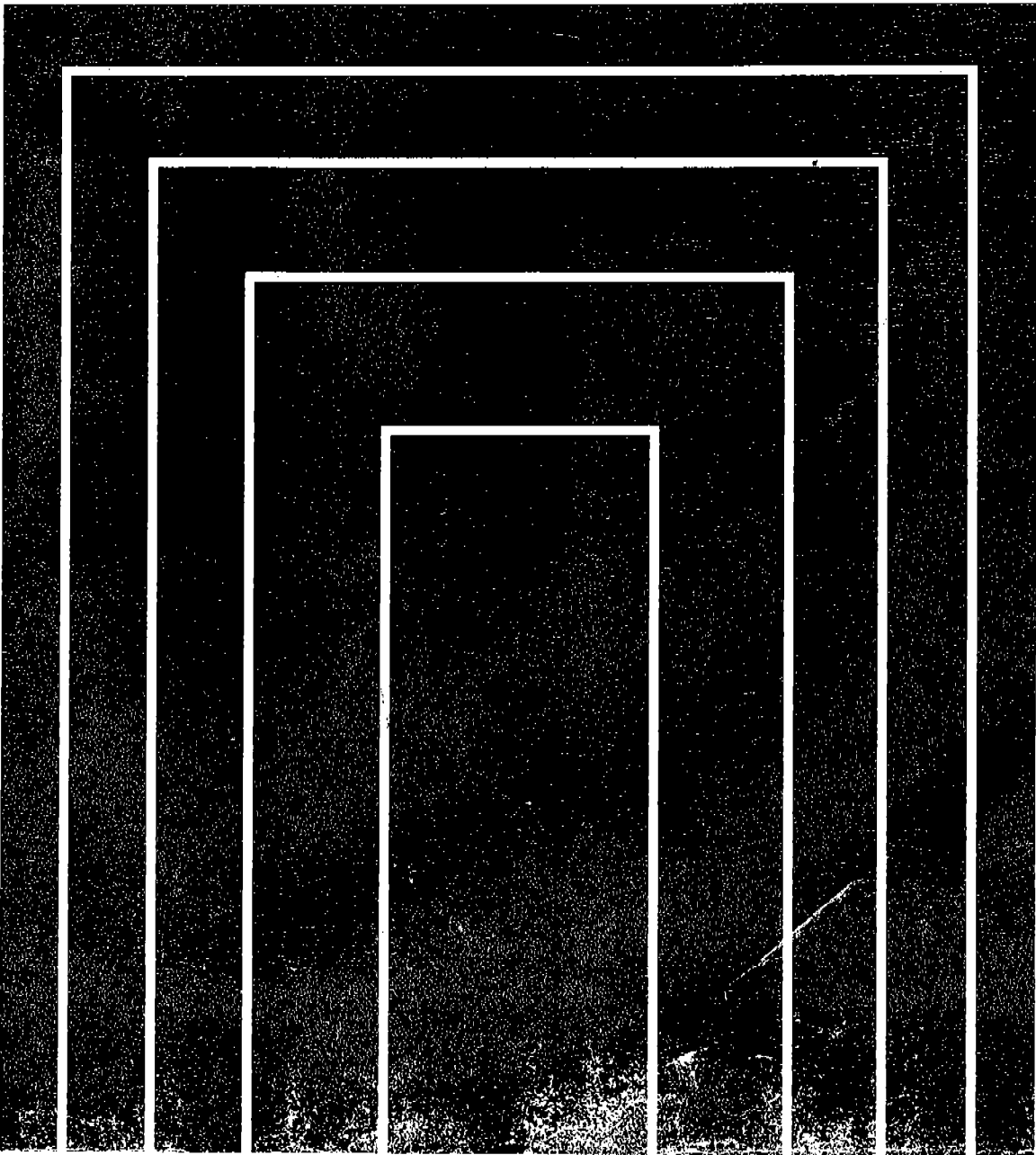


TOYOTA

4A-GE ENGINE

REPAIR MANUAL

FEB., 1997




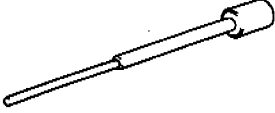
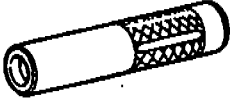
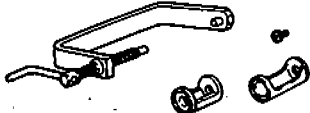
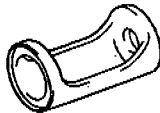








PREPARATION


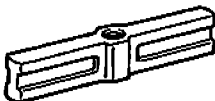
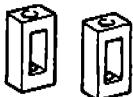
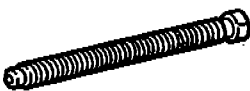



ENGINE MECHANICAL	PP-1
ELECTRONIC FUEL INJECTION	PP-4
COOLING	PP-6
LUBRICATION	PP-7
IGNITION	PP-9
STARTING	PP-10
CHARGING	PP-11

ENGINE MECHANICAL

SST (SPECIAL SERVICE TOOLS)


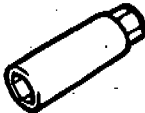



EGGAY-30

	09201-10000	Valve Guide Bushing Remover & Replacer Set	
	(09201-01050)	Valve Guide Bushing Remover & Replacer 5	
	09201-41020	Valve Stem Oil Seal Replacer	
	09202-70020	Valve Spring Compressor	
	(09202-00020)	Attachment	
	09213-54015	Crankshaft Pulley Holding Tool	
	09223-15030	Oil Seal & Bearing Replacer	Crankshaft rear oil seal
	09223-46011	Crankshaft Front Oil Seal Replacer	Camshaft oil seal
	09228-06501	Oil Filter Wrench	
	09330-00021	Companion Flange Holding Tool	Crankshaft pulley
	09636-20010	Upper Ball Joint Dust Cover Replacer	
	09816-30010	Oil Pressure Switch Socket	Oil pressure switch Knock sensor
	09843-18020	Diagnosis Check Wire	

	09950-50010 Puller C Set	
	(09951-05010) Hanger 150	Crankshaft pulley
	(09952-05010) Slide Arm	Crankshaft pulley
	(09953-05020) Center Bolt 150	Crankshaft pulley
	(09954-05030) Claw No.3	Crankshaft pulley
	09950-70010 Handle Set	
	(09951-07150) Handle 150	Valve guide bushing Crankshaft rear oil seal

RECOMMENDED TOOLS

EG0AZ-01

	09043-50100 Bi-hexagon Wrench 10 mm .	
	09045-38162 Spark Plug Wrench .	
	09200-00010 Engine Adjust Kit .	
	09258-00030 Hose Plug Set .	Plug for the vacuum hose, fuel hose etc.
	09904-00010 Expander Set .	

EG000-2U

EQUIPMENT

Caliper gauge	
CO/HC meter	
Compression gauge	

PREPARATION — ENGINE MECHANICAL

Connecting rod aligner	
Cylinder gauge	
Dial indicator	
Dye penetrant	
Heater	
Magnetic finger	
Micrometer	
Piston ring compressor	
Piston ring expander	
Platigauge	
Precision straight edge	
Soft brush	
Spring tester	
Steel square	
Thermometer	
Timing light	
Torque wrench	
Valve seat cutter	
Vernier calipers	

SSM (SERVICE SPECIAL MATERIALS)





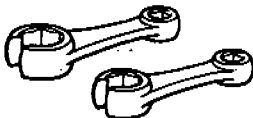



EQ081-0E

08826-00080	Seal Packing Black or equivalent (FIPG)	Camshaft bearing cap Cylinder head cover
08833-00070	Adhesive 1324, THREE BOND 1324 or equivalent	Spark plug tube
08833-00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Timing belt idler pulley

ELECTRONIC FUEL INJECTION




SST (SPECIAL SERVICE TOOLS)

E90CF-32

	09268-41046 Injection Measuring Tool Set	
	(90405-09015) No.1 Union	
	(95336-08070) Hose	
	09268-45012 EFI Fuel Pressure Gauge	
	09631-22020 Power Steering Hose Nut 14 x 17 mm Wrench Set	Fuel line flare nut
	09816-30010 Oil Pressure Switch Socket	Knock sensor
	09842-30070 Wiring "F" EFI Inspection	
	09843-18020 Diagnosis Check Wire	

E90CC-29

RECOMMENDED TOOLS

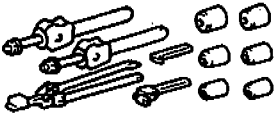





	09082-00040 TOYOTA Electrical Tester.	
	09200-00010 Engine Adjust Kit .	
	09258-00030 Hose Plug Set .	Plug for vacuum hose, fuel hose etc.

EQUIPMENT

Carburetor balancer	Throttle body
Graduated cylinder	Injector
Hexagon wrench	
Sound scope	Injector
Tachometer	
Torque wrench	
Vacuum gauge	


COOLING**SST (SPECIAL SERVICE TOOLS)**

EG12S-0Y

	09230-01010 Radiator Service Tool Set	
	09236-00101 Water Pump Overhaul Tool Set	
	(09236-15010) Bearing Stay	
	(09237-00010) Water Pump Bearing Remover & Replacer	
	(09237-00020) Bearing Stay	
	(09237-00040) Shaft "A"	

RECOMMENDED TOOLS

EG12V-0U

	09082-00040 TOYOTA Electrical Tester.	
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EQUIPMENT

EG12W-14

Heater	Water temperature switch
Radiator cap tester	
Thermometer	Water temperature switch
Torque wrench	

COOLANT

EG12X-10

Item	Capacity	Classification
Engine coolant	6.0 liters (6.3 US qts, 5.3 Imp. qts)	Ethylene-glycol base

SSM (SPECIAL SERVICE MATERIALS)

EG18X-08

08826-00100 Seal Packing 1282B, THREE BOND 1282B or equivalent (FIPG)	Water pump seal
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LUBRICATION

BST (SPECIAL SERVICE TOOLS)

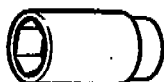
E014J-1A



09032-00100 Oil Pan Seal Cutter



09228-06501 Oil Filter Wrench



09816-30010 Oil Pressure Switch Socket

RECOMMENDED TOOLS

E014J-1A



09200-00010 Engine Adjust Kit



09905-00013 Snap Ring Pliers

EQUIPMENT

E014J-1A

Oil pressure gauge

Precision straight edge

Torque wrench

LUBRICANT

E014J-27

Item	Capacity	Classification
Engine oil		
Dry fill	3.5 liters (3.7 US qts, 3.1 Imp. qts)	API grade SG or SH, multigrade engine oil or ILSAC multigrade engine oil
Drain and refill		
w/ Oil filter change	3.0 liters (3.2 US qts, 2.6 Imp. qts)	
w/o Oil filter change	2.8 liters (3.0 US qts, 2.5 Imp. qts)	

SSM (SPECIAL SERVICE MATERIALS)

EG147-16

08826-00080	Seal Packing Black or equivalent (FIPG)	Oil pan
08833-00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure switch

IGNITION

ST (SPECIAL SERVICE TOOLS)

K01C-0F



09240-00020 Wire Gauge Set

Air gap

RECOMMENDED TOOLS

K01D-0W



09082-00040 TOYOTA Electrical Tester.



09200-00010 Engine Adjust Kit .

EQUIPMENT

K01E-0P



Megger insulation resistance meter

Spark plug

Spark plug cleaner



STARTING**SST (SPECIAL SERVICE TOOLS)**

ST005-1M

	09221-25026 Piston Pin Remover & Replacer	
	(09221-00090) Guide "C"	Center bearing

RECOMMENDED TOOLS

ST007-19

	09082-00040 TOYOTA Electrical Tester.	
	09904-00010 Expander Set.	

EQUIPMENT

ST001-12



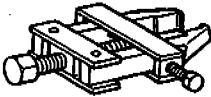





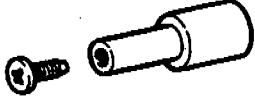
Caliper gauge	Center bearing
Dial indicator	Commutator
Micrometer	Planet carrier shaft
Pull scale	Brush spring
Sandpaper	Commutator
Torque wrench	
V-block	Commutator
Vernier calipers	Commutator; Brush

PREPARATION — CHARGING

CH200-1P



CHARGING

ST (SPECIAL SERVICE TOOLS)

	09285-76010	Injection Pump Camshaft Bearing Cone Replacer	Rotor rear bearing cover
	09286-46011	Injection Pump Spline Shaft Puller	Rectifier end frame
	09820-00021	Alternator Rear Bearing Puller	
	09820-00030	Alternator Rear Bearing Replacer	Rotor rear bearing
	09820-63010	Alternator Pulley Set Nut Wrench Set	
	09950-60010	Replacer Set	Rotor front bearing
	(09951-00260)	Replacer 26	
	(09951-00500)	Replacer 50	
	(09952-06010)	Adapter	

CH200-1S

RECOMMENDED TOOLS

	09082-00040	TOYOTA Electrical Tester.	
	09905-00013	Snap Ring Pliers .	

EQUIPMENT

Battery specific gravity gauge	
Belt tension gauge	
Torque wrench	
Vernier calipers	Rotor (Slip ring), Brush

SERVICE SPECIFICATIONS













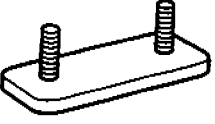
STANDARD BOLT	SS-1
ENGINE MECHANICAL	SS-3
ELECTRONIC FUEL INJECTION	SS-7
COOLING	SS-10
LUBRICATION	SS-11
IGNITION	SS-12
STARTING	SS-13
CHARGING	SS-14

STANDARD BOLT

TORQUE SPECIFICATIONS

SS020-01

HOW TO DETERMINE BOLT STRENGTH

	Mark	Class		Mark	Class
Hexagon head bolt	4—	4T	Hexagon flange bolt w/ washer hexagon bolt	 4 Protruding lines	9T
	5—	5T			
	6—	6T			
	7—	7T			
 Bolt head No.	8—	8T	Hexagon flange bolt w/ washer hexagon bolt	 5 Protruding lines	10T
	9—	9T			
	10—	10T			
	11—	11T			
 No mark		4T	Hexagon flange bolt w/ washer hexagon bolt	 6 Protruding lines	11T
Hexagon flange bolt w/ washer hexagon bolt	 No mark	4T	Stud bolt	 No mark	4T
Hexagon head bolt	 2 Protruding lines	5T			
Hexagon flange bolt w/ washer hexagon bolt	 2 Protruding lines	6T			
Hexagon head bolt	 3 Protruding lines	7T			
Hexagon head bolt	 4 Protruding lines	8T			
			Welded bolt	 Grooved	6T
			Welded bolt		4T

SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			N·m	kgf·cm	ft·lbf	N·m	kgf·cm	ft·lbf
4T	6	1	5	55	48 in.·lbf	6	60	52 in.·lbf
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	—	—	—
5T	6	1	6.5	65	56 in.·lbf	7.5	75	65 in.·lbf
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	—	—	—
6T	6	1	8	80	69 in.·lbf	9	90	78 in.·lbf
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	—	—	—
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	—	—	—
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130

ENGINE MECHANICAL

SERVICE DATA

EG005-24

Idle CO	Concentration	0 - 1.0 %
Compression pressure	at 250 rpm STD	1,330 kPa (13.6 kgf/cm ² , 193 psi) or more
	Minimum	1,080 kPa (11.0 kgf/cm ² , 156 psi)
	Difference of pressure between each cylinder	98 kPa (1.0 kgf/cm ² , 14 psi) or less
Valve clearance	at cold Intake	0.19 - 0.29 mm (0.007 - 0.011 in.)
	Exhaust	0.39 - 0.49 mm (0.015 - 0.020 in.)
Ignition timing	w/ Terminals TE1 and E1 connected	10 ± 2° BTDC @ idle
Idle speed		880 ± 50 rpm
Timing belt tensioner	Protrusion from housing side	11.9 - 12.8 mm (0.469 - 0.504 in.)
Cylinder head	Warpage	
	Cylinder block side Maximum	0.10 mm (0.0039 in.)
	Manifold side Maximum	0.10 mm (0.0039 in.)
	Valve seat	
	Refacing angle	30°, 45°, 60°
	Contacting angle	45°
Valve guide bushing	Contacting width	1.0 - 1.4 mm (0.039 - 0.055 in.)
	Inside diameter	5.010 - 5.030 mm (0.1972 - 0.1980 in.)
	Outside diameter (for repair part) STD	9.727 - 9.738 mm (0.3830 - 0.3834 in.)
Valve	O/S 0.05	9.777 - 9.788 mm (0.3850 - 0.3854 in.)
	Valve overall length STD Intake	98.51 mm (3.8783 in.)
	Exhaust	108.45 mm (4.2697 in.)
	Minimum Intake	97.81 mm (3.8508 in.)
	Exhaust	107.75 mm (4.2421 in.)
	Valve face angle	44.5°
	Stem diameter Intake	4.970 - 4.985 mm (0.1957 - 0.1963 in.)
	Exhaust	4.965 - 4.980 mm (0.1955 - 0.1961 in.)
	Stem oil clearance STD Intake	0.025 - 0.060 mm (0.0010 - 0.0024 in.)
	Exhaust	0.030 - 0.065 mm (0.0012 - 0.0026 in.)
	Maximum Intake	0.08 mm (0.0031 in.)
	Exhaust	0.10 mm (0.0039 in.)
	Margin thickness STD	0.8 - 1.2 mm (0.031 - 0.047 in.)
	Minimum	0.5 mm (0.020 in.)
Valve spring	Deviation Maximum	2.0 mm (0.079 in.)
	Free length	48.97 mm (1.9279 in.)
	Installed tension at 37.7 mm (1.4842 in.)	145 - 165 N (15.2 - 16.8 kgf, 33.5 - 37.0 lbf)
Camshaft	Thrust clearance STD	0.080 - 0.190 mm (0.0031 - 0.0075 in.)
	Maximum	0.25 mm (0.0098 in.)
	Journal oil clearance STD	0.035 - 0.072 mm (0.0014 - 0.0028 in.)
	Maximum	0.10 mm (0.0039 in.)
	Journal diameter	24.949 - 24.965 mm (0.9822 - 0.9829 in.)
	Circle runout Maximum	0.04 mm (0.0016 in.)
	Cam lobe height STD Intake	40.28 - 40.38 mm (1.5858 - 1.5898 in.)
	Exhaust	40.09 - 40.19 mm (1.5783 - 1.5823 in.)
	Minimum Intake	40.13 mm (1.5799 in.)
	Exhaust	39.94 mm (1.5724 in.)

SERVICE SPECIFICATIONS - ENGINE MECHANICAL

Valve lifter	Lifter diameter		23.475 - 23.485 mm (0.9242 - 0.9246 in.)
	Lifter bore diameter		23.500 - 23.521 mm (0.9252 - 0.9260 in.)
	Oil clearance	STD	0.015 - 0.046 mm (0.0006 - 0.0018 in.)
		Maximum	0.10 mm (0.0039 in.)
Manifold	Warpage	Maximum Intake	0.10 mm (0.0039 in.)
		Exhaust	0.30 mm (0.0118 in.)
Cylinder head bolt	Bolt length	Standard	114.0 - 115.0 mm (4.4882 - 4.5276 in.)
		maximum	116.5 mm (4.5866 in.)
Spark plug tube	Protrusion		33.1 - 33.9 mm (1.303 - 1.335 in.)
Cylinder block	Cylinder head surface warpage	Maximum	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD Mark 1	81.000 - 81.010 mm (3.1890 - 3.1894 in.)
		Mark 2	81.010 - 81.020 mm (3.1894 - 3.1898 in.)
		Mark 3	81.020 - 81.030 mm (3.1898 - 3.1902 in.)
		Maximum STD	81.23 mm (3.1980 in.)
		O/S 0.50	81.73 mm (3.2177 in.)
Piston and piston ring	Piston diameter	STD Mark 1	80.895 - 80.905 mm (3.1849 - 3.1852 in.)
		Mark 2	80.905 - 80.915 mm (3.1852 - 3.1856 in.)
		Mark 3	80.915 - 80.925 mm (3.1856 - 3.1860 in.)
		O/S 0.50	81.500 - 81.530 mm (3.2087 - 3.2098 in.)
	Piston oil clearance	STD	0.095 - 0.115 mm (0.0037 - 0.0045 in.)
		Maximum	0.13 mm (0.0051 in.)
	Piston ring groove clearance	No.1	0.040 - 0.080 mm (0.0016 - 0.0031 in.)
		No.2	0.030 - 0.070 mm (0.0012 - 0.0028 in.)
		Oil Teikoku made	0.020 - 0.160 mm (0.0008 - 0.0063 in.)
	Piston ring end gap	Riken made	0.030 - 0.110 mm (0.0012 - 0.0043 in.)
		STD No.1 Teikoku made	0.250 - 0.350 mm (0.0098 - 0.0138 in.)
		Riken made	0.280 - 0.350 mm (0.0110 - 0.0138 in.)
		No.2 Teikoku made	0.350 - 0.500 mm (0.0138 - 0.0197 in.)
		Riken made	0.350 - 0.450 mm (0.0138 - 0.0177 in.)
		Oil Teikoku made	0.100 - 0.350 mm (0.0039 - 0.0138 in.)
		Riken made	0.150 - 0.400 mm (0.0059 - 0.0157 in.)
		Maximum No.1	0.95 mm (0.0374 in.)
		No.2	1.05 mm (0.0413 in.)
		Oil	1.00 mm (0.0394 in.)

Connecting rod	Thrust clearance	STD	0.150 - 0.250 mm (0.0059 - 0.0098 in.)
		Maximum	0.30 mm (0.0118 in.)
	Connecting rod bearing center wall thickness		
	Reference	STD Mark 1	1.486 - 1.490 mm (0.0585 - 0.0587 in.)
		Mark 2	1.490 - 1.494 mm (0.0587 - 0.0588 in.)
		Mark 3	1.494 - 1.498 mm (0.0588 - 0.0590 in.)
	Connecting rod oil clearance	STD STD	0.030 - 0.061 mm (0.0012 - 0.0024 in.)
		U/S 0.25	0.019 - 0.073 mm (0.0007 - 0.0029 in.)
		Maximum	0.08 mm (0.0031 in.)
	Rod bend	Maximum per 100 mm (3.94 in.)	0.03 mm (0.0012 in.)
Crankshaft	Rod twist	Maximum per 100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Connecting rod bolt out side diameter	STD	8.860 - 9.000 mm (0.3488 - 0.3543 in.)
		Minimum	8.60 mm (0.3386 in.)
	Thrust clearance	STD	0.020 - 0.220 mm (0.0008 - 0.0087 in.)
		Maximum	0.30 mm (0.0118 in.)
	Thrust washer thickness		2.440 - 2.490 mm (0.0961 - 0.0980 in.)
	Main journal oil clearance	STD STD	0.015 - 0.045 mm (0.0006 - 0.0018 in.)
		U/S 0.25	0.015 - 0.053 mm (0.0006 - 0.0021 in.)
		Maximum	0.08 mm (0.0031 in.)
	Main journal diameter	STD	47.982 - 48.010 mm (1.8891 - 1.8898 in.)
		U/S 0.25	47.745 - 47.555 mm (1.8797 - 1.8801 in.)
	Main bearing center wall thickness (Reference)		
		STD Mark 1	2.002 - 2.005 mm (0.0788 - 0.0789 in.)
		Mark 2	2.005 - 2.008 mm (0.0789 - 0.0791 in.)
		Mark 3	2.008 - 2.011 mm (0.0791 - 0.0792 in.)
		Mark 4	2.011 - 2.014 mm (0.0792 - 0.0793 in.)
		Mark 5	2.014 - 2.017 mm (0.0793 - 0.0794 in.)
	Crank pin diameter	STD	41.985 - 42.000 mm (1.6530 - 1.6535 in.)
		U/S 0.25	41.735 - 41.750 mm (1.6431 - 1.6437 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Main journal taper and out-of-round	Maximum	0.005 mm (0.0002 in.)
	Crank pin taper and out-of-round	Maximum	0.005 mm (0.0002 in.)

E6000-20

TORQUE SPECIFICATION

Part/tightened	N·m	kgf·cm	ft·lbf
Spark plug x Cylinder head	18	180	13
Distributor x Cylinder head	23	230	17
Idler pulley x Cylinder block	35	350	25
Camshaft timing pulley x Camshaft	59	600	43
No.1 cylinder head cover x Cylinder head	8	80	69 in.·lbf
Tensioner x Oil pump	9.5	95	82 in.·lbf
Timing belt covers x Cylinder head, Cylinder block, Oil pump	9.5	95	82 in.·lbf
Crankshaft pulley x Crankshaft	140	1,400	101
No.2 cylinder head cover x No.1 cylinder head cover	9.5	95	82 in.·lbf
Cylinder head x Cylinder block (1st)	30	300	22
Cylinder head x Cylinder block (2nd)	Turn 90°	Turn 90°	Turn 90°
Cylinder head x Cylinder block (3rd)	Turn 90°	Turn 90°	Turn 90°
Camshaft bearing cap x Cylinder head	17	175	13

SERVICE SPECIFICATIONS - ENGINE MECHANICAL

Engine mounting stay x Cylinder head	35	350	25
No.2 water inlet x Cylinder head	15	150	11
Oil dipstick guide x Alternator adjusting bar	9.5	95	82 in.-lbf
Intake manifold x Cylinder head	22	220	16
Intake manifold stay x Intake manifold, Cylinder block	22	220	16
Engine hanger (RH) x Cylinder head	22	220	16
Water inlet housing x Cylinder head	22	220	16
Water outlet x Cylinder head	22	220	16
OSV x Cylinder head	9.5	95	82 in.-lbf
Exhaust manifold x Cylinder head	50	500	36
Exhaust manifold stay x Exhaust manifold, Cylinder block	45	450	33
Heat insulator x Exhaust manifold	9.5	95	82 in.-lbf
Main bearing cap x Cylinder block	60	610	44
Connecting rod cap x Connecting rod (1st)	29	300	22
Connecting rod cap x Connecting rod (2nd)	Turn 90°	Turn 90°	Turn 90°
Rear oil seal retainer x Cylinder block	9.5	95	82 in.-lbf
Knock sensor x Cylinder block	45	450	33
Water pump x Cylinder block	14	145	11
RH engine mounting bracket x Cylinder block	51	525	38
Alternator adjusting bar x Cylinder block	39	400	29
Rear end plate x Cylinder block	9.5	95	82 in.-lbf
Flywheel x Crankshaft	75	750	54

ELECTRONIC FUEL INJECTION

SERVICE DATA

SS96C-01

Fuel pressure regulator	Fuel pressure at no vacuum	235 - 275 kPa (2.4 - 2.8 kgf/cm ² , 34 - 40 psi)
Fuel pump	Resistance at 20°C (68°F)	0.2 - 3.0 Ω
Injector	Resistance at 20°C (68°F)	13.4 - 14.2 Ω
	Injection volume	65 - 82 cm ³ (4.0 - 5.0 cu in.) per 15 sec.
	Difference between each cylinder	5 cm ³ (0.3 cu in.) or less
	Fuel leakage	One drop or less per minute
Throttle body	Throttle opener setting speed	2,500 rpm or less
Throttle position sensor	Clearance between stop screw and lever	
	0 mm (0 in.) VTA - E2	0.3 - 6.3 kΩ
	0.80 mm (0.031 in.) IDL - E2	0.5 kΩ or less
	1.0 mm (0.040 in.) IDL - E2	Infinity
	Throttle valve fully open VTA - E2	1.8 - 11.5 kΩ
	- VC - E2	3.5 - 6.5 kΩ
EC Valve	Resistance (+B - RSC or RSO) Cold	17.5 - 28.5 Ω
	Hot	17.0 - 24.5 Ω
Camshaft timing oil control valve	Resistance at 20°C (68°F)	11 - 13 Ω
SV for EVAP	Resistance at 20°C (68°F)	30 - 33 Ω
Water temp. sensor and intake air temp. sensor	Resistance at -20°C (-4°F)	10 - 20 kΩ
	at 0°C (32°F)	4 - 7 kΩ
	at 20°C (68°F)	2 - 3 kΩ
	at 40°C (104°F)	0.9 - 1.3 kΩ
	at 60°C (140°F)	0.4 - 0.7 kΩ
	at 80°C (176°F)	0.2 - 0.4 kΩ
Oxygen sensor	Heater coil resistance at 20°C (68°F)	11 - 16 Ω
Vacuum sensor	Power source voltage	4.5 - 5.5 V

SERVICE SPECIFICATIONS - ELECTRONIC FUEL INJECTION

ECU	Condition	Terminals	Voltage
	—	BATT - E1	9 - 14 V
	IG SW ON	+B - E1	9 - 14 V
	IG SW ON	VC - E2	4.5 - 5.5 V
	IG SW ON (Throttle valve fully closed)	VTA - E2	0.3 - 0.8 V
	IG SW ON (Throttle valve open)	VTA - E2	3.2 - 4.9 V
	IG SW ON	PIM - E2	3.3 - 3.9 V
	IG SW ON	#1 - E01, E02	9 - 14 V
	IG SW ON	#2 - E01, E02	9 - 14 V
	IG SW ON	#3 - E01, E02	9 - 14 V
	IG SW ON	#4 - E01, E02	9 - 14 V
	IG SW ON (Intake air temp. 20°C (68°F))	THA - E2	0.5 - 3.4 V
	IG SW ON (Coolant temp. 80°C (176°F))	THW - E2	0.2 - 1.0 V
	Cranking	STA - E1	6 V or more
	IG SW ON (Igniter connector disconnected)	IGF - E1	4.5 - 5.5 V
	Idling	IGT - E1	Pulse generation
	IG SW ON (Engine ECU connector disconnected)	RSC - E1	9 - 14 V
	IG SW ON (Engine ECU connector disconnected)	RSO - E1	9 - 14 V
	No trouble (Check engine warning light off)	W - E1	9 - 14 V
	and engine running		
	IG SW ON (Air conditioning ON)	AC1 - E1	1.5 or less
	IG SW ON (Air conditioning ON)	ACT - E1	4.5 - 5.5
	Maintain engine speed at 2,500 rpm for 2 minutes	VF - E1	1.8 - 3.2 V
	after warming up then return idling		
	Idling	G1 - G -	Pulse generation
	Idling	G2 - G -	Pulse generation
	Idling	NE - G -	Pulse generation
	Maintain engine speed at 2,500 rpm for 2 minutes	OX - E1	Pulse generation
	after warming up		
	Idling	KNK - E1	Pulse generation
	Electric cooling fan ON	ELS1 - E1	7.5 - 14 V
	Electric cooling fan OFF	ELS1 - E1	0 - 1.5 V
	Blower motor ON	ELS2 - E1	7.5 - 14 V
	Blower motor OFF	ELS2 - E1	0 - 1.5 V
	Taillight switch ON	ELS3 - E1	7.5 - 14 V
	Taillight switch OFF	ELS3 - E1	0 - 1.5 V
	Defogger switch ON	ELS4 - E1	7.5 - 14 V
	Defogger switch OFF	ELS4 - E1	0 - 1.5 V
	IG SW ON	HT - E1	9 - 14 V
	Idling	HT - E1	0 - 3 V
	IG SW ON	FC - E1	9 - 14 V
	Idling	FC - E1	0 - 3 V
	IG SW ON	TE1 - E1	9 - 14 V
	IG SW ON	TE2 - E1	9 - 14 V

SERVICE SPECIFICATIONS -- ELECTRONIC FUEL INJECTION

ECU	Condition	Terminals	Resistance
	Throttle valve fully open	VTA - E2	2,400 - 11,200 Ω
	Throttle valve fully closed	VTA - E2	340 - 6,300 Ω
	-	VC - E1	3,100 - 7,200 Ω
	Intake air temp. 20°C (68°F)	THA - E2	2,000 - 3,000 Ω
	Coolant temp. 80°C (176°F)	THW - E2	200 - 400 Ω
	Cold (-10°C (14°F) to 50°C (122°F))	G1, G2 - G-	125 - 200 Ω
	Hot (50°C (122°F) to 100°C (212°F))	G1, G2 - G-	160 - 250 Ω
	Cold (-10°C (14°F) to 50°C (122°F))	NE - G-	125 - 200 Ω
	Hot (50°C (122°F) to 100°C (212°F))	NE - G-	160 - 250 Ω
	Cold (-10°C (14°F) to 50°C (122°F))	RSC - +B	17 - 24.5 Ω
	Hot (50°C (122°F) to 100°C (212°F))	RSC - +B	21.5 - 28.5 Ω
	Cold (-10°C (14°F) to 50°C (122°F))	RSO - +B	17 - 24.5 Ω
	Hot (50°C (122°F) to 100°C (212°F))	RSO - +B	21.5 - 28.5 Ω
	-	HT - +B	11 - 16 Ω
Fuel cut rpm	Fuel return rpm		1,400 rpm

EG04E-00

TORQUE SPECIFICATIONS

Part/tightened	N·m	kgf·cm	ft·lbf
Fuel line (Union bolt type)	29.5	300	22
Fuel line (Flare nut type)	35	350	25
Fuel line (Flare nut type) w/ SST	30	310	22
Fuel pump x Fuel tank	3.4	35	30 in.·lbf
Fuel pressure regulator x Throttle body assembly	7.0	70	60 in.·lbf
Link bracket x throttle body assembly	7.0	70	60 in.·lbf
Table bracket x Throttle body assembly	7.0	70	60 in.·lbf
Injector cover x Throttle body assembly	7.0	70	60 in.·lbf
Fuel inlet hose x Delivery pipe	33	330	24
Throttle body x Intake manifold	7.0	70	60 in.·lbf
Throttle body assembly x cylinder head	28	280	20
Surge tank stay x Cylinder block, throttle body	22	220	16
Intake pipe x Throttle body	22	220	16
Surge tank cover x surge tank	15	150	11
Camshaft timing oil control valve x Cylinder head	8.0	80	71 in.·lbf
SC Valve x Cylinder block	22	220	16
Knock sensor x Cylinder block	44	450	33

COOLING

SERVICE DATA

E007L-2M

Thermostat	Valve opening temperature	80 - 84°C (176 - 183°F)
	Valve lift at 95°C (203°F)	8 mm (0.31 in.) or more
Radiator cap	Relief valve opening pressure	STD 74 - 103 kPa (0.75 - 1.05 kgf/cm ² , 10.7 - 14.9 psi)
	Minimum	59 kPa (0.6 kgf/cm ² , 8.5 psi)
Electric cooling fan	Rotating amperage	3.2 - 4.4 A

TORQUE SPECIFICATIONS

E007M-2M

Part tightened	N·m	kgf·cm	ft·lbf
Cylinder block x Drain plug	35	350	25
Water pump cover x Water pump housing	9.3	92.5	80 in.·lbf
Water pump x Cylinder block	15	150	11
Alternator adjusting bar x Water pump	22	220	16
Oil dipstick guide x No.2 water inlet	9.5	95	82 in.·lbf
Water inlet x Water inlet housing	9.3	95	82 in.·lbf
Fan x Fan motor	6.2	63	55 in.·lbf
Fan motor x Fan shroud	2.6	26	23 in.·lbf

LUBRICATION

SERVICE DATA

EQ15A-17

Oil pressure		at idle speed	59 kPa (0.6 kgf/cm ² , 8.5 psi) or more
		at 3,000 rpm	245 - 490 kPa (2.5 - 5.0 kgf/cm ² , 36 - 71 psi)
Oil pump	Body clearance	STD	0.100 - 0.191 mm (0.0039 - 0.0075 in.)
		Maximum	0.20 mm (0.0079 in.)
	Tip clearance	STD	0.060 - 0.220 mm (0.0024 - 0.0087 in.)
		Maximum	0.35 mm (0.0138 in.)
	Side clearance	STD	0.025 - 0.075 mm (0.0010 - 0.0030 in.)
		Maximum	0.10 mm (0.0039 in.)

TORQUE SPECIFICATIONS

EQ15C-1K

Part tightened	N·m	kgf·cm	ft·lbf
Oil pan x Drain plug	44	450	33
Oil pump body cover x Oil pump body	10	105	8
Oil pump x Cylinder block	22	220	16
Oil strainer x Cylinder block	9.3	95	82 in·lbf
Oil strainer x Oil pump	9.3	95	82 in·lbf
Oil pan x Cylinder block	4.9	50	43 in·lbf
Oil pan x Oil pump	4.9	50	43 in·lbf
Oil pan x Rear oil seal retainer	4.9	50	43 in·lbf
Dipstick guide x Alternator adjusting bar	9.5	95	82 in·lbf
Oil nozzle x Cylinder block	25	250	18

IGNITION

SERVICE DATA

SS06D-01

Firing order	1-3-4-2	
High-tension cord	Resistance	Maximum 25 k Ω per cord
Spark plug	Recommended spark plug	DENSO PK20R11 NGK BKR6EP-11
	Correct electrode gap for new plug	1.1 mm (0.043 in.)
Ignition coil	Primary coil resistance	at cold 0.36 - 0.55 Ω
		at hot 0.45 - 0.65 Ω
	Secondary coil resistance	at cold 9.0 - 15.4 k Ω
		at hot 11.4 - 18.1 k Ω
Distributor	Air gap	0.2 - 0.5 mm (0.008 - 0.020 in.)
	Pickup coil resistance	at cold G1 - G \ominus 125 - 200 Ω
		G2 - G \ominus 125 - 200 Ω
		NE - G \ominus 155 - 250 Ω
		at hot G1 - G \ominus 160 - 235 Ω
		G2 - G \ominus 160 - 235 Ω
		NE - G \ominus 190 - 290 Ω

TORQUE SPECIFICATIONS

IG00L-07

Part tightened	N-m	kgf-cm	ft-lbf
Spark plug x Cylinder head	18	180	13
Distributor x Cylinder head	23	230	17

SERVICE SPECIFICATIONS - STARTING

SS085-01

STARTING

SERVICE DATA

Rated voltage and output power		12 V 0.8 kW
No-load characteristics	Current	90 A or less at 11.5 V
	rpm	3,000 rpm or more
Brush length	STD	14.0 mm (0.551 in.)
	Minimum	9.0 mm (0.354 in.)
Spring installed load		13.7 - 17.6 N (1.4 - 1.8 kgf, 3.1 - 4.0 lbf)
Commutator		
Diameter	STD	28 mm (1.10 in.)
	Minimum	27 mm (1.06 in.)
Undercut depth	STD	0.6 mm (0.024 in.)
	Minimum	0.2 mm (0.008 in.)
Circle runout	Maximum	0.05 mm (0.0020 in.)
Planetary shaft diameter		14.982 - 15.000 mm (0.5898 - 0.5906 in.)
Center bearing		
Inside diameter		15.008 - 15.050 mm (0.5909 - 0.5925 in.)
Oil clearance	STD	0.01 - 0.06 mm (0.0004 - 0.0024 in.)
	Maximum	0.2 mm (0.008 in.)
Pinion clearance	STD	1 - 5 mm (0.04 - 0.20 in.)

STD08-02

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
cover x Brush holder	1.5	15	13 in·lbf
cover x Starter housing	5.9	60	52 in·lbf
magnetic switch x Starter housing	8.3	85	73 in·lbf
1 wire of field frame x Magnetic switch	9.8	100	87 in·lbf

CHARGING

SERVICE DATA

SS06F-01

Battery	Specific gravity	at 20°C (68°F)	1.250 – 1.290
	Voltage	at 20°C (68°F)	12.5 – 12.9 V
Drive belt	Deflection	New belt	3.5 – 4.5 mm (0.14 – 0.18 in.)
		Used belt	6.0 – 7.0 mm (0.24 – 0.28 in.)
	Tension	New belt	686 – 785 N (70 – 80 kgf)
		Used belt	294 – 441 N (30 – 45 kgf)
Alternator	Rated output		12 V – 70 A
	Rotor coil resistance		2.8 – 3.0 Ω
	Slip ring diameter	STD	14.2 mm – 14.4 mm (0.559 – 0.567 in.)
		Minimum	12.8 mm (0.504 in.)
	Brush exposed length	STD	9.5 – 11.5 mm (0.374 – 0.453 in.)
		Minimum	1.5 mm (0.059 in.)
Alternator regulator (IC)	Regulator voltage	at 25°C (77°F)	14.0 – 15.0 V
		at 115°C (239°F)	13.5 – 14.3 V

TORQUE SPECIFICATIONS

CH07X-03

Part tightened	N·m	kgf·cm	ft·lbf
Bearing retainer x Drive end frame	2.6	27	23 in.·lbf
Drive end frame x Rectifier end frame	4.5	46	40 in.·lbf
Pulley nut	110.5	1,125	81
Rectifier holder x Rectifier end frame	3.9	40	36 in.·lbf
Rectifier holder x Coil lead on drive end frame	1.96	20	18 in.·lbf
Rectifier end frame x IC regulator, Brush holder	1.96	20	18 in.·lbf
Rectifier end frame x Rear end cover	4.5	46	40 in.·lbf
Terminal nut	4.1	42	36 in.·lbf

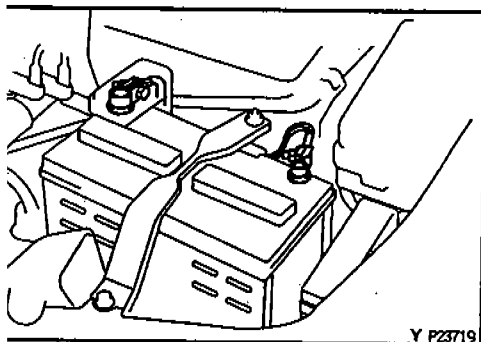
CHARGING

CHARGING SYSTEM	CH-1
ALTERNATOR	CH-5

CHARGING SYSTEM PRECAUTION

CH10J-10

1. Check that the battery cables are connected to the correct terminals.
2. Disconnect the battery cables when the battery is given a quick charge.
3. Do not perform tests with a high voltage insulation resistance tester.
4. Never disconnect the battery while the engine is running.



ON-VEHICLE INSPECTION

CH10J-01

1. CHECK BATTERY ELECTROLYTE LEVEL

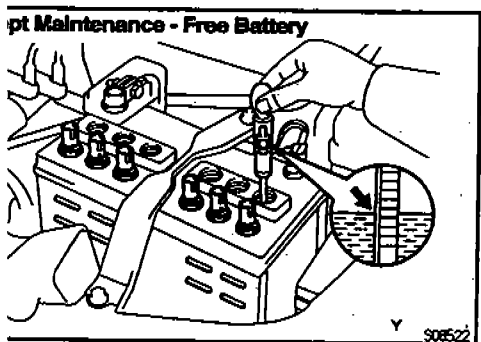
Check the electrolyte quantity of each cell.

Maintenance-Free Battery:

If under the lower level, replace the battery (or add distilled water if possible). Check the charging system.

Except Maintenance-Free Battery:

If under the lower level, add distilled water.



2. Except Maintenance-Free Battery: CHECK BATTERY SPECIFIC GRAVITY

Check the specific gravity of each cell.

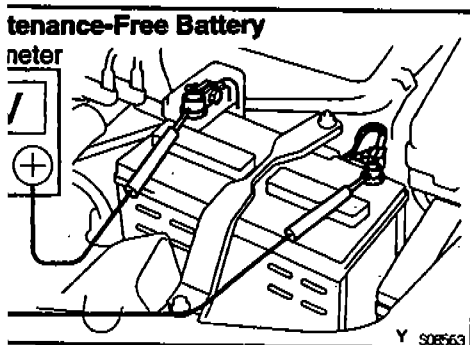
Standard specific gravity:

1.25 – 1.29 at 20°C (68°F)

If the specific gravity is less than specification, charge the battery.

3. Maintenance-Free Battery: CHECK BATTERY VOLTAGE

- (a) After having driven the vehicle and in the case that 20 minutes have not passed after having stopped the engine, turn the ignition switch ON and turn on the electrical system (headlight, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.
- (b) Turn the ignition switch OFF and turn off the electrical systems.
- (c) Measure the battery voltage between the negative (–) and positive (+) terminals of the battery.



Maintenance-Free Battery

Blue

White

Red

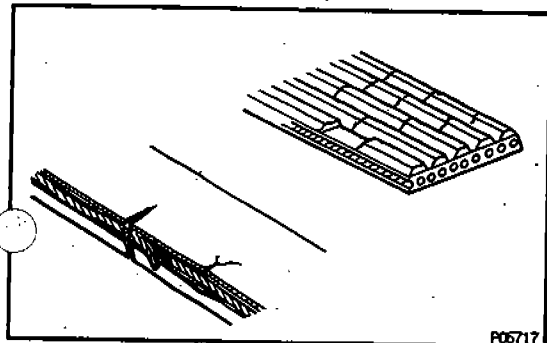


OK

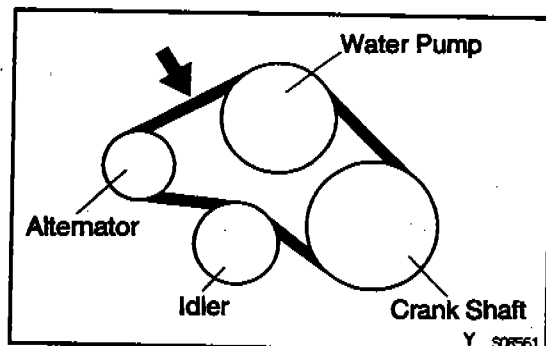
Charging
NecessaryInsufficient
Water

CH0712

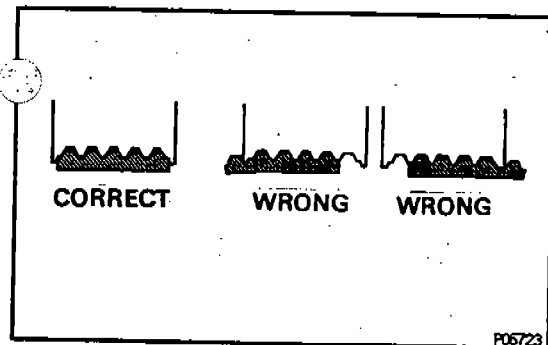
Z11580



P05717



Y 305561



P05723

Standard voltage:

12.5 – 12.9 V at 20°C (68°F)

If the voltage is less than specification, charge the battery.
HINT: Check the indicator as shown in illustration.

4. CHECK BATTERY TERMINALS, FUSIBLE LINK, H-FUSES AND FUSES

- Check that the battery terminals are not loose or corroded.
- Check the fusible link, H-fuses and fuses for continuity.

5. INSPECT DRIVE BELT

- Visually check the belt for excessive wear, frayed cords etc.

If any defect has been found, replace the drive belt.

HINT: Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.

- Check the drive belt deflection by pressing on the belt at the points indicated in the illustration with 98 N (10 kgf, 22 lbf) of pressure.

Drive belt tension:**New belt**

3.5 – 4.5 mm (0.14 – 0.18 in.)

Used belt

6.0 – 7.0 mm (0.24 – 0.28 in.)

If necessary, adjust the drive belt deflection.

Reference

Using a tension gauge, check the drive belt tension.

Drive belt deflection:**New belt**

686 – 785 N (70 – 80 kgf)

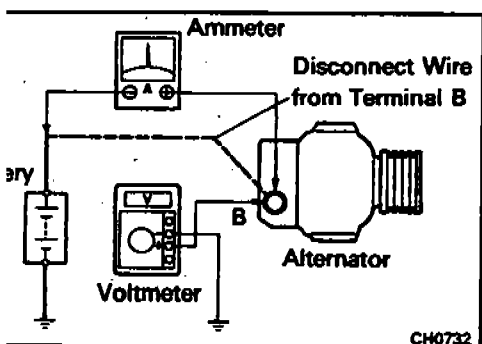
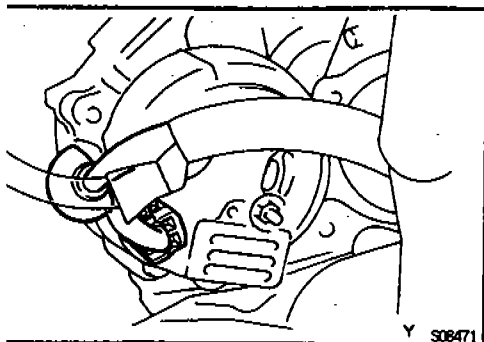
Used belt

294 – 441 N (30 – 45 kgf)

If necessary, adjust the drive belt tension.

HINT:

- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing a belt, check that it fits properly in the ribbed grooves.
- Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.
- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.



6. VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES

- (a) Check that the wiring is in good condition.
- (b) Check that there is no abnormal noise from the alternator while the engine is running.

7. INSPECT DISCHARGE WARNING LIGHT CIRCUIT

- (a) Turn the ignition switch "ON". Check that the discharge warning light comes on.
- (b) Start the engine. Check that the light goes off.
If the light does not operate as specified, troubleshoot the discharge warning light circuit.

8. INSPECT CHARGING CIRCUIT WITHOUT LOAD

HINT: If a battery/alternator tester is available, connect the tester to the charging circuit as per manufacturer's instructions.

- (a) If a tester is not available, connect a voltmeter and ammeter to the charging circuit as follows:
 - Disconnect the wire from terminal B of the alternator and connect it to the negative (-) lead of the ammeter.
 - Connect the positive (+) lead of the ammeter to terminal B of the alternator.
 - Connect the positive (+) lead of the voltmeter to terminal B of the alternator.
 - Ground the negative (-) lead of the voltmeter.
- (b) Check the charging circuit as follows:
With the engine running from idle to 2,000 rpm, check the reading on the ammeter and voltmeter.

Standard amperage:

10 A or less

Standard voltage:

At 25°C (77°F): 14.0 – 15.0 V

At 115°C (239°F): 13.5 – 14.3 V

If the voltmeter reading is more than standard voltage, replace the IC regulator.

If the voltmeter reading is less than the standard voltage, check the IC regulator and alternator as follows:

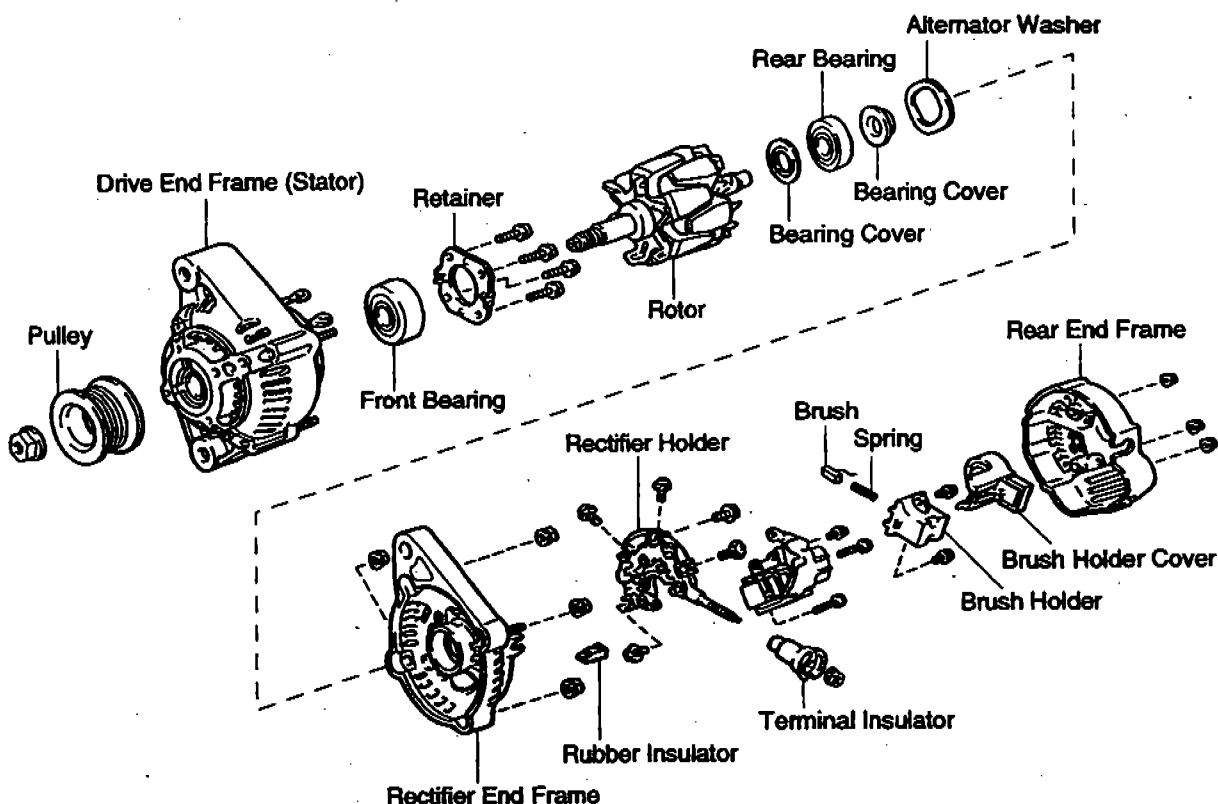
- With terminal F grounded, start the engine and check the voltmeter reading of terminal B.
- If the voltmeter reading is more than standard voltage, replace the IC regulator.
- If the voltmeter reading is less than standard voltage, check the alternator.

9. INSPECT CHARGING CIRCUIT WITH LOAD

- (a) With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater blower switch at "HI".

ALTERNATOR COMPONENTS

CH-5-01

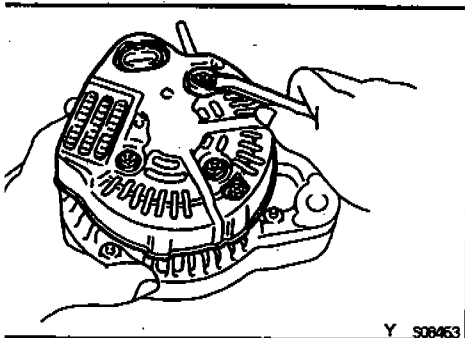
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CH-5-01

DISASSEMBLY

1. REMOVE REAR END COVER

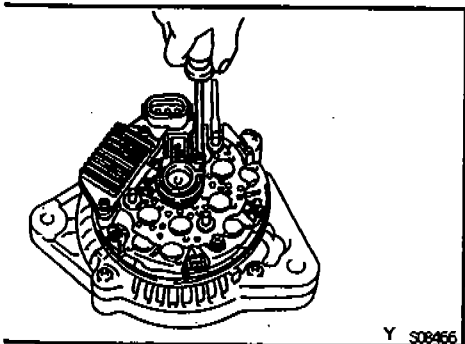
- (a) Remove the nut and terminal insulator.
- (b) Remove the 3 nuts and rear end cover.



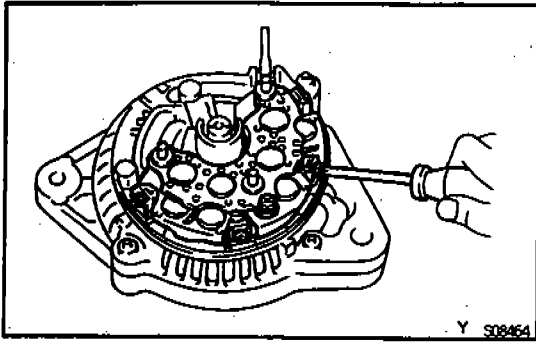
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2. REMOVE BRUSH HOLDER AND IC REGULATOR

- (a) Remove the 5 screws, brush holder and IC regulator.
- (b) Remove the brush holder cover from the brush holder.

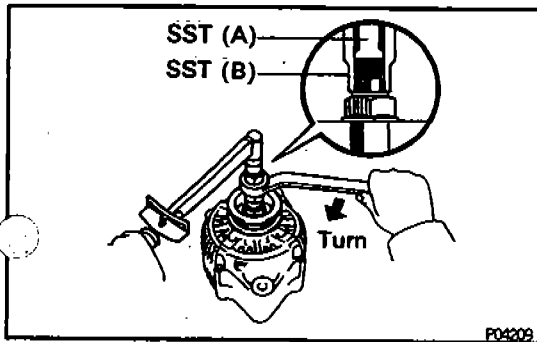


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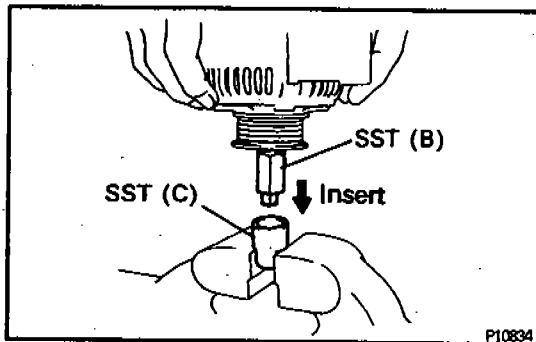
3. REMOVE RECTIFIER HOLDER

- (a) Remove the bolt, 4 screws and rectifier holder.
- (b) Remove the 4 rubber insulators.

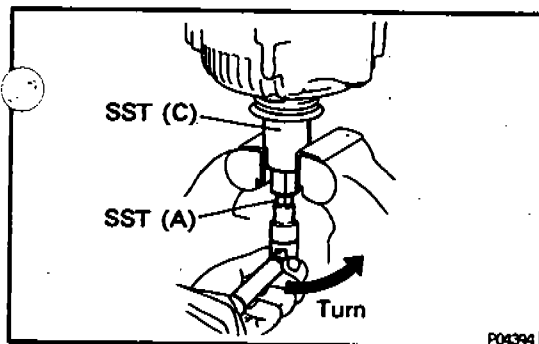


4. REMOVE PULLEY

- (a) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.
SST 09820-63010
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)
- (b) Check that SST (A) is secured to the rotor shaft.



- (c) Mount SST (C) in a vise.
- (d) Install SST (B) into SST (C), and attach the pulley nut to SST (C).



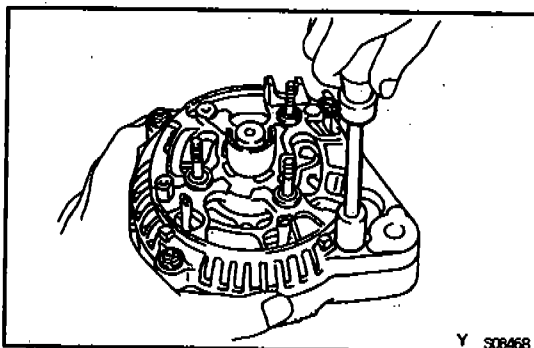
- (e) To loosen the pulley nut, turn SST (A) in the direction shown in the illustration.

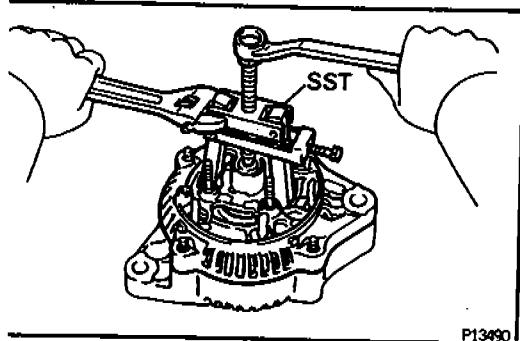
NOTICE: To prevent damage to the rotor shaft, do not loosen the pulley nut more than one-half of a turn.

- (f) Remove the alternator from SST (C).
- (g) Turn SST (B) and remove SST (A and B).
- (h) Remove the pulley nut and pulley.

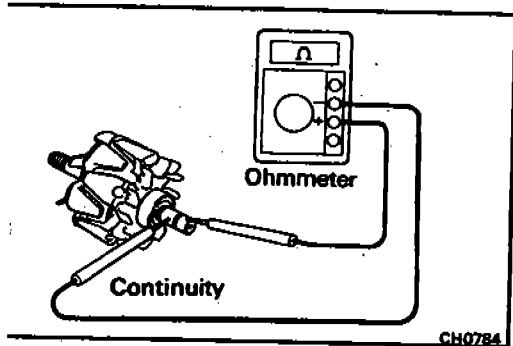
5. REMOVE RECTIFIER END FRAME

- (a) Remove the 4 nuts.





- (b) Using SST, remove the rectifier end frame.
SST 09286-46011
 - (c) Remove the alternator washer from rotor.
- 6. REMOVE ROTOR FROM DRIVE END FRAME**



INSPECTION

Rotor

1. INSPECT ROTOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the slip rings.

Standard resistance:

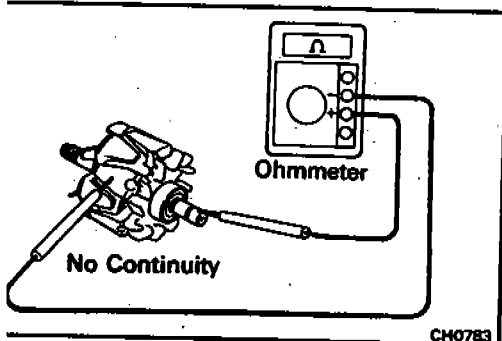
2.8 – 3.0 Ω at 20°C (68°F)

If there is no continuity, replace the rotor.

2. INSPECT ROTOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the slip ring and rotor.

If there is continuity, replace the rotor.



3. INSPECT SLIP RINGS

- (a) Check that the slip rings are not rough or scored. If rough or scored, replace the rotor.

- (b) Using a vernier caliper, measure the slip ring diameter.

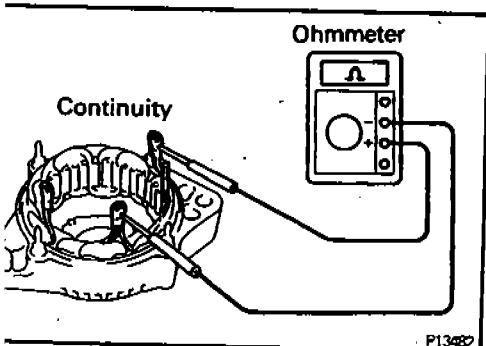
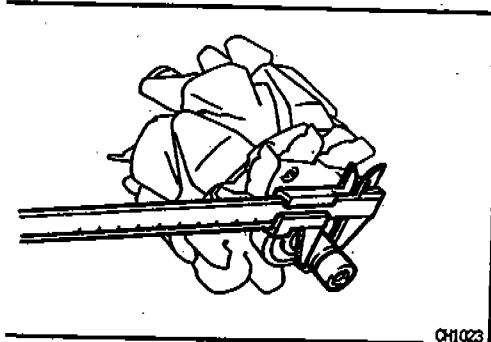
Standard diameter:

14.2 – 14.4 mm (0.559 – 0.567 in.)

Minimum diameter:

12.8 mm (0.504 in.)

If the diameter is less than minimum, replace the rotor.

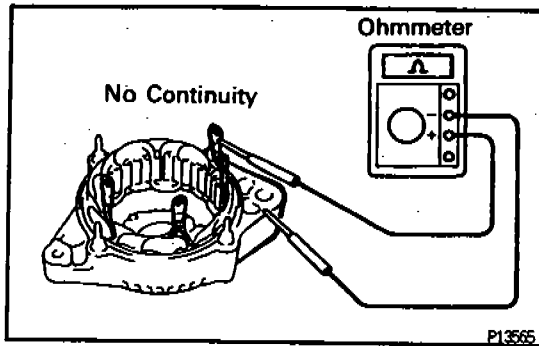


Stator (Drive End Frame)

1. INSPECT STATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the coil leads.

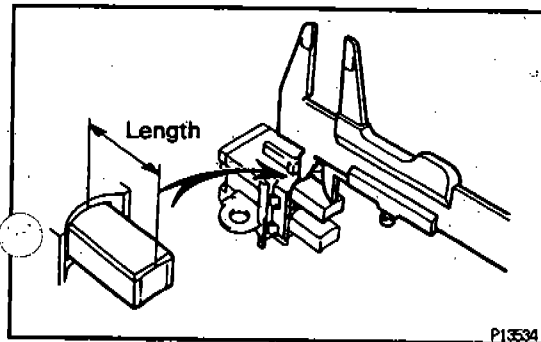
If there is no continuity, replace the drive end frame assembly.



2. INSPECT STATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil lead and drive end frame.

If there is continuity, replace the drive end frame assembly.



Brushes

2. INSPECT EXPOSED BRUSH LENGTH

Using vernier calipers, measure the exposed brush length.

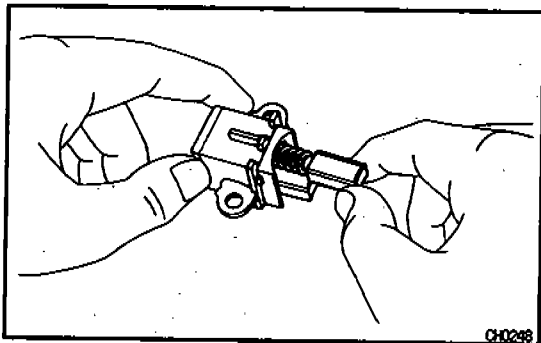
Standard exposed length:

9.5 – 11.5 mm (0.374 – 0.453 in.)

Minimum exposed length:

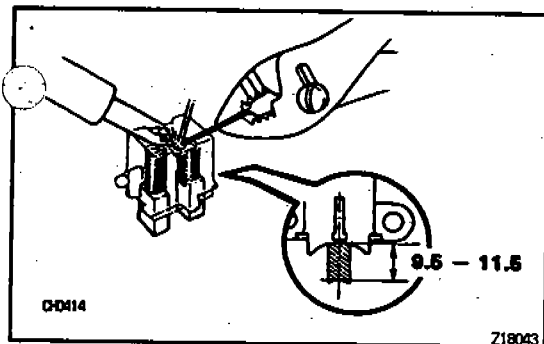
1.5 mm (0.059 in.)

If the exposed length is less than minimum, replace the brushes.



2. IF NECESSARY, REPLACE BRUSHES

- Unsolder and remove the brush and spring.
- Run the wire of a new brush through the spring and the hole in the brush holder, and insert the spring and brush into the brush holder.

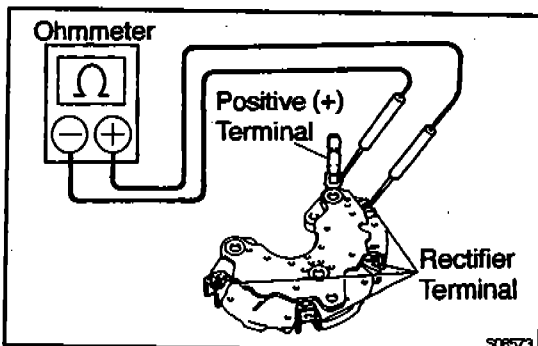


- Solder the brush wire to the brush holder at specified exposed length.

Exposed length:

9.5 – 11.5 mm (0.374 – 0.453 in.)

- Check that the brush moves smoothly in the brush holder.
- Cut off the excess wire.
- Apply insulation paint to the soldered area.

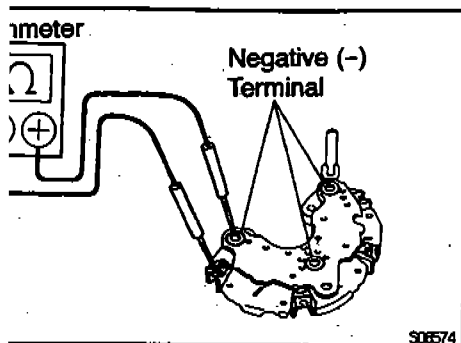


Rectifiers (Rectifier Holder)

1. INSPECT POSITIVE RECTIFIER

- Using an ohmmeter, connect one tester probe to the positive (+) terminal and the other to each rectifier terminal.
- Reverse the polarity of the tester probes and repeat step (a).
- Check that one shows continuity and the other shows no continuity.

If continuity is not as specified, replace the rectifier holder.



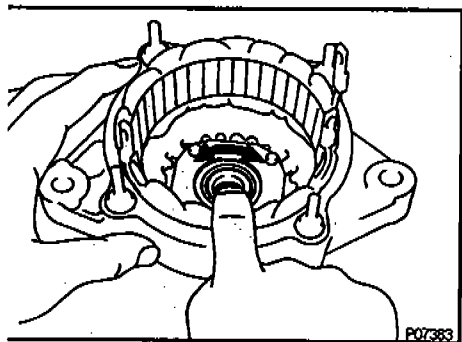
2. INSPECT NEGATIVE RECTIFIER

- Using an ohmmeter, connect one tester probe to each negative (-) terminal and the other to each rectifier terminal.
- Reverse the polarity of the tester probes and repeat step (a).
- Check that one shows continuity and the other shows no continuity.
If continuity is not as specified, replace the rectifier holder.

Bearings

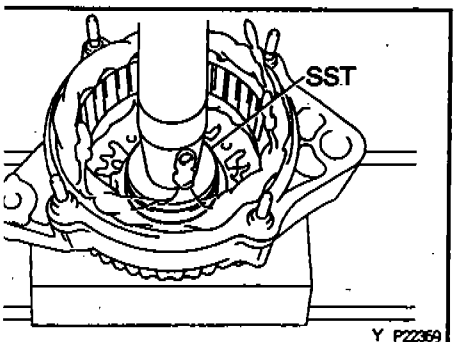
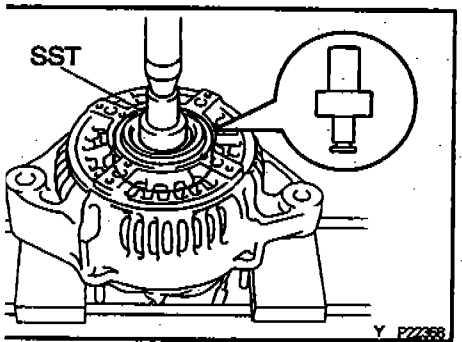
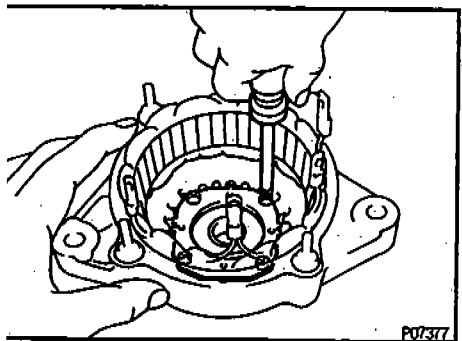
1. INSPECT FRONT BEARING

Check that the bearing is not rough or worn.

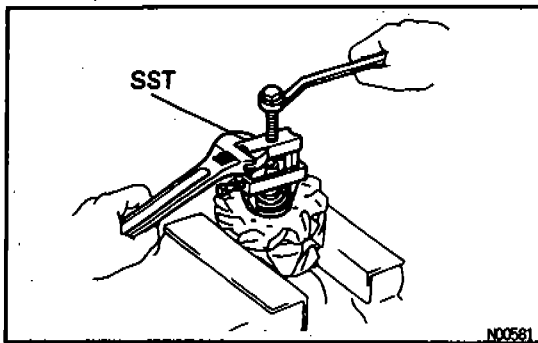


2. IF NECESSARY, REPLACE FRONT BEARING

- Remove the 4 screws and bearing retainer.
- Using SST and a press, press out the bearing.
SST 09950-60010 (09951-00260, 09952-06010)



- Using SST and a press, press out the bearing.
SST 09950-60010 (09951-00260, 09952-06010)
- Install the bearing retainer with the 4 screws.
Torque: 2.6 N·m (26.5 kgf·cm, 19 in·lb)



3. INSPECT REAR BEARING

Check that the bearing is not rough or worn.

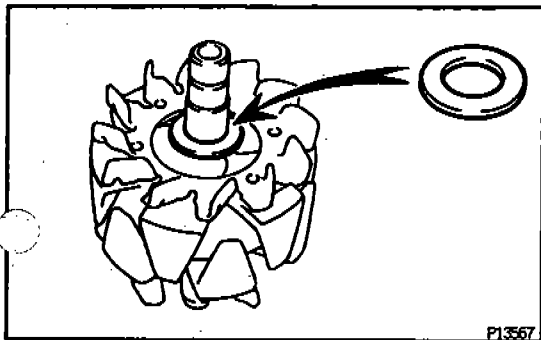
4. IF NECESSARY, REPLACE REAR BEARING

- (a) Using SST, remove the bearing cover (outside) and bearing.

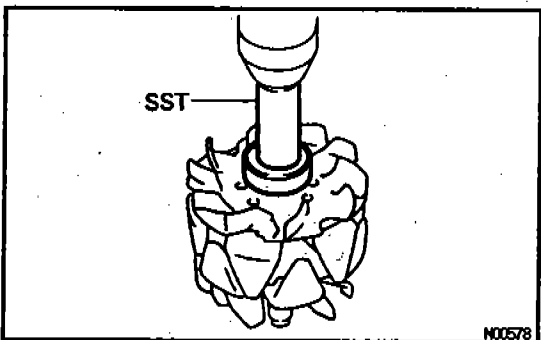
SST 09820-00021

NOTICE: Be careful not to damage the fan.

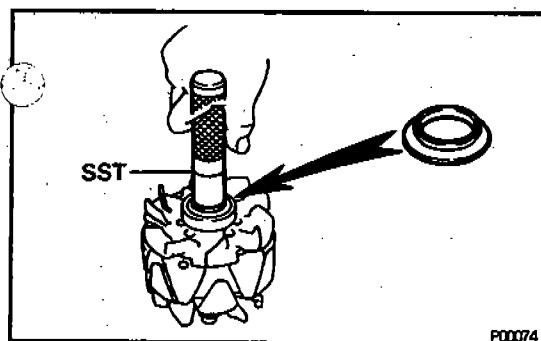
- (b) Remove the bearing cover (inside).



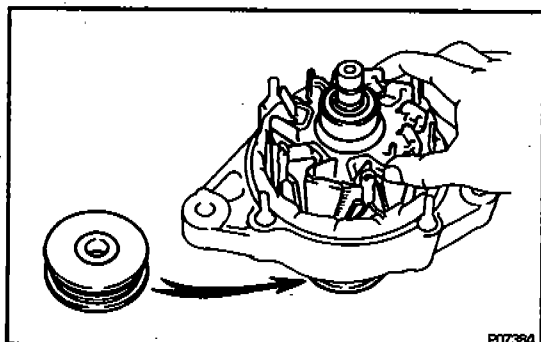
- (c) Place the bearing cover (inside) on the rotor.



- (d) Using SST and a press, press in a new bearing.
SST 09820-00030

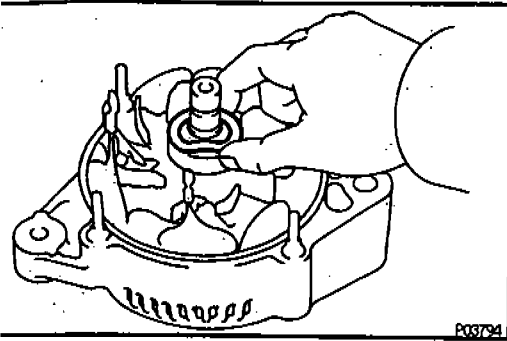


- (e) Using SST, push in the bearing cover (outside).
SST 09285-76010



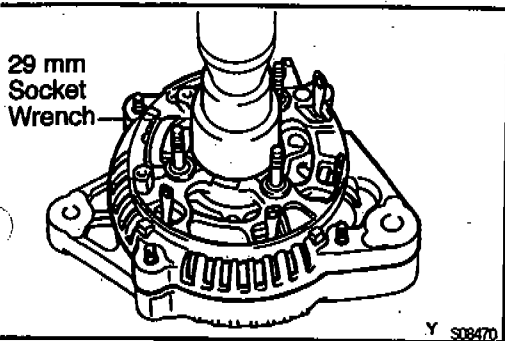
REASSEMBLY

1. PLACE RECTIFIER END FRAME ON PULLEY
2. INSTALL ROTOR TO DRIVE END FRAME

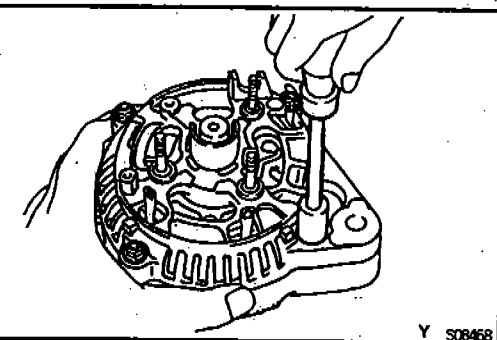


3. INSTALL RECTIFIER END FRAME

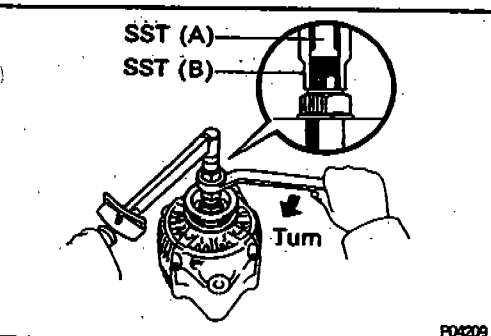
- (a) Place the generator washer on the rotor.



- (b) Using a 29 mm socket wrench and press, slowly press in the rectifier end frame.



- (c) Install the 4 nuts.
Torque: 4.5 N·m (46 kgf·cm, 40 in.-lbf)



4. INSTALL PULLEY

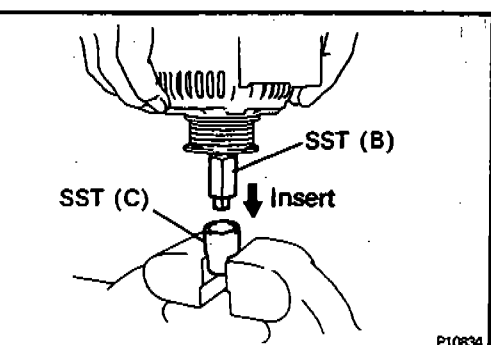
- (a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.

- (b) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.

SST 09820-63010

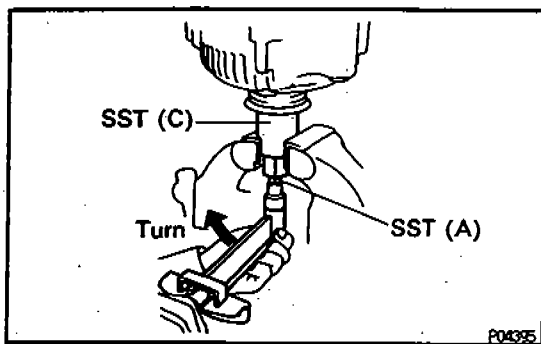
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

- (c) Check that SST (A) is secured to the pulley shaft.

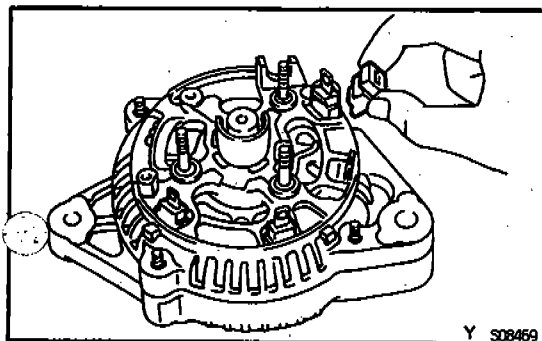


- (d) Mount SST (C) in a vise.

- (e) Install SST (B) into SST (C) and attach the pulley nut to SST (C).

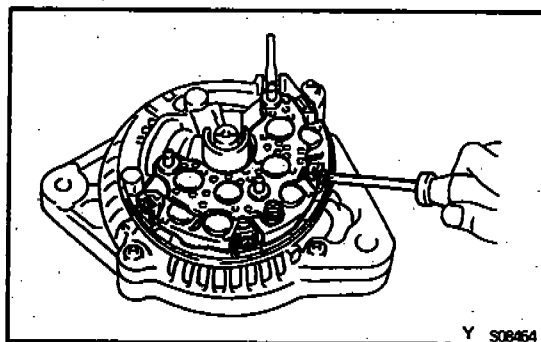


- (f) To torque the pulley nut turn SST (A) in the direction shown in the illustration.
Torque: 110.5 N-m (1,125 kgf-cm, 81 ft-lbf)
- (g) Remove the alternator from SST (C).
- (h) Turn SST (B), and remove SST (A and B).



5. INSTALL RECTIFIER HOLDER

- (a) Install the 4 rubber insulators on the lead wires.
NOTICE: Be careful of the rubber insulators installation direction.

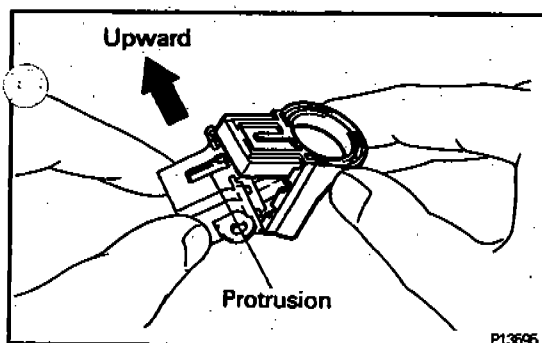


- (b) Install the rectifier holder while pushing it with the bolt and 4 screws.

Torque:

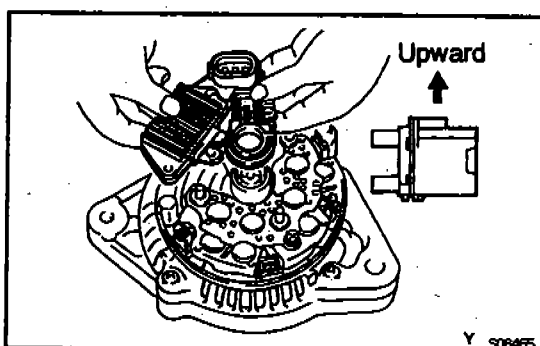
Bolt: 3.9 N-m (40 kgf-cm, 36 in.-lbf)

Screw: 1.96 N-m (20 kgf-cm, 18 in.-lbf)



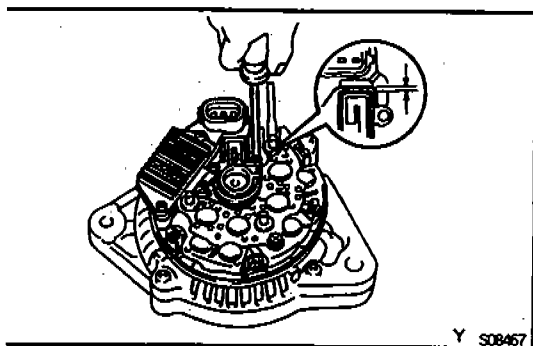
6. INSTALL IC REGULATOR AND BRUSH HOLDER

- (a) Install the brush holder cover to the brush holder.
NOTICE: Be careful of the holder installation direction.

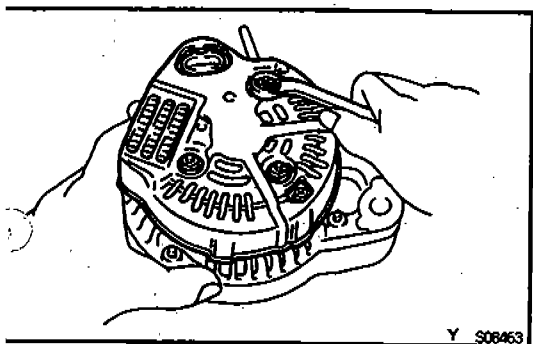


- (b) Place the IC regulator together with the brush holder horizontally on the rectifier end frame.

CHARGING - ALTERNATOR



- (c) Install the 5 screws until there is a clearance of approx. 1 mm (0.04 in.) between the brush holder and connector.
Torque: 1.96 N-m (20 kgf-cm, 18 in.-lbf)
Fit the brush holder cover.

**7. INSTALL REAR END COVER**

- (a) Install the end cover with the 3 nuts.
Torque: 4.5 N-m (46 kgf-cm, 40 in.-lbf)
(b) Install the terminal insulator with the nut.
Torque: 4.1 N-m (42 kgf-cm, 36 in.-lbf)

8. CHECK THAT ROTOR ROTATES SMOOTHLY

ENGINE MECHANICAL

CO/HC	EM-1
COMPRESSION	EM-3
VALVE CLEARANCE	EM-4
IGNITION TIMING	EM-6
IDLE SPEED	EM-8
TIMING BELT	EM-9
CYLINDER HEAD	EM-18
CYLINDER BLOCK	EM-39

CO/HC CHECK

E3007-01

HINT: This check is used only to determine whether or not the idle CO/HC complies with specifications.

1. INITIAL CONDITIONS

- (a) Engine at reach normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected
- (f) SFI system wiring connectors fully plugged
- (g) Ignition timing set correctly
- (h) Transmission in neutral range
- (i) Tachometer and CO/HC meter calibrated by hand

2. START ENGINE

3. RACE ENGINE AT 2,500 RPM FOR APPROX. 180 SECONDS

- 4. INSERT CO/HC METER TESTING PROBE INTO TAILPIPE AT LEAST 40 cm (1.3 ft) DURING IDLING
- 5. CHECK CO/HC CONCENTRATION AT IDLE

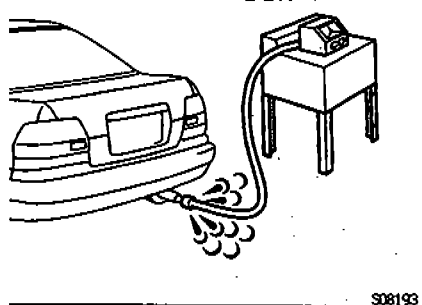
Idle CO concentration:

0 - 1.0 %

Idle HC concentration:

Applicable local regulation

CO/HC Meter



Troubleshooting

If the CO/HC concentration does not conform to specifications, perform troubleshooting in the order given below.

- (a) Check oxygen sensor operation.
(See Oxygen Sensor Inspection under EFI)
- (b) See the table next page for possible causes, and then inspect and correct the applicable causes if necessary.

CO	HC	Problems	Causes
Normal	High	Rough idle	<ol style="list-style-type: none"> 1. Faulty ignitions: <ul style="list-style-type: none"> ● Incorrect timing ● Fouled, shorted or improperly gapped plugs ● Open or crossed high-tension cords ● Cracked distributor cap 2. Incorrect valve clearance 3. Leaky intake and exhaust valves. 4. Leaky cylinder
Low	High	Rough idle (Fluctuating HC reading)	<ol style="list-style-type: none"> 1. Vacuum leaks: <ul style="list-style-type: none"> ● PCV hoses ● Intake manifold ● Throttle body ● ISC valve ● Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	<ol style="list-style-type: none"> 1. Restricted air filter 2. Faulty EFI systems: <ul style="list-style-type: none"> ● Faulty pressure regulator ● Clogged fuel return line ● Defective water temp. sensor ● Defective air temp. sensor ● Faulty engine ECU ● Faulty injectors ● Faulty throttle position sensor ● Defective vacuum sensor

COMPRESSION CHECK

E0030-05

HINT: If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

2. DISCONNECT DISTRIBUTOR CONNECTORS

3. REMOVE OIL FILLER CAP AND NO.2 CYLINDER HEAD COVER

4. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

Disconnect the high-tension cords at the rubber boot. DO NOT pull on the cords.

