

Engine Mechanical System [V6 2.7]

GENERAL	EMA -2
CYLINDER BLOCK	EMA -23
MAIN MOVING SYSTEM	EMA -33
COOLING SYSTEM	EMA -48
LUBRICATION SYSTEM	EMA -62
INTAKE AND EXHAUST SYSTEM	EMA -66
CYLINDER HEAD ASSEMBLY	EMA -76
TIMING SYSTEM	EMA -82

GENERAL**GENERAL** EDJA0100**SPECIFICATIONS**

Description.	Specification	Limit
General		
Type	V-type, DOHC	
Number of cylinders	6	
Bore	86.7 mm (3.4133 in.)	
Stroke	75 mm (2.9528 in.)	
Total displacement	2,656 cc	
Compression ratio	10 : 1	
Firing order	1-2-3-4-5-6	
Idle R.P.M	725 ± 100	
Ignition timing at idle	BTDC 12° ± 8°	
Valve timing		
Intake valve		
Opens (BTDC)	6°	
Closes (ABDC)	46	
Exhaust valve		
Opens (BBDC)	44°	
Closes (ATDC)	8°	
Camshaft		
Drive mechanism	Cogged type belt	
Cam height		
Intake	43.95-44.15 mm (1.7303-1.7382 in.)	43.45mm (1.7106 in.)
Exhaust	43.95-44.15 mm (1.7303-1.7382 in.)	43.45 mm (1.7106 in.)
Journal diameter	25.964-25.980 mm (1.0222-1.0228 in.)	25.914 mm (1.0202 in.)
Bearing oil clearance	0.02-0.061 mm (0.0007-0.0024 in.)	0.1 (0.0039 in.)
End play	0.1-0.15 mm (0.0039-0.0059 in.)	
Cylinder head		
Flatness of cylinder head surface	Max. 0.03 mm (0.0012 in.)	0.05 mm (0.0020 in.)
Flatness of manifold mounting surface		
Intake	Max. 0.15 mm (0.0059 in.)	0.15 mm (0.0059 in.)
Exhaust	Max. 0.15 mm (0.0059 in.)	0.15 mm (0.0059 in.)
Valve guide hole diameter		
0.05 (0.002) O.S.	11.05-11.068 mm (0.435-0.436 in.)	

Description.	Specification	Limit
0.25 (0.010) O.S.	11.25-11.268 mm (0.443-0.444 in.)	
0.50 (0.020) O.S.	11.50-11.518 mm (0.453-0.453 in.)	
Intake valve seat ring hole diameter		
0.3 (0.012) O.S.	33.300-33.325 mm (1.311-1.312 in.)	
Exhaust valve seat ring hole diameter		
0.3 (0.012) O.S.	28.600-28.625 mm (1.126-1.127 in.)	
Valve		
Overall length		
Intake	96.1 mm (3.783 in.)	
Exhaust	97.15 mm (3.825 in.)	
Stem diameter		
Intake	5.965-5.98 mm (0.235-0.2354 in.)	
Exhaust	5.95-5.965 mm (0.234-0.235 in.)	
Face angle	45°-45.5°	
Margin		
Intake	1.0 mm (0.0394 in.)	0.5 mm (0.0197 in.)
Exhaust	1.3 mm (0.0512 in.)	0.8 mm (0.0315 in.)
Clearance (stem- to- guide)		
Intake	0.02-0.05 mm (0.0008-0.0020 in.)	0.10 mm (0.0039 in.)
Exhaust	0.035-0.065 mm (0.0014-0.0026 in.)	0.15 mm (0.0059 in.)
Valve spring		
Free height	42.5 mm (1.6732 in.)	41.5 mm (1.6339 in.)
Load	21.9 kg/ 35 mm (48.4 lb/1.3780 in.)	21.9 kg/ 34 mm (48.4 lb/ 1.3386 in.)
Out of squareness	Max 1.5°	Max 3°
Piston		
Diameter (Standard)	86.68-86.71mm (3.413-3.414 in.)	
Clearance (Piston -to - cylinder)	0.01-0.03 mm (0.0004-0.0012 in.)	
Ring groove width		
No.1	1.230-1.250 mm (0.0484-0.0492 in.)	
No.2	1.220-1.240 mm (0.0480-0.0488 in.)	
Oil	2.515-2.535 mm (0.0990-0.0998 in.)	
Piston for service	0.25 mm (0.010 in.), 0.50 mm (0.020 in.)	
Piston ring		
Number of rings per piston	3	
Compression ring	2	

Description.	Specification	Limit
Oil ring	1	
Compression ring type		
No.1	Inner bevel type.	
No.2	Under cut type	
Oil ring type	3-piece type	
Ring end gap		
No.1	0.20-0.35 mm (0.0079-0.0138 in.)	0.8 mm (0.031 in.)
No.2	0.37-0.52 mm (0.0146-0.0205 in.)	0.8 mm (0.031 in.)
Oil ring side rail	0.2-0.7 mm (0.0079-0.0276 in.)	1.0 mm (0.039 in.)
Ring side clearance		
No.1	0.04-0.08 mm (0.0016-0.0031 in.)	0.1 mm (0.004 in.)
No.2	0.03-0.07 mm (0.0012-0.0028 in.)	0.1 mm (0.004 in.)
Rings for service	0.25 mm (0.010 in.), 0.50 mm (0.020 in.)	
Connecting rod		
Piston pin installation force	2,450-12,255 N (250-1,250 kg, 551-2,755 lb)	
Side clearance (big end)	0.10-0.25 mm (0.0039-0.0098 in.)	0.4 mm (0.016 in.)
Bend	0.05 mm or less/100 mm (0.0020 in. or less/3.937 in.)	
Bearing oil clearance	0.018-0.036 mm(0.0007-0.0014 in.)	0.1 mm (0.004 in.)
Crankshaft		
Journal O.D.	61.982-62.000 mm (2.4402-2.4409 in.)	
Pin O.D.	47.982-48.000 mm (1.8891-1.8898 in.)	
Out-of-round of journal and pin	Max. 0.003 mm (0.00012 in.)	
Taper of journal and pin	Max. 0.005 mm (0.00020 in.)	
End play	0.070-0.250 mm (0.0028-0.0098 in.)	0.4 mm (0.016 in.)
Main bearing oil clearance	0.004-0.022 mm (0.0002-0.0009 in.)	0.1 mm (0.004 in.)
Cylinder block		
Cylinder bore	86.7 mm (3.4134 in.)	
Flatness of gasket surface	Max. 0.03 mm (0.0012 in.)	0.05 mm (0.002 in.)
Out-of-round of cylinder bore	Max. 0.02 mm (0.0008 in.)	
Oil pump		
Side clearance		
Body clearance	0.100-0.181 mm (0.0039-0.0071 in.)	
Side clearance	0.040-0.095 mm (0.0016-0.0037 in.)	

Description.	Specification	Limit
Relief spring		
Free length	43.8 mm (1.724 in.)	
Load	4.6 kg/39.3 mm (10.lb/1.547 in.)	
Oil filter		
Type	Cartridge, full flow	
Engine oil pressure	50 kPa (7.3 psi) or more	
	[Conditions: Oil temperature is 75 to 90°C (167 to 194°F)]	
Cooling method	Engine coolant cooling, forced circulation with electric fan	
Cooling system quantity	7.0 lit (7.4 U.S.qts., 6.1 Imp.qts.) [For V6]	
Thermostat		
Type	Wax pellet type with jiggle valve	
Normal opening temperature	82±2.0°C (179.6±35.6°F)	
Opening temperature range	80°C-84°C (176-183.2°F)	
Wide open temperature	95°C (203°F)	
Radiator cap		
Main valve opening pressure	107.9±14.7 kPa (1.1±0.15 kg/cm ² , 15.64±2.13 psi)	
Main valve closing pressure	83.4 kPa (0.85 kg/ cm ² , 12.1 psi)	
Vacuum valve opening pressure	-6.86 kPa (-0.07 kg/ cm ² , -1.00 psi)	
Air cleaner		
Type	Dry	
Element	Paper type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	

SERVICE STANDARD

Standard value

Coolant concentration

Tropical areas

40%

Other areas

50%

COOLANT

Engine coolant

Ethylene glycol base for aluminum radiator

SEALANT

Engine coolant temperature sensor

LOCTITE 262 or equivalent, Three bond No. 1324 or equivalent.

Oil pressure switch

3M ATD No. 8660 or Three bond No. 1141E

PCV valve

LOCTITE 242 or equivalent

TIGHTENING TORQUE

EDJA0200

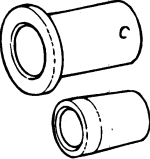
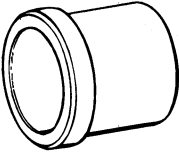
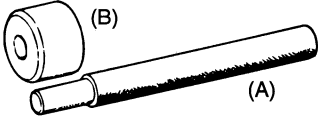
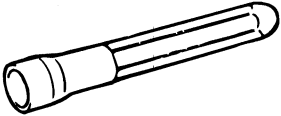
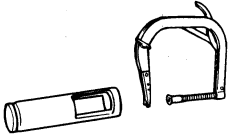
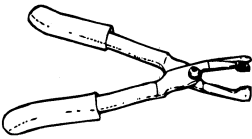
Item	Nm	kg.cm	Lb.ft
Camshaft sprocket bolt	90-110	900-1, 100	65-80
Cylinder head cover bolt	5-6	50-60	3.6-4.3
Main bearing cap bolt			
M10	14-16	140-160	10-12
M7	10-12	100-120	7-9
Connecting rod bolt	16-20+(90°-94°)	160-200+(90°-94°)	12-15+(90°-94°)
Cylinder head bolt (Cold engine)	25+(58°-62°)+(43°-47°)	250+(58°-62°)+(43°-47°)	18+(58°-62°)+(43°-47°)
Oil pan drain plug	35-45	350-450	25-33
Lower oil pan bolt	10-12	100-120	7-9
Upper oil pan bolt			
[10x38 mm (0.937x1.4961 in.)]	30-42	300-420	22-30
[8x22 mm (0.3150x0.866a in.)]	19-28	190-280	14-20
[171.5 mm (6.7519 in.)]	5-7	50-70	4-5
[152.5 mm (6.7520 in.)]	5-7	50-70	4-5
Oil screen bolt	15-22	150-220	11-16
Oil pump case bolt	12-15	120-150	9-11
Oil relief valve plug	40-50	400-500	29-36
Oil pressure switch	15-22	150-220	11-16
Oil pump cover screw	8-12	80-120	6-9
Oil filter	12-16	120-160	9-12
Fly wheel bolt	73-77	730-770	53-56
Drive plate and adaptor plate bolt	73-77	730-770	53-56
Air cleaner body installation bolt	8-12	80-120	6-9
Surge tank stay	15-20	150-200	11-14
Air intake surge tank to intake manifold (bolt)	15-20	150-200	11-14
Air intake surge tank to intake manifold (nut)	15-20	150-200	11-14
Intake manifold to cylinder head	19-21	190-210	14-15
Heat protector to exhaust manifold	12-15	120-150	9-11
Exhaust manifold to cylinder head(Self-locking nut)	25-30	250-300	18-22
Oil level gauge guide to engine	12-15	120-150	9-11
Water outlet fitting bolt	17-20	170-200	12-14
Power steering oil pump bracket to cylinder head	17-26	170-260	12-19
Power steering oil pump to bracket	17-26	170-260	12-19

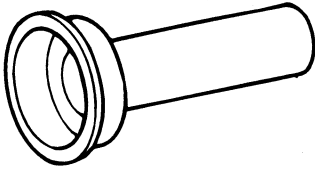
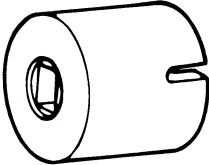
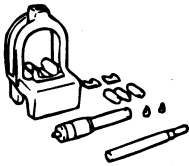
Crank position sensor wheel screw	5-6	50-60	3.6-4.3
Engine mounting insulator bolt	40-55	400-550	29-40
Engine mounting bracket nut	60-80	600-800	43-58
Engine mounting bracket bolt	60-80	600-800	43-58
Engine support bracket stud	30-40	300-400	22-29
Front roll stopper bracket to sub cross member bolt	40-55	400-550	29-40
Front roll stopper insulator bolt and nut	50-65	500-650	36-47
Rear roll stopper bracket to cross member bolt	40-55	400-550	29-40
Rear roll stopper insulator bolt and nut	50-65	600-650	36-47
Transaxle mounting bracket bolt	40-55	400-550	29-40
Transaxle mounting insulator bolt	90-110	900-1,100	65-80
Fuel hose clamp to rear cylinder head assembly	12-15	120-150	9-11
Transaxle mounting plate	10-12	100-120	7-9
Rear plate	10-12	100-120	7-9
Oil seal case	10-12	100-120	7-9
Crankshaft pulley bolt	180-190	1,800-1,900	130-138
Timing belt cover bolt	10-12	100-120	7-9
Engine hanger bracket to engine	20-27	200-270	14-20
Alternator mounting bracket to engine	20-30	200-300	14-22
Alternator mounting nut (Engine front case side)	20-30	200-300	14-22
Alternator mounting bolt (Alternator mounting bracket side)	20-30	200-300	14-22
Starter to transmission (Nut)	20-30	200-300	14-22
Starter to transmission (Bolt)	27-34	270-340	20-25
Drive belt pulley bolt	35-55	350-550	25-40
Drive belt tensioner bolt	20-27	200-270	14-20
Engine coolant pump to cylinder block bolt (Head mark "7" bolt)	15-22	150-220	11-16
Engine coolant temperature sensor	20-40	200-400	14-29
Engine coolant inlet fitting attaching bolt	17-20	170-200	12-14
Throttle body to surge tank bolt	15-20	150-200	11-14
Oxygen sensor to exhaust manifold	40-50	400-500	29-36
Front exhaust pipe to exhaust manifold nut	30-40	300-400	22-29
Front exhaust pipe to catalytic converter bolt	40-60	400-600	29-43
Catalytic converter to center exhaust pipe nut	30-40	300-400	22-29

Center exhaust pipe to main muffler nut	30-40	300-400	22-29
Main muffler hanger support bracket bolt	10-15	100-150	7-11
Delivery pipe installation bolt	10-15	100-150	7-11
Timing belt tensioner pulley bolt	43-55	430-550	31-40
Timing belt idler pulley bolt	50-60	500-600	36-43
Timing belt tensioner arm Fixed bolt	35-55	350-550	25-40
Auto tensioner fixed bolt	20-27	200-270	14-20
Accelerator cable bracket	4-6	40-60	3-4
Spark plug	20-30	200-300	14-22

SPECIAL TOOLS

EDHA0300

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-33000)	 <p style="text-align: right;">HFR20A01</p>	Installation of the crankshaft front oil seal
Camshaft oil seal installer (09221-21000)	 <p style="text-align: right;">HFR20A02</p>	Installation of the camshaft oil seal
Valve guide installer (09222-22000 (B)) (09221-29000 (A))	 <p style="text-align: right;">KFW3003A</p>	Removal and installation of the valve guide
Valve stem oil seal installer (09222-22001)	 <p style="text-align: right;">KFW3002A</p>	Installation of the valve stem oil seal
Valve spring compressor (09222-28000) (09222-28100)	 <p style="text-align: right;">J20-008F</p>	Removal and installation of the intake or exhaust valve
Valve stem oil seal remover (09222-29000)	 <p style="text-align: right;">KFW3009A</p>	Removal of the valve stem oil seal

Tool (Number and name)	Illustration	Use
Crankshaft rear oil seal installer (09231-33000)	 <p style="text-align: right;">KFW3004A</p>	Installation of the crankshaft rear oil seal
Crankshaft wrench (Q9231-33100)	 <p style="text-align: right;">KFW3008A</p>	Used if the crankshaft needs to be rotated to attach the timing belt, etc.
Piston pin remover and installer (09234-33001)	 <p style="text-align: right;">HFR20A10</p>	Removal and installation of the piston pin

TROUBLESHOOTING

EDHA0400

Symptom	Probable cause	Remedy
Crankshaft bearing knock	Worn main bearing Seized bearing Bent crankshaft Excessive crankshaft end play	Replace Replace Replace Replace thrust bearing
Knock piston and connecting rod knock	Worn bearing Seized bearing Worn piston pin Worn piston in cylinder Broken piston ring Improper connecting rod alignment	Replace Replace Replace piston and pin or connecting rod Recondition cylinder Repair or replace Replace
Noisy valves	Faulty auto-lash adjuster Thin or diluted engine oil (low oil pressure) Worn or damaged valve stem or valve guide	Replace Change Replace
Excessively worn cylinder and piston	Shortage of engine oil Dirty engine oil Poor quality of engine oil Improperly assembled piston and connecting rod Improper piston ring end clearance Dirty air cleaner	Add or replace Replace Use proper oil Repair or replace Replace Clean air cleaner assembly and replace the air filter
Connecting rod and main bearing noise	Insufficient oil supply Thin or diluted engine oil Excessive bearing clearance	Check engine oil level Change and find out cause Replace
Damaged crankshaft bearing	Shortage of engine oil Low oil pressure Poor quality of engine oil Worn or out-of-round of crankshaft journal Restricted oil passage in crankshaft Worn bearing Faulty oil pump Bearing improperly installed Non-concentric crankshaft or bearing	Add or replace Adjust or repair Use proper engine oil Repair or replace Clean Replace bearing and check engine oil and lubrication system Repair or replace Repair or replace Replace

Symptom	Probable cause	Remedy
Timing belt noise	Incorrect belt tension	Adjust belt tension
Low compression	Damaged cylinder head gasket Worn or damaged piston rings Worn piston or cylinder Worn or damaged valve seat	Replace gasket Replace rings Repair or replace piston and/or cylinder block Repair or replace valve and/or seat ring
Oil pressure drop	Low engine oil level Faulty oil pressure switch Clogged oil filter Worn oil pump gears or cover Thin or diluted engine oil Oil relief valve stuck (open) Excessive bearing clearance	Check engine oil level Replace Replace Replace Change and find out cause Repair Replace
High oil pressure	Oil relief valve stuck (closed)	Repair or replace
Excessive engine rolling and vibration	Misfire Loose engine roll stopper (front, rear) Loose transaxle mount bracket Loose engine mount bracket Loose center member Broken transaxle mount insulator Broken engine mount insulator Broken engine roll stopper insulator	Correct Re-tighten Re-tighten Re-tighten Re-tighten Replace Replace Replace or replace
Low coolant level	Leakage of coolant Damaged radiator core joint Corroded or cracked hoses (Radiator hose, heater hose, etc) Faulty radiator cap valve or setting of spring Faulty thermostat Faulty engine coolant pump	Correct Replace Replace Replace Replace Replace
Clogged radiator	Foreign material in coolant	Replace

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

CHECKING ENGINE OIL EDHA0500

1. Position a vehicle on a level surface.
2. Turn off the engine.

NOTE

In the case of a vehicle that has not been used for a prolonged period, run the engine for several minutes.

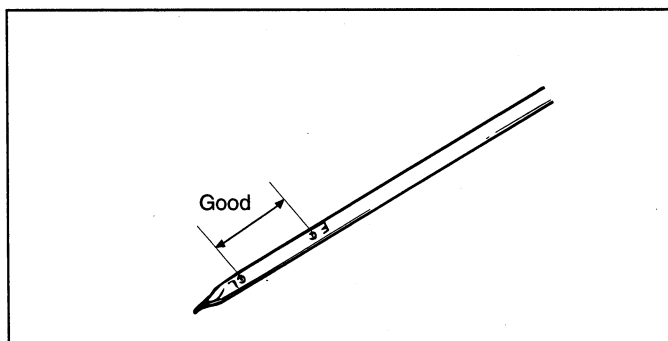
Turn off the engine and wait for 5 minutes at least, then check the oil level.

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

NOTE

When refilling, use the proper grade of engine oil.

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



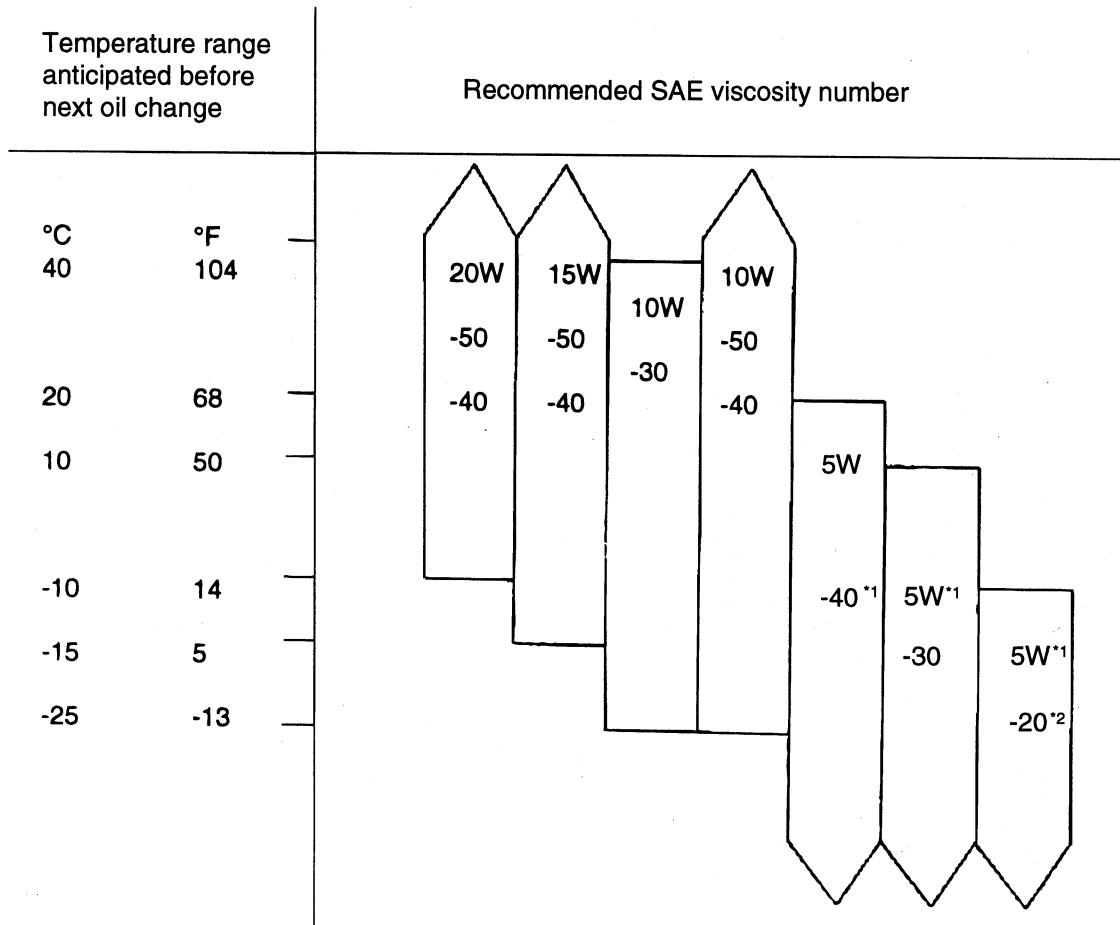
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SELECTION OF ENGINE OIL

EDJA0600

Recommended API classification: SD OR ABOVE SE OR ABOVE [For EC.]

Recommended SAE viscosity grades:



*1 Restricted by driving condition and dealing area.

*2 Not recommended for sustained high speed vehicle operation

EDA9990B

NOTE

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

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

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

CHANGE ENGINE OIL EDJA0700

1. Run the engine until it reaches normal operating temperature.
2. Turn off the engine.
3. Remove the oil filler cap and oil filter and then drain plug.

Drain the engine oil.

4. Tighten the drain plug to the specified torque.

Tightening torque

Oil pan drain plug : 35-45 Nm (350-450 kg.cm, 25-33 lb.ft)

NOTE

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

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

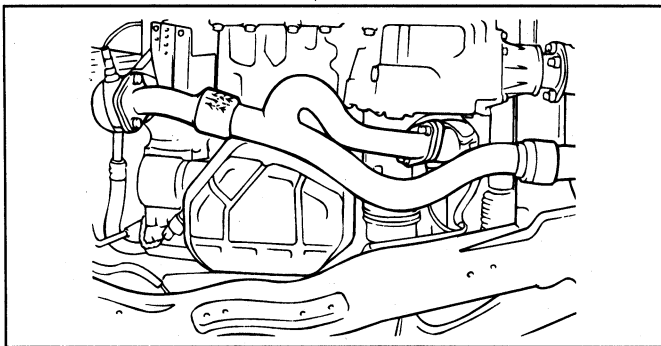
Drain and Refill

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

NOTE

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

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

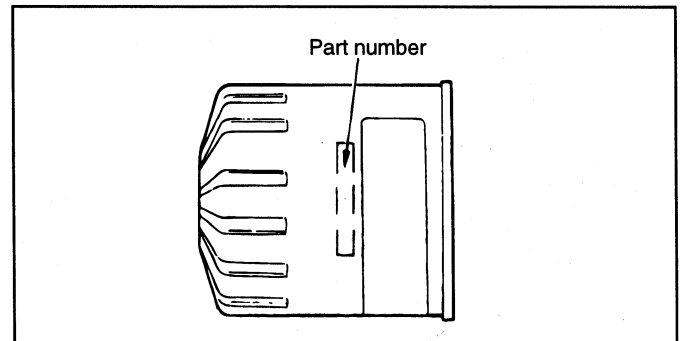


EDJA070A

REPLACEMENT OIL FILTER EDJA0800**FILTER SELECTION**

All Hyundai Motor Company engines are equipped with a high quality, disposable oil filter. This filter is recommended as a replacement filter for all vehicles. The quality of after market replacement filters is various considerably.

High quality of replacement filters should be used to assure the most efficient service. Make sure that the rubber gasket from the old oil filter is completely removed from the contact surface on the engine block before installing a new filter.



ECA9970A

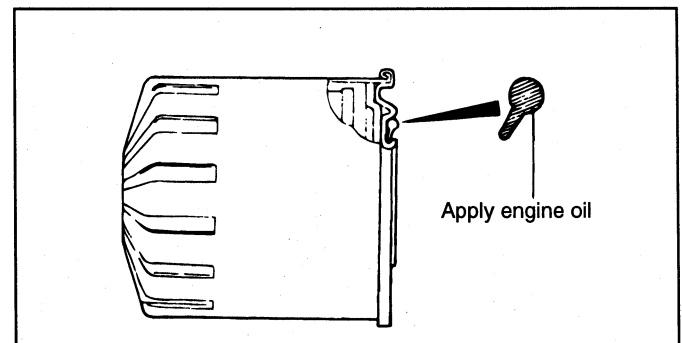
PROCEDURE FOR REPLACING OIL FILTER

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

Tightening torque

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

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



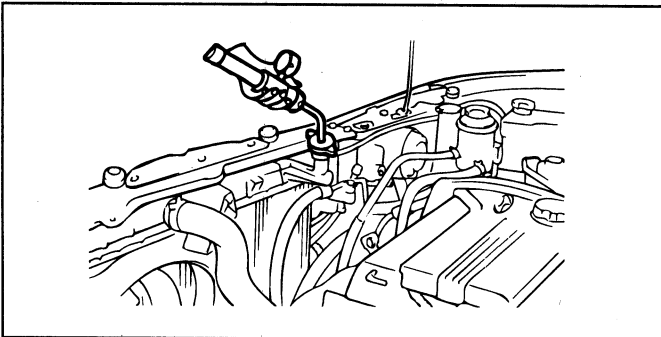
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CHECKING COOLANT LEAK**CHECK** EDHA0900

1. Loosen the radiator cap.
2. Confirm that the coolant level is up to the filler neck.
3. Install a radiator cap tester to the radiator filler neck and apply 150 KPa (21psi, 1.53 kg/cm²) pressure. Hold for two minutes, then check for leakage from the radiator, hoses or connections.

CAUTION

1. Radiator coolant may be extremely hot. Do not open the system while hot, or scalding engine coolant could gush out, causing personal injury. Allow the vehicle to cool before servicing this system.
2. When the tester is removed, be careful not to spill any coolant from it.
3. Be sure to clean away completely any coolant from the area.
4. Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.
4. If there is leakage, repair or replace with the appropriate part.



EDJA100A

RADIATOR CAP PRESSURE TEST EDHA1000

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

 Main valve opening pressure :

 $107.9 \pm 14.7 \text{ kPa (} 1.1 \pm 0.15 \text{ kg/cm}^2 \text{ 15.64} \pm 2.13 \text{ psi)}$

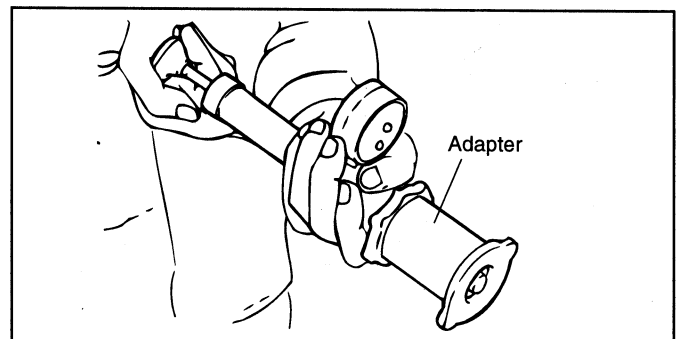
Main valve closing pressure :

 $83.4 \text{ kPa (} 0.85 \text{ kg/cm}^2 \text{, 12.1 psi)}$

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

NOTE

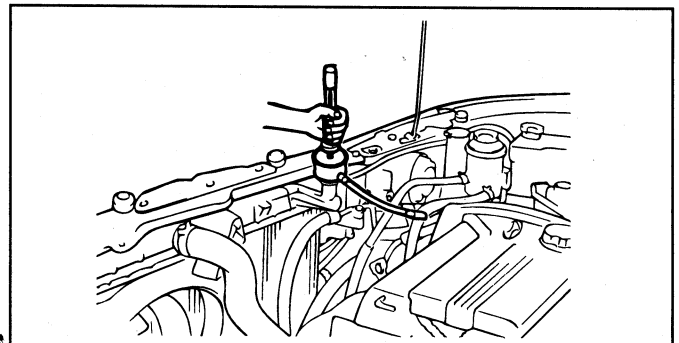
Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an incorrect reading.



ECA9090A

SPECIFIC GRAVITY TEST EDJA1100

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



EDJA110A

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)

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

CAUTION

- If the concentration of the coolant is below 30%, its anti-corrosion property will be adversely affected.

RECOMMENDED COOLANT

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

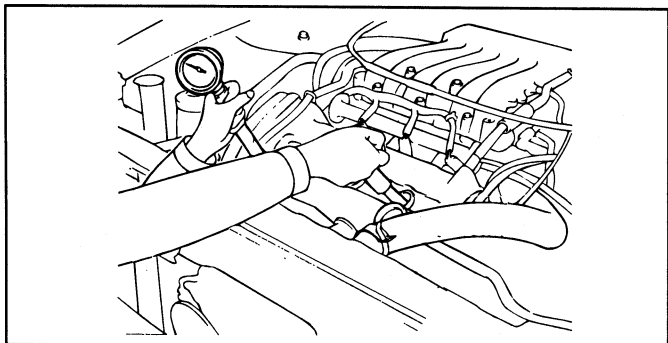
CHECKING COMPRESSION PRESSURE EDHA1200

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

8. Crank the engine and read the gauge.

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

Limit : 1,050kpa(10.7kg/cm² , 149psi)



EDHA015A

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

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

10. If a cylinder's compression or pressure differential is outside the specification, add a small amount of oil through the spark plug hole, and repeat steps 6 to 9.

- 1) If the addition of oil causes the compression to rise, it is possible that the piston ring is be worn.
- 2) If the compression remains the same, valve seizure, poor valve seating or a compression leak in the cylinder head gasket are all possible causes.

Tightening torque

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

TIGHTENING CYLINDER HEAD

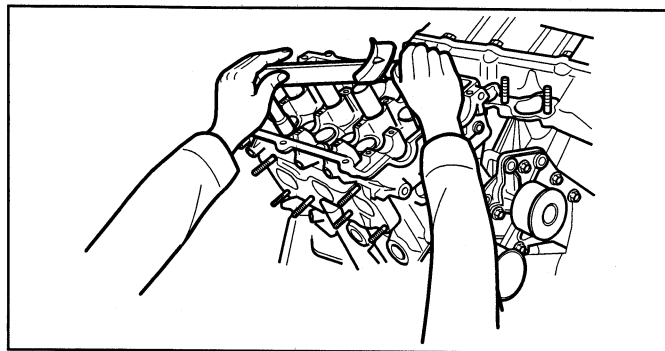
BOLTS EDHA1300

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

Tightening torque

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

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

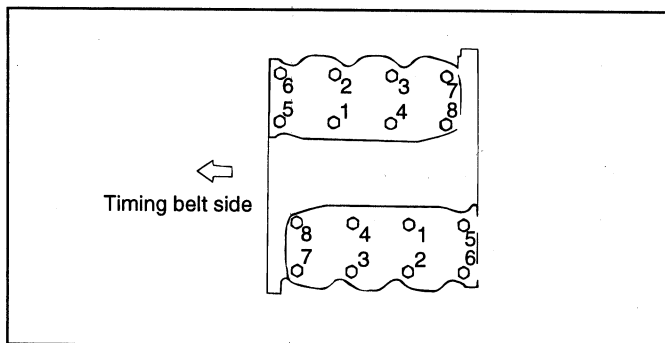


KFW3010A

2. Use the torque - angle method to torque the head bolts.
3. Be sure to follow the specific torque sequence as shown in the illustration.

NOTE

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



EDA9060B

ADJUSTING VALVE CLEARANCE EDHA1400

As the intake and exhaust valves are equipped with hydraulic lash adjusters, there is no need to adjust the valve clearance. The proper function of the hydraulic lash mechanism may be determined by checking for tappet noise. When there is a tappet noise or any unusual noise, check the hydraulic lash adjuster by removing and bleeding or replacing it.

