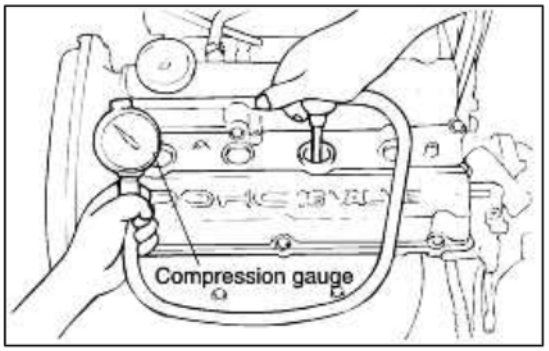
OPTIMA(MS) > 2004 > G 2.4 DOHC > Engine Mechanical System

Engine Mechanical System > General Information > General Information

CHECKING COMPRESSION PRESSURE

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

Limit : 12.5 kg/ cm^2(1.23 MPa, 178 psi) [250-400 rpm]



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

Limit :
Max. 1.0 kg/cm^2 (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, 15-21 lb.ft)

CHECKING ENGINE OIL

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

NOTE

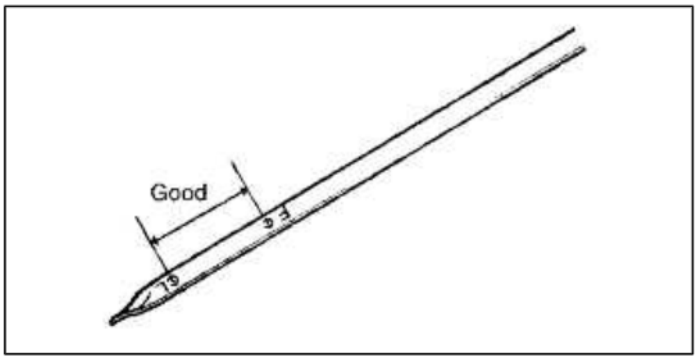
In the case of a vehicle that has been out of service for a prolonged period, run the engine for several minutes. Stop the engine and wait 5 minutes at least, and then check the oil level.

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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.

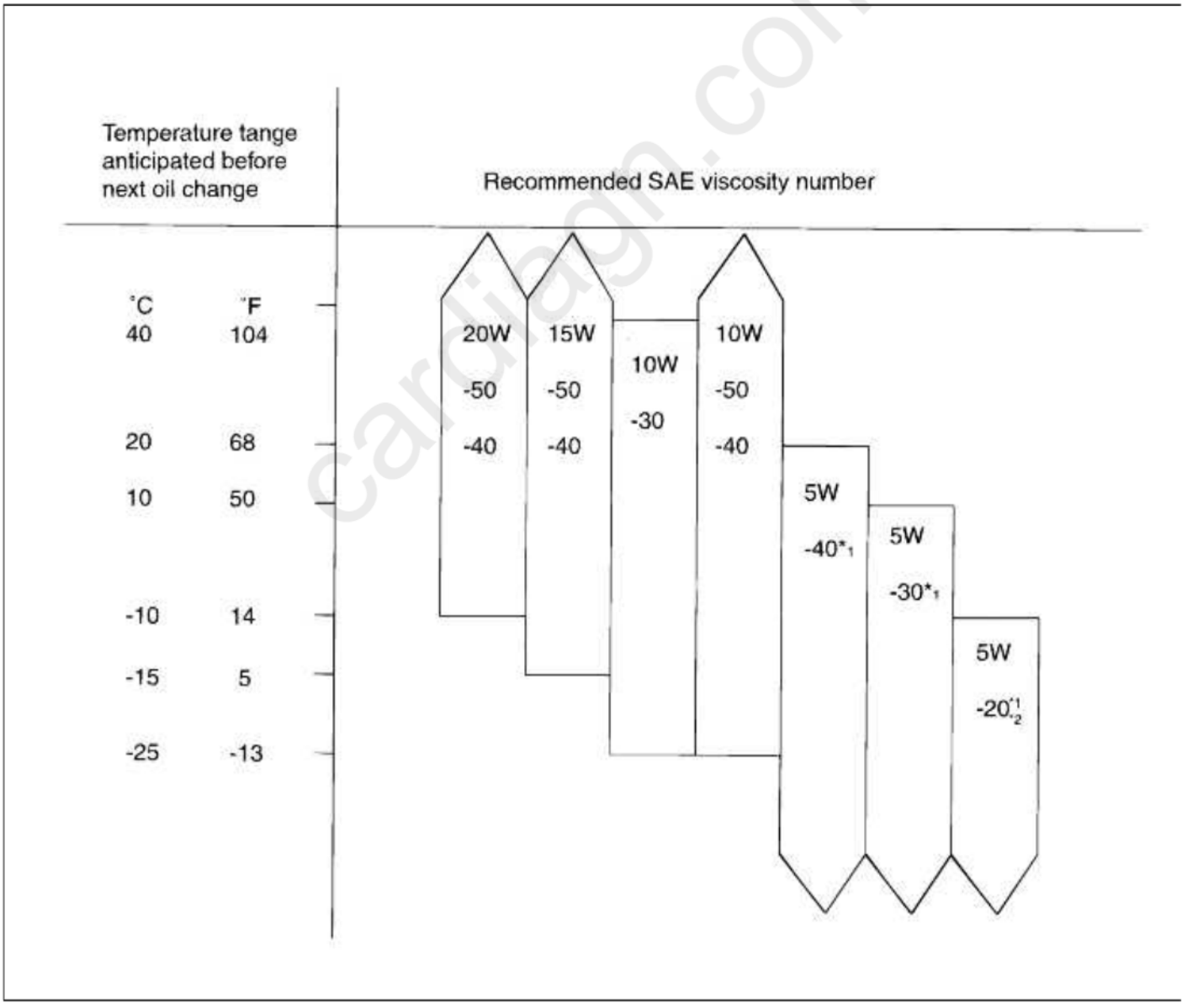


4. Check that the oil is not dirty or mixed with coolant or gasoline and it has the proper viscosity.

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.

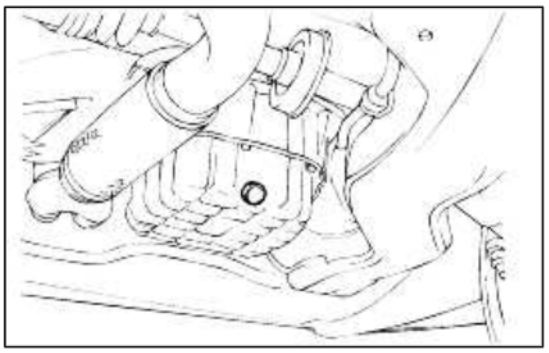
*2. Not recommended for sustained high speed vehicle operation.

NOTE

For best performance and for maximum protection for all types of operation, select only those lubricants
- Confirm the requirements of the API classification.
- Have proper SAE grade number for expected ambient temperature range. Lubricant 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)

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

Capacity
Drain and refill
Without oil filter : 4.0 lit (4.23 U.S.qts., 3.51 lmp.qts.)
With oil filter : 4.3 lit (4.5 U.S.qts., 3.8 lmp.qts)

CAUTION

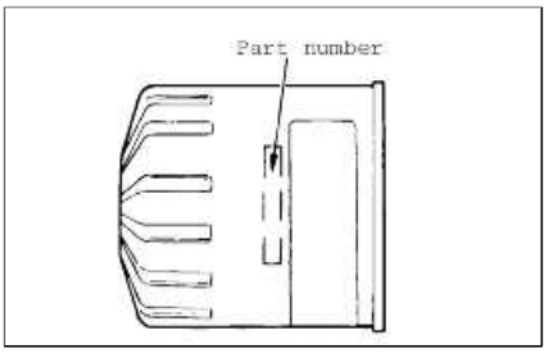
Do not overfill the crankcase. This will cause oil aeration and loss of oil pressure.

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 THE OIL FILTER

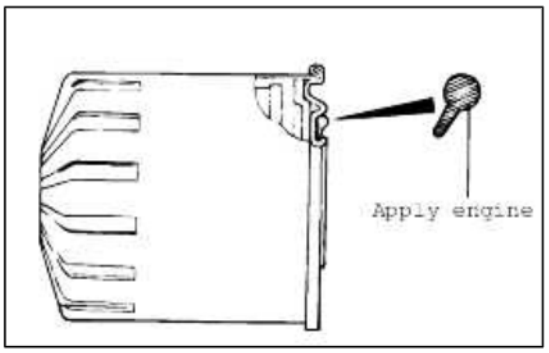
All Kia engines are equipped with a high quality, throw-away oil filter. This filter is recommended as a replacement filter on all vehicles. The quality of replacement filters is various considerably. High guality replacement filters should be used to assure the most efficient service. Make sure that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

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REPLACING THE 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

Oil filter : 17-25 Nm (170-250 kg.cm, 12-28 lb.ft)

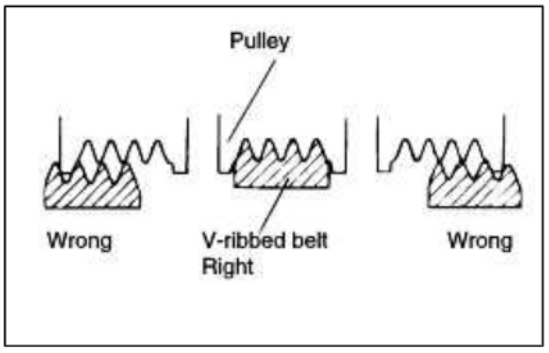
4. Start and run the engine and check for engine oil leak.
5. After stopping the engine, check the oil level and add oil as necessary.

ADJUSTING DRIVE BELTS TENSION

1. Check that the belts are not damaged and are properly fit into the pulley grooves.

CAUTION

- When installing the V-ribbed belt, check that the V-ribs are properly in alignment.
- If noise or slippage is detected, check the belt for wear, damage, or breakage on the pulley contact surface, and check the pulley for scoring. Also check the degree that the belt is deflected.

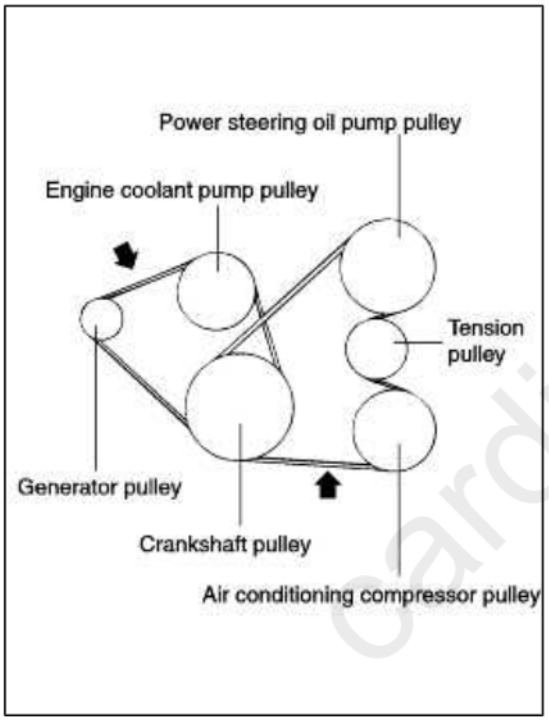


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2. Apply 100 N (22 lbs.) force to the belt back midway between the pulleys as shown in the illustration, measure the amount of deflection with a tension gauge

Standard value :

Items		Inspection	Adjustment	
			New	Used
For generator	Deflection mm (in.)	7.7-12.3 (0.303-0.484)	6.3-7.3 (0.248-0.287)	8.4-10.6 (0.330-0.417)
	Tension N (lb)	300-500 (66-110)	550-650 (121-143)	350-450 (77-99)
For air conditioner compressor and power steering oil pump	Deflection mm (in.)	11.7-15.3 (0.46-0.6)	8.8-11.0 (0.35-0.43)	12.5-14.3 (0.5-0.56)



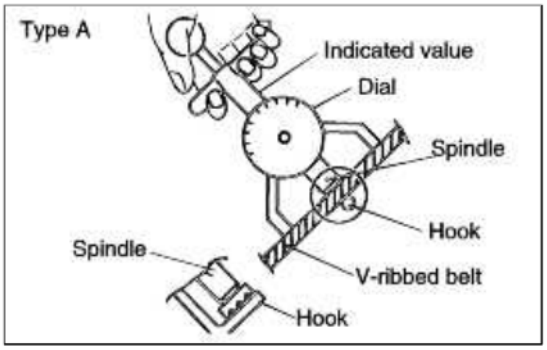
NOTE

- The belt tension must be measured between the specified pulleys.
- When a new belt is installed, adjust the tension to the central value of the standard range indicated under "New" in the above table. And then let the engine idle for 5 minutes or more, and check the standard value indicated under "Inspection".
- When adjusting a belt which has been used or a belt newly installed after 5 minutes or more of operation, refer to the standard value indicated under "Used" in the above table.
- Refer to the standard value indicated under "Inspection" for periodic inspections.

Type A tension gauge

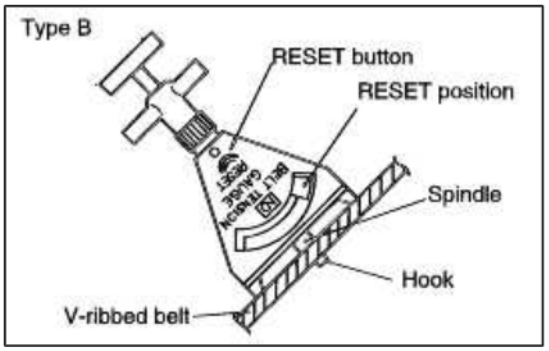
Do not let the dial section of the tension gauge contact other objects during measurement.

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Type B tension gauge

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

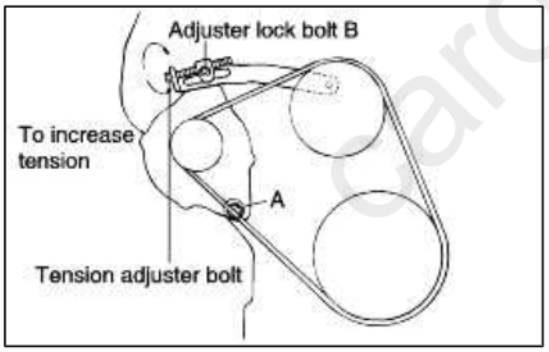


Adjusting the Generator Belt

CAUTION

If the belt is too loose, there will cause noise or sudden wear. If the belt is too tight, the Engine coolant pump bearing or the generator will get damaged.

1. Loosen the generator nut "A" and the tension adjuster lock bolt "B".



2. Using the tension adjuster bolt, adjust the belt tension to the specification.
3. Tighten the adjuster lock bolt "B".
4. Tighten the generator nut "A".

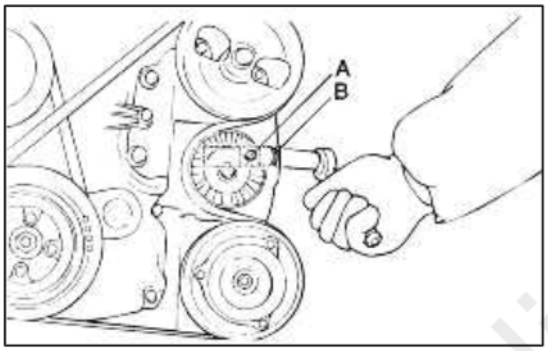
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5. Check the tension or the deflection of belt, readjust if necessary.

Generator Belt Adjustment Tightening torque
Generator nut A : 34-54 Nm (340-540 kg.cm, 25-39 lb.ft)
Adjuster lock bolt B : 20-25 Nm (200-250 kg.cm, 14-18 lb.ft)
Tension adjuster bolt : 8-12 Nm (80-120 kg.cm, 6-8 lb.ft)

Adjusting the belt of Power steering and Air conditioner

1. Loosen the tension pulley adjustment bolt A.



2. Adjust the belt deflection with adjustment bolt B.
3. Tighten the fixing bolt A.
4. Re-check the belt deflection and re-adjust, if necessary.

> NOTE
>
> Before re-checking, crank the engine one or more revolutions.

Checking Lash Adjusters Check

If an abnormal noise is heard from the lash adjusters (tappets), check as follows;

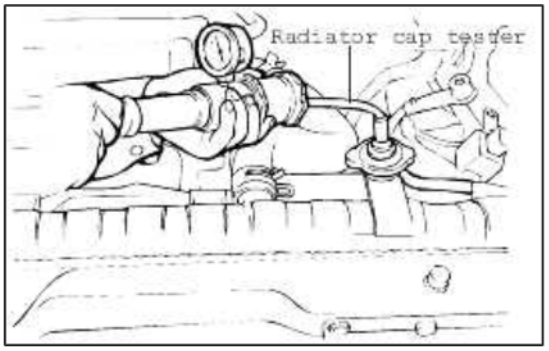
1. While installed to the cylinder head, press the part where the rocker arm contacts the lash adjuster at the very top. If the adjuster is normal, the part pressed will feel very hard.
2. If it always moves easily downward when pressed, there is a malfunction of the lash adjuster and it should be replaced with a new one.
3. If it feels spongy or elastic, probably oil mixed with air has entered the lash adjuster, so follow the steps below:
   A. Check whether the amount of oil is too much or is not enough.
   B. Check whether the reason why air is mixed with oil is a damaged oil screen or oil screen gasket. After repairing the cause of the air leak, warm up the engine and then drive the vehicle at low speed for a while. Stop the engine and leave it off for a few minutes; then restart the engine and drive at low speed. Repeat this proce dure several times during the course of about one hour so as to remove the air from the oil.

CHECKING COOLANT LEAK

1. Loosen the radiator cap.

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



CAUTION

- Radiator coolant may be extremely hot. Do not open the system because 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.
- Be sure to completely clean away any moisture from the places checked.
- When the tester is removed, be careful not to spill any coolant from it.
- Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.

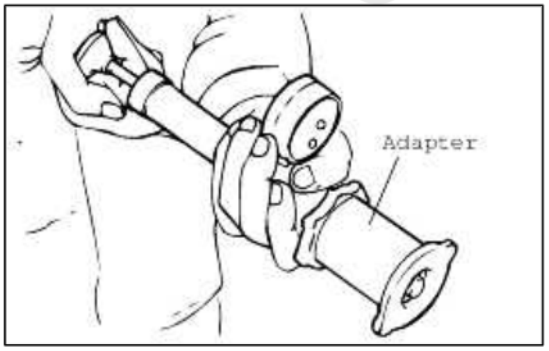
4. If there is leakage, repair or replace the appropriate part.

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 :
96.1-124.5 kPa (0.98-1.27 kg/m², 13.94-18.06 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.

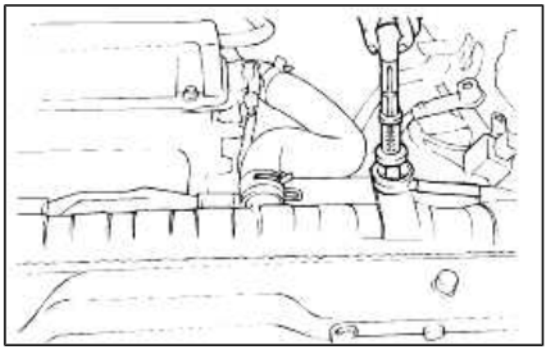
NOTE

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

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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

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. In addition, 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's product.

RECOMMENDED COOLANT

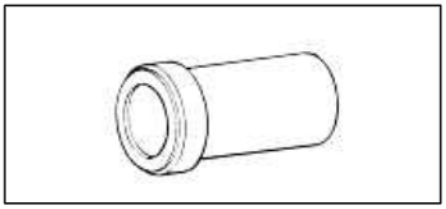
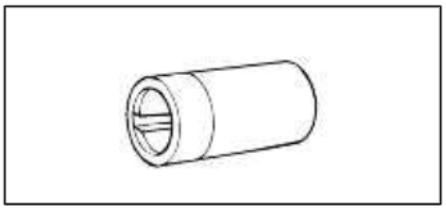
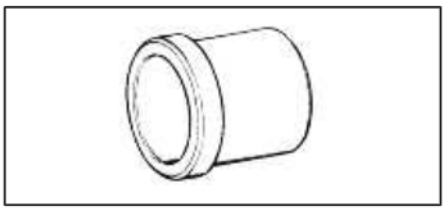
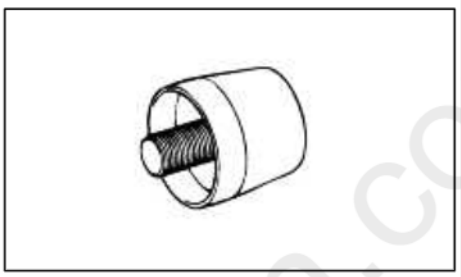
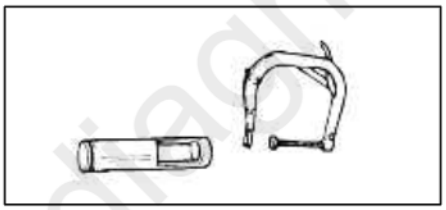
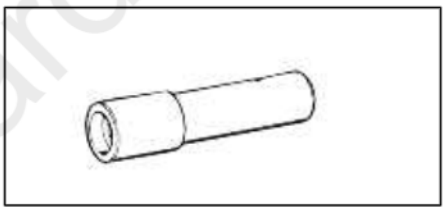
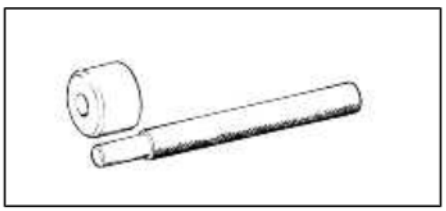
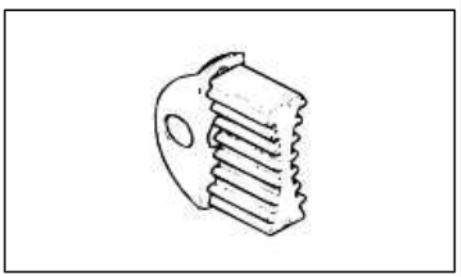
Antifreez	Mixture ratio of anti-freeze in coolant
ETHYLENE GLYCOL	50% [Except tropical areas]
BASE FOR ALUMINUM	40% [Tropical areas]

Engine Mechanical System > General Information > Special Service Tools

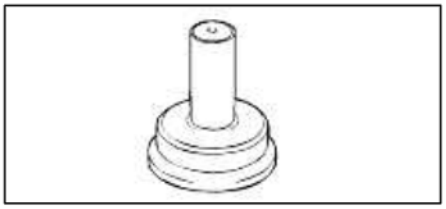
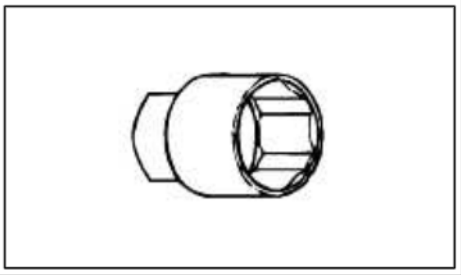
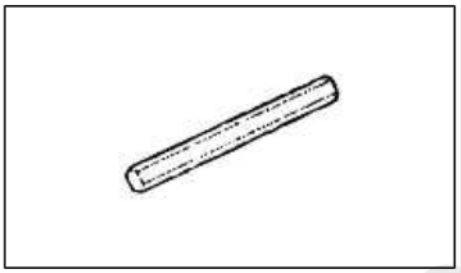
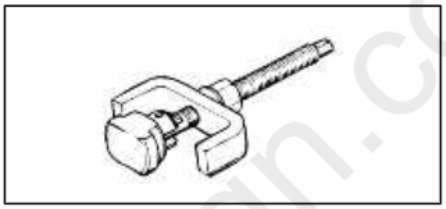
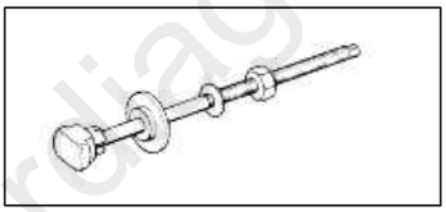
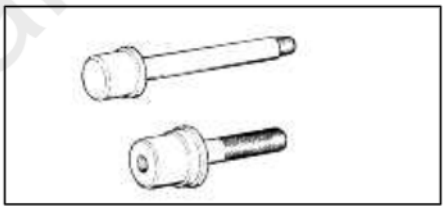
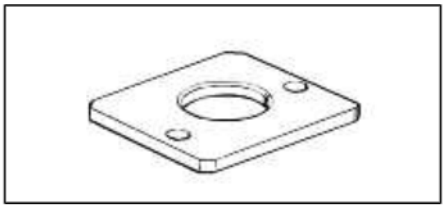
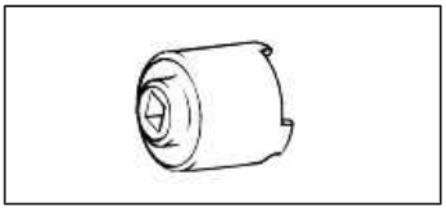
SPECIAL SERVICE TOOLS

Tool (Number and name)	Illustration	Use

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09214-32000 / 09214-M2001 Crankshaft front oil seal installer		Installation of the crankshaft front oil seal (use with 09214-32100/09214-M2100)
09214-32100 / 09214-M2100 Crankshaft front oil seal guide		Installation of the crankshaft front oil seal (use with 09214-32000/09214-M001)
09221-21000 / 09221-M2000 Camshaft oil seal installer		Installation of the camshaft oil seal (use with 09221-21100/09211-M2100)
09221-21100 / 09221-M2100 Camshaft oil seal guide		Used as a guide when pressing in the camshaft oil seal
09222-28000 / 0K993 120 001 Valve spring compressor		Removal and installation of the inlet or exhaust (use with 09222-28100/0K993 120 004)
09222-21100 Valve stem oil seal installer		Installation of the valve stem oil seal
09222-21200 A/B / 09222-M2200 A/B Valve guide installer		Removal and installation of the valve guide
09231-38000 Camshaft locking tool		Fixing the camshaft when replacing the timing belt

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09231-21000 / 09231-M2000 Crankshaft rear oil seal installer		1. Installation of the engine rear oil seal 2. Installation of the crankshaft rear oil seal
09260-32000 Oil pressure switch wrench		Removal and installation of oil pressure switch
09221-32001 / 09221-M2001 Cylinder head bolt wrench		Removal and installation of the cylinder head bolt
09212-32000 / 09212-M2000 Counter balance shaft bearing puller		Removal of front bearing of counter balance shaft
09212-32100 / 09212-M2100 Counter balance shaft bearing puller		Removal of rear bearing of counter balance shaft (use with 09212-32300)
09212-32200 Counter balance shaft bearing installer		Installation of counter balance shaft bearing front and rear (use with 09212-32300)
09212-32300 Guide plate		Removal and installation of counter balance shaft rear bearing (use with 09212-32100 / 09212-M2100, 09212-32200)
09213-33000 Plug cap wrench		Removal and installation of front case cap plug

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Engine Mechanical System > General Information > Troubleshooting

TROUBLESHOOTING

Symptom	Probable cause	Remedy
Low compression	Blown cylinder head gasket	Replace gasket
	Worn or damaged piston rings	Replace rings
	Worn piston or cylinder	Repair or replace piston and/or cylinder block
	Worn or damaged valve seat	Repair or replace valve and/or seat ring
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
Noisy valves	Thin or diluted engine oil (low oil pressure)	Change
	Worn or damaged valve stem or valve guide	Replace
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
Timing belt noise	Incorrect belt tension (Auto tensioner)	Adjust belt tension or Replace auto tensioner.
Low coolant level	Leakage of coolant	
	Damaged radiator core joint	Replace
	Corroded or cracked hoses (Radiator hose, heater hose, etc)	Replace
	Faulty radiator cap valve or setting of spring	Replace
	Faulty thermostat	Replace

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	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	Retighten
	Broken pipe or muffler	Repair or replace
Abnormal noise	Detached baffle plate in muffler	Replace
	Broken rubber hanger	Replace
	Pipe or muffler contacting vehicle body	Correct
	Broken pipe or muffler	Repair or replace

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Engine Mechanical System > General Information > Specifications

SPECIFICATIONS

Description	Specification	Limit
General		
Type	In-line, Double Overhead Camshaft	
Number of cylinders	4	
Bore	86.5 mm (3.41 in.)	
Stroke	100 mm (3.94 in.)	
Total displacement	2351 cc (143.5 cu. in.)	
Compression ratio	10	
Firing order	1-3-4-2	

Idle R.P.M		800 ±100 rpm	
Ignition timing at idling speed Valve timing		BTDC 5°±2°	
valve timing			
Intake valve	Opens (BTDC)	12°	
	Closes (ABDC)	56°	
Exhaust valve	Opens (BBDC)	54°	
	Closes (ATDC)	14°	
Cylinder head			
Flatness of gasket surface		Max. 0.03 mm (0.0012 in.)	0.2 mm (0.008 in.)
Flatness of manifold mounting surface		0.15 mm (0.0059 in.)	0.3 mm (0.012 in.)
Dimensions for reworking oversize valve seat hole			
Intake	0.3 mm (0.012 in.) O.S.	35.300-35.325 mm (1.3898-1.3907 in.)	
	0.6 mm (0.024 in.) O.S	35.600-35.625 mm (1.4016-1.4026 in.)	
Exhaust	0.3 mm (0.012 in.) O.S.	33.300-33.325 mm (1.3110-1.3120 in.)	
	0.6 mm (0.024 in.) O.S	33.600-33.625 mm (1.3228-1.3238 in.)	
Dimensions for reworking oversize valve seat hole (both intake and exhaust)			
0.05 mm (0.002 in.) O.S.		12.050-12.068 mm (0.4744-0.4751 in.)	
0.25 mm (0.010 in.) O.S.		12.250-12.268 mm (0.4823-0.4830 in.)	
0.50 mm (0.020 in.) O.S.		12.500-12.518 mm (0.4921-0.4928 in.)	
Camshaft			
Cam height	Intake	35.493 mm (1.3974 in.)	34.993 mm (1.3777 in.)
	Exhaust	35.317 mm (1.3904 in.)	34.817 mm (1.3707 in.)
	Journal O.D.	26 mm (1.02 in.)	
Bearing oil clearance		0.040-0.076 mm (0.0020-0.0029 in.)	
End play		0.1-0.2 mm (0.004-0.008 in.)	
Valve			
Valve length	Intake	109.5 mm (4.311 in.)	
	Exhaust	109.7 mm (4.319 in.)	
Stem O.D.	Intake	6.565-6.580 mm (0.2585-	

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		0.2591 in.)	
	Exhaust	6.530-6.550 mm (0.2571-0.2579 in.)	
	Face angle	45-45.5°	
Thickness of valve head (margin)	Intake	1.0 mm (0.040 in.)	0.7 mm (0.028 in.)
	Exhaust	1.5 mm (0.059 in.)	1.0 mm (0.040 in.)
Valve stem to valve guide clearance	Intake	0.020-0.047 mm (0.0008-0.0019 in.)	0.10 mm (0.0040 in.)
	Exhaust	0.050-0.085 mm (0.0020-0.0033 in.)	0.15 mm (0.0059 in.)
Valve guide			
Length	Intake	45.5 mm (1.791 in.)	
	Exhaust	50.5 mm (1.988 in.)	
	Service size	0.05, 0.25, 0.50 mm (0.002, 0.010, 0.020 in.) oversize	
Valve seat			
Width of seat contact		0.9-1.3 mm (0.035-0.051 in.)	
Seat angle		44-44.5	
Service size		0.3 mm (0.012 in.), 0.6 mm (0.024 in.) oversize	
Valve spring			
Free length		45.82 mm (1.804 in.)	44.82 mm (1.765 in.)
Load		248 N (55 lb) at installed height	
Out of squareness		Less than 1.5°	4°
Cylinder block			
Cylinder bore		86.5-86.53 mm (3.4055-3.4067 in.)	
Out-of-roundness and taper of cylinder bore		Less than 0.01 mm (0.0004 in.)	
Flatness of gasket surface		Less than 0.05 mm (0.0020 in.)	0.1 mm (0.0040 in.)
Piston			
O.D.		84.97-85.00 mm (3.3453-3.3465 in.)	
Piston-to-cylinder clearance		0.02-0.04 mm (0.0008-0.0012 in.)	
Ring groove width	No. 1	1.21-1.23 mm (0.0476-	

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		0.0484 in.)	
	No. 2	1.51-1.53 mm (0.0595-0.0602 in.)	
	Oil	2.81-2.83 mm (0.1106-0.1114 in.)	
Piston ring			
Side clearance	No. 1	0.03-0.07 mm (0.0012-0.0028 in.)	0.1 mm (0.004 in.)
	No. 2	0.02-0.06 mm (0.0008-0.0024 in.)	0.1 mm (0.004 in.)
End gap	No. 1	0.25-0.35 mm (0.0098-0.0138 in.)	0.8 mm (0.031 in.)
	No. 2	0.40-0.55 mm (0.0157-0.0216 in.)	0.8 mm (0.031 in.)
	Oil ring side rail	0.10-0.40 mm (0.0039-0.0157 in.)	1.0 mm (0.040 in.)
Connecting rod			
Bend		0.05 mm (0.0020 in.) or less per 100 mm (3.937 in.)	
Twist		0.1 mm (0.004 in.) or less per 100 mm (3.937 in.)	
Connecting rod big end to crankshaft side clearance		0.10-0.25 mm (0.0040-0.0098 in.)	0.4 mm (0.0157 in.)
Piston pin press-in load		7,500-17,500 N (1,653-3,858 lb)	
Connecting rod bearing			
Oil clearance		0.015-0.048 mm (0.0008-0.0020 in.)	0.1 mm (0.004 in.)
Crankshaft main bearing			
Oil clearance		No. 1, 2, 4, 5:0.018-0.036mm (0.0007-0.0014 in.) No. 3 :0.024-0.042mm (0.0009-0.0016 in.)	0.1 mm (0.004 in.)
Crankshaft			
Pin O.D.		44.980-45.000 mm (1.7709-1.7717 in.)	
Journal O.D.		56.982-57.000 mm (2.2434-2.2442 in.)	
Out-of-roundness of journal and pin		Less than 0.015 mm (0.0006 in.)	

