OPTIMA(MS) > 2005 > G 2.7 DOHC > Engine Mechanical System

Engine Mechanical System > General Information > General Information

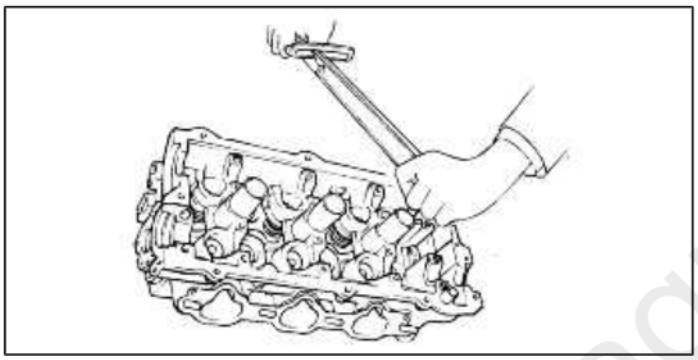
ADJUSTING VALVE CLEARANCE

As the intake and exhaust valves are equipped with auto-lash adjustment mechanisms, there is no need to adjust the valveclearance. The proper function of the auto-lash mechanism may be determined by checking for tappet noise. When there istappet noise or any unusual noise, first check the engine oil pressure. If the engine oil pressure is okay, check the auto-lash by removing and bleeding or replacing it.

TIGHTENING CYLINDER HEAD BOLTS

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

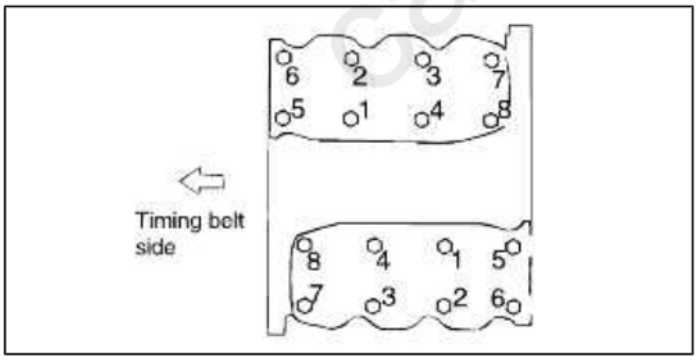
Tightening torque
Cylinder head bolts
Cold [Engine temperature approximately20°C(68°F)] :
25 Nm (250 kg.cm, 18 lb.ft)+(58°~62°)+(43°~47°)



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

NOTE

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



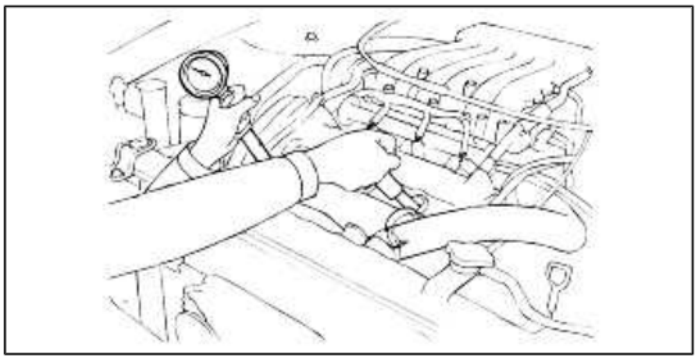
CHECKING COMPRESSION PRESSURE

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

cardiagn.com

8. Crank the engine and read the gauge.

Standard value : 12.2 kg/cm² (1200 kPa, 170 psi)
Limit : 10.7 kg/cm² (1050 kPa, 149 psi)



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

Limit :
Max. 1.0 kg/cm² (100 kPa, 14 psi) between cylinders

10. If a cylinder's compression or pressure differential is below the specification, add a small amount of oil through the spark plug hole and repeat steps from 6 to 9.
    (1) If the addition of oil brings the compression up, it is possible that there is wear between the piston ring and cylinder wall.
    (2) If compression remains the same, valve seizure, poor valve seating or a compression leak from the cylinder head gasket are all possible causes.

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

CHECKING ENGINE OIL

1. Position a vehicle on a level surface.
2. Stop the engine.

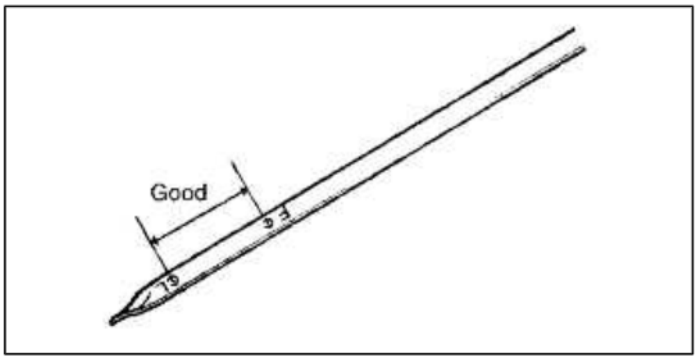
NOTE

In the case of a vehicle that has been out of service for a prolonged period, run the engine for several minutes.
Stop the engine and wait for 5 minutes at least, then check the oil level.

cardiagn.com

3. Check that the engine oil level is within the level range indicated on the oil dipstick. If the oil level is found to have fallen to the lower limit (the MIN mark), refill to the "MAX" mark.

> NOTE
>
> When refilling, use the same type of engine oil as the one currently being used.

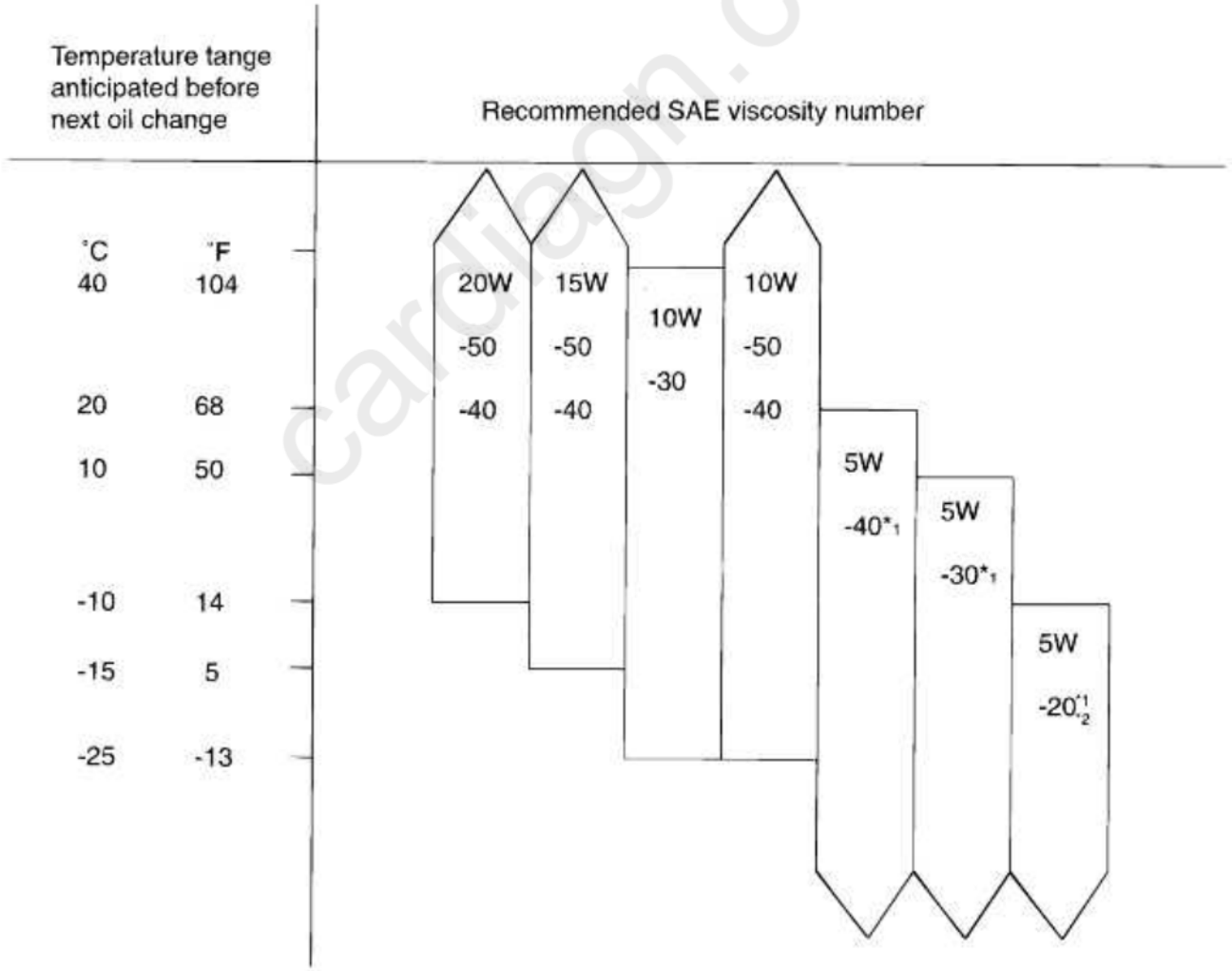


4. Check that the oil not dirty or mixed with coolant or gasoilne, and that it has the proper viscosity.

SELECTION OF ENGINE OIL

Recommended API classification: SG or SG/CD, SH or SH/CD

Recommended SAE viscosity grades:



***1. Restricted by driving and climate condition.**

***2. Not recommended for sustained high speed vehicle operation.**

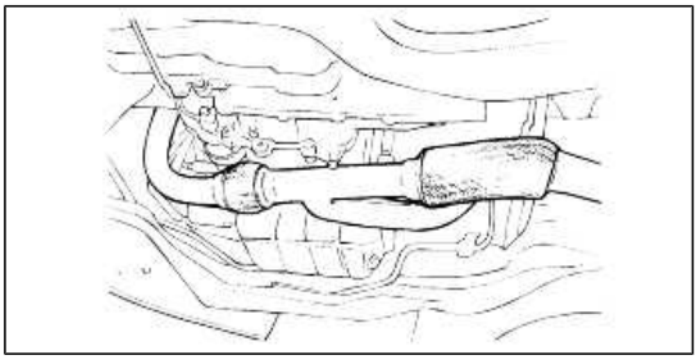
NOTE

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

1. Confirm the requirements of the API classification.
2. Have proper SAE grade number for expected ambient temperature range. Lubricants which do not have both a SAE grade number and an API service classification on the container should not be used.

CHANGING ENGINE OIL

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



4. Re-install and tighten the drain plug to the specified torque.

Tightening torque
Drain plug : 35-45 Nm (350-450 kg.cm, 25-33 lb.ft)

CAUTION

Whenever tightening oil drain plug, use a new drain plug gasket.

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

Drain and Refill
Without oil filter ; 4.5 lit (4.76 U.S.qts., 3.95 Imp.qts.)
With oil filter; 4.8 lit (5.07 U.S.qts., 4.22 Imp.qts.)

CAUTION

Do not overfill the crankcase. This will cause oil aeration and loss of oil pressure.

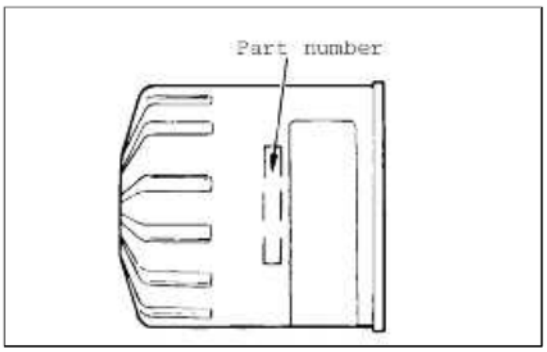
6. Install the oil filler cap.
7. Start and run the engine.
8. Stop the engine and then check the oil level. Add oil if necessary.

REPLACING OIL FILTER

Filter Selection

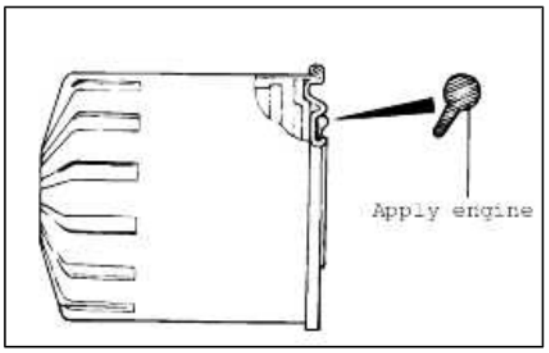
All Kia engines are equipped with a high quality, throw-away oil filter. The filter is recommended as a replacement filter on all vehicles. The quality of replacement filters varies considerably. Only high quality filters should be used to assure the most efficient service. Make sure that the rubber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

cardiagn.com



Procedure for Replacing Oil Filter

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



3. Tighten the oil filter to the specified torque.

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

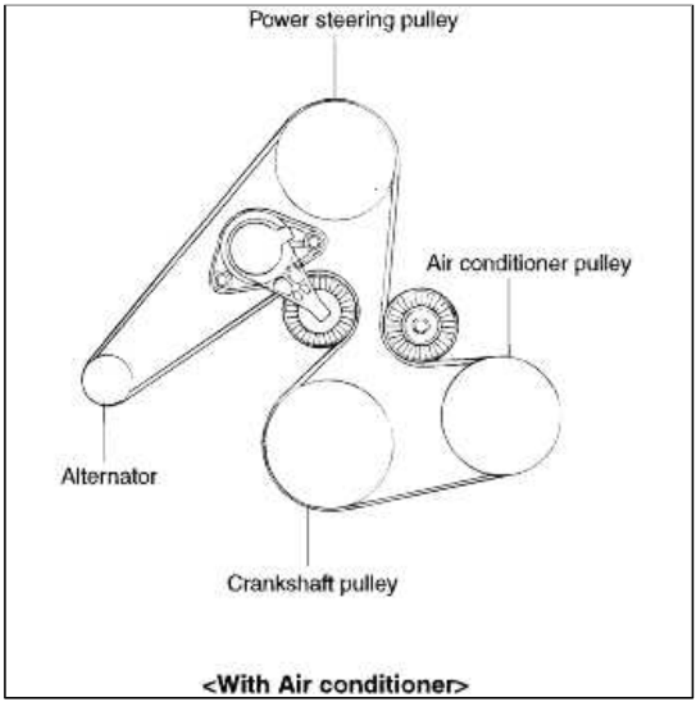
4. Start and run the engine and check engine oil leaks.
5. After stopping the engine, check the oil level and add oil as necessary.

ADJUSTING DRIVE BELT AND TENSIONER

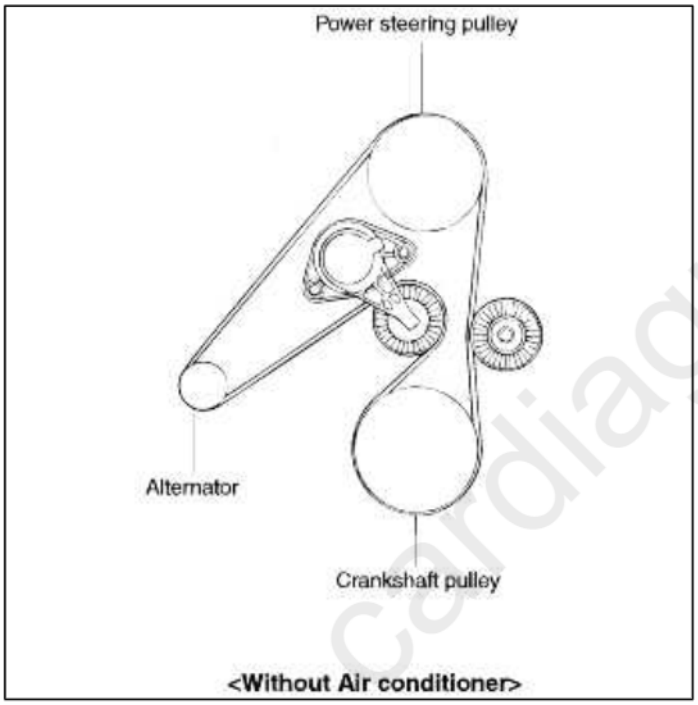
1. Hang the belt on the pulley of the tensioner and install the tensioner.
   (When the tensioner is installed before inserting the belt between timing belt cover and tensioner pulley.)

Tightening torque
Tensioner assembly bolt :
20-27 Nm (200-270 kg.cm, 14-20lb.ft)

carmagn.com

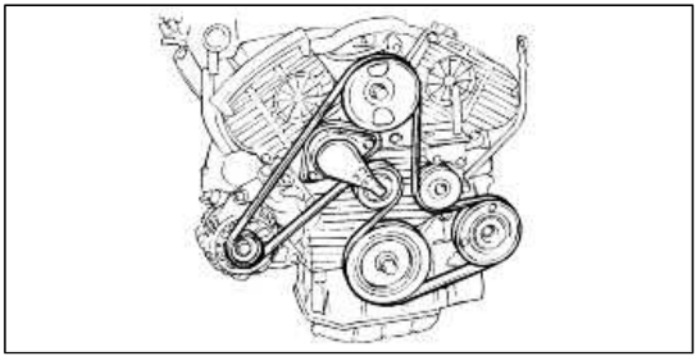


<With Air conditioner>



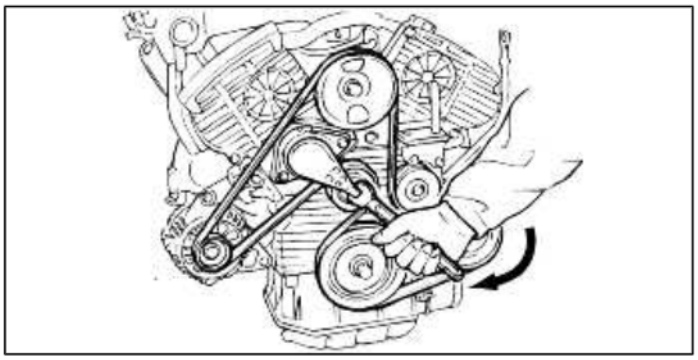
<Without Air conditioner>

2. Install the belt as following order.
[Alternator → Power steering → Crankshaft pulley → Air conditioner pulley → Idler pulley.]

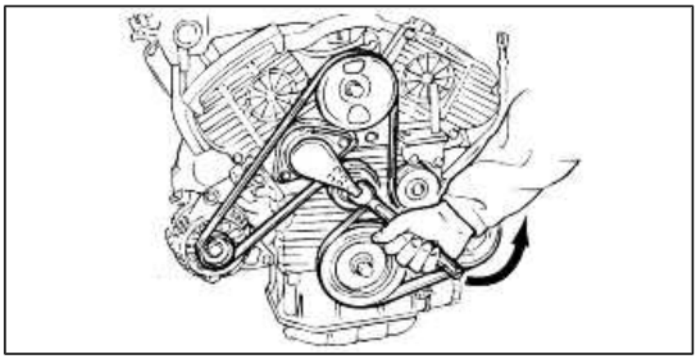


cardiagn.com

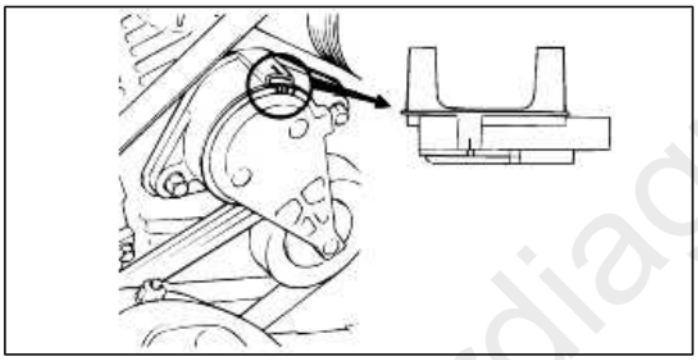
3. Rotate the tensioner arm clockwise (about 14°) with spaner (16mm) and hang the belt to the idler pulley.



4. When installing the belt on the hole of pulley. make sure there is no tooth gap of belt.

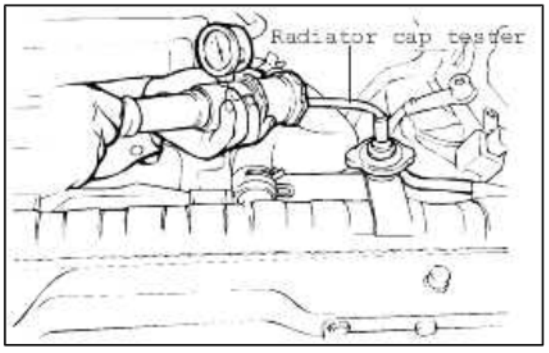


5. The tensioner mark should be between MIN. and MAX. position, if not, replace the belt.



CHECKING COOLANT LEAK

1. Loosen the radiator cap.
2. Confirm that the coolant level is up to the filler neck.
3. Install a radiator cap tester to the radiator filler neck and apply 150 kPa (21 psi, 1.53 kg/cm²) pressure. Hold for twominutes in that condition, while checking for leakage from the radiator, hose or connections.



cardiagn.com

WARNING

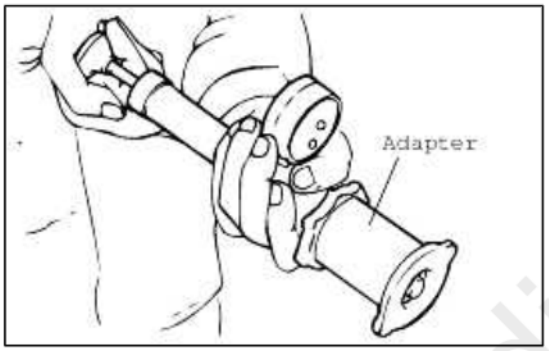
1. Radiator coolant may be extremely hot. Do not open the system while hot, or scalding Engine coolant could spray out causing severe burns and blindness. Allow the vehicle to cool to ambient air temperature before servicing this system.
2. Be sure to completely clean away any moisture from the places checked.
3. When the tester is removed, be careful not to spill any coolant from it.
4. Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.

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

RADIATOR CAP PRESSURE TEST

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

Main valve opening pressure :
93.2-122.6 kPa (0.95-1.25 kg/m², 13.51-17.78 psi)
Main valve closing pressure :
83.4kPa (0.85 kg/cm²,12.1 psi)



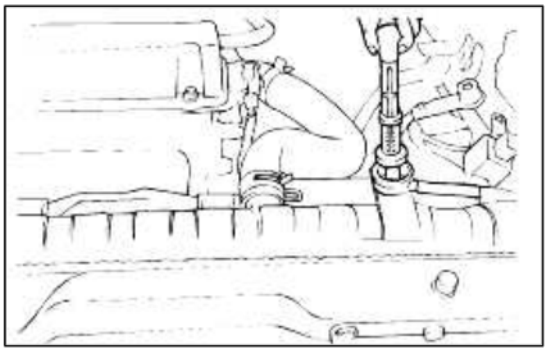
3. Check that the pressure level is maintained at or above the limit.
4. Replace the radiator cap if the reading does not remain at or above the limit.

NOTE

Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an improper indication.

SPECIFIC GRAVITY TEST

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



RELATION BETWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY

cardiagn.com

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

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

CAUTION

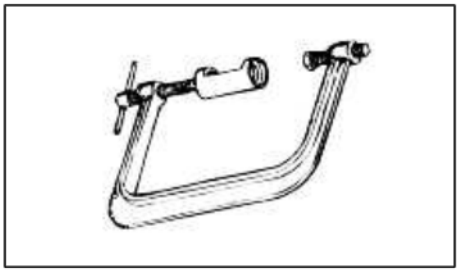
- If the concentration of the coolant is below 30%, the anti-corrosion property will be adversely affected.
- If the concentration is above 60%, both the anti-freeze and engine cooling properties will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level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

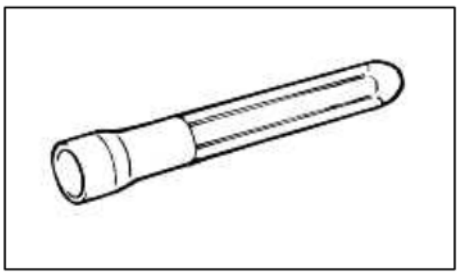
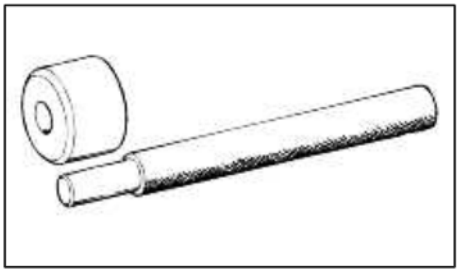
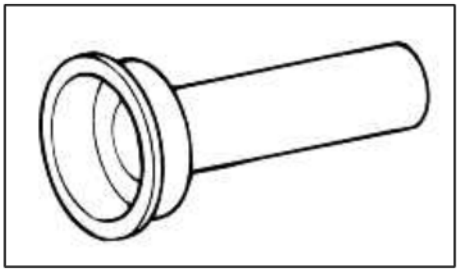
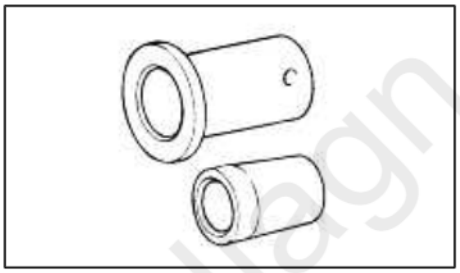
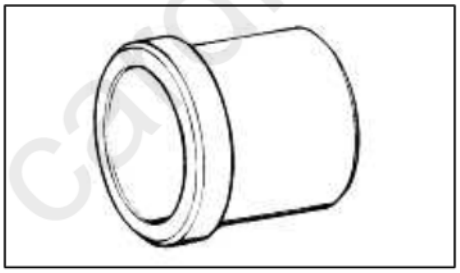
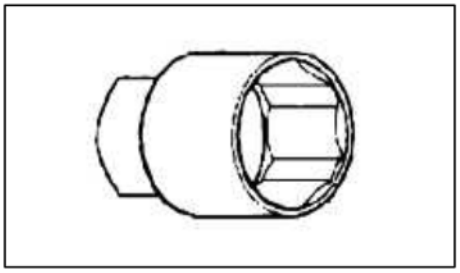
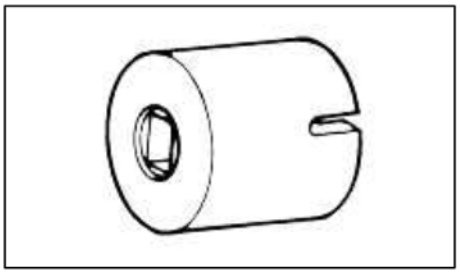
RECOMMENDED COOLANT

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

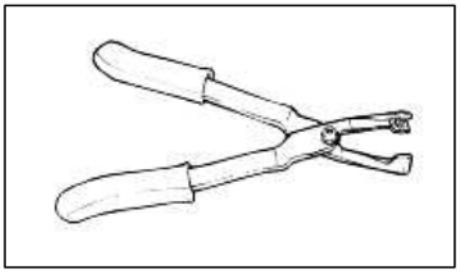
Engine Mechanical System > General Information > Special Service Tools

SPECIALSERVICE TOOLS

Tool (Number and name)	Illustration	Use
09222-28000 /0K993 120 001 Valve spring compressor		Removal and installation of the intake or exhaust valve

09222-22001 Valve stem oil seal installer		Installation of the valve stem oil seal
09221-22000A 09221-29000 Valve guide installer		Removal and installation of the valve guide
09231-33000 Crankshaft rear oil seal installer		Installation of the crankshaft rear oil seal
09214-33000 Crankshaft front oil seal installer		Installation of the crankshaft front oil seal
09221-21000 /09221-M2000 Camshaft oil seal installer		Installation of circular packing
09260-32000 Oil pressure switch wrench		Removal and installation of oil pressure switch
09231-33100 Crankshaft wrench		Used if the crankshaft needs to be rotated to attach the timing belt, etc.

carsdiagn.com

09222-29000 Valve stem oil seal remover		Removal of valve stem oil seal

Engine Mechanical System > General Information > Troubleshooting

TROUBLESHOOTING

Symptom	Probable cause	Remedy
Knocking of crankshaft and bearing	Worn main bearing	Replace
	Seized bearing	Replace
	Bent crankshaft	Replace
	Excessive crankshaft end play	Replace thrust bearing
Piston and connecting rod knocking	Worn bearing	Replace
	Seized bearing	Replace
	Worn piston pin	Replace piston and pin or connecting rod
	Worn piston in cylinder	Recondition cylinder
	Broken piston ring	Repair or replace
	Improper connecting rod alignment	Replace
Noisy valves	Faulty auto-lash adjuster	Replace
	Thin or diluted engine oil (low oil pressure)	Change
	Worn or damaged valve stem or valve guide	Replace
Excessively worn cylinder and piston	Shortage of engine oil	Add or replace Check oil level everyday
	Dirty engine oil	Replace
	Poor oil quality	Use proper oil
	Improperly assembled piston and connecting rod	Repair or replace
	Improper piston ring end clearance	Replace
	Dirty air cleaner	Clean air cleaner assembly and replace the air filter
Connecting rod and/main bearing noise	Insufficient oil supply	Check engine oil level
	Thin or diluted engine oil	Change and find out cause
	Excessive bearing clearance	Replace
	Shortage of engine oil	Add or replace

carlean.com

	Shortage of engine oil	Check oil level everyday
	Low oil pressure	Adjust or repair
	Poor quality engine oil	Use proper engine oil
Damaged crankshaft bearing	Worn or out-of round crankshaft journal	Replace
	Restricted oil passage in crankshaft	Clean
	Worn bearing	Replace bearing and check engine oil lubrication system
	Bearing improperly installed	Replace
	Non-concentric crankshaft or bearing	Replace
Timing belt noise	Incorrect belt tension	Replace
Low compression	Blown cylinder head gasket	Replace gasket
	Worn or damaged piston rings	Replace rings
	Worn piston or cylinder	Repair or replace piston and/or cylinder block
	Worn or damaged valve seat	Repair or replace valve and/or seat ring
Oil pressure drop	Low Engine oil level	Check engine oil level
	Faulty oil pressure switch	Replace
	Clogged oil filter	Replace
	Worn oil pump gears or cover	Replace
	Thin or diluted engine oil	Change and find out cause
	Oil relief valve stuck (open)	Repair
	Excessive bearing clearance	Replace
High oil pressure	Oil relief valve stuck (closed)	Repair
Excessive engine rolling and vibration	Loose engine roll stopper (front, rear)	Re-tighten
	Loose transaxle mount bracket	Re-tighten
	Loose engine mount bracket	Re-tighten
	Loose center member	Re-tighten
	Broken transaxle mount insulator	Replace
	Broken engine mount insulator	Replace
	Broken engine roll stopper insulator	Replace
Low coolant level	Leakage of coolant	Replace
	Damaged radiator core joint Corroded or cracked hoses (Radiator hose, heater hose, etc)	Replace
	Faulty radiator cap valve or setting of spring	Replace
	Faulty thermostat	Replace

carlagn.com

	Faulty Engine coolant pump	Replace
Clogged radiator	Foreign material in coolant	Replace
Abnormally high coolant temperature	Faulty thermostat	Replace
	Faulty radiator cap	Replace
	Restriction of flow in cooling system	Replace
	Loose or missing drive belt	Adjust or replace
	Faulty Engine coolant pump	Replace
	Faulty temperature gauge or wiring	Repair or replace
	Faulty electric fan	Repair or replace
	Faulty thermo-sensor on radiator	Replace
	Insufficient coolant	Refill coolant
Abnormally low coolant temperature	Faulty thermostat	Replace
	Faulty temperature gauge or wiring	Repair or replace
Leakage from oil cooling system	Loose hose and pipe connection	Retighten
	Blocked or collapsed hose and pipe	Replace
Inoperative electrical cooling fan	Damaged	Replace or repair
Exhaust gas leakage	Loose connections	Re-tighten
	Broken pipe or muffler	Repair or replace
Abnormal noise	Detached baffle plate in muffler	Replace
	Broken rubber hanger	Replace
	Pipe or muffler contacting vehicle body	Correct
	Broken pipe or muffler	Repair or replace

carlabon.com

Engine Mechanical System > General Information > Specifications

SPECIFICATIONS

Description	Specification	Limit
General		
Type	V-type, DOHC	
Number of cylinders	6	
Bore		
[2.5 L]	84mm (3.3071 in.)	
[2.7 L]	86.7mm (3.4134 in.)	
Stroke	75 mm (2.9528 in.)	
Total displacement		
[2.5 L]	2,493cc	
[2.7 L]	2,656cc	
Compression ratio	10.0 : 1	
Firing order	1-2-3-4-5-6	
Idle R.P.M	700±100	
Ignition timing at idling speed	BTDC 12°±5°	
Valve timing		
Intake valve		
Opens (BTDC)	6°	
Closes (ABDC)	46°	
Exhaust valve		
Opens (BBDC)	44°	
Closes (ATDC)	8°	
Valve overlap	14°	
Intake valve duration	232°	
Exhaust valve duration	232°	
Camshaft		
Drive mechanism	Cogged type belt	
Cam height	43.95-44.15mm (1.7303-1.7382 in.)	
Journal diameter	25.964-25.980mm (1.0222-1.0228 in.)	
Bearing oil clearance	0.02-0.061mm (0.0007-0.0024 in.)	
End play	0.1-0.15mm (0.0039-0.0059 in.)	43.45mm (1.7106 in.) 25.914mm (1.0202 in.) 0.1 (0.0039 in.)