NOTICE: Pulling on or bending the cords may damage the conductor inside.

5. REMOVE SPARK PLUGS

Using a 16 mm plug wrench, remove the 4 spark plugs.

6. CHECK CYLINDER COMPRESSION PRESSURE

(a) Insert a compression gauge into the spark plug hole.

(b) Fully open the throttle.

(c) While cranking the engine, measure the compression pressure.

HINT: Always use a fully charged battery to obtain engine revolutions of 250 rpm or more.

(d) Repeat steps (a) through (c) for each cylinder.

NOTICE: This measurement must be done in as short a time as possible.

Compression pressure:

1,330 kPa (13.6 kgf/cm², 193 psi) or more

Minimum pressure:

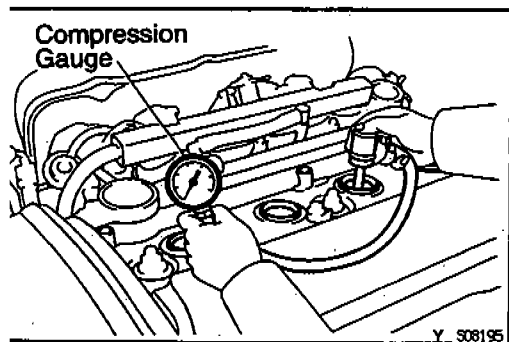
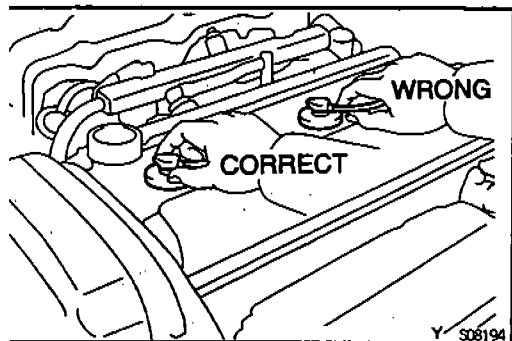
1,080 kPa (11.0 kgf/cm², 156 psi)

Difference between each cylinder:

98 kPa (1.0 kgf/cm², 14 psi) or less

(e) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.

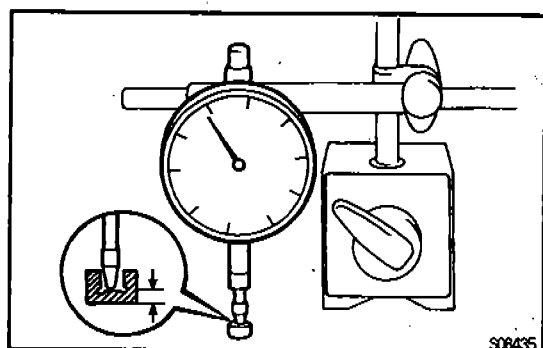
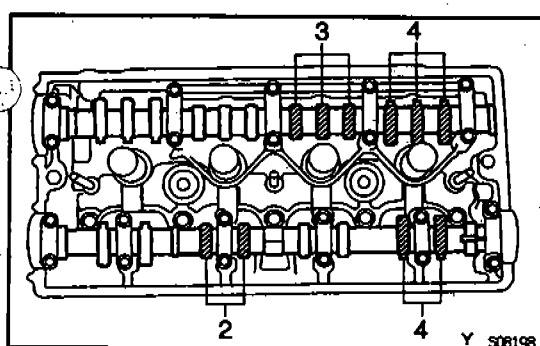
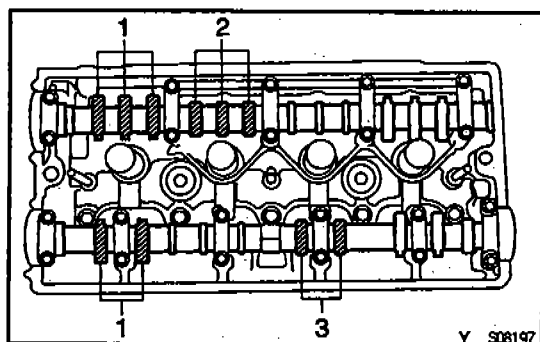
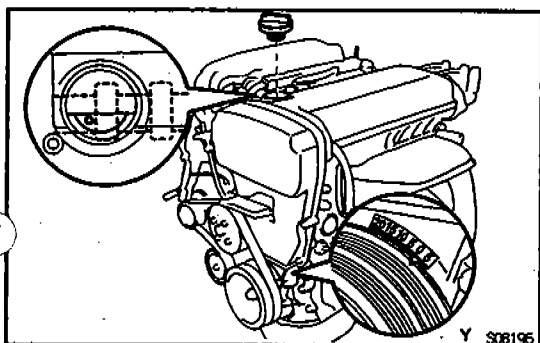
- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.



VALVE CLEARANCE INSPECTION

EM02-01

HINT: Inspect and adjust the valve clearance when the engine is cold.



1. SET NO.1 CYLINDER TO TDC/COMPRESSION

- Remove the oil filler cap.
- Turn the crankshaft pulley and when the concave mark of the camshaft appears, make the notch of the crankshaft pulley meet the timing mark "0" of the No.1 timing belt cover.

If not, turn the crankshaft 1 revolution (360°).

2. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

3. REMOVE CYLINDER HEAD COVER (See timing belt)

4. INSPECT VALVE CLEARANCE

- Check only the valves indicated.
 - Using a thickness gauge, measure the clearance between the valve lifter and camshaft.
 - Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

Valve clearance (Cold):

Intake	0.19 – 0.29 mm (0.007 – 0.011 in.)
Exhaust	0.39 – 0.49 mm (0.015 – 0.020 in.)

- Turn the crankshaft pulley 1 revolution (360°) and align its groove with timing mark "0" of the No.1 timing belt cover.
- Check only the valves indicated shown. Measure the valve clearance. (See procedure in step (a))

5. ADJUST VALVE CLEARANCE

- Remove the timing belt.
(See timing belt)
- Remove the camshafts.
(See cylinder head)
- Remove the valve lifter and adjusting shim.
- Determine the replacement adjusting shim size by these Formula below:

- Using a dial indicator, measure the thickness of the removed shim.

- Calculate the thickness of a new shim so that the valve clearance comes within the specified value.

T Thickness of removed shim

A Measured valve clearance

N Thickness of new shim

Intake	$N = T + (A - 0.24 \text{ mm (0.009 in.)})$
Exhaust	$N = T + (A - 0.44 \text{ mm (0.017 in.)})$

- Select a new shim with a thickness as close as possible to the calculated value.

HINT: For adjusting shim, 10 sizes of supplies are available for every 0.02 mm (0.0008 in.) between 1.70 mm (0.0669 in.) and 1.98 mm (0.0740 in.), 21 sizes for every 0.01 mm (0.0004 in.) between 1.90 mm (0.0748 in.) and 2.10 mm (0.0827 in.) and 10 sizes for every 0.02 mm (0.0008 in.) between 2.12 mm (0.0835 in.) and 2.30 mm (0.0906 in.).

New shim thickness

Shim No.	Thickness mm (in.)	Shim No.	Thickness mm (in.)
78	1.700(0.0669)	10	2.010(0.0791)
79	1.720(0.0677)	11	2.020(0.0795)
80	1.740(0.0685)	12	2.030(0.0799)
81	1.760(0.0693)	13	2.040(0.0803)
82	1.780(0.0701)	14	2.050(0.0807)
83	1.800(0.0709)	15	2.060(0.0811)
84	1.820(0.0717)	16	2.070(0.0815)
85	1.840(0.0728)	17	2.080(0.0819)
86	1.860(0.0732)	18	2.090(0.0823)
87	1.880(0.0740)	19	2.100(0.0827)
88	1.900(0.0748)	20	2.120(0.0835)
89	1.910(0.0752)	21	2.140(0.0843)
01	1.920(0.0756)	22	2.160(0.0850)
02	1.930(0.0760)	23	2.180(0.0858)
03	1.940(0.0764)	24	2.200(0.0866)
04	1.950(0.0768)	25	2.220(0.0874)
05	1.960(0.0772)	26	2.240(0.0882)
06	1.970(0.0776)	27	2.260(0.0890)
07	1.980(0.0780)	28	2.280(0.0898)
08	1.990(0.0783)	29	2.300(0.0906)
09	2.000(0.0787)		

- Place a new adjusting shim on the valve.
- Place the valve lifter.
- Install the camshafts (See cylinder head).
- Install the timing belt (See timing belt).

6. INSTALL CYLINDER HEAD COVER

(See timing belt)

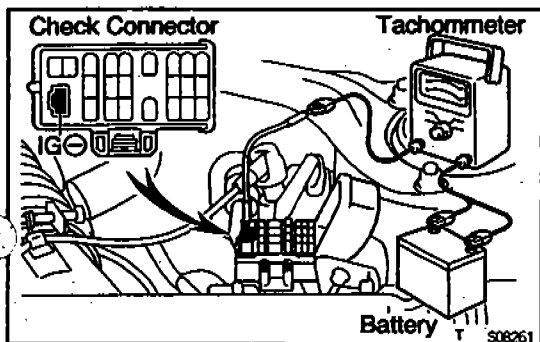
7. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

IGNITION TIMING INSPECTION

EM601-01

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

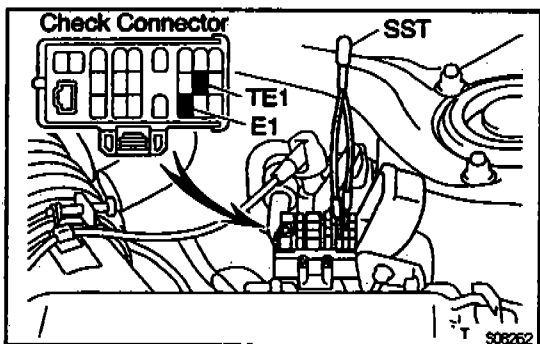


2. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

Connect the test probe of a tachometer to terminal IG of the check connector.

NOTICE:

- Never allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.
- As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before use.

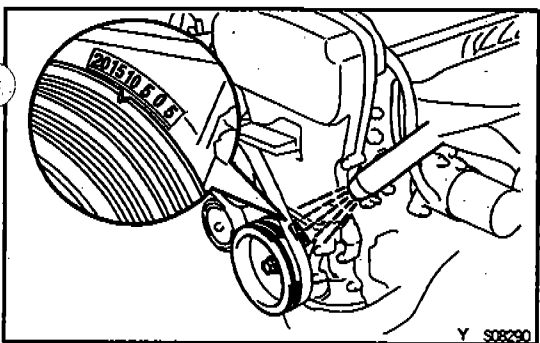


3. INSPECT AND ADJUST IGNITION TIMING

- (a) Using SST, connect terminals TE1 and E1 of the check connector.

SST 09843-18020

HINT: After engine rpm is kept at 1,000 – 1,500 rpm for 5 seconds, check that it returns to idle speed.

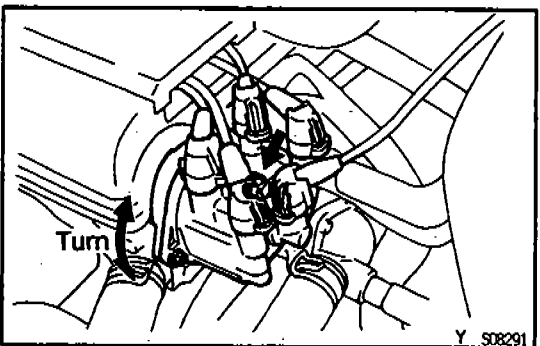


- (b) Using a timing light, check the ignition timing.

Ignition timing:

8 – 12° BTDC @ idle

(Transmission in neutral position)



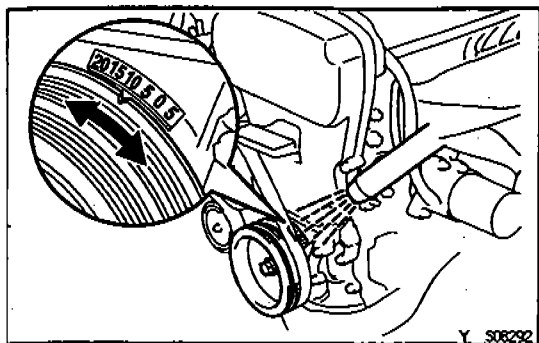
- (c) Loosen the hold-down bolt, and adjust by turning the distributor.

- (d) Tighten the hold-down bolt, and recheck the ignition timing.

Torque: 23 N·m (230 kgf·cm, 17 ft·lbf)

- (e) Remove the SST from the check connector.

SST 09843-18020

**4. FURTHER CHECK IGNITION TIMING**

Ignition timing:

10° or more BTDC @ idle

(Transmission in neutral position)

HINT: When engine speeding up to the engine rotation, confirm that the ignition timing degree increases promptly.

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

IDLE SPEED INSPECTION

EGSYX-02

1. INITIAL CONDITIONS

- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All vacuum lines properly connected
- (e) EFI system wiring connectors fully plugged
- (f) All operating accessories switched OFF
- (g) Ignition timing set correctly
- (h) Transmission in neutral position

2. CONNECT TACHOMETER

(See ignition timing)

3. INSPECT IDLE SPEED

- (a) Race the engine at 2,500 rpm for approx. 90 seconds.
- (b) Check the idle speed.

Idle speed (w/ Cooling fan OFF):

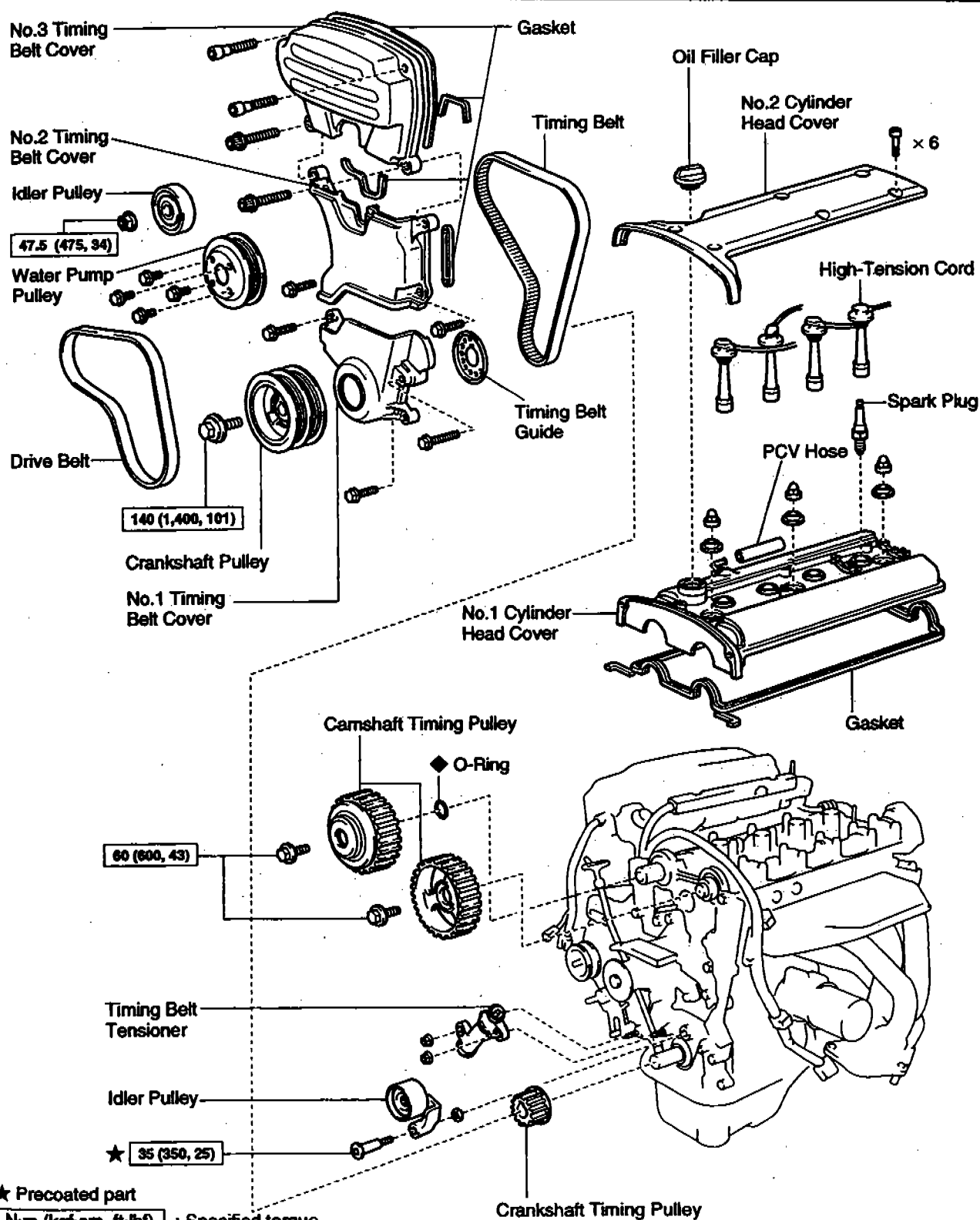
880 \pm 50 rpm

If the idle speed is not as specified, check the ISC system.

4. DISCONNECT TACHOMETER

TIMING BELT COMPONENTS

EG17P-01



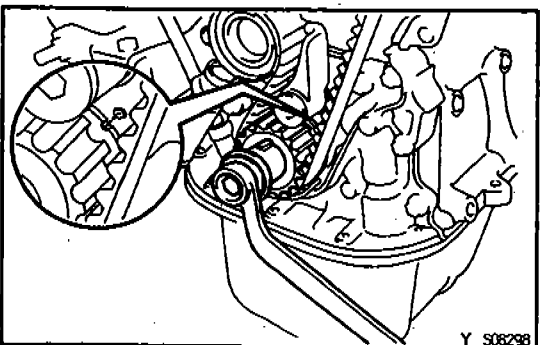
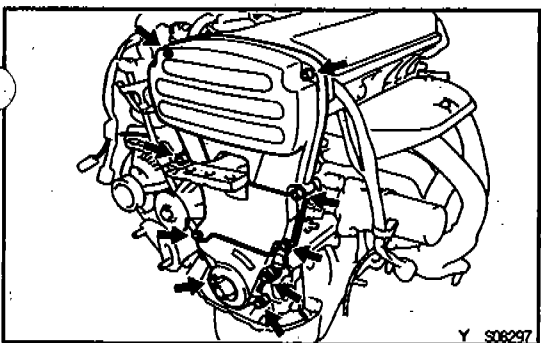
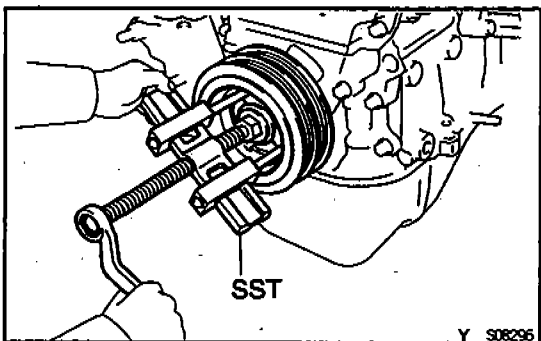
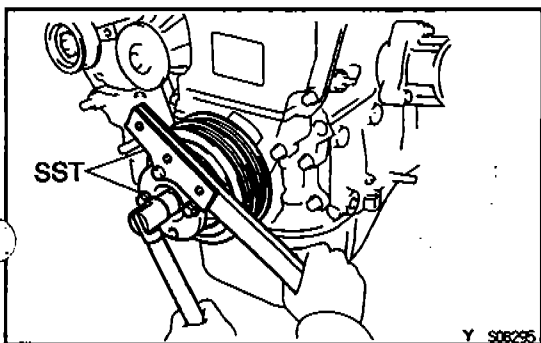
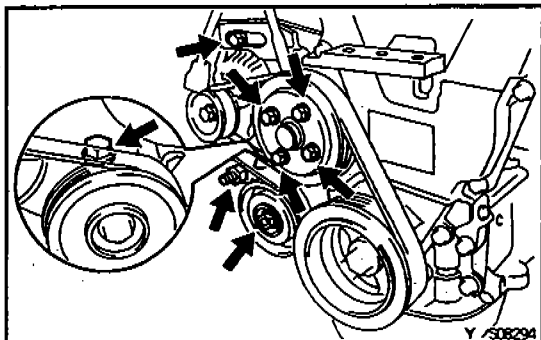
★ Precoated part

N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

Y

S06293



REMOVAL

1. REMOVE ALTERNATOR DRIVE BELT AND WATER PUMP PULLEY

- Loosen the 4 water pump pulley bolts.
- Loosen the idler pulley adjusting lock nut and adjusting bolt.
- Loosen the pivot bolt and adjusting bolt, and remove the drive belt.
- Remove the 4 bolts and water pump pulley.
- Remove the adjusting lock nut and idler pulley.

2. REMOVE CRANKSHAFT PULLEY

- Using SST, remove the pulley bolt.
SST 09213-54015, 09330-00021
- Using SST and the pulley bolt, remove the pulley.
SST 09950-50010 (09951-05010, 09952-05010, 09953-05020, 09554-05030)

3. REMOVE TIMING BELT COVERS

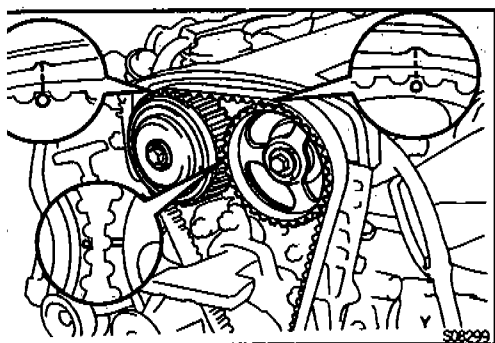
Remove the 9 bolts and timing belt covers.

4. REMOVE TIMING BELT GUIDE

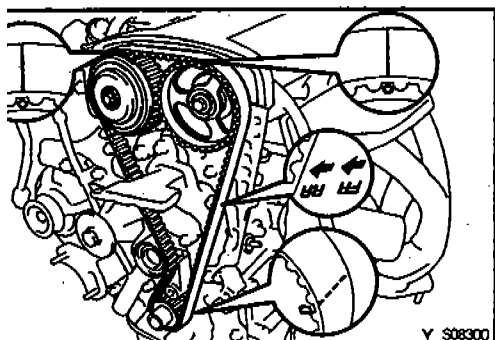
5. SET NO.1 CYLINDER TO TDC/COMPRESSION

- Temporarily install the crankshaft pulley bolt to the crankshaft.
- Turn the crankshaft, and align the timing marks of the crankshaft timing pulley and oil pump body.

NOTICE: Always turn the crankshaft clockwise.



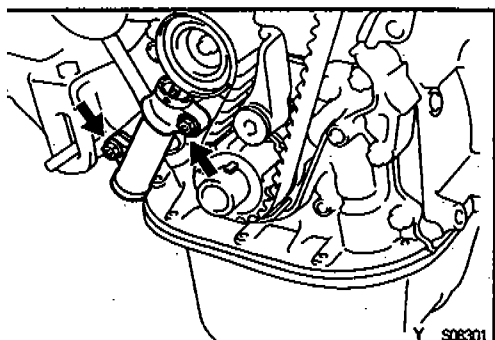
- (c) Check that timing marks of the camshaft timing pulleys and No.1 cylinder head cover are aligned.
If not, turn the crankshaft 1 revolution (360°).
- (d) Remove the crankshaft pulley bolt.



6. IF REUSING TIMING BELT, CHECK INSTALLATION MARKS ON TIMING BELT

Check that there are 3 installation marks and front mark on the timing belt.

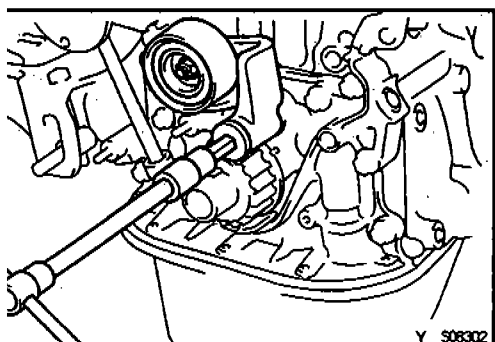
If the installation and front marks have disappeared, before removing the timing belt, place 3 new installation marks on the timing belt to match the timing marks of the timing pulleys, and place a new front mark on the timing belt.



7. REMOVE TIMING BELT TENSIONER

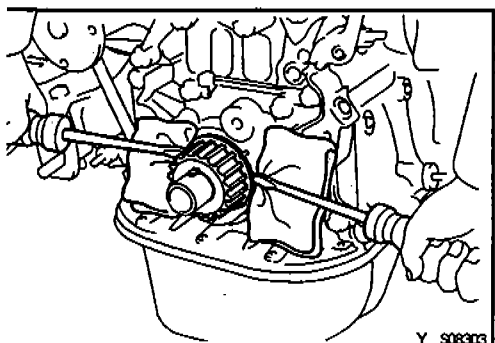
Alternately loosen the 2 nuts, and remove the tensioner.

8. REMOVE TIMING BELT



9. REMOVE IDLER PULLEY

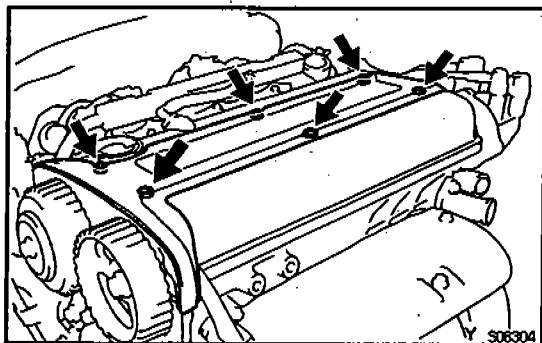
Using a 8 mm hexagon wrench, remove the bolt, pulley and washer.



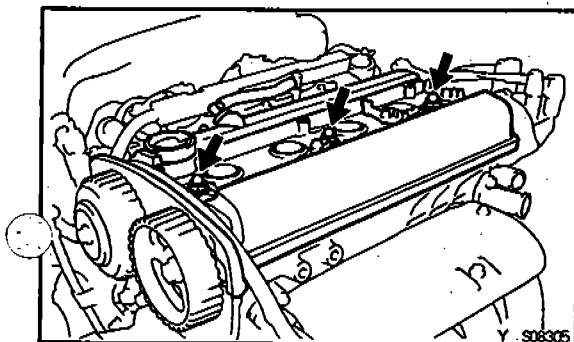
10. REMOVE CRANKSHAFT TIMING PULLEY

If the pulley cannot be removed by hand, use 2 screwdrivers.

NOTICE: Position shop rags as shown to prevent damage.

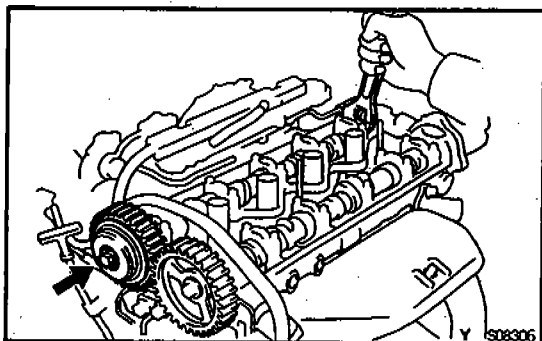
**11. REMOVE NO.2 CYLINDER HEAD COVER**

Remove the 6 bolts and No.2 cylinder head cover.

12. DISCONNECT HIGH-TENSION CORDS**13. REMOVE SPARK PLUG****14. REMOVE CYLINDER HEAD COVER**

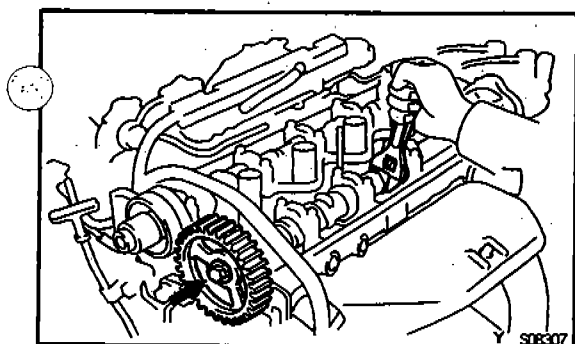
(a) Disconnect the PCV hose.

(b) Remove the 3 cap nuts, seal washers and cylinder head cover.

**15. REMOVE RH CAMSHAFT TIMING PULLEY**

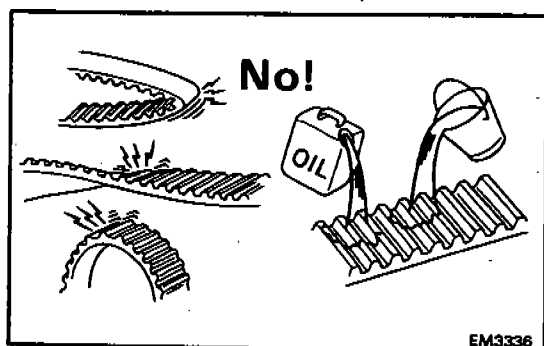
Hold the hexagonal head wrench portion of the camshaft with a wrench, and remove the bolt and timing pulley.

NOTICE: Be careful not to damage the cylinder head with the wrench.

**16. REMOVE LH CAMSHAFT TIMING PULLEY**

Hold the hexagonal head wrench portion of the camshaft with a wrench, and remove the bolt and timing pulley.

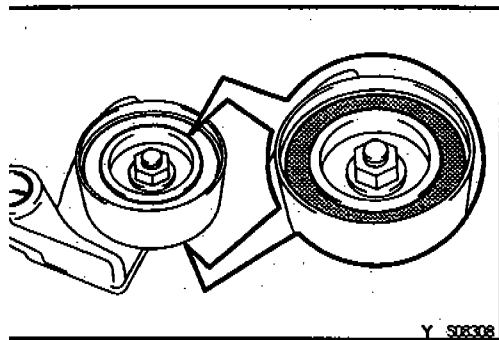
NOTICE: Be careful not to damage the cylinder head with the wrench.

**INSPECTION****1. INSPECT TIMING BELT****NOTICE:**

- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water or steam.
- Do not utilize timing belt tension when installing or removing the mount bolt of the camshaft timing pulley.

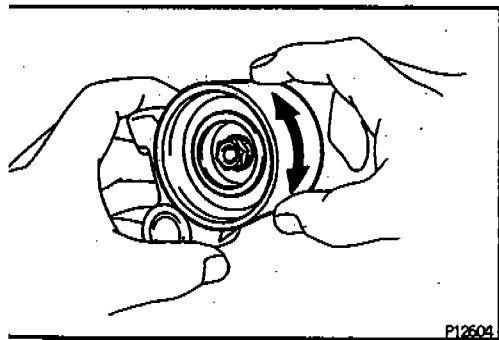
If there are any defects, as shown in the illustrations, check these points:

- (a) Premature parting
 - Check for proper installation.
 - Check the timing cover gasket for damage and proper installation.
 - (b) If the belt teeth are cracked or damaged, check to see if either camshaft is locked.
 - (c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.
 - (d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.
 - (e) If there is noticeable wear on the belt teeth, check timing cover for damage and check gasket has been installed correctly and for foreign material on the pulley teeth.
- If necessary, replace the timing belt.

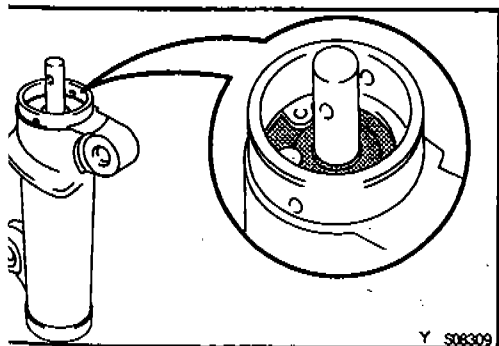


2. INSPECT IDLER PULLEY

- (a) Visually check the seal portion of the idler pulley for oil leakage.
If leakage is found, replace the idler pulley.

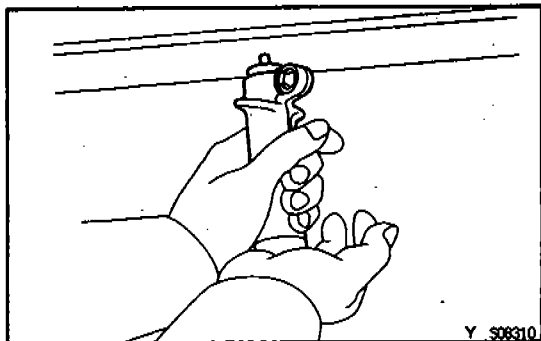


- (b) Check that the idler pulley turns smoothly.
If necessary, replace the idler pulley.

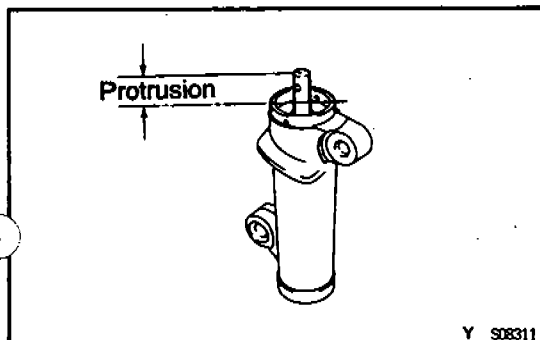


3. INSPECT TIMING BELT TENSIONER

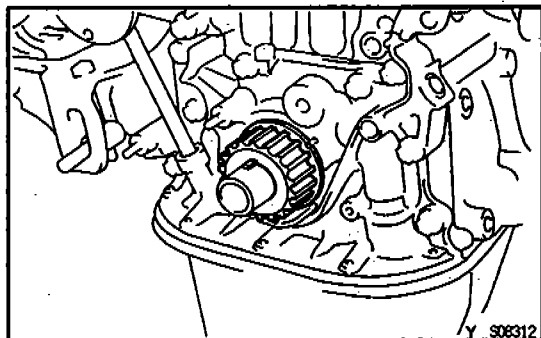
- (a) Visually check the seal portion of the tensioner for oil leakage.
HINT: If there is only the faintest trace of oil on the seal on the push rod side, the tensioner is all right.
If leakage is found, replace the tensioner.



- (b) Hold the tensioner with both hands and push the push rod strongly as shown to check that it doesn't move. If the push rod moves, replace the tensioner.
NOTICE: Never hold the tensioner push rod facing downward.



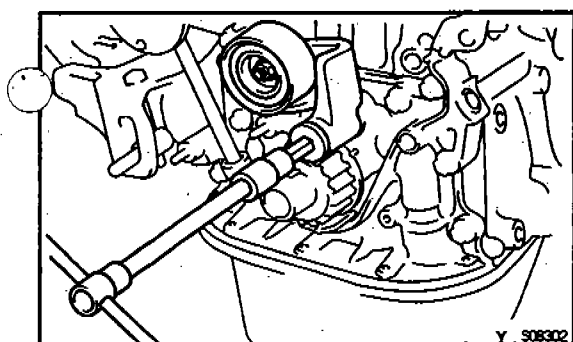
- (c) Measure the protrusion of the push rod from the housing end.
Protrusion:
 11.9 – 12.8 mm (0.469 – 0.504 in.)
 If the protrusion is not as specified, replace the tensioner.



INSTALLATION

1. INSTALL CRANKSHAFT TIMING PULLEY

- (a) Align the pulley set key with the key groove of the timing pulley, and slide on the timing pulley.
 (b) Install the timing pulley, facing the sensor side inward.
NOTICE: Do not scratch the sensor part of the crankshaft timing pulley.

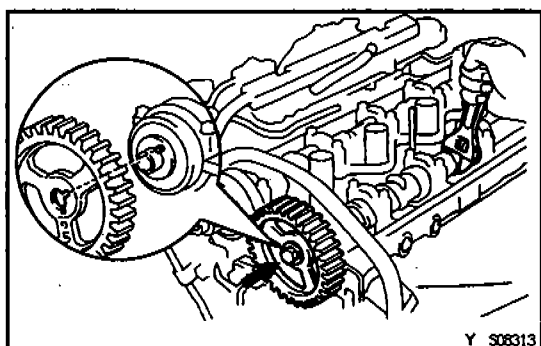


2. INSTALL IDLER PULLEY

Adhesive:

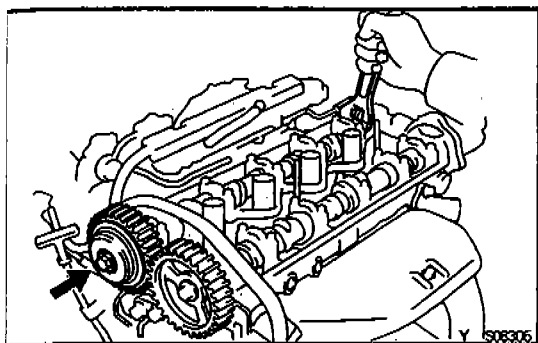
Part No. 08833-00080, THREE BOND 1344,
 LOCTITE 242 or equivalent

- (a) Using a 8 mm hexagon wrench, install the plate washer and idler pulley with the pivot bolt.
Torque: 35 N·m (350 kgf·cm, 25 ft·lbf)
 (b) Check that the pulley bracket moves smoothly.

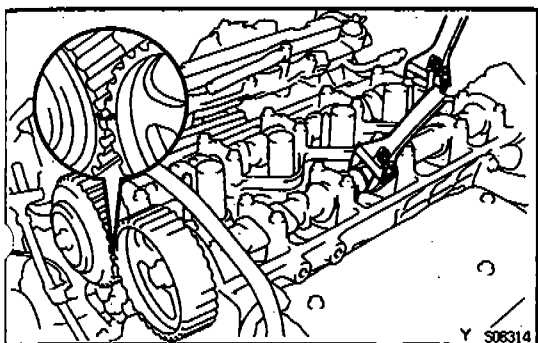


3. INSTALL LH CAMSHAFT TIMING PULLEY

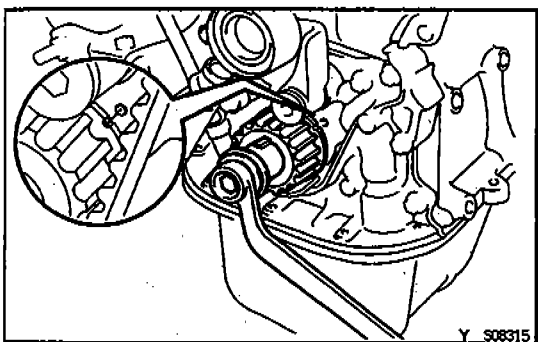
- (a) Align the camshaft knock pin with the knock pin groove on the pulley side without "5" mark and slide on the timing pulley.
 (b) Temporarily install the timing pulley bolt.
 (c) Hold the hexagonal wrench head portion of the camshaft with a wrench, and tighten the timing pulley bolt.
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)

**4. INSTALL RH CAMSHAFT TIMING PULLEY**

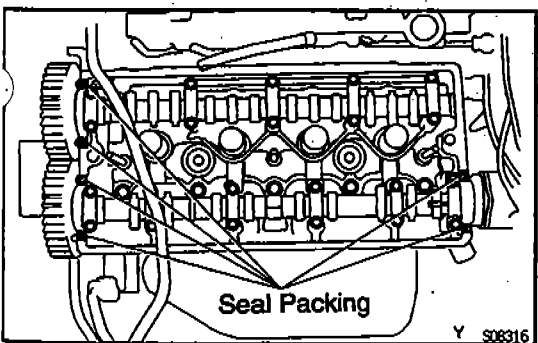
- (a) Install a new O-ring to the camshaft.
- (b) Apply light coat the engine oil to a new O-ring.
- (c) Align the knock pin on the camshaft with the knock pin groove of the timing pulley, and slide on the timing pulley.
- (d) Temporarily install the timing pulley bolt.
- (e) Hold the hexagonal wrench head portion of the camshaft with a wrench, and tighten the timing pulley bolt.
Torque: 59 N·m (600 kgf-cm, 43 ft-lbf)

**5. SET NO.1 CYLINDER TO TDC/COMPRESSION**

- (a) Turn the hexagonal wrench head portion of the camshaft, and align the timing mark of the camshaft timing pulleys.
- (b) Temporarily install No.1 cylinder head cover.
- (c) Check align the timing marks of the pulleys and cylinder head cover.
- (d) Remove cylinder head cover.



- (e) Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.

**6. INSTALL CYLINDER HEAD COVER**

- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to the cylinder head as shown in the illustration.

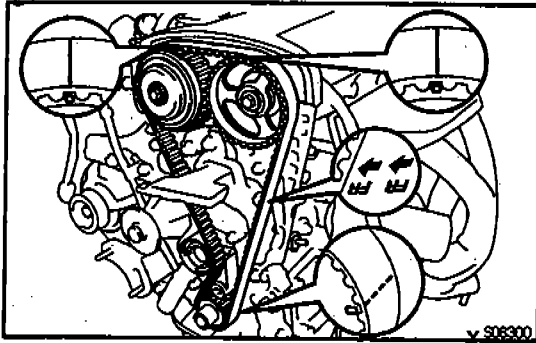
Seal packing:

Part No. 08826-00080 or equivalent

- (c) Install the gasket to the cylinder head cover.
- (d) Install the cylinder head cover with the 3 seal washers and cap nuts.

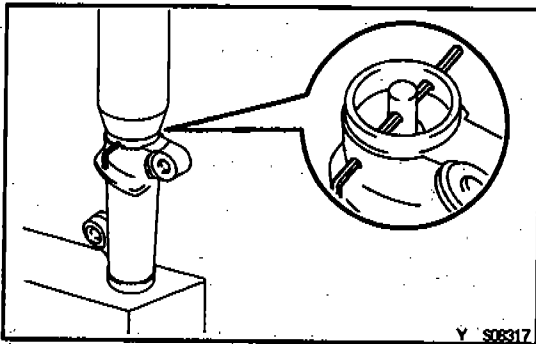
Torque: 8 N·m (80 kgf-cm, 69 in.-lbf)

- (e) Connect the PCV hose to the cylinder head cover.

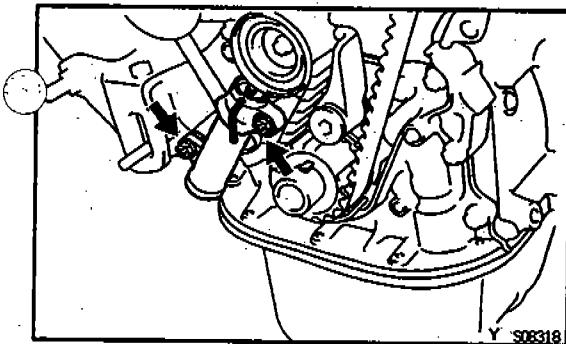
**7. INSTALL TIMING BELT**

NOTICE: The engine should be cold.

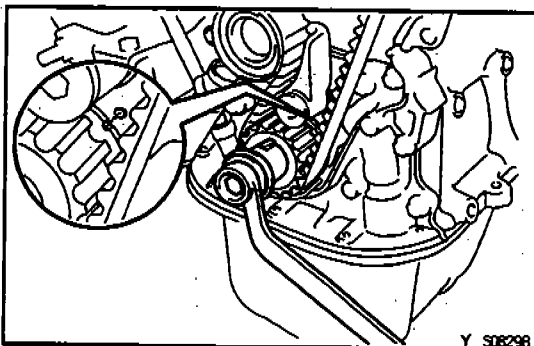
- (a) Remove any oil or water on the pulleys, and keep them clean.
NOTICE: Only wipe the pulleys; do not use any cleansing agent.
- (b) Face the front mark on the timing belt forward.
- (c) Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.
- (d) Align the installation marks on the timing belt with the timing marks of the camshaft timing pulleys.
- (e) Install the timing belt in this order:
 - (1) Crankshaft timing pulley
 - (2) LH camshaft timing pulley
 - (3) RH camshaft timing pulley
 - (4) Idler pulley

**8. SET TIMING BELT TENSIONER**

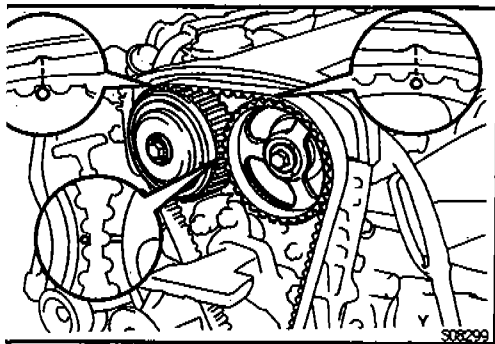
- (a) Using a press, slowly press in the push rod using 981 9,807 N (100 – 1,000 kgf, 200 – 2,205 lbf) of pressure.
- (b) Align the holes of the push rod and housing, pass a 1.2 mm hexagon wrench through the holes to keep the setting position of the push rod.
- (c) Release the press.

**9. INSTALL TIMING BELT TENSIONER**

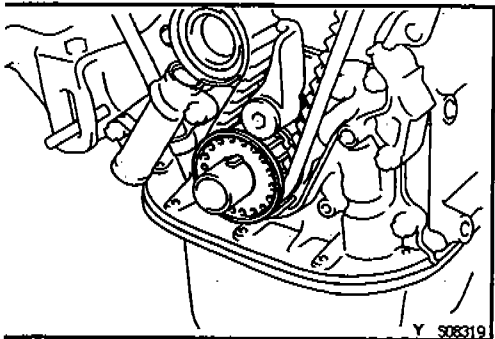
- (a) Temporarily install the tensioner with the 2 bolts.
- (b) Alternately tighten the 2 bolts.
Torque: 9.5 N·m (95 kgf·cm, 82 in.-lbf)
- (c) Remove the 1.27 mm hexagon wrench from the tensioner.

**10. CHECK VALVE TIMING**

- (a) Turn the crankshaft, and align the timing marks of the crankshaft timing pulley and oil pump body.
NOTICE: Always turn the crankshaft clockwise.



- (b) Check that the timing marks of the RH and LH timing pulleys with the timing marks of the No.1 cylinder head cover as shown in the illustration.
If the marks do not align, remove the timing belt and reinstall it.
- (c) Remove the crankshaft pulley bolt.

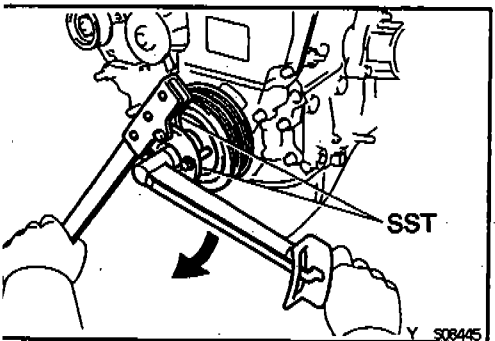


11. INSTALL TIMING BELT GUIDE

Install the guide, facing the cup side outward.

10. INSTALL TIMING BELT COVERS

- (a) Install the No.1 timing belt cover with the 3 bolts.
Torque: 9.5 N·m (95 kgf·cm, 82 in.-lbf)
- (b) Install the No.2, No.3 timing belt covers with the 6 bolts.
Torque: 9.5 N·m (95 kgf·cm, 82 in.-lbf)



13. INSTALL CRANKSHAFT PULLEY

- (a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.
- (b) Using SST, install the pulley bolt.
SST 09213-54015, 09330-00021
Torque: 140 N·m (1,400 kgf·cm, 101 ft.-lbf)

14. INSTALL SPARK PLUGS

15. CONNECT HIGH-TENSION CORDS

16. INSTALL NO.2 CYLINDER HEAD COVER

Torque: 9.5 N·m (95 kgf·cm, 82 in.-lbf)

17. INSTALL OIL FILLER CAP

18. INSTALL WATER PUMP PULLEY AND ALTERNATOR DRIVE BELT

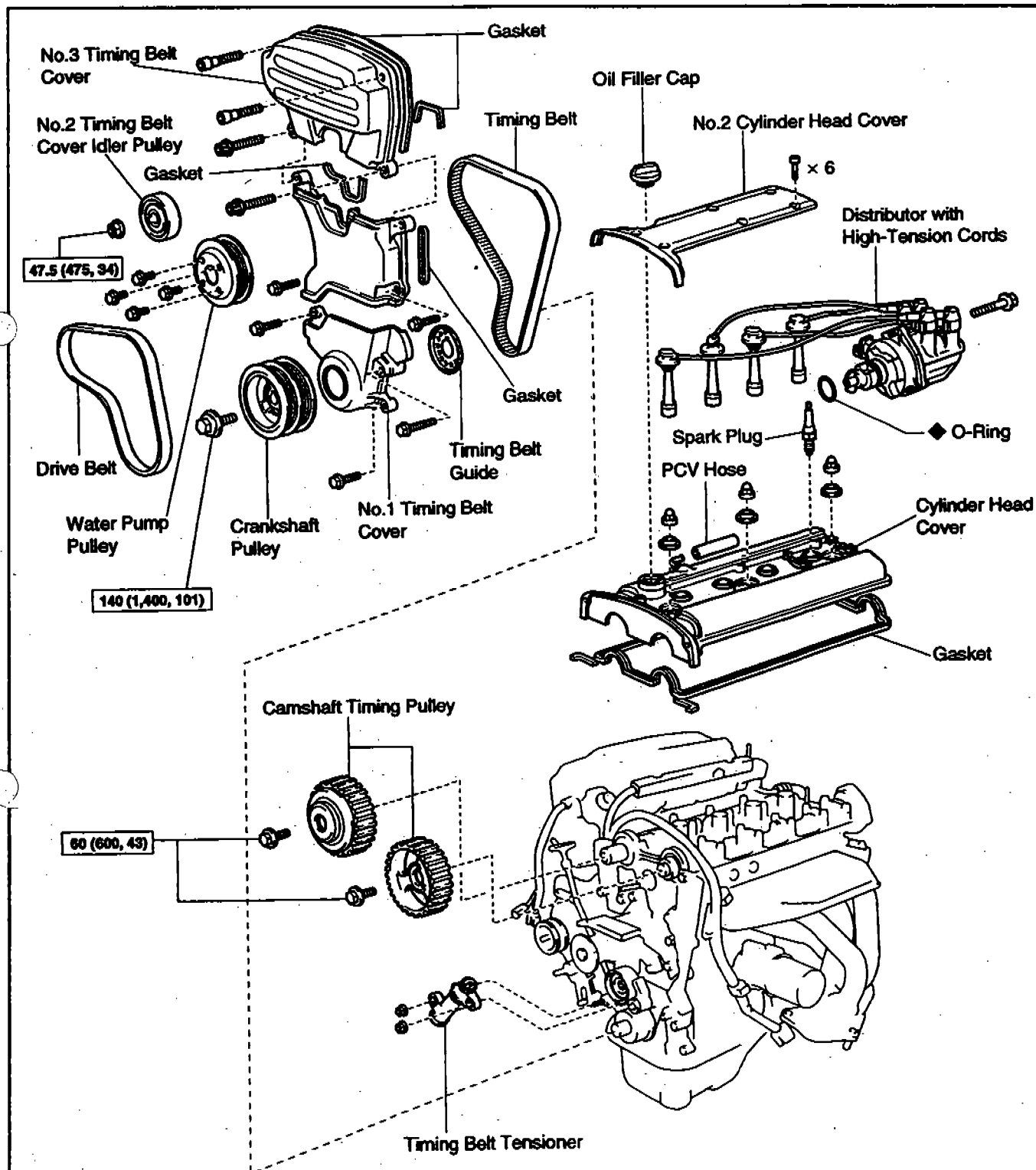
- (a) Temporarily install water pump pulley with the 4 bolts.
- (b) Temporarily install the idler pulley with the nut.
- (b) Install the drive belt with the adjusting bolt and pivot bolt.
- (c) Tighten the nut.
- (d) Tighten the 4 water pump pulley bolts.

19. ADJUST DRIVE BELT

(See CH section)

CYLINDER HEAD COMPONENTS

EG161-08

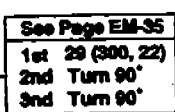


N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

Y

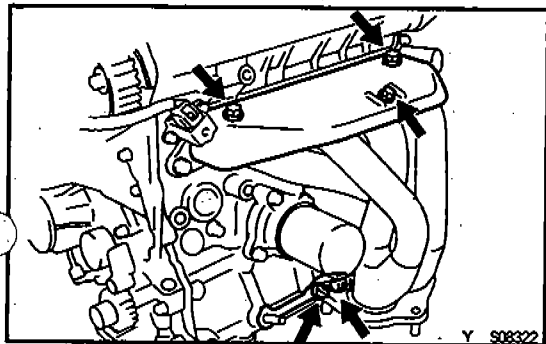
505320



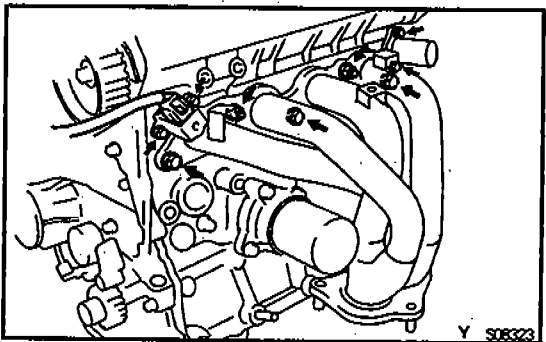
◆ **Non-reusable part**

REMOVAL

1. DRAIN ENGINE COOLANT
2. REMOVE TIMING BELT
(See timing belt)
3. REMOVE DISTRIBUTOR

**4. REMOVE EXHAUST MANIFOLD**

- (a) Remove the 3 bolts and upper heat insulator.
- (b) Remove the 2 bolts and manifold stay.



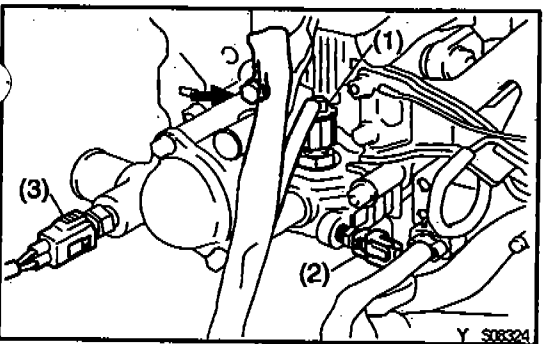
- (c) Remove the 2 bolts, 3 nuts, exhaust manifold and gasket.

5. REMOVE WATER OUTLET

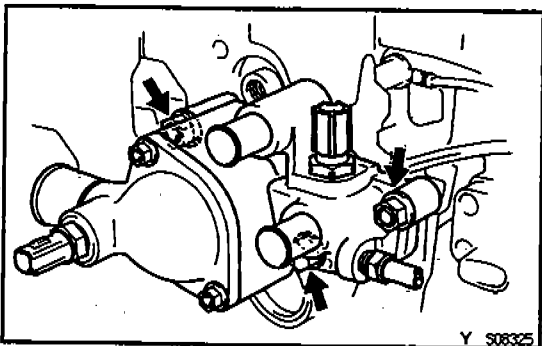
Remove the 2 bolts, water outlet and gasket.

6. REMOVE OIL SWITCHING VALVE (OSV)

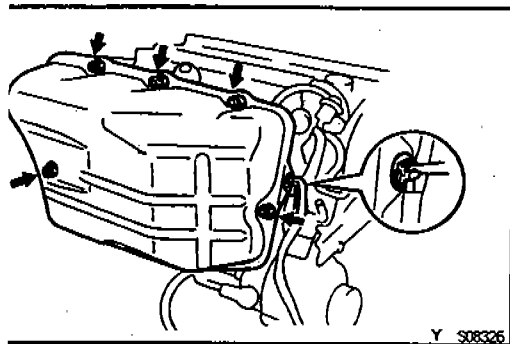
- (a) Remove the 2 bolts, OSV and O-ring.
- (b) Remove the O-ring from the OSV.

7. DISCONNECT OIL PRESSURE SWITCH CONNECTOR**8. REMOVE WATER INLET AND INLET HOUSING**

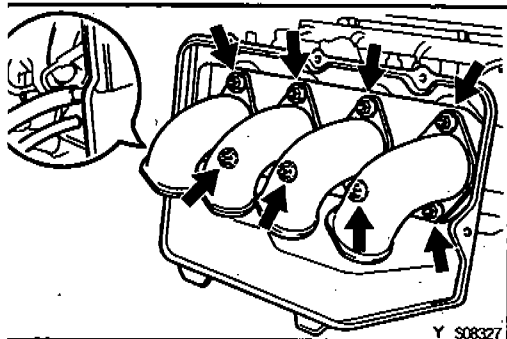
- (a) Disconnect these connectors:
 - (1) Water temperature sensor connector
 - (2) Water temperature switch connector
 - (3) Water temperature sender gauge connector
- (b) Remove the bolt holding the ground wire to the water inlet and inlet housing assembly.
- (c) Disconnect the 2 water bypass hoses.



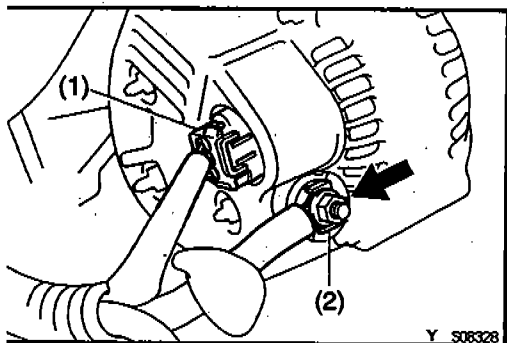
- (d) Remove the bolt, 2 nuts, the water inlet and inlet housing assembly and gasket.

**9. REMOVE SURGE TANK**

- (a) Disconnect the cord clip from the surge tank cover.
- (b) Remove the 5 bolts, surge tank cover and gasket.

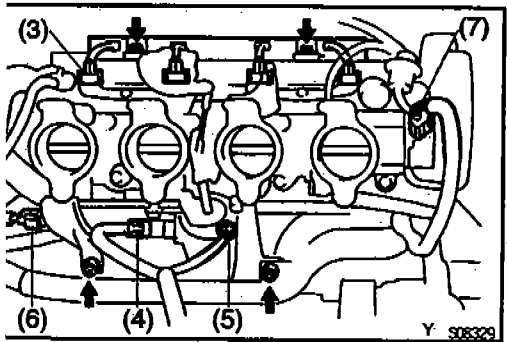


- (c) Remove the 8 bolts and 4 intake pipes.
- (d) Disconnect the vacuum hose and ISC hose from the surge tank.
- (e) Remove the surge tank and gasket.

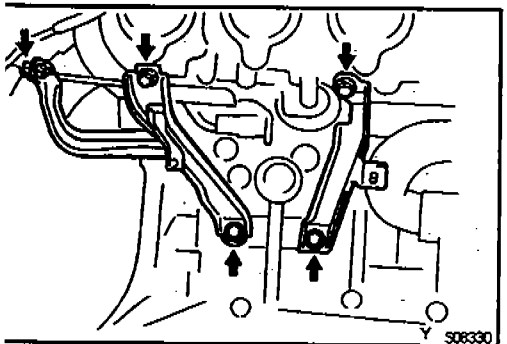
**10. REMOVE ENGINE WIRE PROTECTOR**

- (a) Disconnect these connectors and wire:

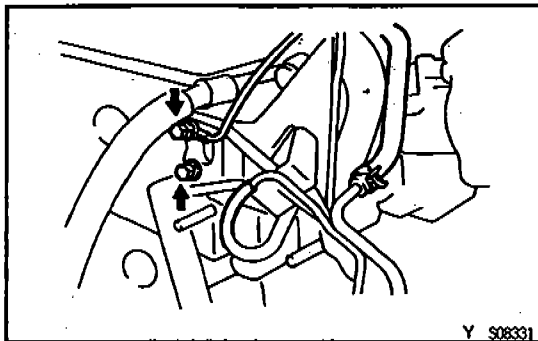
- (1) Alternator wire connector
- (2) Alternator wire



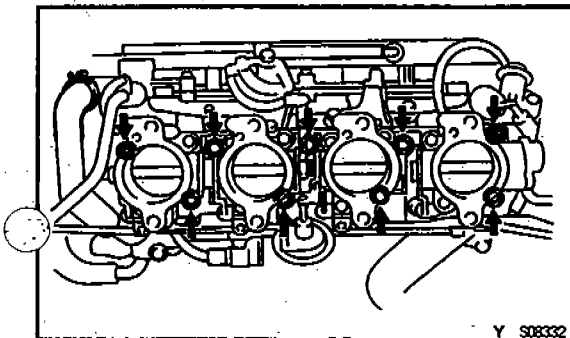
- (3) Injector connectors
- (4) VSV for EVAP connector
- (5) Knock sensor connector
- (6) ISC connector
- (7) Throttle position sensor connector
- (b) Remove the 2 bolts, 2 nuts and engine wire protectors.

**11. REMOVE INTAKE MANIFOLD STAYS**

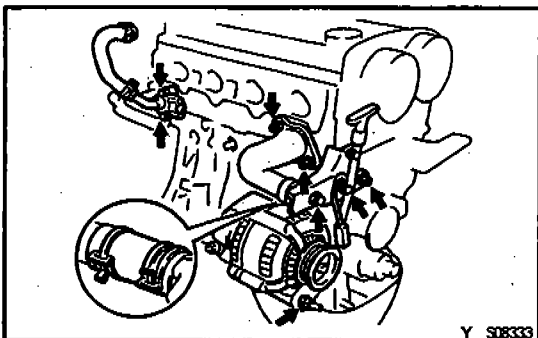
Remove the 5 bolts and intake manifold stays.

**12. REMOVE NO.2 ENGINE HANGER**

- (a) Disconnect the fuel return hose and vacuum hose from the No.2 engine hanger.
- (b) Remove the 2 bolts, ground strap and No.2 engine hanger.

**13. REMOVE INTAKE MANIFOLD**

- (a) Disconnect the ISC hose and PCV hose.
- (b) Remove the 7 bolts, 2 nuts, intake manifold and gasket.

**14. REMOVE OIL DIPSTICK AND GUIDE**

- (a) Remove the mounting bolt and ground strap.
- (b) Pull out the dipstick guide together with the dipstick.
- (c) Remove the O-ring from the dipstick guide.

15. REMOVE ALTERNATOR AND ADJUSTING BAR**16. REMOVE NO.2 WATER INLET**

- (a) Remove the 2 nuts holding the water inlet to the cylinder head.
- (b) Disconnect the inlet hose from the water pump, and remove the No.2 water inlet and gasket.

17. REMOVE ISC VALVE**18. REMOVE CYLINDER HEAD COVER**

Remove the 3 cap nuts, seal washers, cylinder head cover and gasket.

19. REMOVE CAMSHAFT TIMING PULLEYS

(See timing belt)

20. REMOVE ENGINE MOUNTING STAY

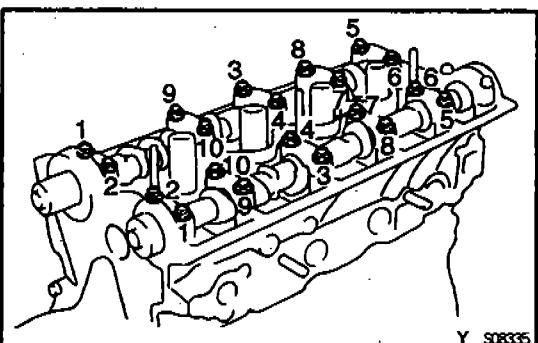
Remove the 2 bolts and engine mounting stay.

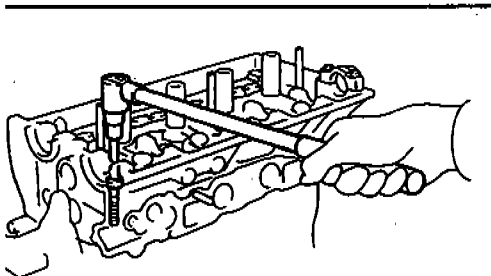
21. REMOVE NO.4 TIMING BELT COVER

Remove the 3 bolts and No.4 timing belt cover.

22. REMOVE CAMSHAFTS

- (a) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown, and remove the 5 bearing caps, oil seal and camshaft. Remove the intake and exhaust camshafts.
- (b) Remove the No.5 bearing cap from the cylinder head.

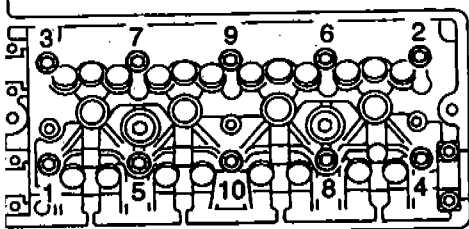


**23. REMOVE CYLINDER HEAD**

- (a) Uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.

NOTICE: Cylinder head warpage or cracking could result from removing bolts in incorrect order.

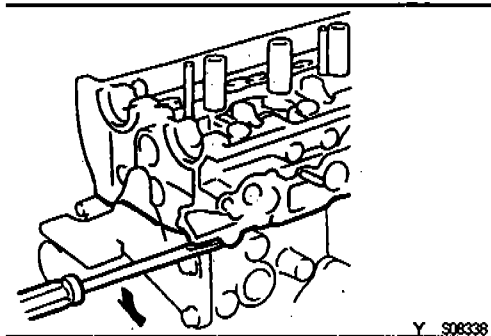
- (b) Remove the 10 plate washers.



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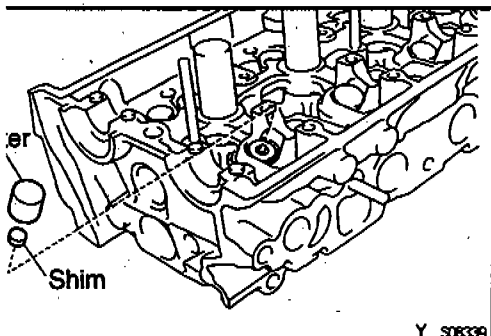


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- (c) Lift the cylinder head from the dowels on the cylinder block and place the head on wooden blocks on a bench. **HINT:** If the cylinder head is difficult to lift off, pry with a screwdriver between the cylinder head and block surfaces.

NOTICE: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

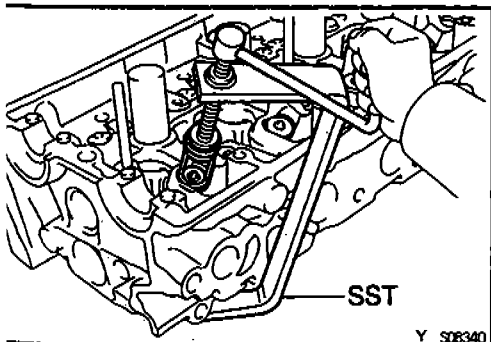


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DISASSEMBLY**1. REMOVE VALVE LIFTERS AND SHIMS**

HINT: Arrange the valve lifters and shims in correct order.



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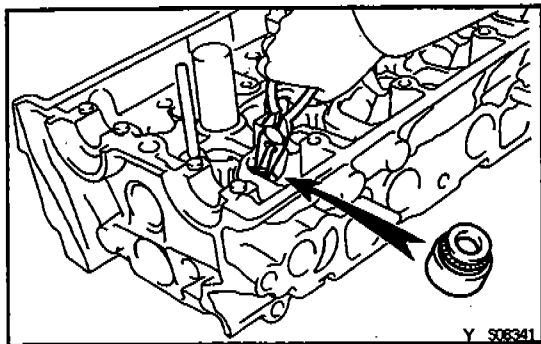
2. REMOVE VALVES

- (a) Using SST, compress the valve spring and remove the 2 keepers.

SST 09202-70020, 09202-00020

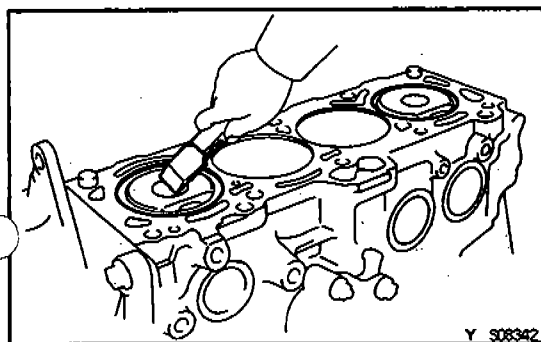
- (b) Remove these parts:

- (1) Spring retainer
- (2) Valve spring
- (3) Valve
- (4) Spring seat



HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.

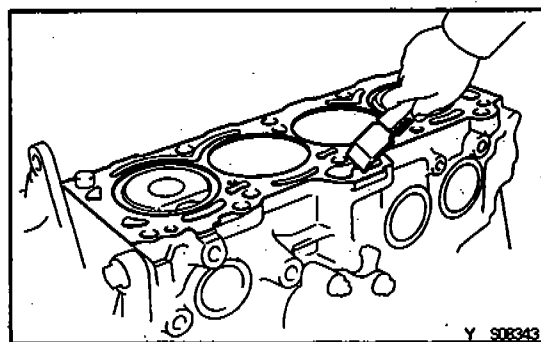
- (c) Using needle-nose pliers, remove the oil seal.



INSPECTION

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

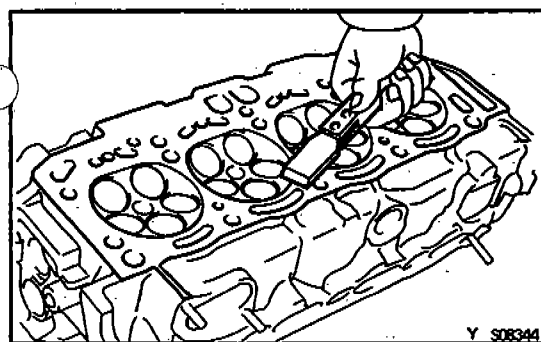
- (a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



- (b) Using a gasket scraper, remove all the gasket material from the cylinder block surface.

- (c) Using compressed air, blow carbon and oil from the bolt holes.

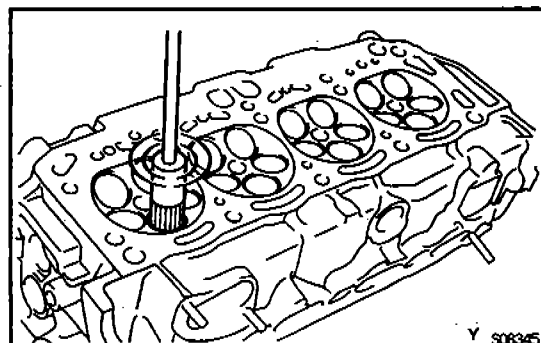
CAUTION: Protect your eyes when using high-compressed air.



2. REMOVE GASKET MATERIAL FROM CYLINDER HEAD

Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

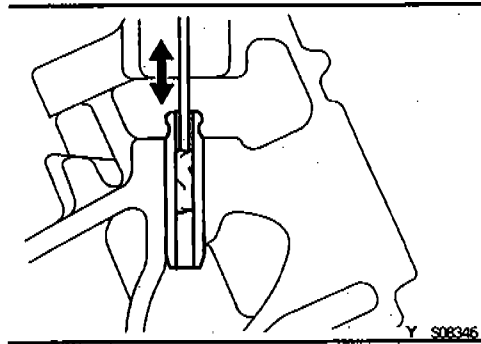
NOTICE: Be careful not to scratch the cylinder block contact surface.



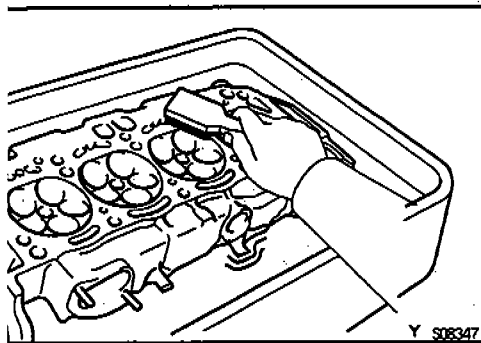
3. CLEAN COMBUSTION CHAMBERS

Using a wire brush, remove all the carbon from the combustion chambers.

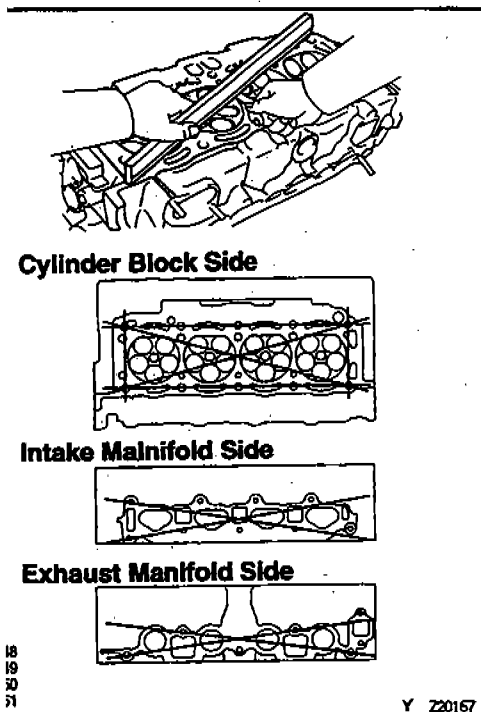
NOTICE: Be careful not to scratch the cylinder block contact surface.

**4. CLEAN VALVE GUIDE BUSHINGS**

Using a valve guide bushing brush and solvent, clean all the guide bushings.

**5. CLEAN CYLINDER HEAD**

Using a soft brush and solvent, thoroughly clean the cylinder head.

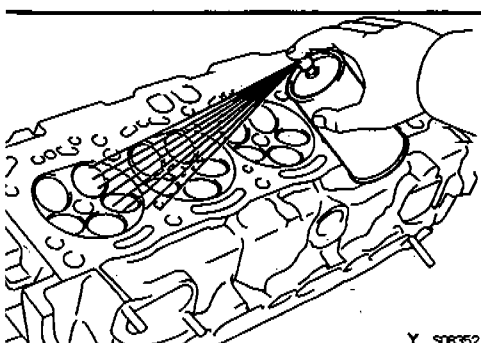
**6. INSPECT FOR FLATNESS OF CYLINDER HEAD**

Using a precision straight edge and thickness gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.

Maximum warpage:

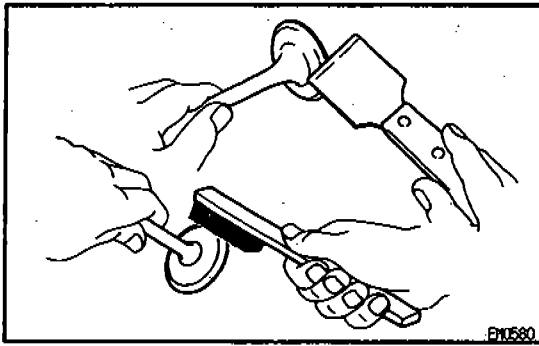
Cylinder block side	0.10 mm (0.0039 in.)
Manifold side	0.10 mm (0.0039 in.)

If warpage is greater than maximum, replace the cylinder head.

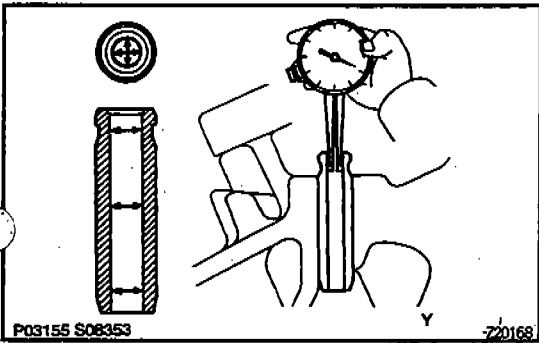
**7. INSPECT FOR CRACKS OF CYLINDER HEAD**

Using a dye penetrant, check the combustion chambers, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.

**8. CLEAN VALVES**

- (a) Using a gasket scraper, chip off any carbon from the valve head.
- (b) Using a wire brush, thoroughly clean the valve.

**9. INSPECT VALVE STEMS AND GUIDE BUSHINGS**

- (a) Using a caliper gauge, measure the inside diameter of the guide bushing.

Bushing inside diameter:

5.010 – 5.030 mm (0.1972 – 0.1980 in.)

- (b) Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

Intake	4.970 – 4.985 mm (0.1957 – 0.1963 in.)
Exhaust	4.965 – 4.980 mm (0.1955 – 0.1961 in.)

- (c) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.

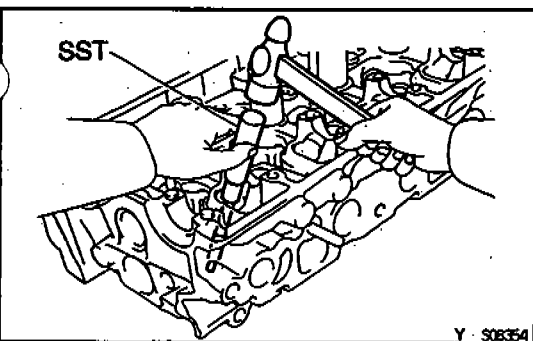
Oil clearance:

Item	Intake	Exhaust
Standard	0.025 – 0.060 mm (0.0010 – 0.0024 in.)	0.030 – 0.065 mm (0.0012 – 0.0026 in.)
Maximum	0.08 mm (0.0031 in.)	0.10 mm (0.0039 in.)

If the clearance is greater than maximum, replace the valve and guide bushing.

10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

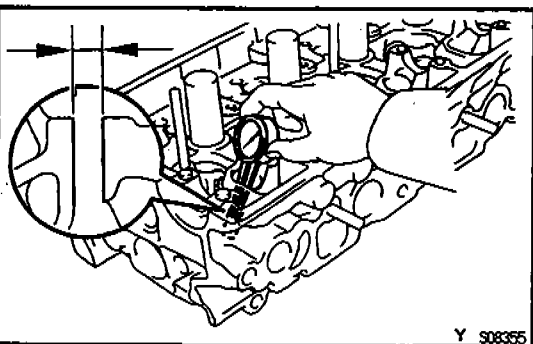
- (a) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).
- (b) Using SST and a hammer, tap out the guide bushing.
SST 09201-10000 (09201-01050),
09950-70010 (09951-07150)



- (c) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Standard valve guide bore (Cold):

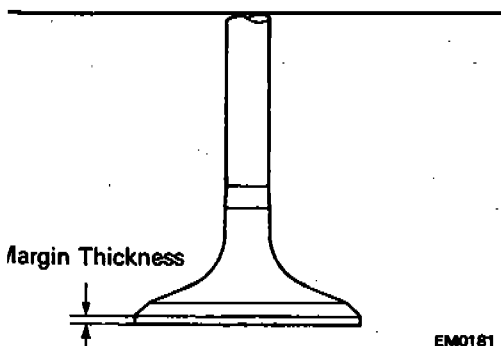
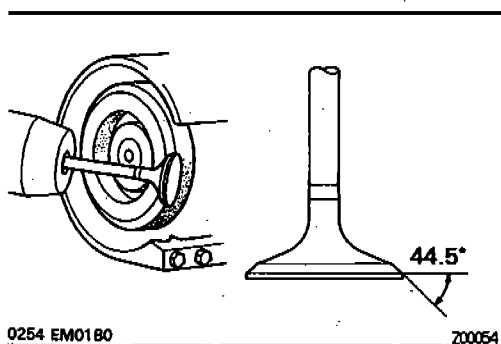
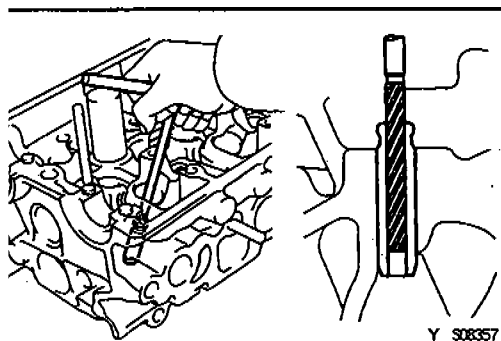
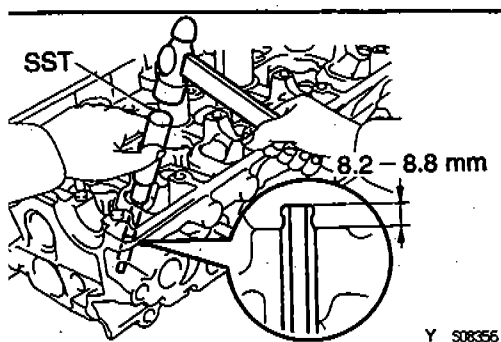
9.679 – 9.701 mm (0.3811 – 0.3819 in.)



Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
9.679 - 9.701 (0.3811 - 0.3819)	Use STD
9.738 - 9.777 (0.3834 - 0.3849)	Use O/S 0.05

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- (d) Select a new guide bushing (STD or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 9.701 mm (0.3819 in.), machine the bushing bore to these dimension:
9.738 - 9.777 mm (0.3834 - 0.3849 in.)
If the bushing bore diameter of the cylinder head is greater than 9.777 mm (0.3849 in.), replace the cylinder head.
- (e) Gradually heat the cylinder head to 80 - 100°C (176 - 212°F).
- (f) Using SST and a hammer, tap in a new guide bushing until there is 8.2 - 8.8 mm (0.323 - 0.346 in.) protruding from the cylinder head.
SST 09201-10000 (09201-01050),
09950-70010 (09951-07150)
- (g) Using a sharp 5 mm reamer, ream the guide bushing to obtain the standard specified clearance (See step 9 above) between the guide bushing and valve stem.

11. INSPECT AND GRIND VALVES

- (a) Grind the valve enough to remove pits and carbon.
(b) Check that the valve is ground to the correct valve face angle.

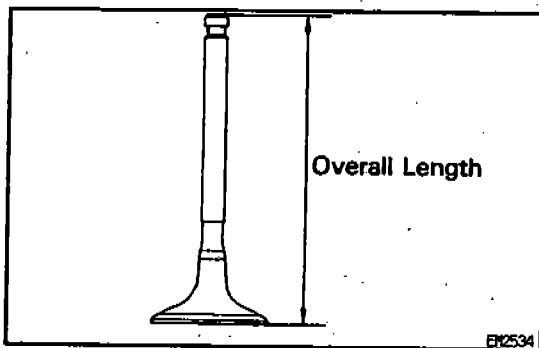
Valve face angle:

45°

- (c) Check the valve head margin thickness.
Margin thickness:

Standard	0.8 - 1.2 mm (0.031 - 0.047 in.)
Minimum	0.5 mm (0.020 in.)

If the margin thickness is less than minimum, replace the valve.

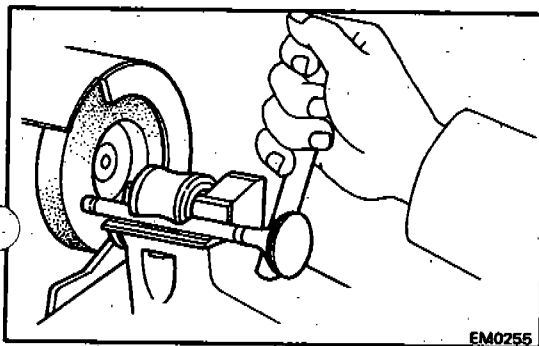


- (d) Check the valve overall length.

Overall length:

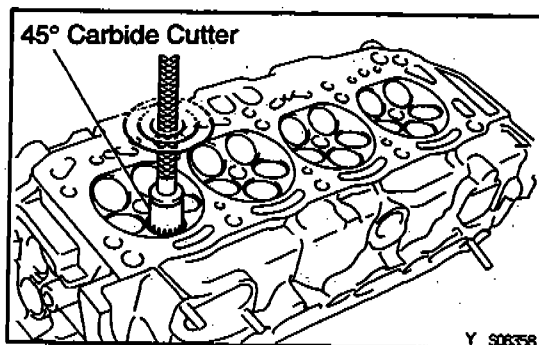
Item	Intake	Exhaust
Standard	98.51 mm (3.8783 in.)	108.45 mm (4.2697 in.)
Minimum	97.81 mm (3.8508 in.)	107.75 mm (4.2421 in.)

If the overall length is less than minimum, replace the valve.



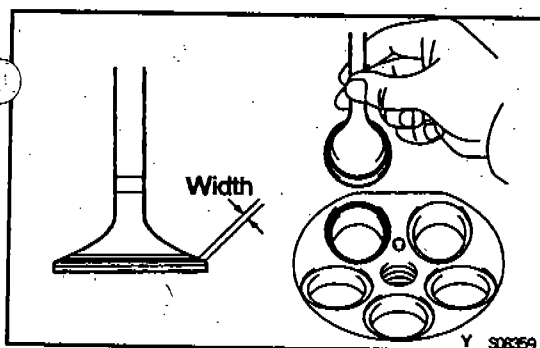
- (e) Check the surface of the valve stem tip for wear. If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTICE: Do not grind off more than minimum.



12. INSPECT AND CLEAN VALVE SEATS

- (a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.

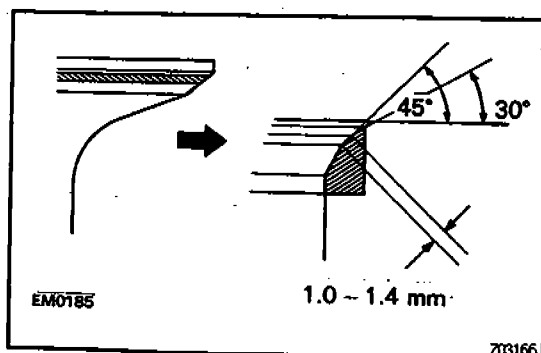


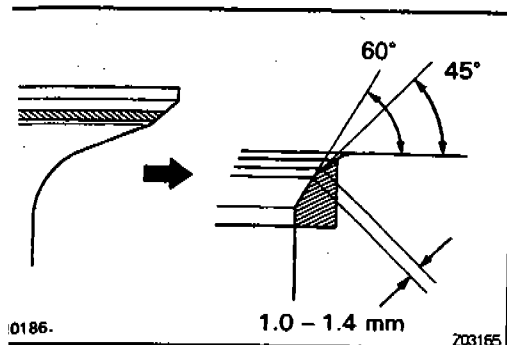
- (b) Check the valve seating position. Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.

