

Engine Mechanical System [2.0/2.4 I4]

GENERAL	EM -2
CYLINDER BLOCK	EM -25
MAIN MOVING SYSTEM	EM -43
COOLING SYSTEM	EM -57
INTAKE AND EXHAUST SYSTEM	EM -68
CYLINDER HEAD ASSEMBLY	EM -78
TIMING SYSTEM	EM -85

GENERAL**GENERAL** ECJA0150**SPECIFICATIONS**

Description	Specification	Limit
General		
Type	In-line, Double Overhead Camshaft	
Number of cylinders	4	
	[2.4 L]	[2.0 L]
Bore	86.5 mm (3.41 in.)	85 mm (3.35 in.)
Stroke	100 mm (3.94 in.)	88 mm (3.46 in.)
Total displacement	2351 cc (143.5 cu.in.)	1977 cc (121.9 cu.in.)
Compression ratio	10:1	←
Firing order	1-3-4-2	←
Idle R.P.M	725 ± 100 rpm	750 ± 100 rpm
Ignition timing at idling speed	BTDC 12° ± 8°	BTDC 10° ± 5°
Valve timing		
Intake valve	[2.4 L]	[2.0 L M/T] [2.0 L A/T]
Opens (BTDC)	18°	15°
Closes (ABDC)	54°	53°
Exhaust valve		53°
Opens (BBDC)	56°	51°
Closes (ATDC)	8°	17°
Cylinder head		
Flatness of gasket surface	Max. 0.03 mm (0.0012 in.)	0.2 mm (0.008 in.)
Flatness of manifold mounting surface	0.15 mm (0.0059 in.)	0.3 mm (0.012 in.)
Dimensions for reworking oversize valve seat hole		
Intake		
0.3 mm (0.012 in.) O.S.	35.3-35.325 mm (1.39-1.3907 in.)	
0.6mm (0.024 in.) O.S.	35.6-35.625 mm (1.40-1.4026 in.)	
Exhaust		
0.3mm (0.012 in.) O.S.	33.3-33.325 mm (1.31-1.3120 in)	
0.6mm (0.024 in.) O.S.	33.6-33.625 mm (1.32-1.3238 in.)	

Description	Specification	Limit
Dimensions for reworking oversize valve guide hole (both intake and exhaust)		
0.05mm (0.002in.) O.S.	12.05-12.068 mm (0.4751 in.)	
0.25mm (0.010in.) O.S.	12.25-12.268 mm (0.4830 in.)	
0.50mm (0.020in.) O.S.	12.50-12.518 mm (0.4928 in.)	
Camshaft		
Cam height		
Intake	35.493 mm (1.3974 in.)	34.993 mm (1.3776 in.)
Exhaust		
M/T		
[2.4 L]	35.204 mm (1.3860 in.)	34.704 mm (1.3663 in.)
[2.0 L]	35.317 mm (1.3904 in.)	34.817 mm (1.3707 in.)
A/T	35.204 mm (1.3860 in.)	34.704 mm (1.3663 in.)
Journal O.D.	26 mm (1.02 in.)	
Bearing oil clearance	0.040-0.076 mm (0.0020-0.0030 in.)	
End play	0.1-0.15 mm (0.004-0.006 in.)	
Valve		
Valve length		
Intake	109.5 mm (4.311 in.)	
Exhaust	109.7 mm (4.319 in.)	
Stem O.D.		
Intake	6.565-6.580 mm (0.2585-0.2591 in.)	
Exhaust	6.530-6.550 mm (0.2571-0.2579 in.)	
Face angle	45°~45°5'	
Thickness of valve head (margin)		
Intake	1.0 mm (0.039 in.)	0.7 mm (0.028 in.)
Exhaust	1.5 mm (0.059 in.)	1.0 mm (0.039 in.)

Description	Specification	Limit
Valve stem to valve guide clearance		
Intake	0.020-0.047 mm (0.0008-0.0019 in.)	0.1 mm (0.0039 in.)
Exhaust	0.050-0.085 mm (0.0020-0.0033 in.)	0.15 mm (0.0059 in.)
Valve guide		
Length		
Intake	45.5 mm (1.791 in.)	
Exhaust	50.5 mm (1.988 in.)	
Service over size	0.05, 0.25, 0.50 mm (0.002, 0.010, 0.020 in.)	
Valve seat		
Width of seat contact	0.9-1.3mm (0.035-0.051 in.)	
Seat angle	44°~44°. 5'	
Service size	0.3 mm (0.012 in.), 0.6 mm (0.024 in.) oversize	
Valve spring		
Free length	45.82 mm (1.804 in.)	44.82 mm (1.7646 in.)
Load	25.3kg/40mm (55.8 lb/1.57 in.) at installed height	
Out- of- square	Less than 1.5°	4°
Cylinder block		
	[2.4 L]	[2.0 L]
Cylinder bore	86.5+0.03 mm (3.406+0.0012 in.)	85.0+0.03 mm (3.346+0.0012 in.)
Out-of-round and taper of cylinder bore	Less than 0.01 mm (0.0004 in.)	
Flatness of gasket surface	Less than 0.05 mm (0.0020 in.)	0.1 mm (0.0039 in.)
Piston		
	[2.4 L]	[2.0 L]
O.D.	86.47-86.5 mm (3.404-3.406 in.)	84.97-85.0 mm (3.345-3.346 in.)
Piston-to-cylinder clearance	0.02-0.04 mm (0.0008-0.0016 in.)	
Ring groove width		
No. 1	1.22-1.24 mm (0.048-0.049 in.)	

Description	Specification	Limit
No. 2	1.51-1.53 mm (0.059-0.060 in.)	
Oil	2.81-2.83 mm (0.111-0.1114 in.)	
Service size	0.5 mm (0.020 in.) oversize	
<hr/>		
Piston ring		
Side clearance		
No. 1	0.03-0.07 mm (0.0012-0.0028 in.)	
No. 2	0.02-0.06 mm (0.0008-0.0024 in.)	0.1 mm (0.0039 in.)
Oil ring	0.06-0.15 mm (0.0024-0.0059 in.)	
End gap		
No. 1	0.25-0.35 mm (0.0098-0.0138 in.)	0.8 mm (0.031 in.)
No. 2	0.40-0.55 mm (0.0157-0.0216 in.)	0.8 mm (0.031 in.)
Oil ring side rail	0.10-0.40 mm (0.0039-0.0157 in.)	1.0 mm (0.039 in.)
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Connecting rod		
Bend	0.05 mm (0.0020 in.)	
Twist	0.1 mm (0.004 in.)	
Connecting rod big end to crankshaft side clearance	0.10-0.25 mm (0.0040-0.0098 in.)	0.4 mm (0.0157 in.)
Piston pin installation force	1250±500 kg (2756±1100 lb.f)	
Connecting rod pin O.D	48-48.015 mm (1.890-1.8903 in.)	
Connecting rod bearing oil clearance	0.015-0.048 mm (0.0008-0.0020 in.)	0.1 mm (0.0039 in.)
Crankshaft main bearing oil clearance		
No. 1,2,4,5 journal	0.018-0.036 mm (0.0007-0.0014 in.)	0.1 mm (0.0039 in.)
No. 3 journal	0.024-0.042 mm (0.0009-0.0016 in.)	
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Crankshaft		
Journal O.D.	56.982-57.000 mm (2.2434-2.2441 in.)	
Out-of-round of journal and pin	Less than 0.015 mm (0.0006 in.)	

Description	Specification	Limit
Taper of journal and pin	Less than 0.005 (0.0002 in.)	
End play	0.05-0.25 mm (0.0020-0.0098 in.)	0.25 mm (0.0098 in.)
Flywheel		
Runout		0.13 mm(0.0051in.)
Oil pressure at idle [Oil temperature is 75-90°C (167-194°F)]	80 kPa (11.6 psi)	
Oil pump		
Tip clearance		
Drive gear	0.16-0.21 mm (0.0063-0.0083 in.)	0.25 mm(0.0098in.)
Driven gear	0.18-0.21 mm (0.0071-0.0083 in.)	0.25 mm(0.0098in.)
Side clearance		
Drive gear	0.08-0.14 mm (0.0031-0.0055 in.)	0.25 mm(0.0098in.)
Driven gear	0.06-0.12 mm (0.0024-0.0047 in.)	0.25 mm(0.0098in.)
Relief spring		
Free length	46.6 mm (1.835 in.)	
Load [61 N (13.5 lb)]	40.1 mm (1.579in.)	
Right silent shaft		
Front journal diameter	18.467-18.480 mm (0.7270-0.7276 in.)	
Rear journal diameter	40.951-40.967mm (1.6516-1.6129in.)	
Oil clearance		
Front	0.020-0.061 mm (0.0008-0.0024 in.)	
Rear	0.050-0.091 mm (0.0020-0.0036 in.)	
Left silent shaft		
Front journal diameter	18.467-18.480mm (0.7270-0.7276in.)	
Rear journal diameter	40.951-40.967 mm (1.6122-1.6130 in.)	
Oil clearance		

Description	Specification	Limit
Front	0.020-0.054 mm (0.0008-0.0021 in.)	
Rear	0.042-0.083 mm (0.0017-0.0033 in.)	
Description	Specification	Limit
Cooling method	Forced circulation with electric fan	
Cooling system quantity	7.0 lit (7.4 U.S.qts., 6.1 Imp.qts.) [For DOHC]	
Thermostat		
Type	Wax pellet type with jiggle valve	
Normal opening temperature	82°C(180°F)	
Opening temperature range	80°C-84°C (176°F-183°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 type	
Element	Unwoven cloth type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	
Coolant temperature sensor		
Type	Thermister type	
Resistance		
20°C (68°F)	2.45±0.14 kΩ	
80°C (176°F)	0.3222 kΩ	

SERVICE STANDARDS**Standard value**

Coolant concentration

Tropical area 40%

Other area 50%

LUBRICANT

Engine coolant Ethylene glycol base for aluminum radiator

SEALANT

Engine coolant temperature sensor LOCTITE 262, three bond No. 1324 or equivalent

Oil pressure switch 3M ATD No. 8660 or Three bond No. 1141E

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

TIGHTENING TORQUE

ECHA0200

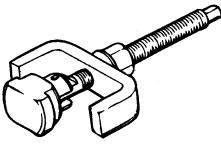
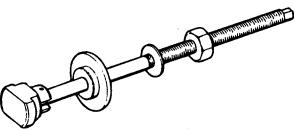
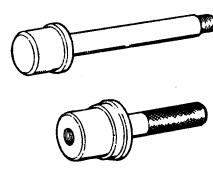
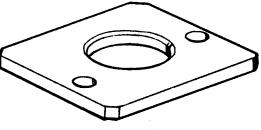
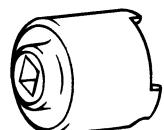
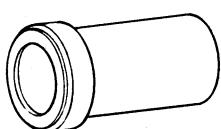
Item	Nm	kg.cm	Lb.ft
Engine mount insulator bolt	90-110	900-1100	65-80
Engine mounting bracket nuts	60-80	600-800	43-58
Engine mounting bracket bolts	60-80	600-800	43-58
Engine Support bracket bolt and nut	55-65	550-650	40-47
Front roll stopper bracket to cross member bolts	40-55	400-550	29-40
Front roll stopper insulator bolt and nut	50-65	500-650	36-47
Rear roll stopper bracket to cross member bolts	50-65	500-650	36-47
Rear roll stopper insulator bolt and nut	50-65	500-650	36-47
Transaxle mounting bracket bolts	60-80	600-800	43-58
Transaxle mounting insulator bolt	90-110	900-1100	65-80
Air conditioner compressor to bracket	23-27	230-270	17-20
Power steering oil pump to bracket	35-45	350-450	25-33
Front exhaust pipe to exhaust manifold	30-40	300-400	22-29
Rocker cover bolt	8-10	80-100	6-7
Center cover bolt	4-5	40-50	3-3.6
Camshaft sprocket bolt	80-100	800-1000	58-72
Camshaft bearing cap bolt	19-21	190-210	14-15
Crankshaft position sensor	10-13	100-130	7-9
Throttle body stay	15-22	150-220	11-16
Air cleaner body installation bolt	8-10	80-100	6-7
Crankshaft sprocket bolt	110-130	1100-1300	80-94
Damper pulley to crankshaft sprocket	20-30	200-300	14-22
Cylinder head bolt (cold engine)			
With new parts	63+Release all bolts +20+90°+90°	630+Release all bolts +200+90°+90°	46+Release all bolts +14+90°+90°
Without new parts.	20+90°+90°	200+90°+90°	14+90°+90°
Intake manifold stay	18-25	180-250	13-18
Tension pulley bracket bolt	23-27	230-270	17-20
Auto tensioner bolt	20-27	200-270	14-20
Tensioner pulley bolt	43-55	430-550	31-40
Idler pulley bolt	30-42	300-420	22-30
Front exhaust pipe clamp bolt	20-30	200-300	14-22

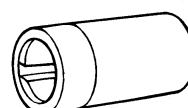
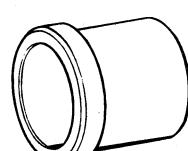
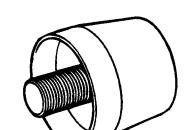
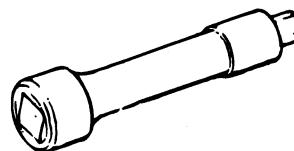
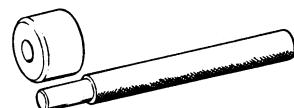
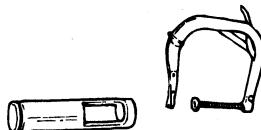
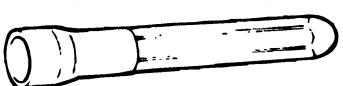
Item	Nm	kg.cm	Lb.ft
Oil pan (lower and upper)	10-12	100-120	7-9
Oil pan drain plug	35-45	350-450	25-33
Oil screen	15-22	150-220	11-16
Oil pump sprocket nut	50-60	500-600	36-43
Oil pressure switch	8-12	80-120	6-9
Oil filter bracket bolt	20-27	200-270	14-20
Oil pump cover bolt	15-18	150-180	11-13
Oil seal case bolt	10-12	100-120	7-9
Plug cap	20-27	200-270	14-20
Front case bolt (M6)	20-27	200-270	14-20
Driven gear bolt	34-40	340-400	25-29
Engine coolant pump pulley bolt	8-10	80-100	6-7
Timing belt upper cover	8-10	80-100	6-7
Timing belt lower cover	8-10	80-100	6-7
Relief plug	40-50	400-500	29-36
Flywheel	130-140	1300-1400	94-101
Drive plate	130-140	1300-1400	94-101
Timing belt rear right cover	10-12	100-120	7-9
Timing belt rear left cover (upper)	10-12	100-120	7-9
Connecting rod cap bolt	20+90°	200+90°	14+90°
Crankshaft bearing cap bolt	25+90°	250+90°	18+90°
Engine hanger			
M8	25-30	250-300	18-22
M10	35-55	350-550	25-40
Alternator support bolt	20-25	200-250	14-18
Alternator brace bolt			
M8x90	8-12	80-120	6-9
M8x40	20-25	200-250	14-18
Engine coolant pump to cylinder block bolt	20-27	200-270	14-20
Engine coolant temperature sensor	20-40	200-400	14-29
Engine coolant inlet fitting attaching bolt	10-15	100-150	7-11
Air cleaner mounting bolts	8-10	80-100	6-7
Resonator mounting bolt (Nut)	8-10	80-100	6-7
Throttle body to intake manifold	15-22	150-220	11-16
Intake manifold mounting bolt (M8)	15-20	150-200	11-14

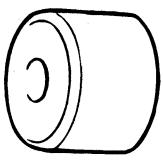
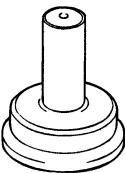
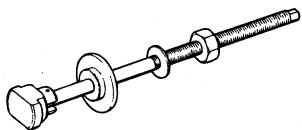
Item	Nm	kg.cm	Lb.ft
Intake manifold mounting nut	30-42	300-420	22-30
Tension rod bracket bolt to tension rod	35-55	350-550	25-40
Ignition coil bolts	8-12	80-120	6-9
Power transistor bolts	10-12	100-120	7-9
Front exhaust manifold bolt to cylinder block	20-30	200-300	14-22
Center exhaust pipe nuts to catalytic converter	30-40	300-400	22-29
Center exhaust pipe bolts to main muffler	30-40	300-400	22-29
Center exhaust pipe bolt to bracket	10-15	100-150	7-11
Hanger bolt to body	10-15	100-150	7-11
Hanger bolt to main muffler	10-15	100-150	7-11
Exhaust manifold nuts (8)	25-30	250-300	18-22
Exhaust manifold nuts (10)	35-55	350-550	25-40
Oxygen sensor	40-50	400-500	29-36
Heat protector bolt to exhaust manifold	12-15	120-150	9-11
Air cleaner bracket bolt	10-13	100-130	7-9
Exhaust manifold cover to exhaust manifold bolt	12-15	120-150	9-11
Oxygen sensor to exhaust manifold	40-50	400-500	29-36
Front exhaust pipe bracket bolt	20-30	200-300	14-22
Main muffler hanger support bracket bolt	10-20	100-200	7-14
Oil level gauge	12-15	120-150	9-11
Stud bolt	30-40	300-400	22-29
Tensioner arm assembly	17-26	170-260	12-19
Balance shaft bolt	34-40	340-400	25-29
Starter bolt to cylinder block	27-35	270-350	20-25
Radiator fan motor bolt	8-10	80-100	6-7
Delivery pipe to cylinder block	10-13	100-130	7-9

SPECIAL TOOLS

ECHA0300

Tool (Number and name)	Illustration	Use
Counter balance shaft bearing puller (09212-32000)	 ECA9930K	Removal of counter balance shaft front bearing
Counter balance shaft bearing puller (09212-32100)	 ECA9930L	Removal of counter balance shaft rear bearing (use with 09212-32300)
Counter balance shaft bearing installer (09212-32200)	 ECA9930M	Installation of counter balance shaft front and rear bearing (use with 09212-32300)
Guide plate (09212-32300)	 ECA9930N	Removal and installation of counter balance shaft rear bearing (use with 09212-32100, 09212-32200)
Plug cap wrench (09213-33000)	 ECA9930O	Removal and installation of front case cap plug
Crankshaft front oil seal installer (09214-32000)	 ECA9930A	Installation of the crankshaft front oil seal (use with 09214-32100)

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal guide (09214-32100)	 ECA9930B	Installation of the crankshaft front oil seal (use with 09214-32000)
Camshaft oil seal installer (09221-21000)	 ECA9930C	Installation of the camshaft oil seal (use with 09221-21100)
Camshaft oil seal guide (09221-21100)	 E2121100	1. Used as a guide when pressing in the camshaft oil seal (use with 09221-21000)
Cylinder head bolt socket (09221-32001)	 ECHA001E	Removal and installation of cylinder head bolts
Valve guide installer (09222-21200A, 09222-21200B)	 ECA9930G	Removal and installation of valve guides
Valve spring compressor (09222-28000) Valve spring compressor holder (09222-28100)	 ECA9930E	Removal and installation of inlet and exhaust valves
Valve stem oil seal install (09222-28200)	 ECHA001G	Installation of valve stem oil seals

Tool (Number and name)	Illustration	Use
Valve guide installer adapter (09222-28400)	 ECHA001I	Installation of valve guides
Crankshaft rear oil seal installer (09231-21000)	 ECA9930H	1. Installation of the engine rear oil seal 2. Installation of the crankshaft rear oil seal
Piston pin remover and installer kit (09234-33001)	 ECA9930L	Removal and installation of piston pins
insert (09234-33002)	 ECA9930J	Removal and installation of piston pins (use with 09234-33001)

TROUBLESHOOTING

ECHA0400

Symptom	Probable cause	Remedy
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
Excessive engine vibration	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	Re-tighten Re-tighten Re-tighten Re-tighten Replace Replace Replace
Noisy valves	Thin or diluted engine oil (low oil pressure) Worn or damaged valve stem or valve guide	Change Replace
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
Timing belt noise	Incorrect belt tension (alternator tensioner, timing belt)	Adjust belt tension
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	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 Restricted of flow in cooling system Loose or missing drive belt Faulty engine coolant pump Faulty temperature sensor wiring Faulty electric fan Faulty thermo-sensor on radiator Insufficient coolant	Replace Replace Replace Adjust or replace Replace Repair or replace Repair or replace Replace Refill coolant
Abnormally low coolant temperature	Faulty thermostat Faulty temperature sensor wiring	Replace Repair or replace
Leakage from oil cooling system	Loose hose and pipe connection Blocked or collapsed hose and pipe	Retighten Replace
Inoperative electrical cooling fan	Damaged, fuse	Replace or repair
Exhaust gas leakage	Loose connections Broken pipe or muffler	Retighten 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 ECJA0500

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

NOTE

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

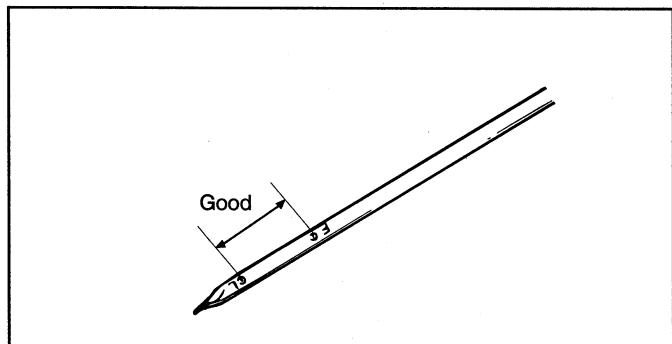
Turn off the engine and wait for 5 minutes at least, and then check the oil level.

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 it has the proper viscosity.



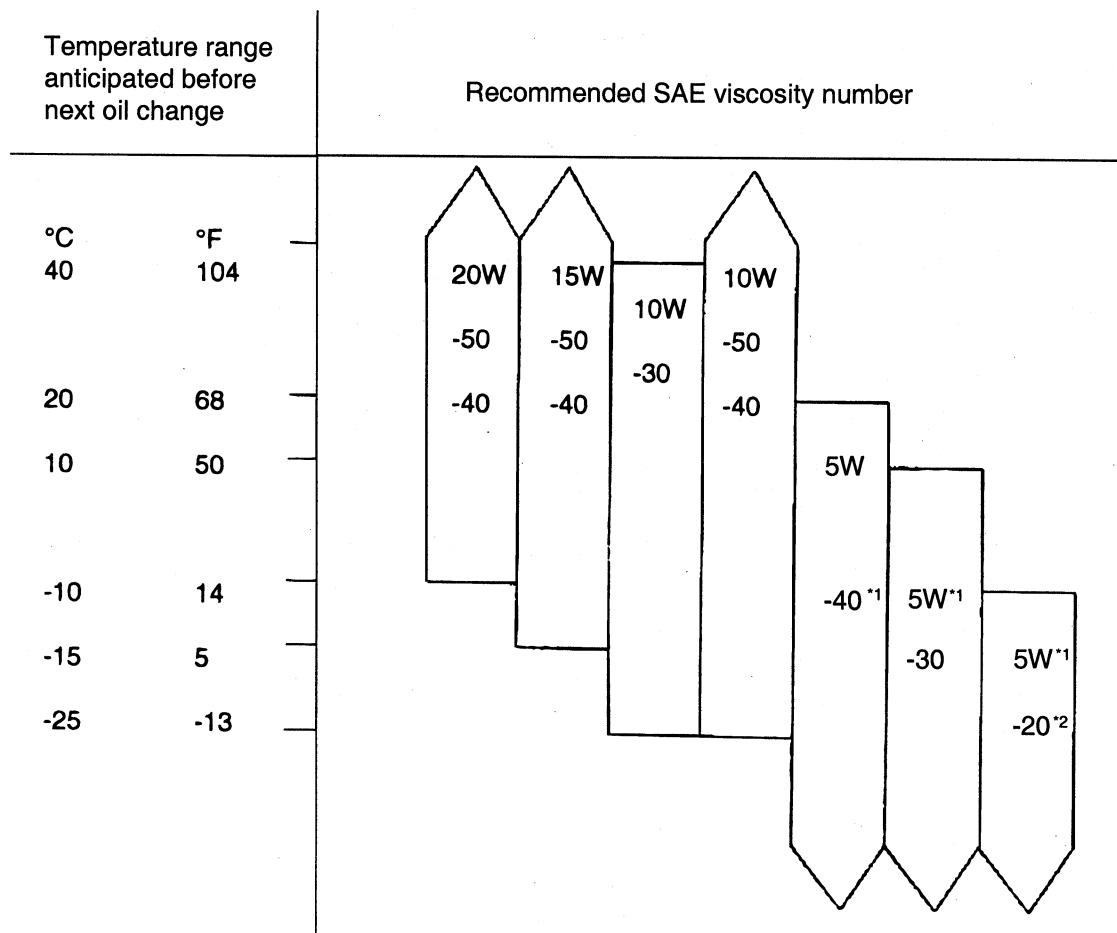
EDA9000A

SELECTION OF ENGINE OIL

ECJA0600

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 SAE grade number and an API service classification on the container should not be used.

CHANGING ENGINE OIL

ECJA0700

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

Capacity :

Drain and refill : 4.3 lit (4.53 U.S.qts., 3.78 Imp.qts.)

NOTE

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

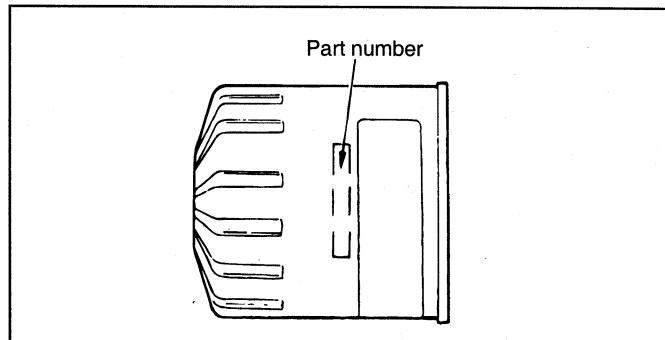
6. Install the oil filler cap.
7. Start and run the engine.
8. Turn off the engine and then check the oil level. Add oil if necessary.

REPLACING THE OIL FILTER

ECJA0800

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 aftermarket replacement filters is considerably diverse.

High quality 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.



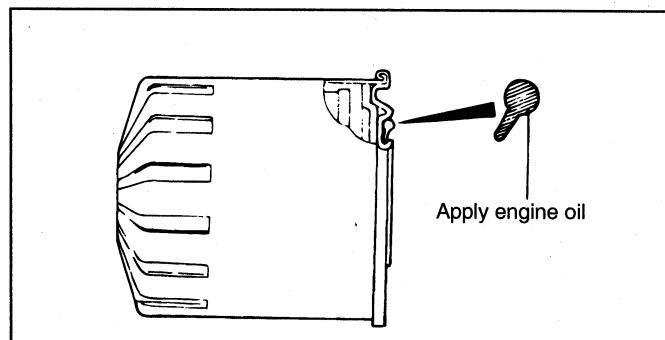
ECA9970A

PROCEDURE FOR REPLACING THE 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 to the specified torque.

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

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



ECA9970B

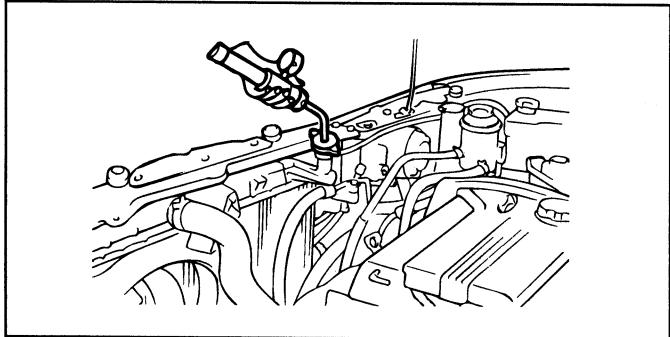
CHECKING COOLANT LEAK

ECJA0900

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

NOTE

1. **Radiator coolant may be extremely hot. Do not open the system because hot, or scalding water could gush out causing personal injury. Allow the vehicle to cool before servicing this system.**
2. **When the tester is removed, be careful not to spill any coolant from it.**
3. **Be sure to clean away completely any 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

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

Main valve opening pressure :

107.9kPa±14.7kPa (1.1±0.15 kg/cm², 15.64±2.13)

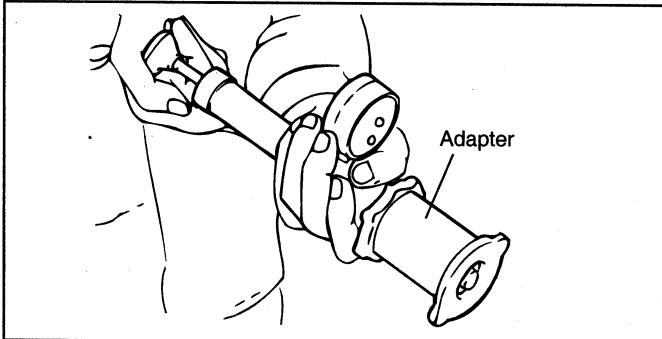
Main valve closing pressure :

83.4 kPa (0.85 kg/cm², 12.1 psi)

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

NOTE

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

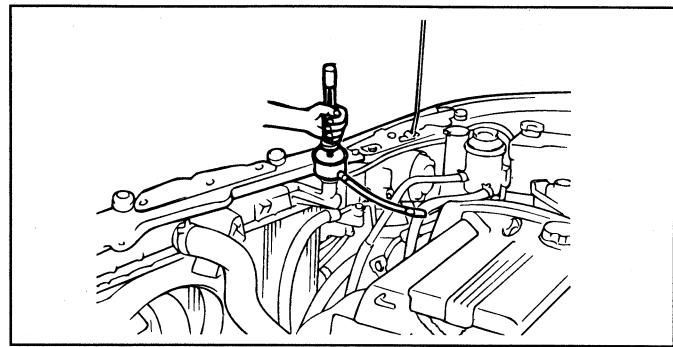


ECA9090A

SPECIFIC GRAVITY TEST

ECJA1000

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



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

CAUTION

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

RECOMMENDED COOLANT

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

CHECKING COMPRESSION

PRESSURE

ECJA1100

1. Before checking engine compression, check the engine oil level. Also check that the starter motor and battery are all in normal operating condition.
2. Start the engine and wait until the engine coolant temperature reaches 80-95°C (176-205°F).
3. Turn off 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 : 1200kpa (12.2Kg/cm², 170 psi)

Limit : 12.0 kg/cm² (1.18 MPa, 171 psi)

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

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

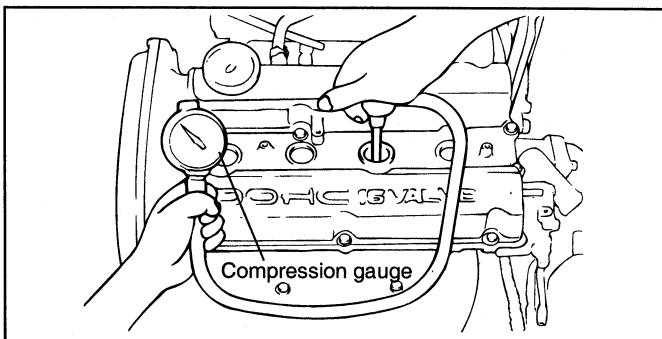
10. If a cylinder's compression or pressure differential is outside the specification, add a small amount of oil through the spark plug hole, and repeat steps 6 to 9.

- 1) If the addition of oil causes the compression to rise, it is likely that there may be wear between the piston ring and cylinder wall.

- 2) If compression remains the same, valve seizure, poor valve seating or a compression leak from the cylinder head gasket are all possible causes.

Tightening torque

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

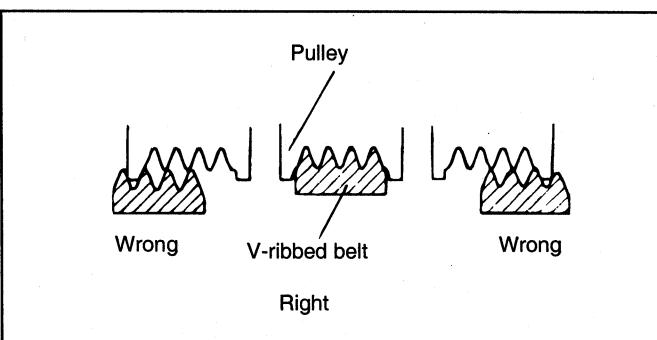


ECA9001A

ADJUSTING DRIVE BELT TENSION

ECJA1200

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



ECA9980A

CAUTION

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

STANDARD VALUE:

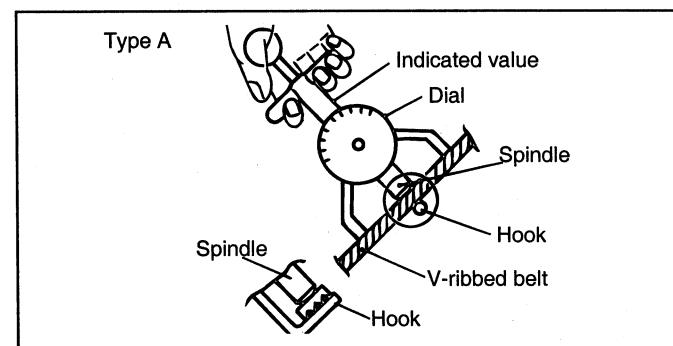
Items		Inspection	Adjustment	
			New	Used
For alternator	Deflection mm (in.)	9.0-10.4 (0.35-0.41)	7.5-9.0 (0.30-0.35)	10 (0.40)
	Tension N (lb)	350-500 (79-112)	600-700 (135-157)	400 (90)
For air conditioner	Deflection mm (in.)	8 (0.31)	5.0-5.5 (0.20-0.22)	6.0-7.0 (0.24-0.28)
	Tension N (lb)	250-500 (56-112)	470-570 (106-128)	320-400 (72-90)
For power steering	Deflection mm (in.)	6.0-9.0 (0.24-0.35)	-	-

NOTE

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

TYPE A TENSION GAUGE

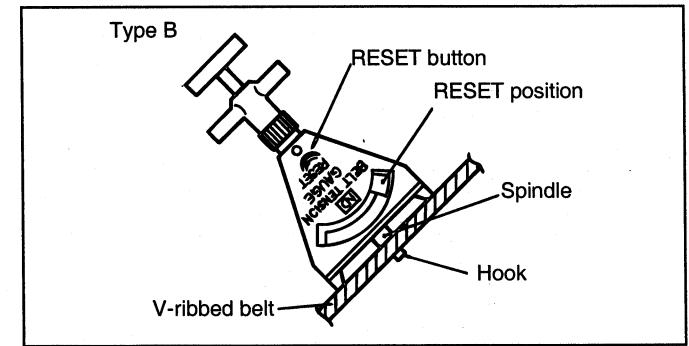
Do not let the dial section of the tension gauge contact other objects during measurement.



