2700 cc Engine

MECHANISM AND FUNCTION

General

The SUBARU XT6 houses a horizontally-opposed 6-cylinder, 4-stroke cycle, liquid cooled OHC gasoline engine. This well-balanced engine, adopting a horizontally opposed piston arrangement, is made of an aluminium alloy, and is lightweight. This engine also adopts the OHC (Over-Head Camshaft) system, hydraulic lash adjuster, and multi point fuel injection system, attaining reliability as well as low fuel consumption, low vibration and powerful performance.

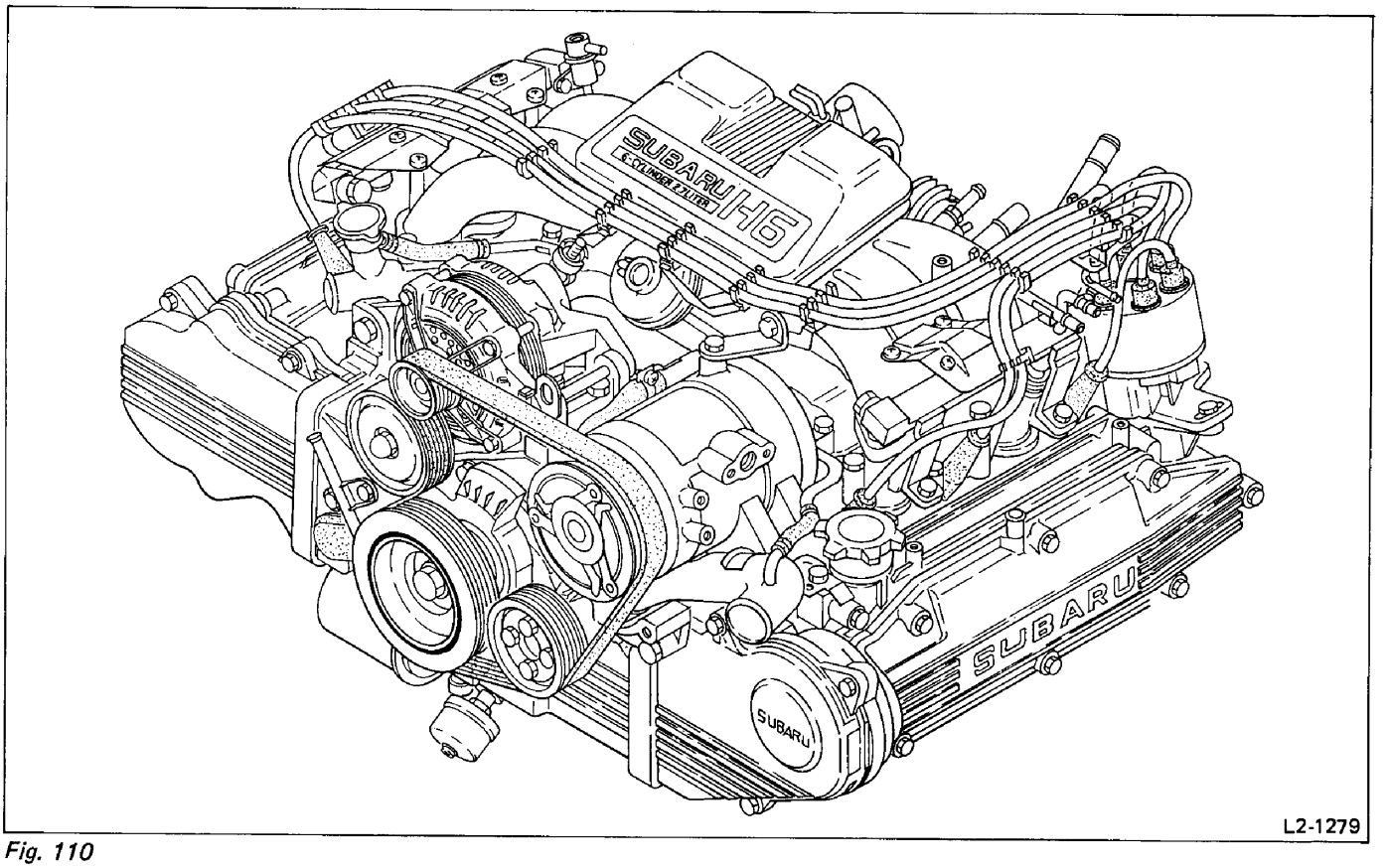


Fig. 110

CYLINDER BLOCK

1) The cylinder block, made of an aluminium alloy, is lightweight and provides good heat conduction, and is divided into two portions, left-side half and right-side half, due to the adoption of a horizontally opposed piston arrangement.

2) Four main journals are provided because of the 6-cylinder engine. These journals are lubricated through oil passages located in the right bank of the engine. The oil passage is enlarged to reduce oil resistance.

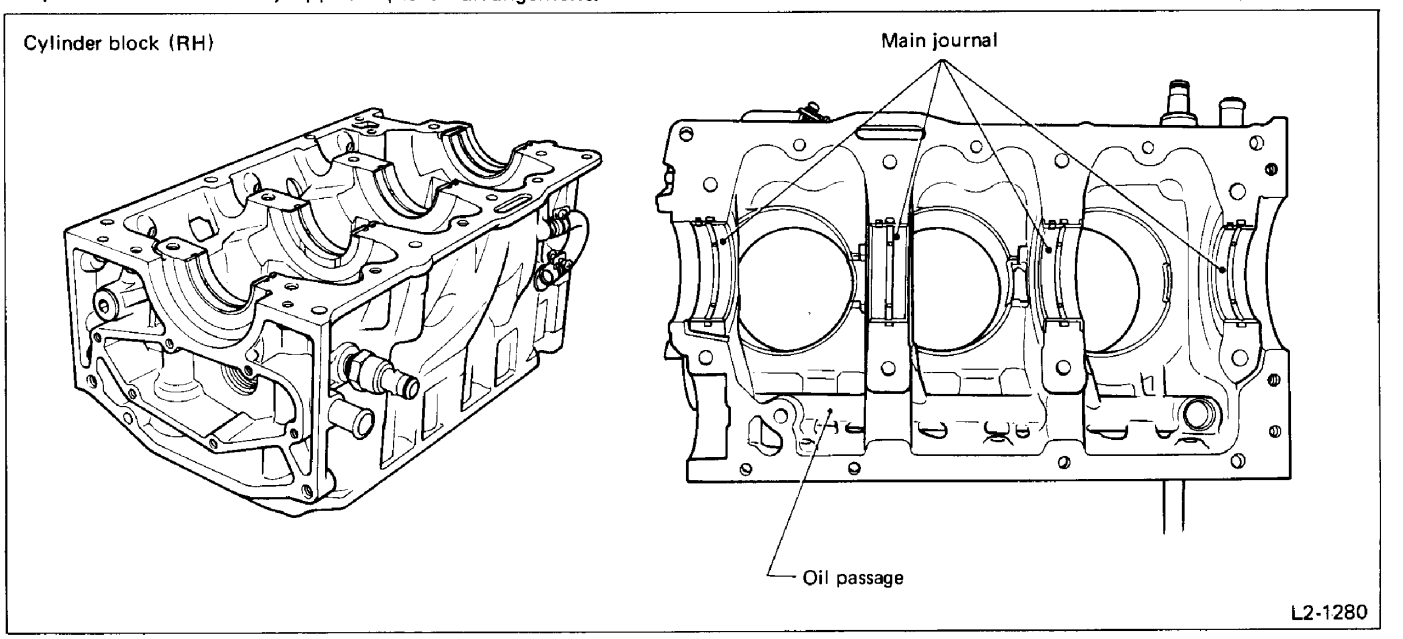


Fig. 111

CYLINDER HEAD

1) The cylinder head, made of an aluminium alloy, forms a part of the bath-tub type combustion chamber which features higher combustion efficiency.

2) The intake ports are independent types. The #1 and #3, and #2 and #4 exhaust ports are assembled types and the #5 and #6 exhaust ports are independent types.

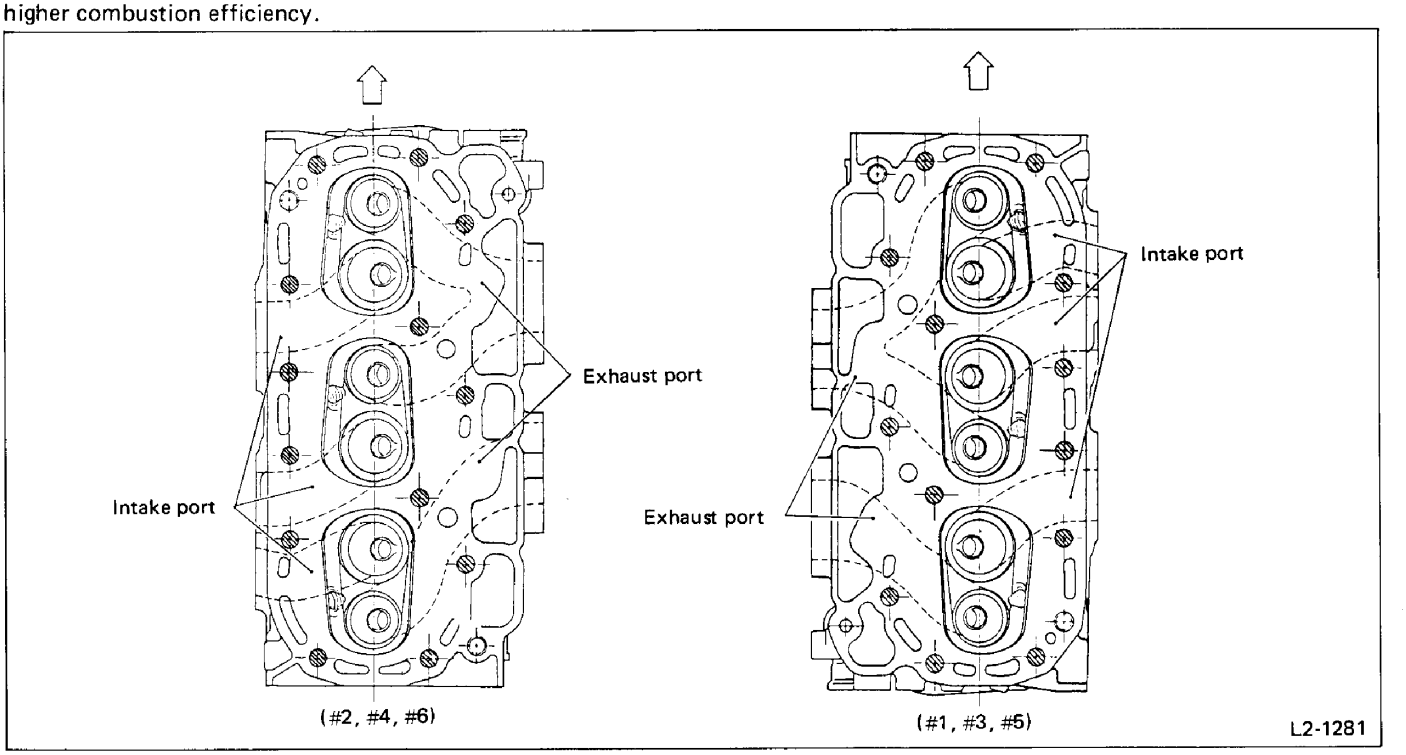


Fig. 112

HEAD GASKET

The head gasket is finished with a silicon-based, cotton-like treatment at the oil coolant passages to improve sealing.

CAMSHAFT CASE

1) The camshaft case holds the camshaft, and is an aluminium die-casting.
2) A rib connects the front journal and the mounting portion of the cam support to strengthen the camshaft case.
3) An oil filler duct and distributor are built into the left camshaft case.
4) An oil passage is provided in the camshaft case at the mounting portion of the cam support.
5) The camshaft case has a floating design which uses O-rings together with mounting bolts.

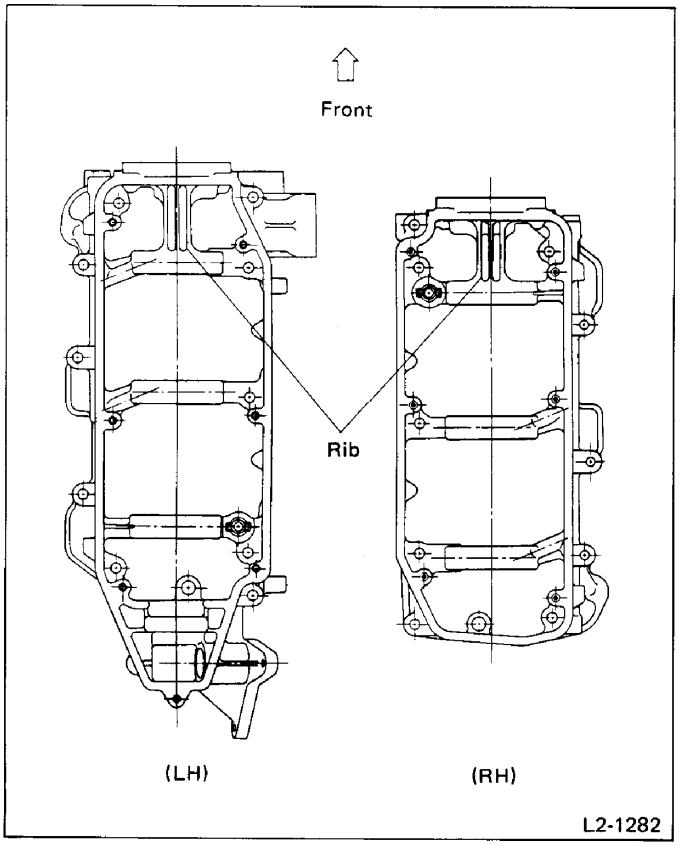


Fig. 113

ROCKER COVER

1) The rocker cover is made from thin, die-cast aluminium and is equipped with an oil separator.
2) This rocker cover adopts a float-supporting system with a rubber ring type gasket and an oil seal washer to reduce the noise level.

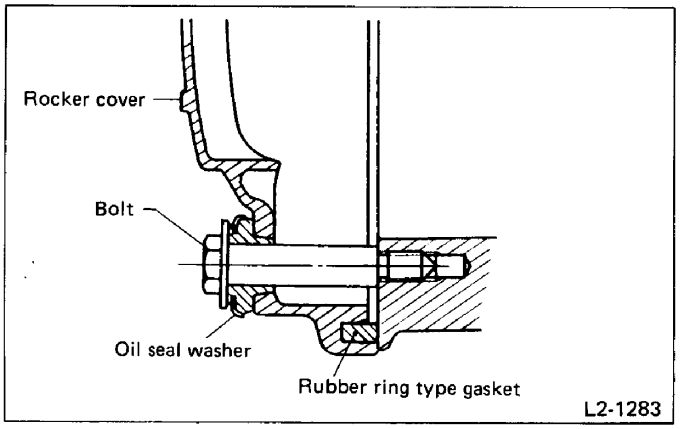


Fig. 114

CRANKSHAFT

The crankshaft is supported by four bearings. Two crank pins are used between adjacent crank journals.
These crank pins are located equally at an angle of 60° and are numbered #1, #6, #3, #2, #5 and #4 in the clockwise direction.

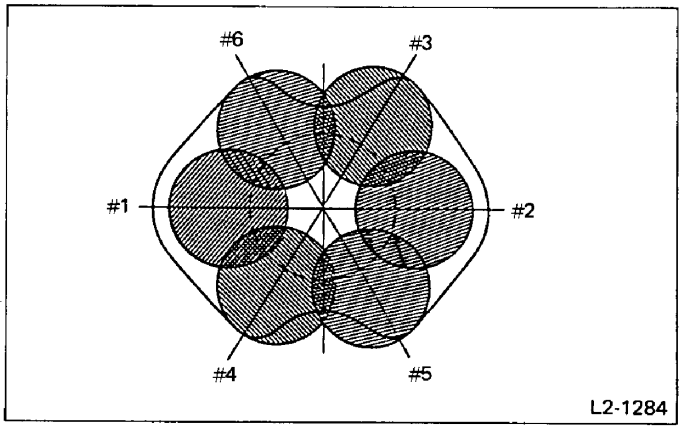


Fig. 115

CRANKSHAFT PULLEY

1) The crankshaft pulley is a damper type into which a bushing is pressed. This results in reduced torsional vibration which occurs in a long crankshaft.
2) The pulley is a one-stage type which is used with a six-crested, ribbed V-belt to improve serviceability. Belt tension is adjusted by moving the screw on the belt-tension pulley.

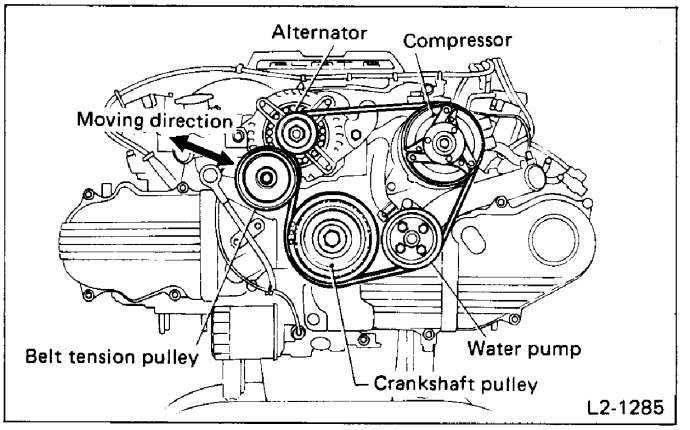


Fig. 116

Valve Mechanism

1) The valve mechanism adopts a timing belt driven overhead camshaft (OHC) type.
2) The valve mechanism is provided with the hydraulic lash adjusters for maintenance-free, noiseless valve operation.
3) The width of the left and right timing belts is designed to accommodate loads.
The left timing belt is equipped with a belt-tension adjuster to maintain constant tension.

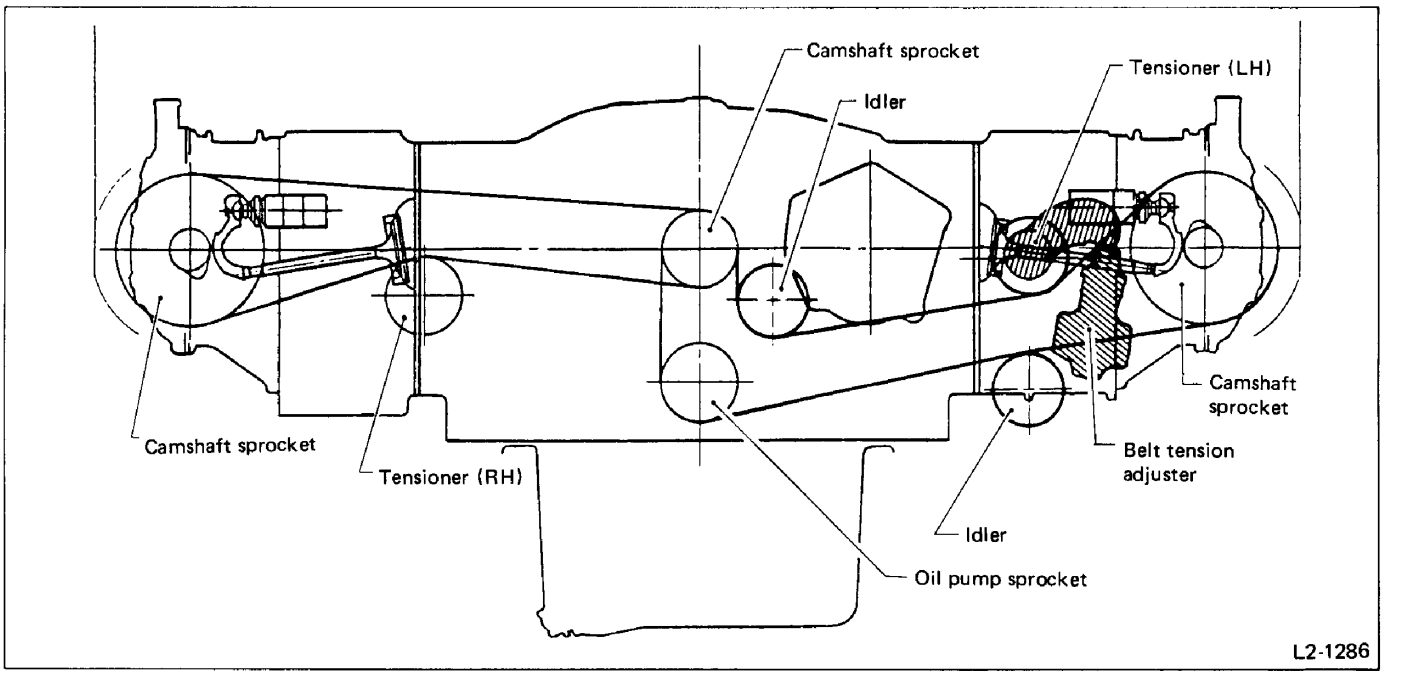


Fig. 117

CAMSHAFT

1) The camshafts are made of special cast iron, and are completely treated with Lubrite except for the bearing portions to improve initial fitting to the rocker arms. The cam rubbed surface is chilled to increase wear-resistance.
2) The cam profile is specially designed for this OHC type, and features higher output and less fuel consumption.
3) The cam base circle has an oil hole for lubricating the rocker arm. The distributor drive gear is mounted on the left-hand camshaft.

VALVE ROCKER AND VALVE LASH ADJUSTER

1) The rocker arms are special steel forgings having great strength and rigidity. Each arm is fitted with a sintered metal tip to improve wear resistance.
2) The hydraulic valve lash adjuster eliminates the need for valve clearance adjustment.
3) The rocker arms and valve lash adjusters are common between intake and exhaust valves.

VALVE AND VALVE SPRING

1) The valve has a small valve stem diameter [7 mm (0.28 in) dia.] to reduce the valve weight.
2) Both the intake and exhaust valve springs are non-linear-pitch, double types.
3) The variable pitch valve spring is adopted to improve valve follow-up performance at high engine speeds.

BELT TENSION ADJUSTER, TENSIONER

1) The belt tension adjuster is oil-filled and consists of a spring and a special screw.
2) The adjuster used with the left timing belt automatically adjusts and maintains belt tension.
3) The left belt tensioner is supported by a self-lubricating, resin bearing.

Operation

The belt tension adjuster applies a constant load to the contact portions and the arm and operates as follows:

- Operation in the direction of belt elongation
  (1) If the left timing belt becomes loose, the adjuster shaft turns counterclockwise by spring tension when viewed from the bottom.
  (2) The rod which meshes with the end of the adjuster shaft is then lifted.
  The rod is not turned by the bearing but moves only up and down.
  (3) The cap, which is coupled to the rod with a cotter pin, moves to push the tensioner arm up.
  (4) When the force lowering the arm by belt tension and the force to raising the cap by spring tension are balanced, the shaft stops. This maintains constant belt tension.
- Operation in the direction of belt contraction
  (Absorbs a change in belt length with a change in temperature)
  Basically, the belt-tension adjuster operates in the reverse manner of belt elongation.

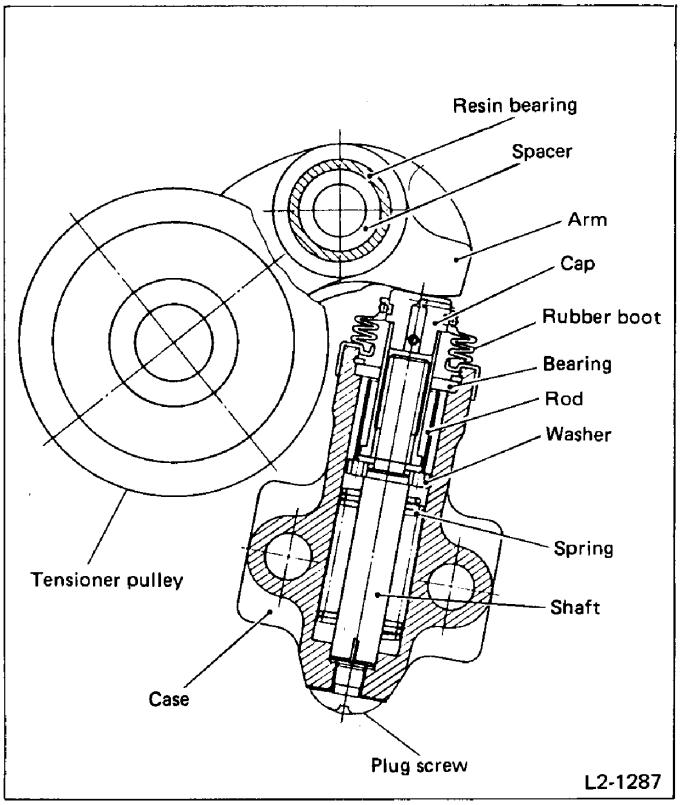


Fig. 118

A screw is used to connect the shaft and rod so that the tensioner arm can be pushed up easily and not pushed down.

CAMSHAFT SPROCKET AND TIMING BELT

1) The camshaft sprocket has special round teeth featuring positive engagement with belt teeth and smooth, low-noise operation.
2) The timing belt is composed of a core featuring great strength and less elongation, and a canvas (tooth face portion) having superior wear resistance and highly heat-resistant rubber.
3) A heavy load is applied to the left timing belt by the oil pump. For this reason, this belt is 6 mm (0.24 in) wider than the right belt.

TIMING BELT COVER

1) The resin-mold timing belt cover, consisting of five pieces, is used to protect the timing belt against dust and water.
2) Right-hand side cover has an access hole for belt tensioner adjustment.

SPECIFICATIONS AND SERVICE DATA

SPECIFICATIONS

ENGINE	Type		Horizontally opposed, liquid cooled, 6-cylinder, 4-stroke gasoline engine with multi-point fuel injection
	Valve arrangement		Over-head camshaft type
	Bore x Stroke mm (in)		92 x 67 (3.62 x 2.64)
	Piston displacement cm^3 (cc, cu in)		2,672 (2,672, 163.05)
	Compression ratio		9.5
	Compression pressure (at 350 rpm) kPa (kg/cm^2, psi)		1,157 (11.8, 168)
	Number of piston rings		Pressure ring: 2, Oil ring: 1
	Intake valve timing	Opening	12° BTDC
		Closing	60° ABDC
	Exhaust valve timing	Opening	60° BBDC
		Closing	16° ATDC
	Idling speed (At neutral (or N) or P position) rpm		750 ± 100
	Firing order		1 → 6 → 3 → 2 → 5 → 4
	Ignition timing BTDC/rpm		20°/750

SERVICE DATA

Cylinder head	Surface warpage limit			0.075 mm	(0.0030 in)
	Surface grinding limit			0.3 mm	(0.012 in)
	Standard height			90.6 mm	(3.567 in)
Valve set	Refacing angle			90°	
	Wear limit			0.5 mm	(0.020 in)
	Contacting width		Intake	1.2 – 1.8 mm	(0.047 – 0.071 in)
			Exhaust	1.5 – 2.0 mm	(0.059 – 0.079 in)
Valve guide	Inner diameter			7.000 – 7.015 mm	(0.2756 – 0.2762 in)
	Protrusion above head			17 – 18 mm	(0.67 – 0.71 in)
Valve stem	Head edge thickness		Intake STD	1.3 mm	(0.051 in)
			Limit	0.8 mm	(0.031 in)
			Exhaust STD	1.3 mm	(0.051 in)
			Limit	0.8 mm	(0.031 in)
	Stem diameter		Intake	6.950 – 6.965 mm	(0.2736 – 0.2742 in)
			Exhaust	6.945 – 6.960 mm	(0.2734 – 0.2740 in)
	Stem oil clearance (between valve guide and valve stem)	STD	Intake	0.035 – 0.065 mm	(0.0014 – 0.0026 in)
			Exhaust	0.040 – 0.070 mm	(0.0016 – 0.0028 in)
		Limit		0.15 mm	(0.0059 in)
	Overall length		Intake & Exhaust	107.58 mm	(4.2354 in)
Valve spring	Free length		Outer spring	51.7 mm	(2.035 in)
			Inner spring	50.3 mm	(1.980 in)
	Squareness		Outer spring	2.3 mm	(0.091 in)
			Inner spring	2.2 mm	(0.087 in)
	Tension/spring height		Outer spring	177.5 – 204.0 N (18.1 – 20.8 kg, 39.9 – 45.9 lb)/ 41.5 mm (1.634 in)	
				447.2 – 513.9 N (45.6 – 52.4 kg, 100.5 – 115.5 lb)/ 31.5 mm (1.240 in)	
			Inner spring	88.3 – 101.0 N (9.0 – 10.3 kg, 19.8 – 22.7 lb)/ 38.5 mm (1.516 in)	
				201.0 – 230.5 N (20.5 – 23.5 kg, 45.2 – 51.8 lb)/ 28.5 mm (1.122 in)	