- (c) Check the valve face and seat for the following:
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
 - If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
 - Check that the seat contact is in the middle of the valve face with the following width:
1.0 – 1.4 mm (0.039 – 0.055 in.)

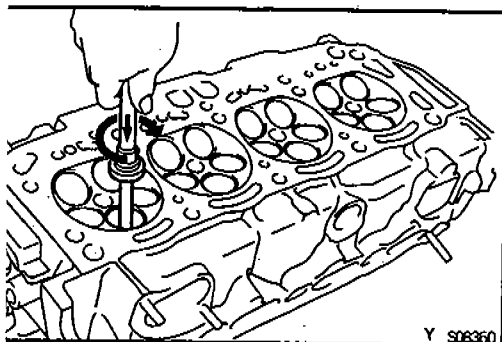
If not, correct the valve seats as follows:

- (1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.

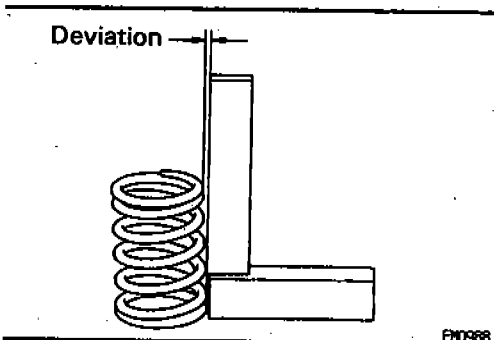




- (2) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



- (d) Hand-lap the valve and valve seat with an abrasive compound.
(e) After hand-lapping, clean the valve and valve seat.



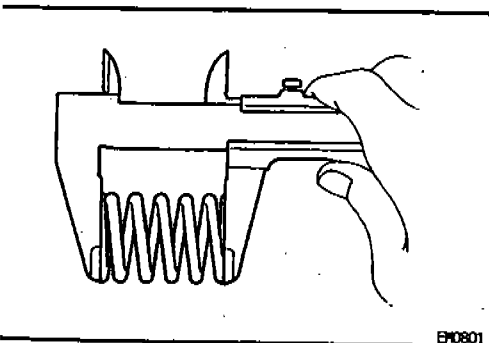
13. INSPECT VALVE SPRINGS

- (a) Using a steel square, measure the squareness of the valve spring.

Maximum squareness:

2.0 mm (0.079 in.)

If the deviation is greater than maximum, replace the valve spring.

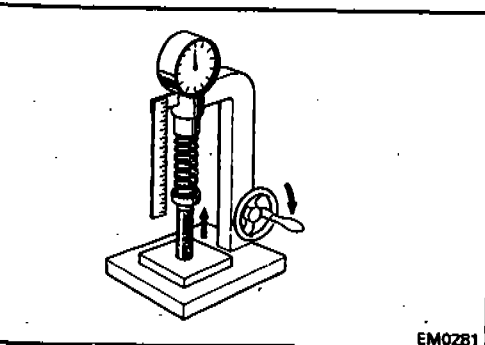


- (b) Using a vernier caliper, measure the free length of the valve spring.

Free length:

48.97 mm (1.9279 in.)

If the free length is not as specified, replace the valve spring.

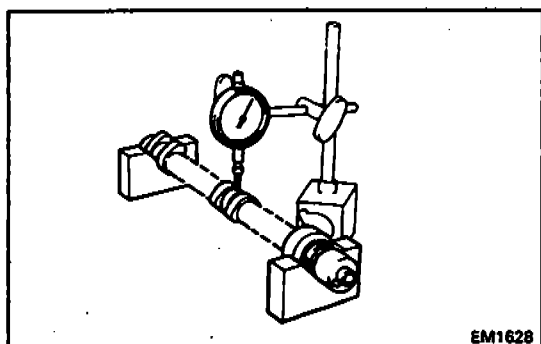


- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension (at 37.7 mm (1.4842 in.)):

149 - 165N (15.2 - 16.8 kgf, 33.5 - 37.0 lbf)

If the installed tension is not as specified, replace the valve spring.

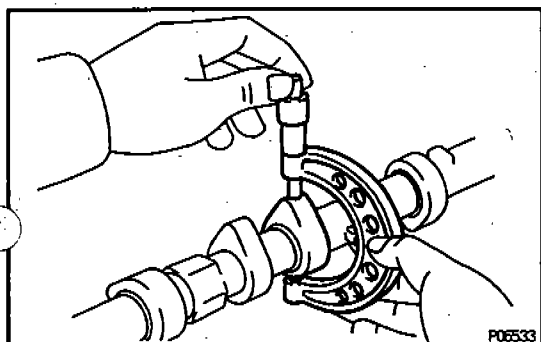
**14. INSPECT CAMSHAFT FOR RUNOUT**

- (a) Place the camshaft on V-blocks.
- (b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:

0.04 mm (0.0016 in.)

If the circle runout is greater than maximum, replace the camshaft.

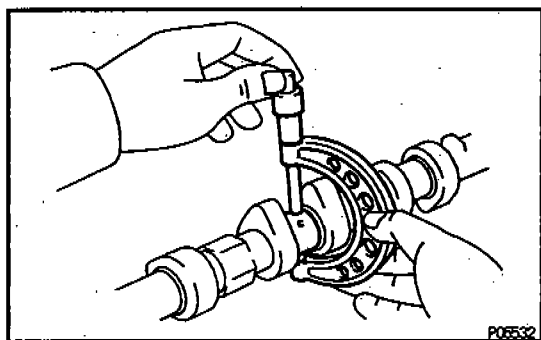
**15. INSPECT CAM LOBES**

Using a micrometer, measure the cam lobe height.

Cam lobe height

Standard	40.28 – 40.38 mm (1.5858 – 1.5898 in.)	40.09 – 40.19 mm (1.5783 – 1.5823 in.)
Minimum	40.13 mm (1.5799 in.)	39.94 mm (1.5724 in.)

If the cam lobe height is less than minimum, replace the camshaft.

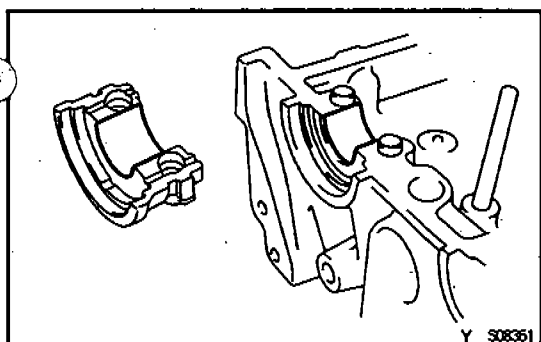
**16. INSPECT CAMSHAFT JOURNALS**

Using a micrometer, measure the journal diameter.

Journal diameter:

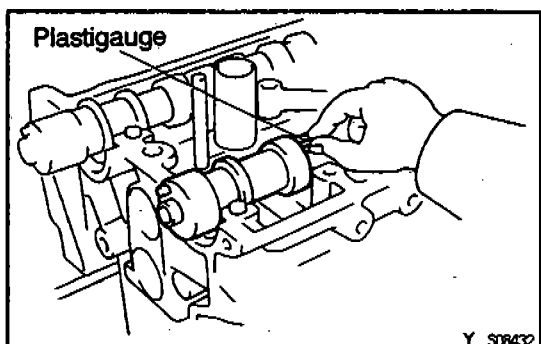
26.949 – 26.965 mm (1.0610 – 1.0616 in.)

If the journal diameter is not as specified, check the clearance.

**17. INSPECT CAMSHAFT BEARINGS**

Check that bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

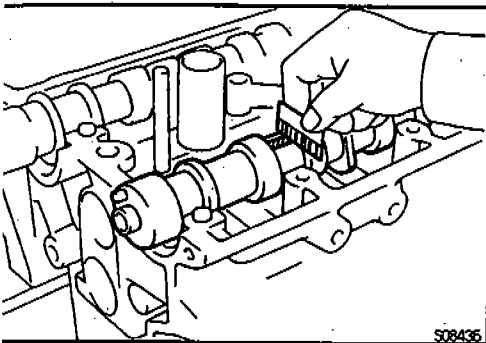
**18. INSPECT CAMSHAFT JOURNAL OIL CLEARANCE**

- (a) Clean the bearing caps and camshaft journals.
- (b) Place the camshaft on the cylinder head.
- (c) Lay a strip of Plastigauge across each of the camshaft journals.
- (d) Install the bearing caps.

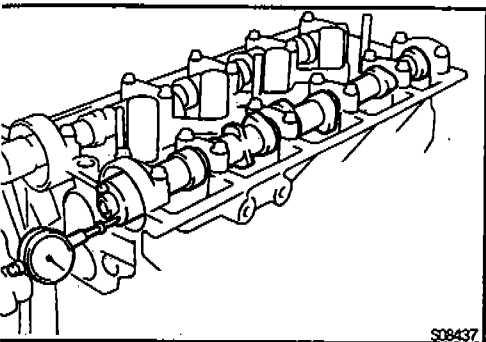
(See step 3 in installation)

Torque: 17 N·m (175 kgf·cm, 13 ft·lbf)

NOTICE: Do not turn the camshaft.



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- (e) Remove the bearing caps.
 - (f) Measure the Plastigage at its widest point.
- Oil clearance:**

Standard	0.035–0.072 mm (0.0014–0.0028 in.)
Maximum	0.10 mm (0.0039 in.)

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

- (g) Completely remove the Plastigage.

19. INSPECT CAMSHAFT THRUST CLEARANCE

- (a) Install the camshaft.
(See step 3 in installation)
- (b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Thrust clearance:

Standard	0.080–0.190 mm (0.0031–0.0075 in.)
Maximum	0.25 mm (0.0098 in.)

If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

20. INSPECT VALVE LIFTERS AND LIFTER BORES

- (a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

Lifter bore diameter:

23.500 – 23.521 mm (0.9252 – 0.9260 in.)

- (b) Using a micrometer, measure the lifter diameter.

Lifter diameter:

23.475 – 23.485 mm (0.9242 – 0.9246 in.)

- (c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

Oil clearance:

Standard	0.015–0.046 mm (0.0006–0.0018 in.)
Maximum	0.10 mm (0.0039 in.)

If the oil clearance is greater than maximum, replace the lifter. If necessary, replace the cylinder head.

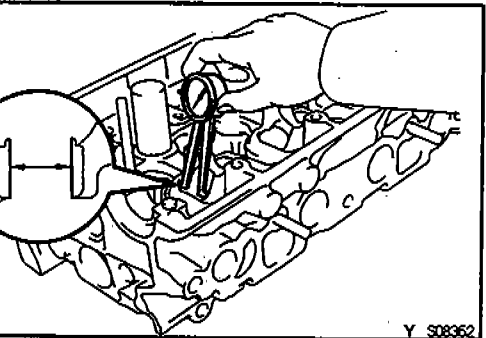
21. INSPECT INTAKE AND EXHAUST MANIFOLDS

Using a precision straight edge and thickness gauge, measure the surface contacting the cylinder head for warpage.

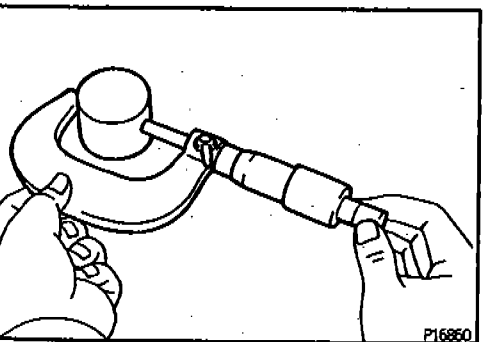
Maximum warpage:

Intake	0.10 mm (0.0039 in.)
Exhaust	0.30 mm (0.0118 in.)

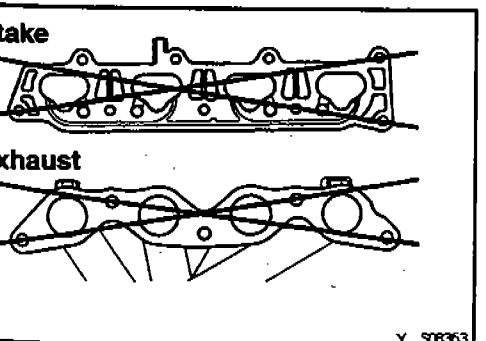
If warpage is greater than maximum, replace the manifold.



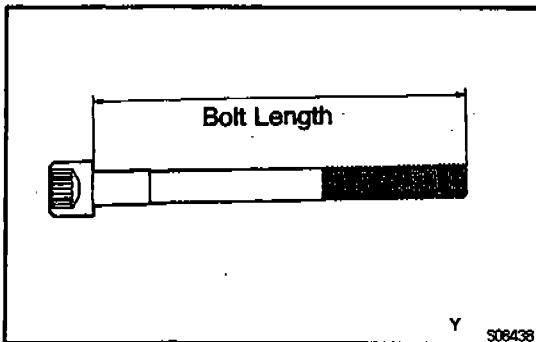
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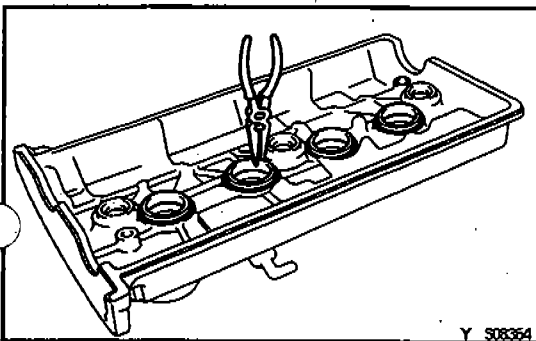
**22. INSPECT CYLINDER HEAD BOLT**

Check the head bolt length.

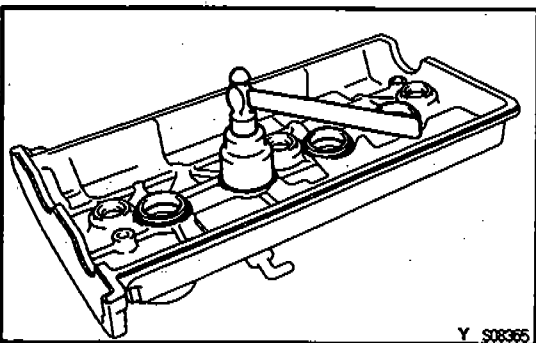
Bolt length:

Standard	114.0 – 115.0 mm (4.4882 – 4.5276 in.)
Maximum	116.5 mm (4.5866 in.)

If length greater than maximum, replace the head bolt.

**23. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKETS**

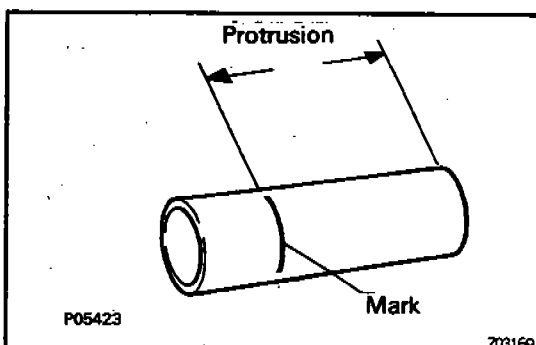
- (a) Using a needle-nose pliers, pry out the tube gasket.



- (b) Using a 32 mm socket wrench and a hammer, tap in a new tube gasket as shown in the illustration.
- (c) Apply a light coat of MP grease to the gasket lip.

REASSEMBLY**HINT:**

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.

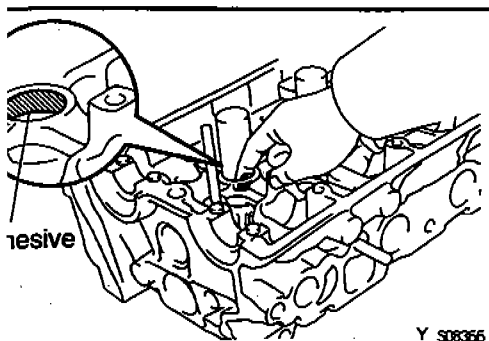
**1. INSTALL SPARK PLUG TUBES**

HINT: When using a new cylinder head, spark plug tubes must be installed.

- (a) Mark the standard position away from the edge, onto the spark plug tube.

Standard protrusion:

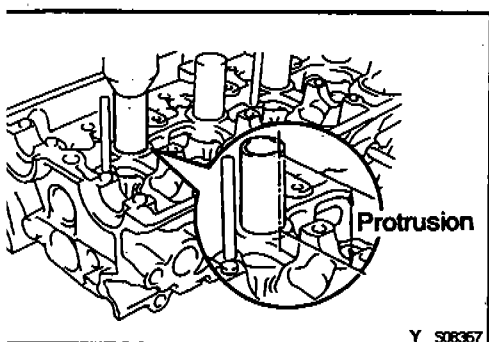
33.1 – 33.9 mm (1.303 – 1.335 in.)



- (b) Apply adhesive to the spark plug tube hole of the cylinder head.

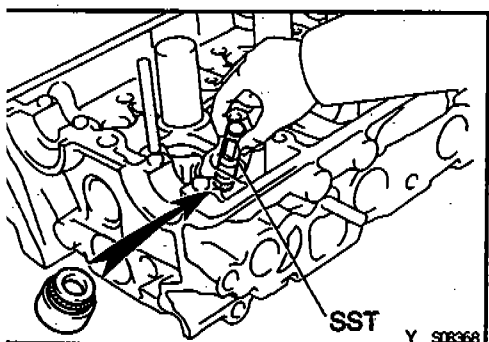
Sealant:

Part No.08833-00070, Adhesive 1324, THREE BOND 1324 or equivalent



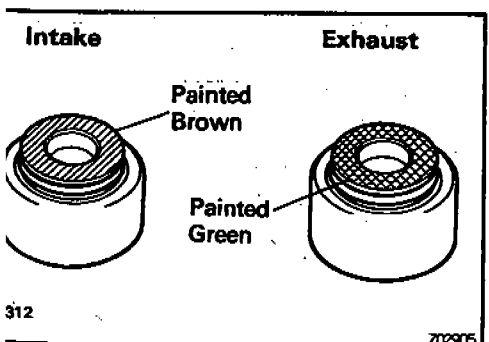
- (c) Using a press, press in a new spark plug tube until there is 33.1 – 33.9 mm (1.303 – 1.335 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

NOTICE: Avoid pressing a new spark plug tube in too far by measuring the amount of protrusion while pressing.

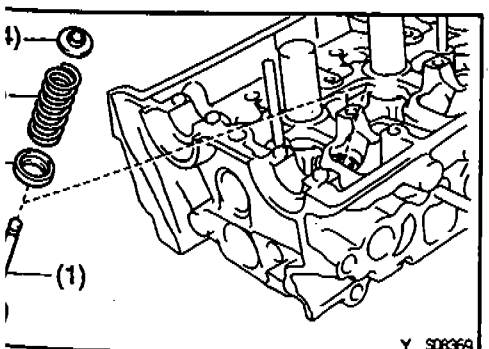


2. INSTALL VALVES

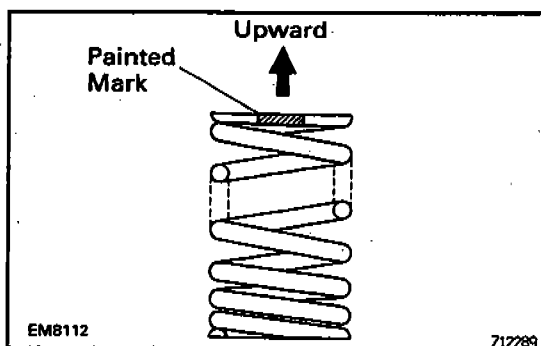
- (a) Using SST, push in a new oil seal.
SST 09201-41020



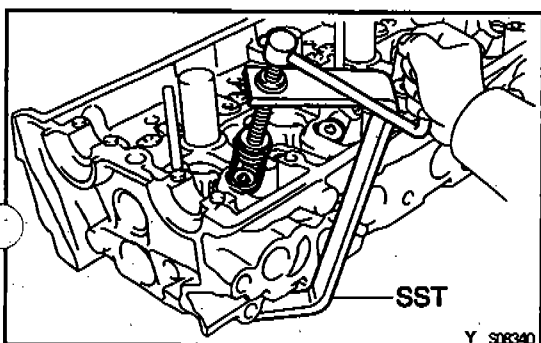
HINT: The intake valve oil seal is gray and the exhaust valve oil seal is green.



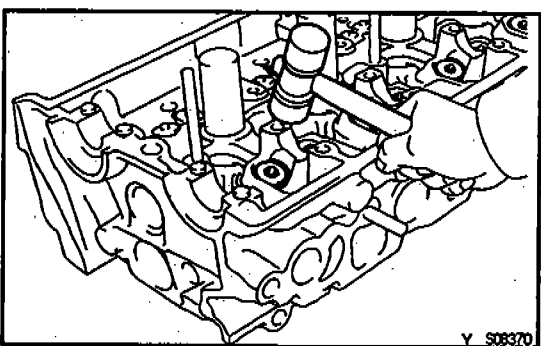
- (b) Install these parts:
- (1) Valve
 - (2) Spring seat
 - (3) Valve spring
 - (4) Spring retainer



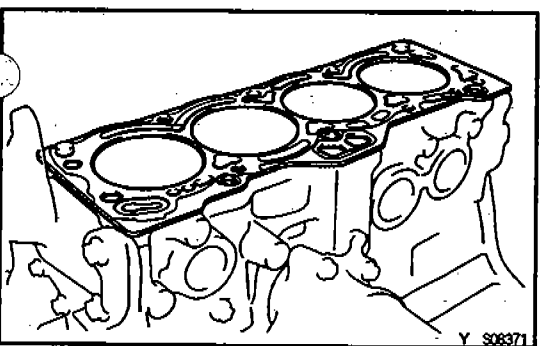
HINT: Install the valve spring, facing the printed mark upward.



- (c) Using SST, compress the valve spring and place the keepers around the valve stem.
SST 09202-70020, 09202-00020



- (d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.
- 3. INSTALL VALVE LIFTERS AND SHIMS**
- (a) Install the adjusting shim and valve lifter.
(b) Check that the valve lifter rotates smoothly by hand.

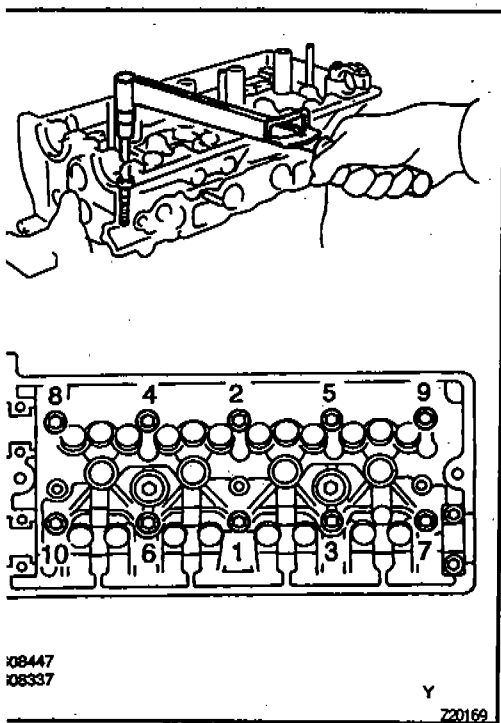


INSTALLATION

1. INSTALL CYLINDER HEAD GASKET

Place a new cylinder head gasket in position on the cylinder block.

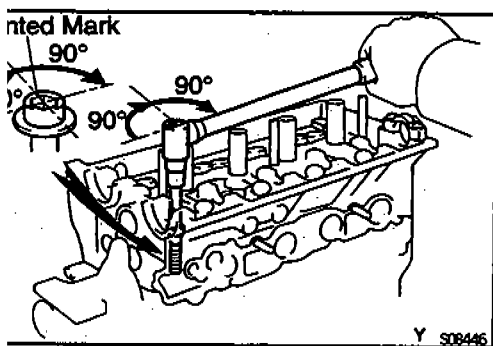
NOTICE: Be careful of the installation direction.



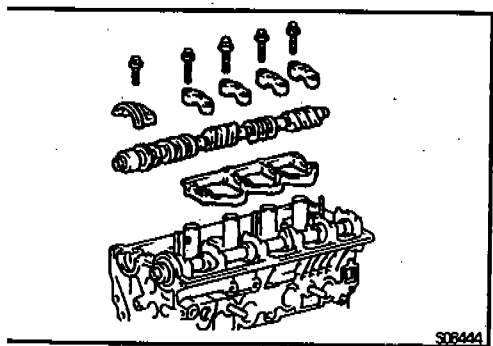
2. INSTALL CYLINDER HEAD

HINT:

- The cylinder head bolts are tightened in 3 progressive steps (steps (c), (e) and (f)).
 - If any bolts is broken or deformed, replace it.
- (a) Place the cylinder head in position on the cylinder head gasket.
 - (b) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
 - (c) Install and uniformly tighten the 10 cylinder head bolts, in several passes, in the sequence shown.
Torque: 30 N·m (300 kgf·cm, 22 ft·lbf)
If any one of the bolts does not meet the torque specification, replace the bolt.

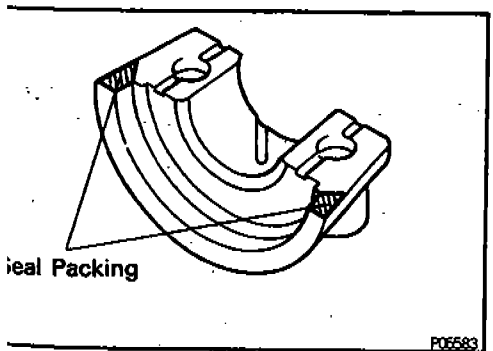


- (d) Mark the front of the cylinder head bolt head with paint.
- (e) Retighten the cylinder head bolts 90° in the numerical order shown.
- (f) Retighten cylinder head bolts by an additional 90°.
- (g) Check that the painted mark is now facing rearward.



3. INSTALL CAMSHAFTS

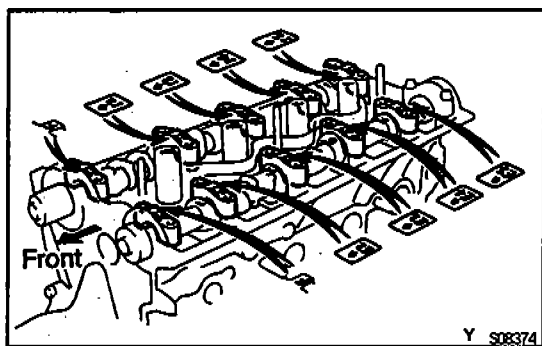
- (a) Intake side:
Install the No.5 bearing cap to the cylinder head.
- (b) Place the 2 camshaft on the cylinder head.
HINT: Exhaust camshaft has slit and intake camshaft does not.



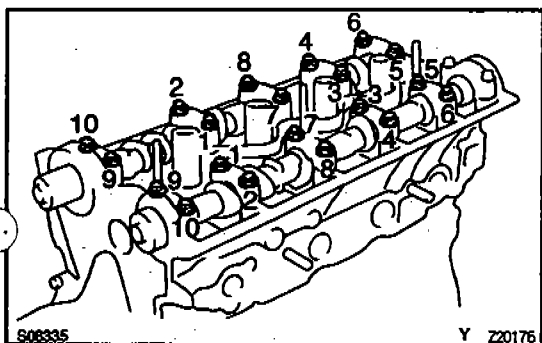
- (c) Remove any old packing (FIPG) material.
- (d) Apply seal packing to the No.1 and No.6 bearing caps as shown in the illustration.

Seal packing:

Part No. 08826-00080 or equivalent

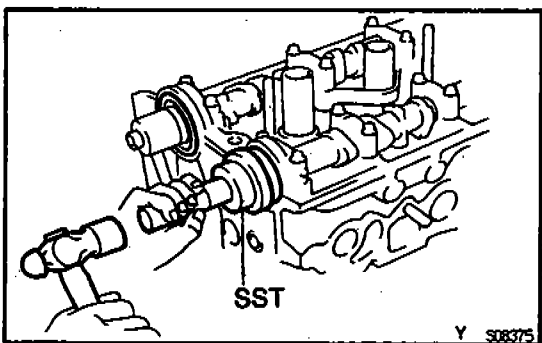


- (e) Install the bearing caps in their proper locations.
HINT: Each bearing cap has a number and front mark.



- (f) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(g) Install and uniformly tighten the 10 bearing cap bolts, several passes, in the sequence shown.
Torque: 17 N·m (175 kgf·cm, 13 ft·lbf)

4. CHECK AND ADJUST VALVE CLEARANCE
(See valve clearance)



5. INSTALL OIL SEAL

- (a) Apply MP grease to a new oil seal lip.
(b) Using SST, tap in the oil seal.

SST 09223-46011

NOTICE:

- Do not install the oil seal with the lip facing the wrong direction.
- Insert the oil seal into the deepest part of the cylinder head.

6. INSTALL NO.4 TIMING BELT COVER

Install the No.4 timing belt cover with 3 bolts.

Torque: 9.5 N·m (95 kgf·cm, 82 in·lbf)

7. INSTALL ENGINE MOUNTING STAY

Torque: 35 N·m (350 kgf·cm, 25 ft·lbf)

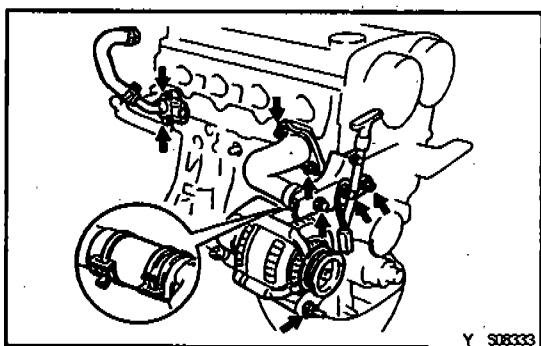
8. INSTALL CAMSHAFT TIMING PULLEYS

(See timing belt)

9. INSTALL CYLINDER HEAD COVER

(See timing belt)

Torque: 8 N·m (80 kgf·cm, 69 in·lbf)



10. INSTALL ISC VALVE

11. INSTALL NO.2 WATER INLET

- (a) Place a new gasket to the cylinder head, facing the protrusion upward.

- (b) Connect the inlet hose to the water pump.

- (c) Install the No.2 water outlet with the 2 nuts.

Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)

12. INSTALL ALTERNATOR ADJUSTING BAR

13. INSTALL OIL DIPSTICK GUIDE AND DIPSTICK

- (a) Install a new O-ring to the dipstick guide.
- (b) Apply soapy water to the O-ring.
- (c) Push in the dipstick guide together with the dipstick, and install them with the bolt and ground strap.

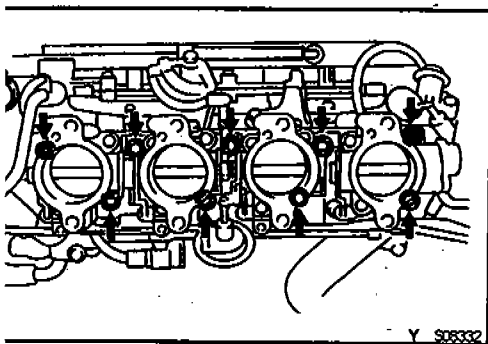
Torque: 9.5 N·m (95 kgf·cm, 82 in.-lbf)

14. INSTALL INTAKE MANIFOLD

- (a) Install a new gasket, the intake manifold with the 7 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.

Torque: 22 N·m (220 kgf·cm, 16 ft-lbf)

- (b) Connect the ISC hose and PCV hose.

**15. INSTALL NO.2 ENGINE HANGER**

- (a) Install the No.2 engine hanger and ground strap with the 2 bolts.

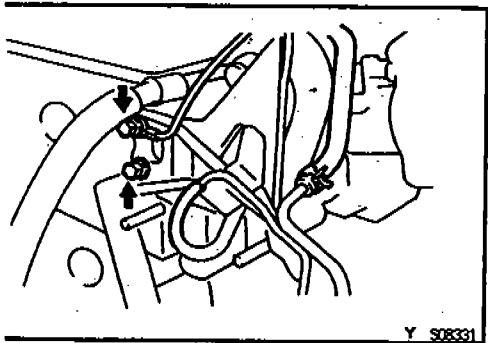
Torque: 22 N·m (220 kgf·cm, 16 ft-lbf)

- (b) Connect the fuel return hose and vacuum hose to the No.2 engine hanger.

16. INSTALL INTAKE MANIFOLD STAYS

Install the manifold stays with the 5 bolts.

Torque: 22 N·m (220 kgf·cm, 16 ft-lbf)

**17. INSTALL ENGINE WIRE PROTECTOR**

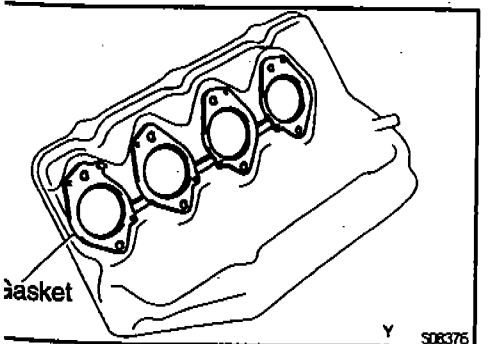
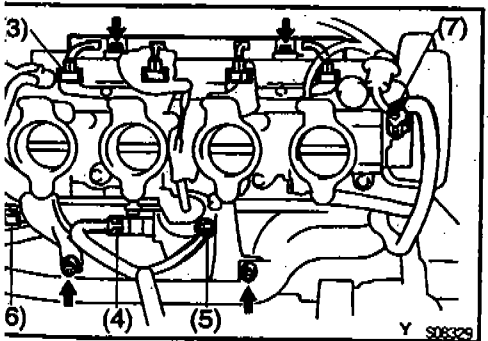
- (a) Install the engine wire protectors with the 2 bolts and 2 nuts.

- (b) Connect these connectors and wire:

- Throttle position sensor connector
- Knock sensor connectors
- VSV for EVAP connector
- Injector connectors
- Alternator wire
- Alternator wire connector

18. INSTALL SURGE TANK

- (a) Install the gasket to the surge tank.
- (b) Install the surge tank to the throttle body.
- (c) Connect the vacuum hose and ISC hose to the surge tank.
- (d) Install the 4 intake pipes with the 8 bolts.
- (e) Install the gasket to the surge tank.
- (f) Install the surge tank cover with the 5 bolts.
- (g) Connect the cord clip to the surge tank cover.



19. INSTALL WATER INLET AND INLET HOUSING

- (a) Install a new gasket, the water inlet and inlet housing assembly with the bolt and 2 nuts.

Torque: 22 N·m (220 kgf·cm, 16 ft·lbf)

- (b) Connect the 2 water bypass hoses.
- (c) Install the ground wire with the bolt.
- (d) Connect these connectors:
- Water temperature sender gauge connector
 - Water temperature switch connector
 - Water temperature sensor connector

20. INSTALL OIL SWITCHING VALVE (OSV)

- (a) Install a new O-ring to the OSV.

- (b) Install the OSV with the 2 bolt.

Torque: 9.5 N·m (95 kgf·cm, 82 in·lbf)

21. INSTALL WATER OUTLET

Install a new gasket and the water outlet with the 2 bolts

Torque: 22 N·m (220 kgf·cm, 16 ft·lbf)

22. INSTALL EXHAUST MANIFOLD

- (a) Install a new gasket, the exhaust manifold with the 2 bolts and 3 nuts. Uniformly tighten the bolts and nuts in several passes.

Torque: 50 N·m (500 kgf·cm, 36 ft·lbf)

- (c) Install the manifold stay with the 2 bolts. Alternately tighten the bolts.

Torque: 45 N·m (450 kgf·cm, 33 ft·lbf)

- (d) Install the upper heat insulator with the 3 bolts.

Torque: 9.5 N·m (95 kgf·cm, 82 in·lbf)

23. INSTALL DISTRIBUTOR**24. INSTALL TIMING BELT**

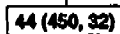
(See timing belt)

25. ADJUST DRIVE BELT

(See CH section)

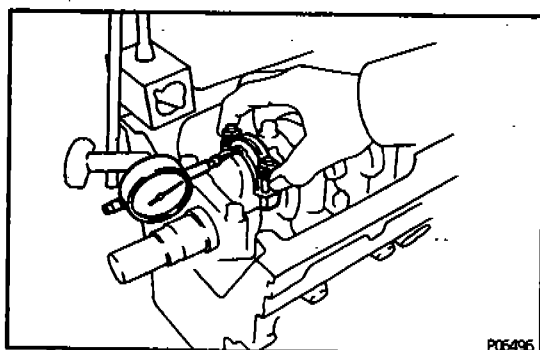
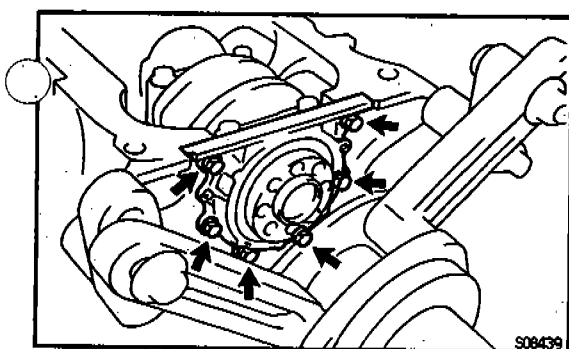
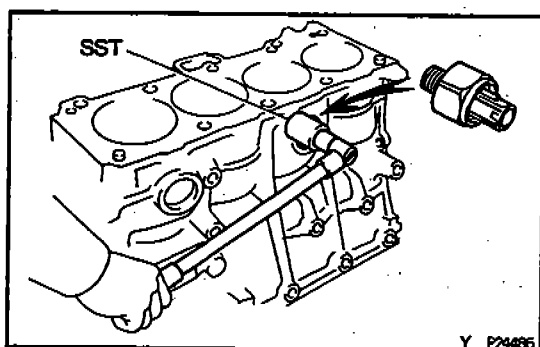
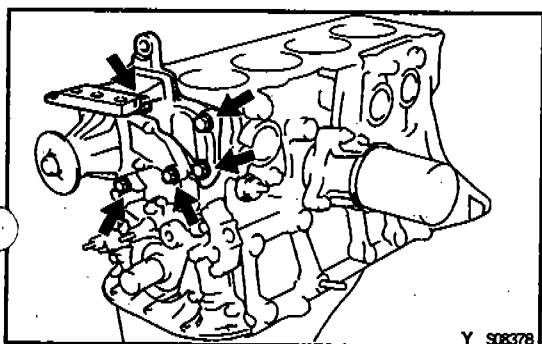
26. FILL WITH ENGINE COOLANT

CYLINDER BLOCK COMPONENTS



DISASSEMBLY

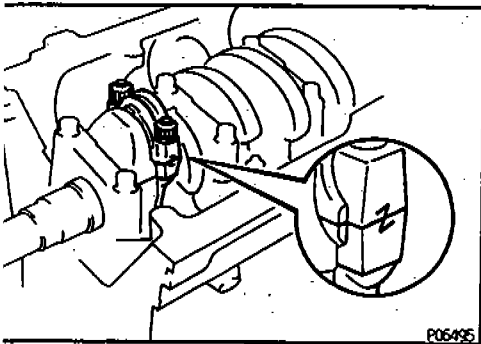
1. **REMOVE FLYWHEEL**
Remove the 6 bolts and flywheel.
2. **REMOVE REAR END PLATE**
Remove the bolt and end plate.
3. **INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY**
4. **REMOVE TIMING BELT AND PULLEYS**
(See timing belt)
5. **REMOVE CYLINDER HEAD**
(See cylinder head)
6. **REMOVE ALTERNATOR BRACKET**
Remove the 2 bolts, nut and alternator bracket.
7. **REMOVE RH ENGINE MOUNTING BRACKET**
Remove the 3 bolts and mounting bracket.
8. **REMOVE WATER PUMP**
 - (a) Remove the 2 bolts and water pump.
 - (b) Remove the O-ring.
9. **REMOVE OIL FILTER**
(See LU section)
10. **REMOVE OIL PRESSURE SWITCH**
(See LU section)
11. **REMOVE OIL FILTER BRACKET**
12. **REMOVE KNOCK SENSOR**
Using SST, remove the knock sensor.
SST 09816-30010
13. **REMOVE OIL PAN AND OIL PUMP**
(See LU section)



14. **REMOVE REAR OIL SEAL RETAINER**
Remove the 6 bolts, retainer and gasket.

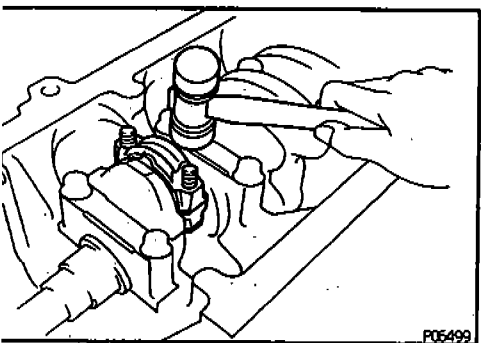
15. **CHECK CONNECTING ROD THRUST CLEARANCE**
Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.
Thrust clearance:

Standard	0.15 - 0.25 mm (0.0059 - 0.0098 in.)
Maximum	0.30 mm (0.0118 in.)

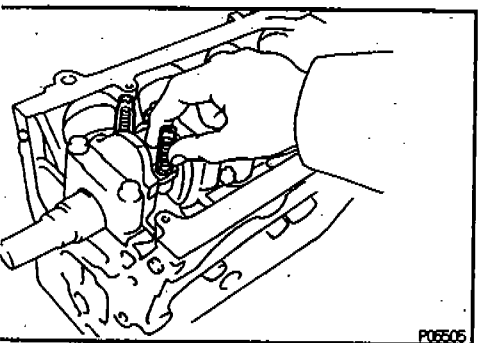


16. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

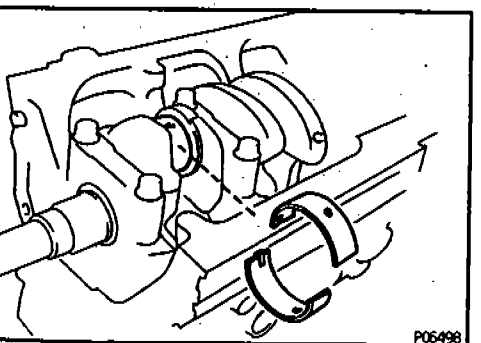
- (a) Check the matchmarks on the connecting rod and cap to ensure correct reassembly.
- (b) Remove the connecting rod cap nuts.



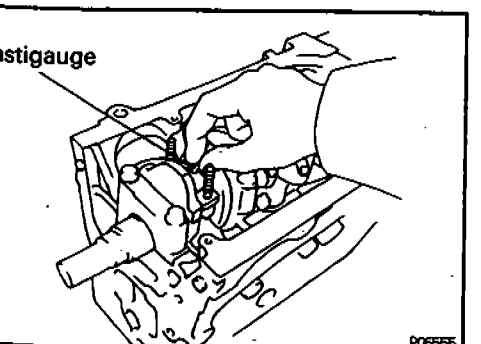
- (c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.
HINT: Keep the lower bearing inserted with the connecting rod cap.



- (d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



- (e) Clean the crank pin and bearing.
- (f) Check the crank pin and bearing for pitting and scratches. If the crank pin or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



- (g) Lay a strip of Plastigauge across the crank pin.
- (h) Install the connecting rod cap.
(See step 10 and 11 in reassembly)

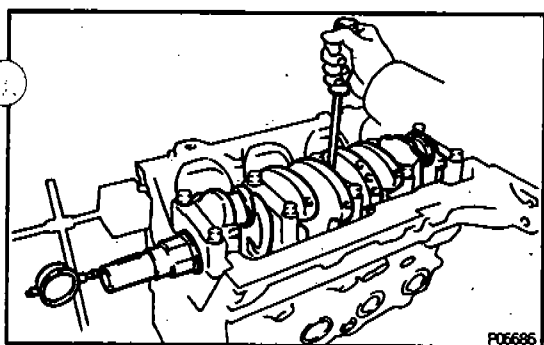
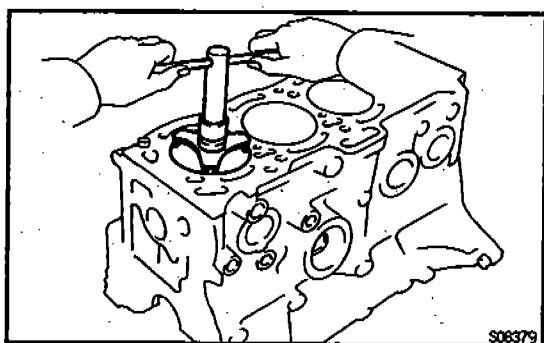
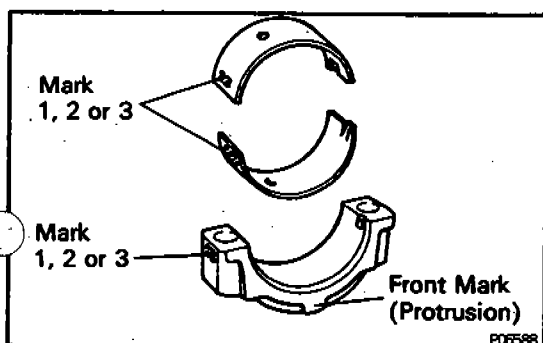
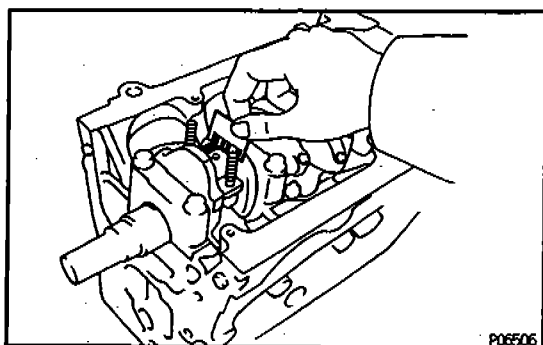
Torque:

1st: 29 N·m (300 kgf·cm, 22 ft·lbf)

2nd: Turn extra 90°

NOTICE: Do not turn the crankshaft.

- (i) Remove the connecting rod cap.
(See procedure (b) and (c) previous page)



- (j) Measure the Plastigage at its widest point.
Standard oil clearance:

Item	STD	U/S 0.25
Standard	0.030 – 0.061 mm (0.0012 – 0.0024 in.)	0.019 – 0.073 mm (0.0007 – 0.0029 in.)
Maximum	0.08 mm (0.0031 in.)	0.08 mm (0.0031 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.
HINT: If using a standard bearing, replace it with one having the same number marked on the connecting rod cap. There are 3 sizes of standard bearings, marked "1", "2", and "3" accordingly.

Standard sized bearing center wall thickness:

Mark "1"	1.486 – 1.490 mm (0.0585 – 0.0587 in.)
Mark "2"	1.490 – 1.494 mm (0.0587 – 0.0588 in.)
Mark "3"	1.494 – 1.498 mm (0.0588 – 0.0590 in.)

- (k) Completely remove the Plastigage.

17. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

- Using a ridge reamer, remove all the carbon from the top of the cylinder.
- Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.
- Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in correct order.

18. CHECK CRANKSHAFT THRUST CLEARANCE

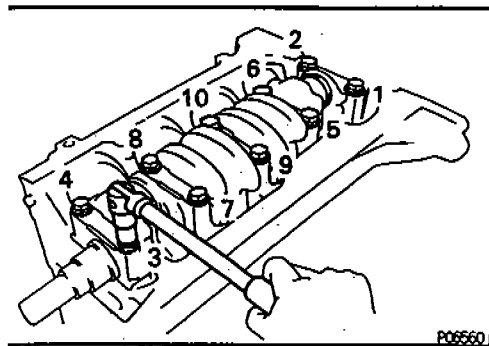
Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.
Thrust clearance:

Standard	0.020 – 0.220 mm (0.0008 – 0.0087 in.)
Maximum	0.30 mm (0.0118 in.)

If the thrust clearance is greater than maximum, replace the thrust washers as a set.

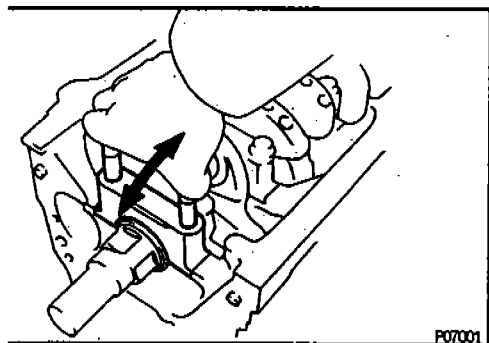
Thrust washer thickness:

2.440 – 2.490 mm (0.0961 – 0.0980 in.)



19. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

- (a) Uniformly loosen and remove the main bearing cap bolts, in several passes, in the sequence shown.



- (b) Using the removed main bearing cap bolts, pry the main bearing cap back and forth, and remove the main bearing caps, lower bearings and lower thrust washers (No.3 main bearing cap only).

HINT:

- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.

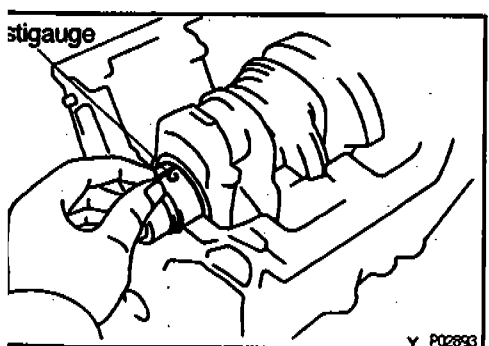
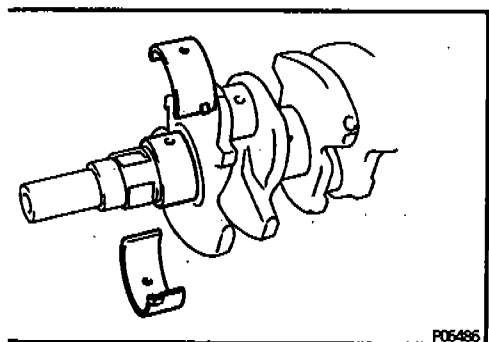
- (c) Lift out the crankshaft.

HINT: Keep the upper bearings and upper thrust washers together with the cylinder block.

- (d) Clean each main journal and bearing.

- (e) Check each main journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.

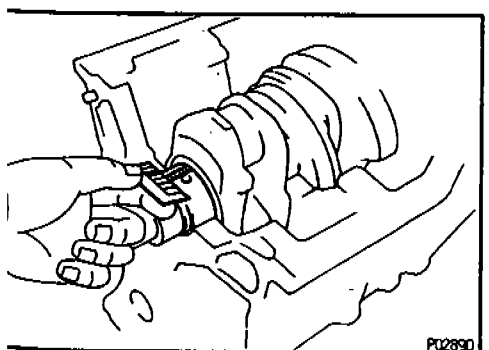


- (f) Place the crankshaft on the cylinder block.
 (g) Lay a strip of Plastigage across each journal.
 (h) Install the main bearing caps.
 (See step 7 in reassembly)

Torque: 60 N·m (610 kgf·cm, 44 ft·lbf)

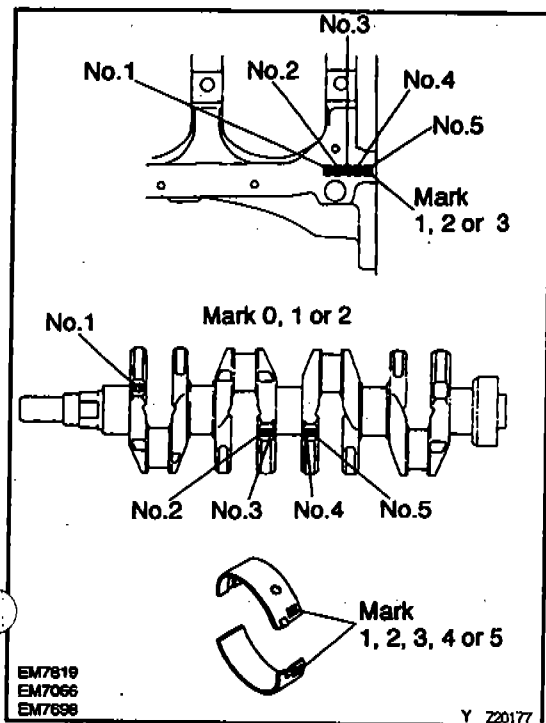
NOTICE: Do not turn the crankshaft.

- (i) Remove the main bearing caps.
 (See procedure (a) and (b) on the previous page)



- (j) Measure the Plastigage at its widest point.
Clearance:

Item	STD	U/S 0.25
Standard	0.015 - 0.045 mm (0.0006 - 0.0018 in.)	0.015 - 0.053 mm (0.0006 - 0.0021 in.)
Maximum	0.08 mm (0.0031 in.)	0.08 mm (0.0031 in.)



HINT: If replacing the cylinder block subassembly, the bearing standard clearance will be: 0.015 – 0.045 mm (0.0006 – 0.0018 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.

HINT: If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then selecting the bearing with the same number as the total. There are 5 sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

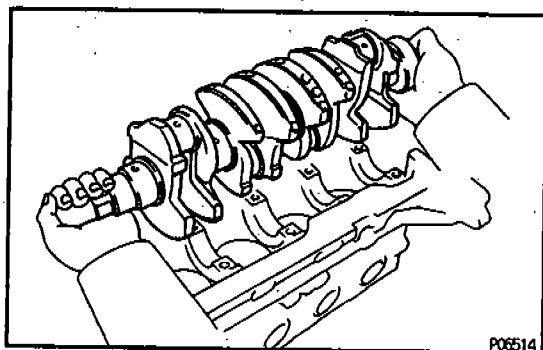
	Number marked									
	1			2			3			
Cylinder block										
Crankshaft	0	1	2	0	1	2	0	1	2	
Use bearing	1	2	3	2	3	4	3	4	5	

EXAMPLE: Cylinder block "2" + Crankshaft "1"
= Total number 3 (Use bearing "3")

- Reference -

	Mark	mm (in.)
Cylinder block main journal bore diameter	"1"	52.025 – 52.031 (2.0482 – 2.0485)
	"2"	52.031 – 52.037 (2.0485 – 2.0487)
	"3"	52.037 – 52.043 (2.0487 – 2.0489)
Crankshaft journal diameter	"0"	47.994 – 48.000 (1.8895 – 1.8898)
	"1"	47.988 – 47.994 (1.8893 – 1.8895)
	"2"	47.982 – 47.988 (1.8891 – 1.8893)
Standard sized bearing center wall thickness	"1"	2.002 – 2.005 (0.0788 – 0.0789)
	"2"	2.005 – 2.008 (0.0789 – 0.0791)
	"3"	2.008 – 2.011 (0.0791 – 0.0792)
	"4"	2.011 – 2.014 (0.0792 – 0.0793)
	"5"	2.014 – 2.017 (0.0793 – 0.0794)

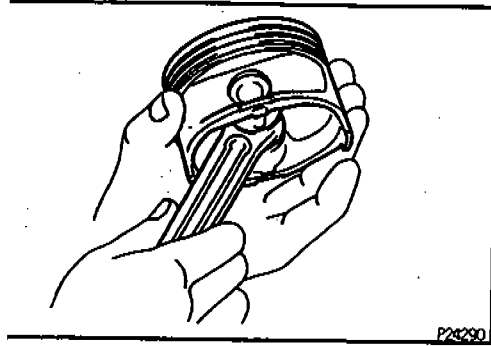
(k) Completely remove the Plastigage.



20. REMOVE CRANKSHAFT

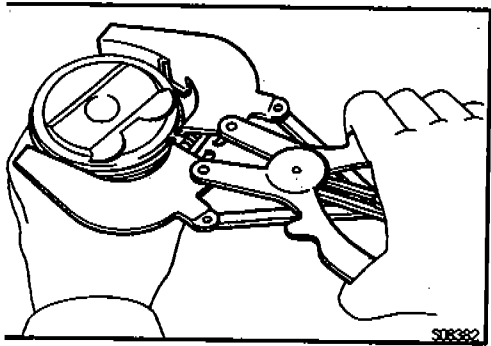
- Lift out the crankshaft.
- Remove the upper bearings and upper thrust washers from the cylinder block.

HINT: Arrange the main bearing caps, bearings and thrust washers in correct order.



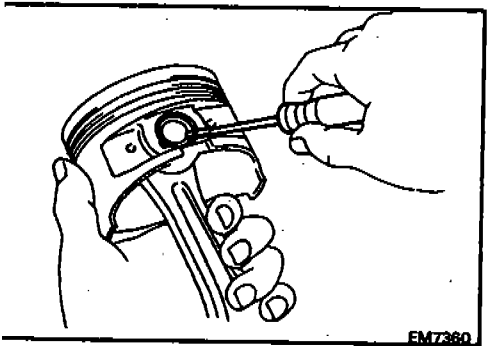
21. CHECK FIT BETWEEN PISTON AND PISTON PIN

Try to move the piston back and forth on the piston pin. If any movement is felt, replace the piston and pin as a set.



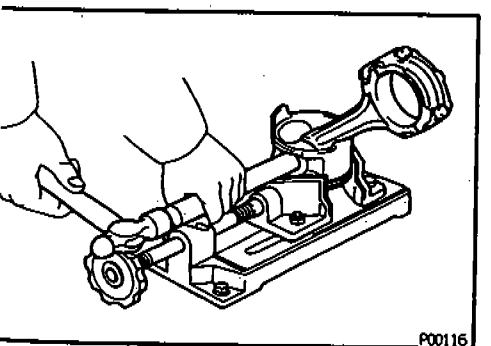
22. REMOVE PISTON RINGS

- (a) Using a piston ring expander, remove the 2 compression rings.
 - (b) Remove the 2 side rails and oil ring by hand.
- HINT: Arrange the piston rings in correct order only.



23. DISCONNECT CONNECTING ROD FROM PISTON

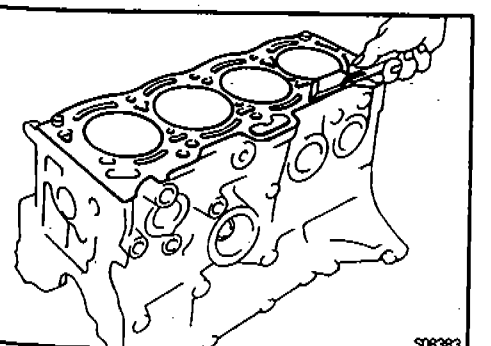
- (a) Using a small screwdriver, pry out the 2 snap rings.
- (b) Gradually heat the piston to approx. 60°C (140°F).



- (c) Using a plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

HINT:

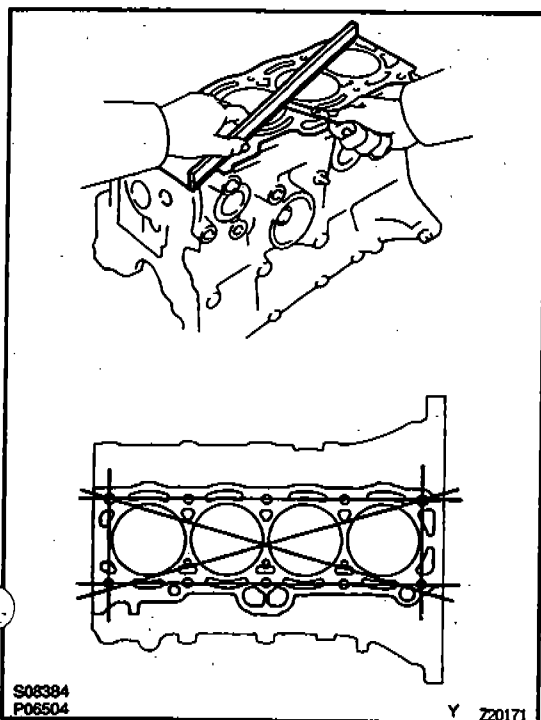
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.



INSPECTION

1. CLEAN CYLINDER BLOCK

- (a) Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
- (b) Using a soft brush and solvent, thoroughly clean the cylinder block.



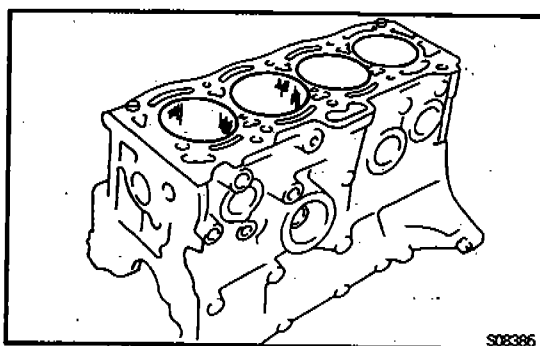
2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

Using a precision straight edge and thickness gauge measure the surfaces contacting the cylinder head gasket for warpage.

Maximum warpage:

0.05 mm (0.0020 in.)

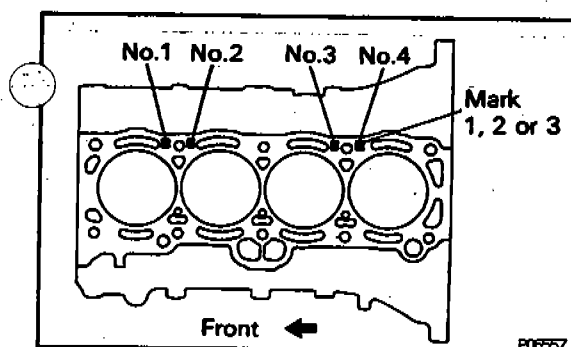
If warpage is greater than maximum, replace the cylinder block.



3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

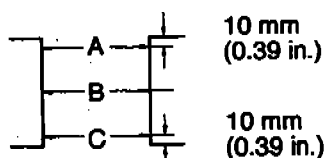
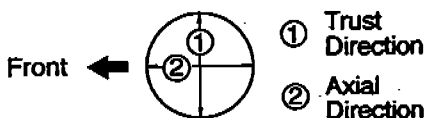
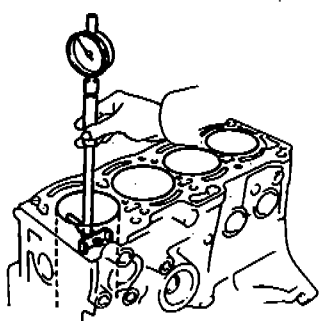
Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all the 4 cylinders. If necessary, replace the cylinder block.



4. INSPECT CYLINDER BORE DIAMETER

HINT: There are 3 sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the top of the cylinder block.



Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

Standard diameter:

STD Mark "1"	81.000 – 81.010 mm (3.1890 – 3.1894 in.)
STD Mark "2"	81.010 – 81.020 mm (3.1894 – 3.1898 in.)
STD Mark "3"	81.020 – 81.030 mm (3.1898 – 3.1902 in.)

Maximum diameter:

STD	81.23 mm (3.1980 in.)
O/S 0.50	81.73 mm (3.2177 in.)

If the diameter is greater than maximum, rebore all the 4 cylinders. If necessary, replace the cylinder block.

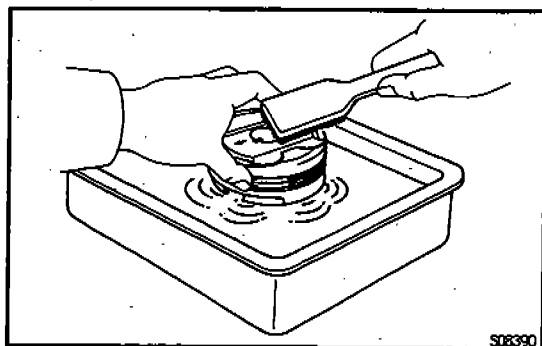
5. REMOVE CYLINDER RIDGE

If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.

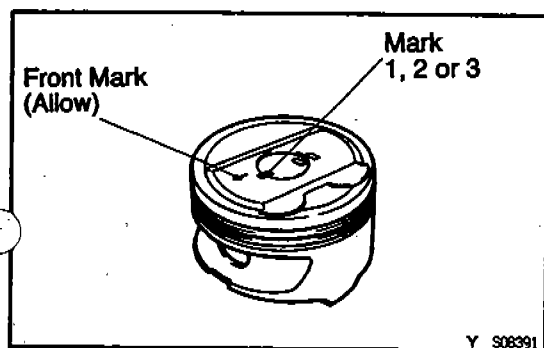
6. CLEAN PISTON

- (a) Using a gasket scraper, remove the carbon from the piston top.

- (b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.

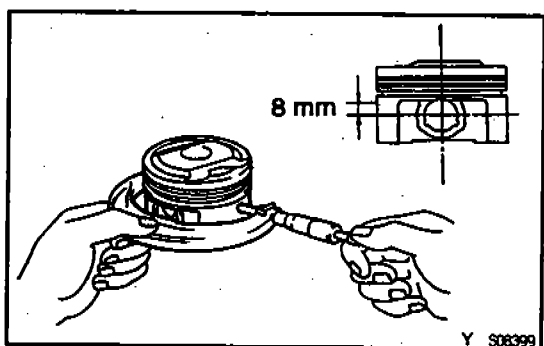


- (c) Using solvent and a brush, thoroughly clean the piston.
NOTICE: Do not use a wire brush.



7. INSPECT PISTON OIL CLEARANCE

HINT: There are 3 sizes of the standard piston diameter marked "1", "2" and "3" accordingly. The mark is stamped on the piston top.



- (a) Using a micrometer, measure the piston diameter at right angles to the piston head, 8.0 mm (0.315 in.) from the piston pin center line.

Piston diameter:

STD Mark "1"	80.895 - 80.905 mm (3.1849 - 3.1852 in.)
STD Mark "2"	80.905 - 80.915 mm (3.1852 - 3.1856 in.)
STD Mark "3"	80.915 - 80.925 mm (3.1856 - 3.1860 in.)
O/S 0.50	81.500 - 81.530 mm (3.2087 - 3.2098 in.)

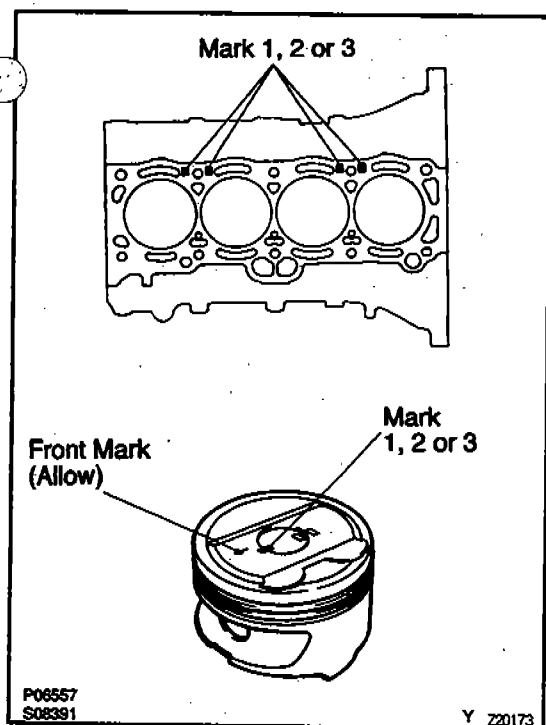
- (b) Measure the cylinder bore diameter in the thrust directions. (See step 4)
(c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

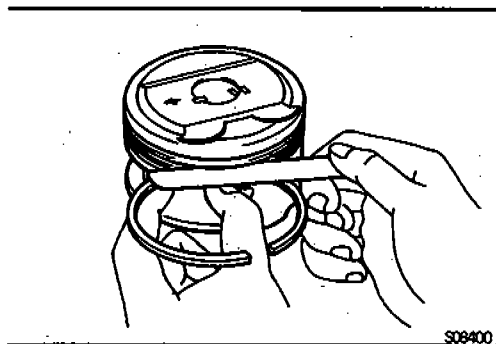
Oil clearance:

Standard	0.095 - 0.115 mm (0.0037 - 0.0045 in.)
Maximum	0.13 mm (0.0051 in.)

If the oil clearance is greater than maximum, replace the 4 pistons and rebores all the 4 cylinders. If necessary, replace the cylinder block.

HINT (Use new cylinder block): Use a piston with the same number mark as the cylinder bore diameter marked on the cylinder block.





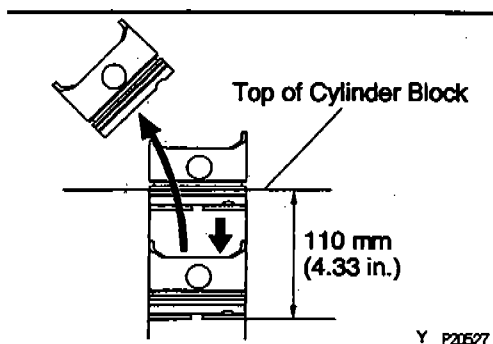
8. INSPECT PISTON RING GROOVE CLEARANCE

Using a thickness gauge, measure the clearance between new piston ring and the wall of the ring groove.

Ring groove clearance:

No.1	0.040–0.080 mm (0.0016–0.0031 in.)
No.2	0.030–0.070 mm (0.0012–0.0028 in.)
OIL	
Teikoku made	0.020–0.160 mm (0.0008–0.0063 in.)
Riken made	0.030–0.110 mm (0.0012–0.0043 in.)

If the clearance is greater than maximum, replace the piston.



9. INSPECT PISTON RING END GAP

- Insert the piston ring into the cylinder bore.
- Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.
- Using a thickness gauge, measure the end gap.

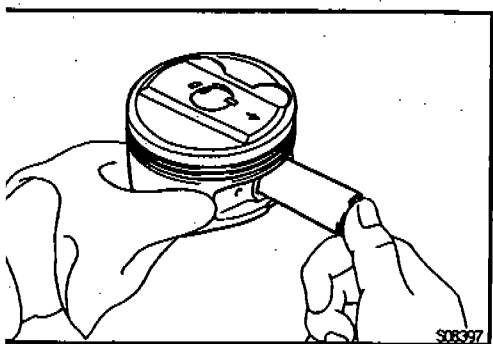
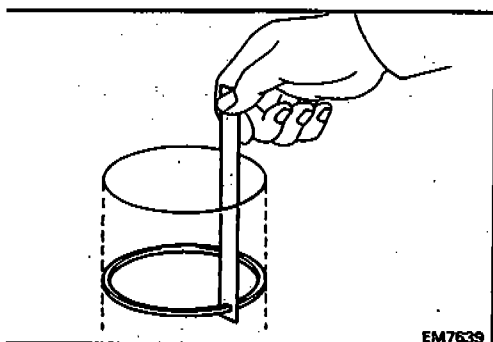
Standard end gap:

	Riken made mm (in.)	Teikoku made mm (in.)
No.1	0.250–0.350 (0.0098–0.0138)	0.280–0.350 (0.0110–0.0138)
No.2	0.350–0.500 (0.0138–0.0197)	0.350–0.450 (0.0138–0.0177)
Oil (Side rail)	0.100–0.350 (0.0039–0.0138)	0.150–0.400 (0.0059–0.0157)

Maximum end gap:

No.1	0.95 mm (0.0374 in.)
No.2	1.05 mm (0.0413 in.)
Oil (Side rail)	1.00 mm (0.0394 in.)

If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, rebore all the 4 cylinders or replace the cylinder block.



10. INSPECT PISTON PIN FIT

At 60°C (140°F), you should be able to push the piston pin into the piston pin hole with your thumb.

11. INSPECT CONNECTING ROD ALIGNMENT

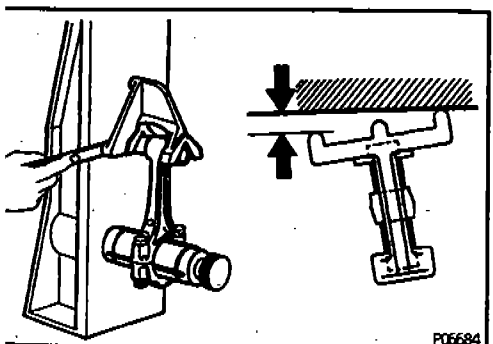
Using a rod aligner and thickness gauge, check the connecting rod alignment.

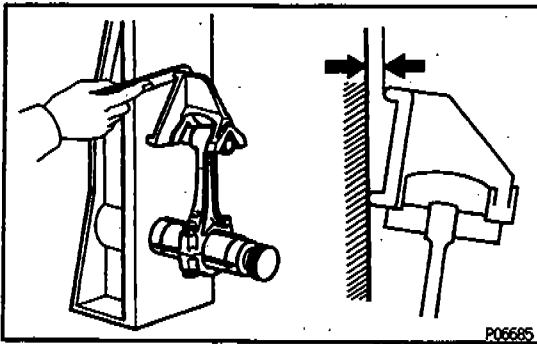
- Check for out-of-alignment.

Maximum out-of-alignment:

0.03 mm (0.0012 in.) per 100 mm (3.94 in.)

If bend is greater than maximum, replace the connecting rod assembly.



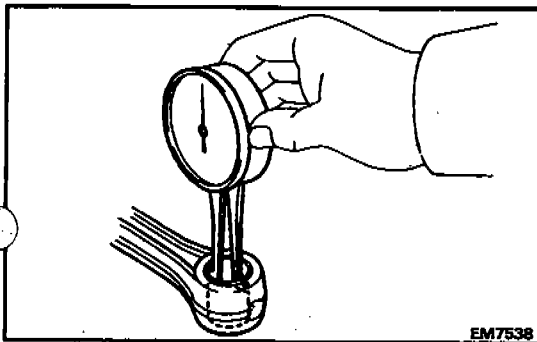


- Check for twist

Maximum twist:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If twist is greater than maximum, replace the connecting rod assembly.

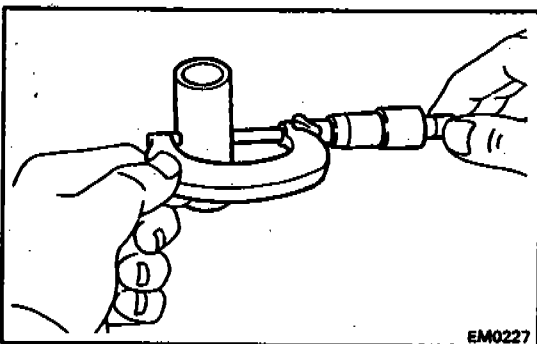


12. INSPECT PISTON PIN OIL CLEARANCE

- (a) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

Bushing inside diameter:

20.010 – 20.022 mm (0.7878 – 0.7883 in.)



- (b) Using a micrometer, measure the piston pin diameter.

Piston pin diameter:

20.004 – 20.016 mm (0.7876 – 0.7880 in.)

- (c) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

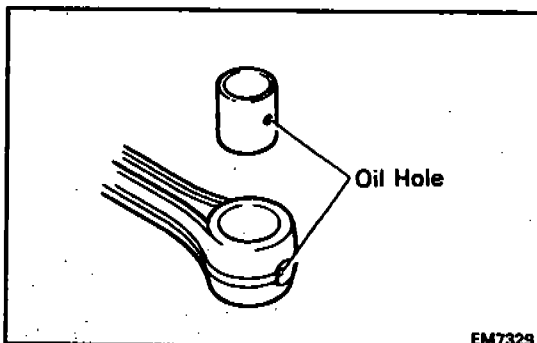
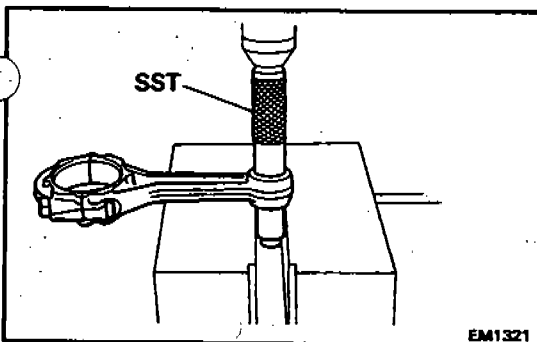
Oil clearance:

Standard	0.004 – 0.008 mm (0.0002 – 0.0003 in.)
Maximum	0.05 mm (0.0020 in.)

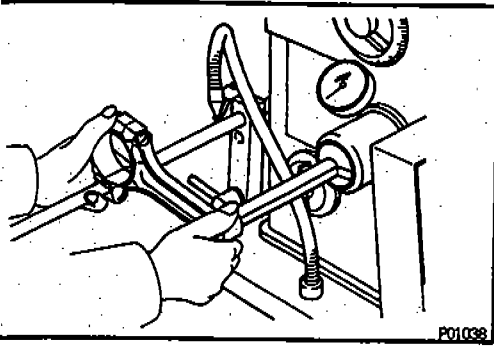
If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set.

13. IF NECESSARY, REPLACE CONNECTING ROD BUSHING

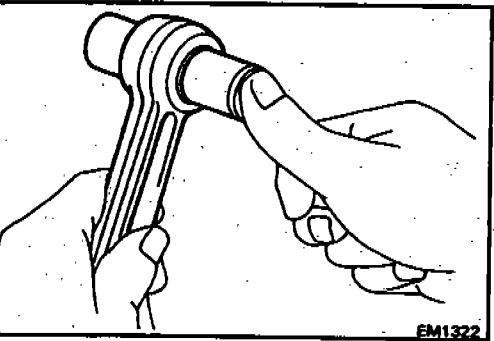
- (a) Using SST and a press, press out the bushing.
SST 09222-30010



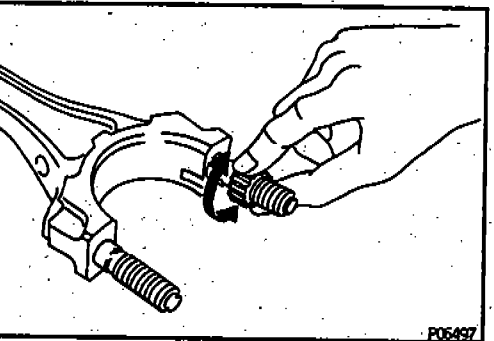
- (b) Align the oil holes of a new bushing and the connecting rod.
- (c) Using SST and a press, press in the bushing.
SST 09222-30010



- (d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (see step 12 above) between the bushing and piston pin.



- (e) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.



14. INSPECT CONNECTING ROD BOLTS

- (a) Install the cap nut to the connecting rod bolt. Check that the cap nut can be turned easily by hand to the end of the thread.
- (b) If the cap nut cannot be turned easily, measure the outside diameter of the connecting rod bolt with a vernier caliper.

Outside diameter:

Standard	7.900 – 8.000 mm (0.3110 – 0.3150 in.)
Minimum	7.85 mm (0.3091 in.)

HINT: If the location of this area cannot be judged by visual inspection, measure the outer diameter at the location shown in the illustration.

If the outside diameter is less than minimum, replace the connecting rod bolt and nut as a set.

15. CYLINDER BORING

HINT:

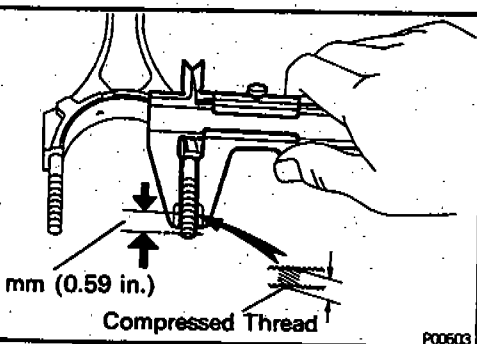
- Bore all the four cylinders for the oversized piston outside diameter.
- Replace all the piston rings with ones to match the oversized pistons.

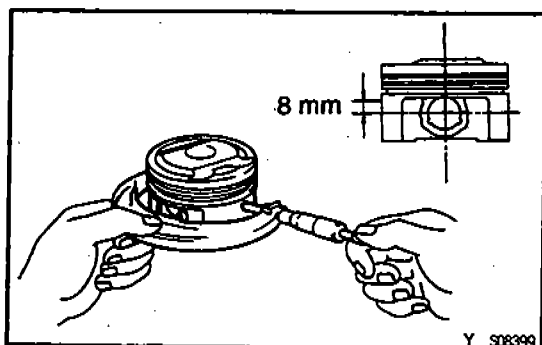
A. Keep oversized pistons

Oversized piston diameter:

O/S 0.50

81.405 – 81.435 mm (3.2049 – 3.2061 in.)



**B. Calculate amount to bore cylinders**

- (a) Using a micrometer, measure the piston diameter at right angles to the piston head, 8.0 mm (0.315 in.) from the piston pin center line.

- (b) Calculate the amount of each cylinder is to be rebored as follows:

$$\text{Size to be rebored} = P + C - H$$

P = Piston diameter

C = Piston oil clearance

0.095 – 0.115 mm (0.0037 – 0.0045 in.)

H = Allowance for honing

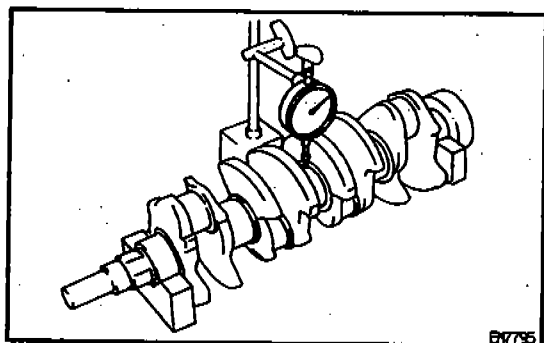
0.02 mm (0.0008 in.) or less

C. Bore and hone cylinder to calculated dimensions

Maximum honing:

0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.

**16. INSPECT CRANKSHAFT FOR RUNOUT**

- (a) Place the crankshaft on V-blocks.
- (b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:

0.03 mm (0.0012 in.)

If the circle runout is greater than maximum, replace the crankshaft.

17. INSPECT MAIN JOURNALS AND CRANK PINS

- (a) Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter:

STD size	47.982 – 48.010 mm (1.8891 – 1.8898 in.)
US 0.25	47.745 – 47.755 mm (1.8797 – 1.8801 in.)

Crank pin diameter:

STD size	41.985 – 42.000 mm (1.6530 – 1.6535 in.)
US 0.25	41.735 – 41.750 mm (1.6431 – 1.6437 in.)

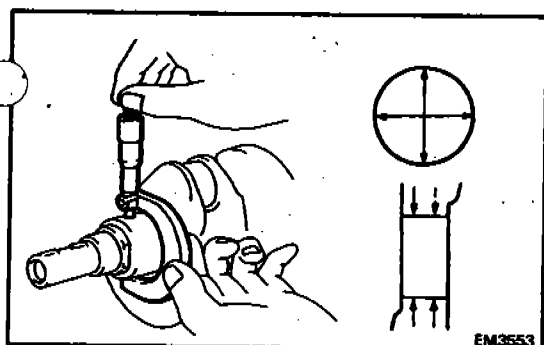
If the diameter is not as specified, check the oil clearance (See step 16 and 19 in disassembly). If necessary, grind or replace the crankshaft.

- (b) Check each main journal and crank pin for taper and out-of-round as shown.

Maximum taper and out-of-round:

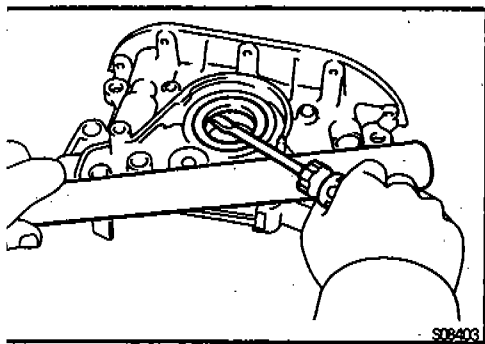
0.005 mm (0.0002 in.)

If the taper and out-of-round is greater than maximum, replace the crankshaft.



18. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure in step 17). Install new main journal and/or crankshaft pin undersized bearings.

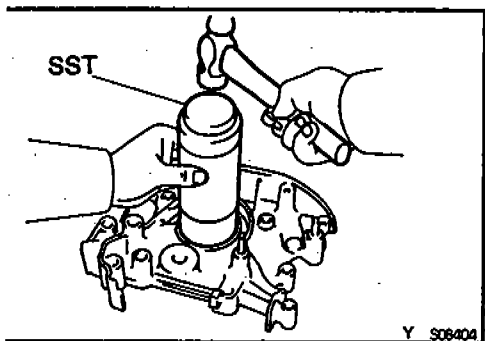


19. REPLACE CRANKSHAFT FRONT OIL SEAL

HINT: There are 2 methods (A and B) to replace the oil seal which are as follows:

A. If oil pump is removed from cylinder block:

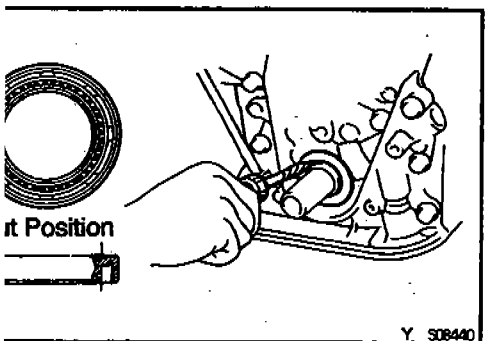
- (a) Using a screwdriver, pry out the oil seal.



- (b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump case edge.

SST 09636-20010

- (c) Apply MP grease to the oil seal lip.

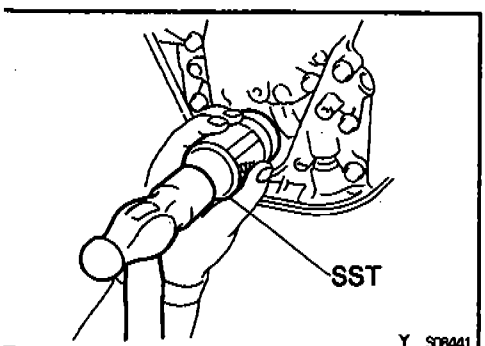


B. If oil pump is installed to the cylinder block:

- (a) Using a knife, cut off the oil seal lip.

- (b) Using a screwdriver, pry out the oil seal.

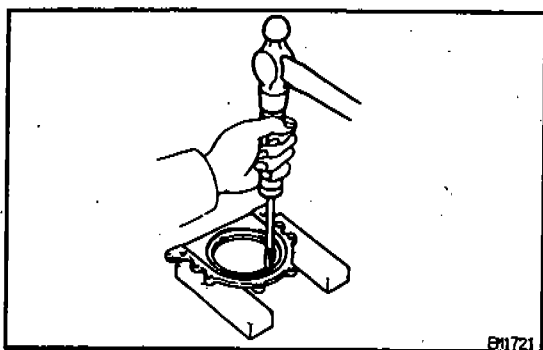
NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.



