ENGINE MECHANICAL

Return to Main Table of Contents

GENERAL

SPECIFICATIONS

Description	Specification		Limit
General			
Type	In-line, Double Over Head Camshaft		
Number of cylinders	4		
	1.6L Eng.	1.8 Eng.	
Bore	82.3 mm (3.240 in.)	81.5 mm (3.209 in.)	
Stroke	75.0 mm (2.953 in.)	88 mm (3.465 in.)	
Total displacement	1595 cc (97.3 cu. in.)	1836 cc (112.04 cu. in.)	
Compression ratio	9.2	9.2	
Firing order	1-3-4-2	←	
Idle R.P.M	750 ± 100 rpm	700 ± 100 rpm	
Ignition timing at idling speed	BTDC 5^{o}± 2^{o}	←	
Valve timing			
Intake valve	1.6L Eng.	1.8L Eng.	
Opens (BTDC)	16^{o} (For M/T), 26^{o} (For A/T)	26^{o}	
Closes (ABDC)	48^{o} (For M/T), 38^{o} (For A/T)	46^{o}	
Exhaust valve			
Opens (BBDC)	43^{o} (For M/T), 53^{o} (For A/T)	55^{o}	
Closes (ATDC)	17^{o} (For M/T), 7^{o} (For A/T)	9^{o}	
Cylinder head			
Flatness of gasket surface	Max. 0.05 mm (0.0020 in.)		0.1 mm (0.0039 in.)
Flatness of manifold mounting surface	0.15 mm (0.0059 in.)		0.2 mm (0.008 in.)
Oversize rework dimensions of valve seat hole			
Intake 0.3 mm (0.012 in.) O.S.	35.300-35.325 mm (1.3898-1.3907 in.)		
0.6 mm (0.024 in.) O.S	35.600-35.625 mm (1.4016-1.4026 in.)		
Exhaust 0.3 mm (0.012 in.) O.S.	33.300-33.325 mm (1.3110-1.3120 in.)		
0.6 mm (0.024) O.S.	33.600-33.625 mm (1.3228-1.3238 in.)		
Oversize rework dimensions of valve guide hole (both intake and exhaust)			
0.05 mm (0.002 in.) O.S.	12.050-12.068 mm (0.4744-0.4751 in.)		
0.25 mm (0.010 in.) O.S.	12.250-12.268 mm (0.4823-0.4830 in.)		
0.50 mm (0.020 in.) O.S.	12.500-12.518 mm (0.4921-0.4928 in.)		
Camshaft			
1.6L Eng.			
Cam height			
Intake	35.200 mm (1.3858 in.)		34.700 mm (1.3661 in.)
Exhaust	34.907 mm (1.3743 in.)		34.407 mm (1.3546 in.)
Journal O.D.	26 mm (1.02 in.)		
Bearing oil clearance	0.05-0.09 mm (0.0020-0.0035)		
End play	0.1-0.2 mm (0.004-0.008 in.)		
1.8L Eng.			
Cam height			
Intake	35.493 mm (1.3974 in.)		34.993 mm (1.3777 in.)
Exhaust	35.200 mm (1.3858 in.)		34.700 mm (1.3661 in.)
Journal O.D.	26 mm (1.02 in.)		
Bearing oil clearance	0.05-0.09 mm (0.0020-0.0035 in.)		
End play	0.1-0.2 mm (0.004-0.008 in.)		

Description	Specification	Limit
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.)
Valve stem to valve guide clearancea		
Intake	0.020-0.047 mm (0.0008-0.0019 in.)	0.10 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 size	0.05, 0.25, 0.50 mm (0.002, 0.010, 0.020 in.) oversize	
Valve seat		
Width of seat contact	0.9-1.3 mm (0.035-0.051 in.)	
Seat angle	44-44.5°	
Service size	0.3 mm (0.012 in.), 0.6 mm (0.024 in.) oversize	
Valve spring		
Free length	48.3 mm (1.902 in,)	47.3 mm (1.862 in.)
Load	300 N (66 lb)/40 mm (1.575 in.)	
Out of squareness	Less than 1.5°	4°
Cylinder block		
Cylinder bore	82.30-82.33 mm (3.2402-3.2413 in.)[1.6L Eng.] 81.50-81.53 mm (3.2087-3.2098 in) [1.8L Eng.]	
Out-of-roundness and taper of cylinder bore	Less than 0.01 mm (0.0004 in.)	
Flatness of gasket surface	Less than 0.05 mm (0.0020 in.)	0.1 mm (0.0039 in.)
Piston		
O.D.	82.27-82.30 mm (3.2390-3.2402 in.) [1.6L Eng.] 81.47-81.50 mm (3.2075-3.2087 in.) [1.8L Eng.]	
Piston-to-cylinder clearance	0.02-0.04 mm (0.0008-0.0016 in.)	
Ring groove width		
No. 1	1.22-1.24 mm (0.0480-0.0488 in.)	
No. 2	1.52-1.54 mm (0.0598-0.0606 in.)	
Oil	3.01-3.03 mm (0.1185-0.1193 in.)	
Service size	0.25, 0.50, 0.75, 1.00 mm (0.010, 0.020, 0.030, 0.039 in.) oversize	

Description	Specification	Limit
Piston ring		
Side clearance		
No. 1, No. 2	0.03-0.07 mm (0.0012-0.0028 in.)	0.1 mm (0.004 in.)
End gap		
1.6L Eng.		
No. 1	0.25-0.40 mm (0.0098-0.9157 in.)	0.8 mm (0.031 in.)
No. 2	0.35-0.50 mm (0.0138-0.0197 in.)	0.8 mm (0.031 in.)
Oil ring side rail	0.20-0.70 mm (0.0079-0.0276 in.)	1.0 mm (0.039 in.)
1.8L Eng.		
No.1	0.25-0.40 mm (0.098-0.0157 in.)	0.8 mm (0.031 in.)
No.2	0.45-0.60 mm (0.0177-0.0236 in.)	0.8 mm (0.031 in.)
Oil ring side rail	0.20-0.70 mm (0.0079-0.0276 in.)	1.0 mm (0.039 in.)
Service size	0.25, 0.50, 0175, 1.00 mm (0.010, 0.020, 0.030, 0.039 in.) oversize	
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 (0.0039-0.0098 in.)	0.4 mm (0.0157 in.)
Piston pin press-in load	7,500-17,500 N (1,653-3,858 lb)	
Connecting rod bearing		
Oil clearance	0.022-0.05 mm (0.00086-0.0020 in.)	0.1 mm (0.004 in.)
Crankshaft main bearing		
Oil clearance	0.02-0.05 mm (0.0008-0.0020 in.)	0.1 mm (0.004 in.)
Crankshaft		
Pin O.D.	45 mm (1.77 in.)	
Journal O.D.	57 mm (2.24 in.)	
Out-of-roundness of journal and pin	Less than 0.015 mm (0.0006 in.)	
Taper of journal and pin	Less than 0.005 (0.0002)	
End play	0.05-0.18 mm (0.0020-0.0071 in.)	0.25 mm (0.0098 in.)
Flywheel		
Runout		0.13 mm (0.0051 in.)
Oil pressure at curb idle speed [Oil tempreature is 75 to 90°C (167 to 194°F)]	80 kPa (11.4 psi) or more	
Oil pump		
Tip clearance		
Drive gear	0.16-0.21 mm (0.0063-0.0083 in.)	0.25 mm (0.0098 in.)
Driven gear	0.13-0.18 mm (0.0051-0.0071 in.)	0.25 mm (0.0098 in.)
Side clearance		
Drive gear	0.08-0.14 mm (0.0031-0.0055 in.)	0.25 mm (0.0098 in.)
Driven gear	0.06-0.12 mm (0.0024-0.0047 in.)	0.25 mm (0.0098 in.)
Relief spring		
Free length	46.6 mm (1.835 in.)	
Load [61 N (13.5 lb)]	40.1 mm (1.579 in.)	

Description	Specification	Limit
Right counter balance shaft		
Front journal diameter	41.959-41.975 mm (1.6519-1.6526 in.)	
Rear journal diameter	40.951-40.967 mm (1.6122-1.6129 in.)	
Oil clearance		
Front	0.020-0.0061 mm (0.0008-0.6024 in.)	
Rear	0.050-0.091 mm (0.0020-0.0036 in.)	
Left counter balance shaft		
Front journal diameter	18.467-18.480 mm (0.7270-0.7276 in.)	
Rear journal diameter	40.959--40.975 mm (1.6126-1.6132 in.)	
Oil clearance		
Front	0.020-0.054 mm (0.0008-0.0021 in.)	
Rear	0.042-0.083 mm (0.0017-0.0033 in.)	

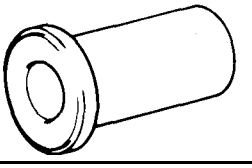
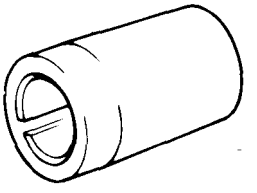
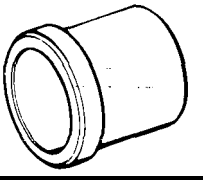
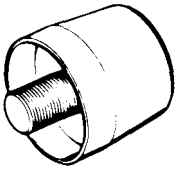
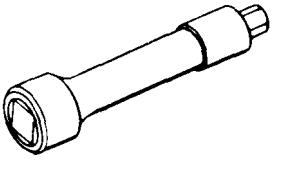
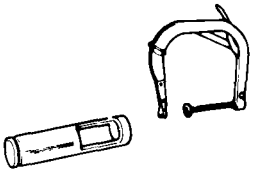
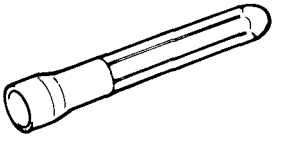
NOTE
O-D. = Outer Diameter
I.D. = Inner Diameter
O.S. = Oversize Diameter
U.S. q Undersize Diameter

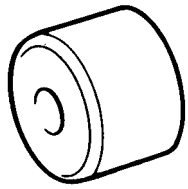
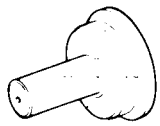
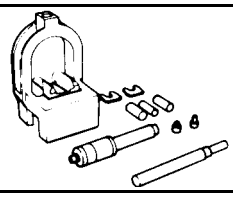
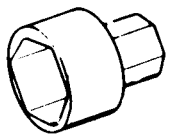
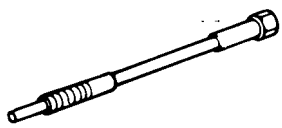
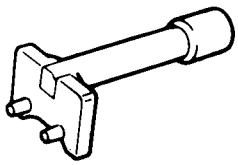
TIGHTENING TORQUE

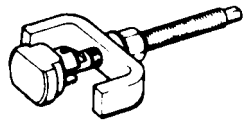
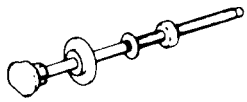
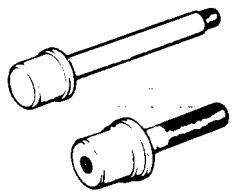
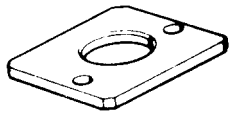
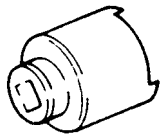
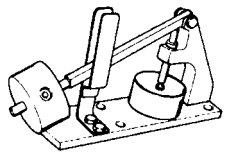
	Nm	kg.cm	lb.ft
Engine mount bracket nut and bolt	50-65	500-650	36-47
Engine mount insulator nut (large)	90-110	900-1100	65-80
Engine mount insulator nut (small)	45-60	450-600	33-43
Front roll stopper insulator nut	45-60	450-600	33-43
Rear roll stopper insulator nut	45-60	450-600	33-43
Fuel high presssure hose to delivery pipe	4-6	40-60	3-4
Accelerator cable adjusting bolt	4-6	40-60	3-4
Front engine support bracket bolt	50-70	500-700	36-51
Front exhaust pipe support bracket bolt	30-42	300-420	22-30
Left engine support bracket bolt	30-42	300-420	22-30
Front roll stopper bracket bolt	55-75	550-750	40-54
Rear roll stopper bracket bolt	110-130	1100-1300	80-94
Engine mount bracket to bracket	17-26	170-260	12-19
Front engine support bracket to bracket	17-26	170-260	12-19
Air conditioning compressor to bracket	23-27	230-270	17-20
Power steering oil pump to bracket	45-55	450-550	32.4-39.6
Front exhaust pipe to exhaust manifold	30-40	300-400	22-29
Rocker cover bolt	2.5-3.5	25-35	2-3
Center cover bolt	2.5-3.5	25-35	2-3
Camshaft sprocket bolt	80-100	800-1000	58-72
Camshaft bearing cap bolt	19-21	190-210	14-15
Crank angle sensor nut	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
Crankshaft pulley to crankshaft sprocket	20-30	200-300	14-22
Cylinder head bolt (cold engine)	105-115	1050-1150	76-83
Intake manifold stay	25-30	250-300	18-22
Tension rod to bracket	35-55	350-550	25-40
Tension pulley bracket bolt	17-26	230-270	12-19
Auto tensioner bolt	20-27	200-270	14-20
Tensioner pulley bolt	43-55	430-550	31-40
Idle pulley bolt	30-42	300-420	22-30
Front exhaust pipe clamp bolt	20-30	200-300	14-22

	Nm	kg.cm	lb.ft
Oil pan	6-8	60-80	4-6
Oil pan drain plug	35-45	350-450	25-33
Oil screen	15-22	150-220	11-16
Oil pump sprocket bolt	50-60	500-600	36-43
Oil pressure switch	8-12	80-120	6-8
Oil filter bracket bolt	15-22	150-220	11-16
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			
M8x30	27-34	270-340	20-26
except M8 x 30	20-27	200-270	14-20
Drive gear bolt	34-40	340-400	25-29
Engine coolant pump pulley bolt	8-10	80-100	6-7
Timing belt upper cover	10-12	100-120	7-9
Timing belt lower cover	10-12	100-120	7-9
Relief plug	40-50	400-500	29-36
Flywheel	130-140	1300-1400	94-101
Drive plate	130-140	1300-1400	94-101
Timing belt rear right cover	10-12	100-120	7-9
Timing belt rear left cover (lower)			
-bolt also securing left engine support bracket	30-42	300-420	22-30
Timing belt rear left cover (upper)	10-12	100-120	7-9
Connecting rod cap bolt	50-53	500-530	36-38
Crankshaft bearing cap bolt	65-70	650-700	47-51
Engine hanger	12-15	120-150	9-11

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09214-32000 Crankshaft front oil seal installer		Installation of the crankshaft front oil seal (use with 09214-32100)
09214-32100 Crankshaft front oil seal guide		Installation of the crankshaft front oil seal (use wiht 09214-32000)
09221-21000 Camshaft oil seal installer		Installation of the camshaft oil seal (use with 09221-21100)
09221-21100 Camshaft oil seal guide		Used as a guide when pressing in the camshaft oil seal (use with 09221-21000)
09221-32001 Cylinder head bolt wrench		Removal and tightening of the cylinder head bolt
09222-28000 Valve spring compressor 09222-28100 Valve spring compressor holder		Removal and installation of the inlet or exhaust valve
09222-28200 Valve stem oil seal installer		Installation of the valve stem oil seal

Tool (Number and name)	Illustration	Use
09222-21200A 09222-212008 Valve guide installer		Removal and installation of the valve guide
09222-28400 Valve guide installer adapter		Installation of the valve guide
09231-21000 Crankshaft rear oil seal installer		1. Installation of the engine rear oil seal 2. Installation of the crankshaft rear oil seal
09234-33001 Piston pin remover and installer kit		Removal and installation of the piston pin
09234-33002 Insert		Removal and installation of the piston pin (use with 09234-33001)
09260-11000 Oil pressure switch wrench		Removal and installation of the oil pressure switch
09244-28000 Auto tensioner set screw		Removal and installation of auto tensioner
09244-28100 Socket wrench		Ajustment of auto tensioner

Tool (Number and name)	Illustration	Use
09212-32000 Counter balance shaft bearing puller		Removal of front bearing of counter balance shaft
09212-32100 Counter balance shaft bearing puller		Removal of rear bearing of counter balance shaft (use with 09212-32300)
09212-32200 Counter balance shaft bearing installer		Installation of counter balance shaft bearing front and rear (use with 09212-32300)
09212-32300 Guide plate		Removal and installation of counter balance shaft rear bearing (use with 09212-32100, 09212-32200)
09213-33000 Plug cap wrench		Removal and installation of front case cap plug
09246-32300 Leak down tester		Test for Leak down of auto lash adjuster

TROUBLESHOOTING

Symptom	Probable cause	Remedy
Low compression	Blown 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 determine cause Repair Replace
High oil pressure	Oil relief valve stuck (closed)	Repair
Excessive engine rolling and 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 determine cause Replace
Timing belt noise	Incorrect belt tension	Adjust belt tension

ENGINE

REPLACING OIL FILTER
Refer to the page 1

CHANGING ENGINE OIL
Refer to the page 1

CHECKING COMPRESSION PRESSURE

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

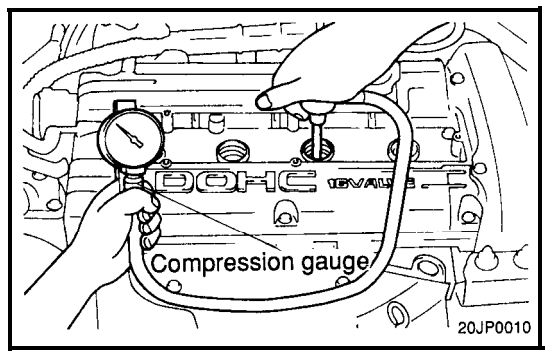
Limit ..... 12.0 kg/cm^2 (1.18 MPa, 171 psi) [250-400 rpm]

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

Limit ... Max. 1.0 kg/cm^2 (100 kPa, 14 psi) between cylinders

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

Tightening torque Spark plug ..... **20-30** Nm (200-300 kg.cm, 15-21 lb.ft)

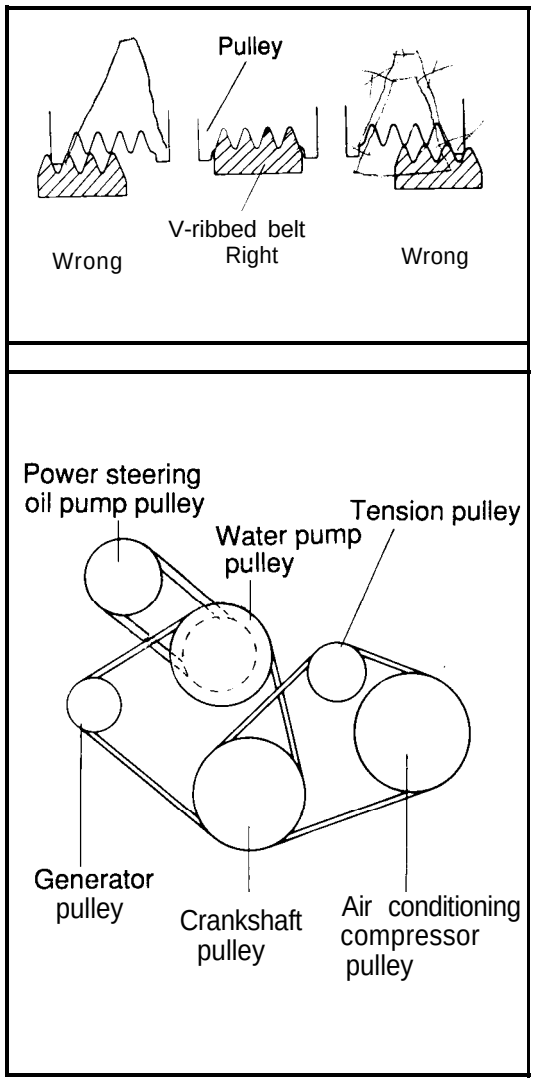


DRIVE BELTS TENSION ADJUSTMENT

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

   CAUTION
   1. When installing the V-ribbed belt, check that the V-ribs are properly in alignment.
   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 for the proper belt deflection measurement.

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



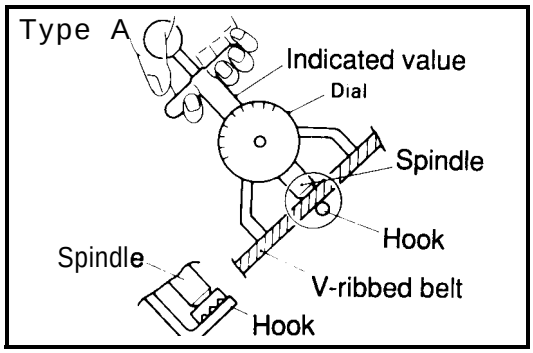
Standard value :

Items		Inspection	Adjustment	
			New	Used
For Generator	Deflection mm (in.)	9.0-10.4 (0.354-0.409)	7.5-9.0 (0.295-0.354)	10 (0.394)
	Tension N (lb)	350-500 (77-110)	500-700 (110-154)	400 (88)
For air conditioning compressor	Deflection mm (in.)	Approx. 8.0 (0.315)	5.0-5.5 (0.197-0.217)	6.0-7.0 (0.236-0.276)
For power steering oil pump	Deflection mm (in.)	6.0-9.0 (0.236-0.354)	–	–

NOTE
1. The belt tension must be measured between the specified pulleys.
2. When a new belt is installed, adjust the tension to the center of the standard range indicated under “New”. And then 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 newly installed after 5 minutes or more of operation, refer to the standard value indicated under “Used”.
4. Refer to the standard value indicated under “Inspection” for periodic inspections.

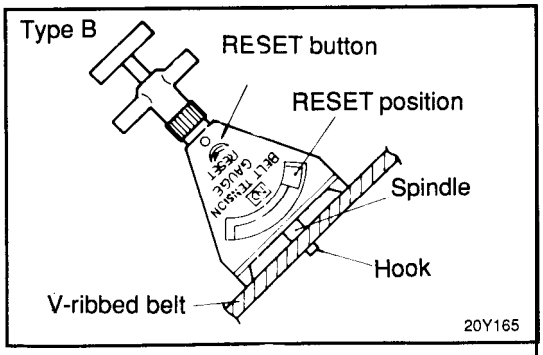
Type A tension gauge

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



Type B tension gauge

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

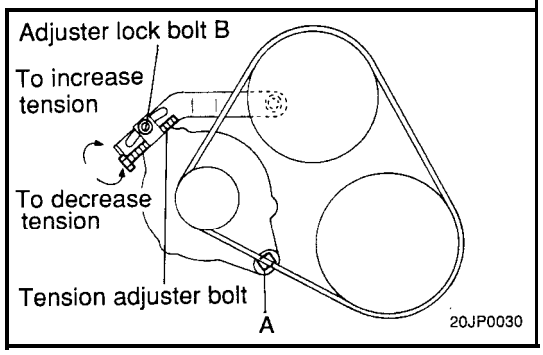


Generator Belt Adjustment

CAUTION

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

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



Tightening torque
Generator nut A .... 20-25 Nm (200-250 kg.cm, 14-18 lb.ft)
Adjuster lock bolt B ... 12-15 Nm (120-150 kgcm, 9-11 lb.ft)
Tension adjuster bolt ..... 8-12 Nm (80-120 kgcm, lb.ft)

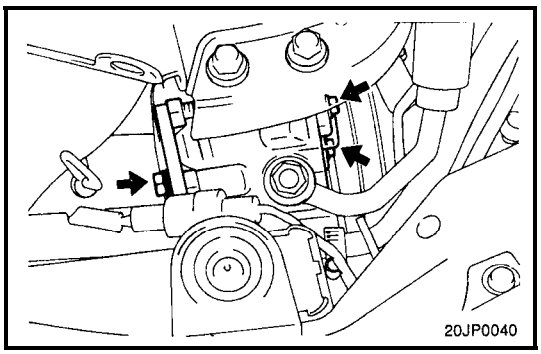
CAUATION

Note that 1.6L and 1.8L Engine V-ribbed velts are different in length.

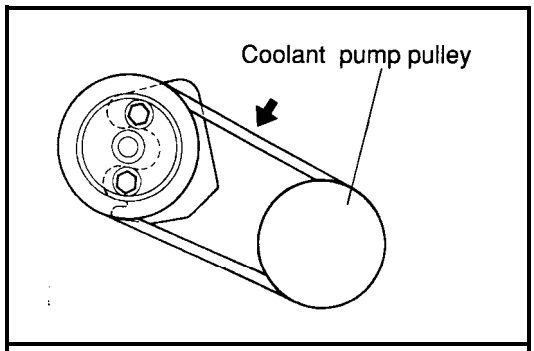
Standard Value
1.6L Eng. ..... 980±5 mm
1.8L Eng. ..... 990±5 mm

Power Steering Oil Pump Belt Adjustment

1. Loosen the adjustment bolt of the power steering oil pump.



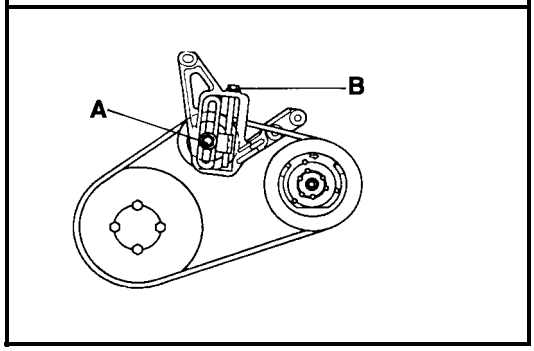
2. Adjust the deflection or the tension of the power steering pump to specification.
3. Tighten the adjustment bolt.
4. Crank the engine one or more revolutions.
5. Check the belt deflection, readjust if necessary.