STD: Standard

Valve lash adjuster	Outer diameter		21.380 – 21.393 mm	(0.8417 – 0.8422 in)
	Cylinder head adjuster hole I.D.		21.400 – 21.441 mm	(0.8425 – 0.8441 in)
	Adjuster-to-hole clearance	STD	0.007 – 0.061 mm	(0.0003 – 0.0024 in)
		Limit	0.1 mm	(0.004 in)
Cylinder block	Surface warpage limit (mating with cylinder head)		0.075 mm	(0.0030 in)
	Surface grinding limit		0.4 mm	(0.016 in)
	Metal housing I.D.		59.000 – 59.018 mm	(2.3228 – 2.3235 in)
	Oil seal hole I.D.	Front and center	59.000 – 59.010 mm	(2.3228 – 2.3232 in)
		Rear	93.000 – 93.035 mm	(3.6614 – 3.6628 in)
	Cylinder bore	STD	91.985 – 92.015 mm	(3.6214 – 3.6226 in)
		Taper limit	0.050 mm	(0.0020 in)
		Out-of roundness limit	0.050 mm	(0.0020 in)
		Piston clearance STD	0.015 – 0.035 mm	(0.0006 – 0.0014 in)
		Limit	0.060 mm	(0.0024 in)
		Enlarging (boring) limit	0.5 mm	(0.020 in)
Piston	Outer diameter	STD	91.970 – 91.980 mm	(3.6209 – 3.6213 in)
		0.25 mm (0.0098 in) OS	92.220 – 92.230 mm	(3.6307 – 3.6311 in)
		0.50 mm (0.0197 in) OS	92.470 – 92.480 mm	(3.6405 – 3.6409 in)
	Standard inner diameter of piston pin hole		20.999 – 21.009 mm	(0.8267 – 0.8271 in)
Piston pin	Outer diameter		20.994 – 21.000 mm	(0.8265 – 0.8268 in)
	Standard clearance between piston pin and hole in piston		0.001 – 0.015 mm	(0.00004 – 0.00059 in)
	Degree of fit		Piston pin must be fitted into position with thumb at 20°C (68°F).	
	Standard clearance between piston pin and hole in connecting rod		0 – 0.022 mm	(0 – 0.0009 in)
Piston ring	Width	Top ring	1.17 – 1.19 mm	(0.0461 – 0.0469 in)
		Second ring	1.47 – 1.49 mm	(0.0579 – 0.0587 in)
		Oil ring	Combination ring	
	Radial wall thickness	Top ring	3.0 – 3.2 mm	(0.118 – 0.126 in)
		Second ring	3.6 – 3.8 mm	(0.142 – 0.150 in)
		Oil ring	Combination ring	
	Piston ring gap	Top & Second ring STD	0.2 – 0.35 mm	(0.0079 – 0.0138 in)
		Limit	1.5 mm	(0.059 in)
		Oil ring STD	0.3 – 0.9 mm	(0.012 – 0.035 in)
		Limit	2.0 mm	(0.079 in)
	Clearance between piston ring and piston ring groove	Top ring STD	0.040 – 0.080 mm	(0.0016 – 0.0031 in)
		Limit	0.15 mm	(0.0059 in)
		Second ring STD	0.030 – 0.070 mm	(0.0012 – 0.0028 in)
		Limit	0.15 mm	(0.0059 in)
		Oil ring STD	0 mm	(0 in)
		Limit	0 mm	(0 in)

STD: Standard OS: Oversize

Connecting rod	Distance between big end and small end hole		116.95 – 117.05 mm	(4.6043 – 4.6083 in)
	Crank pin bore diameter		48.000 – 48.019 mm	(1.8898 – 1.8905 in)
	Piston pin bore diameter		21.000 – 21.016 mm	(0.8268 – 0.8274 in)
	Width at big end		19.35 – 19.43 mm	(0.7618 – 0.7650 in)
	Side clearance	STD	0.070 – 0.330 mm	(0.0028 – 0.0130 in)
		Limit	0.4 mm	(0.016 in)
	Bend twist per 100 mm (3.94 in) in length	Limit	0.10 mm	(0.0039 in)
Connecting rod bearing	Thickness at center portion	STD	1.485 – 1.490 mm	(0.0585 – 0.0587 in)
		0.03 mm (0.0012 in) US	1.500 – 1.505 mm	(0.0591 – 0.0593 in)
		0.05 mm (0.0020 in) US	1.510 – 1.515 mm	(0.0594 – 0.0596 in)
		0.25 mm (0.0098 in) US	1.610 – 1.615 mm	(0.0634 – 0.0636 in)
	Oil clearance	STD	0.010 – 0.070 mm	(0.0004 – 0.0028 in)
		Limit	0.10 mm	(0.0039 in)
Crankshaft	Bend limit		0.035 mm	(0.0014 in)
	Thrust clearance	STD	0.010 – 0.095 mm	(0.0004 – 0.0037 in)
		Limit	0.30 mm	(0.0118 in)
	Crank journal outer diameter	Front STD	54.957 – 54.972 mm	(2.1637 – 2.1642 in)
		0.03 mm (0.0012 in) US	54.927 – 54.942 mm	(2.1625 – 2.1631 in)
		0.05 mm (0.0020 in) US	54.907 – 54.922 mm	(2.1617 – 2.1623 in)
		0.25 mm (0.0098 in) US	54.707 – 54.722 mm	(2.1538 – 2.1544 in)
		Center & Center II STD	54.954 – 54.970 mm	(2.1635 – 2.1642 in)
		0.03 mm (0.0012 in) US	54.924 – 54.940 mm	(2.1624 – 2.1630 in)
		0.05 mm (0.0020 in) US	54.904 – 54.920 mm	(2.1616 – 2.1622 in)
		0.25 mm (0.0098 in) US	54.704 – 54.720 mm	(2.1537 – 2.1543 in)
		Rear STD	54.955 – 54.970 mm	(2.1636 – 2.1642 in)
		0.03 mm (0.0012 in) US	54.925 – 54.940 mm	(2.1624 – 2.1630 in)
		0.05 mm (0.0020 in) US	54.905 – 54.920 mm	(2.1616 – 2.1622 in)
		0.25 mm (0.0098 in) US	54.705 – 54.720 mm	(2.1537 – 2.1543 in)
	Width at center portion		25.970 – 26.015 mm	(1.0224 – 1.0242 in)
	Oil clearance	Front & Rear STD	0.003 – 0.036 mm	(0.0001 – 0.0014 in)
		Limit	0.055 mm	(0.0022 in)
		Center & Center II STD	0.008 – 0.027 mm	(0.0003 – 0.0011 in)
		Limit	0.045 mm	(0.0018 in)
	Out-of roundness		0.030 mm (0.0012 in) or less	
	Grinding limit		0.250 mm	(0.0098 in)
	Crankpin outer diameter	STD	44.995 – 45.010 mm	(1.7715 – 1.7720 in)
		0.03 mm (0.0012 in) US	44.965 – 44.980 mm	(1.7703 – 1.7709 in)
		0.05 mm (0.0020 in) US	44.945 – 44.960 mm	(1.7695 – 1.7701 in)
		0.25 mm (0.0098 in) US	44.745 – 44.760 mm	(1.7616 – 1.7622 in)
	Width		19.50 – 19.68 mm	(0.7677 – 0.7748 in)
	Oil clearance	STD	0.010 – 0.054 mm	(0.0004 – 0.0021 in)
		Limit	0.10 mm	(0.0039 in)
	Out-of roundness		0.030 mm (0.0012 in) or less	
	Grinding limit		0.250 mm	(0.0098 in)

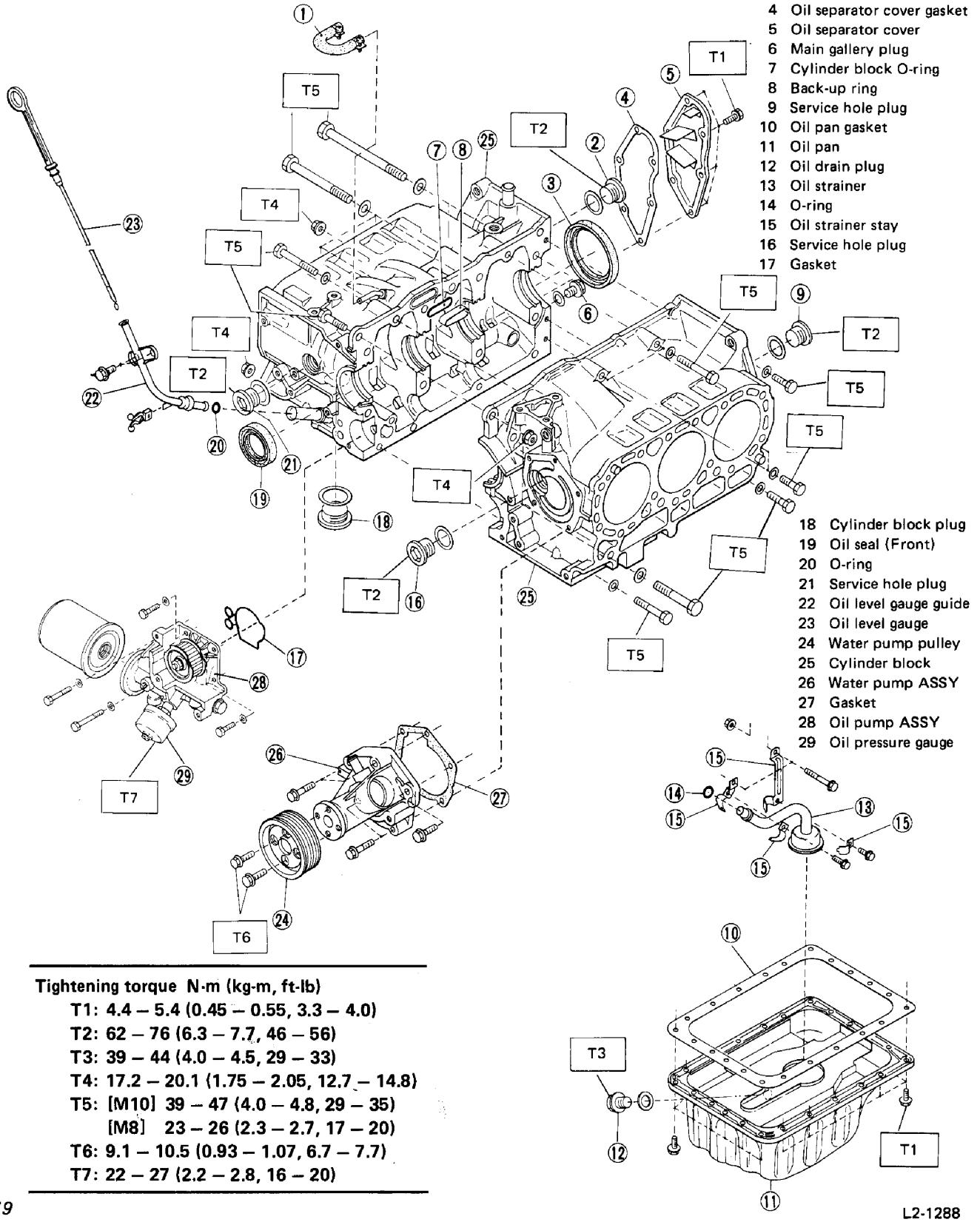
STD: Standard **OS: Oversize** **US: Undersize**

Crankshaft bearing	Thickness	Front & Rear	STD	2.015 – 2.019 mm	(0.0793 – 0.0795 in)
			0.03 mm (0.0012 in) US	2.030 – 2.034 mm	(0.0799 – 0.0801 in)
			0.05 mm (0.0020 in) US	2.040 – 2.044 mm	(0.0803 – 0.0805 in)
			0.25 mm (0.0098 in) US	2.140 – 2.144 mm	(0.0843 – 0.0844 in)
		Center & Center II	STD	2.019 – 2.022 mm	(0.0795 – 0.0796 in)
			0.03 mm (0.0012 in) US	2.034 – 2.037 mm	(0.0801 – 0.0802 in)
			0.05 mm (0.0020 in) US	2.044 – 2.047 mm	(0.0805 – 0.0806 in)
			0.25 mm (0.0098 in) US	2.144 – 2.147 mm	(0.0844 – 0.0845 in)
	Width	Center	STD	25.920 – 25.960 mm	(1.0205 – 1.0220 in)
Camshaft	Bend limit			0.025 mm	(0.0010 in)
	Thrust clearance		STD	0.030 – 0.260 mm	(0.0012 – 0.0102 in)
			Limit	0.35 mm	(0.0138 in)
	Cam lobe height		STD	39.64 – 39.74 mm	(1.5606 – 1.5646 in)
			Wear limit	39.49 mm	(1.5547 in)
	Cam journal outer diameter	Front		37.964 – 37.980 mm	(1.4946 – 1.4953 in)
		Center		48.464 – 48.480 mm	(1.9080 – 1.9087 in)
		Center II		47.964 – 47.980 mm	(1.8883 – 1.8890 in)
		Rear		49.464 – 47.480 mm	(1.9474 – 1.8693 in)
		LH distributor		38.964 – 38.980 mm	(1.5340 – 1.5346 in)
	Oil clearance		STD	0.020 – 0.054 mm	(0.0008 – 0.0021 in)
			Limit	0.070 mm	(0.0028 in)
Camshaft case	Camshaft journal inner diameter	Front (camshaft support inner diameter)		*1 38.000 – 38.018 mm	(1.4961 – 1.4968 in)
		Center		48.500 – 48.525 mm	(1.9094 – 1.9104 in)
		Center II		48.000 – 48.025 mm	(1.8898 – 1.8907 in)
		Rear		47.500 – 47.525 mm	(1.8701 – 1.8711 in)
		Distributor		39.000 – 39.013 mm	(1.5354 – 1.5359 in)
	Camshaft support depth of spigot			19.00 – 19.08 mm	(0.7480 – 0.7512 in)
Camshaft support	I.D.			38.000 – 38.018 mm	(1.4961 – 1.4968 in)
	O.D.			57.971 – 59.990 mm	(2.2823 – 2.3618 in)
	Height of spigot			14.95 – 15.00 mm	(0.5886 – 0.5906 in)

STD: Standard **US: Undersize** ***1 Camshaft support I.D.**

COMPONENT PARTS

Cylinder Block and Oil Pan



1 Water by-pass hose
2 Service hole plug
3 Oil seal (Rear)
4 Oil separator cover gasket
5 Oil separator cover
6 Main gallery plug
7 Cylinder block O-ring
8 Back-up ring
9 Service hole plug
10 Oil pan gasket
11 Oil pan
12 Oil drain plug
13 Oil strainer
14 O-ring
15 Oil strainer stay
16 Service hole plug
17 Gasket
18 Cylinder block plug
19 Oil seal (Front)
20 O-ring
21 Service hole plug
22 Oil level gauge guide
23 Oil level gauge
24 Water pump pulley
25 Cylinder block
26 Water pump ASSY
27 Gasket
28 Oil pump ASSY
29 Oil pressure gauge

Tightening torque N·m (kg-m, ft-lb)

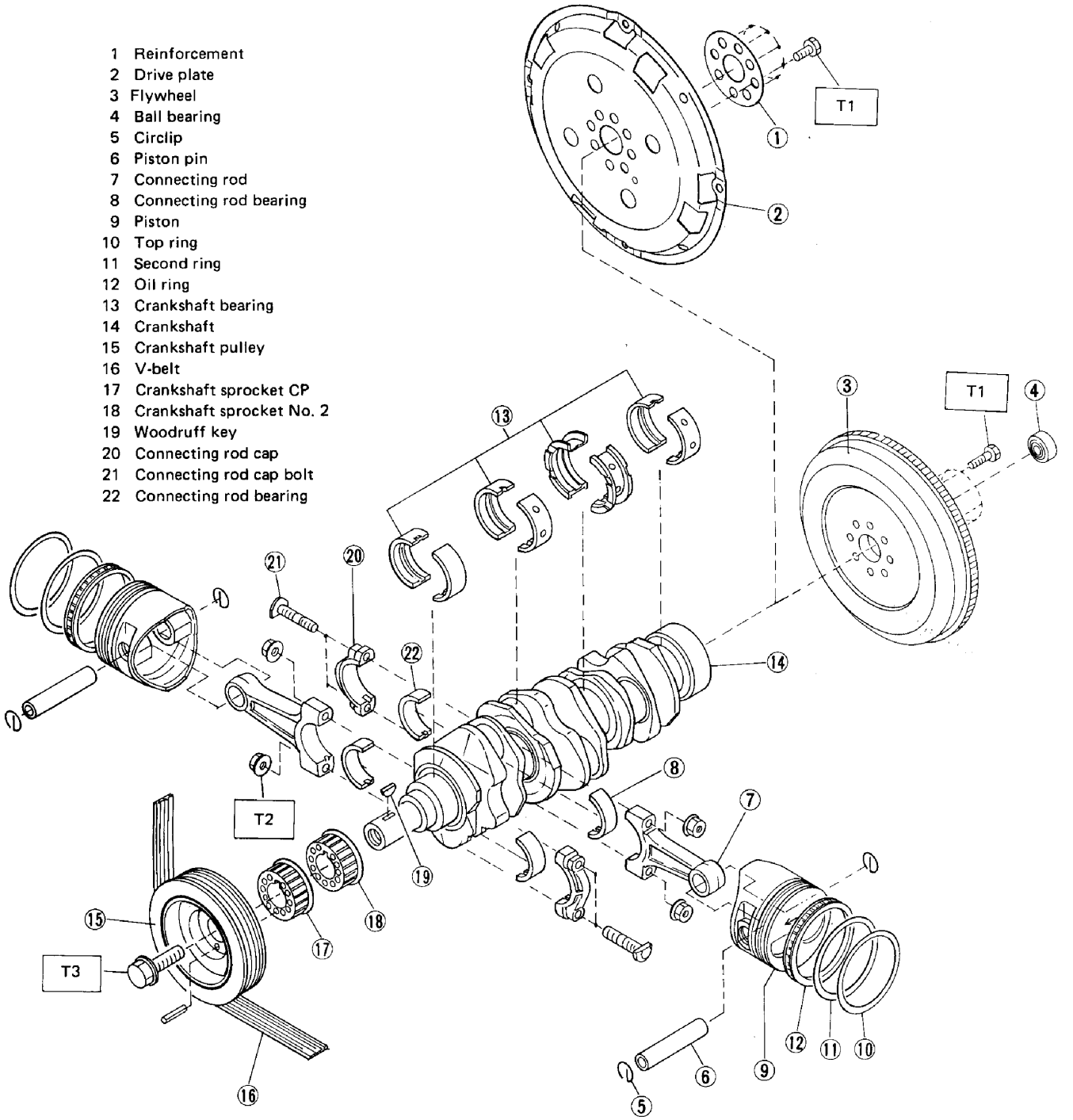
T1: 4.4 – 5.4 (0.45 – 0.55, 3.3 – 4.0)
T2: 62 – 76 (6.3 – 7.7, 46 – 56)
T3: 39 – 44 (4.0 – 4.5, 29 – 33)
T4: 17.2 – 20.1 (1.75 – 2.05, 12.7 – 14.8)
T5: [M10] 39 – 47 (4.0 – 4.8, 29 – 35)
[M8] 23 – 26 (2.3 – 2.7, 17 – 20)
T6: 9.1 – 10.5 (0.93 – 1.07, 6.7 – 7.7)
T7: 22 – 27 (2.2 – 2.8, 16 – 20)

Fig. 119

L2-1288

Crankshaft and Piston

1 Reinforcement
2 Drive plate
3 Flywheel
4 Ball bearing
5 Circlip
6 Piston pin
7 Connecting rod
8 Connecting rod bearing
9 Piston
10 Top ring
11 Second ring
12 Oil ring
13 Crankshaft bearing
14 Crankshaft
15 Crankshaft pulley
16 V-belt
17 Crankshaft sprocket CP
18 Crankshaft sprocket No. 2
19 Woodruff key
20 Connecting rod cap
21 Connecting rod cap bolt
22 Connecting rod bearing

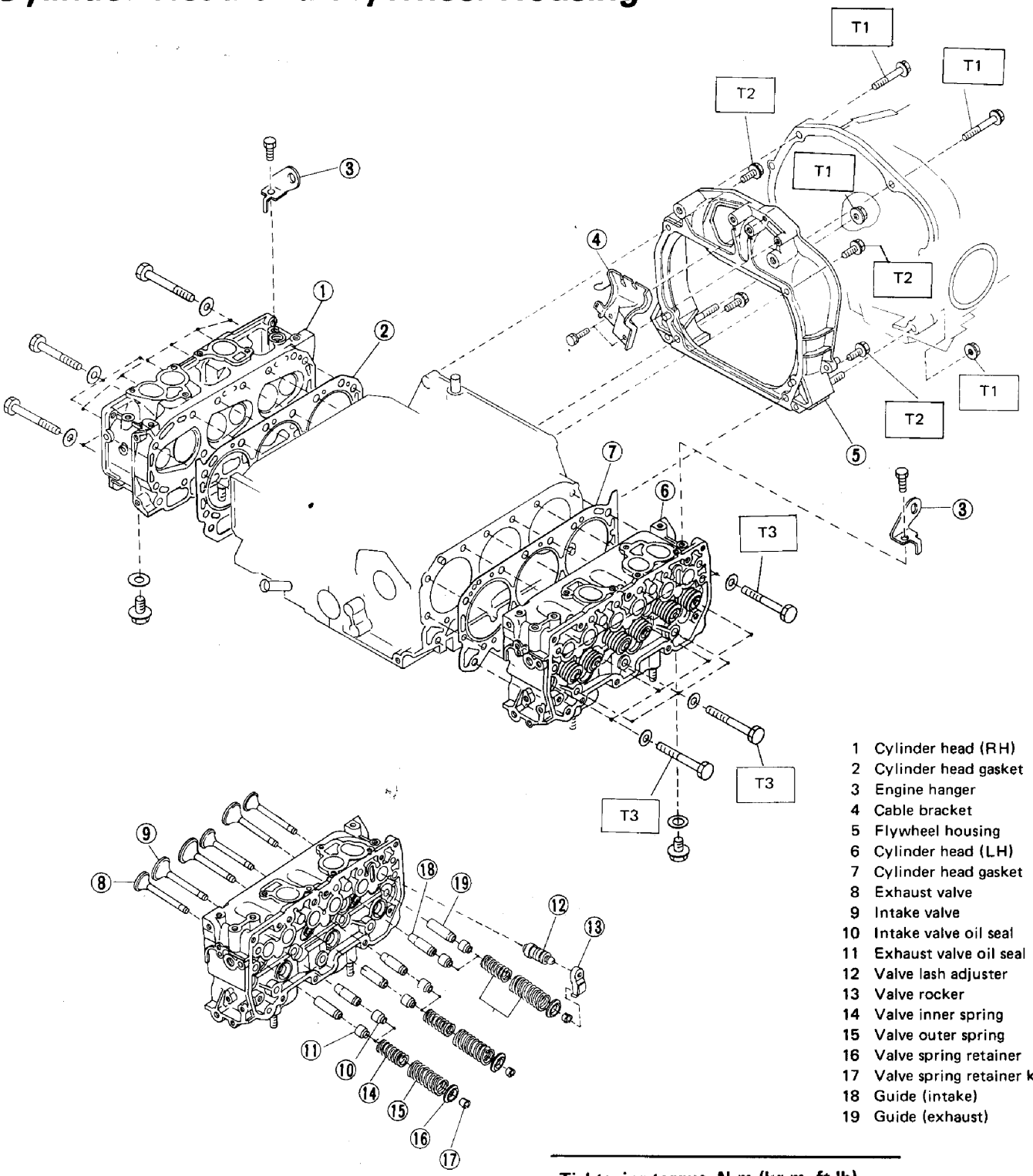


Tightening torque N·m (kg-m, ft-lb)
T1: 69 – 75 (7.0 – 7.6, 51 – 55)
T2: 39 – 42 (4.0 – 4.3, 29 – 31)
T3: 89 – 107 (9.1 – 10.9, 66 – 79)

Fig. 120

L2-1289

Cylinder Head and Flywheel Housing



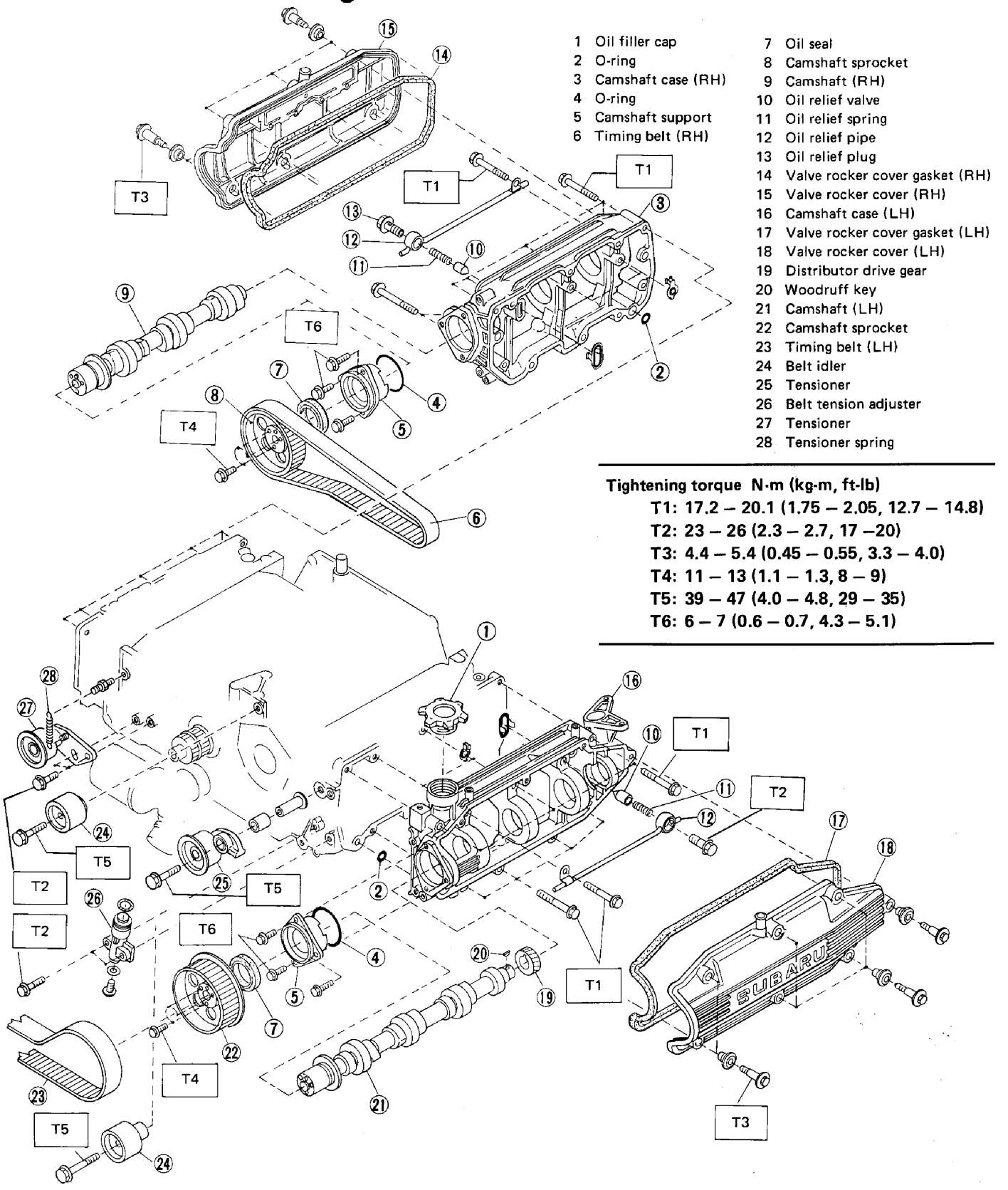
1 Cylinder head (RH)
2 Cylinder head gasket
3 Engine hanger
4 Cable bracket
5 Flywheel housing
6 Cylinder head (LH)
7 Cylinder head gasket
8 Exhaust valve
9 Intake valve
10 Intake valve oil seal
11 Exhaust valve oil seal
12 Valve lash adjuster
13 Valve rocker
14 Valve inner spring
15 Valve outer spring
16 Valve spring retainer
17 Valve spring retainer key
18 Guide (intake)
19 Guide (exhaust)

Tightening torque N·m (kg-m, ft-lb)
T1: 46 – 54 (4.7 – 5.5, 34 – 40)
T2: 34 – 40 (3.5 – 4.1, 25 – 30)
T3: 60 – 68 (6.1 – 6.9, 44 – 50)

Fig. 121

L2-1290

Camshaft and Timing Belt



1 Oil filler cap
2 O-ring
3 Camshaft case (RH)
4 O-ring
5 Camshaft support
6 Timing belt (RH)
7 Oil seal
8 Camshaft sprocket
9 Camshaft (RH)
10 Oil relief valve
11 Oil relief spring
12 Oil relief pipe
13 Oil relief plug
14 Valve rocker cover gasket (RH)
15 Valve rocker cover (RH)
16 Camshaft case (LH)
17 Valve rocker cover gasket (LH)
18 Valve rocker cover (LH)
19 Distributor drive gear
20 Woodruff key
21 Camshaft (LH)
22 Camshaft sprocket
23 Timing belt (LH)
24 Belt idler
25 Tensioner
26 Belt tension adjuster
27 Tensioner
28 Tensioner spring

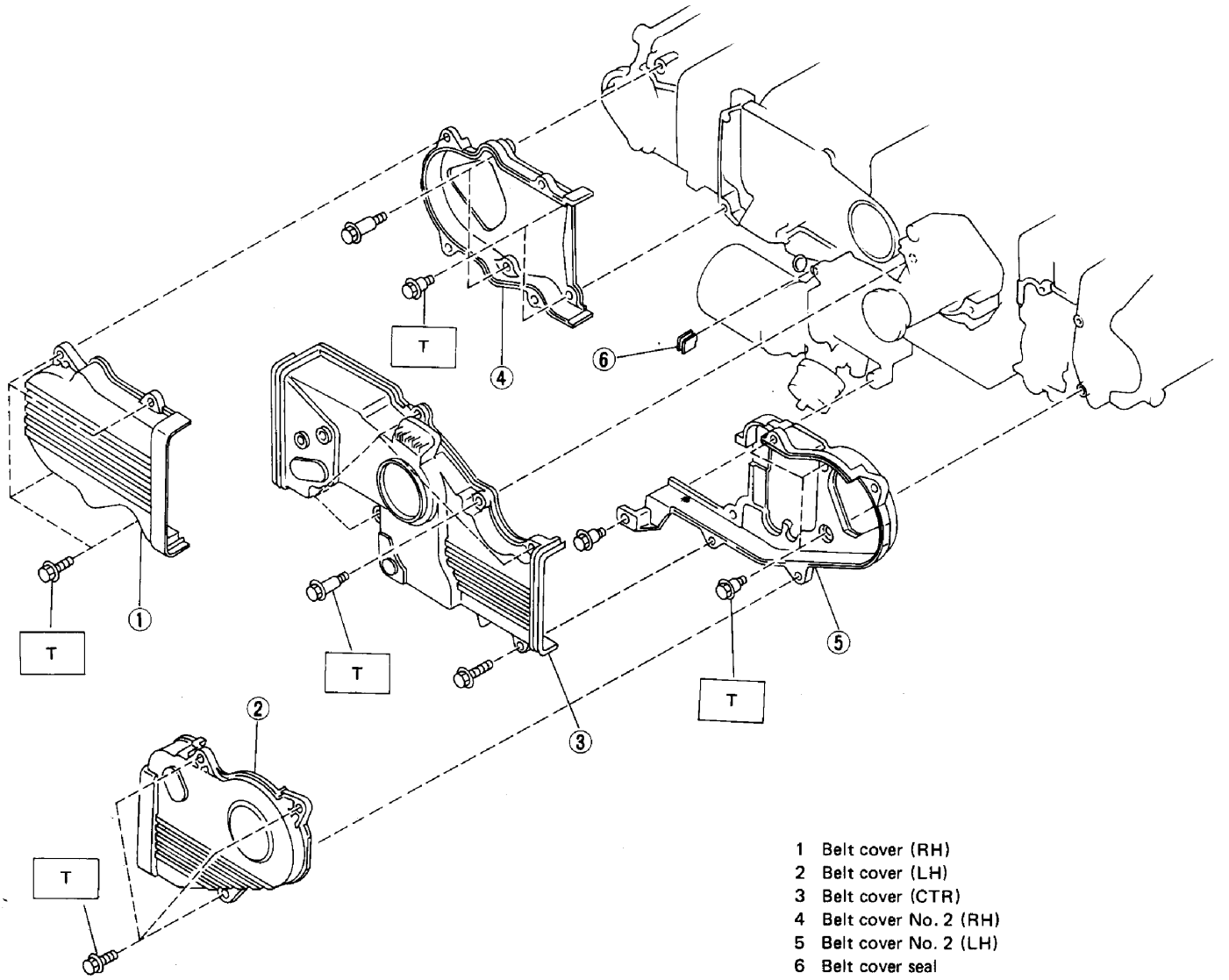
Tightening torque N·m (kg-m, ft-lb)