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Taper of journal and pin		Less than 0.005mm (0.0002 in.)	
End play		0.05-0.25 mm (0.0020-0.0098 in.)	0.25 mm (0.0098 in.)
Flywheel			
Runout			0.13 mm (0.0051 in.)
Oil pressure at curb idle speed [Oil tempreature is 75 to 90°C167 to 194°F)]		80 kPa (11.4 psi) or more	
Oil pump			
Tip clearance	Drive gear	0.160-0.205 mm (0.0063-0.0081 in.)	0.25 mm (0.0098 in.)
	Driven gear	0.180-0.205 mm (0.0071-0.0081 in.)	0.25 mm (0.0098 in.)
Side clearance	Drive gear	0.08-0.14 mm (0.0031-0.0055 in.)	0.25 mm (0.0098 in.)
	Driven gear	0.06-0.12 mm (0.0024-0.0047 in.)	0.25 mm (0.0098 in.)
Relief spring			
Free length		46.6 mm (1.835 in.)	
Load [61 N (13.5 lb)]		40.1 mm (1.579 in.)	
Right silent shaft			
Front journal diameter		41.959-41.975 mm (1.6519-1.6526 in.)	
Rear journal diameter		40.951-40.967 mm (1.6122-1.6129 in.)	
Oil clearance	Front	0.020-0.0061 mm (0.0008-0.0024 in.)	
	Rear	0.050-0.091 mm (0.0020-0.0036 in.)	
Left silent shaft			
Front journal diameter		18.467-18.480 mm (0.7270-0.7276 in.)	
Rear journal diameter		40.959-40.975 mm (1.6126-1.6132 in.)	
Oil clearance	Front	0.020-0.054 mm (0.0008-0.0021 in.)	
	Rear	0.042-0.083 mm (0.0017-0.0033 in.)	
Cooling method		Engine coolant cooling, forced circulation with water pump (Driven belt)	

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Cooling system	Quantity	6.5 lit (6.9 U.S.qts., 5.7 lmp.qts.) [For DOHC]]	
Thermostat	Type	Wax pellet type with jiggle valve	
	Normal opening temperature	82°C (179.6°F)	
	Opening temperature range	80.5°C-83.5°C (176.9 - 182.3°F)	
	Wide open temperature	95°C (203°F)	
Radiator cap	Main valve opening pressure	86.1-124.5 kPa (0.98-1.27 kg/cm², 13.94-18.06 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	
		Unwoven cloth type	
Exhaust pipe			
Muffler		Expansion resonance type	
Suspension system		Rubber hangers	

SERVICE STANDARD

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

LUBRICANT

Engine coolant	Ethylene glycol base for aluminum radiator

SELANT

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

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NOTE

O.D. = Outer Diameter
I.D. = Inner Diameter
O.S. = Oversize Diameter
U.S. = Undersize Diameter

TIGHTENING TORQUE

	Nm	kg·cm	lb·ft
Engine mounting insulator bolt [12x15 mm (0.4724x0.5906 in.)]	90-110	900-1100	65-80
Engine mounting bracket nuts	60-80	600-800	43-58
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	500-600	36-47
Rear roll stopper insulator bolt and nut	50-65	500-600	36-47
Rear roll stopper bracket to transaxle bolts	60-80	600-800	43-58
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	900-1100	65-80
Air conditioner compressor to bracket	23-27	230-270	17-20
Power steering oil pump to bracket	35-45	350-450	25-33
Front exhaust pipe to exhaust manifold	30-40	300-400	22-29
Rocker cover bolt	8-10	80-100	6-7
Center cover bolt	4-5	40-50	3-3.6
Camshaft sprocket bolt	80-100	800-1000	58-72
Camshaft bearing cap bolt	19-21	190-210	14-15
Crankshaft position sensor	10-13	100-130	7-9
Cam position sensing cylinder bolt	15-22	150-220	11-16
Throttle body stay	15-22	150-220	11-16
Air cleaner body installation bolt	8-10	80-100	6-7
Crankshaft sprocket bolt	110-130	1100-1300	80-94
Crankshaft pulley to crankshaft sprocket	20-30	200-300	14-22
Cylinder head bolt (Cold engine)			

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With changing parts.	64+Releas all bolt +20+90°+90°	640+Releas all bolt +200+90°+90°	48+Releas all bolt +14+90°+90°
Without changing parts	20+90°+90°	200+90°+90°	14+90°+90°
Intake manifold stay	18-25	180-250	13-18
Tension pulley bracket bolt	23-27	230-270	17-20
Auto tensioner bolt	20-27	200-270	14-20
Tensioner pulley bolt	43-55	430-550	31-40
Idle pulley bolt	45-55	450-550	33-40
Front exhaust pipe clamp bolt	20-30	200-300	14-22
Oil pan	10-12	100-120	7-9
Oil pan drain plug	35-45	350-450	25-33
Oil screen	15-22	150-220	11-16
Oil pump sprocket nut	50-60	500-600	36-43
Oil pressure switch	8-12	80-120	5.8-8.7
Oil filter bracket bolt	20-27	200-270	14-20
Oil pump cover bolt	15-18	150-180	11-13
Oil seal case bolt	10-12	100-120	7-9
Plug cap	20-27	200-270	14-20
Oil pump case bolt (M 8)	20-27	200-270	14-20
Driven gear bolt	34-40	340-400	25-29
Engine coolant pump pulley bolt	8-10	80-100	6-7
Timing belt upper cover	8-10	80-100	6-7
Timing belt lower cover	8-10	80-100	6-7
Relief plug	40-50	400-500	29-36
Flywheel	130-140	1300-1400	94-101
Drive plate	130-140	1300-1400	94-101
Timing belt rear right cover	10-12	100-120	7-9
Timing belt rear left cover (lower) bolt also securing left engine support bracket	30-42	300-420	22-30
Timing belt rear left cover (upper)	10-12	100-120	7-9
Connecting rod cap bolt	18-22+(90°~94°)	180-220 + (90°~94°)	13-16+(90°~94°)
Crankshaft bearing cap bolt	25+(90°~94°)	250+(90°~94°)	18+(90°~94°)
Engine hanger			
M8	25-30	250-300	8-22
M10	35-55	350-550	25-40

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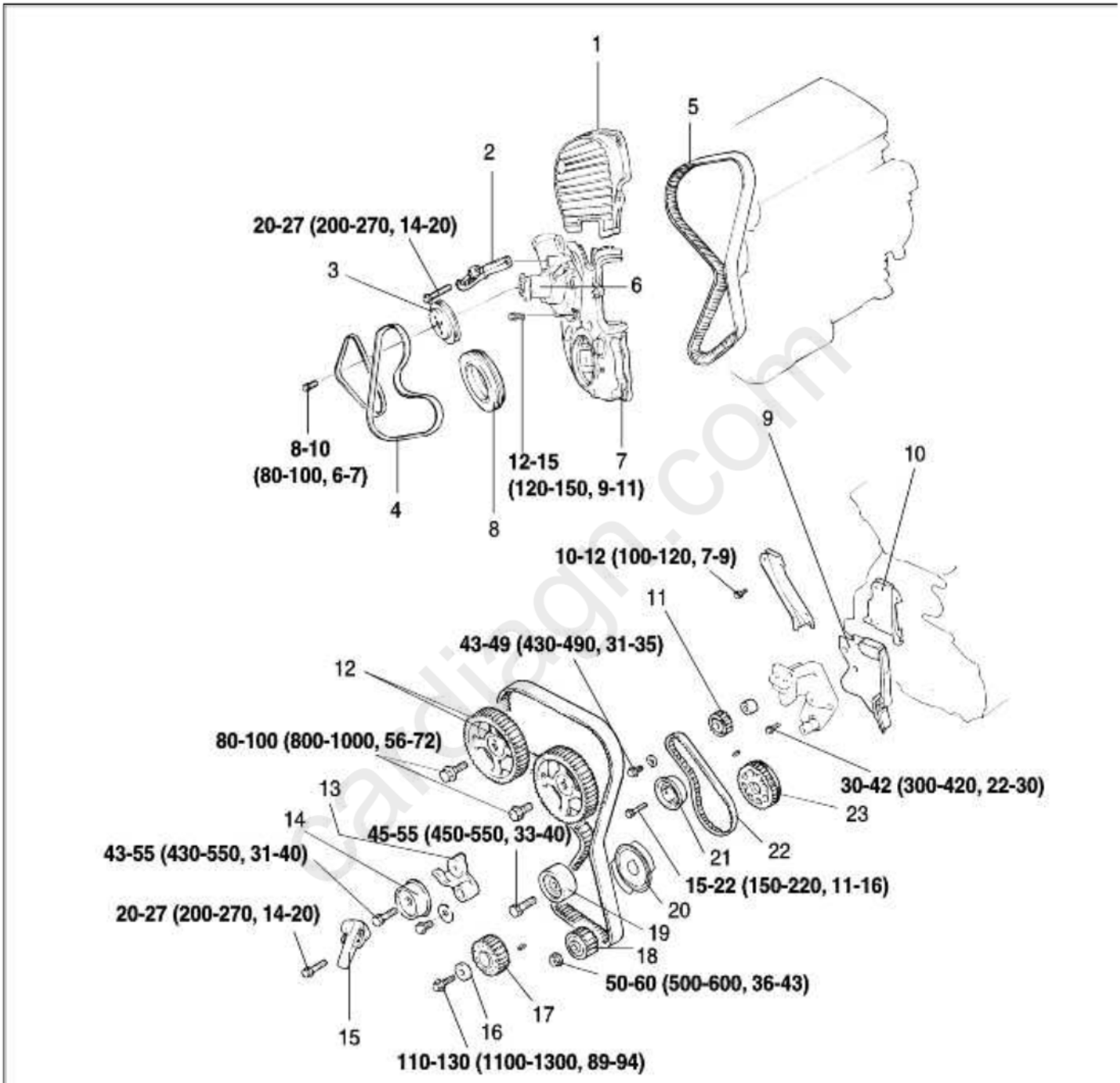
Generator support bolt	20-25	200-250	14-18
Generator brace bolt			
(4T)	12-15	120-150	9-11
(5T)	20-27	200-270	14-20
Engine coolant pump to cylinder block bolt			
Head mark "7" bolt	15-22	150-220	11-15
Engine coolant temperature gauge unit	10-12	100-120	7-9
Engine coolant temperature sensor	20-40	200-400	14-29
Engine coolant outlet fitting attaching bolt	10-15	100-150	7-11
Air cleaner mounting bolts	8-10	80-100	6-7
Resonator mounting bolt	8-10	80-100	6-7
Resonator mounting nut	4-6	40-60	35-47 lb.in
Delivery pipe bolt to engine	10-13	100-130	7-9
Accelerator cable bolts to intake manifold	4-6	40-60	35-47 lb.in
Throttle body to intake manifold	15-22	150-220	11-16
Intake manifold stay bolts	18-22	180-250	13-18
Intake manifold mounting bolt (M8)	15-20	150-200	11-14
Intake manifold mounting bolt (M10)	18-25	180-250	13-18
Intake manifold mounting nut	30-42	300-420	22-30
Tension rod bracket bolt to tension rod	35-55	350-550	25-40
Ignition coil bolts	8-12	80-120	6-9
Power transistor bolts	10-12	100-120	7-9
EGR valve bolts	17-26	170-260	12-19
EGR temperature sensor (California)	10-12	100-120	7-9
Front exhaust pipe nuts to exhaust manifold	30-40	300-400	22-29
Front exhaust pipe bolt to engine	20-30	200-300	14-22
Center exhaust pipe nuts to catalytic converter	30-40	300-400	22-29
Center exhaust pipe bolts to main muffler	30-40	300-400	22-29
Center exhaust pipe bolt to bracket	10-15	100-150	7-11
Hanger bolt to body			
M8:	25-30	250-300	18-22
M10:	35-55	350-550	25-40
Hanger bolt to main muffler	10-15	100-150	7-11
Exhaust manifold nuts to engine nut (M8)	25-30	250-300	18-22
Exhaust manifold nuts to engine nut (M10)	35-55	350-550	25-40
Oxygen sensor	40-50	400-500	29-36

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Heat protector bolt to exhaust manifold	12-15	120-150	9-11

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

COMPONENTS



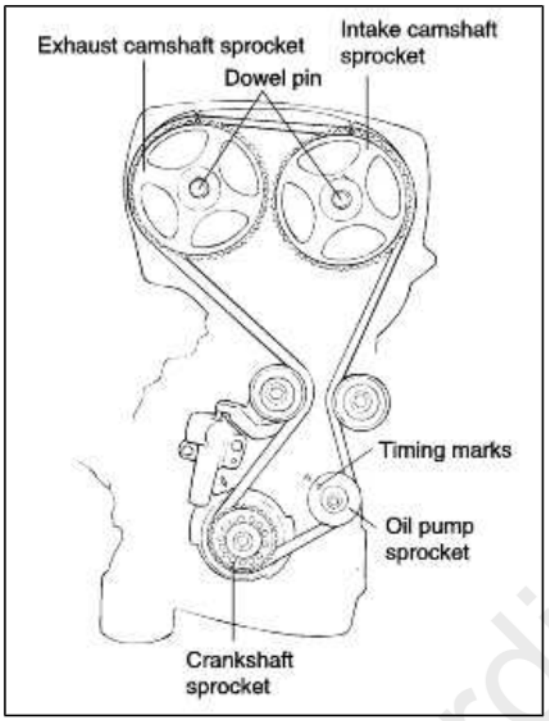
1. Timing belt upper cover
2. Generator brace
3. Engine coolant pump pulley
4. Drive belt (A/C, P/S)
5. Timing belt
6. Engine coolant pump
7. Timing belt lower cover
8. Crankshaft pulley
9. Timing belt rear left cover (lower)
10. Timing belt rear left cover (upper)
11. Counter shaft sprocket
12. Camshaft sprocket
13. Tensioner arm
14. Tensioner pulley
15. Auto tensioner
16. Special washer
17. Crankshaft sprocket
18. Oil pump sprocket
19. Idler pulley
20. Sensing blade
21. Tensioner "B"
22. Timing belt "B"
23. Crankshaft sprocket "B"

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

REMOVAL

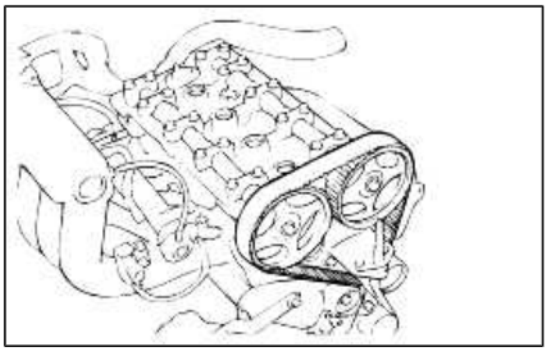
1. Remove the crankshaft pulley, engine coolant pump pulley and drive belt.
2. Remove the timing belt cover.
3. Turn the crankshaft clockwise and align the timing marks so as to bring the No. 1 cylinder to compression top-dead-center position. At this time the timing marks of the camshaft sprocket and the timing marks of the rocker cover should coincide, and the dowel pin of the camshaft sprocket should be at the upper side. Remove the auto tensioner.

> CAUTION
>
> Rotate the crankshaft clockwise.



4. Remove the timing belt.

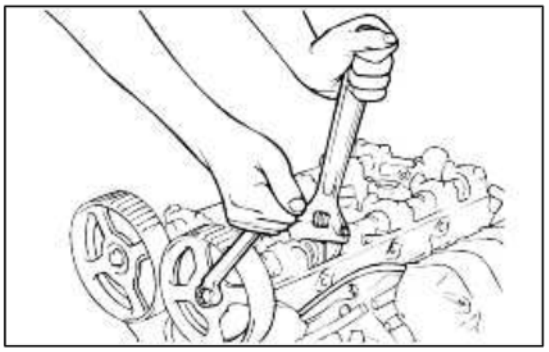
> NOTE
>
> If the timing belt is reused, make an arrow mark indicating the turning direction (or the front of the engine) to make sure that the belt is reinstalled in the same direction as before.



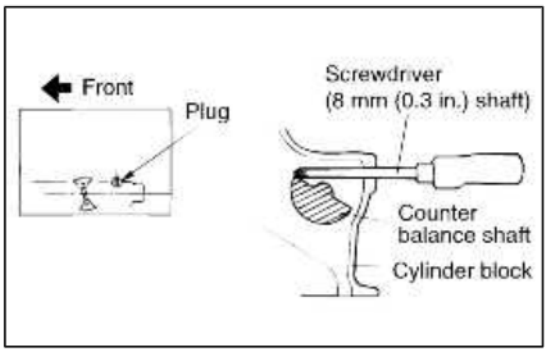
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5. Remove the camshaft sprockets.

> NOTE
>
> Be careful not to damage the cylinder head with the wrench.

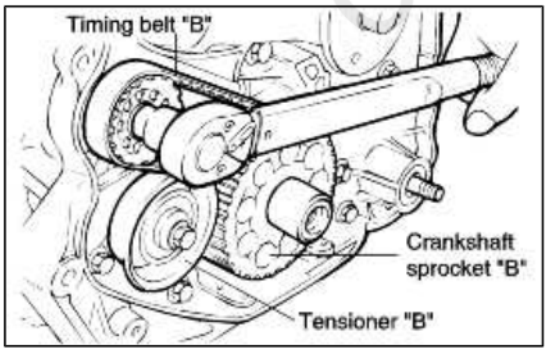


6. When the oil pump sprocket nut is removed, first remove the plug at left side of the cylinder block and insert a screwdriver to check the left counter balance shaft in position. Screwdriver used for this purpose should have a shaft 8 mm (0.3 in.) in diameter which can be inserted more than 60 mm (2.36 in.)



7. Remove the oil pump sprocket retaining nut and remove the oil pump sprocket.
8. Loosen the right counter balance shaft sprocket mounting bolt until it can be loosened by hand.
9. Next, remove tensioner "B" and remove timing belt "B".

> CAUTION
>
> After timing belt "B" has been removed, do not attempt to loosen bolt while holding sprocket with pliers, etc.



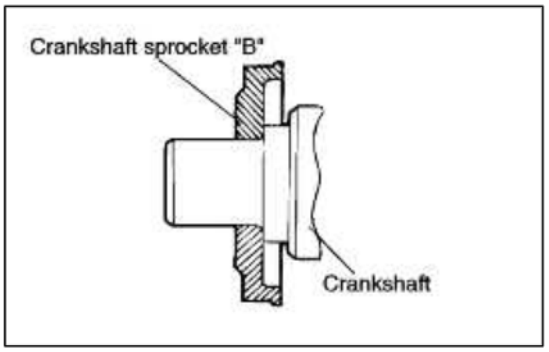
10. Remove the crankshaft sprocket "B" from crankshaft.

INSTALLATION

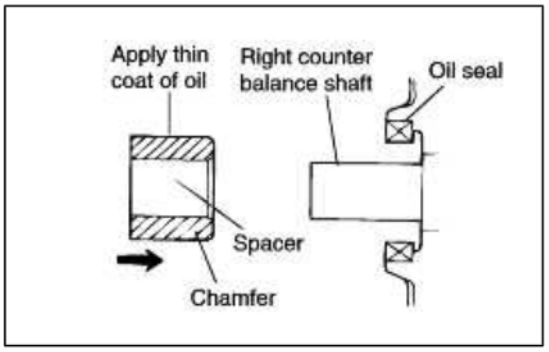
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1. Install crankshaft sprocket "B" into crankshaft.

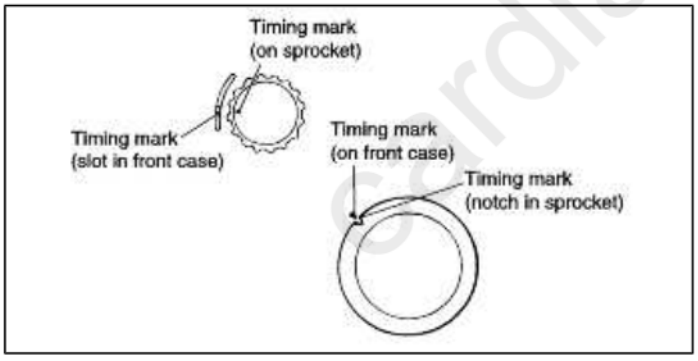
> **CAUTION**
>
> Pay special attention to the direction of the flange. If it is installed in the wrong direction, a broken belt could result.



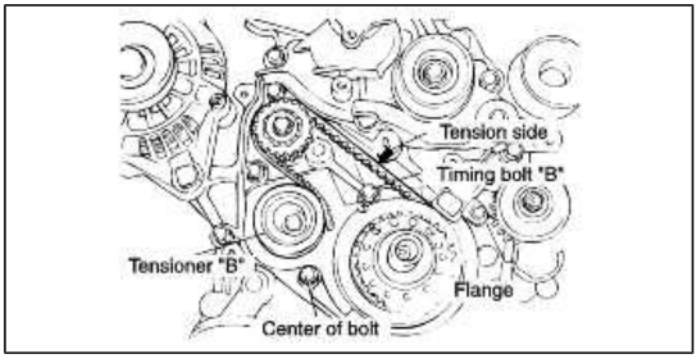
2. Lightly apply engine oil to the outer surface of spacer, and then install the spacer to the right counter balance shaft. Be sure to install in the direction as shown in illustration.



3. Install the counter balance shaft sprocket onto the right counter balance shaft, and then tighten flange bolt by finger tight.
4. Align the timing mark on each sprocket with the corresponding timing mark on the front case.



5. When the timing belt "B" is installed, make certain that tension side has no slack. Install tensioner "B" with center of pulley located on the left side of mounting bolt.



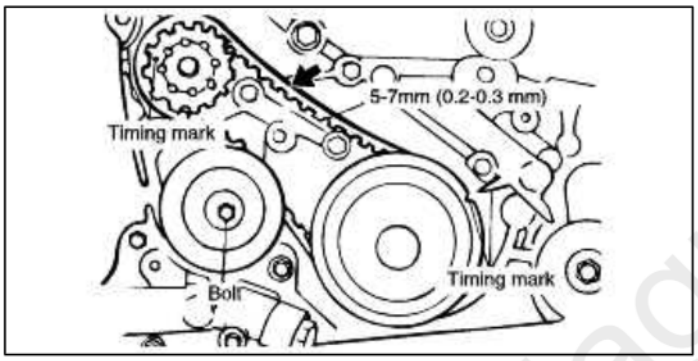
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6. Lift tensioner "B" to tighten the timing belt "B" so that its tension side will be pulled tight. In this condition, tighten a bolt to secure tensioner "B". When a bolt is tightened, be careful to prevent from turning together. If the shaft is turned together, the belt will be overtightened.



7. Check to ensure that timing marks are in alignment.
8. Check to ensure that when the center of span on the tension side is depressed with index finger in direction of arrow, deflection of belt is within specification.

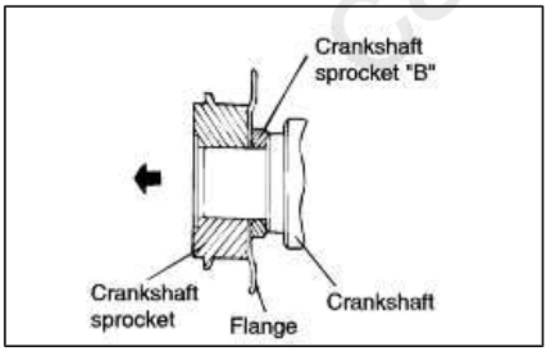
Belt deflection : 5-7 mm (0.2-0.3 in.)



9. Install sensing blade and crankshaft sprocket onto crankshaft. Be sure to install in the direction as shown in illustration.

CAUTION

Pay attention to direction of flange. If it is installed in wrong direction, a broken belt could result.

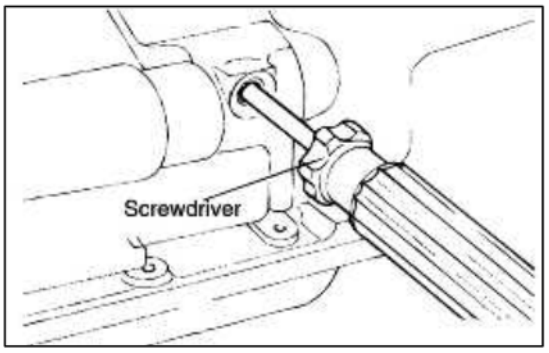


10. Install the special washer and sprocket bolt to crankshaft, and then tighten the sprocket bolt.

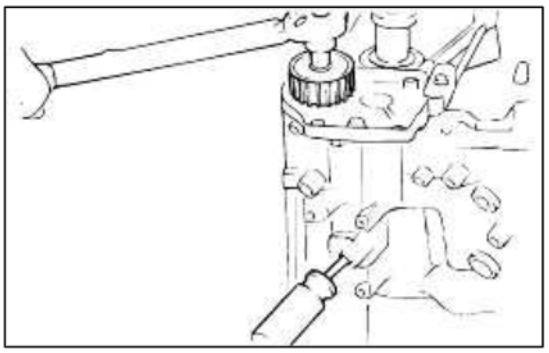
Tightening torque
Crankshaft sprocket bolt :
110-130 Nm (1100-1300 kg.cm, 80-94 lb.ft)

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11. Insert a screwdriver through the plug hole in left side of cylinder block to keep shaft in position.

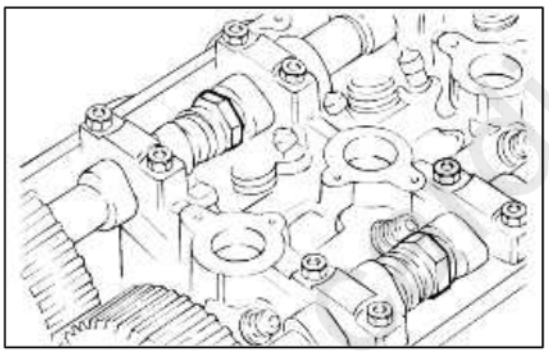


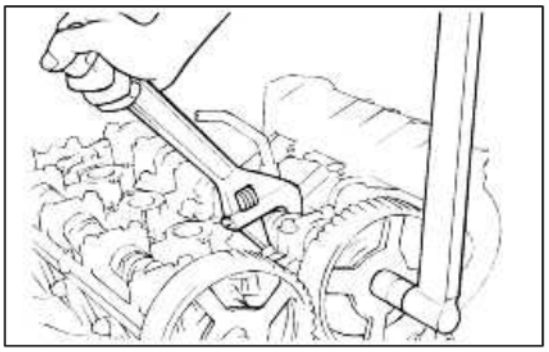
12. Install the oil pump sprocket, and tighten the nut to the specified torque.



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

Tightening torque
Camshaft sprocket bolt :
80-100 Nm (800-1000 kg.cm, 56-72 lb.ft)



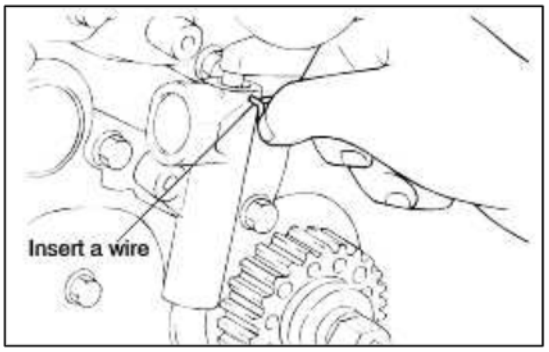


14. Install the auto tensioner.

CAUTION

Leave the set pin installed in the auto tensioner

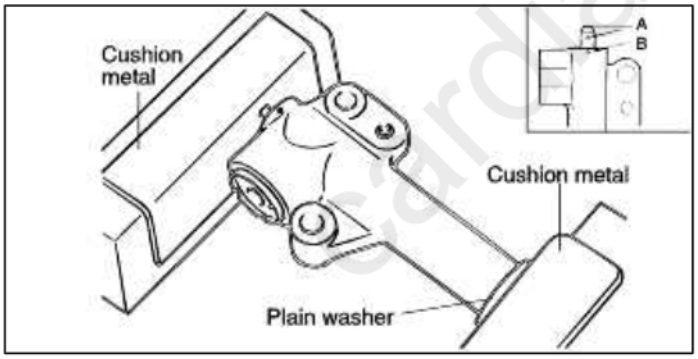
Tightening torque
Auto tensioner bolt :
19.6-26.5 Nm (2.0-2.7 kg.cm, 145-19.5 lb.ft)



NOTE

If the auto tensioner rod is in its fully extended position, reset it as follows.

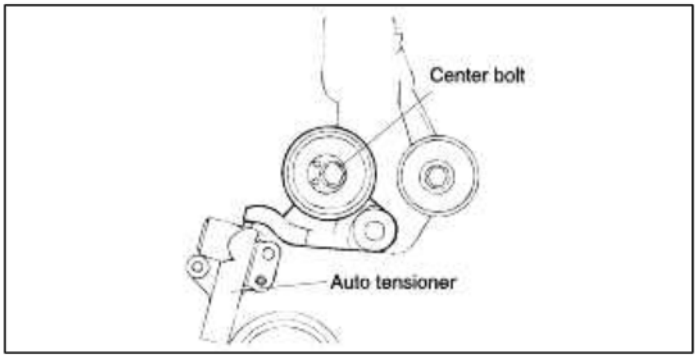
- Clamp it in the vise with soft jaws in a level position. Apply a plain washer if there is a plug at the bottom of the auto tensioner.
- Push in the rod slowly with the vise until the set hole A in the rod is aligned with the set hole B in the cylinder.
- Insert a wire to the set hole A and B.



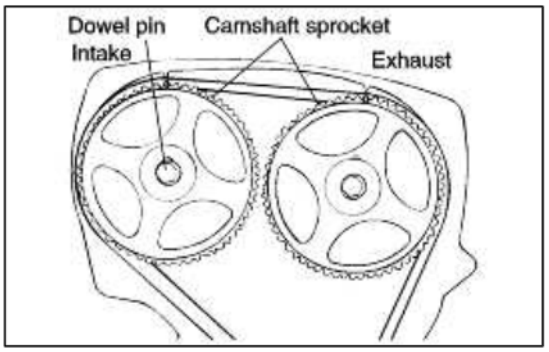
15. Install the tensioner pulley onto the tensioner arm.

CAUTION

Leave the wire installed in the auto tensioner.

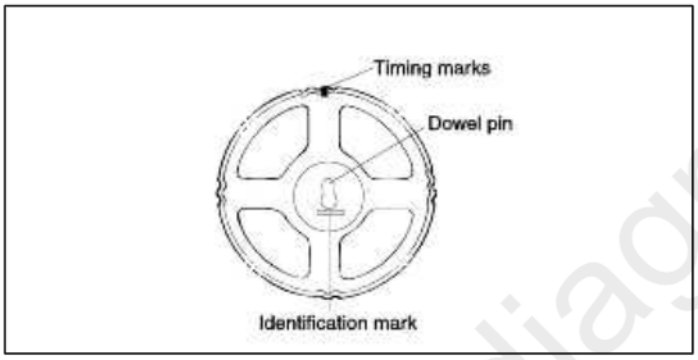


16. Align the timing marks of the camshaft sprocket to the timing marks of the rocker cover. The dowel pin of the camshaft sprocket should be at the upper side.



NOTE

- The identification mark is on the camshaft sprocket.
- Before installing timing belt, if the timing marks of cam shaft sprocket and rocker cover are not concide, do not rotate the cam shaft sprocket more than 2 teeth of sprocket in any direction.
- Rotating sprocket more than 2 teeth makes valve and piston be touched each other.
- In case of rotating the cam shaft sprocket in avoidably more than 2 teeth, rotate the cam shaft sprocket after rotating crank shaft sprocket counter clockwise on basis of timing mark.

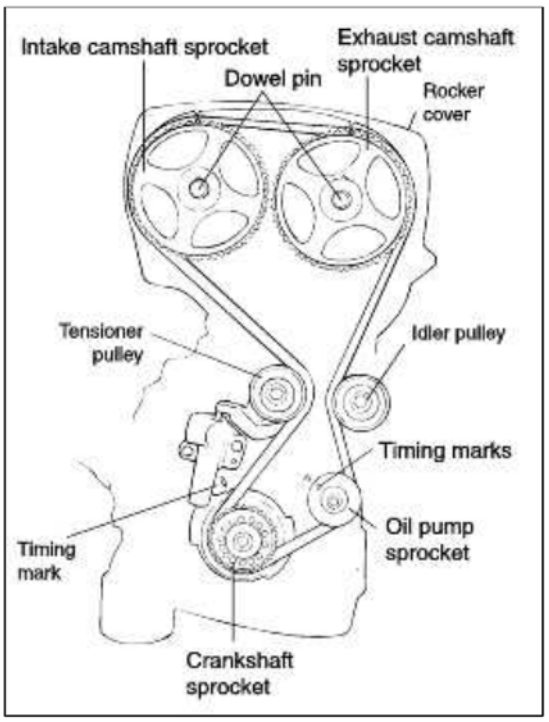


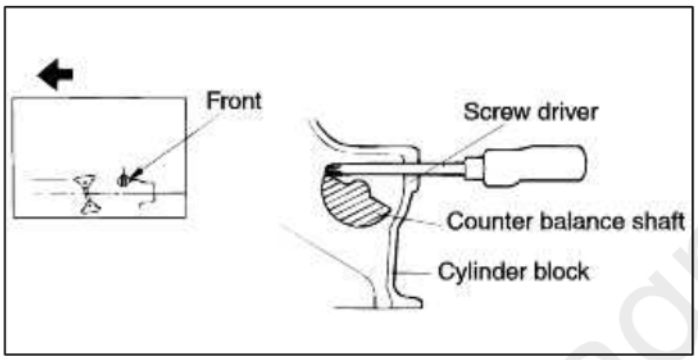
17. Align the timing marks of each sprocket and install the timing belt in this order. Crankshaft sprocket-Oil pump sprocket-Idler pulley-Exhaust camshaft sprocket-Intake camshaft sprocket-Tensioner pulley.

NOTE

- In this step, No.1 is in TDC (Compression stroke).
- When the timing mark of oil pump sprocket is aligned, fist remove the plug at left side of the cylinder block and insert a screwdriver to check the left counter balance shaft in position. Screwdriver used for this purpose should have a shaft 8mm (0.3in)in diameter which can be inserted more than 60mm (2.36in).
- Install the plug at left side of the cylinder block after check timing.

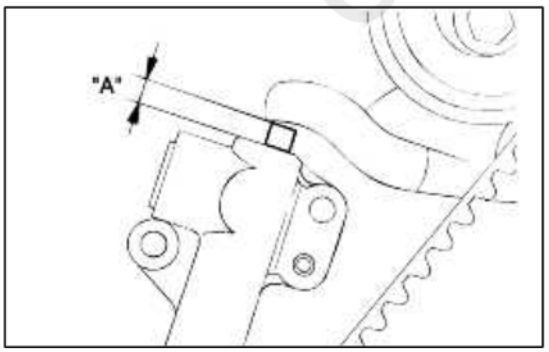
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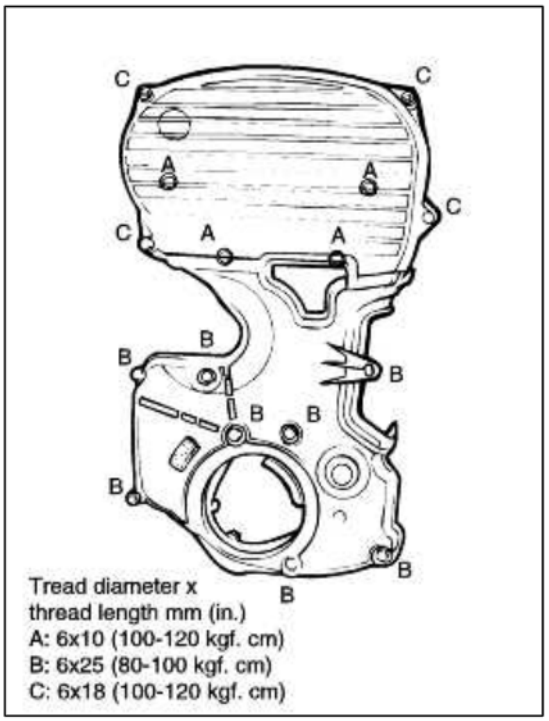
18. Remove a wire from the auto tensioner.
    Rotate the crankshaft two complete turns clockwise and leave it as is for about 5 minutes. Then, measure the auto tensioner protrusion "A" (distance between the tensioner arm and auto tensioner body) to ensure that it is up to specification. If the protrusion exceeds specification, repeat step 14-18

Standard value : 5.5-9.0 mm (0.22-0.35 in.)