Air Conditioning Compressor Belt Adjustment

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

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



Lash Adjusters Check

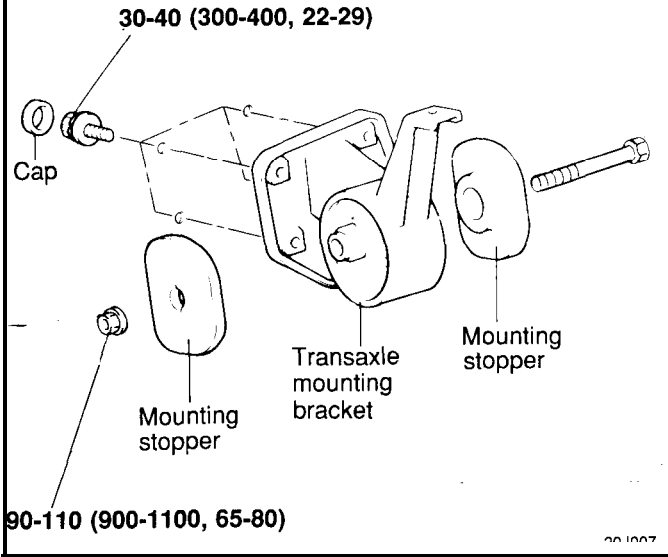
If an abnormal noise is heard from the lash adjusters (tappets), check as follows;

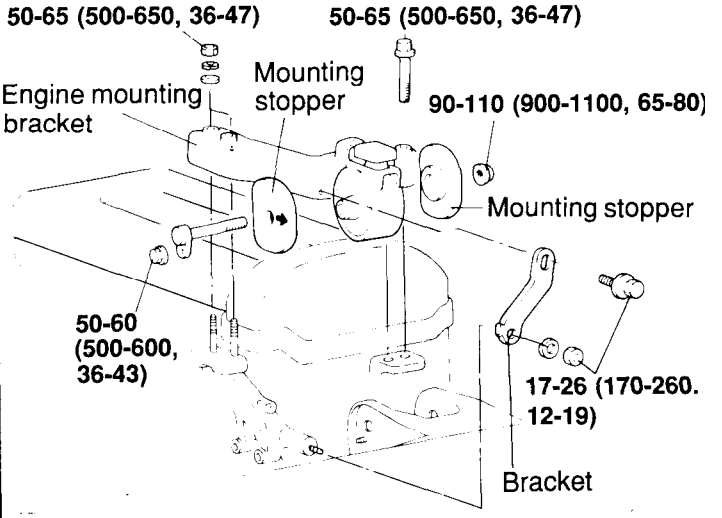
1. While installed to the cylinder head, press the part where the rocker arm contacts the lash adjuster at the very top. If the adjuster is normal, the part pressed will feel very hard.
2. If it easily moves all the way downward when pressed, there is a malfunction of the lash adjuster and it should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

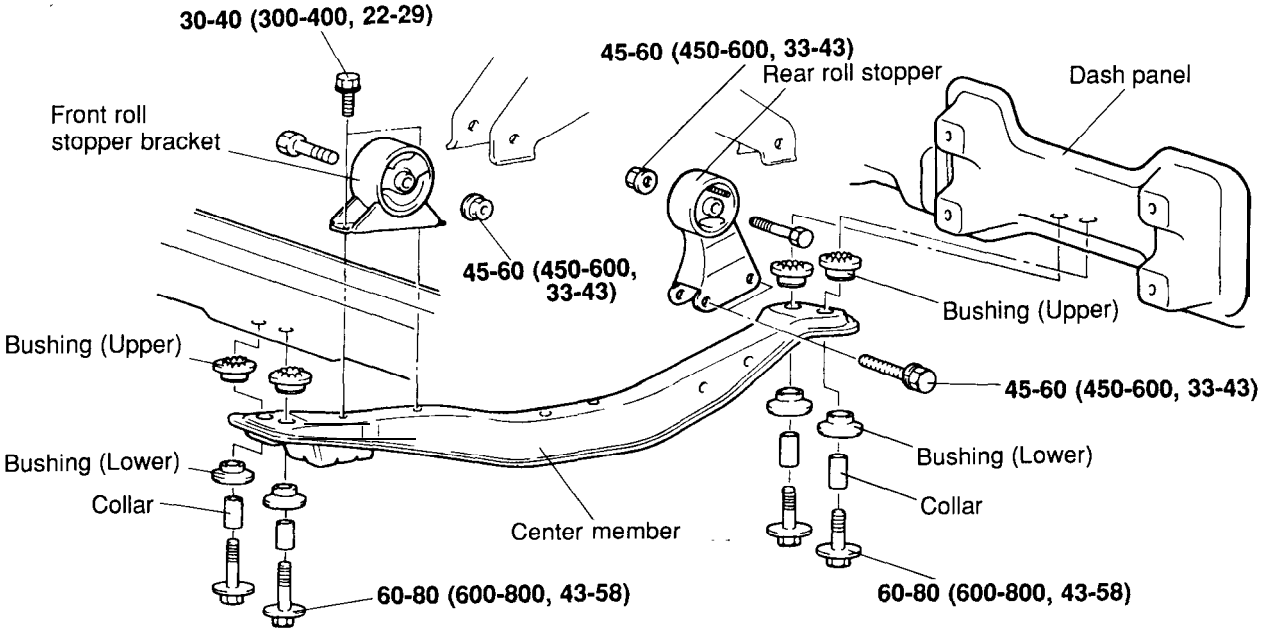
ENGINE MOUNTING

COMPONENTS

TRANSAXLE MOUNTING



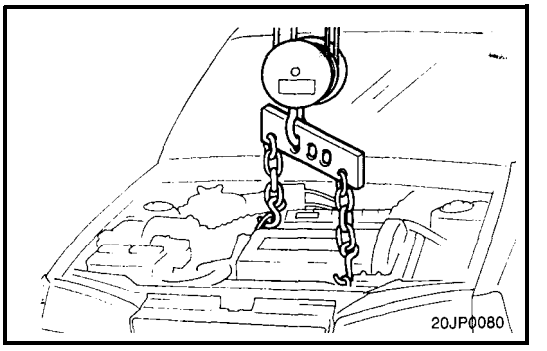




TORQUE : Nm (kg.cm, lb.ft)

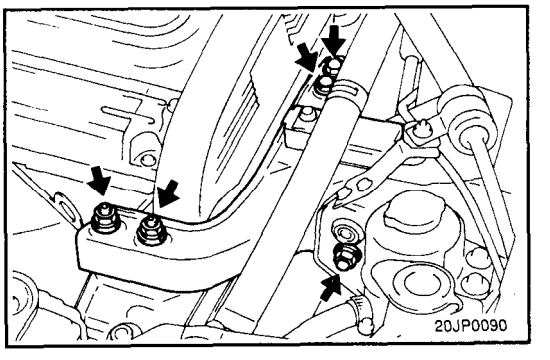
REMOVAL

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



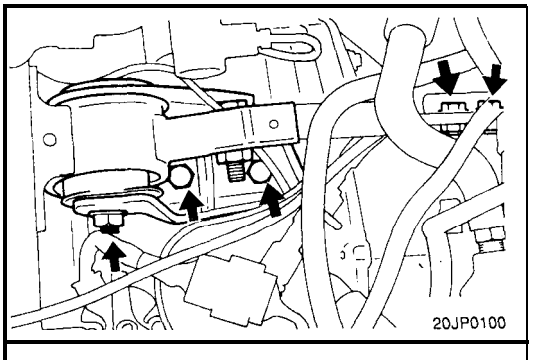
Engine Mounting

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

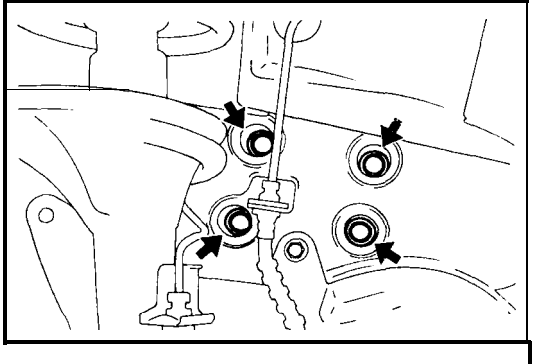


Transaxle Mounting

1. For vehicles with a 5-speed manual transaxle, remove the select control valve.
2. Remove the transaxle mount bolt.

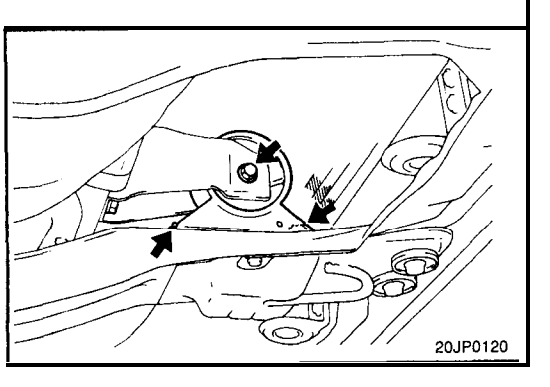


3. Detach the cap from the inside of the right fender shield, remove the transaxle mounting bolts.
4. Remove the transaxle bracket.



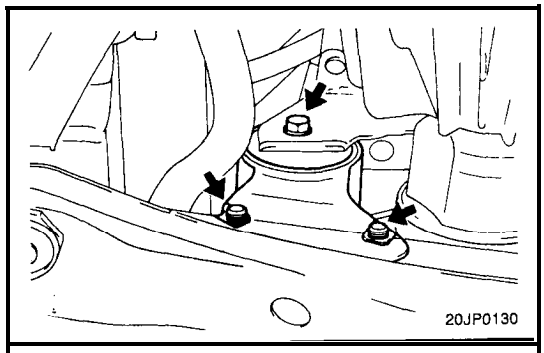
Front Roll Stopper

Remove the front bracket from the center member.



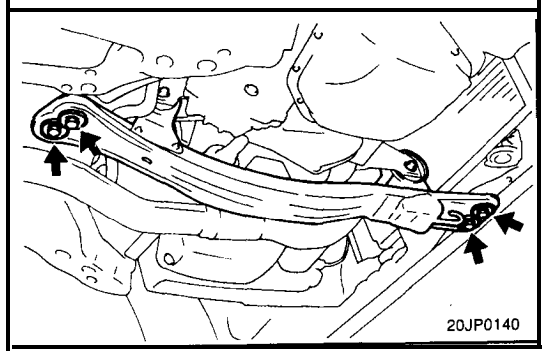
Rear Roll Stopper

Remove the rear roll stopper from the center member.

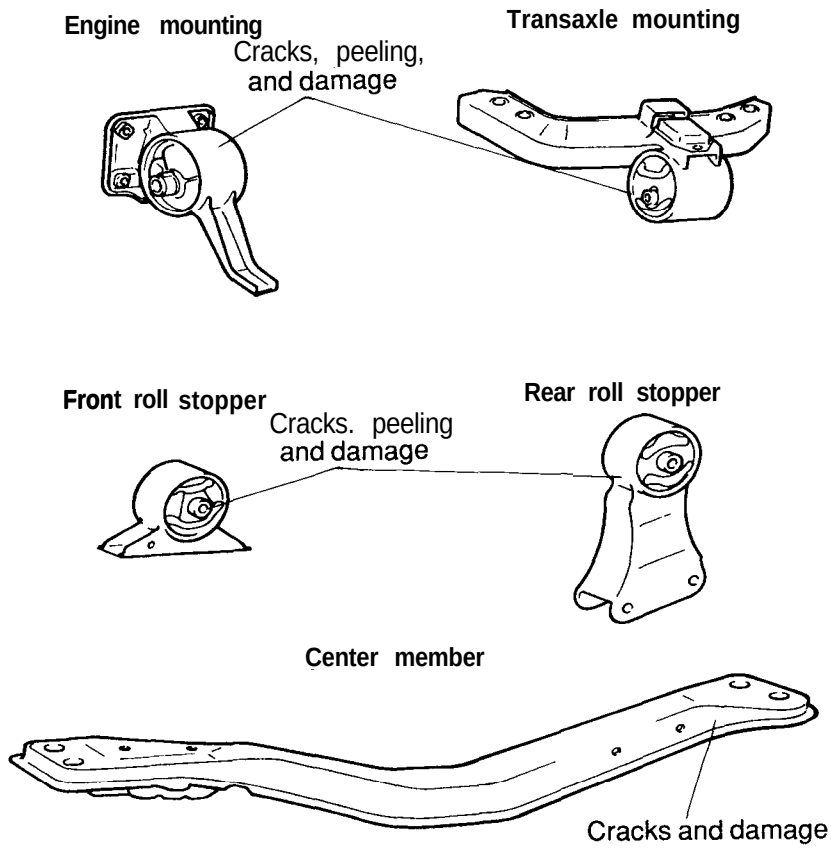


Center member

1. Remove the under cover (R.H.).
2. Remove the front roll stopper mounting bolts.
3. Remove the rear roll stopper mounting bolts.
4. Remove the center member from the body.



INSPECTION ITEMS



ENGINE AND TRANSAXLE ASSEMBLY

REMOVAL

1. Remove the battery.
2. Detach the air cleaner.
3. Disconnect the connectors for the backup lamp and engine harness.
4. For a vehicle with a 5-speed manual transaxle, disconnect the select control valve connector.

5. Disconnect the connectors for the generator harness and the oil pressure gauge wiring.
6. Drain the engine coolant.
7. For vehicles with an automatic transaxle, disconnect the transaxle oil cooler hoses.

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

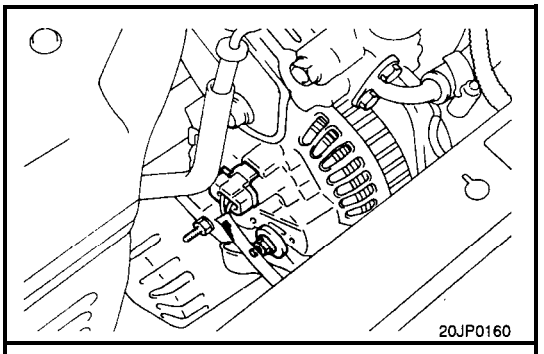
CAUTION
Be careful not to spill any of the oil or fluid out of the hoses, and plug the openings to prevent the entrance of foreign material.

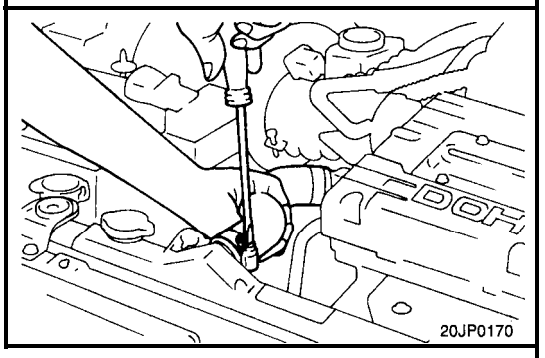
8. Disconnect the radiator upper and lower hoses on the engine side, and then remove the radiator assembly.
9. Disconnect the high tension cable from the ignition coil section.
10. Disconnect the engine ground.
11. Disconnect the brake booster vacuum hose.
12. Remove the main fuel line, and the return and vapor hoses from the engine side.

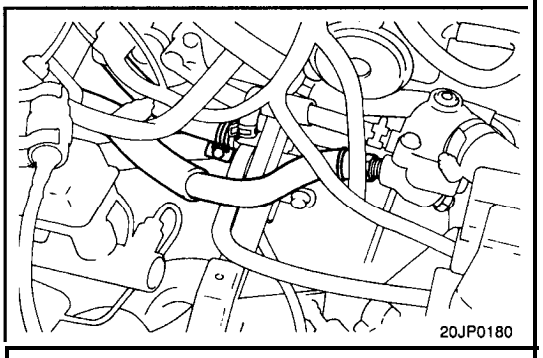
CAUTION
To reduce the residual pressure in the hoses, refer to Group Fuel System “Fuel filter replacement”.

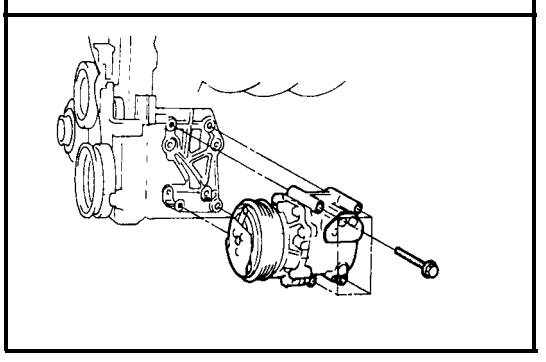
13. Disconnect the heater hoses (inlet and outlet) on the engine side.
14. Disconnect the accelerator cable at the engine side.
15. For vehicles with a manual transaxle, remove the clutch cable from the transaxle.
16. For vehicles with an automatic transaxle, remove the control cable from the transaxle.

17. Disconnect the speedometer cable from the transaxle.
18. Disconnect the air conditioning from the mounting bracket.


20JP0160


20JP0170


20JP0180



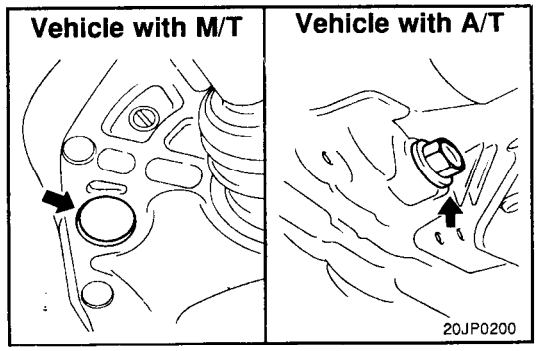
19. Jack up the vehicle.
20. Drain the transaxle oil (or fluid).
21. Disconnect the front exhaust pipe from the manifold.

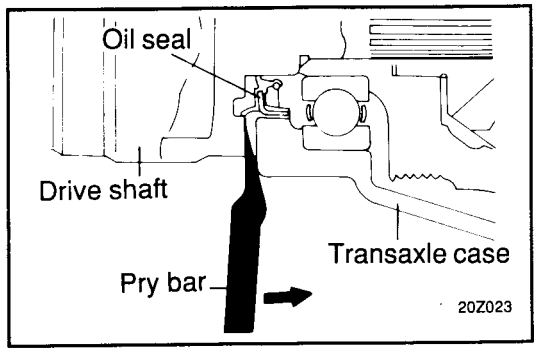
NOTE
Use wire to suspend the exhaust pipe from the bottom of the vehicle.

22. For vehicles with a manual transaxle, remove the shift control rod and extension rod.
23. Remove the lower arm ball joint bolts and the stabilizer bar at the point where it is mounted to the lower arm.
24. Remove the drive shafts from the transaxle case.

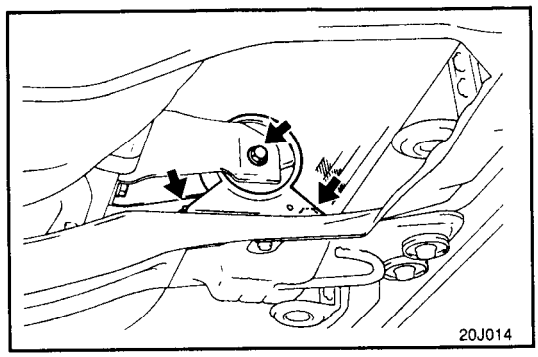
CAUTION
1) Plug the holes of the transaxle case to prevent entry of foreign material.
2) Install new circlips on the drive shafts when reassembling.

25. Hang the lower arm and drive shaft from the body with a string.
26. Attach a cable to the engine, and use a chain hoist to lift the engine only enough to pull cable tight.

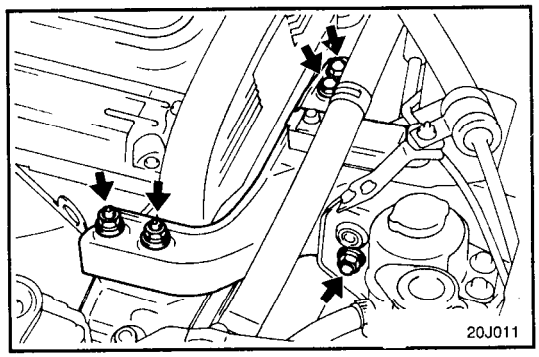




27. Remove the front roll stopper.
28. Separate the rear roll stopper.



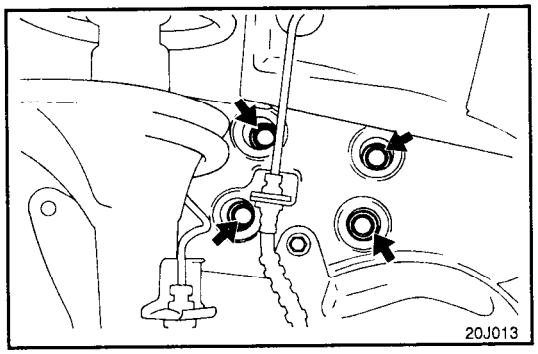
29. Remove the engine mounting insulator bolts.
30. Remove the engine mounting bracket from the engine.



31. Slowly raise the engine (to the extent that the engine and transaxle weights are not applied to the mounting portions) and temporarily hold it in the raised condition.

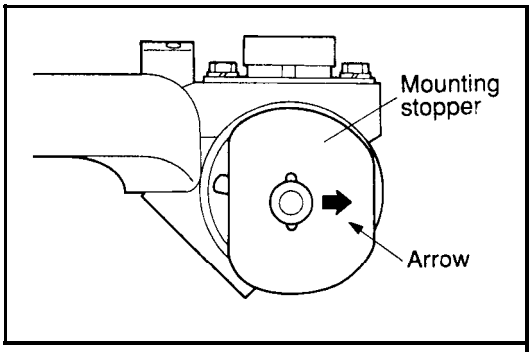
CAUTION
Check that all of the cables, hoses, harnesses, connectors etc. are disconnected from the engine.

32. Remove the caps from inside the right fender shield and remove the transaxle mount bracket bolts.
33. Remove the left mount insulator bolt.
34. While directing the transaxle side downward, lift the engine and transaxle assembly up and out of the vehicles.

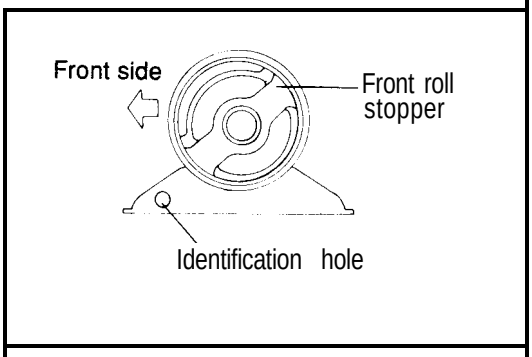


INSTALLATION

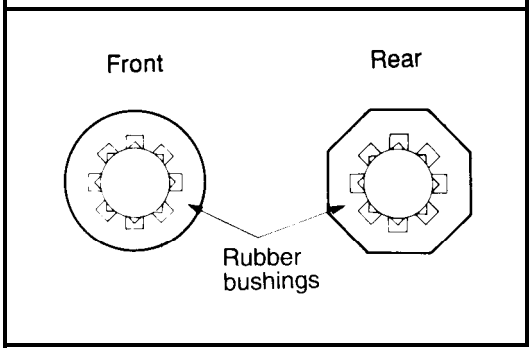
1. While checking the connections of the harnesses, pipes, hoses, etc., and making sure that none of them are being caught, damaged, etc., install the engine and transaxle assembly.
2. Install the mounting stoppers with the arrows on them pointing in the direction shown.