ADJUSTING DRIVE BELT AND TENSIONER EDHA1500

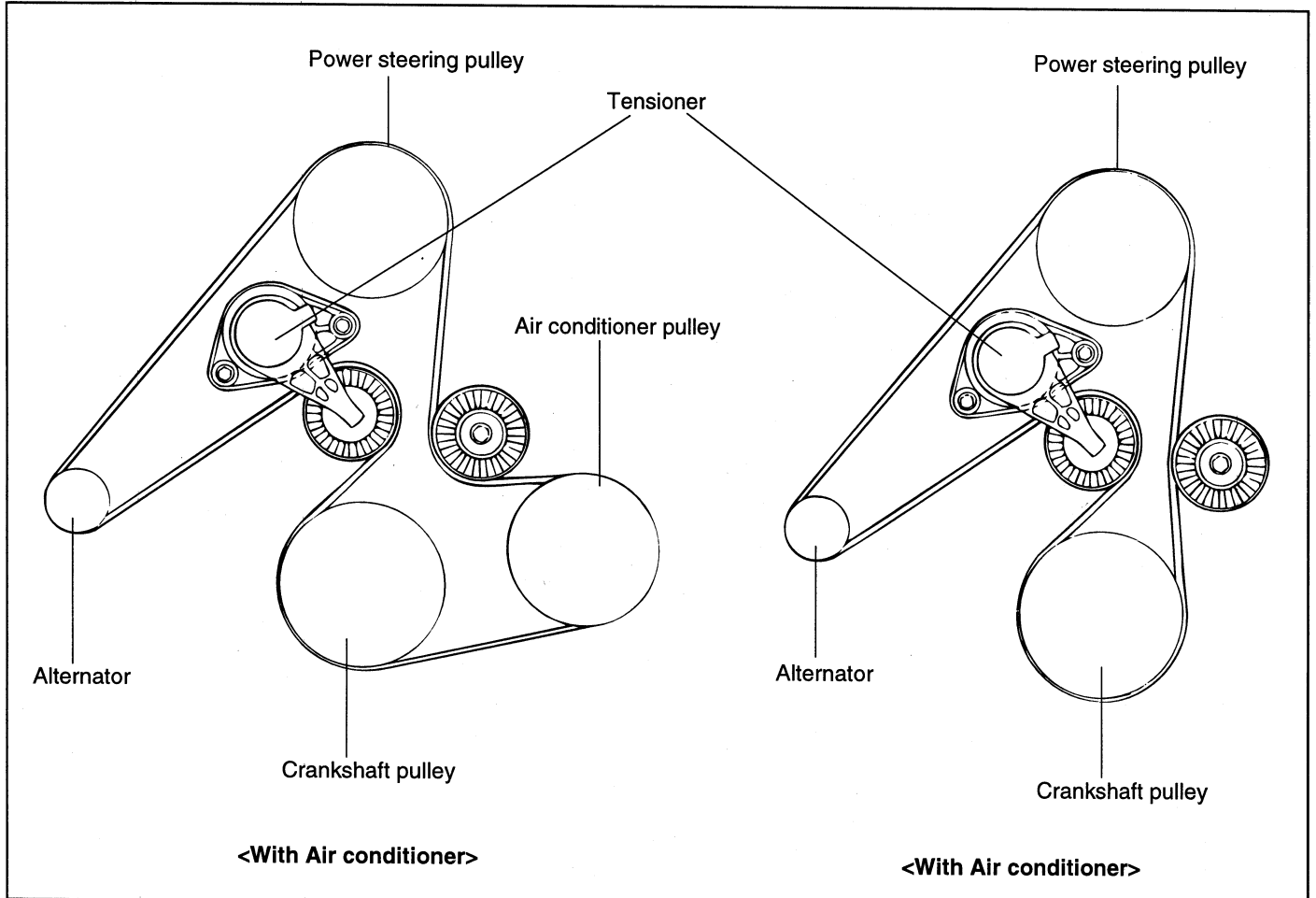
1. Hang the belt on the pulley of the tensioner and install the tensioner.

(If the tensioner is already installed, loosen its mounting bolts to allow belt installation.)

Tightening torque

Tensioner assembly bolt ;

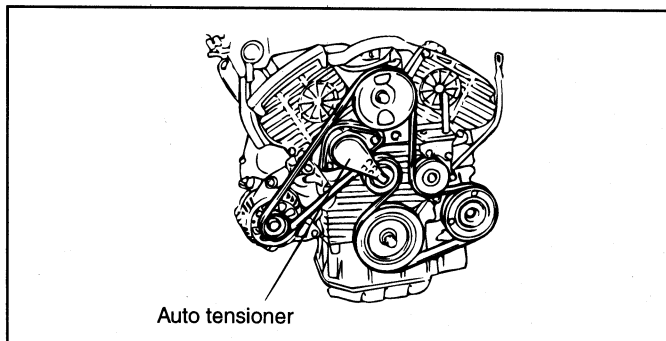
20-27 Nm (200-270 kg.cm, 14-20 lb.ft)



EDA9090A

2. Install the belt in the following order.

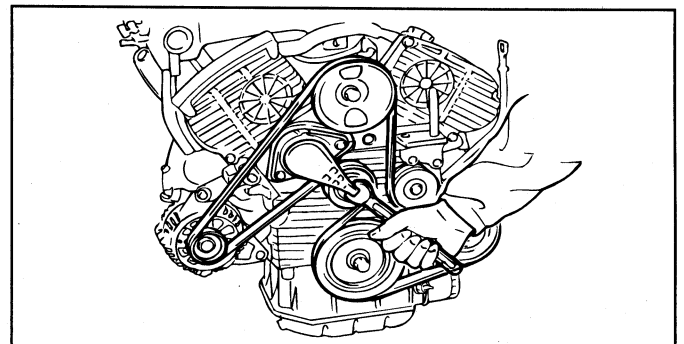
[Alternator ⇒ Power steering ⇒ Crankshaft pulley ⇒ Air conditioner pulley.]



Auto tensioner

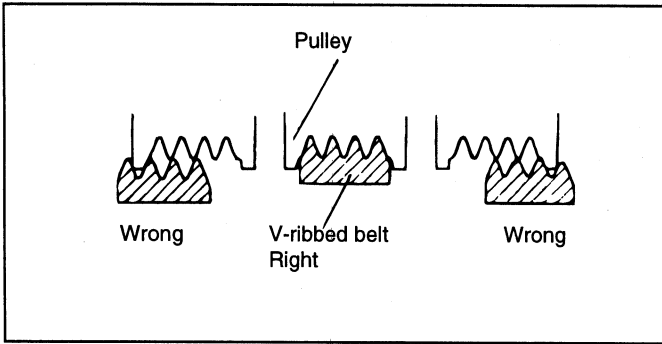
EDA9031A

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



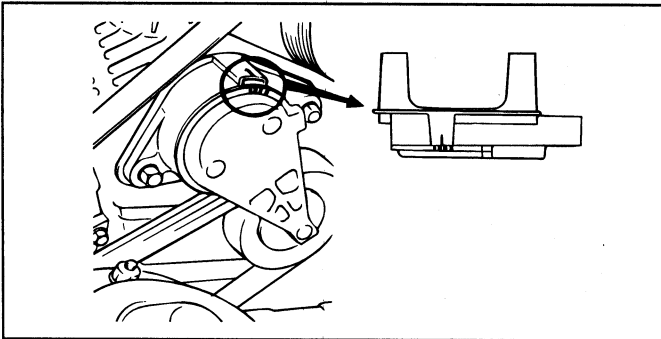
EDA9031B

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



EOYR0020

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

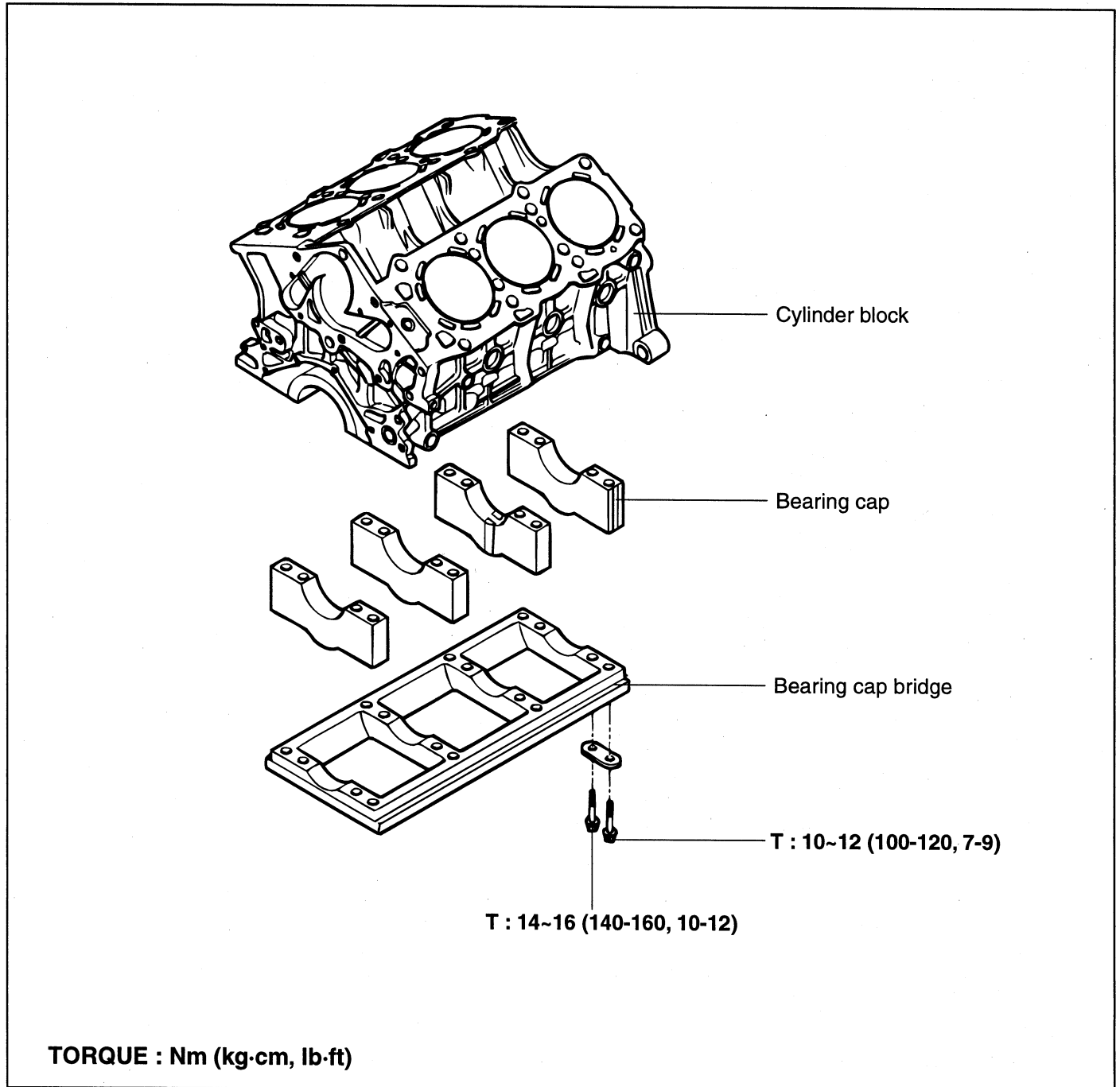


EDA9200A

CYLINDER BLOCK

CYLINDER BLOCK

CYLINDER BLOCK EDHA2000



TORQUE : Nm (kg·cm, lb·ft)

DISASSEMBLY EDHA2200

Remove the timing belt, cylinder head assembly, drive plate, transaxle mounting plate, oil pan and oil pump case.

For further details, refer to the appropriate section.

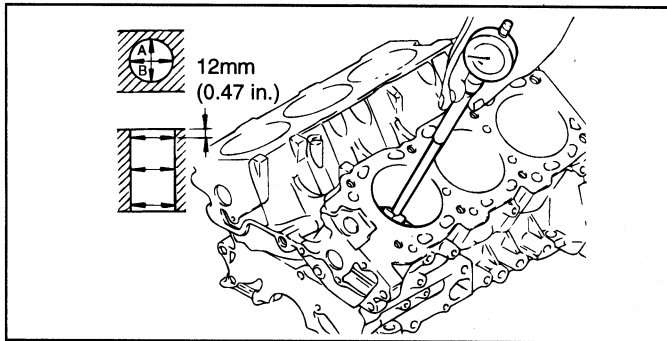
INSPECTION EDHA2300**CYLINDER BLOCK**

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

Level 1 : No.1 piston ring position at TDC

Level 2: Center of cylinder

Level 3 : Bottom of cylinder



EDA9460A

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

Standard value

Cylinder bore : 86.7 mm (3.41 in.)

Out-of-round and taper of cylinder bore :

Max. 0.02 mm (0.0008 in.)

4. If a ridge exists at the top of the cylinder, cut it off with a ridge reamer.

5. Oversize pistons are available in two sizes.

Piston service size and mark mm (in.)

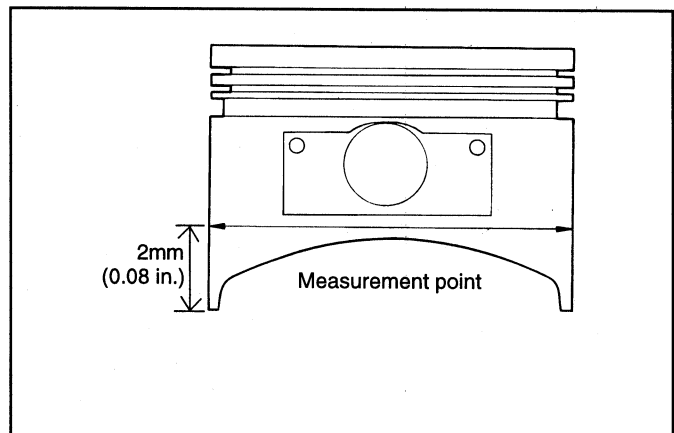
0.25 (0.010) O.S : 0.25

0.50 (0.020) O.S : 0.50

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

Piston-to-cylinder clearance :

0.01-0.03 mm (0.0004-0.0012 in.)



ECA9451A

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

Standard value

Flatness of gasket surface :

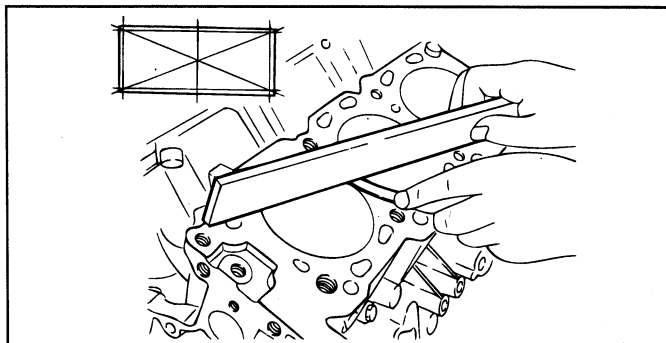
Max. 0.03 mm (0.0012 in.)

Service limit

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

CAUTION

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



EDA9460B

BORING CYLINDER EDHA2400

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

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

NOTE

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

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

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

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

CAUTION

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

- 5.hone the cylinders, finishing them to the proper dimension (piston outside diameter + gap with cylinder).

6. Check the clearance between the piston and cylinder.

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

NOTE

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

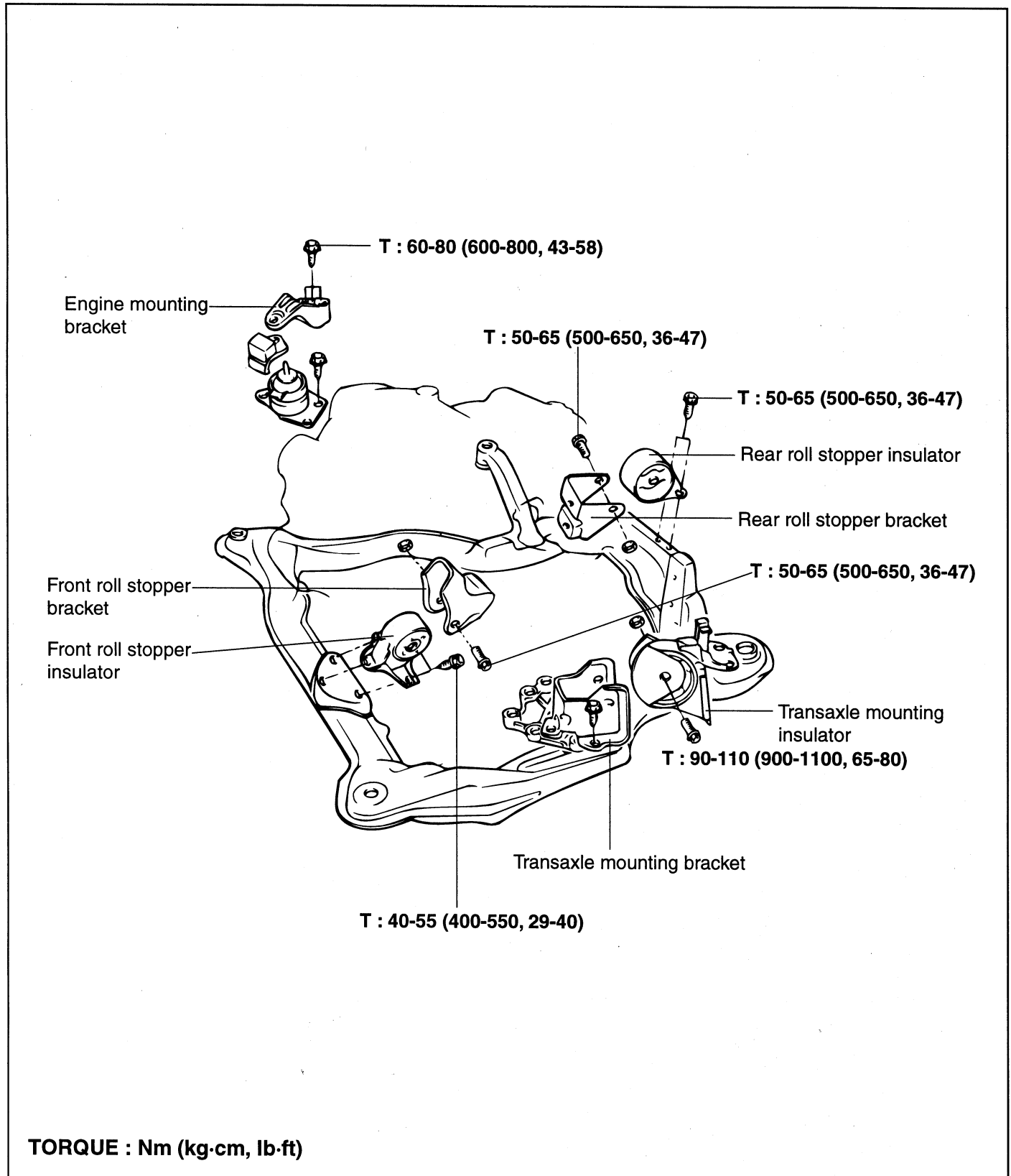
REASSEMBLY EDHA2500

Install the following parts by referring to their respective sections.

1. Crankshaft
2. Drive plate
3. Piston
4. Cylinder head
5. Timing belt
6. Oil pump case

ENGINE MOUNTS

ENGINE MOUNTING EDJA2500

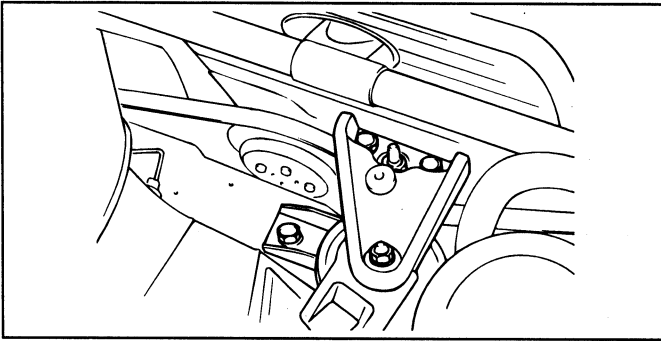


REMOVAL EDJA2600

Attach a cable or chain from the engine hooks and lift so that there is no pressure on the motor mounts.

ENGINE MOUNTING

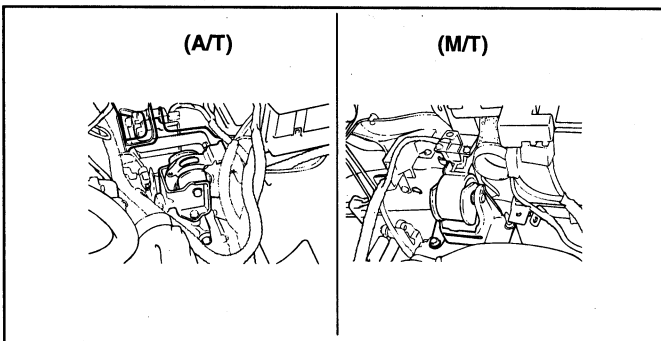
1. Remove the engine mount insulator bolts.
2. Remove the engine mount bracket from the engine.



EDJA310A

TRANSAXLE MOUNTING

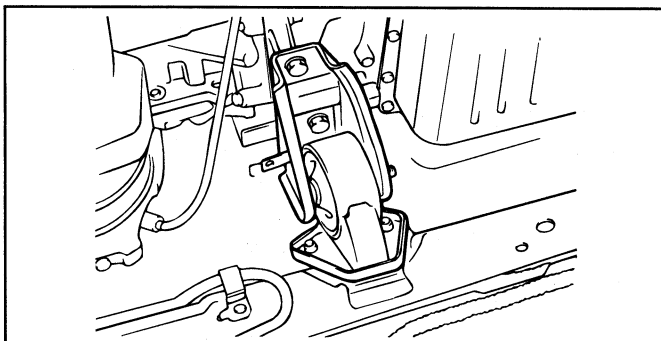
1. Remove the transaxle mounting bolt.
2. Remove the transaxle bracket.



EDJB000A

FRONT ROLL STOPPER

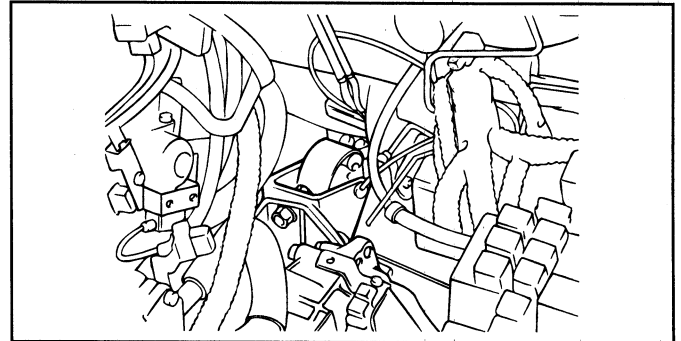
1. Remove the front roll stopper upper and lower bolts.
2. Remove the front roll rod assembly.



EDJA310C

REAR ROLL STOPPER

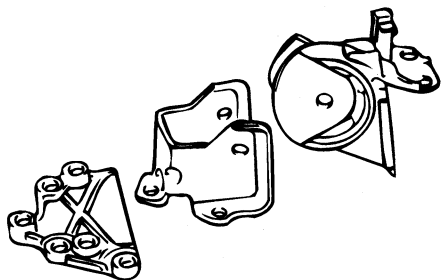
1. Remove the bolt from the rear roll stopper.
2. Remove the rear roll stopper from the sub-frame.



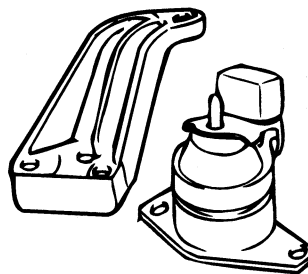
ECHA005B

INSPECTION ITEMS EDHA3200

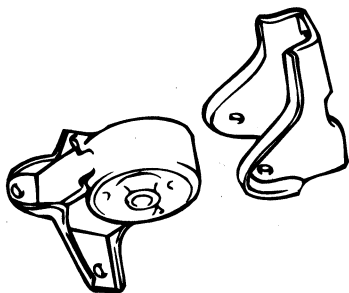
Transaxle mount



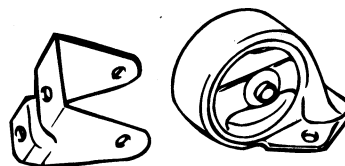
Engine mount



Front roll stopper assembly



Rear roll stopper assembly



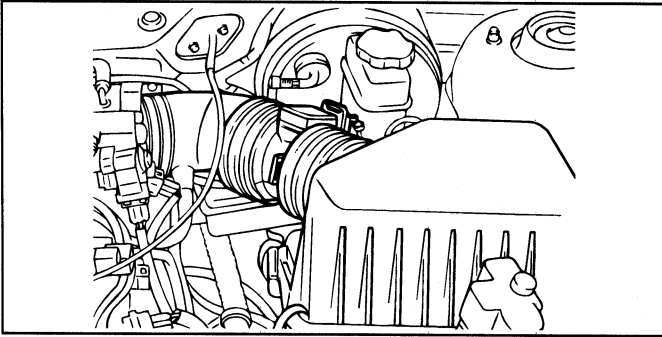
ENGINE AND TRANSAXLE ASSEMBLY

ENGINE AND TRANSAXLE
ASSEMBLY

EDJA2800

REMOVAL

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



EDJAB60A

3. Disconnect the connectors from the engine harness.
 1. Alternator, starter
 2. Power steering switch connector, oil pressure gauge connector
 3. TPS connector
 4. Back up lamp switch connector
 5. A/T solenoid, inhibitor switch connector
 6. Coolant temperature
 7. Ignition coils, power TR connector
 8. Idle speed control valve (ISC) connector
 9. MAP and ATS connectors
 10. Oxygen sensor connector etc.
4. Drain the engine coolant.
5. Disconnect the transaxle oil cooler hoses (A/T).

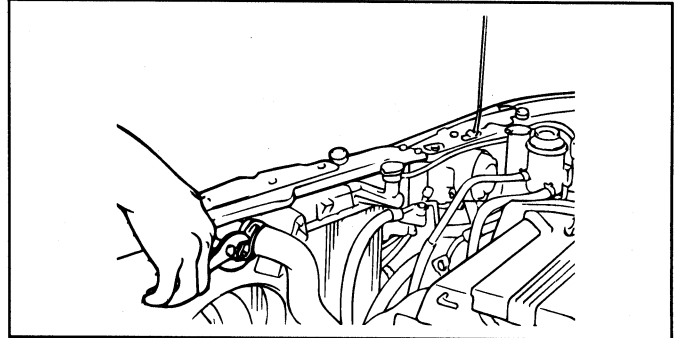
NOTE

When disconnecting hoses, make identification marks to avoid making any mistake when installing them again.

CAUTION

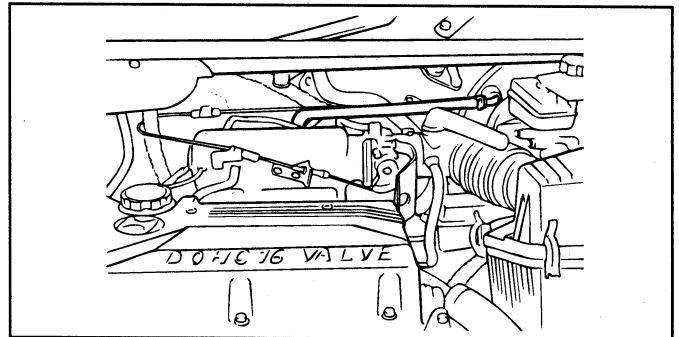
Be careful not to spill any of the oil or fluid from the hoses. Plug the openings to prevent the entry of foreign material.

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



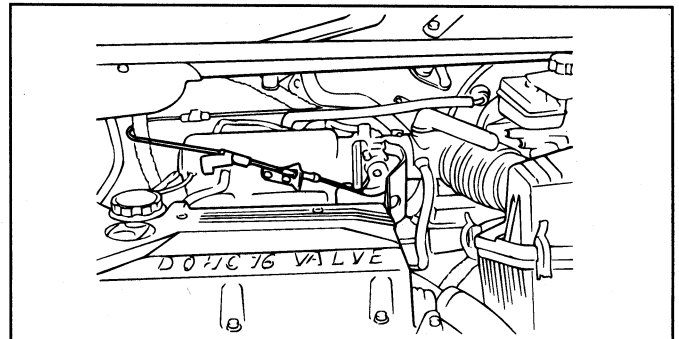
EDJA330A

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



EDHA006B

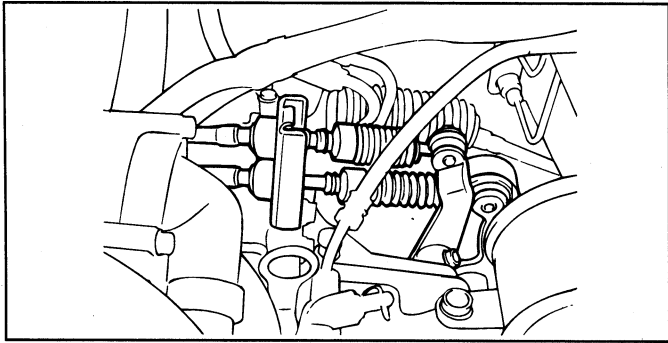
9. Disconnect the heater hoses (inlet and outlet) on the engine side.
10. Disconnect the accelerator cable and cruise control cable at the engine side.



EDHA006E

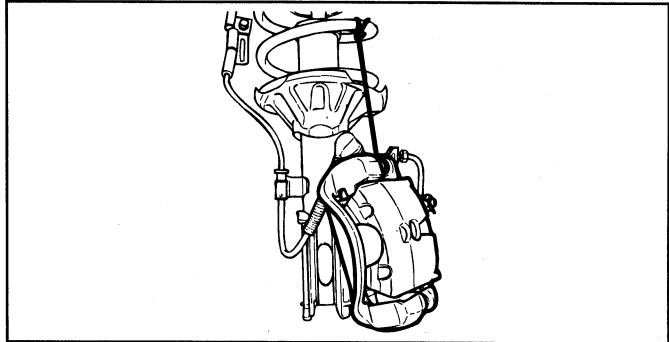
11. Using a special tool, remove the main fuel line (supply and return) at the delivery pipe.
12. Disconnect the speedometer cable from the transaxle.

13. Disconnect the clutch cable or control cable from the transaxle.



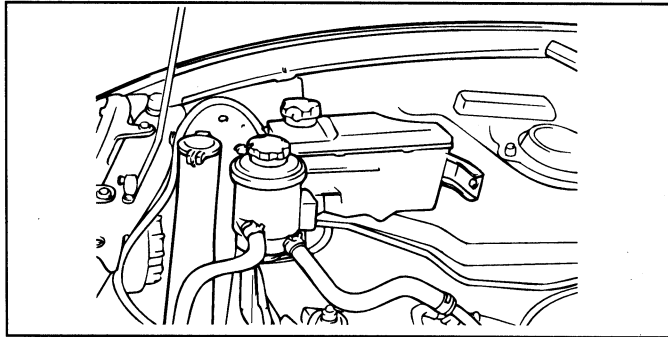
EDHA006F

17. Remove the calliper assembly from the knuckle. Using wire, hang it from the suspension.



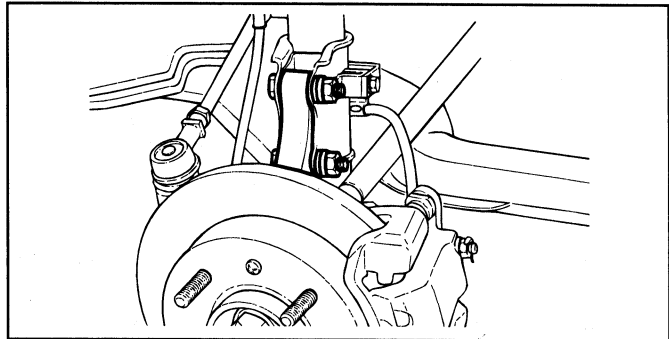
ECHA004J

14. Remove the power steering hose from the oil pump.



EDJA330B

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

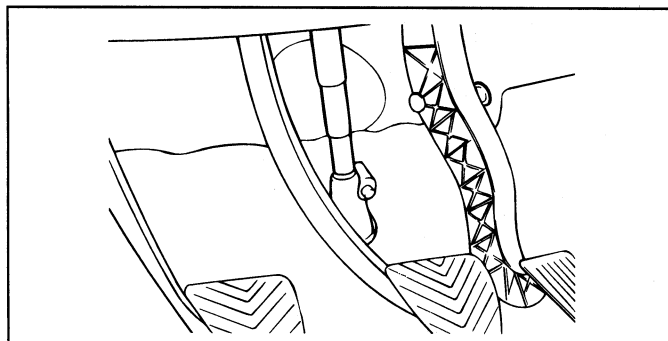


ECHA004K

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

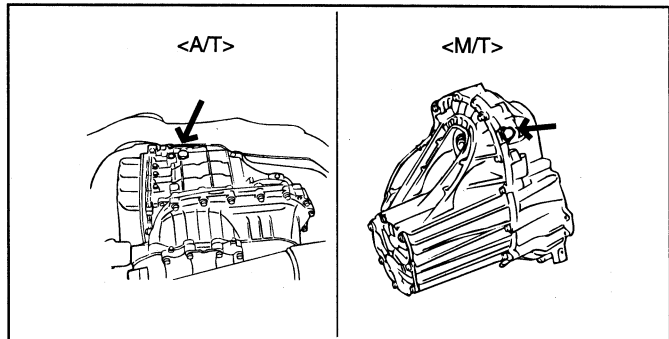
NOTE

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



ECHA004I

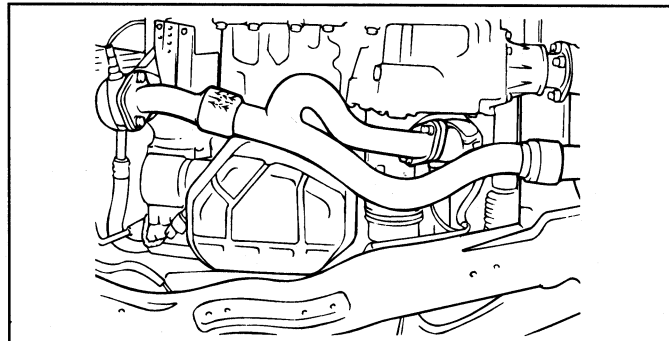
19. Drain the transaxle oil.



ECHA004Z

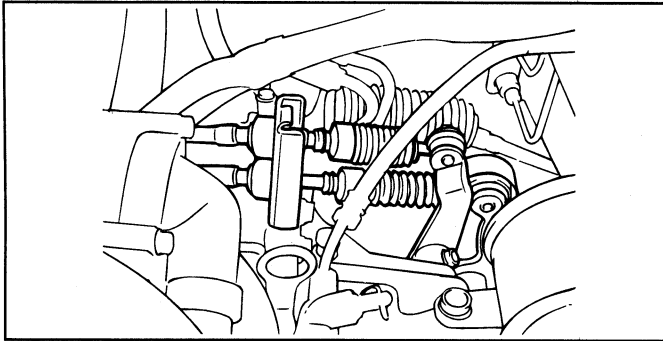
16. Raise the vehicle and then remove the front tire.