- (c) Apply MP grease to a new oil seal lip.

- (d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.

SST 09636-20010



20. REPLACE CRANKSHAFT REAR OIL SEAL

HINT: There are 2 methods (A and B) to replace the oil seal which are as follows:

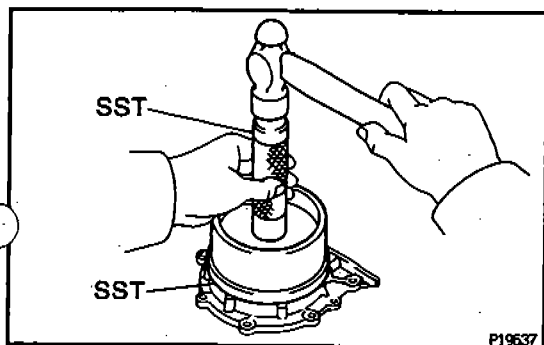
A. If rear oil seal retainer is removed from cylinder block:

- (a) Using a screwdriver and hammer, tap out the oil seal.

- (b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal edge.

SST 09223-15030, 09950-70010 (09951-07150)

- (c) Apply MP grease to the oil seal lip.

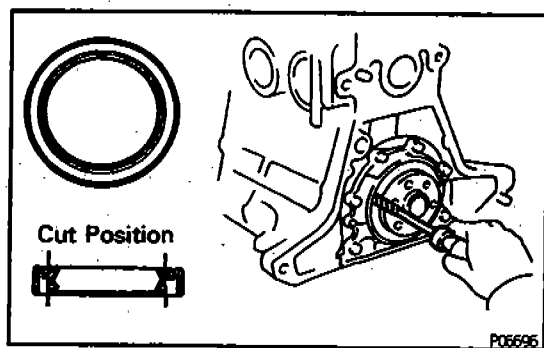


B. If rear oil seal retainer is installed to cylinder block:

- (a) Using a knife, cut off the oil seal lip.

- (b) Using a screwdriver, pry out the oil seal.

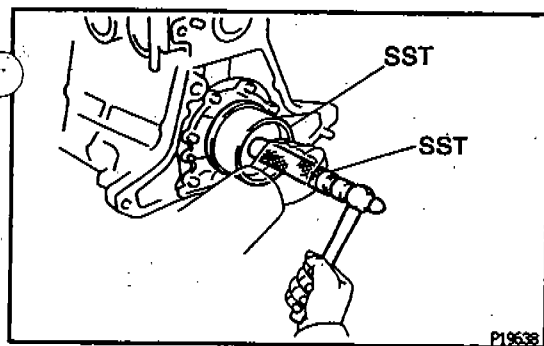
NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.



- (c) Apply MP grease to a new oil seal lip.

- (d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

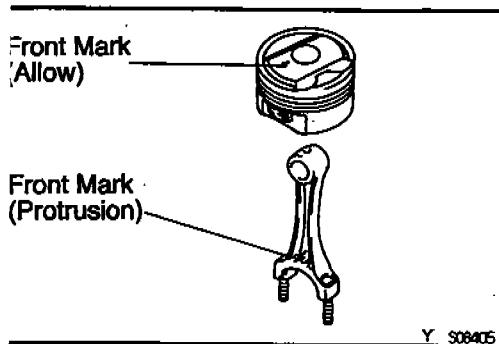
SST 09223-15030, 09950-70010 (09951-07150)



REASSEMBLY

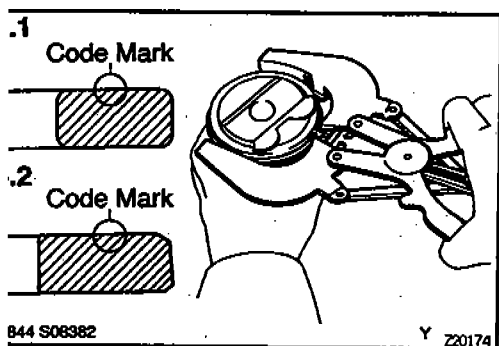
HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.



1. ASSEMBLE PISTON AND CONNECTING ROD

- Install a new snap ring on one side of the piston pin hole.
- Gradually heat the piston to 80–90°C (176–194°F).
- Coat the piston pin with engine oil.
- Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.
- Install a new snap ring on the other side of the piston pin hole.



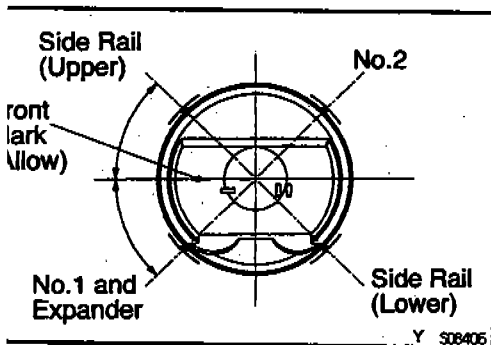
2. INSTALL PISTON RINGS

- Install the oil ring expander and 2 side rails by hand.
- Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

Code mark:

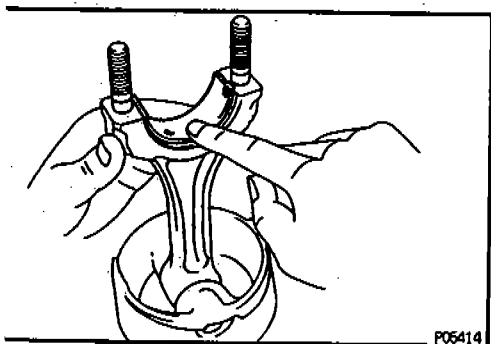
No.1: T or 1R

No.2: 2T or 2R



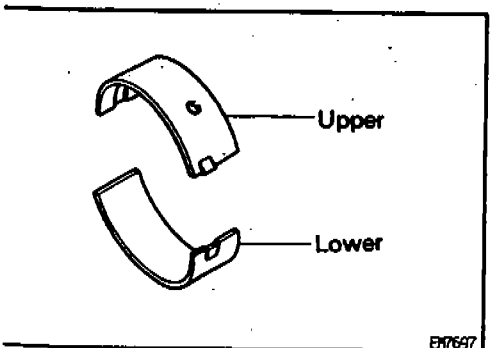
- Position the piston rings so that the ring ends are as shown.

NOTICE: Do not align the ring ends.



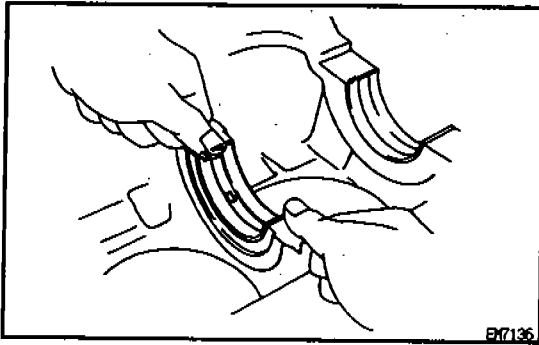
3. INSTALL BEARINGS

- Align the bearing claw with the groove of the connecting rod or connecting rod cap.
- Install the bearings in the connecting rod and connecting rod cap.

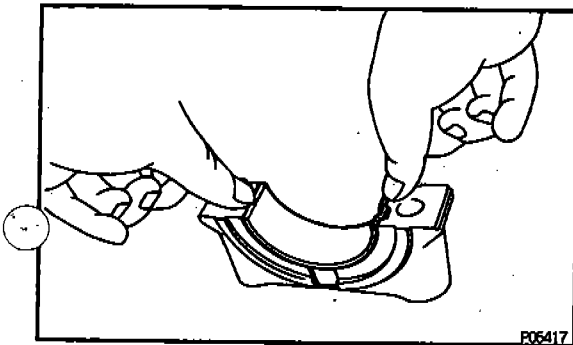


4. INSTALL MAIN BEARINGS

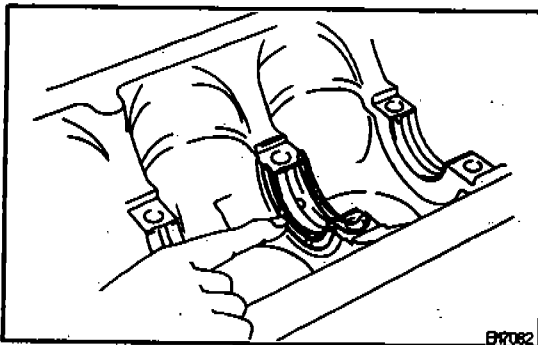
HINT: Upper bearings have an oil groove and oil holes; lower bearings do not.



- (a) Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.



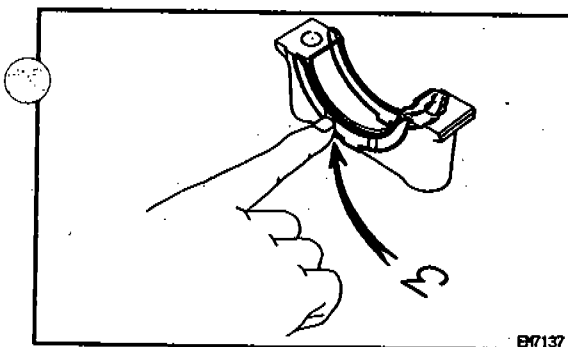
- (b) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.



5. INSTALL UPPER THRUST WASHERS

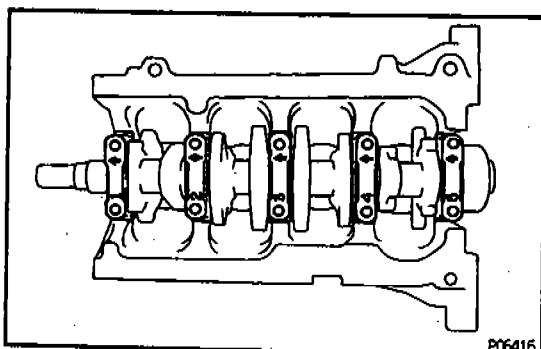
Install the 2 thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.

6. PLACE CRANKSHAFT ON CYLINDER BLOCK

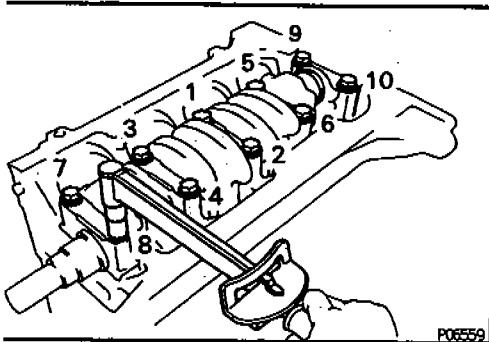


7. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

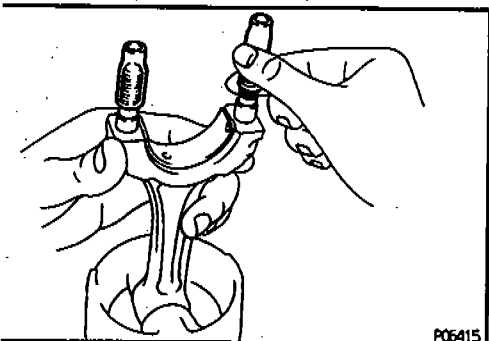
- (a) Install the 2 thrust washers on the No.3 bearing cap with the grooves facing outward.



- (b) Install the 5 main bearing caps in their proper locations. HINT: Each bearing cap has a number and front mark.

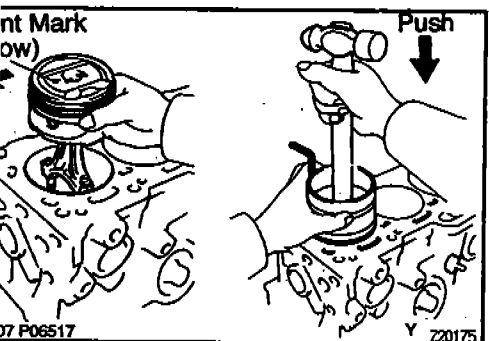


- (c) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.
 - (d) Install and uniformly tighten the 10 bolts of the main bearing caps, in several passes, in the sequence shown.
Torque: 60 N·m (610 kgf·cm, 44 ft·lbf)
 - (e) Check that the crankshaft turns smoothly.
- 8. CHECK CRANKSHAFT THRUST CLEARANCE**
(See step 18 in disassembly)

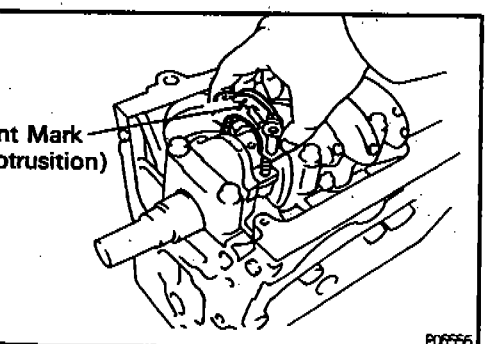


9. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

- (a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



- (b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



10. PLACE CONNECTING ROD CAP ON CONNECTING ROD

- (a) Match the numbered connecting rod cap with the connecting rod.
- (b) Install the connecting rod cap with the front mark facing forward.

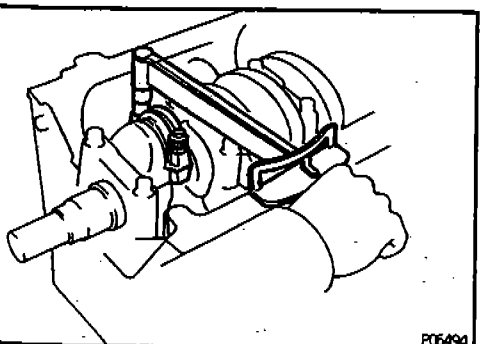
11. INSTALL CONNECTING ROD CAP NUTS

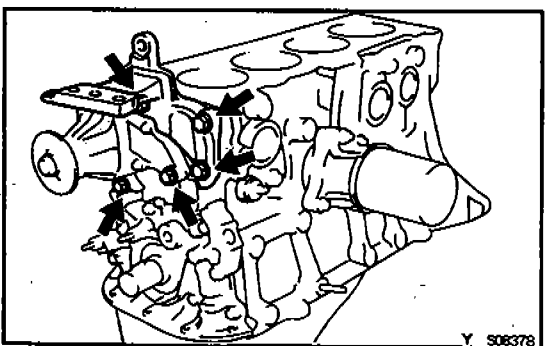
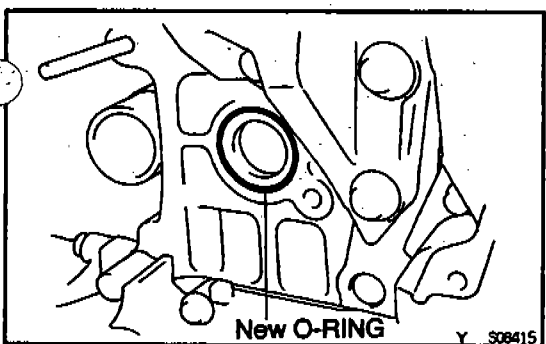
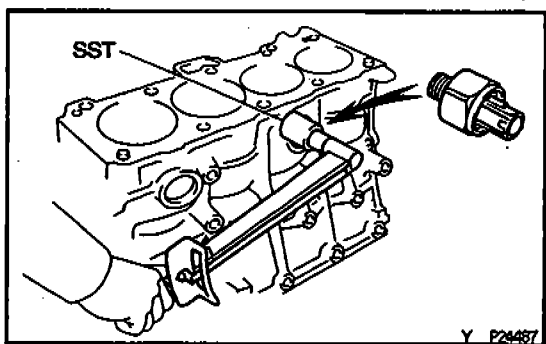
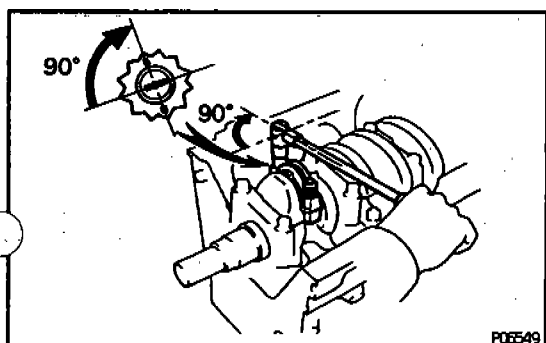
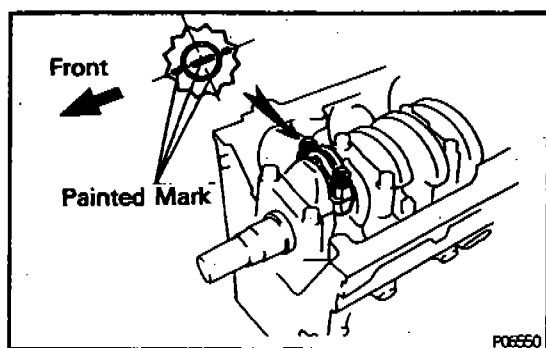
HINT:

- The cap nuts are tightened in 2 progressive steps (steps (b) and (d)).
- If any one of the connecting rod bolts is broken or deformed, replace it.

- (a) Apply a light of engine oil on the threads and under the nuts of the connecting rod cap.
- (b) Install and alternately tighten the cap nuts in several passes.

Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)





If any one of the cap nuts does not meet the torque specification, replace the connecting rod bolt and cap nut as set.

- (c) Mark the cap nut and connecting rod bolt with the paint.

- (d) Retighten the cap nuts 90° as shown.

- (e) Check that the painted mark is now at a 90° angle to the mark on the connecting rod bolt.

- (f) Check that the crankshaft turns smoothly.

12. CHECK CONNECTING ROD THRUST CLEARANCE
(See step 15 in disassembly)

13. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the 6 bolts.
Torque: 9.5 N·m (95 kgf·cm, 82 in.-lbf)

14. INSTALL OIL PUMP AND OIL PAN
(See LU section)

15. INSTALL KNOCK SENSOR

Using SST, install the knock sensor.
SST 09816-30010

Torque: 45 N·m (450 kgf·cm, 33 ft.-lbf)

16. INSTALL OIL FILTER BRACKET

17. INSTALL OIL PRESSURE SWITCH
(See LU section)

18. INSTALL OIL FILTER

(See LU section)

19. INSTALL WATER PUMP

- (a) Place a new O-ring in position on the cylinder block.

- (b) Install the water pump with the 2 bolts.
Torque: 14 N·m (145 kgf·cm, 11 ft.-lbf)

20. INSTALL RH ENGINE MOUNTING BRACKET

Install the mounting bracket with the 3 bolts.

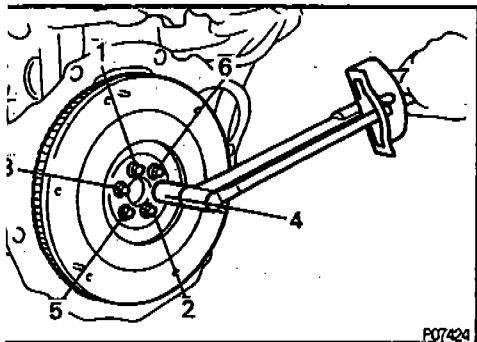
Torque: 51 N·m (525 kgf·cm, 38 ft.-lbf)

21. INSTALL ALTERNATOR BRACKET

Install the alternator bracket with the 2 bolts and nut.

Torque: 39 N·m (400 kgf·cm, 39 ft.-lbf)

22. **INSTALL CYLINDER HEAD**
(See timing belt)
23. **INSTALL TIMING BELT AND PULLEYS**
(See timing belt)
24. **DISCONNECT ENGINE FROM ENGINE STAND**
25. **INSTALL REAR END PLATE**
Torque: 9.5 N·m (95 kgf·cm, 82 in·lbf)



12. **INSTALL FLYWHEEL**
 - (a) Install the flywheel on the crankshaft.
 - (b) Install and uniformly tighten the mounting bolts, in several passes, in the sequence shown.
- Torque: 75 N·m (750 kgf·cm, 54 ft·lbf)

IGNITION

IGNITION SYSTEM	IG-1
DISTRIBUTOR	IG-7

IGNITION SYSTEM ON-VEHICLE INSPECTION

ISSUE-01

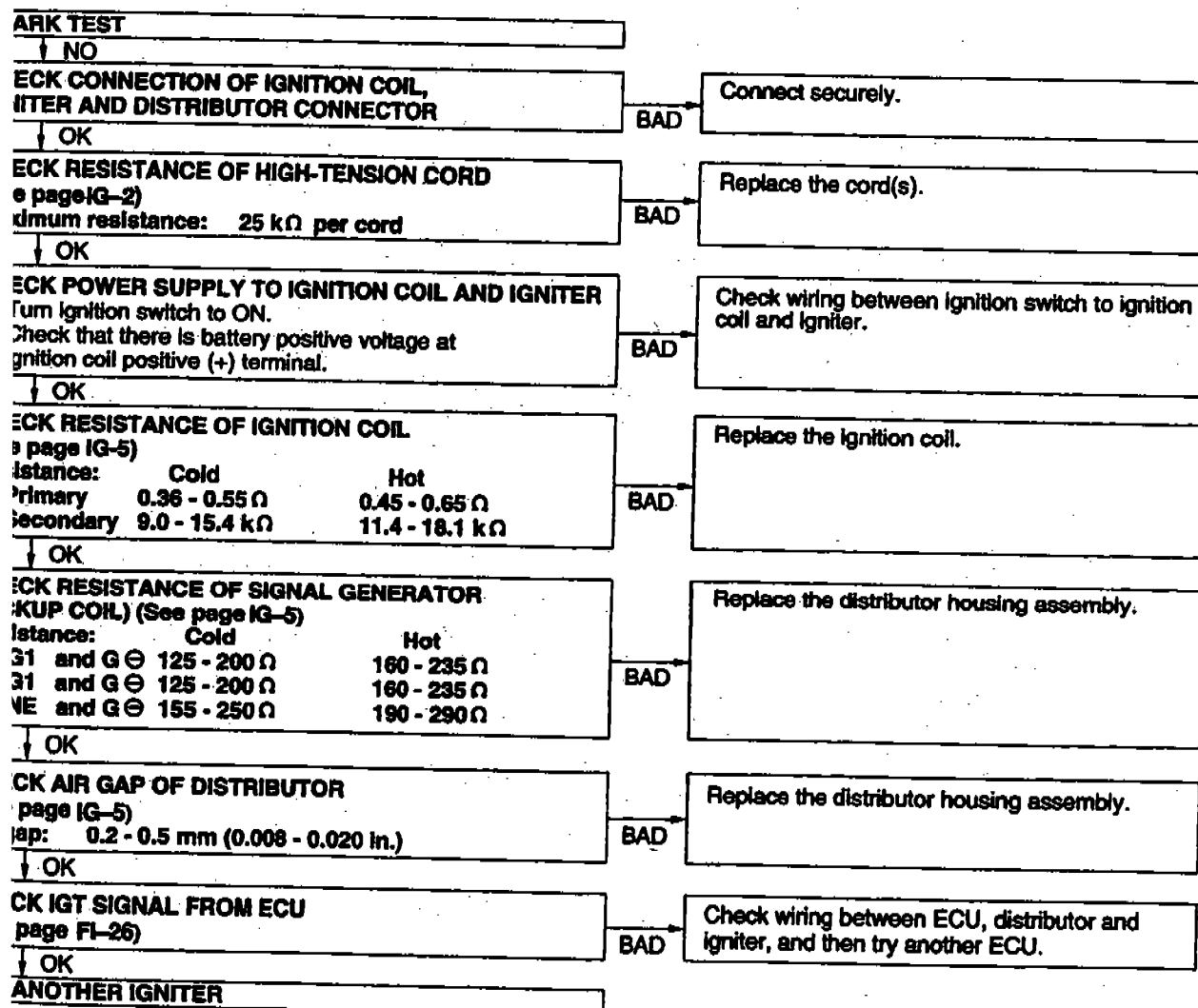
Spark Test

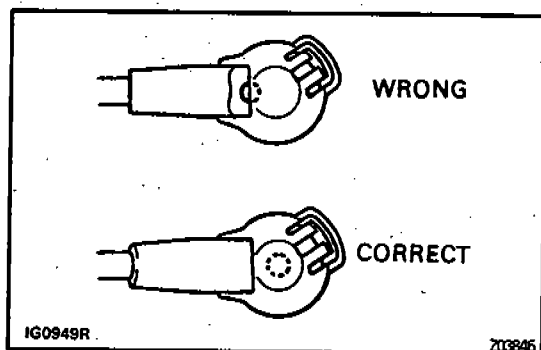
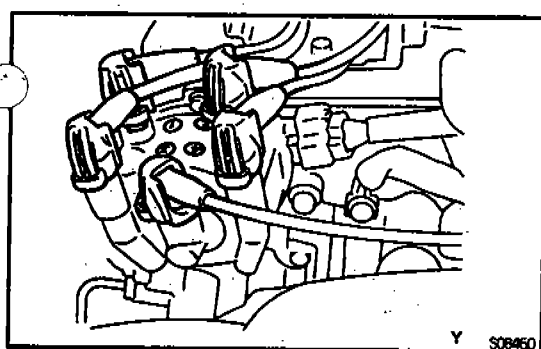
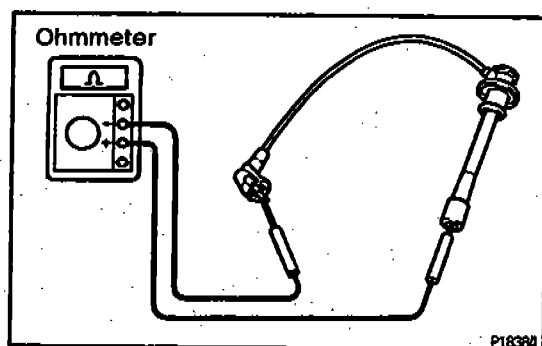
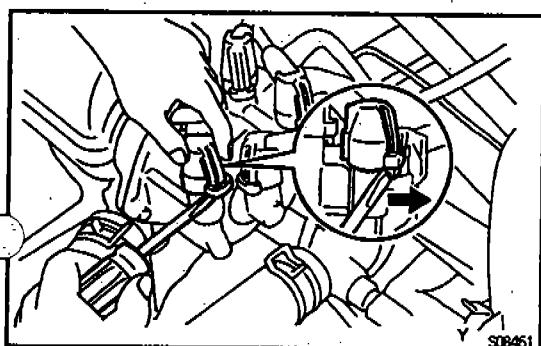
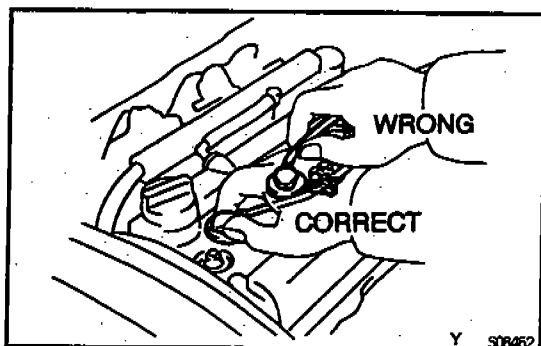
CHECK THAT SPARK OCCURS

- Disconnect the high-tension cord (from the ignition coil) from the distributor cap.
- Hold the end approx. 12.5 mm (0.50 in.) from the body ground.
- See if spark occurs while engine is being cranked.

NOTICE: To prevent gasoline from being injected from injectors during this test, crank the engine for no more than 5 - 10 seconds at time.

If the spark does not occur, perform the test as follows:





High-Tension Cords

1. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

- Remove the 6 screws and No.2 cylinder head cover.
- Disconnect the high-tension cords at the rubber boot. Do not pull on the high-tension cords.

NOTICE: Pulling on or bending the cords may damage the conductor inside.

2. DISCONNECT HIGH-TENSION CORD FROM IGNITION COIL

3. DISCONNECT HIGH-TENSION CORDS FROM DISTRIBUTOR CAP

- Using a screwdriver, lift up the lock claw and disconnect the holder from the distributor cap.
- Disconnect the high-tension cord at the grommet. DO NOT pull on the cords.

NOTICE: Pulling on or bending the cords may damage the conductor inside.

4. INSPECT HIGH-TENSION CORD RESISTANCE

Using an ohmmeter, measure the resistance.

Maximum resistance:

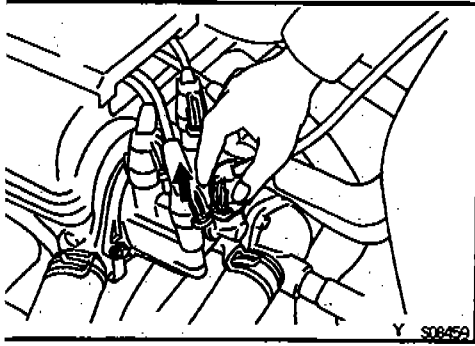
25 k Ω per cord

If the resistance is greater than maximum, check the terminals. If necessary, replace the high-tension cord.

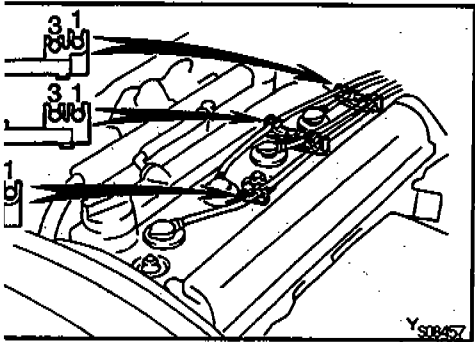
5. RECONNECT HIGH-TENSION CORDS TO DISTRIBUTOR CAP

- Connect the holder and grommet portion to the distributor cap as shown in the illustration.

NOTICE: Check that the holder is correctly installed to the grommet and distributor cap as shown in the illustration.



- (b) Check that the lock claw of the holder is engaged by lightly pulling the holder.



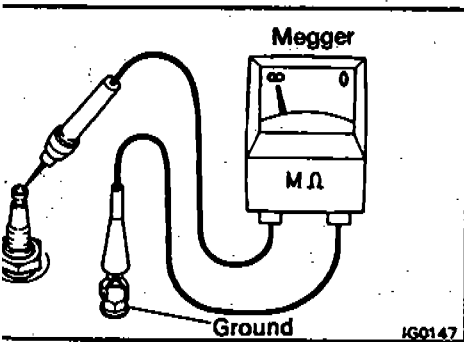
6. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

- (a) Secure the high-tension cords with the clamps as shown in the illustration.
- (b) Reinstall the No.2 cylinder head cover with 6 screws.

Spark Plugs

NOTICE:

- Never use a wire brush for cleaning.
- Never attempt to adjust the electrode gap on a used spark plug.
- Spark plugs should be replaced every 100,000 km (60,000 miles).



1. INSPECT ELECTRODE

Using a megger (insulation resistance meter), measure the insulation resistance.

Standard correct insulation resistance:

10 MΩ or more

If the resistance is less than specified, proceed to step 4.

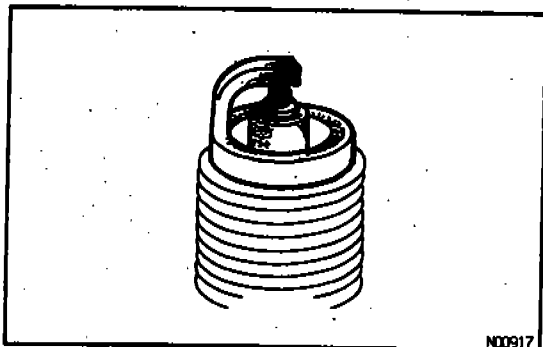
HINT: If a megger is not available, the following simple method of inspection provides fairly accurate results.

Simple Method:

- (a) Quickly race the engine to 4,000 rpm 5 times.
- (b) Remove the spark plug. (See step 2)
- (c) Visually check the spark plug.
If the electrode is dry ... OK
If the electrode is wet ... Proceed to step 3
- (d) Reinstall the spark plug. (See step 6)

2. REMOVE SPARK PLUGS

Using a spark plug wrench, remove the 4 spark plugs.



3. VISUALLY INSPECT SPARK PLUGS

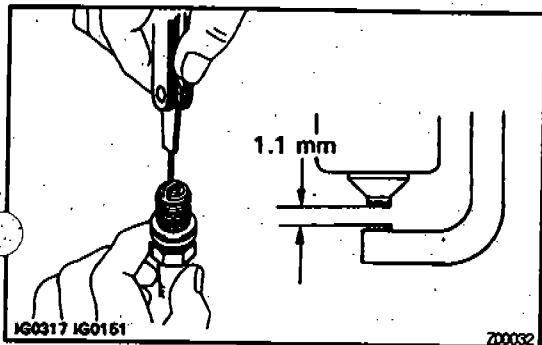
Check the spark plug for thread damage and insulator damage.

If abnormal, replace the spark plug.

Recommended spark plug:

DENSO: PK20R11

NGK: BKR6EP-11



4. INSPECT ELECTRODE GAP

Maximum electrode gap for used spark plug:

1.3 mm (0.051 in.)

If the gap is greater than maximum, replace the spark plug.

Correct electrode gap for new spark plug:

1.1 mm (0.043 in.)

NOTICE: If adjusting the gap of a new spark plug, be sure to adjust only the base of the ground electrode. Do not touch the tip of the ground electrode. Never attempt to adjust the gap on the used plug.

5. CLEAN SPARK PLUGS

If the electrode has traces of wet carbon, allow it to dry and then clean with a spark plug cleaner.

Air pressure:

Below 588 kPa (6 kgf/cm², 85 psi)

Duration:

20 seconds or less

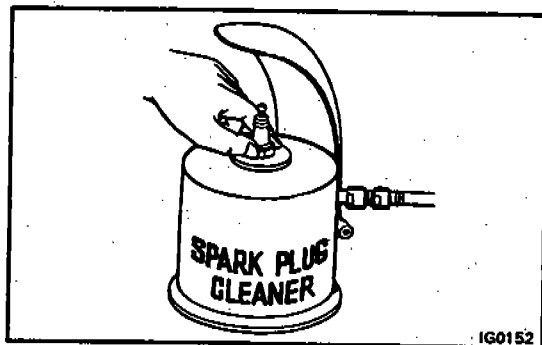
HINT: If there are traces of oil, remove it with gasoline before using the spark plug cleaner.

6. REINSTALL SPARK PLUGS

Using a spark plug wrench, install the 4 spark plugs.

Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)

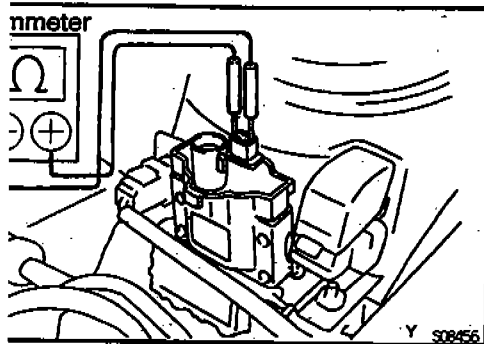
7. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS



Ignition Coil

NOTICE: "Cold" and "Hot" in the following sentences refer to the temperature of the coils themselves. "Cold" is from -10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

1. DISCONNECT IGNITION COIL CONNECTOR
2. DISCONNECT HIGH-TENSION CORD FROM IGNITION COIL



3. INSPECT PRIMARY COIL RESISTANCE

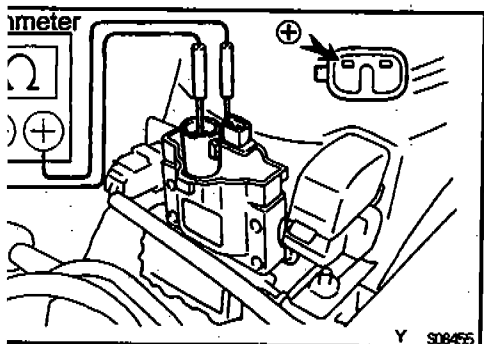
Using an ohmmeter, measure the resistance between the positive (+) and negative (-) terminals.

Primary coil resistance:

Cold: 0.36 – 0.55 Ω

Hot: 0.45 – 0.65 Ω

If the resistance is not as specified, replace the ignition coil.



4. INSPECT SECONDARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between the positive (+) and high-tension terminals.

Secondary coil resistance:

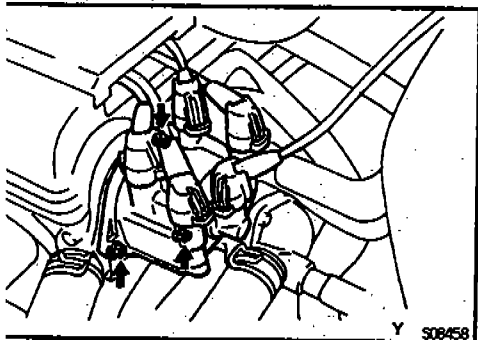
Cold: 9.0 – 15.4 k Ω

Hot: 11.4 – 18.1 k Ω

If the resistance is not as specified, replace the ignition coil.

5. RECONNECT HIGH-TENSION CORD TO IGNITION COIL

6. RECONNECT IGNITION COIL CONNECTOR

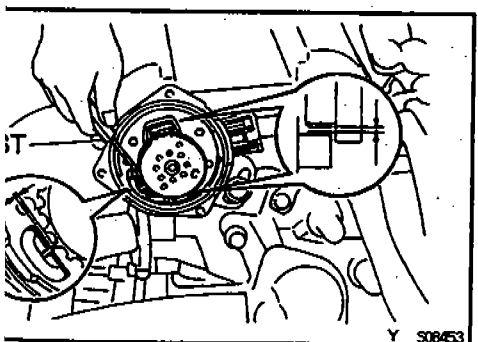


Distributor

NOTICE: "Cold" and "Hot" in the following sentences express the temperature of the coils themselves. "Cold" is from -10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

1. REMOVE DISTRIBUTOR CAP

Remove the 2 bolts, and disconnect the distributor cap from the distributor housing.



2. REMOVE ROTOR

3. INSPECT AIR GAP

Using SST, measure the air gap between the signal rotor and pickup coil projection.

SST 09240-00020

Air gap:

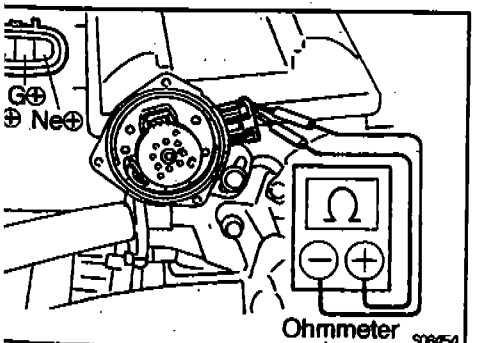
0.2 – 0.5 mm (0.008 – 0.020 in.)

If the air gap is not as specified, replace the distributor housing assembly.

4. DISCONNECT DISTRIBUTOR CONNECTOR

5. INSPECT SIGNAL GENERATOR (PICKUP COIL) RESISTANCE

Using an ohmmeter, measure the resistance between terminals.



Terminal	Cold	Hot
G1 and G \ominus	125 – 200 Ω	160 – 235 Ω
G2 and G \ominus	125 – 200 Ω	160 – 235 Ω
NE and G \ominus	155 – 250 Ω	190 – 290 Ω

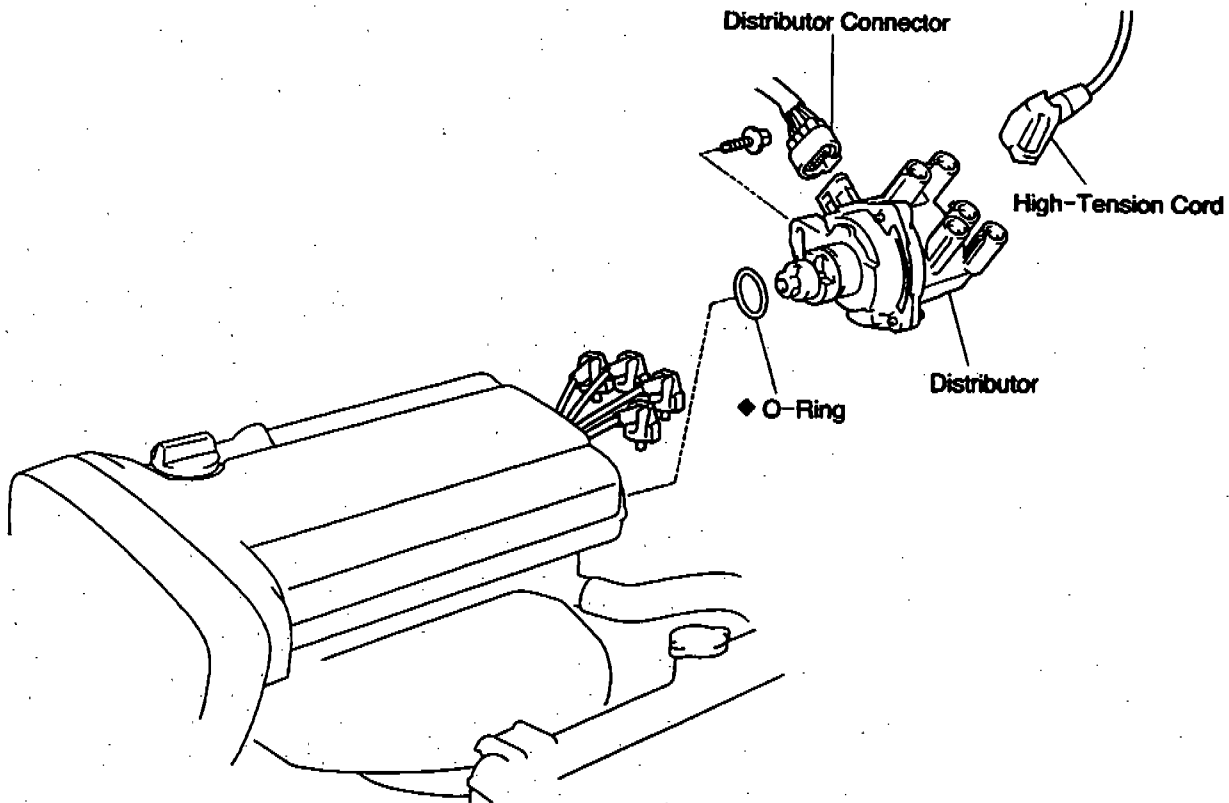
If the resistance is not as specified, replace the distributor housing assembly.

6. **RECONNECT DISTRIBUTOR CONNECTOR**
7. **REINSTALL ROTOR**
8. **REINSTALL DISTRIBUTOR CAP**

Install a new packing and distributor cap with the 2 bolts
Igniter
(See spark test)

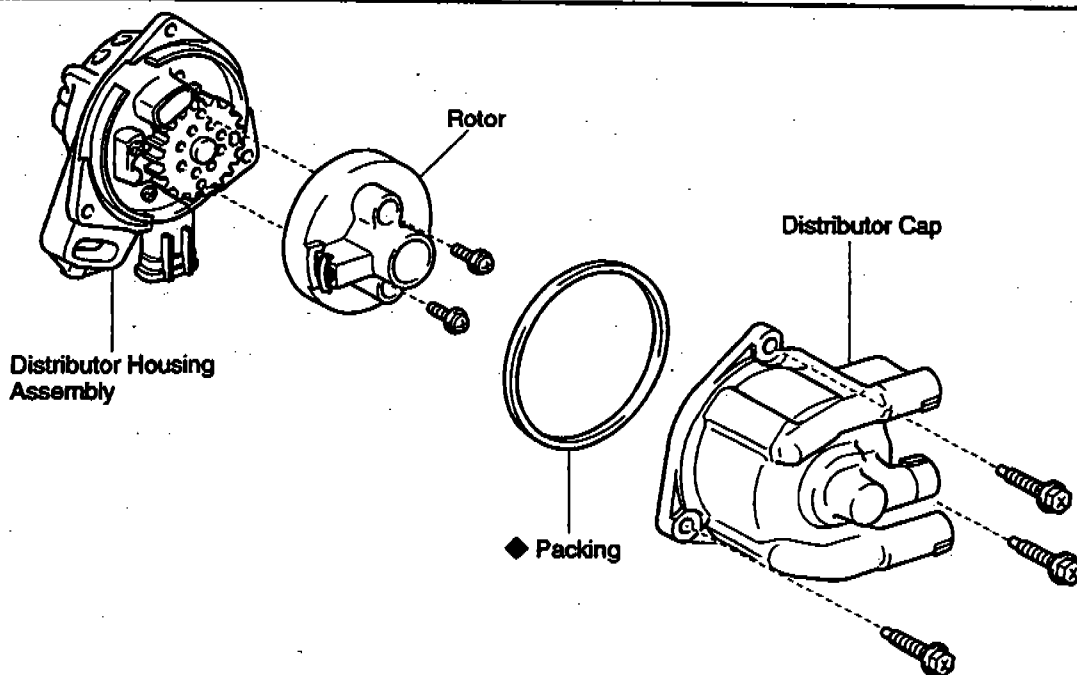
DISTRIBUTOR COMPONENTS

43574-02



Non-reusable part

T 306558



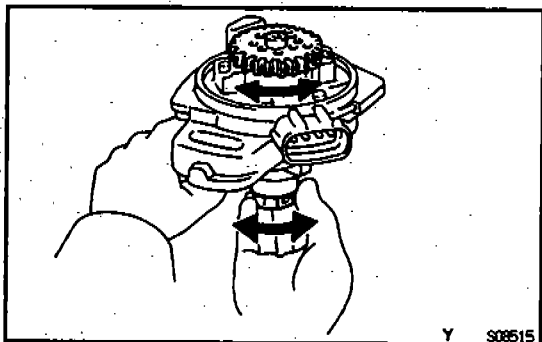
Y 306520

REMOVAL

1. **DISCONNECT DISTRIBUTOR CONNECTOR**
2. **DISCONNECT HIGH-TENSION CORD FROM DISTRIBUTOR CAP**
3. **REMOVE DISTRIBUTOR**
 - (a) Remove the hold-down bolt, and pull out the distributor.
 - (b) Remove the O-ring from the distributor housing.

DISASSEMBLY

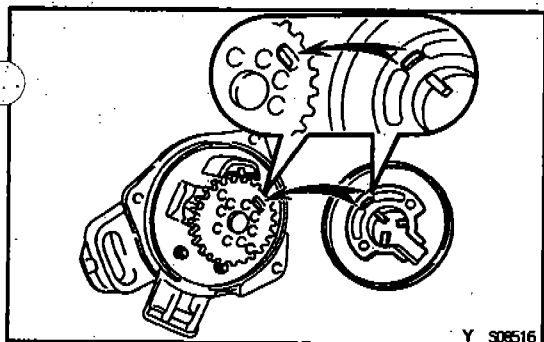
1. **REMOVE DISTRIBUTOR CAP**
Remove the 3 bolts, distributor cap and packing.
2. **REMOVE ROTOR**
Remove the 2 screws and rotor.



INSPECTION

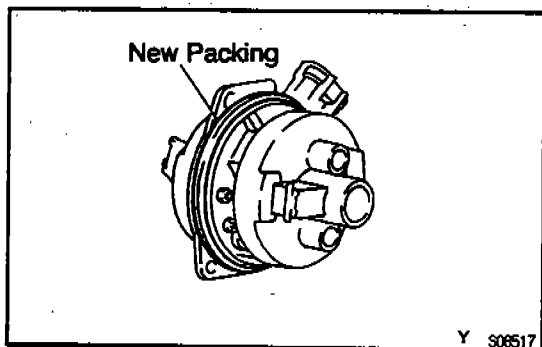
INSPECT SHAFT

Turn the shaft and check that it is not rough or worn. If it feels rough or worn, replace the distributor housing assembly.



REASSEMBLY

1. **INSTALL ROTOR**
 - (a) Align the hollow of the signal rotor with the profile of the rotor.
 - (b) Install the rotor with the 2 screws.
2. **INSTALL DISTRIBUTOR CAP**
 - (a) Install a new packing to the distributor housing.
 - (b) Install the distributor cap with the 3 bolts.

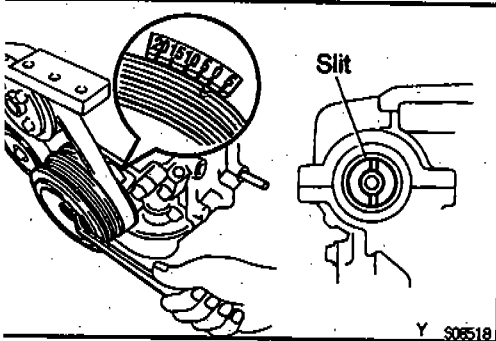


100JL-04

INSTALLATION

1. SET NO. 1 CYLINDER TO TDC/COMPRESSION

Turn the crankshaft clockwise, and position the slit of the intake camshaft as shown in the illustration.



2. INSTALL DISTRIBUTOR

- Install a new O-ring to the housing.
- Apply a light coat of engine oil on the O-ring.
- Align the cutout of the coupling with the line of the housing.
- Insert the distributor, aligning the center of the flange with that of bolt hole on the cylinder head.
- Tighten the hold-down bolt.

Torque: 23 N·m (230 kgf·cm, 17 ft·lbf)

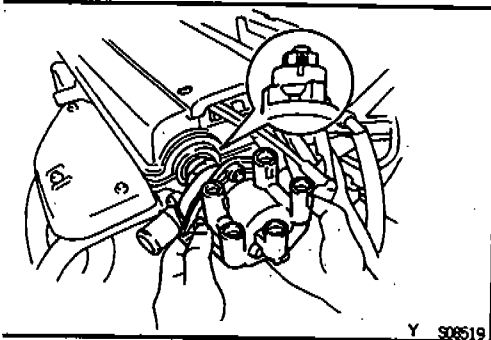
3. CONNECT HIGH-TENSION CORDS TO SPARK PLUGS

Firing order:

1-3-4-2

4. CONNECT HIGH-TENSION CORD TO IGNITION COIL

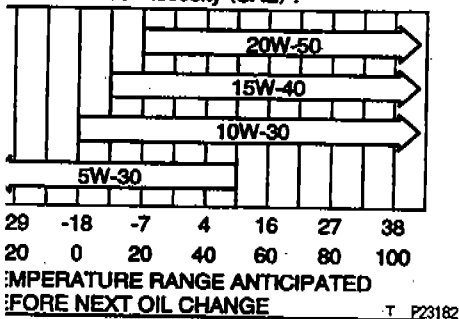
5. CONNECT DISTRIBUTOR CONNECTOR



LUBRICATION

OIL AND FILTER	LU-1
OIL PUMP	LU-4
OIL NOZZLE	LU-10

Recommended Viscosity (SAE) :



OIL AND FILTER INSPECTION

LU228-01

1. CHECK ENGINE OIL QUALITY

Check the oil for deterioration, entry of water, discoloring or thinning.

If the quality is visibly poor, replace the oil.

Oil grade:

API grade SG or SH, multigrade engine oil or ILSAC multigrade engine oil

2. CHECK ENGINE OIL LEVEL

The oil level should be between the "L" and "F" marks on the dipstick.

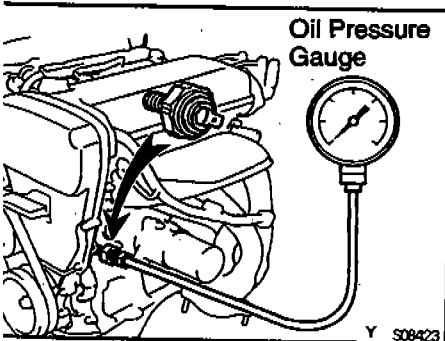
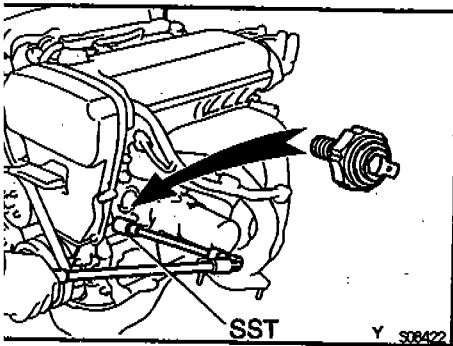
If low, check for leakage and add oil up to "F" mark.

NOTICE:

- When inserting the oil dipstick, insert the curved tip of the dipstick facing the same direction as the curve of the guide.
- If the dipstick gets caught while inserting it, do not force it in. Reconfirm the direction of the dipstick.

3. REMOVE OIL PRESSURE SWITCH, AND INSTALL OIL PRESSURE GAUGE

- (a) Using SST, remove the oil pressure switch.
SST 09816-30010



- (b) Install the oil pressure gauge.

4. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

5. CHECK OIL PRESSURE

Oil pressure:

At idle	59 kPa (0.6 kgf/cm ² , 8.5 psi) or more
At 3,000 rpm	245 – 490 kPa (2.5 – 5.0 kgf/cm ² , 36 – 71 psi)

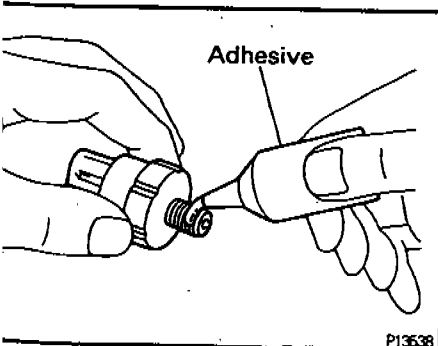
6. REMOVE OIL PRESSURE GAUGE, AND REINSTALL OIL PRESSURE SWITCH

- (a) Remove the oil pressure gauge.
(b) Apply adhesive to 2 or 3 threads of the oil pressure switch.
Adhesive:

Part No. 08833-00080, THREE BOND 1344,
LOCTITE 242 or equivalent

- (c) Using SST, install the oil pressure switch.
SST 09816-30010

7. START ENGINE AND CHECK FOR OIL LEAKS



REPLACEMENT

CAUTION:

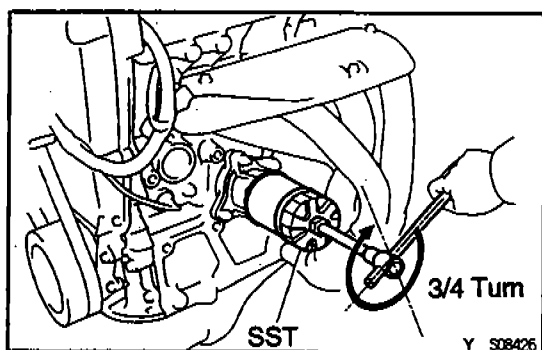
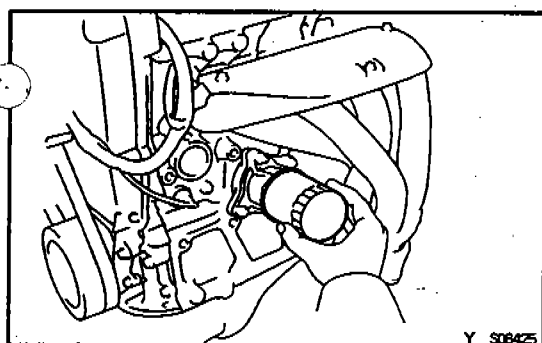
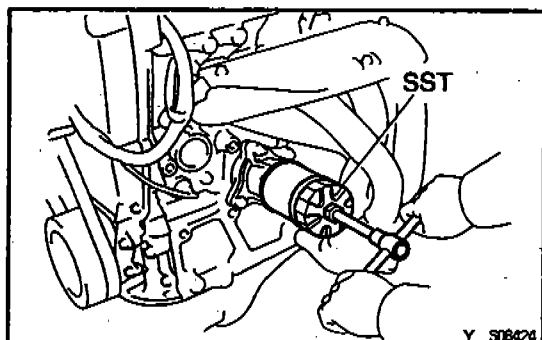
- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Care should be taken, therefore, when changing engine oil to minimize the frequency and length of time your skin is exposed to used engine oil. Protective clothing and gloves that cannot be penetrated by oil should be worn. The skin should be thoroughly washed with soap and water, or use water-less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filters must be disposed of only at designated disposal sites.

1. DRAIN ENGINE OIL

- Remove the oil filler cap.
- Remove the oil drain plug, and drain the oil into a container.

2. REPLACE OIL FILTER

- Using SST, remove the oil filter.
SST 09228-06501
- Clean the oil filter contact surface on the oil filter mounting.
- Lubricate the filter rubber gasket with clean engine oil.
- Tighten the oil filter by hand until the rubber gasket contacts the seat of the filter mounting.



- Using SST, give it an additional 3/4 turn to seat the filter.
SST 09228-06501

3. FILL WITH ENGINE OIL

- (a) Clean and install the oil drain plug with a new gasket.
Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)

- (b) Fill with new engine oil.

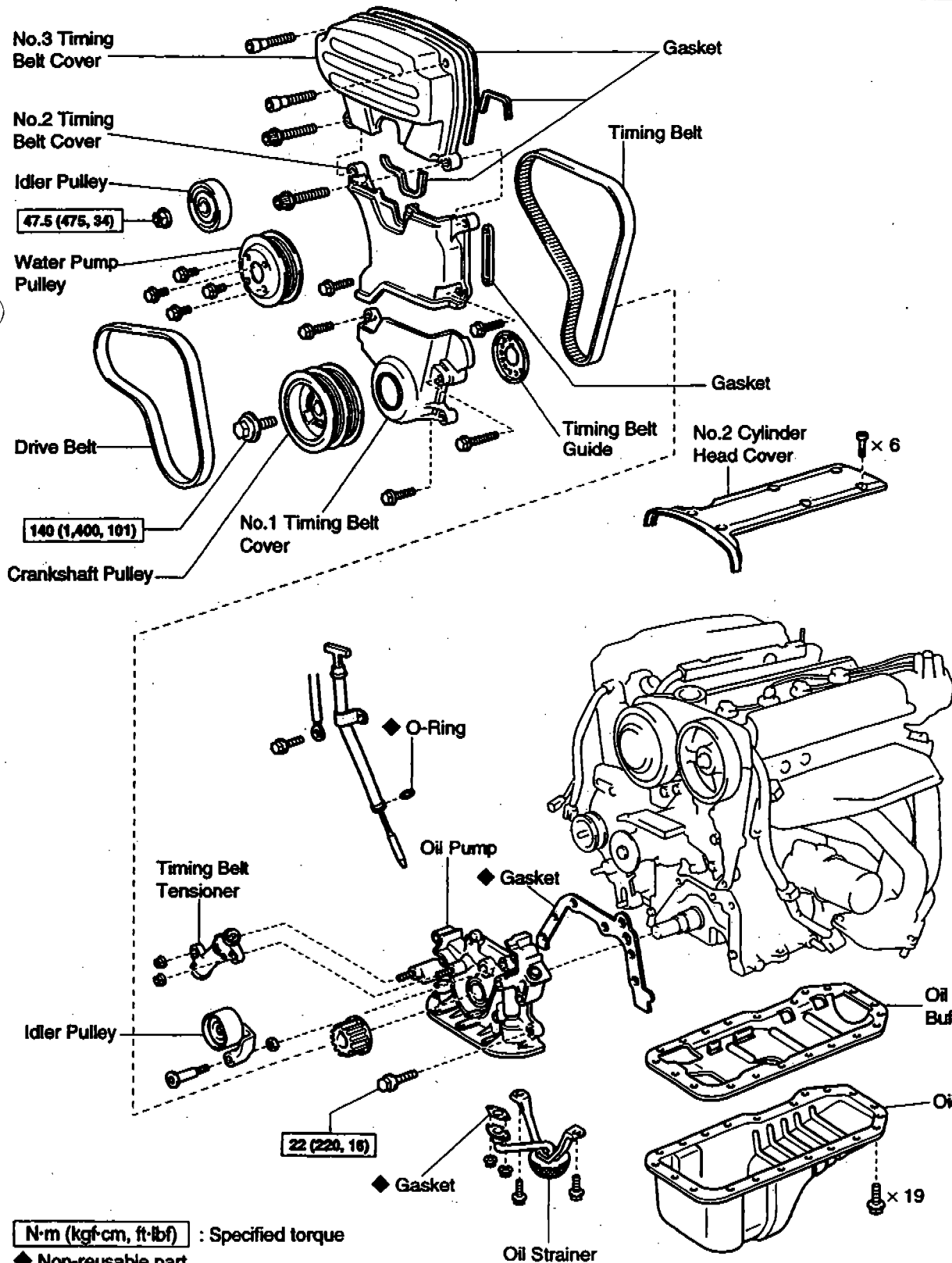
Capacity:

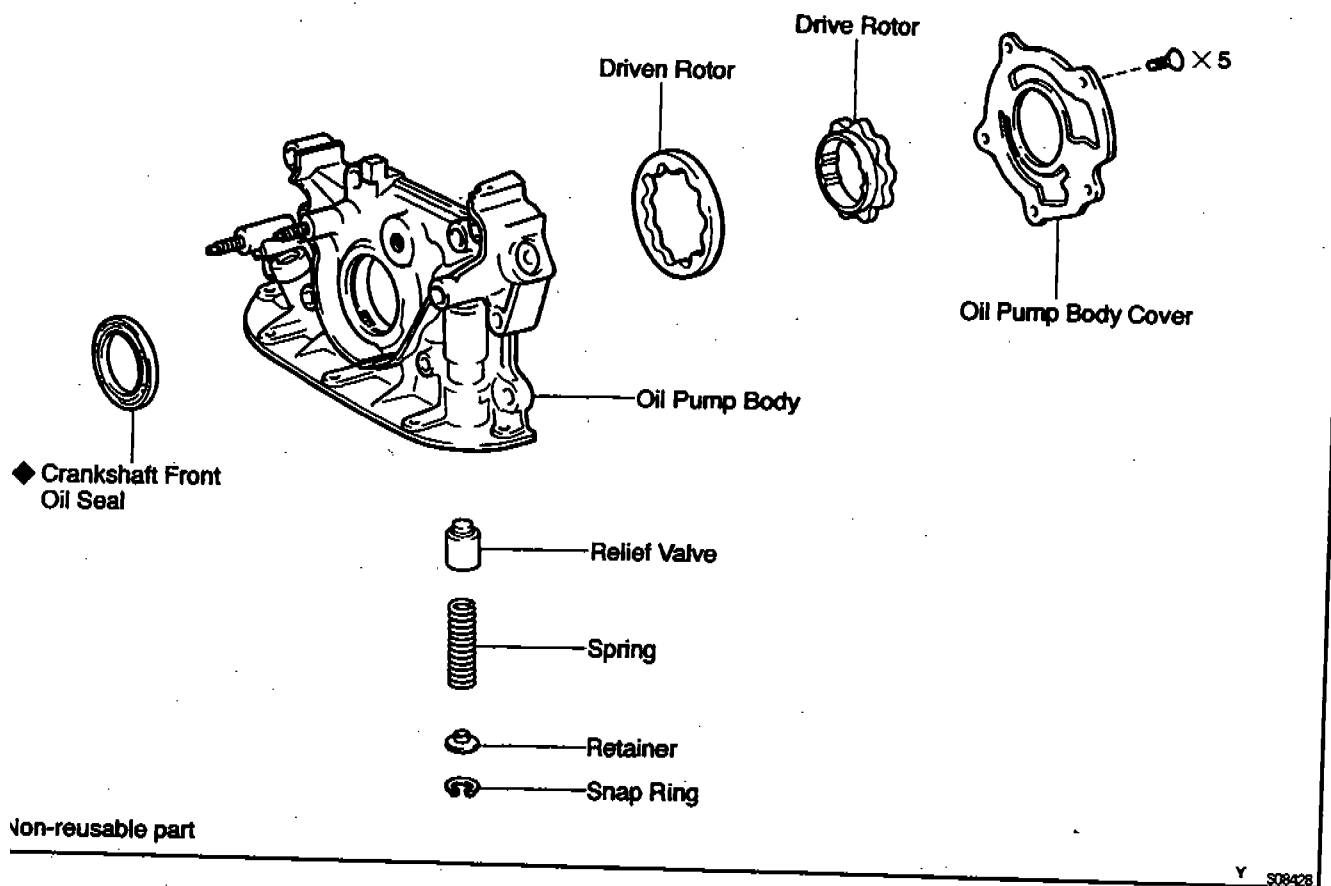
Drain and refill	
w/ Oil filter change	3.0 liters (3.2 US qts, 2.6 Imp. qts)
w/o Oil filter change	2.8 liters (3.0 US qts, 2.5 Imp. qts)
Dry fill	3.5 liters (3.7 US qts, 3.1 Imp. qts)

- (c) Reinstall the oil filler cap.

4. START ENGINE AND CHECK FOR OIL LEAKS**5. RECHECK ENGINE OIL LEVEL**

OIL PUMP COMPONENTS

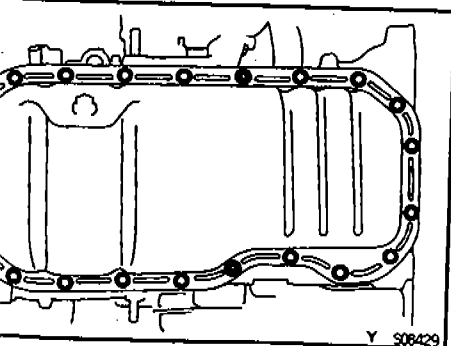


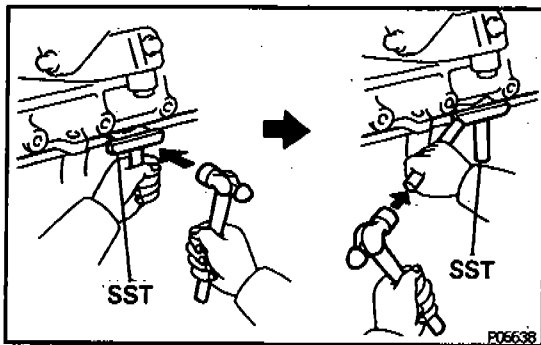


REMOVAL

HINT: When repairing the oil pump, the oil pan and strainer should be removed and cleaned.

1. **DRAIN ENGINE OIL**
2. **REMOVE TIMING BELT**
(See EM section)
3. **REMOVE IDLER PULLEY AND CRANKSHAFT TIMING PULLEY**
(See EM section)
4. **REMOVE OIL DIPSTICK AND GUIDE**
 - (a) Remove the mounting bolt.
 - (b) Pull out the dipstick guide together with the dipstick.
 - (c) Remove the O-ring from the dipstick guide.
5. **REMOVE OIL PAN**
 - (a) Remove the 19 bolts and 2 nuts.

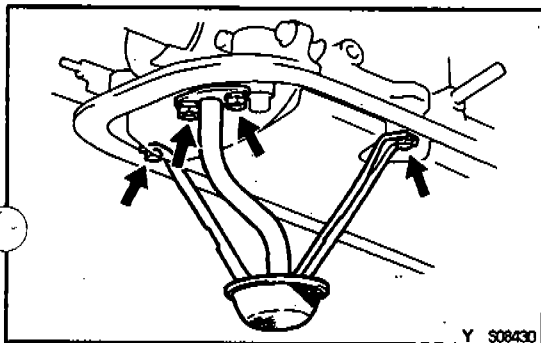




- (b) Insert the blade of SST between the cylinder block and oil pan, and cut off applied sealer and remove the oil pan, SST 09032-00100

NOTICE:

- Do not use SST for the oil pump body side and rear oil seal retainer.
- Be careful not to damage the oil pan flange.

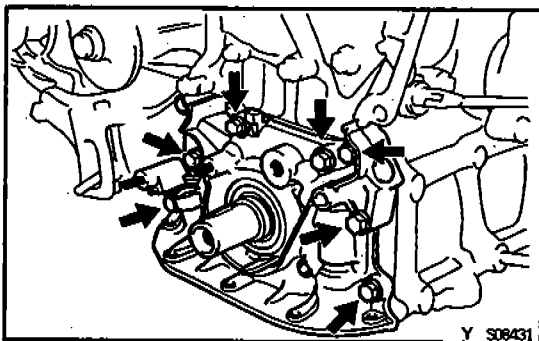


6. REMOVE OIL STRAINER

Remove the 2 bolts, 2 nuts, oil strainer and gasket.

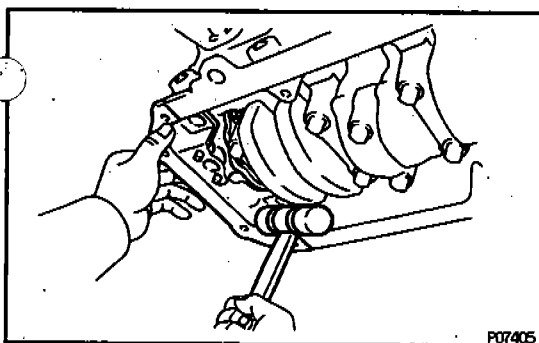
7. REMOVE OIL PAN BUFFLE PLATE

(See procedure step 5)



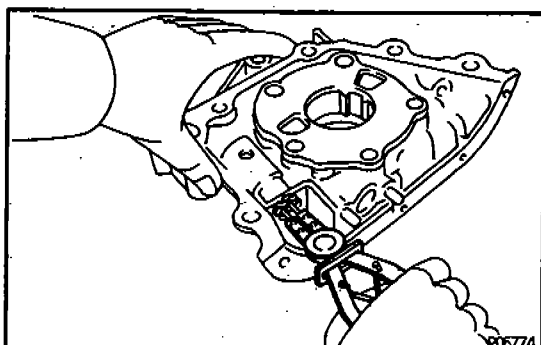
8. REMOVE OIL PUMP

- (a) Remove the 7 bolts.



- (b) Using a plastic-faced hammer, remove the oil pump body, carefully tapping the oil pump body.

- (c) Remove the gasket.



DISASSEMBLY

1. REMOVE RELIEF VALVE

- (a) Using snap ring pliers, remove the snap ring.
(b) Remove the retainer, spring and relief valve.

2. REMOVE DRIVE AND DRIVEN ROTORS

Remove the 5 screws, pump body cover, O-ring, the drive and driven rotors.

E017A-07

INSPECTION

1. INSPECT RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If it doesn't, replace the relief valve. If necessary, replace the oil pump assembly.

2. INSPECT ROTOR BODY CLEARANCE

Using a thickness gauge, measure the clearance between the driven rotor and body.

Standard body clearance:

0.100 – 0.191 mm (0.0039 – 0.0075 in.)

Maximum body clearance:

0.20 mm (0.0079 in.)

If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.

3. INSPECT ROTOR TIP CLEARANCE

Using a thickness gauge, measure the clearance between the drive and driven rotor tips.

Standard tip clearance:

0.060 – 0.220 mm (0.0024 – 0.0087 in.)

Maximum tip clearance:

0.35 mm (0.0138 in.)

If the tip clearance is greater than maximum, replace the rotors as a set.

4. INSPECT ROTOR SIDE CLEARANCE

Using a thickness gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.

Standard side clearance:

0.025 – 0.075 mm (0.0010 – 0.0030 in.)

Maximum side clearance:

0.10 mm (0.0039 in.)

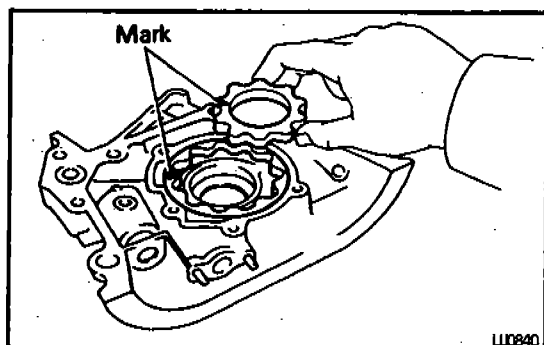
If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.

REPLACEMENT

E008A-02

REPLACE CRANKSHAFT FRONT OIL SEAL

(See EM section)



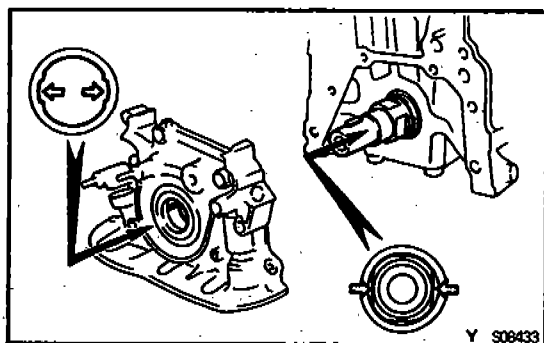
REASSEMBLY

1. INSTALL DRIVE AND DRIVEN ROTORS

- Place the drive and driven rotors into pump body with marks facing the pump body cover side.
- Install the oil pump body cover with the 5 screws. Torque: 10 N·m (105 kgf·cm, 8 ft·lbf)

2. INSTALL RELIEF VALVE

- Insert the relief valve, spring and retainer into the pump body hole.
- Using snap ring pliers, install the snap ring into the pump body hole.



INSTALLATION

1. INSTALL OIL PUMP

- Place a new gasket on the cylinder block.
- Engage the spline teeth of the oil pump with the large teeth of the crankshaft, and install the pump with the 7 bolts.

- Install the oil pump with the 7 bolts. Torque: 22 N·m (220 kgf·cm, 16 ft·lbf)

Bolt length:

35 mm (1.38 in.) for long bolt

25 mm (0.98 in.) for other bolt

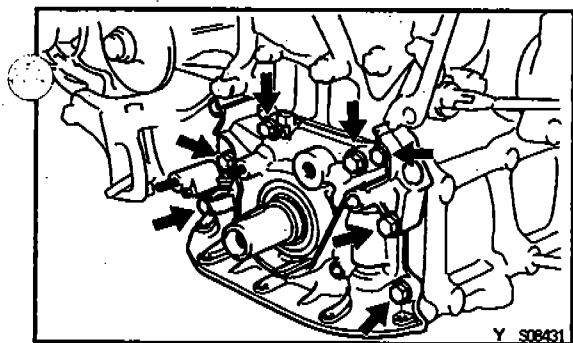
2. INSTALL OIL PAN Baffle PLATE

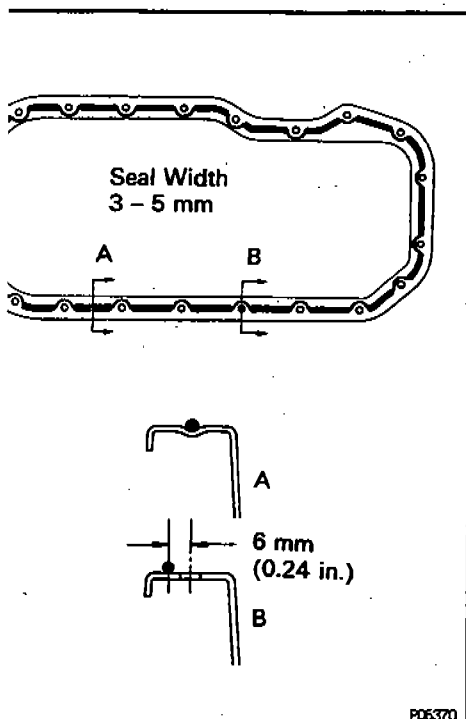
(See procedure step 4)

3. INSTALL OIL STRAINER

Install a new gasket and the oil strainer with the 2 screws and 2 nuts.

Torque: 9.3 N·m (95 kgf·cm, 82 in·lbf)





4. INSTALL OIL PAN

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pan and cylinder block.

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non-residue solvent, clean both sealing surfaces.

NOTICE: Do not use a solvent which will affect the painted surfaces.

- (b) Apply seal packing to the oil pan as shown in the illustration.

Seal packing:

Part No. 08826-00080 or equivalent

- Install a nozzle that has been cut to a 3 - 5 mm (0.12 - 0.20 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

- (c) Install the oil pan with the 19 bolts and 2 nuts.

Torque: 4.9 N-m (50 kgf-cm, 43 in.-lbf)

5. INSTALL OIL DIPSTICK GUIDE AND DIPSTICK

- (a) Install a new O-ring to the dipstick guide.
 (b) Apply soapy water to the O-ring.
 (c) Push in the dipstick guide together with the dipstick, and install them with the bolt.

Torque: 9.3 N-m (95 kgf-cm, 82 in.-lbf)

6. INSTALL CRANKSHAFT TIMING PULLEY AND IDLER PULLEY

(See EM section)

7. INSTALL TIMING BELT

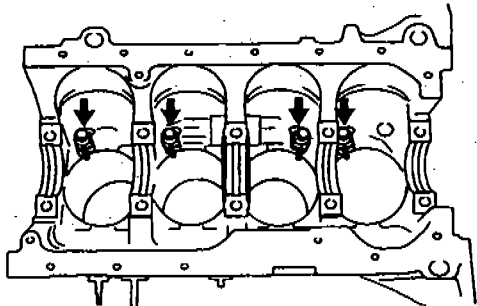
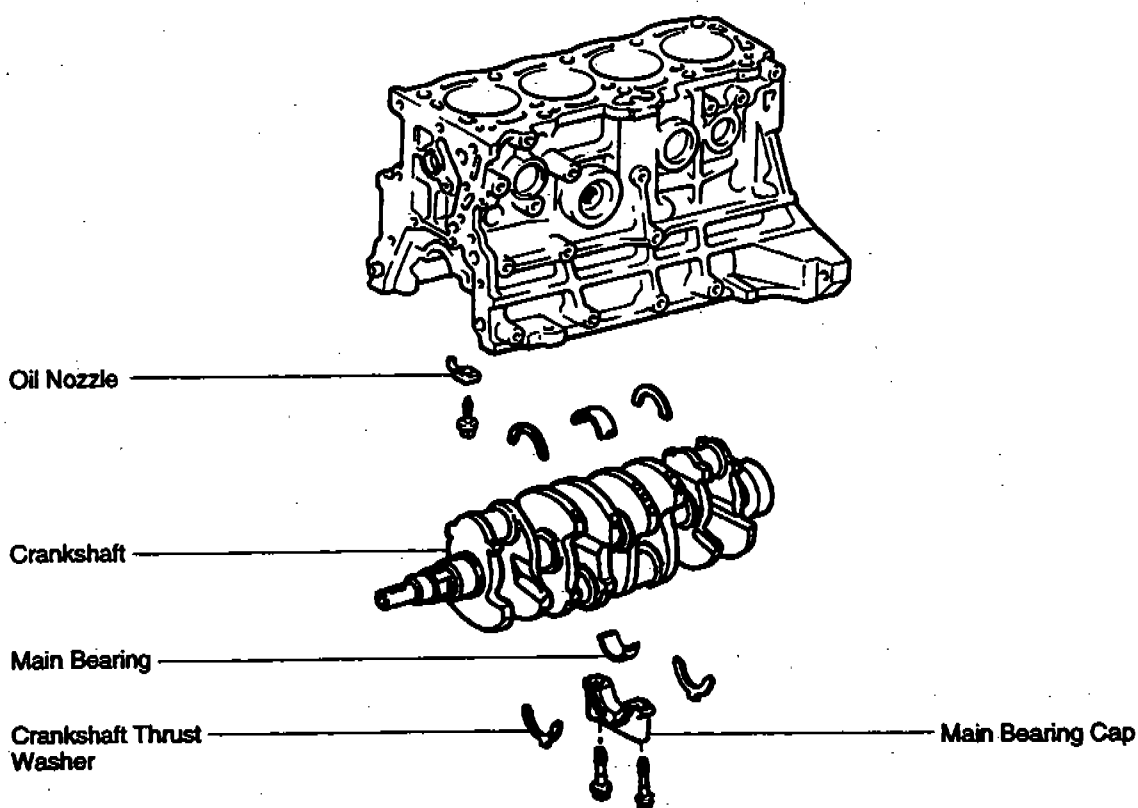
(See EM section)

8. FILL WITH ENGINE OIL

9. START ENGINE AND CHECK FOR OIL LEAKS

10. RECHECK ENGINE OIL LEVEL

OIL NOZZLE COMPONENTS



S08442

REMOVAL

1. **REMOVE CRANKSHAFT**
(See EM section)
2. **REMOVE OIL NOZZLES**

Remove the union bolt and oil nozzle. Remove the nozzles.

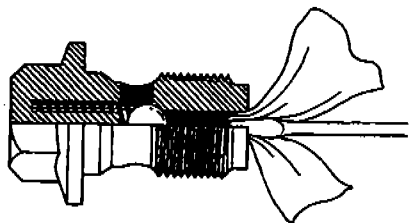
INSPECTION

1. **INSPECT RELIEF VALVES (UNION BOLTS)**

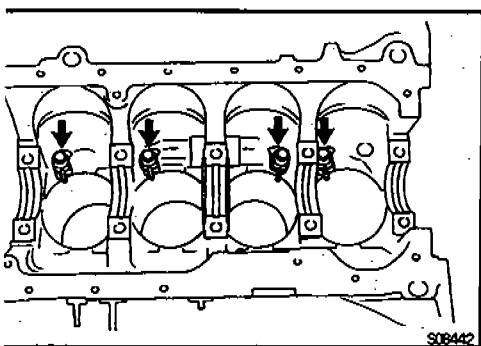
Push the valve with a wooden stick to check if it is stuck. If stuck, replace the union bolts.

2. **INSPECT OIL NOZZLE**

Check the oil nozzles for damage or clogging. If necessary, replace the oil nozzle.



S08443



INSTALLATION

1. INSTALL OIL NOZZLES

Install the oil nozzle with the union bolt. Install the 4 oil nozzles.

Torque: 25 N-m (250 kgf-cm, 18 ft-lbf)

2. INSTALL CRANKSHAFT

(See EM section)

COOLING

COOLANT	CO-1
WATER PUMP	CO-2
THERMOSTAT	CO-8
RADIATOR	CO-10
ELECTRIC COOLING FAN	CO-15
WATER TEMPERATURE SWITCH	CO-17
COOLING FAN RELAY	CO-18
ENGINE MAIN RELAY	CO-19

COOLANT INSPECTION

CC0000-05

1. CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR

The engine coolant level should be between the "LOW" and "FULL" lines, when the engine is cold. If low, check for leaks and add engine coolant up to the "FULL" line.

2. CHECK ENGINE COOLANT QUALITY

- (a) Remove the radiator cap.

CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

- (b) There should not be any excessive deposits of rust or scale around the radiator cap or radiator filler hole, and the coolant should be free from oil.

If excessively dirty, clean the coolant passages and replace the coolant.

- (c) Reinstall the radiator cap.

REPLACEMENT

CC0004-05

1. DRAIN ENGINE COOLANT

- (a) Remove the radiator cap.

CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

- (b) Loosen the radiator drain plug (on the right side of the radiator lower tank) and engine drain plug (on the left front of the cylinder block), and drain the coolant.

- (c) Close the drain plugs.

Torque (Engine drain plug): 35 N·m (350 kgf·cm, 25 ft·lb)

2. FILL ENGINE COOLANT

- (a) Slowly fill the system with coolant.

- Use a good brand of ethylene-glycol base engine coolant and mix it according to the manufacturer's directions.
- Using coolant which includes more than 50 % ethylene-glycol (but not more than 70 %) is recommended.

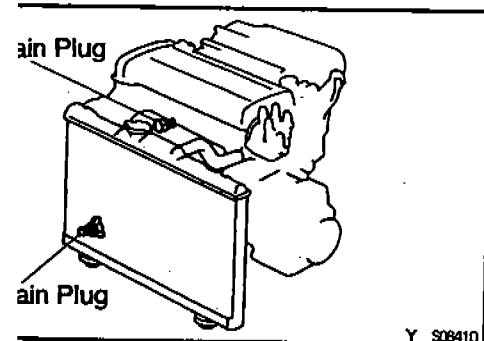
NOTICE:

- Do not use an alcohol type coolant.
- The coolant should be mixed with demineralized water or distilled water.

