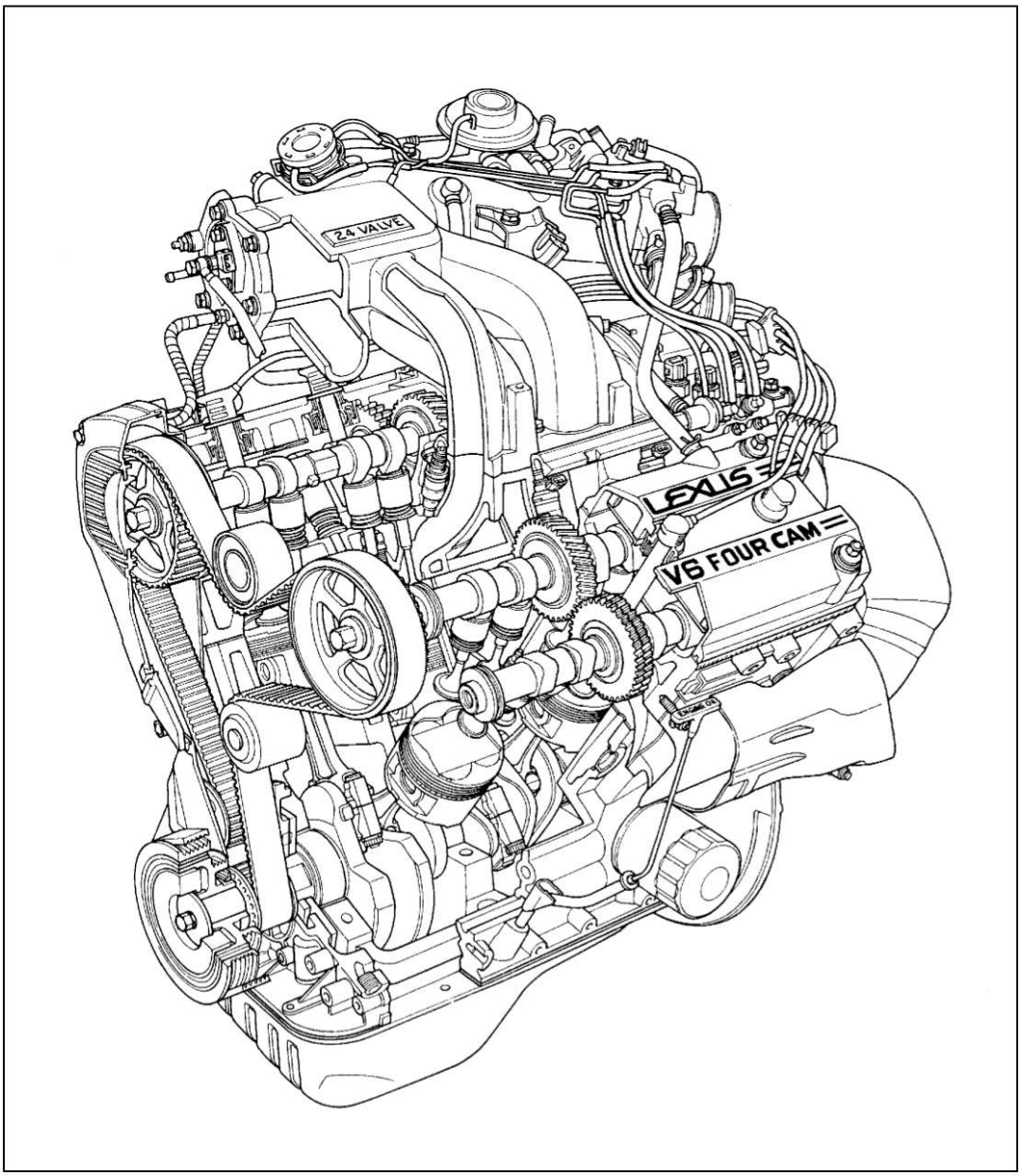
ENGINE MECHANICAL

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DESCRIPTION

The 2VZ–FE engine is a V–6, 2.5 liter, DOHC 24–valve engine.

OPERATION

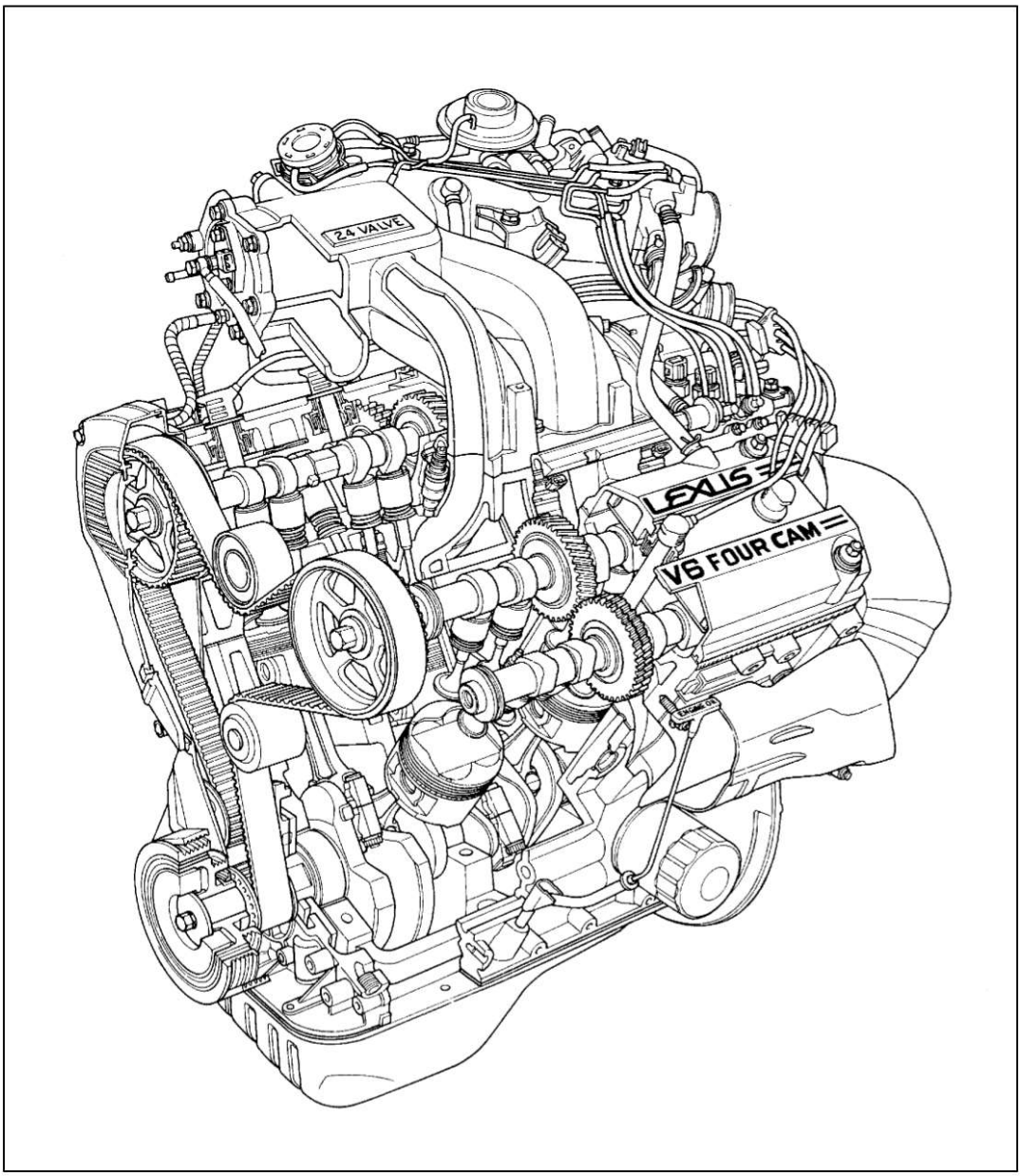


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DESCRIPTION

The 2VZ–FE engine is a V–6, 2.5 liter, DOHC 24–valve engine.

OPERATION



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The 2VZ–FE engine has 6 cylinder in a V arrangement at a bank angle of 60°. From the front of the RH bank cylinders are numbered 1 – 3 – 5, and from the front of the LH bank cylinders are numbered 2 – 4 – 6. The crankshaft is supported by 4 bearings inside the crankcase. These bearings are made of copper and lead alloy.

The crankshaft is integrated with 5 weights for balance. Oil holes are placed in the center of the crankshaft for supplying oil to the connecting rods, pistons and other components.

This engine's ignition order is 1 – 2 – 3 – 4 – 5 – 6. The cylinder head is made of aluminum alloy, with a cross flow type intake and exhaust layout and with pent–roof type combustion chambers. The spark plugs are located in the center of the combustion chambers.

At the front and rear of the intake port of the intake manifold, a water passage has been provided which connects the RH and LH cylinder heads.

Exhaust and intake valves are equipped with irregular pitch springs made of special valve spring carbon steel which are capable of functioning no matter what the engine speed.

The RH and LH intake camshafts are driven by a single timing belt, and a gear on the intake camshaft engages with a gear on the exhaust camshaft to drive it. The camshaft journal is supported at 5 (intake) or 4 (exhaust) places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journals and gears is accomplished by oil being supplied through the oiler port in the center of the camshaft.

Adjustment of the valve clearance is done by means of an outer shim type system, in which valve adjusting shims are located above the valve lifters. This permits replacement of the shims without removal of the camshafts.

The timing belt cover is composed of the resin type No.2 and No.1 above and below the engine RH mounting bracket.

Pistons are made of high temperature–resistant aluminum alloy, and a depression is built into the piston head to prevent interference with the valves.

Piston pins are the semi–floating type, with the pins fastened to the connecting rods by pressure fitting, allowing the pistons and pins to float.

The No.1 compression ring is made of steel and the No.2 compression ring is made of cast iron. The oil ring is made of a combination of steel and stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to hug the cylinder walls when they are mounted on the piston. Compression rings No.1 and No.2 work to prevent gas leakage from the cylinder and the oil ring works to clear oil off the cylinder walls to prevent it from entering the combustion chamber.

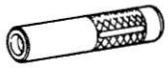
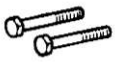
The cylinder block is made of cast iron with a bank angle of 60°. It has 6 cylinders which are approximately twice the length of the piston stroke. The top of the cylinders is closed off by the cylinder heads and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

The oil pan is bolted onto the bottom of the cylinder block. The oil pan is an oil reservoir made of pressed steel sheet. A dividing plate is included inside the oil pan to keep sufficient oil in the bottom of the oil pan even when the vehicle is tilted. This dividing plate also prevents the oil from making waves when the vehicle is stopped suddenly and thus shifting the oil away from the oil pump suction pipe.

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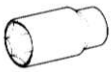
PREPARATION

SST (SPECIAL SERVICE TOOLS)

Illustration	Part No.	Part Name	Note
	09011–38121	12 mm Socket Wrench for 12 Pointed Head	Connecting rod bolts
	09201–41020	Valve Stem Oil Seal Replacer	
	09201–70010	Valve Guide Bushing Remover & Replacer	
	09202–70010	Valve Spring Compressor	
	09213–54015	Crankshaft Pulley Holding Tool	
	09213–60017)	Crankshaft Pulley & Gear Puller Set	
	(09213–00020)	(Body with Bolt)	
	(09213–00030)	(Handle)	
	(09213–00060)	(Bolt Set)	
	09213–70010	Crankshaft Pulley Holding Tool	
	09221–25024	Piston Pin Remover & Replacer	
	(09221–00020)	(Body)	
	(09221–00030)	(Spring)	
	(09221–00181)	(Bushing "E")	
	(09221–00190)	(Guide "K")	

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SST (SPECIAL SERVICE TOOLS) (Cont'd)

Illustration	Part No.	Part Name	Note
	(09221–00200)	(Guide "L")	
	09223–46011	Crankshaft Front Oil Seal Replacer	Crankshaft oil seal
	09223–56010	Crankshaft Rear Oil Seal Replacer	
	09248–55010	Valve Clearance Adjust Tool Set	
	09249–63010	Torque Wrench Adapter	
	09278–54012	Drive Shaft Holding Tool	Camshaft timing pulley
	09309–37010	Transmission Bearing Replacer	Crankshaft front oil seal
	09330–00021	Companion Flange Holding Tool	Crankshaft pulley
	09816–30010	Oil Pressure Switch Socket	Knock sensor

RECOMMENDED TOOLS

Illustration	Part No.	Part Name	Note
	09090–04010	Engine Sling Device	For suspending engine
	09200–00010	Engine Adjust Kit	
	09258–00030	Hose plug Set	Plug for vacuum hose, fuel hose etc.
	09904–00010	Expander Set	

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EQUIPMENT

Part Name	Note
Caliper gauge	
CO/HC meter	
Compression gauge	
Connecting rod aligner	
Cylinder gauge	
Dial indicator	
Engine tune–up tester	
Feeler gauge	
Micrometer	
Precision straight edge	
Spring tester	Valve spring
Steel square	Valve spring
Torque wrench	
Vernier calipers	

SSM (SERVICE SPECIAL MATERIALS)

Part Name	Part No.	Use etc.
Seal packing or equivalent	08826–00080	Camshaft bearing cap Cylinder head cover Rear oil sear retainer
Seal packing 1282B, Three bond 1282B or equivalent	08826–00100	Water by–pass pipe
Adhesive 1324, Three bond 1324 or equivalent	08833–00070	Flywheel or drive plate mount bolt
Adhesive 1344, Three bond 1344, Loctite 242 or equivalent	08833–00080	No. 1 idler pulley mount bolt

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ENGINE TUNE–UP

INSPECTION OF ENGINE COOLANT

(See steps 1 and 2 on page CO–5)

INSPECTION OF ENGINE OIL

(See steps 1 and 2 on page LU–5)

INSPECTION OF BATTERY

(See pages 1 and 2 on page CH–5)

Standard specific gravity:
1.25–1.27 when fully charged at 20°C (68°F)

INSPECTION OF AIR FILTER

(See step 3 on page MA–4)

INSPECTION OF HIGH–TENSION CORDS

(See page IG–7)

Maximum resistance: 25 kΩ per cord

INSPECTION OF DRIVE BELT

(See step 3 on page MA–4)

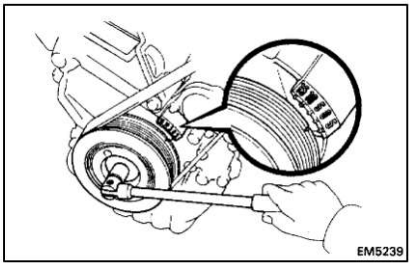
Drive belt tension:	New belt 175 ± 5 lb
	Used belt 115 ± 20 lb

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INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE

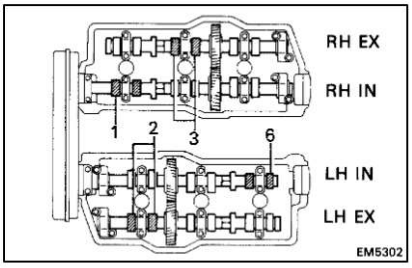
HINT: Adjust the valve clearance while the engine is cold.

1. **REMOVE AIR INTAKE CHAMBER**
   (See steps 1 to 14 pages FI–28 and 29)
2. **REMOVE CYLINDER HEAD COVERS**
   (See step 32 on page EM–34)



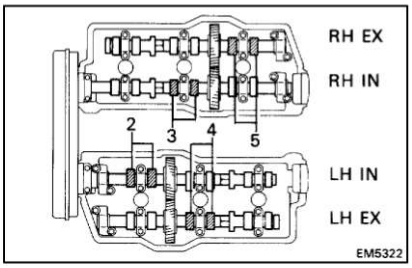
3. **SET NO.1 CYLINDER TO TDC/COMPRESSION**
   (a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the No.1 timing belt cover.
   (b) Check that the valve lifters on the No.1 (IN) are loose and valve lifters on the No.1 (EX) are tight.

   If not, turn the crankshaft one revolution (360°) and align the mark as above.

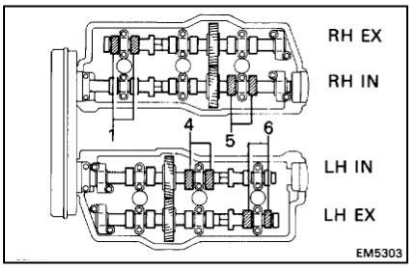


4. **ADJUST VALVE CLEARANCE**
   (a) Check only those valves indicated in the figure.
   - Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
   - Record out of specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

   Valve clearance (Cold):
   Intake 0.13–0.23 mm (0.005–0.009 in.)
   Exhaust 0.27–0.37 mm (0.011–0.015 in.)

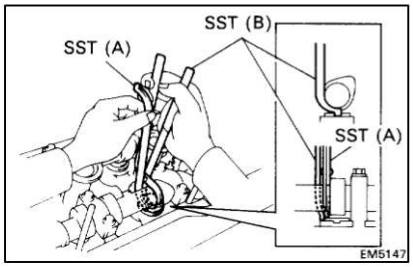


   (b) Turn the crankshaft 2/3 of a revolution (240°), and check only the valves indicated in the figure.
   Measure the valve clearance.
   (See procedure step (a))



   (c) Turn the crankshaft further 2/3 of a revolution (240°), and check only the valves indicated in the figure.
   Measure the valve clearance.
   (See procedure step (a))

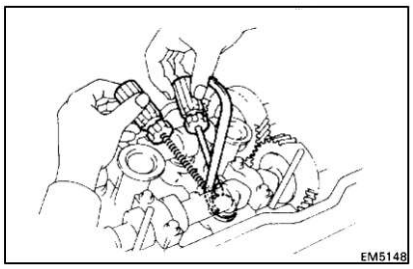
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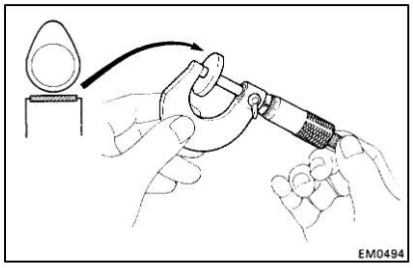
(d) Remove the adjusting shim.
- Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward.
- Press down the valve lifter with SST (A), and place SST (B) between the camshaft and valve lifter. Remove SST (A).

SST 09248–55011

HINT: Before pressing down the valve lifter, position the notch toward the spark plug.



- Remove the adjusting shim with a small screwdriver and magnetic finger.



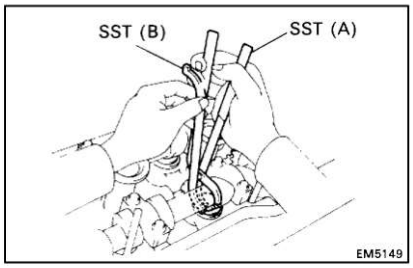
(e) Determine the replacement adjusting shim size by following the Formula or Charts:
- Using a micrometer, measure the thickness of the removed shim.
- Calculate the thickness of a new shim so that the valve clearance comes within specified value.

T . . . . . Thickness of used shim
A . . . . . Measured valve clearance
N . . . . . Thickness of new shim

Intake N = T + (A–0.18 mm (0.007 in.))
Exhaust N = T + (A–0.32 mm (0.013 in.))

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

HINT: Shims are available in seventeen sizes of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).



(f) Install a new adjusting shim.
- Place a new adjusting shim on the valve lifter.
- Press down the valve lifter with SST (A), and remove SST (B).

SST 09248–55011

(g) Recheck the valve clearance.

5. **REINSTALL CYLINDER HEAD COVERS**
(See step 8 on page EM–56)
6. **REINSTALL AIR INTAKE CHAMBER**
(See steps 6 to 20 pages FI–33 to 34)

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Adjusting Shim Selection Using Chart

INTAKE

Measured clearance (mm)	Installed shim thickness (mm)																																												
	2.500	2.525	2.550	2.575	2.600	2.620	2.640	2.650	2.660	2.680	2.700	2.720	2.740	2.750	2.760	2.780	2.800	2.820	2.840	2.850	2.860	2.880	2.900	2.920	2.940	2.950	2.960	2.980	3.000	3.020	3.040	3.050	3.060	3.080	3.100	3.120	3.140	3.150	3.160	3.180	3.200	3.225	3.250	3.275	3.300
0.000 – 0.025						02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	26	26	28
0.026 – 0.050					02	02	02	02	02	04	04	06	06	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	28	28
0.051 – 0.075				02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	28	28	30
0.076 – 0.100			02	02	02	04	04	04	04	06	06	08	08	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	30	30
0.101 – 0.125		02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	30	30	32
0.126 – 0.129		02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	32
0.130 – 0.230																																													
0.231 – 0.250	04	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	
0.251 – 0.275	06	06	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	
0.276 – 0.300	06	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34		
0.301 – 0.325	08	08	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34			
0.326 – 0.350	08	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34	34				
0.351 – 0.375	10	10	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34						
0.376 – 0.400	10	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34							
0.401 – 0.425	12	12	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34									
0.426 – 0.450	12	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34	34										
0.451 – 0.475	14	14	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34												
0.476 – 0.500	14	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34													
0.501 – 0.525	16	16	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34															
0.526 – 0.550	16	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34	34																
0.551 – 0.575	18	18	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																		
0.576 – 0.600	18	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34																			
0.601 – 0.625	20	20	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																					
0.626 – 0.650	20	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34	34																						
0.651 – 0.675	22	22	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																								
0.676 – 0.700	22	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34																									
0.701 – 0.725	24	24	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																											
0.726 – 0.750	24	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34																													
0.751 – 0.775	26	26	28	28	30	30	30	32	32	32	34	34	34	34	34																														
0.776 – 0.800	26	28	28	30	30	32	32	32	32	34	34	34	34	34																															
0.801 – 0.825	28	28	30	30	32	32	32	34	34	34	34	34																																	
0.826 – 0.850	28	30	30	32	32	32	34	34	34	34	34																																		
0.851 – 0.875	30	30	32	32	34	34	34	34	34																																				
0.876 – 0.900	30	32	32	34	34	34	34	34																																					
0.901 – 0.925	32	32	34	34	34	34																																							
0.926 – 0.950	32	34	34	34	34																																								
0.951 – 0.975	34	34	34	34																																									
0.976 – 1.000	34	34	34																																										
1.001 – 1.025	34	34																																											
1.026 – 1.030	34																																												

New shim thicknesses mm (in.)

Shim No.	Thickness	Shim No.	Thickness
02	2.500 (0.0984)	20	2.950 (0.1161)
04	2.550 (0.1004)	22	3.000 (0.1181)
06	2.600 (0.1024)	24	3.050 (0.1201)
08	2.650 (0.1043)	26	3.100 (0.1220)
10	2.700 (0.1063)	28	3.150 (0.1240)
12	2.750 (0.1083)	30	3.200 (0.1260)
14	2.800 (0.1102)	32	3.250 (0.1280)
16	2.850 (0.1122)	34	3.300 (0.1299)
18	2.900 (0.1142)		

Intake valve clearance (Cold):

0.13–0.23 mm (0.005–0.009 in.)

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a No.22 shim.

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Adjusting Shim Selection Using Chart

EXHAUST

Measured clearance (mm)	Installed Shim thickness (mm)																																												
	2.500	2.525	2.550	2.575	2.600	2.620	2.640	2.650	2.660	2.680	2.700	2.720	2.740	2.750	2.760	2.780	2.800	2.820	2.840	2.850	2.860	2.880	2.900	2.920	2.940	2.950	2.960	2.980	3.000	3.020	3.040	3.050	3.060	3.080	3.100	3.120	3.140	3.150	3.160	3.180	3.200	3.225	3.250	3.275	3.300
0.000 – 0.025														02	02	02	02	02	04	04	04	04	06	06	08	08	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	22
0.026 – 0.050												02	02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	22	22
0.051 – 0.075											02	02	02	02	02	02	04	04	06	06	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	24
0.076 – 0.100										02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	24	24
0.101 – 0.125								02	02	02	02	02	04	04	04	04	06	06	08	08	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	26
0.126 – 0.150						02	02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	26	26
0.151 – 0.175					02	02	02	02	02	02	04	04	06	06	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	28
0.176 – 0.200				02	02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	28	28
0.201 – 0.225			02	02	02	02	04	04	04	04	06	06	08	08	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	30
0.226 – 0.250		02	02	02	02	04	04	04	06	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	30	30
0.251 – 0.269		02	02	02	04	04	06	06	06	06	08	08	10	10	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	32
0.270 – 0.370																																													
0.371 – 0.375	04	06	06	08	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	34	34	34	
0.376 – 0.400	04	06	06	08	08	10	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	
0.401 – 0.425	06	06	08	08	10	10	12	12	12	12	14	14	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34		
0.426 – 0.450	06	08	08	10	10	12	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34			
0.451 – 0.475	08	08	10	10	12	12	14	14	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34				
0.476 – 0.500	08	10	10	12	12	14	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34					
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0.526 – 0.550	10	12	12	14	14	16	16	16	18	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34								
0.551 – 0.575	12	12	14	14	16	16	18	18	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34										
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0.626 – 0.650	14	16	16	18	18	20	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34														
0.651 – 0.675	16	16	18	18	20	20	22	22	22	22	24	24	26	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34																
0.676 – 0.700	16	18	18	20	20	22	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																	
0.701 – 0.725	18	18	20	20	22	22	24	24	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34																		
0.726 – 0.750	18	20	20	22	22	24	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																				
0.751 – 0.775	20	20	22	22	24	24	26	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34	34																						
0.776 – 0.800	20	22	22	24	24	26	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																							
0.801 – 0.825	22	22	24	24	26	26	28	28	28	28	30	30	32	32	32	32	34	34	34	34	34																								
0.826 – 0.850	22	24	24	26	26	28	28	28	30	30	30	32	32	32	34	34	34	34	34																										
0.851 – 0.875	24	24	26	26	28	28	30	30	30	30	32	32	34	34	34	34	34																												
0.876 – 0.900	24	26	26	28	28	30	30	30	32	32	32	34	34	34	34	34																													
0.901 – 0.925	26	26	28	28	30	30	32	32	32	32	34	34	34	34	34																														
0.926 – 0.950	26	28	28	30	30	32	32	32	34	34	34	34	34																																
0.951 – 0.975	28	28	30	30	32	32	34	34	34	34	34																																		
0.976 – 1.000	28	30	30	32	32	34	34	34	34	34																																			
1.001 – 1.025	30	30	32	32	34	34	34	34	34																																				
1.026 – 1.050	30	32	32	34	34	34	34																																						
1.051 – 1.075	32	32	34	34	34																																								
1.076 – 1.100	32	34	34	34																																									
1.101 – 1.125	34	34	34																																										
1.126 – 1.150	34	34																																											
1.151 – 1.170	34																																												

New shim thicknesses mm (in.)

Shim No.	Thickness	Shim No.	Thickness
02	2.500 (0.0984)	20	2.950 (0.1161)
04	2.550 (0.1004)	22	3.000 (0.1181)
06	2.600 (0.1024)	24	3.050 (0.1201)
08	2.650 (0.1043)	26	3.100 (0.1220)
10	2.700 (0.1063)	28	3.150 (0.1240)
12	2.750 (0.1083)	30	3.200 (0.1260)
14	2.800 (0.1102)	32	3.250 (0.1280)
16	2.850 (0.1122)	34	3.300 (0.1299)
18	2.900 (0.1142)		

Exhaust valve clearance:

0.27–0.37 mm (0.011–0.015 in.)

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a No.18 shim.

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INSPECTION AND ADJUSTMENT OF IGNITION TIMING

(See page IG–13)

Ignition timing:
10° BTDC @ idle
(w/ Terminals TE1 and E1 connected)

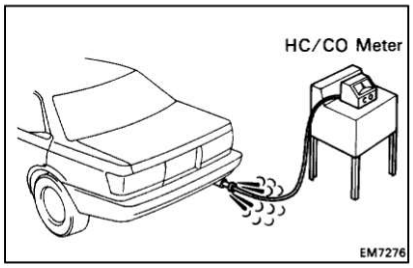
INSPECTION OF IDLE SPEED

Idle speed: 700 ± 50 rpm

IDLE AND/OR 2,500 RPM HC/CO CONCENTRATION CHECK METHOD

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

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 operating accessories switched OFF
   (e) All vacuum lines properly connected
   HINT: All vacuum hoses for EGR systems, etc. should be properly connected.
   (f) EFI system wiring connectors fully plugged in
   (g) Transmission in neutral
   (h) Tachometer and HC/CO meter calibrated aud close at hand



2. **START ENGINE**
3. **RACE ENGINE AT 2,500 RPM FOR APPROX. 2 MINUTES**
4. **INSERT HC/CO METER TESTING PROBE INTO TAILPIPE AT LEAST 40 cm (1.3 ft)**
5. **CHECK HC/CO CONCENTRATION AT IDLE**
   Complete the measuring within three minutes.
   HINT: When performing the 2 mode (2,500 rpm and idle) test, follow the measurement order prescribed by the regulations.
   If the HC/CO concentration at 2,500 rpm does not comply with regulations, try the following procedure.
   Race the engine again at 2,500 rpm for approx. 1 minute and quickly repeat steps 4 and 5 above.
   This may correct the problem.

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INSPECTION AND ADJUSTMENT OF IGNITION TIMING

(See page IG–13)

Ignition timing:
10° BTDC @ idle
(w/ Terminals TE1 and E1 connected)

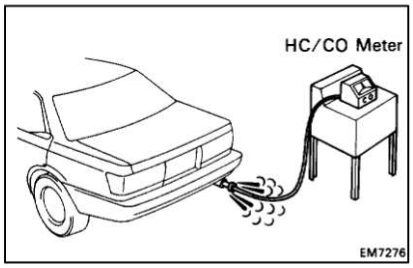
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4. **INSERT HC/CO METER TESTING PROBE INTO TAILPIPE AT LEAST 40 cm (1.3 ft)**
5. **CHECK HC/CO CONCENTRATION AT IDLE**
   Complete the measuring within three minutes.
   HINT: When performing the 2 mode (2,500 rpm and idle) test, follow the measurement order prescribed by the regulations.
   If the HC/CO concentration at 2,500 rpm does not comply with regulations, try the following procedure.
   Race the engine again at 2,500 rpm for approx. 1 minute and quickly repeat steps 4 and 5 above.
   This may correct the problem.

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Troubleshooting

If the HC/CO concentration does not comply with regulations, perform troubleshooting in the order given below.

(a) Check oxygen sensor operation.
(See page FI–54)

(b) See the table below for possible causes, and then inspect and correct the applicable causes if necessary.

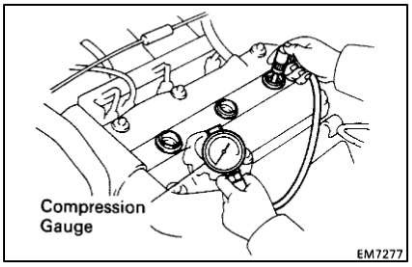
HC	CO	Problem	Cause
High	Normal	Rough idle	1. Faulty ignition: ● Incorrect timing ● Fouled, shorted or improperly gapped plugs ● Open or crossed high–tension cords ● Cracked distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve 4. Leaky intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leak: ● PCV hose ● EGR valve ● Intake manifold ● Air intake chamber ● Throttle body ● ISC valve ● Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Clogged air filter 2. Faulty EFI system ● Faulty pressure regulator ● Clogged fuel return line ● Defective water temp. sensor ● Defective air temp. sensor ● Faulty ECU ● Faulty injector ● Faulty cold start injector ● Faulty throttle position sensor ● Air flow meter

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COMPRESSION CHECK

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. **REMOVE AIR INTAKE CHAMBER**
   (See steps 1 to 14 on pages FI–28 and 29)



3. **DISCONNECT DISTRIBUTOR CONNECTOR**
4. **REMOVE SPARK PLUGS (See page IG–7)**
5. **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 speed of 250 rpm or more.

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

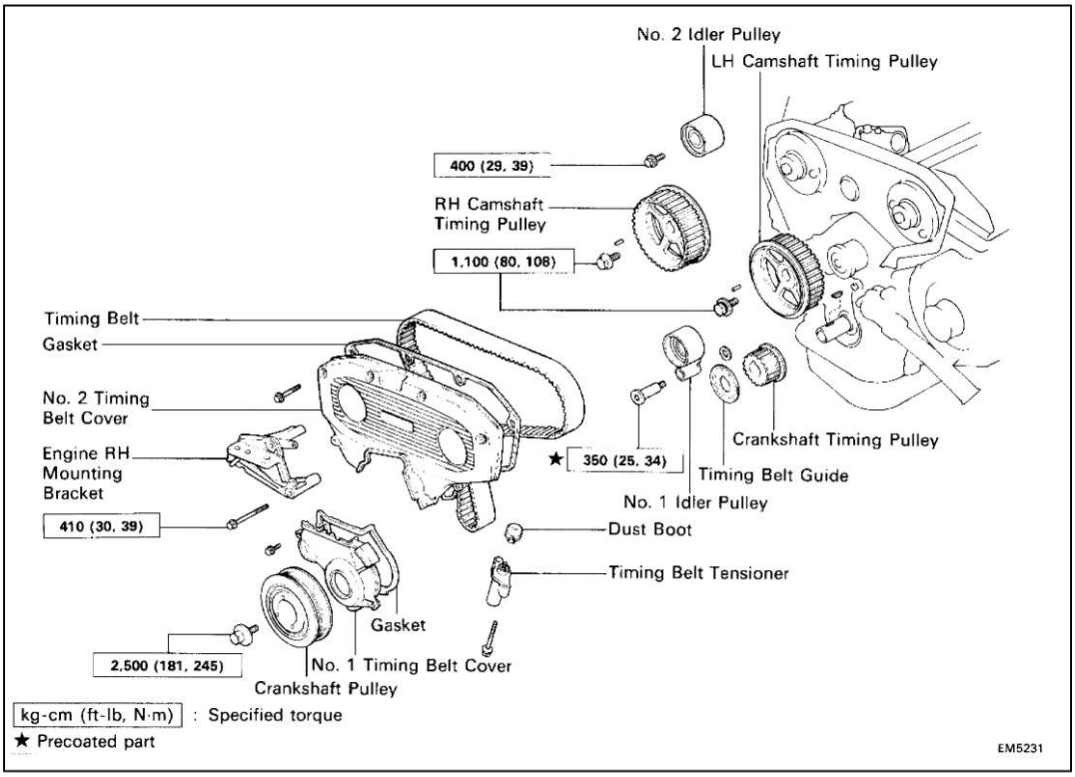
   NOTICE: This measurement must be done in as short a time as possible.

   Compression pressure:
   12.5 kg/cm^2 (178 psi, 1226 kPa) or more
   Minimum pressure:
   10.0 kg/cm^2 (142 psi, 981 kPa)
   Difference between each cylinder:
   1.0 kg/cm^2 (14 psi, 981 kPa) 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 chances are 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.
6. **REINSTALL SPARK PLUGS (See page IG–7)**
   Torque: 180 kg–cm (13 ft–lb, 18 N·m)
7. **RECONNECT DISTRIBUTOR CONNECTOR**
8. **REINSTALL AIR INTAKE CHAMBER**
   (See steps 6 to 20 on pages FI–33 and 34)

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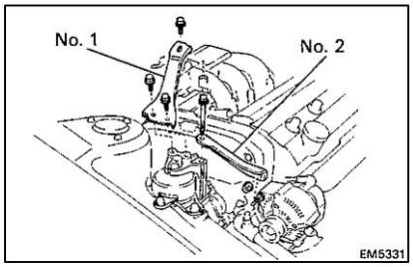
TIMING BELT
COMPONENTS



REMOVAL OF TIMING BELT

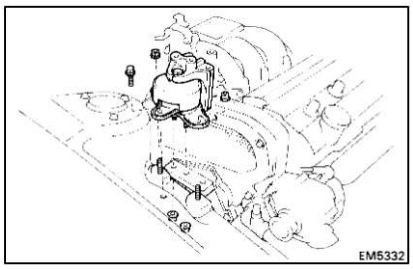
1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
   CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.
2. REMOVE SUSPENSION UPPER BRACE
   (See step 7 on page EM–63)
3. REMOVE CRUISE CONTROL ACTUATOR
   (See step 15 on page EM–64)
4. REMOVE PS OIL RESERVOIR TANK WITHOUT DISCONNECTING HOSES (See step 36 on page EM–67)
5. REMOVE RH FRONT WHEEL
6. REMOVE ALTERNATOR DRIVE BELT
7. REMOVE RH FENDER APRON SEAL
8. REMOVE PS DRIVE BELT

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9. REMOVE RH ENGINE MOUNTING STAYS
(a) Remove the three bolts and No.1 mounting stay.
(b) Remove the bolt, nut and No.2 mounting stay.

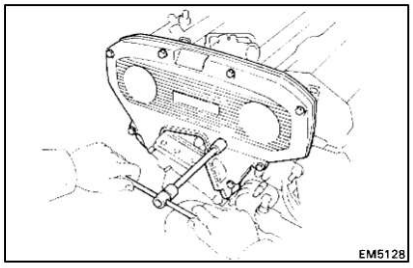
10. SLIGHTLY JACK UP ENGINE
Raise the engine enough to remove the weight from the engine mounting on the right side.



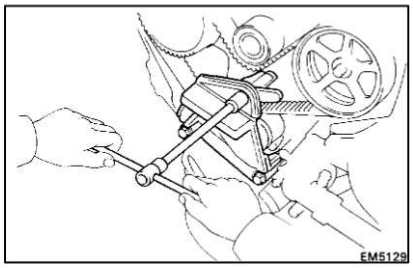
11. REMOVE RH ENGINE MOUNTING INSULATOR
(a) Remove the clamp bolts of the PS oil cooler pipes.
(b) Remove the four nuts, bolt and mounting insulator.

12. REMOVE AIR INTAKE CHAMBER
(See step 1 to 14 on pages FI–28 and 29)

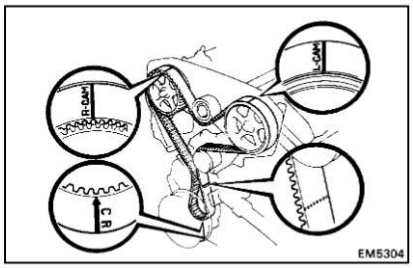
13. REMOVE SPARK PLUGS (See page IG–7)



14. REMOVE NO.2 TIMING BELT COVER
Remove the eight bolts, timing belt cover and gasket.

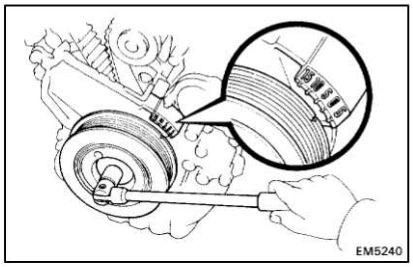


15. REMOVE ENGINE RH MOUNTING BRACKET
Remove the three bolts and mounting bracket.



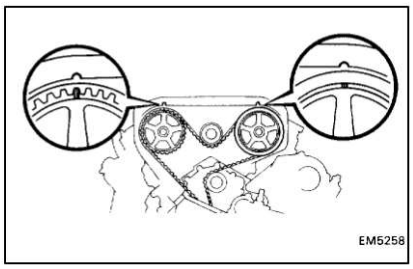
16. IF RE–USING TIMING BELT, CHECK INSTALLATION MARKS ON TIMING BELT
Check that there are four installation marks on the timing belt by turning the crankshaft pulley as shown in the illustration. If the installation marks have disappeared, place a new installation mark on the timing belt before removing each part.

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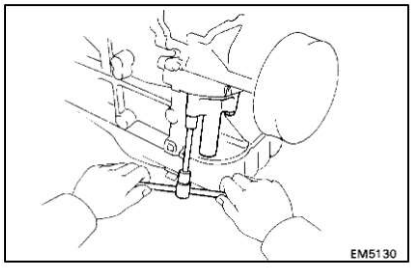
17. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley and align its groove with the timing mark “0” of the No.1 timing belt cover.



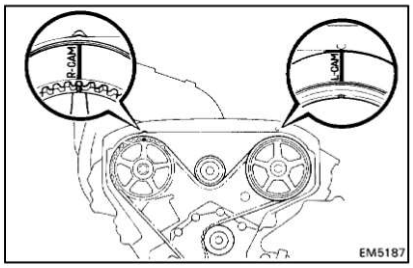
(b) Check that timing marks of the camshaft timing pulleys and No.3 timing belt cover are aligned.

If not, turn the crankshaft one revolution (360˚).



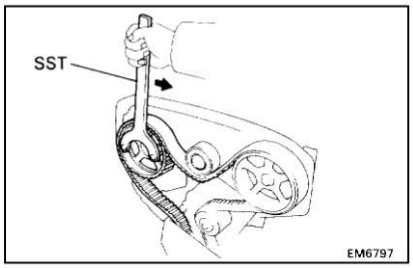
18. REMOVE TIMING BELT TENSIONER

Remove the two bolts, tensioner and dust boot.



19. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

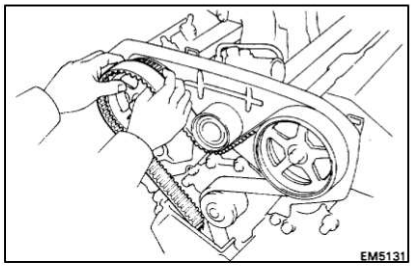
HINT (Re–using timing belt): If the installation marks have disappeared, before removing the timing belt, place new installation marks on the timing belt to match the timing marks of the camshaft timing pulleys.



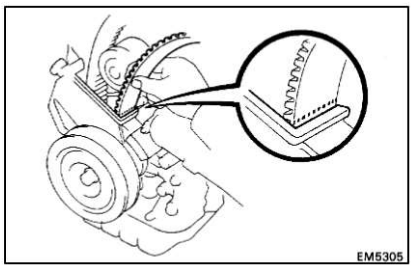
(a) Using SST, loosen the tension between the LH and RH camshaft timing pulleys by slightly turning the RH camshaft timing pulley clockwise.

SST 09278–54012

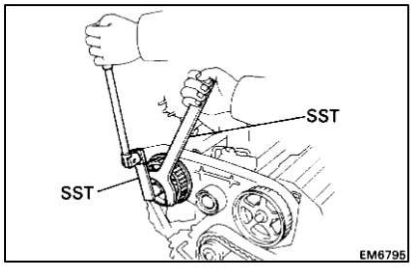
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(b) Remove the timing belt from the camshaft timing pulleys.



HINT (Re–using timing belt): If the installation marks have disappeared, after removing the timing belt from the camshaft timing pulleys, place new installation mark on the timing belt to match the end of the No.1 timing belt cover.

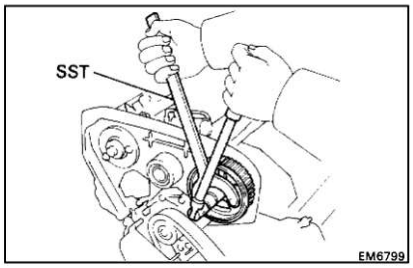


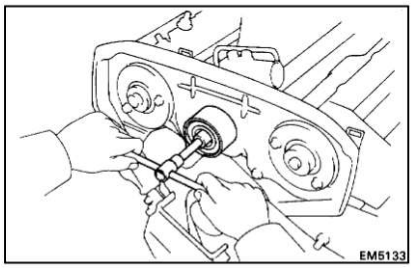
20. REMOVE CAMSHAFT TIMING PULLEYS

Using SST, remove the bolt, timing pulley and knock pin. Remove the two timing pulleys.

SST RH 09249–63010 and 09278–54012 LH 09278–54012

HINT: Arrange the RH and LH pulleys.

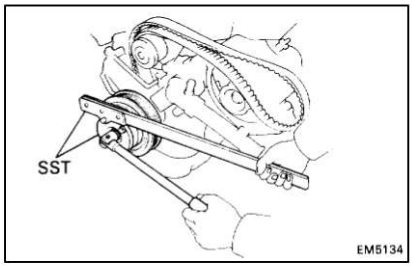




21. REMOVE NO.2 IDLER PULLEY

Remove the bolt and idler pulley.

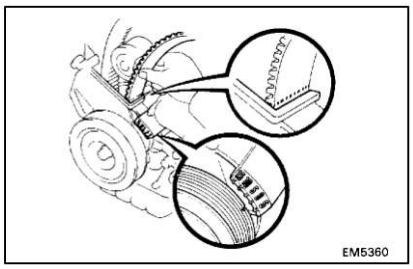
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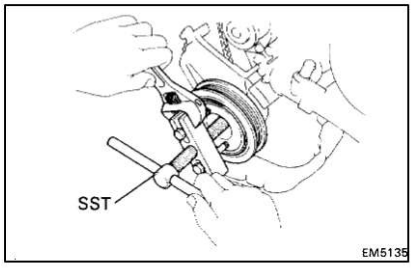
22. REMOVE CRANKSHAFT PULLEY

(a) Using SST, remove the pulley bolt.

SST 09213–54014 (Body), 90213–70010 (90105–08076 (Bolt)) and 09330–00021

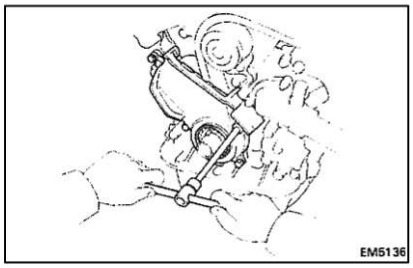


HINT (Re–using timing belt): When the crankshaft pulley bolt is loosened, the position of the timing mark of the crankshaft pulley and also the installation mark may slip, so check and align them again.



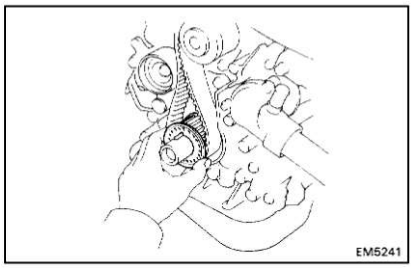
(b) Using SST, remove the pulley.

SST 09213–60017



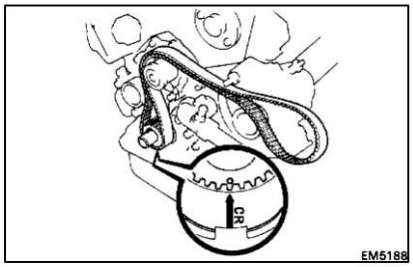
23. REMOVE NO.1 TIMING BELT COVER

Remove the four bolts, timing belt cover and gasket.



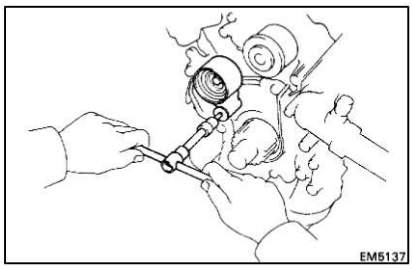
24. REMOVE TIMING BELT GUIDE

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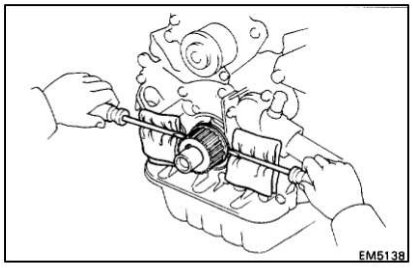
25. REMOVE TIMING BELT

HINT (Re–using timing belt): If the installation marks have disappeared, place a new installation mark on the timing belt to match the drilled mark of the crankshaft timing pulley.



26. REMOVE NO.1 IDLER PULLEY

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

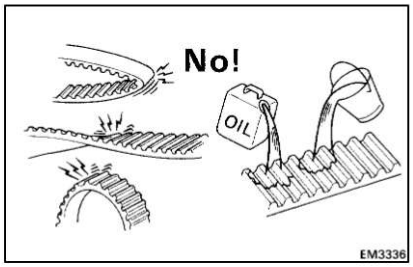


27. REMOVE CRANKSHAFT TIMING PULLEY

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

HINT: Position shop rags as shown to prevent damage.

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INSPECTION OF TIMING BELT COMPONENTS

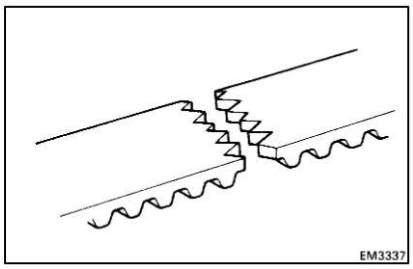
1. **INSPECT TIMING BELT**

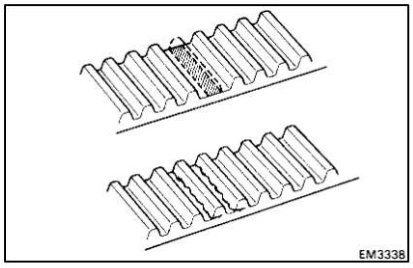
NOTICE:

- **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.**

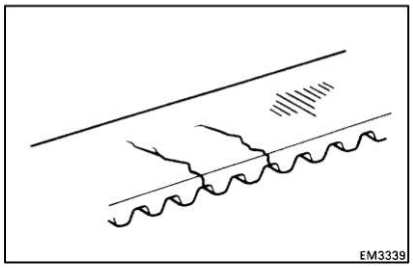
If there are any defects as shown in the figures, check the following points:

(a) Premature parting
- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.

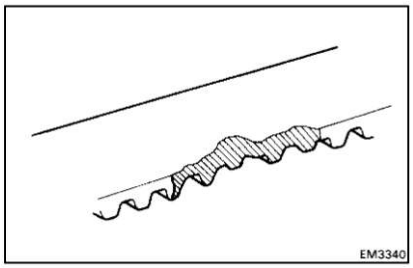




(b) If the belt teeth are cracked or damaged, check to see if either camshaft is locked.

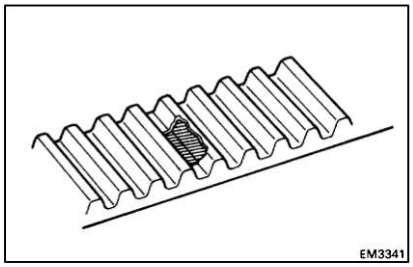


(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.



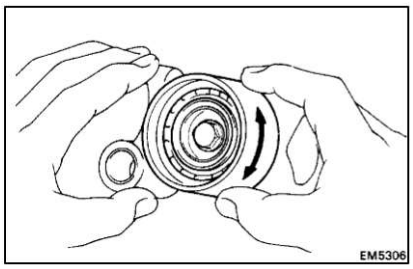
(d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.

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(e) If there is noticeable wear on the belt teeth, check timing cover for damage and check to correct gasket installation and for foreign material on the pulley teeth.

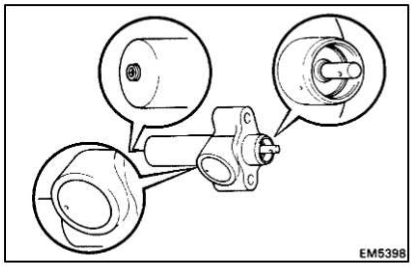
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEYS

Check the turning smoothness of the idler pulley.

If necessary, replace the idler pulley.

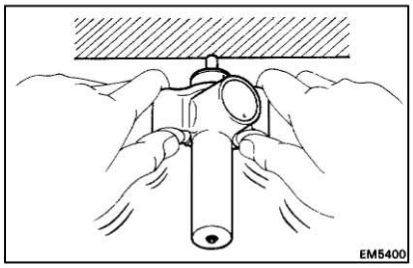


3. INSPECT TIMING BELT TENSIONER

(a) Visually check tensioner for oil leakage.

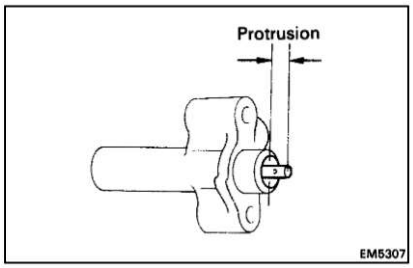
HINT: If there is only the faintest trace of oil on the seal on the push rod side, the tensioner is all right.

If leakage is found, replace the tensioner.



(b) Hold the tensioner with both hands and push the push rod strongly against the floor or wall to check that it doesn't move.

If the push rod moves, replace the tensioner.

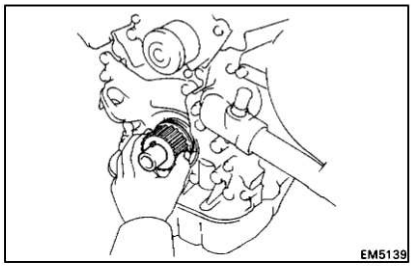


(c) Measure the protrusion of the push rod from the housing end.

Protrusion: 10.5–11.5 mm (0.413–0.453 in.)

If the protrusion is not as specified, replace the tensioner.

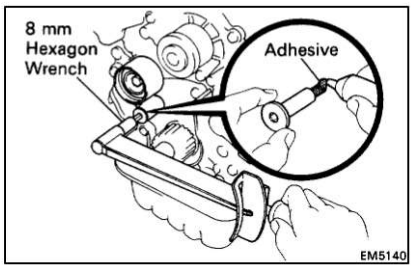
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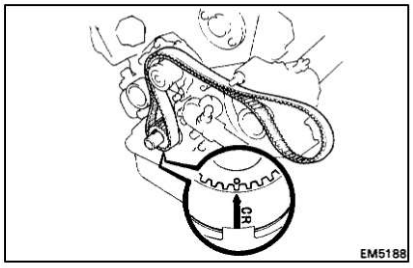
INSTALLATION OF TIMING BELT

(See page EM–15)

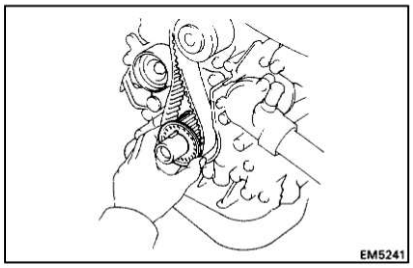
1. **INSTALL CRANKSHAFT TIMING PULLEY**
   (a) Align the pulley set key with the key groove of the timing pulley.
   (b) Slide on the timing pulley, facing the flange side inward.



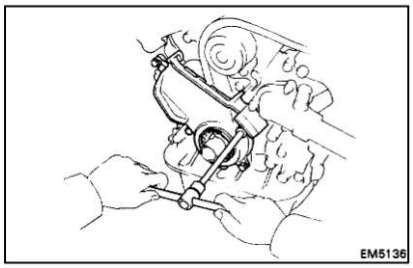
2. **INSTALL NO.1 IDLER PULLEY**
   (a) Apply adhesive to two or three threads of the mount bolt end.
   Adhesive: Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent
   (b) Using a 8 mm hexagon wrench, install the idler pulley with the plate washer and bolt. Torque the bolt.
   Torque: 350 kg–cm (25 ft–lb, 34 N·m)
   (c) Check that the pulley bracket moves smoothly.



3. **TEMPORARILY INSTALL TIMING BELT**
   NOTICE: The engine should be cold.
   (a) Remove any oil or water on the crankshaft timing, No.1 idler and water pump pulleys, and keep them clean.
   (b) Align the installation mark on the timing belt with the drilled mark of the crankshaft timing pulley.
   (c) Install the timing belt on the crankshaft timing, No.1 idler and water pump pulleys.

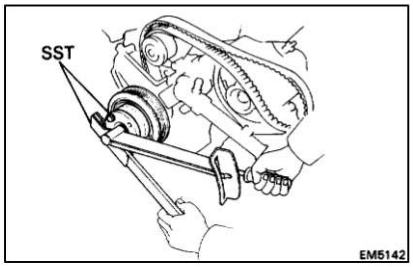


4. **INSTALL TIMING BELT GUIDE**
   Install the belt guide, facing the cup side outward.



5. **INSTALL NO.1 TIMING BELT COVER**
   (a) Install the gasket to the timing belt cover.
   (b) Install the timing belt cover with the four bolts.

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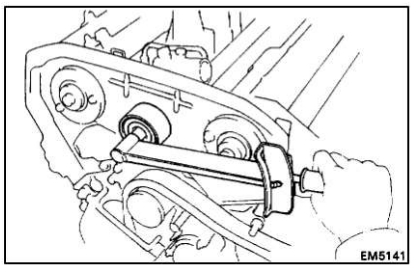
6. INSTALL CRANKSHAFT PULLEY

(a) Align the pulley set key with the key groove of the pulley, slide the pulley.

(b) Using SST, install and torque the bolt.

SST 09213–54014 (Body),
09213–70010 (90105–08076 (Bolt)) and
09330–00021

Torque: 2,500 kg–cm (181 ft–lb, 245 N·m)

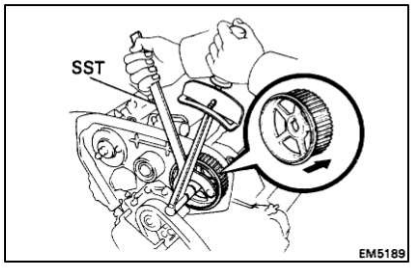


7. INSTALL NO.2 IDLER PULLEY

(a) Install the idler pulley with the bolt. Torque the bolt.

Torque: 400 kg–cm (29 ft–lb, 39 N·m)

(b) Check that the idler pulley moves smoothly.



8. INSTALL LH CAMSHAFT TIMING PULLEY

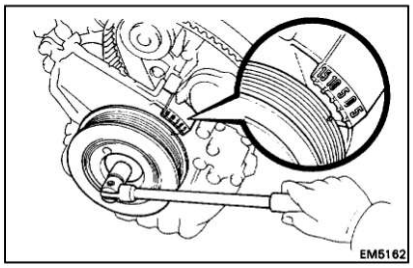
(a) Slide the timing pulley, facing the flange side outward.

(b) Align the knock pin hole of the camshaft with the knock pin groove of the timing pulley, and install the knock pin.

(c) Using SST, install and torque the bolt.

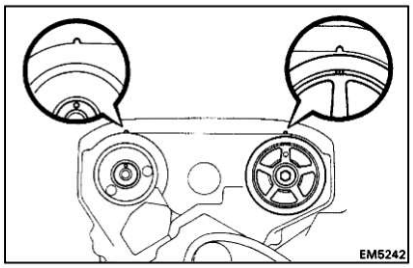
SST 09278–54012

Torque: 1,100 kg–cm (80 ft–lb, 108 N·m)



9. SET NO.1 CYLINDER TO TDC/COMPRESSION

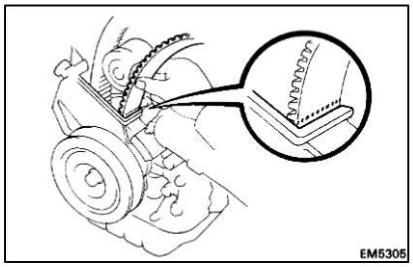
(a) (Crankshaft Position)
Turn the crankshaft pulley, and align its groove with the “O” timing mark of the No.1 timing belt cover.



(b) (RH Camshaft Pulley Position)
Turn the camshaft, align the knock pin hole of the camshaft with the timing mark of the No.3 timing belt cover.

(c) (LH Camshaft Pulley Position)
Turn the camshaft timing pulley, align the timing marks of the camshaft timing pulley and No.3 timing belt cover.

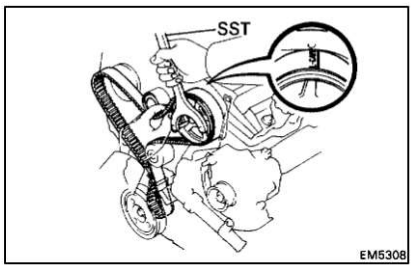
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10. INSTALL TIMING BELT TO LH CAMSHAFT TIMING PULLEY

(a) Check that the installation mark on the timing belt matches the end of the No.1 timing belt cover.

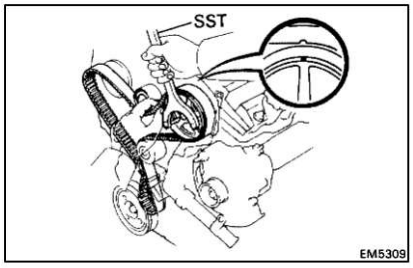
If the installation mark do not align, shift the meshing of the timing belt and crankshaft timing pulley until they align.



(b) Remove any oil or water on the LH camshaft timing pulley, and keep it clean.

(c) Using SST, slightly turn the LH camshaft timing pulley clockwise. Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley, and hang the timing belt on the LH camshaft timing pulley.

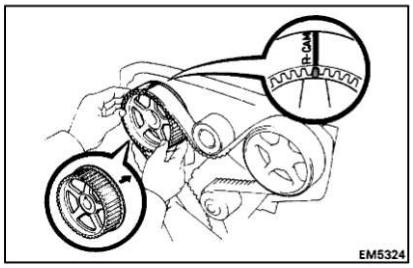
SST 09278–54012



(d) Using SST, align the timing marks of the LH camshaft pulley and No.3 timing belt cover.

SST 09278–54012

(e) Check that the timing belt has tension between the crankshaft timing and LH camshaft timing pulleys.