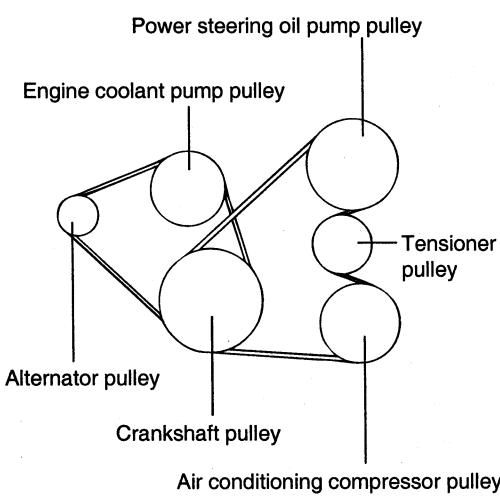
ECA9980C

TYPE B TENSION GAUGE

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



ECA9980D



ECA9002A

ADJUSTING THE ALTERNATOR BELT

CAUTION

If the belt is too loose, it will cause noise or sudden wear.

If the belt is too tight, the engine coolant pump bearing or the alternator can be damaged.

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

Tightening torque

Alternator nut A :

35-55 Nm (350-550 kg.cm, 25-40 lb.ft)

Adjuster lock bolt B :

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

Tension adjuster bolt :

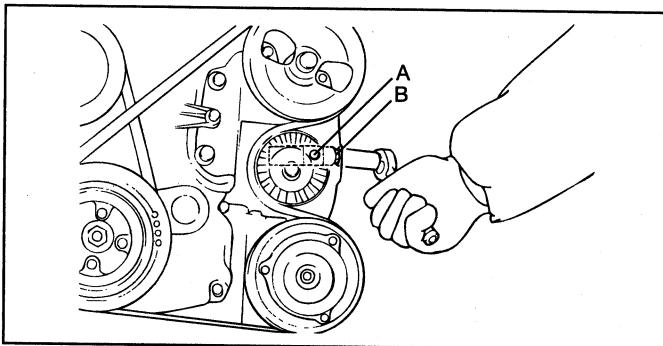
8-12 Nm (80-120 kg.cm, 6-9 lb.ft)

ADJUSTING POWER STEERING AND AIR CONDITIONER BELTS

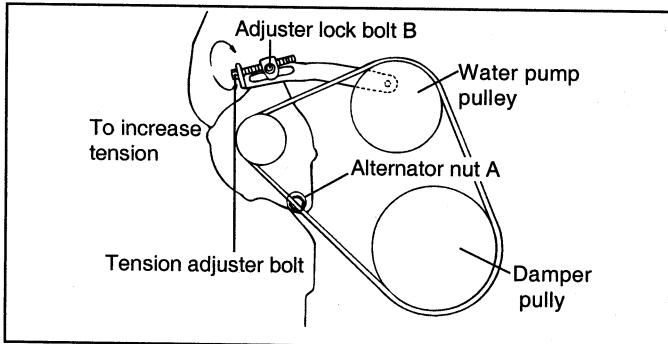
1. Loosen the tension pulley adjustment bolt A.
2. Adjust the belt deflection with adjustment bolt B.
3. Tighten bolt A.
4. Recheck the belt deflection and readjust, if necessary.

NOTE

Before rechecking, crank the engine one more revolution.



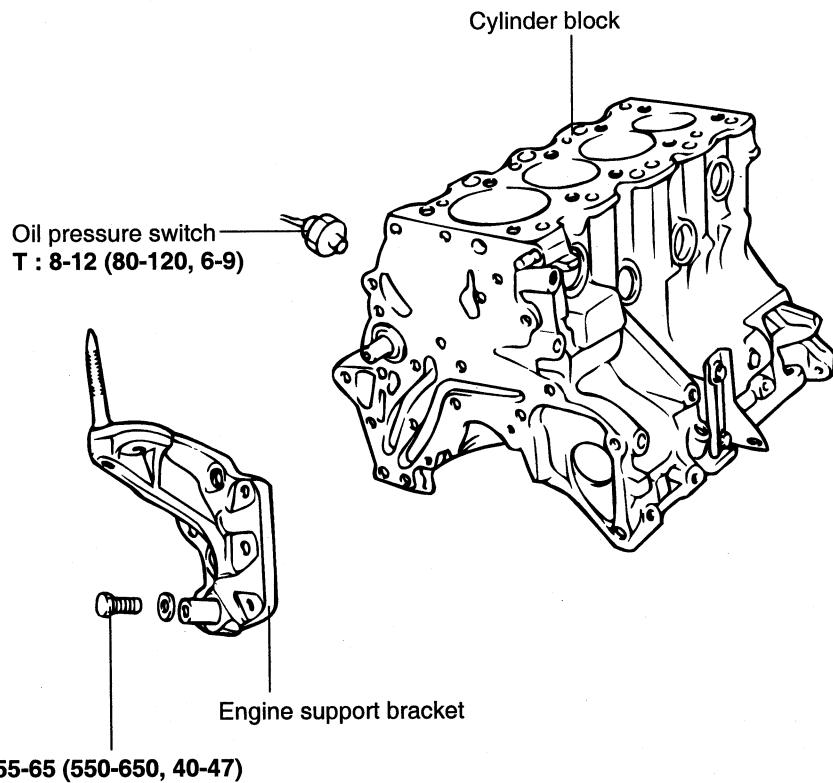
ECA9004A



ECA9003A

CYLINDER BLOCK**CYLINDER BLOCK****CYLINDER BLOCK**

ECHA1500

**TORQUE : Nm (kg·cm, lb·ft)**

ECHA150A

DISASSEMBLY

ECHA1600

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

For further details, refer to the appropriate section.

INSPECTION

ECHA1750

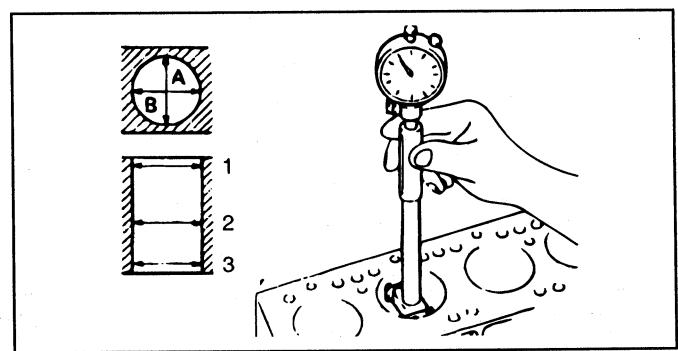
CYLINDER BLOCK

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 and in the directions of A and B.

Level 1: No. 1 piston ring position at TDC

Level 2 : Center of cylinder

Level 3 : Bottom of cylinder



ECA9450A

3. If the cylinder bores show more than 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 piston and rings should be installed.

Standard value

Cylinder bore :

86.5+0.03 mm (3.41+0.0012 in.) [2.4L]

85.0+0.03 mm (3.35+0.0012 in.) [2.0L]

Out-of-round and taper of cylinder bore :

Max. 0.01mm(0.0004 in.)

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

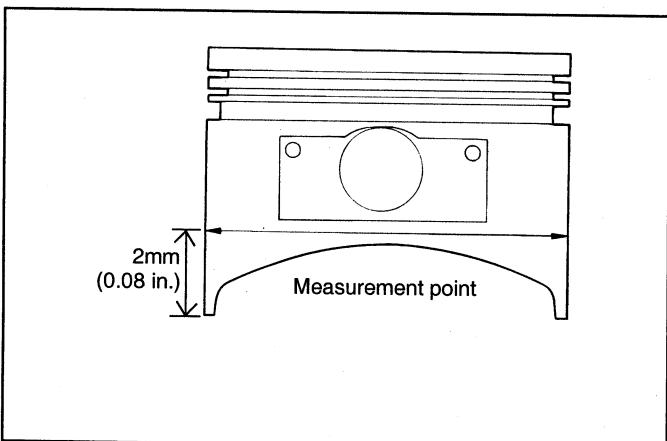
PISTON SERVICE SIZE AND MARK MM (IN.)

Identification Mark	Size
0.50	0.50 (0.020) O.S.

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

Piston-to-cylinder clearance :

0.02-0.04mm(0.0008-0.0016 in.)



ECA9451A

6. Check for damage and cracks.

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

Standard value

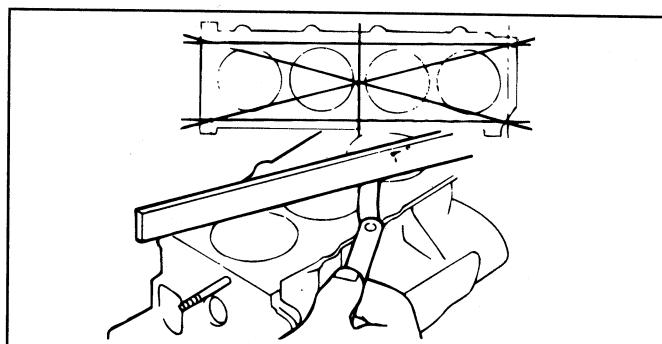
Flatness of cylinder block : Max. 0.05mm(0.0020 in.)

Service limit

Flatness of cylinder block : 0.1mm(0.0039 in.)

NOTE

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



ECA9450B

BORING CYLINDER

1. Oversize pistons should be selected on the basis of the largest cylinder bore.

Identification Mark	Size
0.50	0.50 mm (0.020 in.) O.S.

NOTE

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

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

3. On the basis of the measured O.D., calculate the new bore size.

New bore size = Piston O.D + 0.02 to 0.04 mm (0.0008 to 0.0016 in.) (clearance between piston and cylinder) - 0.02 mm (0.0008 in.) (honing margin.)

4. Bore each of cylinders to the calculated size.

NOTE

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

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

NOTE

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

REASSEMBLY

ECHA1800

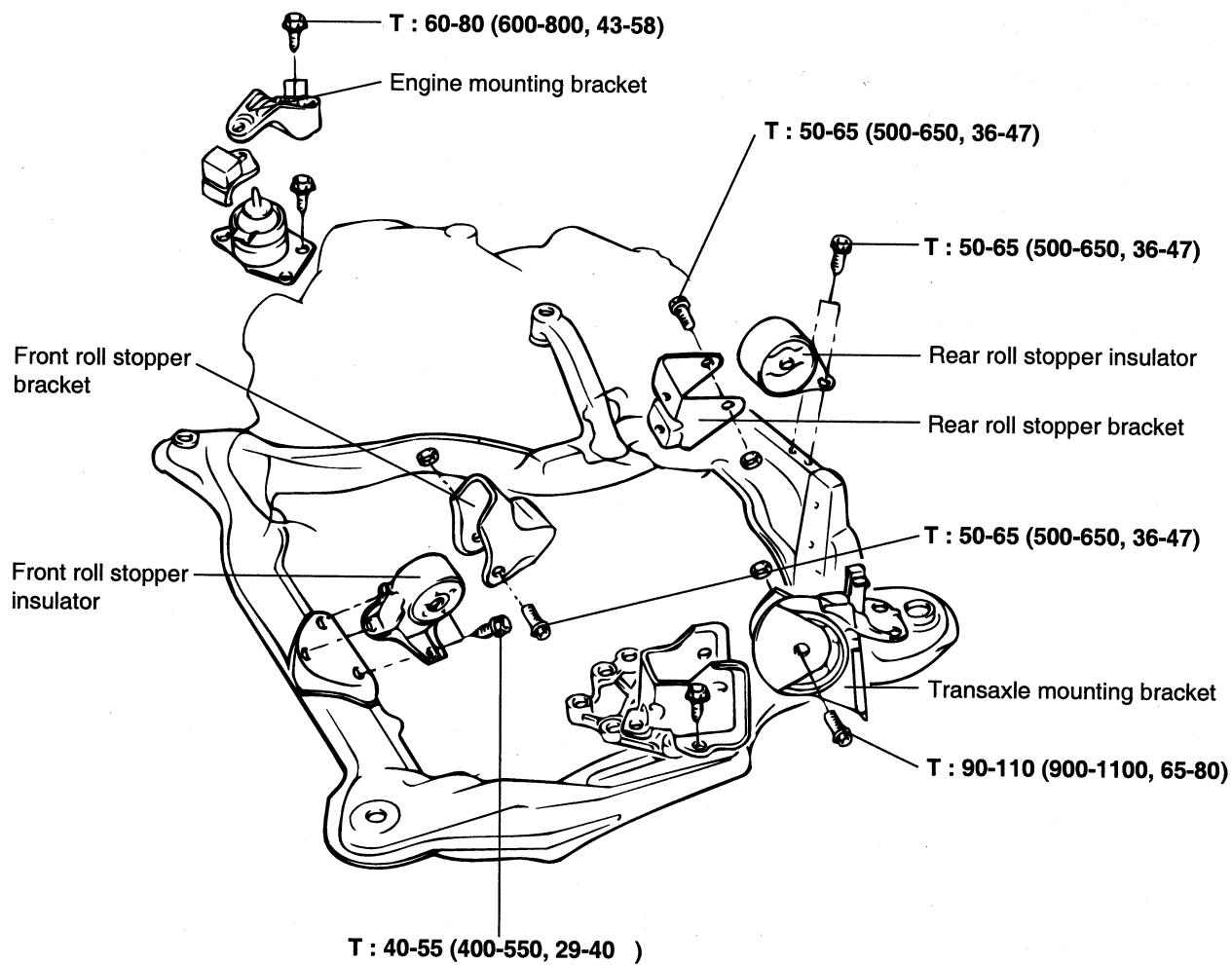
Install the following parts by referring to their respective paragraphs.

1. Crankshaft
2. Flywheel
3. Piston
4. Cylinder head
5. Timing belt train
6. Front case

ENGINE MOUNTS

ENGINE MOUNTING

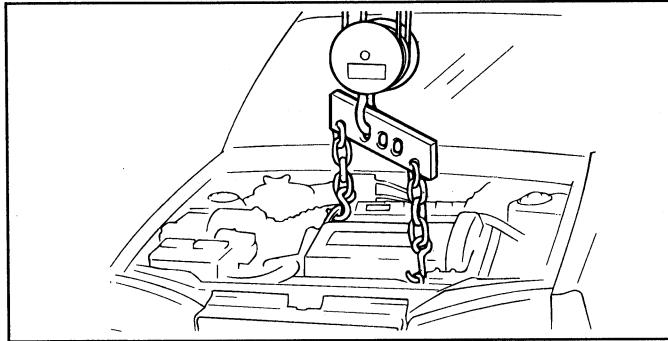
ECJA2000



TORQUE : Nm (kg.cm, lb·ft)

REMOVAL ECJA2100

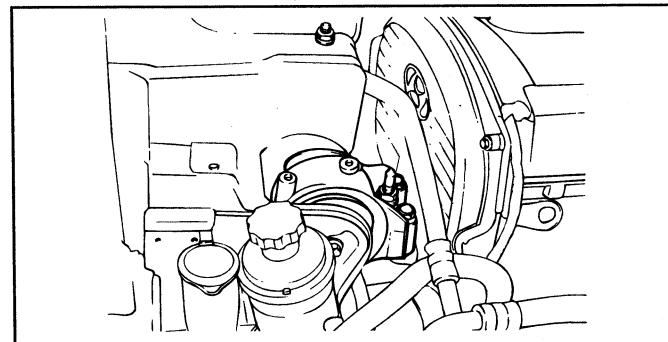
Attach a chain or cable to the engine hooks and lift enough so that there is no pressure on the motor mounts.



ECA9120A

ENGINE MOUNTING

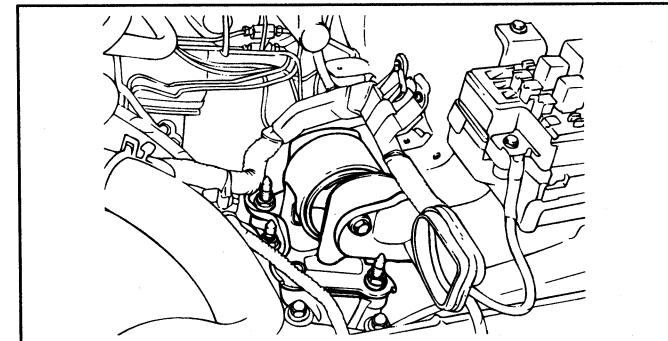
1. Remove the engine mounting insulator bolts.
2. Remove the engine mounting bracket from the engine.



ECA9006A

TRANSAXLE MOUNTING

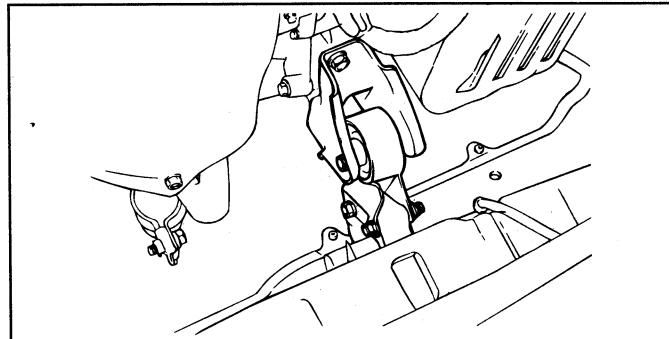
1. Remove the transaxle mounting insulator bolts.
2. Remove the transaxle mounting bracket from the transaxle.



ECA9007A

FRONT ROLL STOPPER

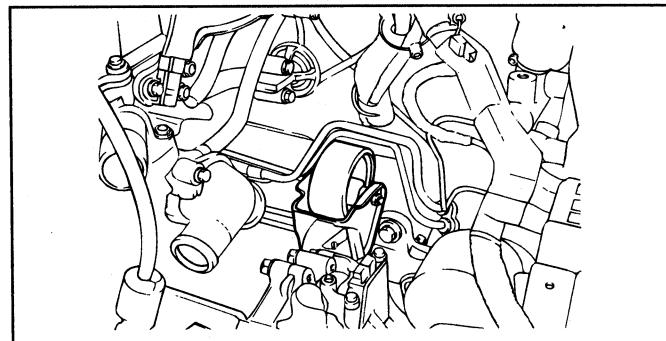
Remove the front roll stopper bracket from the sub-frame.



ECA9008A

REAR ROLL STOPPER

1. Remove the bolt from the rear roll stopper.
2. Remove the rear roll stopper from the subframe.

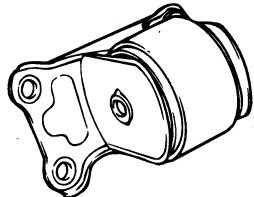


ECA9009A

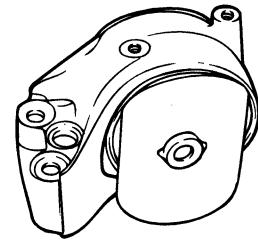
INSPECTION ITEMS

ECHA2200

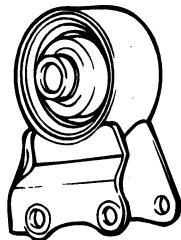
Transaxle mounting



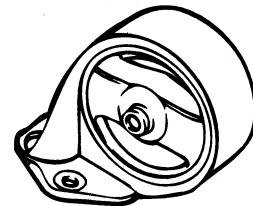
Engine mounting



Front roll stopper assembly



Rear roll stopper assembly



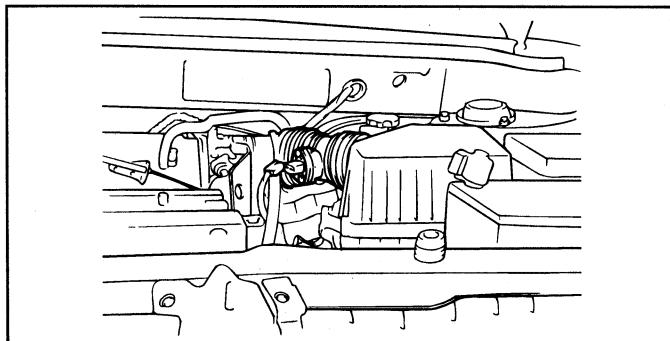
ECA9010A

ENGINE AND TRANSAXLE ASSEMBLY

ECJA2300

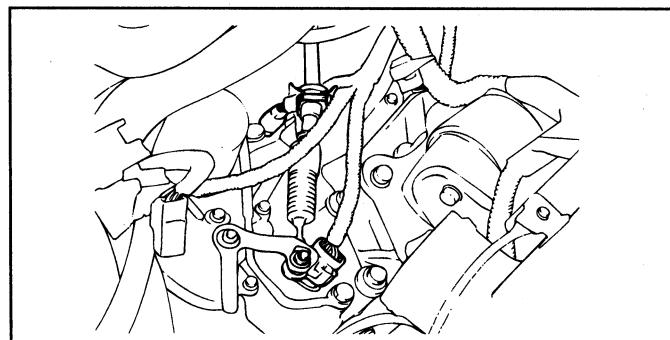
REMOVAL

1. Remove the battery.
2. Detach the air cleaner.

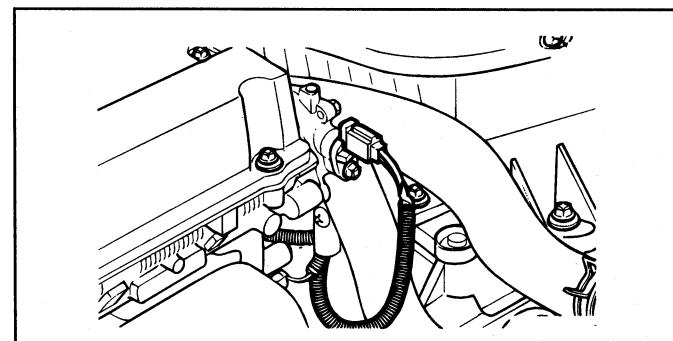


ECJA870B

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



ECA9014A



ECHA004C

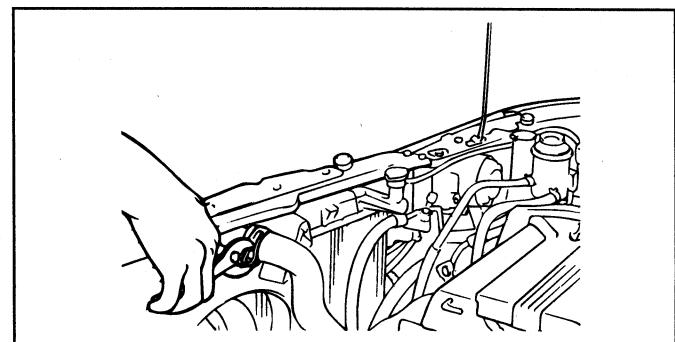
4. Drain the engine coolant.
5. For a vehicle with automatic transaxles, disconnect the transaxle oil cooler hoses.

NOTE

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

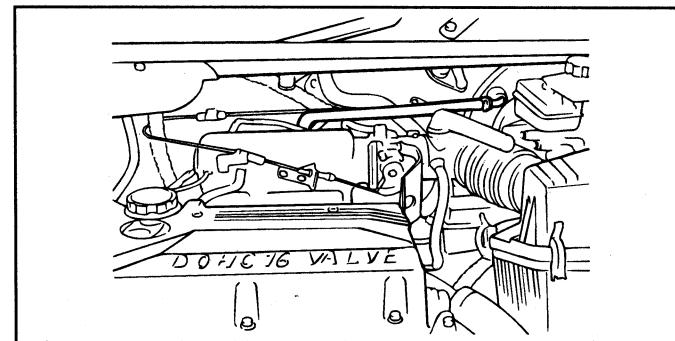
CAUTION

- Be careful not to spill any of oil or fluid out of 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.



EDJA830A

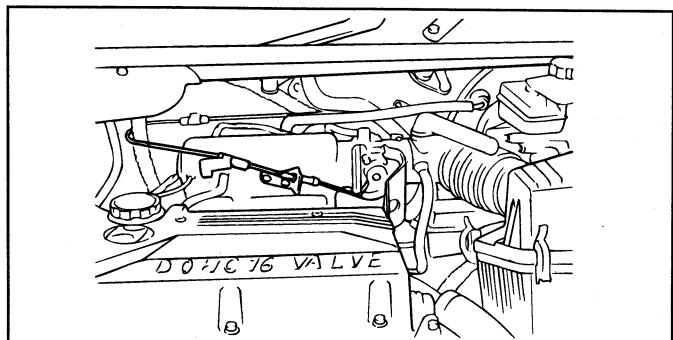
7. Disconnect the engine ground.
8. Disconnect the brake booster vacuum hose.



EDHA006B

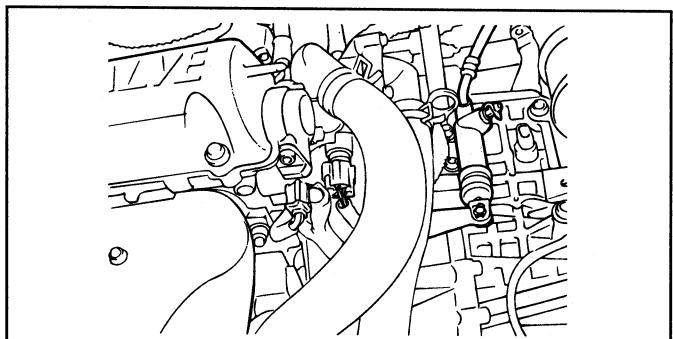
9. Disconnect the heater hoses (inlet and outlet) on the engine side.

10. Disconnect the accelerator cable at the engine side.



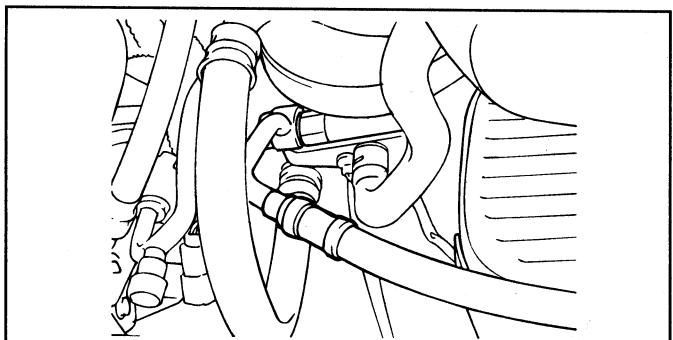
EDHA006E

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



ECHA004N

14. Disconnect the power steering suction hose and return hose from the pump.

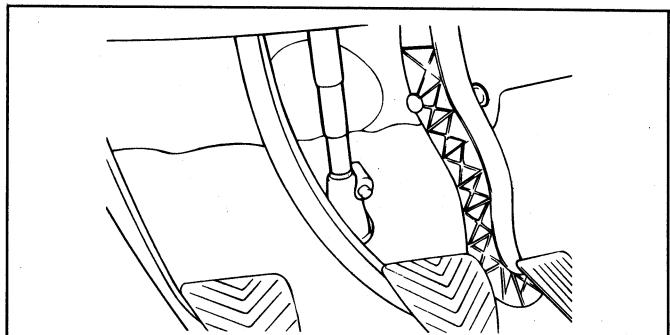


ECHA004H

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

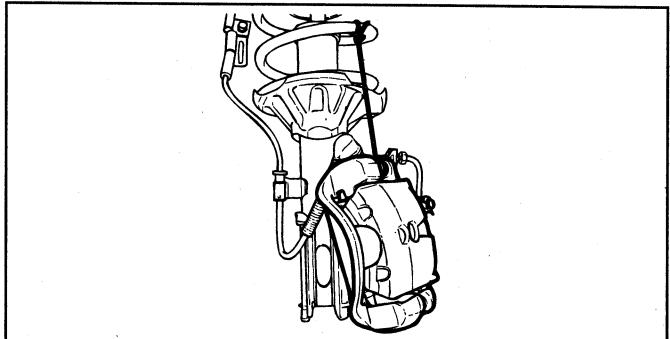
NOTE

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



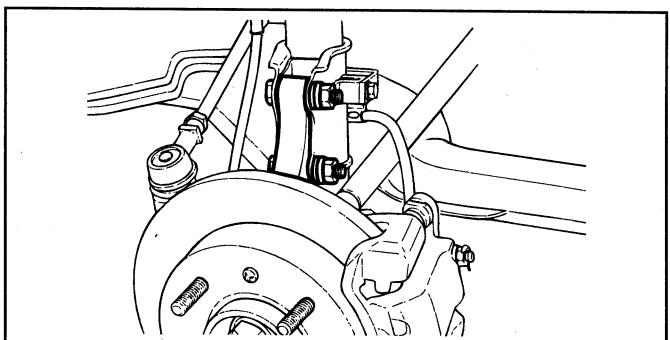
ECHA004I

16. Raise the vehicle and then remove the front tire.
 17. Remove the calliper assembly from the knuckle. Tie it using wire, hang it from the suspension.



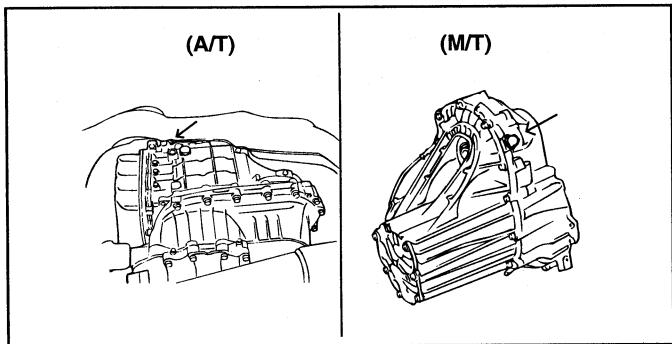
ECHA004J

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



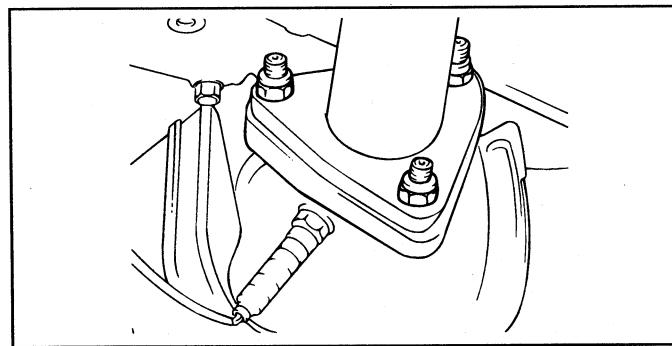
ECHA004K

19. Drain the transaxle oil.



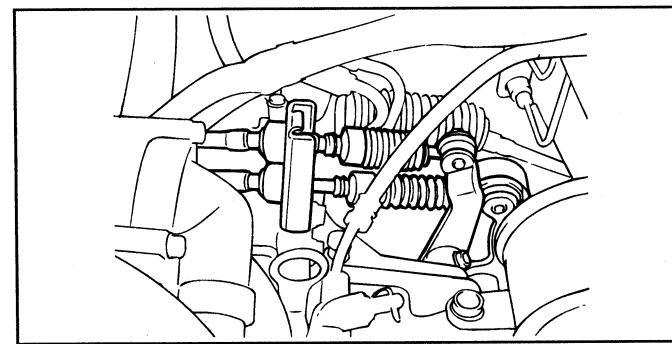
EDHA004Z

20. Remove the front muffler bolts.



ECJA230B

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

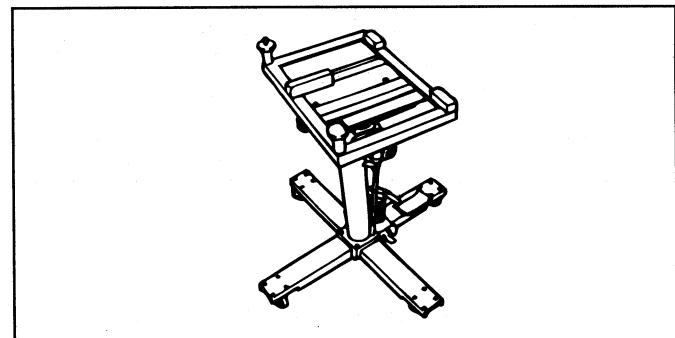


EDHA006F

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

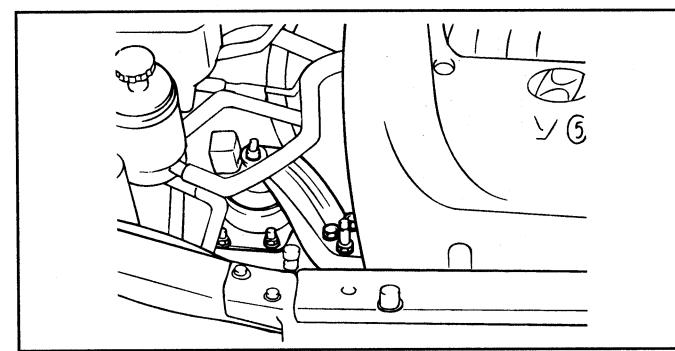
NOTE

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

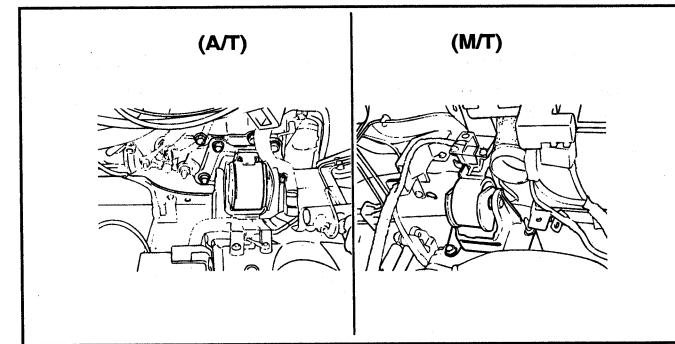


ECHA004O

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

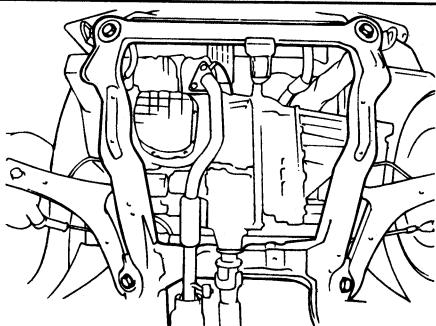


EDHA004A

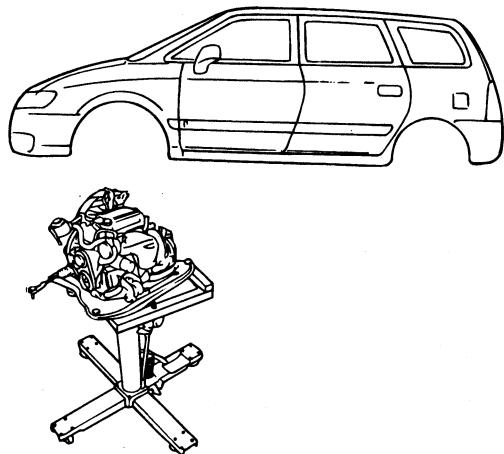


EDHA004C

24. Remove the sub-frame installation bolts.

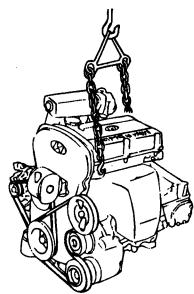


EDJA230C



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.