Description	Specification	Limit
Cylinder headl		
Flatness of gasket surface	Max. 0.03mm (0.0012 in.)	0.05mm (0.0020 in.)

cardiagn.com

Flatness of manifold mounting surface		
Intake	Max. 0.15mm (0.0059 in.)	0.15mm (0.0059 in.)
Exhaust	Max. 0.15mm (0.0059 in.)	0.15mm (0.0059 in.)
Valve guide hole diameter		
0.05 (0.002) O.S.	11.05-11.068mm (0.435-0.4357 in.)	
0.25 (0.010) O.S.	11.25-11.268mm (0.443-0.4436 in.)	
0.50 (0.020) O.S.	11.50-11.518mm (0.453-0.4535 in.)	
Intake valve seat ring hole diameter		
0.3 (0.012) O.S.	33.300-33.325mm (1.311-1.312 in.)	
Exhaust valve seat ring hole diameter		
0.3 (0.012) O.S.	28.600-28.621mm (1.126-1.127 in.)	
Valve		
Overall length		
Intake	96.1mm (3.7835 in.)	
Exhaust	97.15mm (3.8248 in.)	
Stem diameter		
Intake	5.965-5.98mm (0.2348-0.2354 in.)	
Exhaust	5.95-5.965mm (0.2343-0.2348 in.)	
Face angle	45°-45.5°	
Margin		
Intake	1.0mm (0.0394 in.)	0.5mm (0.0197 in.)
Exhaust	1.3mm (0.0512 in.)	0.8mm (0.0315 in.)
Clearance (stem-to-guide)		
Intake	0.02-0.05mm (0.0008-0.0020 in.)	0.10mm (0.0038 in.)
Exhaust	0.035-0.065mm (0.0014-0.0026 in.)	0.15mm (0.0059 in.)
Valve spring		
Free height	42.5mm (1.6732 in.)	41.5mm (1.6339 in.)
Load	21.9kg / 35mm (48.4lb / 1.3780 in.)	21.9kg / 34mm (48.4lb / 1.3386 in.)
Out of squareness	Max 1.5°	Max 3°
Piston		
Diameter (Standard)		
[2.5 L]	83.98-84.01mm (3.3063-3.3075 in.)	
[2.7 L]	86.68-86.71mm (3.4126-3.4138 in.)	

cardiagn.com

Clearance (Piston-to-cylinder)	0.010-0.030mm (0.0004-0.0012 in.)	
Ring groove width		
No.1	1.230-1.250mm (0.0484-0.0492 in.)	
No.2	1.2200-1.240mm (0.0480-0.0488 in.)	
Oil	2.515-2.535mm (0.0990-0.0998 in.)	
Piston for service	0.25mm (0.010 in.), 0.50mm (0.020 in.)	
Piston ring		
Number of rings per piston	3	
Compression rings	2	
Oil ring	1	
Compression ring type		
No.1	Barrel type, steel	
No.2	Taper type, special cast iron	
Oil ring type	3-piece type	
Ring end gap		
No.1	0.20-0.35mm (0.0079-0.0138 in.)	0.8mm (0.031 in.)
No.2	0.37-0.52mm (0.0146-0.0205 in.)	0.8mm (0.031 in.)
Oil ring type	0.2-0.7mm (0.0079-0.0276 in.)	1.0mm (0.039 in.)
Ring end gap		
No.1	0.04-0.08mm (0.0016-0.0031 in.)	0.1mm (0.004 in.)
No.2	0.03-0.07mm (0.0012-0.0028 in.)	0.1mm (0.004 in.)
Rings for service	0.25mm (0.010 in.), 0.50mm (0.020 in.), Oversize	
Connecting rod		
Piston pin press-in load	2,450-12,255N (250-1,250 kg, 551-2,755 lb)	
Side clearance (Big end)	0.10-0.25mm (0.0039-0.0098 in.)	0.4mm (0.016 in.)
Bend	0.05mm or less / 100mm (0.0020 in. or less/3.937 in.)	
Twist	0.1mm or less / 100mm (0.0039 in. or less / 3.937 in.)	
Bearing		
Oil clearance	0.018-0.036mm (0.0007-0.0014 in.)	0.1mm (0.004 in.)
Crankshaft		
Journal O.D	61.982-62.000mm (2.4402-2.4409 in.)	
Pin O.D	47.982-48.000mm (1.8891-1.8898 in.)	
Out-of roundness of journal and pin	Max. 0.003mm (0.00012 in.)	

cardiagn.com

Taper of journal and pin	Max 0.005mm (0.0002 in.)	
End play	0.070-0.250mm (0.0028-0.0098 in.)	0.3mm (0.012 in.)
Main bearing		
Oil clearance	0.004-0.022mm (0.0002-0.0009 in.)	0.1mm (0.004 in.)
Cylinder block		
Cylinder bore		
[2.5 L]	84.00-84.03mm (3.3071-3.3083 in.)	
[2.7 L]	86.7mm (3.4134 in.)	0.05mm (0.002 in.)
Flatness of gasket surface	Max. 0.03mm (0.0012 in.)	
Out-of-roundness and taper	Max. 0.02mm (0.0008 in.)	
Oil pump		
Side clearance		
Body clearance	0.100-0.181mm (0.0039-0.0071 in.)	
Side clearance	0.040-0.095mm (0.0016-0.0037 in.)	
Relief spring		
Free length	43.8mm (1.724 in.)	
Load	3.7 kg / 40.1mm (8.2lb, 1.579 in.)	
Oil filter		
Type	Cartridge, full flow	
Engine oil pressure	80 kPa (11.4 psi) or more [Conditions: Oil temperature is 75 to 90°C (167 to 194°F)]	
Cooling method	Engine coolant cooling, forced circulation with electric fan	
Cooling system		
Quantity	7.1 lit (7.5 U.S. qts., 6.2 lmp. qts.) [For V6	
Thermostat		
Type	Wax pellet type with jiggle valve	
Normal opening temperature	82°C (179.6°F)	
Opening temperature range	80°C - 84°C (176-183.2°F)	
Wide open temperature	95°C (203°F)	
Radiator cap		
Main valve opening pressure	93.2-122.6 kPa (0.95-1.25 kg/cm², 13.51-17.78 psi)	
Main valve closing pressure	83.4 kPa (0.85 kg/cm², 12.1 psi)	
Vacuum valve opening pressure	-6.86 kPa (-0.07 kg/cm², -1.00 psi)	
Air cleaner		
Type	Dry type	
Element	Unwoven cloth type	

carmgm.com

Exhaust pipe	
Muffler	Expansion resonance type
Suspension system	Rubber hangers

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

Engine coolant	Ethylene glycol base for aluminum radiator

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

TIGHTENING TORQUE

	Nm	Kg·cm	lb·ft
Crankshaft bolt	180-190	1,800-1,900	130-138
Timing belt tensioner	20-27	200-270	14.5-19.5
Camshaft sprocket bolt	90-110	900-1,100	65-80
Cylinder head cover bolts	5-6	50-60	42-52 lb·in
Main bearing cap bolts			
M10:	27-33+(90°~95°)	270-330 + (90°~95°)	19.5-23.9 + (90°~95°)
M8:	13-19+(90°~95°)	130-190 + (90°~95°)	9.6-14 + (90°~95°)
Connecting rod bolts	16-20+(90°~94°)	160-200 + (90°~94°)	11.6-14 + (90°~94°)
Cylinder head bolts			
Cold engine	25 + (60°~64°) + (45°~49°)	250 + (60°~64°) + (45°~49°)	18 + (60°~64°) + (45°~49°)
Oil pan drain plug	35-45	350-450	26-32
Lower oil pan bolt	10-12	100-120	7.2-9
Upper oil pan bolt [10x38 mm (0.937x1.4961 in.)]	30-42	300-420	22-30
[8x22 mm (0.3150x0.8661 in.)]	19-28	190-280	14-20
[171.5 mm (6.7519 in.)]	5-7	50-70	3.7-5

cardiagn.com

[152.5 mm (6.7520 in.)]	5-7	50-70	3.7-5
Oil screen bolt	15-22	150-220	11-15
Oil pump case bolts	12-15	120-150	9-10
Oil relief valve plug	40-50	400-500	29-36
Oil pressure switch	8-12	80-120	5.8-8.7
Oil pump cover screw	8-12	80-120	5.8-8.7
Oil filter	17-25	170-250	12-18
Flywheel bolt	73-77	730-770	53-55
Drive plate and adaptor plate bolt	73-77	730-770	53-55
Distributor adaptor assembly to engine	12-15	120-150	9-10
Air cleaner body installation bolt	8-12	80-120	6-9
Surge tank stay	15-20	150-200	11-14
Air intake surge tank to intake manifold (bolt)	15-20	150-200	11-14
Air intake surge tank to intake manifold (nut)	15-20	150-200	11-14
Intake manifold to engine	19-21	190-210	13.7-15
Heat protector to exhaust manifold	12-15	120-150	14
Exhaust manifold to engine	25-30	250-300	12-22
Oil level gauge guide to engine	12-15	120-150	9-11
Water outlet fitting bolt	17-20	170-200	12.3-14.5
Power steering oil pump bracket to front cylinder head assembly	17-26	170-260	12-19
Power steering oil pump to bracket	17-26	170-260	12-19
Crank position sensor wheel screw	5-6	50-60	42-52 lb·in
Engine mounting insulator bolt. [12x15 mm (0.4724x0.5906 in.)]	90-110	900-1,100	65-80
Engine mounting bracket nut.	60-80	600-800	43-58

cardiagn.com

Engine mounting bracket bolts. [12x60 mm (0.4724x2.3622 in.)]	60-80	600-800	43-58
Front roll stopper bracket to sub frame bolts.	60-80	600-800	43-58
Front roll stopper insulator bolt and nut. [10x85 mm (0.3937x3.3465 in.)]	50-65	500-650	36-47
Front roll stopper bracket to transaxle bolts.	60-80	600-800	43-58
Rear roll stopper bracket to sub frame bolts.	50-65	500-650	36-47
Rear roll stopper insulator bolt and nut.	50-65	500-650	36-47
Rear roll stopper bracket to transaxle bolts.	50-65	500-650	36-47
Transaxle mounting sub bracket nut.	60-80	600-800	43-58
Transaxle mounting bracket bolts.	60-80	600-800	43-58
Transaxle mounting insulator bolt. [12x15 mm (0.4724x0.5906 in.)]	90-110	900-1,100	65-80
Starter to engine bolt.	27-34	270-340	20-25
Generator inlet pipe to front cylinder head assembly	12-15	120-150	9-11
Fuel hose clamp to rear cylinder head assembly	12-15	120-150	9-11
Transaxle mounting plate	10-12	100-120	7-9
Rear plate	8-10	80-100	5.8-7.2
Oil seal case	10-12	100-120	7.3-8.6
Crankshaft pulley bolt	180-190	1,800-1,900	130-138
Timing belt cover bolt	10-12	100-120	7-9
Engine hanger bracket to engine	20-27	200-270	14-20
Generator mount bracket to engine	20-30	200-300	14-22

cardiagn.com

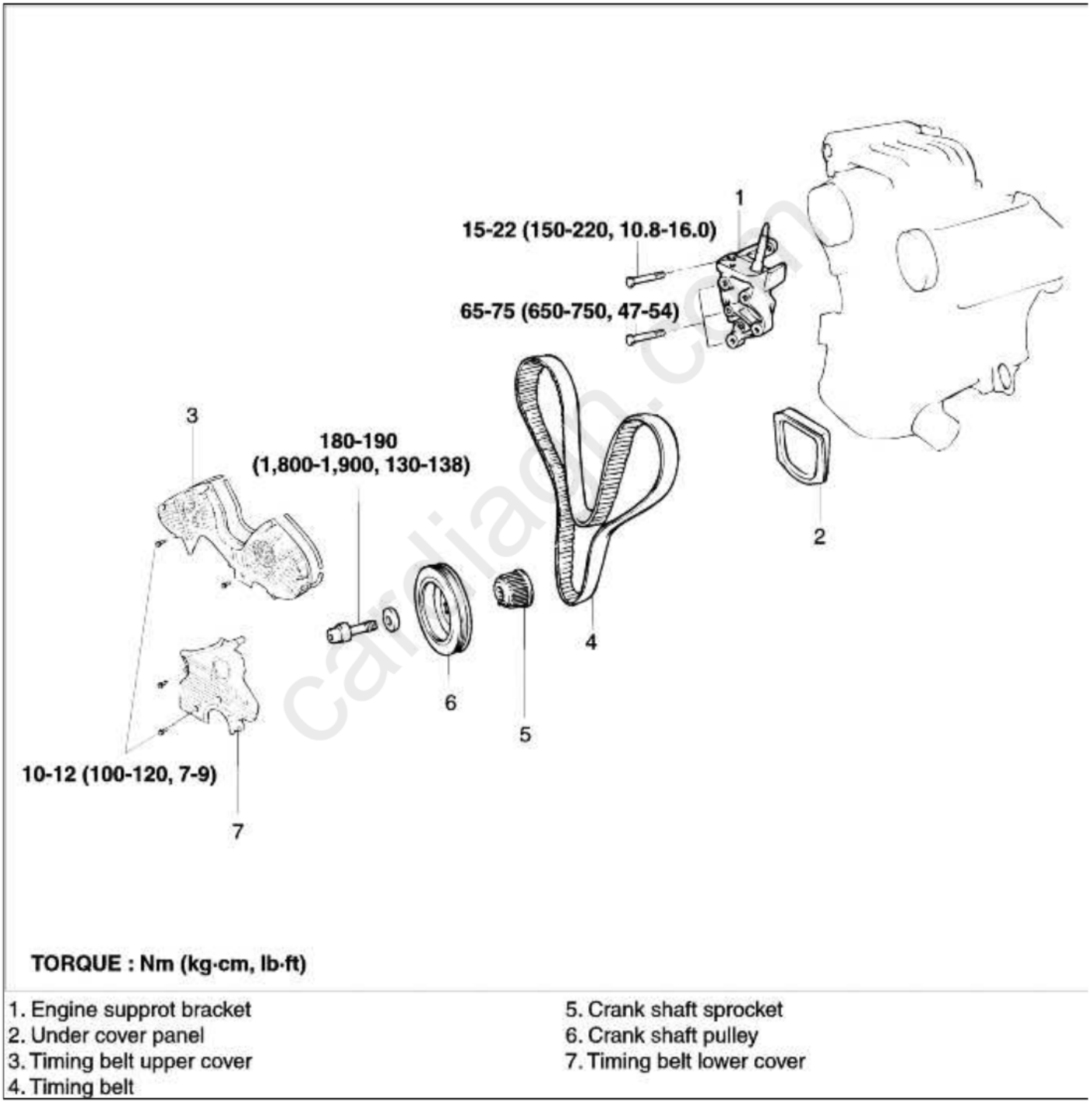
Generator mount nut (Engine front case side)	20-30	200-300	14-22
Generator mount bolt (Generator mount bracket side)	20-30	200-300	14-22
Starter to engine (Nut)	20-30	200-300	14-22
Drive belt pulley bolt	35-55	350-550	26-40
Drive belt tensioner bolt	20-27	200-270	14-20
Engine coolant pump to cylinder block bolt			
Head mark "7" bolt	15-22	150-220	11-15
Engine coolant temperature sensor	20-40	200-400	14-29
Engine coolant inlet fitting attaching bolt	17-20	170-200	12-14
Air cleaner mounting bolts	8-12	80-120	6-9
Intake manifold to cylinder head nuts	19-21	190-210	14-15
Throttle body to surge tank bolts	15-20	150-200	11-14
Exhaust manifold to cylinder head nuts	25-30	250-300	18-22
Exhaust manifold heat protector to exhaust manifold bolts	12-15	120-150	9-11
Oxygen sensor to exhaust manifold	40-50	400-500	29-36
Front exhaust pipe to exhaust manifold nuts	30-40	300-400	22-29
Front exhaust pipe to catalytic converter bolts	40-60	400-600	29-43
Catalytic converter to center exhaust pipe nuts	30-40	300-400	22-29
Center exhaust pipe to main muffler nuts	30-40	300-400	22-29
Main muffler hanger support bracket bolts	10-15	100-150	7-11
Delivery pipe installation bolts	10-15	100-150	7-11
Timing belt tensioner pulley bolt	43-55	430-550	31-40
Timing belt idler pulley bolt	50-60	500-600	36-43

cardiagn.com

Timing belt tensioner arm Fixed bolt	35-55	350-550	26-40
Auto tensioner fixed bolt	20-27	200-270	14-20
Starter to engine (Bolt)	27-34	270-340	20-25

Engine Mechanical System > Timing System > Timing Belt > Components and Components Location

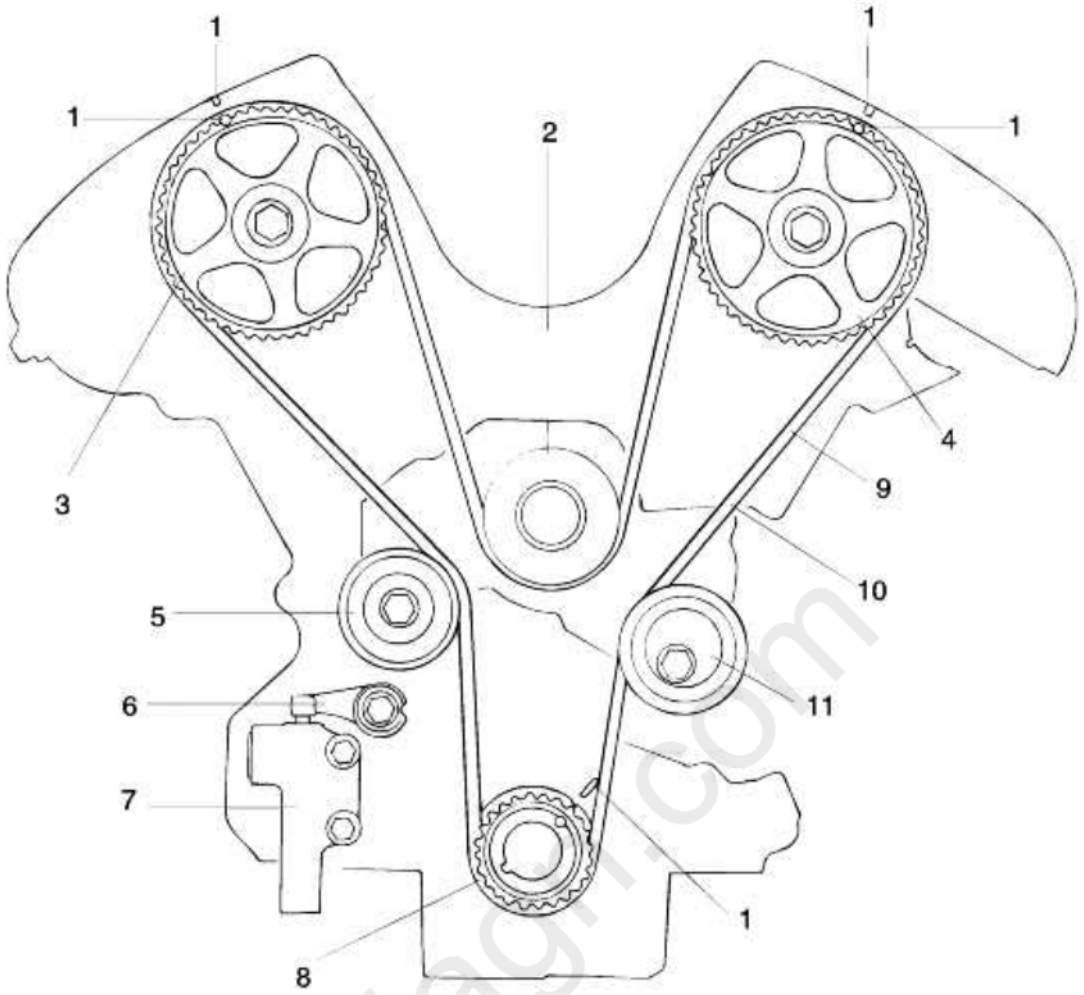
COMPONENTS



1. Engine supprot bracket
2. Under cover panel
3. Timing belt upper cover
4. Timing belt
5. Crank shaft sprocket
6. Crank shaft pulley
7. Timing belt lower cover

Components Location

TIMING BELT



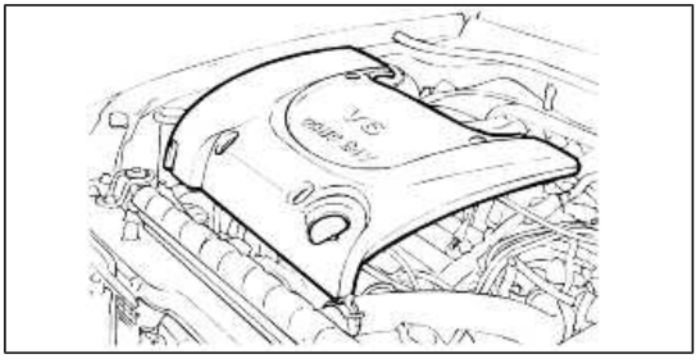
1. Timing mark
2. Engine coolant pump pulley
3. Camshaft sprocket (Front side)
4. Camshaft sprocket (Rear side)
5. Timing belt tensioner
6. Tensioner arm
7. Auto tensioner
8. Crankshaft sprocket
9. Timing belt
10. Tension side
11. Idler pulley

cardiagn.com

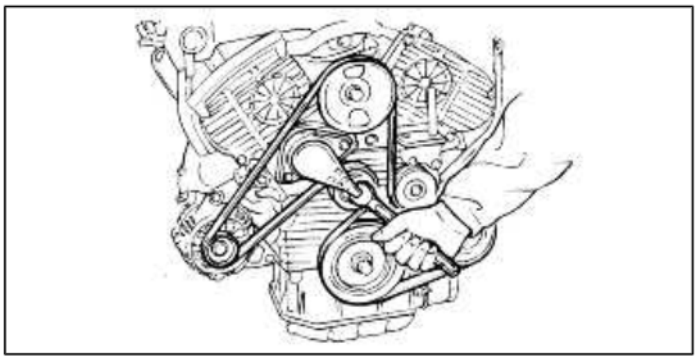
Engine Mechanical System > Timing System > Timing Belt > Repair procedures

REMOVAL

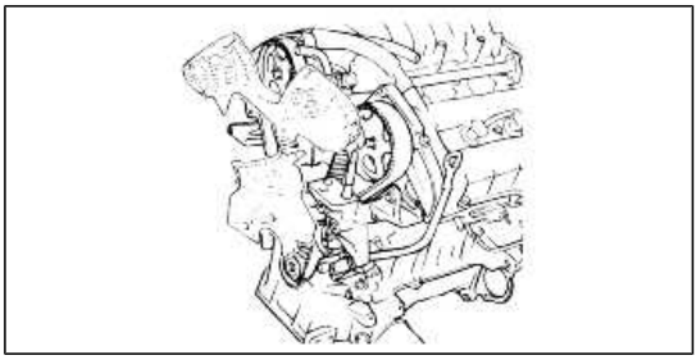
1. Remove the engine cover.



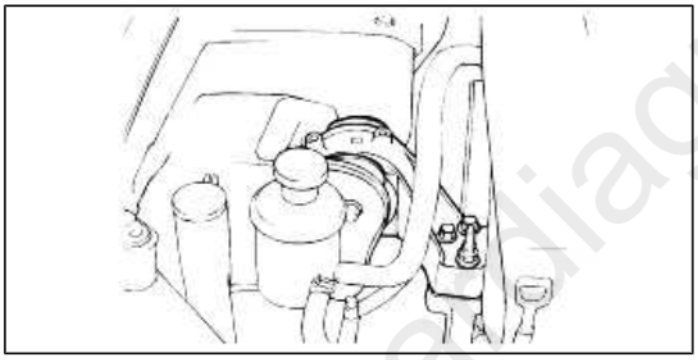
2. Using the spanner [16mm], rotate the tensioner arm clockwise.(about 14°) and remove the belt from pulley.



3. Remove the coolant pump pulley, idler pulley, tensioner pulley and crankshaft pulley.
4. Remove the upper and lower timing belt covers.



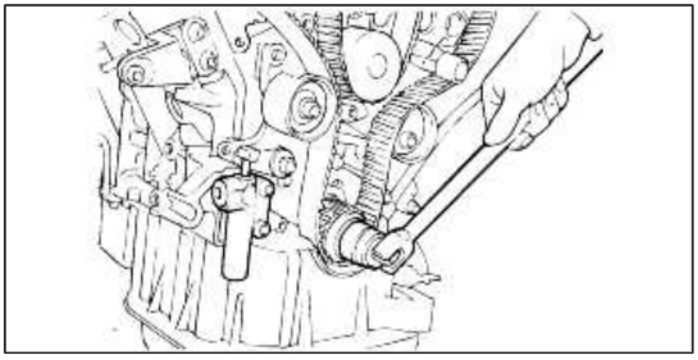
5. Support the engine with garage jack or wooden block and remove the engine mounting insulator.
6. Remove the engine mount bracket from the engine.



7. Remove the auto tensioner.

NOTE

Rotate the crankshaft clockwise and align the timing mark to get the No.1 cylinder's piston to be in TDC position (compression stroke). At this time, the timing mark of camshaft sprocket and cylinder head cover should coincide each other.

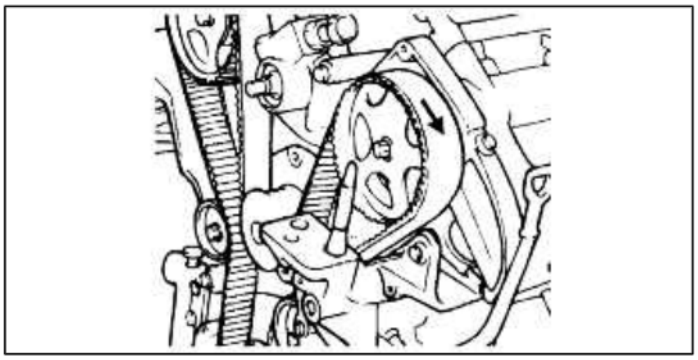


cardiagn.com

8. Remove the timing belt.

NOTE

When using the timing belt again, make sure of marking the rotating direction on the belt so as to install correctly.



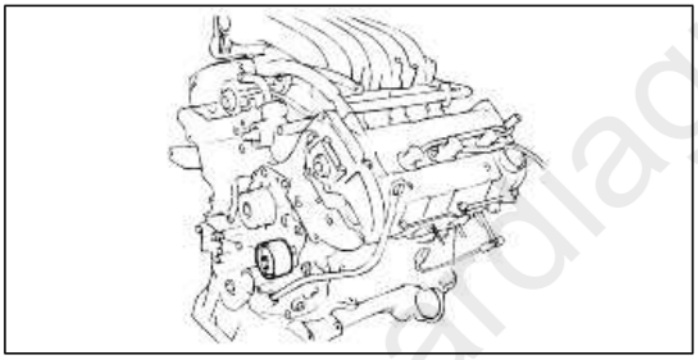
INSTALLATION

The method of installing Timing belt and Auto tensioner.

1. Install idler pulley to water pump boss.

NOTE

Insert and install idler pulley to the pin spring that is pressed and inserted in the water pump boss.



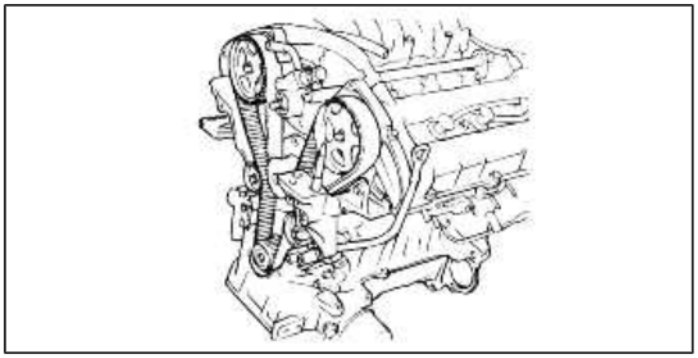
2. Install tensioner arm and plane washer to cylinder block.
3. Install tensioner pulley to the tensioner arm.

carolagn.com

4. Install sprockets and align the timing mark.

NOTE

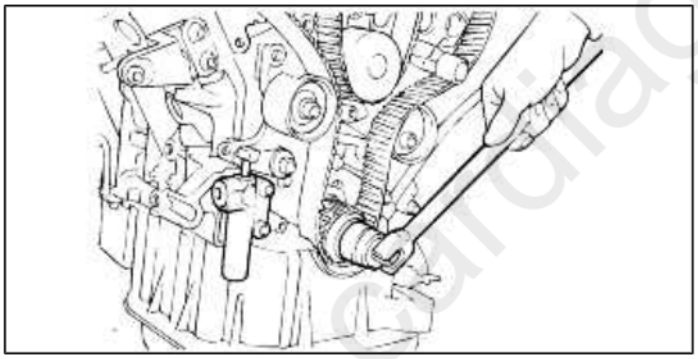
- When installing camshaft sprocket, fasten the sprocket tightly with holding the hexagonal part of the camshaft.
- Before installing timing belt, if the timing marks of cam sprocket and cylinder head cover do not coincide, do not rotate the cam sprocket more than 3 teeth of sprocket in any direction. Rotating sprocket more than 3 teeth might make valve and piston touched each other.
- In case of rotating the cam sprocket unavoidably more than 3 teeth, rotate the cam sprocket after rotating 3 teeth in the side of crank counter-clockwise on the base of timing mark.



5. Install the auto tensioner to the front case.

NOTE

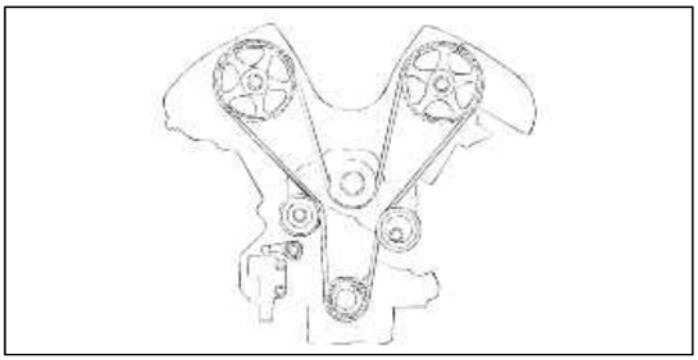
At this time auto tensioner's set pin should be assembled completely.



6. Align the timing marks of each sprocket and install the timing belt in this order. Crankshaft sprocket → Idler pulley → Intake cam sprocket (LH side) → Water pump pulley → Intake cam sprocket (RH side) → Tensioner pulley.

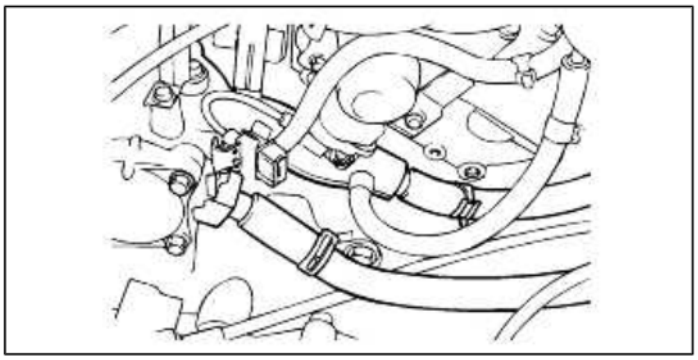
NOTE

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

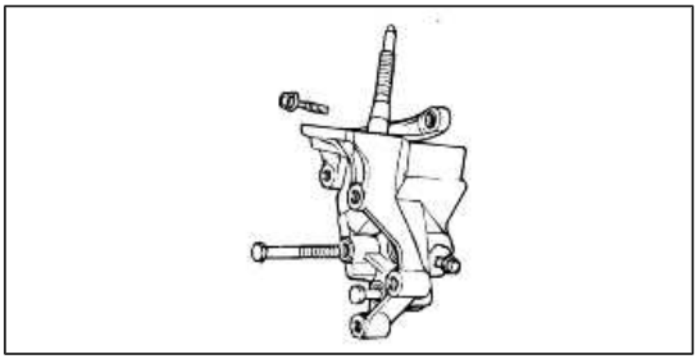


cardiagn.com

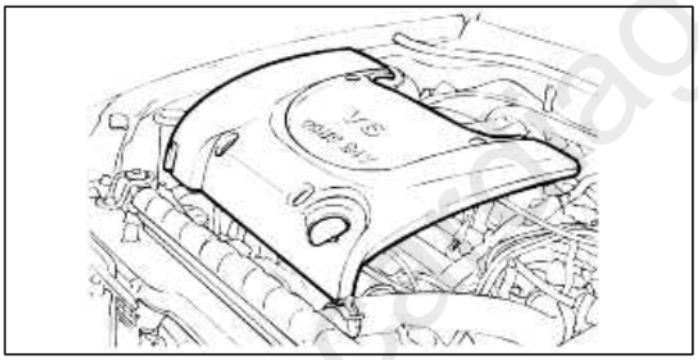
7. Pull out the set pin of the auto tensioner.



8. Install the engine mount bracket from the engine.



9. Install the engine mounting insulator.
10. Install the upper and lower timing belt covers.
11. Install the coolant pump pulley, idler pulley, tensioner pulley and crankshaft pulley.
12. Using the spanner [16mm], rotate the tensioner arm clockwise (about 14°) and lnstall the belt from pulley.
13. Install the engine cover.



14. Install the oil filler cap.

The method to adjust the tension of timing belt.

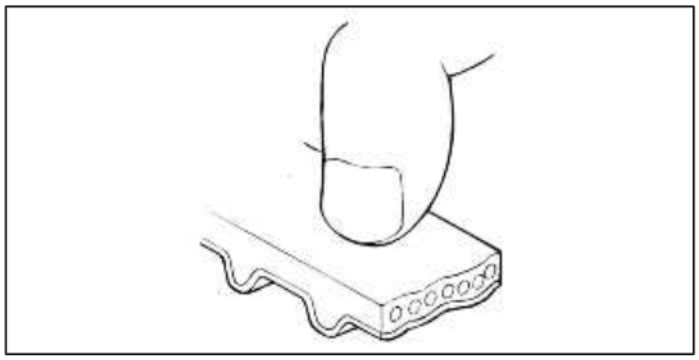
1. Rotate the crankshaft in 2 turns clockwise and measure the projected load of auto tensioner in the TDC (# 1 Compression stroke) after 5 minutes.
2. Check the projected length is 6-8 mm.
3. Check again if the timing marks of each sprocket are in specified position.