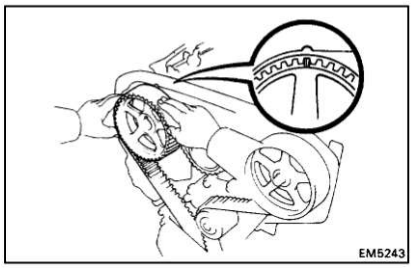


11. INSTALL RH CAMSHAFT TIMING PULLEY AND TIMING BELT

(a) Remove any oil or water on the RH camshaft timing and No.2 idler pulleys, and keep them clean.

(b) Align the installation mark on the timing belt with the timing mark of the RH camshaft timing pulley.

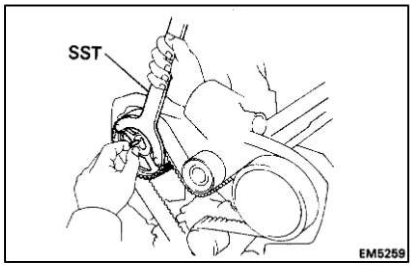
(c) Hang the timing belt on the RH camshaft timing pulley, facing the flange side inward.



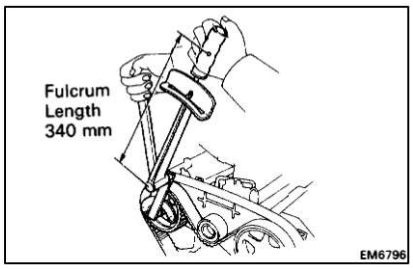
(d) Align the timing marks of the RH camshaft timing pulley and No.3 timing belt cover.

(e) Slide the RH camshaft timing pulley on the camshaft.

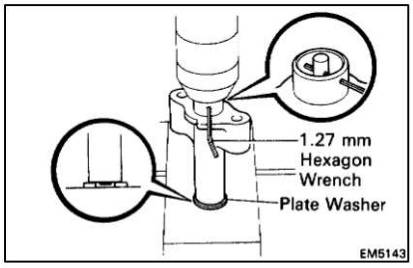
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(f) Using SST, align the knock pin hole of the camshaft with the knock pin groove of the pulley and install the knock pin.
SST 09278–54012

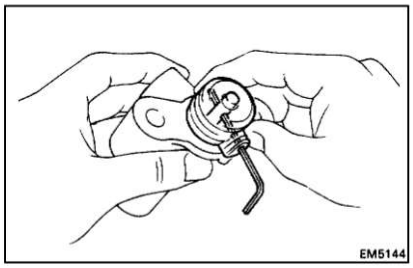


(g) Using SST, install and torque the bolt.
SST 09249–63010 and 09278–54012
Torque: 760 kg–cm (55 ft–lb, 75 N·m)
HINT: Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

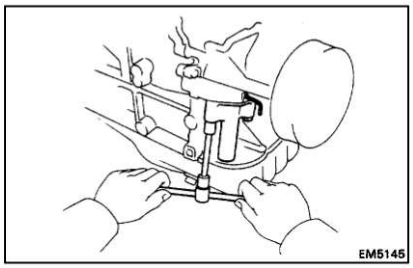


12. SET TIMING BELT TENSIONER

(a) Place a plate washer between the tensioner and a block.
(b) Using a press, slowly press in the push rod using 100–1,000 kg (220–2,205 lb, 981–9,807 N) of pressure.
(c) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
(d) Release the press.



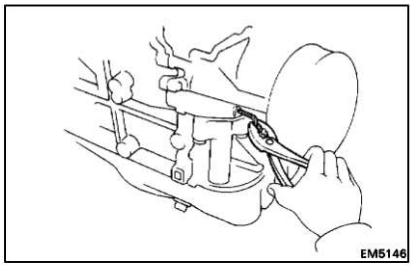
(e) Install the dust boot to the tensioner.



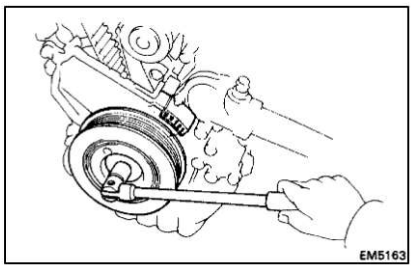
13. INSTALL TIMING BELT TENSIONER

(a) Install the tensioner with the two bolts.
Torque: 270 kg–cm (20 ft–lb, 26 N·m)

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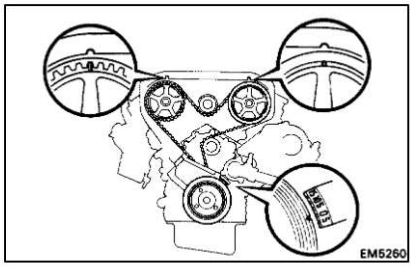
(b) Remove the 1.27 mm hexagon wrench from the tensioner.



14. CHECK VALVE TIMING

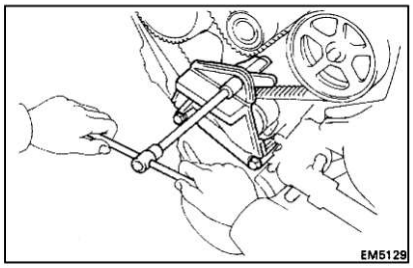
(a) Turn the crankshaft pulley two revolutions from TDC to TDC.

HINT: Always turn the crankshaft clockwise.



(b) Check that each pulley aligns with the timing marks as shown in the figure.

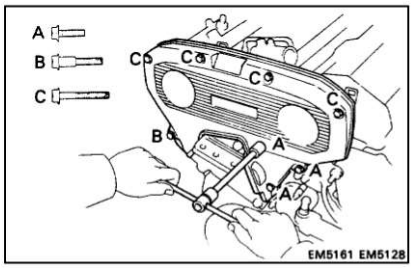
If the marks do not align, remove the timing belt and reinstall it.



15. INSTALL ENGINE RH MOUNTING BRACKET

Install the mounting bracket with the three bolt.

Torque: 410 kg–cm (30 ft–lb, 39 N·m)



16. INSTALL NO.2 TIMING BELT COVER

(a) Install the gasket to the timing belt cover.

(b) Install the timing belt cover with the eight bolts.

HINT: Use the bolts indicated by A, B and C.

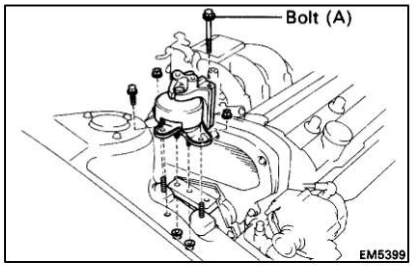
17. INSTALL SPARK PLUGS (See page IG–8)

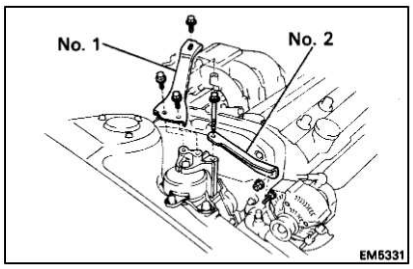
Torque: 180 kg–cm (13 ft–lb, 18 N·m)

18. INSTALL AIR INTAKE CHAMBER

(See steps 6 to 20 on pages FI–33 to 34)

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19. INSTALL RH ENGINE MOUNTING INSULATOR

(a) Attach the mounting insulator to the mounting bracket and body, temporarily install the mounting insulator four nuts, bolt the mounting stay bolt (A).

(b) Torque the mounting insulator with four nuts and bolt. Do not torque the mounting stay bolt (A) yet.

Torque:

Bolt		**650 kg–cm (47 ft–lb, 64 N·m)**
Nut	**To bracket**	**530 kg–cm (38 ft–lb, 52 N·m)**
	To body	**900 kg–cm (65 ft–lb, 88 N·m)**

(c) Install the two clamp bolts of the PS oil cooler pipes.

20. LOWER ENGINE

21. INSTALL RH ENGINE MOUNTING STAYS

(a) Install the No.1 mounting stay with the three bolts. Torque the bolts.

Torque: 530 kg–cm (38 ft–lb, 52 N·m)

(b) Install the No.2 mounting stay with the bolt and nut. Torque the bolt and nut.

Torque:

Bolt	**670 kg–cm (48 ft–lb, 66 N·m)**
Nut	**530 kg–cm (38 ft–lb, 52 N·m)**

22. INSTALL PS PUMP DRIVE BELT

Adjust the drive belt.

Drive belt tension:	**New belt**	**125 ± 20 lb**
	Used belt	**80 ± 25 lb**

23. INSTALL ALTERNATOR DRIVE BELT

Adjust the drive belt. (See pages MA–4)

Drive belt tension:	**New belt**	**175 ± 5 lb**
	Used belt	**115 ± 20 lb**

24. INSTALL RH FRONT FENDER APRON SEAL

25. INSTALL RH FRONT WHEEL

26. INSTALL PS OIL RESERVOIR TANK
(See step 6 on page EM–88)

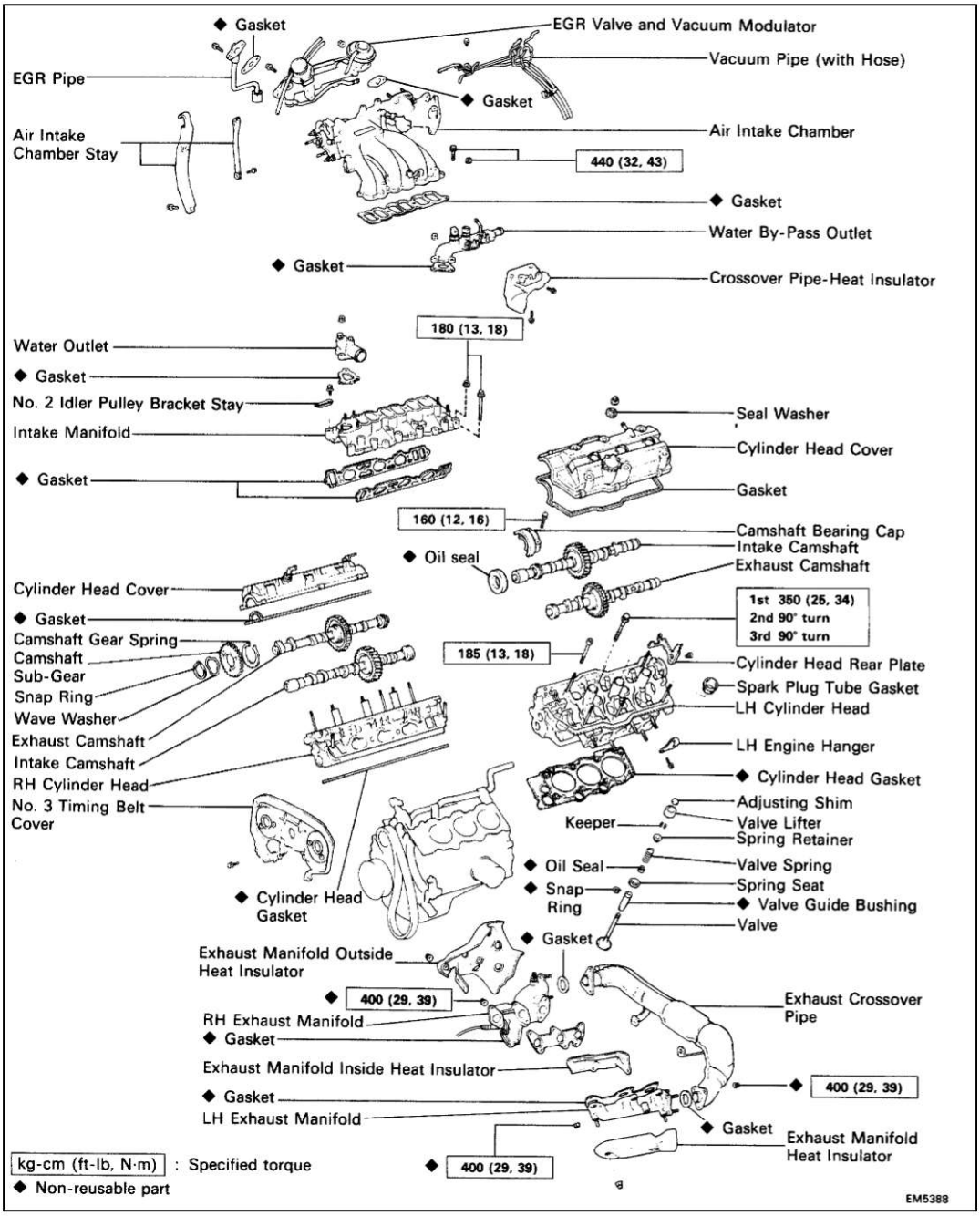
27. INSTALL CRUISE CONTROL ACTUATOR
(See step 27 on page EM–97)

28. INSTALL SUSPENSION UPPER BRACE
(See step 35 on page EM–98)

29. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

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CYLINDER HEADS
COMPONENTS

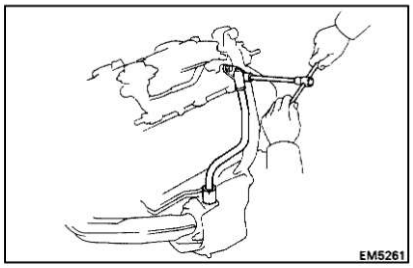


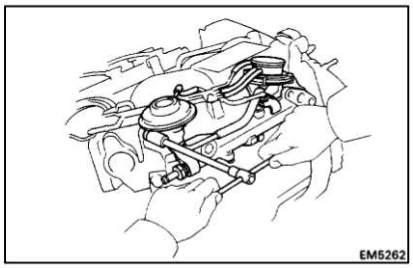
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REMOVAL OF CYLINDER HEADS

(See page EM–29)

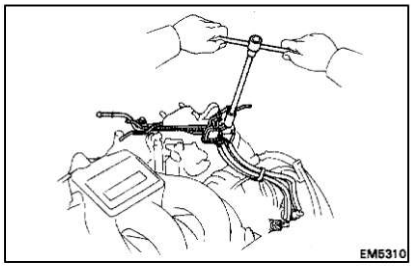
1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
   CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.
2. DRAIN ENGINE COOLANT (See page CO–5)
3. REMOVE SUSPENSION UPPER BRACE
   (See step 7 on page EM–63)
4. (A/T)
   DISCONNECT THROTTLE CABLE FROM THROTTLE BODY
5. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY
6. REMOVE CRUISE CONTROL ACTUATOR AND VACUUM PUMP (See step 15 on page EM–64)
7. REMOVE AIR CLEANER HOSE
   (a) Disconnect the following hoses:
      (1) ISC valve air hose
      (2) Vacuum pipe hose
   (b) Remove the air cleaner hose.
8. REMOVE ENGINE RH UNDER COVER
9. REMOVE SUSPENSION LOWER CROSSMEMBER
   (See step 27 on page EM–65)





10. REMOVE FRONT EXHAUST PIPE
    (See step 28 on page EM–65)
11. REMOVE ALTERNATOR (See page CH–8)
12. REMOVE ISC VALVE
    (See steps 3 to 5 on pages FI–44 and FI–45)
13. REMOVE THROTTLE BODY
    (See steps 6 and 7 on page FI–41)
14. REMOVE EGR PIPE
    (a) Loosen the union nut.
    (b) Remove the two bolts, EGR pipe and gasket.
15. REMOVE EGR VALVE AND VACUUM MODULATOR
    (a) Disconnect the four vacuum pipe hoses.
    (b) Remove the two bolts, two nuts, the EGR valve, vacuum modulator assembly and gasket.

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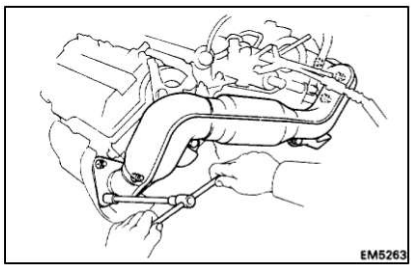
16. REMOVE VACUUM PIPE

(a) Disconnect the following hoses:
(1) Four BVSV vacuum hoses
(2) Fuel pressure VSV hose
(3) A/C control valve vacuum hose
(b) Remove the two bolts and vacuum pipe.

17. REMOVE DISTRIBUTOR (See page IG–10)

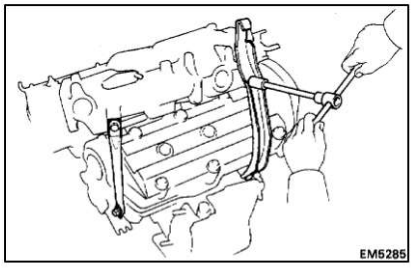
18. REMOVE EXHAUST CROSSOVER PIPE

Remove the six nuts, two bolts, crossover pipe and two gaskets.



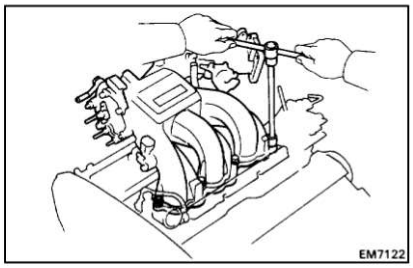
19. DISCONNECT COLD START INJECTOR CONNECTOR

20. REMOVE COLD START INJECTOR TUBE
(See step 3 on page FI–22)

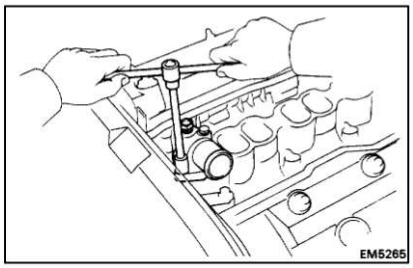


21. REMOVE AIR INTAKE CHAMBER

(a) Disconnect the following hoses:
(1) PCV hose
(2) Vacuum sensing hose
(3) Fuel pressure VSV hose
(4) A/C control valve vacuum hose
(5) (CALIF. only)
EGR gas temperature sensor connector
(b) Remove the four bolts and two intake chamber stays.
(c) Remove the two bolts, two nuts, intake chamber and two gaskets.



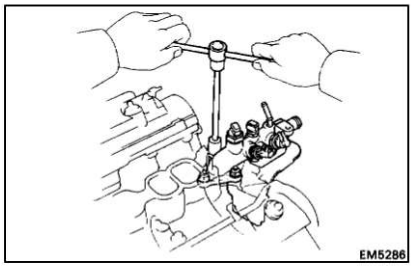
22. REMOVE DELIVERY PIPES AND INJECTORS
(See steps 15 to 19 on pages FI–29 and 30)



23. REMOVE WATER OUTLET

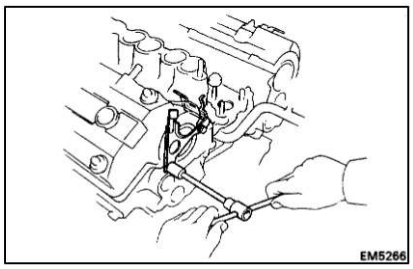
(a) Disconnect the following connector and hose:
(1) Water temperature sensor connector
(2) Radiator upper hose
(b) Remove the three nuts, water outlet and gasket.

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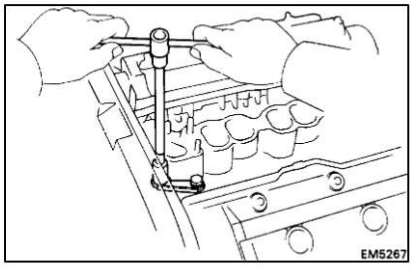
24. REMOVE WATER BY–PASS OUTLET

(a) Disconnect the following connectors and hose:
  (1) Cold start injector time switch connector
  (2) Water temperature sensor connector
  (3) Heater water by–pass hose
(b) Remove the three nuts, water by–pass outlet and gasket.
(c) Remove the two bolts and crossover pipe heat insulator from the water by–pass outlet.



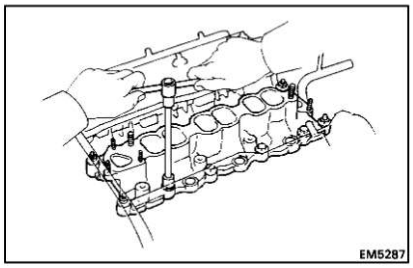
25. REMOVE CYLINDER HEAD REAR PLATE

Remove the two bolts and rear plate.

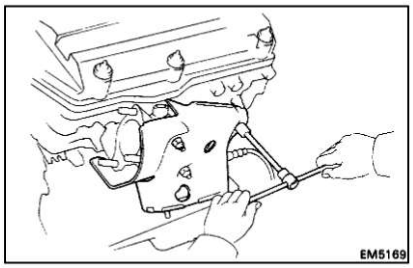


26. REMOVE INTAKE MANIFOLD

(a) Remove the two bolts and No.2 idler pulley bracket stay.



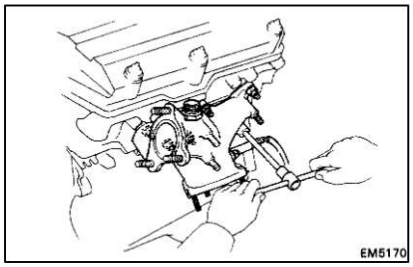
(b) Remove the eight bolts, four nuts, intake manifold and two gaskets.



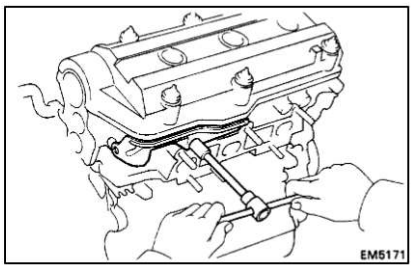
27. REMOVE RH EXHAUST MANIFOLD

(a) Disconnect the main oxygen sensor connector.
(b) Remove the three nuts and outside heat insulator.

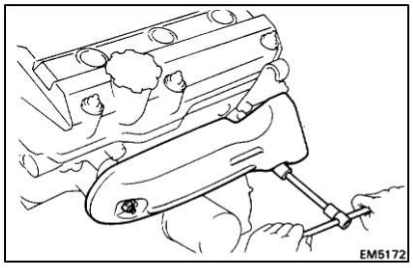
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(c) Remove the six nuts, exhaust manifold and gasket.

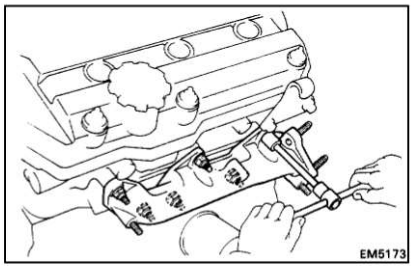


(d) Remove the bolt and inside heat insulator.



28. REMOVE LH EXHAUST MANIFOLD

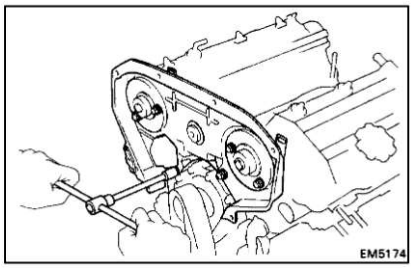
(a) Remove the two nuts and heat insulator.



(b) Remove the six nuts, exhaust manifold and gasket.

29. REMOVE SPARK PLUGS (See page IG–7)

30. REMOVE TIMING BELT, CAMSHAFT TIMING PULLEYS AND NO.2 IDLER PULLEY
(See steps 3 to 19 on pages EM–15 to 18)



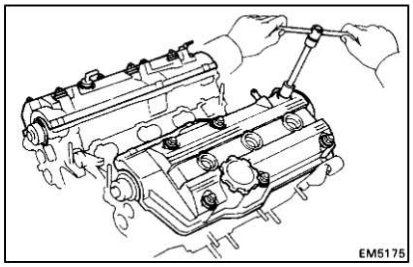
31. REMOVE NO.3 TIMING BELT COVER

Remove the six bolts and timing belt cover.

NOTICE:

- **Support the belt, so the meshing of the crankshaft timing pulley and timing belt does not shift.**
- **Be careful not to drop anything inside of the timing belt cover.**
- **Do not allow the belt to come into contact with oil, water or dust.**

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32. REMOVE CYLINDER HEAD COVERS

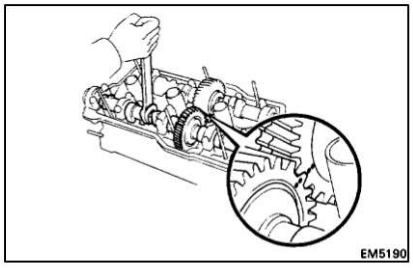
Remove the six nuts, seal washers, cylinder head cover and gasket. Remove the two cylinder head covers.

33. REMOVE SPARK PLUG TUBE GASKETS

Remove the six tube gaskets.

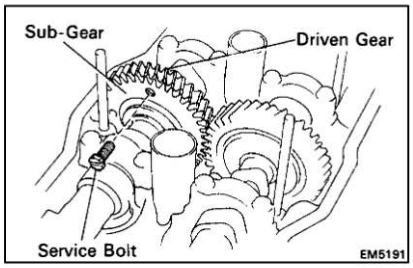
34. REMOVE CAMSHAFTS

NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be held level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



A. Remove exhaust camshaft of RH cylinder head

(a) Align the timing marks (two pointed marks) of the camshaft drive and driven gears by turning the camshaft with a wrench.

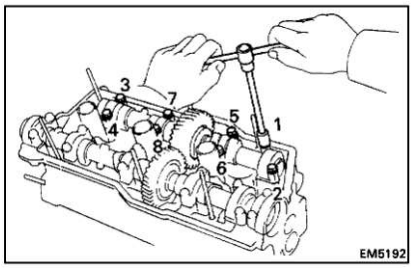


(b) Secure the exhaust camshaft sub–gear to the driven gear with a service bolt.

Recommended service bolt:

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16–20 mm (0.63–0.79 in.)

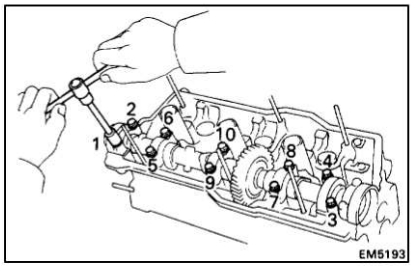
HINT: When removing the camshaft, make certain that the torsional spring force of the sub–gear has been eliminated by the above operation.



(c) Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.

(d) Remove the four bearing caps and exhaust camshaft.

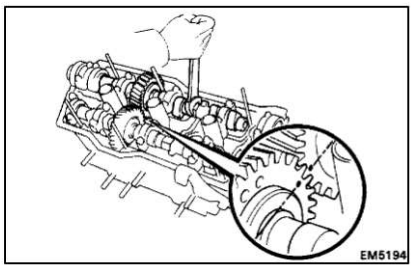
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B. Remove intake camshaft of RH cylinder head

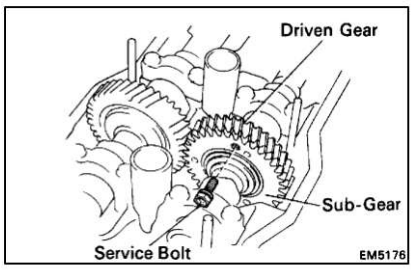
(a) Uniformly loosen and remove the ten bearing cap bolts in several passes in the sequence shown.

(b) Remove the five bearing caps, oil seal and intake camshaft.



C. Remove exhaust camshaft of LH cylinder head

(a) Align the timing marks (one pointed mark) of the camshaft drive and driven gears by turning the camshaft with a wrench.

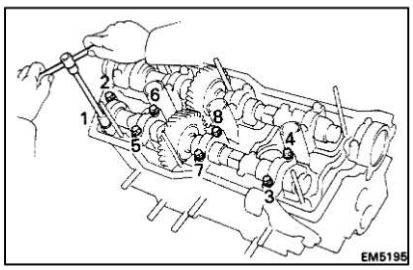


(b) Secure the exhaust camshaft sub–gear to the driven gear with a service bolt.

Recommended service bolt:

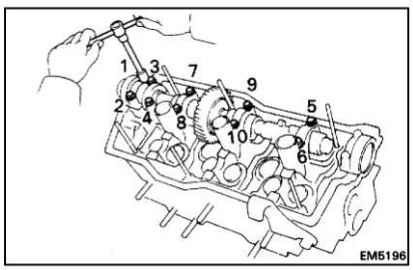
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16–20 mm (0.63–0.79 in.)

HINT: When removing the camshaft, make certain that the torsional spring force of the sub–gear has been eliminated by the above operation.



(c) Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.

(d) Remove the four bearing caps and exhaust camshaft.

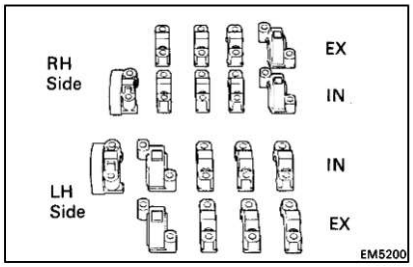


D. Remove intake camshaft of LH cylinder head

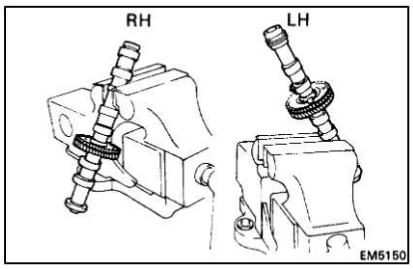
(a) Uniformly loosen and remove the ten bearing cap bolts in several passes in the sequence shown.

(b) Remove the five bearing caps, oil seal and intake camshaft.

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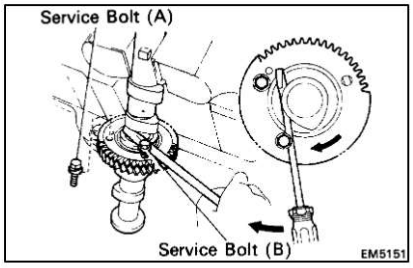
HINT: Arrange the bearing caps incorrect order.



35. DISASSEMBLE EXHAUST CAMSHAFTS

(a) Mount the hexagonal wrench head portion of the camshaft in a vise.

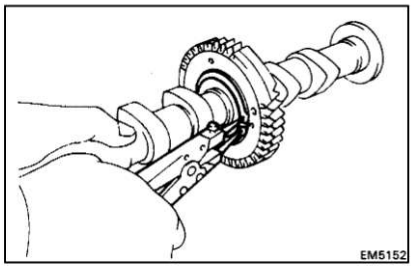
NOTICE: Be careful not to damage the camshaft.



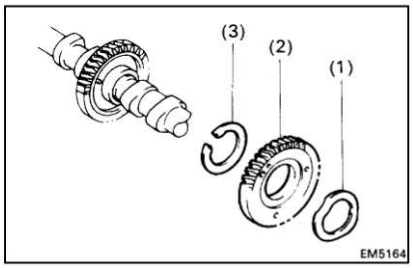
(b) Insert a service bolt (A) into the service hole of the camshaft sub–gear.

(c) Using a screwdriver, turn the sub–gear clockwise, and remove the service bolt (B).

NOTICE: Be careful not to damage the camshaft.



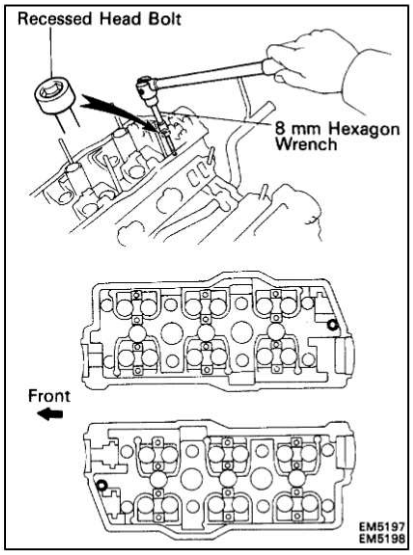
(d) Using snap ring pliers, remove the snap ring.



(e) Remove the following parts:
(1) Wave washer
(2) Camshaft sub–gear
(3) Camshaft gear spring

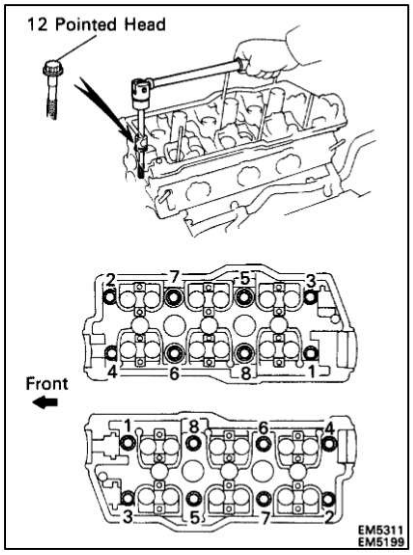
HINT: Arrange the camshaft sub–gears and gear springs (RH and LH).

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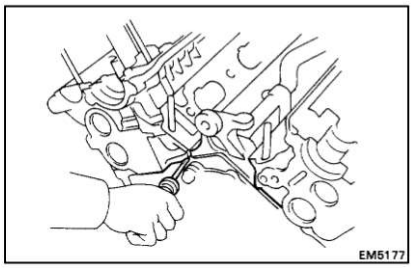
36. REMOVE CYLINDER HEADS

(a) Using a 8 mm hexagon wrench, remove the cylinder head (recessed head) bolts.



(b) Uniformly loosen and remove the cylinder head (12 pointed head) bolts in several passes in the sequence shown.

NOTICE: Head warpage or cracking could result from removing bolts in an incorrect order.

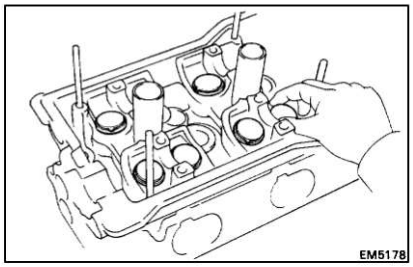


(c) Lift the cylinder head from the dowels on the cylinder block and place the two cylinder heads on wooden blocks on a bench.

HINT: If the cylinder head is difficult to lift off, pry with a screwdriver between the cylinder head and cylinder block.

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

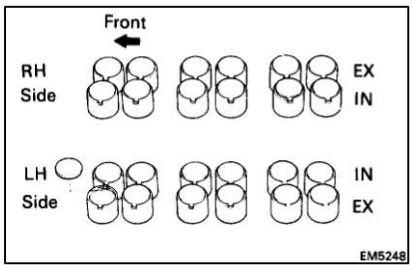
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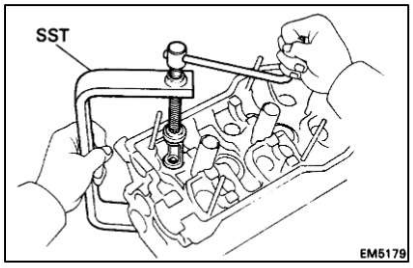
DISASSEMBLY OF CYLINDER HEADS

(See page EM–29)

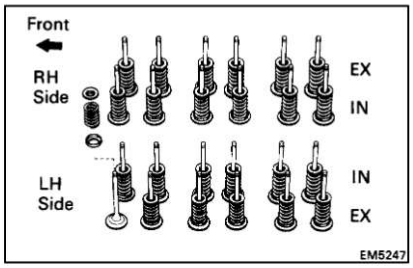
1. **REMOVE VALVE LIFTERS AND SHIMS**



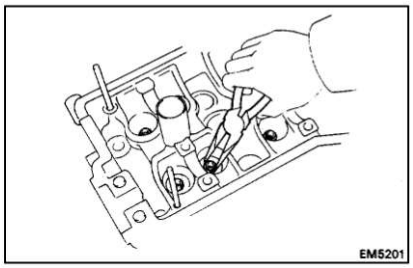
HINT: Arrange the valve lifters and shims in correct order.



2. **REMOVE VALVES**
   (a) Using SST, compress the valve spring and remove the two keepers.
   SST 09202–70010
   (b) Remove the spring retainer, valve spring, valve and spring seat.

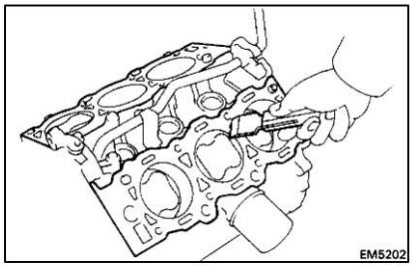


HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.



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

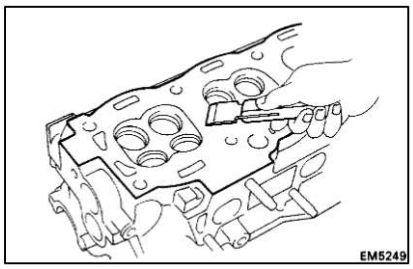
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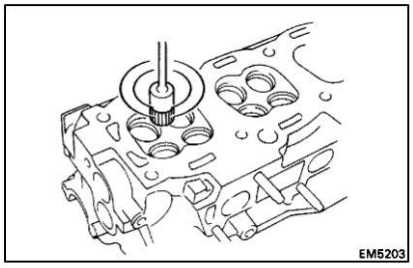
INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

1. **CLEAN TOP OF PISTONS AND TOP OF 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 surfaces.
   (b) Using a gasket scraper, remove all the gasket material from the top surfaces of the cylinder block.
   (c) Using compressed air, blow carbon and oil from the bolt holes.

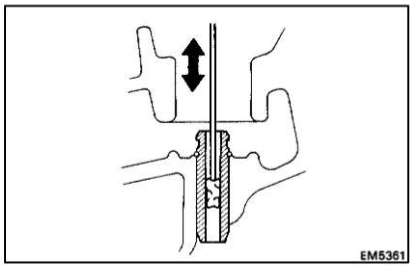
   CAUTION: Protect your eyes when using high–pressure compressed air.



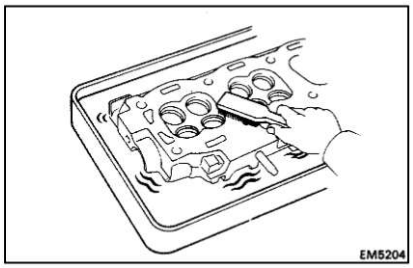
2. **REMOVE GASKET MATERIAL**
   Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.
   NOTICE: Be careful not to scratch the surfaces.



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.

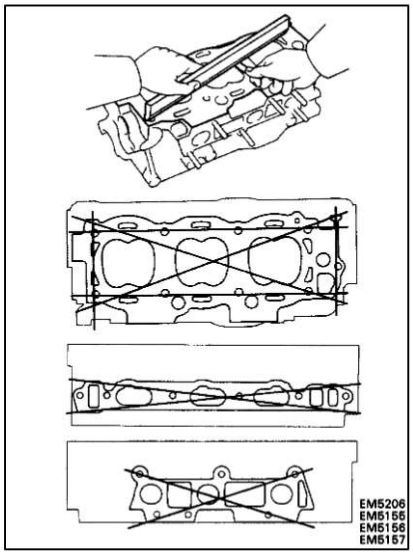


4. **CLEAN VALVE GUIDE BUSHINGS**
   Using a valve guide bushing brush and solvent, clean all the guide bushings.



5. **CLEAN CYLINDER HEADS**
   Using a soft brush and solvent, thoroughly clean the cylinder heads.

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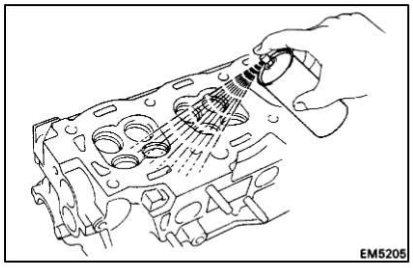


6. INSPECT CYLINDER HEADS FOR FLATNESS

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

Maximum warpage: 0.10 mm (0.0039 in.)

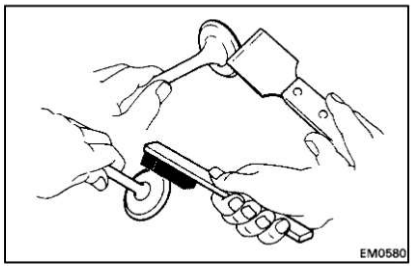
If warpage is greater than maximum, replace the cylinder head.



7. INSPECT CYLINDER HEAD FOR CRACKS

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

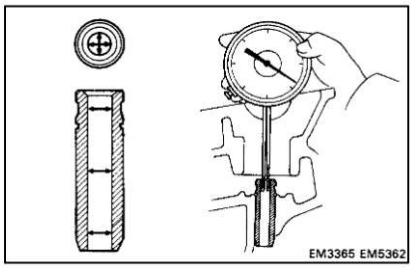
If cracked, replace the cylinder head.



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.



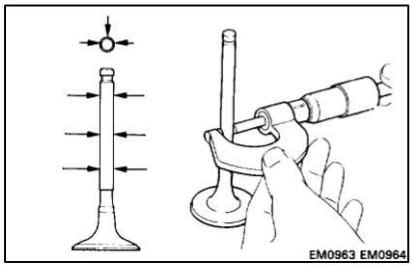
9. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

6.010–6.030 mm (0.2366–0.2374 in.)

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

Valve stem diameter:

Intake	**5.970–5.985 mm (0.2350–0.2356 in.)**
Exhaust	**5.965–5.980 mm (0.2348–0.2354 in.)**

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

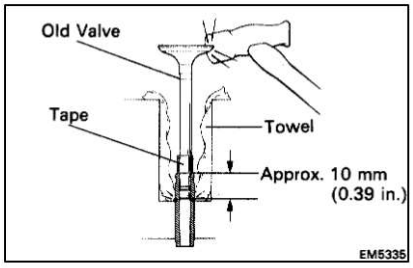
Standard oil clearance:

Intake	**0.025–0.060 mm (0.0010–0.0024 in.)**
Exhaust	**0.030–0.065 mm (0.0012–0.0026 in.)**

Maximum oil clearance:

Intake	**0.08 mm (0.0031 in.)**
Exhaust	**0.10 mm (0.0039 in.)**

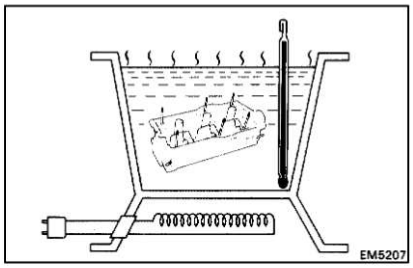
If the clearance is greater than maximum, replace the valve and guide bushing.



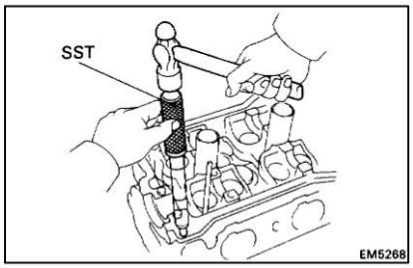
10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

(a) Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer.

NOTICE: Be careful not to damage the valve lifter hole.

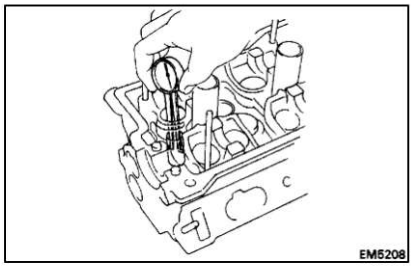


(b) Gradually heat the cylinder head to 80–1005C (176–212°F).



(c) Using SST and a hammer, tap out the guide bushing.
SST 09201–70010

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

Both intake and exhaust

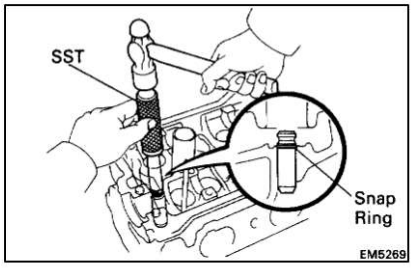
Bushing bore diameter mm (in.)	Bushing size
11.000–11.027 (0.4331–0.4342)	Use STD
11.050–11.077 (0.4350–0.4361)	Use O/S 0.05

(e) Select a new guide bushing (STD size or O/S 0.05).

If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to the following dimension:

11.050–11.077 mm (0.4350–0.4361 in.)

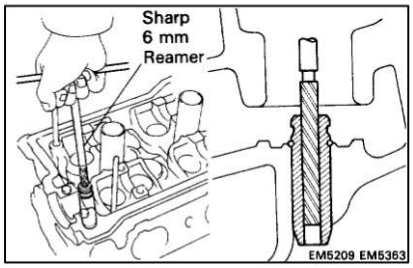
If the bushing bore diameter of the cylinder head is greater than 11.077 mm (0.4361 in.), replace the cylinder head.



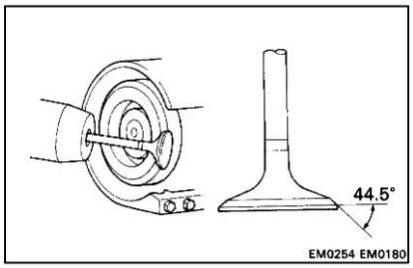
(f) Gradually heat the cylinder head to 80–1005C (176–2125F).

(g) Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.

SST 09201–70010



(h) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM–41) between the guide bushing and valve stem.



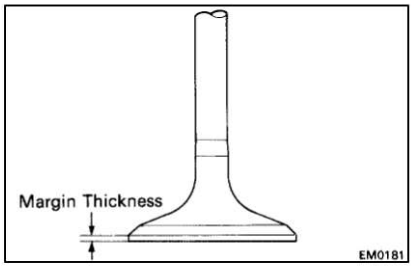
11. INSPECT AND GRIND VALVES

(a) Grind the valve enough to remove pits and carbon.

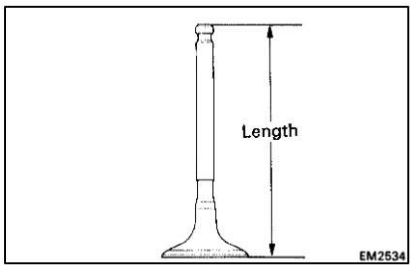
(b) Check that the valve is ground to the correct valve face angle.

Valve face angle: 44.5°

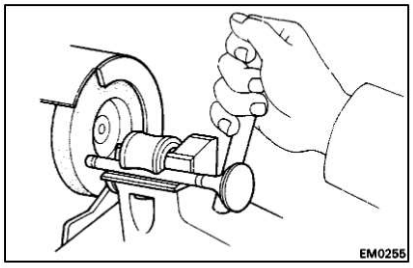
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(c) Check the valve head margin thickness.
Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.5 mm (0.020 in.)
If the margin thickness is less than minimum, replace the valve.

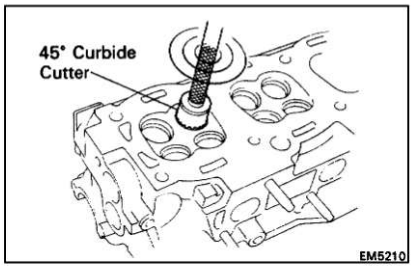


(d) Check the valve overall length.
Standard overall length:
Intake 96.1 mm (3.783 in.)
Exhaust 96.2 mm (3.787 in.)
Minimum overall length:
Intake 95.6 mm (3.764 in.)
Exhaust 95.7 mm (3.768 in.)
If the overall length is less than minimum, replace the valve.

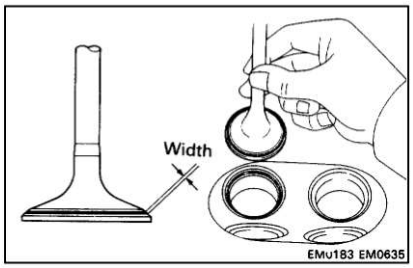


(e) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.
NOTICE: Do not grind off more than the minimum.

12. INSPECT AND CLEAN VALVE SEATS

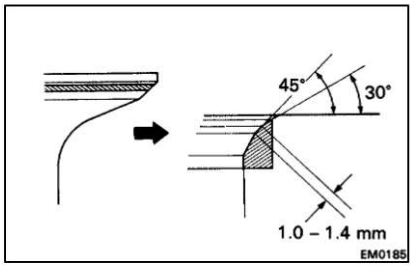


(a) Using a 45° carbide cutter, resurface the valve seats.
Remove only enough metal to clean the seats.



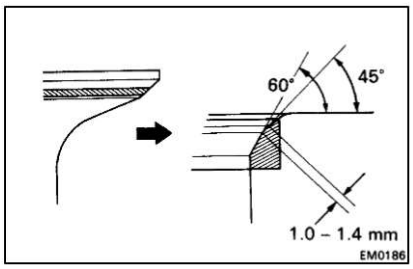
(b) Check the valve seating position.
Apply a thin coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate the valve.
(c) Check the valve face and seat for the following:
- If blue appears 360° around the face, the valve is concentric. If not, 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.)

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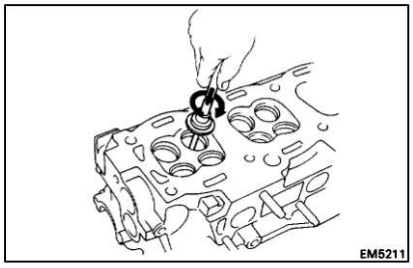


If not, correct the valve seats as follows:

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

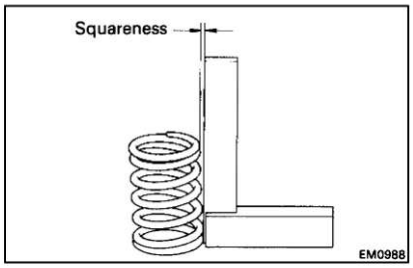


(2) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



(d) Hand–lap the valve and valve seat with an abrasive compound.

(e) After hand–lapping, clean the valve and valve seat.

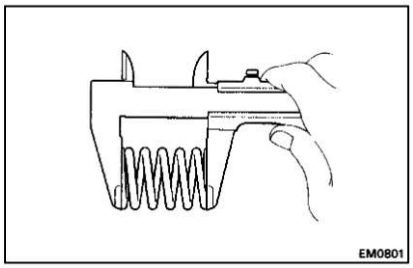


13. INSPECT VALVE SPRINGS

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

Maximum squareness: 2.0 mm (0.075 in.)

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

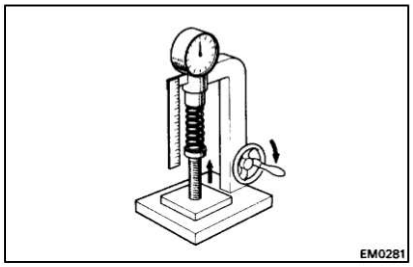


(b) Using vernier calipers, measure the free length of the valve spring.

Free length: 42.6 mm (1.677 in.)

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

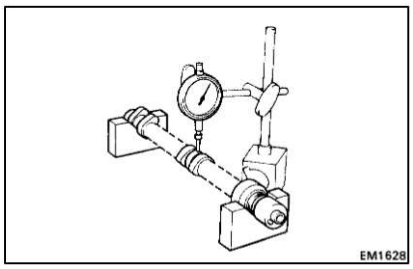
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(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:
18.6–21.4 kg (41.0–47.2 lb, 182–210 N)
at 33.8 mm (1.331 in.)

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



14. INSPECT CAMSHAFTS AND BEARINGS

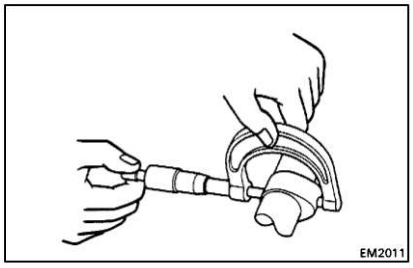
A. Inspect camshaft for runout

(a) Place the camshaft on V–blocks.

(b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.06 mm (0.0024 in.)

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



B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

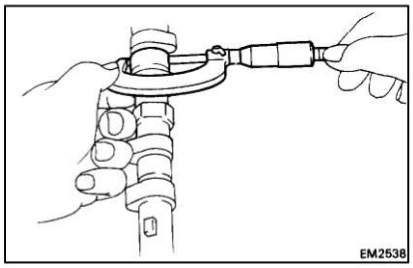
Standard cam lobe height:

Intake	**39.510–39.610 mm (1.5555–1.5594 in.)**
Exhaust	**38.960–39.060 mm (1.5339–1.5378 in.)**

Minimum cam lobe height:

Intake	**39.36 mm (1.5496 in.)**
Exhaust	**38.81 mm (1.5279 in.)**

If the cam lobe height is greater than maximum, replace the camshaft.

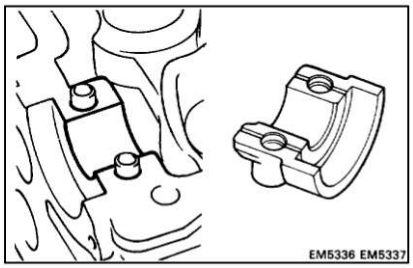


C. Inspect camshaft journals

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 oil clearance.

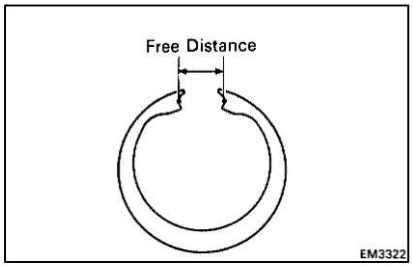


D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

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

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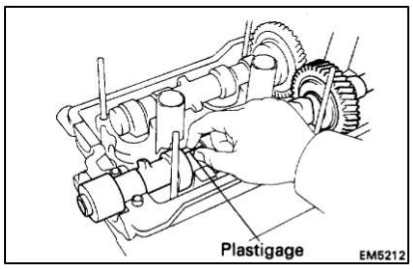


E. Inspect camshaft gear spring

Using vernier calipers, measure the free distance between the spring end.

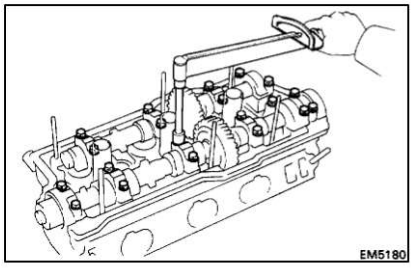
Free distance: 18.2–18.8 mm (0.712–0.740 in.)

If the free distance is not as specified, replace the gear spring.



F. Inspect camshaft journal oil clearance

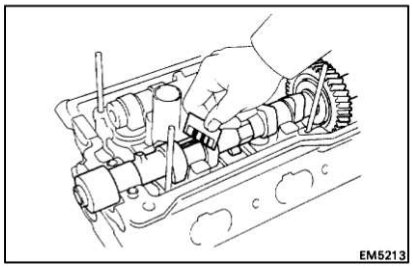
(a) Clean the bearing caps and camshaft journals.
(b) Place the camshafts on the cylinder head.
(c) Lay a strip of Plastigage across each of the camshaft journals.



(d) Install the bearing caps.
(See step 4 on pages EM–52 to 55)

Torque: 160 kg–cm (12 ft–lb, 16 N–m)

NOTICE: Do not turn the camshaft.



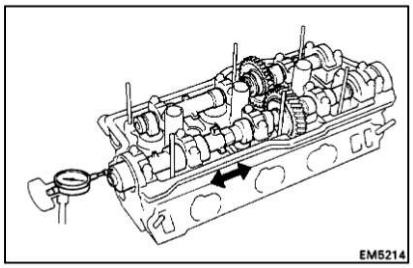
(e) Remove the bearing caps.
(f) Measure the Plastigage at its widest point.

Standard oil clearance: 0.035–0.072 mm (0.0014–0.0028 in.)

Maximum oil clearance: 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.



G. Inspect camshaft thrust clearance

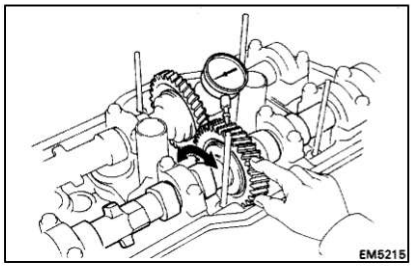
(a) Install the camshafts.
(See step 4 on pages EM–52 to EM–55)
(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance: 0.030–0.080 mm (0.0012–0.0031 in.)

Maximum thrust clearance: 0.12 mm (0.0047 in.)

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

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H. Inspect camshaft gear backlash

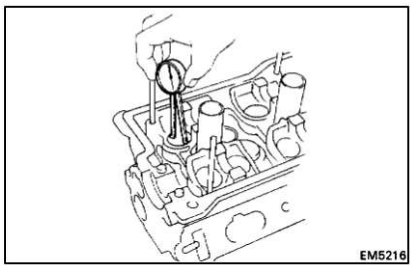
(a) Install the camshafts without installing the exhaust camshaft sub–gear.
(See step 4 on pages EM–52 to 55)

(b) Using a dial indicator, measure the backlash.

Standard backlash: **0.020–0.200 mm (0.0008–0.0079 in.)**

Maximum backlash: **0.30 mm (0.0188 in.)**

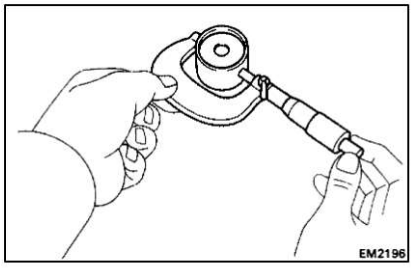
If the backlash is greater than maximum, replace the camshafts.



15. INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter: **28.000–28.021 mm (1.1024–1.1032 in.)**



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

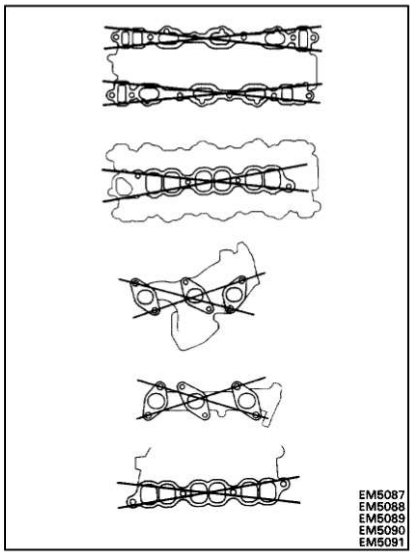
Lifter diameter: **27.975–27.985 mm (1.1014–1.1018 in.)**

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

Standard oil clearance: **0.015–0.046 mm (0.0005–0.0018 in.)**

Maximum oil clearance: **0.07 mm (0.0028 in.)**

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



16. INSPECT INTAKE MANIFOLD, EXHAUST MANIFOLDS AND AIR INTAKE CHAMBER

(a) (Intake Manifold)
Using precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head and air intake chamber for warpage.

Maximum warpage: **0.10 mm (0.0039 in.)**

If warpage is greater than maximum, replace the intake manifold.

(b) (Exhaust Manifolds)
Measure the surfaces contacting the cylinder head for warpage.

Maximum warpage: **1.00 mm (0.0394 in.)**

If warpage is greater than maximum, replace the exhaust manifold.

(c) (Air Intake Chamber)
Measure the surfaces contacting the intake manifold for warpage.

Maximum warpage: 0.10 mm (0.0039 in.)

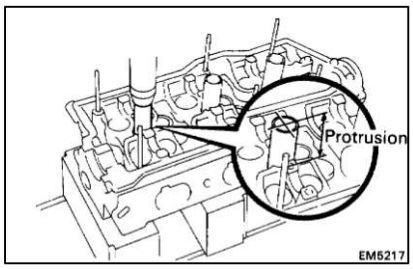
If warpage is greater than maximum, replace the air intake chamber.

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ASSEMBLY OF CYLINDER HEADS

(See page EM–29)

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.

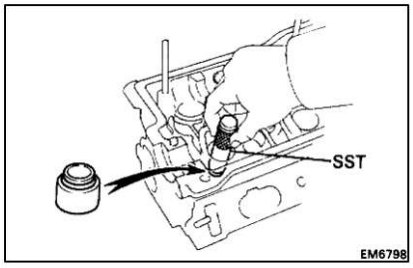


1. INSTALL SPARK PLUG TUBES

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

Using a press, press in a new spark plug tube until there is 45.5–45.9 mm (1.791–1.807 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

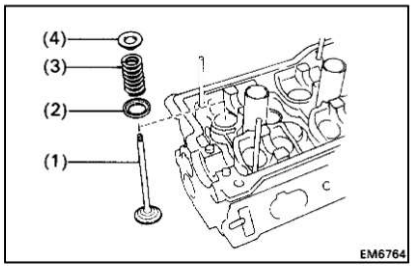
NOTICE: Avoid pressing a new spark plug tube in too far by measuring the amount of protrusion while pressing.



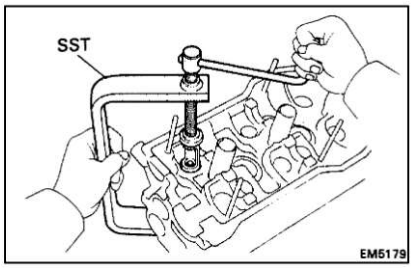
2. INSTALL VALVES

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

SST 09201–41020



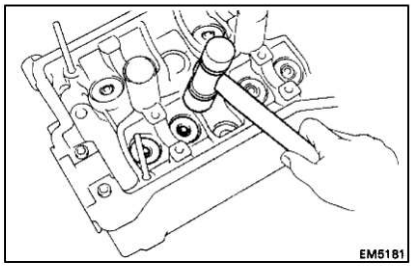
(b) Install the following parts:
- (1) Valve
- (2) Spring seat
- (3) Valve spring
- (4) Spring retainer



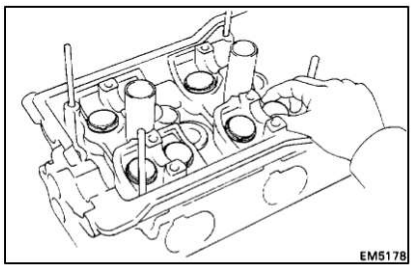
(c) Using SST, compress the valve spring and place the two keepers around the valve stem.

