2005 ENGINE

Engine Mechanical System (G4GC-GSL 2.0L) - Tiburon

SPECIFICATIONS

ENGINE GENERAL SPECIFICATIONS (G4GC - GSL 2.0L)

Description	Specifications	Limit
General		
Type	In-line, Double Overhead Camshaft	
Number of cylinder	4	
Bore	82mm (3.228in)	
Stroke	93.5mm (3.681 in.)	
Total displacement	1975cc (120.52cu.in.)	
Compression ratio	10.1	
Firing order	1-3-4-2	
Valve timing		
Intake valve		
Opens (ATDC)	11°	
Closes (ABDC)	59°	
Exhaust		
Opens (BBDC)	42°	
Closes (ATDC)	6°	
Valve		
Valve length		
Intake	114.34mm (4.5016in.)	
Exhaust	116.8mm (4.598in.)	
Stem O.D.		
Intake	5.965 ~ 5.98mm (0.2348 ~ 0.2354in.)	
Exhaust	5.950 ~ 5.965mm (0.2343 ~ 0.2348in.)	
Face angle thickness of valve head (Margin)		
Intake	1.15mm (0.0452in.)	0.8mm (0.031 in.)
Exhaust	1.35mm (0.0531 in.)	1.0mm (0.039in.)
Valve stem to valve guide clearance		
Intake	0.02 ~ 0.05mm (0.0008 ~ 0.0019in.)	0.10mm (0.0039in.)
Exhaust	0.035 ~ 0.065mm (0.0014 ~ 0.0026in.)	0.13mm (0.0051 in.)

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Valve guide		
Installed dimension O.D		
Intake	46mm (1.811 in.)	
Exhaust	54.5mm (2.146in.)	
Service oversize	0.05, 0.25, 0.50mm	
	(0.002, 0.010, 0.020in.) oversize	
Valve seat		
Width of seat contact		
Intake	1.1 ~ 1.5mm (0.043 ~ 0.059in.)	
Exhaust	1.3 ~ 1.7mm (0.051 ~ 0.066in.)	
Seat angle	45°	
Oversize	0.3, 0.6mm (0.012, 0.024in.) oversize	
Valve spring		
Free length	48.86mm (1.9236in.)	
Load	18.8kg/39mm (41.45lb/1.535in.)	
Installed height	39mm (1.5354in.)	
Squareness	1.5° MAX.	
Valve clearance		
Cold (20°C[68°F])		
Intake	0.20mm (0.0079in.)	0.12 ~ 0.28mm (0.0047-0.0110 in.)
Exhaust	0.28mm (0.0110 in,)	0.20 ~ 0.38mm (0.0079 ~ 0.0150in.)
Cylinder head		
Flatness of gasket surface	Max. 0.03mm (0.0012in.)	0.06mm (0.0024in.)
Flatness of manifold mounting surface	Max. 0.15mm (0.0059in.)	0.03mm (0.0012in.)
Oversize rework dimensions of		
Valve seat hole		
Intake		
0.3mm (0.012in.) O.S.	33.300 ~ 33.325mm (1.3110 ~ 1.3120in.)	
0.6mm (0.024in.) O.S.	33.600 ~ 33.625mm (1.3228 ~ 1.3238in.)	
Exhaust		
0.3mm (0.012in.) O.S.	28.800 ~ 28.821mm (1.1338 ~ 1.1346in.)	
0.6mm (0.024in.) O.S.	29.100 ~ 29.121mm (1.1456 ~ 1.1465in.)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)		

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0.05mm (0.002in.) O.S	11.05 ~ 11.068mm (0.435 ~ 0.4357in.)	
0.25mm (0.010 in.) O.S	11.25 ~ 11.268mm (0.443 ~ 0.4436in.)	
0.50mm (0.020in.) O.S	11.50 ~ 11.518mm (0.453 ~ 0.4535in.)	
Cylinder block		
Cylinder bore	82.00 ~ 82.03mm (3.2283 ~ 3.2295in.)	
Out-of-round and taper of cylinder bore	Less than 0.01 mm (0.0004in.)	
Clearance with piston (To set limits to new parts)	0.02 ~ 0.04mm (0.0008 ~ 0.0016in.)	
Piston		
O.D (To set limits to new parts)	81.97 ~ 82.00mm (3.2271 ~ 3.2283in.)	
Service oversize	0.25, 0.50mm (0.010, 0.020in.) oversize	
Piston ring		
Side clearance		
No.1	0.04 ~ 0.08mm (0.0015 ~ 0.0031 in.)	0.1mm (0.004in.)
No.2	0.03 ~ 0.07mm (0.0012 ~ 0.0027in.)	
End gap		
No.1	0.23 ~ 0.38mm (0.0090 ~ 0.0149in.)	1mm (0.039in.)
No.2	0.45 ~ 0.60mm (0.0177 ~ 0.0236in.)	1mm (0.039in.)
Oil ring side rail	0.20 ~ 0.60mm (0.0078 ~ 0.0236in.)	1mm (0.039in.)
Service oversize	0.25, 0.50mm (0.010, 0.020in.) oversize	
Connecting rod		
Bend	0.05mm (0.0020in.) or less	
Twist	0.1mm (0.004in.) or less	0.4mm (0.0157in.)
Connecting rod big end to crankshaft side clearance	0.100 ~ 0.250mm (0.0039 ~ 0.010in.)	
Connecting rod bearing		
Oil clearance (To seat limits to new parts)	0.024 ~ 0.042mm (0.0009 ~ 0.0016in.)	
Undersize	0.25mm (0.01 in.)	
Camshaft		

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Cam height		
Intake	44.618mm (1.7566in.)	44.518mm (1.7527in.)
Exhaust	44.518mm (1.7527in.)	44.418mm (1.7487in.)
Journal O.D.	28mm (1.1023in.)	
Bearing oil clearance	0.02 ~ 0.061mm (0.0008 ~ 0.0024in.)	0.1mm (0.0039in.)
End play	0.1 ~ 0.2mm (0.004 ~ 0.008in.)	
Crankshaft		
Pin O.D.	45mm (1.77in.)	
Journal O.D.	57mm (2.244in.)	
Bend	0.03mm (0.0012in.) or less	
Out-of-round, taper of journal and pin	0.005mm (0.0002in.) or less	0.030mm (0.0012in.)
End play	0.06 ~ 0.260mm (0.0023 ~ 0.010 in.)	
Undersize rework dimension of pin		
0.25mm (0.010 in.)	44.725 ~ 44.740mm (1.7608 ~ 1.7614in.)	
Undersize rework dimension of journal		
0.25mm (0.010 in.)	56.727 ~ 56.742mm (2.2333 ~ 2.2339in.)	
Crankshaft bearing		
Oil clearance	0.028 ~ 0.046mm (0.0011 ~ 0.0018in.)	
Flywheel		
Runout	0.1mm (0.0039in.)	0.13mm (0.0051 in.)
Cooling method	Water-cooled, pressurized. Forced circulation with electrical fan	
Coolant		
Quantity	6 liter (6.3U.S qts, 5.2lmp. qts)	
Radiator		
Type	Pressurized corrugated fin type	
Radiator cap		
Main valve opening pressure	83 ~ 110kpa (12 ~ 16psi, 0.83 ~ 1.1 kg/cm^2)	
Vacuum valve opening pressure	-7kpa (-100psi, -0.07kg/cm^2) or less	
Thermostat		
Type	Wax pellet type with jiggle valve	
Valve opening temperature	82°C (177°F)	

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Full-opening temperature	95°C (201°F)	
Coolant pump	Centrifugal type impeller	
Drive belt		
Type	V-ribbed belt	
Engine coolant temperature sensor		
Type	Heat-sensitive thermistor type	
Resistance	2.31 ~ 2.59Kohms at 20°C (68°F)	
Oil pump		
Clearance between outer circumference and front case.	0.120 ~ 0.185mm (0.0049 ~ 0.0073in.)	
Front case tip clearance	0.025 ~ 0.069mm (0.0009 ~ 0.0027in.)	
Side clearance		
Inner gear	0.04 ~ 0.085mm (0.0016 ~ 0.0033in.)	
Outer gear	0.04 ~ 0.09mm (0.0016 ~ 0.0035in.)	
Engine oil pressure at 1500 RPM	245KPa (2.5kg/cm^2 , 35.5psi)	
[Oil temperature is 90 to 110°C		
(194 to 230°F)]		
Relief spring		
Free height	43.8mm (1.725in.)	
Load	3.7+/-0.4kg at 40.1mm (3.15+/-0.88lb/1.578in.)	
Air cleaner		
Type	Dry type	
Element	Unwoven cloth type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	

SERVICE STANDARDS

SERVICE STANDARD SPECIFICATIONS

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

TIGHTENING TORQUE

TIGHTENING TORQUE SPECIFICATIONS

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Item	Nm	kgf.cm	lbf.ft
Cylinder Block			
Front engine support bracket bolt and nut	35 ~ 50	350 ~ 500	25 ~ 37
Front roll stopper bracket bolt	70 ~ 90	700 ~ 900	51 ~ 65
Rear roll stopper bracket bolt	70 ~ 90	700 ~ 900	51 ~ 65
Rear engine stopper bracket bolt	35 ~ 50	350 ~ 500	25 ~ 37
Engine Mounting			
Right mounting insulator (large) nut	90 ~ 110	900 ~ 1100	65 ~ 80
Right mounting insulator (small) nut	45 ~ 60	450 ~ 600	33 ~ 44
Right mounting bracket to engine	50 ~ 65	500 ~ 650	36 ~ 48
Nuts and bolts			
Transmission mount insulator nut	90 ~ 110	900 ~ 1100	65 ~ 80
Transmission insulator bracket to	40 ~ 50	400 ~ 500	30 ~ 36
Side member bolt			
Rear roll stopper insulator nut	50 ~ 65	500 ~ 650	36 ~ 48
Rear roll stopper bracket to center	40 ~ 50	400 ~ 500	30 ~ 36
Member bolts			
Front roll stopper insulator nut	50 ~ 65	500 ~ 650	36 ~ 48
Front roll stopper bracket to center	40 ~ 50	400 ~ 500	30 ~ 36
Member bolts.			
Main Moving			
Connecting rod cap nut	50 ~ 53	500 ~ 530	36 ~ 39
Crankshaft bearing cap bolt	28 ~ 32 + (60°~64°)	280 ~ 320 + (60° ~ 64°)	20.6 ~ 23.6 + (60° ~ 64°)
Fly wheel (1) bolt	120 ~ 130	1200 ~ 1300	88 ~ 95
Drive plate (2) bolt	120 ~ 130	1200 ~ 1300	88 ~ 95
Engine cover	4 ~ 6	40 ~ 60	3 ~ 4
Heat protector	15 ~ 20	150 ~ 200	11 ~ 15
Water pipe bracket bolts	12 ~ 15	120 ~ 150	9 ~ 11
Cooling system			

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Alternator support bolt and nut	20 ~ 25	200 ~ 250	14 ~ 18
Alternator lock bolt	12 ~ 15	120 ~ 150	9 ~ 11
Alternator bracket mounting bolt	20 ~ 27	200 ~ 270	15 ~ 20
Coolant pump pulley bolts	8 ~ 10	80 ~ 100	6 ~ 7
Coolant pump bolts	20 ~ 27	200 ~ 270	14 ~ 19
Coolant temperature sensor	20 ~ 40	200 ~ 400	15 ~ 30
Coolant inlet fitting nuts	15 ~ 20	150 ~ 200	11 ~ 14
Thermostat housing bolts and nuts	15 ~ 20	150 ~ 200	11 ~ 14
Lubrication system			
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
Oil pressure switch	13 ~ 15	130 ~ 150	9.7 ~ 11
Intake and Exhaust system			
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	16 ~ 23	160 ~ 230	12 ~ 17
Nuts and bolts			
Intake manifold stay to cylinder	18 ~ 25	180 ~ 250	13 ~ 18
Block bolts			
Throttle body to surge tank nuts	15 ~ 20	150 ~ 200	11 ~ 14
Exhaust manifold to cylinder head nuts	43 ~ 55	430 ~ 550	32 ~ 40
Exhaust manifold cover to exhaust	17 ~ 22	170 ~ 220	12.5 ~ 16
Manifold bolts			
Oxygen sensor to front muffler	50 ~ 60	500 ~ 600	36 ~ 43
Oxygen sensor to exhaust manifold	50 ~ 60	500 ~ 600	36 ~ 43
Front exhaust pipe to exhaust	30 ~ 40	300 ~ 400	22 ~ 29
Manifold nuts			

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Front exhaust pipe bracket bolts	30 ~ 40	300 ~ 400	22 ~ 29
Front exhaust pipe to catalytic	40 ~ 60	400 ~ 600	29 ~ 43
Converter bolts			
Main muffler hanger support	10 ~ 15	100 ~ 150	7 ~ 11
Bracket bolts			
Cylinder head			
Cylinder head bolts ~ M10	25 + (60°~65°) +	250 + (60°~65°) +	18 + (60°~65°) +
	(60°~65°)	(60°~65°)	(60°~65°)
Cylinder head bolts ~ M12	30 + (60°~65°) +	300 + (60°~65°) +	22 + (60°~65°) +
	(60°~65°)	(60°~65°)	(60°~65°)
Intake manifold nuts	18 ~ 25	180 ~ 250	13 ~ 18
Exhaust manifold nuts	43 ~ 55	430 ~ 550	32 ~ 41
Cylinder head cover bolts	8 ~ 10	80 ~ 100	6 ~ 7
Camshaft bearing cap bolts	14 ~ 15	140 ~ 150	10 ~ 11
Oil control valve bolt	10 ~ 12	100 ~ 120	7.3 ~ 8.8
OCV Filter	41 ~ 51	410 ~ 510	30 ~ 37.6
CVVT unit to exhaust camshaft bolt	66 ~ 78	660 ~ 780	48.7 ~ 57.5
Rear plate bolts	8 ~ 10	80 ~ 100	6 ~ 7
Timing Belt			
Crankshaft pulley bolt	170 ~ 180	1700 ~ 1800	125 ~ 133
Camshaft sprocket bolt	100 ~ 120	1000 ~ 1200	74 ~ 89
Timing belt tensioner bolts	43 ~ 550	430 ~ 550	31 ~ 40
Timing belt cover bolts	8 ~ 10	80 ~ 100	6 ~ 7
Front case bolts	20 ~ 27	200 ~ 270	14 ~ 20
Timing belt idler bolt	43 ~ 55	430 ~ 550	31 ~ 40
(1) Manual Transmission (2) Automatic Transmission			

COMPRESSION

NOTE: If the there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. Warm up and stop engine.

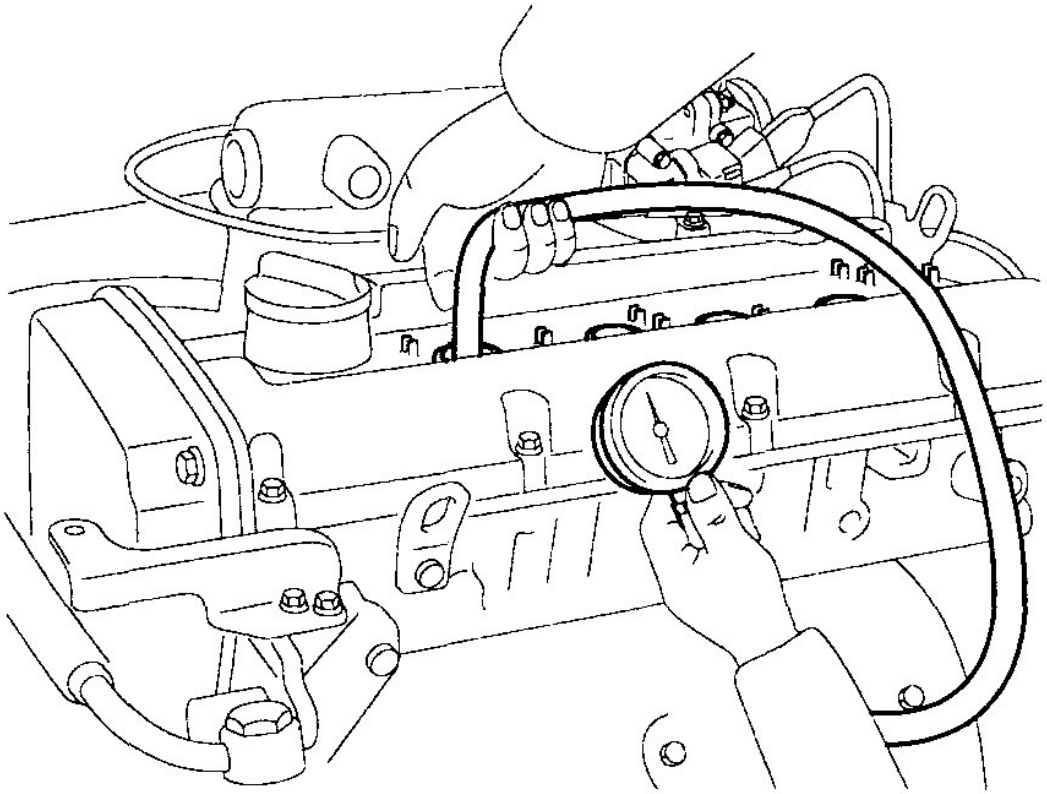
   Allow the engine to warm up to normal operating temperature.

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2. Remove ignition coils. (See **IGNITION SYSTEM** .)
3. Remove spark plugs.

   Using a 16mm plug wrench, remove the 4 spark plugs.

4. Check cylinder compression pressure.
   a. Insert a compression gauge into the spark plug hole.



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Fig. 1: Inserting Compression Gauge Into Spark Plug Hole
Courtesy of HYUNDAI MOTOR CO.

   b. Fully open the throttle.
   c. While cranking the engine, measure the compression pressure.

NOTE: Always use a fully charged battery to obtain engine speed of 250 RPM or more.

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d. Repeat steps (a) through (c) for each cylinder.

NOTE: This measurement must be done in as short a time as possible.

Compression pressure :

1,420kPa (14.5kgf/cm^2 , 206psi)

Minimum pressure :

1,270kPa (13kgf/cm^2 , 184psi)

Difference between each cylinder:

100kPa (1.0kgf/cm^2 , 15psi) or less

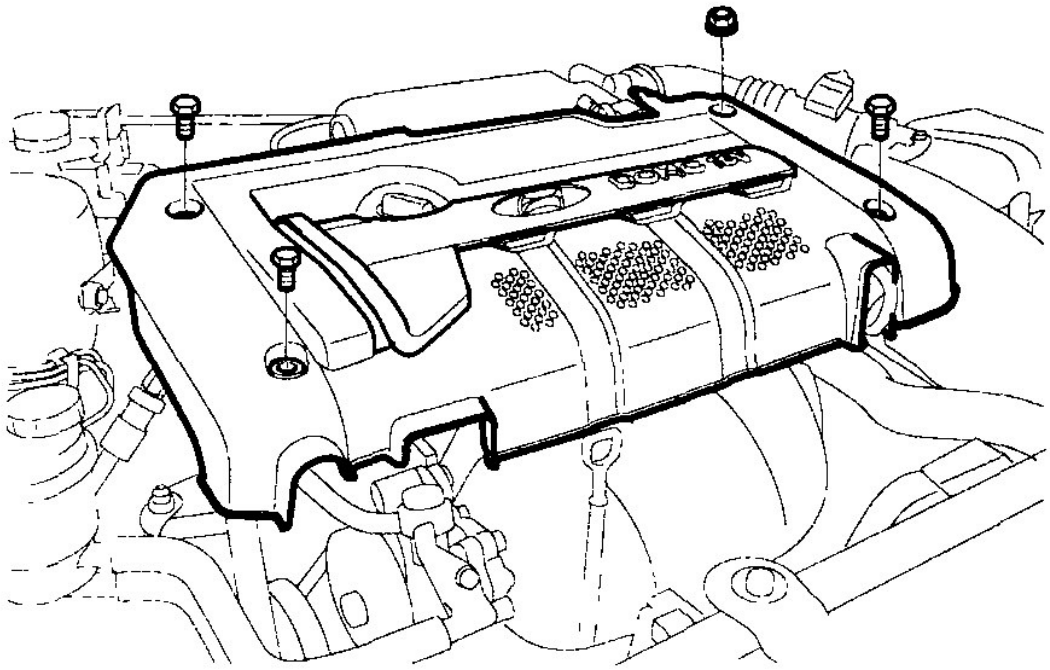
e. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.
   - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
   - If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

5. Reinstall spark plugs.
6. Install ignition coils. (See **IGNITION SYSTEM** .)

TIMING BELT TENSION ADJUSTMENT

1. Remove the engine cover(A).

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Fig. 2: Removing Engine Cover
Courtesy of HYUNDAI MOTOR CO.

2. Remove RH front wheel.
3. Remove the 4 bolts(B) and timing belt upper cover(A).

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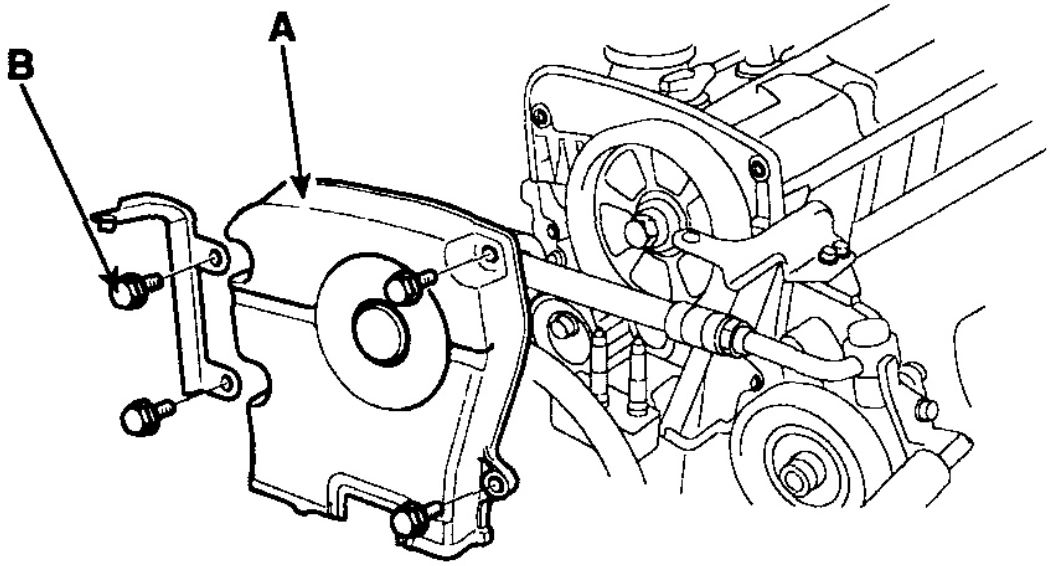


Fig. 3: Removing Bolts And Timing Belt Upper Cover
Courtesy of HYUNDAI MOTOR CO.

4. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover.

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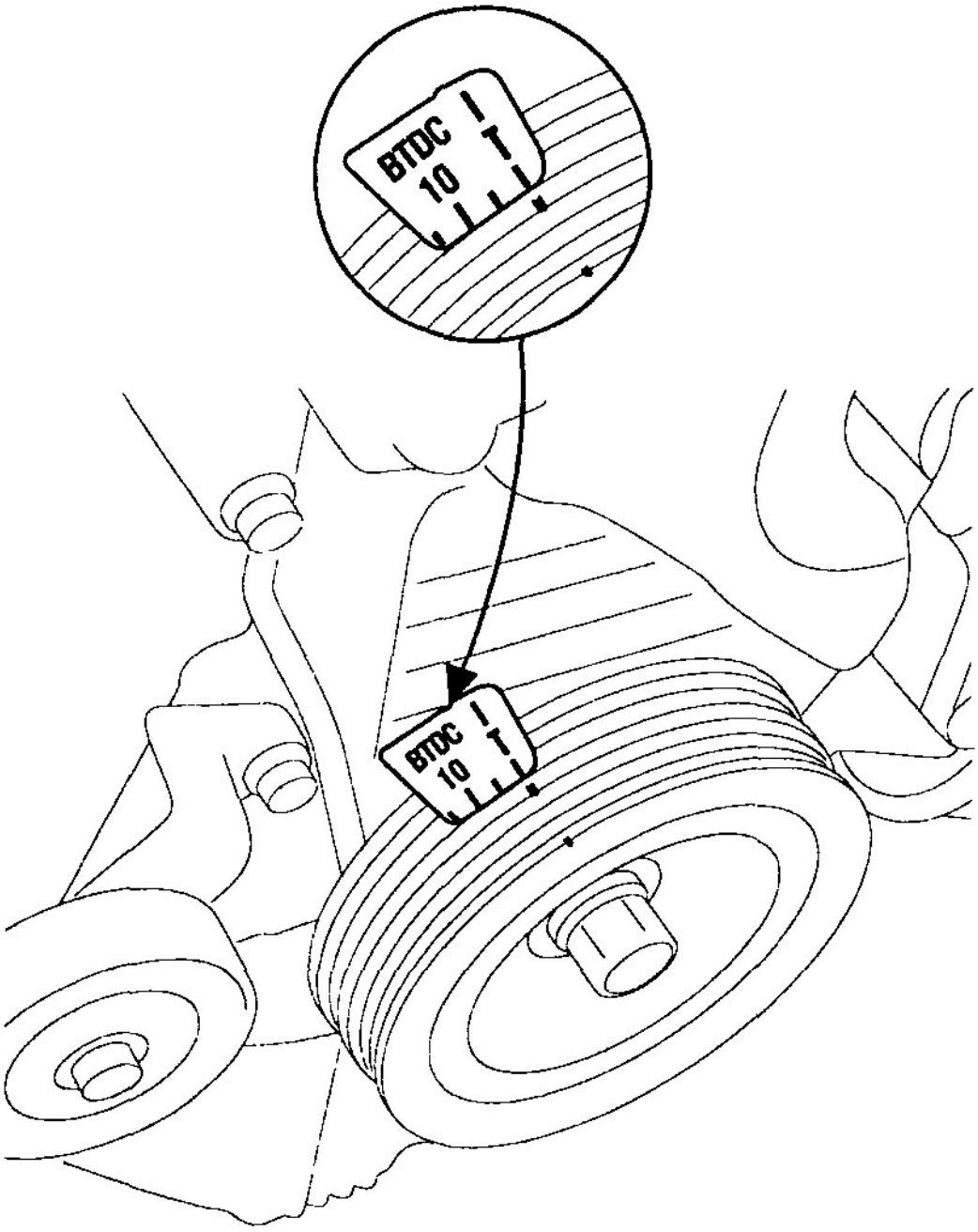
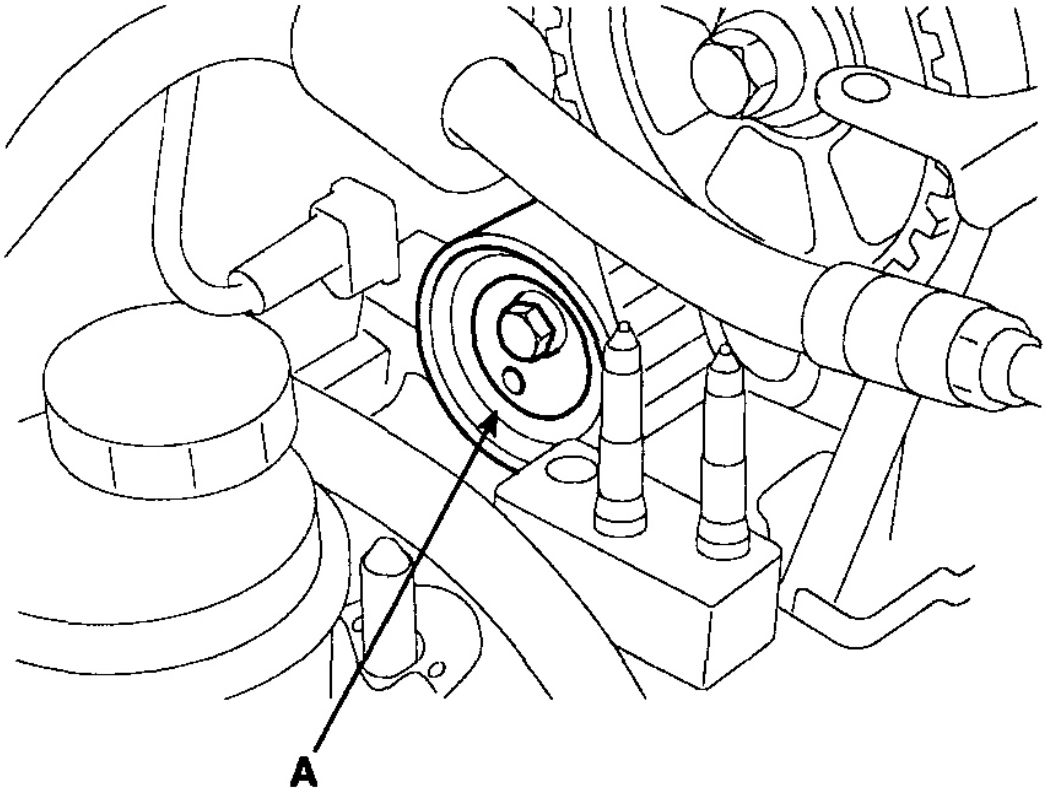


Fig. 4: Aligning Crankshaft Pulley Groove With Timing Mark "T" Of Timing Belt Cover
Courtesy of HYUNDAI MOTOR CO.

5. Temporarily loosen tensioner pulley(A) by center bolt.

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Fig. 5: Loosening Tensioner Pulley By Center Bolt
Courtesy of HYUNDAI MOTOR CO.

6. Timing belt tension adjusting.
    1. Rotate crankshaft in regular direction (clock wise view from front) through angle equivalent to two teeth (18°) of camshaft sprocket(A).

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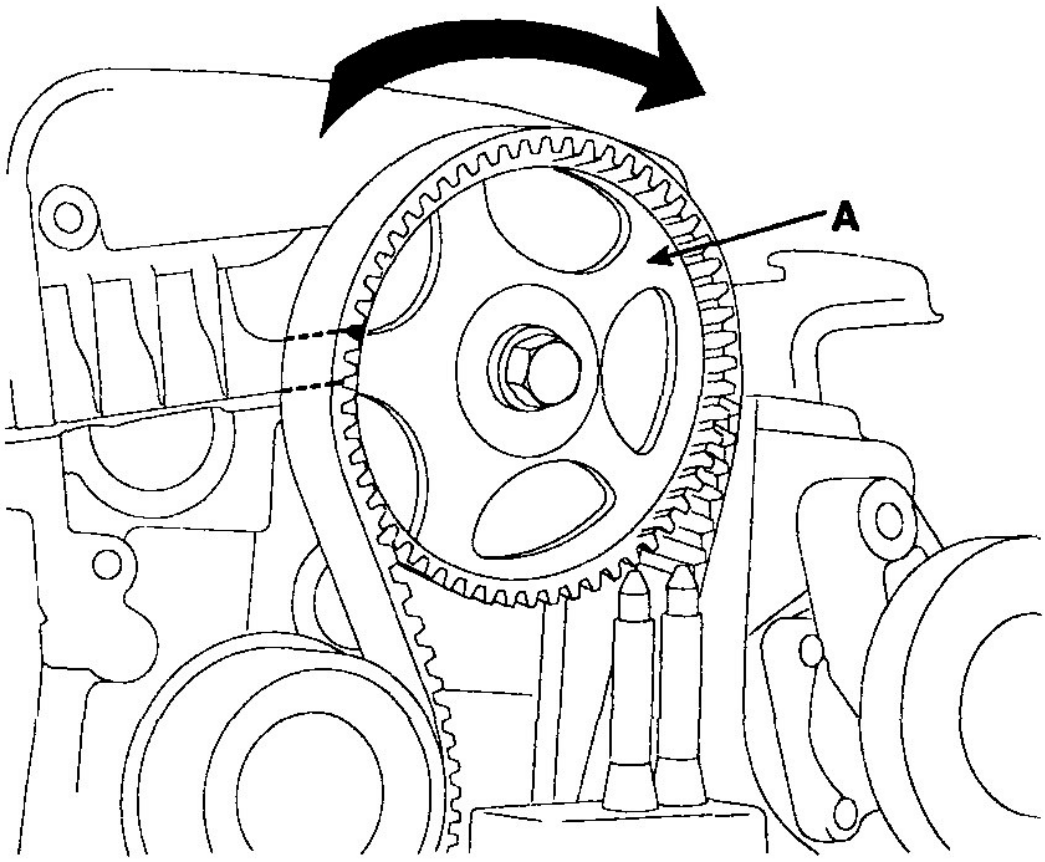
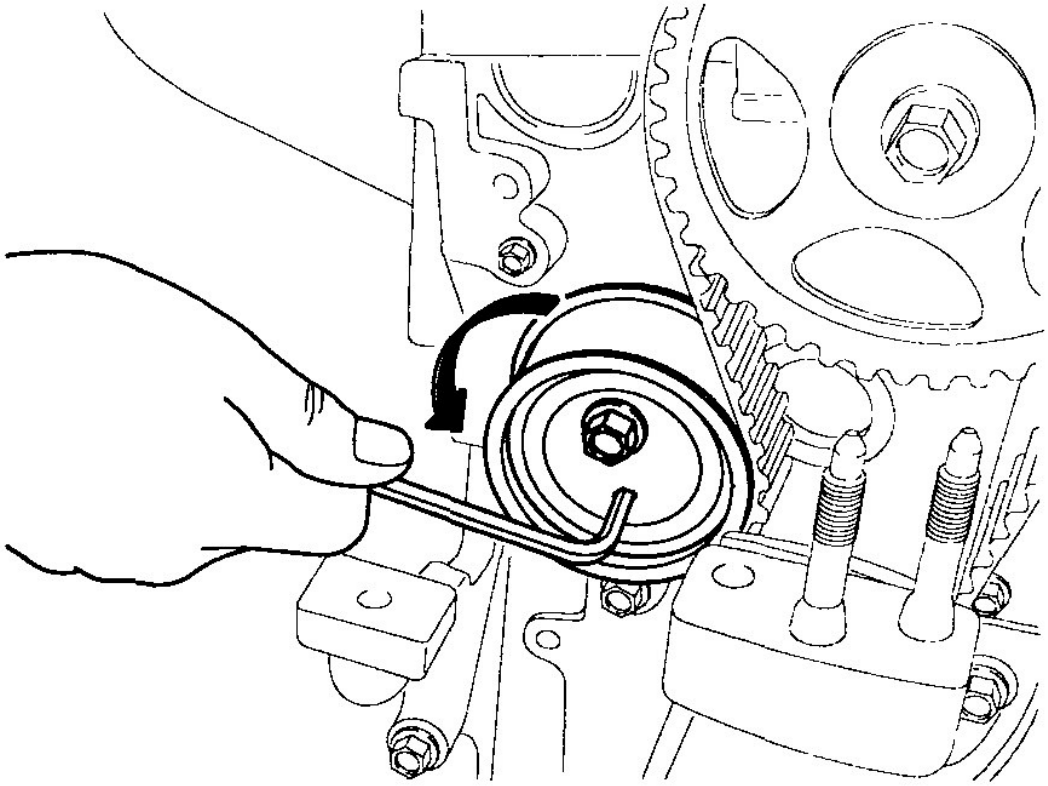


Fig. 6: Rotating Crankshaft Adjusting Timing Belt Tension
Courtesy of HYUNDAI MOTOR CO.

2. Give tension to tinning belt rotating tensioner in arrow direction tool and set tinning belt not to give slack to tension side.

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Fig. 7: Rotating Tensioner For Giving Tension To Timing Belt
Courtesy of HYUNDAI MOTOR CO.

3. Tightening tensioner bolt.

   Tightening torque

   Tensioner bolt

   43 ~ 55Nm (430 ~ 550kgf.cm, 32 ~ 40lbf.ft)

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

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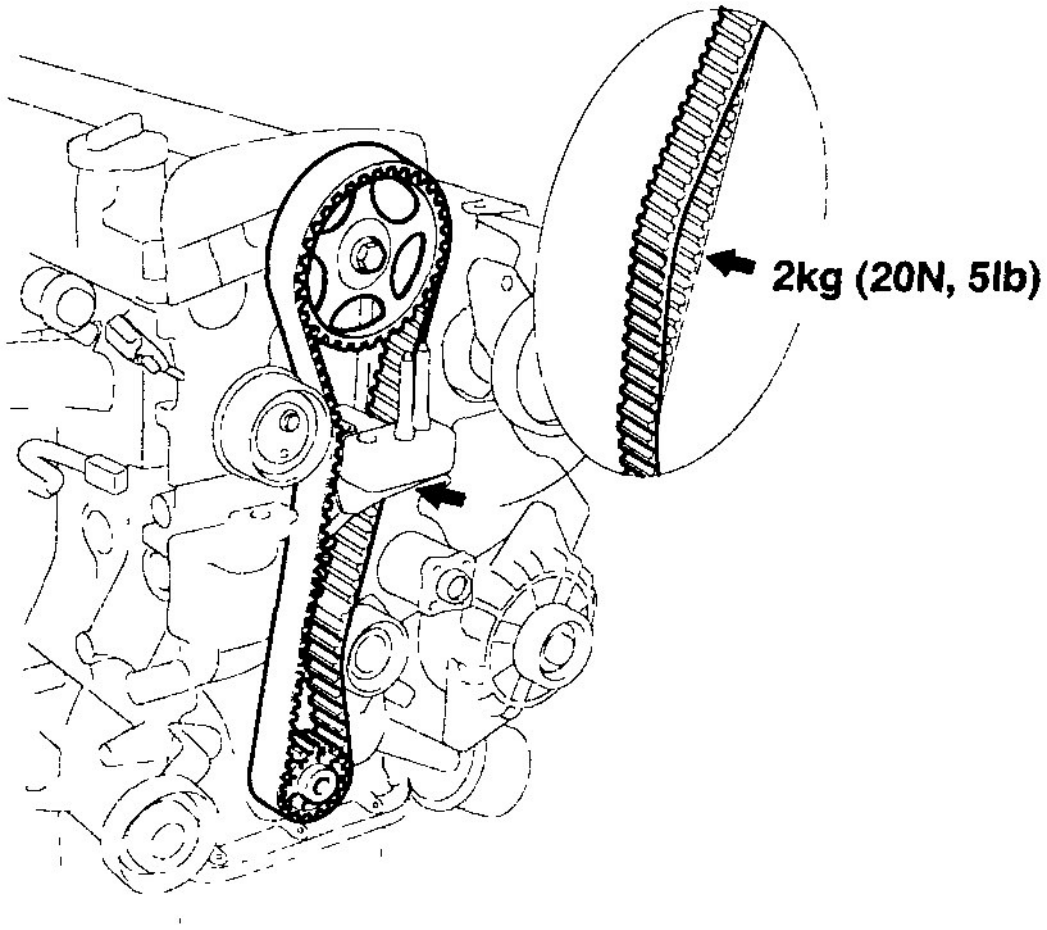


Fig. 8: Rechecking Belt Tension
Courtesy of HYUNDAI MOTOR CO.

7. Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing mark.
8. Install the timing belt upper cover(A) with 4 bolts(B).

Tightening torque

8 ~ 10Nm (80 ~ 100kgf.cm, 6 ~ 7lbf.ft)

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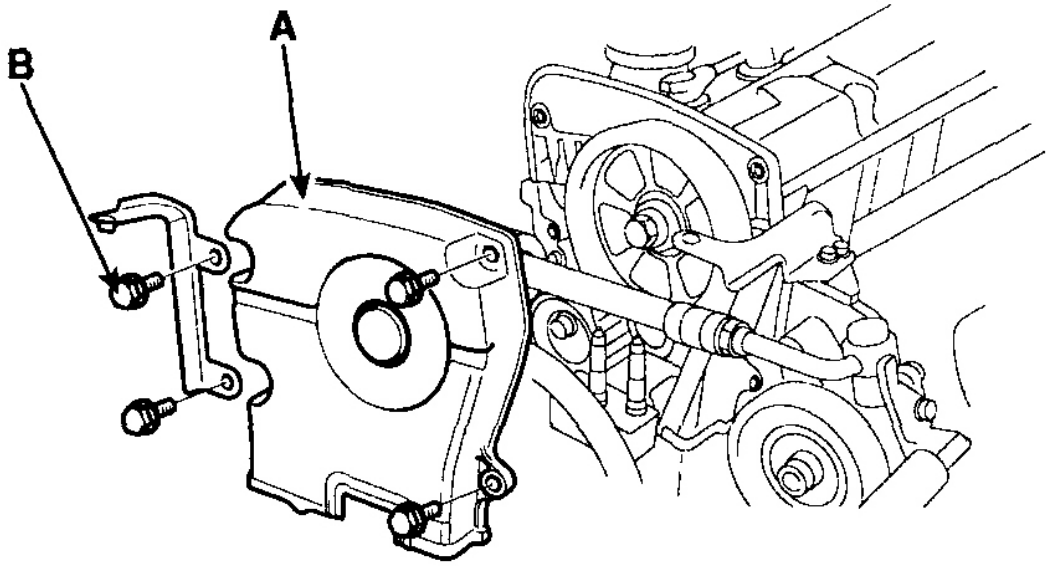


Fig. 9: Installing Timing Belt Upper Cover With 4 Bolts
Courtesy of HYUNDAI MOTOR CO.

9. Install RH front wheel.
10. Install engine cover(A).

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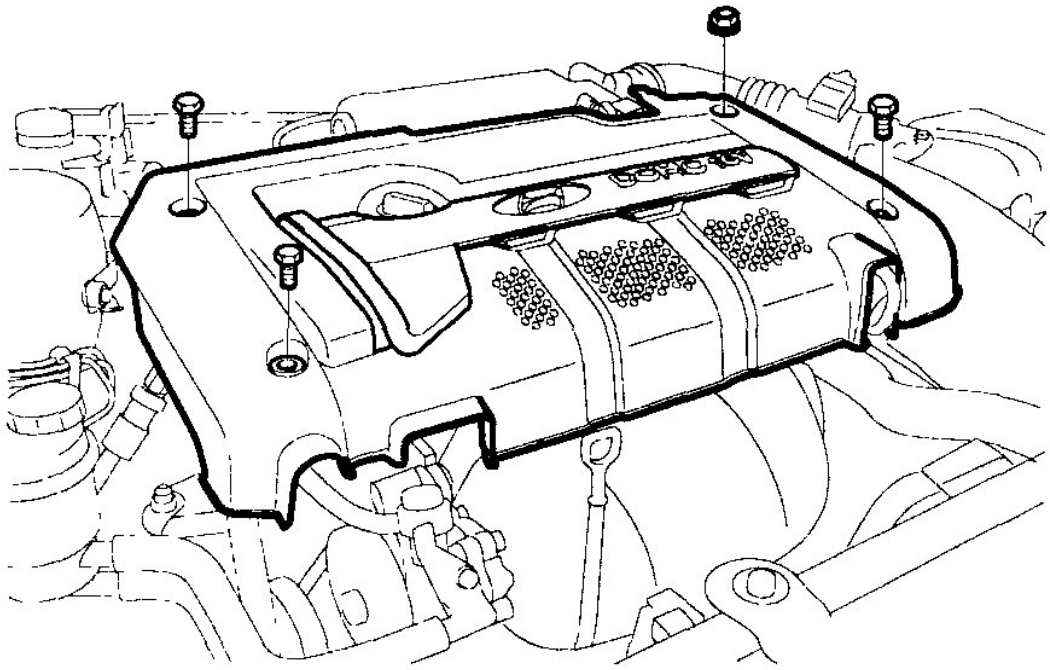


Fig. 10: Installing Engine Cover
Courtesy of HYUNDAI MOTOR CO.

VALVE CLEARANCE INSPECTION AND ADJUSTMENT

MLA (MECHANICAL LASH ADJUSTER)

NOTE: Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature: 2°C) and cylinder head is installed on the cylinder block.

1. Remove the engine cover. (See **COMPRESSION**)
2. Remove the upper timing belt cover.

   (See **TIMING BELT TENSION ADJUSTMENT**)

   a. Loosen the upper timing cover bolts and then remove the cover.
3. Remove the cylinder head cover.
   a. Disconnect the spark plug cables and do not pull on the spark plug by force.

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

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b. Disconnect the PCV hose(A) and the breather hose(B) from the cylinder head cover.

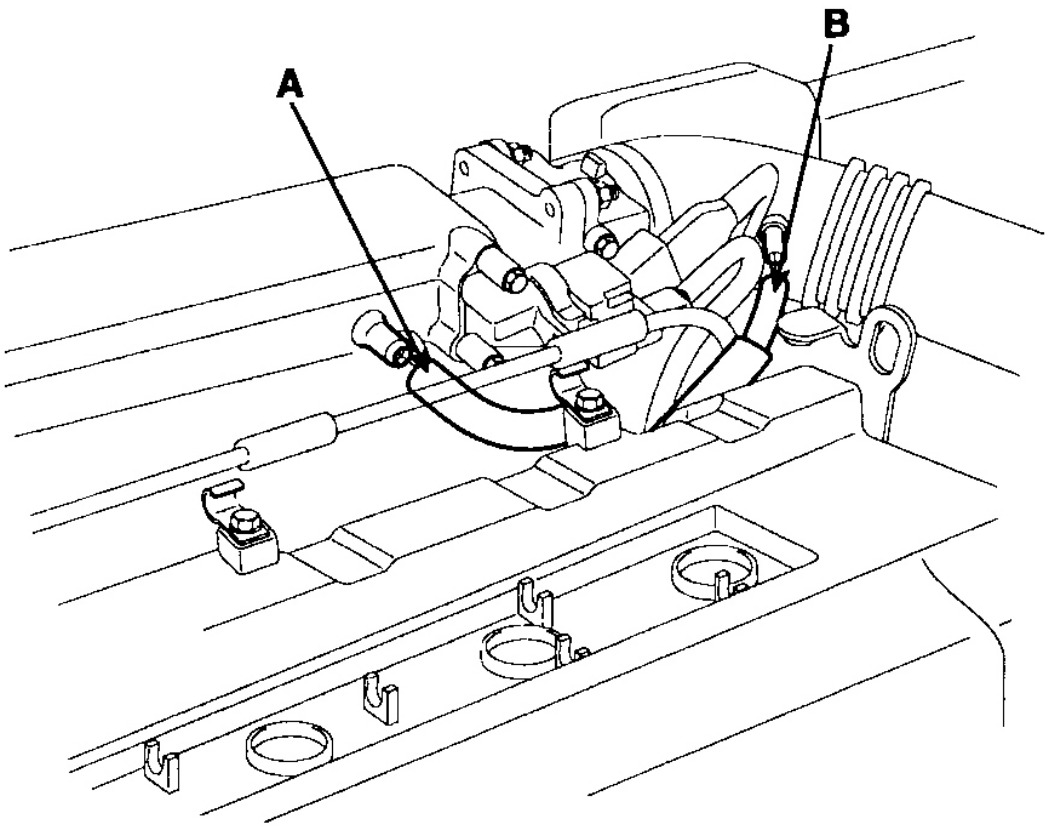


Fig. 11: Disconnecting PCV Hose And Breather Hose From Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

c. Disconnect the accelerator cable(A) from the cylinder head cover.

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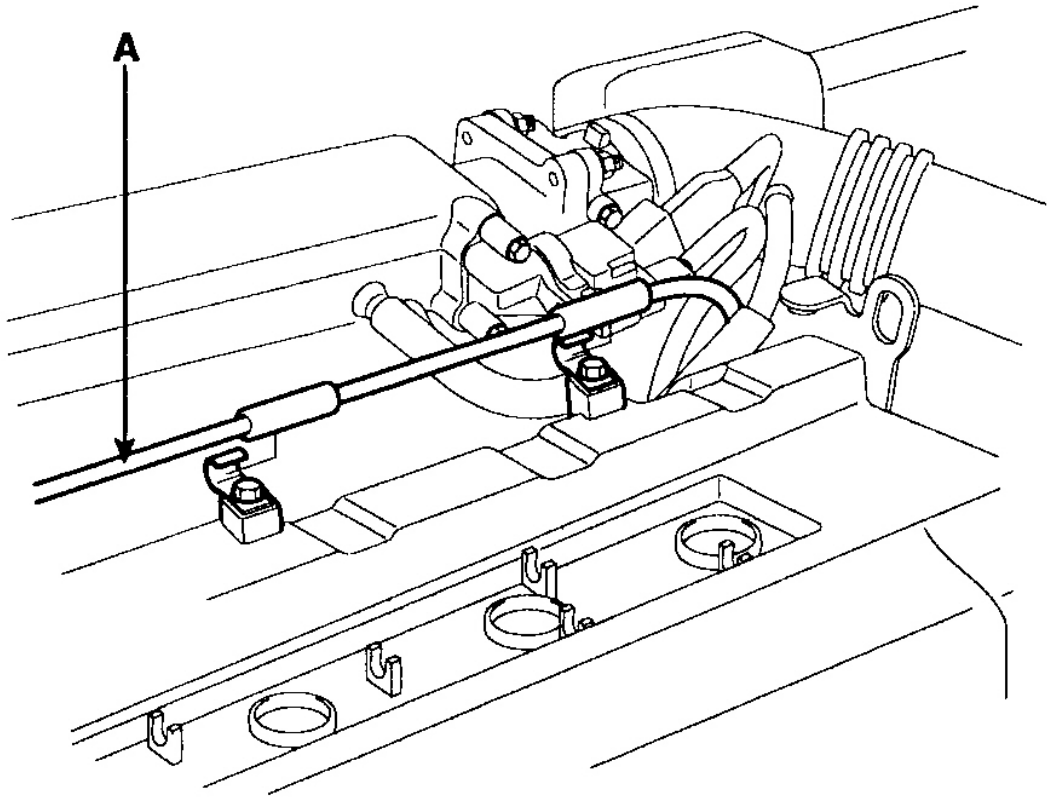


Fig. 12: Disconnecting Accelerator Cable From Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

d. Loosen the cylinder head cover bolts(B) and then remove the cover(A) and gasket.

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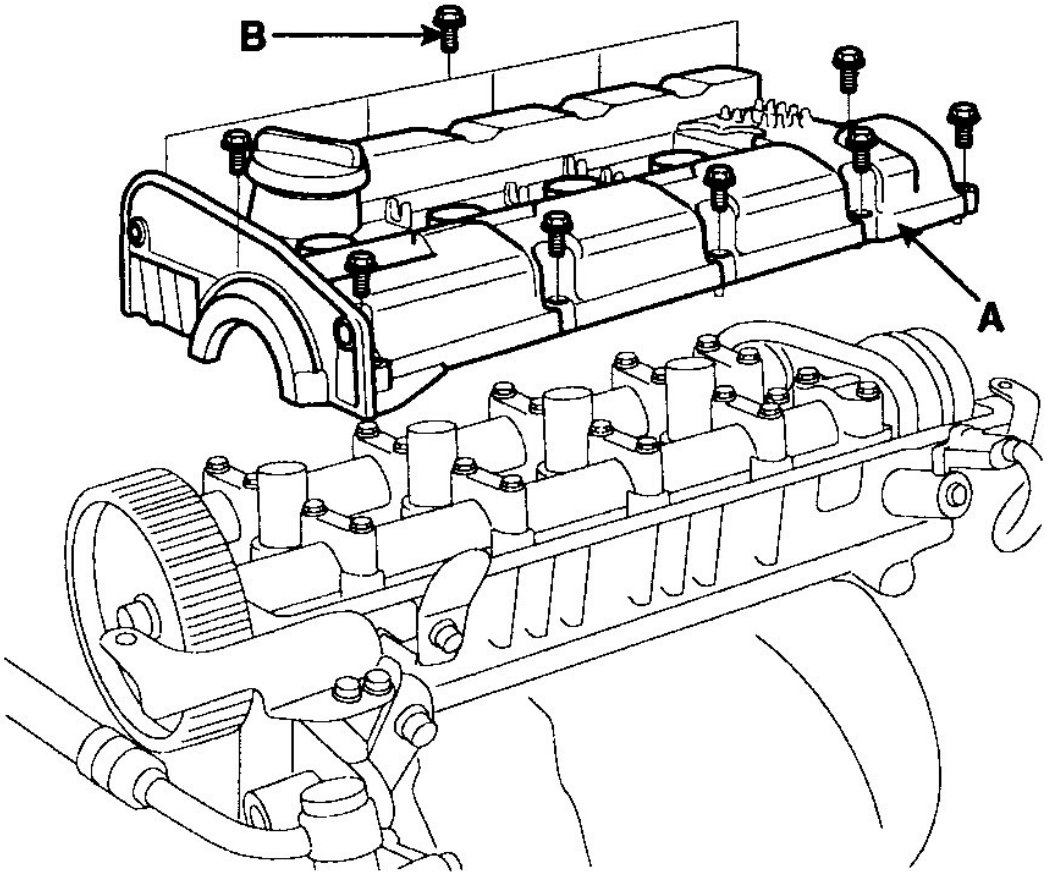


Fig. 13: Removing Cylinder Head Cover Bolts, Cover And Gasket
Courtesy of HYUNDAI MOTOR CO.

4. Set No. 1 cylinder to TDC/compression.
    a. Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing belt cover.

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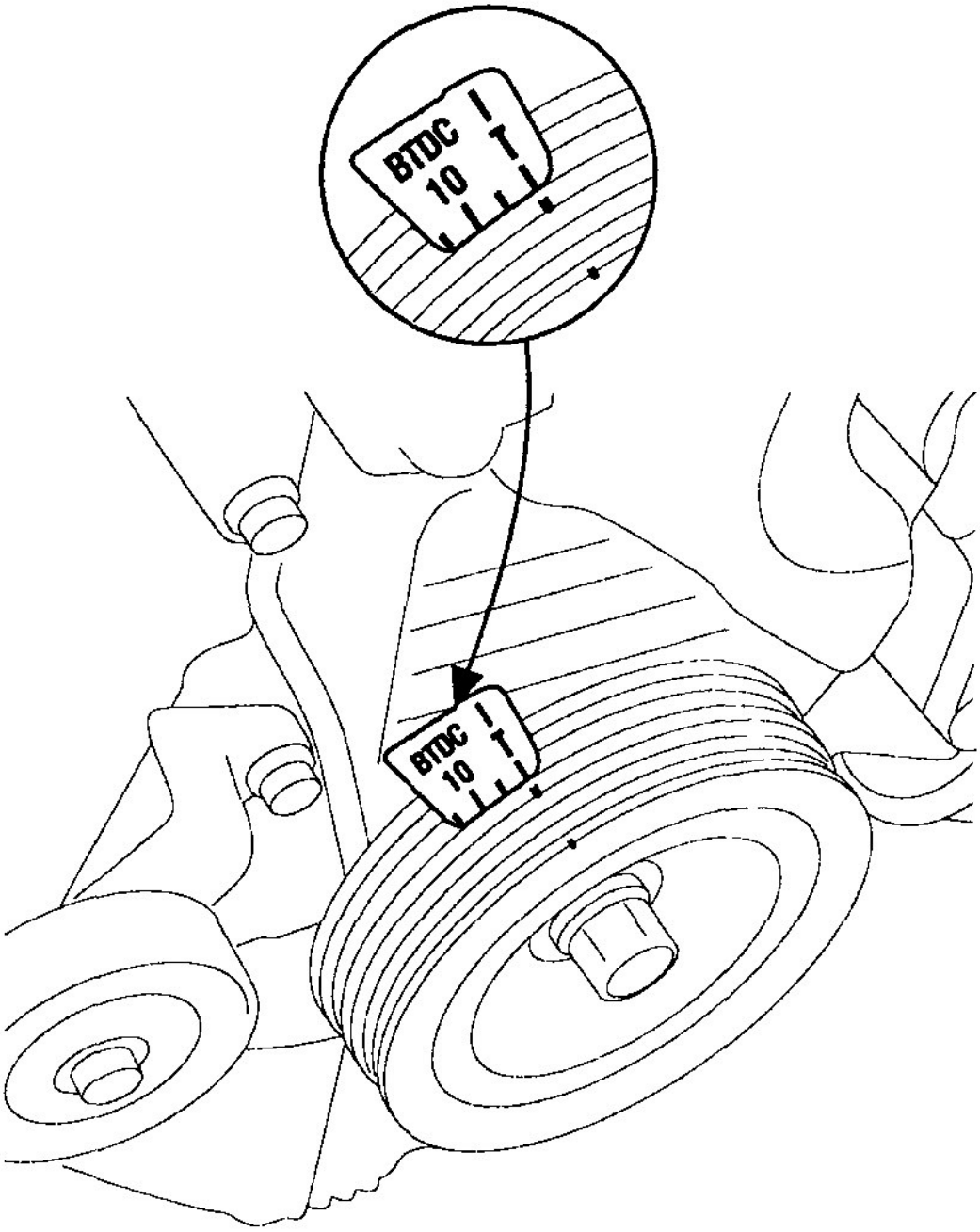


Fig. 14: Aligning Crankshaft Pulley Groove With Timing Mark "T" Of Lower Timing Belt Cover
Courtesy of HYUNDAI MOTOR CO.

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b. Check that the hole of the camshaft timing pulley(A) is aligned with the timing mark of the bearing cap.

   If not, turn the crankshaft one revolution (360°)

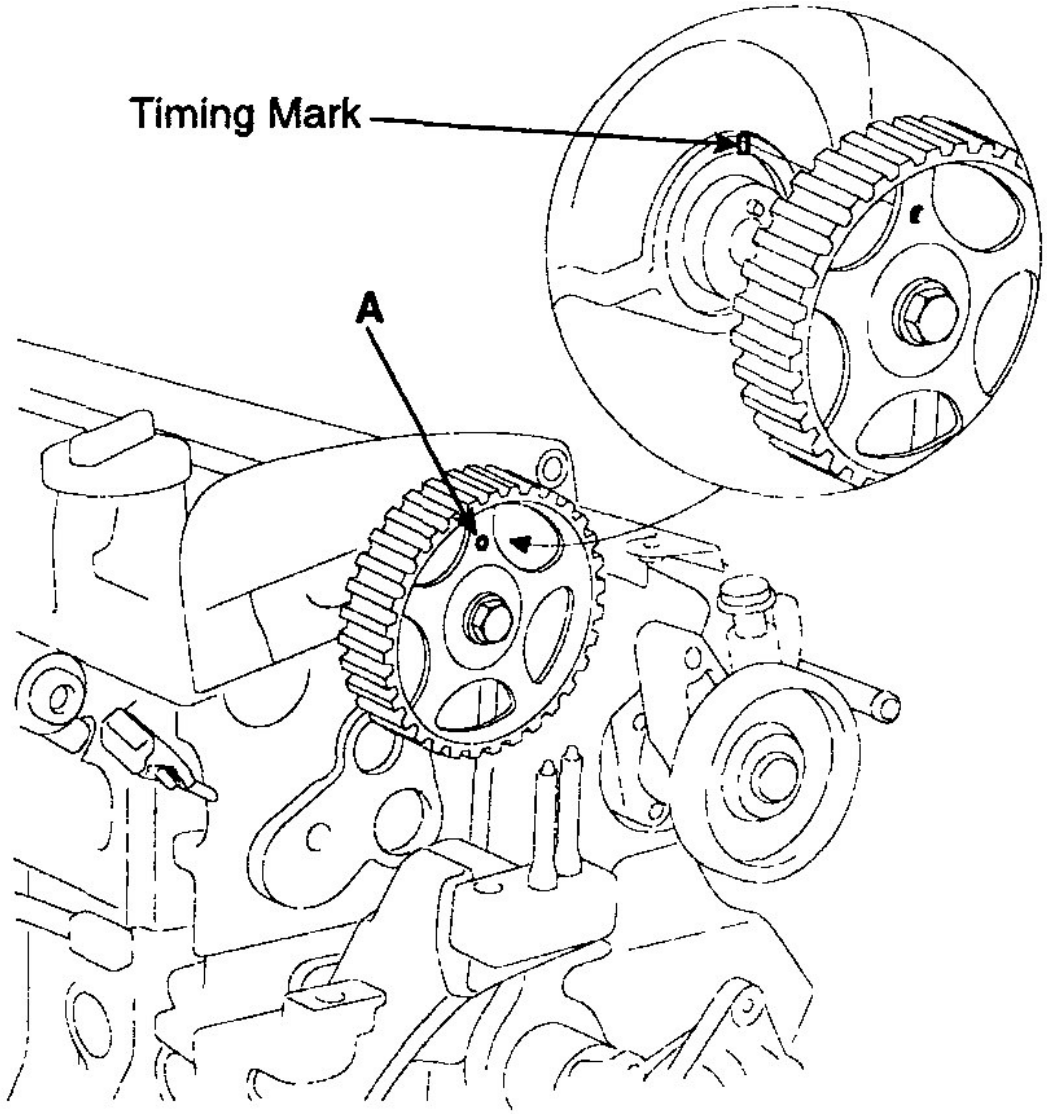
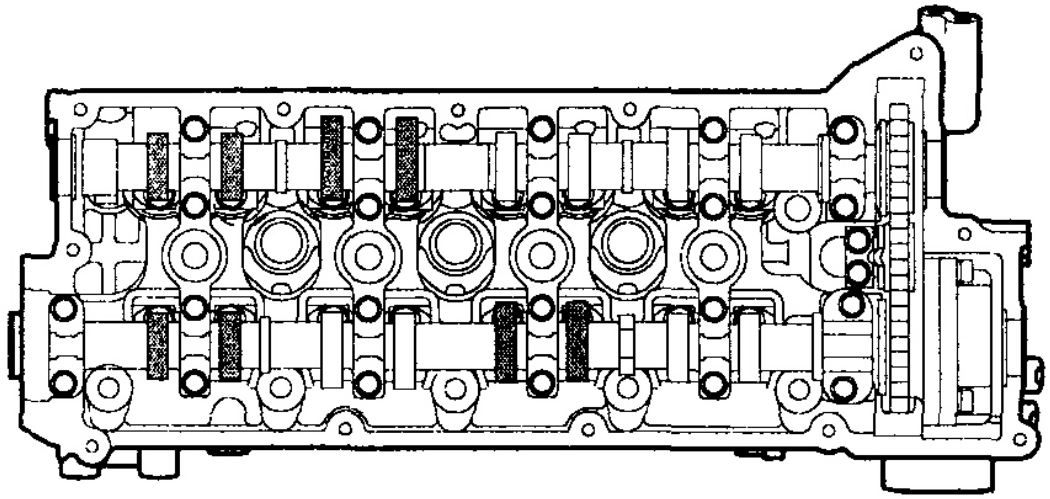


Fig. 15: Aligning Hole Of Camshaft Timing Pulley With Timing Mark Of Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

5. Inspect the valve clearance.

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a. Check only the valve indicated as shown. [No. 1 cylinder: TDC/Compression] measure the valve clearance.



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Fig. 16: Identifying Valves
Courtesy of HYUNDAI MOTOR CO.

- Using a thickness gauge, measure the clearance between the tappet shim and the base circle of camshaft.
- Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

Valve clearance

Specification

Engine coolant temperature: 20°C [68°F]

Intake: 0.20mm (0.0079in.)

Exhaust; 0.28mm (0.0110in.)

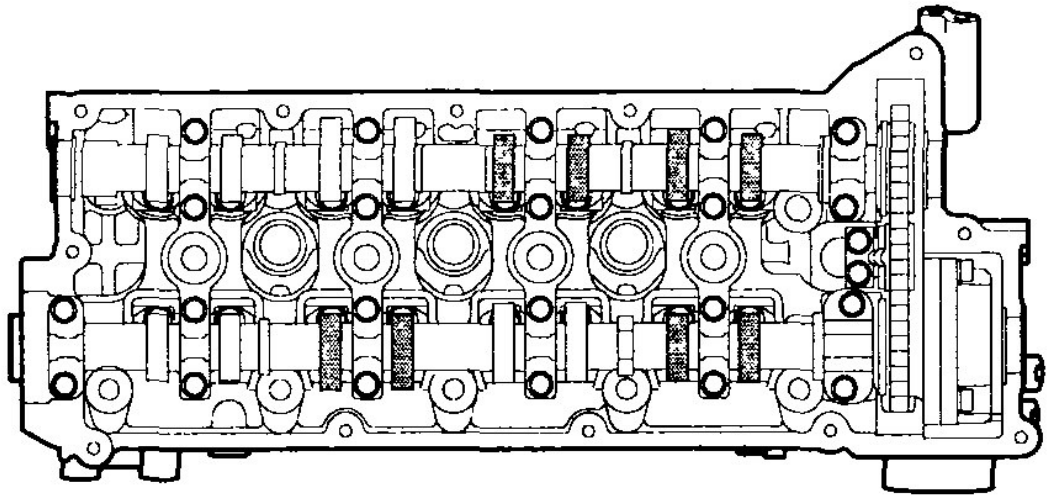
Limit

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

Exhaust: 0.20 ~ 0.38mm (0.0079 ~ 0.0150in.)

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b. Turn the crankshaft pulley one revolution (360°) and align the groove with timing mark "T" of the lower timing belt cover.
c. Check only valves indicated as shown. [No. 4 cylinder: TDC/compression]. Measure the valve clearance. (See procedure in step 6)



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Fig. 17: Identifying Valves
Courtesy of HYUNDAI MOTOR CO.

6. Adjust the intake and exhaust valve clearance.
   a. Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve is upward.
   b. Using the SST (09220-2D000), press down the valve lifter and place the stopper between the camshaft and valve lifter and remove the special tool.

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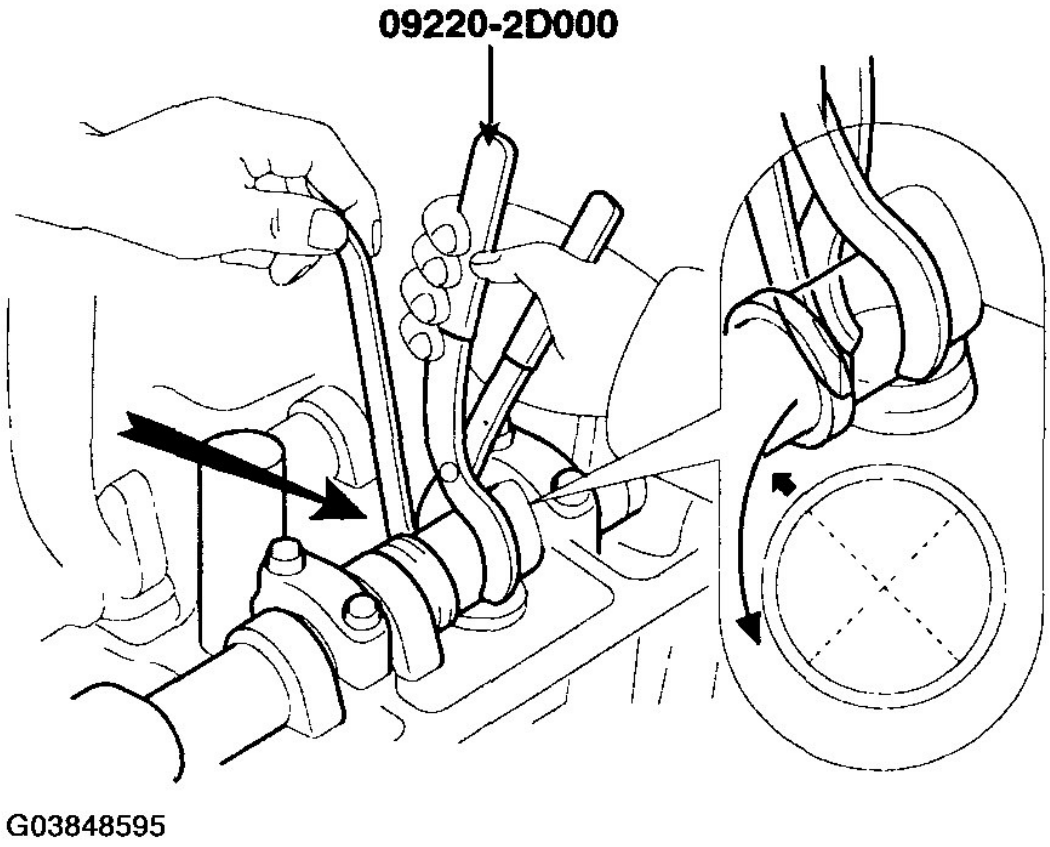


Fig. 18: Using SST (09220-2D000) To Press Down Valve Lifter And Placing Stopper Between Camshaft And Valve Lifter
Courtesy of HYUNDAI MOTOR CO.

c. Remove the adjusting shim with a small screw driver(A) and magnet(B).

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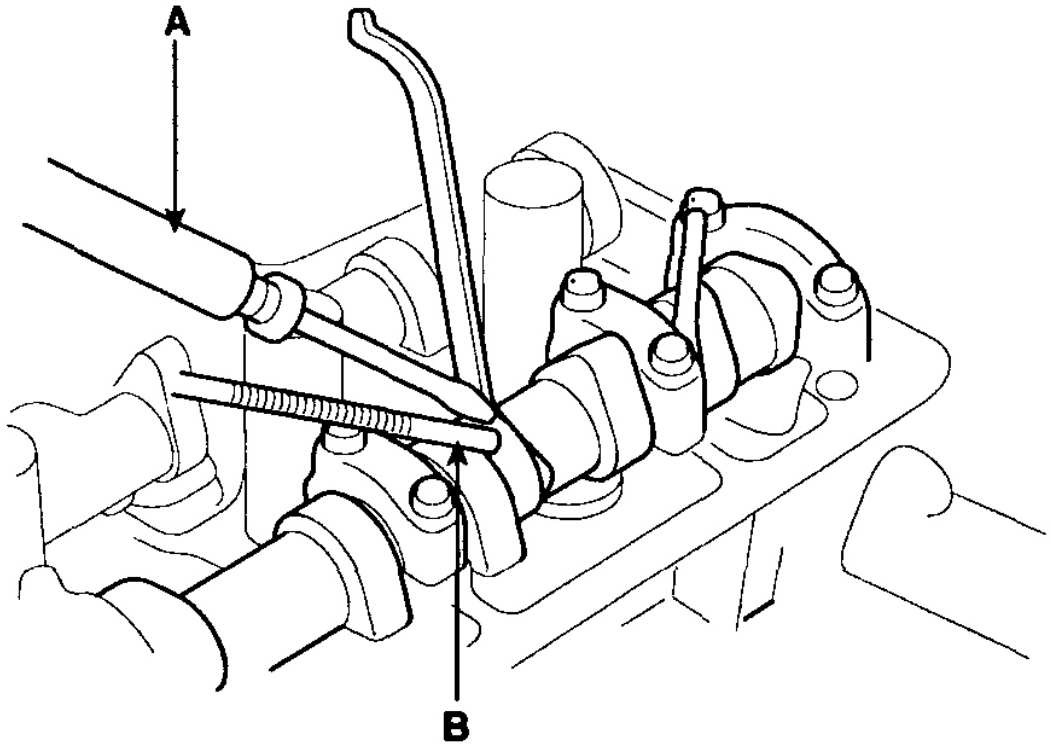


Fig. 19: Removing Adjusting Shim With Small Screw Driver And Magnet
Courtesy of HYUNDAI MOTOR CO.

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

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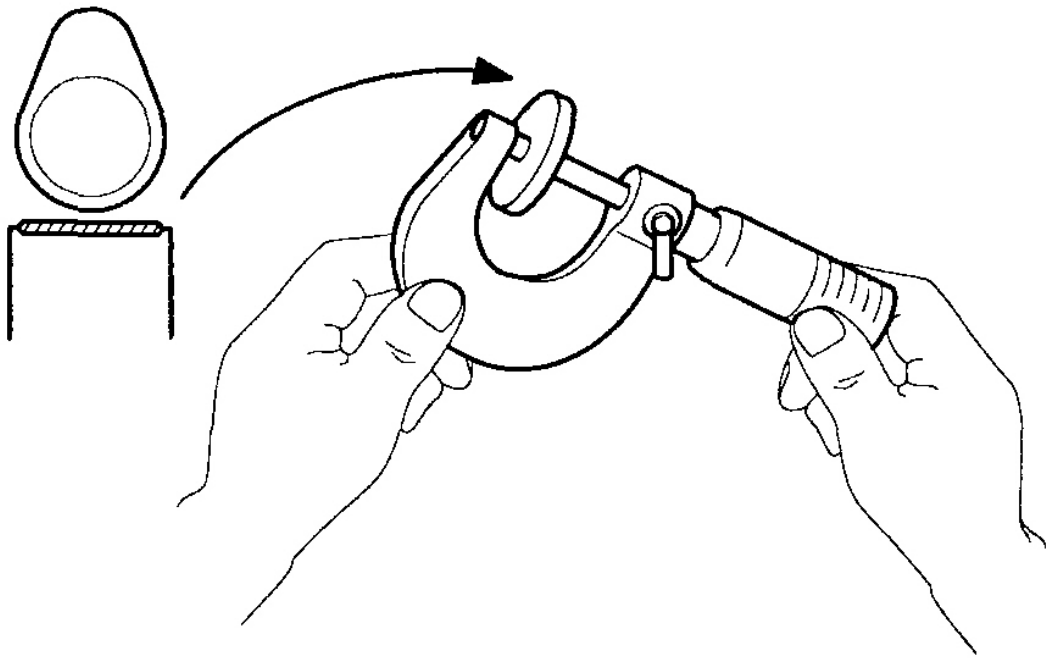


Fig. 20: Measuring Thickness Of Removed Shim Using Micrometer
Courtesy of HYUNDAI MOTOR CO.

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

Valve clearance (Engine coolant temperature: 20°C)

T: Thickness of removed shim

A: Measured valve clearance

N: Thickness of new shim

Intake: N = T + [A - 0.20mm (0.0079in.)]

Exhaust: N = T + [A-0.28mm (0.0110in.)]

f. Select a new shim with a thickness as close as possible to the calculated value. Refer to the Adjusting shim selection chart.

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

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

Valve clearance (Engine coolant temperature: 20°C)

[Specification]

Intake: 0.20mm (0.0079 in.)

Exhaust: 0.28mm (0.0110 in.)

[Limit] (After adjusting valve clearance)

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

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

Adjusting Shim Selection Chart (Intake)

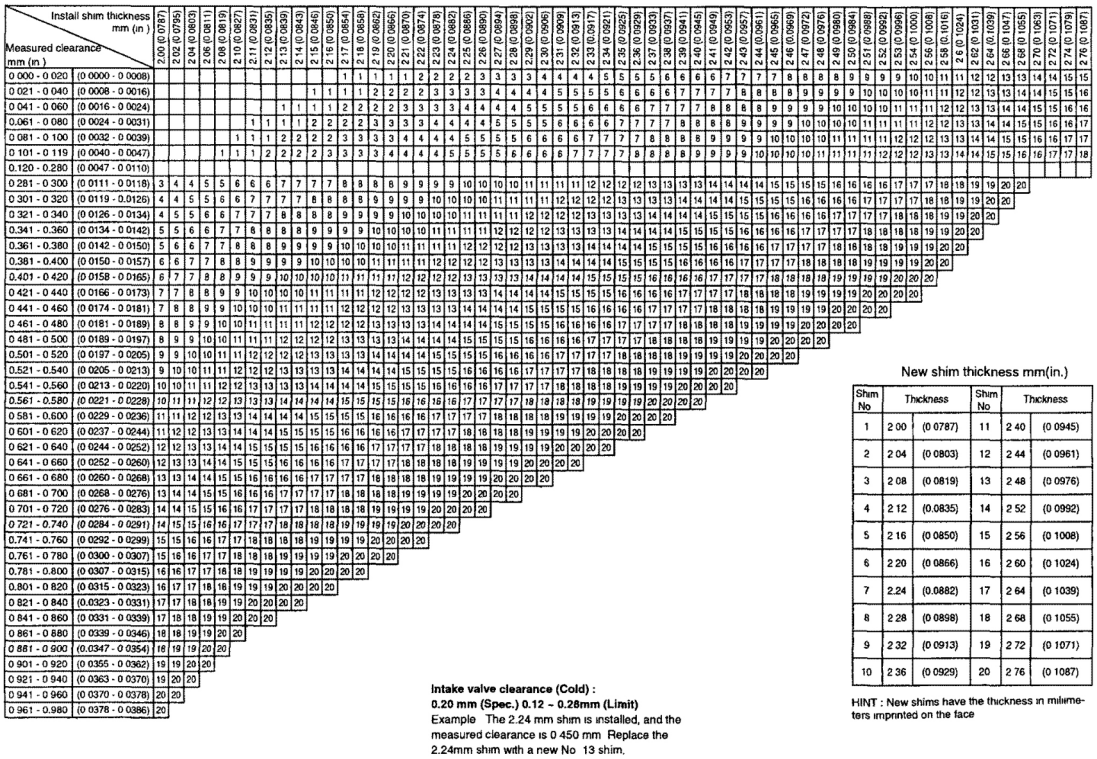


Fig. 21: Adjusting Shim Selection Chart (Intake)
Courtesy of HYUNDAI MOTOR CO.

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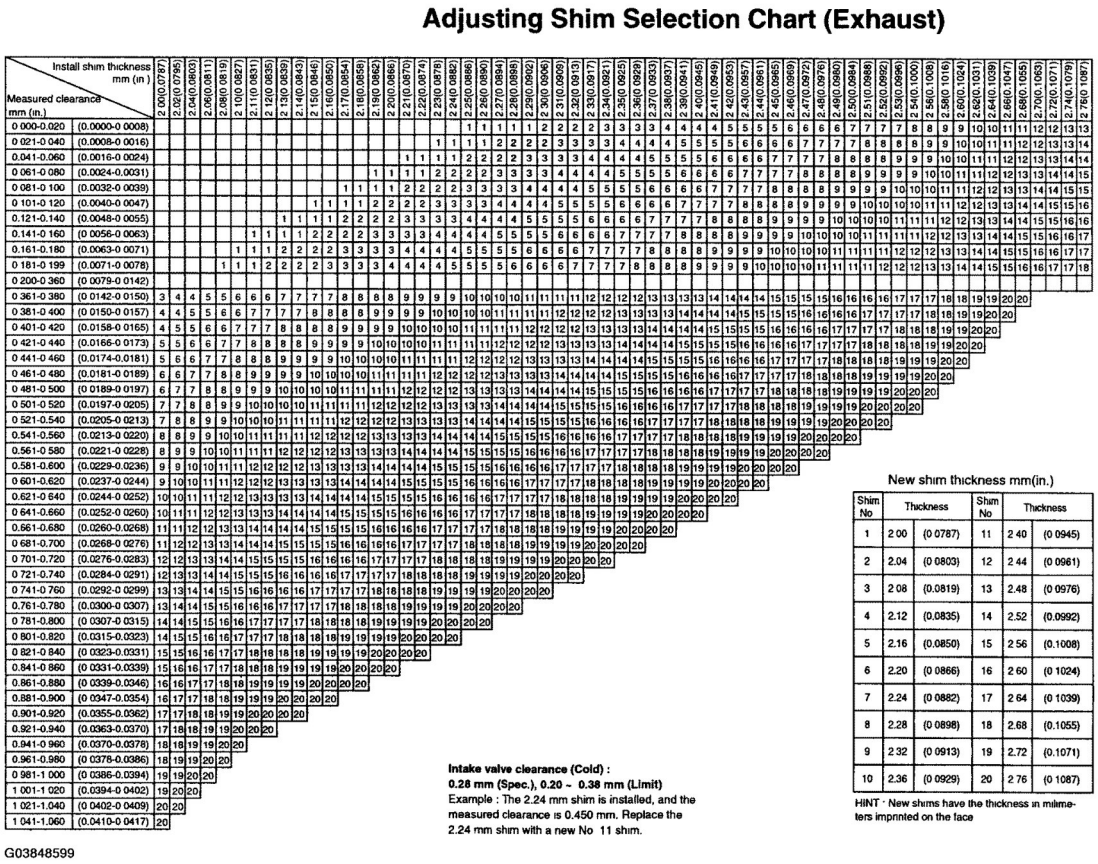


Fig. 22: Adjusting Shim Selection Chart (Exhaust)
Courtesy of HYUNDAI MOTOR CO.

TROUBLESHOOTING

PROBLEM SYMPTOM DIAGNOSTIC

Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression. Repair or replace as required.
	Worn crankshaft thrust bearings	Replace the crankshaft and bearings as required
Engine misfire with abnormal valve train noise.	Stuck valves. (Carbon buildup on the valve stem)	Repair or replace as required
	Excessive worn or misaligned timing chain	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and valve lifters.

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Engine misfire with coolant consumption	• Faulty cylinder head gasket and/or cranking or other damage to the cylinder head and engine block cooling system. • Coolant consumption may or may not cause the engine to overheat.	• Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. • Repair or replace as required.
Engine misfire with excessive oil consumption	Worn valves, guides and/or valve stem oil seals.	Repair or replace as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	• Inspect the cylinder for a loss of compression. • Repair or replace as required.
Engine noise on start-up, but only lasting a few seconds.	Incorrect oil viscosity	• Drain the oil. • Install the correct viscosity oil.
	Worn crankshaft thrust bearing.	• Inspect the thrust bearing and crankshaft. • Repair or replace as required.
Upper engine noise, regardless of engine speed.	Low oil pressure	Repair or replace as required.
	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stretched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	• Inspect the camshaft lobes. • Replace the timing camshaft and valve lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.	Inspect the valves and valve guides, then repair as required.
Lower engine noise, regardless of engine speed	Low oil pressure.	Repair or required.
	Loose or damaged flywheel.	Repair or replace the flywheel.
	Damaged oil pan, contacting the oil pump screen.	• Inspect the oil pan. • Inspect the oil pump screen. • Repair or replace as required.

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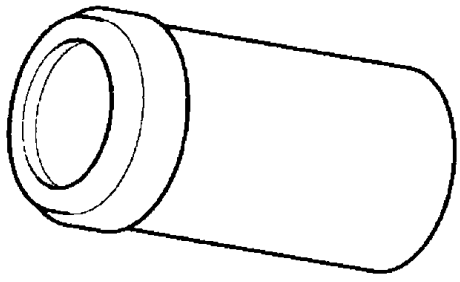
	Oil pump screen loose, damaged or restricted.	• Inspect the oil pump screen. • Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	• Inspect the piston, piston pin and cylinder bore. • Repair as required.
	Excessive piston pin-to-piston clearance	• Inspect the piston, piston pin and the connecting rod. • Repair or replace as required.
	Excessive connecting rod bearing clearance	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft pin journals.
	Excessive crankshaft bearing clearance	Inspect the following components, and repair as required. • The crankshaft bearings. • The crankshaft main journals.
	Incorrect piston, piston pin and connecting rod installation	• Verify the piston pins and connecting rods are installed correctly. • Repair as required.
Engine noise under load	Low oil pressure	Repair or replace as required.
	Excessive connecting rod bearing clearance	Inspect the following components and repair as required : • The connecting rod bearings. • The connecting rods. • The crankshaft
	Excessive crankshaft bearing clearance	Inspect the following components, and repair as required. • The crankshaft bearings. • The crankshaft main journals. • The cylinder block.

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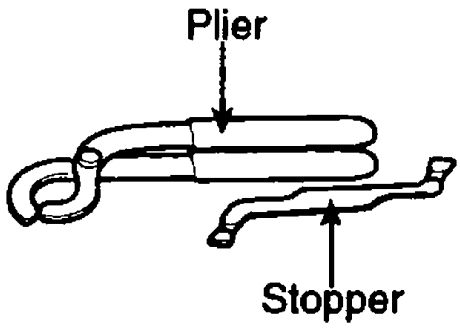
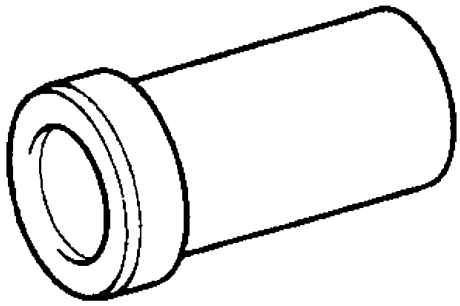
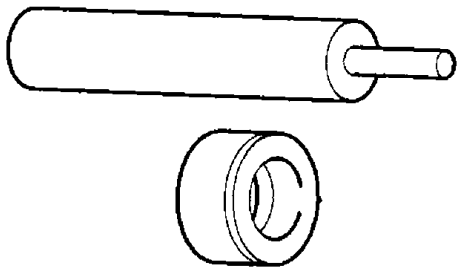
Engine will not crank-crankshaft will not rotate	Hydraulically locked cylinder • Coolant/antifreeze in cylinder. • Oil in cylinder. • Fuel in cylinder	1. Remove spark plugs and check for fluid. 2. Inspect for broken head gasket. 3. Inspect for cracked engine block or cylinder head. 4. Inspect for a sticking fuel injector and/or leaking fuel regulator.
	Broken timing chain and/or timing chain and/or timing chain gears.	1. Inspect timing chain and gears. 2. Repair as required.
	Material in cylinder • Broken valve • Piston material • Foreign material	1. Inspect cylinder for damaged components and/or foreign materials. 2. Repair or replace as required.
	Seized crankshaft or connecting rod bearings.	1. Inspect crankshaft and connecting rod bearing. 2. Repair as required.
	Bent or broken connecting rod.	1. Inspect connecting rods. 2. Repair as required.
	Broken crankshaft	1. Inspect crankshaft. 2. Repair as required.

SPECIAL TOOLS

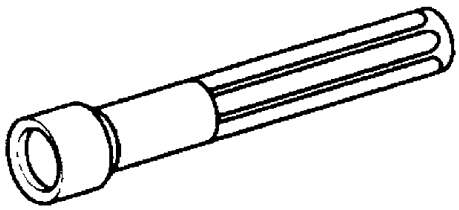
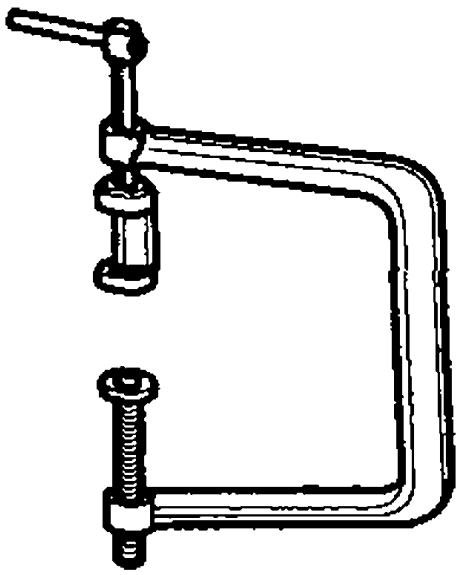
SPECIAL TOOLS DESCRIPTION

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-33000)	 G03848600	Installation of the front oil seal

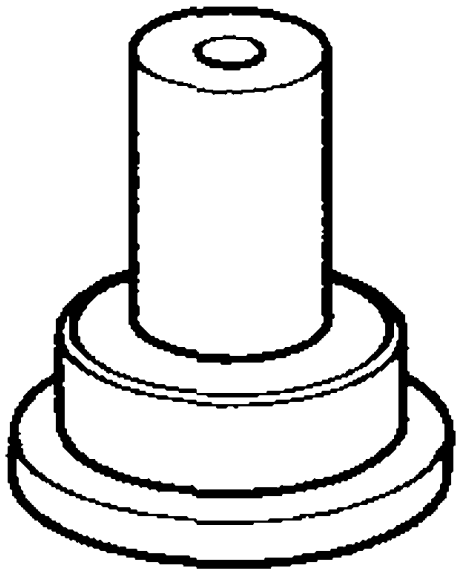
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Valve clearance adjust tool set (09220-2D000)	 G03848601	Removal and installation of the tappet shim
Camshaft oil seal installer (09221-21000)	 G03848602	Installation of the camshaft oil seal
Valve guide installer (09221-3F100 A/B)	 G03848603	Remove and installation of the valve guide
Valve stem oil seal installer (09222-22001)		Installation of the valve stem oil seal

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	 G03848604	
Valve spring compressor & adaptor (09222-28000, 09222-28100)	 G03848605	Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer (09231-21000)		1. Installation of the engine rear oil seal 2. Installation of the crankshaft rear oil seal

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TIMING SYSTEM

TIMING BELT

COMPONENT

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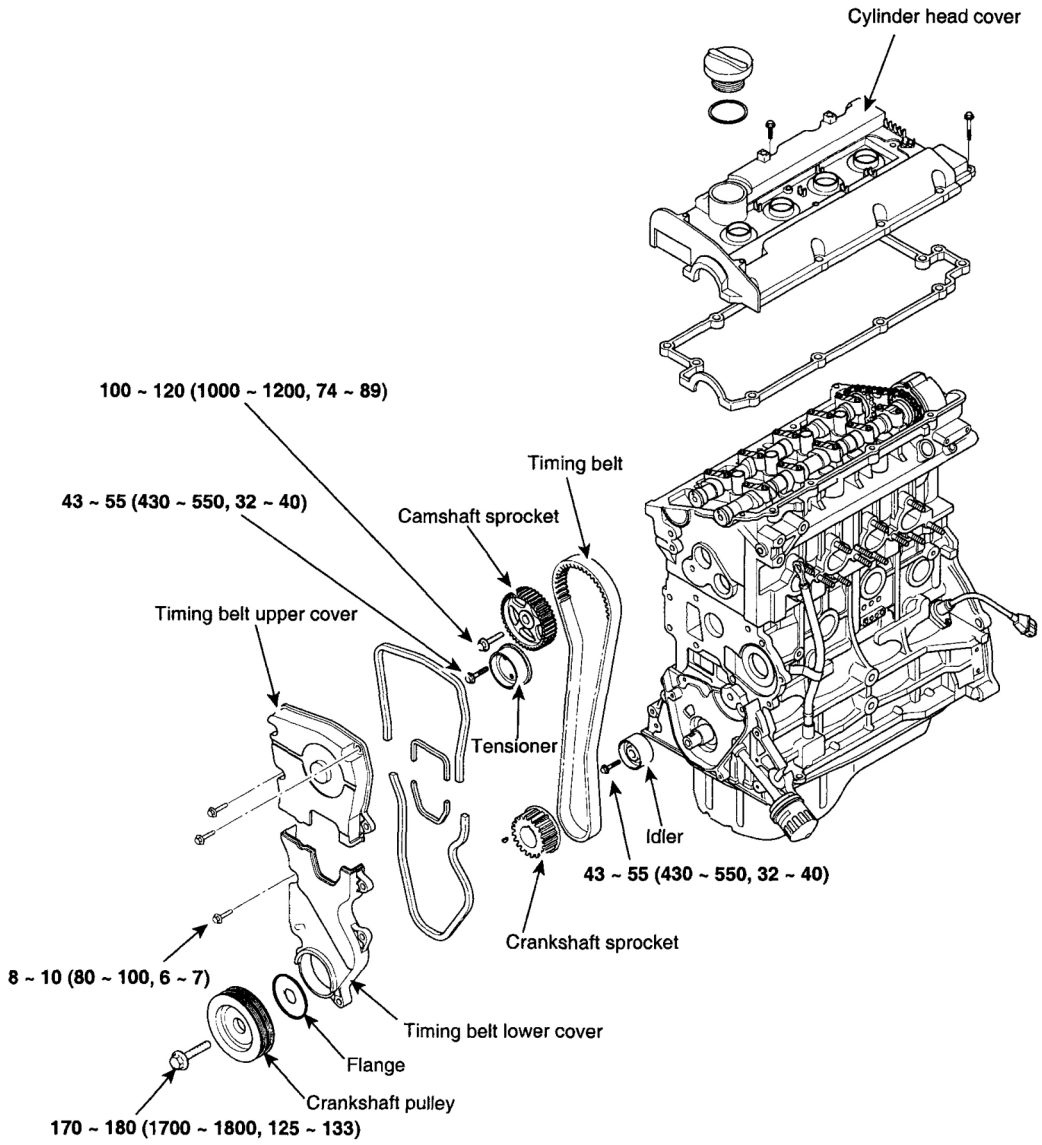


Fig. 23: Identifying Timing System Components And Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

Engine removal is not required for this procedure.