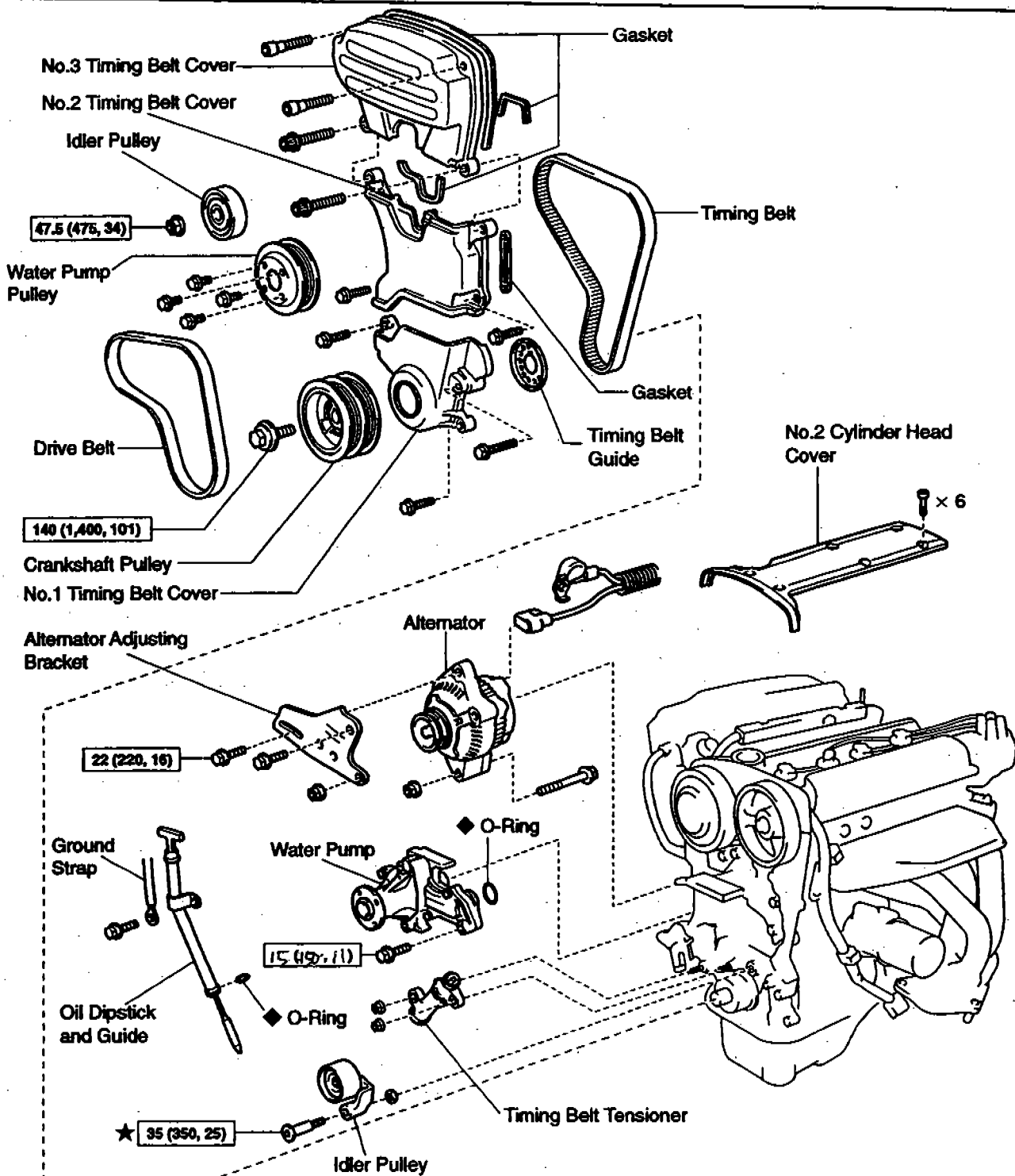
Capacity: 5.3 liters (5.6 US qts, 4.7 Imp. qts)

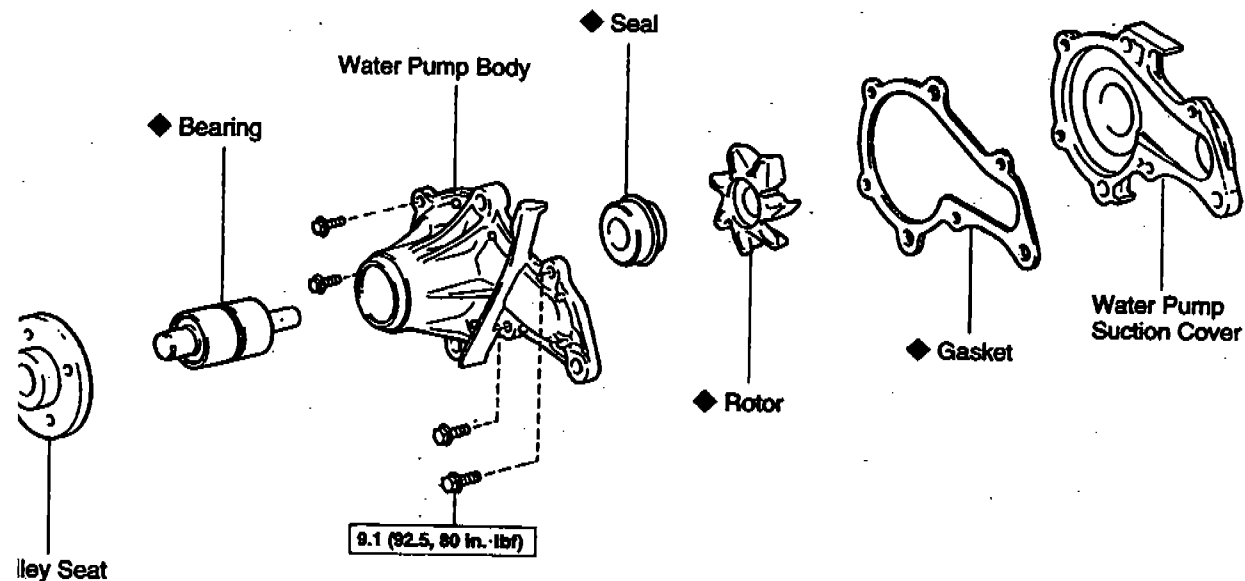
- (b) Reinstall the radiator cap.
(c) Start the engine, and bleed the cooling system.
(d) If necessary, refill coolant into the reservoir up to the "FULL" line.

3. CHECK ENGINE COOLANT FOR LEAKS



WATER PUMP COMPONENTS



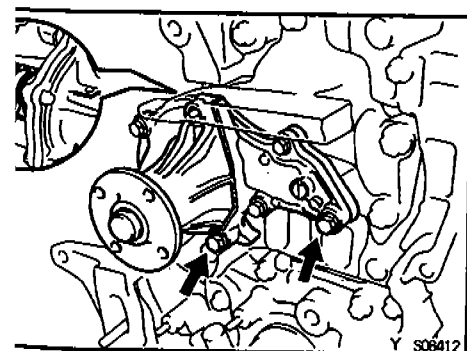


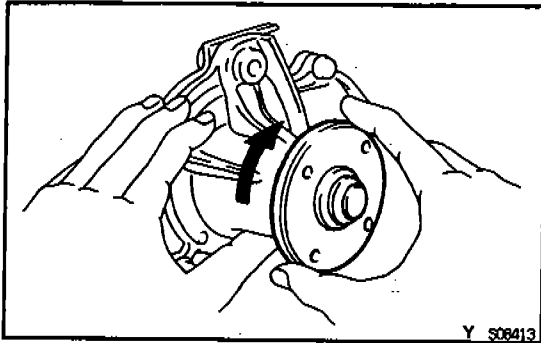
(kgf·cm, ft·lbf) : Specified torque
 on-reusable part

Y P24520

REMOVAL

1. DRAIN ENGINE COOLANT
2. REMOVE ALTERNATOR DRIVE BELT AND WATER PUMP PULLEY
(See EM section)
3. REMOVE TIMING BELT AND IDLER PULLEY
(See EM section)
4. REMOVE OIL DIPSTICK AND GUIDE
 - (a) Remove the mounting bolt and ground strap.
 - (b) Pull out the dipstick guide together with the dipstick.
 - (c) Remove the O-ring from the dipstick guide.
5. REMOVE ALTERNATOR AND ADJUSTING BAR
6. REMOVE WATER PUMP
 - (a) Remove the 2 bolts holding the water pump to the cylinder head.
 - (b) Disconnect the water pump from the water hose and remove the water pump.
 - (c) Remove the O-ring from the cylinder block.

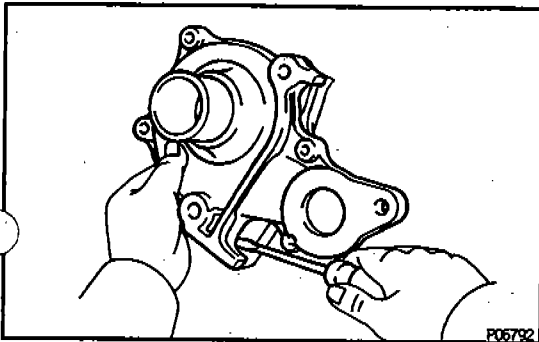




INSPECTION

INSPECT WATER PUMP

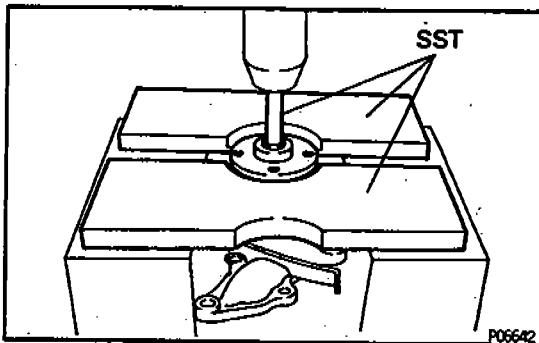
- (a) Visually check the air hole and water hole for coolant leakage.
If leakage is found, replace the water pump.
- (b) Turn the pulley and check that the water pump bearing moves smoothly and quietly.
If necessary, replace the water pump.



DISASSEMBLY

1. REMOVE WATER PUMP SUCTION COVER

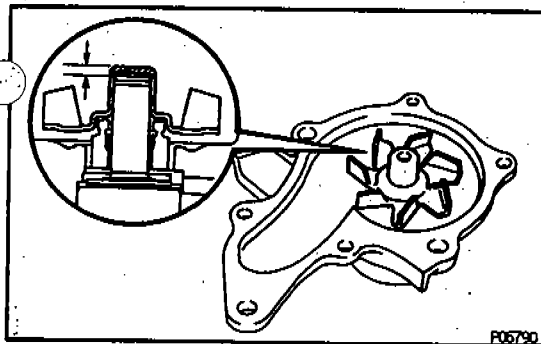
- (a) Remove the 4 bolts.
- (b) Using a screwdriver, pry off the water pump suction cover.



2. REMOVE PULLEY SEAT

Using SST and a press, press the shaft of the bearing to remove pulley seat.

SST 09236-00101 (09237-00010, 09237-00040)

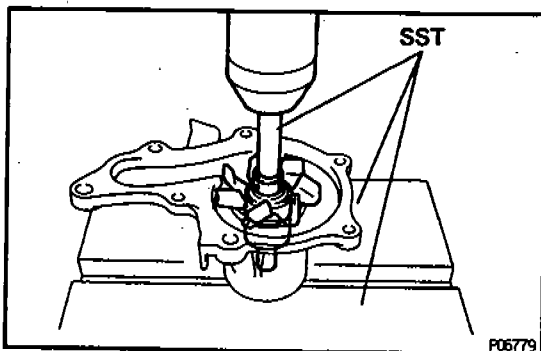


3. REMOVE WATER PUMP BEARING

- (a) Using a grinding wheel, grind the water pump rotor as shown.

NOTICE: Do not grind water pump bearing shaft.

- (b) Gradually heat the water pump body to approx. 80°C (185°F).

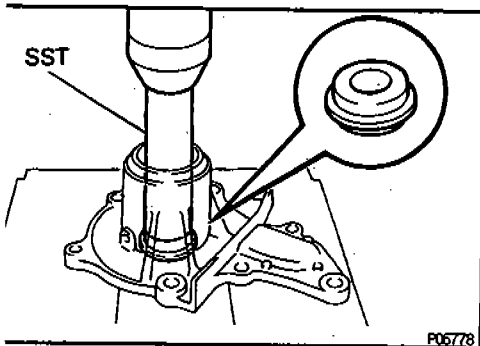


- (c) Using SST and a press, press the shaft of the bearing to remove the rotor and bearing.

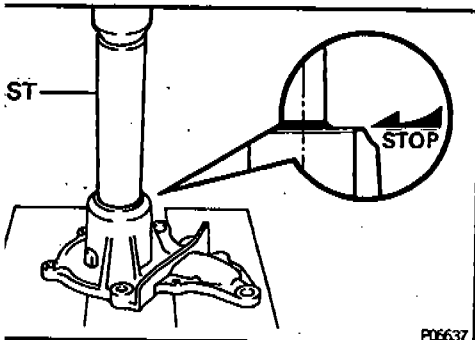
SST 09236-00101 (09237-00010, 09237-00040)

- (d) Remove the seal set from the water pump body.

NOTICE: Do not damage the water pump body.

**4. REMOVE SEAL**

Using SST and a press, press out the seal.
SST 09236-00101 (09236-15010)

**REASSEMBLY**

E0801-02

HINT: Always assemble the water pump with a new seal set, a new rotor and a new bearing.

1. INSTALL WATER PUMP BEARING

- (a) Gradually heat the water pump body to approx. 8.°C (185°F).
- (b) Using SST and a press, press the outer race of the bearing until its surface is flush with the water pump body surface.

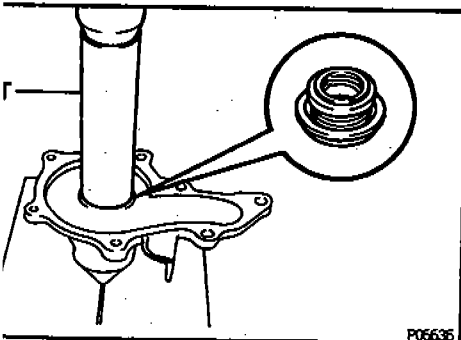
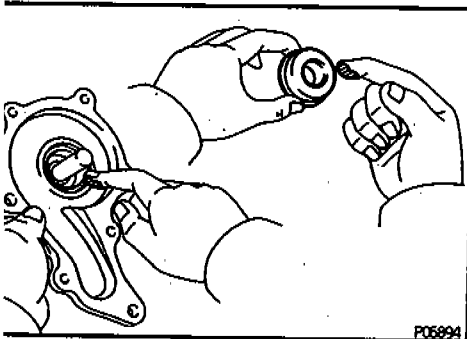
SST 09236-00101 (09237-00020)

2. INSTALL SEAL

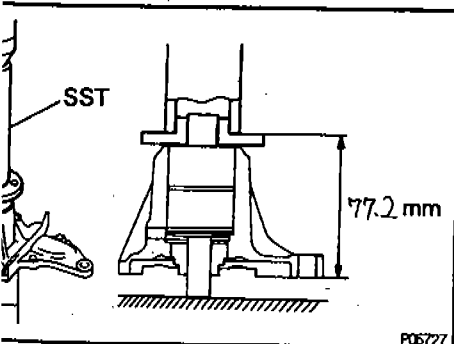
- (a) Apply a seal packing to a new seal and pump body.

Seal packing:

Part No. 08826-00100 or equivalent

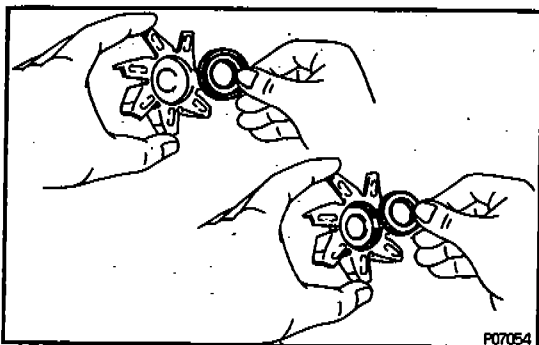


- (b) Using SST and a press, press in the seal.
SST 09236-00101 (09237-00020)

**3. INSTALL PULLEY SEAT**

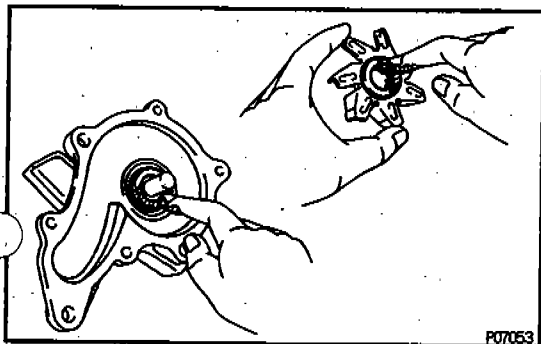
Using SST and a press, press in the pulley seat on the water pump bearing shaft to 77.2 mm (3.040 in.) from the installation surface of the pump body.

SST 09236-00101 (09237-00020)

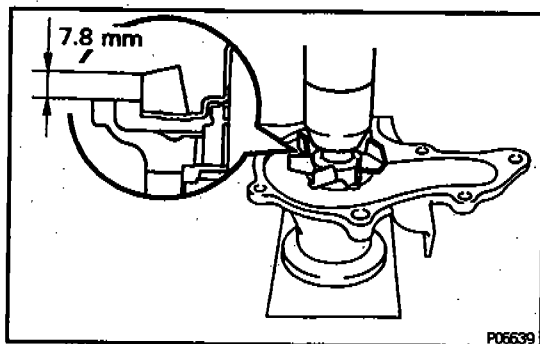


4. INSTALL ROTOR

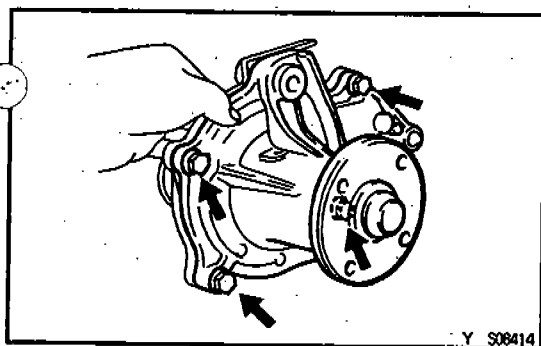
- (a) Install a new packing and seat into the rotor.



- (b) Apply a little silicon oil to the seat and rotor contact face.



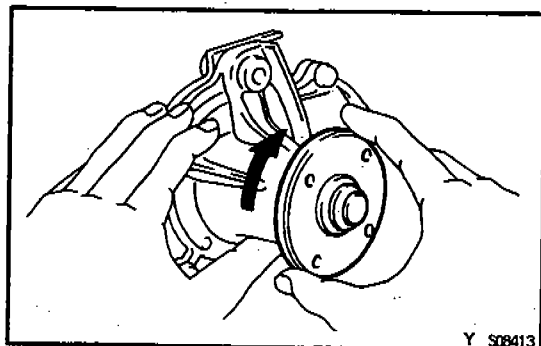
- (c) Using a press, press in a new rotor on the water pump bodying shaft to 7.8 mm (0.307 in.) from the installation surface of the pump body.



5. INSTALL WATER PUMP SUCTION COVER

Install the water pump suction cover with a new gasket and the 4 bolts.

Torque: 9.3 N·m (92.5 kgf·cm, 80 in.-lbf)

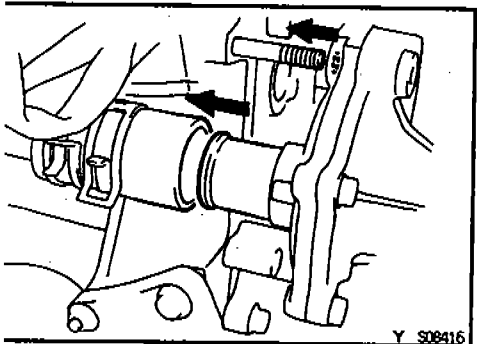
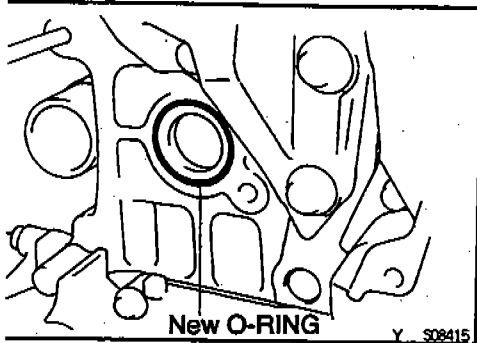


6. CHECK THAT WATER PUMP ROTATES SMOOTHLY

INSTALLATION

1. INSTALL WATER PUMP

- (a) Place a new O-ring in position on the cylinder block.



- (b) Attach the water pump to the water hose and cylinder block.

- (c) Connect the water pump to the water hose.

- (d) Install the 2 bolts.

Torque: 15 N-m (150 kgf-cm, 11 ft-lbf)

2. INSTALL ALTERNATOR AND ADJUSTING BAR

Torque: 22 N-m (220 kgf-cm, 16 ft-lbf)

3. INSTALL OIL DIPSTICK GUIDE AND DIPSTICK

- (a) Install a new O-ring to the dipstick guide.

- (b) Apply soapy water to the O-ring.

- (c) Push in the dipstick guide together with the dipstick, and install it with the bolt and ground strap.

Torque: 9.5 N-m (95 kgf-cm, 82 in.-lbf)

4. INSTALL TIMING BELT AND IDLER PULLEY

(See EM section)

5. INSTALL WATER PUMP PULLEY AND ALTERNATOR DRIVE BELT

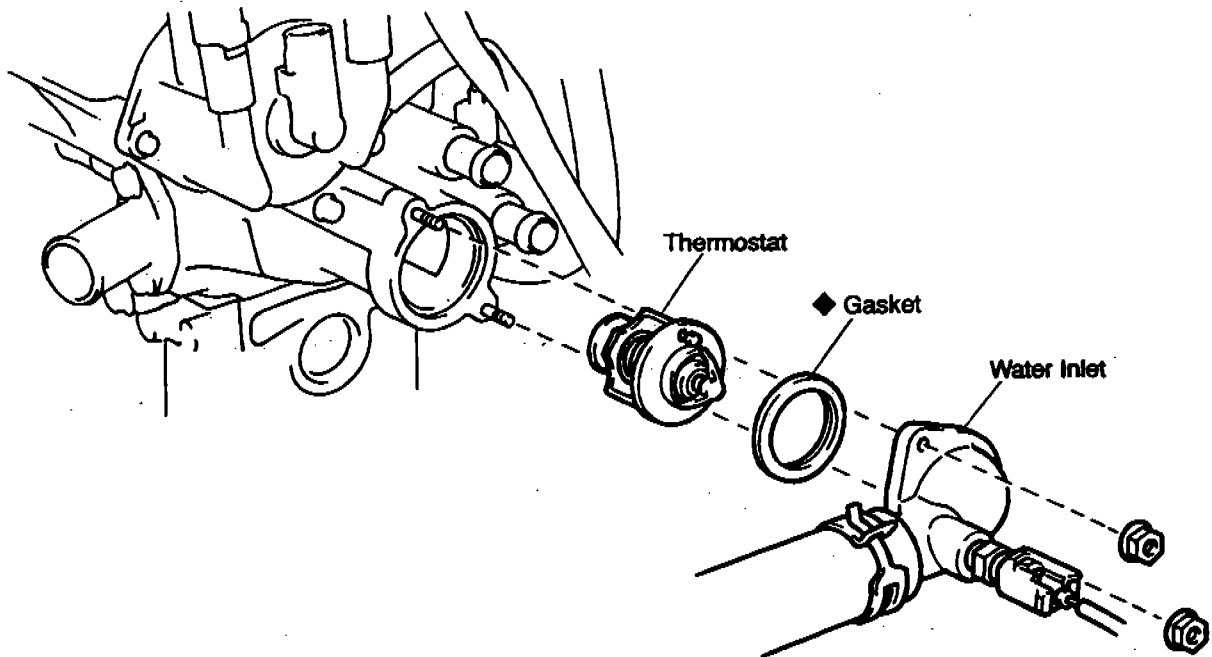
(See EM section)

6. FILL WITH ENGINE COOLANT

7. START ENGINE AND CHECK FOR COOLANT LEAKS

THERMOSTAT COMPONENTS

E8130-00



◆ Non-reusable parts

REMOVAL

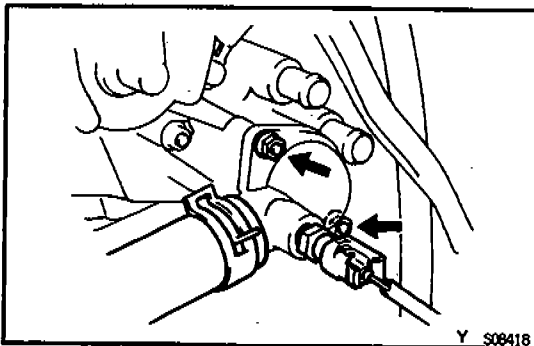
HINT: Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not move the thermostat, even if the engine tends to overheat.

1. DRAIN ENGINE COOLANT

2. DISCONNECT WATER TEMPERATURE SWITCH CONNECTOR

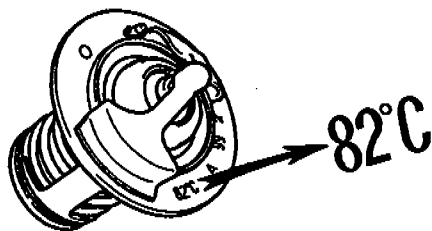
3. REMOVE WATER INLET AND THERMOSTAT

- (a) Remove the 2 nuts and water inlet from the water inlet housing.
- (b) Remove the thermostat.
- (c) Remove the gasket from the thermostat.



Y S08418

E01394-01



P13255

INSPECTION

INSPECT THERMOSTAT

HINT: The thermostat is numbered with the valve opening temperature.

- (a) Immerse the thermostat in water and gradually heat the water.
- (b) Check the valve opening temperature.

Valve opening temperature:

80 – 84°C (176 – 183°F)

If the valve opening temperature is not as specified, replace the thermostat.

- (c) Check the valve lift.

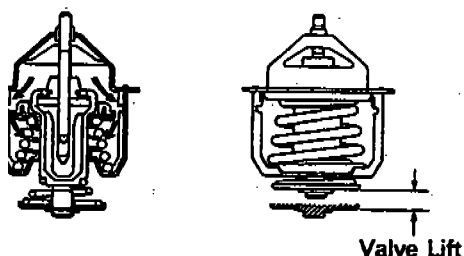
Valve lift:

8 mm (0.31 in.) or more at 95°C (203°F)

If the valve lift is not as specified, replace the thermostat.

- (d) Check that the valve spring is tight when the thermostat is fully closed.

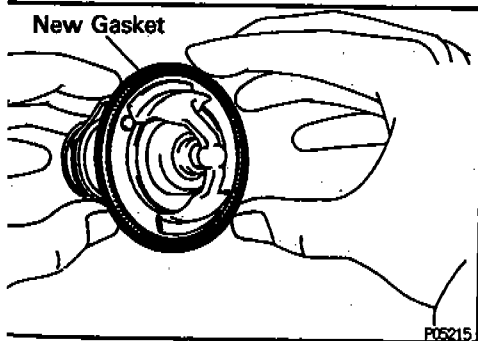
If not closed, replace the thermostat.



Valve Lift

C01233

New Gasket



P05215

INSTALLATION

E0804-02

1. PLACE THERMOSTAT IN WATER INLET HOUSING

- (a) Install a new gasket to the thermostat.
- (b) Align the jiggle valve of the thermostat with the upper side of the stud bolt, and insert the thermostat in the water inlet housing.

HINT: The jiggle valve may be set within 15° of either side of the prescribed position.

2. INSTALL WATER INLET

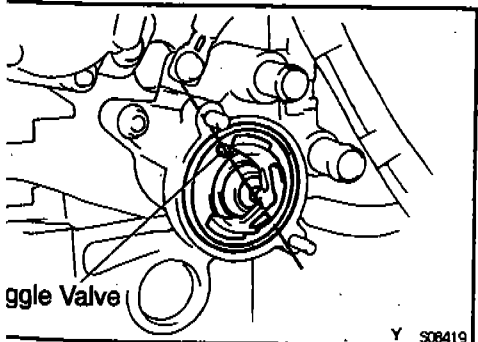
Install the water inlet with the 2 nuts.

Torque: 9.3 N·m (95 kgf·cm, 82 in.-lbf)

3. CONNECT WATER TEMPERATURE SWITCH CONNECTOR

4. FILL WITH ENGINE COOLANT

5. START ENGINE AND CHECK FOR COOLANT LEAKS



Y 308419

RADIATOR ON-VEHICLE CLEANING

Using water or a steam cleaner, remove any mud or dirt from the radiator core.

NOTICE: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. (i.e. Maintain distance between the cleaner nozzle and radiator core.)

ON-VEHICLE INSPECTION

1. REMOVE RADIATOR CAP

CAUTION: To avoid the danger of being burned, do not move the radiator cap while the engine and radiator are hot, as fluid and steam can be blown out under pressure.

2. INSPECT RADIATOR CAP

NOTICE:

- If the radiator cap has contaminations, always rinse it with water.
- When performing steps (a) and (b) below, keep the radiator pump tester at an angle of over 30° above horizontal.
- Before using a radiator cap tester, wet the relief valve and pressure valve with engine coolant or water.

- (a) Using a radiator cap tester, slowly pump the tester to check that air is coming from the vacuum valve.

Pump speed:

1 push/3 seconds or more

NOTICE: Push the pump at a constant speed.

If air is not coming from the vacuum valve, replace the radiator cap.

- (b) Pump the tester and measure the relief valve opening pressure.

Pump speed:

1 push within 1 second

NOTICE: This pump speed is for the first pump only (in order to close the vacuum valve). After this, the pump speed can be reduced.

Standard opening pressure:

74 – 103 kPa

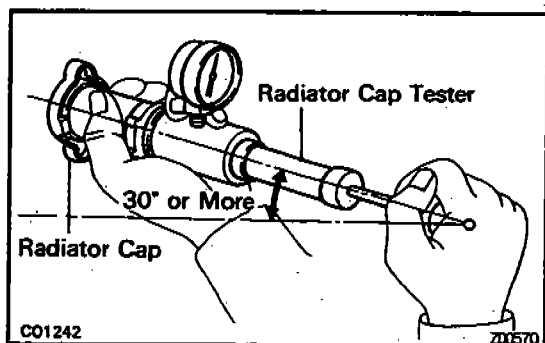
(0.75 – 1.05 kgf/cm², 10.7 – 14.9 psi)

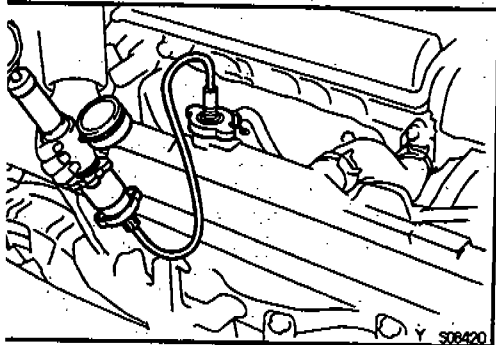
Minimum opening pressure:

59 kPa (0.6 kgf/cm², 8.05 psi)

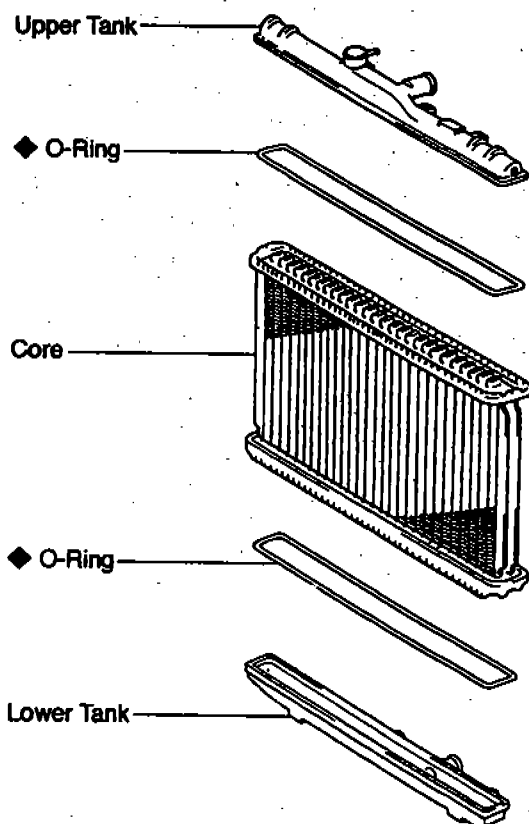
HINT: Use the tester's maximum reading as the opening pressure.

If the opening pressure is less than minimum, replace the radiator cap.

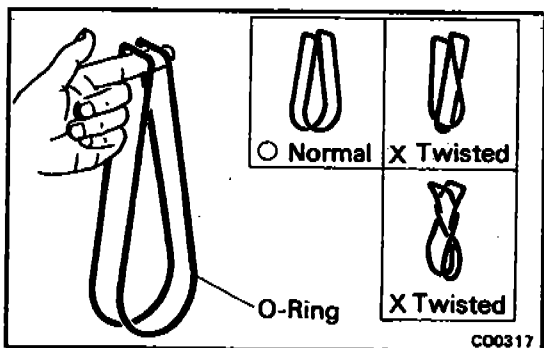
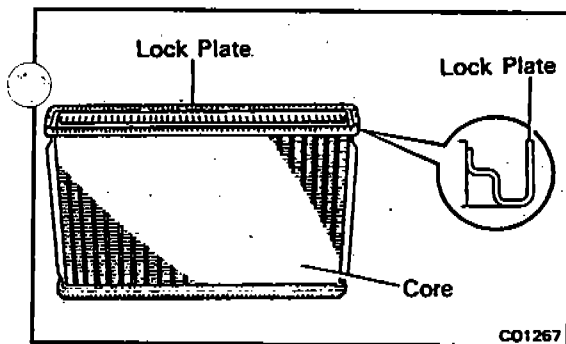
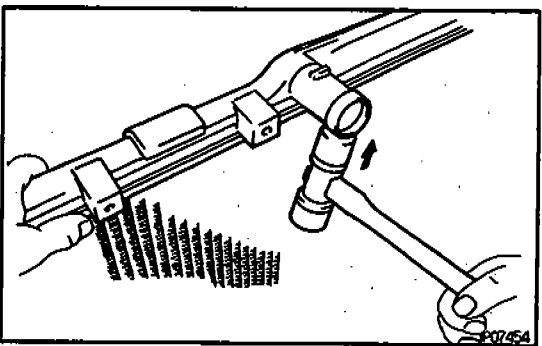
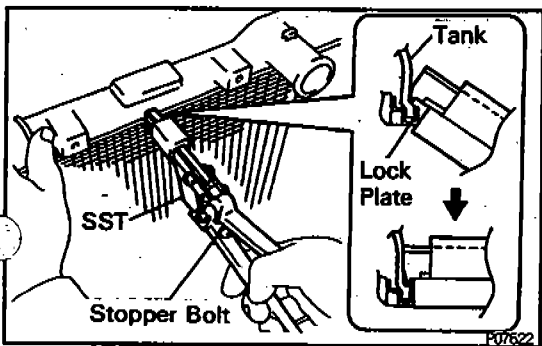
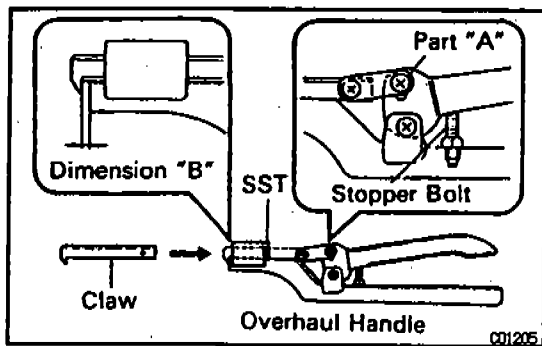


**3. INSPECT COOLING SYSTEM FOR LEAKS**

- (a) Fill the radiator with coolant and attach a radiator cap tester.
 - (b) Warm up the engine.
 - (c) Pump it to 118 kPa (1.2 kgf/cm², 17.1 psi), and check that the pressure does not drop.
- If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, cylinder block and cylinder head.

4. REINSTALL RADIATOR CAP**COMPONENTS**

Non-reusable parts



DISASSEMBLY

1. ASSEMBLY SST

SST 09230-01010

- Install the claw to the overhaul handle, inserting it in the hole in part "A" as shown in the diagram.
- While gripping the handle, adjust the stopper bolt so that dimension "B" shown in the diagram is 0.2–0.5 mm (0.008–0.020 in.).

NOTICE: If this adjustment is not done, the claw may be damaged.

2. UNCAULK LOCK PLATES

Using SST to release the caulking, squeeze the handle until stopped by the stopper bolt.

SST 09230-01010

3. REMOVE TANKS AND O-RINGS

- Lightly tap the radiator hose inlet (or outlet) with a flat faced hammer and remove the tank.
- Remove the O-ring.

ASSEMBLY

1. INSPECT LOCK PLATE

Inspect the lock plate for damage.

HINT:

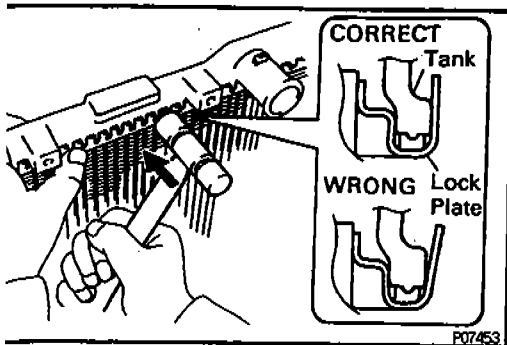
- If the sides of the lock plate groove are deformed, reassembly of the tank will be impossible.
- Therefore, first correct any deformation with pliers or a similar object. Water leakage will result if the bottom of the lock plate groove is damaged or deformed. Therefore repair or replace if necessary.

NOTICE: The radiator can only be recaulked 2 times. After the 2nd time, the radiator core must be replaced.

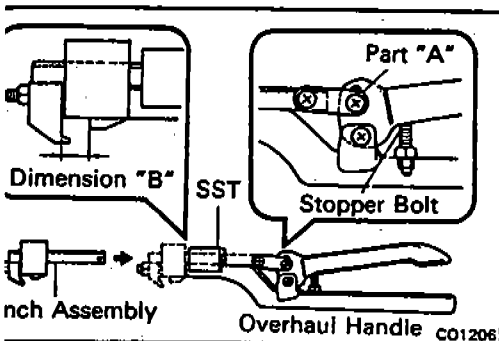
2. INSTALL NEW O-RINGS AND TANKS

- After checking that there are no foreign objects in the lock plate groove, install the new O-ring without twisting it.

HINT: When cleaning the lock plate groove, lightly rub it with sand paper without scratching it.



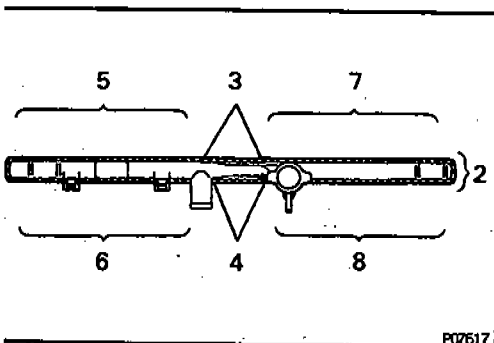
- (b) Install the tank without damaging the O-ring.
- (c) Tap the lock plate with a soft-faced hammer so that there is no gap between it and the tank.



3. ASSEMBLY SST

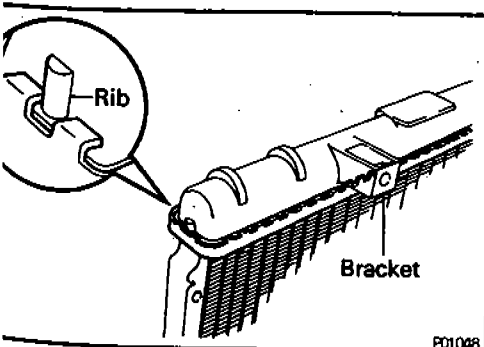
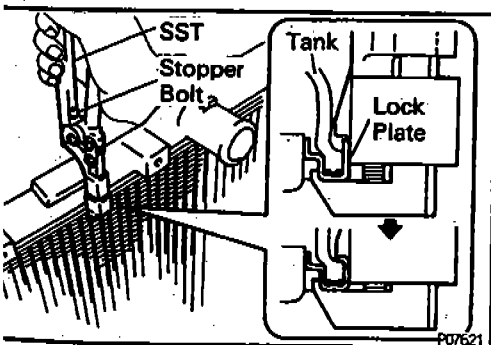
SST 09230-01010

- (a) Install the punch assembly to the overhaul handle, inserting it in the hole in part "A" as shown in the illustration.
- (b) While gripping the handle, adjust the stopper bolt so that dimension "B" shown in the diagram is 7.7 mm (0.03 in.)



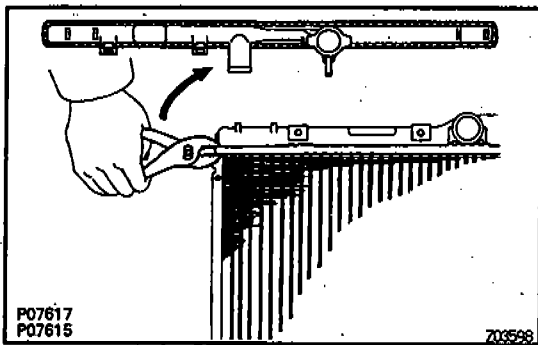
4. CAULK LOCK PLATE

- (a) Lightly press SST against the lock plate in the order shown in the illustration. After repeating this a few times, fully caulk the lock plate by squeezing the handle until stopped by the stopper plate.
- SST 09230-01010

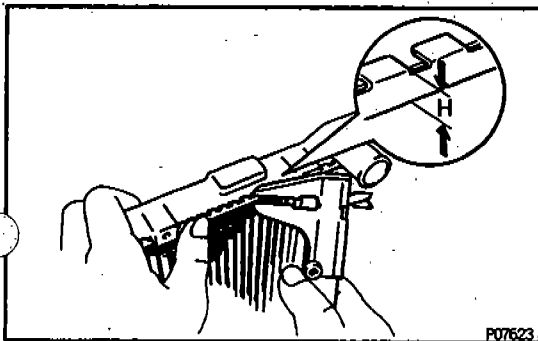


HINT:

- Do not stake the areas protruding around the pipes, brackets or tank ribs.



- The points shown in the illustration cannot be staked with the SST.
- Use a plier or similar object and be careful not to damage the core plates.

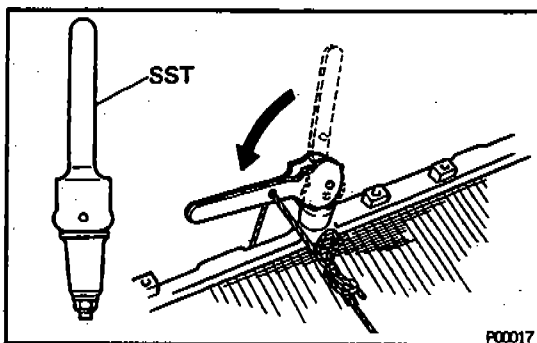


- (b) Check the lock plate height (H) after completing the caulking.

Plate height:

7.75 – 8.25 mm (0.3051 – 0.3248 in.)

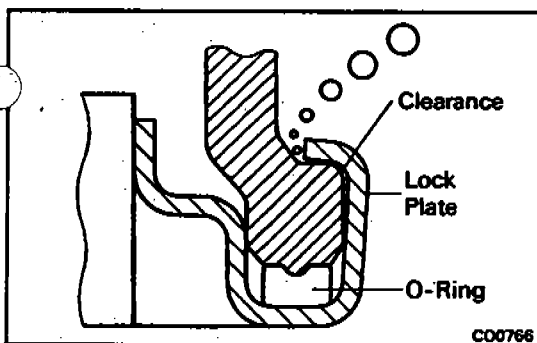
If not within the specified height, adjust the stopper of the handle again and perform the caulking again.



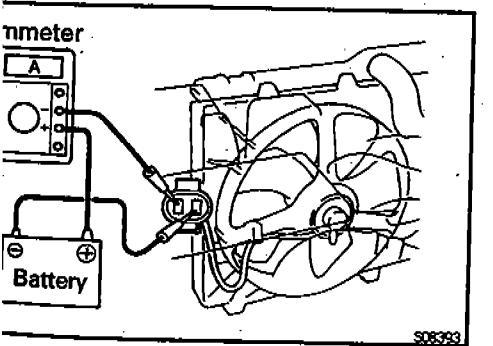
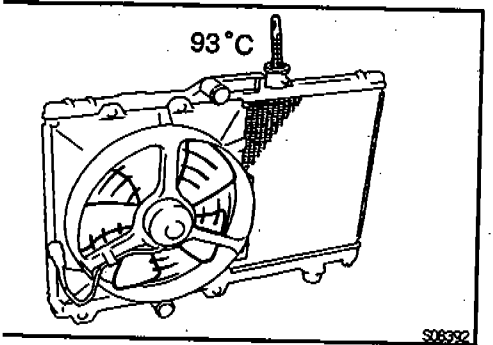
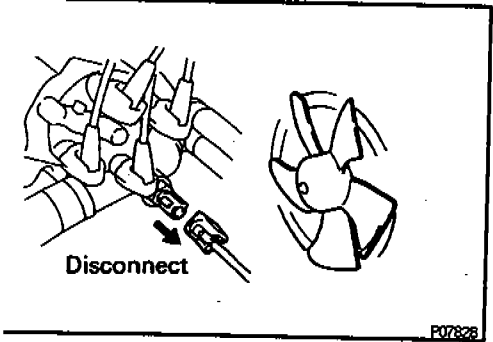
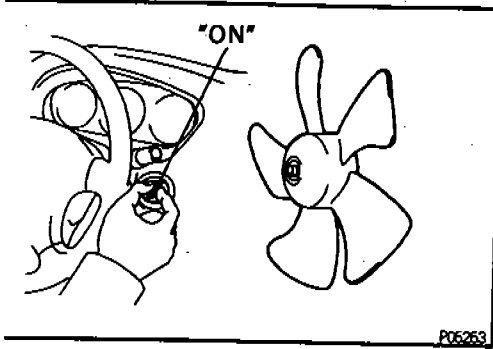
5. INSPECT FOR WATER LEAKS

- Tighten the drain cock.
 - Plug the inlet and outlet pipes of the radiator with SST 09230-01010.
 - Using a radiator cap tester, apply pressure to the radiator.
- Test pressure:

177 kPa (1.8 kgf/cm², 26 psi)



- Inspect for water leaks.
- HINT: On radiators with resin tanks, there is a clearance between the tank and lock plate where a minute amount of air will remain, giving the appearance of air leaks when the radiator is submerged in water. Therefore, before doing the water leak test, first swirl the radiator around in the water until all air bubbles disappear.



ELECTRIC COOLING FAN ON-VEHICLE INSPECTION

CO250-01

1. CHECK COOLING FAN OPERATION WITH LOW TEMPERATURE (Below 83°C (181°F))

- Turn the ignition switch ON.
- Check that the cooling fan stops.
If not, check the cooling fan relay and water temperature switch, and check for a separated connector or severed wire between cooling fan relay and water temperature switch.
- Disconnect the water temperature switch connector.
- Check that the cooling fan rotates.
If not, check the cooling fan relay, cooling fan, engine main relay and fuse, and check for a short circuit between the cooling fan relay and water temperature switch.
- Reconnect the water temperature switch connector.

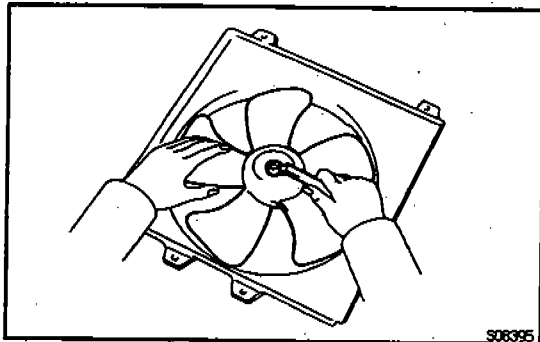
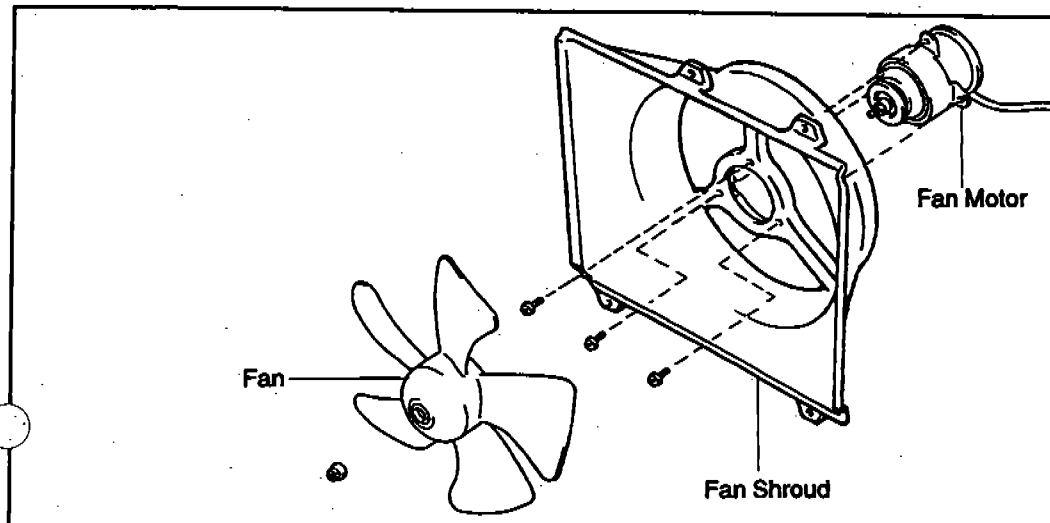
2. CHECK COOLING FAN OPERATION WITH HIGH TEMPERATURE (Above 93°C (199°F))

- Start the engine, and raise coolant temperature to above 93°C (199°F).
- Check that the cooling fan rotates.
If not, replace the water temperature switch.

3. INSPECT COOLING FAN

- Disconnect the cooling fan connector.
- Connect battery and ammeter to the cooling fan connector.
- Check that the cooling fan rotates smoothly, and check the reading on the ammeter.
Standard amperage:
3.2 – 4.4 A
- Reconnect the cooling fan connector.

COMPONENTS

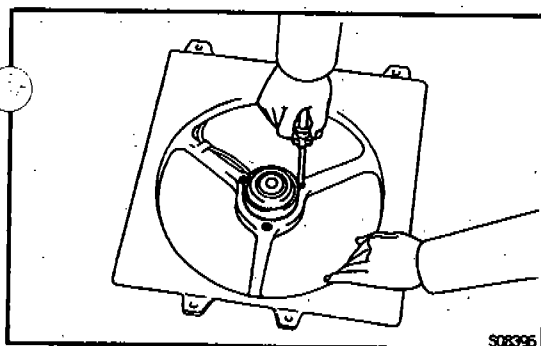


DISASSEMBLY

1. REMOVE FAN

Remove the nut and fan.

Torque: 6.2 N·m (63 kgf·cm, 55 in.-lbf)



2. REMOVE FAN MOTOR

Remove the 3 screws and fan motor.

Torque: 2.6 N·m (26 kgf·cm, 23 in.-lbf)

REASSEMBLY

Reassembly is in the reverse order of disassembly.

WATER TEMPERATURE SWITCH INSPECTION

80258-00

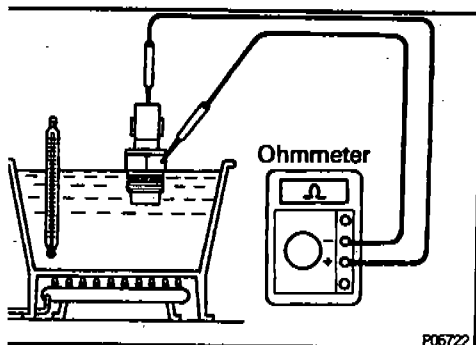
1. DRAIN ENGINE COOLANT
2. REMOVE WATER TEMPERATURE SWITCH

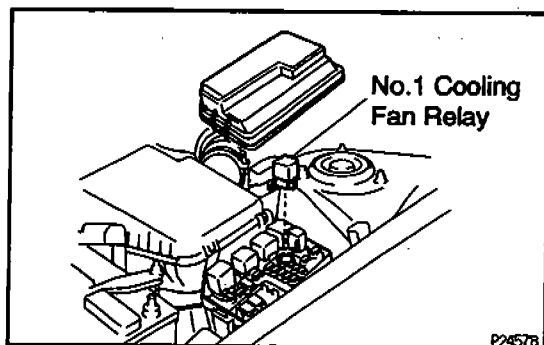
3. INSPECT WATER TEMPERATURE SWITCH

- (a) Using an ohmmeter, check that there is no continuity between the terminals when the coolant temperature is above 93°C (199°F).
- (b) Using an ohmmeter, check that there is continuity between the terminals when the coolant temperature is below 83°C (181°F).

If continuity is not as specified, replace the switch.

4. REINSTALL WATER TEMPERATURE SWITCH
5. REFILL WITH ENGINE COOLANT



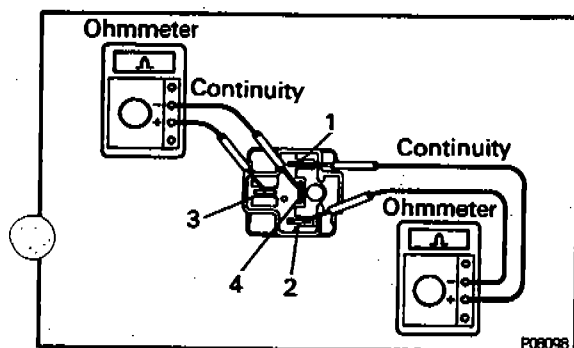


NO.1 COOLING FAN RELAY INSPECTION

1. REMOVE NO.1 COOLING FAN RELAY ("FAN NO.1")

2. INSPECT NO.1 COOLING FAN RELAY CONTINUITY

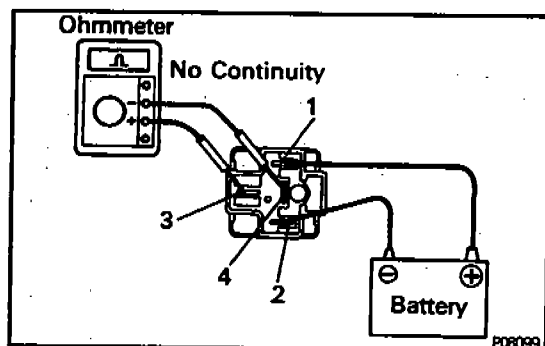
- (a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.
- (b) Check that there is continuity between terminals 3 and 4. If continuity is not as specified, replace the relay.

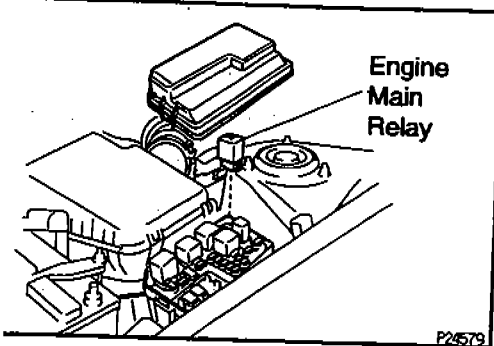


3. INSPECT NO.1 COOLING FAN RELAY OPERATION

- (a) Apply battery voltage across terminals 1 and 2.
- (b) Using an ohmmeter, check that there is no continuity between terminals 3 and 4. If operation is not as specified, replace the relay.

4. REINSTALL NO.1 COOLING FAN RELAY





ENGINE MAIN RELAY INSPECTION

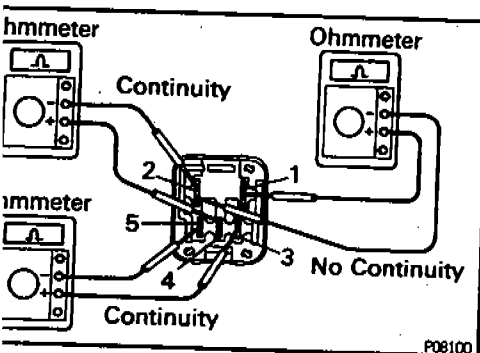
20020-04

1. REMOVE ENGINE MAIN RELAY ("ENGINE MAIN")

2. INSPECT ENGINE MAIN RELAY CONTINUITY

- Using an ohmmeter, check that there is continuity between terminals 3 and 5.
- Check that there is continuity between terminals 2 and 4.
- Check that there is no continuity between terminals 1 and 2.

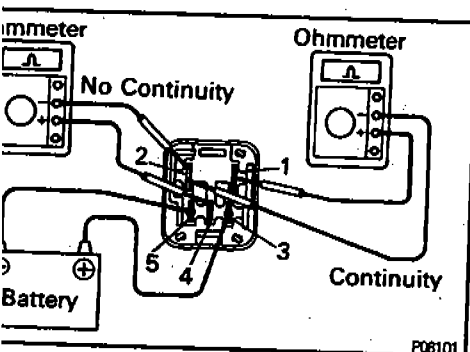
If continuity is not as specified, replace the relay.



3. INSPECT ENGINE MAIN RELAY OPERATION

- Apply battery voltage across terminals 3 and 5.
 - Using an ohmmeter, check that there is no continuity between terminals 2 and 4.
 - Check that there is continuity between terminals 1 and 2.
- If operation is not as specified, replace the relay.

4. REINSTALL ENGINE MAIN RELAY



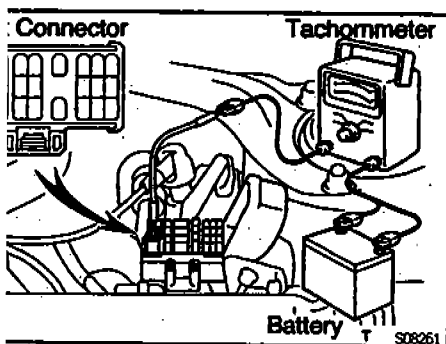
ELECTRONIC FUEL INJECTION

EFI SYSTEM	FI-1
DIAGNOSIS SYSTEM	FI-5
TROUBLESHOOTING w/ VOLT, OHMMETER	FI-14
REFERENCE VALUE OF ENGINE ECU DATA	FI-30
FUEL PUMP	FI-31
FUEL PRESSURE REGULATOR	FI-37
INJECTOR	FI-39
THROTTLE BODY	FI-45
CAMSHAFT TIMING OIL CONTROL VALVE	FI-56
ISC VALVE	FI-57
EFI MAIN RELAY	FI-60
CIRCUIT OPENING RELAY	FI-61
VSV FOR EVAP	FI-62
WATER TEMPERATURE SENSOR	FI-64
INTAKE AIR TEMPERATURE (IAT) SENSOR	FI-65
VACUUM SENSOR	FI-66
KNOCK SENSOR	FI-67
OXYGEN SENSOR	FI-68
ENGINE ECU	FI-70
FUEL CUT RPM	FI-73

EFI SYSTEM PRECAUTION

SP040-01

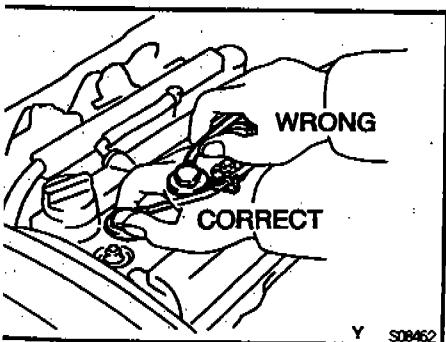
1. Before working on the fuel system, disconnect the negative (-) terminal cable from the battery.
HINT: Any diagnostic trouble code retained by the computer will be erased when the negative (-) terminal cable is removed from the battery.
Therefore, if necessary, read the diagnosis before removing the negative (-) terminal cable from the battery.
2. Do not smoke or work near an open flame when working on the fuel system.
3. Keep gasoline away from rubber or leather parts.



Maintenance Precautions

1. PRECAUTION WHEN CONNECTING GAUGE

- (a) Use battery as the power source for the timing light, tachometer, etc.
- (b) Connect the tester probe of a tachometer to the terminal IG \ominus of the check connector.



2. IN EVENT OF ENGINE MISFIRE, FOLLOWING PRECAUTIONS SHOULD BE TAKEN

- (a) Check proper connection of battery terminal cables, etc.
- (b) Handle high-tension cords carefully.
- (c) After repair work, check that the ignition coil terminals and all other ignition system lines are reconnected securely.
- (d) When cleaning the engine compartment, be especially careful to protect the electrical system from water.

3. PRECAUTIONS WHEN HANDLING OXYGEN SENSOR

- (a) Do not allow oxygen sensor to drop or hit against an object.
- (b) Do not allow the sensor to come into contact with water.

Air Induction System

1. Separation of the engine oil dipstick, oil filler cap, PCV hose, etc. may cause the engine to run out of tune.

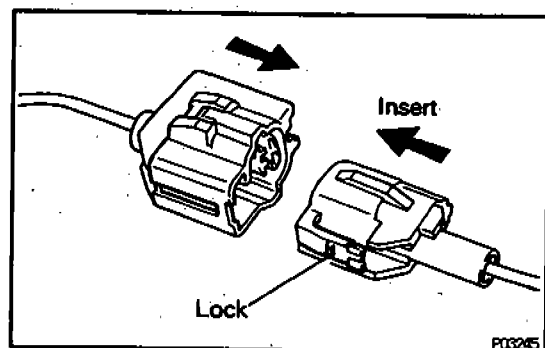
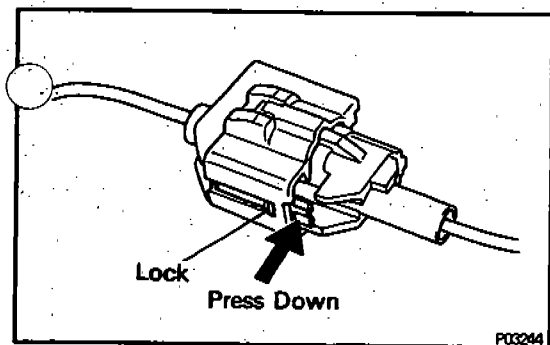
2. Disconnection, looseness or cracks in the parts of the air induction system between the throttle body and cylinder head will allow air suction and cause the engine to run out of tune.

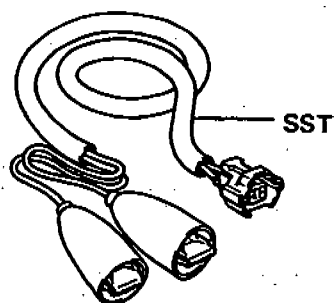
Electronic Control System

1. Before removing EFI wiring connectors, terminals, etc. first disconnect the power by either turning the ignition switch OFF or disconnecting the negative (-) terminal cable from the battery.

HINT: Always check the diagnostic code before disconnecting the negative (-) terminal cable from the battery.

2. When installing the battery, be especially careful not to incorrectly connect the positive (+) and negative (-) cables.
3. Do not permit parts to receive a severe impact during removal or installation. Handle all EFI parts carefully, especially the ECU.
4. Do not be careless during troubleshooting as there are numerous transistor circuits and even slight terminal contact can further troubles.
5. Do not open the ECU cover.
6. When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on the EFI parts and wiring connectors.
7. Parts should be replaced as an assembly.
8. Care is required when pulling out and inserting wiring connectors.
 - (a) Release the lock and pull out the connector, pulling on the connectors.
 - (b) Fully insert the connector and check that it is locked.
9. When inspecting a connector with a volt/ohmmeter
 - (a) Carefully take out the water-proofing rubber if it is a water-proof type connector.
 - (b) Insert the test probe into the connector from the wiring side when checking the continuity, amperage or voltage.
 - (c) Do not apply unnecessary force to the terminal.
 - (d) After checking, install the water-proofing rubber on the connector securely.





FI2553

10. Use SST for inspection or test of the injector or its wiring connector.
SST 09842-30070

Fuel System

1. When disconnecting the high pressure fuel line, a large amount of gasoline will spill out, so observe the following procedures:
 - (a) Put a container under the connection.
 - (b) Slowly loosen the connection.
 - (c) Disconnect the connection.
 - (d) Plug the connection with a rubber plug.

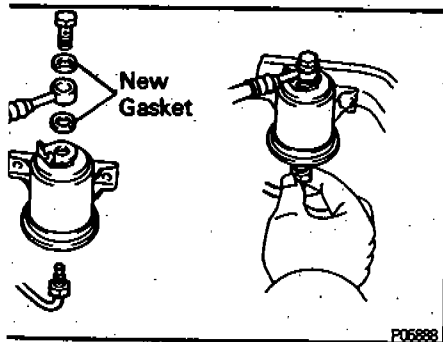
2. When connecting the flare nut or union bolt on the high pressure pipe union, observe the following procedures:

Union Bolt Type:

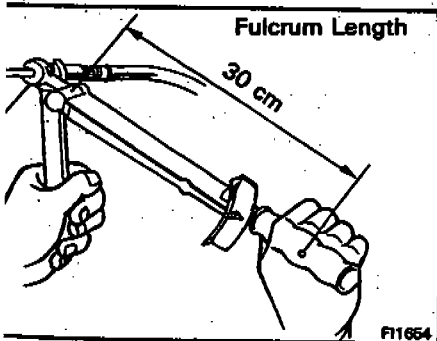
- (a) Always use a new gasket.
- (b) Tighten the union bolt by hand.
- (c) Tighten the union bolt to the specified torque.
Torque: 29.5 N·m (300 kgf·cm, 22 ft·lbf)

Flare Nut Type:

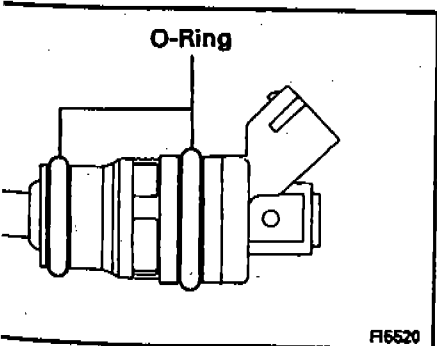
- (a) Apply a light coat of engine oil to the flare and tighten the flare nut by hand.
- (b) Using SST, tighten the flare nut to the specified torque.
SST 09631-22020
Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)
HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).



P05888

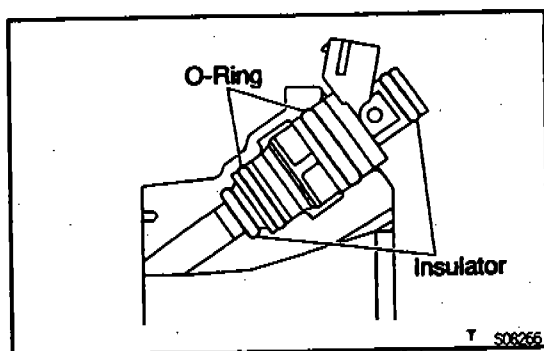


FI1654

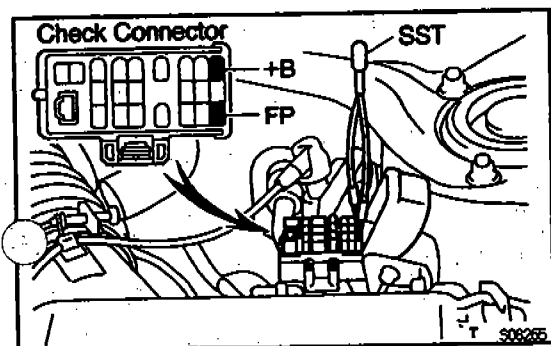


FI5520

3. Observe the following precautions when removing and installing the injectors.
 - (a) Never reuse the O-ring.
 - (b) When placing a new O-ring on the injector, take care not to damage it in any way.
 - (c) Coat a new O-ring with spindle oil or gasoline before installing—never use engine, gear or brake oil.



4. Install the injector to delivery pipe and intake manifold as shown in the illustration.



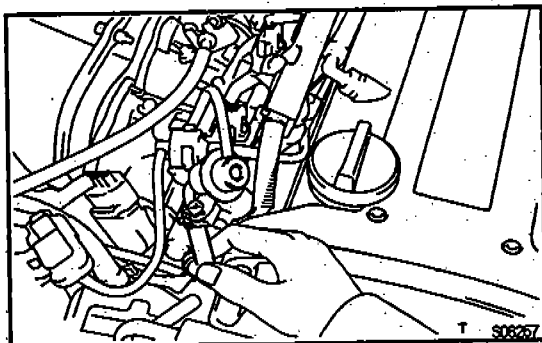
5. Check that there are no fuel leaks after performing maintenance anywhere on the fuel system.

- (a) Using SST, connect terminals +B and FP of the check connector.

SST 09843-18020

- (b) Turn the ignition switch ON.

NOTICE: Do not start the engine.



- (c) Pinch the fuel return hose. The pressure in the high pressure line will rise to approx. 392 kPa (4kgf/cm², 57 psi). In this state, check to see that there are no leaks from any part of the fuel system.

NOTICE: Always pinch the hose. Avoid bending as it may cause the hose to crack.

- (d) Turn the ignition switch OFF.

- (e) Remove the SST from the check connector.

SST 09843-18020



"CHECK" Engine Warning Light

F07777

DIAGNOSIS SYSTEM

CHECK ENGINE WARNING LIGHT CHECK

E05E-02

1. The check engine warning light will come on when the ignition switch is at ON and the engine is not running.
2. When the engine is started, the check engine warning light should go off. If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.

DIAGNOSTIC CODES OUTPUT

E0675-08

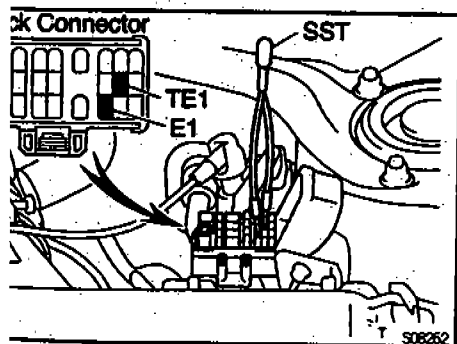
Normal mode:

To obtain an output of diagnostic codes, proceed as follows:

1. Initial conditions
 - (a) Battery voltage 11 V or more
 - (b) Throttle valve fully closed
 - (c) Accessories switched OFF
 - (d) Engine at normal operating temperature
2. Turn the ignition switch ON.
3. Using SST, connect terminals TE1 and E1 of the check connector.

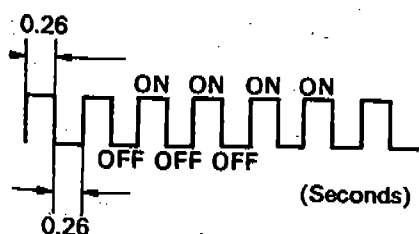
CAUTION: Do not start the engine.

SST 09843-18020
4. Read the diagnostic code as indicated by the number of flashes of the check engine warning light.



S08282

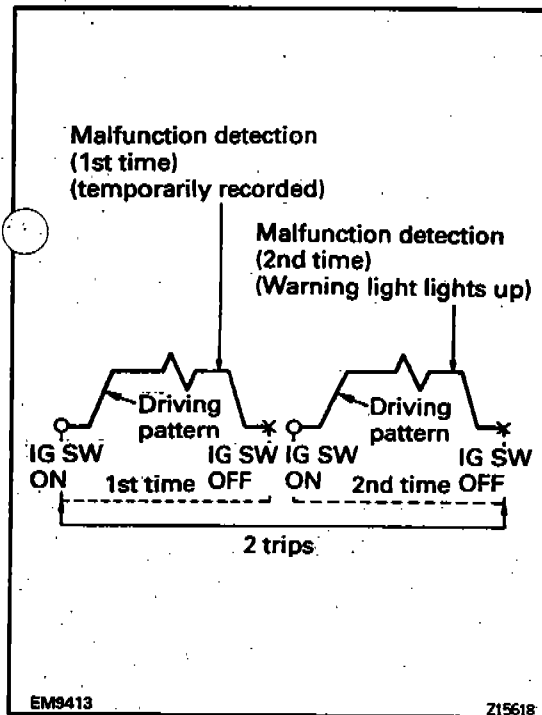
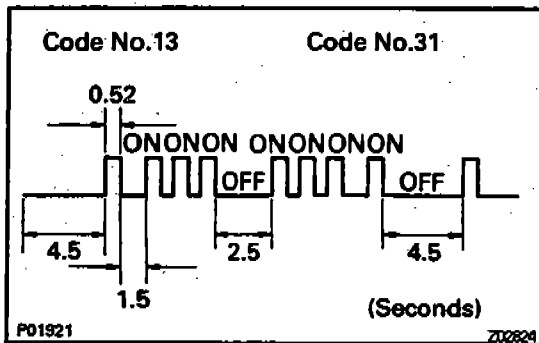
Malfunction



Z00101

Diagnostic Codes

- (a) Normal System Operation (no malfunction)
 - The light will alternately blink ON and OFF at 0.26 second intervals.
- (b) Malfunction Code Indication
 - In the event of a malfunction, the light will blink every 0.52 seconds. The 1st number of blinks will equal the 1st digit of a 2 digit diagnostic code, and after a 1.5 second pause, the 2nd number of blinks will equal



the second digit. If there are 2 or more codes, there will be a 2.5 second pause between each code.

- After all the codes have been output, there will be a 4.5 second pause and they will all be repeated along the terminals TE1 and E1 of the check connector are connected.

HINT: In the event of a number of trouble codes, indication will begin from the smaller value and continue to the larger.

(c) 2 trip detection logic:

Diagnostic code 21 use "2 trip detection logic". With this logic, when a malfunction is first detected, the malfunction is temporarily stored in the ECU memory. If the same case is detected again during the second drive test, this second detection causes the warning light to light up.

The 2 trip repeats the same mode a 2nd time. (However, the ignition switch must be turned OFF between the 1st time and 2nd time.) In the Test Mode, the check engine warning light lights up the 1st time a malfunction is detected.

5. After the diagnosis check, remove the SST from the check connector.

SST 09843-18020

Test mode:

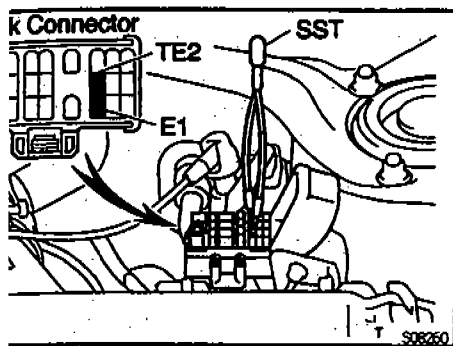
HINT:

- Compared to the normal mode, the test mode has an increased sensing ability to detect malfunctions.
- It can also detect malfunctions in the starter signal circuit, air conditioning signal.
- Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the test mode.

To obtain an output of diagnostic codes, proceed as follows:

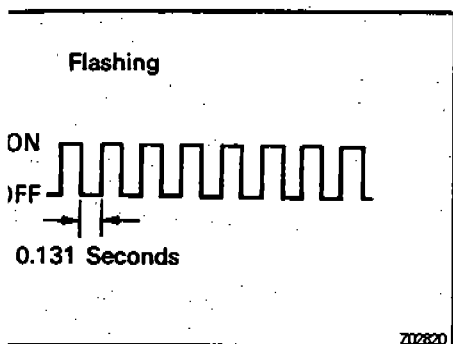
1. Initial conditions
 - (a) Battery voltage 11 V or more
 - (b) Throttle valve fully closed
 - (c) Accessories switched OFF
2. Turn the ignition switch OFF.

ELECTRONIC FUEL INJECTION - DIAGNOSIS SYSTEM

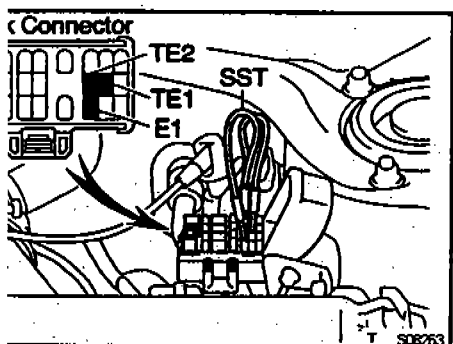


3. First, using SST, connect terminals TE2 and E1 of the check connector.
SST 09843-18020
4. Turn the ignition switch ON to begin the diagnosis in the test mode.

HINT: To confirm that the test mode is operating, check that the check engine warning light flashes when the ignition switch is turned ON.



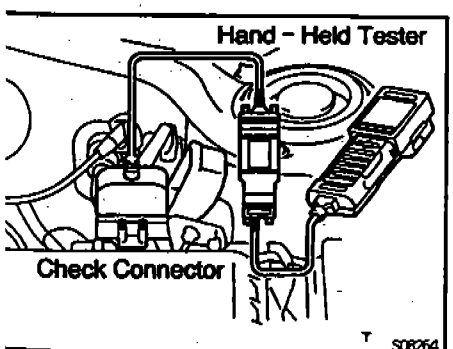
5. Start the engine and drive the vehicle at a speed of 10 km/h (6 mph) or higher.
6. Simulate the conditions of the malfunction described by the customer.



7. Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843-18020
8. Read the diagnostic code as indicated by the number of flashes of the check engine warning light.
9. After the diagnosis check, remove the SST from the check connector.
SST 09843-18020

HINT:

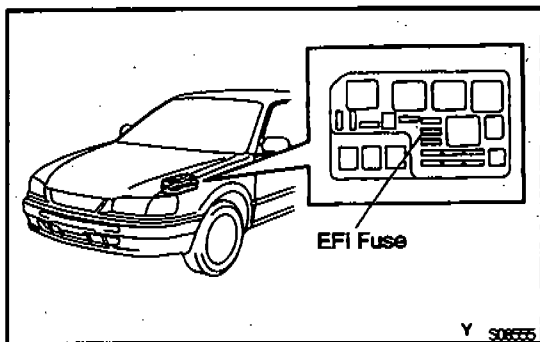
- The test mode will not start if terminals TE2 and E1 are connected after the ignition switch is turned ON.
- The starter signal and vehicle speed signal will be diagnosed by the ECU as malfunctions, and code Nos. 42, and 43 will be output, if the operation in step 5 is not done.
- When the air conditioning is on or when the accelerator pedal is depressed, code "51" (Switch condition signal) is output, but this is not abnormal.



DIAGNOSTIC CODE CHECK USING HAND-HELD TESTER

1. Hook up the hand-held tester to the check connector.
2. Read the diagnostic codes by following the prompts on the tester screen.

Please refer to the hand-held tester operator's manual for further details.



DIAGNOSTIC CODE CANCELLATION

1. After repair of the trouble area, the diagnostic code retained in memory by the ECU must be cancelled out by removing the EFI fuse (15A) for 10 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch OFF.

HINT:

- Cancellation can also be done by removing the negative (-) terminal cable from the battery, but in this case, other memory systems (clock, etc.) will also be cancelled out.
 - If the diagnostic code is not cancelled out, it will be retained by the ECU and appear along with a new code in the event of future trouble.
 - If it is necessary to work on engine components requiring removal of the battery terminal, a check must first be made to see if a diagnostic code has been recorded.
2. After cancellation, road test the vehicle to check that a normal code is now read on the check engine warning light. If the same diagnostic code appears, it indicates that the trouble area has not been repaired thoroughly.

DIAGNOSIS INDICATION

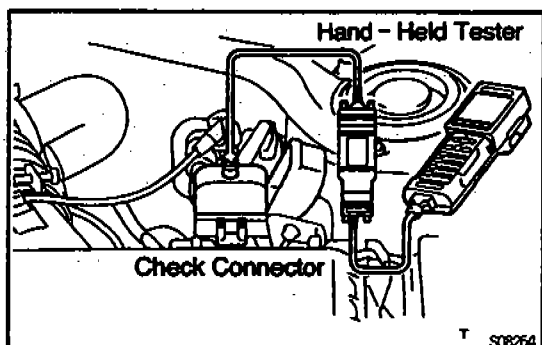
1. When 2 or more codes are indicated, the lowest number (code) will appear first.
2. All detected diagnostic codes, except code Nos. 42, 43 and 51 under the test mode will be retained in memory by the ECU from the time of detection until cancelled out.
3. Once malfunction is cleared, the check engine warning light in the combination meter will go off but the diagnostic code(s) remains stored in ECU memory.

ECU DATA MONITOR USING HAND-HELD TESTER

1. Hook up the hand-held tester to the check connector.
2. Monitor the ECU data by following the prompts on the tester screen.

HINT: Hand-held tester has a "Snapshot" function which records the monitored data.

Please refer to the hand-held tester operator's manual for further details.



N09S48

DIA
ONTDTC
No.

12

13

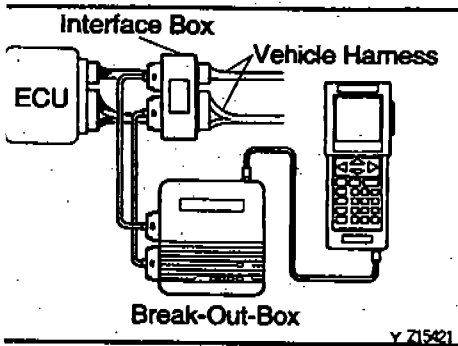
14

21

22

24

E039Y-0K



ECU TERMINAL VALUES MEASUREMENT USING BREAK-OUT-BOX AND HAND-HELD TESTER

1. Hook up the break-out-box and hand-held tester to the vehicle.
2. Read the ECU input/output values by following the prompts on the tester screen.

HINT: Hand-held tester has a "Snapshot" function. This records the measured values and is effective in the diagnosis of intermittent problems.

Please refer to the hand-held tester/break-out-box operator's manual for further details.

E032E-04










GNOSTIC CODES

a malfunction is detected during the diagnostic code check, refer to the circuit indicated in the table, and turn to the corresponding page.

our readings may vary from the parameters listed in the table, depending on the instruments used.

Number of blinks of Check Engine Warning Light	System	Check Engine Warning Light ^{*1}		Diagnosis	Trouble Area	Memory ^{*2}	See Page
		Normal Mode	Test Mode				
 FI1401	Normal	—	—	Output when no other code is recorded.	—	—	—
 FI1606	RPM Signal	ON	N.A.	<ul style="list-style-type: none"> • No G or NE signal is not input to ECU for 2 sec. or more after cranking. • Open in G-circuit. 	<ul style="list-style-type: none"> • Open or short in G, NE circuit • Distributor • ECU 	○	—
 FI1607	RPM Signal	ON	ON	No NE signal to ECU for 50 m sec. or more at 1,000 rpm or more.	<ul style="list-style-type: none"> • Open or short in NE circuit • Distributor • ECU 	○	—
 FI1608	Ignition Signal	ON	N.A.	No IGF signal to ECU for 4 consecutive IGT signals during engine running.	<ul style="list-style-type: none"> • Open or short in IGF or IGT circuit from igniter to ECU • Igniter • ECU 	○	FI-26
 FI1609	Oxygen Sensor Signal	OFF	N.A.	Open or short in heater circuit of oxygen sensor for 0.5 sec. or more. (HT)	<ul style="list-style-type: none"> • Open or short in heater circuit of oxygen sensor • Oxygen sensor • ECU 	○	FI-21 FI-29 FI-66 FI-68
			ON	At normal driving speed (below 100 km/h (60 mph) and engine speed is above 1,500 rpm), amplitude of oxygen sensor signal (OX) is reduced to between 0.35 - 0.70 V continuously for 60 sec. or more. ^{*3} (2 trip detection logic)	<ul style="list-style-type: none"> • Open or short in oxygen sensor circuit • Oxygen sensor • Open or short in vacuum sensor circuit • Vacuum sensor • ECU 		
 FI1610	Water Temp. Sensor Signal	ON	ON	Open or short in water temp. sensor circuit for 0.5 sec. or more. (THW)	<ul style="list-style-type: none"> • Open or short in water temp. sensor circuit • Water temp. sensor • ECU 	○	FI-24 FI-64
 FI1611	Intake Air Temp. Sensor Signal	OFF	ON	Open or short in intake air temp. sensor circuit for 0.5 sec. or more. (THA)	<ul style="list-style-type: none"> • Open or short in intake air temp. sensor circuit • Intake air temp. sensor • ECU 	○	FI-23 FI-65

DIAGNOSTIC CODES (Cont'd)

DTC No.	Number of blinks of Check Engine Warning Light	System	Check Engine Warning Light ^{*1}		Diagnosis	Trouble Area	Memory ^{*2}	See Page
			Normal Mode	Test Mode				
25	 FI2502	Air-Fuel Ratio Lean Malfunction	OFF	ON	Oxygen sensor output in less than 0.45 V for at least 90 sec. when oxygen sensor is warmed up (racing at 1,500 rpm or more). ^{*3} (2 trip detection logic)	<ul style="list-style-type: none"> • Open in injector circuit • Fuel line pressure (injector leak, blockage) • Ignition system (spark plug, igniter) • Vacuum sensor (air intake) • Open or short in oxygen sensor circuit • Oxygen sensor • ECU 	○	FI-22 FI-29 FI-68
31	 FI1812	Vacuum Sensor Signal	ON	ON	Open or short in vacuum sensor signal for 0.5 sec. or more. (PIM)	<ul style="list-style-type: none"> • Open or short in vacuum sensor circuit • Vacuum sensor • ECU 	○	FI-21 FI-66
33	 BE3033	Idle Speed Control Valve System	ON	ON	Open or short in idle speed control valve circuit.	<ul style="list-style-type: none"> • Open or short in idle speed control valve circuit • ISC Valve 	○	FI-27
41	 FI1814	Throttle Position Sensor Signal	OFF	ON	Open or short in throttle position sensor circuit for 0.5 sec. or more. (VTA)	<ul style="list-style-type: none"> • Open or short in throttle position sensor circuit • Throttle position sensor • ECU 	○	FI-19
42	 FI1815	Vehicle Speed Sensor Signal	ON	OFF	No vehicle speed sensor signal to ECU for at least 8 sec. during heavy load driving with engine speed between 2,000 rpm and 5,000 rpm.	<ul style="list-style-type: none"> • Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECU 	○	-
43	 FI1816	Starter Signal	N.A.	OFF	No starter signal to ECU when cranking with Test mode. (STA)	<ul style="list-style-type: none"> • Open or short in starter signal circuit • Open or short in ignition switch or starter relay circuit • ECU 	×	FI-25
52	 FI1818	No.1 Knock Sensor Signal (front side)	ON	N.A.	No No.1 knock sensor signal to ECU for crank revolutions with engine speed between 2,000 rpm and 6,000 rpm. (KNK1)	<ul style="list-style-type: none"> • Open or short in knock sensor circuit • Knock sensor (looseness) • ECU 	○	FI-67
53	 FI1819	Knock Control Signal	ON	N.A.	ECU (for knock sensor control) malfunction at engine speed between 700 rpm and 6,000 rpm.	<ul style="list-style-type: none"> • ECU 	×	-
51	 FI1817	Switch Condition Signal	OFF	N.A.	Displayed when A/C is ON with check terminals TE1 and E1 connected in test mode.	<ul style="list-style-type: none"> • A/C switch system • Accelerator pedal, cable • ECU 	×	-

REMARKS:

*1: "ON" displayed in the diagnosis mode column indicates that the check engine warning light is lighted up when a malfunction is detected. "OFF" indicates that the check engine warning light does not light up during malfunction diagnosis, even if a malfunction is detected.

*2: "○" in the memory column indicates that a diagnostic code is recorded in the ECU memory when a malfunction occurs. "×" indicates that a diagnostic code is not recorded in the ECU memory even if a malfunction occurs. Accordingly, output of diagnostic results is performed with the ignition switch ON.

*3: "2 trip detection logic". (See step 4 (c) in trouble codes output (normal mode))

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN

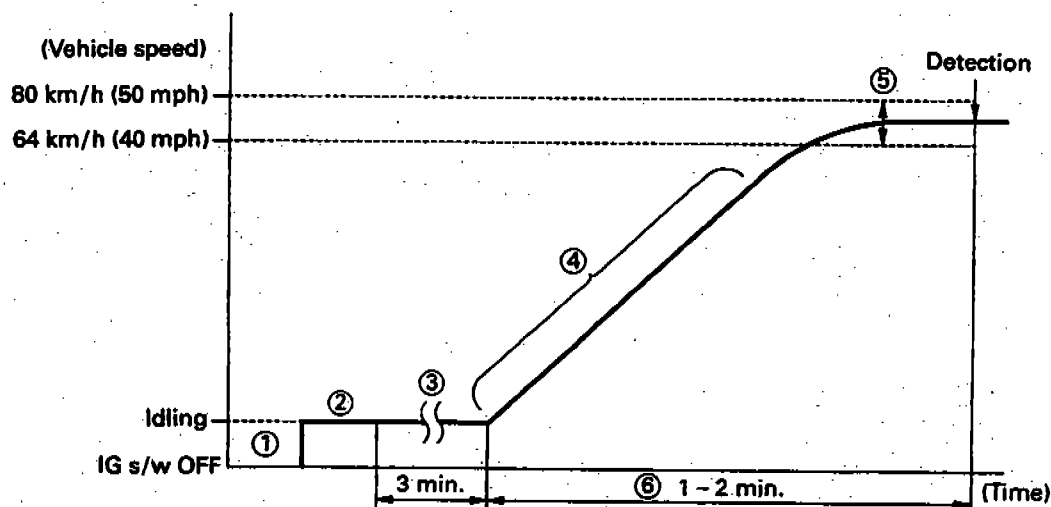
Use of the driving pattern

To simulate diagnostic code detecting condition after diagnostic code is recorded.