3. When the engine and transaxle assembly is in place temporarily tighten the front roll stopper.



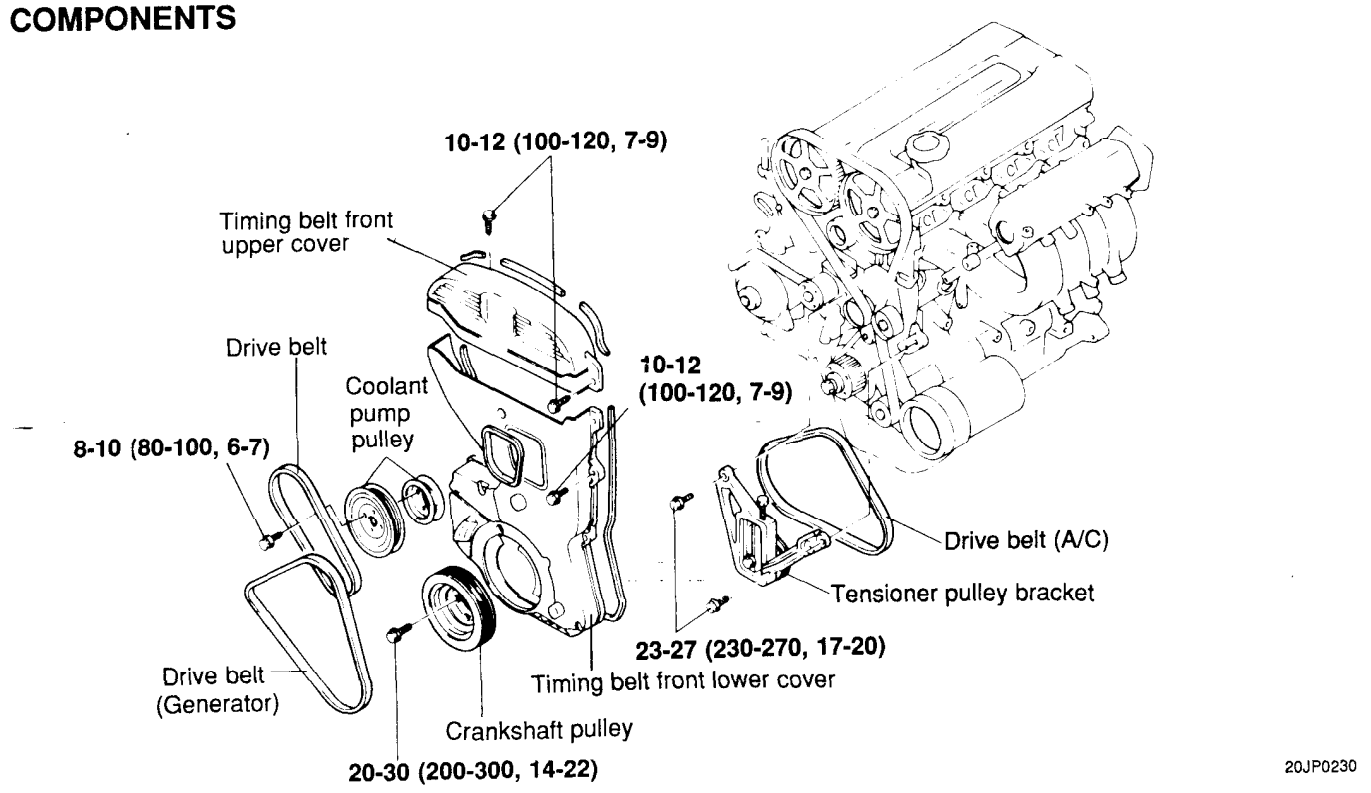
4. The front and rear center member rubber bushings and collars are different.

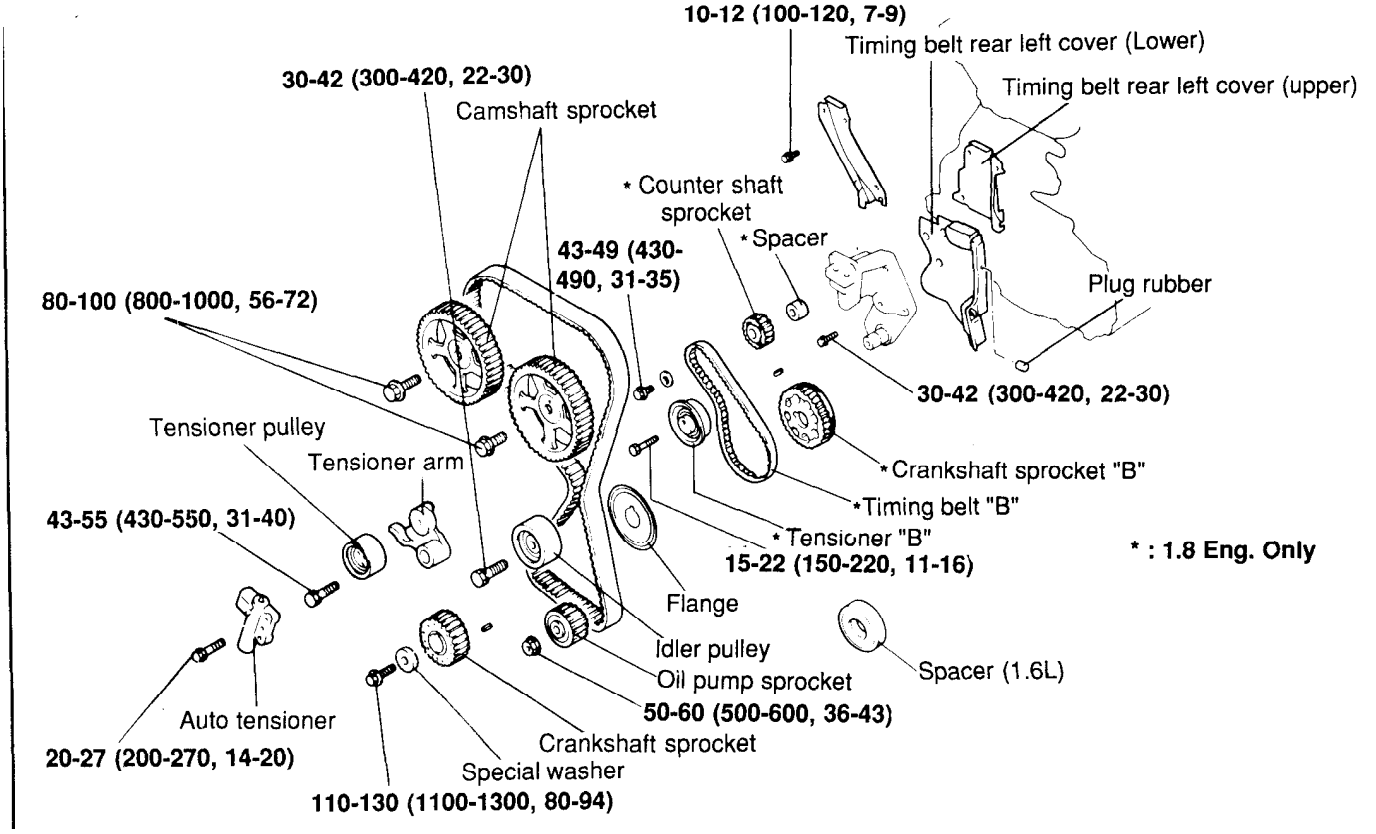


5. After the weight of the engine and transaxle assembly has been put on each insulator, tighten to specified torque.
6. Reassemble all of the components removed during disassembly. Be especially careful to properly secure all components, including fuel, electrical and fluid pipe connections.
7. Refill the coolant and check for leaks.
8. Refill the transaxle fluid, test its operation, and check for leaks.
9. Check the operation of the transaxle control cable and accelerator cable. Adjust as necessary.
10. Check for proper operation of each of the various gauges.

TIMING BELT

COMPONENTS





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

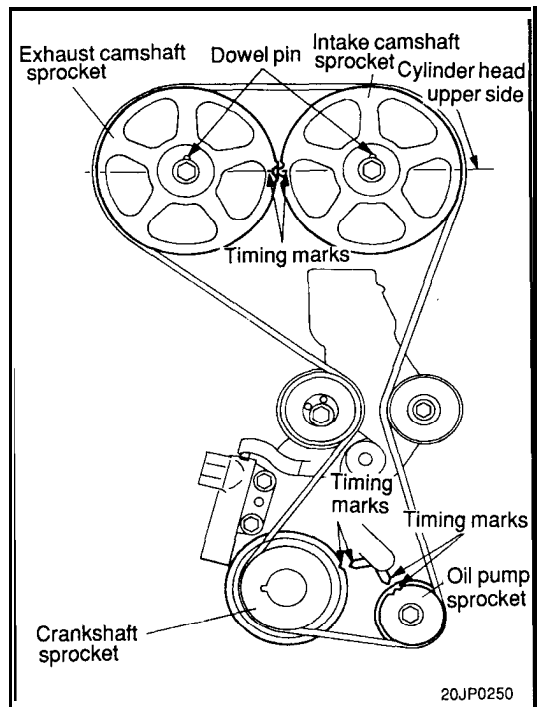
REMOVAL

[Step 6-10 for 1.8L Eng.]

1. Remove the crankshaft pulley, engine coolant pump pulley and drive belt.
2. Remove the timing belt cover.
3. Turn the crankshaft clockwise and align the timing marks so as to bring the No. 1 cylinder to compression top-dead-center position.

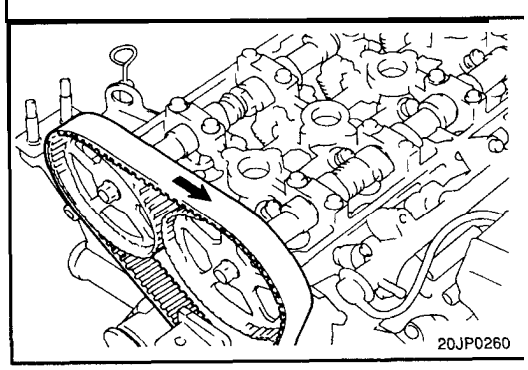
   At this time the timing marks of the camshaft sprocket and the upper surface of the cylinder head should coincide, and the dowel pin of the camshaft sprocket should be at the upper side. Remove the auto tensioner.

   CAUTION
   Rotate the crankshaft clockwise.



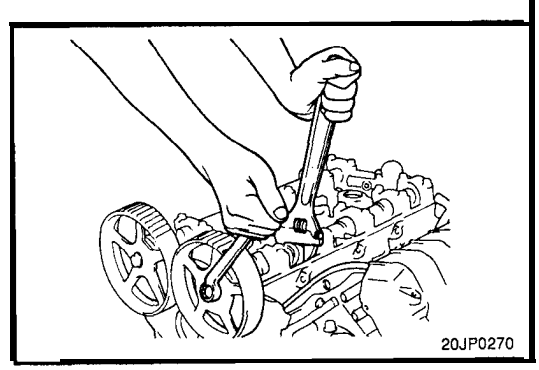
4. Remove the timing belt.

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

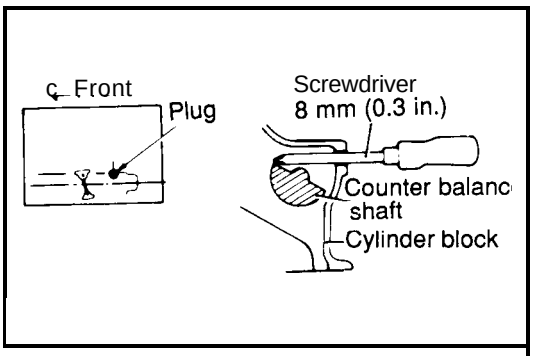


5. Remove the camshaft sprockets.

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



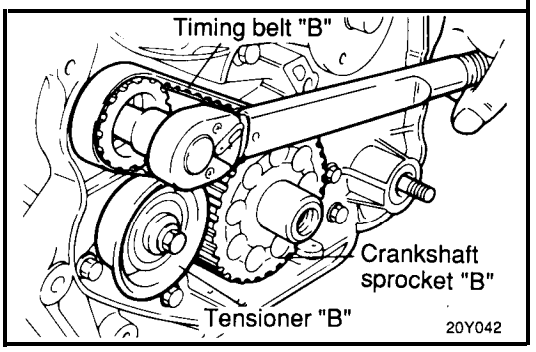
6. When the oil pump sprocket nut is removed, first remove the plug at left side of the cylinder block and insert a screwdriver to keep the left counter balance shaft in position.
   Screwdriver used for this purpose should have a shaft 8mm (0.3 in.) in diameter which can be inserted more than 60 mm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



8. Loosen the right counter balance shaft sprocket mounting bolt until it can be loosened by hand.
9. Next, remove tensioner “B” and remove timing belt “B”.

-CAUTION
After timing belt “B” has been removed, do not attempt loosening bolt, while holding sprocket with pliers, etc.

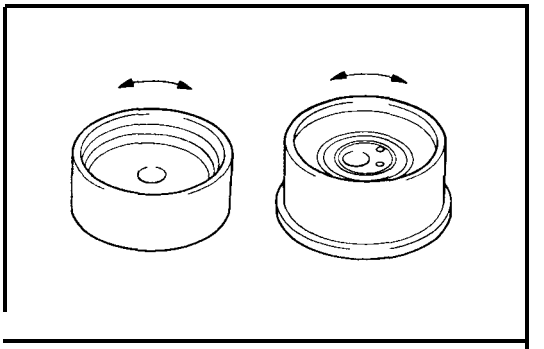
1O. Remove the crankshaft sprocket “B” from crankshaft



INSPECTION

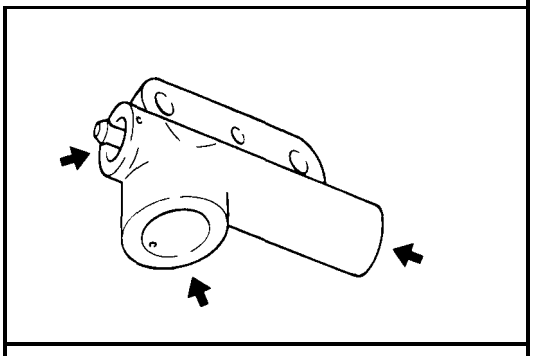
Sprockets, Tensioner Pulley, and Idler Pulley

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



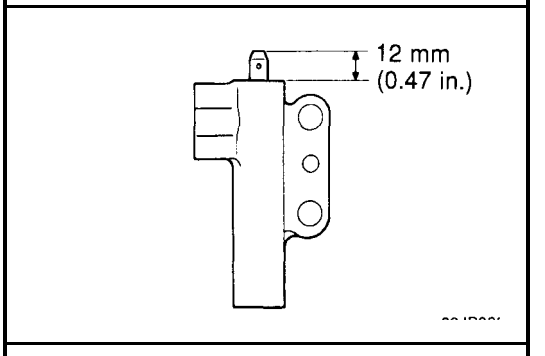
Auto Tensioner

1. Check the auto tensioner for leaks and replace as necessary.
2. Check the rod end for wear or damage and replace as neces--sary.



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

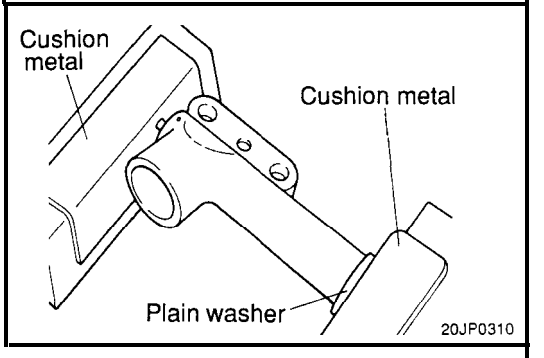
Standard value	12 mm (0.47 in.)



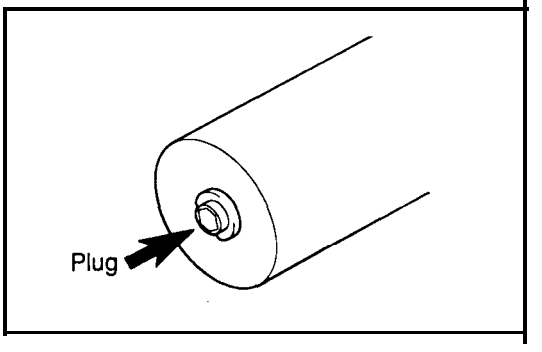
4. Using a vise soft jaws push in the auto tensioner rod. If the rod can be easily retracted, replace the auto tensioner. You should feel a fair amount of resistance when pushing the rod in.

CAUTION

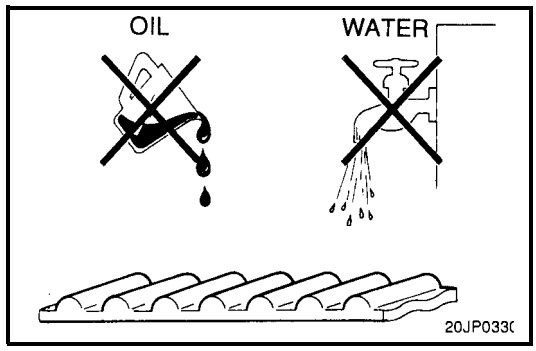
1. Clamp the auto tensioner in the vise so that it is level. Use soft jaws in the vise to avoid damaging the auto tensioner.



2. If the plug is at the bottom of the auto tensioner, insert a plain washer to prevent direct contact if the plug with the vise.

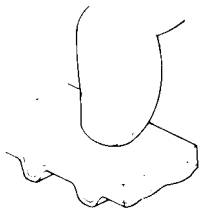


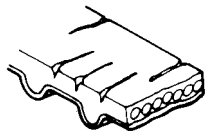
Timing Belt

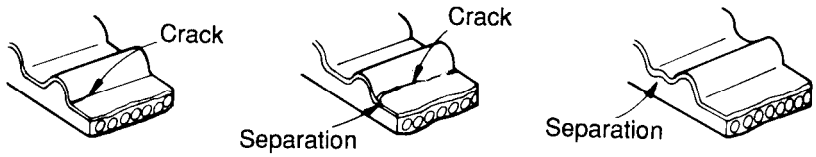


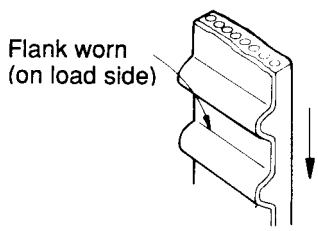
1. Check the belt for oil or dust deposits. Replace if necessary. Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension adjusted, check the belt in detail. If the following flaws are evident, replace the belt with a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

Description	Flaw conditions
1. Hardened back surface rubber	Back surface glossy. Non-elastic and so hard that when a finger nail is forced into-it, no mark is produced.
2. Cracked back surface rubber	
3. Cracked or separating canvas	
4. Badly worn teeth (initial stage)	Canvas on load side tooth flank worn (Fluffy canvas fibers, rubber gone and color changed to white, and unclear canvas texture)

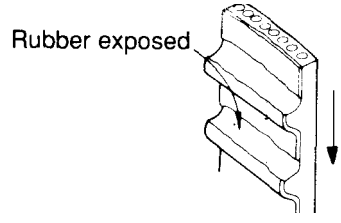


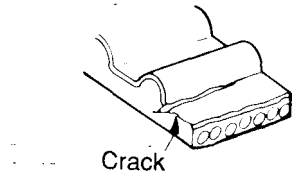


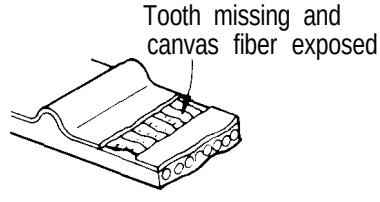


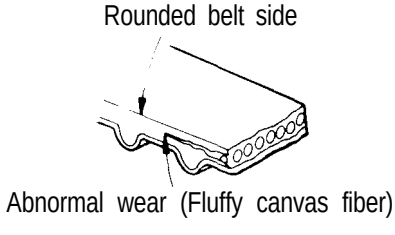


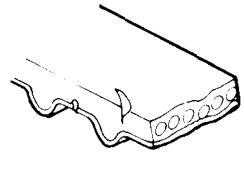
Description	Flaw conditions
5. Badly worn teeth (last stage)	Canvas on load side tooth flank worn down and rubber exposed (tooth width reduced)
6. Cracked tooth bottom	
7. Missing tooth	
8. Side of belt badly worn	
9. Side of belt cracked	NOTE Normal belt should have precisely cut sides as if produced by a sharp knife.









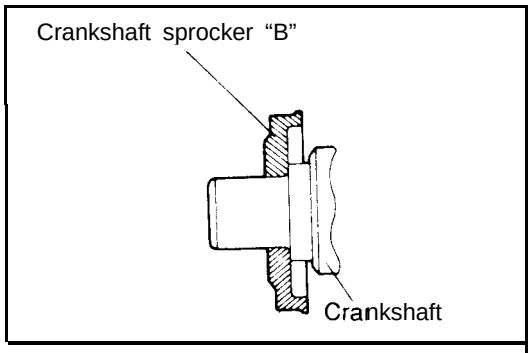


INSTALLATION

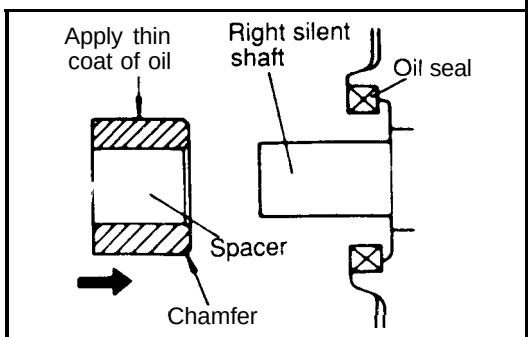
[Step 1-9, 11-12 for 1.8L Eng.]

1. Install crankshaft sprocket “B” into crankshaft.

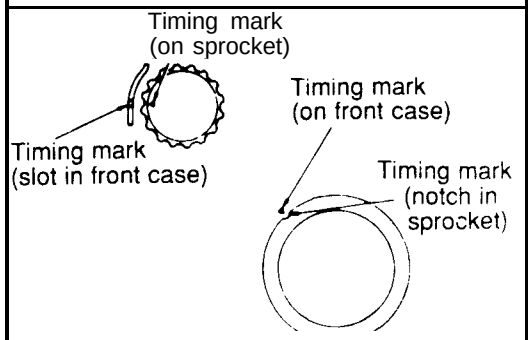
CAUTION
Pay special attention to the direction of the flange. if it is installed in the wrong direction, a broken belt could result.



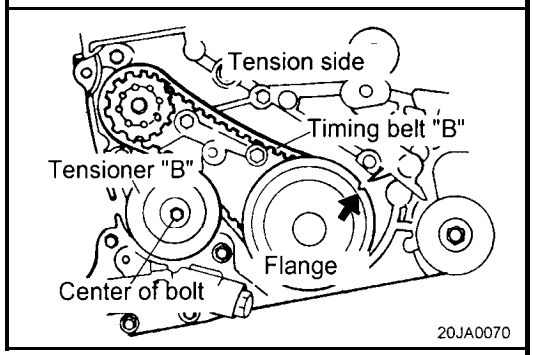
2. Lightly apply engine oil to the outer surface of spacer, and then install in the direction as shown in illustration.
3. Install counter balance shaft sprocket onto right counter balance shaft, and then tighten flange bolt finger tight.



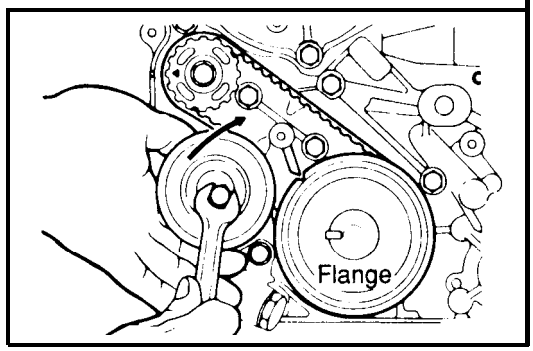
4. Align timing mark on each sprocket with corresponding timing mark on the front case.



5. When timing belt “B” is installed, make certain that tension side has no slack.
   Install tensioner ”B” with center of pulley located on the left side of mounting bolt and with pulley flange directed toward front of engine.

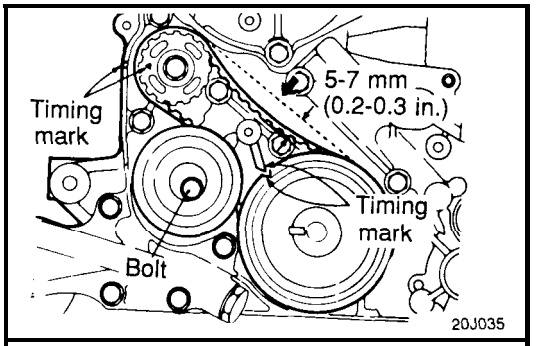


6. Lift tensioner ”B” to tighten timing belt “B” so that its tension side will be pulled tight. In this condition, tighten bolt to secure tensioner ”B”. When bolt is tightened, use care to prevent shaft from turning together. If shaft is turned together, belt will be over-tightened.



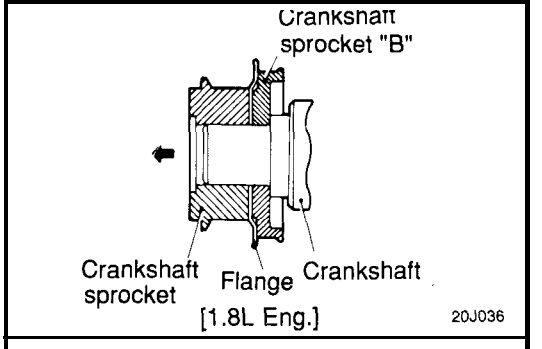
7. Check to ensure that timing marks are in alignment.
8. Check to ensure that when center of span on the tension side is depressed with index finger in direction of arrow, deflection of belt is within specification.

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



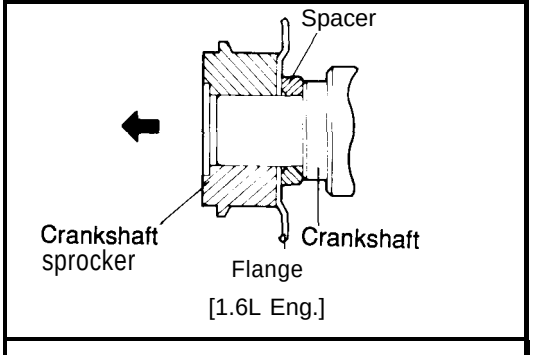
9. install flange crankshaft sprocket onto crankshaft. Be sure to install in the direction as shown in illustration.