ECA9021A

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

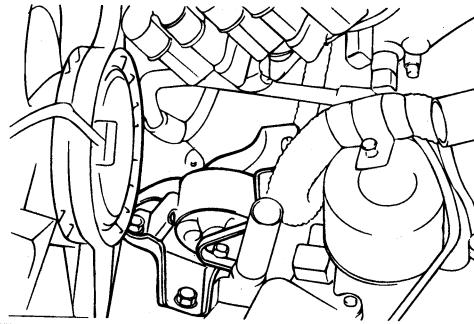
INSTALLATION

ECJA2400

1. When installing the engine and transaxle, check the connections of harnesses, pipes, hoses, etc. make sure that none of them are caught, damaged, etc.
2. Install the front roll stopper to the bracket roughly.

Tightening torque

Service standard : 50-65 Nm (500-650kg.cm, 36-47 lb.ft)

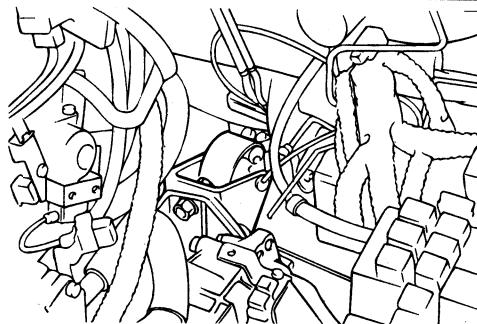


ECHA005A

3. Install the rear roll stopper to the bracket.

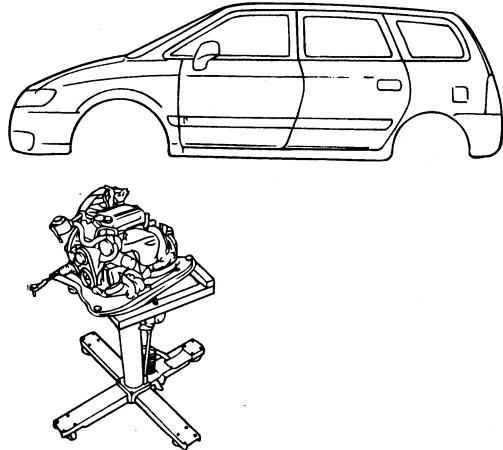
Tightening torque

Service standard : 50-65Nm(500-650kg.cm, 36-47 lb.ft)



ECHA005B

4. Install the engine/transaxle to the sub-frame assembly. Use the T/M jack to raise the assembly slowly adjust it to the vehicle body.

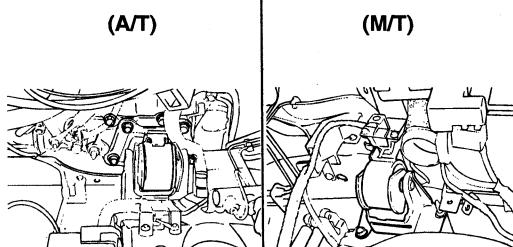


EDHA006I

5. Install the transaxle mounting bracket.

Tightening torque

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

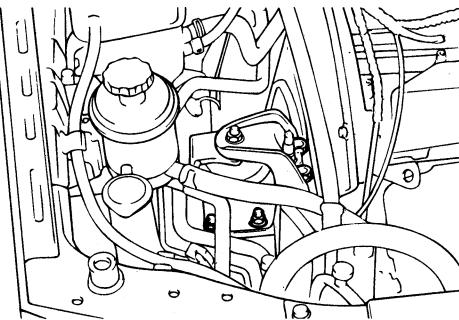


EDHA004C

6. Install the engine bracket (right side).

Tightening torque

Service standard : 60-80Nm(600-800kg.cm, 43-58 lb.ft)



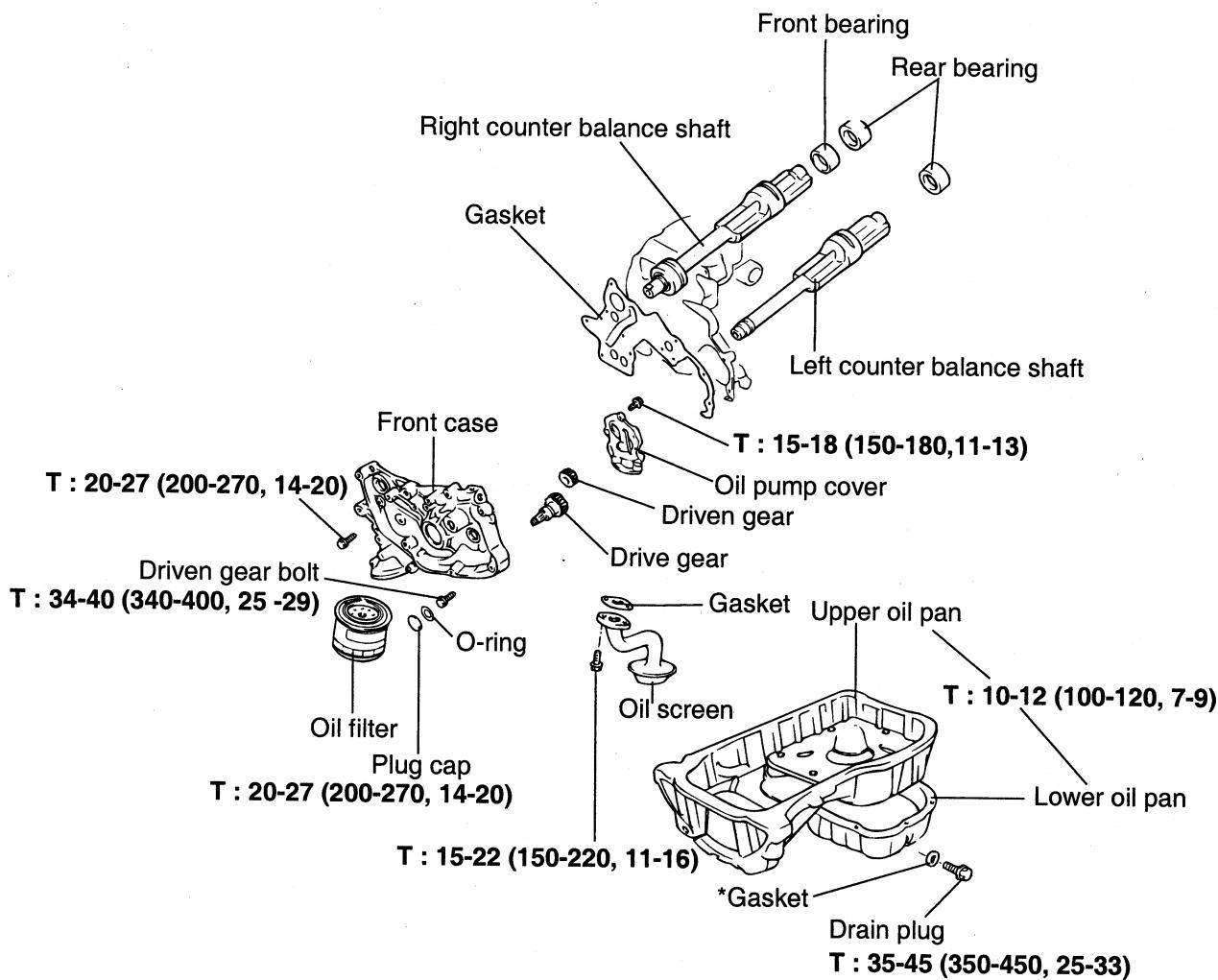
ECHA005E

7. To install all of parts, follow the removal procedures in the reverse order.
8. Refill the coolant and then check for leaks.
9. Refill the transaxle oil and check for leaks, then test its operation.
10. Check the operation of the transaxle control cable and accelerator cable.
11. Check the proper operation of each gauge.

FRONT CASE

OIL PUMP CASE, OIL PUMP AND
COUNTER BALANCE SHAFT

ECHA2500



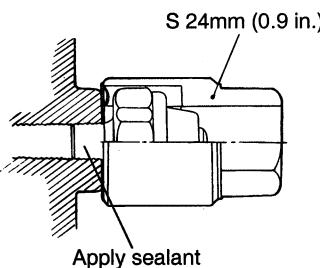
TORQUE : Nm (kg.cm, lb.ft)

*Drain plug gasket
should not be used
again.

DISASSEMBLY

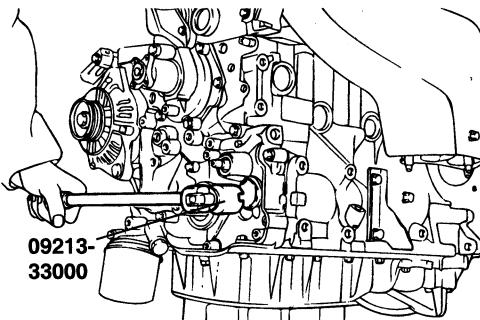
ECHA2600

1. Remove the timing belt. Refer to "Timing Belt."
2. Remove all the oil pan bolts.
3. Tap the oil pan with a rubber hammer and remove the pan. (upper and lower parts)
4. Remove the oil screen and gasket.
5. Remove the front case assembly.
6. Remove the oil pressure switch.



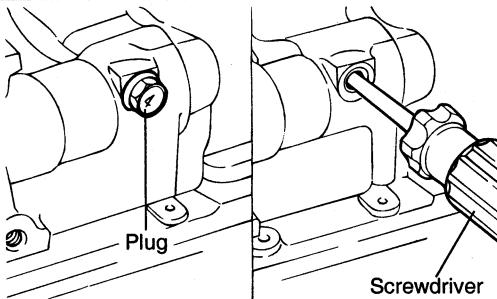
ECHA260A

7. Remove the oil filter bracket and gasket.
8. Using the special tool (09213-33000) remove the plug cap from the oil pump portion of the front case.



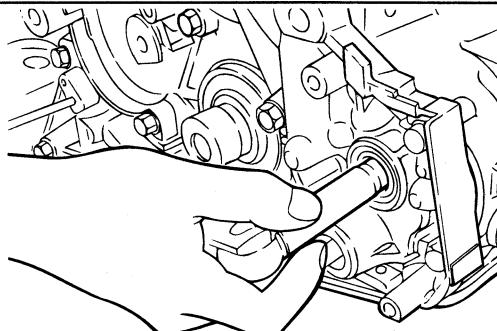
ECA9040A

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



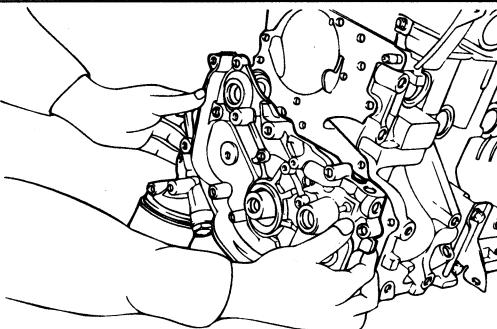
ECA9310C

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



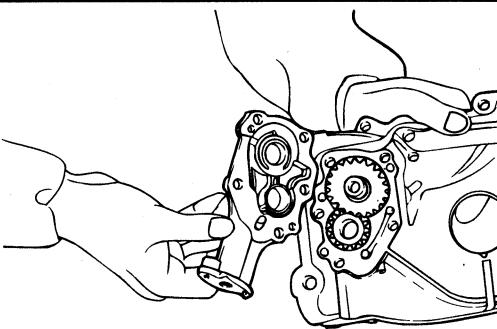
ECA9310D

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



ECA9041A

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



ECA9042A

14. Remove the screw driver.

(Step. 9)

INSPECTION

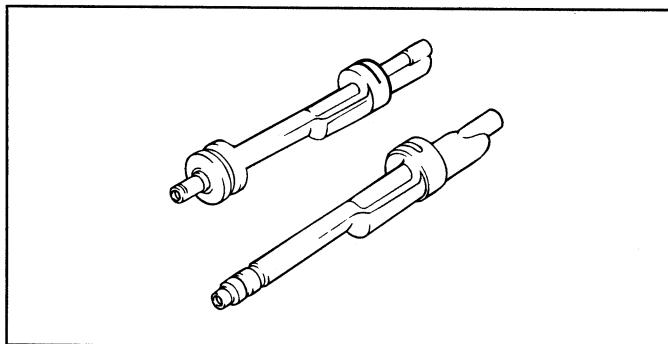
ECJA2700

FRONT CASE

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

COUNTER BALANCE SHAFT

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



ECA9043A

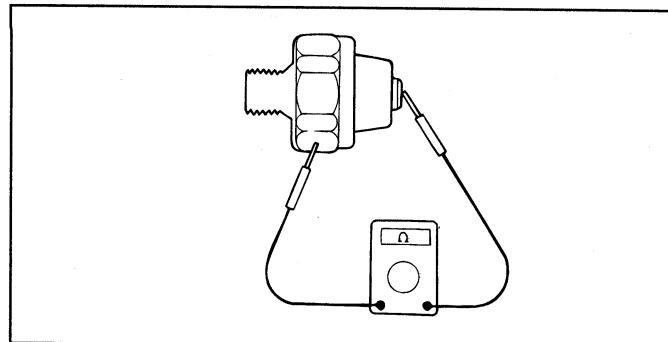
OIL SEAL

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

OIL PRESSURE SWITCH

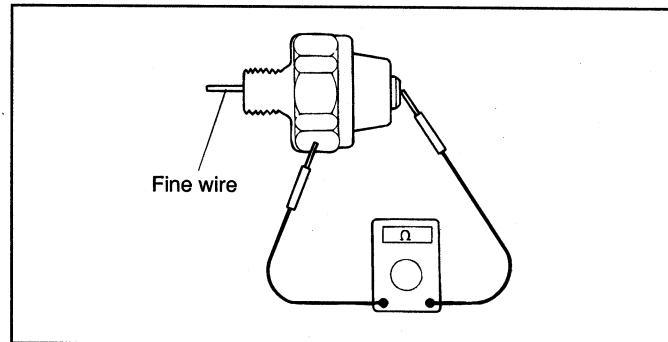
1. Check the continuity between the terminal and the body with an ohmmeter.

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



ECA9320D

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



ECA9320E

OIL PUMP

1. Assemble the oil pump gear to the front case and rotate it to verify smooth rotation with no looseness.
2. Make sure that there is no ridge wear on the contact surface between the front case and the gear surface of the oil pump cover.

3. Install the drive and driven gears to the front case. Measure the tip clearance of the gears.

[Standard value]

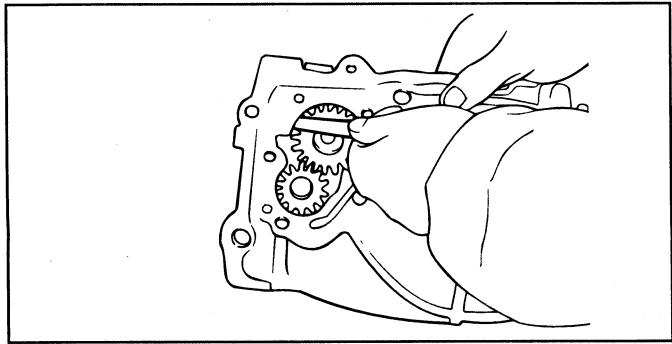
Drive gear : 0.16-0.21mm(0.0063-0.0083 in.)

Driven gear : 0.18-0.21mm(0.0071-0.0083 in.)

[Limit]

Drive gear : 0.25mm(0.0098 in.)

Driven gear : 0.25mm(0.0098 in.)



ECA9044A

4. Check the side clearance.

[Standard value]

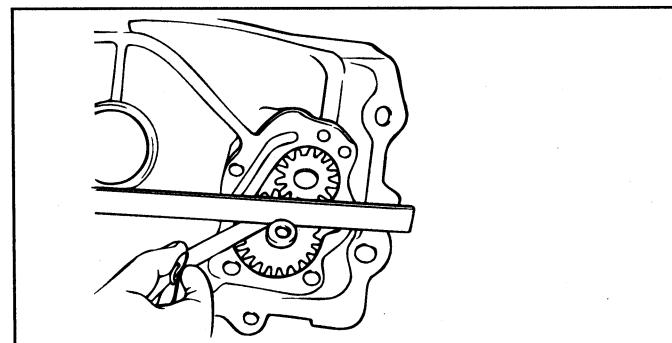
Drive gear : 0.08-0.14mm(0.0031-0.0055in.)

Driven gear : 0.06-0.12mm(0.0024-0.0047in.)

[Limit]

Drive gear : 0.25mm(0.0098 in.)

Driven gear : 0.25mm(0.0098 in.)



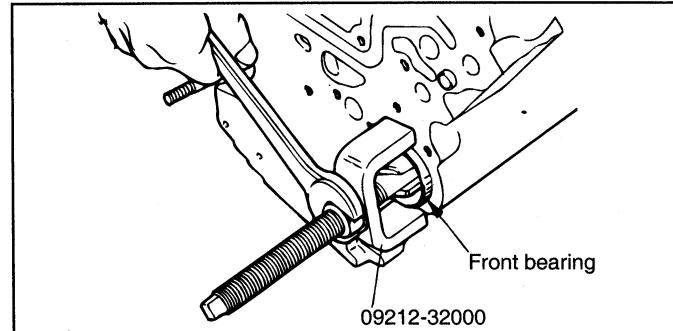
ECA9045A

COUNTER BALANCE SHAFT BEARING

ECJA2800

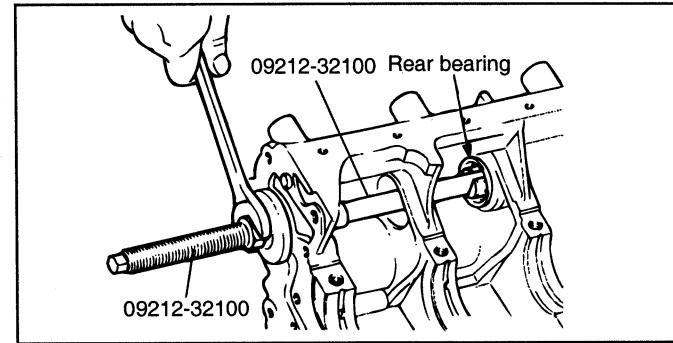
REPLACEMENT

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



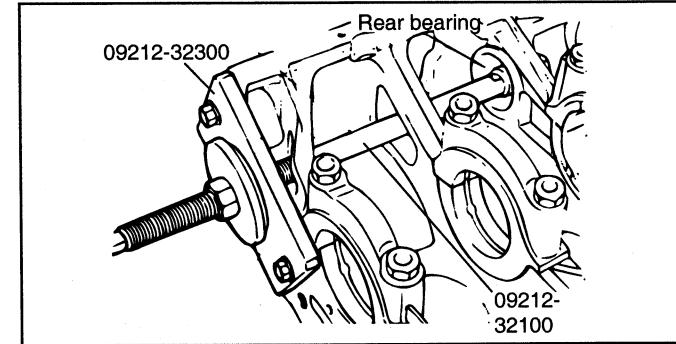
ECA9330A

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



ECHA280A

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



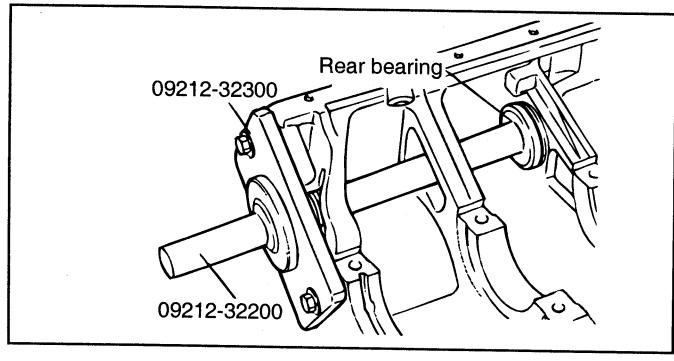
ECHA280B

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

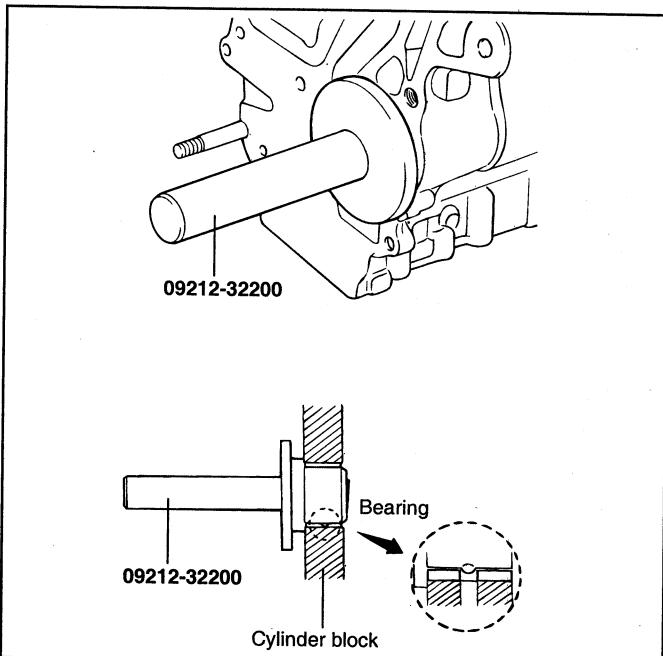
NOTE

1. Apply engine oil to the outside of rear bearing and bearing hole in cylinder block.

2. The left rear bearing has no oil holes.



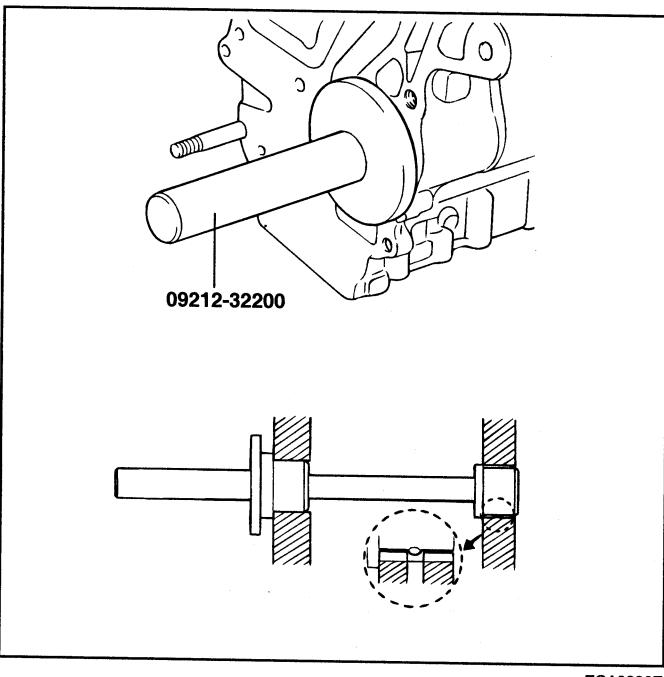
6. Using a special tool, install the front bearing of the right counter balance shaft to the cylinder block.



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

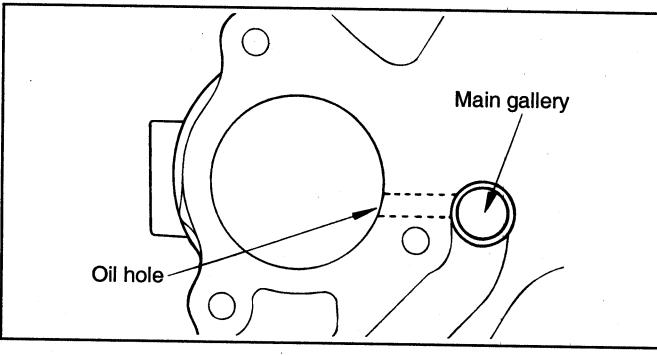
NOTE

- 1. Apply engine oil to the outside surface of the bearing.**
- 2. Make sure that the bearing oil hole is aligned with the oil hole of cylinder block.**



NOTE

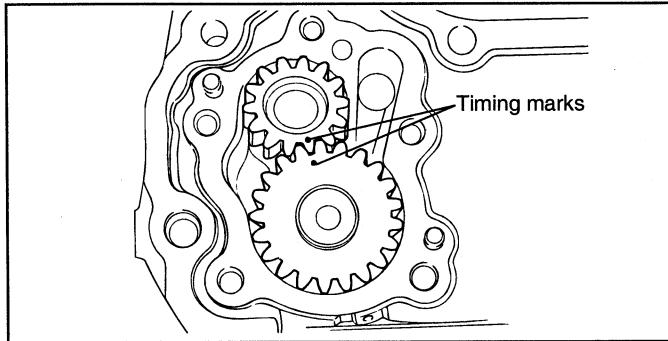
Make sure that the bearing oil hole is aligned with the oil hole cylinder block.



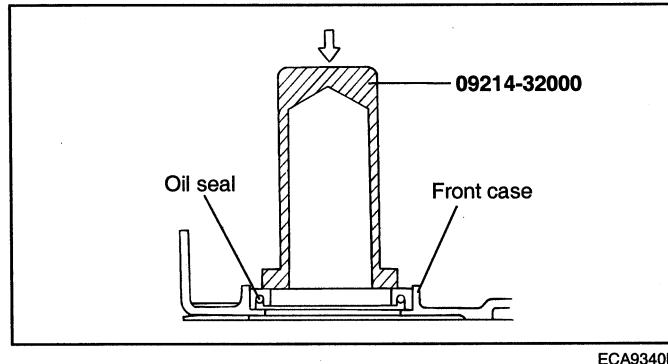
REASSEMBLY

ECJA2900

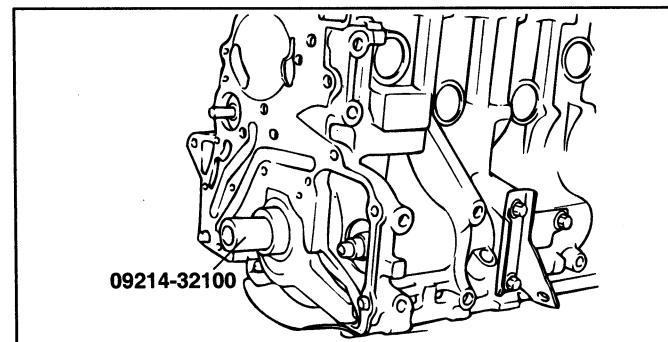
1. Apply engine oil to the gear and align the two timing marks.



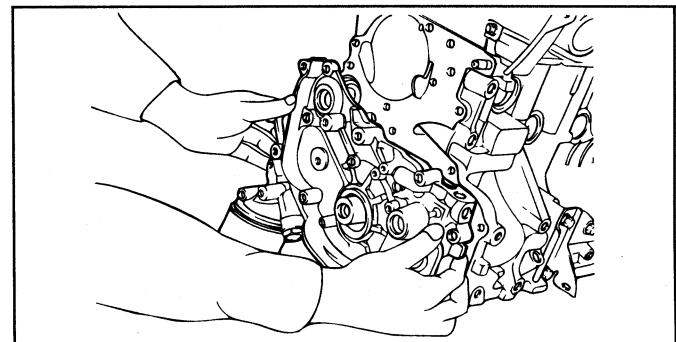
2. Using the special tool, the crankshaft front oil seal installer (09214-32000), install the crankshaft front oil seal into the front case.



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



4. Install a new front case gasket to the front case assembly and tighten the flange bolts temporarily.

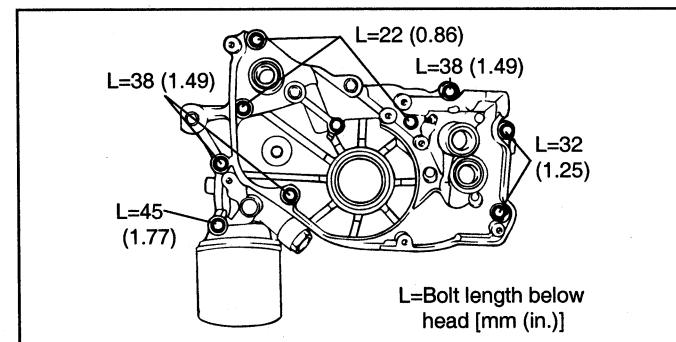


5. Install the front case assembly with a new gasket. Tighten bolts to the specified torque.

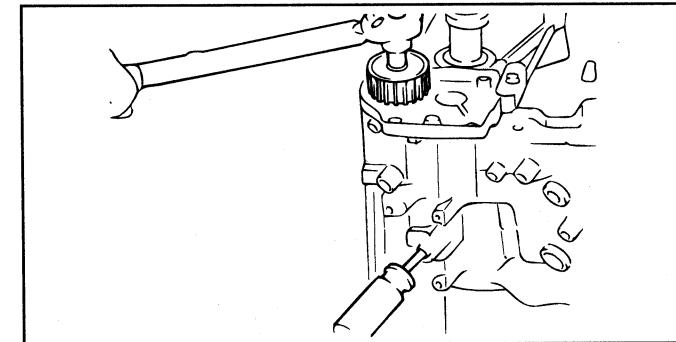
Front case assembly

Tightening torque :

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

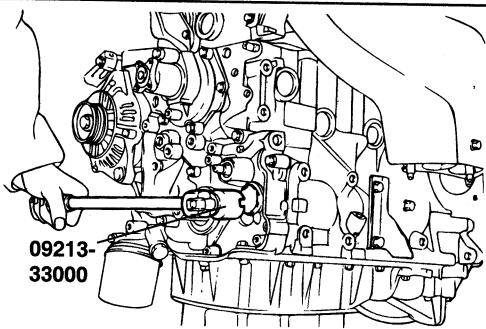


6. Insert a screwdriver into the plug hole in left side of cylinder block. After verifying that the shaft is in the proper position, replace the bolt and tighten it.



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

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



ECA9040A

Plug cap

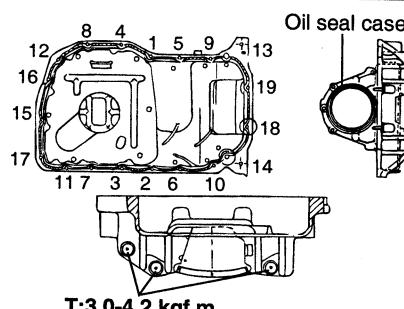
Tightening torque :

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

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

NOTE

1. Apply sealant approximately 4 mm (0.16 in.) in thickness.
2. After the application of the sealant, install the oil pan within 15 minutes.



ECJA290A

10. Note the difference in bolt lengths at the locations shown.

Install the upper and lower oil pans and tighten the bolts to the specified torque.

Tightening torque

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

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

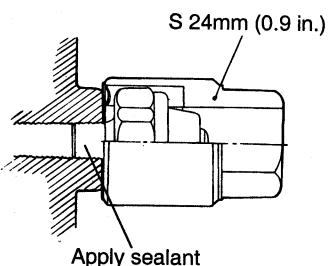
Sealant : Threebond 1104 or equivalent

NOTE

Do not torque the oil pressure switch excessively.