1. Remove the engine cover. (See **COMPRESSION**)
2. Remove RH front wheel.

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3. Remove 2 bolts(B) and RH side cover(A).

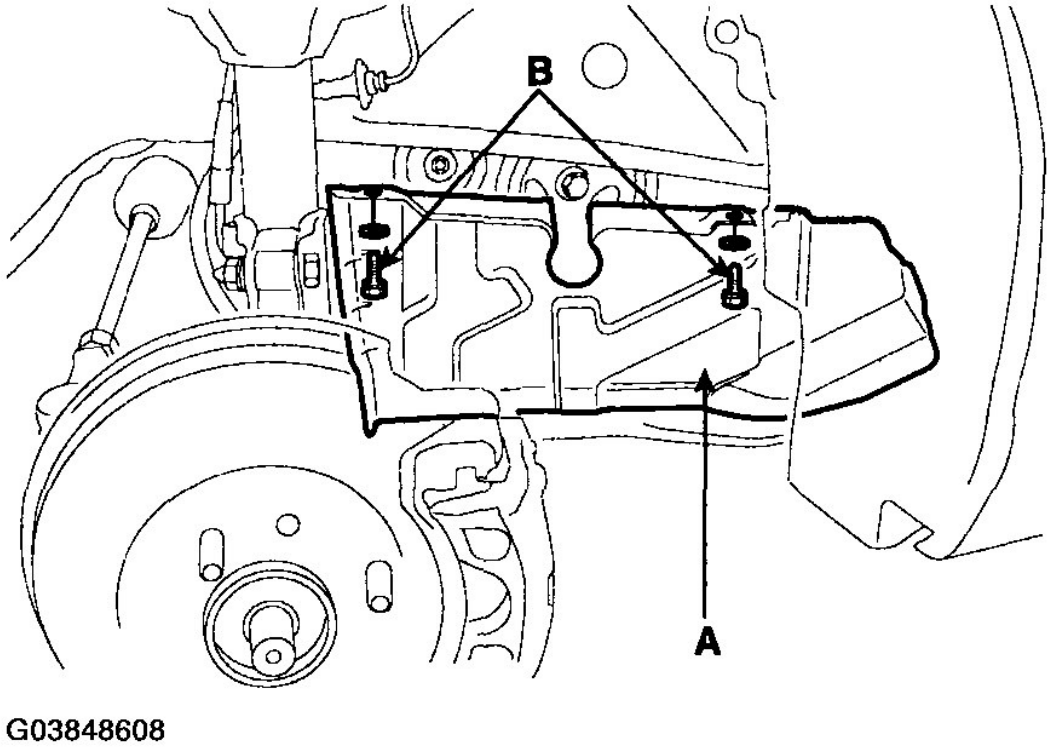


Fig. 24: Removing 2 Bolts And RH Side Cover
Courtesy of HYUNDAI MOTOR CO.

4. Remove the engine mount bracket.
    1. Set the jack to the engine oil pan.

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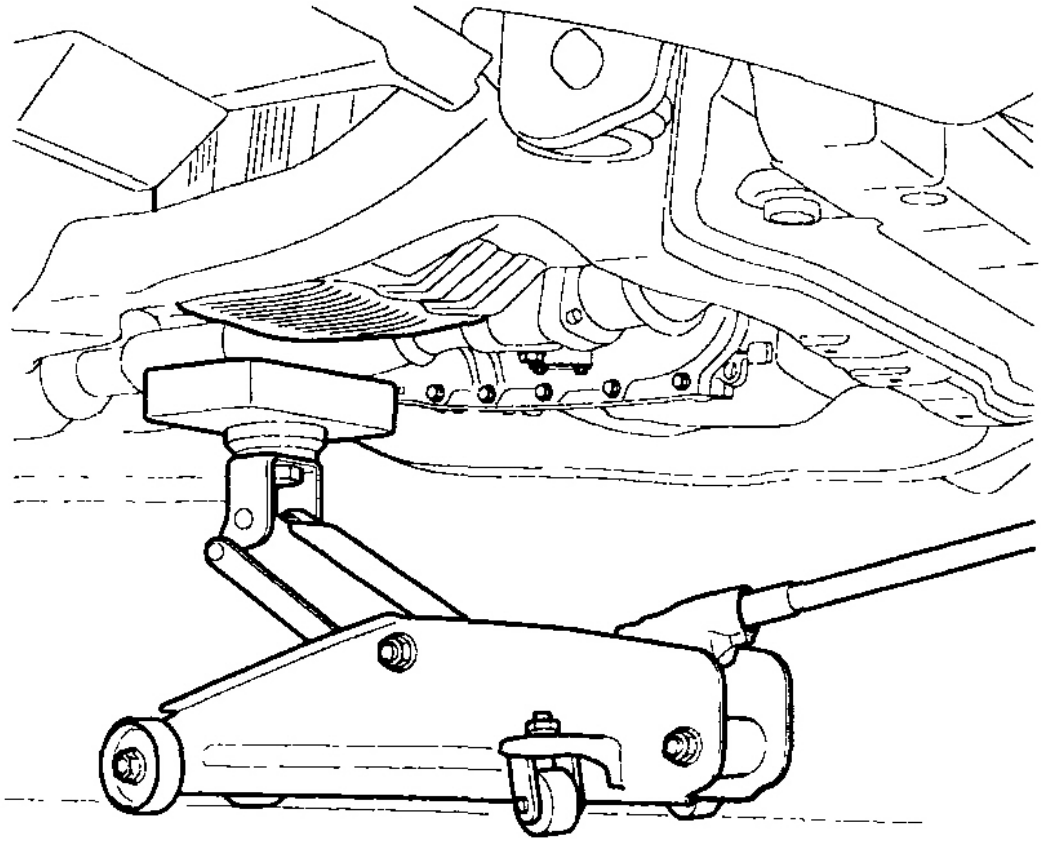


Fig. 25: Setting Jack To Engine Oil Pan
Courtesy of HYUNDAI MOTOR CO.

NOTE: Place wooden block between the jack and engine oil pan.

2. Remove the bolt(B), 3 nuts(C, D) and engine mount bracket(A).

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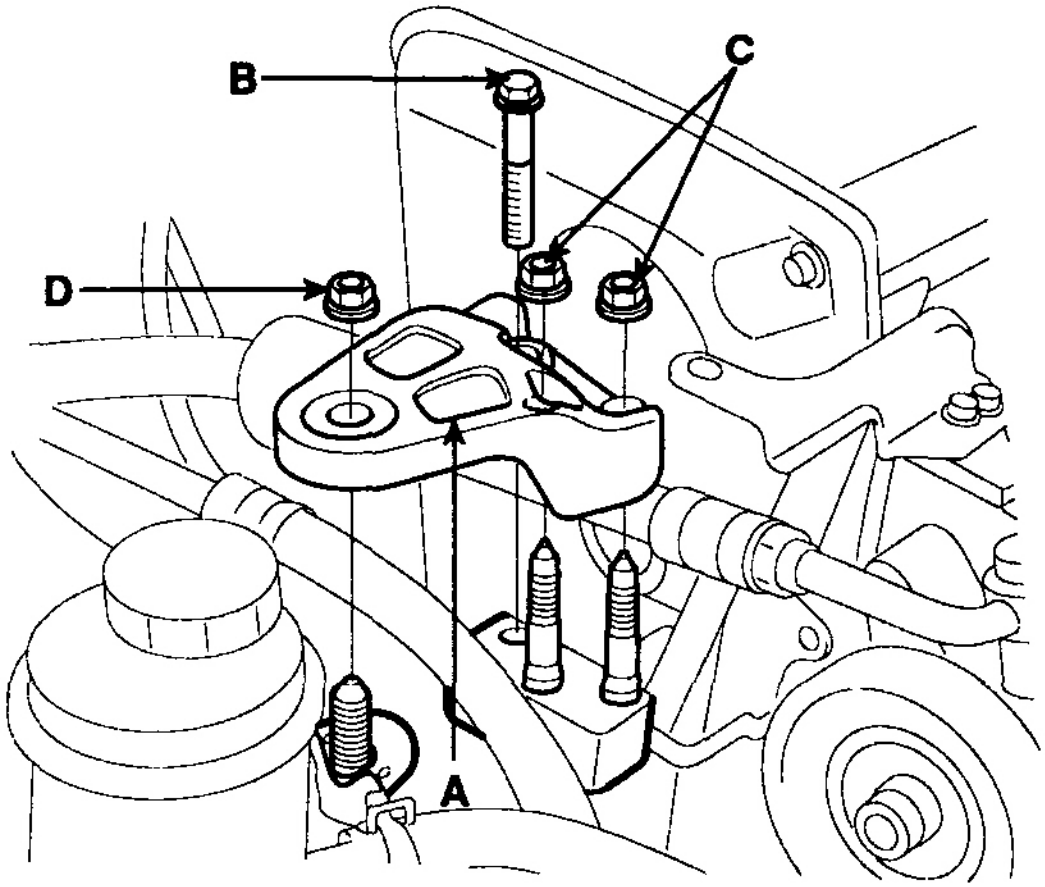
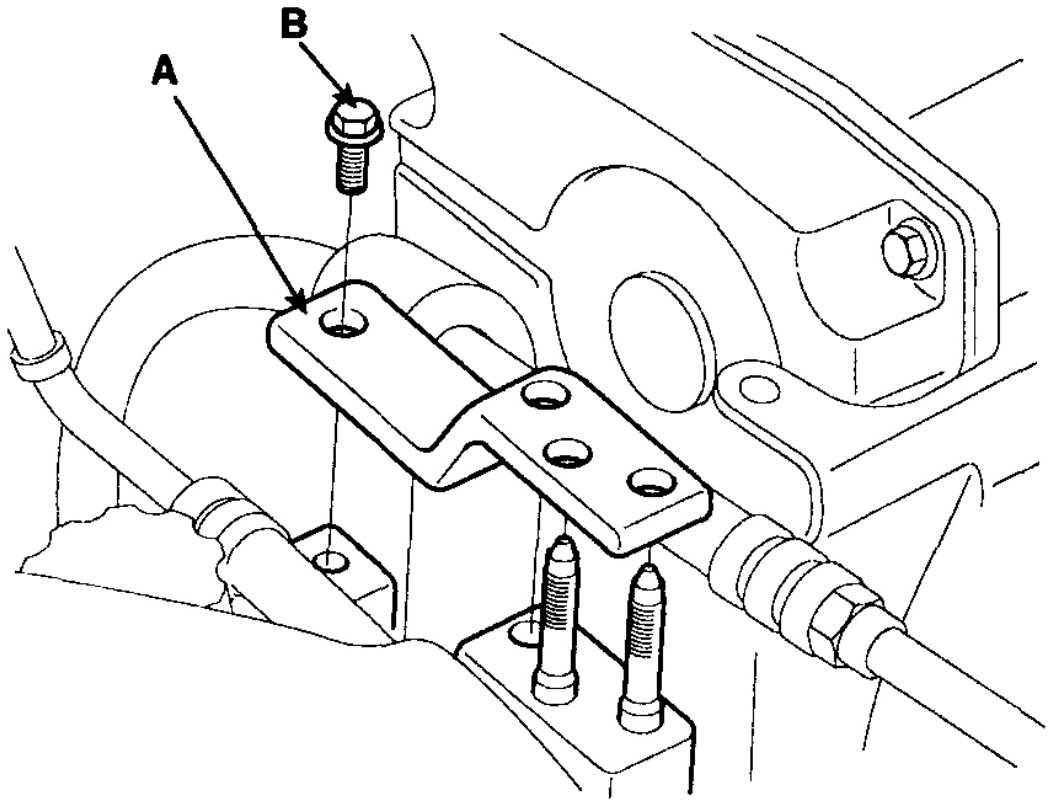


Fig. 26: Removing Bolt, 3 Nuts And Engine Mount Bracket
Courtesy of HYUNDAI MOTOR CO.

3. Remove the bolt(B) and stay plate(A).

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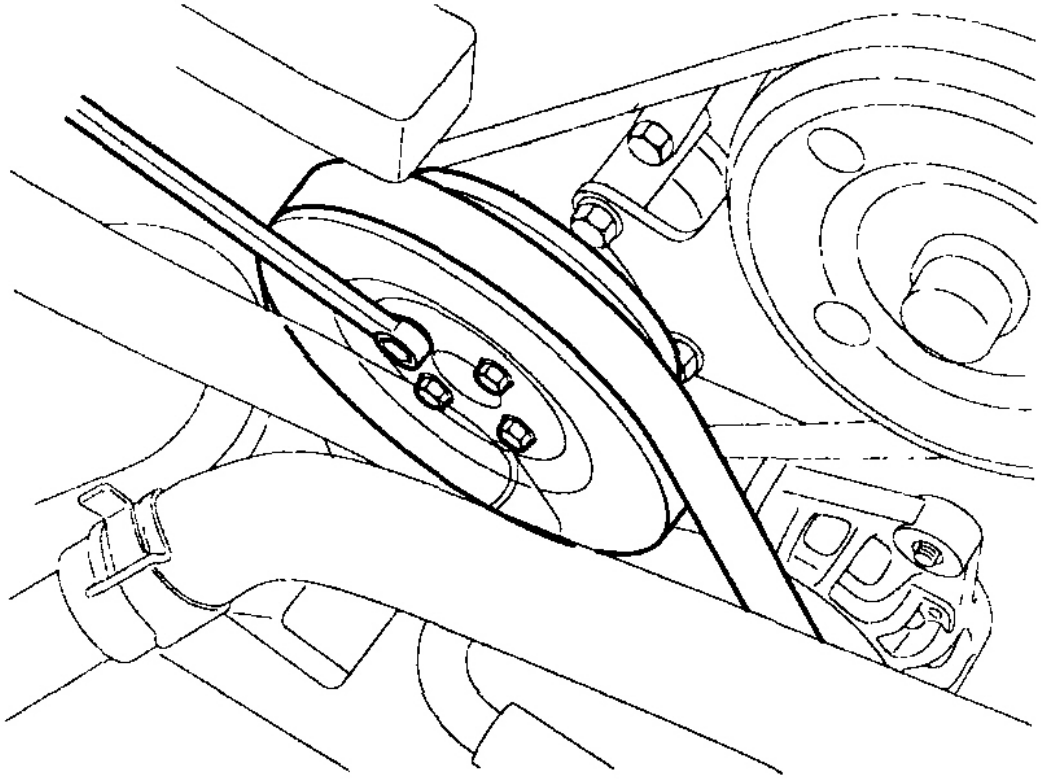


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Fig. 27: Removing Bolt And Stay Plate
Courtesy of HYUNDAI MOTOR CO.

5. Temporarily loosen the water pump pulley bolts.

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Fig. 28: Loosening Water Pump Pulley Bolts
Courtesy of HYUNDAI MOTOR CO.

6. Remove alternator belt. (See **ALTERNATOR BELT INSPECTION AND ADJUSTMENT**)
7. Remove air compressor belt. (See **REPLACEMENT**)
8. Remove power steering belt. (See **MECHANICAL POWER STEERING SYSTEM**)
9. Remove 4 bolts and water pump pulley.
10. Remove the 4 bolts and timing belt upper cover. (See **TIMING BELT TENSION ADJUSTMENT**)
11. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover. (See **TIMING BELT TENSION ADJUSTMENT**)
12. Remove the crankshaft pulley bolt(B) and crankshaft pulley (A).

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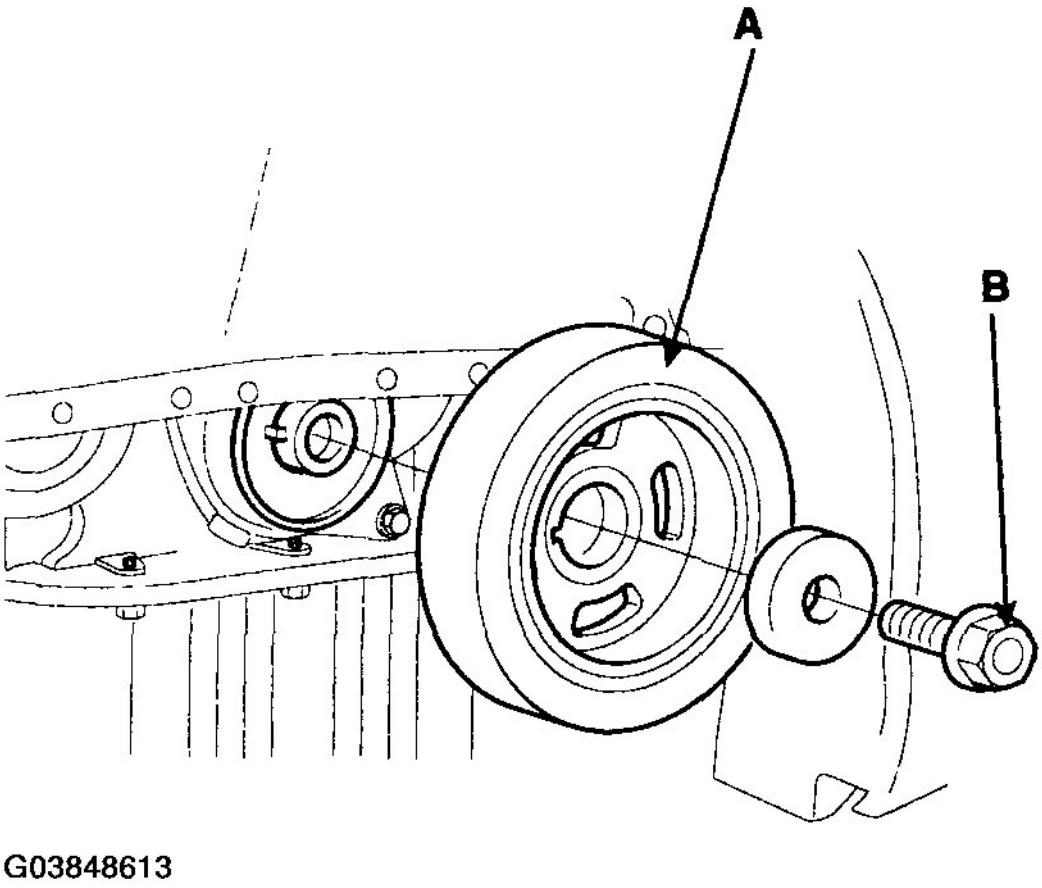


Fig. 29: Removing Crankshaft Pulley Bolt And Crankshaft Pulley
Courtesy of HYUNDAI MOTOR CO.

13. Remove the crankshaft flange(A).

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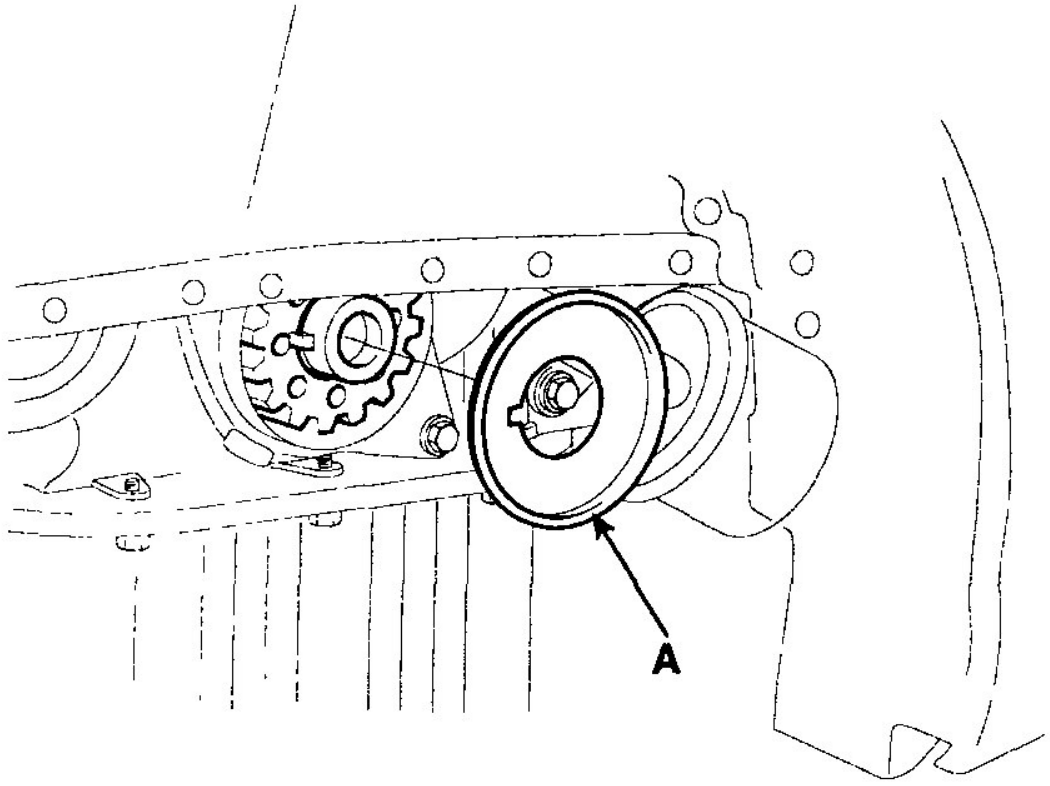


Fig. 30: Removing Crankshaft Flange
Courtesy of HYUNDAI MOTOR CO.

14. Remove the 5 bolts(B) and timing belt lower cover(A).

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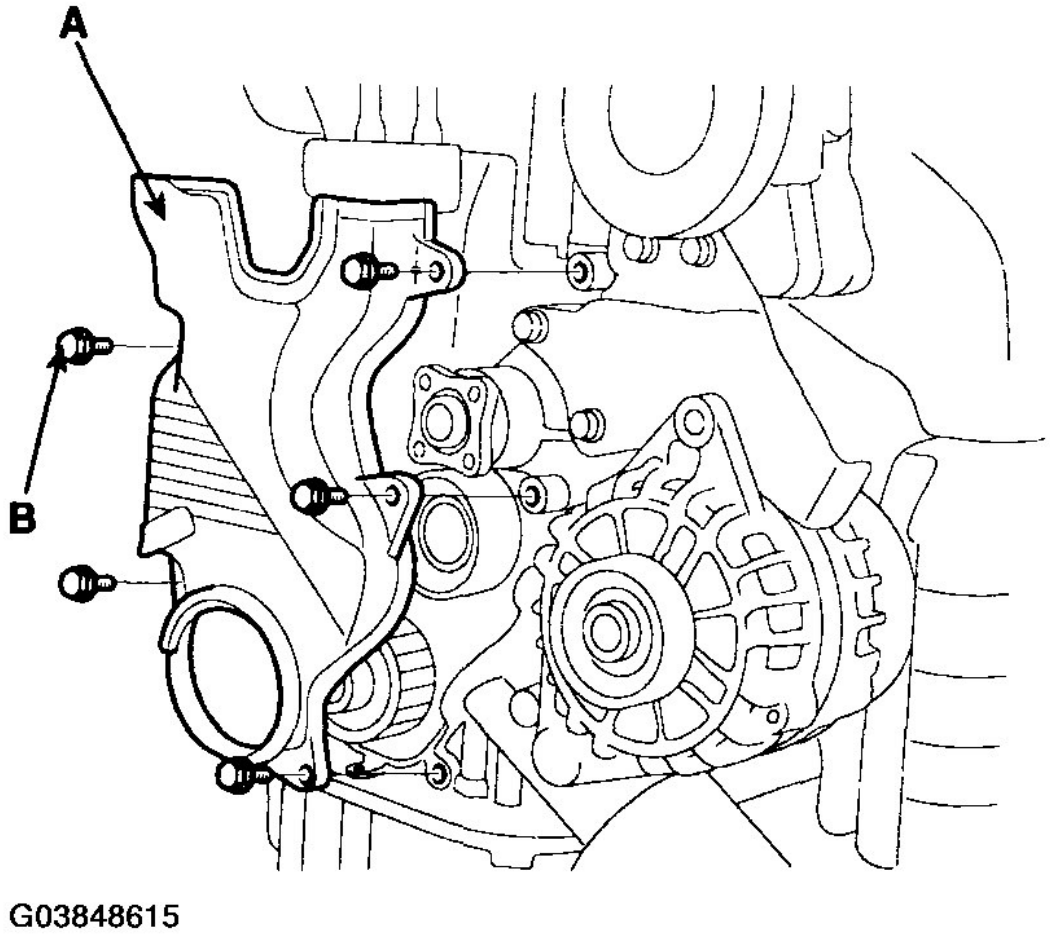


Fig. 31: Removing 5 Bolts And Timing Belt Lower Cover
Courtesy of HYUNDAI MOTOR CO.

15. Remove the timing belt tensioner(A) and timing belt(B).

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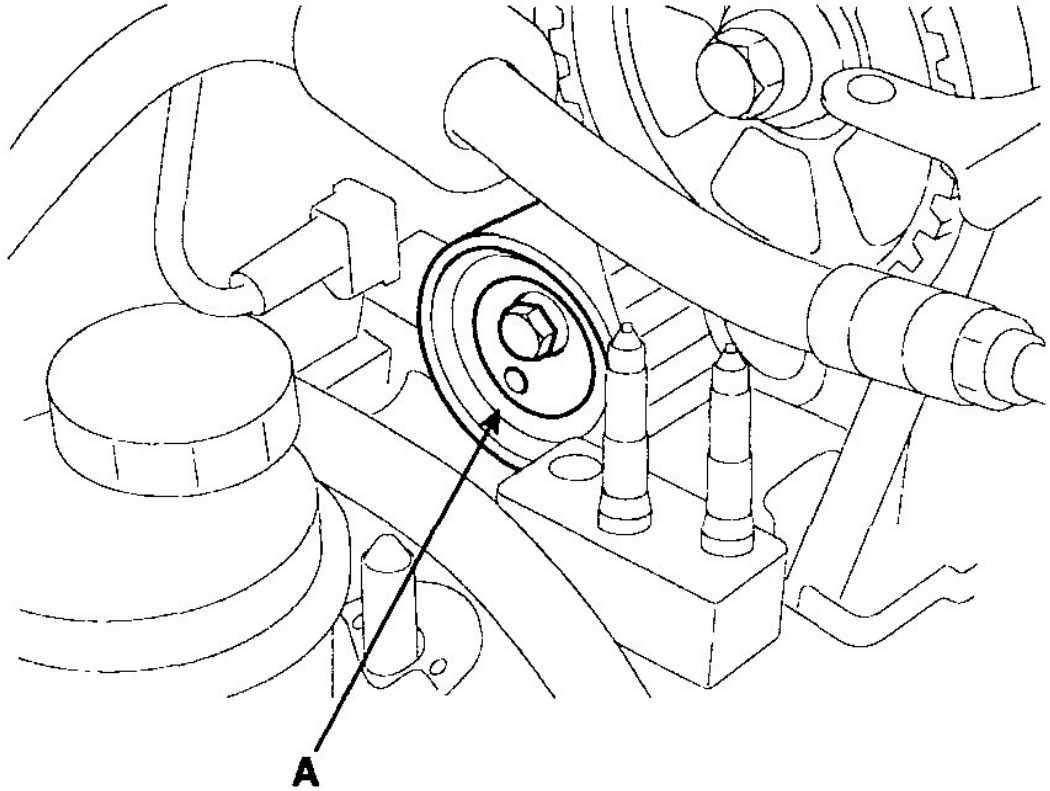


Fig. 32: Removing Timing Belt Tensioner
Courtesy of HYUNDAI MOTOR CO.

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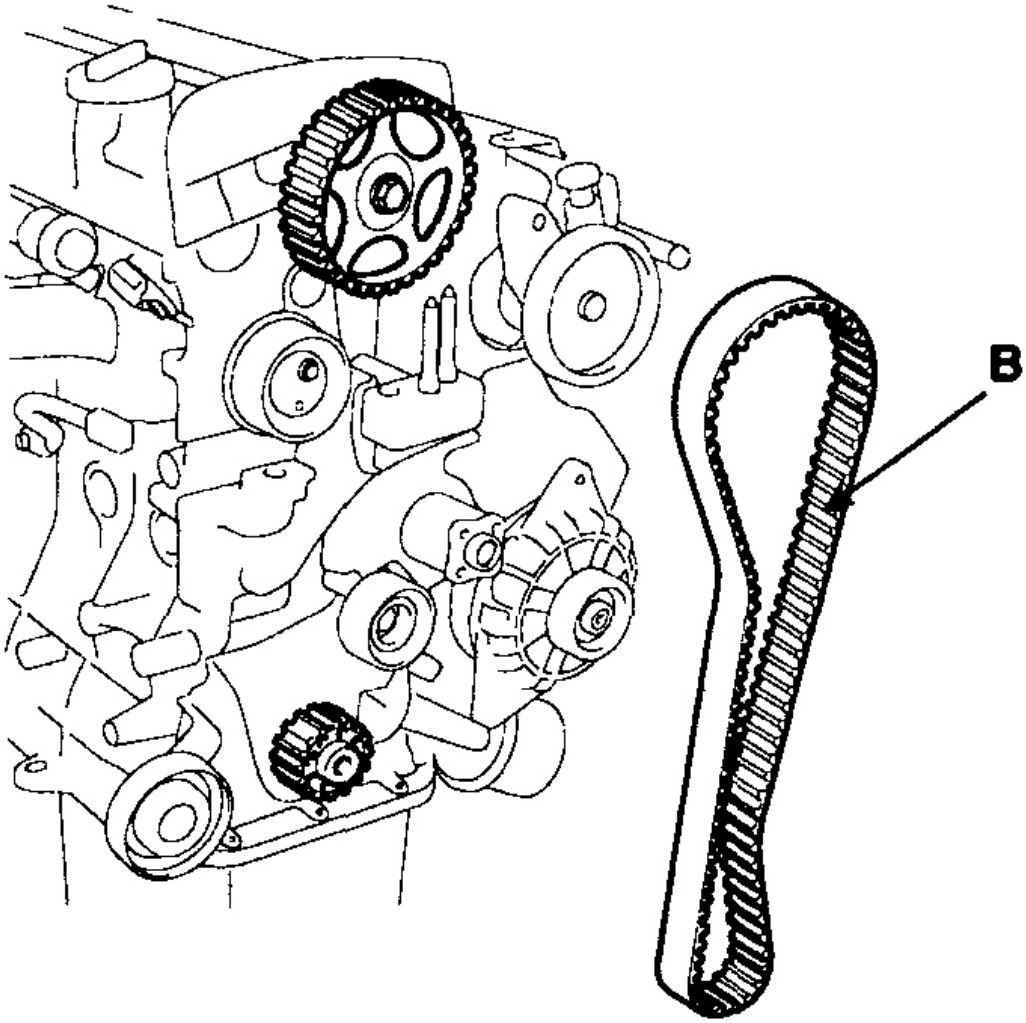


Fig. 33: Removing Timing Belt
Courtesy of HYUNDAI MOTOR CO.

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

16. Remove the bolt(B) and timing belt idler(A).

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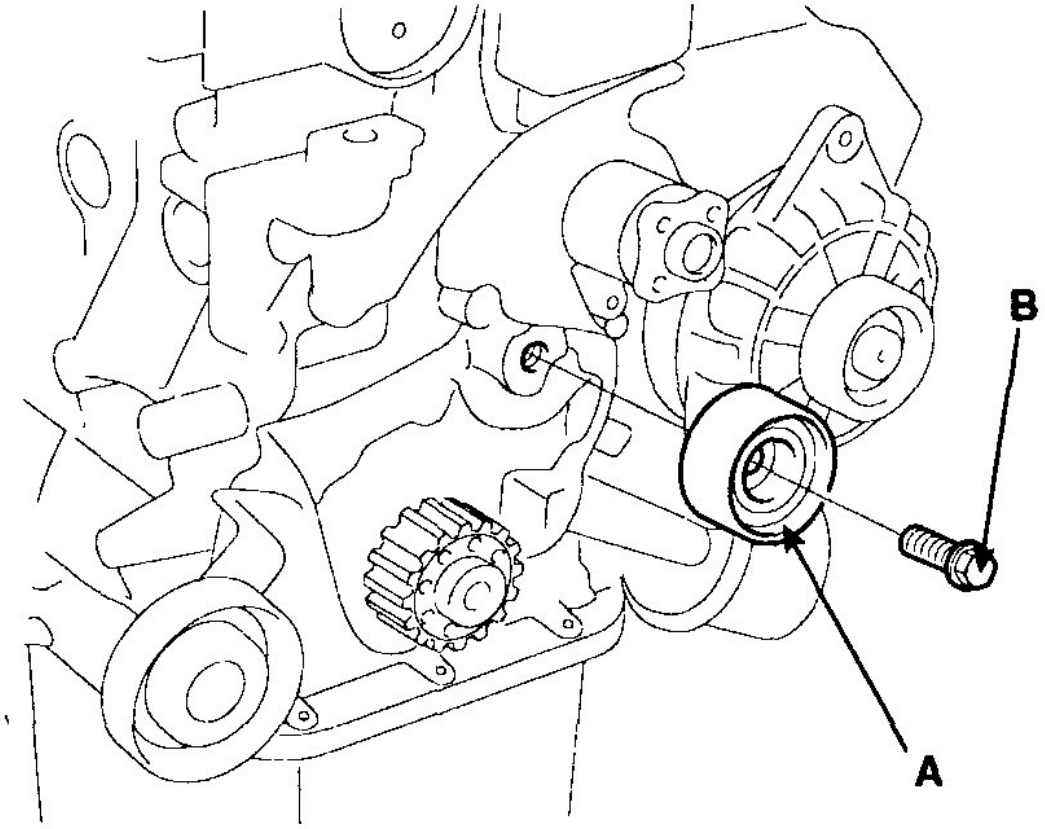


Fig. 34: Removing Bolt And Timing Belt Idler
Courtesy of HYUNDAI MOTOR CO.

17. Remove the crankshaft sprocket(A).

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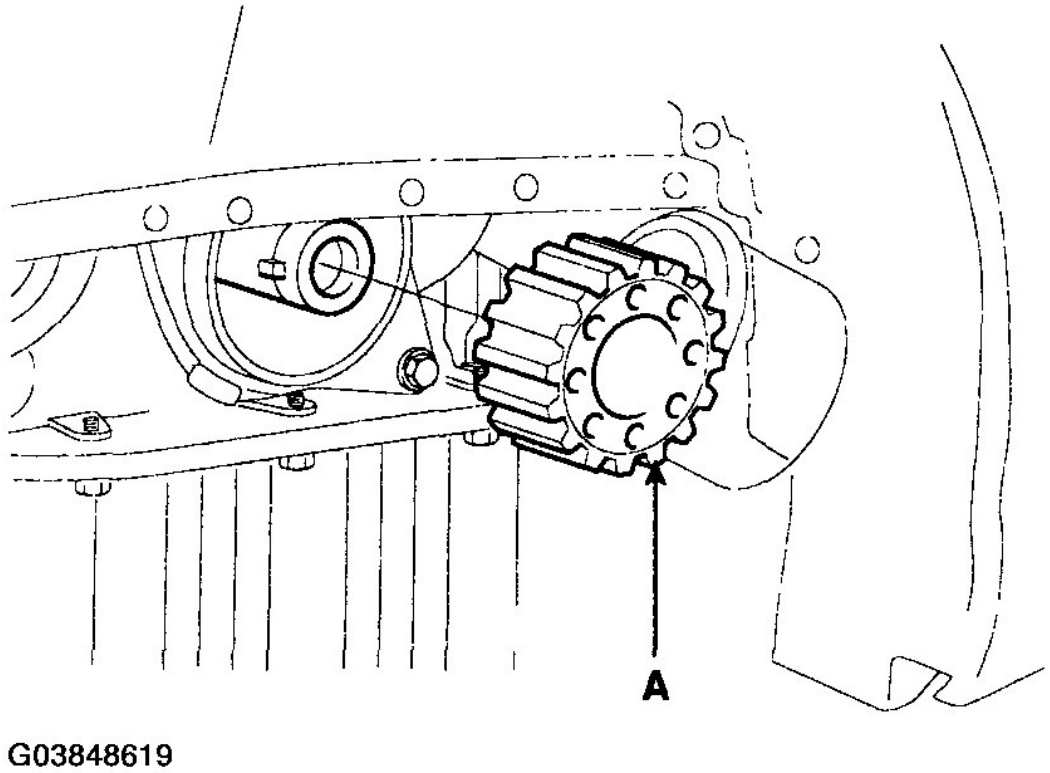
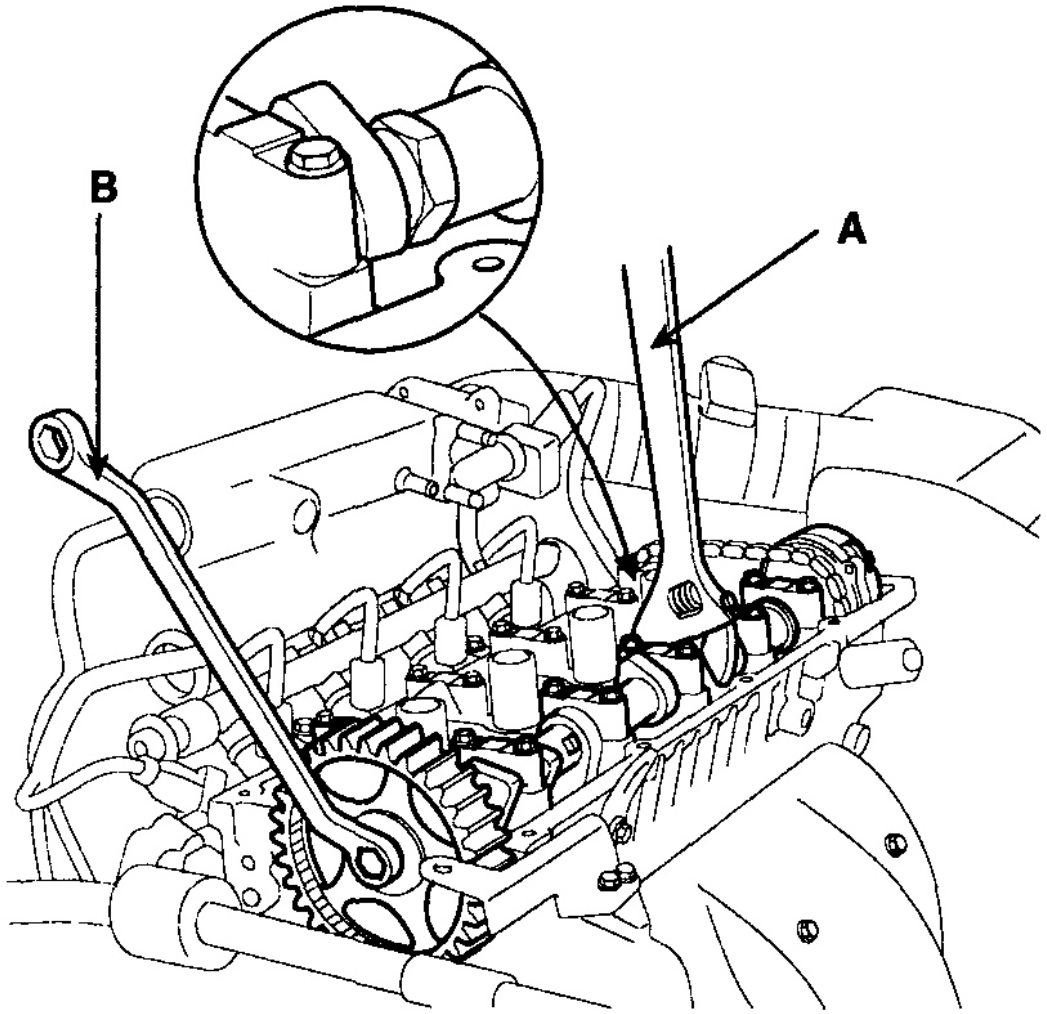


Fig. 35: Removing Crankshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

18. Remove the cylinder head cover.
    1. Remove the spark plug cable.
    2. Remove the accelerator cable from the cylinder head cover. (See **VALVE CLEARANCE INSPECTION AND ADJUSTMENT**)
    3. Remove the PCV (Positive Crankcase ventilation) hose and breather hose. (See **VALVE CLEARANCE INSPECTION AND ADJUSTMENT**)
    4. Remove the 12 bolts and cylinder head cover. (See **VALVE CLEARANCE INSPECTION AND ADJUSTMENT**)
19. Remove camshaft sprocket.
    1. Hold the hexagonal head wrench(A) portion of the camshaft with a wrench(B), and remove the bolt and camshaft sprocket(C).

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Fig. 36: Removing Bolt And Camshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

CAUTION: Be careful not to damage the cylinder head and valve lifter with the wrench.

INSPECTION

SPROCKETS, TENSIONER, IDLER

1. Check the camshaft sprocket, crankshaft sprocket, tensioner pulley, and Idler pulley for abnormal wear, cracks, or damage. Replace as necessary.

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

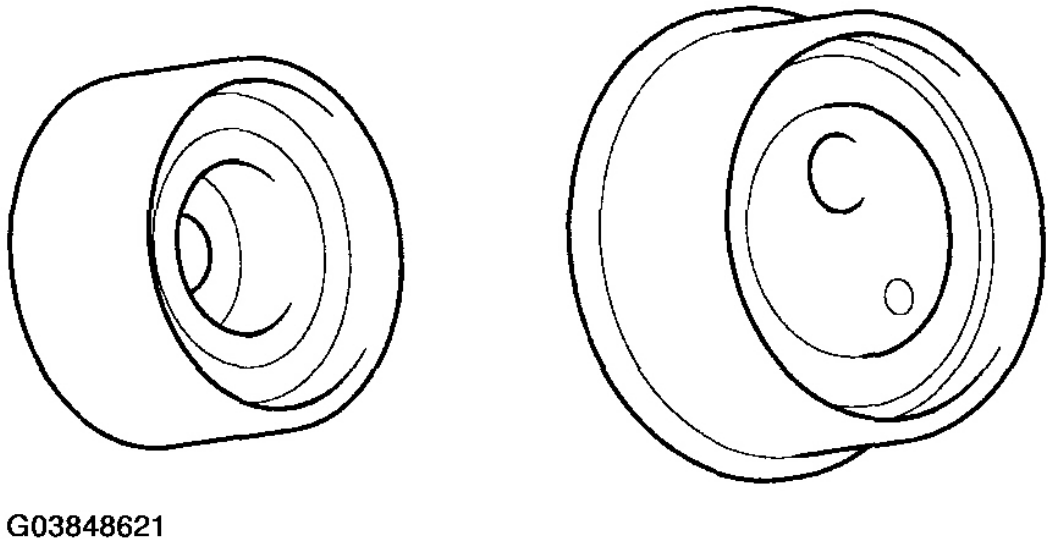


Fig. 37: Identifying Tensioner Pulley And Idler Pulley
Courtesy of HYUNDAI MOTOR CO.

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.

NOTE:

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

INSTALLATION

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

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1. Temporarily install the camshaft sprocket bolt.
2. Hold the hexagonal head wrench(A) portion of the camshaft with a wrench(B), and tighten the camshaft sprocket(C) bolt.

Tightening torque

Camshaft sprocket bolt

100 ~ 120Nm (1000 ~ 1200kgf.cm, 74 ~ 89lbf.ft)

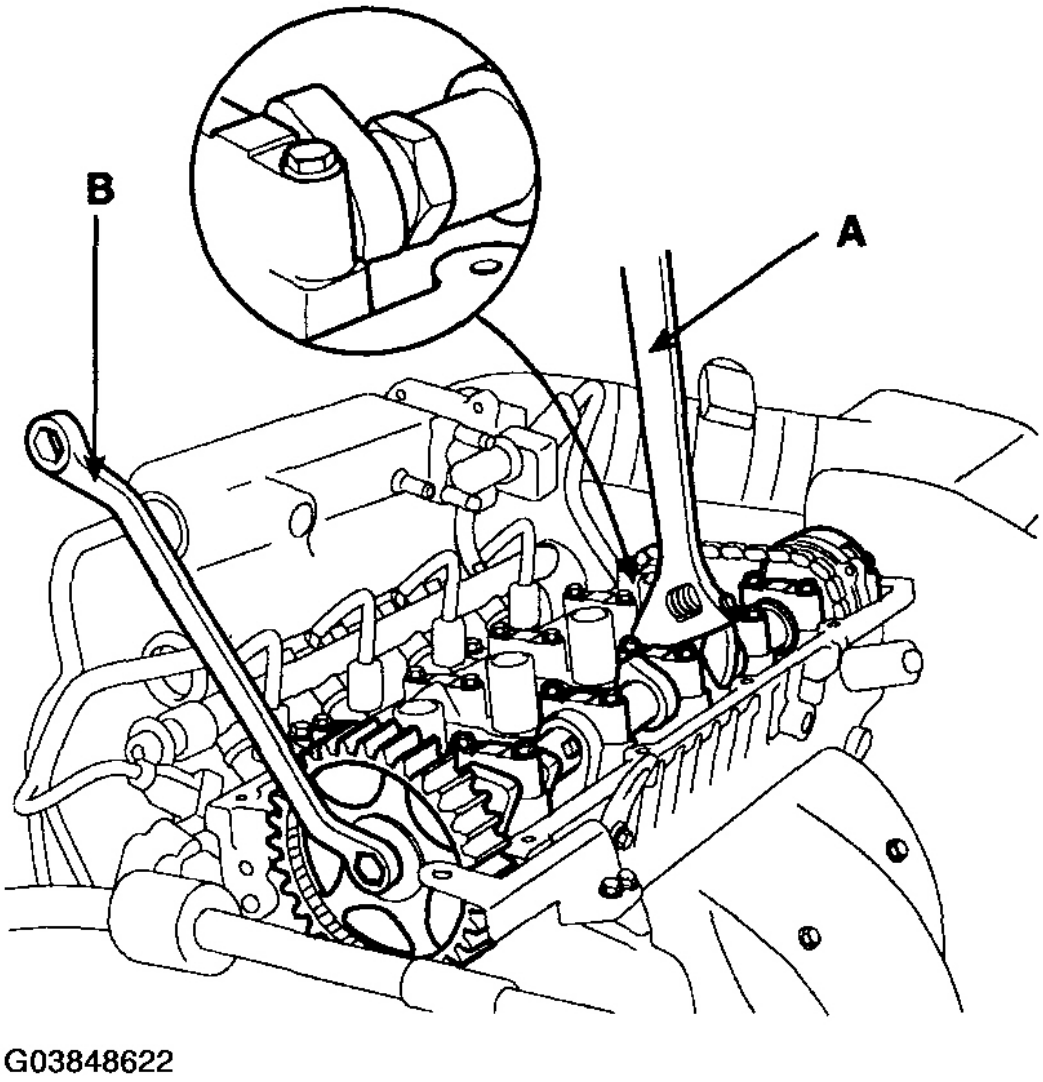


Fig. 38: Tightening Camshaft Sprocket Bolt
Courtesy of HYUNDAI MOTOR CO.

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2. Install cylinder head cover.
    1. Install cylinder head cover(A) and 12 bolts(B).

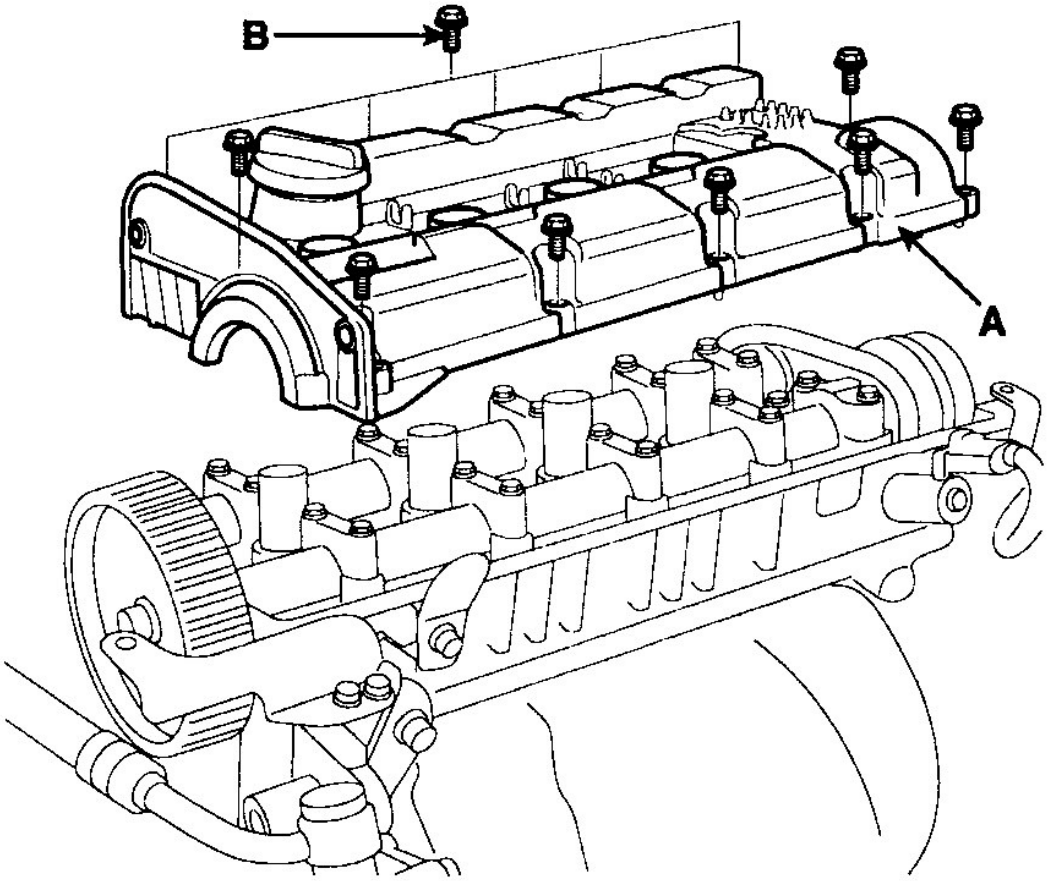


Fig. 39: Installing Cylinder Head Cover And 12 Bolts
Courtesy of HYUNDAI MOTOR CO.

2. Install the PCV hose(A) and breather hose(B).

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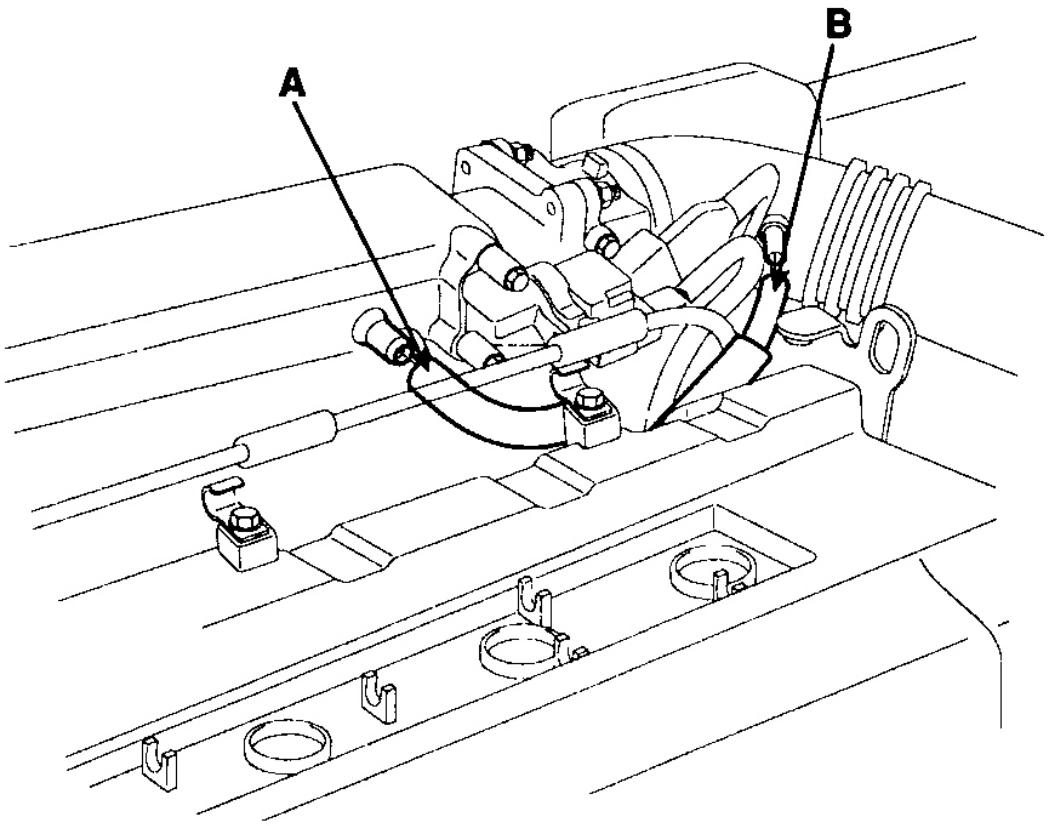


Fig. 40: Installing PCV Hose And Breather Hose
Courtesy of HYUNDAI MOTOR CO.

3. Install the accelerator cable(A) from the cylinder head cover.

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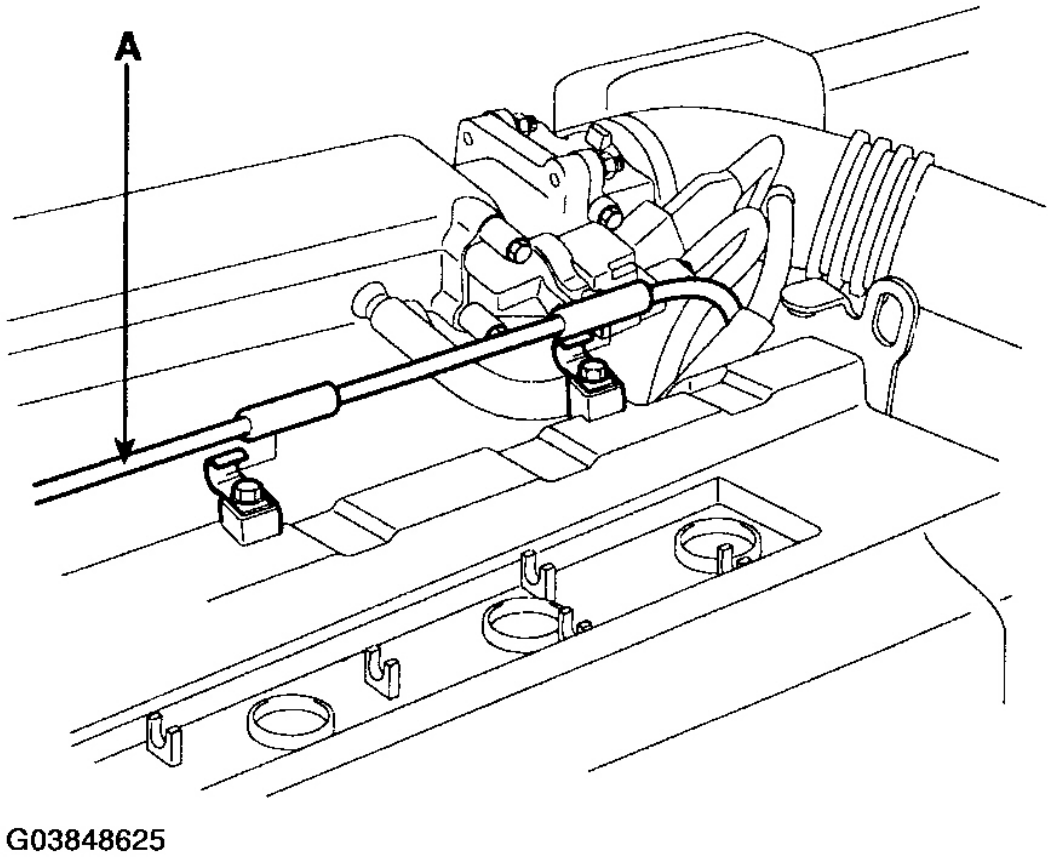


Fig. 41: Installing Accelerator Cable From Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

4. Install the spark plug cable.

3. Install the crankshaft sprocket(A).

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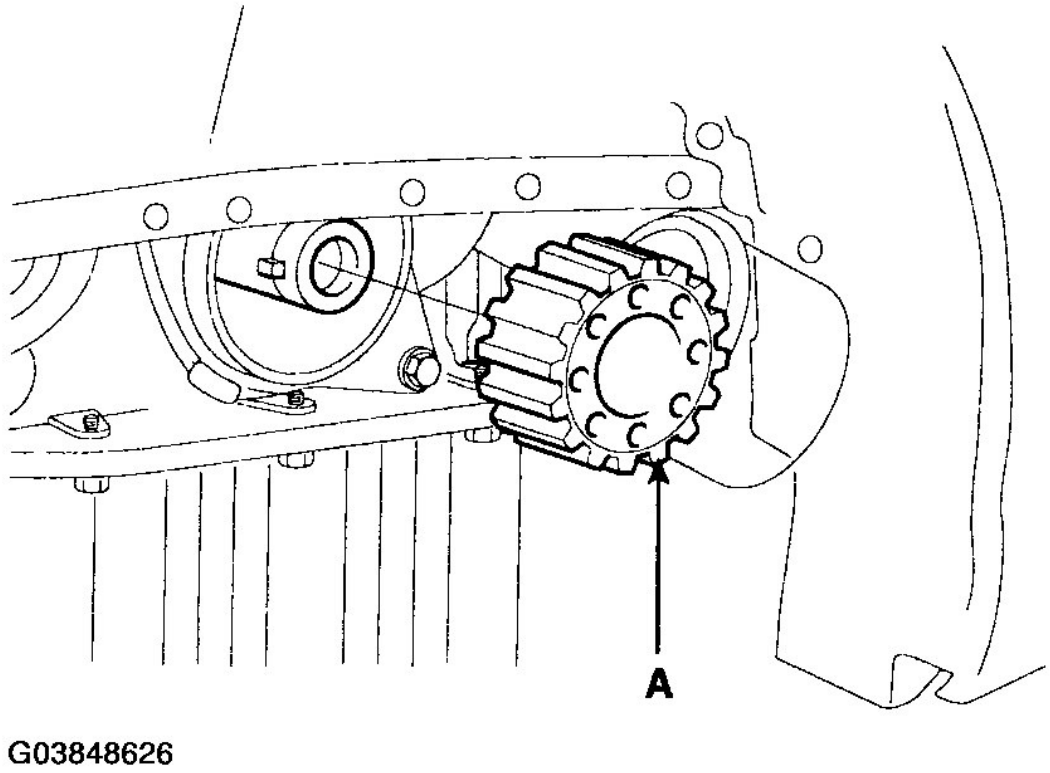


Fig. 42: Installing Crankshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

4. Align the timing marks of the camshaft sprocket(A) and crankshaft sprocket(B) with the No.1 piston placed at top dead center and its compression stroke.

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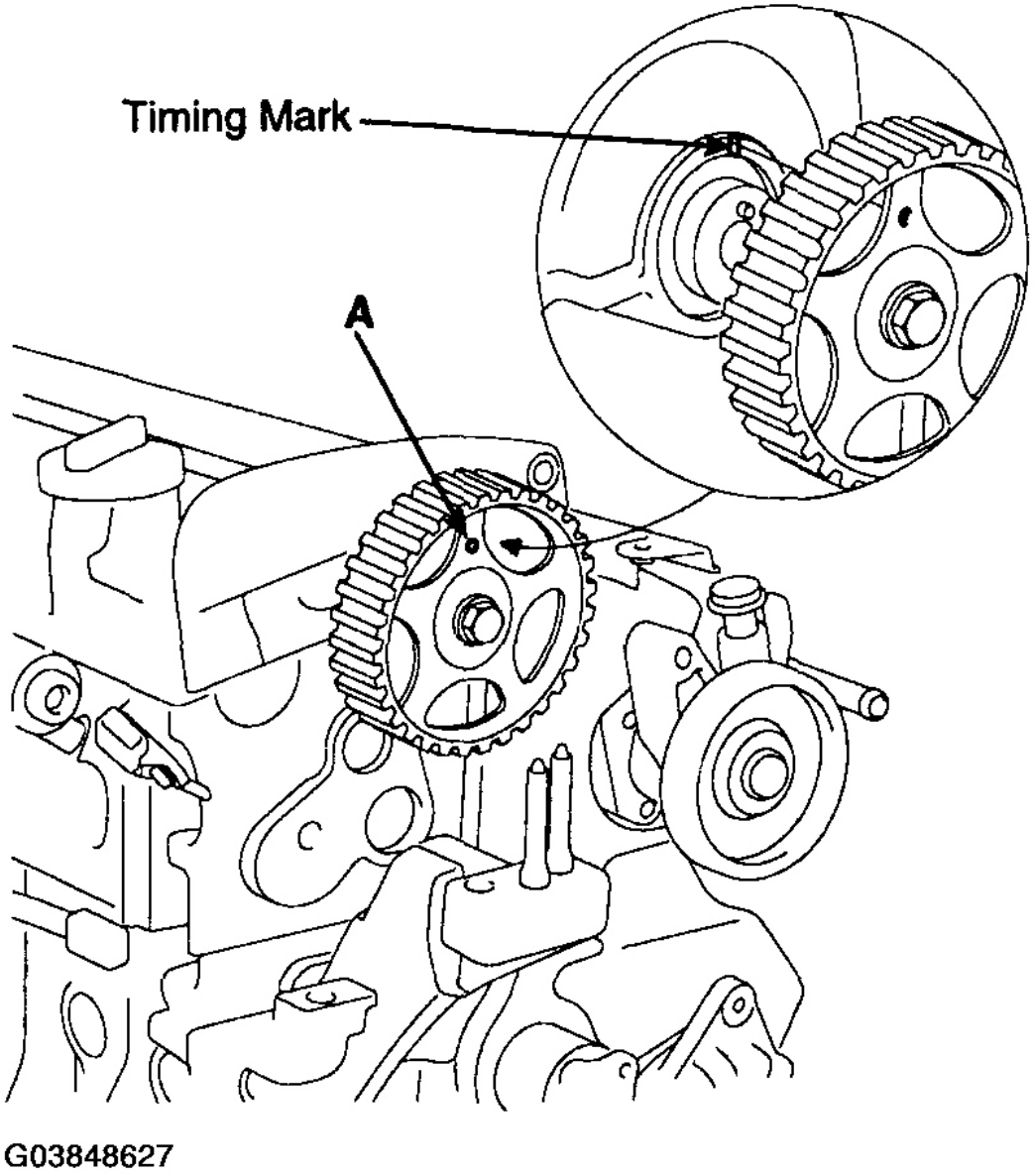


Fig. 43: Aligning Timing Marks Of Camshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

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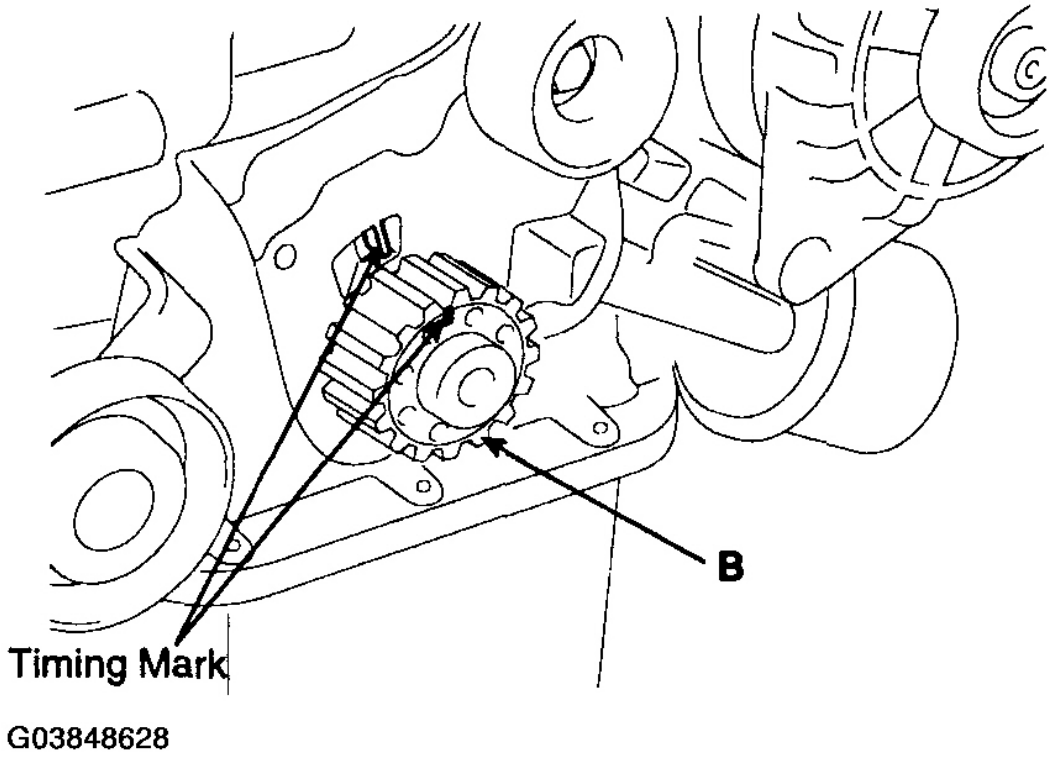


Fig. 44: Aligning Timing Marks Of Crankshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

5. Install the idler pulley(A) and tighten the bolt(B) to the specified torque.

   Tightening torque

   Idler pulley bolt

   43 ~ 55Nm (430 - 550kgf.m, 32 ~ 40lbf.ft)

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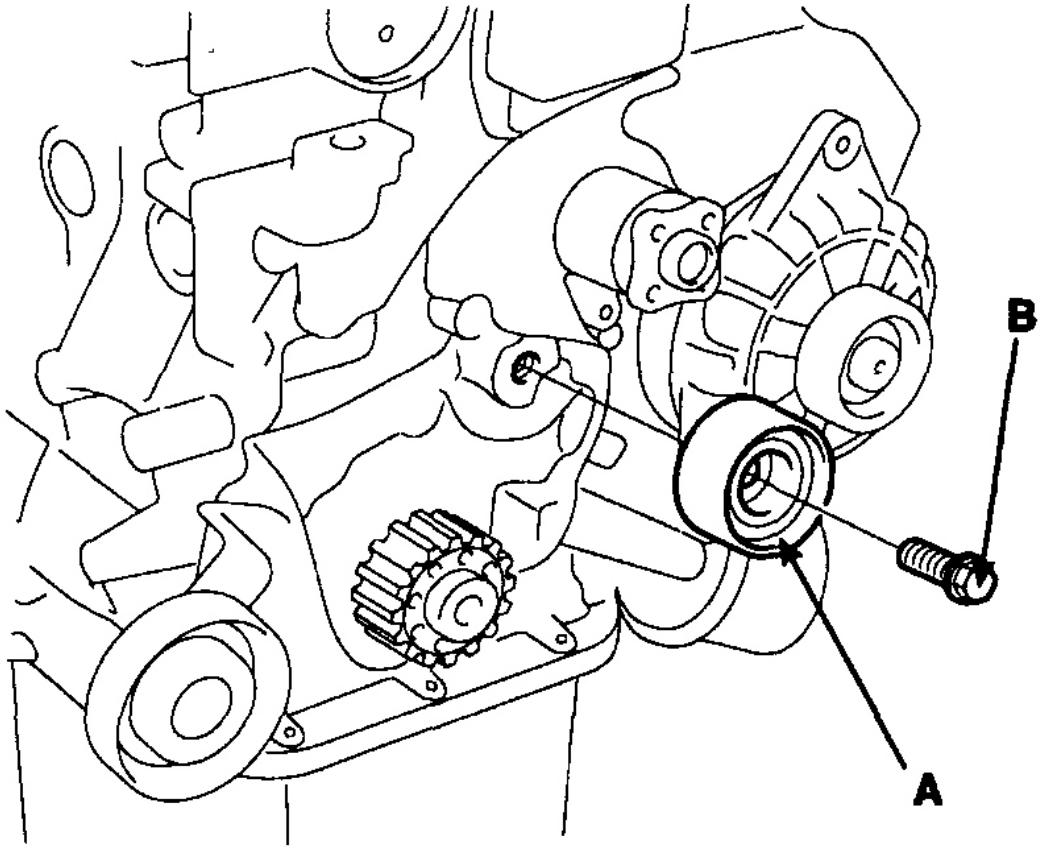


Fig. 45: Installing Idler Pulley And Tightening Bolt To Specified Torque
Courtesy of HYUNDAI MOTOR CO.

6. Temporarily install the timing belt tensioner(A) with plain washer(B).

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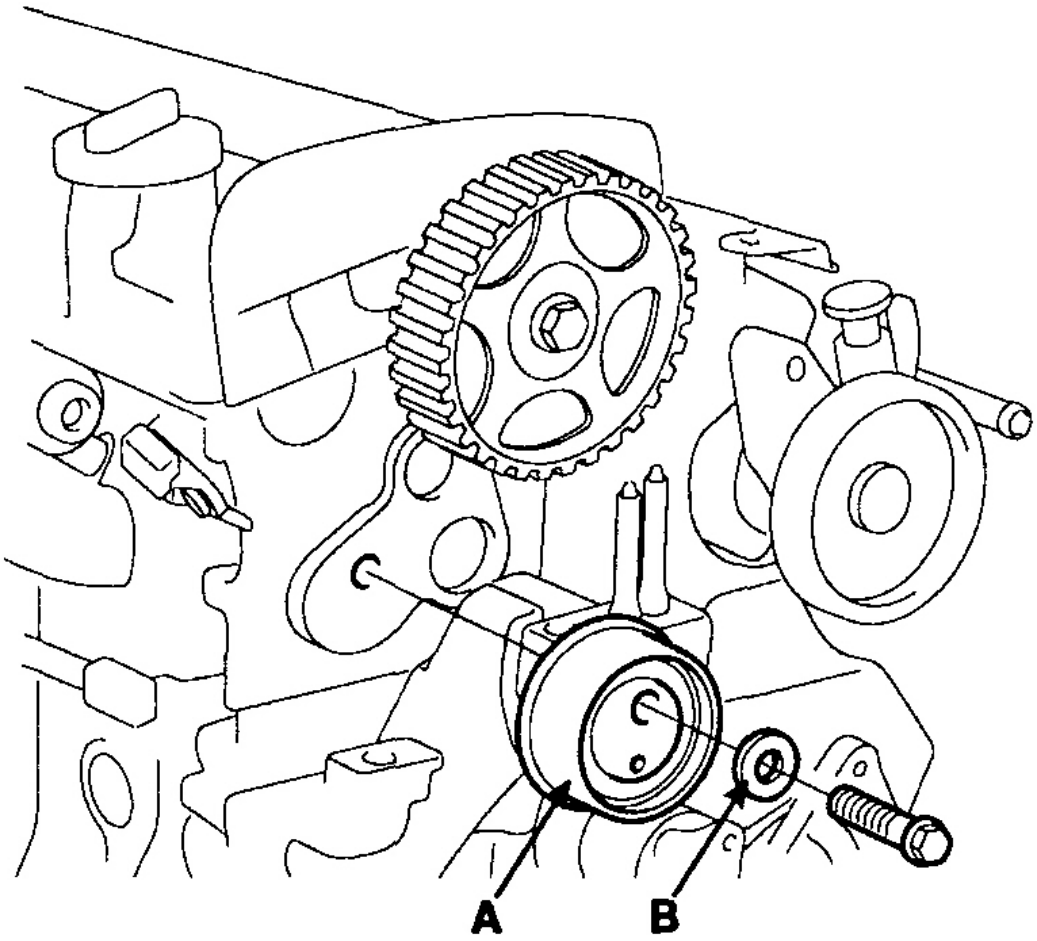


Fig. 46: Installing Timing Belt Tensioner With Plain Washer
Courtesy of HYUNDAI MOTOR CO.

7. Install the timing belt so as not to give excessive slack at the center of the belt. Install the timing belt with the following procedure.

   Crankshaft sprocket (A) --> Idler pulley (B) --> Camshaft sprocket (C) --> timing belt tensioner (D).

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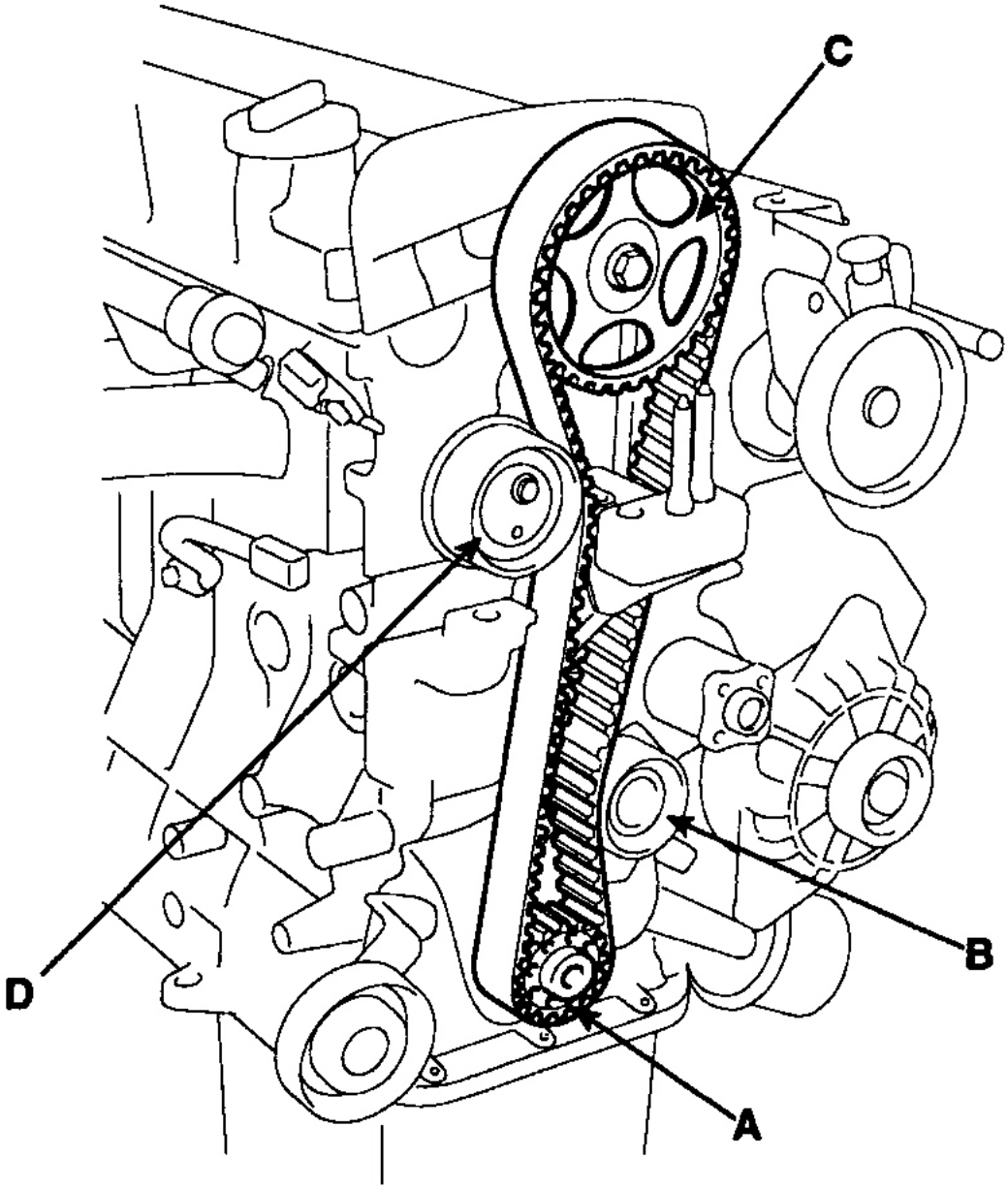


Fig. 47: Installing Timing Belt
Courtesy of HYUNDAI MOTOR CO.

8. Temporarily fasten tensioner pulley by center bolt to add force at belt.
9. Timing belt tension adjusting
    1. Rotate crankshaft in regular direction (clock wise view from front) through angle equivalent to two

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teeth (18°) of camshaft sprocket(A).

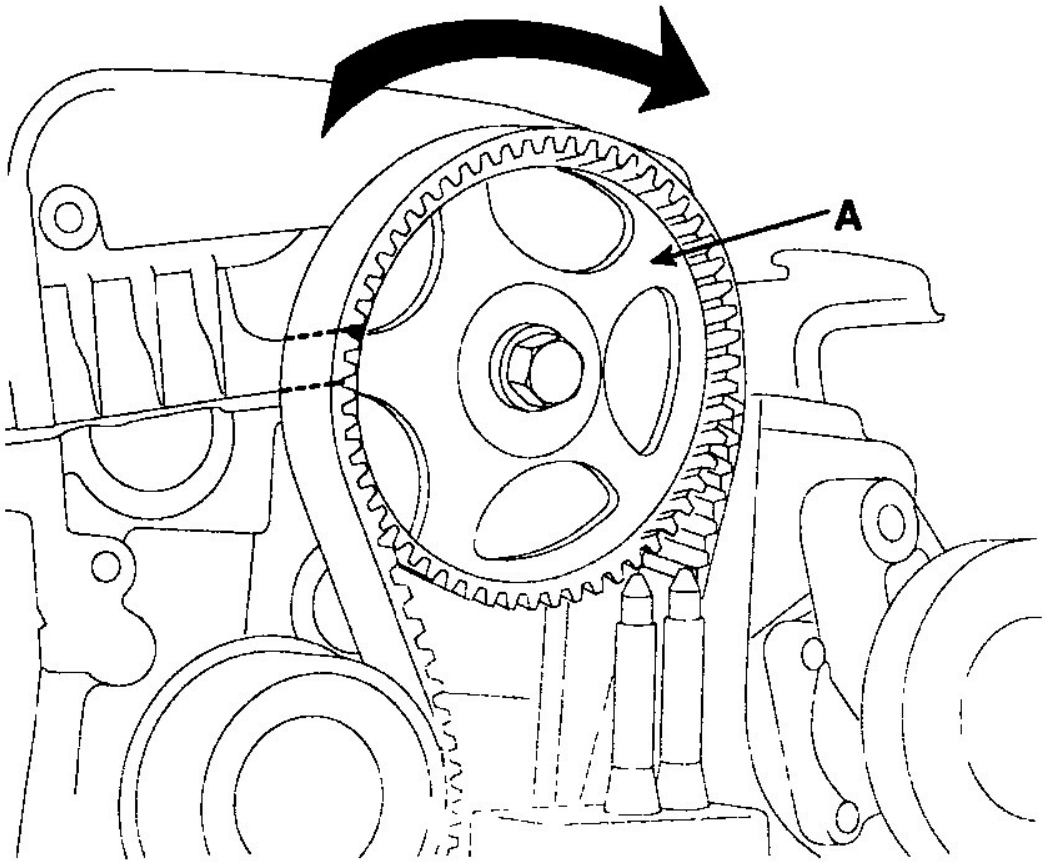
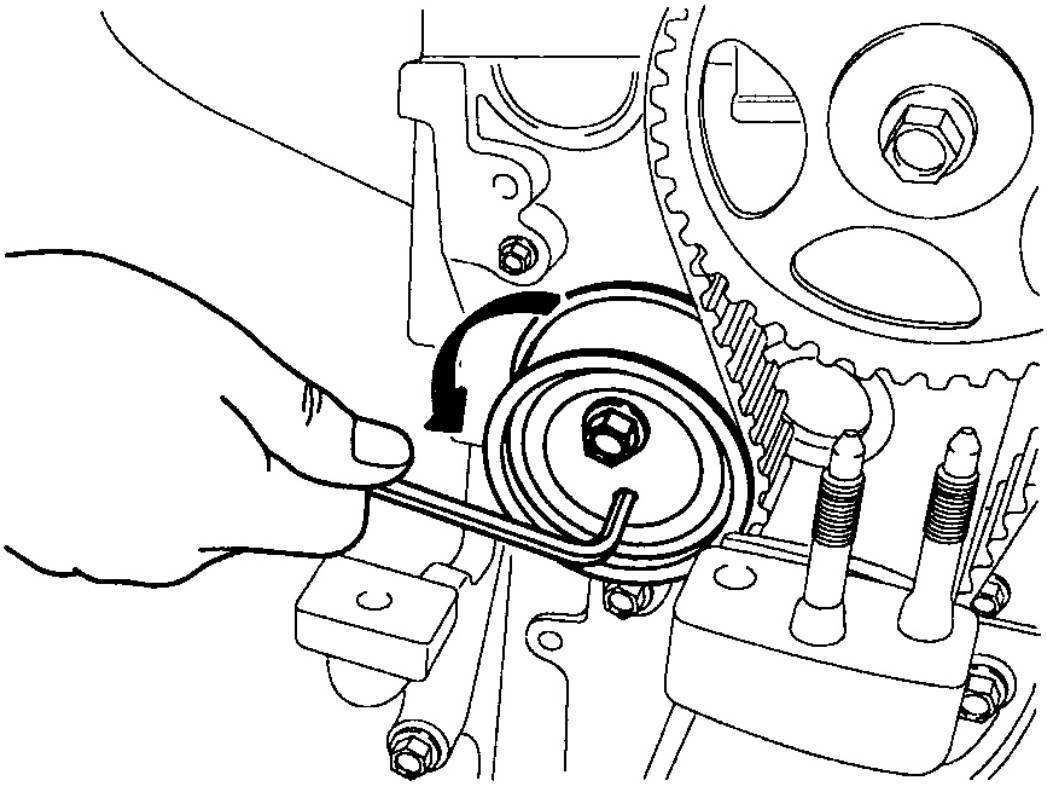


Fig. 48: Rotating Crankshaft For Adjusting Timing Belt Tension
Courtesy of HYUNDAI MOTOR CO.

2. Give tension to timing belt by rotating tensioner in direction of the arrow with tool and set timing belt not to give slack to tension side.

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Fig. 49: Rotating Tensioner For Giving Tension To Timing Belt
Courtesy of HYUNDAI MOTOR CO.

3. Tightening tensioner bolt.

   Tightening torque

   Tensioner bolt

   43 ~ 55Nm (430 ~ 550kgf.cm, 32 ~ 40lbf.ft)

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

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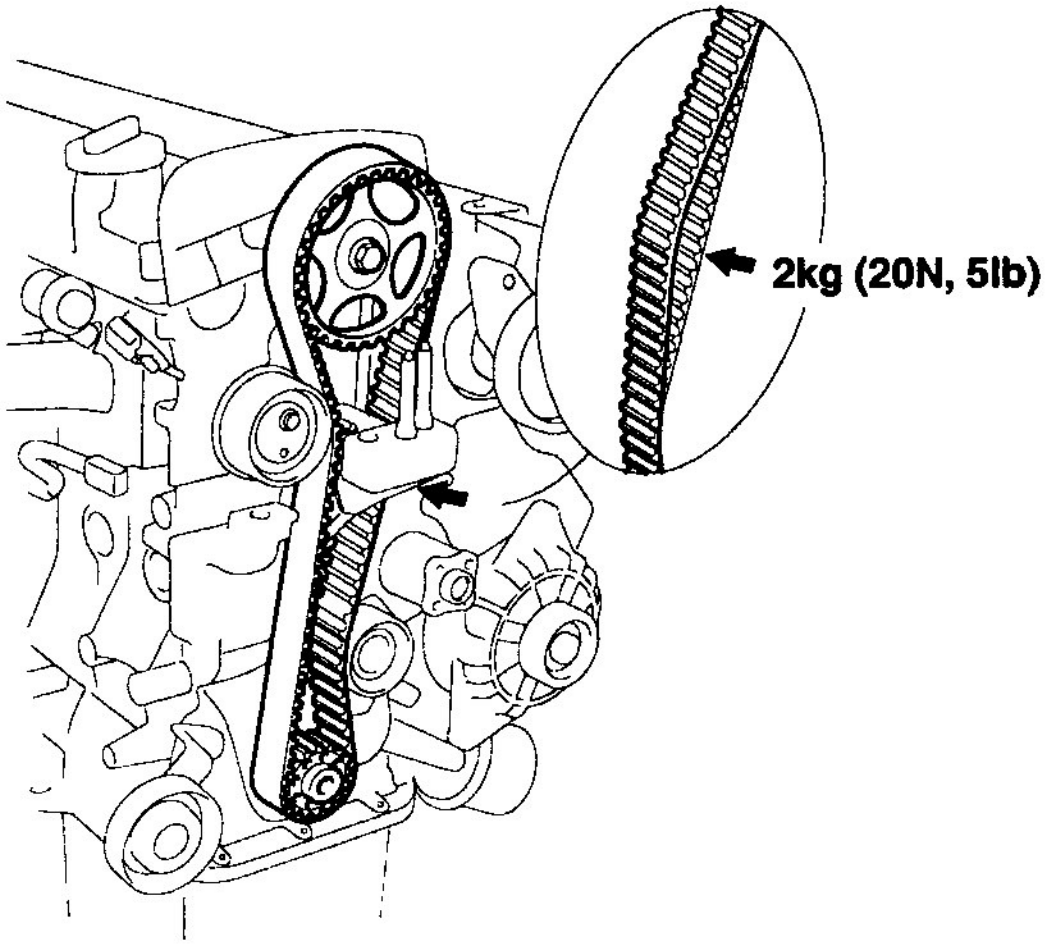


Fig. 50: Rechecking Belt Tension
Courtesy of HYUNDAI MOTOR CO.

10. Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing mark.
11. Install the timing belt lower cover(A) with 5 bolts(B).

Tightening torque

Timing belt cover bolt

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

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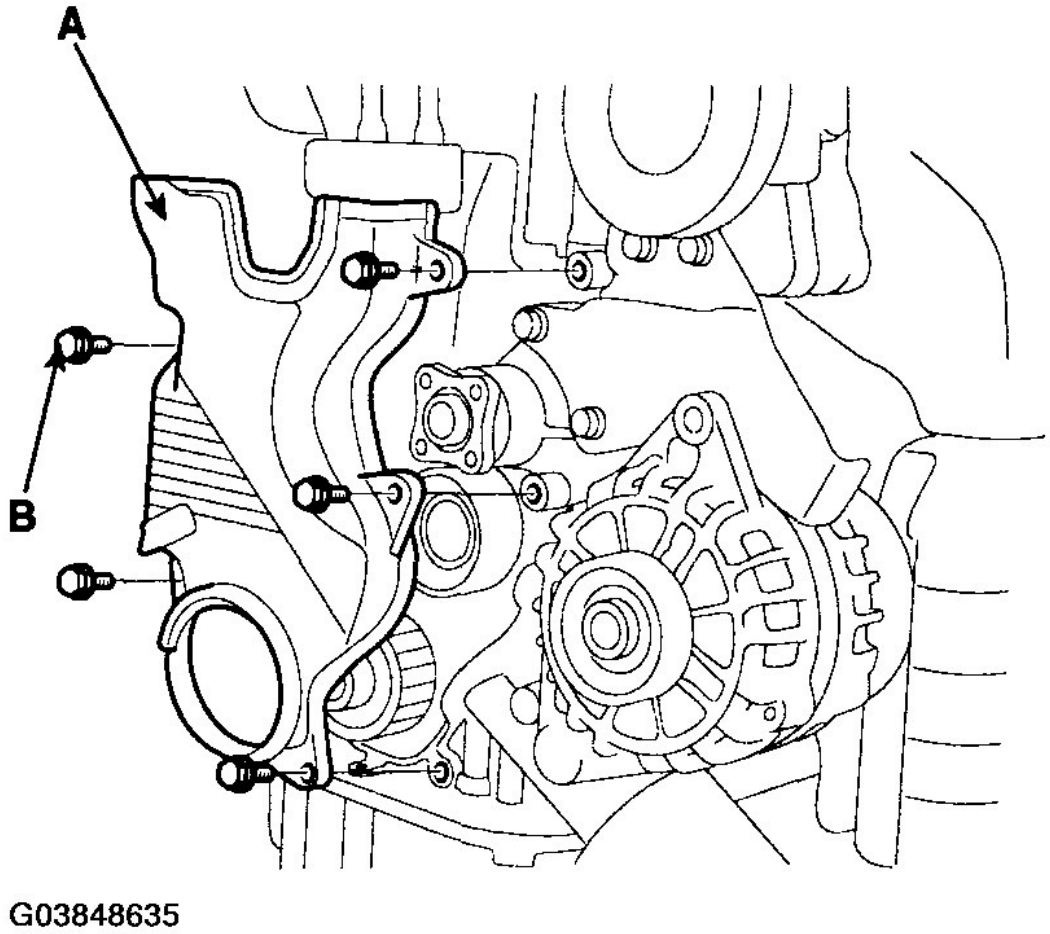


Fig. 51: Installing Timing Belt Lower Cover With 5 Bolts
Courtesy of HYUNDAI MOTOR CO.