20. Remove the front muffler bolts.



EDJA070A

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

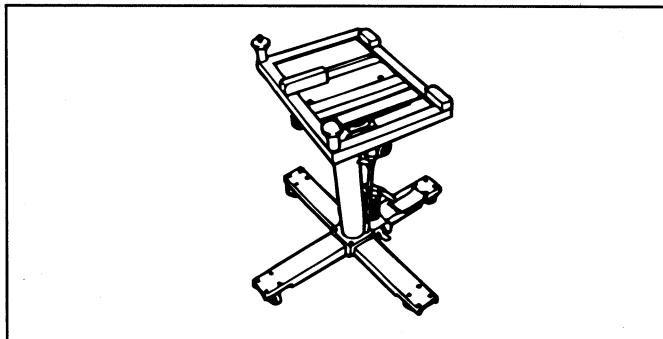


EDHA006F

22. Put the special fixtue on the T/M jack and then adjust it to the sub-frame.

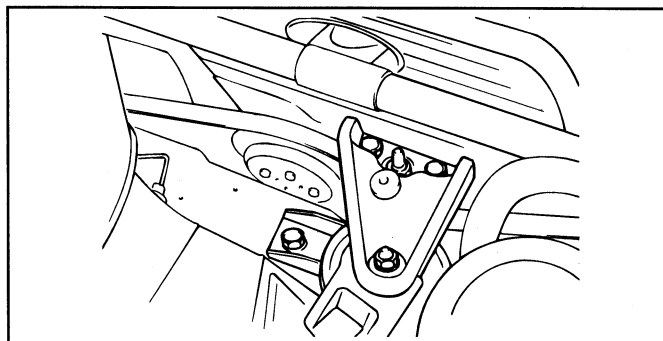
NOTE

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

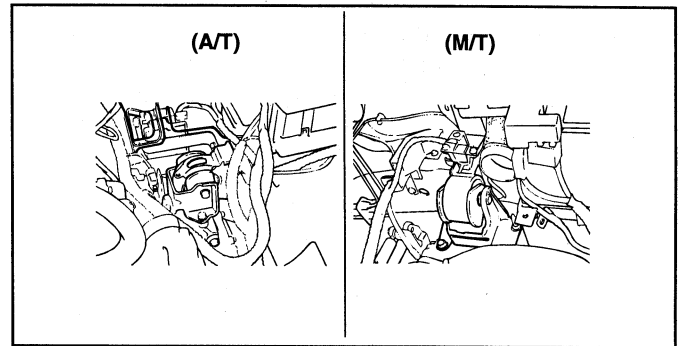


ECHA0040

23. Remove the engine mount bracket and the transaxle mount bracket.

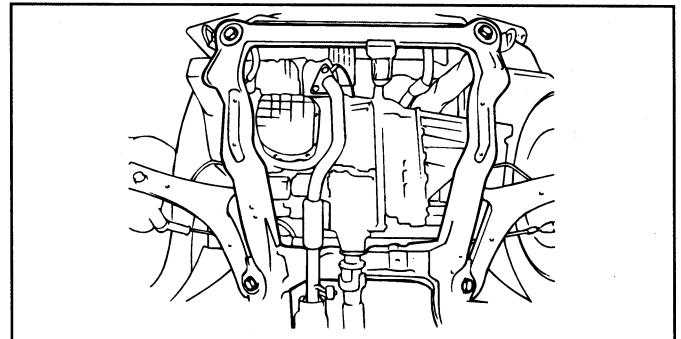


EDJA310A

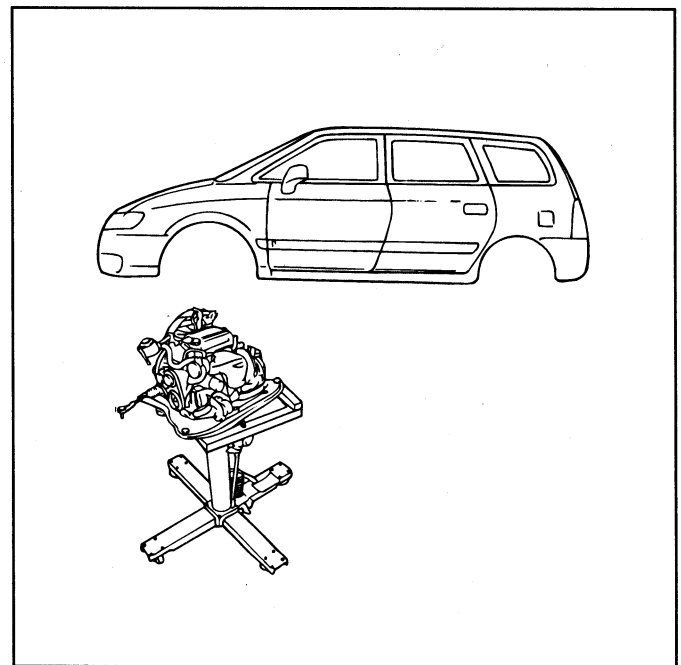


EDJB000A

24. Remove the sub-frame installation bolts.

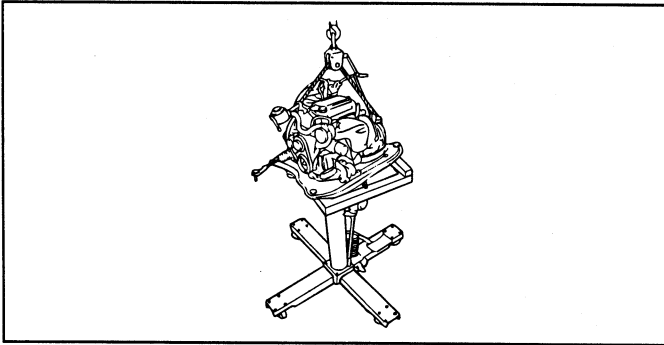


EDJA230C



EDHA006I

25. After removing the drive shaft, lower the engine and transaxle assembly on the jack. Then remove the front roll stopper and the rear roll stopper.



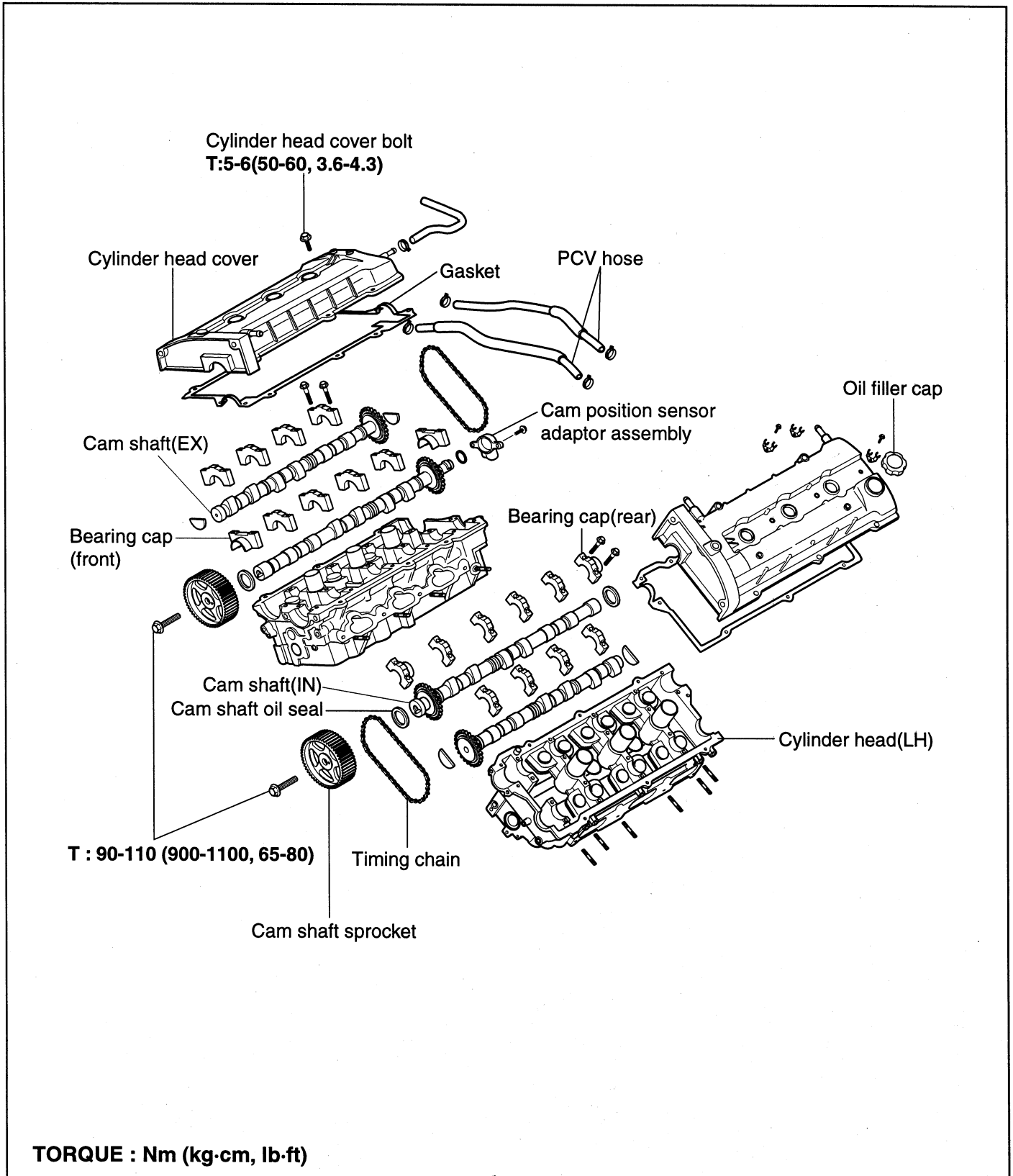
EDHA006L

26. Remove the engine and transaxle assembly as a unit.

MAIN MOVING SYSTEM

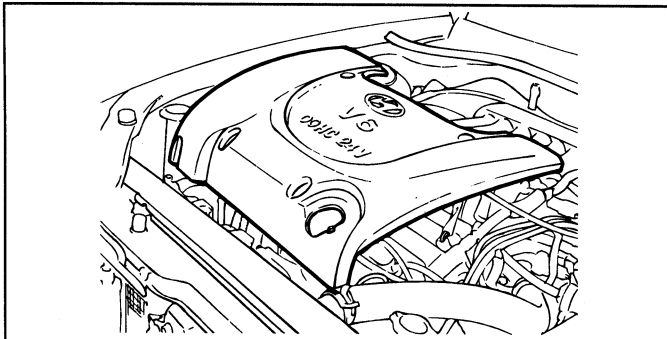
CAM SHAFT

CAMSHAFTS EDHA4000



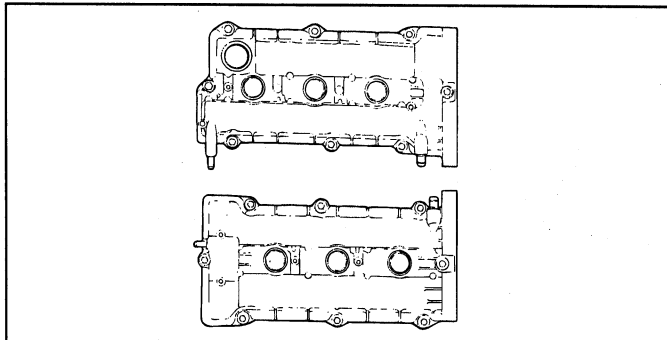
DISASSEMBLY EDHA4100

1. Remove the engine cover and intake manifold.



EDA007A

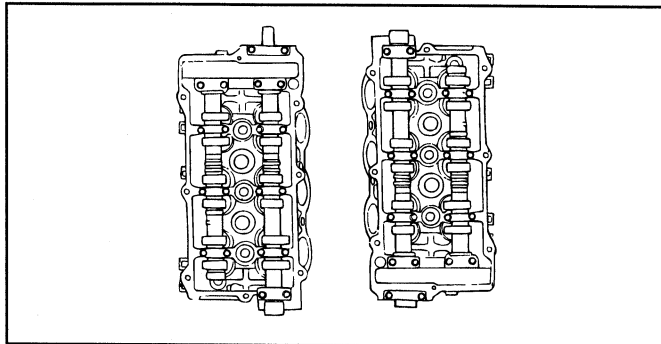
2. Disconnect the breather hose and the engine harness.
3. Remove the power steering pulley, air conditioner pulley, crankshaft pulley, idler pulley and tensioner pulley.
4. Remove the timing belt cover.
5. Loosen the auto tensioner.
6. Remove the timing belt from the camshaft sprocket.
7. Remove the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



EDA9091A

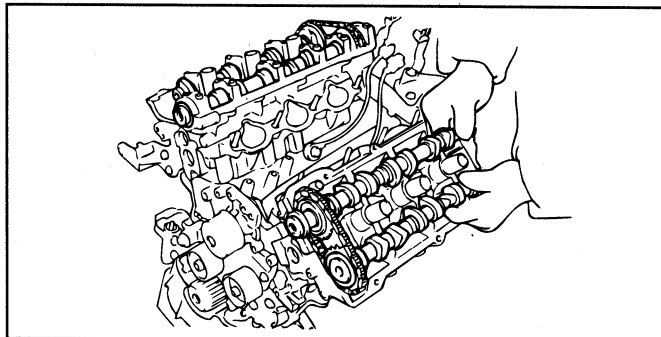
9. Remove the camshaft sprockets.

10. Remove the camshaft bearing caps.



EDA9036A

11. Remove the camshafts.



EDA9032A

INSPECTION EDJA3200

CAMSHAFTS

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

Cam height

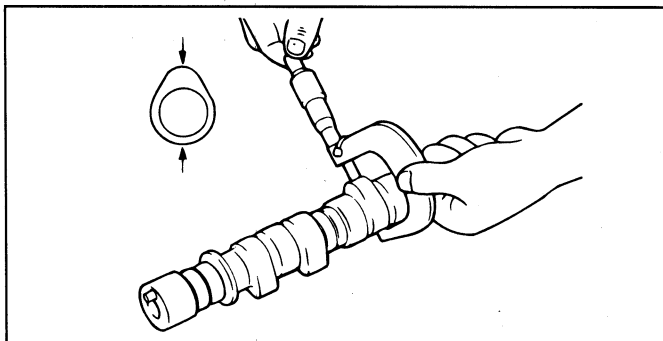
[Standard]

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

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

[Limit]

Intake/Exhaust : 43.45mm(1.7106 in.)



EDA9260A

4. Check each bearing for damage. If the bearing surface is excessively damaged, replace the cylinder head assembly or camshaft bearing cap, as necessary.

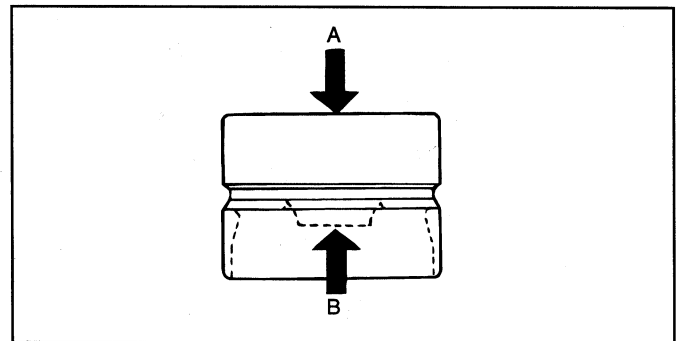
Camshaft end play : 0.1-0.15mm(0.0039-0.0059 in.)

OIL SEAL (CAMSHAFT FRONT)

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

HLA (HYDRAULIC LASH ADJUSTER)

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



EDA9260B

3. Check the cam surface for abnormal wear or damage, and replace if necessary.

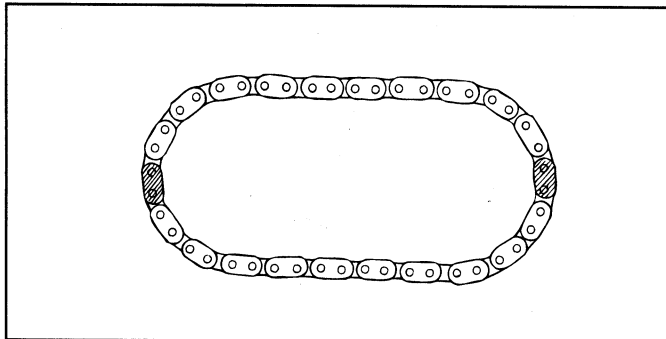
Problem	Possible cause	Action
1. Temporary noise when starting a cold engine	Normal	This noise will disappear after the oil in the engine reaches the normal pressure.
2. Continuous noise when the engine is started after parking more than 48 hours.	Oil leakage of the high pressure chamber on the HLA, allowing air to get in.	<p>Noise will disappear within 15 minutes when engine runs at 2000-3000 rpm. If it doesn't disappear, refer to step 7 below.</p> <p>CAUTION Do not run engine at a speed higher than 3000 rpm, as this may damage the HLA.</p>
3. Continuous noise when the engine is first started after rebuilding cylinder head.	Insufficient oil in cylinder head oil gallery.	
4. Continuous noise when the engine is started after excessively cranking the engine by the starter motor or band.	Oil leakage of the high-pressure chamber in the HLA, allowing air to get in. Insufficient oil in the HLA.	
5. Continuous noise when the engine is running after changing the HLA.		

Problem	Possible cause	Action
6. Continuous noise during idle after high engine speed.	Engine oil level too high or too low.	Check oil level. Drain or add oil as necessary.
	Excessive amount of air in the oil at high engine speed.	Check oil supply system.
	Deteriorated oil.	Check oil quality. If deteriorated, replace with specified type.
7. Noise continues for more than 15 minutes.	Low oil pressure.	Check oil pressure and oil supply system of each part of engine.
	Faulty HLA.	Remove the cylinder head cover and press HLA down by hand. If it moves, replace the HLA.

WARNING
Be careful with the hot HLAS.

TIMING CHAIN

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

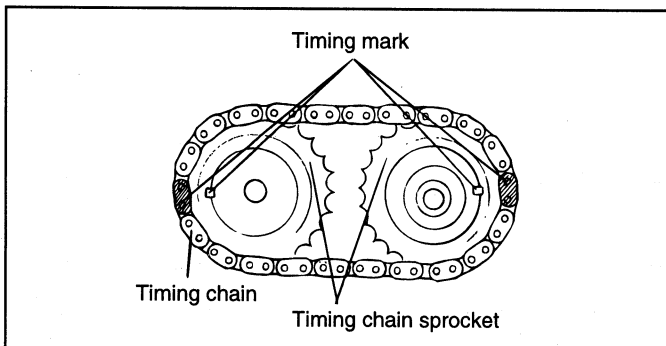


EDA9033A

REASSEMBLY

EDJA3300

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

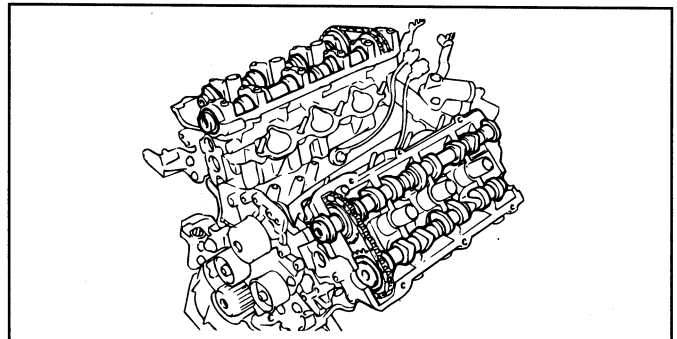


EDA9270A

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

NOTE

To check the press fit, the camshaft (IN) and timing chain sprocket should be separable by a force greater than 1000kg (MIN.) at room temperature.

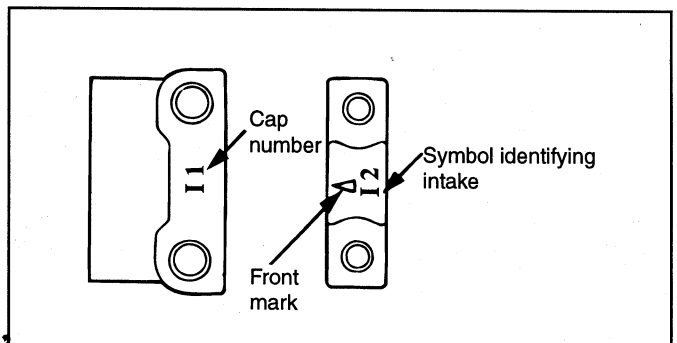


EDA9035A

4. Install the bearing caps. Check the markings on the caps for intake/exhaust identification symbol.

I: Intake camshaft

E: Exhaust camshaft



HFR20B64

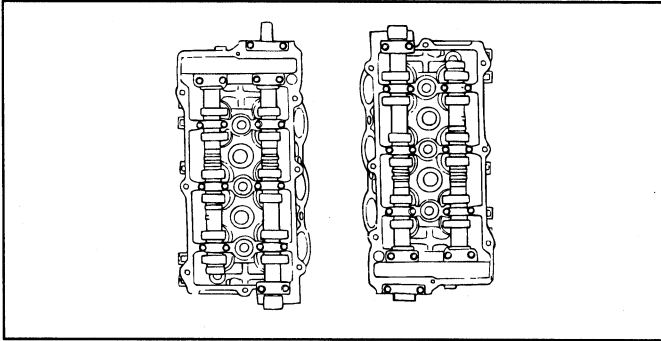
- Tighten the bearing caps to the specified torque in two or three increments as shown.

Tightening torque

Bearing cap bolt :

M 10 : 14-16 Nm(140-160 kg.cm, 10-12 lb.ft)

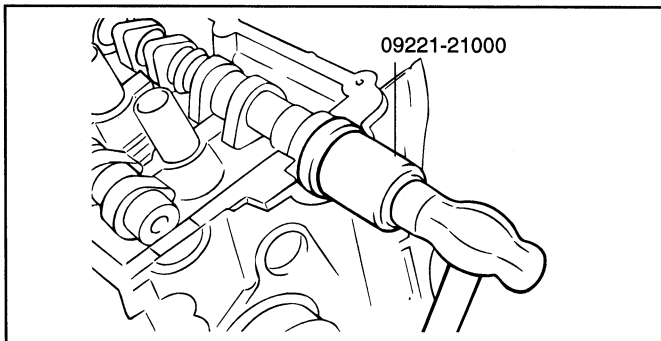
M 7 : 10 -12 Nm(100-120 kg.cm, 7-9 lb.ft)



EDA9036A

- Using the special tool, the camshaft oil seal installer (09221-21000), install the camshaft oil seal. Be sure to apply engine oil to the external surface of the oil seal.

Insert the oil seal along the camshaft front end and install it with a hammer until it is seated.



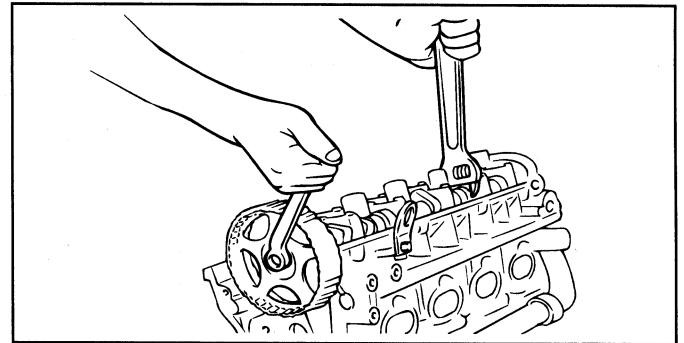
EDA9270E

- Install the camshaft sprocket to the specified torque.

Tightening torque

Camshaft sprocket bolt :

90-110Nm(900-1100kg.cm, 65-80lb.ft)



EDA9270F

- Install the cylinder head cover.

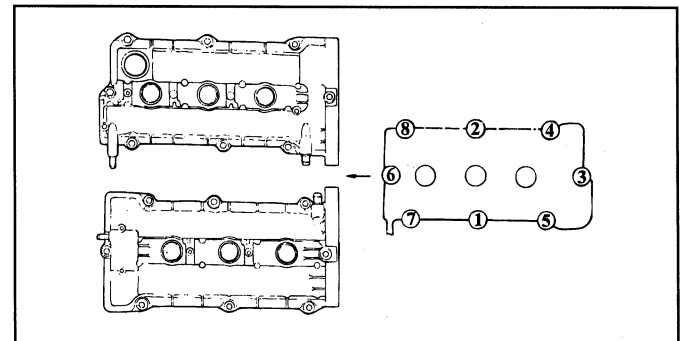
Tightening torque

Cylinder head cover bolts :

5-6Nm(50-60kg.cm, 3.6-4.4 lb.ft)

<Tightening procedure>

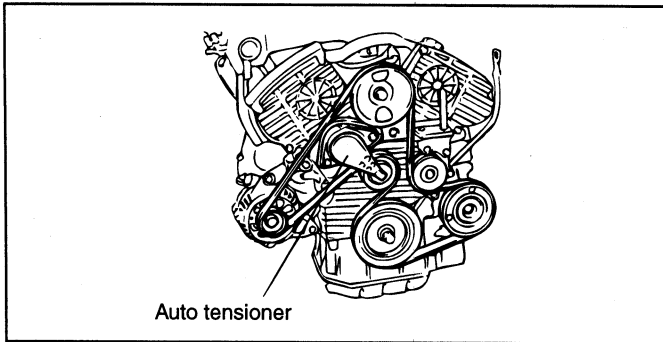
- Tighten all bolts temporarily to half of the specified torque in the sequence 1.2.3.4.5.6.7.8
- Retighten all bolts to the specified torque.



KFW3066A

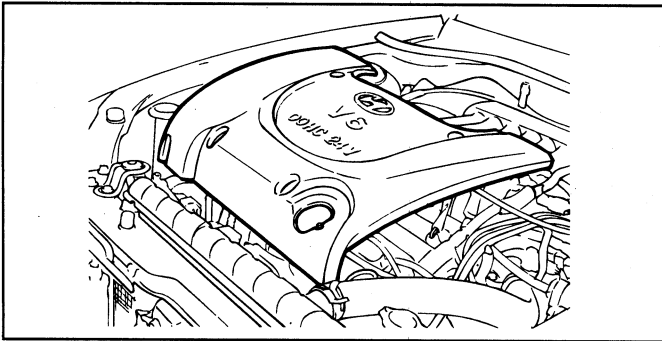
- Install the spark plug cables and, center cover.
- Install the timing belt and then tighten the auto tensioner pulley.
- Install the timing belt cover.

12. Install the power steering pulley, air conditioner pulley, crankshaft pulley and tensioner pulley.



EDA9031A

13. Connect the breather hose and engine harness.



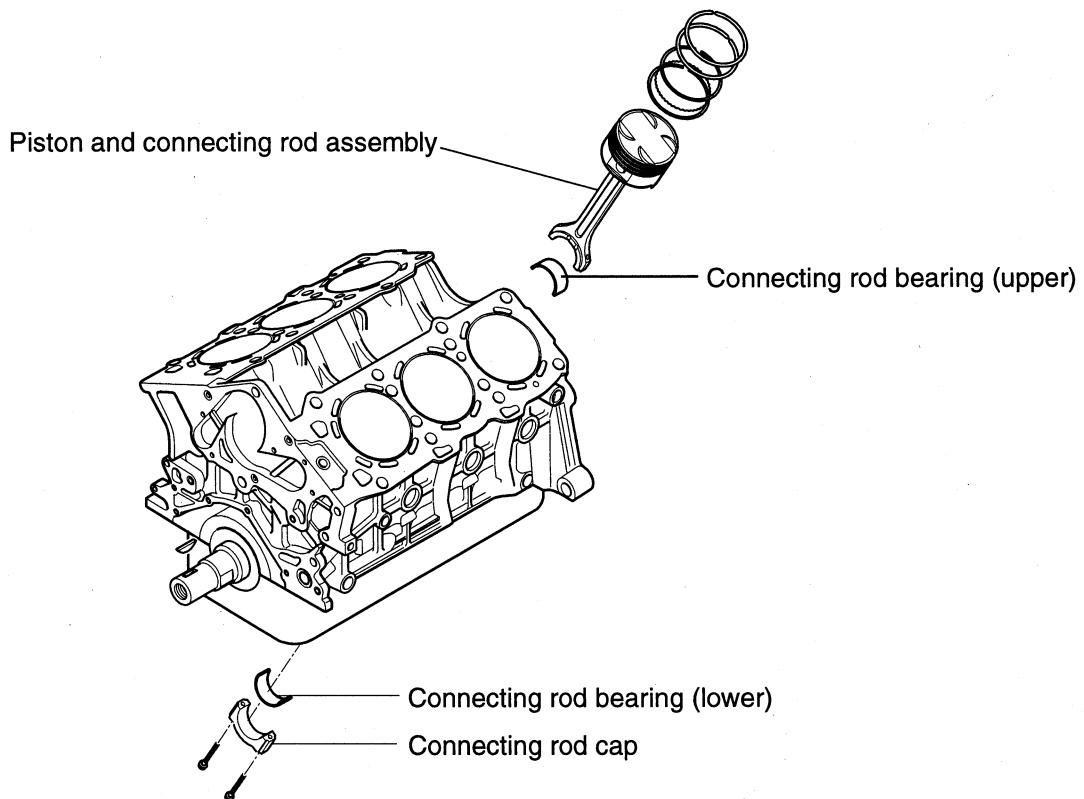
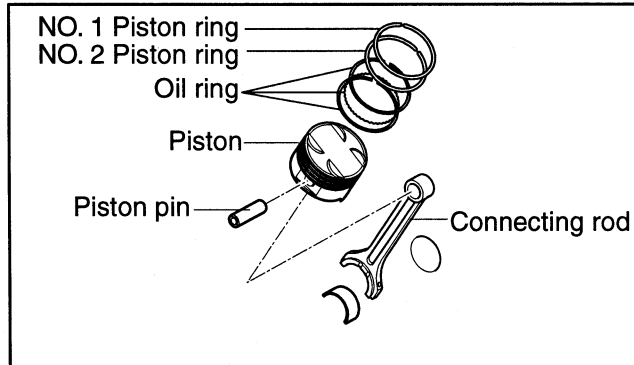
EDA9022A

14. Install the intake manifold and engine cover.

CONNECTING ROD

PISTONS AND CONNECTING
RODS

EDHA4600



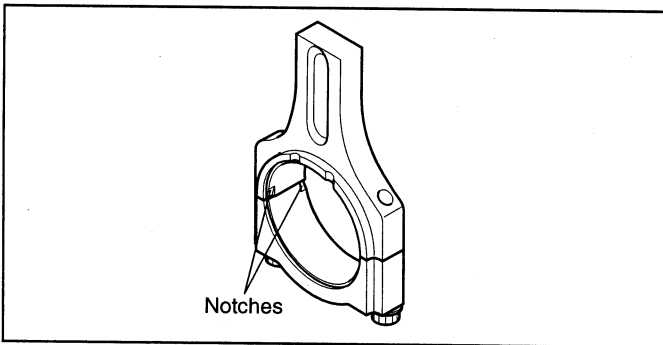
T : 16-20 (160-200, 12-14)+(90°-94°)

TORQUE : Nm (kg·cm, lb·ft)

DISASSEMBLY EDJA3600**CONNECTING ROD CAP****CAUTION**

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

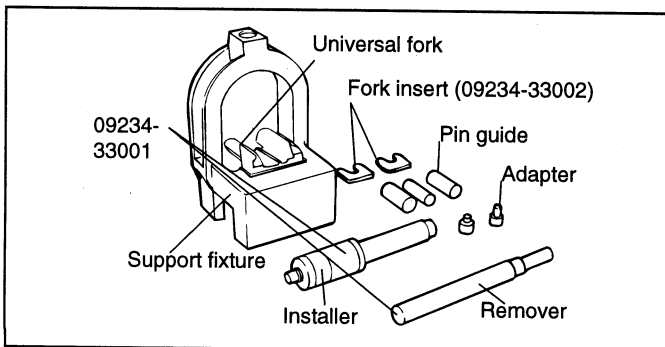
1. Remove the connecting rod cap bolts, then remove the caps and the big end lower bearing mark for reassembly.
2. Push each piston connecting rod assembly toward the top of the cylinder.



KFW3049A

DISASSEMBLY AND REASSEMBLY OF THE PISTON PIN

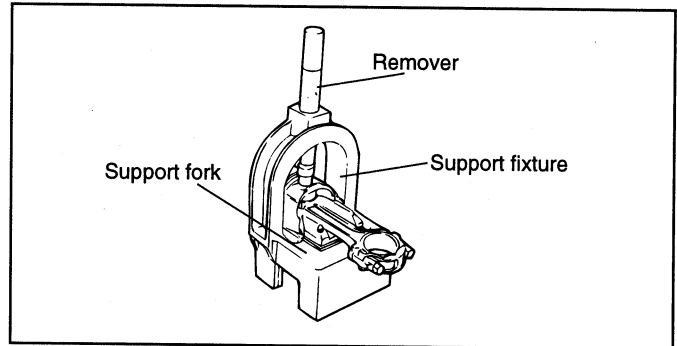
1. Using the special tools 09234 - 33001 and 09234 - 3002, disassemble and reassemble the piston and connecting rod.



ECA9361A

2. The piston pin is a press fit in the rod little end, and the piston floats on the pin.
3. The tool consists of a support fixture with fork inserts, guides, adapters, an installer and a remover. The piston is supported in the support fixture while the pin is being installed or removed. Guides help position the pin as it is installed or removed, while the rod is supported by fork inserts.

4. To remove the pin from the piston, place the piston in the support fixture with the rod resting on the fork inserts. Pass the remover tool through the top of the support fixture and use it to press out the pin.

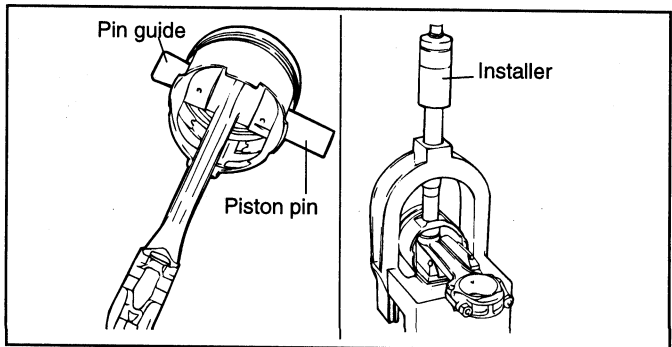


EDA9048A

5. To install a new pin, the proper fork inserts must be in place to support the rod.
6. Position the rod inside the piston. Insert the proper pin guide through one side of the piston and through the rod. Hand tap the pin guide so it is held by the piston. Insert the new pin into the piston from the other side and set the assembly into the support fixture with the pin guide facing down.

NOTE

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



ECA9361C

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

CAUTION

Do not exceed 1250 ± 500 kg (2765 ± 1100 lb) of force when the installing tool seats against the top of the arch.

INSPECTION EDJA9700

PISTONS AND PISTON PINS

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

PISTON RINGS

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

Piston ring side clearance

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

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

[Limit]

No.1 : 0.1 mm (0.004 in.)

No.2 : 0.1 mm (0.004 in.)

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

Piston ring end gap

[Standard dimensions]

No.1 : 0.20-0.35 mm (0.0079-0.0138 in.)

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

Oil ring side rail : 0.2-0.7 mm (0.0079-0.0276)

[Limit]

No.1, No.2 : .0.8 mm (0.031 in.)

Oil ring side rail : 1.0 mm (0.039 in.)

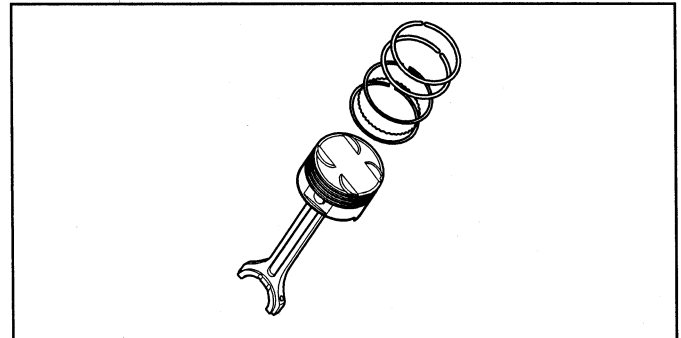
When replacing the ring without correcting the cylinder bore, check the gap with the ring situated at the lower part of cylinder that is less worn out.