T1: 17.2 – 20.1 (1.75 – 2.05, 12.7 – 14.8)
T2: 23 – 26 (2.3 – 2.7, 17 –20)
T3: 4.4 – 5.4 (0.45 – 0.55, 3.3 – 4.0)
T4: 11 – 13 (1.1 – 1.3, 8 – 9)
T5: 39 – 47 (4.0 – 4.8, 29 – 35)
T6: 6 – 7 (0.6 – 0.7, 4.3 – 5.1)

Fig. 122

L2-1291

Belt Cover



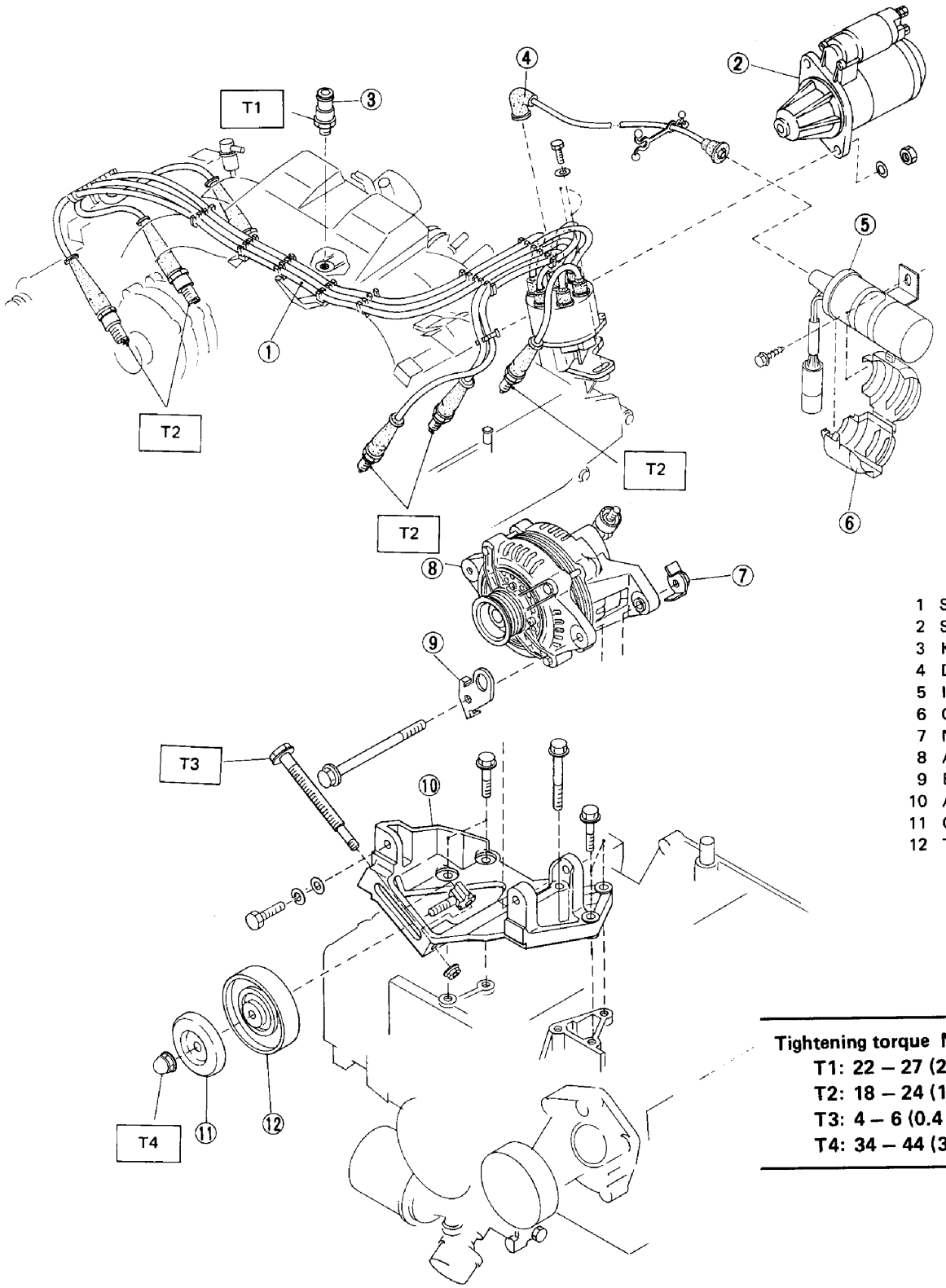
1 Belt cover (RH)
2 Belt cover (LH)
3 Belt cover (CTR)
4 Belt cover No. 2 (RH)
5 Belt cover No. 2 (LH)
6 Belt cover seal

Tightening torque N·m (kg-m, ft-lb)
T: 4.4 – 5.4 (0.45 – 0.55, 3.3 – 4.0)

Fig. 123

L2-1292

Electrical Equipment



1 Spark plug cord
2 Starter
3 Knock sensor
4 Distributor
5 Ignition coil
6 Cover
7 Nut plate
8 Alternator
9 Engine hanger
10 Alternator bracket
11 Cover
12 Tensioner pulley

Tightening torque N·m (kg-m, ft-lb)
T1: 22 – 27 (2.2.– 2.8, 16 – 20)
T2: 18 – 24 (1.8 – 2.4, 13 – 17)
T3: 4 – 6 (0.4 – 0.6, 2.9 – 4.3)
T4: 34 – 44 (3.5 – 4.5, 25 – 33)

Fig. 124

L2-1293

SERVICE PROCEDURE

General Precautions

- Before disassembling engine, install ENGINE STAND (499817100) x 2.

Place a 5 cm (2.0 in) high wooden block under the ENGINE STAND at four places so that the oil pan does not touch the floor.

- Drain coolant and engine oil.
- All parts should be thoroughly cleaned, paying special attention to the engine oil passages, pistons and bearings.
- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil prior to ASSY.
- Be careful not to let oil, grease or coolant contact the timing belt and clutch disc.
- All removed parts, if to be reused, should be reinstalled in the original positions and directions.
- Gaskets and lock washers must be replaced with new ones. Liquid gasket should be used where specified to prevent leakage.
- Bolts, nuts and washers should be replaced with new ones as required.
- Even if necessary inspections have been made in advance, proceed with ASSY work while making rechecks.

Timing Belt and Belt Cover

REMOVAL

1) Loosen water pump pulley mounting bolts.
2) Loosen two alternator mounting bolts.
3) Loosen the tension pulley lock nut to release V-belt tension. When removing V-belt, check that adjuster bolt is turned counterclockwise fully in the direction which loosens the belt.

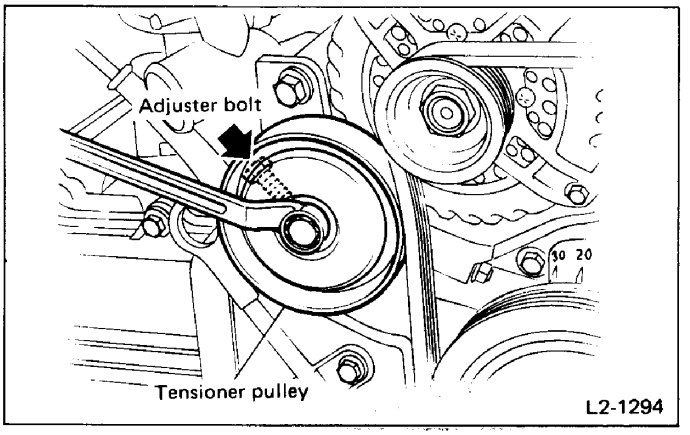


Fig. 125

4) Remove water pump pulley.
5) Remove crankshaft pulley. To lock crankshaft, use FLYWHEEL STOPPER [manual transmission model] or DRIVE PLATE STOPPER [automatic transmission model].

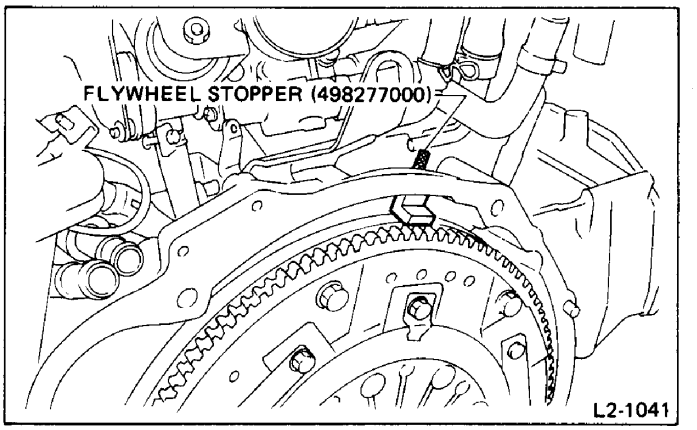


Fig. 126

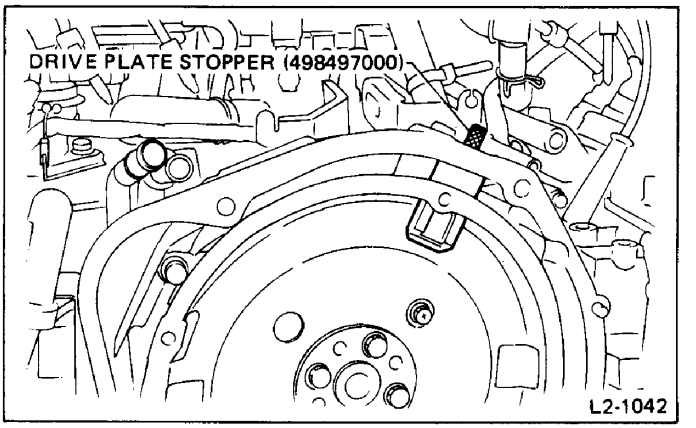


Fig. 127

6) Disconnect lead from oil pressure switch.
7) Remove oil level gauge guide together with gauge.

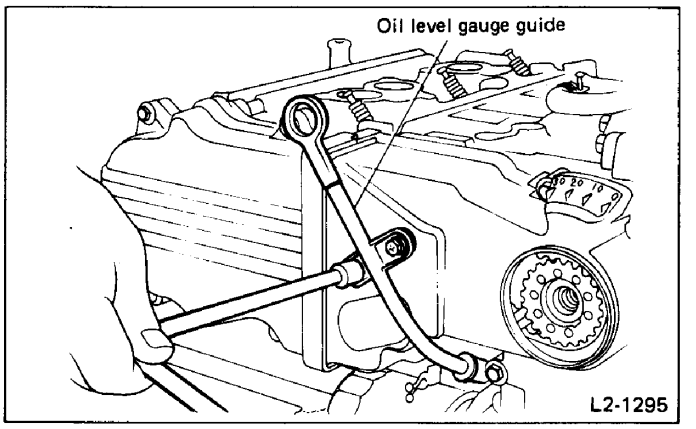


Fig. 128

8) Remove belt covers RH, LH and CTR.

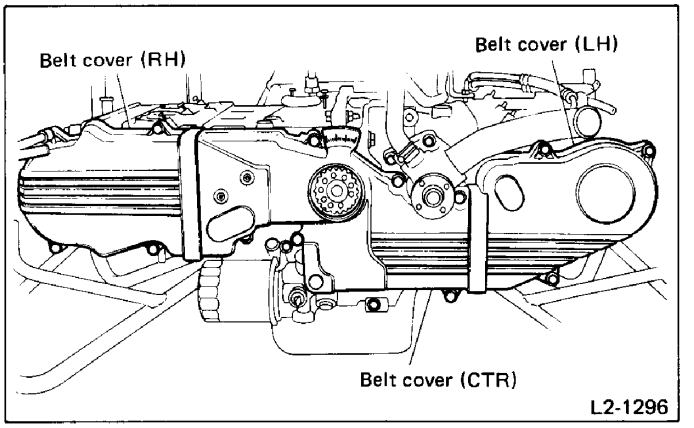


Fig. 129

9) Removing timing belt RH.
(1) Loosen tensioner mounting bolts on #1 cylinder by 1/2 turn.
(2) With tensioner fully turned to slacken belt, tighten mounting bolts.

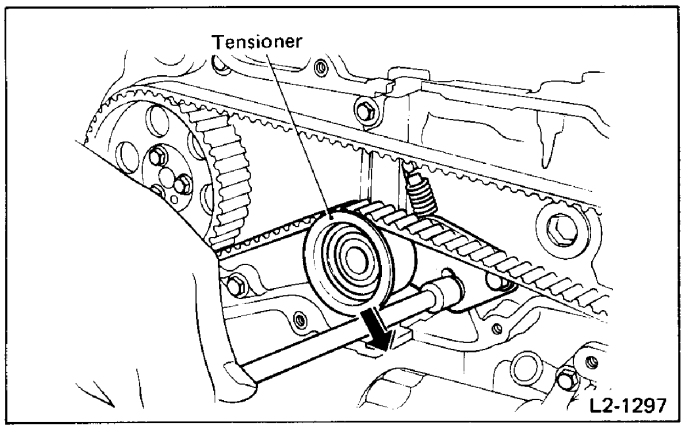


Fig. 130

(3) Mark rotating direction of timing belt, then remove belt.

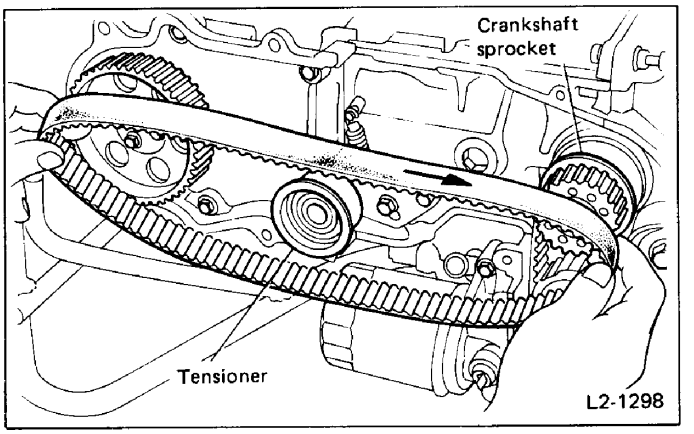


Fig. 131

10) Remove tensioner RH.
11) Remove crankshaft sprocket.
12) Removing timing belt LH.
(1) Remove idler pulley.

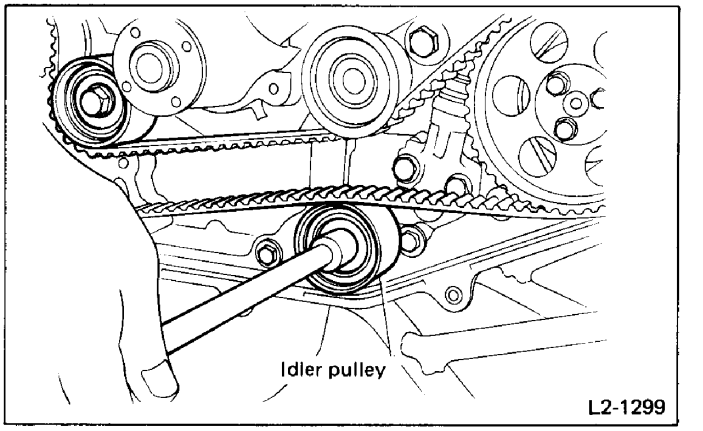


Fig. 132

(2) Remove plug rubber.

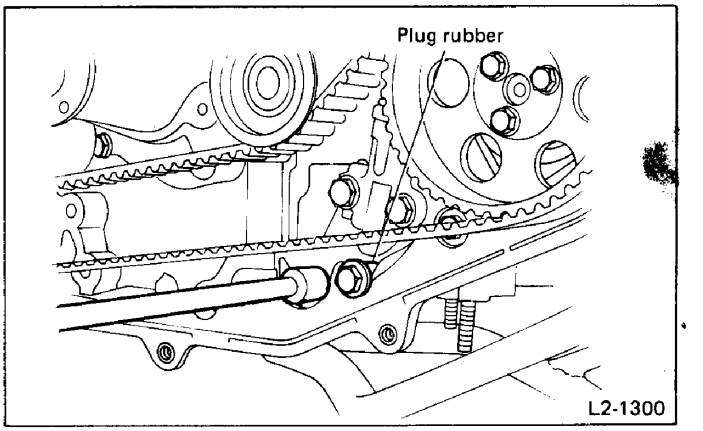


Fig. 133

(3) Remove plug screw from belt tension adjuster lower side.

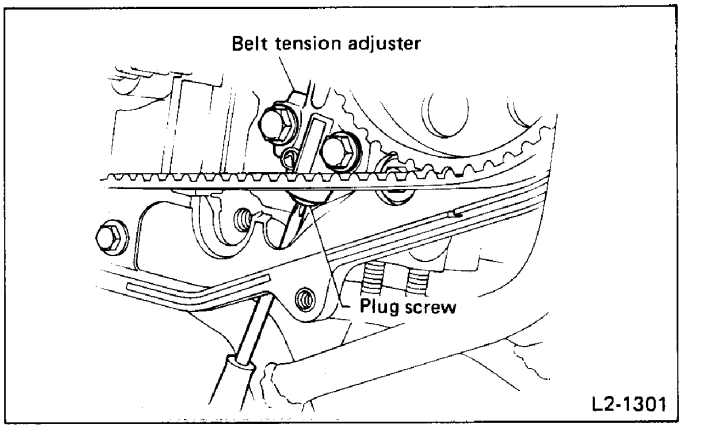


Fig. 134

(4) Insert a standard screwdriver into the hole in the bottom of belt tension adjuster. Turn the screw clockwise to loosen belt tension and install BELT ADJUSTER STOPPER (13082AA000). Remove the left belt tensioner.

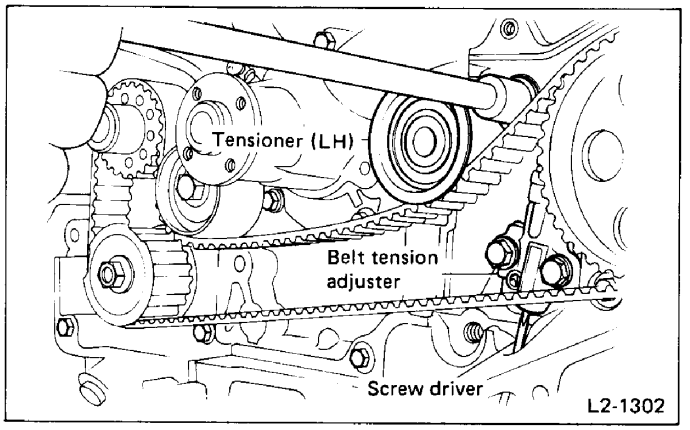


Fig. 135

(5) Remove timing belt after marking rotating direction of belt.

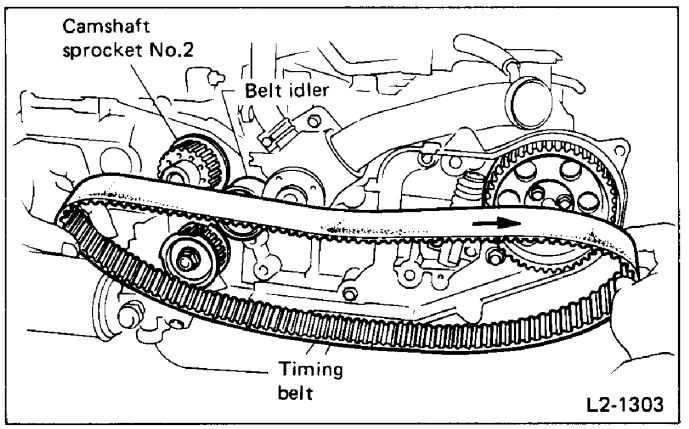


Fig. 136

13) Remove crankshaft sprocket No. 2 and idler pulley.
14) Remove belt tension adjuster.

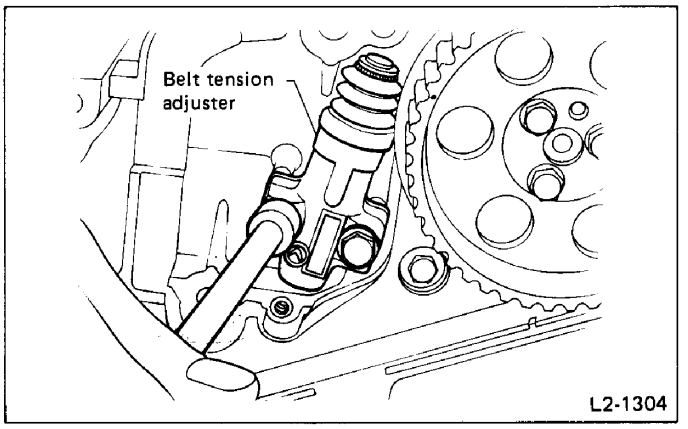


Fig. 137

After removing belt tension adjuster, reinstall plug screw in the bottom.

15) Remove camshaft sprocket RH and LH.

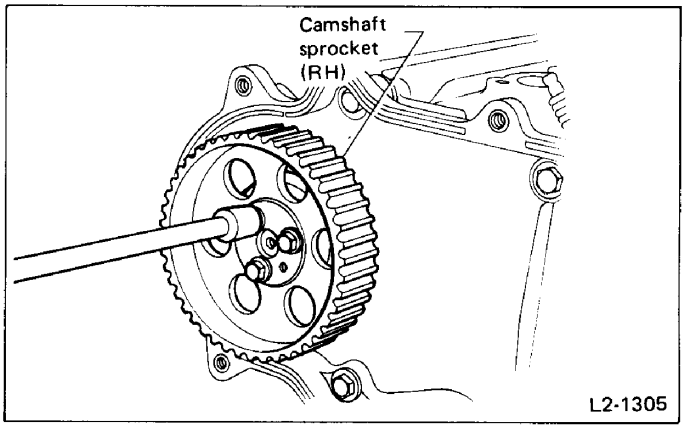


Fig. 138

16) Remove belt cover No. 2 RH and LH.

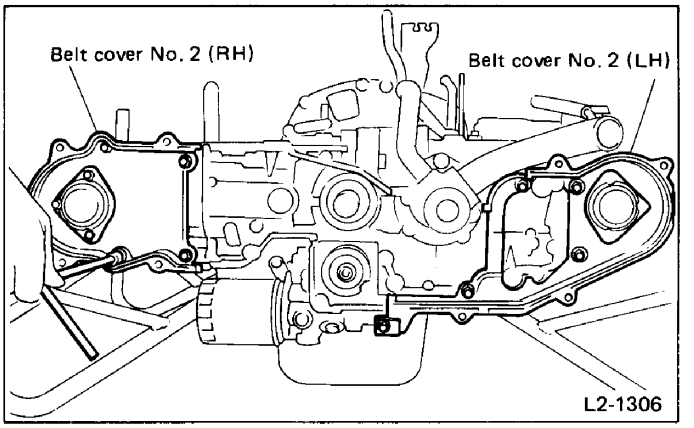


Fig. 139

INSPECTION

TIMING BELT

1) Check timing belt teeth for breaks, cracks, and wear. If any fault is found, replace belt.
2) Check the condition of back side of belt; if any crack is found, replace belt.

a. Be careful not to let oil, grease or coolant contact the belt. Remove quickly and thoroughly if this happens.
b. Do not bend the belt sharply.

TIMING BELT TENSIONER

1) Check tensioner roller for smooth rotation. Replace roller if noise or excessive play is noted.
2) Measure the out-of-squareness of tensioner roller H. If it exceeds 0.5 mm (0.020 in), replace roller.

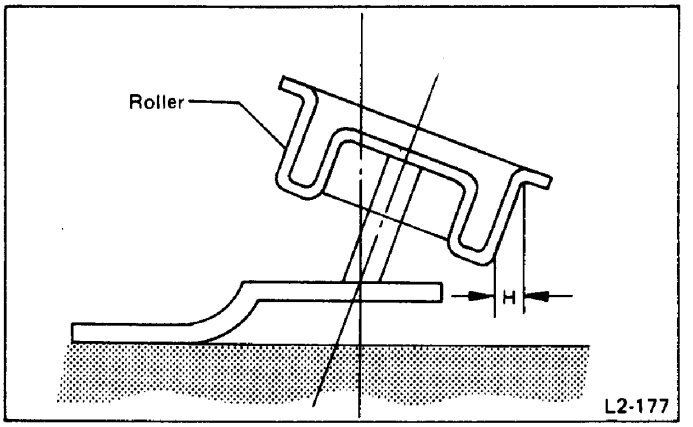


Fig. 141

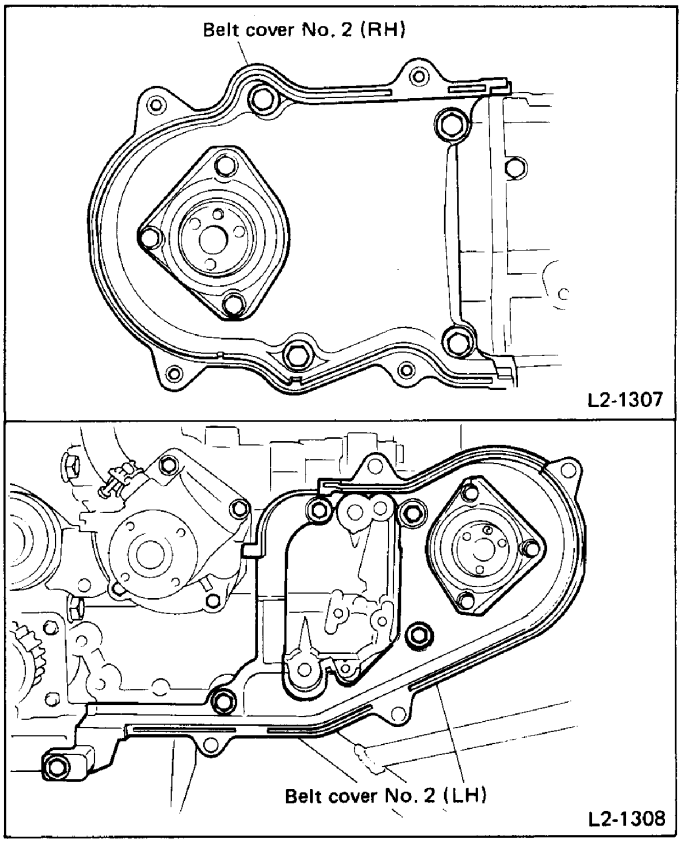


Fig. 142

BELT IDLER

Check idler for smooth rotation. Replace if noise or excessive play is noted.

INSTALLATION

1) Install belt cover No. 2 RH and LH.

Tightening torque:
4.4 – 5.4 N·m (0.45 – 0.55 kg-m, 3.3 – 4.0 ft-lb)

2) Install camshaft sprockets to right and left camshafts.

Tightening torque:
11 – 13 N·m (1.1 – 1.3 kg-m, 8 – 9 ft-lb)

3) Install belt tension adjuster.
(1) Remove plug screw from belt tension adjuster lower side.

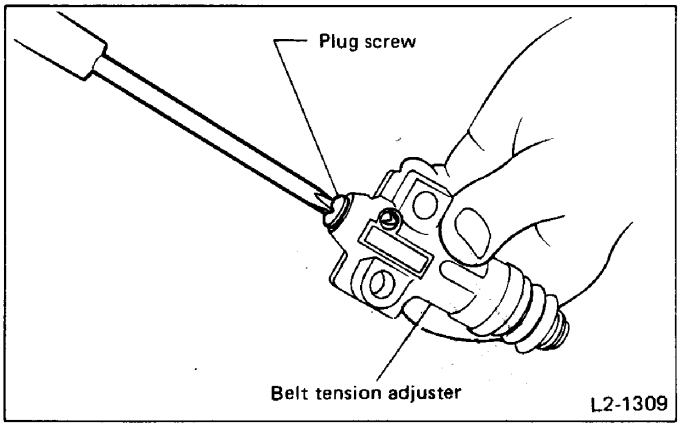


Fig. 143

(2) Insert a standard screwdriver into the hole in the bottom of belt tension adjuster. Turn the screw clockwise to compress rubber boot. Then install BELT ADJUSTER STOPPER (13082AA0000).

The clip furnished as a spare part can be used in place of BELT ADJUSTER STOPPER.