12. Install the flange and crankshaft pulley(A).

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

    Tightening torque

    Crankshaft pulley bolt

    170 ~ 180Nm (1700 ~ 1800kgf.cm, 125 ~ 133lbf.ft)

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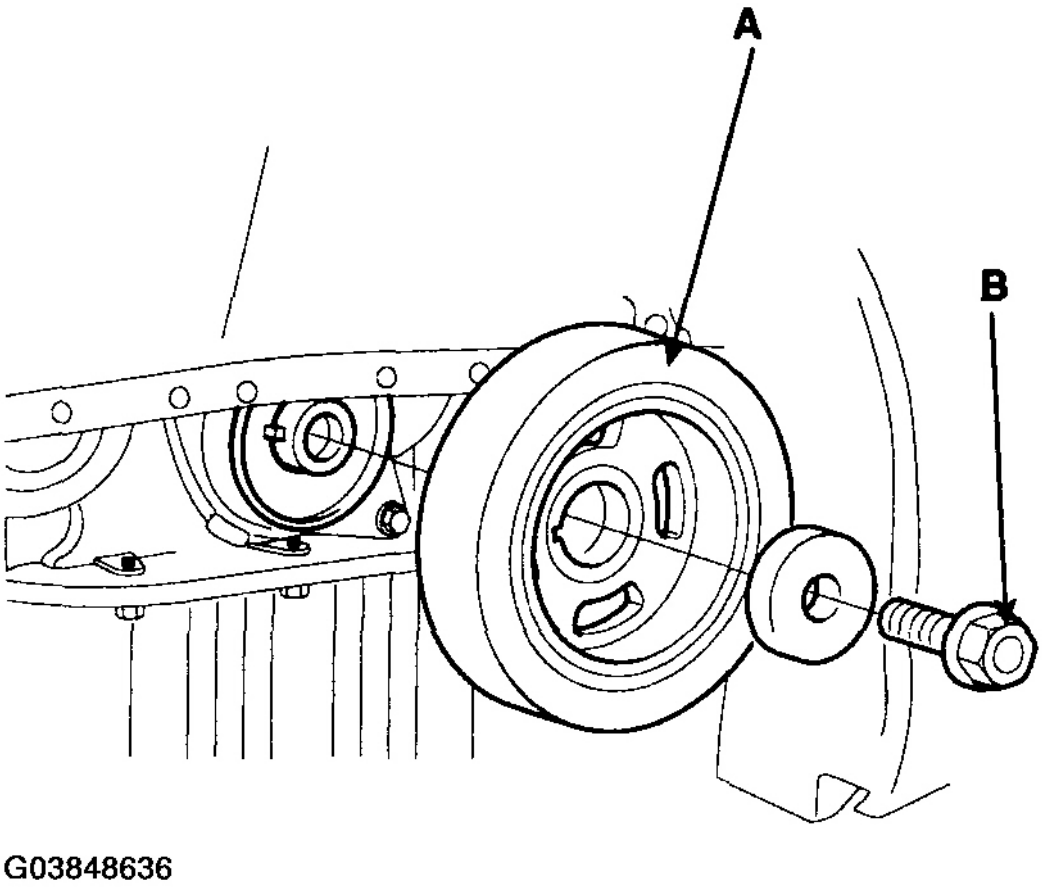


Fig. 52: Installing Flange And Crankshaft Pulley
Courtesy of HYUNDAI MOTOR CO.

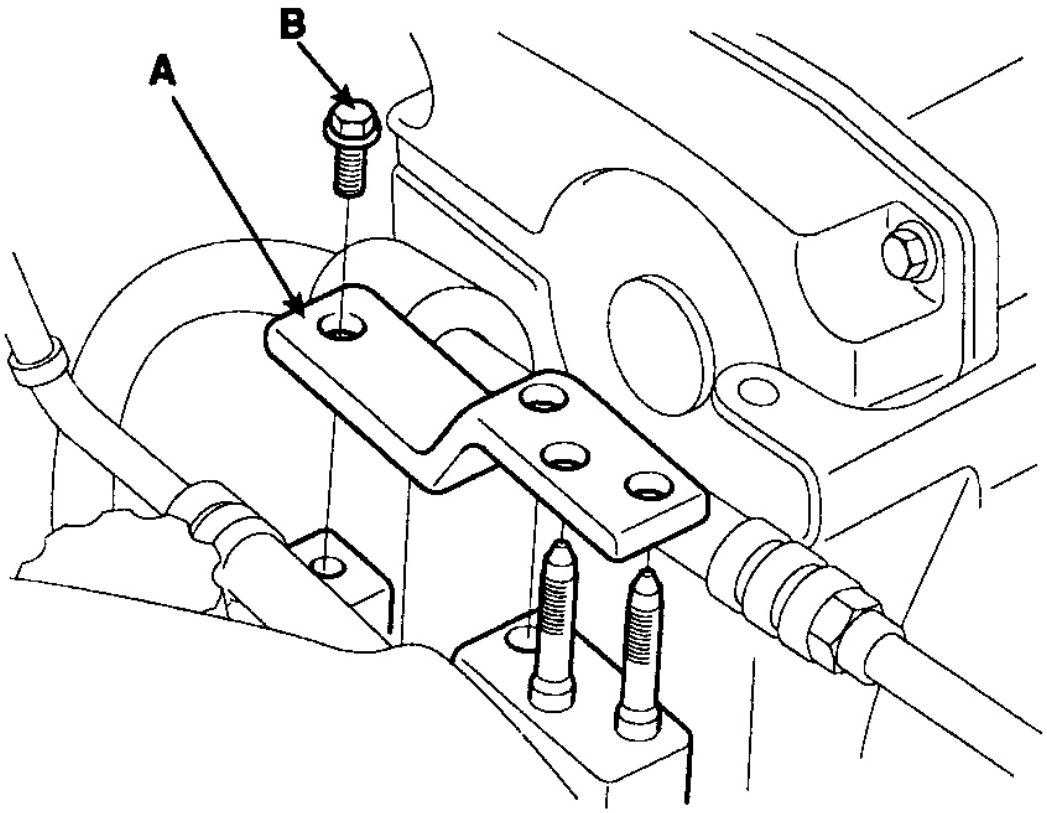
13. Install the timing belt upper cover with 4 bolts. (See **TIMING BELT TENSION ADJUSTMENT**)
14. Install the coolant pump pulley with 4 bolts.
15. Install power steering belt. (See **MECHANICAL POWER STEERING SYSTEM**)
16. Install air compressor belt. (See **COMPRESSOR**)
17. Install alternator belt. (See **ALTERNATOR BELT INSPECTION AND ADJUSTMENT**)
18. Install the engine mount bracket.
    1. Install the stay plate(A) with bolt(B).

       Tightening torque

       Stay plate bolt

       43 ~ 55Nm (430 ~ 550kgf.cm 32 ~ 40lbf.ft)

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Fig. 53: Installing Stay Plate With Bolt
Courtesy of HYUNDAI MOTOR CO.

2. Install engine mount bracket(A) with 3 nuts and bolt.

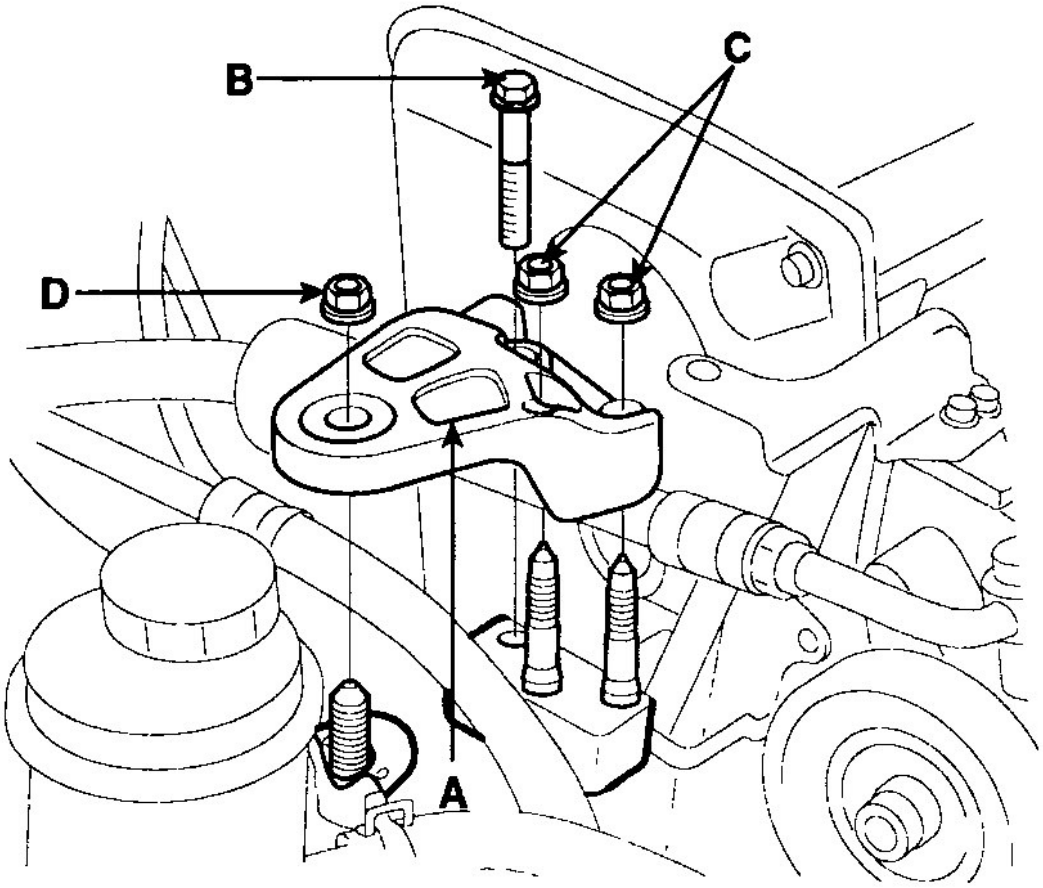
Tightening torque

Bolt(B), Nuts(C)

50 ~ 60Nm (500 ~ 600kgf.ft, 37 ~ 48lbf.ft)

Nut(D): 60 ~ 80Nm (600 ~ 800kgf.m 44 ~ 59lbf.ft)

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Fig. 54: Installing Engine Mount Bracket With 3 Nuts And Bolt
Courtesy of HYUNDAI MOTOR CO.

19. Install RH side cover(A) with 2 bolts(B).

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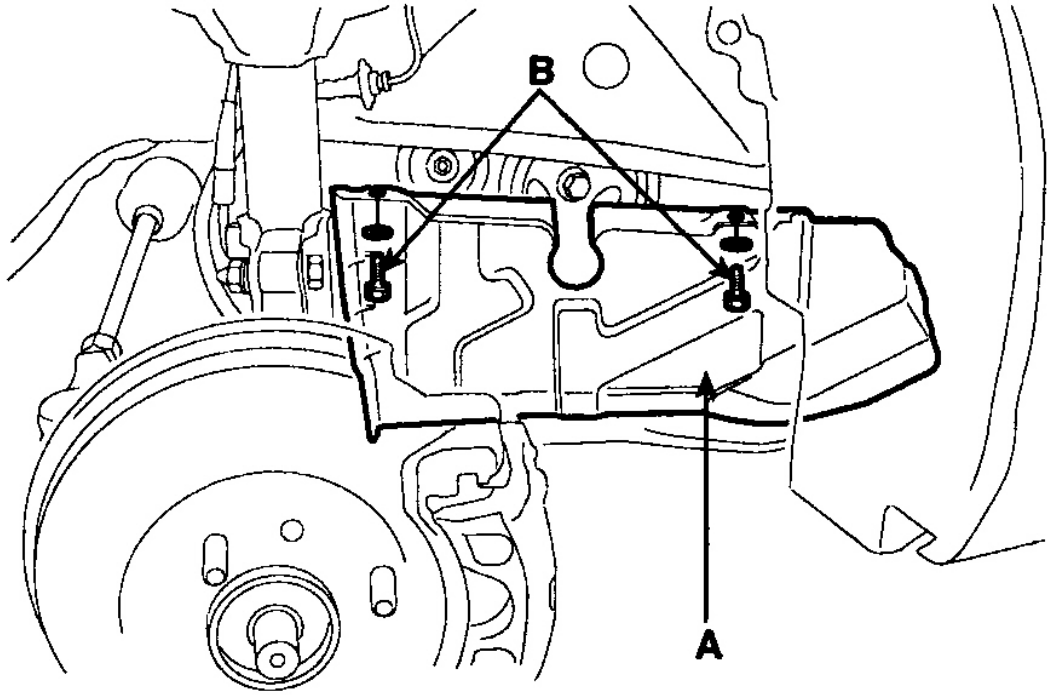


Fig. 55: Installing RH Side Cover With 2 Bolts
Courtesy of HYUNDAI MOTOR CO.

20. Install RH front wheel.
21. Install engine cover with 4 bolts. (See **TIMING BELT TENSION ADJUSTMENT**)

CYLINDER HEAD ASSEMBLY

COMPONENTS

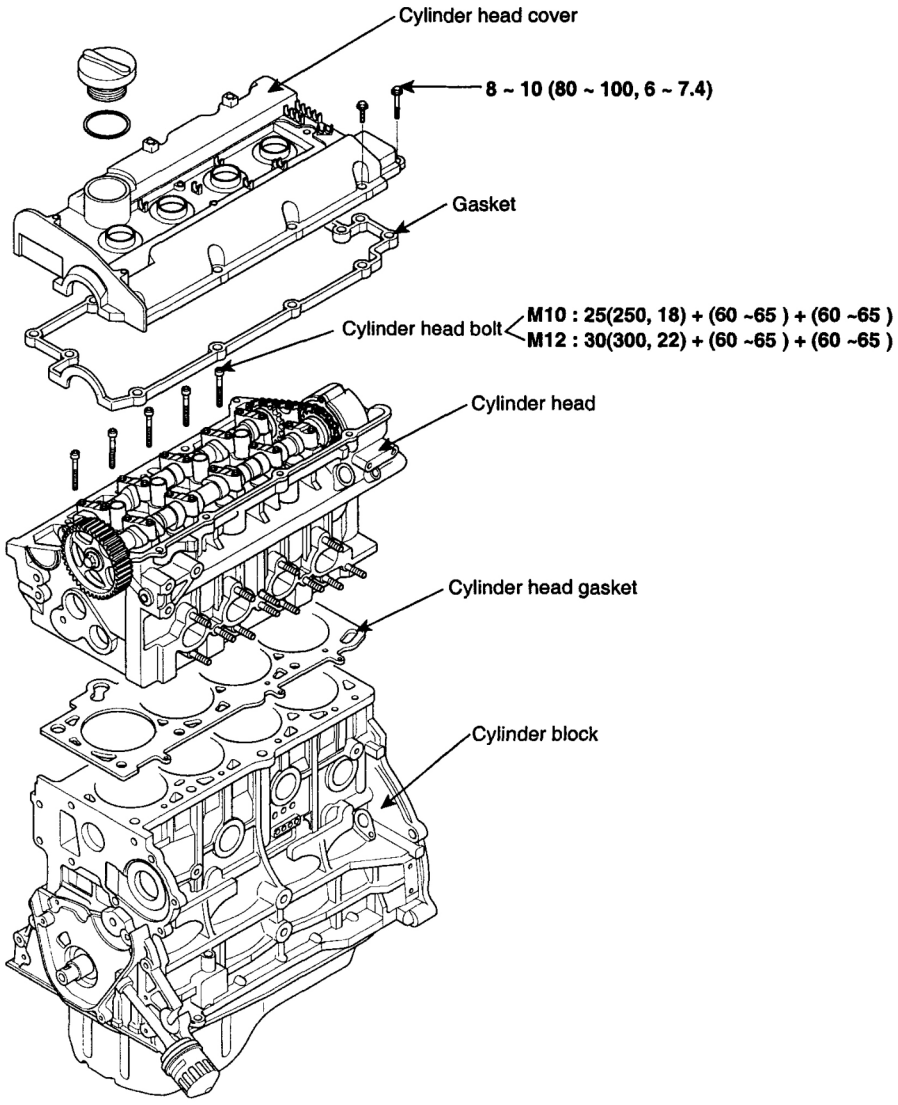


Fig. 56: Identifying Cylinder Head Assembly Components And Torque Specifications (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

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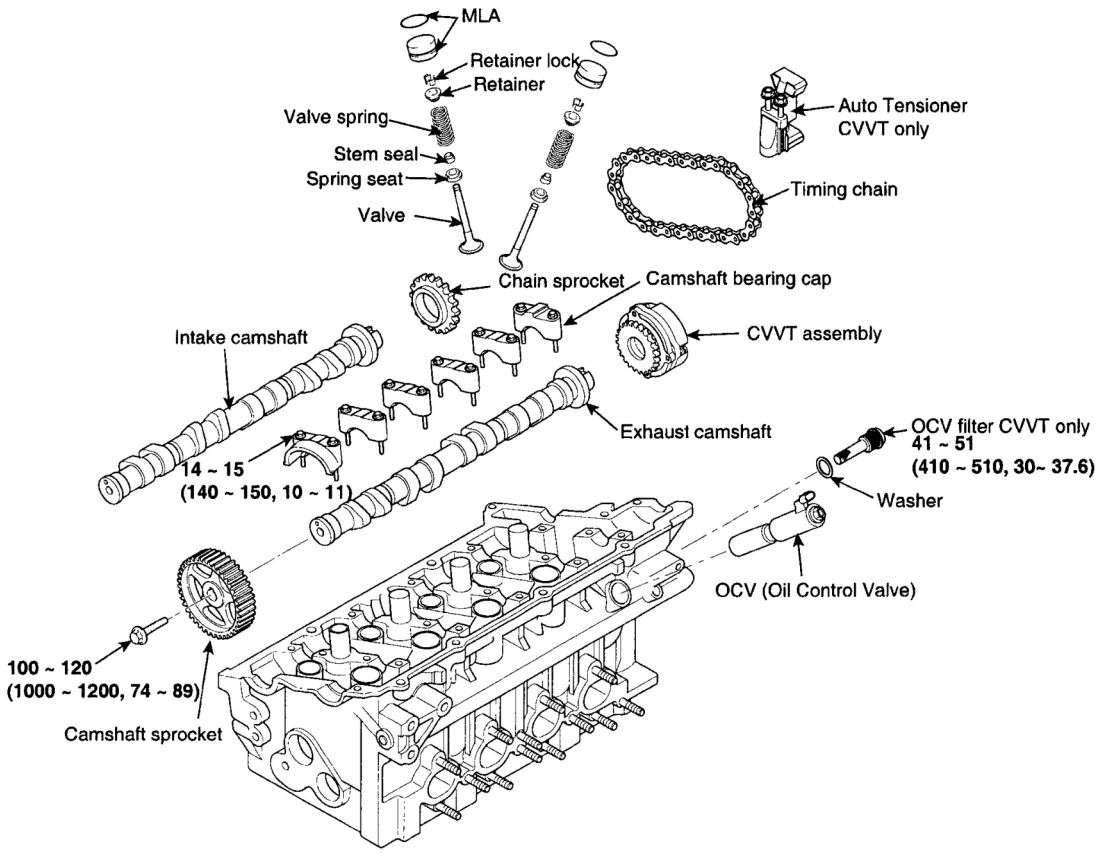


Fig. 57: Identifying Cylinder Head Assembly Components And Torque Specifications (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

Engine removal is not required for this procedure.

CAUTION:

- **Use fender covers to avoid damaging painted surfaces.**
- **To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.**
- **When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.**
- **To avoid damage, unplug the wiring connectors carefully while holding the connector portion.**

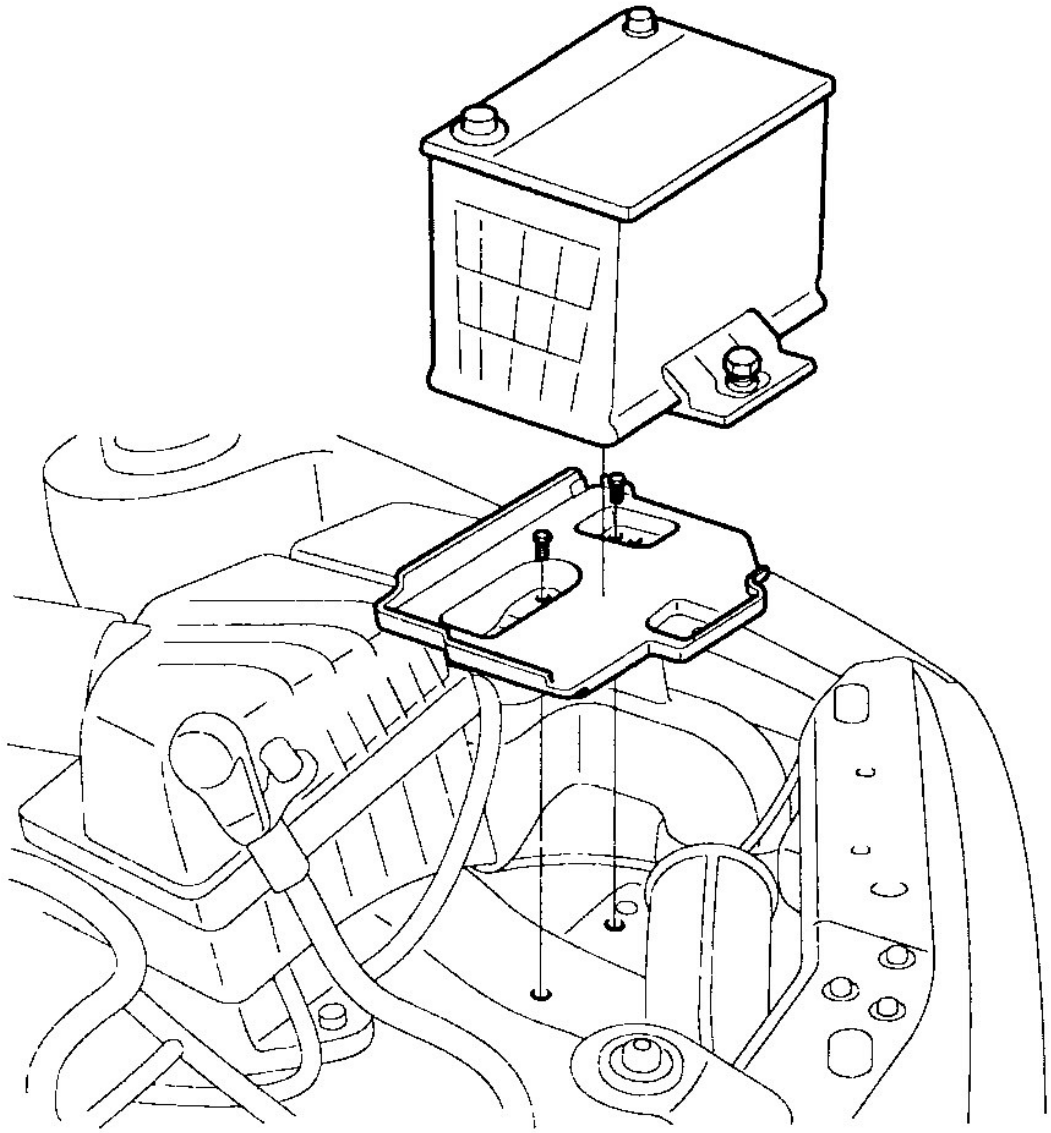
NOTE:

- **Mark all wiring and hoses to avoid mis-connection.**

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- **Inspect the timing belt before removing the cylinder head.**
- **Turn the crankshaft pulley so that the No. 1 piston is at top dead center. (See TIMING BELT TENSION ADJUSTMENT)**

1. Disconnect the negative terminal from the battery.



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Fig. 58: Removing Battery From Tray
Courtesy of HYUNDAI MOTOR CO.

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2. Remove the engine cover. (See **COMPRESSION**)
3. Drain the engine coolant.

   Remove the radiator cap to speed draining.

4. Remove the intake air hose and air cleaner assembly.
   1. Disconnect the AFS connector.
   2. Disconnect the breather hose from air cleaner hose.
   3. Remove the intake air hose and air cleaner assembly.
5. Remove the upper radiator hose(A) and lower radiator hose(B).

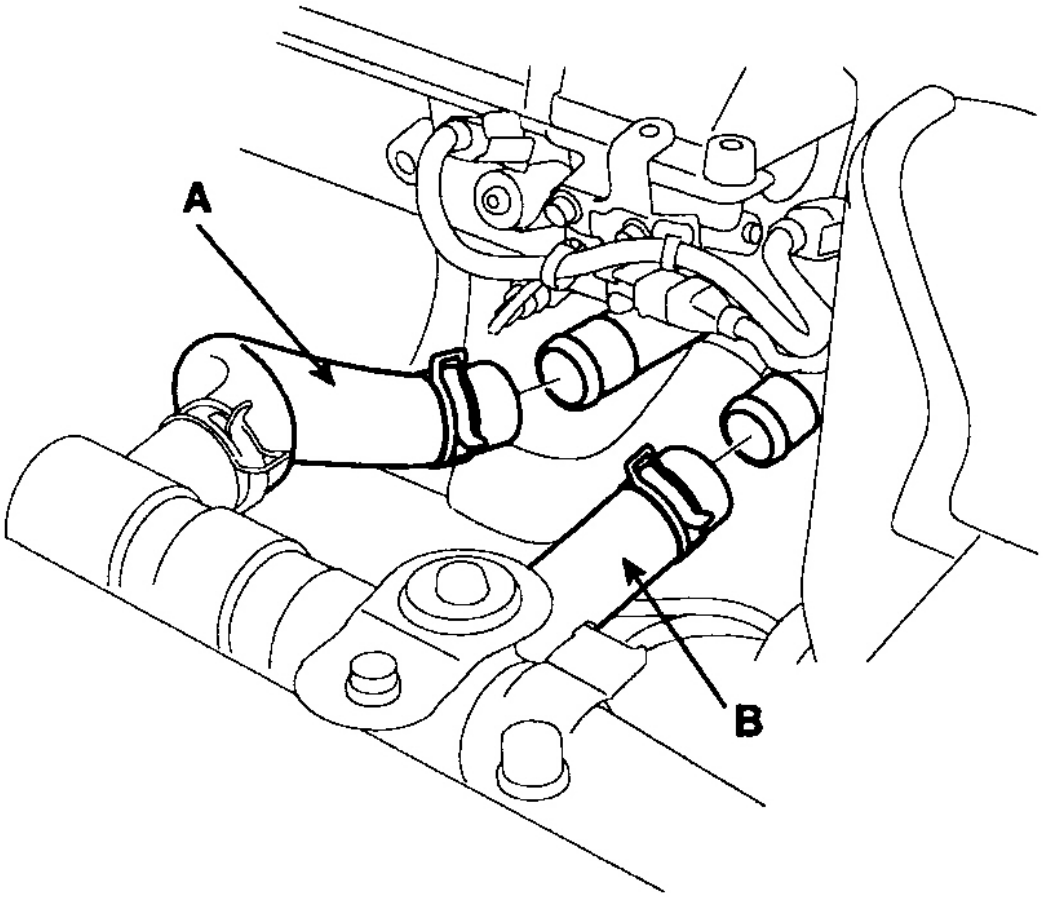


Fig. 59: Removing Upper Radiator Hose And Lower Radiator Hose
Courtesy of HYUNDAI MOTOR CO.

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6. Remove the heater hoses(A).

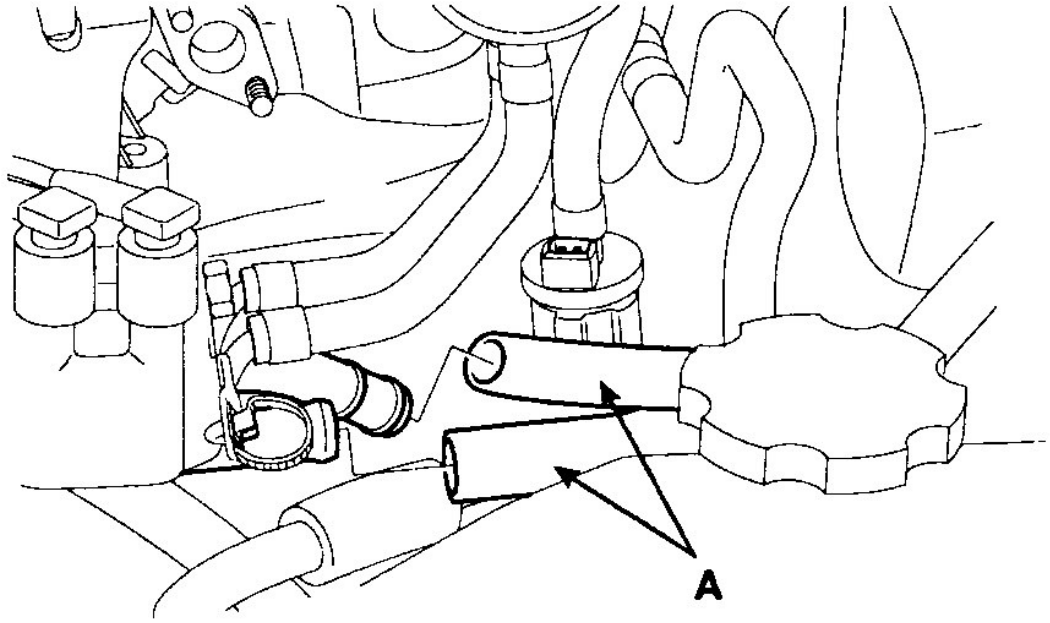


Fig. 60: Removing Heater Hoses
Courtesy of HYUNDAI MOTOR CO.

7. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
    1. OCV (Oil control Valve) connector(A).
    2. Oil temperature sensor connector(B).
    3. ECT (Engine Coolant Temperature) sensor connector(C).
    4. Ignition coil connector(D).

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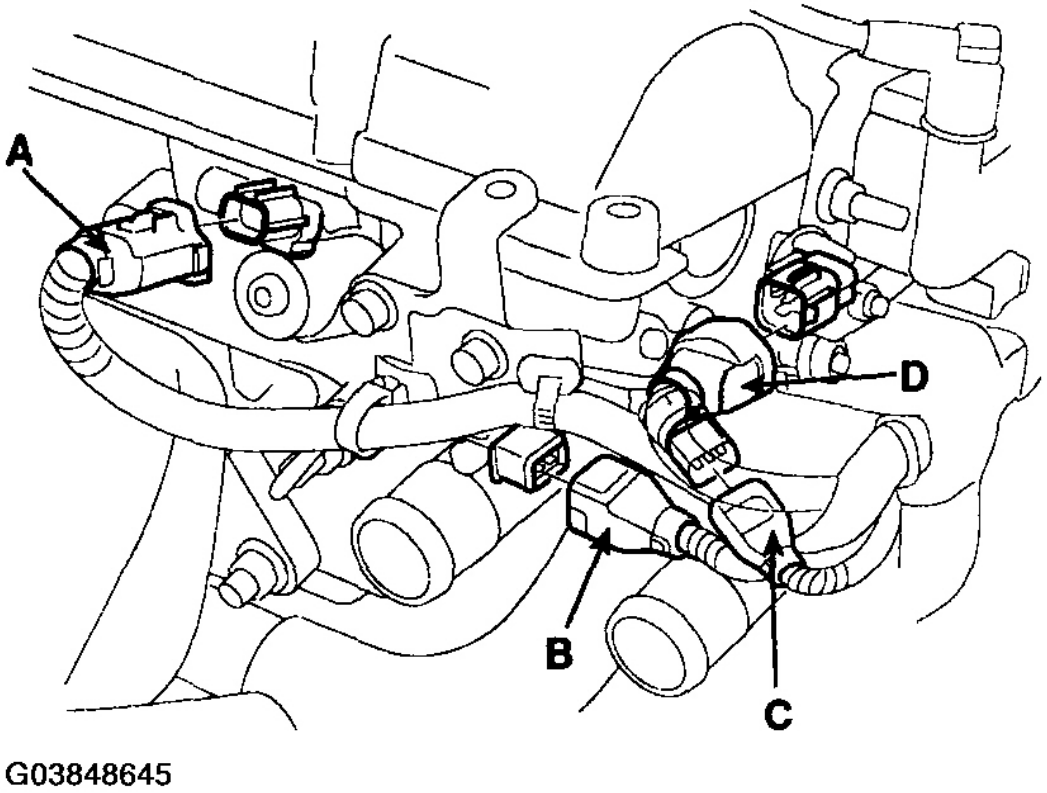


Fig. 61: Removing Engine Wire Harness Connectors And Wire Harness Clamps From Cylinder Head And Intake Manifold
Courtesy of HYUNDAI MOTOR CO.

5. TPS (Throttle Position Sensor) connector(A).
6. ISA (Idle Speed Actuator) connector(B).

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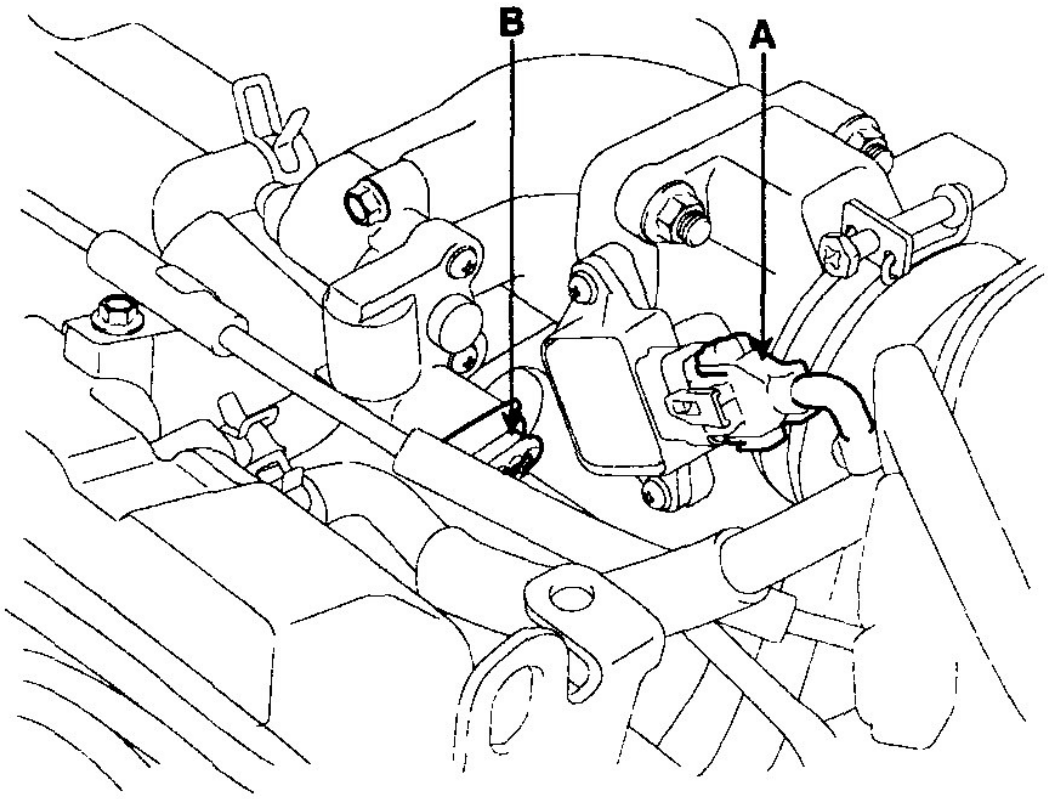


Fig. 62: Removing Throttle Position Sensor Connector And Idle Speed Actuator Connector
Courtesy of HYUNDAI MOTOR CO.

7. CMP (Camshaft Position Sensor) connector(A).
8. Four fuel injector connectors(B).
9. Knock sensor connector(C).
10. Disconnect ground cable(D) from the intake manifold.

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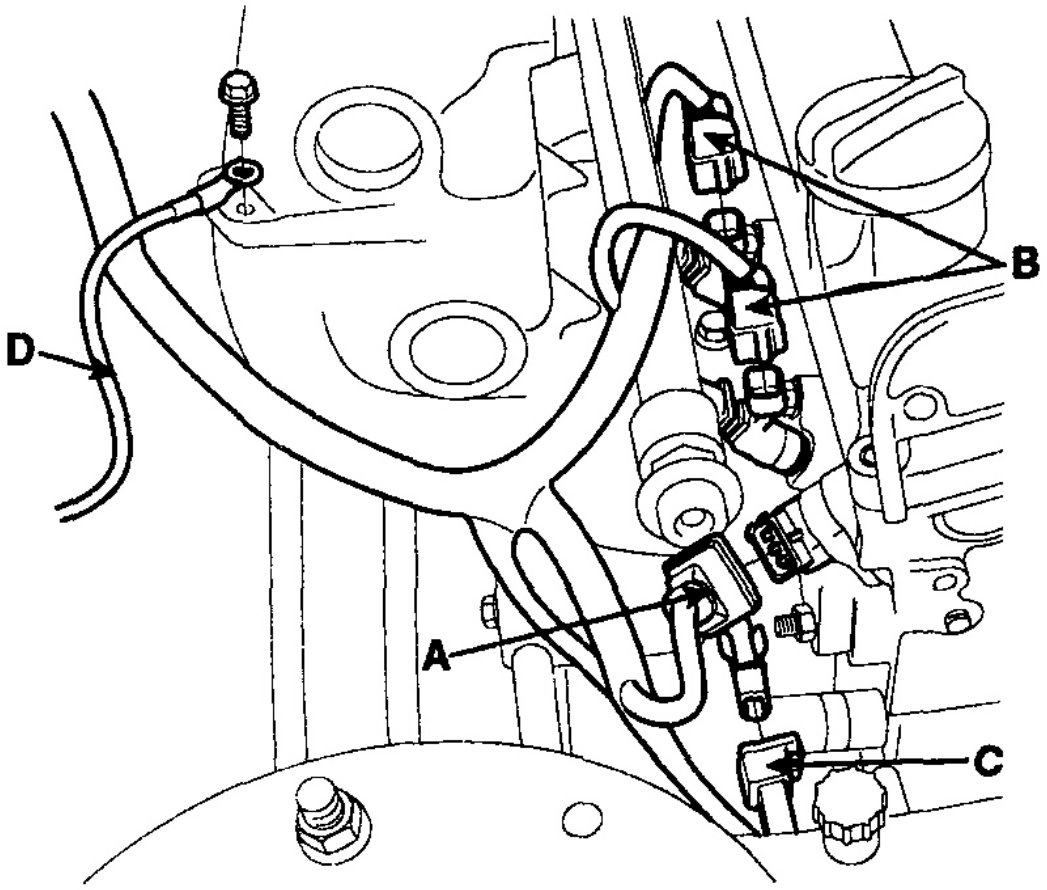


Fig. 63: Removing CMP, Four Fuel Injector Connectors, Knock Sensor Connector And Ground Cable
Courtesy of HYUNDAI MOTOR CO.

11. Front heated oxygen sensor connector(A).

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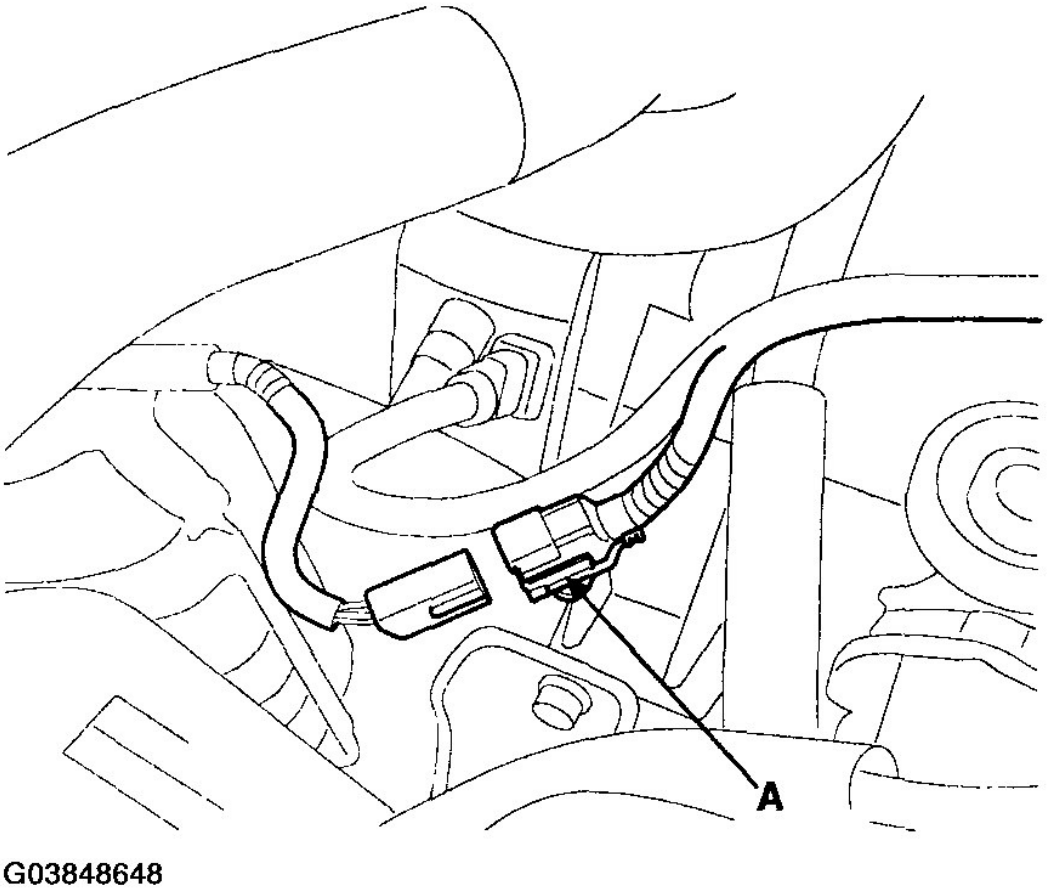


Fig. 64: Front Heated Oxygen Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

12. PCSV (Purge Control Solenoid Valve) connector(A).

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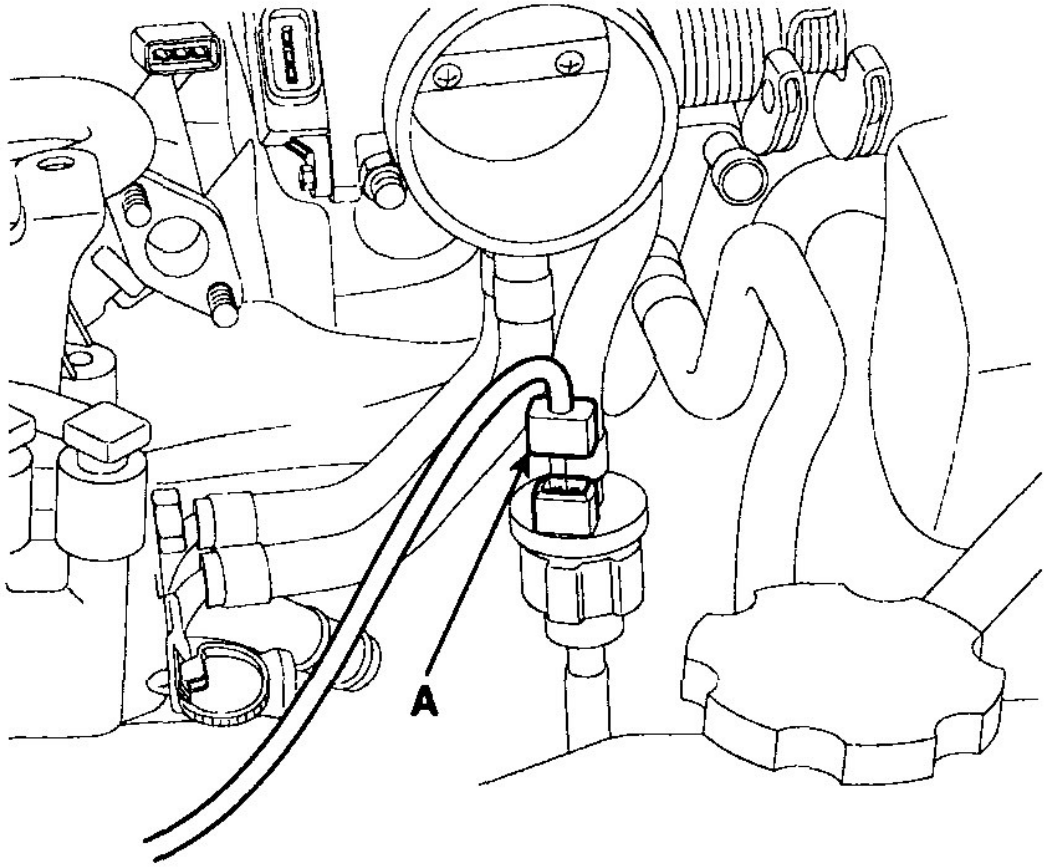


Fig. 65: Disconnecting Purge Control Solenoid Valve Connector
Courtesy of HYUNDAI MOTOR CO.

8. Remove the fuel inlet hose(A) from delivery pipe.

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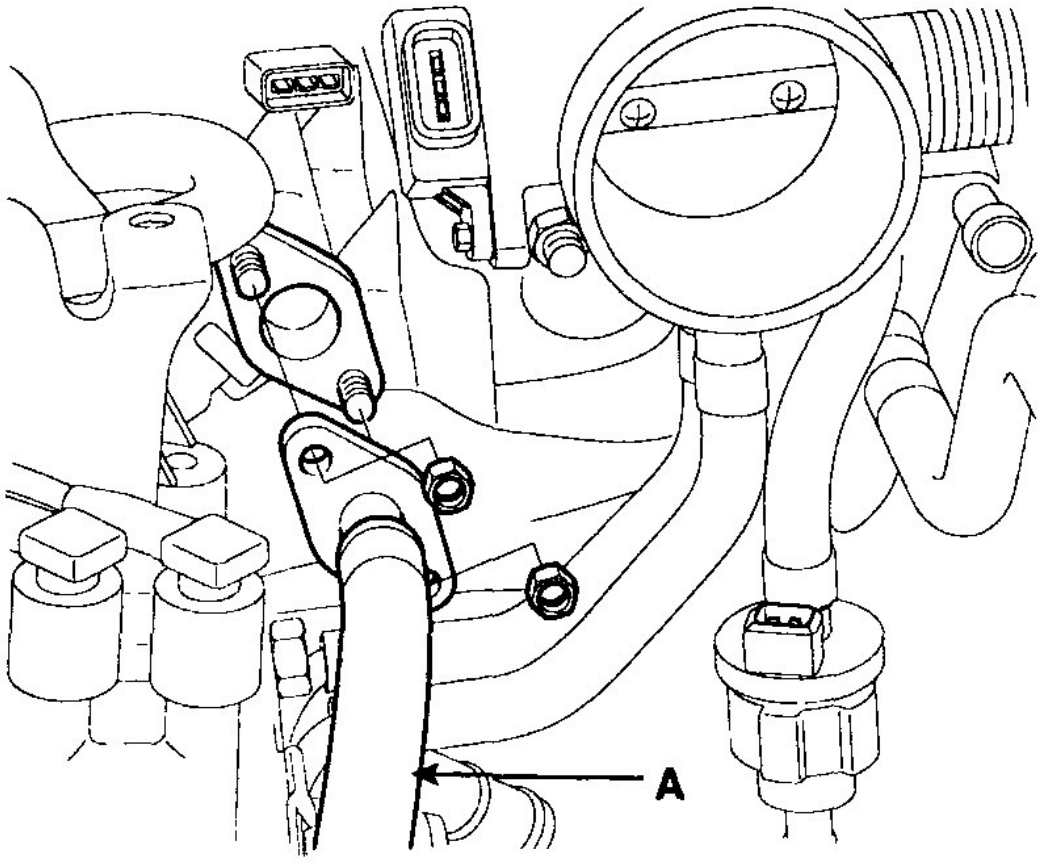


Fig. 66: Removing Fuel Inlet Hose From Delivery Pipe
Courtesy of HYUNDAI MOTOR CO.

9. Remove the PCSV hose(A).

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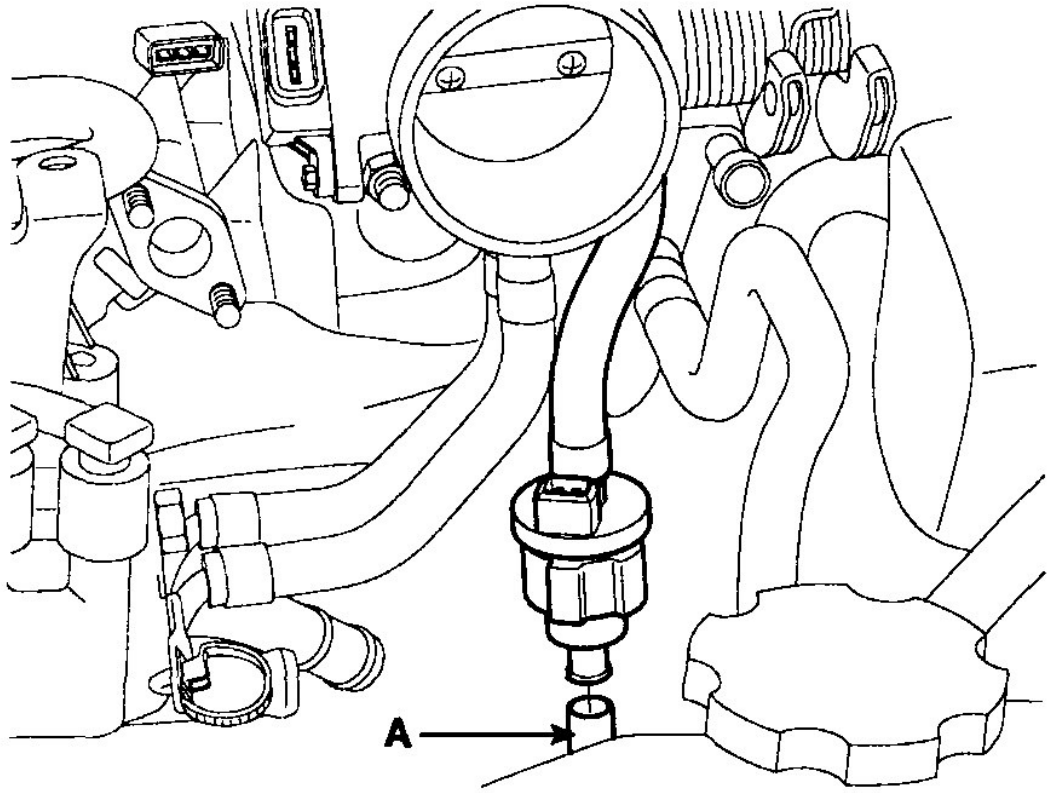
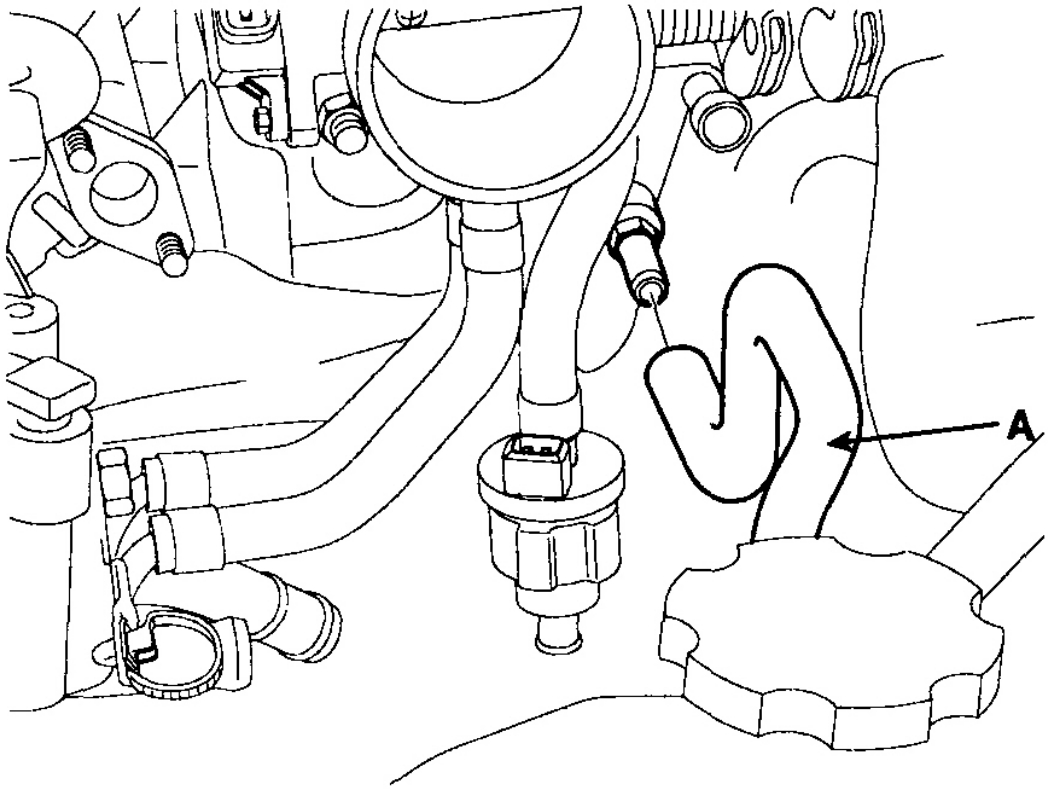


Fig. 67: Removing Purge Control Solenoid Valve Hose
Courtesy of HYUNDAI MOTOR CO.

10. Remove the brake booster vacuum hose(A).

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Fig. 68: Removing Brake Booster Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

11. Remove the accelerator cable by loosening the lock-nut, then slip the cable end out of the throttle linkage.
12. Remove the power steering pump. (See **MECHANICAL POWER STEERING SYSTEM**)
13. Remove the power steering pump bracket bolts(A).

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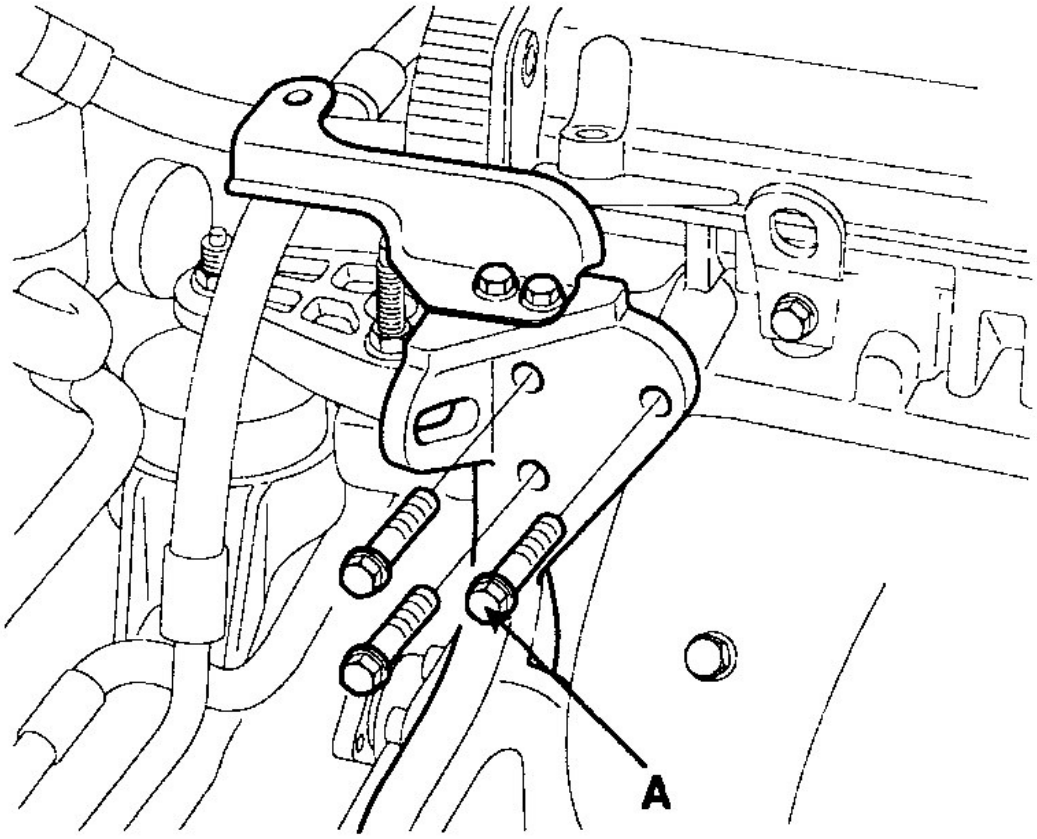


Fig. 69: Removing Power Steering Pump Bracket Bolts
Courtesy of HYUNDAI MOTOR CO.

14. Remove the spark plug cable. (See **IGNITION SYSTEM**)
15. Remove the PCV hose. (See **VALVE CLEARANCE INSPECTION AND ADJUSTMENT**)
16. Remove the cylinder head cover. (See **VALVE CLEARANCE INSPECTION AND ADJUSTMENT**)
17. Remove the timing belt. (See **REMOVAL**)
18. Remove the exhaust manifold. (See **EXHAUST MANIFOLD**)
19. Remove the intake manifold. (See **REMOVAL**)
20. Remove the camshaft sprocket. (See **REMOVAL**)
21. Remove the timing chain auto tensioner(A).

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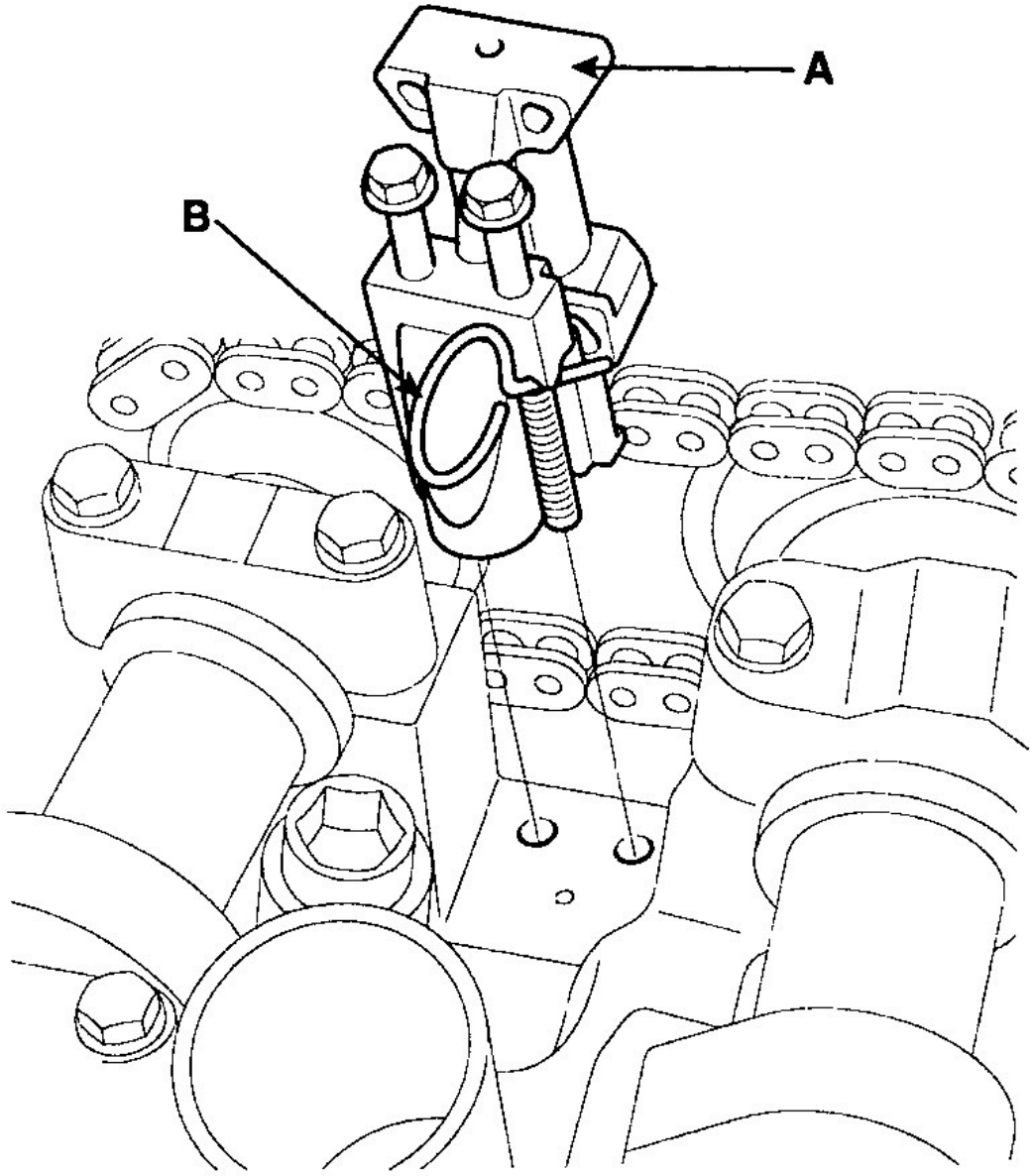
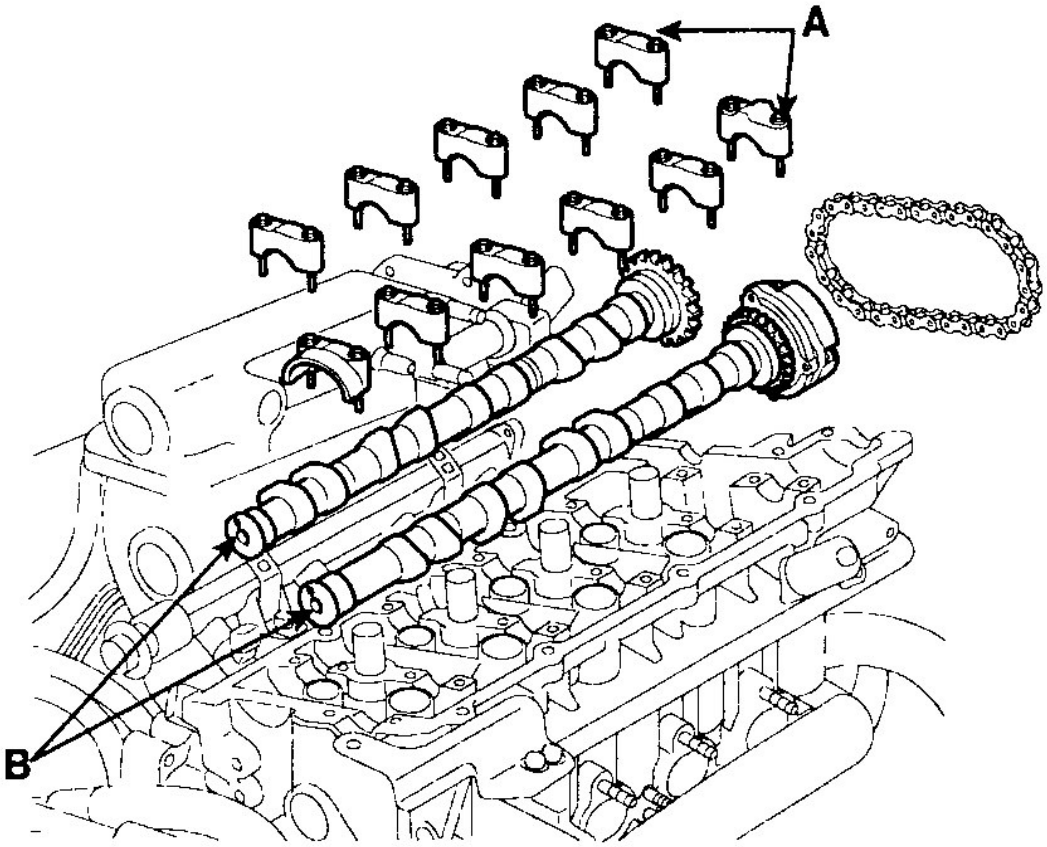


Fig. 70: Removing Timing Chain Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.

22. Remove the camshaft bearing caps(A) and camshafts(B).

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Fig. 71: Removing Camshaft Bearing Caps And Camshafts
Courtesy of HYUNDAI MOTOR CO.

23. Remove the OCV (oil control valve)(A).

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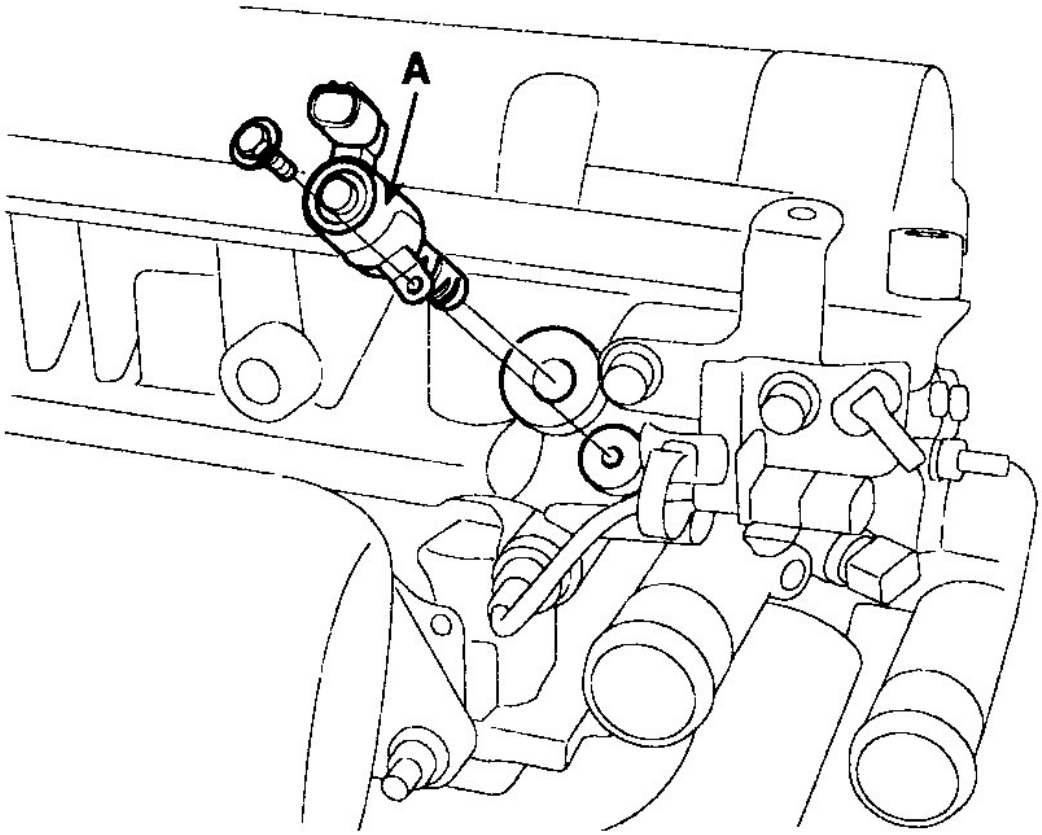
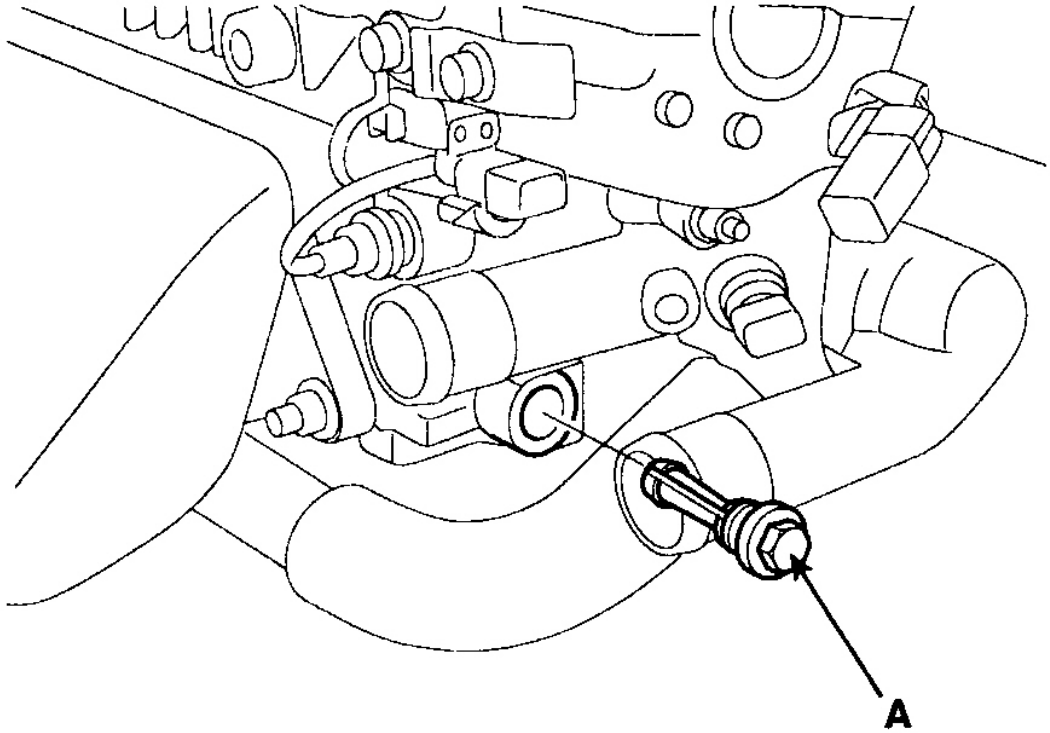


Fig. 72: Removing Oil Control Valve
Courtesy of HYUNDAI MOTOR CO.

24. Remove the OCV (oil control valve) filter(A).

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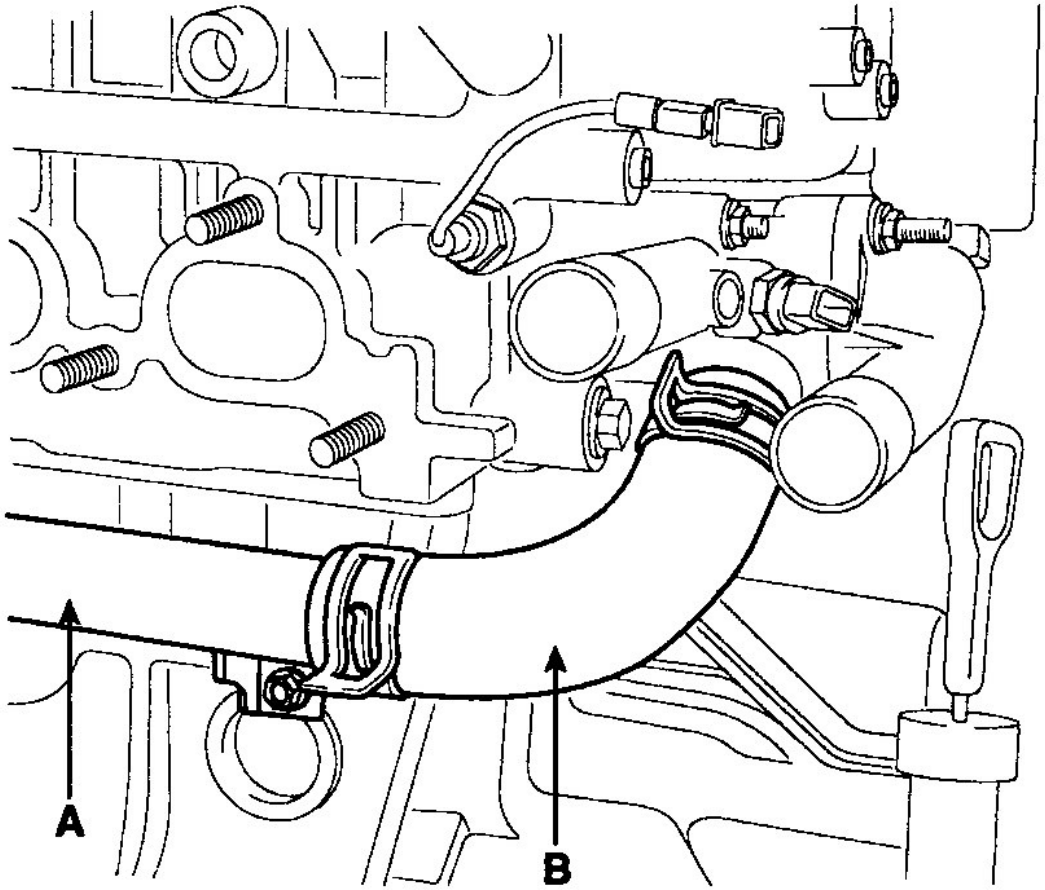


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Fig. 73: Removing Oil Control Valve Filter
Courtesy of HYUNDAI MOTOR CO.

25. Remove the water hose(B) from the water pipe(A).

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Fig. 74: Removing Water Hose From Water Pipe
Courtesy of HYUNDAI MOTOR CO.

26. Remove the cylinder head bolts, then remove the cylinder head.
    1. Using 8mm and 10mm hexagon wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown. Remove the 10 cylinder head bolts and plate washers.

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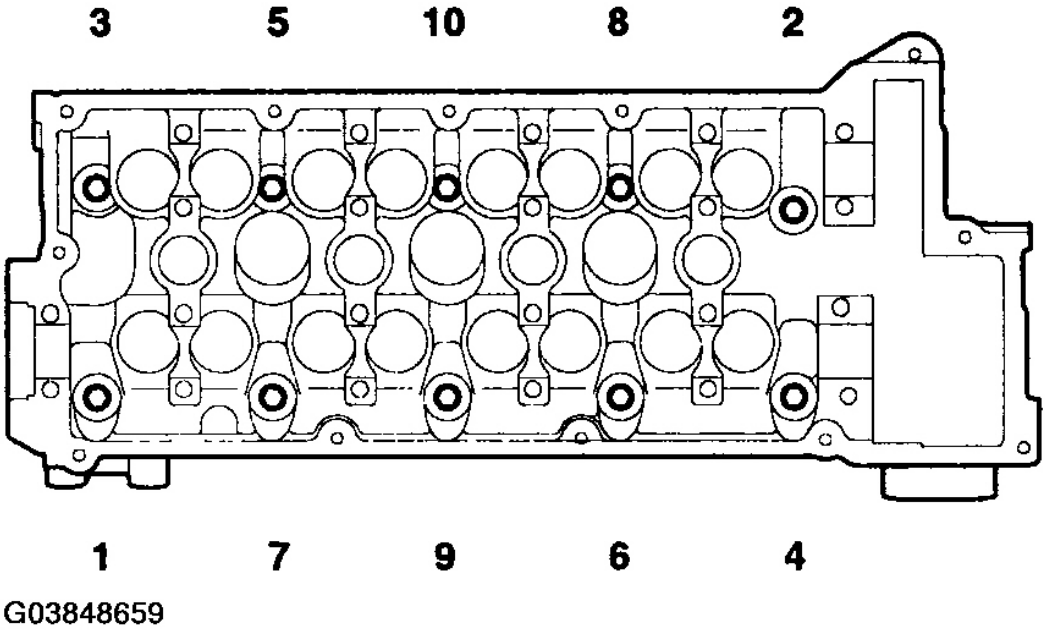


Fig. 75: Identifying Removal Sequence Of Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

CAUTION: Head warpage or cracking could result from removing bolts in an incorrect order.

2. Lift the cylinder head from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench.

CAUTION: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

DISASSEMBLY

NOTE: Identify MLA (Mechanical Lash Adjuster), valves, valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove MLAs(A).

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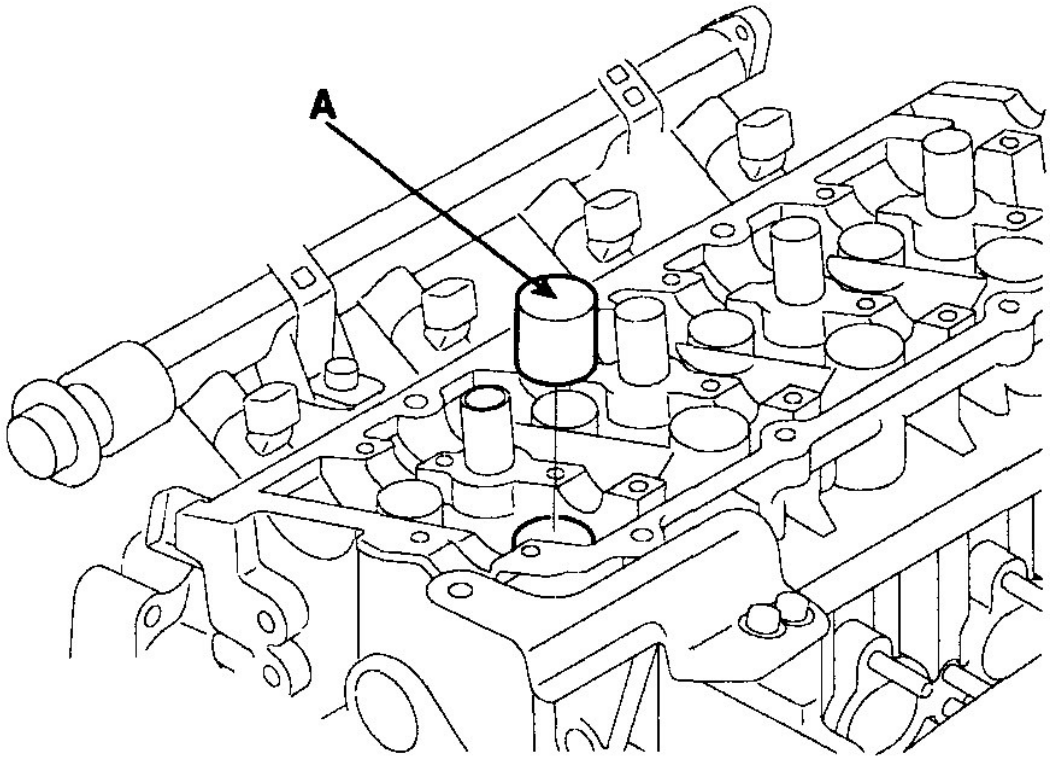


Fig. 76: Removing Mechanical Lash Adjuster
Courtesy of HYUNDAI MOTOR CO.

2. Remove valves.
    1. Using SST(09222-28000, 09222-28100), compress the valve spring and remove retainer lock.

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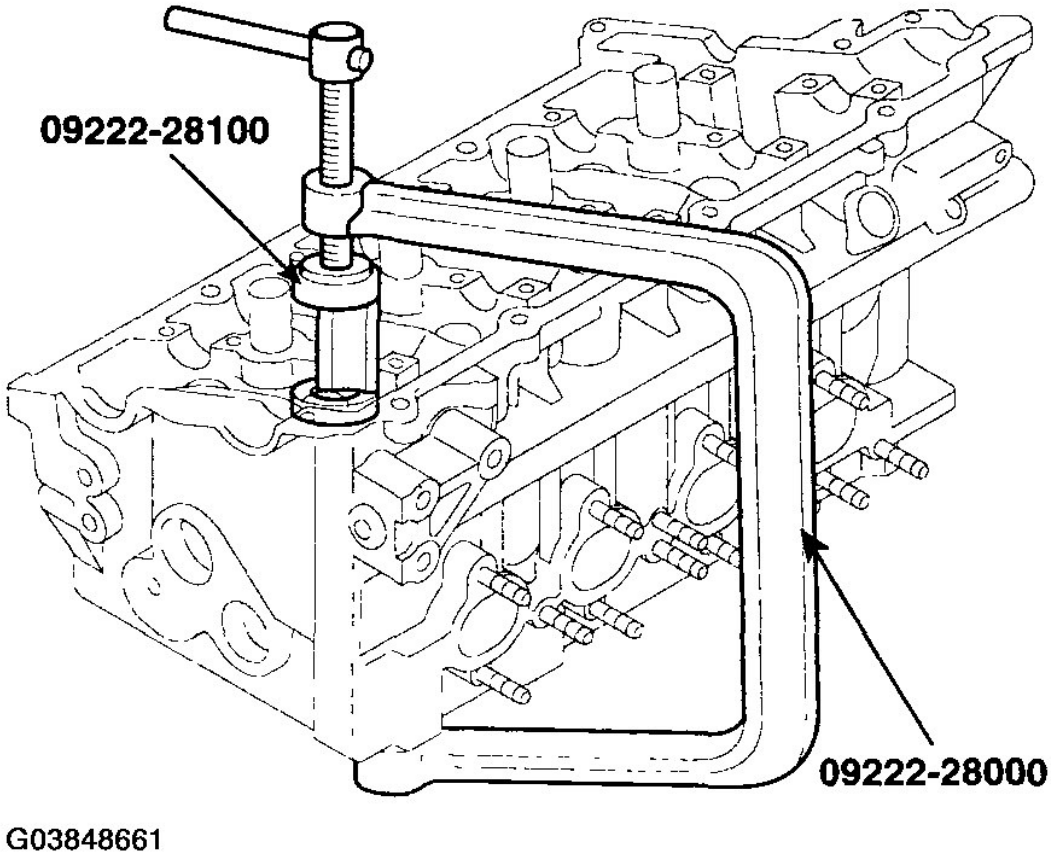


Fig. 77: Using SST (09222-28000, 09222-28100) To Compress Valve Spring And Removing Retainer Lock
Courtesy of HYUNDAI MOTOR CO.

2. Remove the spring retainer.
3. Remove the valve spring.
4. Remove the valve.
5. Using needle-nose pliers, remove the oil seal.
6. Using a magnetic finger, remove the spring seat.

INSPECTION

CYLINDER HEAD

1. Inspect for flatness.

   Using a precision straight edge and feeler gauge, measure the surface the contacting the cylinder block and the manifolds for warpage.

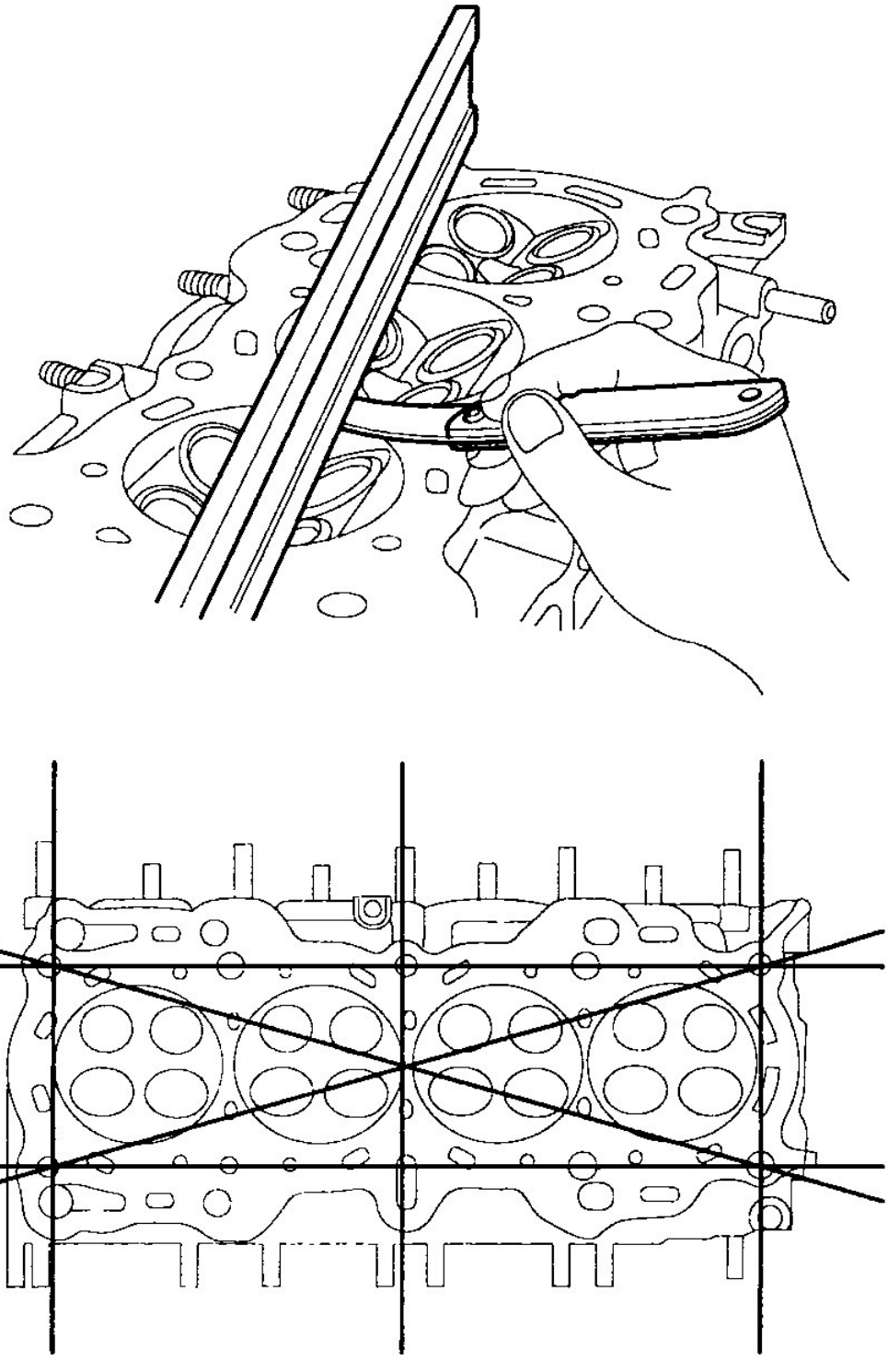
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Flatness of cylinder head gasket surface

Standard: Less than 0.03mm (0.0012in.)

Limit: 0.05mm (0.0020in.)

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Fig. 78: Measuring Surface Contacting Cylinder Block And Manifolds For Warpage Using Precision Straight Edge And Feeler Gauge
Courtesy of HYUNDAI MOTOR CO.

2. Inspect for cracks.

   Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

VALVE AND VALVE SPRING

1. Inspect valve stems and valve guides.
   1. Using a caliper gauge, measure the inside diameter or the valve guide.

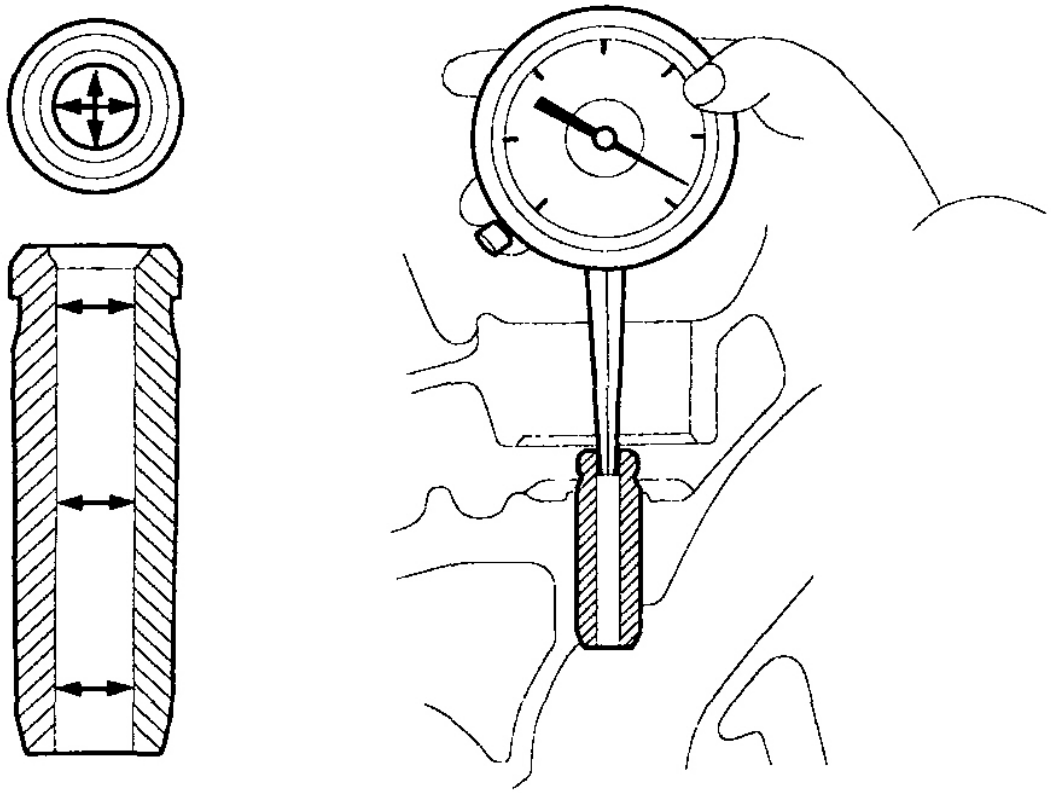


Fig. 79: Using Caliper Gauge To Measure Inside Diameter Or Valve Guide
Courtesy of HYUNDAI MOTOR CO.