Piston ring service size and mark

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

NOTE

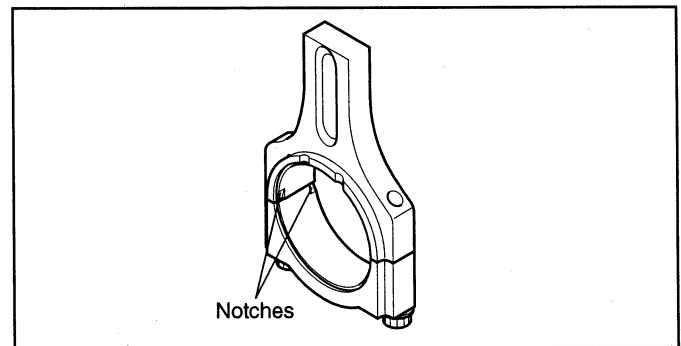
The mark can be found on the upper side of the ring next to the end.



KFW3037C

CONNECTING RODS

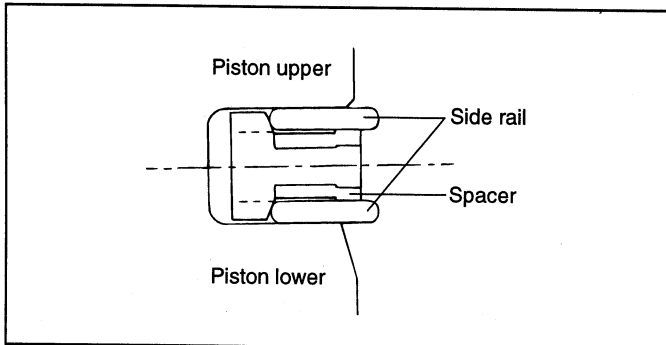
1. When the connecting rod cap is installed, make sure that the cylinder numbers, marked on rod end cap at disassembly, match. When a new connecting rod is installed, make sure that the notches holding the bearing in place are on the same side.
2. Replace the connecting rod if it is damaged at either end of the thrust faces. If it has a stratified wear, or if the surface of the inside diameter of the small end is severely rough, replace the rod.



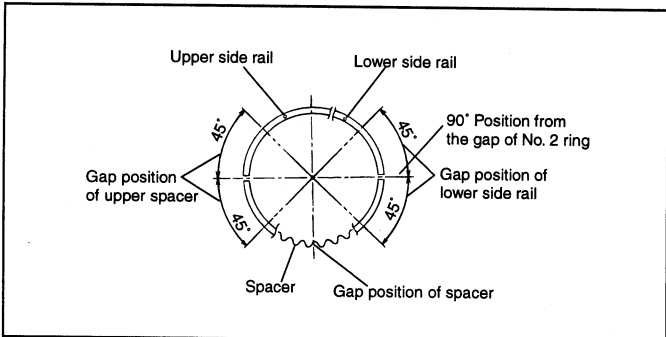
KFW3049A

REASSEMBLY EDJA3800

1. Install the spacer.



ECA9082A



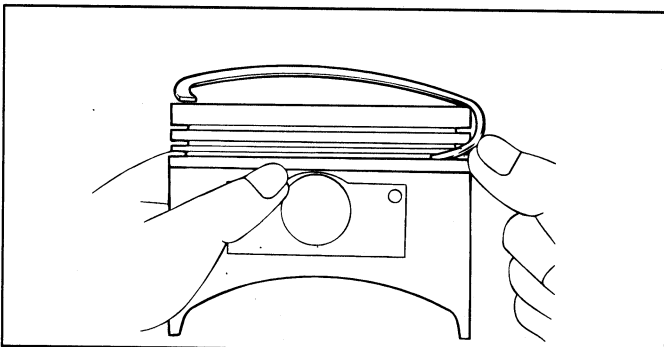
EDJA490A

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

CAUTION

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

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

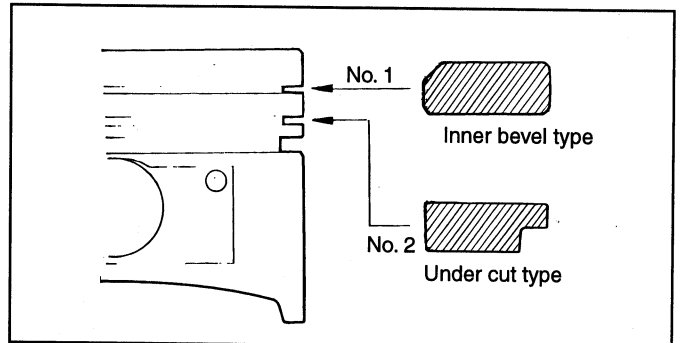


ECA9380B

4. Apply engine oil around the piston and piston grooves.

5. Using a piston ring expander, install the No.2 piston ring.

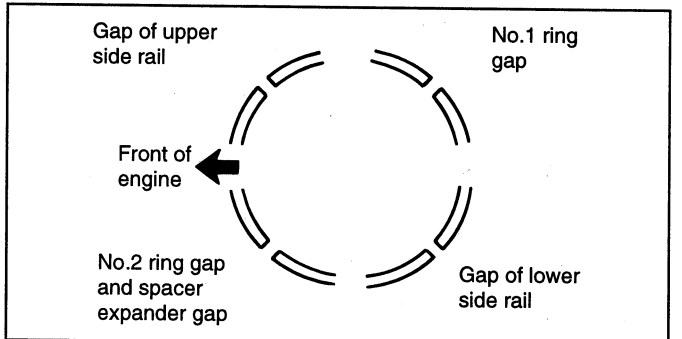
6. Install the No. 1 piston ring.



EDJA490B

7. Position each piston ring end gap as far away from its neighboring gaps as possible. Make sure that the gaps are not positioned in the thrust and pin directions.

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



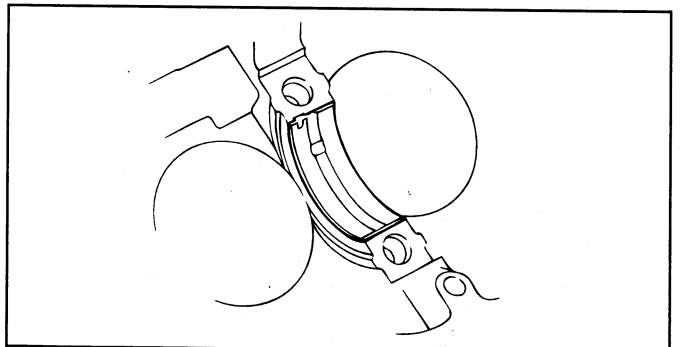
ECA9380D

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

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

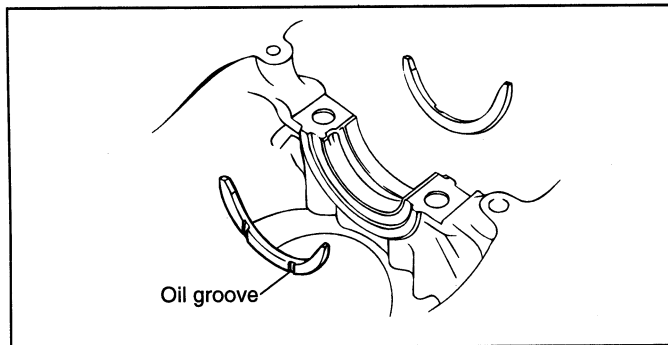
CAUTION

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



EDA9390E

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



EDA9390F

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

Tightening torque

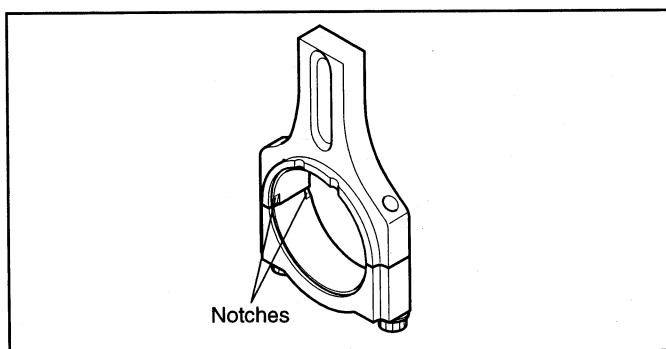
Connecting rod bolt :

16-20 Nm (160-200 kg.cm, 12-15 lb.ft)+(90°-94°)

CAUTION

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

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



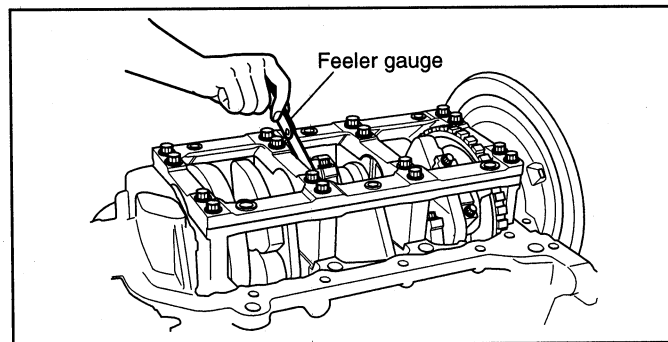
KFW3049A

16. Check the connecting rod side clearance.

Connecting rod side clearance

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

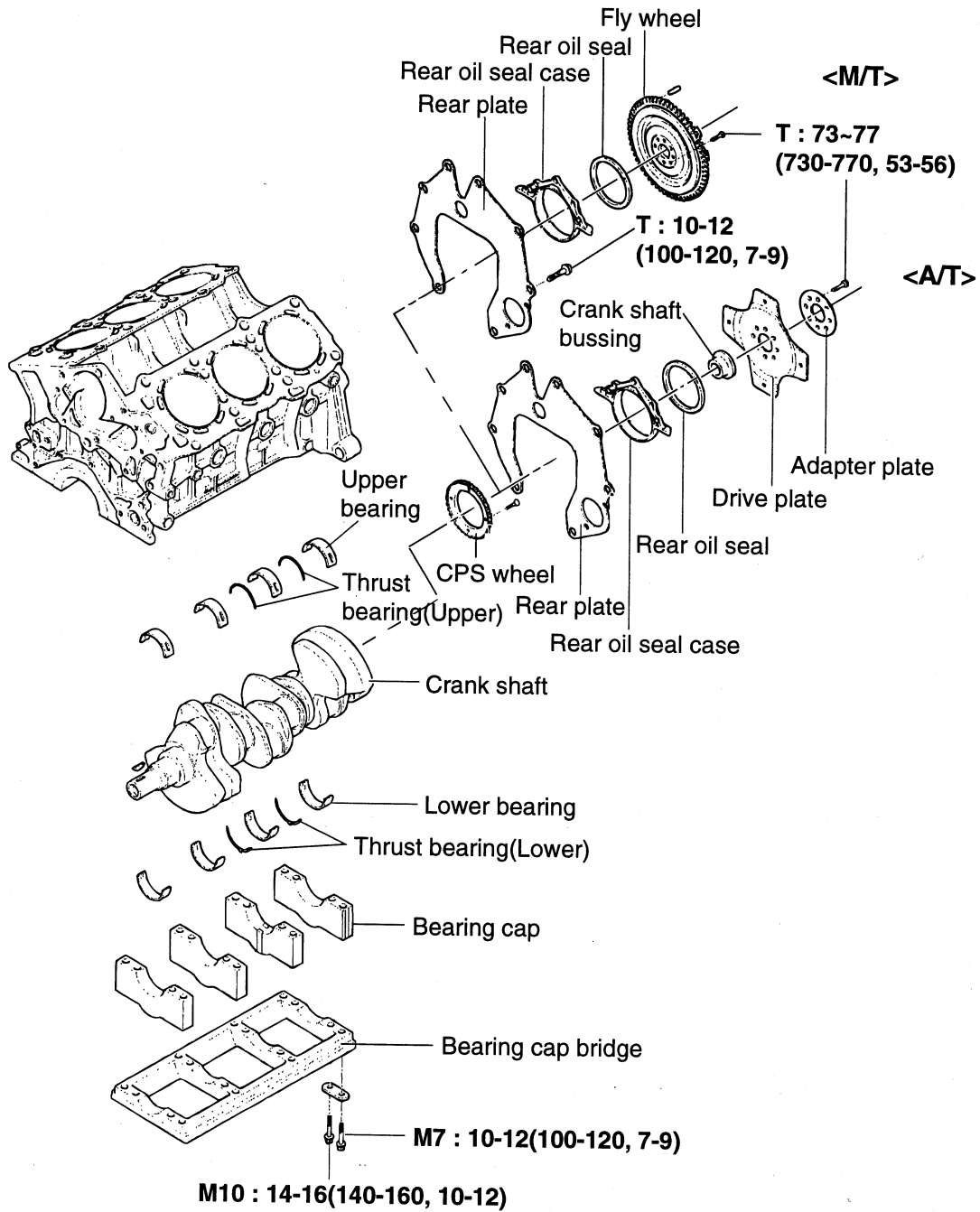
Limit : 0.4 mm (0.0157 in.)



KFW3056A

CRANK SHAFT

CRANKSHAFT EDHA5000



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

DISASSEMBLY EDHA5100

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

NOTE

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

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

INSPECTION EDHA5200

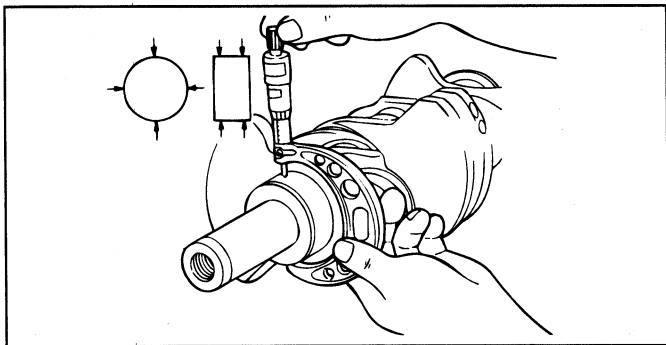
CRANKSHAFT

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

Standard value

Crankshaft journal O.D :
61.982-62.000 mm (2.4402-2.4409 in.)

Crankshaft pin O.D :
47.982-48.000 mm (1.8890-1.8898 in.)



ECA9410A

MAIN BEARINGS AND CONNECTING ROD BEARINGS

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

MEASURING OIL CLEARANCE

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

Standard value

Oil clearance

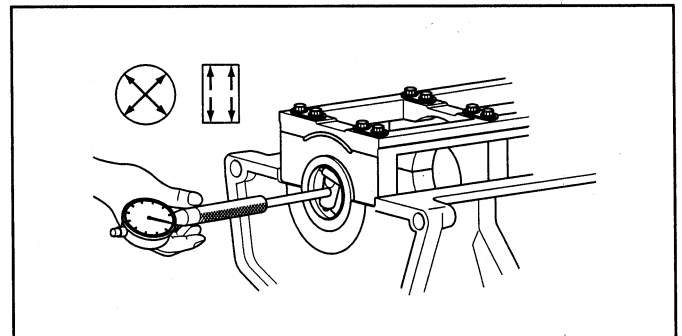
Crankshaft main bearing :

0.004-0.022 mm (0.00015-0.00087 in.)

Connecting rod bearing :

0.018-0.036 mm (0.00071-0.00141 in.)

LIMIT : 0.1mm (0.004 in.)



KFW3058A

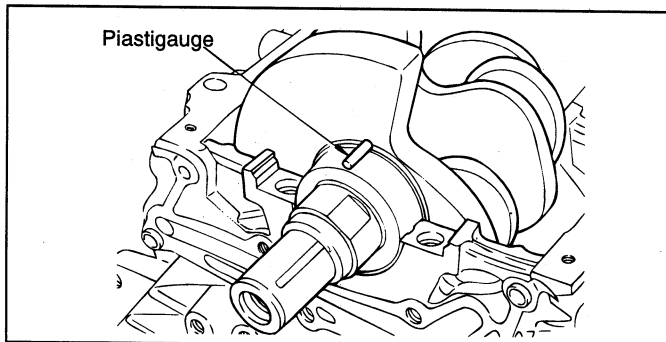
PLASTIC GAUGE METHOD

Plastic gauge may be used to measure the clearance.

1. Remove oil, grease and any other dirt from the bearings and journals.
2. Cut the plastic gauge the same length as the width of the bearing and place it in parallel with the journal, avoiding the oil holes.
3. Install the crankshaft, bearings and caps and tighten them to the specified torques. During this operation, do not turn the crankshaft. Remove the caps. Measure the width of the plastic gauge at the widest part by using the scale printed on the gauge package.

If the clearance exceeds the service limit, the bearing should be replaced or an undersize bearing should be used. When installing a new crankshaft, be sure to use standard size bearings.

If the standard clearance can not be obtained even after replacing the bearing, the journal and pin should be ground to the undersize and a bearing of the corresponding size should be installed.



EDA9420C

OIL SEAL

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

DRIVE PLATE (A/T)

Replace distorted, damaged, or cracked drive plates.

FLYWHEEL (M/T)

See EM section.

REASSEMBLY EDHA5300**MAIN BEARING**

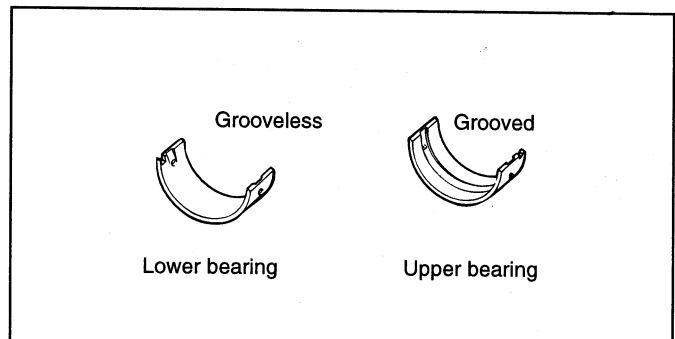
1. Install a grooved main bearing (upper bearing) on the cylinder block side.
2. Install a grooveless main bearing (lower bearing) on the main bearing cap side.
3. Install the crankshaft. Apply engine oil to journal and pin.
4. Install the bearing caps with the arrow mark directed toward the front of the engine. Cap number must be correct.
5. Tighten the cap bolts to the specified torque.

Tightening torque

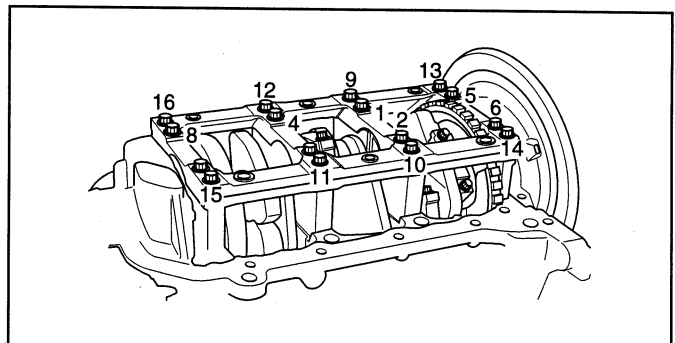
Main bearing cap bolts :

M7(9-16) : 10-12Nm (100-120 kg.cm, 7-9 lb.ft)

M10(1-8) : 14-16 Nm(140-160 kg.cm, 10-12 lb.ft)



EDA9420D



KFW3056B

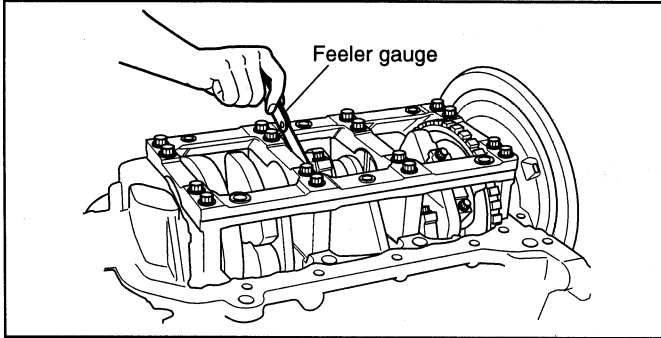
6. Cap bolts should be tightened evenly in stages 4 to 5 increments before they are tightened to the specified torque.

7. Make certain that crankshaft turns freely and check the end play of the crankshaft.

Crankshaft end play

Standard : 0.070-0.250mm (0.0028-0.0098 in.)

Limit : 0.4 mm (0.016 in.)



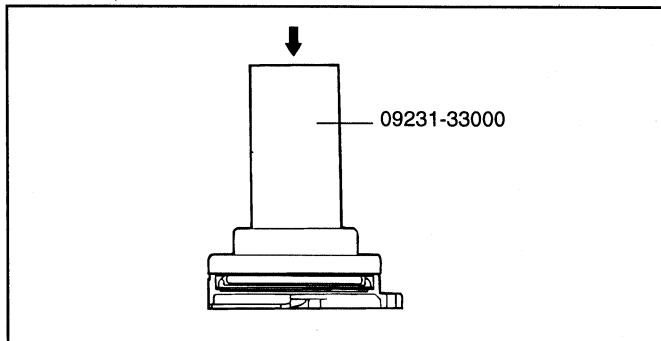
KFW3056A

8. Using special tool(09231-33000), install the rear oil seal in oil seal case.
9. Apply sealant to the area shown in the illustration. Install the oil seal case in the cylinder block.

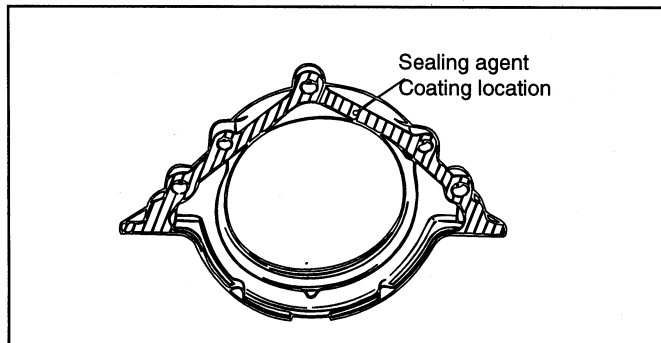
Tightening torque

Oil seal case bolt :

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



EDA9430C



EDA9430D

10. Tighten the rear plate to the specified torque.

Tightening torque

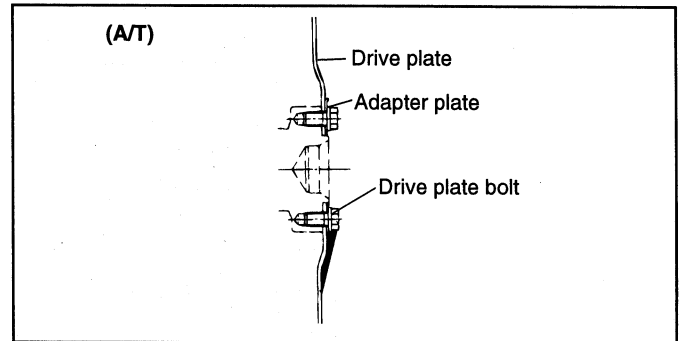
Rear plate : 10 -12 Nm (100 -120 kg.cm, 7-9 lb.ft)

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

Tightening torque

Drive plate and adapter plate bolt :

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



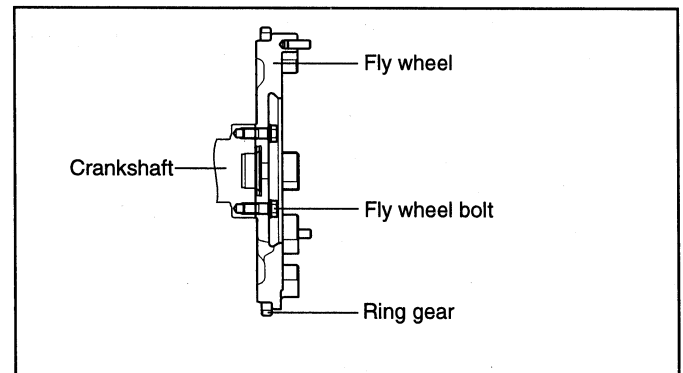
EDJA530A

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

Tightening torque

Fly wheel installation bolt :

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



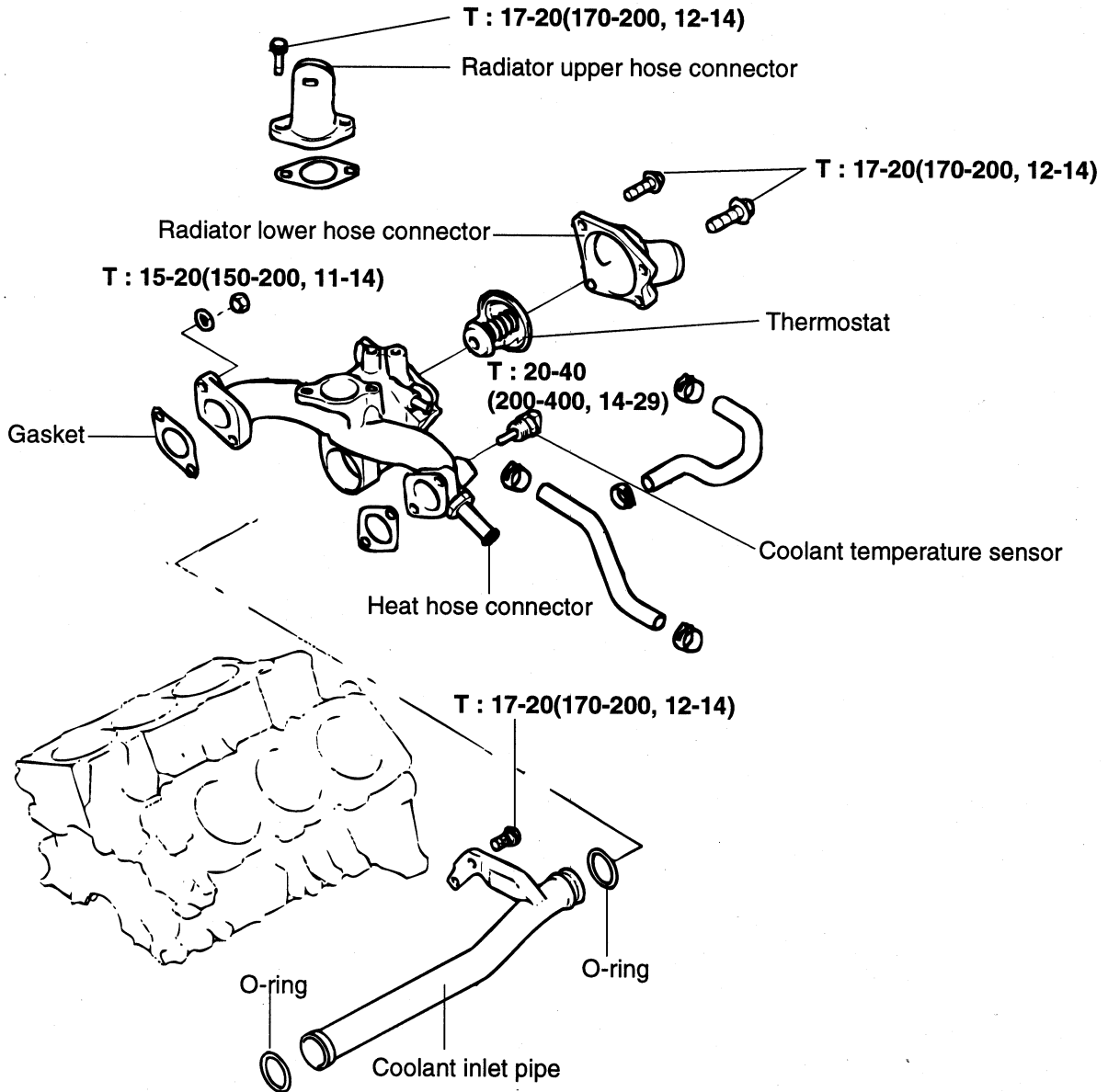
KFW3062B

COOLING SYSTEM

ENGINE COOLANT HOSE/PIPES

ENGINE COOLANT HOSE AND PIPE

EDHA6000



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

INSPECTION EDHA6100

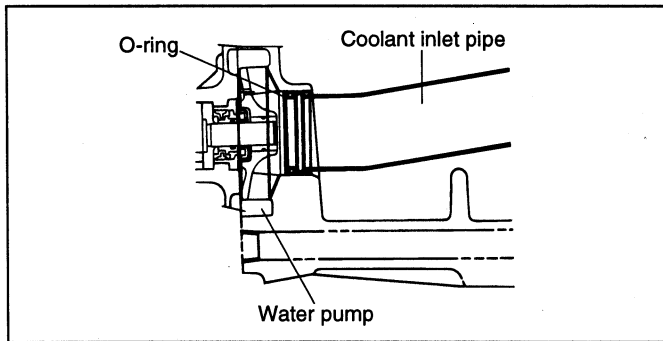
Check the engine coolant pipe and hose for cracks, damage and restrictions. Replace if necessary.

REASSEMBLY EDJA4700

Fit the O-ring in the groove of the engine coolant inlet pipe end. Wet the periphery of the O-ring with water and insert the engine coolant inlet pipe.

NOTE

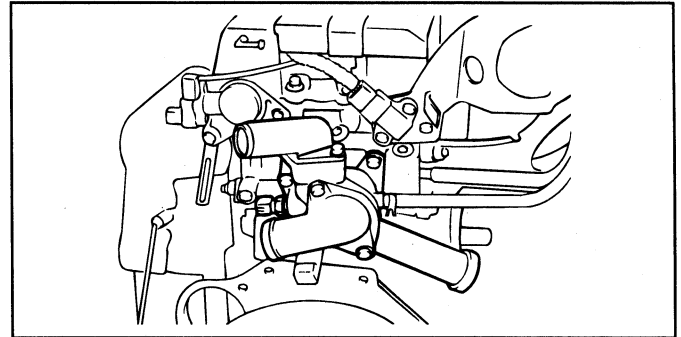
1. Do not apply oil or grease to the engine coolant pipe O-ring.
2. Keep the engine coolant pipe connections free of sand, dust, etc.
3. Insert the engine coolant pipe into the end of the engine coolant pump inlet.
4. Whenever installing the engine coolant inlet pipe, always replace the O-ring with a new one.



HEW2513B

COOLANT TEMPERATURE SENSOR EDJA4800**REMOVAL**

1. Drain the engine coolant.
2. Remove the engine harness after disconnecting the ground cable of the battery.
3. Remove the engine coolant sensor.



EDJA600B

INSTALLATION EDHA6400

1. Apply sealant to the sensor's threads. Tighten it to the specified torque.

Recommended sealant :

Three bond NO. 1324 or LOCTITE 262

Tightening torque

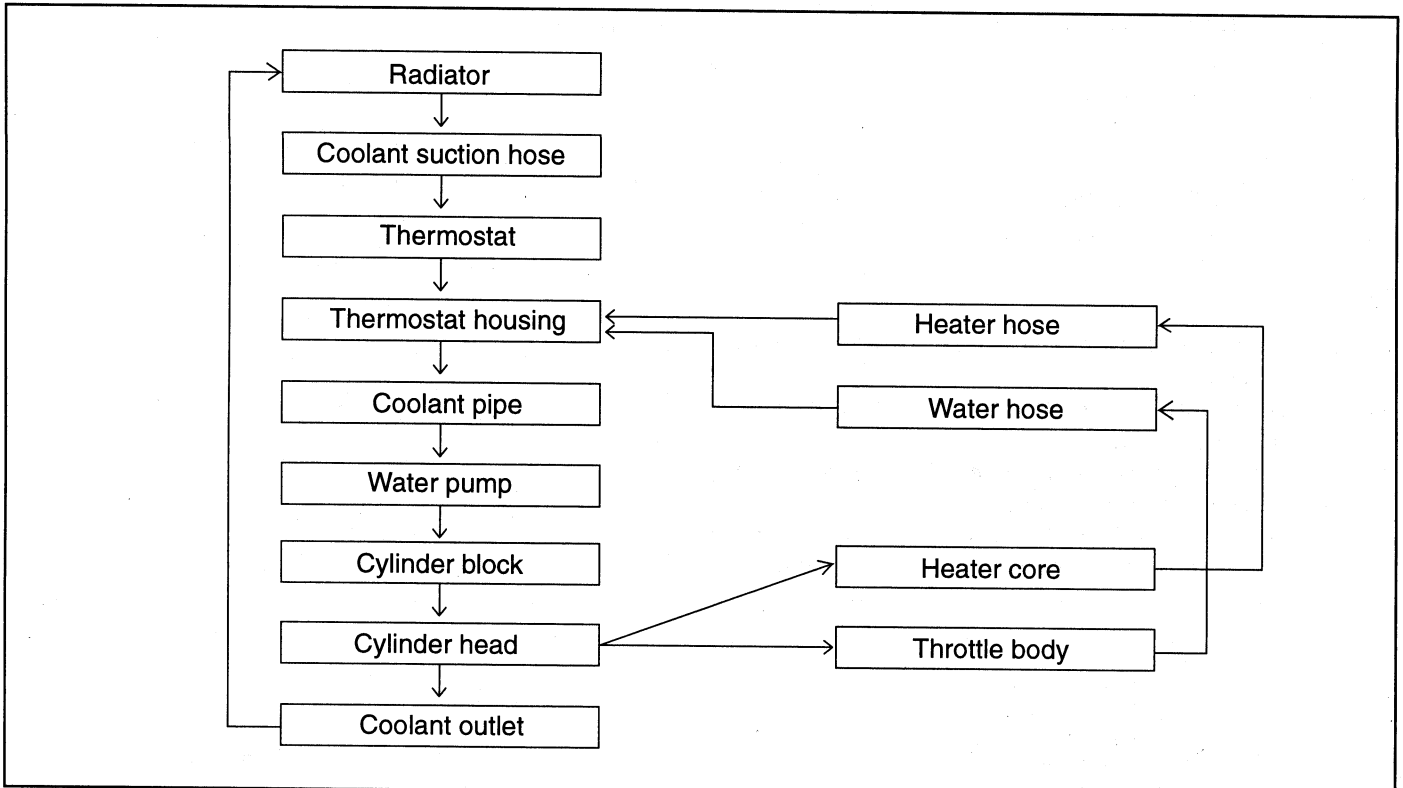
The coolant sensor :

20-40Nm(200-400 kg.cm, 14-29 lb.ft)