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

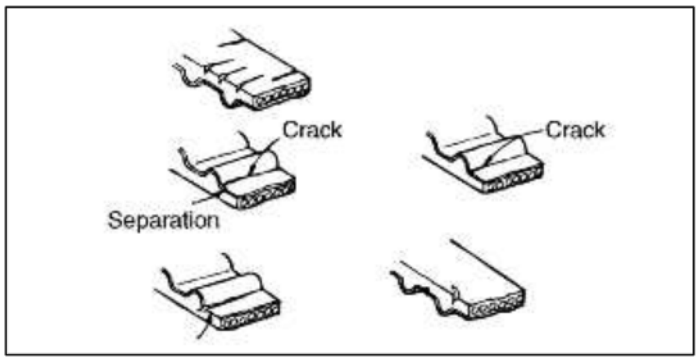
INSPECTION

1. Closely inspect the belt. If the following problems are evident, replace the belt with a new one.

(1) Hardened back surface rubber Back surface glossy. Non-elastic and so hard that even if a finger nail is forced into it, no mark is produced.

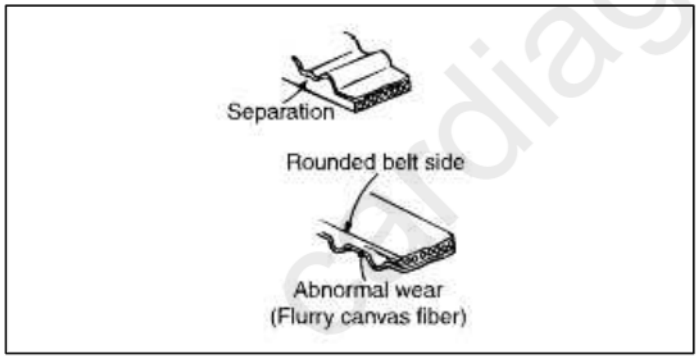


(2) Cracked surface rubber



(3) Side of belt badly worn

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



(4) Teeth badly worn

Initial stage:

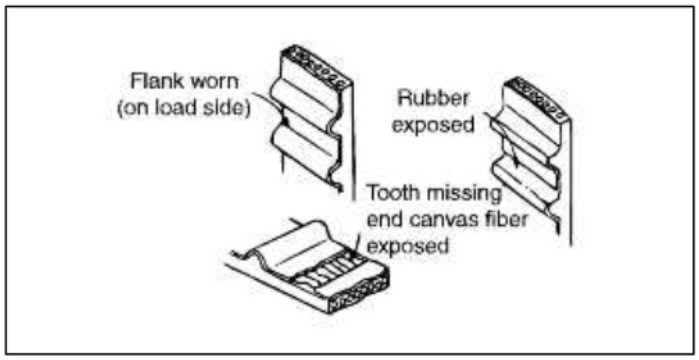
Canvas on the load side of the tooth flank worn (fluffy canvas fibers, rubber gone and color changed to white, unclear canvas texture)

Last stage:

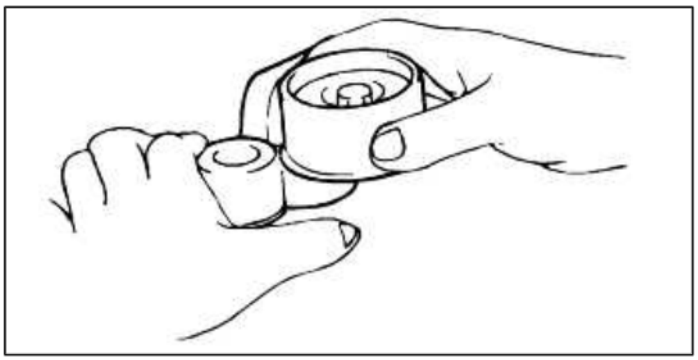
Canvas on the load side of the tooth flank worn down and rubber exposed (tooth width reduced)

cardiagn.com

(5) Missing tooth



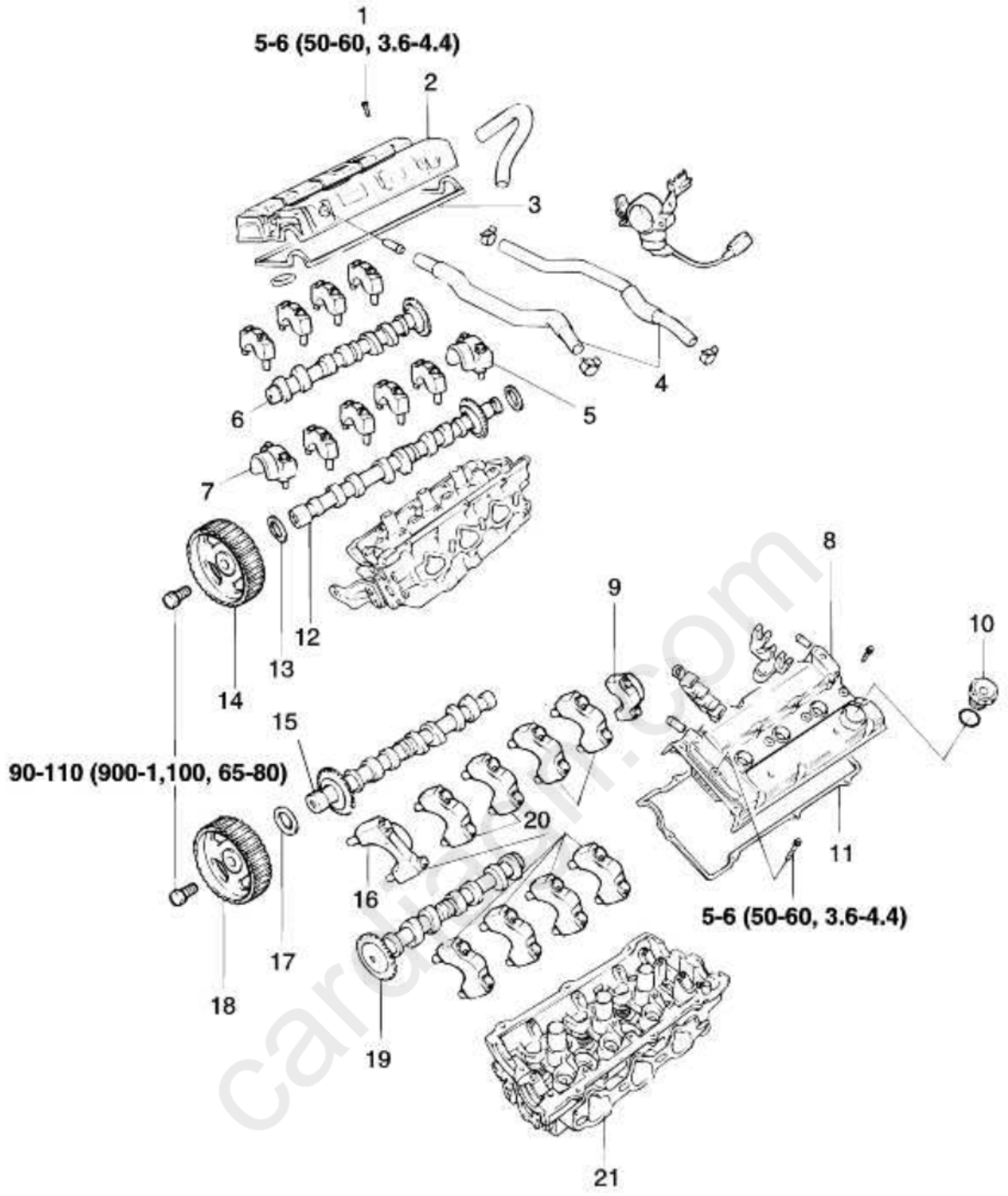
2. If backlash or an irregular noise is observed when rotating the pulley, replace the timing belt tensioner and Idler pulley.



Engine Mechanical System > Cylinder Head Assembly > Camshaft > Components and Components Location

COMPONENTS

cardiagn.com



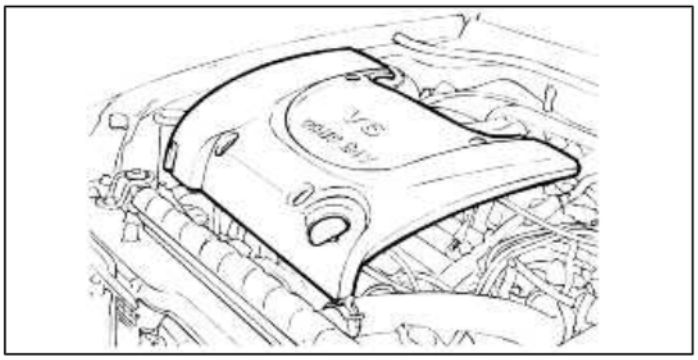
TORQUE : Nm (kg·cm lb·ft)

1. Cylinder head cover bolt	8. Cylinder head cover	15.Camshaft (IN)
2. Cylinder head cover	9. Bearing cap (Rear)	16.Bearing cap (Front)
3. Gasket	10.Oil filler cap	17.Camshaft oil seal
4. PCV hose	11.Gasket	18.Camshaft sprocket
5. Bearing cap (Rear)	12.Camshaft (IN)	19.Camshaft (EX)
6. Camshaft (EX)	13.Camshaft oil seal	20.Bearing cap
7. Bearing cap (Front)	14.Camshaft sprocket	21.Cylinder head

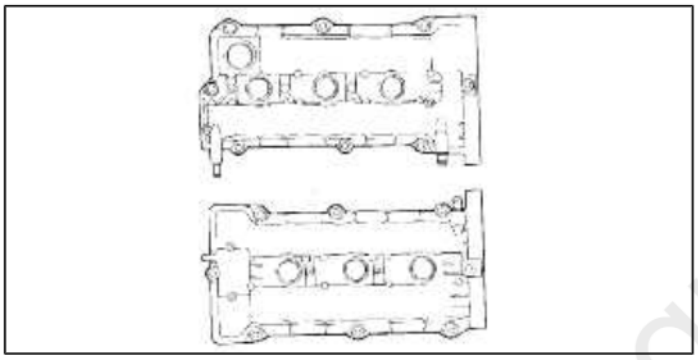
Engine Mechanical System > Cylinder Head Assembly > Camshaft > Repair procedures

REMOVAL

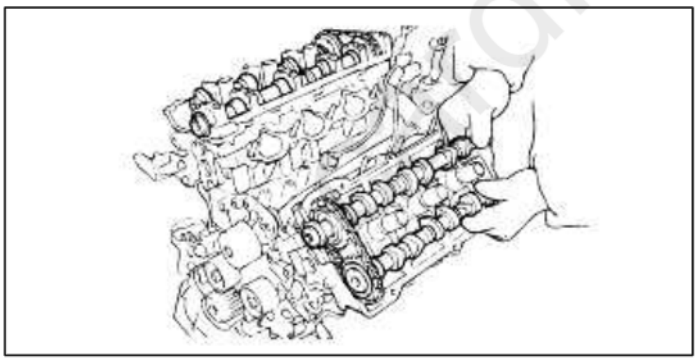
1. Remove the engine cover and intake manifold



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

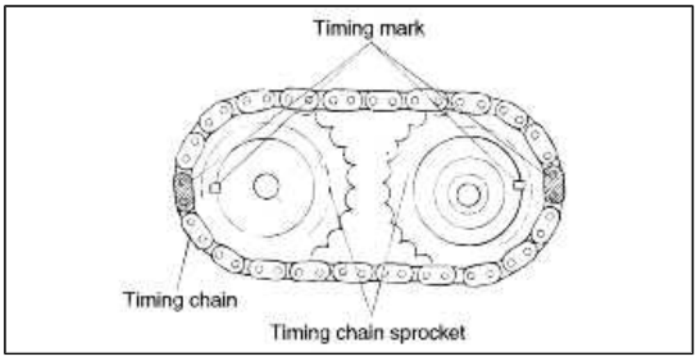


9. Remove the camshaft sprocket.
10. Remove the camshaft bearing caps.
11. Remove the camshaft.



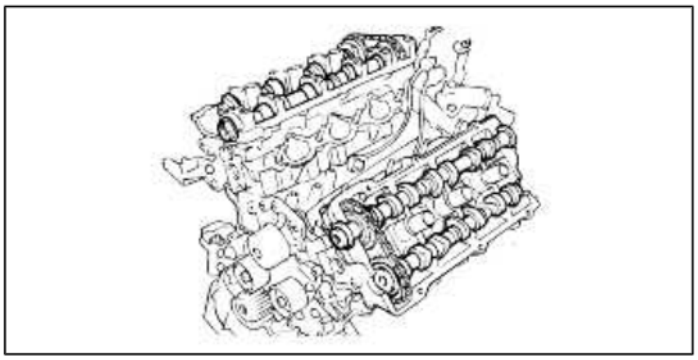
INSTALLATION

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

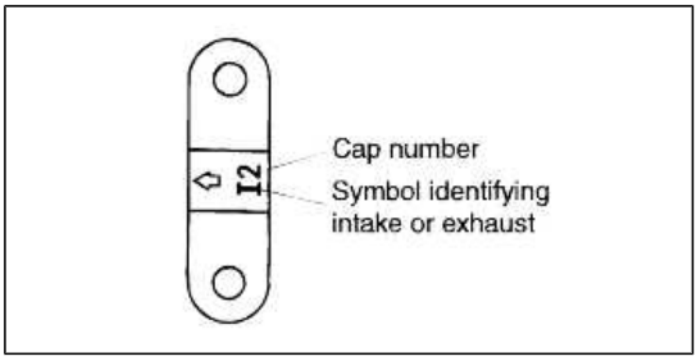


mdiagn.com

3. Install the camshaft after lubricating the journal of camshaft with engine oil.

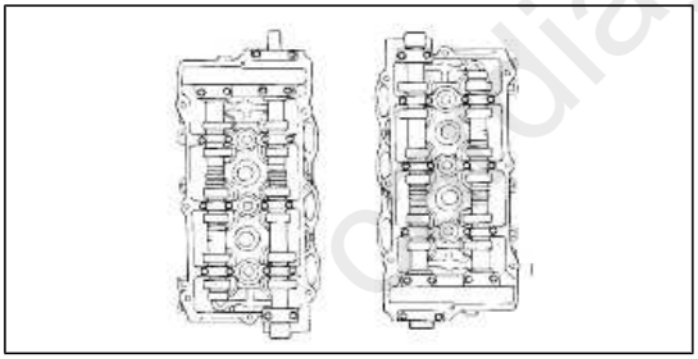


4. Install the bearing caps. Check the markings on the caps for intake/exhaust identification symbol.
   I : Intake camshaft
   E : Exhaust camshaft

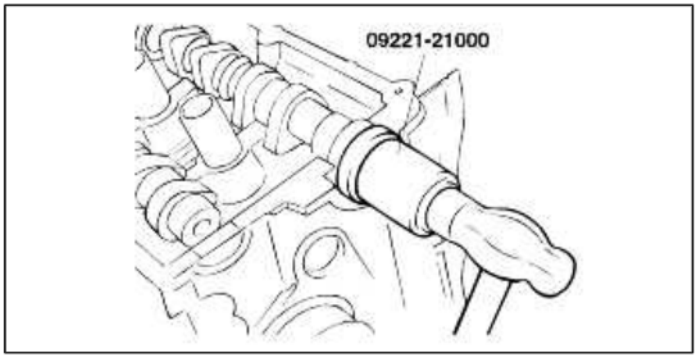


5. Tighten the bearing caps to the specified torque in two or three steps as shown.

Tightening torque
Bearing cap bolt : 14-15Nm(140-150kg·cm, 10-11 lb·ft)

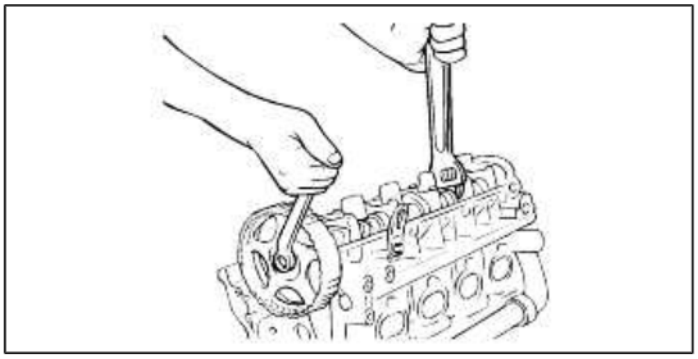


6. Using the special tool, camshaft oil seal installer (09221-21000), press fit the camshaft oil seal. Be sure to apply engine oil to the external surface of the oil seal.
   Insert the oil seal along the camshaft front end and install by driving the installer with a hammer until the oil seal pulley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



7. Install the camshaft sprocket to the specified torque.

Tightening torque
Camshaft sprocket bolt :
90-110Nm (900-1100kg·cm, 65-80 lb·ft)

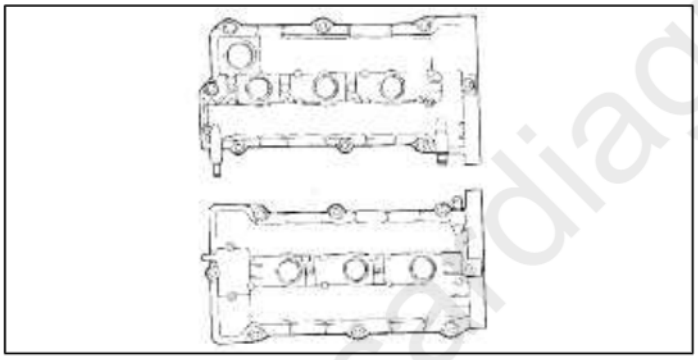


8. Install the cylinder head cover.

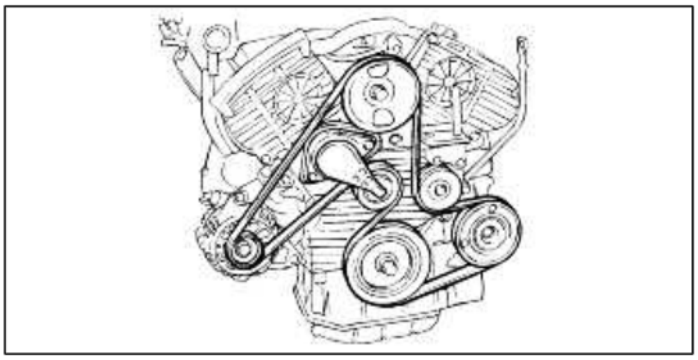
Tightening torque
Cylinder head cover bolts :
5-6Nm (50-60kg·cm, 3.6-4.4 lb·ft)

(1) Tighten all bolts with temporary torque. (half of the standard torque) in orders of 1. 2. 3. 4. 5. 6. 7. 8.

(2) Tighten all bolts with standard torque.

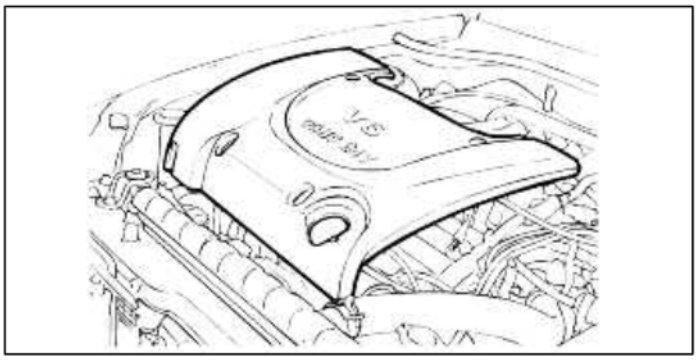


9. Install the spark plug cables, center cover.
10. Install the timing belt and then tighten the timing belt tensioner pulley.
11. Install the timing belt cover.
12. Install the coolant pump pulley and crankshaft pulley, and tensioner pulley.



cardiagn.com

13. Install the intake manifold and engine cover.



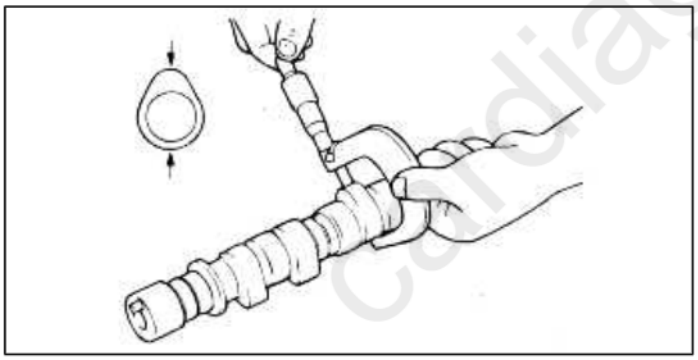
14. Install the oil filler cap.
15. Connect the breather hose and engine harness.

INSPECTION

Camsahfts

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

Cam height
[Standard]
Intake : 43.95-44.15mm (1.7303-1.7382) in.)
Exhaust : 43.95-44.15mm (1.7303-1.7382) in.)
[Limit]
Intake : 43.45 mm (1.7106 in.)
Exhaust : 43.45 mm (1.7106 in.)



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

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

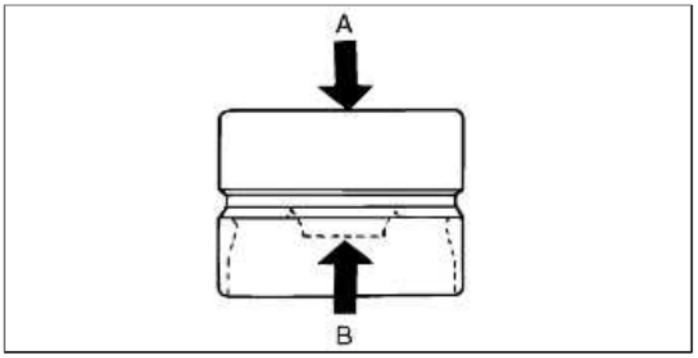
Oil Seal (camshaft front)

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

HLA (Hydraulic Lash Adjuster)

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

cardiagn.com

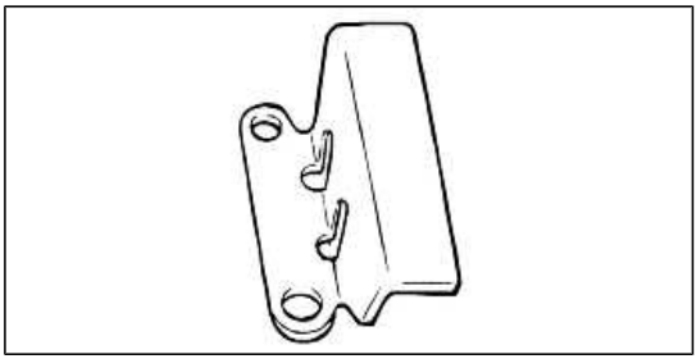


Problem	Possible cause	Acftion
Temporary noise on starting a cold engine	Normal	This noise will disappear after the oil in the engine reaches normal pressure.
Continuous noise when engine is started after longer than 48 hours parking.	Oil leakage of the high pressure chamber on HLA, allowing air to get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

Chain guide

carmanuals.com

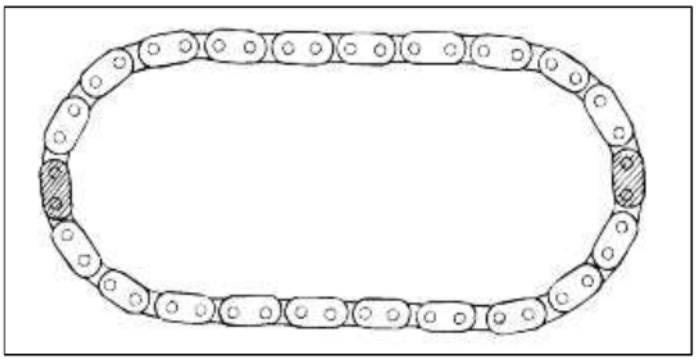
1. Check the chain guide for bend, cracks or damage.
   Replace if necessary.



2. Check the rubber part of chain guide for abnormal wear.
   Replace if necessary.

Timing chain

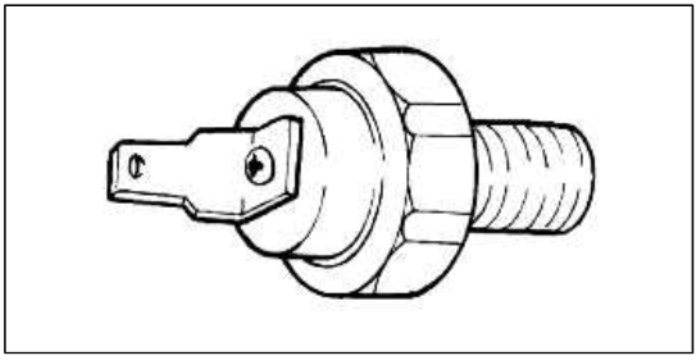
Check the bushing and plate of timing chain for wear. Replace if there is severe wear.



Oil Pressure Switch

1. If "OIL PRESSURE" indicating lamp lights when ignition switch is "ON" and goes out when engine is started and runs at idle, then everything is in order. If "OIL PRESSURE" lamp does not light up when ignition switch is "ON" check the switch, lamp and wiring.
2. If there is current flow when ignition switch is set to "ON" and if there is no current flow when engine is running at idle, switch is good. If the switch is good, check the lamp and wiring.

Oil pressure switch operation pressure :
19.8-39.2 kPa (0.2-0.4 kg/cm², 2.8-5.6 psi)

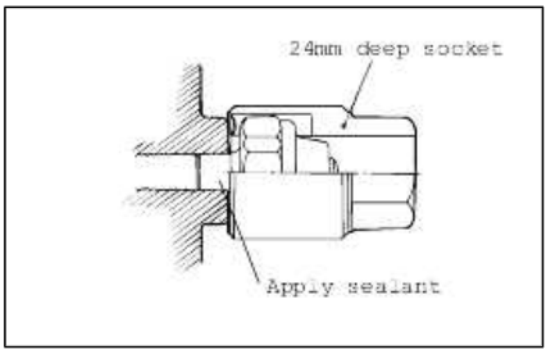


cardiagn.com

3. Using the special tool (09260-32000), tighten the switch to the specified torque.

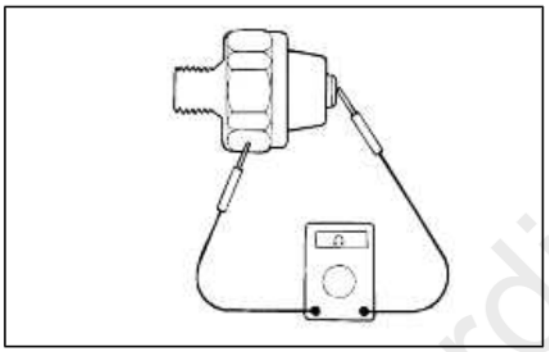
> NOTE
>
> Do not torque the oil pressure switch too much.

Tightening torque
Oil pressure switch and sender assembly :
8-12 Nm (80-120 kg.cm, 5.8-8.7 lb.ft)

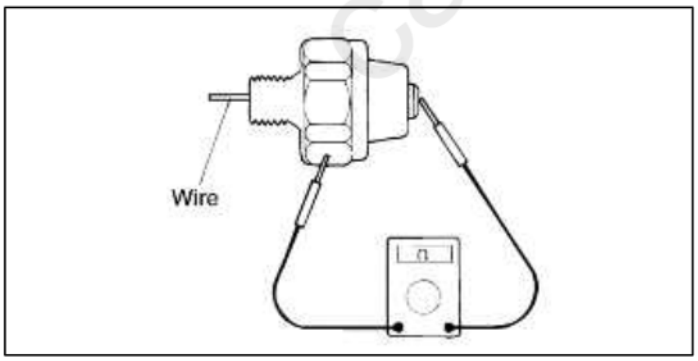


INSPECTION

1. Check the continuity between the terminal and the body with an ohmmeter.
   If there is no conitnuity, replace the oil pressure switch.



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 it.

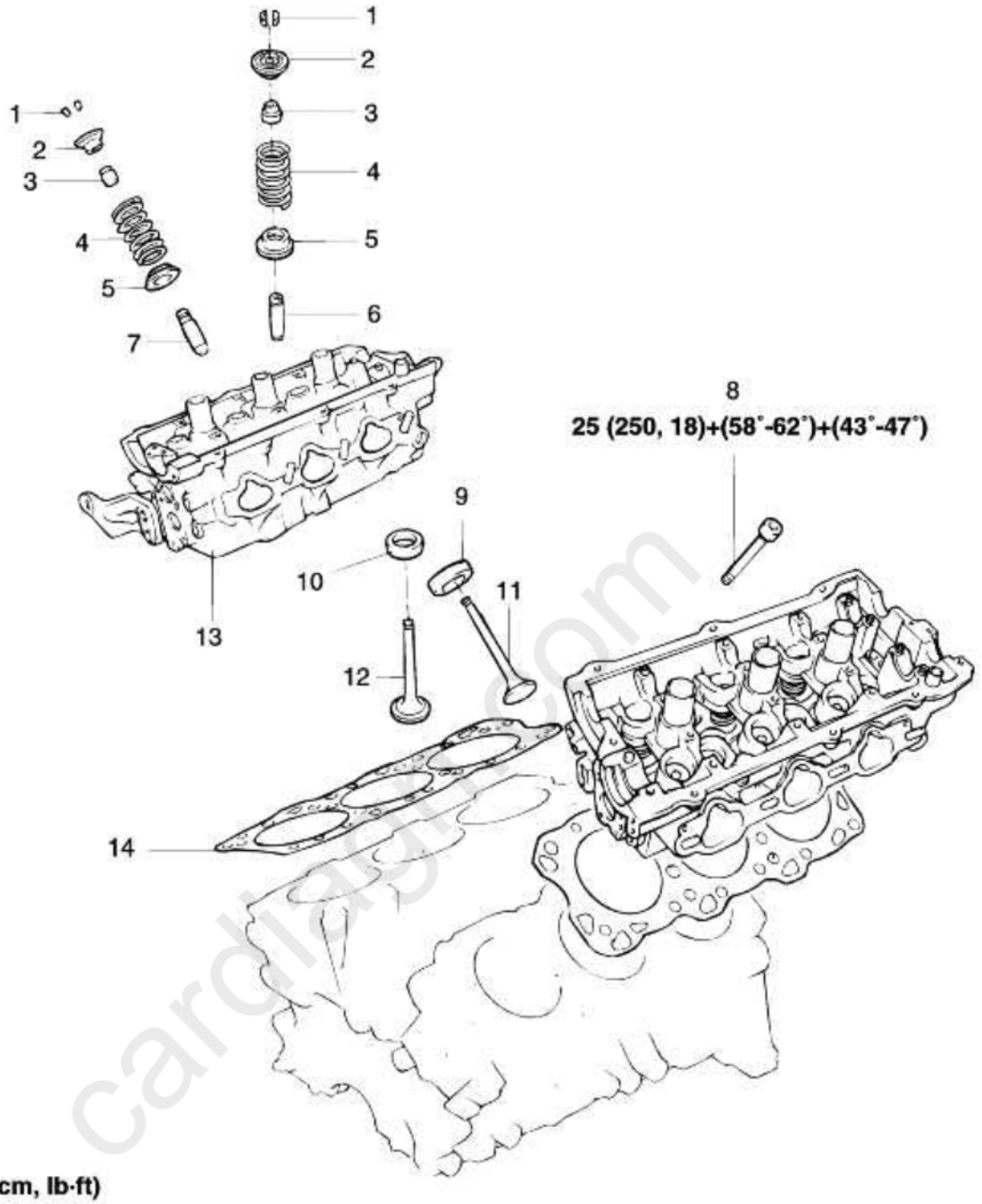


3. Or, if there is no continuity when a 50 kPa (7 psi) vacuum is applied through the oil hole, the switch is operating properly.
   Check that air doesn't leak. If air leaks, the diaphragm is broken. Replace the switch.

Engine Mechanical System > Cylinder Head Assembly > Cylinder Head > Components and Components Location

COMPONENTS

cardiagn.com



TORQUE : Nm (kg·cm, lb·ft)

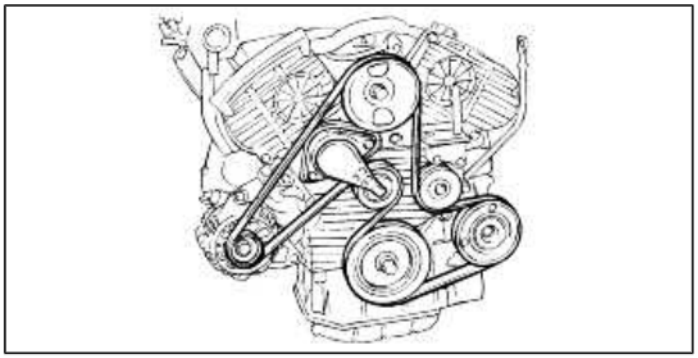
1. Retainer lock
2. Valve spring retainer
3. Valve stem seal
4. Valve spring
5. Valve spring seat
6. Inlet valve guide
7. Exhaust valve guide
8. Cylinder head bolt
9. Exhaust valve seat
10. Inlet valve seat
11. Exhaust valve
12. Inlet valve
13. Cylinder head
14. Cylinder head gasket

Engine Mechanical System > Cylinder Head Assembly > Cylinder Head > Repair procedures

DISASSEMBLY

1. Drain the coolant and disconnect the upper radiator hose.
2. Remove the breather hose and air-intake hose.
3. Remove the vaucuum hose, fuel hose and coolant hose.
4. Remove the intake manifold.