To check that the malfunction is corrected when the repair is completed confirming that diagnostic code is no longer detected.

Code No.	21	Oxygen Sensor Circuit
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Malfunction: Deterioration of Oxygen Sensor



- ① Disconnect the EFI fuse (15A) for 10 sec. or more, with IG switch OFF. Initiate test mode (Connect terminals TE2 and E1 of check connector with IG switch OFF).
- ② Start the engine and warm it up with all accessories switched OFF.
- ③ Let the engine idle for 3 min..
- ④ Accelerate gradually with in the range 1,300 ~ 1,700 rpm (Centered around 1,500 rpm) with the A/C switch ON and 5th gear.
(Take care that the engine speed does not fall below 1,200 rpm when shifting. Gradually depress the accelerator pedal and keep it steady so that engine braking does not occur).
- ⑤ Maintain the vehicle speed at 64 - 80 km/h (40 - 50 mph).
- ⑥ Keep the vehicle running for 1 - 2 min. after starting acceleration.

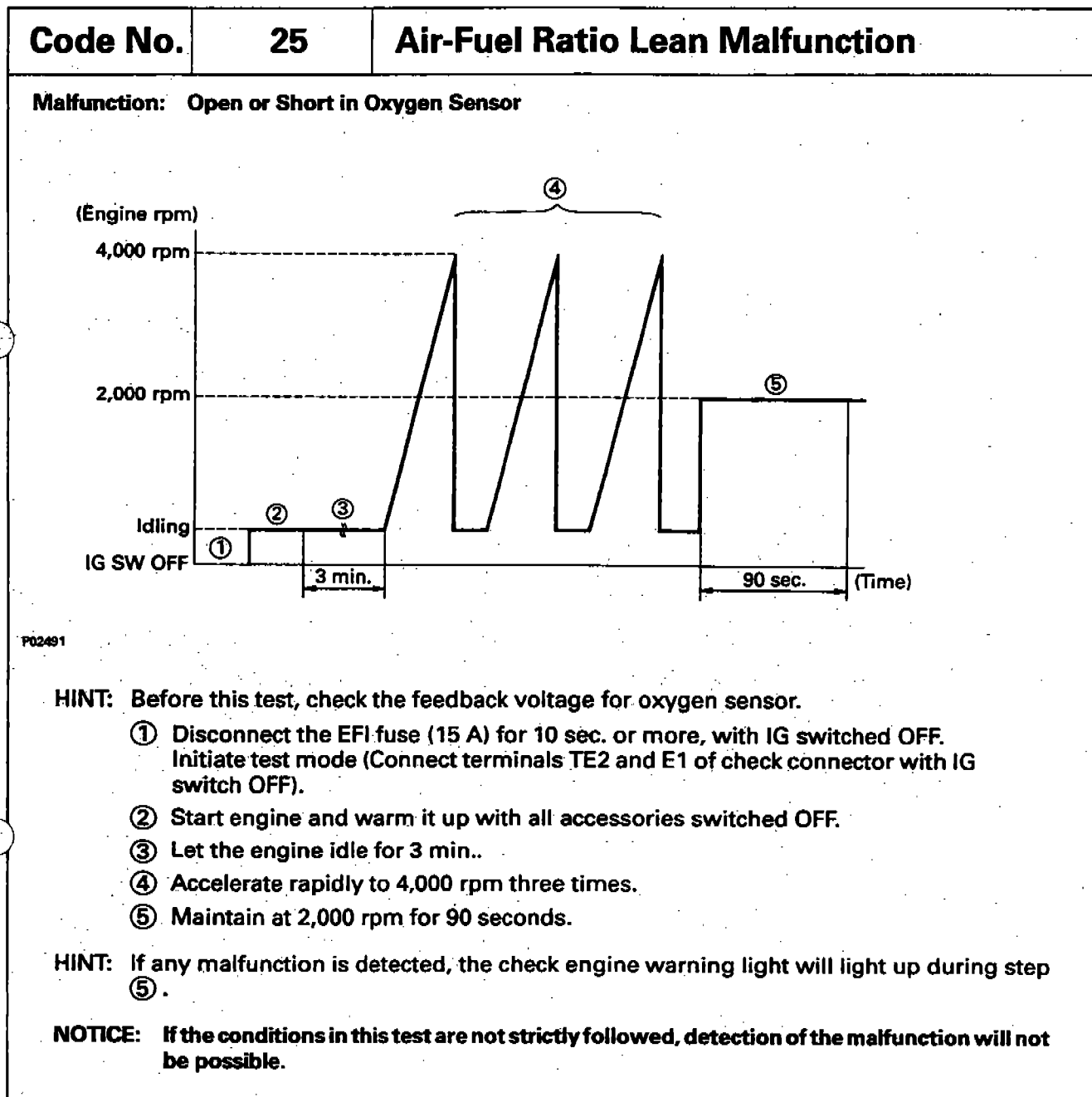
HINT: If a malfunction exists, the malfunction indicator lamp will light up after approx. 60 sec. from the start of acceleration.

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

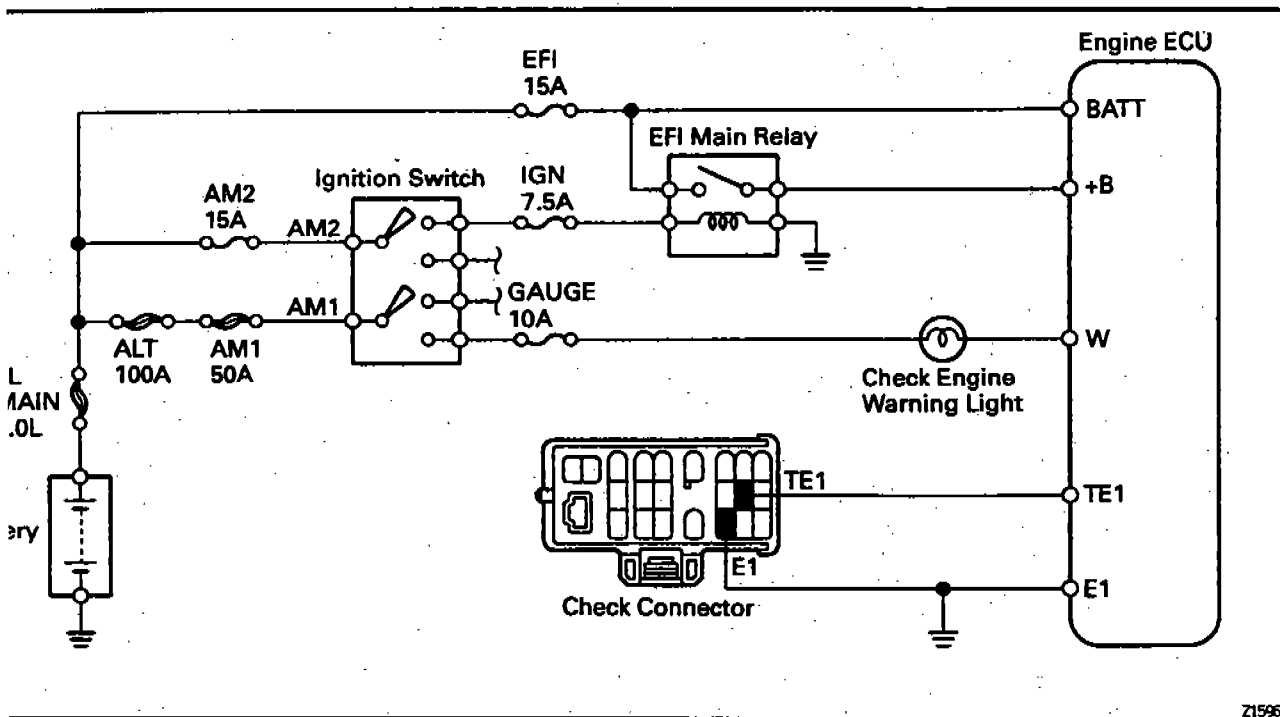
DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

Purpose of the driving pattern

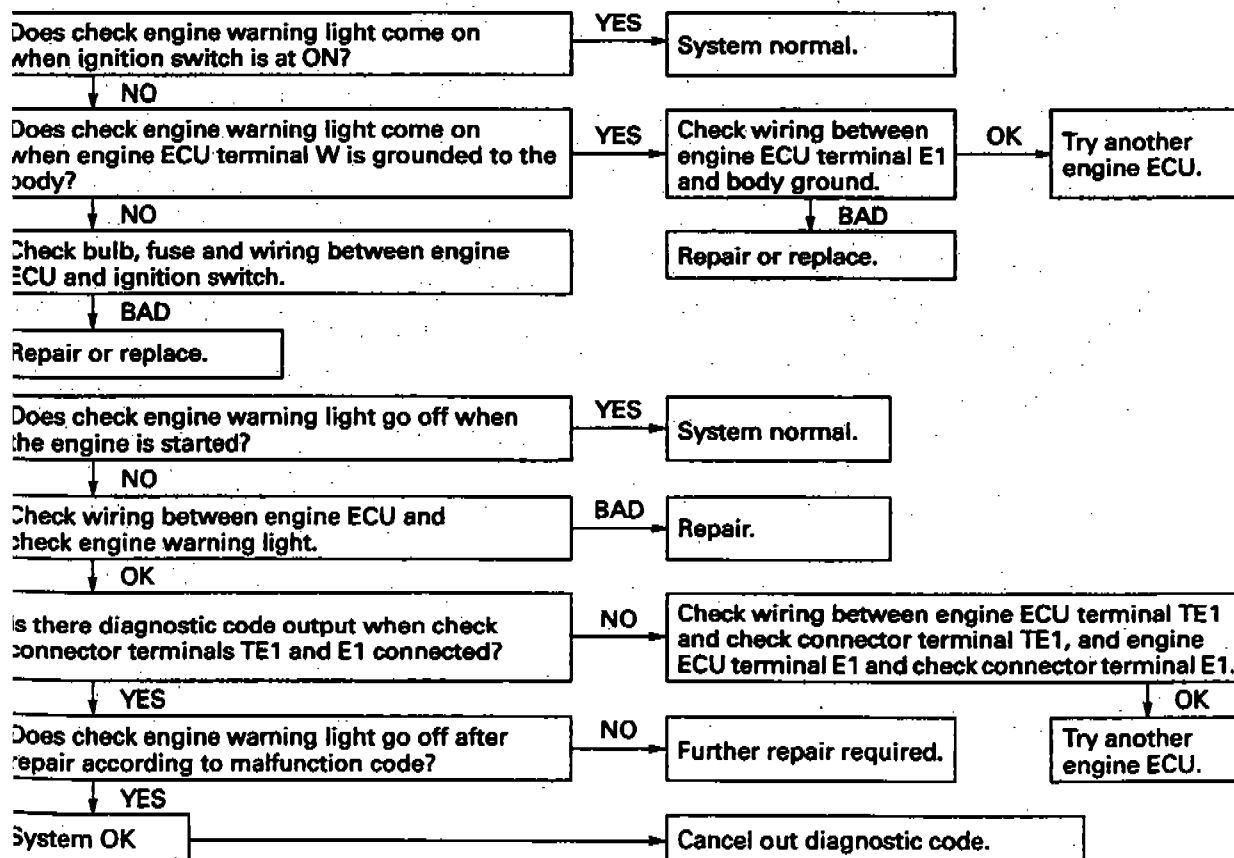
- (a) To simulate diagnostic code detecting condition after diagnostic code is recorded.
- (b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic code is no longer detected.



DIAGNOSIS CIRCUIT INSPECTION



715265

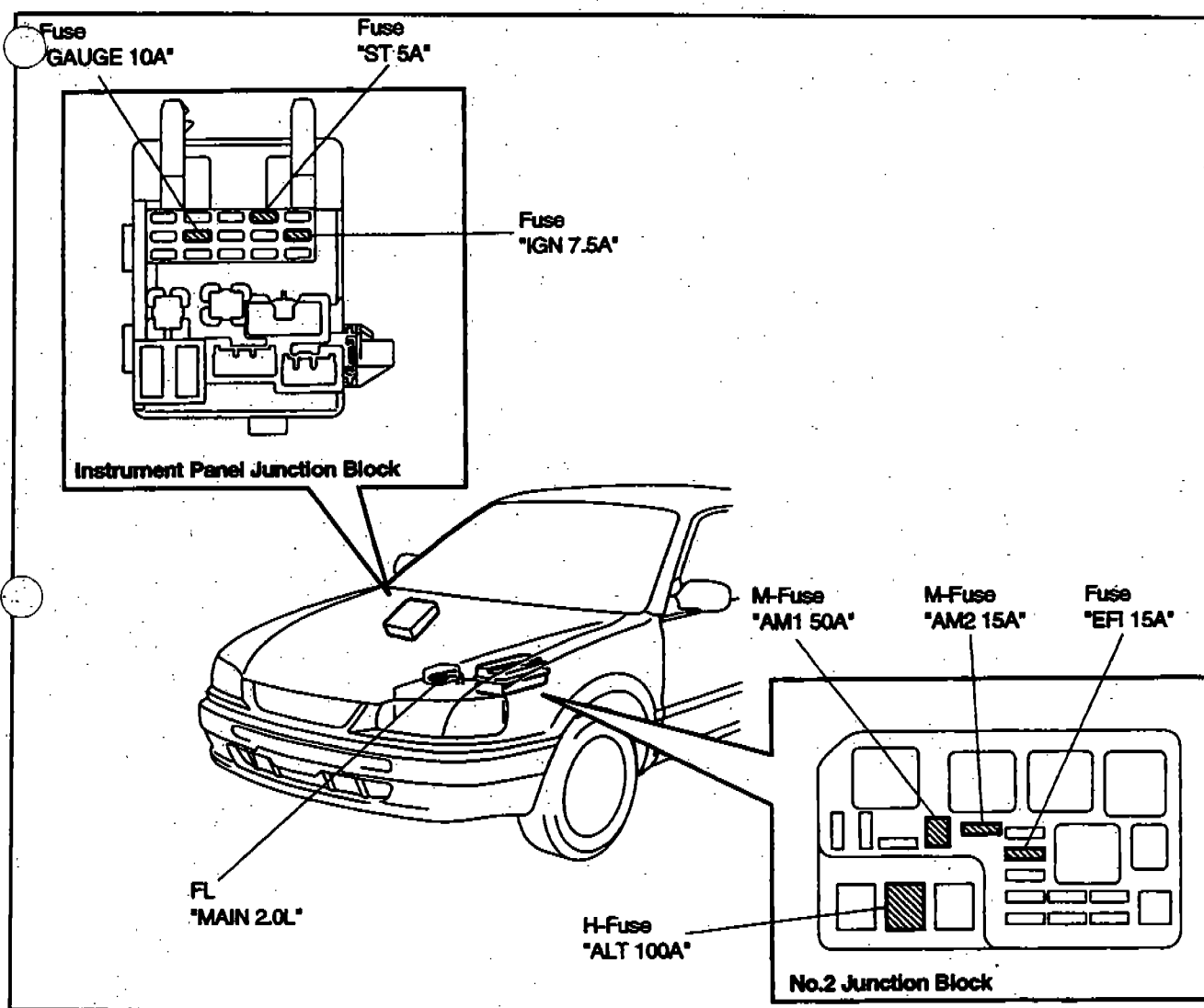


TROUBLESHOOTING w/ VOLT, OHMMETER

HINT:

- The following troubleshooting procedures are designed for inspection of each separate system, and therefore the actual procedure may vary somewhat. However, troubleshooting should be performed while referring to the inspection methods described in this manual.
- Before beginning inspection, it is best to first make a simple check of the fuses, H-fuses, fusible link and the condition of the connectors.
- The following troubleshooting procedures are based on the supposition that the trouble lies in either a short or open circuit within the computer.
- If engine trouble occurs even though proper operating voltage is detected in the computer connector, then it can be assumed that the ECU is faulty and should be replaced.

LOCATION



EFI SYSTEM CHECK PROCEDURE

PREPARATION

Disconnect the ECU from the vehicle body.

HINT:

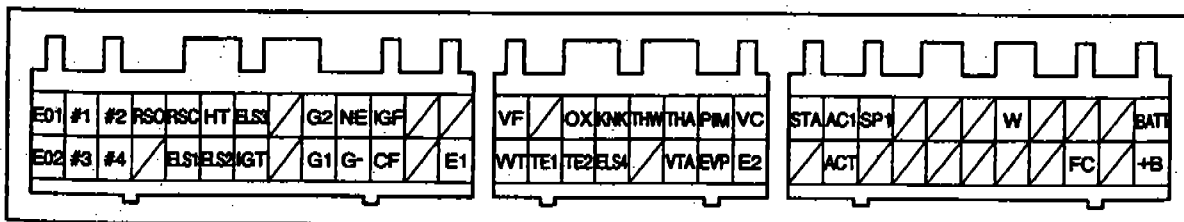
- Do all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11 V or more when the ignition switch is in the "ON" position.

Using a voltmeter with high impedance (10 k Ω /V minimum), measure the voltage at each terminal of the wiring connectors.

Engine ECU Terminals

Symbol	Terminal Name	Symbol	Terminal Name	Symbol	Terminal Name
E01	POWER GROUND		—	AC1	A/C AMPLIFIER
E02	POWER GROUND		—	ACT	A/C AMPLIFIER
#1	INJECTOR		—	SP1	SPEED SENSOR
#3	INJECTOR	E1	ENGINE GROUND		—
#2	INJECTOR	VF	CHECK CONNECTOR		—
#4	INJECTOR	VVT	CAMSHAFT OIL CONTROL VALVE		—
RSO	ISC VALVE		—		—
	—	TE1	CHECK CONNECTOR		—
RSC	ISC VALVE	OX	OXYGEN SENSOR		—
ELS1	ELECTRIC COOLING FAN RELAY	TE2	CHECK CONNECTOR		—
HT	HEATED OXYGEN SENSOR	KNK	KNOCK SENSOR	W	WARNING LIGHT
ELS2	BLOWER RELAY	ELS4	DEFROGGER SWITCH		—
ELS3	TAILLIGHT RELAY	THW	WATER TEMP. SENSOR		—
IGT	IGNITER		—		—
	—	THA	INTAKE AIR TEMP. SENSOR		—
	—	VTA	THROTTLE POSITION SENSOR	FC	CIRCUIT OPENING RELAY
G2	CRANKSHAFT POSITION SENSOR	PIM	VACUUM SENSOR		—
G1	CRANKSHAFT POSITION SENSOR	EVP	EVAP		—
NE	CRANKSHAFT POSITION SENSOR	VC	VACUUM SENSOR, THROTTLE POSITION SENSOR	BATT	BATTERY
G-	CRANKSHAFT POSITION SENSOR	E2	SENSOR GROUND	+B	BATTERY
IGF	IGNITER	STA	STARTER RELAY		
CF	COOLING FAN RELAY		—		

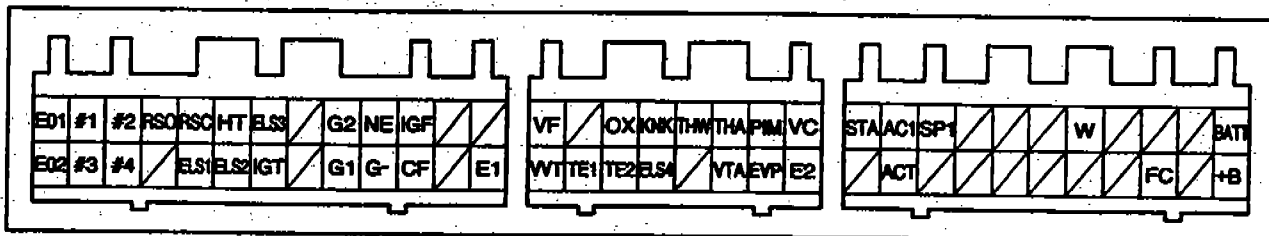
Engine ECU Terminals



Engine ECU Wiring Connectors Voltage

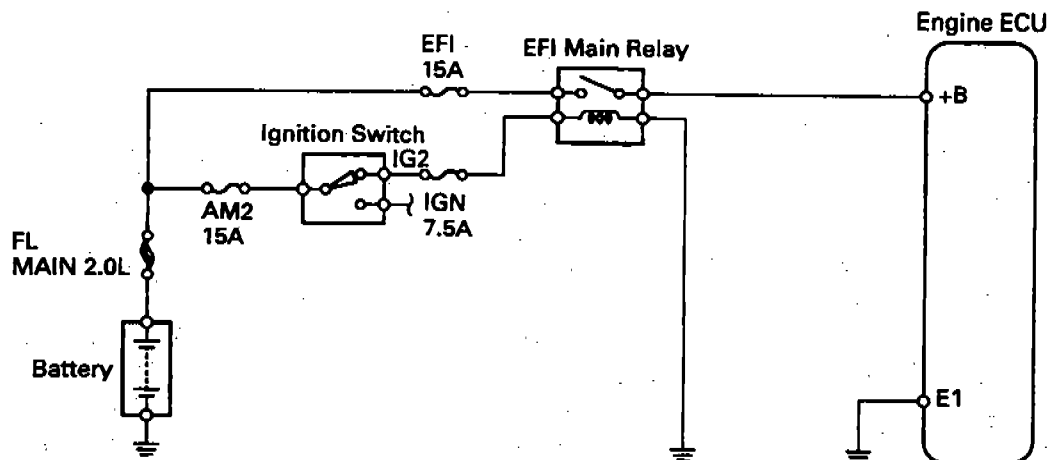
No.	Terminals	Condition		STD voltage (V)	See page
1	+B-E1	IG SW ON		9-14	FI-17
2	BATT-E1	—		9-14	FI-18
3	VC-E2	IG SW ON	—	4.5-5.5	FI-19
	VTA-E2		Throttle valve fully closed	0.3-0.8	
			Throttle valve fully open	3.2-4.9	
4	PIM-E2	IG SW ON		3.3-3.9	FI-21
	VC-E2			4.5-5.5	
5	#1 #4 - E01 - E02				
6	THA-E2	IG SW ON	Intake air temperature 20°C (68°F)	0.5-3.4	FI-23
7	THW-E2		Coolant temperature 80°C (176°F)	0.2-1.0	FI-24
8	STA-E1	Cranking		6 or more	FI-25
9	IGF-E1	IG SW ON	Igniter connector disconnected	4.5-5.5	FI-26
	IGT-E1	Idling		Pulse generation	
10	RSC RSO -E1	IG SW ON	Engine ECU connectors disconnected	9-14	FI-27
11	W-E1	No trouble (Check engine warning light off) and engine running		9-14	FI-28

Engine ECU Terminals

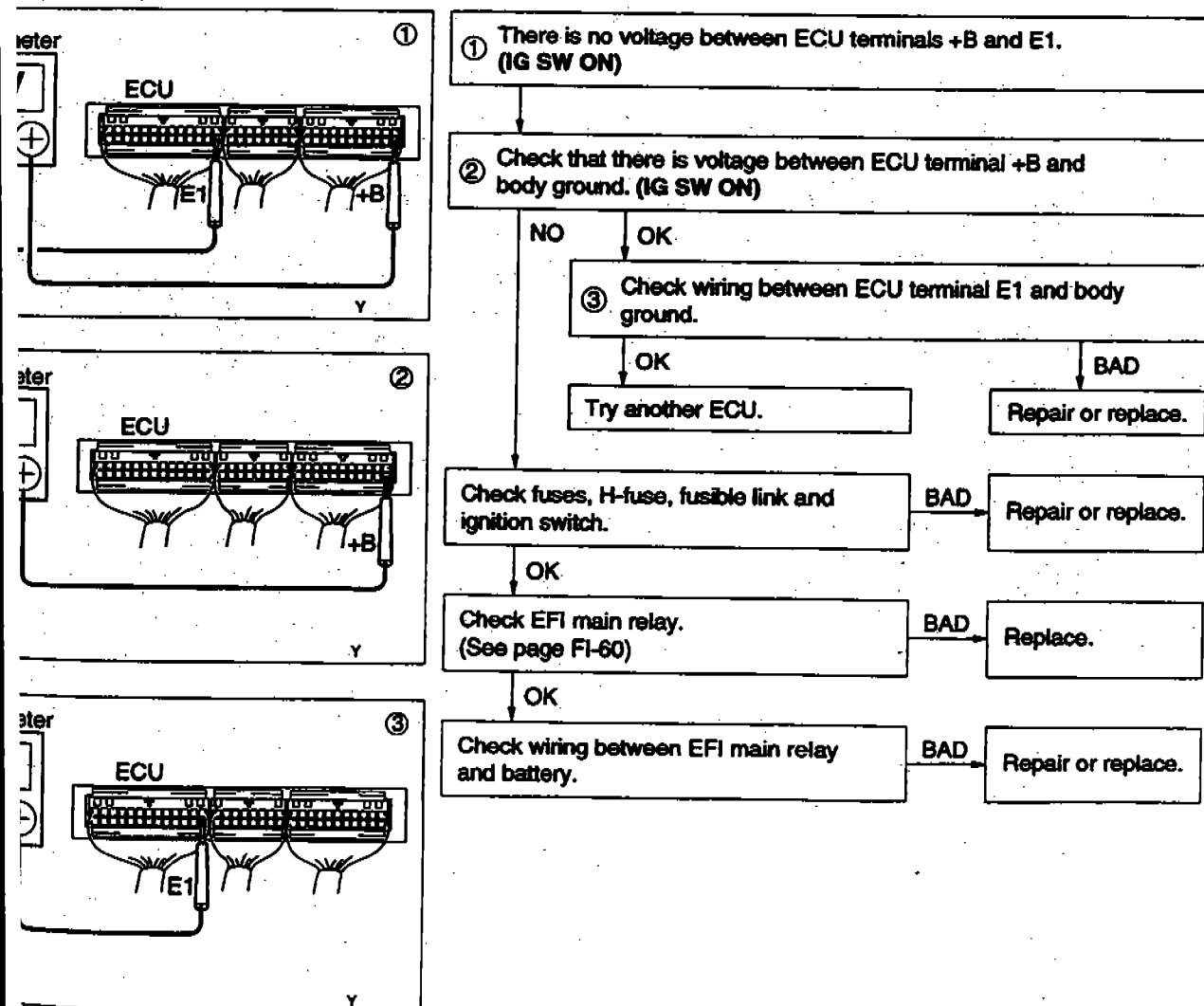


ELECTRONIC FUEL INJECTION - TROUBLESHOOTING w/ VOLT, OHMMETER

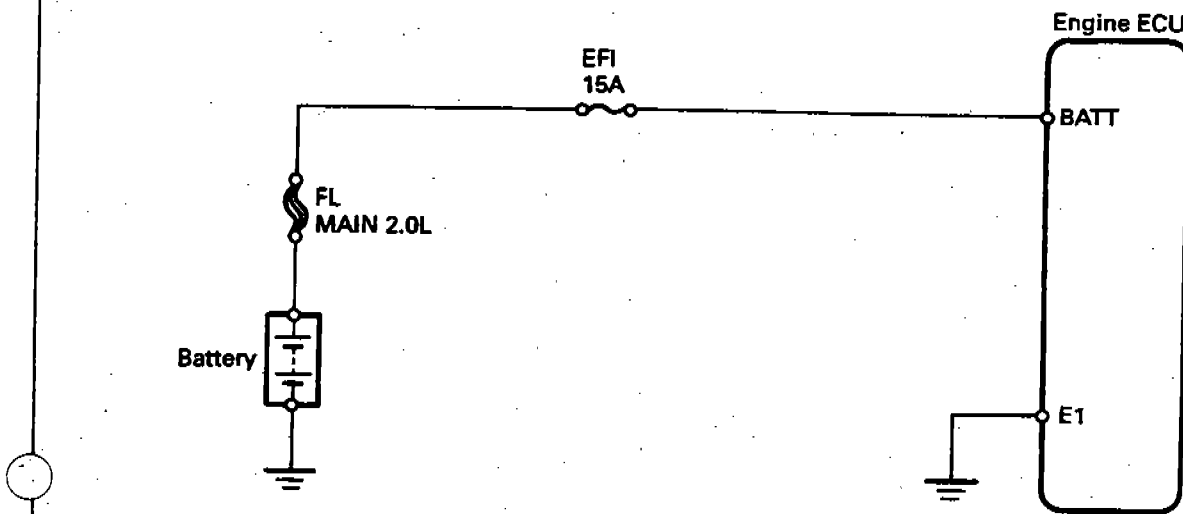
Terminals	Trouble	Condition	STD voltage
+B - E1	No voltage	IG SW ON	9 - 14 V



V06828

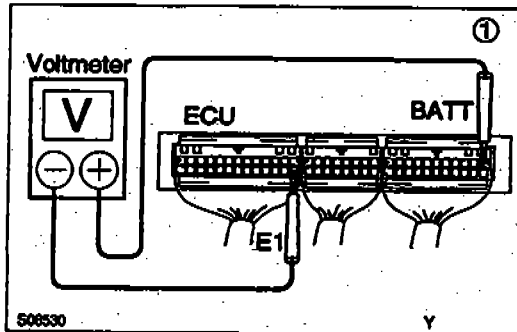


No.	Terminals	Trouble	Condition	STD voltage
2	BATT - E1	No voltage	-	9 - 14 V



P01086

V0852



508530

Y

① There is no voltage between ECU terminals BATT and E1.

② Check that there is voltage between ECU terminal BATT and body ground.

NO

OK

③ Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Repair or replace.

Check fuse and fusible link.

BAD

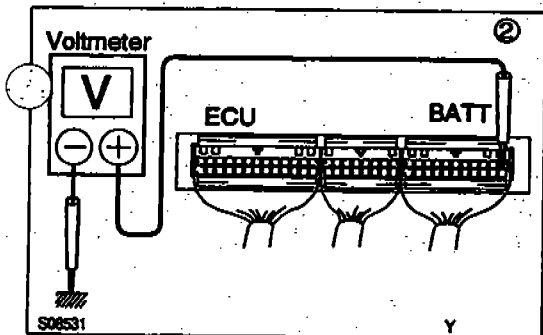
Replace.

OK

Check wiring between ECU terminal and battery.

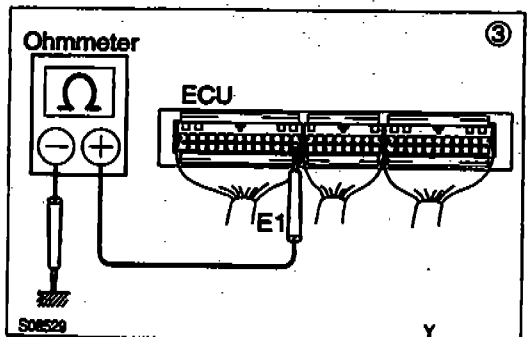
BAD

Repair or replace.



508531

Y



508529

Y

No.

3

22185

Voltm

V

Voltm

V

Voltm

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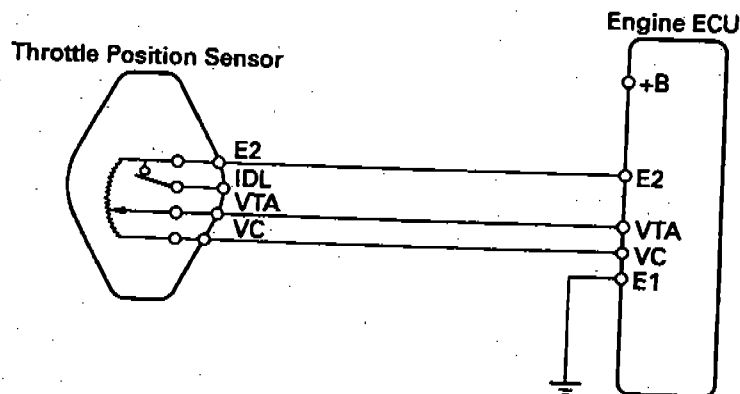
Voltm

V

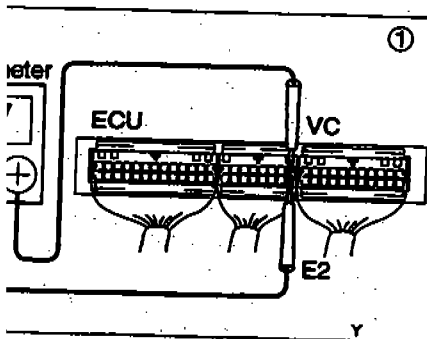
Voltm

V

Terminals	Trouble	Condition		STD voltage
VC - E2	No voltage	IG SW ON		4.5 - 5.5 V
VTA - E2			Throttle valve fully closed	0.3 - 0.8 V
			Throttle valve fully open	3.2 - 4.9 V



V06417



• VC - E2

① There is no voltage between ECU terminals VC and E2. (IG SW ON)

② Check that there is voltage between ECU terminal +B and body ground. (IG SW ON)

OK

NO

③ Check throttle position sensor.

BAD

OK

Repair or replace.

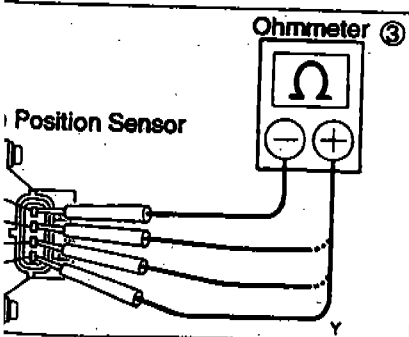
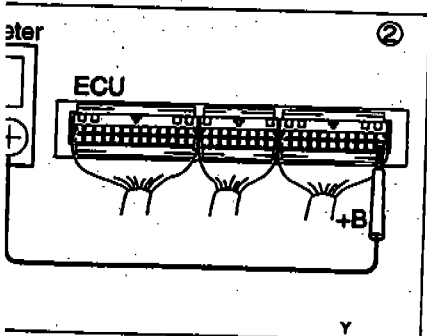
Check wiring between ECU and throttle position sensor.

OK

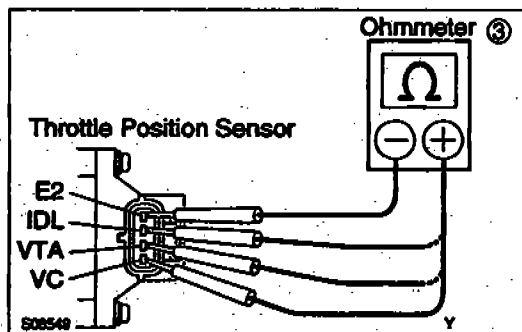
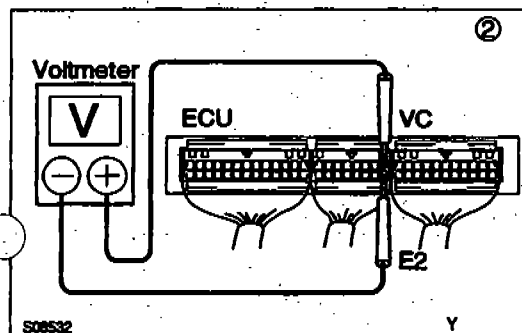
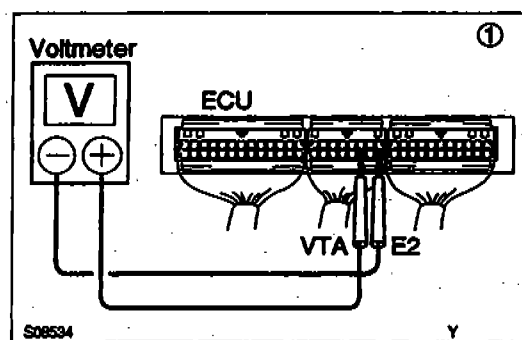
BAD

Try another ECU.

Repair or replace wiring.



Y V09073



• VTA - E2

① There is no specified voltage at ECU terminals VTA and E2.
(IG SW ON)

② Check that there is voltage between ECU terminals VC and E2.
(IG SW ON)

NO

Refer to VC - E2 trouble section.

OK

③ Check throttle position sensor.

OK

BAD → Repair or replace.

OK

Check wiring between ECU and throttle position sensor.

BAD

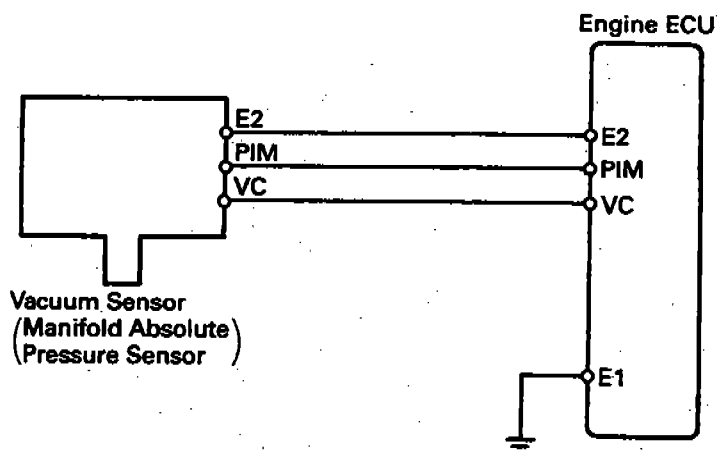
Repair or replace.

OK

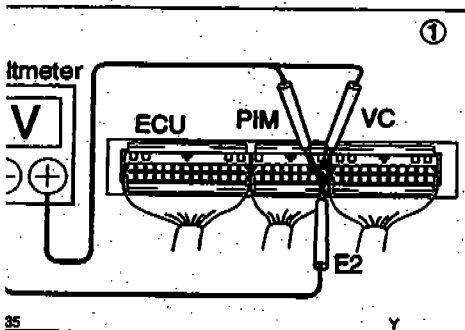
Try another ECU.

ELECTRONIC FUEL INJECTION - TROUBLESHOOTING w/ VOLT, OHMMETER

Terminals	Trouble	Condition	STD voltage
PIM - E2	No voltage	IG SW ON	3.3 - 3.9 V
VC - E2			4.5 - 5.5 V



V06419



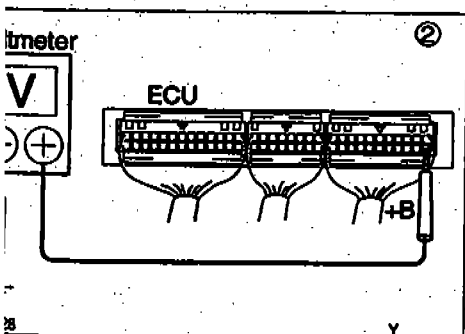
① There is no voltage between ECU terminals PIM or VC and E2. (IG SW ON)

② Check that there is voltage between ECU terminal +B and body ground. (IG SW ON)

OK

NO

Refer to No.1.
(See page FI-17)



③ Check wiring between ECU terminal E1 and body ground.

OK

BAD

Check vacuum sensor.

Repair or replace.

BAD

OK

Replace vacuum sensor.

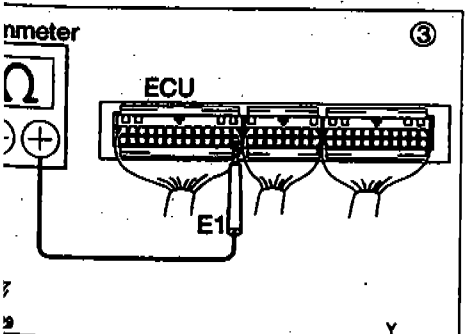
Check wiring between ECU and vacuum sensor.

OK

BAD

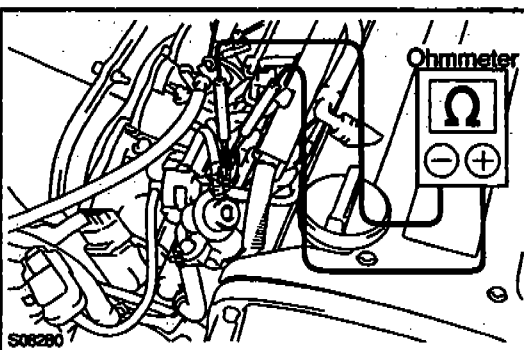
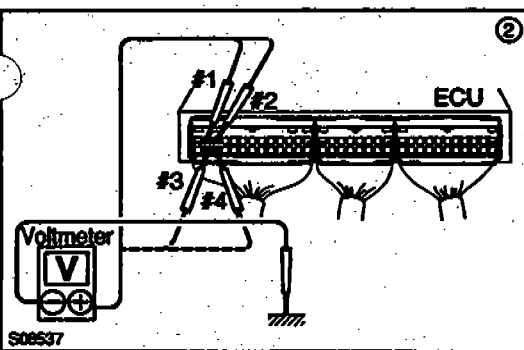
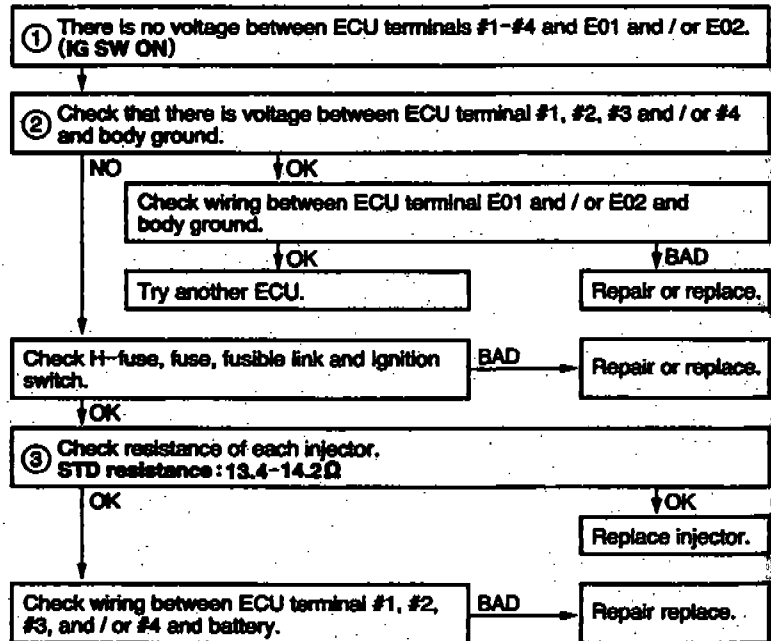
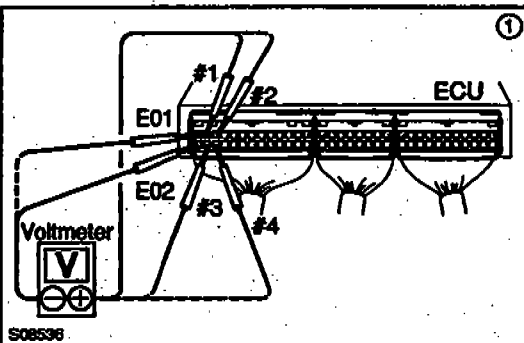
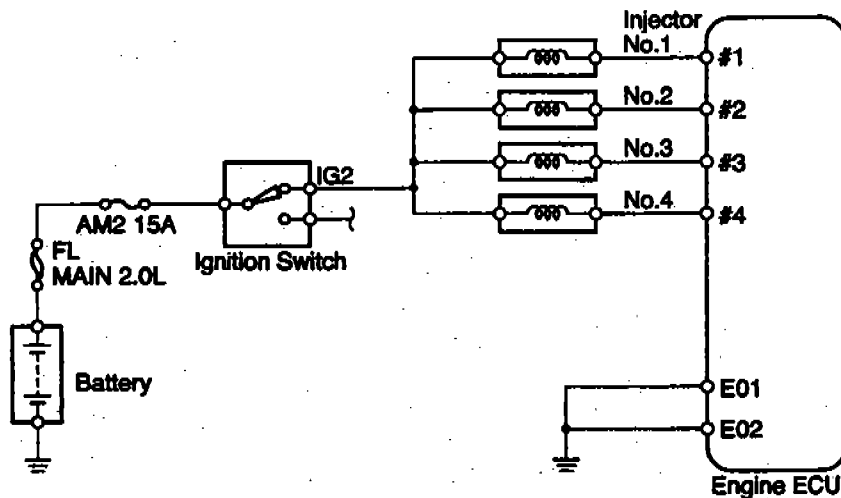
Try another ECU.

Repair or replace.

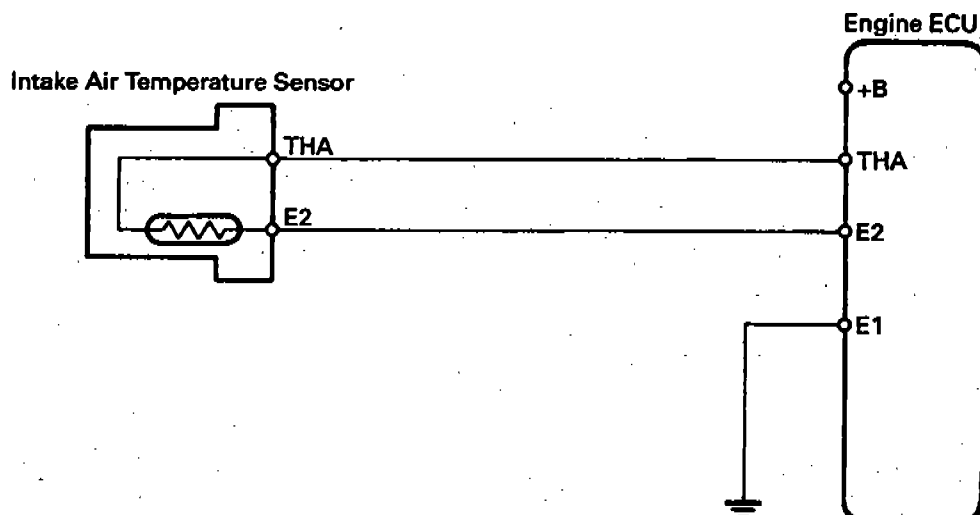


V V09075

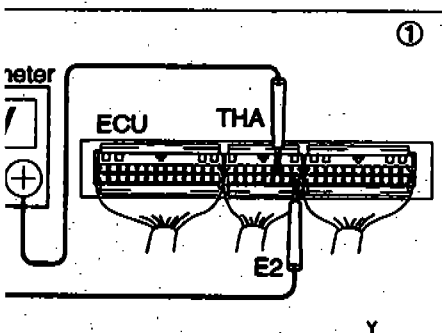
No.	Terminals	Trouble	Condition	STD voltage
5	#1 - E01 #4 - E02	No voltage	IG SW ON	9 - 14 V



Terminals	Trouble	Condition		STD voltage
THA - E2	No voltage	IG SW ON	Intake air temperature 20°C (68°F)	0.5 - 3.4 V



V05422



①

① There is no voltage between ECU terminals THA and E2.
(IG SW ON)

② Check that there is voltage between ECU terminal +B and body ground. (IG SW ON)

OK

NO

Refer to No.1.
(See page FI-17)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check intake air temp. sensor.

Repair or replace.

BAD

OK

Replace intake
air temp. sensor.

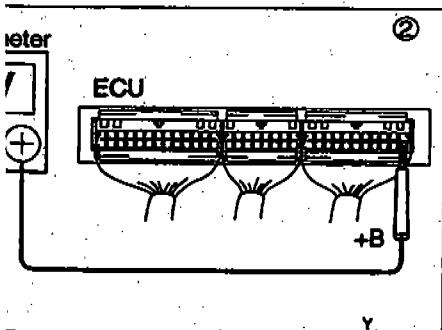
Check wiring between ECU and air temp.
sensor.

OK

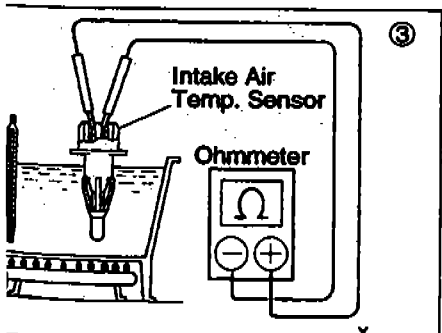
BAD

Try another ECU.

Repair or replace.



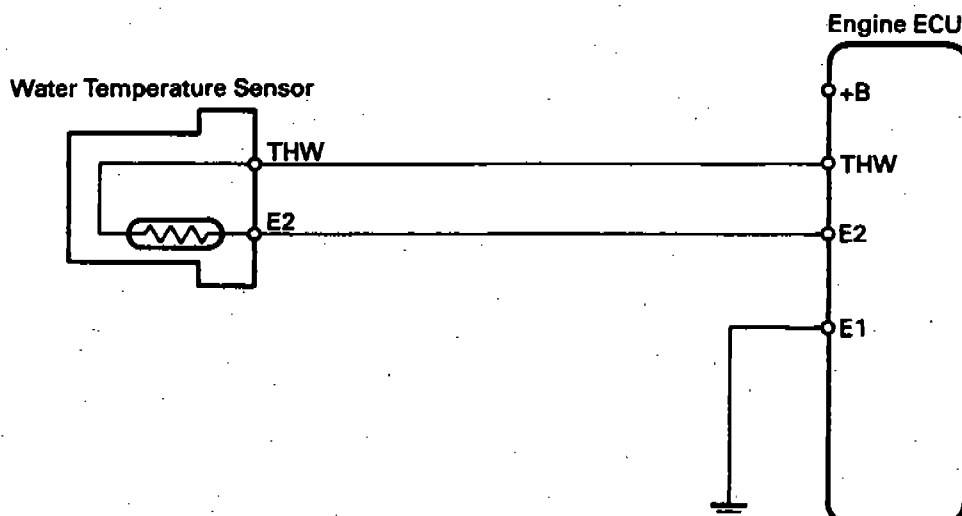
②



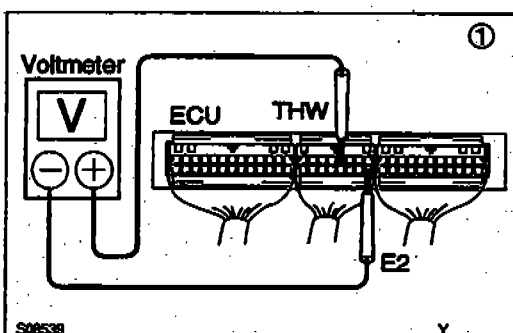
③

V V09069

No.	Terminals	Trouble	Condition	STD voltage
7	THW - E2	No voltage	IG SW ON Coolant temperature 80°C (176°F)	0.2 - 1.0 V



FI3572



① There is no voltage between ECU terminals THW and E2.
(IG SW ON)

② Check that there is voltage between ECU terminal +B and body ground. (IG SW ON)

OK

NO

Refer to No.1.
(See page FI-17)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check water temp. sensor.

Repair or replace.

BAD

Replace water temp. sensor.

OK

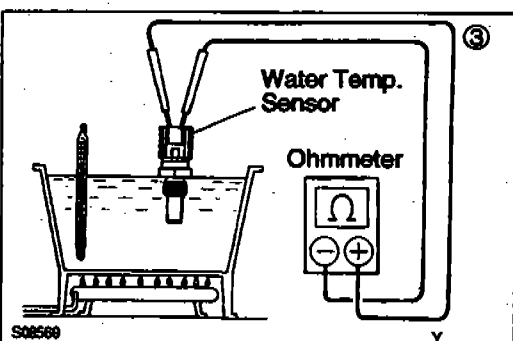
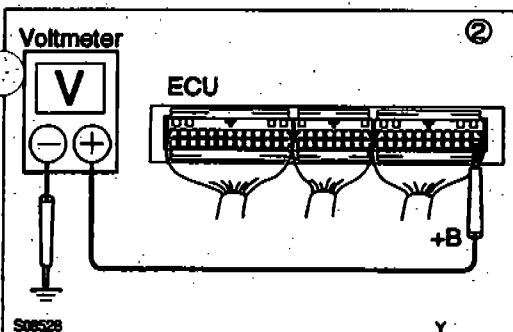
Check wiring between ECU and water temp. sensor.

OK

Try another ECU.

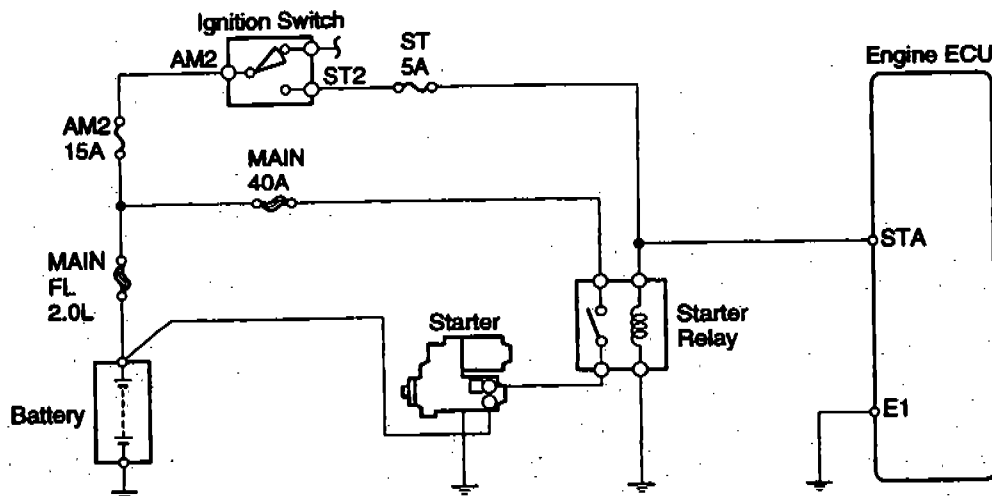
BAD

Repair or replace.



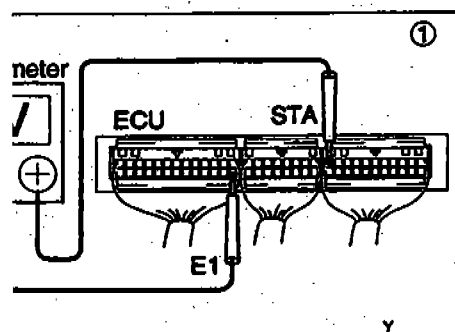
ELECTRONIC FUEL INJECTION - TROUBLESHOOTING w/ VOLT, OHMMETER

Id.	Terminals	Trouble	Condition	STD voltage
8	STA - E1	No voltage	Cranking	6 V or more



8547

V09062



① There is no voltage between ECU terminals STA and E1.
(IG SW START)

Check starter operation.

OK

Check wiring between ECU terminal STA and ignition switch terminal ST2.

OK

BAD

Repair or replace.

② Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Repair or replace.

Check H-fuses, fusible link, battery, wiring, ignition switch and starter relay.

BAD

Repair or replace.

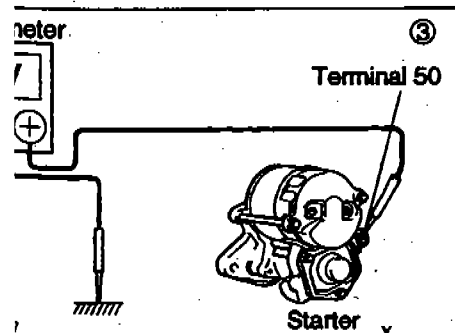
③ Check that there is voltage at starter terminal 50.
(IG SW START) STD voltage: 6 - 14 V

OK

NO

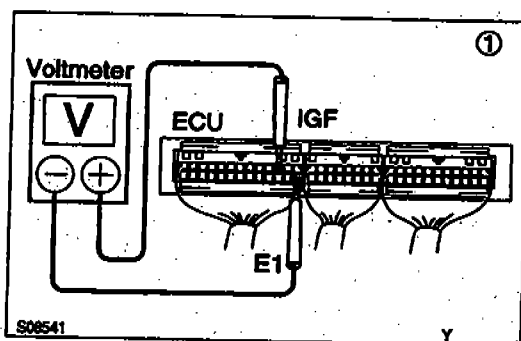
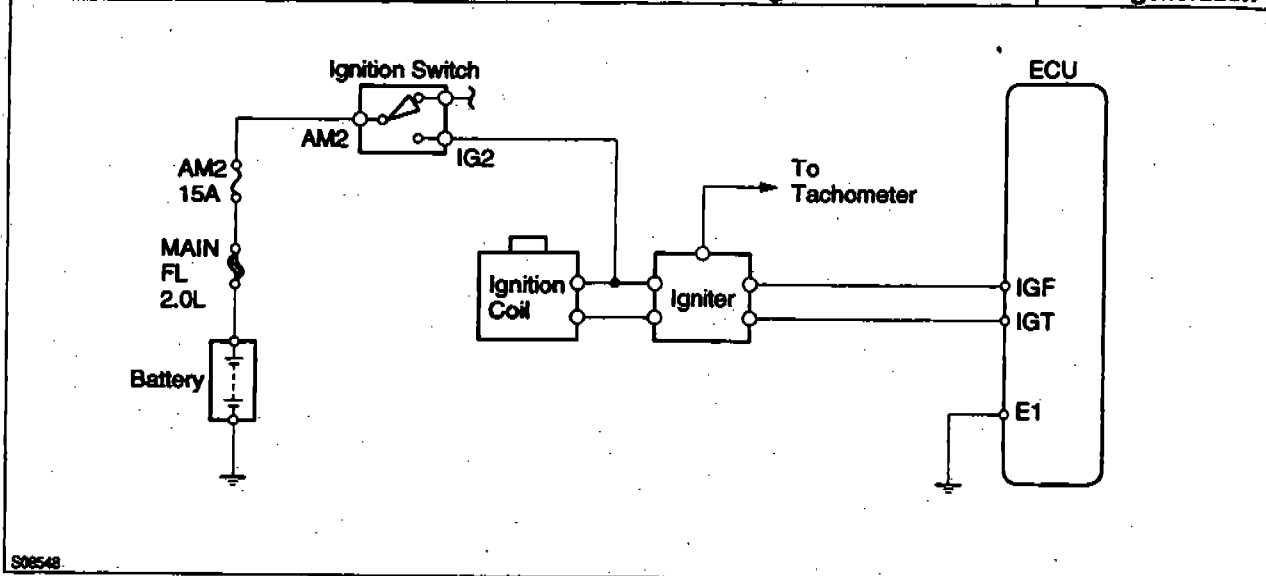
Check starter.

Check wiring between ignition switch terminal ST2 and starter terminal 50.



V09070

No.	Terminals	Trouble	Condition		STD voltage
9	IGF - E1	No voltage	IG SW ON	Igniter connector disconnected	4.5 - 5.5 V
	IGT - E1	No voltage	Idling		Pulse generation



① There is no voltage between ECU terminals IGF and E1. (Disconnect igniter connector, IG SW ON)

② Check that there is voltage between ECU terminals IGT and E1. (Idling)

NO

OK

③ Check wiring between ECU terminal E1 and body ground.

BAD

Repair or replace.

OK

Try another ECU.

Check H-fuse, fuse, fusible link and ignition switch.

BAD

Repair or replace.

OK

Check ignition coil.

BAD

Repair or replace.

OK

Check wiring between ECU and battery.

BAD

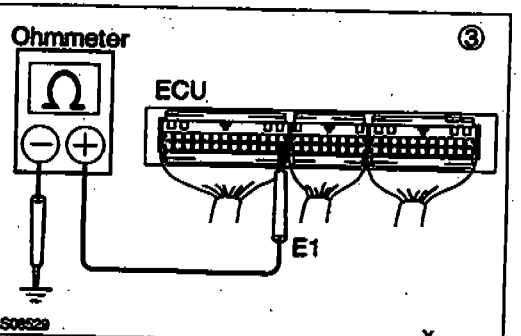
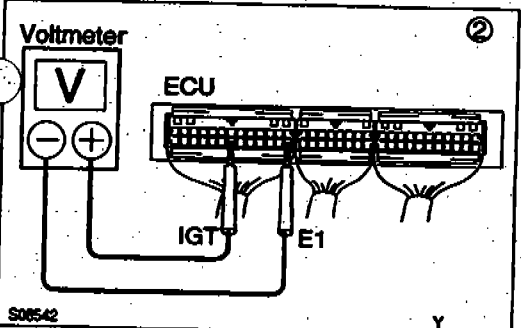
Repair or replace.

OK

Check igniter.

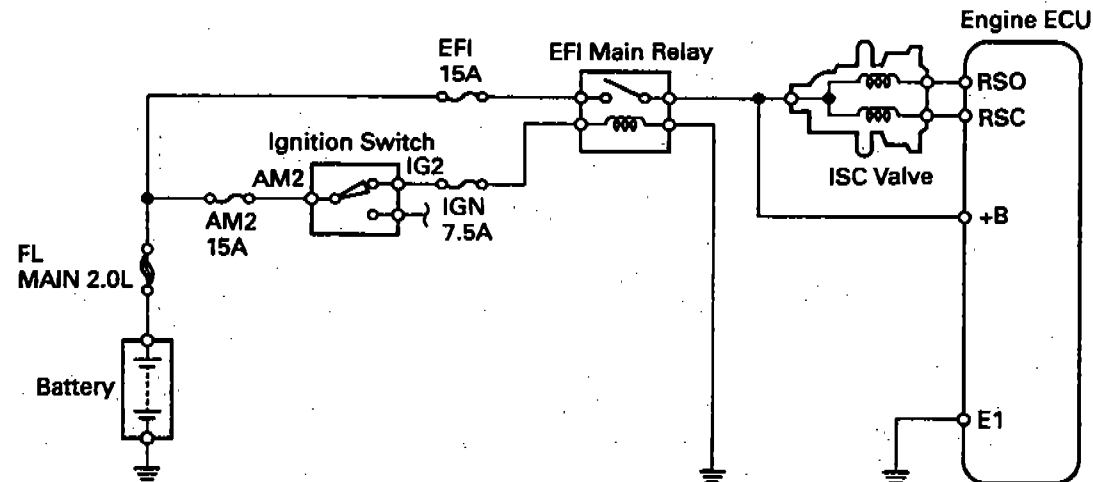
BAD

Repair or replace.

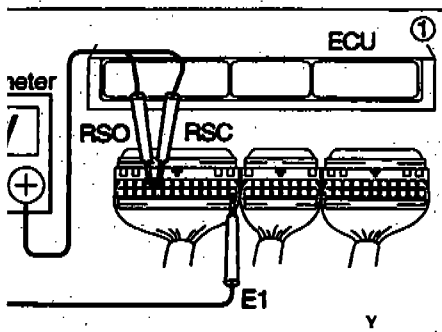


ELECTRONIC FUEL INJECTION — TROUBLESHOOTING w/ VOLT, OHMMETER

Terminals	Trouble	Condition		STD voltage
RSC RSO - E1	No voltage	IG SW ON	Engine ECU connectors disconnected	9 - 14 V



V05833



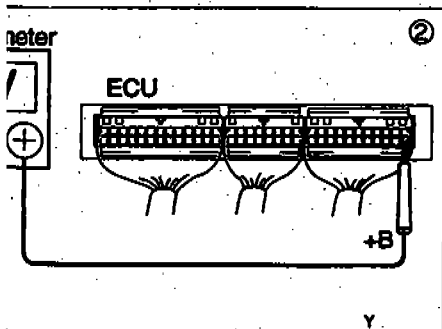
There is no voltage between terminals RSC or RSO and E1 of ECU connector.
 ① (IG SW ON, Engine ECU connectors disconnected)

Check that there is voltage between ECU terminal +B and body ground. (IG SW ON)
 ②

OK

NO

Refer to No.1.
 (See page FI-17)



Check resistance between ISC valve terminals +B and RSC or RSO.
 ③ STD resistance: 19.3 - 22.3 Ω

Cold: 17.5 - 28.5 Ω Hot: 17.0 - 24.5 Ω

BAD

Replace ISC valve.

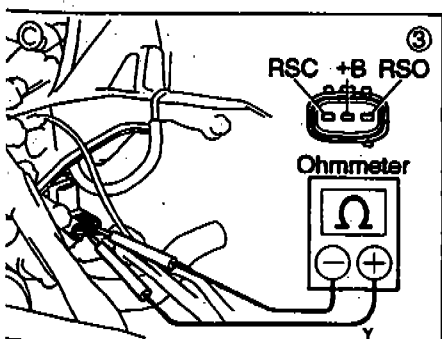
OK

Check wiring between ECU and ISC valve.
 OK

BAD

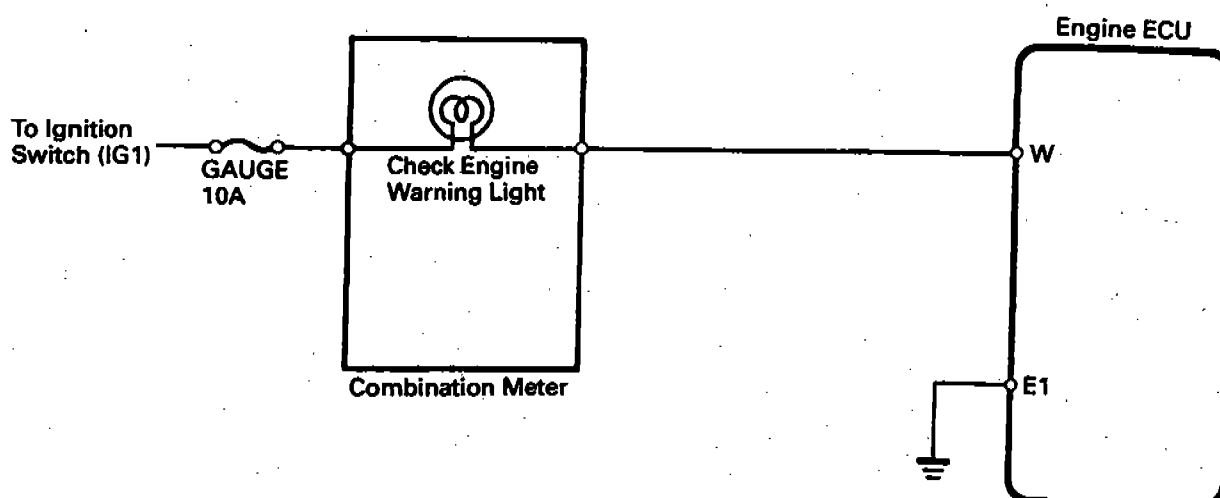
Repair or replace wiring.

Try another ECU.

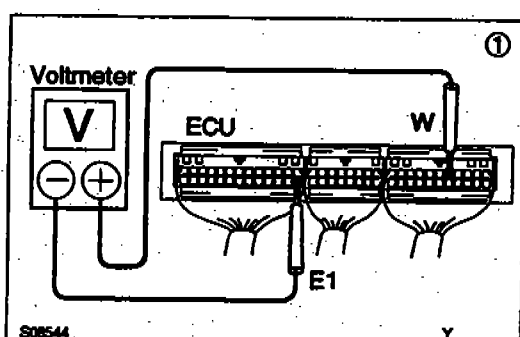


Y V05071

No.	Terminals	Trouble	Condition	STD voltage
11	W - E1	No voltage	No trouble (Check engine warning light off) and engine running.	9 - 14 V



FI0728



① There is no voltage between ECU terminals W and E1. (Idling)

② Check that there is voltage between ECU terminal W and body ground.

NO

OK

③ Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Repair or replace.

Check GAUGE fuse (10A) and check engine warning light.

OK

BAD

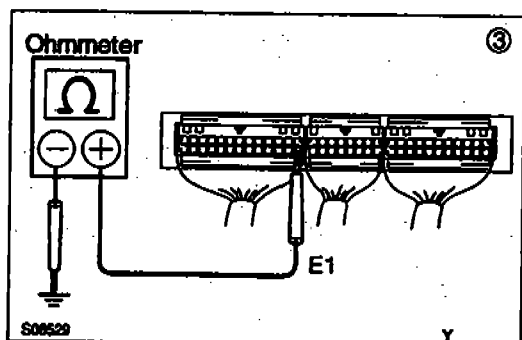
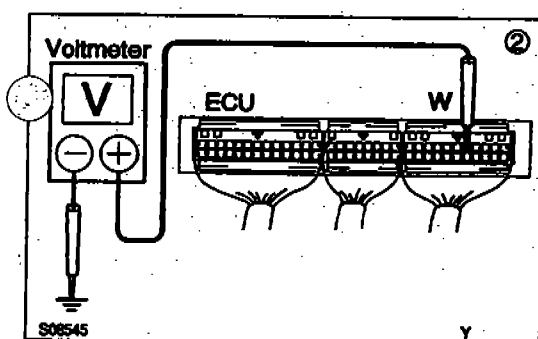
Repair or replace.

Fuse blows again

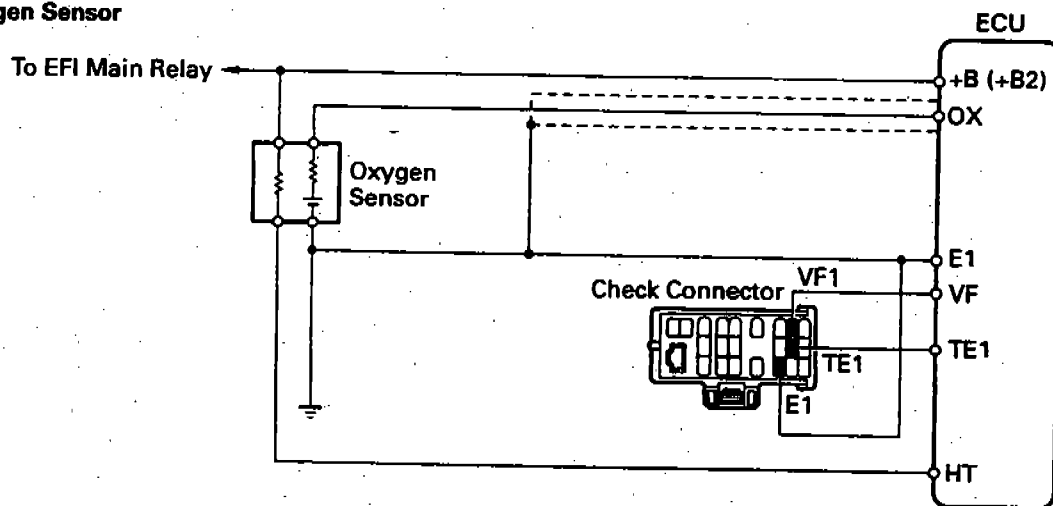
Check wiring between ECU terminal W and fuse.

BAD

Repair or replace.

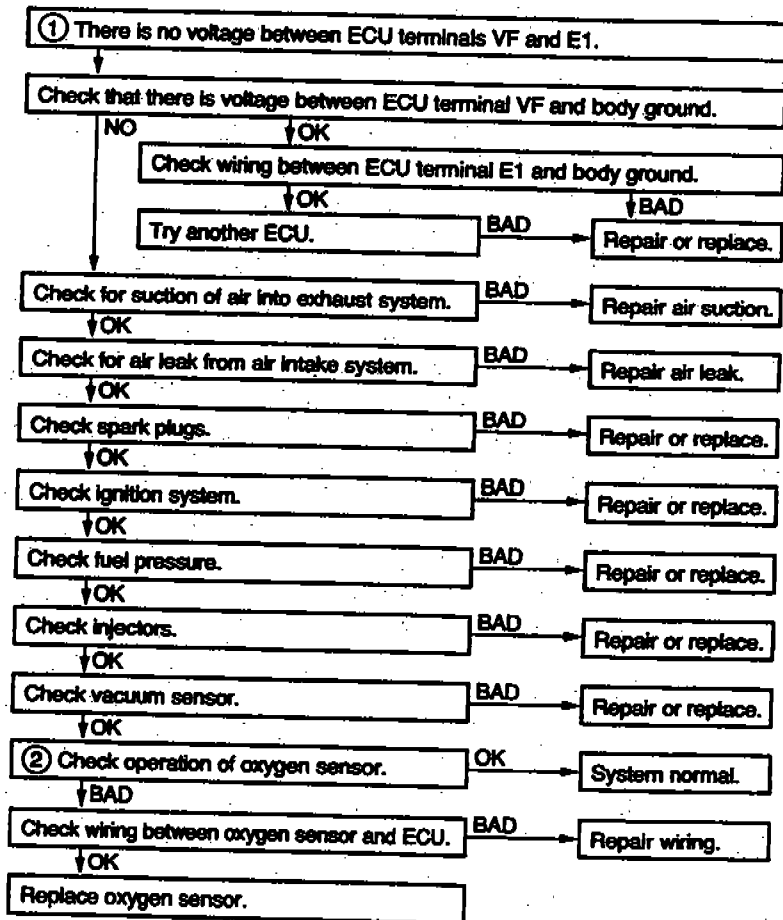
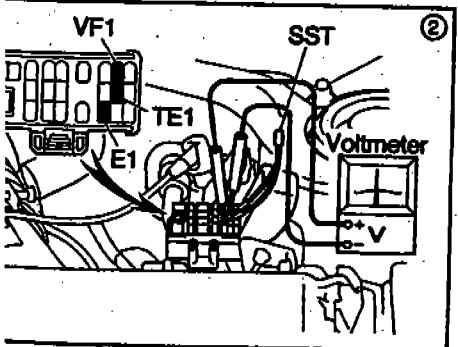
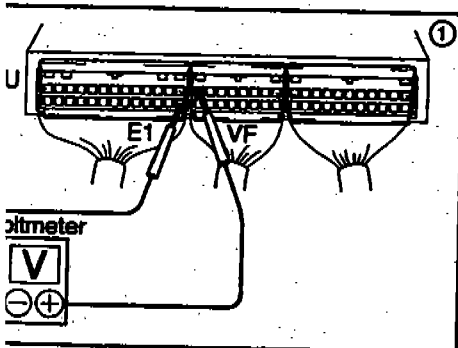


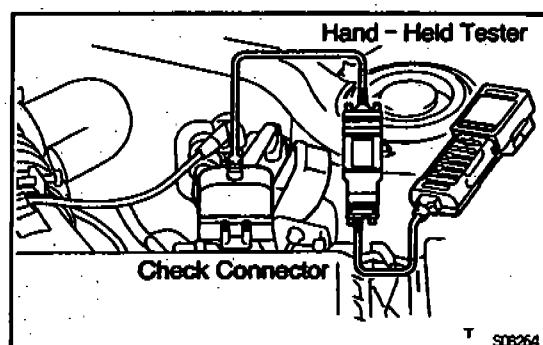
Oxygen Sensor



23390

717525





REFERENCE VALUE OF ENGINE ECU DATA

HINT: Engine ECU data can be monitored by hand-held tester.

1. Hook up the hand-held tester to the check connector.
2. Monitor engine ECU data by following the prompts on the tester screen.

Please refer to the hand-held tester operator's manual for further details.

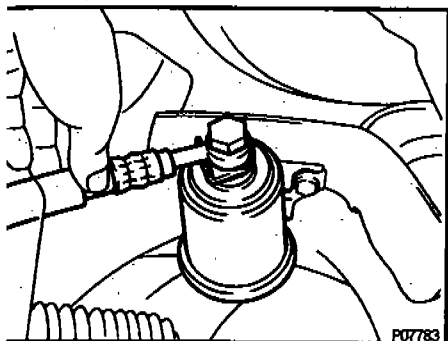
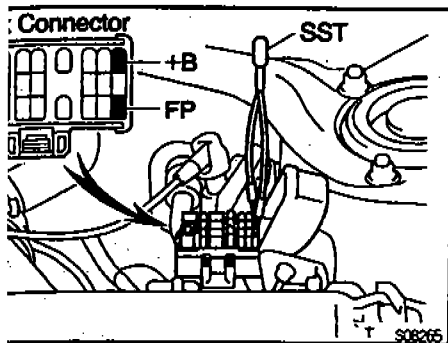
REFERENCE VALUE FOR ENGINE ECU DATA (Engine at normal operating temp.)

Item	Inspection condition	Reference value
INJECTOR	Engine cold to hot	Gradually decreases
	Engine idling at normal operating temp.*1	Approx. 3 - 4 msec
IGNITION	Increase engine speed	Gradually increases
ISC DUTY	Engine idling at normal operating temp.*1	Approx. 29 - 39 %
	A/C switch ON	Duty ratio increases
	A/T shifting in "D" position	Duty ratio increases
ENGINE SPD	RPM kept stable (Comparison with tachometer)	No great changes
INTAKE MAN.	Engine idling at normal operating temp.*1	Approx. 160 - 350 mmHg
	Increase engine speed	Gradually increases
COOLANT TEMP.	Engine at normal operating temp.	75 - 95°C (167 - 203°F)
THROTTLE	Closed throttle position	Below 5°
	Wide open throttle	Above 70°
	From closed throttle position to wide open throttle	Gradually increases
VEHICLE SPD	During driving (Comparison with speedometer)	No large differences
TARGET A/F L	Engine idling at normal operating temp.	2.50 ± 0.7 V
A/F FB LEFT	RPM stable at 2,500 rpm with normal operating temp.	ON
KNOCK FB	Depress throttle pedal suddenly during idling	ON
STA SIGNAL	During cranking	ON
IDL SIGNAL	Closed throttle position	ON
A/C SIGNAL	A/C switch ON	ON
Ox L	RPM stable at 2,500 rpm with normal operating temp.	RICH LEAN is repeated

*1: All accessories and A/C are switch OFF.

*2: If the engine coolant temp. sensor circuit is open or shorted, the engine ECU assumes an engine coolant temp. value of 80°C (176°F).

*3: When feedback control is forbidden, 0 V is displayed.



FUEL PUMP ON-VEHICLE INSPECTION

508265-01

1. CHECK FUEL PUMP OPERATION

- (a) Using SST, connect terminals +B and FP of the check connector.

SST 09843-18020

NOTICE: Do not connect wrong the terminals.

- (b) Turn the ignition switch ON.

NOTICE: Do not start the engine.

- (c) Check that there is pressure in the fuel inlet hose from the fuel filter.

HINT: If there is fuel pressure, you will hear the sound of the fuel flowing.

If there is no pressure, check these parts:

- Fusible link
- H-Fuses
- Fuses
- EFI main relay
- Fuel pump
- Wiring connections

- (d) Turn the ignition switch OFF.

- (e) Remove the SST from the check connector.

SST 09843-18020

2. INSPECT FUEL PRESSURE

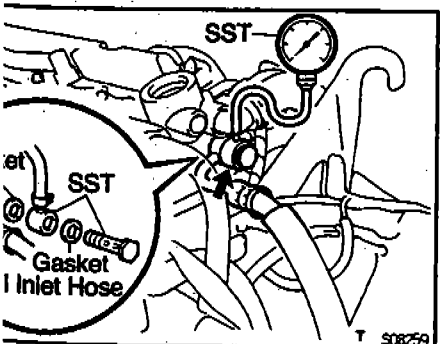
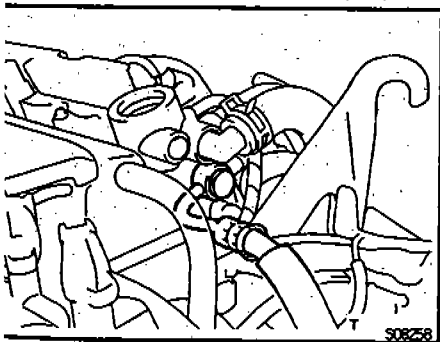
- (a) Check that battery voltage is above 11 V.

- (b) Disconnect the negative (-) terminal cable from the battery.

- (c) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the delivery pipe.

HINT:

- Put a suitable container or shop towel under the delivery pipe.
- Slowly loosen the union bolt.



- (d) Install the fuel inlet hose and SST (pressure gauge) to the delivery pipe with the 3 gaskets and SST (union bolt).

SST 09268-45012

Torque: 33 N·m (330 kgf·cm, 24 ft·lbf)

- (e) Wipe off any splattered gasoline.

- (f) Reconnect the negative (-) terminal cable to the battery.

- (g) Using SST, connect terminals +B and FP of the check connector.

SST 09843-18020

- (h) Turn the ignition switch ON.
(i) Measure the fuel pressure.

Fuel pressure:

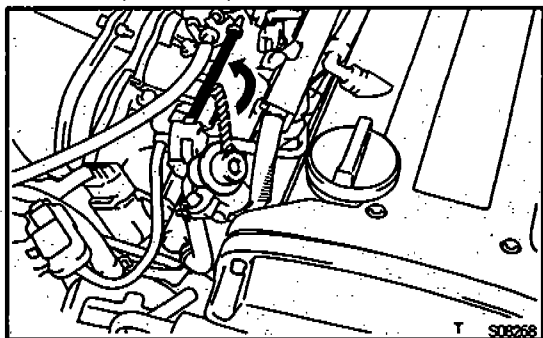
235 - 275 kPa (2.4 - 2.8 kgf/cm², 34 - 40 psi)

If pressure is high, replace the fuel pressure regulator.

If pressure is low, check these parts:

- Fuel hoses and connection
- Fuel pump
- Fuel filter
- Fuel pressure regulator

- (j) Remove the SST from the check connector.
SST 09843-18020
(k) Start the engine.



- (l) Disconnect the vacuum sensing hose from the fuel pressure regulator, and plug the hose end.

- (m) Measure the fuel pressure at idle.

Fuel pressure:

235 - 275 kPa (2.4 - 2.8 kgf/cm², 34 - 40 psi)

- (n) Reconnect the vacuum sensing hose to the fuel pressure regulator.

- (o) Measure the fuel pressure at idle.

Fuel pressure:

196 kPa (2.0 kgf/cm², 28 psi)

If pressure is not as specified, check the vacuum sensing hose and fuel pressure regulator.

- (p) Stop the engine.
(q) After checking fuel pressure, disconnect the negative terminal cable from the battery and carefully remove the SST to prevent gasoline from splashing.

SST 09268-45012

- (r) Connect the fuel inlet hose to the delivery pipe with 2 new gaskets and the union bolt.

Torque: 33 N·m (330 kgf·cm, 24 ft·lbf)

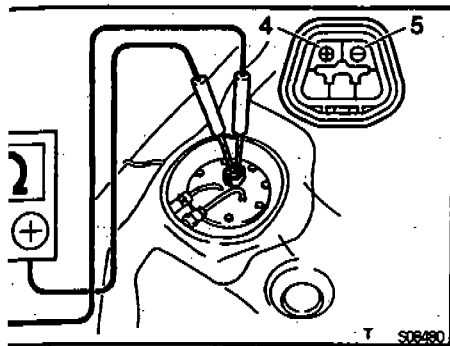
- (s) Check for fuel leaks.

3. REMOVE REAR SEAT CUSHION

4. REMOVE FLOOR SERVICE HOLE COVER

5. DISCONNECT FUEL PUMP & SENDER GAUGE CONNECTOR

ELECTRONIC FUEL INJECTION - FUEL PUMP

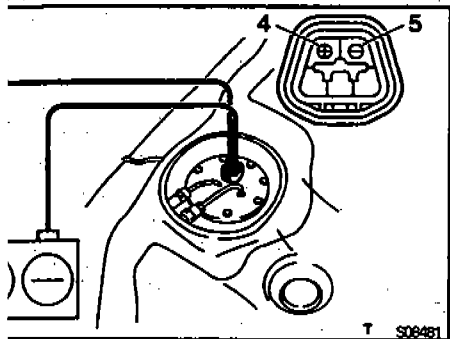
**6. INSPECT FUEL PUMP RESISTANCE**

Using an ohmmeter, measure the resistance between the terminals 4 and 5.

Resistance:

0.2 – 3.0 Ω at 20°C (68°F)

If the resistance is not as specified, replace the fuel pump.

**7. INSPECT FUEL PUMP OPERATING**

Connect the positive (+) lead from the battery to terminal 4 of the connector, and the negative (-) lead to terminal 5. Check that the fuel pump operates.

If operation is not as specified, replace the fuel pump.

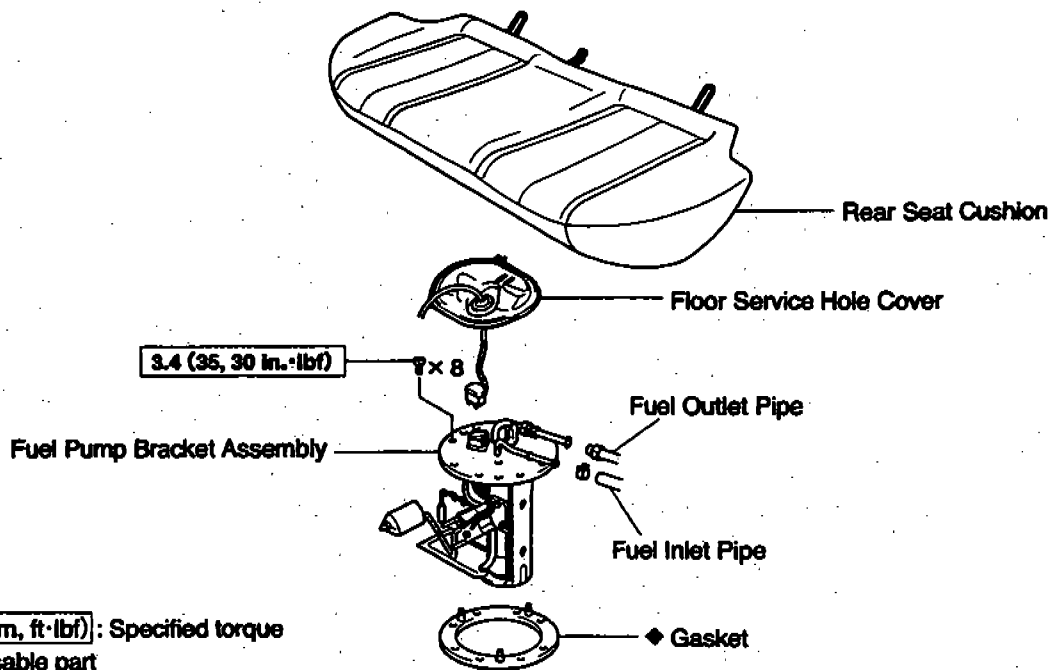
NOTICE:

- These tests must be performed quickly (within 10 seconds) to prevent the coil from burning out.
- Keep the fuel pump as far away from the battery as possible.
- Always perform switching at the battery side.