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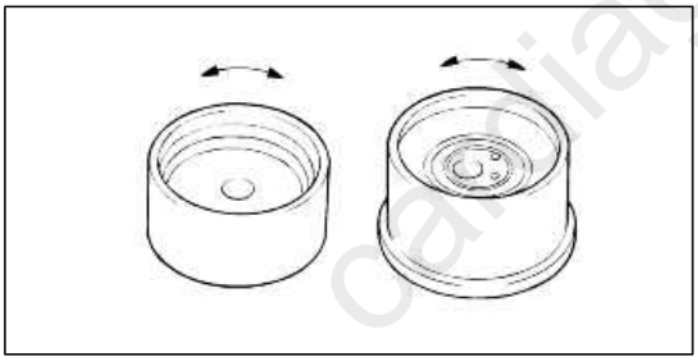
19. Install the timing belt lower cover and the timing belt upper cover.



INSPECTION

Sprockets, Tensioner Pulley, and Idler Pulley

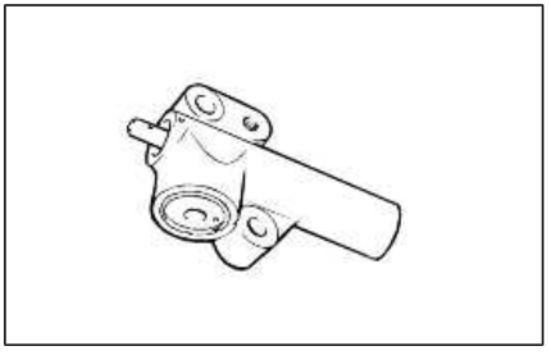
1. Check the camshaft sprocket, crankshaft sprocket, tensioner pulley, and idler pulley for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner pulley and the idler pulley for easy and smooth pulley rotation and check for play or noise. Replace as necessary.



3. Replace if there is grease leak.

Auto Tensioner

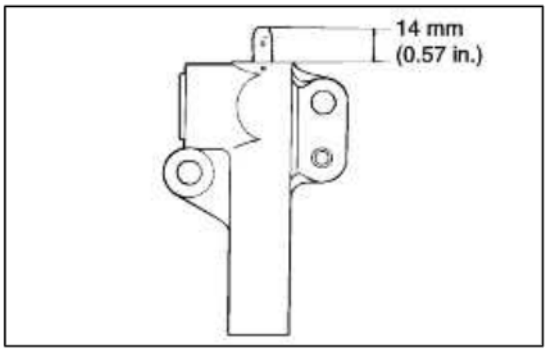
1. Check the auto tensioner for leak and replace as necessary.
2. Check the rod end for wear or damage and replace as necessary.



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3. Measure the rod protrusion. If it is out of specification, replace the auto tensioner.

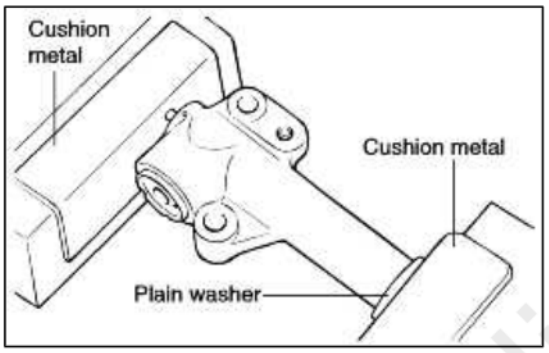
Standard value : 14.5mm (0.57 in.)



4. Using a vise soft jaws push the auto tensioner rod. If the rod can be easily retracted, replace the auto tensioner. You should feel a great deal of resistance when pushing the rod in.

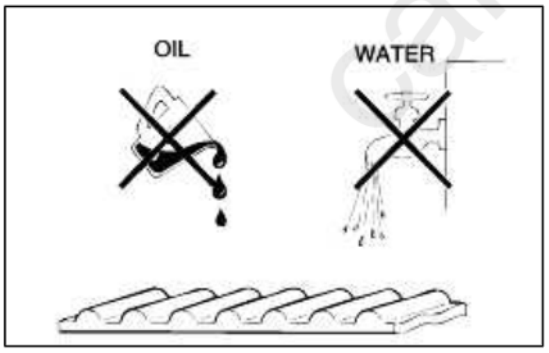
CAUTION

Clamp the auto tensioner in the vise so that it can be level. Use soft jaws in the vise to avoid damaging the auto tensioner.



Timing Belt

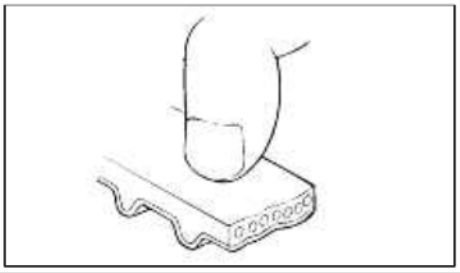
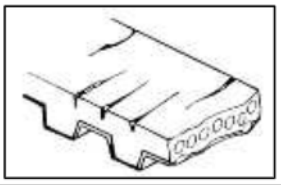
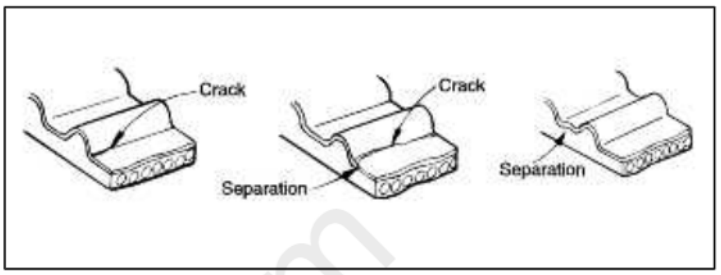
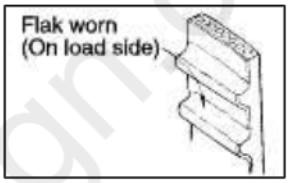
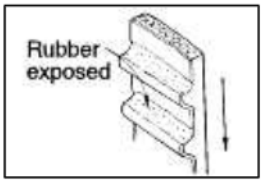
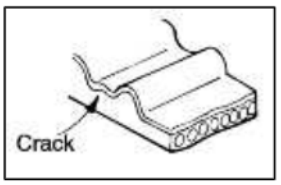
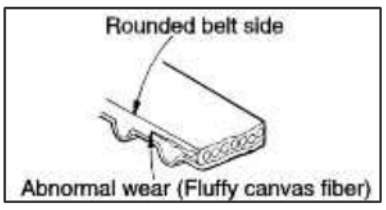
1. Check the belt for oil or dust deposits. Replace if necessary. Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.



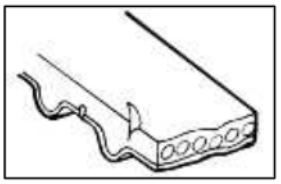
2. When the engine is overhauled or belt tension adjusted, check the belt in detail. If the following flaws are evident, replace the belt with a new one.

Description	Flaw conditions
Hardened back surface rubber	Back surface glossy. Non-elastic and so hard that when a finger nail is forced into it, no mark is produced.

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Cracked back surface rubber	
Cracked or separating canvas	
Badly worn teeth (initial stage)	Canvas on load side tooth flank worn (Fluffy canvas fibers, rubber gone and color changed to white, and unclear canvas texture) 
Badly worn teeth (last stage)	Canvas on load side tooth flank worn down and rubber exposed (tooth width reduced) 
Cracked tooth bottom	
Missing tooth	
Side of belt badly worn	

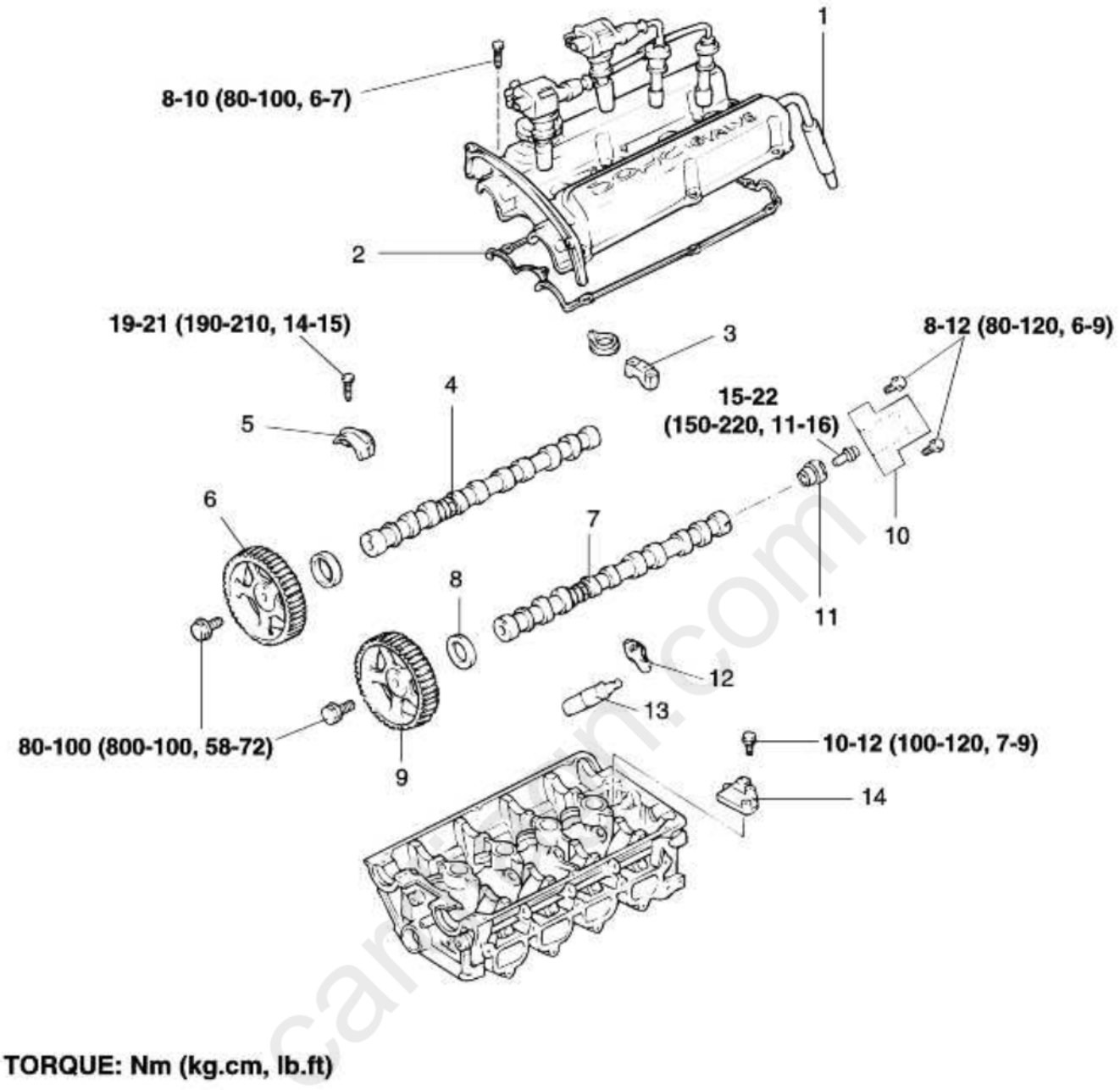
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	NOTE Normal belt should have precisely cut sides as if produced by a sharp knife.
Side of belt cracked	

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

COMPONENTS

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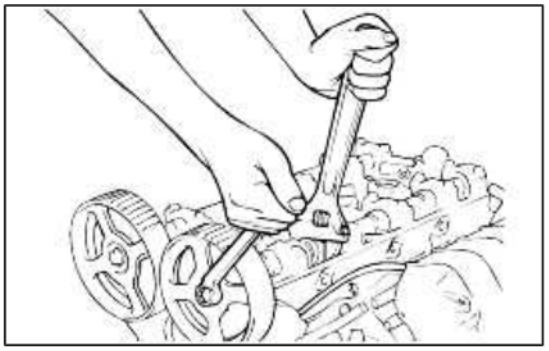
1. Breather hose
2. Gasket
3. Bearing cap (Rear)
4. Intake camshaft
5. Bearing cap (front)
6. Camshaft sprocket
7. Exhaust camshaft
8. Camshaft oil seal
9. Camshaft sprocket
10. Support assembly
11. Camposition sensing cylinder
12. Rocker arm
13. Lash adjuster
14. Oil delivery body

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

REMOVAL

1. Disconnect the negative terminal from battery.
2. Drain the engine coolant.
3. Remove the breather hose between the air cleaner and the rocker cover.
4. Remove the air cleaner.

5. Remove the timing belt cover.
6. Remove the rocker cover, crank angle sensor.
7. Loosen the camshaft, sprocket bolts and remove the camshaft sprockets.



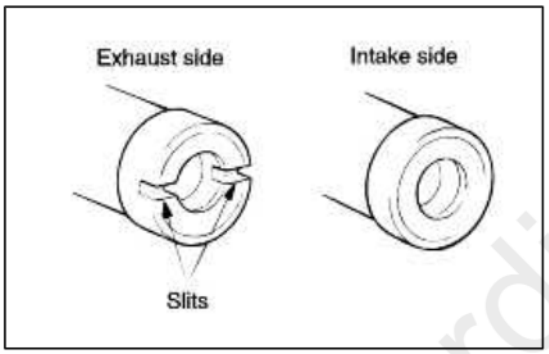
8. Loosen the bearing cap bolts and remove the bearing caps, camshafts, rocker arms, lash adjusters.

INSTALLATION

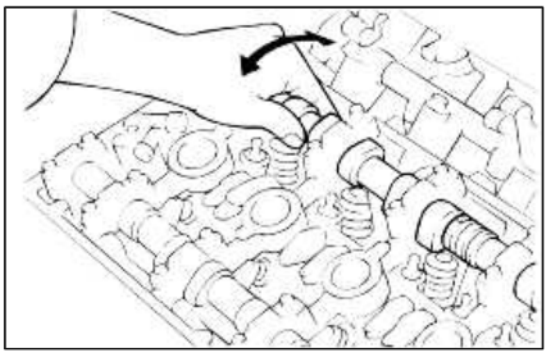
1. Install the camshafts on the cylinder head.

NOTE

- Apply engine oil to journals and cams of the cam shafts.
- The intake camshaft has a slit on its rear end for driving the crankshaft position sensor.

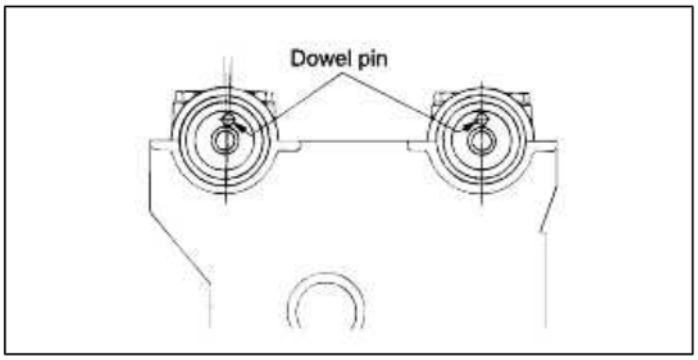


2. Install the bearing caps. Check the markings on the caps for intake/exhaust identification symbol.
   R : Intake camshaft
   L : Exhaust camshaft
3. Check that the camshaft can be easily turned by hand. After checking, remove the bearing caps and the camshafts, and then install the rocker arms.



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4. Make sure that the dowel pins on the camshaft sprocket end are located on the top.

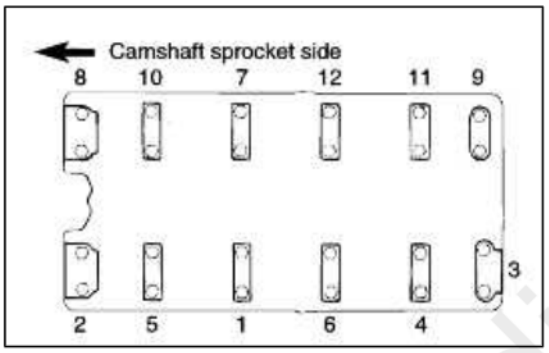


5. Tighten the bearing caps to the specified torque in two or three steps as shown.

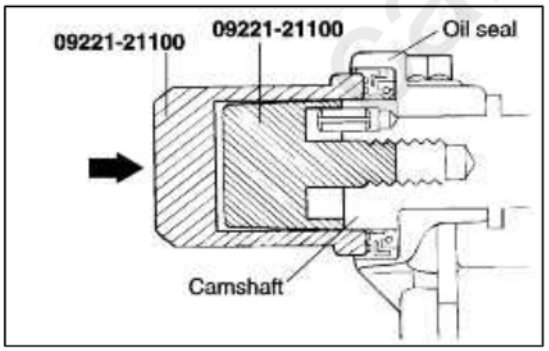
NOTE

Tighten the rocker arms uniformly.

Tightening torque
Rocker arm bolts :
19-21 Nm (190-210 kg.cm, 14-15 lb.ft)

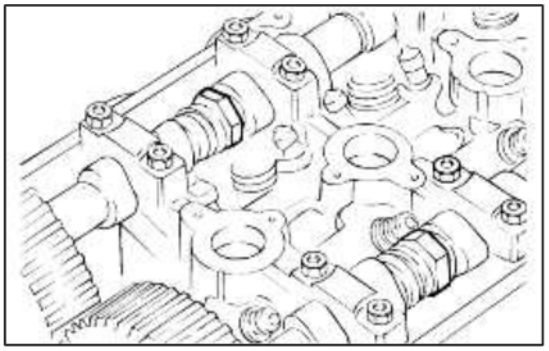


6. Using special tools, Camshaft Oil Seal Installer and guide (09221-21000, 09221-21100), press fit the camshaft oil seal. Be sure to apply engine oil to the external surface of the oil seal. Insert the oil seal along the camshaft front end and install by driving the installer with a hammer until the oil seal is fully seated.



7. Install the camshaft sprockets to the specified torque.

Tightening torque
Camshaft sprocket bolts :
80-100 Nm (800-1000 kg.cm, 58-72 lb.ft)



8. Install the rocker cover. Apply sealant as shown.

Tightening torque

Rocker cover bolts : 8-10 Nm (80-100 kg.cm, 6-7 lb.ft)

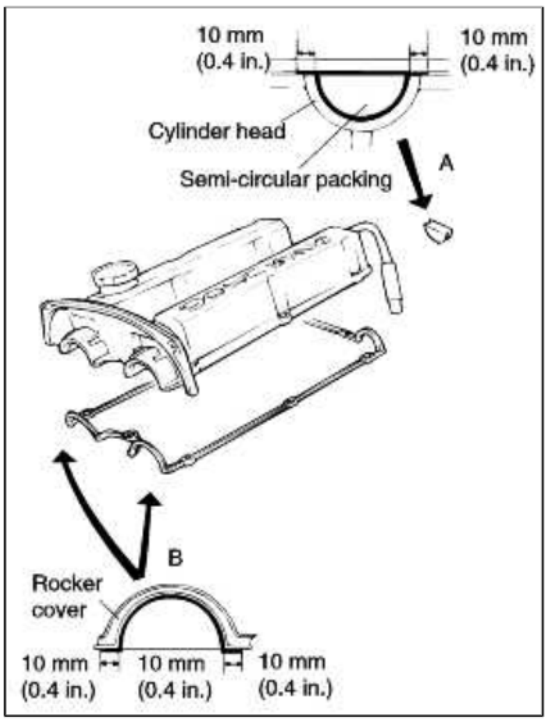
Center cover bolts : 4-5 Nm (40-50 kg.cm, 3-3.6 lb.ft)

Sealant

A Portion : Threebond No. 1212D or equivalent

B Portion : Threebond No. 1212D or equivalent

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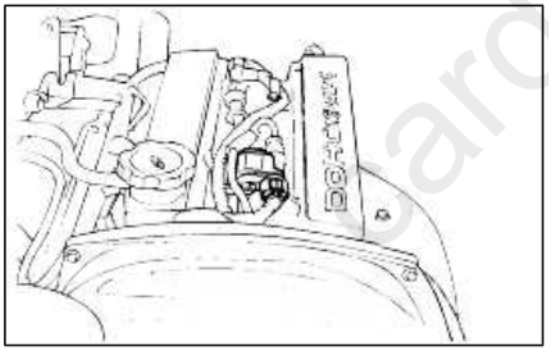


Bolt length x Diameter

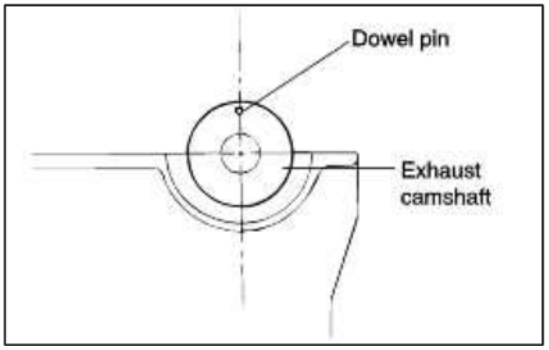
Center cover bolt : 16 mm x 6 mm

Rocker cover bolt : special bolt

9. Install the spark plugs, ignition coil, connect the connector and then install the center cover.



10. Locate the dowel pin on the sprocket side of the exhaust cam shaft.



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11. Align the notch of the camshaft sensor to the hole in camshaft (intake manifold side) and tighten the bolts.

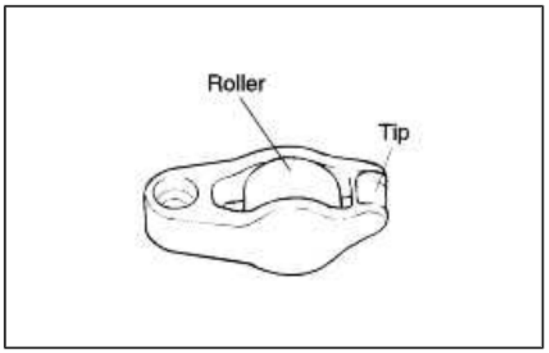
> NOTE
>
> The camshaft position sensor can be installed even when the punch mark is positioned opposite the notch; however, the position results in incorrect fuel injection and ignition timings.

12. Install the camshaft position sensor on the cylinder head.

INSPECTION

Rocker Arms

1. Check rotation of the roller. If it does not rotate smoothly or if looseness is evident, replace it.

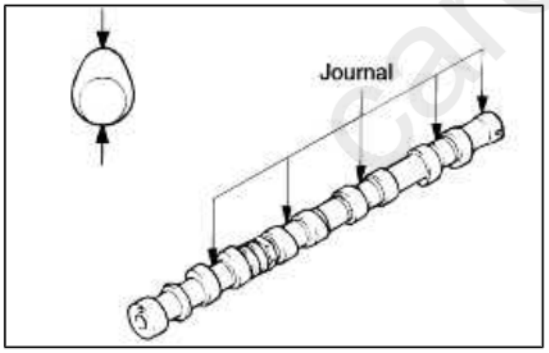


2. Check the roller and replace if there are any dent, damage or signs of bearing seizure.
3. Check the valve contact surface for possible damage or seizure and replace as necessary.

Camshafts

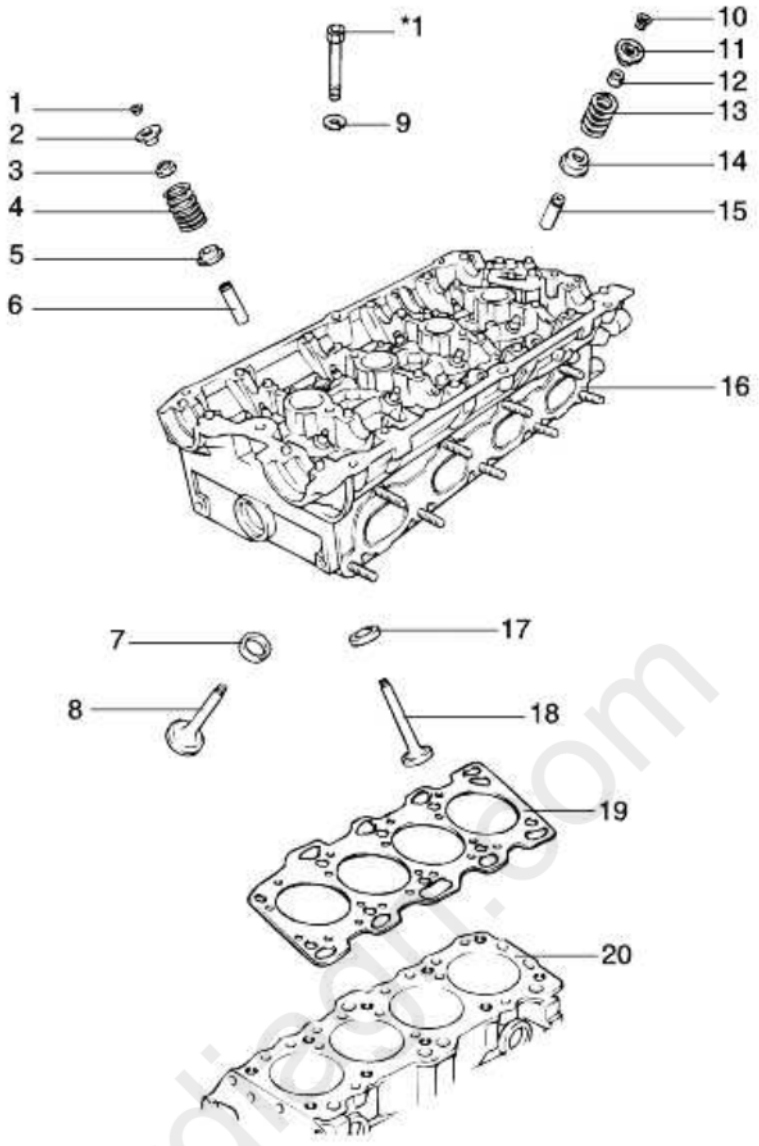
1. Check the camshaft journals for wear. If the journals are badly worn, replace the camshaft.
2. Check the cam lobes for damage. If the lobe is damaged or worn excessively, replace the camshaft.

Cam height	[Standard]	[Limit]
Intake	35.493 mm (1.3974 in.)	34.993 mm (1.3777 in.)
Exhaust	35.317 mm (1.3904 in.))	34.817 mm (1.3707 in.)



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

COMPONENTS



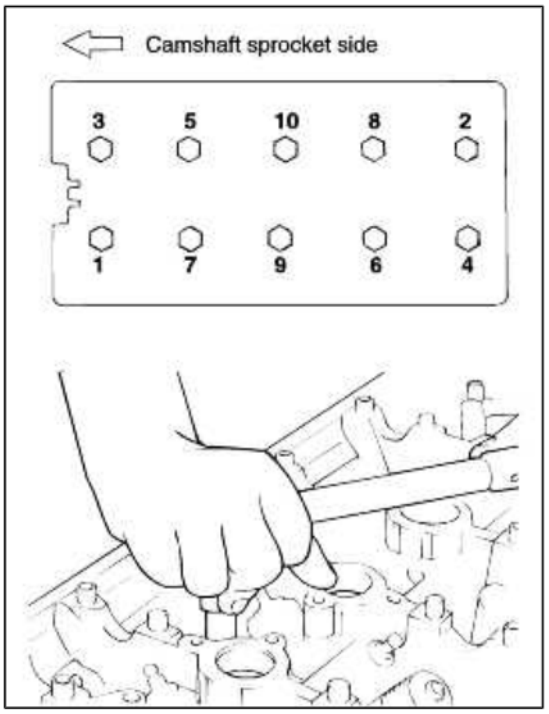
*1: Cylinder head bolt
With changine parts: 20 (200, 14) + Releas all bolts + 20 (200, 14) + 90°+ 90°
Without changing parts : 20 (200, 14) + 90°+ 90°

1. Retainer lock
2. Valve spring retainer
3. Valve stem seal
4. Valve spring
5. Valve spring seat
6. Intake valve guide
7. Exhaust valve seat
8. Exhaust valve
9. Washer
10. Retainer lock
11. Valve spring retainer
12. Valve stem seal
13. Valve spring
14. Valve spring seat
15. Exhaust valve guide
16. Cylinder head
17. Intake valve seat
18. Intake valve
19. Cylinder head gasket
20. Cylinder block

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

Disassembly

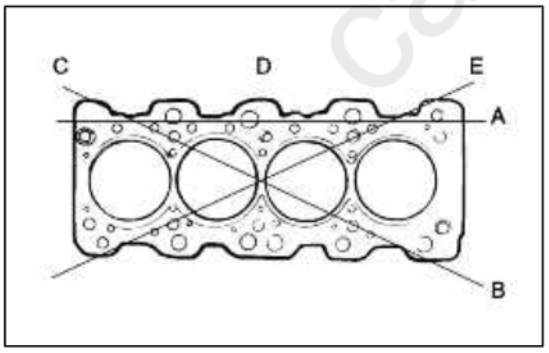
1. Remove the cylinder head bolts as shown in the illustration.



INSPECTION

1. Check the cylinder head for cracks damage and coolant leakage. If cracked, replace the cylinder head.
2. Remove scale, sealing compound and carbon deposits completely. After cleaning oil passages, apply compressed air to them to make certain that the passages are not clogged.
3. Check the cylinder head gasket surface for flatness by using a straight edge in the direction of A, B, ... as shown. If flatness exceeds service limit in any direction, either replace the cylinder head, or lightly machine the cylinder head gasket surface.

Flatness of cylinder head gasket surface
[Standard dimension] : Less than 0.05 mm (0.002 in.)
[Limit] : 0.2 mm (0.008 in.)



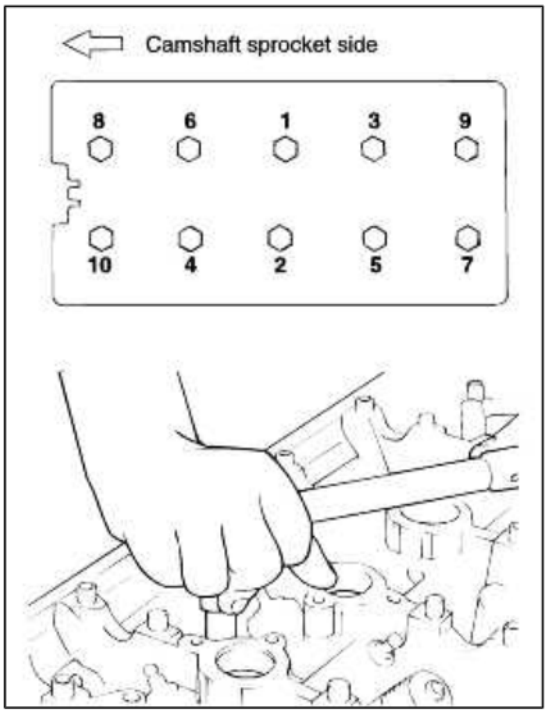
Reassembly

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1. Install the cylinder head bolts as shown in the illustration.

NOTE

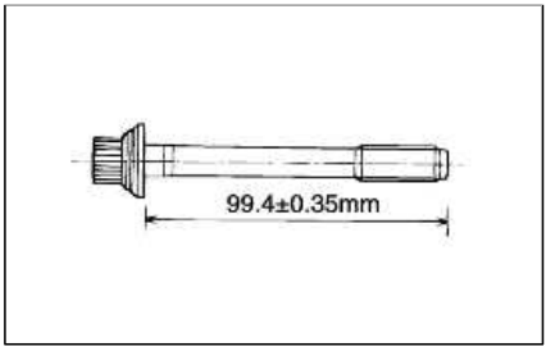
Check and measure the length of bolt. Maximum length : 99.4 ± 0.35 mm (3.9 in.)

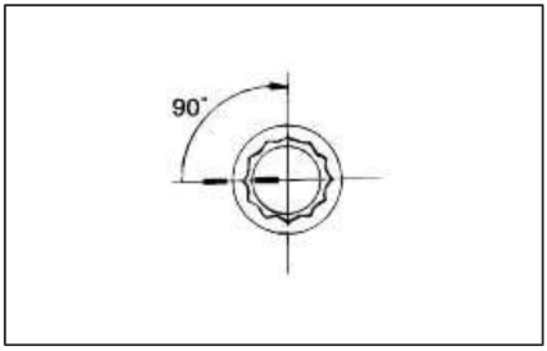


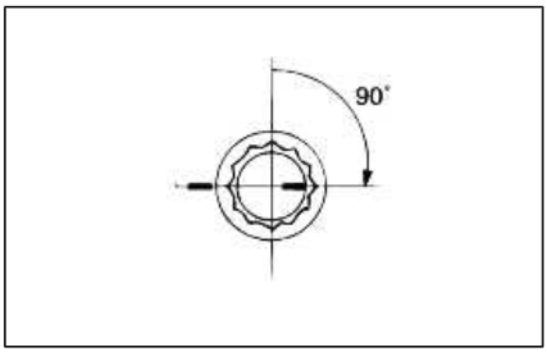
2. Tighten the bolts according to the following procedure.

Step	Operation	Remarks
1	Tighten to 20Nm (200kg·cm, 14lb·ft)	Carry out as shown in the illustration
2	Tighten 90° of a turn	As shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
3	Fully loosen	Carry out as the reverse order of the illustration.
4	Tighten to 20Nm (200kg·cm, 14lb·ft)	Carry out as shown in the illustration
5	Tighten 90° of a turn	As shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
6	Tighten 90° of a turn	As shown in the illustration. Check that the painted mark of the head bolt is lined up with that of the cylinder head.

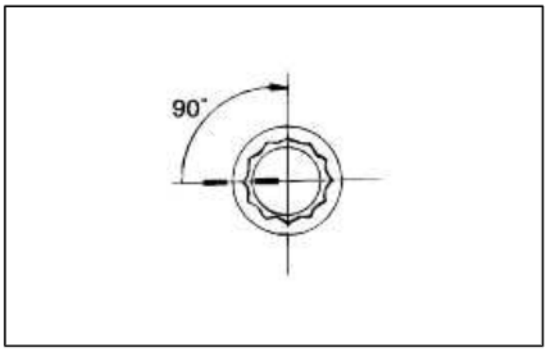
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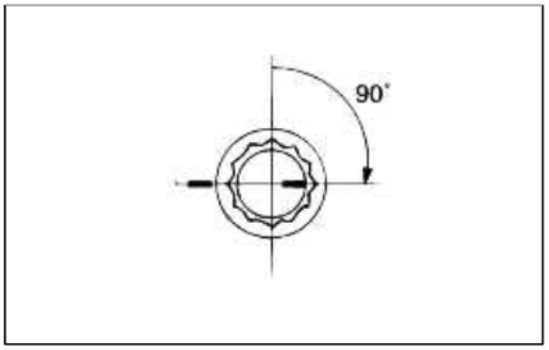




Step	Operation	Remarks
1	Tighten to 2Nm (20kg·m,0.14lb·ft)	Carry out as shown in the illustration
2	Tighten 90° of a turn	As shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
3	Tighten 90° of a turn	As shown in the illustration. Check that the painted mark of the head bolt is lined up with that of the cylinder head.