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

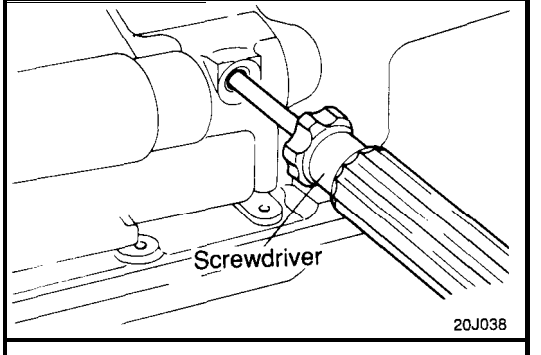


10. Install special washer and sprocket bolt to crankshaft, and then tighten the sprocket bolt. [for 1.6L Eng.]

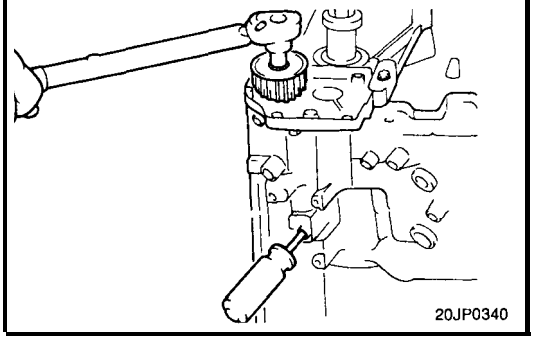
Tightening torque	
Crankshaft sprocket bolt	110-130 Nm (1100-1300 kg.cm, 80-94 lb.ft)



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

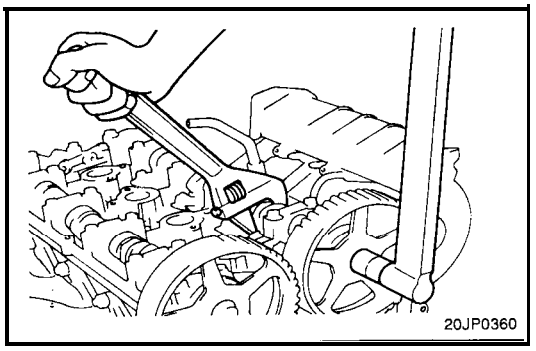


12. Install the oil pump sprocket, and tighten the nut to the specified torque.



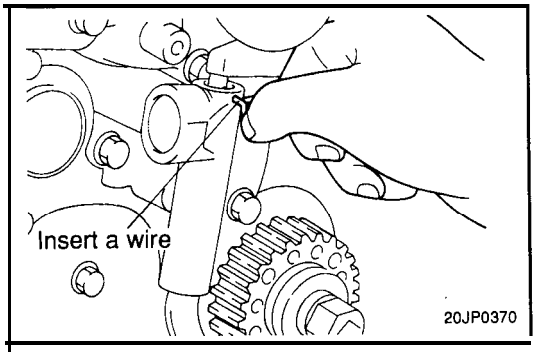
13. Install the camshaft sprocket and tighten the bolt to the specified torque.

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



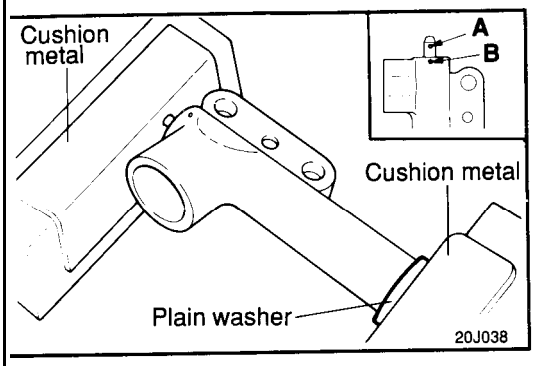
14. Install the auto tensioner.

CAUTION
Leave the wire installed in the auto tensioner



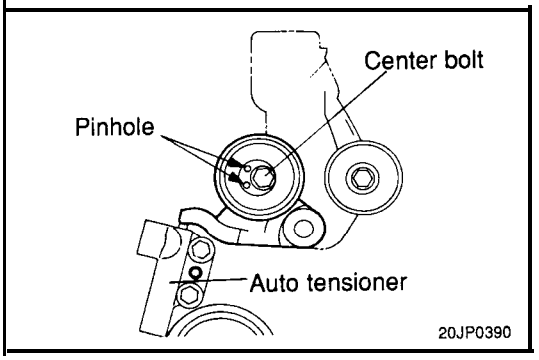
NOTE
If the auto tensioner rod is in its fully extended position, reset it as follows.

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

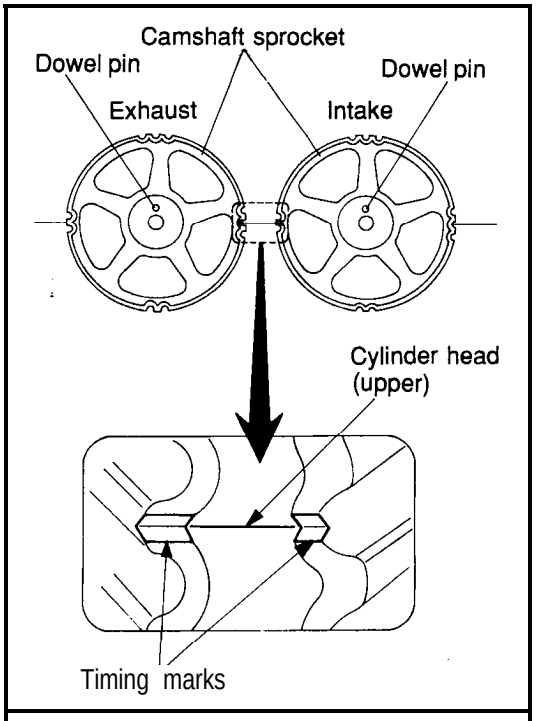


15. Install the tensioner pulley onto the tensioner arm. And locate the pinhole in the tensioner pulley shaft to the left of the center bolt and then tighten the center bolt finger-tight.

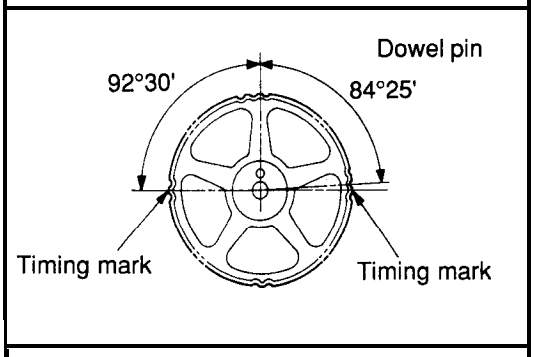
CAUTION
Leave the wire installed in the auto tensioner.



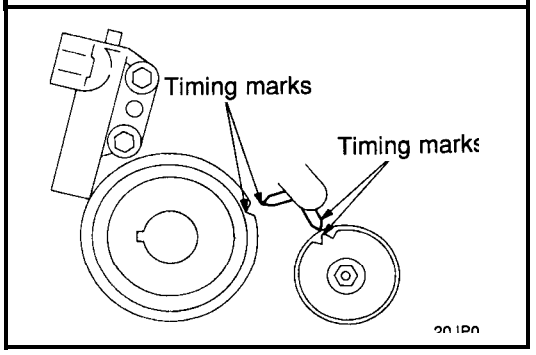
16. Turn the two sprockets so that their dowel pins are located on top. Then, align the timing marks facing each other with the top surface of the cylinder head.



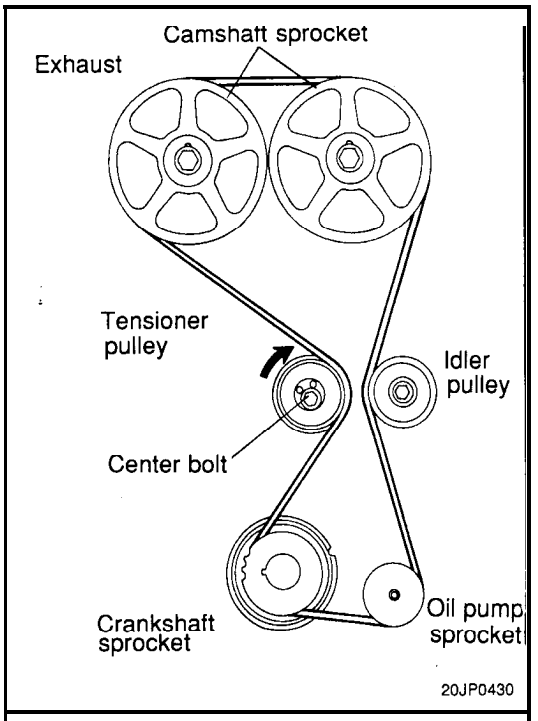
NOTE
The same camshaft sprocket is used for the Intake and exhaust camshafts and is provided with two timing marks. When the sprocket is mounted on the exhaust camshaft, use the timing mark on the right with the dowel pin hole on top. For the intake camshaft sprocket, use the one on the left with the dowel pin hole on top.



17. Align the crankshaft sprocket timing marks.
18. Align the oil pump sprocket timing marks.

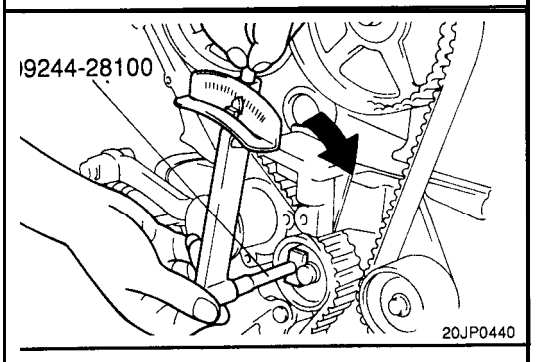


19. Install the timing belt around the tensioner pulley and crankshaft sprocket. Then secure the timing belt onto the tensioner pulley with your left hand.
20. Pulling the belt with your right hand, install it around the oil pump sprocket.
21. Install the belt around the idler pulley.
22. Install it 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 5]. Then, pulling the belt with both hands, install it around the exhaust camshaft sprocket.
24. Gently raise the tensioner pulley as shown by the arrow, so that the belt does not sag, and temporarily tighten the center bolt.

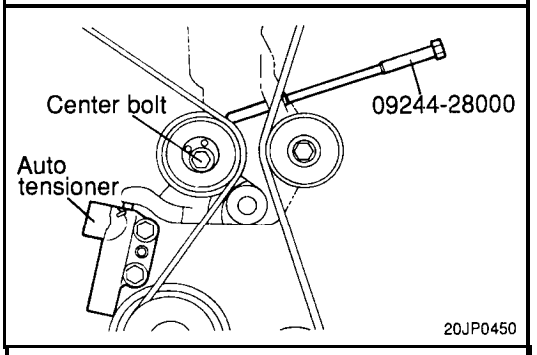


25. After turning the crankshaft 1/4 turn counterclockwise, turn it clockwise to move the No. 1 cylinder to top dead center.
26. Loosen the center bolt, and then, as shown in the illustration, attach the special tool and a torque wrench and apply a torque of 2.6-2.8 Nm (1.88-2.03 lb.ft.).
    If the body interferes with the special tool and the torque wrench, use a jack to slightly raise the engine assembly.

    NOTE
    Use a torque wrench measuring within a range of 0-3 Nm (0-2.2 lb.ft.).



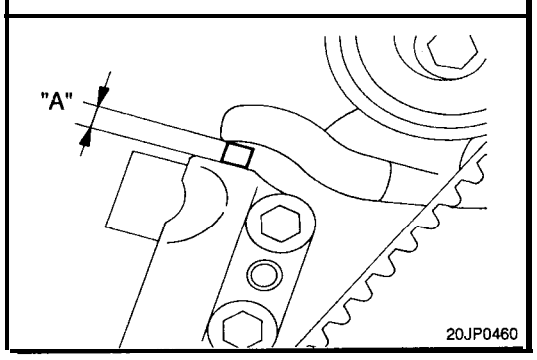
27. Holding the tensioner pulley with the special tool and torque wrench, tighten the center bolt to specification. Screw the special tool into the engine left support bracket until its end makes contact with the tensioner arm. At that point, screw the special tool some more and then remove the set wire attached to the auto tensioner.
28. Remove the special tool.



29. Rotate the crankshaft two complete turns clockwise and leave it as is 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 up to specification.

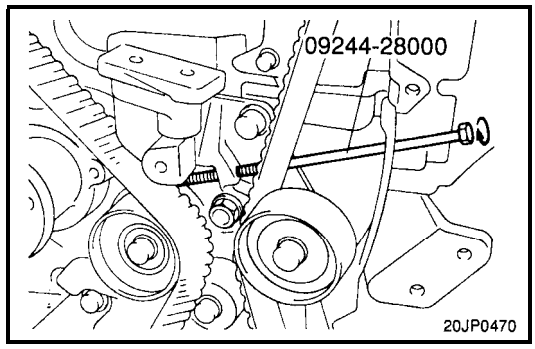
Standard value	3.8-4.5 mm (0.15-0.18 in.)

    If it is out of specification, repeat steps 25 through 29 until the specified value is obtained.



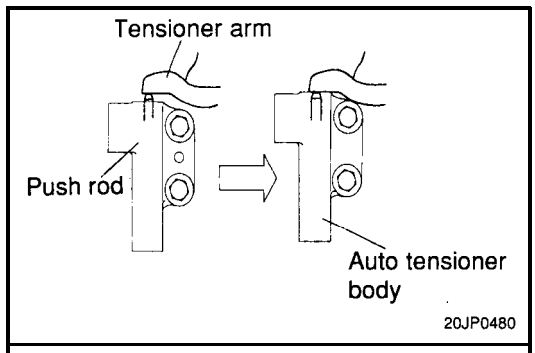
NOTE
If the clearance "A" between the tensioner arm and the auto tensioner body cannot be measured (When the engine is mounted on the vehicle, for example), the following alternative method may be used.

1. Screw in the special tool until its end makes contact with the tensioner arm.

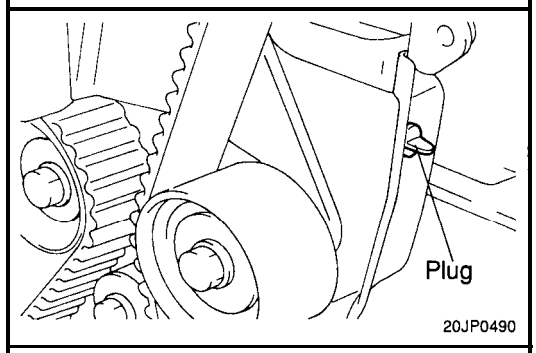


2. Starting with that position, screw in the special tool some more to retract the auto tensioner push rod while counting the number of turns of the tool makes until the tensioner arm is brought into contact with the auto tensioner body.
   Make sure that the number of turns the special tool makes conforms with the standard value.

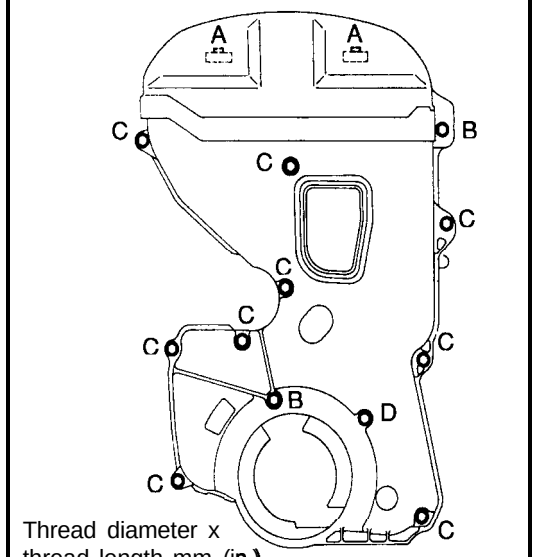
Standard value	2.5-3 turns



30. Install the rubber plug to the timing belt rear cover.



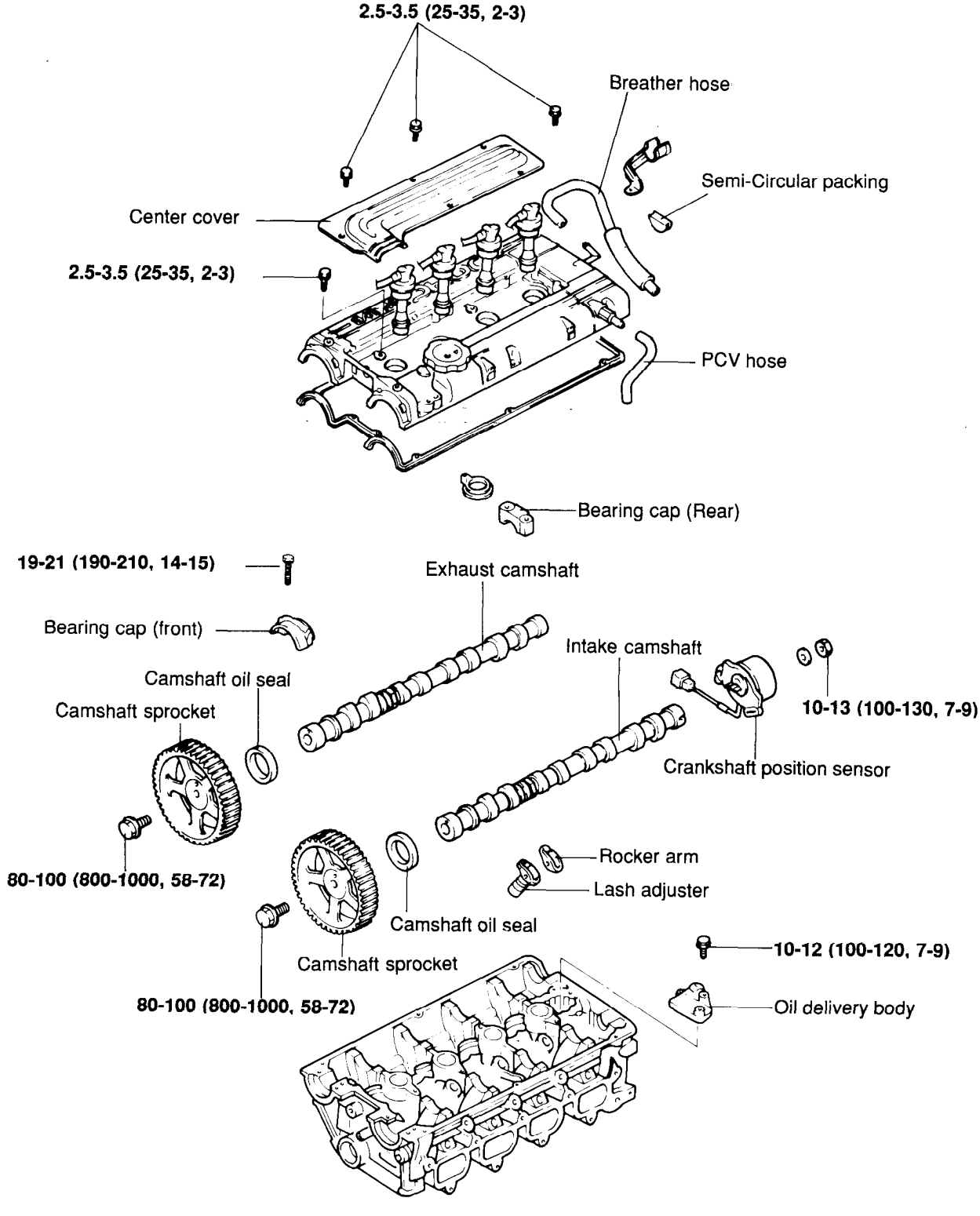
31. Install the timing belt lower cover and the timing belt upper cover.



Thread diameter x thread length mm (in.)
A: 6 x 16 (0.24 x 0.63)
B: 6 x 25 (0.24 x 0.98)
C: 6 x 18 (0.24 x 0.71)
D: 6 x 28 (0.24 x 1.10)

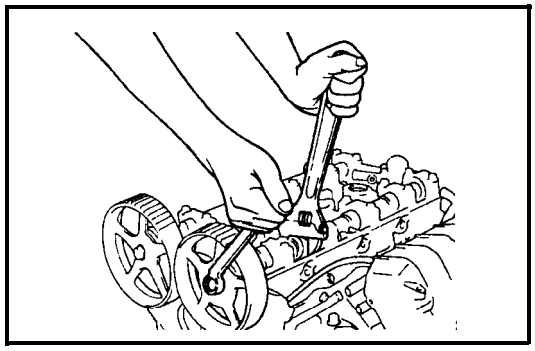
CAMSHAFTS AND ROCKER ARMS

COMPONENTS



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

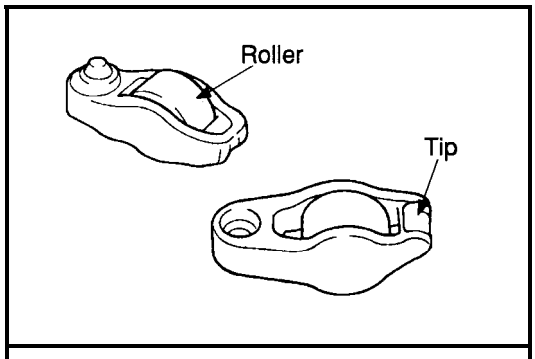
REMOVAL



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

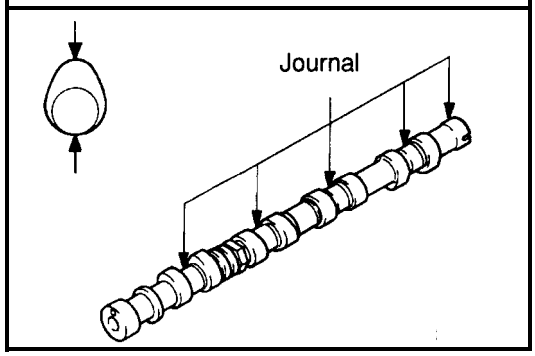
INSPECTION

Rocker Arms



1. Check rotation of the roller. If it does not rotate smoothly or if looseness is evident, replace it.
2. Check the roller. Replace there are any dents, damage or evidence of seizure.
3. Check the valve contact surface for possible damage or seizure and replace as necessary.

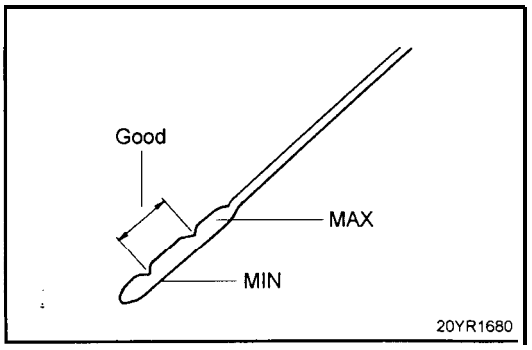
Camshafts



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

Cam height	
[Standard]	
1.6L Eng.	
Intake	35.200 mm (1.3858 in.)
Exhaust	34.907 mm (1.3743 in,)
1.8L Eng.	
Intake	35.493 mm (1.3974 in.)
Exhaust	35.200 mm (1.3858 in.)
[Limit]	
1.6L Eng.	
Intake	34.700 mm (1.3661 in.)
Exhaust	34.407 mm (1.3546 in.)
1.8L Eng.	
Intake	34.993 mm (1.3777in.)
Exhaust	34.700 mm (1.3661 in.)

Auto Lash Adjuster Check



1. Check the engine oil, and refill or replace oil if necessary.

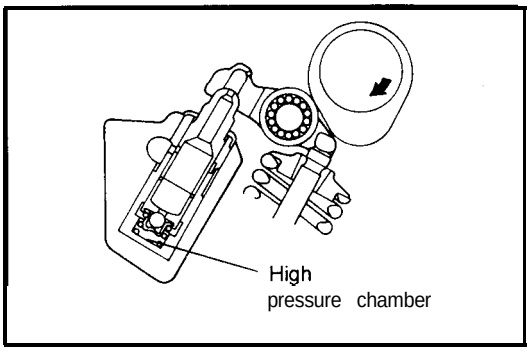
NOTE

1. **If the oil amount is small, air will be sucked from the oil strainer and mixed in the oil passage.**
2. **If the oil amount is excessive, the oil will be stirred by the crank and mixed with a large amount of air.**
3. **Air and oil can not be separated easily in the deteriorated oil, and the amount of air mixed in the oil increases.**

If such air mixed in the oil enters the high pressure chamber in the auto lash adjuster, the air in the high-pressure chamber will be compressed while the valve is opened, the auto lash adjuster will be excessively compressed and abnormal noise will be occurred when the valve is closed.

In this case, however, it will return to be normal when the air entrapped in the adjuster is released.

Above phenomenon can be occurred when the valve clearance is improperly adjusted to be excessive large.



2. Start and slowly race the engine several times (10 times or less).

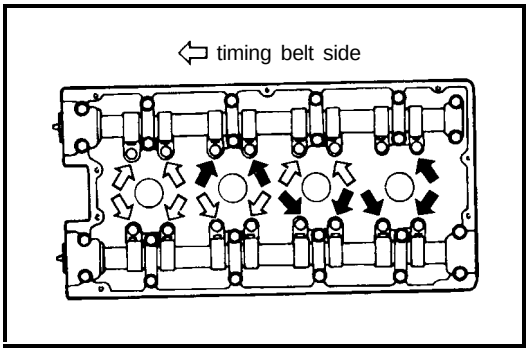
If the abnormal noise is eliminated by racing the engine, it means that the air has been released from the high-pressure chamber of the lash adjuster and the function of the lash adjuster is returned to normal.