SST 09202–70010

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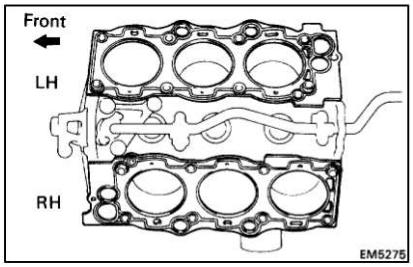
(c) Using a plastic–faced hammer, lightly tap the valve stem tip to assure proper fit.



3. INSTALL VALVE LIFTERS AND SHIMS

Check the valve lifter rotates smoothly by hand.

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INSTALLATION OF CYLINDER HEADS

(See page EM–29)

1. INSTALL CYLINDER HEADS

A. Place cylinder head on cylinder block

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

NOTICE: Be careful of the installation direction.

(b) Place the cylinder head in position on the cylinder head gasket.

B. Install cylinder head (12 pointed head) bolts

HINT:

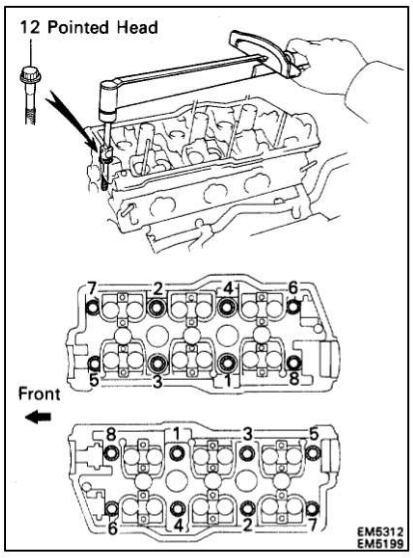
- The cylinder head bolts are tightened in three progressive steps (steps (b), (d) and (e)).
- If any bolts is broken or deformed, replace it.

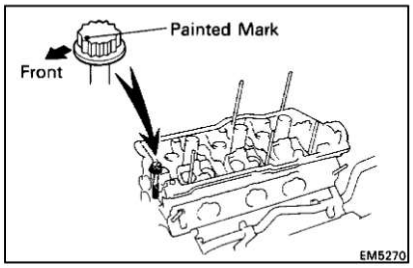
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

(b) Install and uniformly tighten the cylinder head bolts in several passes in the sequence shown.

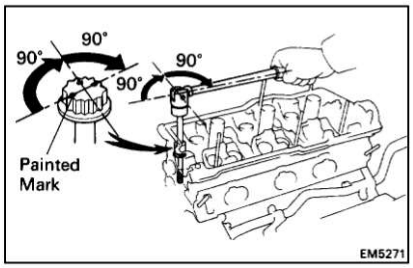
Torque: 350 kg–cm (25 ft–lb, 34 N·m)

If any one of the bolts does not meet the torque specification, replace the bolt.





(c) Mark the front of the cylinder head bolt head with paint.

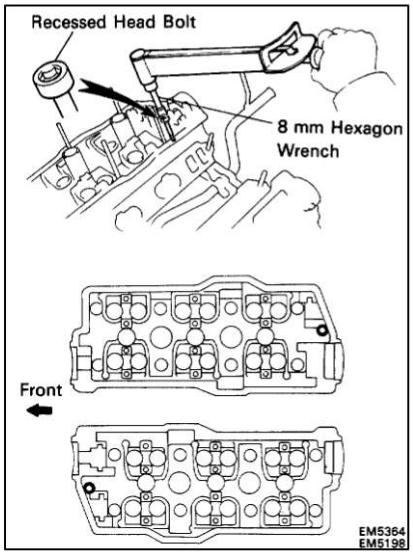


(d) Retighten the cylinder head bolts 90° in the numerical order shown.

(e) Retighten cylinder head bolts by an additional 90°.

(f) Check that the painted mark is now facing rearward.

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C. Install cylinder head (recessed head) bolts

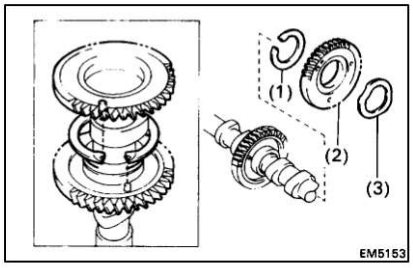
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

(b) Using a 8 mm hexagon wrench, install the cylinder head bolts.

Torque: 185 kg–cm (13 ft–lb, 18 N·m)

2. INSTALL LH ENGINE HANGER

Torque: 380 kg–cm (27 ft–lb, 37 N·m)



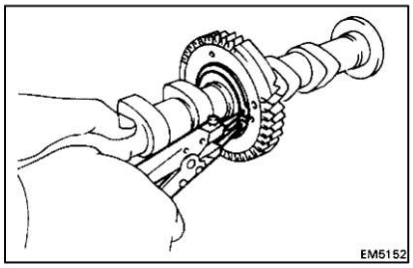
3. ASSEMBLE EXHAUST CAMSHAFTS

(a) Install the following parts:

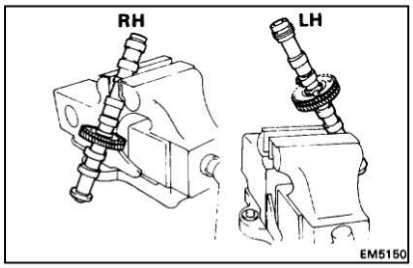
(1) Camshaft gear spring

(2) Camshaft sub–gear

(3) Wave washer



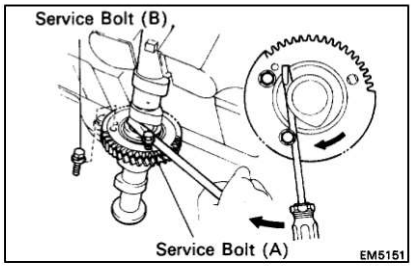
(b) Using snap ring pliers, install the snap ring.



(c) Mount the hexagonal wrench head portion of the camshaft in a vise.

NOTICE: Be careful not to damage the camshaft.

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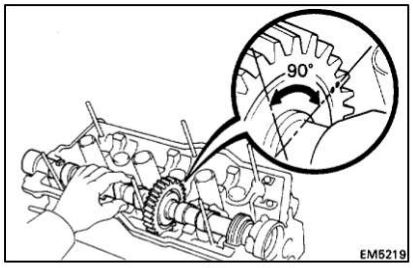


(d) Insert a service bolt (A) into the service hole of the camshaft sub–gear.
(e) Using a screwdriver, align the holes of the camshaft driven gear and sub–gear by turning camshaft subgear clockwise, and install a service bolt (B).

NOTICE: Be careful not to damage the camshaft.

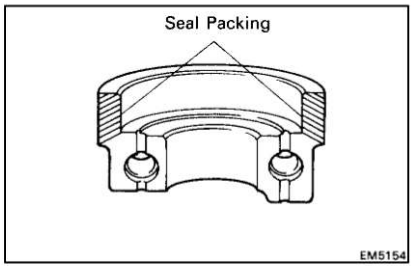
4. INSTALL CAMSHAFTS

NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be held level while it is being installed. If the camshaft is not level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

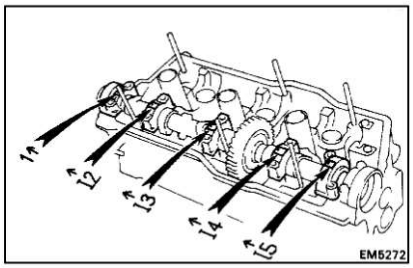


A. Install intake camshaft of RH cylinder head

(a) Apply MP grease to the thrust portion of the camshaft.
(b) Place the intake camshaft at 905 angle of timing mark (two pointed marks) on the cylinder head.

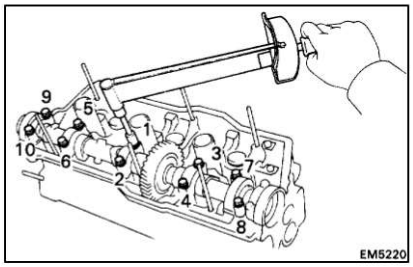


(c) Apply seal packing to the No.1 bearing cap as shown.
Seal packing: Part No. 08826–00080 or equivalent



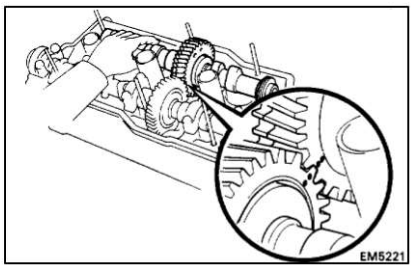
(d) Install the five bearing caps in their proper locations.

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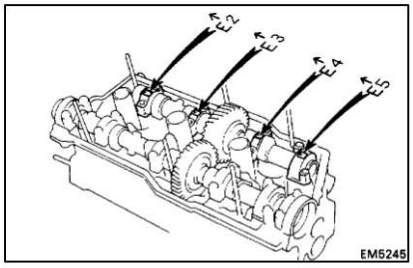
(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(f) Install and uniformly tighten the ten bearing cap bolts in several passes in the sequence shown.

Torque: 160 kg–cm (12 ft–lb, 16 N·m)

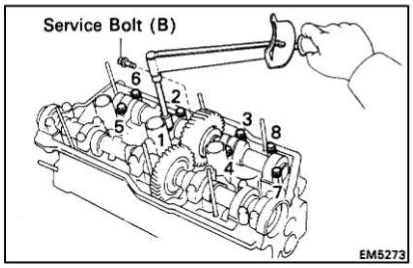


B. Install exhaust camshaft of RH cylinder head

(a) Apply MP grease to the thrust portion of the camshaft.
(b) Align the timing marks (two pointed marks) of the camshaft drive and driven gears.
(c) Place the exhaust camshaft on the cylinder head.



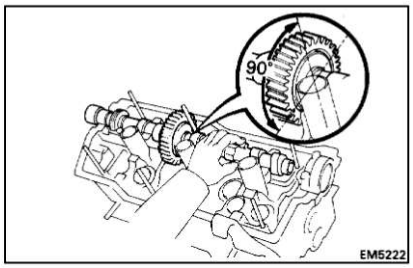
(d) Install the four bearing caps in their proper locations.



(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(f) Install and uniformly tighten the eight bearing cap bolts in several passes in the sequence shown.

Torque: 160 kg–cm (12 ft–lb, 16 N·m)

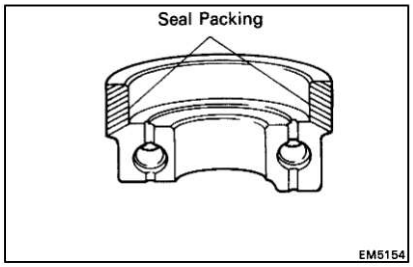
(g) Remove the service bolt (B).



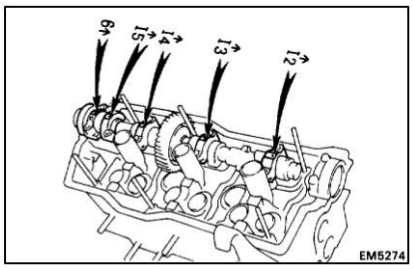
C. Install intake camshaft of LH cylinder head

(a) Apply MP grease to the thrust portion of the camshaft.
(b) Place the intake camshaft at 90° angle of timing mark (one pointed mark) on the cylinder head.

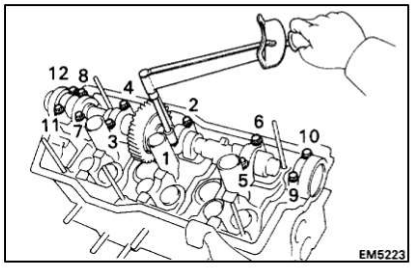
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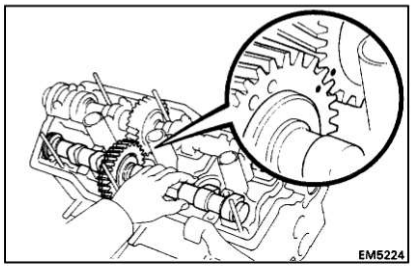
(c) Apply seal packing to the No.1 bearing cap as shown.
Seal packing: Part No. 08826–00080 or equivalent



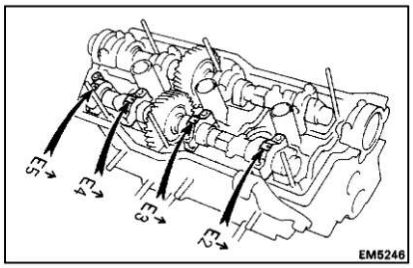
(d) Install the five bearing caps in their proper locations.



(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(f) Install and uniformly tighten the ten bearing cap bolts in several passes in the sequence shown.
Torque: 160 kg–cm (12 ft–lb, 16 N·m)

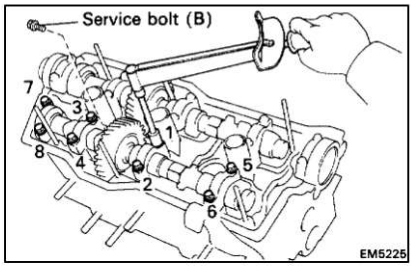


D. Install exhaust camshaft of LH cylinder head
(a) Apply MP grease to the thrust portion of the camshaft.
(b) Align the timing marks (one pointed mark) of the camshaft drive and driven gears.
(c) Place the intake camshaft on the cylinder head.



(d) Install the four bearing caps in their proper locations.

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(e) Apply a light coat of engine oil on the threads and under the heads of bearing cap bolts.
(f) Install and uniformly tighten the eight bearing cap bolts in several passes in the sequence shown.

Torque: 160 kg–cm (12 ft–lb, 16 N·m)

(g) Remove the service bolt (B).

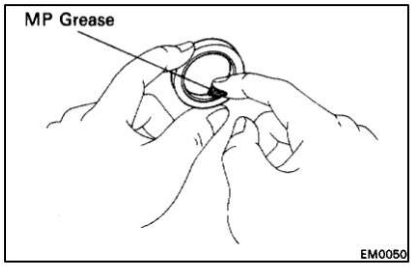
5. CHECK AND ADJUST VALVE CLEARANCE

(See page EM–9)

Turn the camshaft and position the cam lobe upward, and check and adjust the valve clearance.

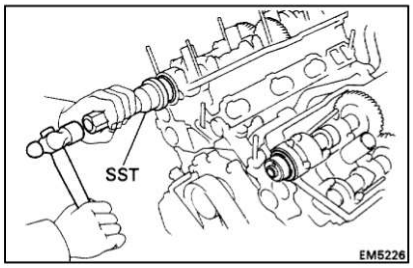
Valve clearance (Cold):

Intake	**0.13–0.23 mm (0.005–0.009 in.)**
Exhaust	**0.27–0.37 mm (0.011–0.015 in.)**



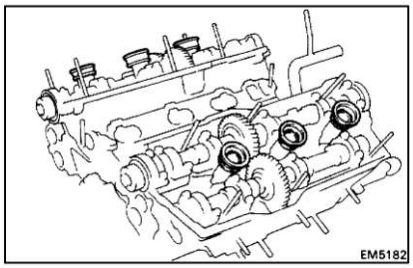
6. INSTALL CAMSHAFT OIL SEALS

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



(b) Using SST, tap in the oil seals.

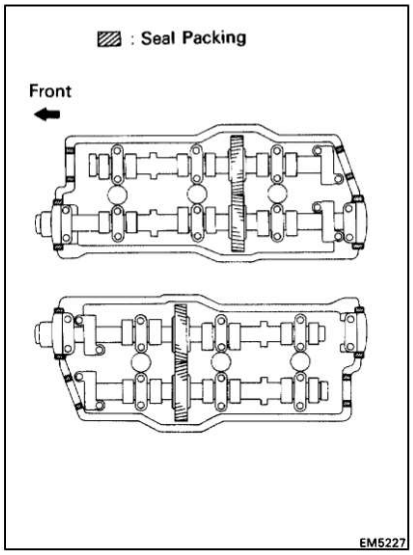
SST 09223–46011



7. INSTALL SPARK PLUG TUBE GASKETS

Install the six tube gaskets.

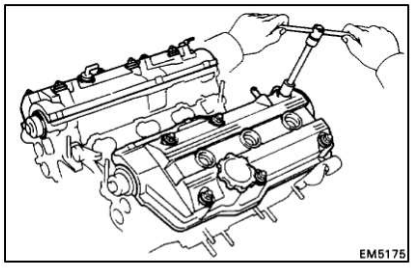
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8. INSTALL CYLINDER HEAD COVERS

(a) Apply seal packing to the cylinder heads as shown in the figure.

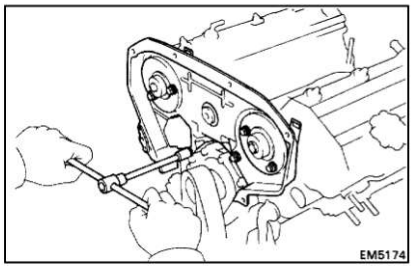
Seal packing: Part No. 08826–00080 or equivalent



(b) Install the gasket to the cylinder head cover.

(c) Install the cylinder head cover with the six seal washers and nuts. Install the two cylinder head covers.

Torque: 60 kg–cm (52 in.–lb, 5.9 N·m)



9. INSTALL NO.3 TIMING BELT COVER

Install the timing belt cover with the six bolts.

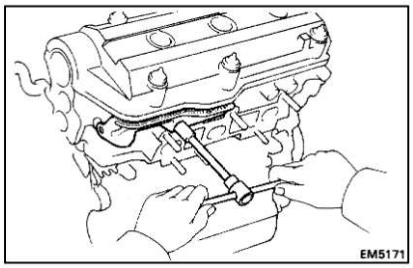
Torque: 75 kg–cm (65 in.–lb, 7.4 N·m)

10. INSTALL NO.2 IDLER PULLEY, CAMSHAFT TIMING PULLEYS AND TIMING BELT

(See steps 7 to 26 on pages EM–24 to 28)

11. INSTALL SPARK PLUGS (See page IG–8)

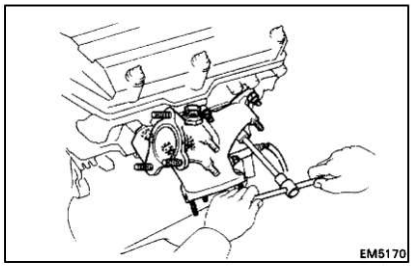
Torque: 180 kg–cm (13 ft–lb, 18 N·m)



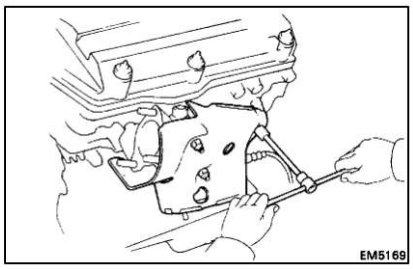
12. INSTALL RH EXHAUST MANIFOLD

(a) Install the inside heat insulator with the bolt.

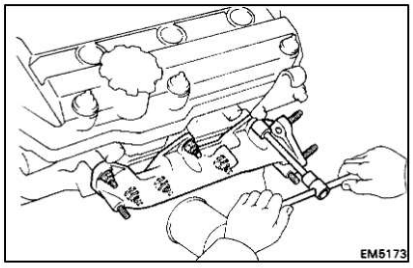
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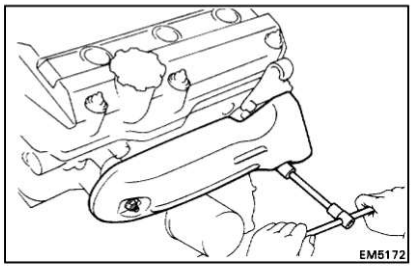
(b) Install a new gasket and the exhaust manifold with six new nuts, Uniformly tighten the nuts in several passes.
Torque: 400 kg–cm (29 ft–lb, 39 N·m)



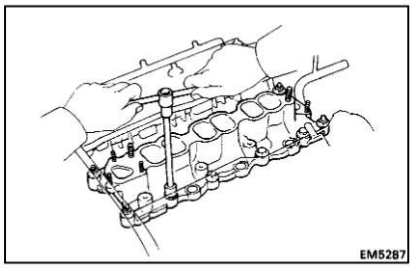
(c) Install the outside heat insulator with the three nuts.
(d) Connect the oxygen sensor connector.



13. INSTALL LH EXHAUST MANIFOLD
(a) Install a new gasket and the exhaust manifold with six new nuts, Uniformly tighten the nuts in several passes.
Torque: 400 kg–cm (29 ft–lb, 39 N·m)

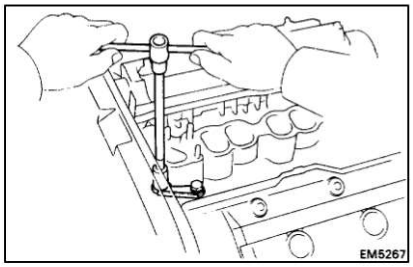


(b) Install the heat insulator with the two nuts.



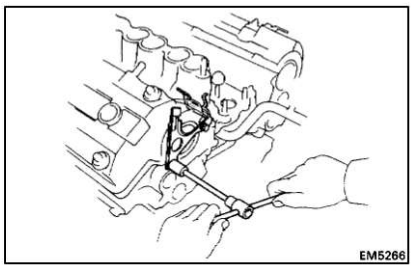
14. INSTALL INTAKE MANIFOLD
(a) Install two new gaskets and the intake manifold with the eight bolts and four nuts, Uniformly tighten the bolts and nuts in several passes.
Torque: 180 kg–cm (13 ft–lb, 18 N·m)

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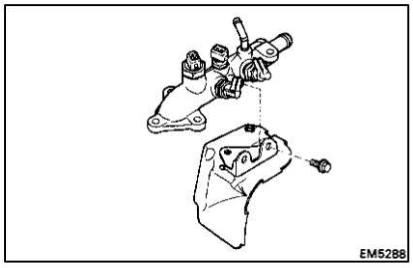
(b) Install the No.2 idler pulley bracket stay with the two bolts.

Torque: 185 kg–cm (13 ft–lb, 18 N·m)



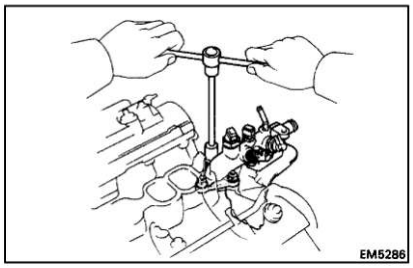
15. INSTALL CYLINDER HEAD REAR PLATE

Install the rear plate with the two bolts.



16. INSTALL WATER BY–PASS OUTLET

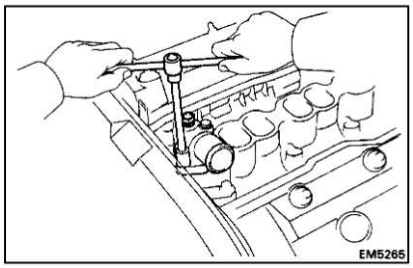
(a) Install the crossover pipe heat insulator with the two bolts.



(b) Install a new gasket and the water by–pass outlet with the three nuts.

Torque: 200 kg–cm (14 ft–lb, 20 N·m)

(c) Connect the following connectors and hose:
(1) Heater water by–pass hose
(2) Cold start injector time switch connector
(3) Water temperature switch



17. INSTALL WATER OUTLET

(a) Install a new gasket and the water outlet with the three nuts.

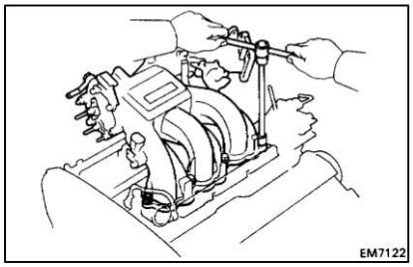
Torque: 85 kg–cm (73 ft–lb, 8.3 N·m)

(b) Connect the following hose and connector:
(1) Radiator upper hose
(2) Water temperature sensor connector

18. INSTALL INJECTORS AND DELIVERY PIPES

(See steps 1 to 5 on pages FI–32 and 33)

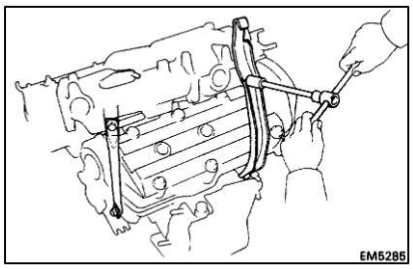
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19. INSTALL AIR INTAKE CHAMBER

(a) Install two new gaskets and the intake chamber with the two bolts and two nuts.

Torque: 440 kg–cm (32 ft–lb, 43 N·m)



(b) Install the two intake chamber stays with the four bolts.

Torque: 380 kg–cm (27 ft–lb, 37 N·m)

(c) Connect the following hoses:
- (1) PCV hose
- (2) Vacuum sensing hose
- (3) (CALIF. only) EGR gas temperature sensor connector
- (4) A/C control valve air hose

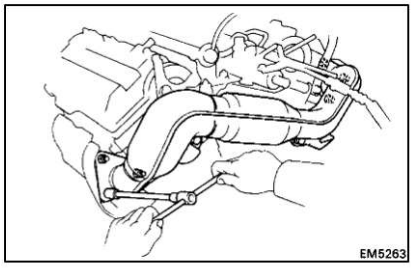
20. INSTALL COLD START INJECTOR TUBE
(See step 2 on page FI–24)

21. CONNECT COLD START INJECTOR CONNECTOR

22. INSTALL EXHAUST CROSSOVER PIPE

(a) Install new two gaskets to the RH and LH exhaust manifolds.

(b) Install the crossover pipe with the six nuts and two bolts.



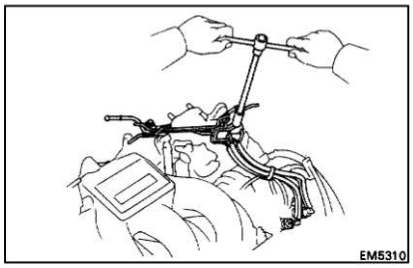
Torque:
Nut 400 kg–cm (29 ft–lb, 39 N·m)
Bolt 350 kg–cm (25 ft–lb, 34 N·m)

23. INSTALL DISTRIBUTOR (See page IG–11)

24. INSTALL VACUUM PIPE

(a) Install the vacuum pipe with the two bolts.

(b) Connect the following hoses:
- (1) Four BVSV vacuum hoses
- (2) A/C control valve vacuum hose

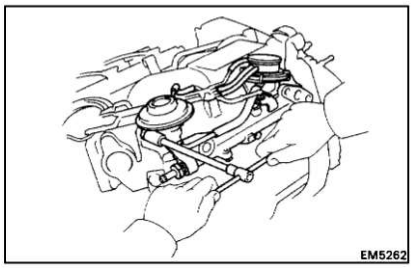


25. INSTALL EGR VALVE AND VACUUM MODULATOR

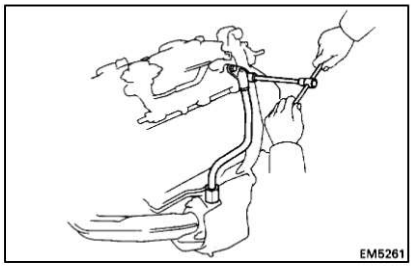
(a) Install a new gasket and the EGR valve and vacuum modulator with the two bolts and two nuts.

Torque: 185 kg–cm (13 ft–lb, 18 N·m)

(b) Install the four vacuum pipe hoses.



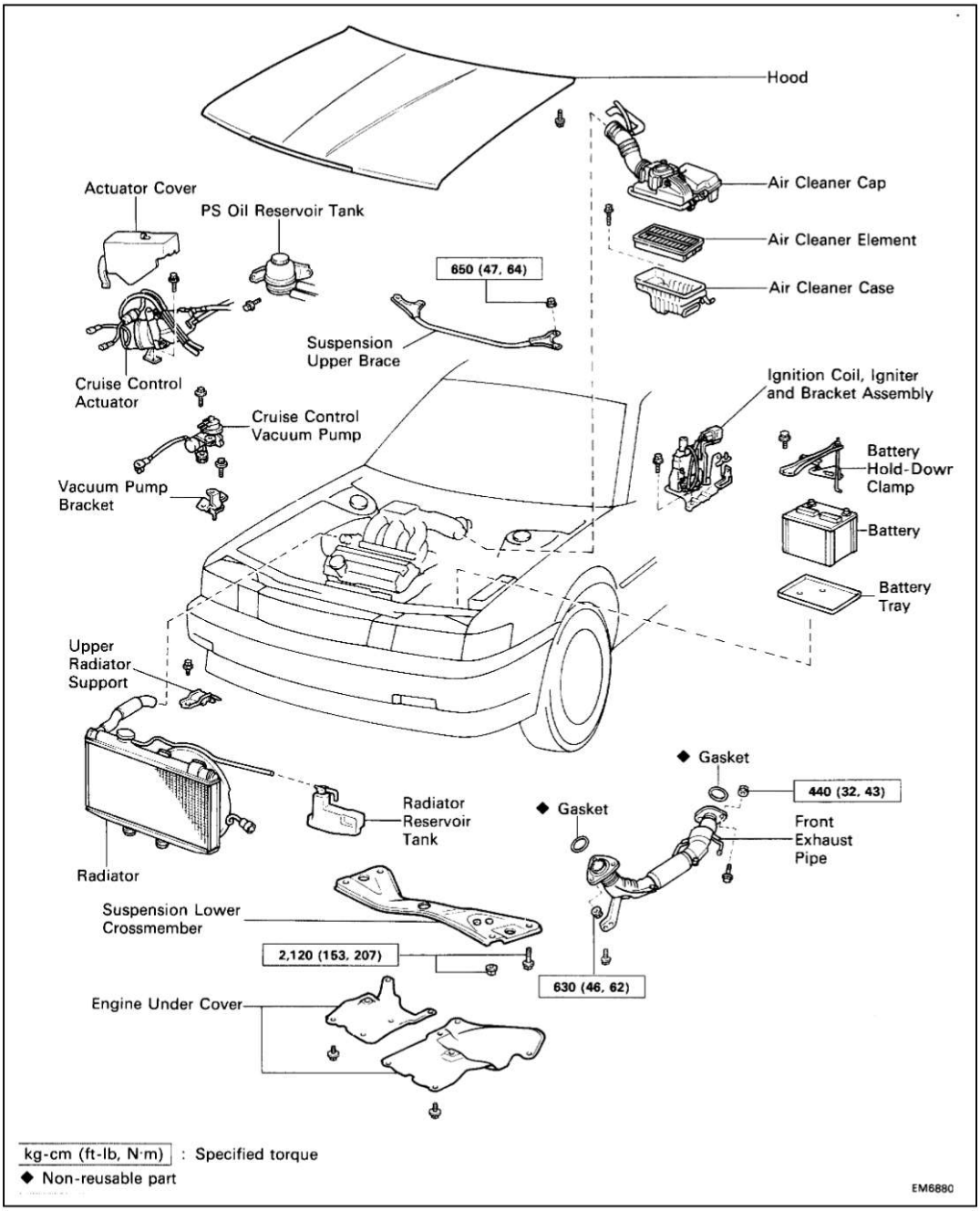
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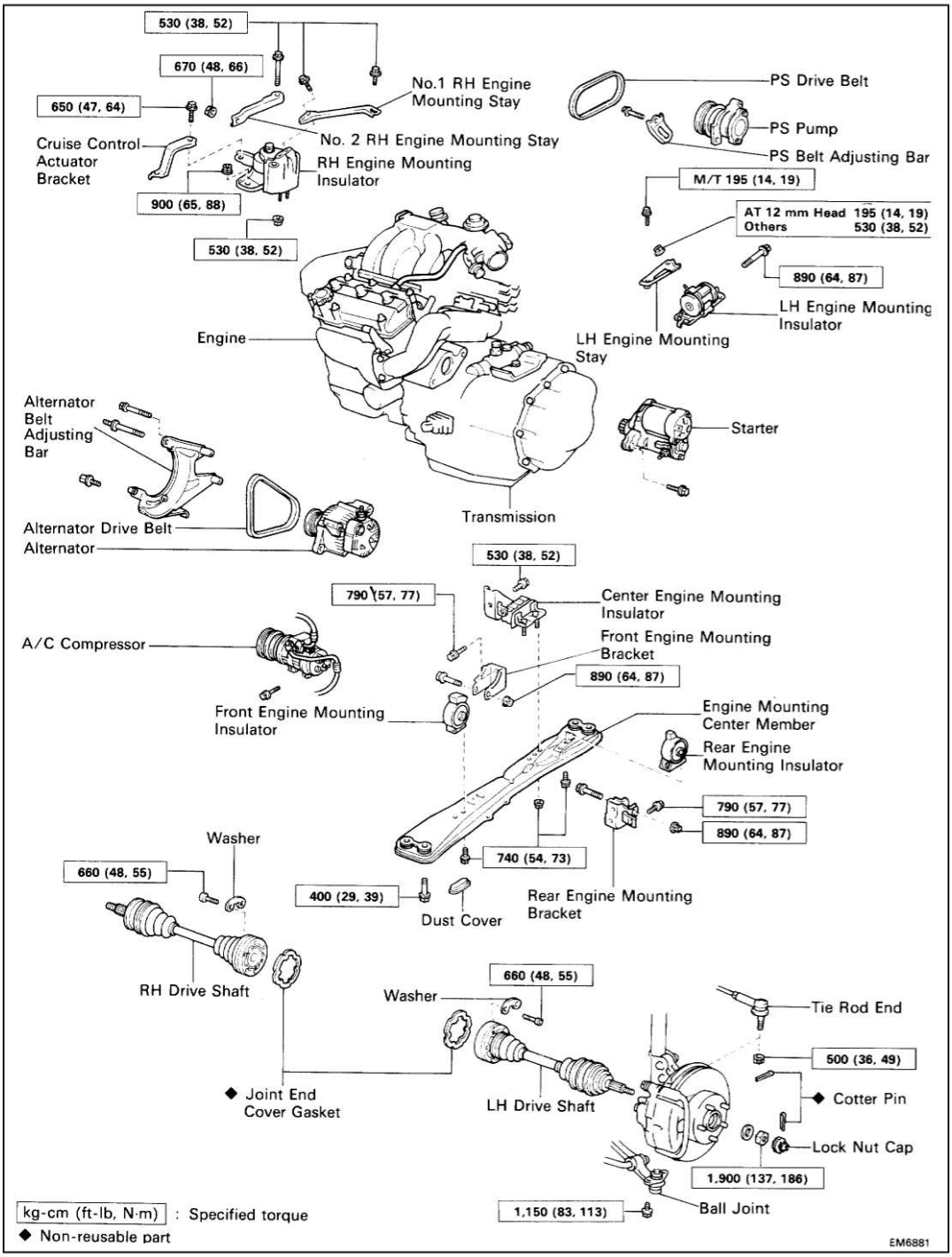
26. **INSTALL EGR PIPE**
Install a new gasket and the EGR pipe with the two bolts and union nut.
Torque:
Bolt 185 kg–cm (13 ft–lb, 18 N·m)
Nut 800 kg–cm (58 ft–lb, 78 N·m)
27. **INSTALL THROTTLE BODY**
(See steps 1 and 2 on page FI–43)
28. **INSTALL ISC VALVE**
(See steps 1 to 3 on page FI–45)
29. **INSTALL ALTERNATOR (See page CH–8)**
30. **INSTALL FRONT EXHAUST PIPE**
(See step 14 on page EM–96)
31. **INSTALL RH ENGINE UNDER COVER**
32. **INSTALL AIR CLEANER HOSE**
33. **INSTALL CRUISE CONTROL ACTUATOR**
(See step 27 on page EM–97)
34. **INSTALL ACCELERATOR CABLE, AND ADJUST IT**
35. **(A/T)**
CONNECT THROTTLE CABLE, AND ADJUST IT
36. **INSTALL SUSPENSION UPPER BRACE**
(See step 35 on page EM–98)
37. **FILL WITH ENGINE COOLANT (See page CO–5)**
38. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
39. **START ENGINE AND CHECK FOR LEAKS**
40. **ADJUST IGNITION TIMING (See on page IG–13)**
Ignition timing:
10° BTDC @ idle
(w/ Terminals TE1 and E1 connected)
41. **PERFORM ROAD TEST**
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
42. **RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL**

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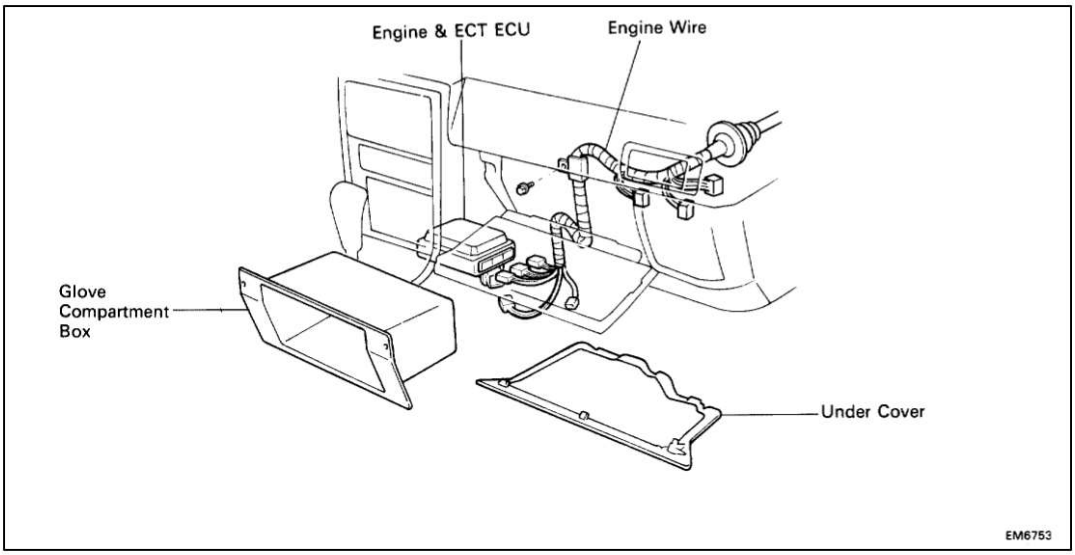
CYLINDER BLOCK
REMOVAL OF ENGINE



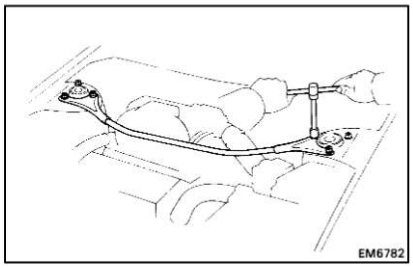
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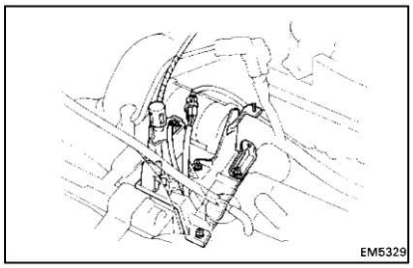
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1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
   CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.
2. **REMOVE HOOD**
3. **REMOVE BATTERY**
   Disconnect the ground strap.



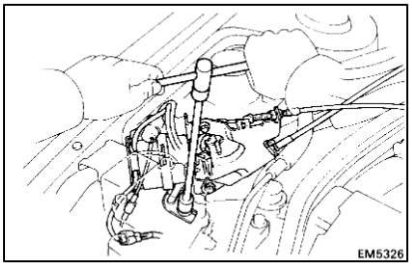
4. **REMOVE ENGINE UNDER COVERS**
5. **DRAIN ENGINE COOLANT (See page CO–5)**
6. **DRAIN ENGINE OIL**
7. **REMOVE SUSPENSION UPPER BRACE**
   Remove the four bolts and upper brace.



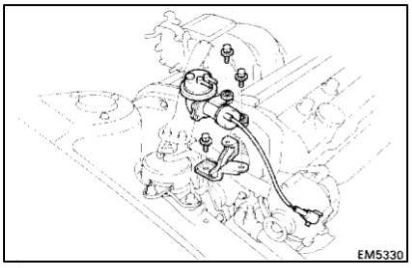
8. **REMOVE IGNITION COIL, IGNITER AND BRACKET ASSEMBLY**
   (a) Disconnect the following cord and connectors:
      (1) Igniter connector
      (2) Noise filter connector
      (3) High–tension cord
   (b) Remove the two bolts, the ignition coil, igniter and bracket assembly.

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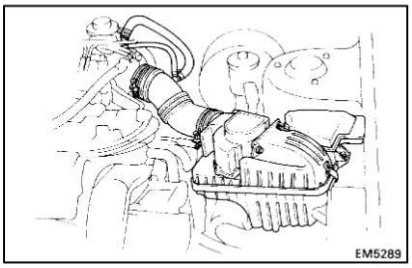
9. **REMOVE RADIATOR (See pages CO–12 and 13)**
10. **REMOVE ALTERNATOR (See page CH–8)**
11. **REMOVE ALTERNATOR BELT ADJUSTING BAR**
12. **REMOVE RADIATOR RESERVOIR TANK**
13. **DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY**
14. **(A/T)**
    DISCONNECT THROTTLE CABLE FROM THROTTLE BODY



15. **REMOVE CRUISE CONTROL ACTUATOR**
    (a) Remove the dust cover.
    (b) Disconnect the following hoses and connector:
        (1) Actuator vacuum hoses
        (2) Actuator connector
    (c) Remove the four bolts, actuator and bracket.



    (d) Disconnect the vacuum pump connector.
    (e) Remove the three bolts, vacuum pump and bracket.

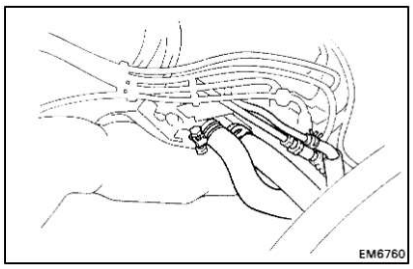


16. **REMOVE AIR CLEANER ASSEMBLY**
    (a) Disconnect the following connector and hoses:
        (1) Air flow meter connector
        (2) ISC valve air hose
        (3) Vacuum pipe air hose
    (b) Disconnect the four air cleaner cap clips.
    (c) Disconnect the air cleaner hose, and remove the air cleaner cap, hoses, and air flow meter assembly.
    (d) Remove the air cleaner element.
    (e) Remove the three bolts and air cleaner case.

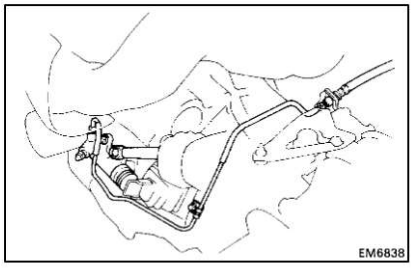
17. **DISCONNECT WIRES AND CONNECTORS**
    (a) Check connector
    (b) Ground straps from LH fender apron
    (c) Connectors from relay box
    (d) Engine room wire connector

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18. **DISCONNECT VACUUM HOSES**
    (a) Brake booster vacuum hose from air intake chamber
    (b) A/C control valve vacuum hose from air intake chamber
    (c) A/C control valve vacuum hose from vacuum pipe (on air intake chamber)
    (d) Charcoal canister vacuum hose from vacuum pipe (on air intake chamber)
19. **DISCONNECT GROUND STRAP FROM TRANSAXLE**

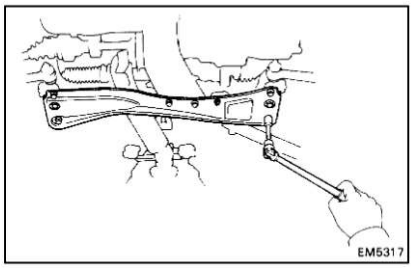


20. **DISCONNECT HEATER HOSES**
21. **DISCONNECT FUEL HOSES**
    CAUTION: Catch leaking fuel in a container.
22. **(M/T)**
    REMOVE STARTER



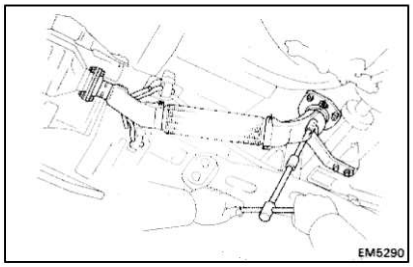
23. **(M/T)**
    REMOVE CLUTCH RELEASE CYLINDER AND TUBE CLAMP WITHOUT DISCONNECTING TUBE
24. **DISCONNECT SPEEDOMETER CABLE**
25. **DISCONNECT TRANSAXLE CONTROL CABLE(S)**

26. **DISCONNECT ENGINE WIRE FROM CABIN**
    (a) Remove the under cover.
    (b) Remove the glove compartment box.
    (c) Disconnect the following connectors:
        (1) Three engine & ECT ECU connectors
        (2) Circuit opening relay connector
        (3) Cowl wire connector
        (4) Instrument panel wire connector
    (d) Pull out the engine wire from the cowl panel.



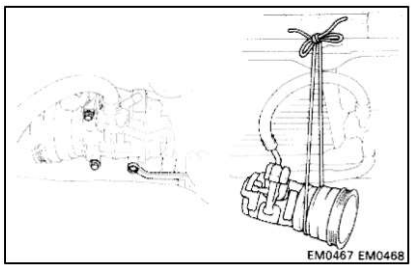
27. **REMOVE SUSPENSION LOWER CROSSMEMBER**
    Remove the two bolts, two nuts and crossmember.

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28. REMOVE FRONT EXHAUST PIPE

(a) Remove the two pipe stay bolts.
(b) Remove the two bolts and nuts, and disconnect the front pipe from the center pipe. Remove the gasket.
(c) Remove the three nuts, front pipe and gasket.



29. REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES

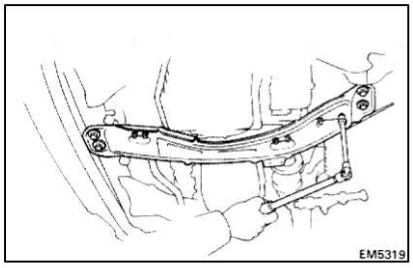
(a) Disconnect the two connectors.
(b) Remove the four compressor bolts.

HINT: Put aside the compressor, and suspend it to the radiator support with a string.

30. REMOVE DRIVE SHAFTS (See pages SA–23 to 25)

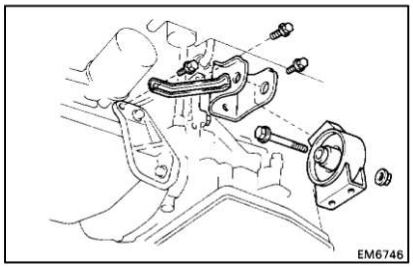
31. REMOVE PS PUMP WITHOUT DISCONNECTING HOSES

HINT: Put aside the pump and suspend it to the cowl with a string.



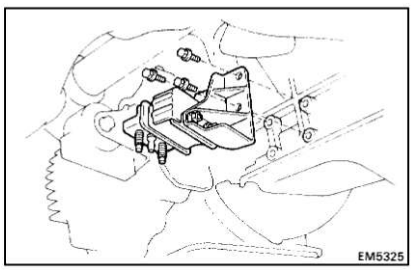
32. REMOVE ENGINE MOUNTING CENTER MEMBER

Remove the eight bolts, two nuts and center member.



33. REMOVE FRONT ENGINE MOUNTING INSULATOR AND BRACKET

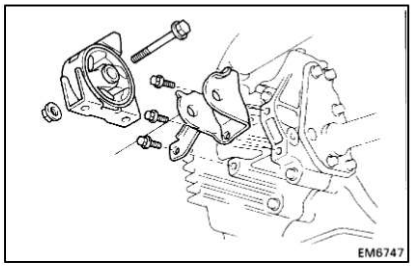
(a) Remove the nut, through bolt and mounting insulator.
(b) Remove the three bolts and mounting bracket.



34. REMOVE CENTER ENGINE MOUNTING INSULATOR AND BRACKET ASSEMBLY

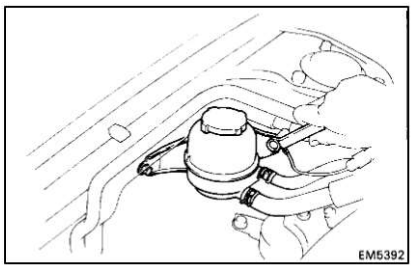
Remove the three bolts, the mounting bracket and insulator assembly.

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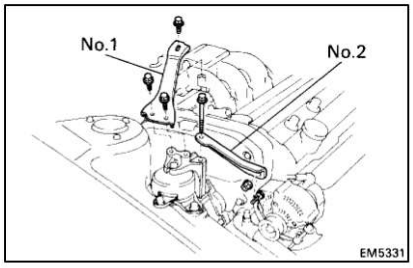
35. REMOVE REAR ENGINE MOUNTING INSULATOR AND BRACKET

(a) Remove the nut, through bolt and mounting insulator.
(b) Remove the three bolts and mounting bracket.



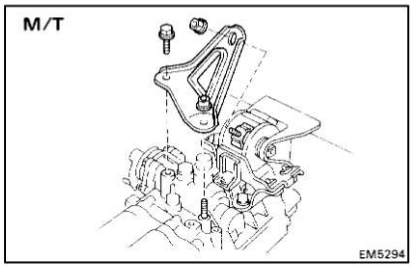
36. REMOVE PS OIL RESERVOIR TANK WITHOUT DISCONNECTING HOSES

Remove the two bolts and reservoir tank. Disconnect the ground strap.



37. REMOVE ENGINE RH MOUNTING STAYS

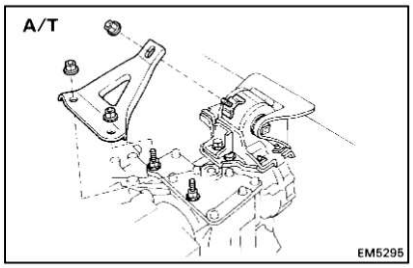
(a) Remove the three bolts and No.1 mounting stay.
(b) Remove the bolt, nut and No.2 mounting stay.



38. REMOVE ENGINE LH MOUNTING STAY

(M/T)

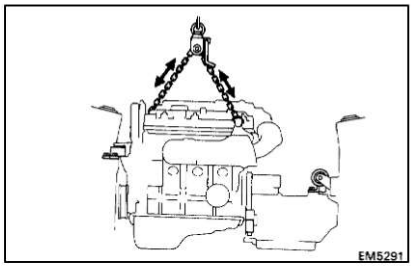
Remove the bolt, two nuts and mounting stay.



(A/T)

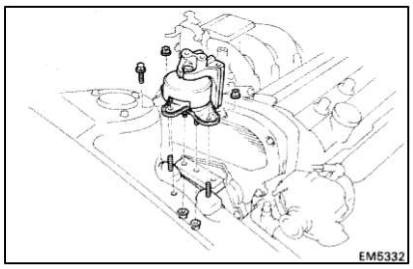
Remove the three nuts and mounting stay.

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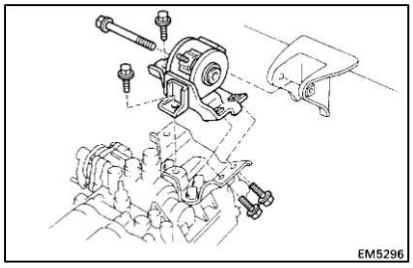


39. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE

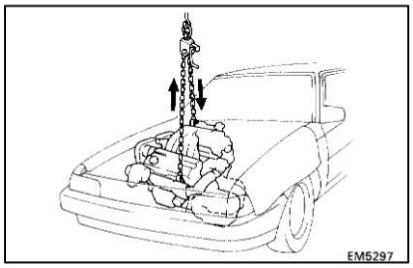
(a) Attach the engine chain hoist to the engine hangers.



(b) Remove the clamp bolts of the PS oil cooler pipes.
(c) Remove the four nuts, bolt and RH mounting insulator.



(d) Remove the through bolt, nut, four bolts and LH mounting insulator.
(e) Remove the three bolts and LH mounting bracket.



(f) Lift the engine out of the vehicle slowly and carefully.

NOTICE: Be careful not to hit the PS gear housing or neutral start switch.

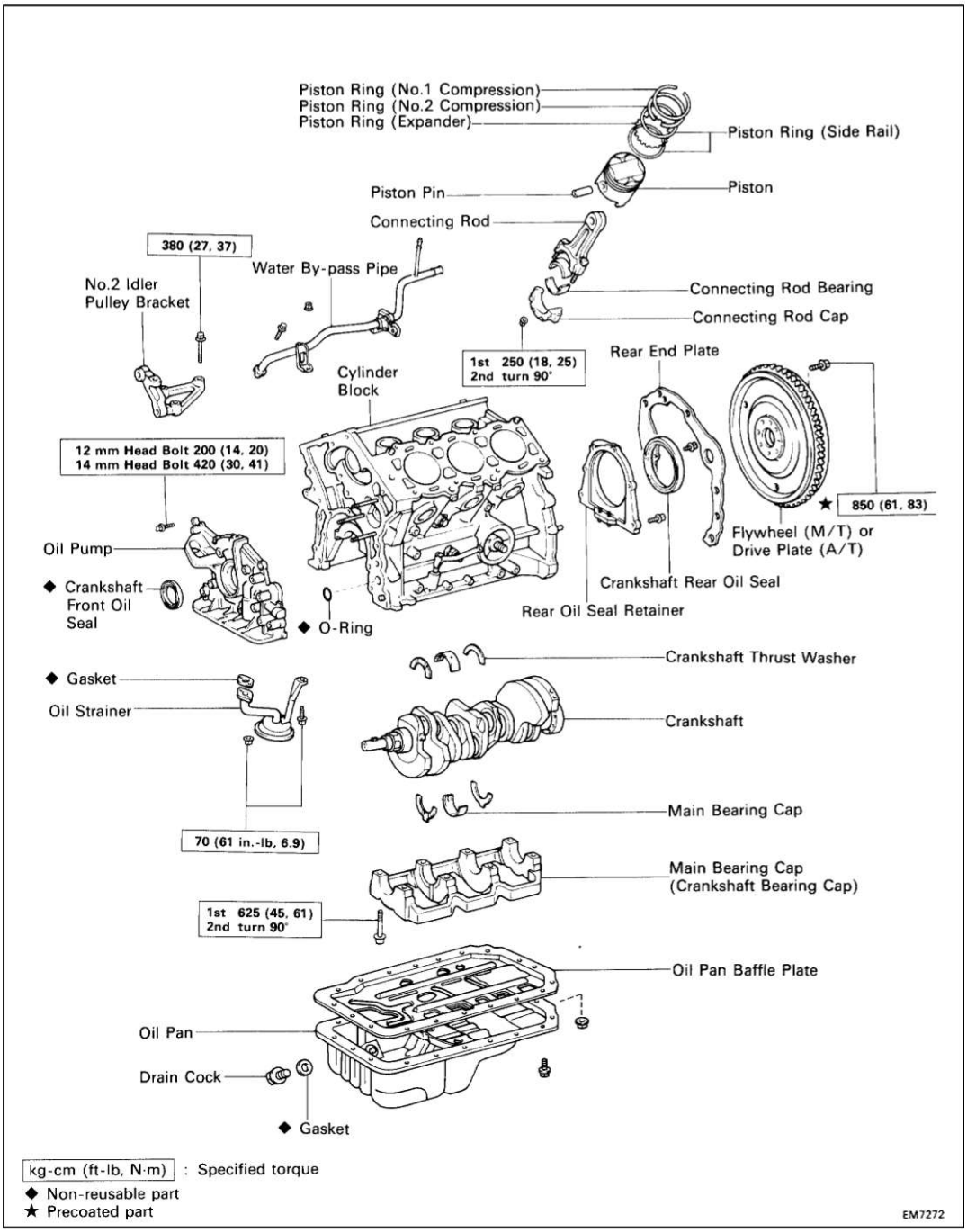
(g) Make sure that the engine is clear of all wiring, hoses and cables.
(h) Place the engine and transaxle assembly onto the stand.

40. (A/T)
REMOVE STARTER (See page ST–5)

41. SEPARATE ENGINE AND TRANSAXLE
(See page MT–8 or AT–15)

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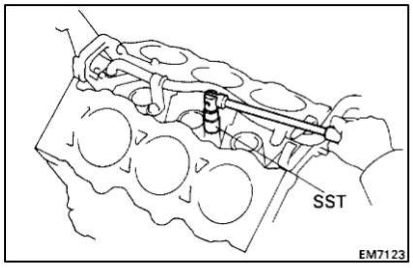
COMPONENTS



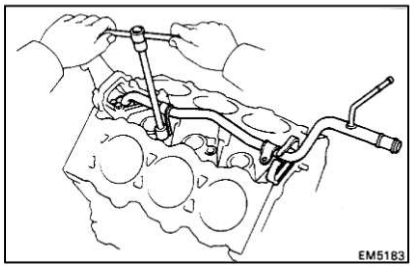
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PREPARATION FOR DISASSEMBLY

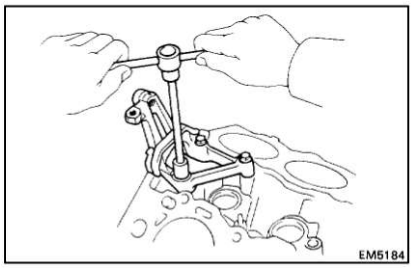
1. (M/T)
   REMOVE CLUTCH COVER AND DISC
2. (M/T)
   REMOVE FLYWHEEL
3. (A/T)
   REMOVE DRIVE PLATE
4. REMOVE REAR END PLATE
   Remove the bolt and end plate.
5. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
6. REMOVE DISTRIBUTOR (See page IG–9)
7. REMOVE TIMING BELT AND PULLEYS
   (See pages EM–16 to 20)
8. REMOVE CYLINDER HEADS
   (See pages EM–30 to 37)



9. REMOVE WATER PUMP (See page CO–6)
10. REMOVE OIL PAN AND OIL PUMP
    (See page LU–8)
11. REMOVE OIL FILTER (See page LU–6)
12. REMOVE KNOCK SENSOR
    Using SST, remove the knock sensor.
    SST 09816–30010

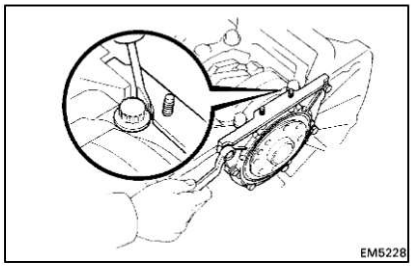


13. REMOVE WATER BY–PASS PIPE
    Remove the two bolts, two nuts and by–pass pipe.



14. REMOVE NO.2 IDLER PULLEY BRACKET
    Remove the three bolts and mounting bracket.

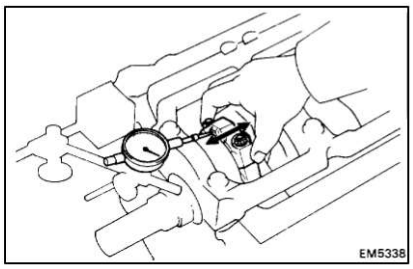
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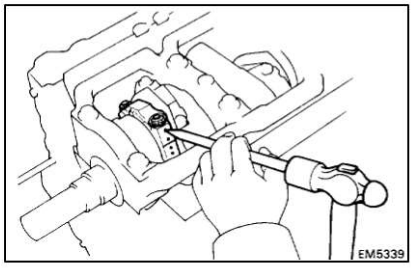
DISASSEMBLY OF CYLINDER BLOCK

(See page EM–69)

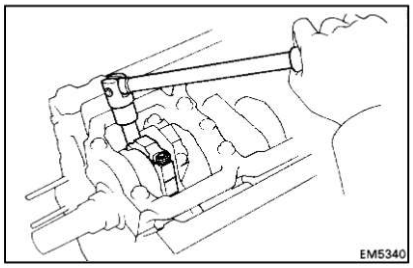
1. **REMOVE REAR OIL SEAL RETAINER**
   Remove the six bolts and retainer.



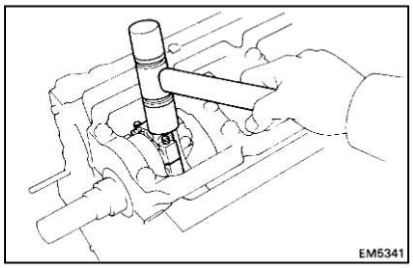
2. **CHECK CONNECTING ROD THRUST CLEARANCE**
   Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.
   Standard thrust clearance: 0.150–0.330 mm (0.0059–0.0130 in.)
   Maximum thrust clearance: 0.38 mm (0.0150 in.)
   If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.



3. **REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE**
   (a) Using a punch or numbering stamp, place the matchmarks on the connecting rod and cap to ensure correct reassembly.