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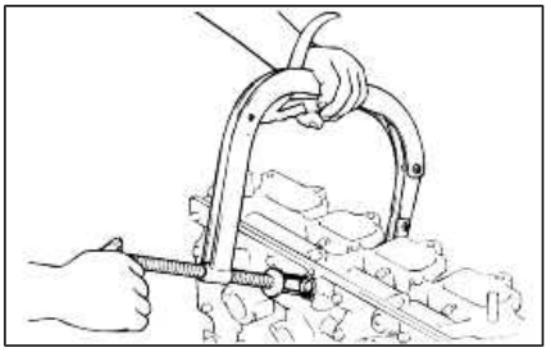
Engine Mechanical System > Cylinder Head Assembly > Valve > Repair procedures

Disassembly

1. Using 12 mm socket, remove the retainer lock. Next remove the spring retainer, valve spring, spring seat and valve.

NOTE

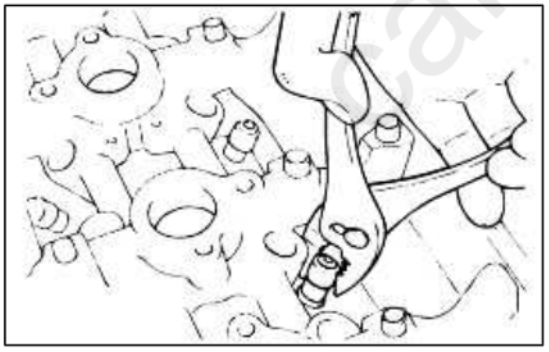
Keep these parts so that they can be reinstalled in their orignal positions.



2. Remove the valve stem seals with pliers, and discard.

NOTE

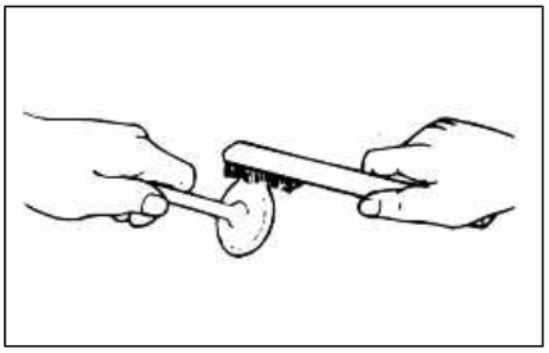
Do not reuse the valve stem seals.



INSPECTION

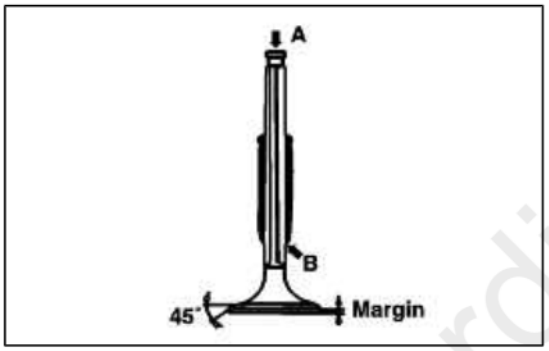
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1. Using a wire brush, clean the valve thoroughly.



2. Check each valve for wear, damage and distortion of head and stem at B. Repair or correct if necessary. If stem end A is pitted or worn, resurface as necessary. This correction must be limited to a minimum. Also resurface the valve face. Replace the valve if the margin has decreased to less than the service limit.

Margin
[Standard dimension]
Intake : 1.0 mm (0.040 in.)
Exhaust : 1.5 mm (0.059 in.)
[Limit]
Intake : 0.7 mm (0.028 in.)
Exhaust : 1.0 mm (0.040 in.)

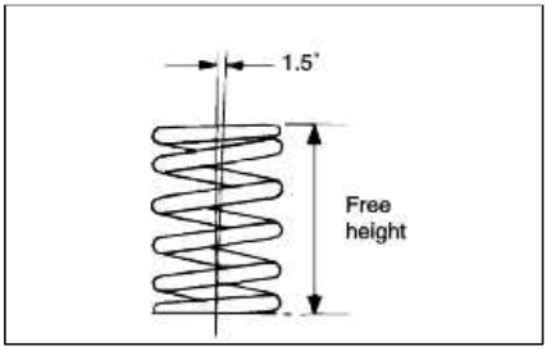


Valve Springs

1. Check free length and tension of the valve spring. If they exceed the service limit, replace the spring.
2. Using a square, test the squareness of each spring. If the spring is excessively out of square, replace it.

Valve spring
[Standard Value]
Free height : 45.82 mm (1.804 in.)
Load : 248 N (55 lb)at installed height
Out of square : 1.5°or less
[Limit]
Free height : -1.0 mm (-0.039 in.)
Out of square : 4°

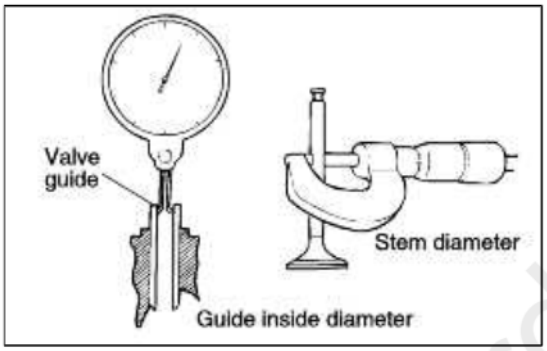
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Valve Guides

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

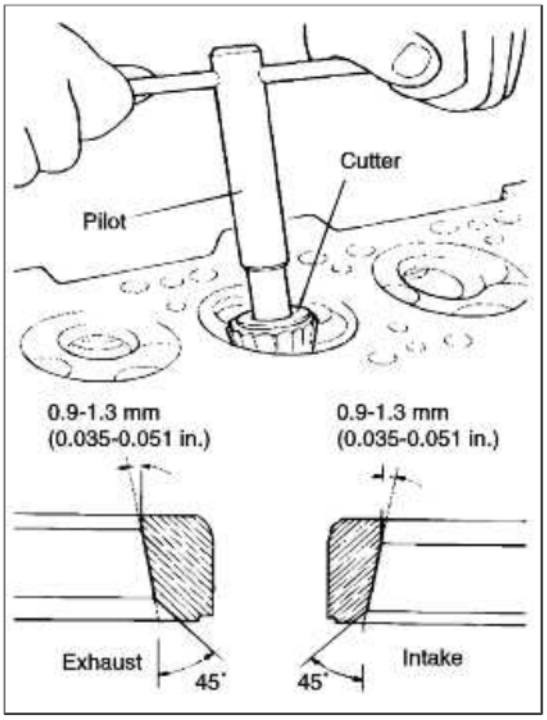
Valve stem-to-guide clearance
[Standard dimension]
Intake : 0.020-0.047 mm (0.0008-0.0019 in.)
Exhaust : 0.050-0.085 mm (0.0020-0.0033 in.)
[Limit]
Intake : 0.1 mm (0.0040 in.)
Exhaust : 0.15 mm (0.0059 in.)



Valve Seat Insert

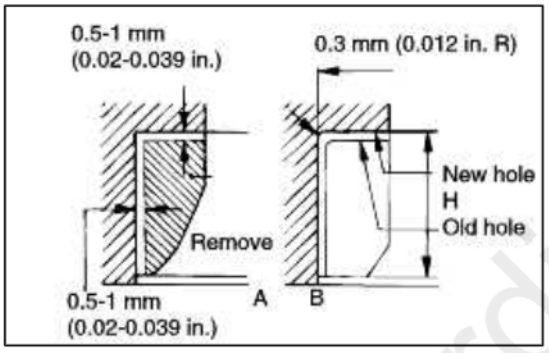
Check the valve seat for overheating and improper contact with the valve face. Recondition or replace the seat if necessary. Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, and then recondition the seat. Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face.

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Procedures for Replacing Valve Seat Insert

1. Any valve seat insert that has been worn over the service limit should be removed at normal temperature after cutting away most of the insert wall using valve seat cutters as shown in Fig. "A".



2. After removing the seat insert, machine the seat insert bore using a reamer or a cutter. Cut to the size shown in the table.
3. Heat the cylinder head to about 250°C (480°F) and press in the oversize seat insert. The oversize seat insert should be at normal room temperature for installation. After installing a new valve seat insert, resurface the valve seat using the same procedure as in paragraph 1. in Valve Seat Insert.

Valve Seat Insert Oversizes

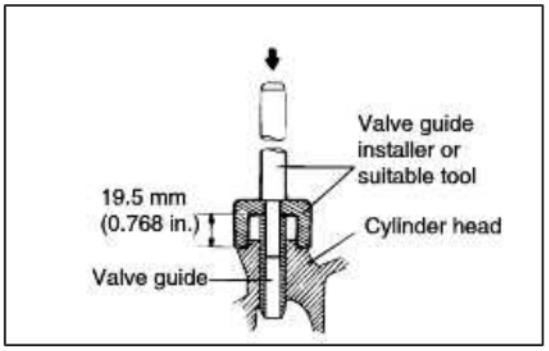
Description	Size mm (in.)	Size mark	Seat insert height H mm (in.)	Cylinder head I.D. mm (in.)
Intake valve seat	0.3 (0.012) O.S.	30	8.4-8.6 (0.330-0.338)	35.300-35.325 (1.3898-1.3907)
insert	0.6 (0.024) O.S.	60	8.7-8.9 (0.342-0.350)	35.600-35.625 (1.4016-1.4026)
Exhaust valve seat	0.3 (0.012) O.S.	30	8.0-8.2 (0.314-0.322)	33.300-33.325 (1.3110-1.3120)
insert	0.6 (0.024) O.S.	60	8.3-8.5 (0.326-0.334)	33.600-33.625 (1.3228-1.3238)

Procedures for Replacing Valve Guide

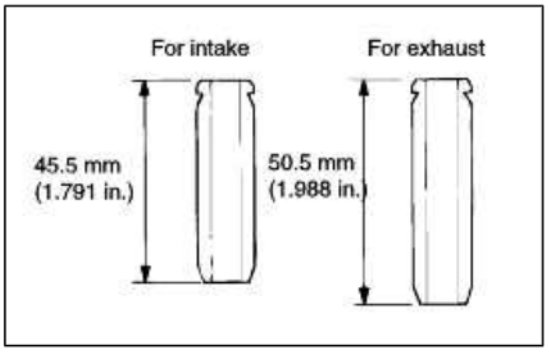
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The valve guide is installed by using a press fit. Using a Valve Guide Installer (09222-21200 A/B and 09222-28400) or suitable tool, replace the valve guide according to the following procedure.

1. Using the push rod of the Valve Guide Installer, push the valve guide out toward the cylinder block with a press.



2. Machine the valve guide insert hole in the cylinder head to the specified oversize of the new valve guide.
3. Using the Valve Guide Installer or suitable tool, press fit the valve guide. The use of the valve guide installer makes it possible to press fit the valve guide to a predetermined height. The valve guide should be installed from the top of the cylinder head. Note that intake and exhaust valve guides are different in length [45.5 mm (1.791 in.) for intake and 50.5 mm (1.988 in.) for exhaust.]



4. After the valve guides have been installed, insert new valves and check the clearance.
5. Whenever valve guides are replaced, check that the valve is seated in contact with then and recondition the valve seats as necessary.

Size mm (in.)	Size mark	Cylinder head hole size mm (in.)
0.05 (0.002) O.S.	5	12.050-12.068 (0.4744-0.4751)
0.25 (0.010) O.S.	25	12.250-12.268 (0.4823-0.4830)
0.50 (0.020) O.S.	50	12.500-12.518 (0.4921-0.4928)

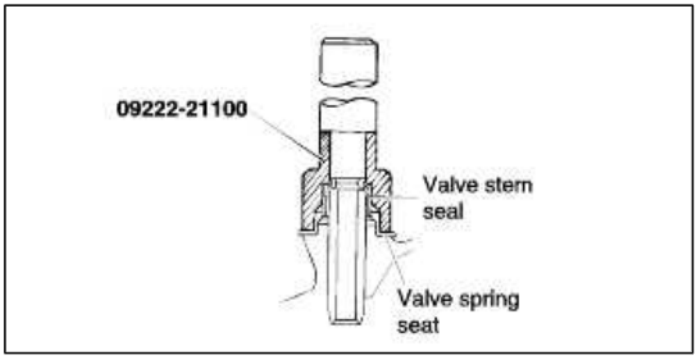
INSTALLATION

NOTE

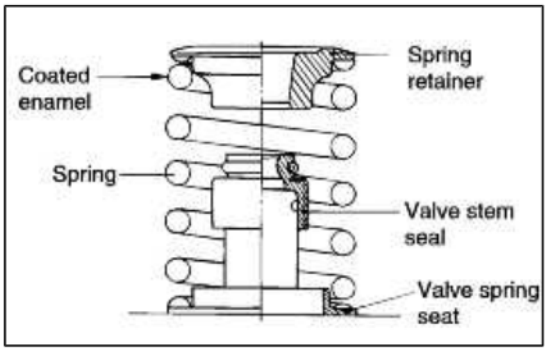
- Clean each part before assembly.
- Apply engine oil to sliding and rotating parts.

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1. After installing the spring seat, fit the stem seal onto the valve guide. Fit the seal in by lightly tapping the Special Tool, Valve Stem Oil Seal Installer. The seal is installed in the specified position by means of the special tool. Incorrect installation of the seal will adversely affect the lip I.D. and eccentricity, resulting in oil leakage down the valve guides. When installing, therefore, be careful not to twist the seal. Do not reuse old stem seals.

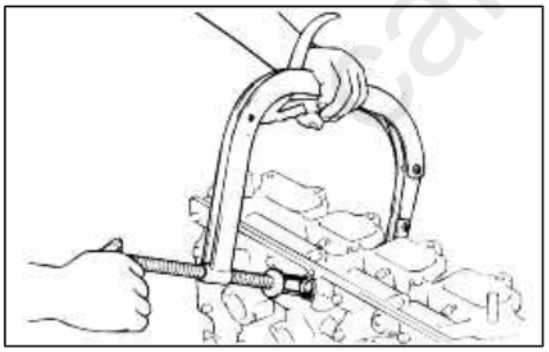


2. Apply engine oil to each valve. Insert the valves into the valve guides. Avoid inserting the valve into the seal by force. After inserting, check that the valve moves smoothly.
3. Install springs and spring retainers. Valve springs should be installed with the enamel coated side toward the valve spring retainer.



4. Using the special tool, Valve Spring Compressor (09221-29100) remove the retainer lock. Next remove the spring retainer, valve spring, spring seat and valve.

> NOTE
>
> Keep these parts so that they can be reinstalled in their original positions.



5. Clean all gasket surfaces of the cylinder block and cylinder head.
6. Install a new cylinder head gasket onto the cylinder head assembly. Do not apply sealant to the gasket and do not reuse the old cylinder head gasket.

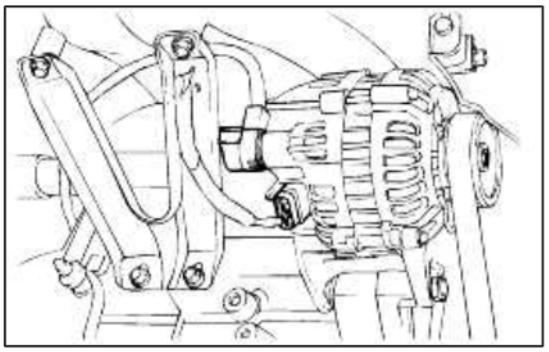
Engine Mechanical System > Engine And Transaxle Assembly > Engine And Transaxle Assembly > Repair procedures

REMOVAL

1. Remove the battery.
2. Detach the air cleaner.
3. Disconnect the connectors for the backup lamp and engine harness.

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4. For a vehicle with a 5-speed manual transaxle, disconnect the select control valve connector.
5. Disconnect the connectors for the generator harness and the oil pressure gauge wiring.



6. Drain the engine coolant.
7. For vehicles with an automatic transaxle, disconnect the transaxle oil cooler hoses.

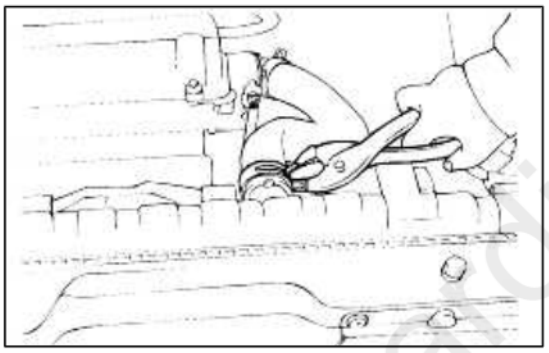
NOTE

When disconnecting the hoses, make identification marks to avoid making any mistakes in reconnecting them.

CAUTION

Be careful not to spill oil or fluid out of the hoses, and plug the openings to prevent the entrance of foreign material.

8. Disconnect the radiator upper and lower hoses on the engine side.

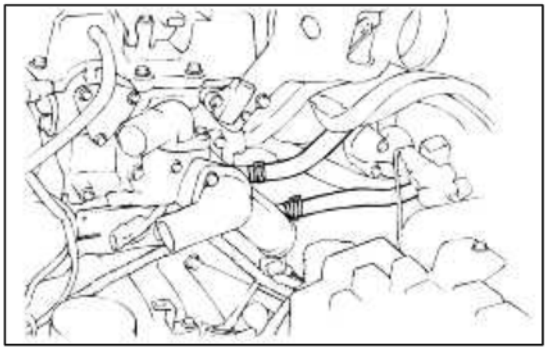


9. Disconnect the engine ground.
10. Disconnect the brake booster vacuum hose.
11. Remove the main fuel line, and the return and vapor hoses from the engine side.

CAUTION

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

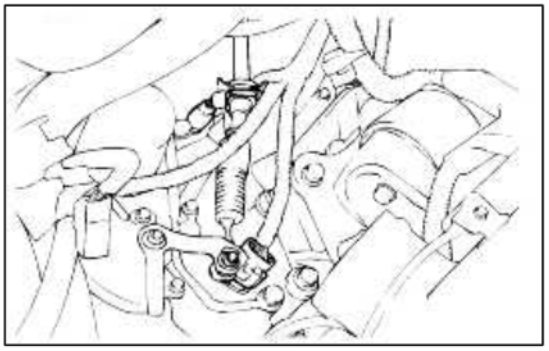
12. Disconnect the heater hoses (inlet and outlet) on the engine side.



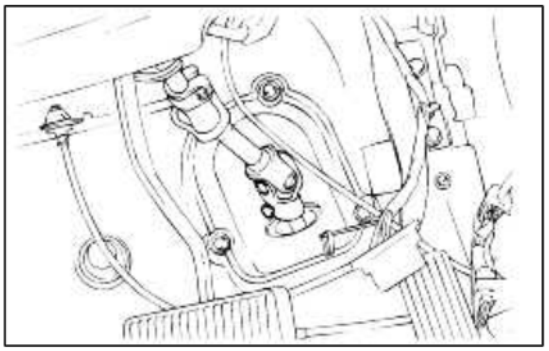
13. Disconnect the accelerator cable at the engine side.

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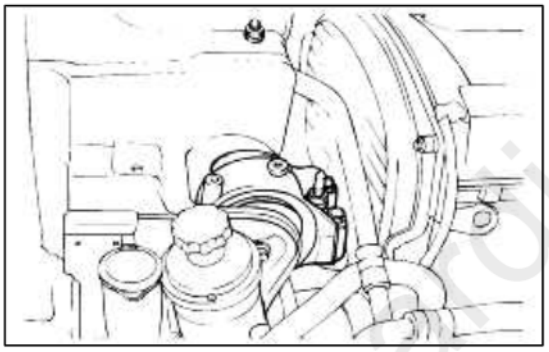
14. For vehicles with a manual transaxle, remove the clutch cable from the transaxle.
15. For vehicles with an automatic transaxle, remove the control cable from the transaxle.
16. For vehicles with manual transaxle, remove the shift control rod and extension rod.
17. Disconnect the connector of the vehicle speed sensor from the transaxle.



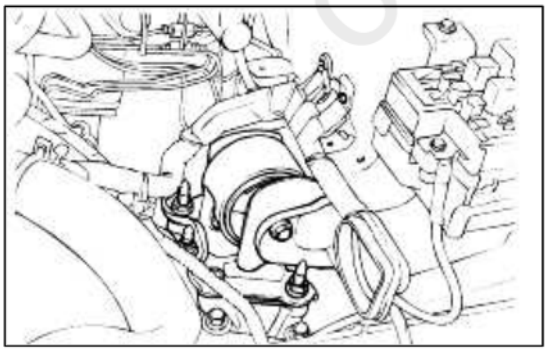
18. Separate the column shaft from the steering gear box.



19. Remove the engine mounting insulator.

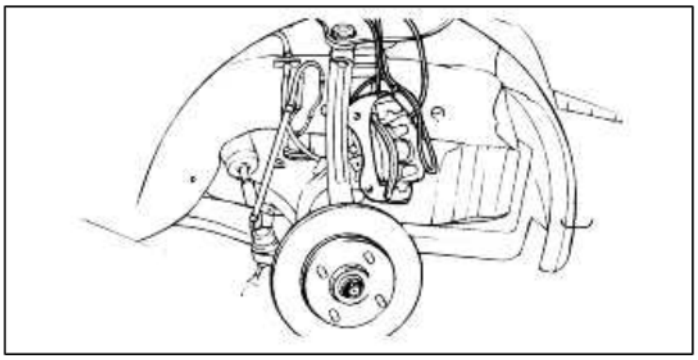


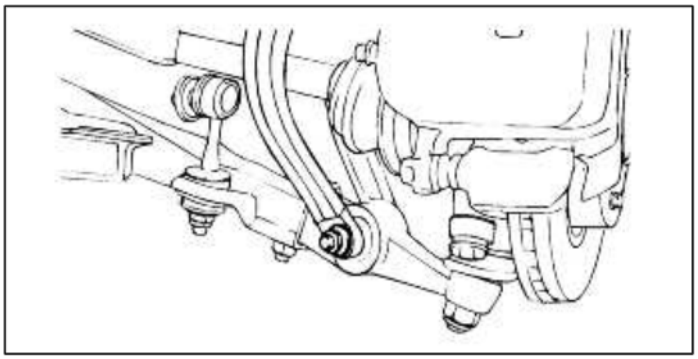
20. Remove the transaxle mounting insulator.

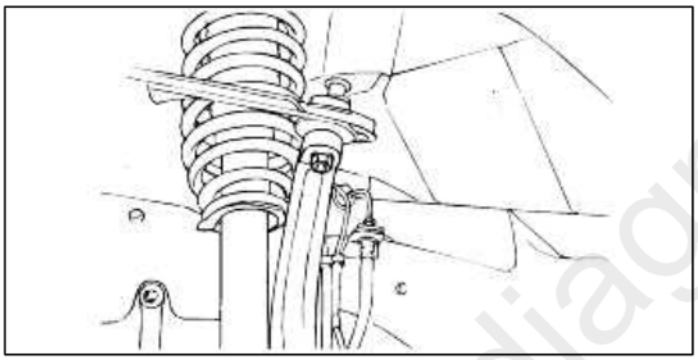


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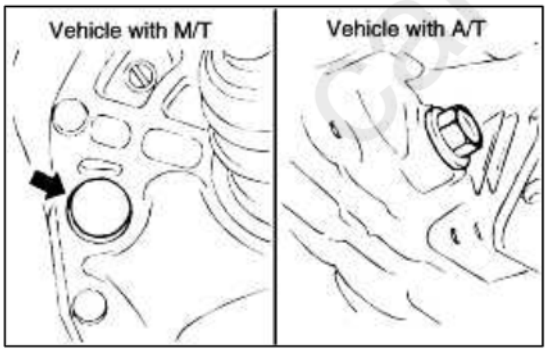
21. After removing the wheel and attaching the wheel speed sensor and caliper to the body, disconnect the lower arm and the fork, and then separate the upper arm and knuckle.







22. Jack up the vehicle.
23. Drain the transaxle oil (or fluid).



24. Disconnect the front exhaust pipe from the manifold.

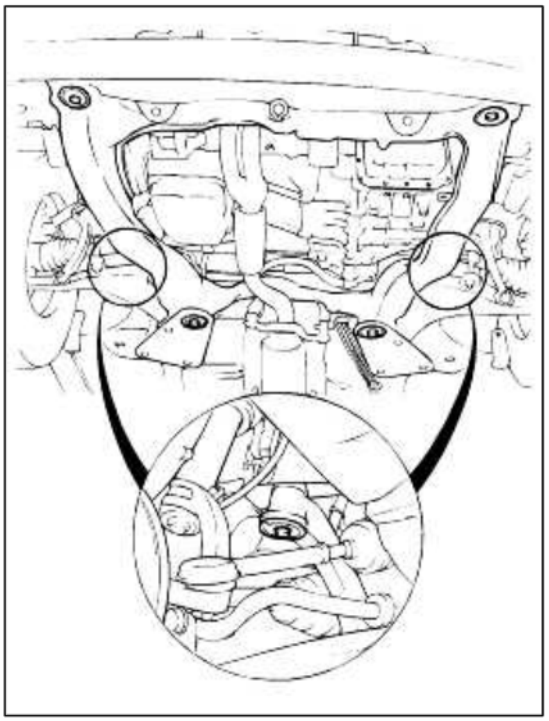
> NOTE
>
> Use wire to suspend the exhaust pipe from the bottom of the vehicle.

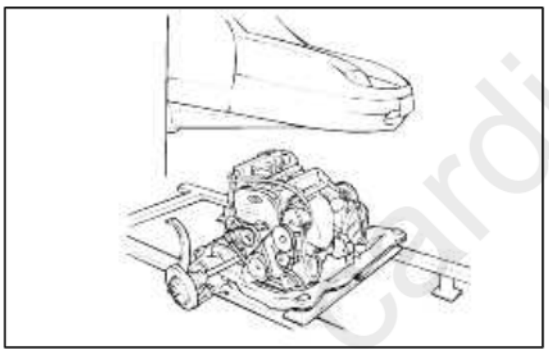
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25. Place the supporter under the sub-frame.

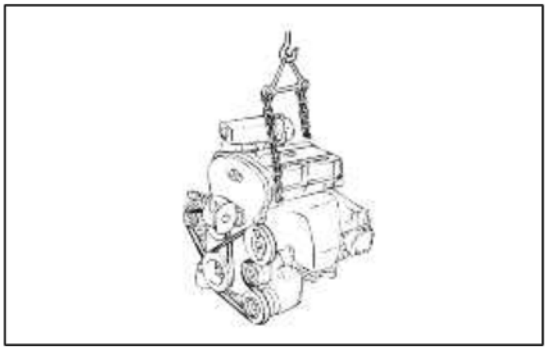
> CAUTION
>
> Check that all of the cables, hoses, harnesses, connectors etc are disconnected from the engine.

26. In order to remove the sub-frame, engine, transaxle, steering gear box and drive shaft all together. Loosen the sub-frame bolts (6ea) slowly and lift the vehicle with lifter.





27. Remove the driver shaft and hang the engine and transaxle at the hoist, then separate engine and transaxle from the sub-frame. To separate the engine and transaxle from the sub-frame remove the Engine mounting bracket and Transaxle mounting bracket, and then lift up the hoist.



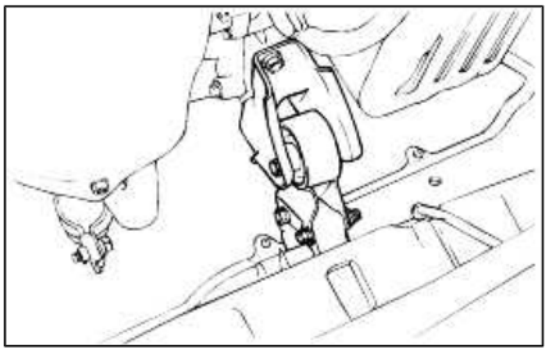
INSTALLATION

1. While checking the connections of the harnesses, pipes, hoses, etc., mak sure that none of them is being caught, damaged, etc.

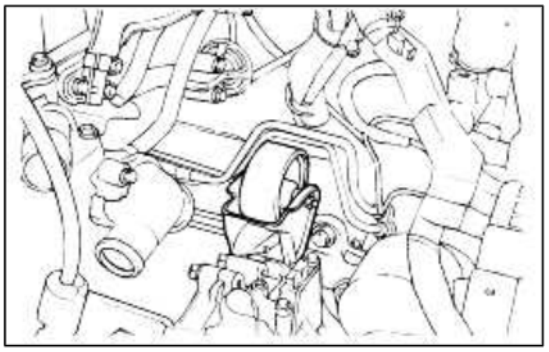
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2. To place the engine and transaxle assembly on the sub-frame install the front roll stopper and rear roll stoper between the sub-frame and engine, transaxle assembly.

> NOTE
>
> Especially, when installing front roll stopper mounting bracket, be careful not to be crushed the insulator, If being crushed, idle vibration is high.



3. To install the engine transaxle and sub-frame follow the removal procedures in the reverse order.

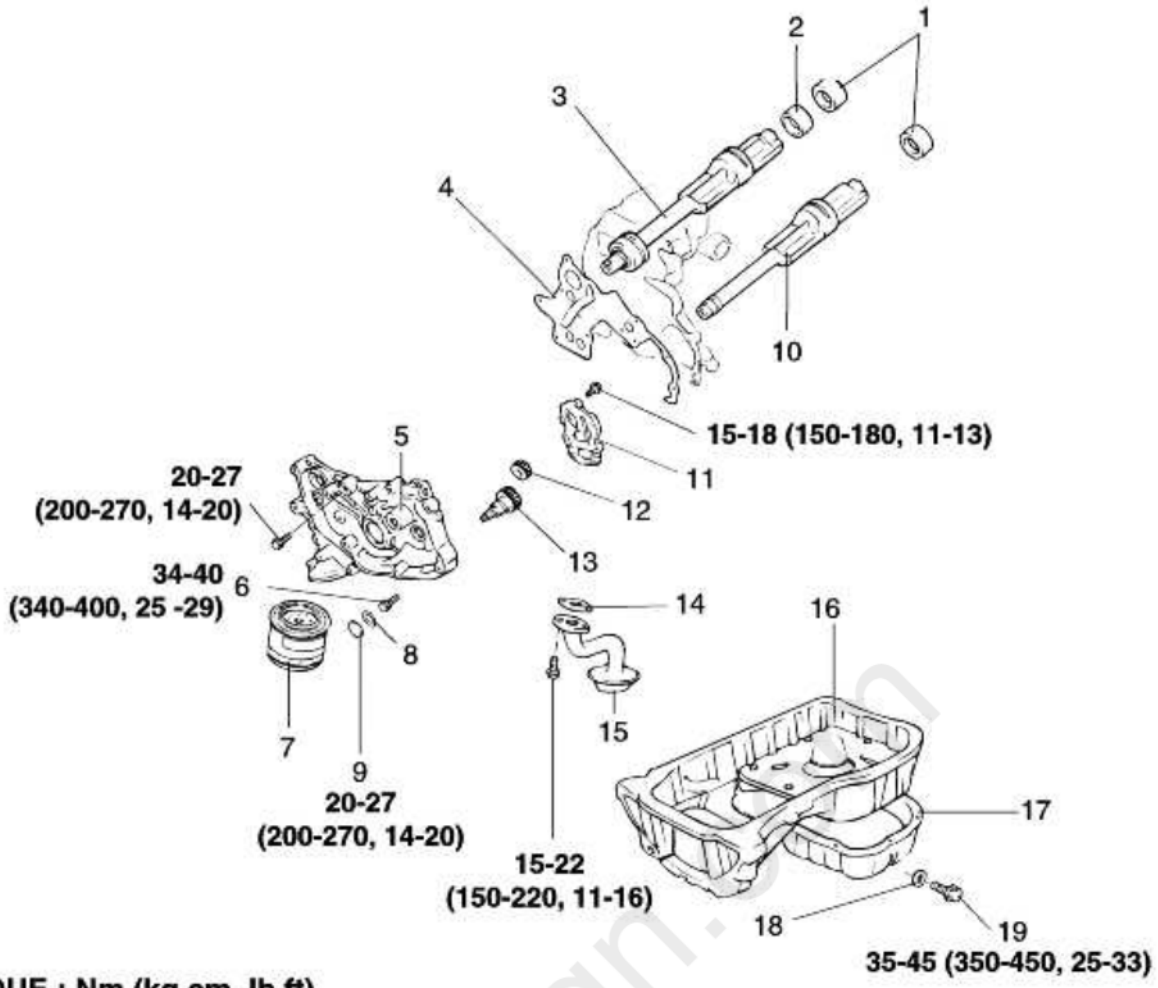


4. Refill the coolant and check for leak.
5. Refill the transaxle fluid, test its operation, and check for leak.
6. Check for the operation of the transaxle control cable and accelerator cable. Adjust as necessary.
7. Check for proper operation of each of the various gauges.

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

COMPONENTS

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1. Rear bearing
2. Front bearing
3. Right counter balance shaft
4. Gasket
5. Oil pump case
6. Driven gear bolt
7. Oil filter
8. O-ring
9. Plug cap
10. Left counter balance shaft
11. Oil pump cover
12. Driven gear
13. Drive gear
14. Gasket
15. Oil screen
16. Upper oil pen
17. Lower oil pen
18. Gasket
19. Drain plug

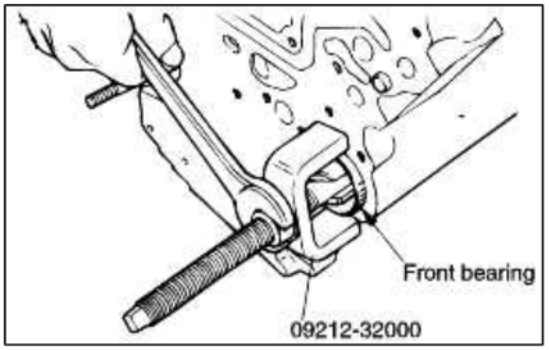
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Engine Mechanical System > Cylinder Block > Balance Shaft > Repair procedures

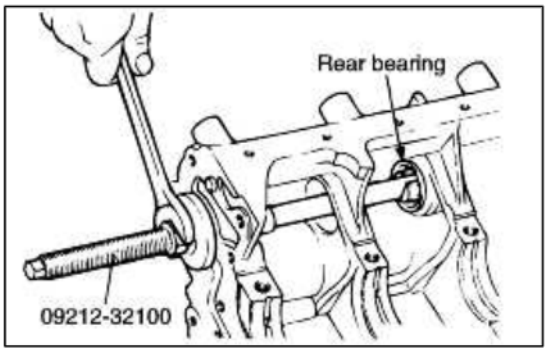
REPLACEMENT

counter balance shaft bearing

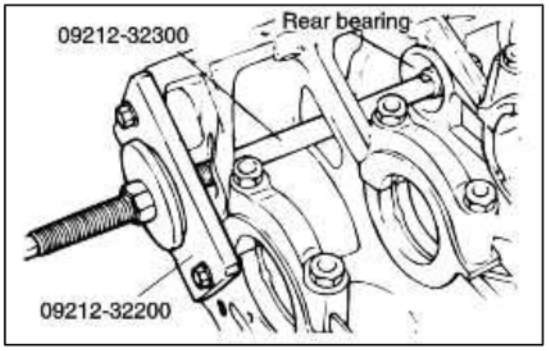
1. Using a special tool, remove the right counter balance shaft front bearing from the cylinder block.



2. Using a special tool, remove the right counter balance shaft rear bearing from the cylinder block.



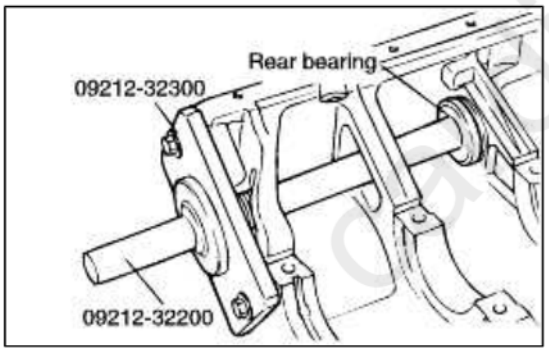
3. Using a special tool, remove the left counter balance shaft rear bearing from cylinder block. At this time, install special tool on the front surface of cylinder block to hold the bearing puller.