2. Connect the coolant sensor to the harness.
3. Connect the ground cable of battery.
4. Refill the coolant.

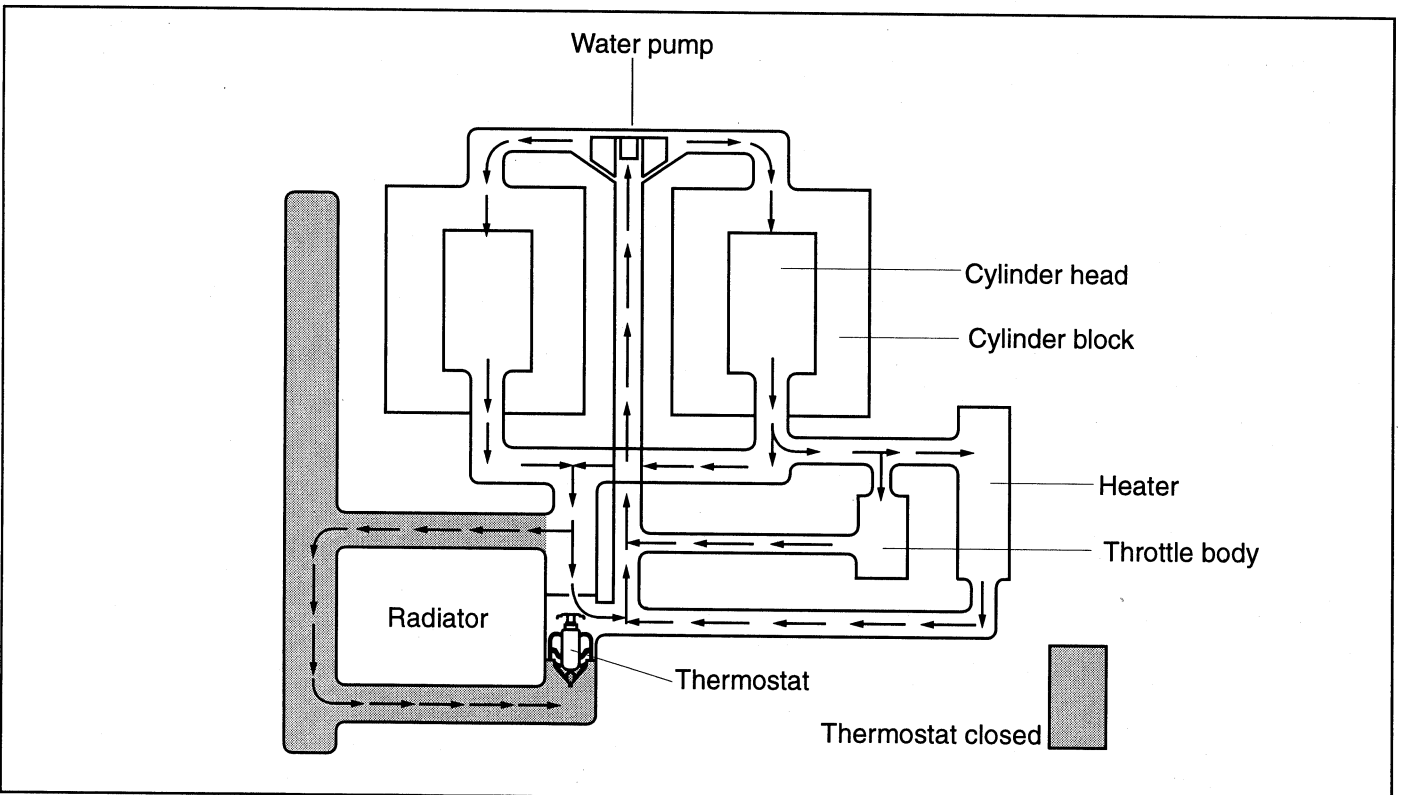
COOLING SYSTEM EDHA6500

INLET CONTROL



EDHA650A

FLOW CHART

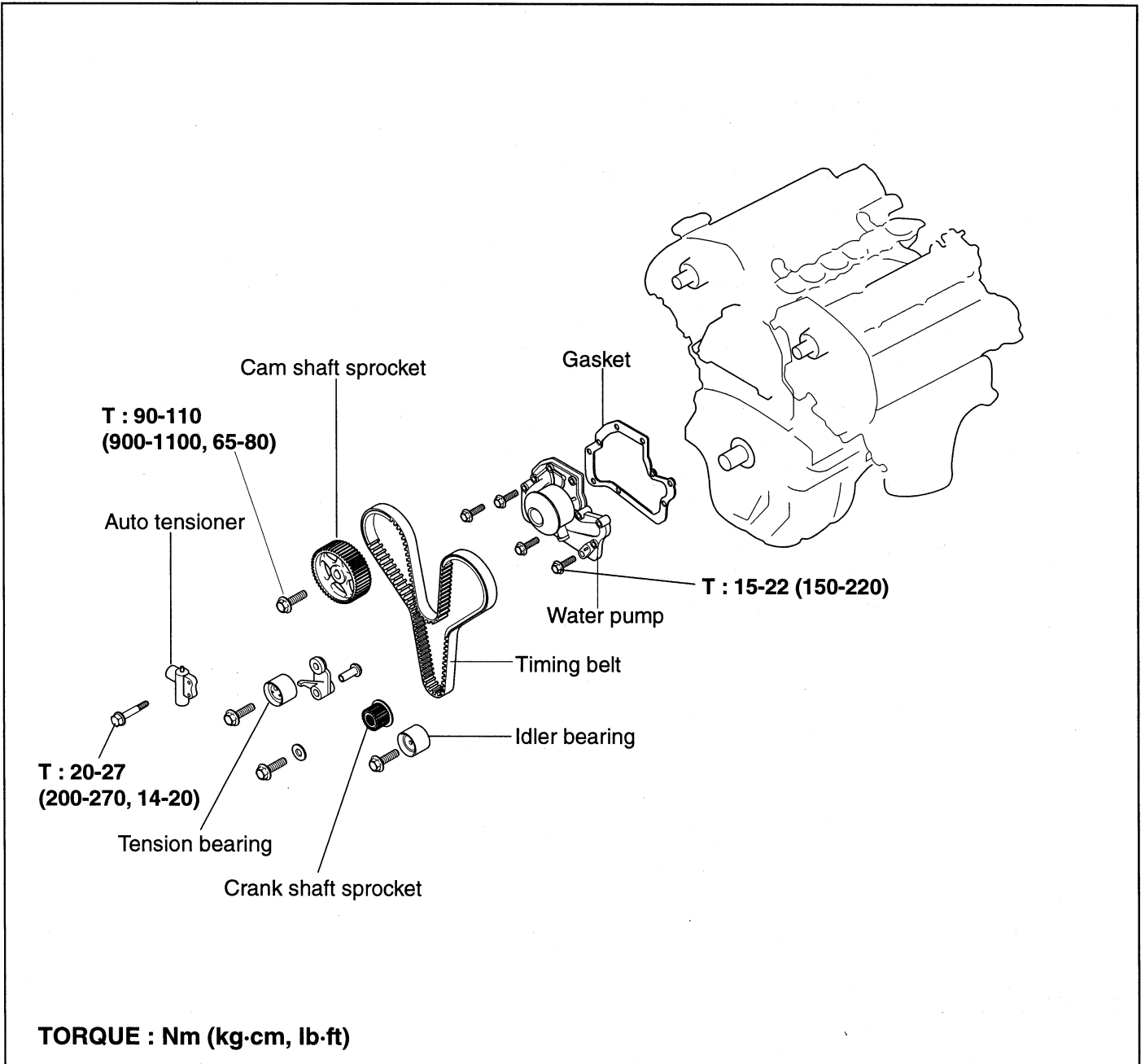


KFW3201A

ENGINE COOLANT PUMP

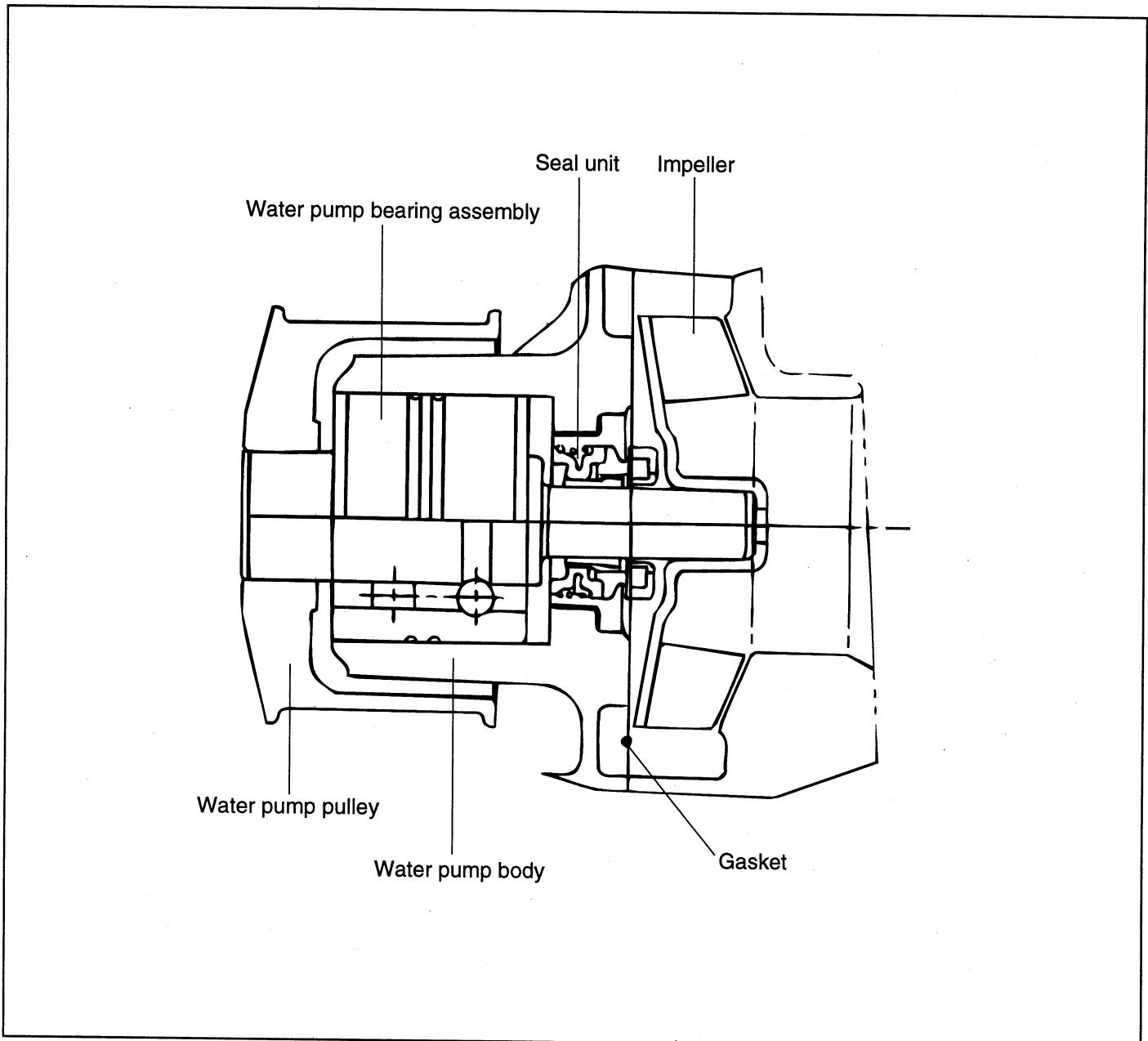
ENGINE COOLANT PUMP [FOR V-6
ENGINE]

EDHA7000



ENGINE COOLANT PUMP

EDHA7100



EDJA710A

REMOVAL

EDHA7200

1. Using the drain plug, drain the coolant.
2. Remove the drive belt and the engine coolant pump pulley.
3. Remove the timing belt cover, the auto tensioner and idler pulley.
4. Remove the engine coolant pump mounting bolts.
5. Remove the engine coolant pump assembly from the cylinder block.

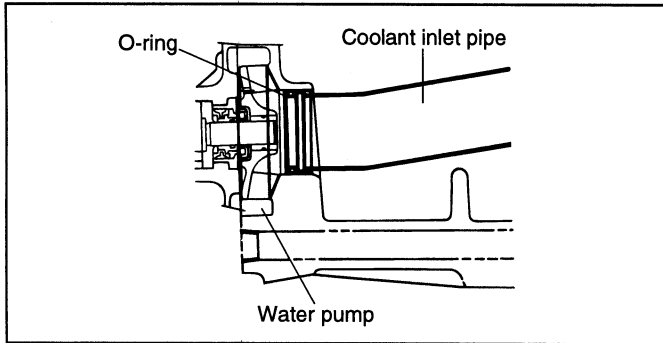
INSPECTION

EDHA7300

1. Check the engine coolant pump for cracks, damage or wear, and replace the pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation and replace the pump assembly if necessary.
3. Check the seal it for leaks and replace the pump assembly if necessary.

INSTALLATION EDJA5600

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



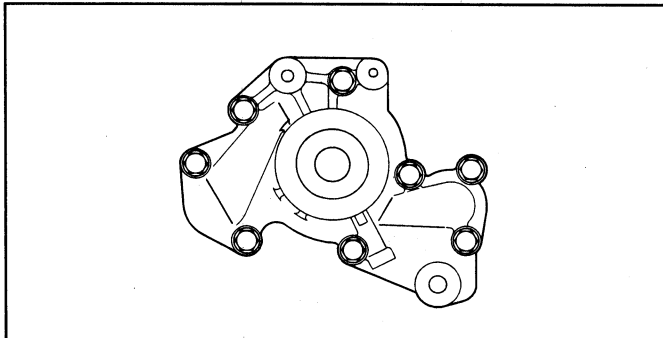
HEW2513B

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

Tightening torque

Engine coolant pump bolt :

Head mark "7" : 15-22 (150-220, 11-16)

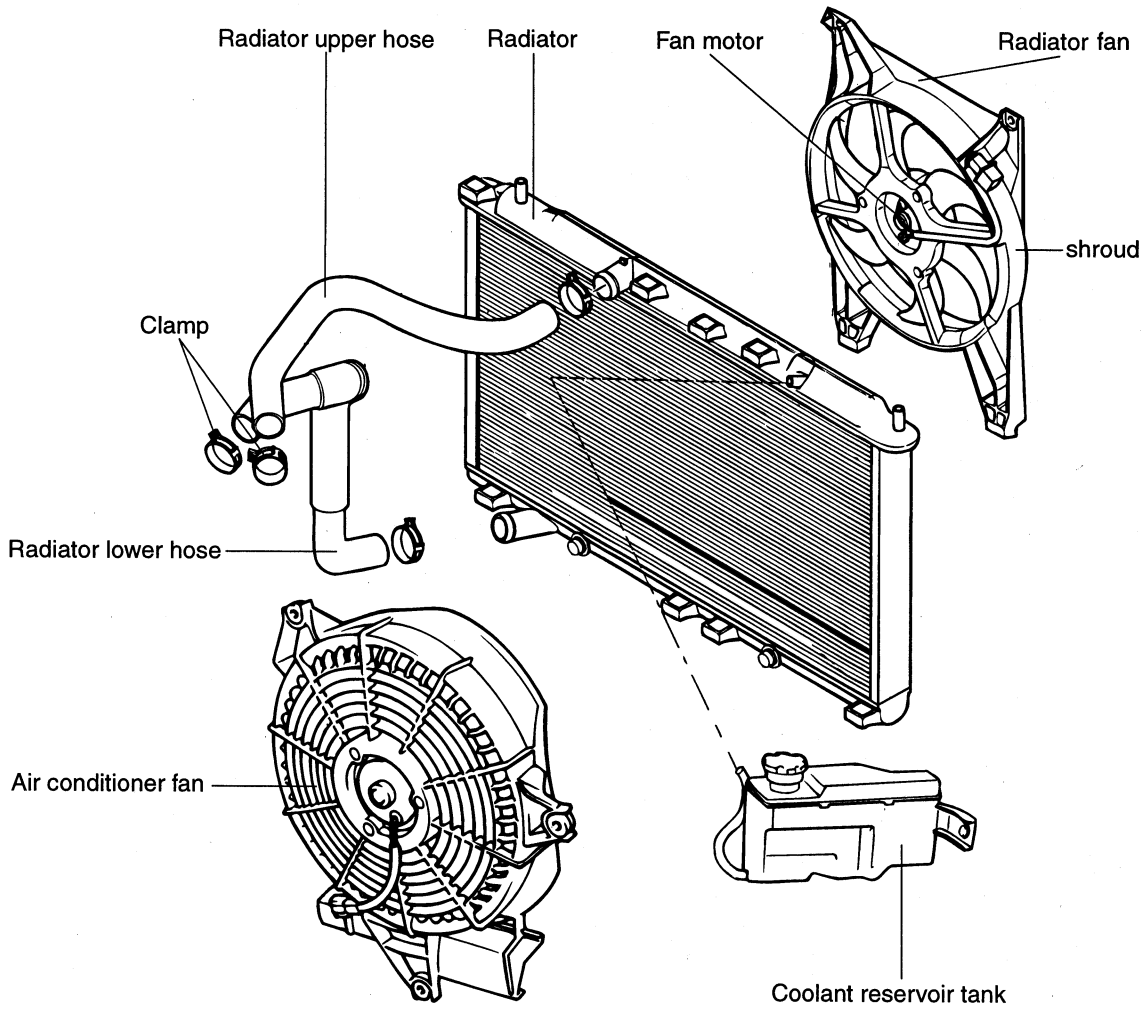


HEW2512A

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

RADIATOR

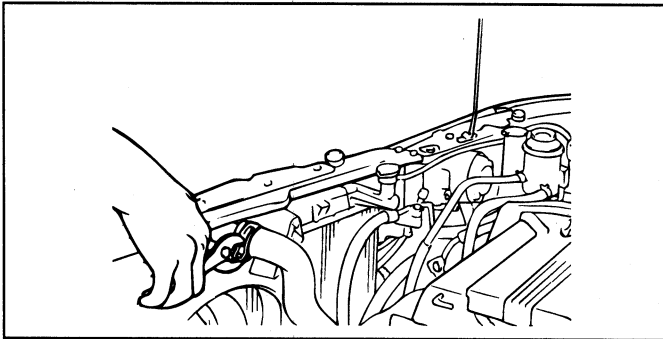
RADIATOR EDJA6000



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

REMOVAL EDJA6100

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 marking the radiator hose and the hose clamp the ease reassembly.



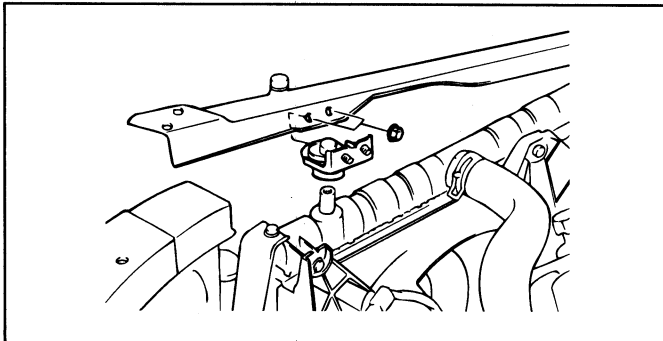
EDJA330A

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

CAUTION

Cover or plug the hose and inlets of the radiator so that dust and other foreign material etc. can not enter after the hose is disconnected from the radiator.

6. Remove the radiator mounting bolt.



EDHA001C

7. Remove the radiator and the fan motor.
8. Remove the radiator fan motor and condenser fan motor from the radiator.

INSPECTION EDHA8000

1. Check for foreign material between the 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 reservoir tank for damage.
6. Check the automatic transaxle oil cooler hoses for cracking, damage or deterioration (only A/T).

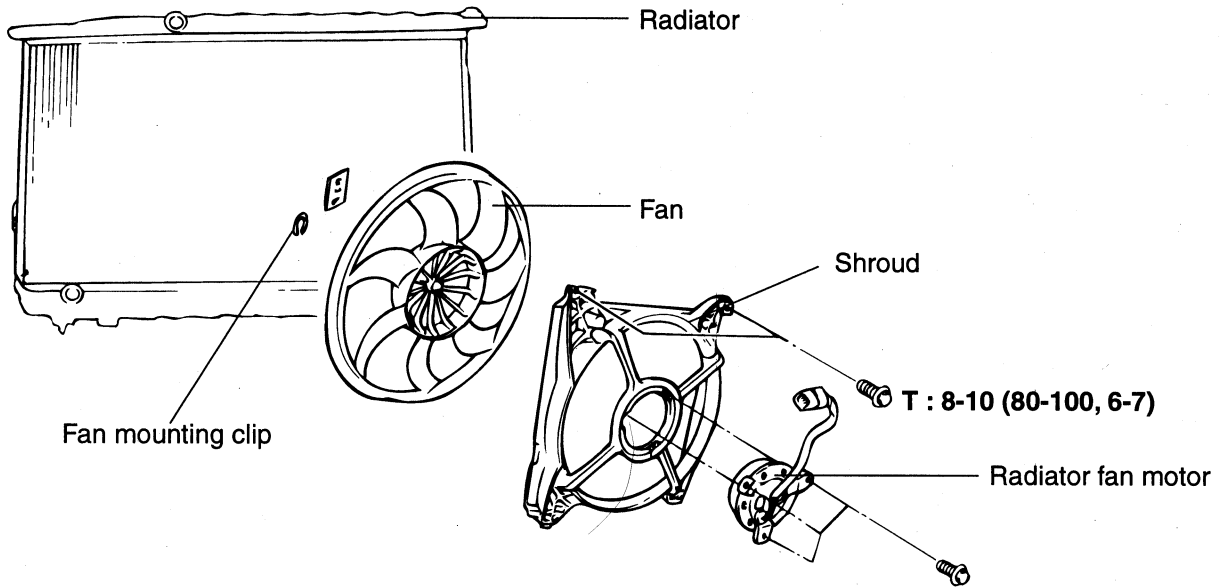
INSTALLATION EDJA6300

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

RADIATOR PAN MOTOR

RADIATOR FAN MOTOR

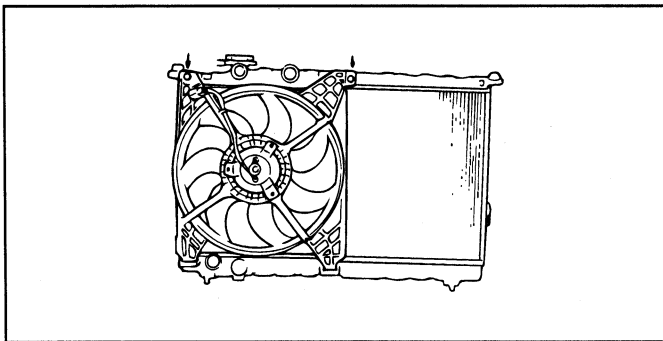
ASSEMBLY EDHA8500



TORQUE : Nm (kg·cm, lb·ft)

REMOVAL EDJA6500

1. Disconnect the ground cable from the battery cable.
2. Disconnect the connectors from the fan motor and the harness from the shroud.
3. For vehicles with automatic transaxles, remove the oil cooler hose from the shroud.
4. Remove the four bolts holding the shroud.
5. Remove the shroud with the fan motor.
6. Remove the fan mounting clip and detach the fan from the fan motor.
7. Remove the three screws and detach the fan motor.

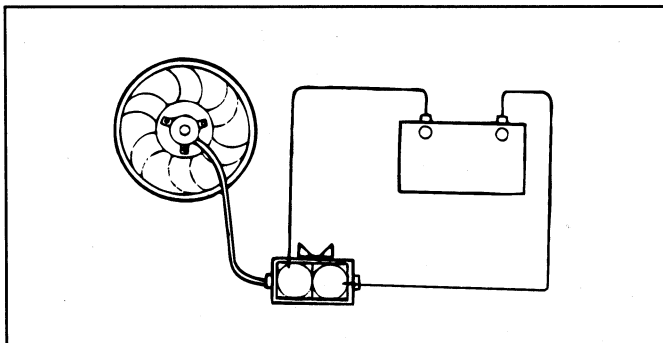


ECA9060A

INSPECTION EDJA6600

RADIATOR FAN MOTOR AND CONDENSER FAN MOTOR

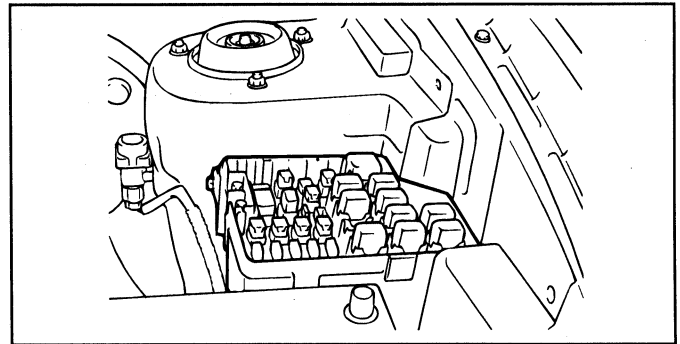
1. Check that the radiator fan rotates when battery voltage is applied between the terminals.
2. Check that there are no abnormal noises while the motor is running.



ECHA011C

RADIATOR FAN MOTOR RELAY

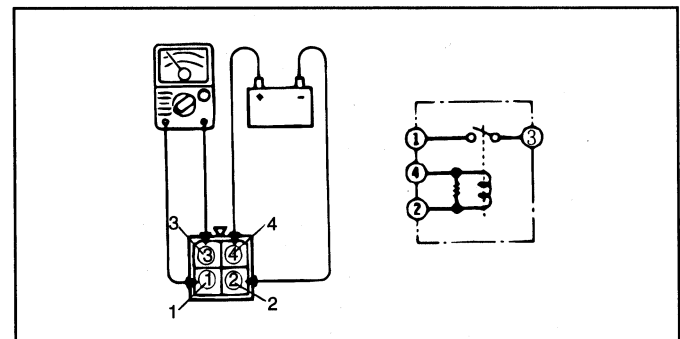
1. Remove the radiator fan motor relay (High and Low) from the relay box in the engine room.



ECJA630A

2. Check the continuity of the terminals.

Current	Terminal No.	Yes or No
ON	Terminal 1-3	Continuity
OFF	Terminal 1-3	Non continuity
	Terminal 2-4	Continuity



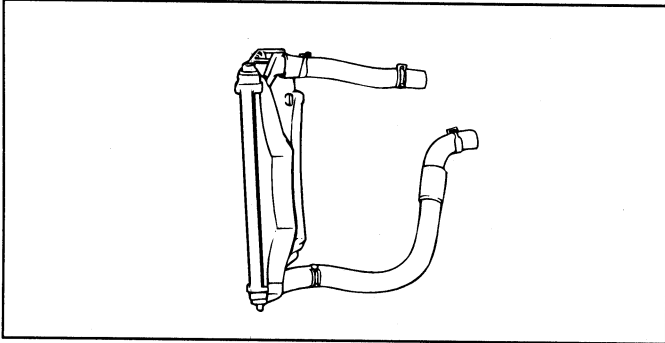
HFR25016

INSTALLATION EDHA8800

Installation is the reverse of removal.

NOTE

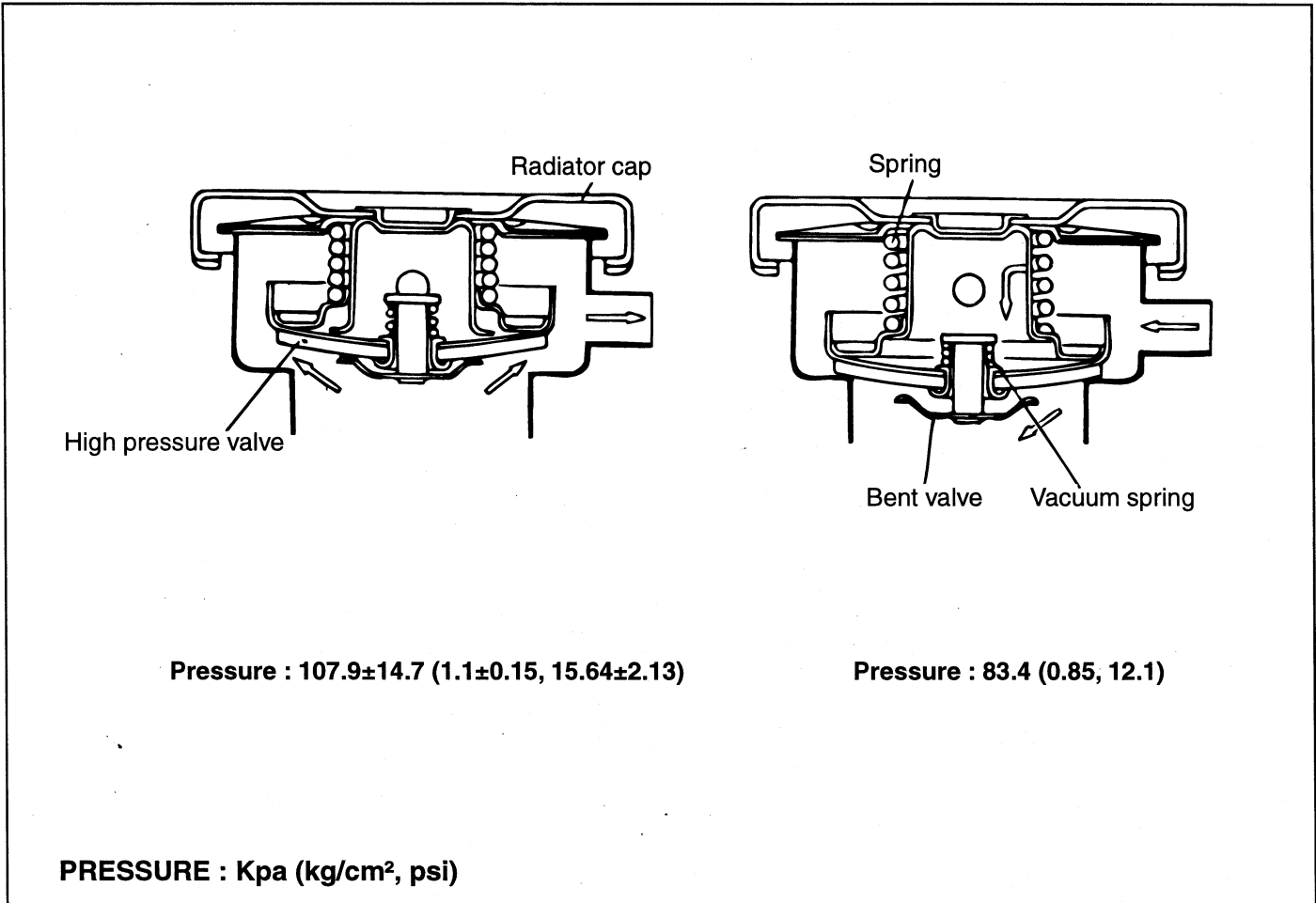
1. **Make sure the cooling fan does not come into contact with the shroud when installed.**
2. **After installation, make sure there is no unusual noise or vibration when the fan is rotating.**



ECA9061A

RADIATOR CAP

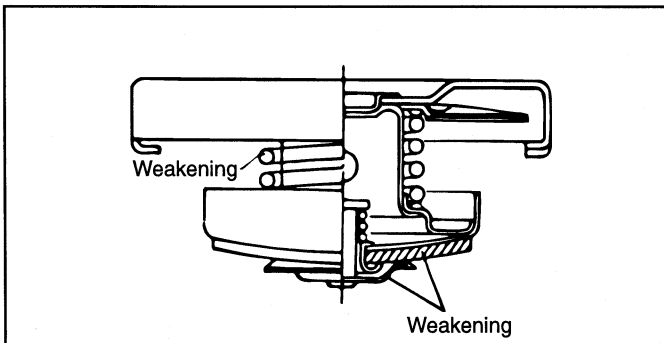
RADIATOR CAP EDHA8200



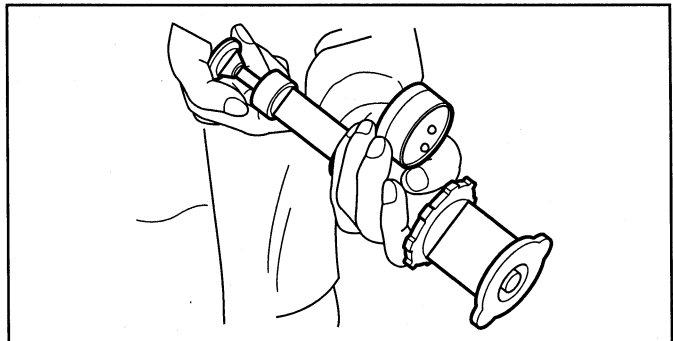
HCT25012

INSPECTION EDHA8300

1. Check the radiator cap for damage, cracks or weakening.



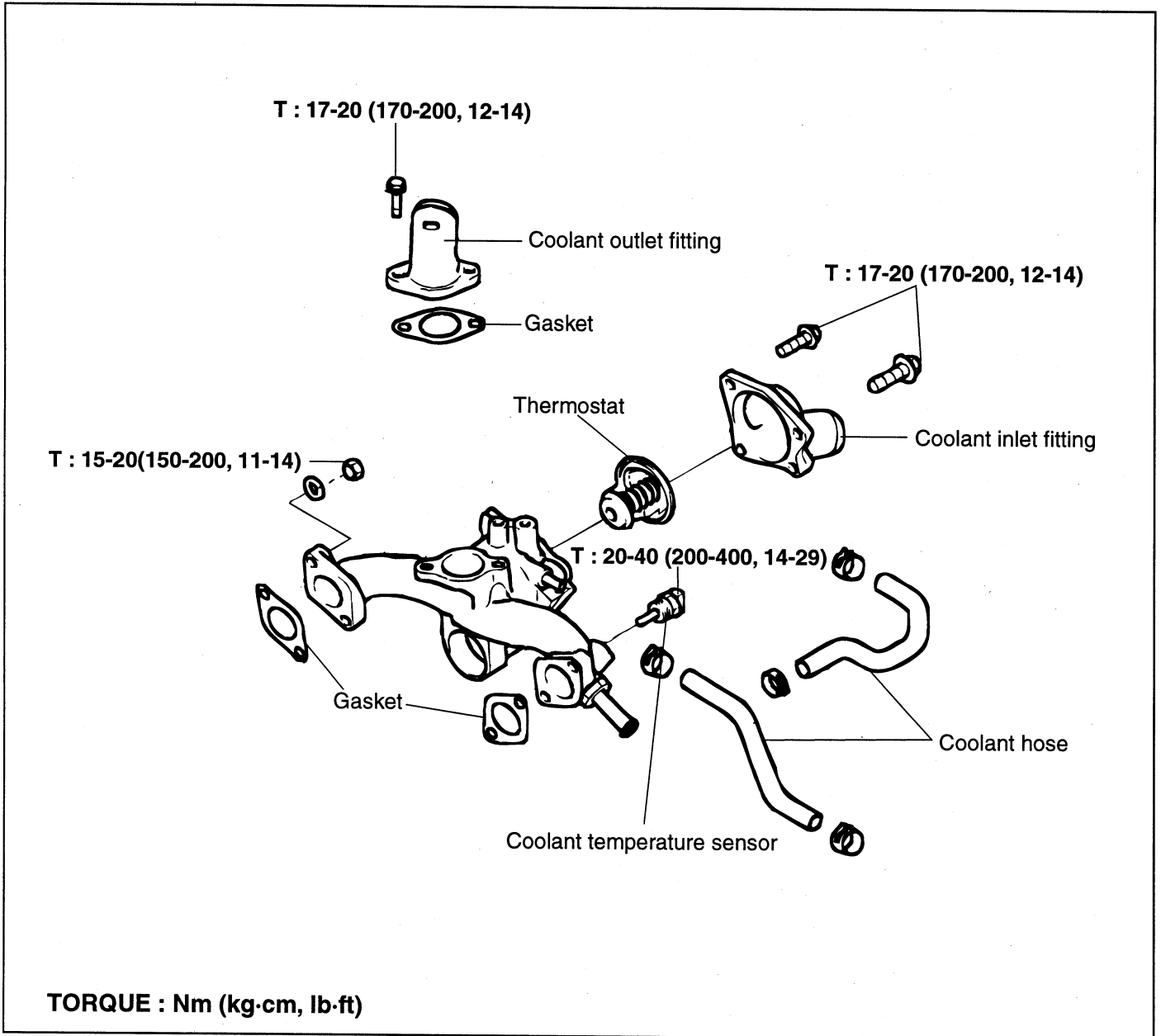
4. Replace the radiator cap if the reading does not hold steady for about 10 seconds.