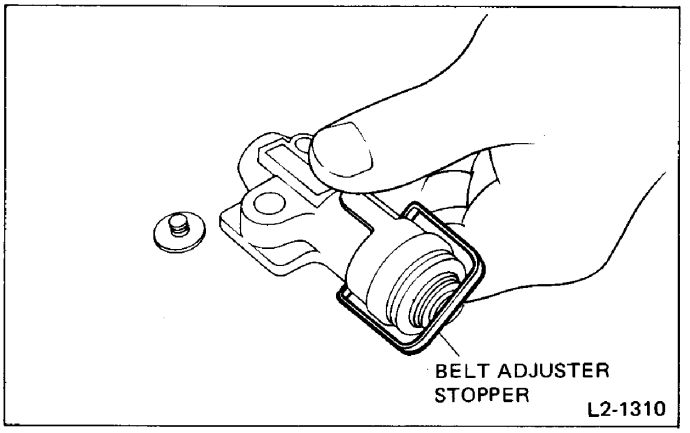


Fig. 144

(3) Using a syringe, add engine oil through air vent hole on top of rubber boot until it overflows.

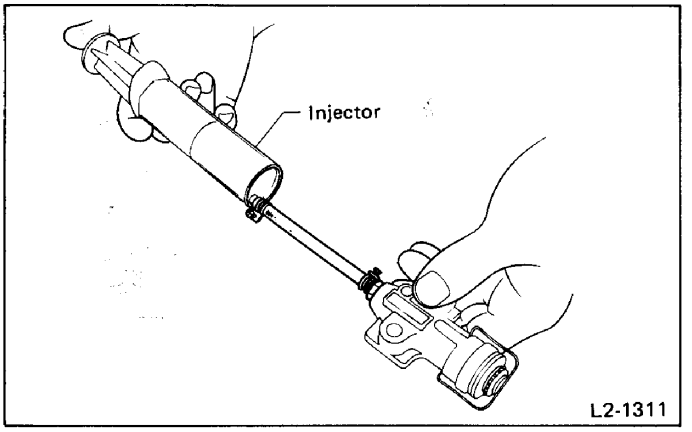


Fig. 145

(4) Install plug screw.

Be sure to use a new plug screw gasket.

(5) Install belt tension adjuster.

Tightening torque:
23 – 26 N·m (2.3 – 2.7 kg-m, 17 – 20 ft-lb)

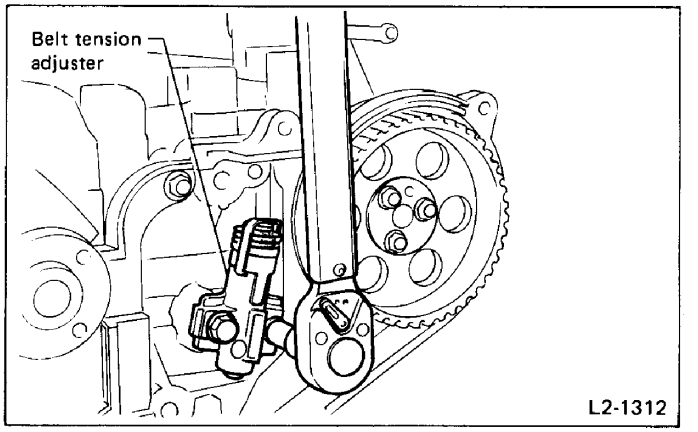


Fig. 146

4) Install plug rubber.

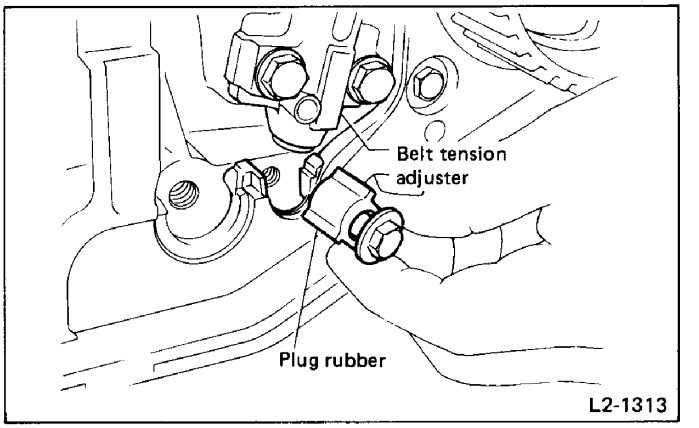


Fig. 147

5) Install idler pulley.

Tightening torque:
39 – 47 N·m (4.0 – 4.8 kg-m, 29 – 35 ft-lb)

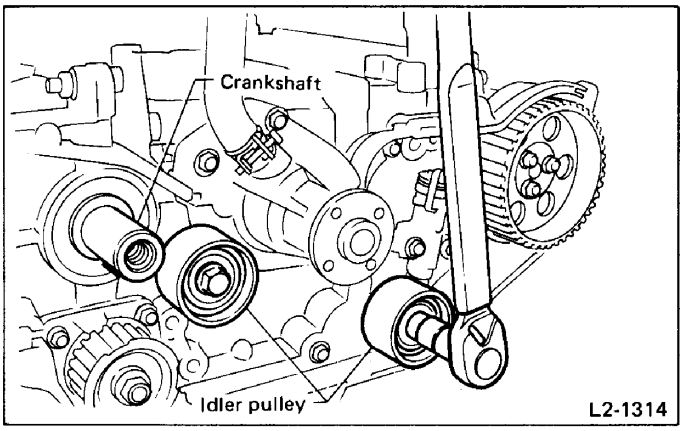


Fig. 148

6) Install crankshaft sprocket No. 2 to crankshaft.

Sprocket No. 2 can be identified by the absence of dowel pin.

7) Install timing belt LH.
(1) Align the center of three lines scribed on flywheel with timing mark on flywheel housing.

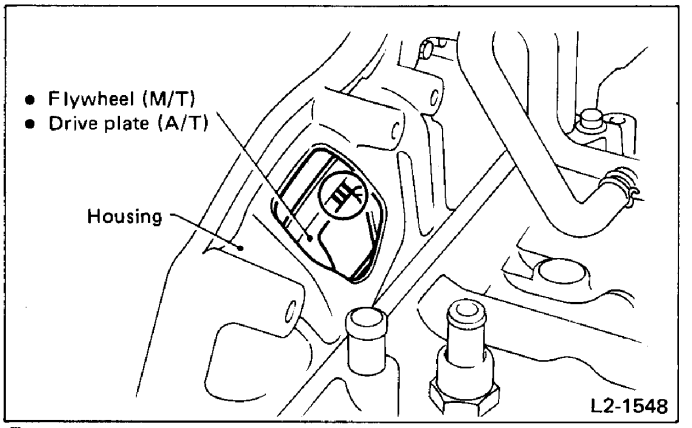


Fig. 149

(2) Align timing mark on camshaft sprocket LH with notch in belt cover.

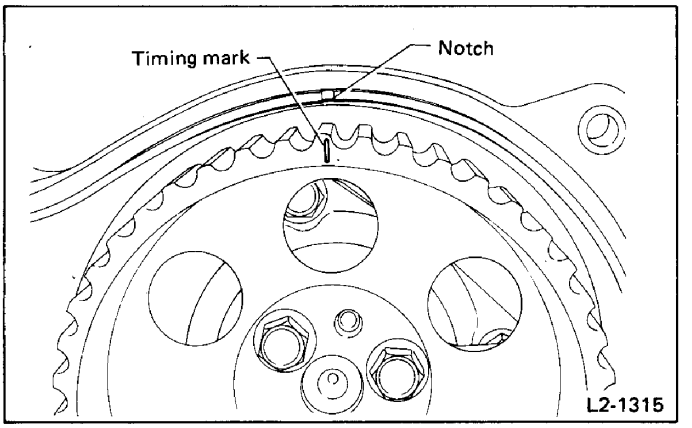


Fig. 150

(3) Install timing belt from the crankshaft side. Be careful not to loosen it.

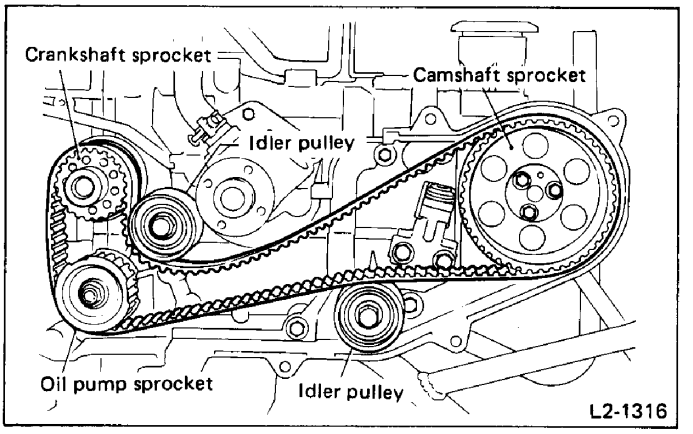


Fig. 151

(4) Install left tensioner. Check that it moves smoothly after installation.

Tightening torque:
39 – 47 N·m (4.0 – 4.8 kg-m, 29 – 35 ft-lb)

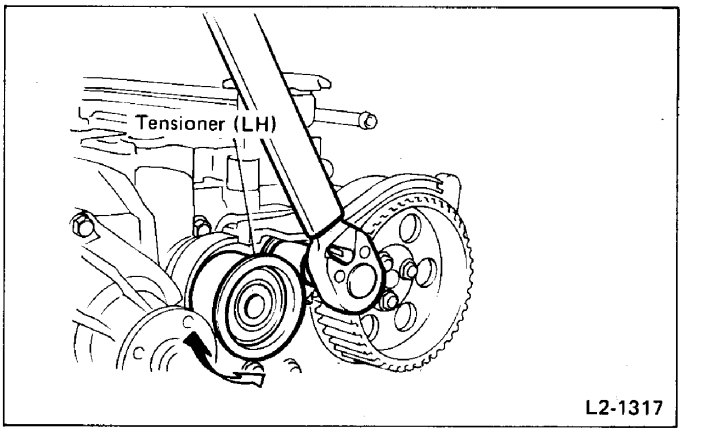


Fig. 152

(5) Remove BELT ADJUSTER STOPPER from belt tension adjuster.

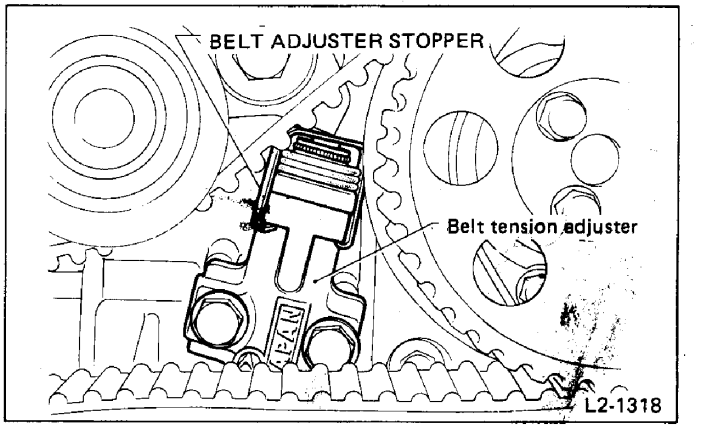


Fig. 153

a. Check that the end of left tensioner arm contacts top of belt tension adjuster.
b. Make sure that flywheel timing mark and camshaft sprocket LH timing mark are in their normal positions.

8) Install timing belt RH.
(1) Turn crankshaft one turn clockwise from the position where timing belt LH was installed and align the center of three lines scribed on the flywheel with timing mark on flywheel housing.
(2) Align timing mark on camshaft sprocket RH with the notch in belt cover.

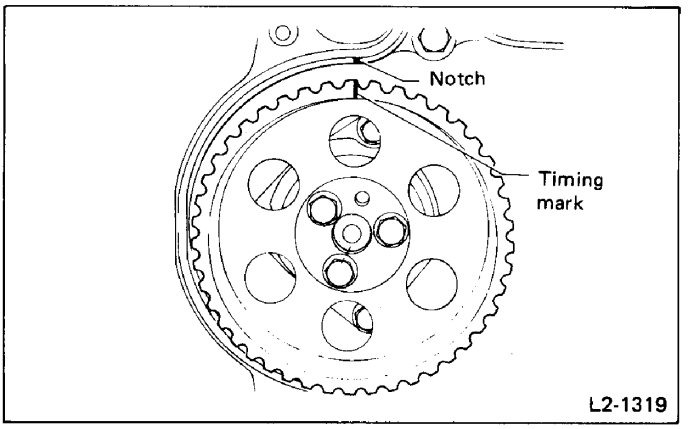


Fig. 154

(3) Temporarily tighten bolts ⓐ and ⓑ while moving the right tensioner down in the direction of the arrow. Loosen bolt ⓐ 180°.

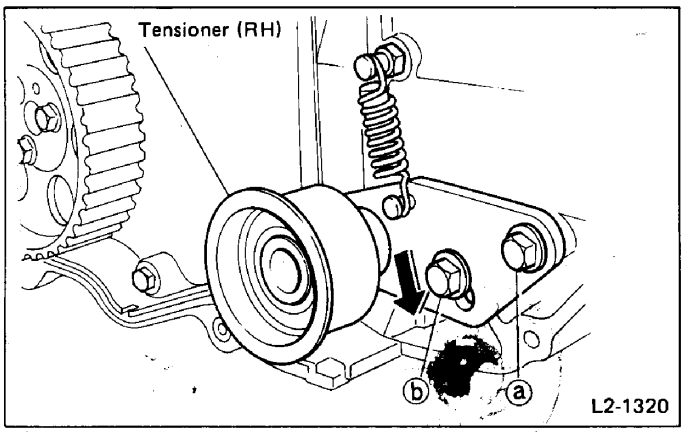


Fig. 155

(4) Install crankshaft sprocket to crankshaft.

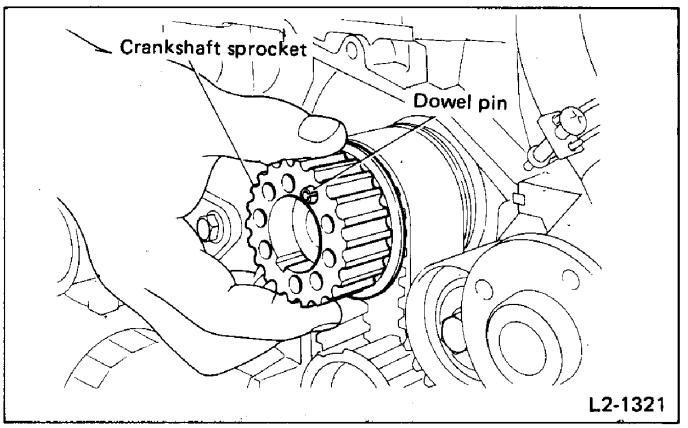


Fig. 156

(5) Install timing belt from the crankshaft side. Be careful not to loosen it.

(6) Loosen tensioner RH tightening bolt ⓑ by 1/2 turn to apply tension to belt.

(7) Apply the specified torque to camshaft sprocket RH in counterclockwise direction using BELT TENSION WRENCH (499437100). While applying torque, tighten tensioner RH tightening bolt ⓑ temporarily, then tighten bolt ⓐ temporarily.

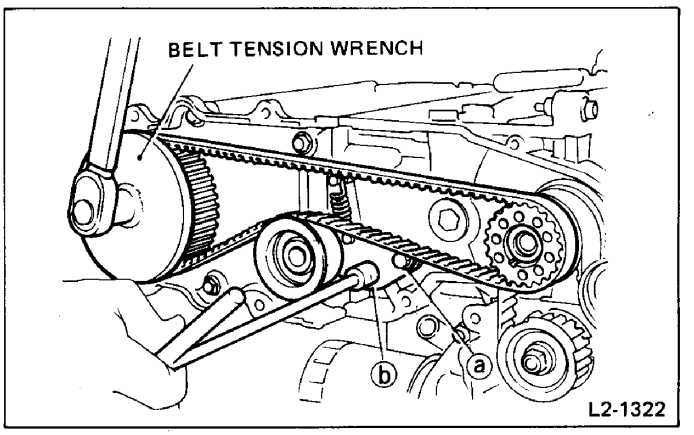


Fig. 157

When torquing sprocket, be extremely careful not to apply excessive force to it. Excessive belt tension will greatly reduce belt life.

Belt tension	Torque to cam sprocket
147 – 245 N (15 – 25 kg, 33 – 55 lb)	24 – 25 N·m (2.4 – 2.6 kg-m, 17 – 19 ft-lb)

(8) Tighten bolt ⓑ and bolt ⓐ, in that order, to the specified torque.

Tightening torque:
23 – 26 N·m (2.3 – 2.7 kg-m, 17 – 20 ft-lb)

Make sure that flywheel timing mark and camshaft sprocket RH timing mark are in their normal positions.

9) Install belt cover CTR.

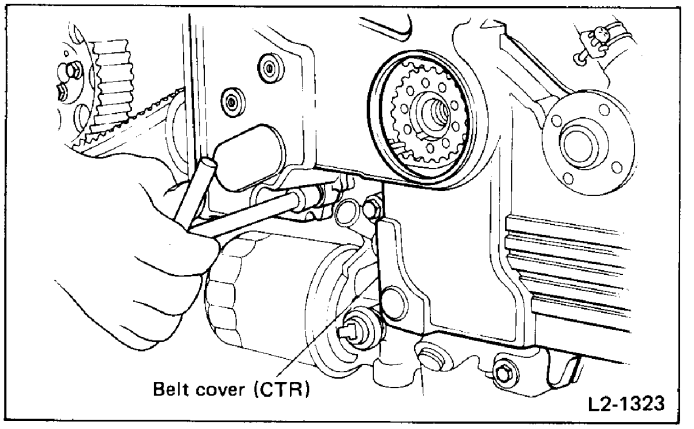


Fig. 158

10) Install crankshaft pulley to crankshaft using FLYWHEEL STOPPER (498277000) [manual transmission model] or DRIVE PLATE STOPPER (498497000) [automatic transmission model] to lock crankshaft.

When tightening bolt, apply engine oil to the threads, then tighten.

Tightening torque:
89 – 107 N·m (9.1 – 10.9 kg-m, 66 – 79 ft-lb)

11) Install oil level gauge guide.

Tightening torque:
4.4 – 5.4 N·m (0.45 – 0.55 kg-m, 3.3 – 4.0 ft-lb)

12) Install water pipe. Apply coolant to O-ring beforehand.
13) Install water pump pulley to water pump ASSY, and tighten nuts temporarily.
14) Install belt covers RH and LH.
15) Install compressor (A/C).
16) Install alternator.

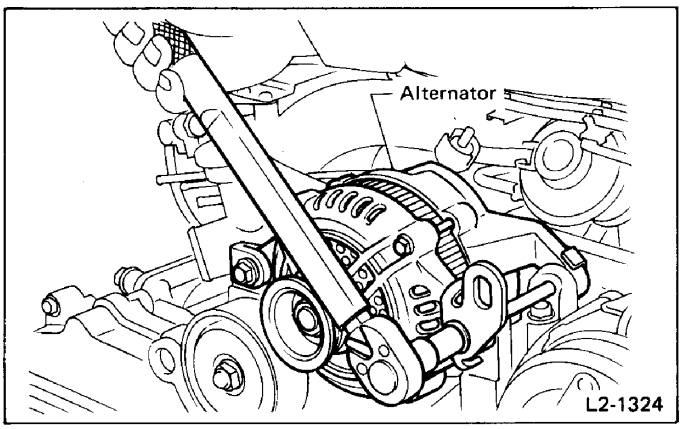


Fig. 159

17) Install V-belt and apply proper tension to the belt.
(1) Loosen belt tension pulley lock nut.
(2) Turn adjusting bolt to adjust belt tension.
The belt tightens when the bolt is turned clockwise and vice versa.

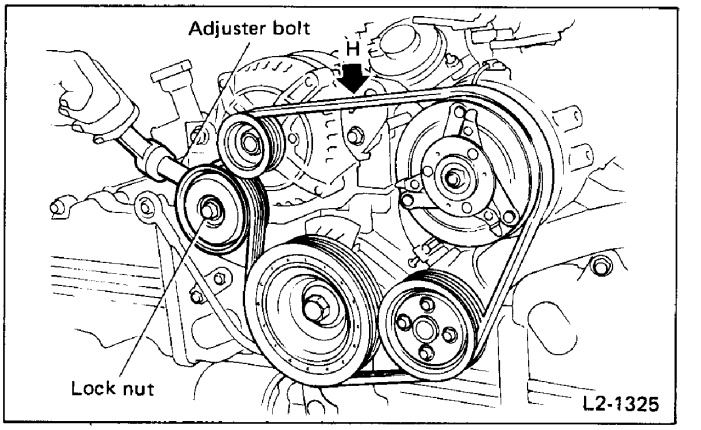


Fig. 160

	H: mm (in) / 98 N (10 kg, 22 lb)	Tension: N (kg, lb)
New belt	5.5 – 6.5 (0.217 – 0.256)	637 – 736 (65 – 75, 143 – 165)
Existing belt	6.5 – 7.5 (0.256 – 0.295)	441 – 637 (45 – 65, 99 – 143)

(3) Tighten lock nut.

Tightening torque:
34 – 44 N·m (3.5 – 4.5 kg-m, 25 – 33 ft-lb)

(4) After adjusting belt tension, turn adjusting bolt counterclockwise to lock.

Tightening torque:
4 – 6 N·m (0.4 – 0.6 kg-m, 2.9 – 4.3 ft-lb)

When replacing belt with a new one, adjust its tension to the specification, then readjust it to the same specification after running engine for 5 minutes in consideration of its initial expansion.

18) Tighten water pump pulley mounting bolts.

Camshaft and Valve Rocker

REMOVAL

1) Removing distributor
   (1) Disconnect high-tension cords from spark plug.
   (2) Remove distributor by removing mounting bolts.
2) Remove timing belt, belt cover and related parts. (Refer to "Timing Belt and Belt Cover".)
3) Remove water pipe.
4) Remove PCV hoses from rocker cover.
5) Remove valve rocker covers.
6) Remove camshaft cases, camshaft support, and camshaft as a unit.

When removing camshaft case, valve rockers may come off. To prevent them from being damaged, be sure to place waste cloth or rubber mat under cylinder head.

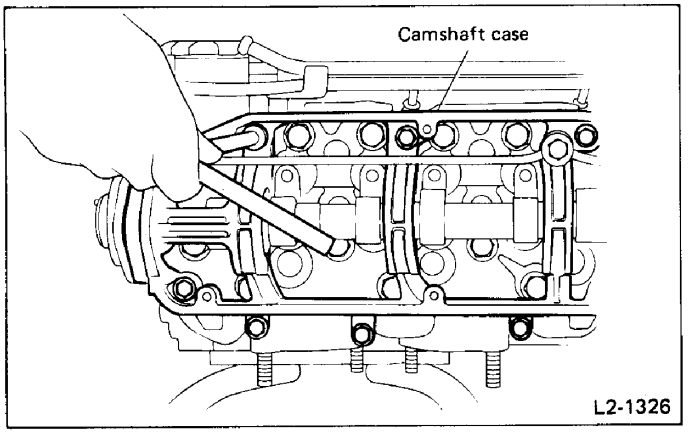


Fig. 161

7) Remove valve lash adjusters from cylinder head.

a. Do not lay down removed adjusters; keep them erect.
b. Retain removed valve rockers and adjusters in the order of their removal so that they can be reinstalled correctly.

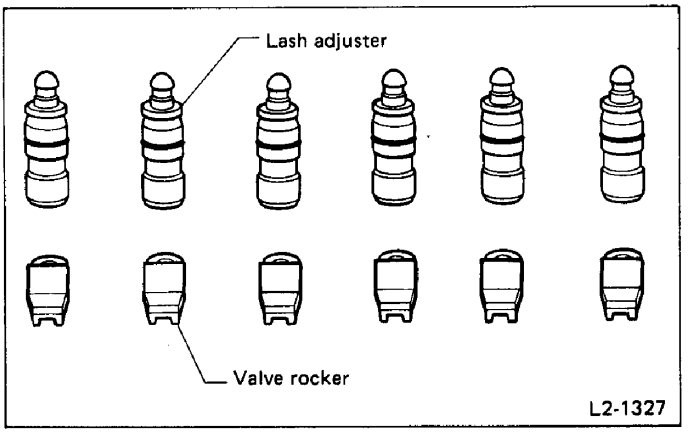


Fig. 162

DISASSEMBLY

1) Remove camshaft support.
2) Remove camshaft.

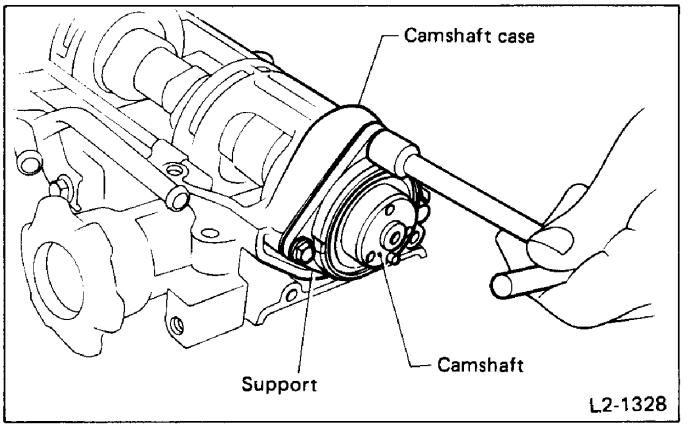


Fig. 163

3) Remove oil relief plug, then remove oil relief pipe, relief valve spring, and relief valve.

INSPECTION

CAMSHAFT

1) Measure the bend, and repair or replace if necessary.

Limit:
0.025 mm (0.0010 in)

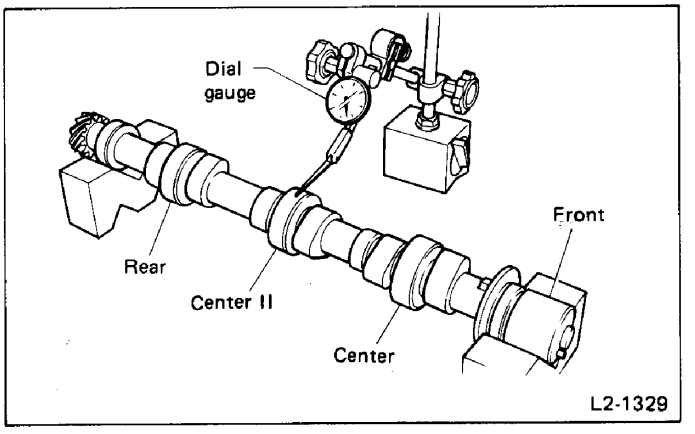


Fig. 164

2) Check journal for damage and wear. Replace if faulty.

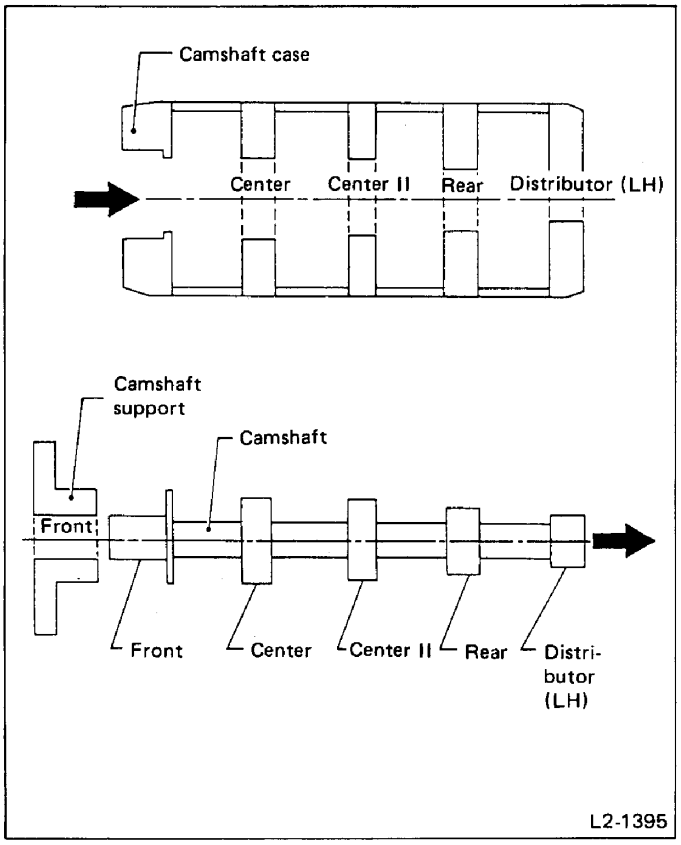


Fig. 165

Item		Front	Center	Center II	Rear	Distributor LH
Cam case journal hole I.D.		38.000 – 38.018 mm*1 (1.4961 – 1.4968 in)	48.500 – 48.525 mm (1.9094 – 1.9104 in)	48.000 – 48.025 mm (1.8898 – 1.8907 in)	47.500 – 47.525 mm (1.8701 – 1.8711 in)	39.000 – 39.013 mm (1.5354 – 1.5359 in)
Camshaft journal O.D.		37.964 – 37.980 mm (1.4946 – 1.4953 in)	48.464 – 48.480 mm (1.9080 – 1.9087 in)	47.964 – 47.980 mm (1.8883 – 1.8890 in)	47.464 – 47.480 mm (1.8687 – 1.8693 in)	38.964 – 38.980 mm (1.5340 – 1.5346 in)
Clearance at journal	Standard	0.020 – 0.054 mm (0.0008 – 0.0021 in)				
	Limit	0.070 mm (0.0028 in)				

*1: Camshaft support I.D.

3) Measure thrust clearance between camshaft and camshaft support. If the limit is exceeded, replace camshaft support.

Thrust clearance:
Standard
0.03 – 0.26 mm (0.0012 – 0.0102 in)
Limit
0.35 mm (0.0138 in)

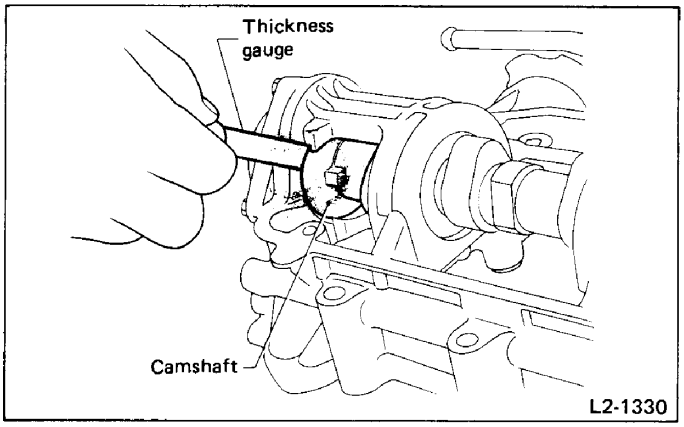


Fig. 166

4) Check cam face condition; remove minor faults by grinding with oil stone. Measure the cam height H; replace if the limit has been exceeded.