4. Using a special tool, install the left counter balance shaft rear bearing to the cylinder block.

NOTE

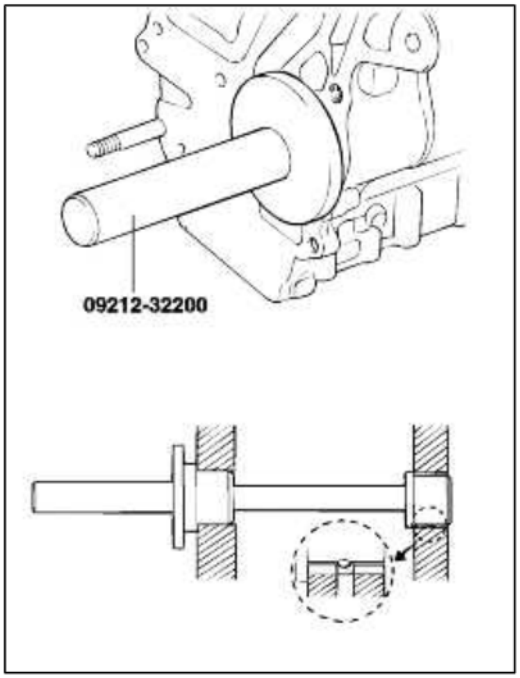
- Apply engine oil to the rear bearing outer circumfer- ence and bearing hole in cylinder block.
- The left rear bearing has no oil holes.



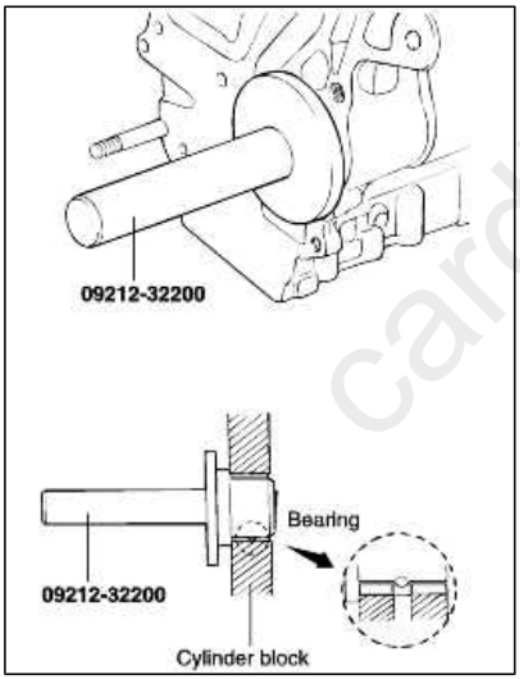
5. Using a special tool, install the right counter balance shaft rear bearing to the cylinder block.

NOTE

- Apply engine oil to the outer surface of bearing.
- Make sure that the bearing oil hole is aligned with the oil hole of cylinder block.



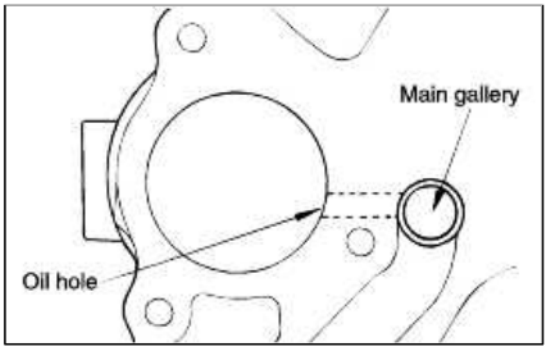
6. Using a special tool, install the right counter balance shaft front bearing to the cylinder block.



NOTE

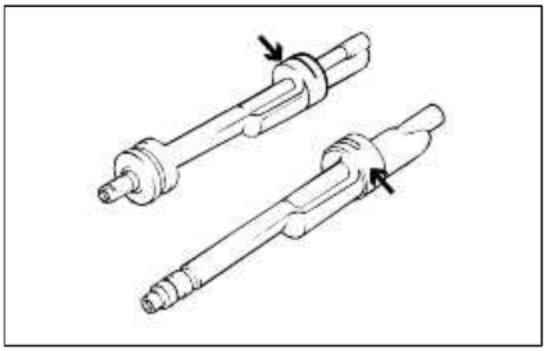
Make sure that the bearing oil hole is aligned with the oil hole of cylinder block.

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INSPECTION

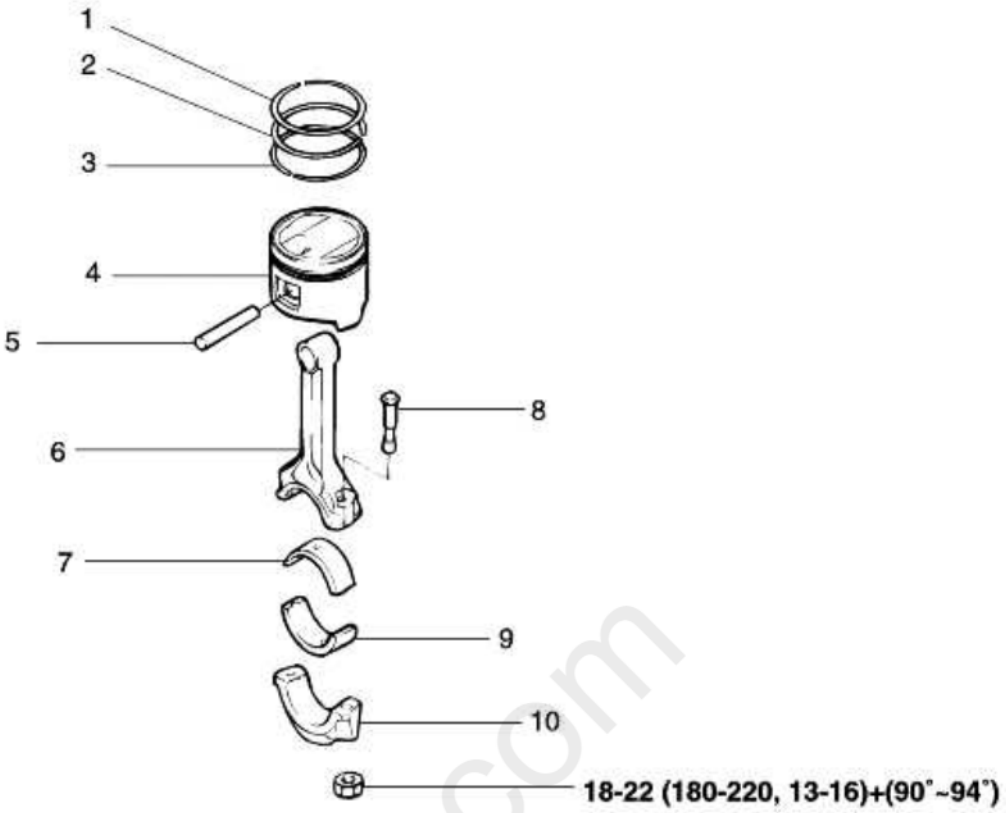
Check journals for wear or seizure. If excessive wear or seizure is evident, check the bearing carefully. If necessary, replace the counter balance shaft bearing or both.



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

COMPONENTS

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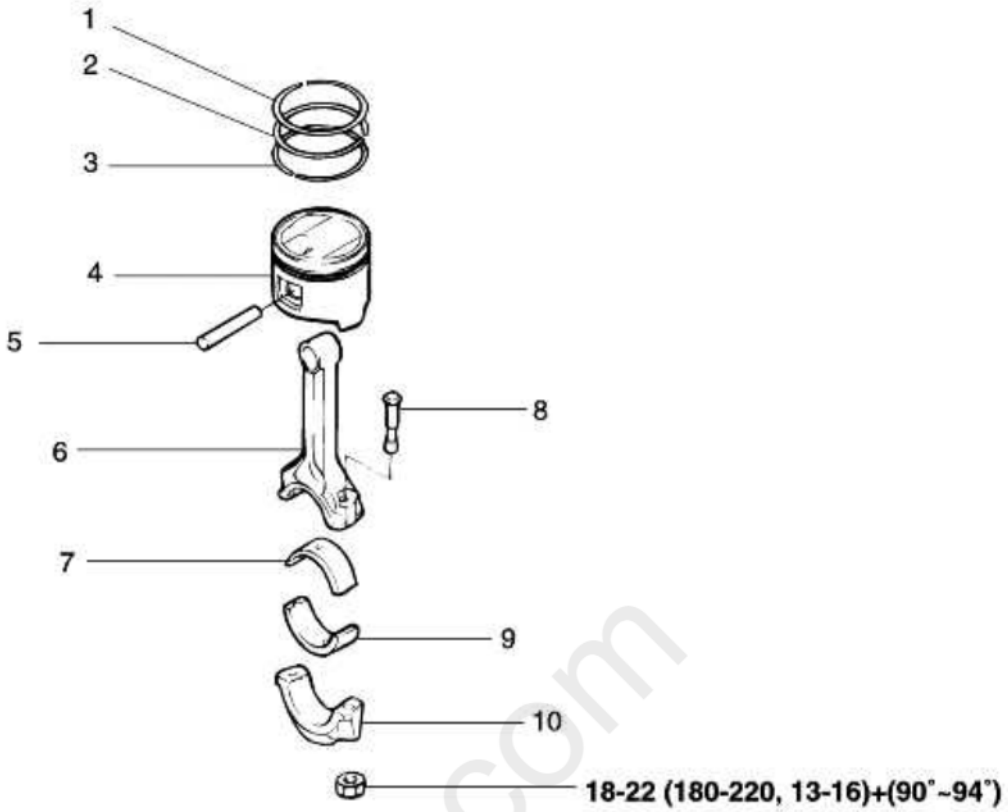


TORQUE : Nm (kg·cm, lb·ft)

1. No.1 piston ring
2. No.2 piston ring
3. Oil ring
4. Piston
5. Piston pin
6. Connecting rod
7. Upper bearing
8. Bolt
9. Lower bearing
10. Connecting rod bearing cap

COMPONENTS

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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. Upper bearing
8. Bolt
9. Lower bearing
10. Connecting rod bearing cap

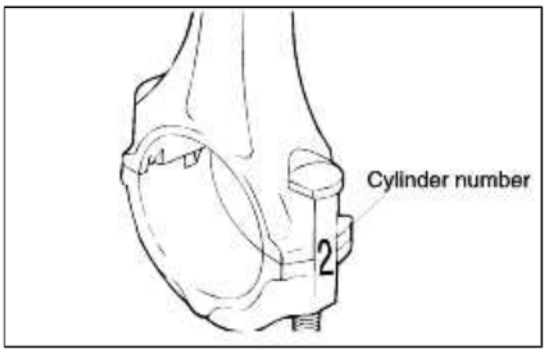
Engine Mechanical System > Cylinder Block > Piston and Connecting Rod > Repair procedures

Disassembly

Connecting Rod Cap

NOTE

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.

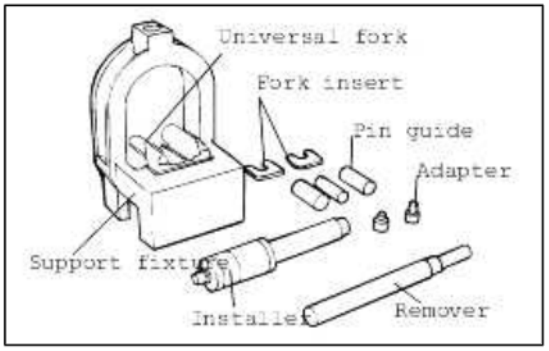
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2. Push each piston-connecting rod assembly toward the top of the cylinder.

Disassembly

piston pin

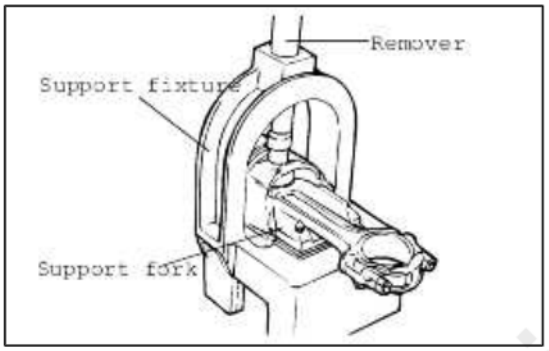
1. Use the special tools (09234-33001), to disassemble and reassemble the piston and connecting rod.



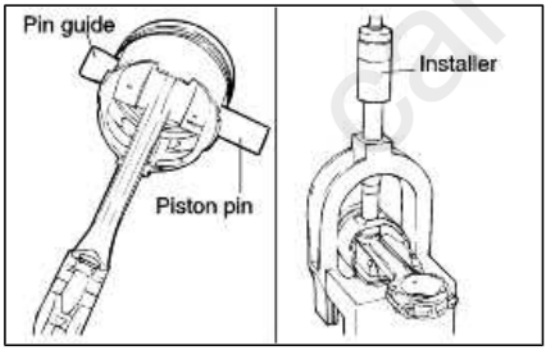
2. Place the proper insert in the fork of the tool. Position the insert between the connecting rod and the piston.
3. Insert the proper tool for removal through the hole in the arch of the tool.

NOTE

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



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

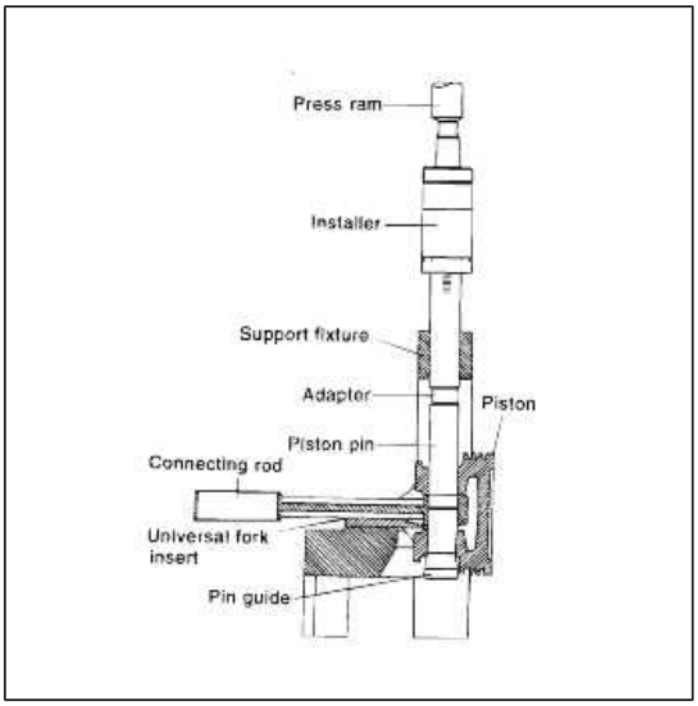


NOTE

The pin guide centers the conneting rod in the pistion. 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.

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

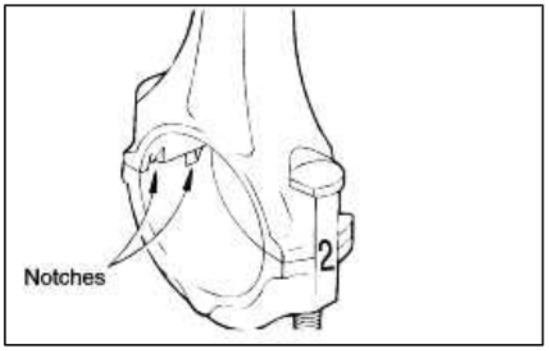


7. Adjust the installing arbor to the proper length by turning the numbered sleeve on the lettered shaft until the specified alpha numeric setting from the application chart is obtained. Turn knurled nut to lock numbered sleeve on shaft.
8. Insert the installing arbor through the hole in the arch of the tool. Press the 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 5000 pounds of force when stopping the installing 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 step wear in, or a severely rough surface on, 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.

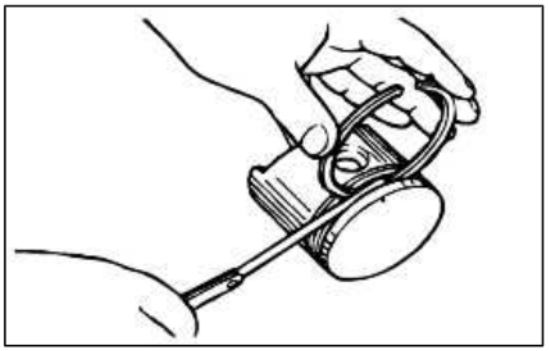
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2. Check each piston ring for breakage, damage and abnormal wear. Replace the defective rings. When the piston requires replacement, its rings should also be replaced.
3. Check the piston pin fits in the piston pin hole. Replace any piston and pin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

Piston Rings

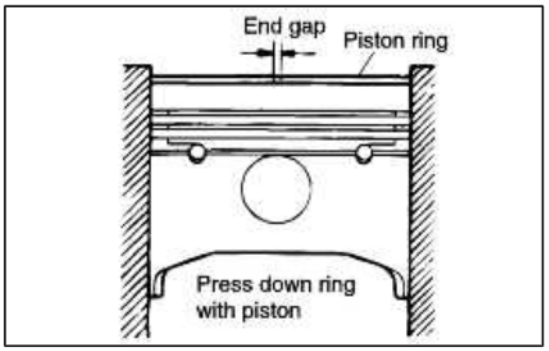
1. Measure the piston ring side clearance. If the measured value exceeds the service limit, insert a new ring in a ring groove to measure the side clearance. If the clearance still exceeds the service limit, replace the piston and rings together. If it is less than the service limit, replace the piston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

[Standard value]
Piston ring side clearance :
No.1 : 0.03-0.07mm (0.0012-0.0028 in.)
No.2 : 0.02-0.06 mm (0.0008-0.0024 in.)
[Limit] : 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 : 0.25-0.35 mm (0.0098-0.0138 in.)
No.2 : 0.40-0.55 mm (0.0157-0.0216 in.)
Oil ring side rail :
0.10-0.40 mm (0.0039-0.0157 in.)
[Limit]
No.1, No.2 : 0.8mm(0.031in.)
Oil ring side rail : 1.0 mm (0.039 in.)

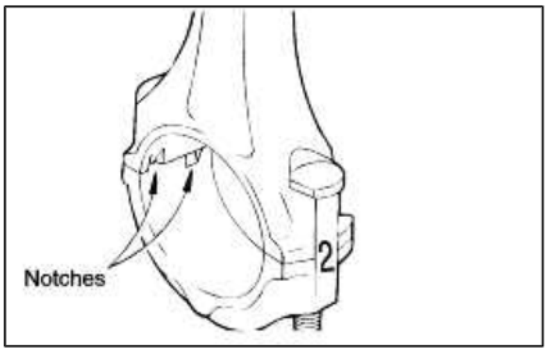


Reassembly

1. Make sure that the front mark of piston and front mark (identification mark) of connecting rod are directed toward front of engine.

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

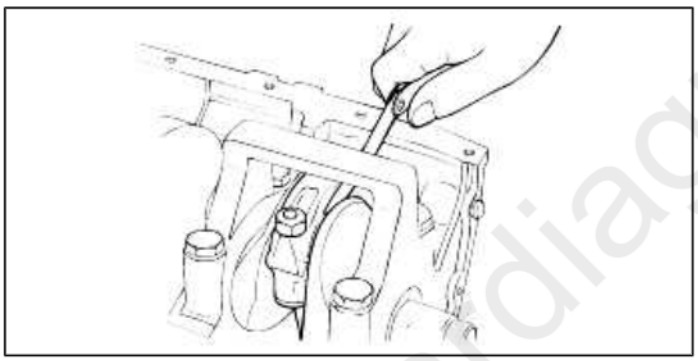


4. Tighten the connecting rod cap nuts.

Tightening torque
Connecting rod cap nuts :
18-22 Nm (180-220 kg.cm, 13-16 lb.ft) + (90°~94°)

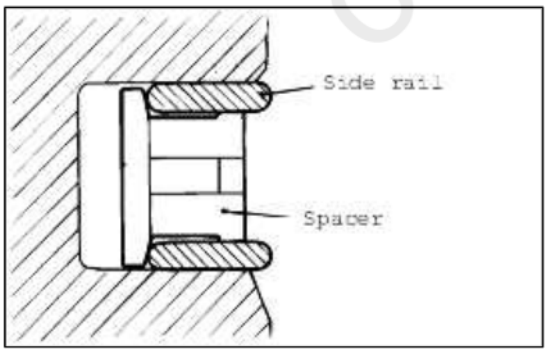
5. Check connecting rod side clearance.

Side clearance : 0.10-0.25 mm (0.004-0.0098 in.)
Limit : 0.4 mm (0.0157 in.)



Reassembly

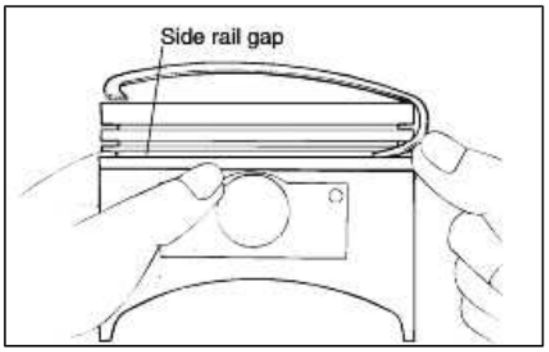
1. Install the spacer.



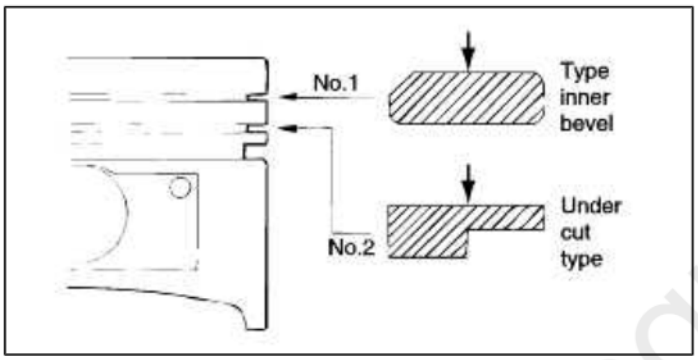
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2. Install the upper side rail. To install the side rail, first put one end of the side rail between piston ring groove and spacer, hole it down firmly, and then press down the portion which is to be inserted into groove with a finger as illustrated.

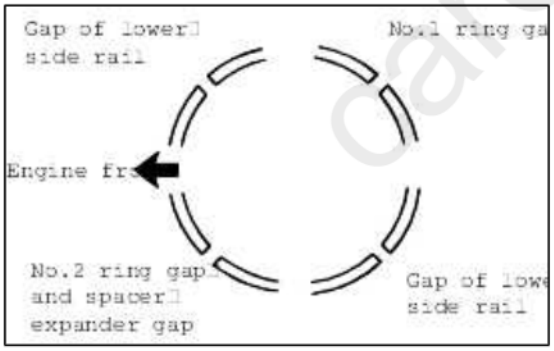
> NOTE
>
> Do not use piston ring expander when installing the side rail.



3. Install the lower side rail by same procedure as Step 2.
4. Using piston ring expander, install No.2 piston ring.



5. Install No.1 piston ring.
6. Apply engine oil around a piston and piston rings.
7. Position each piston ring end gap as far apart from neighboring gaps as possible. Make sure that gaps are not positioned in thrust and pin directions.

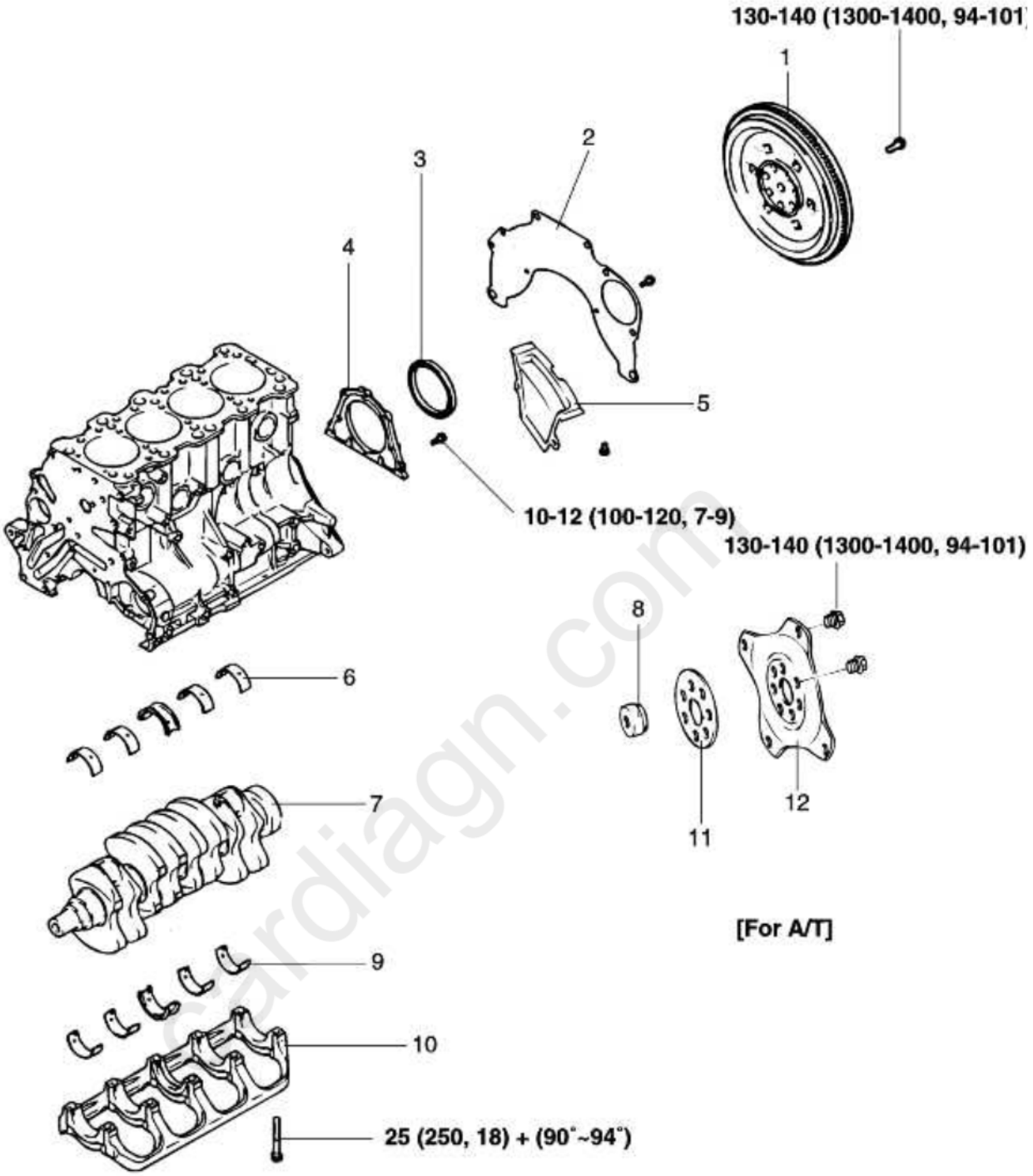


8. Hold piston rings firmly in a piston ring compressor as they are inserted into cylinder.

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

COMPONENTS

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TORQUE : Nm (kg·cm, lb·ft)

1. Flywheel
2. Rear plate
3. Oil seal
4. Oil seal case
5. Bell housing cover
6. Upper bearing
7. Crankshaft
8. Crankshaft bushing
9. Lower bearing
10. Bearing cap
11. Adapter plate
12. Drive plate

Engine Mechanical System > Cylinder Block > Crankshaft > Repair procedures

Disassembly

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

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

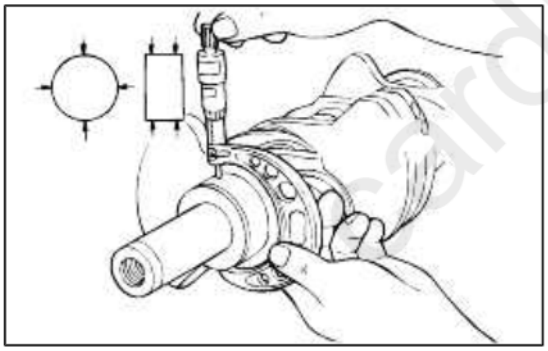
4. Remove the main bearing caps and remove the crankshaft.
   Keep the bearings in order according to the cap number.

INSPECTION

Crankshaft

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

Standard value
Crankshaft journal O.D : 56.982-57.000mm(2.2434-2.2442.in.)
Crankshaft pin O.D : 44.980-45.000 mm (1.7709-1.7717in.)



Main Bearings and Connecting Rod Bearings

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

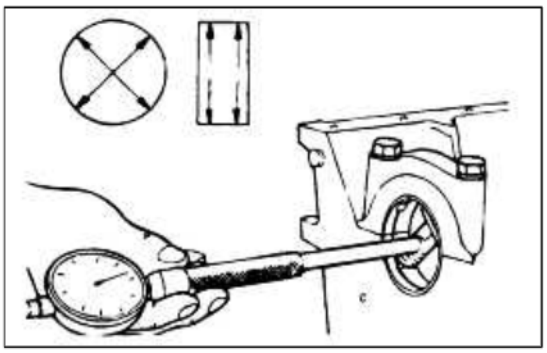
Measuring Oil Clearance

To check the oil clearance, measure the outside diameter of the crankshaft journal and the crank pin 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 - No. 1, 2, 4, 5 : 0.018-0.036 (0.0007 - 0.0014) and No. 3 : 0.024 - 0.042 (0.0009 - 0.0016)

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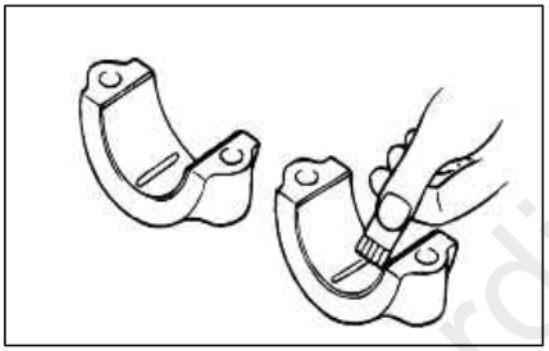
Connecting rod bearing : 0.015-0.048 mm



How to Use Plastic Gauge

Plastigauge may be used to measure the clearance.

1. Remove oil and grease and any other dirt from bearings and journals.
2. Cut plastigauge to the same length as the width of the bearing and place it in parallel with the journal, off oil holes.
3. Install the crankshaft, bearings and caps and tighten them to the specified torques. During this operation, do not turn the crank shaft. Remove the caps. Measure the width of the plastigauge at the widest part by using a scale printed on the gauge package. If the clearance exceeds the service limit, the bearing should be replaced. When installing a new crankshaft, be sure to use standard size of bearings. If the clearance exceeds the service limit, the bearing should be replaced. When installing a new crankshaft, be sure to use standard size of bearing.



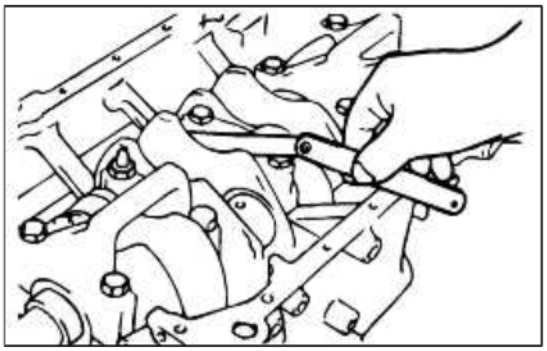
Oil Seal

Check front and rear oil seals for damage or worn lips. Replace any seat that is defective.

Bearing Caps

After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace crankshaft bearings.

Standard value : 0.05-0.25 mm (0.0020-0.0098 in.)
Limit : 0.25 mm (0.0098 in.)



Drive Plate

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Replace deformed, damaged, or cracked drive plates.

INSPECTION

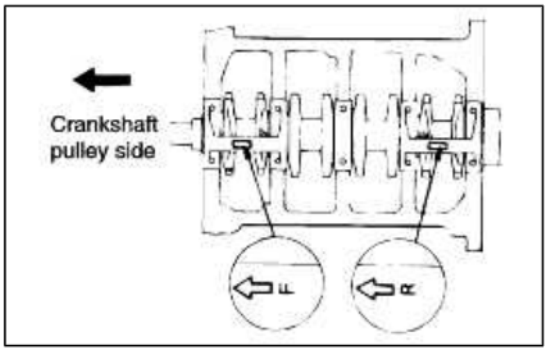
1. Check the clutch disc contacting surface of the flywheel for damage and wear. Replace the flywheel if excessively damaged or worn.
2. Check the clutch disc contacting surface of the flywheel for runout.

Limit
Flywheel run-out : 0.13 mm (0.0051 in.)

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

Reassembly

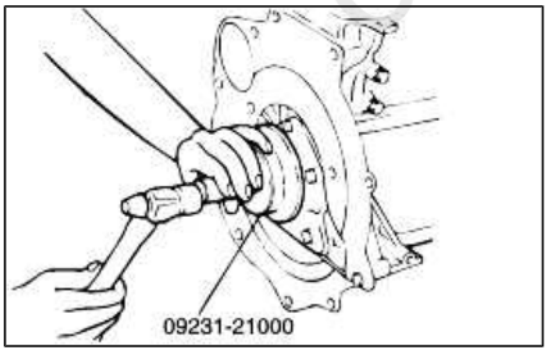
1. Install grooved main bearing (upper bearing) and thrust bearing on cylinder block side.
2. Install grooveless main bearing (lower bearing) on main bearing cap side.
3. Install crankshaft. Apply engine oil to journal and pin.
4. Caps should be installed with arrow mark directed toward front of engine. Cap number must be correct.



5. Tighten cap bolts to specified torque in sequence of center No.2, No.4, front and rear caps.

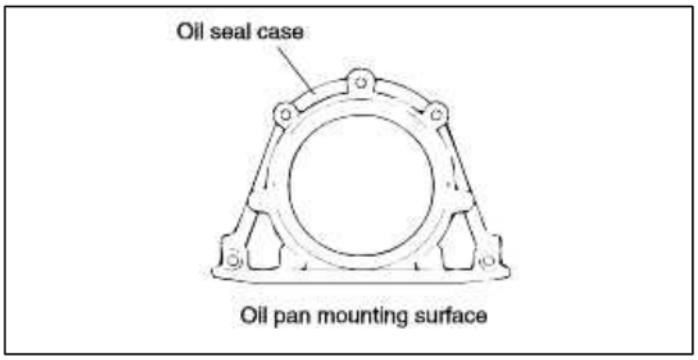
Tightening torque
Main bearing cap bolts : 25 Nm(250, 18 lb.ft) + (90°~94°)

6. Cap bolts should be tightened evenly in from 4 to 5 stages before they are tightened to specified torque.
7. Make certain that crankshaft turns freely and has proper end play.
8. Using a special tool install oil seal in oil seal case.



9. Install the oil seal into the oil seal case so that the oil hole in the separator is directed downward (arrow in illustration).