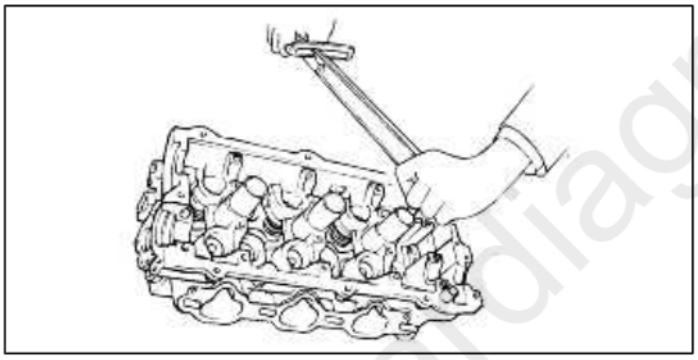
5. Remove the cables from the spark plugs. The cables should be removed by holding the boot portion.
6. Remove the ignition coil.
7. Remove the upper and lower timing belt cover.



8. Remove the timing belt and camshaft sprockets.
9. Remove the heat protector and exhaust manifold assembly.
10. Remove the coolant pump pulley and head cover.
11. Remove the intake and exhaust camshaft.
12. Remove the cylinder head assembly. The cylinder head bolts should be removed, in the sequence as shown in the illustration in two or three steps.
13. Remove the gasket pieces from the cylinder block top surface and cylinder head bottom surface.

NOTE

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



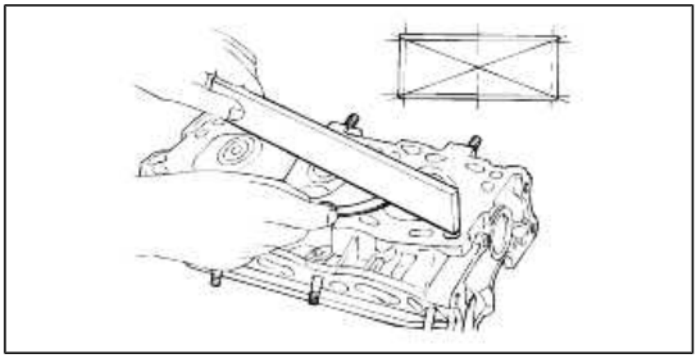
INSPECTION

1. Remove scale, sealing compound and carbon deposits completely. After cleaning oil passages, apply compressed air to make certain that the passages are not clogged.
2. Visually check the cylinder head for cracks, damage or water leakage.

cardiagn.com

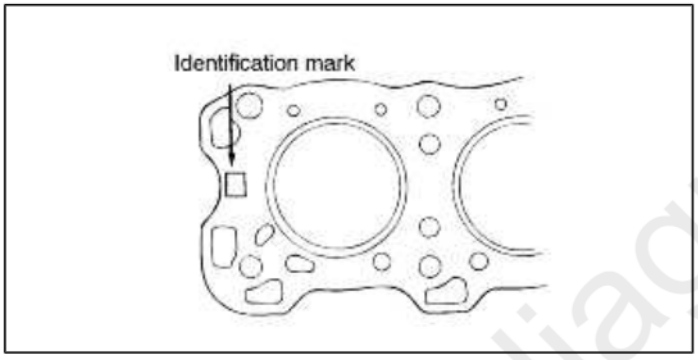
3. Check the cylinder head gasket surface for flatness with a straight edge and feeler as shown in illustration.

Cylinder head flatness :
Standard dimension : Max. 0.03 mm (0.0012 in.)
Service limit : 0.05 mm (0.002 in.)



Reassembly

1. Clean both gasket surfaces of the cylinder head and cylinder block.
2. Verify the identification marks on the cylinder head gasket.

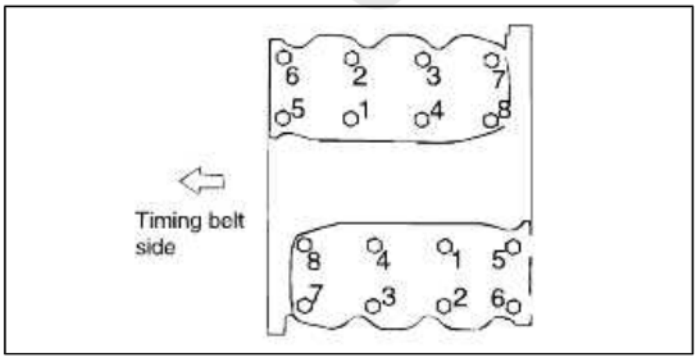


3. Position the gasket surface to have the identification mark towards the cylinder head.

NOTE

Do not apply sealant to these surfaces.

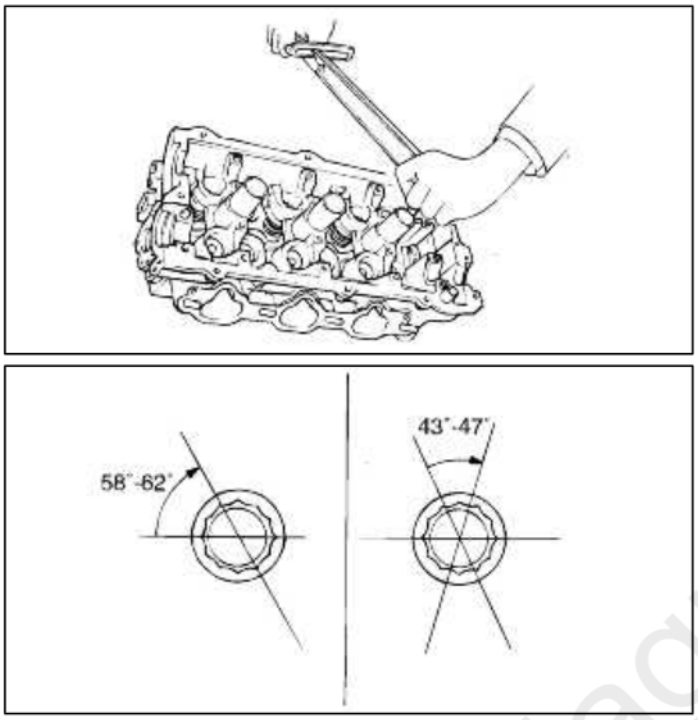
4. Torque the cylinder head bolts in the sequence shown in the illustration.



cardiagn.com

5. Install the cylinder head bolts. Starting at top center, tighten all cylinder head bolts in sequence as shown in illustration. Repeat the procedures, tightening all cylinder head bolt to the specified torque again.

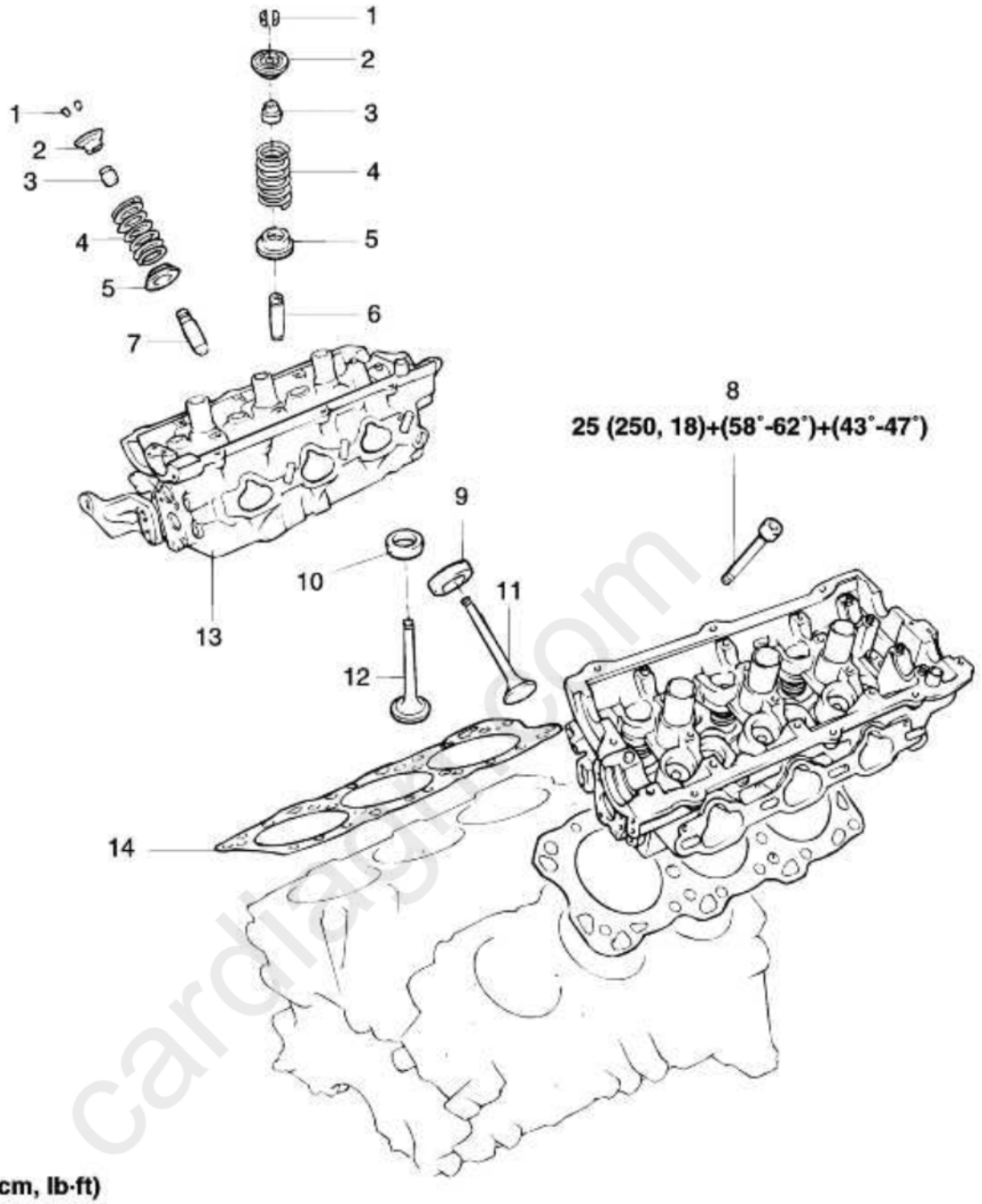
Tightening procedure.
(1) Tighten all bolts (1 - 8):
25 Nm (250 kg.cm, 18 lb.ft)
(2) Tighten all bolts (1 - 8): 58°~ 62°of a turn
(3) Tighten all bolts (1 - 8): 43°~ 47°of a turn



Engine Mechanical System > Cylinder Head Assembly > Valve > Components and Components Location

COMPONENTS

cardiagn.com



TORQUE : Nm (kg·cm, lb·ft)

1. Retainer lock
2. Valve spring retainer
3. Valve stem seal
4. Valve spring
5. Valve spring seat
6. Inlet valve guide
7. Exhaust valve guide
8. Cylinder head bolt
9. Exhaust valve seat
10. Inlet valve seat
11. Exhaust valve
12. Inlet valve
13. Cylinder head
14. Cylinder head gasket

Engine Mechanical System > Cylinder Head Assembly > Valve > Repair procedures

REPLACEMENT

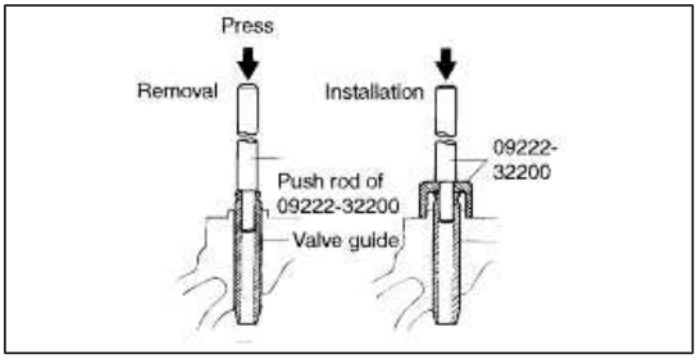
Reconditioning Valve Seat

1. Before reconditioning, check the valve guide for wear. Replace worn guide if necessary, and then recondition the the valve seat.
2. To recondition the valve seat, use the Valve Seat Cutter and Pilot.

3. After reconditioning, the valve and valve seat should be lapped lightly with a lapping compound.

Replacing Valve Guide

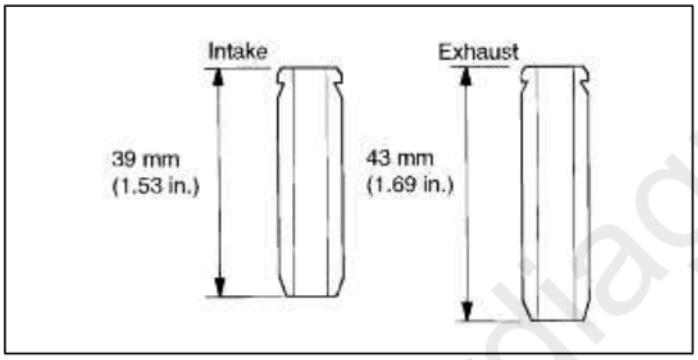
1. Using the Special tool (09222-32200), press down the old valve guide toward the bottom of cylinder head.



2. Recondition the valve guide hole so that it matches the newly press-fit oversize valve guide.

Valve Guide Insert Oversizes

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



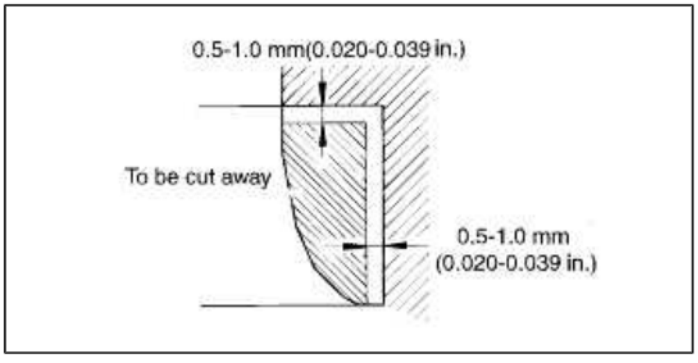
3. Using the special tool (09221-29000(A), 09221-22000(B)) press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head. Keep in mind that the valve guides are different in length.
4. After the valve guide is press-fit, insert a new valve and check for proper clearance.
5. After the valve guide has been replaced, check proper valve face to valve seat contact.

NOTE

Do not install a valve guide of the same size again.

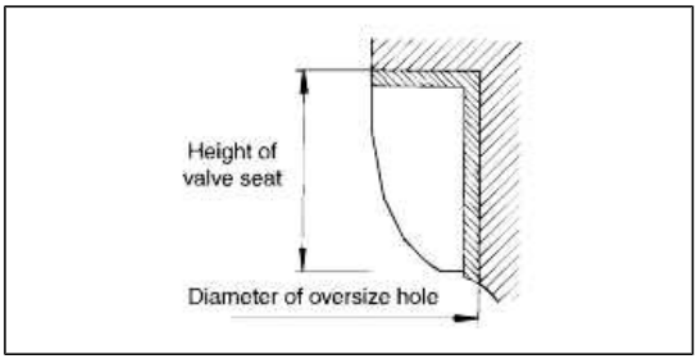
Replacing Valve Seat Insert

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



cardiagn.com

2. Adjust the press fit diameter of the valve seat on the cylinder head side so that it can match the diameter of the oversize valve seat.



Description	Intake valve seat insert	Exhaust valve seat insert
Size mm (in.)	0.3 (0.012) O.S.	0.3 (0.012) O.S.
Size mark	30	30
Seat insert height H mm (in.)	7.9-8.1 (0.311-0.319)	7.9-8.1 (0.311-0.319)
Cylinder head I.D. mm (in.)	33.300-33.325 (1.311-1.312)	28.600-28.621 (1126-1.127)

3. Heat the cylinder head to about 250°C (480°F) and press an oversize seat insert fit for the insert bore in the cylinder head at normal temperature .
4. Treat the valve seat in the way shown in the illustration.
5. Use the lapping compound, and lap the valve.

Valve seat contact width
Intake : 1.1-1.5 mm (0.043-0.059 in.)
Exhaust : 1.3-1.7 mm (0.051-0.067 in.)

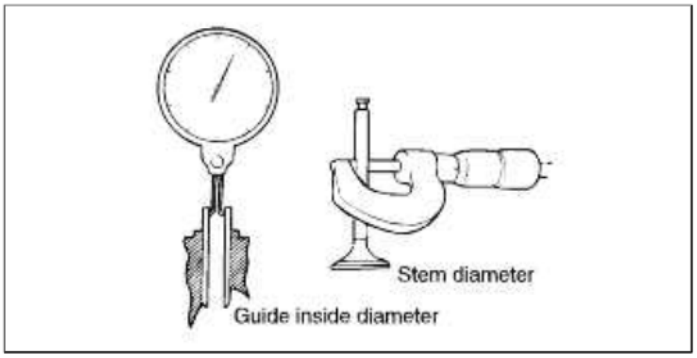
INSPECTION

Valve Guides

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

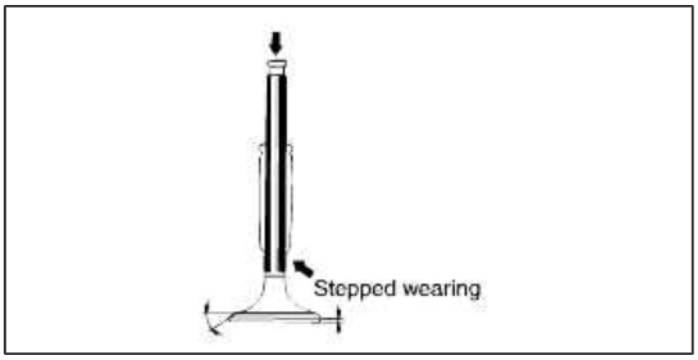
Valve stem-to-guide clearance
Standard value
Intake : 0.02-0.05 mm (0.0009-0.0020 in.)
Exhaust : 0.035-0.065 mm (0.0014-0.0026 in.)
Service limit
Intake : 0.10 mm (0.0039 in.)
Exhaust : 0.15 mm (0.0059 in.)

cardiagn.com



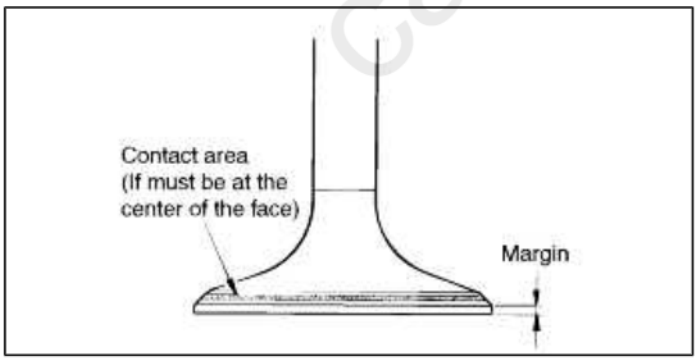
Valve

1. Replace the valve stem if it is worn (stepped, worn or damaged). Also replace it if the stem end (the surface contacting the auto-lash adjuster) is recessed.



2. Check the valve face contact area, and recondition or replace as necessary.
3. Replace the valve if the width of the margin (thickness of the valve head) is less than the minimum specified.

Valve margin
Standard value
Intake side : 1.0 mm (0.0394 in.)
Exhaust side : 1.3 mm (0.0512 in.)
Service limit
Intake side : 0.5 mm (0.0197 in.)
Exhaust side : 0.8 mm (0.0315 in.)



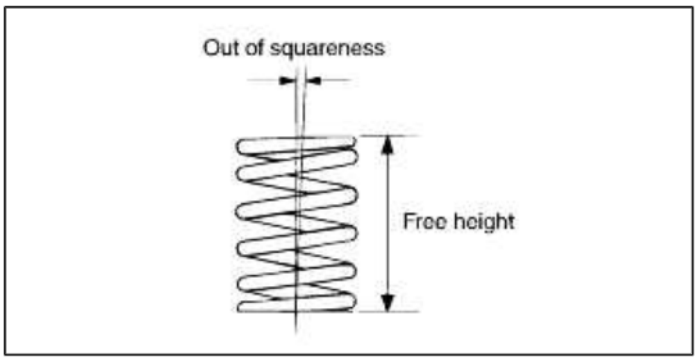
Valve Springs

1. Check free height of each valve spring and replace if necessary.

cardiagn.com

2. Using a square, test squareness of each valve spring. If spring is excessively out of square, replace it.

Valve spring
Standard value
Free height : 42.5 mm (1.6732 in.)
Load : 21.9 kg/35 mm (49 lb/1.3780 in.)
Out of squareness : Max. 1.5°
Service limit
Free height : 41.5 mm (1.6339 in.)
Load : 21.9 kg/34 mm (49 lb/1.3386 in.)
Out of squareness : Max. 3°

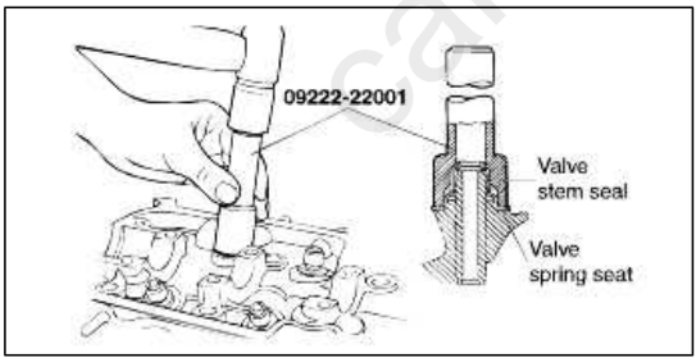


Reassembly

1. Install the spring seats.
2. Using the special tool (09222-22001), lightly tap the seal into place. The seal is installed in the specified position, using the special tool.

NOTE

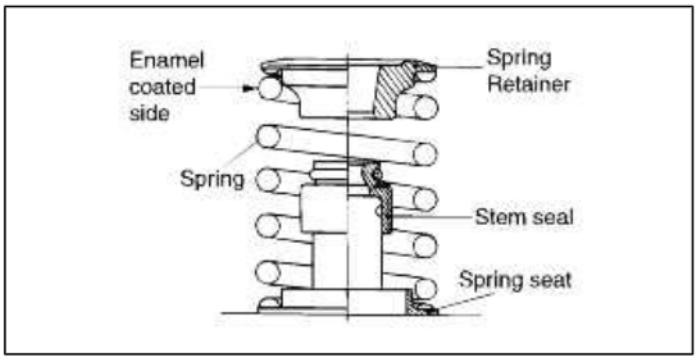
- Do not reuse old valve stem seals.
- Incorrect installation of the seal could result in oil leakage down the valve guides.



3. Apply engine oil to each valve. Insert valves into guides. Avoid forcing the valve into the seal. After installing the valve, check that it moves smoothly.

cardiagn.com

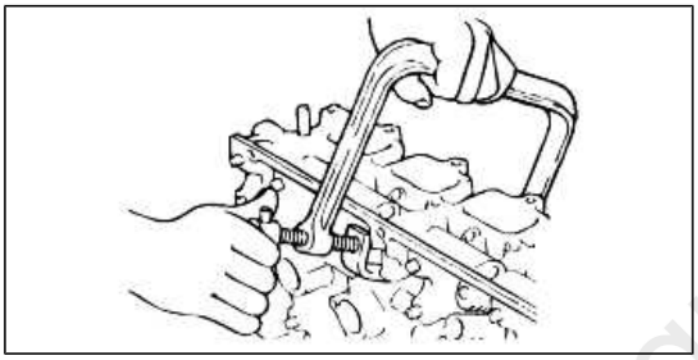
4. Valve springs should be installed with the enamel coated side toward the valve spring retainer.



5. Using the special tool (09222-28000), compress the spring and install the retainer locks. After installation of the valves, make certain that the retainer locks are correctly in place before releasing the valve spring compressor.

NOTE

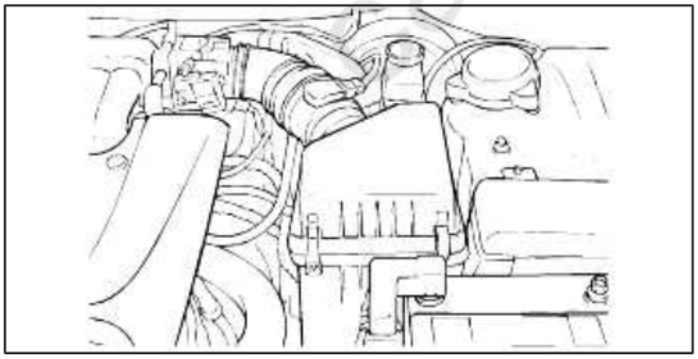
When the spring is compressed, check that the valve stem seal is not pressed against the bottom of retainer.



Engine Mechanical System > Engine And Transaxle Assembly > Engine And Transaxle Assembly > Repair procedures

REMOVAL

1. Remove the battery and engine cover.
2. Detach the air cleaner.



3. Disconnect the connectors for the engine harness.
4. Disconnect the connectors for the alternator harness, the oil pressure switch and the oil pressure sensor.
5. Drain the engine coolant.

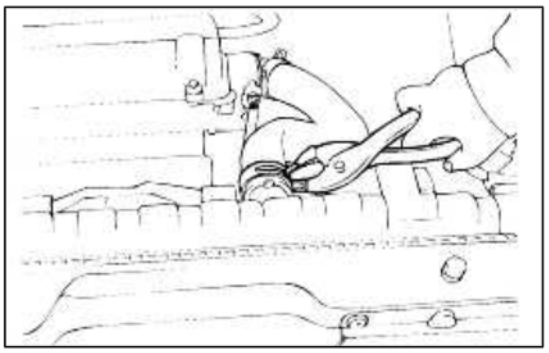
cardiagn.com

6. Disconnect the transaxle oil cooler hoses.

> NOTE
>
> When disconnecting the hoses, make identification marks to avoid making any mistakes when installing them again.

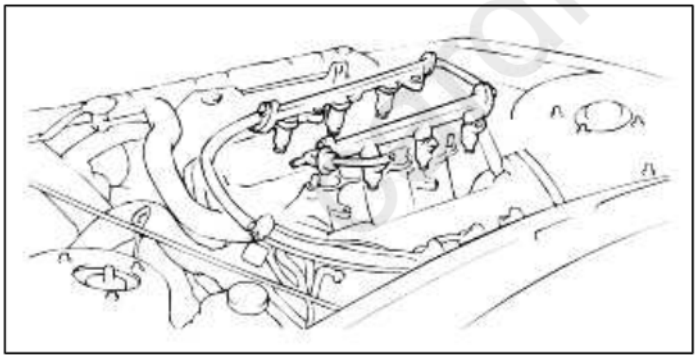
> CAUTION
>
> Be careful not to spill any of the oil or fluid out of the hoses. Plug the openings to prevent the entry of foreign material.

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

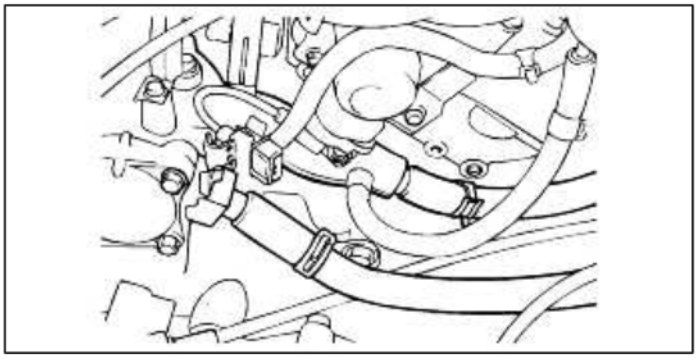


8. Disconnect the high tension cable and all wires to the distributor from the ignition coil.
9. Disconnect the engine ground.
10. Disconnect the brake booster vacuum hose.
11. Remove the main fuel line, and the return and vapor hoses from the engine side.

> CAUTION
>
> To reduce the residual pressure in the hoses, refer to Group Fuel System "Fuel filter replacement".

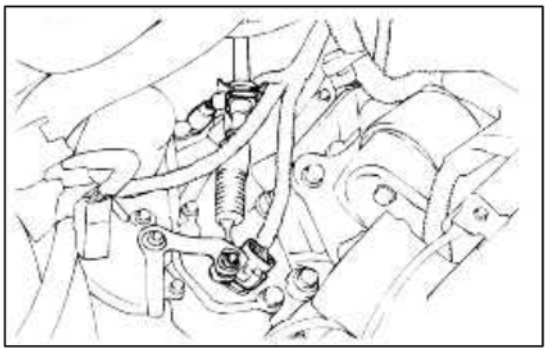


12. Disconnect the heater hoses (inlet and outlet) on the engine side.

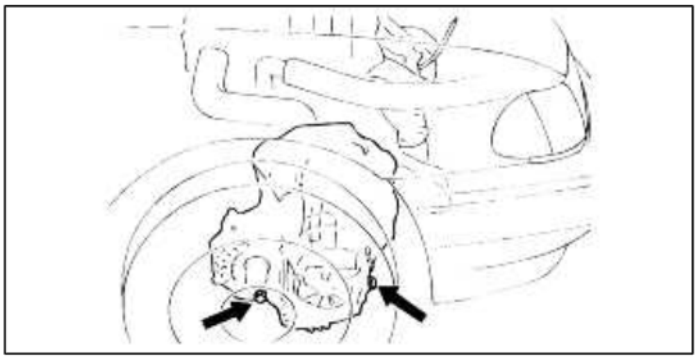


13. Disconnect the accelerator cable and cruise control cable at the engine side.
14. Remove the control cable from the transaxle.

15. Disconnect the speedometer cable from the transaxle.



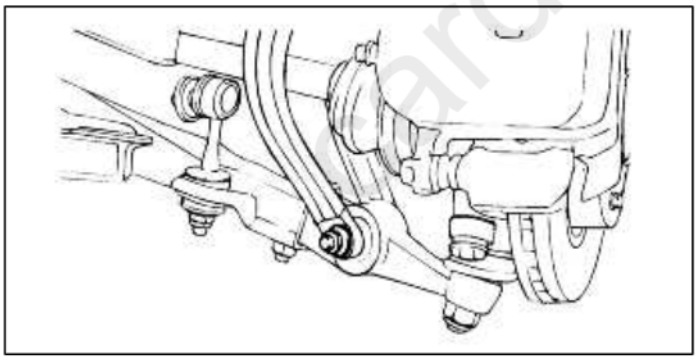
16. Remove the power steering oil pump hose.
17. Raise the vehicle.
18. Remove the oil pan shield.
19. Drain the transaxle oil.

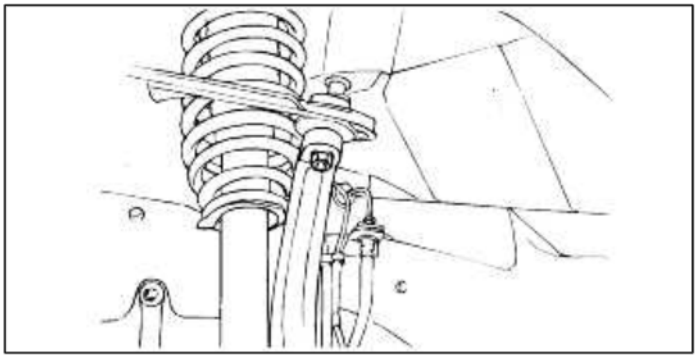


20. Disconnect the front exhaust pipe from the manifold.

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

21. Remove the lower arm ball joint bolts and upper arm bolt from the knuckle.

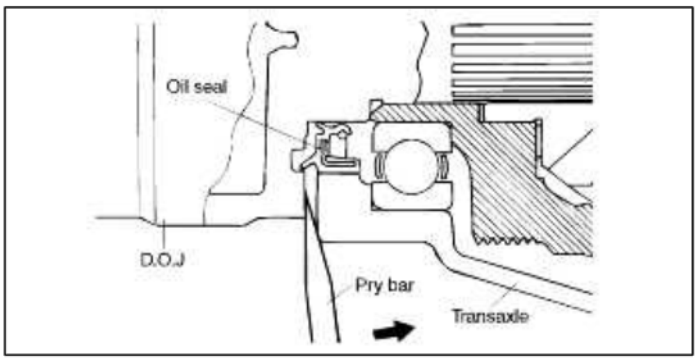




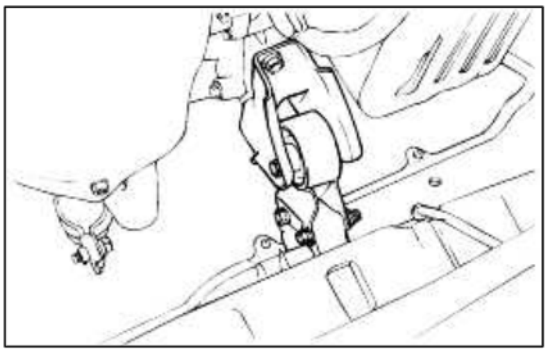
cardiagn.com

22. Remove the drive shafts from the transaxle housing.

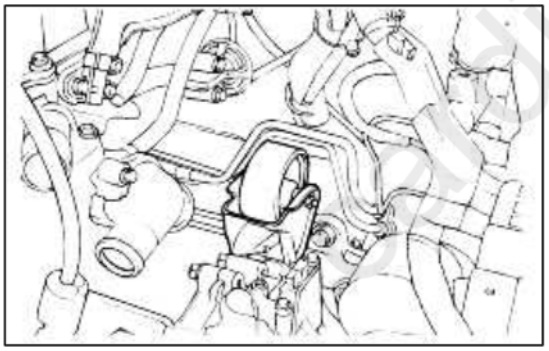
> **CAUTION**
>
> 1. Plug up the holes of the transaxle case to prevent entry of foreign material.
> 2. The circlips on the drive shafts should be replaced when installing again.



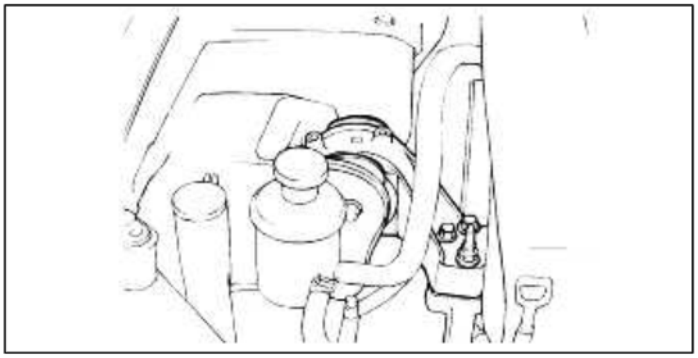
23. Attach a cable to the engine, and use a chain hoist to lift the engine only enough to pull the cable tight.
24. Remove the front roll stopper.