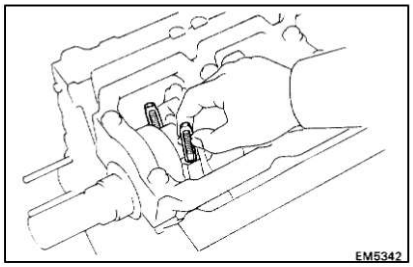


   (b) Using SST, remove the connecting rod cap nuts.
   SST 09011–38121

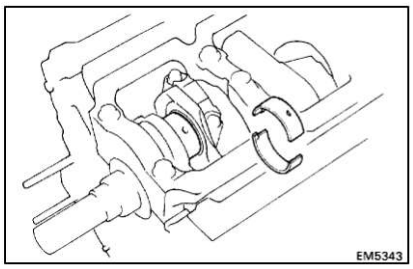


   (c) Using a plastic–faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.
   HINT: Keep the lower bearing inserted with the connecting cap.

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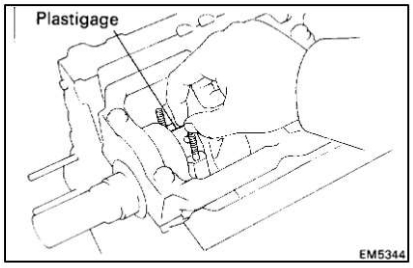


(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

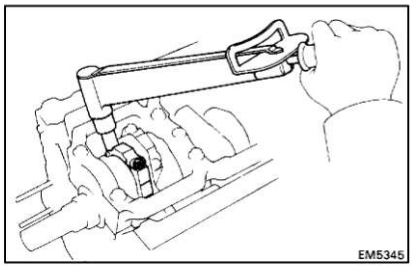


(e) Clean crank pin and bearing.
(f) Check the crank pin and bearing for pitting and scratches.

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



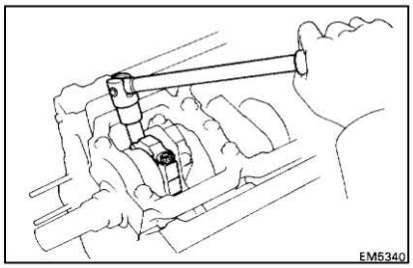
(g) Lay a strip of Plastigage across the crank pin.



(h) Install the connecting rod cap with the two nuts.
(See step 6 on pages EM–89 and 90)

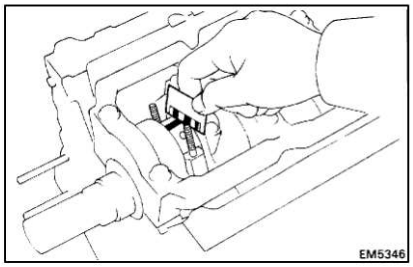
Torque: 1st 250 kg–cm (18 ft–lb, 25 N·m)
2nd turn 90°

NOTICE: Do not turn the crankshaft.



(i) Remove the two nuts and connecting rod cap.
(See procedure (b) and (c) above)

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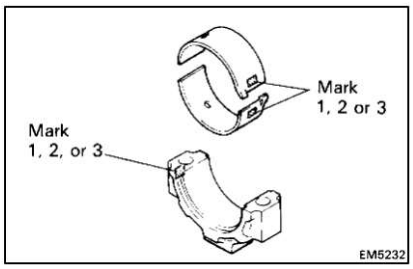
(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD	**0.028–0.065 mm (0.0011–0.0026 in.)**
U/S	**0.25 0.027–0.080 mm (0.0011–0.0031 in.)**

Maximum oil clearance: 0.08 mm (0.0031 in.)

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



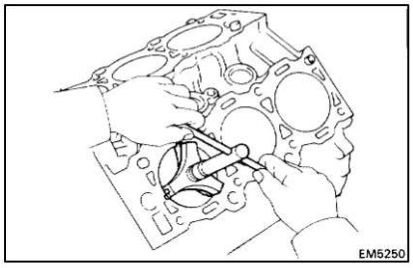
HINT: If using a standard bearing, replace with one having the same number marked on the connecting rod cap. There are three sizes of standard bearings, marked “1”, “2” and “3” accordingly.

(Reference)

Standard sized bearing center wall thickness:

Mark “1”	**1.484–1.488 mm (0.0584–0.0586 in.)**
Mark “2”	**1.488–1.492 mm (0.0586–0.0587 in.)**
Mark “3”	**1.492–1.496 mm (0.0587–0.0589 in.)**

(k) Completely remove the Plastigage.



4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

(a) Using a ridge reamer, remove the all carbon from the top of the cylinder.

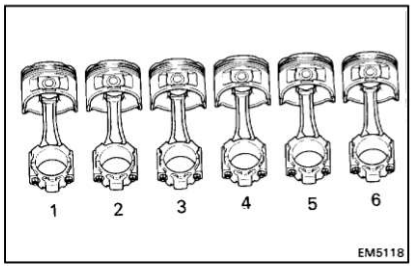
(b) Cover the connecting rod bolts.

(See page EM–72)

(c) 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.



5. CHECK CRANKSHAFT THRUST CLEARANCE

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

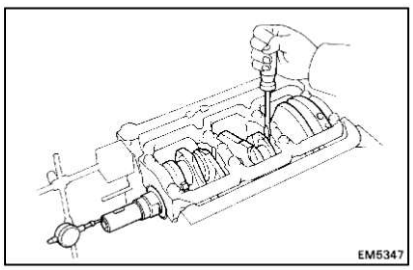
Standard thrust clearance: 0.020–0.220 mm (0.0008–0.0087 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

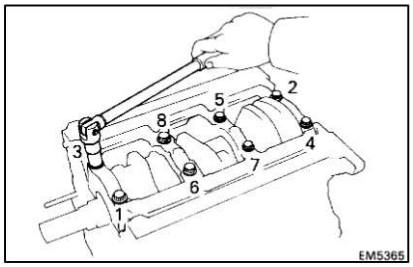
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:

2.440–2.490 mm (0.0961–0.0980 in.)

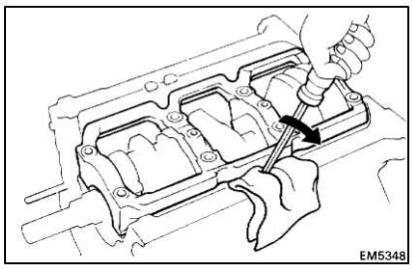


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6. REMOVE MAIN BEARING CAP AND CHECK OIL CLEARANCE

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



(b) Using a screwdriver, pry up the main bearing cap, and remove the main bearing cap, lower main bearings and lower thrust washers (No.2 journal position of main bearing cap only).

HINT: Keep the lower main bearings and lower thrust washers together with the main bearing cap.

(c) Lift out the crankshaft.

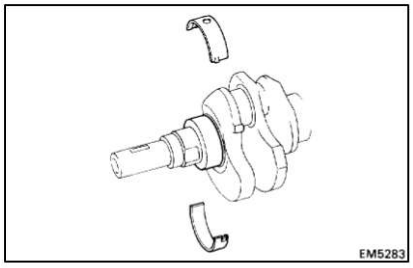
HINT: Keep the upper main bearings and upper thrust washers together with the cylinder block.

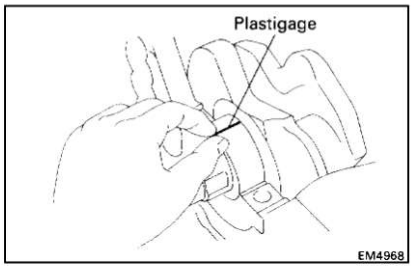
(d) Clean each main journal and bearing.

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

If the journal or bearing is damaged, replace the bearings.

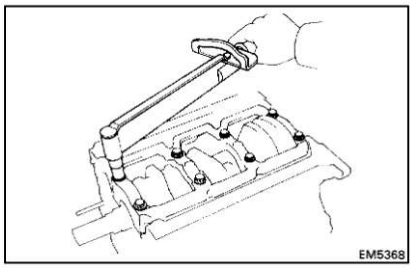
If necessary, grind or replace the crankshaft.





(f) Place the crankshaft on the cylinder block.

(g) Lay a strip of Plastigage across each journal.



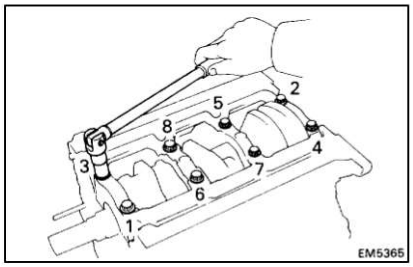
(h) Install the main bearing cap with the eight bolts.

(See step 4 on page EM–88)

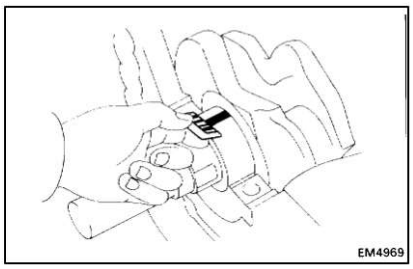
Torque: 1st 625 kg–cm (45 ft–lb, 61 N·m)
2nd turn 90°

NOTICE: Do not turn the crankshaft.

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(i) Remove the eight bolts and main bearing cap.
(See procedure (a) and (b) above)



(j) Measure the Plastigage at its widest point.

Standard clearance:

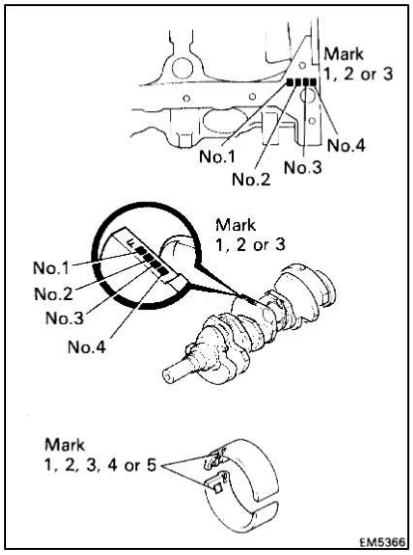
STD	**0.029–0.056 mm (0.0011–0.0022 in.)**
U/S	**0.25 0.028–0.080 mm (0.0011–0.0031 in.)**

Maximum clearance: 0.08 mm (0.0031 in.)

HINT: If replacing the cylinder block subassembly, the bearing standard clearance will be:
0.031–0.067 mm (0.0012–0.0026 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 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 five sizes of standard bearings, marked “1”, “2”, “3”, “4” and “5” accordingly.



	Number marked								
Cylinder block	1			2			3		
Crankshaft	0	1	2	0	1	2	0	1	2
Bearing	1	2	3	2	3	4	3	4	5

EXAMPLE: Cylinder block “2” + Crankshaft “1”
= Total number (Use Bearing “3”)

(Reference)

Cylinder block main journal bore diameter:

Mark “1”	**68.010–68.016 mm (2.6776–2.6778 in.)**
Mark “2”	**68.016–68.022 mm (2.6778–2.6780 in.)**
Mark “3”	**68.022–68.028 mm (2.6780–2.6783 in.)**

Crankshaft journal diameter:

Mark “0”	**63.996–64.000 mm (2.5195–2.5197 in.)**
Mark “1”	**63.990–63.996 mm (2.5193–2.5195 in.)**
Mark “2”	**63.985–63.990 mm (2.5191–2.5193 in.)**

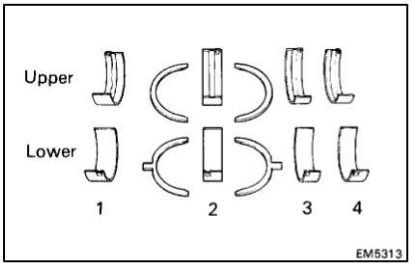
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(Reference) (Cont'd)

Standard sized bearing center wall thickness:

Mark "1" 1.989–1.992 mm (0.0783–0.0784 in.)
Mark "2" 1.992–1.995 mm (0.0784–0.0785 in.)
Mark "3" 1.995–1.998 mm (0.0785–0.0787 in.)
Mark "4" 1.998–2.001 mm (0.0787–0.0788 in.)
Mark "5" 2.001–2.004 mm (0.0788–0.0789 in.)

(k) Completely remove the Plastigage.

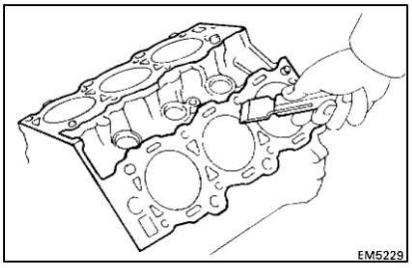


7. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.
(b) Remove the upper main bearings and upper thrust washers from cylinder block.

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

INSPECTION OF CYLINDER BLOCK

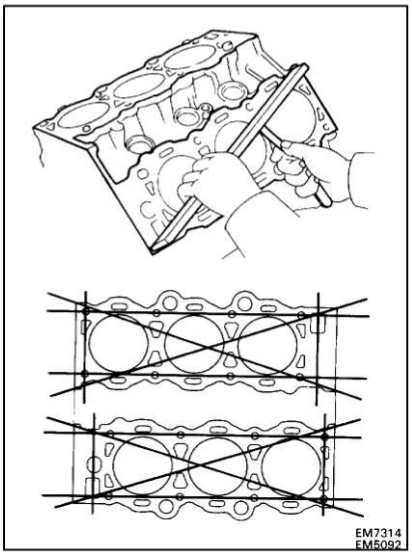


1. REMOVE GASKET MATERIAL

Using a gasket scraper, remove all the gasket material from the top surfaces of the cylinder block.

2. CLEAN CYLINDER BLOCK

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



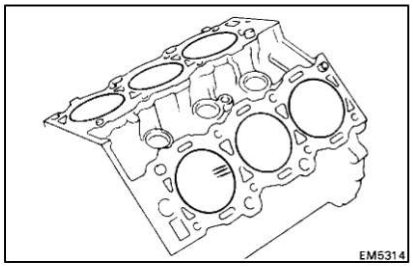
3. INSPECT TOP SURFACES OF CYLINDER BLOCK FOR FLATNESS

Using precision straight edge and feeler gauge, measure the top surfaces of the cylinder block for warpage.

Maximum warpage: 0.05 mm (0.0020 in.)

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

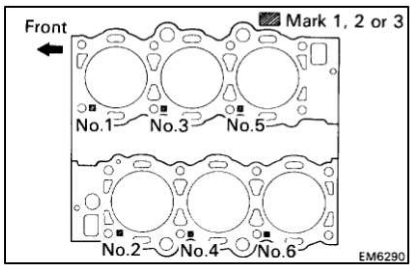
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4. INSPECT CYLINDER FOR VERTICAL SCRATCHES

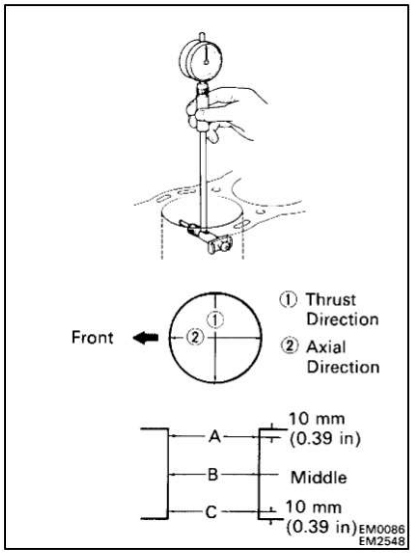
Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all the six cylinders or replace the cylinder block.



5. INSPECT CYLINDER BORE DIAMETER

HINT: There are three 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 axial directions.

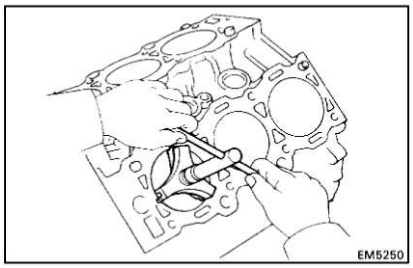
Standard diameter:

STD Mark “1”	**87.500–87.510 mm (3.4449–3.4453 in.)**
Mark “2”	**87.510–87.520 mm (3.4453–3.4457 in.)**
Mark “3”	**87.520–87.530 mm (3.4457–3.4461 in.)**

Maximum diameter:

STD	**87.73 mm (3.4539 in.)**
O/S 0.50	**88.23 mm (3.4736 in.)**

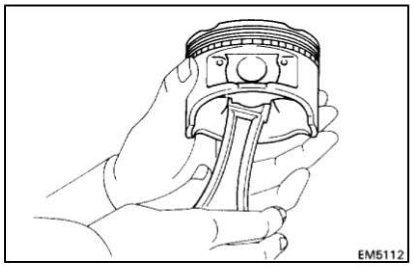
If the diameter is greater than maximum, rebore all the six cylinders or replace the cylinder block.



6. 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.

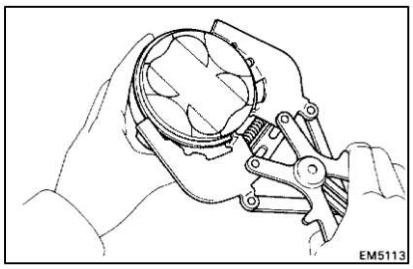
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DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

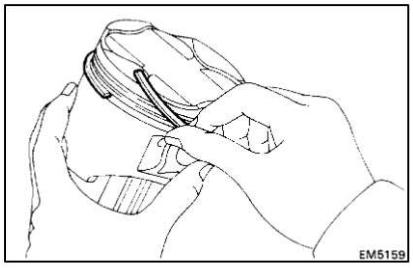
1. CHECK FIT BETWEEN PISTON AND PISTON PIN

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.



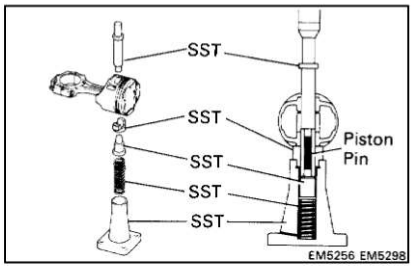
2. REMOVE PISTON RINGS

(a) Using a piston ring expander, remove the two compression rings.



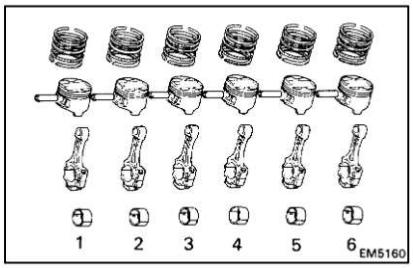
(b) Remove the two side rails and oil ring expander by hand.

HINT: Arrange the rings in correct order only.



3. DISCONNECT CONNECTING ROD FROM PISTON

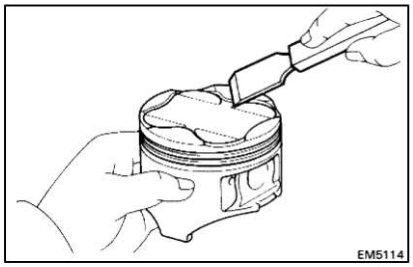
Using SST, press out the piston pin from the piston.
SST09221–25024 (09221–00020, 09221–00030, 09221–00181, 09221–00190, 09221–00200)



HINT:

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

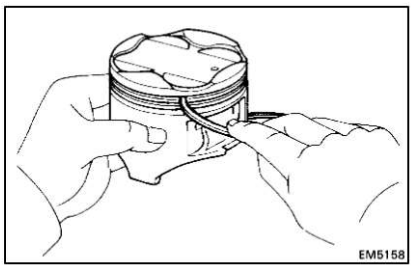
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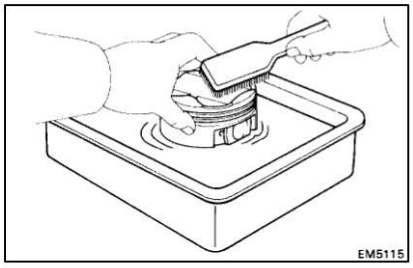
INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CLEAN PISTON

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



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



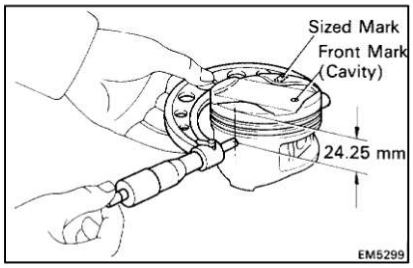
(c) Using solvent and a brush, thoroughly clean the piston.

NOTICE: Do not use a wire brush.

2. INSPECT PISTON DIAMETER AND OIL CLEARANCE

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

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 24.25 mm (0.9547 in.) from the piston head.



Piston diameter:

STD	**Mark "1"**	**87.445–87.455 mm (3.4427–3.4431 in.)**
STD	**Mark "2"**	**87.455–87.465 mm (3.4431–3.4435 in.)**
STD	**Mark "3"**	**87.465–87.475 mm (3.4435–3.4439 in.)**
O/S 0.50		**87.945–87.975 mm (3.4624–3.4636 in.)**

(b) Measure the cylinder bore diameter in the thrust directions. (See step 5 on page EM–77)

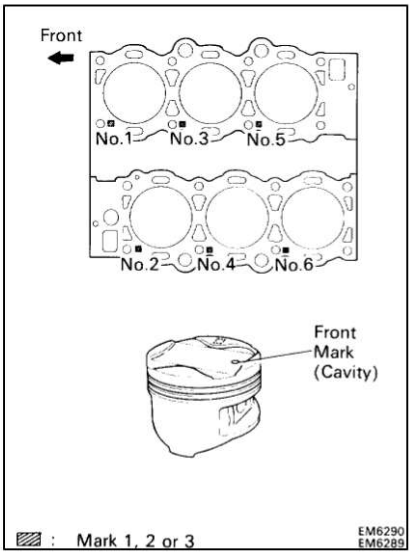
(c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance: **0.045–0.065 mm (0.0018–0.0026 in.)**

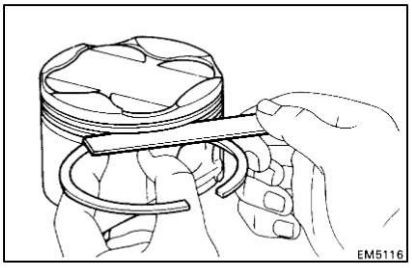
Maximum oil clearance: **0.085 mm (0.0033 in.)**

If the oil clearance is greater than maximum, replace all the six pistons. If necessary, rebore all the six cylinders or replace the cylinder block.

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



3. INSPECT CLEARANCE BETWEEN WALL OF RING GROOVE AND NEW PISTON RING

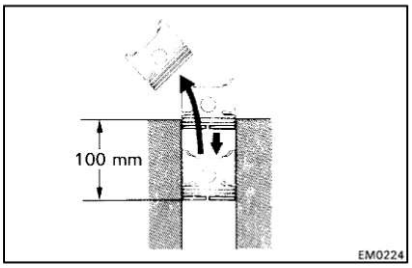
Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

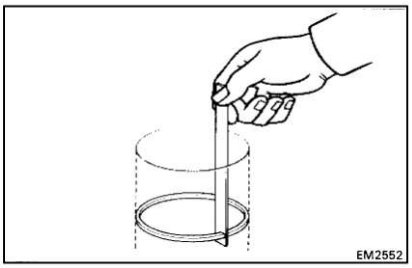
Ring groove clearance:

No.1 0.010–0.080 mm (0.0004–0.0031 in.)

No.2 0.030–0.070 mm (0.0012–0.0028 in.)

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





4. INSPECT PISTON RING END GAP

(a) Insert the piston ring into the cylinder bore.

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 100 mm (3.94 in.) from the top of the cylinder block.

(c) Using a feeler gauge, measure the ring end gap.

Standard ring end gap:

No.1	**0.300–0.540 mm (0.0118–0.0213 in.)**
No.2	**0.350–0.620 mm (0.0138–0.0244 in.)**
Oil (Side rail)	**0.200–0.570 mm (0.0079–0.0224 in.)**

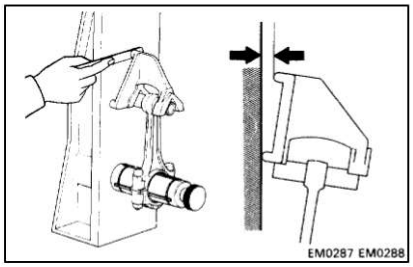
Maximum ring end gap:

No.1	**1.14 mm (0.0449 in.)**
No.2	**1.22 mm (0.0480 in.)**
Oil (Side rail)	**1.17 mm (0.0461 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 six cylinders or replace the cylinder block.

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5. INSPECT CONNECTING ROD

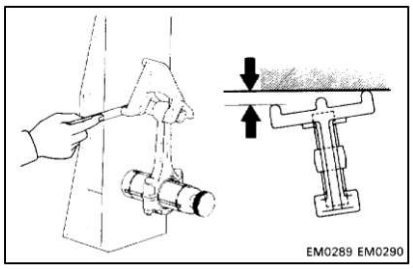
Using a rod aligner, check the connecting rod alignment.

- Check for bending.

Maximum bending:

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

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

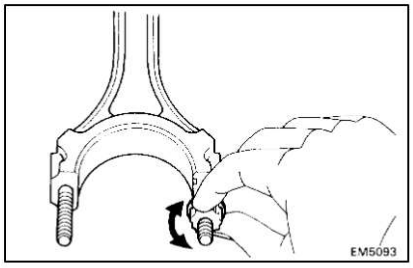


- Check for twist.

Maximum twist:

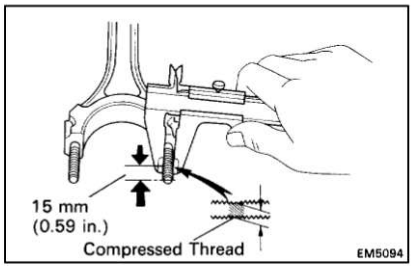
0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

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



6. 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 outer diameter of the compressed thread with calipers.

Standard outer diameter: 7.860–8.000 mm (0.3094–0.3150 in.)

Minimum outer diameter: 7.60 mm (0.2992 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 outer diameter is less than minimum, replace the connecting rod and cap nut as a set.

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BORING OF CYLINDERS

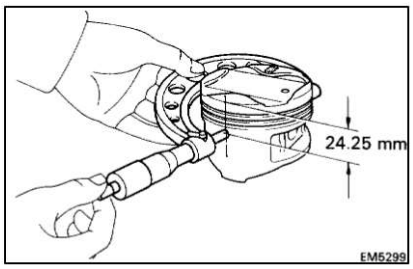
HINT:

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

1. KEEP OVERSIZED PISTONS

Oversized piston diameter:

O/S 0.50 87.945–87.975 mm
(3.4624–3.4636 in.)



2. CALCULATE AMOUNT TO BORE CYLINDER

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 24.25 mm (0.9547 in.) from the piston head.

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

Size to be rebored = P + C – H

P = Piston diameter

C = Piston oil clearance
0.045–0.065 mm (0.0018–0.0026 in.)

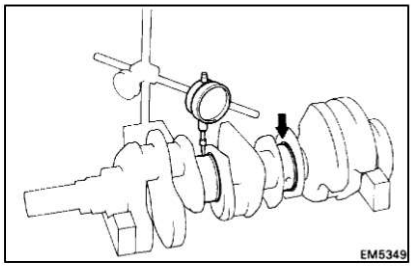
H = Allowance for honing
0.02 mm (0.0008 in.) or less

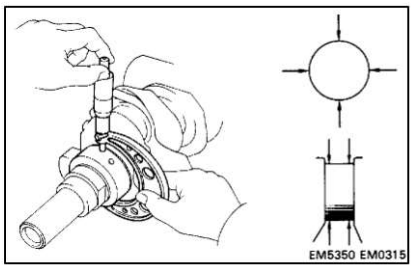
3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

Maximum honing: 0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.

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INSPECTION AND REPAIR OF CRANKSHAFT

1. 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: 0.06 mm (0.0024 in.)

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

2. INSPECT MAIN JOURNALS AND CRANK PINS

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

Main journal diameter:

STD	**63.985–64.000 mm (2.5191–2.5197 in.)**
U/S 0.25	**63.745–63.755 mm (2.5096–2.5100 in.)**

Crank pin diameter:

STD	**47.987–48.000 mm (1.8892–1.8898 in.)**
U/S 0.25	**47.745–47.755 mm (1.8797–1.8801 in.)**

If the diameter is not as specified, check the oil clearance (See pages EM–71 to EM–75).

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

Maximum taper and out–of–round: 0.02 mm (0.0008 in.)

If the taper or out–of–round is greater than maximum, grind or replace the crankshaft.

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

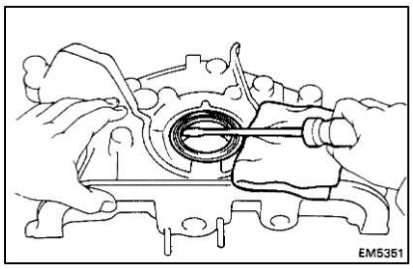
Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure step 2).

Install new main journal and/or crank pin undersized bearings.

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REPLACEMENT OF CRANKSHAFT OIL SEALS

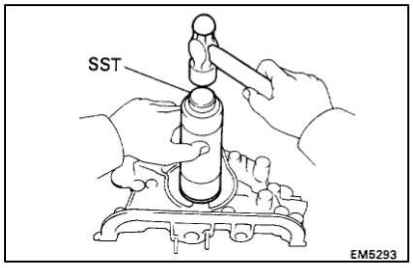
HINT: There are two methods (A and B) to replace the oil seal which are as follows:



1. REPLACE CRANKSHAFT FRONT OIL SEAL

A. If oil pump is removed from cylinder block:

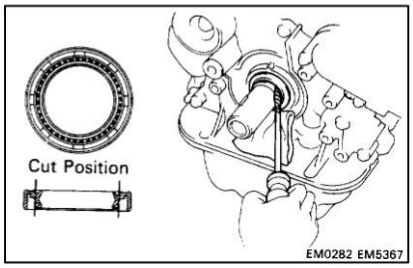
(a) Using a screwdriver, pry out the oil seal.



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

SST 09309–37010

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

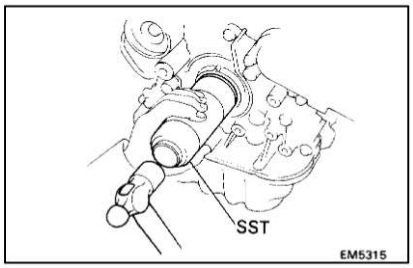


B. If oil pump is installed to the cylinder block:

(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.

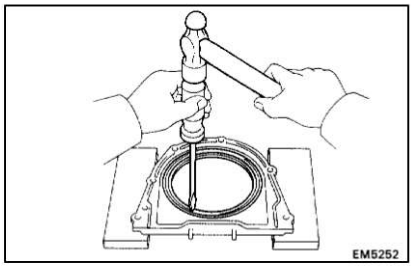


(c) Apply MP grease to a new oil seal lip.

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

SST 09309–37010

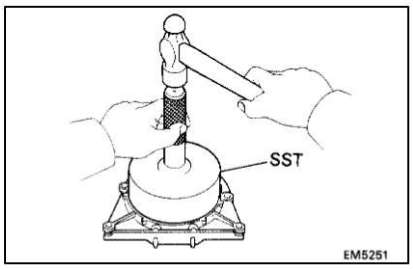
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2. REPLACE CRANKSHAFT REAR OIL SEAL

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

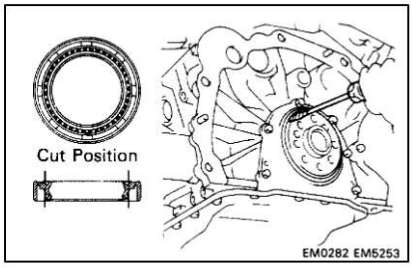
(a) Using screwdriver and hammer, tap out the oil seal.



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

SST 09223–56010

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

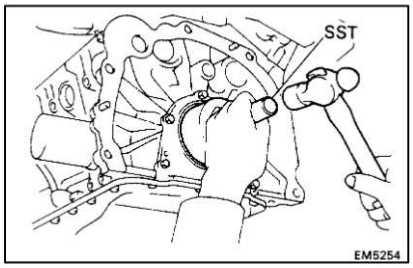


B. If rear oil seal retainer is installed to cylinder block:

(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.

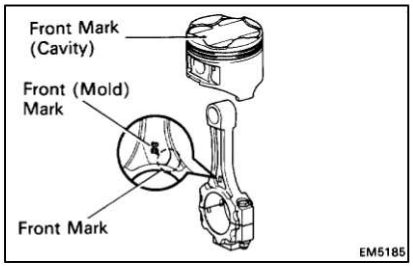


(c) Apply MP grease to a new oil seal lip.

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

SST 09223–56010

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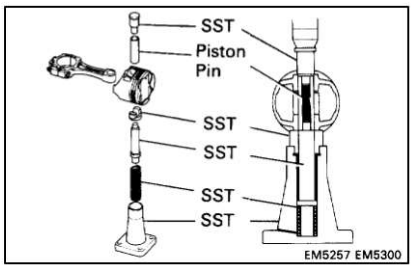
ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

1. ASSEMBLE PISTON AND CONNECTING ROD

(a) Align the front marks of the piston and connecting rod.

Connecting rod front (mold) mark:

B6, 1B, 8A, C3 or etc.

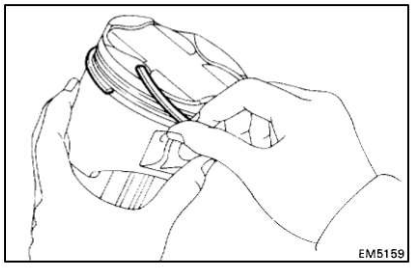


(b) Coat the piston pin and piston hole of the piston with engine oil.

(c) Using SST, press in the piston pin.

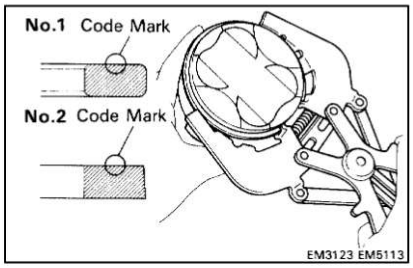
SST 09221–25024 (09221–00020, 09221–00030, 09221–00181, 09221–00190, 09221–00200)

(d) Check that the piston smoothly moves back and forth on the piston pin.



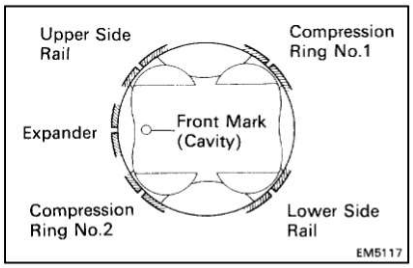
2. INSTALL PISTON RINGS

(a) Install the oil ring expander and two side rails by hand.



(b) Using a piston ring expander, install the two compression rings with the code mark facing upward.

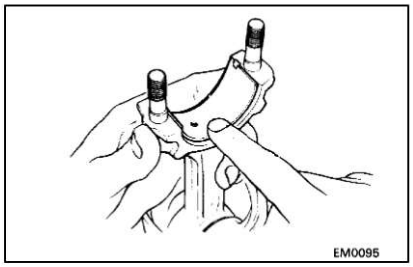
Code mark: **No.1 T or 1R**
No.2 T2 or 2R



(c) Position the piston rings so that the ring ends are as shown.

NOTICE: Do not align the ring ends.

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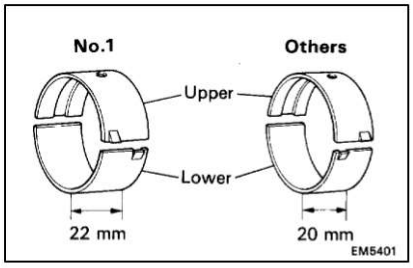


3. **INSTALL BEARINGS**
   (a) Align the bearing claw with the groove of the connecting rod or connecting cap.
   (b) Install the bearings in the connecting rod and connecting rod cap.

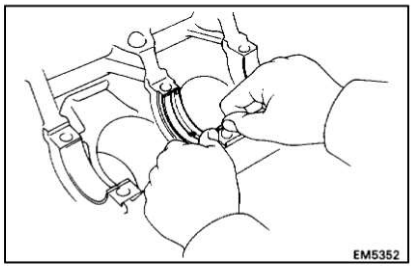
ASSEMBLY OF CYLINDER BLOCK

(See page EM–69)

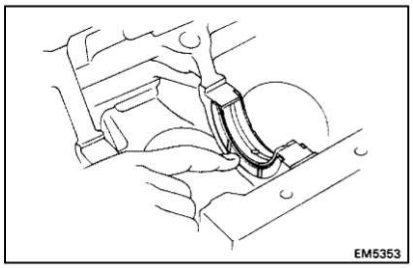
HINT:
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O–rings and oil seals with new parts.



1. **INSTALL MAIN BEARINGS**
   HINT:
   - Main bearings come in widths of 20 mm (0.79 in.) and 22 mm (0.87 in.). Install the 22 mm (0.87 in.) bearings in the No.1 cylinder block journal position with the main bearing caps. Install the 20 mm (0.79 in.) bearings in the other positions.
   - Upper bearings have an oil holes: lower bearings do not.

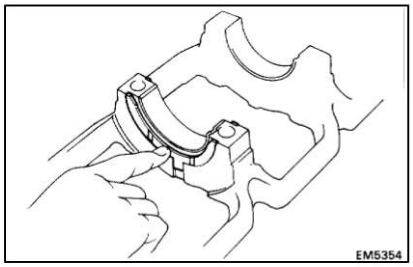


   (a) Align the bearing claw with the claw groove of the main bearing cap or cylinder block.
   (b) Install the bearings in the cylinder block and main bearing cap.



2. **INSTALL UPPER THRUST WASHERS**
   Install the thrust washers under the No.2 journal position of the block with the oil grooves facing outward.
3. **PLACE CRANKSHAFT ON CYLINDER BLOCK**

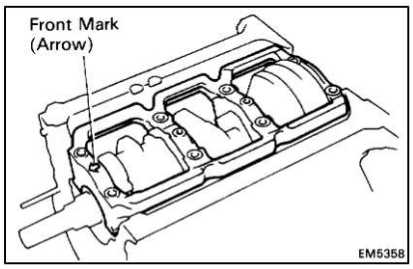
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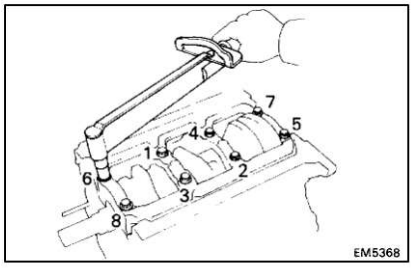
4. INSTALL MAIN BEARING CAP AND LOWER THRUST WASHERS

A. Place main bearing cap and lower thrust washers on cylinder block

(a) Install the thrust washers on the No.2 journal position of the bearing cap with the grooves facing outward.



(b) Install the main bearing cap with the front mark facing forward.



B. Install main bearing cap bolts

HINT:

- The main bearing cap bolts are tightened in two progressive steps (steps (b) and (d)).
- If any main bearing cap bolt is broken or deformed, replace it.

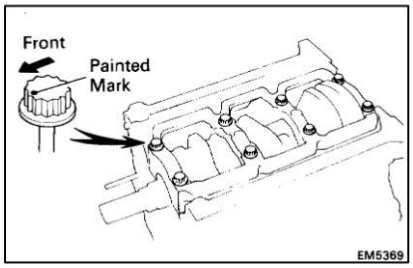
(a) Apply a light coat of engine oil on the threads and under the heads of the main bearing caps.

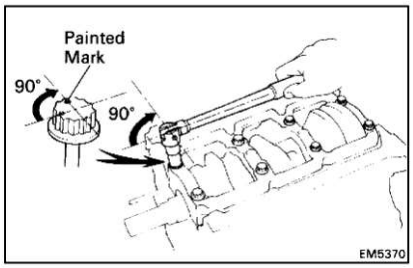
(b) Install and uniformly tighten the eight main bearing cap bolts in several passes in the sequence shown.

Torque: 625 kg–cm (45 ft–lb, 61 N·m)

If any one of the main bearing cap bolts does not meet the torque specification, replace the cap bolt.

(c) Mark the front of the main bearing cap bolt with paint.





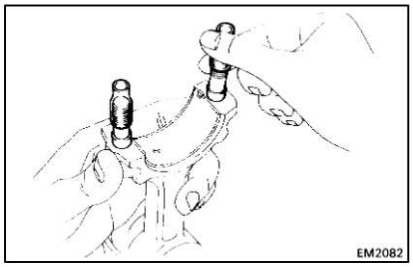
(d) Retighten the main bearing cap bolts 90° in the numerical order shown.

(e) Check that the painted mark is now at a 90° angle to the front.

(f) Check that the crankshaft turns smoothly.

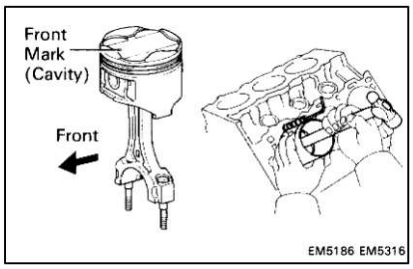
(g) Check the crankshaft thrust clearance.
(See step 5 on page EM–73)

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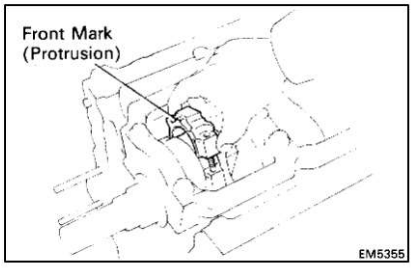


5. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

(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.

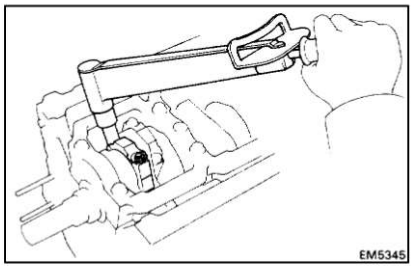


6. INSTALL CONNECTING ROD CAPS

A. 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.



B. Install connecting rod cap nuts

HINT:

- The connecting rod cap nuts are tightened in two progressive steps (steps (b) and (d)).
- If any connecting rod bolt is broken or deformed, replace them.

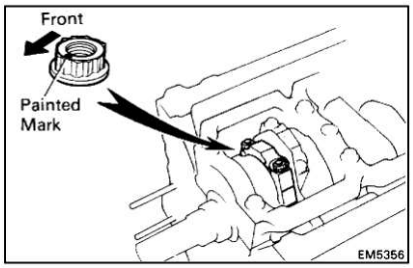
(a) Apply a light of engine oil on the threads and under the nuts of the connecting rod cap.

(b) Using SST, install and alternately tighten the nuts of the connecting rod cap in several passes.

SST 09011–38121

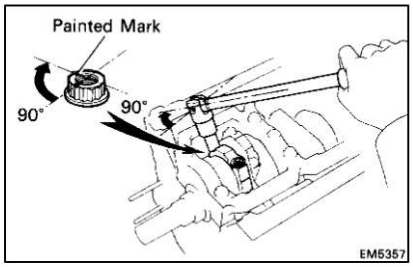
Torque: 250 kg–cm (18 ft–lb, 25 N·m)

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



(c) Mark the front of the connecting rod cap nut with paint.

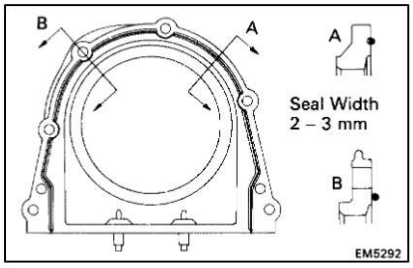
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(d) Retighten the connecting rod cap nuts 90° in the numerical order shown.
(e) Check that the painted mark is now at a 90° angle to the front.
(f) Check that the crankshaft turns smoothly.
(g) Check the connecting rod thrust clearance.
(See step 2 on page EM–71)

7. INSTALL REAR OIL SEAL RETAINER

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



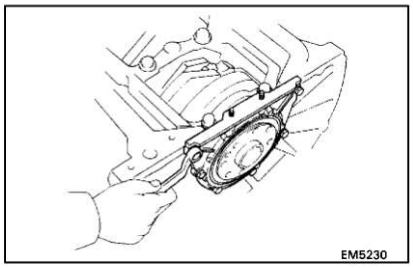
(b) Apply seal packing to the retainer as shown in the figure.

Seal packing: Part No. 08826–00080 or equivalent

- Install a nozzle that has been cut to a 2–3 mm (0.08–0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

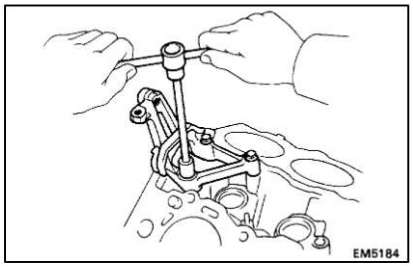
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



(c) Install the retainer with the six bolts.

Torque: 80 kg–cm (69 in.–lb, 7.8 N·m)

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POST ASSEMBLY

1. INSTALL NO.2 IDLER PULLEY BRACKET

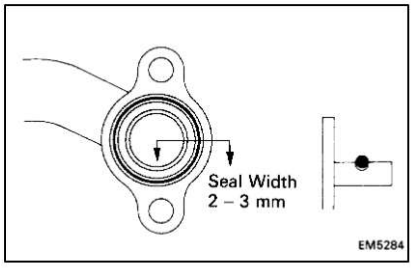
Install the pulley bracket with the three bolts. Torque the bolts.

Torque: 380 kg–cm (27 ft–lb, 37 N·m)

2. INSTALL WATER BY–PASS PIPE

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the by–pass pipe 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.



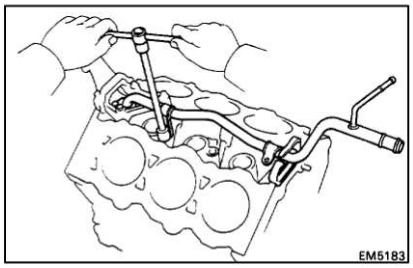
(b) Apply seal packing to the groove of the by–pass pipe.

Seal packing: Part No. 08826–00100 or equivalent

- Install a nozzle that has been cut to a 2–3 mm (0.08–0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

- 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 by–pass pipe with the two bolts and two nuts.

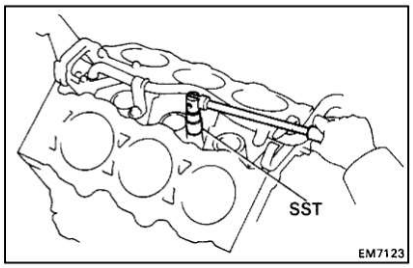
Torque: 85 kg–cm (74 in.–lb, 8.3 N·m)

3. INSTALL KNOCK SENSOR

Using SST, install the knock sensor.

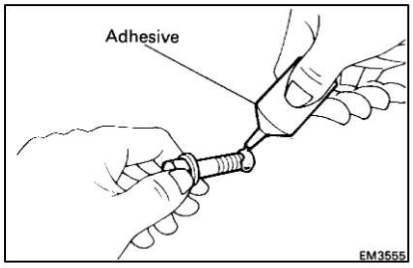
SST 09816–30010

Torque: 450 kg–cm (33 ft–lb, 44 N·m)

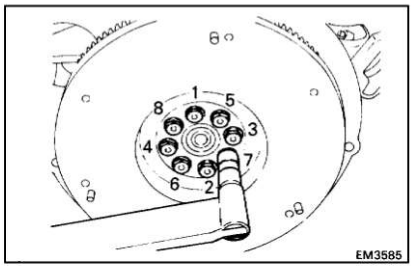


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4. **INSTALL OIL FILTER (See page LU–6)**
5. **INSTALL OIL PUMP AND OIL PAN (See page LU–11)**
6. **INSTALL WATER PUMP (See page CO–7)**
7. **INSTALL CYLINDER HEADS (See pages EM–50 to 60)**
8. **INSTALL PULLEYS AND TIMING BELT (See pages EM–23 to 28)**
9. **INSTALL DISTRIBUTOR (See page IG–10)**
10. **REMOVE ENGINE STAND**
11. **INSTALL REAR END PLATE**
    Install the end plate with the bolt.
    Torque: 75 kg–cm (65 in.–lb, 7.4 N·m)



12. **(M/T)**
    INSTALL FLYWHEEL
    (a) Apply adhesive to two or three threads of the mount bolt end.
    Adhesive: Part No. 08833–00070, THREE BOND 1324 or equivalent



    (b) Install the flywheel on the crankshaft.
    (c) Install and uniformly tighten the eight mount bolts in several passes, in the sequence shown.
    Torque: 850 kg–cm (61 ft–lb, 83 N·m)

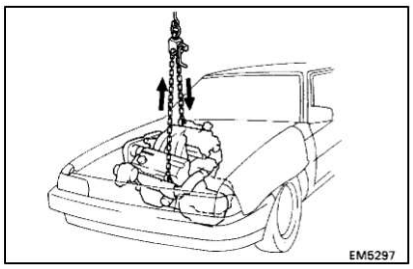
13. **(A/T)**
    INSTALL DRIVE PLATE (See procedure step 12)
    Torque: 850 kg–cm (61 ft–lb, 83 N·m)
14. **(M/T)**
    INSTALL CLUTCH DISC AND COVER

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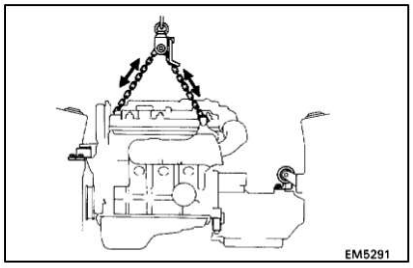
INSTALLATION OF ENGINE

(See page EM–61 to 63)

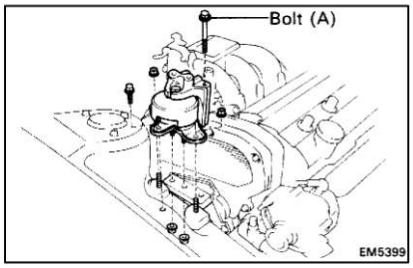
1. ASSEMBLE ENGINE AND TRANSAXLE
(See page MT–8 or AT–15)
2. (A/T)
INSTALL STARTER (See page ST–5)



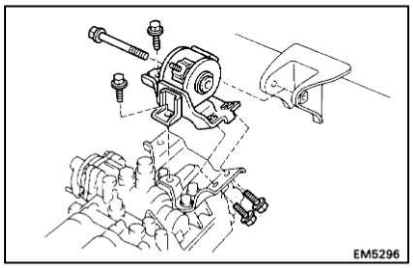
3. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE
(a) Attach the engine chain hoist to the engine hangers.
(b) Lower the engine into the engine compartment.
Tilt the transaxle downward, lower the engine and clear the LH mounting.
NOTICE: Be careful not to hit the PS gear housing or neutral start switch.



(c) Keep the engine level, and align RH and LH mounting with the body bracket.



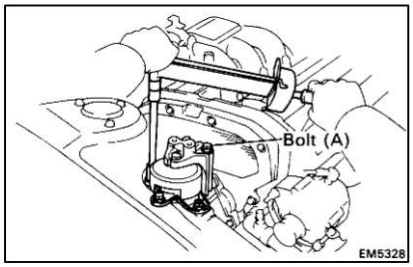
(d) Attach the RH mounting insulator to the mounting bracket and body, and temporarily install the four nuts and bolt.
(e) Temporarily install the No.2 mounting stay bolt (A).



(f) Install the LH mounting bracket to the transaxle case with the three bolts. Torque the bolts.
Torque: 530 kg–cm (38 ft–lb, 52 N·m)
(g) Attach the LH mounting insulator to the mounting bracket with the three bolts, and install and torque the four bolts and through bolt.
Torque:

Bolt	**530 kg–cm (38 ft–lb, 52 N·m)**
Through bolt	**890 kg–cm (64 ft–lb, 87 N·m)**

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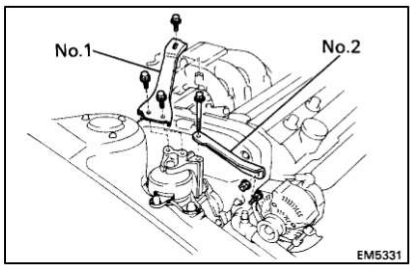
(h) Torque the four nuts and bolt of the RH mounting insulator. Do not torque the bolt (A) yet.

Torque:

Bolt		**650 kg–cm (47 ft–lb, 64 N·m)**
Nut	**To bracket**	**530 kg–cm (38 ft–lb, 52 N·m)**
	To body	**900 kg–cm (65 ft–lb, 88 N·m)**

(i) Remove the engine hoist chain from the engine.

(j) Install the two clamp bolts of the PS oil cooler pipes.



4. CONNECT RH ENGINE MOUNTING STAYS

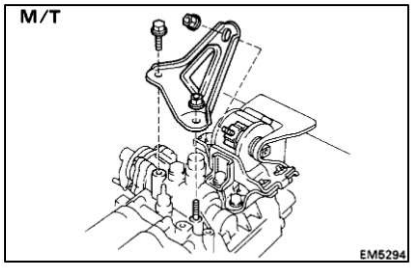
(a) Install the No.1 mounting stay with the three bolts. Torque the bolts.

Torque: 530 kg–cm (38 ft–lb, 52 N·m)

(b) Install the No.2 mounting stay with the bolt and nut. Torque the bolt and nut.

Torque:

Bolt	**670 kg–cm (48 ft–lb, 66 N·m)**
Nut	**530 kg–cm (38 ft–lb, 52 N·m)**



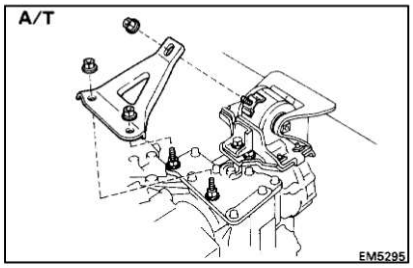
5. CONNECT LH ENGINE MOUNTING STAY

(M/T)

Install the mounting stay with the bolt and two nuts. Torque the bolt and nuts.

Torque:

Nut	**530 kg–cm (38 ft–lb, 52 N·m)**
Bolt	**195 kg–cm (14 ft–lb, 19 N·m)**

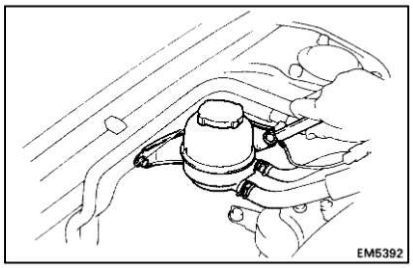


(A/T)

Install the mounting stay with the three nuts. Torque the nuts.

Torque:

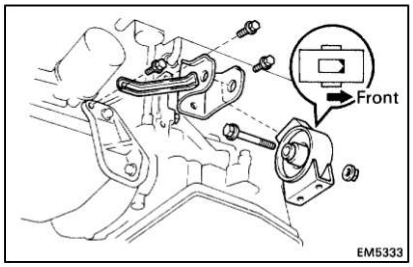
12 mm nut (A)	**210 kg–cm (15 ft–lb, 21 N·m)**
14 mm nut (B)	**530 kg–cm (38 ft–lb, 52 N·m)**



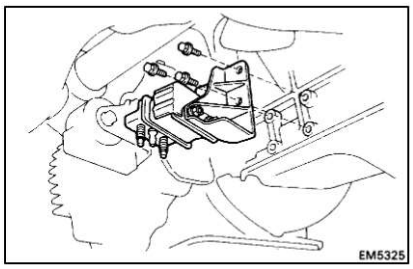
6. INSTALL PS OIL RESERVOIR TANK

Install the reservoir tank with the two bolts. Connect the ground strap.

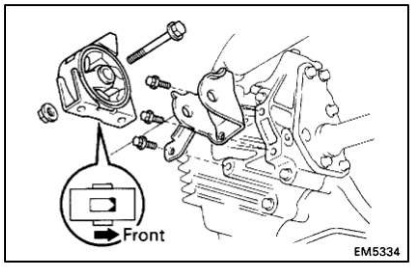
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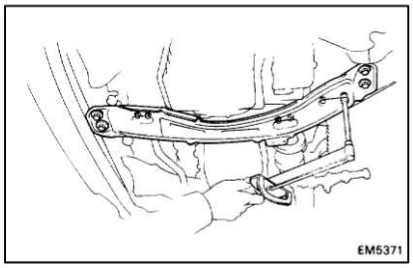
7. **INSTALL FRONT ENGINE MOUNTING BRACKET AND INSULATOR**
   (a) Install the mounting bracket with the three bolts.
   Torque the bolts.
   Torque: 790 kg–cm (57 ft–lb, 77 N·m)
   (b) Temporarily install the mounting insulator with the through bolt and a new nut.



8. **INSTALL CENTER ENGINE MOUNTING BRACKET AND INSULATOR ASSEMBLY**
   Install the mounting bracket and insulator assembly with the three bolts. Torque the bolts.
   Torque: 530 kg–cm (38 ft–lb, 52 N·m)

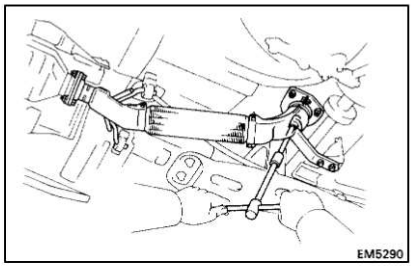


9. **INSTALL REAR ENGINE MOUNTING BRACKET AND INSULATOR**
   (a) Install the mounting bracket with the three bolts.
   Torque the bolts.
   Torque: 790 kg–cm (57 ft–lb, 77 N·m)
   (b) Temporarily install the mounting insulator with the through bolt and a new nut.



10. **INSTALL ENGINE MOUNTING CENTER MEMBER**
    (a) Install the engine mounting center member with the four bolts. Torque the bolts.
    Torque: 400 kg–cm (29 ft–lb, 39 N·m)
    (b) Install and torque the four bolts and two nuts holding the insulators (front, center and rear) to the center member.
    Torque: 740 kg–cm (54 ft–lb, 73 N·m)
    (c) Torque the mounting insulator through bolts (front and rear).
    Torque: 890 kg–cm (64 ft–lb, 87 N·m)
11. **INSTALL PS PUMP**
12. **INSTALL DRIVE SHAFTS (See pages SA–26 to 28)**
13. **INSTALL A/C COMPRESSOR**
    (a) Install the compressor with the four bolts.
    (b) Connect the two connectors.

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14. INSTALL FRONT EXHAUST PIPE

(a) Place two new gaskets on the front pipe.

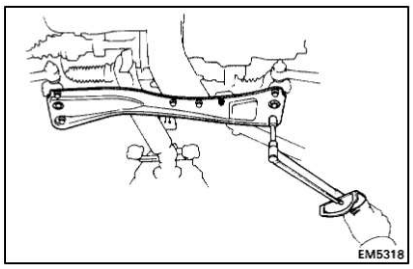
(b) Install the front pipe with the two bolts and five new nuts. Torque the nuts.

Torque:

To manifold 630 kg–cm (46 ft–lb, 62 N·m)

To converter 440 kg–cm (32 ft–lb, 43 N·m)

(c) Install the two pipe stay bolts.



15. INSTALL SUSPENSION LOWER CROSSMEMBER

Install the crossmember with the two bolts and two nuts. Torque the bolts and nuts.

Torque: 2,120 kg–cm (153 ft–lb, 207 N·m)

16. CONNECT ENGINE WIRE TO CABIN

(a) Push in the engine wire through the cowl panel.

(b) Connect the following connectors.

(1) Three TCCS ECU connectors

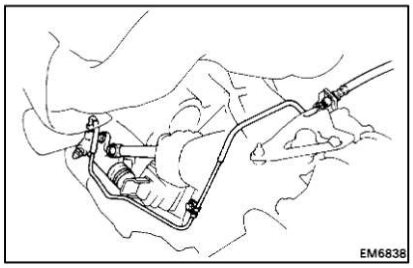
(2) Circuit opening relay connector

(3) Cowl wire connector

(4) Instrument panel wire connector

(c) Install the glove compartment box.

(d) Install the under cover.