10. Install the new oil seal case gasket and oil seal case assembly.

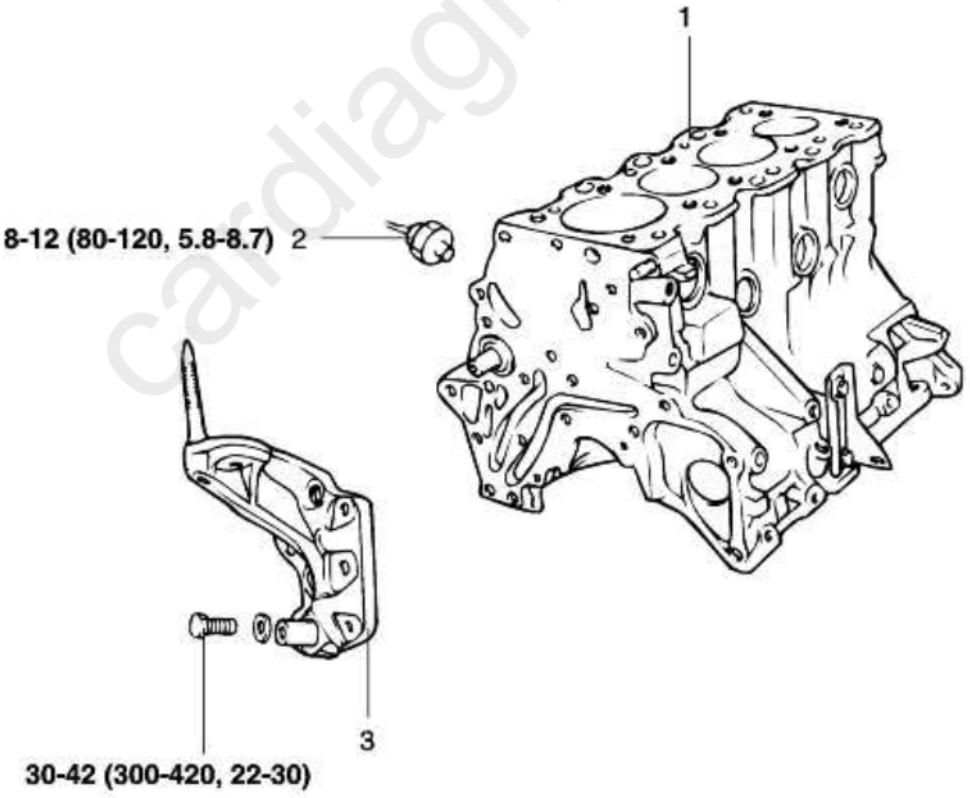


11. Install the rear plate to the cylinder block.
12. Install the flywheel assembly and tighten the bolts to the specified torque.

Tightening torque
Flywheel bolt :
130-140 Nm (1,300-1,400 kg.cm, 94-101 lb.ft)

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

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

1. Cylinder block
2. Oil pressure switch
3. Engine support bracket, left

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

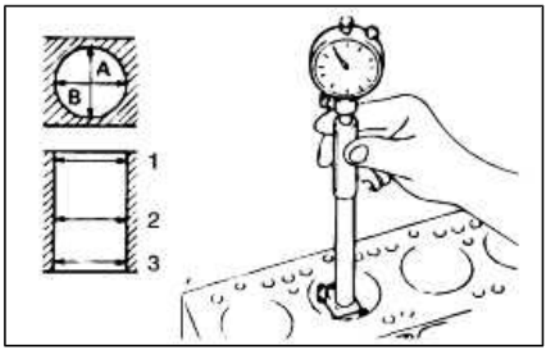
REMOVAL

Remove the cylinder head, timing belt train, front case, flywheel, piston and crankshaft. For further details, refer to the respective chapters.

INSPECTION

Cylinder Block

1. Visually check the cylinder block for scores, rust and corrosion. Also check for cracks or any other defects. Correct or replace the block if defective.
2. Measure cylinder bore with a cylinder gauge at three levels in 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 cylinder bores show more the specified out-of-round or taper, or if the cylinder walls are badly scuffed or scored, the cylinder block should be re-bored and honed and fitted with oversize pistons and rings.

Standard value
Cylinder bore : 85.00-85.03 mm (3.3465-3.3476 in.)
Out-of-roundness and taper of cylinder bore : Max. 0.01 mm (0.0004 in.)

4. If cylinder top ridge is worn in stages, cut away with ridge reamer.
5. Oversize piston is available in one size.

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

6. To rebore the cylinder to oversize, keep the specified clearance between the oversize piston and the bore, and make surethat all pistons used are of the same oversize. The standard measurement of the piston outside diameter is taken at a level 2 mm (0.08 in.) above the bottom of the piston skirt and across the thrust faces.

Piston-to-cylinder wall clearance :
0.02-0.04 mm (0.0008-0.0012 in.)

7. Check for damage and cracks.

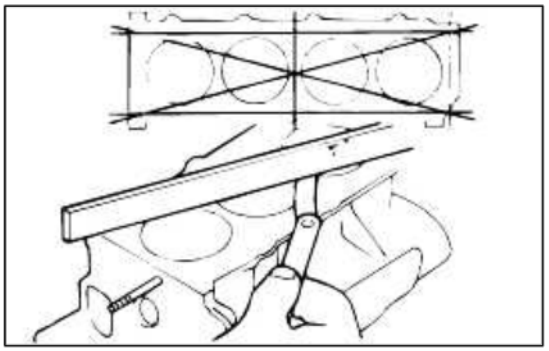
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8. Check top surface for flatness. If excessive flatness is evident, grind to minimum limit or replace.

Standard value
Flatness of gasket surface : Max. 0.05 mm (0.0020 in.)
Cylinder block (New) height : 284 mm (11.18 in.)
Service limit
Flatness of gasket surface : 0.1 mm (0.0039 in.)
Overall height : -0.2 mm (-0.0079 in.)

NOTE

The cylinder block gasket surface should be ground within -0.2 mm (-0.0079 in.) including the ground surface of cylinder head gasket surface.



Boring Cylinder

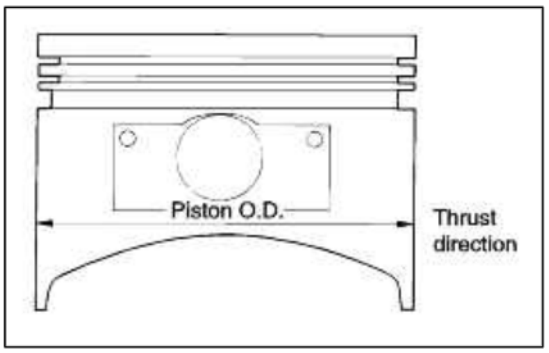
1. Oversize pistons to be used should be determined on the base of the largest bore cylinder.

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

NOTE

Size mark is stamped on top of piston.

2. Measure outside diameter of piston to be used.
3. On the base of measured piston O.D., calculate boring finish dimension.
   Boring finish dimension = Piston O.D + 0.02-0.04 mm (0.0008-0.0016 in.) (clearance between O.D and cylinder)-0.02 mm (0.008 in.) (honing margin.)



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

NOTE

To prevent distortion that may result from temperature rise during honing, bore cylinders, working from No.2 to No.4 to No.1 to No.3.

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

NOTE

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

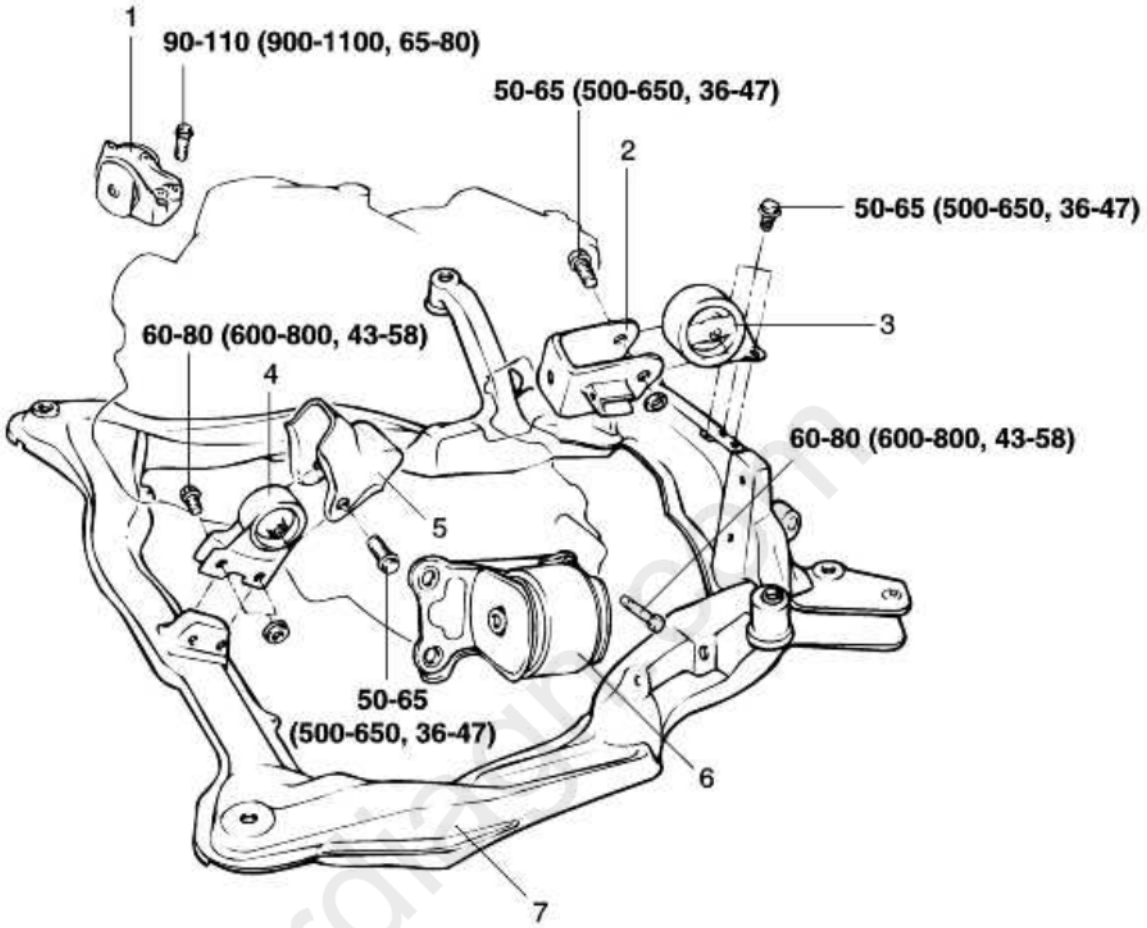
REASSEMBLY

1. Install the following parts by referring to the respective para-graphs.
   (1) Crankshaft
   (2) Flywheel
   (3) Piston
   (4) Cylinder head
   (5) Timing belt train
   (6) Front case

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

COMPONENTS

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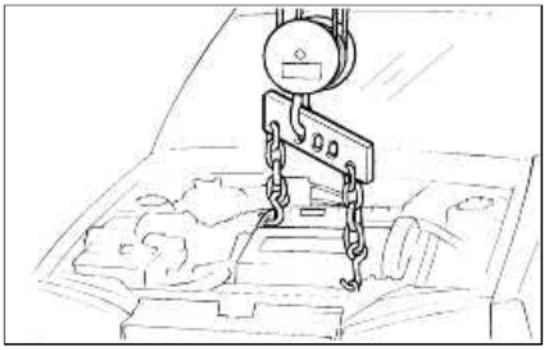
TORQUE : Nm (kg.cm, lb.ft)

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

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

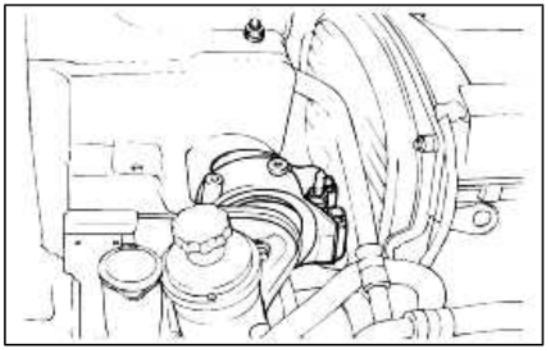
REMOVAL

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



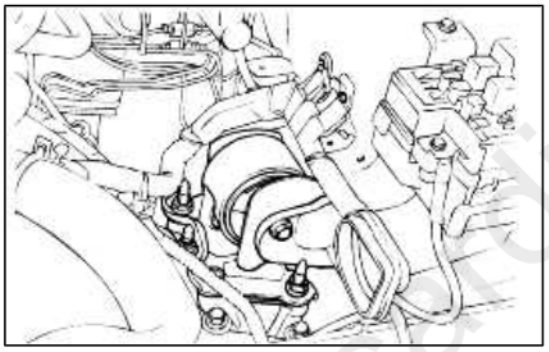
Engine Mounting

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



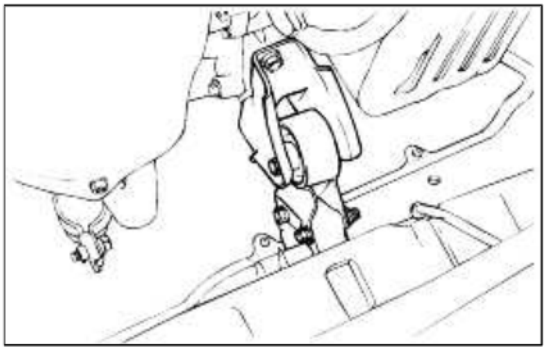
Transaxle Mounting

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



Front Roll Stopper

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

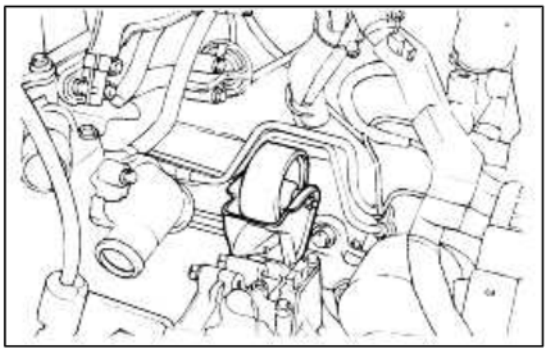


Rear Roll Stopper

1. Remove the bolt from the rear roll stopper.

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2. Remove the rear roll stopper from the subframe.



INSPECTION ITEMS

Transaxle mounting



Engine mounting



Front roll stopper assembly



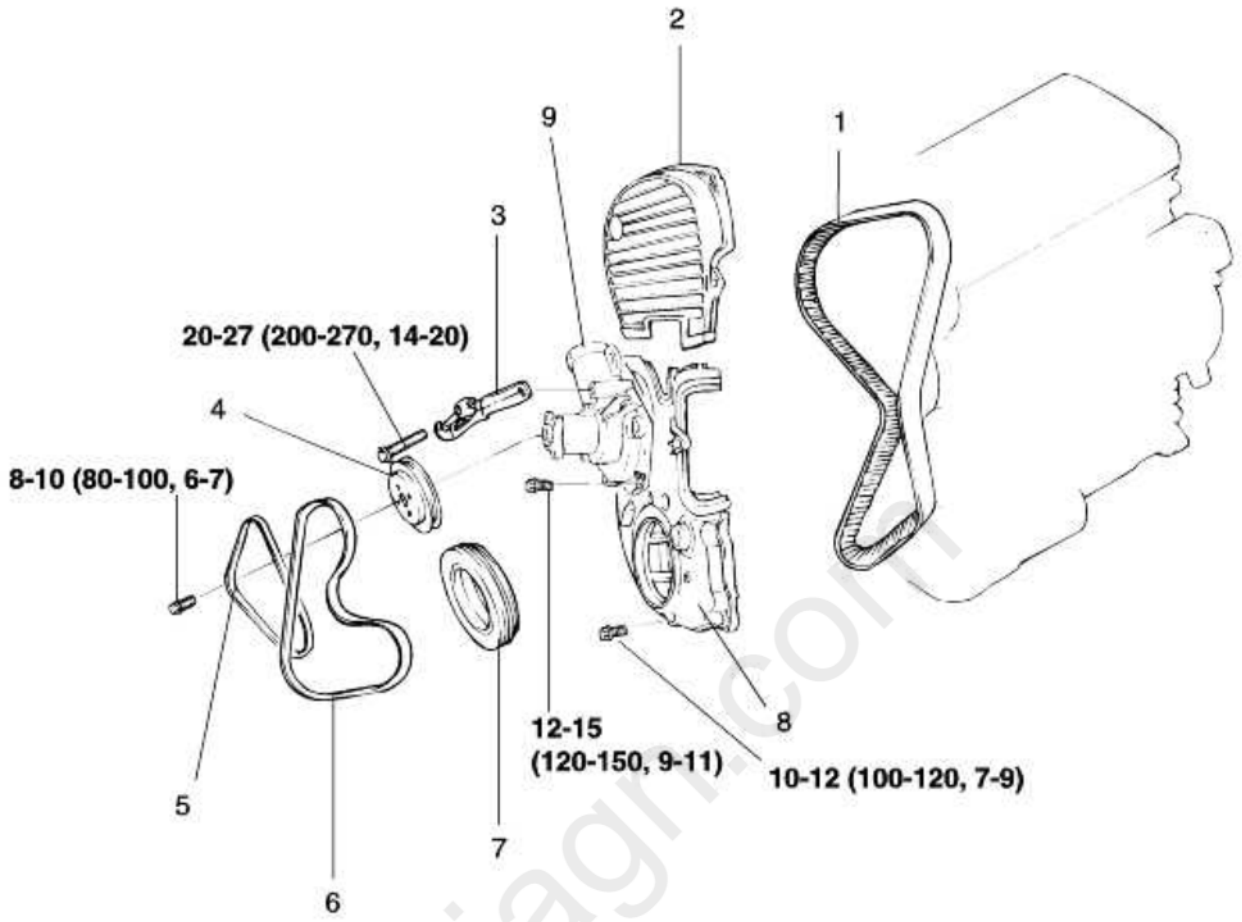
Rear roll stopper assembly



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

COMPONENTS



TOR QUE : Nm (kg·cm, lb·ft)

1. Timing belt
2. Timing belt upper cover
3. Generator brace
4. Engine coolant pump pulley
5. Drive belt (Alternator)
6. Drive belt (Power steering)
7. Crankshaft pulley
8. Timing belt front lower cover
9. Engine coolant pump

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

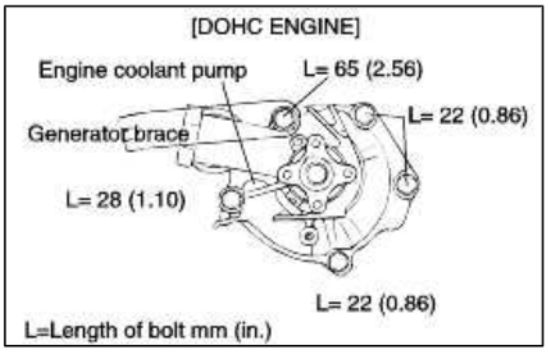
REMOVAL

1. Drain the coolant and disconnect the radiator outlet hose and Engine coolant by-pass hose from the engine coolant pump.
2. Remove the drive belt and engine coolant pump pulley.
3. Remove the timing belt covers and the timing belt tensioner.
4. Remove the engine coolant pump mounting bolts and then remove the alternator brace.
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 O-ring onto the groove on the front end of the engine coolant pipe, then wet the O-ring with engine coolant.
   Do not apply oil or grease.
3. Install new Engine coolant pump gasket and Engine coolant pump assembly. Tighten the bolts to specified torque.

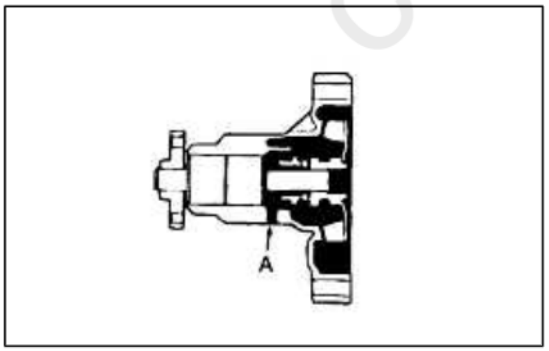
Tightening torque
Engine coolant pump bolt :
20-27 Nm (200-270 kg.cm, 14-20 lb.ft)



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

INSPECTION

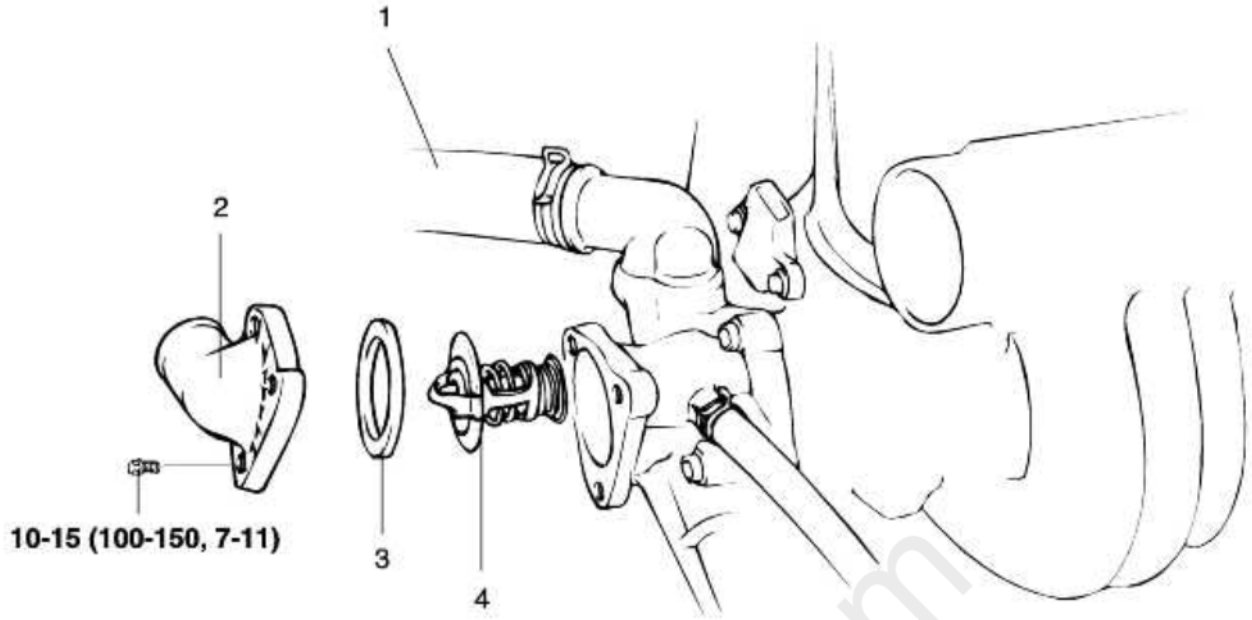
1. Check the engine coolant pump for cracks, damage or wear, and replace the engine coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the engine coolant pump assembly if necessary.
3. Check the seal unit for leaks, and replace the engine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



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

COMPONENTS

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TOR QUE : Nm (kg·cm, lb·ft)

1. Radiator upper hose (Engine side)
2. Coolant inlet fitting
3. Gasket
4. Thermostat

Engine Mechanical System > Cooling System > Thermostat > Repair procedures

REMOVAL

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

INSTALLATION

1. Check to ensure that the flange of the thermostat is correctly seated in the socket of the thermostat housing. If the thermostat is installed in the wrong direction, the bottom of the thermostat will touch the rib inside the intake manifold, making it impossible to seat flange in position.
2. Install a new gasket and Engine coolant outlet fitting.

Tightening torque
Engine coolant outlet fitting bolt :
10-15 Nm (100-150 kg.cm, 7-11 lb.ft)

3. Refill the coolant.

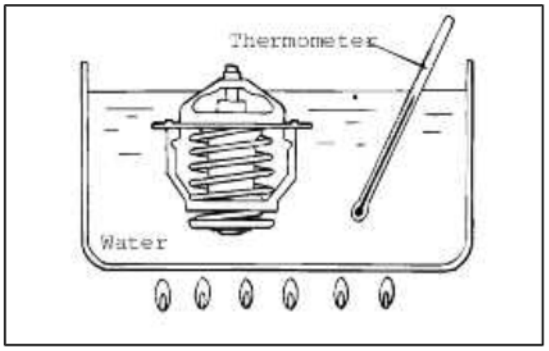
INSPECTION

1. Heat the thermostat as shown in the illustration.
2. Check that the valve operates properly.

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3. Check to determine the temperature at which the valve begins to open.

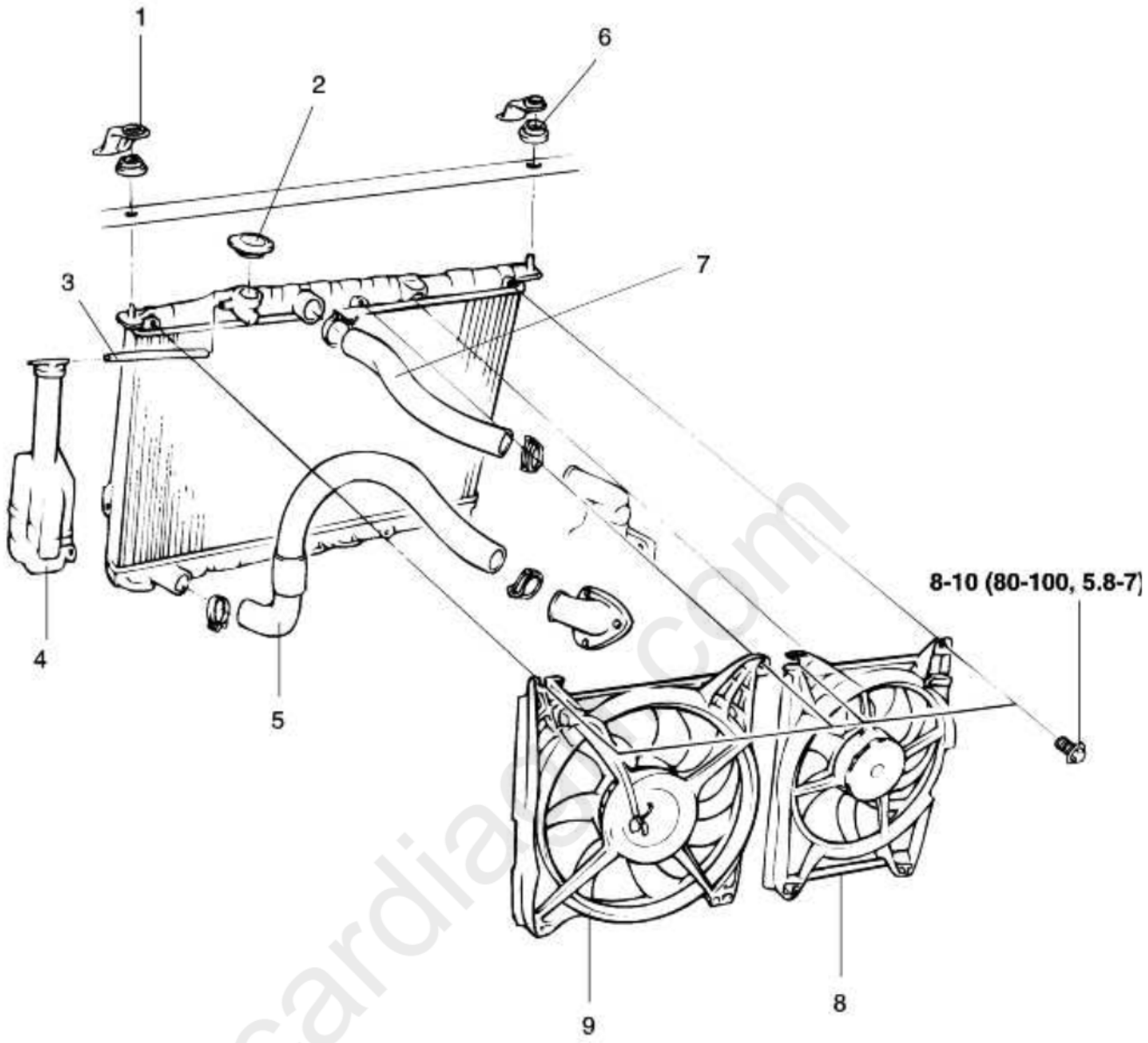
Valve opening temperature :
80.5-83.5°C (176.9-182.3°F)
Full opening temperature : 95°C (203°F)



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

COMPONENTS

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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

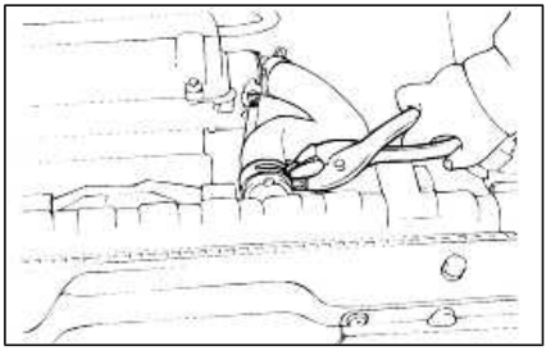
REMOVAL

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.

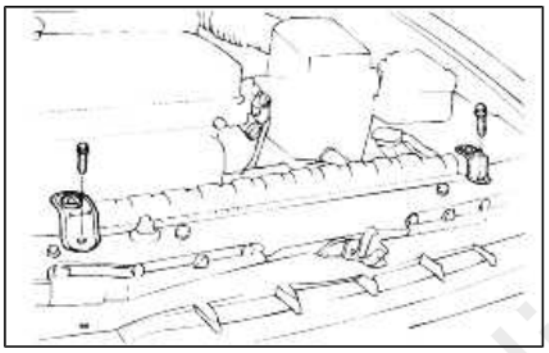
2. Disconnect the fan motor connector.
3. Loosen the radiator drain plug to drain the coolant.
4. Disconnect the upper and lower hoses and overflow tube after making marks on the radiator hose and the hose clamp.



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 materials, etc. do not enter after the hose has been 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 has warmed up enough so that the thermostat valve opens, and then stop the engine.
3. Remove the radiator cap and pour the coolant to the filler neck of the radiator. Fill the reservoir tank with the coolant to the upper level.
4. Check that there is no leakage from the radiator, hoses or connections.

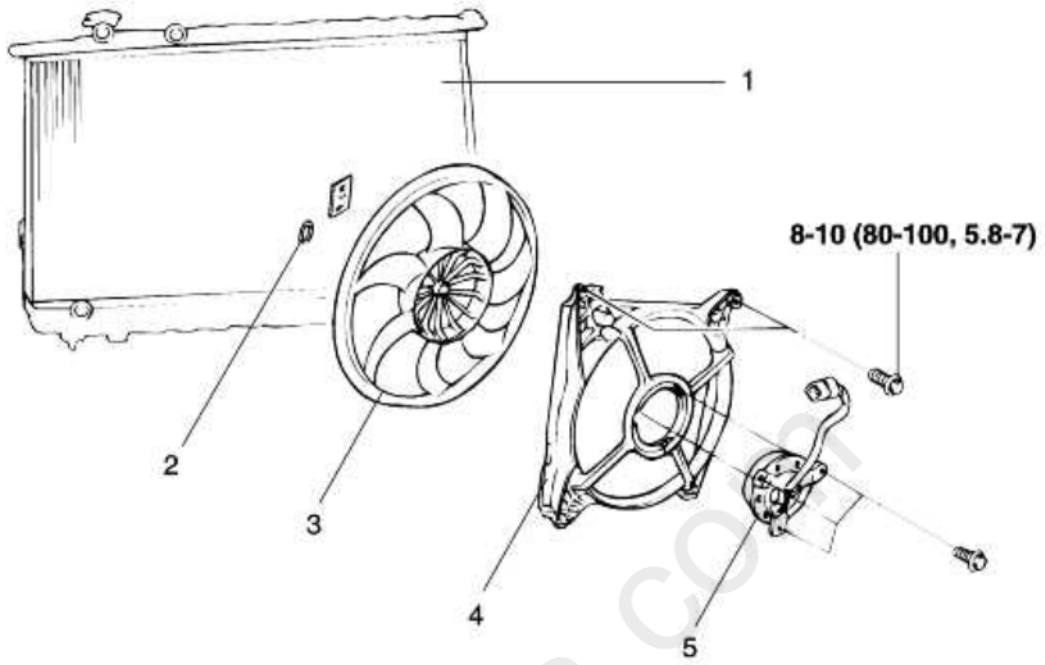
INSPECTION

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

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COMPONENTS



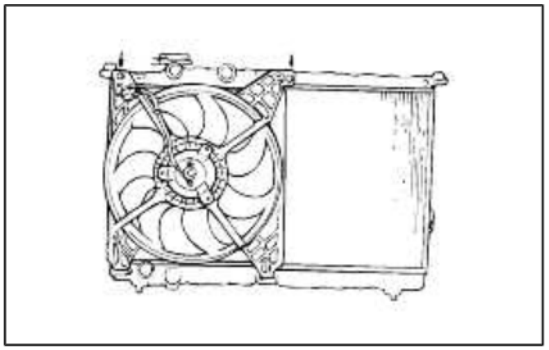
TORQUE : Nm (kg·cm, lb· ft)

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.



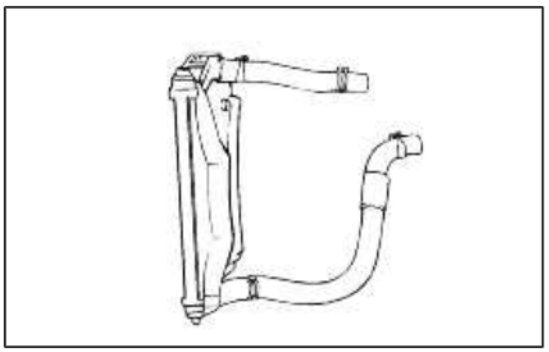
5. Remove the shroud with the fan motor.
6. Remove the fan mounting clip and detach the fan from fan motor.
7. Remove the three screws and detach the fan motor.

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INSTALLATION

1. Installation is the reverse order of removal procedures.

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

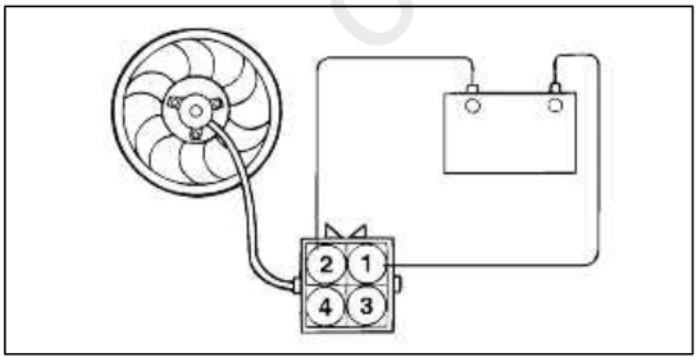


Inspection

Radiator fan motor and condenser fan motor

1. Check that the radiator fan rotates when battery voltage is applied between the terminals (as shown table below).
2. Check that abnormal noises are not produced while the motor is turning.