Tightening torque

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



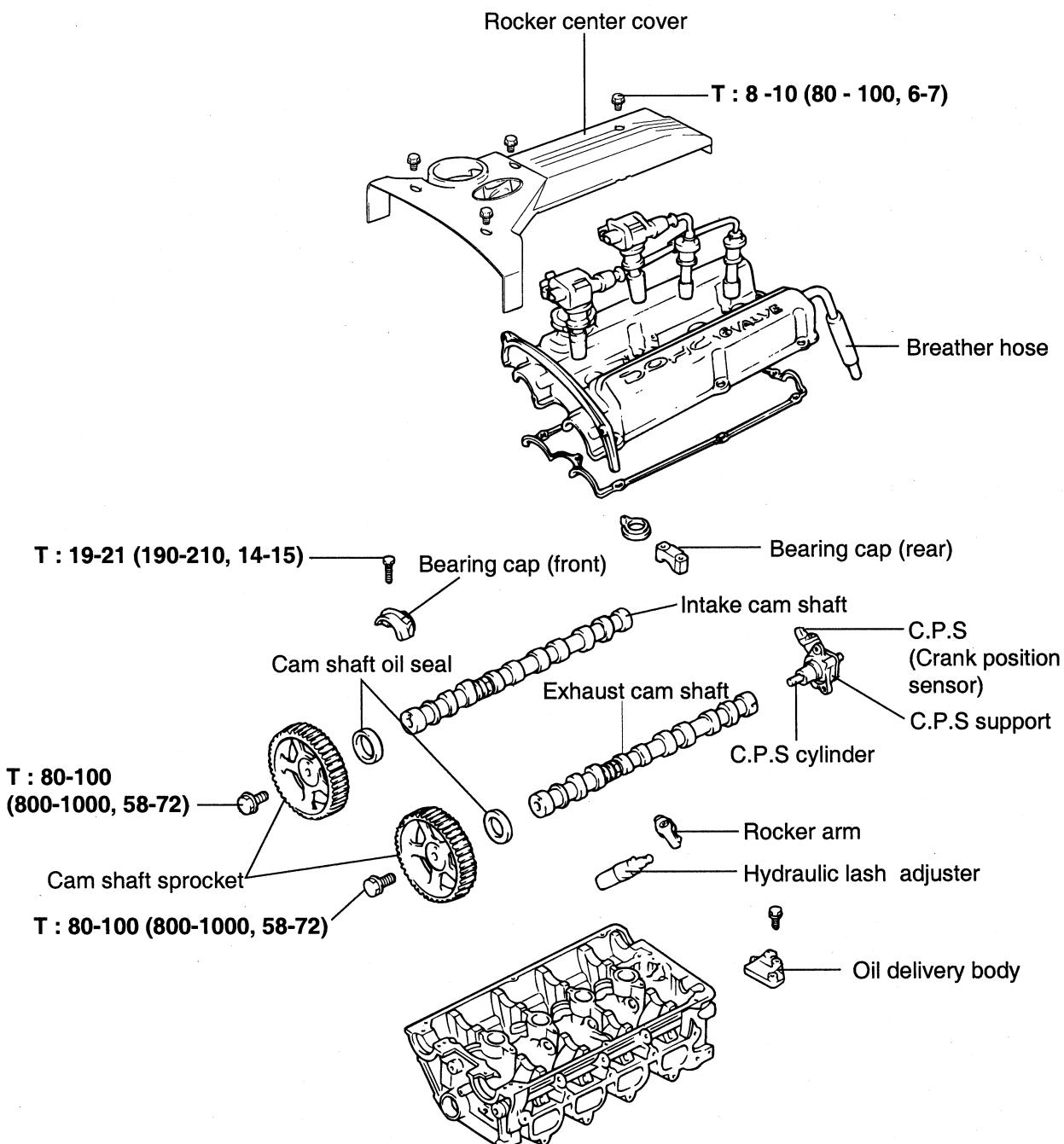
ECHA260A

MAIN MOVING SYSTEM

CAM SHAFT

CAMSHAFTS AND ROCKER ARMS

ECHA3000



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

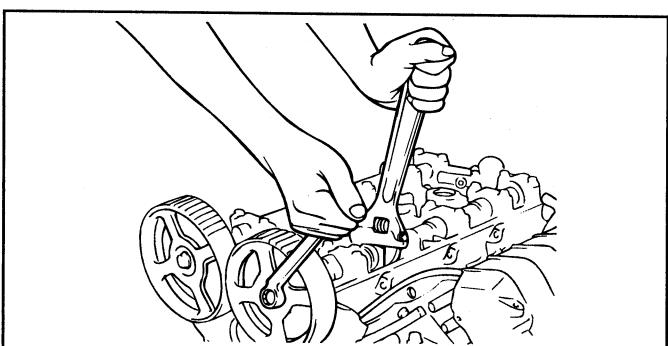
ECHA053A

DISASSEMBLY ECJA3100

1. Disconnect the negative terminal from the battery.
2. Drain the engine coolant.
3. Remove the breather hose between the air cleaner and the rocker cover.
4. Remove the air cleaner.
5. Remove the timing belt cover.
6. Remove the rocker cover and crank shaft position sensor.
7. Loosen the camshaft sprocket bolts then remove the camshaft sprockets.
8. Loosen the camshaft bearing cap bolts and remove the bearing caps, camshafts, rocker arms and lash adjusters.

CAUTION

Loosen the cap bolts in increments to avoid bending the camshafts.

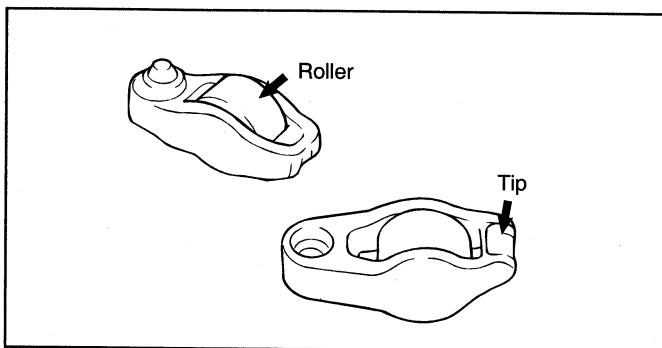


ECA9170C

INSPECTION ECJA3200**ROCKER ARMS**

1. Check rotation of the roller. If they do not rotate smoothly or are loose, replace them.
2. Check the roller surface. Replace if there is any dent, damage or evidence of seizure.

3. Check the valve contact surface for possible damage or evidence of seizure. Replace if necessary.



ECA9240A

CAMSHAFTS

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

Cam height

[Standard]

Intake : 35.493 mm (1.3974 in.)

Exhaust :

[2.4L] M/T : 35.204 mm (1.3860 in.)

[2.0L] M/T : 35.317 mm (1.3904 in.)

A/T : 35.204 mm (1.3866 in.)

[Limit]

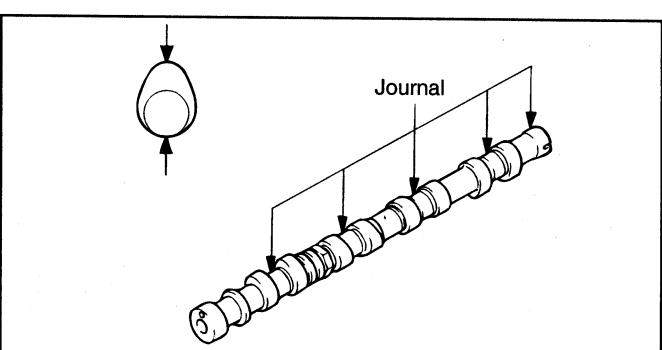
Intake : 35.993 mm (1.4170 in.)

Exhaust :

[2.4L] M/T : 34.704 mm (1.3663 in.)

[2.0L] M/T : 34.817 mm (1.3707 in.)

A/T : 34.704 mm (1.3663 in.)



ECA9240B

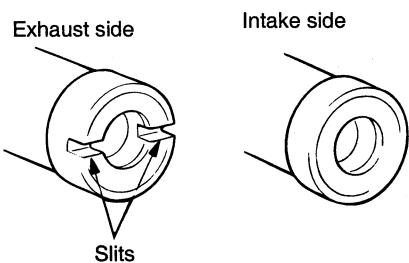
REASSEMBLY ECJA3300

1. Install the camshafts on the cylinder head.

Do not install the rocker arms yet.

NOTE

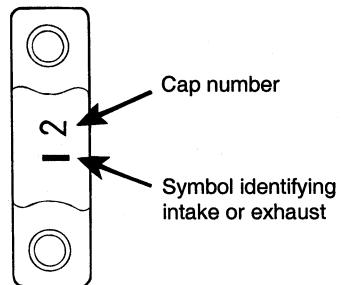
1. Apply engine oil to journals and cams of the camshafts.
2. The exhaust camshaft has a slit on its rear end for the crankshaft position sensor.



ECA9250A

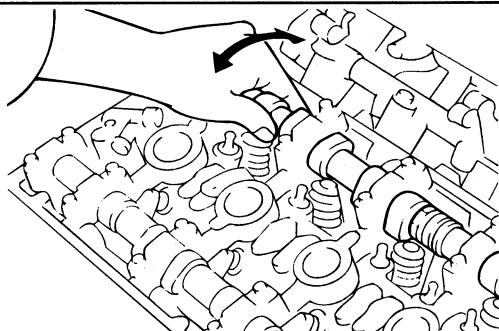
2. Install the bearing caps. The markings on the caps are for intake/exhaust identification.

I : Intake camshaft. E : Exhaust camshaft



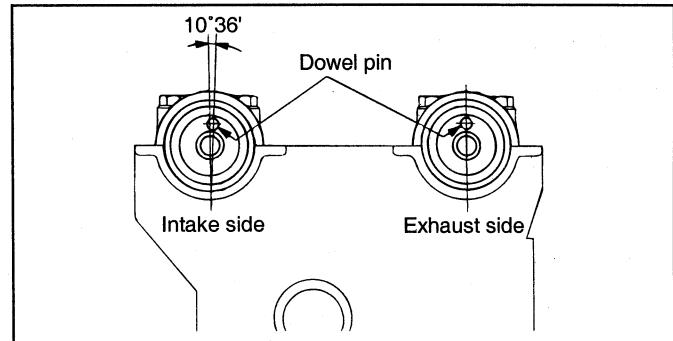
ECA9250B

3. Check that the camshaft can be easily turned by hand. After checking, remove the bearing caps and the camshafts, and then install the rocker arms.



ECA9250C

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



ECHA330A

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

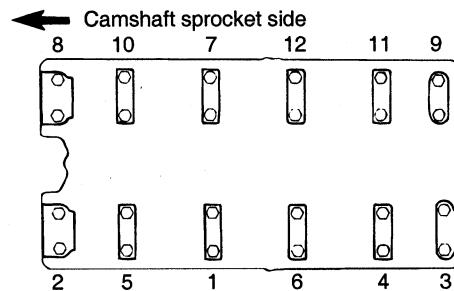
NOTE

Tighten the rocker arms uniformly.

Tightening torque

Bearing cap bolts:

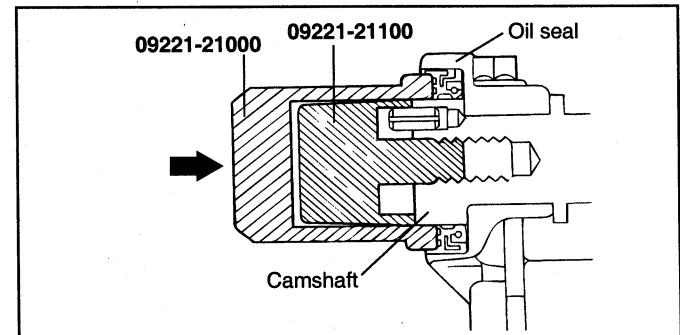
19-21 Nm (190-210 kg.cm, 14-15 lb.ft)



ECHA330B

6. Using the special tools, camshaft oil seal Installer and guide (09221-21000, 09221-21100),. 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 by driving the installer with a hammer until the oil seal is fully seated.



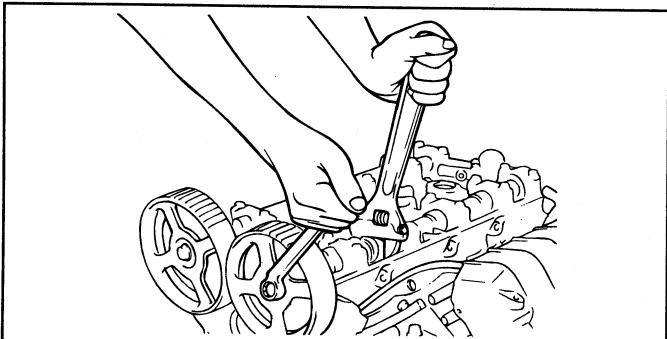
ECHA330C

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

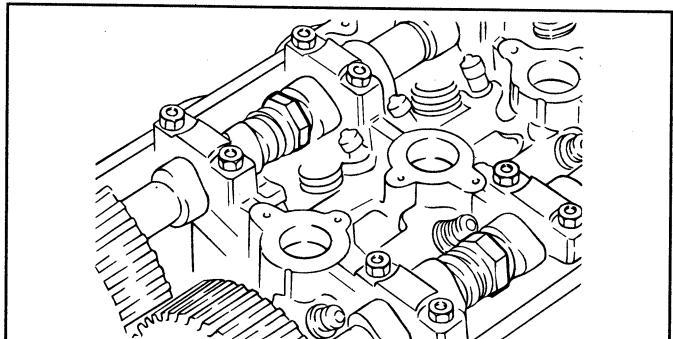
Tightening torque

Camshaft sprocket bolts :

80-100 Nm (800-1000 kg.cm, 58-72lb.ft)



FGA9170G



ECAR3101

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

Tightening torque

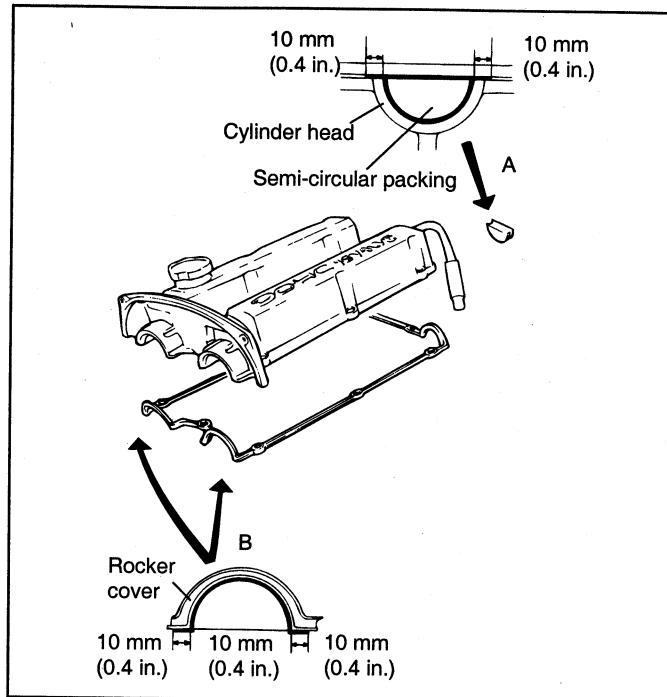
Rocker cover bolts : 8-10 Nm (80-100 kg.cm, 6-7 lb ft)

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

Sealant

A Portion : Threebond No. 10 or equivalent

B Portion : Threebond No. 1212D or equivalent

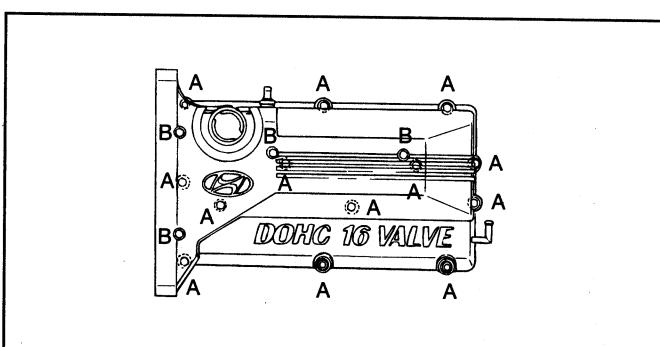


FGA9034A

Bolt

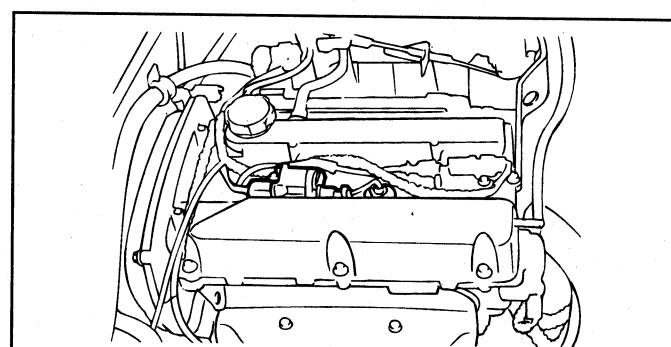
A : 13EA (Rocker cover bolts)

B : 4EA (Center cover bolts)



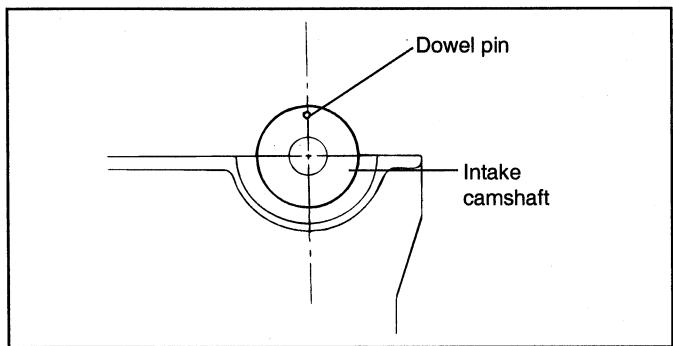
ECAD003EA

9. Install the spark plugs, and ignition coils. Connect the secondary wires and then install the center cover.



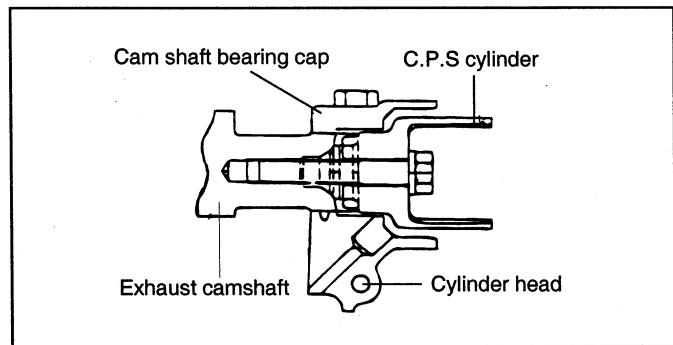
SCHÄFFER

10. Install the dowel pin on the sprocket side of the intake cam shaft.



ECA9250L

11. Install the crank position sensor support assembly after installing the crank position sensor cylinder on the exhaust camshaft.

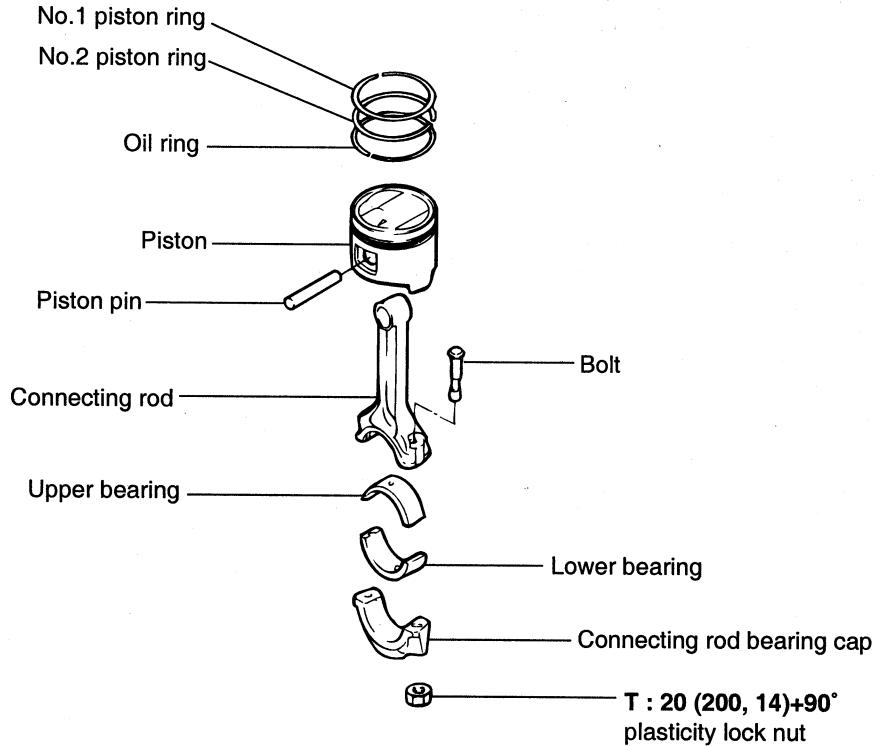


ECHA008B

CONNECTING ROD

PISTON AND CONNECTING ROD

ECHA3500



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

ECHA350A

DISASSEMBLY

ECJA3600

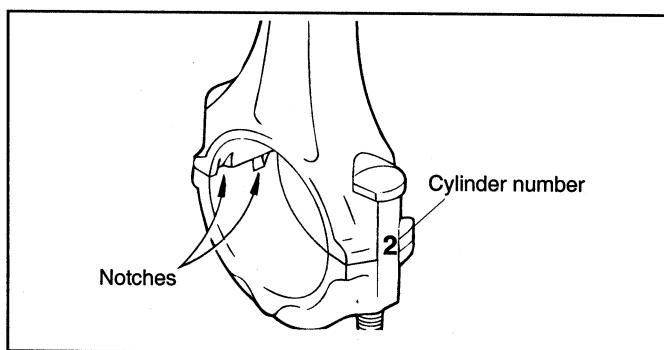
2. Push each piston-connecting rod assembly toward the top of the cylinder.

CONNECTING ROD CAP

NOTE

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

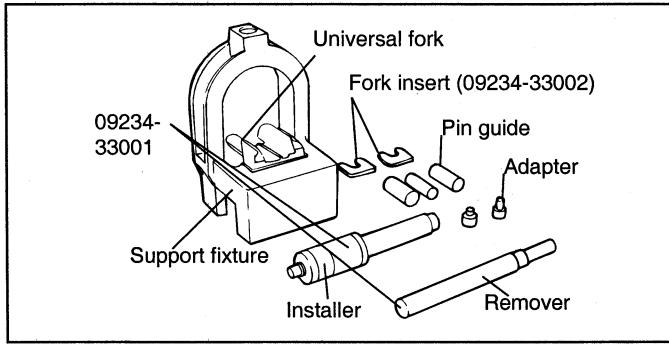
1. Remove the connecting rod cap nuts and then remove the caps and the big end lower bearing. Mark for reassembly.



ECA9360A

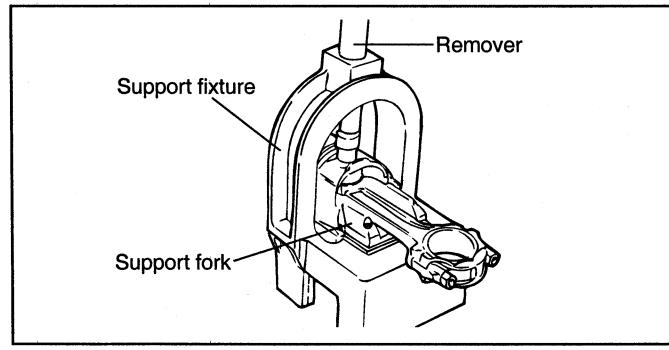
DISASSEMBLY AND REASSEMBLY OF PISTON PIN

1. Use the special tools 09234 - 33001 and 09234 - 33002, 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 while 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.

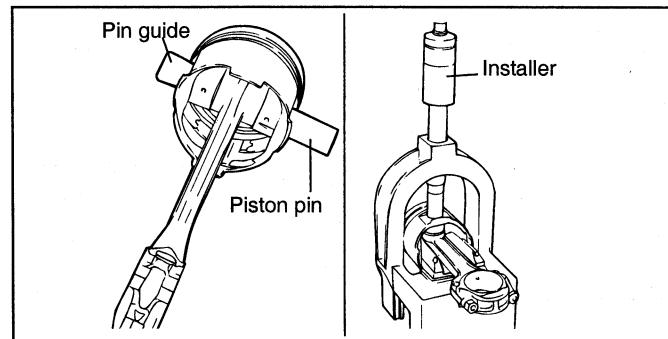


ECA9361B

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 though 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 fort inserts. If the wrong size pin guide is used, the piston and pin will not line up with the support fixture.

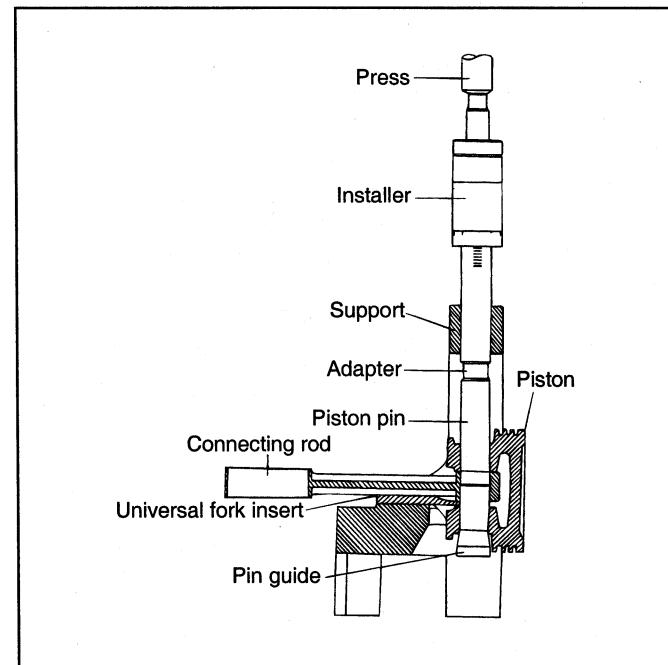


ECA9361C

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 (2756 \pm 1102 lb) of force when stopping the installing arbor sleeve against the arch.



EOY055C

INSPECTION ECJA3700**PISTON AND PISTON PINS**

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

PISTON RINGS

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

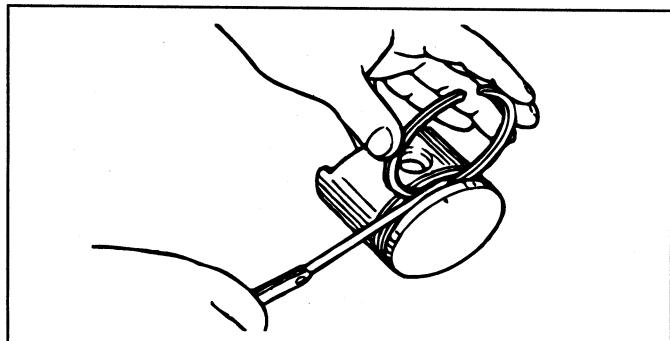
Standard value

Piston ring side clearance :

No. 1 : 0.03-0.07mm(0.0012-0.0028 in.)

No. 2 : 0.02-0.06mm(0.0008-0.0024 in.)

Oil ring : 0.06-0.15 mm (0.0024-0.0059 in.)



ECA9370A

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 : 0.25-0.35mm(0.0098-0.0138 in.)

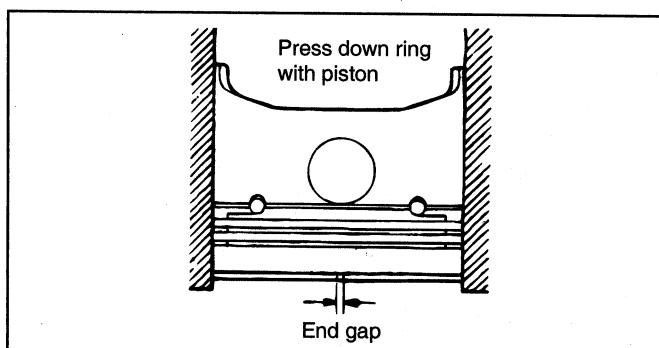
No.2 : 0.40-0.55mm(0.0157-0.0216 in.)

Oil ring side rail : 0.10-0.40mm(0.0039-0.0157 in.)

[Limit]

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

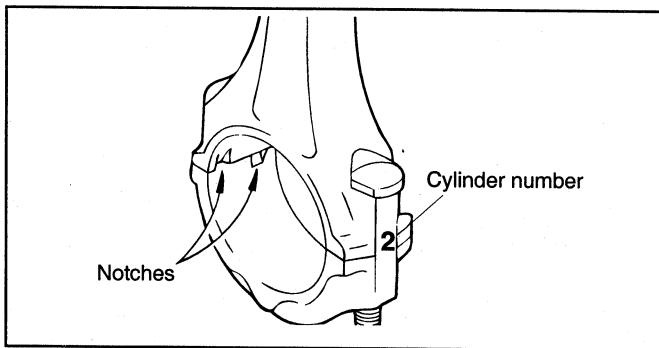
Oil ring side rail : 1.0mm(0.039 in.)



ECA9370B

CONNECTING RODS

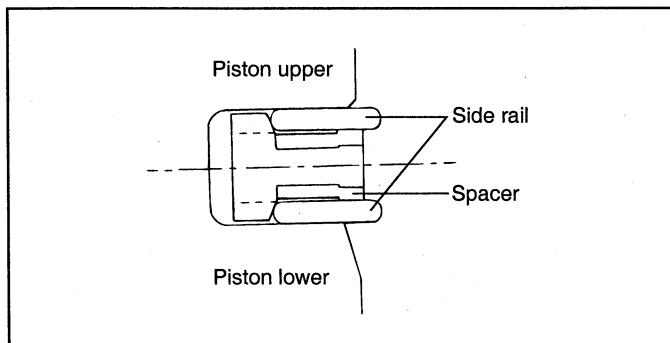
1. When the connecting rod cap is installed, make sure that cylinder numbers, marked on the rod end cap at disassembly, match. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
2. Replace the connecting rod if it is damaged at either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



ECA9360A

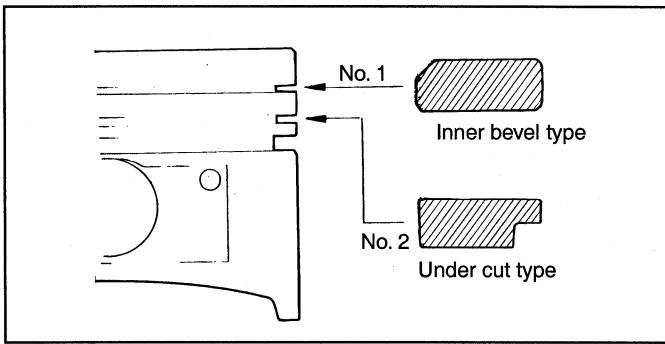
REASSEMBLY ECJA3800

1. Install the spacer.



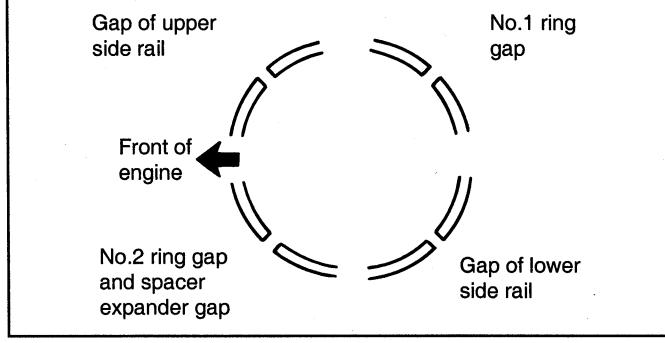
ECA9082A

6. Install the No. 1 piston ring.



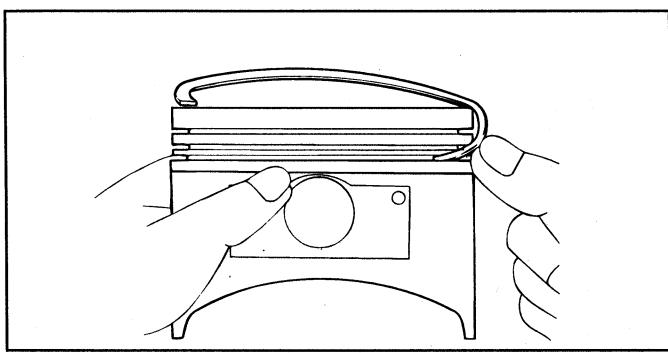
EDJA490B

7. Place each piston ring end gap as far apart from its neighboring gaps as possible. Make sure that 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. 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.
10. When the connecting rod cap is installed, make sure that the cylinder numbers put on the rod and cap at disassembly match.
11. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.



ECA9380B

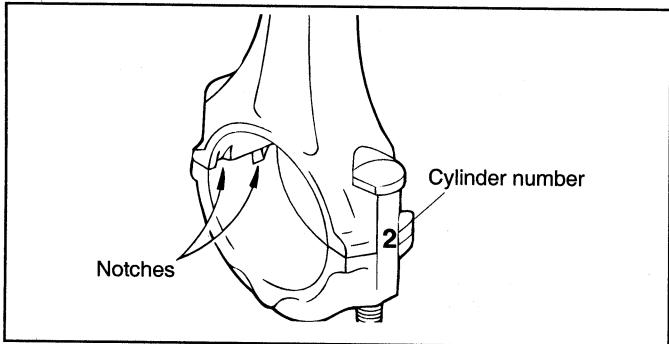
4. Apply engine oil around the piston and piston grooves.
5. Using piston ring expander, install the No. 2 piston ring.

12. Tighten the connecting rod cap nuts.

Tightening torque

Connecting rod cap nuts :

20Nm(200kg.cm, 14 lb.ft)+90°



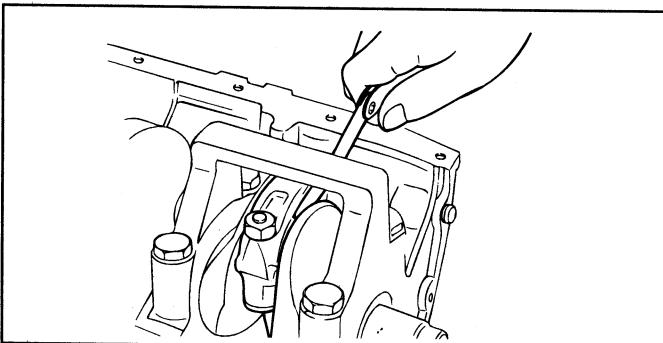
ECA9360A

13. Check the connecting rod side clearance.

Connecting rod side clearance

standard : 0.10-0.25mm(0.004-0.0098 in.)

Limit : 0.4 mm (0.0157 in.)