25. Remove the rear roll stopper.



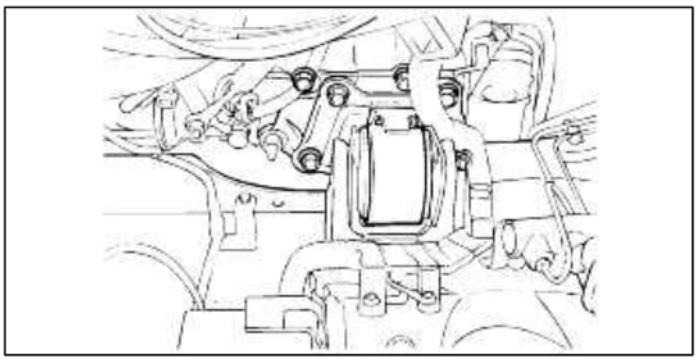
26. Disconnect the connector of starter motor harness.
27. Remove the engine mount bolts.
28. Remove the bolts and nuts that fasten the engine mount bracket to the body.



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

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

30. Remove the transaxle mounting bracket bolts.

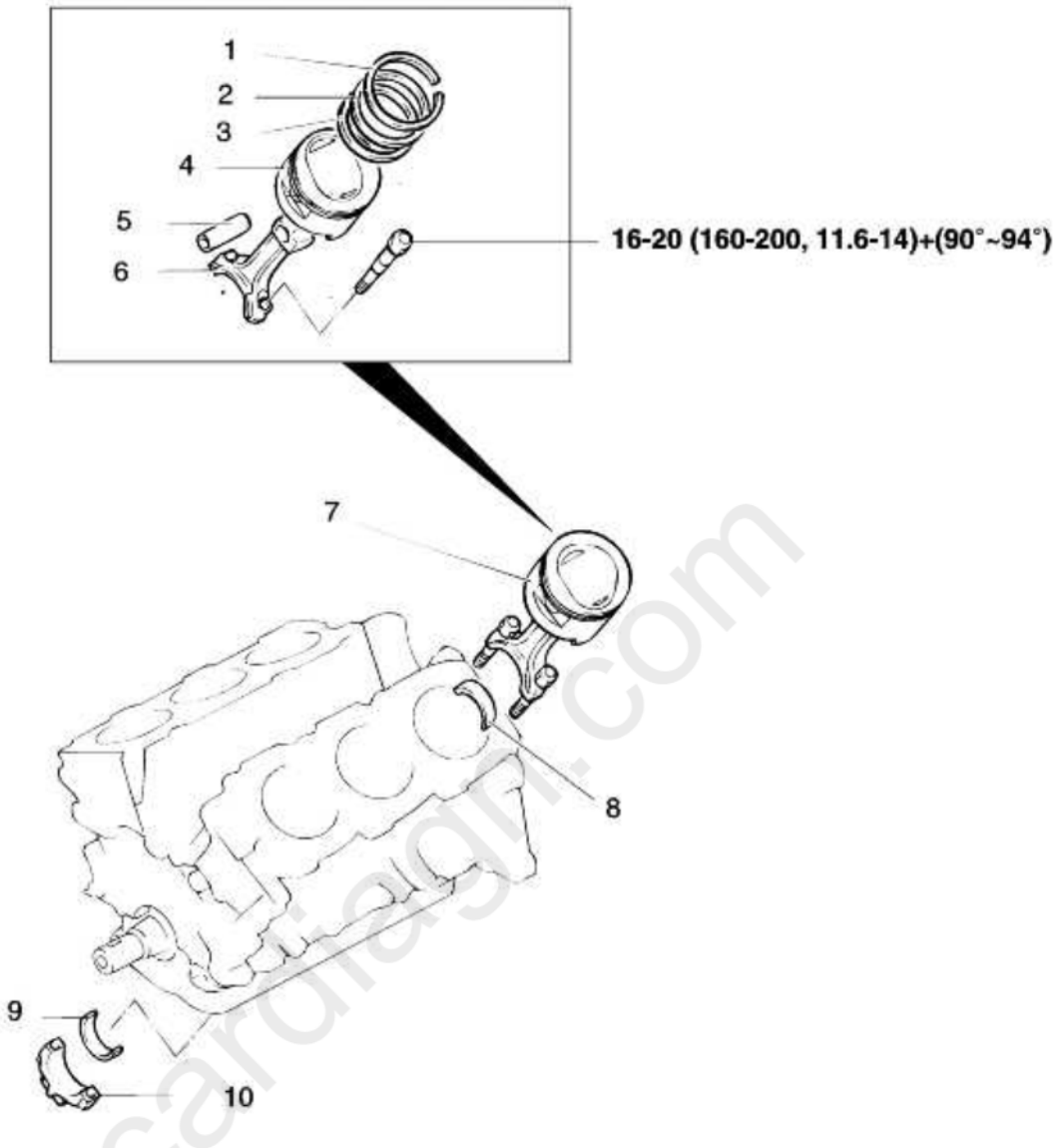


31. Remove the left mount insulator bolt.
32. While directing the transaxle side downward, lift the engine and transaxle assembly up out of the vehicle.

Engine Mechanical System > Cylinder Block > Piston and Connecting Rod > Components and Components Location

COMPONENTS

cardiagn.com



TORQUE : Nm (kg·cm, lb·ft)

1. No.1 piston ring
2. No.2 piston ring
3. Oil ring
4. Piston
5. Piston pin
6. Connecting rod
7. Piston and connecting rod assembly
8. Connecting rod bearing (upper)
9. Connecting rod bearing (lower)
10. Connecting rod cap

Engine Mechanical System > Cylinder Block > Piston and Connecting Rod > Repair procedures

Disassembly

Connecting Rod Cap

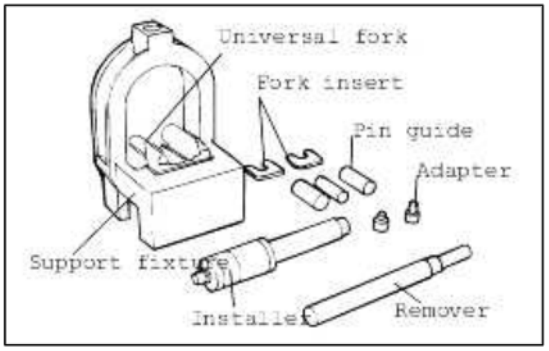
CAUTION

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

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

Piston pin

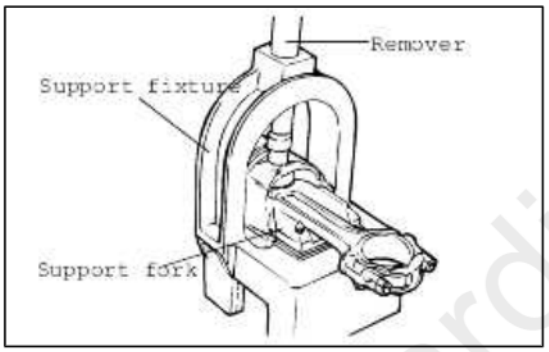
1. Use the special tools (09234-33001) disassemble and re-assemble the piston and connecting rod.



2. Place the proper insert in the fork of the tool. Position the insert between the connecting rod and the piston.
3. Insert the proper removal tool through the hole in the arch of the tool.

CAUTION

Center the piston, rod and pin assembly with the removal arbor.



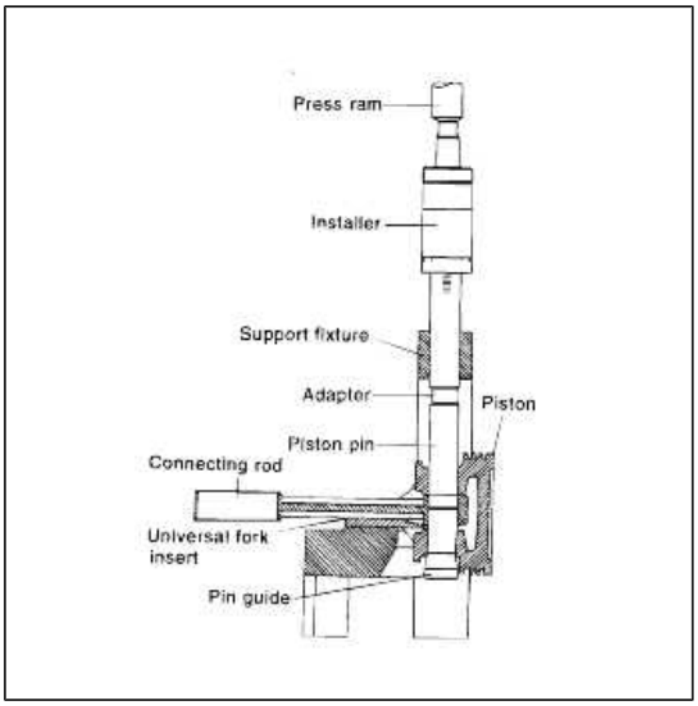
4. Press the piston pin out of the connecting rod.
5. Install the proper pin guide (refer to application chart) through the piston and into the connecting rod. Hand tap the pin guide into the piston for proper retention. Drop the piston pin into the other side of the piston.

CAUTION

The pin guide centers the connecting rod in the piston. When the piston, connecting rod, piston pin and pin guide assembly are positioned on the fork of the tool, the pin guide will also center this assembly in the tool. If a pin guide that is too small is used, the piston assembly will not be located centrally in the tool, and damage may occur to the fork and/or the insert of the tool.

cardiagn.com

6. Install piston assembly onto fork assembly of a tool. The tool will support connecting rod at the piston pin. Be sure that piston assembly is slid onto the fork until the pin guide contacts the fork insert.



7. Adjust the installing arbor to the proper length by turning the numbered sleeve on the lettered shaft until the specified alphanumeric setting from the application chart is obtained. Turn knurled nut to lock numbered sleeve on shaft.
8. Insert the installing arbor through the hole in the arch of the tool. Press piston pin into the connecting rod until the sleeve on the installing arbor contacts the top of the tool arch. The pin guide will fall out of the connecting rod as the piston pin is pressed in.

> CAUTION
>
> Do not exceed 1250 kgf of force when installing the arbor sleeve against the arch.

INSPECTION

1. When the connecting rod cap is installed, make sure that cylinder numbers put on the rod end 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.
2. Replace the connecting rod if it is damaged on the thrust faces at either end, and also if it has a step wear in, or severely rough surface of, the inside diameter of the small end.

INSPECTION

Piston and Piston Pins

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

Piston Rings

cardiagn.com

1. Measure the piston ring side clearance. If the measured value exceeds the service limit, insert a new ring in a ring groove to measure the side clearance. If the clearance still exceeds the service limit, replace the piston and rings together. If it is lessthan the service limit, replace the piston rings only.

Piston ring side clearance
No.1 : 0.04-0.08 mm (0.0016-0.0031 in.)
No.2 : 0.03-0.07 mm (0.0012-0.0028 in.)
[Limit]
No.1 : 0.1 mm (0.004 in.)
No.2 : 0.1 mm (0.004 in.)

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

Piston ring end gap
[Standard dimension]
No.1 : 0.20-0.35 mm (0.0079-0.0138 in.)
No.2 : 0.37-0.52 mm (0.0146-0.0205 in.)
Oil ring side rail : 0.20-0.7 mm (0.0079-0.0276 in.)
[Limit]
No.1, No.2 : 0.8 mm (0.031 in.)
Oil ring side rail : 1.0 mm (0.039 in.)

When replacing the ring without correcting the cylinder bore, check the gap with the ring situated at the lower part of cylinder that is less worn.
When replacing a ring, be sure to use a ring of the same size.

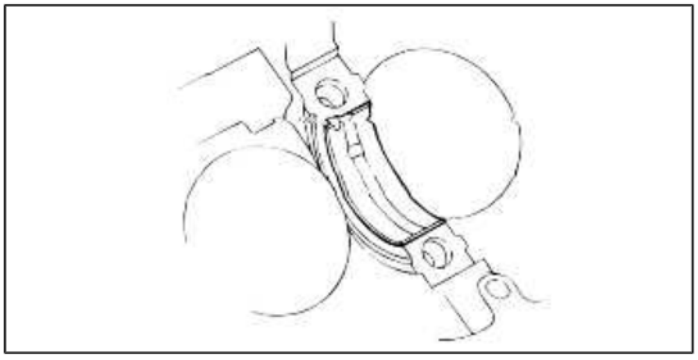
Piston ring service size and mark
STD : None
0.25 mm (0.010 in.) O.S. : 25
0.50 mm (0.020 in.) O.S. : 50

NOTE

The mark can be found on the upper side of the ring next tothe end.

Reassembly

1. Install the upper main bearings in the cylinder block.

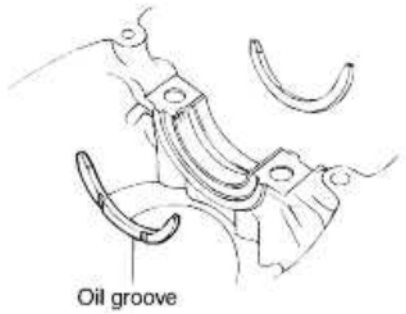


cardiagn.com

2. Install the lower main bearings in the main bearing caps.

> CAUTION
>
> Install the bearing with the oil hole in the block.

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



4. Make sure that the front mark of the piston and the front mark (identification mark) of the connecting rod are directed toward the front of the engine.
5. When the connecting rod cap is installed, make sure that the cylinder numbers put on the rod and cap at disassembly match.
6. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
7. When assembling, bolts should be fastened by plastic region angle - controlled method as follwing.
   (1) Apply oil to the thread of nuts and spot areas.
   (2) Tighten the connecting rod bolt.

Tightening torque
Connecting rod bolt :
16-20 Nm (160-200kg.cm, 11.6-14 lb.ft) +(90°~94°)

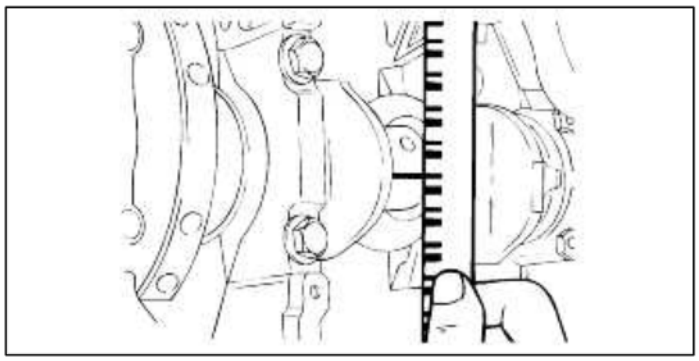
> CAUTION
>
> After removing the connecting rod bolt, do not use bolt again.

8. Check the bearing clearance as follows:
   (1) Remove oil and dirt from the bearings and journals.
   (2) Cut plastic gauge to the same length as the width of the bearing and place it in parallel with the journal, avoiding the oil holes.
   (3) Install the bearing and cap. Tighten to the specified torque. During this operation, do NOT turn the crankshaft.

cardiagn.com

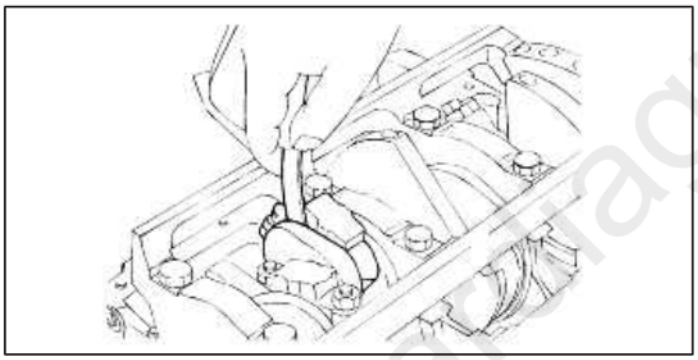
(4) Remove the cap, measure the width of the plastic gauge at the widest part by using the scale printed on the plastic gauge package.

Connecting rod cap
Bearing clearance
Standard : 0.018-0.036 mm (0.0007-0.0014 in.)
Limit : 0.1 mm (0.0039 in.)



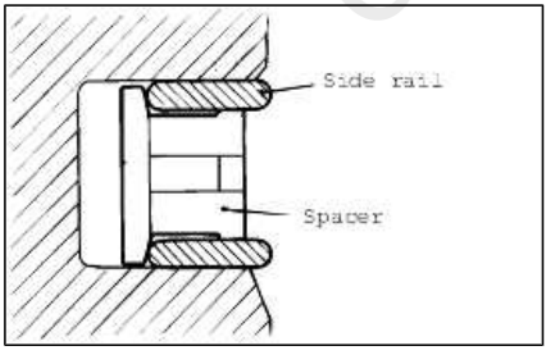
9. Check the connecting rod side clearance.

Side clearance : 0.10-0.25 mm (0.0039-0.0098 in.)
Limit : 0.4 mm (0.016 in.)



Reassemlby

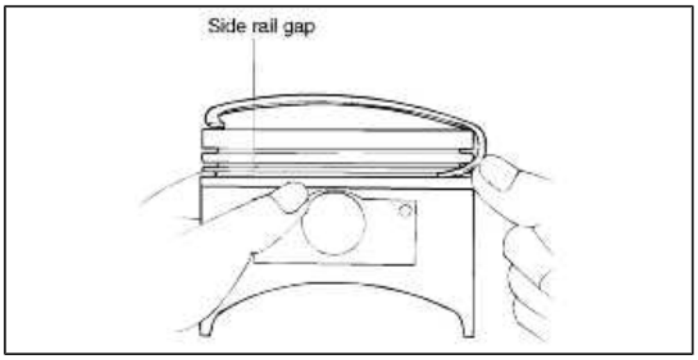
1. Install the spacer.



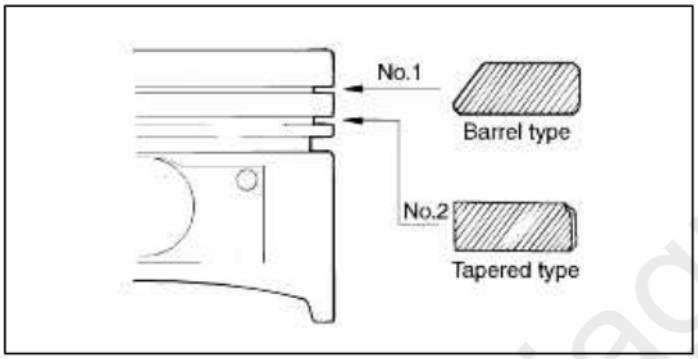
carmagn.com

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

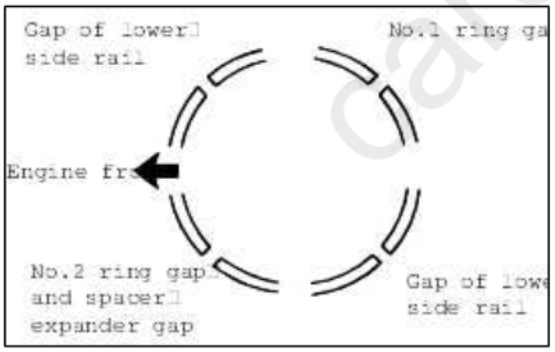
> CAUTION
>
> Do not use a piston ring expander when installing side rail in order to protect side rail.



3. Install the lower side rail by the same procedure as Step 2.
4. Apply engine oil around the piston and piston rings.
5. Using a piston ring expander, install the No.2 piston ring.



6. Install the No.1 piston ring.
7. Position each piston ring end gap as far away from neighboring gaps as possible. Make sure that the gaps are not positioned in the thrust and pin directions.

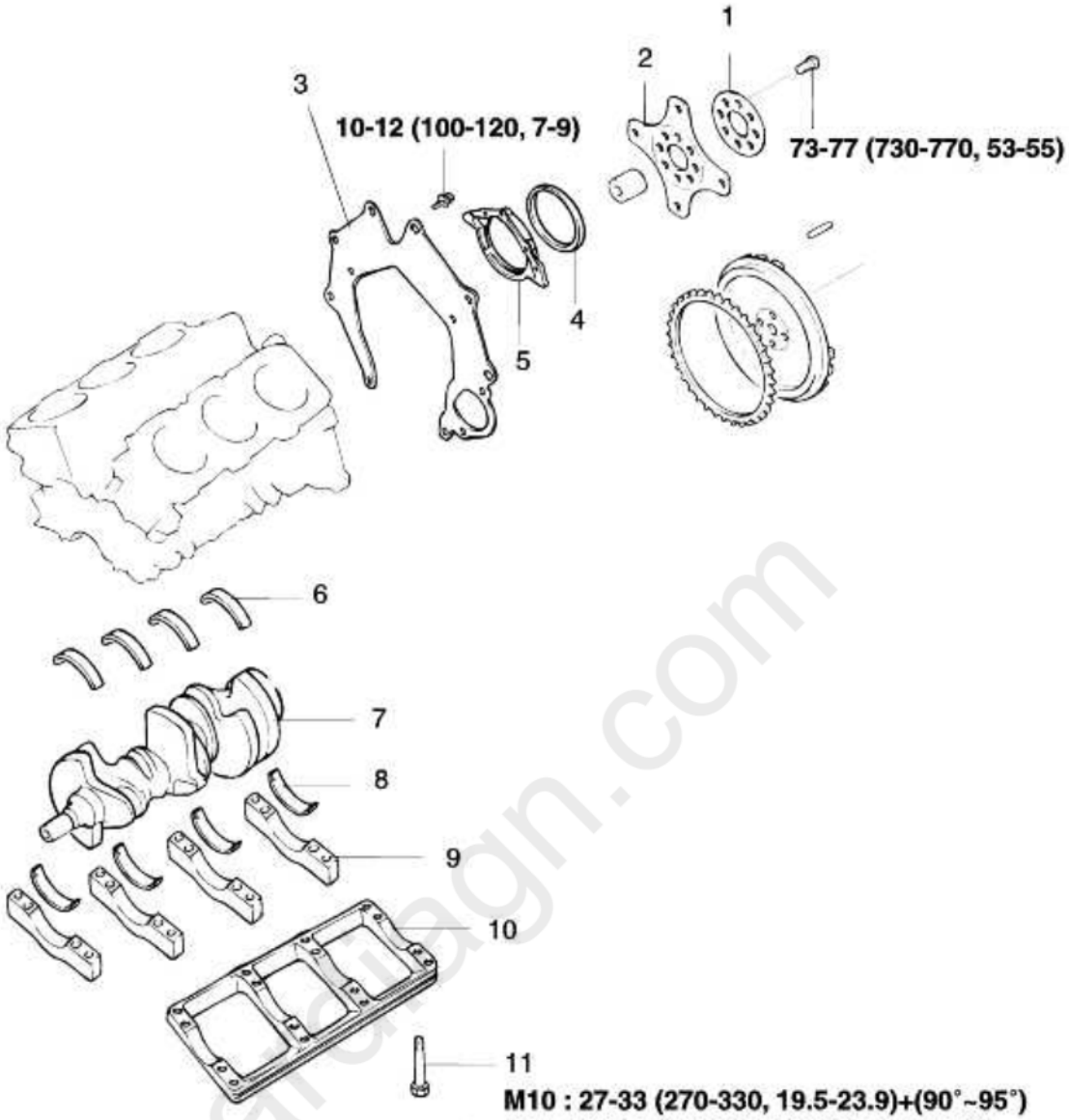


8. Hold piston rings firmly in a piston ring compressor as they are inserted into cylinder.

Engine Mechanical System > Cylinder Block > Crankshaft > Components and Components Location

COMPONENTS

cardiagn.com



TORQUE : Nm (kg·cm, lb·ft)

1. Adaptor plate
2. Drive plate
3. Transaxle mounting plate
4. Rear oil seal
5. Oil seal case
6. Upper bearing
7. Crank shaft
8. Lower bearing
9. Thrust bearing
10. Main bearing cap
11. Main bearing cap bolt

Engine Mechanical System > Cylinder Block > Crankshaft > Repair procedures

Disassemlby

1. Remove the timing belt, cylinder head assembly, drive plate, transaxle mounting plate oil pan. For details, refer to their respective chapters.
2. Remove the oil seal case and the rear oil seal.

3. Remove the connecting rod caps.

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

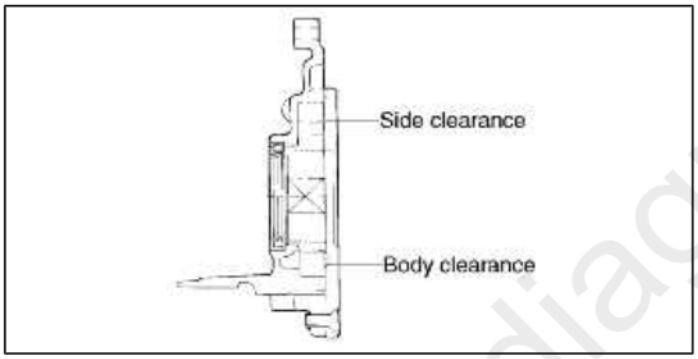
4. Remove the main bearing caps and remove the crankshaft. Keep the bearings in order by cap number.

INSPECTION

Crankshaft

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

Standard value
Crankshaft journal O.D. :
61.982-62.000 mm (2.4402-2.4409 in.)
Crankshaft pin O.D. :
47.982-48.000 mm (1.8891-1.8898 in.)



Main Bearings and Connecting Rod Bearings

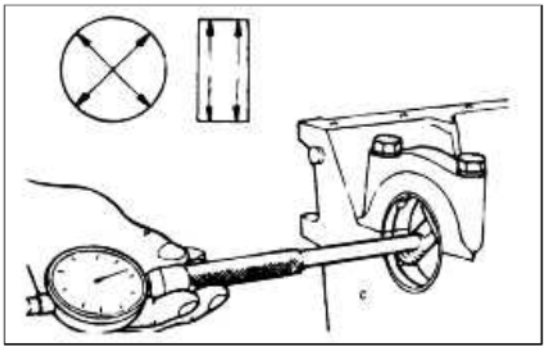
Visually inspect each bearing for peeling, melt, seizure and improper contact. Replace any defective bearings.

Measuring Oil Clearance

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

Standard value
Oil clearance
Crankshaft main bearing :
0.004-0.022 mm (0.0002-0.0009 in.)
Connecting rod bearing :
0.018-0.036 mm (0.0007-0.0014 in.)

cardiagn.com



Plastic gauge Method

Plastic gauge may be used to measure the clearance.

1. Remove oil and grease and any other dirt from the bearings and journals.
2. Cut the plastic gauge to the same length as the width of the bearing and place it in parallel with the journal, avoiding the oil holes.



3. Install the crankshaft, bearings and caps and tighten them to the specified torques. During this operation, do not turn the crankshaft. Remove the caps. Measure the width of the plastigauge at the widest part by using the scale printed on the gauge package.
   If the clearance exceeds the service limit, the bearing should be replaced or an undersize bearing should be used.
   When installing a new crankshaft, be sure to use standard size bearings.
   Should the standard clearance not be obtained even after replacing the bearing, the journal and pin should be ground to the undersize and a bearing of the corresponding size should be installed.

Oil Seal

Check the front and rear oil seals for damage or worn surfaces.

Replace any seat that is defective.

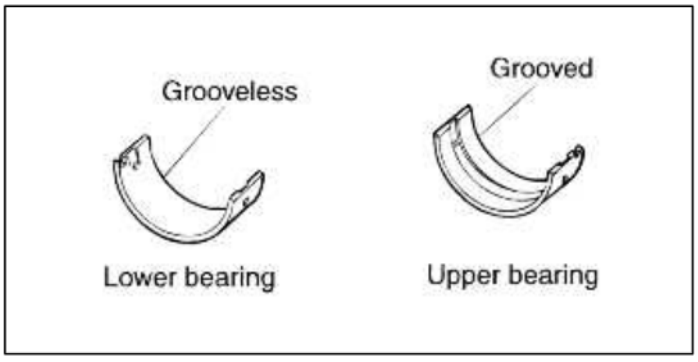
Drive Plate

Replace distorted, damaged, or cracked drive plates.

Reassembly

Main Bearing

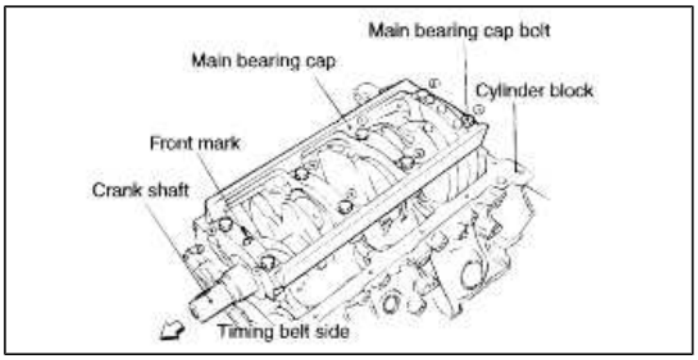
1. Install the grooved main bearing (upper bearing) on the cylinder block side.



2. Install the grooveless main bearing (lower bearing) on the main bearing cap side.
3. Install the crankshaft. Apply engine oil to the journal and pin.

cardiagn.com

4. Caps should be installed with the arrow mark directed toward the front of the engine. The cap number sequence must be correct.

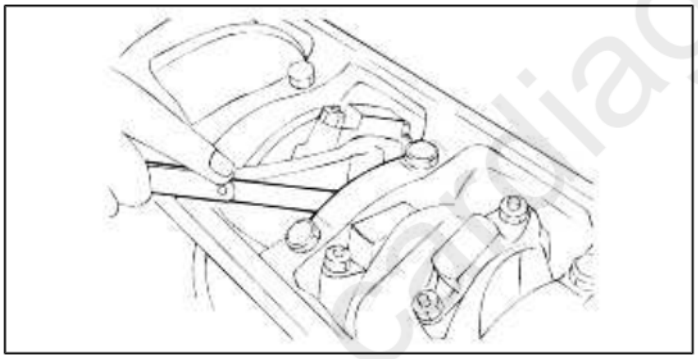


5. Tighten all cap bolts to the specified torque and then rotate all bolts to specified angle.

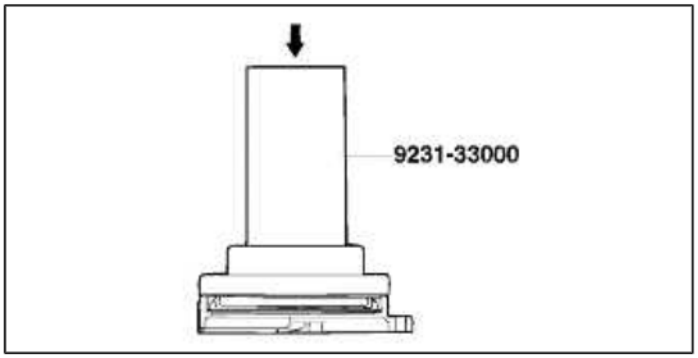
Tightening torque
Main bearing cap bolts :
M8:14-18 Nm (140-180 kg.cm, 10-13 lb.ft) + (90°~94°)
M10: 27-33 Nm (270-330 kg.cm, 19.5-23.9 lb.ft)+(90°~94°)

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

Crankshaft end play
Standard : 0.070-0.250 mm (0.0028-0.0098 in.)
Limit : 0.35 mm (0.014 in.)