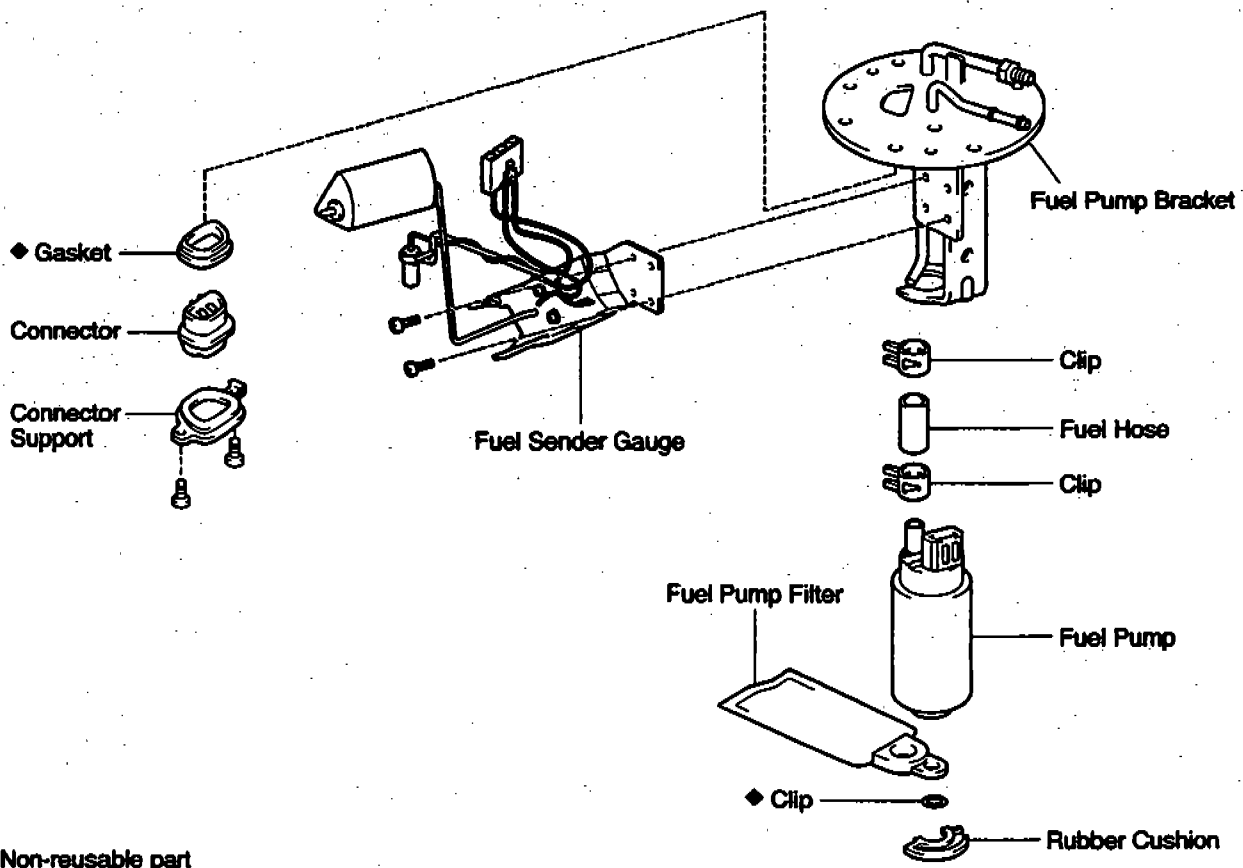
8. RECONNECT FUEL PUMP & SENDER GAUGE CONNECTOR**9. REINSTALL FLOOR SERVICE HOLE COVER****10. REINSTALL REAR SEAT CUSHION**

COMPONENTS

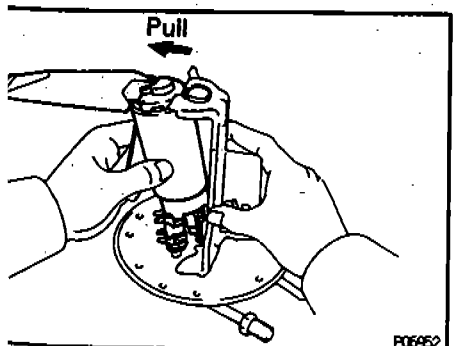
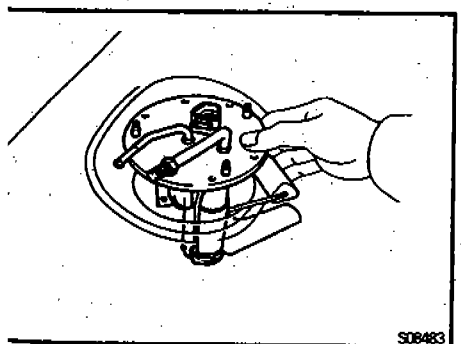
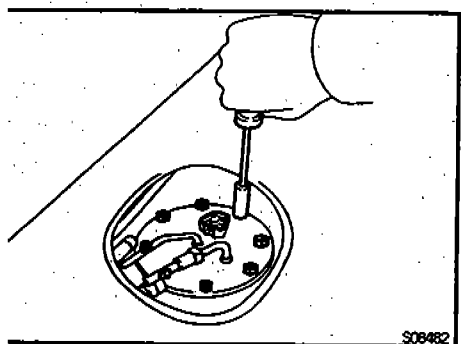
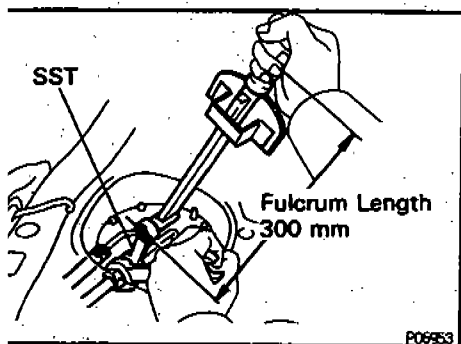
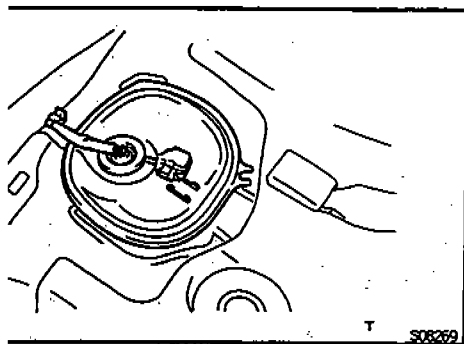
5F049-01



T 50223



T 50223



REMOVAL

CAUTION: Do not smoke or work near an open flame when working on the fuel pump.

1. **REMOVE REAR SEAT CUSHION**
2. **REMOVE FLOOR SERVICE HOLE COVER**
 - (a) Remove the service hole cover.
 - (b) Disconnect the fuel pump & sender gauge connector.
3. **DISCONNECT FUEL PIPE AND HOSE FROM FUEL PUMP BRACKET**

CAUTION: Remove the fuel filter cap to prevent the fuel from flowing out.

- (a) Using SST, disconnect the outlet pipe from the pump bracket.

SST 09631-22020

Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)

INSTALLATION HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

- (b) Disconnect the return hose from the pump bracket.

4. **REMOVE FUEL PUMP BRACKET ASSEMBLY FROM FUEL TANK**

- (a) Remove the 8 bolts.

Torque: 3.4 N·m (35 kgf·cm, 30 in.-lbf)

- (b) Pull out the pump bracket assembly.

- (c) Remove the gasket from the pump bracket.

INSTALLATION HINT: Install a new gasket to the pump bracket.

DISASSEMBLY

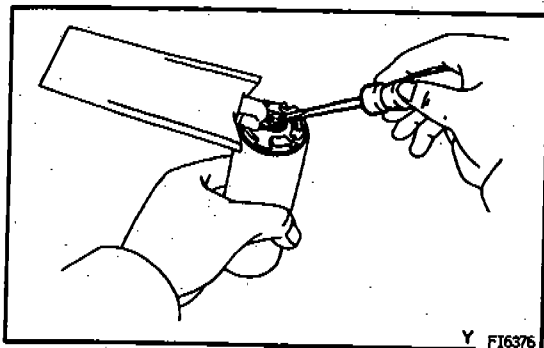
1. **REMOVE FUEL PUMP FROM FUEL PUMP BRACKET**

- (a) Pull off the lower side of the fuel pump from the pump bracket.

- (b) Disconnect the fuel pump connector.

- (c) Disconnect the fuel hose from the fuel pump, and remove the fuel pump.

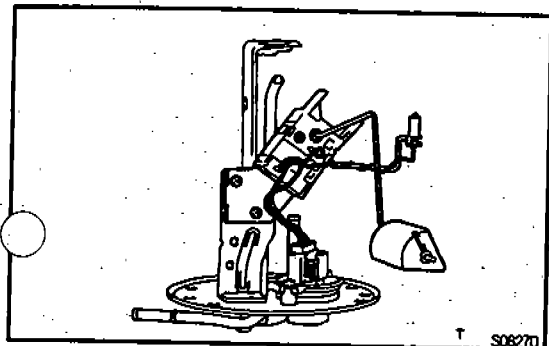
- (d) Remove the rubber cushion from the fuel pump.



2. REMOVE FUEL PUMP FILTER FROM FUEL PUMP

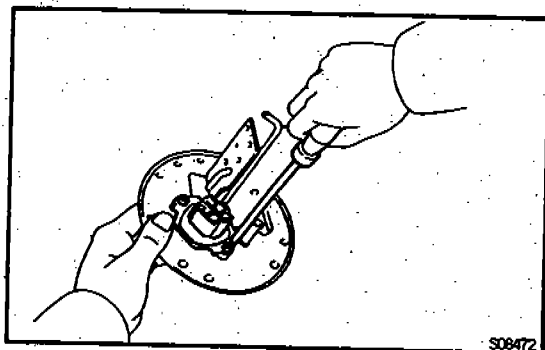
- (a) Using a small screwdriver, remove the clip.
- (b) Pull out the pump filter.

ASSEMBLY HINT: Install the pump filter with a new clip.



3. REMOVE FUEL SENDER GAUGE FROM FUEL PUMP BRACKET

- (a) Disconnect the fuel sender gauge connector.
- (b) Remove the 2 screws and sender gauge.



4. REMOVE CONNECTOR

Remove the 2 screws, connector support, connector and gasket.

INSTALLATION HINT: Install the connector with a new gasket.

REASSEMBLY

Reassembly is in the reverse order of disassembly.

INSTALLATION

Installation is in the reverse order of removal.

FUEL PRESSURE REGULATOR ON-VEHICLE INSPECTION

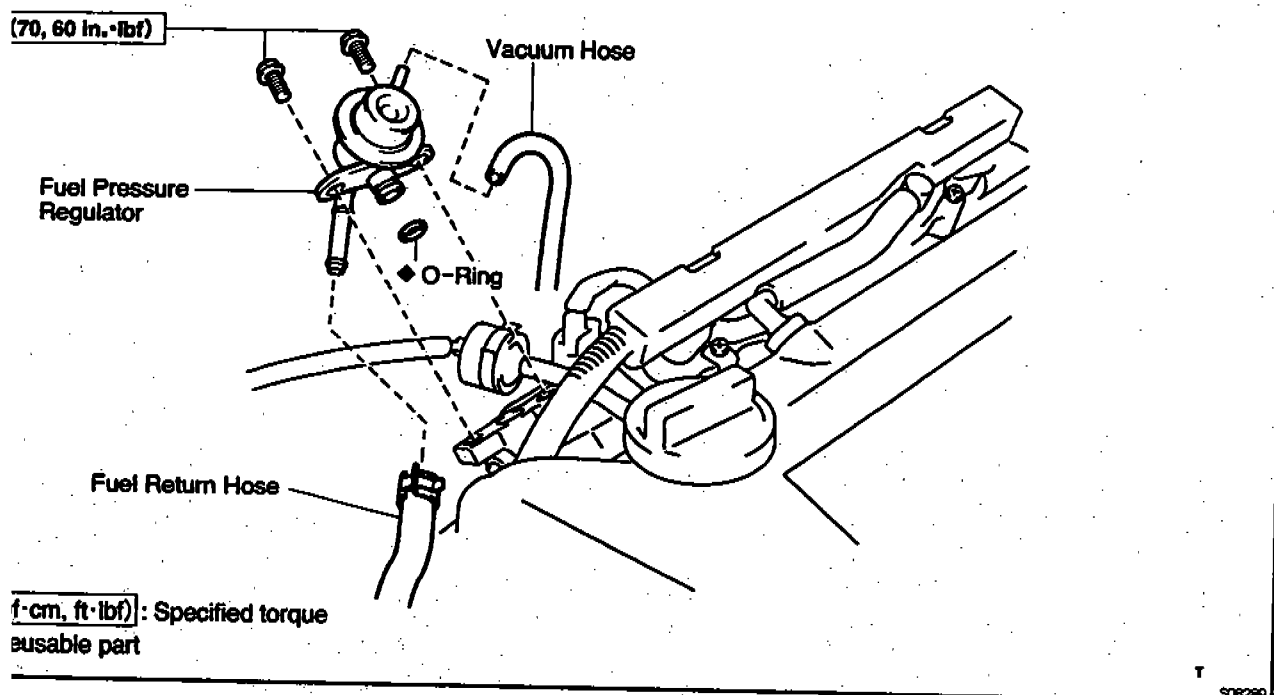
E0005-13

INSPECT FUEL PRESSURE

(See step 2 in on-vehicle inspection in fuel pump)

E01AC-20

COMPONENTS



T

S08269

E01AD-AJ

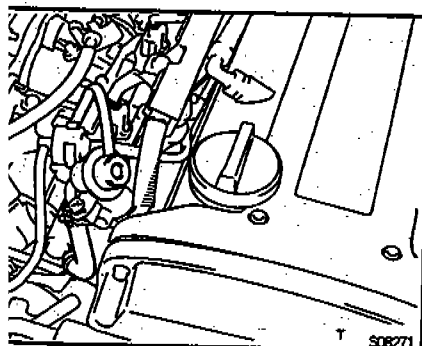
REMOVAL

1. DISCONNECT VACUUM SENSING HOSE FROM FUEL PRESSURE REGULATOR
2. DISCONNECT FUEL RETURN HOSE FROM FUEL PRESSURE REGULATOR

HINT: Put a suitable container or shop towel under the pressure regulator.

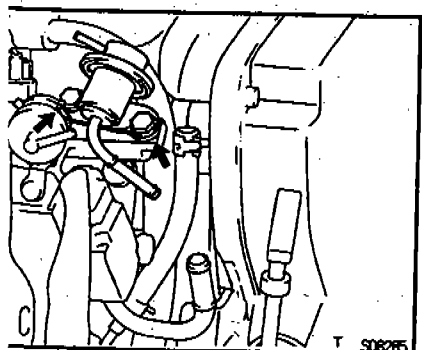
3. REMOVE FUEL PRESSURE REGULATOR

- (a) Remove the 2 bolts, and pull out the pressure regulator.
- (b) Remove the O-ring from the pressure regulator.



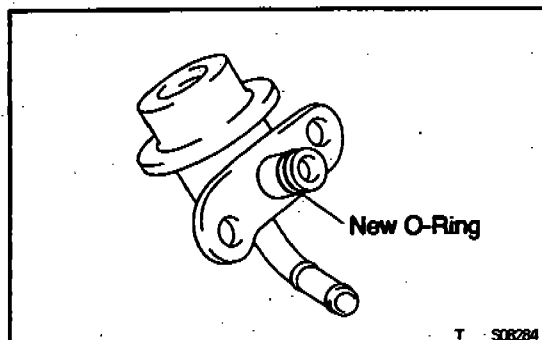
T

S08271



T

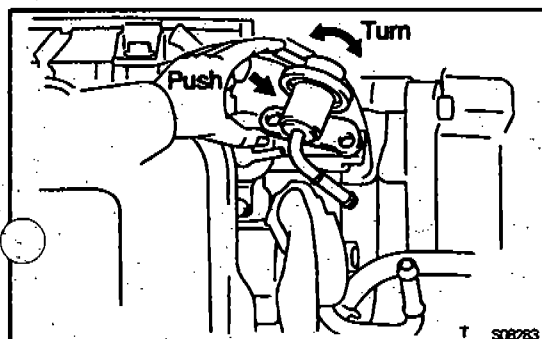
S08285



INSTALLATION

1. INSTALL FUEL PRESSURE REGULATOR

- (a) Apply a light coat of gasoline to a new O-ring, and install it to the pressure regulator.



- (b) While turning the pressure regulator left and right, install it to the delivery pipe.

- (c) Install the pressure regulator with the 2 bolts.
Torque: 7.0 N·m (70 kgf·cm, 60 in·lbf)

2. CONNECT FUEL RETURN HOSE TO FUEL PRESSURE REGULATOR

3. CONNECT VACUUM SENSING HOSE TO FUEL PRESSURE REGULATOR

4. START ENGINE AND CHECK FOR FUEL LEAKAGE

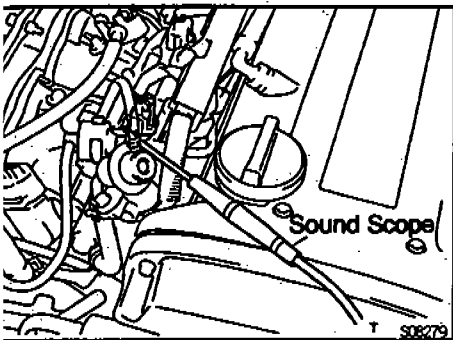
INJECTOR ON-VEHICLE INSPECTION

E052X-02

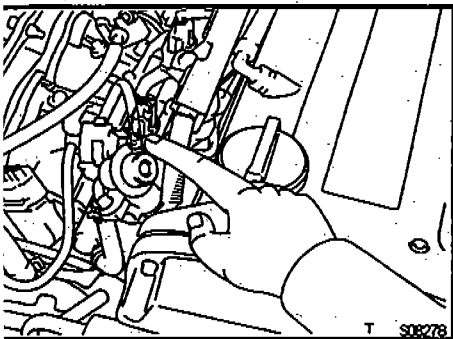
1. INSPECT INJECTOR OPERATION

Check operation sound from each injector.

- (a) With the engine running or cranking, use a sound scope to check that there is normal operating noise in proportion to engine speed.



- (b) If you have no sound scope, you can check the injector transmission operation with your finger.
If no sound or unusual sound is heard, check the wiring connector, injector or injection signal from the ECU.



2. INSPECT INJECTOR RESISTANCE

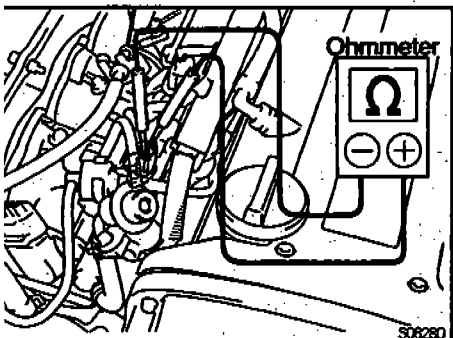
- (a) Disconnect the injector connector.
(b) Using an ohmmeter, measure the resistance between the terminals.

Resistance:

13.4 – 14.2 Ω at 20°C (68°F)

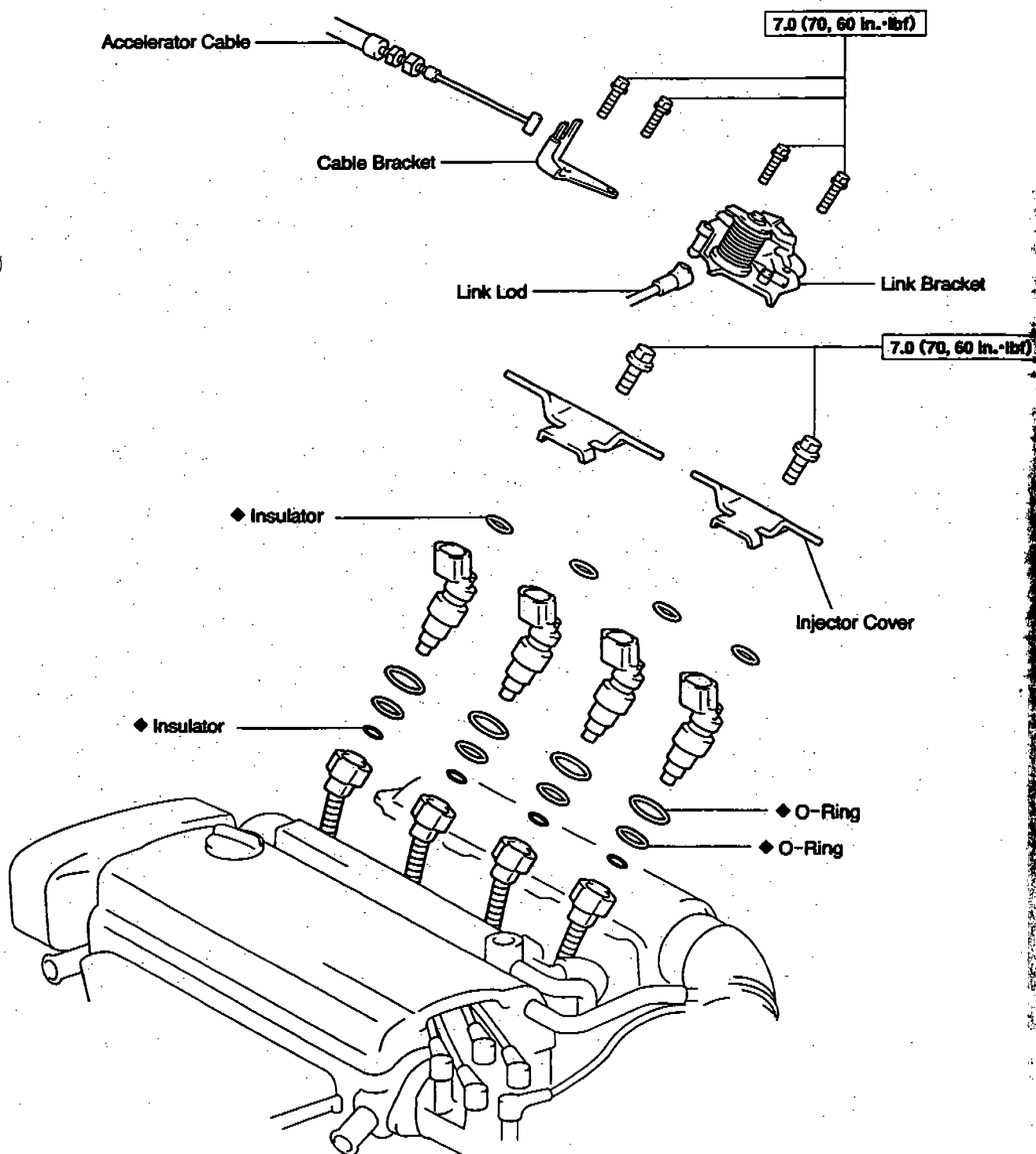
If the resistance is not as specified, replace the injector.

- (c) Reconnect the injector connector.



COMPONENTS

E0130-01



N·m (kgf·cm, ft·lbf): Specified torque

◆ Non-reusable part

T 3287

6054-03

REMOVAL**1. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY****2. REMOVE LINK BRACKET AND CABLE BRACKET**

- (a) Disconnect link rod from link bracket.

- (b) Remove the 2 bolts and link bracket.

- (c) Remove the 2 bolts and cable bracket.

3. DISCONNECT INJECTOR CONNECTORS**4. REMOVE INJECTORS**

- (a) Remove the bolt and injector cover. Remove the 2 injector covers.

- (b) Remove the insulator from each injector.

- (c) Pull out the 4 injectors from throttle body.

- (d) Remove the 2 O-rings and insulator from each injector.

INSPECTION**1. INSPECT INJECTOR INJECTION**

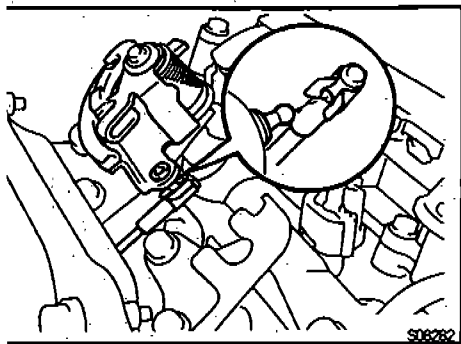
CAUTION: Keep injector clean of sparks during the test.

- (a) Remove the throttle body assembly.

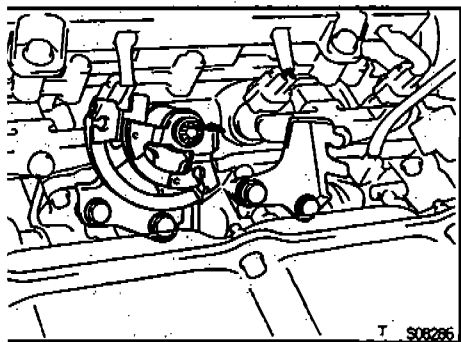
(See throttle body)

- (b) Install the 4 injectors to throttle body assembly.

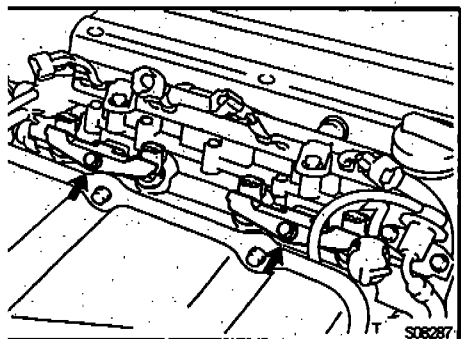
- (c) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel filter outlet.



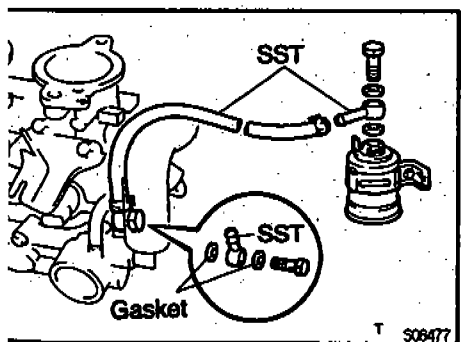
S06282



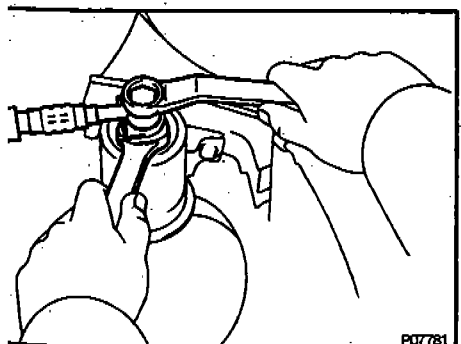
T S06286



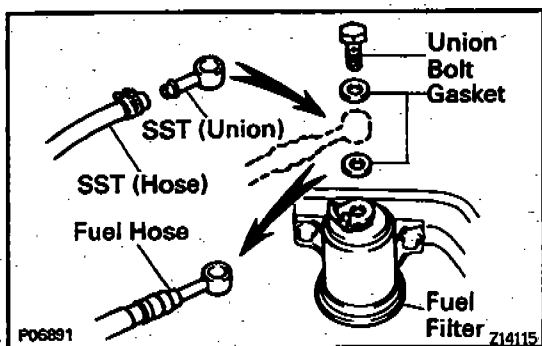
T S06287



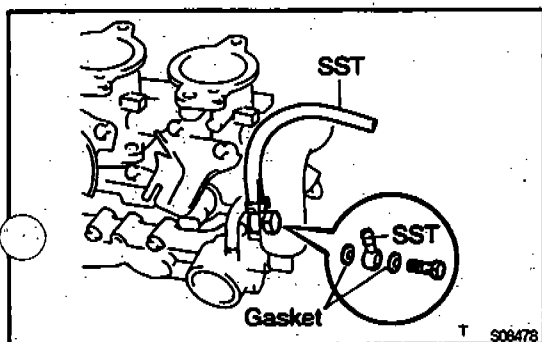
T S06477



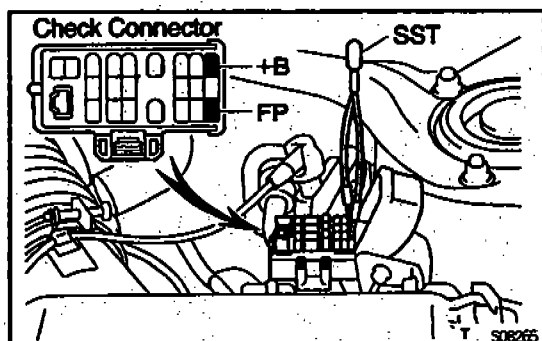
P07781



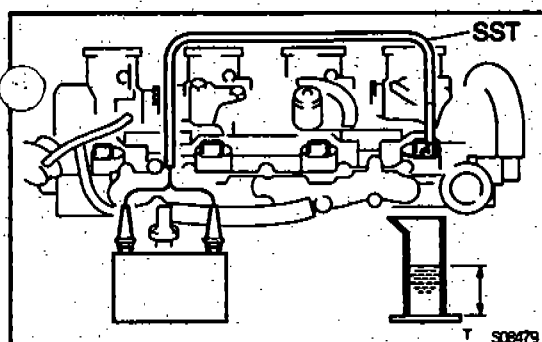
- (d) Connect SST (union and hose) to the fuel filter outlet with the 2 gaskets and union bolt.
SST 09268-41046 (90405-09015, 95336-08070)
Torque: 29.5 N·m (300 kgf·cm, 22 ft·lbf)



- (e) Connect SST (union and hose) to the throttle body assembly with the 2 gasket and union bolt



- (f) Using SST, connect terminals +B and FP of the check connector.
SST 09843-18020
(g) Reconnect negative (-) terminal cable to the battery.
(h) Turn the ignition switch ON.
NOTICE: Do not start the engine.



- (i) Connect SST (wire) to the injector and battery for 10 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.
SST 09842-30070

Volume:

65 - 82 cm³ (4.0 - 5.0 cu in.) per 15 sec.

Difference between each injector:

5 cm³ (0.3 cu in.) or less

If the injection volume is not as specified, replace the injector.

2. INSPECT LEAKAGE

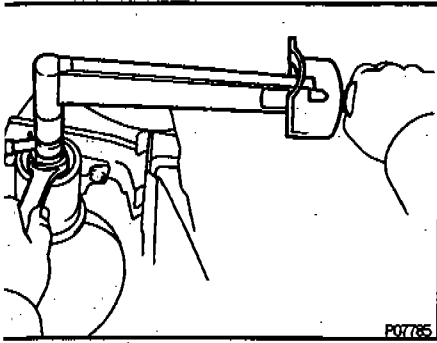
- (a) In the condition above, disconnect the test probes of SST (wire) from the battery and check the fuel leakage from the injector.

SST 09842-30070

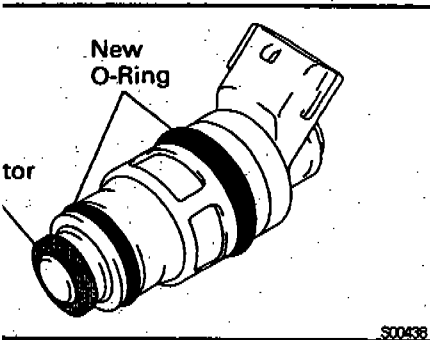
Fuel drop:

One drop or less per minute

ELECTRONIC FUEL INJECTION - INJECTOR



- (b) Turn the ignition switch OFF.
- (c) Disconnect the negative (-) terminal cable from the battery.
- (d) Remove the SST.
SST 09268-41046 (90405-09015, 95336-08070)
09843-18020
- (e) Reinstall the fuel inlet hose to the fuel filter outlet with 2 new gaskets and the union bolt.
Torque: 29.5 N·m (300 kgf·cm, 22 ft·lbf)
- (f) Remove the 4 injectors from the throttle body assembly.
- (g) Reinstall the throttle body assembly.
(See throttle body)

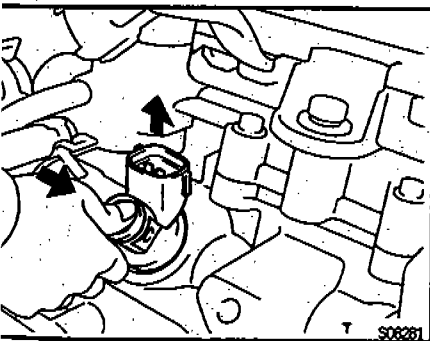


INSTALLATION

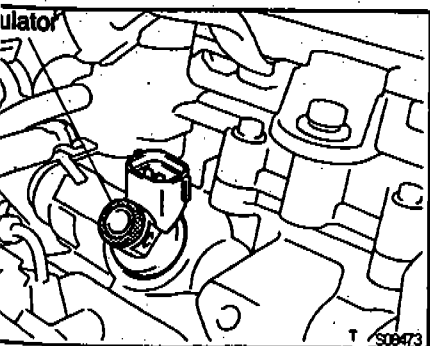
SFO45-01

1. INSTALL INJECTORS AND DELIVERY PIPE

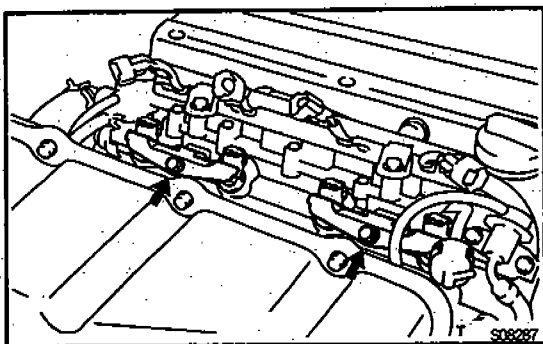
- (a) Install 2 new O-rings and a new insulator to each injector.
- (b) Apply a light coat of gasoline to 2 new O-rings.



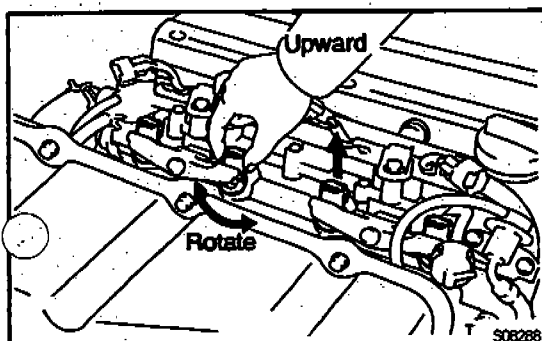
- (c) Push in the 4 injectors.
- (d) Position the injector connector upward.



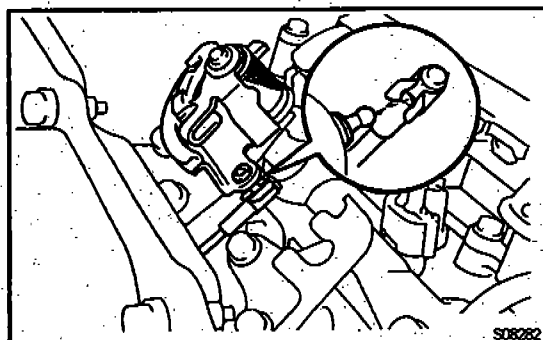
- (e) Install 4 new insulators.



- (f) Temporarily install the injector cover with the bolt. Install the 2 injector covers.



- (g) Check that the injectors rotate smoothly.
HINT: If the injectors do not rotate smoothly, the probable cause is in correct installation of the O-rings. Replace the O-rings.
- (h) Position the injector connector upward.



- (i) Tighten the bolt holding the injector cover to the throttle body. Hold the 2 injector covers.

Torque: 7.0 N·m (70 kgf·cm, 60 in.-lbf)

2. CONNECT INJECTOR CONNECTORS

3. INSTALL LINK BRACKET AND CABLE BRACKET

- (a) Install the cable bracket with the 2 bolts.

Torque: 7.0 N·m (70 kgf·cm, 60 in.-lbf)

- (b) Install the link bracket with the 2 bolts.

Torque: 7.0 N·m (70 kgf·cm, 60 in.-lbf)

- (c) Connect the link rod to the link bracket.

4. CONNECT ACCELERATOR CABLE TO THROTTLE BODY

THROTTLE BODY ON-VEHICLE INSPECTION

SF048-01

1. INSPECT THROTTLE BODY

- (a) Check that the throttle linkage moves smoothly.

- (b) Check the vacuum at the purge port.

- Start the engine.
- Check the vacuum with your finger.

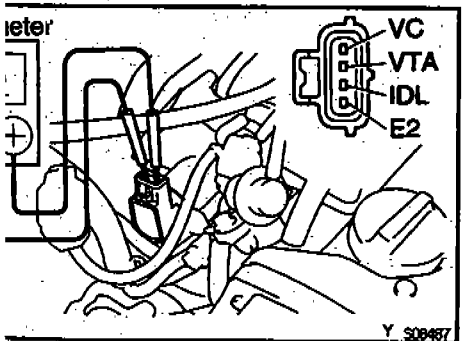
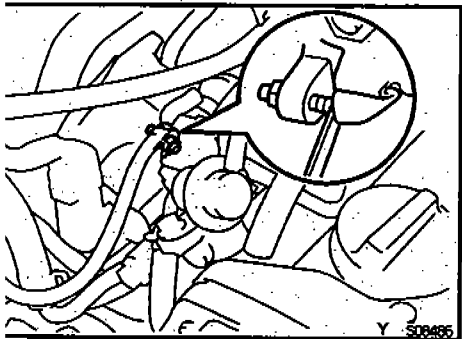
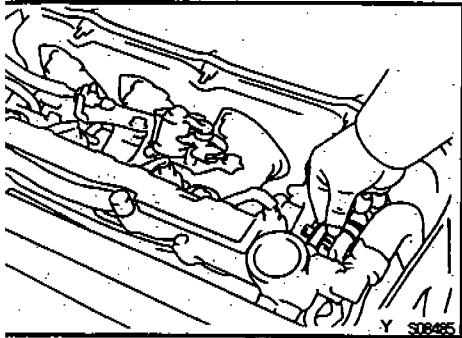
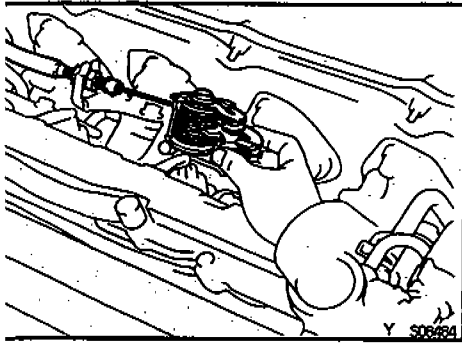
2. INSPECT THROTTLE POSITION SENSOR

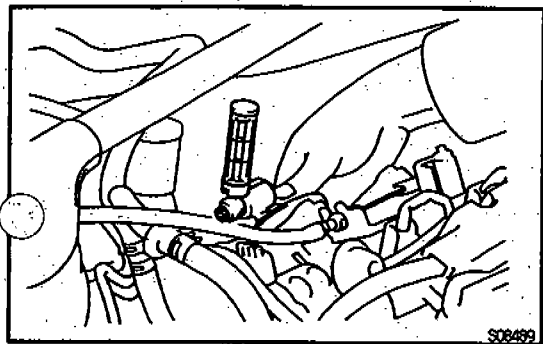
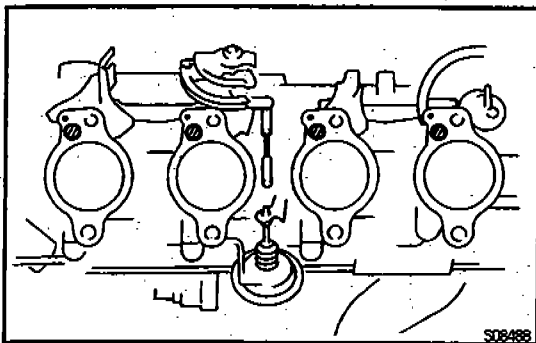
- (a) Disconnect the throttle position sensor connector.
- (b) Insert a feeler gauge between the throttle stop screw and throttle lever.

- (c) Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA - E2	0.3 - 6.3 k Ω
0.8 mm (0.031 in.)	IDL - E2	0.5 k Ω or less
1.0 mm (0.040 in.)	IDL - E2	Infinity
Throttle valve fully open	VTA - E2	1.8 - 11.5 k Ω
-	VC - E2	3.5 - 6.5 k Ω

- (d) Reconnect the sensor connector.





3. ADJUST THROTTLE BODY

- (a) Remove the surge tank.
- (b) Fully close the bypass screws of the No.1, No.2, No.3 and No.4 throttle bodies.
- (c) Allow the engine to warm up to normal operating temperature.

- (d) Using a carburetor balancer, search out the maximum air flowed cylinder.
- (e) Using the carburetor balancer, and adjusting the bypass screws, tune the other three cylinders in the same as the maximum air flowed cylinder.

HINT: Do not loosen the bypass screw until it becomes of flange surface of the throttle body.

- (f) Stop the engine.
- (g) Reinstall the surge tank.
- (h) Start the engine.
- (i) Check that the idle speed is stable in the specification.

Idle speed
830 - 930 rpm

If not within the specified idle speed, stop the engine and screw the bypass screws which adjust as step (e) in 1/4 turns.

- (j) Repeat step (i) until the idle speed becomes stable in specification.

4. INSPECT THROTTLE OPENER

- (a) Allow the engine to warm up to normal operating temperature.

- (b) Disconnect the vacuum hose from the throttle opener and plug the hose end.

- (c) Check the throttle opener setting speed.

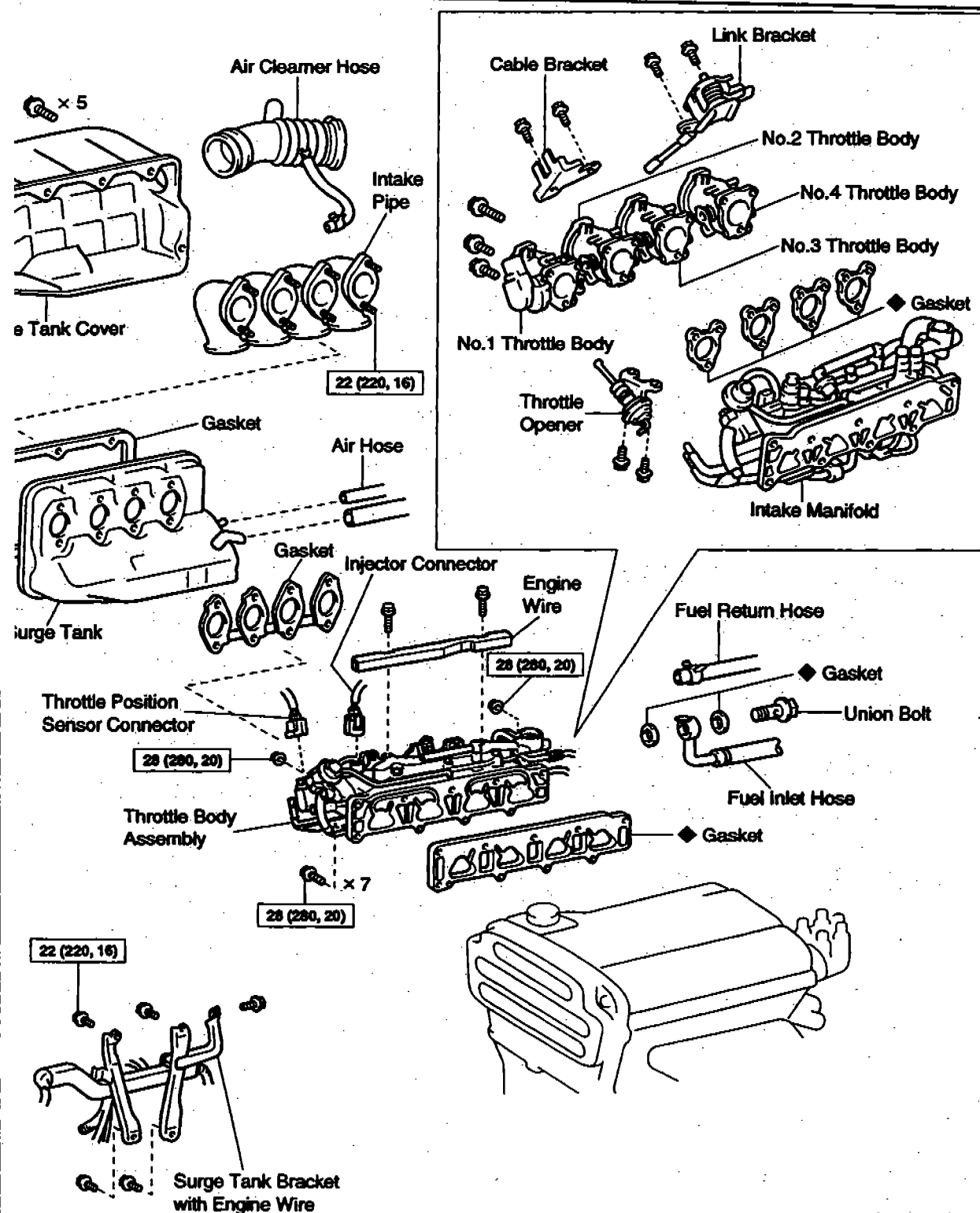
Throttle opener setting speed:

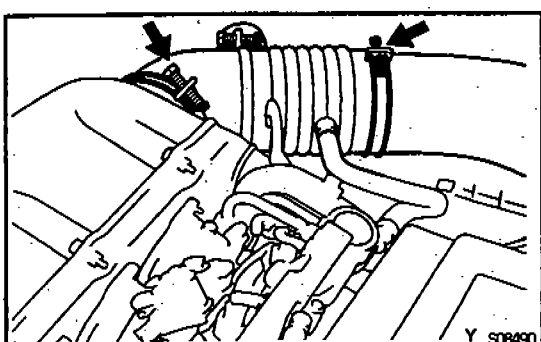
2,500 rpm or less

- (d) If the throttle opener setting speed is not as specified, adjust or replace the throttle opener.
(See step 8 in installation)

COMPONENTS

E0130-35



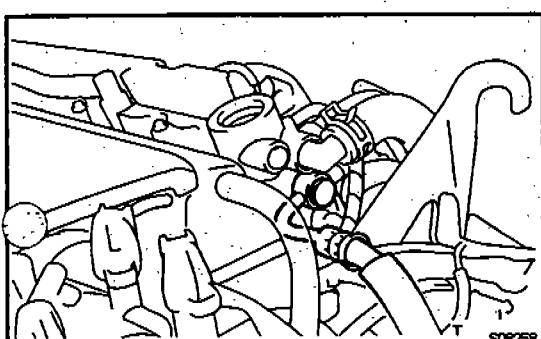


REMOVAL

1. REMOVE AIR CLEANER HOSE

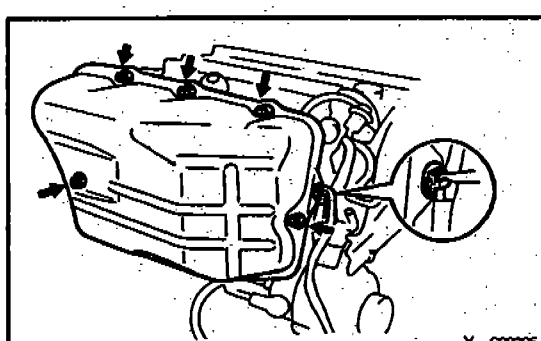
- (a) Loosen the 2 air cleaner hose clamp bolts.
- (b) Disconnect the air hose.
- (c) Remove the air cleaner hose.

2. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY



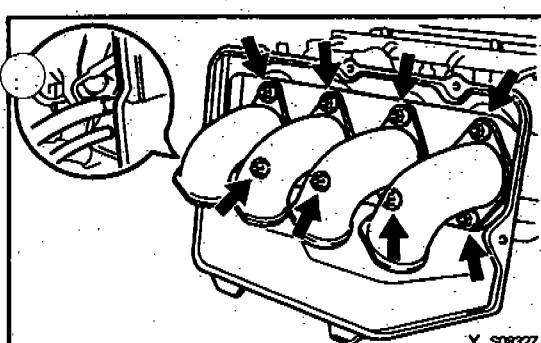
3. DISCONNECT FUEL HOSES

- (a) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the throttle body.
- (b) Disconnect the fuel return hose from the throttle body.

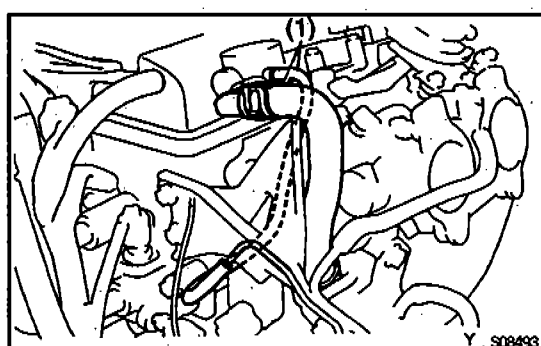


4. REMOVE SURGE TANK

- (a) Disconnect the cord clip from the surge tank.
- (b) Using a 5 mm hexagon wrench, remove the 5 bolts, surge tank cover and gasket.



- (c) Disconnect the vacuum hose and ISC hose from the surge tank.
- (d) Remove the 2 bolts with the intake pipe. Remove the 4 intake pipes, surge tank and gasket.

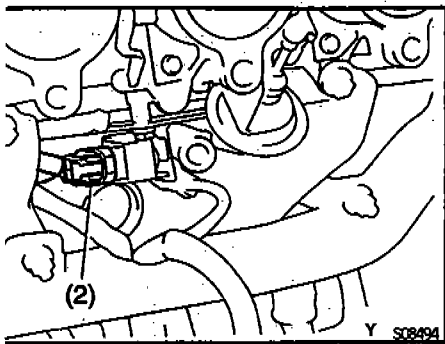


5. REMOVE THROTTLE BODY ASSEMBLY

- (a) Disconnect these connectors and hoses:
 - (1) Air hoses

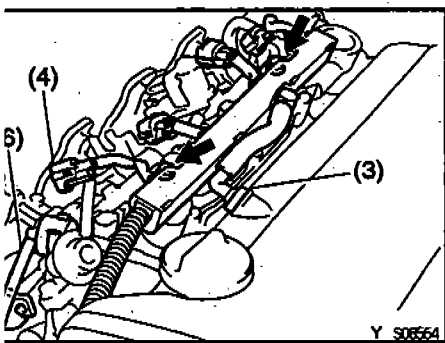
ELECTRONIC FUEL INJECTION - THROTTLE BODY

- (2) VSV for EVAP connector



- (3) PCV hose
 (4) Injector connectors
 (5) Throttle position sensor connector
 (6) Vacuum hose

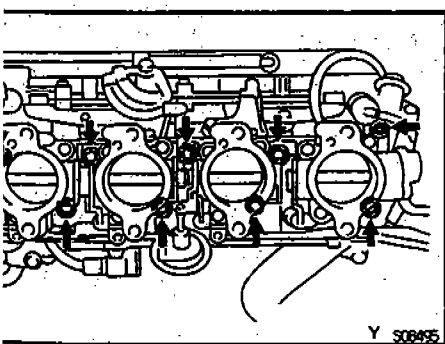
- (b) Remove the 2 bolts and engine wire from the throttle body.



- (c) Remove the 5 bolts and the 2 surge tank stays with the engine wire from the throttle body.

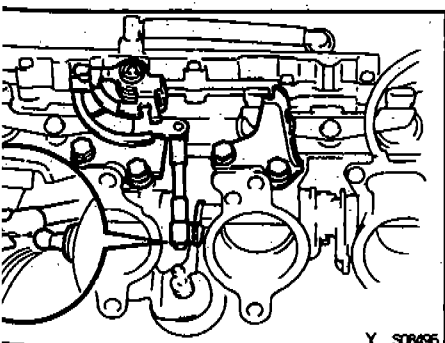


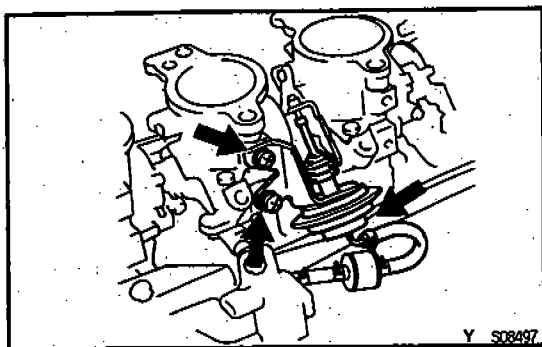
- (d) Remove the 2 nuts, 7 bolts, throttle body assembly and gasket.



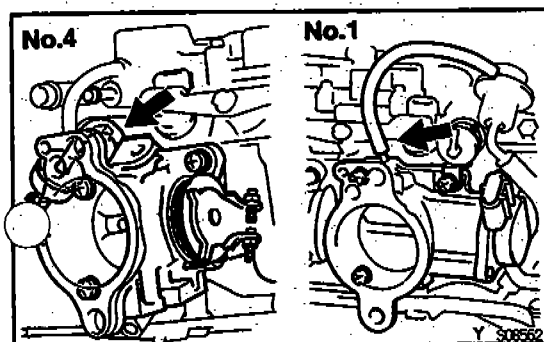
6. REMOVE LINK BRACKET AND ACCELERATOR CABLE BRACKET

- (a) Disconnect the link rod from the throttle lever.
 (b) Remove the 2 bolts and link bracket.
 (c) Remove the 2 bolts and accelerator cable bracket.

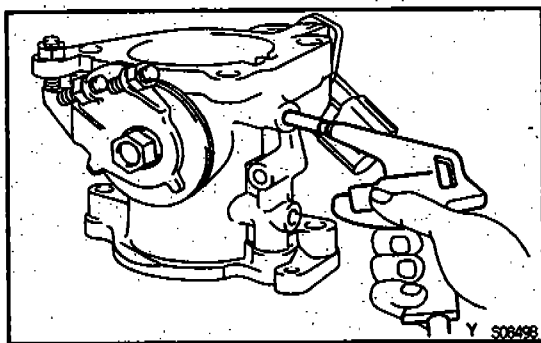


**7. REMOVE THROTTLE OPENER**

- (a) Disconnect the vacuum hose from the throttle opener.
- (b) Remove the 2 screws and throttle opener.

**8. REMOVE NO.1 - NO.4 THROTTLE BODIES**

- (a) No.1 and No.4:
Disconnect the vacuum hose from the throttle body.
- (b) No.1:
Remove the 3 screws, clip, throttle body and gasket.
- (c) No.2 - No.4:
Remove the 3 screws, throttle body and gasket. Remove the No.2 - No.4 throttle bodies and gaskets.

**INSPECTION****1. CLEAN THROTTLE BODY**

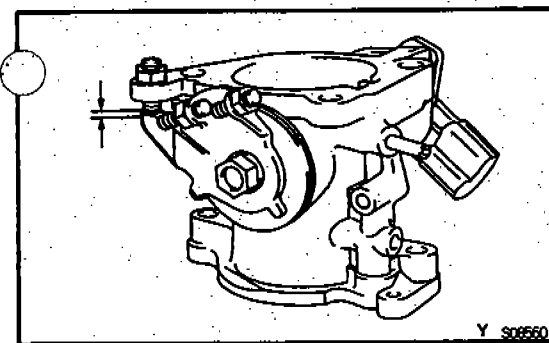
Using compressed air, clean all the passages and apertures. Clean the all throttle bodies.

NOTICE: To prevent deterioration, do not clean the throttle position sensor.

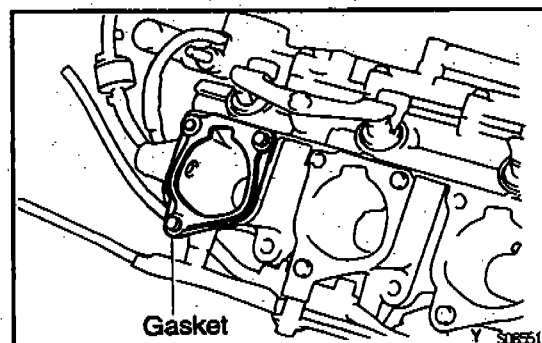
2. INSPECT THROTTLE VALVE

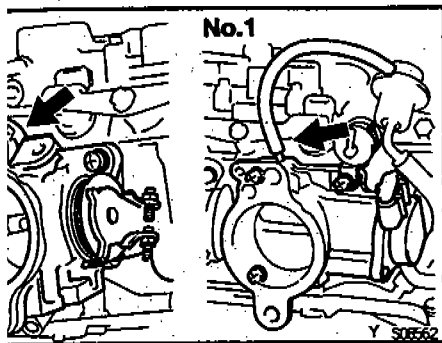
Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is closed.

NOTICE: Do not adjust the throttle stop screws.

3. INSPECT THROTTLE POSITION SENSOR
(See step 2 in on-vehicle inspection)**INSTALLATION****1. INSTALL NO.1 - NO.4 THROTTLE BODIES**

- (a) No.1:
Install a new gasket and the throttle body with the 3 screws and clip.
Torque: 7.0 N·m (70 kgf·cm, 60 in·lbf)
- (b) No.2 - No.4:
Install a new gasket and the throttle body with the 3 screws. Install the No.2 - No.4 throttle bodies.





Torque: 7.0 N·m (70 kgf·cm, 60 ft·lbf)

- (c) No.1 and No.4:

Connect the vacuum hose to the throttle body.

2. INSTALL THROTTLE OPENER

- (a) Install the throttle opener with the 2 bolts.
(b) Connect the vacuum hose to the throttle opener.

3. INSTALL LINK BRACKET AND ACCELERATOR CABLE BRACKET

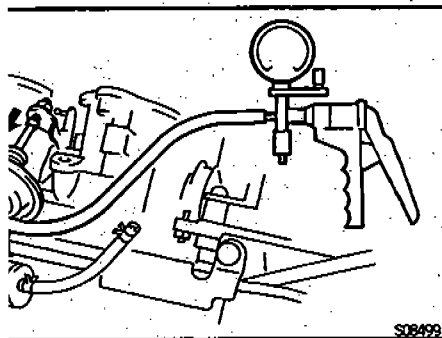
- (a) Install the accelerator cable bracket with the 2 bolts.

Torque: 7.0 N·m (70 kgf·cm, 60 in·lbf)

- (b) Install the link bracket with the 2 bolts.

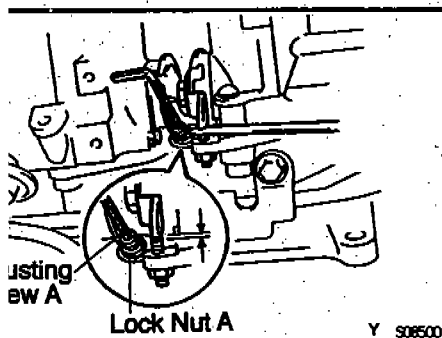
Torque: 7.0 N·m (70 kgf·cm, 60 in·lbf)

- (c) Connect the link rod to the throttle lever.



4. ADJUST NO.1 THROTTLE BODY

- (a) Apply vacuum to the throttle opener.



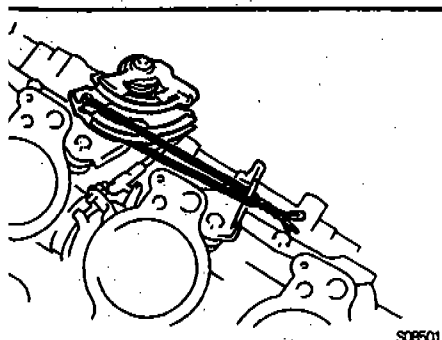
- (b) Loosen the lock nut A.

- (c) Using a feeler gauge and 2 mm hexagon wrench, turn the adjusting screw A to adjust the clearance as shown in the illustration.

Clearance:

0.03 mm (0.001 in.)

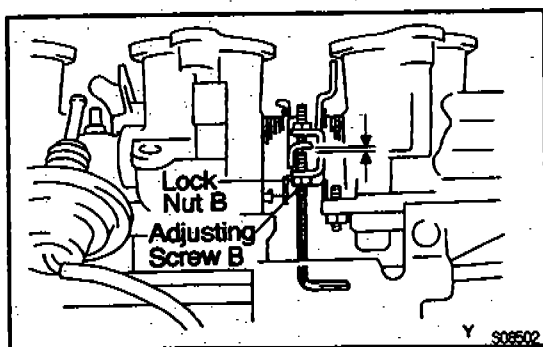
- (d) Tighten the lock nut A.



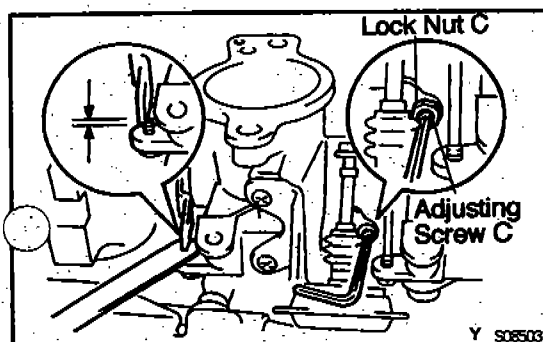
- (e) Open fully the throttle valve.

- (f) Using a wire, fix the link as keep step (e).

NOTICE: Do not fix the throttle valve by inserting the tools.

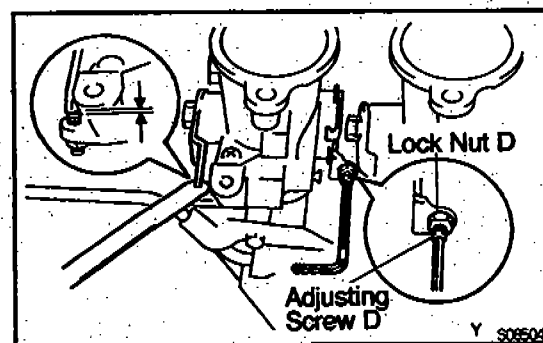


- (g) Loosen the lock nut B.
 - (h) Using a 2 mm hexagon wrench, turn the adjusting screw B until the clearance becomes 0 mm (0 in.).
 - (i) Return the adjusting screw B 0.33 to 0.50 turns then tighten the lock nut B.
- Clearance:**
0.15 - 0.25 mm (0.006 - 0.010 in.)
- (j) Remove the wire.

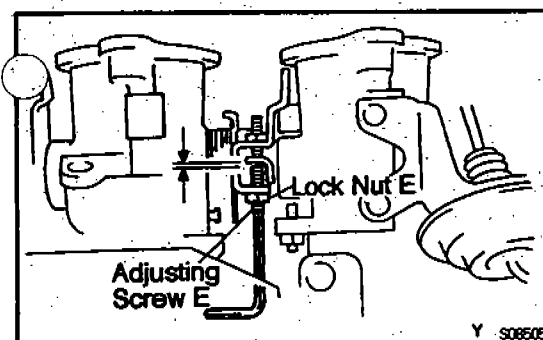


5. ADJUST NO.2 THROTTLE BODY

- (a) See procedure (a) to (d) in step 4.
 - (b) Loosen the lock nut C.
 - (c) Using a feeler gauge and 2 mm hexagon wrench, turn the adjusting screw C to adjust the clearance as shown in the illustration.
- Clearance:**
0.03 mm (0.001 in.)
- (d) Tighten the lock nut C.



- (e) Loosen the lock nut D.
 - (f) Using a feeler gauge and 2 mm hexagon wrench, turn the adjusting screw D to adjust the clearance as shown in the illustration.
- Clearance:**
0.03 mm (0.001 in.)
- (g) Tighten the lock nut D.



- (h) See procedure (e) to (i) in step 4.
 - (i) Loosen the lock nut E.
 - (j) Using a 2 mm hexagon wrench, turn the adjusting screw E until the clearance becomes 0 mm (0 in.).
 - (k) Return the adjusting screw E 0.33 to 0.50 turns then tighten the lock nut E.
- Clearance:** 0.15 - 0.25 mm (0.006 - 0.010 in.)
- (l) Remove the wire.

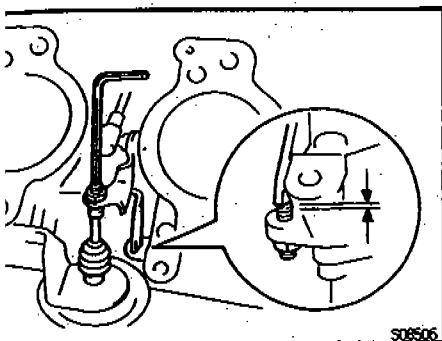
6. ADJUST NO.3 THROTTLE BODY

- (a) Apply vacuum to the throttle opener.
- (b) See procedure (b) to (c) and (i) to (l) in step 5.

7. ADJUST NO.4 THROTTLE BODY

- (a) Apply vacuum to the throttle opener.
- (b) See procedure (e) to (g) and (i) to (l) in step 5.

ELECTRONIC FUEL INJECTION - THROTTLE BODY

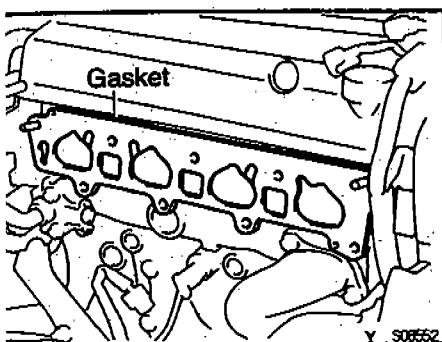
**8. ADJUST THROTTLE OPENER**

- (a) Loosen the lock nut.
- (b) Using a feeler gauge and 2 mm hexagon wrench, turn the adjusting screw to adjust the clearance as shown in the illustration.

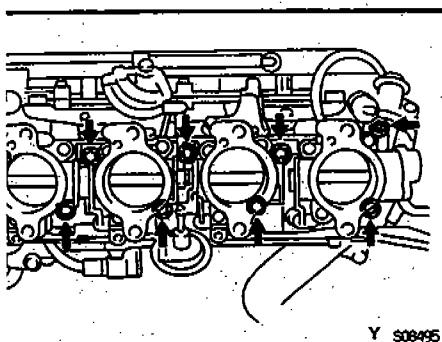
Clearance:

1.23 – 1.37 mm (0.048 – 0.054 in.)

- (c) Tighten the lock nut.

**9. INSTALL THROTTLE BODY ASSEMBLY**

- (a) Place a new gasket to the cylinder head.



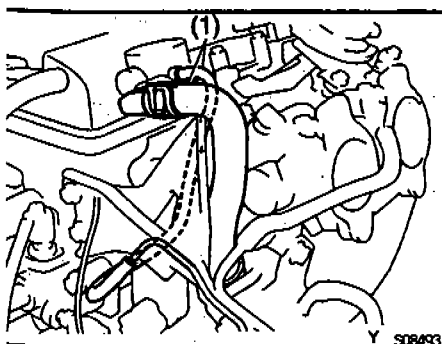
- (b) Install the throttle body assembly with the 7 bolts and 2 nuts.

Torque: 28 N·m (280 kgf·cm, 20 ft·lbf)



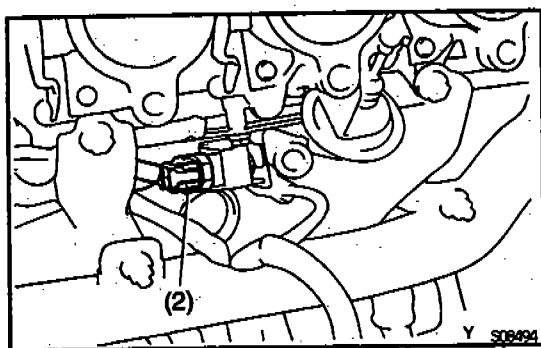
- (c) Install the 2 surge tank stays with the engine wire and 4 bolts.

Torque: 22 N·m (220 kgf·cm, 16 ft·lbf)

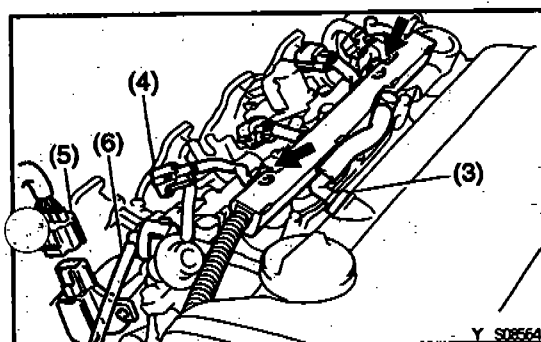


- (d) Connect the these connectors and hoses:

- (1) Air hoses



(2) VSV for EVAP connector



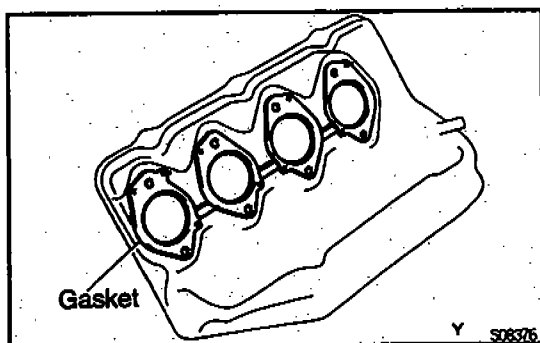
(3) PCV hose

(4) Injector connectors

(5) Throttle position sensor connector

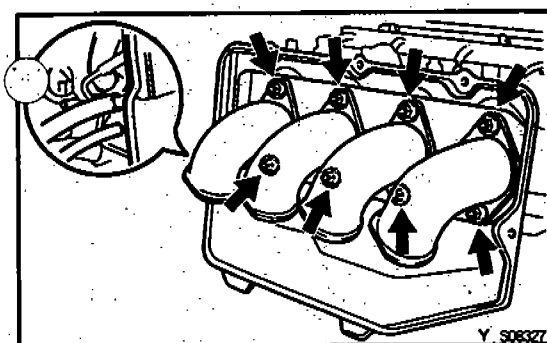
(6) Vacuum hose

(e) Install the engine wire with the 2 bolts.



10. INSTALL SURGE TANK

(a) Place the gasket in position on the surge tank.

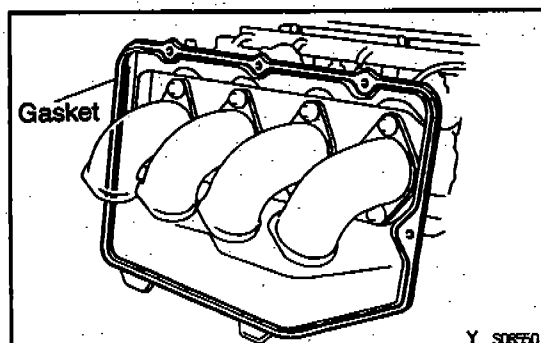


(b) Place the surge tank with the gasket in position on the throttle body.

(c) Install the intake pipe with the 2 bolts. Install the 4 intake pipes.

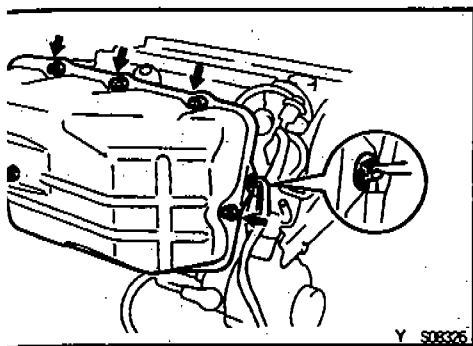
Torque: 22 N·m (220 kgf·cm, 16 ft·lbf)

(d) Connect the vacuum hose and ISC hose.

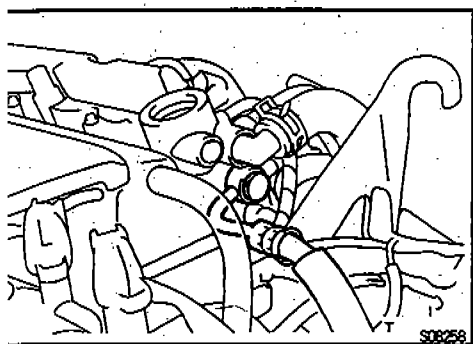


(e) Place the gasket in position on the surge tank.

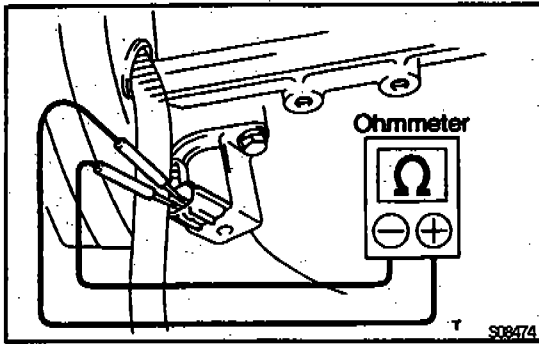
ELECTRONIC FUEL INJECTION - THROTTLE BODY



- (f) Using a 5 mm hexagon wrench, install the surge tank cover with the 5 bolts.
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)
- (g) Connect the cord clip to the surge tank.



11. **CONNECT FUEL HOSES**
 - (a) Install the fuel inlet hose with 2 new gaskets and the union bolt.
Torque: 33 N·m (330 kgf·cm, 24 ft·lbf)
 - (b) Connect the fuel return hose the throttle body.
12. **CONNECT ACCELERATOR CABLE TO THROTTLE BODY**
13. **INSTALL AIR CLEANER HOSE**
 - (a) Install the air cleaner hose.
 - (b) Tighten the 2 air cleaner hose clamp bolts.
 - (c) Connect the air hose.
14. **ADJUST THROTTLE BODY ASSEMBLY BALANCE**
(See step 3 in on-vehicle inspection)
15. **CHECK THROTTLE OPENER**
(See step 4 in on-vehicle inspection)



CAMSHAFT TIMING OIL CONTROL VALVE

ON-VEHICLE INSPECTION

INSPECT OIL CONTROL VALVE RESISTANCE

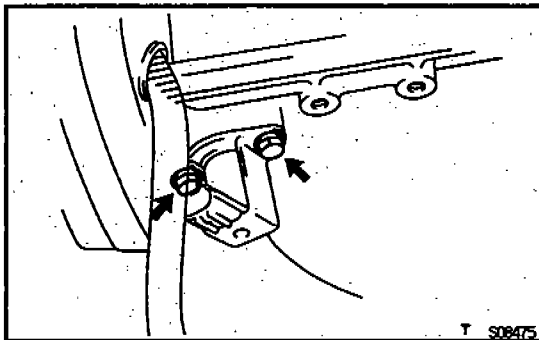
- Disconnect the oil control valve connector.
- Using an ohmmeter, measure the resistance between the terminals.

Resistance:

11 – 13 Ω at 20°C (68°F)

If the resistance is not as specified, replace the valve.

- Reconnect the oil control valve connector.



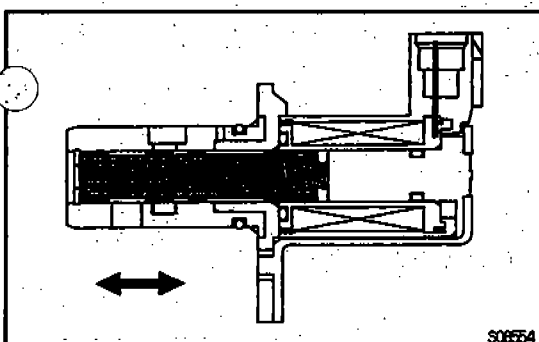
REMOVAL

REMOVE OIL CONTROL VALVE

- Disconnect the oil control valve connector.
- Remove the 2 bolts, oil control valve and O-ring.

INSTALLATION HINT: Use a new O-ring.

Torque: 8.0 N·m (80 kgf·cm, 71 in.-lbf)



INSPECTION

INSPECT OIL CONTROL VALVE OPERATION

Apply battery voltage across the terminals, then check the movement of the valve.

If operation is not as specified, replace the oil control valve.

INSTALLATION

Installation is in the reverse order of removal.

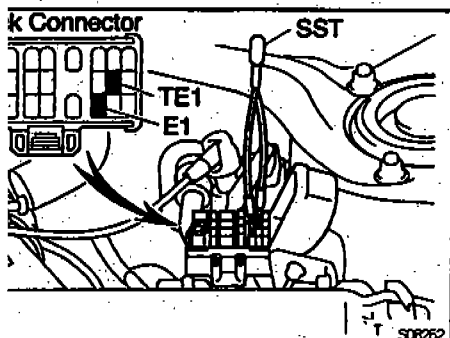
ISC VALVE ON-VEHICLE INSPECTION

E0541-00

1. INSPECT ISC VALVE OPERATION

(a) Initial conditions:

- Engine at normal operating temperature
- Idle speed set correctly
- Transmission in neutral position



(b) Using SST, connect terminals TE1 and E1 of the check connector.

SST 09843-18020

(c) After engine speed are kept at 1,000 – 1,500 rpm for 5 seconds, check that they return to idle speed.

If the rpm operation is not as specified, check the ISC valve, wiring and ECU.

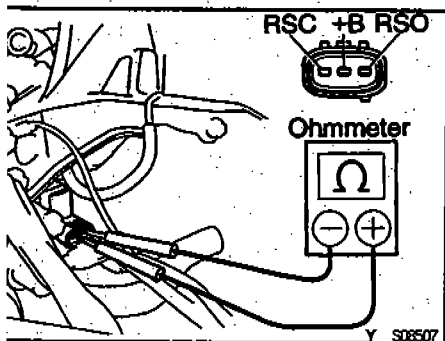
(d) Remove the SST from the check connector.

SST 09843-18020

2. INSPECT ISC VALVE RESISTANCE

NOTICE: "Cold" and "Hot" in the following sentences express the temperature of the coils themselves. "Cold" is from -10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

(a) Disconnect the ISC valve connector.



(b) Using an ohmmeter, measure the resistance between terminal +B and other terminals (RSC, RSO).

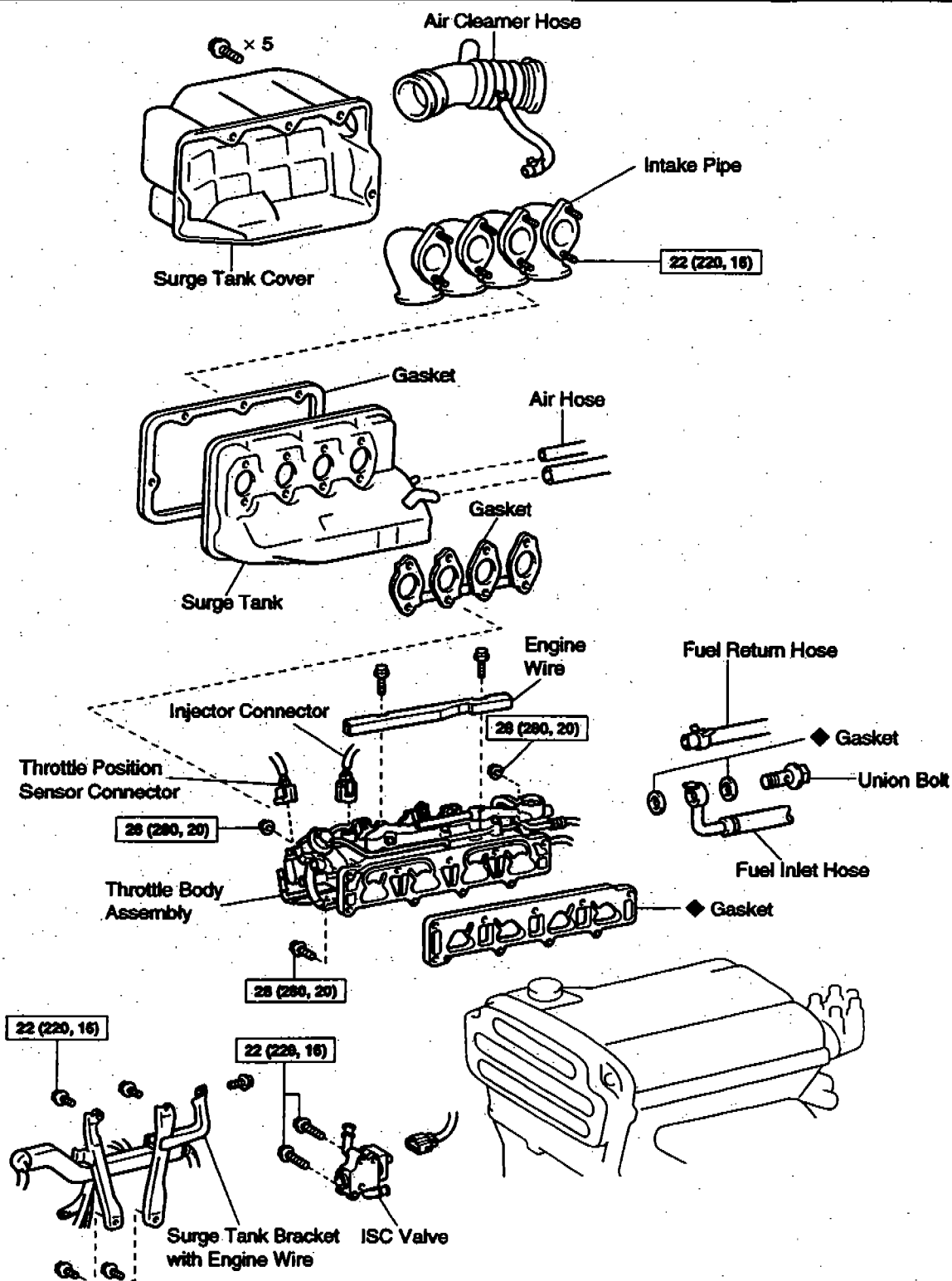
Resistance:

Cold: $17.5 - 28.5 \Omega$ Hot: $17.0 - 24.5 \Omega$

If resistance is not as specified, replace the ISC valve.

(c) Reconnect the ISC valve connector.

COMPONENTS



N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

E2161-01

REMOVAL

1. REMOVE THROTTLE BODY ASSEMBLY
(See throttle body)
2. REMOVE ISC VALVE

Remove the 2 bolts and ISC valve.
Torque: 22 N·m (220 kgf·cm, 16 ft·lbf)

INSPECTION

BF040-01

INSPECT ISC VALVE OPERATION

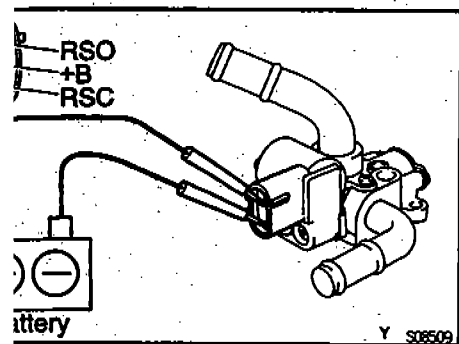
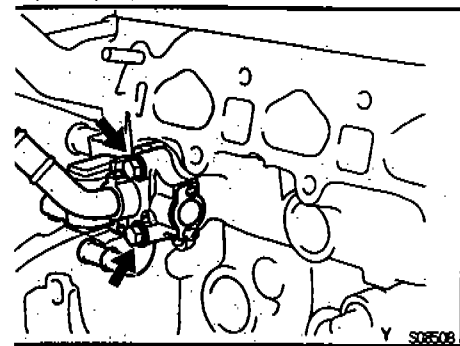
- (a) Connect the positive (+) lead from the battery to terminal +B and negative (-) lead to terminal RSC, and check operating sound.
- (b) Connect the positive (+) lead from the battery to terminal +B and negative (-) lead to terminal RSO, and check operating sound.

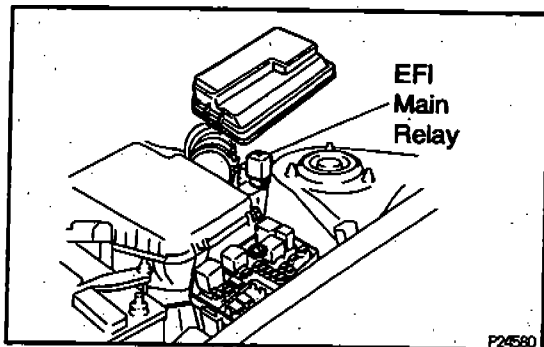
If operation is not as specified, replace the ISC valve.

INSTALLATION

E0620-02

Installation is in the reverse order of removal.



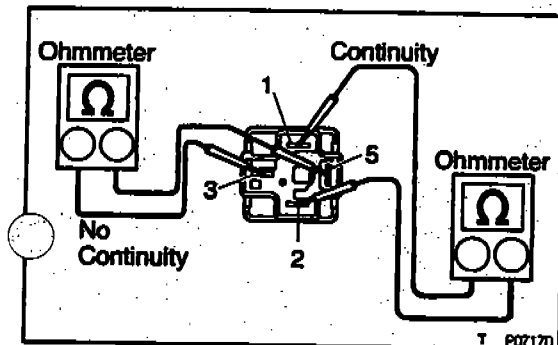


EFI MAIN RELAY INSPECTION

1. REMOVE EFI MAIN RELAY (Marking: EFI)

2. INSPECT EFI MAIN RELAY CONTINUITY

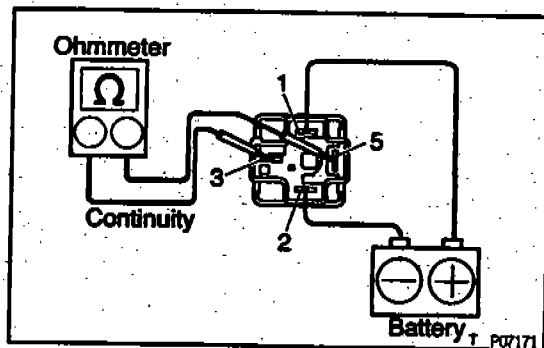
- Using an ohmmeter, check that there is continuity between terminals 1 and 2.
 - Check that there is no continuity between terminals 3 and 5.
- If continuity is not as specified, replace the relay.



3. INSPECT EFI MAIN RELAY OPERATION

- Apply battery voltage across terminals 1 and 2.
 - Using an ohmmeter, check that there is continuity between terminals 3 and 5.
- If operation is not as specified, replace the relay.

4. REINSTALL EFI MAIN RELAY



CIRCUIT OPENING RELAY INSPECTION

1. REMOVE RH COWL SIDE TRIM
2. REMOVE CIRCUIT OPENING RELAY

3. INSPECT CIRCUIT OPENING RELAY CONTINUITY

- (a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.
- (b) Check that there is no continuity between terminals 3 and 5.