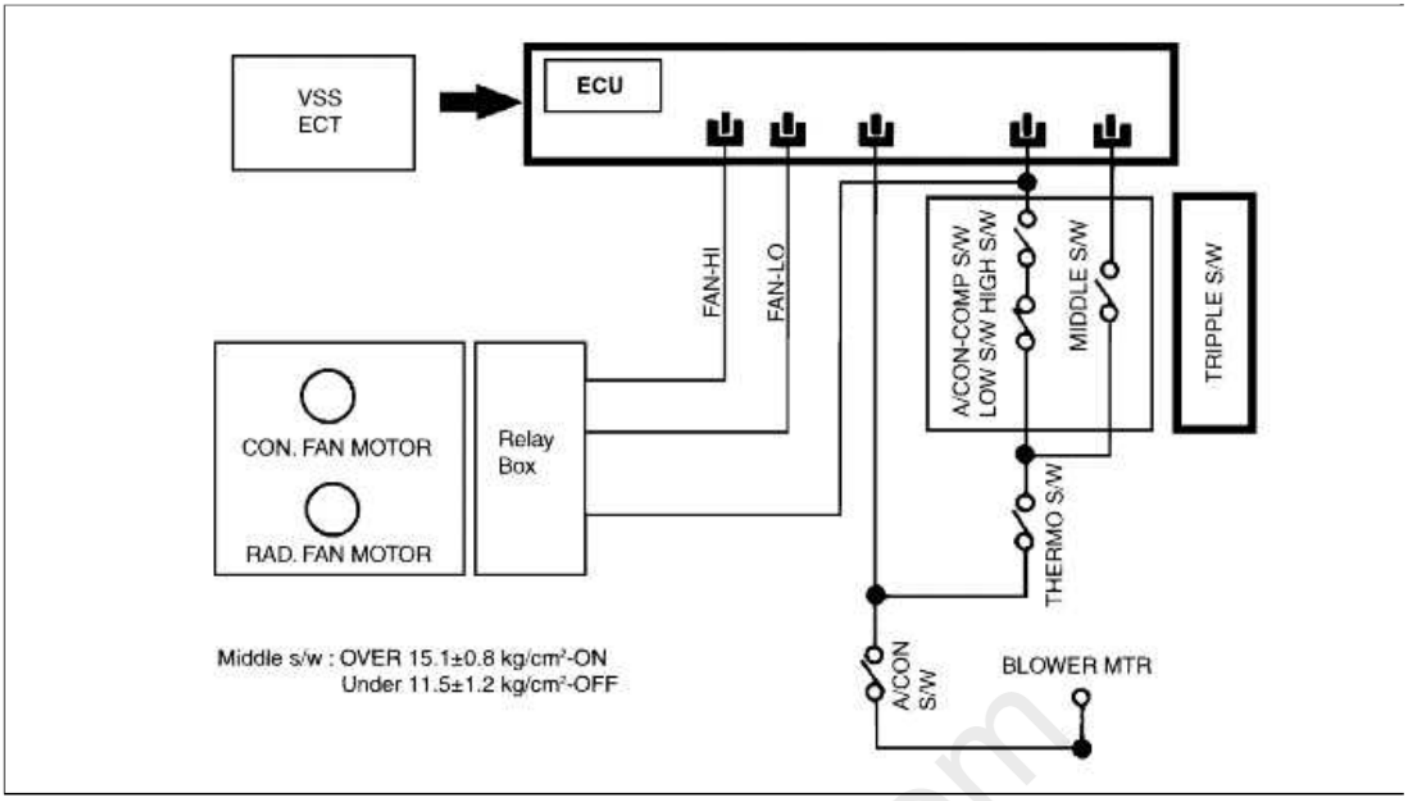
Item \ Terminal	1	2	3	4	MOTOR SPEED
RADIATOR FAN MOTOR	⊕		⊖		LOW
	⊕	⊕		⊖	MIDDLE
	⊕	⊕	⊖	⊖	HIGH
CONDENSER FAN MOTOR		⊕	⊖		LOW
	⊕	⊕		⊖	MIDDLE
	⊕	⊕	⊖	⊖	HIGH



Cooling Fan Control System

ECM controls the cooling fan in 3 steps (LO/ MIDDLE/ HI) according to the vehicle speed, the air-conditioning load and engine coolant temperature.

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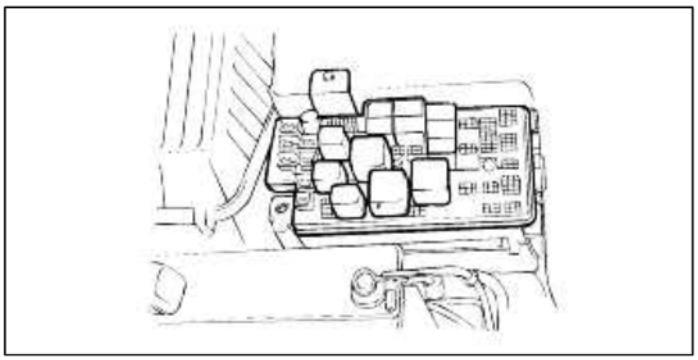


ECM Control logic

ECM		A/C	FAN	
LOW	HIGH		RADIATOR	CONDENSOR
OFF	OFF	ON/OFF	OFF	OFF
ON	OFF	OFF	LOW	OFF
ON	OFF	ON	LOW	LOW
OFF	ON	ON/OFF	MID	MID
ON	ON	OFF	HIGH	MID
ON	ON	ON	HIGH	HIGH

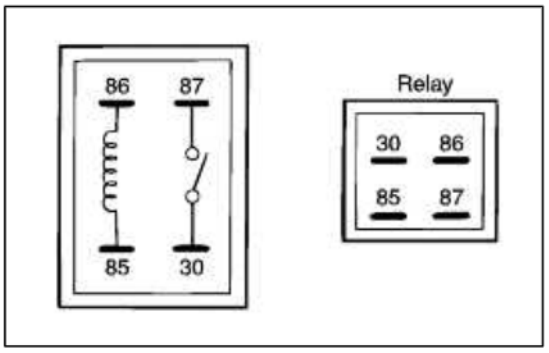
Radiator Fan Motor Relay

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



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2. Check the continuity of the terminals "86" and "85" with an ohmmeter.

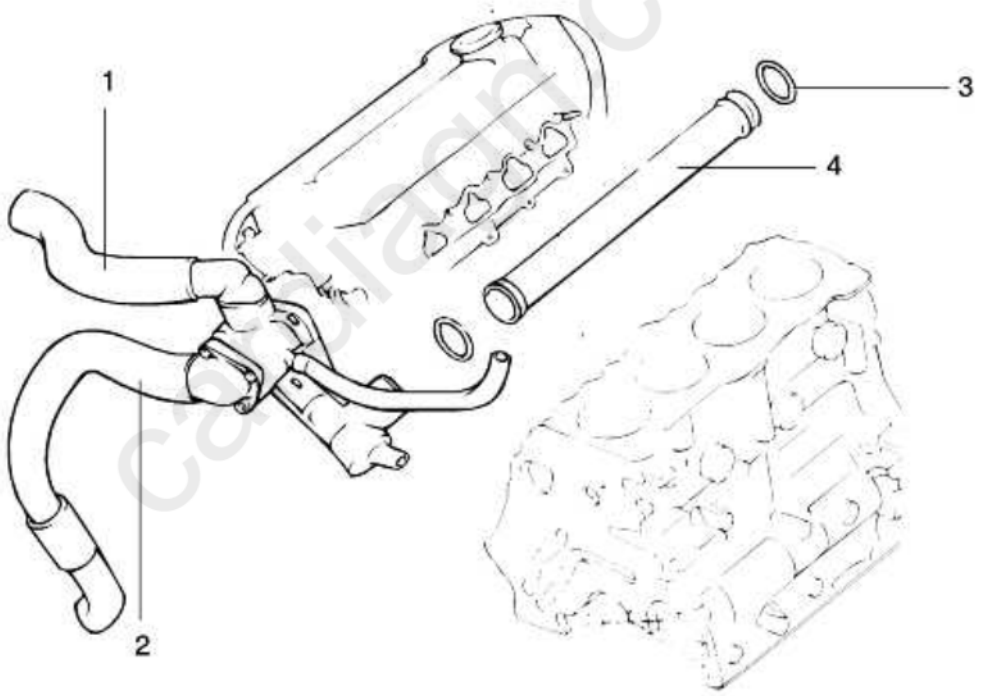


3. Apply DC12 V to the terminals "86" and ground the terminal "85".
4. Check the continuity between the terminals "87" and "30".

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

COMPONENTS

[DOHC ENGINE]



1. Radiator upper hose
2. Radiator lower hose
3. O-ring
4. Engine coolant inlet pipe

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

INSTALLATION

Fit O-ring in the groove provided at engine coolant inlet pipe end, wet the periphery of O-ring and insert engine coolant inlet pipe.

NOTE

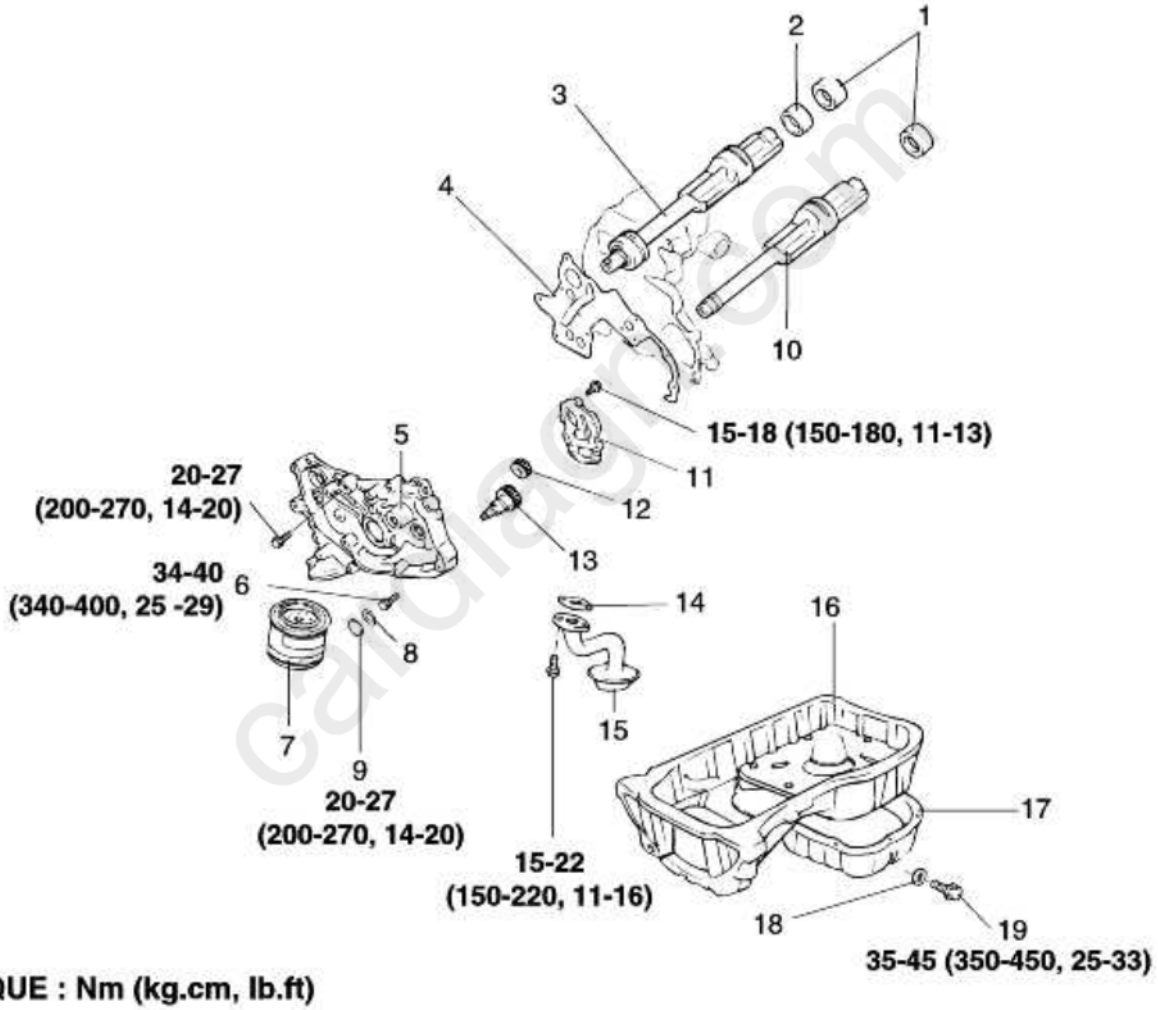
- Do not apply oils or greases to Engine coolant pipe O-ring.
- Keep the Engine coolant pipe connections free of sand, dust, etc.
- Insert Engine coolant pipe to its end bottoms.
- While installing the engine coolant inlet pipe, always replace the O-ring with a new one.

INSPECTION

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

Engine Mechanical System > Lubrication System > Oil Pump > Components and Components Location

COMPONENTS

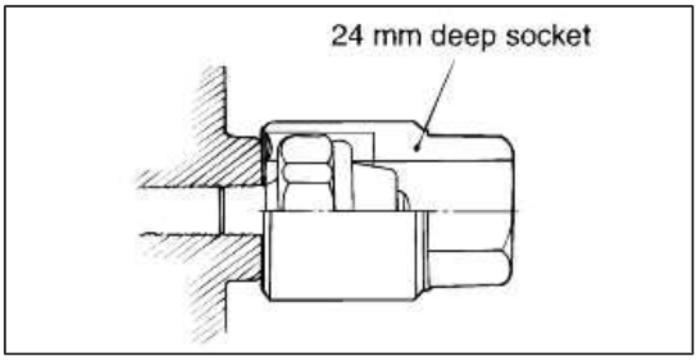


1. Rear bearing
2. Front bearing
3. Right counter balance shaft
4. Gasket
5. Oil pump case
6. Driven gear bolt
7. Oil filter
8. O-ring
9. Plug cap
10. Left counter balance shaft
11. Oil pump cover
12. Driven gear
13. Drive gear
14. Gasket
15. Oil screen
16. Upper oil pen
17. Lower oil pen
18. Gasket
19. Drain plug

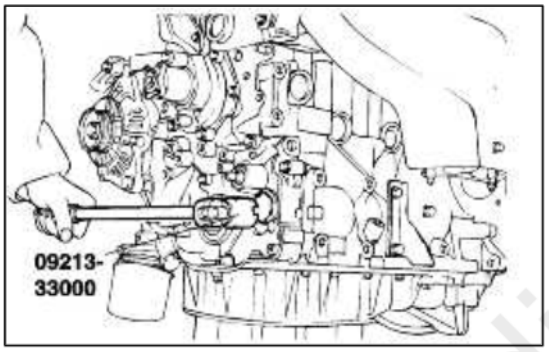
Engine Mechanical System > Lubrication System > Oil Pump > Repair procedures

REMOVAL

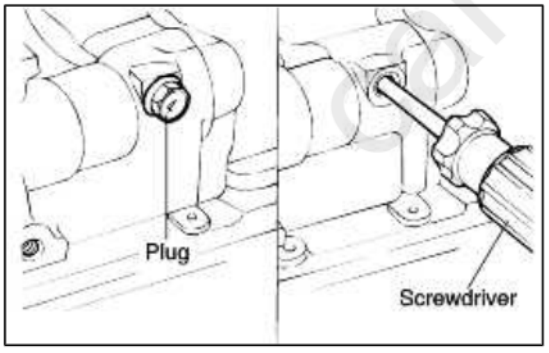
1. Remove the timing belt. Refer to "Timing Belt".
2. Remove all the oil pan bolts.
3. Remove the oil pan.
4. Remove the oil screen and gasket.
5. Remove the relief plunger and gasket, and then take off the relief spring and relief valve from the oil filter bracket.
6. Remove the oil pressure switch.



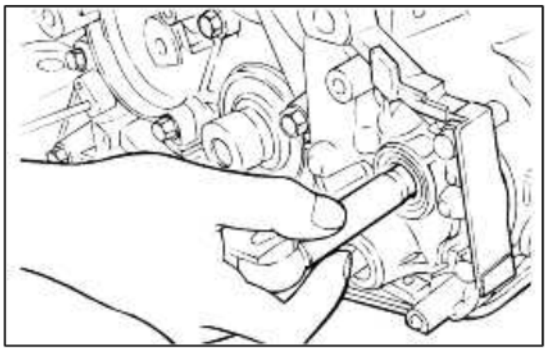
7. Remove the oil filter bracket and gasket.
8. Using the special tool, remove the plug cap from the oil pump portion of front case.



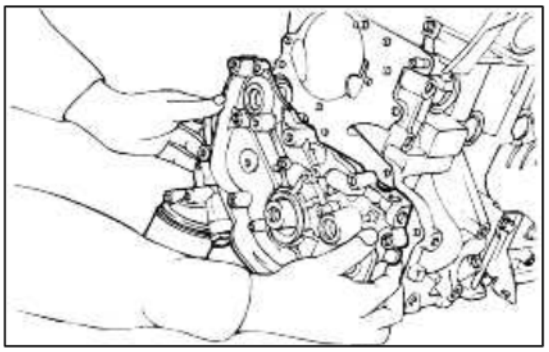
9. Remove the left side of cylinder block plug and insert a screw driver with an 8 mm (0.32 in.) diameter shaft into plug hole. The screwdriver shaft must be inserted more than 60 mm (2.4 in.)



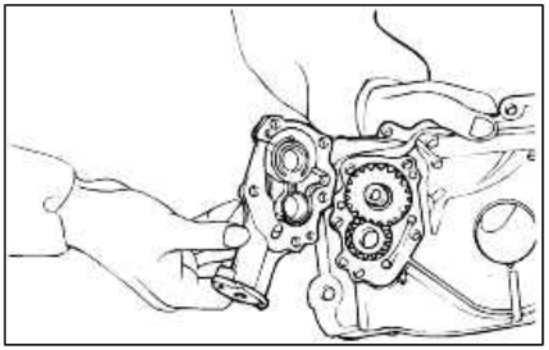
10. Remove the oil pump driven gear and left the counter balance shaft retaining bolt.



11. Remove the front case mounting bolts and remove the front case assembly and gasket. Remove the two counter balance shafts from the cylinder block.

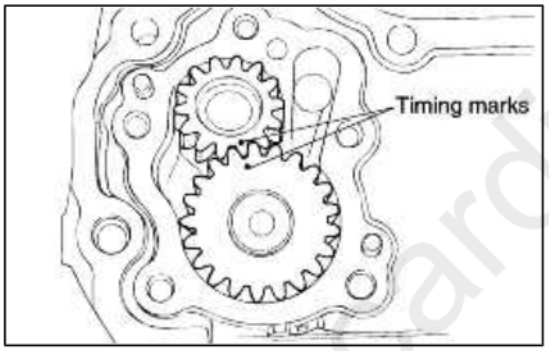


12. Remove the oil pump cover from the front case.
13. Remove the oil pump gears from the front case.

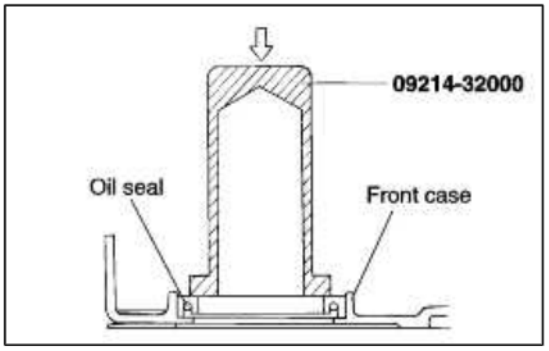


INSTALLATION

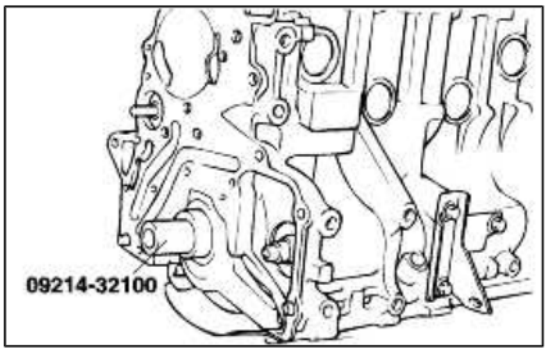
1. Apply engine oil to the gear and align the two timing marks.



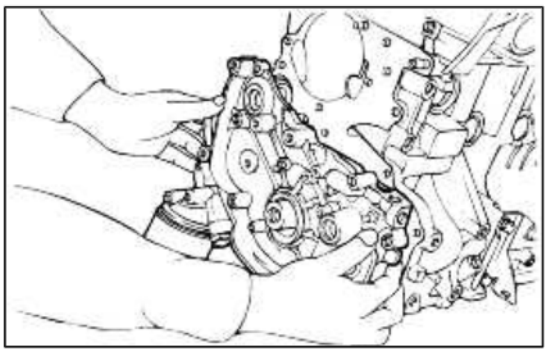
2. Using the special tool, Crankshaft Front Oil Seal Installer (09214-32000), install the crankshaft front oil seal into the front case.



3. Set the special tool (09214-32100) on the front end of crankshaft and apply a thin coat of engine oil to the outer circumference of the special tool to install the front case.

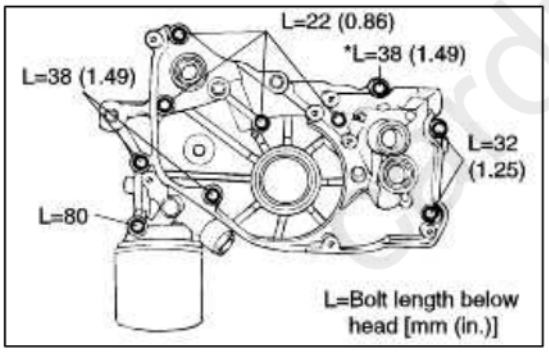


4. Install the front case assembly through a new front case gasket and temporarily tighten the flange bolts (other than those for tightening the filter bracket).

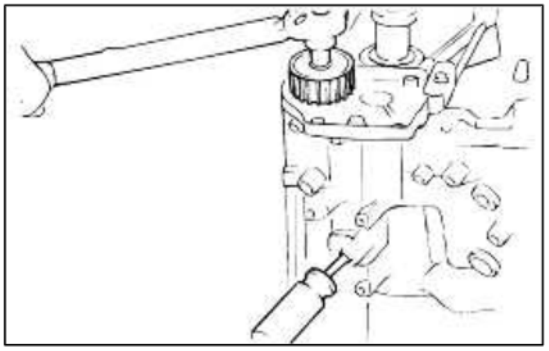


5. Install the front case assembly with a new gasket, and tighten the bolts to the specified torque.

Front case assembly
Tightening torque
All except : 20-27 Nm (200-270 kg.cm, 14-20 lb.ft)



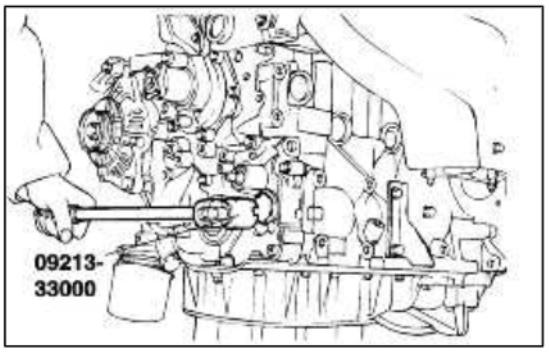
6. Insert a screwdriver through plug hole in left side of cylinder block. After checking that the shaft is in position, tighten.



7. Install a new O-ring to the groove of front case.

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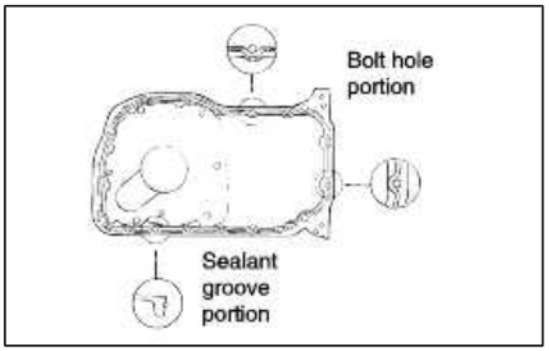
8. Using a special tool, install the plug case and tighten to the specified torque.



9. Apply sealant into the groove of the pan flange as shown.

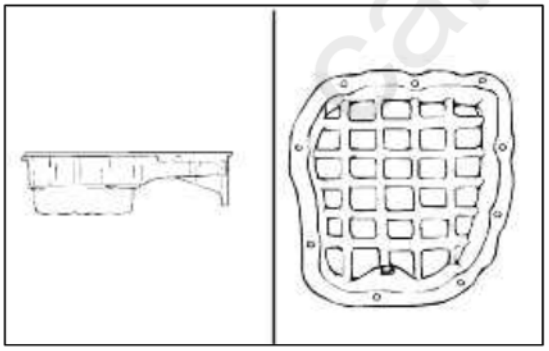
NOTE

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



10. Note the difference in bolt lengths at the location shown. Install the oil pan and tighten the bolts to the specified torque.

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



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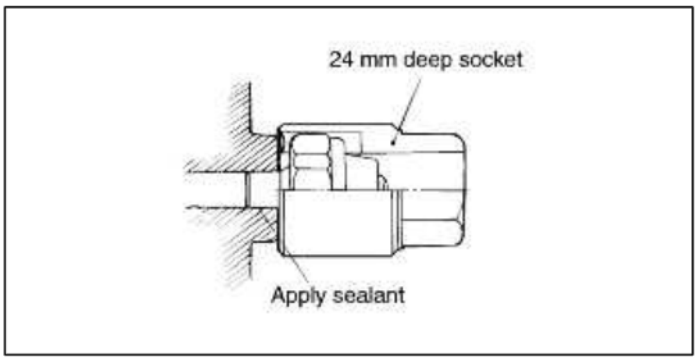
11. Using the special tool, install the oil pressure switch after applying sealant to the threaded area.

Sealant : Threebond 1104 or equivalent

NOTE

Do not torque the oil pressure switch excessively.

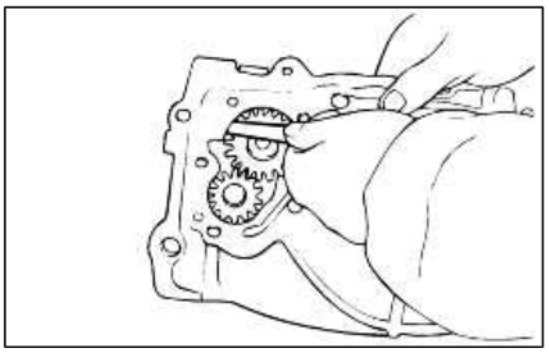
Tightening torque
Oil pressure switch : 8-12 Nm (80-120 kg.cm, 6-8 lb.ft)



INSPECTION

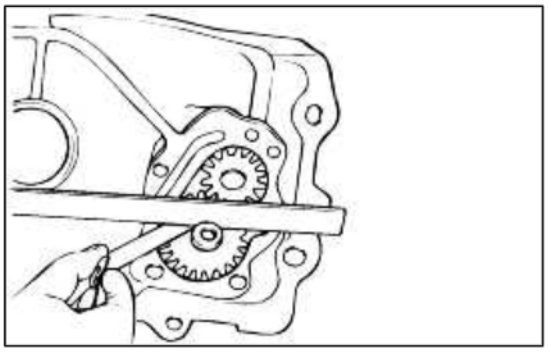
1. Assemble the oil pump gear to the front case and rotate it to ensure smooth rotation with no looseness.
2. Ensure that there is no ridge wear on the contact surface between the front case and gear surface of the oil pump cover.
3. With the drive and driven gears installed into the front case, measure the tip clearance of the gears.

[Standard value]
Drive gear : 0.160-0.205 mm (0.0063-0.0081 in.)
Driven gear : 0.180-0.205 mm (0.0071-0.0081 in.)
[Limit]
Drive gear : 0.25 mm (0.0098 in.)
Driven gear : 0.25 mm (0.0098 in.)



4. Check the side clearance.

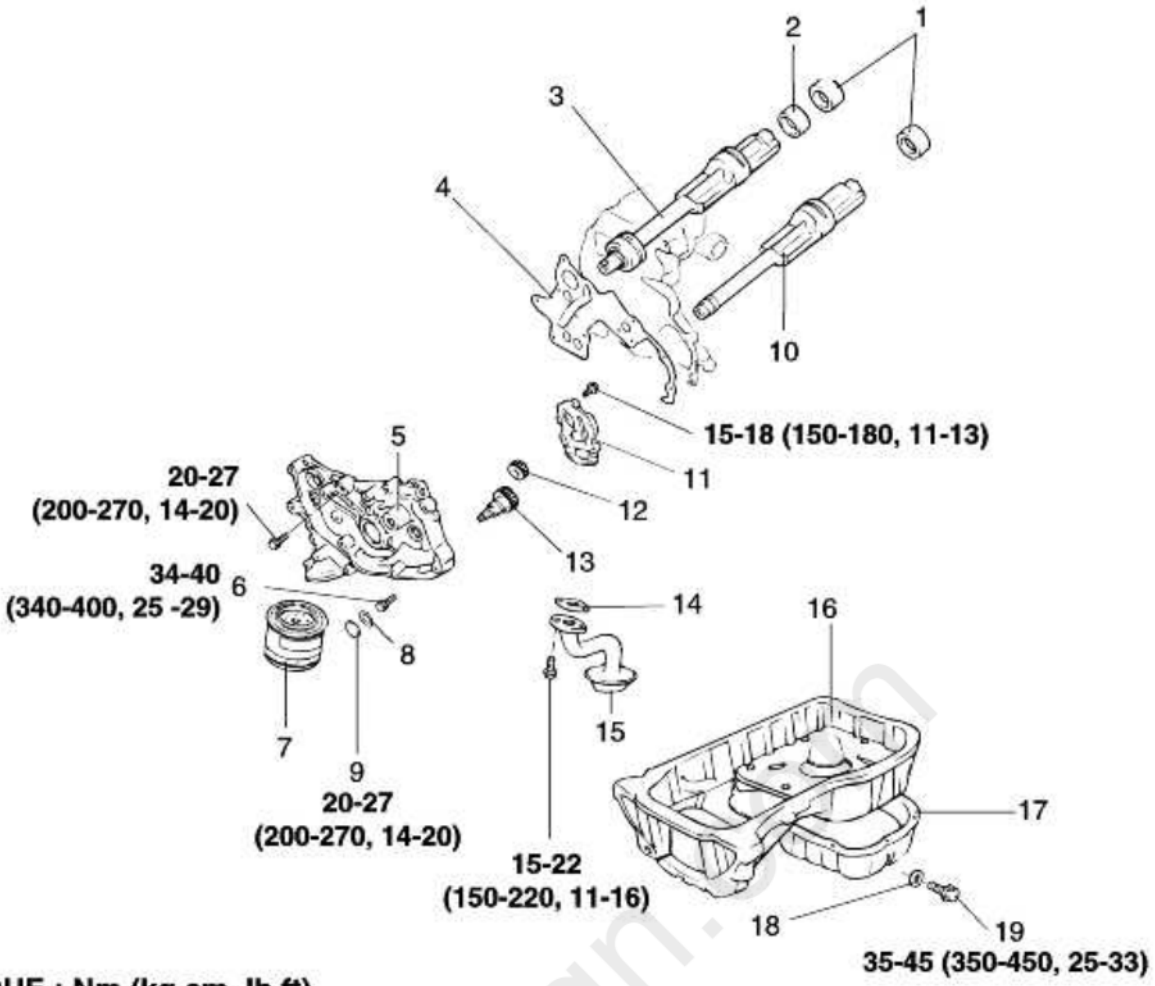
[Standard value]
Drive gear : 0.08-0.14 mm (0.0031-0.0055 in.)
Driven gear : 0.06-0.12 mm (0.0024-0.0047 in.)
[Limit]
Drive gear : 0.25 mm (0.0098 in.)
Driven gear : 0.25 mm (0.0098 in.)



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

COMPONENTS

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1. Rear bearing
2. Front bearing
3. Right counter balance shaft
4. Gasket
5. Oil pump case
6. Driven gear bolt
7. Oil filter
8. O-ring
9. Plug cap
10. Left counter balance shaft
11. Oil pump cover
12. Driven gear
13. Drive gear
14. Gasket
15. Oil screen
16. Upper oil pen
17. Lower oil pen
18. Gasket
19. Drain plug

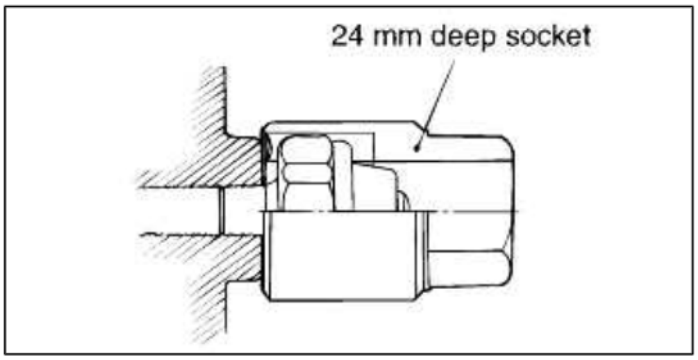
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Engine Mechanical System > Lubrication System > Front Case > Repair procedures

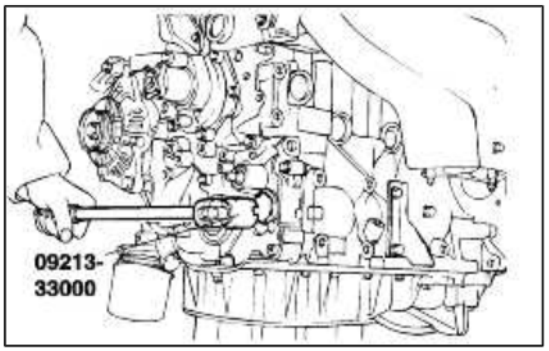
REMOVAL

1. Remove the timing belt. Refer to "Timing Belt".
2. Remove all the oil pan bolts.
3. Remove the oil pan.
4. Remove the oil screen and gasket.
5. Remove the relief plunger and gasket, and then take off the relief spring and relief valve from the oil filter bracket.

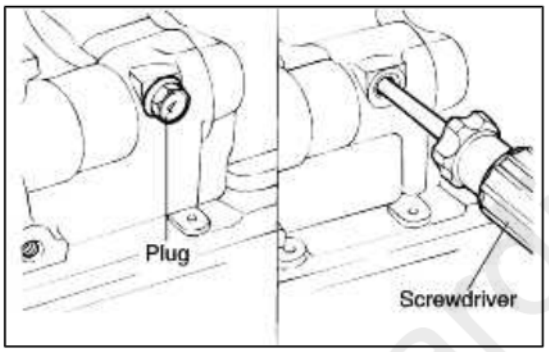
6. Remove the oil pressure switch.



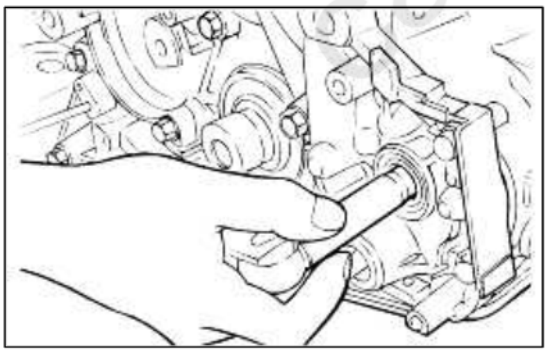
7. Remove the oil filter bracket and gasket.
8. Using the special tool, remove the plug cap from the oil pump portion of front case.



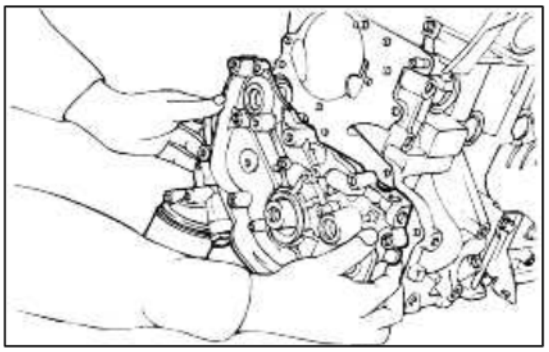
9. Remove the left side of cylinder block plug and insert a screw driver with an 8 mm (0.32 in.) diameter shaft into plug hole. The screwdriver shaft must be inserted more than 60 mm (2.4 in.)