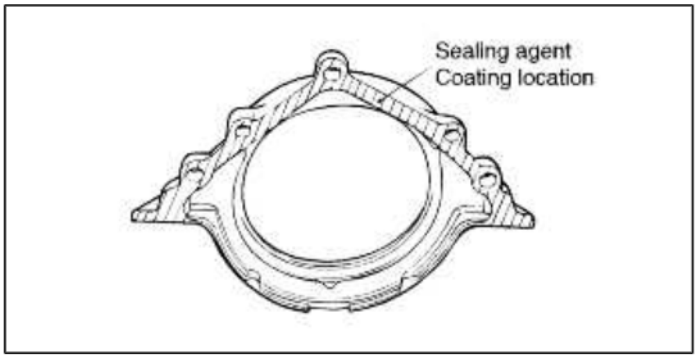
8. Using the special tool (09231-33000), install the rear oil seal in the oil seal case.



carjiagn.com

9. Apply sealant to the area shown in the illustration. Install the oil seal case on the cylinder block.

Tightening torque
Oil seal case bolt :
10-12 Nm (100-120 kg.cm, 7.3-8.6 lb.ft)

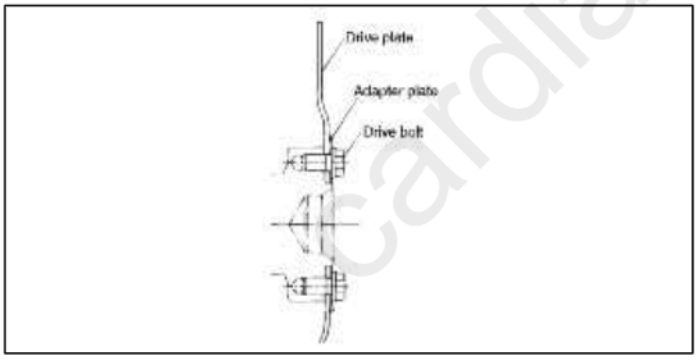


10. Tighten the transaxle mounting plate to the specified torque.

Tightening torque
Transaxle mounting plate bolt :
10-12 Nm (100-120 kg.cm, 7.3-8.6 lb.ft)

11. Tighten the drive plate and the adapter plate.

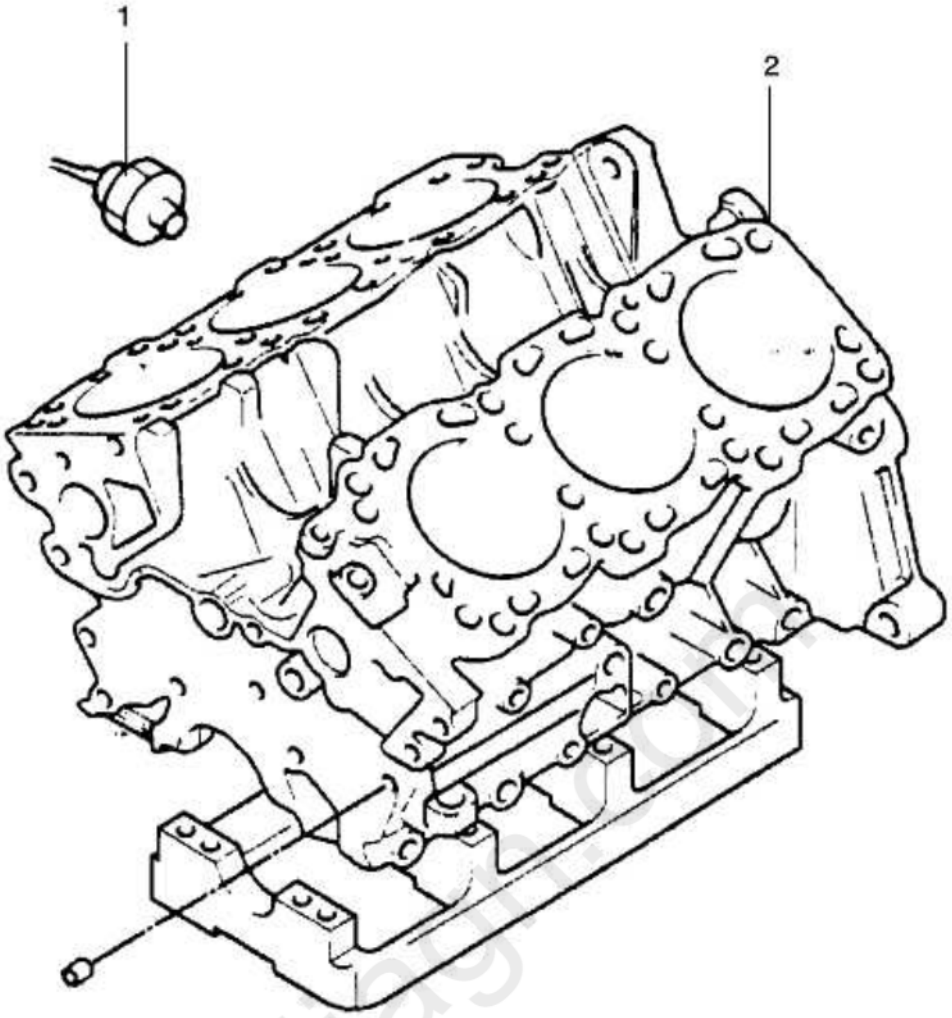
Tightening torque
Drive plate and adaptor plate bolt :
73-77 Nm (730-770 kg.cm, 53-55 lb.ft)



Engine Mechanical System > Cylinder Block > Cylinder Block > Components and Components Location

COMPONENTS

cardiagn.com



1. Oil pressure switch
2. Cylinder block

Engine Mechanical System > Cylinder Block > Cylinder Block > Repair procedures

REMOVAL

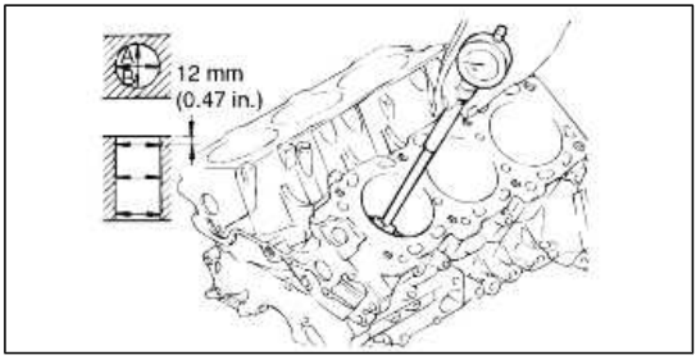
Remove the timing belt, cylinder head assembly, drive plate, transaxle mounting plate, oil pan and the oil pump case. For further details, refer to their respective chapters.

INSPECTION

Cylinder Block

1. Visually check the cylinder block for scores, rust and crorrosion. Also check for cracks or any other defects. Repair or replace the block if defective.

2. Measure the cylinder bore with a cylinder gauge at the three levels indicated in the directions of A and B.
   Level 1 : No.1 piston ring position with piston at TDC
   Level 2 : Center of cylinder
   Level 3 : Bottom of cylinder



3. If the cylinder bores show more than the specified out-of-round or taper, or if the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed. New oversize pistons and rings should be installed.

Standard value
Cylinder bore : 84.00-84.04 mm (3.3071-3.3087 in.)
Out-of-roundness and taper of cylinder bore :
Max. 0.02 mm (0.0008 in.)

---

4. If a ridge exists at the top of the cylinder, cut it away with a ridge reamer.
5. Oversize pistons are available in two sizes.

Piston service size and mark mm (in.)
0.25 (0.010) O.S. : 0.25
0.50 (0.020) O.S. : 0.50

---

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

Piston-to-cylinder wall clearance :
0.010-0.030 mm (0.0004-0.0012 in.)

---

7. Check for damage or cracks in the cylinders.

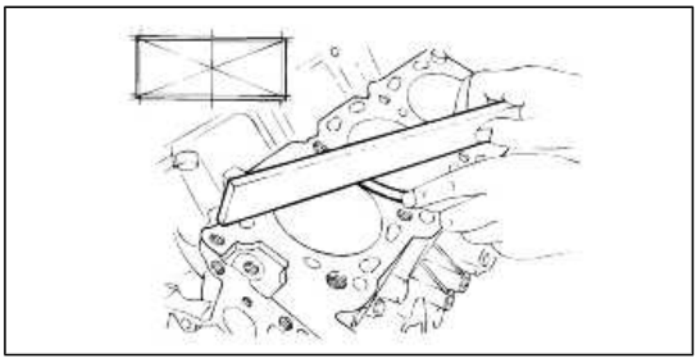
carDiagn.com

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

Standard value
Flatness of gasket surface :
Max. 0.03 mm (0.0012 in.)
Service limit
Flatness of gasket surface : 0.05 mm (0.0002 in.)

CAUTION

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



Boring Cylinder

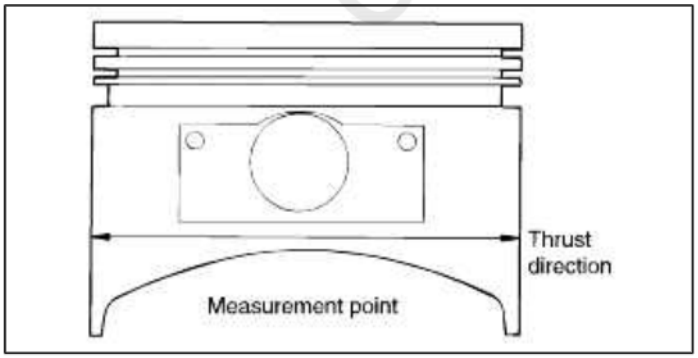
1. Oversize pistons used should be determined on the base of the largest bore cylinder.

Size	Identification mark
0.25 mm (0.010 in.) O.S.	0.25
0.50 mm (0.020 in.) O.S.	0.50

NOTE

Size mark is stamped on top of the piston.

2. Measure the outside diameter of the piston to be used.



3. On the base of the measured O.D., calculate the boring finish dimension.
Boring finish dimension = Piston O.D + 0.01 to 0.03 mm (0.0004 to 0.0012 in.) (clearance between piston and cylinder) - 0.01 mm (0.0004 in.) (honing margin.)

cardiagn.com

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 sequence.

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

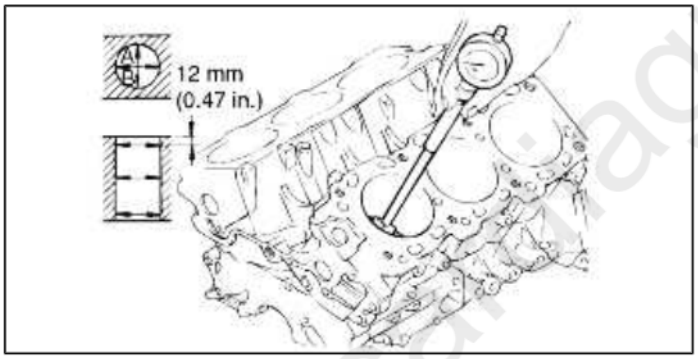
Standard : 0.01-0.03 mm (0.0004-0.0012 in.)

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

INSPECTION

Cylinder Block

1. Visually check the cylinder block for scores, rust and crorrosion. Also check for cracks or any other defects. Repair or replace the block if defective.
2. Measure the cylinder bore with a cylinder gauge at the three levels indicated in the directions of A and B.
   Level 1 : No.1 piston ring position with piston at TDC
   Level 2 : Center of cylinder
   Level 3 : Bottom of cylinder



3. If the cylinder bores show more than the specified out-of-round or taper, or if the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed. New oversize pistons and rings should be installed.

Standard value
Cylinder bore : 84.00-84.04 mm (3.3071-3.3087 in.)
Out-of-roundness and taper of cylinder bore :
Max. 0.02 mm (0.0008 in.)

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

Piston service size and mark mm (in.)
0.25 (0.010) O.S. : 0.25
0.50 (0.020) O.S. : 0.50
0.75 (0.030) O.S. : 0.75
1.00 (0.039) O.S. : 1.00

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

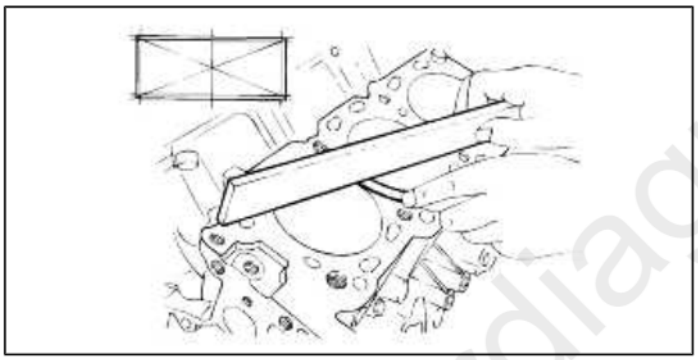
Piston-to-cylinder wall clearance :
0.010-0.030 mm (0.0004-0.0012 in.)

7. Check for damage or cracks in the cylinders.
8. Check the top surface of the cylinder block for flatness. If the top surface exceeds limits, grind to the minimum limit or replace.

Standard value
Flatness of gasket surface :
Max. 0.03 mm (0.0012 in.)
Service limit
Flatness of gasket surface : 0.05 mm (0.0002 in.)

CAUTION

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



Boring Cylinder

1. Oversize pistons used should be determined on the base of the largest bore cylinder.

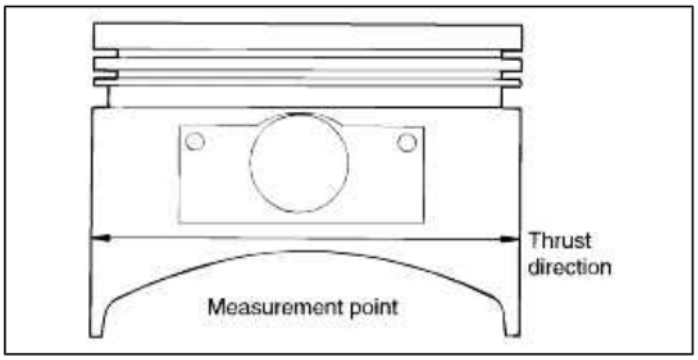
Size	Identification mark
0.25 mm (0.010 in.) O.S.	0.25
0.50 mm (0.020 in.) O.S.	0.50
0.75 mm (0.030 in.) O.S.	0.75
1.00 mm (0.039 in.) O.S.	1.00

NOTE

Size mark is stamped on top of the piston.

cardiagn.com

2. Measure the outside diameter of the piston to be used.



3. On the base of the measured O.D., calculate the boring finish dimension.
   Boring finish dimension = Piston O.D + 0.01 to 0.03 mm (0.0004 to 0.0012 in.) (clearance between piston and cylinder) - 0.01 mm (0.0004 in.) (honing margin.)
4. Bore each of the cylinders to the calculated size.

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

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

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

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

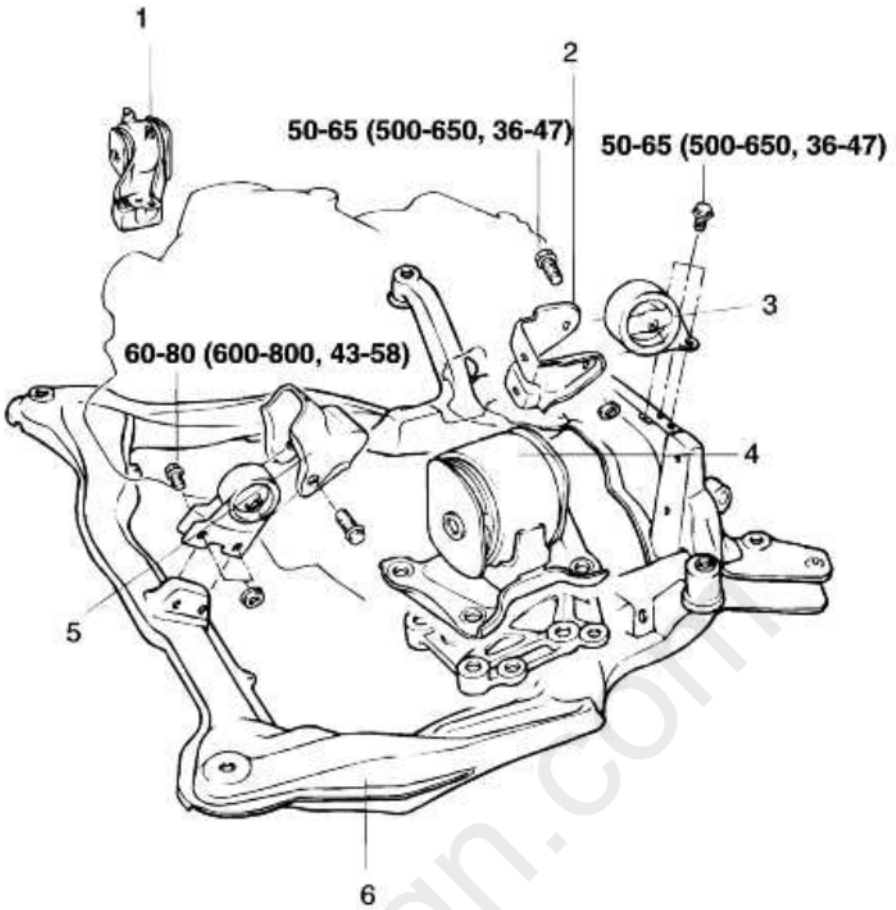
REASSEMBLY

1. Install the following parts by referring to their respective sections.
   (1) Crankshaft
   (2) Drive plate
   (3) Piston
   (4) Cylinder head
   (5) Timing belt
   (6) Oil pump case

Engine Mechanical System > Cylinder Block > Engine Mounts > Components and Components Location

COMPONENTS

cardiagn.com



TORQUE : Nm (kg·cm, lb·ft)

1. Engine mounting bracket
2. Rear roll stopper bracket
3. Rear roll stopper
4. Transaxle mounting bracket
5. Front roll stopper bracket
6. Sub-frame

cardiagn.com

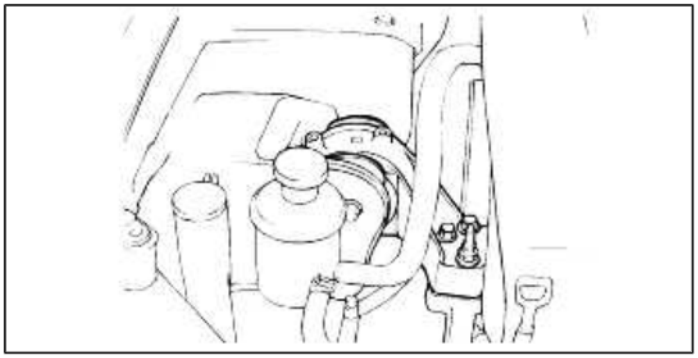
Engine Mechanical System > Cylinder Block > Engine Mounts > Repair procedures

REMOVAL

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

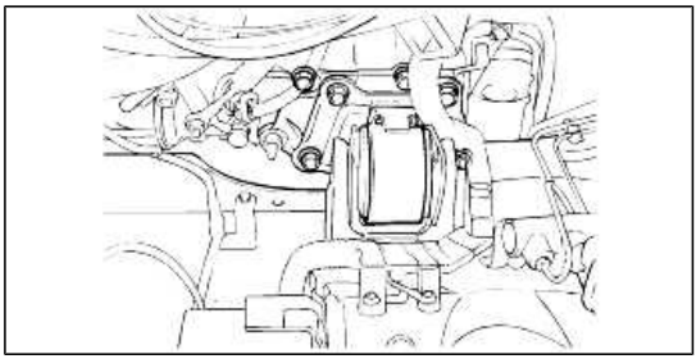
Engine Mounting

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



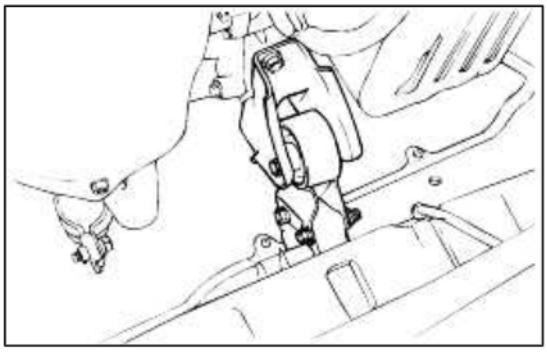
Transaxle Mounting

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



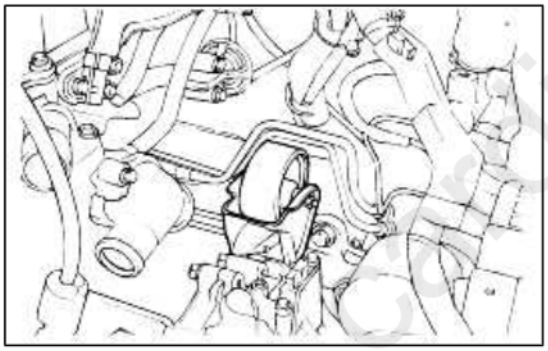
Front Roll Stopper

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



Rear Roll Stopper

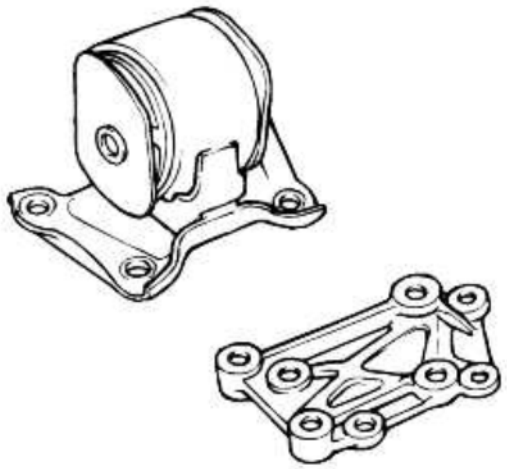
1. Remove the bolt from the rear roll stopper.
2. Remove the rear roll stopper from the sub-frame.



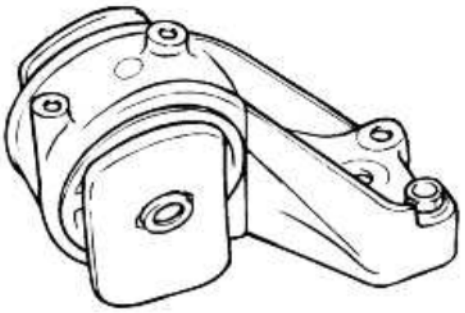
INSPECTION ITEMS

Carsdiagn.com

Transaxle mount



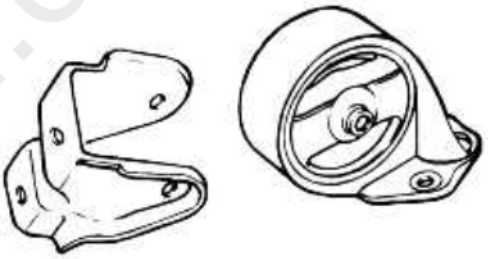
Engine mount



Front roll stopper assembly



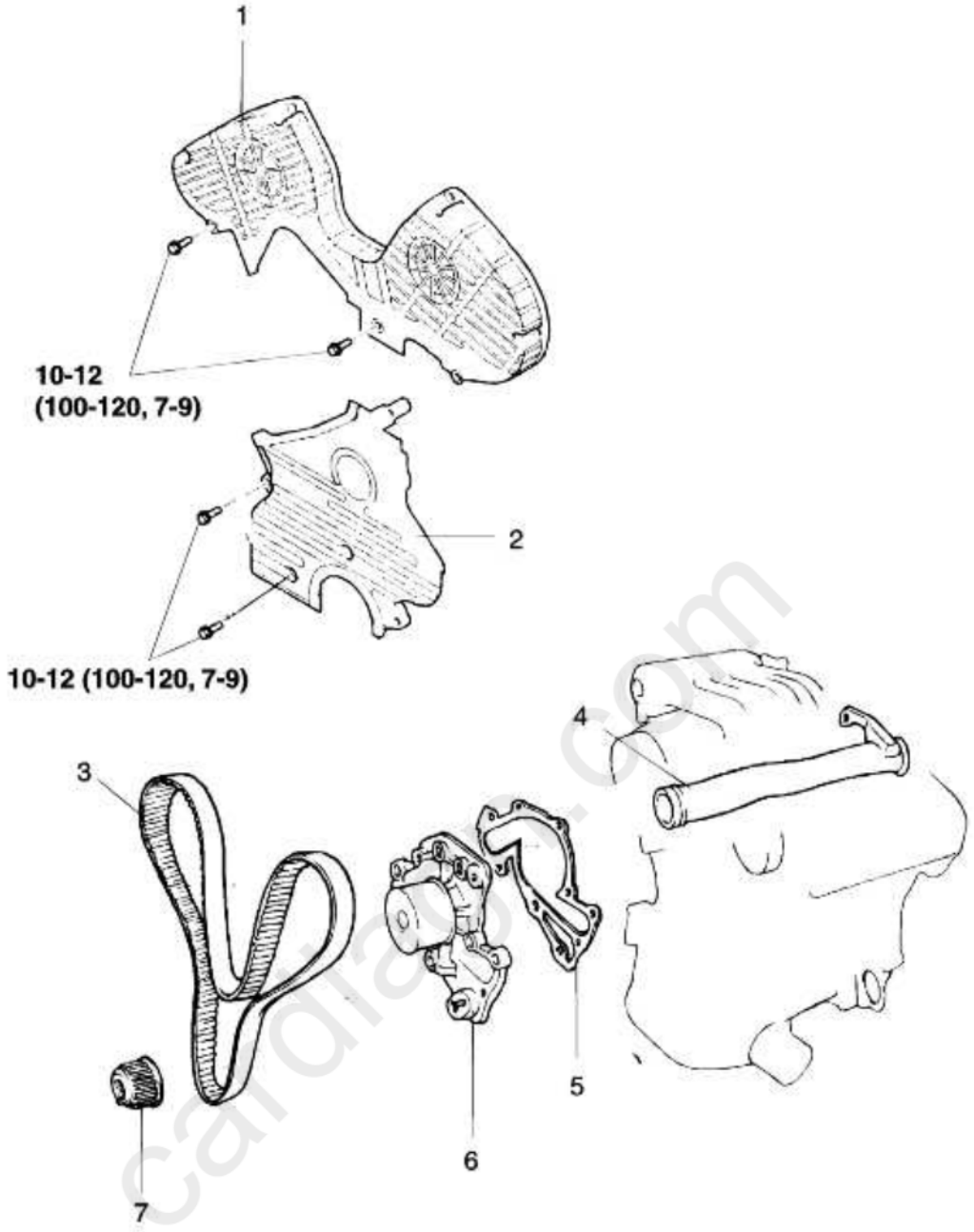
Rear roll stopper assembly



cardiagn.com

Engine Mechanical System > Cooling System > Water pump > Components and Components Location

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

1. Timing belt upper cover outer
2. Timing belt lower cover
3. Timing belt
4. Inlet engine coolant pipe
5. Gasket
6. Engine coolant pump
7. Crank shaft sprocket

Engine Mechanical System > Cooling System > Water pump > Repair procedures

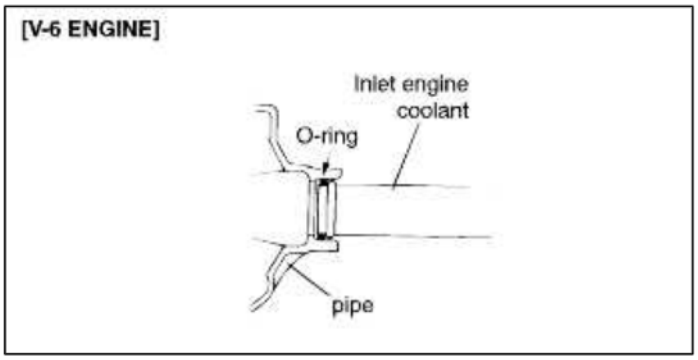
REMOVAL

1. Using the drain plug, drain the coolant.
2. Remove the drive belt and engine coolant pump pulley.
3. Remove the timing belt covers, the timing belt tensioner and idler.
4. Remove the engine coolant pump mounting bolts.

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

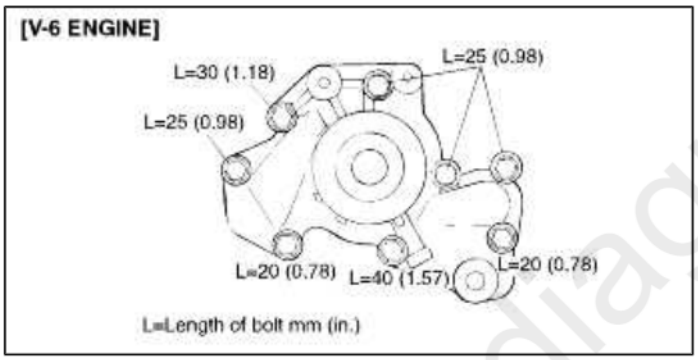
INSTALLATION

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



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

Tightening torque
Engine coolant pump bolt :
15-22 Nm (150-220 kg.cm, 11-16 lb.ft)



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

INSPECTION

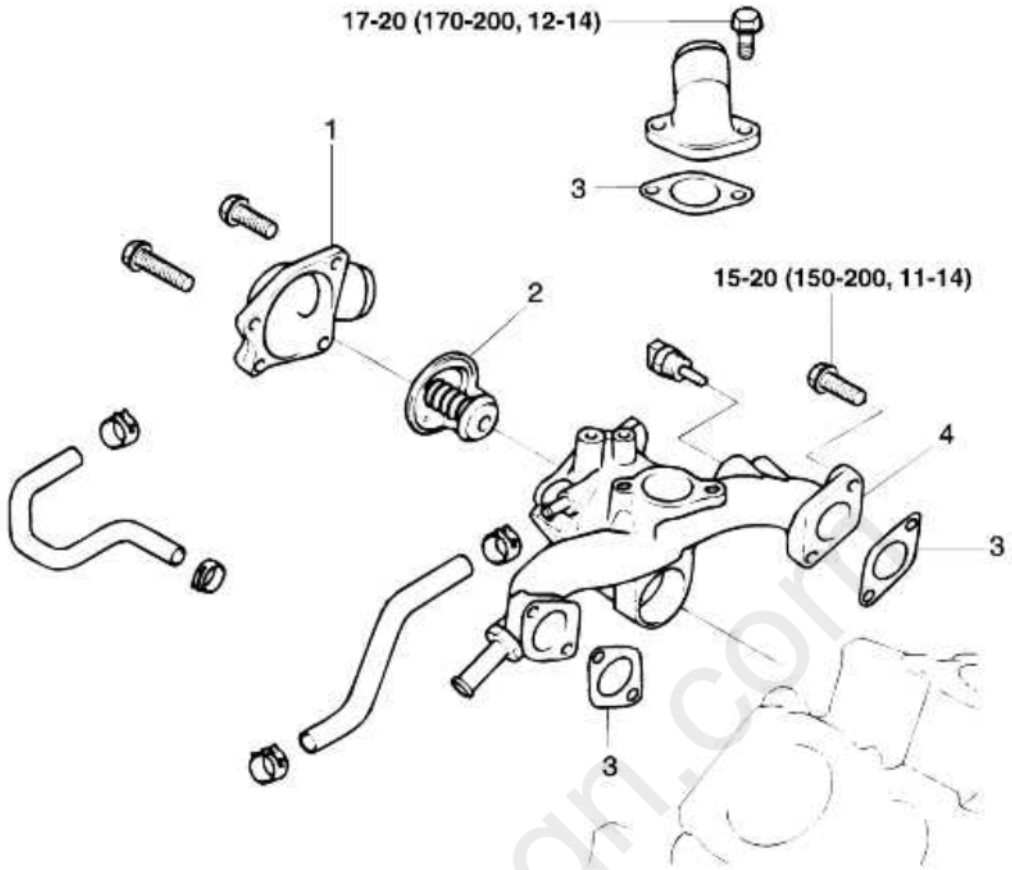
1. Check the engine coolant pump for cracks, damage or wear, and replace the engine coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the engine coolant pump assembly if necessary.
3. Check the seal unit for leaks, and replace the engine coolant pump assembly if necessary.
4. Check engine coolant leakage. If engine coolant leaks from hole "A" seal unit is defective. Replace the engine coolant pump assembly.

Engine Mechanical System > Cooling System > Thermostat > Components and Components Location

COMPONENTS

cardiagn.com

[V-6 ENGINE]



TORQUE : Nm (kg·cm, lb·ft)

1. Coolant outlet fitting
2. Thermostat
3. Gasket
4. Engine coolant outlet fitting

cardiagn.com

Engine Mechanical System > Cooling System > Thermostat > Repair procedures

REMOVAL

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

INSTALLATION

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

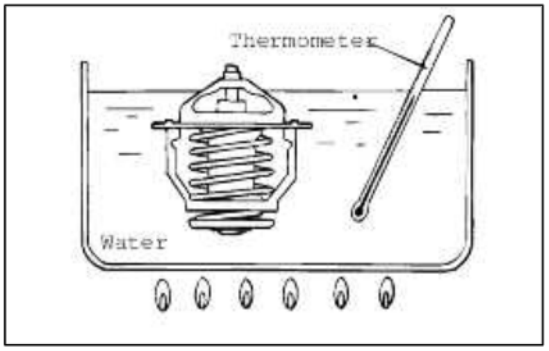
Tightening torque
Engine coolant inlet fitting bolt :
17-20 Nm (170-200 kg.cm, 12-14 lb.ft)

3. Refill the coolant.

INSPECTION

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

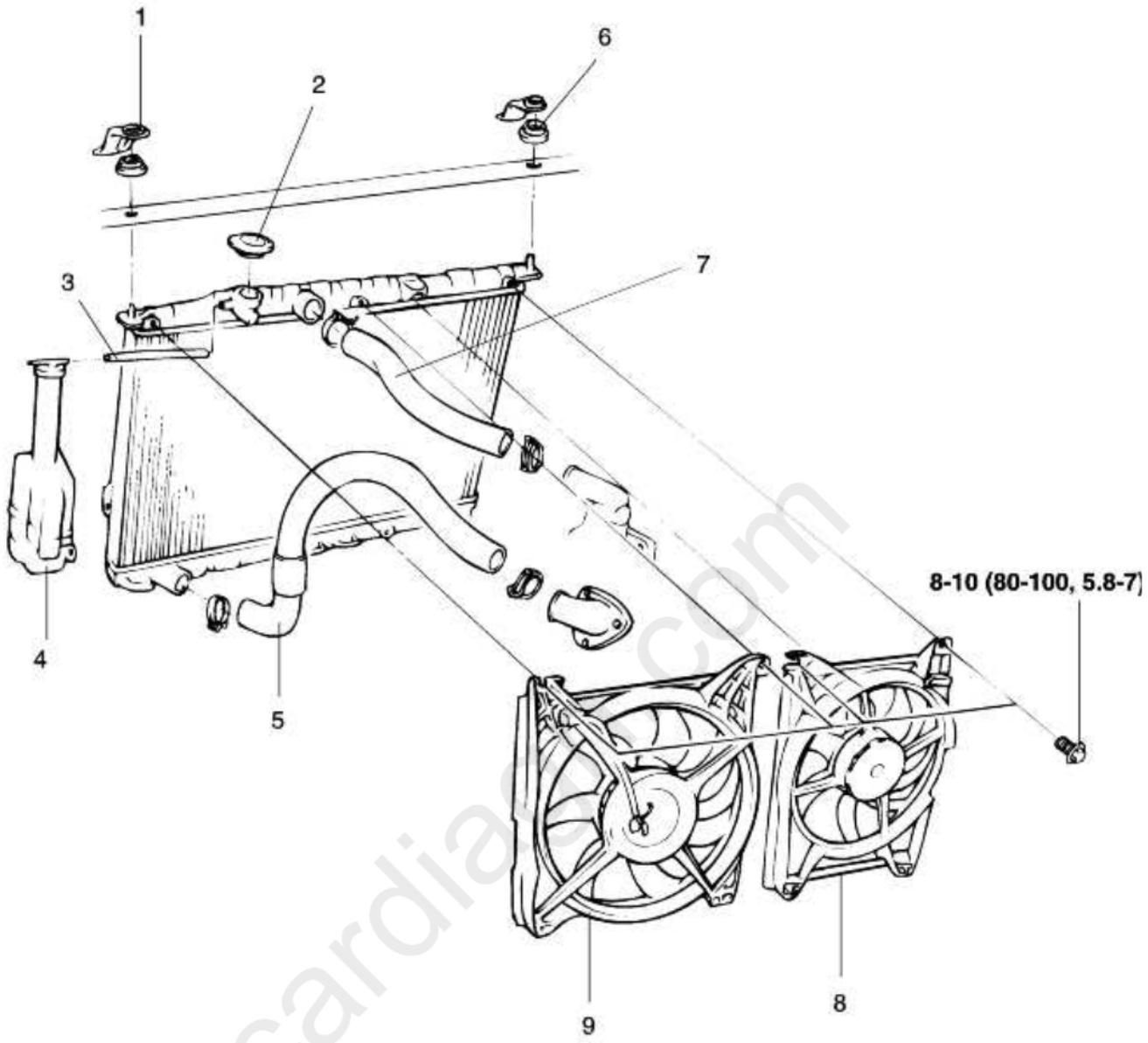
Valve opening temperature : 80-84°C (176-183.2°F)
Full opening temperature : 95°C (203°F)



Engine Mechanical System > Cooling System > Radiator > Components and Components Location

COMPONENTS

cardiagn.com



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

1. Upper insulator
2. Radiator cap
3. Overflow tube
4. Reservoir tank
5. Radiator lower hose
6. Upper insulator
7. Radiator upper hose
8. Condenser fan motor assembly
9. Radiator fan motor assembly

Engine Mechanical System > Cooling System > Radiator > Repair procedures

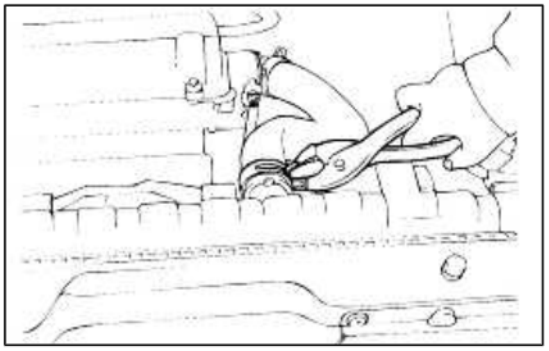
REMOVAL

WARNING

Never open or disassemble any portion of the cooling system until the engine temperature has dropped to ambient air temperature. Engine coolant escaping under heat and resulting pressure can cause severe burns and blindness.