   2. Using a micrometer, measure the diameter of the valve stem.

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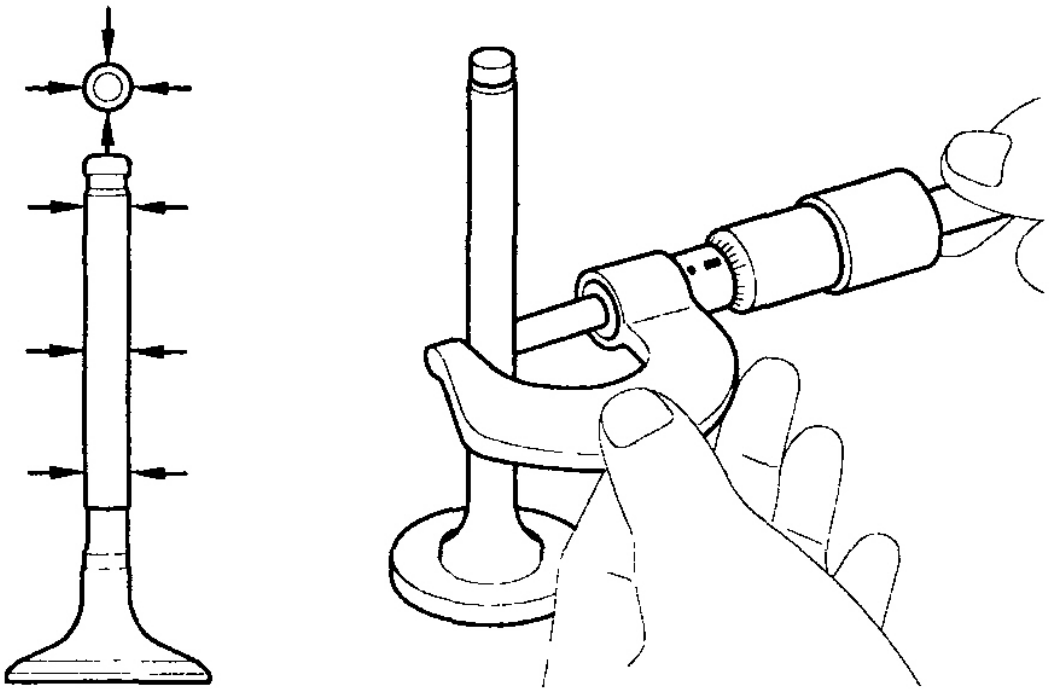


Fig. 80: Using Micrometer To Measure Diameter Of Valve Stem
Courtesy of HYUNDAI MOTOR CO.

3. Subtract the valve stem diameter measurement from the valve guide inside diameter measurement.

Valve stem-to-guide clearance

[Standard]

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

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

[Limit]

Intake: 0.1mm (0.0040 in.)

Exhaust: 0.13mm (0.0051 in.)

If the clearance is greater than maximum, replace the valve and valve guide.

2. Inspect valves.

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1. Check the valve is ground to the correct valve face angle.
2. Check that the surface of the valve for wear. If the valve face is worn, replace the valve.
3. Check the valve head margin thickness.

   If the margin thickness is less than minimum, replace the valve.

   Margin

   [Standard]

   Intake: 1.15mm (0.0453 in.)

   Exhaust: 1.35mm (0.0531 in.)

   [Limit]

   Intake: 0.8mm (0.0315 in.)

   Exhaust: 1.0mm (0.040 in.)

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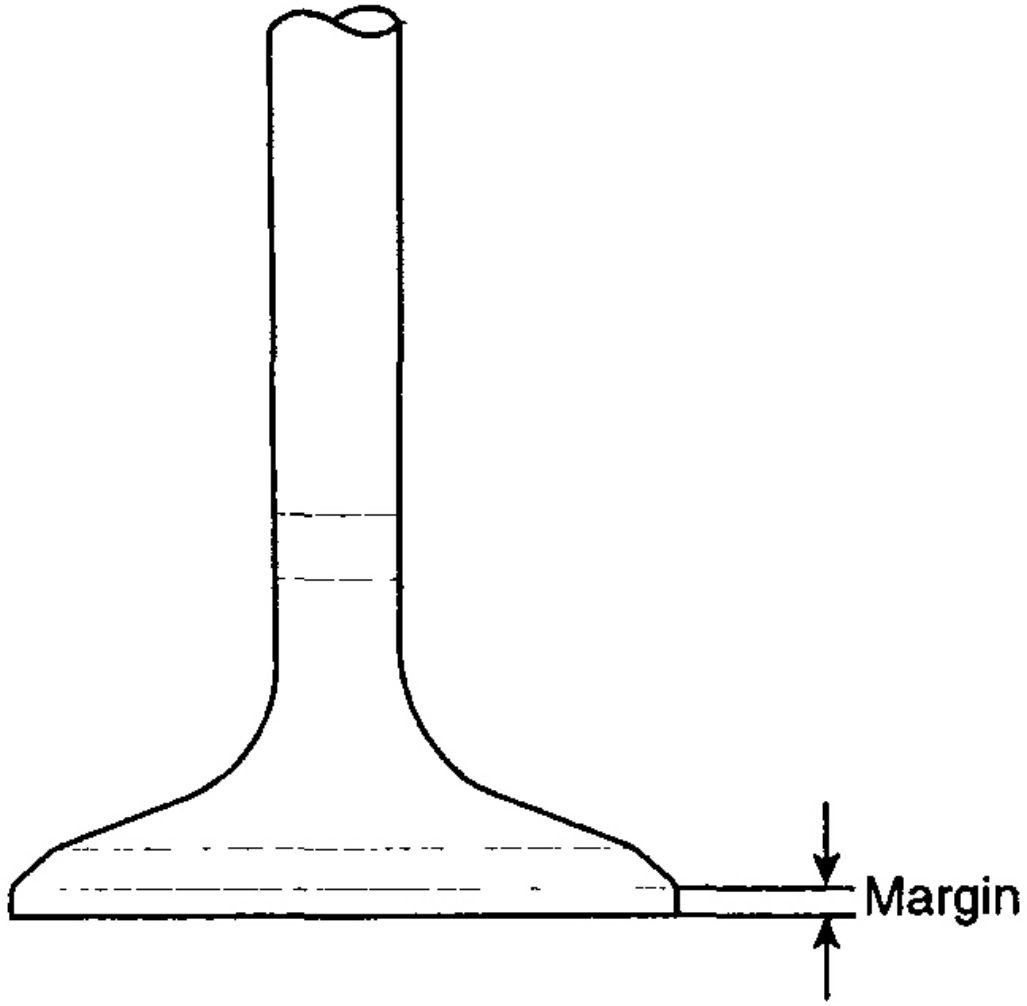


Fig. 81: Checking Valve Head Margin Thickness
Courtesy of HYUNDAI MOTOR CO.

4. Check the surface of the valve stem tip for wear. If the valve stem tip is worn, replace the valve.

3. Inspect valve seats

Check the valve seat for evidence of overheating and improper contact with the valve face.

Replace the seat if necessary.

Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, then

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recondition the seat. Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face.

4. Inspect valve springs.
    1. Using a steel square, measure the out-of-square of the valve spring.
    2. Using a vernier calipers, measure the free length of the valve spring.

    Valve spring

    [Standard]

    Free height: 48.86mm (1.9236in.)

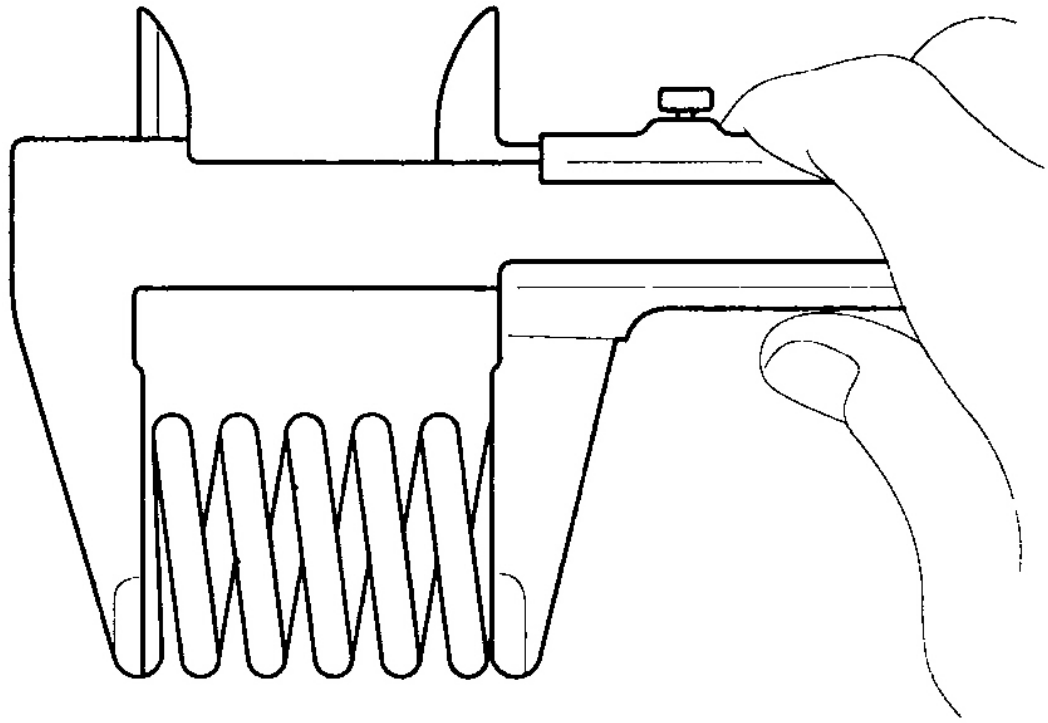
    Load: 18.8kg/39 mm (41.45lb/1.535in.)

    [Limit]

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

    Out-of-square: 3°

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Fig. 82: Using Vernier Calipers To Measure Free Length Of Valve Spring
Courtesy of HYUNDAI MOTOR CO.

If the free length is not as specified, replace the valve spring.

CAMSHAFT

1. Inspect cam lobes.

   Using a micrometer, measure the cam lobe height.

   Cam height

   [Standard value]

   Intake: 44.618mm (1.7566in.)

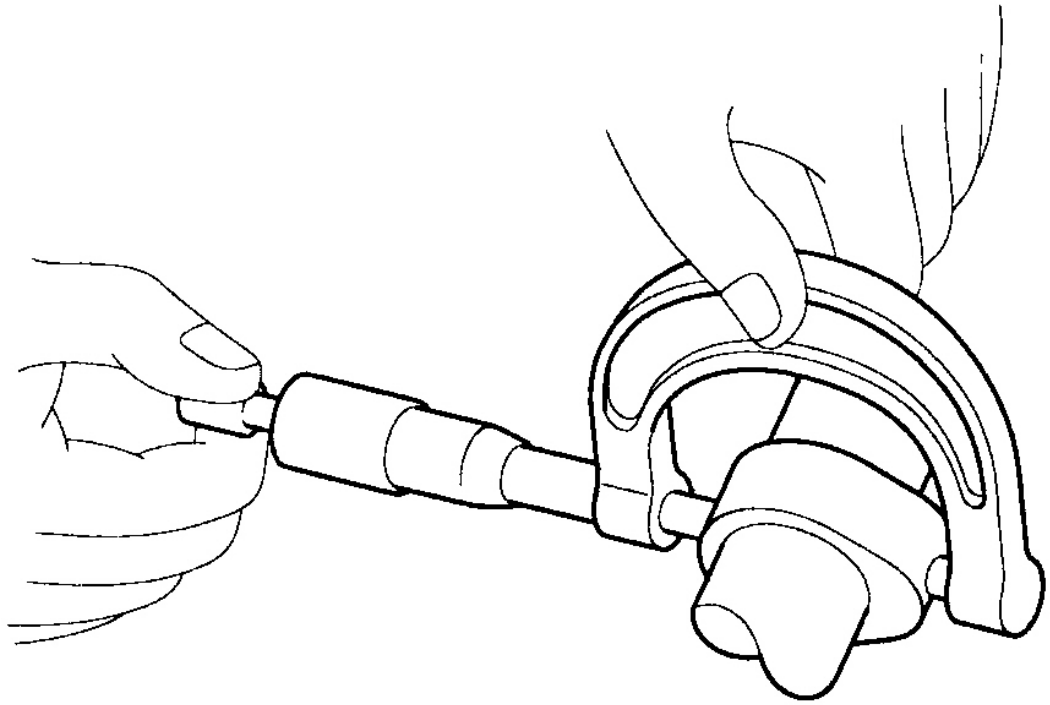
   Exhaust: 44.518mm (1.7527in.)

   [Limit]

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Intake: 44.518mm (1.7527in.)

Exhaust: 44.418mm (1.7487in.)



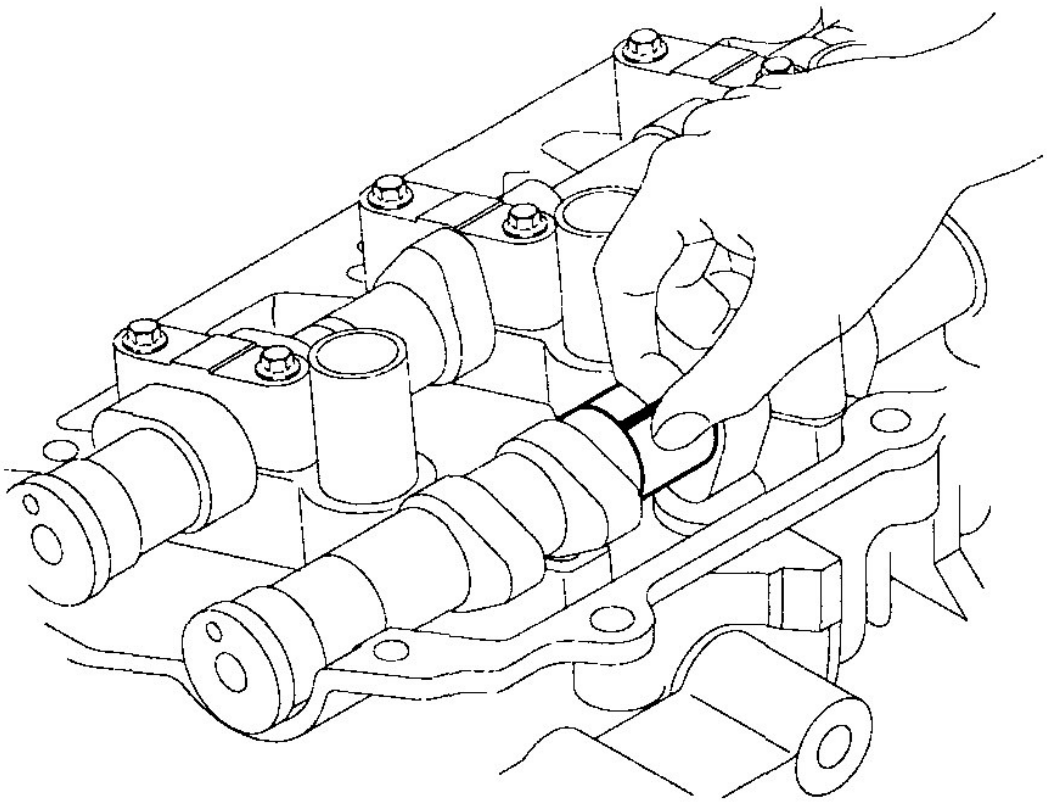
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Fig. 83: Using Micrometer To Measure Cam Lobe Height
Courtesy of HYUNDAI MOTOR CO.

If the cam lobe height is less than minimum, replace the camshaft.

2. Inspect camshaft journal clearance.
    1. Clean the bearing caps and camshaft journals.
    2. Place the camshafts on the cylinder head.
    3. Lay a strip of plastigage across each of the camshaft journal.

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Fig. 84: Laying Strip Of Plastigage Across Each Of Camshaft Journal
Courtesy of HYUNDAI MOTOR CO.

4. Install the bearing caps. (See **INSTALLATION**)

CAUTION: Do not turn the camshaft.

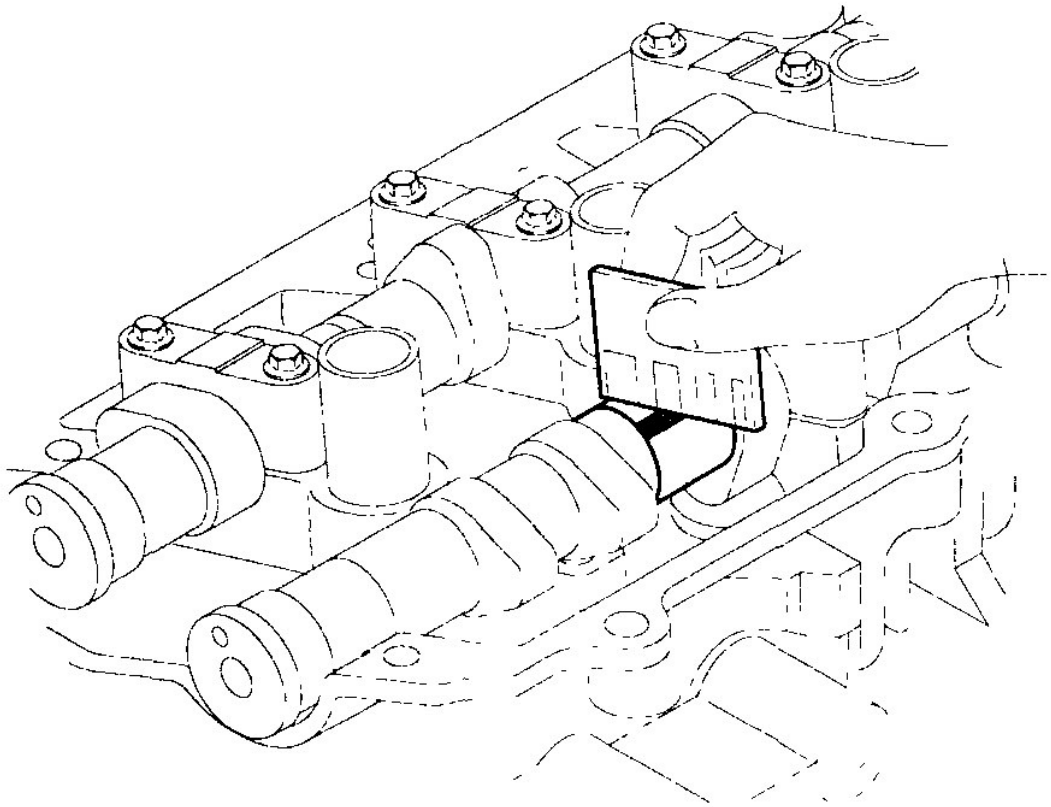
5. Remove the bearing caps.
6. Measure the plastigage at its widest point.

Bearing oil clearance

[Standard value]: 0.02 ~ 0.061 mm (0.0008 ~ 0.0024in.)

[Limit]: 0.1mm (0.0039in.)

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Fig. 85: Measuring Plastigage At Its Widest Point
Courtesy of HYUNDAI MOTOR CO.

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

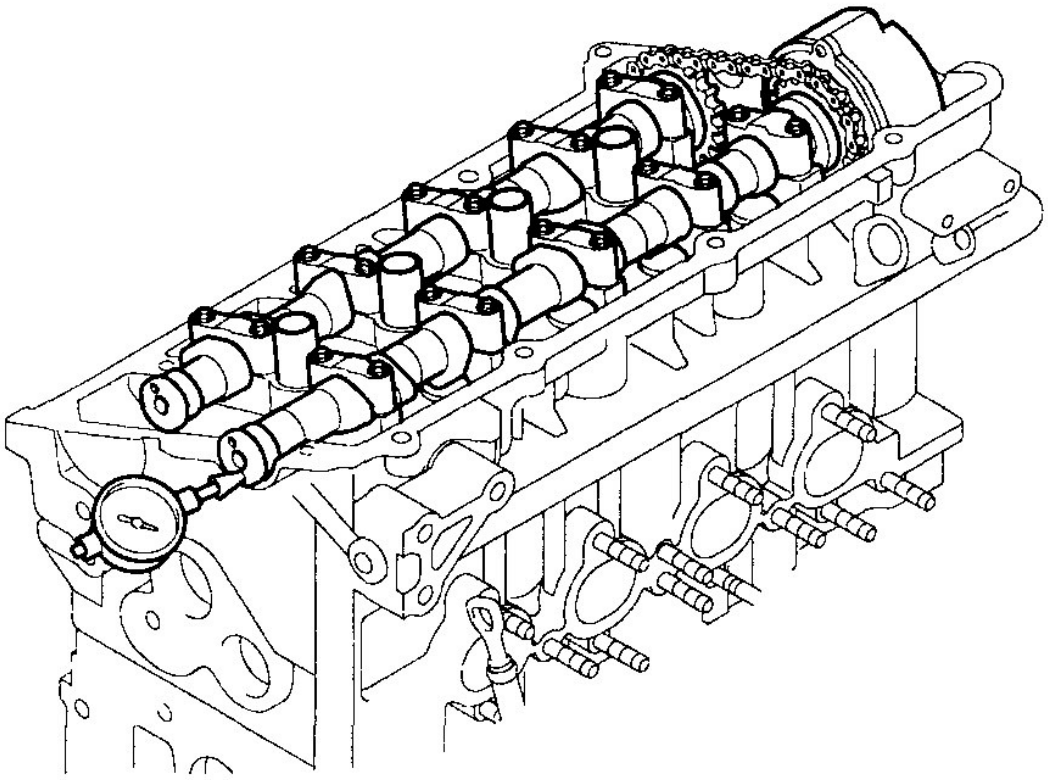
7. Completely remove the plastigage.
8. Remove the camshafts.

3. Inspect camshaft end play.
    1. Install the camshafts. (See **INSTALLATION**)
    2. Using a dial indicator, measure the end play while moving the camshaft back and forth.

    Camshaft end play

    [Standard value]: 0.1 ~ 0.2mm (0.004 ~ 0.008in.)

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Fig. 86: Using Dial Indicator To Measure End Play While Moving Camshaft Back And Fort
Courtesy of HYUNDAI MOTOR CO.

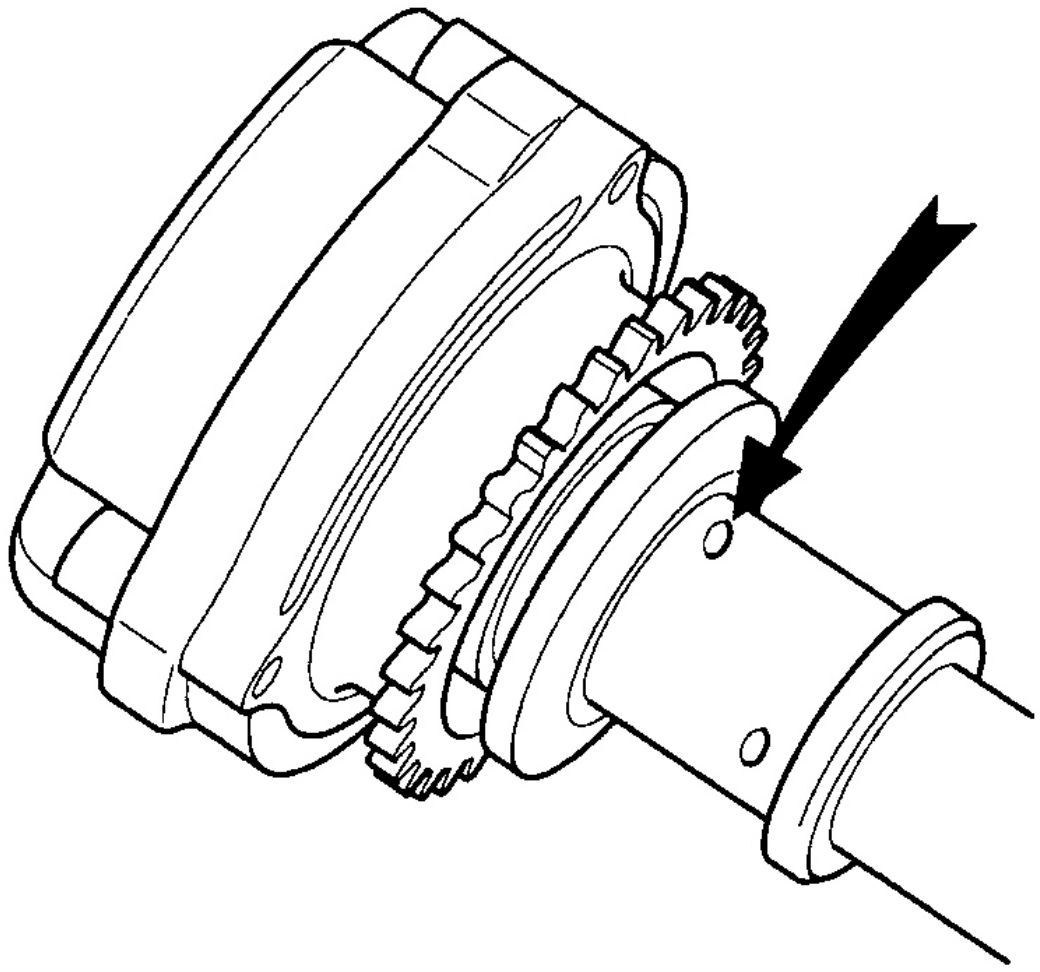
If the end play is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

3. Remove the camshafts.

CVVT ASSEMBLY

1. Inspect CVVT assembly.
    1. Check that the CVVT assembly will not turn.
    2. Apply vinyl tape to all the parts except the one indicated by the arrow in the illustration.

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Fig. 87: Applying Vinyl Tape Except Hole
Courtesy of HYUNDAI MOTOR CO.

3. Wind tape around the tip of the air gun and apply air of approx. 100kpa (1 kgf/cm^2 , 14psi) to the port of the camshaft.

   (Perform this order to release the lock pin for the maximum delay angle locking.)

   NOTE: When the oil splashes, wipe it off with a shop rag and the likes.

4. Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand.

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Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.

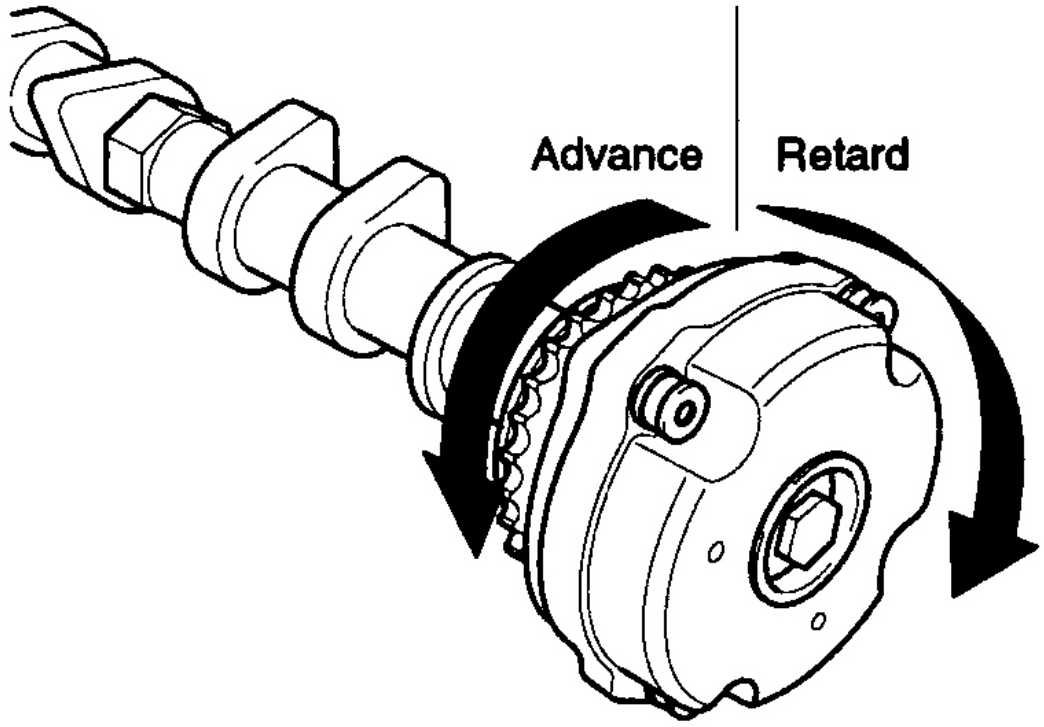


Fig. 88: Turning CVVT Assembly To Advance And Retard Angle Side
Courtesy of HYUNDAI MOTOR CO.

5. Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no disturbance.

   Standard: Movable smoothly in the range about 20°

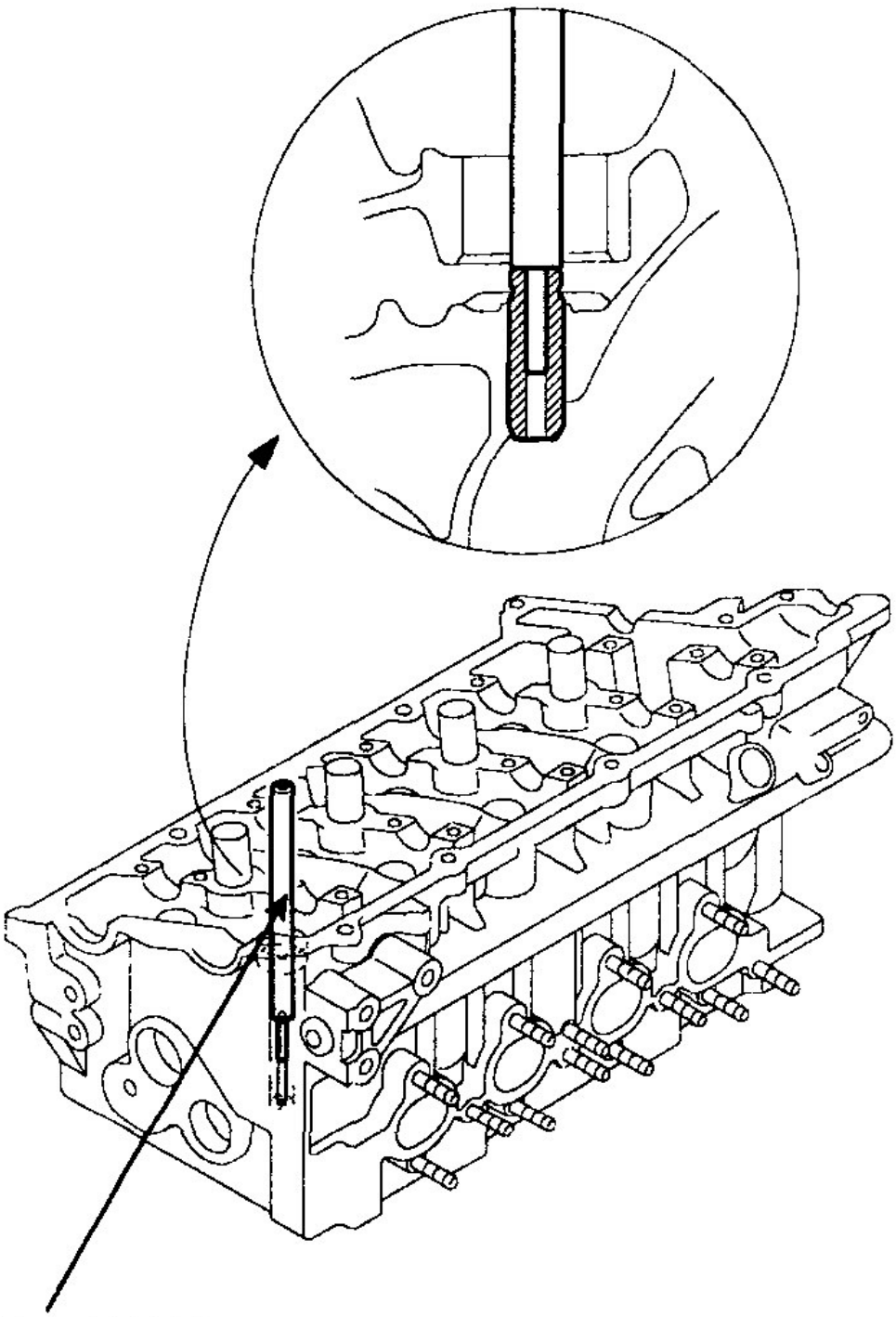
6. Turn the CVVT assembly with your hand and lock it at the maximum delay angle position.

REPLACEMENT

VALVE GUIDE

1. Using the SST (09221-3F100A), withdraw the old valve guide toward the bottom of cylinder head.

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09221-3F100A

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Fig. 89: Using SST (09221-3F100A) To Withdraw Old Valve Guide Toward Bottom Of Cylinder Head
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 SST (09221-3F100A/B), press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head. Keep in mind that the intake and exhaust valve guides are different in length.

OVERSIZE VALVE GUIDE SPECIFICATIONS

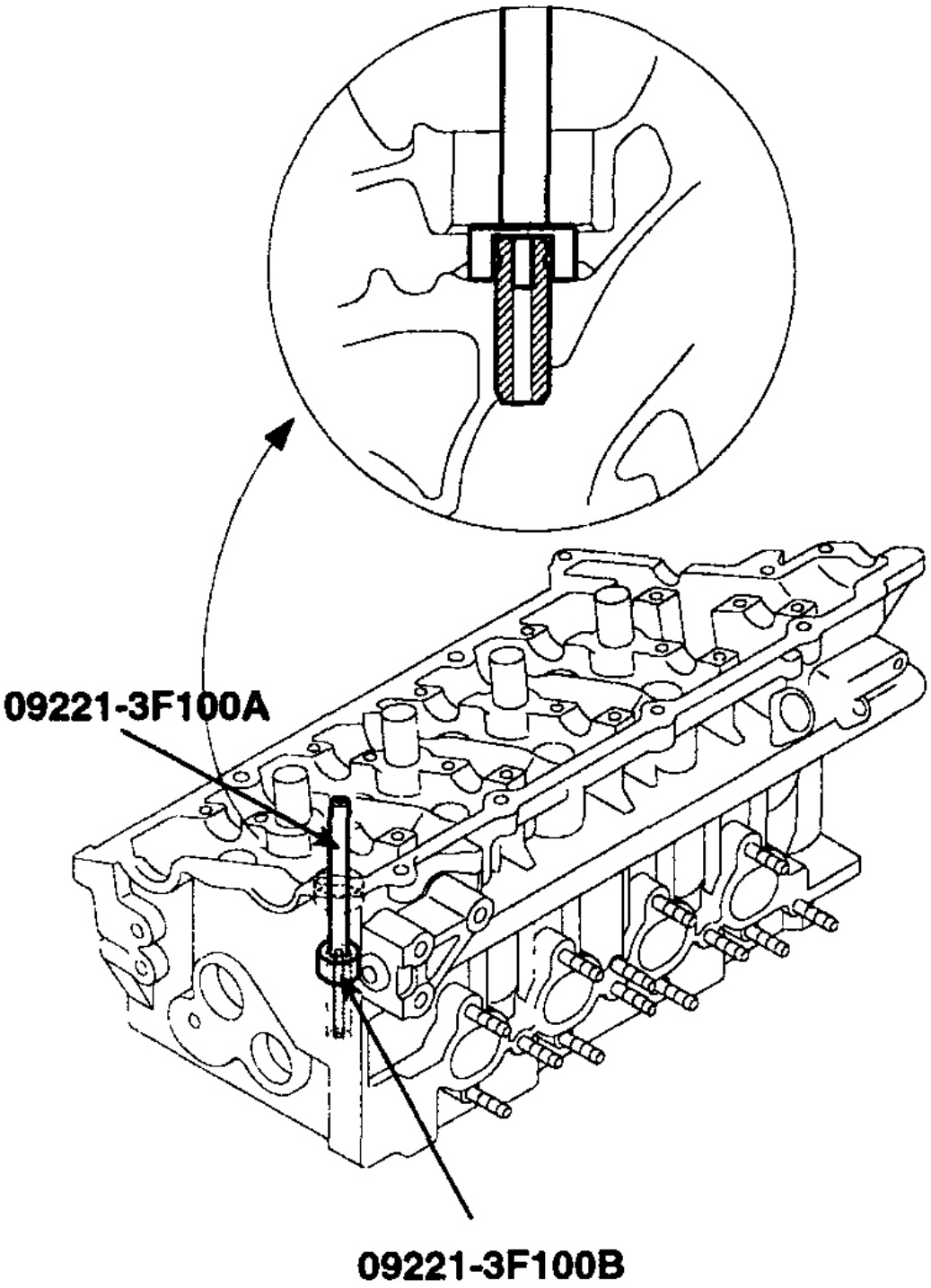
Over size mm(in.)	Size mark	Oversize valve guide hole size mm(in.)
0.05 (0.002)	5	11.05 ~ 11.068 (0.4350 ~ 0.4357)
0.25 (0.010)	25	11.25 ~ 11.268 (0.4429 ~ 0.4436)
0.50 (0.020)	50	11.50 ~ 11.518 (0.4528 ~ 0.4535)

Valve guide length

Intake: 46mm (1.8in.)

Exhaust: 54.5mm (2.15in.)

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Fig. 90: Using SST(09221-3F100A/B) To Press-Fit Valve Guide
Courtesy of HYUNDAI MOTOR CO.

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

REASSEMBLY

NOTE: Thoroughly clean all parts to be assembled.
Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
Replace oil seals with new ones.

1. Install valves.
    1. Install the spring seats.
    2. Using SST(09222-22001), push in a new oil seal.

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

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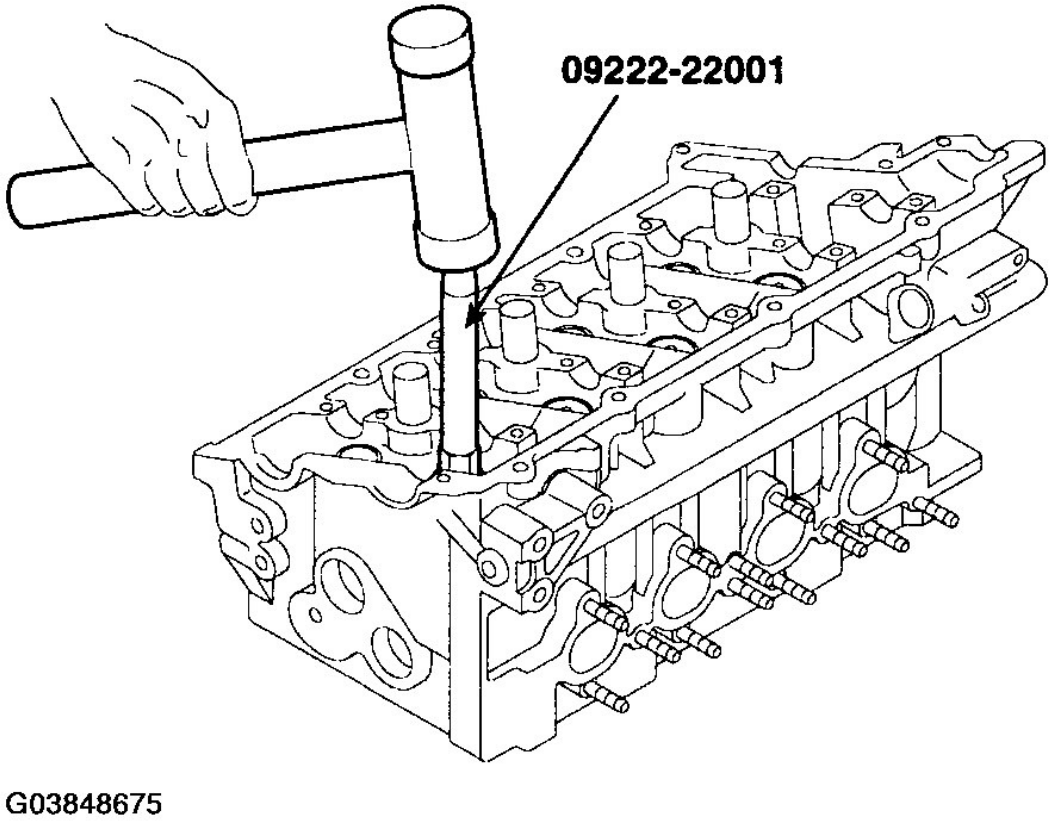


Fig. 91: Using Sst(09222-22001) To Push In New Oil Seal
Courtesy of HYUNDAI MOTOR CO.

3. Install the valve, valve spring and spring retainer.

NOTE: Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer.

4. Using the SST(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.

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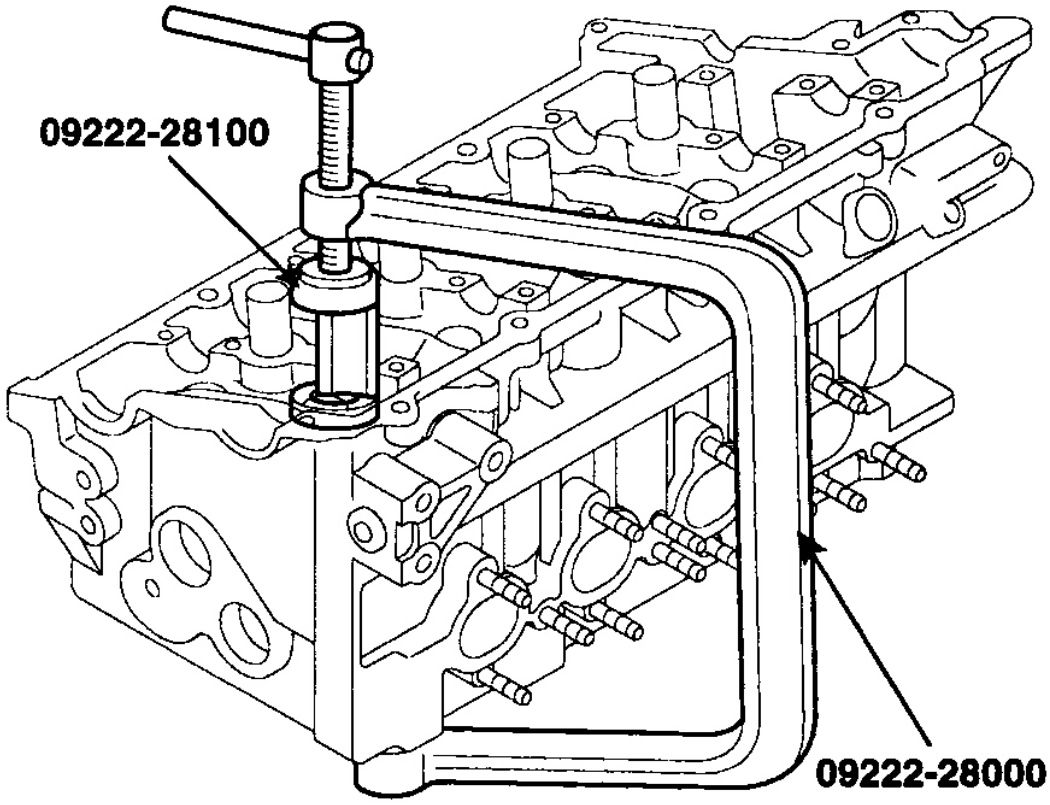


Fig. 92: Using SST(09222-28000, 09222-28100) To Compress Spring And Install Retainer Locks
Courtesy of HYUNDAI MOTOR CO.

5. Lightly tap the end of each valve stem two or three times with the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.

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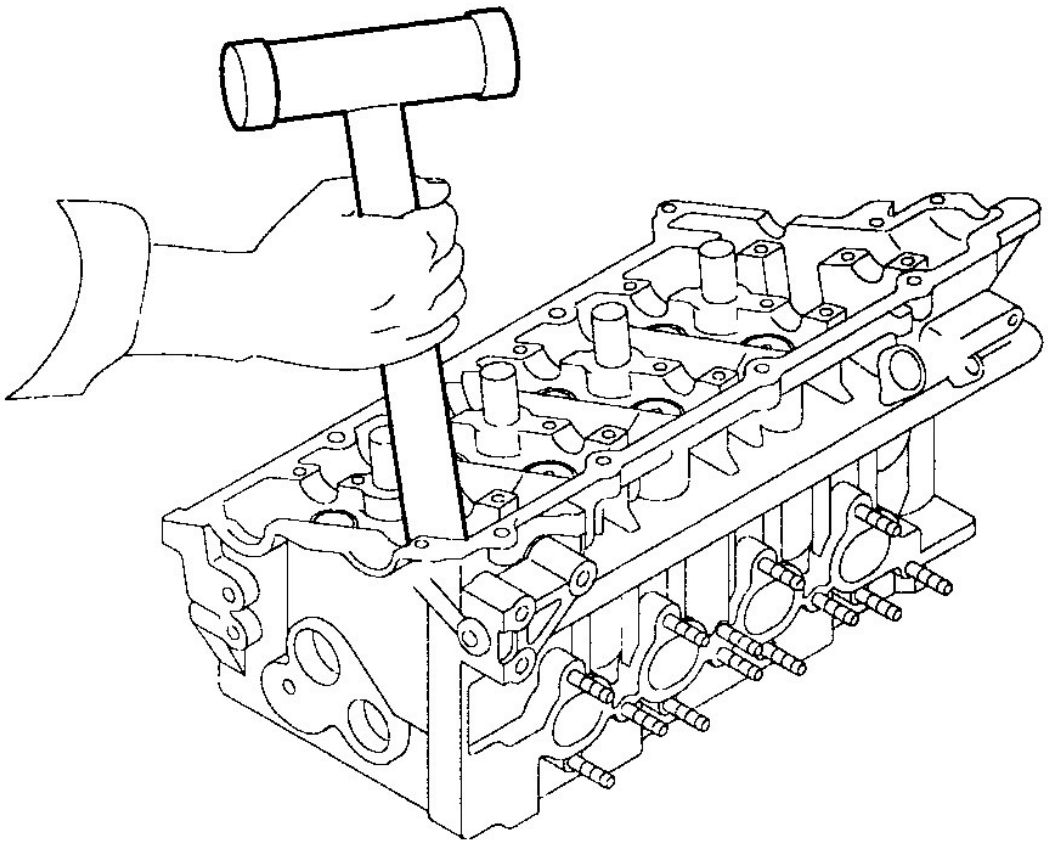


Fig. 93: Lightly Tapping End Of Each Valve Stem Two Or Three Times With Wooden Handle Of A Hammer
Courtesy of HYUNDAI MOTOR CO.

2. Install MLAs.

   Check that the MLA rotates smoothly by hand.

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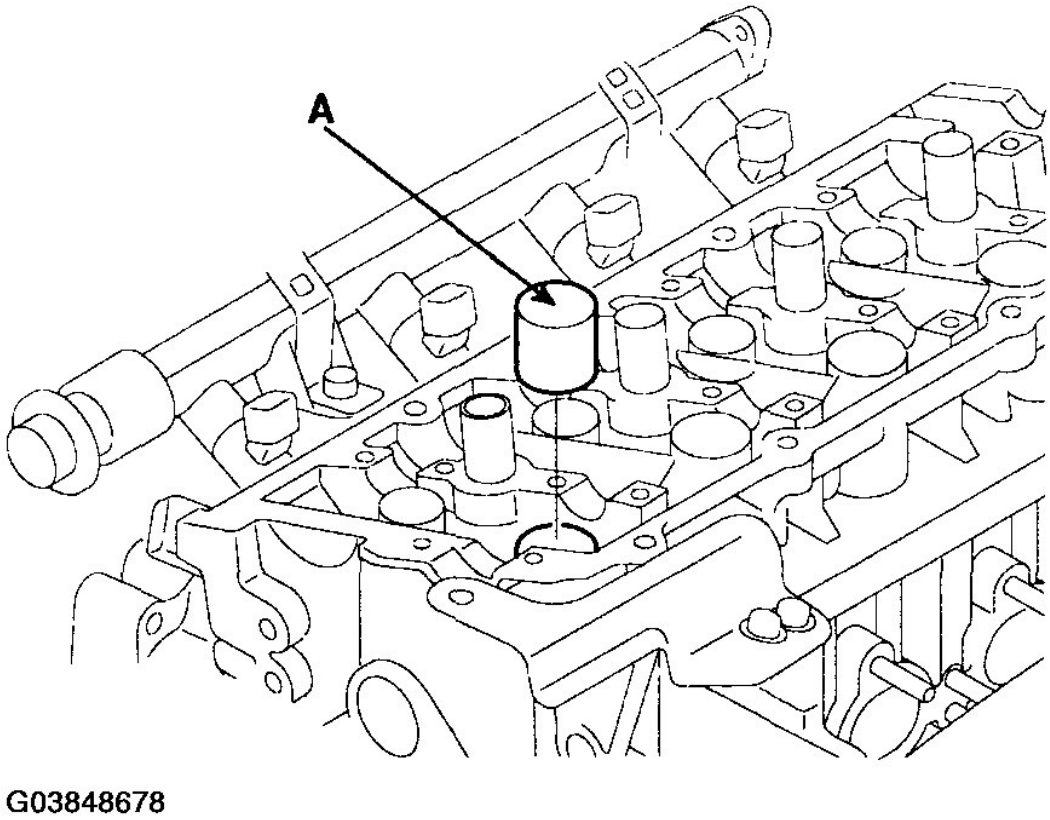


Fig. 94: Installing Mechanical Lash Adjuster
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

NOTE:

- **Thoroughly clean all parts to be assembled.**
- **Always use a new head and manifold gasket.**
- **The cylinder head gasket is a metal gasket. Take care not to bend it.**
- **Rotate the crankshaft, set the No. 1 piston at TDC. (See TIMING BELT TENSION ADJUSTMENT)**

1. Install the cylinder head gasket(A) on the cylinder block.

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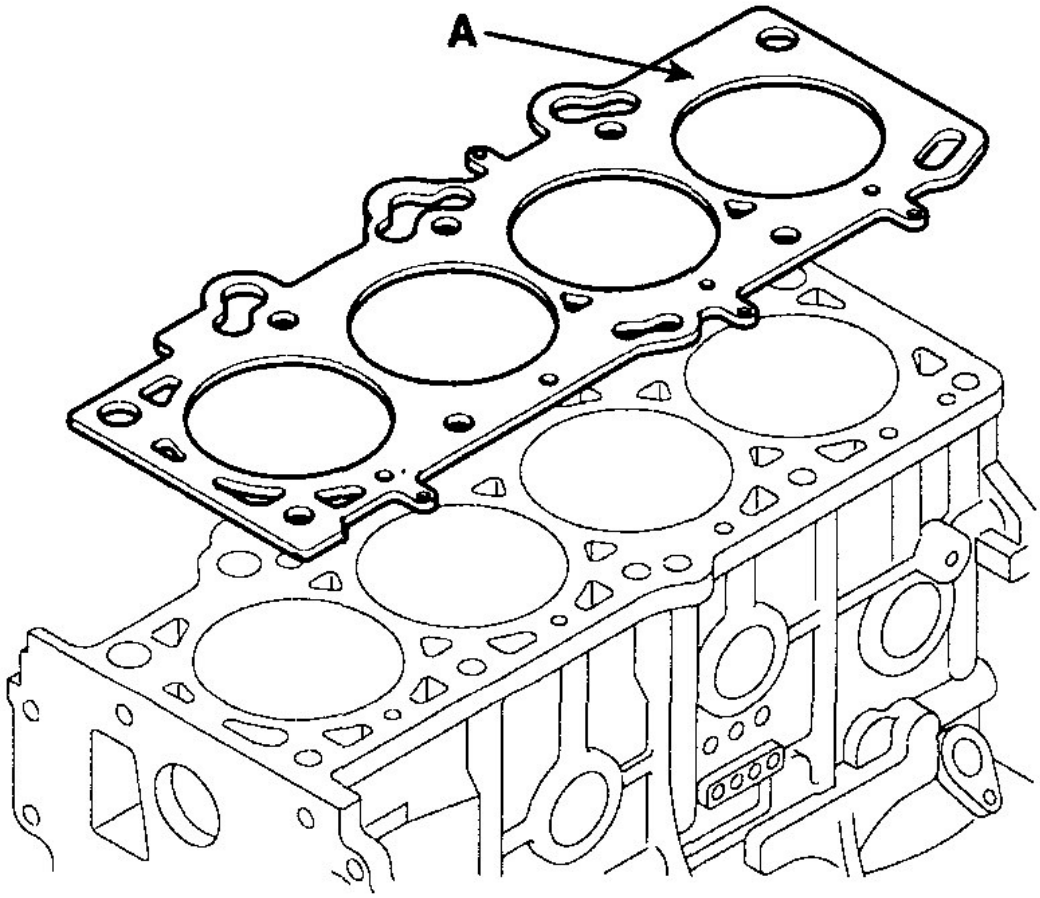


Fig. 95: Installing Cylinder Head Gasket On Cylinder Block
Courtesy of HYUNDAI MOTOR CO.

NOTE: Be careful of the installation direction.

2. Place the cylinder head carefully in order not to damage the gasket with the bottom part of the end.
3. Install cylinder head bolts.
    1. Apply a light coat if engine oil on the threads and under the heads of the cylinder head bolts.
    2. Using 8mm and 10mm hexagon wrench, install and tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.

Tightening torque

M10 :

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25Nm (250kgf.cm, 18lbf.ft) + (60° ~ 65°) + (60° ~ 65°)

M12 :

30Nm (300kgf.cm, 22lbf.ft) + (60° ~ 65°) + (60° ~ 65°)

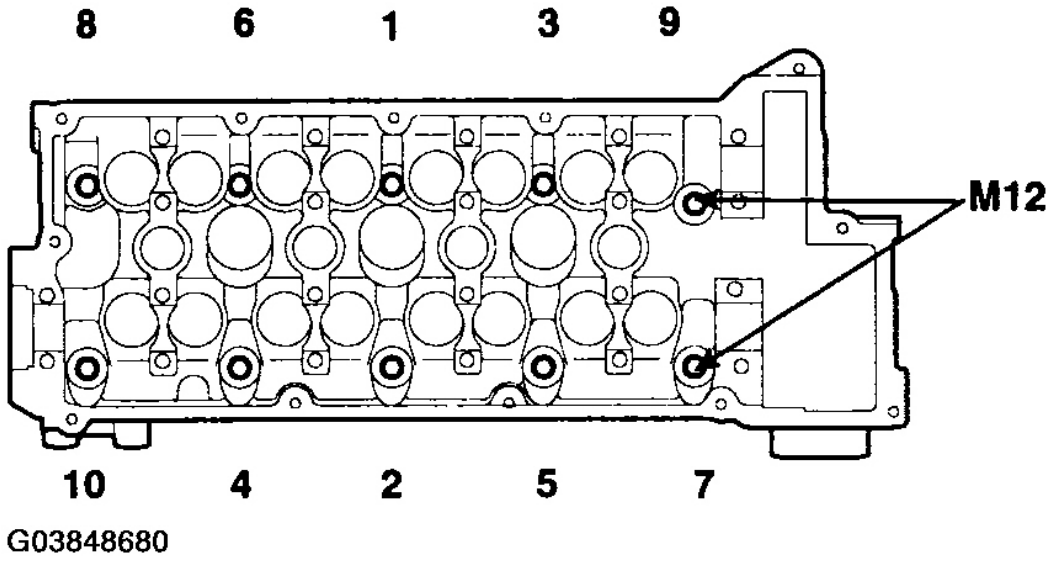


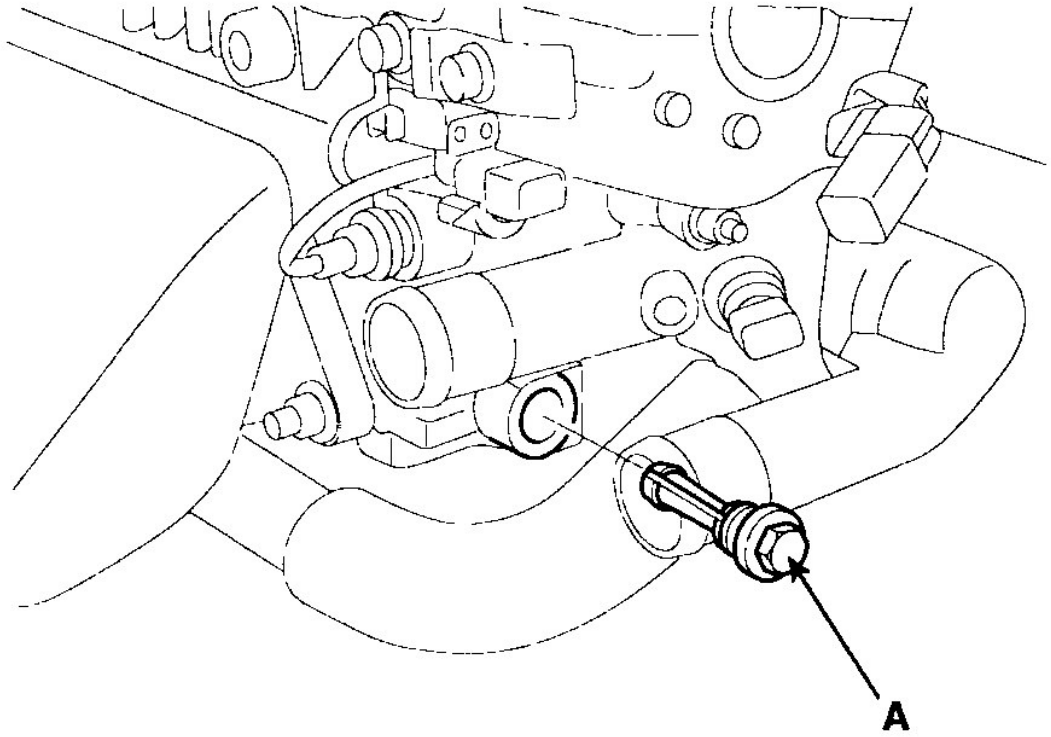
Fig. 96: Identifying Tightening Sequence Of Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

4. Install OCV filter(A).

Tightening torque

41 ~ 51 Nm (410 ~ 510kgf.cm, 30 ~ 37.6lbf.ft)

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Fig. 97: Installing OCV Filter
Courtesy of HYUNDAI MOTOR CO.

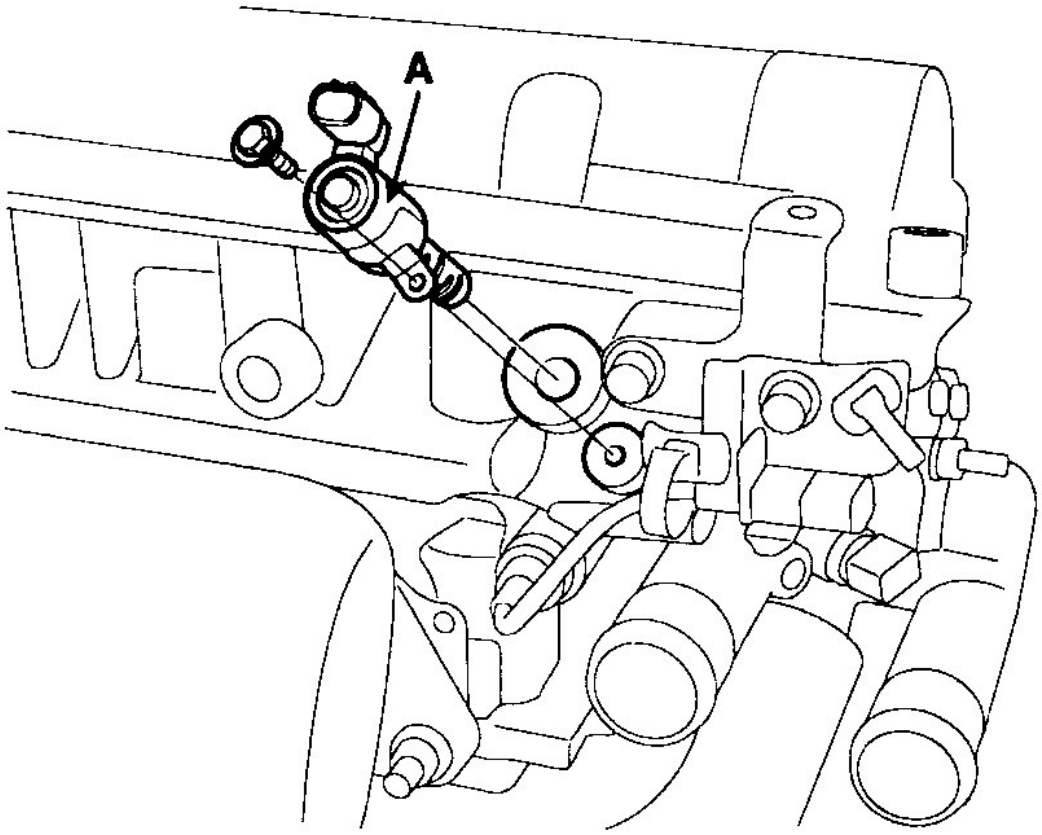
NOTE: Always use a new OCV filter gasket.
Keep clean the OCV filter.

5. Install OCV(A).

Tightening torque

10 ~ 12Nm(100 ~ 120kgf.cm, 7.3 ~ 8.8lbf.ft)

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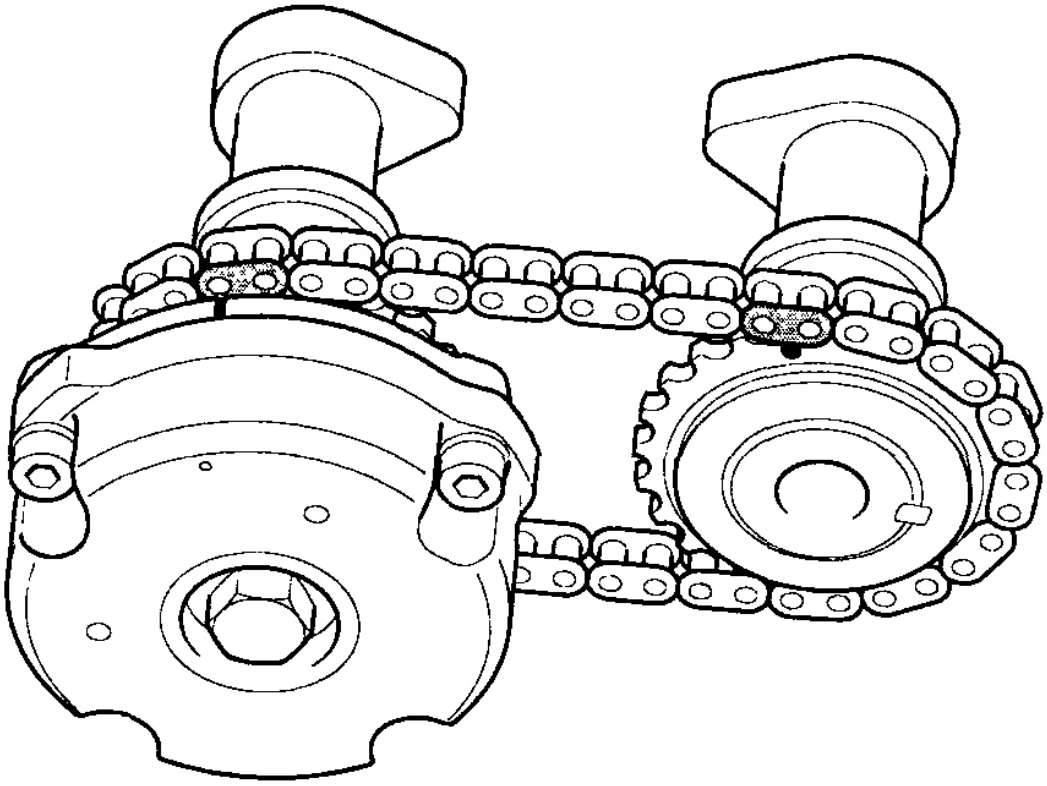
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Fig. 98: Installing OCV
Courtesy of HYUNDAI MOTOR CO.

CAUTION:
- **Do not reuse the OCV when dropped.**
- **Keep clean the OCV.**
- **Do not hold the OCV sleeve during servicing.**
- **When the OCV is installed on the engine, do not move the engine with holding the OCV yoke.**

6. Install the camshafts.
    1. Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.

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Fig. 99: Aligning Camshaft Timing Chain With Intake Timing Chain Sprocket And Exhaust Timing Chain Sprocket
Courtesy of HYUNDAI MOTOR CO.

2. Install the camshafts(A) and bearing caps(B).

   Tightening torque

   14 ~ 15Nm (140 ~ 150kgf.cm, 10 ~ 11lbf.ft)

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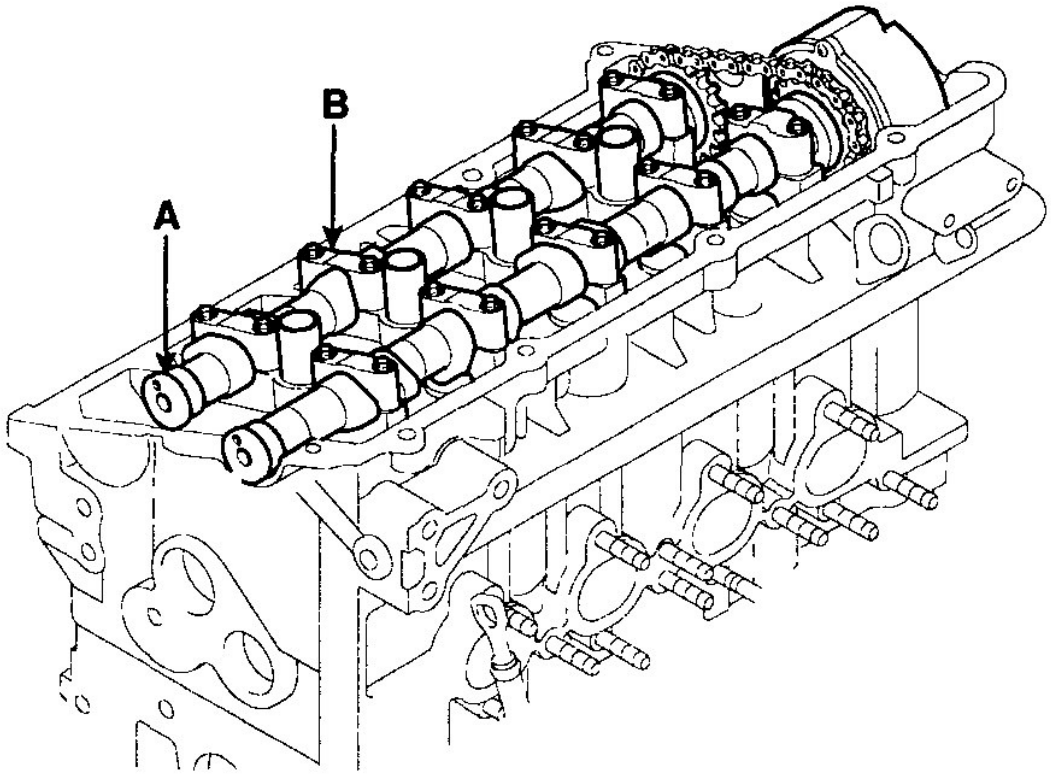


Fig. 100: Installing Camshafts And Bearing Caps
Courtesy of HYUNDAI MOTOR CO.

3. Install the timing chain auto tensioner(A).

   Tightening torque

   8 ~ 10Nm (80 ~ 100kgf.cm, 6 ~ 7.4lbf.ft)

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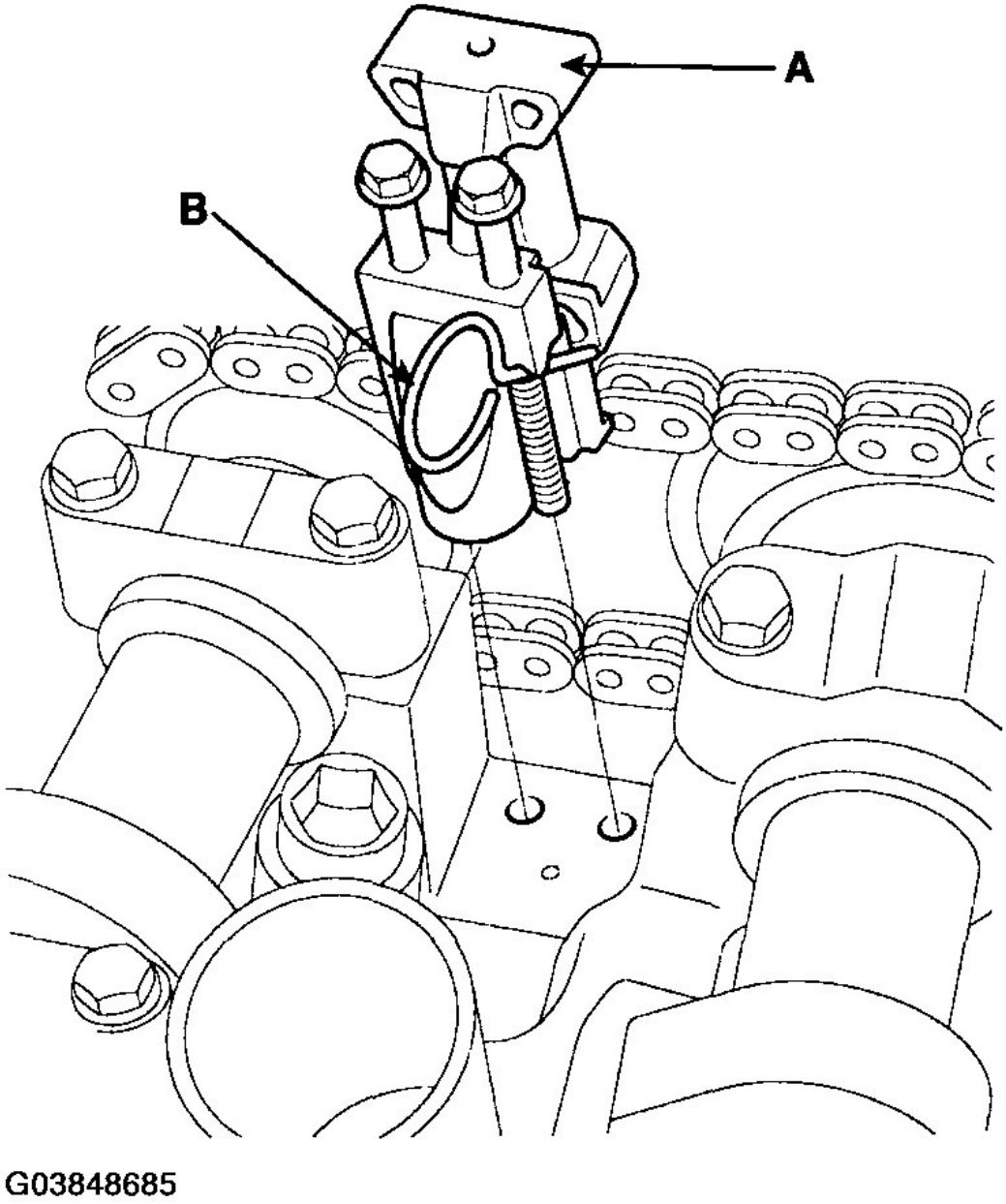


Fig. 101: Installing Timing Chain Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.

4. Remove the auto tensioner stopper pin(B).

7. Check and adjust valve clearance. (See **VALVE CLEARANCE INSPECTION AND ADJUSTMENT**)
8. Using the SST (09221-21000), install the camshaft bearing oil seal.

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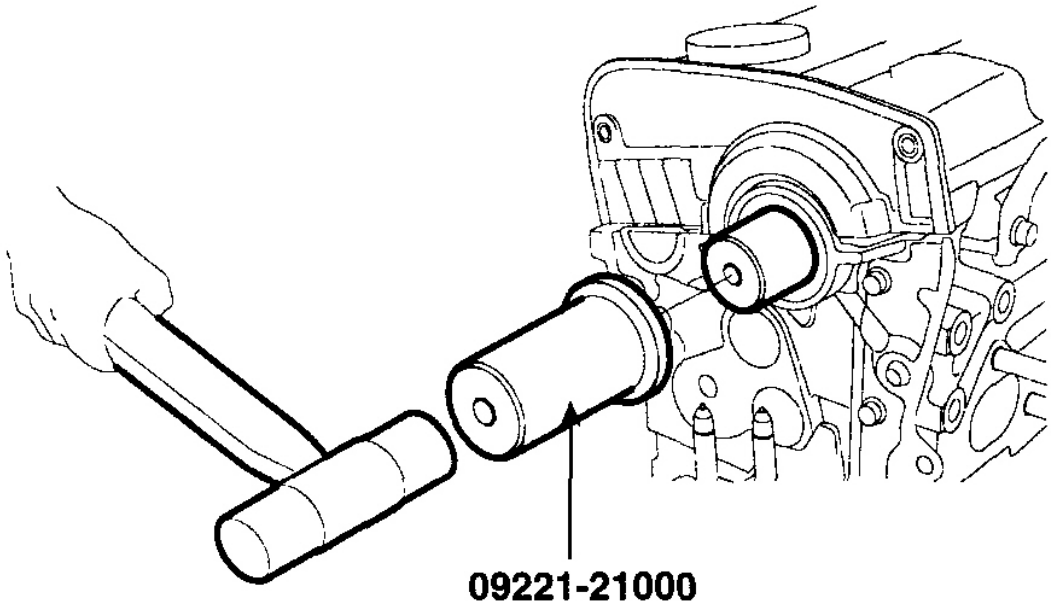


Fig. 102: Using SST (09221-21000) To Install Camshaft Bearing Oil Seal
Courtesy of HYUNDAI MOTOR CO.

9. Install the camshaft sprocket. (See **INSPECTION**)
10. Install the timing belt. (See **INSPECTION**)
11. Install the cylinder head cover.
    1. Install the cylinder head cover gasket(A) in the groove of the cylinder head cover(B).

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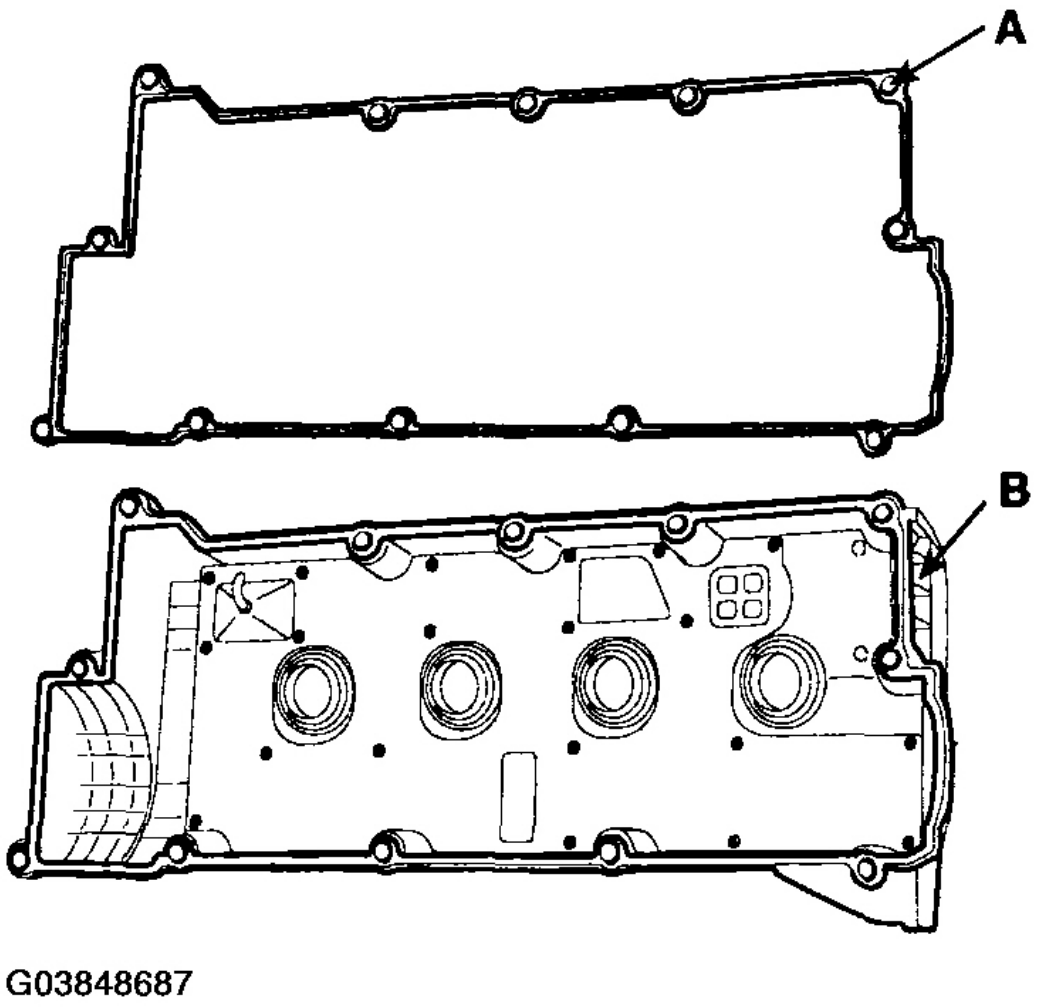


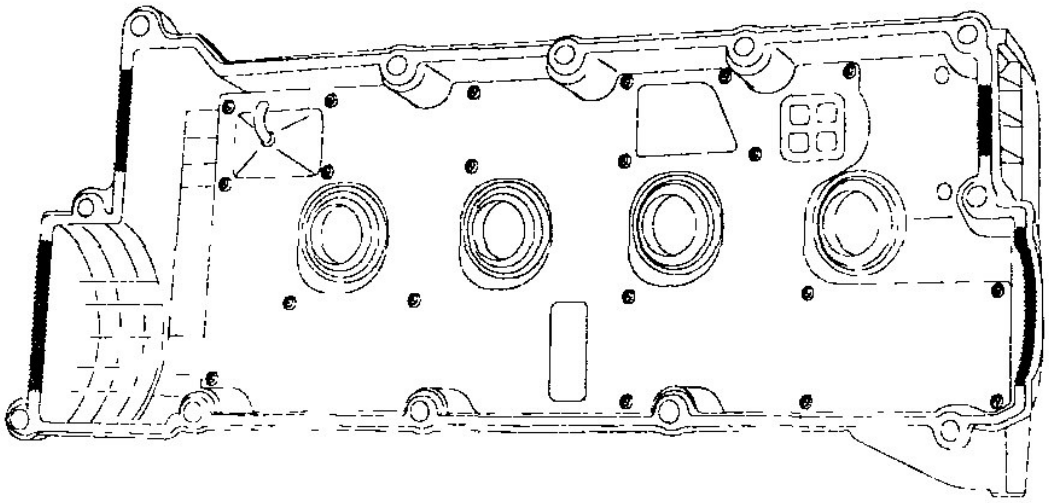
Fig. 103: Installing Cylinder Head Cover Gasket In Groove Of Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- **Before installing the head cover gasket, thoroughly clean the head cover gasket and the groove.**
- **When installing, make sure the head cover gasket is seated securely in the corners of the recesses with no gap.**

2. Apply liquid gasket to the head cover gasket at the corners of the recess.

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Fig. 104: Applying Liquid Gasket To Head Cover Gasket At Corners Of Recess
Courtesy of HYUNDAI MOTOR CO.

NOTE:

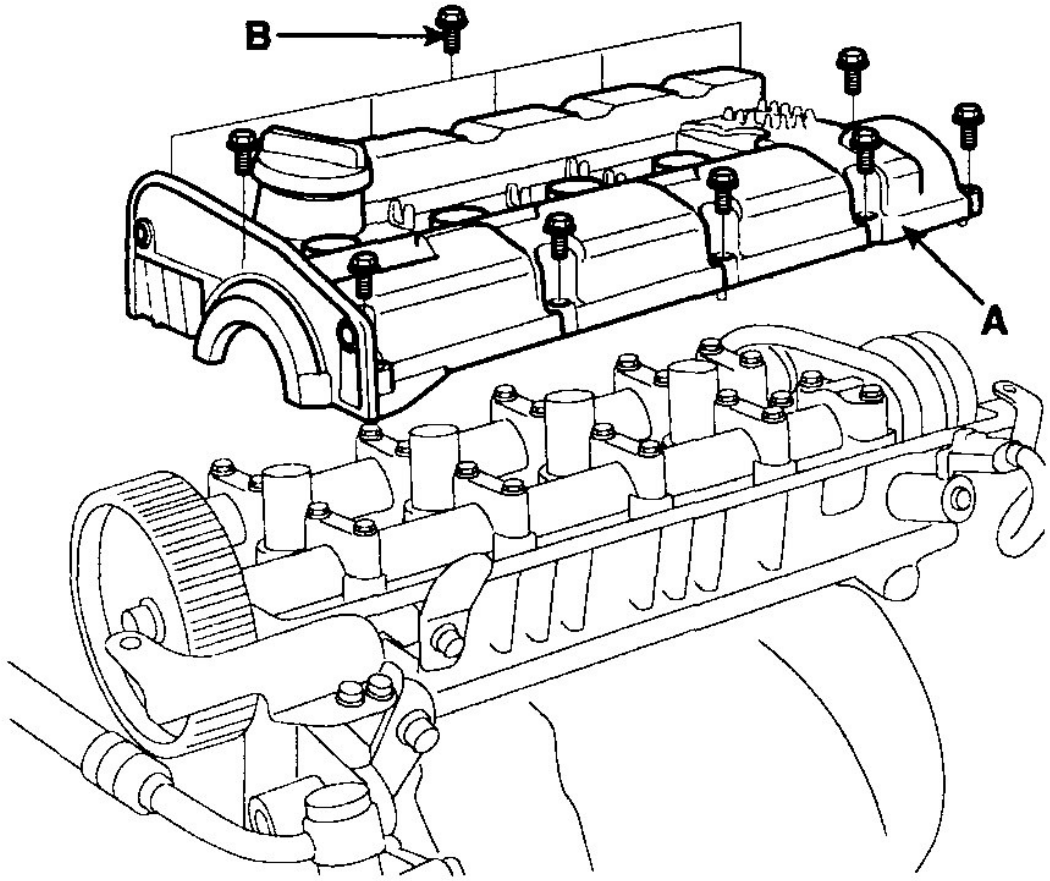
- **Use liquid gasket, loctite No. 5999.**
- **Check that the mating surfaces are clean and dry before applying liquid gasket**
- **After assembly, wait at least 30 minutes before filling the engine with oil.**

3. Install the cylinder head cover(A) with the 12bolts(B). Uniformly tighten the bolts in several passes.

Tightening torque

P8 ~ 10Nm (80 ~ 100kgf.cm, 6 ~ 7.4lbf.ft)

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Fig. 105: Installing Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

12. Install the intake manifold.
13. Install the exhaust manifold.
14. Install the PCV. (See **INSTALLATION**)
15. Install the spark plug cable. (See **INSPECT SPARK PLUG AND SPARK PLUG CABLE**)
16. Install the power steering pump bracket bolts(A).

Tightening torque

35 ~ 50Nm (350 ~ 500kgf.cm, 26 ~ 37lbf.ft)

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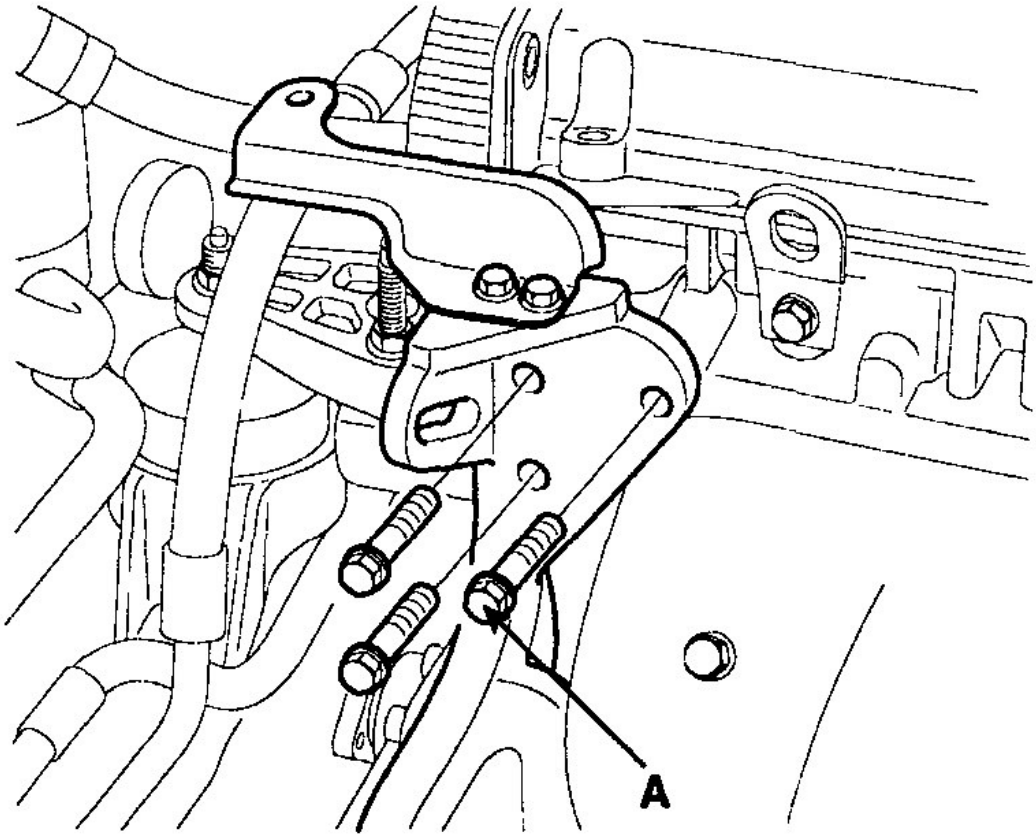


Fig. 106: Installing Power Steering Pump Bracket Bolts
Courtesy of HYUNDAI MOTOR CO.

17. Install the power steering pump. (See **MECHANICAL POWER STEERING SYSTEM**)
18. Install the accelerator cable.
19. Install the bake booster hose(A).

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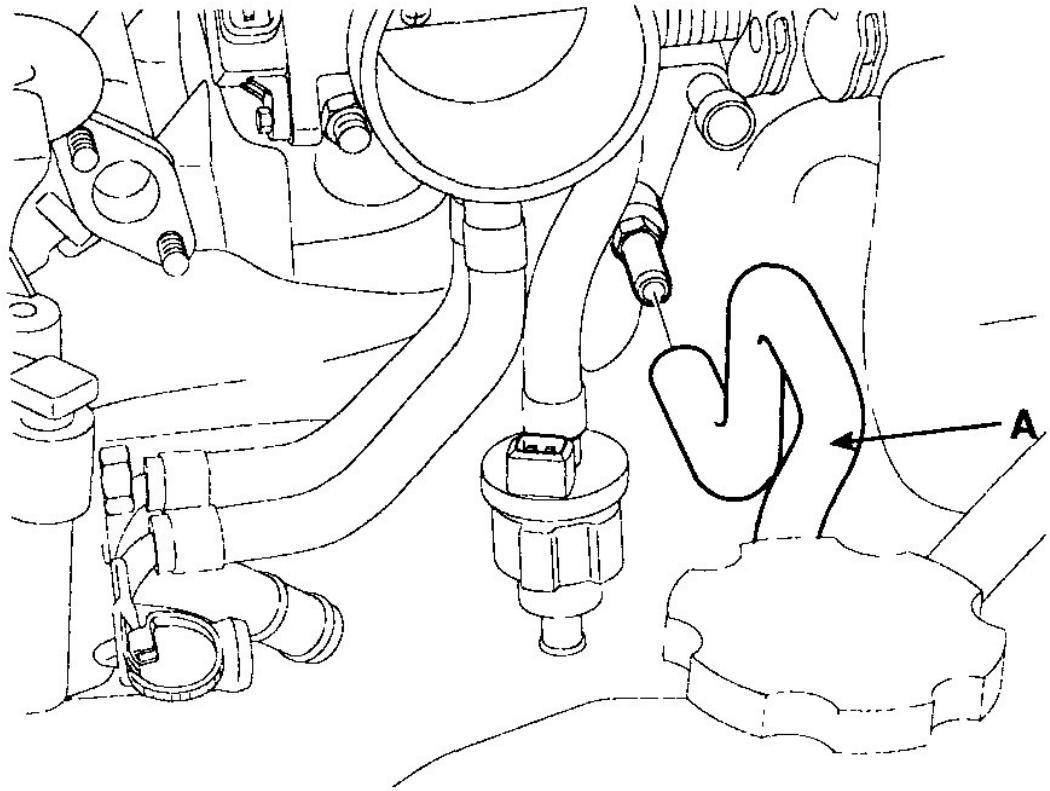


Fig. 107: Installing Bake Booster Hose
Courtesy of HYUNDAI MOTOR CO.

20. Install the PCSV hose(A).

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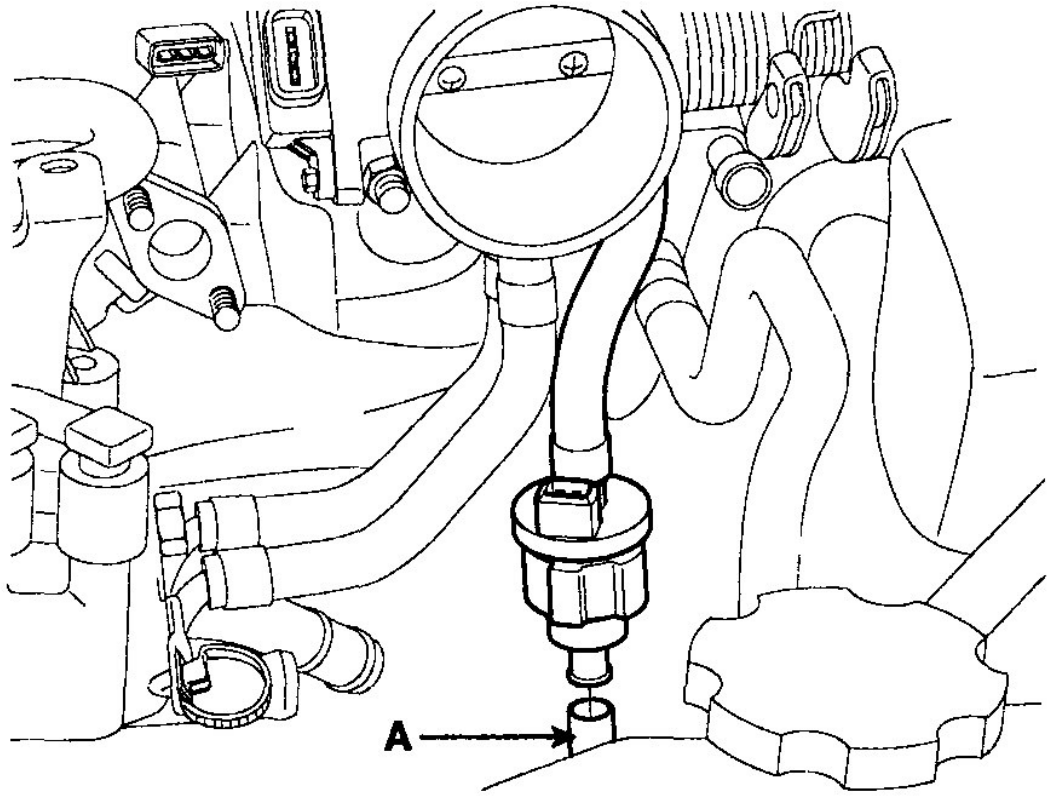


Fig. 108: Installing PCSV Hose
Courtesy of HYUNDAI MOTOR CO.