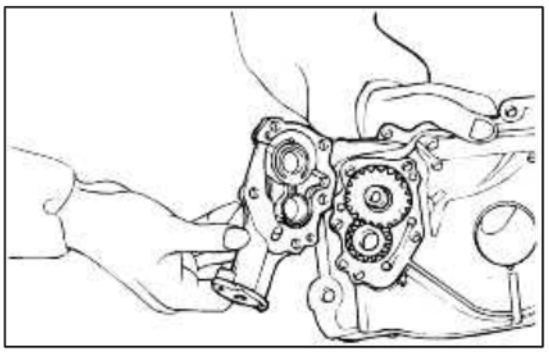
10. Remove the oil pump driven gear and left the counter balance shaft retaining bolt.



11. Remove the front case mounting bolts and remove the front case assembly and gasket. Remove the two counter balance shafts from the cylinder block.

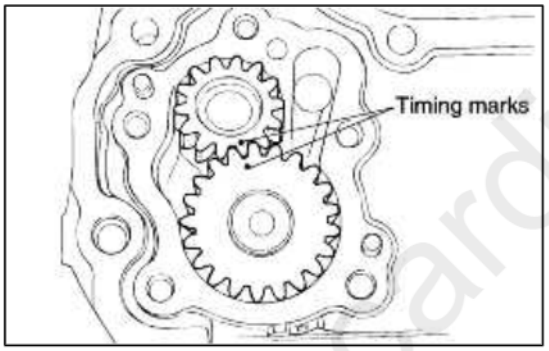


12. Remove the oil pump cover from the front case.
13. Remove the oil pump gears from the front case.

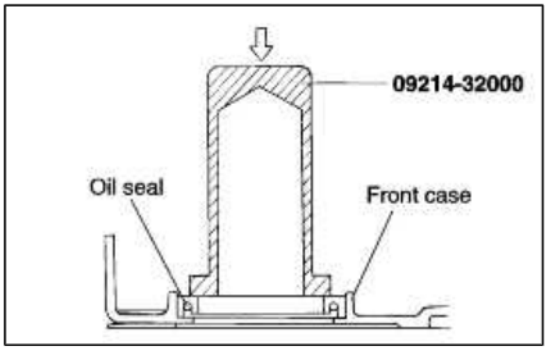


INSTALLATION

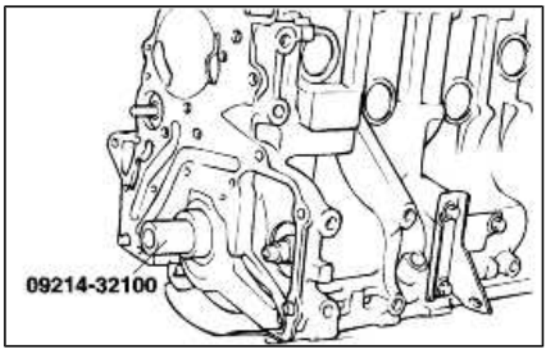
1. Apply engine oil to the gear and align the two timing marks.



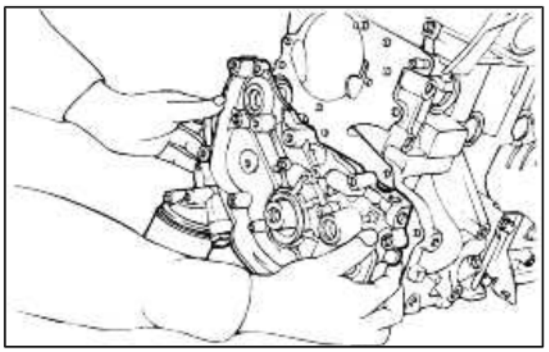
2. Using the special tool, Crankshaft Front Oil Seal Installer (09214-32000), install the crankshaft front oil seal into the front case.



3. Set the special tool (09214-32100) on the front end of crankshaft and apply a thin coat of engine oil to the outer circumference of the special tool to install the front case.

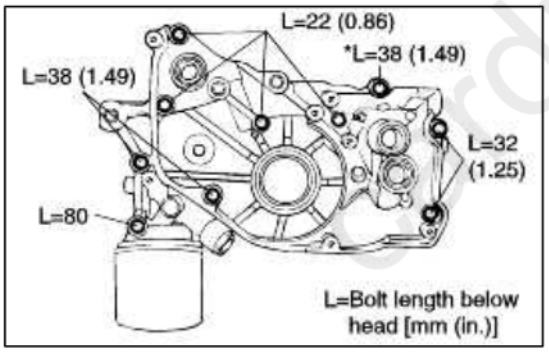


4. Install the front case assembly through a new front case gasket and temporarily tighten the flange bolts (other than those for tightening the filter bracket).

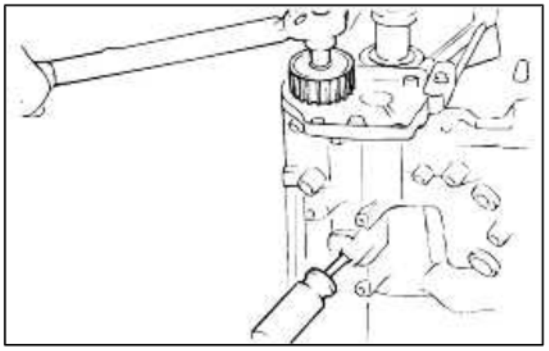


5. Install the front case assembly with a new gasket, and tighten the bolts to the specified torque.

Front case assembly
Tightening torque
All except : 20-27 Nm (200-270 kg.cm, 14-20 lb.ft)



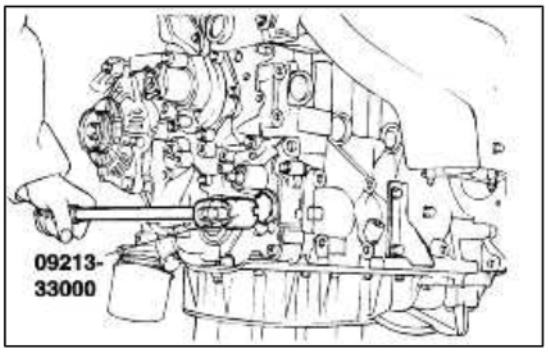
6. Insert a screwdriver through plug hole in left side of cylinder block. After checking that the shaft is in position, tighten.



7. Install a new O-ring to the groove of front case.

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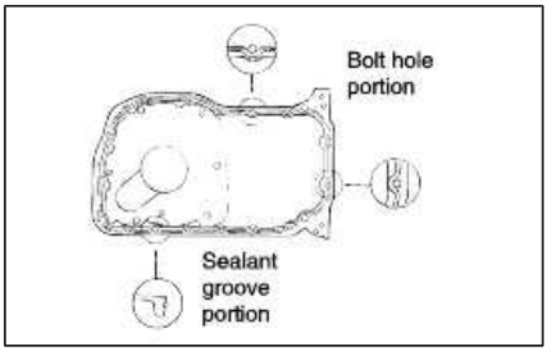
8. Using a special tool, install the plug case and tighten to the specified torque.



9. Apply sealant into the groove of the pan flange as shown.

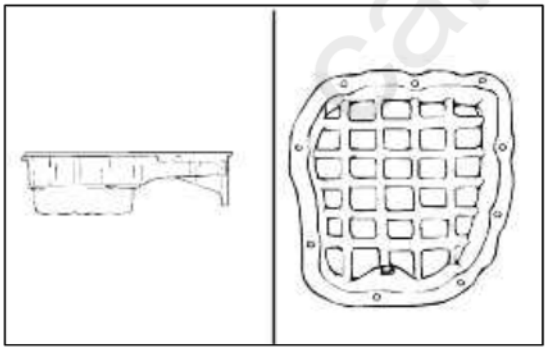
NOTE

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



10. Note the difference in bolt lengths at the location shown. Install the oil pan and tighten the bolts to the specified torque.

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



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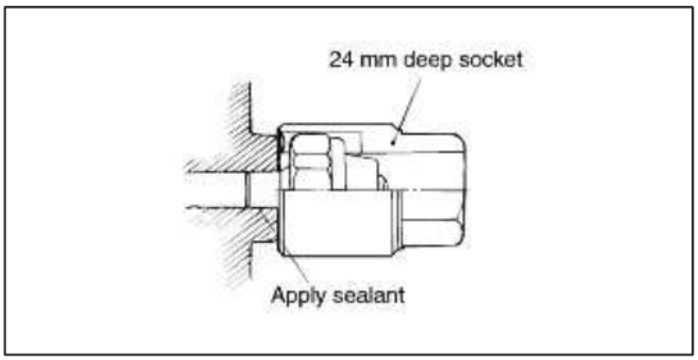
11. Using the special tool, install the oil pressure switch after applying sealant to the threaded area.

Sealant : Threebond 1104 or equivalent

NOTE

Do not torque the oil pressure switch excessively.

Tightening torque
Oil pressure switch : 8-12 Nm (80-120 kg.cm, 6-8 lb.ft)



INSPECTION

Front Case

1. Check oil holes for clogging and clean if necessary.
2. Check the counter balance shaft front bearing section for wear, damage and seizure. If there is anything wrong with the section, replace the front case.
3. Check the front case for crack and other damage. Replace the cracked or damaged front case.

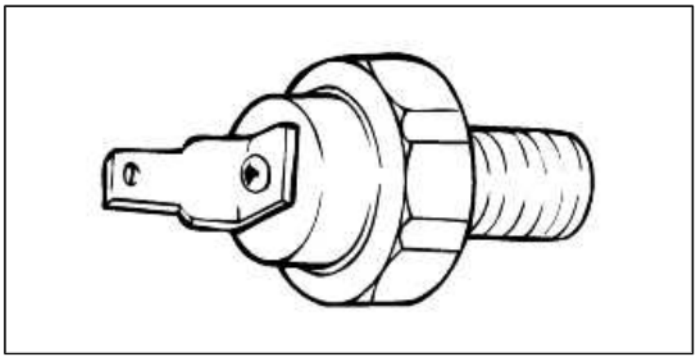
Oil Seal

1. Check the oil seal lip for wear and damage. Replace the oil seal if necessary.
2. Check the oil seal lip for deterioration. Replace the oil seal if necessary.

Oil Pressure Switch

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

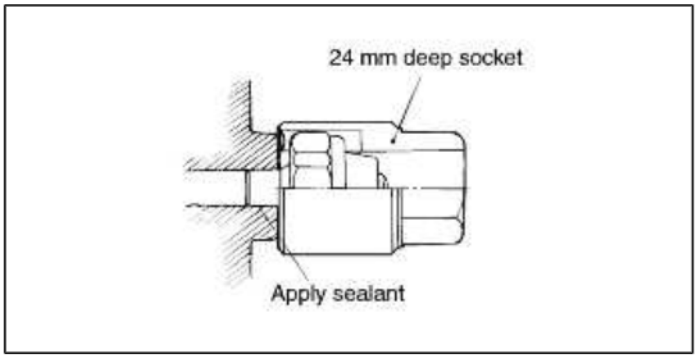
Oil pressure switch operation pressure :
14.71-29.42 kPa (0.15-0.3 kg/cm² ,2.1-4.3 psi)



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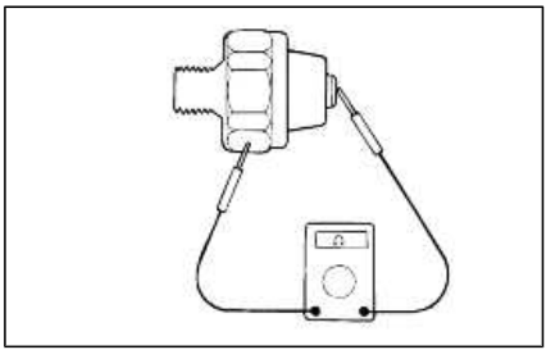
3. Using 24mm deep socket, tighten the switch to the specified torque.

Tightening torque
Oil pressure switch and sensor assembly :
8-12 N·m (80-120 kg-cm, 5.8-8.7 lb·ft)

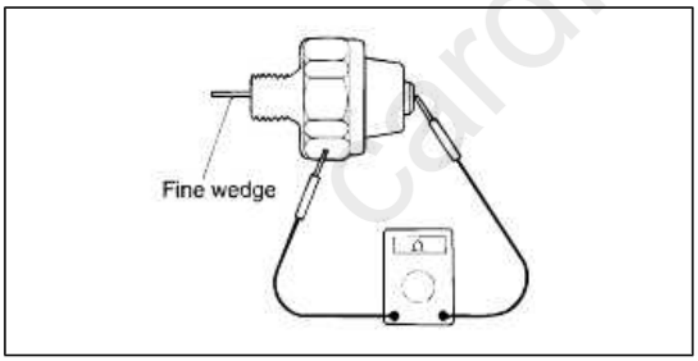


Oil Pressure Sensor Assembly

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 wire is pushed. If there is continuity even when the fine wire is pushed, replace it.

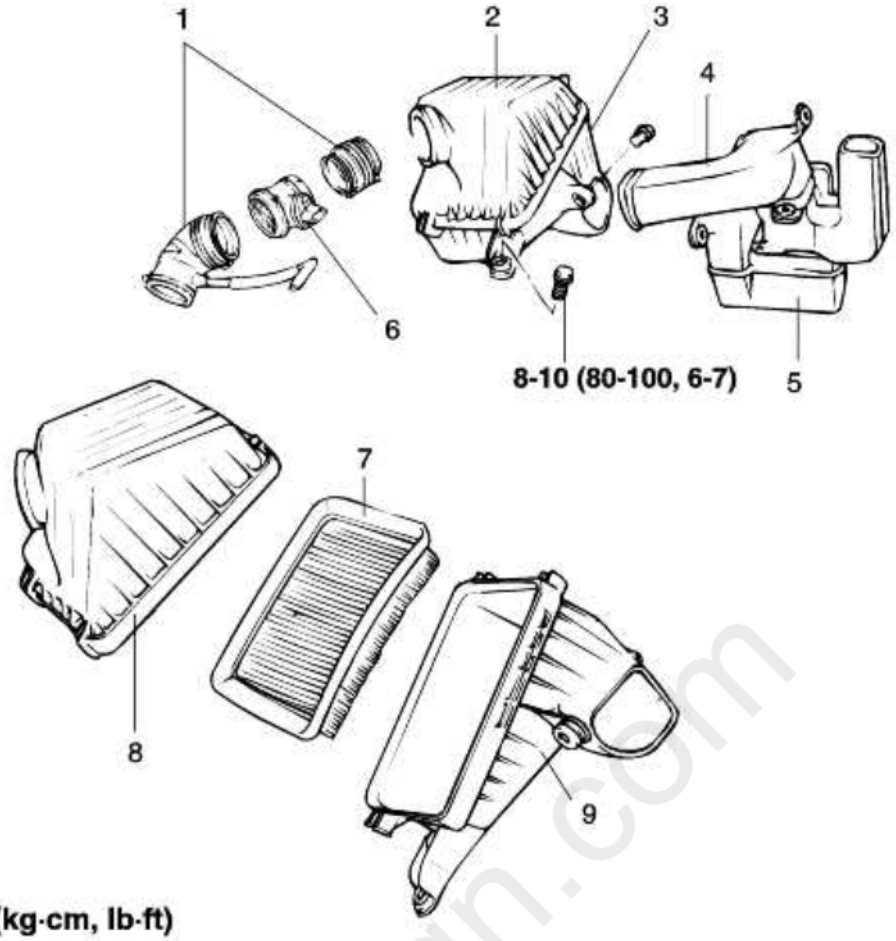


3. Or, if there is no continuity when a 50 kPa (7 psi) vacuum is applied through the oil hole, the switch is operating properly.
   Check that air doesn't leak. If air leaks, the diaphragm is broken. Replace the switch.

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

COMPONENTS

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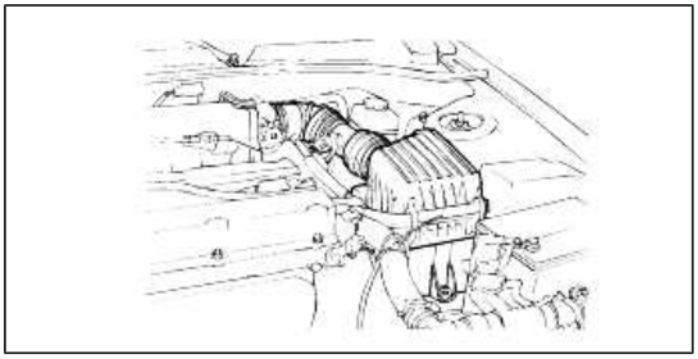


1. Air intake hose
2. Air cleaner
3. Air cleaner body
4. Air duct
5. Air duct
6. Air flow sensor
7. Air cleaner element
8. Air cleaner cover
9. Air cleaner body

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

REMOVAL

1. Remove the air intake hose and air duct connected to the air cleaner, and the resonator.



2. Remove the three bolts attaching the air cleaner mounting brackets.
3. Detach the air cleaner.

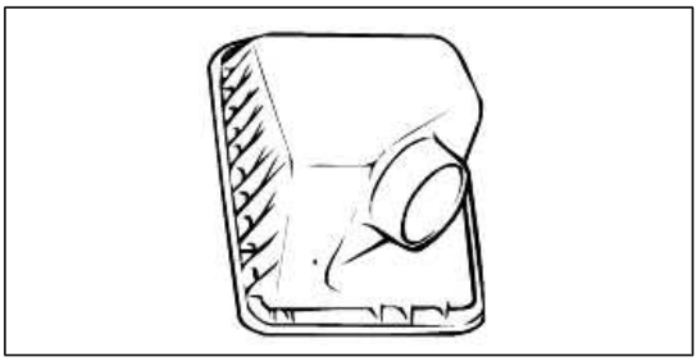
INSTALLATION

Install the air cleaner according to the reverse order of removal.

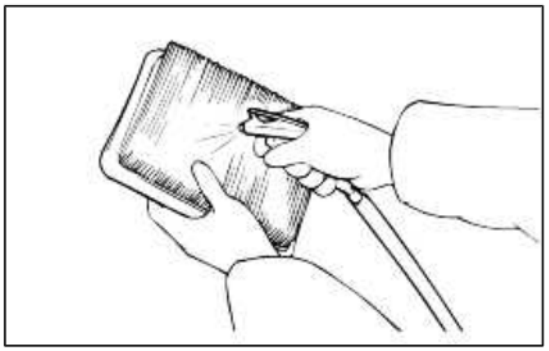
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INSPECTION

1. Check the air cleaner body, cover, or packing for distortion, corrosion or damage.



2. Check the air duct for damage.
3. Check the air cleaner element for restriction, contamination or damage.
   If the element is slightly restricted, remove the dust and other contaminants by blowing to the inside through the element.

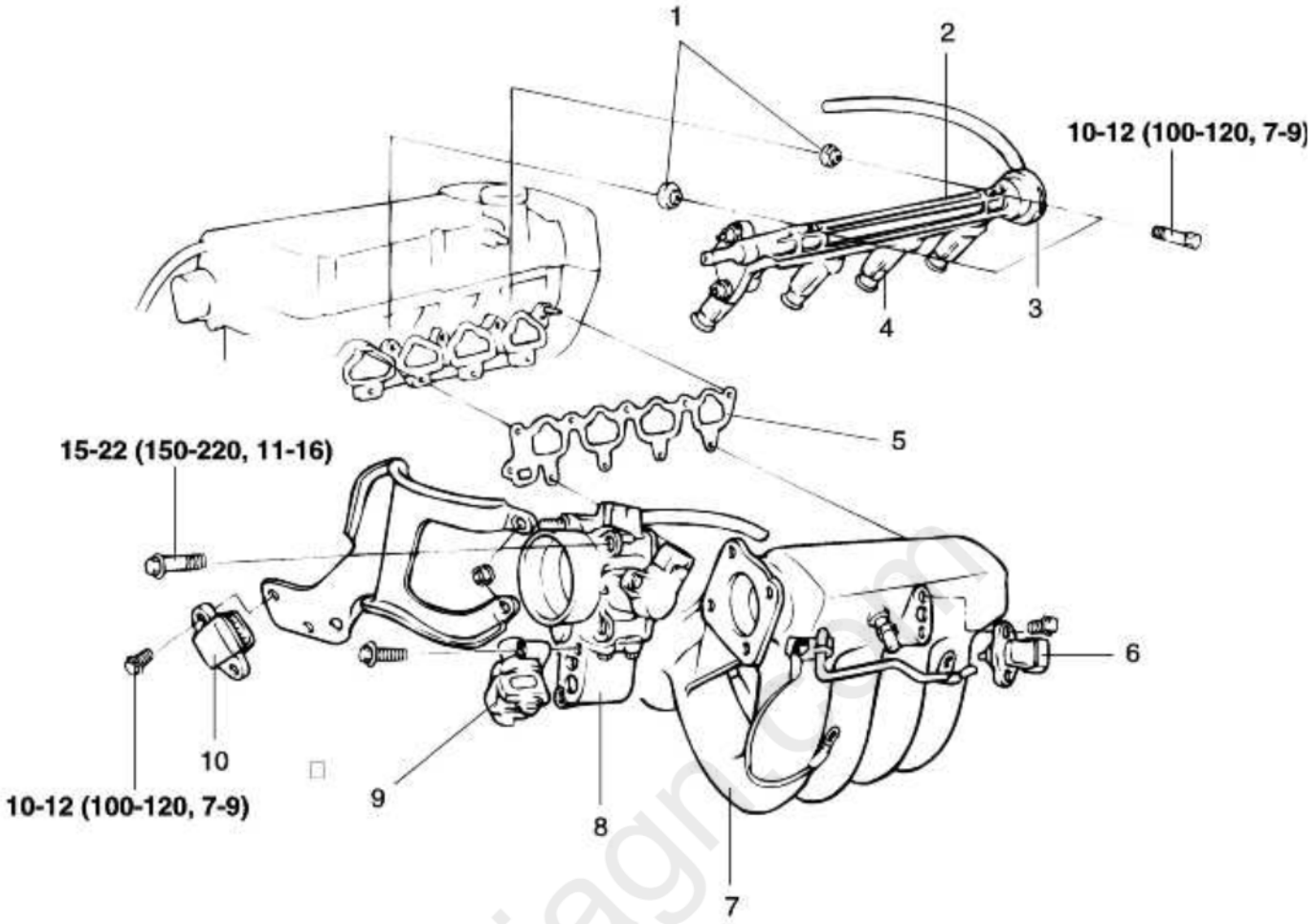


4. Check the air cleaner housing for restriction, contamination or damage.
5. Check the resonator for damage.

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

COMPONENTS

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TORQUE : Nm (kg·cm, lb·ft)

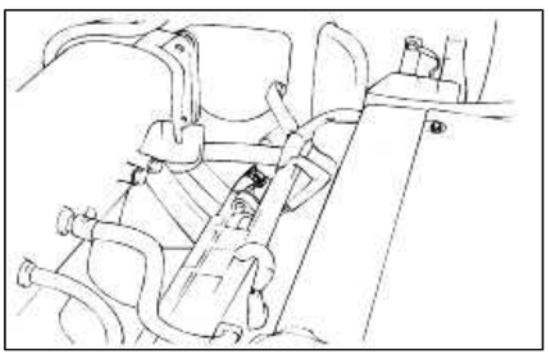
1. Insulator
2. Delivery pipe
3. Fuel pressure regulator
4. Injector
5. Gasket
6. MAP & ATS Senser
7. Intake manifold
8. Throttle body
9. ISA
10. Power transistor

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

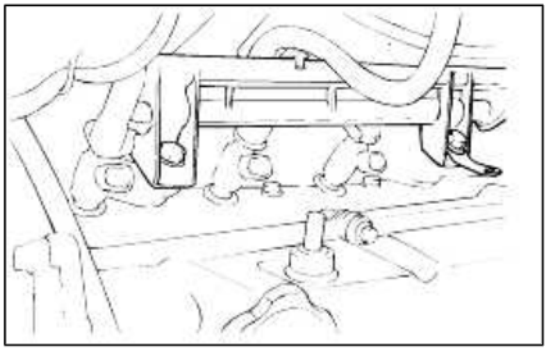
REMOVAL

1. Disconnect the high pressure fuel hose connection after draining pressure in the fuel pipe line to prevent overflow of fuel. (Refer to "Fuel system").



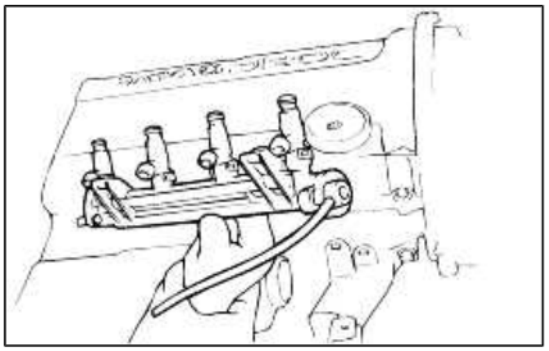
2. Remove the delivery pipe with the fuel injectors and pressure regulator attached.

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



INSTALLATION

1. Make sure that the injector is not dropped, when installing the delivery pipe.



INSPECTION

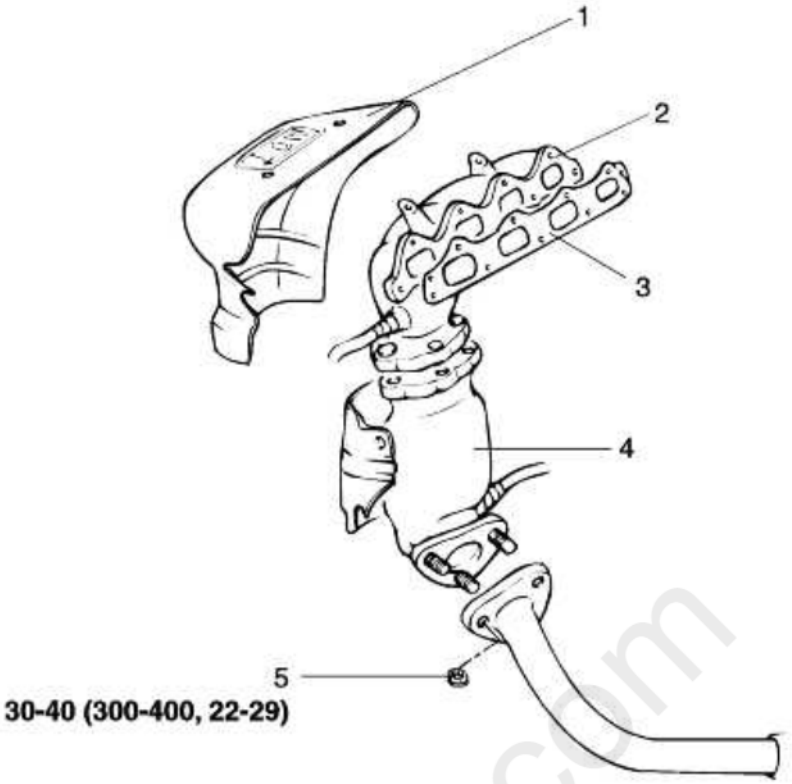
Intake Manifold

1. Check for damage or cracking of any part.
2. Check for obstructions in the vacuum outlet port and the gas passage.

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

COMPONENTS

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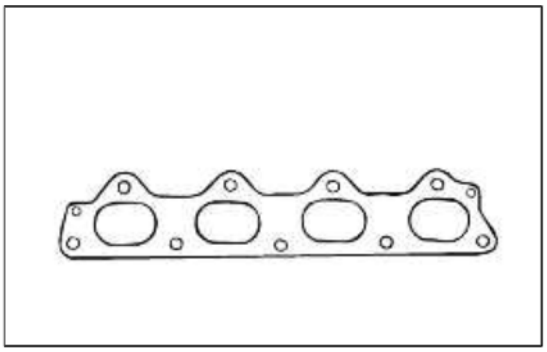
TORQUE : Nm (kg.cm, lb.ft)

1. Heat protector
2. Exhaust manifold
3. Exhaust manifold gasket
4. Front catalytic converter
5. Self-locking nut

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

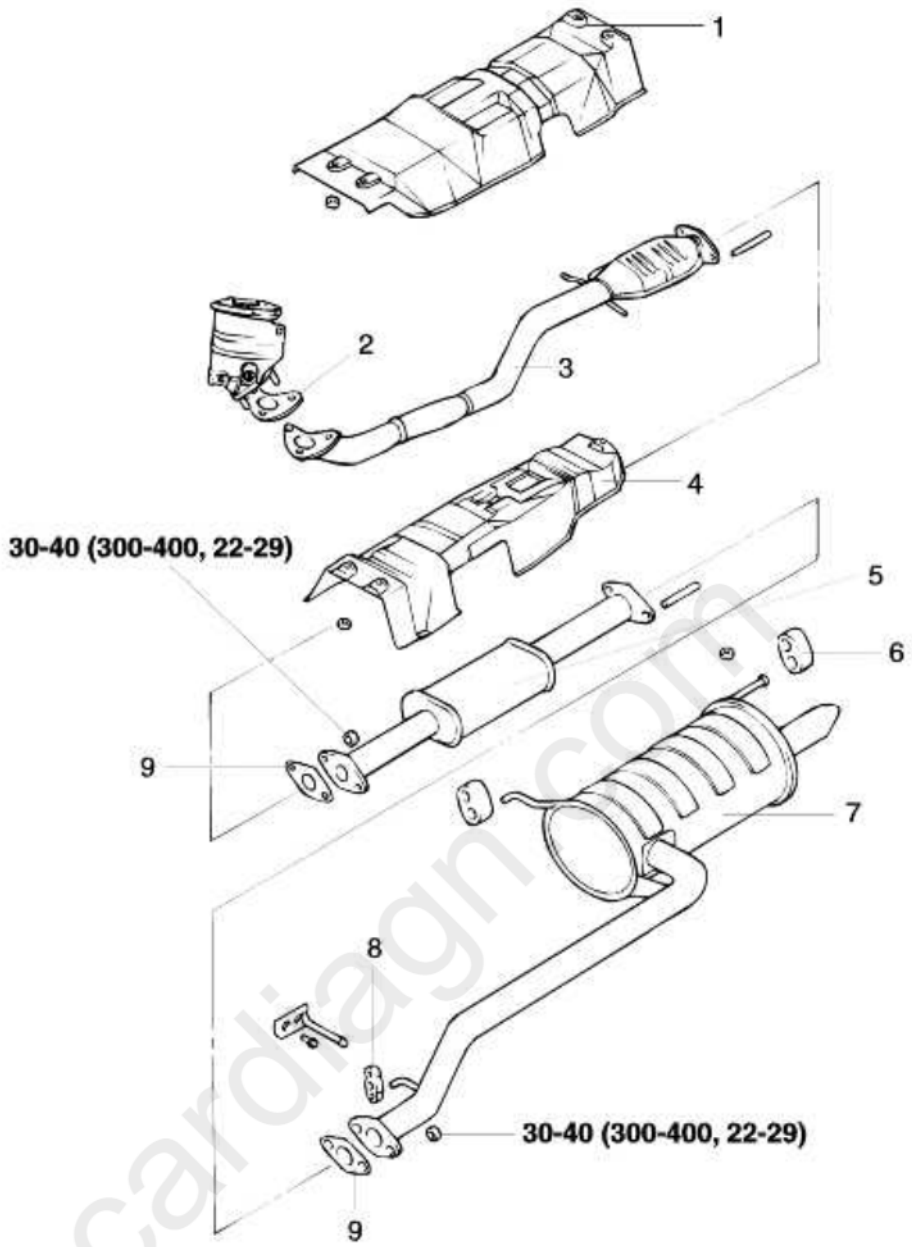
INSPECTION

Check for damage or cracking of any part.
Check for flaking damage of the gasket.



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

COMPONENTS



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

1. Front floor heat protector
2. Gasket
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

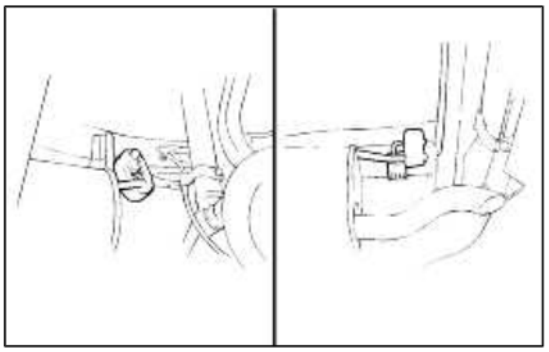
REMOVAL

Main Muffler

CAUTION

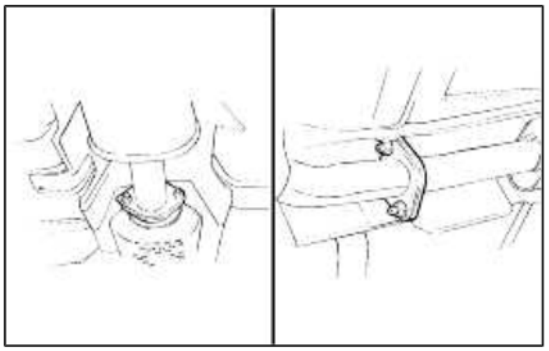
Before removing or inspecting the exhaust system, ensure that the exhaust system is cool enough.

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



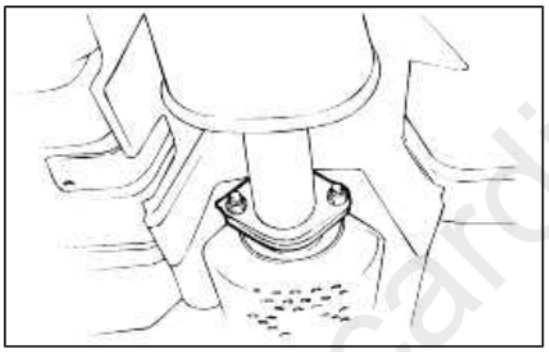
Center Exhaust Pipe

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

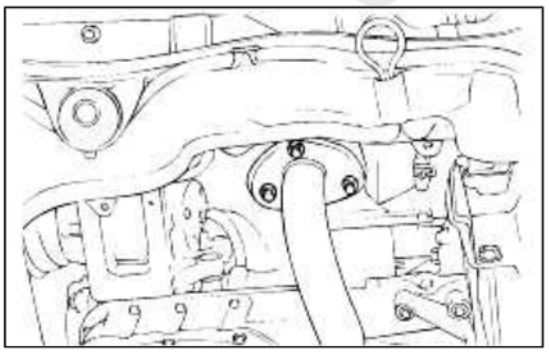


Front Exhaust Pipe (Including rear catalytic converter.)

1. Remove the front exhaust pipe from the center exhaust pipe.

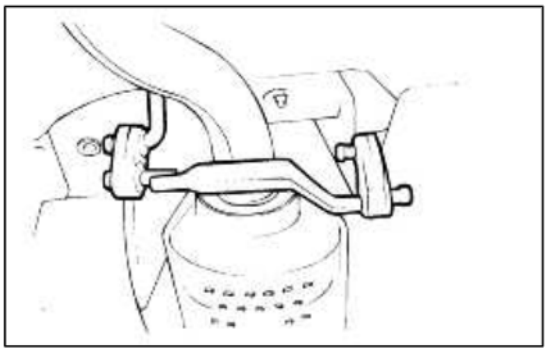


2. Remove the front exhaust pipe from the exhaust manifold (Including front catalytic converter)



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



INSTALLATION

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

INSPECTION

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

Engine Mechanical System > Troubleshooting > P0128

TROUBLESHOOTING PROCEDURE FOR DTC

Diagnostic trouble code No. P0128	**Engine Coolant Thermostat Open 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

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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 P0116, P0117, P0118, 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. • **2.3~2.9V (2.31~2.59 kΩ) @ 20°C (68°F)** • **0.4~1.0V (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.		

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