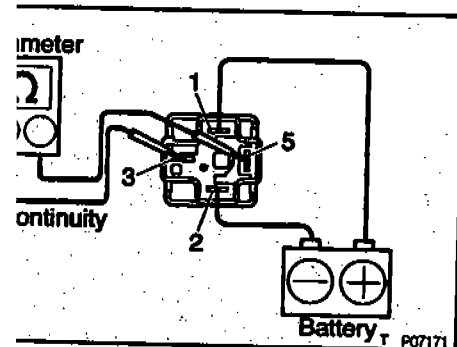
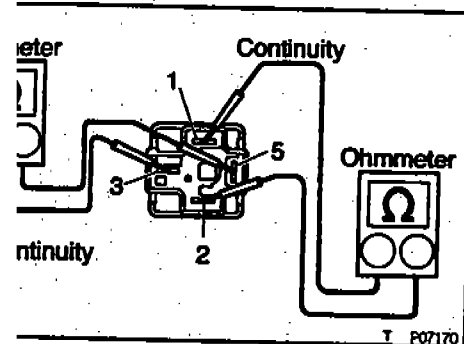
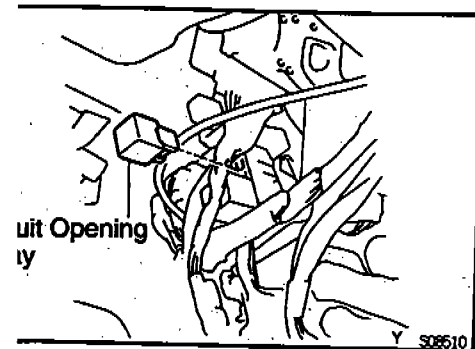
If continuity is not as specified, replace the relay.

4. INSPECT CIRCUIT OPENING RELAY OPERATION

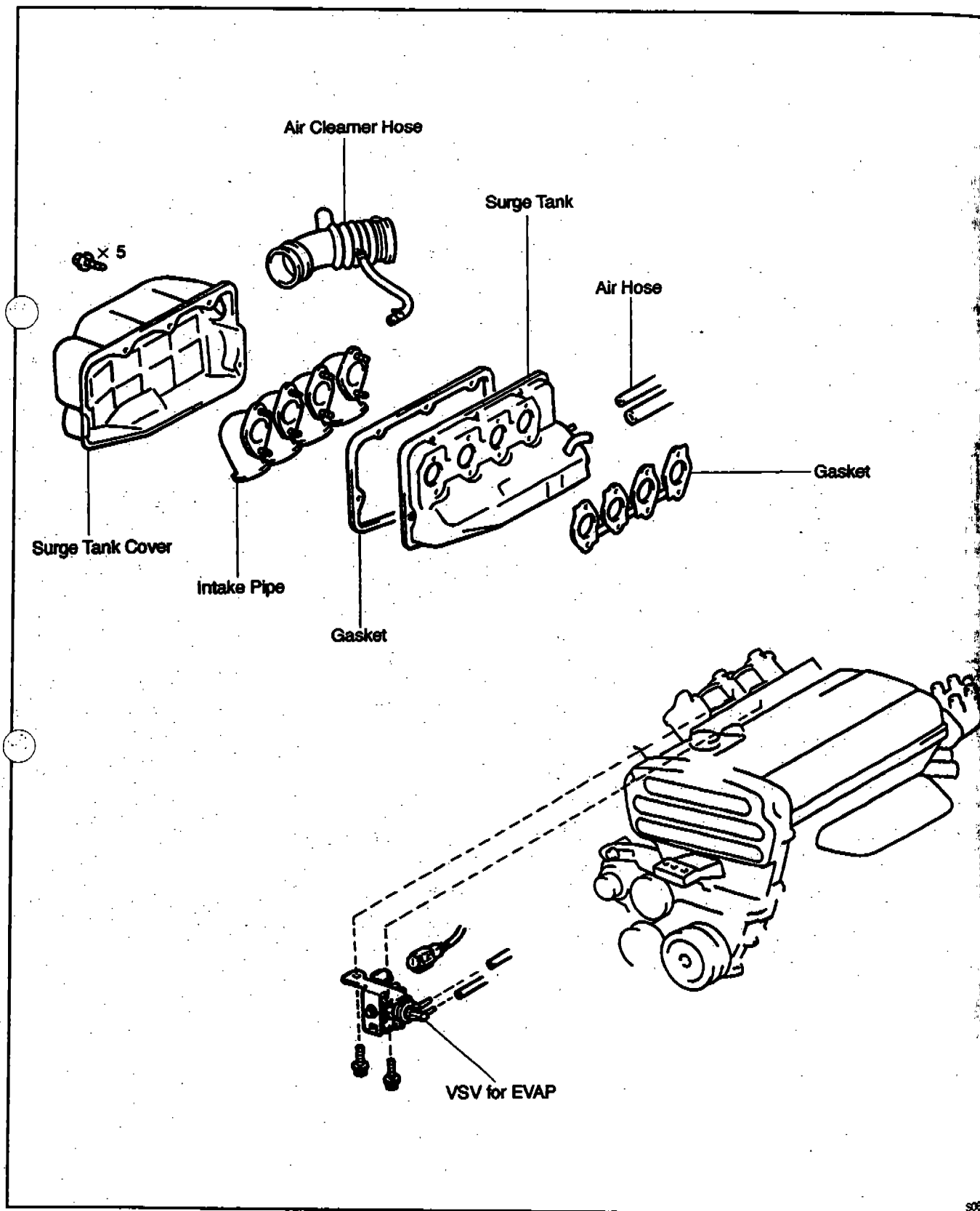
- (a) Apply battery voltage across terminals 1 and 2.
- (b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If operation is not as specified, replace the relay.

5. REINSTALL CIRCUIT OPENING RELAY
6. INSTALL RH COWL SIDE TRIM



VSV FOR EVAP COMPONENTS



INSPECTION

1. **REMOVE SURGE TANK**
2. **REMOVE VSV**
 - (a) Disconnect the 2 EVAP hoses from the VSV.
 - (b) Remove the 2 bolts and VSV.

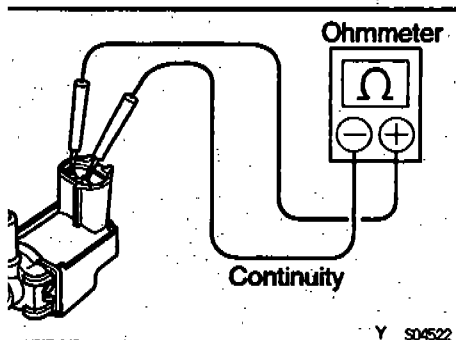
3. **INSPECT VSV FOR OPEN CIRCUIT**

Using an ohmmeter, check that there is continuity between the terminals.

Resistance:

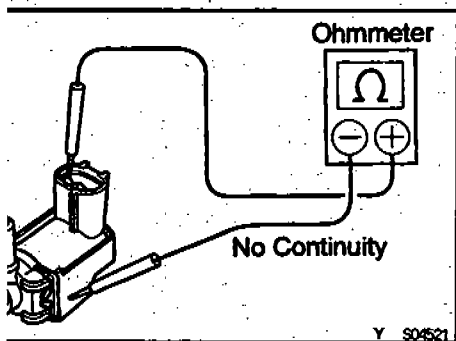
30 – 33 Ω at 20°C (68°F)

If there is no continuity, replace the VSV.

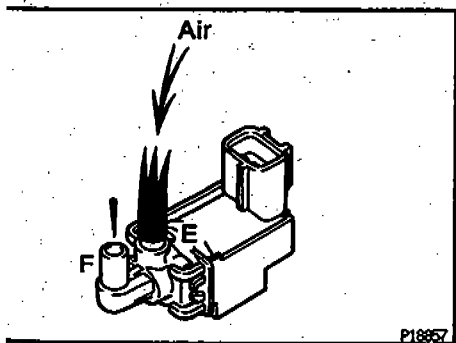
4. **INSPECT VSV FOR GROUND**

Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.

5. **INSPECT VSV OPERATION**

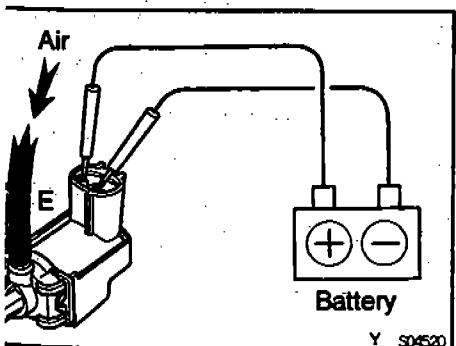
- (a) Check that air flows with difficulty from port E to port F.

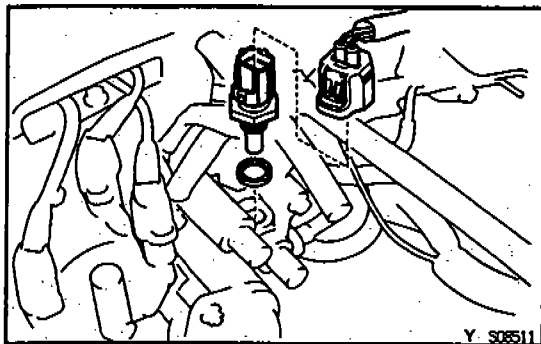


- (b) Apply battery voltage across the terminals.
- (c) Check that air flows from port E to port F. If operation is not as specified, replace the VSV.

6. **REINSTALL VSV**

- (a) Install the VSV with the screw.
- (b) Connect the 2 EVAP hoses to the VSV.

7. **REINSTALL EMISSION CONTROL VALVE SET**8. **REINSTALL HIGH-TENSION CORD COVER**9. **REINSTALL V-BANK COVER**



WATER TEMPERATURE SENSOR INSPECTION

1. DRAIN ENGINE COOLANT
2. REMOVE WATER TEMPERATURE SENSOR

3. INSPECT WATER TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

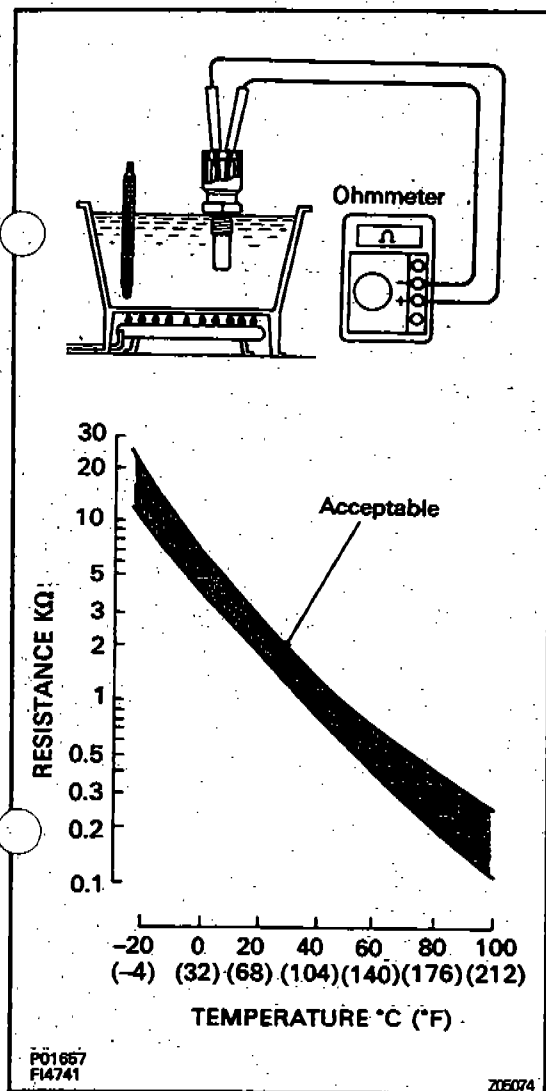
Refer to the graph

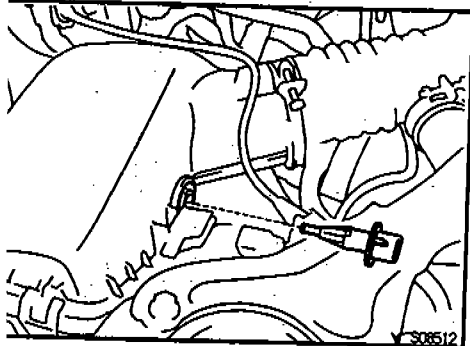
If the resistance is not as specified, replace the water temperature sensor.

4. REINSTALL WATER TEMPERATURE SENSOR

Install a new gasket to the water temperature sensor.

5. FILL RADIATOR WITH ENGINE COOLANT





INTAKE AIR TEMPERATURE (IAT) SENSOR INSPECTION

EQ 144-01

1. REMOVE IAT SENSOR

2. INSPECT IAT SENSOR RESISTANCE

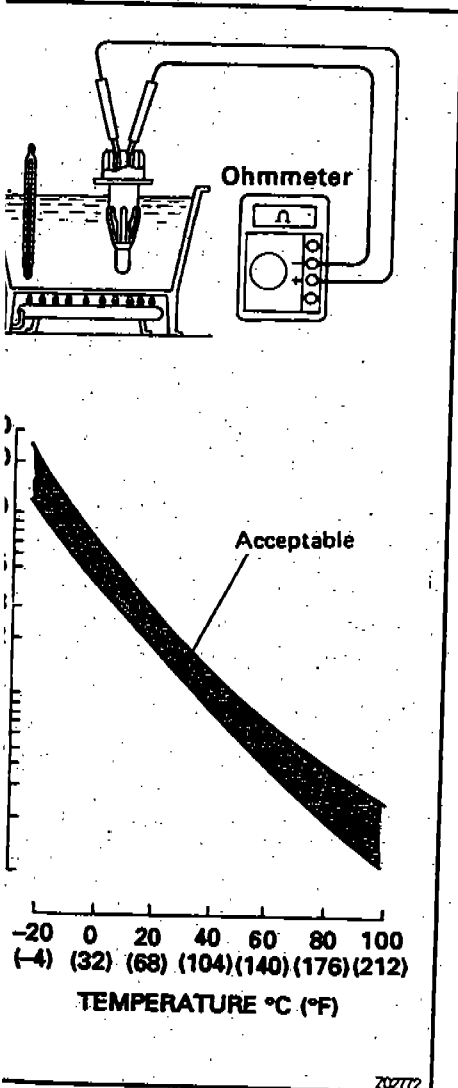
Using an ohmmeter, measure the resistance between the terminals.

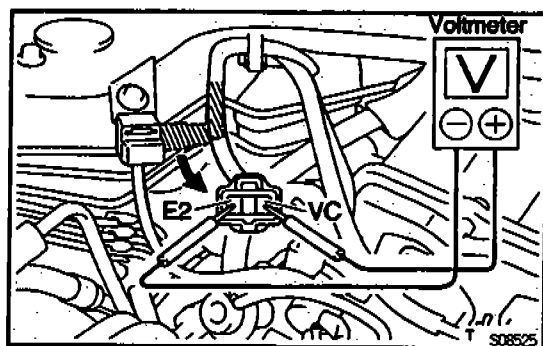
Resistance:

Refer to the graph

If the resistance is not as specified, replace the IAT sensor.

3. REINSTALL IAT SENSOR





VACUUM SENSOR INSPECTION

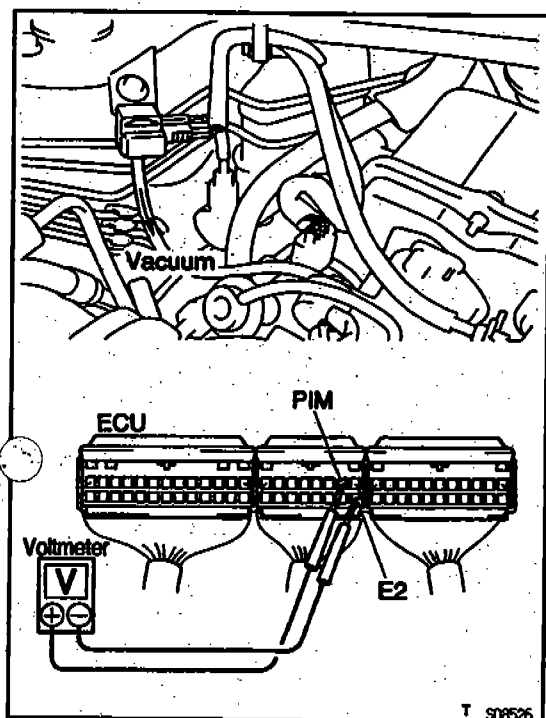
1. INSPECT POWER SOURCE VOLTAGE OF VACUUM SENSOR

- Disconnect the vacuum sensor connector.
- Turn the ignition switch ON.
- Using a voltmeter, measure the voltage between connector terminals VC and E2 of the wiring harness side.

Voltage:

4.5 – 5.5 V

- Turn the ignition switch OFF.
 - Reconnect the vacuum sensor connector.
- ### 2. INSPECT POWER OUTPUT OF VACUUM SENSOR
- Turn the ignition switch ON.
 - Disconnect the vacuum hose on the air intake manifold side.



- Connect a voltmeter to terminals PIM and E2 of the ECU and measure the output voltage under ambient atmospheric pressure.
- Apply vacuum to the vacuum sensor in 13.3 kPa (100 mmHg, 3.94 in.Hg) segments to 66.7 kPa (500 mmHg, 19.69 in.Hg).
- Measure the voltage drop from step (c) above for each segment.

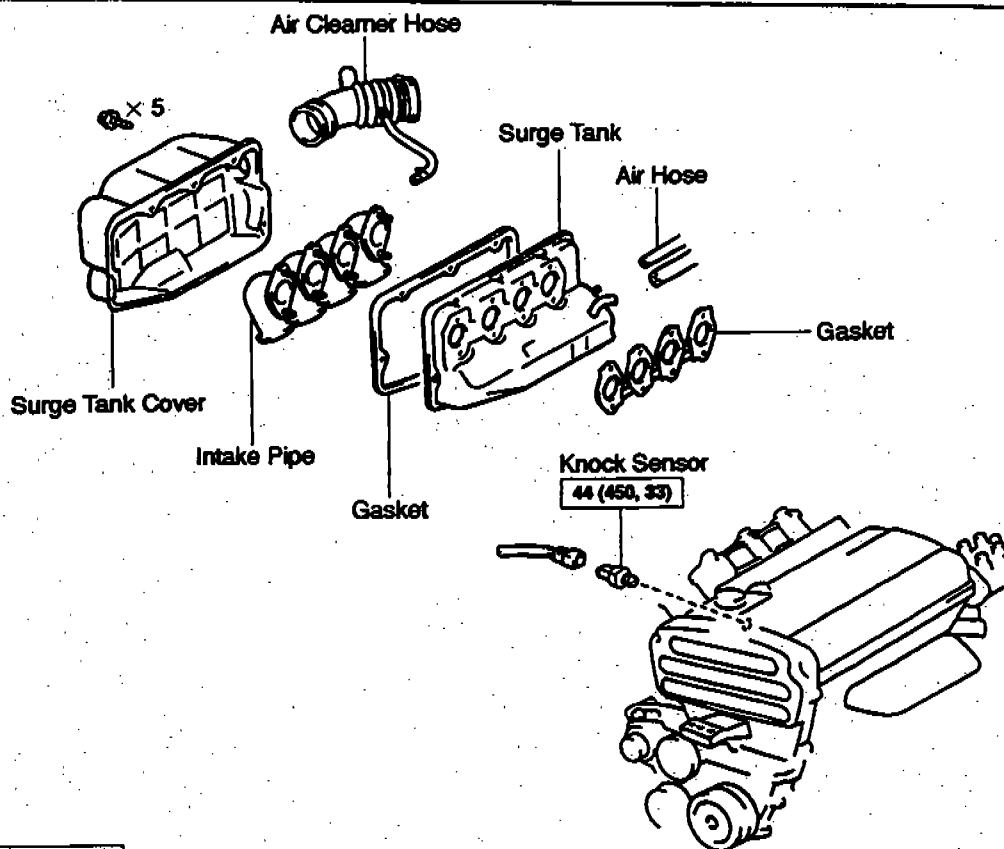
Voltage drop:

Applied Vacuum kPa (mmHg) (in.Hg)	13.3 (100) (3.94)	26.7 (200) (7.87)	40.0 (300) (11.81)	53.5 (400) (15.75)	66.7 (500) (19.69)
Voltage drop V	0.3 – 0.5	0.7 – 0.9	1.1 – 1.3	1.5 – 1.7	1.9 – 2.1

- Reconnect the vacuum hose to the intake manifold.

KNOCK SENSOR COMPONENTS

E054E-04



(kgf-cm, ft-lbf) : Specified torque

Y
306513

E054E-06

INSPECTION

1. REMOVE SURGE TANK

2. REMOVE KNOCK SENSOR

- (a) Disconnect the knock sensor connector.
- (b) Using SST, remove the knock sensor.
SST 09816-30010

3. INSPECT KNOCK SENSOR

Using an ohmmeter, check that there is no continuity between the terminal and body.

If there is continuity, replace the sensor.

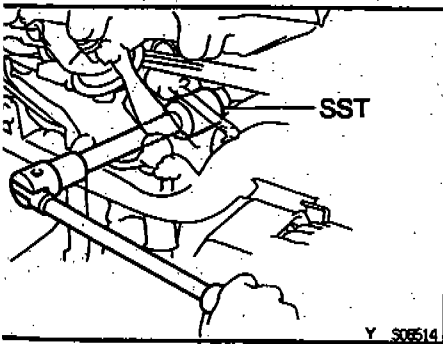
4. REINSTALL KNOCK SENSOR

- (a) Using SST, install the knock sensor.
SST 09816-30010

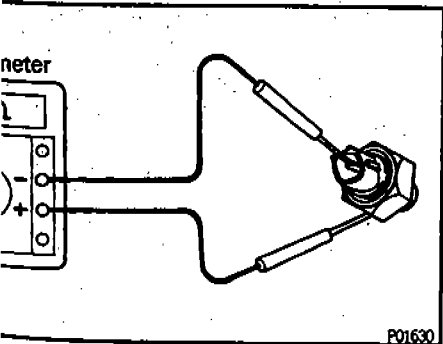
Torque: 44 N·m (450 kgf-cm, 33 ft-lbf)

- (b) Connect the knock sensor connector.

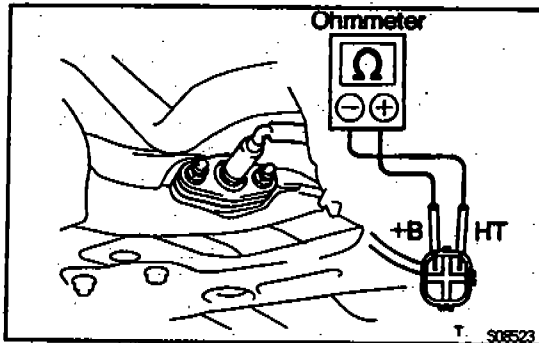
5. REINSTALL SURGE TANK



Y 306514



P01630



OXYGEN SENSOR INSPECTION

1. INSPECT HEATER RESISTANCE OF OXYGEN SENSOR

- Disconnect the oxygen sensor connector.
- Using an ohmmeter, measure the resistance between the terminals +B and HT.

Resistance:

11 – 16 Ω at 20°C (68°F)

If the resistance is not as specified, replace the sensor.

Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)

- Reconnect the oxygen sensor connector.

2. WARM UP ENGINE

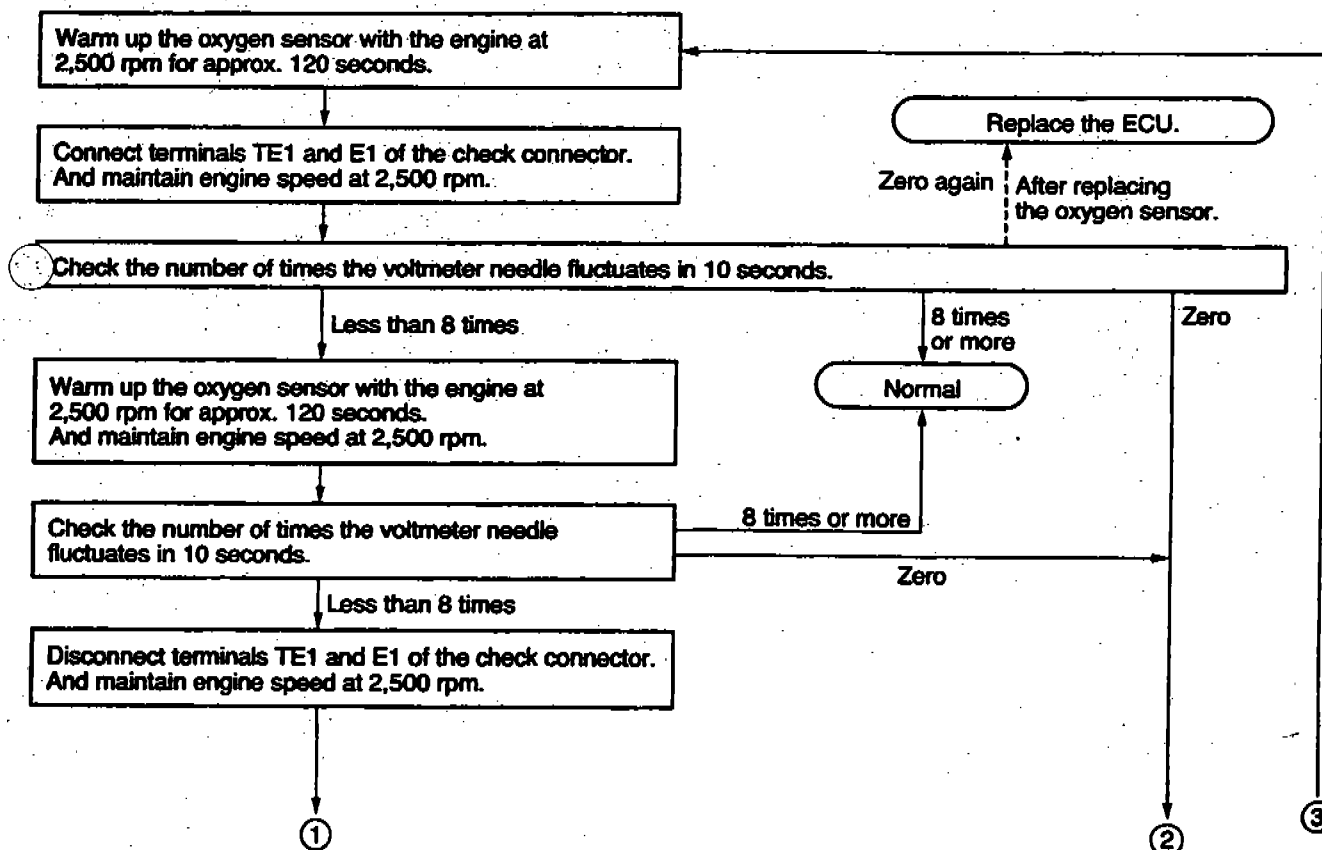
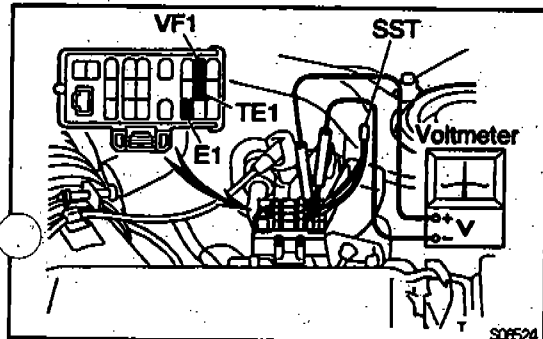
Allow the engine to warm up to normal operating temperature.

3. INSPECT FEEDBACK VOLTAGE

Connect the positive (+) tester probe of a voltmeter to terminal VF1 of the check connector, and negative (–) tester probe to terminal E1. Do the test as described.

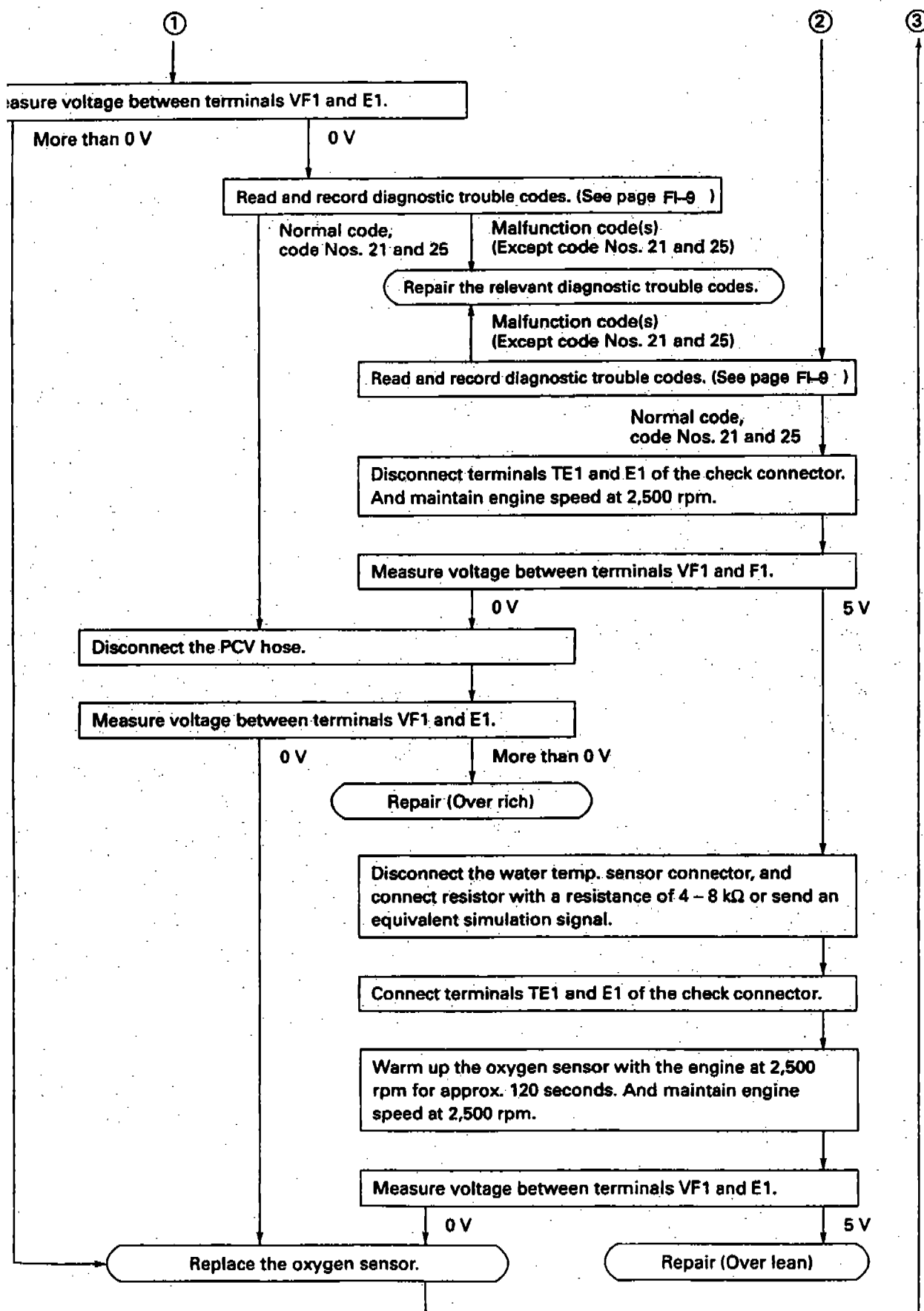
HINT: Use SST when connecting between terminals T and E1 of the check connector.

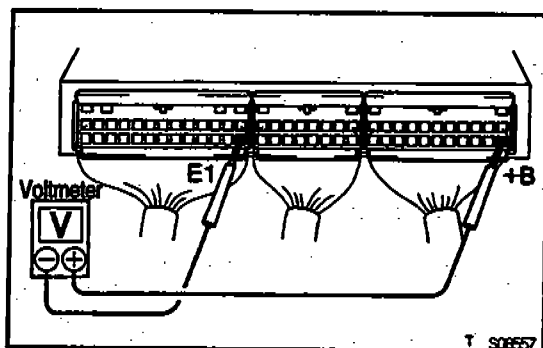
SST 09843–18020



CONTINUED ON PAGE FI-69

CONTINUED FROM PAGE FI-68





ENGINE ECU INSPECTION

HINT: The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the engine ECU.

1. PREPARATION

(See EFI check procedure in Troubleshooting w/ Volt, Ohmmeter)

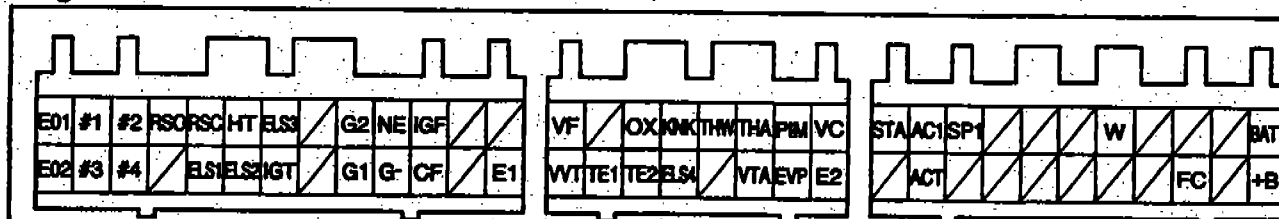
2. INSPECT VOLTAGE OF ECU

- Turn the ignition switch ON.
- Measure the voltage between each terminal of the wiring connectors.

HINT:

- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11 V or more with the ignition switch is ON.

Engine ECU Terminals

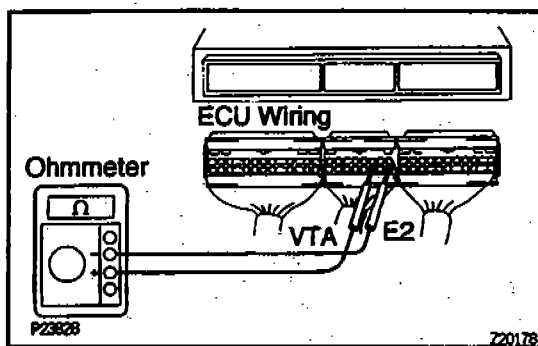


ECU Wiring Connectors Voltage

Terminals	Condition	STD voltage (V)
BATT - E1		9 - 14
+B - E1	IG SW ON	9 - 14
VC - E2	IG SW ON	4.5 - 5.5
VTA - E2	IG SW ON (Throttle valve fully closed)	0.3 - 0.8
VTA - E2	IG SW ON (Throttle valve open)	3.2 - 4.9
PIM - E2	IG SW ON	3.3 - 3.9
#1 - E01, E02	IG SW ON	9 - 14
#2 - E01, E02	IG SW ON	9 - 14
#3 - E01, E02	IG SW ON	9 - 14
#4 - E01, E02	IG SW ON	9 - 14
THA - E2	IG SW ON (Intake air temp. 20°C (68°F))	0.5 - 3.4
THW - E2	IG SW ON (Coolant temp. 80°C (176°F))	0.2 - 1.0
STA - E1	Cranking	6 or more
IGF - E1	IG SW ON (Igniter connector disconnected)	4.5 - 5.5
IGT - E1	Idling	Pulse generation
RSC - E1	IG SW ON (Engine ECU connector disconnected)	9 - 14
RSO - E1	IG SW ON (Engine ECU connector disconnected)	9 - 14

ELECTRONIC FUEL INJECTION - ENGINE ECU

W - E1	No trouble (Check engine warning light off) and engine running	9 - 14
AC1 - E1	IG SW ON (Air conditioning ON)	1.5 or less
ACT - E1	IG SW ON (Air conditioning ON)	4.5 - 5.5
VF - E1	Maintain engine speed at 2,500 rpm for 2 minutes after warming up then return idling	1.8 - 3.2
G1 - G-	Idling	Pulse generation
G2 - G-	Idling	Pulse generation
NE - G-	Idling	Pulse generation
OX - E1	Maintain engine speed at 2,500 rpm for 2 minutes after warming up	Pulse generation
KNK - E1	Idling	Pulse generation
ELS1 - E1	Electric cooling fan ON	7.5 - 14
ELS1 - E1	Electric cooling fan OFF	0 - 1.5
ELS2 - E1	Blower motor ON	7.5 - 14
ELS2 - E1	Blower motor OFF	0 - 1.5
ELS3 - E1	Taillight switch ON	7.5 - 14
ELS3 - E1	Taillight switch OFF	0 - 1.5
ELS4 - E1	Defogger switch ON	7.5 - 14
ELS4 - E1	Defogger switch OFF	0 - 1.5
HT - E1	IG SW ON	9 - 14
HT - E1	Idling	0 - 3
FC - E1	IG SW ON	9 - 14
FC - E1	Idling	0 - 3
TE1 - E1	IG SW ON	9 - 14
TE2 - E1	IG SW ON	9 - 14



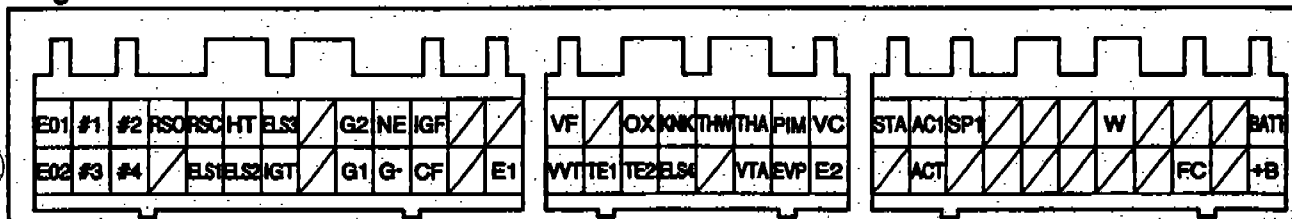
3. INSPECT RESISTANCE OF ECU

- Turn the ignition switch OFF.
- Disconnect the 3 connectors from the ECU.
- Measure the resistance between each terminal of the wiring connectors.

NOTICE:

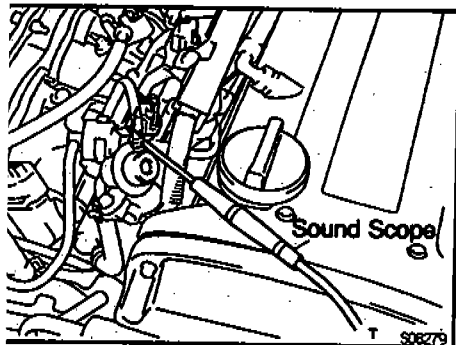
- Do not touch the ECU terminals.
- The tester probe should be inserted in the wiring connector from the wiring side.

Engine ECU Terminals



ECU Wiring Connectors Resistance

Terminals	Condition	STD resistance (Ω)
VTA - E2	Throttle valve fully open	2,400 - 11,200
VTA - E2	Throttle valve fully closed	340 - 6,300
VC - E2	-	3,100 - 7,200
THA - E2	Intake air temp. 20°C (68°F)	2,000 - 3,000
THW - E2	Coolant temp. 80°C (176°F)	200 - 400
G1, G2 - G-	Cold (-10°C (14°F) to 50°C (122°F))	125 - 200
G1, G2 - G-	Hot (50°C (122°F) to 100°C (212°F))	160 - 250
NE - G-	Cold (-10°C (14°F) to 50°C (122°F))	125 - 200
NE - G-	Hot (50°C (122°F) to 100°C (212°F))	160 - 250
RSC - +B	Cold (-10°C (14°F) to 50°C (122°F))	17 - 24.5
RSC - +B	Hot (50°C (122°F) to 100°C (212°F))	21.5 - 28.5
RSO - +B	Cold (-10°C (14°F) to 50°C (122°F))	17 - 24.5
RSO - +B	Hot (50°C (122°F) to 100°C (212°F))	21.5 - 28.5
HT - +B	-	11 - 16



FUEL CUT RPM INSPECTION

E60224-04

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

2. CONNECT TACHOMETER TO ENGINE (See EM section)

3. INSPECT FUEL CUTOFF OPERATION

- (a) Increase the engine speed to at least 2,500 rpm.
- (b) Check for injector operating noise.
- (c) Check that when the throttle lever is released, injector operation noise stops momentarily and then resumes.

HINT: Measure with the A/C OFF.

Fuel return speed:

1,400 rpm

4. DISCONNECT TACHOMETER

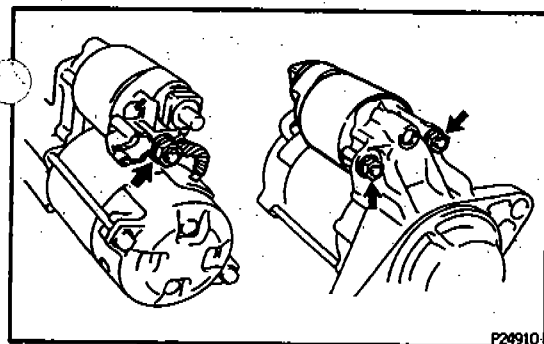
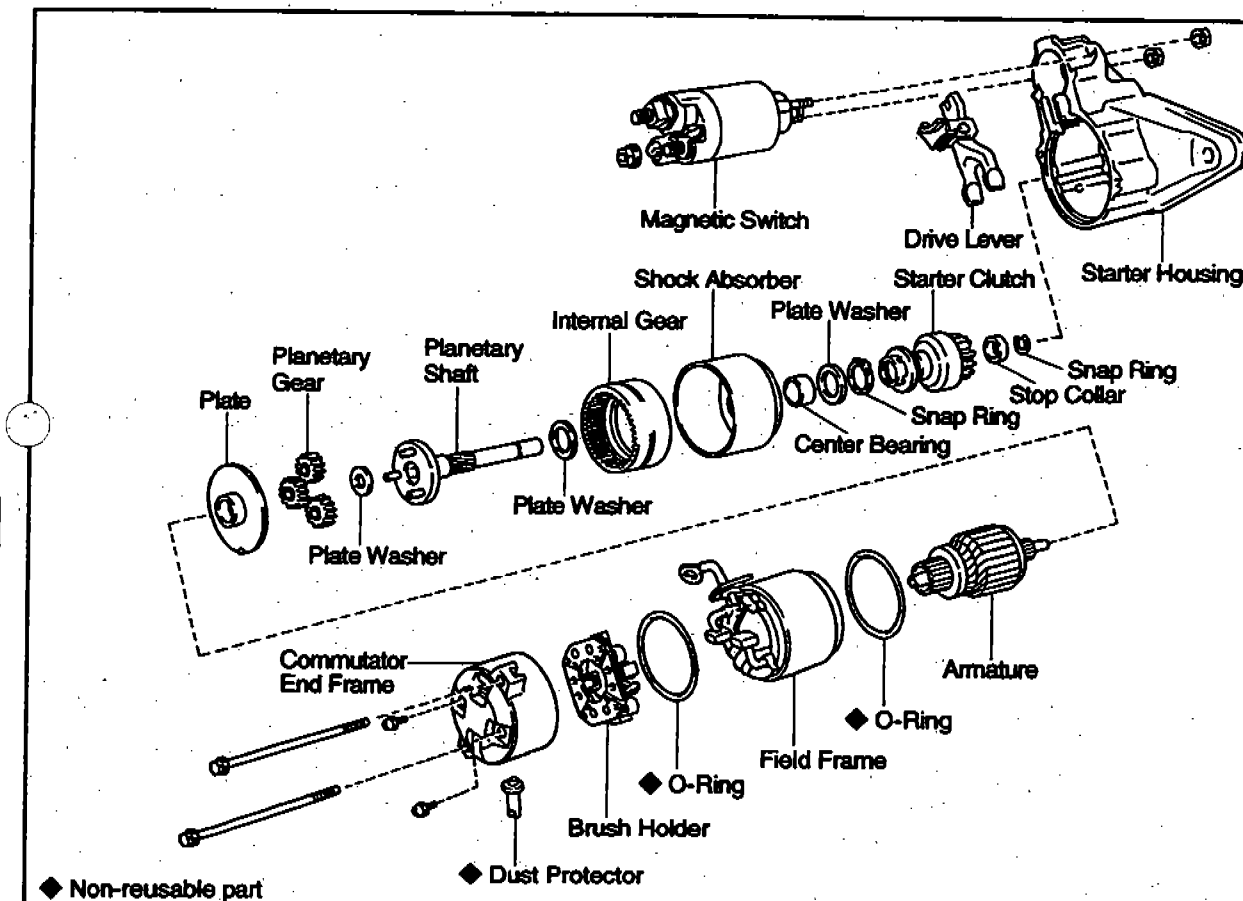
STARTING SYSTEM ON-VEHICLE INSPECTION

ST00K-25

NOTICE: Before changing the starter, check the following items again:

- Connector connection
- Accessory installation, e.g.: theft deterrent system

STARTER COMPONENTS



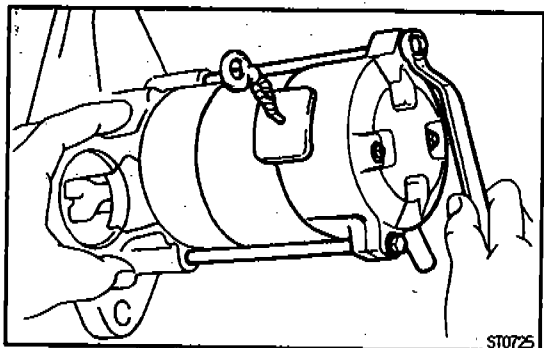
DISASSEMBLY

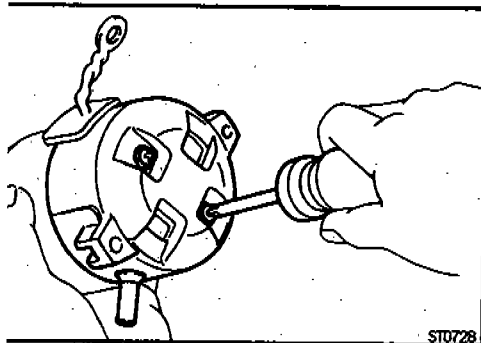
1. REMOVE MAGNETIC SWITCH

- Remove the nut, and disconnect the lead wire from the magnetic switch terminal.
- Loosen the 2 nuts holding the magnetic switch to the starter housing.
- Pull the magnetic switch and while lifting the front part of the magnetic switch, release the plunger hook from the drive lever, then release the magnetic switch.

2. REMOVE FIELD FRAME AND ARMATURE

Remove the 2 through bolts, and pull out the field frame together with the armature.

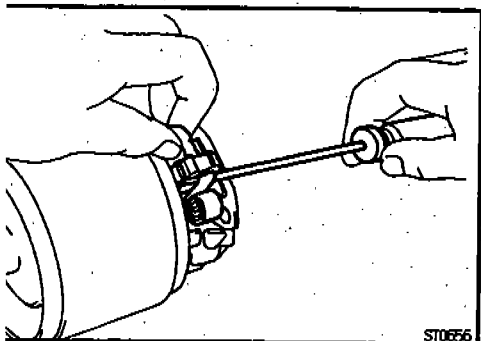




3. REMOVE COMMUTATOR END FRAME

Remove the 2 screws and commutator end frame, and hold down the lead wire while releasing the commutator end frame.

NOTICE: To avoid interference between the brush holder and the dust protector pull the commutator end frame away at an angle.



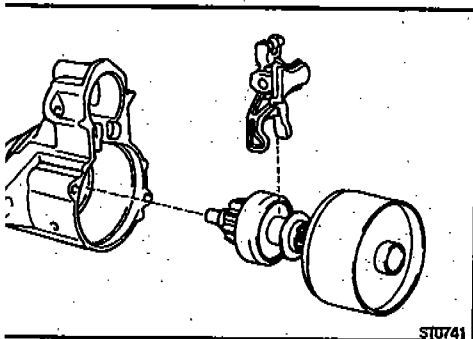
4. REMOVE BRUSH HOLDER

(a) Using a screwdriver, hold the spring back and disconnect the brush holder.

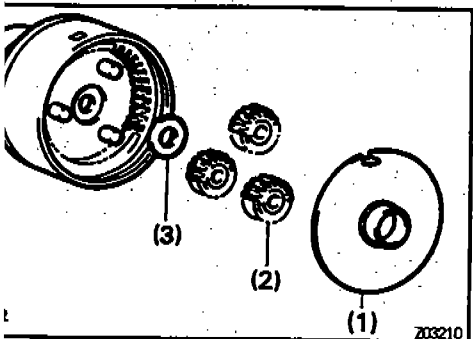
(b) Disconnect the 4 brushes, and remove the brush holder.

5. REMOVE ARMATURE FROM FIELD FRAME

6. REMOVE 2 O-RINGS FROM FIELD FRAME



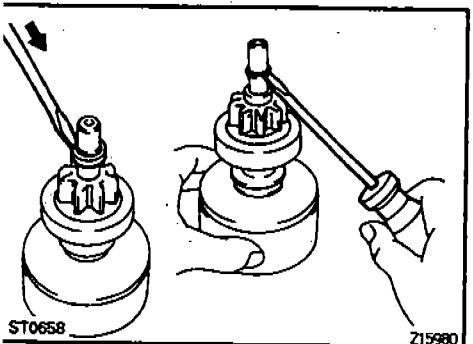
7. REMOVE DRIVE LEVER AND STARTER CLUTCH WITH SHOCK ABSORBER FROM STARTER HOUSING



8. REMOVE PLANETARY GEARS

Remove these parts from the shock absorber.

- (1) Plate
- (2) 3 planetary gears
- (3) Plate washer

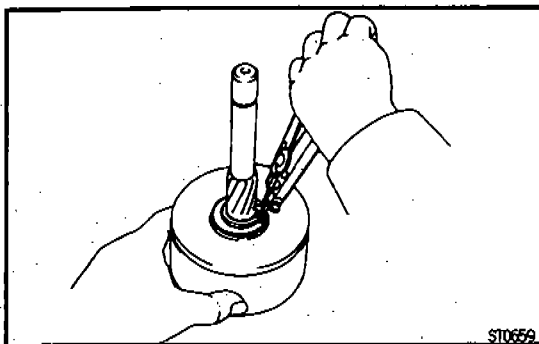


9. REMOVE STARTER CLUTCH

(a) Using a screwdriver, tap in the stop collar towards the starter clutch.

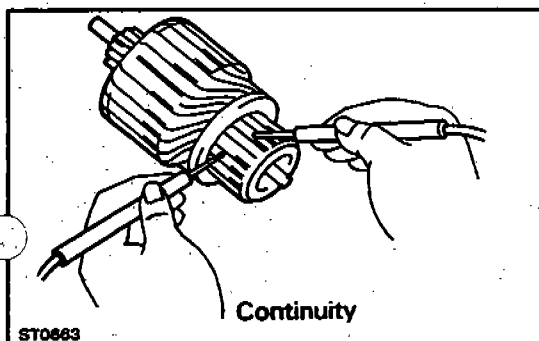
(b) Using a screwdriver, pry off the snap ring.

(c) Remove the stop collar and starter clutch from the planetary shaft.



10. REMOVE PLANETARY SHAFT AND INTERNAL GEAR

- (a) Using snap ring pliers, remove the snap ring and plate washer.
- (b) Remove the planetary shaft and plate washer.

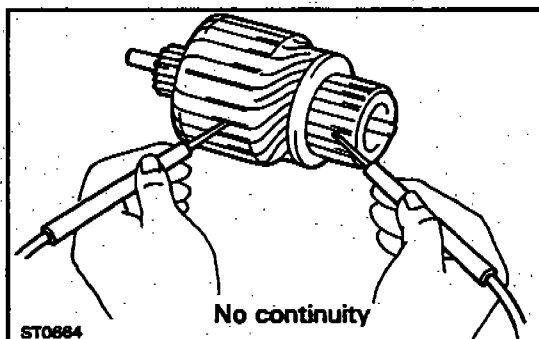


INSPECTION

Armature Coil

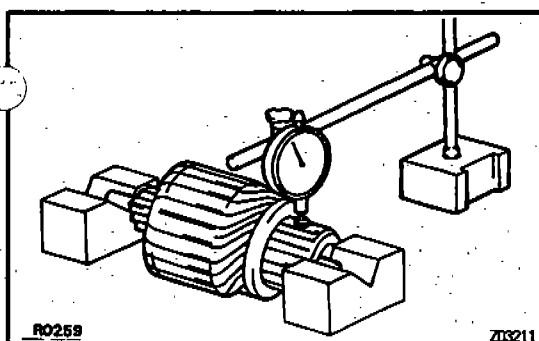
1. INSPECT COMMUTATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the segments of the commutator. If there is no continuity between any segment, replace the armature.



2. INSPECT COMMUTATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the commutator and armature coil core. If there is continuity, replace the armature.



Commutator

1. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES

If the surface is dirty or burnt, correct with sandpaper (No.400) or a lathe.

2. INSPECT COMMUTATOR CIRCLE RUNOUT

- (a) Place the armature on V-blocks.
- (b) Using a dial gauge, measure the circle runout.

Maximum circle runout:

0.05 mm (0.0020 in.)

If the circle runout is greater than maximum, correct it on a lathe.

3. INSPECT COMMUTATOR DIAMETER

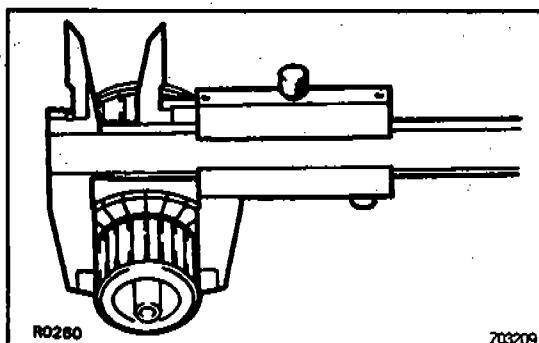
Using vernier calipers, measure the commutator diameter.

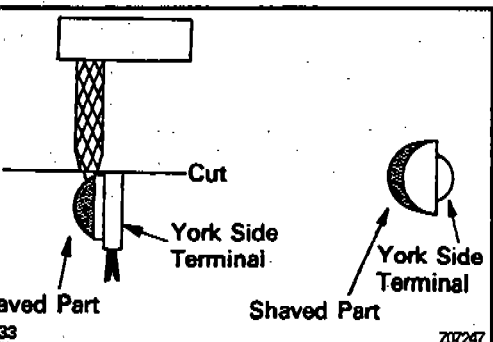
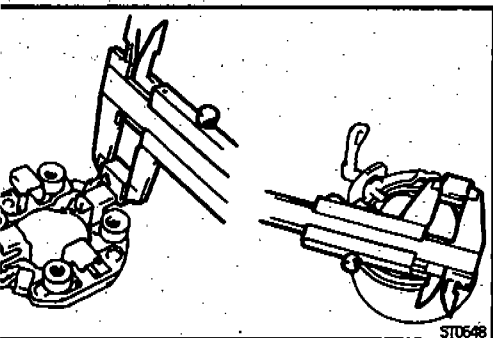
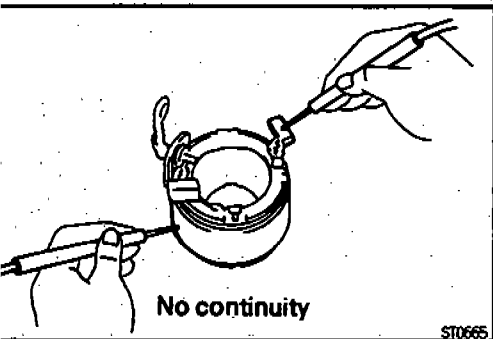
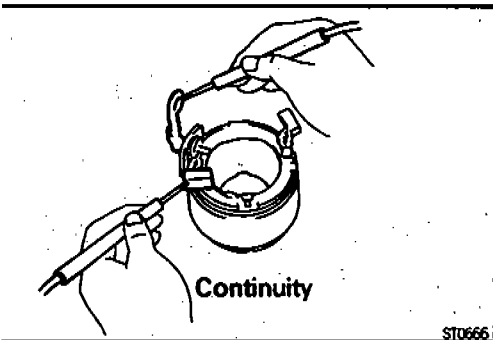
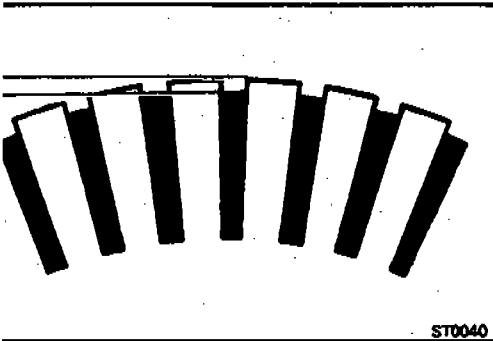
Standard diameter:

28.0 mm (1.10 in.)

Minimum diameter:

27.0 mm (1.06 in.)





If the diameter is less than minimum, replace the armature.

4. INSPECT UNDERCUT DEPTH

Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

Standard undercut depth:

0.6 mm (0.024 in.)

Minimum undercut depth:

0.2 mm (0.008 in.)

If the undercut depth is less than minimum, correct it with a hacksaw blade.

Field Frame (Field Coil)

1. INSPECT FIELD COIL FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

If there is no continuity, replace the field frame.

2. INSPECT FIELD COIL GROUND

Using an ohmmeter, check that there is no continuity between the field coil end and field frame.

If there is continuity, repair or replace the field frame.

Brushes

1. INSPECT BRUSH LENGTH

Using vernier calipers, measure the brush length.

Standard length:

14.0 mm (0.551 in.)

Minimum length:

9.0 mm (0.354 in.)

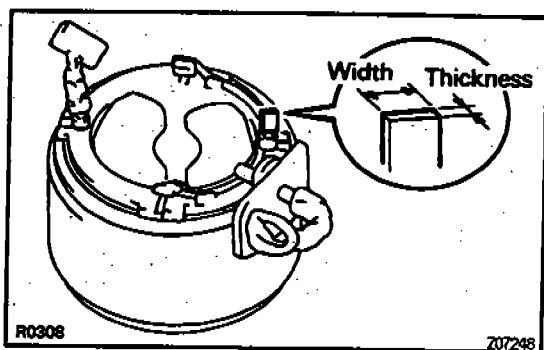
If the length is less than minimum, replace the brush (field frame side) or brush holder, and dress with an emery cloth.

2. IF NECESSARY, REPLACE BRUSHES

HINT: Only the 2 brushes of the positive (+) side (yoke side) are exchangeable, negative (-) side brush must be changed in the body with the brush holder.

(a) Cut the brush lead wire at the terminal side.

(b) Shave welded mark of the brush lead wire with sandpaper etc., and correct the terminal to the specified.



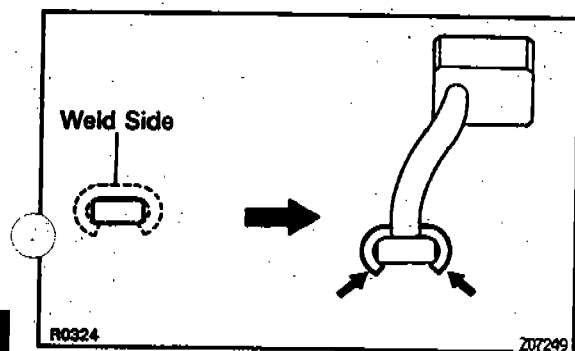
NOTICE: Part to be shaved is so narrow that you should take care not to harm the field coil.

Specified width:

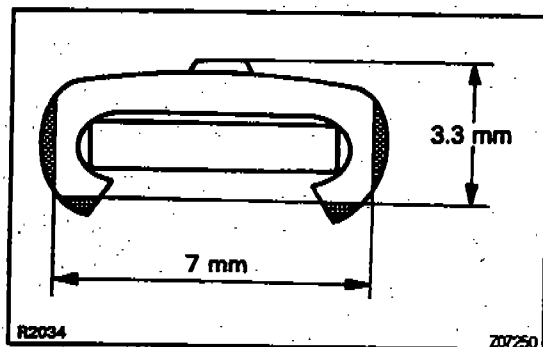
5.0 mm (0.197 in.)

Specified thickness:

1.5 - 1.7 mm (0.059 - 0.067 in.)



- (c) Press the plate of the supply brush on the welded side of the terminal lead wire.



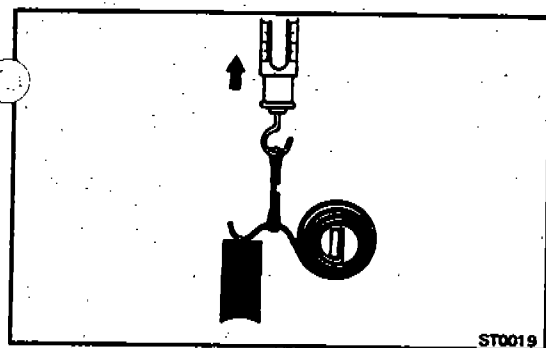
- (d) Solder the pressed part, and shave to the specified measures with the sandpaper etc.

Specified width: 7.0 mm (0.276 in.)

Specified thickness: 3.3 mm (0.130 in.)

HINT:

- Heat the soldered part well, and flow the solder on the side of the plate, take care not to flow it into the terminal lead wire.
- Take care not to flow the solder into the field.



Brush Springs

INSPECT BRUSH SPRING LOAD

Take the pull scale reading the instant the brush spring separates from the brush.

Spring installed load:

13.7 - 17.6 N (1.4 - 1.8 kgf, 3.1 - 4.0 lbf)

Minimum spring installed load:

8.8 N (0.9 kgf, 2.0 lbf)

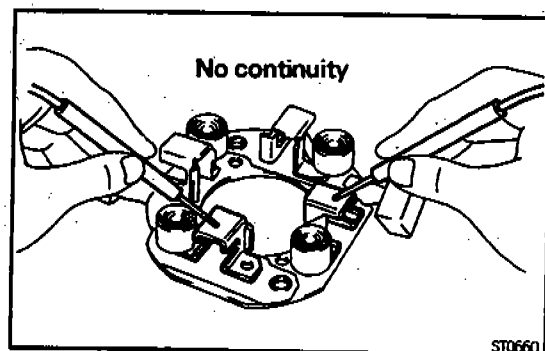
If the installed load is not as specified, replace the brush springs.

Brush Holder

INSPECT BRUSH HOLDER INSULATION

Using an ohmmeter, check that there is no continuity between the positive (+) and negative (-) brush holders.

If there is continuity, repair or replace the brush holder.



Clutch and Gears**1. INSPECT GEAR TEETH**

Check the gear teeth on the planetary gear, internal gear and starter clutch for wear or damage.

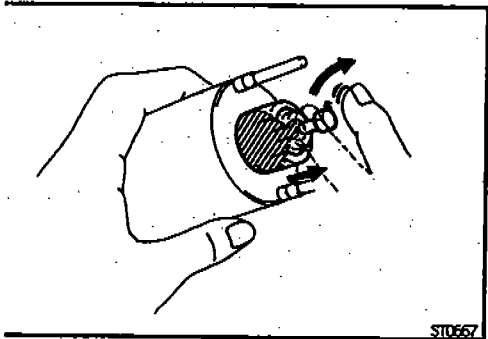
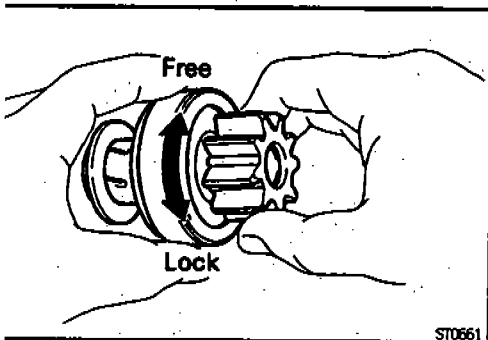
If the gear is damaged, replace it.

If the starter clutch teeth are damaged, replace the starter clutch and also inspect the flywheel ring gear for wear or damage.

2. INSPECT STARTER CLUTCH

Rotate the clutch pinion gear clockwise and check that it turns freely. Try to rotate the clutch pinion gear counter-clockwise and check that it locks.

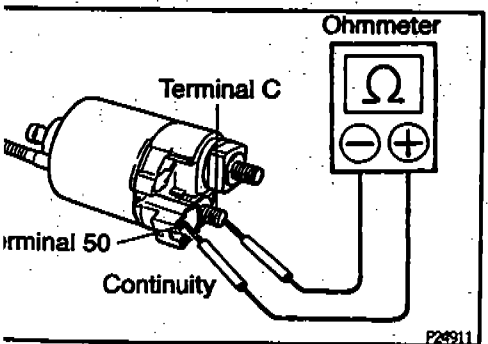
If necessary, replace the starter clutch.

**Magnetic Switch****1. INSPECT PLUNGER**

Push in the plunger and replace it.

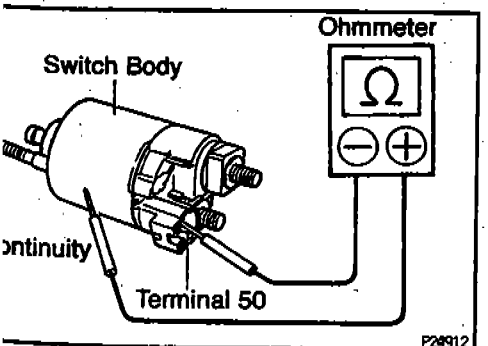
Check that it returns quickly to its original position.

If necessary, replace the magnetic switch.

**2. DO PULL-IN COIL OPEN CIRCUIT TEST**

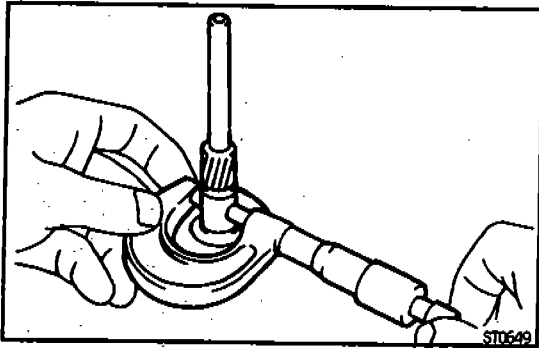
Using an ohmmeter, check that there is continuity between terminals 50 and C.

If there is no continuity, replace the magnetic switch.

**3. DO HOLD-IN COIL OPEN CIRCUIT TEST**

Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

If there is no continuity, replace the magnetic switch.



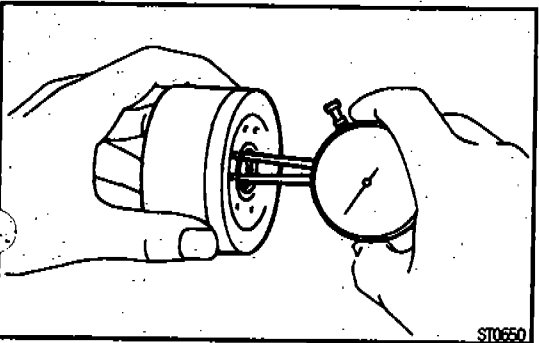
Planetary Shaft and Center Bearing

1. INSPECT PLANET CARRIER SHAFT AND CENTER BEARING

- (a) Using a micrometer, measure the outer diameter of the surface in contact with the center bearing of the planetary shaft.

Standard shaft diameter:

14.982 – 15.000 mm (0.5898 – 0.5906 in.)



- (b) Using a caliper gauge, measure the inside diameter of the center bearing.

Center bearing inside diameter:

15.008 – 15.050 mm (0.5909 – 0.5925 in.)

- (c) Subtract the planetary shaft diameter from the bearing inside diameter measurement.

Standard center bearing oil clearance:

0.01 – 0.06 mm (0.0004 – 0.0024 in.)

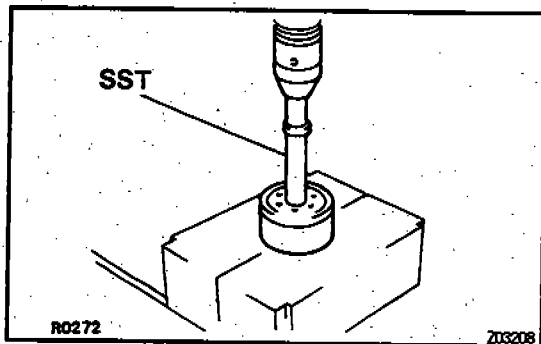
Maximum center bearing oil clearance:

0.2 mm (0.008 in.)

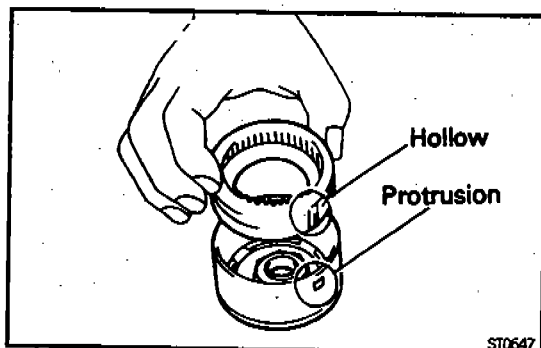
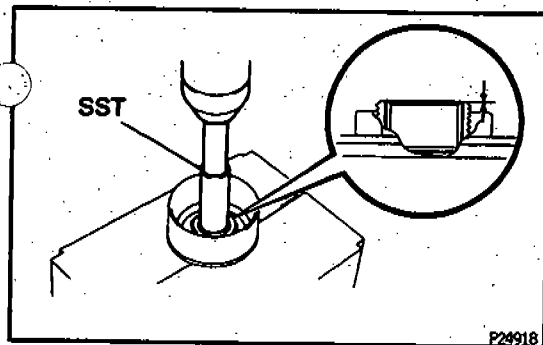
If the clearance is greater than maximum, replace the planetary shaft and center bearing.

2. IF NECESSARY, REPLACE CENTER BEARING

- (a) Using SST and press, press out the center bearing. SST 09221-25026 (09221-00090)



- (b) Using SST and a press in a new center bearing to the position shown in the illustration. SST 09221-25026 (09221-00071)



- (c) Align the hollow of the internal gear with the protrusion on the side the shock absorber, and remove the internal gear.

ST0646

REASSEMBLY

HINT: Use high temperature-resistant grease to lubricate the bearings and sliding parts when assembling the starter.

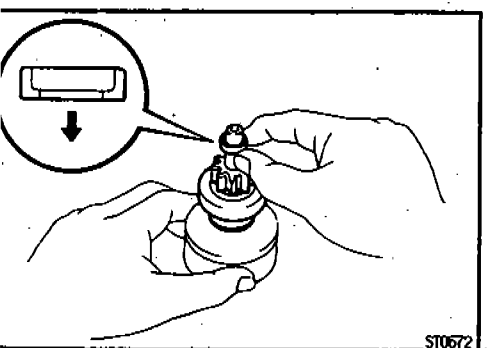
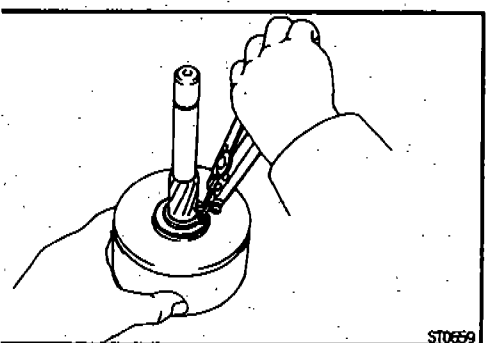
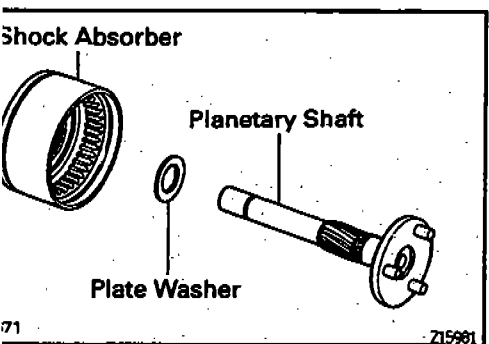
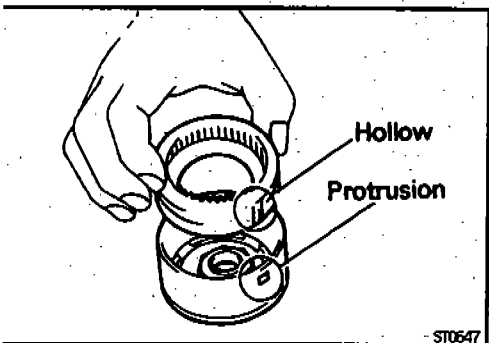
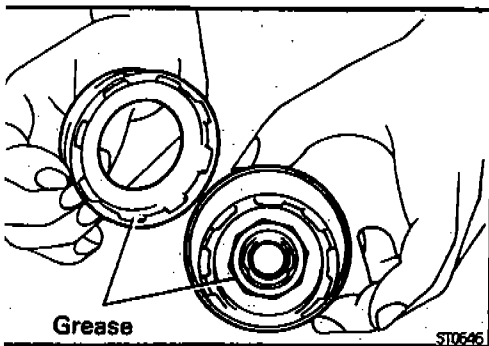
1. INSTALL INTERNAL GEAR AND PLANETARY SHAFT

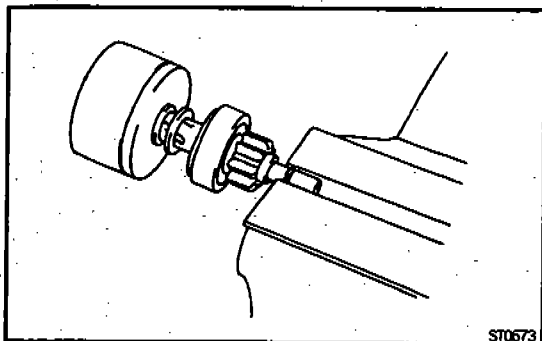
- (a) Apply grease to the internal gear touching the shock absorber and planetary gears.
- (b) Align the hollow of the internal gear with the protrusion inside the shock absorber.
- (c) Insert and turn the internal gear so that it interlocks with the shock absorber.
- (d) Apply turbine oil with additives to the center bearing.
- (e) Apply grease to the plate washer, and install it to the planetary shaft.
- (f) Install the planetary shaft to the shock absorber.

- (g) Using snap ring pliers, install the plate washer and snap ring.

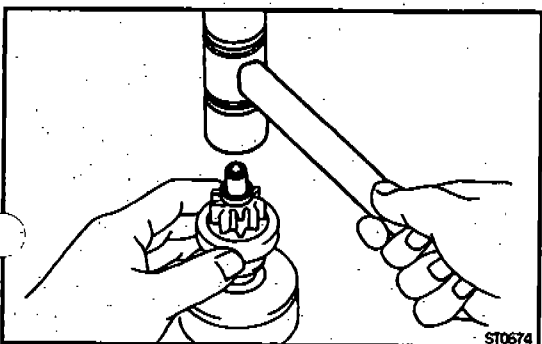
2. INSTALL STARTER CLUTCH

- (a) Apply grease to the bushing and spline of the starter clutch and stop collar.
- (b) Place the starter clutch and stop collar on the planetary shaft.

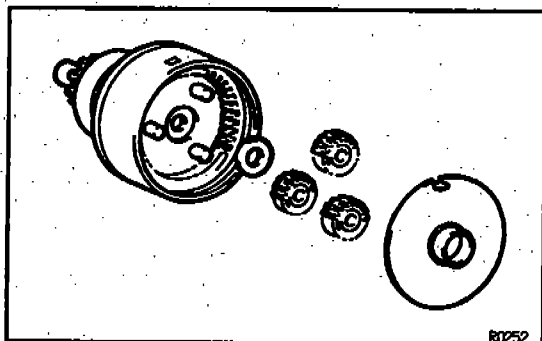




- (c) Apply grease to the snap ring, and install it to the planetary shaft groove.
- (d) Using a vise, compress the snap ring.

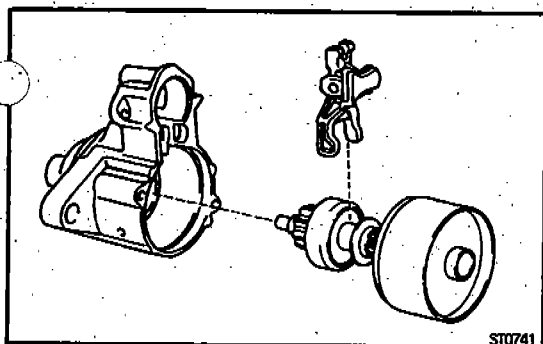


- (e) Hold the starter clutch, tap the planetary shaft and install the stop collar onto the snap ring with a plastic-faced hammer.



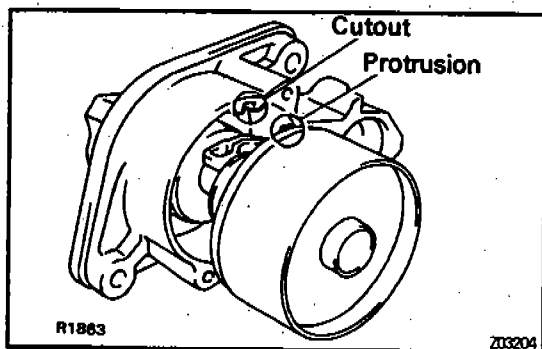
3. INSTALL PLANETARY GEARS

- (a) Apply grease to the planetary gears and flange pin parts of the planetary shaft.
- (b) Install the plate washer and 3 planetary gears.
- (c) Align the cutout of the plate with the protrusion inside the shock absorber, and install the plate.

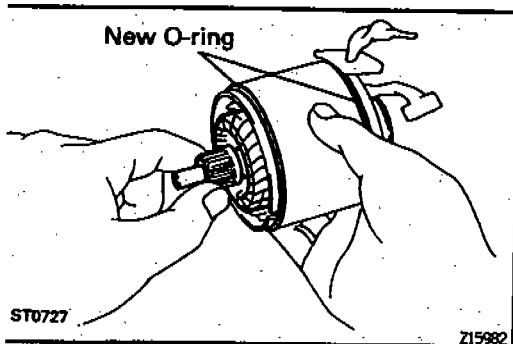


4. INSTALL DRIVE LEVER AND STARTER CLUTCH WITH SHOCK ABSORBER

- (a) Apply turbine oil with additives to the bearing of the starter housing.
- (b) Apply grease to the drive lever touching the starter pivot part of the drive lever.
- (c) Install the drive lever to the starter clutch.



- (d) Align the protrusion of the shock absorber with the cutout of the starter housing and install them.

**5. INSTALL 2 NEW O-RINGS TO FIELD FRAME****6. PLACE ARMATURE INTO FIELD FRAME****7. INSTALL BRUSH HOLDER**

- (a) Place the brush holder in position on the armature.
- (b) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder. Connect the 4 brushes.

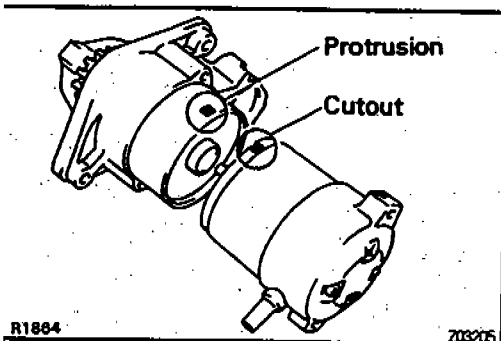
HINT: Check that positive (+) lead wires are not grounded.

8. INSTALL COMMUTATOR END FRAME

- (a) Apply turbine oil with additives to the bearing of the end frame.
- (b) Install the end frame with the 2 screws.

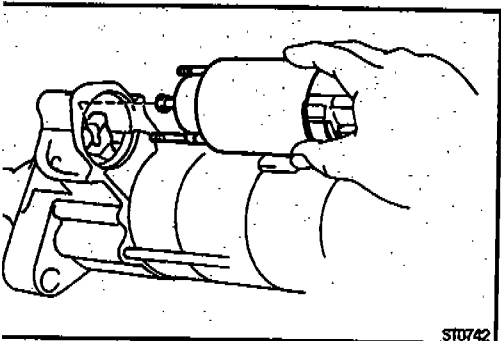
Torque: 1.5 N·m (15 kgf·cm, 13 in.-lbf)

NOTICE: To avoid interference between the brush holder and the dust protector pull the commutator end frame away at an angle.

**9. INSTALL FIELD FRAME AND ARMATURE ASSEMBLY**

- (a) Align the cutout of the field frame with the protrusion of the shock absorber.
- (b) Install the field frame and armature assembly with the 2 through bolts.

Torque: 5.9 N·m (60 kgf·cm, 52 in.-lbf)

**10. INSTALL MAGNETICS SWITCH**

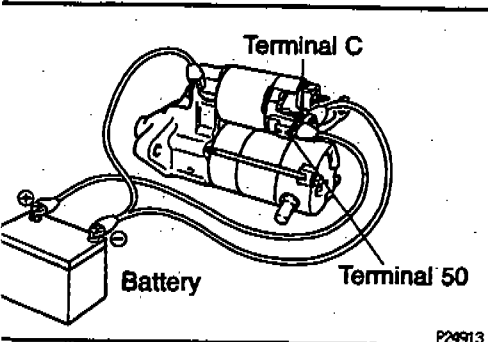
- (a) Install the plunger cover to the magnetic switch.
- (b) Hang the plunger of the magnetic switch to the drive lever from the upper side.
- (c) Install the magnetic switch with the 2 nuts. Torque: 8.3 N·m (85 kgf·cm, 73 in.-lbf)
- (d) Connect the lead wire to the terminal, and install the nut. Torque: 9.8 N·m (100 kgf·cm, 87 in.-lbf)

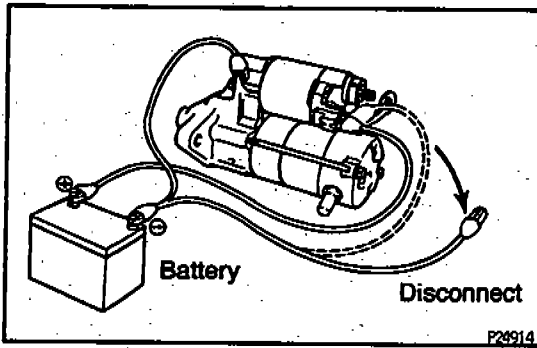
TEST

NOTICE: These tests must be done within 3 to 5 seconds to avoid burning out the coil.

1. DO PULL-IN TEST

- (a) Disconnect the field coil lead from terminal C.
- (b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward. If the clutch pinion gear does not move, replace the magnetic switch.



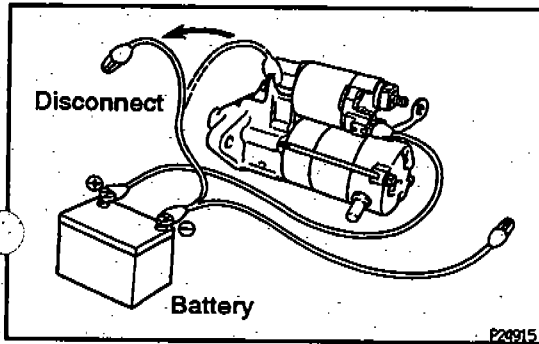


2. DO HOLD-IN TEST

With the battery connected as above and with the clutch pinion gear out disconnect the negative (–) lead from terminal C.

Check that the clutch pinion gear remains out.

If the clutch pinion gear returns inward, replace the magnetic switch.

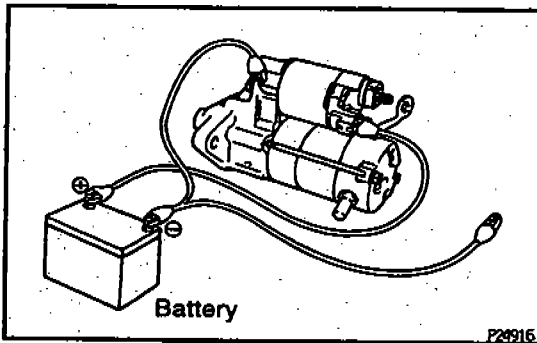


3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (–) lead from the switch body.

Check that the clutch pinion gear returns inward.

If the clutch pinion gear does not return, replace the magnetic switch.



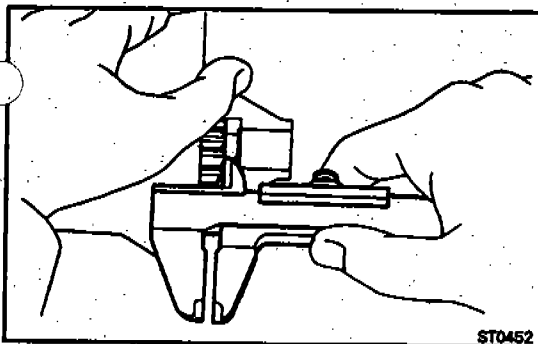
4. INSPECT CLUTCH PINION GEAR CLEARANCE

(a) Connect the battery to the magnetic switch as shown.

(b) Move the pinion gear toward the armature to remove slack and measure the clearance between the pinion gear end and stop collar.

Standard clearance:

1–5 mm (0.04–0.20 in.)



5. DO NO-LOAD PERFORMANCE TEST

(a) Connect the field coil lead to terminal C. Make sure the lead is not grounded.

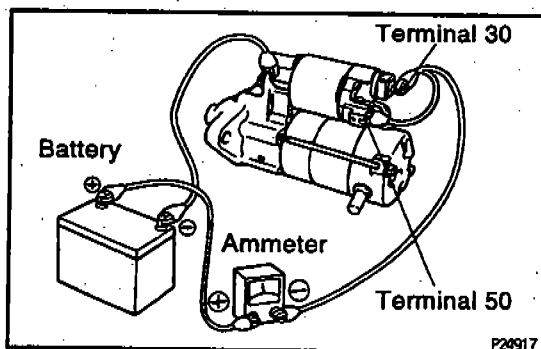
(b) Connect the battery and ammeter to the starter as shown.

(c) Check that the starter rotates smoothly and steadily with the clutch pinion gear moving out.

Check that the ammeter reads the specified current.

Specified current:

At 11.5 V: Less than 90 A



STARTER RELAY

ST-13-01

1. REMOVE STARTER RELAY (Marking: "ST")

2. INSPECT RELAY CONTINUITY

- (a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

- (b) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.

3. INSPECT RELAY OPERATION

- (a) Apply battery voltage across terminals 1 and 2.

- (b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If there is no continuity, replace the relay.

4. REINSTALL STARTER RELAY