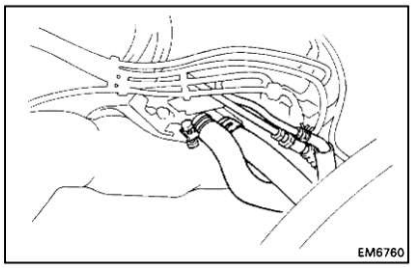


17. CONNECT TRANSAXLE CONTROL CABLE(S)

18. CONNECT SPEEDOMETER CABLE

19. (M/T)
INSTALL CLUTCH RELEASE CYLINDER AND TUBE CLAMP

20. (M/T)
INSTALL STARTER



21. CONNECT FUEL HOSES

22. CONNECT HEATER HOSES

23. CONNECT GROUND STRAP TO TRANSAXLE

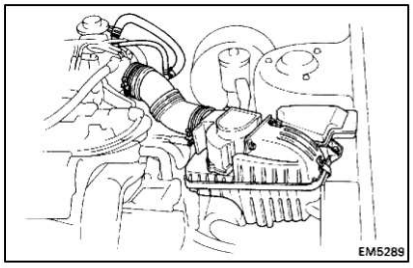
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24. CONNECT VACUUM HOSES

(a) Brake booster vacuum hose to air intake chamber
(b) A/C idle–up vacuum hose to air intake chamber
(c) A/C idle–up vacuum hose to vacuum pipe (on air intake chamber)
(d) Charcoal canister vacuum hose to vacuum pipe (on air intake chamber)

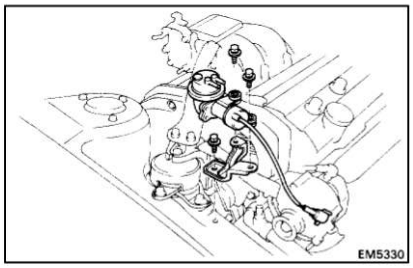
25. CONNECT WIRES AND CONNECTORS

(a) Check connector
(b) Theft deterrent horn connector
(c) Ground straps from LH fender apron
(d) Connectors from relay box
(e) Engine room wire connector



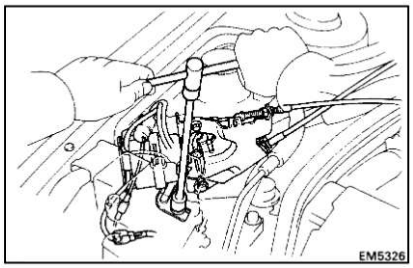
26. INSTALL AIR CLEANER ASSEMBLY

(a) Install the air cleaner case with the three bolts.
(b) Install the air cleaner element.
(c) Connect the air cleaner hose, and install the air cleaner cap and air flow meter assembly with the four clips.
(d) Connect the following connector and hoses:
  (1) Air flow meter connector
  (2) ISC valve air hose
  (3) Vacuum pipe air hose



27. INSTALL CRUISE CONTROL ACTUATOR

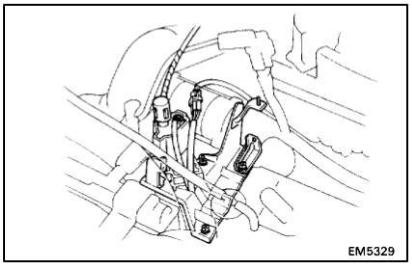
(a) Install the vacuum pump and bracket with the three bolts.
(b) Connect the vacuum pump connector.



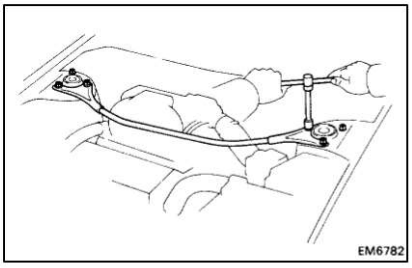
(c) Install the actuator and bracket with the four bolts.
(d) Connect the following hoses and connector:
  (1) Actuator vacuum hoses
  (2) Actuator connector
(e) Install the dust cover.

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28. **(A/T)**
INSTALL THROTTLE CABLE, AND ADJUST IT
29. **INSTALL ACCELERATOR CABLE, AND ADJUST IT**
30. **INSTALL RADIATOR RESERVOIR TANK**
31. **INSTALL ALTERNATOR BELT ADJUSTING BAR**
32. **INSTALL ALTERNATOR (See page CH–8)**
33. **INSTALL RADIATOR (See page CO–13)**


EM5329

34. **INSTALL IGNITION COIL, IGNITER AND BRACKET ASSEMBLY**
(a) Install the ignition coil, igniter and bracket assembly with the two bolts.
(b) Connect the following cord and connectors:
(1) Igniter connector
(2) Noise filter connector
(3) High–tension cord


EM6782

35. **INSTALL SUSPENSION UPPER BRACE**
Install the upper brace with the four nuts.
Torque: 650 kg–cm (47 ft–lb, 64 N·m)

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36. **INSTALL BATTERY**
Connect the grand strap.
37. **FILL WITH ENGINE COOLANT (See page CO–5)**
38. **FILL WITH ENGINE OIL (See page LU–8)**
Capacity:
Drain and refill
w/ Oil filter change
3.9 liters (4.1 US qts, 3.4 Imp. qts)
w/o Oil filter change
3.7 liters (3.9 US qts, 3.3 Imp. qts)
Dry fill 4.6 liters (4.8 US qts, 4.0 Imp. qts)
39. **START ENGINE AND CHECK FOR LEAKS**
40. **PERFORM ENGINE ADJUSTMENT**
(a) Adjust the engine drive belt. (See page CH–5)
Drive belt tension: New belt 175 ± 5 lb
Used belt 115 ± 20 lb
(b) Adjust the PS drive belt. (See page SR–17)
Drive belt tension: New belt 125 ± 25 lb
Used belt 80 ± 20 lb

(c) Adjust the ignition timing. (See page IG–12)

Ignition timing:

10° BTDC @ idle

(w/ Terminals TE1 and E1 connected)

41. **INSTALL ENGINE UNDER COVERS**
42. **INSTALL HOOD**
43. **PERFORM ROAD TEST**

    Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
44. **RECHECK ENGINE COOLANT AND ENGINE OIL LEVELS**

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SERVICE SPECIFICATIONS

SPECIFICATIONS

Idle speed				700 ± 50 rpm	
Intake manifold vacuum	at Idle speed			440 mmHg (17.32 in. Hg, 58.6 kPa) or more	
Compression pressure	at 250 rpm	STD		12.5 kg/cm^2 (178 psi, 1,226 kPa) or more	
		Limit		10.0 kg/cm^2	142 psi 981 kPa
	Difference of pressure between each cylinder			1.0 kg/cm^2 (14 psi, 98 kPa) or less	
Cylinder head	Cylinder block surface warpage		Limit	0.10 mm	0.0039 in.
	Valve seat	Refacing angle		30°, 45°, 60°	
		Contacting angle		45°	
		Contacting width		1.0–1.4 mm	0.039–0.055 in.
Valve guide bushing	Inside diameter			6.010–6.030 mm	0.2366–0.2374 in.
	Outside diameter		STD	11.048–11.059 mm	0.4350–0.4354 in.
			O/S 0.05	11.098–11.109 mm	0.4369–0.4374 in.
Valve	Valve overall length	STD	Intake	96.1 mm	3.783 in.
			Exhaust	96.2 mm	3.787 in.
		Limit	Intake	95.6 mm	3.764 in.
			Exhaust	95.7 mm	3.768 in.
	Valve face angle			44.5°	
	Stem diameter		Intake	5.970–5.985 mm	0.2350–0.2356 in.
			Exhaust	5.965–5.980 mm	0.2348–0.2354 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.
			Intake	0.08 mm	0.0031 in.
			Exhaust	0.10 mm	0.0039 in.
	Margin thickness	STD		1.0 mm	0.039 in.
		Limit		0.5 mm	0.020 in.
Valve spring	Free length			42.6 mm	1.677 in.
	Installed tension	at 33.8 mm (1.331 in.)		18.6–21.4 kg (41.0–47.2 lb, 182–210 N)	
	Squareness	Limit		2.0 mm	0.075 in.
Valve lifter	Lifter diameter			27.975–27.985 mm	1.1014–1.1018 in.
	Cylinder head lifter bore diameter			28.000–28.021 mm	1.1024–1.1032 in.
	Oil clearance	STD		0.015–0.046 mm	0.0005–0.0018 in.
		Limit		0.07 mm	0.0028 in.
Manifold	Warpage	Limit	Intake	0.10 mm	0.0039 in.
			Exhaust	1.00 mm	0.0394 in.
Air intake chamber	Warpage	Limit		0.10 mm	0.0039 in.
Camshaft	Thrust clearance	STD		0.030–0.080 mm	0.0012–0.0031 in.
		Limit		0.12 mm	0.0047 in.
	Journal oil clearance	STD		0.035–0.072 mm	0.0014–0.0028 in.
		Limit		0.10 mm	0.0039 in.
	Journal diameter			26.949–26.965 mm	1.0610–1.0616 in.
	Circle runout	Limit		0.06 mm	0.0024 in.

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SPECIFICATIONS (Cont'd)

Camshaft (cont'd)	Cam lobe height	STD	Intake	39.510–39.610 mm	1.5555–1.5594 in.
			Exhaust	38.960–39.060 mm	1.5339–1.5378 in.
		Limit	Intake	39.36 mm	1.5496 in.
			Exhaust	38.81 mm	1.5279 in.
	Camshaft gear backlash	STD		0.020–0.200 mm	0.0008–0.0079 in.
		Limit		0.30 mm	0.0188 in.
	Camshaft gear spring end free distance			18.2–18.8 mm	0.712–0.740 in.
Timing belt tensioner	Protrusion (from housing end)			10.5–11.5 mm	0.413–0.453 in.
Cylinder block	Cylinder head surface warpage		Limit	0.05 mm	1.0020 in.
	Cylinder bore diameter	STD	Mark 1	87.500–87.510 mm	3.4449–3.4453 in.
			Mark 2	87.510–87.520 mm	3.4453–3.4457 in.
			Mark 3	87.520–87.530 mm	3.4457–3.4461 in.
		Limit	STD	87.73 mm	2.4539 in.
			O/S 0.50	88.23 mm	3.4736 in.
Piston and piston ring	Piston diameter	STD	Mark 1	87.445–87.455 mm	3.4427–3.4431 in.
			Mark 2	87.455–87.465 mm	3.4431–3.4435 in.
			Mark 3	87.465–87.475 mm	3.4435–3.4439 in.
		O/S 0.50		87.945–87.975 mm	3.4624–3.4636 in.
	Piston oil clearance		STD	0.045–0.065 mm	0.0018–0.0026 in.
			Limit	0.085 mm	0.0033 in.
	Piston ring groove clearance		No.1	0.010–0.080 mm	0.0004–0.0031 in.
			No.2	0.030–0.070 mm	0.0012–0.0028 in.
	Piston ring end gap	STD	No.1	0.300–0.540 mm	0.0118–0.0213 in.
			No.2	0.350–0.620 mm	0.0138–0.0244 in.
			Oil	0.200–0.570 mm	0.0079–0.0224 in.
		Limit	No.1	1.12 mm	0.0441 in.
			No.2	1.20 mm	0.0472 in.
			Oil	1.15 mm	0.0453 in.
Connecting rod	Thrust clearance		STD	0.150–0.330 mm	0.0059–0.0130 in.
			Limit	0.38 mm	0.0150 in.
	Connecting rod oil clearance				
		STD	STD	0.028–0.065 mm	0.0011–0.0026 in.
			U/S 0.25	0.027–0.080 mm	0.0011–0.0031 in.
		Limit		0.08 mm	0.0031 in.
	Connecting rod bearing center wall thickness				
			Mark 1	1.484–1.488 mm	0.0584–0.0586 in.
			Mark 2	1.488–1.492 mm	0.0586–0.0587 in.
			Mark 3	1.492–1.496 mm	0.0587–0.0589 in.
	Rod bending per 100 mm (3.94 in.)		Limit	0.05 mm	0.0020 in.
	Rod twist per 100 mm (3.94 in.)		Limit	0.15 mm	0.0059 in.
	Connecting rod bolt outer diameter		STD	7.860–8.000 mm	0.3094–0.3150 in.
			Limit	7.60 mm	0.2992 in.
Crankshaft	Thrust clearance		STD	0.020–0.220 mm	0.0008–0.0087 in.
			Limit	0.30 mm	0.0118 in.
	Thrust washer thickness			2.440–2.490 mm	0.0961–0.0980 in.

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SPECIFICATIONS (Cont'd)

Crankshaft (cont'd)	Main journal oil clearance STD	STD	0.029–0.056 mm	0.0011–0.0022 in.
		U/S 0.25	0.028–0.080 mm	0.0011–0.0031 in.
	Limit		0.08 mm	0.0031 in.
	Main journal diameter	STD	63.985–64.000 mm	2.5191–2.5197 in.
		U/S 0.25	63.745–63.755 mm	2.5096–2.5100 in.
	Main bearing center wall thickness	Mark 1	1.989–1.992 mm	0.0783–0.0784 in.
		Mark 2	1.992–1.995 mm	0.0784–0.0785 in.
		Mark 3	1.995–1.998 mm	0.0785–0.0787 in.
		Mark 4	1.998–2.001 mm	0.0787–0.0788 in.
		Mark 5	2.001–2.004 mm	0.0788–0.0789 in.
	Crank pin diameter	STD	47.987–48.000 mm	1.8892–1.8898 in.
		U/S 0.25	47.745–47.755 mm	1.8797–1.8801 in.
	Circle runout	Limit	0.06 mm	0.0024 in.
	Main journal taper and out–of–round	Limit	0.02 mm	0.0008 in.
	Crank pin taper and out–of–round	Limit	0.02 mm	0.0008 in.

TORQUE SPECIFICATIONS

Part tightened	kg–cm	ft–lb	N·m
No. 1 idler pulley X Oil pump	350	25	34
No. 2 idler pulley X No. 2 idler pulley bracket	400	29	39
Camshaft timing pulley X Camshaft	1,100	80	108
Crankshaft pulley X Crankshaft	2,500	181	245
Timing belt tensioner X Oil pump	270	20	26
Engine RH mounting bracket X Cylinder block	410	30	39
Cylinder head X Cylinder block 12–sided bolt 1st	350	25	34
2nd	Turn 90°		
3rd	Turn 90°		
Recessed head bolt	185	13	18
LH engine hanger X LH Cylinder head	380	27	37
Camshaft bearing cap X Cylinder head	160	12	16
Cylinder head cover X Cylinder head	60	52 in.–lb	5.9
No. 3 timing belt cover X Cylinder head	75	65 in.–lb	7.4
No. 3 timing belt cover X Cylinder block	75	65 in.–lb	7.4
Exhaust manifold X Cylinder head	400	29	39
Intake manifold X Cylinder head	180	13	18
No. 2 idler pulley bracket stay X Intake manifold	185	13	18
No. 2 idler pulley bracket stay X No. 2 idler pulley bracket	185	13	18
Water by–pass outlet X Intake manifold	200	14	20
Water outlet X Intake manifold	85	73 in.–lb	8.3
Air intake chamber X Intake manifold	440	32	43
Air intake chamber stay X Air intake chamber	380	27	37
Air intake chamber stay X Cylinder head	380	27	37
Crossover pipe X Exhaust manifold	400	29	39
Crossover pipe X Cylinder head	350	25	34
Crossover pipe X Cylinder block	350	25	34
EGR valve X Air intake chamber	185	13	18

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TORQUE SPECIFICATIONS (Cont'd)

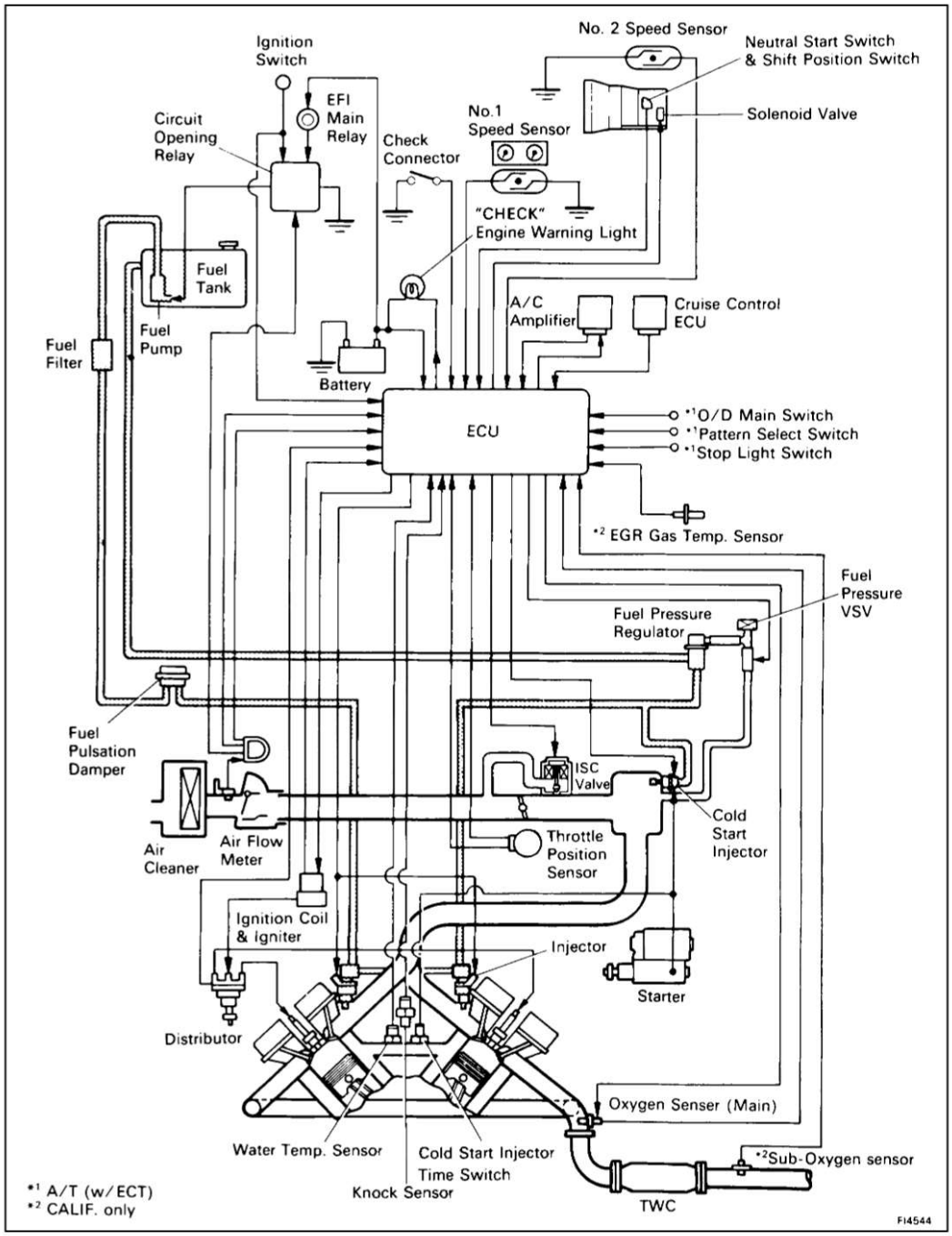
Part tightened			kg–cm	ft–lb	N·m
EGR pipe X EGR valve			185	13	18
EGR pipe X RH exhaust manifold			800	58	78
Main bearing cap X Cylinder block		1st	625	45	61
		2nd	Turn 90°		
Connecting rod cap X Connecting rod		1st	250	18	25
		2nd	Turn 90°		
Rear oil seal retainer X Cylinder block			80	69 in.–lb	7.8
No. 2 idler pulley bracket X Cylinder block			380	27	37
Water by–pass pipe X Cylinder block			85	74 in.–lb	8.3
Rear end plate X Cylinder block			75	65 in.–lb	7.4
Flywheel X Crankshaft			850	61	83
Drive plate X Crankshaft			850	61	83
Engine RH mounting insulator X Engine mounting bracket			530	38	52
Engine RH mounting insulator X Body		Bolt	650	47	64
		Nut	900	65	88
Engine LH mounting insulator X Engine mounting bracket			530	38	52
Engine LH mounting insulator X Body			890	64	87
No. 1 engine RH mounting stay X Air intake chamber			530	38	52
No. 1 engine RH mounting stay X Engine RH mounting insulator			530	38	52
No. 2 engine RH mounting stay X Alternator			530	38	52
No. 2 engine RH mounting stay X Engine RH mounting insulator			670	48	66
Engine LH mounting stay X Transaxle	M/T	Bolt	195	14	19
		Nut	530	38	52
	A/T	12 mm nut	210	15	21
		14 mm nut	530	38	52
Engine LH mounting stay X Engine mounting insulator			530	38	52
Engine front mounting bracket X Engine mounting center member			740	54	73
Engine front mounting bracket X Transaxle			790	57	77
Engine front mounting insulator X Engine mounting bracket			890	64	87
Engine center mounting bracket X Cylinder block			530	38	52
Engine rear mounting bracket X Transaxle			790	57	77
Engine rear mounting insulator X Engine mounting bracket			890	64	87
Engine mounting center member X Body			400	29	39
Engine mounting center member X Engine front mounting insulator			740	54	73
Engine mounting center member X Engine center mounting insulator			740	54	73
Engine mounting center member X Engine rear mounting insulator			740	54	73
Exhaust front pipe X Exhaust manifold			630	46	62
Exhaust front pipe X Catalytic converter			440	32	43
Suspension lower crossmember X Body			1,550	112	152
Suspension lower crossmember X Engine mounting center member			400	29	39

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EFI SYSTEM

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DESCRIPTION



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The EFI system is composed of three basic sub–systems: Fuel, Air Induction and Electronic Control Systems.

FUEL SYSTEM

Fuel is supplied under constant pressure to the EFI injectors by an electric fuel pump. The injectors inject a metered quantity of fuel into the intake manifold in a accordance with signals from the ECU (Electronic Control Unit).

AIR INDUCTION SYSTEM

The air induction system provides sufficient air for engine operation.

ELECTRONIC CONTROL SYSTEM

The ES250 2VZ–FE engines is equipped with a which centrally controls the EFI, ESA, ISC, Diagnosis systems etc. by means of an Electronic Control Unit (ECU–formerly EFI computer) employing a microcomputer.

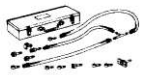
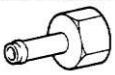
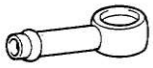
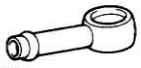
By means of the ECU, the controls the following functions:

1. Electronic Fuel Injection (EFI)
   The ECU receives signals from various sensors indicating changing engine operation conditions such as:
   Intake air volume
   Intake air temperature
   Coolant temperature
   Engine rpm
   Acceleration/deceleration
   Exhaust oxygen content etc.
   The signals are utilized by the ECU to determine the injection duration necessary for an optimum air–fuel ratio.
2. Electronic Spark Advance (ESA)
   The ECU is programmed with data for optimum ignition timing under any and all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, coolant temperature, etc.), the microcomputer (ECU) triggers the spark at precisely the right instant. (See IG section)
3. Idle Speed Control (ISC)
   The ECU is programmed with target idling speed values to respond to different engine conditions (coolant temperature, air conditioner ON/OFF, etc.). Sensors transmit signals to the ECU which control the flow of air through the by–pass of the throttle valve and adjust idle speed to the target value. (See page FI–44)
4. Diagnosis
   The ECU detects any malfunctions abnormalties in the sensor network and lights a ”CHECK” engine warning light on the instrument panel. At the same time, the trouble is identified and a diagnostic code is recorded by the ECU. The diagnostic code can be read by the number of blinks of the ”CHECK” engine warning light when terminals TE1 and E1 are connected. The diagnostic codes are refer to the later page. (See page TR–9)
5. Fail–Safe Function
   In the event of the sensor malfunctioning, a back–up circuit will take over to provide minimal driveability, and the ”CHECK” engine warning light will illuminate.

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PREPARATION

SST (SPECIAL SERVICE TOOLS)

Illustration	Part No.	Part Name	Note
	09268–41045	Injection Measuring Tool Set	
	(09268–41060)	(No. 3 Union)	
	(09268–41080)	(No. 6 Union)	
	(90405–09015)	(No. 1 Union)	
	09268–45012	EFI Fuel Pressure Gauge	
	09631–22020	Power Steering Hose Nut 14 x 17 mm Wrench Set	Fuel line flare nut
	09842–30050	Wiring "A" EFI Inspection	
	09842–30070	Wiring "F" EFI Inspection	
	09843–18020	Diagnosis Check Wiring	

RECOMMENDED TOOLS

Illustration	Part No.	Part Name	Note
	09082–00015	TOYOTA Electrical Tester	
	09200–00010	Engine Adjust Kit	
	09258–00030	Hose Plug Set	Plug for vacuum hose, fuel hose etc.

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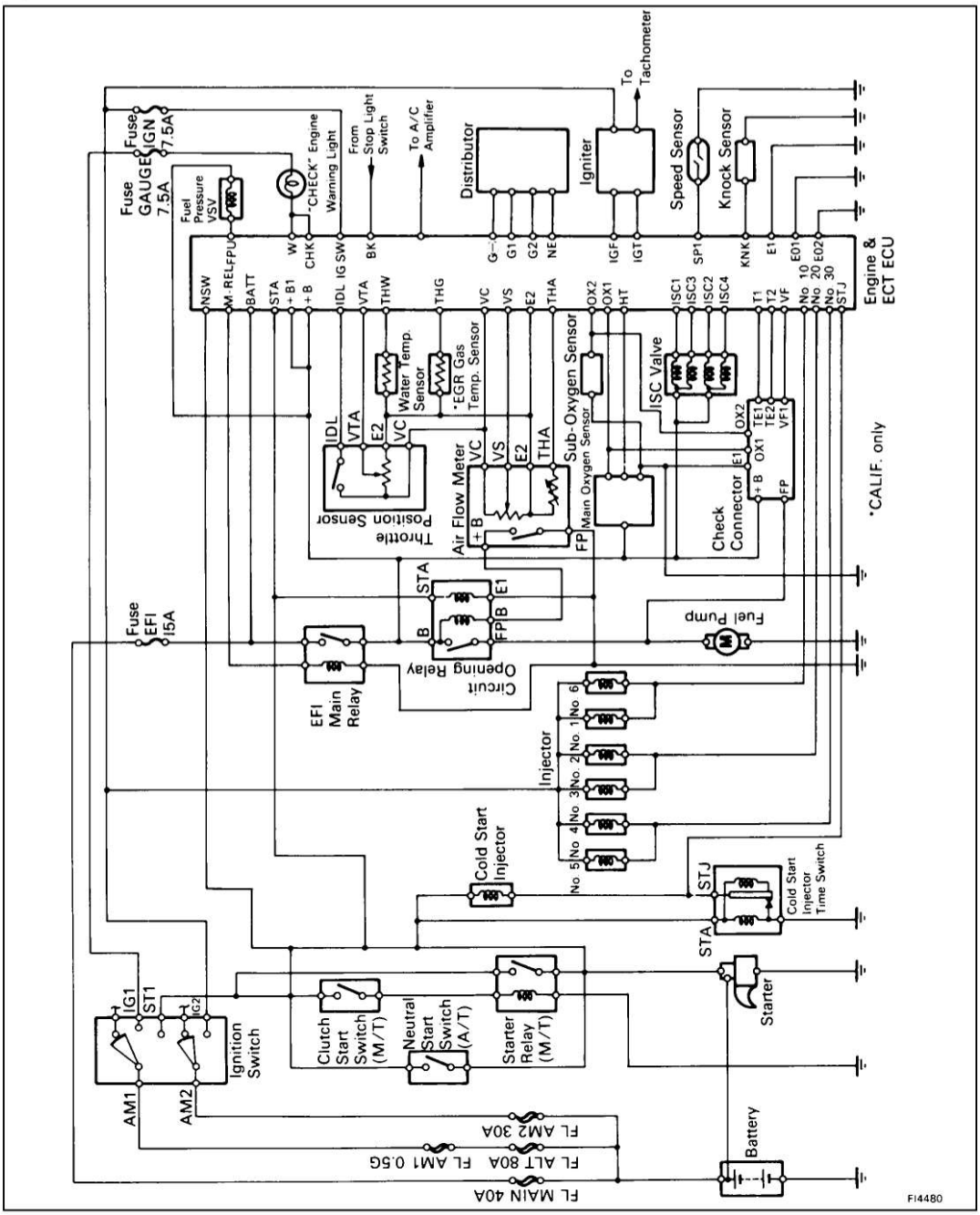
EQUIPMENT

Part Name	Note
Graduated cylinder	Injector
Ohmmeter	
Sound scope	Injector
Tachometer	
Torque wrench	
Voltmeter	

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OPERATION

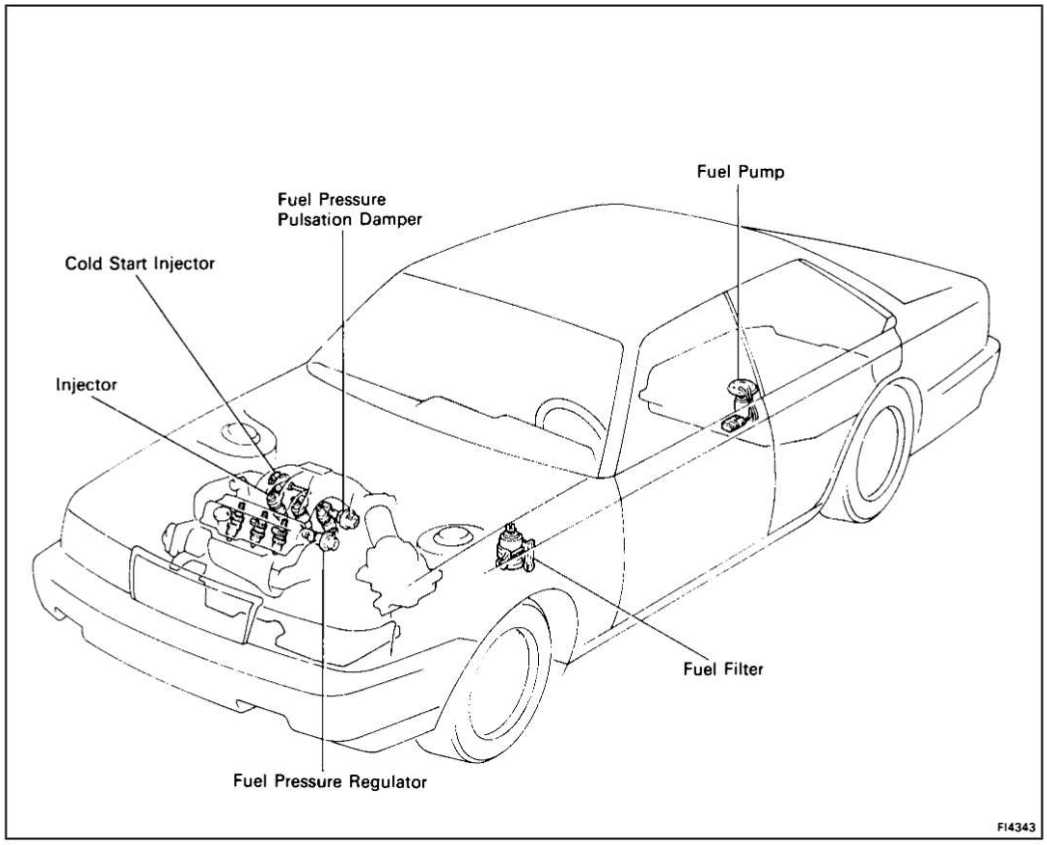
System Circuit



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System Operation

FUEL SYSTEM



Fuel is pumped up by the fuel pump, flows through the fuel filter and is distributed to each injector and cold start injector at a set pressure maintained by the pressure regulator.

The fuel pressure regulator adjusts the pressure of the fuel from the fuel line (high pressure side) to a pressure 2.9 kg/cm^2 (41 psi, 284 kPa) higher than the pressure inside the intake manifold, and excess fuel is returned to the fuel tank through the return pipe. When the engine is hot, the fuel pressure is increased to control percolation in the fuel system and improve restartability and idling stability.

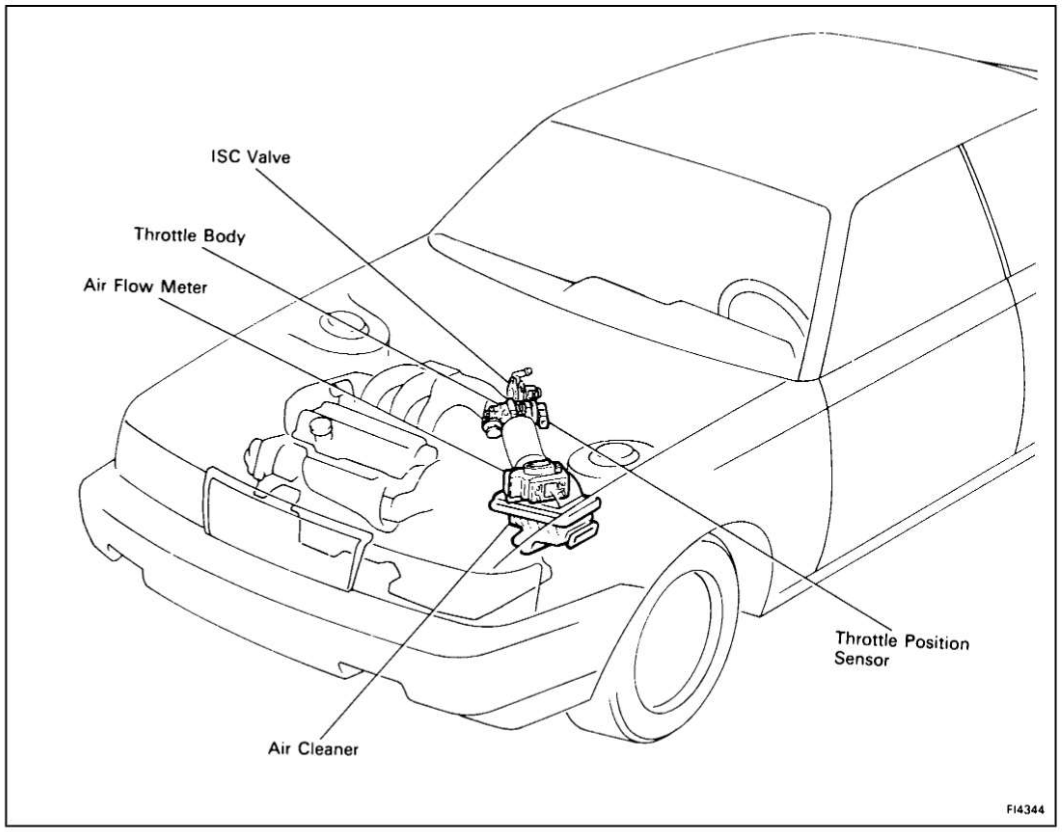
The pulsation damper absorbs the slight fluctuations in fuel pressure caused by fuel injector from the injector.

The injectors operate on input of injection slights from the ECU and inject fuel into the intake manifold.

Cold start injector operates when starting with low coolant temperature or at normal temperature ranges, injecting fuel into the air intake chamber to improve startability.

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AIR INDUCTION SYSTEM



Air filtered through the air cleaner passes through the air flow meter and the amount flowing to the air intake chamber is determined according to the throttle valve opening in the throttle body and the engine rpm.

The air flow meter measures the intake air flow by the opening of the measuring plate in response to the volume of intake air to the engine.

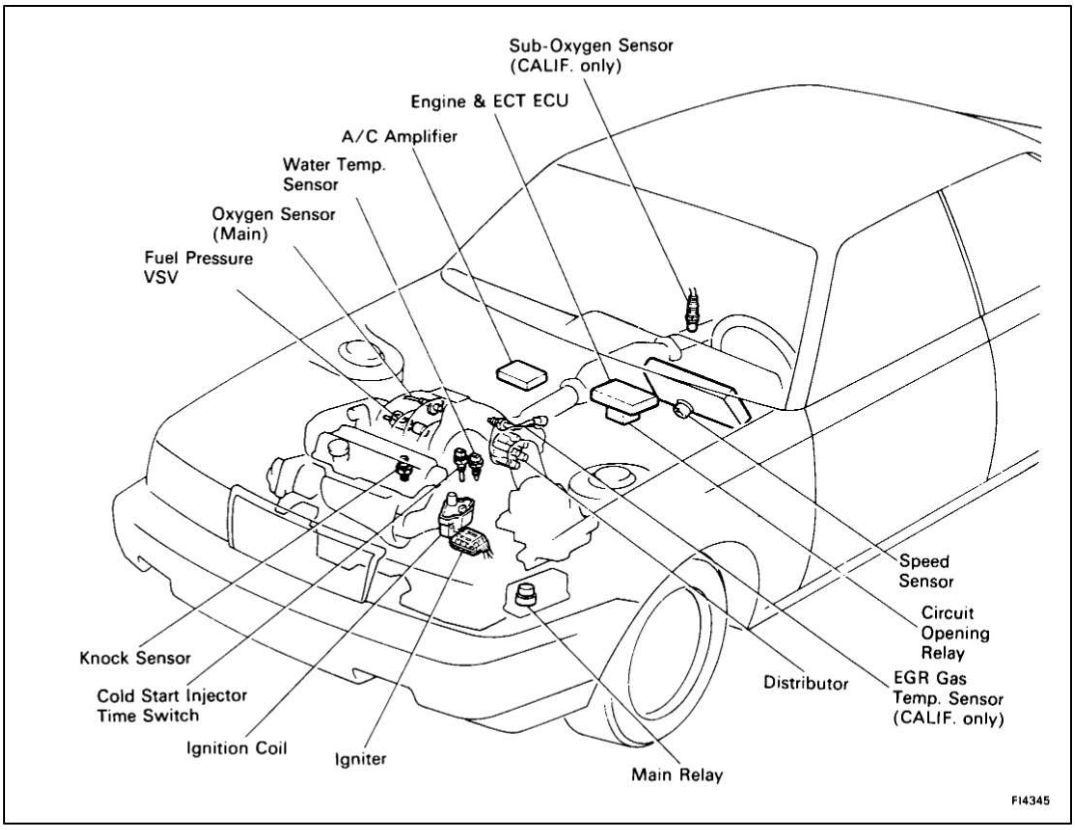
Located in the throttle body is the throttle valve, which regulates the volume of intake air to the engine. Intake air controlled by the throttle valve opening is distributed from the air intake chamber to the manifold of each cylinder and is drawn into the combustion chamber.

At low temperature the ISC valve opens, the air flows through the ISC valve, as well as the throttle body, into the air intake chamber. During engine warming up, even if the throttle valve is completely closed, air flows to the air intake chamber, thereby increasing the idle speed (first idle operation).

The air intake chamber prevents pulsation of the intake air, reduces the influence on the air flow meter and increases the accuracy of the measurement of the intake air volume. It also prevents intake air interference in each cylinder.

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ELECTRONIC CONTROL SYSTEM



The control system consists of sensors which detect various engine conditions, and a ECU which determines the injection volume (timing) based on the signals from the sensors.

The various sensors detect the intake air volume, engine rpm, oxygen density in the exhaust gas, coolant temperature, intake air temperature and atmospheric pressure etc. and convert the information into an electrical signal which is sent to the ECU. Based on these signals, the ECU calculates the optimum ignition timing for the current conditions and operates the injectors.

The ECU not only controls the fuel injection timing, but also the self diagnostic function which records the occurrence of a malfunction, ignition timing control, idle rpm control, EGR control, fuel pressure control and fuel pump control.

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PRECAUTIONS

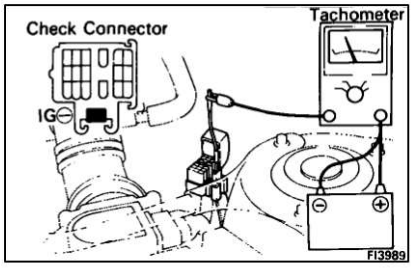
1. **Before working on the fuel system, disconnect the cable from negative (–) terminal of the battery.**
   HINT: Any diagnostic code retained by the computer will be erased when the battery terminal is removed.
   Therefore, if necessary, read the diagnosis before removing the battery terminal.
   CAUTION: Work must be started after mapprox. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.

2. **Do not smoke or work on open flame when working on the fuel system.**

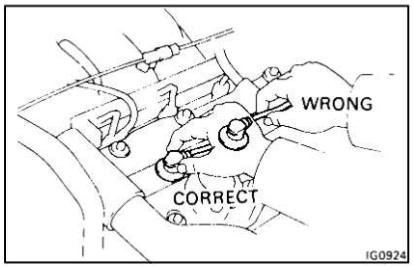
3. **Keep gasoline off rubber or leather parts.**

INSPECTION PRECAUTIONS

MAINTENANCE PRECAUTIONS



1. **CHECK CORRECT ENGINE TUNE–UP**
   (See page EM–7)
2. **PRECAUTIONS WHEN CONNECTING GAUGE**
   (a) Use the battery as the power source for the timing light, tachometer, etc.
   (b) Connect the test probe of a tachometer to the terminal IG (–) of the check connector.



3. **IN EVENT OF ENGINE MISFIRE FOLLOWING PRECAUTIONS SHOULD BE TAKEN**
   (a) Check proper connection of battery terminals, 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.

4. **PRECAUTIONS WHEN HANDLING OXYGEN SENSOR(S)**
   (a) Do not allow the oxygen sensor to drop or hit against an object.
   (b) Do not allow the sensor to come into contact with water.

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PRECAUTIONS

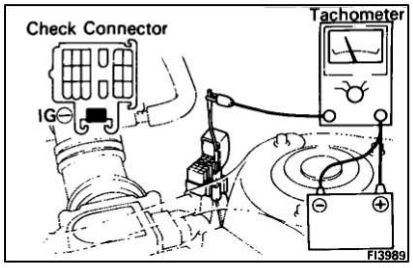
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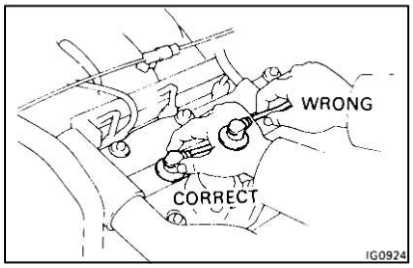
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INSPECTION PRECAUTIONS

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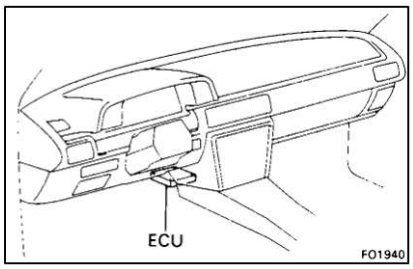
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IF VEHICLE IS EQUIPPED WITH MOBILE RADIO SYSTEM (HAM, CB, ETC.)

The ECU has been designed so that it will not be affected by outside interference.

However, if your vehicle is equipped with a CB radio transceiver, etc. (even one with about 10 W output), it may, at times, have an affect upon ECU operation, especially if the antenna and feeder are installed nearby.

Therefore, observe the following precautions:

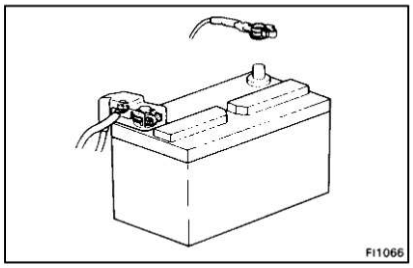


1. Install the antenna as far away as possible from the ECU. The ECU is located under the radio so the antenna should be installed at the rear side of the vehicle.
2. Keep the antenna feeder as far away as possible from the ECU wires–at least 20 cm (7.87 in.)–and, especially, do not wind them together.
3. Check that the feeder and antenna are properly adjusted.
4. Do not equip your vehicle with a powerful mobile radio system.
5. Do not open the cover or the case of the ECU unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)

AIR INDUCTION SYSTEM

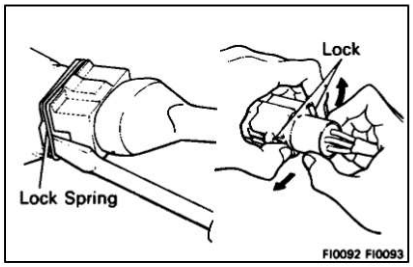
1. Separation of the engine oil dipstick, oil filler cap, PCV hose, etc. may cause the engine to run out of tune.
2. Disconnection, looseness or cracks in the parts of the air induction system between the throttle body and cylinder head will allow air suction and cause the engine to run out of tune.

ELECTRONIC CONTROL SYSTEM

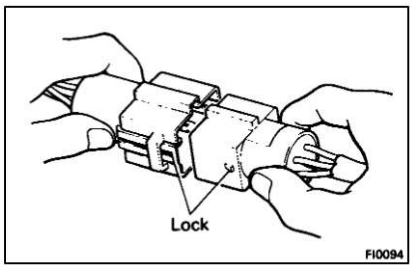


1. Before removing EFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch OFF or disconnecting the battery terminals.
2. When installing the battery, be especially careful not to incorrectly connect the positive (+) and negative (–) cables.
3. Do not 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 cause 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.

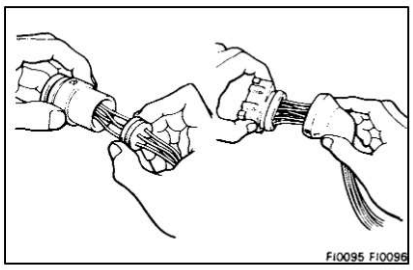
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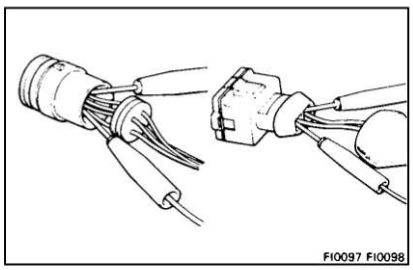
8. Care is required when pulling out and inserting wiring connectors.
   (a) Release the lock and pull out the connector, pulling on the connectors.



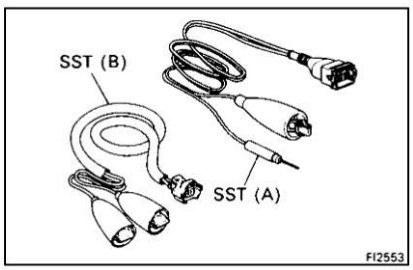
   (b) Fully insert the connector and check that it is locked.



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.

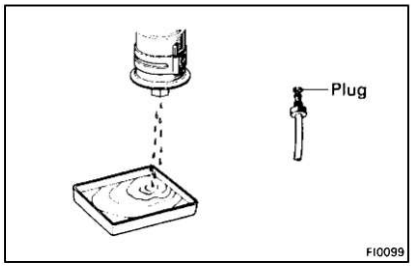


   (b) Insert the test probe into the connector from wiring side when checking the continuity, amperage or voltage.
   (c) Do not apply unnecessary force to the terminal.
   (d) After checking, install the water–proofing rubber on the connector securely.



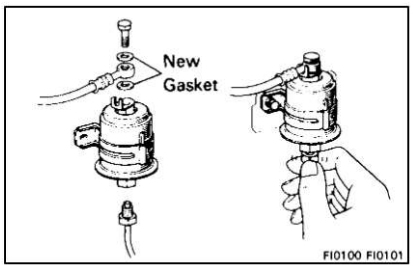
10. Use SST for inspection or test of the injector, cold start injector or its wiring connector.
    SST 09842–30050 (A) and 09842–30070 (B)

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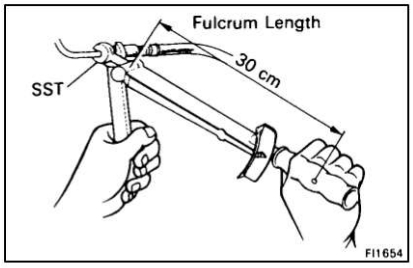


FUEL SYSTEM

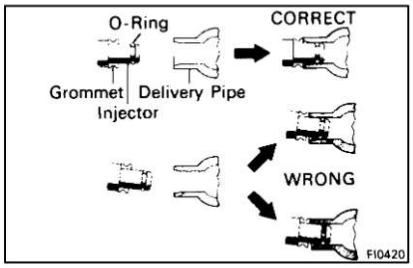
1. When disconnecting the high fuel pressure line, a large amount of gasoline will spill out, so observe the following procedures:
   (a) Put a container under the connection.
   (b) Slowly loosen the connection.
   (c) Disconnect the connection.
   (d) Plug the connection with a rubber plug.



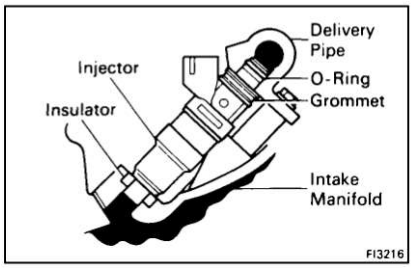
2. When connecting the flare nut or union bolt on the high pressure pipe union, observe the following procedures:
   (Union Bolt Type)
   (a) Always use a new gasket.
   (b) Tighten the union bolt by hand.
   (c) Tighten the union bolt to the specified torque.
   Torque: 300 kg–cm (22 ft–lb, 29 N·m)



   (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: 310 kg–cm (22 ft–lb, 30 N·m)
   HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

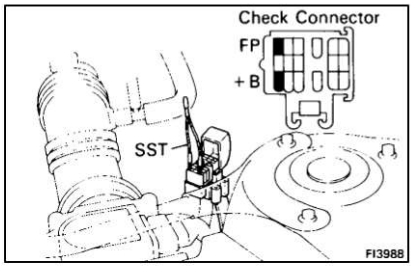


3. Observe the following precautions when removing and installing the injectors.
   (a) Never reuse the O–ring.
   (b) When placing a new O–ring on the injector, take care not to damage it in any way.
   (c) Coat a new O–ring with spindle oil or gasoline before installing–never use engine, gear or brake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

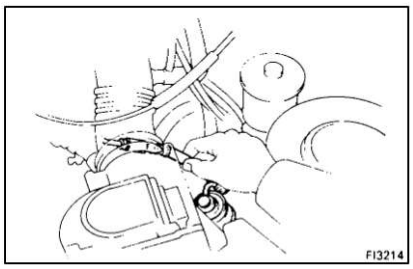


4. Install the injector to delivery pipe and intake manifold as shown in the figure.

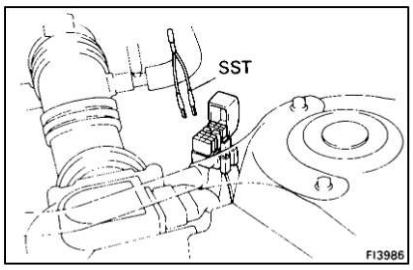
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5. Check that there are no fuel leaks after performing any maintenance on the fuel system.
   (a) Using SST, connect terminals +B and FP of the check connector.
   SST 09843–18020
   (b) With engine stopped, turn the ignition switch ON.



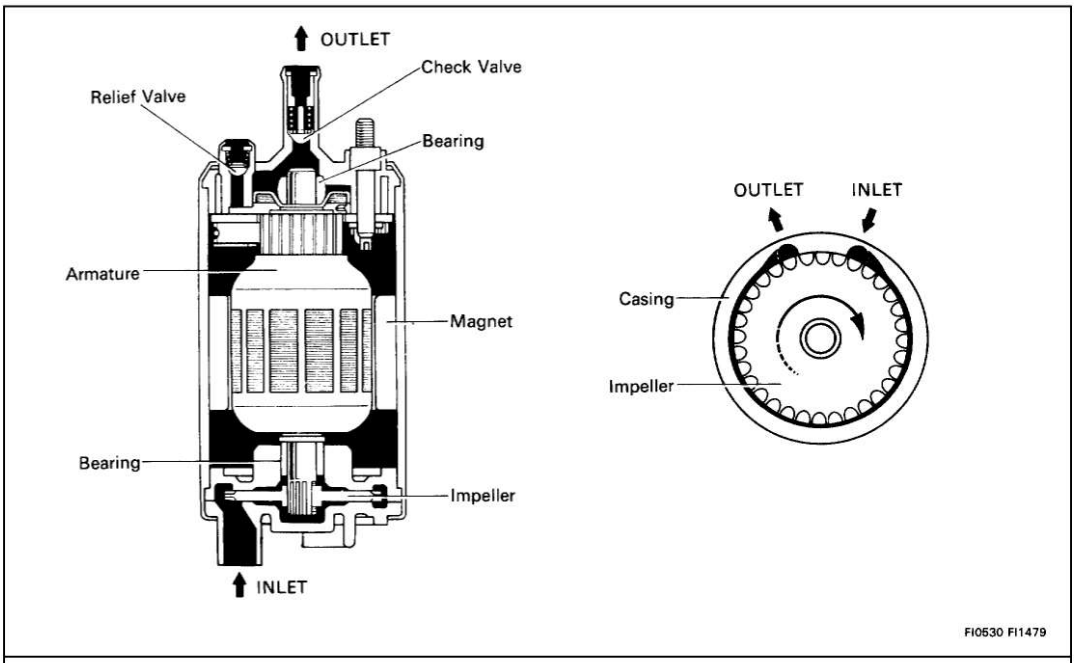
   (c) When the fuel return hose is pinched, the pressure within high pressure line will rise to approx. 4 kg/cm2 (57 psi, 392 kPa). In this state, check to see that there are no leaks from any part of the fuel system.
   NOTICE: Always pinch the hose. Avoid bending as it may cause the hose to crack.

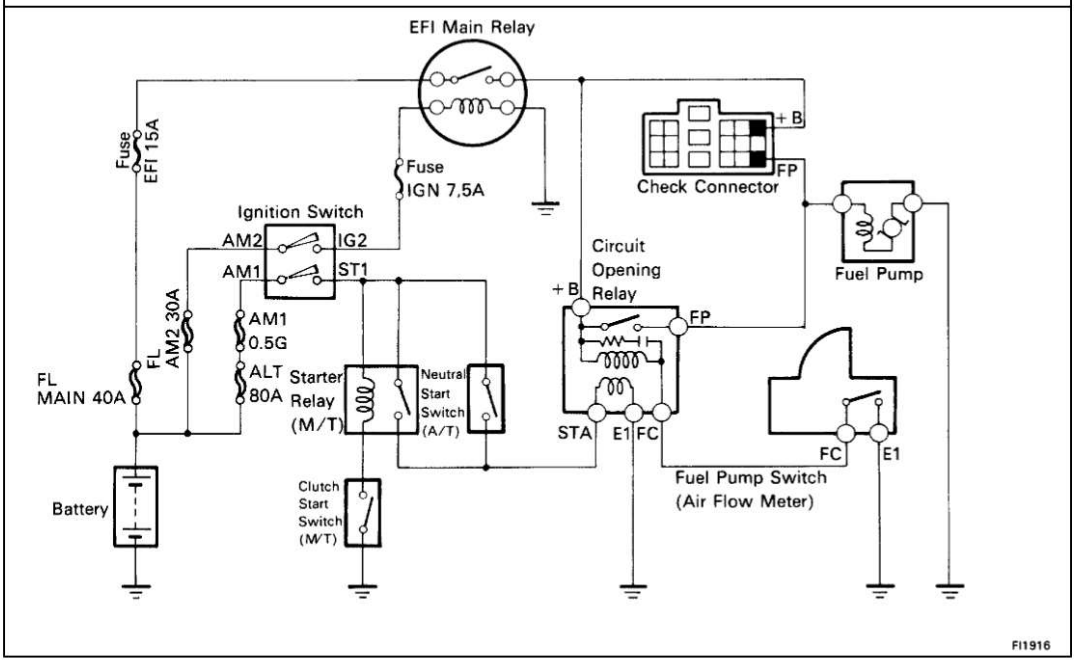


   (d) Turn the ignition switch OFF.
   (e) Remove the SST.
   SST 09843–18020

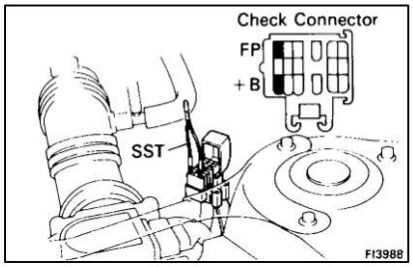
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FUEL SYSTEM
Fuel Pump





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ON–VEHICLE INSPECTION

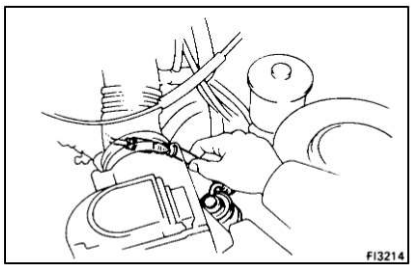
1. CHECK FUEL PUMP OPERATION

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

SST 09843–18020

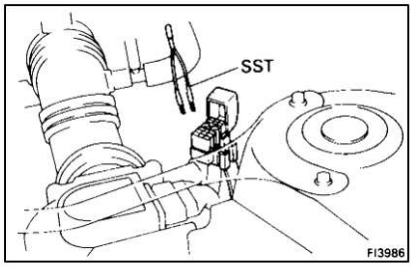
(b) Turn the ignition switch ON.

NOTICE: Do not start the engine.



(c) Check that there is pressure in the hose from the fuel filter.

HINT: At this time, you will hear fuel return noise.



(d) Remove SST.

SST 09843–18020

(e) Turn the ignition switch OFF.

If there is no pressure, check the following parts:

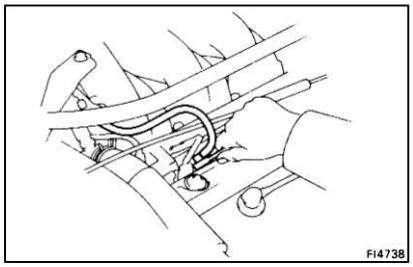
- Fusible links
- Fuses (EFI 15 A, IGN 7.5 A)
- EFI main relay
- Fuel pump
- ECU
- Wiring connections

2. CHECK FUEL PRESSURE

(a) Check that the battery voltage is above 12 volts.

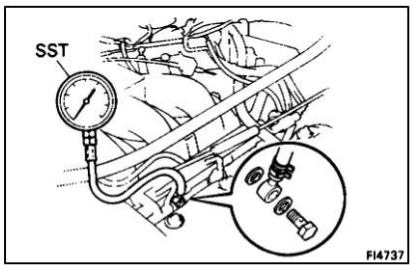
(b) Disconnect the cable from the negative (–) terminal of the battery.

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(c) Disconnect the cold start injector connector.
(d) Put a suitable container or shop towel under the cold start injector tube.
(e) Remove the union bolt and two gaskets, and disconnect the cold start injector tube from the LH delivery pipe.

HINT: Slowly loosen the union bolt.

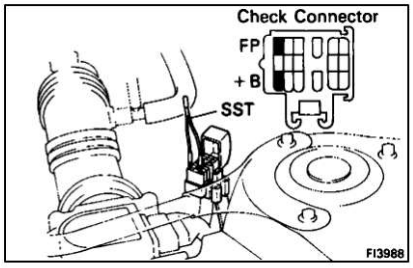


(f) Install SST (pressure gauge) to the LH delivery pipe with two new gaskets and the union bolt.

SST 09268–45012

Torque: 200 kg–cm (14 ft–lb, 20 N·m)

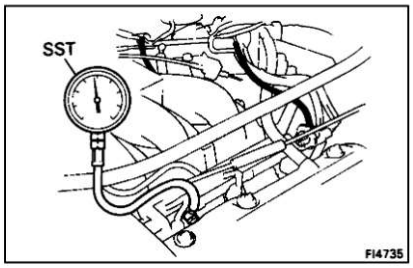
(g) Wipe off any splattered gasoline.



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

SST 09843–18020

(i) Reconnect the battery negative (–) cable.



(j) Turn the ignition switch ON.
(k) Measure the fuel pressure.

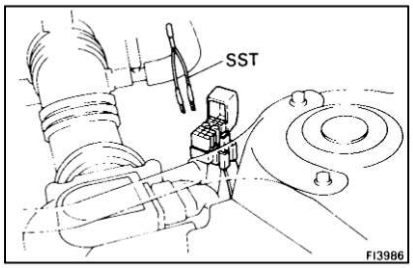
Fuel pressure: 2.7–3.1 kg/cm^2
(38 – 44 psi, 265 – 304 kPa)

If pressure is high, replace the fuel pressure regulator.
If pressure is low, check the following parts:

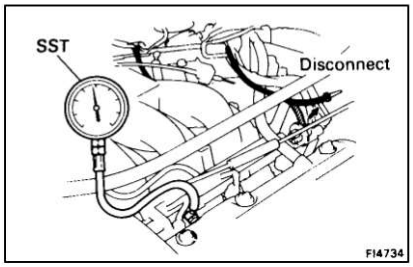
- Fuel hoses and connection
- Fuel pump
- Fuel filter
- Fuel pressure regulator

(l) Remove SST.

SST 09843–18020

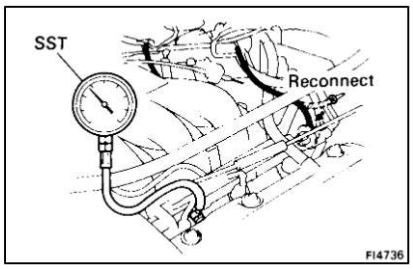


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(m) Start the engine.
(n) Disconnect the vacuum sensing hose from the fuel pressure regulator, and plug the hose end.
(o) Measure the fuel pressure at idling.

Fuel pressure: 2.7 – 3.1 kg/cm^2
(38–44 psi, 265–304 kPa)



(p) Reconnect the vacuum sensing hose to the fuel pressure regulator.
(q) Measure the fuel pressure at idling.