21. Install the fuel inlet hose(A).

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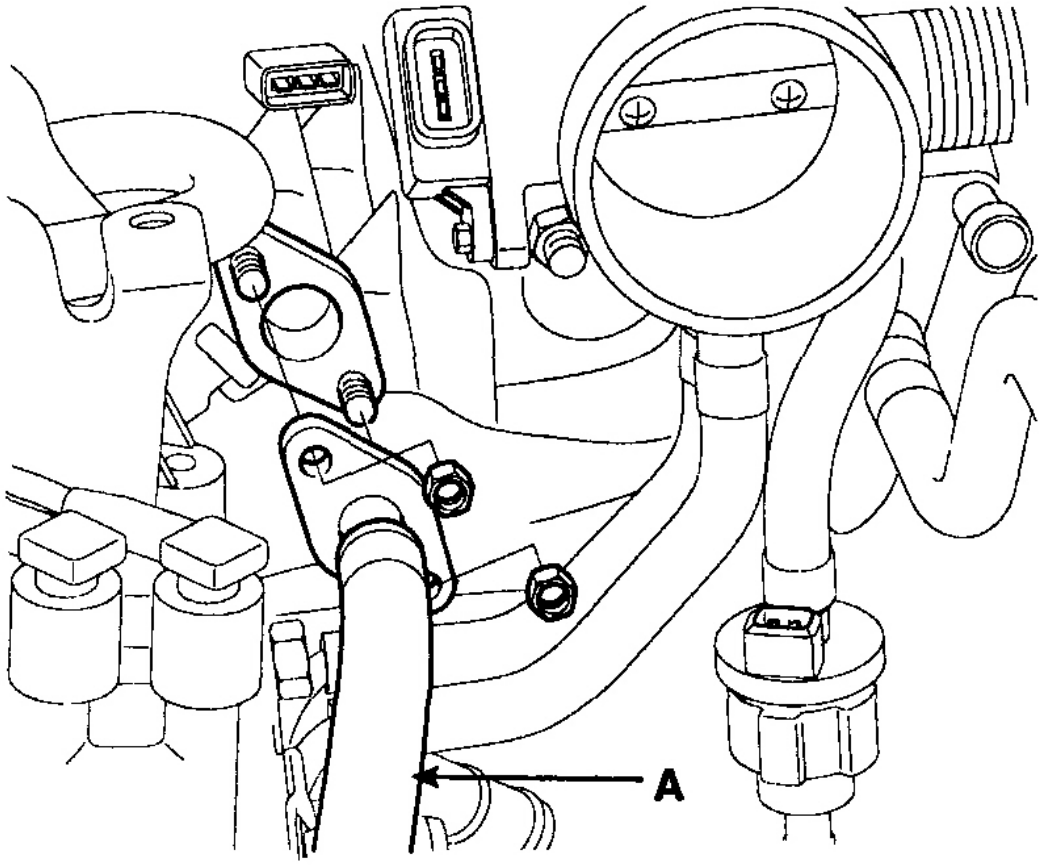


Fig. 109: Installing Fuel Inlet Hose
Courtesy of HYUNDAI MOTOR CO.

22. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.
    1. PCSV connector(A).

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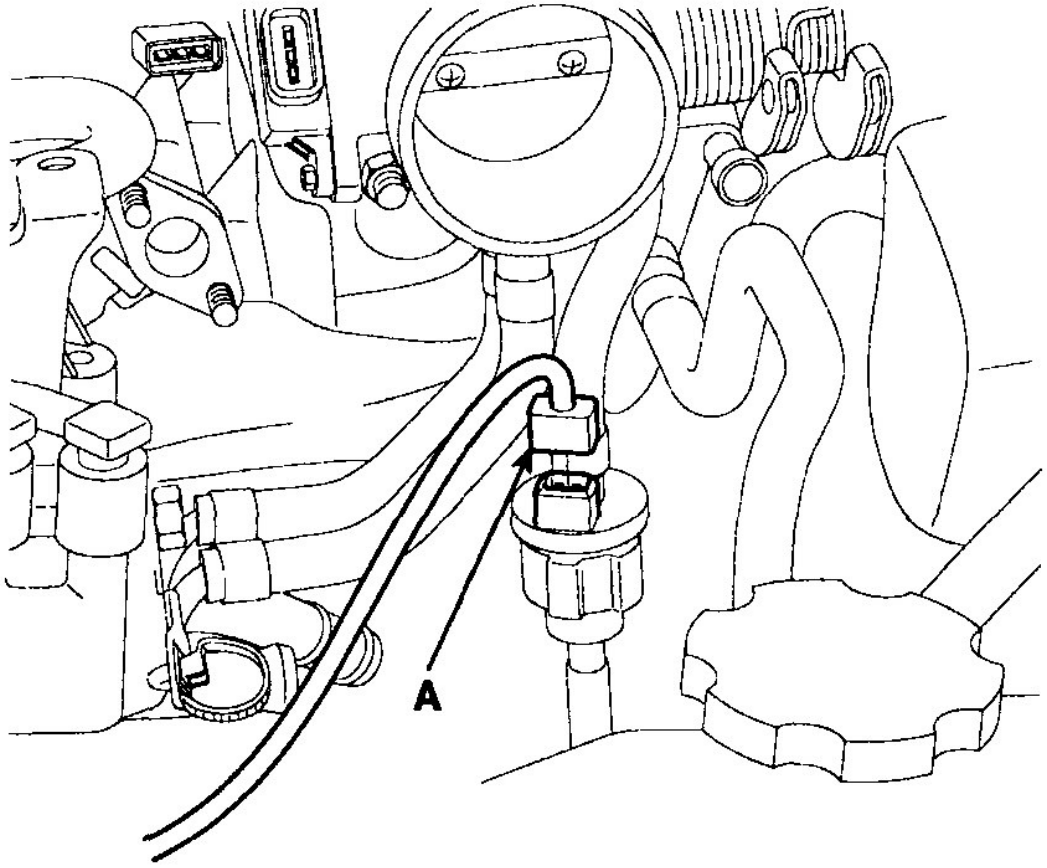


Fig. 110: Installing PCSV Connector
Courtesy of HYUNDAI MOTOR CO.

2. Front heated oxygen sensor connector(A).

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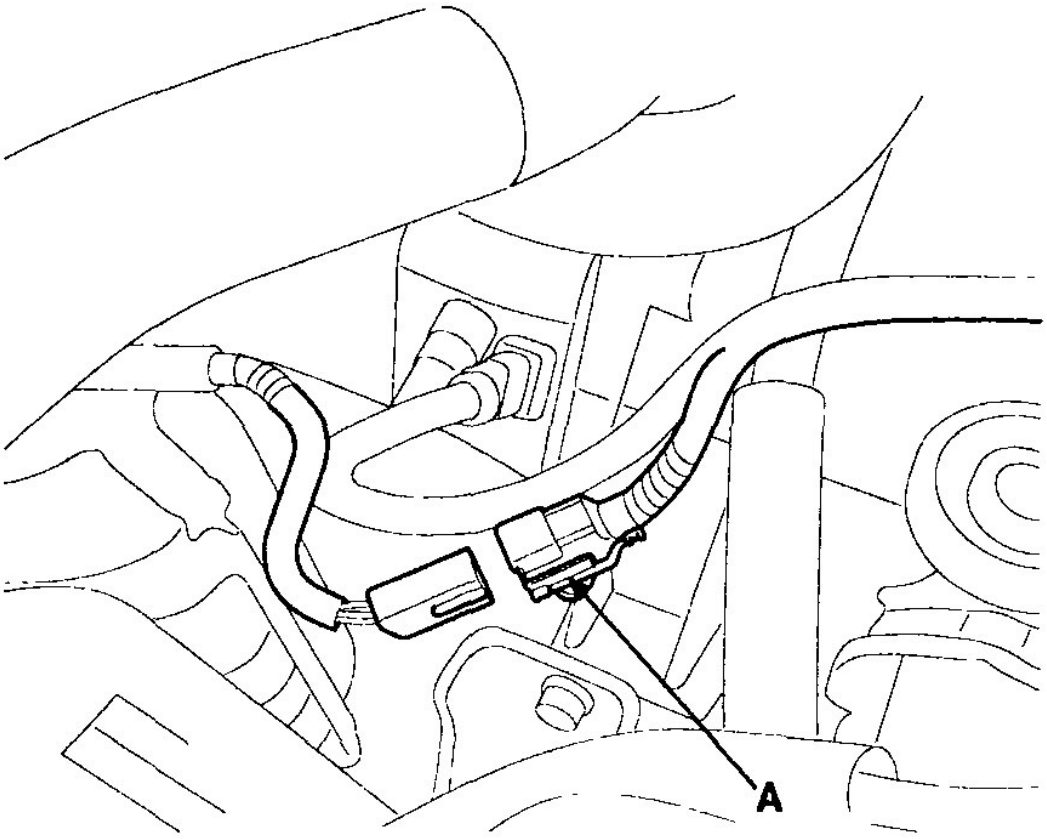


Fig. 111: Installing Front Heated Oxygen Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

3. Connect the ground cable to the intake manifold(D).
4. Knock sensor connector(C).
5. Four fuel injector connectors(B).
6. CMP connector(A).

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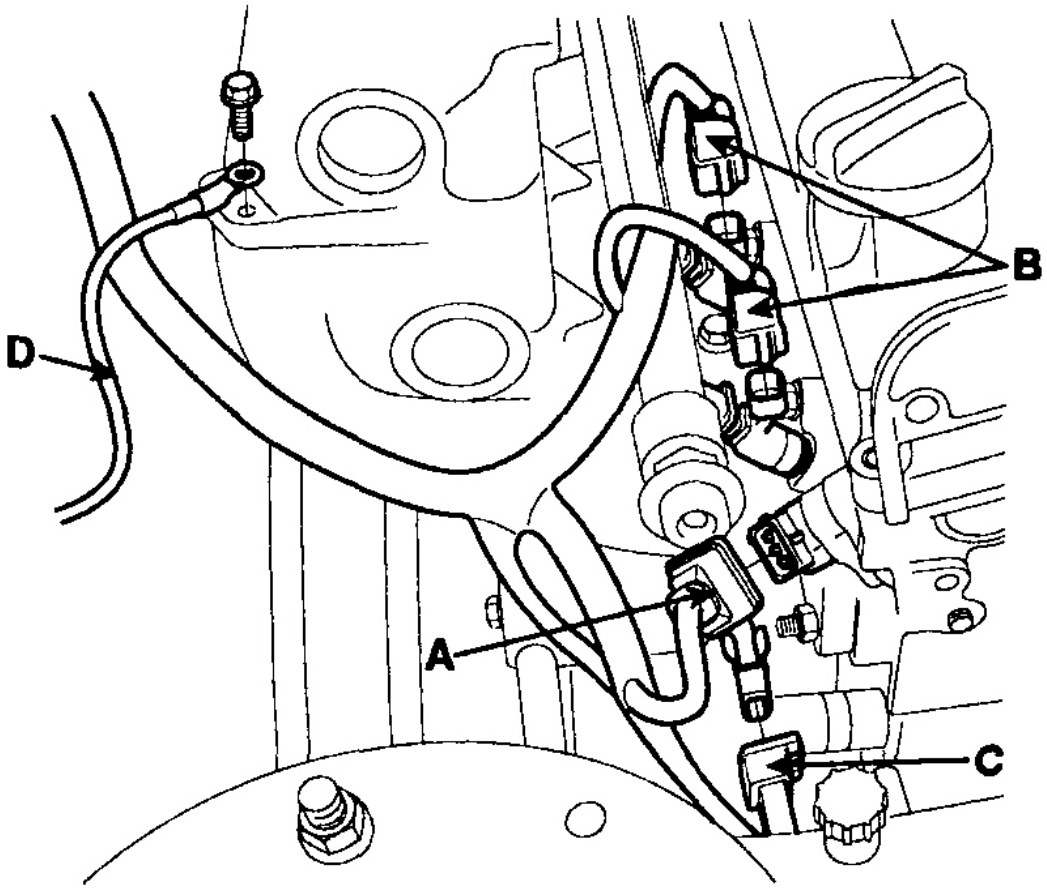
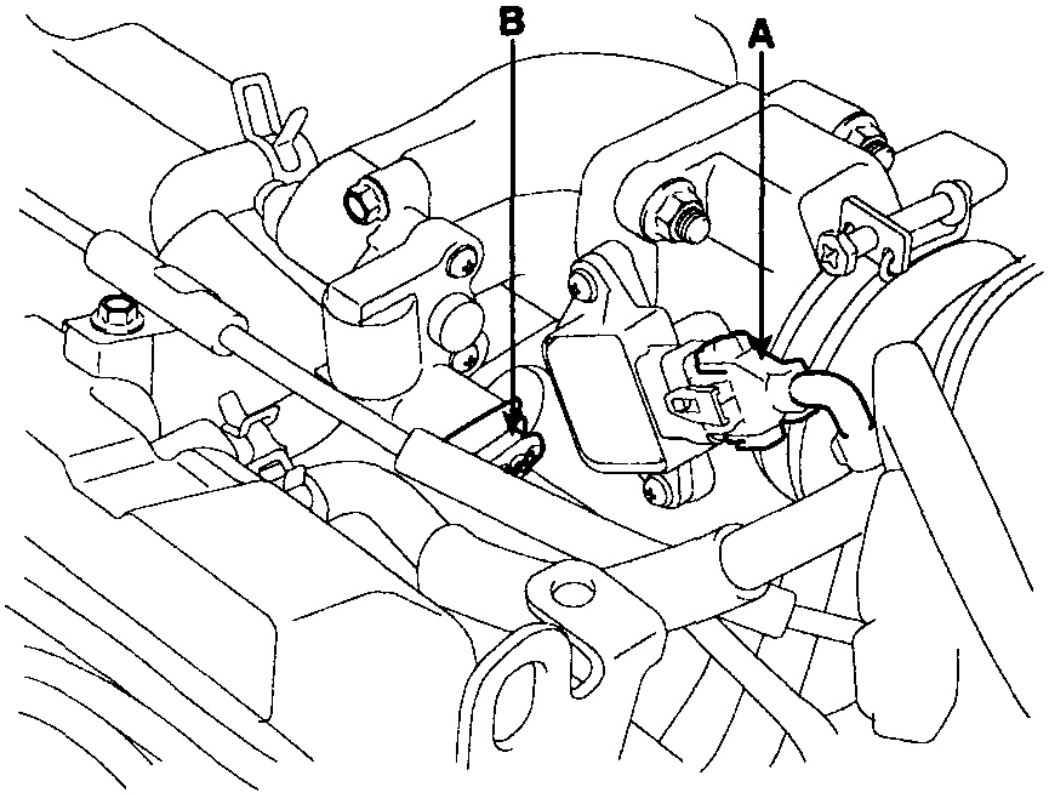


Fig. 112: Connecting Ground Cable, Knock Sensor Connector, Four Fuel Injector Connectors And CMP Connector
Courtesy of HYUNDAI MOTOR CO.

7. ISA connector(B).
8. TPS connector(A).

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Fig. 113: Connecting ISA Connector And TPS Connector
Courtesy of HYUNDAI MOTOR CO.

9. To Intake Manifold(D).
10. ECT sensor connector(C).
11. Oil temperature sensor connector(B).
12. OCV connector(A).

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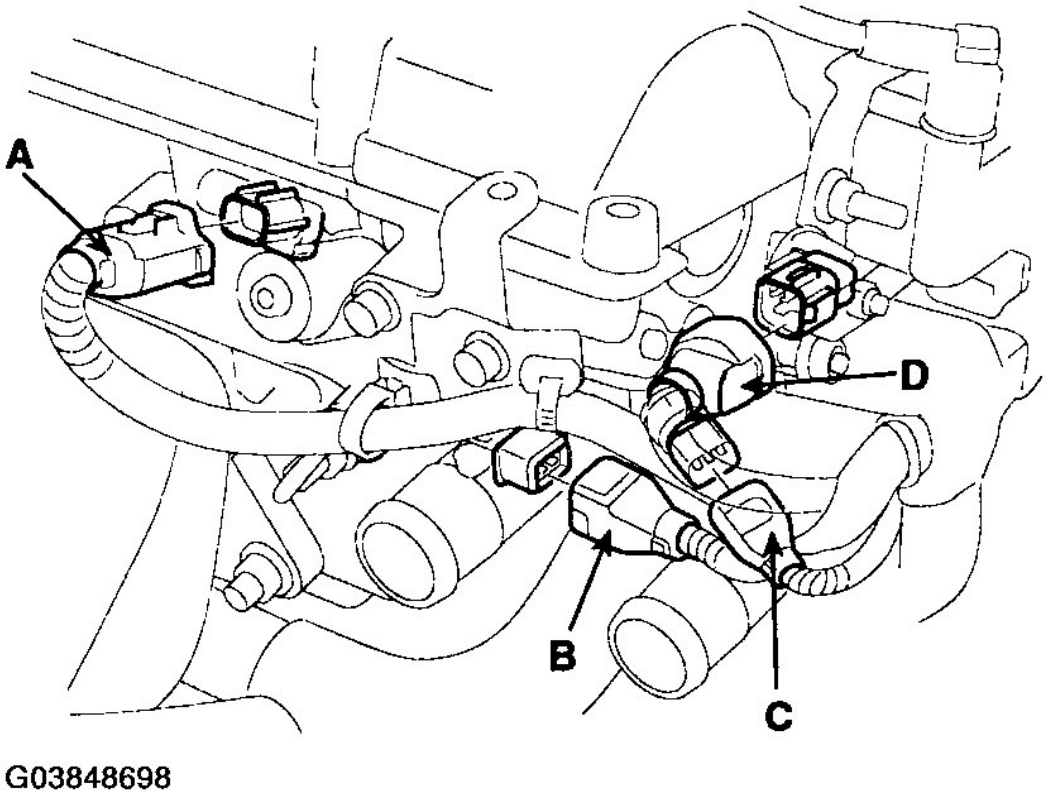


Fig. 114: Connecting OCV Connector, ECT Sensor Connector And Oil Temperature Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

23. Install the heater hoses(A).

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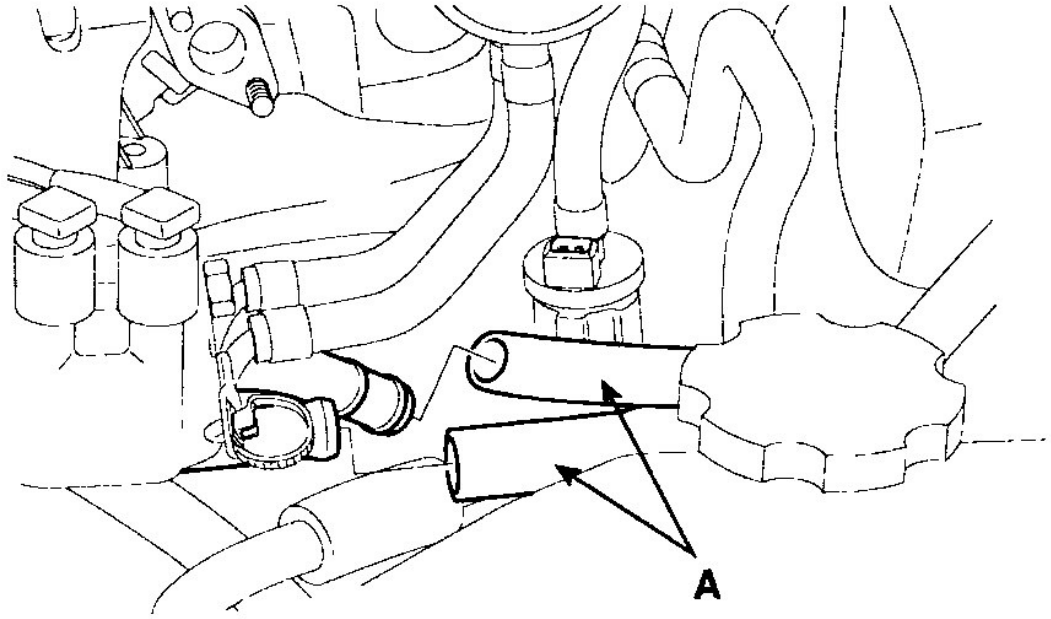


Fig. 115: Installing Heater Hoses
Courtesy of HYUNDAI MOTOR CO.

24. Install the upper radiator hose(A) and lower radiator hose(B).

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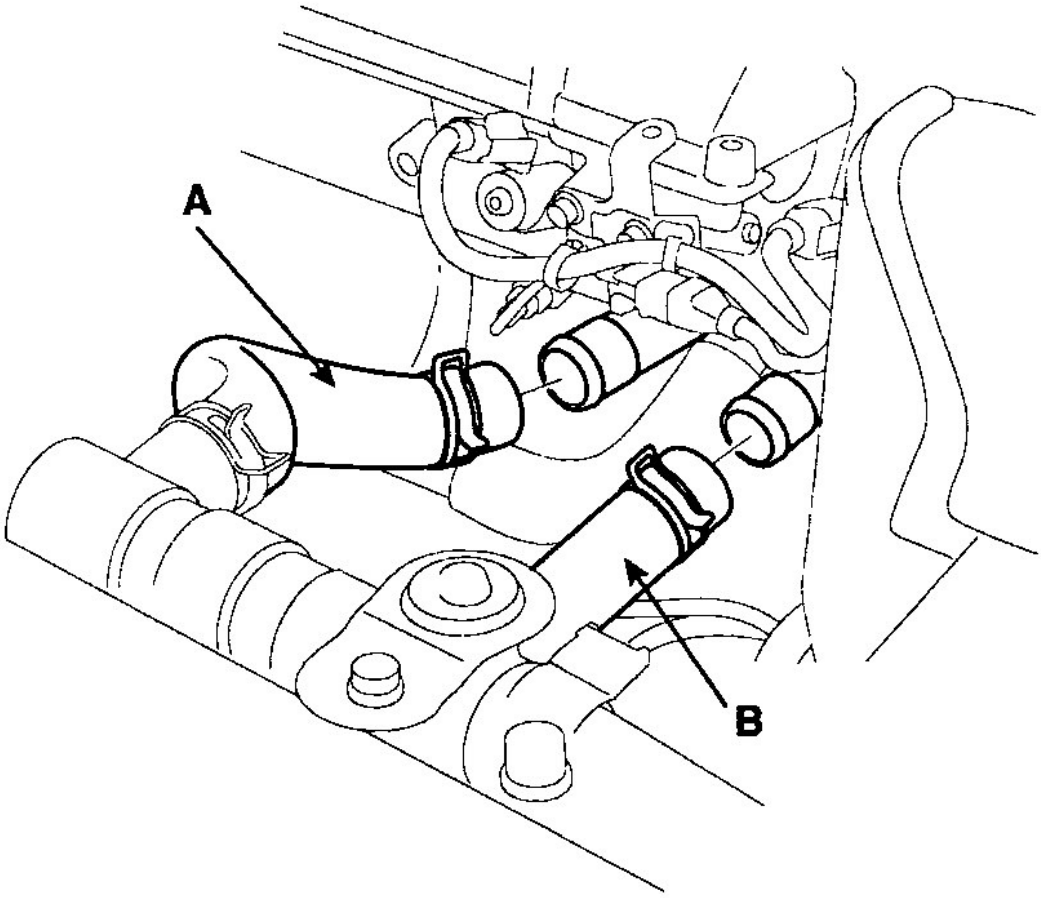


Fig. 116: Installing Upper Radiator Hose And Lower Radiator Hose
Courtesy of HYUNDAI MOTOR CO.

25. Install the intake air hose and air cleaner assembly.
26. Install the engine cover. (See **TIMING BELT TENSION ADJUSTMENT**)
27. Connect the negative terminal to the battery.
28. Fill with engine coolant.
29. Start the engine and check for leaks.
30. Recheck engine coolant level and oil level.

ENGINE AND TRANSAXLE ASSEMBLY

REMOVAL

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CAUTION:

- **Use fender covers to avoid damaging painted surfaces.**
- **To avoid damage, unplug the wiring connectors carefully while holding the connector portion.**

NOTE:

- **Mark all wiring and hoses to avoid misconnection.**
- **Inspection the timing belt before removing the cylinder head.**
- **Turn the crankshaft pulley so that the No. 1 piston is at top dead center. (See TIMING BELT TENSION ADJUSTMENT)**

1. Disconnect the negative terminal from the battery.

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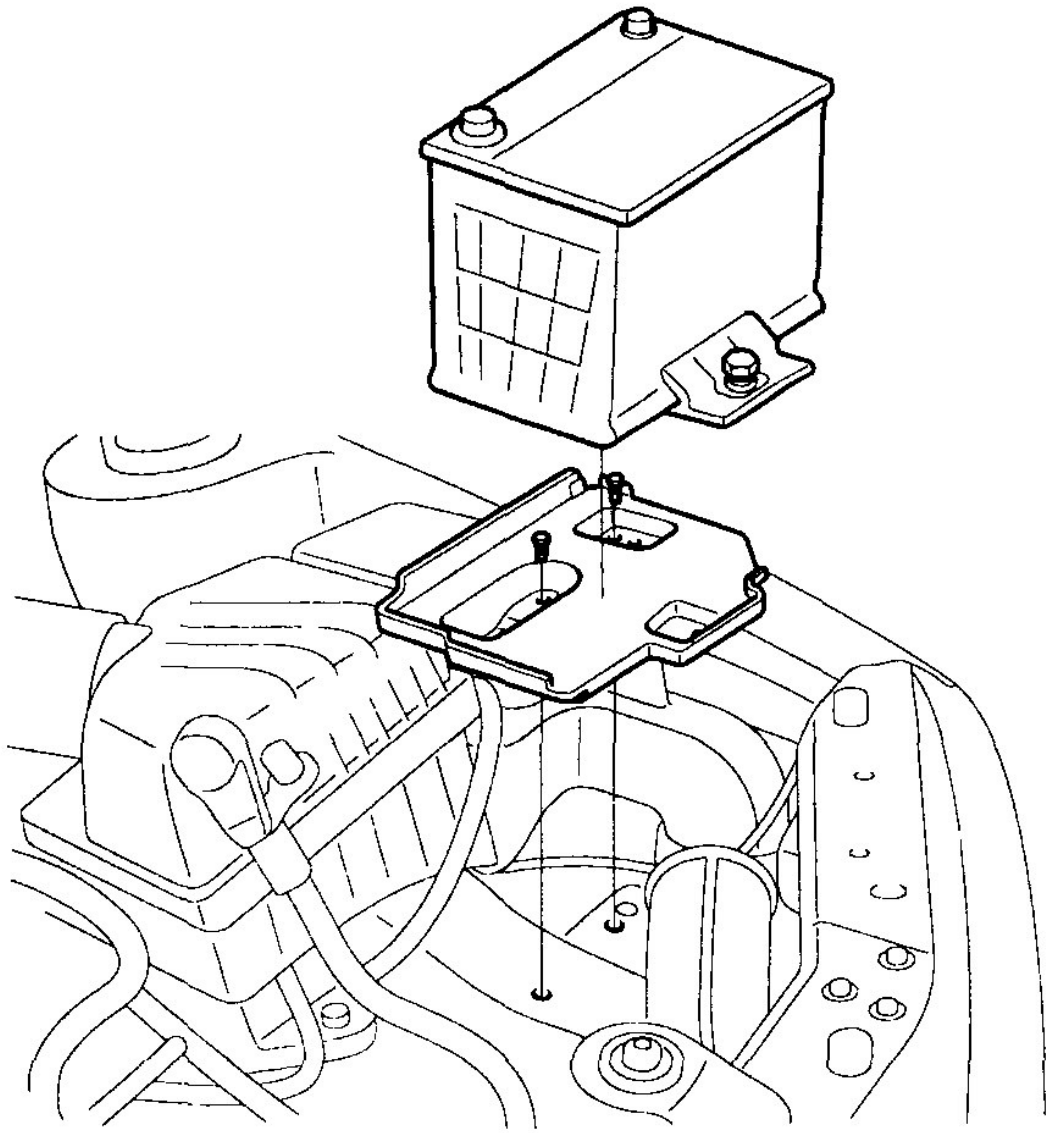


Fig. 117: Removing battery from tray
Courtesy of HYUNDAI MOTOR CO.

2. Remove the engine cover.
3. Drain the engine coolant.

   Remove the radiator cap to speed draining.

4. Remove the intake air hose and air cleaner assembly.

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1. Disconnect the AFS connector.
2. Disconnect the breather hose from air cleaner hose.
3. Remove the intake air hose and air cleaner.

5. Remove the upper radiator hose(A) and lower radiator hose(B).

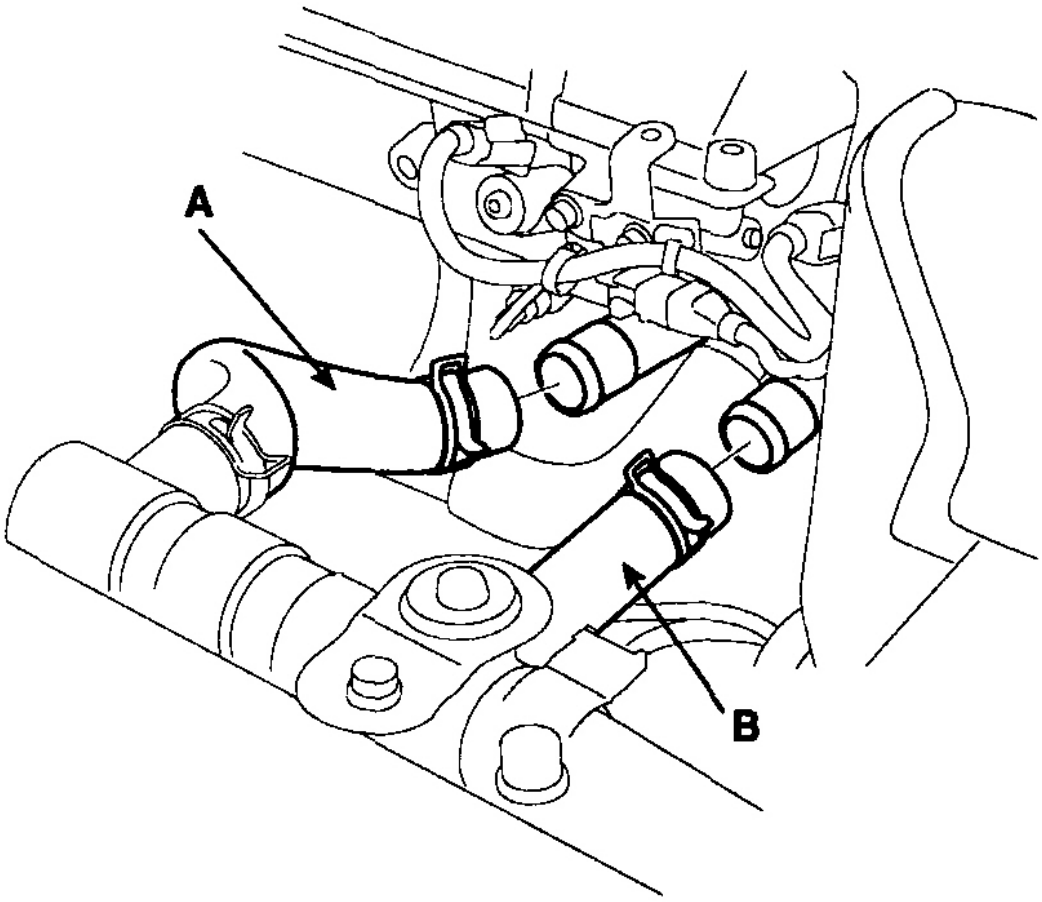
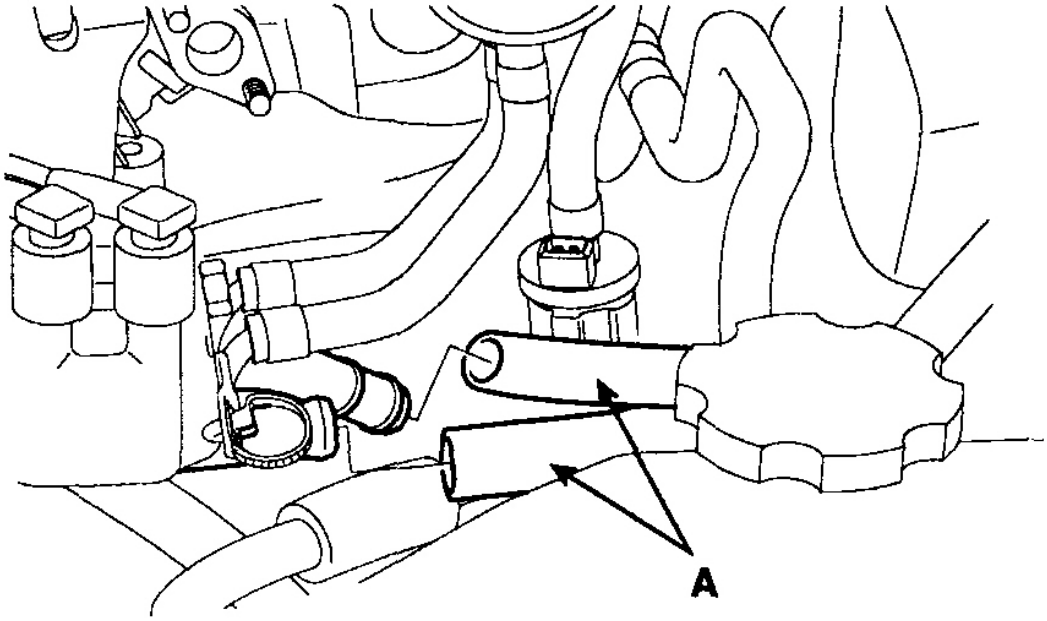


Fig. 118: Removing Upper Radiator Hose And Lower Radiator Hose
Courtesy of HYUNDAI MOTOR CO.

6. Remove the heater hoses(A).

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Fig. 119: Removing Heater Hoses
Courtesy of HYUNDAI MOTOR CO.

7. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
    1. OCV(Oil Control Valve) connector(A).
    2. Oil temperature sensor connector(B).
    3. ECT(Engine Coolant Temperature) sensor(C) connector.
    4. Ignition coil connector(D).

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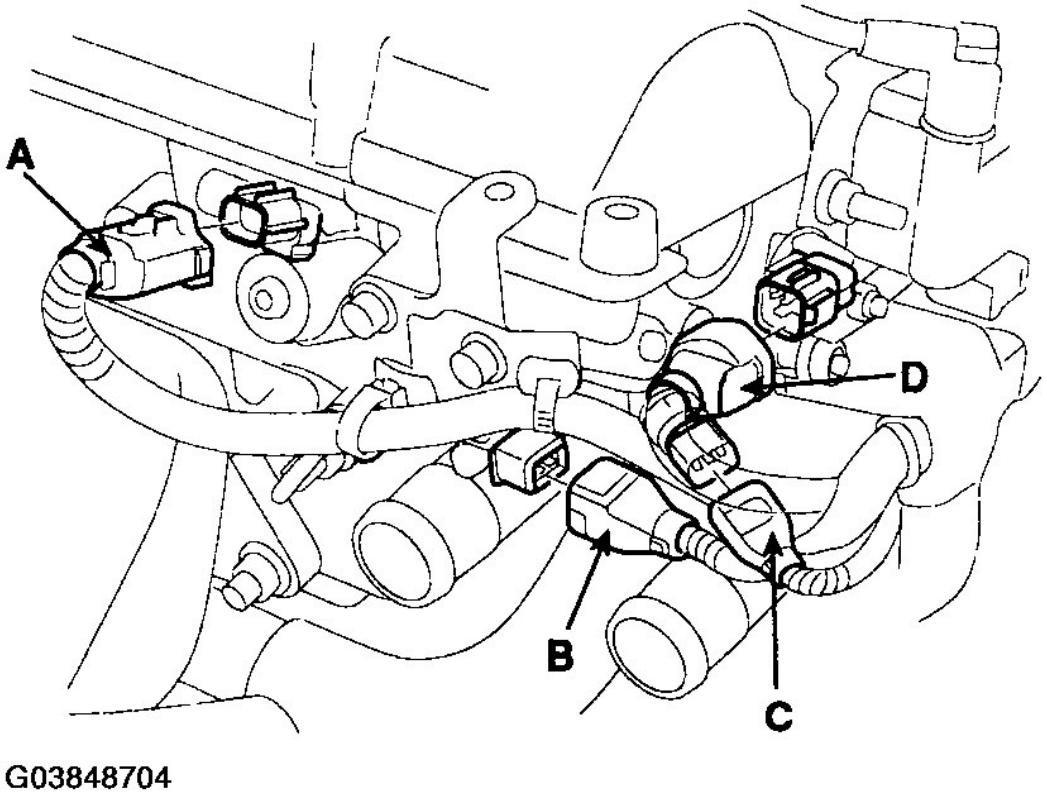


Fig. 120: Removing Engine Wire Harness Connectors And Wire Harness Clamps From Cylinder Head And Intake Manifold
Courtesy of HYUNDAI MOTOR CO.

5. TPS(Throttle Position Sensor) connector(A).
6. ISA(Idle Speed Actuator) connector(B).

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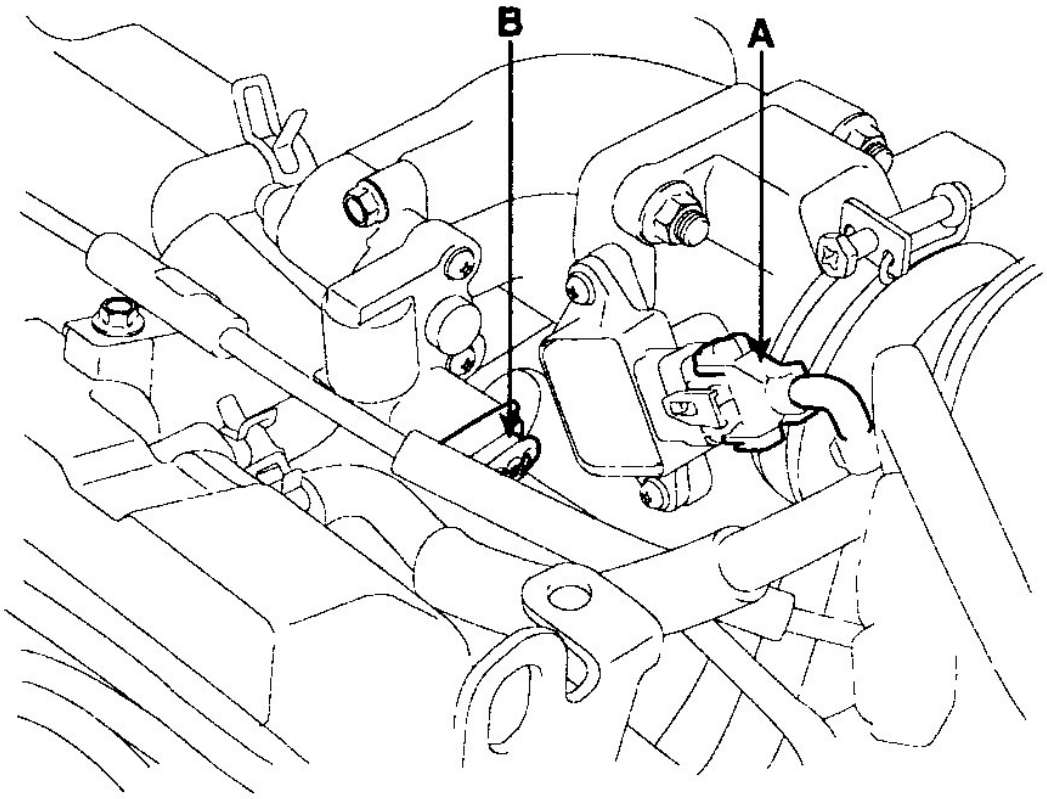


Fig. 121: Removing Throttle Position Sensor Connector And Idle Speed Actuator Connector
Courtesy of HYUNDAI MOTOR CO.

7. CMP(Camshaft Position Sensor) connector(A).
8. Four fuel injector connectors(B).
9. Knock sensor connector(C).
10. Disconnect ground cable(D) from the intake manifold.
11. Compressor switch(F).

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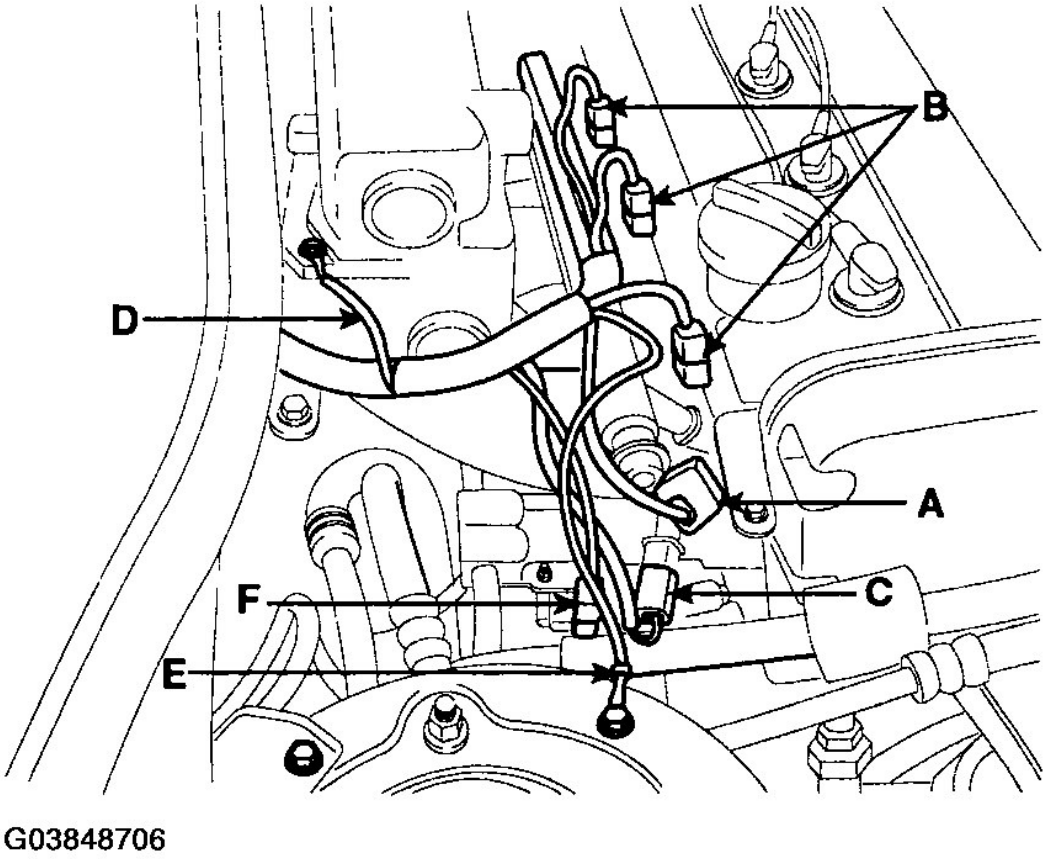


Fig. 122: Disconnecting CMP Connector, 4 Fuel Injector Connectors, Knock Sensor Connector, Compressor Switch And Ground Cable
Courtesy of HYUNDAI MOTOR CO.

12. Front heated oxygen sensor(A) connector.
13. CKP sensor(B) connector.
14. Oil pressure switch(C) connector.

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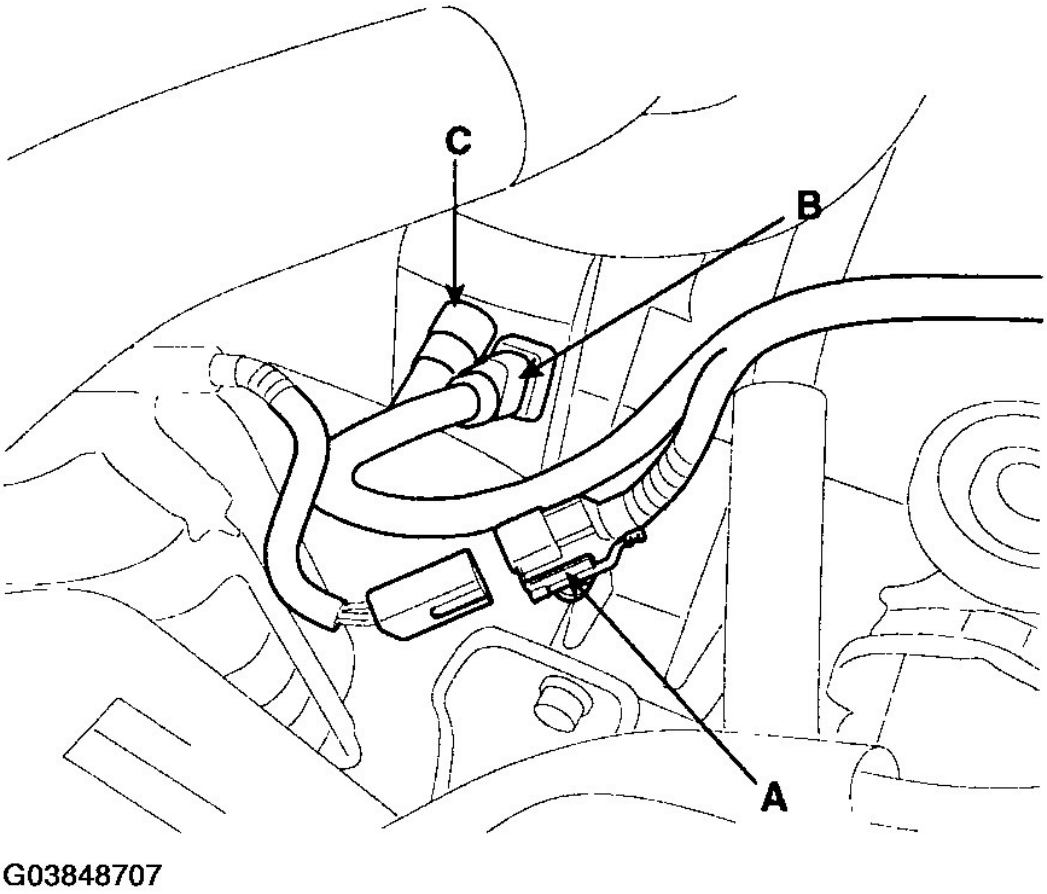


Fig. 123: Disconnecting Front Heated Oxygen Sensor Connector, CKP Sensor Connector And Oil Pressure Switch Connector
Courtesy of HYUNDAI MOTOR CO.

15. PCSV(Purge Control Solenoid Valve)(A) connector.

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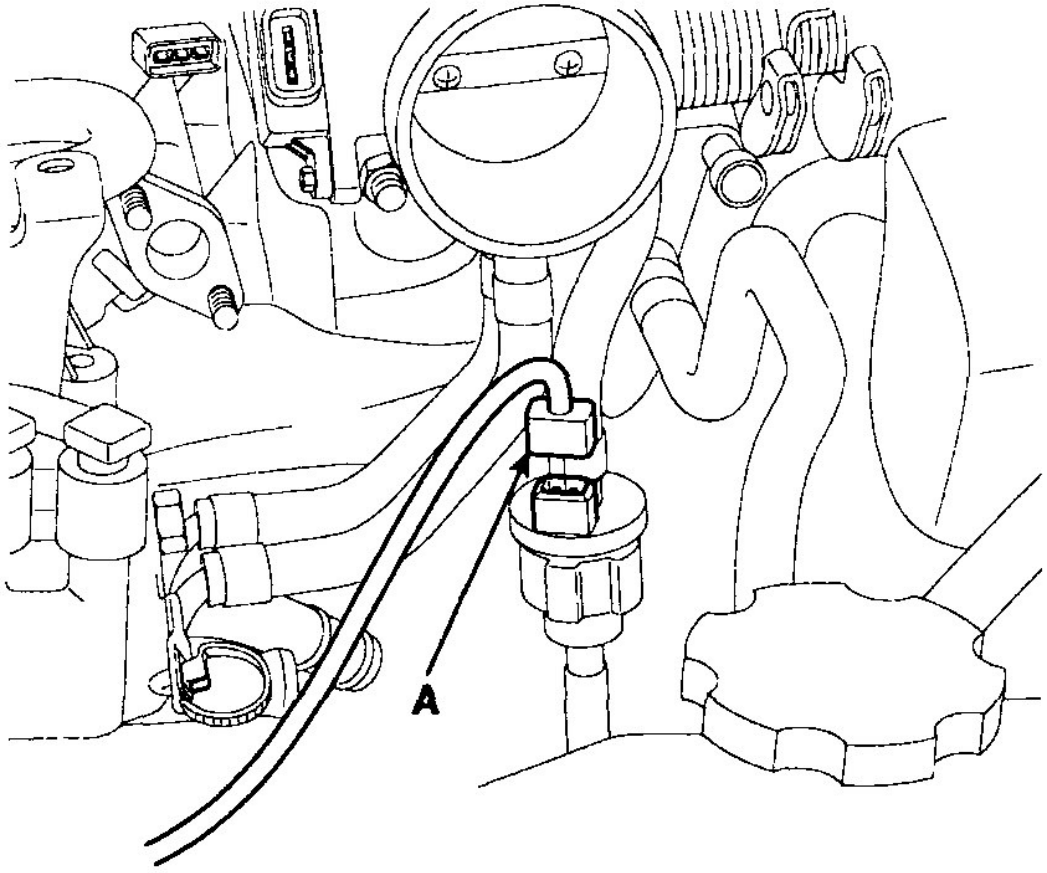


Fig. 124: Disconnecting Purge Control Solenoid Valve Connector
Courtesy of HYUNDAI MOTOR CO.

8. Remove the fuel inlet from delivery pipe(A).

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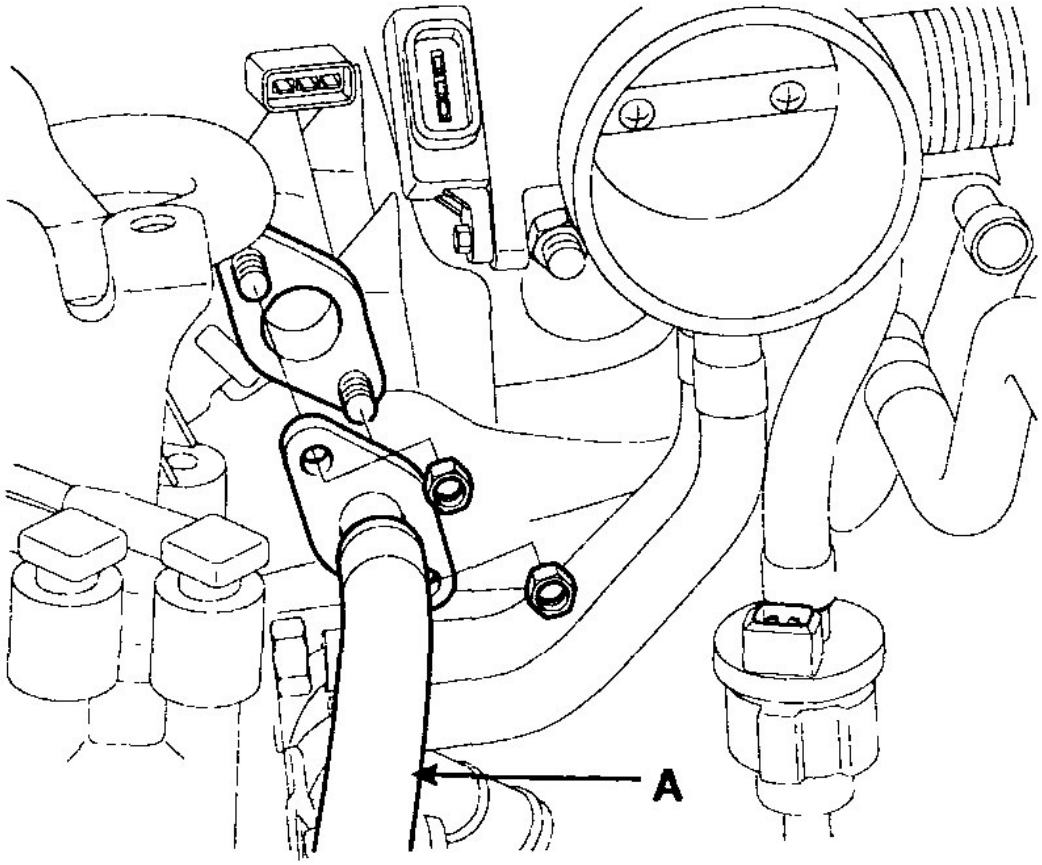


Fig. 125: Removing Fuel Inlet From Delivery Pipe
Courtesy of HYUNDAI MOTOR CO.

9. Remove the PCSV hose(A).

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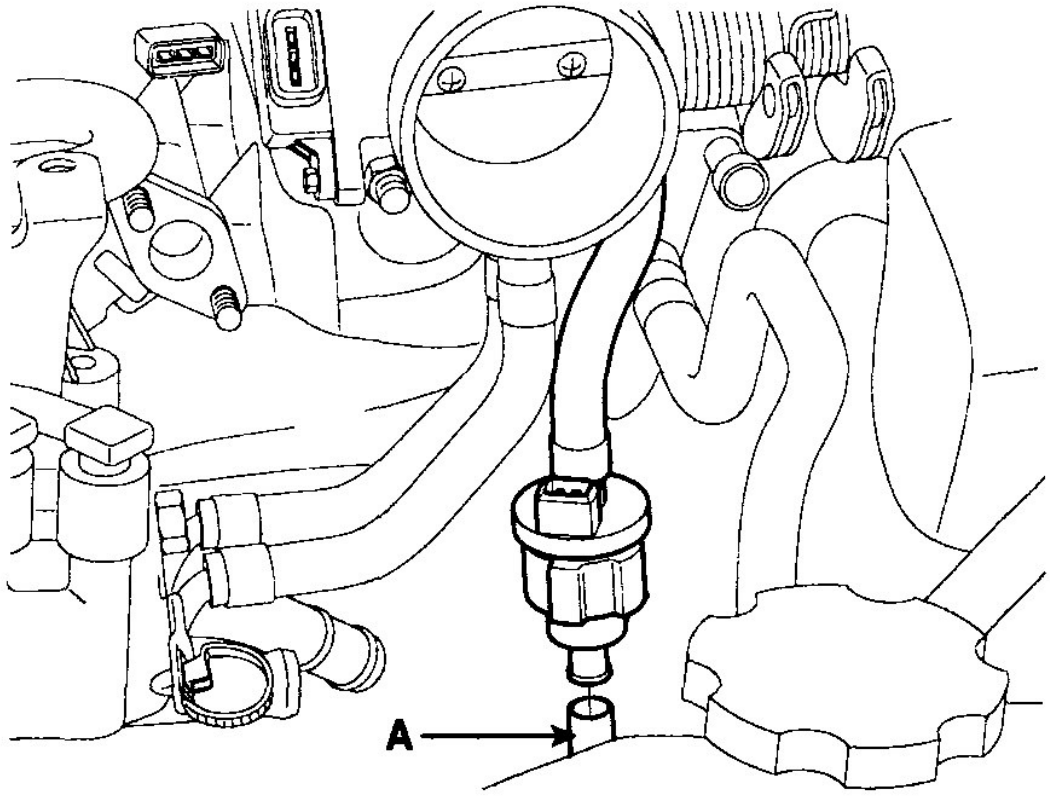
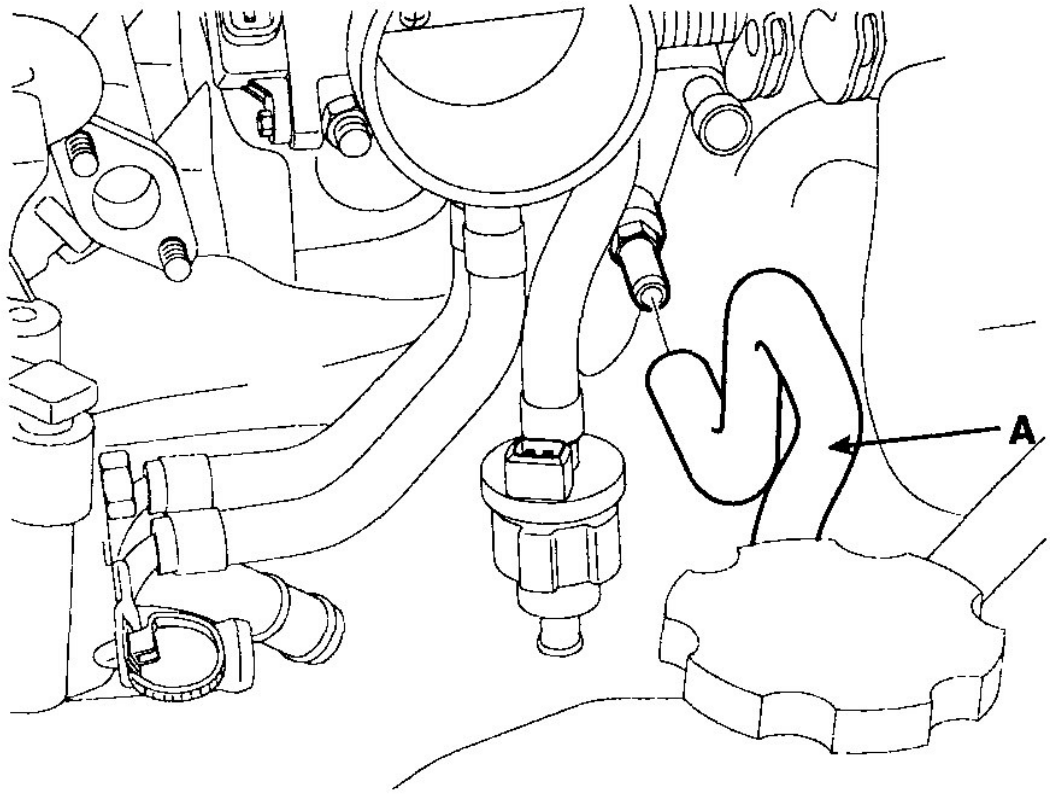


Fig. 126: Removing Purge Control Solenoid Valve Hose
Courtesy of HYUNDAI MOTOR CO.

10. Remove the brake booster vacuum hose(A).

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Fig. 127: Removing Brake Booster Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

11. Remove the accelerator cable by loosening the lock-nut, then slip the cable end out of the throttle linkage.
12. Remove the power steering pump. (See **MECHANICAL POWER STEERING SYSTEM**)
13. Remove the battery body bracket.
14. Disconnect the transaxle wire harness connector.
    a. Disconnect the inhibitor switch connector(A).
    b. Disconnect the transaxle range connector(B).
    c. Disconnect the input shaft speed connector(C).

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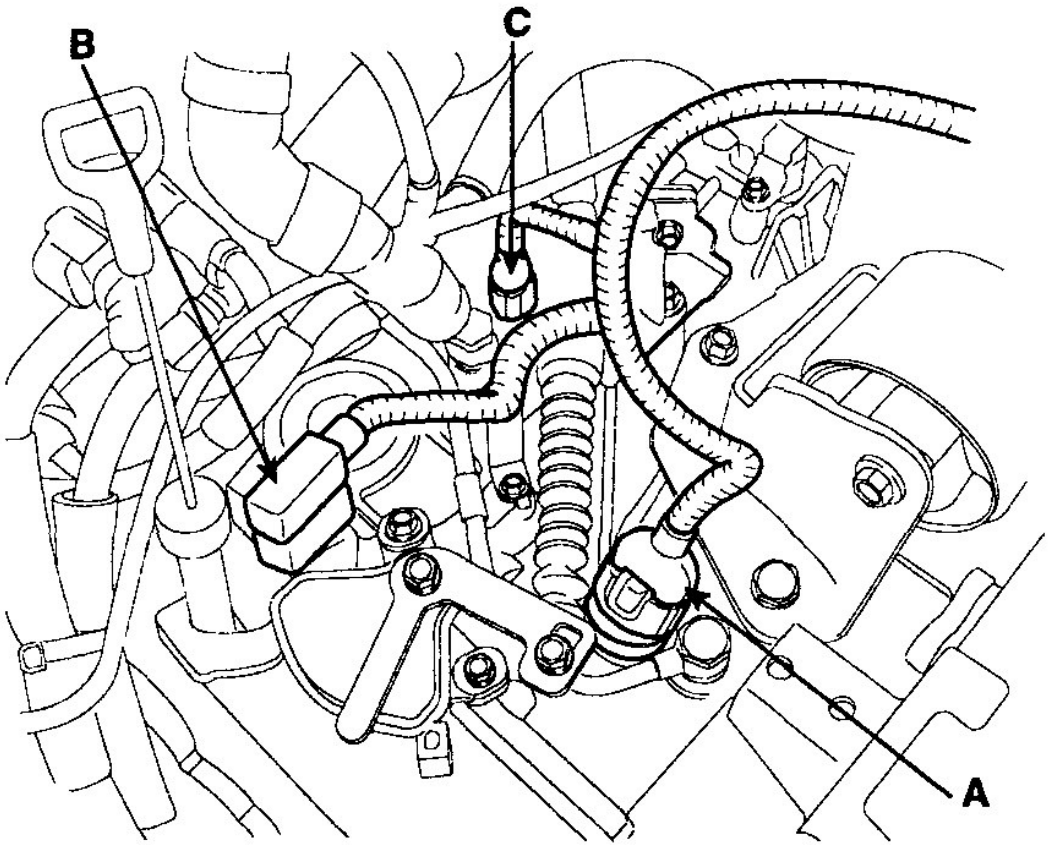
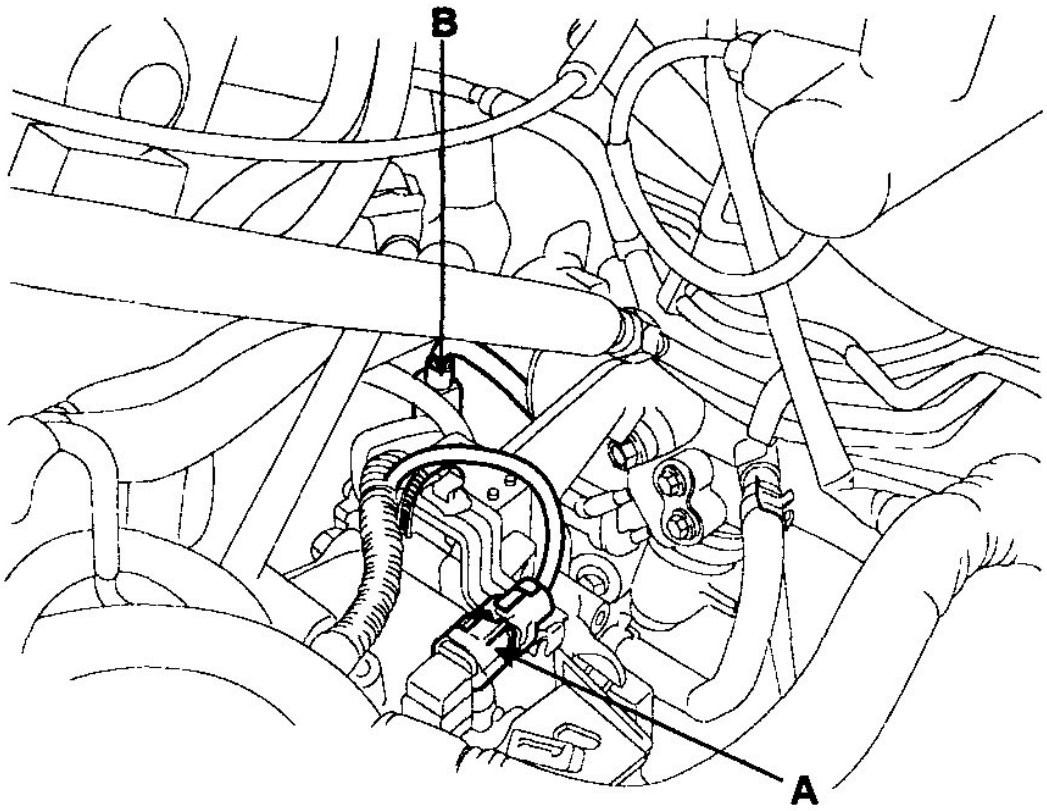


Fig. 128: Disconnecting Transaxle Wire Harness Connector
Courtesy of HYUNDAI MOTOR CO.

d. Disconnect the output shaft speed connector(A).
e. Disconnect the vehicle speed sensor connector(B).

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Fig. 129: Disconnecting Output Shaft Speed Connector And Vehicle Speed Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

15. Remove the control cable(A) transaxle range switch.

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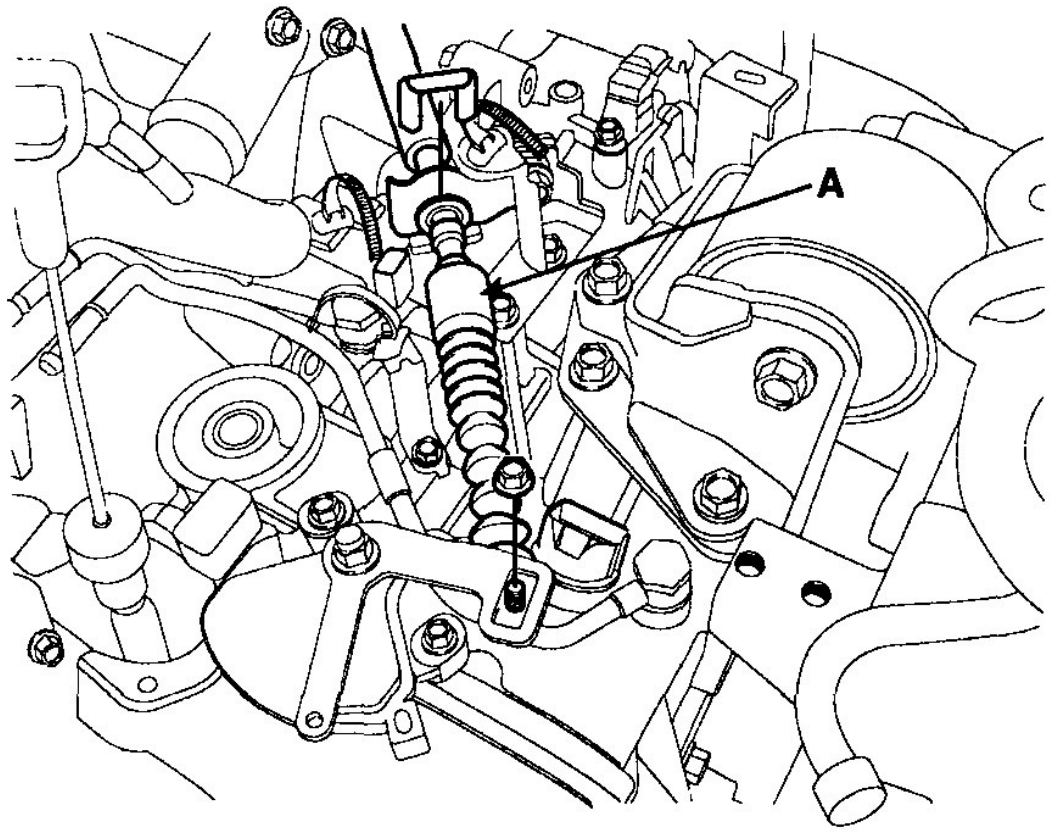


Fig. 130: Removing Control Cable Transaxle Range Switch
Courtesy of HYUNDAI MOTOR CO.

16. Remove the transaxle oil cooler hose(A) (A/T).

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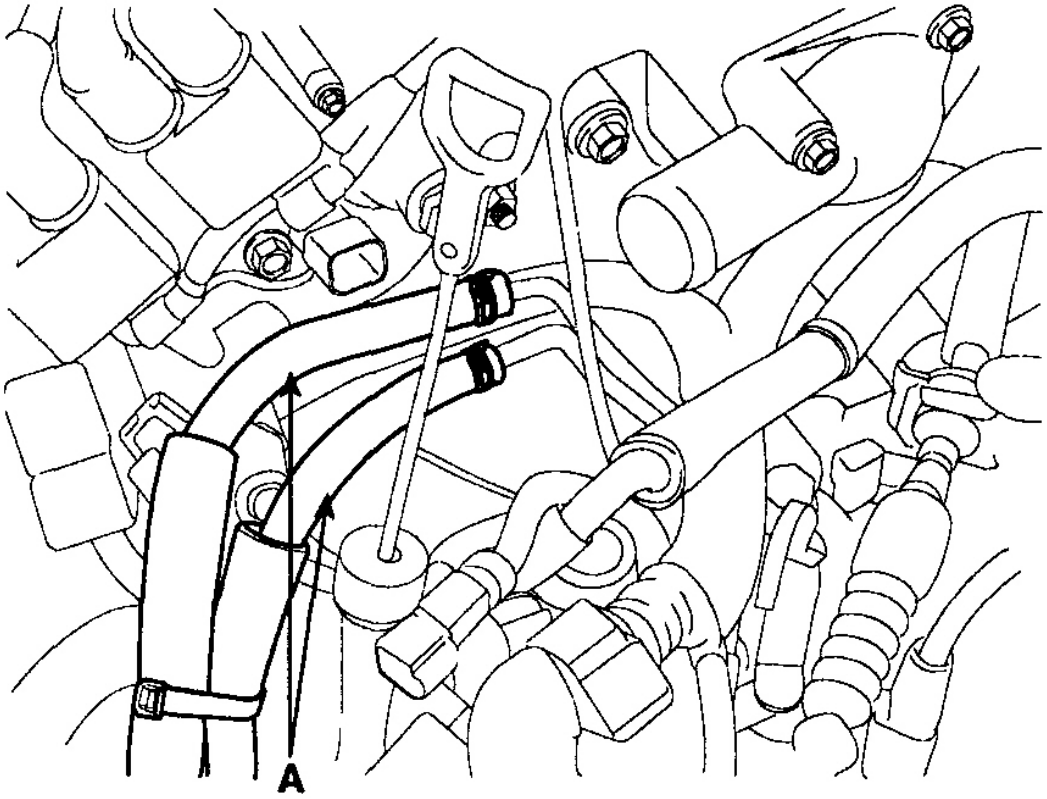


Fig. 131: Removing Transaxle Oil Cooler Hose (A/T)
Courtesy of HYUNDAI MOTOR CO.

17. Remove the under cover.
18. Remove the front exhaust pipe(A).

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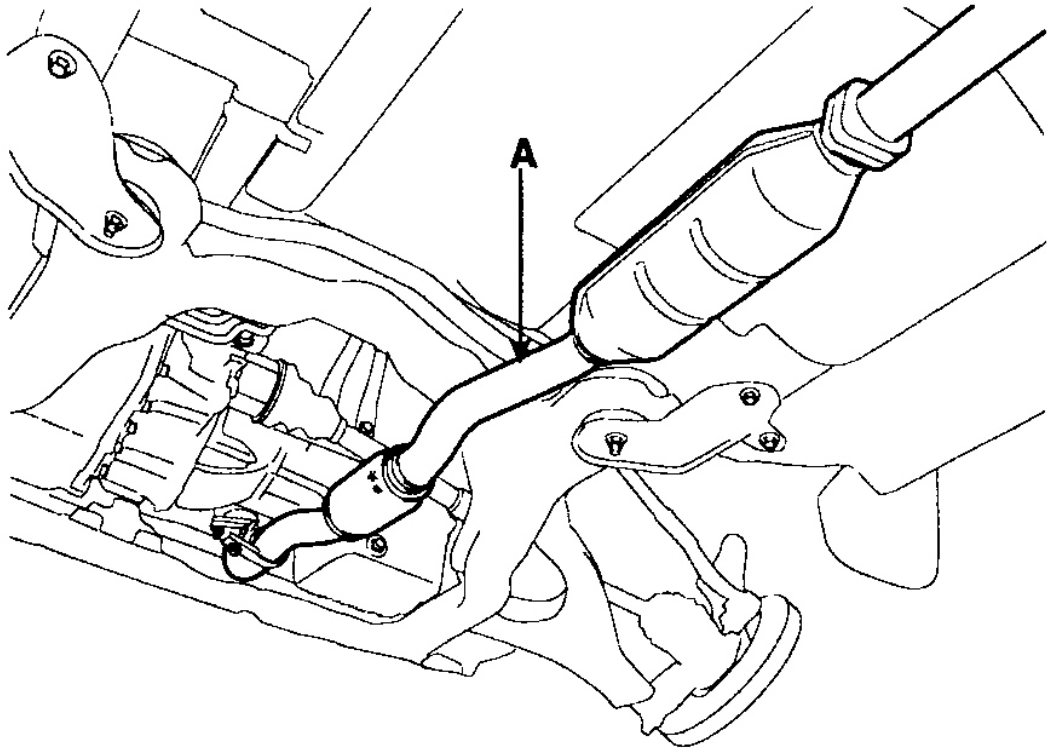


Fig. 132: Removing Front Exhaust Pipe
Courtesy of HYUNDAI MOTOR CO.

19. Disconnect the ABS wheel speed sensor(A) from both front knuckles. (See **FRONT AXLE**)

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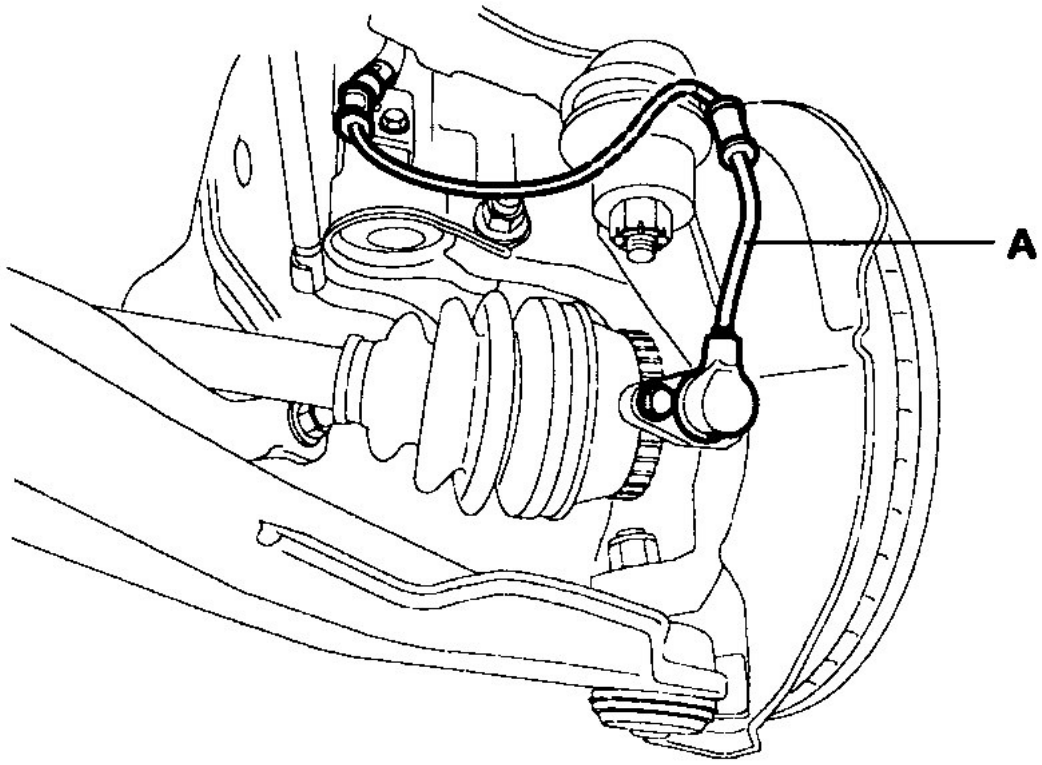
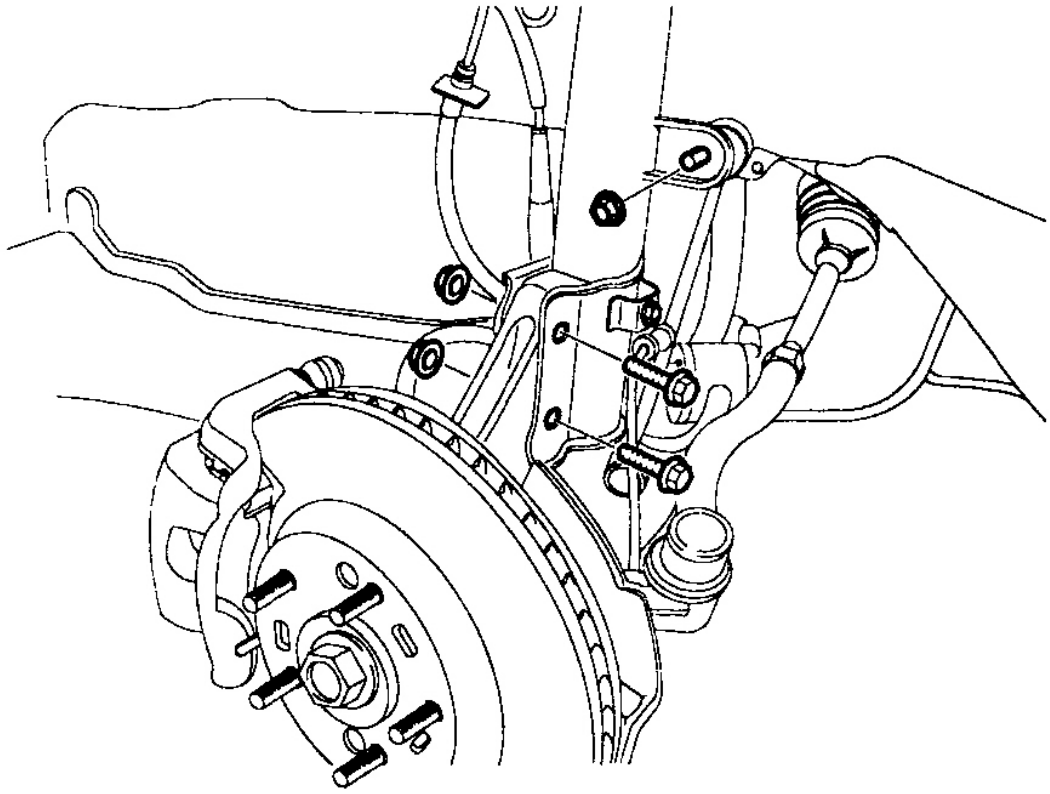


Fig. 133: Removing ABS Wheel Speed Sensor From Both Front Knuckles
Courtesy of HYUNDAI MOTOR CO.

20. Remove the front strut lower mounting bolts and nuts. (See **FRONT STRUT ASSEMBLY**)

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Fig. 134: Removing Front Strut Lower Mounting Bolts And Nuts
Courtesy of HYUNDAI MOTOR CO.

21. Remove the caliper and hang the caliper assembly(A).

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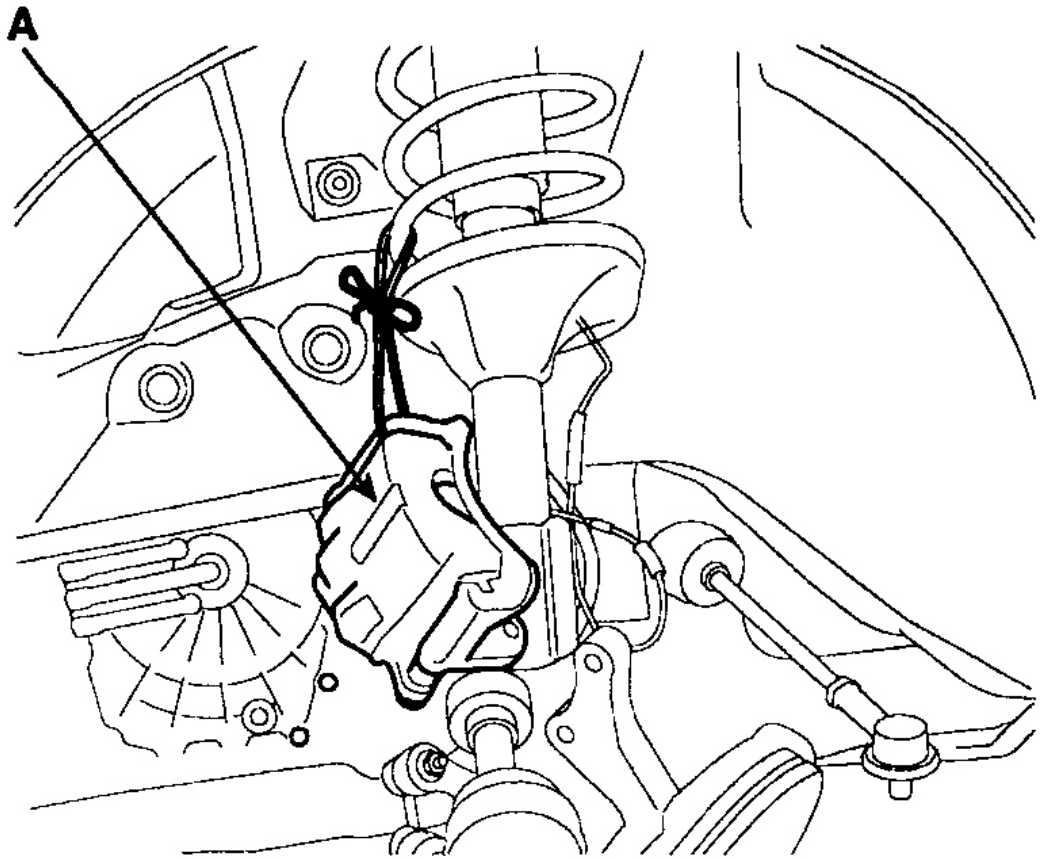


Fig. 135: Removing Caliper And Hanging Caliper Assembly
Courtesy of HYUNDAI MOTOR CO.

22. Remove the steering u-joint mounting bolt(A).

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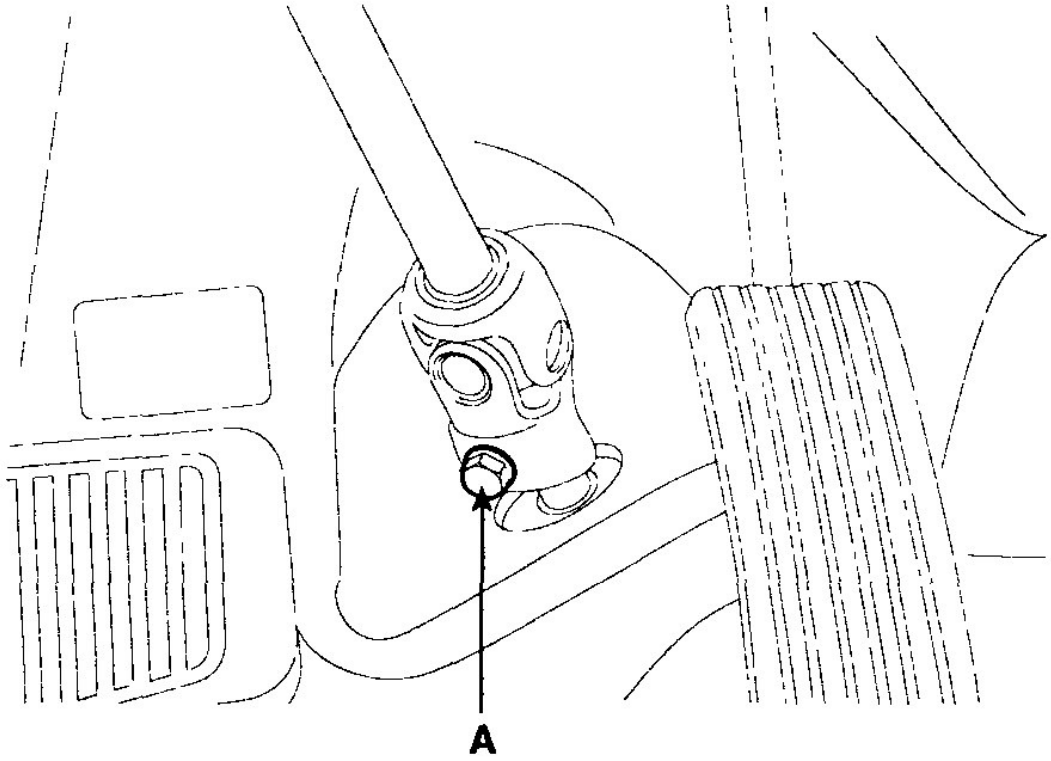


Fig. 136: Removing Steering U-Joint Mounting Bolt
Courtesy of HYUNDAI MOTOR CO.

23. Install the jack for supporting engine and transaxle assembly.
24. Remove the engine mounting bracket(A).

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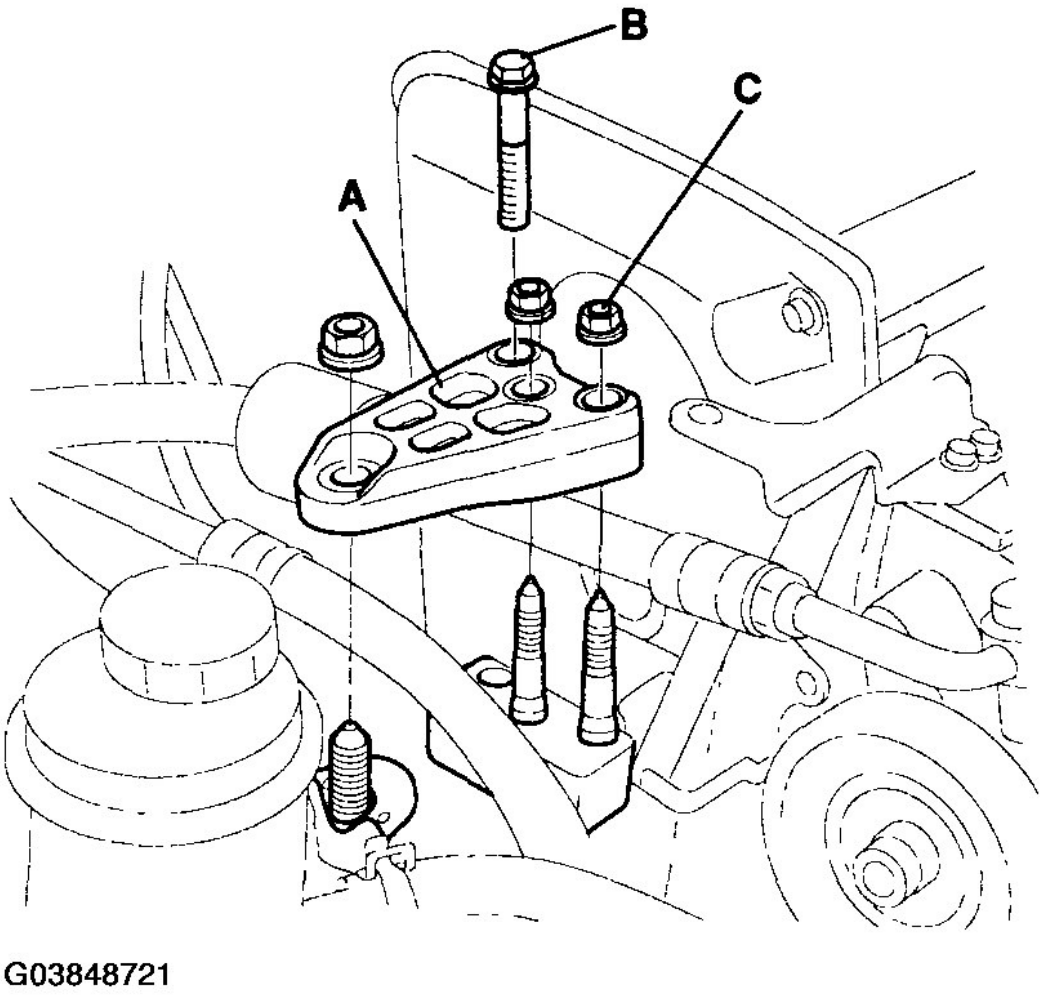
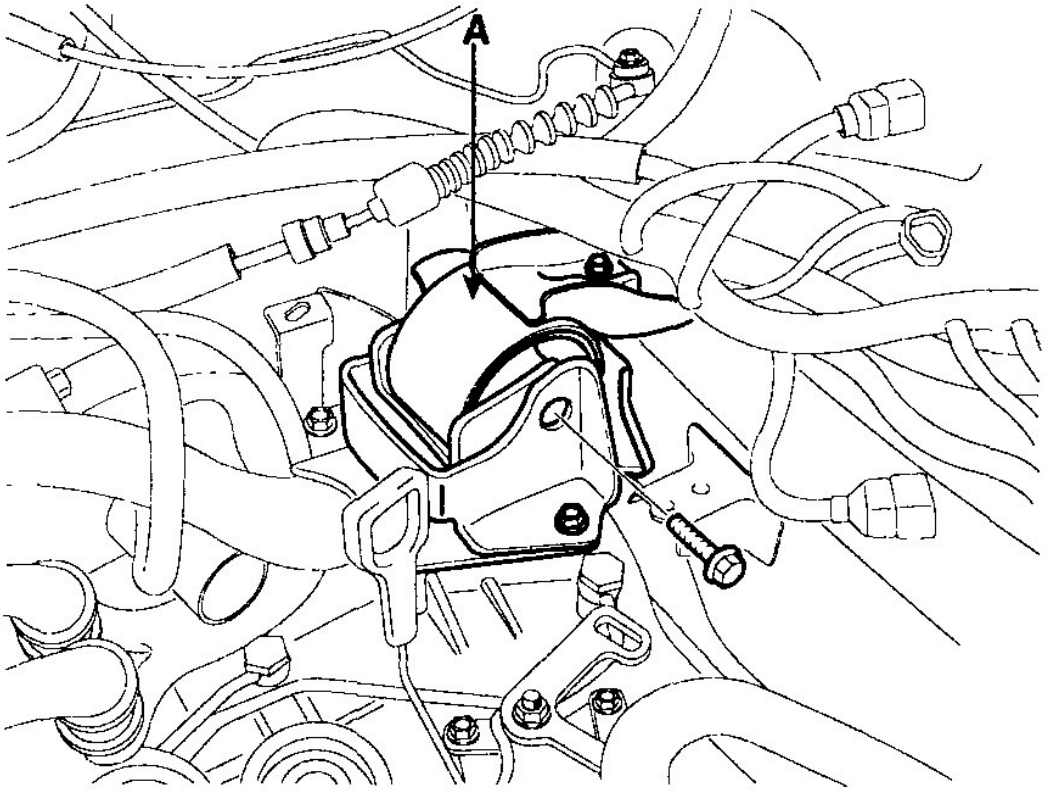


Fig. 137: Removing Engine Mounting Bracket
Courtesy of HYUNDAI MOTOR CO.