2. Connect the tester to the radiator cap.
3. Increase the pressure until the indicator of the gauge stops moving.

THERMOSTAT

THERMOSTAT EDHA9000



REMOVAL EDHA9100

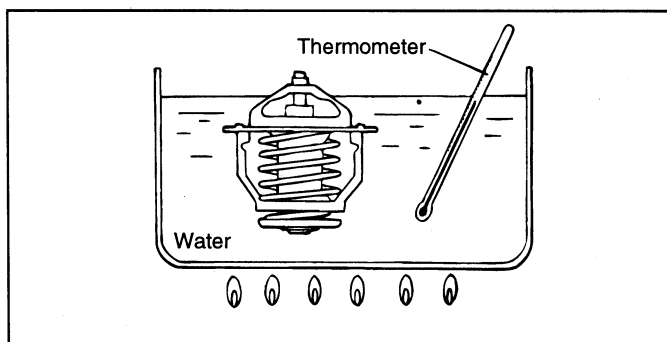
1. Drain the coolant to thermostat level or below.
2. Remove the inlet fitting and gasket.
3. Remove the thermostat.

INSPECTION EDHA9200

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

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

Full opening temperature : 95°C (203°C)



ECA9600A

INSTALLATION EDHA9300

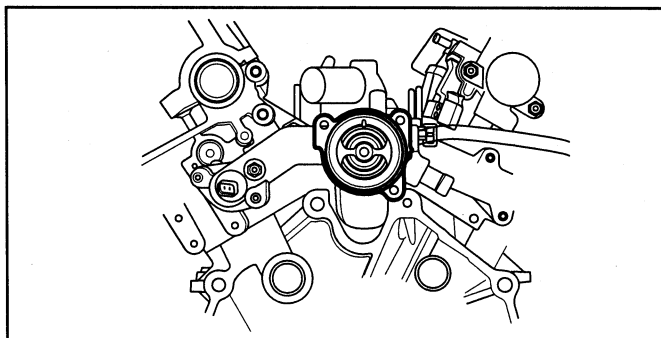
1. Check that the flange of the thermostat is correctly placed in the socket of the thermostat housing.
2. Install the inlet fitting.

Tightening torque

Engine coolant inlet fitting bolt :

17-20 Nm (170-200 kg.cm, 12-14 lb.ft)

3. Refill the coolant.

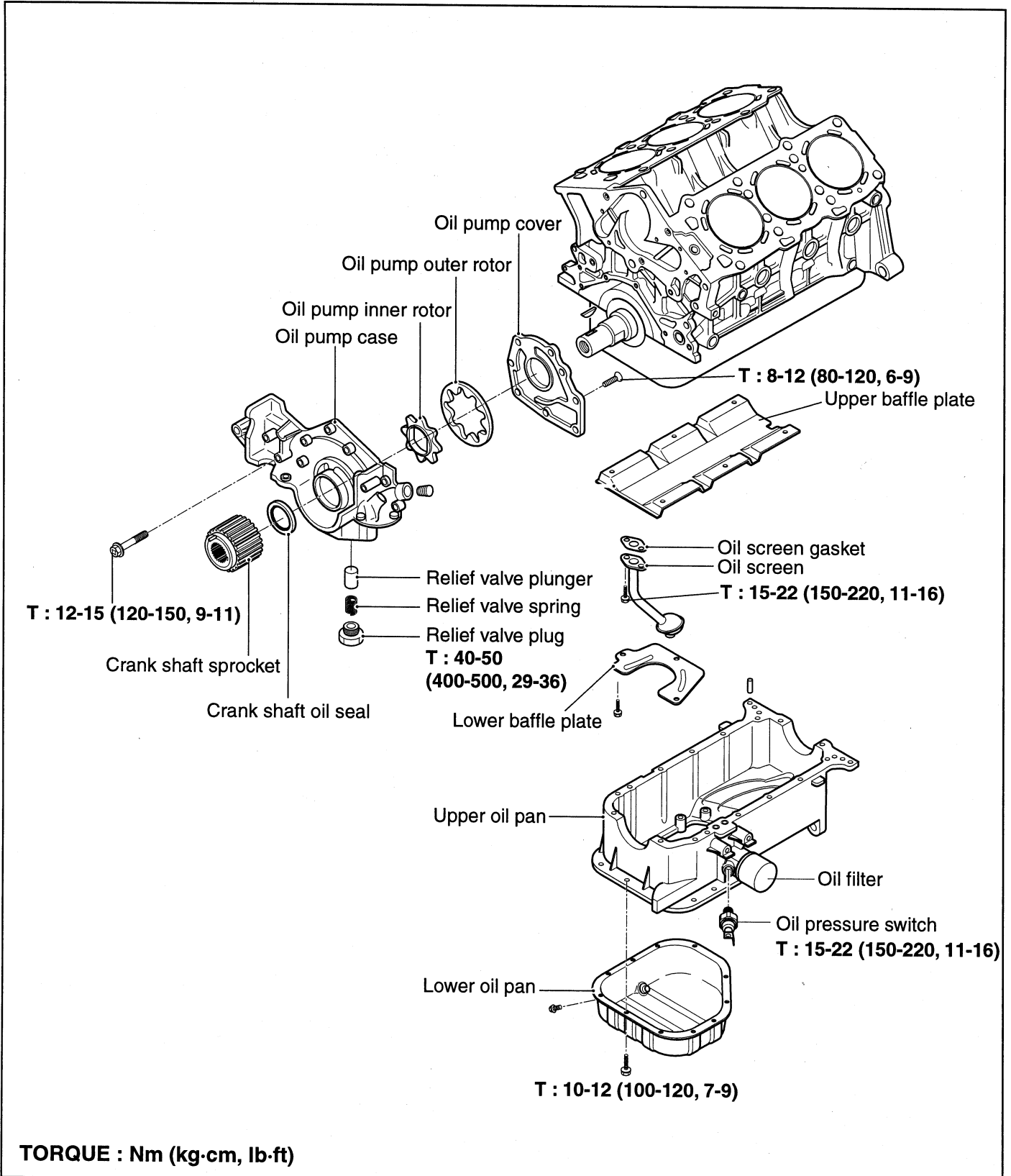


KFW3223A

LUBRICATION SYSTEM

OIL PUMP

OIL PUMP AND OIL PAN EDHA9400



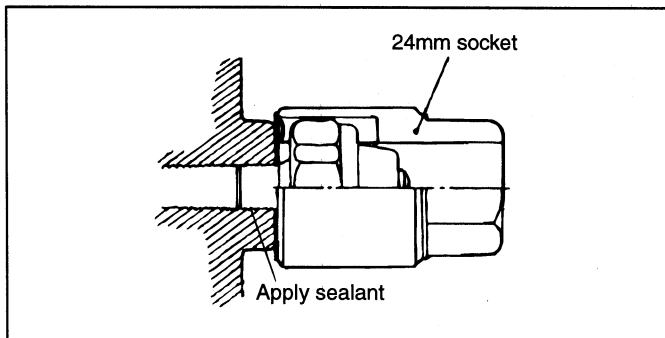
DISASSEMBLY EDHA9500

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

NOTE

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

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



HFR20A33

INSPECTION EDJA7700

OIL PUMP

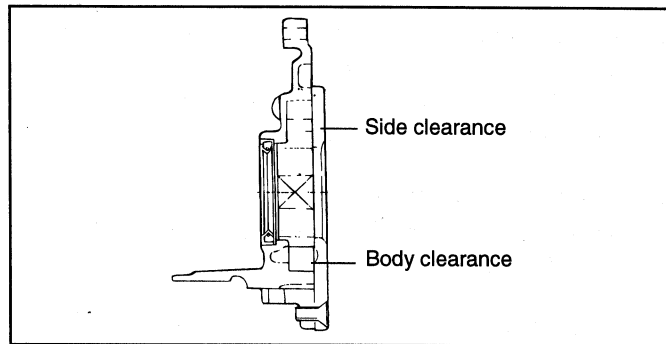
1. Visually check the parts of the oil pump case for cracks and damage.
2. Assemble the rotor on the oil pump and then check the clearance with a thickness gauge.

Oil pump side clearance

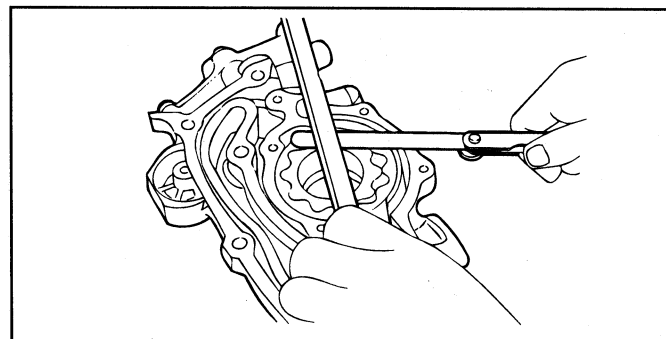
Standard value

Body clearance: 0.100-0.181mm (0.0039-0.0071 in.)

Side clearance: 0.040-0.095mm (0.0016-0.0037 in.)



EDA9041A



EDA9340B

RELIEF PLUNGER AND SPRING

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

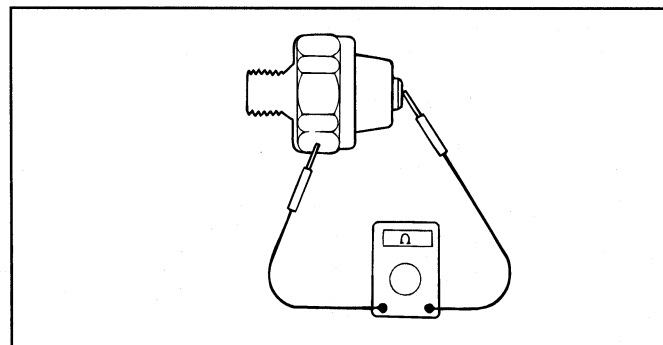
OIL FILTER BRACKET

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

OIL PRESSURE SWITCH

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

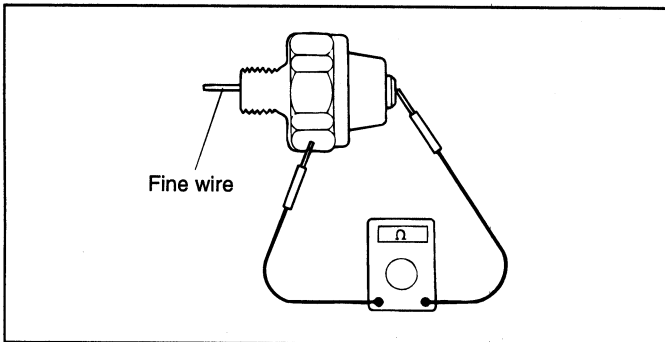
If there is no continuity, replace the oil pressure switch.



ECA9320D

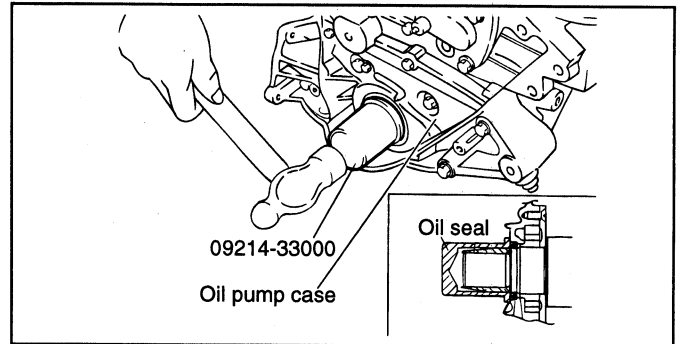
- Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.
- If there is no continuity when a 50 kpa (7 psi) vacuum is applied through the oil hole, the switch is operating properly.

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



ECA9320E

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



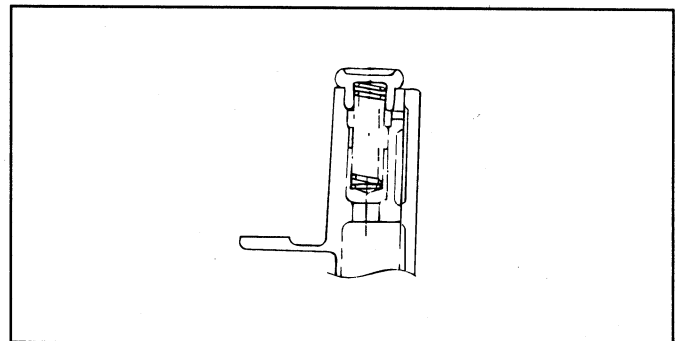
EDA9350B

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

Tightening torque

Oil relief valve plug :

40-50 Nm (400-500 kg.cm, 29-36 lb.ft)



EDA9044A

- Install the oil screen and a new gasket.

Tightening torque

Oil screen bolt :

15-22 Nm (150-220 kg.cm, 11-15 lb.ft)

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

NOTE

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

Operation Pressure

Oil pressure switch :

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

REASSEMBLY EDHA9700

- Install the oil pump case with the gasket.

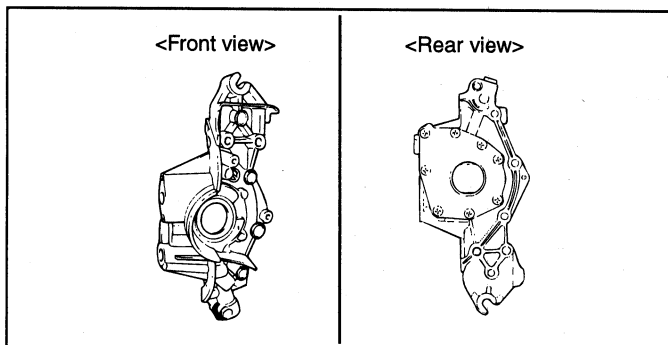
Tightening torque

Oil pump case bolt :

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

Oil pump cover screw :

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



EDA9042A

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

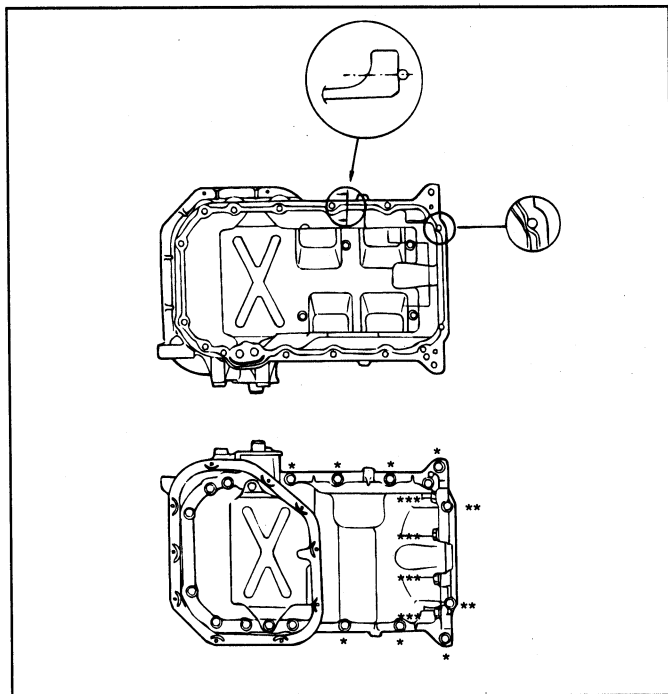
Tightening torque

Oil pan bolt :

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

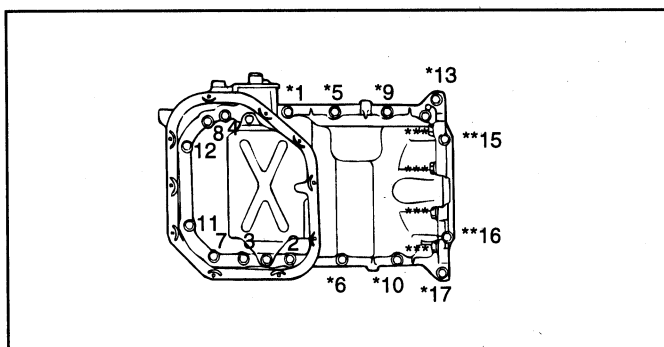
** : 5-7 Nm (50-70 kg.cm, 4-5 lb.ft)

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



EDA9045A

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



EDA9045B

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

Sealant :

Three bond No.1141E or 3M ATD No. 8660 or equivalent

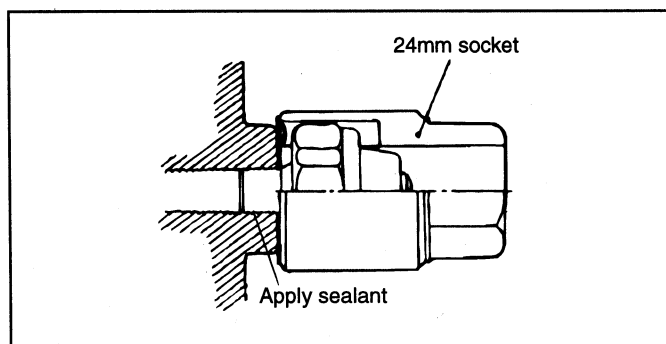
NOTE

Do not torque the oil pressure switch too much.

Tightening torque

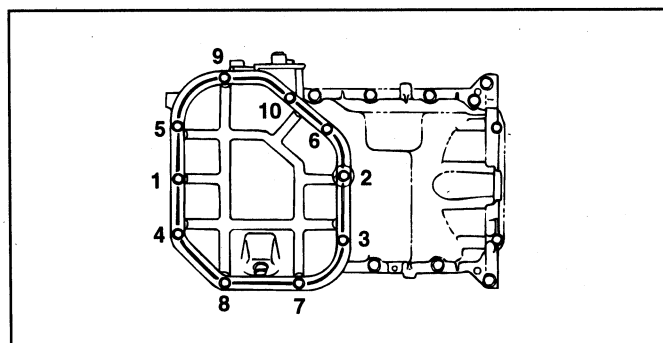
Oil pressure switch :

15-22 Nm (150-220 kg.cm, 11-16 lb.ft)



HFR20A33

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

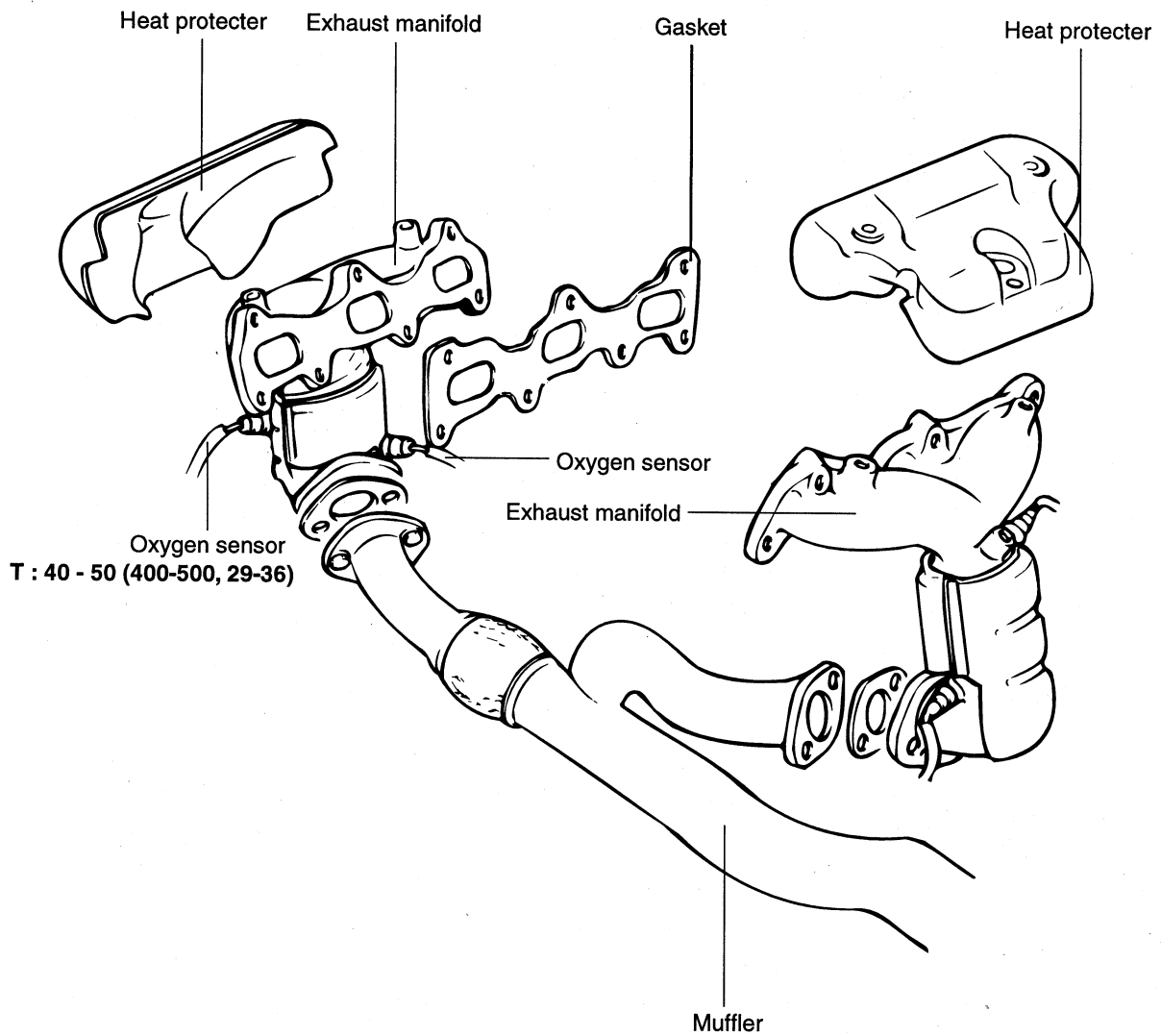


EDJA970A

INTAKE AND EXHAUST SYSTEM

EXHAUST MANIFOLD

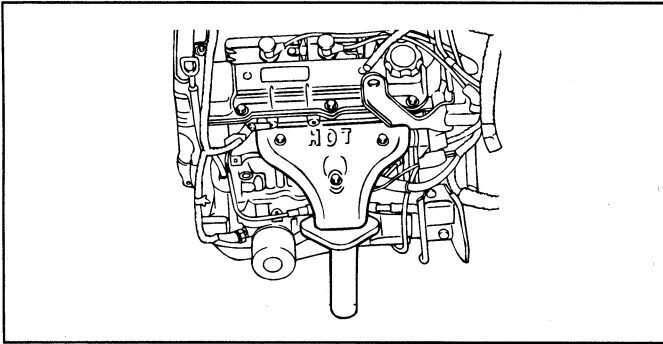
EXHAUST MANIFOLD EDJA8000



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

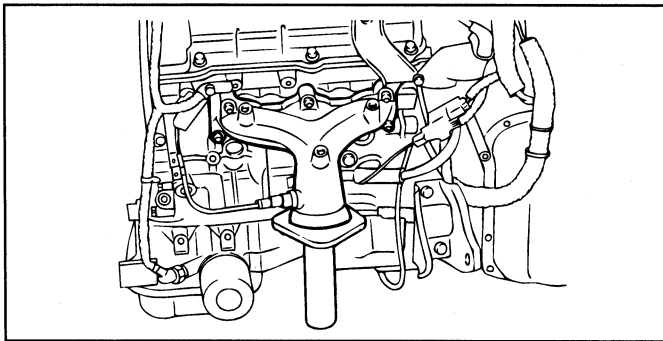
REMOVAL EDHAA100

1. Remove the heat protector.



EDHA011A

2. Remove the exhaust manifold.



EDHA011B

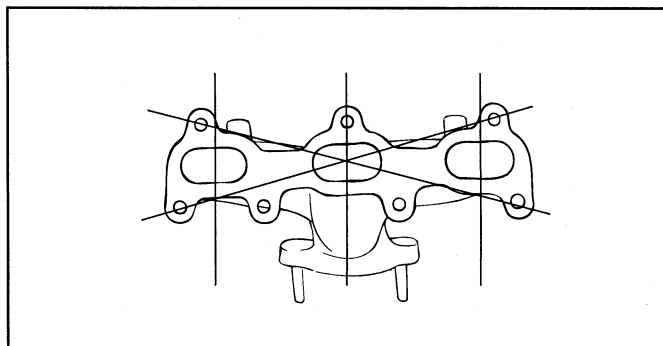
3. Remove the exhaust manifold gasket.

INSPECTION EDHAA200

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

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

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



EDA9069A

3. Check the exhaust manifold for damage and cracks.

INSTALLATION EDHAA300

1. Install the exhaust manifold with gasket.

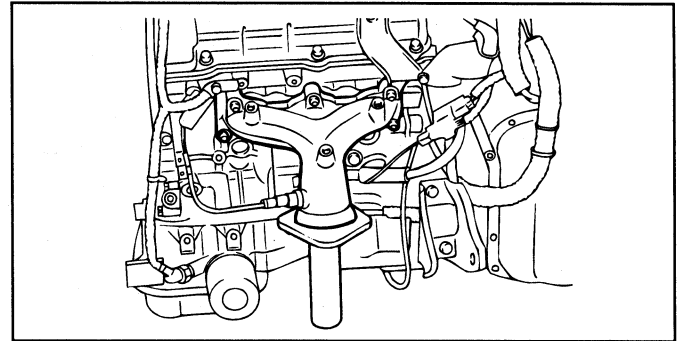
Tightening torque

Exhaust manifold :

25-30N.m (250-300 kg.cm, 18-22 lb.ft)

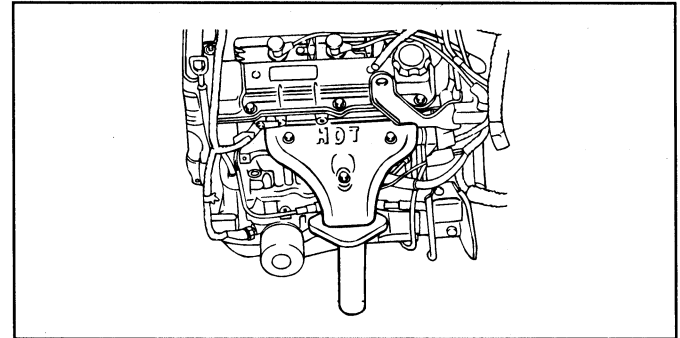
NOTE

Do not re - use an exhaust manifold gasket.



EDHA011B

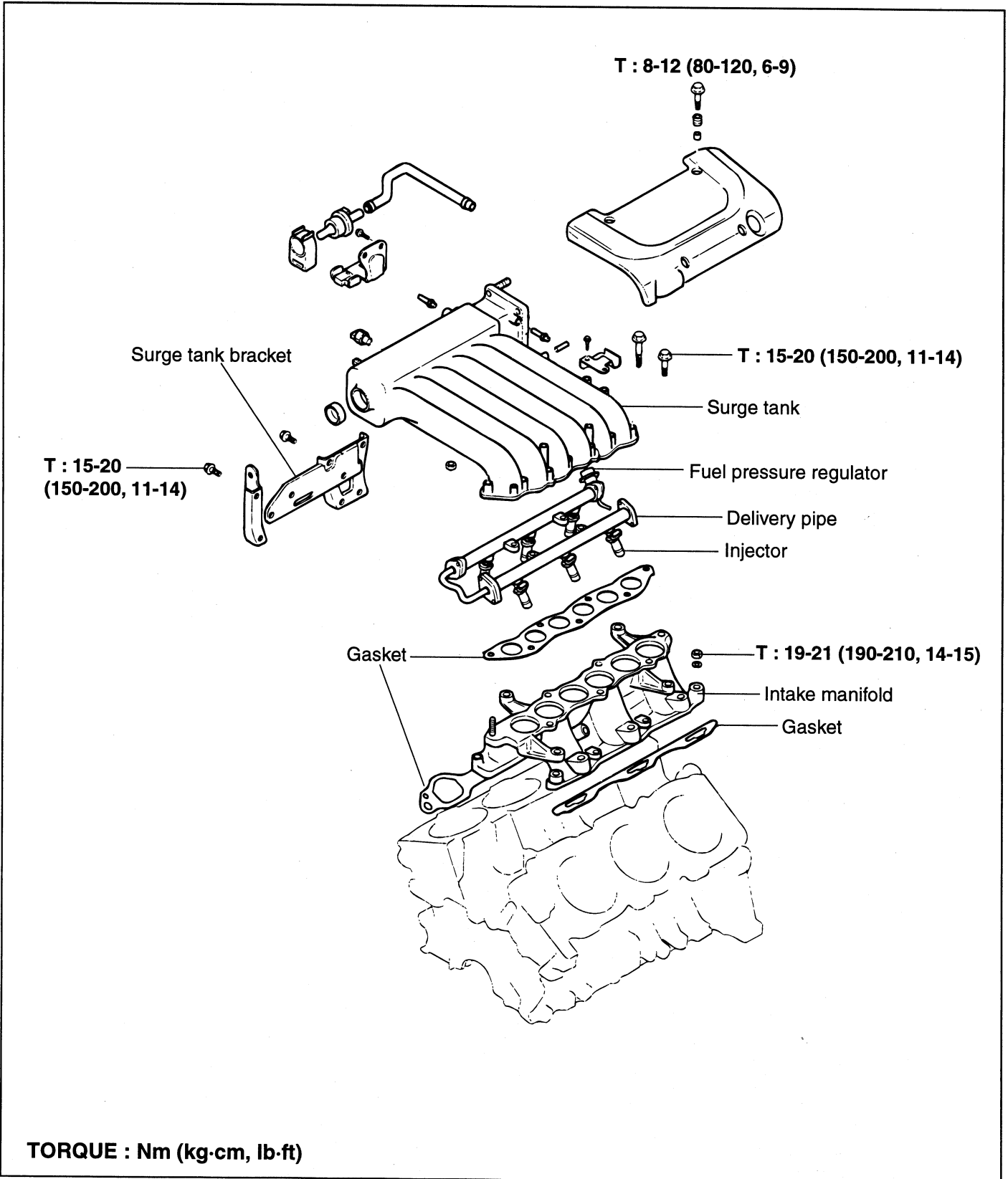
2. Install the heat protector.



EDHA011A

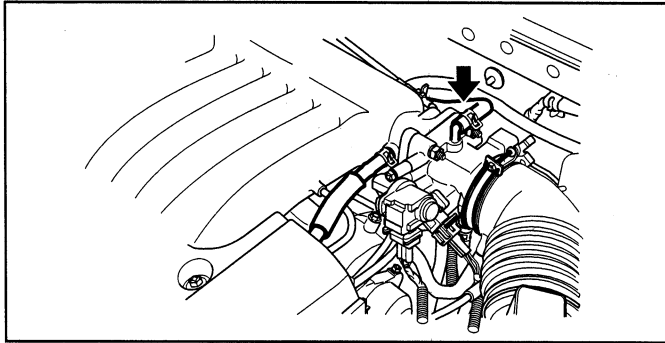
INTAKE MANIFOLD

INTAKE MANIFOLD EDHAA500



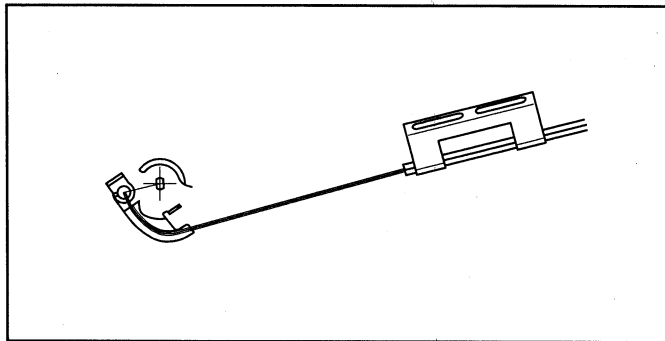
REMOVAL EDHAA600

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



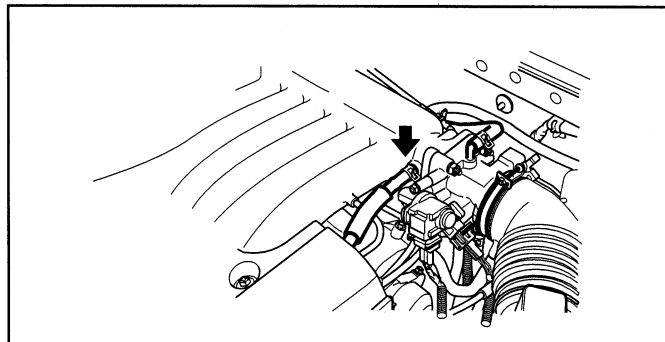
KFW3230A

2. Remove the accelerator and cruise control cables.
3. Remove the engine coolant hose and throttle body.



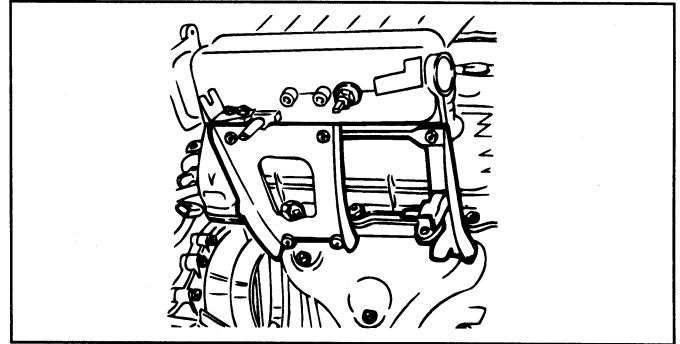
KFW3231A

4. Remove the P.C.V. hose and brake booster vacuum hoses.
5. Disconnect the vacuum hose connections.



KFW3230B

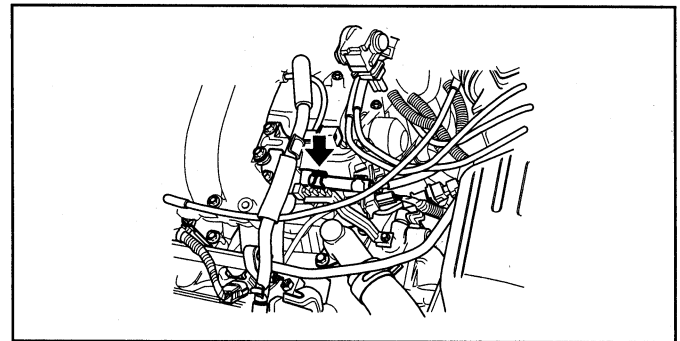
6. Remove the surge tank stay.



KFW2817A

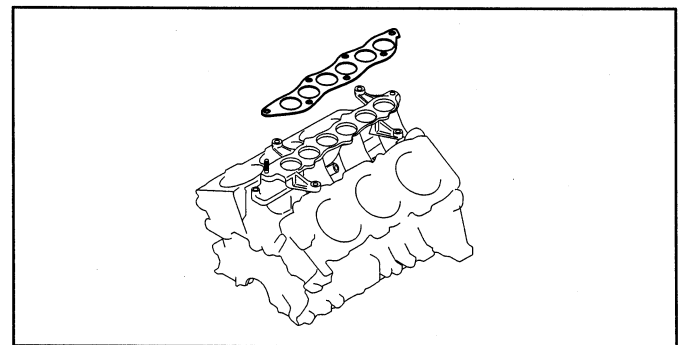
7. Bleed off the pressure in the fuel pipe line to prevent the fuel from spilling.