*Gradually increase the engine speed from the idle to 3,000 rpm (for 30 seconds), and then gradually slow down the engine to the idling speed (for 30 seconds).

NOTE

1. **If the vehicle is parked on a slope for a long time, the oil will be sometimes reduced from the lash adjuster, and air will enter the high-pressure chamber when the engine is started.**
2. **After the vehicle is parked for a long time, the oil will go out of the oil passage. Since it takes a little time to supply oil to the lash adjuster, air sometimes enters the high-pressure chamber.**

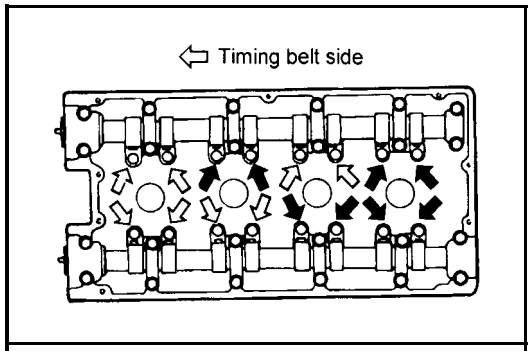
3. If any abnormal noise is not eliminated by racing, check the lash adjuster.

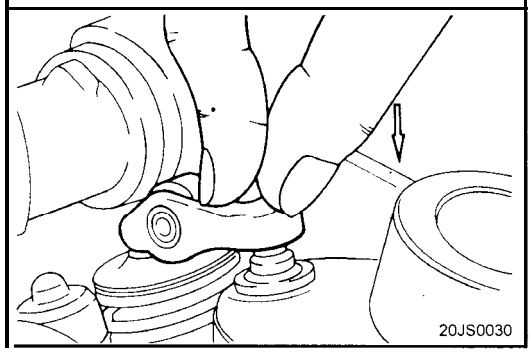


1) Stop the engine.
2) Set the engine so that cylinder No. 1 is positioned at the top dead center of the compression cycle.
3) Press the rocker arm at the area indicated by the arrow mark (⇨) to check whether the rocker arm is lowered or not.
4) Slowly turn the crankshaft 360 degrees clock wise.

5) In the same procedure as Step 3) check the rocker arm at the area indicated by the arrow (➡) mark.
6) If the rocker arm is lowered easily when pressing the rocker arm as shown in right illustration, the lash adjuster defective and must be replaced. Replace the lash adjuster according to the following procedure.
When replacing the lash adjuster, bleed the air from all adjusters and assemble them. Then inspect referring to the step 1) to 5) and confirm that there are no abnormalities.

NOTE
The lash adjuster can be accurately checked for defects with the leak down test.
If the rocker arm is extremely hard when it is pressed down, the lash adjuster is normal, so please consider other cause of abnormal sound.



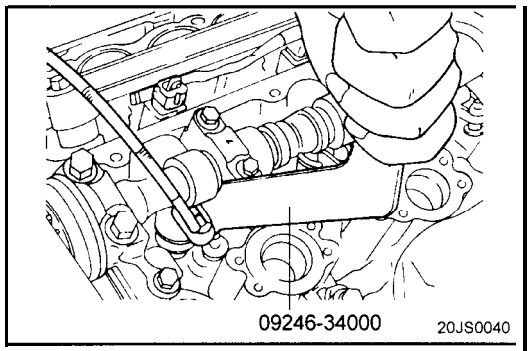


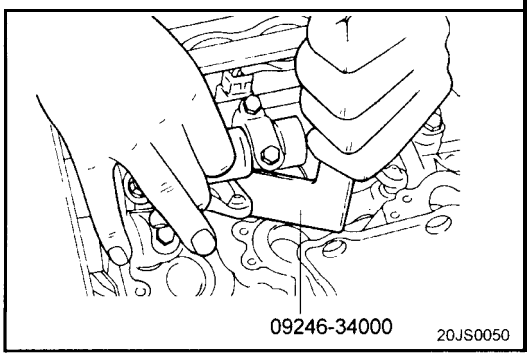
Auto Lash Adjuster Replacement

CAUTION
In the cylinder from which the auto lash adjuster is to be removed, the valve will contact the piston when the valve is pressed down, so turn the crankshaft and lower the position of the piston.
The rocker arms lifted by the cam cannot be removed. In this case, turn the crankshaft to lower the cam height, and then remove.

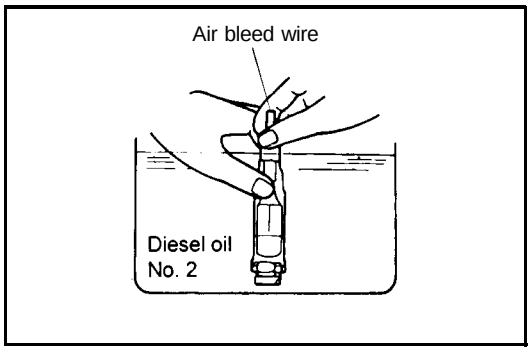
1. Use the special tool (09246-34000) to press the valve and then remove the roller rocker arm.
2. Pull out the auto lash adjuster after bleeding from the cylinder head.
3. Assemble the new lash adjuster onto the cylinder head.
4. Use the special tool to press the valve and then install the roller rocker arm.

NOTE:
When installing the rocker arm, place the pivot side of the rocker arm onto the lash adjuster first. Then place the slippery side of the rocker arm onto the valve stem end.





Bleeding Auto Lash Adjuster



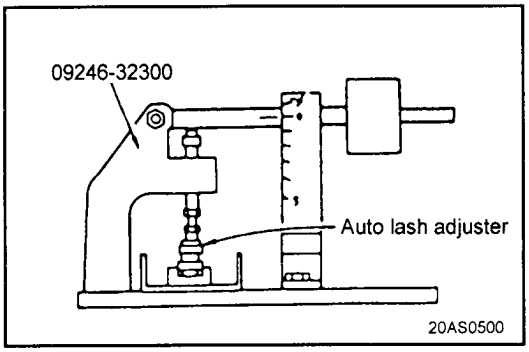
1. With inserting a air bleed wire into the hole of the auto lash adjuster, move the plunger up and down 4 or 5 times.
2. Remove the air bleed wire and push the plunger strongly by finger.
   If it moves eve slightly, repeat steps 1 and 2. If the plunger moves even after repeating the steps several times, replace the auto-lash adjuster.

CAUTION

1. Since the auto-lash adjuster is a precision part, take care that foreign objects such as dirt are not entered when servicing. Do not attempt to disassemble the auto-lash adjuster. Use clean Diesel oil for cleaning the auto-lash adjuster.

-2. The fully bled auto-lash adjuster should be hold in up-right position to make sure the Diesel oil in the adjuster is not split.

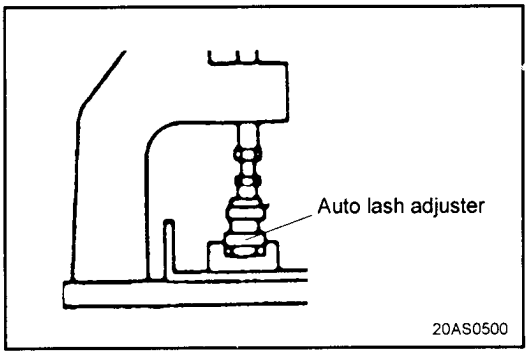
Auto Lash Adjuster Leak Down Test



1. Set a auto-lash adjuster in a special tool (09246-32300) as shown.
2. After the plunger has fallen slightly [0.2-0.5 mm (0.008-0.020 in.)], measure the subsequent fall-down rate.

Standard fall-down rate:
..... 5 to 20 seconds/mm
[Diesel No.2 oil or equivalent
with temperature 15-25°C (59-77°F)]

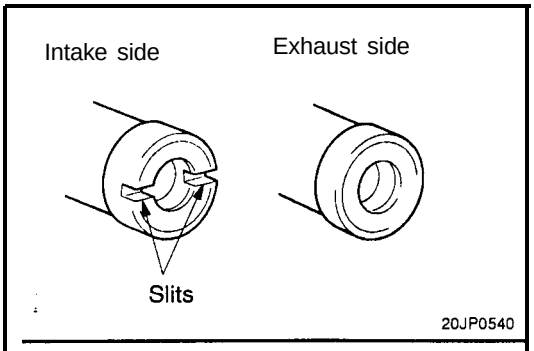
3. If a leak-down tester is not available, check the auto-lash adjuster as follows.
   1) Check if there is any abnormal noise with idling at normal operating temperature.
   2) If there is abnormal noise, air bleeding from the auto lash adjuster should be needed.
   3) Bleed the air referring to the step then check for abnormal noise while the engine is in idling state.
   4) If there is still abnormal noise, replace the auto-lash adjuster.



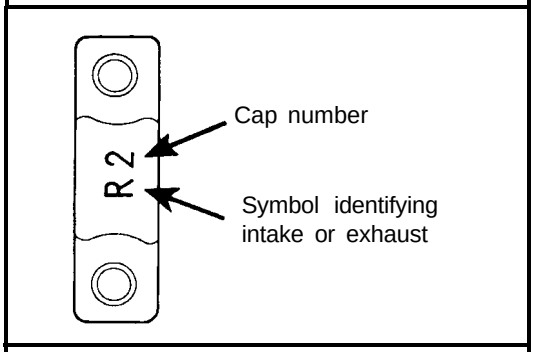
INSTALLATION

1. Install the camshafts on the cylinder head.

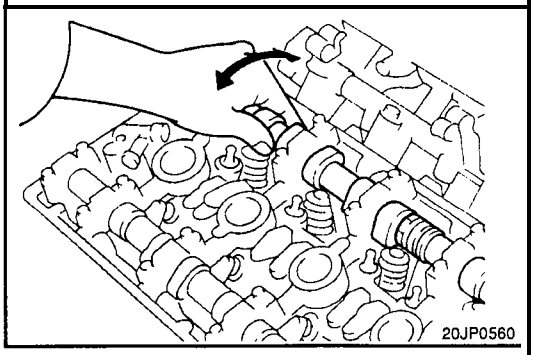
   NOTE
   1. Apply engine oil to journals and cams of the camshafts.
   2. The intake camshaft has a slit on Its rear end for driving the crank angle sensor.



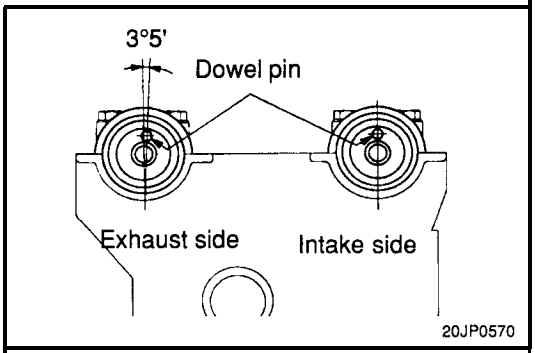
2. Install the bearing caps. Check the markings on the caps for intake/exhaust identification symbol.
   L : Intake camshaft
   R : Exhaust camshaft



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



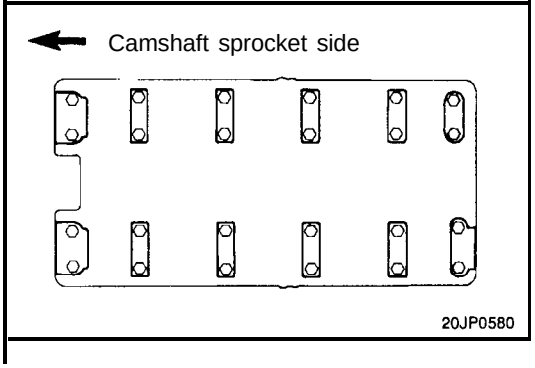
4. Make sure that the dowel pins on the camshaft sprocket end are located on the top.



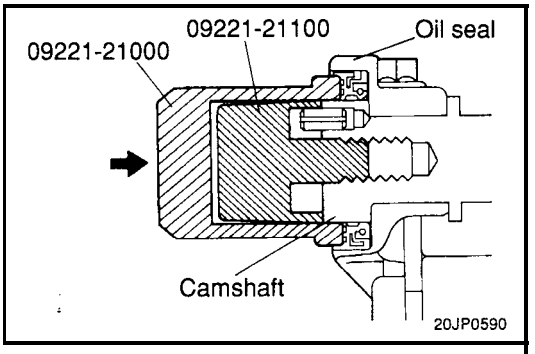
5. Tighten the bearing caps to the specified torque in two or three steps as shown.

   NOTE
   Tighten the rocker arms uniformly.

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

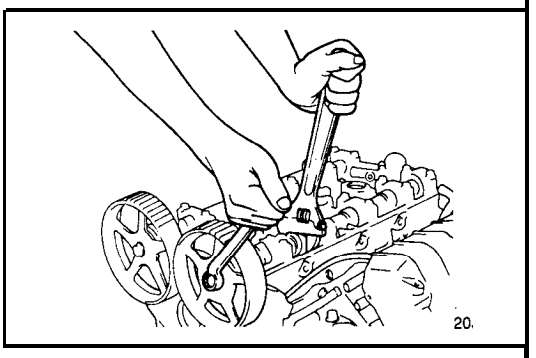


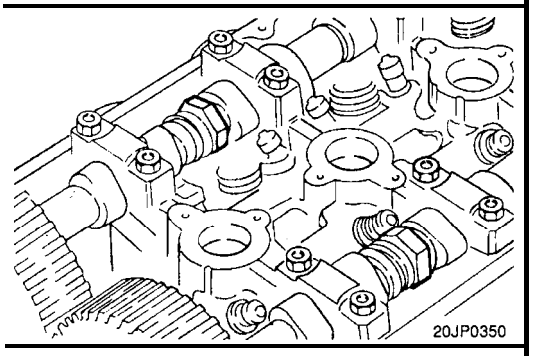
6. Using special tools, Camshaft Oil Seal Installer and guide (09221-21000,09221-21100), press fit the camshaft oil seal. Be sure to apply engine oil to the external surface of the oil seal. Insert the oil seal along the camshaft front end and install by driving the installer with a hammer until the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



7. Install the camshaft sprockets to the specified torque.

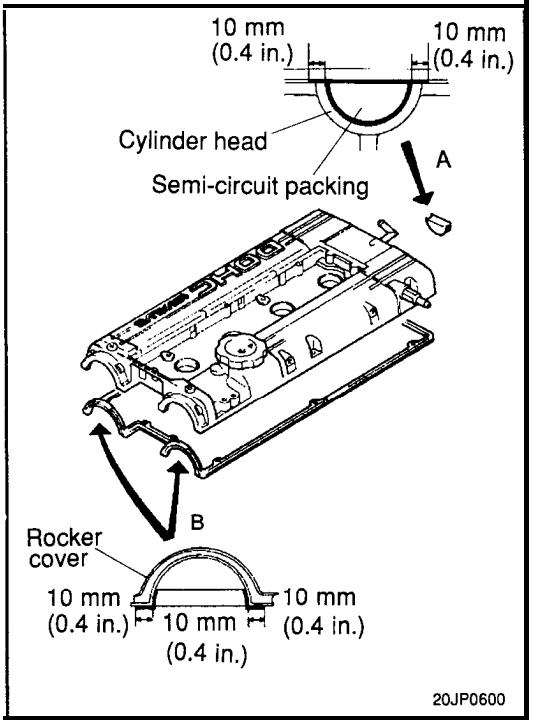
Tightening torque	
Camshaft sprocket bolts	80-100 Nm (800-1000 kg.cm, 58-72 lb.ft)



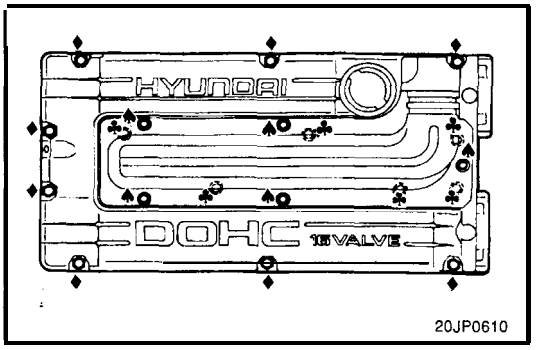


8. Install the rocker cover. Apply sealant as shown.

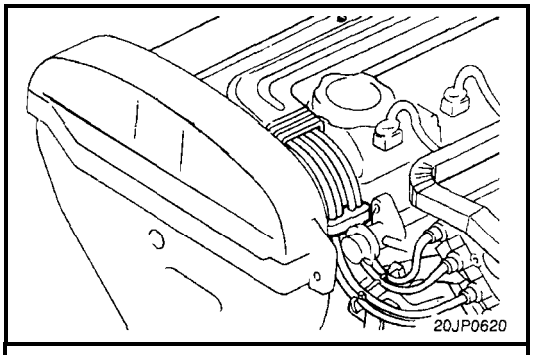
Tightening torque	
Rocker cover bolts	2.5-3.5 Nm (25-35 kg.cm, 2-3 lb.ft)
Sealant	
A Portion	Threebond No. 10 or equivalent
B Portion	Threebond No. 1212D or equivalent



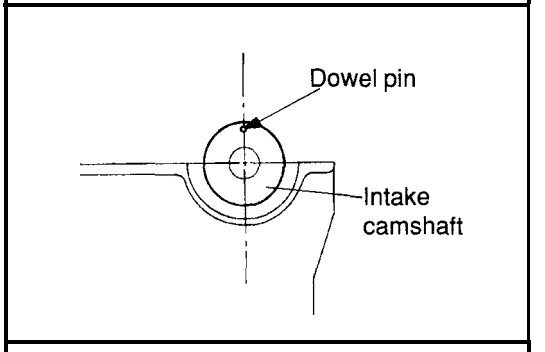
Bolt length x Diameter
♦ :25mmx6mm
♣ :20mmx6mm
♠ :15mmx6mm



9. Install the spark plugs, center cover and the rubber as shown in the illustration.

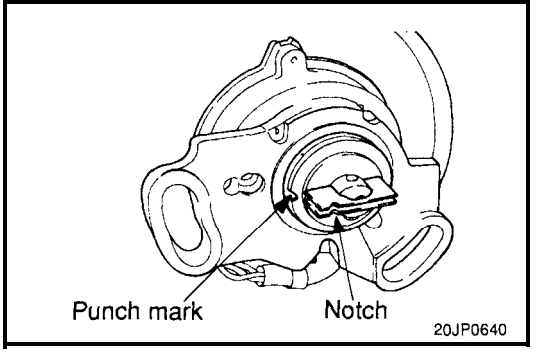


10. Locate the dowel pin on the sprocket side of the intake camshaft at the top.



11. Align the punch mark on the crankshaft position sensor housing with the notch in plate.

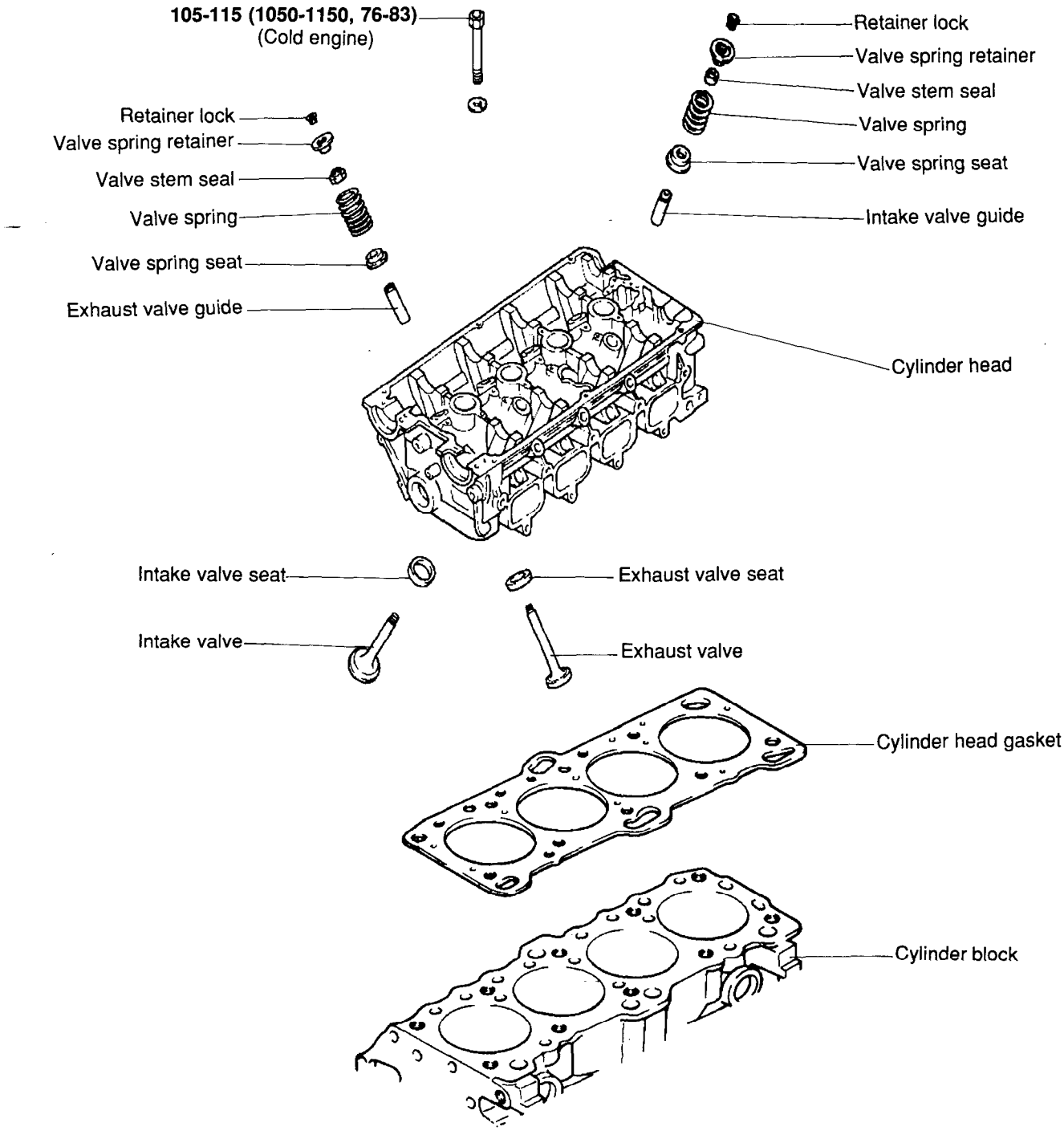
NOTE
The crankshaft position sensor can be Installed even when the punch mark is positioned opposite the notch; however, the position results in incorrect fuel injection and ignition timings.



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

CYLINDER HEAD AND VALVES

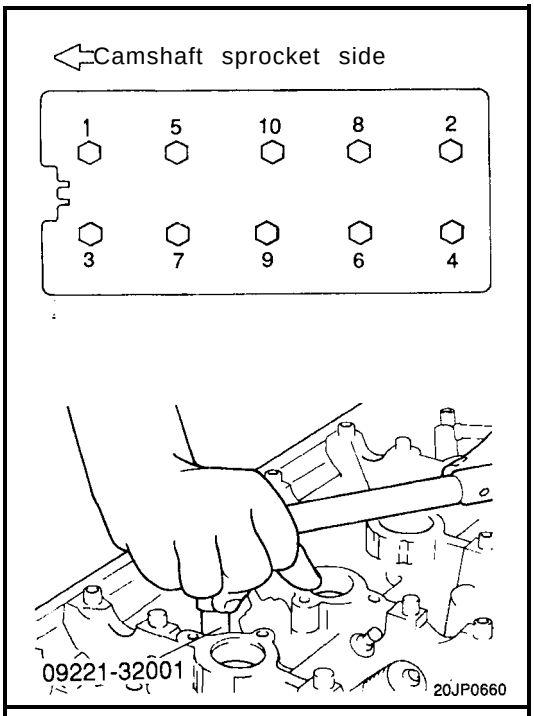
COMPONENTS



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

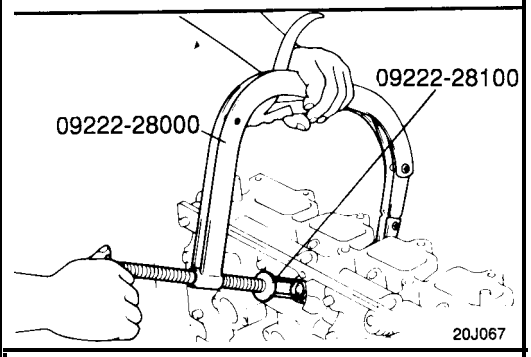
REMOVAL

1. Using the special tool, Cylinder Head Bolt Wrench (09221-32001), remove the cylinder head bolts as shown in the illustration.



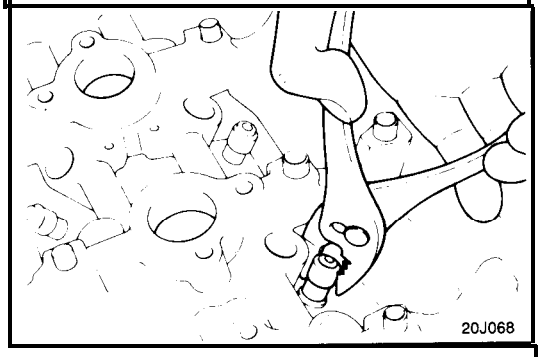
2. Using the special tool, Valve Spring Compressor (09222-28000, 09222-28100), remove the retainer lock. Next remove the spring retainer, valve spring, spring seat and valve.