Fuel pressure: 2.3 – 2.6 kg/cm^2
(33–37 psi, 226–265 kPa)

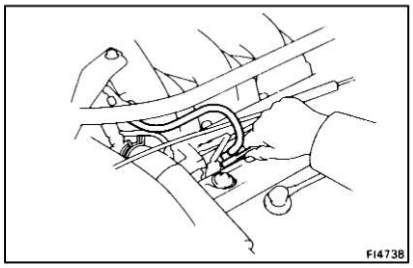
If pressure is not as specified, check the vacuum sensing hose and fuel pressure regulator.

(r) Stop the engine. Check that the fuel pressure remains 1.5 kg/cm^2 (21 psi, 147 kPa) or more for 5 minutes after the engine is turned off.

If pressure is not as specified, check the fuel pump, pressure regulator and/or injector.

(s) After checking fuel pressure, disconnect the battery negative (–) cable and carefully remove the SST to prevent gasoline from splashing.

SST 09268–45012



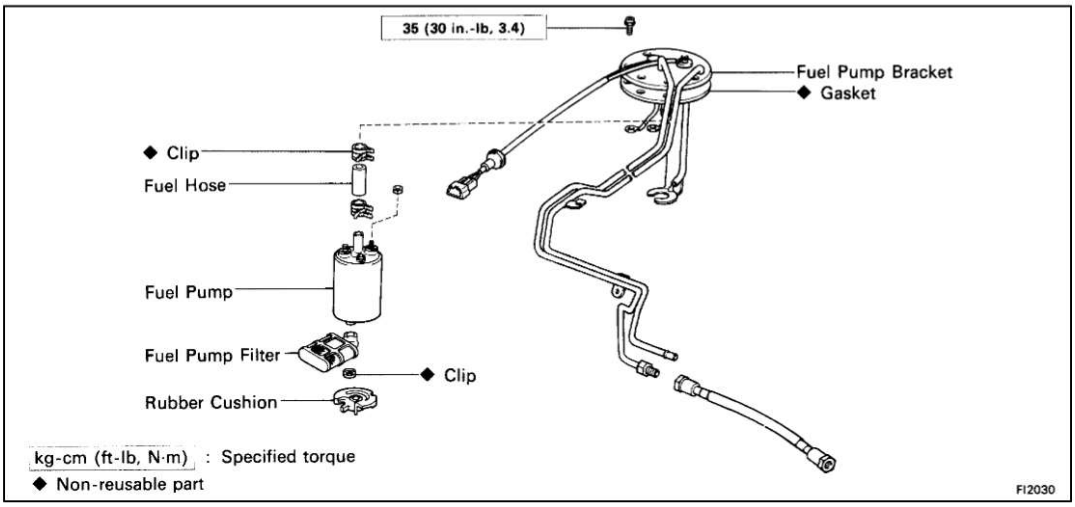
(t) Install the cold start injector tube with two new gaskets and the union bolt.

Torque: 200 kg–cm (14 ft–lb, 20 N·m)

(u) Reconnect the cold start injector connector.
(v) Reconnect the cable to the negative (–) terminal of the battery.
(w) Check for fuel leakage. (See page FI–14)

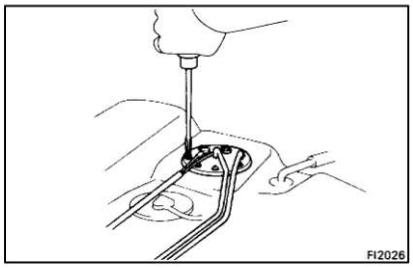
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REMOVAL OF FUEL PUMP

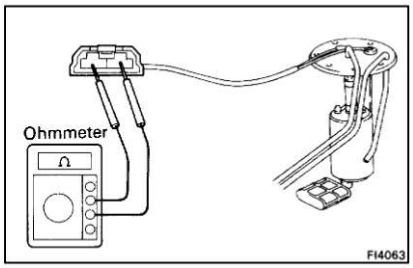


CAUTION: Do not smoke or work near an open flame when working on the fuel pump.

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
   CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.
2. **REMOVE FUEL TANK**
   (See procedure FI–35)
3. **REMOVE FUEL PUMP BRACKET FROM FUEL TANK**
   (a) Remove the bolt of the bracket.
   (b) Remove the seven screws, pull out the pump bracket.

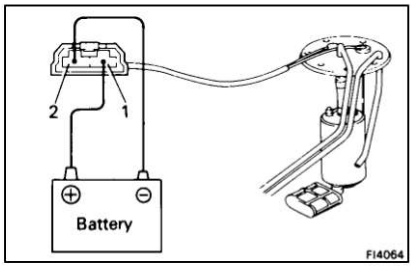


INSPECTION OF FUEL PUMP



1. **INSPECT FUEL PUMP RESISTANCE**
   Using an ohmmeter, measure the resistance between the terminals.
   Resistance: 0.2 – 3.0 Ω
   If the resistance is not as specified, replace the fuel pump or bracket.

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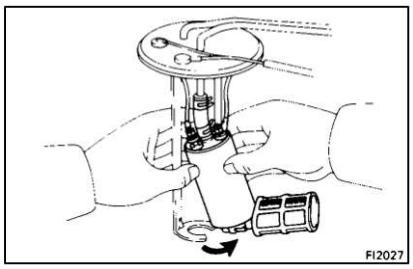
2. INSPECT FUEL PUMP OPERATION

Connect the positive (+) lead from the battery to terminal 1 of the connector, and the negative (–) lead to terminal 2. Check that the fuel pump operates.

NOTICE:

- **These tests must be performed quickly (within 10 seconds) to prevent the coil from burning out.**
- **Keep the fuel pump as away from the battery as possible.**
- **Always perform switching at the battery side.**

If operation is not as specified, replace the fuel pump or bracket.

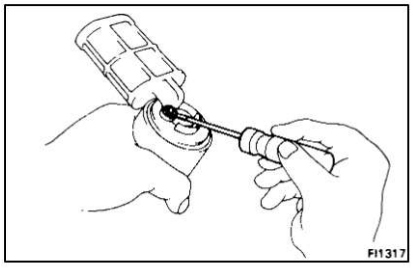


DISASSEMBLY OF FUEL PUMP

(See page FI–19)

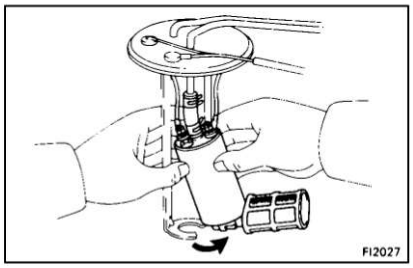
1. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET

(a) Pull off the lower side of the fuel pump from the bracket.
(b) Remove the rubber cushion from the fuel pump.
(c) Remove the two nuts, and disconnect the wires from the fuel pump.
(d) Disconnect the fuel hose 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.



INSTALLATION AND ASSEMBLY OF FUEL PUMP

(See page FI–19)

1. INSTALL FUEL PUMP FILTER TO FUEL PUMP

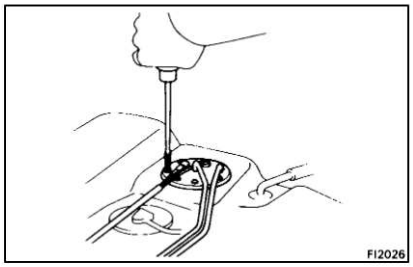
Install the pump filter with a new clip.

2. INSTALL FUEL PUMP TO FUEL PUMP BRACKET

(a) Connect the fuel hose to the outlet port of the fuel pump.
(b) Connect the wires to the fuel pump with the two nuts.
(c) Install the rubber cushion to the fuel pump.
(d) Push the lower side of the fuel pump, and install the fuel pump.

3. CHECK THAT FUEL PUMP OPERATES

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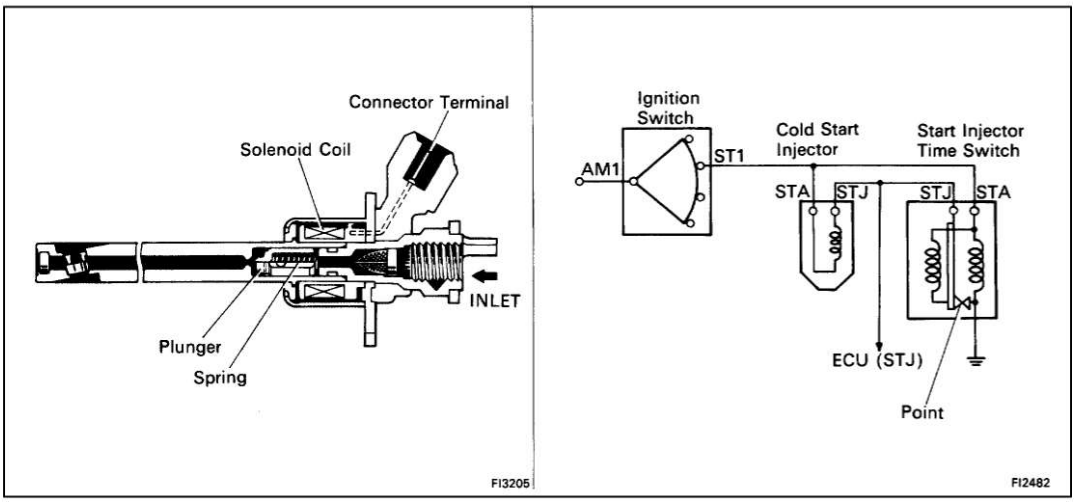
4. **INSTALL FUEL PUMP BRACKET TO FUEL TANK**
   (a) Install a new gasket and the pump bracket with the seven screws.
   Torque: 40 kg–cm (35 in.–lb, 3.9 N·m)
   (b) Install the bolt of the bracket.

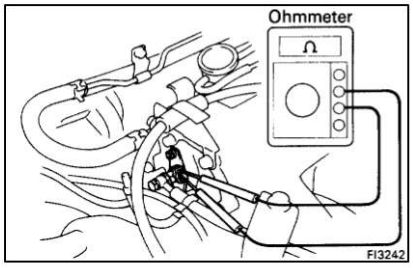
5. **INSTALL FUEL TANK**
   When installing the fuel tank, refer to FI–35 for the installation position of the cushion and the tightening torque.

6. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

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Cold Start Injector





ON–VEHICLE INSPECTION

INSPECT RESISTANCE OF COLD START INJECTOR

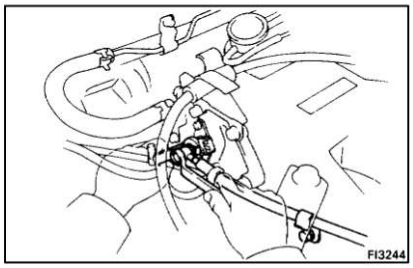
(a) Disconnect the cold start injector connector.

(b) Using an ohmmeter, measure the resistance between the terminals.

Resistance: 2 – 4 Ω

If the resistance is not as specified, replace the cold start injector.

(c) Reconnect the cold start injector connector.



REMOVAL OF COLD START INJECTOR

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

   CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.

2. **DISCONNECT COLD START INJECTOR CONNECTOR**

3. **DISCONNECT COLD START INJECTOR TUBE**

   (a) Put a suitable container or shop towel under the injector tube.

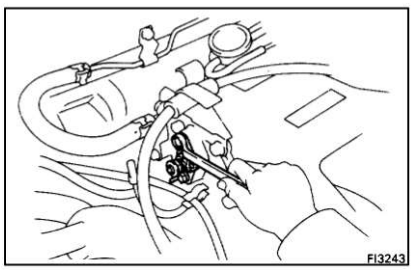
   (b) Remove the union bolt and two gaskets, and disconnect the injector tube.

   HINT: Slowly loosen the union bolt.

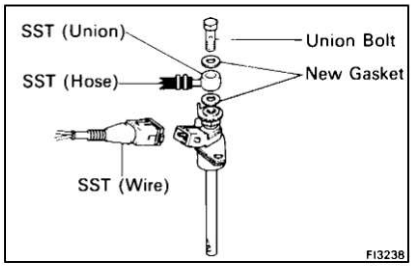
   (c) Disconnect the injector tube from the clamp.

4. **REMOVE COLD START INJECTOR**

   Remove the two bolts, cold start injector and gasket.



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INSPECTION OF COLD START INJECTOR

1. **INSPECT INJECTION OF COLD START INJECTOR**

CAUTION: Keep clear of sparks during the test.

(a) Install SST (two unions) to the injector and delivery pipe with new gaskets and the union bolts.

SST 09268–41045 (09268–41080)

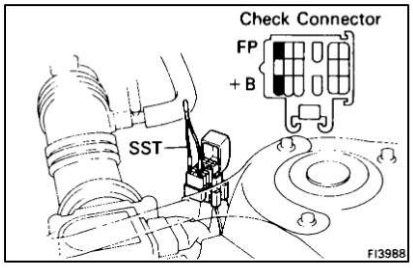
(b) Connect SST (hose) to the unions.

SST 09268–41045

(c) Connect SST (wire) to the injector.

SST 09842–30050

(d) Put a container under the injector.



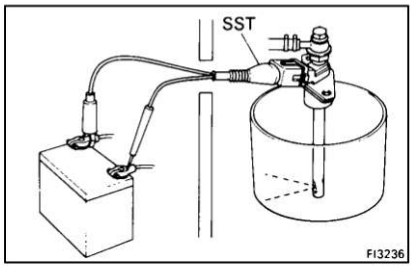
(e) Using SST, connect terminals +B and FP of the check connector.

SST 09843–18020

(f) Reconnect the battery negative (–) cable.

(g) Turn the ignition switch ON.

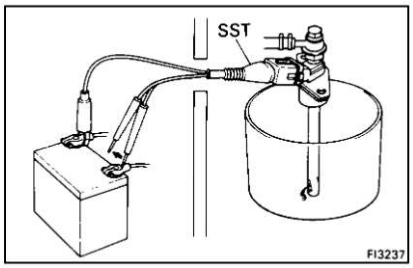
NOTICE: Do not start the engine.



(h) Connect the test probes of the SST (wire) to the battery, and check that the fuel spray is as shown.

SST 09842–30050

NOTICE: Perform this check within the shortest possible time.



2. **INSPECT LEAKAGE**

(a) In the condition above, disconnect the test probes of SST (wire) from the battery and check fuel leakage from the injector.

SST 09842–30050

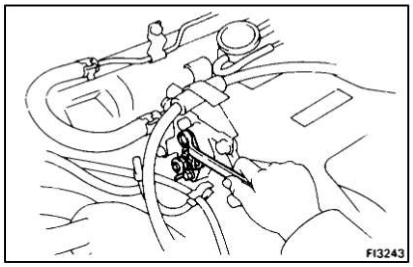
Fuel drop: One drop or less per minute

(b) Disconnect the battery negative (–) cable.

(c) Remove SST.

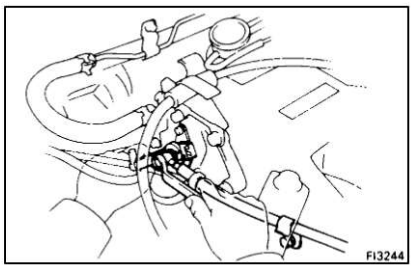
SST 09268–41045, 09842–30050 and 09843–18020

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INSTALLATION OF COLD START INJECTOR

1. **INSTALL COLD START INJECTOR**
   Install a new gasket and the injector with the two bolts.
   Torque: 55 kg–cm (48 in.–lb, 5.4 N·m)



2. **CONNECT COLD START INJECTOR TUBE**
   (a) Connect the injector tube to clamp.
   (b) Connect the injector tube with new two gaskets and the union bolt.
   Torque: 200 kg–cm (14 ft–lb, 20 N·m)

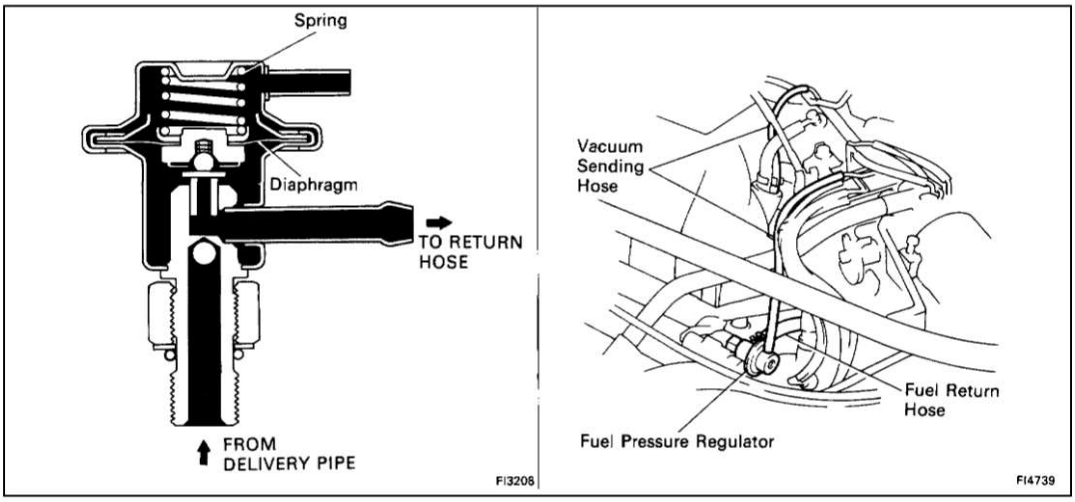
3. **CONNECT COLD START INJECTOR CONNECTOR**

4. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

5. **CHECK FOR FUEL LEAKAGE (See page FI–14)**

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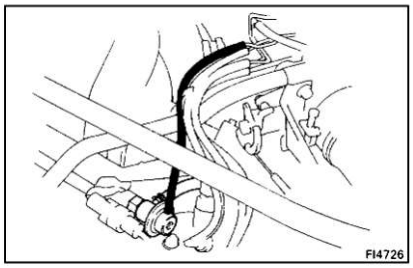
Fuel Pressure Regulator



ON–VEHICLE INSPECTION

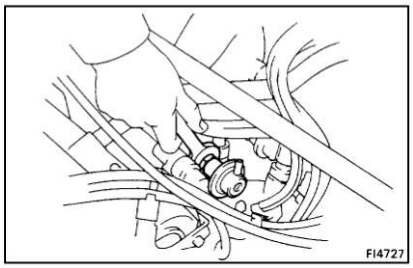
INSPECT FUEL PRESSURE (See page FI–16)

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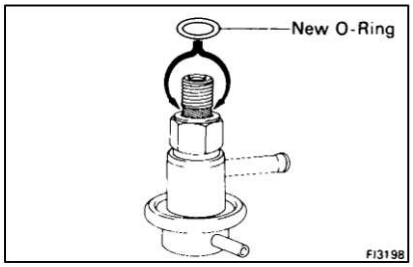


REMOVAL OF FUEL PRESSURE REGULATOR

1. **DISCONNECT VACUUM SENSING HOSE**
2. **DISCONNECT FUEL RETURN HOSE**
   (a) Put a suitable container or shop towel under the pressure regulator.
   (b) Disconnect the return hose from the pressure regulator.

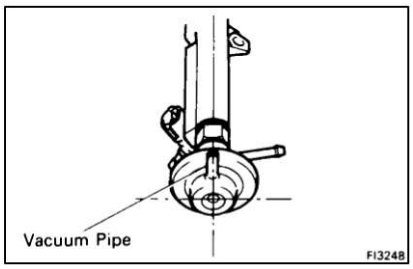


3. **REMOVE FUEL PRESSURE REGULATOR**
   Loosen the lock nut, and remove the pressure regulator.

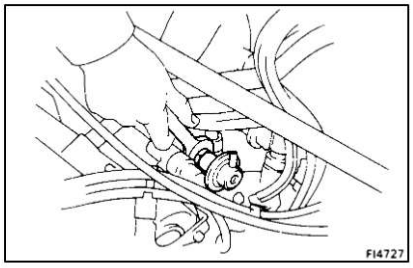


INSTALLATION OF FUEL PRESSURE REGULATOR

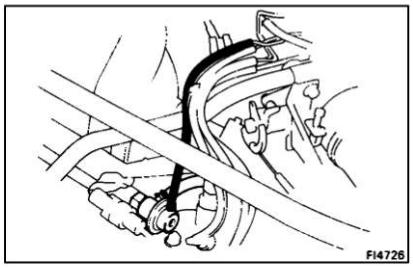
1. **INSTALL FUEL PRESSURE REGULATOR**
   (a) Fully loosen the lock nut of the pressure regulator.
   (b) Apply a light coat of gasoline to a new O–ring, and install it to the pressure regulator.



   (c) Thrust the pressure regulator completely into the delivery pipe by hand.
   (d) Turn the pressure regulator counterclockwise until the vacuum pipe faces in the direction indicated in the figure.



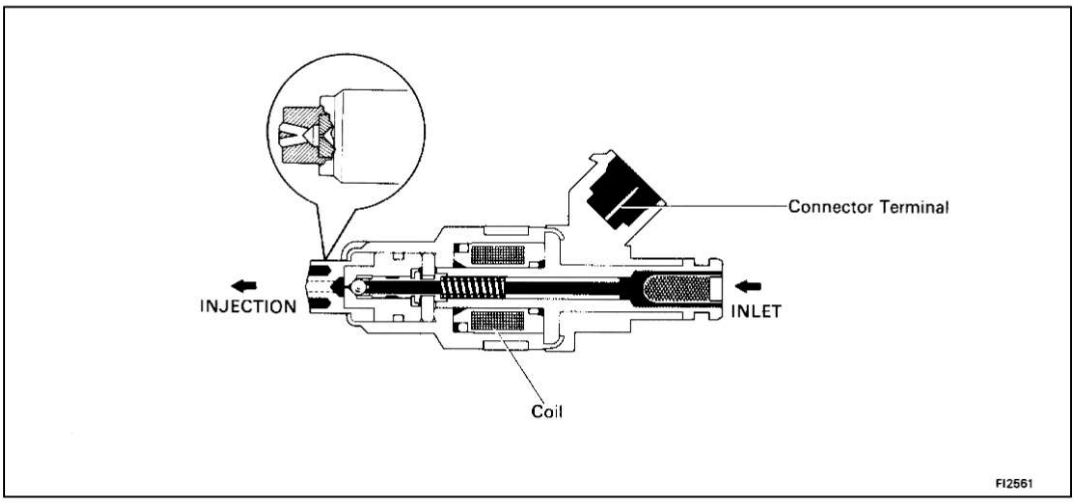
   (e) Tighten the lock nut.
   Torque: 330 kg – cm (24 ft–lb, 32 N·m)



2. **CONNECT FUEL RETURN HOSE**
3. **CONNECT VACUUM SENSING HOSE**
4. **CHECK FOR FUEL LEAKAGE (See page FI–14)**

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Injectors

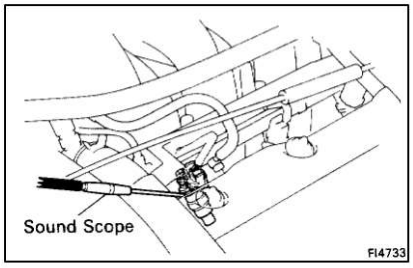


ON–VEHICLE INSPECTION

1. INSPECT INJECTOR OPERATION

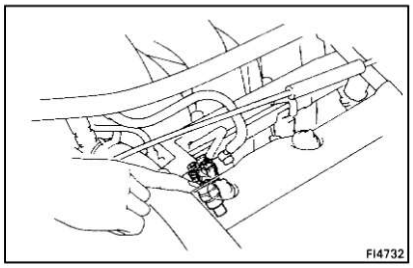
Check operation sound from each injector.

(a) With the engine running or cranking, use a sound scope to check that there is normal operating noise in proportion to engine rpm.



(b) If you have no sound scope, you can check the injector transmission operation with your finger.

If no sound or an unusual sound is heard, check the wiring connector, injector or injection signal from ECU.



2. INSPECT INJECTOR RESISTANCE

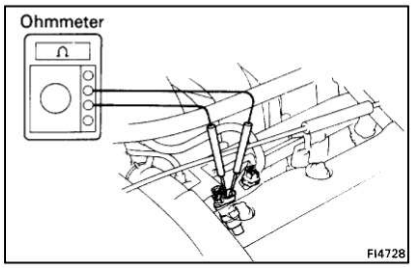
(a) Disconnect the injector connector.

(b) Using an ohmmeter, measure the resistance between the terminals.

Resistance: Approx. 13.8 Ω

If the resistance is not as specified, replace the injector.

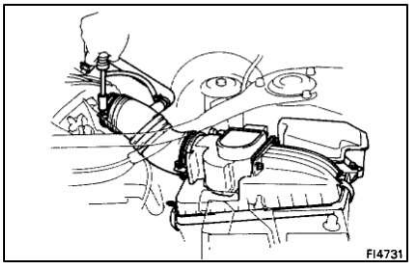
(c) Reconnect the injector connector.



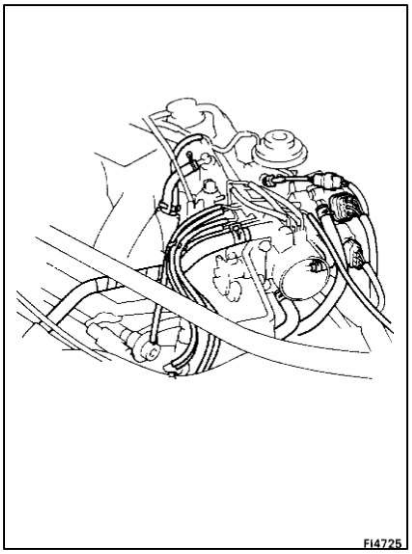
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REMOVAL OF INJECTORS

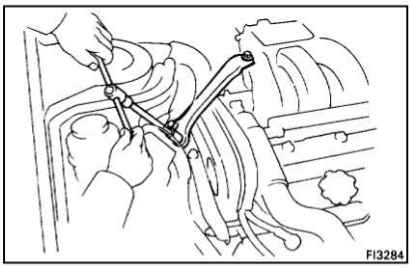
1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
   CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.
2. **DRAIN ENGINE COOLANT (See page CO–5)**


FI4731

3. **(A/T)**
   DISCONNECT THROTTLE CABLE FROM THROTTLE BODY AND BRACKET
4. **DISCONNECT ACCELERATOR CABLE AND BRACKET FROM THROTTLE BODY AND AIR INTAKE CHAMBER**
5. **REMOVE AIR CLEANER CAP, AIR FLOW METER AND AIR CLEANER HOSE**
   (a) Disconnect the air flow meter connector.
   (b) Disconnect the air hoses.
   (c) Loosen the air cleaner hose clamp bolt.
   (d) Disconnect the air cleaner cap clips.
   (e) Remove the air cleaner cap and air flow meter together with the air cleaner hose.

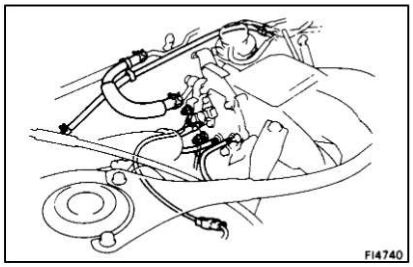

FI4725

6. **DISCONNECT HOSES AND CONNECTORS**
   (a) PCV hoses
   (b) Vacuum sensing hose
   (c) Water by–pass hoses
   (d) Fuel pressure VSV hose
   (e) Emission control vacuum hoses
   (f) ISC connector
   (g) Throttle position sensor connector
   (h) (CALIF. only)
   EGR gas temp. sensor connector

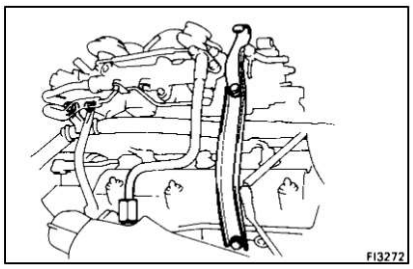

FI3284

7. **REMOVE NO.1 RH ENGINE MOUNTING STAY**
   Remove the three bolts and mounting stay.
8. **DISCONNECT COLD START INJECTOR CONNECTOR**
9. **DISCONNECT COLD START INJECTOR TUBE**
   (See step 3 on page FI–22)

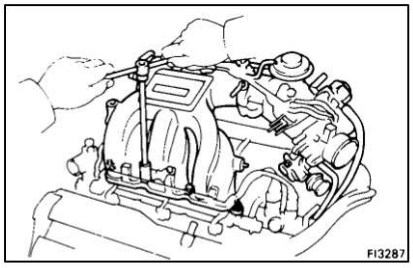
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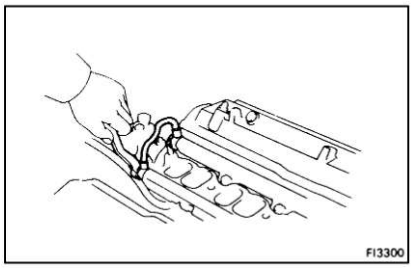
10. DISCONNECT HOSES AND PARTS
(a) Brake booster vacuum hose
(b) PS vacuum and air hoses
(c) Cruise control vacuum hose
(d) Ground strap connector
(e) Wire harness clamp
Remove the nut, and disconnect the wire harness clamp.



11. DISCONNECT WIRE HARNESS CLAMP
Remove the nut and disconnect the wire harness.
12. DISCONNECT EGR PIPE
13. REMOVE NO.1 ENGINE HANGER AND AIR INTAKE CHAMBER STAY
(a) Remove the two bolts and No.1 engine hanger.
(b) Remove the bolt, and disconnect the air intake chamber stay from air intake chamber.

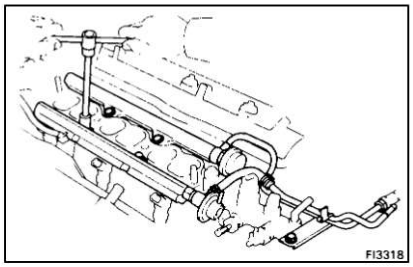


14. REMOVE AIR INTAKE CHAMBER
Remove the two bolts, nuts, air intake chamber and gasket.
15. DISCONNECT CONNECTORS
(a) Cold start injector connector
(b) Water temperature sensor connector
(c) Six injector connectors
16. DISCONNECT WIRE HARNESS CLAMPS FROM LH DELIVERY PIPE
Disconnect the three wire harness clamp.
17. DISCONNECT FUEL INLET AND TWO RETURN HOSES
(a) Disconnect the fuel return hoses from the fuel pressure regulator and No.1 fuel pipe.
(b) Disconnect the fuel inlet hose from the fuel filter.



18. REMOVE NO.2 FUEL PIPE
Remove the two union bolts, four gaskets and No.2 fuel pipe.

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19. REMOVE DELIVERY PIPES AND INJECTORS

(a) Remove the two bolts and LH delivery pipe together with three injectors.

NOTICE: Be careful not to drop the injectors, when removing the delivery pipe.

(b) Remove the three bolts and RH delivery pipe with the No.1 fuel pipe and three injectors.

NOTICE: Be careful not to drop the injectors, when removing the delivery pipe.

(c) Pull out the six injectors from the delivery pipes.

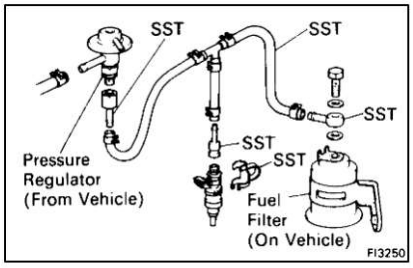
(d) Remove the six insulators and four spacers from the intake manifold.

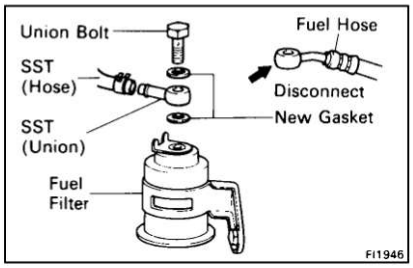
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INSPECTION OF INJECTORS

1. INSPECT INJECTOR INJECTION

CAUTION: Keep clear of sparks during the test.



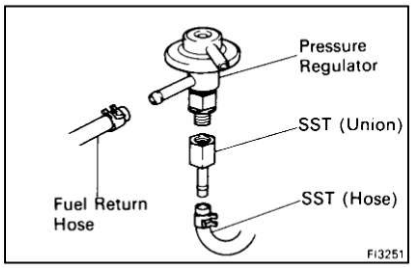


(a) Disconnect the fuel hose from the fuel filter outlet.

(b) Connect SST (union and hose) to the fuel filter outlet with two new gaskets and the union bolt.

SST 09268–41045 (90405–09015)

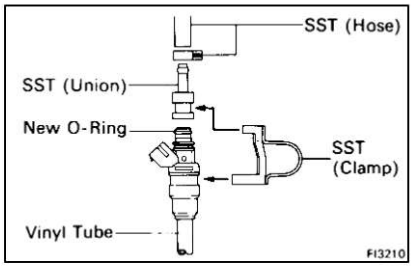
HINT: Use the vehicle's fuel filter.



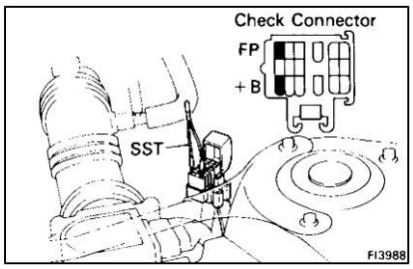
(c) Remove the pressure regulator. (See page FI–27)

(d) Connect the fuel return hose and SST (hose) to the pressure regulator with SST (union).

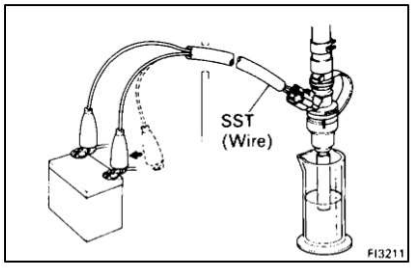
SST 09268–41045 (09268–41060)



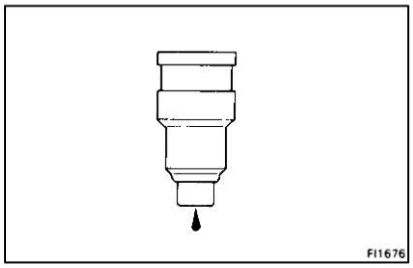
(e) Install a new O–ring to the injector.
(f) Connect SST (union and hose) to the injector, and hold the injector and union with SST (clamp).
SST 09268–41045
(g) Put the injector into the graduated cylinder.
HINT: Install a suitable vinyl hose onto the injector to prevent gasoline from splashing out.



(h) Using SST, connect terminals +B and FP of the check connector.
SST 09843–18020
(i) Reconnect the battery negative (–) cable.
(j) Turn the ignition switch ON.
NOTICE: Do not start the engine.

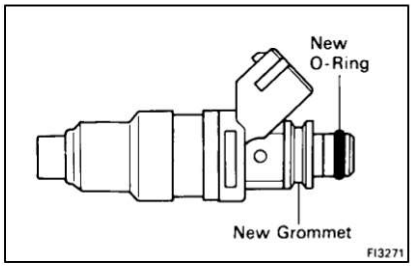


(k) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector two or three times.
SST 09842–30070
Volume: 45–55 cc (2.7–3.4 cu in.) per 15 sec.
Difference between each injector:
5 cc (0.3 cu in.) or less
If the injection 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
(b) Disconnect the battery negative (–) cable.
(c) Remove SST.
SST 09268–41045 and 09843–18020

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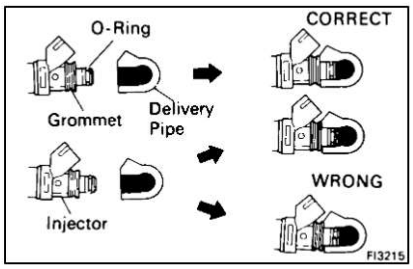


INSTALLATION OF INJECTORS

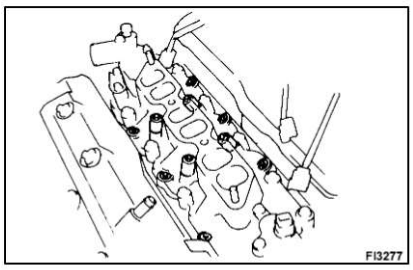
1. INSTALL INJECTORS AND DELIVERY PIPES

(a) Install a new grommet to the injector.

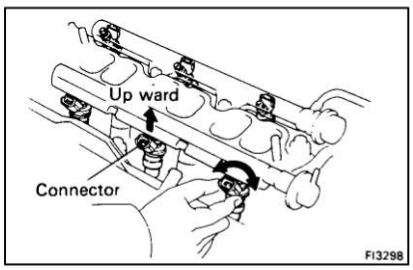
(b) Apply a light coat of gasoline to a new O–ring and install it to the injector.



(c) While turning the injector left and right, install it to the delivery pipes. Install the six injectors.



(d) Place the six insulators and four spacers in position on the intake manifold.



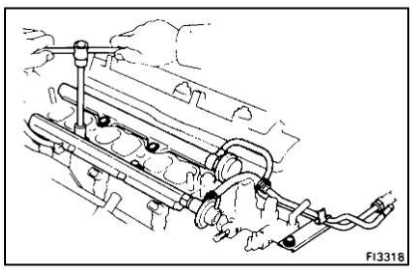
(e) Place the three injectors together with the RH delivery pipe and No.1 fuel pipe in position on the intake manifold.

(f) Place the three injectors together with the LH delivery pipe in position on the intake manifold.

(g) Check that the injectors rotate smoothly.

HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O–rings. Replace the O–rings.

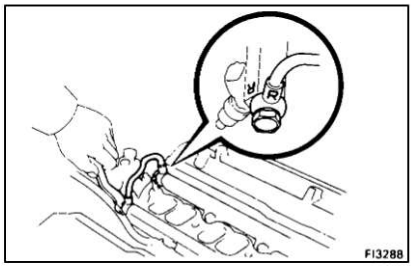
(h) Position the injector connector upward.



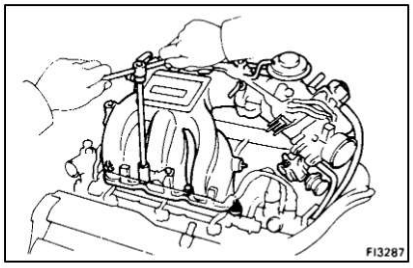
(i) Install the five bolts.

Torque: 130 kg–cm (9 ft–lb, 13 N·m)

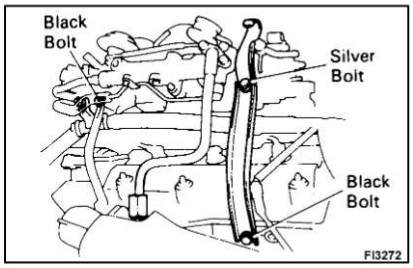
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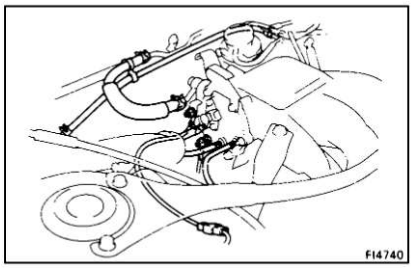
2. **INSTALL NO.2 FUEL PIPE**
   Install the No.2 fuel pipe with four new gaskets and the union bolts as shown in the illustration.
   Torque: 330 kg–cm (24 ft–lb, 32 N·m)
3. **CONNECT FUEL INLET AND RETURN HOSES**
   (a) Connect the inlet hose to the fuel filter with two new gaskets and union bolt.
   (b) Connect the two return hoses to the pressure regulator and No.1 fuel pipe.
4. **CONNECT THREE WIRE HARNESS CLAMPS TO LH DELIVERY PIPE**
5. **CONNECT CONNECTORS**
   (a) Six injector connectors
   (b) Cold start injector connector
   (c) Water temperature connector



6. **INSTALL AIR INTAKE CHAMBER**
   Install a new gasket and the air intake chamber with the two bolts and nuts.
   Torque: 440 kg–cm (32 ft–lb, 43 N·m)

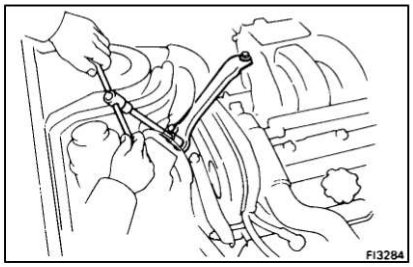


7. **CONNECT EGR PIPE**
   Torque: 800 kg–cm (58 ft–lb, 78 N·m)
8. **CONNECT WIRE HARNESS CLAMP**
   Connect the wire harness clamp with the nut.
9. **INSTALL NO.1 ENGINE HANGER AND AIR INTAKE CHAMBER STAY**
   (a) Connect the air intake chamber stay with the two bolts.
   Torque: 380 kg–cm (27 ft–lb, 37 N·m)
   (b) Install the No.1 engine hanger with the two bolts.
   Torque: 380 kg–cm (27 ft–lb, 37 N·m)

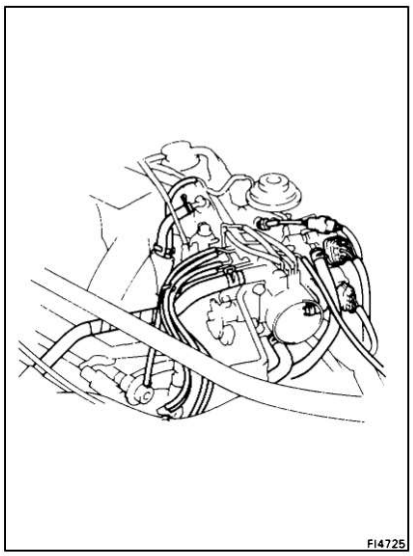


10. **DISCONNECT HOSES AND PARTS**
    (a) Wire harness clamp
    Connect the wire harness clamp with the nut.
    (b) Brake booster vacuum hose
    (c) PS vacuum and air hoses
    (d) Cruise control vacuum hose
    (e) Ground strap connector

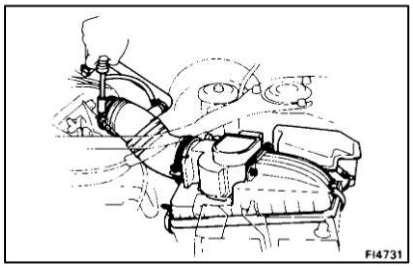
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11. **CONNECT COLD START INJECTOR TUBE**
(See step 2 on page FI–24)
12. **CONNECT COLD START INJECTOR CONNECTOR**
13. **INSTALL NO.1 RH ENGINE MOUNTING STAY**
Install the mounting stay with the three bolts.
Torque: 530 kg–cm (38 ft–lb, 52 N·m)



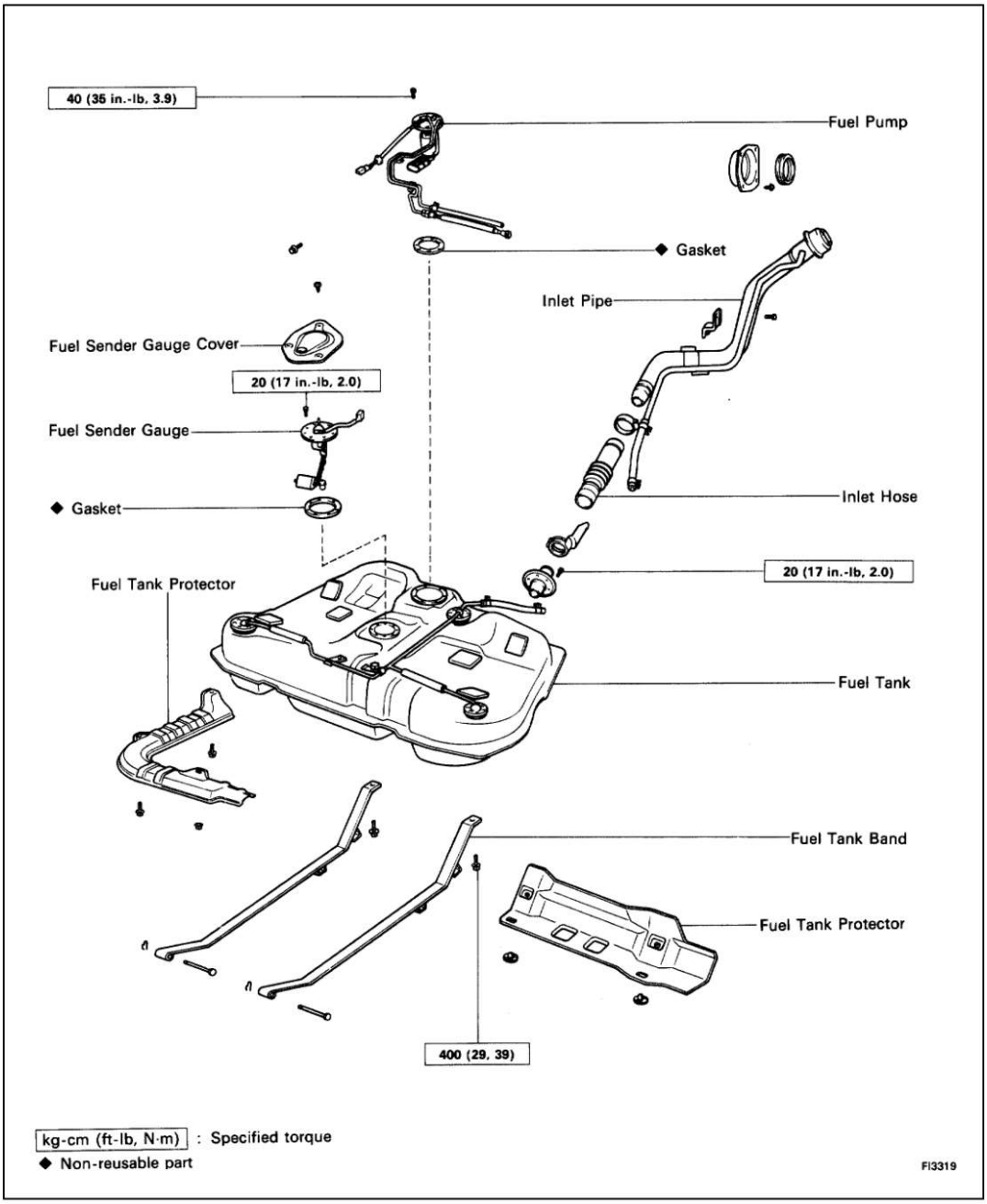
14. **CONNECT CONNECTORS AND HOSES**
(a) ISC connector
(b) Throttle position sensor connector
(c) (CALIF. only)
EGR gas temp. sensor connectors
(d) PCV hoses
(e) Vacuum sensing hoses
(f) Water by–pass hoses
(g) Fuel pressure VSV hose
(h) Emission control vacuum hoses



15. **INSTALL AIR CLEANER CAP, AIR FLOW METER AND AIR CLEANER HOSE**
(a) Connect the air cleaner hose, and install the air cleaner cap and air flow meter with the four clips.
(b) Tighten the air cleaner hose clamp bolt.
(c) Connect the air hoses.
(d) Connect the air flow meter connector.
16. **CONNECT ACCELERATOR CABLE AND BRACKET TO THROTTLE BODY AND AIR INTAKE CHAMBER**
17. **(A/T)**
CONNECT THROTTLE CABLE TO THROTTLE BODY AND BRACKET, AND ADJUST IT
18. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
19. **FILL WITH COOLANT (See page CO–5)**
20. **CHECK FOR FUEL LEAKAGE (See page FI–14)**

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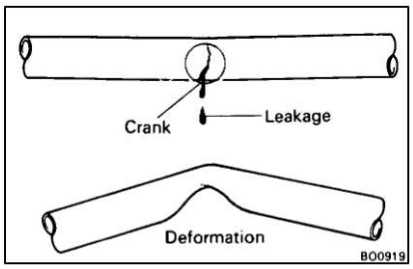
Fuel Tank and Lines
COMPONENTS



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PRECAUTIONS

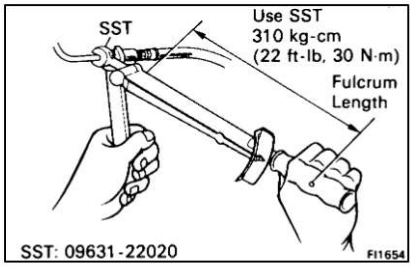
1. **Always use new gaskets when replacing the fuel tank or component parts.**
2. **Apply the proper torque to all parts tightened.**

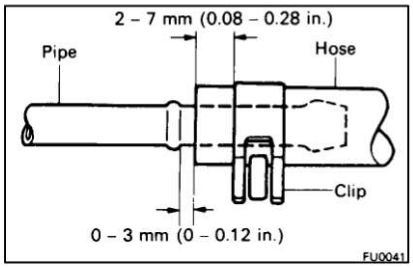


INSPECT FUEL LINES AND CONNECTIONS

(a) Check the fuel lines for cracks or leakage, and all connections for deformation.
(b) Check the fuel tank vapor vent system hoses and connections for looseness, sharp bends or damage.
(c) Check the fuel tank for deformation, cracks, fuel leakage or tank band looseness.
(d) Check the filler neck for damage or fuel leakage.
(e) Hose and tube connections are as shown in the illustration.

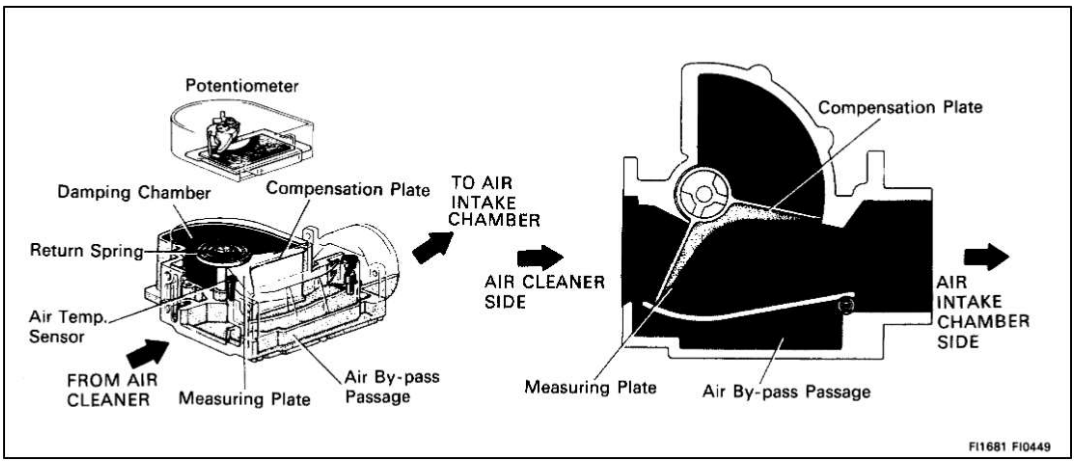
If a problem is found, repair or replace the parts as necessary.

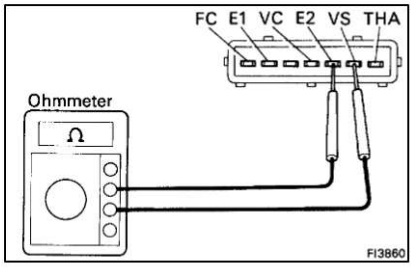


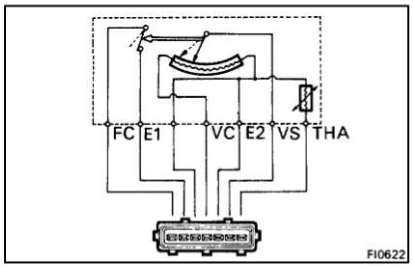


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AIR INDUCTION SYSTEM
Air Flow Meter







ON–VEHICLE INSPECTION

INSPECT RESISTANCE OF AIR FLOW METER

(a) Disconnect the air flow meter connector.
(b) Using an ohmmeter, measure the resistance between each terminal.

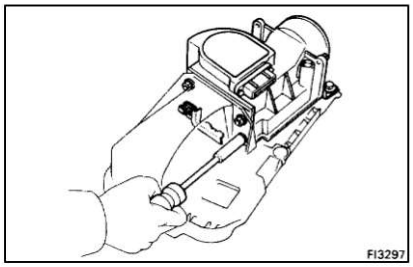
Between terminals	Resistance (Ω)	Temp. °C(°F)
VS – E2	200 – 600	–
VC – E2	200 – 400	–
THA – E2	10,000 – 20,000 4,000 – 7,000 2,000 – 3,000 900 – 1,300 400 – 700	–20 (–4) 0 (32) 20 (68) 40 (104) 60 (140)
FC – E1	Infinity	–

If the resistance is not as specified, replace the air flow meter.
(c) Reconnect the air flow meter connector.

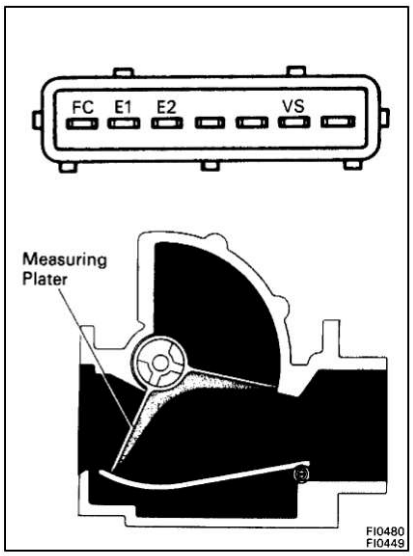
REMOVAL OF AIR FLOW METER

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
Caution: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable disconnected from the battery.

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2. DISCONNECT AIR FLOW METER CONNECTOR
3. DISCONNECT AIR CLEANER HOSE
4. REMOVE AIR CLEANER CAP AND AIR FLOW METER ASSEMBLY
5. REMOVE AIR FLOW METER FROM AIR CLEANER CAP
   (a) Remove the two bolts and resonator.
   (b) Pry off the lock plate, and remove the bolt, four nuts, four plates washers, air flow meter and gasket.



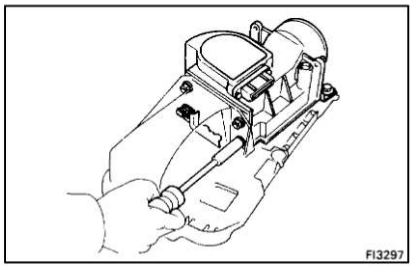
INSPECTION OF AIR FLOW METER

INSPECT RESISTANCE OF AIR FLOW METER

Using an ohmmeter, measure the resistance between each terminal by moving the measuring plate.

Between terminals	Resistance (Ω)	Measuring plate opening
FC – E1	Infinity	Fully closed
	Zero	Other than closed
VS – E2	200–600	Fully closed
	20–1,000	Fully open

HINT: Resistance between terminals E2 and VS will change in a wave pattern as the measuring plate slowly opens.
If the resistance is not as specified, replace the air flow meter.

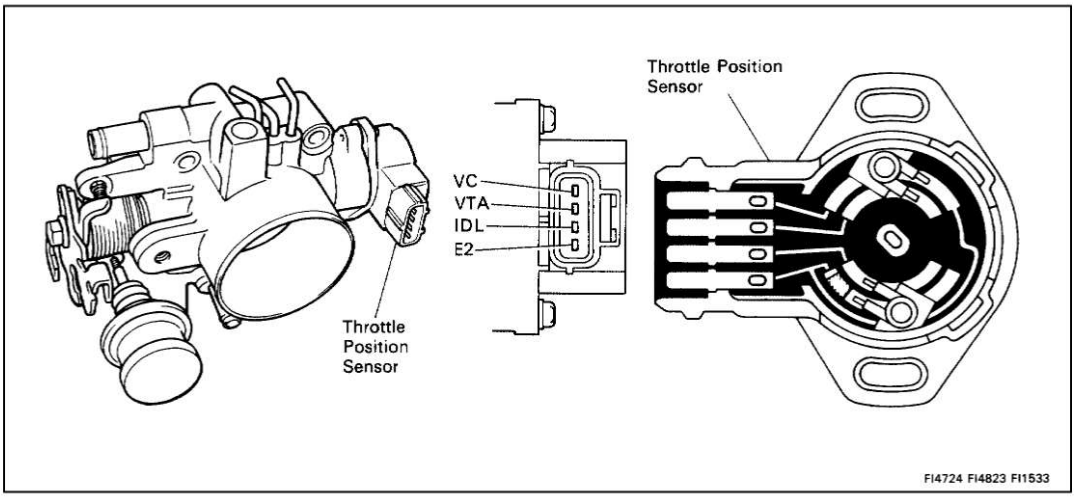


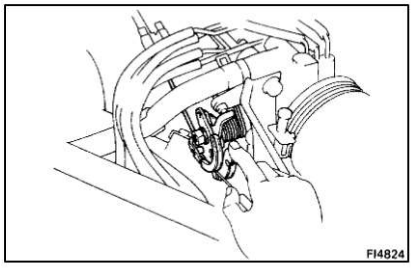
INSTALLATION OF AIR FLOW METER

1. INSTALL AIR FLOW METER TO AIR CLEANER CAP
   (a) Install the air flow meter with the gasket, lock plate, four plate washers, four nuts and bolt. Pry the lock plate on the nut.
   (b) Install the resonator with the two bolts.
2. INSTALL AIR CLEANER CAP AND AIR FLOW METER ASSEMBLY
3. CONNECT AIR CLEANER HOSE
4. CONNECT AIR FLOW METER CONNECTOR
5. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

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Throttle Body

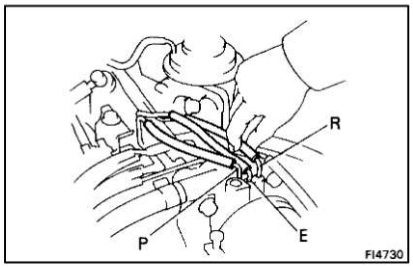




ON–VEHICLE INSPECTION

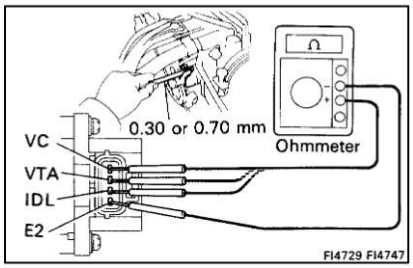
1. INSPECT THROTTLE BODY

(a) Check that the throttle linkage moves smoothly.



(b) Check the vacuum at each port.
- Start the engine.
- Check the vacuum with your finger.

Port name	At idling	Other than idling
P	No vacuum	Vacuum
E	No vacuum	Vacuum
R	No vacuum	Vacuum



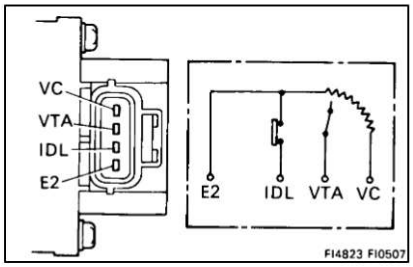
2. INSPECT THROTTLE POSITION SENSOR

(a) Disconnect the sensor connector.

(b) Insert a feeler gauge between the throttle stop screw and stop lever.

(c) Using an ohmmeter, measure the resistance between each terminal.

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Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.3 – 6.3 kΩ
0.30 mm (0.012 in.)	IDL – E2	2.3 kΩ or less
0.70 mm (0.028 in.)	IDL – E2	Infinity
Throttle valve fully opened	VTA – E2	3.5 – 10.3 kΩ
–	VC – E2	4.25 – 8.25 kΩ

(d) Reconnect the sensor connector.

3. INSPECT AND ADJUST DASH POT (DP)

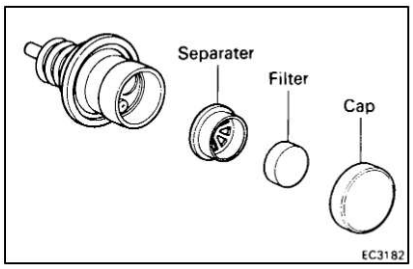
A. Warm up engine

Allow the engine to warm up to normal operating temperature.

B. Check idle speed

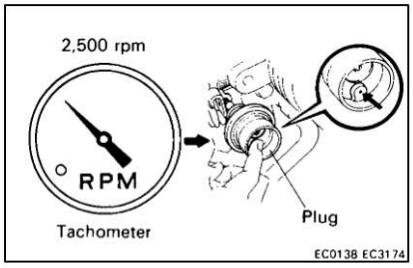
Idle speed: 800 ± 50 rpm

C. Remove cap, filter and separator from DP



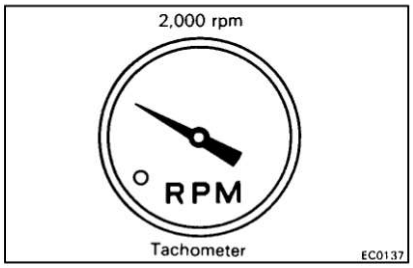
D. Check and adjust DP setting speed

(a) Maintain the engine at 2,500 rpm.
(b) Plug the VTV hole with your finger.



(c) Release the throttle valve.
(d) Check that the DP is set.