8. Disconnect the connector from high pressure hose.



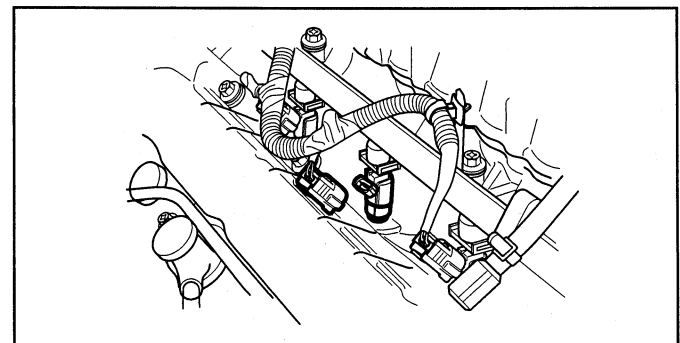
KFW3234A

9. Remove the surge tank and gasket.



KFW3236A

10. Disconnect the fuel injector harness connector.

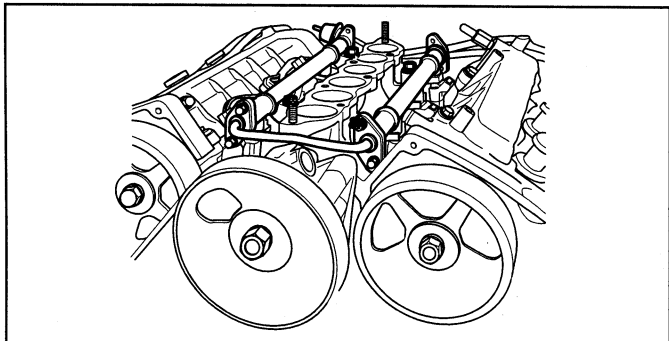


KFW3237A

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

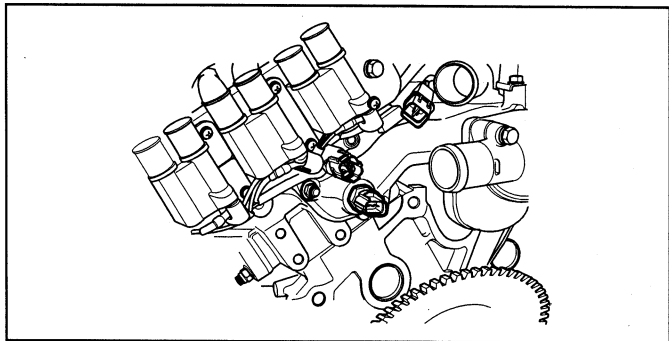
NOTE

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

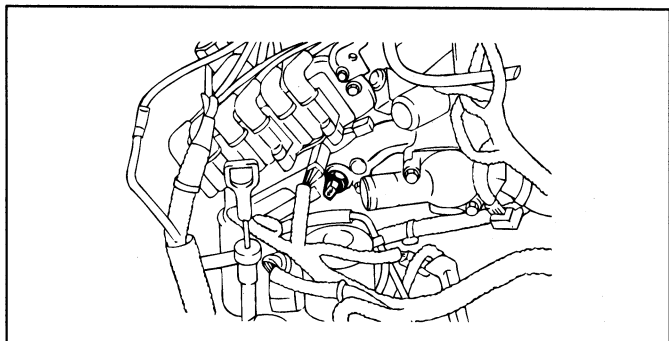


KFW3238A

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

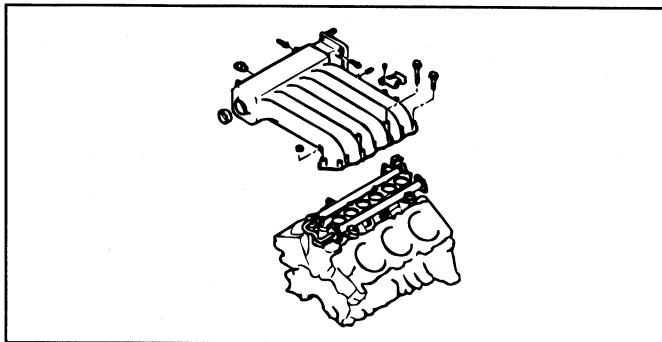


KFW5012A



EDHA021B

13. Remove the surge tank.



KFW3239A

INSPECTION

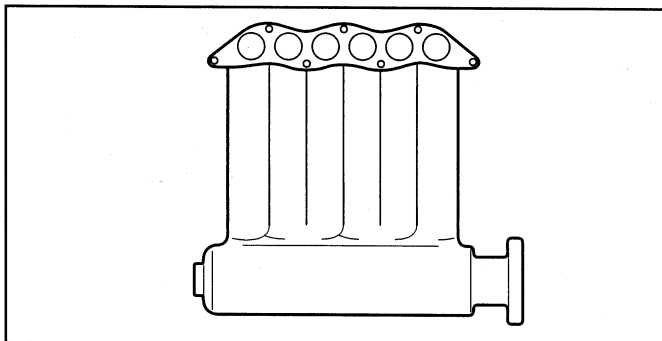
EDHAA700

SURGE TANK AND INTAKE MANIFOLD

1. Check the surge tank and intake manifold for damage, cracking or restriction of the vacuum outlet port, water or gas passages.
2. Check for distortion on the surface using a straight edge and feeler gauge.

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

Service limit : 0.2 mm (0.0078 in.)



KFW3240A

INSTALLATION EDHAA800

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

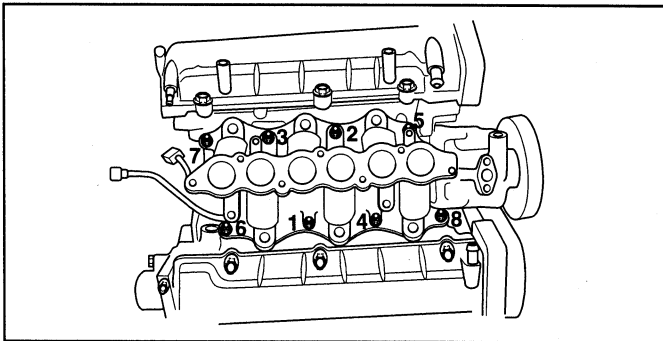
Tightening torque

Intake manifold :

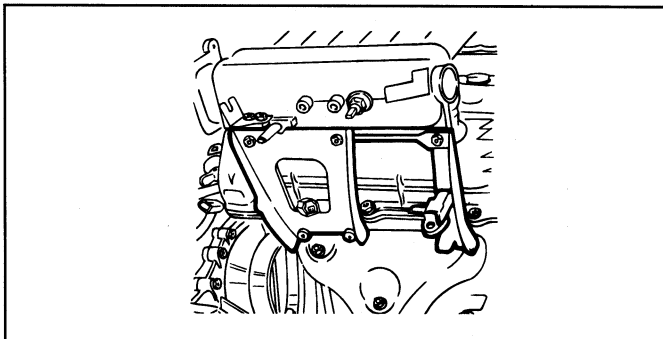
19-21 N.m (190-210 kg.cm, 14-15 lb.ft)

Surge tank :

15-20 N.m (150-200 kg.cm, 11-14lb.ft)



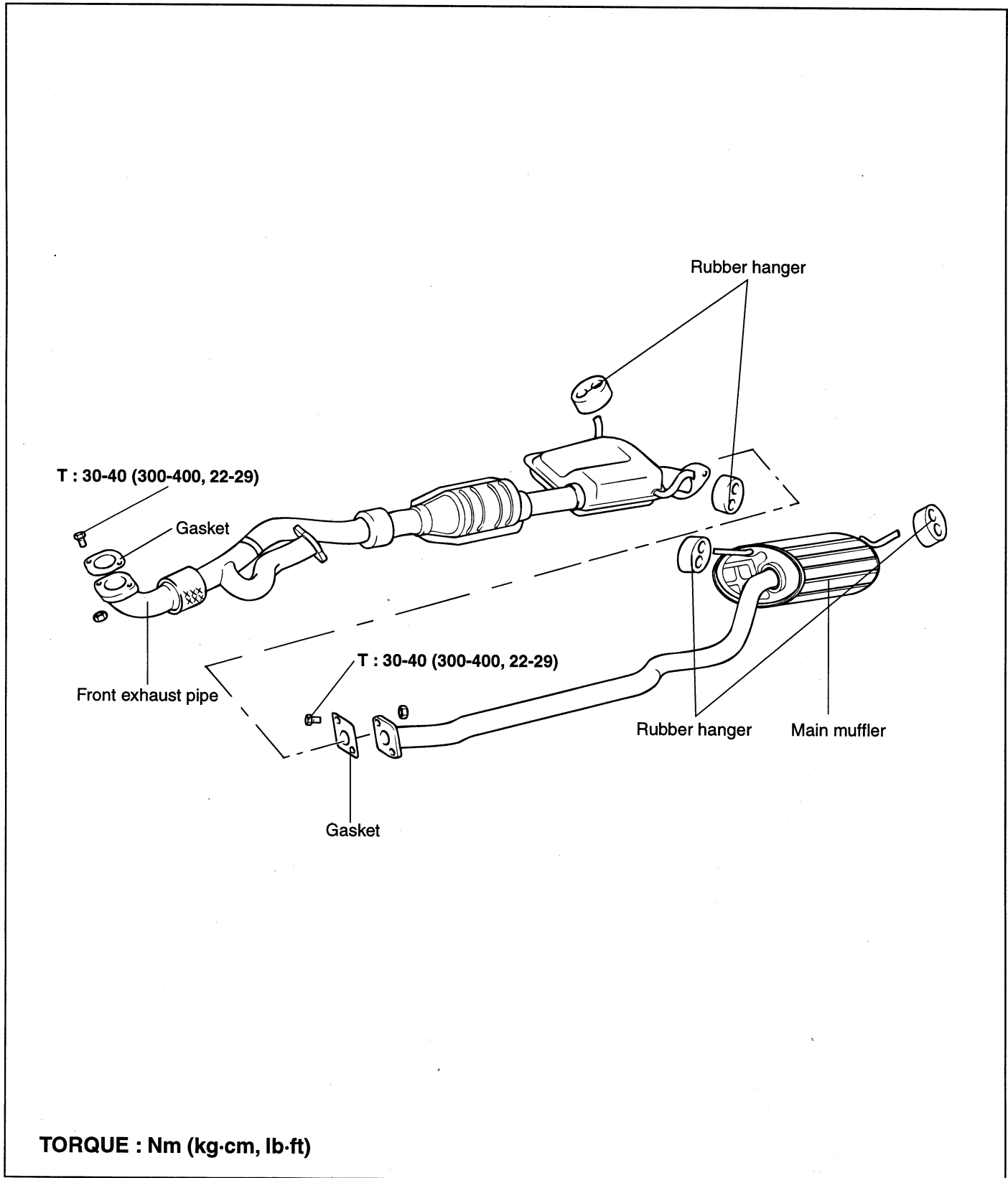
KFW3241A



HEW2817A

MUFFLER

MUFFLERS EDJA9000



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

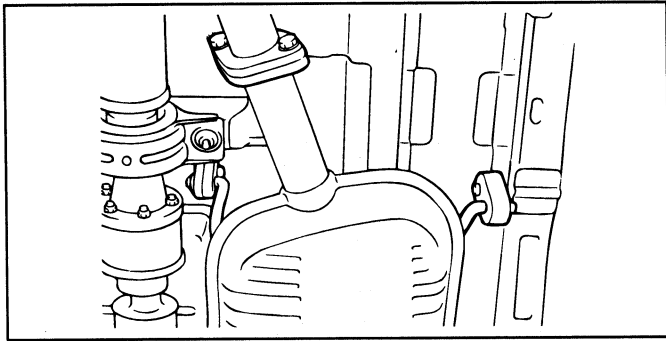
REMOVAL EDJA9100

MAIN MUFFLER

CAUTION

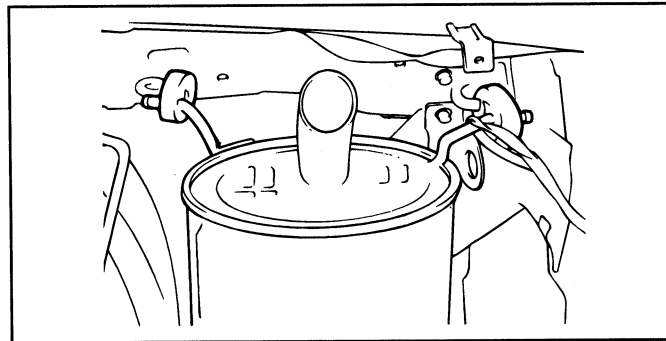
Before removing or inspecting the exhaust system, ensure that the exhaust system is cool.

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

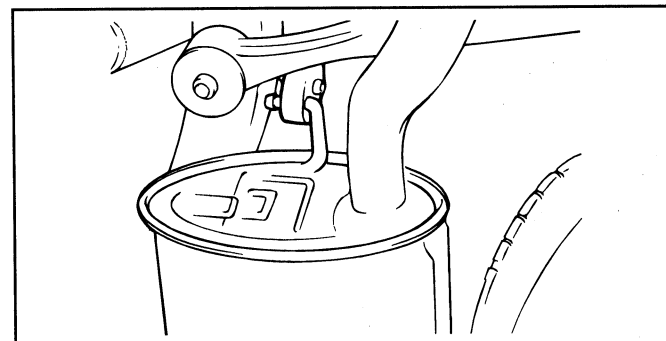


ECJA810A

2. Remove the rubber hangers and the main muffler.



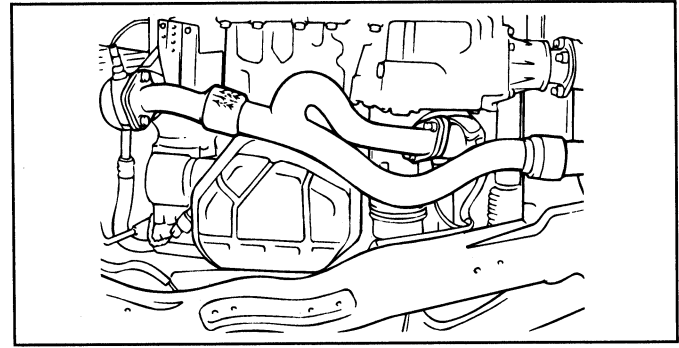
ECJA810B



ECJA810C

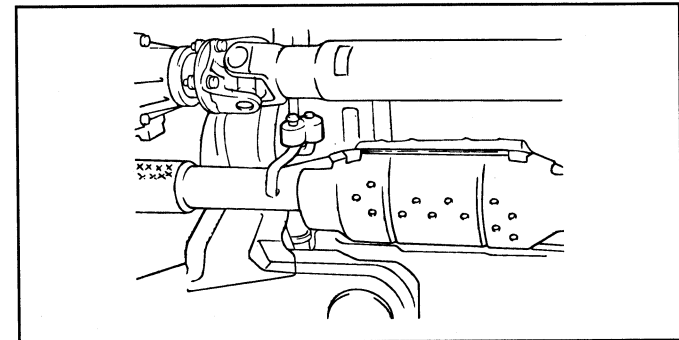
FRONT EXHAUST PIPE (INCLUDING CATALYTIC CONVERTER)

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

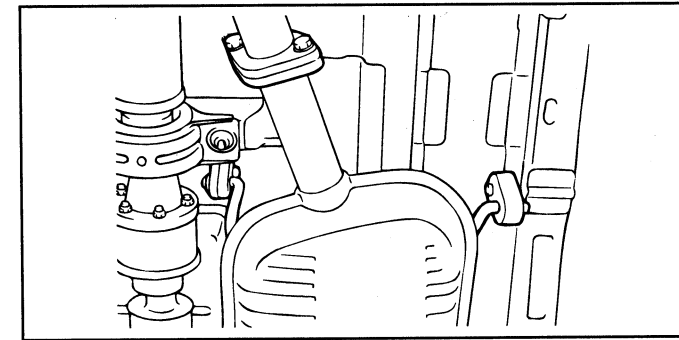


EDJA070A

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



EDJA810C



ECJA810A

INSPECTION EDHAB200

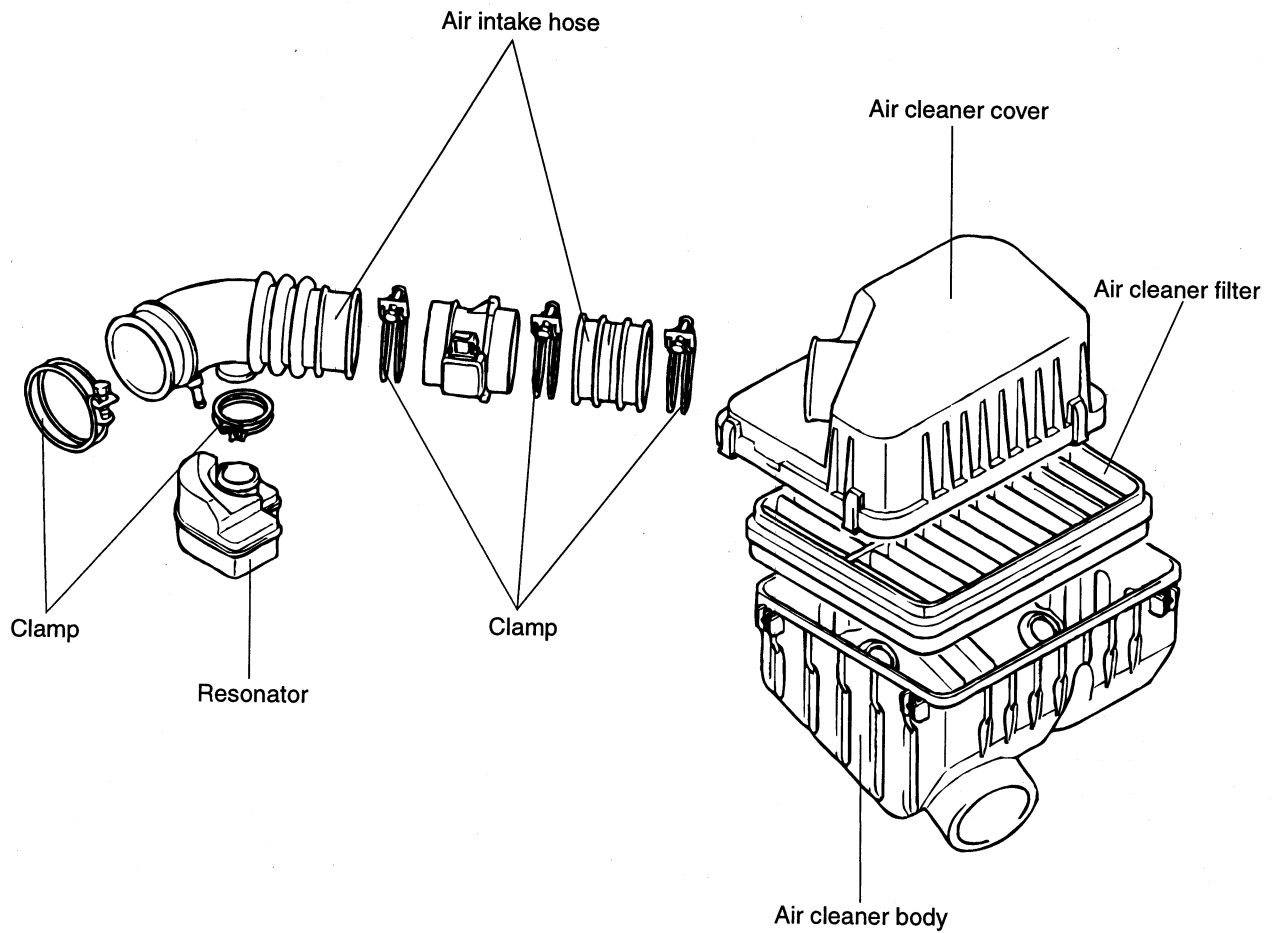
1. Check the mufflers and pipes for leaks, corrosion and damage.
2. Check the rubber hangers for deterioration and cracks.

INSTALLATION EDHAB300

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

AIR CLEANER (ACL)

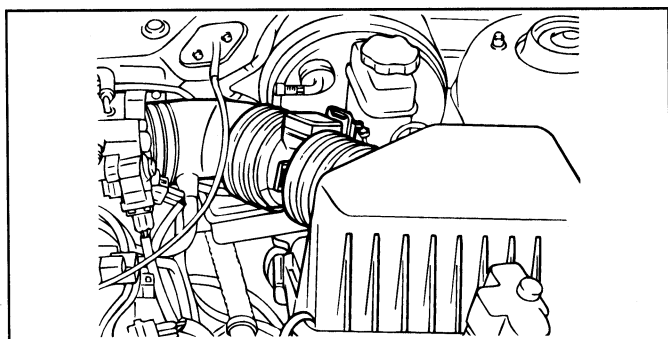
AIR CLEANER EDJA9500



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

REMOVAL EDJA9600

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



EDJAB60A

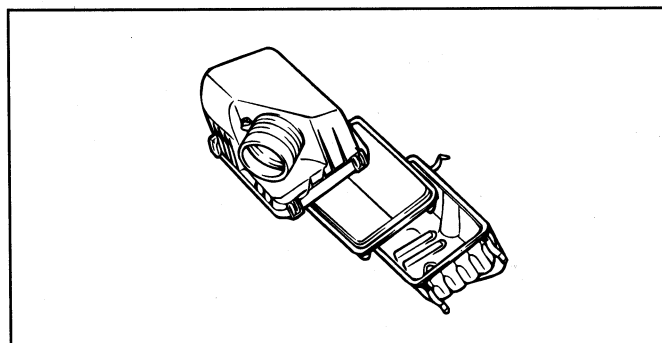
5. Remove the air flow sensor from the air intake hose.

CAUTION

Do not pull on the air flow sensor wires.

INSPECTION EDJA9700

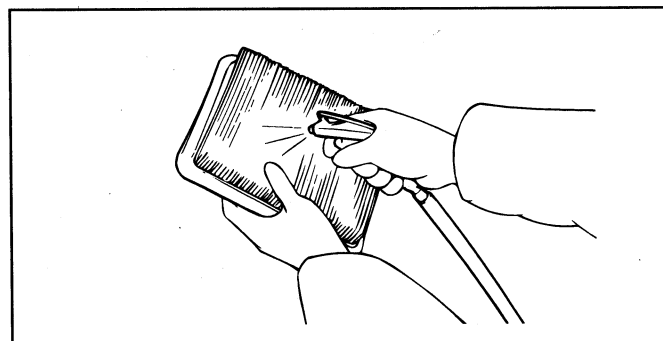
1. Check the air intake hose, air cleaner cover for damage.
2. Check the air duct for damage.



ECJA870A

3. Check the air cleaner element for restriction, contamination or damage.

If the element is slightly restricted, remove dust and debris by blowing compressed air from the inside of the element. Replace the element if it cannot be cleaned.



ECA9066A

INSTALLATION EDHAB800

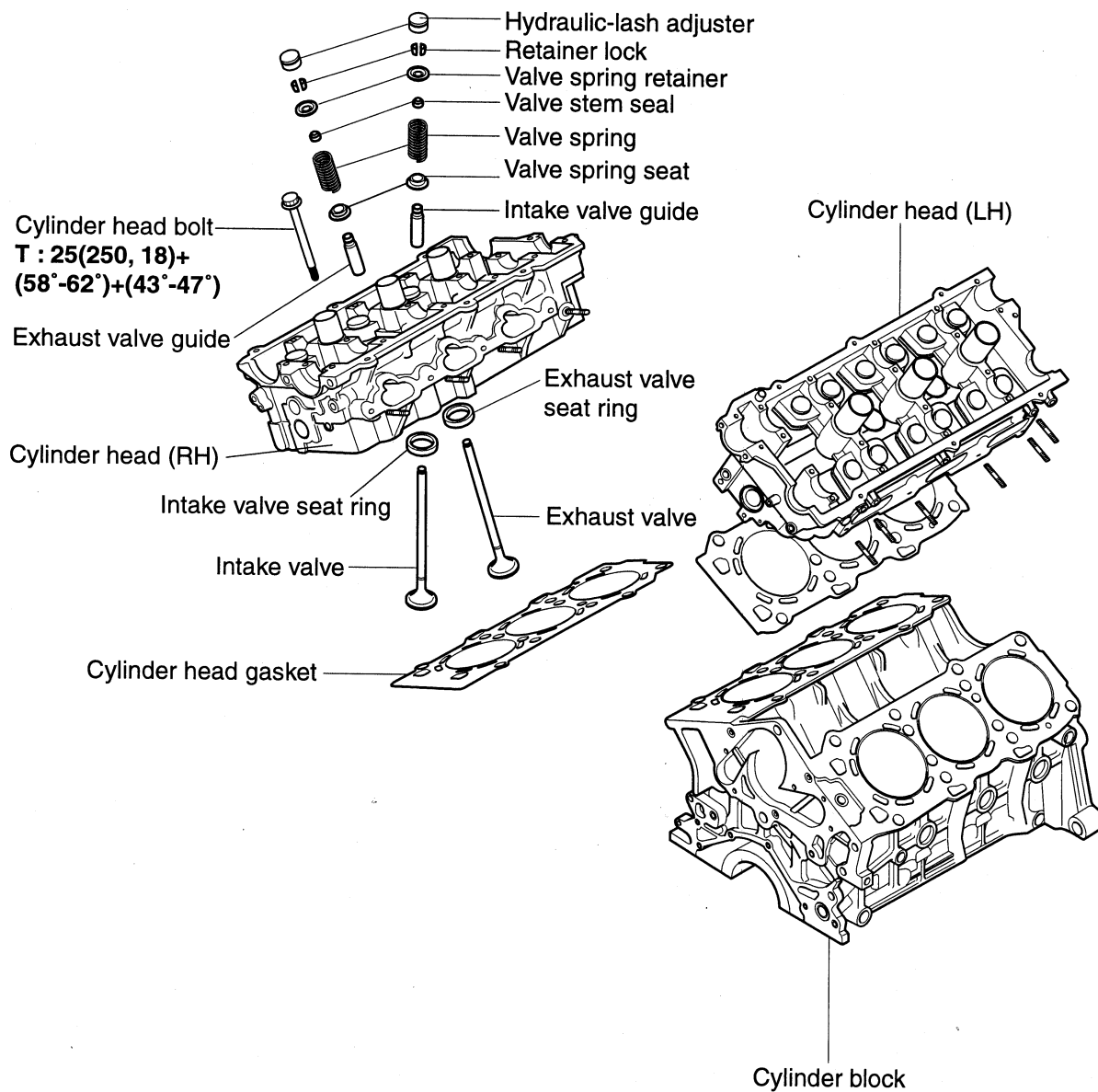
1. Install the air cleaner assembly following the reverse order of removal.

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

CYLINDER HEADS, VALVES AND VALVE SPRINGS

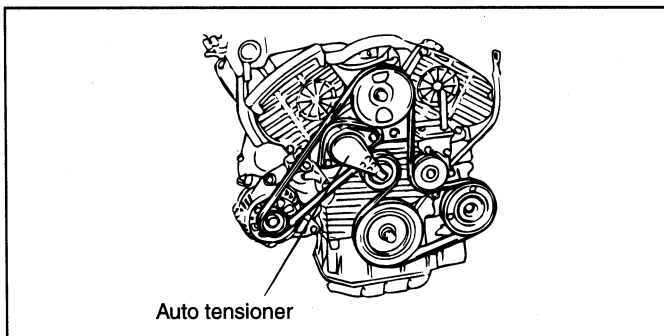
EDHAC000



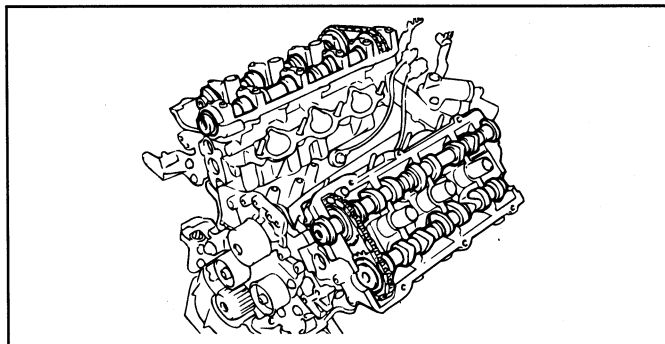
TORQUE : Nm (kg-cm, lb-ft)

DISASSEMBLY EDHAC100

1. Drain the coolant and disconnect the upper radiator hose.
2. Remove the breather hose and air-intake hose.
3. Remove the vacuum hose, fuel hose and coolant hose.
4. Remove the intake manifold.
5. Remove the cables from the spark plugs. The cables should be removed by holding the boot portion.
6. Remove the ignition coil.
7. Remove the upper and lower timing belt cover.
8. Remove the timing belt and camshaft sprockets.
9. Remove the heat protector and exhaust manifold assembly.
10. Remove the coolant pump pulley and head cover.
11. Remove the intake and exhaust camshaft.



EDA9031A



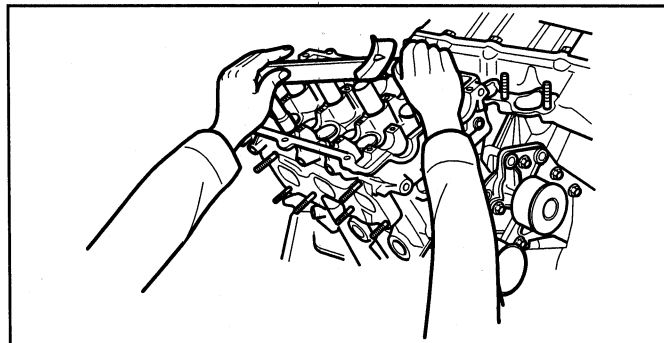
EDA9035A

12. Remove the cylinder head assembly. The cylinder head bolts should be removed using the S12 mm socket, in two or three steps.

13. Clean the gasket pieces from the cylinder block top surface and cylinder head bottom surface.

NOTE

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



KFW3010A

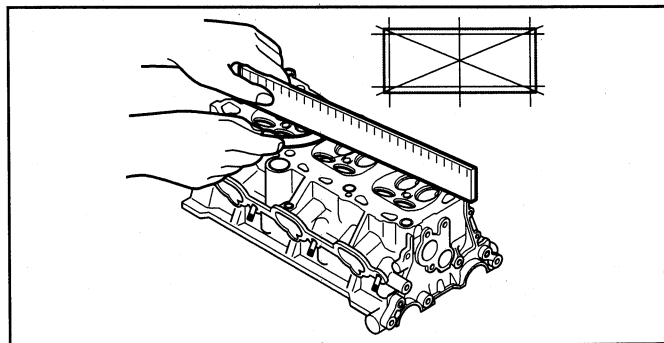
INSPECTION EDHAC200**CYLINDER HEAD**

1. Remove scale, sealing compound and carbon deposits. After cleaning oil passages, apply compressed air to make certain that the passages are not clogged.
2. Visually check the cylinder head for cracks, damage or water leakage.
3. Check the cylinder head surface for flatness with a straight edge and feeler gauge as shown in the illustration.

Cylinder head flatness:

Standard dimensions : Max. 0.03mm(0.0059 in.)

Service limit : 0.05mm(0.0020 in.)



KFW3047A

VALVE GUIDES

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

Valve stem-to-guide clearance

Standard value

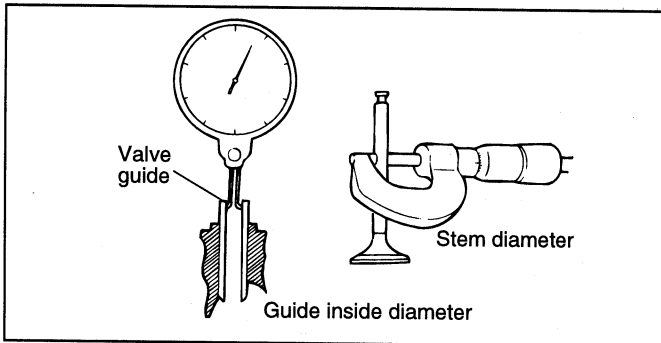
Intake : 0.02-0.05mm(0.0009-0.0020 in.)

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

Service limit

Intake : 0.10mm(0.0039 in.)

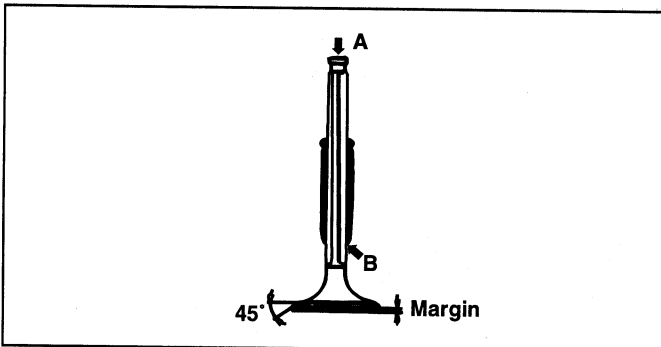
Exhaust : 0.15mm(0.0059 in.)



ECA9281D

VALVE

1. Replace the valve if its stem is bent, worn or damaged. Also replace it if the stem end (the surface contacting the hydraulic-lash adjuster) is hollowed out.
2. Check the valve face contact area, and recondition or replace as necessary.



ECA9281B

3. Replace the valve if the width of the margin (thickness of the valve head) is less than the minimum specified.

Valve margin

Standard value

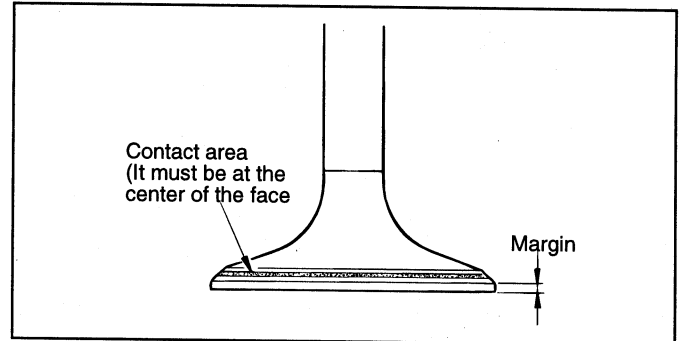
Intake : 1.0mm(0.0394 in.)

Exhaust : 1.3mm(0.0512 in.)

Service limit

Intake : 0.5mm(0.0197 in.)

Exhaust : 0.8mm(0.0315 in.)



EDA9300D

VALVE SPRING

1. Check the free height of each valve spring and replace if necessary.
2. Using a square, test the squareness of each valve spring. If the spring is excessively out-of-square, replace it.

Valve spring

Standard value

Free height : 42.5mm(1.6732 in.)

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

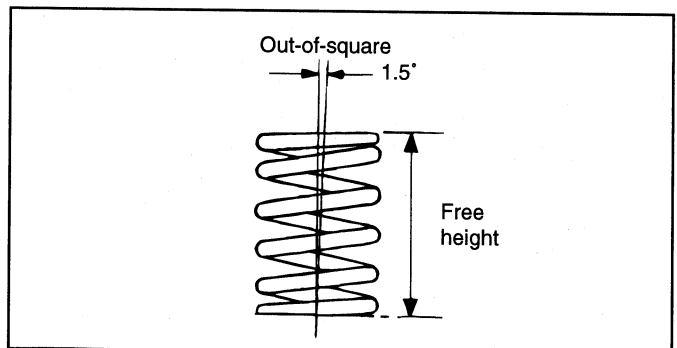
Out of squareness : Max. 1.5°

Service limit

Free height : .41.5mm(1.6339 in.)