Height H mm (in)	Wear limit mm (in)
39.69 ± 0.05 (1.5626 ± 0.0020)	39.49 (1.5547)

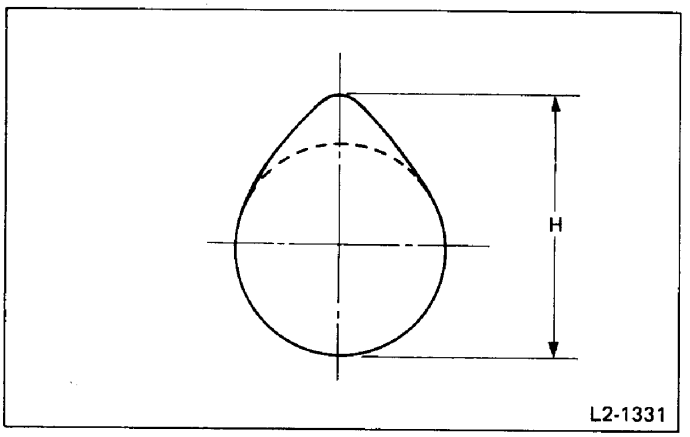


Fig. 167

5) Measure backlash between distributor drive gear and distributor driven gear. If the limit is exceeded, replace distributor drive gear.

a. Measure backlash after assembling the engine because camshaft must be prevented from turning.
b. Attach a dial gauge to distributor driven gear rotate rotor to measure backlash.

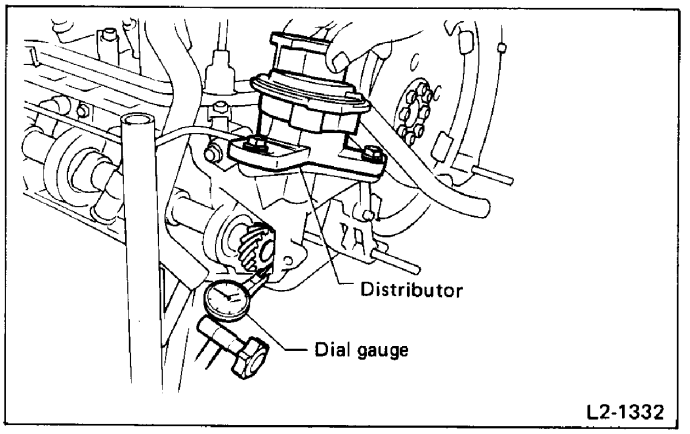


Fig. 168

Backlash:
Standard
0.015 – 0.126 mm (0.0006 – 0.0050 in)
Limit
0.180 mm (0.0071 in)

6) Replace gear using a press and CAMSHAFT HOLDER (498027000).

VALVE ROCKER

If cam or valve contact surface of valve rocker is worn or dented, repair by removing the minimum necessary amount. If worn heavily, replace valve rocker.

VALVE LASH ADJUSTER

Stand adjuster vertically. Push pivot portion forcefully to check that no air is in the adjuster.

The new adjuster is provided with a pin which must be removed before using.

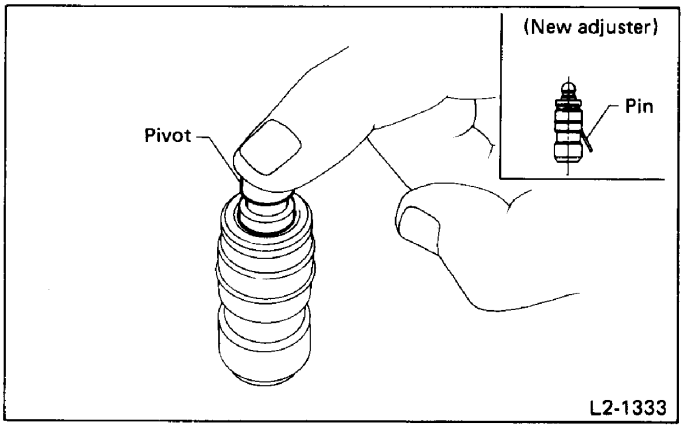


Fig. 169

ASSEMBLY

1) Press-fit oil seal into camshaft support by using INSTALLER (498037000), then attach O-ring.
Apply oil to O-ring beforehand.
2) Install oil relief valve, relief valve spring, oil relief pipe, and oil relief plug to camshaft case.

Tightening torque:
23 – 26 N·m (2.3 – 2.7 kg-m, 17 – 20 ft-lb)

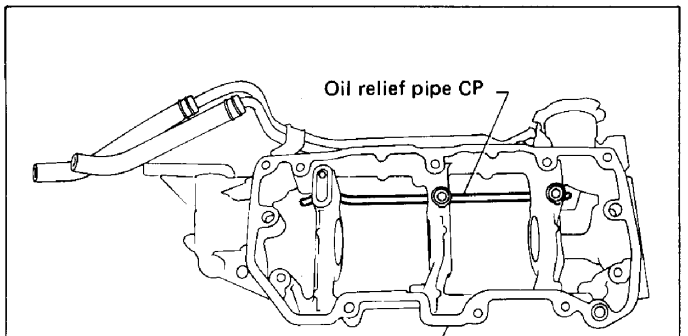


Fig. 170

3) Install woodruff key to camshaft, then press-fit distributor drive gear by using CAMSHAFT HOLDER (498027000) and PRESS (899754112).

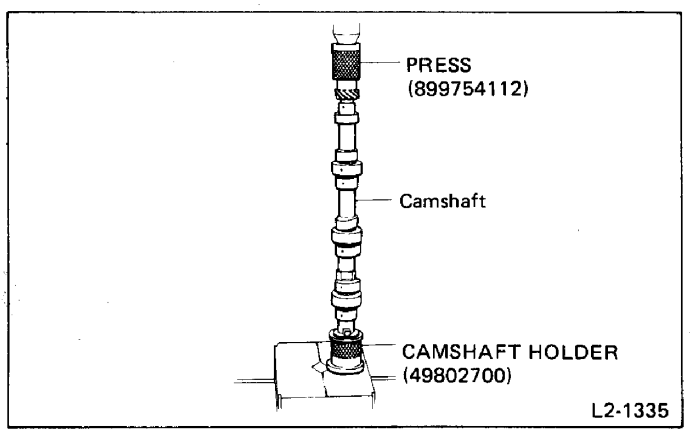


Fig. 171

4) Insert camshaft into camshaft case, and install camshaft support.

Tightening torque:
5.9 – 6.9 N·m (0.60 – 0.70 kg-m, 4.3 – 5.1 ft-lb)

Apply oil to the surfaces of camshaft case journal hole, camshaft journal hole and camshaft support oil seal lip.

INSTALLATION

1) Insert valve lash adjusters into cylinder head.

Be sure to insert each valve lash adjuster to its original position.

2) Apply grease to spherical surface and sliding surface of each valve rocker, then secure valve rockers to the respective valve adjusters and valves.

Be sure to apply grease; otherwise, valve rocker will drop off.

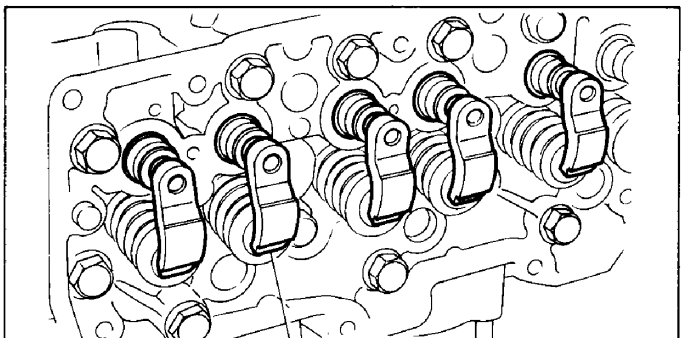


Fig. 172

3) Apply fluid packing (Three-bond 1207B or equivalent) to groove of each camshaft case, then install to cylinder head.

Tightening torque:
23 – 26 N·m (2.3 – 2.7 kg-m, 17 – 20 ft-lb)

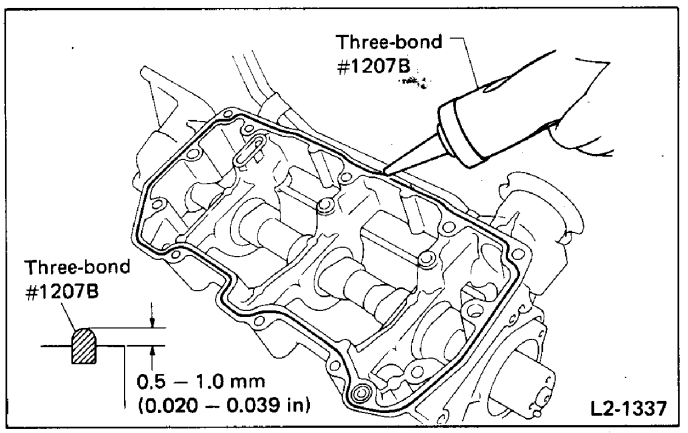


Fig. 173

After installing, abundantly apply engine oil to sliding surfaces of cam and valve rocker.

4) Attach gaskets to valve rocker covers, and install the covers to camshaft cases with rocker cover washers and bolts.
5) Install PCV hoses.
6) Install timing belt, belt cover and related parts.
(Refer to "Timing Belt and Belt Cover".)
7) Install oil filler duct.
8) Install water pipe.
9) Install distributor, proceeding as follows:
(1) Bring #1 cylinder piston to its top dead center on compression stroke. Set camshaft sprocket to the position shown in Figure.

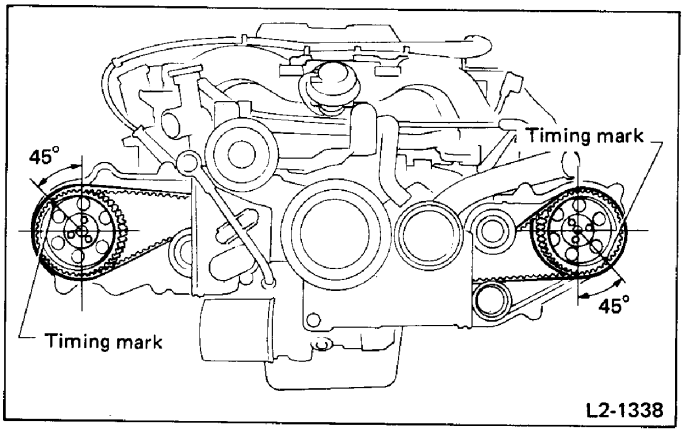


Fig. 174

(2) Align distributor housing match mark with pinion gear match mark to set #1 cylinder at igniting position.

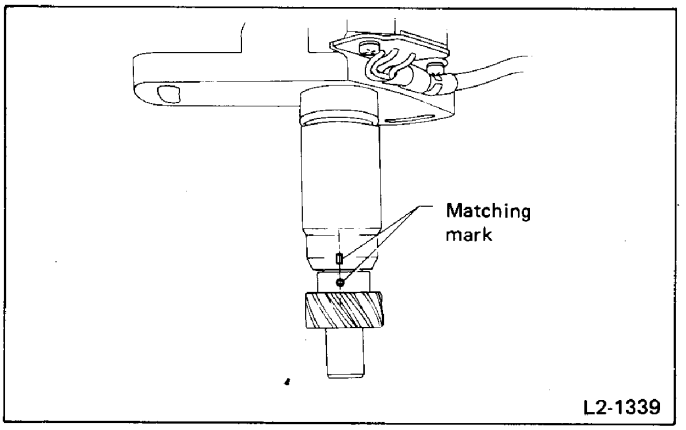


Fig. 175

(3) Install distributor to camshaft case.
(4) Connect lead wires.
(5) Install plug cord and high-tension cord.

11) Install right and left belt covers.

Cylinder Head

REMOVAL

1) Remove timing belt, belt cover and related parts. (Refer to "Timing Belt and Belt Cover".)
2) Remove camshaft cases, lash adjuster and related parts. (Refer to "Camshaft and Valve Rocker".)
3) Remove alternator.
4) Remove compressor (A/C).
5) Remove bolts attaching intake manifold to cylinder head, and then lift intake manifold from cylinder head.

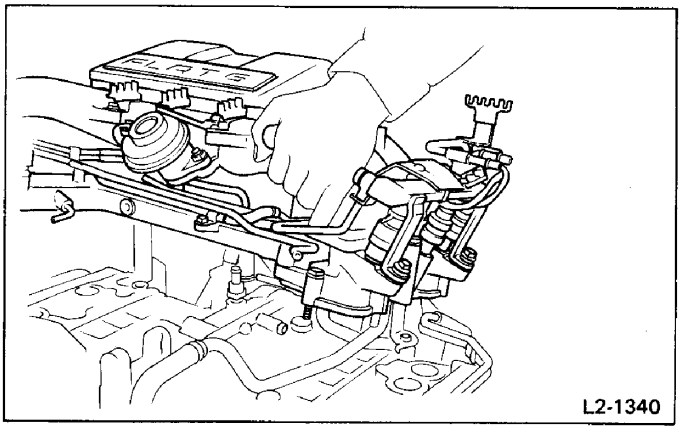


Fig. 176

6) Remove water by-pass pipe to cylinder head.
7) Remove alternator bracket to cylinder head.

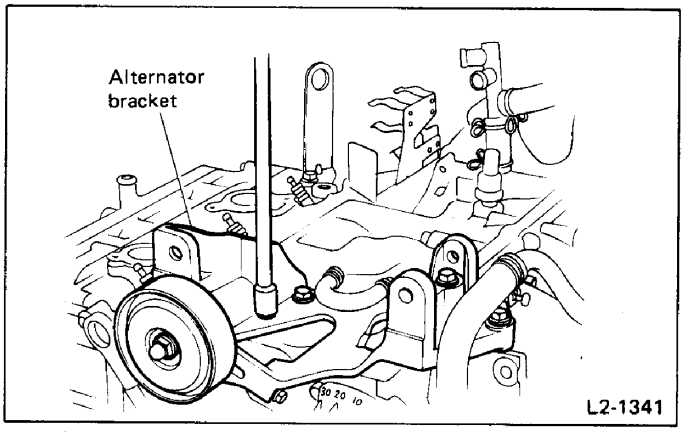


Fig. 177

8) Remove spark plugs.
9) Remove cylinder heads from cylinder block.

Loosen cylinder head bolts in two or three steps, in the order shown in figure below, and remove them.

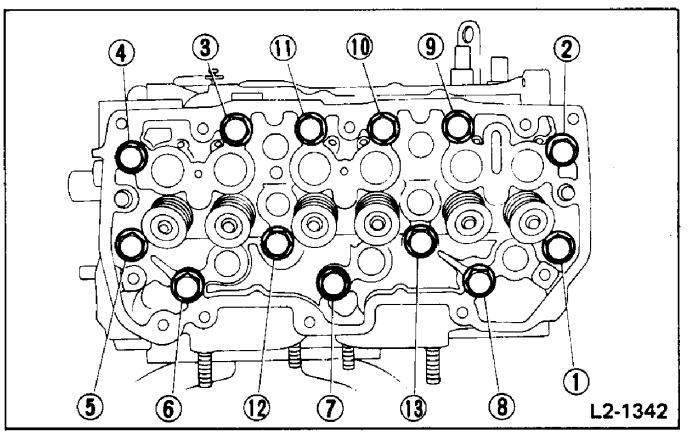


Fig. 178

10) Using VALVE SPRING PRESS ASSY (899724100), compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.

Mark each valve to prevent confusion.

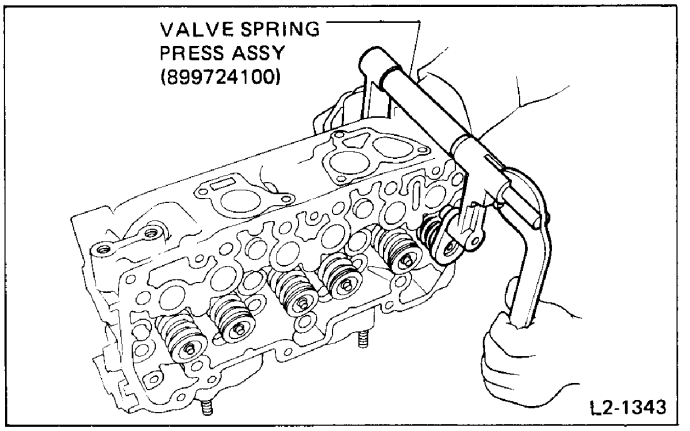


Fig. 179

INSPECTION

CYLINDER HEAD

1) Make sure that no crack or other damage exists. In addition to visual inspection, inspect important areas by means of red check.

2) Measure the warping of the cylinder head surface that mates with cylinder block by using a straight edge and thickness gauge.

If the warping exceeds 0.075 mm (0.0030 in), regrind the surface with a surface grinder.

Warping limit:
0.075 mm (0.0030 in)
Grinding limit:
0.3 mm (0.012 in)

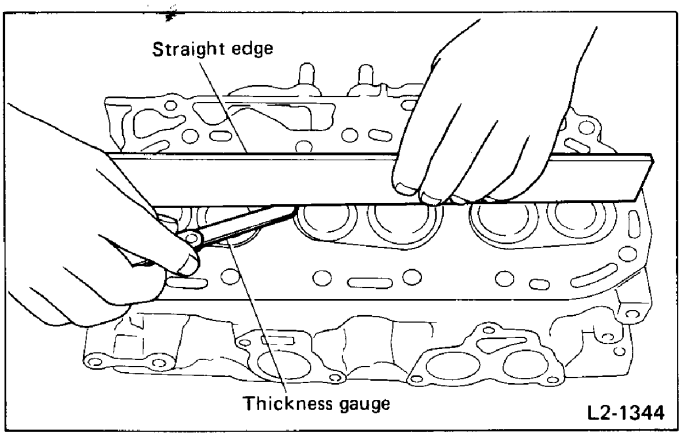


Fig. 180

3) Inspect intake and exhaust valve seats, and correct the contact surfaces with valve seat cutter if they are defective or when valve guides are replaced.

W (contacting width):
Intake
1.2 – 1.8 mm (0.047 – 0.071 in)
Exhaust
1.5 – 2.0 mm (0.059 – 0.079 in)
Wear limit of valve seat (measured in direction of valve axis):
0.5 mm (0.020 in) for both intake and exhaust valves

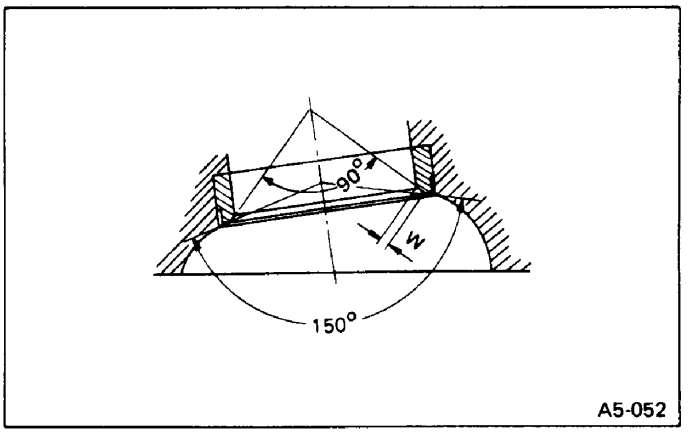


Fig. 181

VALVE GUIDE

1) Check the clearance between valve guide and stem. The clearance can be checked by measuring the outside diameter of valve stem and the inside diameter of valve guide with outside and inside micrometers respectively.

Specifications for valve stem and valve guide		
Standard clearance between valve guide and valve stem	Intake	0.035 – 0.065 mm (0.0014 – 0.0026 in)
	Exhaust	0.040 – 0.070 mm (0.0016 – 0.0028 in)
Limit of clearance between valve guide and valve stem		0.15 mm (0.0059 in)
Standard inside diameter of valve guide		7.000 – 7.015 mm (0.2756 – 0.2762 in)
Standard diameter of valve stem	Intake	6.950 – 6.965 mm (0.2736 – 0.2742 in)
	Exhaust	6.945 – 6.960 mm (0.2734 – 0.2740 in)

2) If the clearance between valve guide and stem exceeds the specification, replace guide as follows:

(1) Place cylinder head on CYLINDER HEAD TABLE with the combustion chamber upward so that valve guides enter the holes in CYLINDER HEAD TABLE.

(2) Insert VALVE GUIDE REMOVER into valve guide and press it down to remove valve guide.

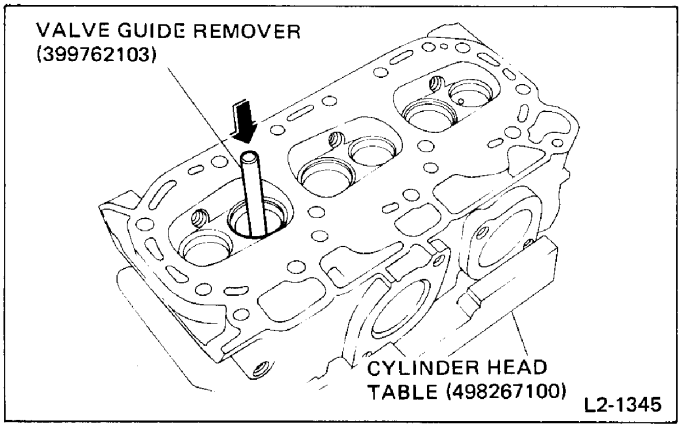


Fig. 182

(3) Turn cylinder head upside down and place VALVE GUIDE ADJUSTER as shown in the figure.

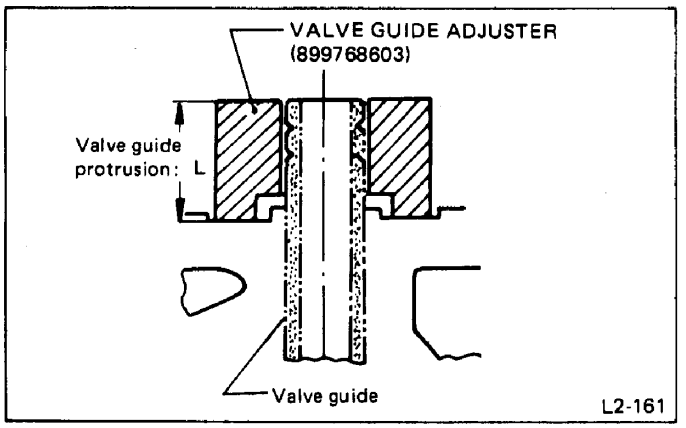


Fig. 183

(4) Before installing new valve guide, make sure that neither scratches nor damages exist on the inside surface of the valve guide holes in cylinder head.

(5) Put new valve guide, coated with sufficient oil, in cylinder, and insert VALVE GUIDE REMOVER into valve guide. Press in until the valve guide upper end is flush with the upper surface of VALVE GUIDE ADJUSTER.

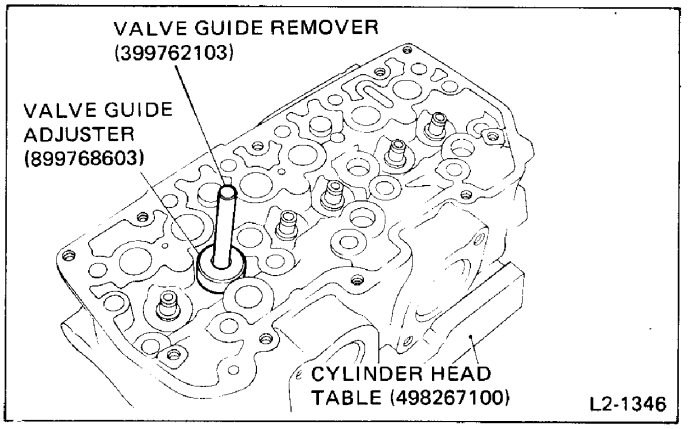


Fig. 184

(6) Check the valve guide protrusion.

Valve guide protrusion: L
17 – 18 mm (0.67 – 0.71 in)

(7) Ream the inside of valve guide with VALVE GUIDE REAMER (399762104). Gently rotate the reamer clockwise while pressing it lightly into valve guide, and return it also rotating clockwise. After reaming, clean valve guide to remove chips.

a. Apply engine oil to the reamer when reaming.
b. If the inner surface of the valve guide is torn, the edge of the reamer should be slightly ground with an oil stone.
c. If the inner surface of the valve guide becomes lustrous and the reamer does not cut chips, use a new reamer or remedy the reamer.

(8) Recheck the contact condition between valve and valve seat after replacing valve guide.

INTAKE AND EXHAUST VALVE OIL SEAL

Replace oil seal with new one, if lip is damaged or spring is out of place, or when the surfaces of intake valve and valve seat are reconditioned or intake valve guide is replaced.

Press in oil seal to the specified dimension indicated in the figure, using OIL SEAL INSTALLER.

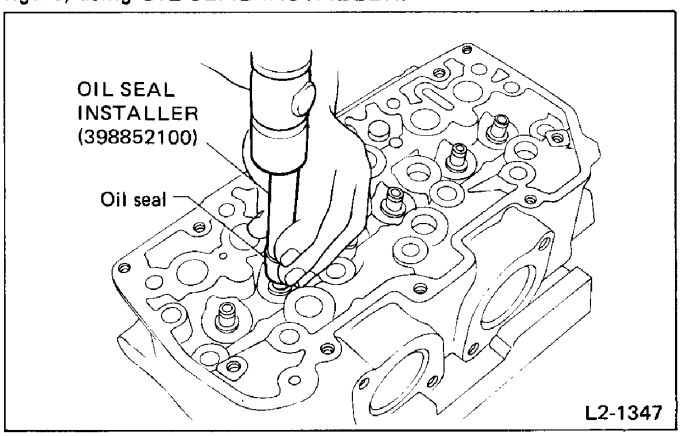


Fig. 185

a. Apply engine oil to oil seal before force-fitting.
b. Differentiate between intake valve oil seal and exhaust valve oil seal by noting their difference in height.

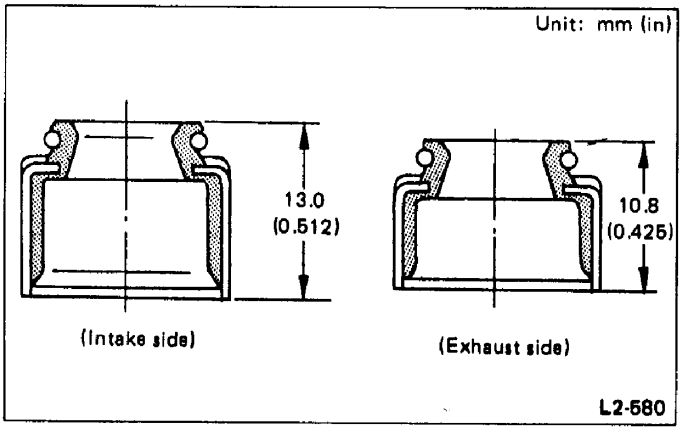


Fig. 186

INSTALLATION

1) Install the oil seals to the valve guides using OIL SEAL INSTALLER (398852100).
2) Coat the stem of each valve with engine oil and insert the valve into the valve guide. Attach the valve springs and retainer. Then compress the valve springs using VALVE SPRING PRESS and fit the valve spring retainer key.

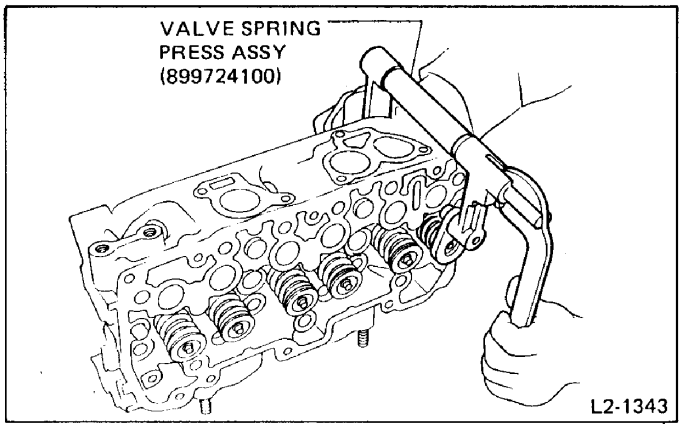


Fig. 187

After installing, tap the valve spring retainers lightly with a wooden hammer for better seating.

3) Install cylinder heads to cylinder block with new gaskets.

a. When tightening bolts, apply oil to the threads.
b. Be sure to install washers with their convex/chamfered sides facing bolt heads.

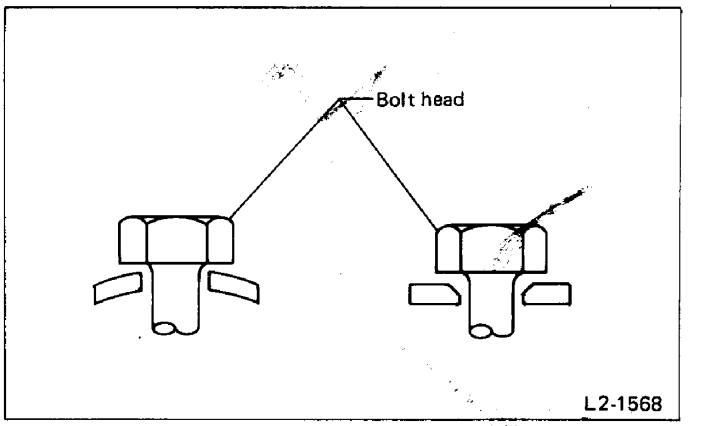


Fig. 188-①

c. Be careful as there are two types of bolts.