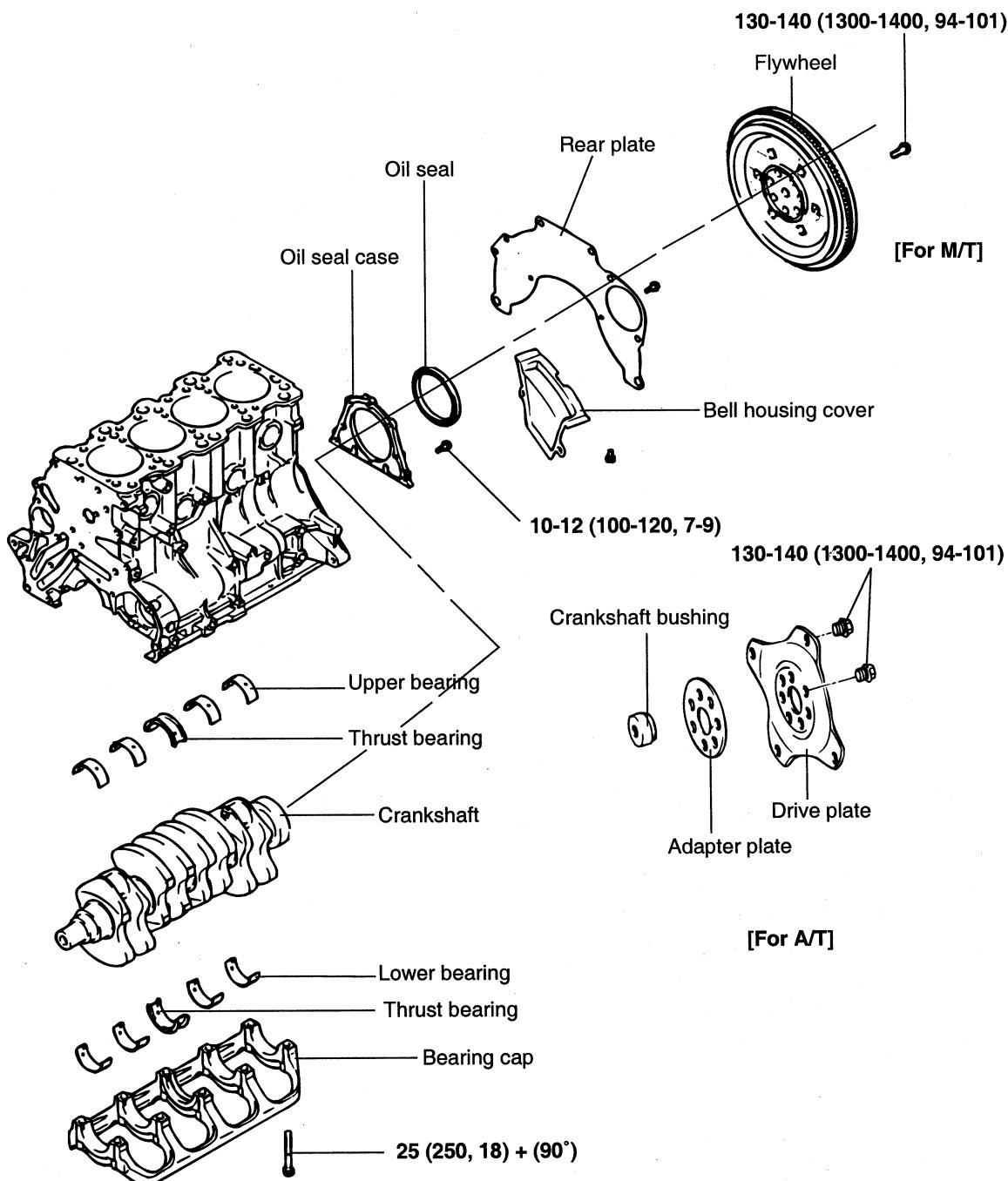


ECA9380F

CRANK SHAFT

CRANKSHAFT, FLYWHEEL

ECHA4000



TORQUE : Nm (kg·cm, lb·ft)

ECHA400A

DISASSEMBLY ECJA4100

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

NOTE

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

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

INSPECTION ECJA4200**CRANKSHAFT**

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

Standard value

Crankshaft journal O.D. :

56.982-57.000mm(2.2434-2.2441 in.)

Crankshaft pin O.D. :

44.980-45.000mm(1.7709-1.7717 in.)

MEASURING OIL CLEARANCE

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

Standard value

Oil clearance

Crankshaft main bearing

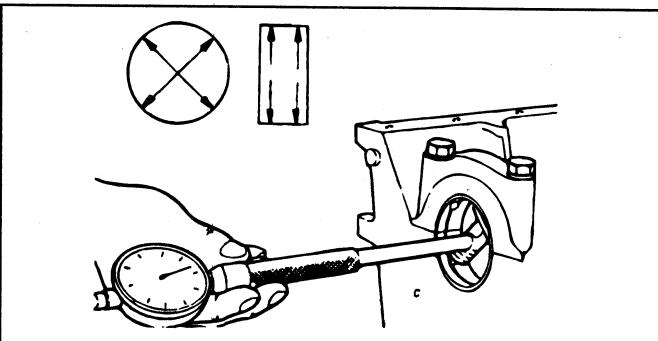
No.1,2,4,5 : 0.018-0.036 mm (0.0007-0.0014 in.)

No.3 : 0.024-0.042 mm (0.0009-0.0017 in.)

Connecting rod bearing :

0.015-0.048 mm (0.0006-0.0019 in.)

Limit : 0.1 mm (0.0039 in.)

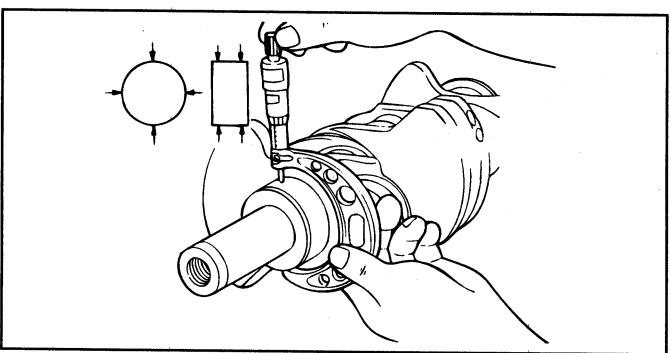


ECA9410B

HOW TO USE PLASTIC GAUGE

Plasticgauge may be used to measure the clearance.

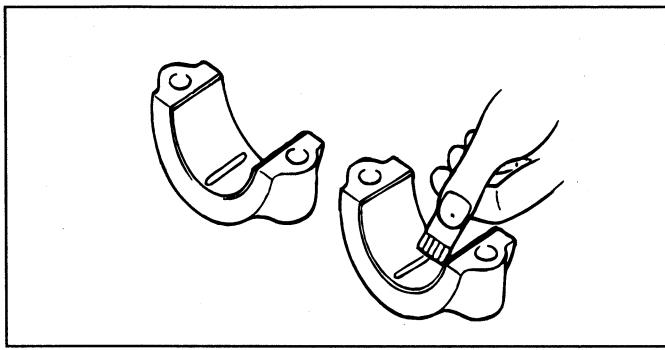
1. Remove oil, grease and any other dirt from the bearings and journals.
2. Cut the plasticgauge to the same length as the width of the bearing and place it in parallel with the journal, avoiding the oil holes.
3. Install the crankshaft, bearings and caps and tighten them to the specified torques. During this operation, do not turn the crankshaft. Remove the caps. Measure the width of the plasticgauge 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.



ECA9410A

MAIN BEARINGS AND CONNECTING ROD BEARINGS

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



ECA9410C

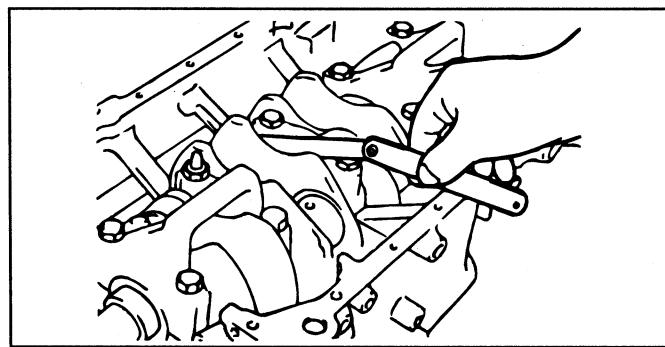
OIL SEAL

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

BEARING CAPS

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

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



ECA9410D

DRIVE PLATE (A/T)

Replace distorted, damaged, or cracked drive plates.

FLYWHEEL (M/T)

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

Limit

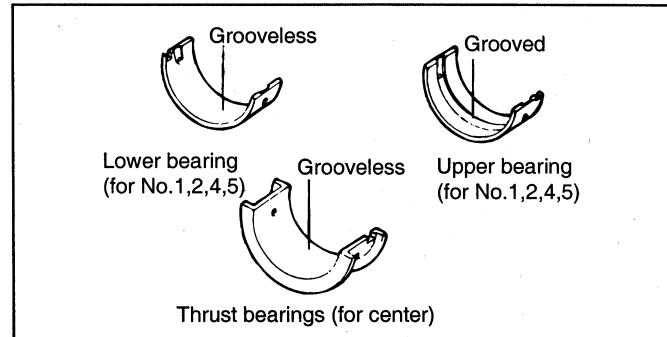
Flywheel run-out : 0.13mm(0.0051 in.)

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

REASSEMBLY

ECJA4300

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. Both upper and lower center thrust bearings are grooveless.



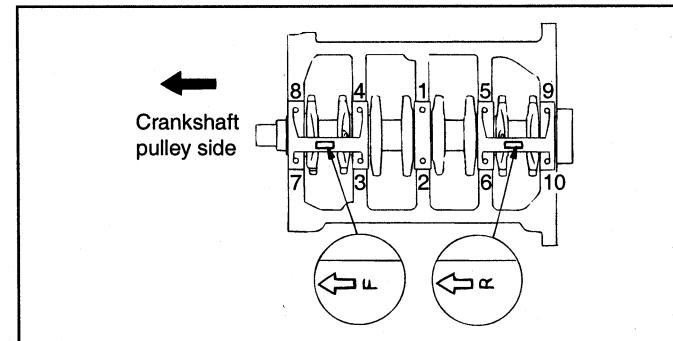
ECA9420A

4. Apply engine oil to journals and pins. Install the crankshaft.
5. Install the bearing caps with the arrow mark directed toward the front of the engine. The cap number must be correct.
6. Tighten the cap bolts to the specified torque.

Tightening torque

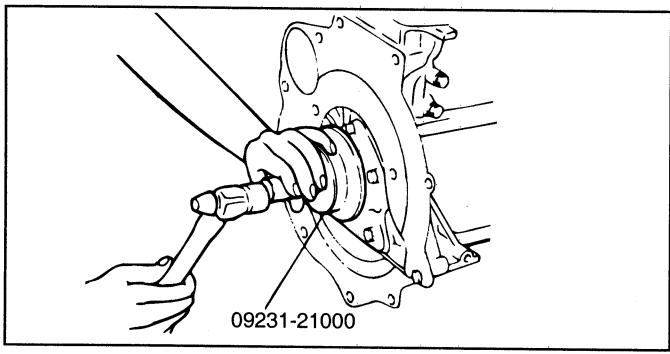
Main bearing cap bolts : 25 Nm (250, 18lb.ft) + (90°)

7. Cap bolts should be tightened evenly in 4 to 5 increments before they are tightened to the specified torque.
8. Make sure that the crankshaft turns freely and check the end play of the crankshaft.



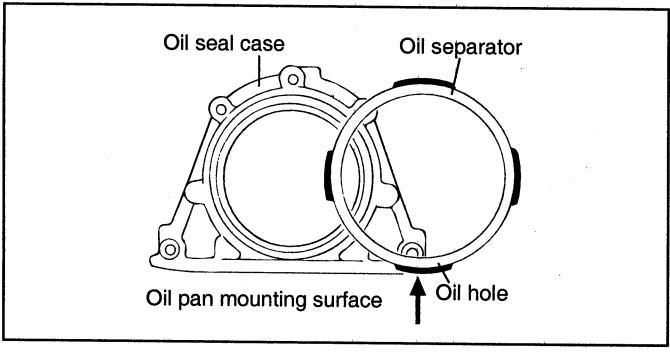
EOY062B

9. Using a special tool (09231-21000). Install the oil seal in the oil seal case. A new oil seal should be used.



ECA9420C

10. Install the oil seal into the oil seal case so that the oil hole in the separator may be directed downward (arrow in illustration)



ECA9053A

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

Tightening torque

Oil seal case :

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

<For M/T>

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

Tightening torque

Flywheel bolt :

130-140 Nm (1300-1400kg.cm,94-101lb.ft)

<For A/T>

14. Install the adapter plate to the cylinder block.
 15. Install the drive plate and tighten the bolts to the specified torque.

Tightening torque

Drive plate :

130-140 Nm (1300-1400kg.cm,94-101lb.ft)

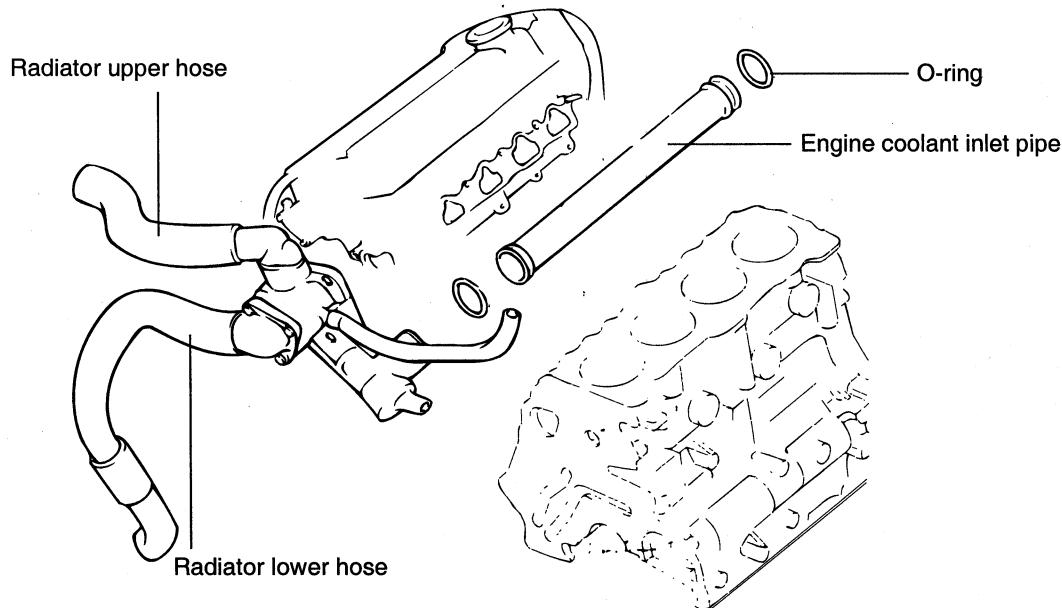
COOLING SYSTEM

ENGINE COOLANT HOSE/PIPES

ENGINE COOLANT HOSE AND PIPE

ECHA4500

[DOHC ENGINE]



ECA9081B

INSPECTION

ECHA4600

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

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.

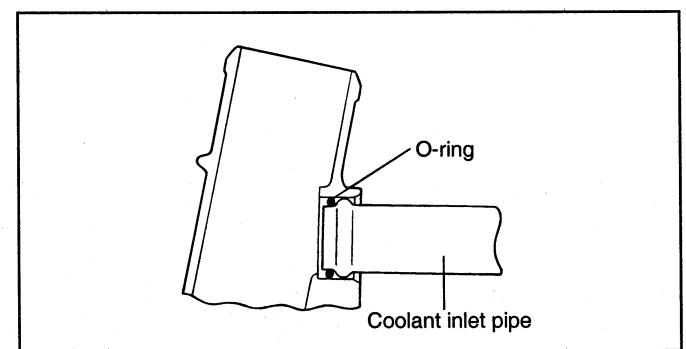
REASSEMBLY

ECHA4700

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

NOTE

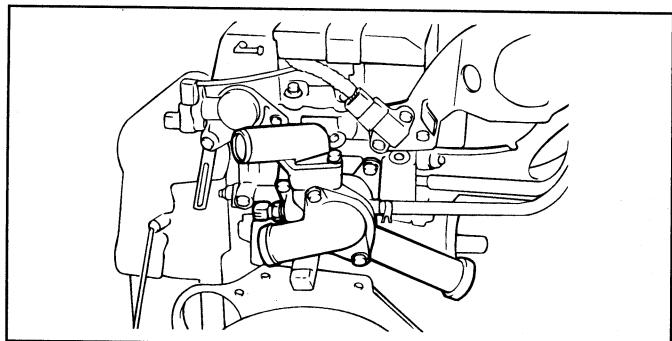
1. Do not apply oil or grease to engine coolant pipe O-ring.
2. Keep the engine coolant pipe connections free of sand, dust, etc.



ECA9570A

COOLANT TEMPERATURE**SENSOR** ECJA4800**REMOVAL**

1. Drain the coolant to a level below the bottom of the sensor.
2. Disconnect the ground cable from the battery and then remove the sensor connector.
3. Remove the coolant sensor.



EDJA600B

INSTALLATION

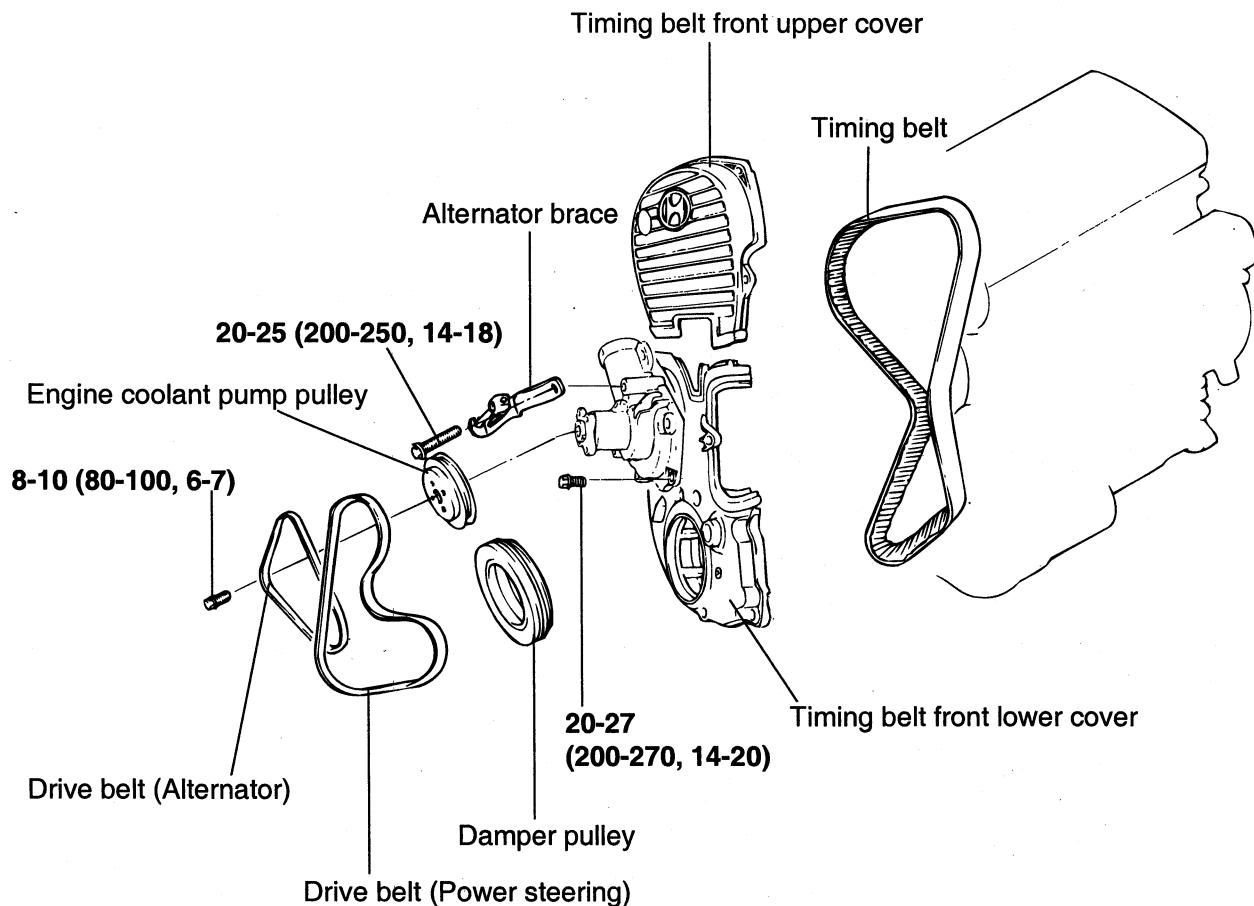
ECJA4900

1. Tighten the coolant temperature sensor to the specified torque after applying the sealant to the screw area.

Recommended sealant :Threebond No. 1324N or LOCTITE 262**Tightening torque****The coolant temperature sensor :**20-40Nm (200-400 kg.cm, 14-29 lb.ft)

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

ENGINE COOLANT PUMP

ENGINE COOLANT PUMP [FOR DOHC
ENGINE] ECHA5000

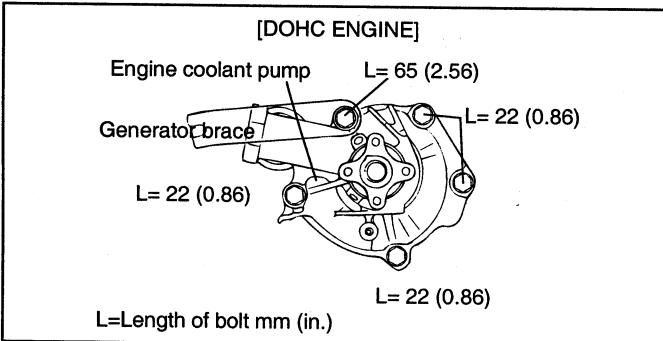
TORQUE : Nm (kg·cm, lb·ft)

REMOVAL ECHA5100

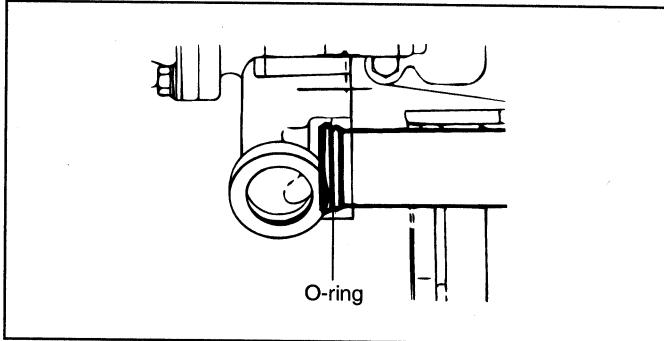
1. Drain the coolant and disconnect the coolant pump inlet pipe.
2. Remove the drive belt and engine coolant pump pulley.
3. Remove the timing belt covers and the timing belt tensioner.
4. Remove the engine coolant pump mounting bolts, then remove the alternator brace.
5. Remove the engine coolant pump assembly from the cylinder block.

INSPECTION ECJA5200

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

**INSTALLATION** ECHA5300

1. Clean the gasket surfaces of the engine coolant pump body and the cylinder block.
2. Install the new O-ring onto the groove on the front end of the engine coolant pipe, then wet the O-ring with water. Do not apply oil or grease.



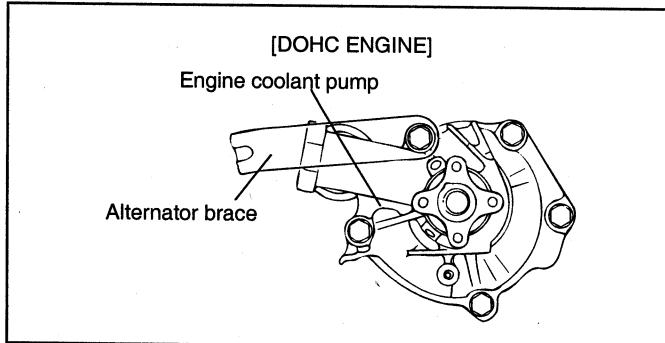
3. Install a new engine coolant pump gasket and engine coolant pump assembly. Tighten the bolts to the specified torque.

Tightening torque

Engine coolant pump bolt :

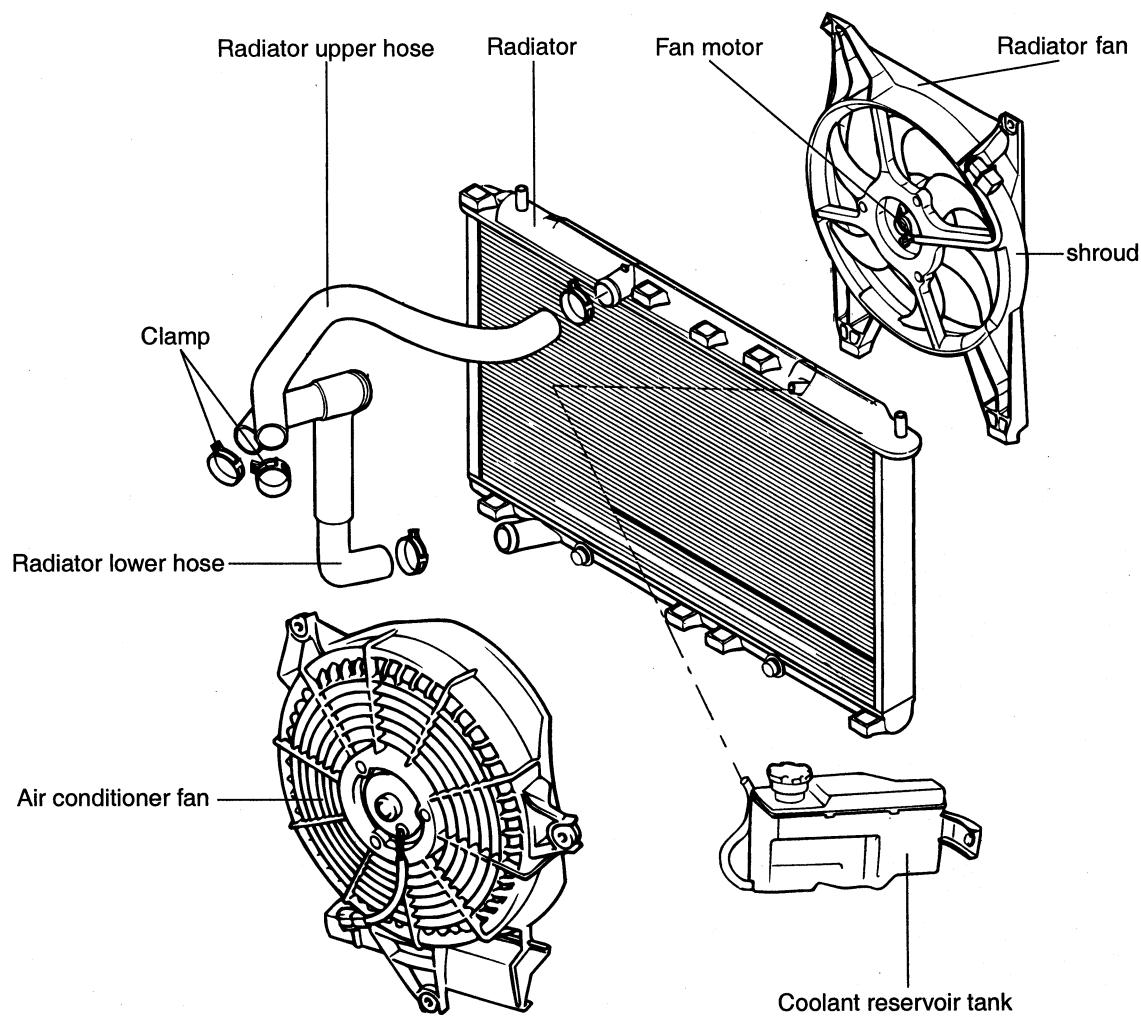
20-27Nm(200-270kg.cm, 14-20lb.ft)

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



RADIATOR**RADIATOR**

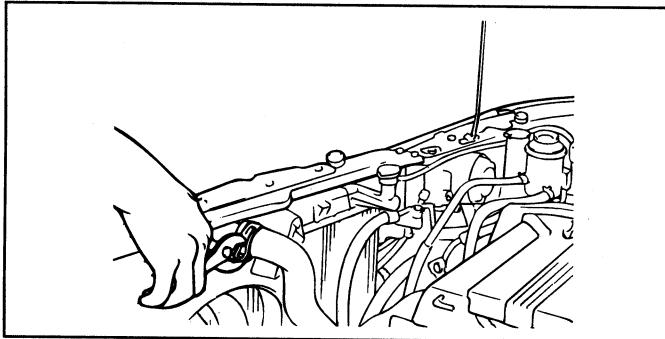
ECJA5500

**TORQUE : Nm (kg·cm, lb·ft)**

ECJA550A

REMOVAL ECJA5600

1. Disconnect the ground cable from the battery terminal.
2. Disconnect the fan motor connector.
3. Loosen the radiator drain plug to drain the coolant.
4. Disconnect the upper and lower hoses and overflow tube after making marks on the radiator hose and the hose clamp. to ease. reassembly.



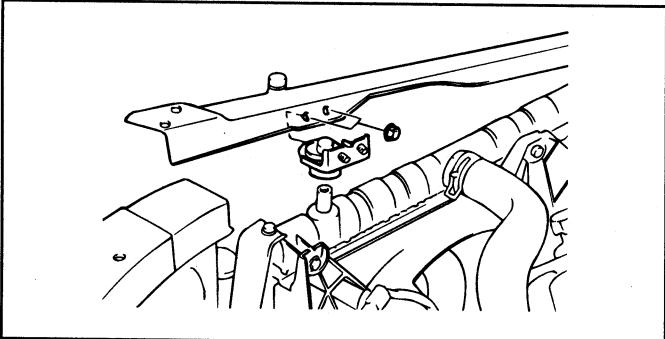
EDJA330A

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 materials can not enter after the hose is disconnected from the radiator.

6. Remove the radiator upper mounting bolt.



EDHA001C

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

INSPECTION ECHA5700

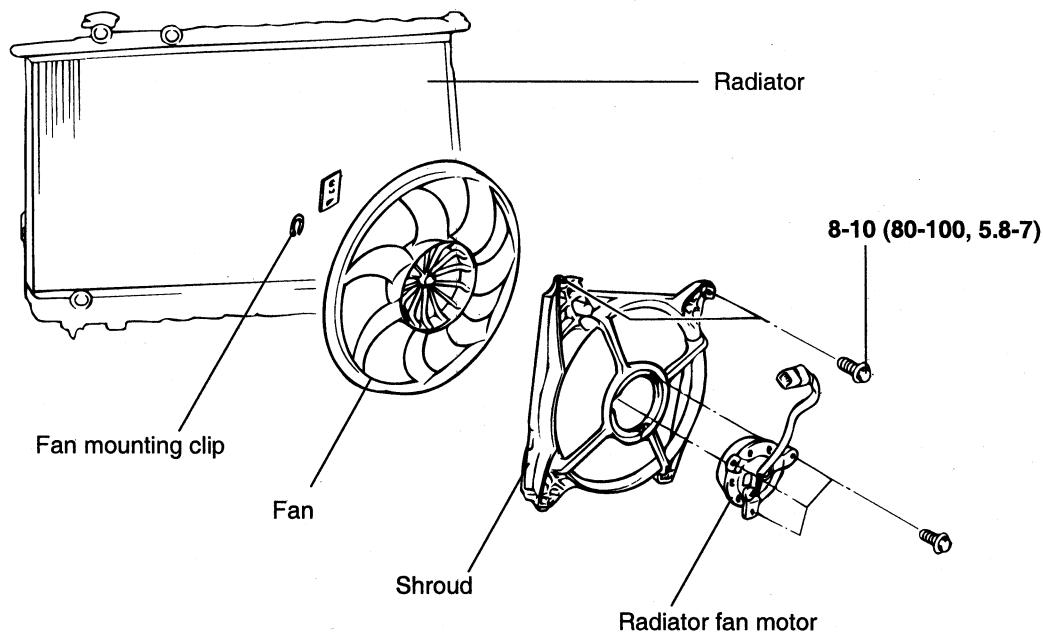
1. Check for foreign material between the radiator fins.
2. Check the radiator fins for damage and straighten if necessary.
3. Check the radiator for corrosion, damage, rust or scale.
4. Check the radiator hoses for cracks, damage or deterioration.
5. Check the reservoir tank for damage.
6. Check the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

INSTALLATION ECHA5800

1. Fill the radiator and reservoir tank with clean coolant mixture.
2. Run the engine until the coolant has warmed up enough so that the thermostat valve is open. Then, stop the engine.
3. Remove the radiator cap and pour the coolant into the filler neck of the radiator. Fill the reservoir tank with the coolant to the upper level. Replace the radiator cap.
4. Check that there are no leaks from the radiator, hoses or connections.

RADIATOR FAN MOTOR**RADIATOR FAN MOTOR****ASSEMBLY**

ECHA6200

**TORQUE : Nm (kg·cm, lb·ft)**

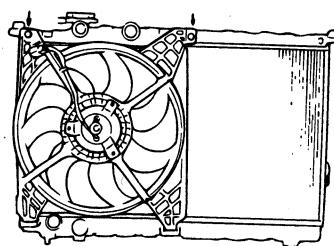
ECA9059A

REMOVAL

ECJA6000

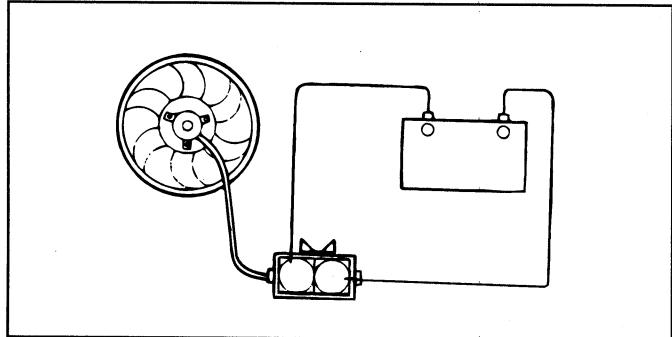
1. Disconnect the ground cable from the battery cable.
2. Disconnect the connectors from the fan motor and the harness from the shroud.
3. For vehicles with automatic transaxles, remove the oil cooler hose from the shroud.
4. Remove the four bolts holding the shroud.
5. Remove the shroud with the fan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



INSPECTION**Radiator Fan Motor**

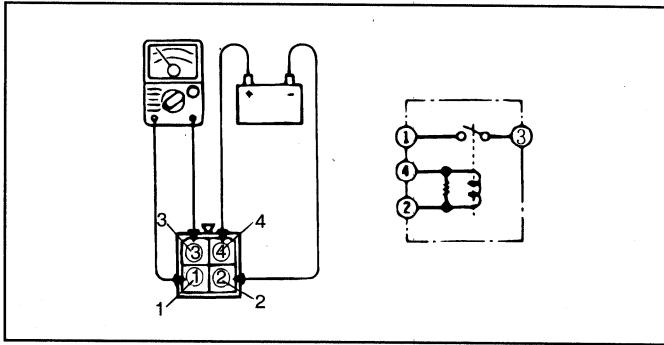
1. Check that the radiator fan rotates when battery voltage is applied between the terminals (as shown in the table below).
2. Check that abnormal noise is not produced while the motor is turning.