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



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

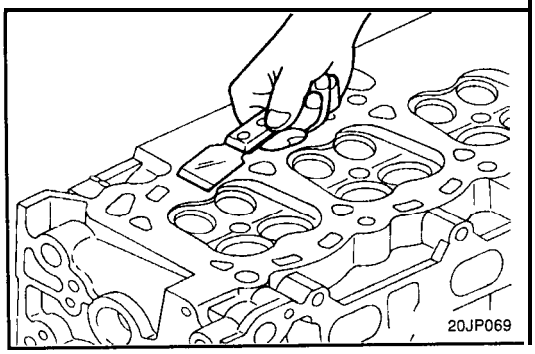
NOTE
Do not reuse the valve stem seals.



INSPECTION

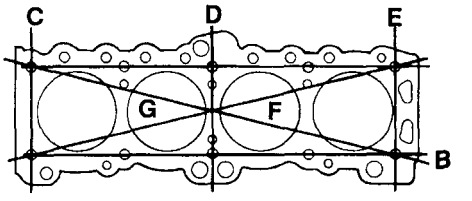
Cylinder head

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 oil passages, apply compressed air to make certain that the passages are not clogged.



3. Check the cylinder head gasket surface for flatness by using a straight edge in the direction of A, B, ... as shown.
   If flatness exceeds service limit in any direction, either replace the cylinder head, or lightly machine the cylinder head gasket surface.

Flatness of cylinder head gasket surface	
[Standard dimension]	Less than 0.05 mm (0.002 in.)
[Limit]	0.1 mm (0.0039 in.)



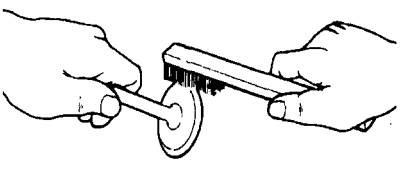
Valves

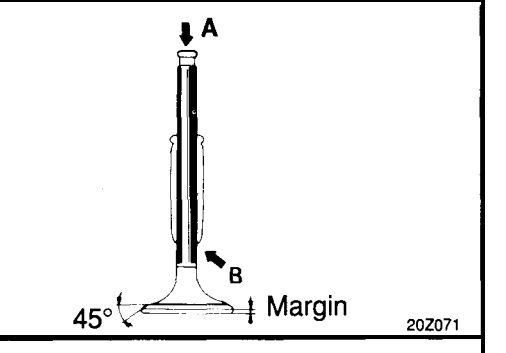
1. Using a wire brush, clean the valve thoroughly.
2. Check each valve for wear, damage and distortion of head and stem at B. Repair or correct if necessary.

If stem end A is pitted or worn, resurface as necessary. This correction must be limited to a minimum. Also resurface the valve face.

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

Margin	
[Standard dimension]	
Intake	1.0 mm (0.039 in.)
Exhaust	1.5 mm (0.059 in.)
[Limit]	
Intake	0.7 mm (0.028 in.)
Exhaust	1.0 mm (0.039 in.)

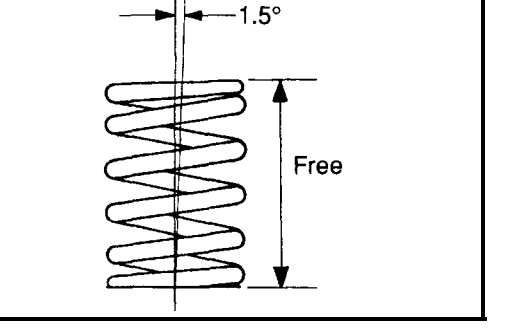




Valve Springs

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

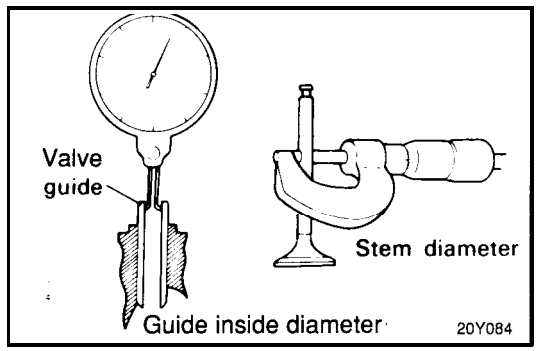
Valve spring	
[Standard Value]	
Free height	48.3 mm (1.902 in.)
Load	300 N (66 lb)/40 mm (1.575 in.)
Out of square	1.5° or less
[Limit]	
Free hight.....	-1.0 mm (-0.039 in.)
Out of square	4°



Valve Guides

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

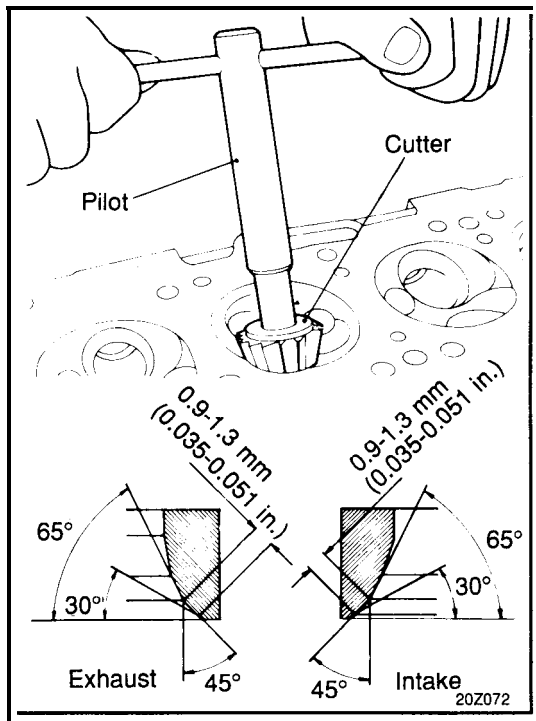
Valve stem-to-guide clearance
- [Standard dimension]
  - Intake ..... 0.020-0.047 mm (0.0008-0.0019 in.)
  - Exhaust ..... 0.050-0.085 mm (0.0020-0.0033 in.)
- [Limit]
  - Intake ..... 0.1 mm (0.0039 in.)
  - Exhaust ..... 0.15 mm (0.0059 in.)



Valve Seat Insert

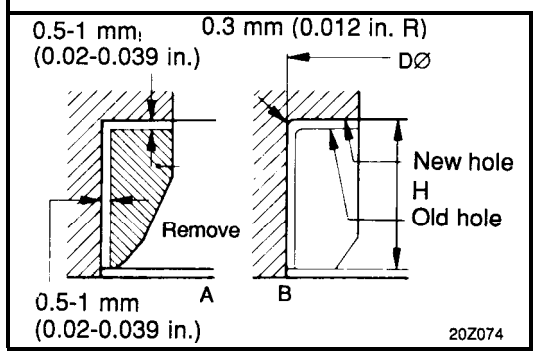
Check the valve seat for evidence of overheating and improper contact with the valve face. Recondition or replace the seat if necessary.

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



Valve Seat Insert Replacement Procedure

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



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

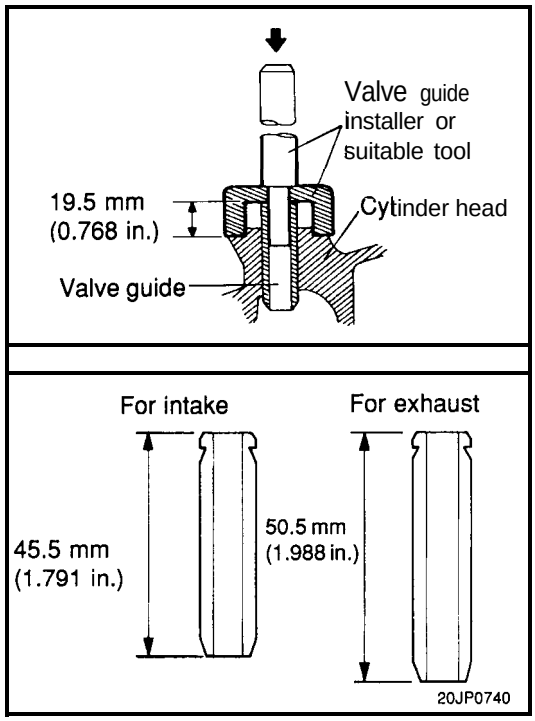
Valve Seat Insert Oversizes

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

Valve Guide Replacement Procedures

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

1. Using the push rod of the Valve Guide Installer, push the valve guide out toward the cylinder block with a press.
2. Machine the valve guide insert hole in the cylinder head to the specified oversize of the new valve guide.
3. Using the Valve Guide Installer or suitable tool, press fit the valve guide. The use of the valve guide installer makes it possible to press fit the valve guide to a predetermined height. The valve guide should be installed from the top of the cylinder head. Note that intake and exhaust valve guides are different in length [45.5 mm (1.791 in.) for intake and 50.5 mm (1.988 in.) for exhaust.]
4. After the valve guides have been installed, insert new valves and check the clearance.
5. Whenever valve guides are replaced, check for valve to seat contact and recondition the valve seats as necessary.

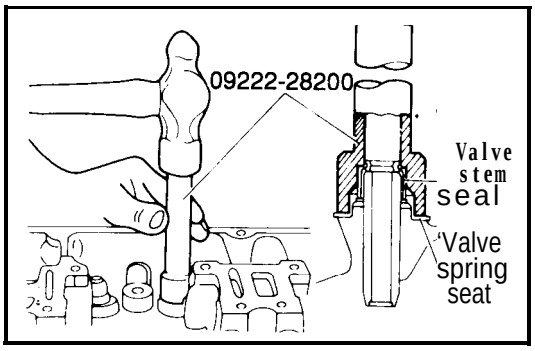


Valve Guide Oversizes

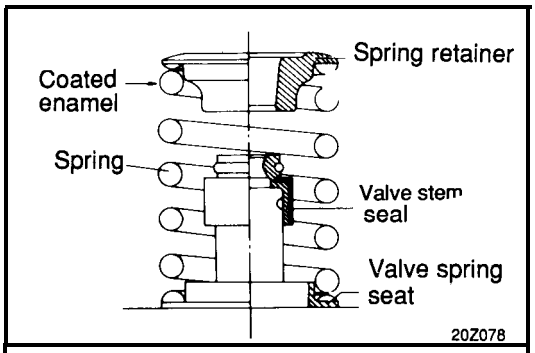
Size mm (in.)	Size mark	Cylinder head hole size mm (in.)
0.05 (0.002)O.S.	5	12.050-12.068(0.4744-0.4751)
0.25 (0.010)O.S.	25	12.250-12.268(0.4823-0.4830)
0.50 (0.020)0.S.	50	12.500-12.518(0.4921-0.4928)

INSTALLATION

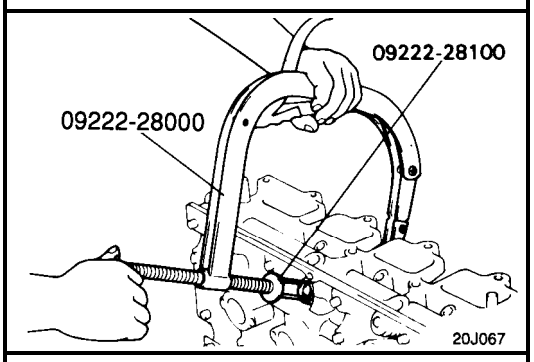
NOTE
1) Clean each part before assembly.
2) Apply engine oil to sliding and rotating parts.



1. After installing the spring seat, fit the stem seal onto the valve guide.
   To install, fit the seal in by lightly tapping the Special Tool, Valve Stem Oil Seal Installer (09222-28200).
   The seal is installed in the specified position by means of the special tool. Incorrect installation of the seal will adversely affect the lip I.D. and eccentricity, resulting in oil leakage down the valve guides. When installing, therefore, be careful not to twist the seal. Do not reuse old stem seals.
2. Apply engine oil to each valve. Insert the valves into the valve guides. Avoid inserting the valve into the seal with force.
   After insertion, check to see if the valve moves smoothly.

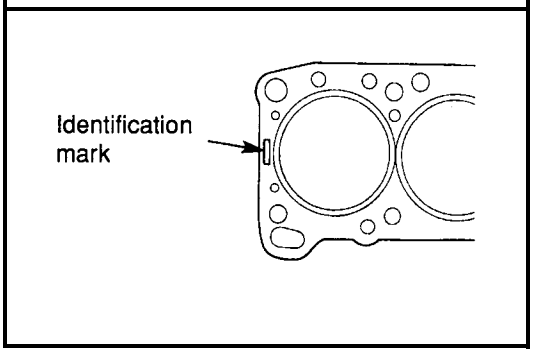


3. Install springs and spring retainers.
   Valve springs should be installed with the enamel coated side toward the valve spring retainer.



4. Using the special tool, Valve Spring Compressor (09222-28000, 09222-28100), remove the retainer lock. Next remove the spring retainer, valve spring, spring seat and valve.

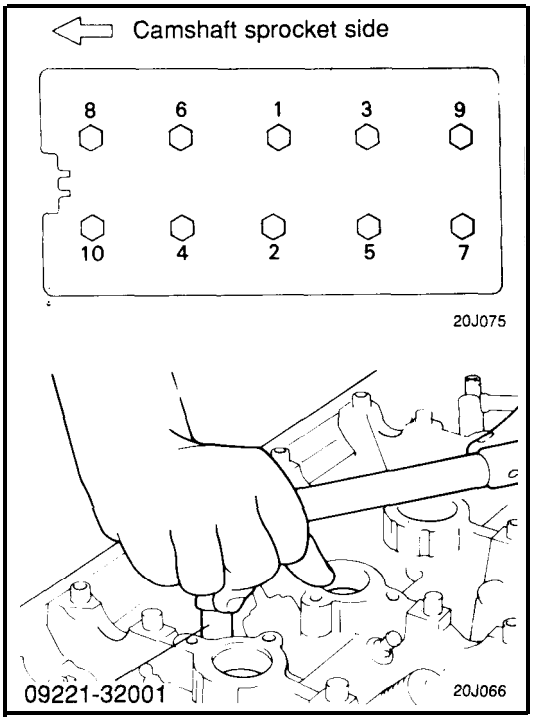
   NOTE
   Keep these parts in order so that they can be reinstalled in their original positions.



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

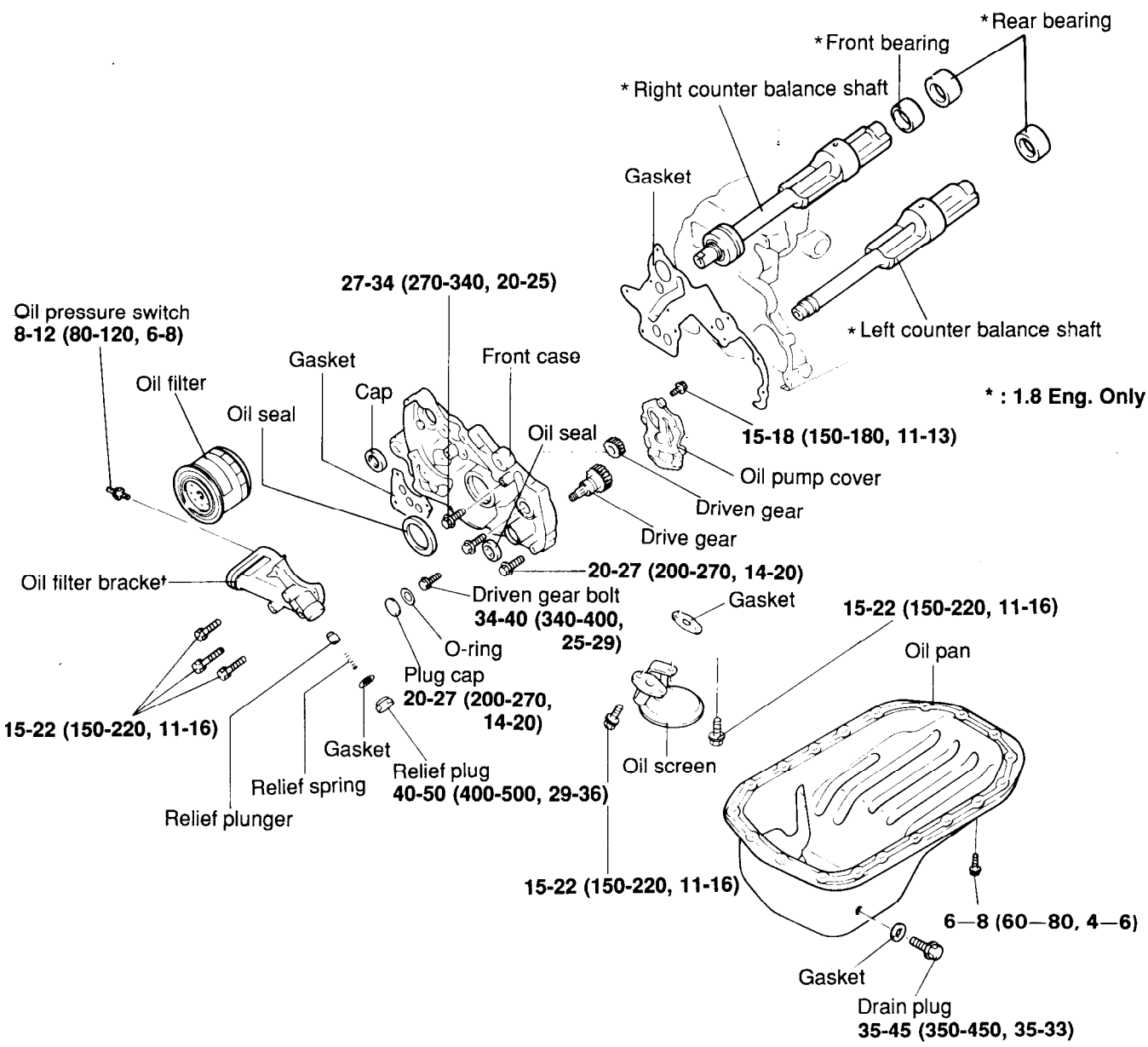
7. Using the special tool, Cylinder Head Bolt Wrench (09221-32001), install the cylinder head bolts as shown in the illustration.

Tightening torque	
Cylinder head bolt [cold engine]	105-115 Nm (1050-1150 kg.cm, 76-83 lb.ft)



FRONT CASE, OIL PUMP COUNTER BALANCE SHAFT

COMPONENTS

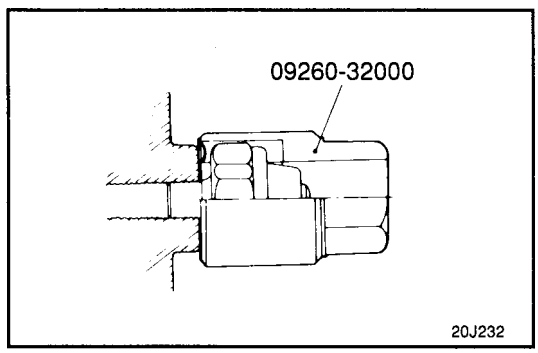


TORQUE : Nm (kg.cm, lb.ft)

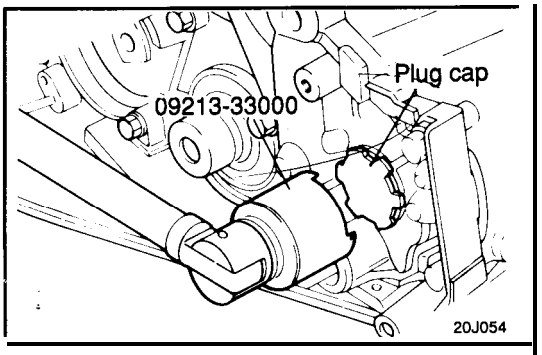
REMOVAL

[Step 8-10, 12 for 1.8L Eng.]

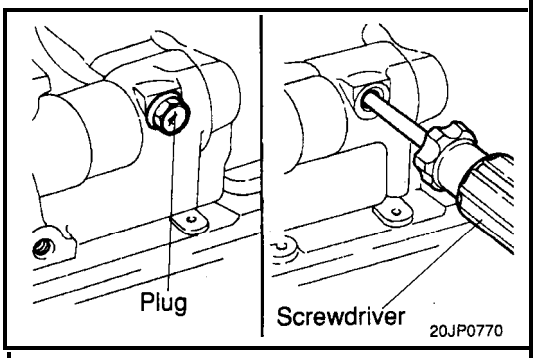
1. Remove the timing belt. Refer to “Timing Belt”.
2. Remove all the oil pan bolts.
3. Remove the oil pan.
4. Remove the oil screen and gasket.
5. Remove the relief plunger and gasket, and then take off the relief spring and relief valve from the oil filter bracket.
6. Remove the oil pressure switch.



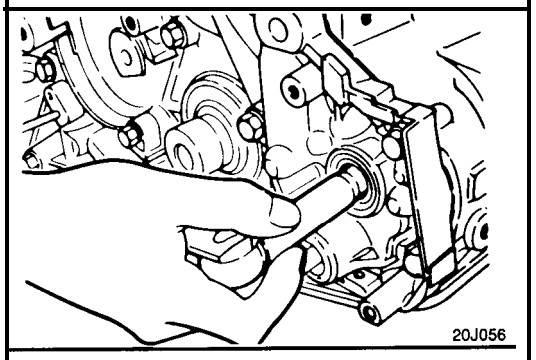
7. Remove the oil filter bracket and gasket.
8. Using the special tool, remove the plug cap from the oil pump portion of front case.



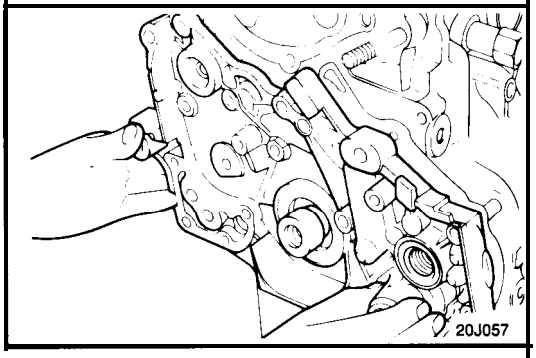
9. Remove the left side cylinder block plug and insert a screwdriver with an 8 mm (0.32 in.) diameter shaft into plug hole. Screwdriver shaft must be inserted more than 60 mm (2.4 in.)



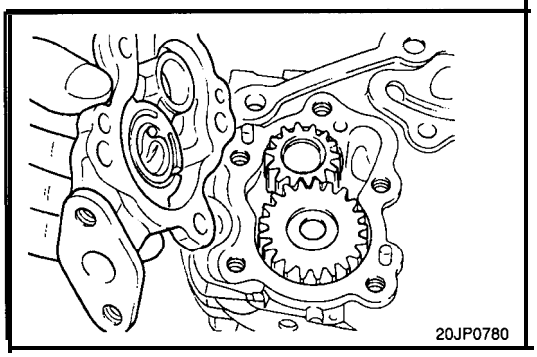
10. Remove the oil pump driven gear and left counter balance shaft retaining bolt.



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



13. Remove the oil pump cover from the front case.
14. Remove the oil pump from front case.



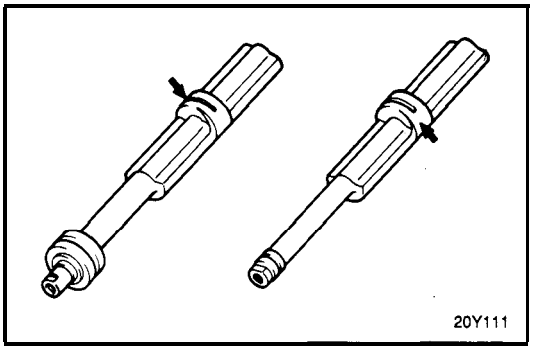
INSPECTION

Front Case

1. Check oil holes for clogging and clean if necessary.
2. Check counter balance shaft front bearing section for wear, damage and seizure. If there is anything wrong with the section, replace the front case. [for 1.8L Eng.]
3. Check the front case for cracks and other damage. Replace cracked or damaged front case.

Counter Balance Shaft [for 1.8L Eng.]

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

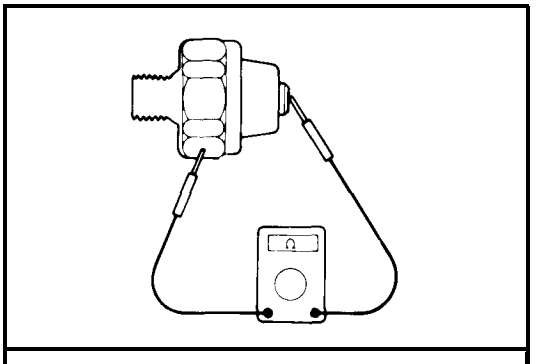


Oil Seal

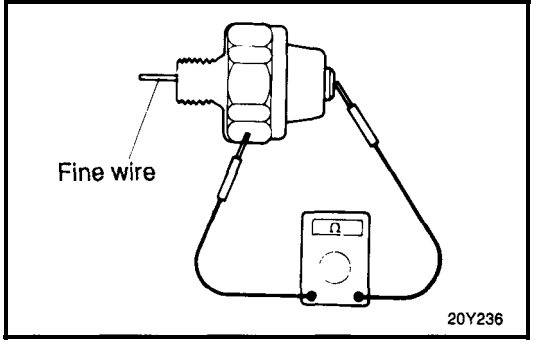
1. Check the oil seal lip for wear and damage. Replace oil seal if necessary.
2. Check the oil seal lip for deterioration. Replace oil seal if necessary.