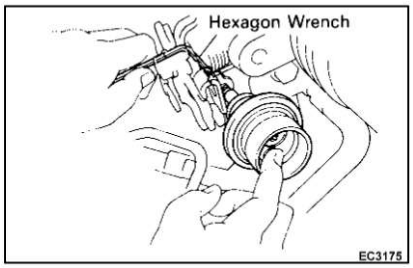
DP setting speed: 2,000 rpm
(w/ Cooling fan OFF)



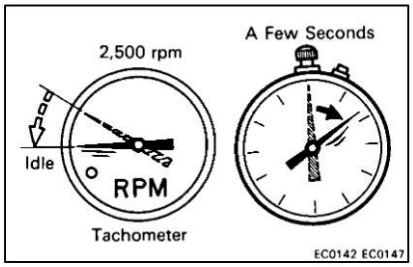
If not as specified, adjust with the DP adjusting screw.

E. Reinstall DP separator, filter and cap

HINT: Install the filter with the coarser surface facing the atmospheric side (outward).



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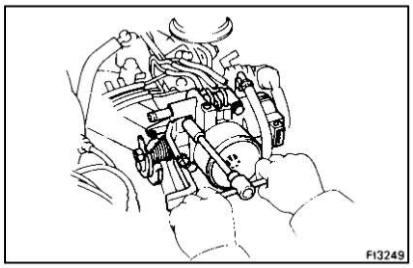
F. Check VTV operation

Race the engine at 2,500 rpm for a few seconds, release the throttle valve and check that the engine returns to idle in a few seconds.

REMOVAL OF THROTTLE BODY

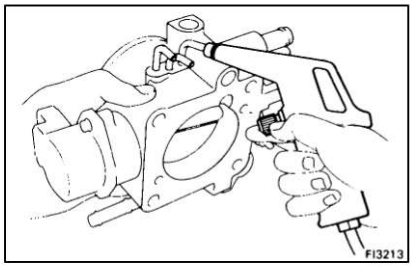
1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
   CAUTION: Work must be started after approx. 20 seconds or longer fron the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.
2. **DRAIN ENGINE COOLANT (See page CO–5)**
3. **(A/T)**
   DISCONNECT THROTTLE CABLE FROM THROTTLE LINKAGE
4. **DISCONNECT ACCELERATOR CABLE FROM THROTTLE LINKAGE**
5. **REMOVE AIR CLEANER CAP, AIR FLOW METER AND AIR CLEANER HOSE (See step 5 or page FI–28)**
6. **DISCONNECT THROTTLE POSITION SENSOR CONNECTOR**
7. **REMOVE THROTTLE BODY**
   (a) Disconnect the following hoses:
   - PCV hose
   - Water by–pass hoses
   - Emission control vacuum hoses

   (b) (A/T)
   Remove the two bolts and throttle cable bracket.



(c) Remove the four (M/T) or three (A/T) bolts, throttle body and gasket.

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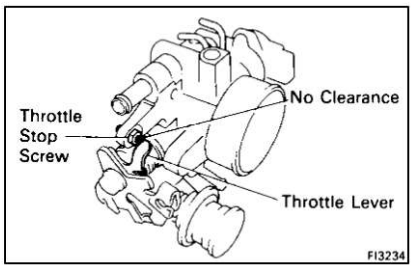
INSPECTION OF THROTTLE BODY

1. CLEAN THROTTLE BODY

(a) Using a soft brush and carburetor cleaner, clean the cast parts.

(b) Using compressed air, clean all the passages and apertures.

NOTICE: To prevent deterioration, do not clean the throttle position sensor.

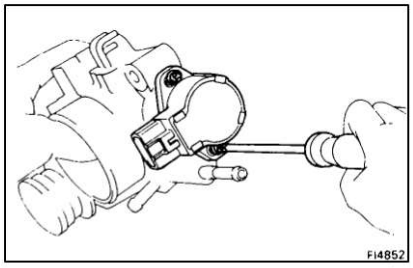


2. INSPECT THROTTLE VALVE

Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.

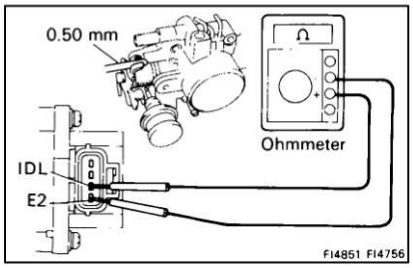
3. INSPECT THROTTLE POSITION SENSOR

(See step 2 on pages FI–39 and 40)



4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

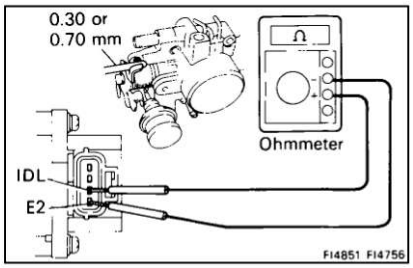
(a) Loosen the two set screws of the sensor.



(b) Insert a 0.50 mm (0.020 in.) feeler gauge, between the throttle stop screw and stop lever.

(c) Connect the test probe of an ohmmeter to the terminals IDL and E2 of the sensor.

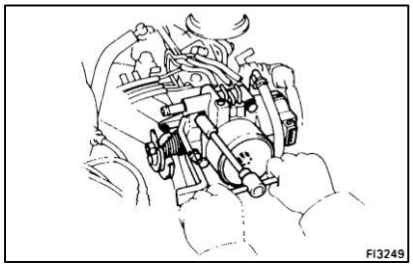
(d) Gradually turn the sensor clockwise until the ohmmeter deflects, and secure it with the two set screws.



(e) Recheck the continuity between terminals IDL and E2.

Clearance between lever and stop screw	Continuity (IDL–E2)
0.30 mm (0.012 in.)	Continuity
0.70 mm (0.028 in.)	No continuity

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INSTALLATION OF THROTTLE BODY

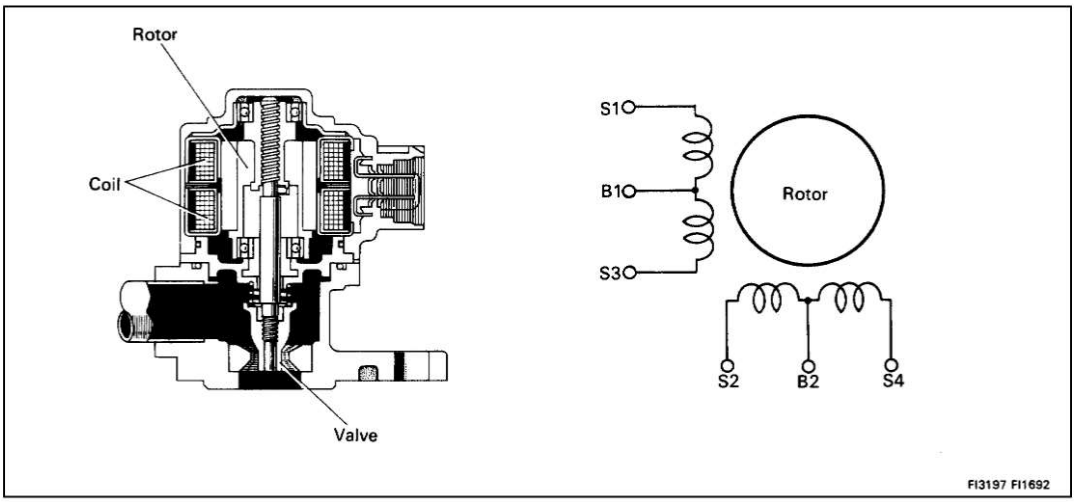
1. **INSTALL THROTTLE BODY**
   (a) Install a new gasket and the throttle body with the four (M/T) or three (A/T) bolts.
   Torque: 130 kg–cm (9 ft–lb, 13 N·m)

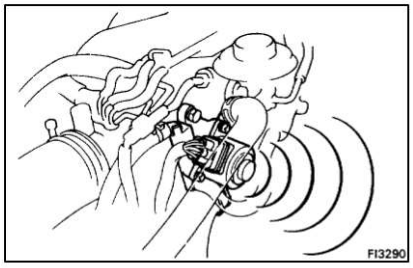
   (b) (A/T)
   Install the throttle cable bracket with the two bolts.
   Torque: 130 kg–cm (9 ft–lb, 13 N·m)
   (c) Connect the following hoses:
   - PCV hose
   - Water by–pass hoses
   - Emission control vacuum hoses

2. **CONNECT THROTTLE POSITION SENSOR CONNECTOR**
3. **INSTALL AIR CLEANER CAP, AIR FLOW METER AND AIR CLEANER HOSE (See step 15 or page FI–34)**
4. **CONNECT ACCELERATOR CABLE, AND ADJUST IT**
5. **(A/T)**
   CONNECT THROTTLE CABLE, AND ADJUST IT
6. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
7. **FILL WITH ENGINE COOLANT (See page CO–5)**

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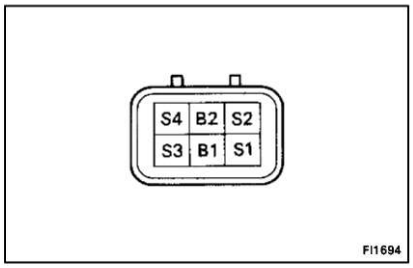
Idle Speed Control (ISC) Valve





ON–VEHICLE INSPECTION

1. **CHECK FOR OPERATING SOUND FROM ISC VALVE**
   Check that there is a clicking sound immediately stopping the engine.

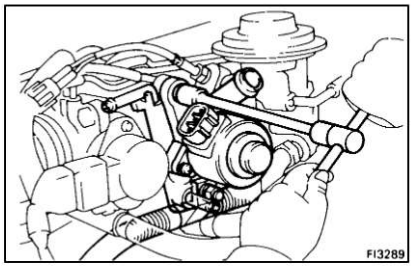


2. **INSPECT ISC VALVE RESISTANCE**
   (a) Disconnect the ISC valve connector.
   (b) Using an ohmmeter, measure the resistance between terminal B1 – S1 or S3, and B2 – S2 or S4.
   Resistance: B1 – S1 or S3 10 – 30 Ω
   B2 – S2 or S4 10 – 30 Ω
   If resistance is not as specified, replace the ISC valve.
   (c) Reconnect the ISC valve connector.

REMOVAL OF ISC VALVE

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
   CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.
2. **DRAIN ENGINE COOLANT (See page CO–5)**

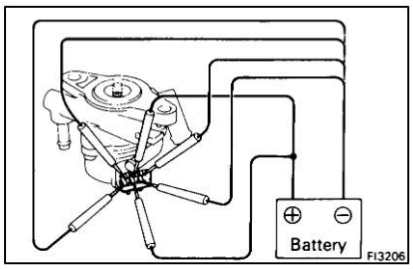
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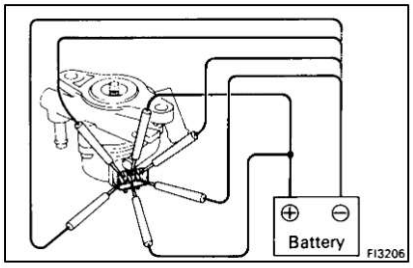
3. **DISCONNECT ISC VALVE CONNECTOR**
4. **DISCONNECT AIR HOSE AND TWO WATER BY–PASS HOSES**
5. **REMOVE ISC VALVE**
   (a) Remove the nut, and disconnect the wire harness clamp.
   (b) Remove the two bolts, ISC valve and gasket.

INSPECTION OF ISC VALVE

INSPECT ISC VALVE OPERATION

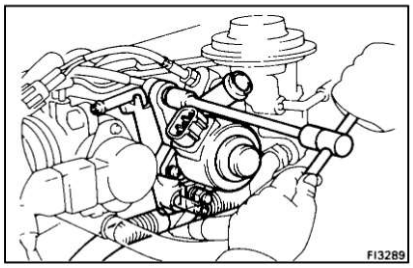


(a) Apply battery voltage to terminals B1 and B2, and while repeatedly grounding S1 – S2 – S3 – S4 – S1 in sequence, check that the valve moves toward the closed position.



(b) Apply battery voltage to terminals B1 and B2, and while repeatedly grounding S4 – S3 – S2 – S1 – S4 in sequence, check that the valve moves toward the open position.

If operation is not as specified, replace the ISC valve.

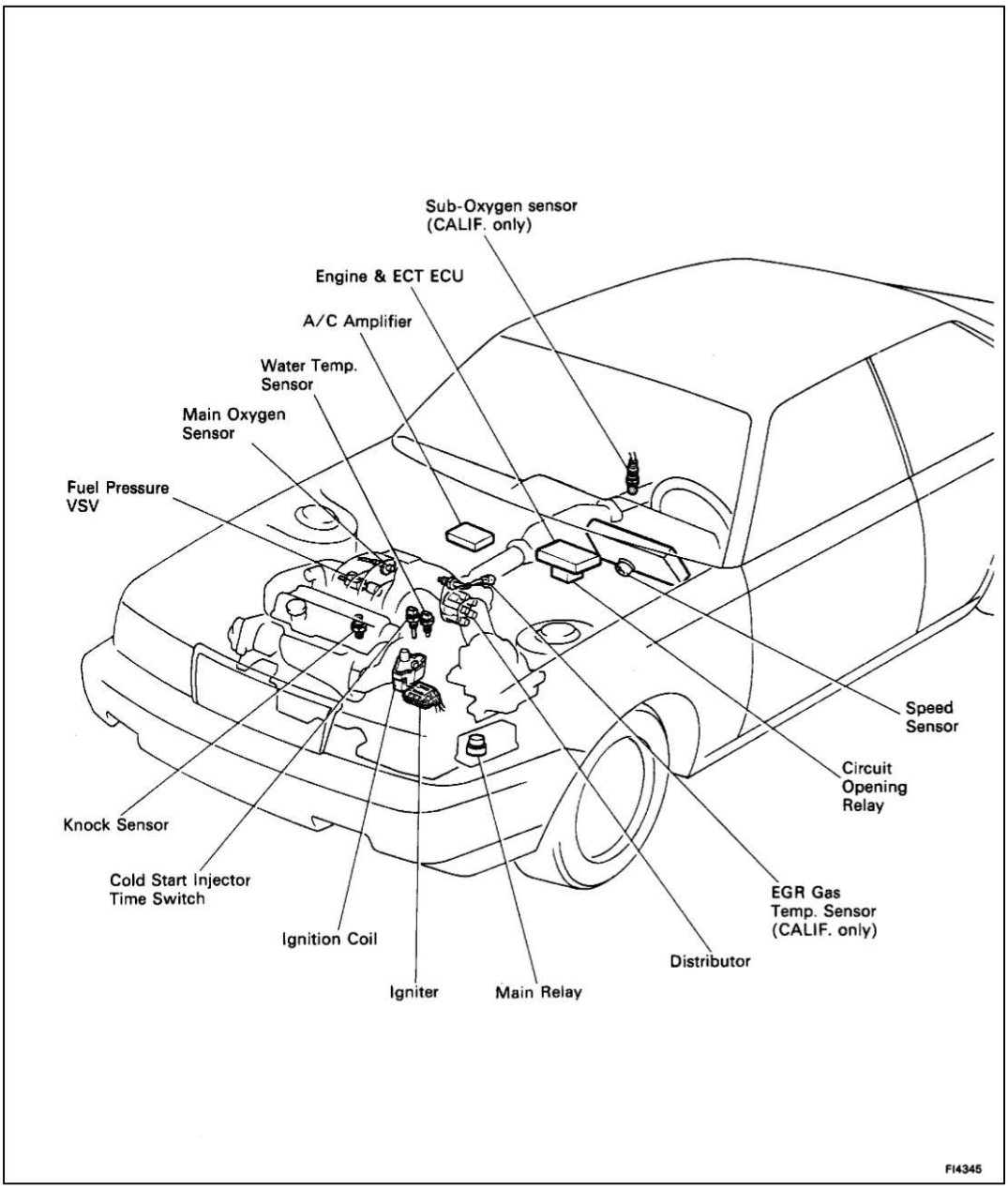


INSTALLATION OF ISC VALVE

1. **INSTALL ISC VALVE**
   (a) Install a new gasket and the ISC valve with the two bolts.
   Torque: 130 kg–cm (9 ft–lb, 13 N·m)
   (b) Connect the wire harness clamp with the nut.
2. **CONNECT TWO WATER BY–PASS HOSES AND AIR HOSE**
3. **CONNECT ISC VALVE CONNECTOR**
4. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
5. **FILL WITH ENGINE COOLANT (See page CO–5)**

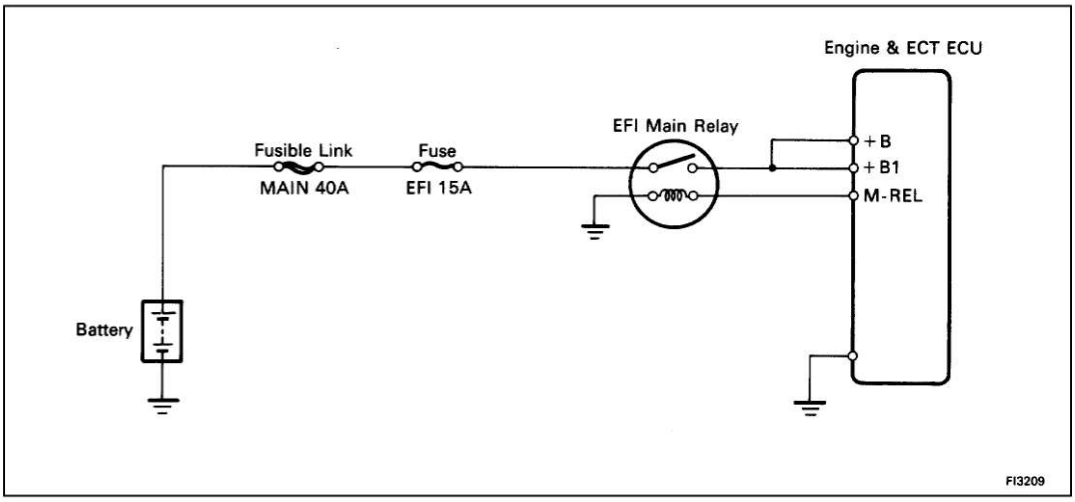
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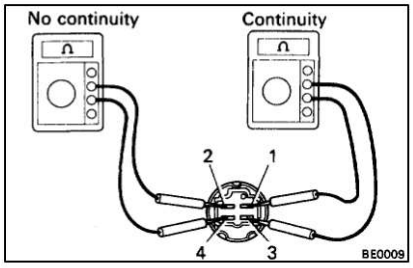
ELECTRONIC CONTROL SYSTEM
Location of Electronic Control Parts



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EFI Main Relay

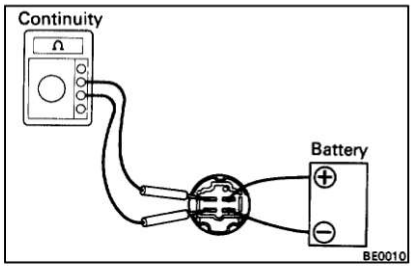




INSPECTION OF EFI MAIN RELAY

1. **INSPECT RELAY CONTINUITY**
   (a) Using an ohmmeter, check that there is continuity between terminals 1 and 3.
   (b) Check that there is no continuity between terminals 2 and 4.

   If continuity is not as specified, replace the relay.

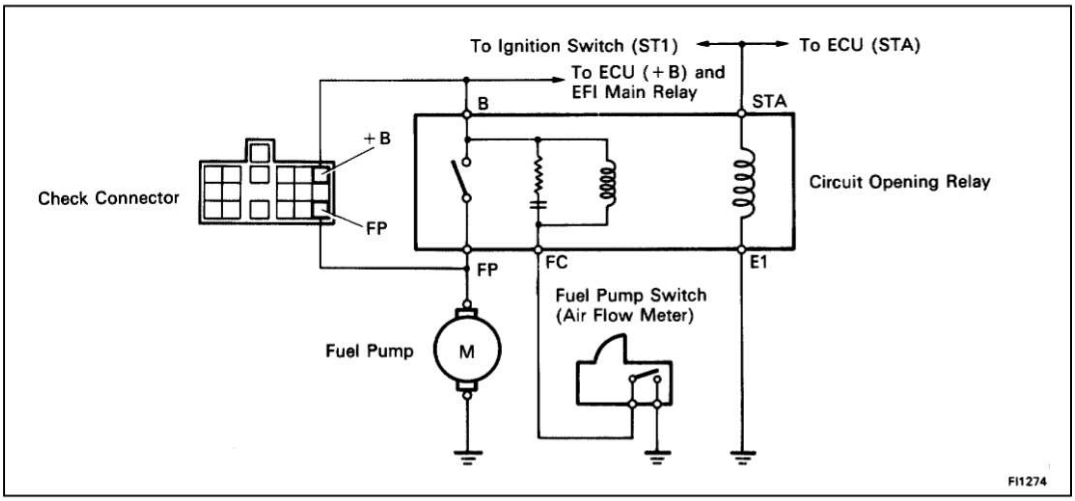


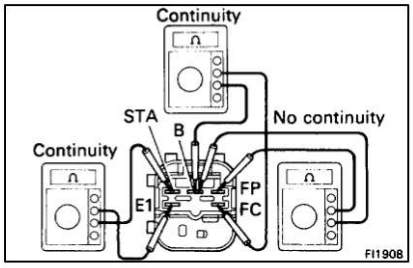
2. **INSPECT RELAY OPERATION**
   (a) Apply battery voltage across terminals 1 and 3.
   (b) Using an ohmmeter, check that there is continuity between terminals 2 and 4.

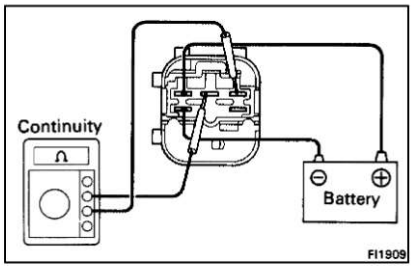
   If operation is not as specified, replace the relay.

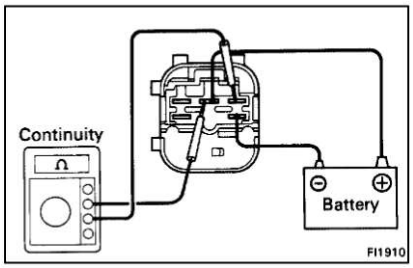
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Circuit Opening Relay









INSPECTION OF CIRCUIT OPENING RELAY

1. **INSPECT RELAY CONTINUITY**
   (a) Using an ohmmeter, check that there is continuity between terminals STA and E1.
   (b) Check that there is continuity between terminals +B and FC.
   (c) Check that there is no continuity between terminals +B and FP.

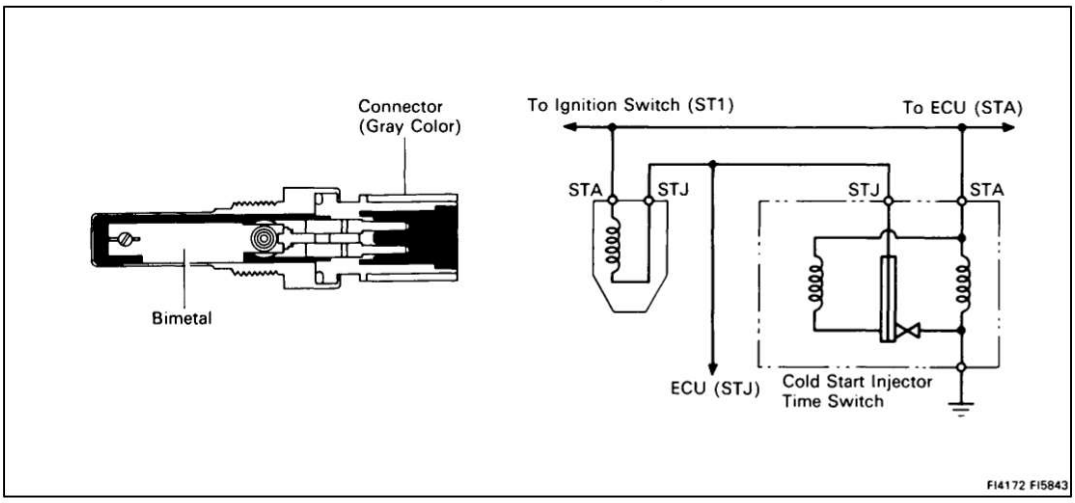
   If continuity is not as specified, replace the relay.

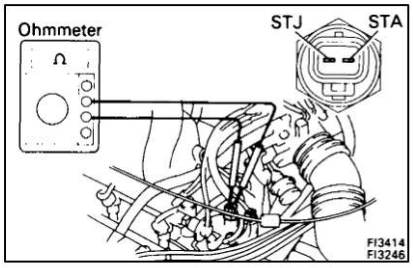
2. **INSPECT RELAY OPERATION**
   (a) Apply battery voltage across terminals STA and E1.
   (b) Using an ohmmeter, check that there is continuity between terminals +B and FP.
   (c) Apply battery voltage across terminals +B and FC.
   (d) Check that there is continuity between terminals +B and FP.

   If operation is not as specified, replace the relay.

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Cold Start Injector Time Switch





INSPECTION OF COLD START INJECTOR TIME SWITCH

INSPECT RESISTANCE OF COLD START INJECTOR TIME SWITCH

Using an ohmmeter, measure the resistance between each terminal.

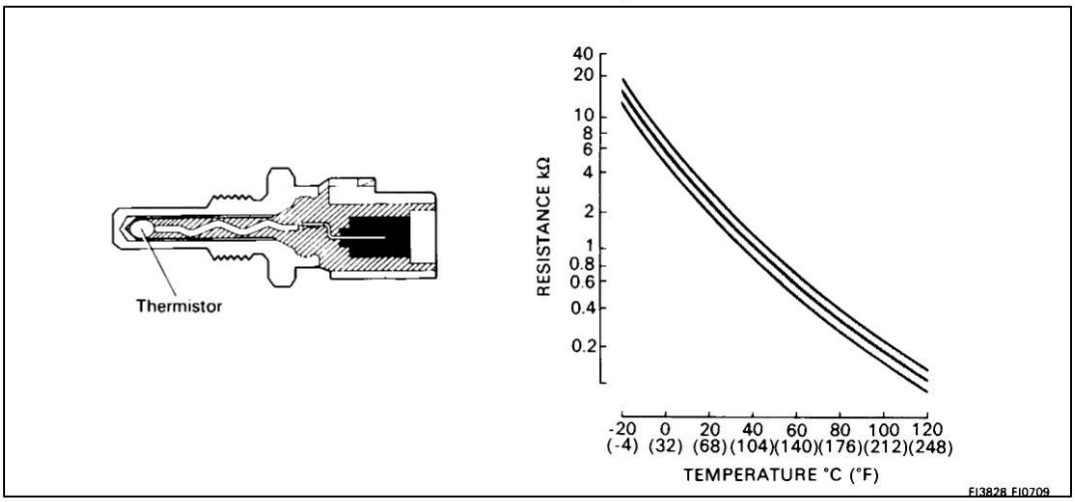
Resistance:

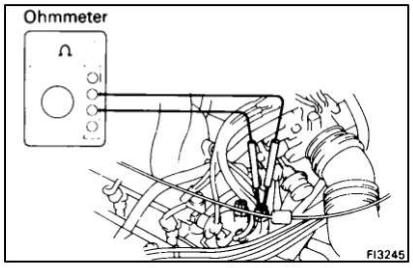
STA – STJ	**25 – 45 Ω below 15°C (59°F)**
	65 – 85 Ω above 30°C (86°F)
STA – Ground	**25 – 85 Ω**

If the resistance is not as specified, replace the switch.

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Water Temperature Sensor





INSPECTION OF WATER TEMPERATURE SENSOR

INSPECT RESISTANCE OF WATER TEMPERATURE SENSOR

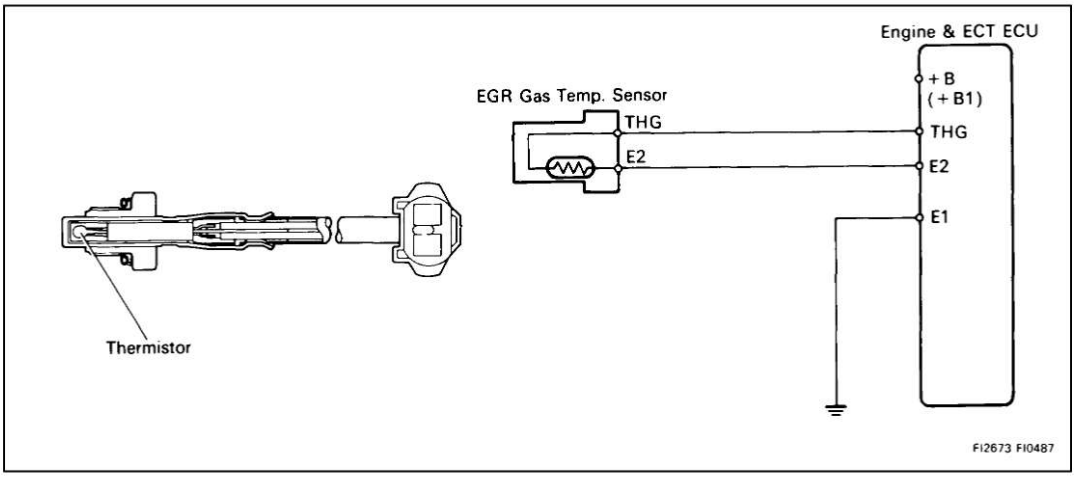
Using an ohmmeter, measure the resistance between the terminals.

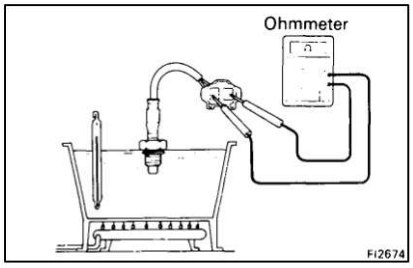
Resistance: Refer to the chart

If the resistance is not as specified, replace the sensor.

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EGR Gas Temperature Sensor (CALIF. only)





INSPECTION OF EGR GAS TEMPERATURE SENSOR

INSPECT EGR GAS TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

69.40 – 88.50 kΩ at 50°C (112°F)

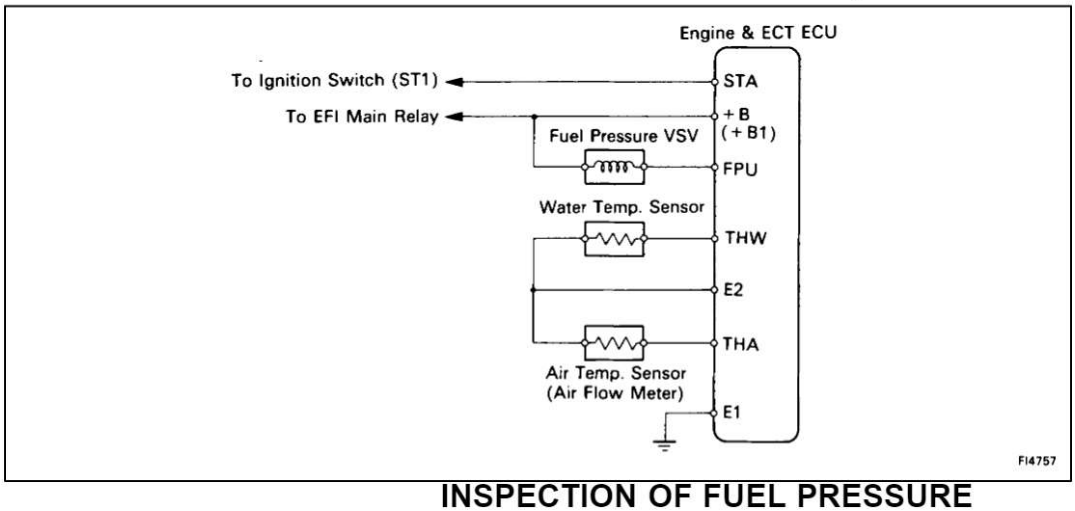
11.89 – 14.37 kΩ at 100°C (212°F)

2.79 – 3.59 kΩ at 150°C (302°F)

If the resistance is not as specified, replace the sensor.

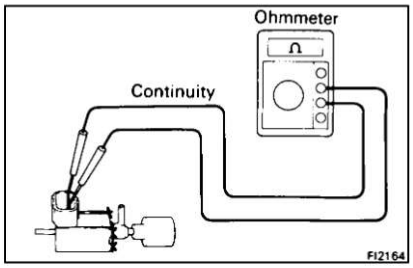
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Fuel Pressure Control System



INSPECTION OF FUEL PRESSURE COTROL SYSTEM

1. **INSPECT WATER TEMPERATURE SENSOR**
   (See page FI–50)
2. **INSPECT INTAKE AIR TEMPERATURE SENSOR**
   (See page FI–37)



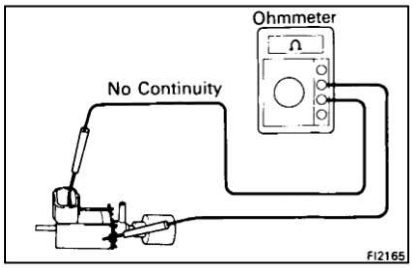
3. **INSPECT FUEL PRESSURE VSV**

A. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity between terminals.

Resistance (Cold): 33–39 Ω

If there is no continuity, replace the VSV.

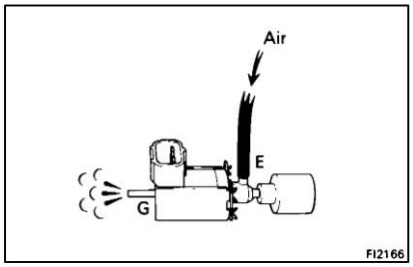


B. Inspect VSV for ground

Using an ohmmeter, check that there is no continuity between each terminal and body.

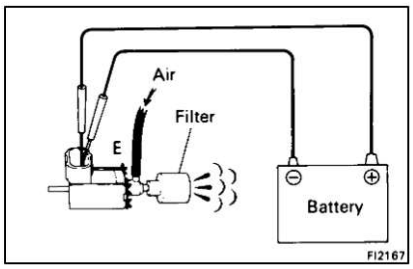
If there is continuity, replace the VSV.

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C. Inspect VSV operation

(a) Check that air flows from ports E to G.

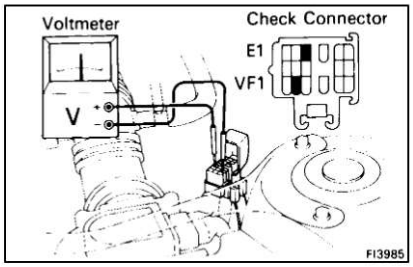


(b) Apply battery voltage across the terminals

(c) Check that air flows from port E to filter.

If operation is not as specified, replace the VSV.

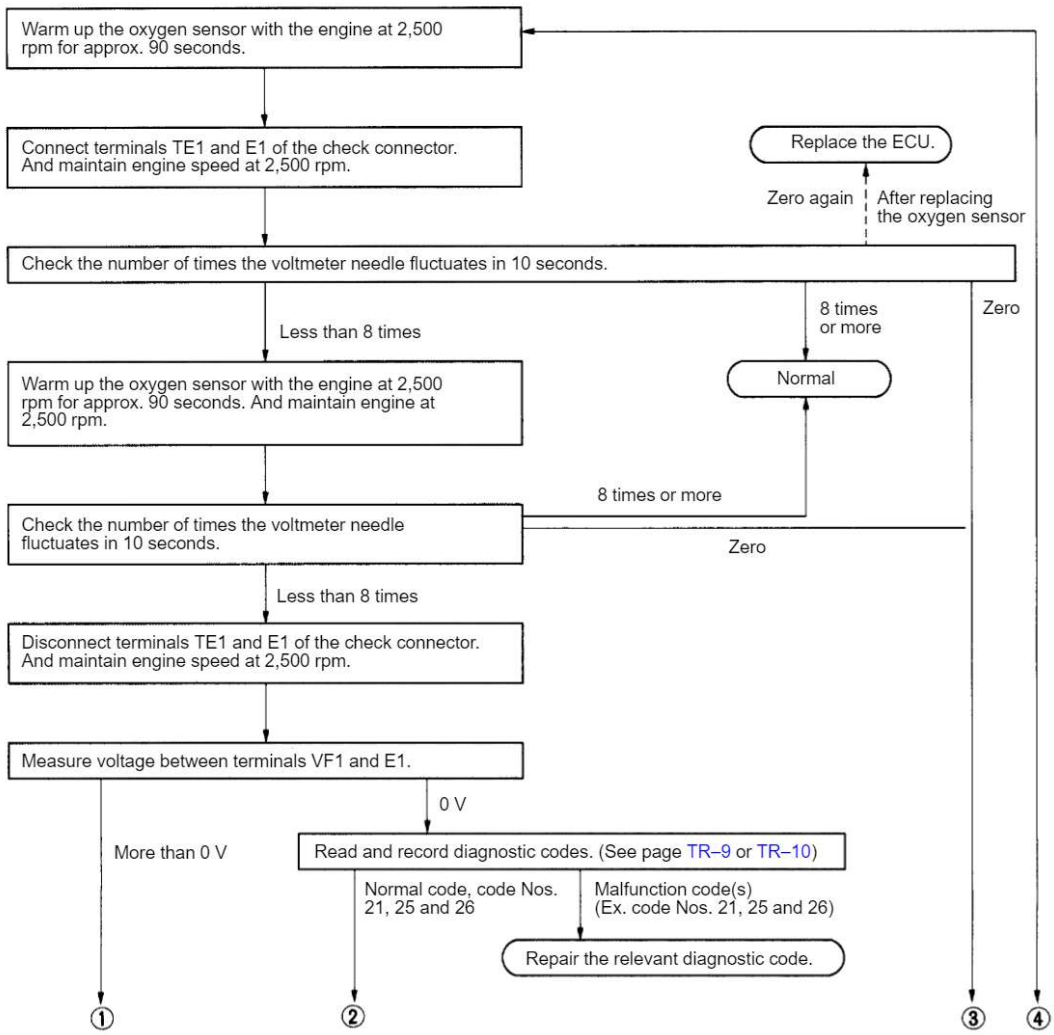
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Oxygen Sensor (Main)

INSPECTION OF OXYGEN SENSOR

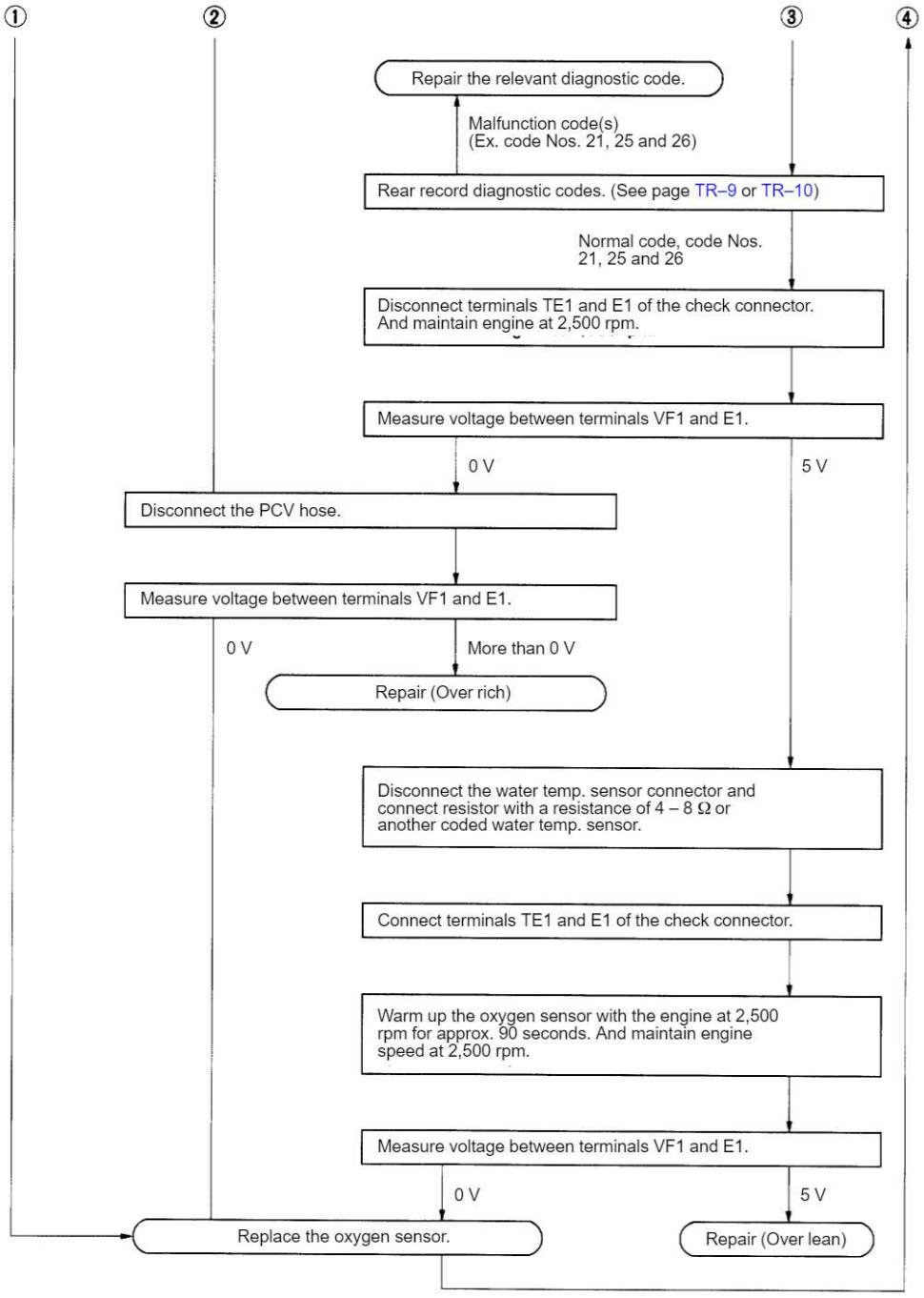
1. **WARM UP ENGINE**
   Allow the engine to warm up to normal operating temperature.
2. **INSPECT FEEDBACK VOLTAGE**
   Connect the positive (+) probe of a voltmeter to terminal VF1 of the check connector, and negative (–) probe to terminal E1. Perform the test as follows:



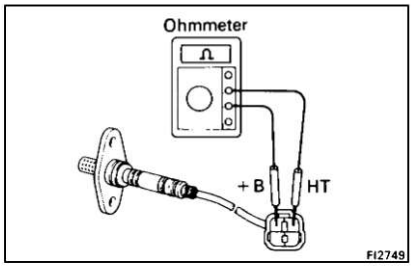
CONTINUED ON PAGE FI–55

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CONTINUED FROM PAGE FI–54



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3. **INSPECT HEATER RESISTANCE OF OXYGEN SENSOR**
Using an ohmmeter, measure the resistance between terminals +B and HT.
Resistance (Cold): 5.1–6.3 Ω at 20°C (68°F)
If the resistance is not as specified, replace the sensor.

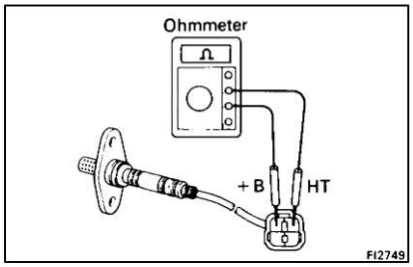
Sub–Oxygen Sensor (CALIF. only)

INSPECTION OF SUB–OXYGEN SENSOR

INSPECT SUB–OXYGEN SENSOR

HINT: Inspect only when code No.27 is displayed.
(a) Cancel diagnostic code. (See page TR–11)
(b) Warm up the engine until it reaches normal operating temperature.
(c) (M/T)
Drive for 5 minutes or more between 80 km/h (50 mph) and 100 km/h in 4th or 5th gear.
(A/T)
Drive for 5 minutes or more between 80 km/h (50 mph) and 100 km/h (62 mph) in “D” range.
(d) Following the conditions in step (c), press fully on the accelerator pedal for 2 seconds or more.
HINT: Do not exceed 100 km/h (62 mph), or diagnostic code will be cancelled.
(e) Stop the vehicle and turn the ignition switch to OFF.
(f) Carry out steps (b), (c) and (d) again to test acceleration.
If code No. 27 appears again, check the sub–oxygen sensor circuit. If the circuit is normal, replace the suboxygen sensor.

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3. **INSPECT HEATER RESISTANCE OF OXYGEN SENSOR**
Using an ohmmeter, measure the resistance between terminals +B and HT.
Resistance (Cold): 5.1–6.3 Ω at 20°C (68°F)
If the resistance is not as specified, replace the sensor.

Sub–Oxygen Sensor (CALIF. only)

INSPECTION OF SUB–OXYGEN SENSOR

INSPECT SUB–OXYGEN SENSOR

HINT: Inspect only when code No.27 is displayed.
(a) Cancel diagnostic code. (See page TR–11)
(b) Warm up the engine until it reaches normal operating temperature.
(c) (M/T)
Drive for 5 minutes or more between 80 km/h (50 mph) and 100 km/h in 4th or 5th gear.
(A/T)
Drive for 5 minutes or more between 80 km/h (50 mph) and 100 km/h (62 mph) in “D” range.
(d) Following the conditions in step (c), press fully on the accelerator pedal for 2 seconds or more.
HINT: Do not exceed 100 km/h (62 mph), or diagnostic code will be cancelled.
(e) Stop the vehicle and turn the ignition switch to OFF.
(f) Carry out steps (b), (c) and (d) again to test acceleration.
If code No. 27 appears again, check the sub–oxygen sensor circuit. If the circuit is normal, replace the suboxygen sensor.

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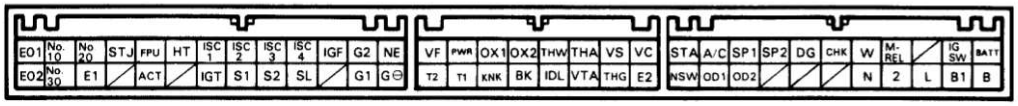
Electronic Control Unit (ECU)

TERMINALS OF ECU

Symbol	Terminal name	Symbol	Terminal name
EO1	POWER GROUND	*2OX2	SUB–OXYGEN SENSOR
EO2	POWER GROUND	*1BK	STOP LIGHT SWITCH
No. 10	INJECTOR (No. 1 and No. 6)	THW	WATER TEMPERATURE SENSOR
No. 30	INJECTOR (No. 4 and No. 5)	IDL	THROTTLE POSITION SENSOR
No. 20	INJECTOR (No. 2 and No. 3)	THA	AIR TEMPERATURE SENSOR
E1	ECC GROUND	VTA	THROTTLE POSITION SENSOR
STJ	COLD START INJECTOR	VS	AIR FLOW METER
	–	THG	EGR GAS TEMPERATURE SENSOR
FPU	FUEL PRESSURE VSV	VC	AIR FLOW METER THROTTLE POSITION SENSOR
ACT	A/C AMPLIFIER	E2	SENSOR GROUND
HT	MAIN OXYGEN SENSOR HEATER	STA	STARTER MAGNETIC SWITCH
	–	*1NSW	NEUTRAL START SWITCH
ISC1	ISC VALVE (No. 1 Coil)	A/C	A/C COMPRESSOR
IGT	IGNITER	*1OD1	CRUISE CONTROL ECU
ISC2	ISC VALVE (No. 2 Coil)	SP1	No. 1 SPEED SENSOR (Meter Side)
*1S1	ECT SOLENOID	*1OD2	O/D MAIN SWITCH
ISC3	ISC VALVE (No. 3 Coil)	*1SP2	No. 2 SPEED SENSOR (A/T Side)
*1S2	ECT SOLENOID		–
ISC4	ISC VALVE (No. 4 Coil)	*1DG	TDCL
*1SL	ECT SOLENOID		–
IGF	IGNITER	*2CHK	SUB–OXYGEN SENSOR
	–		–
G2	DISTRIBUTOR	W	CHECK ENGINE WARNING LIGHT
G1	DISTRIBUTOR	*1N	SHIFT POSITION SWITCH
NE	DISTRIBUTOR	M–REL	EFI MAIN RELAY
G	DISTRIBUTOR	*12	SHIFT POSITION SWITCH
VF	CHECK CONNECTOR		–
T2	TDCL	*1L	SHIFT POSITION SWITCH
*1PWR	PATTERN SELECT SWITCH	IGSW	IGNITION SWITCH
T1	CHECK CONNECTOR, TDCL	+B1	EFI MAIN RELAY
OX1	OXYGEN SENSOR (MAIN)	BATT	BATTERY
KNK	KNOCK CONTROL SENSOR	+B	EFI MAIN RELAY

Engine & ECT ECU Terminals

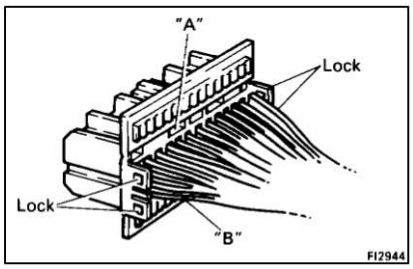
*1 A/T (w/ ECT)
*2 CALIF. only



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INSPECTION OF ECU

HINT: The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the ECU.

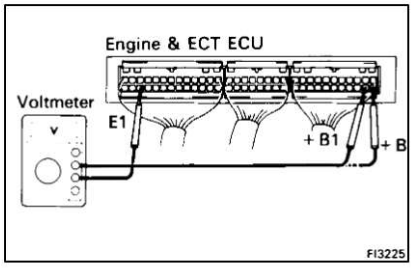


1. PREPARATION

(a) Disconnect the connectors from the ECU.
(b) Remove the locks as shown in the illustration so that the test probe(s) can easily come in.

NOTICE: Pay attention to sections "A" and "B" in the illustration which can be easily broken.

(c) Reconnect the connectors to the ECU.



2. INSPECT VOLTAGE OF ECU

Check the voltage between each terminal of the wiring connectors.

- Turn the ignition switch ON.
- Measure the voltage at each terminal.

HINT:

- Perform all voltage measurements with the connectors connected.
- erify that the battery voltage is 11 V or more when the ignition switch is ON.

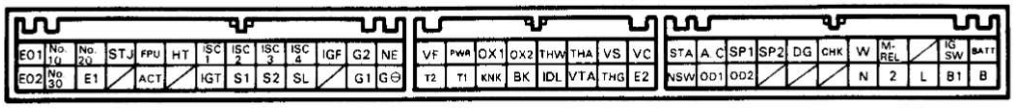
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Voltage at ECU Wiring Connectors

Terminals	Condition		STD voltage (V)
BATT – E1	–		10 – 14
IG SW – E1	IG SW ON		
M-REL – E1			
+B, +B1 – E1			
IDL – E2	IG SW ON	Throttle valve open	4 – 6
VTA – E2		Throttle valve fully closed	0.1 – 1.0
		Throttle valve open	3.2 – 4.2
VC – E2		–	4 – 6
VS – E2		Measuring plate fully closed	3.7 – 4.3
		Measuring plate fully open	0.2 – 0.5
	Idling		1.6 – 4.1
	3,000 rpm		1.0 – 2.0
No. 10, No. 20, No. 30 – E1, E2	IG SW ON		10 – 14
THA – E2	IG SW ON	Intake air temp. 20°C (68°F)	1 – 3
THW – E2		Coolant temp. 80°C (176°F)	0.1 – 1.0
STA – E1	Cranking		6 – 14
IGT – E1	Cranking idling		0.7 – 1.0
ISC1, ISC2, ISC3, ISC4 – E1	IG SW ON		9 – 14
W – E1	No trouble (“CHECK” engine warning light off) and engine running		10 – 14
*1A/C – E1	IG SW ON	Air conditioning ON	8 – 14
*1ACT – E1		Heater blower SW ON	4 – 6
T1, T2 – E1		Check connector TE1 – E1 not connected	4 – 6
		Check connector TE1 – E1 connected	0.5 or less
		Shift position P or N range	0 – 2
*2NSW – E1		Ex. shift position P or N range	10 – 14
*2BK – E1	Stop light SW ON (Brake pedal depressed)		10 – 14

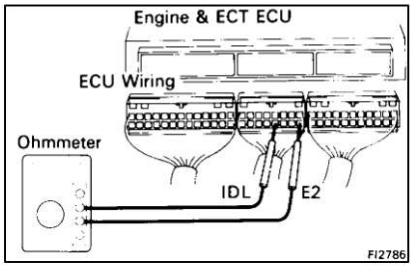
Engine & ECT ECU Terminals

*1 w/ A/C
*2 w/ ECT



FI2796

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3. **INSPECT RESISTANCE OF ECU**

NOTICE:

- **Do not touch the ECU terminals.**
- **The tester probe should be inserted into the wiring connector from the wiring side.**

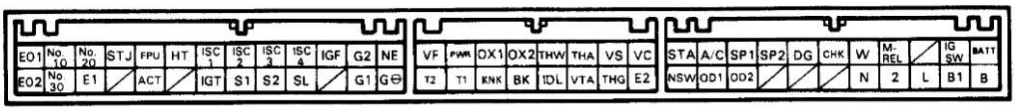
Check the resistance between each terminal of the wiring connectors.

- Disconnect the connectors from the ECU.
- Measure the resistance at each terminal.

Resistance of ECU Wiring Connectors

Terminals	Condition	STD resistance (Ω)
IDL – E2	Throttle valve open	Infinity
	Throttle valve fully closed	2,300 or less
VTA – E2	Throttle valve fully open	3,500 – 10.300
	Throttle valve fully closed	300 – 6,300
VC – E2	–	200 – 400
VS – E2	Measuring plate fully closed	200 – 600
	Measuring plate fully open	20 – 1,200
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 (–) NE	–	140 – 180
ISC1 ISC2 – +B ISC3 – +B1 ISC4	–	10 – 30

Engine & ECT ECU Terminals



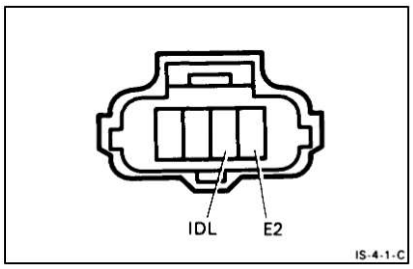
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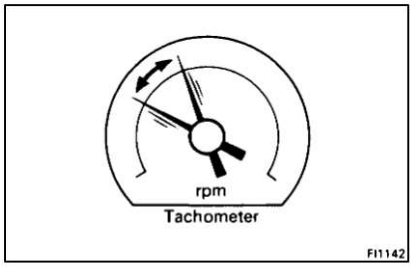
Fuel Cut RPM

INSPECTION OF FUEL CUT RPM

1. **WARM UP ENGINE**
   Allow the engine to warm up to normal operating temperature.
2. **INSPECT FUEL CUT RPM**
   (a) Disconnect the connector from the throttle position sensor.



(b) Connect terminals IDL and E2 of the wiring connector.



(c) Gradually raise the engine rpm and check that there is fluctuation between the fuel cut and fuel return points.

HINT:
- The vehicle should be stopped.
- Measure with the A/C OFF.