ECHA011C

2. Check the continuity of the terminals "2" and "4" with an ohmmeter.

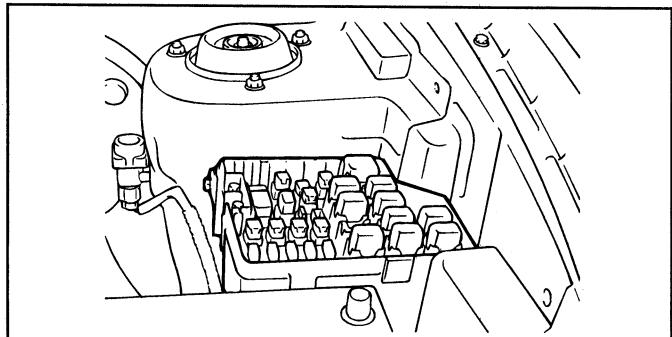
Item	Terminal No.	Yes or No
ON	Terminal 1-3	Continuity
OFF	Terminal 1-3	Non continuity
	Terminal 2-4	Continuity



HFR25016

RADIATOR FAN MOTOR RELAY

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



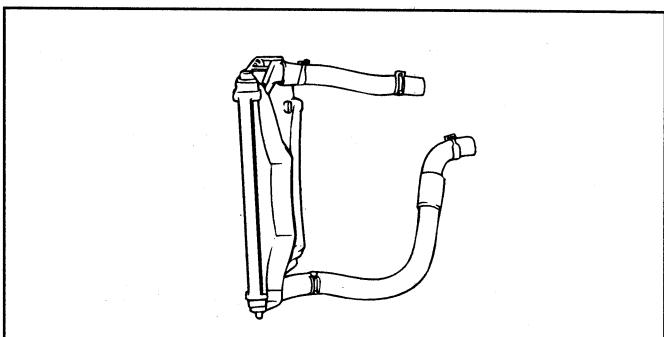
ECJA630A

INSTALLATION ECJA6100

Installation is in the reverse order of removal procedures.

NOTE

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

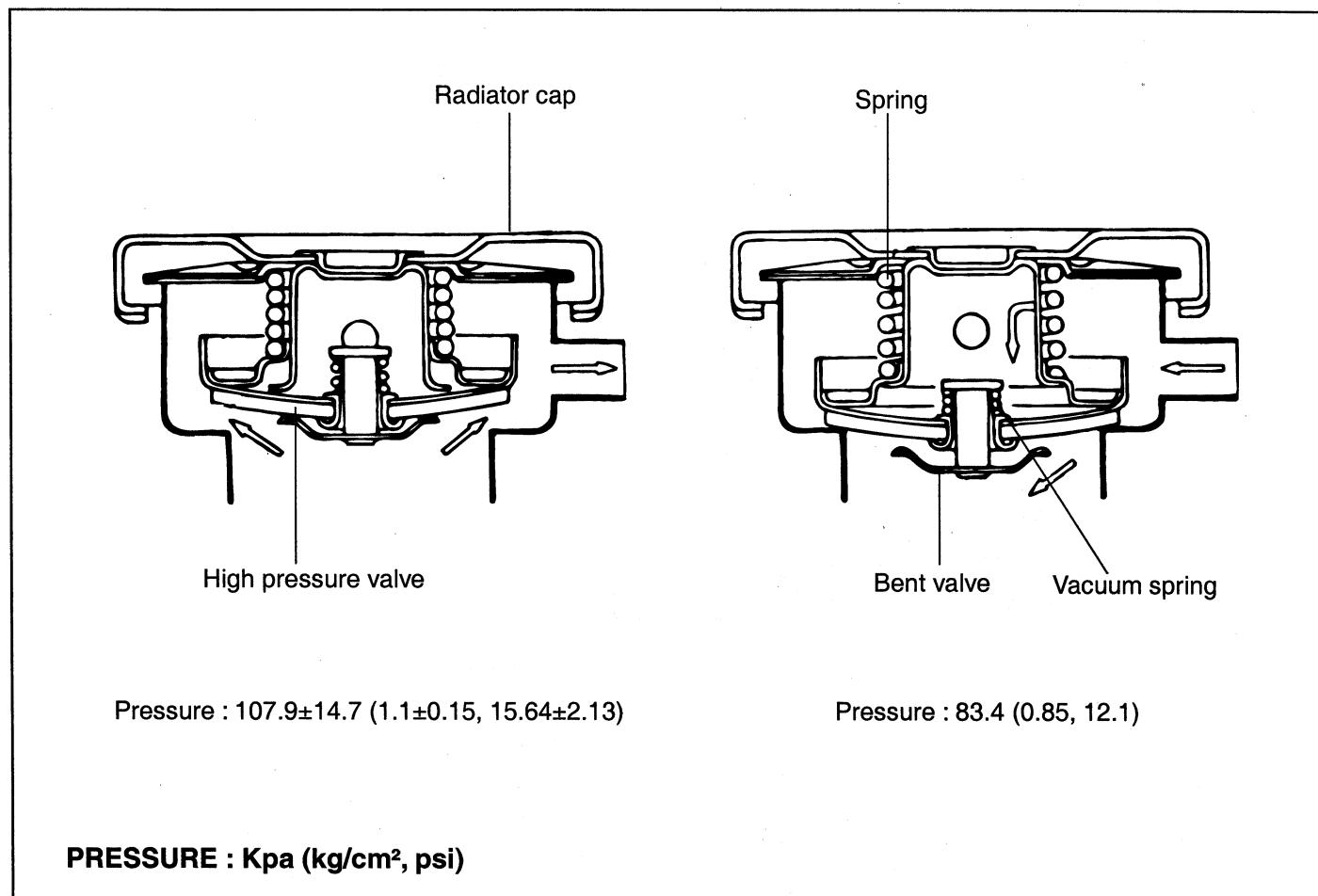


ECA9061A

RADIATOR CAP

ECHA5900

RADIATOR CAP

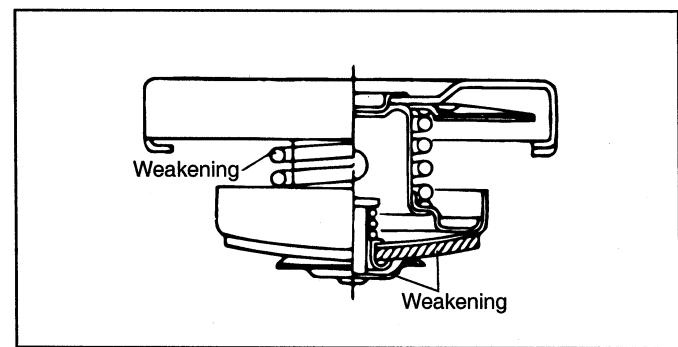


ECHA014A

INSPECTION

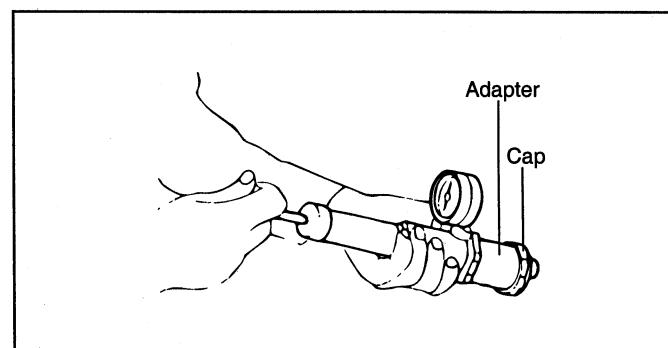
ECJA6300

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



ECHA014B

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

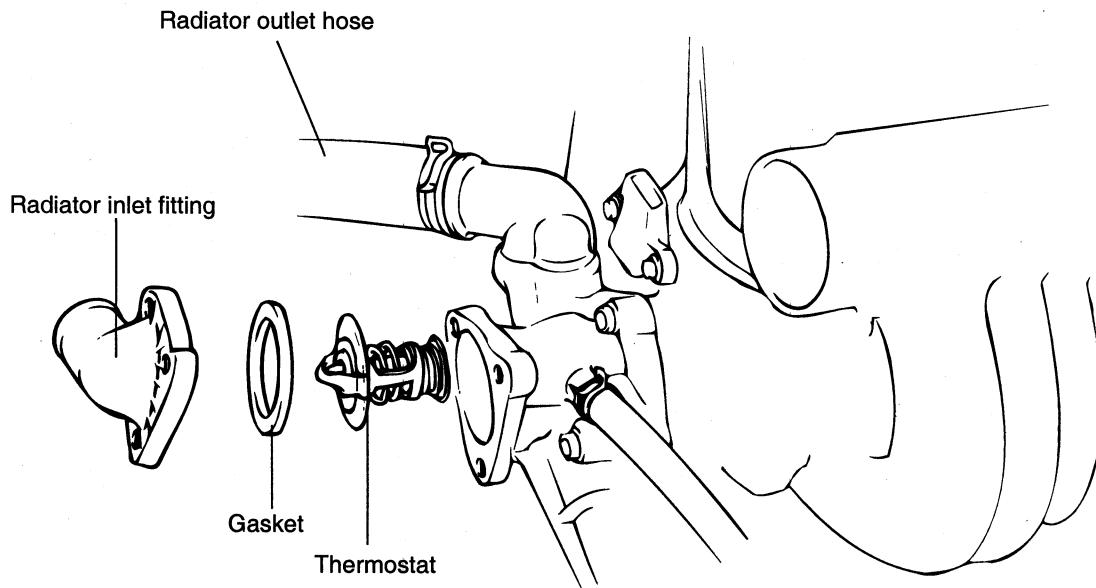


ECHA014C

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

THERMOSTAT**THERMOSTAT**

ECHA6600



ECHA660A

REMOVAL

ECHA6700

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

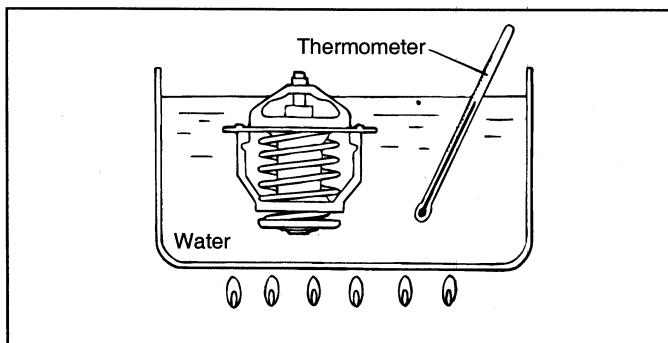
INSPECTION ECHA6800

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)

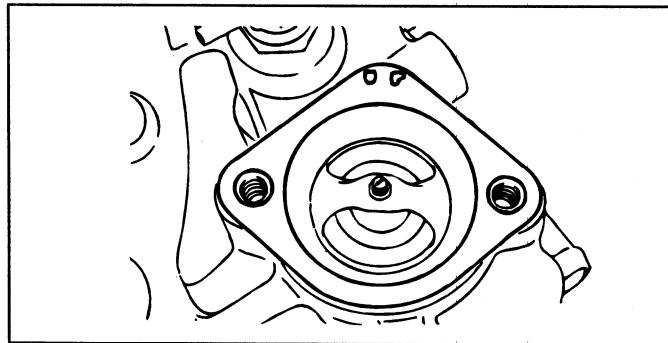
Full opening temperature : 95°C(203°F)



ECA9600A

INSTALLATION ECHA6900

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



ECHA013B

Tightening torque

Engine coolant inlet fitting bolt :

10-15Nm(100-150kg.cm, 7-11lb.ft)

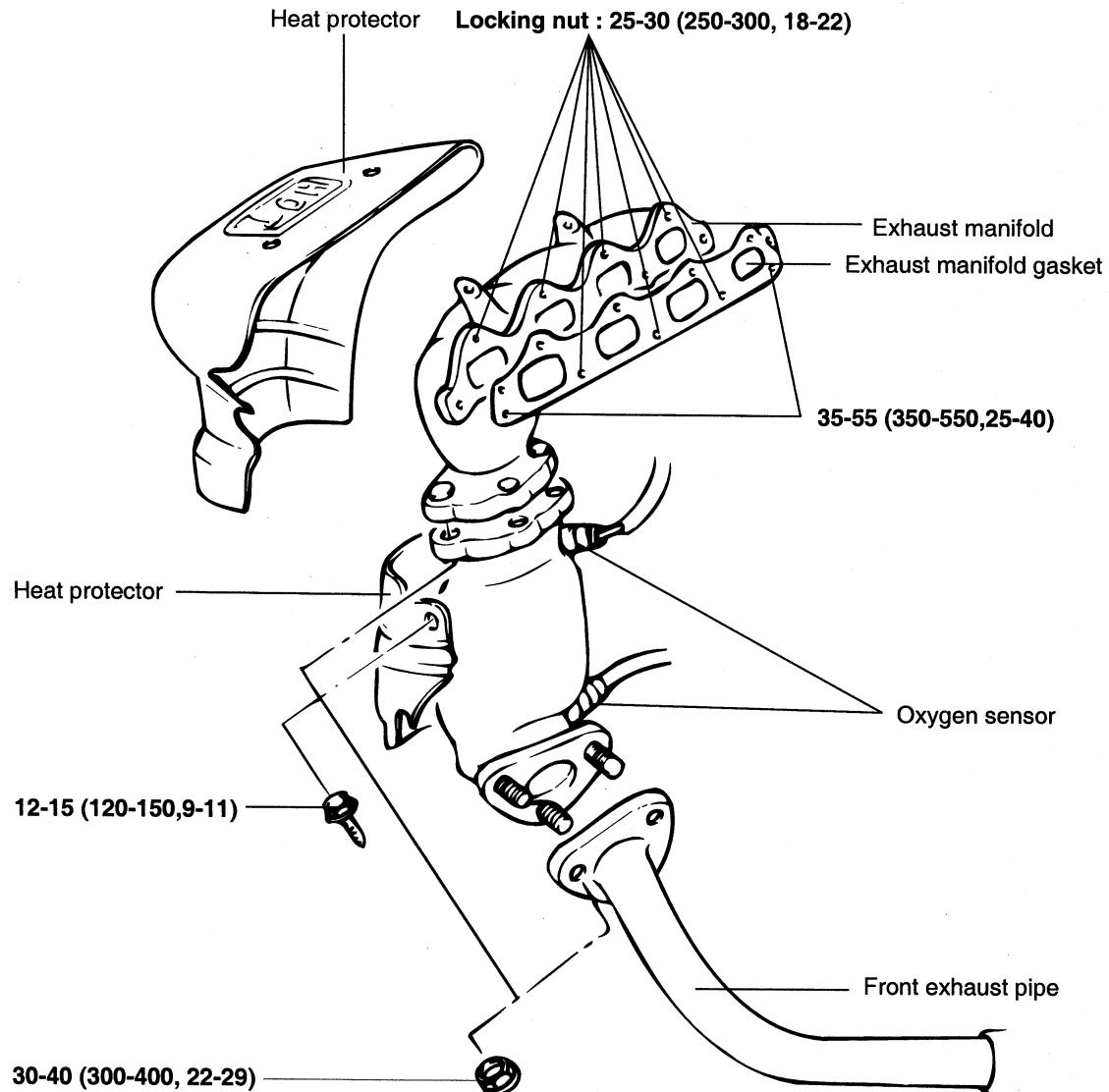
3. Refill the coolant.

INTAKE AND EXHAUST SYSTEM

EXHAUST PIPE

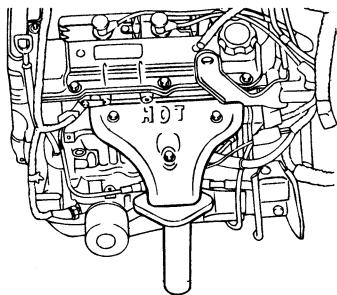
EXHAUST MANIFOLD

ECJA7000

**TORQUE : Nm (kg.cm, lb·ft)**

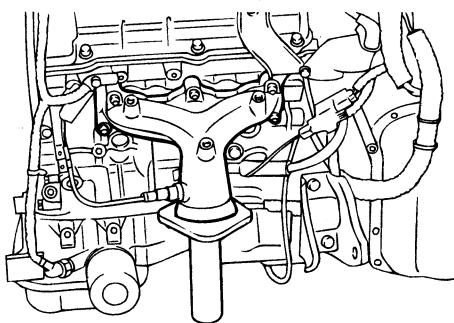
REMOVAL ECHA7100

1. Remove the heat protector.



EDHA011A

2. Remove the exhaust manifold.



EDHA011B

3. Remove the exhaust manifold gasket.

INSPECTION

1. Check for damage or cracking.
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.)

Service limit : 0.3 mm (0.012 in.)

3. Check the exhaust manifold for damage and cracking.

INSTALLATION ECHA7200

1. Install the exhaust manifold with its gasket.

Tightening torque

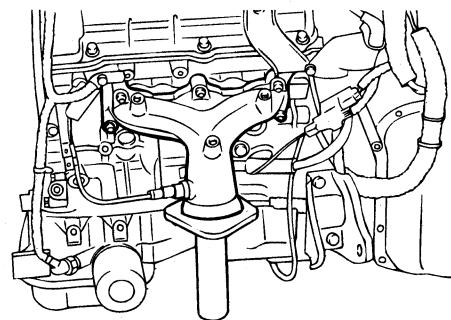
Exhaust manifold

M8 : 25-30 N.m (250-300 kg.cm, 18-22 lb.ft)

M10 : 35-55 N.m (350-550 kg.cm, 25-40 lb.ft)

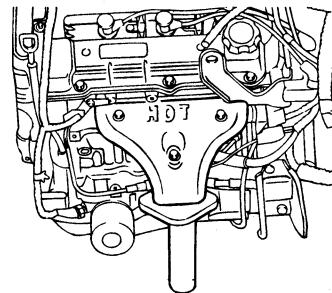
NOTE

Do not use the used exhaust manifold gasket.



EDHA011B

2. Install the heat protector.

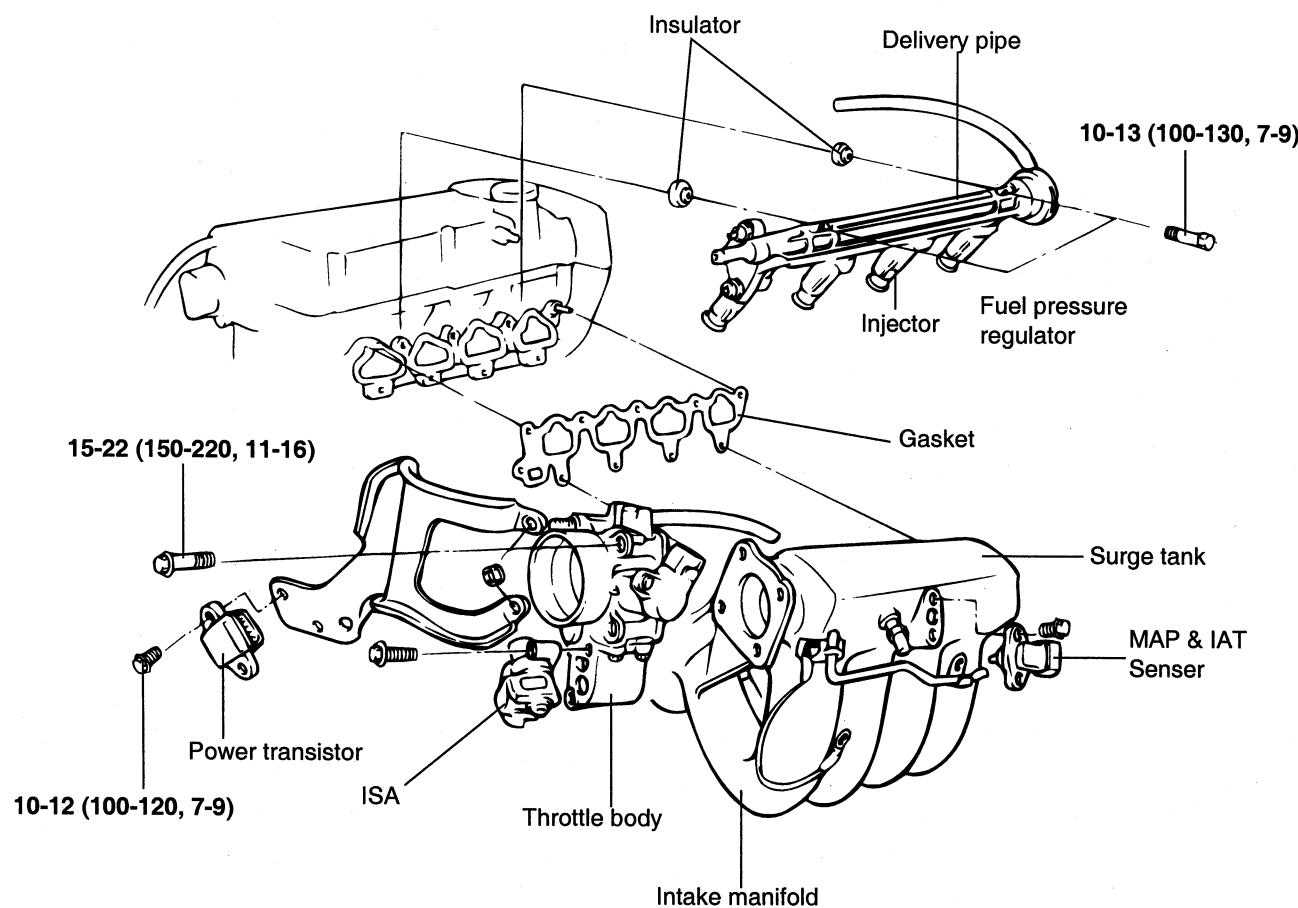


EDHA011A

INTAKE MANIFOLD

INTAKE MANIFOLD

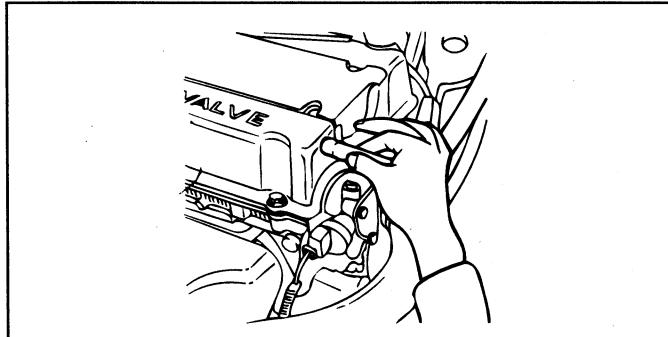
ECHA7500



TORQUE : Nm (kg·cm, lb·ft)

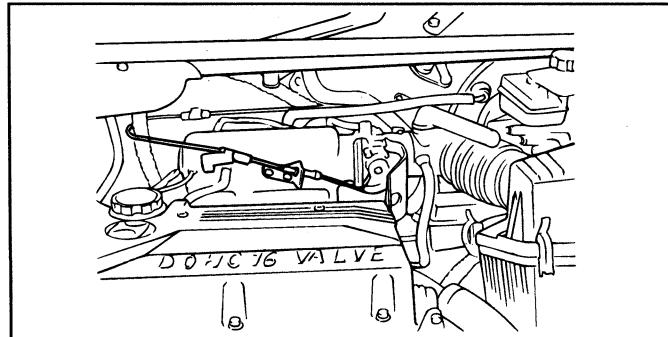
REMOVAL ECJA7600

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



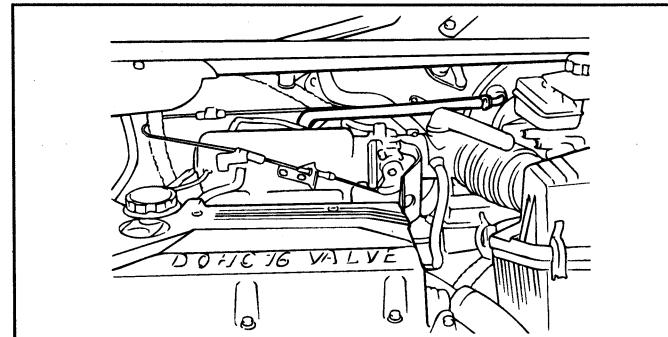
ECHA016A

2. Remove the accelerator cable.



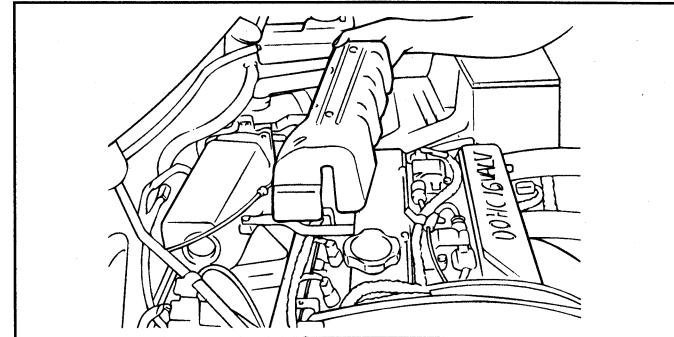
EDHA006E

3. Remove the engine coolant hose and throttle body.
4. Remove the P.C.V. valve and brake boost vacuum hose.
5. Disconnect the vacuum hose connector.



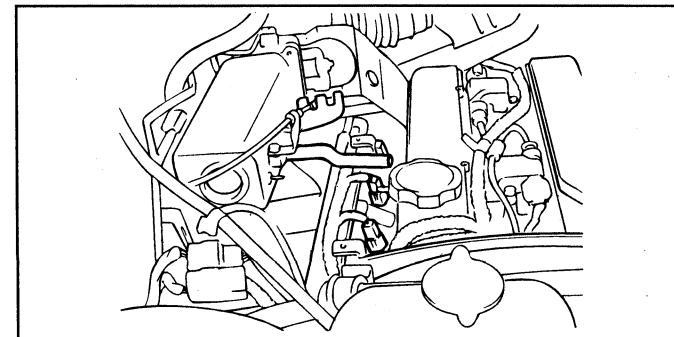
EDHA006B

6. Remove the injector cover.



ECHA016I

7. Bleed off pressure in the fuel pipe line to prevent fuel from spilling and then disconnect the high pressure hose.
8. Disconnect the fuel injector harness connector.

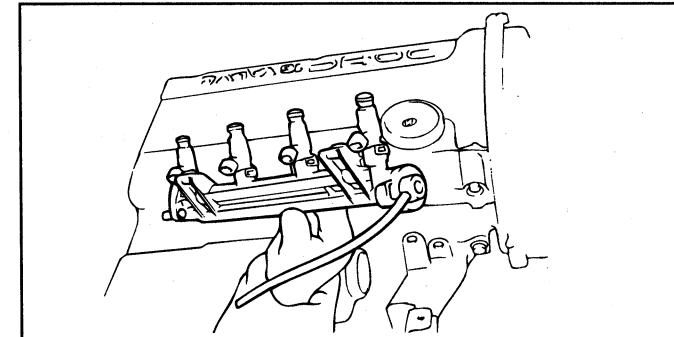


ECHA055A

9. Remove the delivery pipe with fuel injectors and the pressure regulator.

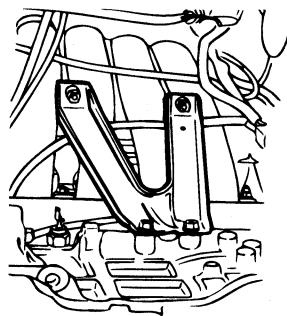
NOTE

When the delivery pipe is removed, do not drop the injectors.



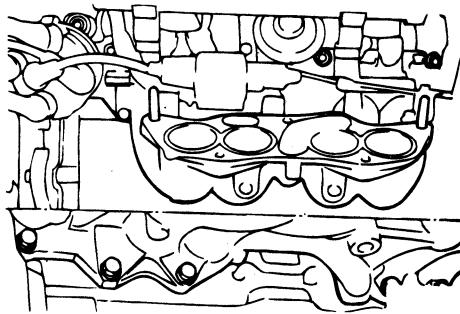
ECA9070A

10. Remove the intake manifold stay.



ECHA016C

11. Remove the intake manifold.



ECHA016J

INSPECTION

ECHA7700

INTAKE MANIFOLD AND SURGE TANK

1. Check the parts for damage or cracking.
2. Check for restrictions in the vacuum outlet port, water or gas passages.
3. Check for flatness using a straight edge and feeler gauge.

Standard value : 0.15 mm (0.06 in.) or less

Service limit : 0.2 mm (0.0078 in.)

INSTALLATION

ECJA7800

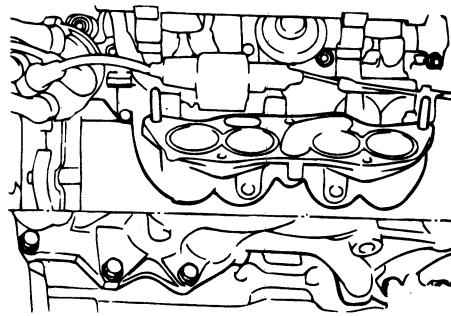
1. Install the intake manifold and new gasket to the specified torque.

Tightening torque

Intake manifold

Bolt : 15-20Nm (150-120 kg.cm, 11-14 lb.ft)

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

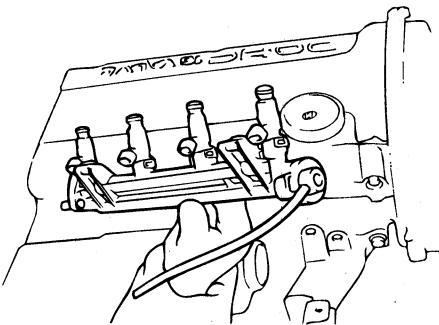


ECHA016J

2. Install the delivery pipe and injector assembly to the intake manifold.

NOTE

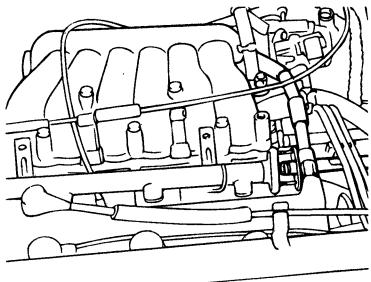
Make certain that there is no interferences between the injectors and injector ports on the intake manifold.



ECA9070A

3. Install the surge tank stay.
4. Connect the fuel injector connector and wiring harness and then install the cover.

5. Connect the high pressure hoses.



ECHA016B

6. Connect the vacuum hoses.

Tightening torque

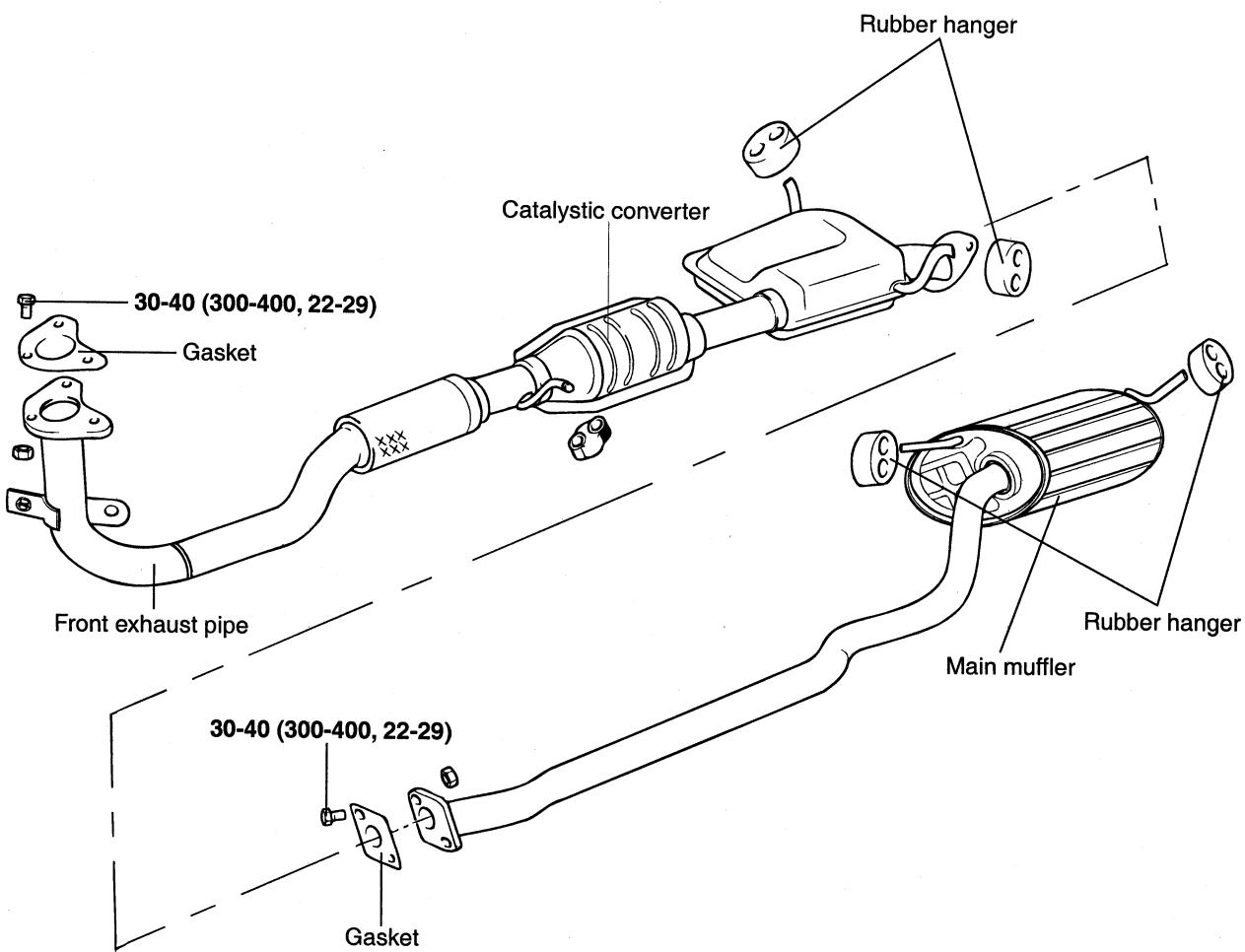
Intake manifold stay and cylinder block :

18-25Nm (180-250 kg.cm, 13-18 lb.ft)

7. Connect the PCV valve and brake boost hoses.
8. Install the air breather hose.
9. Install the accelerator cable.

MUFFLER**MUFFLERS**

ECJA8000

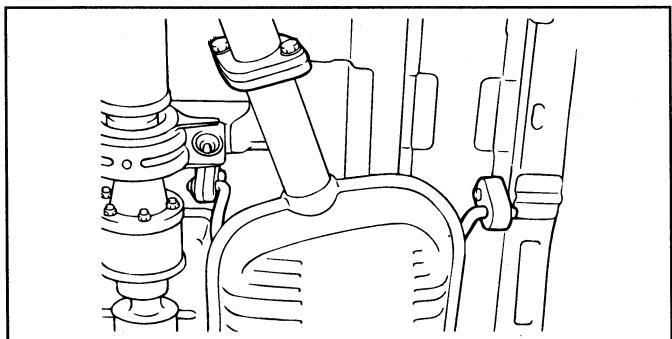
**TORQUE : N·m (kg·cm, lb·ft)**

ECJA800A

REMOVAL ECJA8100**MAIN MUFFLER****CAUTION**

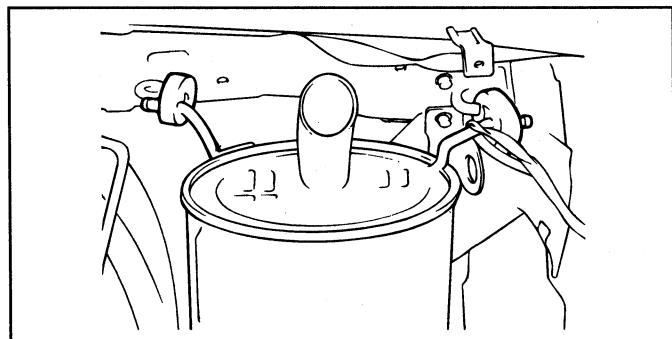
Before removing or inspecting the exhaust system, ensure that the exhaust system is cool.