25. Remove the transaxle mounting bracket(A).

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Fig. 138: Removing Transaxle Mounting Bracket
Courtesy of HYUNDAI MOTOR CO.

26. Remove the sub frame mounting bolts and nuts.

Tightening torque

A: 160 ~ 180Nm (1600 ~ 1800kgf.cm, 118 ~ 133lbf.ft)

B: 70 ~ 90Nm (700 ~ 900kgf.cm, 52 ~ 66lft.ft)

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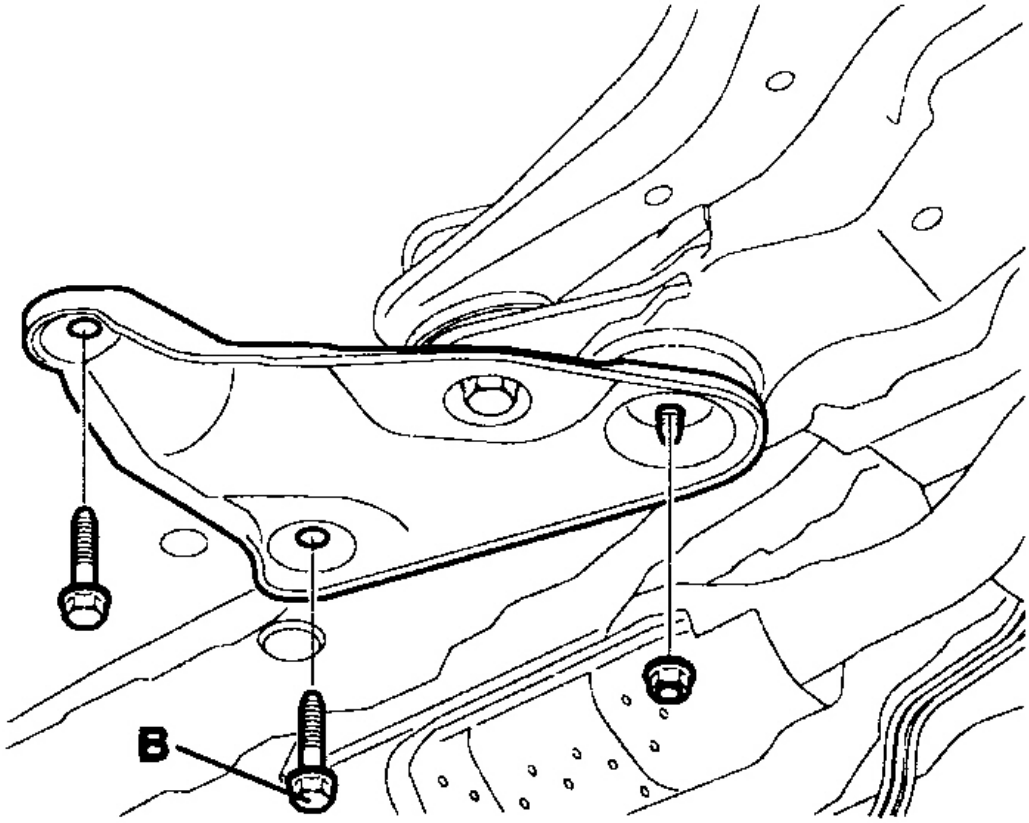


Fig. 139: Removing Sub Frame Mounting Bolts And Nuts (Torque Specifications A)
Courtesy of HYUNDAI MOTOR CO.

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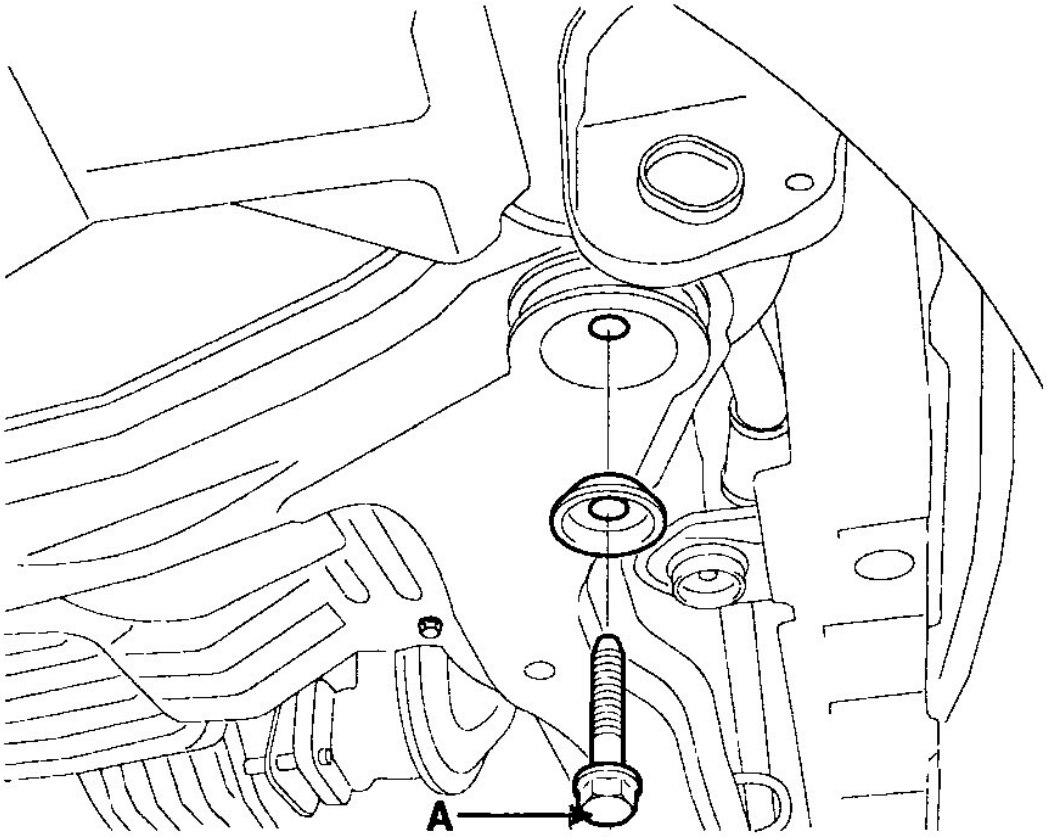


Fig. 140: Removing Sub Frame Mounting Bolts And Nuts (Torque Specifications B)
Courtesy of HYUNDAI MOTOR CO.

27. Jack up the vehicle.

INSTALLATION

Installation is in the reverse order of removal.

Perform the following :

- Adjust the shift cable.
- Adjust the throttle cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator with engine coolant.

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- Bleed air from the cooling system with the heater valve open.
- Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.

  After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressureizes.

  Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

ENGINE BLOCK

COMPONENTS

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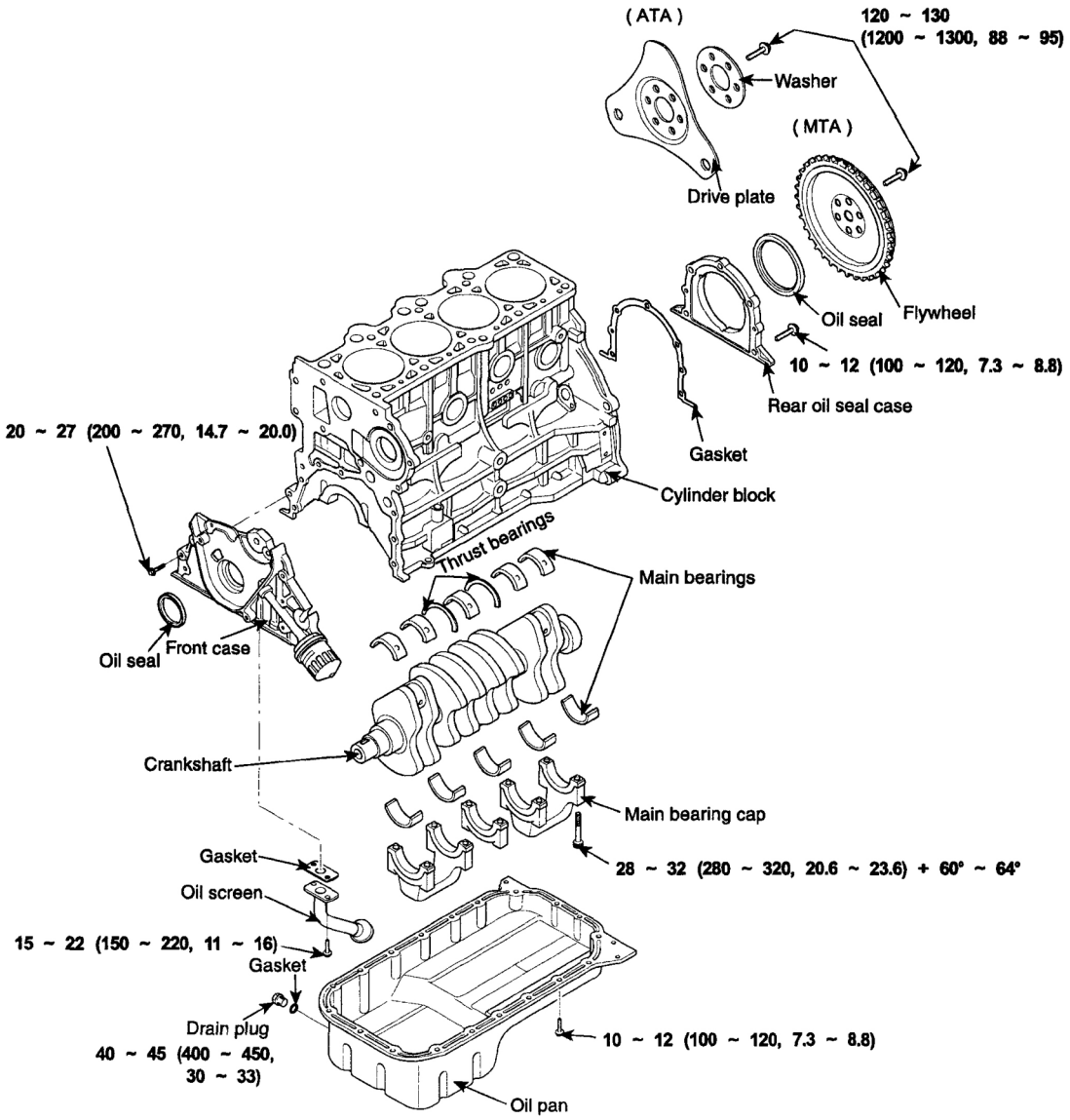
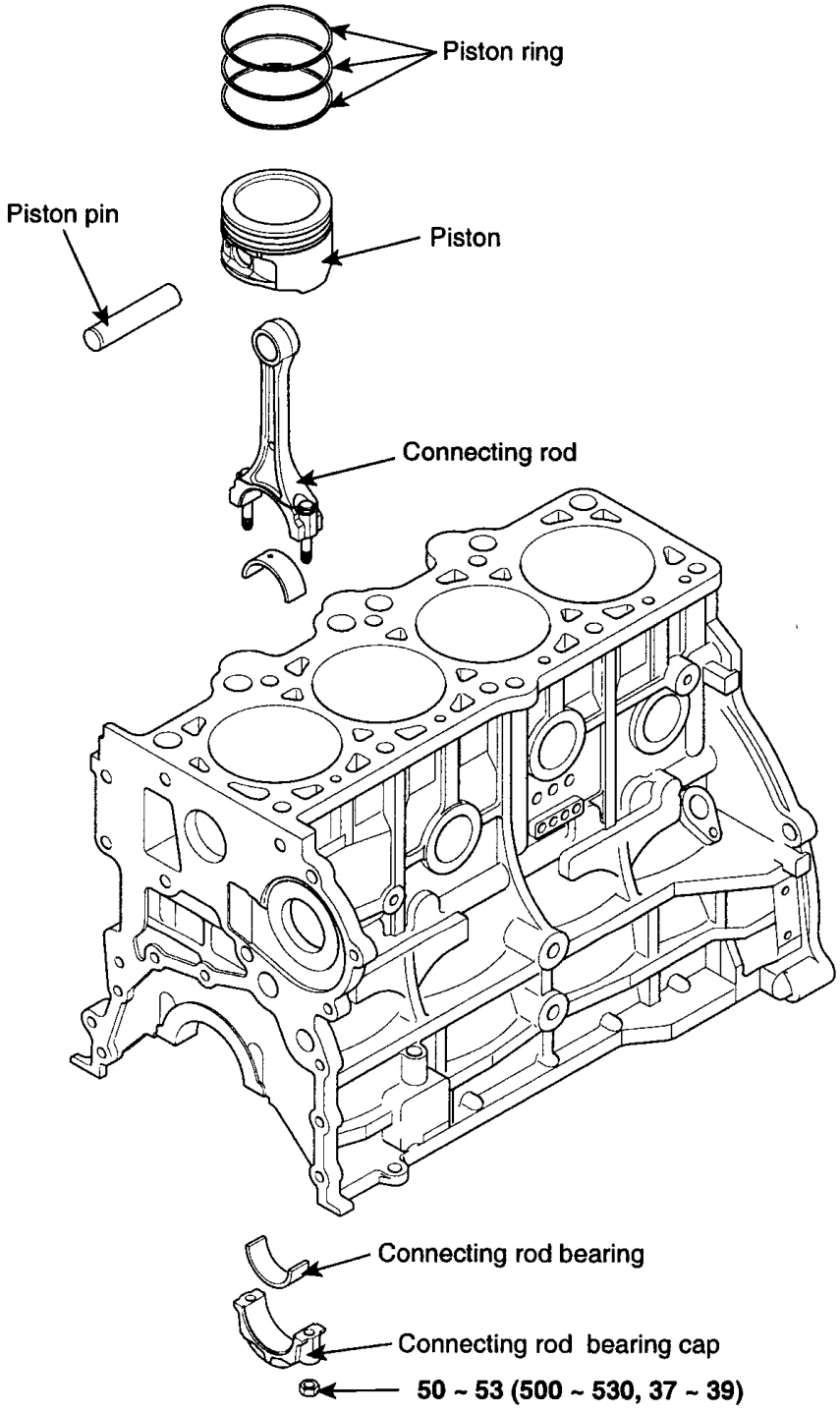


Fig. 141: Identifying Engine Block Components And Torque Specifications (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

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

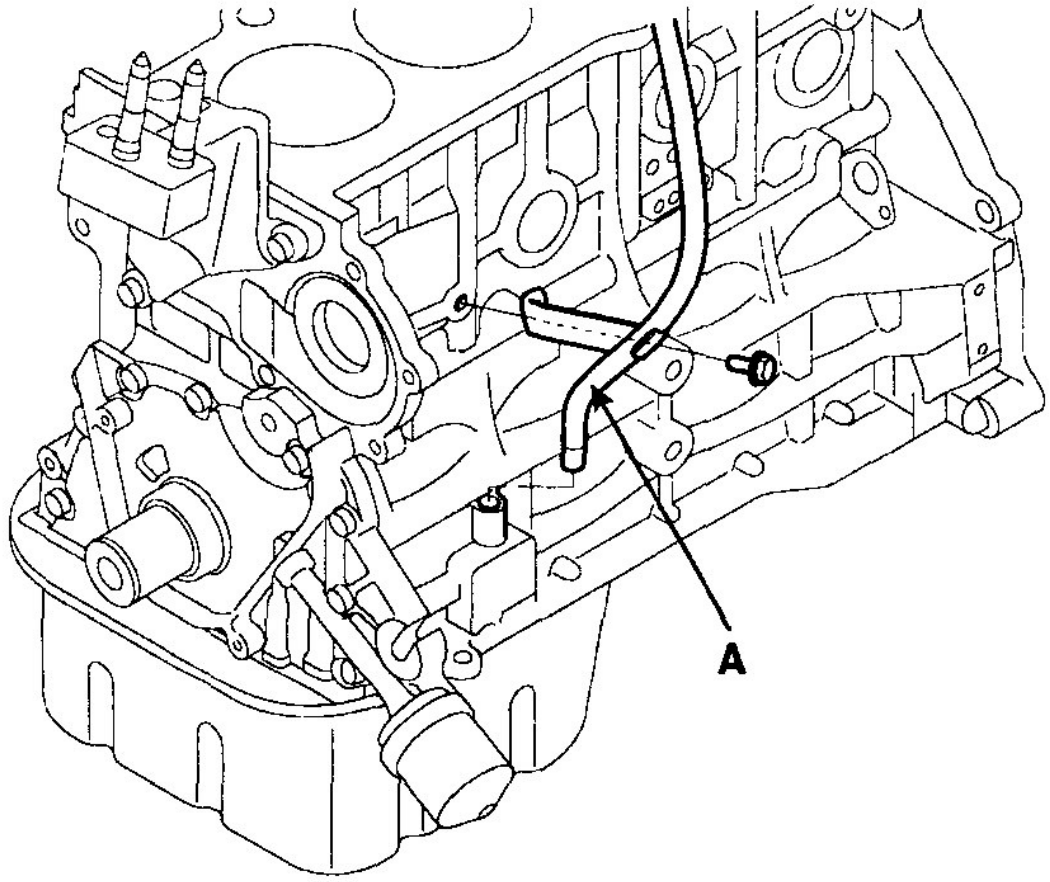
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Fig. 142: Identifying Engine Block Components And Torque Specifications (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. M/T: remove flywheel.
2. A/T: remove drive plate.
3. Install engine to engine stand for disassembly.
4. Remove timing belt. (See **REMOVAL**)
5. Remove cylinder head. (See **REMOVAL**)
6. Remove oil level gauge assembly(A).

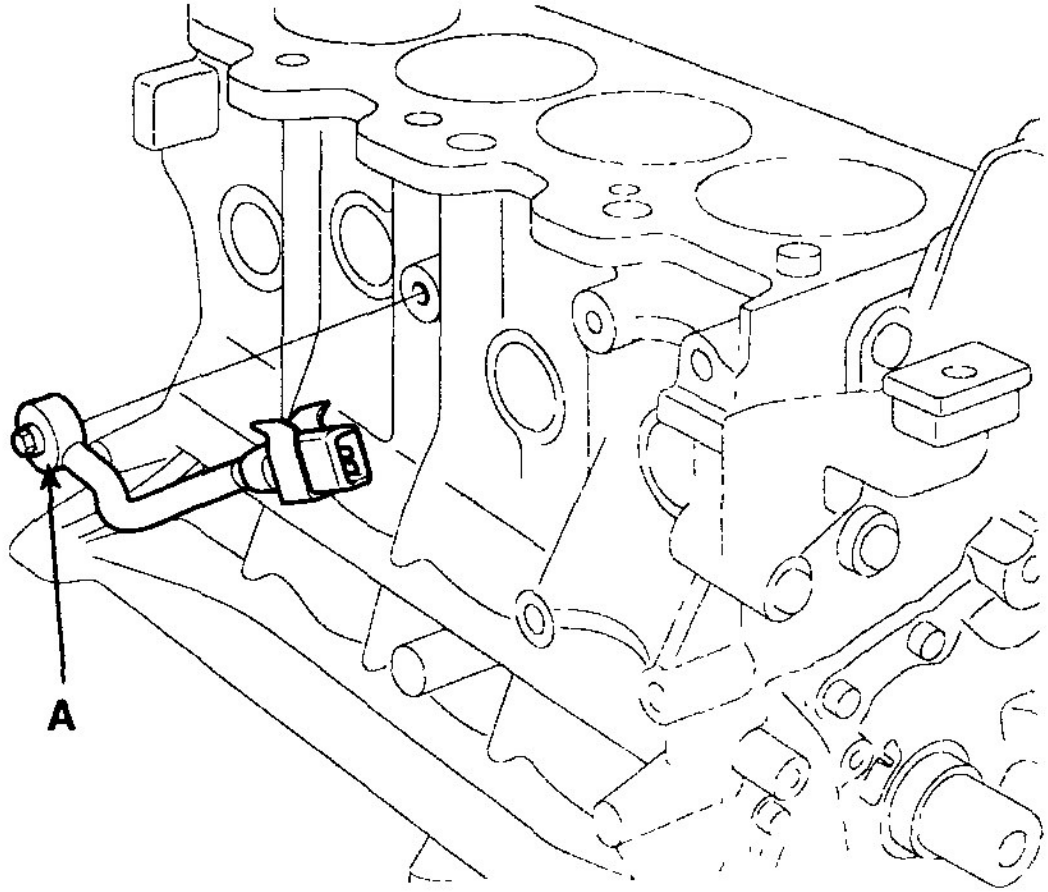


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Fig. 143: Removing Oil Level Gauge Assembly
Courtesy of HYUNDAI MOTOR CO.

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7. Remove knock sensor(A).

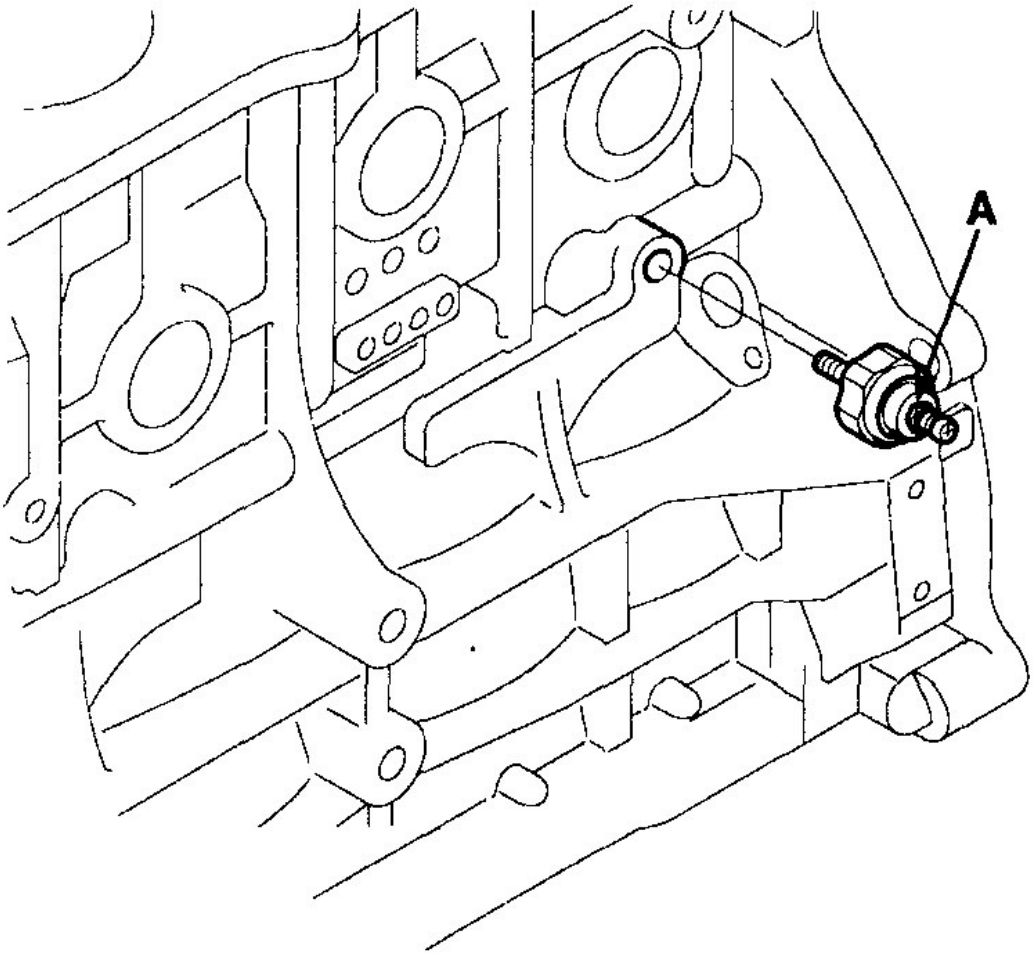


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Fig. 144: Removing Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

8. Remove oil pressure sensor(A).

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Fig. 145: Removing Oil Pressure Sensor
Courtesy of HYUNDAI MOTOR CO.

9. Remove water pump. (See **CAP TESTING**)
10. Remove oil pan(A).

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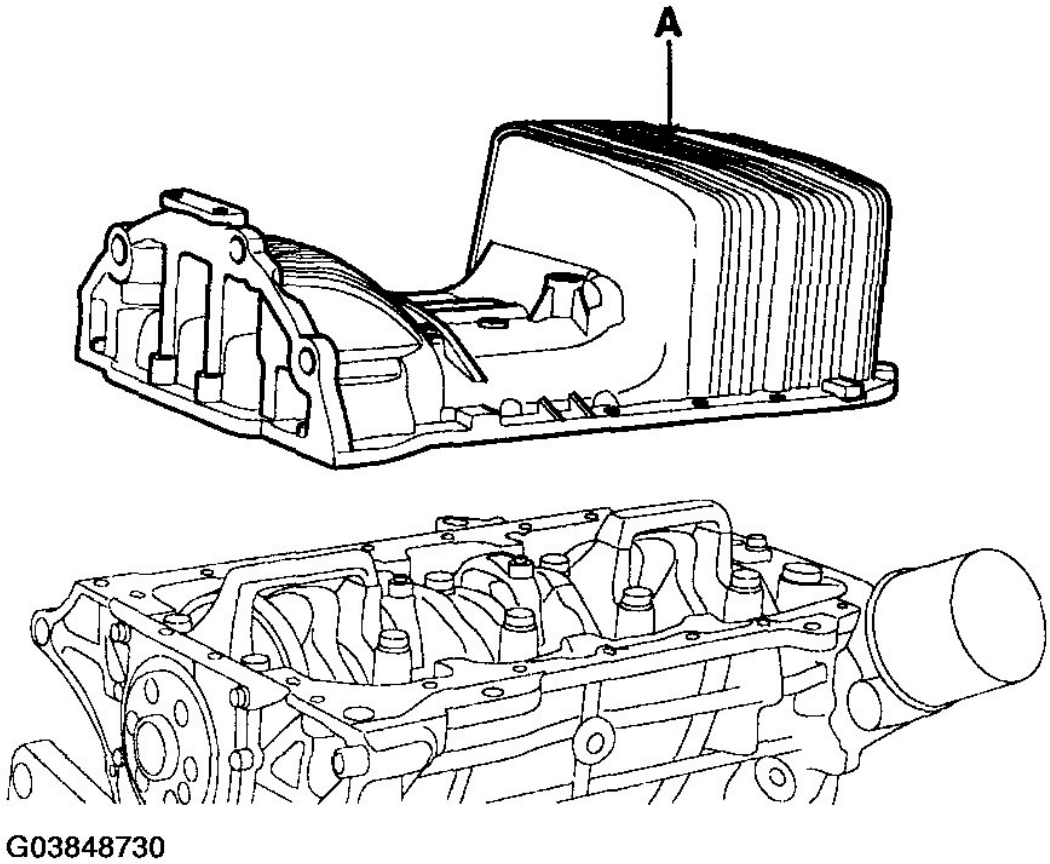


Fig. 146: Removing Oil Pan
Courtesy of HYUNDAI MOTOR CO.

11. Remove oil screen.

    Remove the 2 bolts(C), oil screen(A) and gasket(B).

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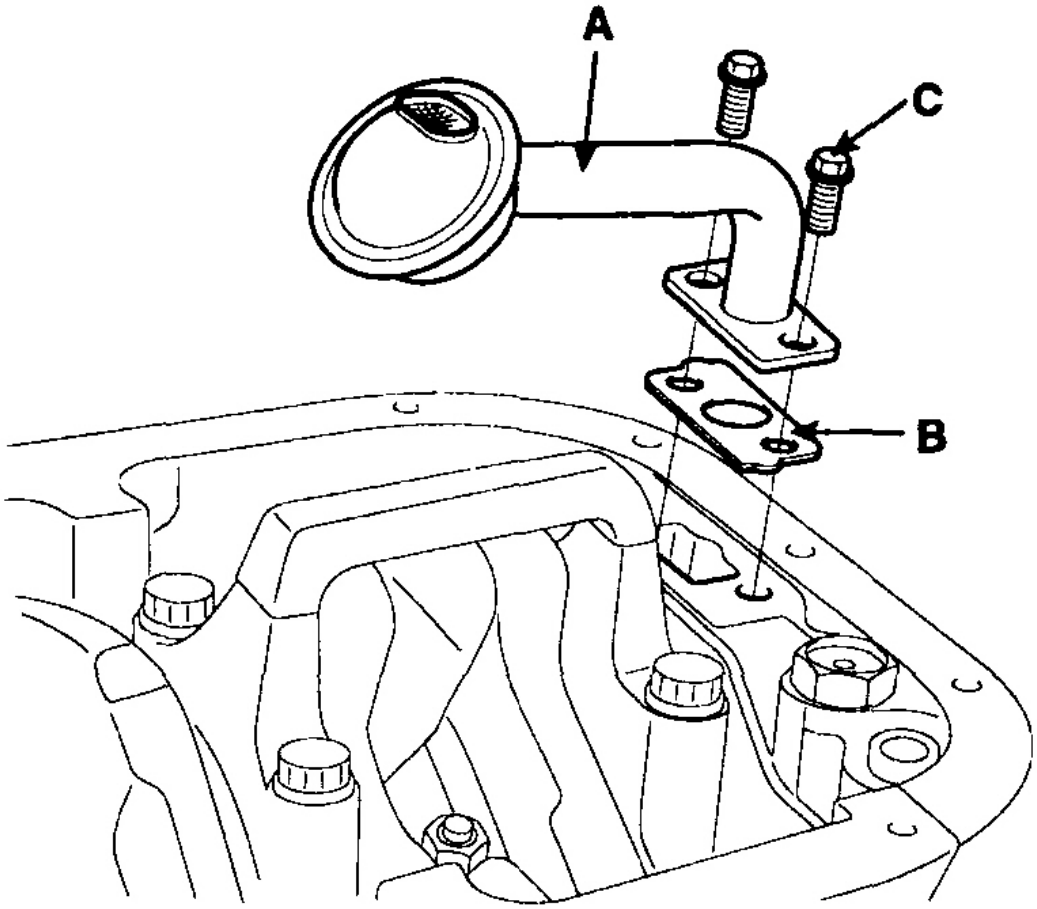


Fig. 147: Removing 2 Bolts, Oil Screen And Gasket
Courtesy of HYUNDAI MOTOR CO.

12. Check the connecting rod end play. (See **INSPECTION**)
13. Remove the connecting rod caps and check oil clearance. (See **INSPECTION**)
14. Remove piston and connecting rod assemblies.
    1. Using a ridge reamer, remove all the carbon from the top of the cylinder.
    2. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

NOTE:

- **Keep the bearings, connecting rod and cap together.**
- **Arrange the piston and connecting rod assemblies in the correct order.**

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15. Remove front case. (See **REMOVAL**)
16. Remove rear oil seal case.

    Remove the 5 bolts(B) and rear oil seal case(A).

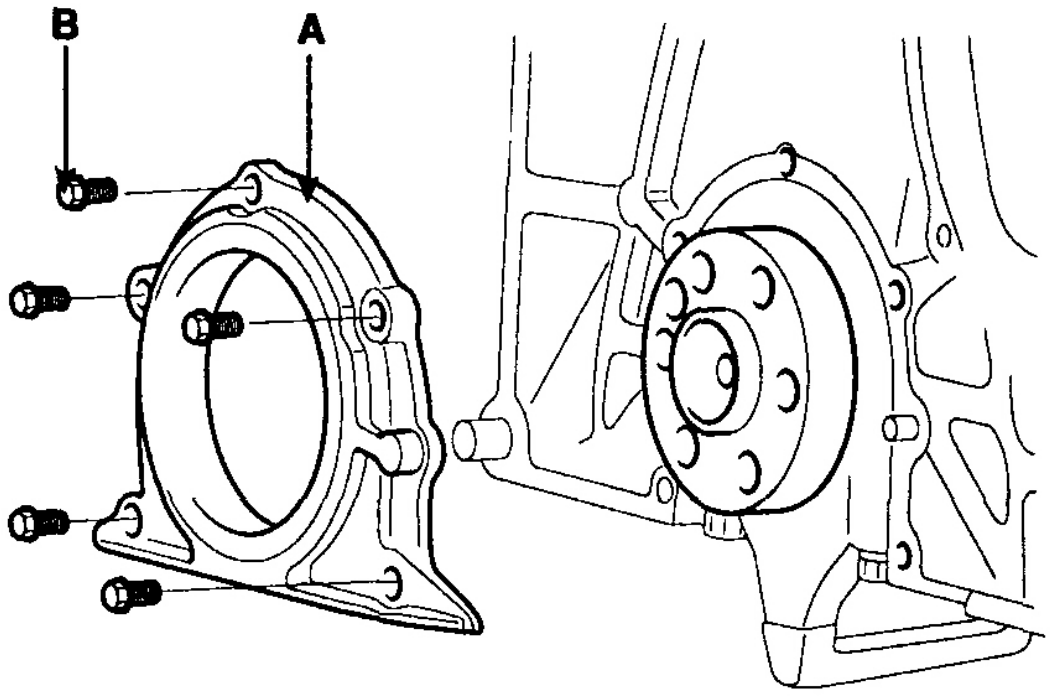


Fig. 148: Removing 5 Bolts And Rear Oil Seal Case
Courtesy of HYUNDAI MOTOR CO.

17. Remove crankshaft bearing cap and check oil clearance. (See 3)
18. Check the crankshaft end play. (See 4)
19. Lift the crankshaft(A) out of the engine, being careful not to damage journals.

NOTE: Arrange the main bearings and thrust bearings in the correct order.

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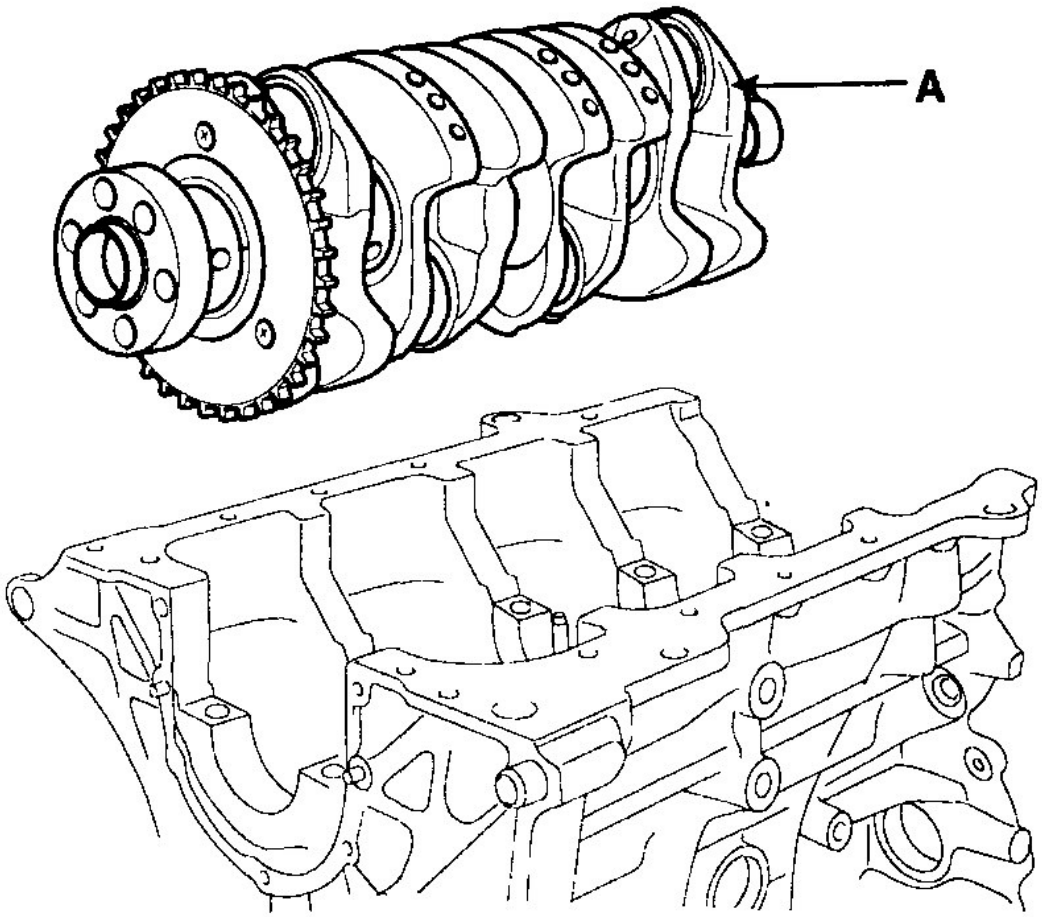


Fig. 149: Lifting Crankshaft Out Of Engine
Courtesy of HYUNDAI MOTOR CO.

20. Check fit between piston and piston pin.

    Try to move the piston back and forth on the piston pin. If any movement is felt, replace the piston and pin as a set.

21. Remove piston rings.
    1. Using a piston ring expender, remove the 2 compression rings.
    2. Remove 2 side rails and the spacer by hand.

NOTE: Arrange the piston rings in the correct order only.

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22. Disconnect connecting rod from piston.

INSPECTION

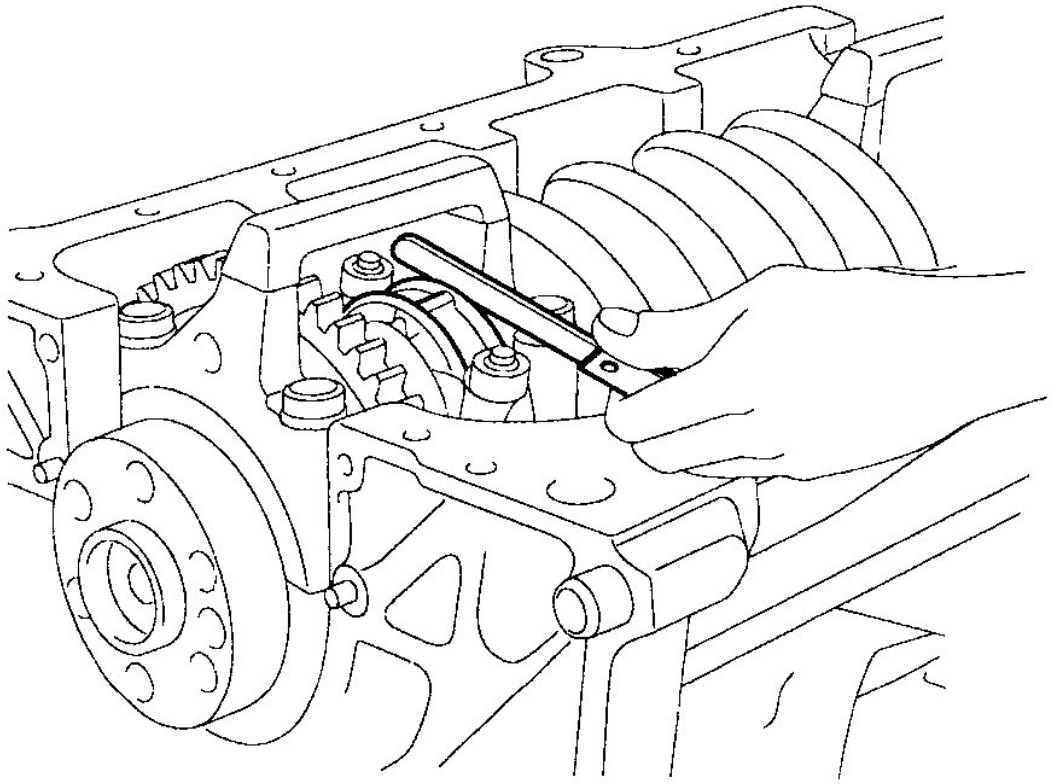
CONNECTING ROD AND CRANKSHAFT

1. Check the connecting rod end play.

   Using a feeler gauge, measure the end play while moving the connecting rod back and forth.

   Standard end play: 0.1 ~ 0.25mm(0.004 ~ 0.010in.)

   Maximum end play: 0.4mm(0.016in.)



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Fig. 150: Using Feeler Gauge To Measure End Play While Moving Connecting Rod Back And Forth
Courtesy of HYUNDAI MOTOR CO.

- If out-of-tolerance, install a new connecting rod.

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- If still out-of-tolerance, replace the crankshaft.

2. Check the connecting road bearing oil clearance.
    1. Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
    2. Remove 2 connecting rod cap nuts.
    3. Remove the connecting rod cap and bearing half.
    4. Clean the crank pin and bearing.
    5. Place plastigage across the crank pin.
    6. Reinstall the bearing half and cap, and torque the nuts.

        Tightening torque

        P50 ~ 53Nm (500 ~ 530kgf.cm, 36.9 ~ 39lbf.ft)

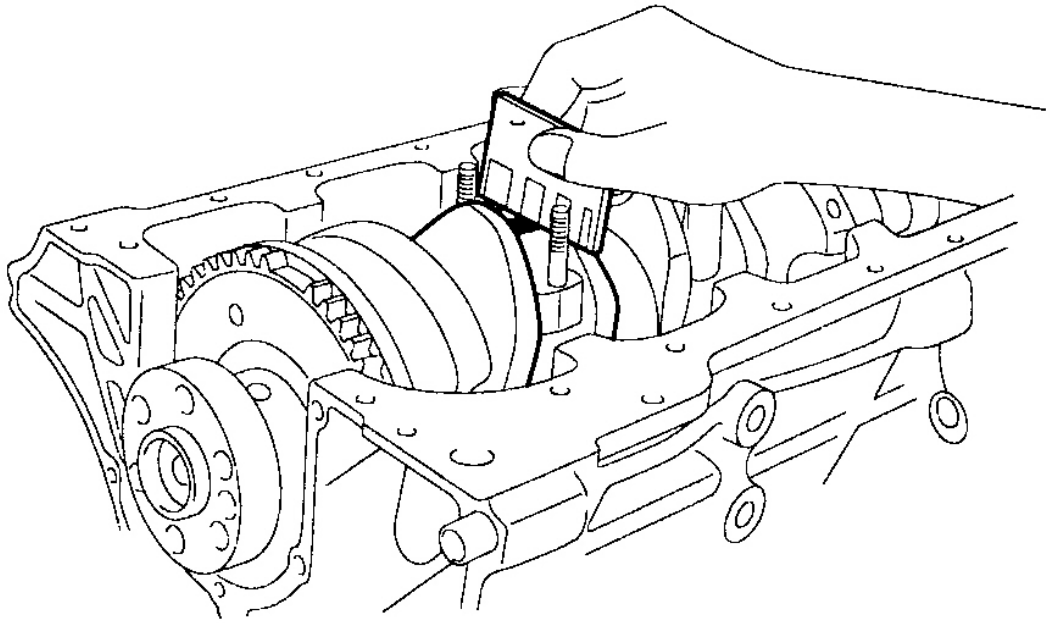
        NOTE: Do not turn the crankshaft.

    7. Remove 2 nuts, connecting rod cap and bearing half.
    8. Measure the plastigage at its widest point.

        Standard oil clearance

        0.024 ~ 0.042mm(0.0009 ~ 0.0017in.)

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Fig. 151: Measuring Plastigage At Its Widest Point
Courtesy of HYUNDAI MOTOR CO.

9. If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

10. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION: If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

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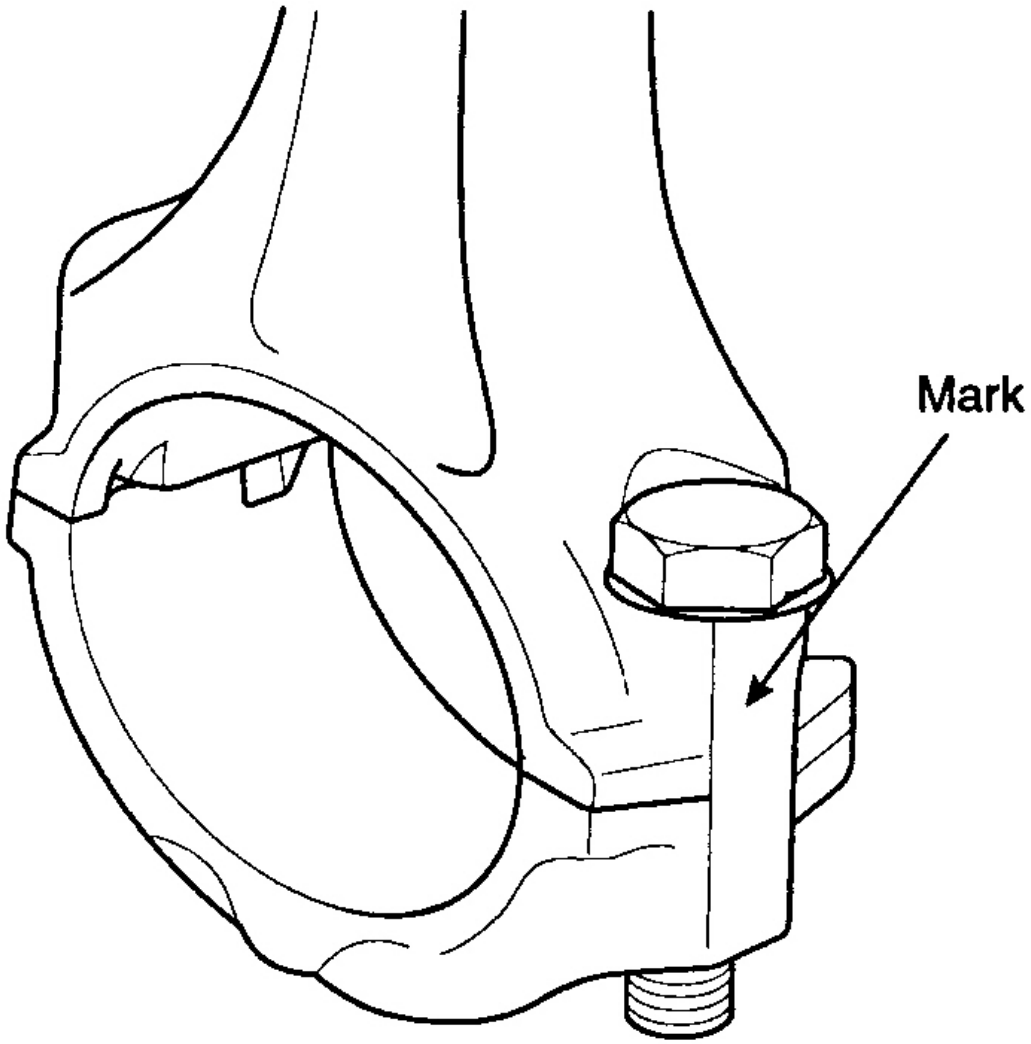


Fig. 152: Identifying Connecting Rod Mark Location
Courtesy of HYUNDAI MOTOR CO.

CONNECTING ROD INSIDE DIAMETER SPECIFICATIONS

CLASS	MARK	INSIDE DIAMETER
a	A	48.00 ~ 48.006mm (1.8896 ~ 1.8899in.)
b	B	48.006 ~ 48.012mm (1.8899 ~ 1.8902in.)
c	C	48.012 ~ 48.018mm (1.8902 ~

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		1.8904in.)

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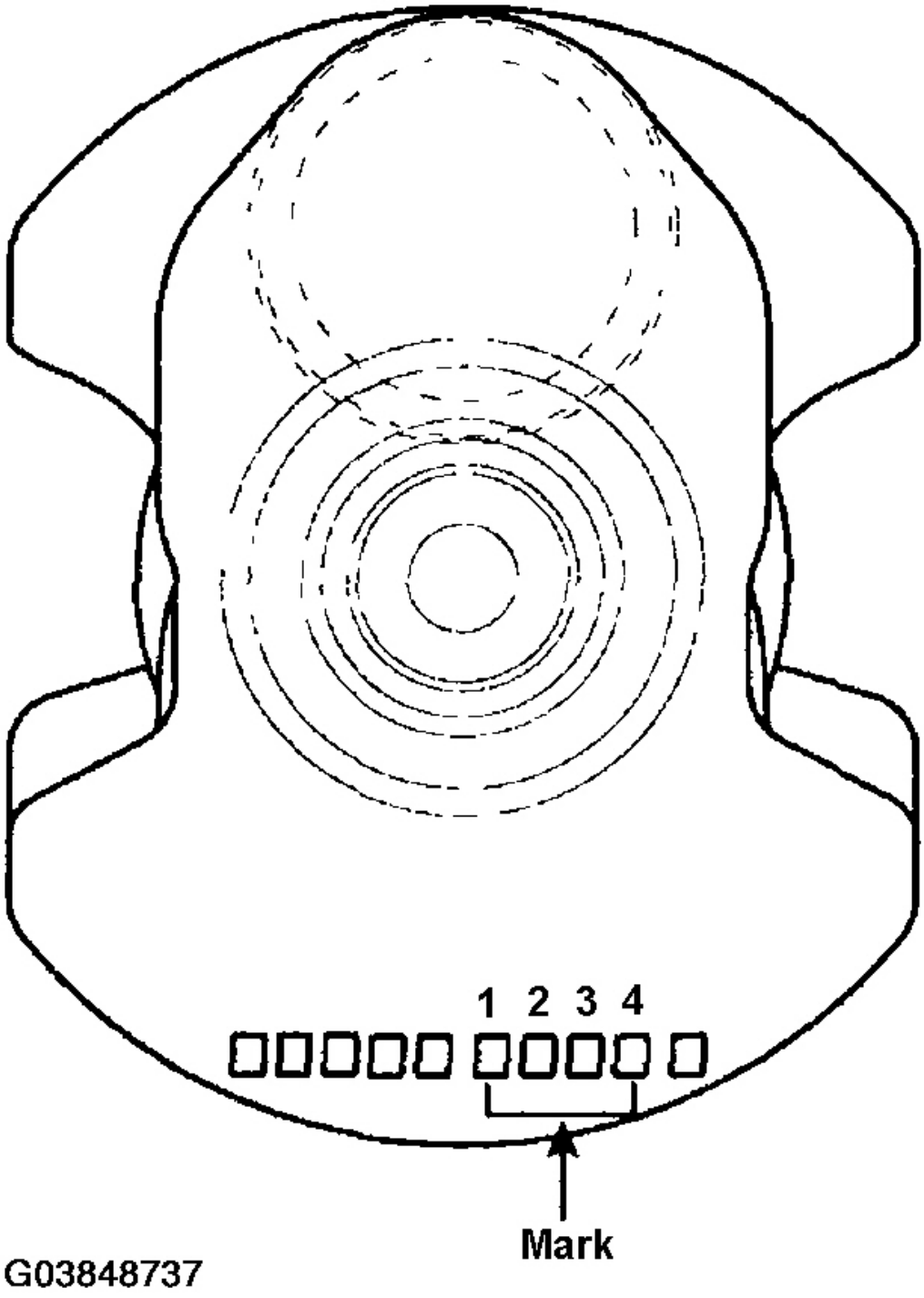


Fig. 153: Identifying Crankshaft Pin Mark Location

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Courtesy of HYUNDAI MOTOR CO.

CRANKSHAFT PIN OUTSIDE DIAMETER SPECIFICATIONS

CLASS	MARK	OUTSIDE DIAMETER OF PIN
I	1	44.960 ~ 44.966mm (1.7700 ~ 1.7703in.)
II	2	44.952 ~ 44.960mm (1.7698 ~ 1.7700in.)
III	3	44.946 ~ 44.952mm (1.7695 ~ 1.7698in.)

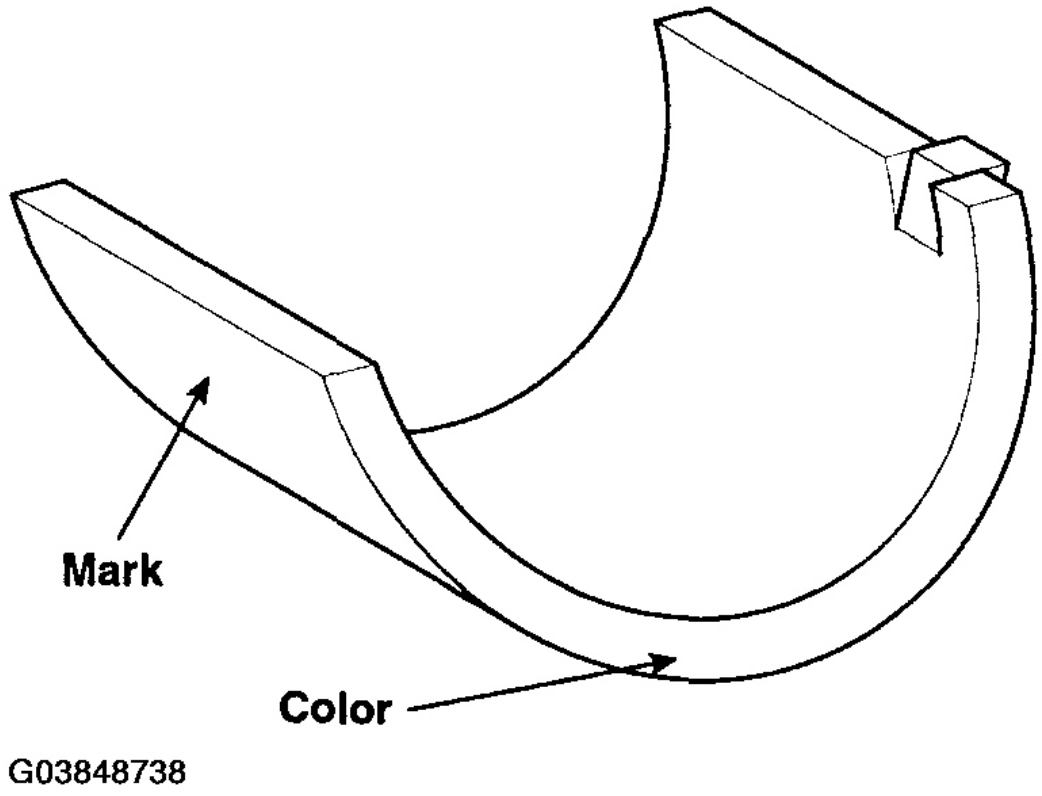


Fig. 154: Identifying Connecting Rod Bearing Identification Mark Location
Courtesy of HYUNDAI MOTOR CO.

CONNECTING ROD BEARING THICKNESS SPECIFICATIONS

CLASS	MARK	THICKNESS OF BEARING
AA	BLUE	1.514 ~ 1.517mm (0.0596 ~ 0.0597in.)

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A	BLACK	1.511 ~ 1.514mm (0.0595 ~ 0.0596in.)
B	NONE	1.508 ~ 1.511mm (0.0594 ~ 0.0595in.)
C	GREEN	1.505 ~ 1.508mm (0.0593 ~ 0.0594in.)
D	YELLOW	1.502 ~ 1.505mm (0.0591 ~ 0.0593in)

11. Selection

CONNECTING ROD IDENTIFICATION MARK AND ASSEMBLING CLASSIFICATION OF BEARING

CRANKSHAFT IDENTIFICATION MARK	CONNECTING ROD IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (YELLOW)	a (WHITE)	D (YELLOW)
	b (NONE)	C (GREEN)
	c (YELLOW)	B (NONE)
II (NONE)	a (WHITE)	C (GREEN)
	b (NONE)	B (NONE)
	c (YELLOW)	A (BLACK)
III (WHITE)	a (WHITE)	B (NONE)
	b (NONE)	A (BLACK)
	c (YELLOW)	AA (BLUE)

3. Check the crankshaft bearing oil clearance.
    1. To check main bearing-to-journal oil clearance, remove the main caps and bearing halves.
    2. Clean each main journal and bearing half with a clean shop tower.
    3. Place one strip of plastigage across each main journal.
    4. Reinstall the bearings and caps, then torque the bolts.

        Tightening torque

        30Nm (300kgf.cm, 22lbf.ft) + 60° ~ 65°

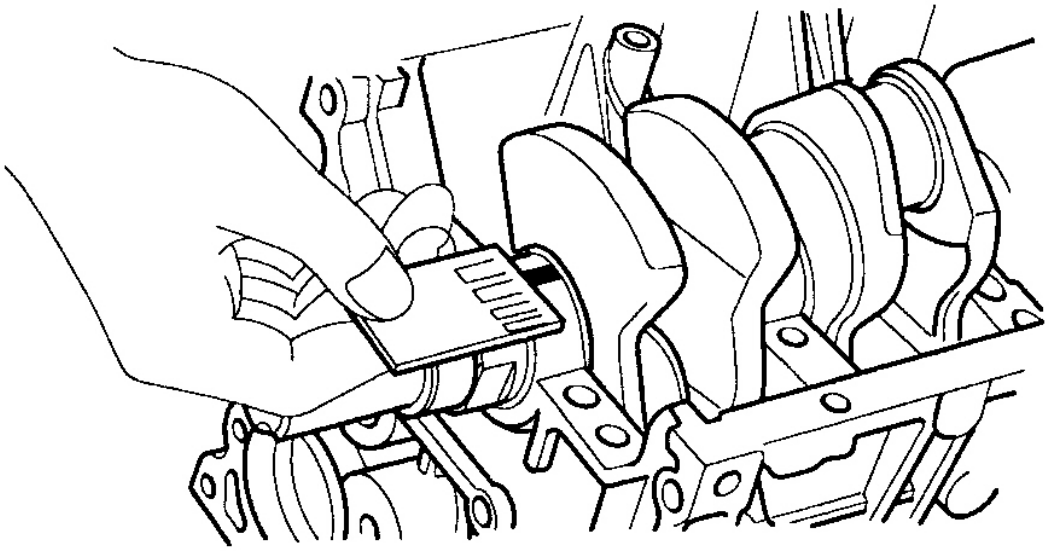
        NOTE: Do not turn the crankshaft.

    5. Remove the cap and bearing again, and measure the widest part of the plastigage.

        Standard oil clearance

        0.028 ~ 0.046mm (0.0011 ~ 0.0018in.)

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Fig. 155: Measuring Widest Part Of Plastigage
Courtesy of HYUNDAI MOTOR CO.

6. If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

7. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION: If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

CONNECTING RODS

1. When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at disassembly match. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.

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2. Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.
3. Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

   Allowable bend of connecting rod :

   0.05mm/100mm (0.0020 in./3.94 in.) or less

   Allowable twist of connecting rod :

   0.1mm/100mm (0.0039 in./3.94 in.) or less

   Crankshaft bore mark location

   Letters have been stamped on the end of the block as a mark for the size of each of the 5 main journal bores.

   Use them, and the numbers or bar stamped on the crank (marks for main journal size), to choose the correct bearings.

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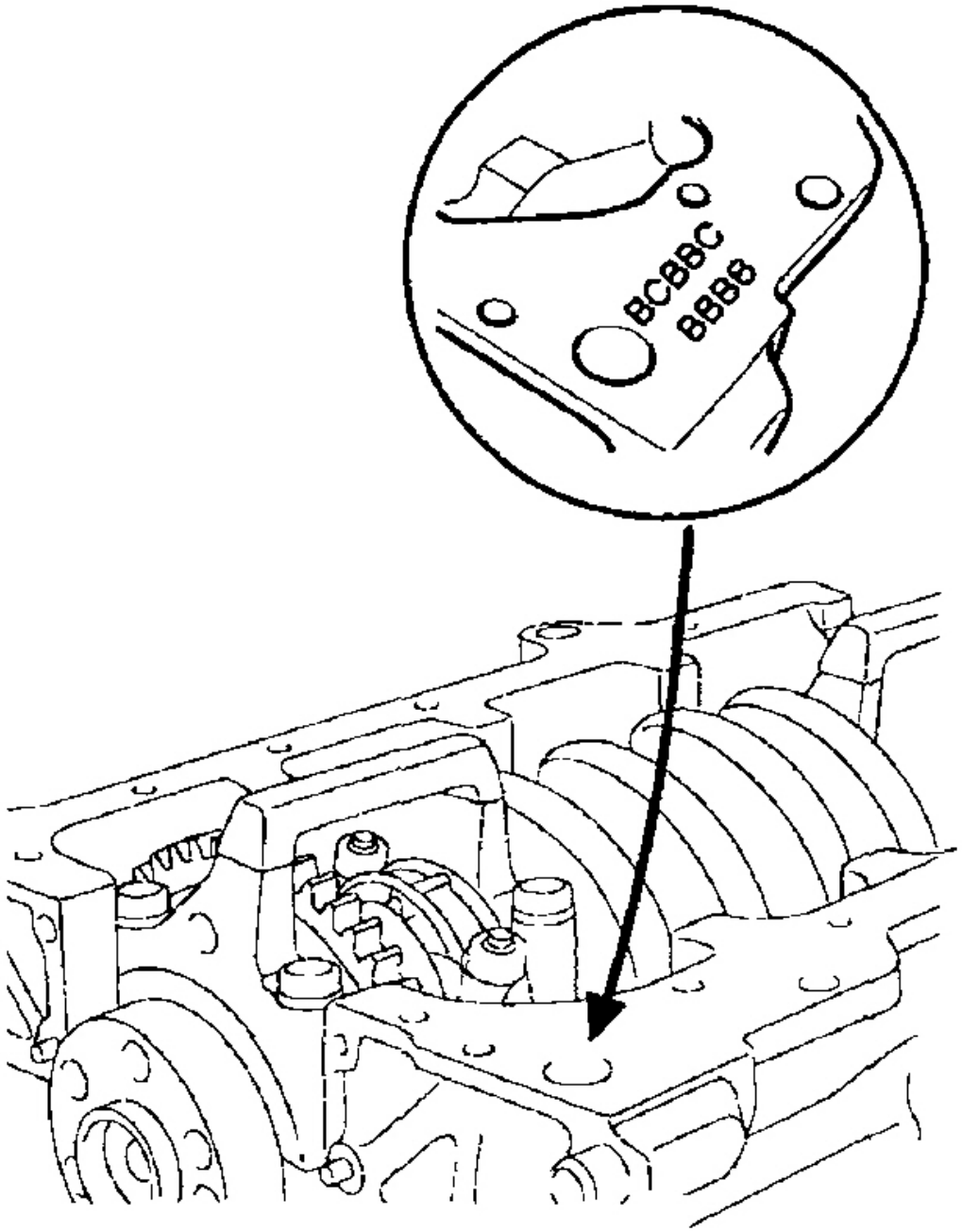


Fig. 156: Identifying Crankshaft Bore Mark Location
Courtesy of HYUNDAI MOTOR CO.

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INSIDE DIAMETER SPECIFICATIONS

CLASS	MARK	INSIDE DIAMETER
a	A	61.000 ~ 61.006mm (2.4015 ~ 2.4018in.)
b	B	61.006 ~ 61.012mm (2.4018 ~ 2.4020in.)
c	C	61.012 ~ 61.018mm (2.4020 ~ 2.4023in.)

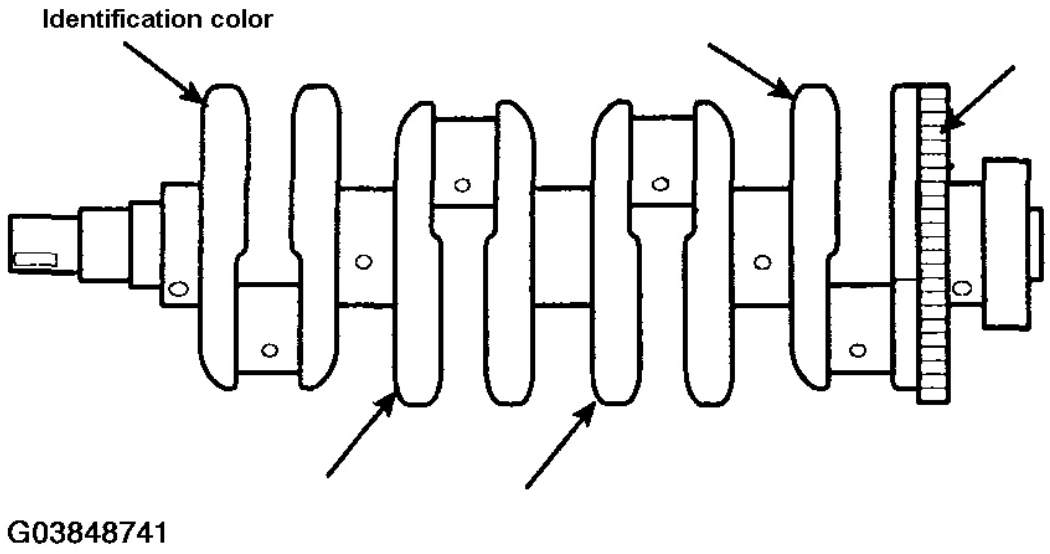


Fig. 157: Identifying Crankshaft Journal Mark Location
Courtesy of HYUNDAI MOTOR CO.

CRANKSHAFT JOURNAL OUTSIDE DIAMETER SPECIFICATIONS

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
1	YELLOW	56.956 ~ 56.962mm (2.2423 ~ 2.2426in.)
II	NONE	56.948 ~ 56.956mm (2.2420 ~ 2.2423in.)
III	WHITE	56.942 ~ 56.948mm (2.2418 ~ 2.2420in.)

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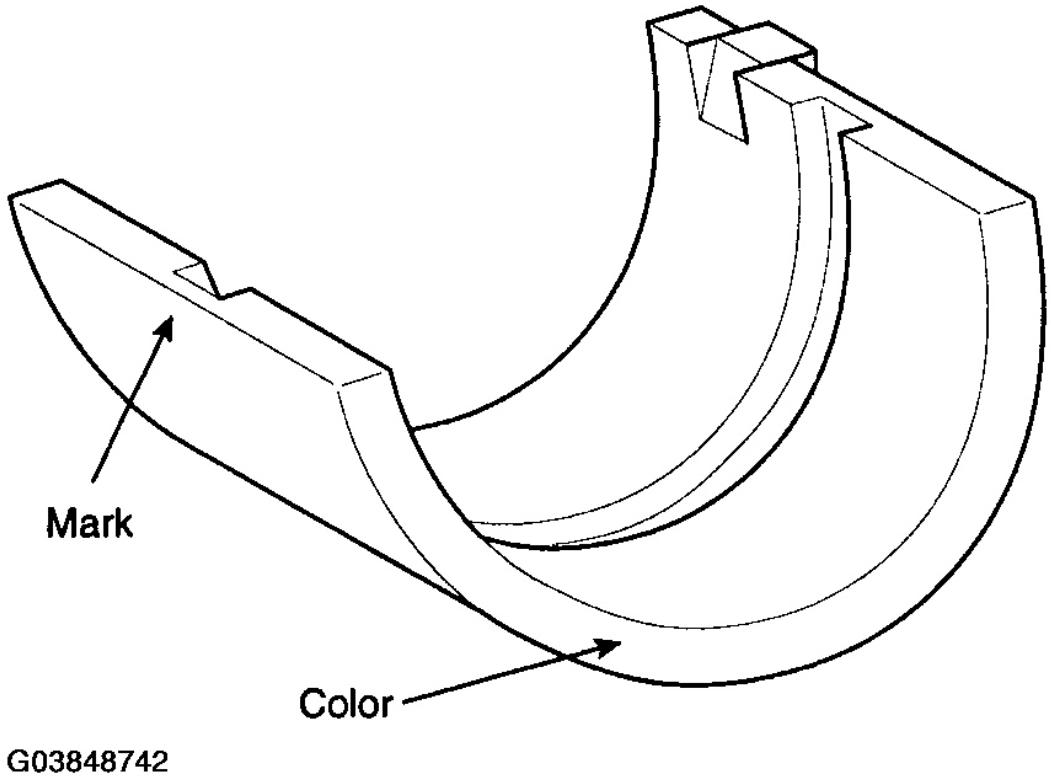


Fig. 158: Identifying Crankshaft Bearing Identification Mark Location
Courtesy of HYUNDAI MOTOR CO.

CRANKSHAFT BEARING THICKNESS SPECIFICATIONS

CLASS	MARK	THICKNESS OF BEARING
AA	BLUE	2.014 ~ 2.017mm (0.0793 ~ 0.0794in.)
A	BLACK	2.011 ~ 2.014mm (0.0791 ~ 0.0793in.)
B	NONE	2.008 ~ 2.011mm (0.0790 ~ 0.0791in.)
C	GREEN	2.005 ~ 2.008mm (0.0789 ~ 0.790in.)
D	YELLOW	2.002 ~ 2.005mm (0.0788 ~ 0.0789in.)

CRANKSHAFT BORE IDENTIFICATION MARK AND ASSEMBLING CLASSIFICATION OF BEARING

CRANKSHAFT	CRANKSHAFT BORE	ASSEMBLING CLASSIFICATION OF

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IDENTIFICATION MARK	IDENTIFICATION MARK	BEARING
I (YELLOW)	a (A)	D (YELLOW)
	b(B)	C (GREEN)
	c(C)	B (NONE)
II (NONE)	a (A)	C (GREEN)
	b(B)	B (NONE)
	c(C)	A (BLACK)
III (WHITE)	a (A)	B (NONE)
	b(B)	A (BLACK)
	c(C)	AA (BLUE)

4. Check crankshaft end play.

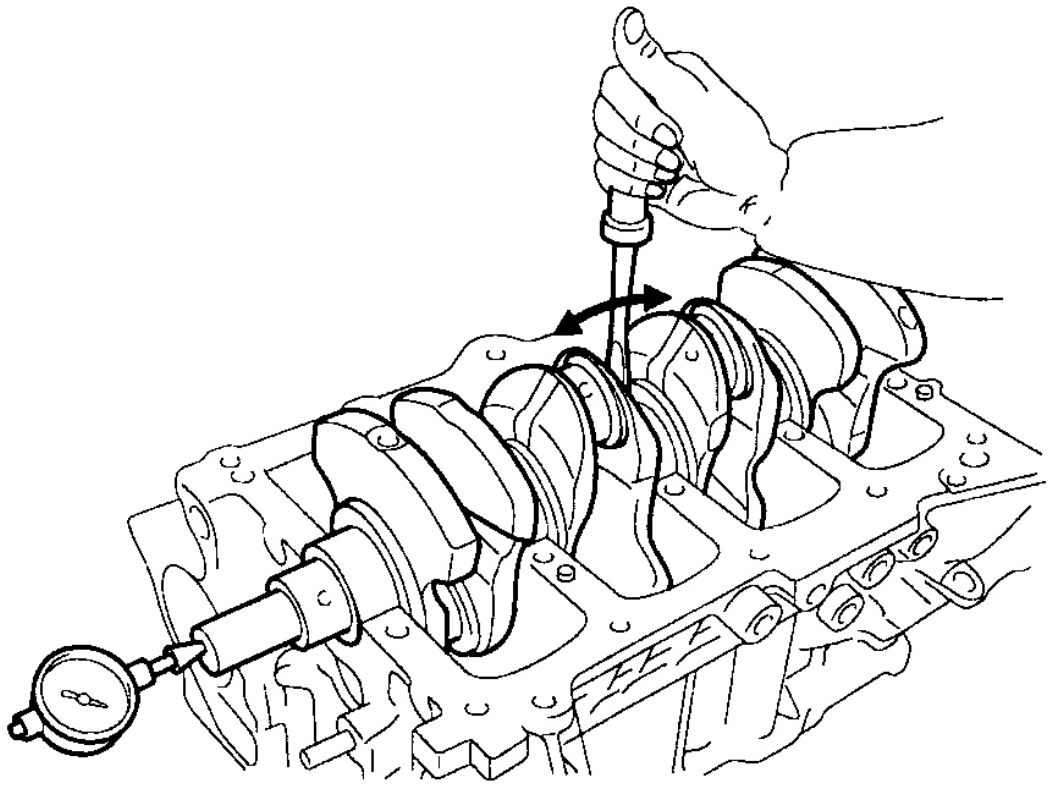
   Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

   Standard end play

   0.06 ~ 0.26mm (0.0023 ~ 0.010in.)

   Limit: 0.30mm (0.0118in.)

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Fig. 159: Using Dial Indicator To Measure Thrust Clearance While Prying Crankshaft Back And Forth With Screwdriver
Courtesy of HYUNDAI MOTOR CO.

If the end play is greater than maximum, replace the thrust bearings as a set.

Thrust bearing thickness

2.44 ~ 2.47mm(0.096 ~ 0.097in.)

5. Inspect main journals and crank pins

   Using a micrometer, measure the diameter of each main journal and crank pin.

   Main journal diameter: 57mm (2.165in.)

   Crank pin diameter: 45mm (1.77in.)

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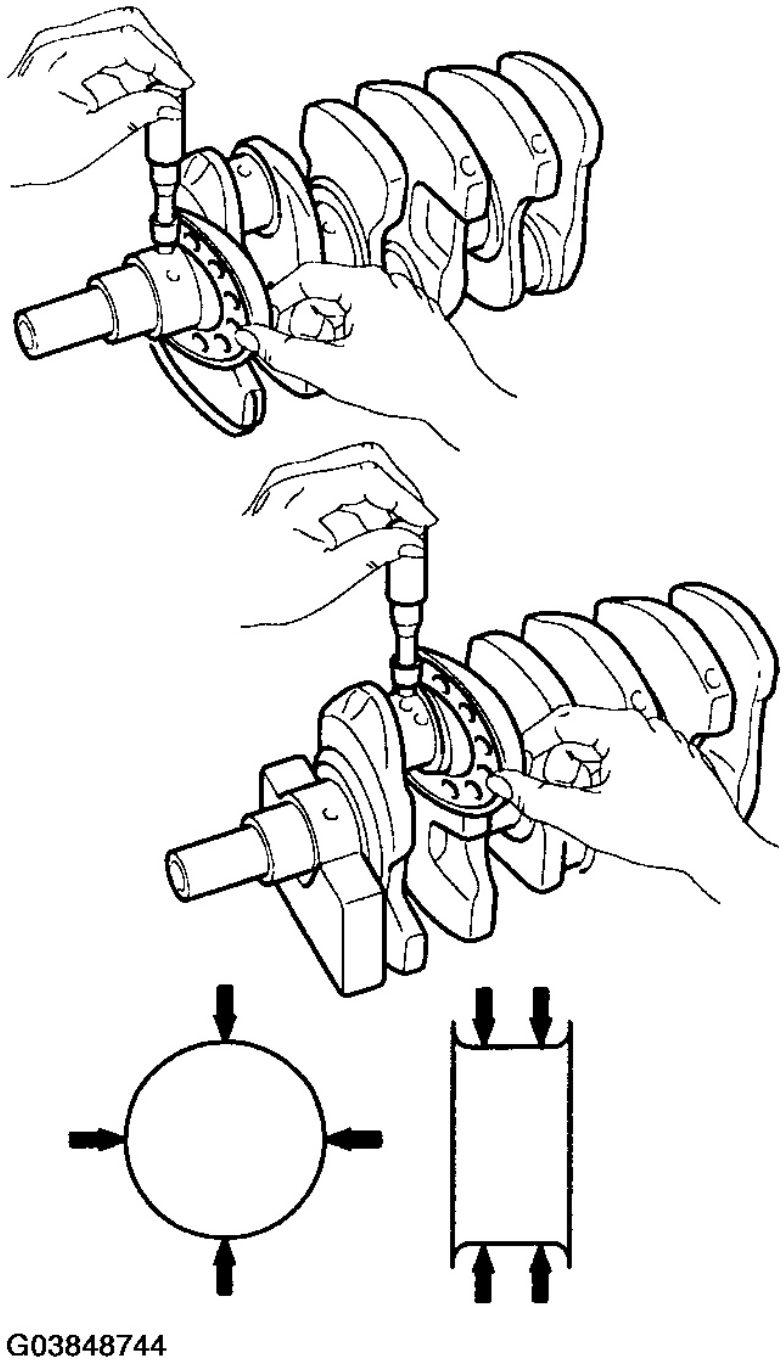


Fig. 160: Using Micrometer To Measure Diameter Of Each Main Journal And Crank Pin
Courtesy of HYUNDAI MOTOR CO.

CYLINDER BLOCK

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1. Remove gasket material.

   Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

2. Clean cylinder block

   Using a soft brush and solvent, thoroughly clean the cylinder block.

3. Inspect top surface of cylinder block for flatness.

   Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

   Flatness of cylinder block gasket surface

   Standard: Less than 0.03mm(0.0012 in.)

   Limit: 0.05 mm (0.0020 in.)

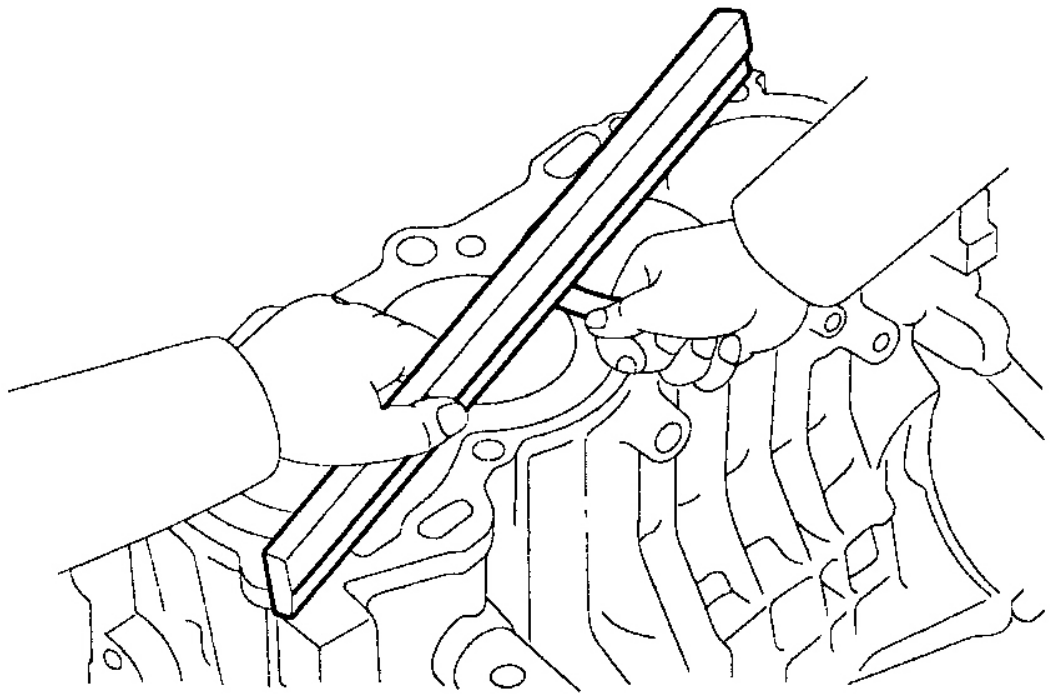


Fig. 161: Using Precision Straight Edge And Feeler Gauge To Measure Surface Contacting Cylinder Head Gasket For Warpage

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Courtesy of HYUNDAI MOTOR CO.

4. Inspect cylinder bore diameter

   Visually check the cylinder for vertical scratches.

   If deep scratches are present, replace the cylinder block.

5. Inspect cylinder bore diameter

   Using a cylinder bore gauge, measure the cylinder bore diameter at the position in the thrust and axial directions.

   Standard diameter

   82.00 ~ 82.03mm (3.2283 ~ 3.2295in.)

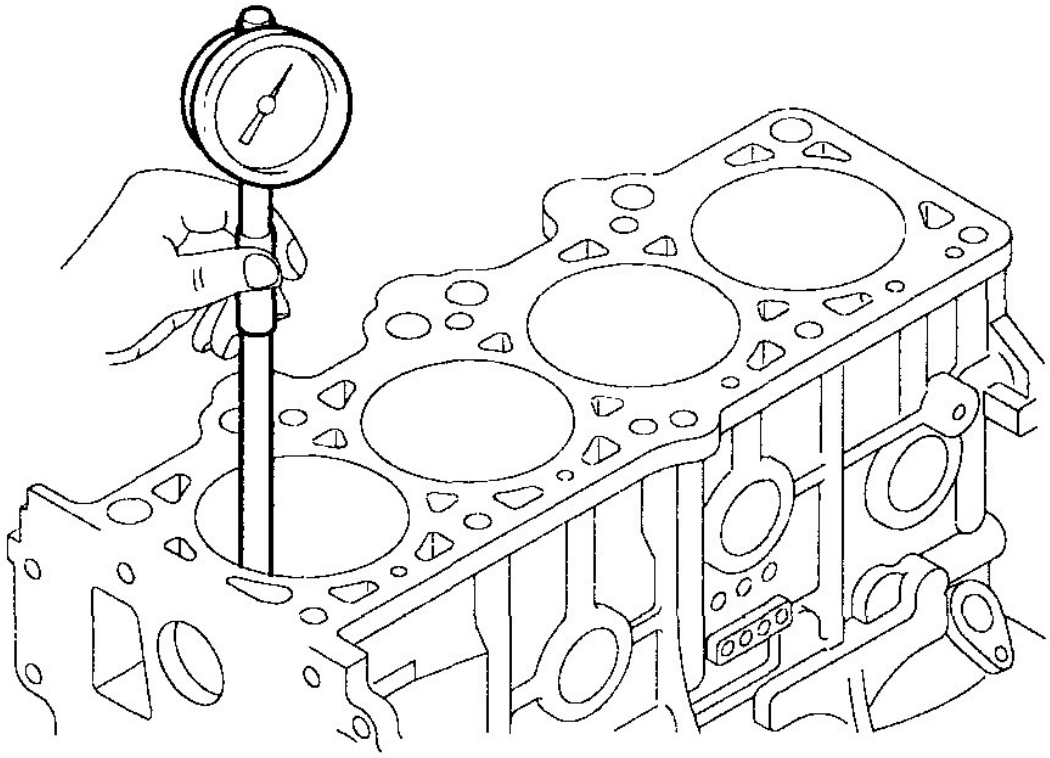
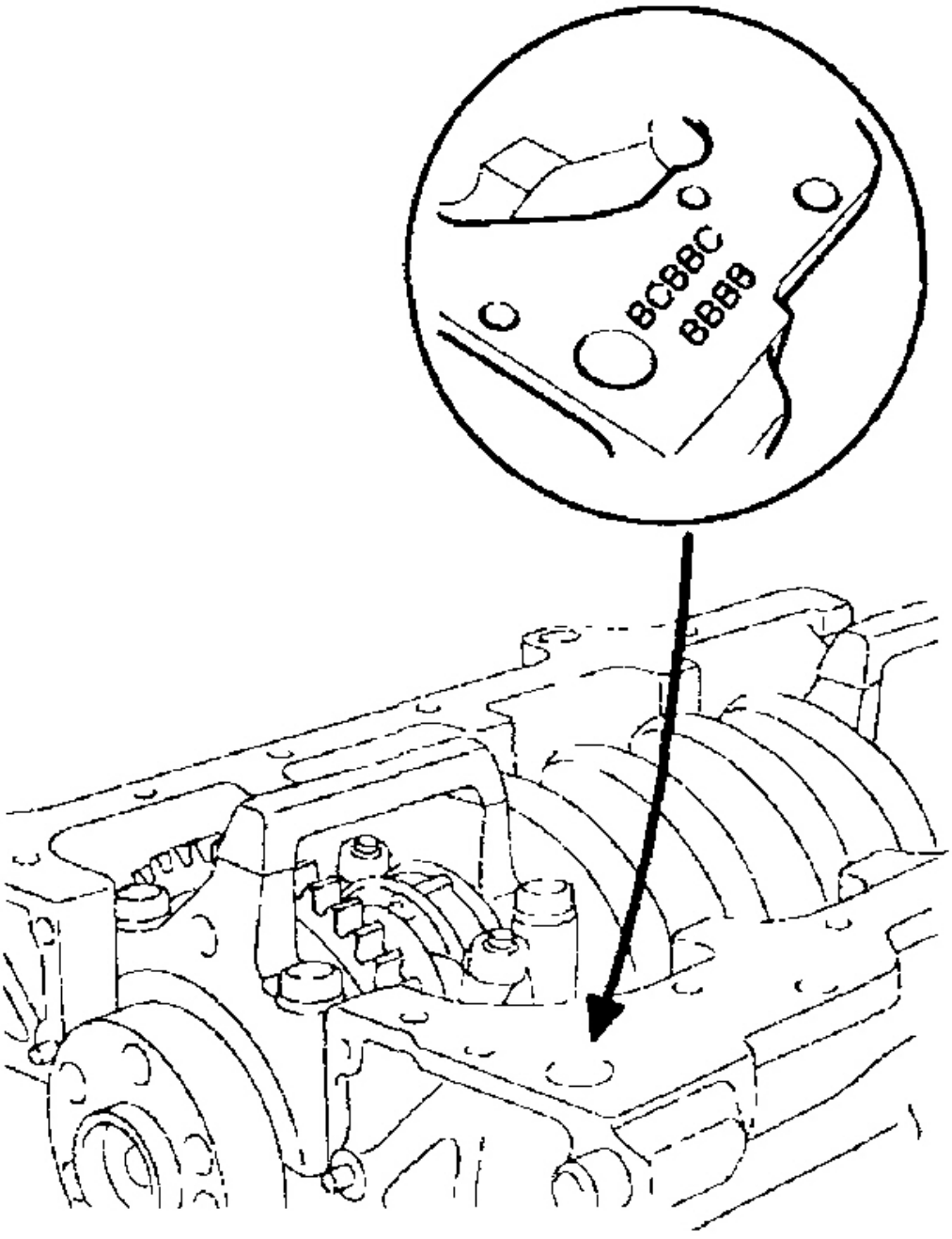


Fig. 162: Using Cylinder Bore Gauge To Measure Cylinder Bore Diameter At Position In Thrust And Axial Directions
Courtesy of HYUNDAI MOTOR CO.

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



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Fig. 163: Identifying Cylinder Bore Size Code On Cylinder Block Bottom Face
Courtesy of HYUNDAI MOTOR CO.

CYLINDER BORE INNER DIAMETER SPECIFICATIONS

Class	Cylinder bore inner diameter	Size code
A	82.00 ~ 82.01mm (3.228 ~ 3.2287in.)	A
B	82.01 ~ 82.02mm (3.2287 ~ 3.2291in.)	B
C	82.02 ~ 82.03mm (3.2291 ~ 3.2295in.)	C

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

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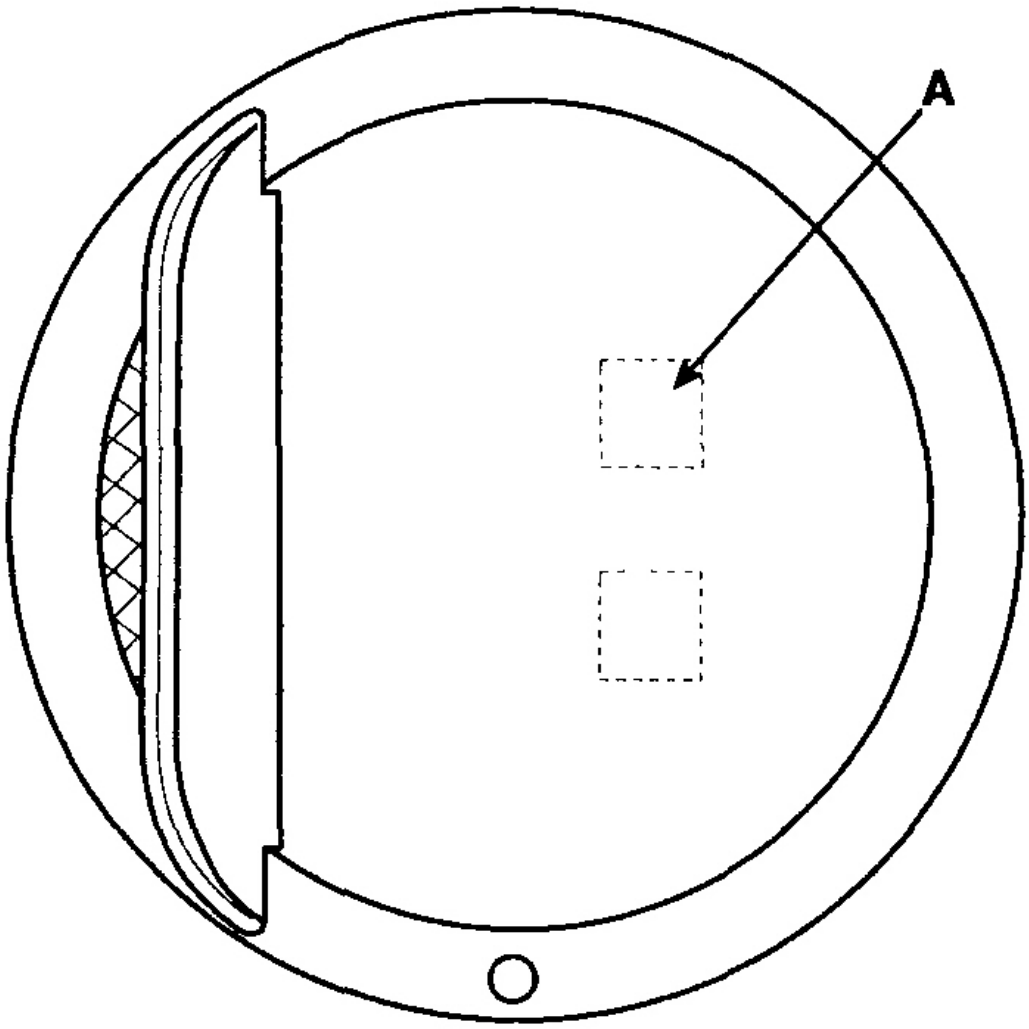


Fig. 164: Identifying Piston Size Code On Piston Top Face
Courtesy of HYUNDAI MOTOR CO.

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

PISTON OUTER DIAMETER SPECIFICATIONS

Class	Piston outer diameter	Size code
A	81.97 ~ 81.98mm (3.2271 ~ 3.2275in.)	A
B	81.98 ~ 81.99mm (3.2275 ~	None

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	3.2279in.)	
C	81.99 ~ 82.00mm (3.2279 ~ 3.2283in.)	C

8. Select the piston related to cylinder bore class.

   Clearance: 0.02 ~ 0.04mm (0.00078 ~ 0.00157in.)