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

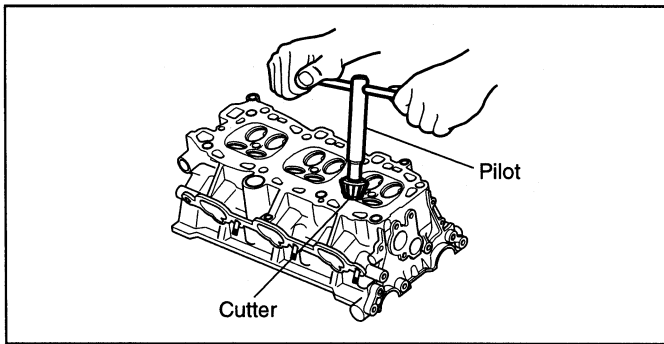
Out of squareness : Max. 3°



ECA9281C

RECONDITIONING VALVE SEAT

1. Before reconditioning, check the valve guide for wear. Replace worn guides if necessary and then recondition the valve seats.
2. Recondition the valve seat using the Valve Seat Cutter and Pilot.
3. After reconditioning, the valve and valve seat should be lapped lightly with a lapping compound.



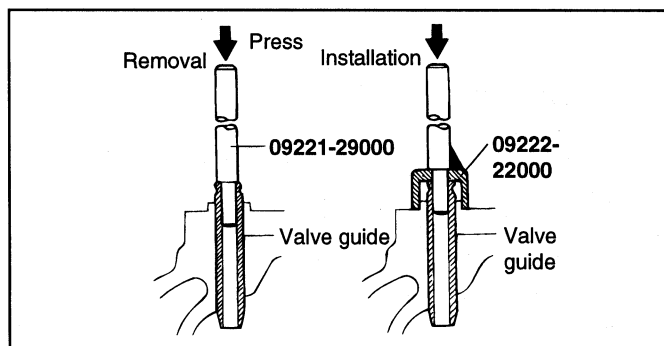
KFW3048A

REPLACING VALVE GUIDE

1. Using the special tool (09221-29000), withdraw the old valve guide out the bottom of the cylinder head.
2. Recondition the valve guide hole so that it can receive the newly press-fitted oversize valve guide.

VALVE GUIDE OVSIZES

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



EDA9300G

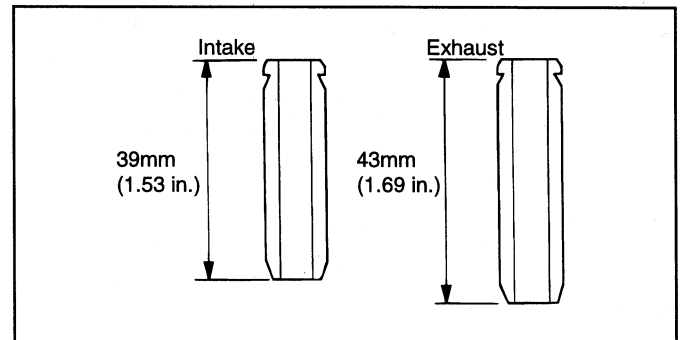
3. Using the special tool (09221-29000(A), 09222-22000(B)) press-fit the valve guide. The valve guide

must be press-fitted from the upper side of the cylinder head. Keep in mind that the intake and exhaust valve guides are different in length.

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

NOTE

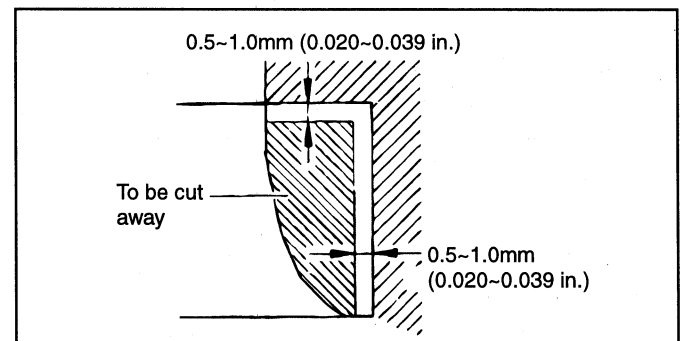
Do not install a valve guide unless it is oversize.



EOY168A

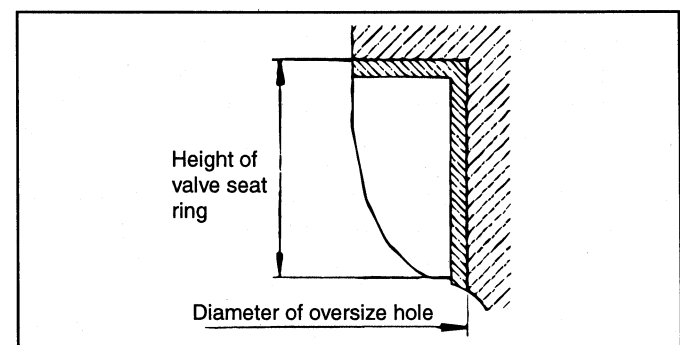
REPLACING VALVE SEAT RING

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



EOYR3940

2. Enlarge the diameter of the valve seat so that it matches the specified hole diameter of the new valve seat ring.



EOY167A

VALVE SEAT RING OVERSIZES

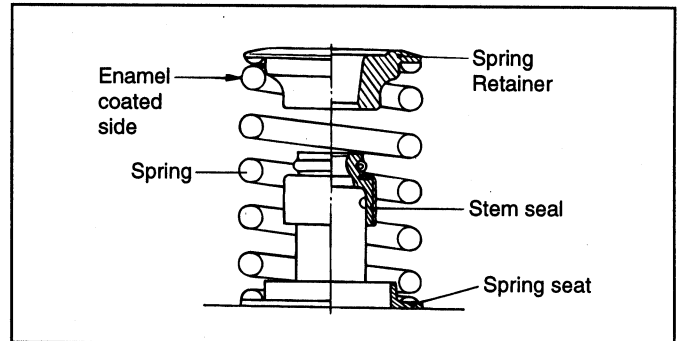
Description	Size mm (in.)	Size Mark	Seat ring height H mm (in.)	Oversize hole diameter I.D. mm (in.)
Intake valve seat ring	0.3 (0.012) O.S.	30	7.9-8.1 (0.311-0.319)	33.300-33.325 (1.311-1.312)
Exhaust valve seat ring	0.3 (0.012) O.S.	30	7.9-8.1 (0.311-0.319)	28.600-28.625 (1.126-1.127)

- Heat the cylinder head to about 250°C (480°F) and press-fit an oversize seat ring for the bore in the cylinder head.
- Using lapping compound, lap the valve to the new seat.

Valve seat contact width

Intake : 1.1-1.5mm(0.043-0.059 in.)

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



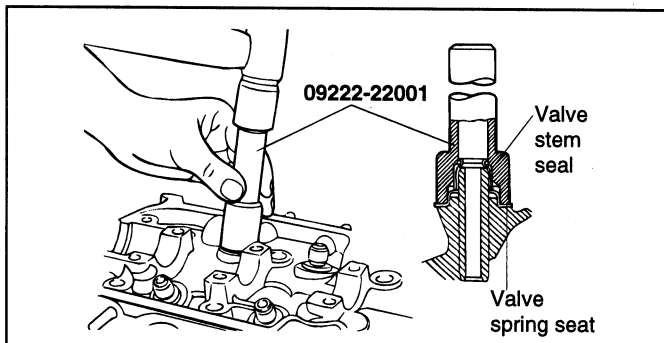
ECA9290B

REASSEMBLY EDHAC300

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

NOTE

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

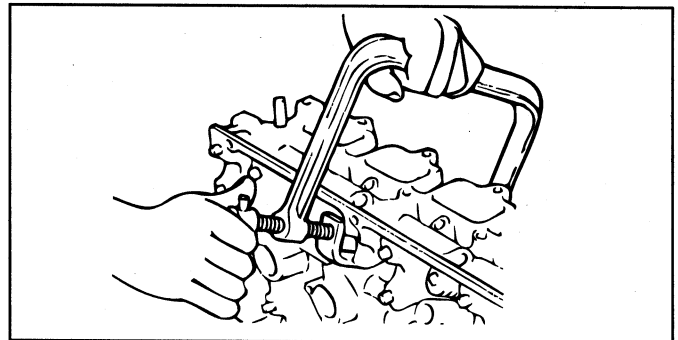


EDHAC30A

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

NOTE

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



EDAA040B

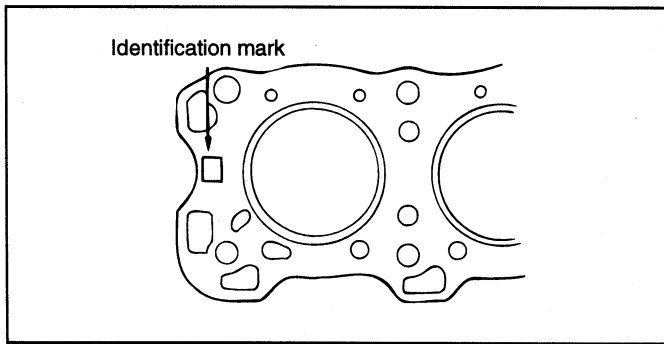
- Apply engine oil to each valve. Insert the valve into their guides. Avoid pushing the valve into the seal by force. After installing the valve, check that it moves smoothly.
- Place valve springs so that the side coated with enamel faces toward the valve spring retainer.

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

- Install the gasket so that the surface with the identification mark faces toward the cylinder head.

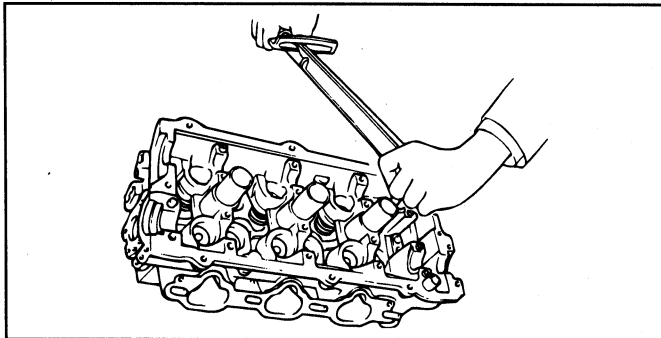
NOTE

Do not apply sealant to these surfaces.



EDA9310D

- Tighten the cylinder head bolts in the sequence shown in the illustration with a torque wrench.



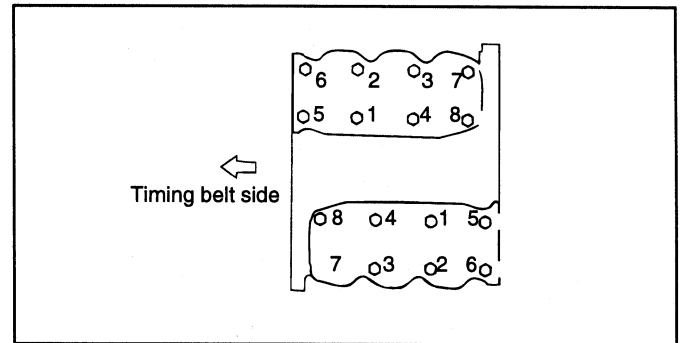
EDA9010A

- Tighten the cylinder head bolts using the torque - angle method. Starting at top center, tighten all cylinder head bolts in sequence as shown in the illustration, using the 12 mm socket.

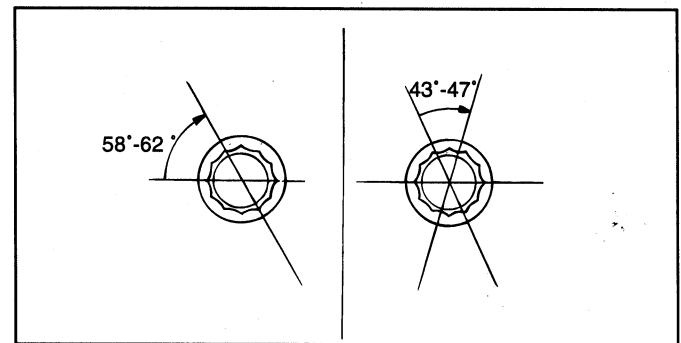
Tightening procedure

Cylinder head bolt :

25 Nm (250kg.cm, 18.1 lb.ft)+(58°-62°)+(43°-47°)



EDA9960B

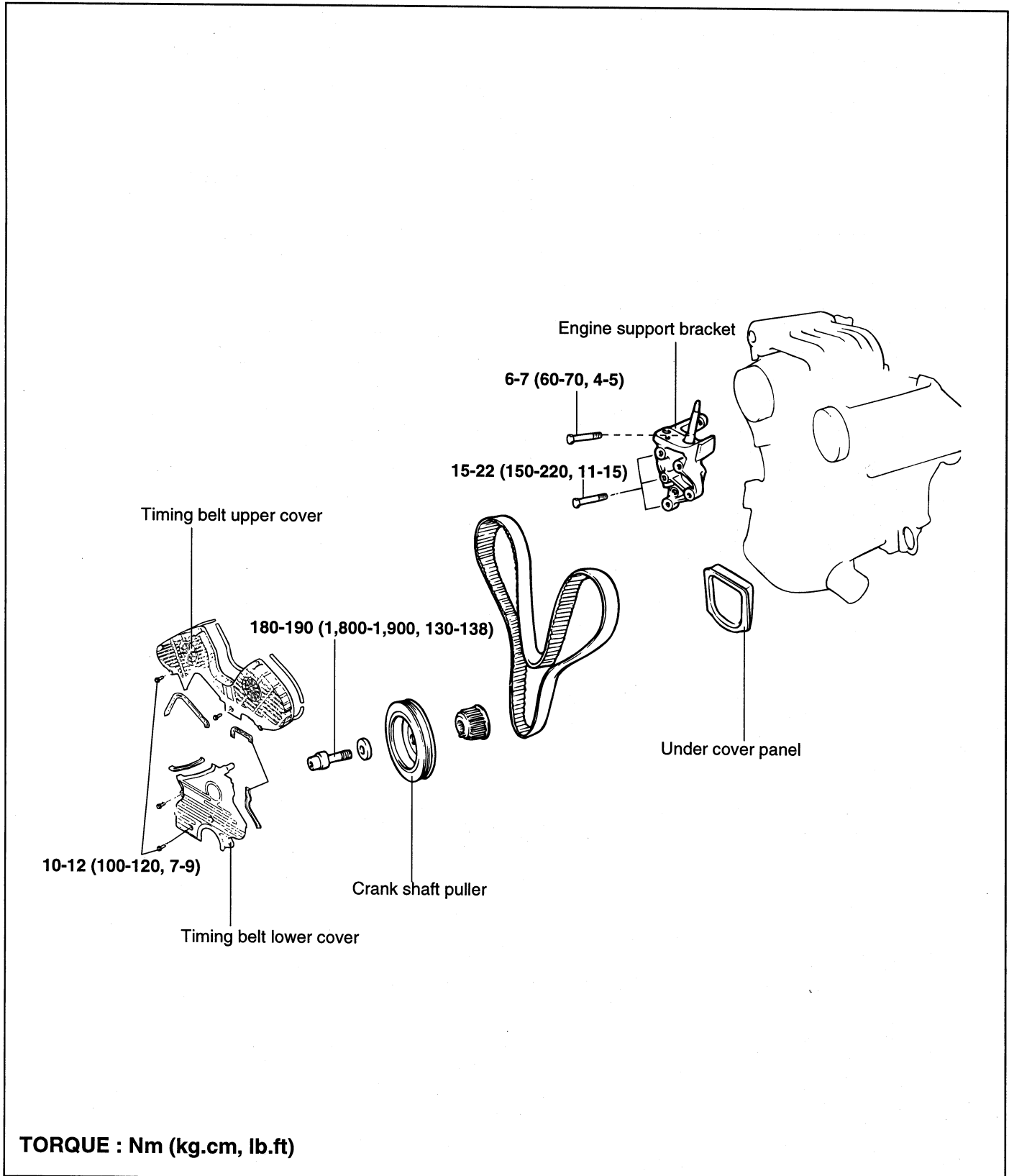


EDAA086B

TIMING SYSTEM

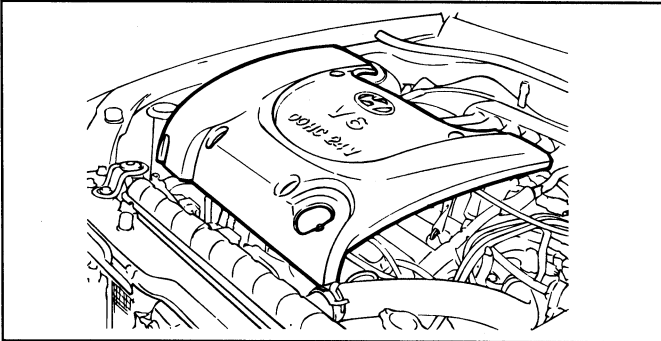
TIMMING BELT

TIMING BELT EDHAD000



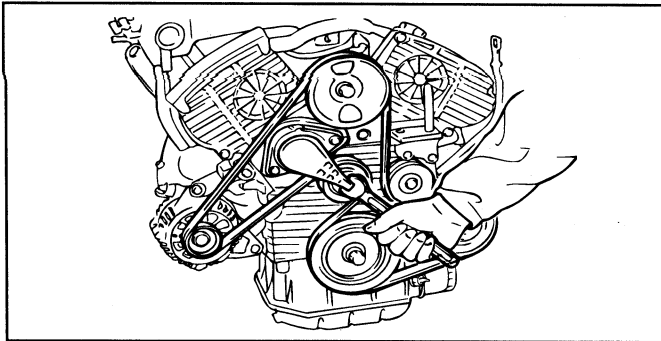
REMOVAL EDJAA600

1. Remove the engine cover.



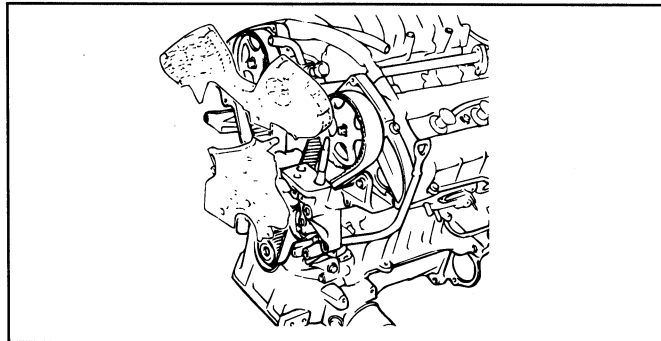
EDA9022A

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



EDA9031B

4. Remove the upper and lower timing belt covers.



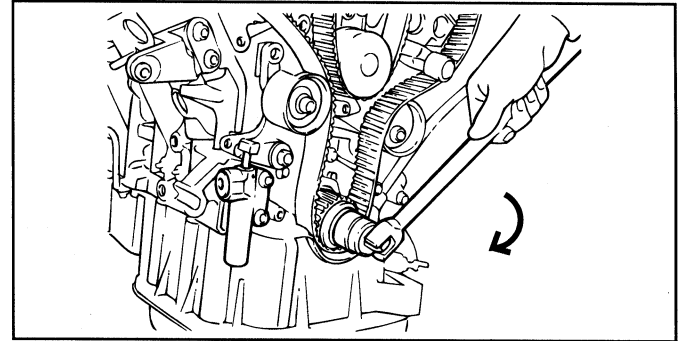
EDA9027A

5. Remove the auto tensioner.

NOTE

Rotate the crankshaft clockwise and align the timing mark to set the No.1 cylinder's piston to TDC (compression stroke).

At this time, the timing marks of the camshaft sprocket and cylinder head cover should coincide with each other.

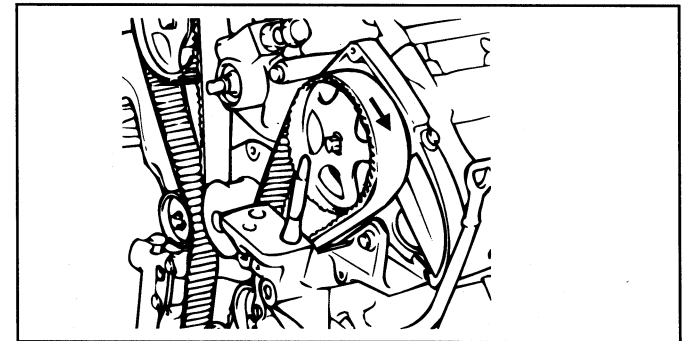


EDA9024A

6. Unbolt the tensioner to remove the timing belt.

NOTE

If you plan to use the timing belt again, mark the rotation direction on the belt so you reinstall it correctly.



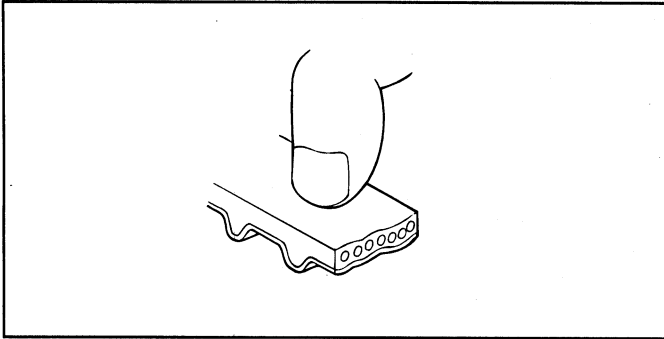
EDA9023A

INSPECTION EDHAD200

1. Inspect the belt closely. If the following problems are evident, replace the belt with a new one.

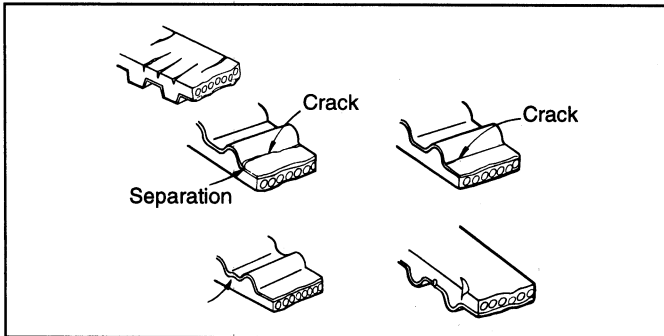
1) Hardened back surface of rubber

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



ECA9200B

2) Cracked back surface of rubber.

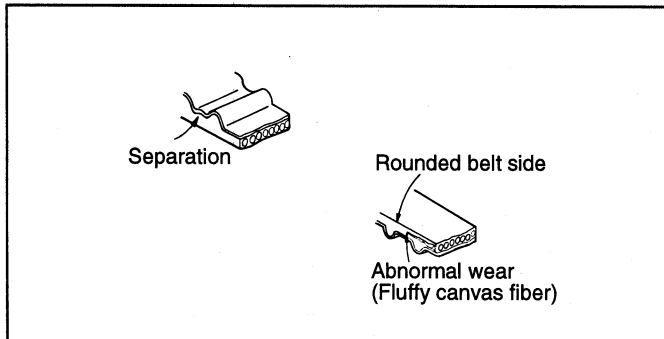


EDA9220B

3) Side of belt is badly worn.

NOTE

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



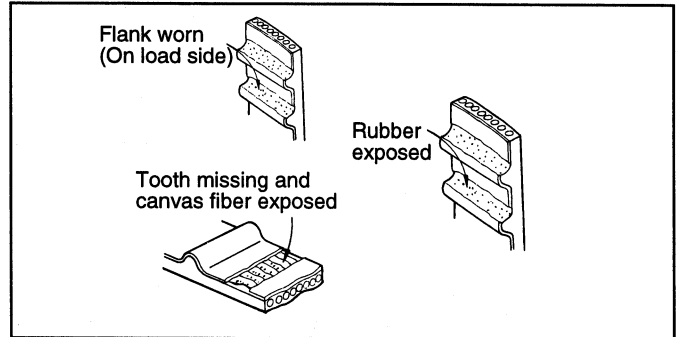
EDA9220C

4) Teeth are badly worn out.

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

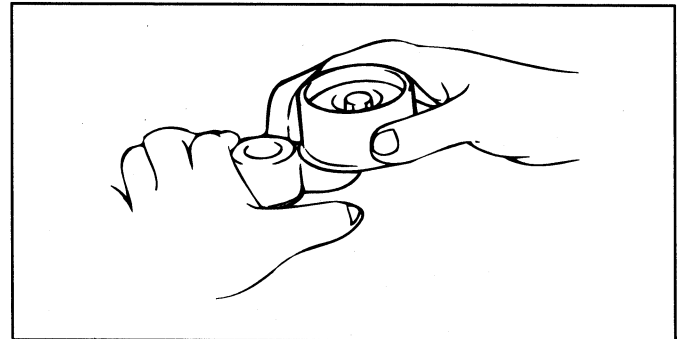
Last stage : Canvas on the load side of the tooth flank worn down and rubber exposed (tooth width reduced).

5) Missing tooth



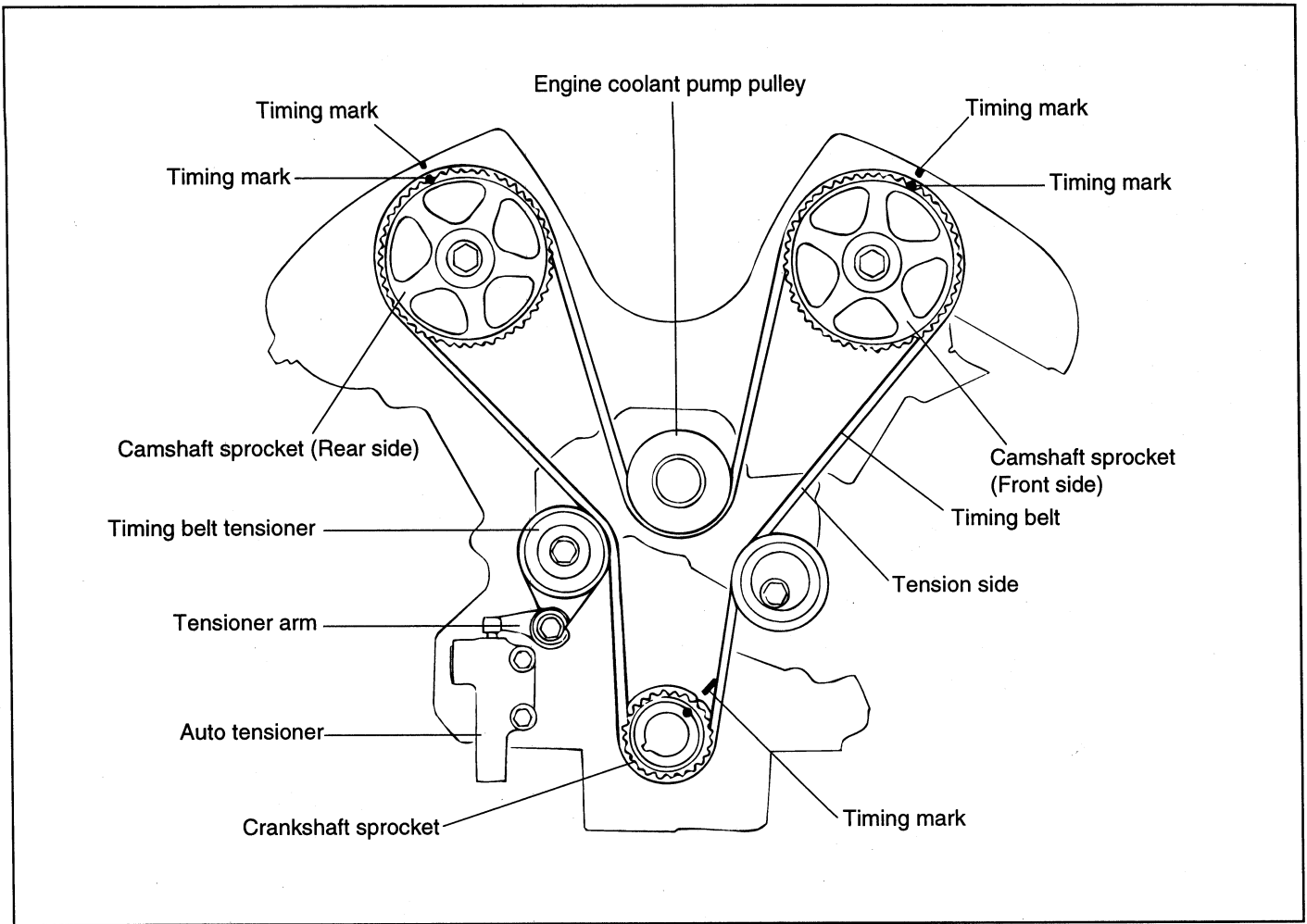
EDA9220D

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



EDA9025A

TIMING BELT EDHAD500



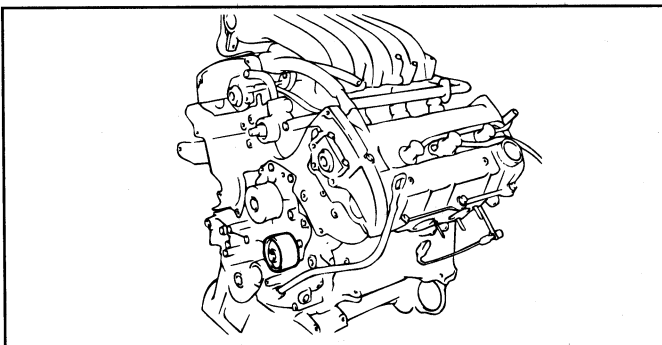
EDJAD50A

INSTALLATION EDJAB100

1. Install the idler pulley to water pump boss.

NOTE

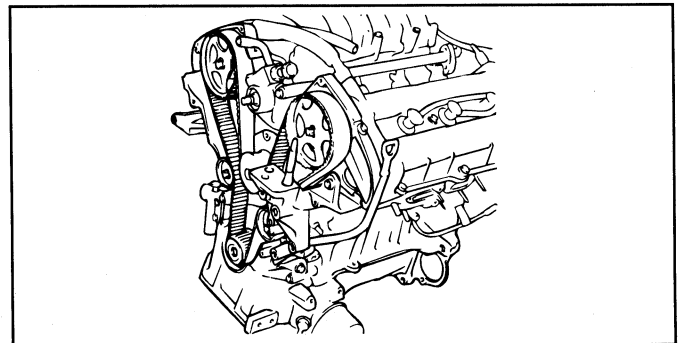
Insert and install the idler pulley to the roll pin that is pressed in the water pump boss.



EDA9028A

2. Install the tensioner arm and plain washer to the cylinder block.

3. Install the tensioner pulley to the tensioner arm.
4. Install the camshaft sprockets and align the timing marks.



EDA9029A

NOTE

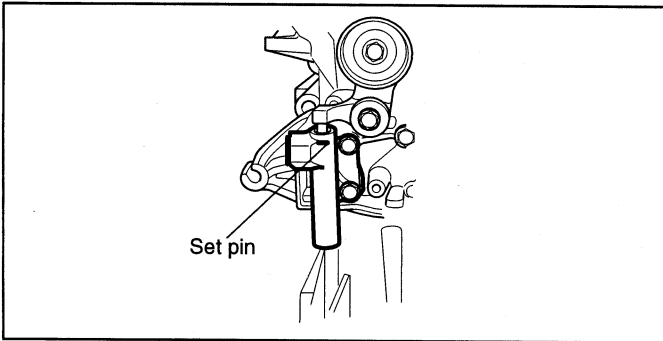
- When installing the camshaft sprockets, fasten them tightly while holding the hexagonal part of the camshaft.

- Before installing the timing belt, if the timing marks of the cam sprocket and the cylinder head cover do not coincide, do not rotate the cam sprocket more than 3 teeth in either direction.
- Rotating the sprocket more than 3 teeth may allow the valve and piston to touch each other.
- If the cam sprocket is rotated more than 3 teeth unavoidably, rotate the crankshaft counter-clockwise a bit before rotating the cam sprocket.

5. Install the auto tensioner to the front case.

NOTE

At this time auto tensioner's set pin should be compressed and secured with set pin.



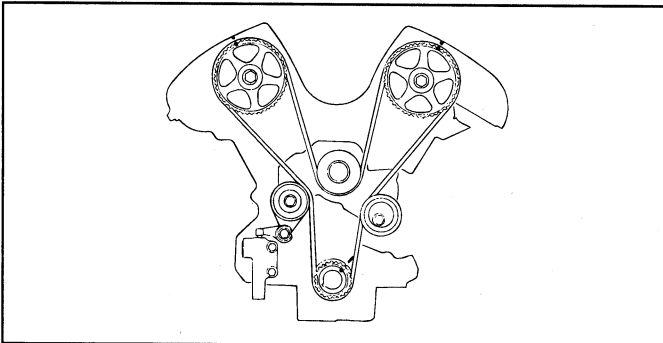
KFW3026C

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

Crankshaft sprocket ⇒ Idler pulley ⇒ camshaft sprocket (LH side) ⇒ Water pump pulley ⇒ camshaft sprocket (RH side) ⇒ Tensioner pulley.

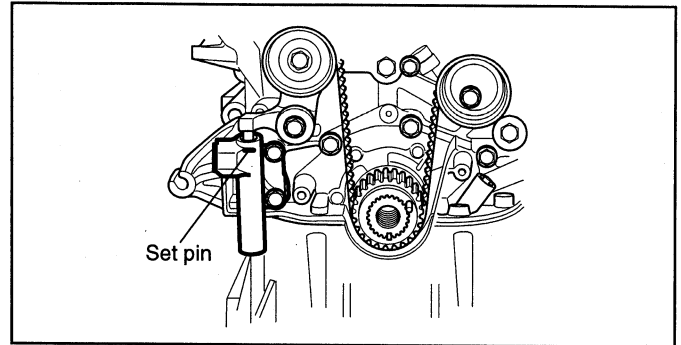
NOTE

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



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



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8. Install the upper and lower timing belt covers.

9. Install the power steering pump pulley, idler pulley, tensioner pulley and crankshaft pulley.

10. Using the wrench [16mm], rotate the tensioner arm clockwise (about 14°) and install the belt to the pulley.

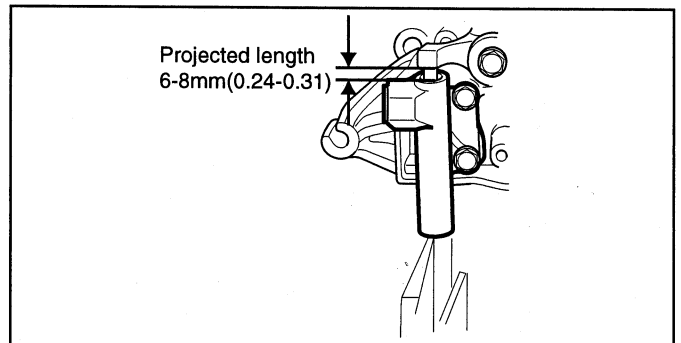
11. Install the engine cover.

HOW TO ADJUST THE TENSION OF THE TIMING BELT

1. Rotate the crankshaft 2 turns clockwise and measure the projected length of the auto tensioner at TDC (# 1 Compression stroke) after 5 minutes.
2. The projected length should be 6-8 mm.
3. Verify that the timing marks of each sprocket are in their specified position.

NOTE

If the timing marks are not in their specified position, repeat from 6 above.



KFW3026B