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

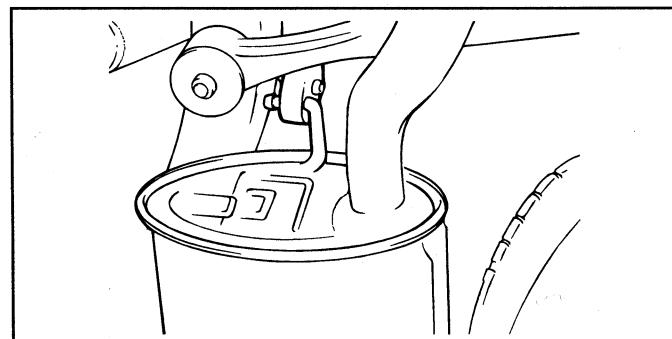


ECJA810A

2. Remove the rubber hangers and remove the main muffler.



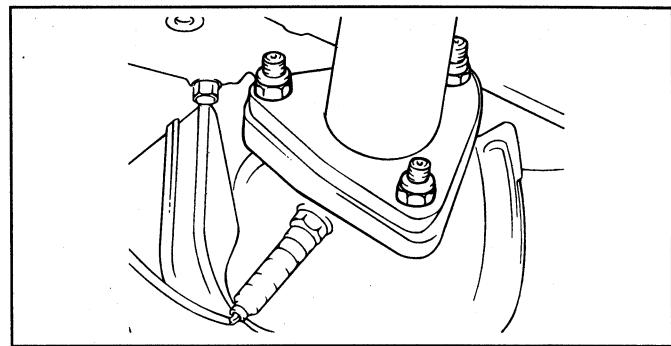
ECJA810B



ECJA810C

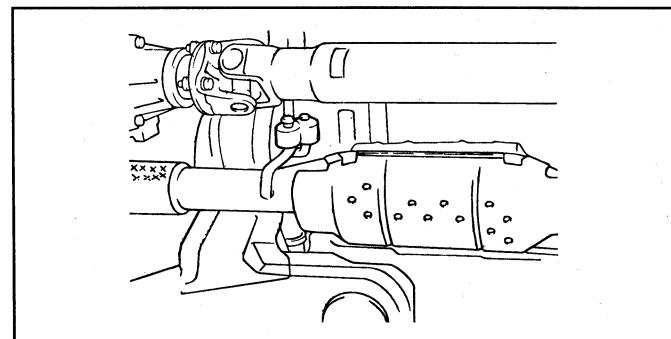
FRONT EXHAUST PIPE (INCLUDING CATALYTIC CONVERTER)

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

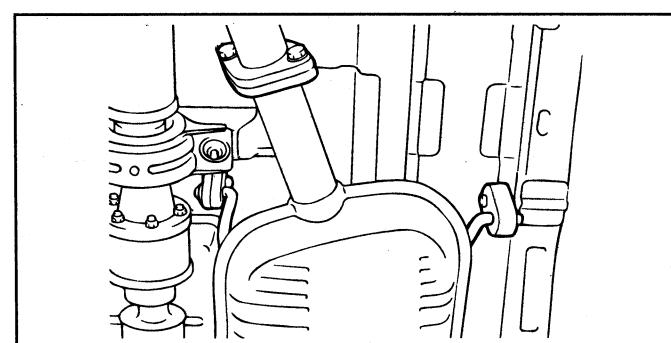


ECJA230B

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



EDJA810C



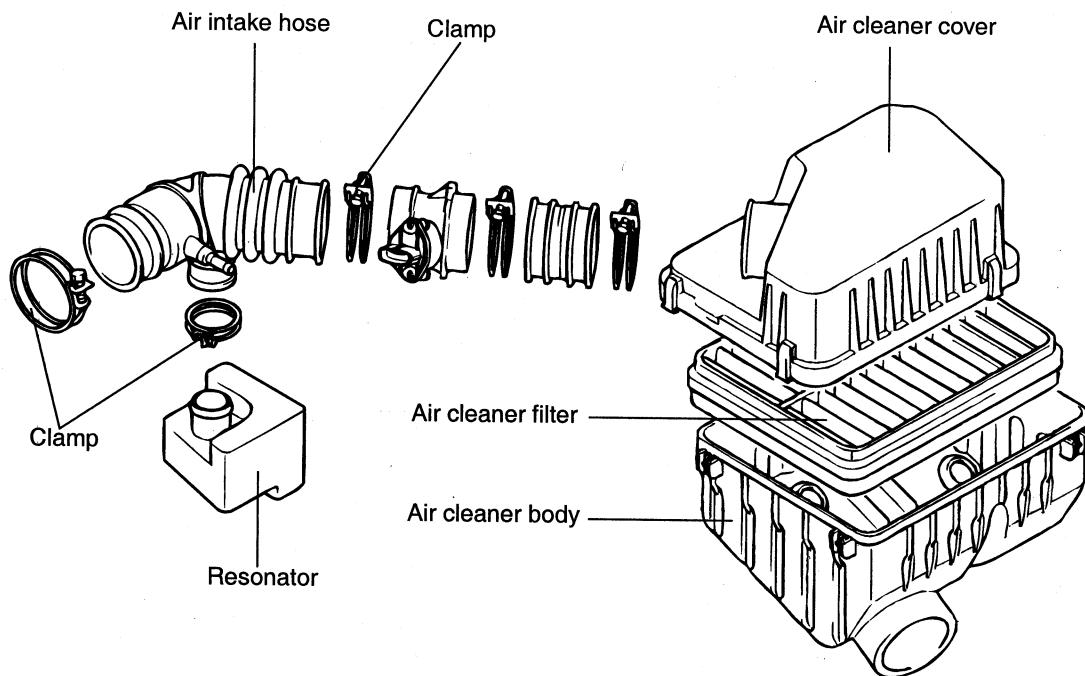
ECJA810A

INSPECTION ECJA8200

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

INSTALLATION ECJA8300

1. Temporarily install the front exhaust pipe (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 of components.

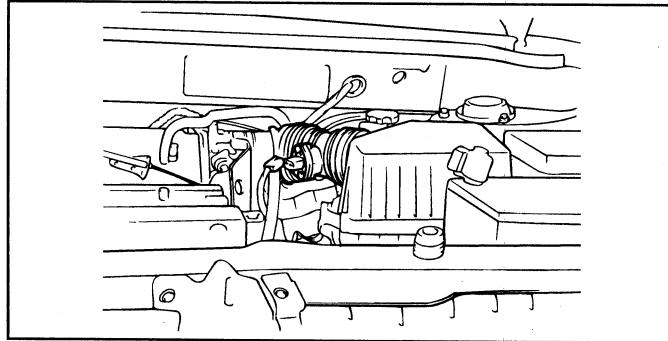
AIR CLEANER (ACL)**AIR CLEANER** ECJA8500**TORQUE : Nm (kg·cm, lb·ft)**

ECJA850A

REMOVAL

ECJA8600

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



ECJA870B

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

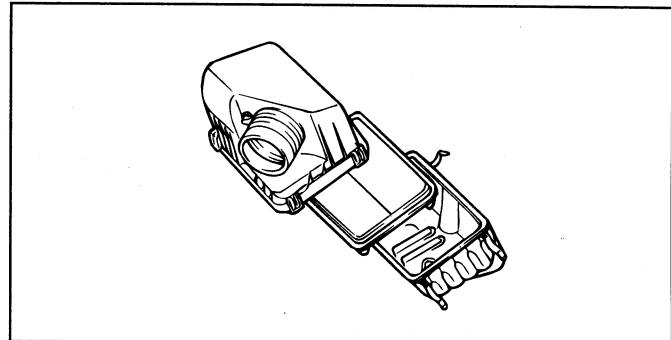
CAUTION

Do not pull on the air flow sensor wires.

INSPECTION

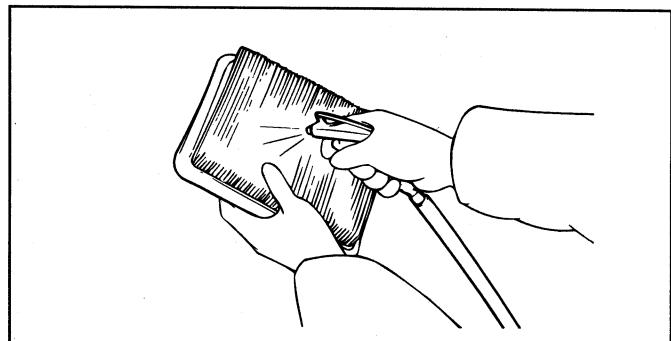
ECJA8700

1. Check the air cleaner body, cover, or filter for distortion, corrosion or 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 the dust and debris by blowing compressed air from the inside of the element.



ECA9066A

INSTALLATION

ECHA8800

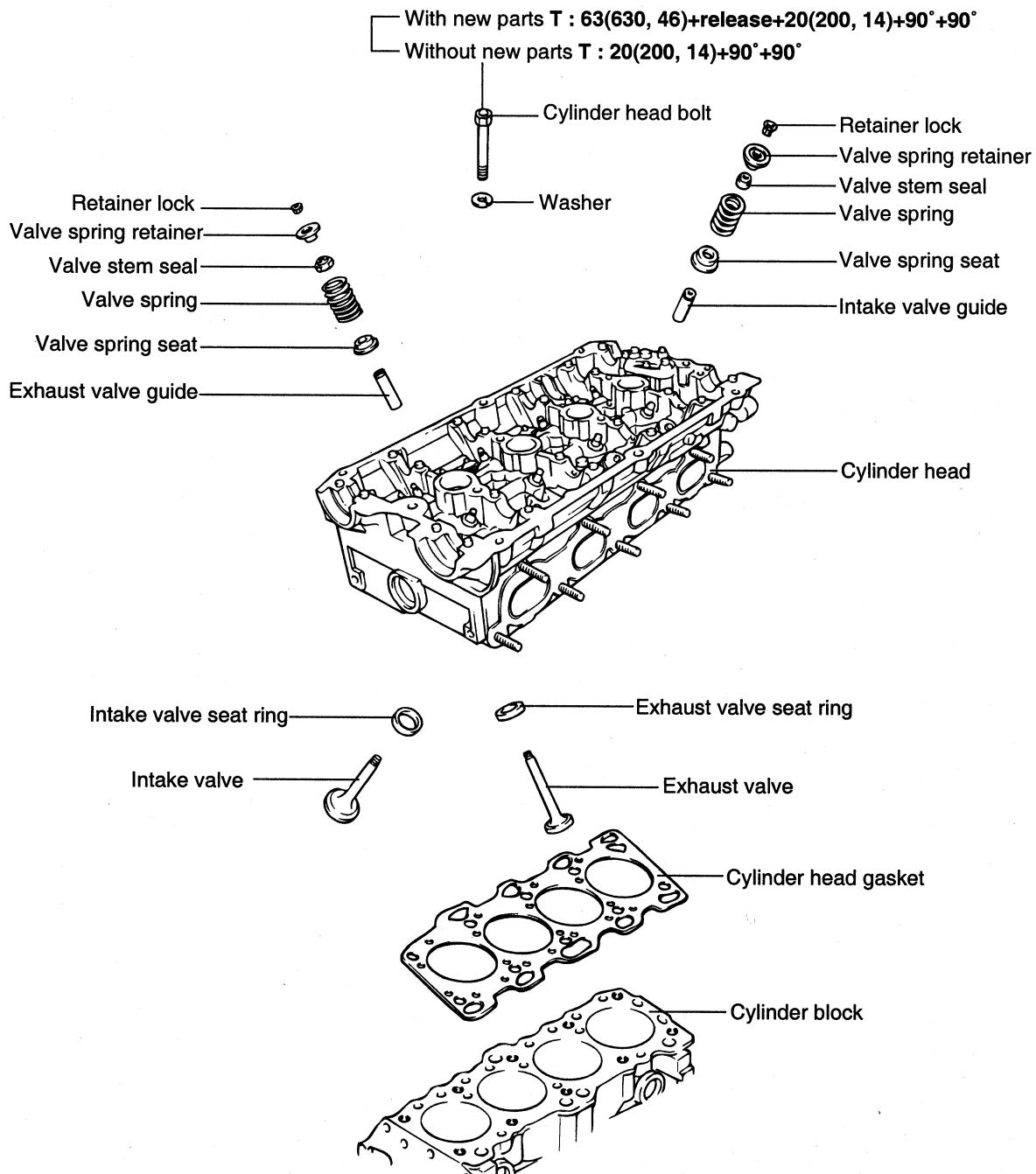
Install the air cleaner assembly following the reverse order of removal.

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

CYLINDER HEAD AND VALVES

ECHA9000



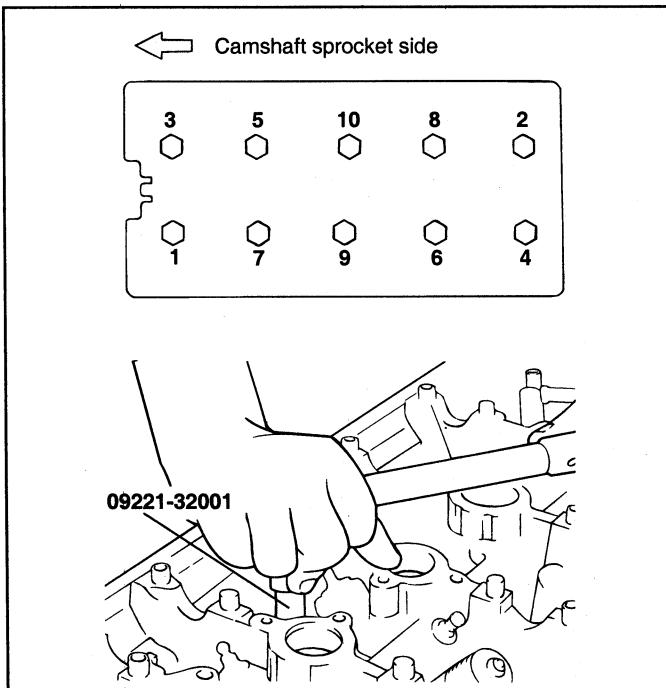
TORQUE : Nm (kg·cm, lb·ft)

ECHA900A

DISASSEMBLY

ECJA9100

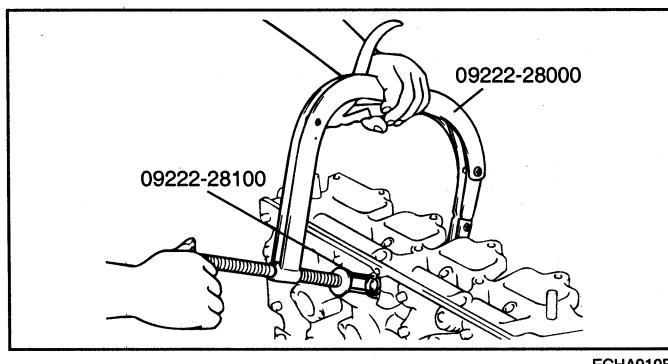
1. Using a special tool (09221-32001), remove the cylinder head bolts in the order shown in the illustration.



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

NOTE

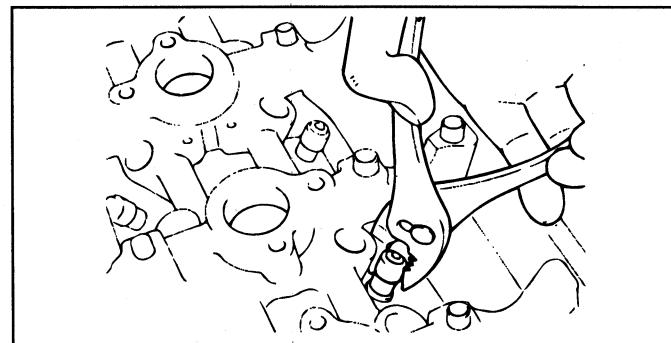
Arrange these parts so that they can be reinstalled in their original positions.



3. Remove the valve stem seals with pliers.

NOTE

Do not reuse the valve stem seals.

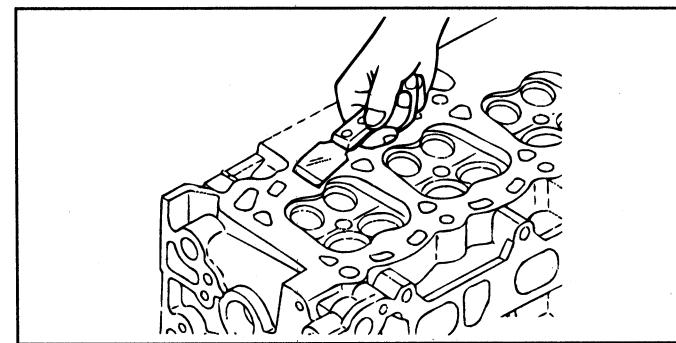


INSPECTION

ECHA9200

CYLINDER HEAD

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

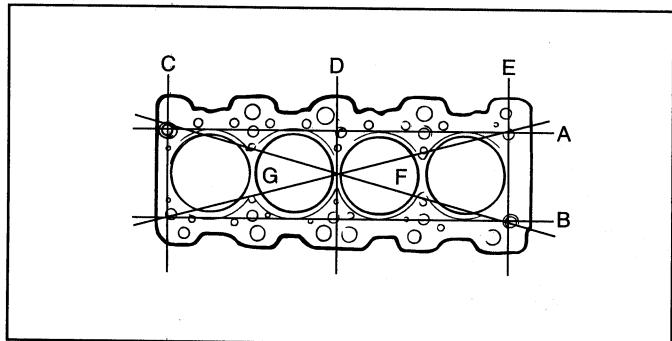


3. Check the cylinder head surface for flatness in the direction as shown in the illustration. If flatness exceeds service limit in any direction, either replace the cylinder head or machine the cylinder head matching surface lightly.

Flatness of cylinder head gasket surface

Standard : Less than 0.03mm(0.0012 in.)

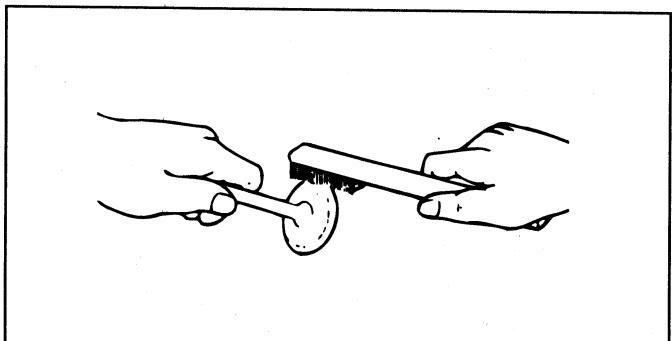
Limit : 0.2 mm (0.008 in.)



ECHA920A

VALVES

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



ECA9281A

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

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

Margin

[Standard]

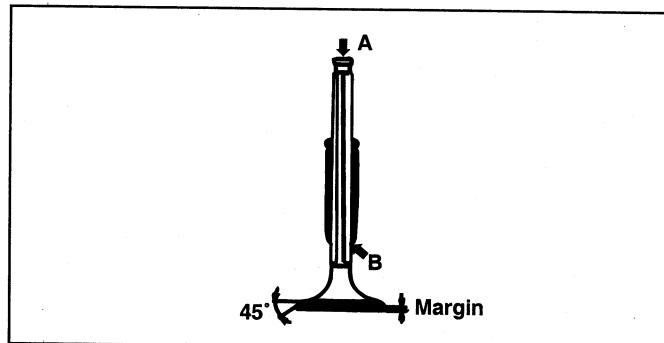
Intake : 1.0mm(0.040 in.)

Exhaust : 1.5mm(0.059 in.)

[Limit]

Intake : 0.7mm(0.028 in.)

Exhaust : 1.0mm(0.040 in.)



ECA9281B

VALVE SPRINGS

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

Valve spring

[Standard]

Free height : 45.82mm(1.804 in.)

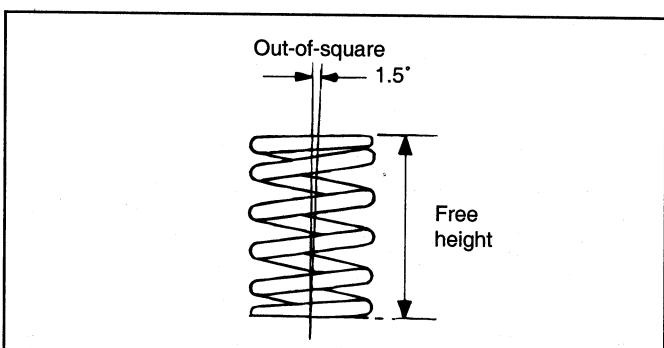
Load : 25.3kg/40mm (55.8 lb/1.57 in.)

Out of square : 1.5° or less

[Limit]

Free height : 44.82mm(1.7646in.)

Out of square : 4°



ECA9281C

VALVE GUIDES

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

Valve stem-to-guide clearance

[Standard]

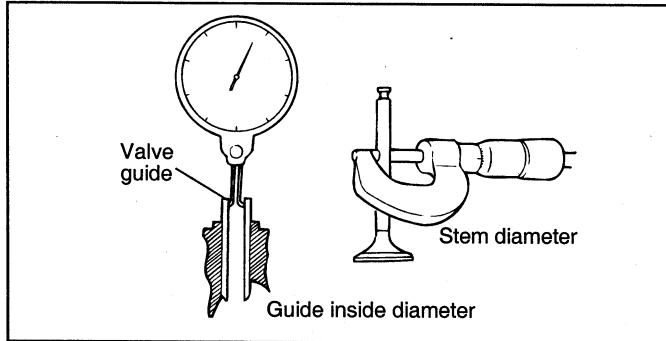
Intake : 0.020-0.047mm(0.0008-0.0020 in.)

Exhaust : 0.050-0.085mm(0.0020-0.0033 in.)

[Limit]

Intake : 0.1mm(0.0040 in)

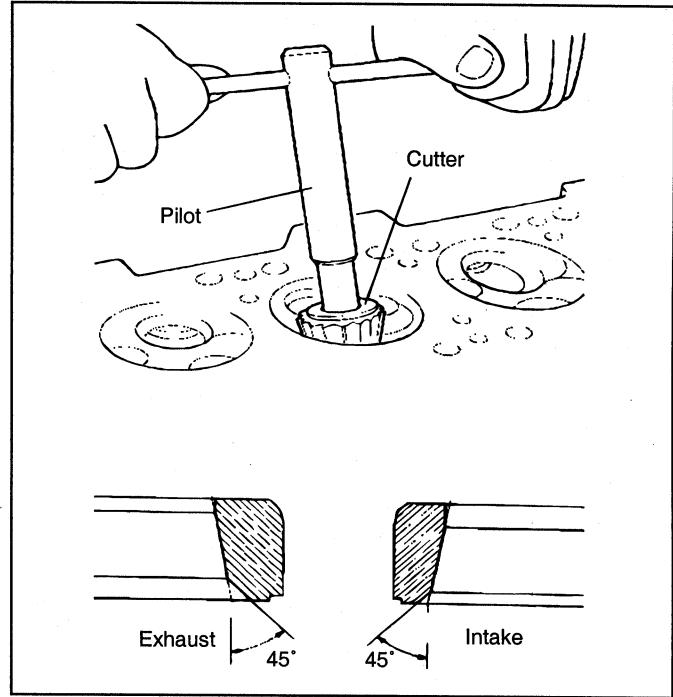
Exhaust : 0.15mm(0.0059 in.)



ECA9281D

RECONDITIONING VALVE SEAT

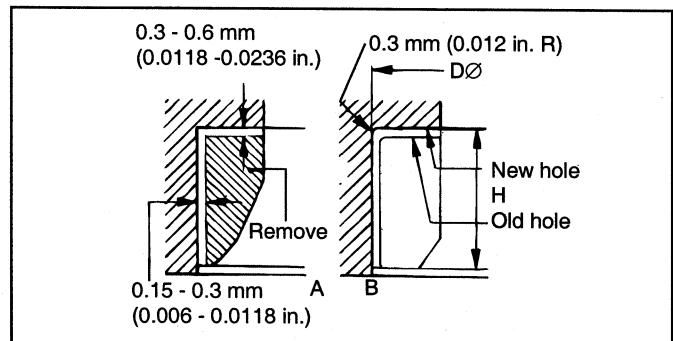
Check the valve seat for overheating and unequal contact with the valve face. Recondition or replace the seat if necessary. Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it and then recondition the seat. Recondition the valve seat with a valve seat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



ECA920B

REPLACING THE VALVE SEAT RING

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



ECA9281F

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

Valve seat contact width :

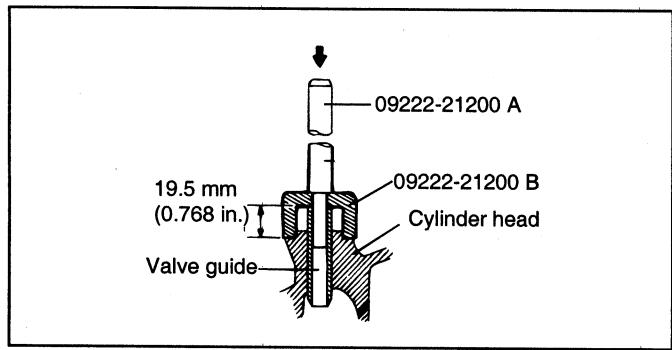
0.9 -1.3 mm (0.035-0.051 in.)

VALVE SEAT INSERT OVERSIZES

Description	Size mm (in.)	Size mark	Seat ring height H mm (in.)	Oversize hole diameter I.D. mm (in.)
Intake valve	0.3 (0.012) O.S.	30	7.9-8.1 (0.311-0.319)	35.300-35.325 (1.3898-1.3907)
	0.6 (0.024) O.S.	60	8.2-8.4 (0.323-0.331)	35.600-35.625 (1.4016-1.4026)
Exhaust valve	0.3 (0.012) O.S.	30	7.9-8.1 (0.311-0.319)	33.300-33.325 (1.3110-1.3120)
	0.6 (0.024) O.S.	60	8.2-8.4 (0.323-0.331)	33.600-33.625 (1.3228-1.3238)

REPLACING VALVE GUIDE

1. Using the special tool (09222-21200A), withdraw the old valve guide toward the bottom of cylinder head.
2. Recondition the valve guide hole so that it can match the newly press-fitted oversize valve guide.

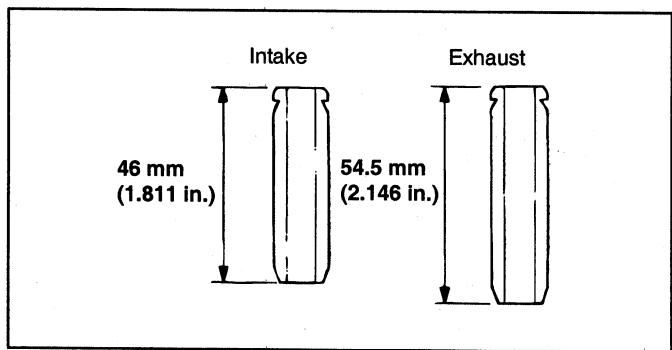


ECA9281G

3. Using the special tool (09222-21200 A, 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.

NOTE

Do not install a valve guide unless it is oversize.



ECA9281H

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

VALVE GUIDE OVERSIZES

Over size mm (in.)	Size mark	Oversize valve guide hole size mm (in.)
0.05 (0.002)	5	12.050-12.068 (0.4744-0.4751)
0.25 (0.010)	25	12.250-12.268 (0.4823-0.4830)
0.50 (0.020)	50	12.500-12.518 (0.4921-0.4928)

REASSEMBLY

ECJA9300

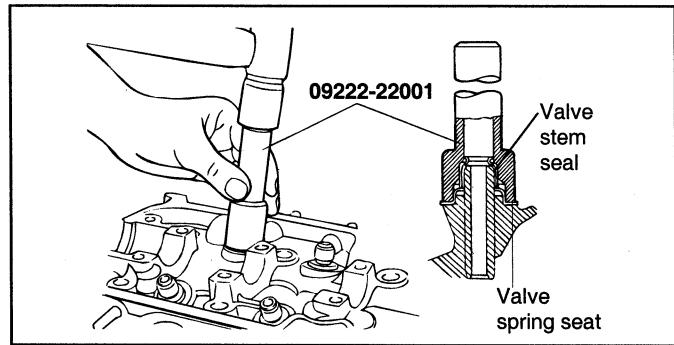
NOTE

1. Clean each part before assembly.
2. Apply engine oil to the sliding and rotating parts.
1. Install the spring seats.
2. Using a special tool (09222-28200), tap the seal in position lightly.

NOTE

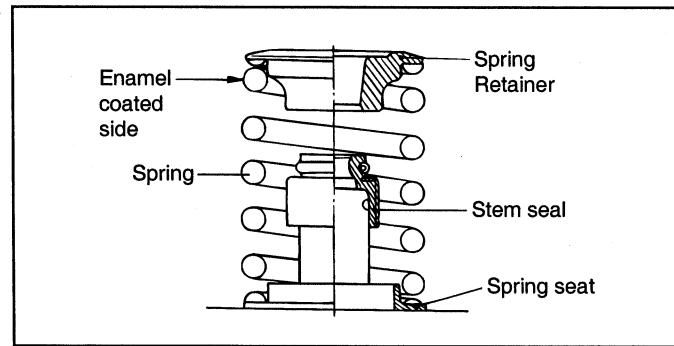
- Do not reuse old valve stem seals.
- Incorrect installation of the seal could result in oil leakage past the valve guides.

3. Apply engine oil to each valve. Insert the valve into the valve guide. Avoid pushing the valve into the seal by force. After inserting the valve, check that it moves smoothly.



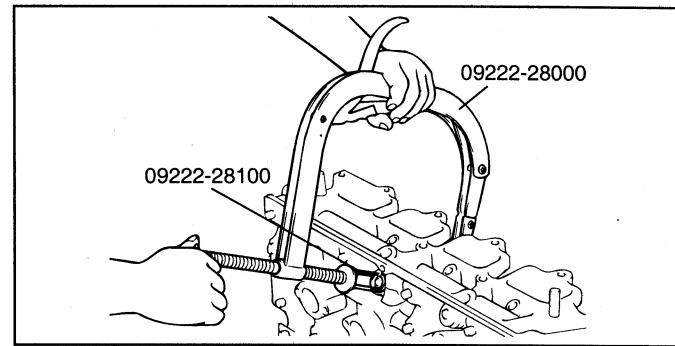
ECHA930A

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



ECA9290B

5. 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.



ECHA910B

NOTE

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

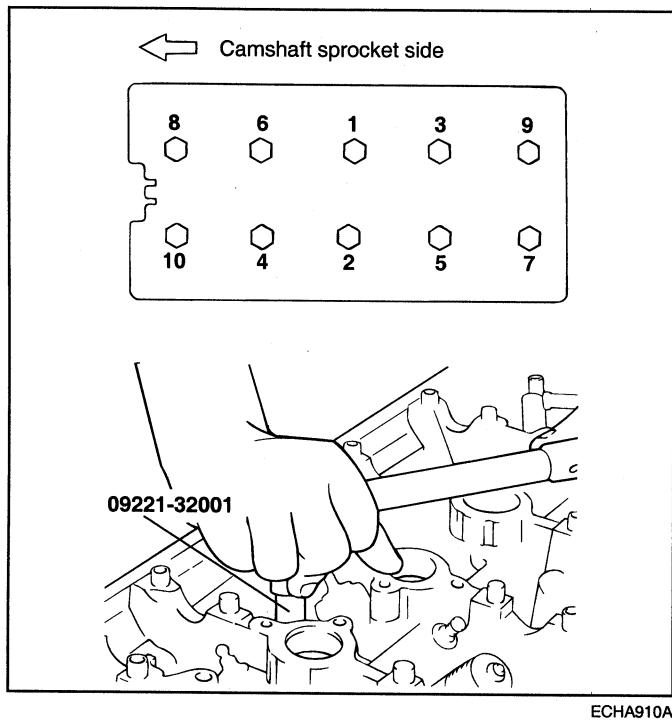
6. Clean both gasket surfaces of the cylinder block and cylinder head.
7. Verify the identification marks on the cylinder head gasket.
8. Install the gasket so that the surface with the identification mark faces toward the cylinder head.