Bolt position	Color	Bolt length
①, ②, ⑨, ⑬	Silver	118.5 mm (4.665 in)
Others	Yellow	132.5 mm (5.217 in)

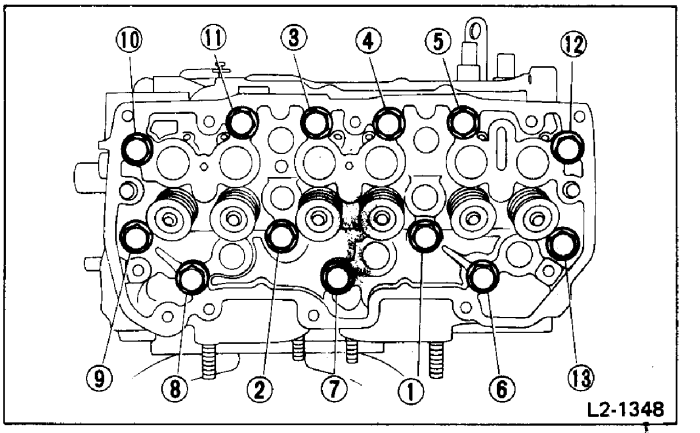


Fig. 188-②

(1) Tighten all bolts in two steps in the order indicated above:

1st step: 39 N·m (4.0 kg-m, 29 ft-lb)
2nd step: 64 N·m (6.5 kg-m, 47 ft-lb)

(2) Loosen all bolts at least 90° in reverse order.
(3) Tighten all bolts to specified torque.

Tightening torque:
60 – 68 N·m (6.1 – 6.9 kg-m, 44 – 50 ft-lb)

4) Install spark plugs.
5) Install bolt attaching water by-pass pipe bracket to cylinder head.
6) Install bolts attaching intake manifold to cylinder head.
7) Install bolts attaching alternator bracket to cylinder head.

8) Install camshaft cases, lash adjustor and related parts. (Refer to "Camshaft and Valve Rocker".)
9) Install timing belt, belt cover and related parts. (Refer to "Timing Belt and Belt Cover".)

After completing engine ASSY and mounting engine on car, be sure to retighten cylinder head bolts. (Refer to "2-2 ON-CAR SERVICES".)

Valve and Valve Springs

REMOVAL

1) Remove cylinder from engine ASSY. (Refer to "Cylinder Head".)
2) Using VALVE SPRING PRESS ASSY, compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.

Mark each valve to prevent confusion.

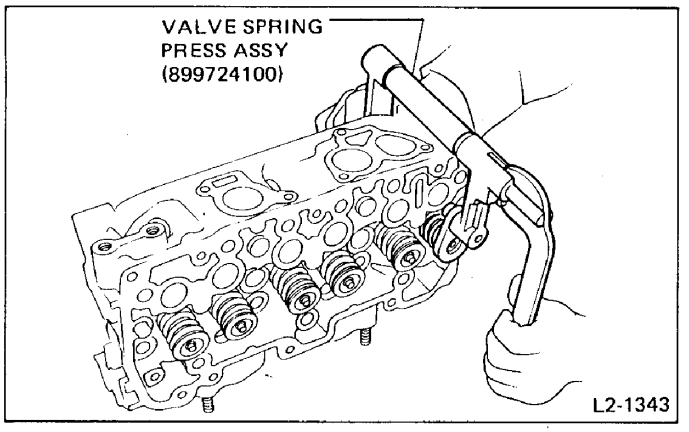


Fig. 189

INSPECTION

INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of valve, and replace if damaged, worn, or deformed, or if "H" is less than the specified limit.

Valve	H		Overall length
	Standard	Limit	
Intake	1.3 mm (0.051 in)	0.8 mm (0.031 in)	107.58 mm (4.235 in)
Exhaust	1.3 mm (0.051 in)	0.8 mm (0.031 in)	107.58 mm (4.235 in)

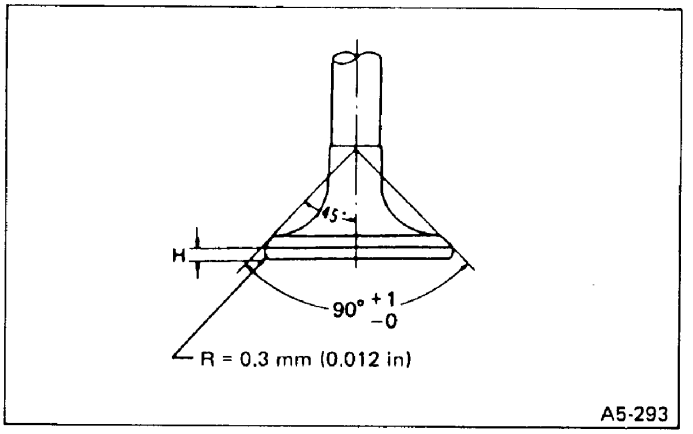


Fig. 190

2) If the contact surface of valve is damaged, or if the stem end is recessed, correct with a valve refacer, grinding as little as possible.

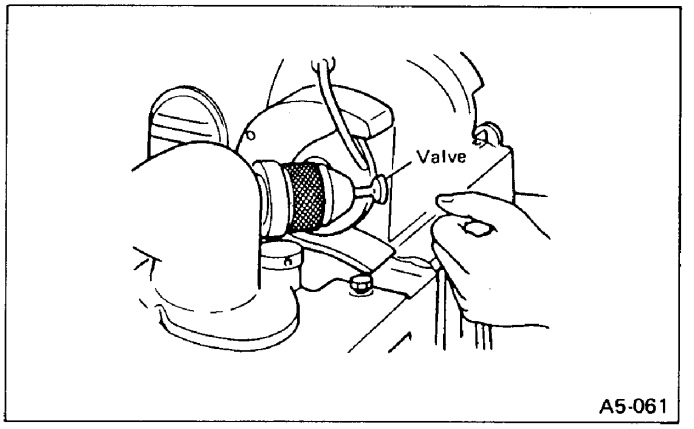


Fig. 191

VALVE SPRINGS

1) Check valve springs for damage, free length, and tension. Replace valve spring if it is not to the specifications presented below.
2) To measure the squareness of the valve spring, stand the spring on a surface plate and measure its deflection at the top using a try square.

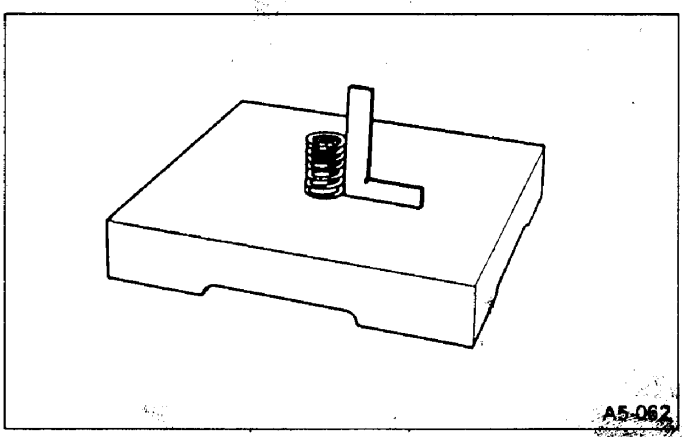


Fig. 192

	Outer spring	Inner spring
Free length	51.7 mm (2.035 in)	50.3 mm (1.980 in)
Tension/ spring height	177.5 – 204.0 N (18.1 – 20.8 kg, 39.9 – 45.9 lb)/ 41.5 mm (1.634 in)	88.3 – 101.0 N (9.0 – 10.3 kg, 19.8 – 22.7 lb)/ 38.5 mm (1.516 in)
	447.2 – 513.9 N (45.6 – 52.4 kg, 100.5 – 115.5 lb)/ 31.5 mm (1.240 in)	201.0 – 230.5 N (20.5 – 23.5 kg, 45.2 – 51.8 lb)/ 28.5 mm (1.122 in)
Squareness	2.3 mm (0.091 in)	2.2 mm (0.087 in)

ASSEMBLY

Coat the stem of each valve with engine oil and insert the valve into the valve guide. Attach the valve springs and retainer. Then compress the valve springs using VALVE SPRING PRESS (899724100) and fit the valve spring retainer key.

After installing, tap the valve spring retainers lightly with a wooden hammer for better seating.

Cylinder Block

REMOVAL

1) Remove distributor and plug cord.

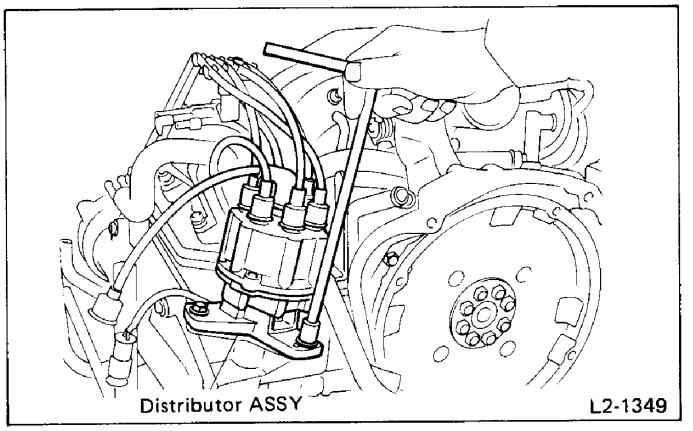


Fig. 193

2) Loosen water pump pulley mounting nuts or bolts.
3) Remove alternator and V-belt.
4) Removal of intake manifold ASSY
   (1) Remove hoses and tubes from cylinder block side.
   (2) Disconnect each harness.
   (3) Disconnect knock sensor harness.
   (4) Remove intake manifold ASSY from engine.

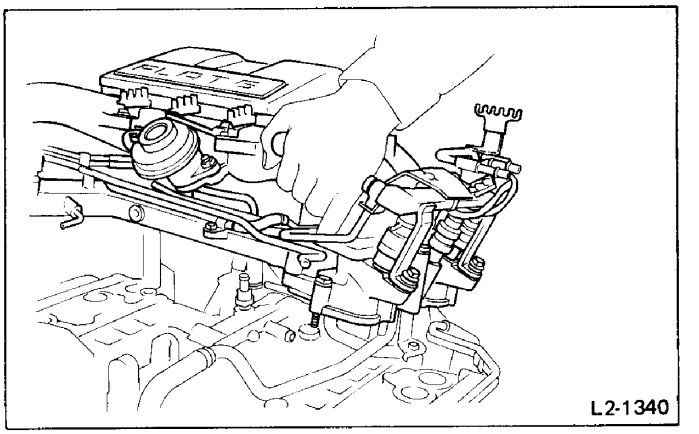


Fig. 194

5) Remove alternator brackets.
6) Remove PCV connector and harness clamp.

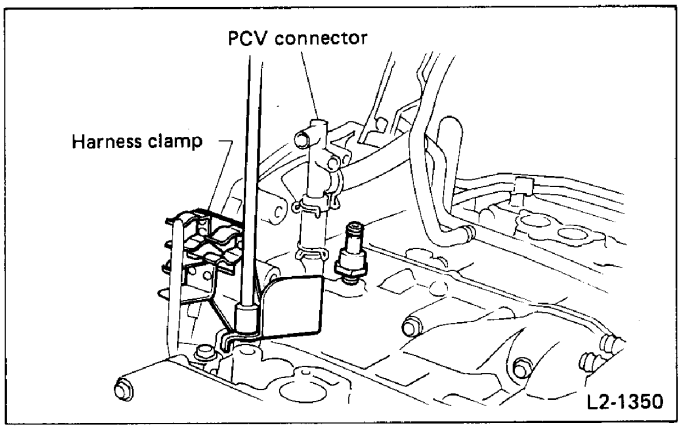


Fig. 195

7) Remove oil filler duct.
8) Remove water pipe.
9) Remove crankshaft pulley. To lock crankshaft, use FLYWHEEL STOPPER (498277000) [manual transmission model] or DRIVE PLATE STOPPER (498497000) [automatic transmission model].
10) Remove water pump pulley and pulley cover.
11) Remove oil level gauge guide together with gauge.
12) Remove timing belt, belt cover and related parts. (Refer to "Timing Belt and Belt Cover".)
13) Remove water pump together with hose.

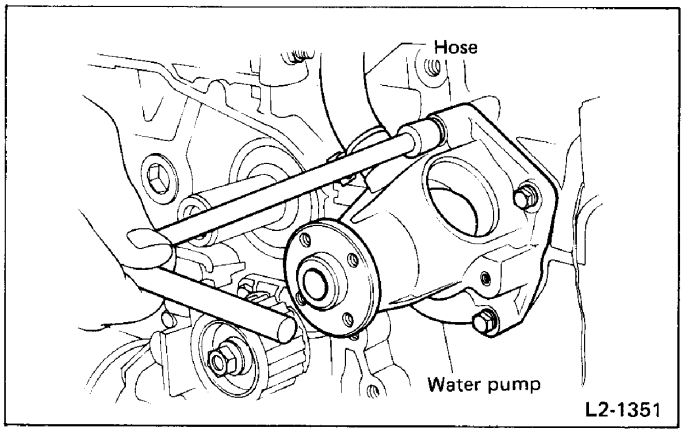


Fig. 196

14) Remove oil pump by aligning notch in oil pump pulley with bolt position, then remove pump outer rotor from cylinder block.

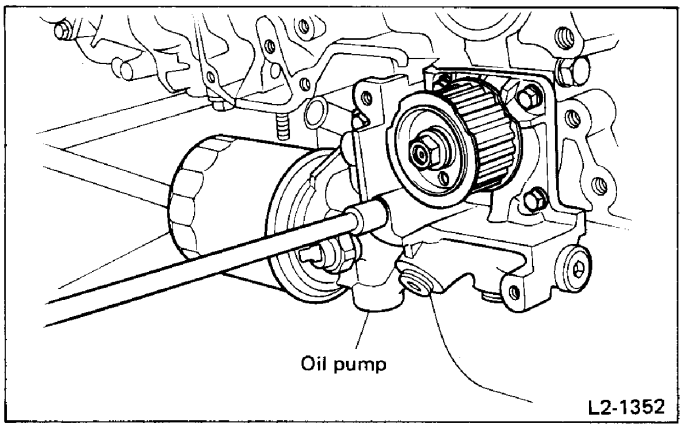


Fig. 197

15) Remove flywheel [manual transmission model] or drive plate [automatic transmission model], and take out flywheel housing with housing cover. To lock crankshaft, use FLYWHEEL STOPPER (498277000) or DRIVE PLATE STOPPER (498497000).

16) Remove flywheel housing.

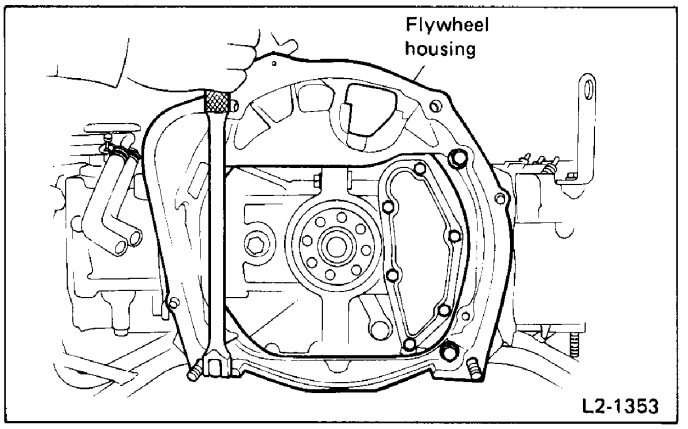


Fig. 198

17) Remove camshaft, valve rocker and related parts. (Refer to "Camshaft and Valve Rocker".)

18) Remove cylinder heads and gaskets.

19) Remove oil pan.

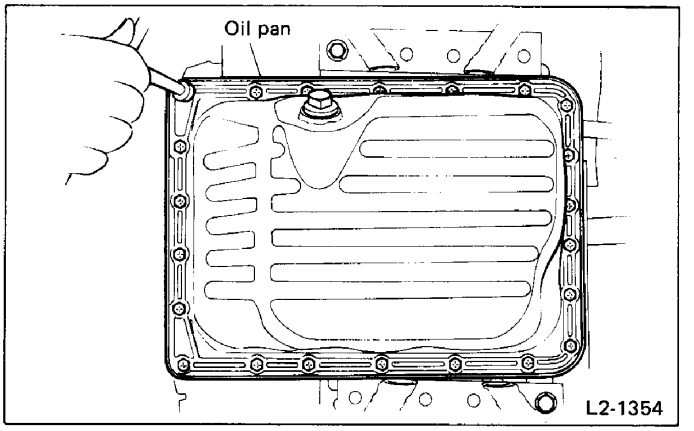


Fig. 199

Do not remove oil strainer from cylinder block.

DISASSEMBLY

1) Remove oil separator cover.

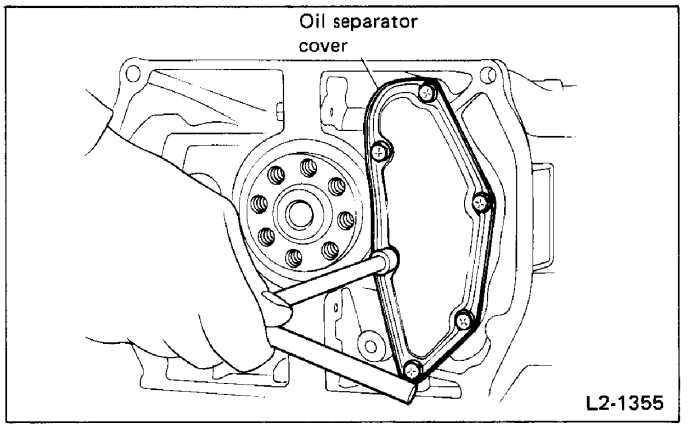


Fig. 200

2) Remove service hole plugs from cylinder block.

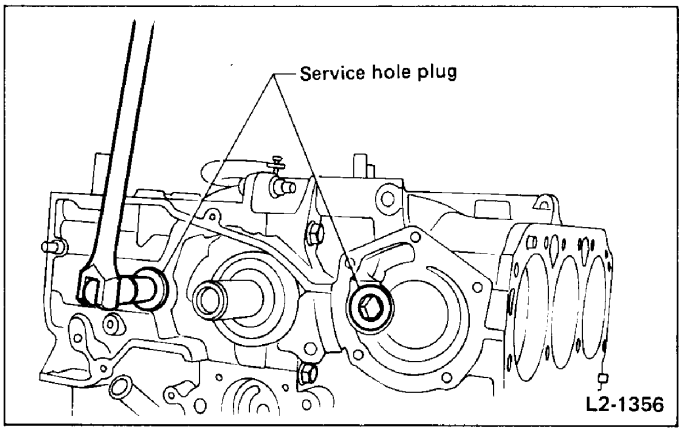


Fig. 201

3) Rotate crankshaft to bring #1 and #2 pistons to BDC position.

To turn crankshaft, turn crankshaft pulley bolt and not the crankshaft pulley.

4) Remove piston circlip through service hole of #1 and #2 cylinders.

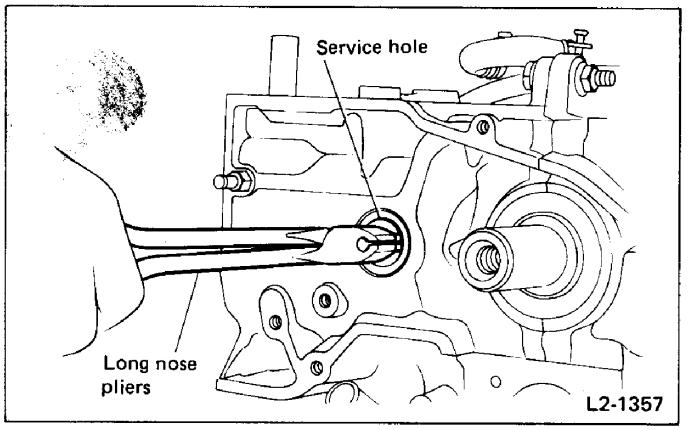


Fig. 202

5) Draw out piston pin from #1 and #2 pistons using PISTON PIN REMOVER.

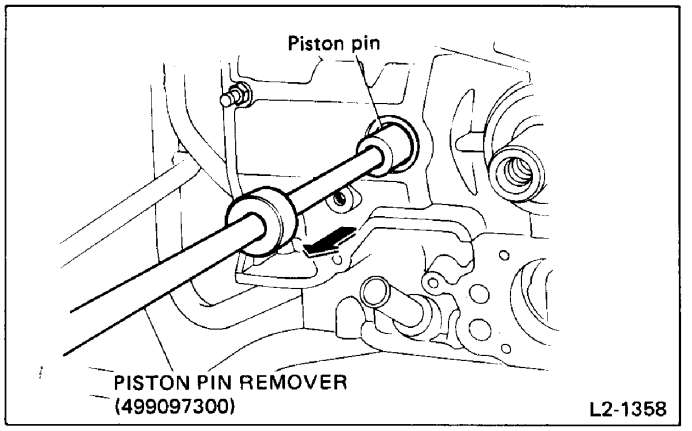


Fig. 203

6) Turn crankshaft and remove #5 & #6 and #3 & #4 in a manner similar to removal of #1 and #2.

7) Remove all cylinder block connecting bolts except one bolt of #3 cylinder.

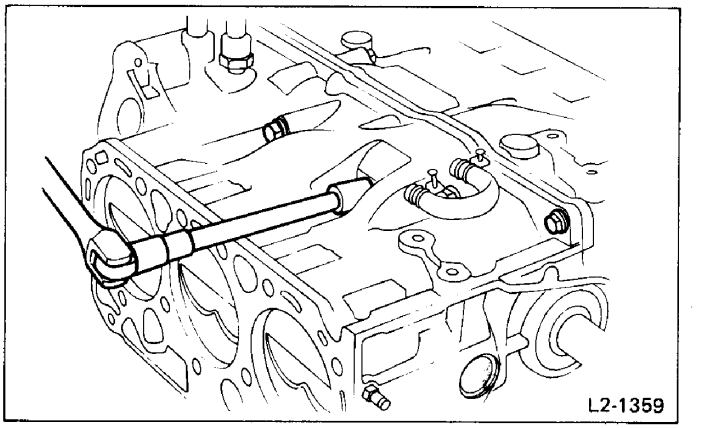


Fig. 204

8) Set up cylinder block so that #1, #3 and #5 cylinders are on the upper side, then separate left-hand and right-hand cylinder blocks.

When separating cylinder block, do not allow the connecting rod to fall and damage the cylinder block.

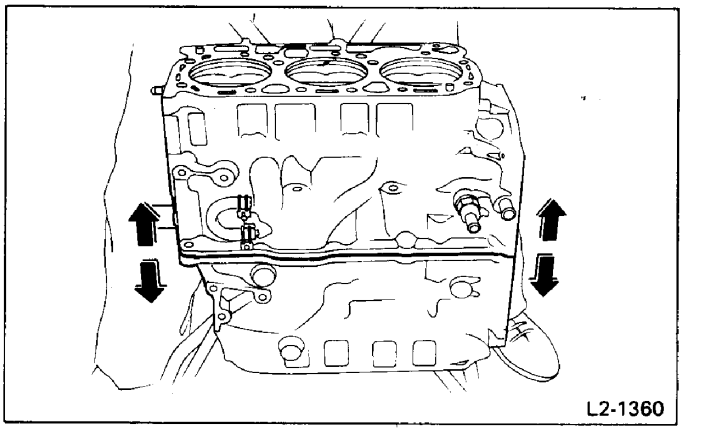


Fig. 205

9) Remove coolant passage O-ring and back-up ring from cylinder block.

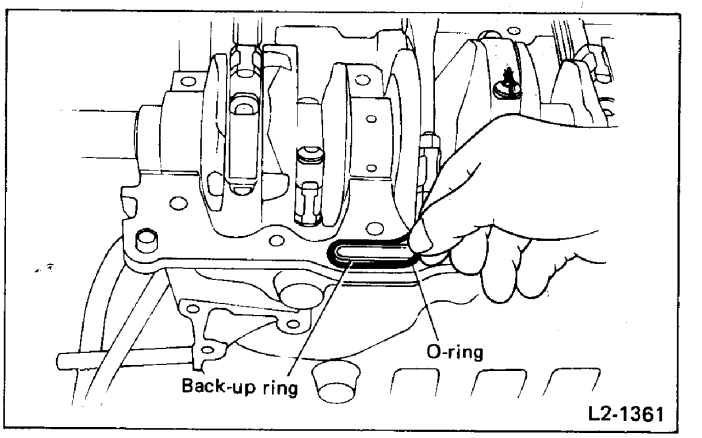


Fig. 206

10) Remove front oil seal and rear oil seal from crankshaft.
11) Remove crankshaft together with connecting rod from cylinder block.

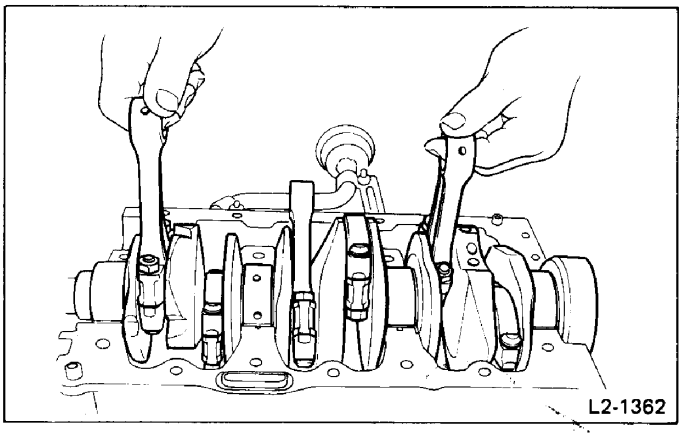


Fig. 207

12) Draw out each piston from cylinder block using wooden bar or hammer handle.

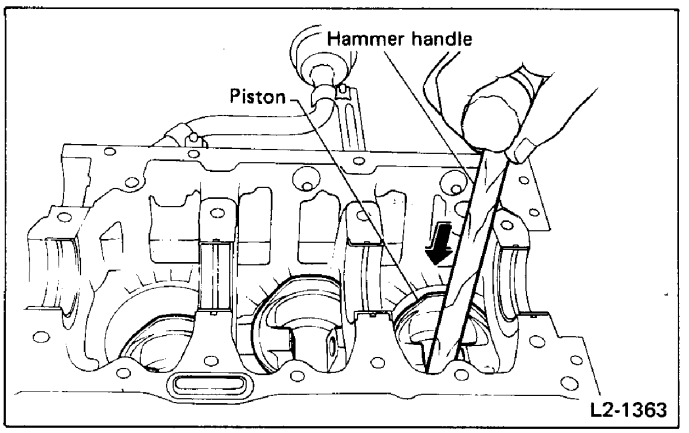


Fig. 208

13) Remove crankshaft bearings from cylinder block using hammer handle.

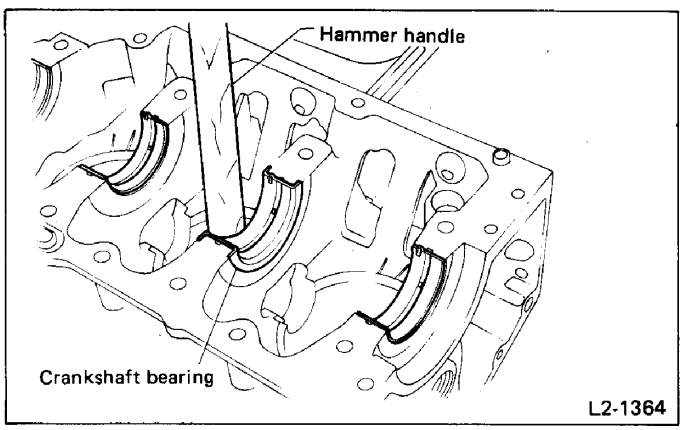


Fig. 209

INSPECTION

CYLINDER BLOCK

Check cylinder block for the following items, and correct or replace if defective.
1) Check for cracks and damage visually. Especially, inspect important parts by means of red check.
2) Check the oil passages for clogging.
3) Inspect the cylinder block surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

Warping limit:
0.075 mm (0.0030 in)
Grinding limit:
0.4 mm (0.016 in)

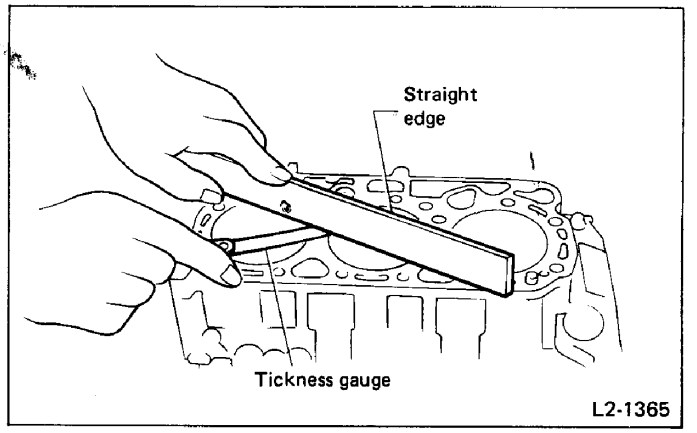


Fig. 210

CYLINDER AND PISTON

1) Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights shown in the figure, using a cylinder bore gauge.

Measurement should be performed at a temperature of 20°C (68°F).

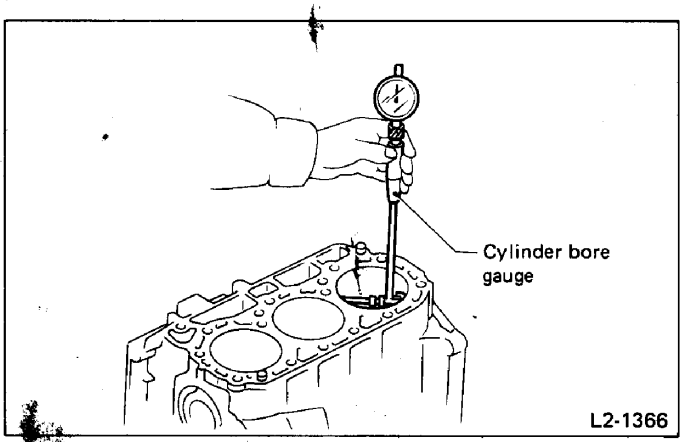


Fig. 211

Cylinder bore		
Standard diameter		91.985 – 92.015 mm (3.6214 – 3.6226 in)
Taper	Limit	0.050 mm (0.0020 in)
Out-of-round	Limit	0.050 mm (0.0020 in)
Cylinder-to-piston clearance at 20°C (68°F)	Standard	0.015 – 0.035 mm (0.0006 – 0.0014 in)
	Limit	0.06 mm (0.0024 in)

2) Boring and honing

(1) If the value of taper, out-of-roundness, or cylinder-to-piston clearance measured exceeds the specified limit or if there is any damage on the cylinder wall, rebore it to use an oversize piston.