1. Disconnect the ground cable from the battery terminal.

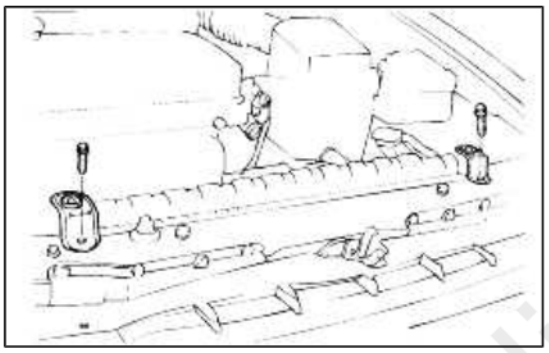
2. Disconnect the fan motor connector.
3. Loosen the radiator drain plug to drain the coolant.
4. Disconnect the upper and lower hoses and overflow tube after making marks on the radiator hose and the hose clamp.



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

> CAUTION
>
> Cover or plug the hose and nipple part of the radiator so that dust, foreign material etc. Do not enter after the hose is disconnected from the radiator.

6. Remove the radiator mounting bolt.



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

INSTALLATION

1. Fill the radiator and reservoir tank with clean coolant mixture.
2. Run the engine until the coolant warms up enough so that the thermostat valve opens, and then stop the engine.
3. Remove the radiator cap and pour the coolant up to the filler neck of the radiator. Fill the reservoir tank to the upper level.
4. Check that there is no leakage from the radiator, hoses or connections.

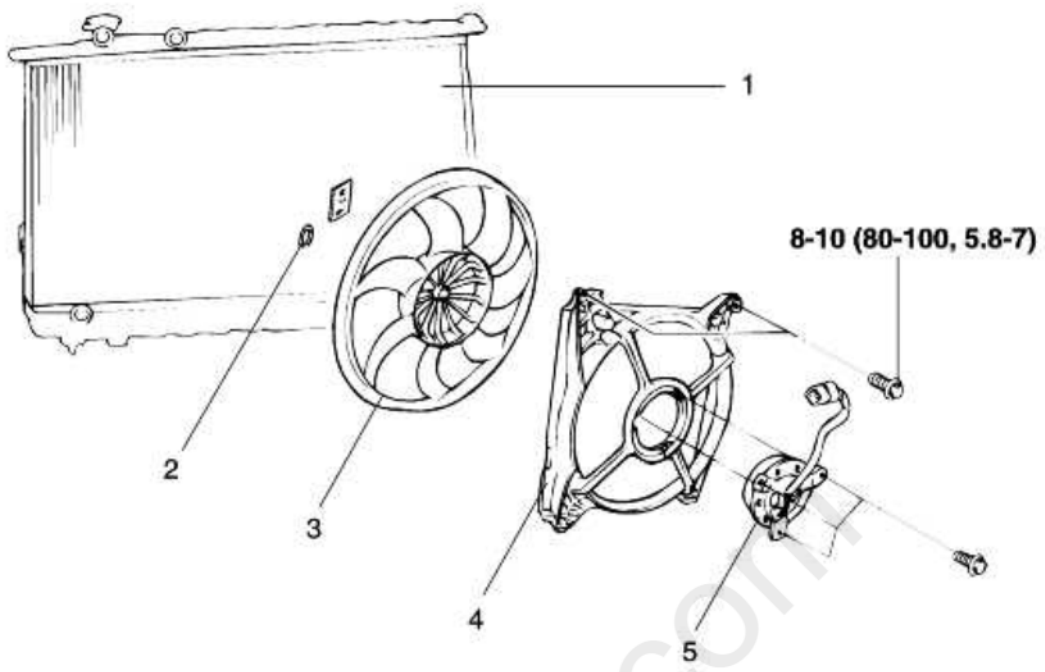
INSPECTION

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

Engine Mechanical System > Cooling System > Cooling Fan Motor Assembly > Components and Components Location

COMPONENTS

carDiagn.com



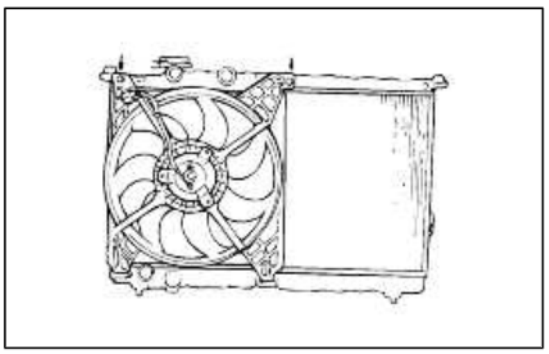
TORQUE : Nm (kg·cm, lb· ft)

1. Radiator
2. Fan mounting clip
3. Fan
4. Shroud
5. Radiator fan motor

Engine Mechanical System > Cooling System > Cooling Fan Motor Assembly > Repair procedures

REMOVAL

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



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

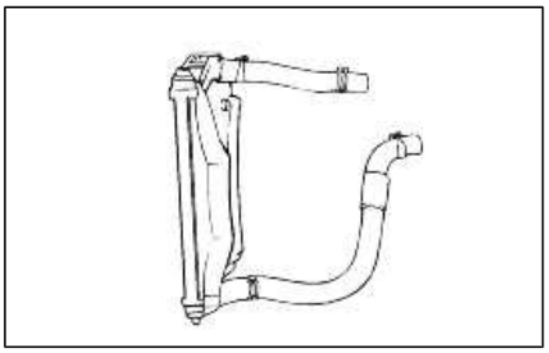
INSTALLATION

cardiagn.com

1. Installation is in the reverse order of removal procedures.

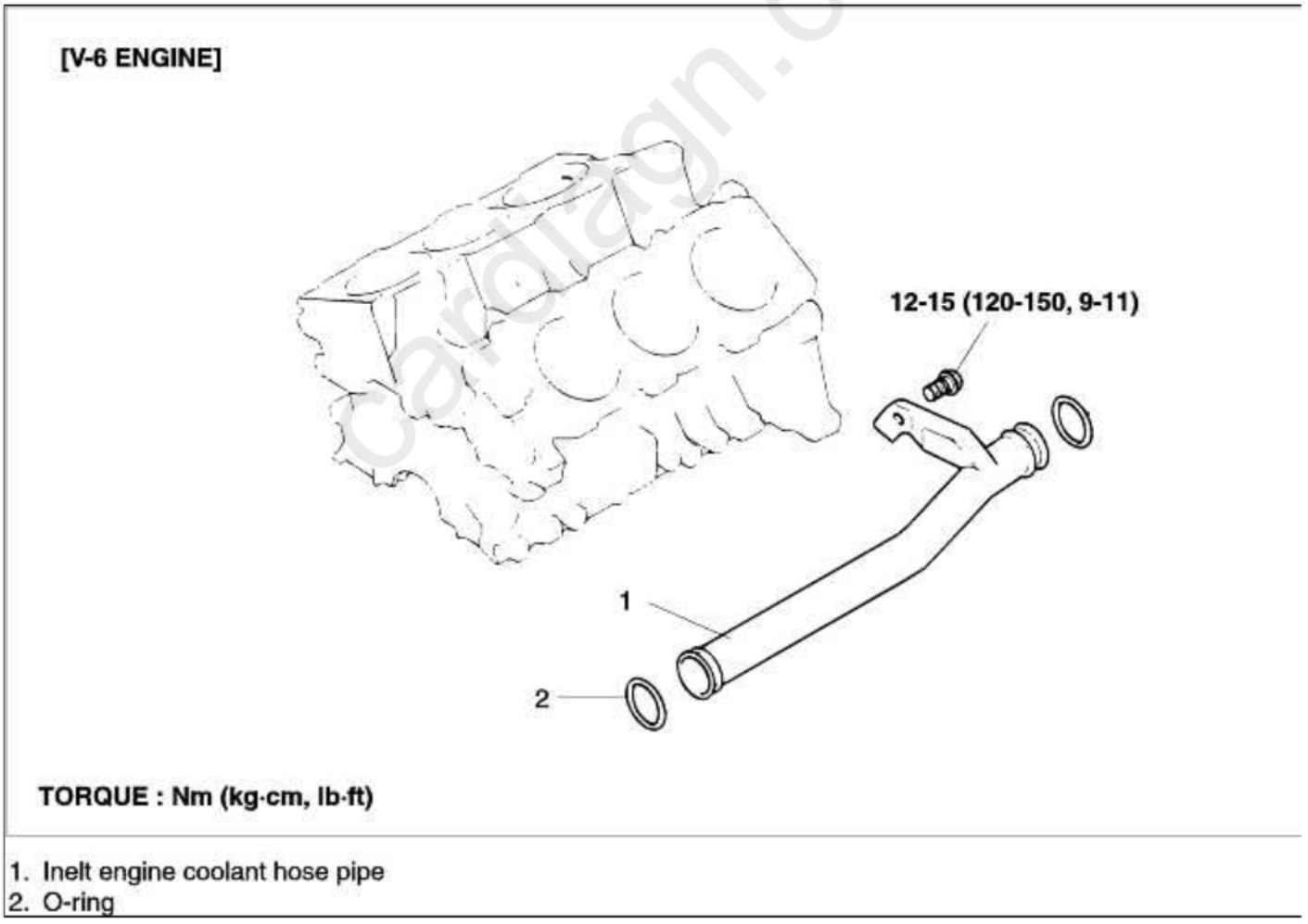
CAUTION

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



Engine Mechanical System > Cooling System > Engine Coolant Hose / Pipes > Components and Components Location

COMPONENTS



1. Inelt engine coolant hose pipe
2. O-ring

Engine Mechanical System > Cooling System > Engine Coolant Hose / Pipes > Repair procedures

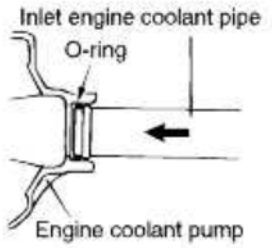
cardiagn.com

INSTALLATION

NOTE

1. Do not apply oils or greases to Engine coolant pipe O-ring.
2. Keep the Engine coolant pipe connections free of sand, dust, etc.
3. Insert Engine coolant pipe to its end bottoms.
4. While installing the engine coolant inlet pipe, always replace the O-ring with a new one.

[V-6 ENGINE]



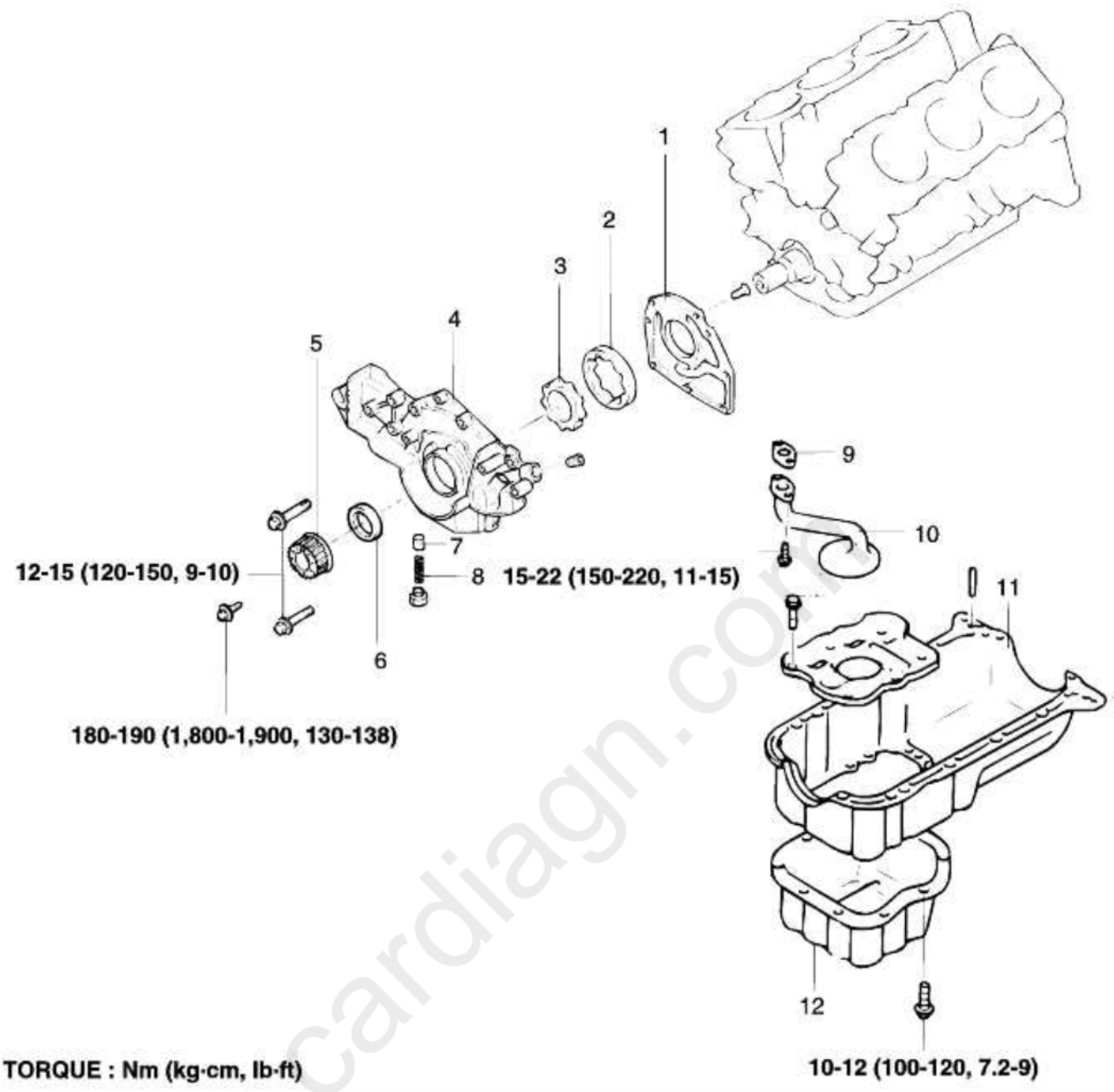
INSPECTION

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

Engine Mechanical System > Lubrication System > Front Case > Components and Components Location

COMPONENTS

cardiagn.com



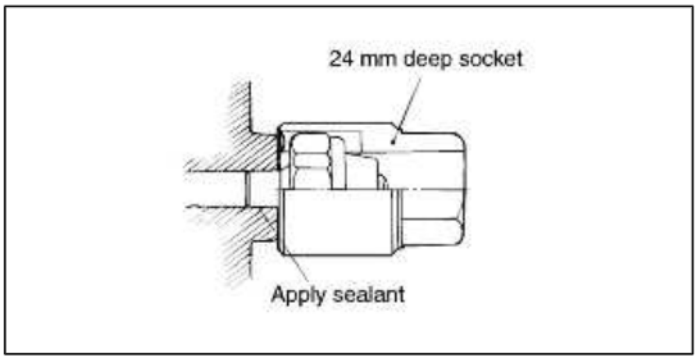
1. Oil pump cover
2. Oil pump outer rotor
3. Oil pump inner rotor
4. Oil pump case
5. Crank shaft sprocket
6. Crank shaft oil seal
7. Relief plunger
8. Relief spring
9. Oil screen gasket
10. Oil screen
11. Upper oil pan
12. Lower oil pan

Engine Mechanical System > Lubrication System > Front Case > Repair procedures

REMOVAL

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

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

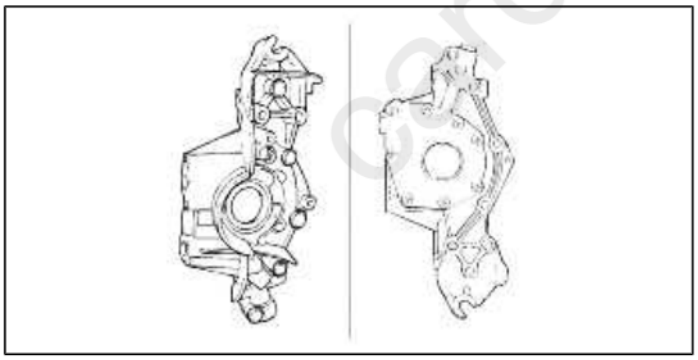


2. Remove the oil filter and the oil pan.
3. Remove the oil screen and gasket.
4. Remove the three bracket securing bolts and remove the oil filter bracket and gasket.
5. Remove the oil relief valve plug from the oil pump case.
6. Remove the oil pump case.

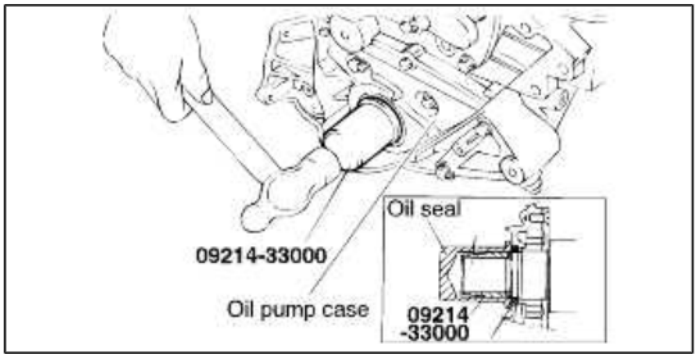
INSTALLATION

1. Install the oil pump case with the gasket.

Tightening torque
Oil pump case bolt :
12-15 Nm (120-150 kg.cm, 9-10 lb.ft)
Oil pump cover screw :
8-12 Nm (80-120 kg.cm, 5.8-8.6 lb.ft)



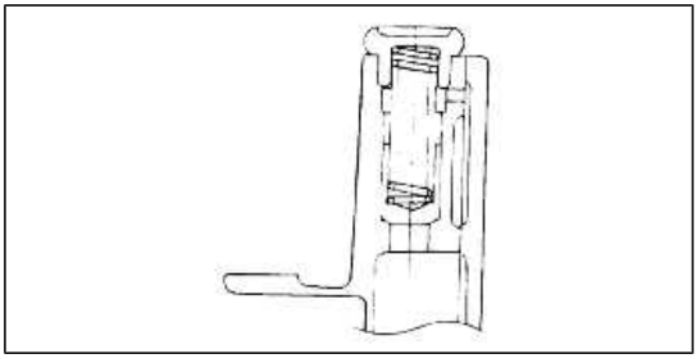
2. Install the oil seal into the oil pump case as far as possible, using special tool (09214-33000).



cardiagn.com

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

Tightening torque
Oil relief valve plug :
40-50 Nm (400-500 kg.cm, 29-36 lb.ft)



4. Install the oil screen and a new gasket.

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

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

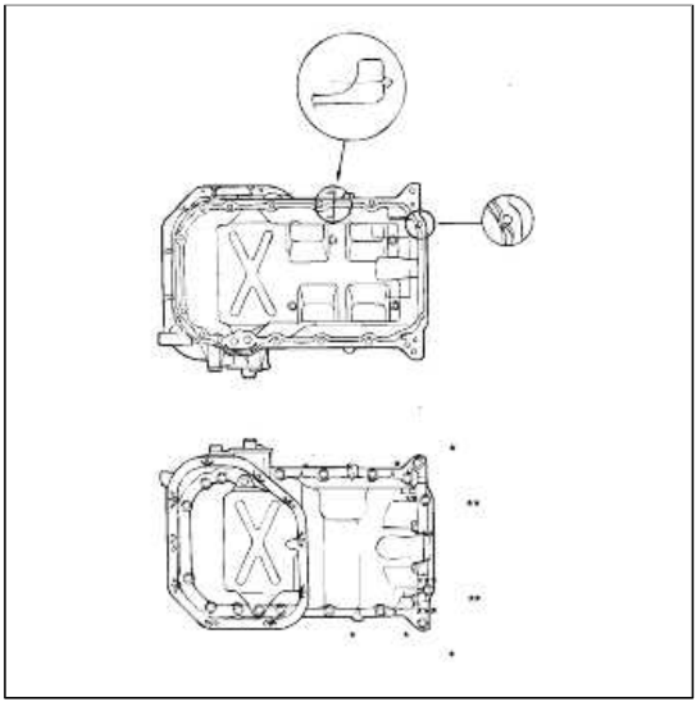
NOTE

1. Make the first cut from the end of the nozzle furnished with the sealant approx. 4 mm. After application of the sealant, do not exceed 15 minutes before installing the oil pan.
2. Do not apply the sealant to the range A shown in the illustration on the oil pan flange.

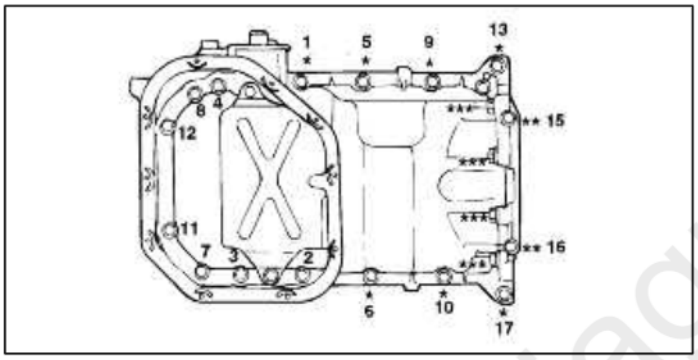
7. Install the oil pan and tighten the bolts to the specified torque.

Tightening torque
Oil pan bolt :
*19-28 Nm (190-280 kg.cm, 13.75-20.27lb.ft)
** 5-7 Nm (50-70 kg.cm, 3.7-5.0 lb.ft)
*** 30-42 Nm (300-420 kg.cm, 21.70-30.40 lb.ft)

cardiagn.com



8. Tighten the oil pan bolt as shown in figure.



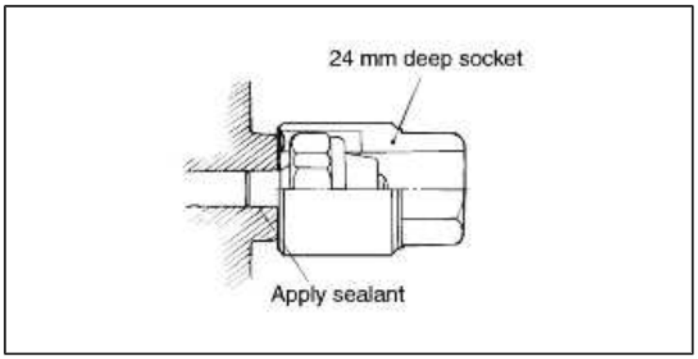
9. Using 24 mm deep socket, install the oil pressure switch after applying sealant to the threaded area.

Sealant : Threebond 1104 or equivalent

NOTE

Do not torque the oil pressure switch too much.

Tightening torque
Oil pressure switch :
8-12 Nm (80-120 kg.cm, 5.8-8.6 lb.ft)



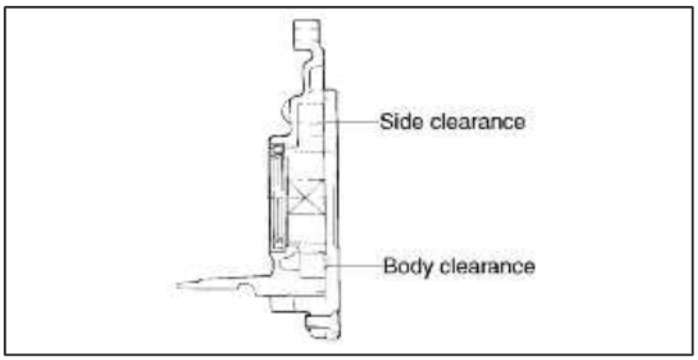
cardiagn.com

INSPECTION

Oil Pump

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

Oil pump side clearance
Standard value
Body clearance : 0.100-0.181 mm (0.0039-0.0071 in.)
Side clearance : 0.040-0.095 mm (0.0016-0.0037 in.)



Relief Plunger and Spring

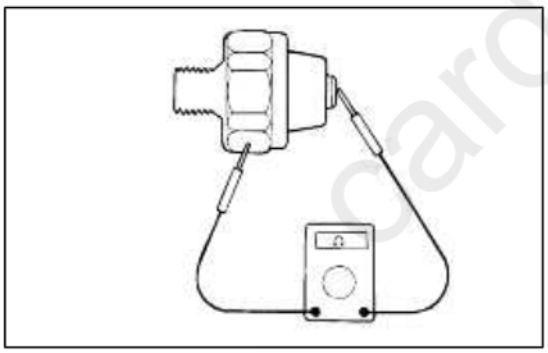
1. Check the relief plunger for smooth operation.
2. Check the relief spring for a deformation or break.

Oil Filter Bracket

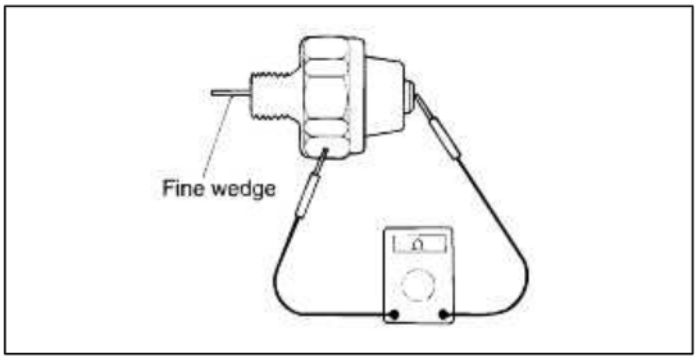
1. Make sure that there is no damage on the oil filter installation surface.
2. Check the oil filter bracket for oil leak or cracks.

Oil Pressure Switch

1. Check the continuity between the terminal and the body with an ohmmeter.
   If there is no continuity, replace the oil pressure switch.



2. Check the continuity between the terminal and the body when the fine wedge is pushed. If there is continuity even when the fine wedge is pushed, replace it.

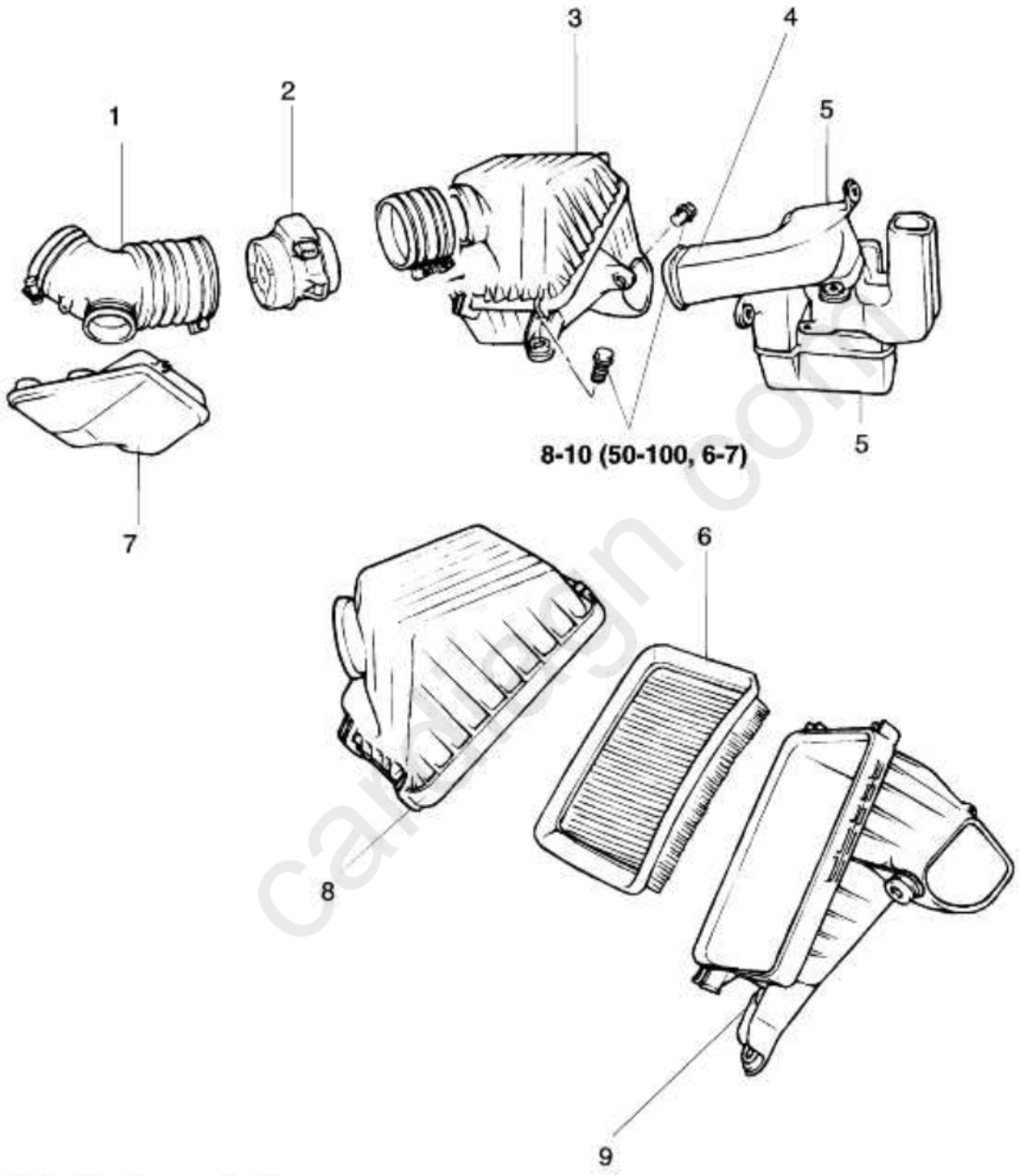


3. Or, if there is no continuity when a 50 kPa (70 psi) vacuum is applied through the oil hole, the switch is operating properly. Check that air doesn't leak. If air leaks, the diaphragm is broken, and replace it.

cardiagn.com

Engine Mechanical System > Intake And Exhaust System > Air Cleaner > Components and Components Location

COMPONENTS

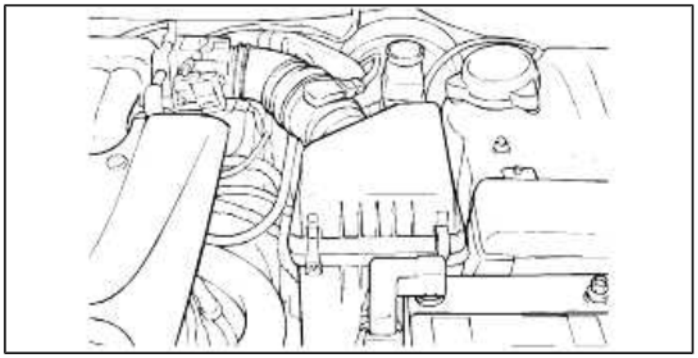


1. Air intake hose
2. Air flow sensor
3. Air cleaner
4. Air cleaner body
5. Air duct
6. Air cleaner element
7. Resonator
8. Air cleaner cover
9. Air cleaner body

Engine Mechanical System > Intake And Exhaust System > Air Cleaner > Repair procedures

REMOVAL

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



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

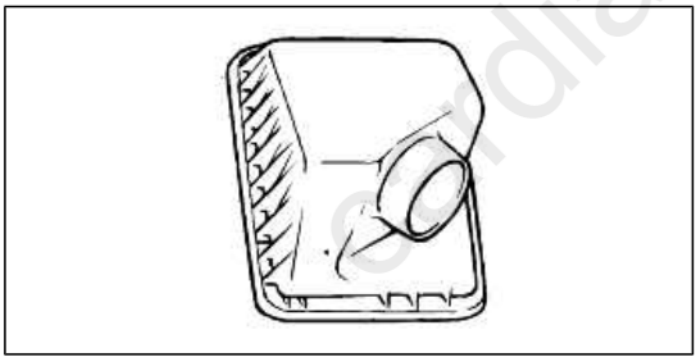
> CAUTION
>
> Do not pull the air flow sensor harness.