Oil Pressure Switch

1. Check the continuity between the terminal and the body with an ohmmeter.
   If there is continuity, replace the oil pressure switch.



2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace it.
3. Or, if there is no continuity when a 50 kPa (7 psi) vacuum is applied through the oil hole, the switch is operating properly. Check to see that air doesn't leak. If air leaks, the diaphragm is broken. Replace the switch.

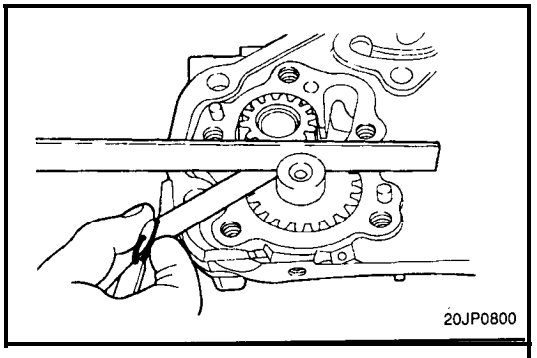


Oil Pump

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

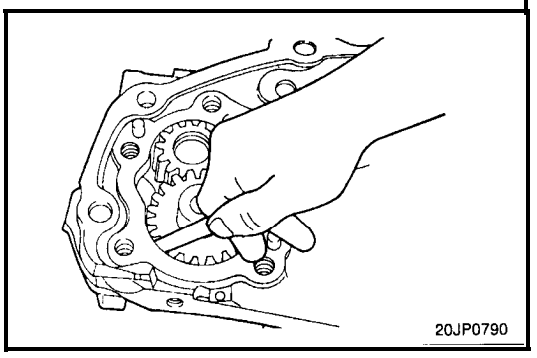
3. With the drive and driven gears installed into the front case, measure the tip clearance of the gears.

[Standard value]
Drive gear ..... 0.16-0.21 mm (0.0063-0.0083 in.)
Driven gear ..... 0.13-0.18 mm (0.0051-0.0071 in.)
[Limit]
Drive gear ..... **0.25** mm (0.0098 in.)
Driven gear ..... 0.25 mm (0.0098 in.)



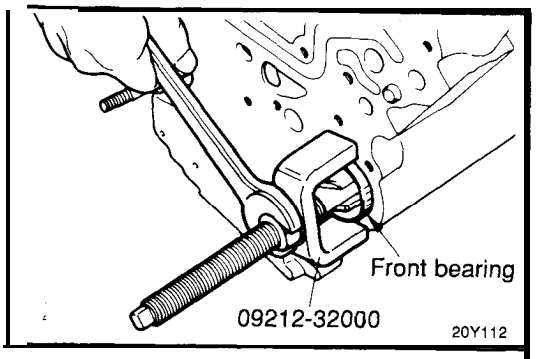
4. Check the side clearance.

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

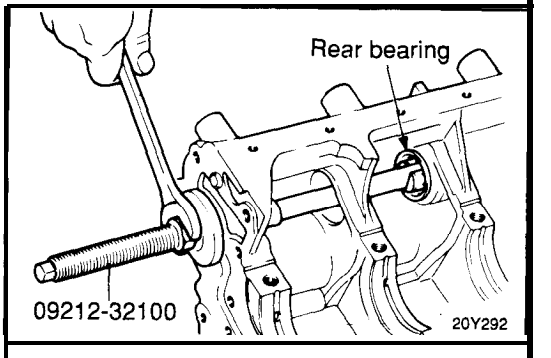


COUNTER BALANCE SHAFT BEARING REPLACEMENT [for 1.8L Eng.]

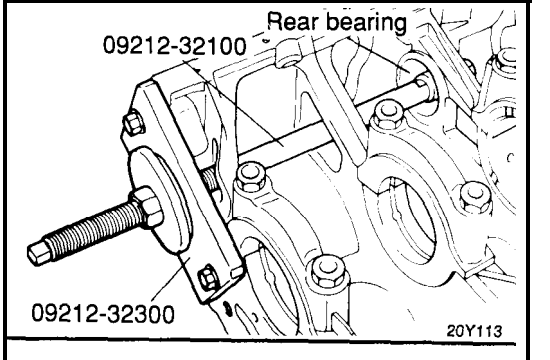
1. Using special tool, remove the right counter balance shaft front bearing from the cylinder block.



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

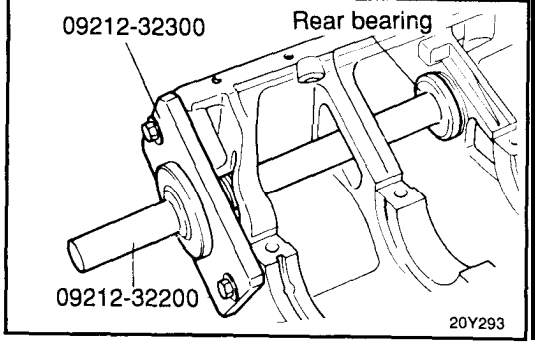


3. Using special tool, remove the left counter balance shaft rear bearing from cylinder block. At this time, install special tool on front surface of cylinder block to hold bearing puller.



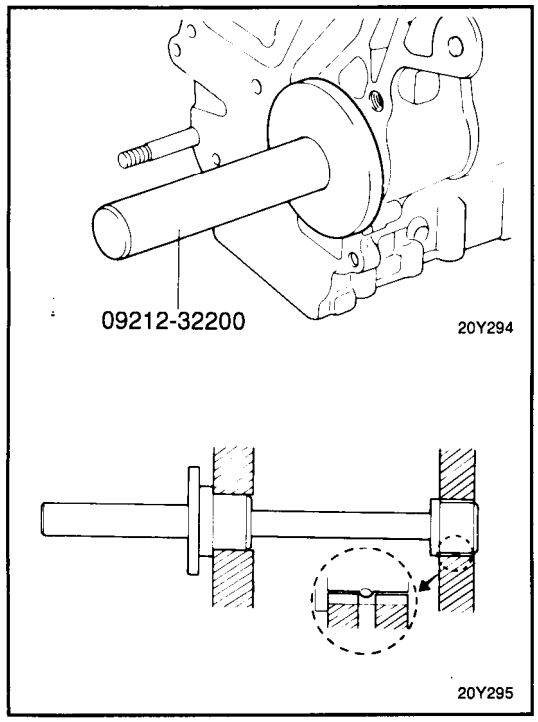
4. Using special tool, install the left counter balance shaft rear bearing to the cylinder block.

NOTE
1. Apply engine oil to the rear bearing outer circumference and bearing hole in cylinder block.
2. The left rear bearing has no oil holes.

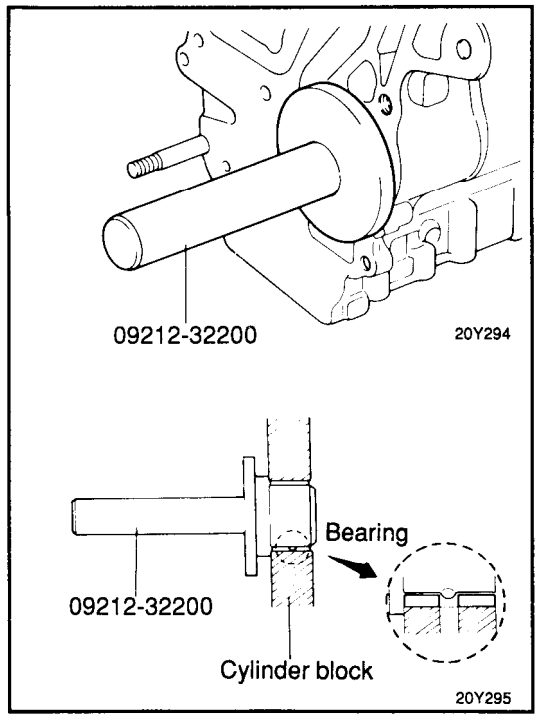


5. Using special tool, install the right counter balance shaft rear bearing to the cylinder block.

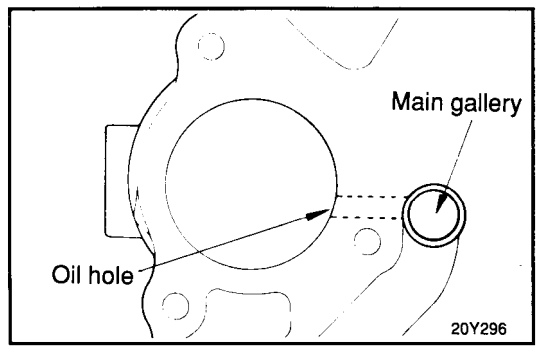
NOTE
1. Apply engine oil to outer surface of bearing.
2. Make sure that bearing oil hole is aligned with oil hole of cylinder block.



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



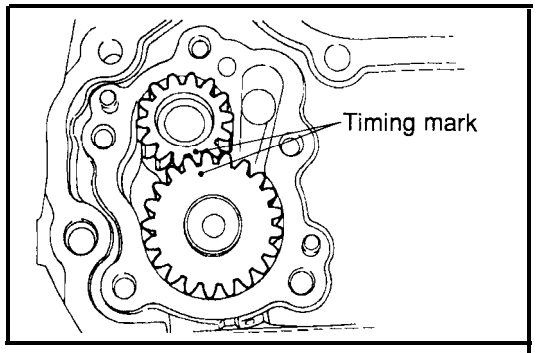
NOTE
Make sure that bearing oil hole is aligned with oil hole of cylinder block.



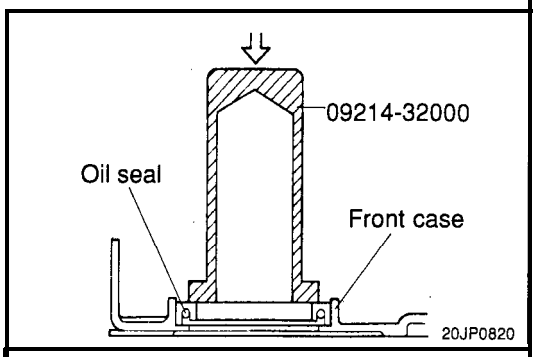
INSTALLATION

[Step 6-8 for 1.8L Eng.]

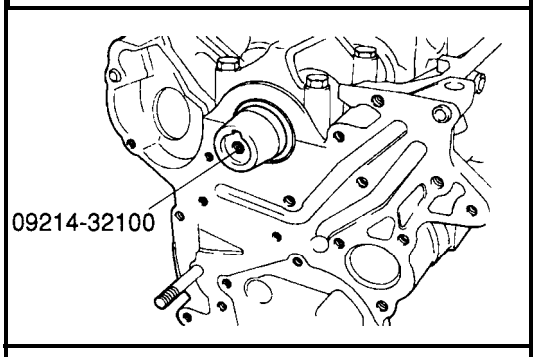
1. Apply engine oil to the gear and align the two timing marks.



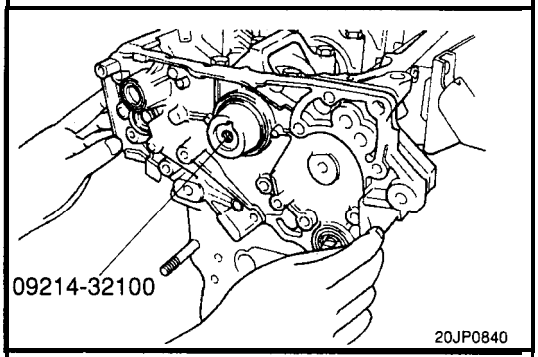
2. Using the special tool, Crankshaft Front Oil Seal Installer (09214-32000), install the crankshaft front oil seal into the front case.



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

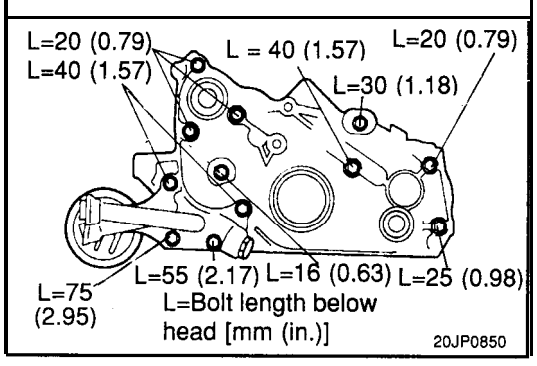


4. Install the front case assembly through a new front case gasket and temporarily tighten the flange bolts (other than those for tightening the filter bracket).

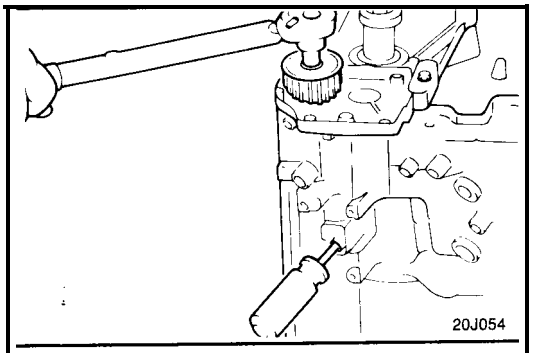


5. Install the front case assembly with a new gasket, and tighten the bolts to the specified torque.

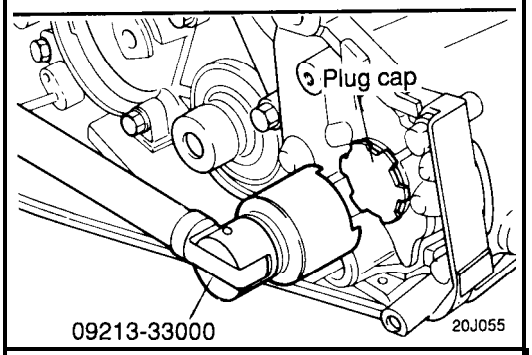
Front case assembly Tightening torque	
*	27-34 Nm (270-340 kg.cm, 20-25 lb.ft)
All except*	20-27 Nm (200-270 kg.cm, 14-20 lb.ft)
Oil filter bracket bolts	15-22 Nm (150-220 kg.cm, 11-16 lb.ft)



6. Insert screwdriver through plug hole in left side of cylinder block to keep shaft in position, and then tighten.

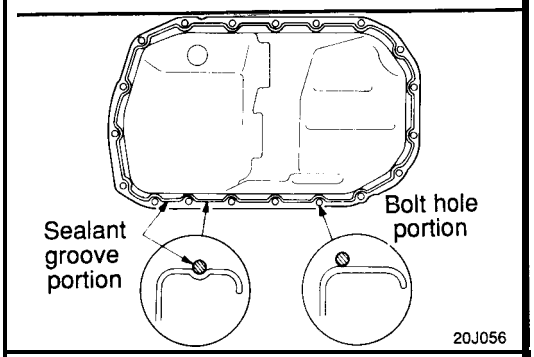


7. Install a new O-ring to the groove of front case.
8. Using special tool, install the plug case and tighten to specified torque.



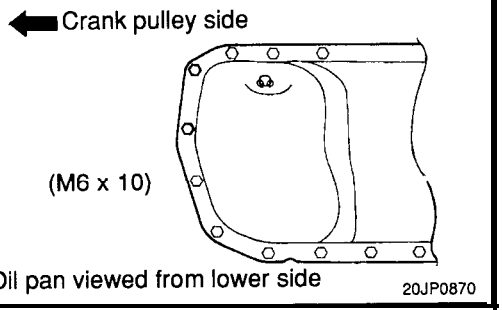
9. Apply sealant into the groove of the pan flange as shown.

NOTE
1) Apply sealant approx. 4 mm (0.16 in.) in thickness.
2) After application of sealant, do not exceed 15 minutes before installing the oil pan.
List what type of sealant to use.



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

Tightening torque	
Oil pan bolt	6-8 Nm (60-80 kg.cm, 4-6 lb.ft)

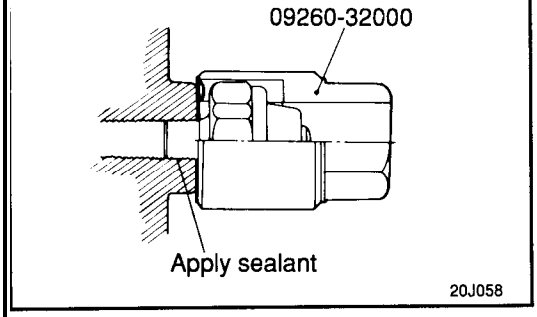


11. Using the special tool, install the oil pressure switch after applying sealant to the threaded area.

Sealant	Three bond 1104 or equivalent

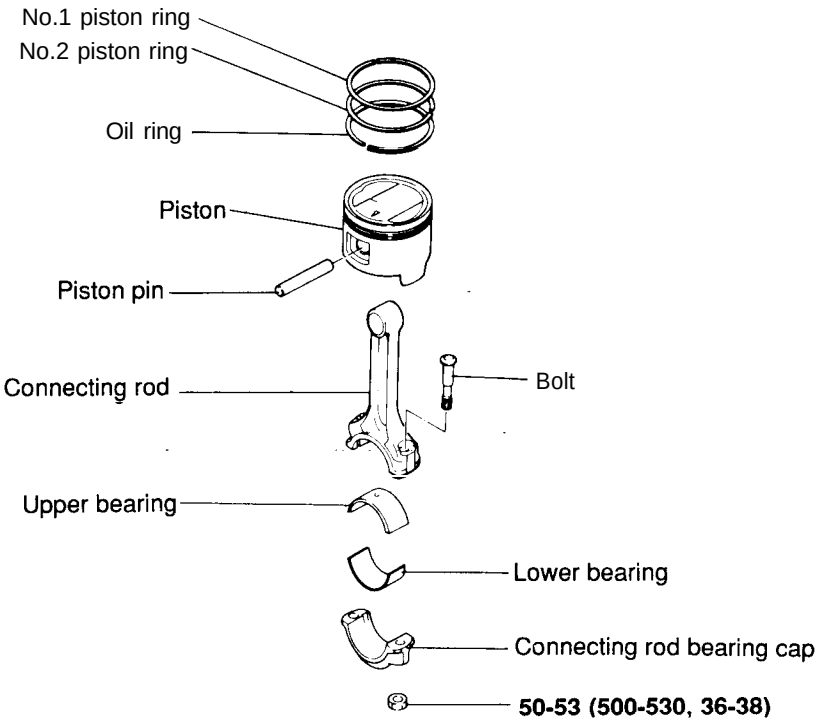
NOTE
Do not over torque the oil pressure switch.

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



PISTON AND CONNECTING ROD

COMPONENTS



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

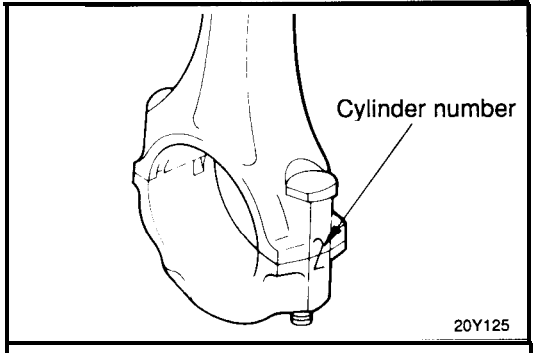
REMOVAL

Connecting Rod Cap

NOTE

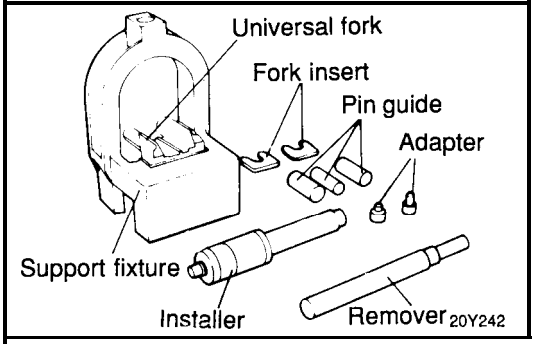
Keep the bearings in order with their corresponding connecting rods **(according to cylinder numbers) for proper reassembly.**

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



Piston Pin Removal and Installation Procedures

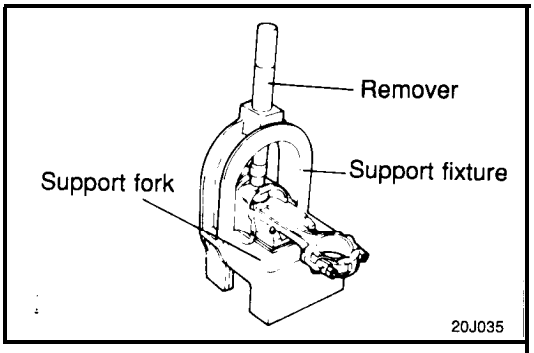
1. Use the special tools (09234-33001) to disassemble and reassemble the piston and connecting rod.
2. Place the proper insert in the fork of the tool. Position the insert between the connecting rod and the piston.



3. Insert the proper removal tool through the hole in the arch of the tool.

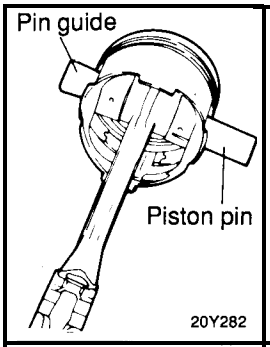
   NOTE
   Center the piston, rod and pin assembly with the removal arbor.

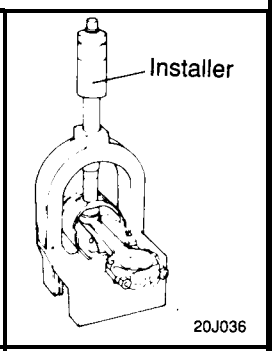
4. Press the piston pin out of the connecting rod.



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

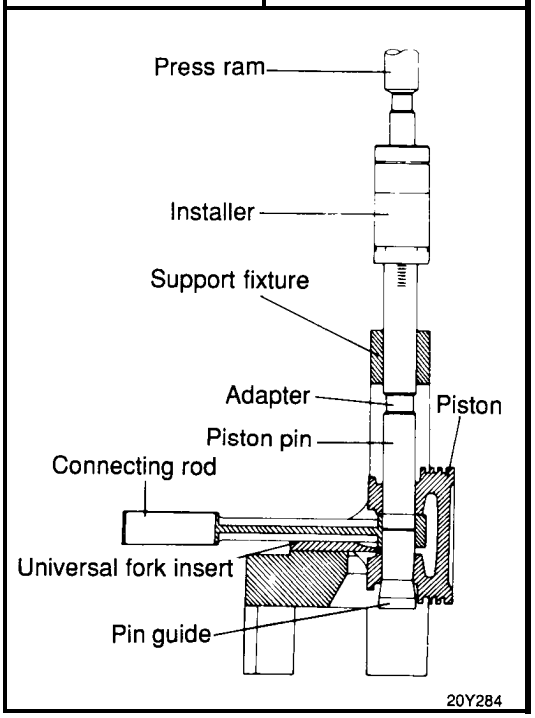
   NOTE
   The pin guide centers the conneting rod in the piston. When the piston, connecting rod, piston pin and pin guide assembly are positioned on the fork of the tool, the pin guide will also center this assembly in the tool. if a pin guide that is too small is used, the piston assembly will not be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





6. Install piston assembly onto fork assembly of tool. Tool will support connecting rod at the piston pin. Be sure piston assembly is slid onto the fork until the pin guide contacts the fork insert.
7. Adjust the installing arbor to the proper length by turning the numbered sleeve on the lettered shaft until the specified alpha numeric setting from the application chart is obtained. Turn knurled nut to lock numbered sleeve on shaft.
8. Insert the installing arbor through the hole in the arch of the tool. Press piston pin into the connecting rod until the sleeve on the installing arbor contacts the top of the tool arch. The pin guide will fall out of the connecting rod as the piston pin is pressed in.

   CAUTION
   Do not exceed 5000 pounds of force when stopping the installing arbor sleeve against the arch.

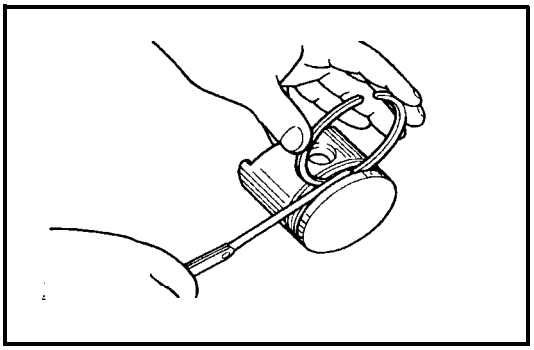


INSPECTION

Piston and Piston Pins

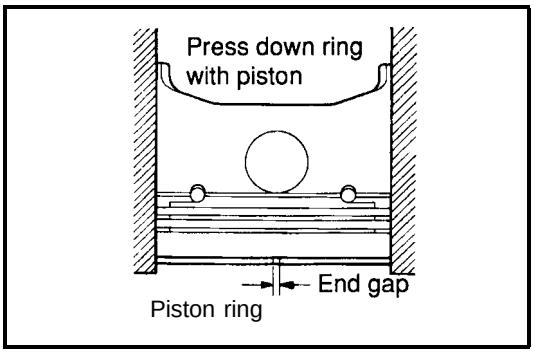
1. Check each piston for scuffing, scoring, wear and other defects. Replace any piston that is defective.
2. Check each piston ring for breakage, damage and abnormal wear. Replace the defective rings. When the piston requires replacement, its rings should also be replaced.
3. Check the piston pin fit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

Piston Rings



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

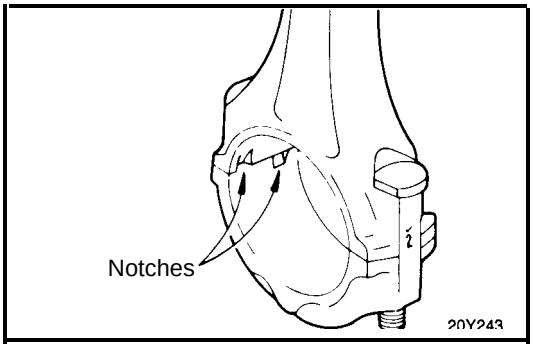
[Standard value]	
Piston ring side clearance	0.03-0.07 mm (0.0012-0.0028 in.)
[Limit]	0.1 mm (0.004 in.)