NOTE

Check and measure the length of each head bolt.

Maximum length : 99.4 mm (3.9 in.)

9. Tighten the bolts to the specified torque.



ECHA910A

Tightening torque

With used parts (head bolt, cylinder head, cylinder block) :

20Nm (200 kg.cm, 14 lb.ft)+90°+90°

With new parts (even if only onething is replaced) :

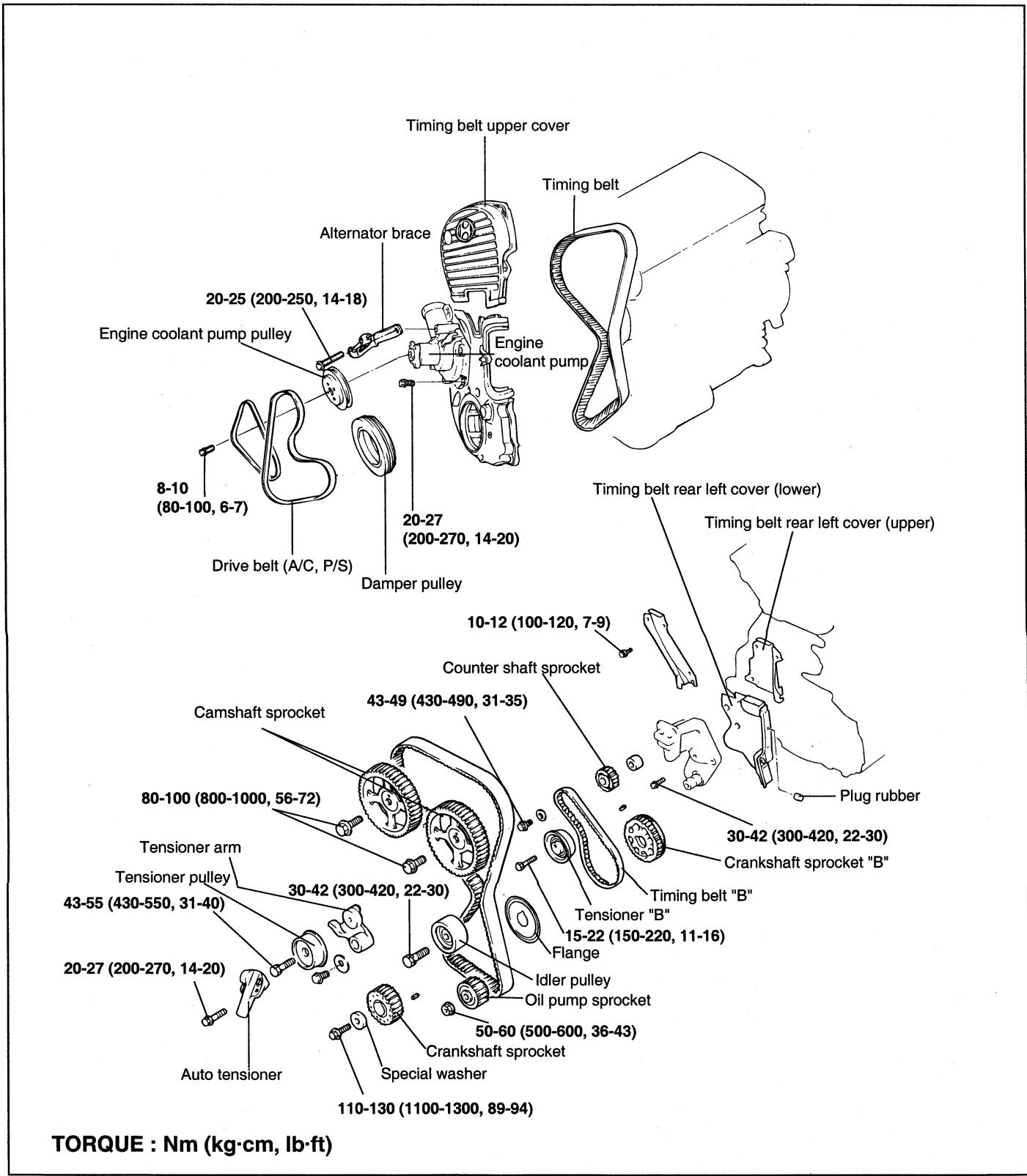
64Nm (640 kg.cm, 46 lb.ft)+release+20Nm (200 kg.cm, 14 lb.ft)+90°+90°

TIMING SYSTEM

TIMMING BELT

TIMING BELT

ECHA9500

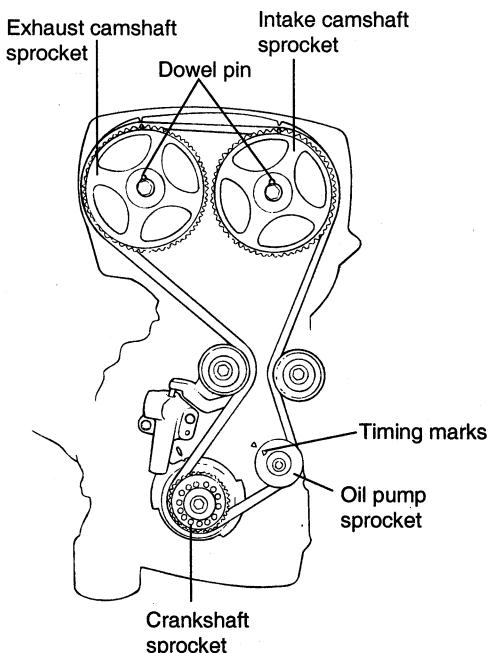


REMOVAL ECJA9600**CAUTION**

Rotate the crankshaft clockwise and align the timing marks to set the No. 1 cylinder's piston to TDC.

At this time, the timing marks of the camshaft sprocket and cylinder head cover should coincide with each other and the dowel pin of the camshaft sprocket should be at the upper side.

1. Remove the crankshaft pulley, engine coolant pump pulley and drive belt.
2. Remove the timing belt cover.
3. Remove the auto tensioner.

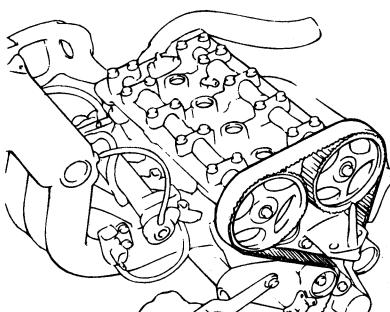


ECA9023A

NOTE

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

4. Remove the timing belt.

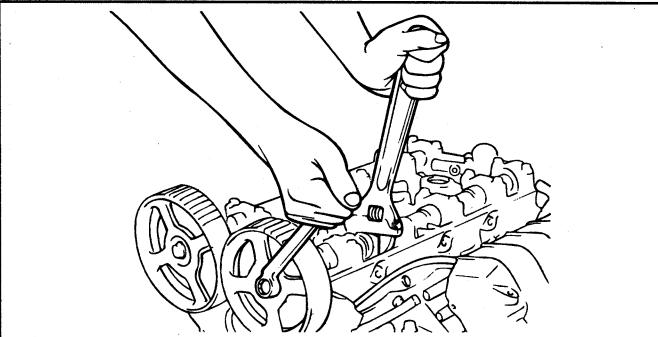


ECA9024A

5. Remove the camshaft sprockets.

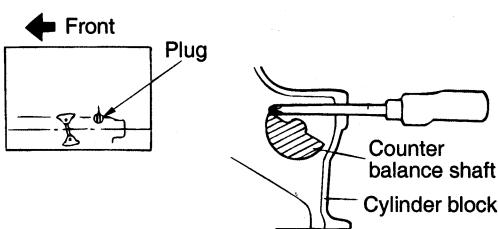
NOTE

Be careful not to damage the cylinder head and camshaft sprocket with the wrench.



ECA9170C

6. When the oil pump sprocket nut is removed, first remove the plug at the left side of the cylinder block and insert a screwdriver to keep the left counter balance shaft in position. Use a screwdriver with a shaft measuring 8 mm (0.3in.) in diameter which can be inserted by more than 60 mm (2.36 in.)
7. Remove the oil pump sprocket retaining nut and the oil pump sprocket.



ECA9170D

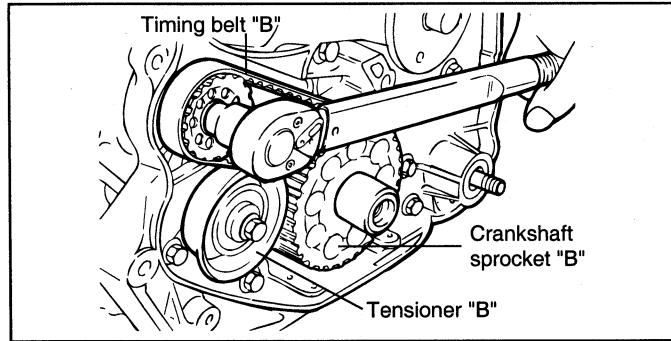
8. Loosen the right counter balance shaft sprocket mounting bolt until it can be loosened by hand.

9. Next, remove the tensioner "B" and then the timing belt "B".

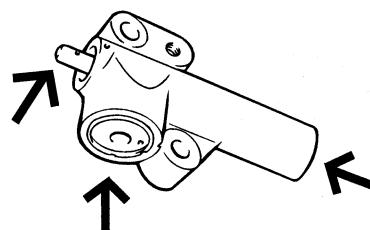
CAUTION

After the timing belt "B" is removed, do not attempt to loosen bolts while holding the sprocket with pliers or any other tool.

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



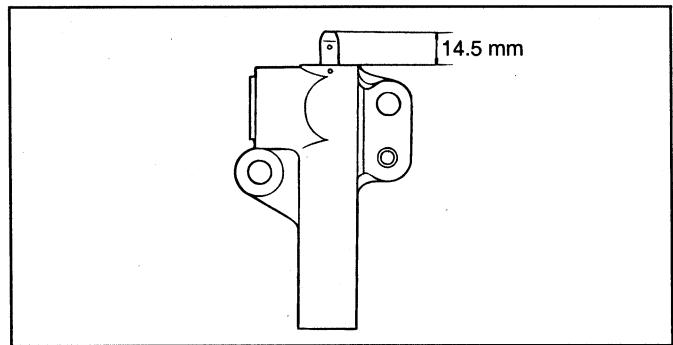
ECA9025A



ECA9026A

2. Check the rod end for wear or damage and replace if necessary.

Standard value : 14.5 mm (0.57 in)



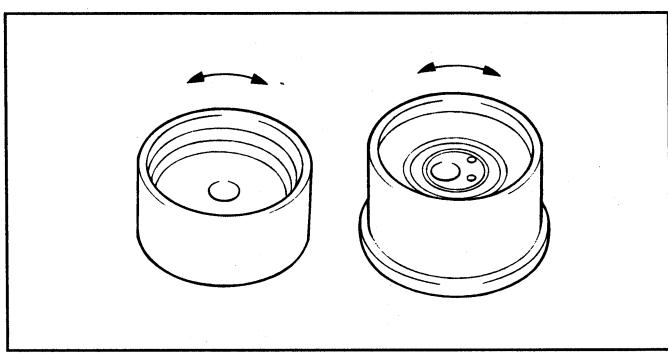
ECHA970A

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

4. Using a soft jaw vise, compress the auto tensioner rod. slowly. If the rod can be easily retracted, replace the auto tensioner. You should feel extensive resistance when pushing the rod in. And it must be compressed in several steps.

NOTE

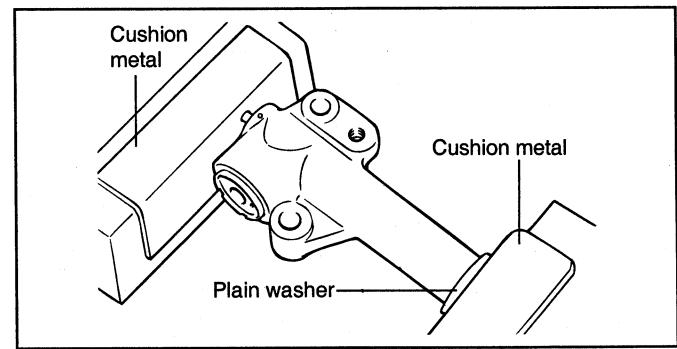
Clamp the auto tensioner in the vise so that it is level. Use soft jaws in the vise to avoid damaging the auto tensioner.



EOY025A

AUTO TENSIONER

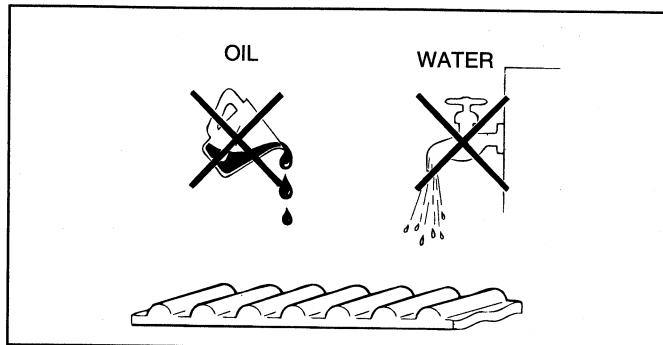
1. Check the auto tensioner for leaking and replace if necessary.



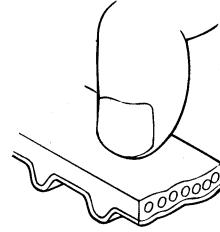
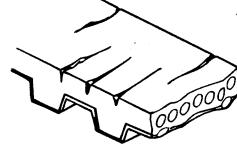
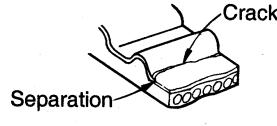
ECA9028A

TIMING BELT

1. Check the belt for oil or dust deposit. Replace if necessary. Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension is adjusted, check the belt carefully. If any of the following flaws are evident, replace the belt with a new one.



ECA9200A

Description	Flaw conditions
1. Hardened back surface of rubber	<p>Back surface is glossy, Non-elastic and so hard that, when your fingernail is pressed into it, no mark is produced.</p> 
2. Cracked back surface of rubber	
3. Cracked or separating canvas	
4. Badly worn out teeth (initial stage)	
	<p>Tooth flank shows canvas on the load side (Fluffy canvas fibers, rubber changed into white color and unclear canvas texture)</p>

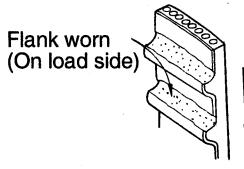
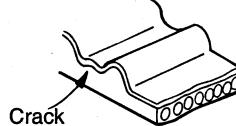
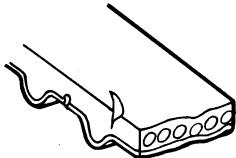
ECA9200B

ECA9200Y

ECA9200I

ECA9200J

ECA9200K

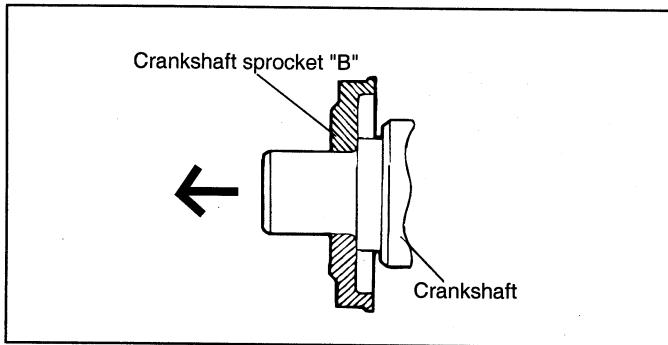
Description	Flaw conditions
5. Badly worn out teeth (last stage)	 <p>Flank worn (On load side)</p> <p>ECA9200C</p>
6. Cracked tooth bottom	 <p>Tooth flank worn and rubber exposed on load side (tooth width reduced)</p> <p>Rubber exposed</p> <p>ECA9200D</p>
7. Missing tooth	 <p>Crack</p> <p>Tooth missing and canvas fiber exposed</p> <p>ECA9200E</p>
8. Badly worn side of belt	 <p>Rounded belt side</p> <p>Abnormal wear (Fluffy canvas fiber)</p> <p>ECA9200F</p>
9. Cracked side of belt	 <p>ECA9200G</p> <p>ECA9200H</p>

INSTALLATION ECJA9800

1. Install the crankshaft sprocket "B" into the crankshaft.

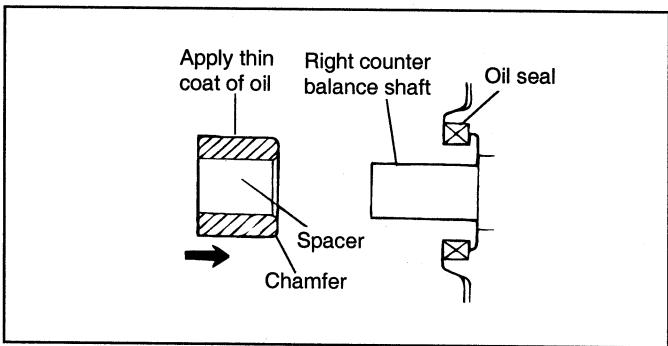
CAUTION

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



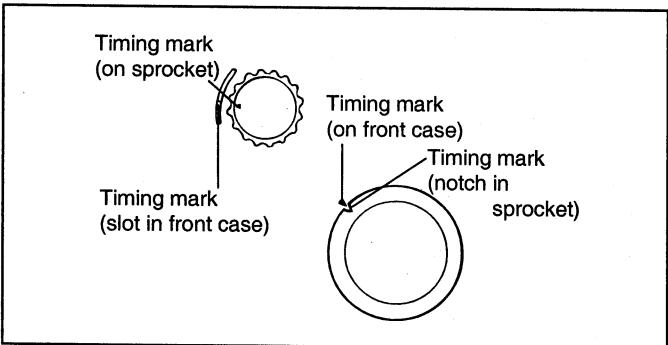
ECA9210A

2. Apply engine oil to the outer surface of the spacer lightly and then install the spacer to the right counter balance shaft. Be sure to install in the direction shown in the illustration.
3. Install the counter balance shaft sprocket onto the right counterbalance shaft and then tighten its flange bolt by hand tightly.



ECA9210B

4. Align the timing mark on each sprocket with the corresponding timing mark on the front case.

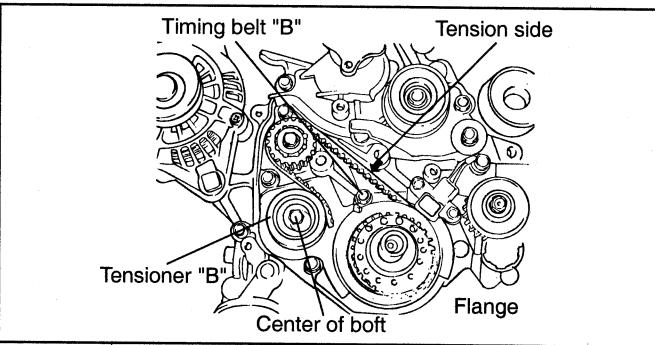


ECA9210C

5. When the timing belt "B" is installed, make certain that its tension side has no slack.

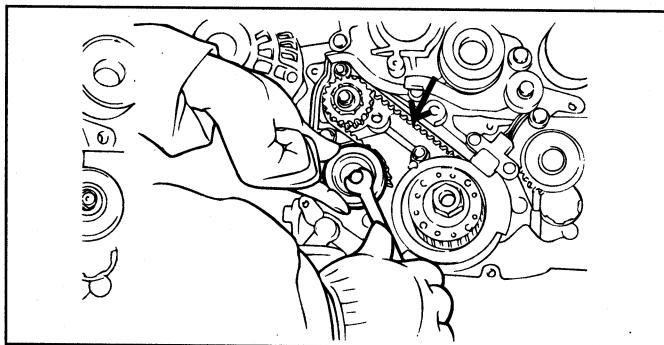
Install the tensioner "B" so the center of the pulley is located on the left side of the mounting bolt and in the pulley flange faces the front of the engine.

Align the timing mark on the right counter balance shaft sprocket with the timing mark on the front case.



ECA9084A

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



ECA9083A

7. Check to ensure that the timing marks are in alignment.

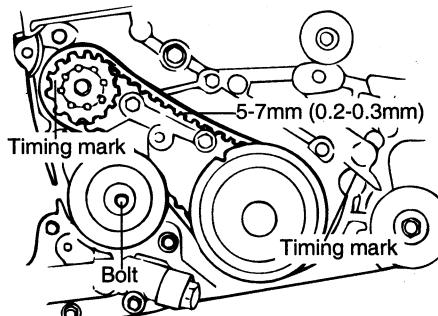
8. Verify the tension of the timing belt.

Method 1 : Verify that, when the center of the span on the tension side is depressed with an index finger in the direction of arrow, the deflection of the belt is within specification.

Belt deflection : 5-7 mm (0.20-0.28 in)

Method 2 : Measure the tension of the timing belt by using a tension gaugent.

Span length	Pressure	Torque
139mm (5.47 in.)	0.42 kg/cm ² (42 kPa)	50-100Nm (500-1000kg.cm, 36-72 lb.ft)

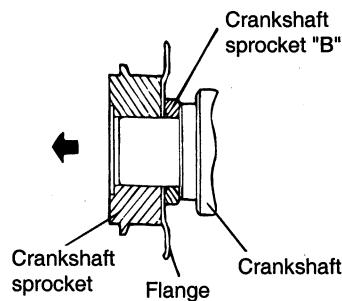


ECA9210F

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

CAUTION

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



ECA9210G

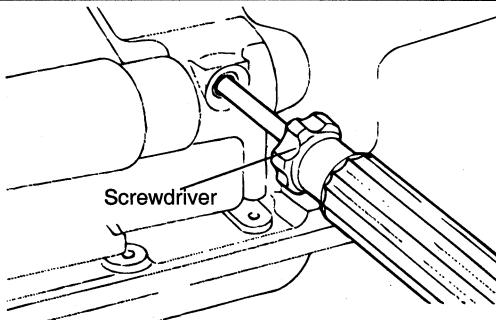
10. Install the special washer and sprocket bolt to the crankshaft and then tighten the sprocket bolt.

Tightening torque

Crankshaft sprocket bolt :

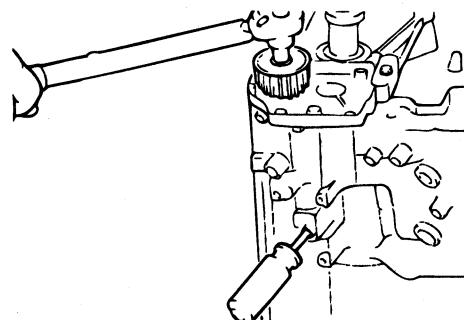
110-130 Nm (1100-1300 kg.cm, 80-94 lb.ft)

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



ECA9210H

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



ECA9210I

Tightening torque

Oil pump sprocket :

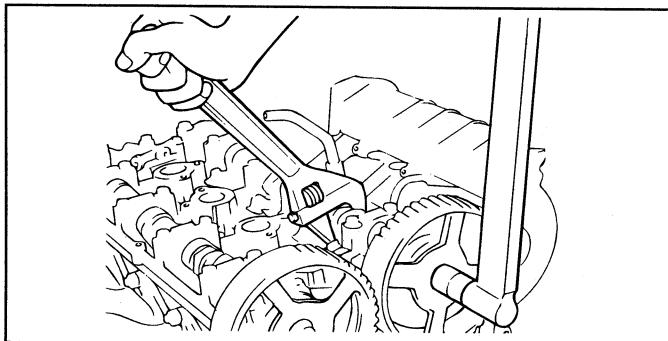
50-60 Nm (500-600 kg.cm, 36-43 lb.ft)

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

Tightening torque

Camshaft sprocket bolt :

80-100 Nm (800-1000 kg.cm, 58-72 lb.ft)

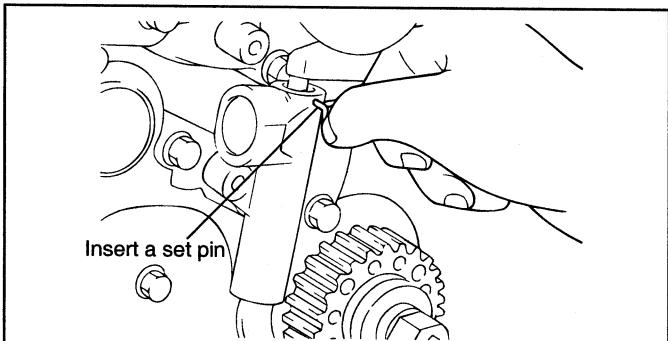


ECA9210K

14. Install the auto tensioner.

CAUTION

Leave the set pin installed in the auto tensioner.

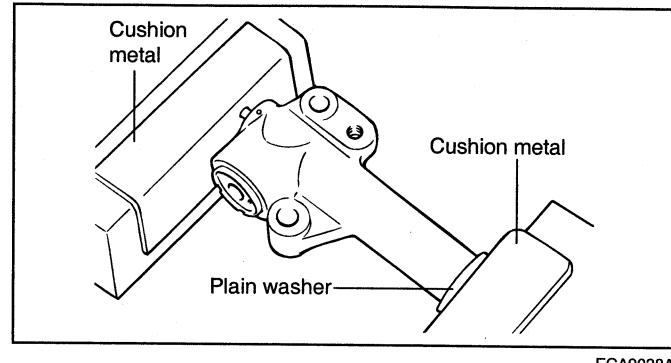


ECHA980A

NOTE

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

1. Clamp it in a vise equipped with soft jaws, in a level position. Use a plain washer if there is a plug at the bottom of the auto tensioner.
2. Compress the rod slowly with the vise until the set hole in the rod is aligned with set hole in the cylinder.



ECA9028A

3. Insert a set pin through the auto tensioner body and rod.

CAUTION

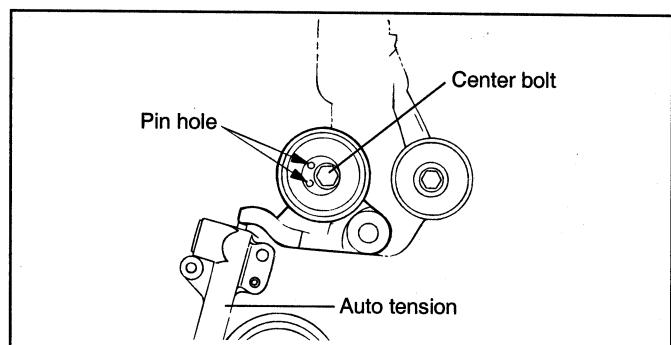
Leave the set pin installed in the auto tensioner.

15. Install the tensioner pulley onto the tensioner arm.

Tightening torque

Tensioner pulley

43-55 N.m (430-550 kg.cm, 31-40 lb.ft)



ECA9210N

16. Rotate the camshaft sprockets so that the dowel pin of the camshaft sprocket is at the upper side. Set the timing mark of sprocket correctly.

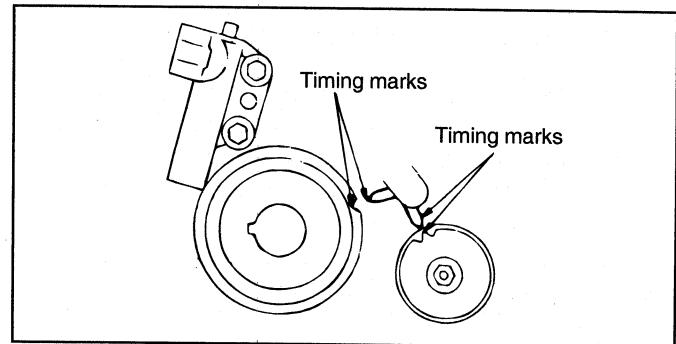
NOTE

1. Before installing the timing belt, if the timing mark of the camsprocket doesn't coincide with that of the rocker cover, do not rotate the cam sprocket more than 2 teeth of the sprocket in any direction.

Rotating the sprocket more than 2 teeth may make the valve and piston touch each other.

2. If it is necessary to rotate the cam sprocket more than 2 teeth, rotate the crank sprocket counter clock wise first based on the timing mark.

After the camsprocket is properly timed return the crankshaft to TDC.



ECHA007D

19. Install the timing belt counter clockwise around the tensioner pulley and crankshaft sprocket. Hold the timing belt onto the tensioner pulley with your left hand.

20. Pulling the belt with your right hand, install it around the oil pump sprocket.

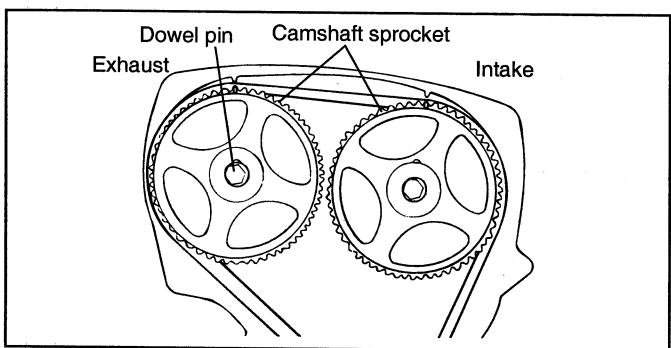
21. Install the belt around the right- hand idler pulley.

22. Install the belt around the intake camshaft sprocket.

23. Turn the exhaust camshaft sprocket one tooth clockwise to align its timing mark with the cylinder head top surface [see illustration in step 16]. Then, pulling the belt with both hands, install it around the exhaust camshaft sprocket.

24. Gently raise the tensioner pulley so that the belt doesn't sag and tighten the pulley's center bolt temporarily.

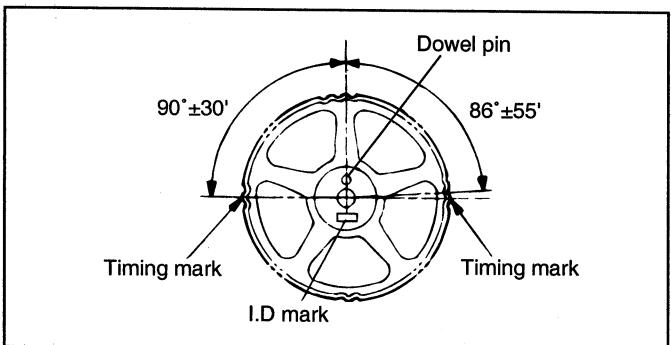
25. Check again whether the timing mark of each sprocket is correct.



ECA9029A

NOTE

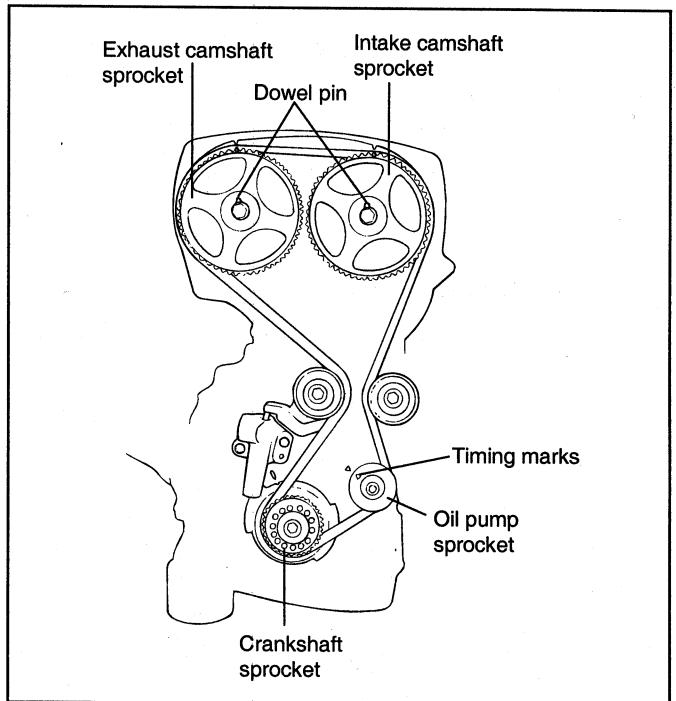
When exhaust and intake camshaft sprocket is used and install it after checking I.D mark depending on the engine displacement.



ECHA007C

17. Align the crankshaft sprocket timing marks.

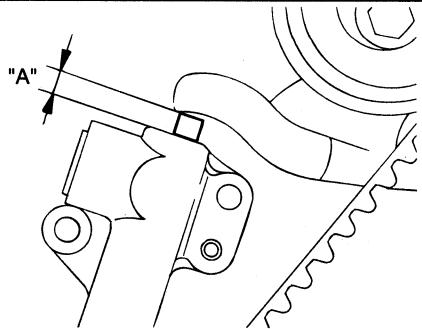
18. Align the oil pump sprocket timing marks.



ECA9023A

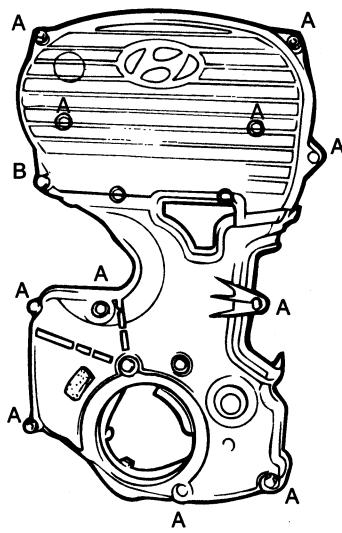
26. Remove the set pin in the auto tensioner.
27. Rotate the crankshaft two turns clockwise and leave it for about 15 minutes. Then, measure the auto tensioner protrusion "A" (Distance between the tensioner arm and auto tensioner body) to ensure that it is within the specification.

Standard value : 6-9 mm (0.24-0.35 in)



ECA9210R

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



A:8-10 N.m (80-100 kg.cm, 6-7 lb.ft)

B:10-12 N.m (100-120 kg.cm, 7-9 lb.ft)

ECHA980B