INSTALLATION

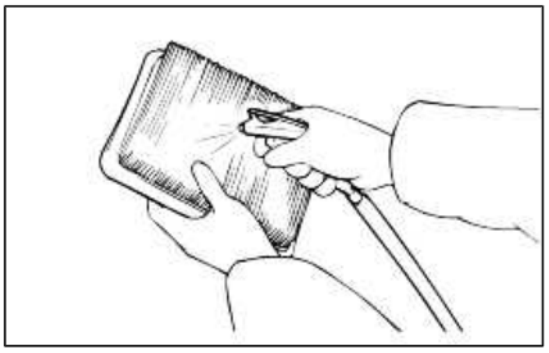
1. Blow the air inside of air cleaner to remove dust and debris.
2. Install the air cleaner according to the reverse order of removal.

INSPECTION

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



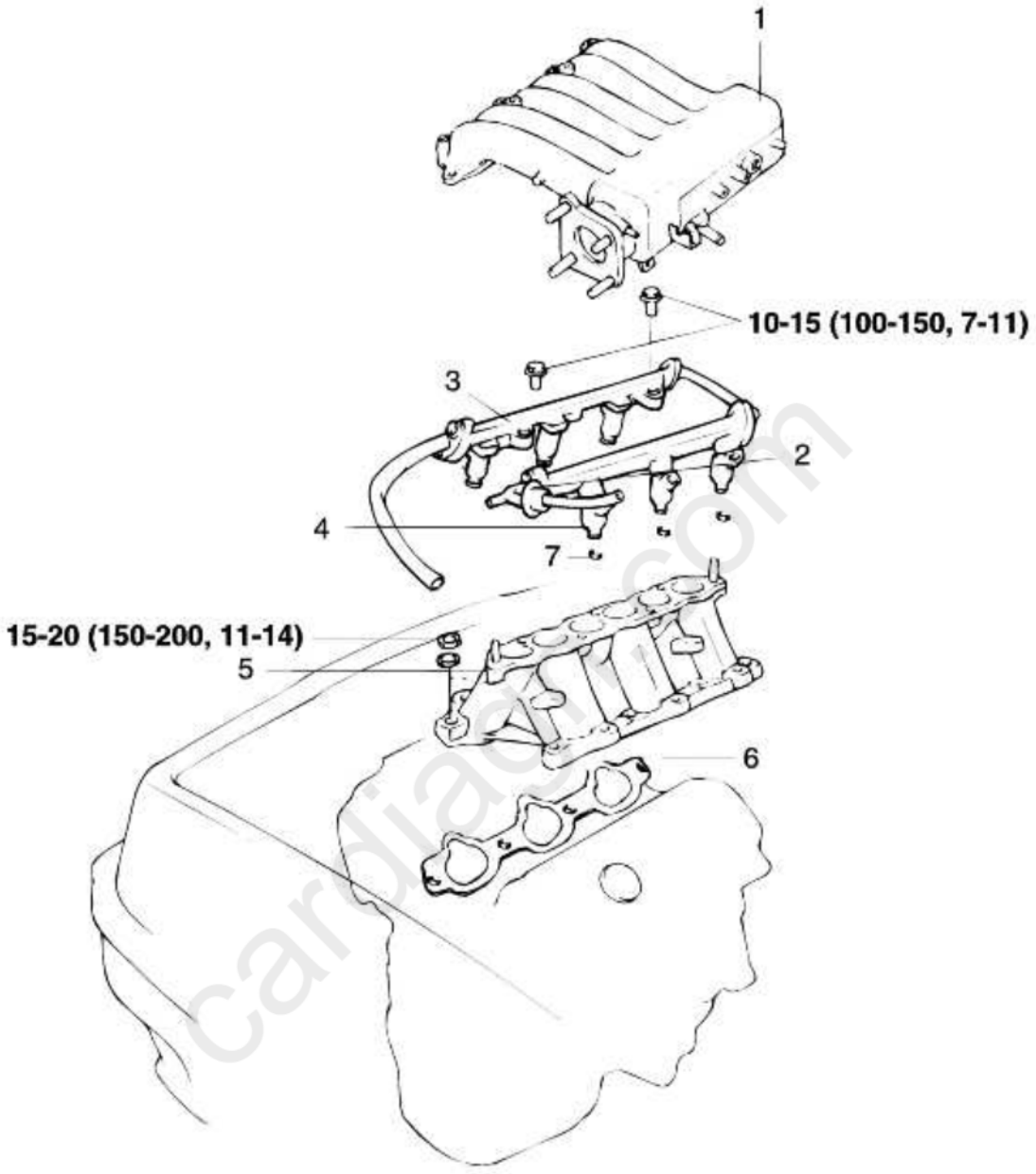
3. Check the air cleaner element for restriction, contamination or damage. If the element is slightly restricted, remove dust and debris by blowing the inside of the element. Replace the element if it cannot be cleaned.



Engine Mechanical System > Intake And Exhaust System > Intake Manifold > Components and Components Location

cardiagn.com

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

1. Air intake surge tank
2. Pressure regulator
3. Delivery pipe
4. Fuel injector
5. Intake manifold
6. Gasket
7. Insulator

Engine Mechanical System > Intake And Exhaust System > Intake Manifold > Repair procedures

REMOVAL

1. Remove the air intake surge tank.

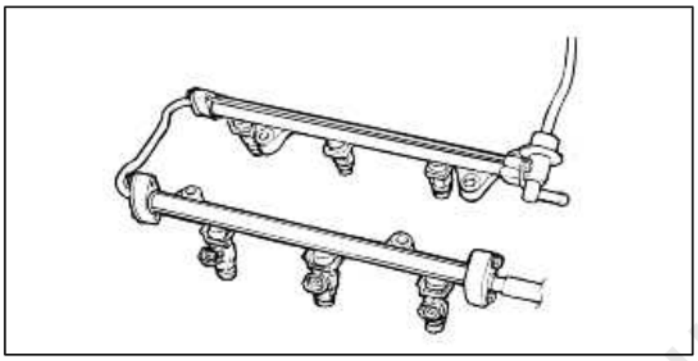
2. Remove the high pressure fuel hose.

> CAUTION
>
> Reduce the internal pressure of the high pressure fuel hose prior to disconnecting. For more details, refer to FUEL SYSTEM "Fuel filter replacement".

3. Disconnect the fuel return hose.
4. Remove the delivery pipe with the fuel injector.

> NOTE
>
> Be careful not to drop the injector when removing the delivery pipe.

> CAUTION
>
> Be aware that fuel may flow out when removing the injector.

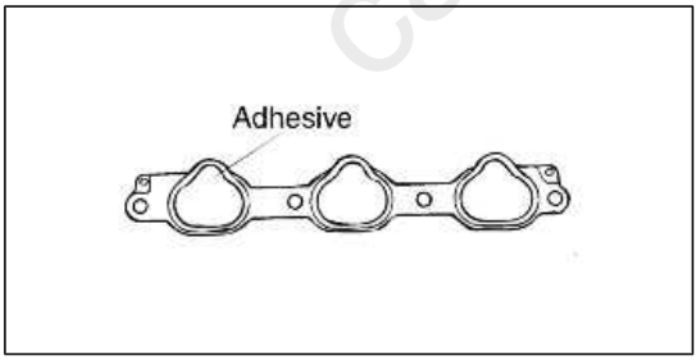


5. Remove the intake manifold and gasket.

INSTALLATION

1. Install the intake manifold and delivery pipe according to the reverse order of removal.

> CAUTION
>
> Do not use the used intake manifold gasket.



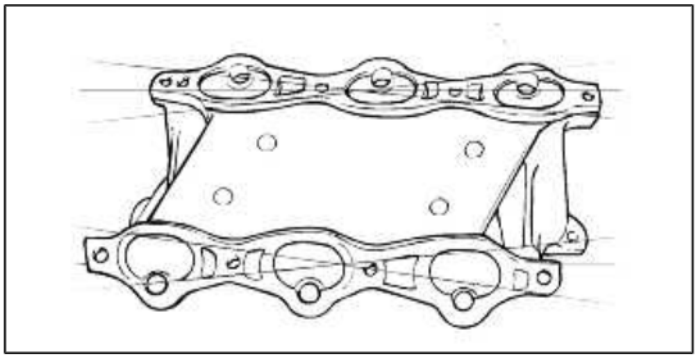
INSPECTION

1. Check the intake manifold for damage, cracking, or restriction of the vacuum outlet port, water and or gas passages.

cardiagn.com

2. Check for distortion of the cylinder head mounting surface and surgetank mounting surface by using a straight edge and feeler gauge.

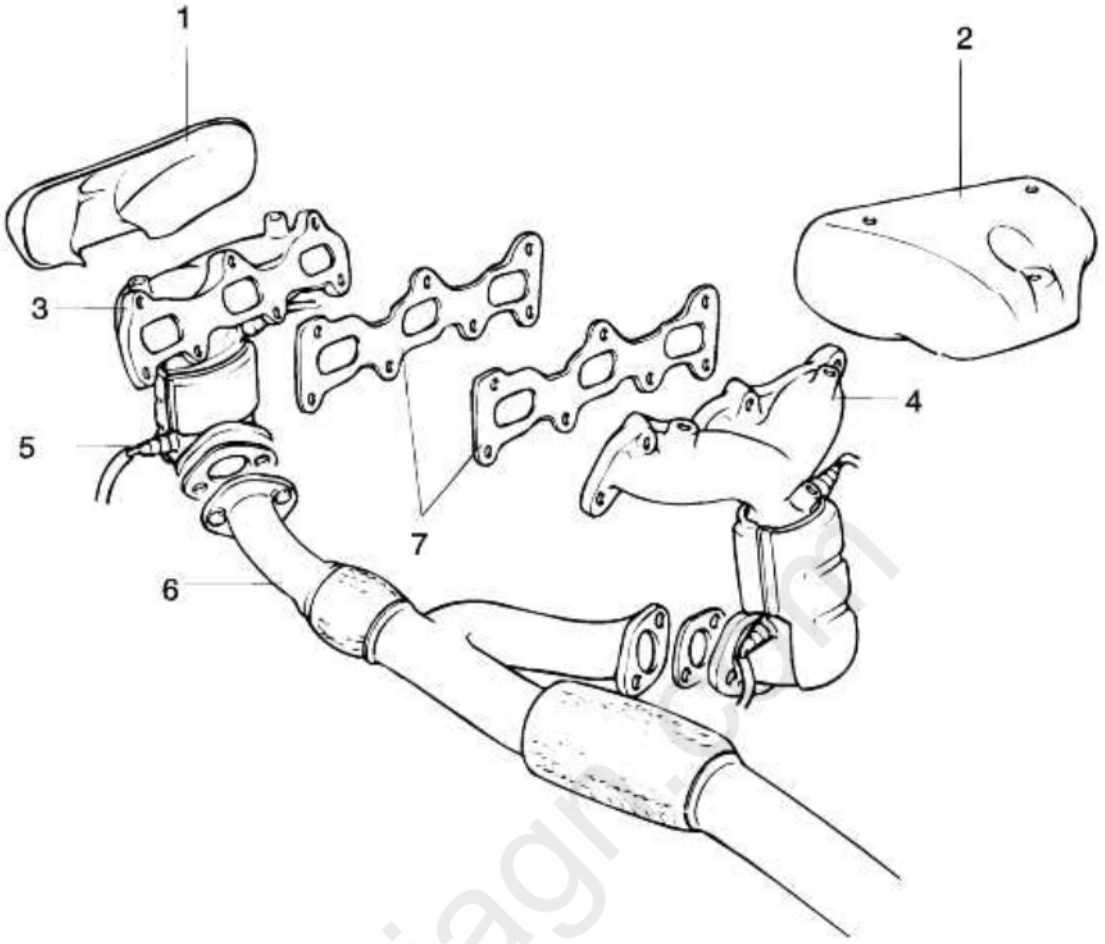
Standard value : 0.15 mm (0.006 in.) or less
Service limit value : 0.2 mm (0.0078 in.)



Engine Mechanical System > Intake And Exhaust System > Exhaust Manifold > Components and Components Location

COMPONENTS

cardiagn.com



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

1. Exhaust manifold heat protector (Front)
2. Exhaust manifold heat protector (Rear)
3. Exhaust manifold (Front)
4. Exhaust manifold (Rear)
5. Oxygen sensor
6. Front exhaust pipe
7. Gasket

Cardiagn.com

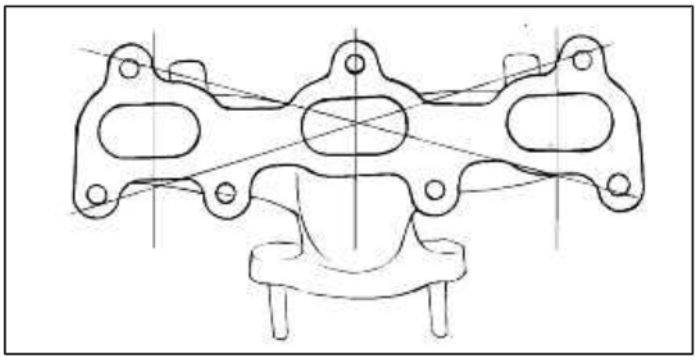
Engine Mechanical System > Intake And Exhaust System > Exhaust Manifold > Repair procedures

INSPECTION

1. Check for damage or cracking.

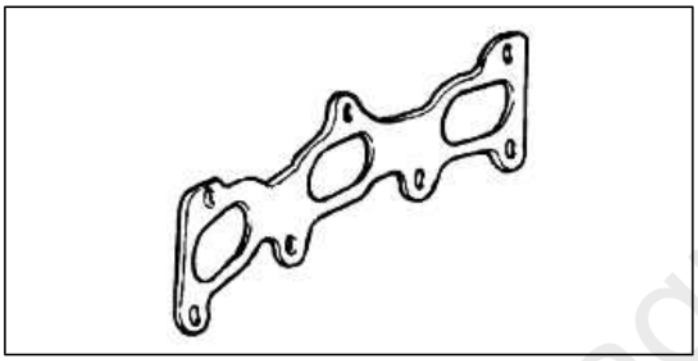
2. Using a straight edge and a feeler gauge, check for distortion on the cylinder head mating surface.

Standard value : 0.15 mm (0.006 in.) or less
Service limit : 0.3 mm (0.012 in.) or less



CAUTION

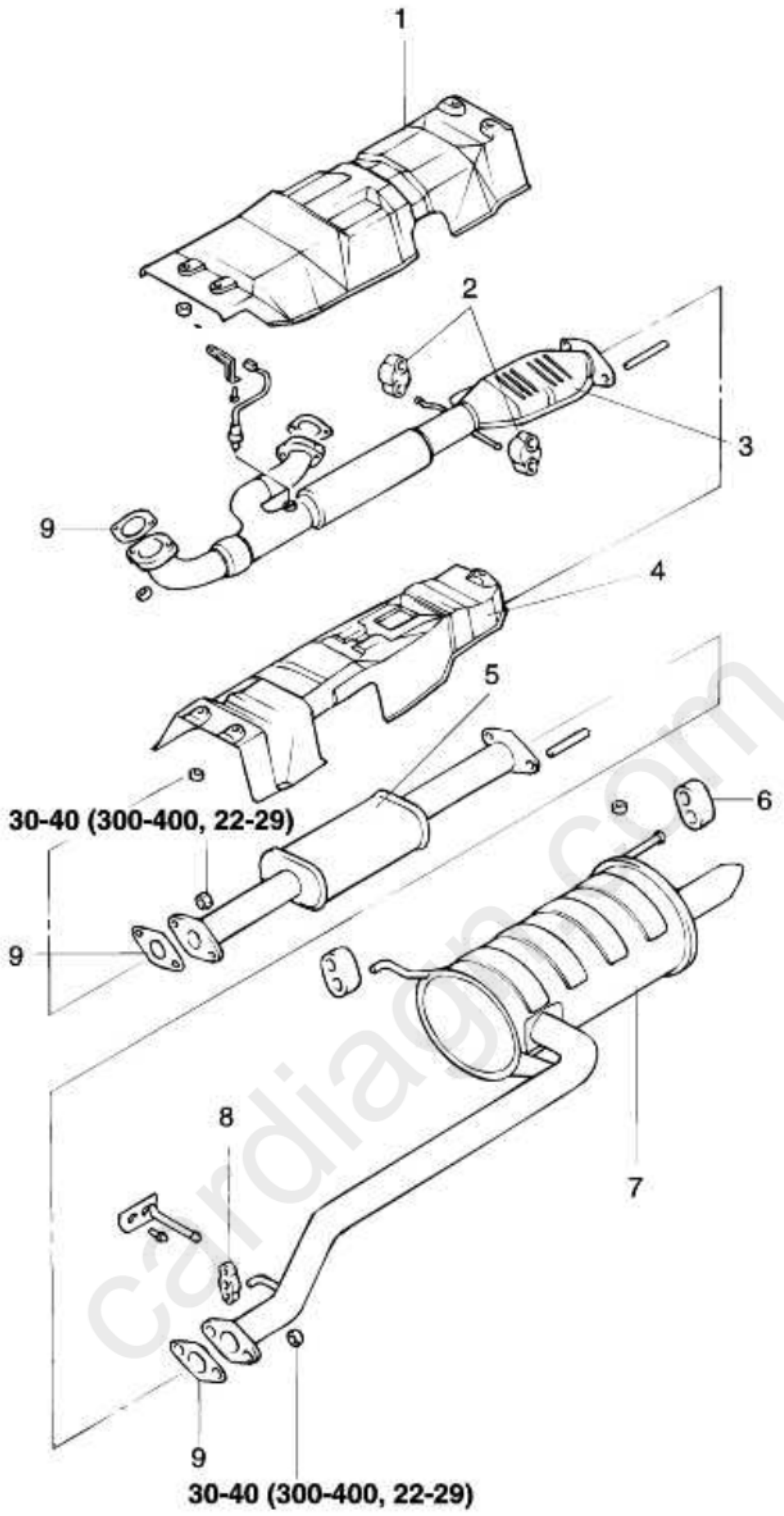
Do not use the used exhaust manifold gasket.



Engine Mechanical System > Intake And Exhaust System > Muffler > Components and Components Location

COMPONENTS

cardiagn.com



TORQUE : N·m (kg·cm, lb·ft)

1. Front floor heat protector
2. Rubber hangers
3. Front exhaust pipe
4. Rear floor heat protector
5. Center exhaust pipe
6. Rubber hangers
7. Main muffler
8. Rubber hangers
9. Gasket

Engine Mechanical System > Intake And Exhaust System > Muffler > Repair procedures

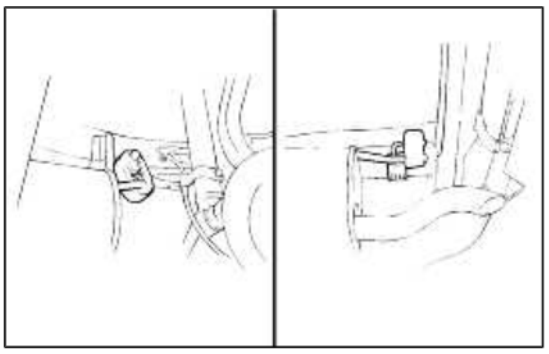
REMOVAL

Main Muffler

CAUTION

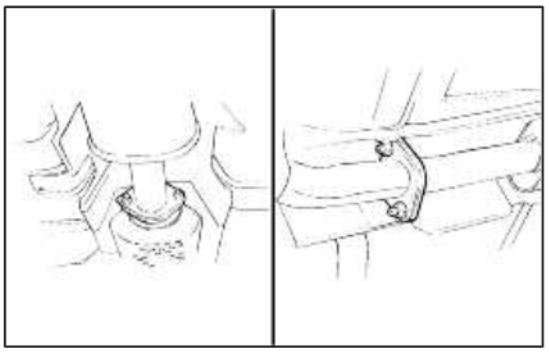
Before removing or inspecting the exhaust system, ensure that the exhaust system is cool.

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



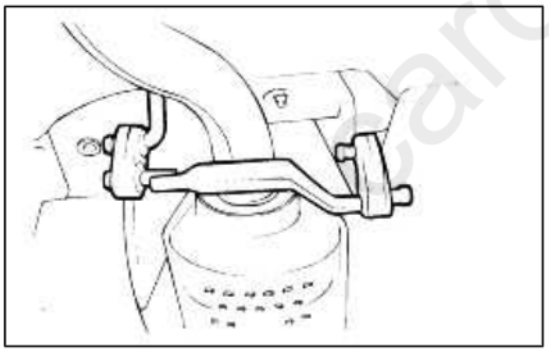
Center Exhaust Pipe

1. Disconnect the center exhaust pipe from the main muffler.
2. After disconnecting from the front exhaust pipe, remove the center exhaust pipe.



Front Exhaust Pipe (Including catalytic converter)

1. Remove the front exhaust pipe from the center exhaust pipe.
2. Remove the front exhaust pipe from the exhaust manifold (Including catalytic converter)
3. Remove the front exhaust pipe from the rubber hanger.



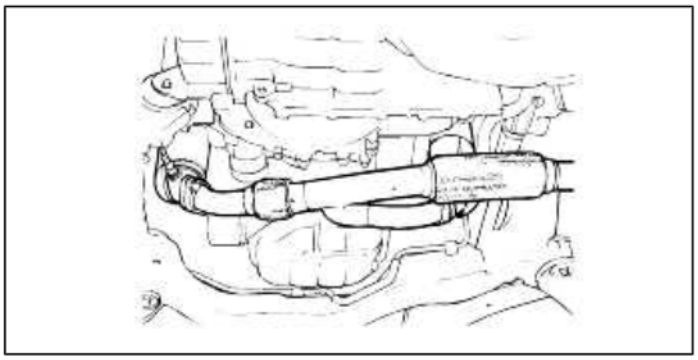
INSTALLATION

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

INSPECTION

carmanualsdesign.com

1. Check the mufflers and pipes for corrosion and damage.

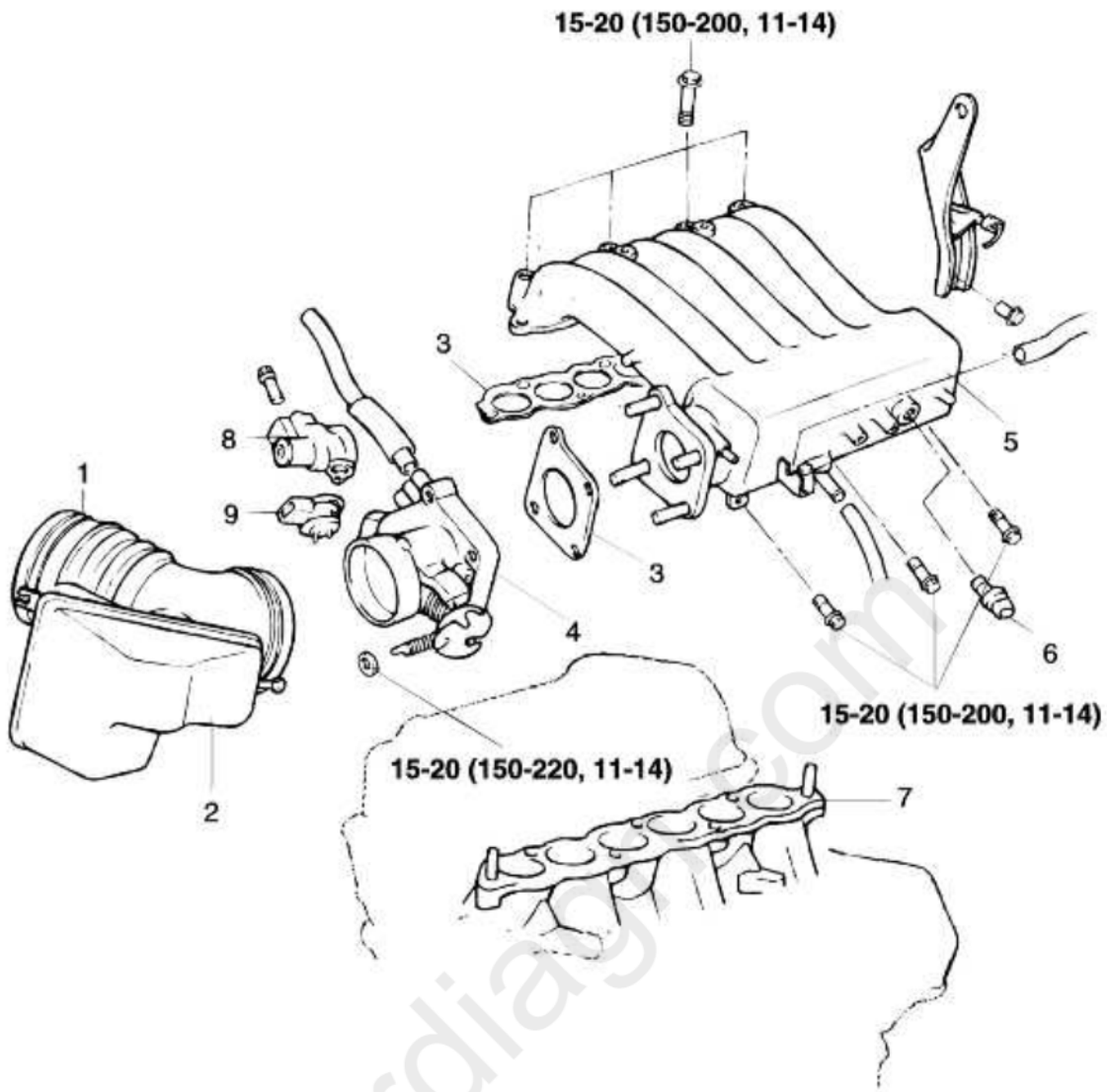


2. Check the rubber hangers for deterioration and cracks.

Engine Mechanical System > Intake And Exhaust System > Surge Tank > Components and Components Location

COMPONENTS

cardiagn.com



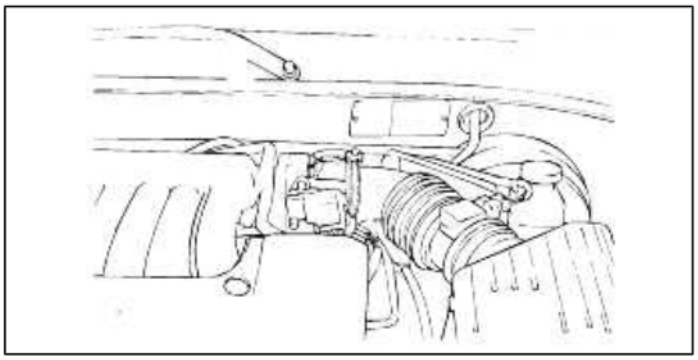
TORQUE : N·m (kg·cm, lb·ft)

1. Air intake hose
2. Resonator
3. Gasket
4. Throttle body
5. Air intake surge tank
6. Air temperature sensor
7. Intake manifold
8. I.S.A
9. T.P.S

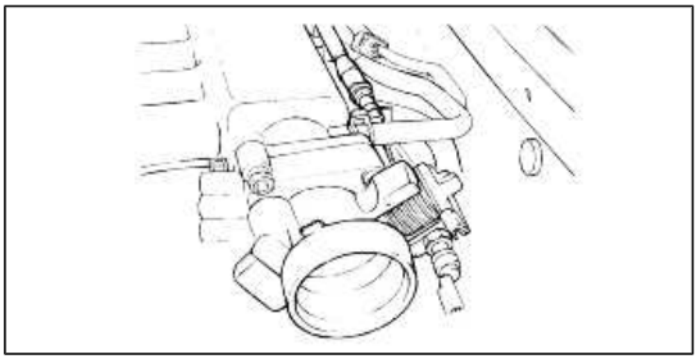
Engine Mechanical System > Intake And Exhaust System > Surge Tank > Repair procedures

REMOVAL

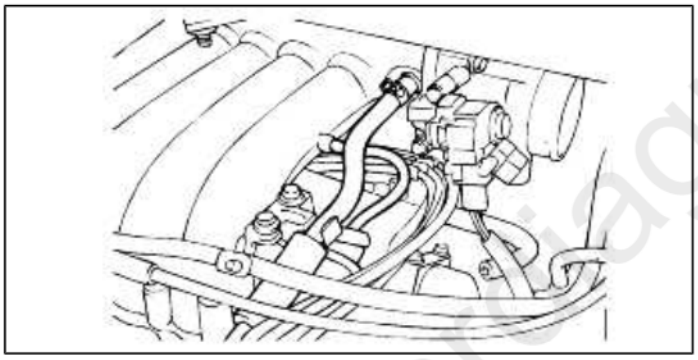
1. Remove the air intake hose connected to the throttle body.



2. Remove the accelerator and cruise control cables.



3. Remove the engine coolant hose.
4. Remove the P.C.V. hose and brake booster vacuum hoses.



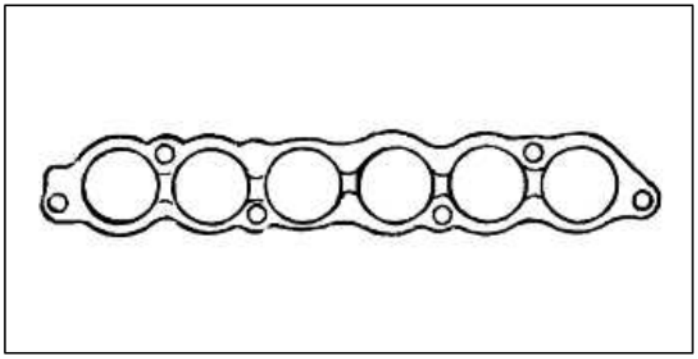
5. Disconnect the vacuum hose connections.
6. Remove the ISA, TPS and ATS connector.
7. Remove the surge tank stay.
8. Remove the air intake surge tank and surge tank gasket.

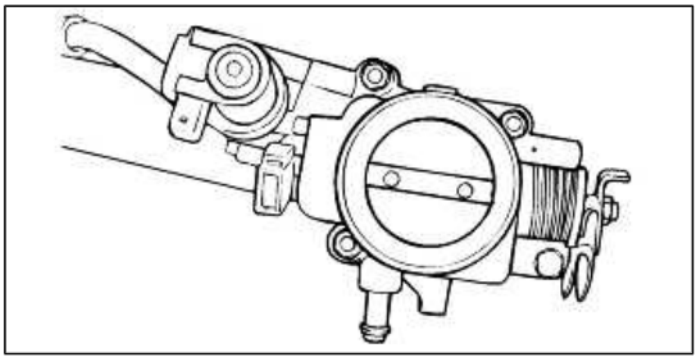
INSTALLATION

carsiagn.com

1. Install the surge tank and throttle body according to the reverse order of removal.

> CAUTION
>
> Do not use the used surge tank gasket.

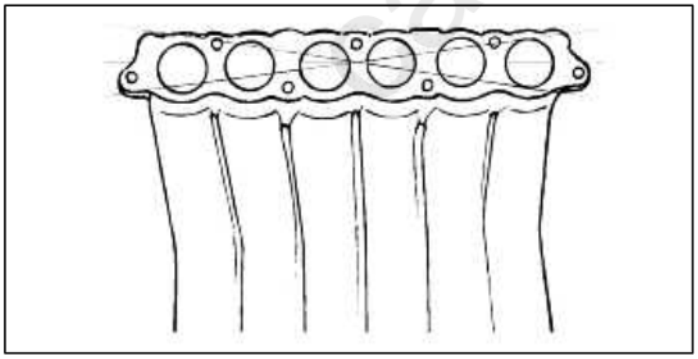




INSPECTION

1. Check the intake surge tank for defect or cracks. Replace if defective.
2. Check coolant passage ways for restrictions. Clean if necessary.
3. Check deflection of installation surface with straight edge and feeler gauge.

Standard value : Within 0.15 mm (0.006 in.)
Service limit : 0.2 mm (0.008 in.)



Engine Mechanical System > Troubleshooting > P0128

TROUBLESHOOTING PROCEDURE FOR DTC

Diagnostic trouble code No. P0128	**Coolant Thermostat Stuck**
[Related items]	• Thermostat stuck opened • After engine start-up, the elapsed time before feedback operation is initiated is too long (engine coolant temperature sensor input is insufficient for closed loop operation) • Poor connections between WTS and ECU • Misplaced, loose or corroded terminals • Contaminated, deteriorated WTS

step	Inspection		Action
1	Remove thermostat and check that thermostat is stuck. Is thermostat okay?	Yes	Go to step 2.
		No	Temporarily install a known good thermostat and check for proper operation. If problem is corrected, replace thermostat.
2	Connect SCAN TOOL to data link connector or OBD-II check connector and turn ignition to ON. Is DTC P0115, P0116, or P0125 set?	Yes	Do all repairs associated with those codes before proceeding this procedure.
		No	Go to step 3.
3	Start engine and allow engine to idle until engine reaches operating temperature. Using SCAN TOOL and monitor WTS signals. • **3.6~3.8V (2.31~2.59 KΩ) @ 20°C (68°F)** • **1.2~1.5V (0.31~0.33 KΩ) @ 80°C (176°F)** Is signal within specifications?	Yes	Problem is intermittent or was repaired and engine control module memory was not cleared. Check terminal connections at ECU and WTS.
		No	Go to step 4.
4	Check WTS for contamination, deterioration or damage. Is WTS contaminated, deteriorated or damaged?	Yes	Clean WTS with cleaner before installing. If damaged or deteriorated, replace.
		No	Go to step 5.
5	Thoroughly check for loose, bent or corroded connectors at ECU and WTS connectors. With ignition OFF, disconnect ECU and WTS connectors. Measure resistance between WTS and ECU on all two circuits. Is resistance all below 1 Ω?	Yes	Go to step 6.
		No	Repair as necessary
6	Return vehicle to original condition. Clear all diagnostic trouble codes. Verify by driving vehicle with SCAN TOOL connected and monitor for pending codes.		

cardiagn.com