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

Piston ring end gap	
[Standard dimension]	
1.6L Eng.	
No.1	0.25-0.40 mm (0.0098-0.0157 in.)
No.2	0.35-0.50 mm (0.0138-0.0197 in.)
Oil ring side rail	0.20-0.70 mm (0.0079-0.0276 in.)
1.8L Eng.	
No.1	0.25-0.40 mm (0.0098-0.0157 in.)
No.2	0.45-0.60 mm (0.0177-0.0236 in.)
Oil ring side rail	0.20-0.70 mm (0.0079-0.0276 in.)
[Limit]	
No.1, No.2	0.8 mm (0.031 in.)
Oil ring side rail	1.0 mm (0.039 in.)

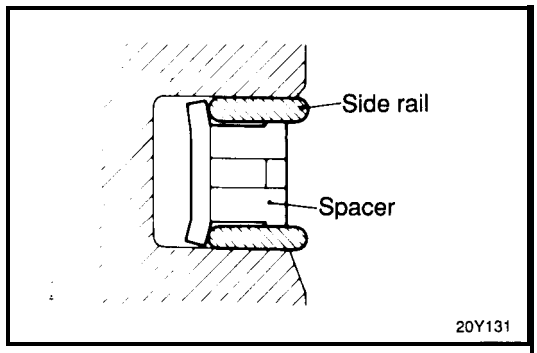
Connecting Rods



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

INSTALLATION

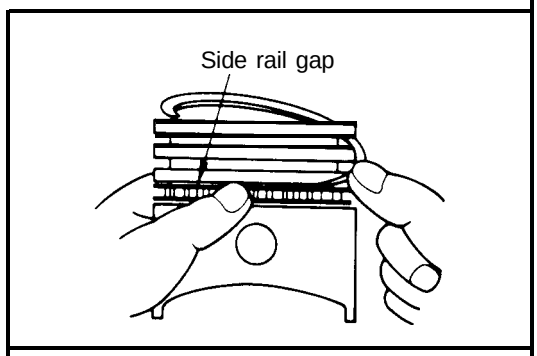
1. Install the spacer.



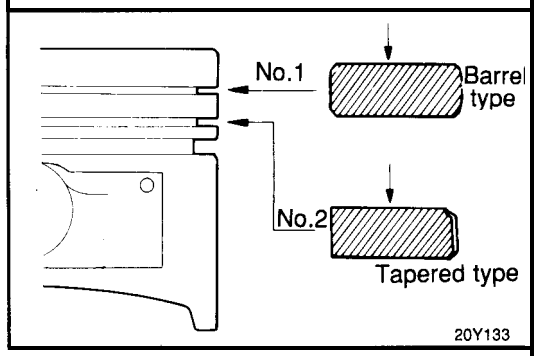
2. Install upper side rail. To install side rail, first put one end of side rail between piston ring groove and spacer, hole it down firmly, and then press down the portion which is to be inserted into groove with a finger as illustrated.

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

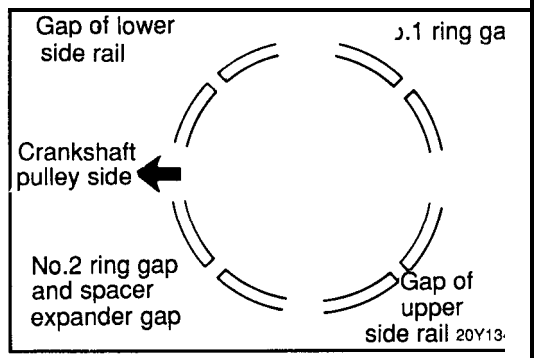
3. Install lower side rail by same procedure as Step 2.



4. Using piston ring expander, install No.2 piston ring.
5. Install No.1 piston ring.
6. Apply engine oil around piston and piston rings.

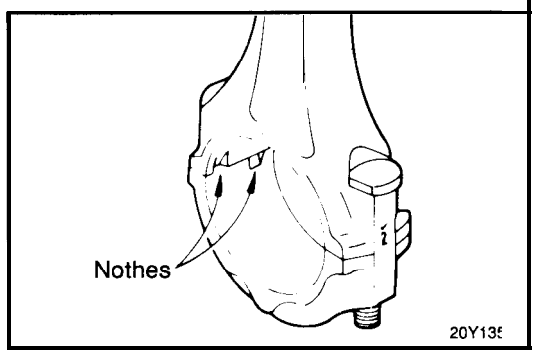


7. Position each piston ring end gap as for apart from neighboring gaps as possible. Make sure that gaps are not positioned in thrust and pin directions.
8. Hold piston rings firmly in a piston ring compressor as they are inserted into cylinder.



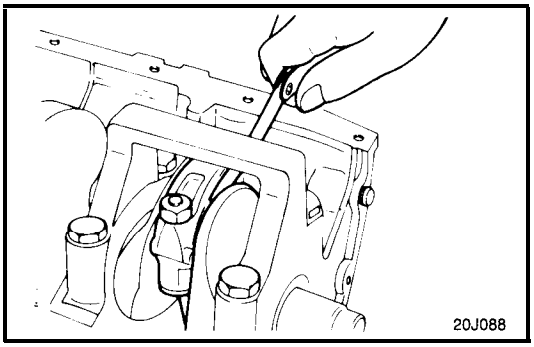
9. Make sure that front mark of piston and front mark (identification mark) of connecting rod are directed toward front of engine.
10. When connecting rod cap is installed, make sure that cylinder numbers put on rod and cap at disassembly match.
11. When new connecting rod is installed, make sure that notches Notches for holding bearing in place are on same side.
12. Tighten the connecting rod cap nuts.

Tightening torque	
Connecting rod cap nuts	50-53 Nm (500-530 kg.cm, 36-38 lb.ft)



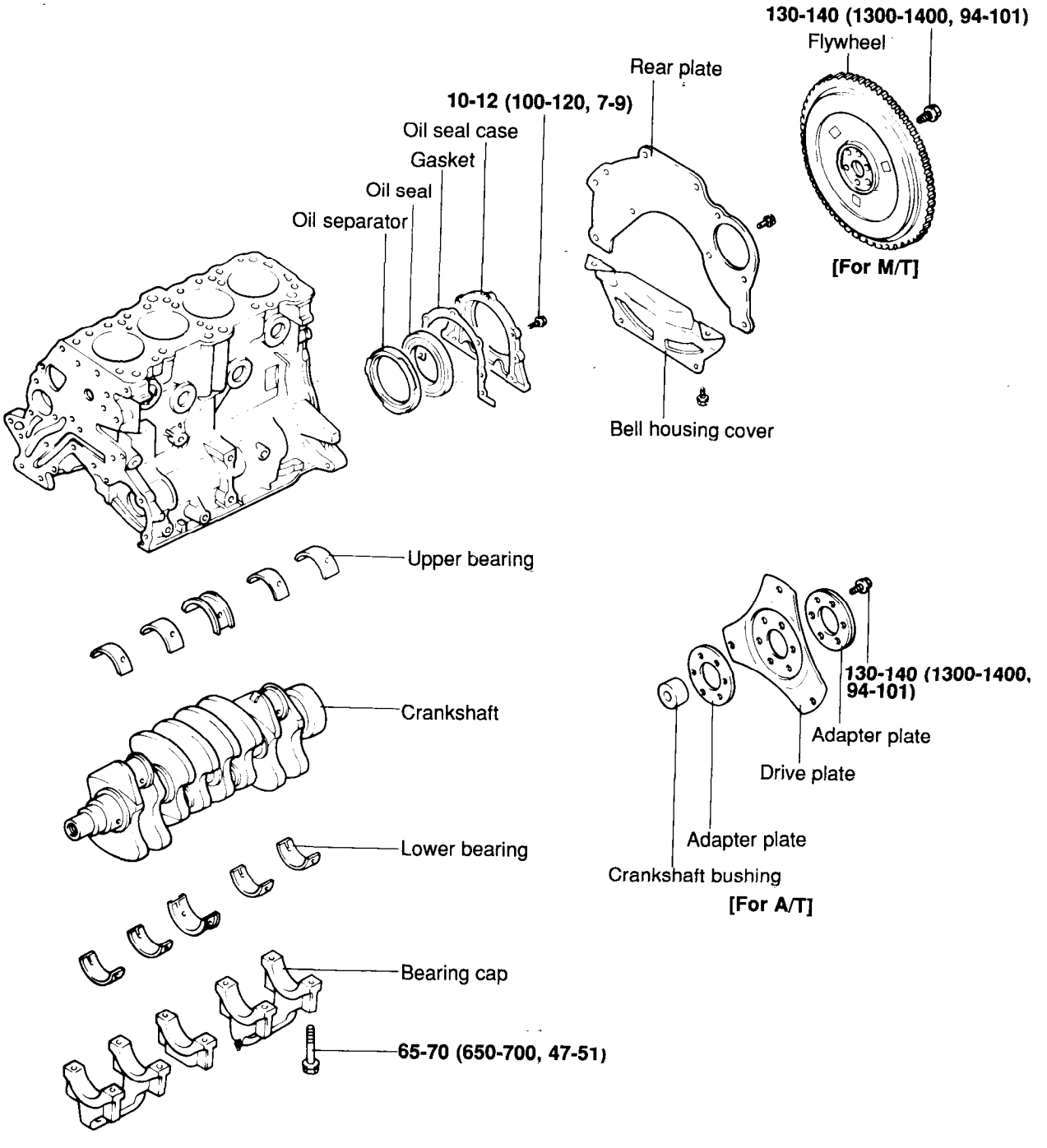
13. Check connecting rod side clearance.

Side clearance	0.10-0.25 mm (0.0039-0.0098 in.)
Limit	0.4 mm (0.0157 in.)



CRANKSHAFT, FLYWHEEL

COMPONENTS



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

REMOVAL

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

NOTE
Mark the main bearing caps to permit reassembly in the original position and direction.

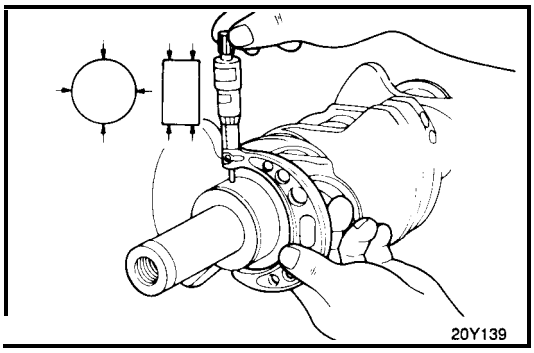
4. Remove the main bearing caps and remove the crankshaft. Keep the bearings in order by cap number.

INSPECTION

Crankshaft

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

Standard value	
Crankshaft journal O.D	57 mm (2.24 in.)
Crankshaft pin O.D	45 mm (1.77 in.)



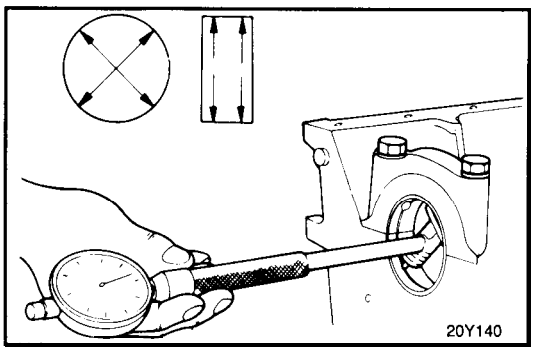
Main Bearings and Connecting Rod Bearings

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

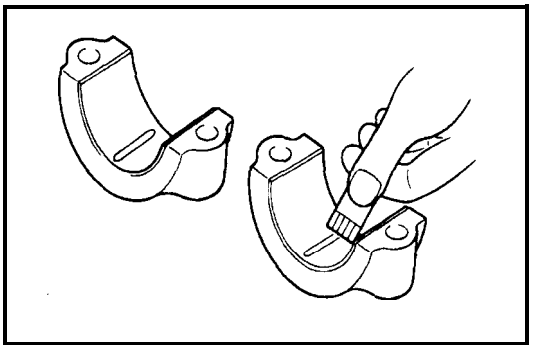
Oil Clearance Measurement

To check the oil clearance, measure the outside diameter of the crankshaft journal and the crank pin and the inside diameter of the bearing. The clearance can be obtained by calculating the difference between the measured outside and inside diameters.

Standard value	
Oil clearance	
Crankshaft main bearing	0.02-0.05 mm (0.0008-0.0020 in.)
Connecting rod bearing	0.02-0.05 mm (0.0008-0.0020 in.)
Limit	0.1 mm (0.004 in.)



Plastigauge Method



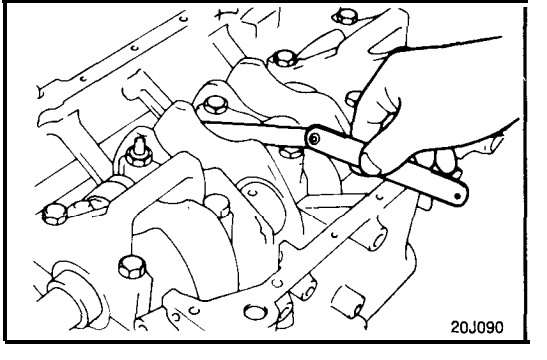
Plastigauge may be used to measure the clearance.

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

Oil Seal

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

Bearing Caps



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

Standard value	.0.05-0.18 mm (0.0020-0.0071 in.)
Limit	0.25 mm (0.0098 in.)

Drive Plate

Replace deformed, damaged, or cracked drive plates.

Flywheel

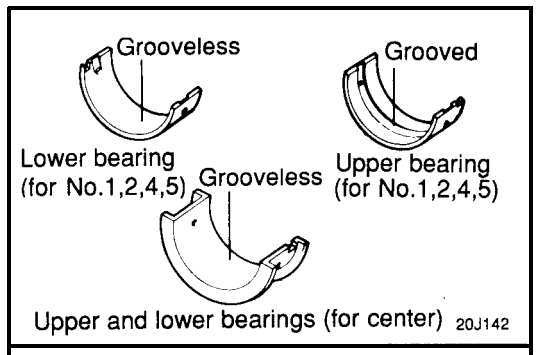
1. Check the clutch disc contacting surface of the flywheel for damage and wear. Replace the flywheel if excessively damaged or worn.
2. Check the clutch disc contacting surface of the flywheel for run-out.

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

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

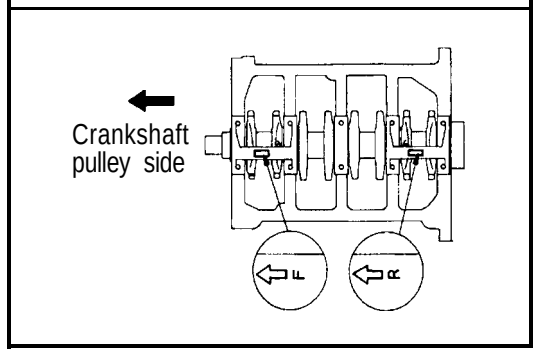
INSTALLATION

1. Install grooved main bearing (upper bearing) on cylinder block side.
2. Install grooveless main bearing (lower bearing) on main bearing cap side.
3. Both upper and lower bearings for center are grooveless.



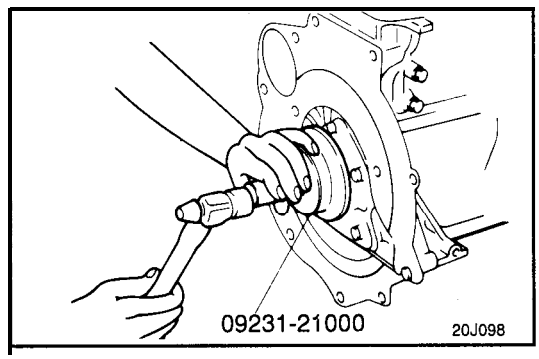
4. Install crankshaft. Apply engine oil to journal and pin.
5. Caps should be installed with arrow mark directed toward front of engine. Cap number must be correct.
6. Tighten cap bolts to specified torque in sequence of center No.2, No.4, front and rear caps.

Tightening torque	
Main bearing cap bolts	65-70 Nm (650-700 kg.cm, 47-51 lb.ft)

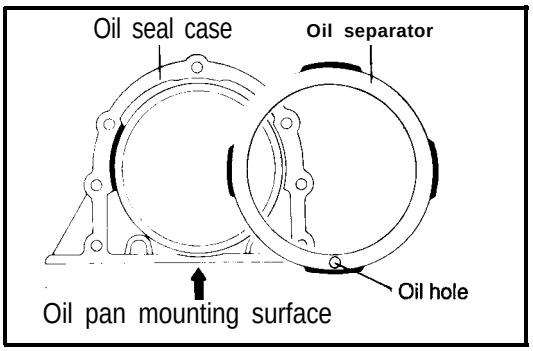


7. Cap bolts should be tightened evenly in 4 to 5 stages before they are tightened to specified torque.
8. Make certain that crankshaft turns freely and has proper end play.

9. Using special tool (09231-21000), install oil seal in oil seal case.



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



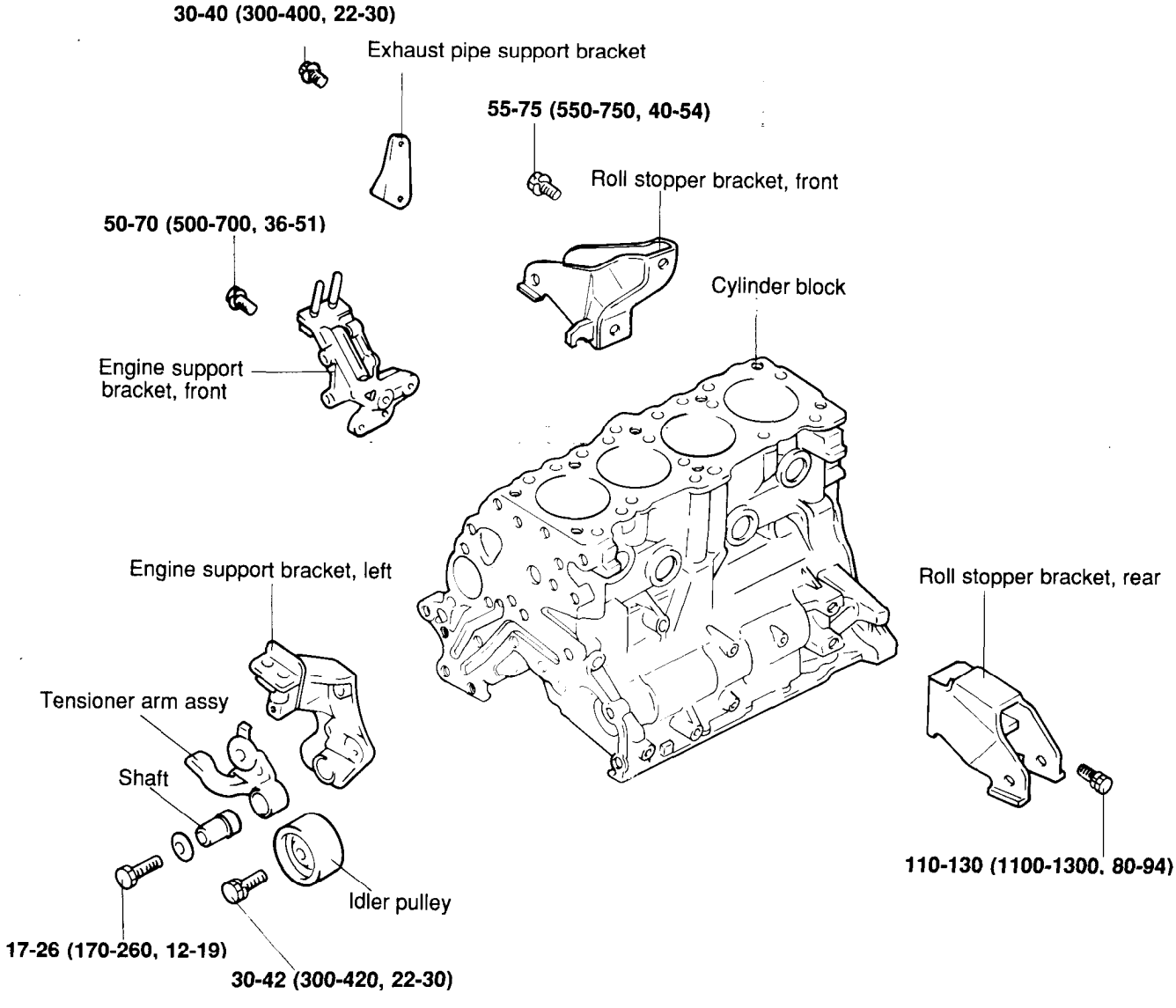
11. Install the new oil seal case gasket and oil seal case assembly.
12. Install the rear plate to the cylinder block.

13. Install the flywheel assembly and tighten the bolts to the specified torque.

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

CYLINDER BLOCK

COMPONENTS



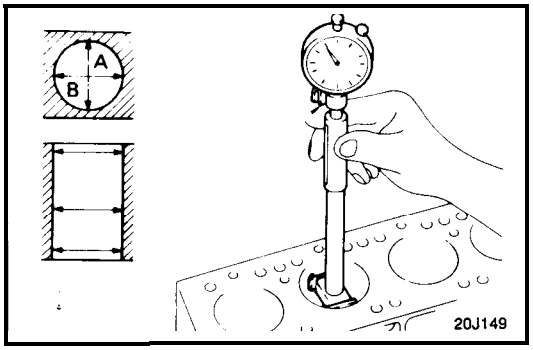
TORQUE : Nm (kg.cm, lb.ft)

REMOVAL

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

INSPECTION

Cylinder Block



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

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

Standard value	
Cylinder bore	
1.6L Eng.:	82.3-82.33 mm (3.2402-3.2413 in.)
1.8L Eng.:	81.5-8153 mm (3.2087-3.2098 in.)
Out-of-roundness and taper of cylinder bore	Max. 0.01 mm (0.0004 in.)

4. If cylinder top ridge is worn in stages, cut away with ridge reamer.
5. Oversize pistons are available in four sizes.

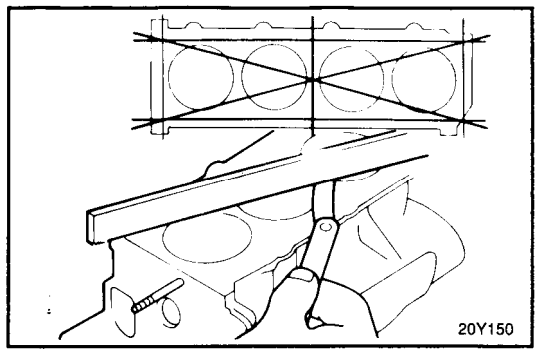
Piston service size and mark mm (in.)	
0.25 (0.010) O.S.	0.25
0.50 (0.020) O.S.	0.50
0.75 (0.030) O.S.	0.75
1.00 (0.039) O.S.	1.00

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

Piston-to-cylinder wall clearance	**0.02-0.04** mm (0.0008-0.0016 in.)

7. Check for damage and cracks.

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



Standard value	
Flatness of gasket surface	Max. 0.05 mm (0.0020 in.)
Cylinder block (New) height	275 mm (10.83 in.)[1.6L Eng.] 284 mm (11.18 in.)[1.8L Eng.]
Service limit	
Flatness of gasket surface	0.1 mm (0.0039 in.)
Overall height	-0.2 mm (-0.0079 in.)

NOTE
The cylinder block gasket surface should be ground to within -0.2 mm (-0.0079 in.) even with the grind of cylinder head gasket surface.

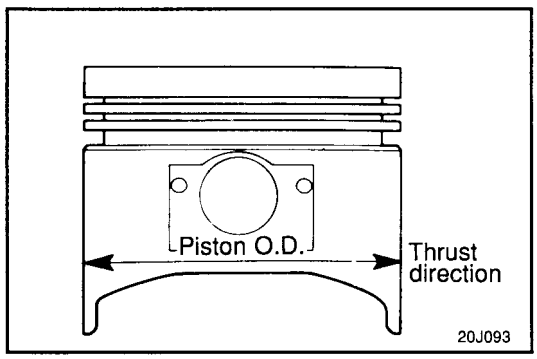
Boring Cylinder

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

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

NOTE
Size mark is stamped on top of piston.

2. Measure outside diameter of piston to be used.
3. Based on measured piston O.D., calculate boring finish dimension.



Boring finish dimension = Piston O.D + 0.02-0.04 mm (0.0008-0.0016 in.) (clearance between O.D and cylinder)- 0.02 mm (0.008 in.) (honing margin.)

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

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

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

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

INSTALLATION

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