BORING CYLINDER

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

   OVERSIZE PISTON SPECIFICATIONS

Identification Mark	Size
0.25	0.25mm (0.010in.)
0.50	0.50mm (0.020in.)

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

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

   New bore size = Piston O.D + 0.02 to 0.04mm

   (0.0008 to 0.0016in.) (clearance between piston and cylinder) - 0.01mm (0.0004in.) (honing margin.)

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

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

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

   Standard: 0.02 ~ 0.04mm (0.0008 ~ 0.0016in.)

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

PISTON AND RINGS

1. Clean piston
   1. Using a gasket scraper, remove the carbon from the piston top.
   2. Using a groove cleaning tool or broken ring, clean the piston ring grooves.

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3. Using solvent and a brush, thoroughly clean the piston.

NOTE: Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 47 mm (1.85 in.) from the top land of the piston.

Standard diameter

81.97 ~ 82.00mm (3.2272 ~ 3.2283in.)

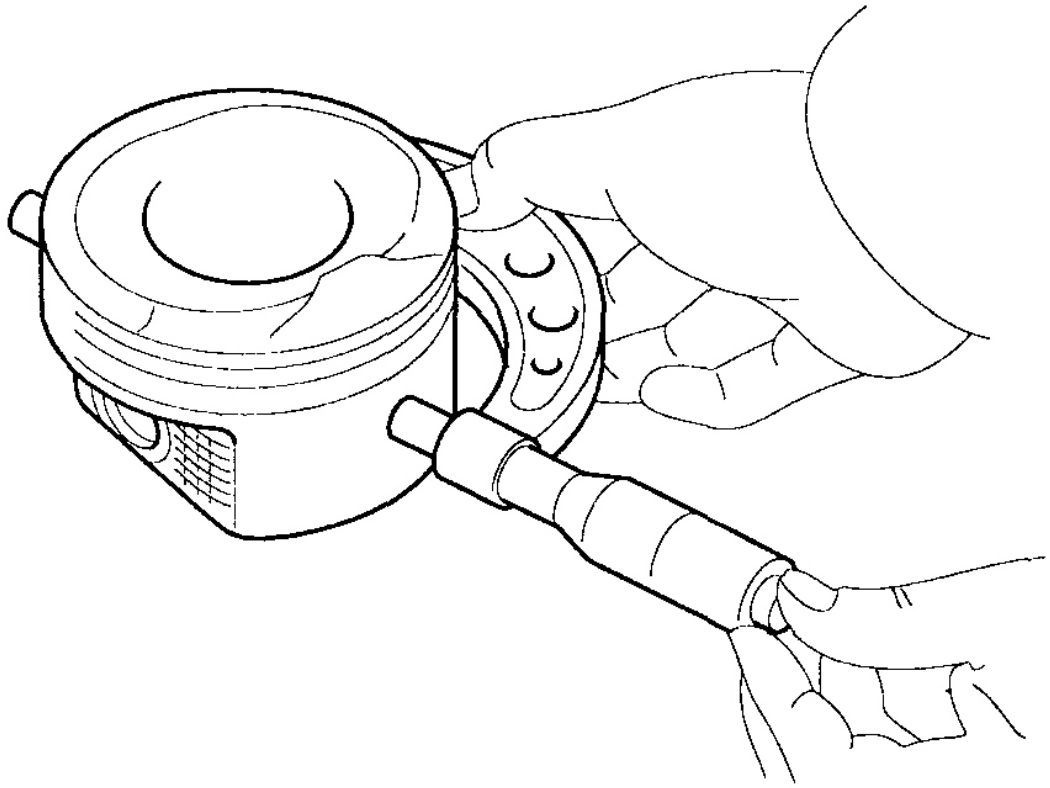


Fig. 165: Measuring Outside Diameter Of Piston
Courtesy of HYUNDAI MOTOR CO.

3. Calculate the difference between the cylinder bore diameter and the piston diameter.

Piston-to-cylinder clearance

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0.02 ~ 0.04mm(0.0008 ~ 0.0016in.)

4. Inspect the piston ring side clearance.

   Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

   Piston ring side clearance

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

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

   Limit

   No. 1: 0.1mm (0.004in.)

   No. 2: 0.1mm (0.004in.)

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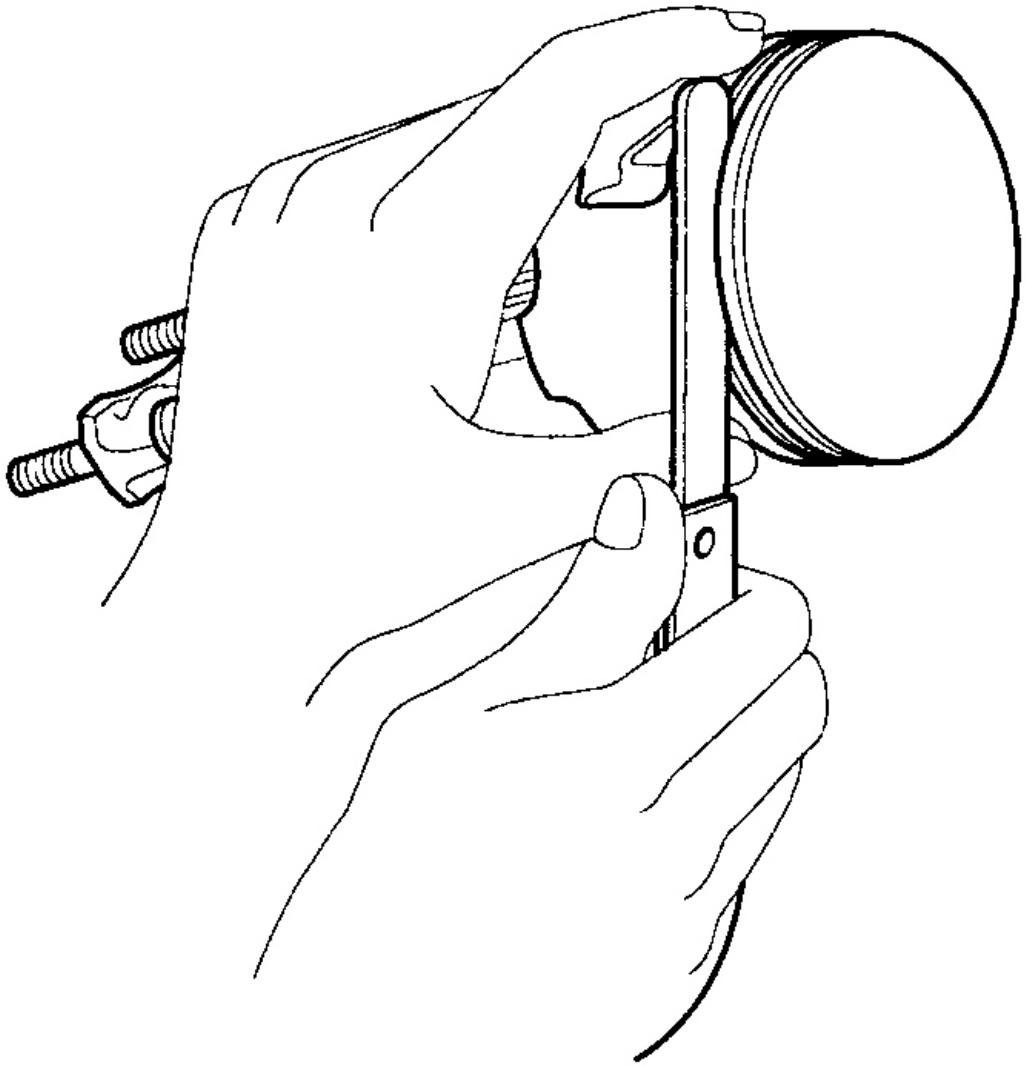


Fig. 166: Using Feeler Gauge To Measure Clearance Between New Piston Ring And Wall Of Ring Groove
Courtesy of HYUNDAI MOTOR CO.

If the clearance is greater than maximum, replace the piston.

5. Inspect piston ring end gap.

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

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If the gap exceeds the service limit, replace the piston ring. If the gap is too large, recheck the cylinder bore diameter against the wear limits in **CYLINDER BORE INNER DIAMETER SPECIFICATION**. If the bore is over the service limit, the cylinder block must be rebored. (See **BORING CYLINDER**)

Piston ring end gap

Standard

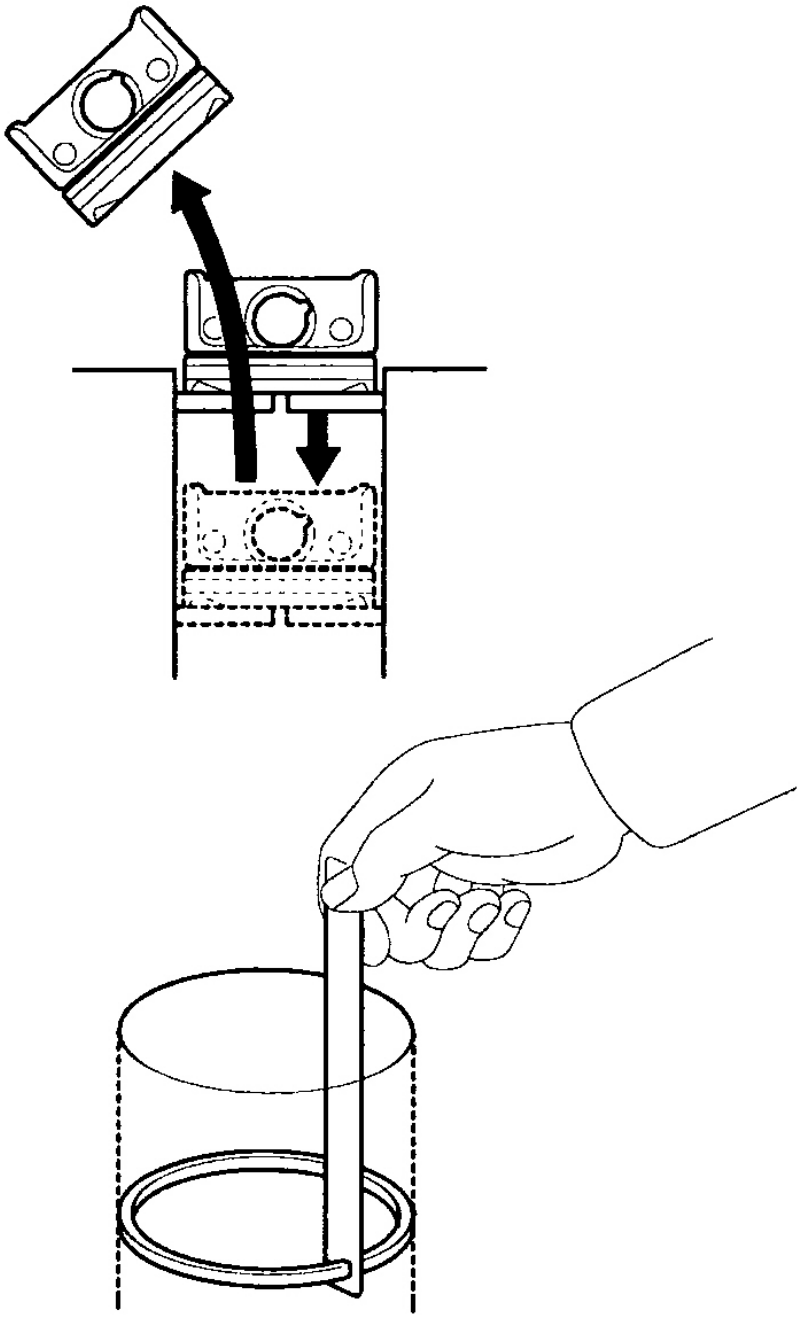
No.1: 0.23 ~ 0.38mm (0.0091 ~ 0.0150in.)

No.2: 0.45 ~ 0.60mm (0.0177 ~ 0.0236in.)

Limit

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

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Fig. 167: Inspecting Piston Ring End Gap
Courtesy of HYUNDAI MOTOR CO.

PISTON PINS

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1. Measure the diameter of the piston pin.

   Piston pin diameter

   20.001 ~ 20.006mm (0.7874 ~ 0.7876in.)

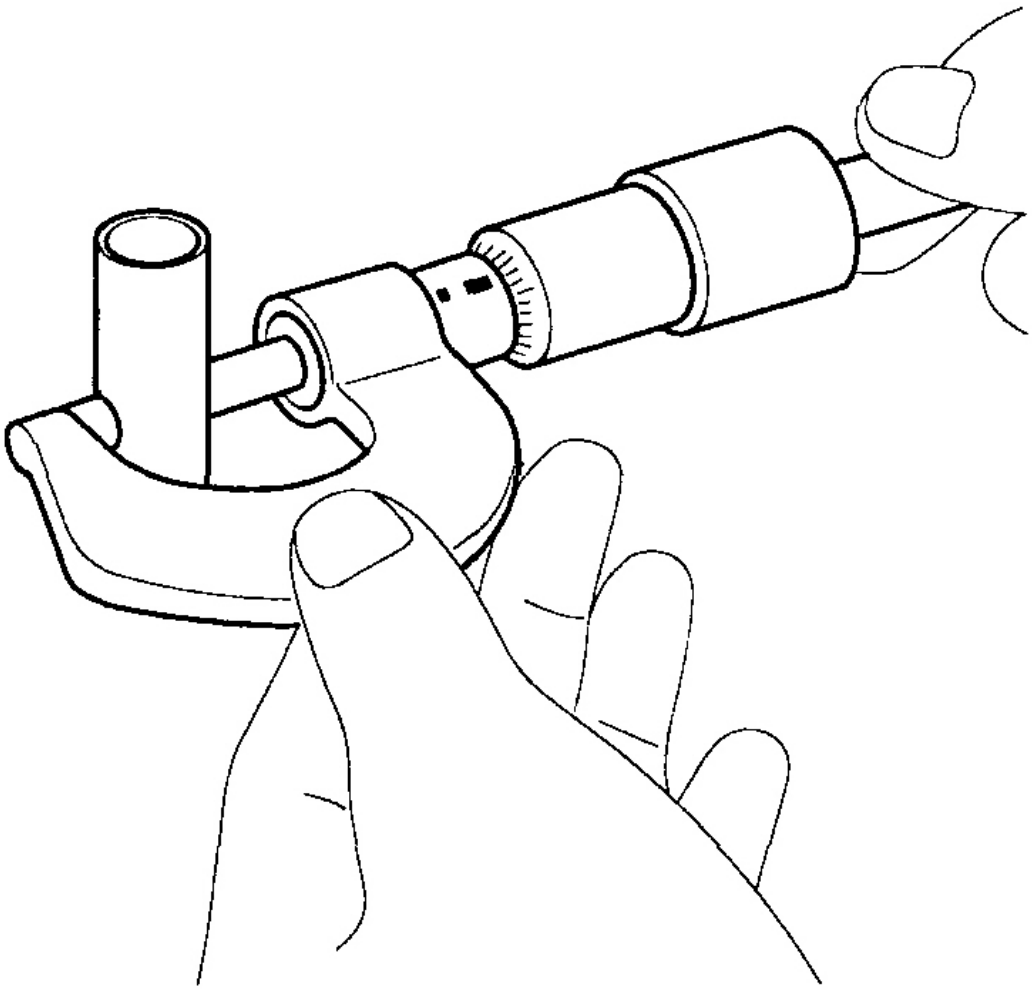


Fig. 168: Measuring Diameter Of Piston Pin
Courtesy of HYUNDAI MOTOR CO.

2. Measure the piston pin-to-piston clearance.

   Piston pin-to-piston clearance

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0.01 ~ 0.02mm (0.0004 ~ 0.0008in.)

3. Check the difference between the piston pin diameter and the connecting rod small end diameter.

   Piston pin-to-connecting rod interference

   0.016 ~ 0.032mm (0.00063 ~ 0.00126in.)

OIP PRESSURE SWITCH

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

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

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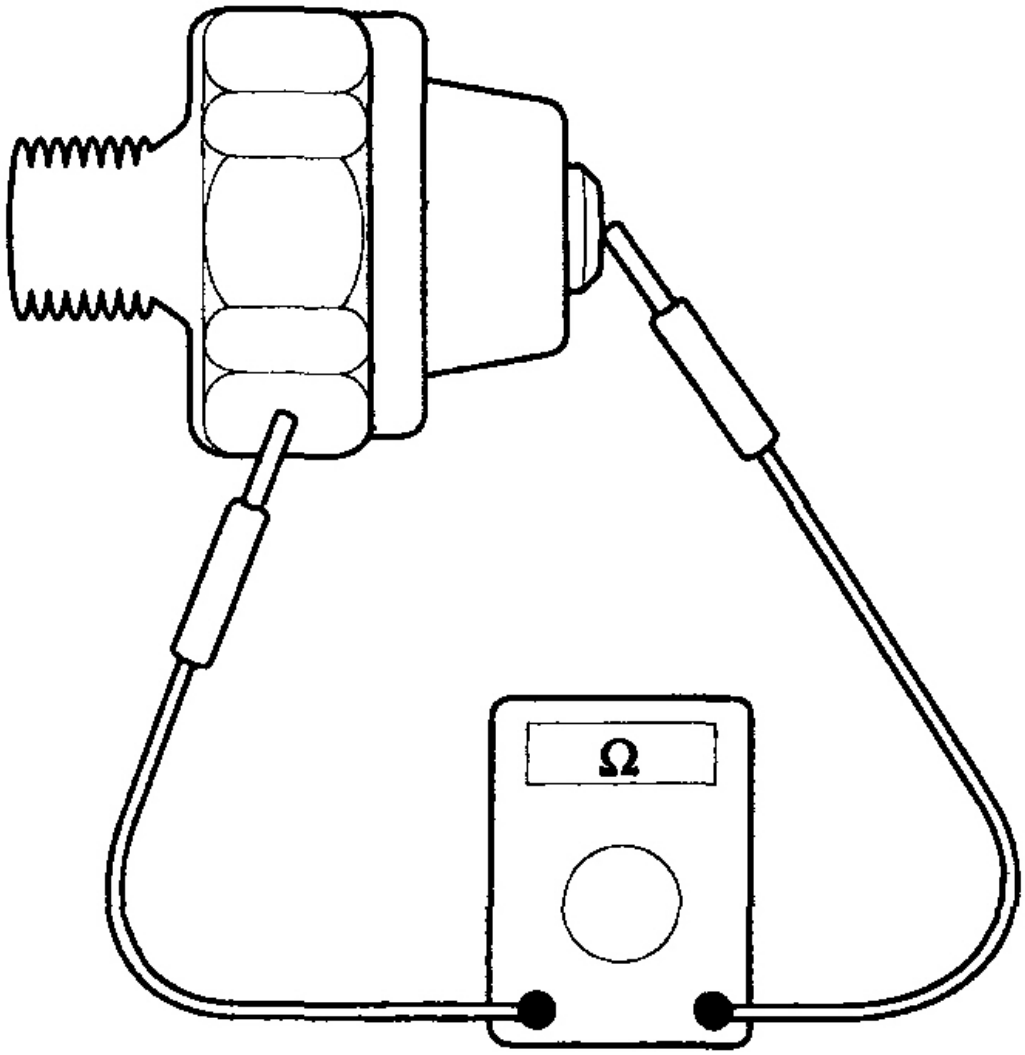


Fig. 169: Checking Continuity Between OIP Pressure Switch Terminal And Body (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

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 50kpa (7psi) vacuum is applied through the oil hole, the switch is operating properly.

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

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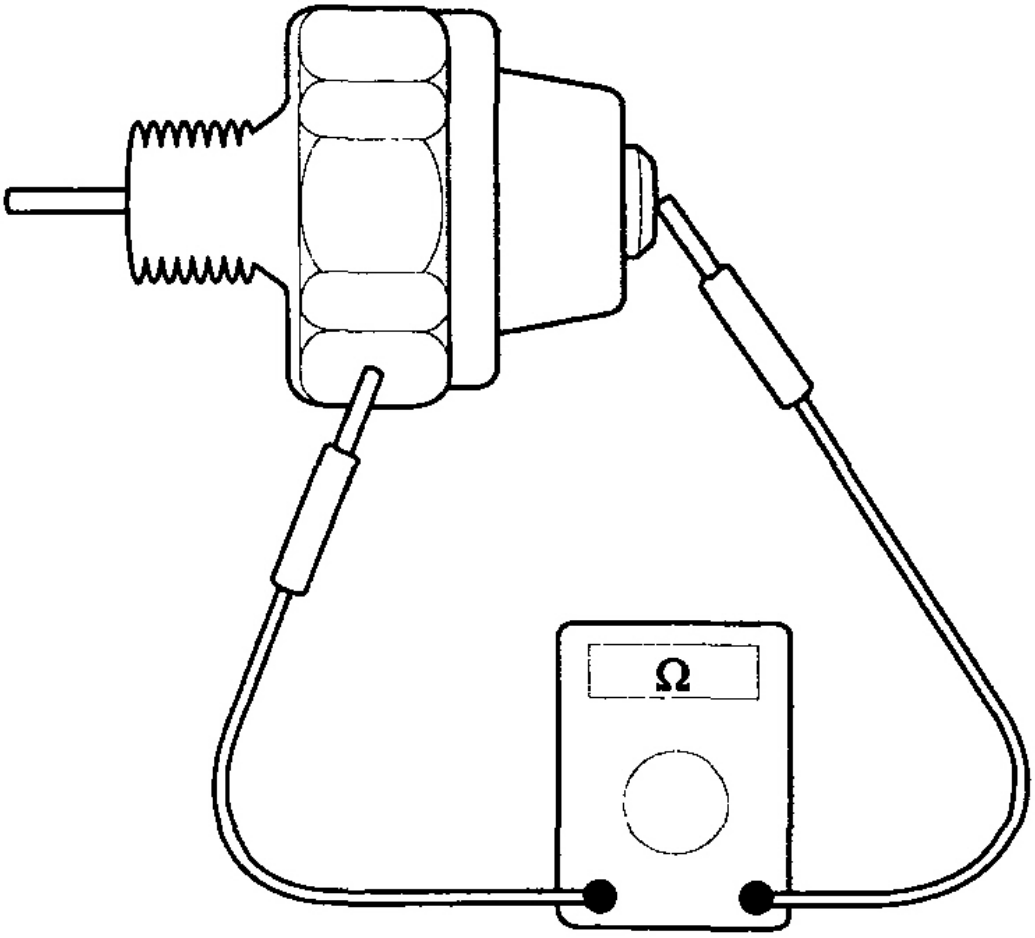


Fig. 170: Checking Continuity Between OIP Pressure Switch Terminal And Body (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

NOTE:

- **Thoroughly clean all parts to assembled.**
- **Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.**
- **Replace all gaskets, O-rings and oil seals with new parts.**

1. Assemble piston and connecting rod.
    1. Use a hydraulic press for installation.

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2. The piston front mark and the connecting rod front mark must face the timing belt side of the engine.

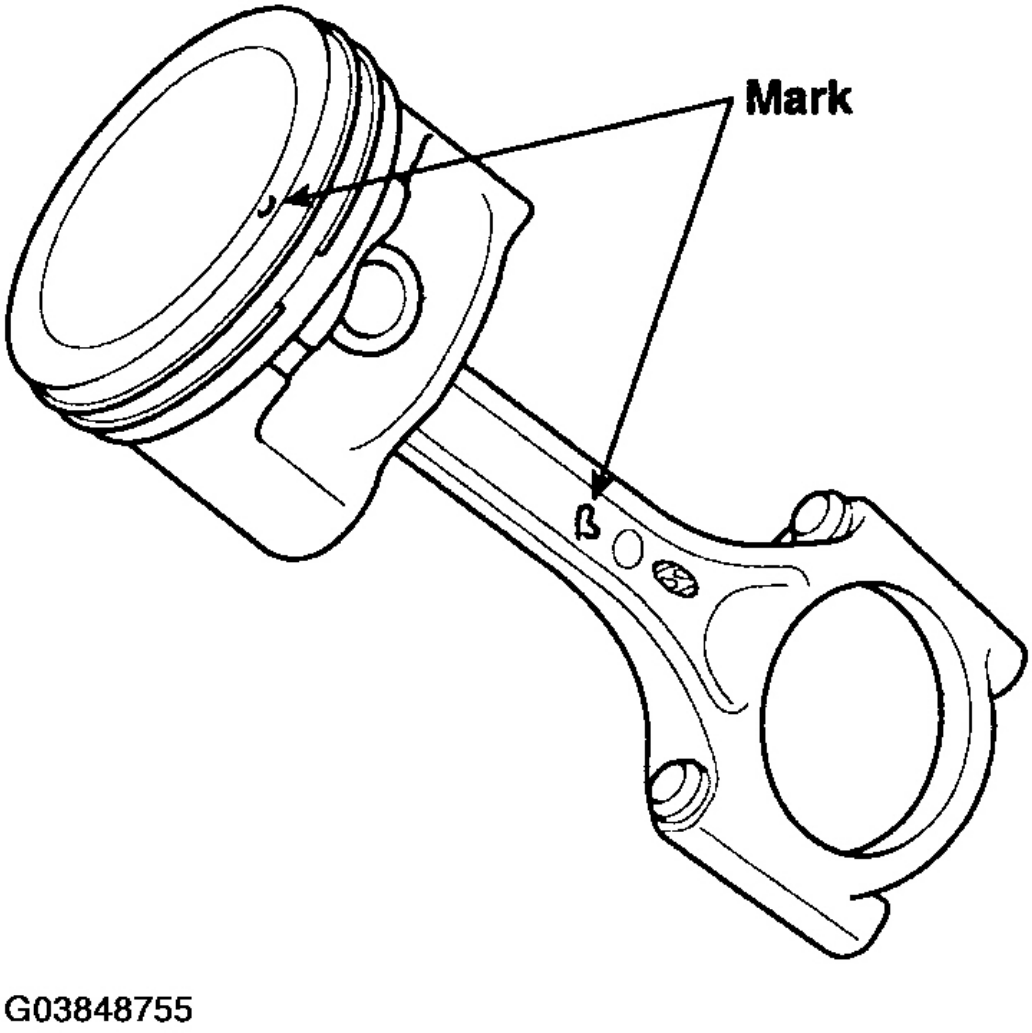
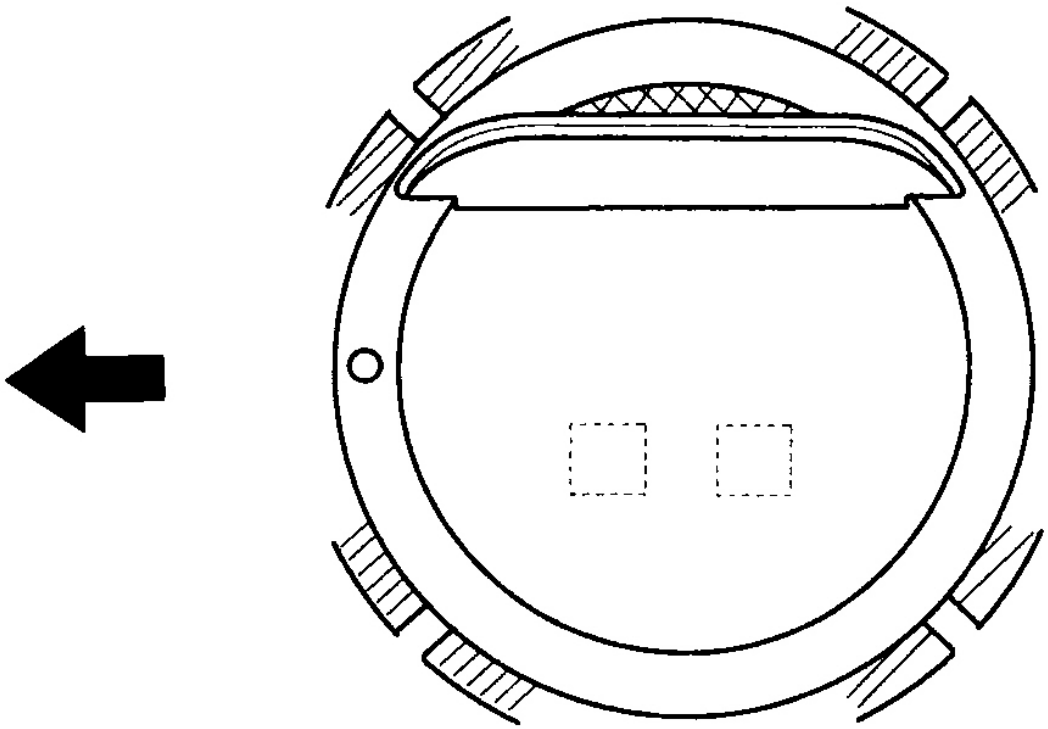


Fig. 171: Identifying Piston Front Mark And Connecting Rod Front Mark
Courtesy of HYUNDAI MOTOR CO.

2. Install piston rings.
    1. Install the oil ring spacer and 2 side rails by hand.
    2. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
    3. Position the piston rings so that the ring ends are as shown.

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Fig. 172: Identifying Piston Ring Ends
Courtesy of HYUNDAI MOTOR CO.

3. Install connecting rod bearings.
    1. Align the bearing claw with the groove of the connecting rod or connecting rod cap.
    2. Install the bearings(A) in the connecting rod and connecting rod cap(B).

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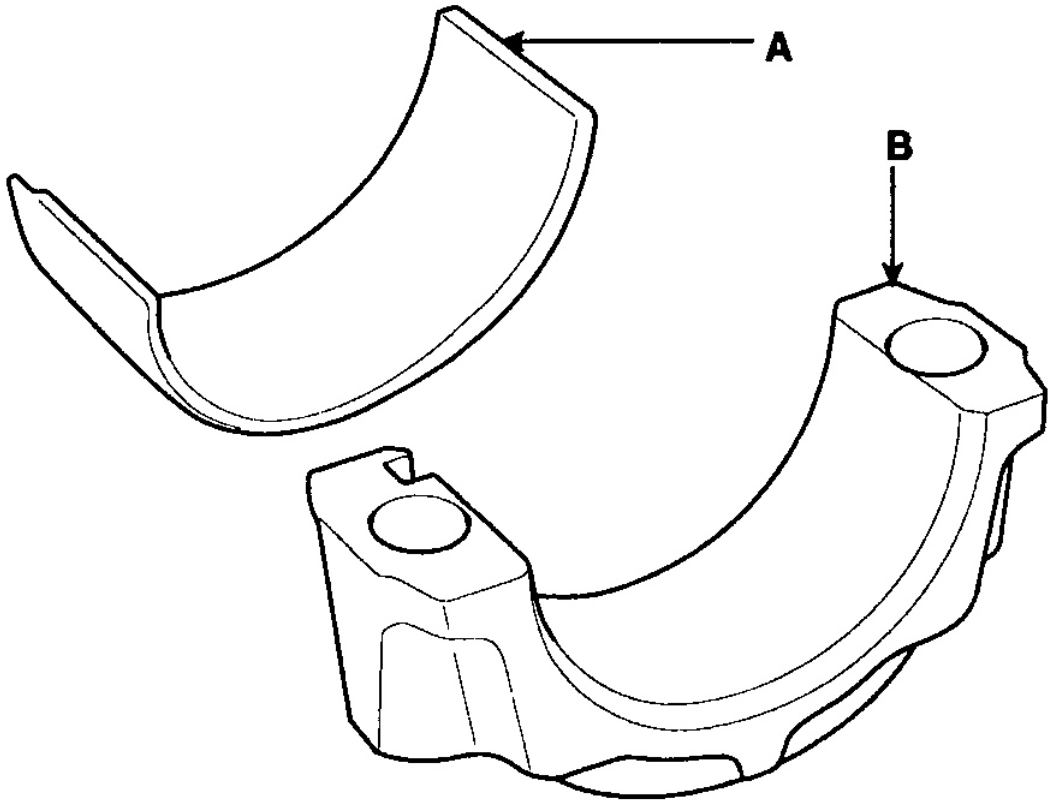


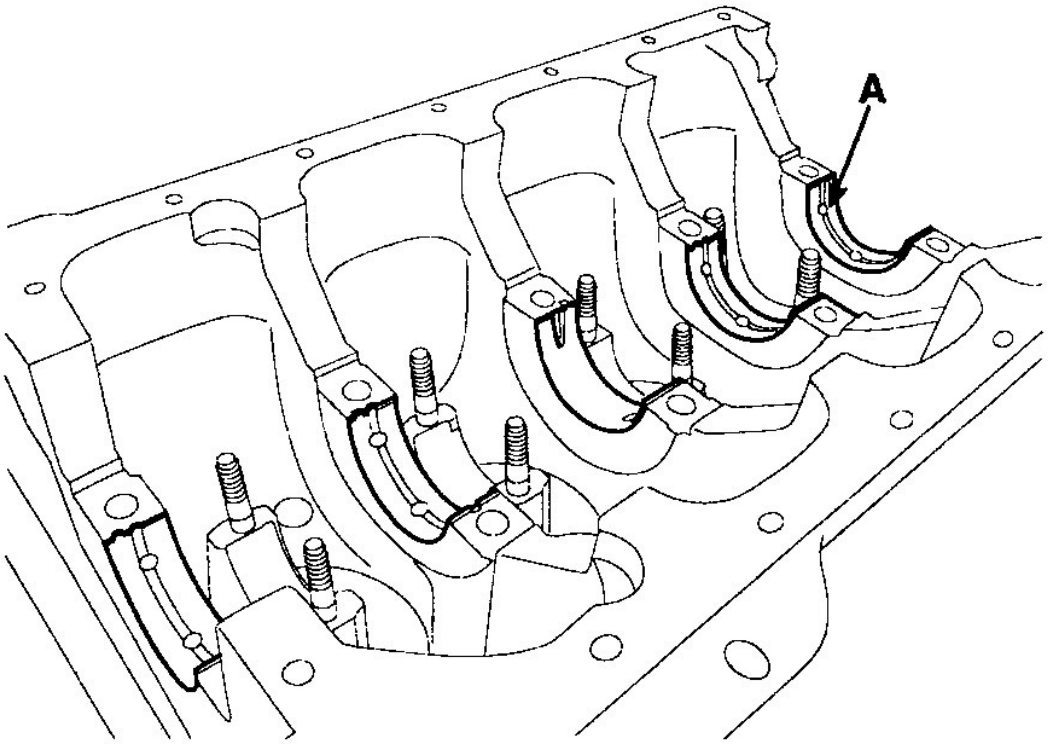
Fig. 173: Installing Bearings In Connecting Rod And Connecting Rod Cap
Courtesy of HYUNDAI MOTOR CO.

4. Install main bearings.

NOTE: Upper 1, 2, 4, 5 bearings have an oil groove of oil holes; Lower bearings do not.

1. Align the bearing claw with the claw groove of the cylinder block, push in the 5 upper bearings(A).

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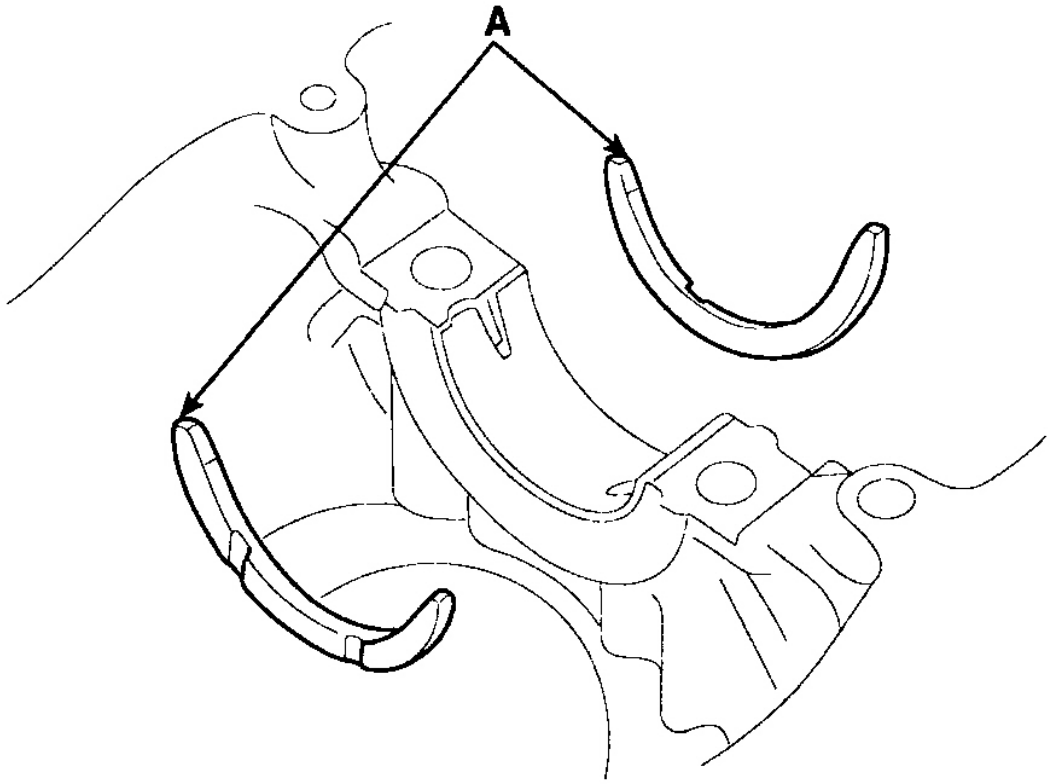
Fig. 174: Aligning Bearing Claw With Claw Groove Of Cylinder Block Pushing In 5 Upper Bearings
Courtesy of HYUNDAI MOTOR CO.

2. Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

5. Install thrust bearings.

   Install the 2 thrust bearings(A) under the No.3 journal position of the cylinder block with the oil grooves facing outward.

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Fig. 175: Installing Thrust Bearings
Courtesy of HYUNDAI MOTOR CO.

6. Place crankshaft on the cylinder block.
7. Place main bearing caps on cylinder block.
8. Install main bearing cap bolts.

Tightening torque

Main bearing cap bolt

28 ~ 32Nm (280 ~ 320kgf.cm, 20.6 ~ 23.6lb.ft) + 60° ~ 64°

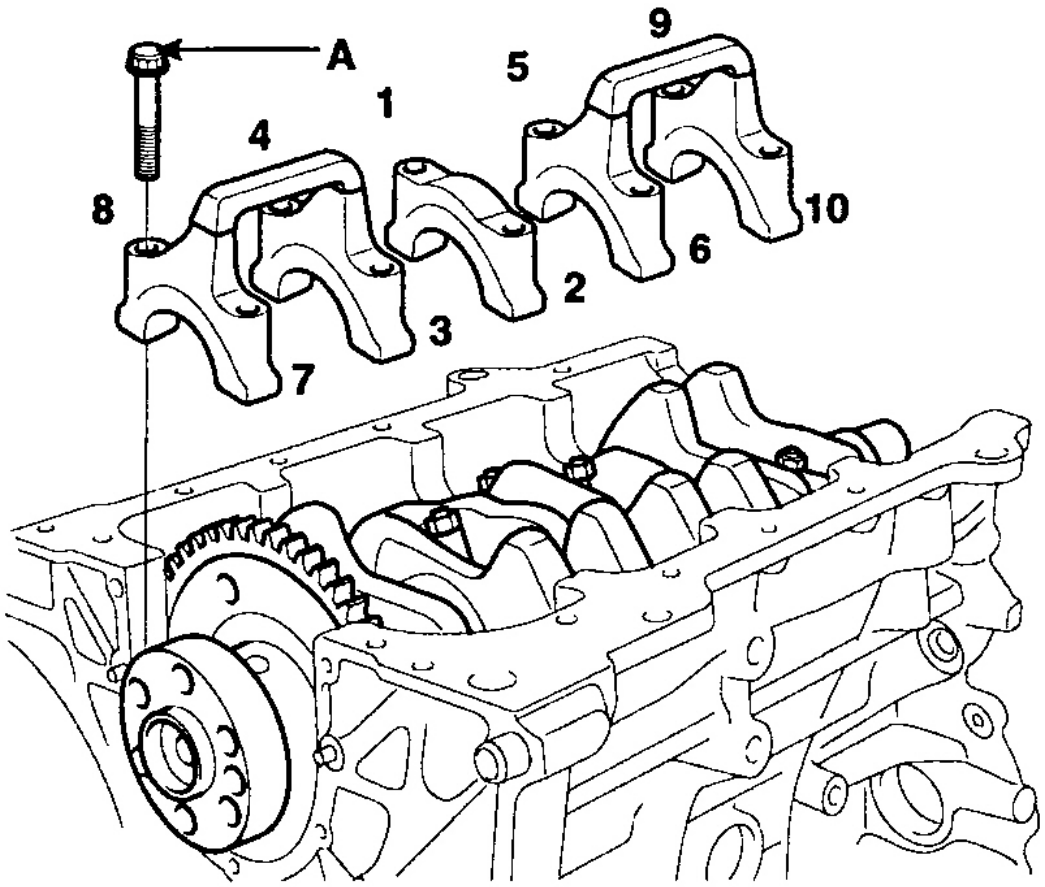
NOTE:

- **The main bearing cap bolts are tightened in 2 progressive steps.**
- **If any of the bearing cap bolts in broken or deformed, replace it.**

1. Apply a light coat of engine oil on the threads and under the bearing cap bolts.
2. Install and uniformly tighten the 10 bearing cap bolts(A), in several passes, in the sequence shown.

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Tightening torque: 30Nm (300kgf.cm, 22lbf.ft)



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Fig. 176: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of HYUNDAI MOTOR CO.

3. Retighten the bearing cap bolts by 60°~65° in the numerical order shown.
4. Check that the crankshaft turns smoothly.

9. Check crankshaft end play. (See 4)
10. Install piston and connecting rod assemblies.

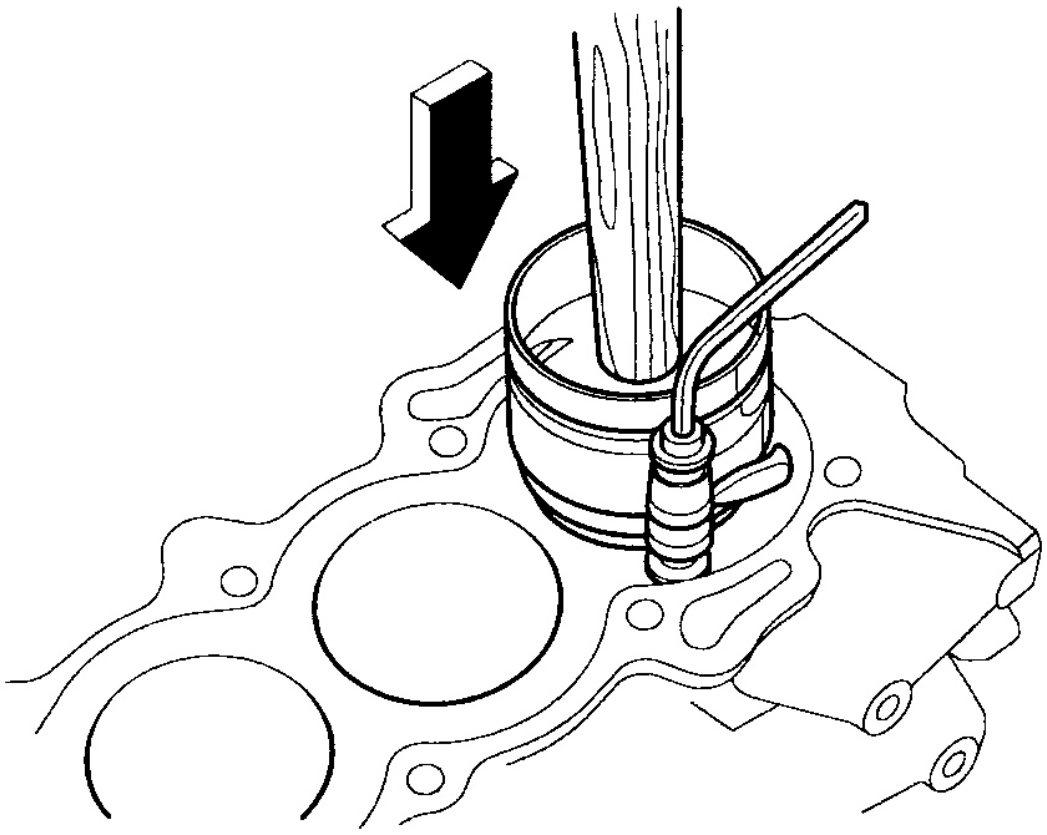
NOTE: Before installing the pistons, apply a coat of engine oil to the ring grooves and cylinder bores.

1. Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.

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2. Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
3. Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into place.
4. Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the nuts: 50 ~ 53Nm (500 ~ 530kgf.cm, 36.9 ~ 39lbf.ft)

NOTE: Maintain downward force on the ring compressor to prevent the rings from expanding before entering the cylinder bore.



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Fig. 177: Installing Piston And Connecting Rod Assemblies
Courtesy of HYUNDAI MOTOR CO.

11. Install a new gasket and rear oil seal case(A) with 5 bolts(B).

Tightening torque

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10 ~ 12Nm (100 ~ 120kgf.cm, 7.3 ~ 8.8lbf.ft)

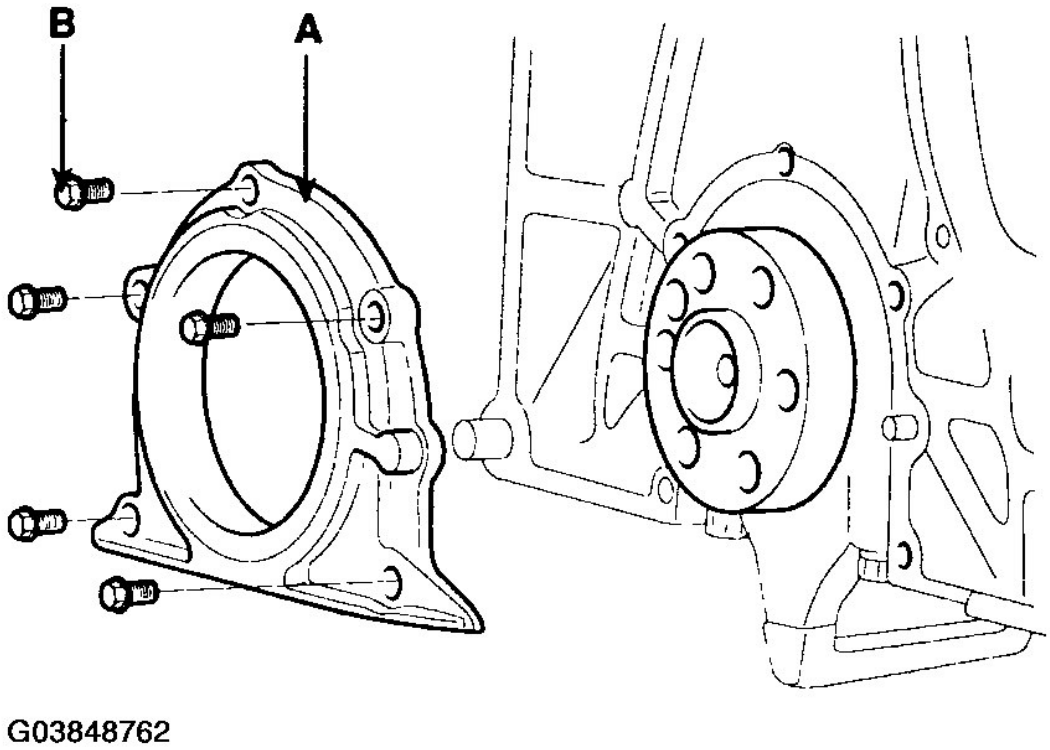


Fig. 178: Installing New Gasket And Rear Oil Seal Case With 5 Bolts
Courtesy of HYUNDAI MOTOR CO.

NOTE: Check that the mating surfaces are clean and dry.

12. Install rear oil seal.
    1. Apply engine oil to a new oil seal lip.
    2. Using SST(09231-21000) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

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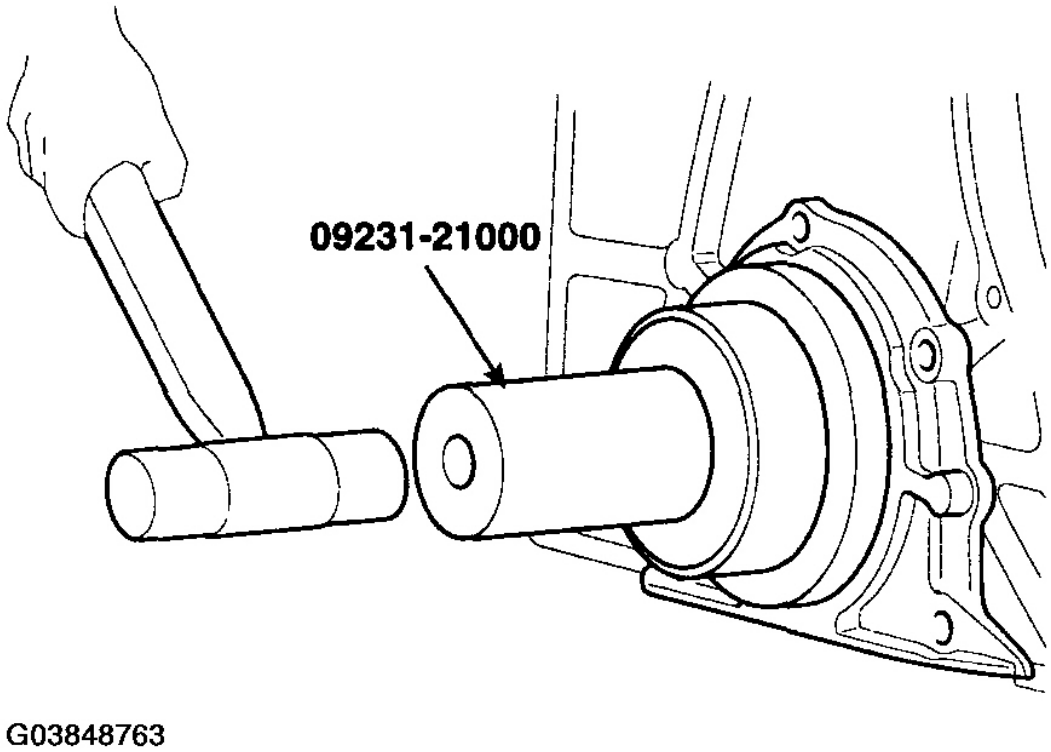


Fig. 179: Using SST (09231-21000) And Hammer, Tap In The Oil Seal Until Its Surface Is Flush With The Rear Oil Seal Retainer Edge
Courtesy of HYUNDAI MOTOR CO.

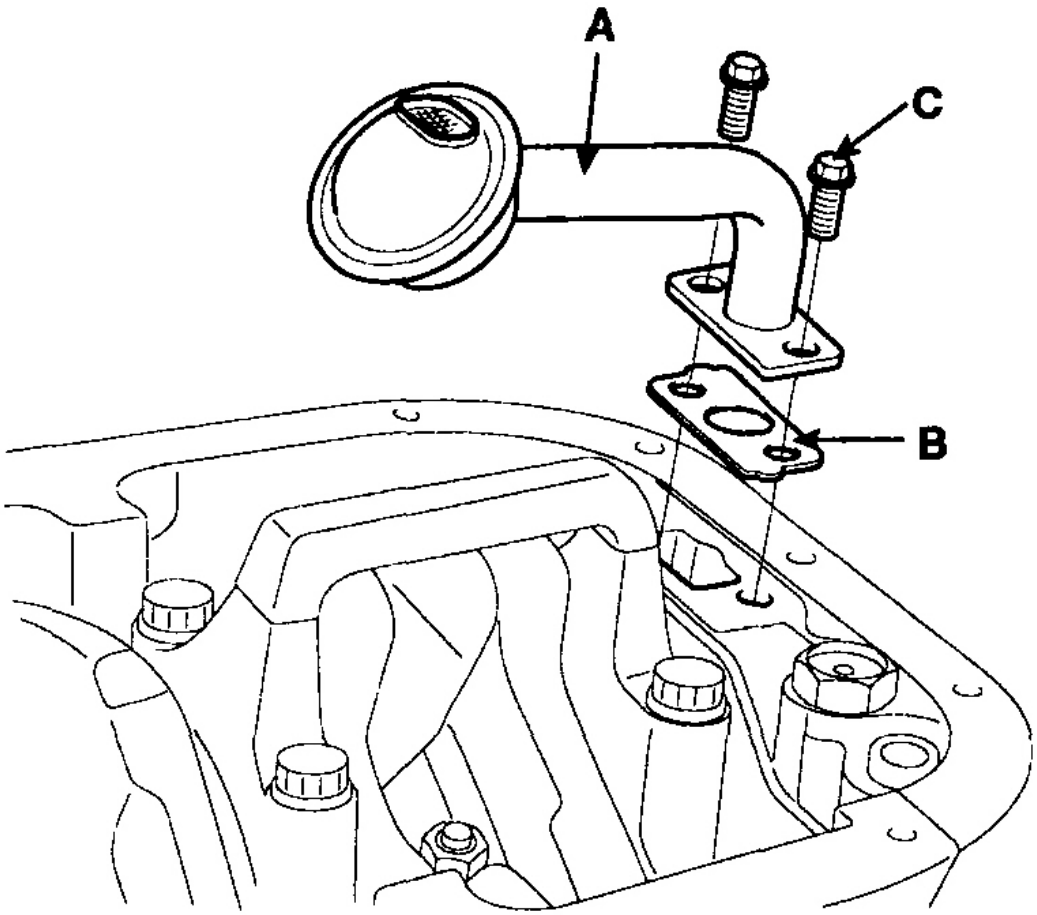
13. Install front case. (See **EXHAUST MANIFOLD**)
14. Install oil screen.

    Install a new gasket(A) and oil screen(B) with 2 bolts(C).

    Tightening torque

    15 ~ 22Nm (150 ~ 220kgf.cm, 11 ~ 16lbf.ft)

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Fig. 180: Installing New Gasket And Oil Screen With 2 Bolts
Courtesy of HYUNDAI MOTOR CO.

15. Install oil pan.
    1. Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

       NOTE: Check that the mating surfaces are clean and dry before applying liquid gasket.

    2. Apply liquid gasket as an even bead, centered between the edges of the mating surface. Use liquid gasket MS 721-40A or equivalent.

       NOTE:
       - **To prevent leakage of oil, apply liquid gasket to the inner**

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threads of the bolt holes.

- **Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.**
- **After assembly, wait at least 30 minutes before filling the engine with oil.**

3. Install the oil pan(A) with the 19 bolts.

   Uniformly tighten the bolts in several passes.

   Tightening torque

   10 ~ 12Nm (100 ~ 120kgf.cm, 7.3 ~ 8.8lbf.ft)

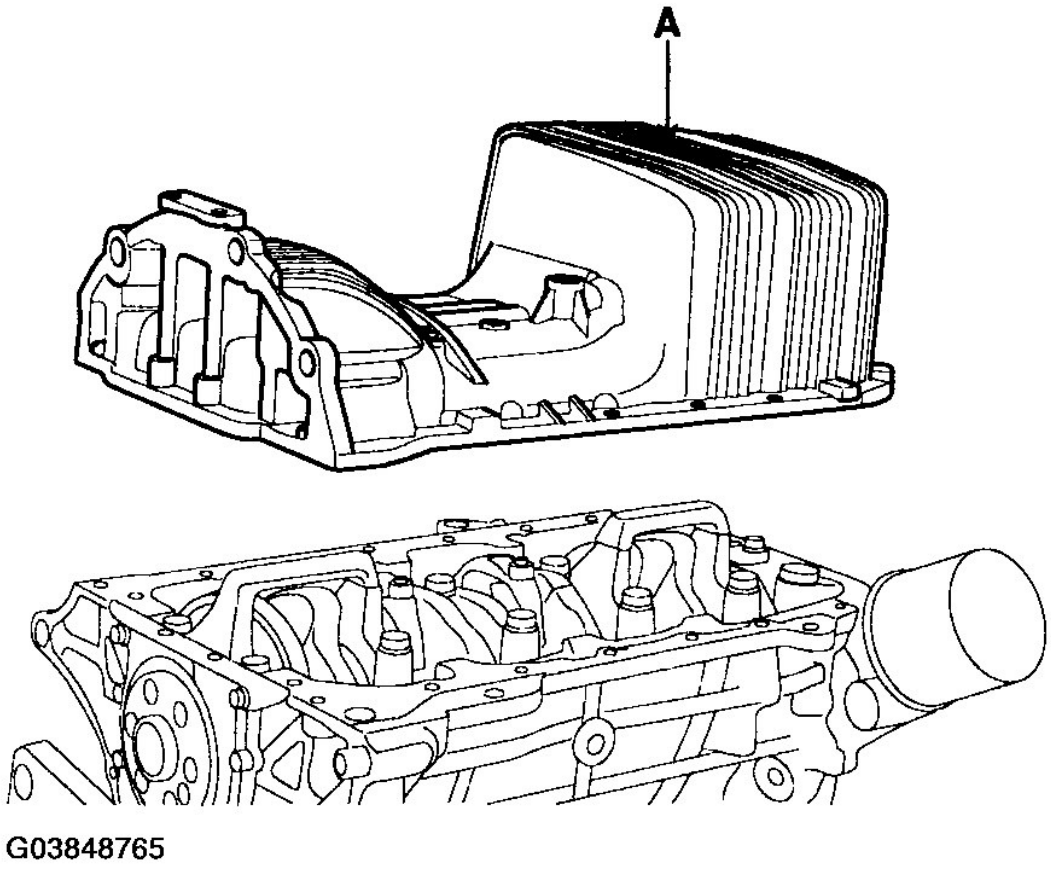


Fig. 181: Installing Oil Pan With 19 Bolts
Courtesy of HYUNDAI MOTOR CO.

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16. Install water pump. (See **INSTALLATION**)
17. Install oil pressure sensor.
    1. Apply adhesive to 2 or 3 threads.

       Adhesive: MS 721-39(B) or equivalent.

    2. Install the oil pressure sensor (A).

       Tightening torque

       15 ~ 22Nm (150 ~ 220kgf.cm, 11 ~ 16lbf.ft)

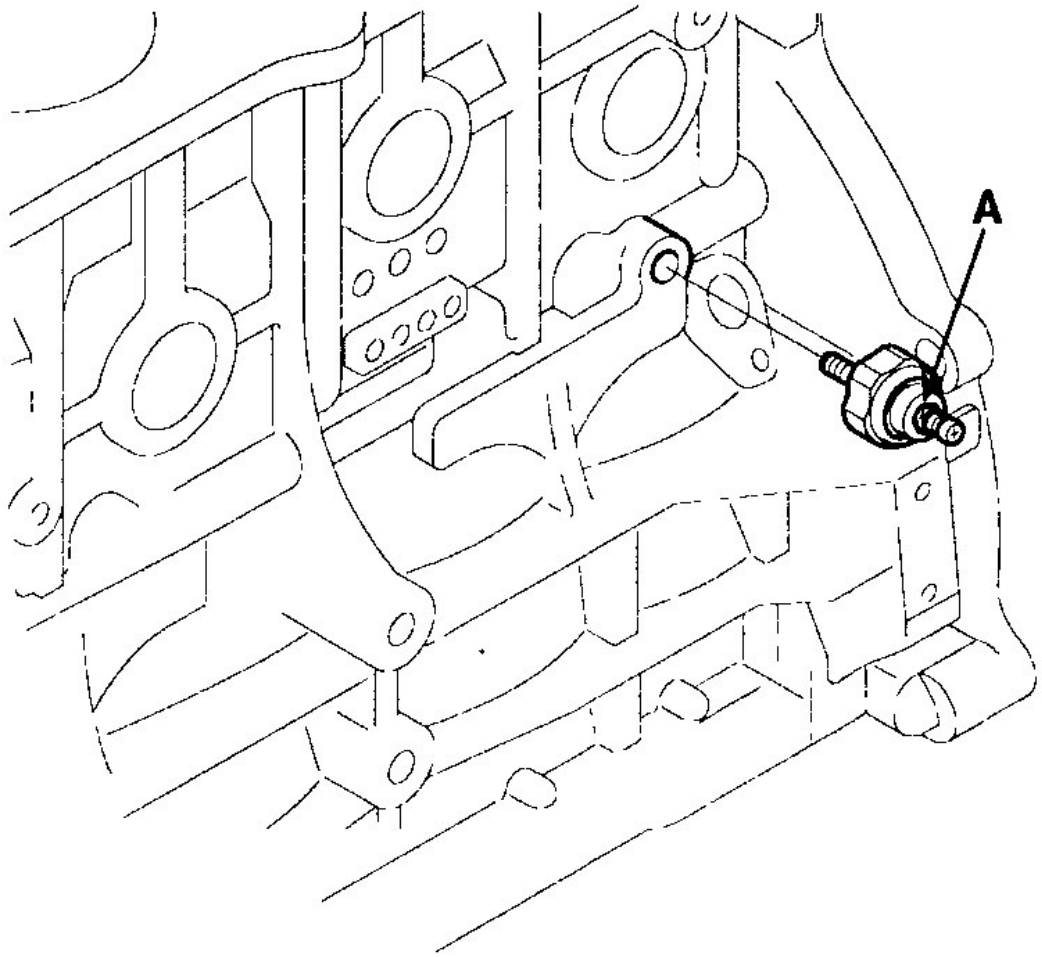


Fig. 182: Installing Oil Pressure Sensor

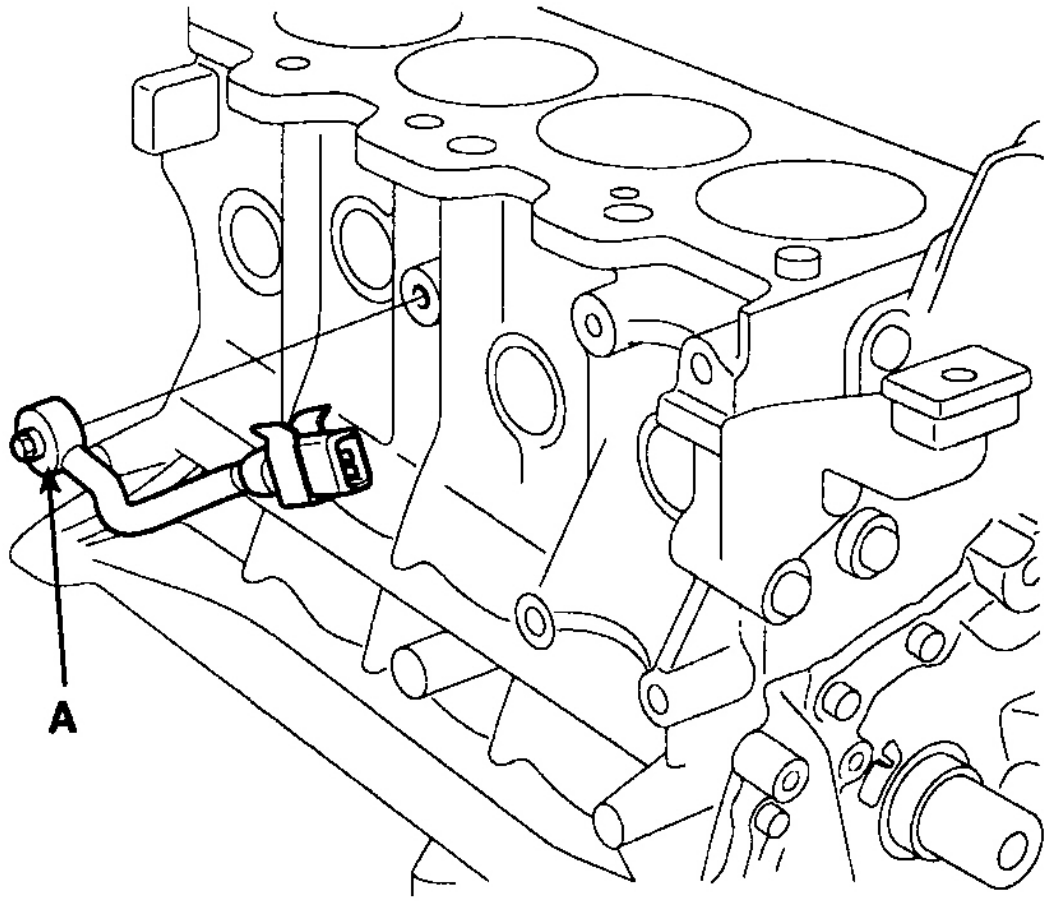
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Courtesy of HYUNDAI MOTOR CO.

18. Install knock sensor(A).

Tightening torque

17 ~ 27Nm (170 ~ 270kgf.cm, 12.5 ~ 20lbf.ft)



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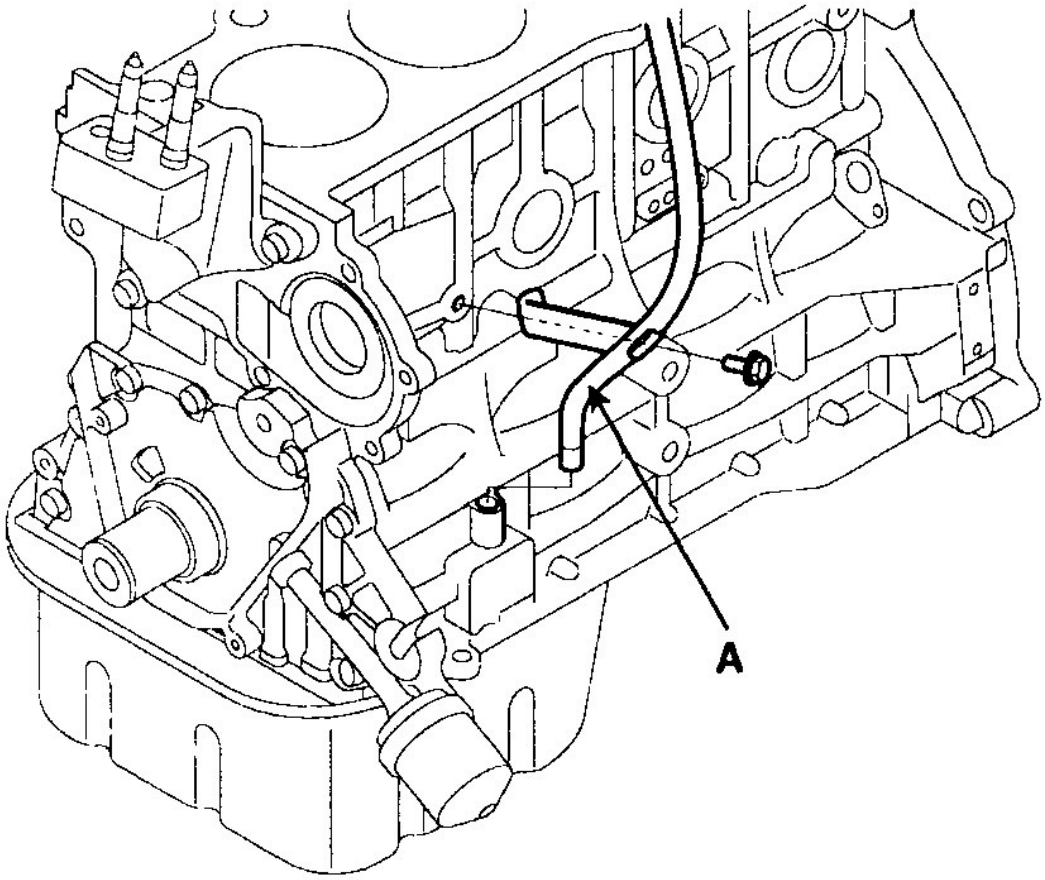
Fig. 183: Installing Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

19. Install oil level gauge assembly.
    1. Install a new O-ring on the oil level gauge.
    2. Apply engine oil on the O-ring.
    3. Install the oil level gauge assembly(A) with the bolt.

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Tightening torque

12 ~ 15Nm (120 ~ 150kgf.cm, 9 ~ 11lbf.ft)



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Fig. 184: Installing Oil Level Gauge Assembly With The Bolt
Courtesy of HYUNDAI MOTOR CO.

20. Install cylinder head. (See **INSTALLATION**)
21. Install timing belt. (See **INSPECTION**)
22. Remove engine stand.
23. A/T: Install drive plate.

Tightening torque

120 ~ 130Nm (1200 ~ 1300kgf.cm, 89 ~ 96lbf.ft)

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24. M/T: Install flywheel.

Tightening torque

120 ~ 130Nm (1200 ~ 1300kgf.cm, 89 ~ 96lbf.ft)

COOLING SYSTEM

COMPONENT

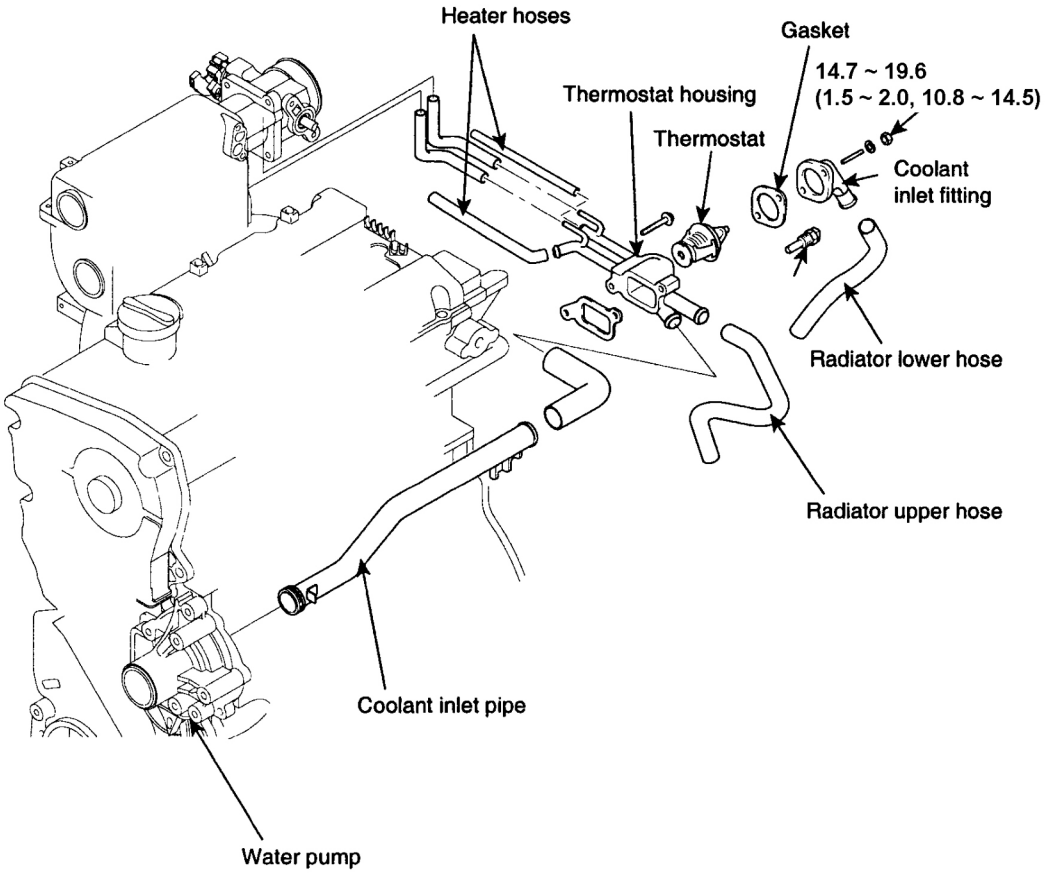


Fig. 185: Identifying Cooling System Components And Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

ENGINE COOLANT REFILLING AND BLEEDING

WARNING: Never remove the radiator cap when the engine is hot. Serious scalding

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could be caused by hot fluid under high pressure escaping from the radiator.

CAUTION: When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on the 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 radiator cap.
3. Loosen the drain plug, and drain the coolant.
4. Tighten the radiator drain plug(A) 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. Fill fluid mixture with coolant and water (4:6) slowly through the radiator cap. Push the upper/lower hoses of the radiator so as bleed air easily.

NOTE:

- **Use only genuine antifreeze/coolant.**
- **For best corrosion protection, the coolant concentration must be maintained year-round at 50% minimum. Coolant concentrations less than 50% may not provide sufficient protection against corrosion or freezing.**
- **Coolant concentrations greater then 60% will impair cooling efficiency and are not recommended.**

CAUTION:

- **Do not mix different brands of antifreeze/coolants.**
- **Do not use additional rust inhibitors or anti-rust products; they may not be compatible with the coolant.**

7. Start the engine and run coolant circulates.

   When the cooling fan operates and coolant circulates, refill coolant through the radiator cap.

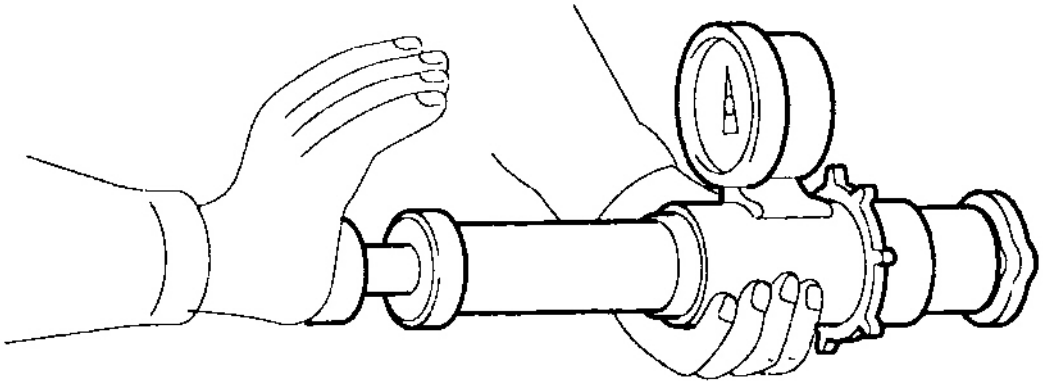
8. Repeat 7 until the cooling fan 3 ~ 5 times and bleed air sufficiently out of the cooling system.
9. Install the radiator cap and fill the reservoir tank to the "MAX" line with coolant.
10. Run the vehicle under idle until the cooling fan operates 2 ~ 3 times.
11. Stop the engine and wait coolant gets cool.
12. Repeat 6 to 11 until the coolant level doesn't fall any more, bleed air out of the cooling system.

NOTE: Recheck the coolant level in the reservoir tank for 2 ~ 3 days after replacing coolant.

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CAP TESTING

1. Remove the radiator cap, wet its seal with engine coolant, then install the no pressure tester.



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Fig. 186: Installing No Pressure Tester
Courtesy of HYUNDAI MOTOR CO.

2. Apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm^2 , 14 ~ 19psi)
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

TESTING

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install it on the pressure tester.
2. Apply a pressure tester to the radiator and apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm^2 14 ~ 18psi).
3. Inspect for engine coolant leaks and a drop in pressure.
4. Remove the tester and reinstall the radiator cap.

NOTE: Check for engine oil in the coolant and/or coolant in the engine oil.

REMOVAL

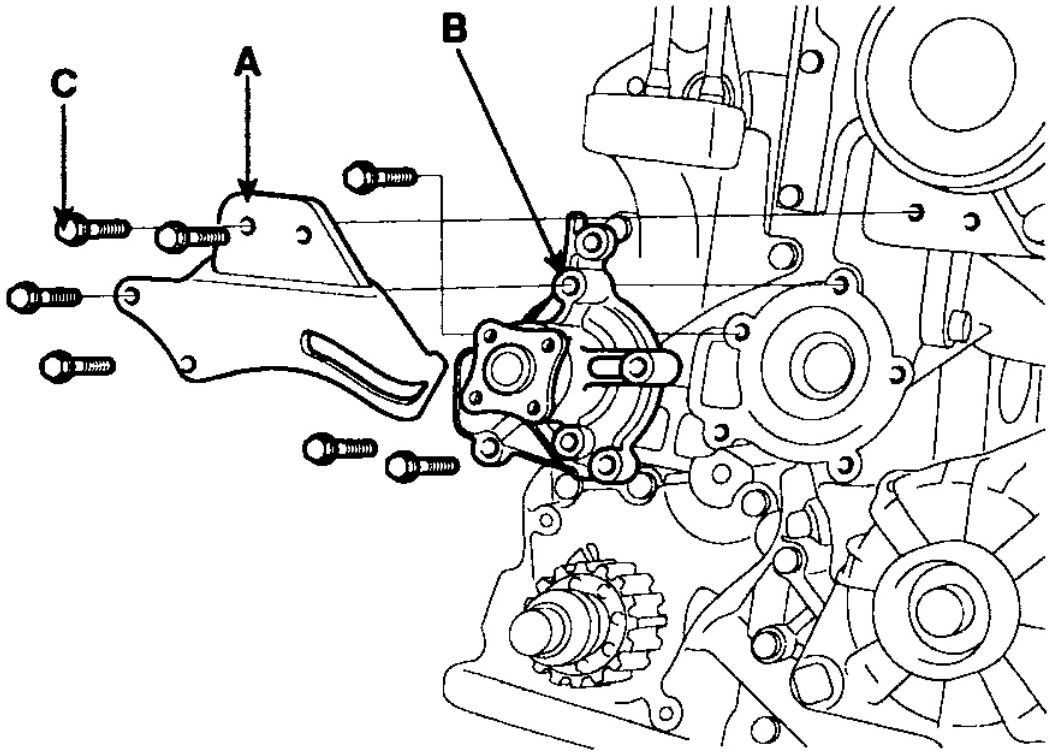
WATER PUMP

1. Drain the engine coolant.

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WARNING: System is under high pressure when the engine is hot. To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.

2. Remove drive belts.
3. Remove the timing belt. (See **REMOVAL**)
4. Remove the timing belt idler. (See 16)
5. Remove the water pump.
    1. Remove the 4 bolts and pump pulley.
    2. Remove the 2 bolts(C), then remove the alternator brace(A).
    3. Remove the water pump(B) and gasket.



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Fig. 187: Removing Water Pump
Courtesy of HYUNDAI MOTOR CO.

THERMOSTAT

NOTE: Removal of the thermostat would have an adverse effect, causing a lowering of

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cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. Drain engine coolant so its level is below thermostat.
2. Remove water inlet(A), gasket and thermostat.

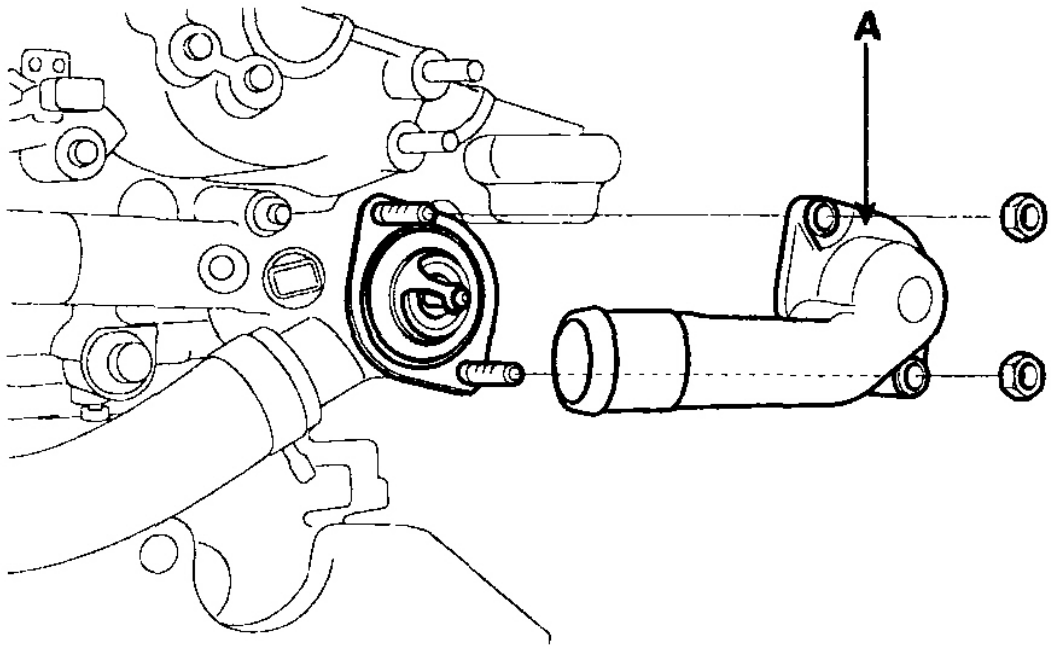


Fig. 188: Removing Water Inlet, Gasket And Thermostat
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

WATER PUMP

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.

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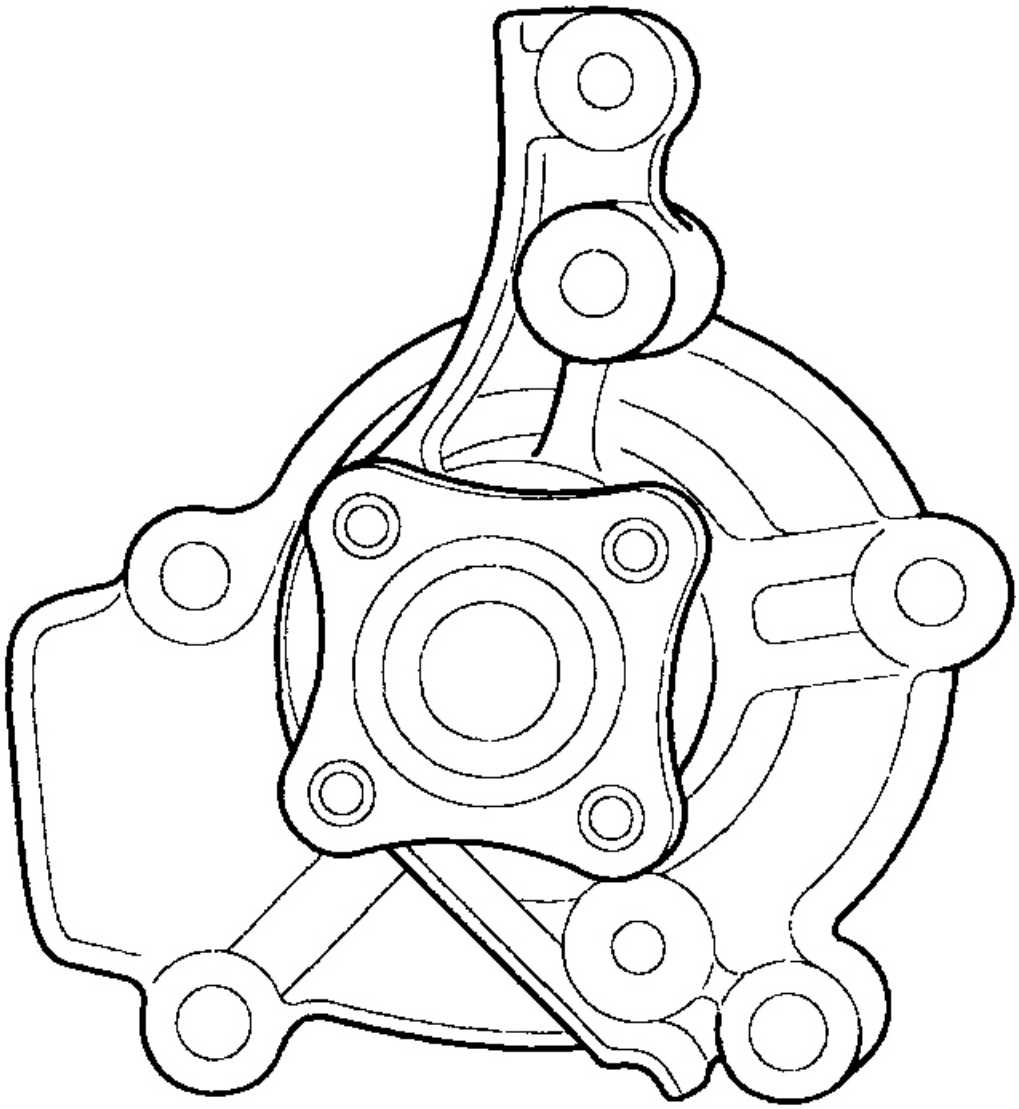


Fig. 189: Inspecting Water Pump For Damage
Courtesy of HYUNDAI MOTOR CO.

3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly

NOTE: A small amount of "weeping" from the bleed hole is normal.

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THERMOSTAT

1. Immerse the thermostat in water and gradually heat the water.

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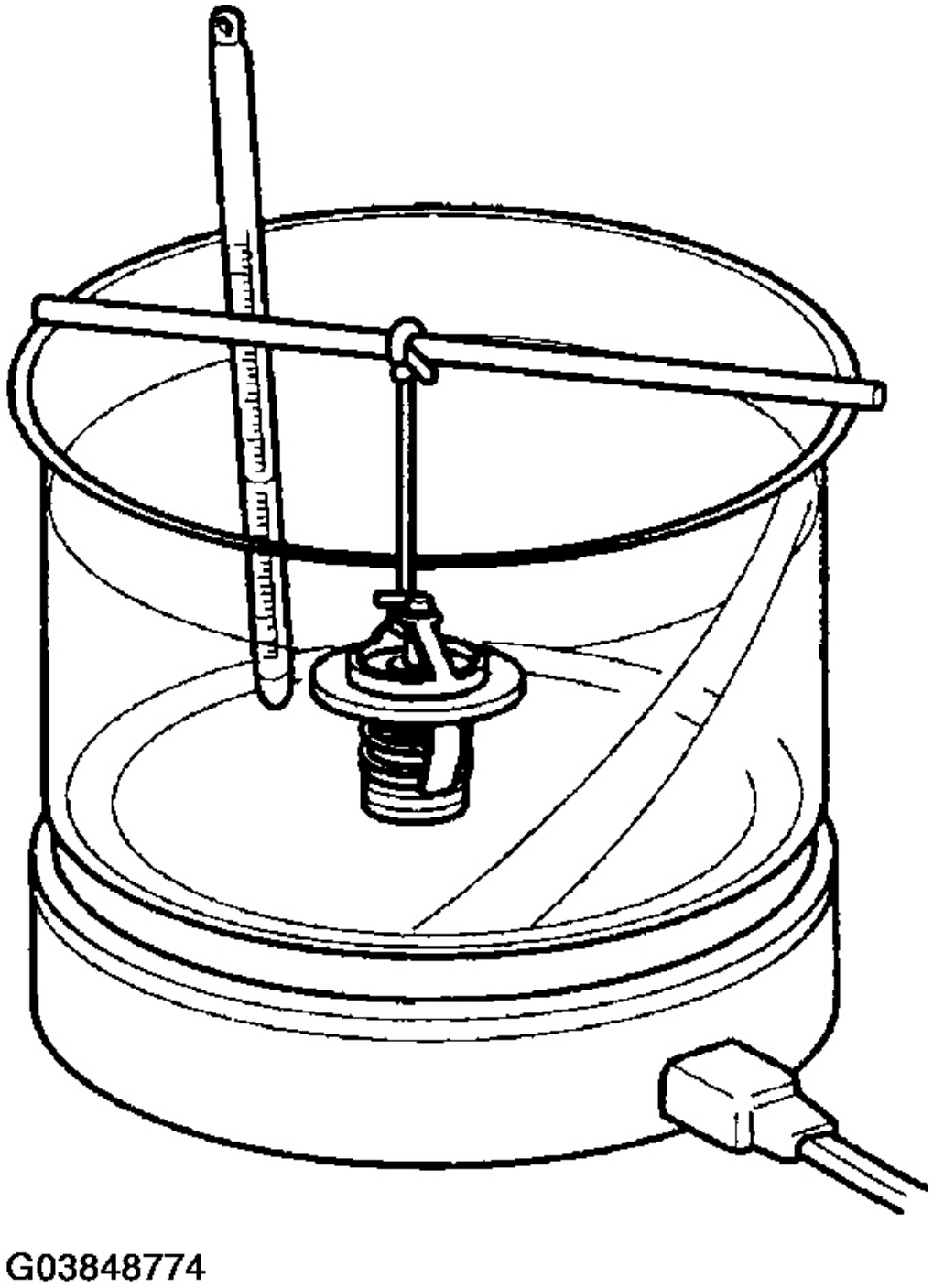


Fig. 190: Immersing Thermostat In Water
Courtesy of HYUNDAI MOTOR CO.

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2. Check the valve opening temperature.

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

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

   If the valve opening temperature is not as specified, replace the thermostat.

3. Check the valve lift.

   Valve lift: 8mm (0.3in.) or more at 95°C (205°F)

   If the valve lift is not as specified, replace the thermostat.

