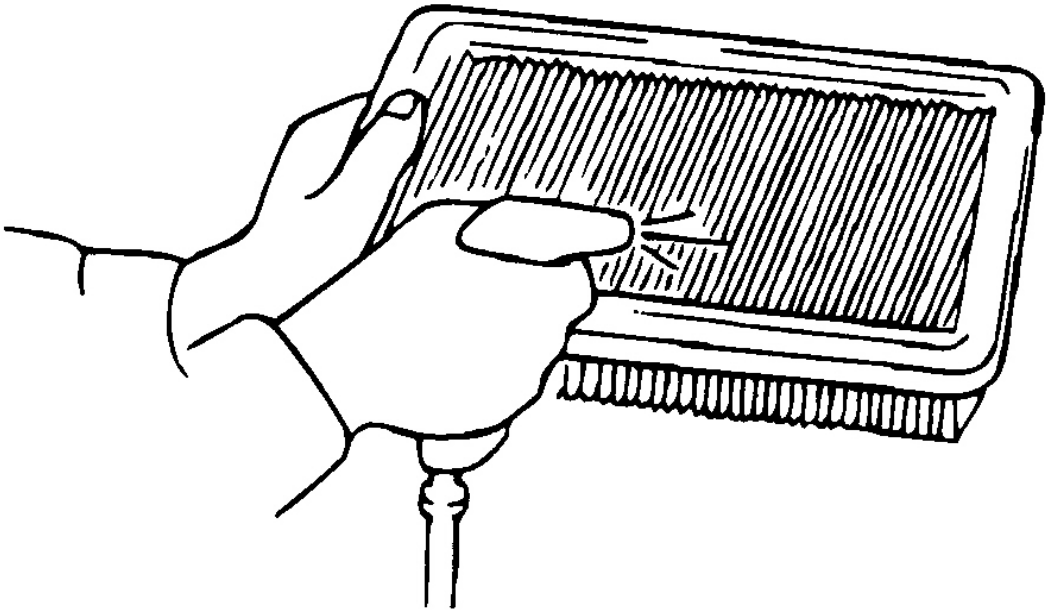


Fig. 191: Checking Air Cleaner Body, Cover, Or Filter For Distortion, Corrosion Or Damage
Courtesy of HYUNDAI MOTOR CO.

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



G03851235

Fig. 192: Removing Dust & Other Contaminants By Blowing Compressed Air
Courtesy of HYUNDAI MOTOR CO.

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

INSTALLATION

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