When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and use oversize pistons. Do not perform boring on one cylinder only, nor use an oversize piston for one cylinder only.

(2) Get six of the oversize pistons and measure the outer diameter of each piston at the height shown in the figure. (Thrust direction)

Measurement should be performed at a temperature of 20°C (68°F).

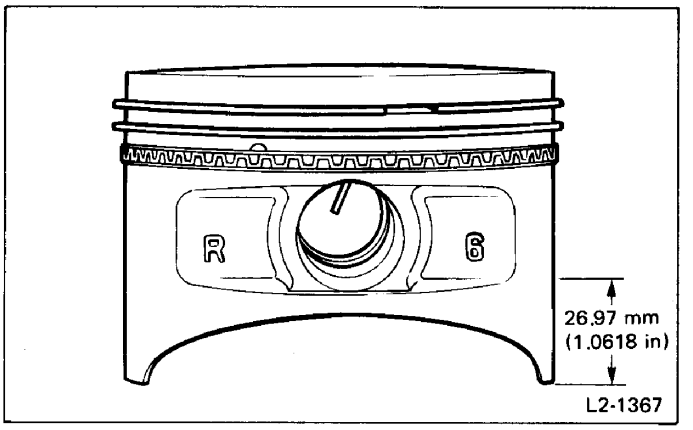


Fig. 212

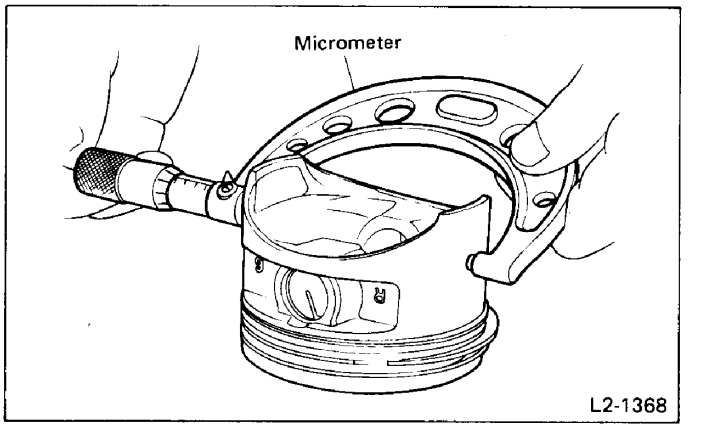


Fig. 213

Piston outer diameter:
Standard
91.970 – 91.980 mm (3.6209 – 3.6213 in)
0.25 mm (0.0098 in) oversize
92.220 – 92.230 mm (3.6307 – 3.6311 in)
0.50 mm (0.0197 in) oversize
92.470 – 92.480 mm (3.6405 – 3.6409 in)

(3) If the cylinder inner diameter exceeds the following enlarging limit after boring and honing, replace the cylinder block.

Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, pay attention to this when measuring the cylinder diameter.

Enlarging limit of cylinder inner diameter:
0.5 mm (0.020 in)

ASSEMBLY

1) Install ENGINE STANDS (499817100) to cylinder blocks. When installing ENGINE STANDS, fit bolts to the holes marked with "R" on the #1, #3 and #5 cylinder sides, and to the holes marked with "L" on the #2, #4 and #6 cylinder sides.
2) Install crankshaft bearings to cylinder blocks.
3) Install crankshaft to left-hand cylinder block.

Apply engine oil to sliding surfaces of crankshaft journal and crankshaft bearing.

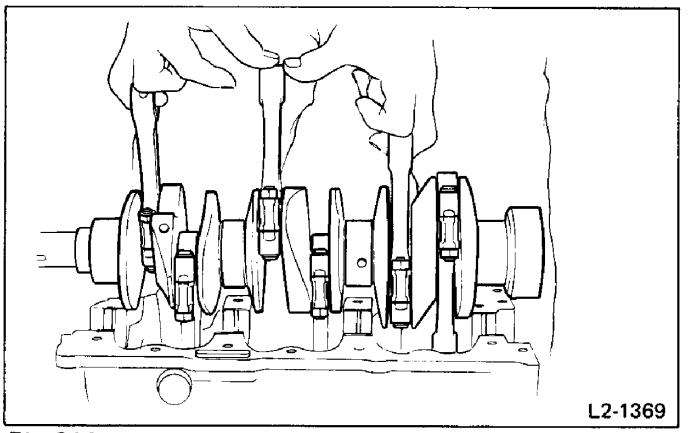


Fig. 214

4) Fit O-ring and back-up ring to coolant passage of left-hand cylinder block.

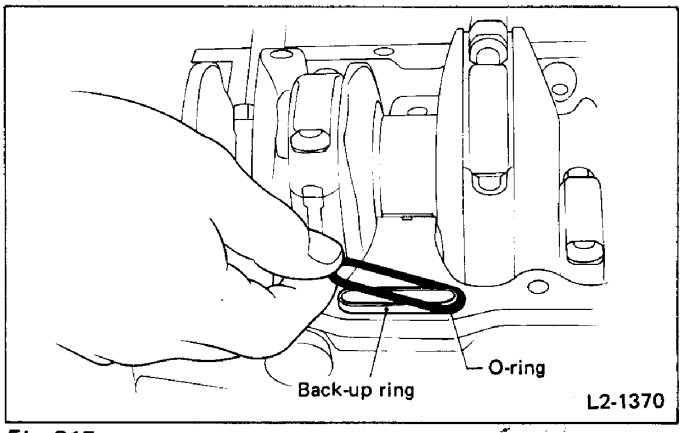


Fig. 215

5) Clean mating surfaces of cylinder block using thinner. Apply liquid packing (Three Bond 1215 or equivalent) to the mating surface (one side only).

Be careful not to extend liquid packing to coolant and oil passages.

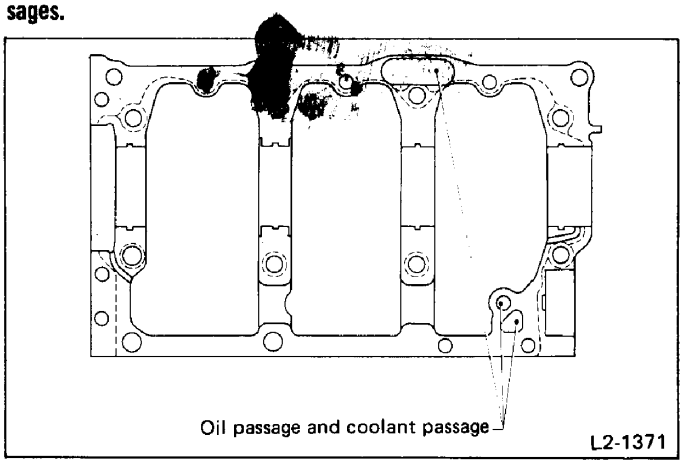


Fig. 216

6) With left-hand cylinder block facing down, install right-hand cylinder block. After tightening bolts temporarily, lay cylinder block down, then tighten bolts to the specified torque.

Make sure O-ring is fitted correctly in groove.

Tightening torque:
10 mm bolt
39 – 47 N·m (4.0 – 4.8 kg-m, 29 – 35 ft-lb)
8 mm bolt
23 – 26 N·m (2.3 – 2.7 kg-m, 17 – 20 ft-lb)

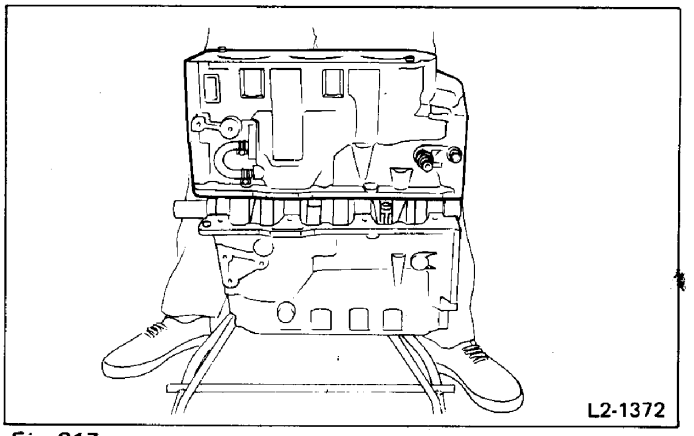


Fig. 217

7) Position the gaps of the piston rings and oil ring as shown in the figure.

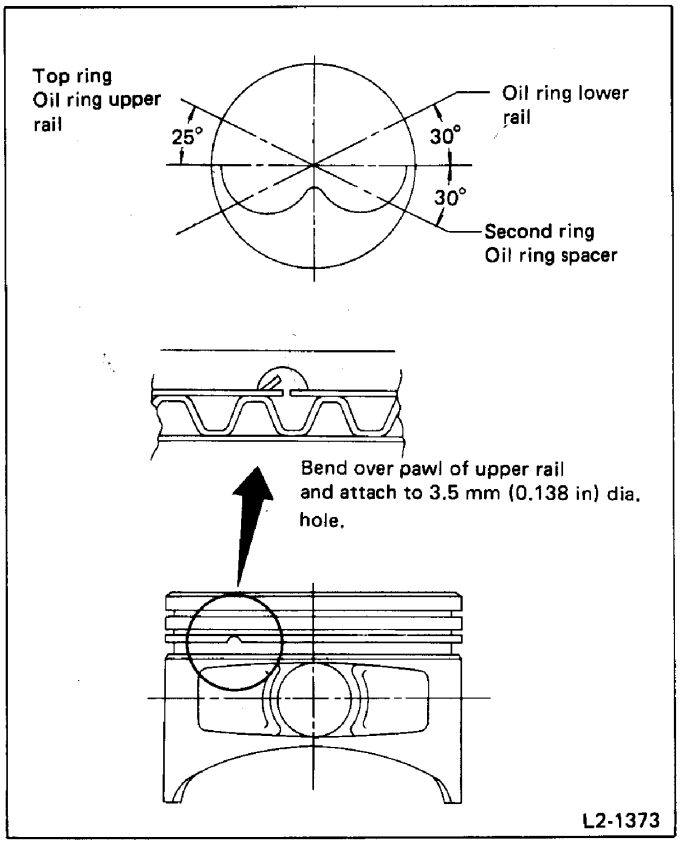


Fig. 218

8) Install pistons in cylinder as follows:
(1) Apply oil to the circumference of piston and the inner surface of cylinder.
(2) With the #5 and #6 cylinders facing downwards, turn crankshaft until the #3 and #4 connecting rod comes to the bottom dead center. Then insert the #4 piston into cylinder by using PISTON GUIDE (398744300).

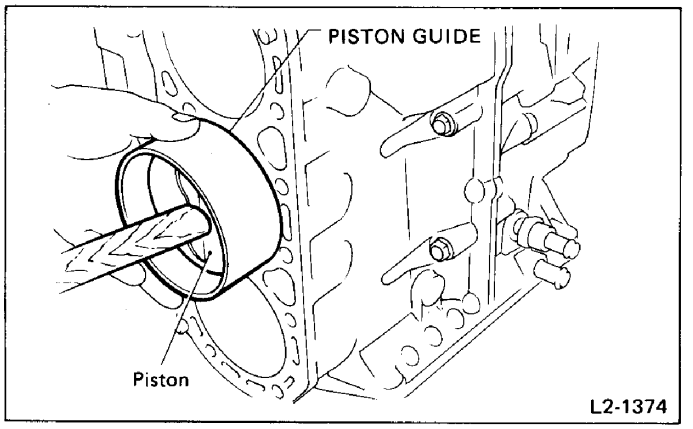


Fig. 219

(3) Install piston pin through the service hole after aligning the service hole, piston pin hole, and connecting rod small end with PISTON PIN GUIDE (499017000).

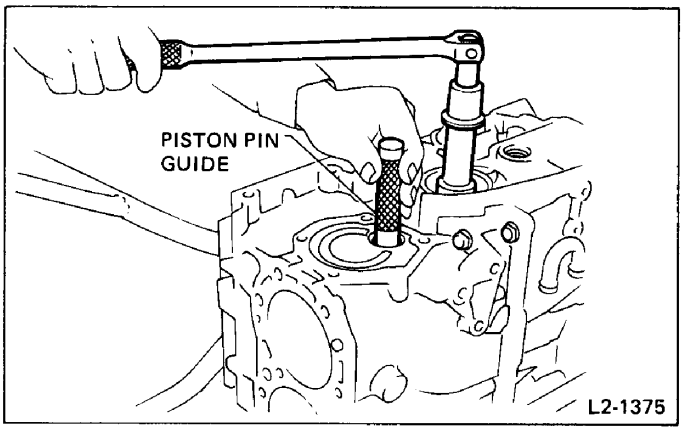


Fig. 220

(4) Install circlips through the service hole, using long-nosed pliers.

Circlip must be installed in correct direction with its end facing out.

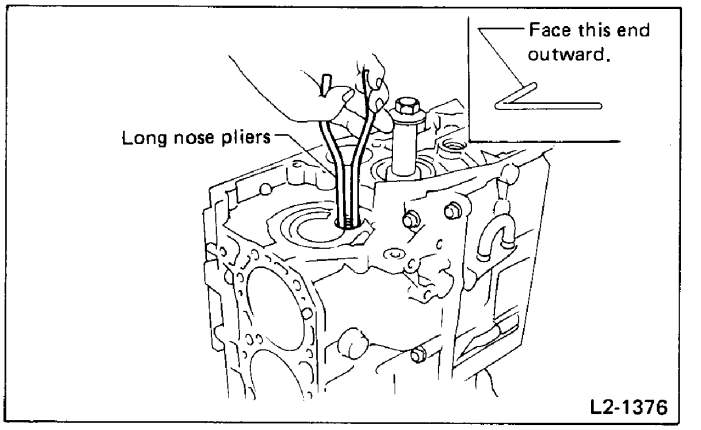


Fig. 221

(5) Circlips must be installed in the order of #3, #1, #2, #5 and #6 pistons.
(6) Turn crankshaft, and check whether piston and circlip are assembled correctly.

9) Apply fluid packing (Three-bond 1205 or equivalent) to plugs, and tighten it with aluminium gasket placed in between.

Tightening torque:
62 – 76 N·m (6.3 – 7.7 kg-m, 46 – 56 ft-lb)

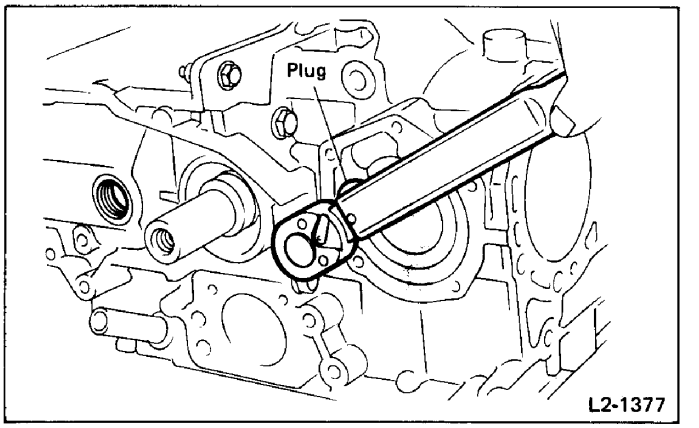


Fig. 222

10) Install front oil seal to cylinder block using INSTALLER (499567100).

Coat the outside surface of oil seal with engine oil and oil seal lip with grease. Force-fit oil seal squarely into position.

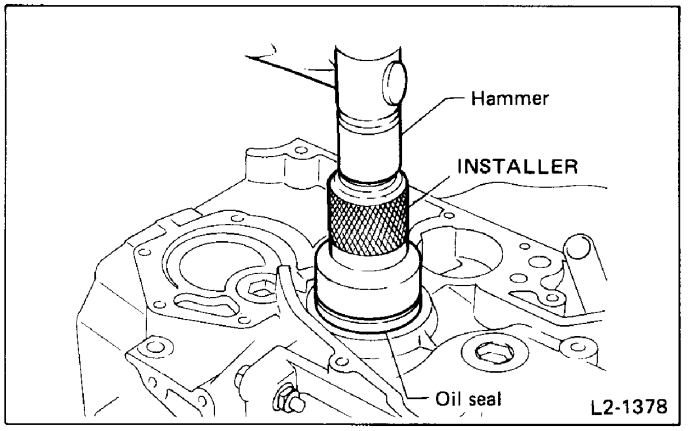


Fig. 223

11) Install rear oil seal to cylinder block using INSTALLER (499587000).

Coat the outside surface of oil seal with engine oil, and oil seal lip with grease. Force-fit oil seal squarely into position.

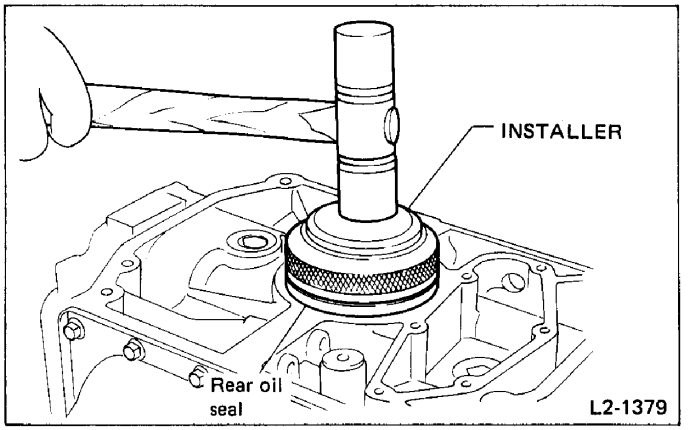


Fig. 224

12) Install oil separator cover with gasket placed in between.

Tightening torque:
4.4 – 5.4 N·m (0.45 – 0.55 kg-m, 3.3 – 4.0 ft-lb)

13) Install flywheel housing.

Tightening torque:
34 – 40 N·m (3.5 – 4.1 kg-m, 25 – 30 ft-lb)

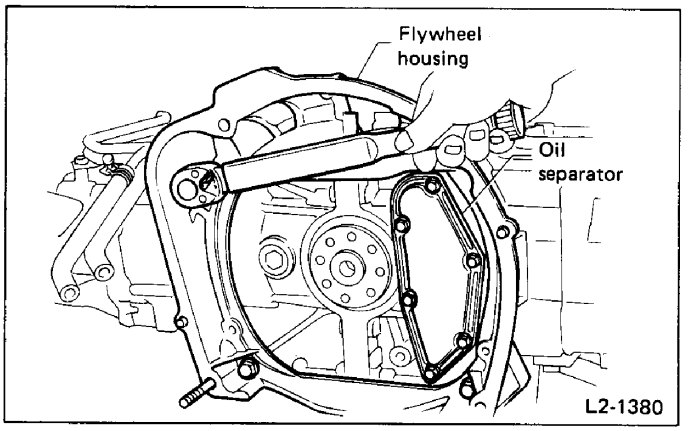


Fig. 225

INSTALLATION

1) Install oil pan.

Tightening torque:
4.4 – 5.4 N·m (0.45 – 0.55 kg-m, 3.3 – 4.0 ft-lb)

2) Install cylinder heads to cylinder blocks with gaskets placed between.
When tightening bolts, apply oil to the threads and tighten them in two successive steps until the final tightening is at the specified torque.
(Refer to "Cylinder Head".)

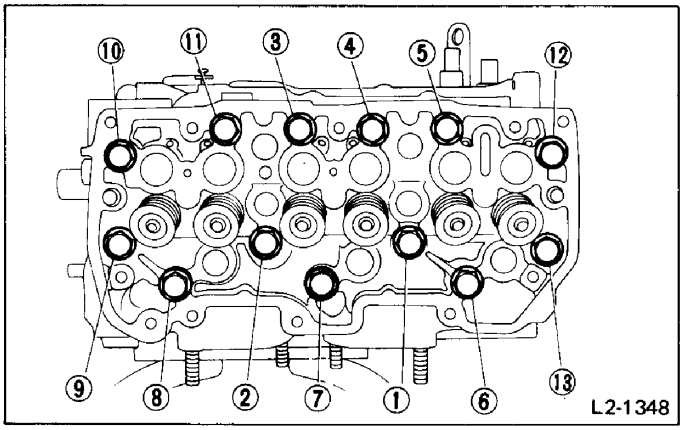


Fig. 226

Tightening torque:
60 – 68 N·m (6.1 – 6.9 kg-m, 44 – 50 ft-lb)

3) Install flywheel to crankshaft using FLYWHEEL STOPPER (498277000) for locking crankshaft. [Manual transmission model]

Tightening torque:
69 – 75 N·m (7.0 – 7.6 kg-m, 51 – 55 ft-lb)

4) Install drive plate and reinforcement using DRIVE PLATE STOPPER (498497000) for locking crankshaft. [Automatic transmission model]

Tightening torque:
69 – 75 N·m (7.0 – 7.6 kg-m, 51 – 55 ft-lb)

5) Position the clutch cover so that the "●" marks on the flywheel and clutch cover are spaced 120° or more.
Install clutch disc and clutch cover with bolts and spring washers, aligning clutch disc with flywheel by inserting CLUTCH DISC GUIDE (499747000) into needle bearing fitted in flywheel. [Manual transmission model]

Tightening torque:
14.2 – 17.2 N·m
(1.45 – 1.75 kg-m, 10.5 – 12.7 ft-lb)

6) Install seal to water pump, then install the water pump to cylinder block with gasket placed between.

7) Install oil pump ASSY, proceeding as follows:
(1) Thoroughly remove excess fluid packing from rotor housing of cylinder block.
(2) Apply a small amount of fluid packing (Three-bond 1207B or equivalent) to the portion indicated by arrow in figure in cylinder block.

Remove any Three Bond 1207B which protrudes into rotor chamber.

(3) Apply ample engine oil to rotor housing, then insert outer rotor into rotor housing by setting it as shown.
(4) Set oil pump pulley as shown, and install oil pump ASSY to cylinder block with gasket placed between. After installing, make sure pulley can be rotated smoothly.

Apply grease to oil pump gasket to prevent dislocation from the groove.

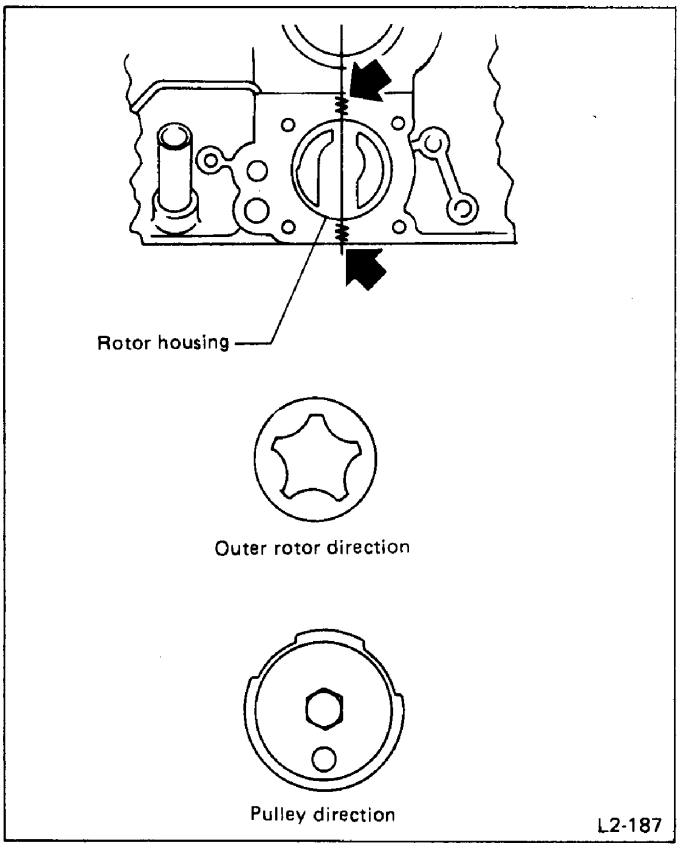


Fig. 227

8) Insert valve lash adjusters into cylinder head.

Be sure to insert each valve lash adjuster to its original position.

9) Apply grease to spherical surface and sliding surface of each valve rocker, then secure valve rockers to the respective valve adjusters and valves.

Be sure to apply grease; otherwise, valve rocker will drop off.

10) Apply fluid packing (Three-bond 1207B or equivalent) to groove of each camshaft case, then install to cylinder head.

Tightening torque:
23 – 26 N·m (2.3 – 2.7 kg-m, 17 – 20 ft-lb)

After installing, abundantly apply engine oil to sliding surfaces of cam and valve rocker.

11) Attach gaskets to valve rocker covers, and install the covers to camshaft cases with rocker cover washers and bolts.

Tightening torque:
4.4 – 5.4 N·m (0.45 – 0.55 kg-m, 3.3 – 4.0 ft-lb)

12) Install timing belt, belt cover and related parts. (Refer to "Timing Belt and Belt Cover".)

13) Install crank pulley to crankshaft using FLYWHEEL STOPPER (498277000) [manual transmission model] or DRIVE PLATE STOPPER (498497000) [automatic transmission model] to lock crankshaft.

Tightening torque:
89 – 107 N·m (9.1 – 10.9 kg-m, 66 – 79 ft-lb)

14) Install water pump pulley and pulley cover to water pump ASSY, and tighten bolts temporarily.
15) Install oil level gauge and gauge guide. Apply engine oil to O-ring beforehand.
16) Install oil filler duct and bracket.
17) Install water by-pass pipe, hose, and water pipe. Apply coolant O-rings beforehand.
18) Install knock sensor.

Tightening torque:
22 – 27 N·m (2.2 – 2.8 kg-m, 16 – 20 ft-lb)

19) Install alternator brackets.

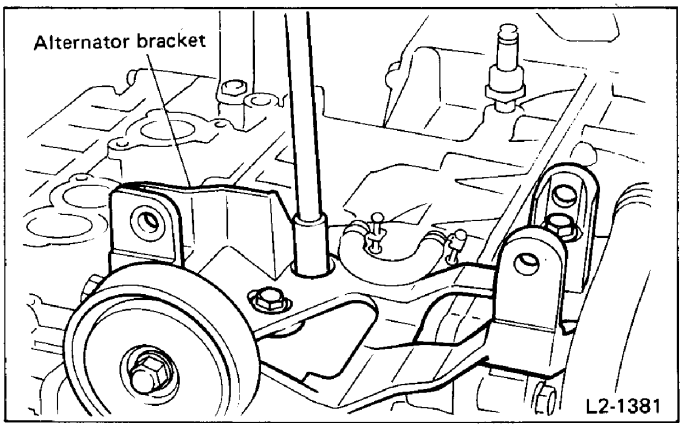


Fig. 228

20) Install PCV connector and harness clamp.

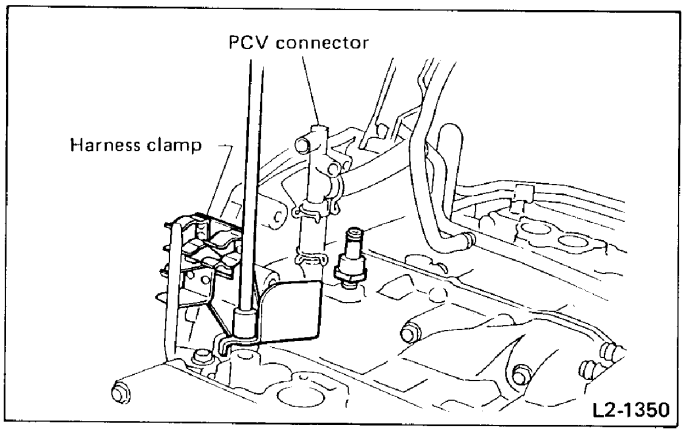


Fig. 229

21) Install intake manifold ASSY.

Tightening torque:
18 – 22 N·m (1.8 – 2.2 kg-m, 13 – 16 ft-lb)

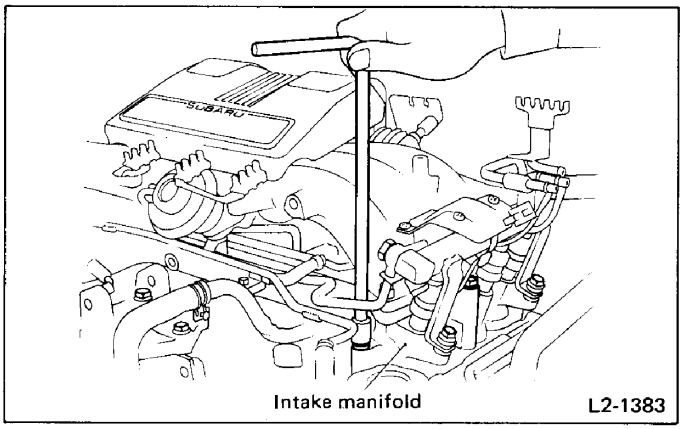


Fig. 230

22) Install harnesses.
23) Install hoses and tubes.
24) Install alternator to bracket, and tighten bolts temporarily.
25) Install distributor, proceeding as follows:
(1) Bring #1 cylinder piston to its top dead center on compression stroke. Set camshaft sprocket to the position shown in Figure.