INSTALLATION

WATER PUMP

1. Install the water pump.
   1. Install the water pump(B) and a new gasket with the 3 bolts.

      Tightening torque

      20 ~ 27Nm (200 ~ 270kgf.cm, 15 ~ 20lbf.ft)

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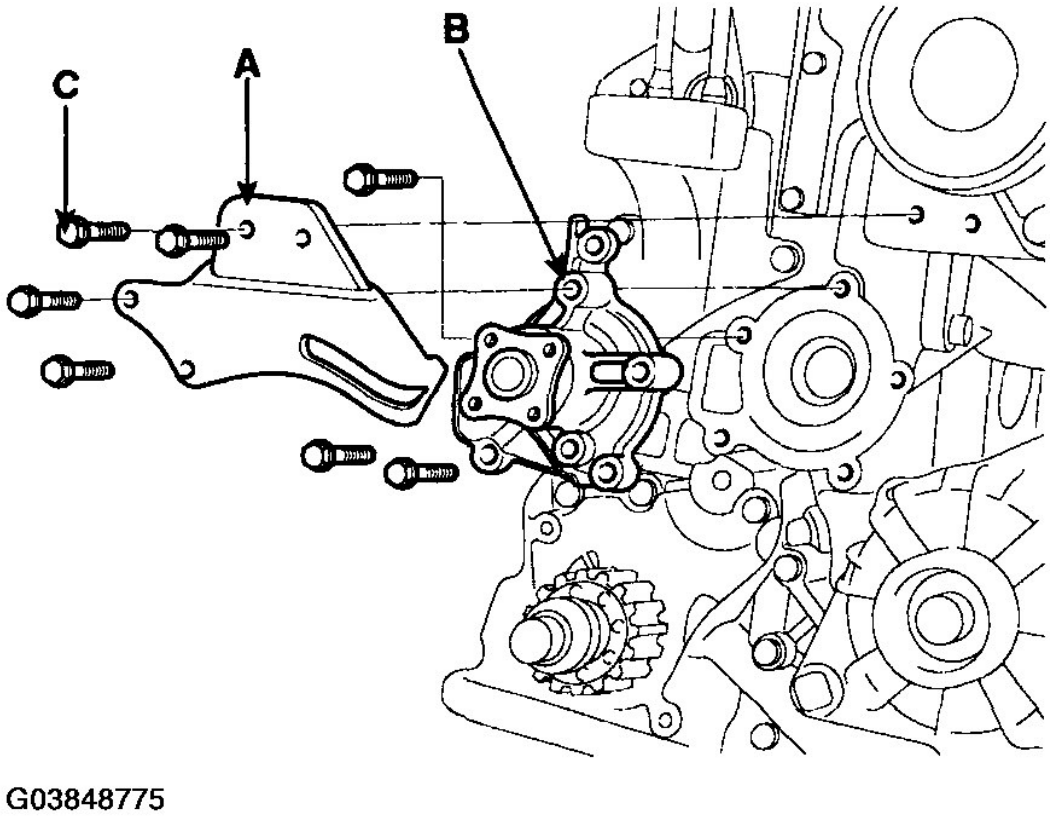


Fig. 191: Installing water pump, new gasket with 3 bolts
Courtesy of HYUNDAI MOTOR CO.

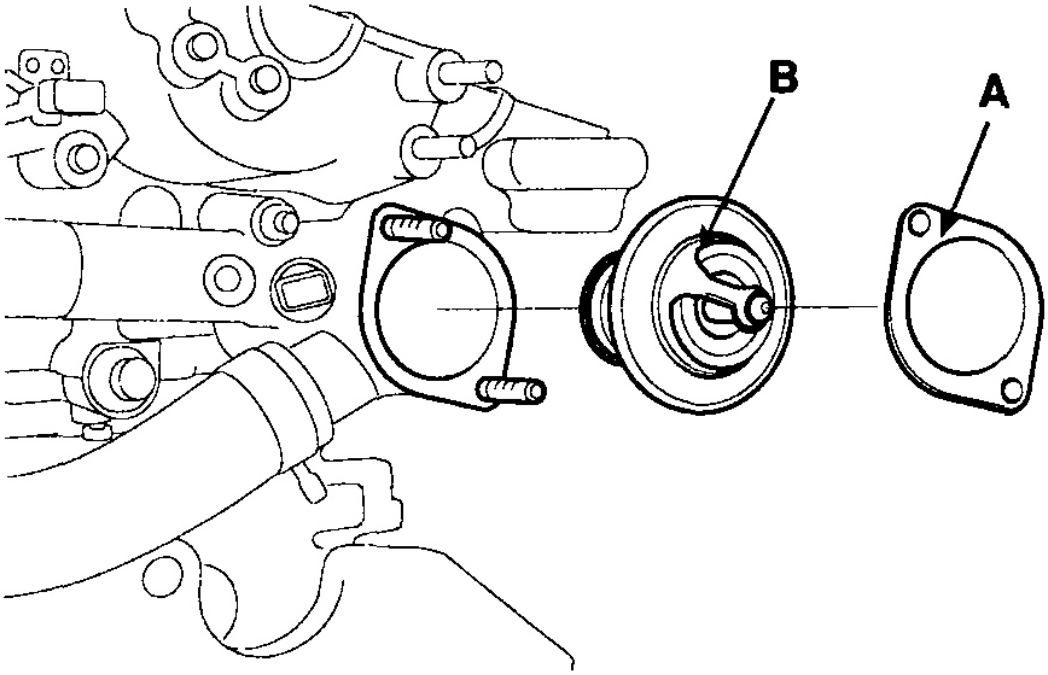
2. Install the alternator brace(A) with the 2 bolts(C).
3. Install the 4 bolts and pump pulley.

2. Install the timing belt idler. (See 5)
3. Install the timing belt. (See **INSPECTION**)
4. Install drive belts.
5. Fill with engine coolant.
6. Start engine and check for leaks.
7. Recheck engine coolant level.

THERMOSTAT

1. Place thermostat in thermostat housing.
    1. Install the thermostat with the jiggle valve upward.
    2. Install a new gasket(A) to the thermostat(B).

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Fig. 192: Installing New Gasket To Thermostat
Courtesy of HYUNDAI MOTOR CO.

2. Install water inlet(A).

Tightening torque

15 ~ 20Nm (150 ~ 200kgf.cm, 9 ~ 14lbf.ft)

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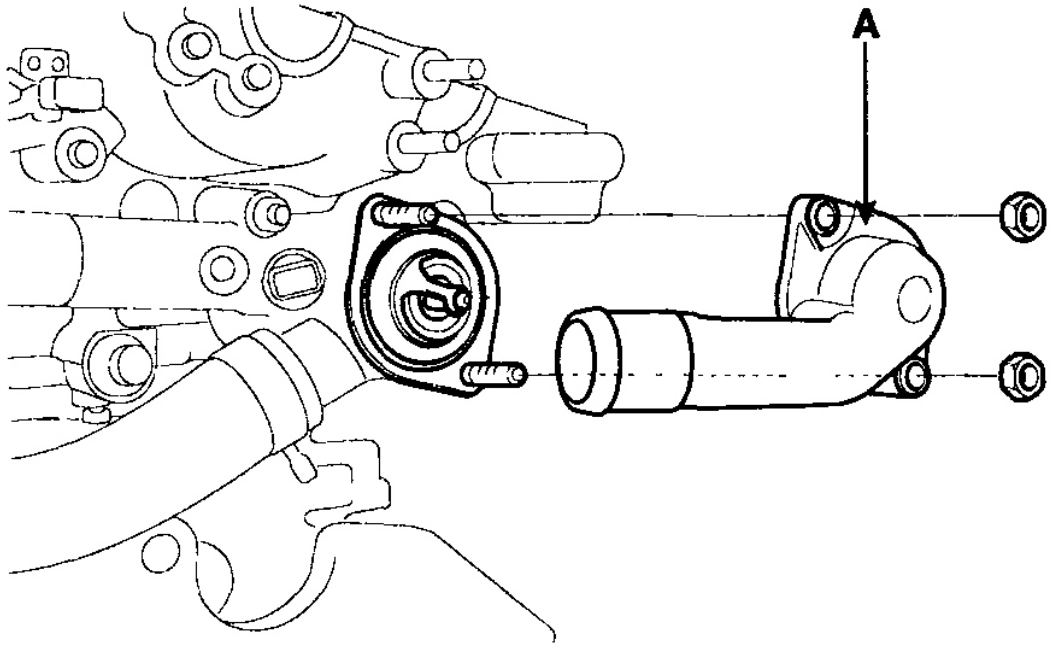


Fig. 193: Installing Water Inlet
Courtesy of HYUNDAI MOTOR CO.

3. Fill with engine coolant.
4. Start engine and check for leaks.

LUBRICATION SYSTEM

COMPONENT

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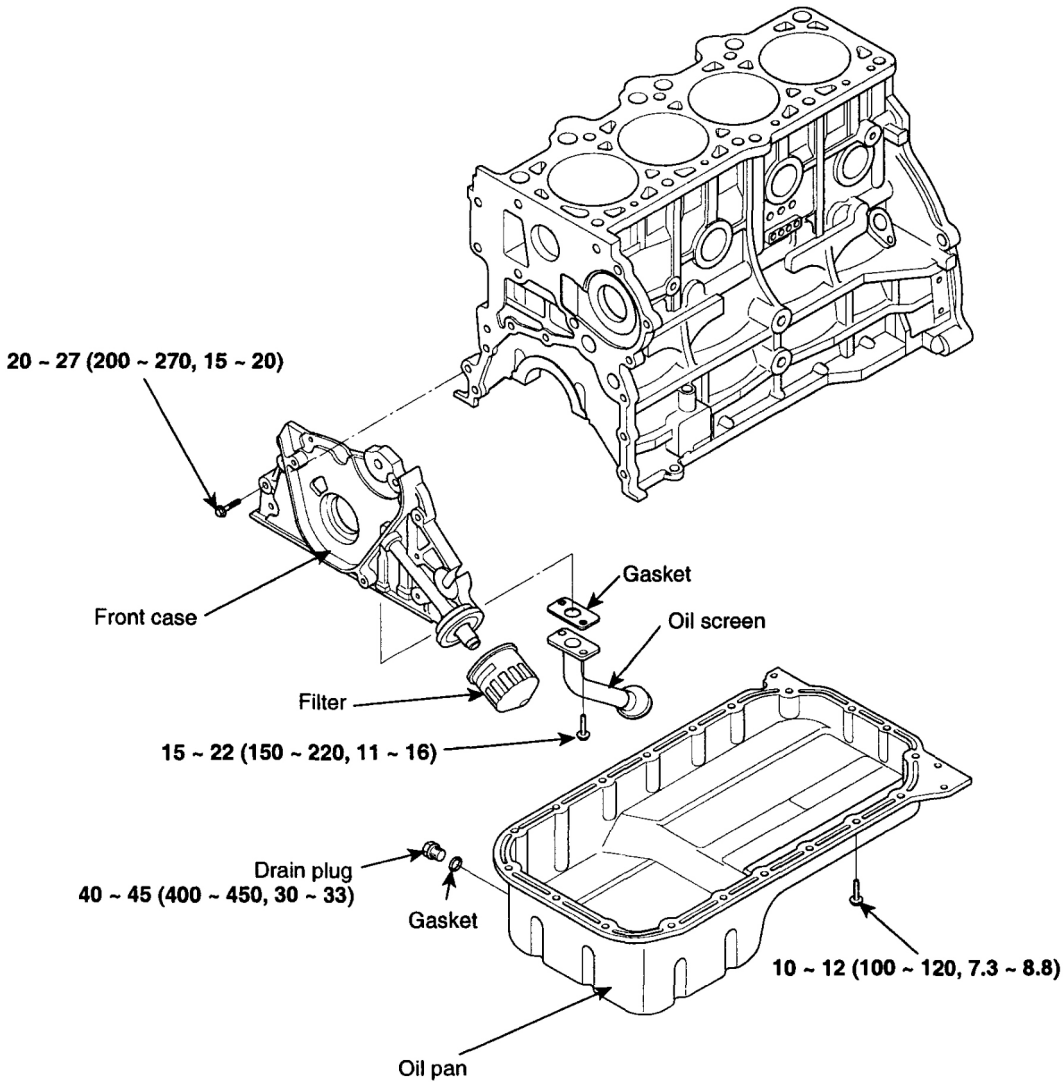


Fig. 194: Identifying Lubrication System Components And Torque Specifications (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

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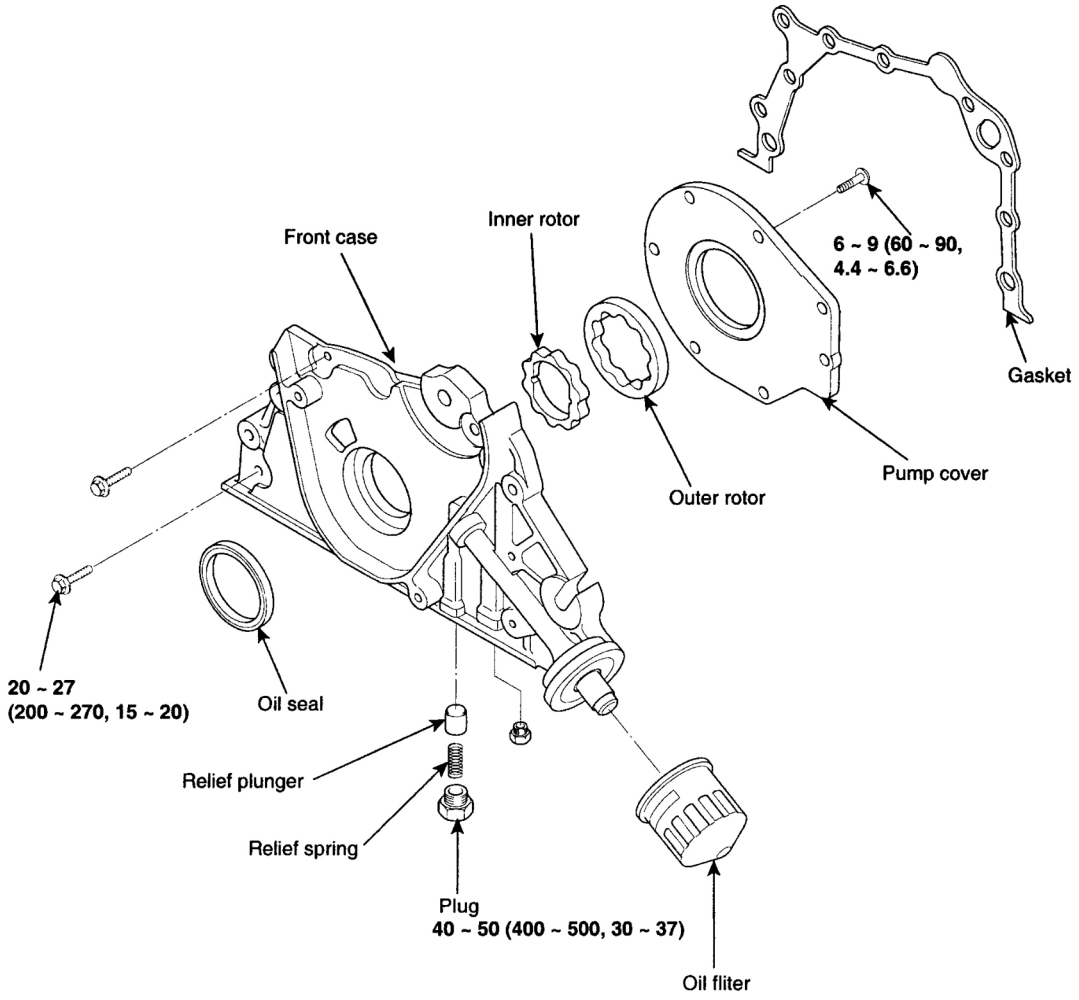


Fig. 195: Identifying Lubrication System Components Torque Specifications (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

OIL AND FILTER

CAUTION:

- **Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.**
- **Exercise caution in order to minimize the length and frequency of contact of your skin to used oil. Wear protective clothing and gloves. Wash your skin thoroughly with soap and water, or use water-less hand cleaner, to remove any used engine oil. Do not use gasoline,**

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thinners, or solvents.

- **In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.**

1. Drain engine oil.
   a. Remove the oil filter cap.
   b. Remove the oil drain plug, and drain the oil into a container.
2. Replace oil filter.
   a. Remove the oil filter.
   b. Check and clean the oil filter installation surface.
   c. Check the part number of the new oil filter is as same as old one.
   d. Apply clean engine oil to the gasket of a new oil filter.
   e. Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
   f. Tighten it an additional 3/4 turn.
3. Refill with engine oil filter.
   a. Clean and install the oil drain plug with a new gasket.

      Tightening torque

      40 ~ 45Nm (400 ~ 450kgf.cm, 30 ~ 33lbf.ft)

   b. Fill with fresh engine oil

      Capacity

      Drain and refill

      W/Oil filter change: 4.0I (4.23U.S.qts, 3.52lmp qts)

      W/O Oil filter change: 3.7I (3.90U.S.qts, 3.26lmp qts)

   c. Install the oil filter cap.
4. Start engine and check for oil leaks.
5. Recheck engine oil level.

INSPECTION

1. Check engine oil quality

   Check the oil for deterioration, entry of water, discoloring or thinning.

   If the quality is visibly poor, replace the oil.

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2. Check engine oil level.

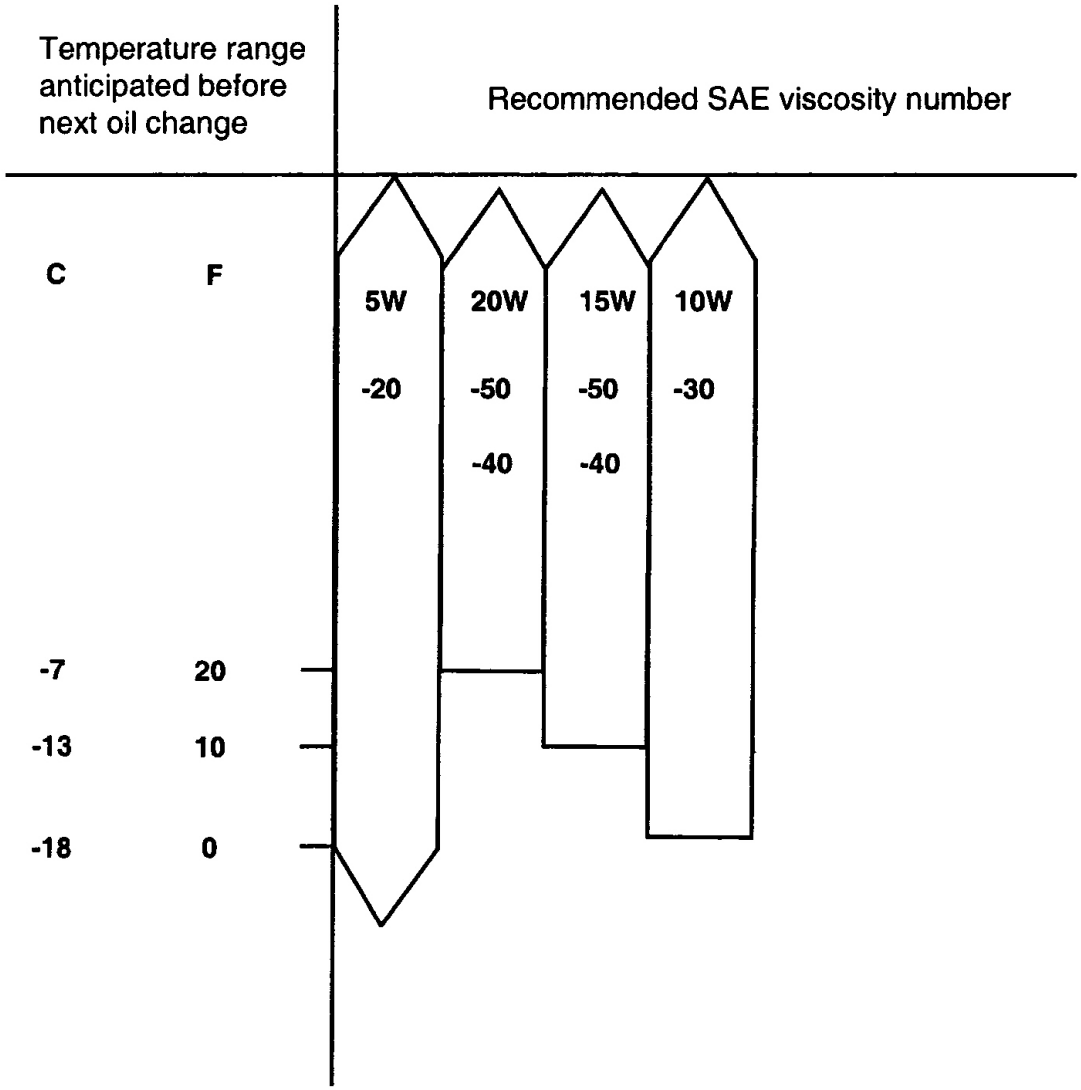
   After warming up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "F" marks on the dipstick.

   If low, check for leakage and add oil up to the "F" mark.

   NOTE: Do not fill with engine oil above the "F" mark.

SELECTION OF ENGINE OIL

RECOMMENDED API CLASSIFICATION: SH OR ABOVE



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Fig. 196: Recommended SAE Viscosity Grades Chart
Courtesy of HYUNDAI MOTOR CO.

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

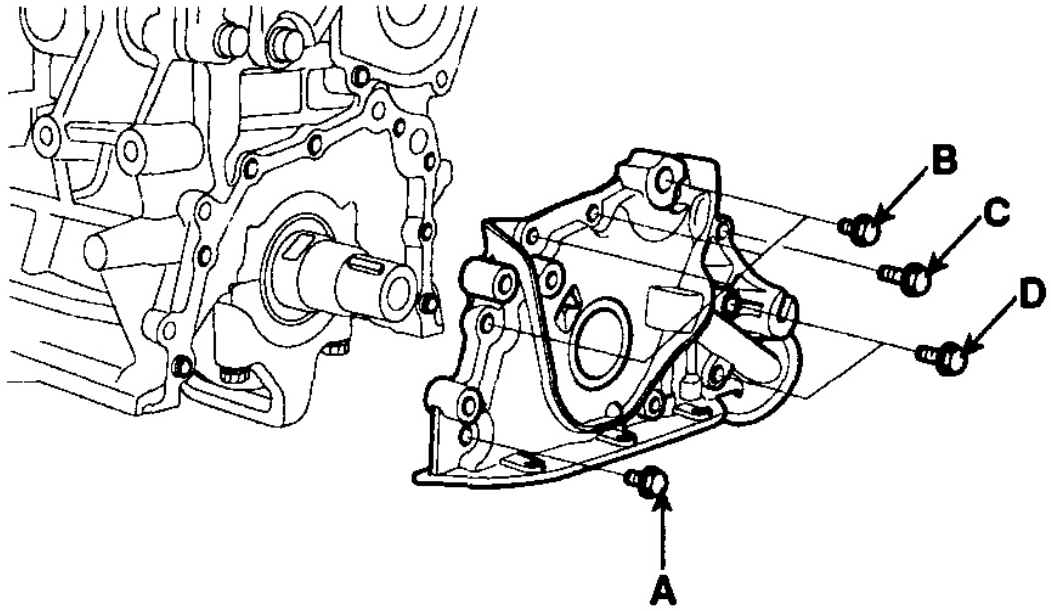
- **Satisfy the requirement of the API classification.**
- **Have proper SAE grade number for expected ambient temperature range.**

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

REMOVAL

1. Drain engine oil.
2. Remove the drive belts.
3. Turn the crankshaft and align the white groove on the crankshaft pulley with the pointer on the lower cover. (See 4)
4. Remove the timing belt. (See **REMOVAL**)
5. Remove the oil pan and oil screen. (See step 10 for oil pan and step 11 for oil screen.)
6. Remove the front case.

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Fig. 197: Removing Front Case
Courtesy of HYUNDAI MOTOR CO.

1. Remove the screws(B) from the pump housing, then separate the housing and cover(A).

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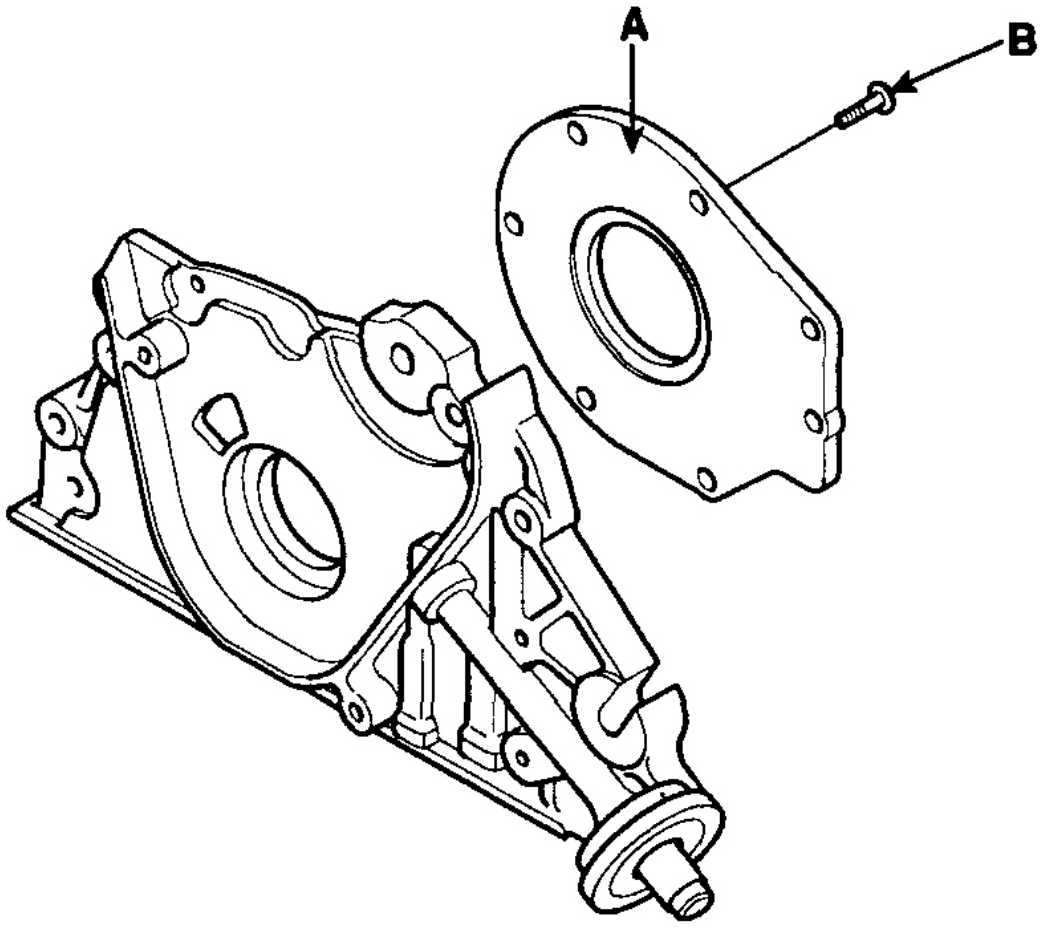
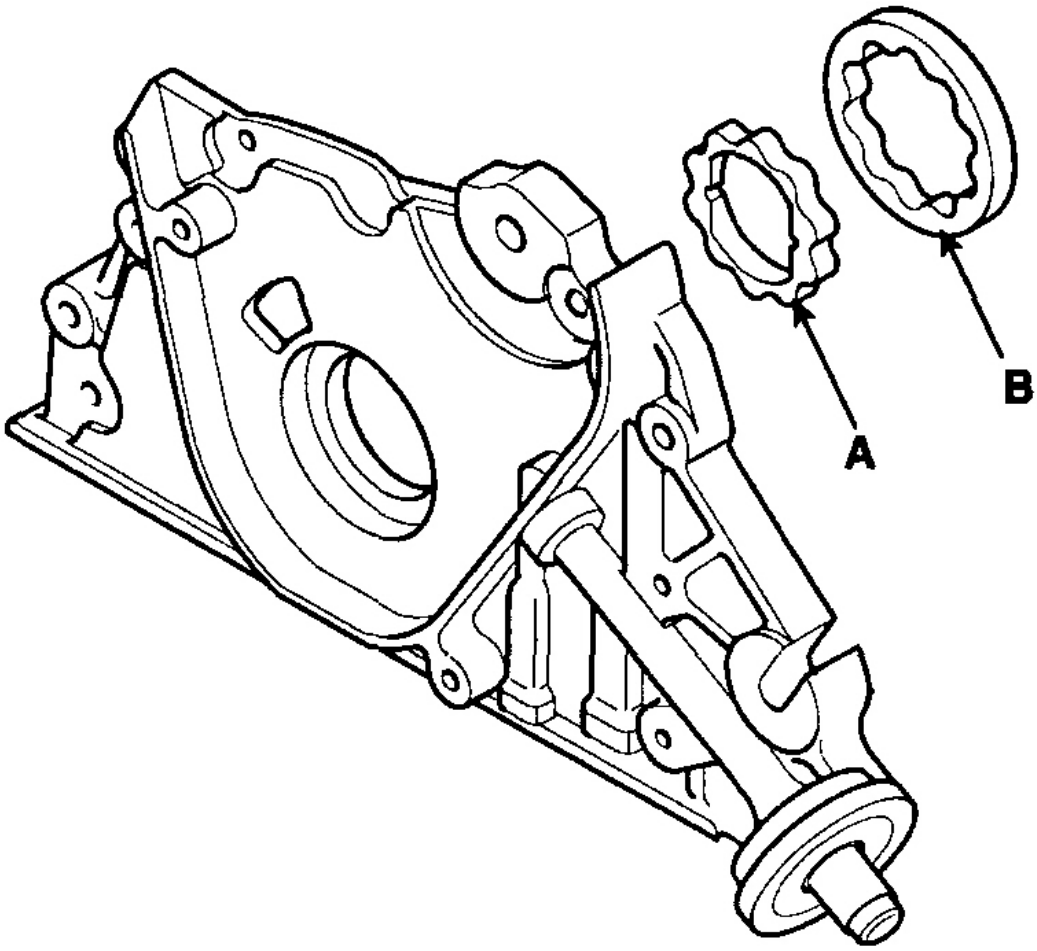


Fig. 198: Removing Screws From Pump Housing And Separating Housing And Cover
Courtesy of HYUNDAI MOTOR CO.

2. Remove the inner(A) and outer(B) rotors.

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Fig. 199: Removing Inner And Outer Rotors
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Remove the relief plunger.

   Remove the plug(A), spring(B) and relief plunger(C).

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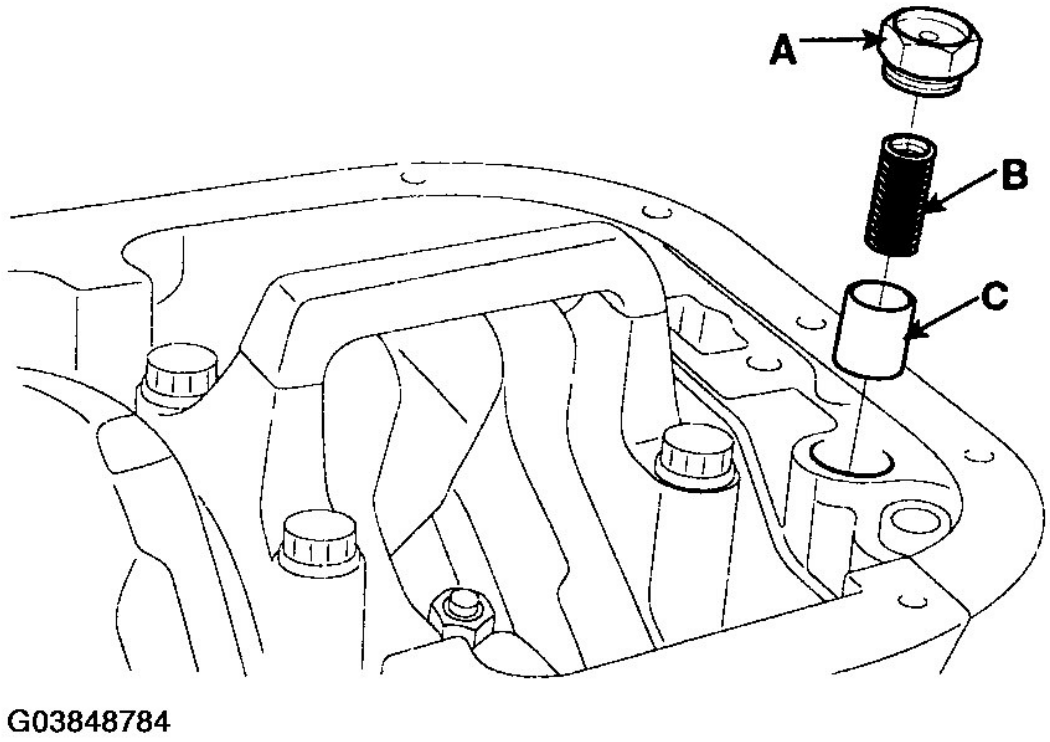


Fig. 200: Removing Plug, Spring And Relief Plunger
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

1. Inspect relief plunger.

   Coat the valve with engine oil and check that it falls smoothly into the plunger hole by its own weight.

   If it does not, replace the relief plunger. If necessary, replace the front case.

2. Inspect relief valve spring.

   Inspect for distorted or broken relief valve spring.

   Standard value

   Free height: 43.8mm (1.724 in.)

   Load: 3.7+/-0.4kg/40.1mm (8.14+/-0.88lb/1.579 in.)

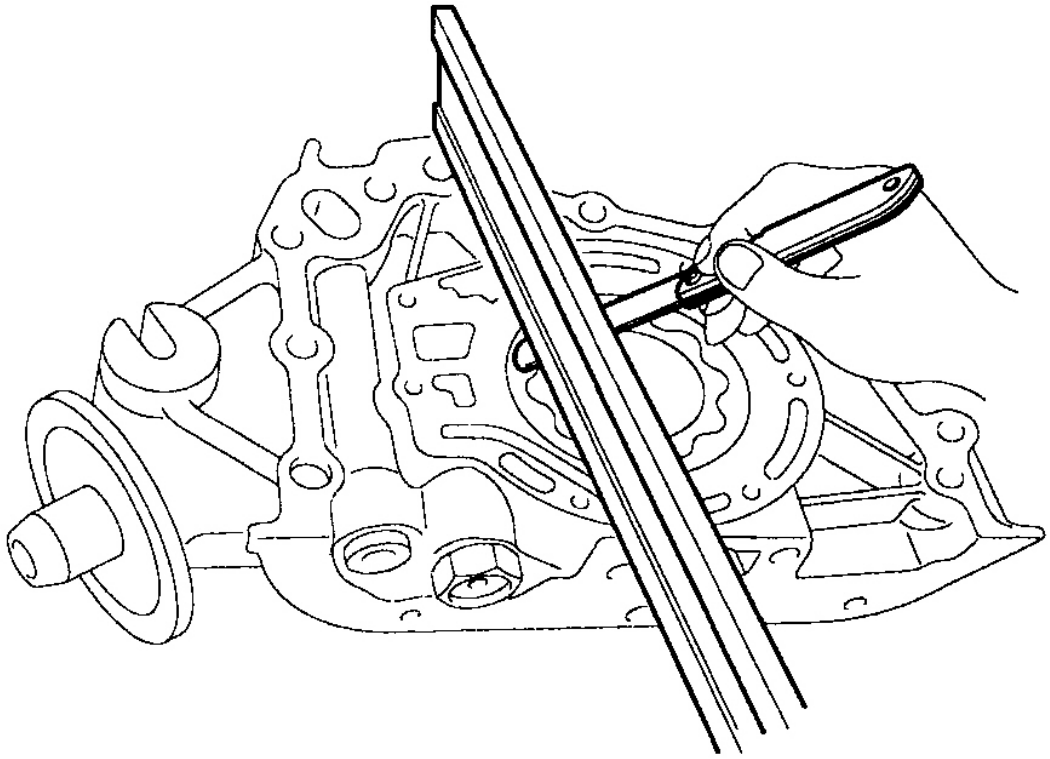
3. Inspect rotor side clearance.

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Using a feeler gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.

ROTOR SIDE CLEARANCE SPECIFICATION

Side clearance	Outer gear	0.04 ~ 0.09mm (0.0016 ~ 0.0035in.)
	Inner gear	0.04 ~ 0.085mm (0.0016 ~ 0.0033in.)



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Fig. 201: Using Feeler Gauge And Precision Straight Edge To Measure Clearance Between Rotors And Precision Straight Edge
Courtesy of HYUNDAI MOTOR CO.

If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front case.

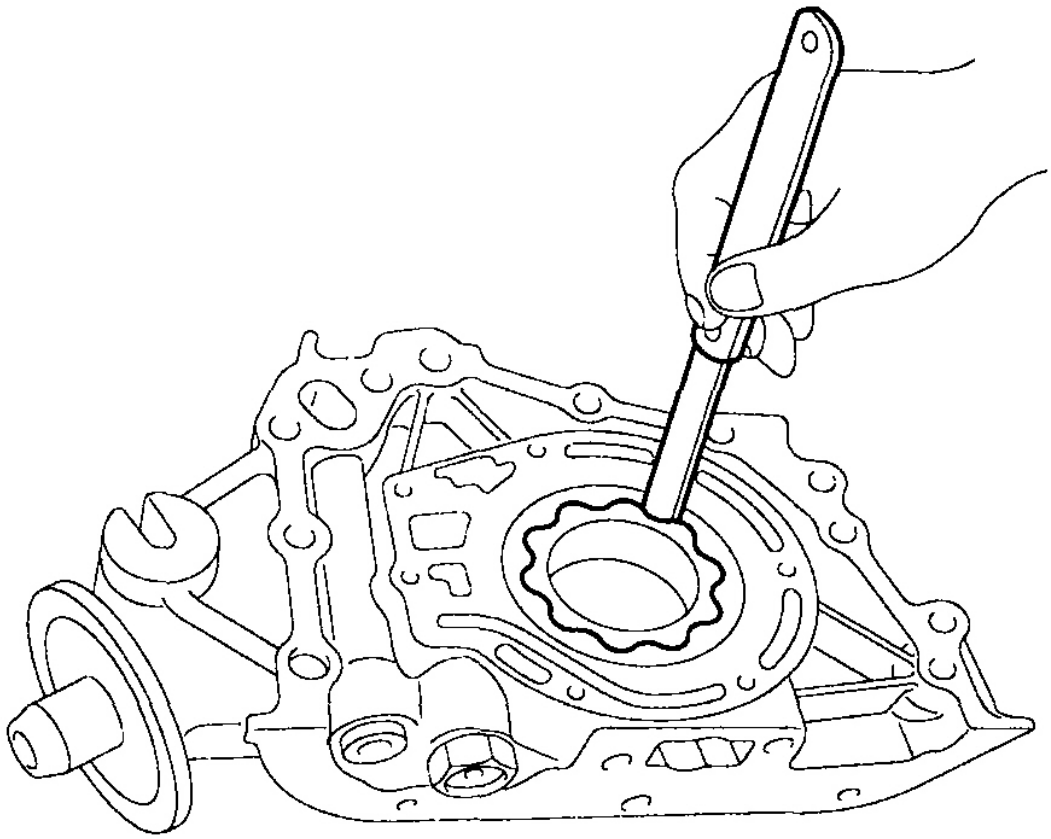
4. Inspect rotor tip clearance.

   Using a feeler gauge, measure the tip clearance between the inner and outer rotor tips.

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Tip clearance

0.025 ~ 0.069 mm(0.0010 ~ 0.0027 in.)



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Fig. 202: Using Feeler Gauge To Measure Tip Clearance Between Inner And Outer Rotor Tips
Courtesy of HYUNDAI MOTOR CO.

If the tip clearance is greater than maximum, replace the rotor as a set.

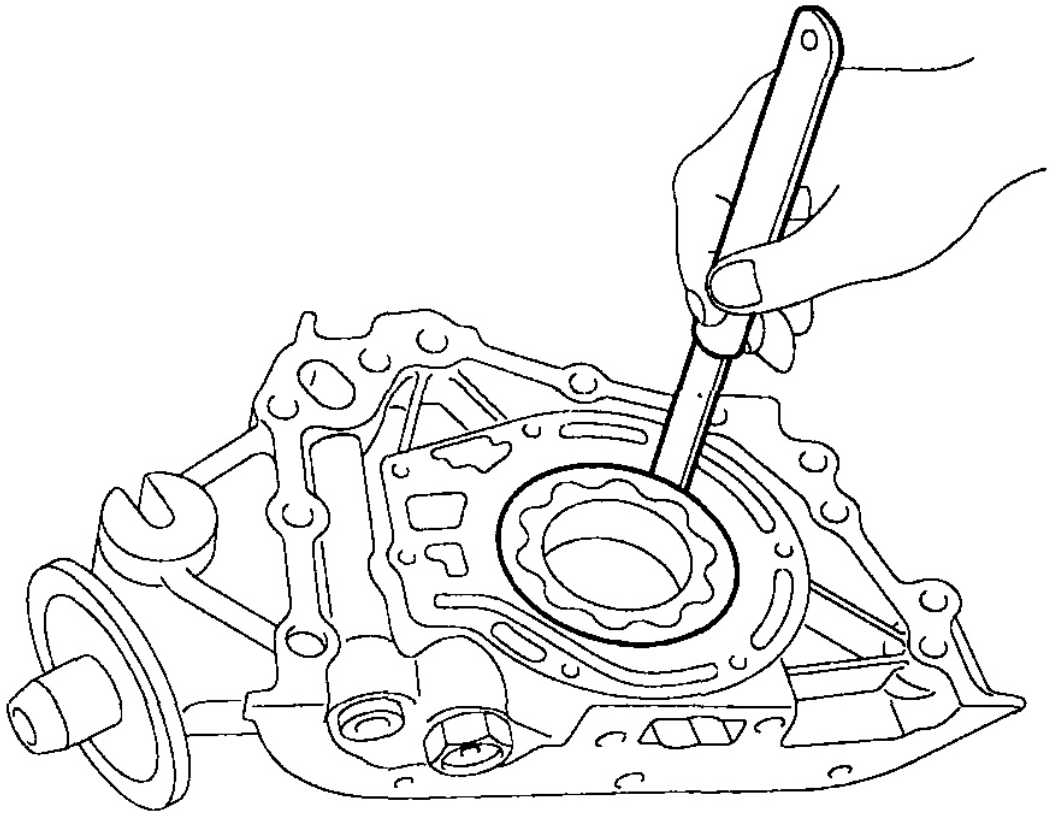
5. Inspect rotor body clearance.

   Using a feeler gauge, measure the clearance between the outer rotor and body.

   Body clearance

   0.12 ~ 0.185 mm(0.0047 ~ 0.0073 in.)

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Fig. 203: Using Feeler Gauge To Measure Clearance Between Outer Rotor And Body
Courtesy of HYUNDAI MOTOR CO.

If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front case.

REASSEMBLY

1. Install relief plunger.

   Install relief plunger(A) and spring(B) into the front case hole, and install the plug(A).

   Tightening torque

   40 ~ 50Nm (400 ~ 500kgf.cm, 30 ~ 37lbf.ft)

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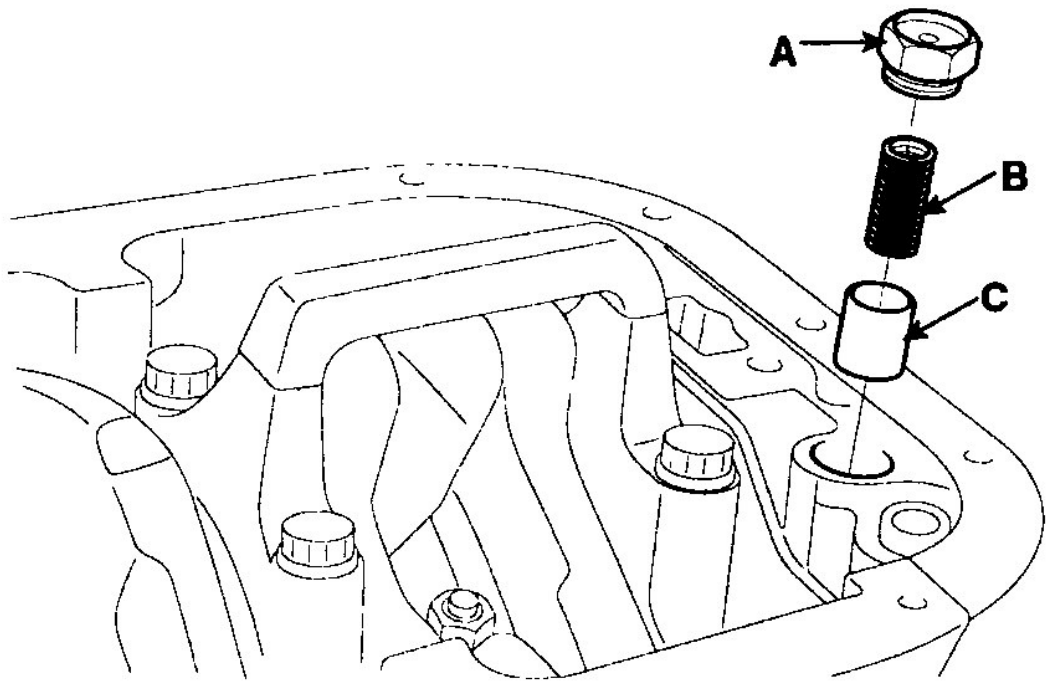


Fig. 204: Installing Relief Plunger And Spring Into Front Case Hole And Installing Plug
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

1. Install oil pump.
    1. Place the inner and outer rotors into front case with the marks facing the oil pump cover side.
    2. Install the oil pump cover(A) to front case with the 7 screws(B).

    Tightening torque

    6 ~ 9Nm (60 ~ 90kgf.cm, 4.4 ~ 6.6lbf.ft)

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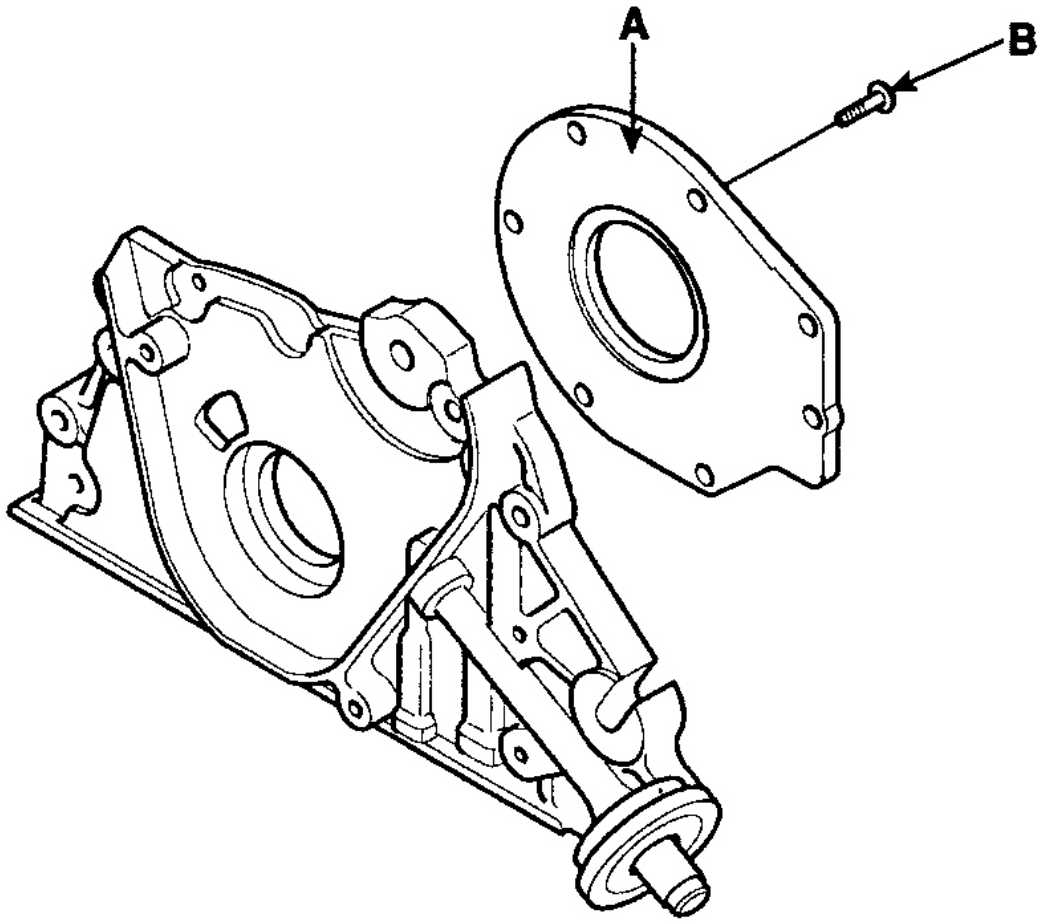
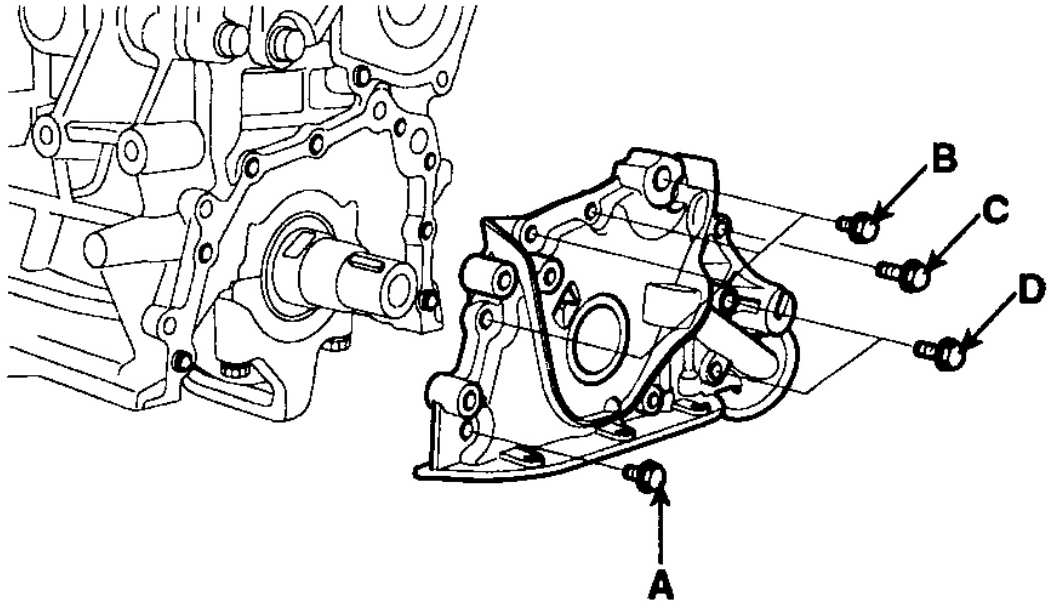


Fig. 205: Installing Oil Pump Cover To Front Case With 7 Screws
Courtesy of HYUNDAI MOTOR CO.

2. Check that the oil pump turns freely.
3. Install the oil pump on the cylinder block.

   Place a new front case gasket on the cylinder block. Apply engine oil to the lip of the oil pump seal. Then, install the oil pump onto the crankshaft. When the pump is in place, clean any excess grease off the crankshaft and check that the oil seal lip is not distorted.

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Fig. 206: Installing Oil Pump On Cylinder Block
Courtesy of HYUNDAI MOTOR CO.

Body length

(A): 25mm (0.98in)

(B): 20mm (0.787in)

(C): 38mm (1.496in)

(D): 45mm (1.771 in)

Tightening torque

20 ~ 27Nm (200 ~ 270kg.cm, 14.5 ~ 19.8lb.ft)

4. Apply a light coat of oil to the seal lip.
5. Using the SST (09214-33000), install the oil seal.

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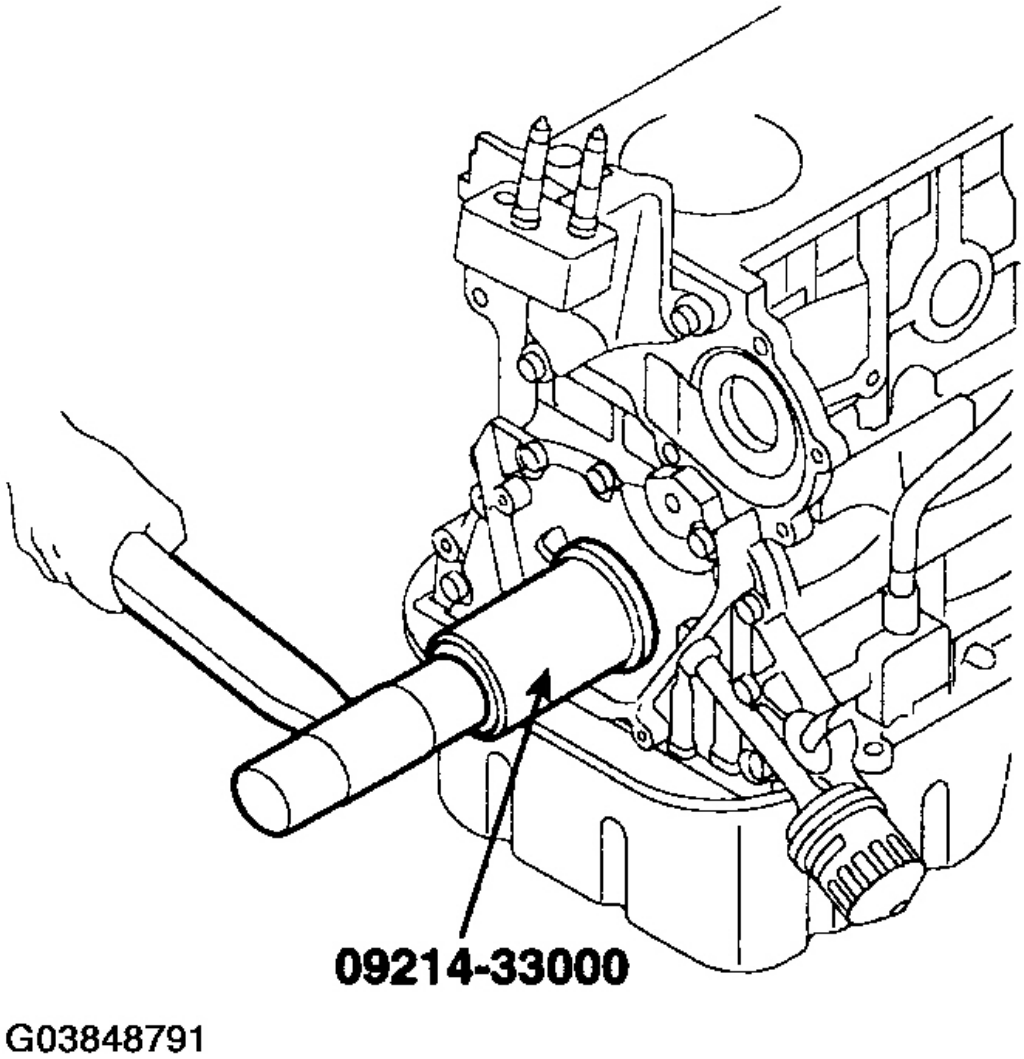


Fig. 207: Using SST (09214-33000) To Install Oil Seal
Courtesy of HYUNDAI MOTOR CO.

6. Install the oil screen. (See steps11)
7. Install the oil pan. (See steps 10)

NOTE: Clean the oil pan gasket mating surfaces.

INTAKE AND EXHAUST SYSTEM

COMPONENT

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INTAKE MANIFOLD

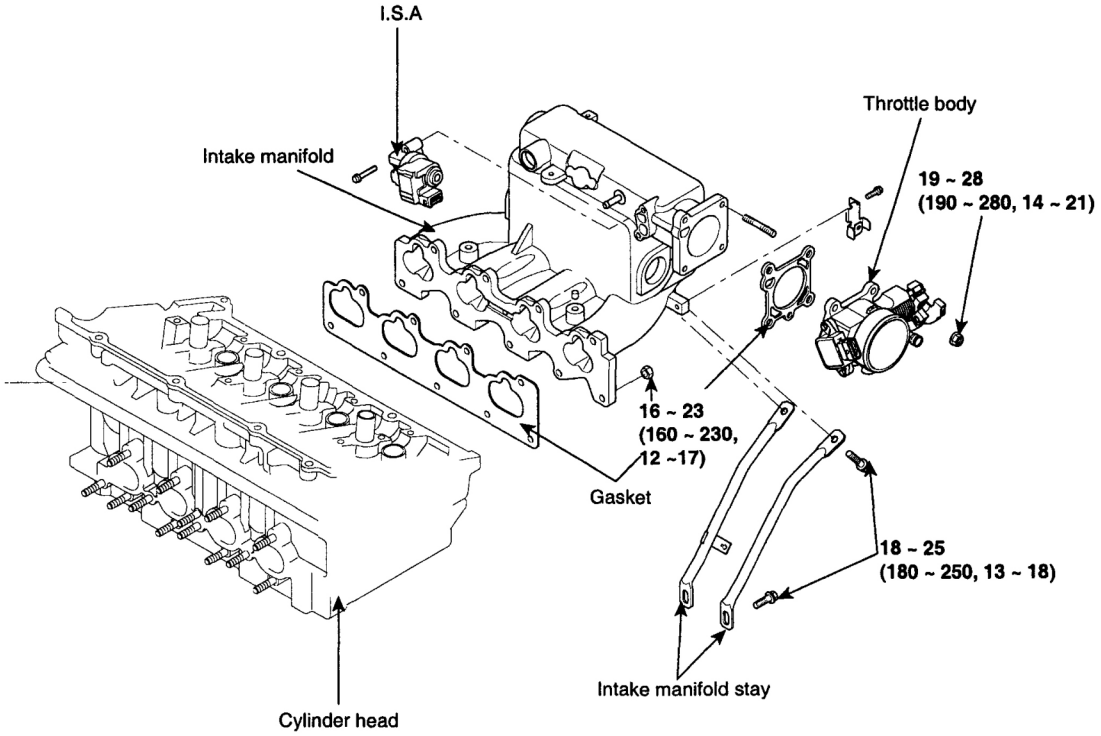


Fig. 208: Identifying Intake Manifold Components And Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

EXHAUST MANIFOLD

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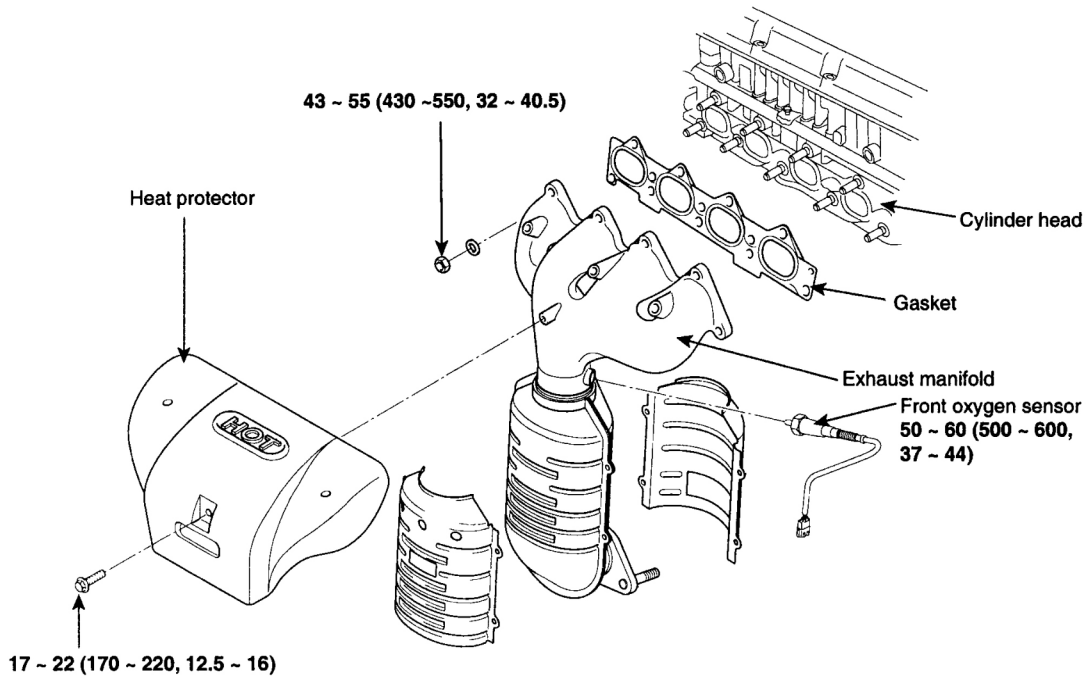


Fig. 209: Identifying Exhaust Manifold Components And Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

MUFFLER

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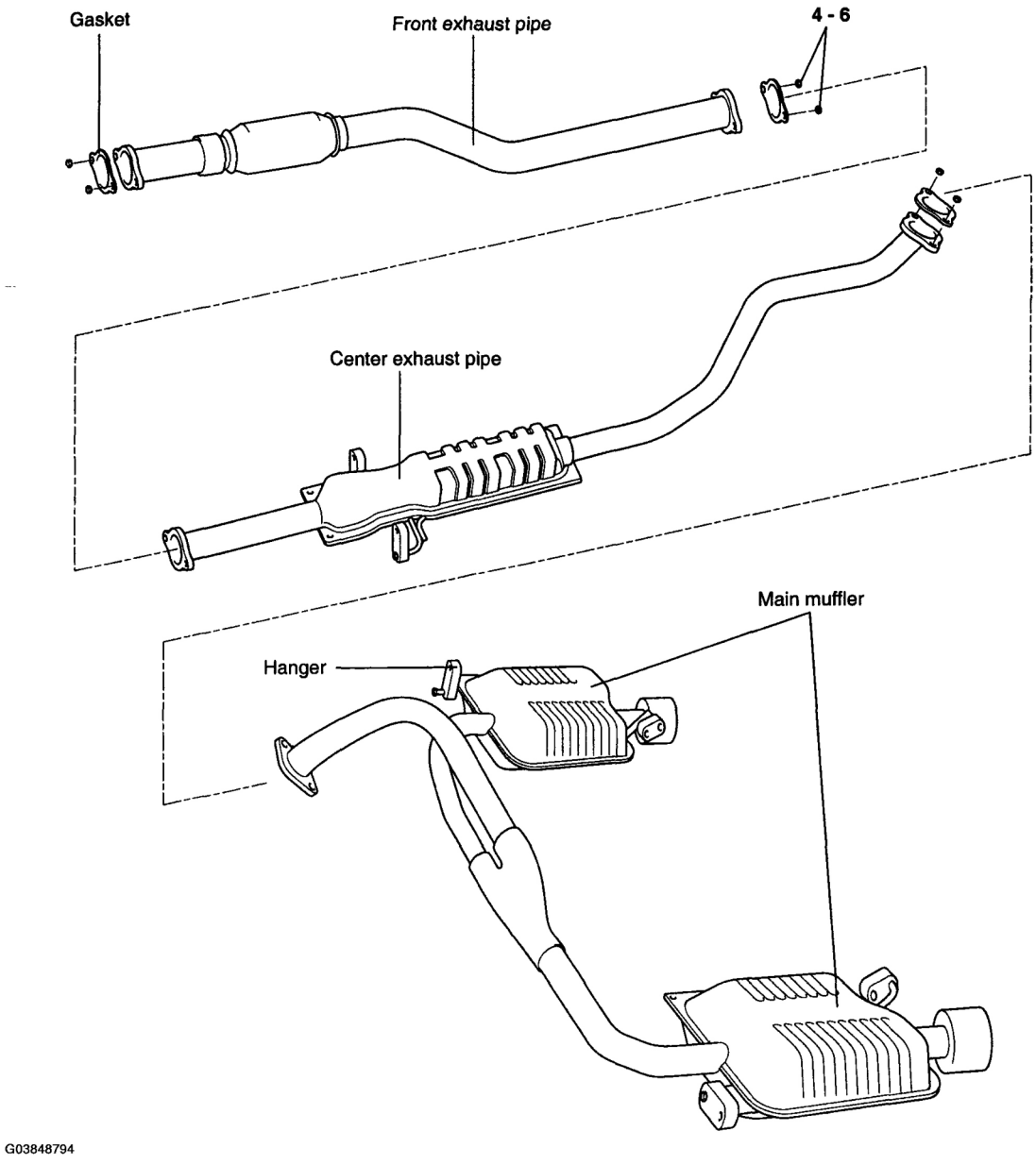


Fig. 210: Identifying Muffler Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

INTAKE MANIFOLD

1. Remove the engine cover. (See **COMPRESSION**)
2. Disconnect the TPS connector(A) and ISA connector(B).

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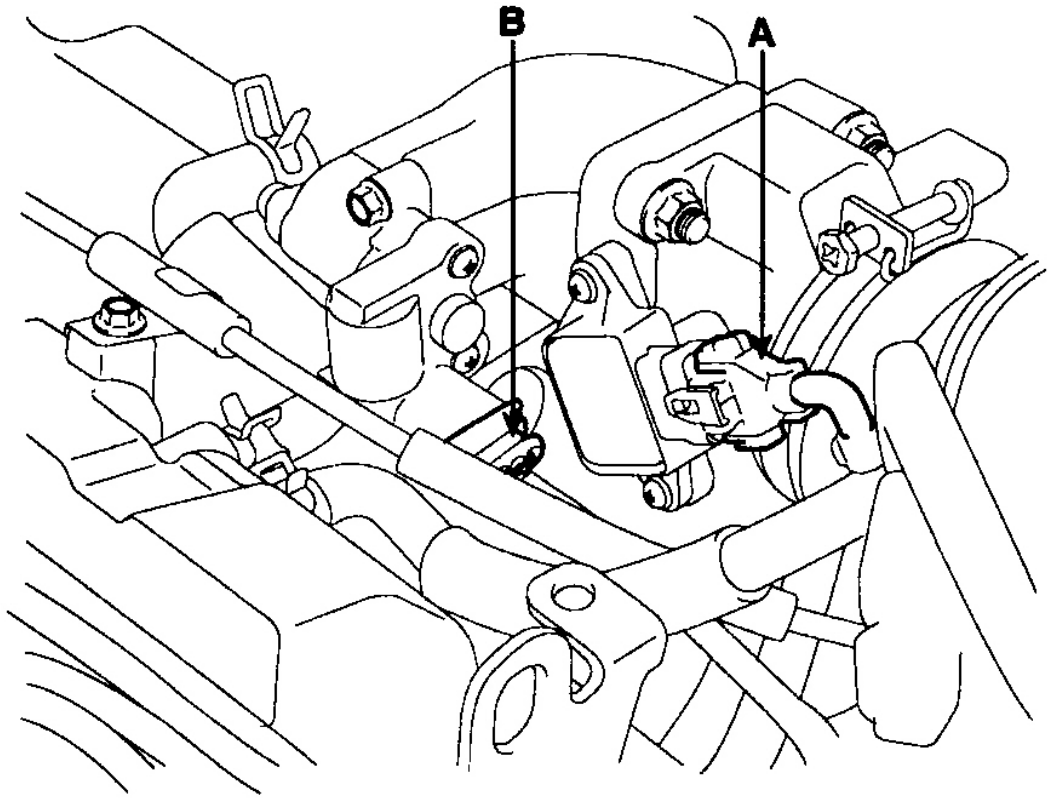


Fig. 211: Disconnecting TPS Connector And ISA Connector
Courtesy of HYUNDAI MOTOR CO.

3. Remove the PCV hose(A) and breather hose(B).

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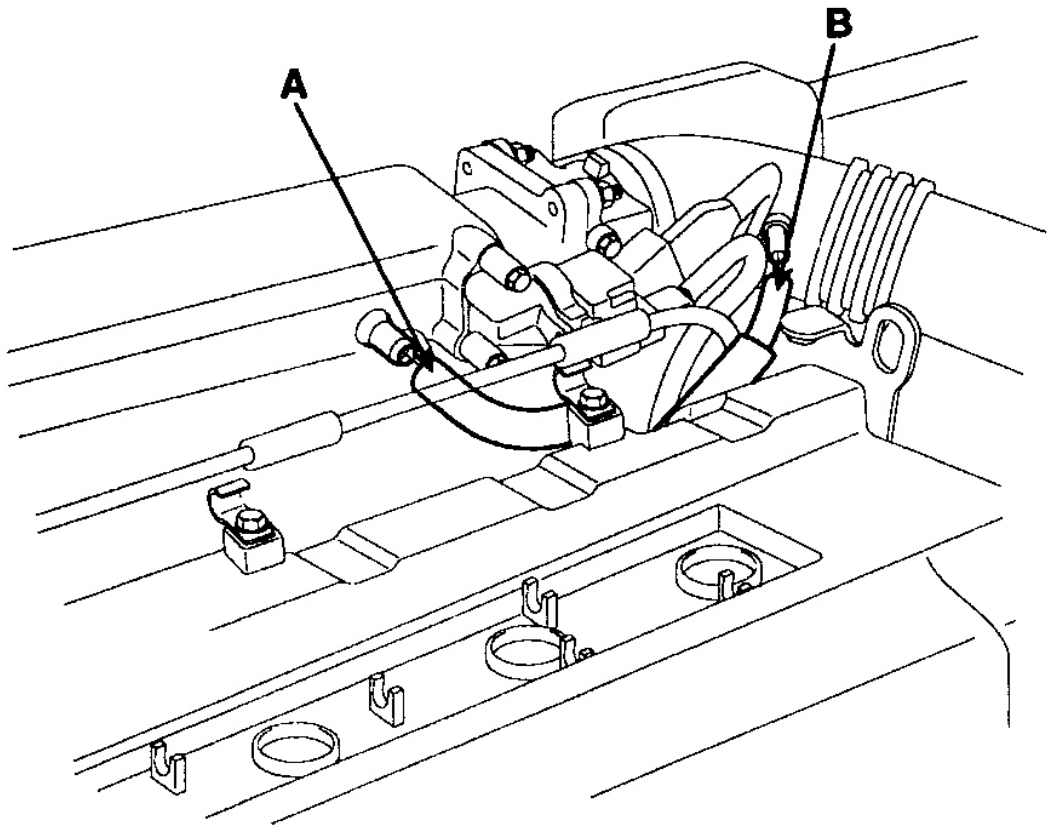


Fig. 212: Removing PCV Hose And Breather Hose
Courtesy of HYUNDAI MOTOR CO.

4. Remove the accelerator cable by loosening the lock-nut, then slip the cable end out of the throttle linkage.
5. Remove the delivery pipe(A).

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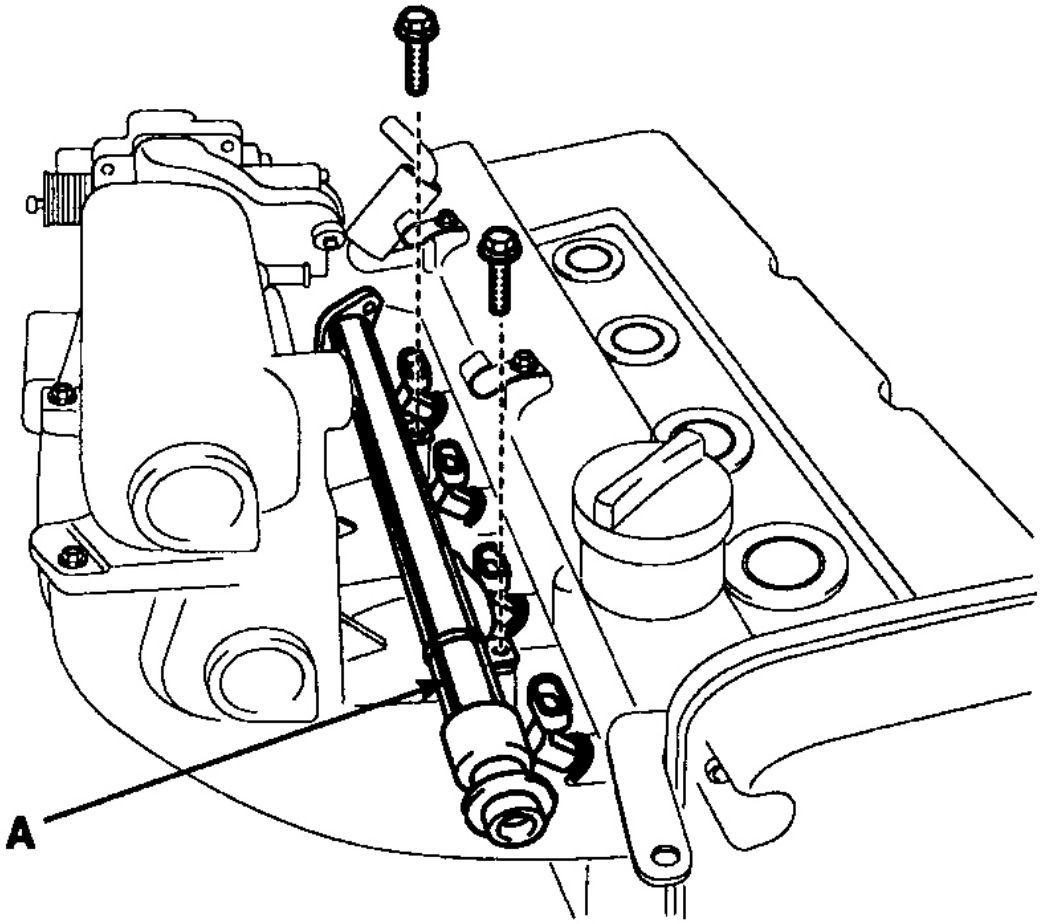


Fig. 213: Removing Delivery Pipe
Courtesy of HYUNDAI MOTOR CO.

6. Remove the heater hoses(A), PCSV(B), and brake vacuum hose(C).

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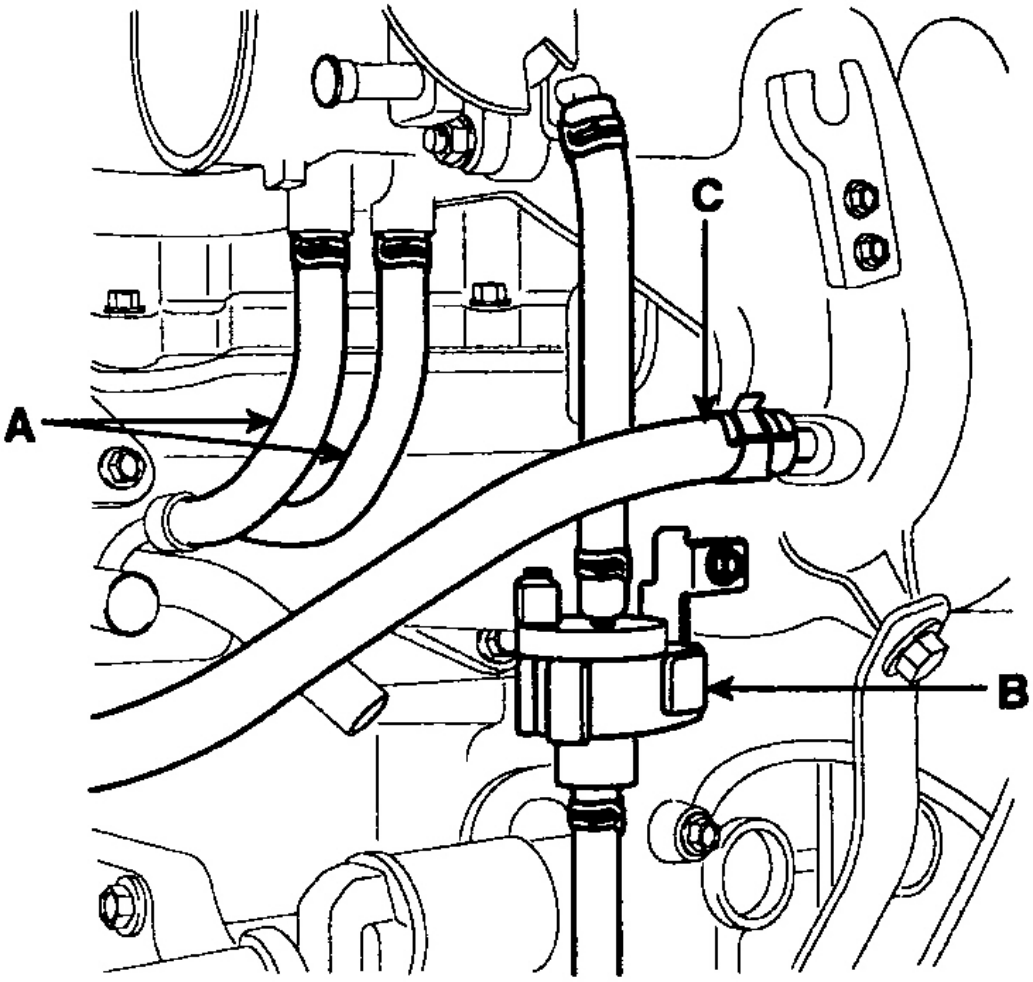


Fig. 214: Removing Heater Hoses, PCSV And Brake Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

7. Remove the intake manifold stay(A).

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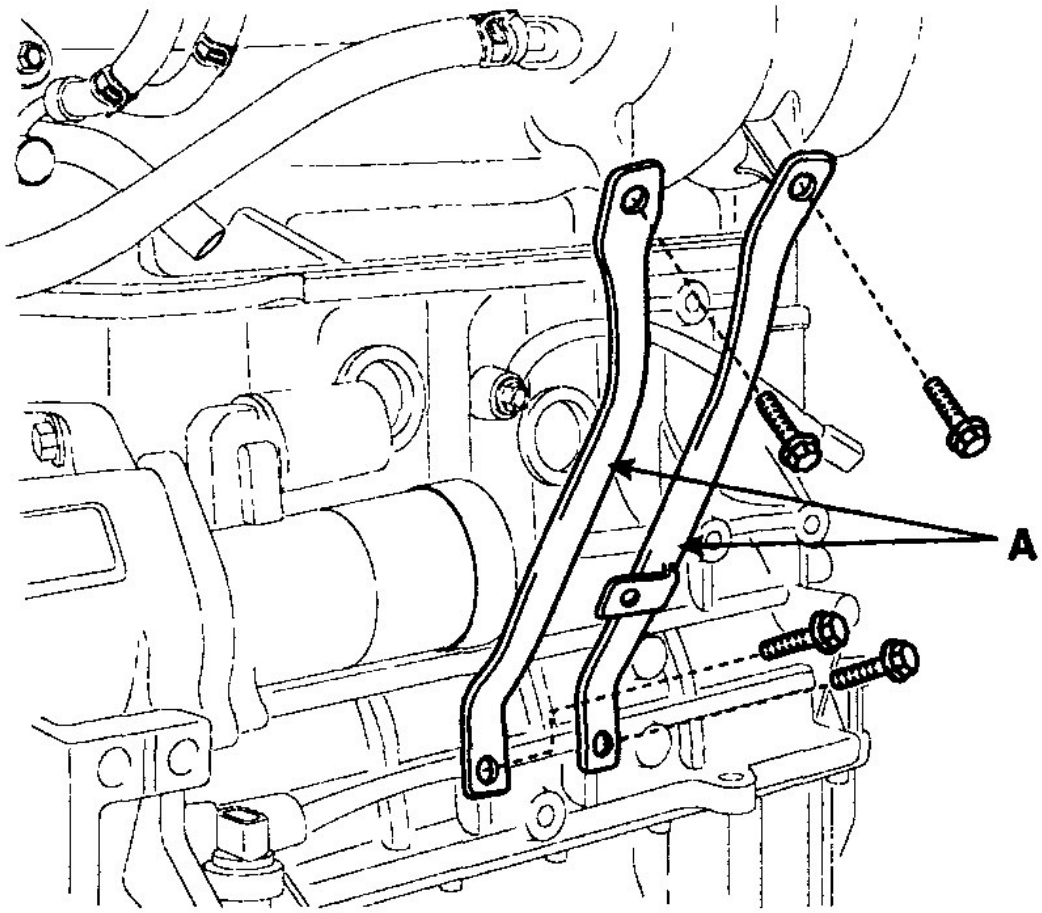
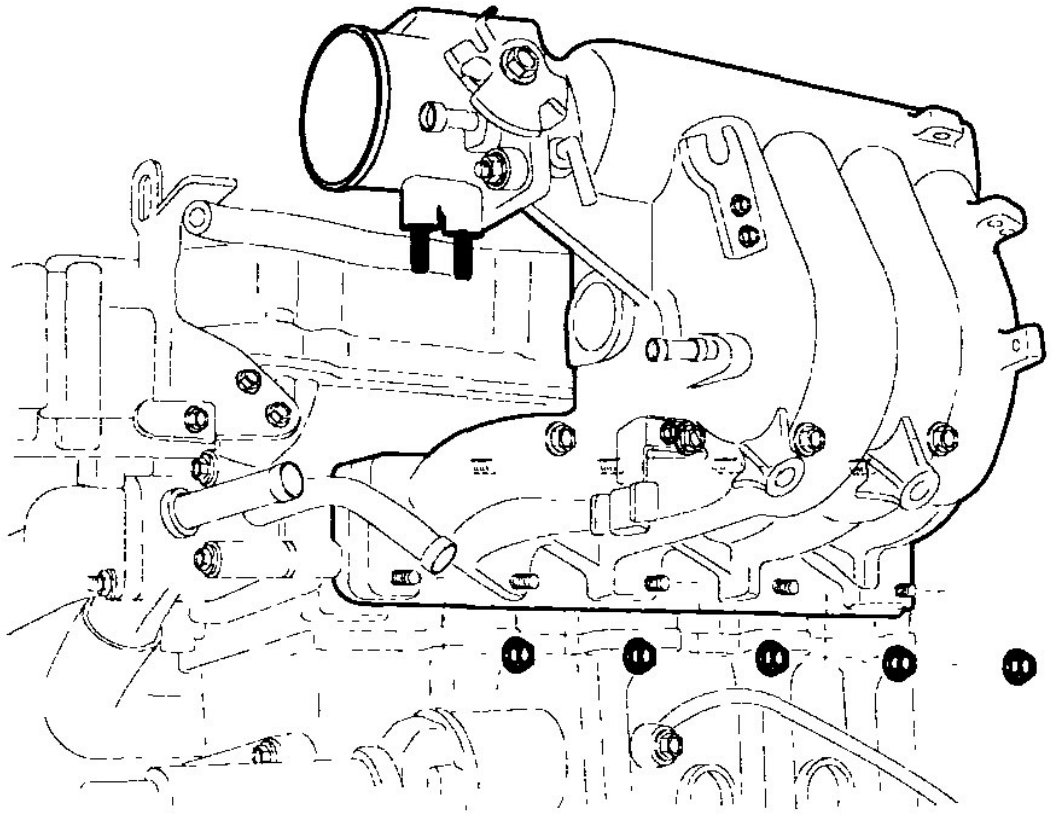


Fig. 215: Removing Intake Manifold Stay
Courtesy of HYUNDAI MOTOR CO.

8. Remove the intake manifold.

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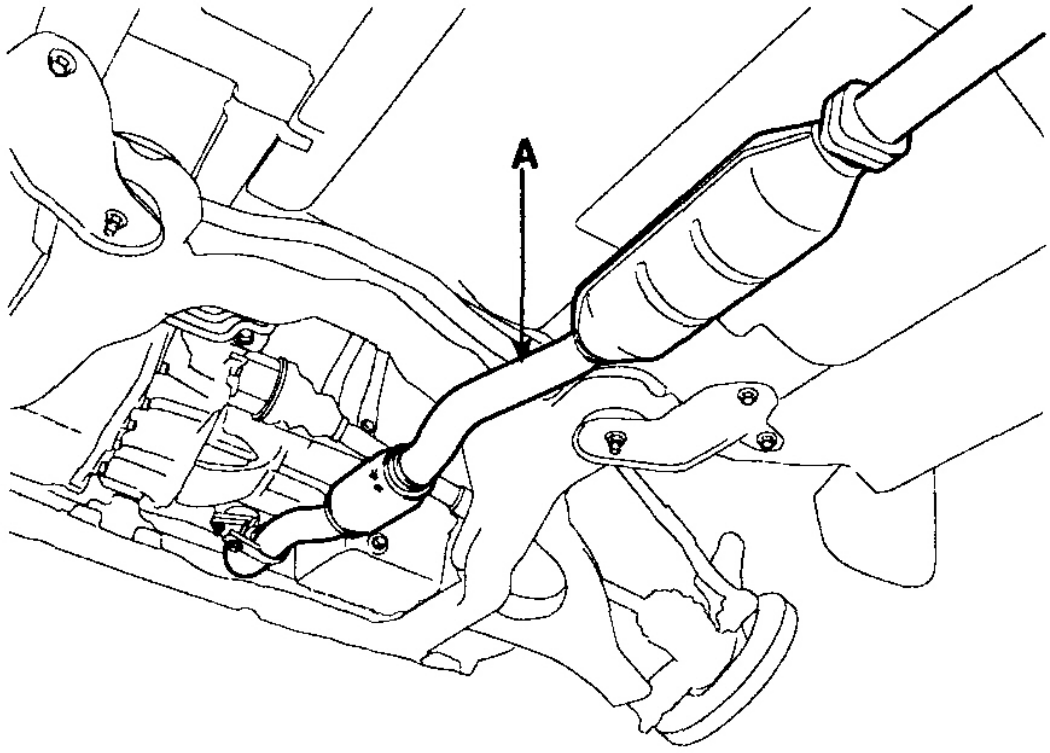
Fig. 216: Removing Intake Manifold
Courtesy of HYUNDAI MOTOR CO.

9. Installation is in the reverse order of removal.

EXHAUST MANIFOLD

1. Remove the engine cover. (See **COMPRESSION**)
2. Remove the front oxygen sensor connector.
3. Remove the front muffler(A).

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Fig. 217: Removing Front Muffler
Courtesy of HYUNDAI MOTOR CO.

4. Remove the heat protector.

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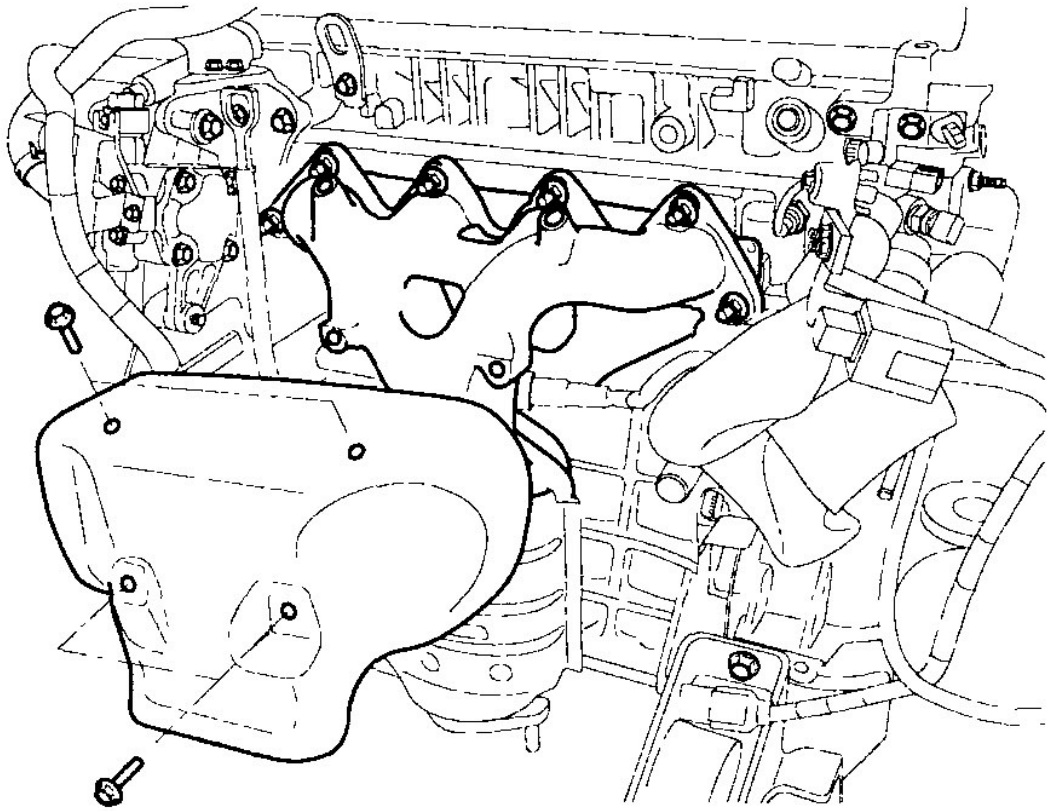
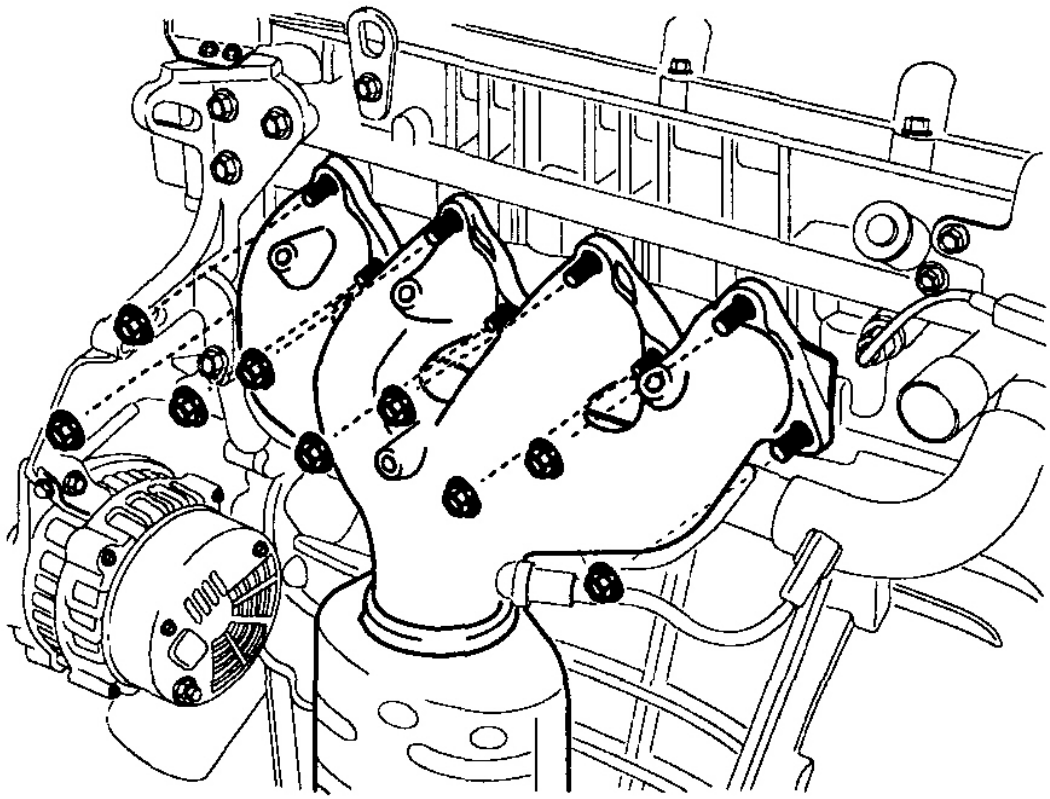


Fig. 218: Removing Heat Protector
Courtesy of HYUNDAI MOTOR CO.

5. Remove the exhaust manifold.

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Fig. 219: Removing Exhaust Manifold
Courtesy of HYUNDAI MOTOR CO.

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