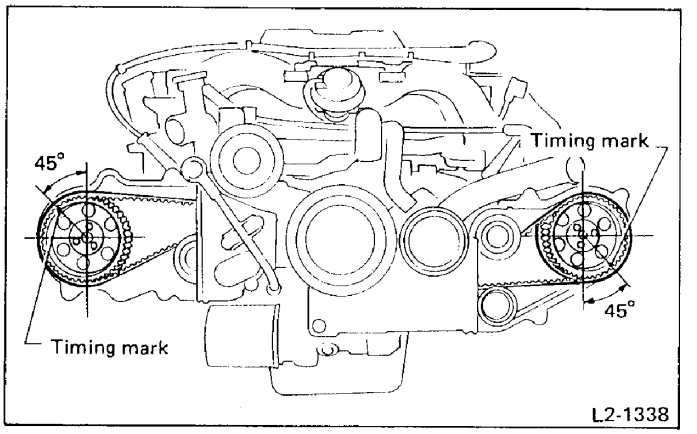


Fig. 231

(2) Align distributor housing match mark with pinion gear match mark to set #1 cylinder at igniting position.

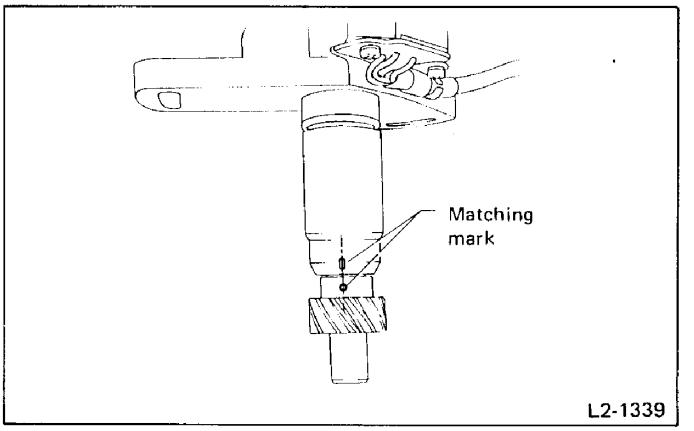


Fig. 232

(3) Install distributor to camshaft case.
(4) Connect lead wires.
(5) Install plug cord and high-tension cord.
26) Install right and left belt covers.
27) Remove ENGINE STAND.

Crankshaft and Piston

DISASSEMBLY

PISTON

1) Remove the piston rings using the piston ring expander.

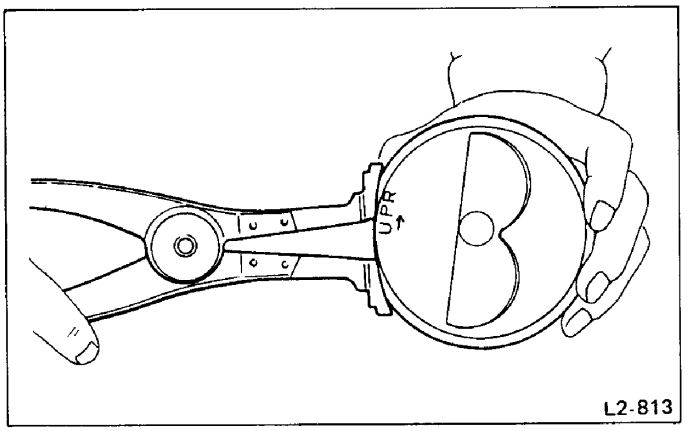


Fig. 233

2) Remove the oil ring by hand.

Arrange the removed piston rings in good order to prevent confusion.

CONNECTING ROD

Remove connecting rod cap mounting nuts, and take out connecting rod from crankshaft.

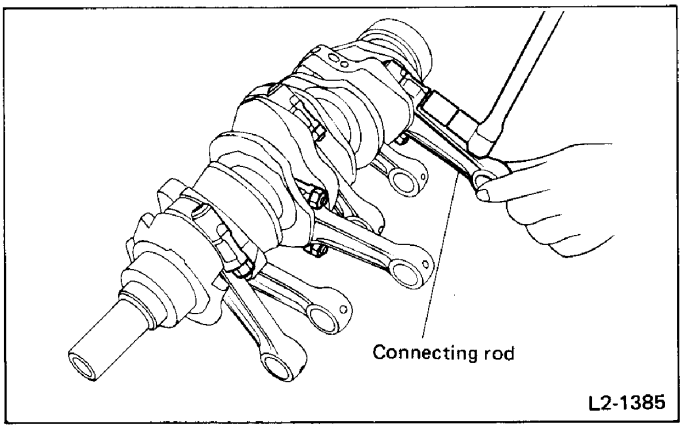


Fig. 234

Arrange removed connecting rod and connecting rod cap in good order to prevent confusion.

INSPECTION

PISTON AND PISTON PIN

1) Check pistons and piston pins for damage, cracks, and wear and the piston ring grooves for wear and damage. Replace if defective.
2) Measure the piston-to-cylinder clearance at each cylinder as instructed in CYLINDER AND PISTON. If any of the clearances is not to specification, replace the piston or bore the cylinder to use an oversize piston.
3) Make sure that piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if defective.

Specifications for piston and piston pin:
Standard outer diameter of piston pin
20.994 – 21.000 mm (0.8265 – 0.8268 in)
Standard inner diameter of piston pin hole
20.999 – 21.009 mm (0.8267 – 0.8271 in)
Standard clearance between piston pin and hole in piston
0.001 – 0.015 mm (0.00004 – 0.00059 in)
Standard clearance between piston pin and hole in connecting rod
0 – 0.022 mm (0 – 0.0009 in)

If burr is created on piston pin hole when removing circlip, carefully remove it so that piston pin can move.

PISTON RING

1) If piston ring is broken, damaged, or worn, or if its tension is insufficient, or when the piston is replaced, replace piston ring with a new one of the same size as the piston.

"R" is marked on the end of the top and second rings. When installing the rings to the piston, face this mark upward.

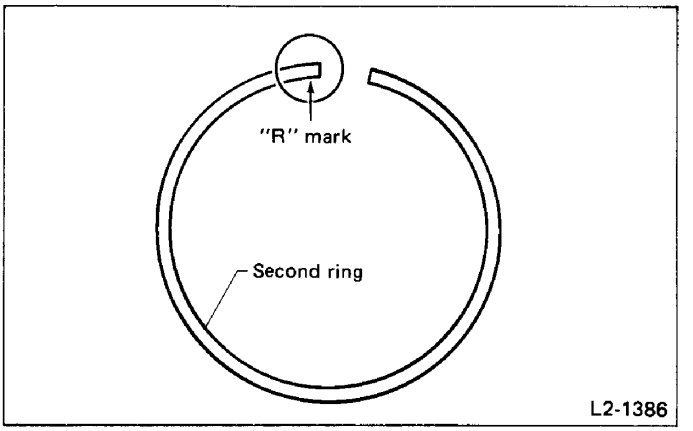


Fig. 235

The oil ring is a combined ring consisting of two rails and a spacer in between. When installing, be careful not to make misassembly.

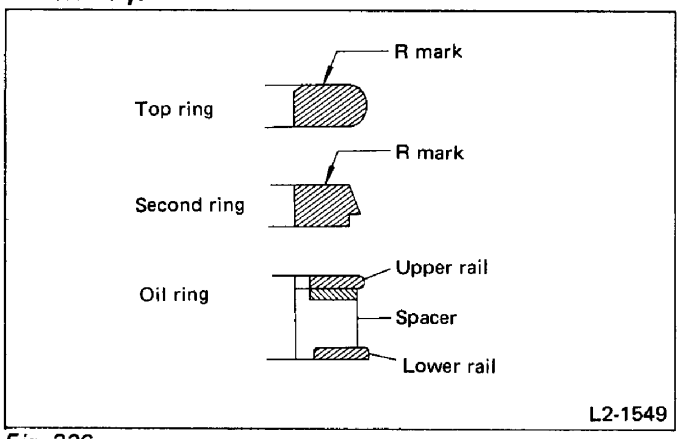


Fig. 236

2) Squarely place piston ring in cylinder and measure the piston ring gap with a thickness gauge.

		Standard	Limit
Piston ring gap	Top ring	0.20 – 0.35 mm (0.0079 – 0.0138 in)	1.5 mm (0.059 in)
	Second ring	0.20 – 0.35 mm (0.0079 – 0.0138 in)	1.5 mm (0.059 in)
	Oil ring rail	0.3 – 0.90 mm (0.012 – 0.0354 in)	2.0 mm (0.079 in)

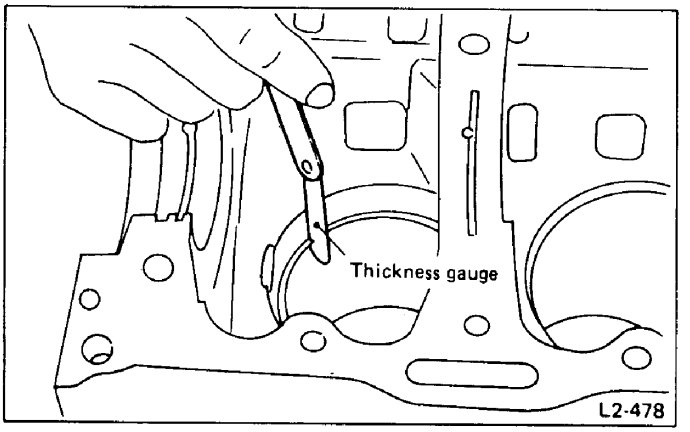


Fig. 237

3) Measure the clearance between piston ring and piston ring groove with a thickness gauge.

Before measuring the clearance, clean the piston ring groove and piston ring.

		Standard	Limit
Clearance between piston ring and piston ring groove	Top ring	0.04 – 0.08 mm (0.0016 – 0.0031 in)	0.15 mm (0.0059 in)
	Second ring	0.03 – 0.07 mm (0.0012 – 0.0028 in)	0.15 mm (0.0059 in)
	Oil ring	0	0

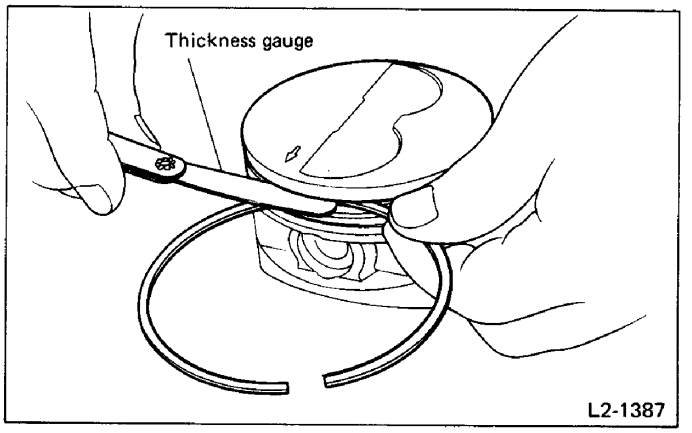


Fig. 238

CONNECTING ROD

1) Replace connecting rod, if the large or small end thrust surface is damaged.

2) Check for bend or twist using a connecting rod aligner. Replace connecting rod if the bend or twist exceeds the limit.

Limit of bend or twist per 100 mm (3.94 in) in length: 0.10 mm (0.0039 in)

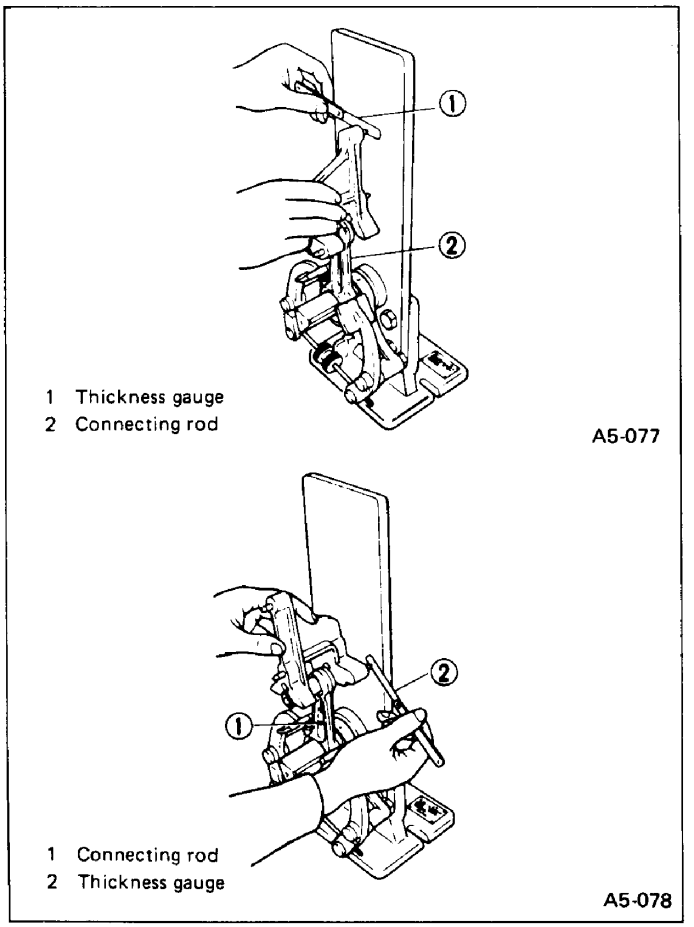


Fig. 239

3) Install connecting rod fitted with bearing to crankshaft and measure the side clearance (thrust clearance). Replace connecting rod if the side clearance exceeds the specified limit.

Connecting rod side clearance:
Standard
0.070 – 0.330 mm (0.0028 – 0.0130 in)
Limit
0.4 mm (0.016 in)

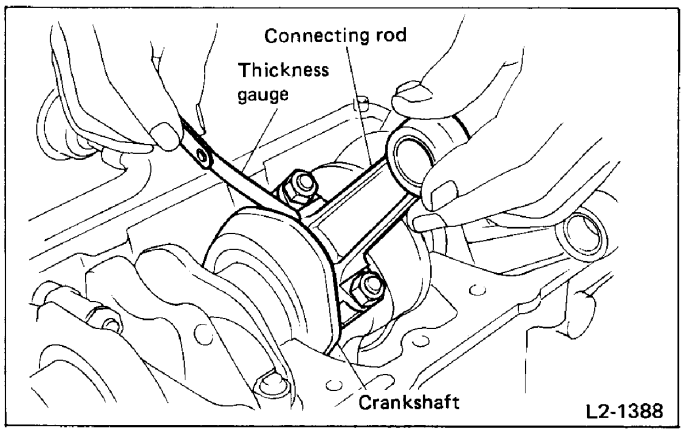


Fig. 240

4) Inspect connecting rod bearing for scar, peeling, seizure, melting, wear, etc.
5) Measure the oil clearance on individual connecting rod bearings by means of plastigauge according to the following procedure.
(1) Wipe off oil, dust, etc. on the surfaces to be measured.
(2) Cut the plastigauge to the width of the bearing, place it on the crankpin parallel with the crankshaft axis, and install connecting rod. Tighten connecting rod nuts to the specified torque.

Tightening torque:
39 – 42 N·m (4.0 – 4.3 kg-m, 29 – 31 ft-lb)

During this measurement, do not allow relative movement between the crankpin and connecting rod.

(3) Remove connecting rod and measure the width of the plastigauge with the scale printed on the plastigauge case. If any oil clearance is not within specification, replace the defective bearing with a new one of standard size or undersize as necessary, and replace or recondition the crankshaft as necessary. (See the table below.)

Connecting rod oil clearance:
Standard
0.010 – 0.070 mm (0.0004 – 0.0028 in)
Limit
0.10 mm (0.0039 in)

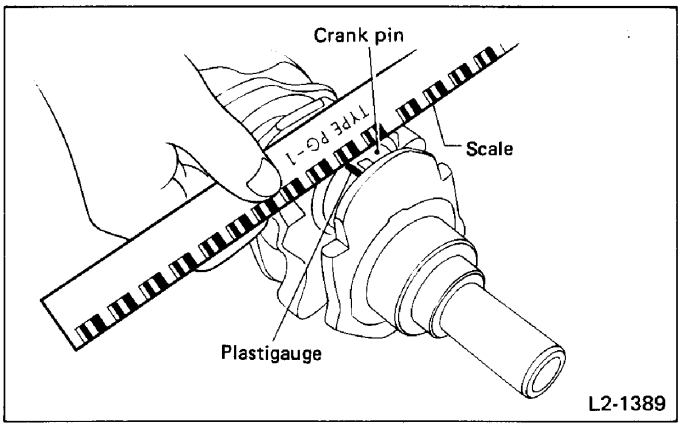


Fig. 241

Connecting rod bearing	
Bearing size	Thickness at center of bearing
Standard	1.485 – 1.490 mm (0.0585 – 0.0587 in)
0.03 mm (0.0012 in) undersize	1.500 – 1.505 mm (0.0591 – 0.0593 in)
0.05 mm (0.0020 in) undersize	1.510 – 1.515 mm (0.0594 – 0.0596 in)
0.25 mm (0.0098 in) undersize	1.610 – 1.615 mm (0.0634 – 0.0636 in)

6) Inspect bushing at connecting rod small end, and replace if worn or damaged. Also measure the piston pin clearance at the connecting rod small end.

Standard clearance between piston pin and bushing in connecting rod:
0 – 0.022 mm (0 – 0.0009 in)

CRANKSHAFT AND CRANKSHAFT BEARING

1) Clean crankshaft completely and check for cracks by means of red check etc., and replace if defective.
2) Measure the crankshaft bend, and correct or replace if it exceeds the limit.

When measuring, place both the front and rear journals on blocks located on a surface plate, and apply a dial gauge to the center journal.

Crankshaft bend limit:
0.035 mm (0.0014 in)

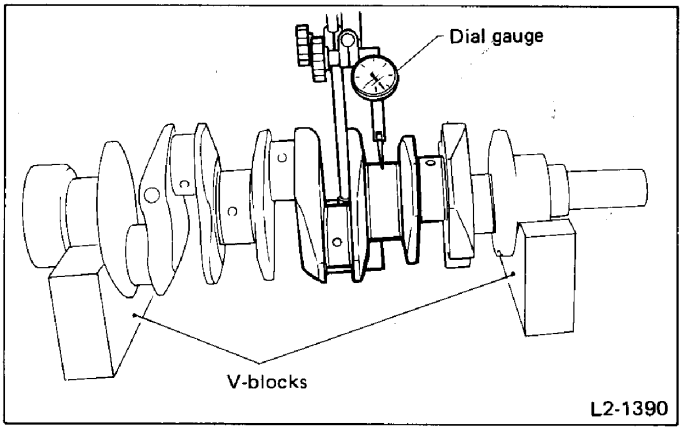


Fig. 242

3) Inspect the crank journal and crankpin for wear. If not to specifications, replace bearing with an undersize one, and replace or recondition crankshaft as necessary. When grinding crank journal or crankpin, finish them to the specified dimensions according to the undersize bearing to be used.

Crankpin and crank journal:
Out-of-roundness
0.03 mm (0.0012 in) or less
Grinding limit
0.25 mm (0.0098 in)

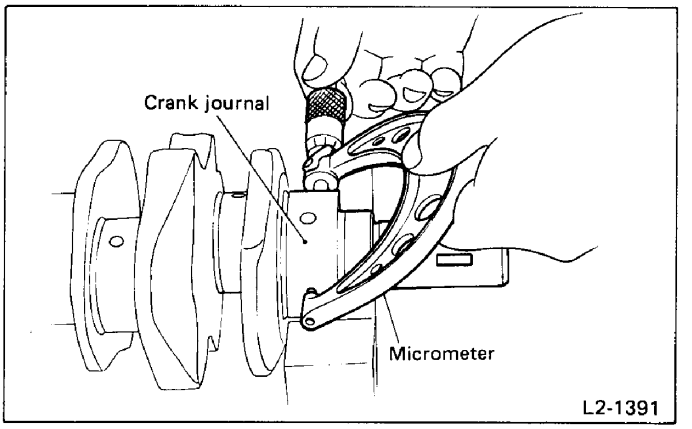


Fig. 243

4) Measure the thrust clearance of crankshaft at center bearing. If the clearance exceeds the limit, replace bearing.

Crankshaft thrust clearance
Standard
0.010 – 0.095 mm (0.0004 – 0.0037 in)
Limit
0.3 mm (0.0118 in)

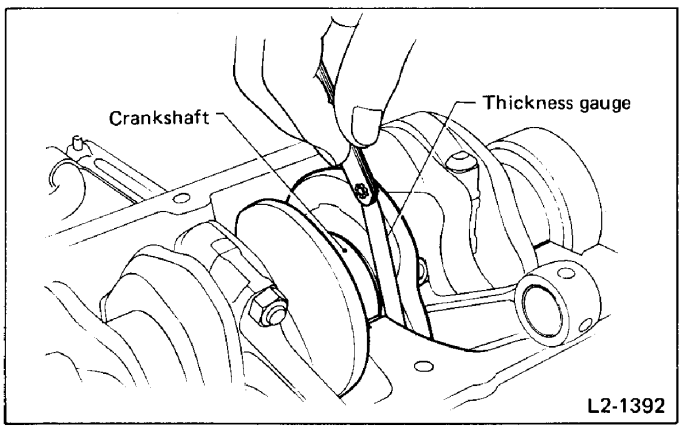


Fig. 244

5) Inspect individual crankshaft bearings for signs of flaking, seizure, melting, and wear.

6) Measure the oil clearance on each crankshaft bearing by means of plastigauge as follows:

(1) Wipe off oil, dust, etc. on the surfaces to be measured.

(2) Install bearings in crankcase and set crankshaft in position.

(3) Cut the plastigauge to the bearing width and place it on journal parallel with the crankshaft axis. Be careful not to put it on the oil hole or groove. Bring together the crankcase halves and tighten bolts to the specified torque.

During the work, the crankshaft must not be turned nor the crankcase inverted.

Torque:
39 – 47 N·m (4.0 – 4.8 kg-m, 29 – 35 ft-lb)

	Crankpin O.D.	Crank journal O.D.		
		Front	Center, Center II	Rear
Standard	44.995 – 45.010 mm (1.7715 – 1.7720 in)	54.957 – 54.972 mm (2.1637 – 2.1642 in)	54.954 – 54.970 mm (2.1635 – 2.1642 in)	54.955 – 54.970 mm (2.1636 – 2.1642 in)
0.03 mm (0.0012 in) undersize	44.965 – 44.980 mm (1.7703 – 1.7709 in)	54.927 – 54.942 mm (2.1625 – 2.1631 in)	54.924 – 54.940 mm (2.1624 – 2.1630 in)	54.925 – 54.940 mm (2.1624 – 2.1630 in)
0.05 mm (0.0020 in) undersize	44.945 – 44.960 mm (1.7695 – 1.7701 in)	54.907 – 54.922 mm (2.1617 – 2.1623 in)	54.904 – 54.920 mm (2.1616 – 2.1622 in)	54.905 – 54.920 mm (2.1616 – 2.1622 in)
0.25 mm (0.0098 in) undersize	44.745 – 44.760 mm (1.7616 – 1.7622 in)	54.707 – 54.722 mm (2.1538 – 2.1544 in)	54.704 – 54.720 mm (2.1537 – 2.1543 in)	54.705 – 54.720 mm (2.1537 – 2.1543 in)

(4) Remove all bolts and separate crankcase. Measure the plastigauge width with the scale printed on the plastigauge case.

(5) If the measurement is not within the specification, replace defective bearing with an undersize one, and replace or recondition crankshaft as necessary.

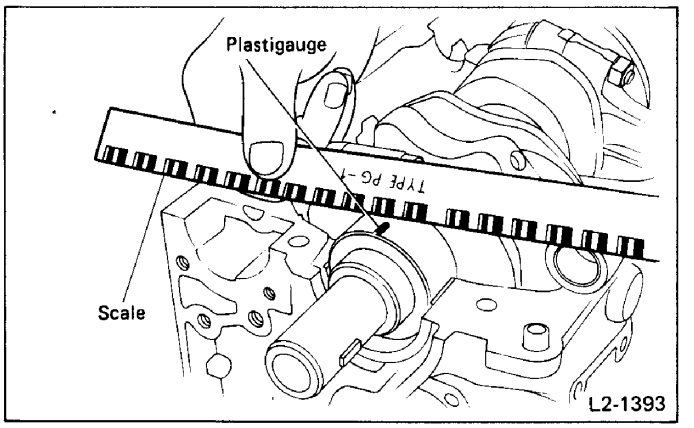


Fig. 245

Crankshaft oil clearance		
Standard	Center & Center II	0.008 – 0.027 mm (0.0003 – 0.0011 in)
	Front & Rear	0.003 – 0.036 mm (0.0001 – 0.0014 in)
Limit	Center & Center II	0.045 mm (0.0018 in)
	Front & Rear	0.055 mm (0.0022 in)

Dimensions of bearing		
Crankshaft bearing size	Thickness of bearing at center	
	Front & Rear	Center & Center II
Standard	2.015 – 2.019 mm (0.0793 – 0.0795 in)	2.019 – 2.022 mm (0.0795 – 0.0796 in)
0.03 mm (0.0012 in) undersize	2.030 – 2.034 mm (0.0799 – 0.0801 in)	2.034 – 2.037 mm (0.0801 – 0.0802 in)
0.05 mm (0.0020 in) undersize	2.040 – 2.044 mm (0.0803 – 0.0805 in)	2.044 – 2.047 mm (0.0805 – 0.0806 in)
0.25 mm (0.0098 in) undersize	2.140 – 2.144 mm (0.0843 – 0.0844 in)	2.144 – 2.147 mm (0.0844 – 0.0845 in)

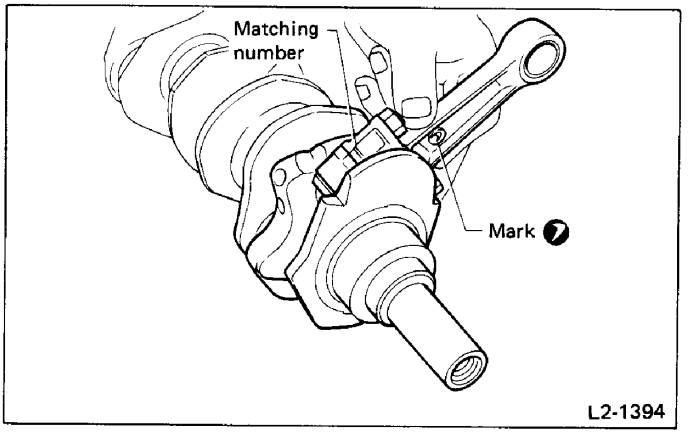


Fig. 246

ASSEMBLY

CRANKSHAFT

1) Install connecting rod bearings on connecting rods and connecting rod caps.

Apply oil to the surfaces of the connecting rod bearings.

2) Install connecting rods and connecting rod caps on crankshaft with connecting rod bolts and nuts.

Torque (Connecting rod nut):
39 – 42 N·m (4.0 – 4.3 kg-m, 29 – 31 ft-lb)
with oil on threads

a. Position each connecting rod with the side marked ❼ facing forward.
b. Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.
c. When tightening the connecting rod nuts, apply oil on the threads.

PISTON

1) Install piston rings on pistons as follows.
Install oil ring spacer, upper rail and lower rail in this order by hand. Then install second ring and top ring with a piston ring expander.

2) Position the gaps of the piston rings and oil ring as shown in the figure.

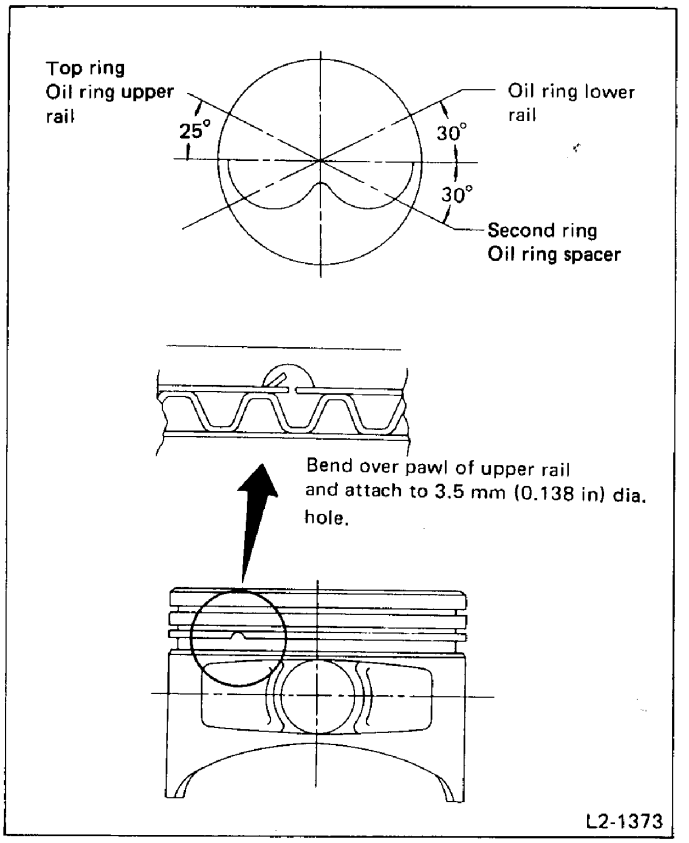


Fig. 247

3) Install circlip to piston.
The circlip must be fitted to the end that faces inside of crankcase when piston is inserted.

Circlip must be installed in correct direction with its end facing out.

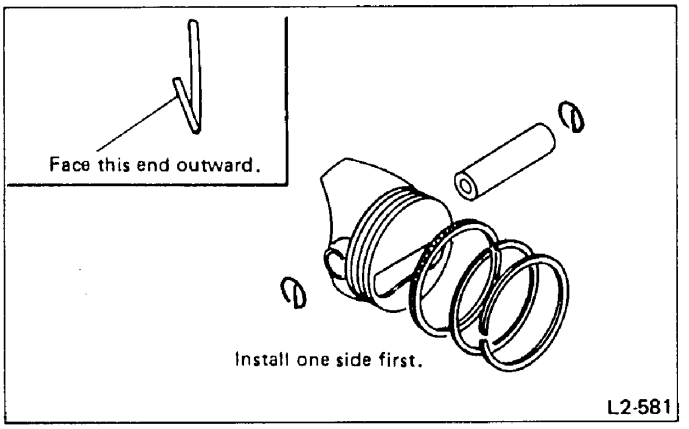


Fig. 248

TROUBLESHOOTING

Refer to "1800 cc Engine TROUBLESHOOTING".