Fuel cut rpm: 1,800 rpm
Fuel return rpm: 1,200 rpm

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SERVICE SPECIFICATIONS

SPECIFICATIONS

Fuel pressure regulator	Fuel pressure	at no vacuum	2.7 – 3.1 kg/cm^2 (38 – 44 psi, 265 – 304 kPa)
Cold start injector	Resistance		2 – 4 Ω
	Fuel leakage		One drop or less per minute
Injector	Resistance		Approx. 13.8 Ω
	Injection volume		45 – 55 cc (2.7 – 3.4 cu in.)/15 sec
	Difference volume between each injector		5 cc (0.31 cu in.) or less
	Fuel leakage		One drop or less per minute
Air flow meter	Resistance VS – E2		200 – 600 Ω (Measuring plate fully closed)
			20 – 1,200 Ω (Measuring plate fully open)
	VC – E2		200 – 400 Ω
	FC – E1		Infinity (Measuring plate fully closed)
			Zero (Others)
	THA – E2	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

Throttle position sensor	Clearance between stop screw and lever		Between terminals	Resistance
	0 mm	0 in.	VTA – E2	0.3 – 6.3 kΩ
	0.30 mm	0.012 in.	IDL – E2	2.3 kΩ or less
	0.70 mm	0.028 in.	IDL – E2	Infinity
	Throttle valve fully open		VTA – E2	3.5 – 10.3 kΩ
	–		VC – E2	4.25 – 8.25 kΩ

ISC valve	Resistance		B1 – S1 or S3	10 – 30 Ω
			B2 – S2 or S4	10 – 30 Ω
Cold start injector time switch	Resistance	STA – STJ	below 15°C (59°F)	25 – 45 Ω
			above 30°C(59°F)	65 – 85 Ω
		STA – Ground		25 – 85 Ω
Water 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
EGR gas temp. sensor (CALIF. only)	Resistance		at 50°C (122°F)	69.40 – 88.50 kΩ
			at 100°C (212°F)	11.89 – 14.37 kΩ
			at 150°C (302°F)	2.79 – 3.59 kΩ
Fuel pressure VSV	Resistance			33 – 39 Ω
Main oxygen sensor	Heater resistance			5.1 – 6.3 Ω

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SPECIFICATIONS (Cont'd)

ECU	HINT: ● Perform all voltage and resistance measurements with the ECU connected. ● Verify that the battery voltage is 11 V or above with the ignition switch is ON.			
	Voltage			
	Terminals	Condition		STD voltage (V)
	BATT – E1	–		10 – 14
	IG SW – E1	IG SW ON		
	M–REL – E1			
	+B, +B1 – E1			
	IDL – E2	IG SW ON	Throttle valve open	4 – 6
	VTA – E2		Throttle valve fully closed	0.1 – 1.0
			Throttle valve open	3.2 – 4.2
	VC – E2		–	4 – 6
	VS – E2		Measuring plate fully closed	3.7 – 4.3
			Measuring plate fully open	0.2 – 0.5
		Idling		1.6 – 4.1
		3,000 rpm		1.0 – 2.0
	No. 10, No. 20 – EO1, EO2 No. 30	IG SW ON		10 – 14
	THA – E2	IG SW ON	Intake air temp. 20°C (68°F)	1 – 3
	THW – E2		Coolant temp. 80°C (176°F)	0.1 – 1.0
	STA – E1	Cranking		6 – 14
	IGT – E1	Cranking or idling		0.7 – 1.0
	ISC1, ISC2, ISC3, ISC4 – E1	IG SW ON		9 – 14
	W – E1	No trouble ("CHECK" engine warning light off) and engine running		10 – 14
	*1A/C – E1	IG SW ON	Air conditioning ON	10 – 14
	*1 ACT – E1		Heater blower SW ON	4 – 6
	T1, T2 – E1		Check connector TE1 – E1 not connected	4 – 6
			Check connector TE1 – E1 connected	0.5 or less
			Shift position P on N range	0 – 2
	*2NSW – E1		Ex. shift position P or N range	10 – 14
	*2BK – E1		Stop light SW ON (Brake pedal depressed)	10 – 14

*1 w/o ECT *2 w/ ECT

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SPECIFICATIONS (Cont'd)

ECU (cont'd)	Resistance		
	Terminals	Condition	STD resistance (Ω)
	IDL – E2	Throttle valve open	Infinity
		Throttle valve fully closed	2,300 or less
	VTA – E2	Throttle valve fully open	3,500 – 10,300
		Throttle valve fully closed	300 – 6,300
	VC – E2	–	200 – 400
	VS – E2	Measuring plate fully closed	200 – 600
		Measuring plate fully open	20 – 1,200
	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 (–) NE	–	140 – 180
	ISC1 ISC2 ISC3 ISC4	– + B – + B1	10 – 30

TORQUE SPECIFICATIONS

Part tightened		kg–cm	ft–lb	N·m
Fuel line	Union bolt type	300	22	29
	Flare nut type	310	22	30
Fuel pump X Fuel tank		40	35 in.–lb	3.9
Fuel inlet pipe x Fuel tank		20	17 in.–lb	2.0
Fuel tank band x Body		400	29	39
Cold start injector x Air intake chamber		55	48 in.–lb	5.4
Cold start injector tube x Cold start injector		200	14	20
Cold start injector tube X Delivery pipe		200	14	20
Fuel pressure regulator x Delivery pipe		330	24	32
Delivery pipe X Intake manifold		130	9	13
No. 2 fuel pipe x Delivery pipe		330	24	32
Air intake chamber x Intake manifold		440	32	43
EGR pipe nut		800	58	78
No. 1 engine hanger		380	27	37
Air intake chamber stay		380	27	37
No. 1 RH engine mounting stay x Air intake chamber		530	38	52
No. 1 RH engine mounting stay x RH engine mounting insulator		530	38	52
Throttle body x Air intake chamber		130	9	13
ISC valve x Air intake chamber		130	9	13

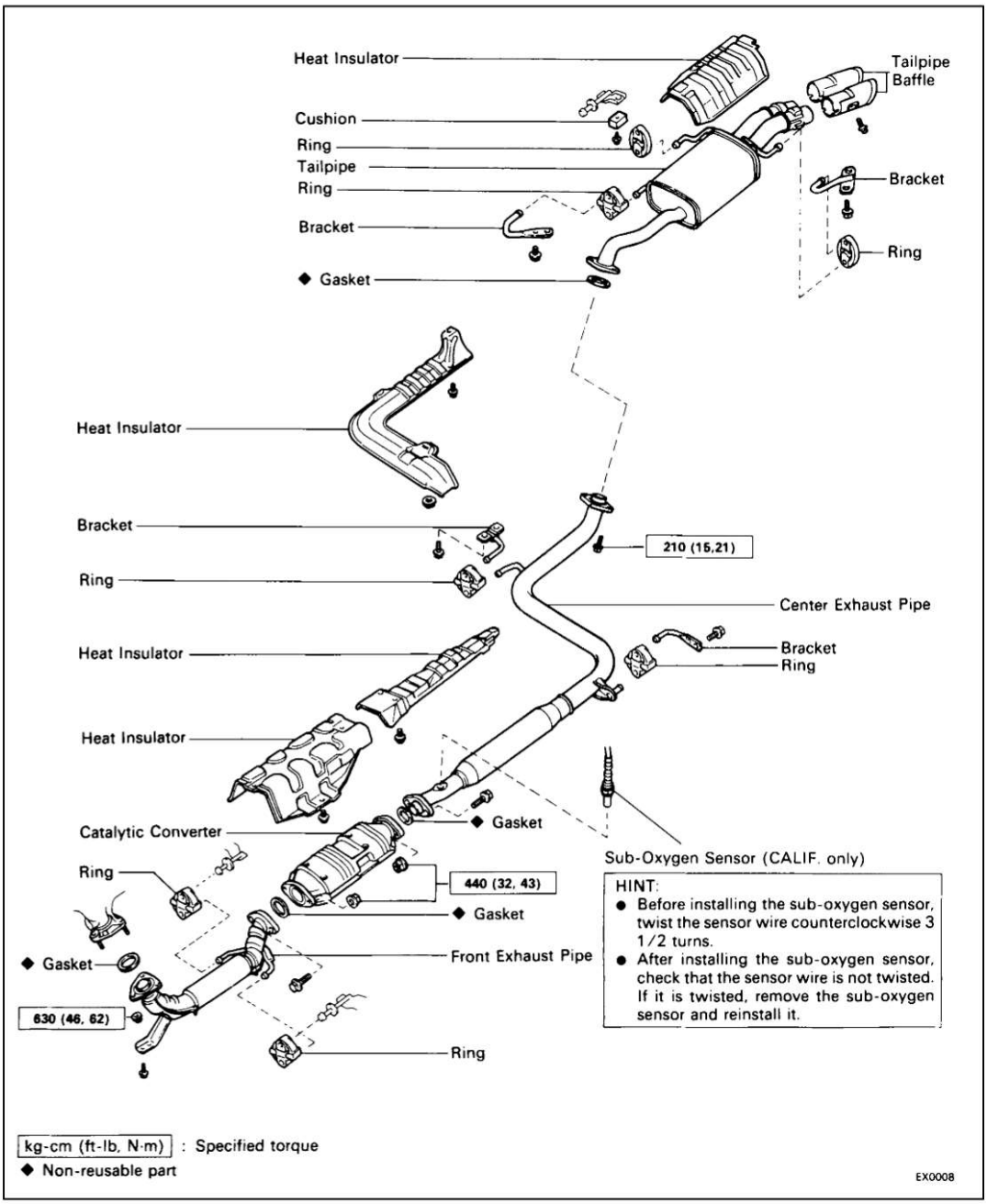
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EXHAUST SYSTEM

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EXHAUST PIPES AND HEAT INSULATORS

COMPONENTS



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EMISSION CONTROL SYSTEMS

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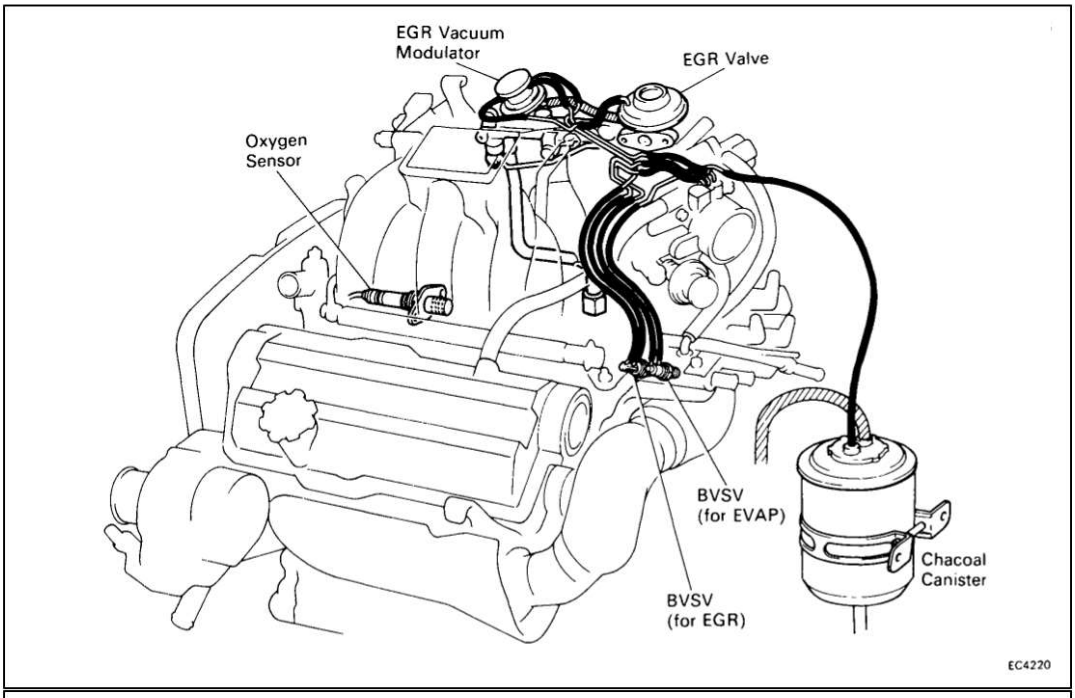
SYSTEM PURPOSE

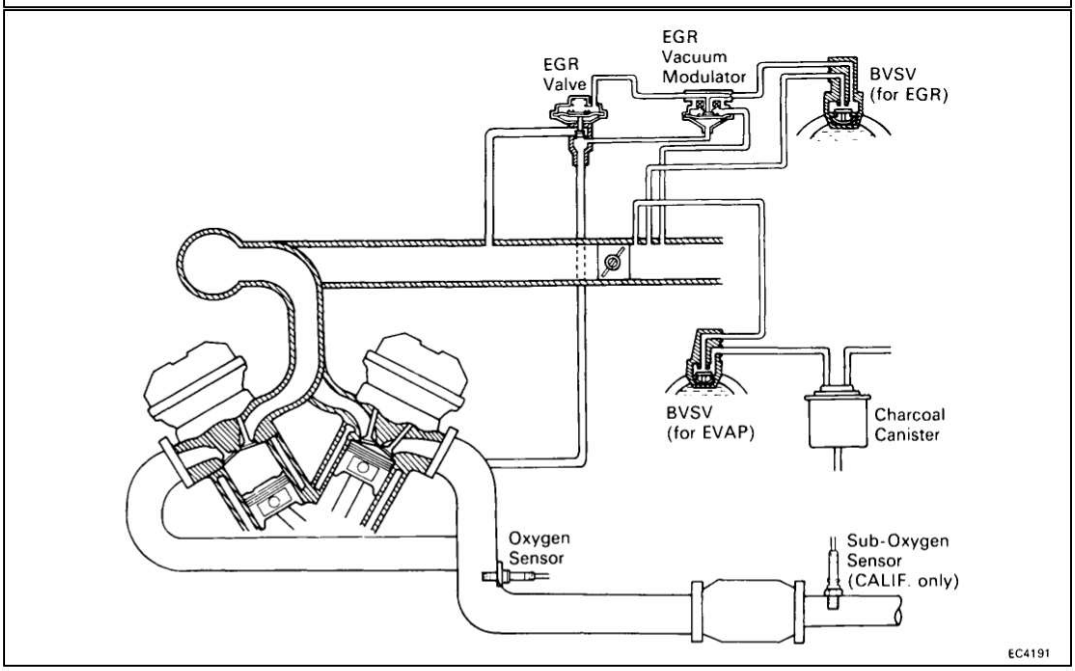
System	Abbreviation	Purpose
Positive Crankcase ventilation	PCV	Reduces blow–by gas (HC)
Fuel evaporative emission control	EVAP	Reduces evaporative HC
Exhaust gas recirculation	EGR	Reduces NOx
Three–way catalyst	TWC	Reduces HC, CO and NOx
Electronic fuel injection*	EFI	Regulates all engine conditions for reduction of exhaust emissions.

Remark * For inspection and repair of the EFI system, refer to EFI section of this manual.

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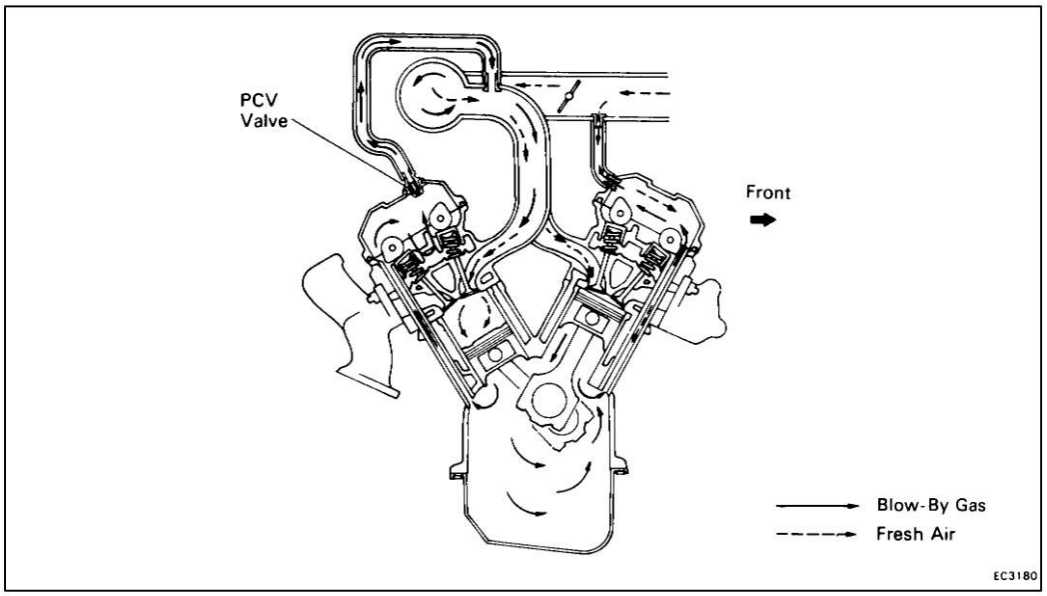
COMPONENT LAYOUT AND SCHEMATIC DRAWING





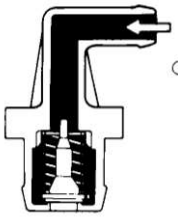
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POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM



To reduce HC emission, crankcase blow–by gas (HC) is routed through the PCV valve to the air intake chamber for combustion in the cylinders

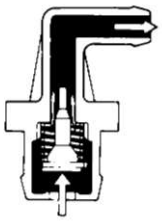
Engine not Running



○ PCV VALVE IS CLOSED.

EC1367

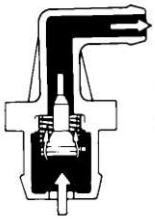
Normal Operation



○ PCV VALVE IS OPEN.
○ VACUUM PASSAGE IS LARGE.

EC1200

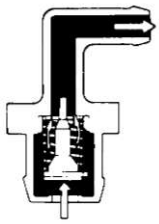
Idling or Deceleration



○ PCV VALVE IS OPEN.
○ VACUUM PASSAGE IS SMALL.

EC1226

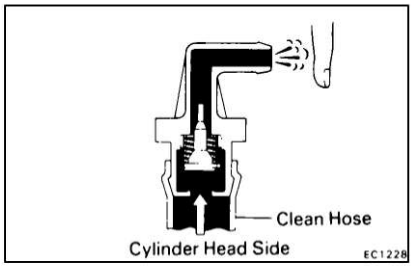
Acceleration or High Load



○ PCV VALVE IS FULLY OPEN.

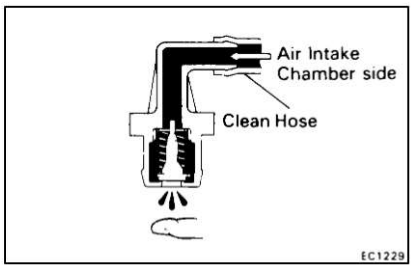
EC1227

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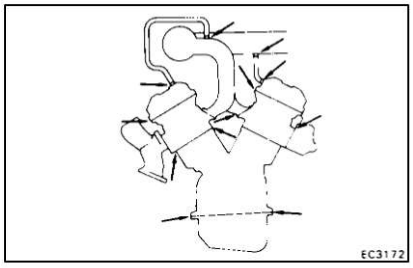


INSPECTION OF PCV VALVE

1. **REMOVE PCV VALVE**
2. **INSTALL CLEAN HOSE TO PCV VALVE**
3. **BLOW AIR FROM CYLINDER HEAD SIDE**
   Check that air passes through easily.
   NOTICE: Do not suck air through the valve.
   Petroleum substances inside the valve are harmful.



4. **BLOW AIR FROM AIR INTAKE CHAMBER SIDE**
   Check that air passes through with difficulty.
   If the PCV valve fails either of the checks, replace it.
5. **REMOVE CLEAN HOSE FROM PCV VALVE**
6. **REINSTALL PCV VALVE**



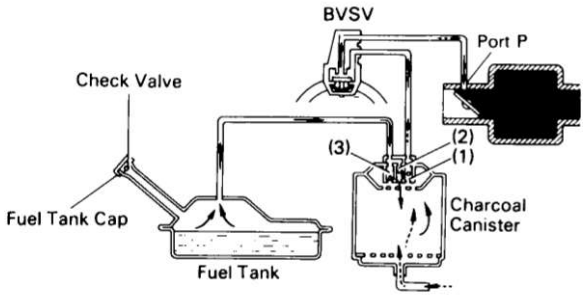
INSPECTION OF PCV HOSE AND CONNECTIONS

VISUALLY INSPECT HOSE AND CONNECTIONS

Check for cracks, leaks or damage.

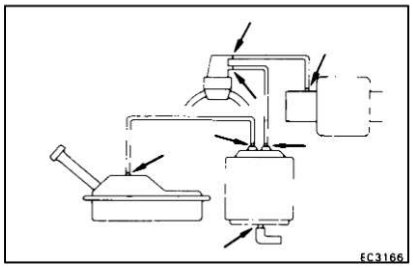
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FUEL EVAPORATIVE EMISSION CONTROL (EVAP) SYSTEM



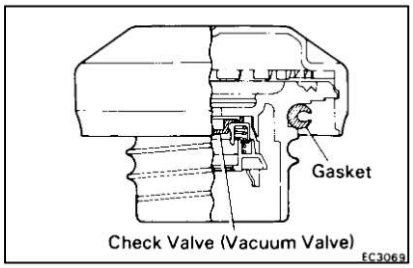
To reduce HC emissions, evaporated fuel from the fuel tank is routed through the charcoal canister to the intake manifold for combustion in the cylinders.

Coolant Temp.	BVSV	Throttle Valve Opening	Canister Check Valve			Check Valve in Cap	Evaporated Fuel (HC)
			(1)	(2)	(3)		
Below 35°C (95°F)	CLOSED	–	–	–	–	–	HC from tank is absorbed into the canister.
Above 54°C (129°F)	OPEN	Positioned below port P	CLOSED	–	–	–	
		Positioned above port P	OPEN	–	–	–	HC from canister is led into air intake chamber.
High pressure in tank	–	–	–	OPEN	CLOSED	CLOSED	HC from tank is absorbed into the canister.
High vacuum in tank	–	–	–	CLOSED	OPEN	OPEN	Air is led into the fuel tank.



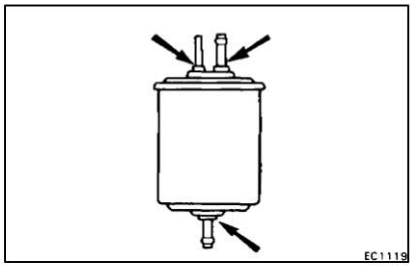
INSPECTION OF FUEL VAPOR LINES, FUEL TANK AND TANK CAP

1. **VISUALLY INSPECT LINES AND CONNECTIONS**
   Look for loose connections, sharp bends or damage.
2. **VISUALLY INSPECT FUEL TANK**
   Look for deformation, cracks or fuel leakage.



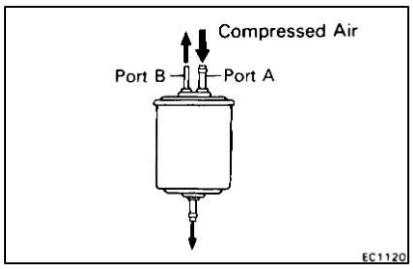
3. **VISUALLY INSPECT FUEL TANK CAP**
   Check if the cap and/or gasket are deformed or damaged.
   If necessary, repair or replace the cap.

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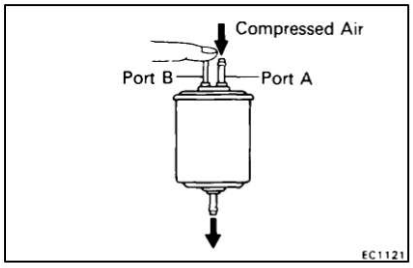
INSPECTION OF CHARCOAL CANISTER

1. **REMOVE CHARCOAL CANISTER**
2. **REMOVE DUST COVER FROM CHARCOAL CANISTER**
3. **VISUALLY INSPECT CHARCOAL CANISTER**
   Look for cracks or damage.

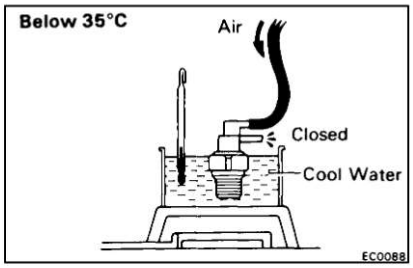


4. **CHECK FOR CLOGGED FILTER AND STUCK CHECK VALVE**
   (a) Using low pressure compressed air, blow into port A and check that air flows without resistance from the other pipes.
   (b) Blow into port B and check that air does not flow from the other pipes.

   If a problem is found, replace the charcoal canister.



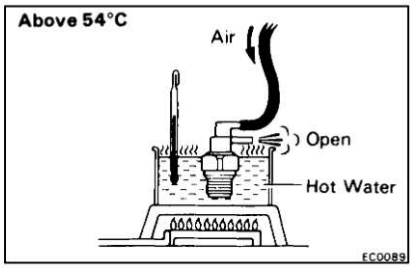
5. **CLEAN FILTER IN CANISTER**
   Clean the filter by blowing 3 kg/cm^2 (43 psi, 294 kPa) of air into port A while holding port B closed.
   HINT:
   - Do not attempt to wash the canister.
   - No activated carbon should come out.
6. **REINSTALL DUST COVER TO CHARCOAL CANISTER**
7. **REINSTALL CHARCOAL CANISTER**



INSPECTION OF BVSV

CHECK BVSV BY BLOWING AIR INTO PIPE

(a) Drain the coolant from the radiator into a suitable container.
(b) Remove the BVSV from the water by–pass outlet.
(c) Cool the BVSV to below 35°C (95°F) with cool water.
(d) Blow air into a pipe and check that the BVSV is closed.



(e) Heat the BVSV to above 54°C (129°) with hot water.
(f) Blow air into a pipe and check that the BVSV is open.

If a problem is found, replace the BVSV.

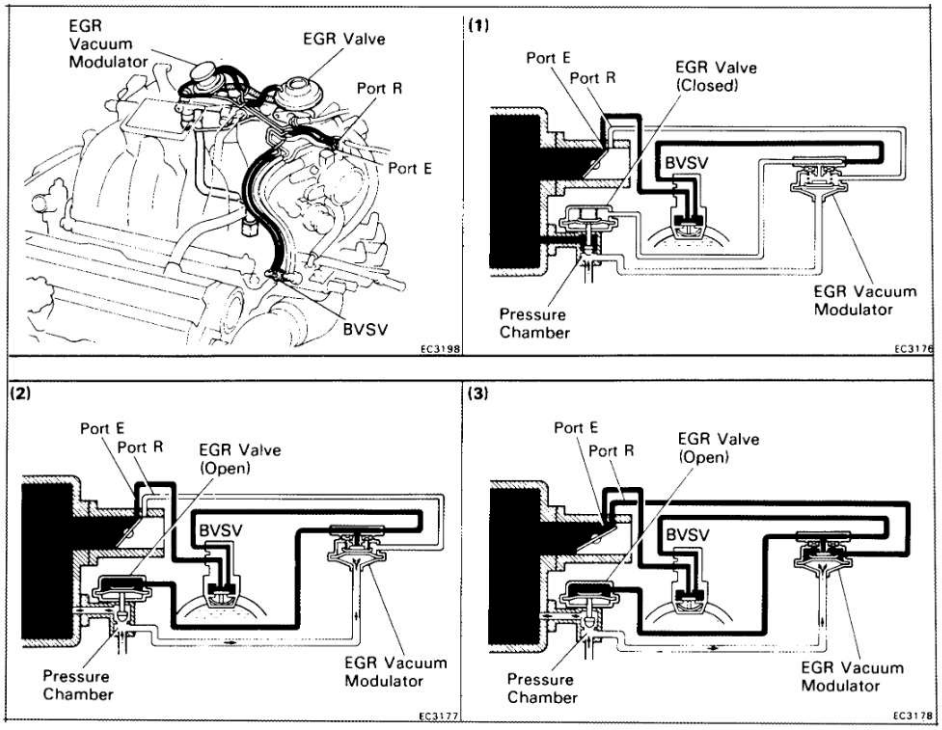
(g) Apply adhesive to two or three threads of the BVSV, and reinstall.

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

(h) Refill the radiator with coolant.

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EXHAUST GAS RECIRCULATION (EGR) SYSTEM



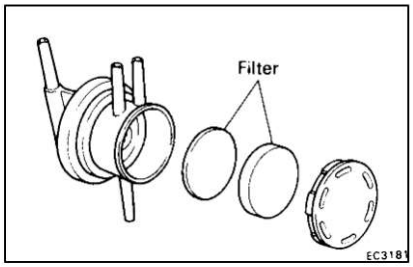
To reduce NOx emissions, part of the exhaust gasses are recirculated through the EGR valve to the intake manifold to lower the maximum combustion temperature.

Coolant Temp.	BVSV	Throttle Valve Opening Angle	Pressure in the EGR Valve pressure chamber		EGR Vacuum Modulator	EGR Valve	Exhaust Gas
Below 40°C (104°F)	CLOSED	–	–		–	CLOSED	Not recirculated
Above 54°C (129°F)	OPEN	Positioned below port E	–		–	CLOSED	Not recirculated
		Positioned between port E and port R	(1) LOW	* Pressure constantly alternating between low and high	OPENS passage to atmosphere	CLOSED	Not recirculated
			(2) HIGH		CLOSES passage to atmosphere	OPEN	Recirculated
		Positioned above port R	(3) HIGH	–	CLOSES passage to atmosphere	OPEN	Recirculated (increase)

Remarks: * Pressure increase → Modulator closes → EGR valve opens → Pressure drops → EGR valve closes → Modulator opens →

** When the throttle valve is positioned above port R, the EGR vacuum modulator will close the atmosphere passage and open the EGR valve to increase the EGR gas, even if the exhaust pressure is insufficiently low.

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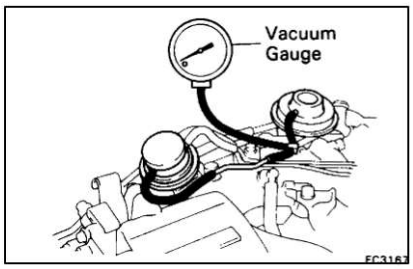


INSPECTION OF EGR SYSTEM

1. CHECK AND CLEAN FILTERS IN EGR VACUUM MODULATOR

(a) Check the filters for contamination or damage.
(b) Using compressed air, clean the filters.

HINT: Install the filters with the coarser surface facing the atmospheric side (outward).

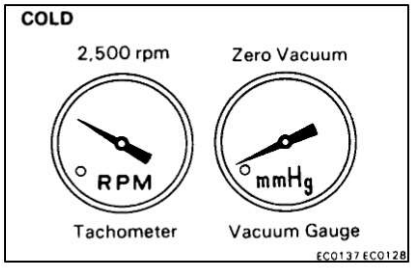


2. PREPARATION

Using a 3–way connector, connect a vacuum gauge to the hose between the EGR valve and vacuum pipe.

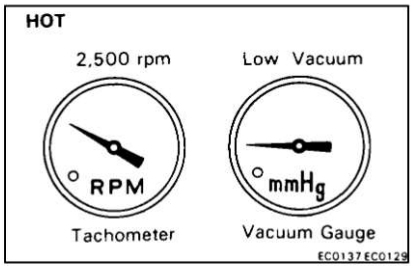
3. CHECK SEATING OF EGR VALVE

Start the engine and check that the engine starts and runs at idle.



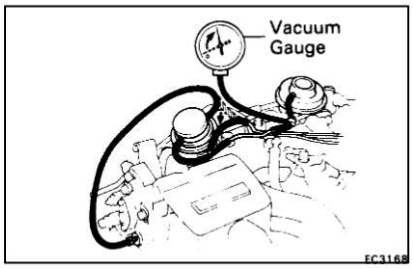
4. CHECK BVSV WITH COLD ENGINE

(a) The coolant temperature should be below 40 °C (104 °F).
(b) Check that the vacuum gauge indicates zero at 2,500 rpm.



5. CHECK BVSV AND EGR VACUUM MODULATOR WITH HOT ENGINE

(a) Warm up the engine.
(b) Check that the vacuum gauge indicates low vacuum at 2,500 rpm.

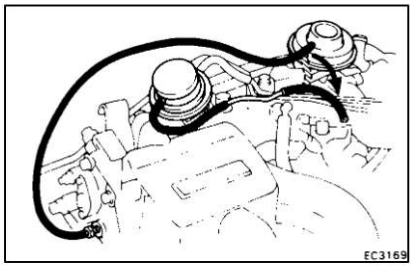


(c) Disconnect the vacuum hose from the R port of the EGR vacuum modulator and connect the R port directly to the intake manifold with another hose.
(d) Check that the vacuum gauge indicates high vacuum at 3,500 rpm.

HINT: As large amount of EGR gas enters, the engine will misfire slightly.

(e) Remove the vacuum gauge and reconnect the vacuum hoses to the proper locations.

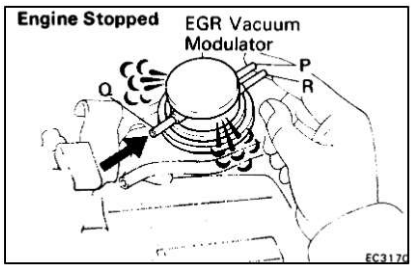
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6. CHECK EGR VALVE

(a) Apply vacuum directly to the EGR valve with the engine idling.
(b) Check that the engine runs rough or dies.
(c) Reconnect the vacuum hoses to the proper locations.

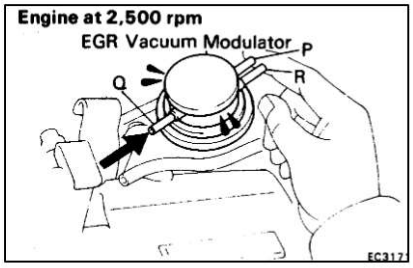
IF NO PROBLEM IS FOUND WITH THIS INSPECTION, SYSTEM IS NORMAL; OTHERWISE INSPECT EACH PART



INSPECTION OF EGR VACUUM MODULATOR

CHECK EGR VACUUM MODULATOR OPERATION

(a) Disconnect the vacuum hoses from ports P, Q and R of the EGR vacuum modulator.
(b) Block ports P and R with your finger.
(c) Blow air into port Q, and check that the air passes through to the air filter side freely.
(d) Start the engine, and maintain speed at 3,500 rpm.
(e) Repeat the above test. Check that there is a strong resistance to air flow.
(f) Reconnect the vacuum hoses to the proper locations.



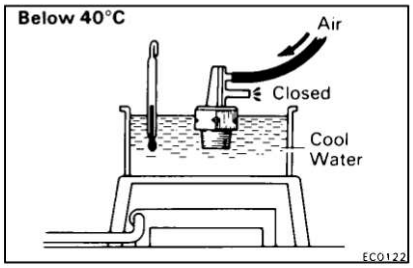
INSPECTION OF EGR VALVE

1. REMOVE EGR VALVE

Check for sticking and heavy carbon deposits.
If a problem is found, replace the valve.

2. REINSTALL EGR VALVE

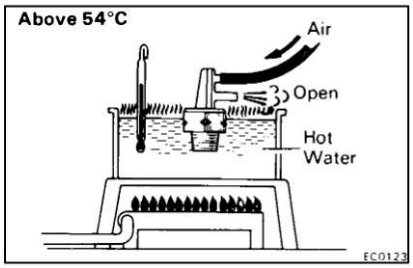
Install a new gasket.



INSPECTION OF BVSV

CHECK BVSV BY BLOWING AIR INTO PIPE

(a) Drain the coolant from the radiator into a suitable container.
(b) Remove the BVSV from the water by–pass outlet.
(c) Cool the BVSV to below 40°C (104°F) with cool water.
(d) Blow air into the pipe, and check that the BVSV is closed.



(e) Heat the BVSV to above 54°C (129°F) with hot water.
(f) Blow air into the pipe, and check that the BVSV is open.

If a problem is found, replace the BVSV.

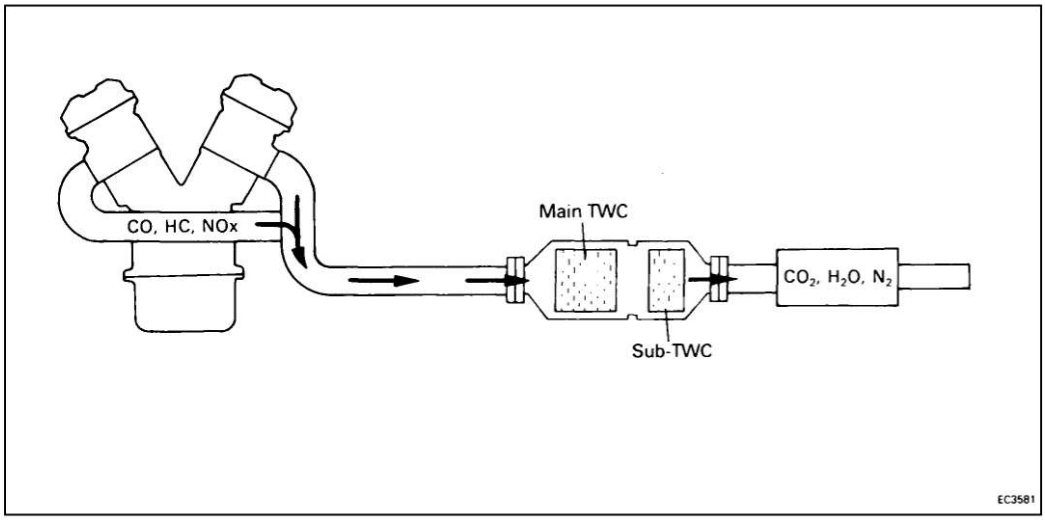
(g) Apply adhesive to two or three threads of the BVSV, and reinstall.

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

(h) Refill the radiator with coolant.

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THREE–WAY CATALYST (TWC) SYSTEM

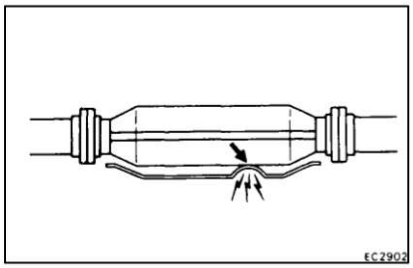


To reduce CO, HC, and NOx emissions, they are oxidized, reduced and converted into nitrogen (N_2), carbon dioxide (CO_2) and water (H_2O) by the catalyst.

Exhaust Port		Main TWC		Sub–TWC		Exhaust Gas
CO HC NOx	→	OXIDIZATION AND REDUCTION	→	OXIDIZATION AND REDUCTION	→	CO_2 H_2O N_2

INSPECTION OF EXHAUST PIPE ASSEMBLY

1. CHECK CONNECTIONS FOR LOOSENESS OR DAMAGE
2. CHECK CLAMPS FOR WEAKNESS, CRACKS OR DAMAGE

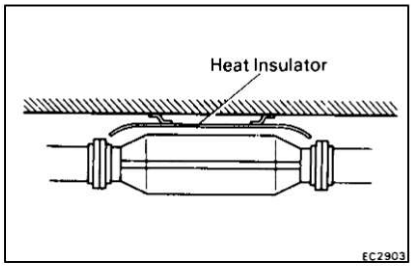


INSPECTION OF CATALYTIC CONVERTER

CHECK FOR DENTS OR DAMAGE

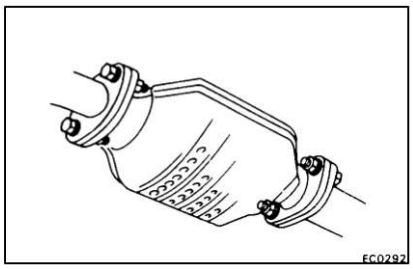
If any part of protector is damaged or dented to the extent that it contacts the converter, repair or replace it.

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INSPECTION OF HEAT INSULATOR

1. CHECK HEAT INSULATOR FOR DAMAGE
2. CHECK FOR ADEQUATE CLEARANCE BETWEEN CATALYTIC CONVERTER AND HEAT INSULATOR



REPLACEMENT OF CATALYTIC CONVERTER

1. REMOVE CONVERTER
   (a) Jack up the vehicle.
   (b) Check that the converter is cool.
   (c) Remove the four bolts and nuts holding the pipes to the converter.
   (d) Remove the converter and two gaskets.
2. REINSTALL CONVERTER
   (a) Place new two gaskets on the front and rear pipes.
   (b) Install the converter with the bolts and nuts. Torque the bolts and nuts.

   Torque: 440 kg–cm (32 ft–lb, 43 N·m)

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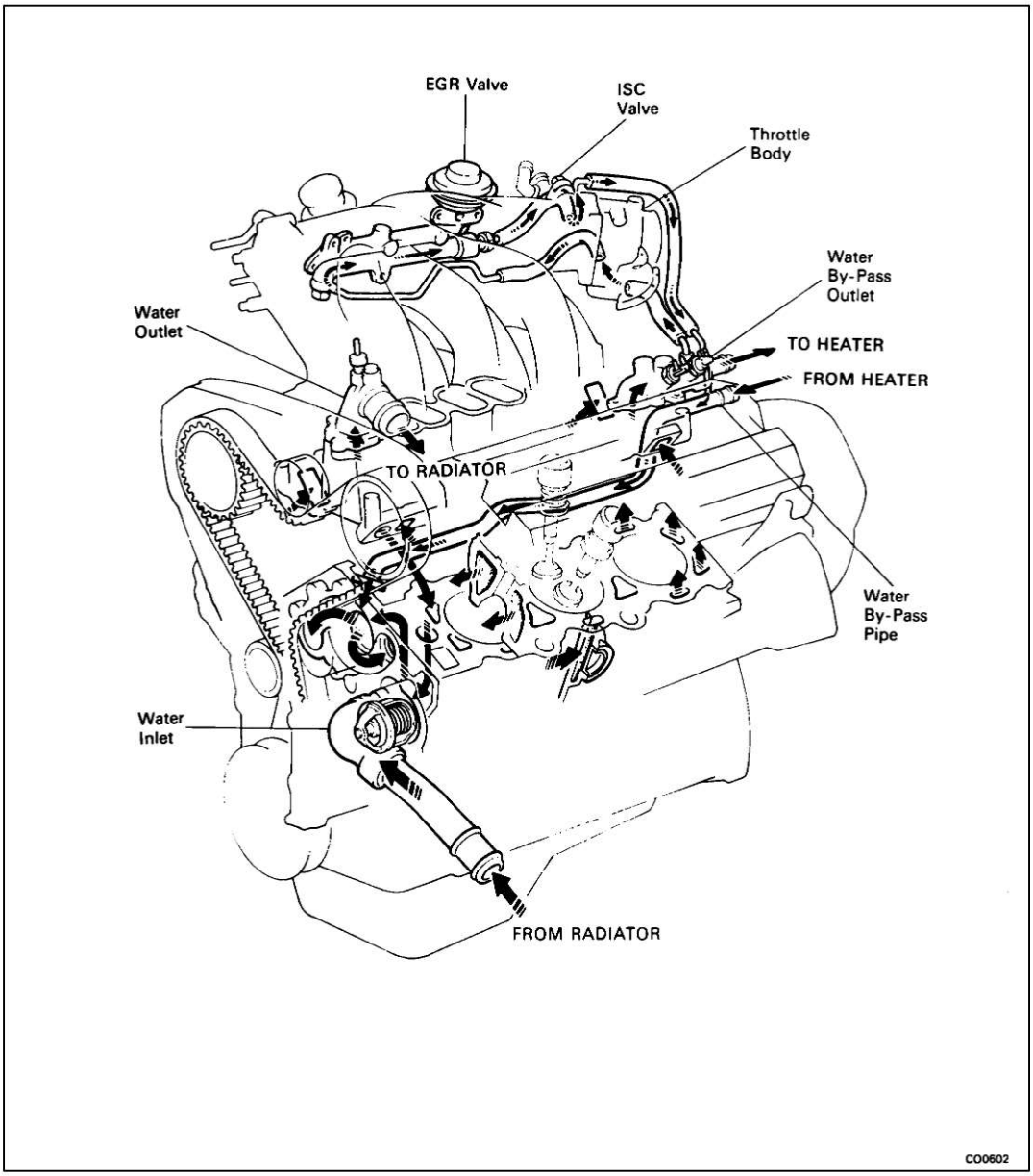
COOLING SYSTEM

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DESCRIPTION

This engine utilizes a pressurized, forced circulation cooling system which includes a thermostat equipped with a by–pass valve mounted on the inlet side.

OPERATION

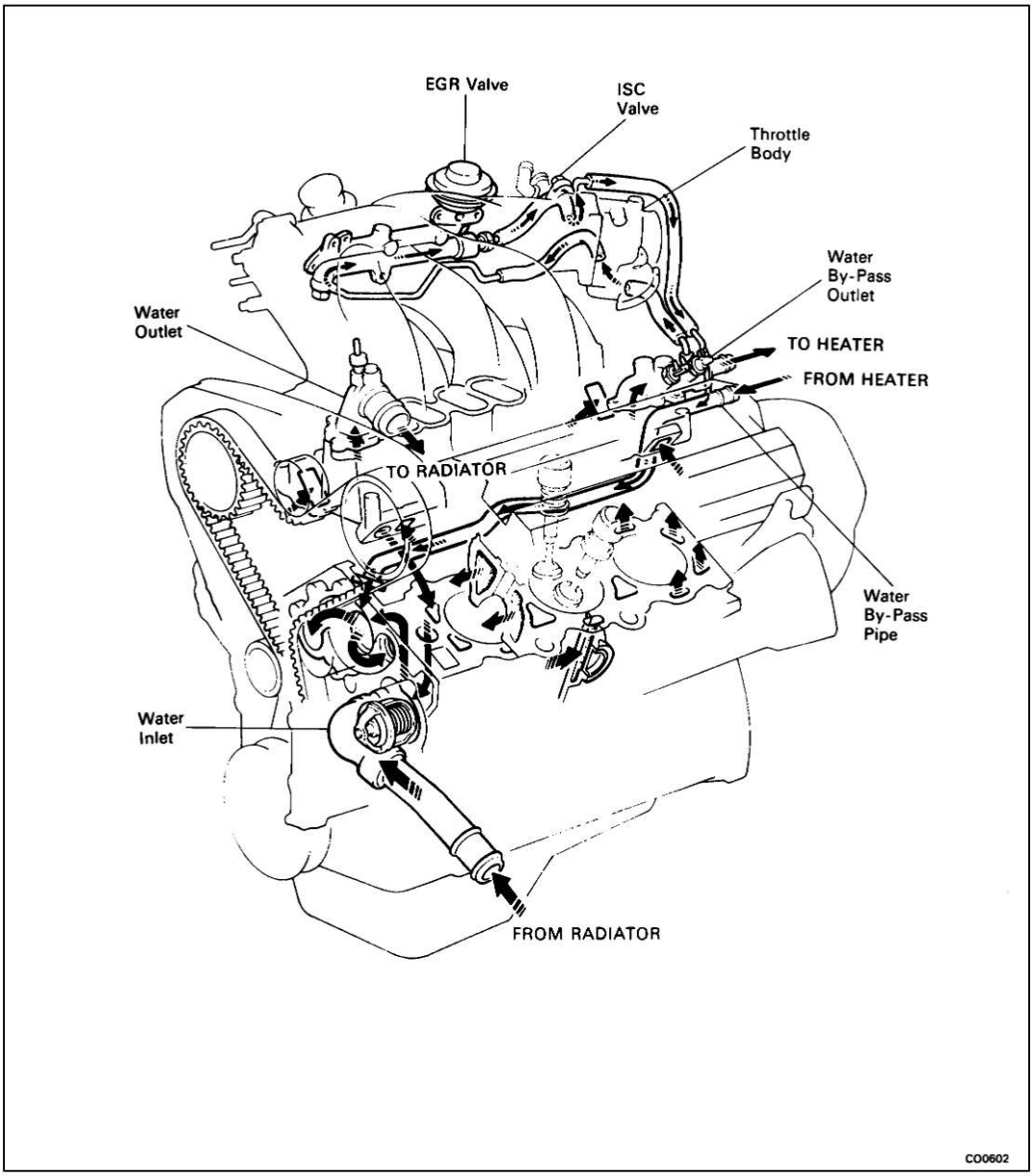


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DESCRIPTION

This engine utilizes a pressurized, forced circulation cooling system which includes a thermostat equipped with a by–pass valve mounted on the inlet side.

OPERATION



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The cooling system is composed of the water jacket (inside the cylinder block and cylinder head), radiator, water pump, thermostat, electric fan, hoses and other components.
Coolant which is heated in the water jacket is pumped to the radiator, through which an electric fan blows air to cool the coolant as it passes through. Coolant which has been cooled is then sent back to the engine by the water pump, where it cools the engine.
The water jacket is a network of channels in the shell of the cylinder block and cylinder head through which coolant passes. It is designed to provide adequate cooling of the cylinders are combustion chambers which become heated during engine operation.

RADIATOR

The radiator performs the function of cooling the coolant which has passed through the water jacket and become hot, and it is mounted in the front of the vehicle. The radiator consists of an upper tank and lower tank, and a core which connects the two tanks. The upper tank contains the inlet for coolant from the water jacket and the filler inlet. It also has a hose attached through which excess coolant or steam can flow. The lower tank has an outlet and drain cock for the coolant. The core contains many tubes through which coolant flows from the upper tank to the lower tank as well as cooling fins which radiate heat away from the coolant in the tubes. The air sucked through the radiator by the electric fan, as well as the wind generated by the vehicle's travel, passes through the radiator, cooling the coolant. Models with automatic transmission include an automatic transmission fluid cooler built into the lower tank of the radiator. A fan with an electric motor is mounted behind the radiator to assist the flow of air through the radiator. The fan operates when the coolant temperature becomes high in order to prevent it from becoming too high.

RADIATOR CAP

The radiator cap is a pressure type cap which seals the radiator, resulting in pressurization of the radiator as the coolant expands. The pressurization prevents the coolant from boiling even when the coolant temperature exceeds 100˚C (212˚F). A relief valve (pressurization valve) and a vacuum valve (negative pressure valve) are built into the radiator cap. The relief valve opens and lets steam escape through the overflow pipe when the pressure generated inside the cooling system exceeds the limit (coolant temperature: 110–120˚C, 230–248˚F, pressure; 0.3–1.0 kg/cm^2, 4.3–14.2 psi, 29.4–98.1 kPa). The vacuum valve opens to alleviate the vacuum which develops in the coolant system after the engine is stopped and the coolant temperature drops. The valve's opening, allows the coolant in the reservoir tank to return to the cooling system.

RESERVOIR TANK

The reservoir tank is used to catch coolant which overflows the cooling system as a result of volumetric expansion when the coolant is heated. The coolant in the reservoir tank returns to the radiator when the coolant temperature drops, thus keeping the radiator full at all times and avoiding needless coolant loss. Check the reservoir tank level to learn if the coolant needs to be replenished.

WATER PUMP

The water pump is used for forced circulation of coolant through the cooling system. It is mounted on the front of the cylinder block and driven by a timing belt.

THERMOSTAT

The thermostat has a wax type bypass valve and is mounted in the water inlet housing. The thermostat includes a type of automatic valve operated by fluctuations in the coolant temperature. This valve closes when the coolant temperature drops, preventing the circulation of coolant through the engine and thus permitting the engine to warm up rapidly. The valve opens when the coolant temperature has risen, allowing the circulation of coolant. Wax inside the thermostat expands when heated and contracts when cooled. Heating the wax thus generates pressure which overpowers the force of the spring which keeps the valve closed, thus opening the valve. When the wax cools, its contraction causes the force of the spring to take effect once more, closing the valve. The thermostat in this engine operates at a temperature of 82˚C (180˚F).

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PREPARATION

RECOMMENDED TOOLS

Illustration	Part No.	Part Name	Note
	09082–00015	TOYOTA Electrical Tester	

EQUIPMENT

Part Name	Note
Ammeter	
Ohmmeter	
Radiator cap tester	
Torque wrench	

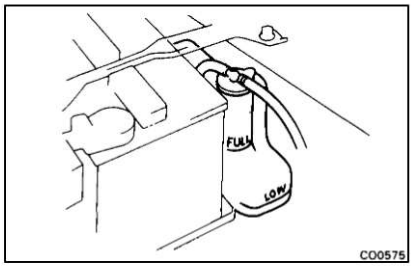
LUBRICANT

Item		Capacity			Classification
		Liters	US qts	Imp. Qts	
Engine Coolant	M/T	9.5	10.0	8.4	Ethylene–glycol base
	A/T	9.4	9.9	8.3	

SSM (SPECIAL SERVICE MATERIALS)

Part Name	Part No.	Use etc.
Seal packing 1282B, Three bond 1282B or equivalent	08826–00100	Water pump

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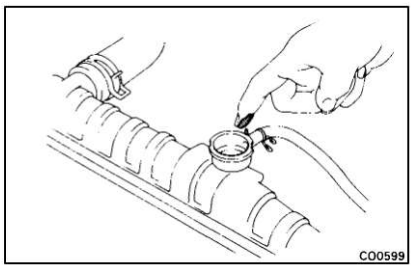


CHECK AND REPLACEMENT OF ENGINE COOLANT

1. CHECK ENGINE COOLANT LEVEL AT RESERVE TANK

The coolant level should be between the "LOW" and "FULL" lines.

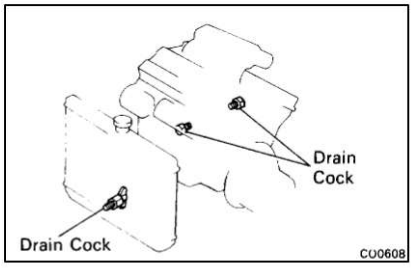
If low, check for leaks and add coolant up to the "FULL" line.



2. CHECK ENGINE COOLANT QUALITY

There should not be any excessive deposits of rust or scales around the radiator cap or radiator filler hole, and the coolant should be free from oil.

If excessively dirty, replace the coolant.



3. REPLACE ENGINE COOLANT

(a) Remove the radiator cap.

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

(b) Drain the coolant from the radiator drain cock and engine drain plugs. (Engine drain plugs are at the front center and rear right of engine block.)

(c) Close the drain cocks.

Torque (Engine drain cock):
300 kg–cm (22 ft–lb, 29 N·m)

(d) To release the air, loosen the union bolt of the water outlet five revolutions.

(e) Slowly fill the system with coolant.

HINT:

- Use a good brand of ethylene–glycol base coolant, mixed according to the manufacturer's directions.
- We recommended more than 50% ethylene–glycol and alcohol (but more than 70%) be used for your system.

Capacity (w/ Heater):
M/T 9.5 liters (10.0 US qts, 8.4 Imp. qts)
A/T 9.4 liters (9.9 US qts, 8.3 Imp. qts)

(f) Tighten the union bolt of the water outlet.

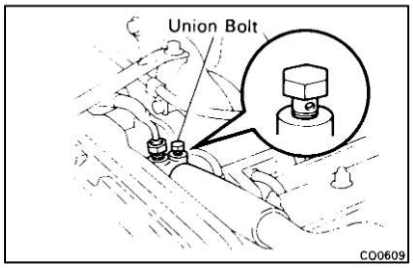
Torque: 180 kg–cm (13ft–lb, 18 N·m)

(g) Install the radiator cap.

(h) Warm up the engine and check for leaks.

(i) Recheck the coolant level and refill as necessary.

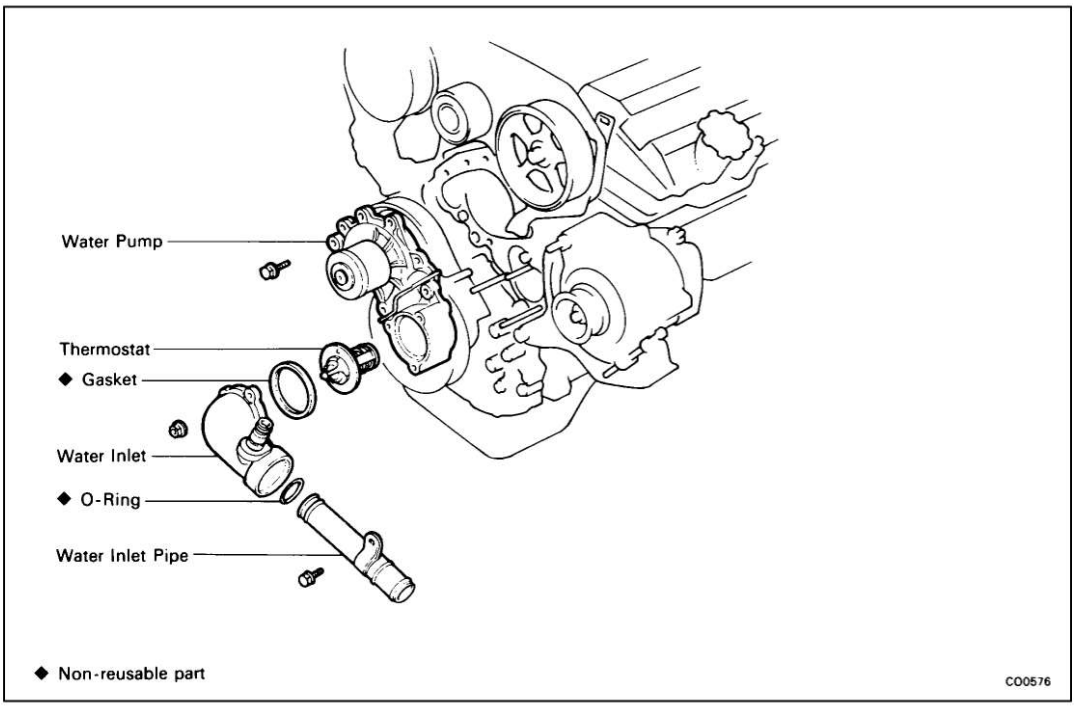
HINT: When the coolant has been depleted, refill with coolant and repeat steps (d) to (i).



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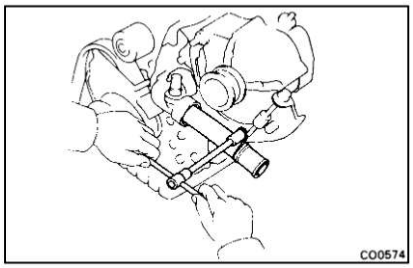
WATER PUMP

COMPONENTS

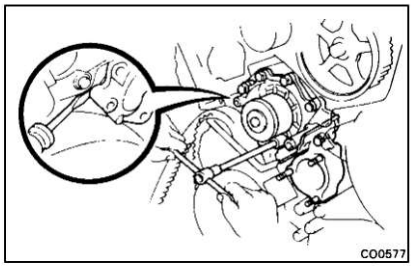


REMOVAL OF WATER PUMP

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
   CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.
2. **DRAIN ENGINE COOLANT (See page CO–5)**
3. **DISCONNECT RADIATOR LOWER HOSE FROM WATER INLET PIPE**
4. **DISCONNECT TIMING BELT FROM WATER PUMP PULLEY (See pages EM–15 to 18)**
5. **REMOVE WATER INLET PIPE**
   (a) Remove the bolt holding the water inlet pipe to the alternator belt adjusting bar.
   (b) Remove the water inlet pipe and O–ring.
6. **REMOVE WATER INLET AND THERMOSTAT (See steps 4 to 6 on page CO–9)**



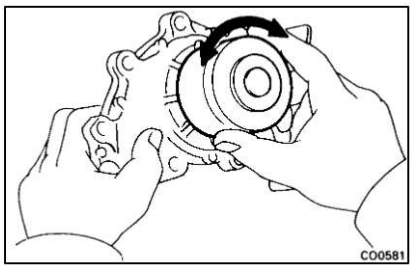
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7. REMOVE WATER PUMP

(a) Remove the seven bolts.

(b) Remove the water pump by prying a screwdriver between the water pump and cylinder block.



INSPECTION OF WATER PUMP

INSPECT WATER PUMP

Turn the pulley and check that the water pump bearing moves smoothly and quietly.

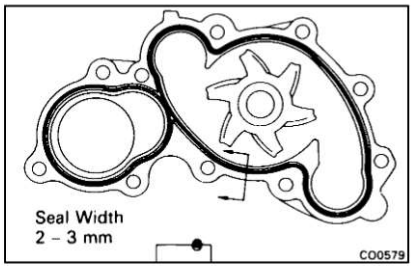
INSTALLATION OF WATER PUMP

(See page CO–6)

1. INSTALL WATER PUMP

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the water pump 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.



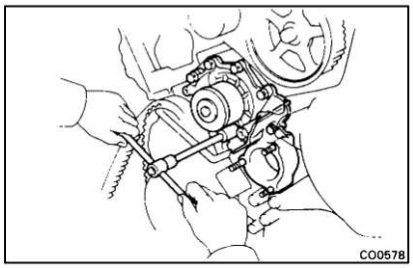
(b) Apply seal packing to the water pump groove.

Seal packing: Part No. 08826–00100 or equivalent

- Install a nozzle that has been cut to a 2–3 mm (0.08–0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

- 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.



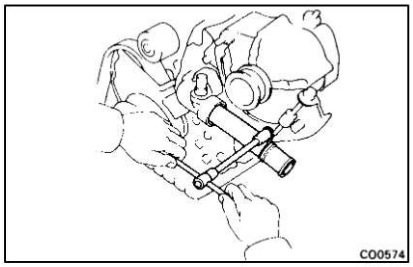
(c) Install the water pump with the seven bolts.

Torque: 200 kg–cm (14 ft–lb, 20 N·m)

2. INSTALL WATER INLET AND THERMOSTAT

(See steps 1 to 3 on page CO–10)

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3. **INSTALL WATER INLET PIPE**
   (a) Install a new O–ring to the water inlet pipe.
   (b) Apply soapy water to the O–ring.
   (c) Connect the water inlet pipe to the water inlet.
   (d) Install the bolt holding the water inlet pipe to the alternator belt adjusting bar.
   Torque: 200 kg–cm (14 ft–lb, 20 N·m)

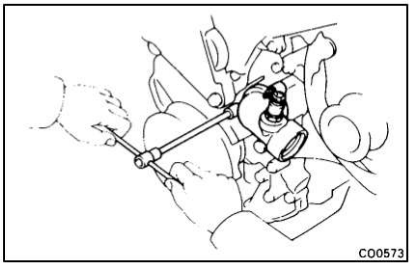
4. **INSTALL TIMING BELT (See pages EM–24 to 28)**
5. **CONNECT RADIATOR LOWER HOSE**
6. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
7. **FILL WITH ENGINE COOLANT (See page CO–5)**

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THERMOSTAT

REMOVAL OF THERMOSTAT

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
   CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.
2. **DRAIN ENGINE COOLANT (See page CO–5)**
3. **REMOVE WATER INLET PIPE**
   (See steps 3 and 5 on page CO–6)
4. **DISCONNECT WATER TEMPERATURE SENSOR CONNECTOR**
5. **REMOVE WATER INLET**
   Remove the three nuts and water inlet from the water pump.
6. **REMOVE THERMOSTAT AND GASKET**

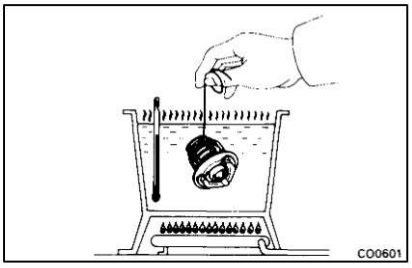


INSPECTION OF THERMOSTAT

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)

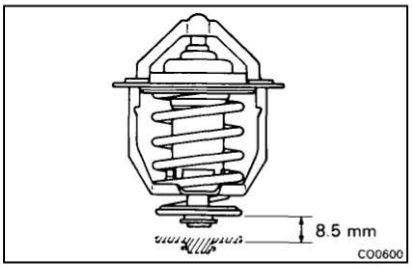
If the valve opening temperature is not as specified, replace the thermostat.

(c) Check the valve lift.

Valve lift:

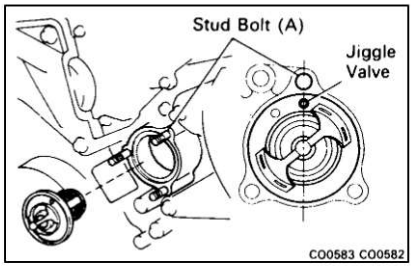
8.5 mm (0.335 in.) or more at 95°C (203°F)

If the valve lift is less than specification, replace the thermostat.



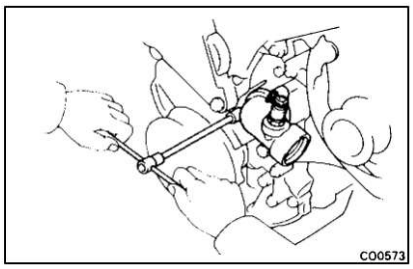
(d) Check that the valve spring is tight when the thermostat is fully closed.

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INSTALLATION OF THERMOSTAT

1. **PLACE THERMOSTAT IN WATER PUMP**
   (a) Install a new gasket to the thermostat.
   (b) Align the jiggle valve of the thermostat with stud bolt (A), and insert the thermostat in the water pump.



2. **INSTALL WATER INLET**
   Install the water inlet with the three nuts.
   Torque: 200 kg–cm (14 ft–lb, 20 N·m)

3. **CONNECT WATER TEMPERATURE SENSOR CONNECTOR**
4. **INSTALL WATER INLET PIPE**
   (See steps 3 and 5 on page CO–8)
5. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
6. **FILL WITH ENGINE COOLANT (See page CO–5)**
7. **START ENGINE AND CHECK FOR LEAKS**

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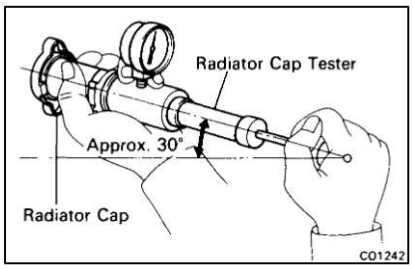
RADIATOR

CLEANING OF RADIATOR

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

NOTICE: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. If the cleaner nozzle pressure is 30–35 kg/cm^2 (427–498 psi, 2,942–3,432 kPa), keep a distance at least 40–50 cm (15.75–19.69 in.) between the radiator core and cleaner nozzle.

INSPECTION OF RADIATOR



1. **INSPECT RADIATOR CAP**

NOTICE: When performing steps (a) and (b) below, keep the radiator pump tester at an angle of approx. 30° above the horizontal.

(a) Using a radiator cap tester, slowly pump the tester and check that air is coming from the relief valve.

Pump speed: 1 push/3 seconds or more

NOTICE: Push the pump at a constant speed.

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

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

Pump speed:

1st time	**1 push/1 second or less**
2nd time or more	**Any speed**

Standard opening pressure:

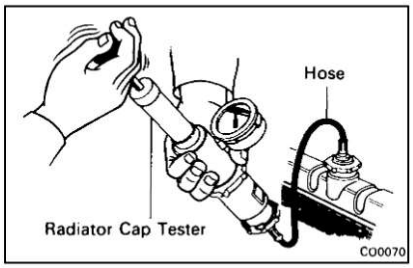
0.75–1.05 kg/cm^2

(10.7–14.9 psi, 74–103 kPa)

Minimum opening pressure:

0.6 kg/cm^2 (8.5 psi, 59 kPa)

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



2. **INSPECT COOLING SYSTEM FOR LEAKS**

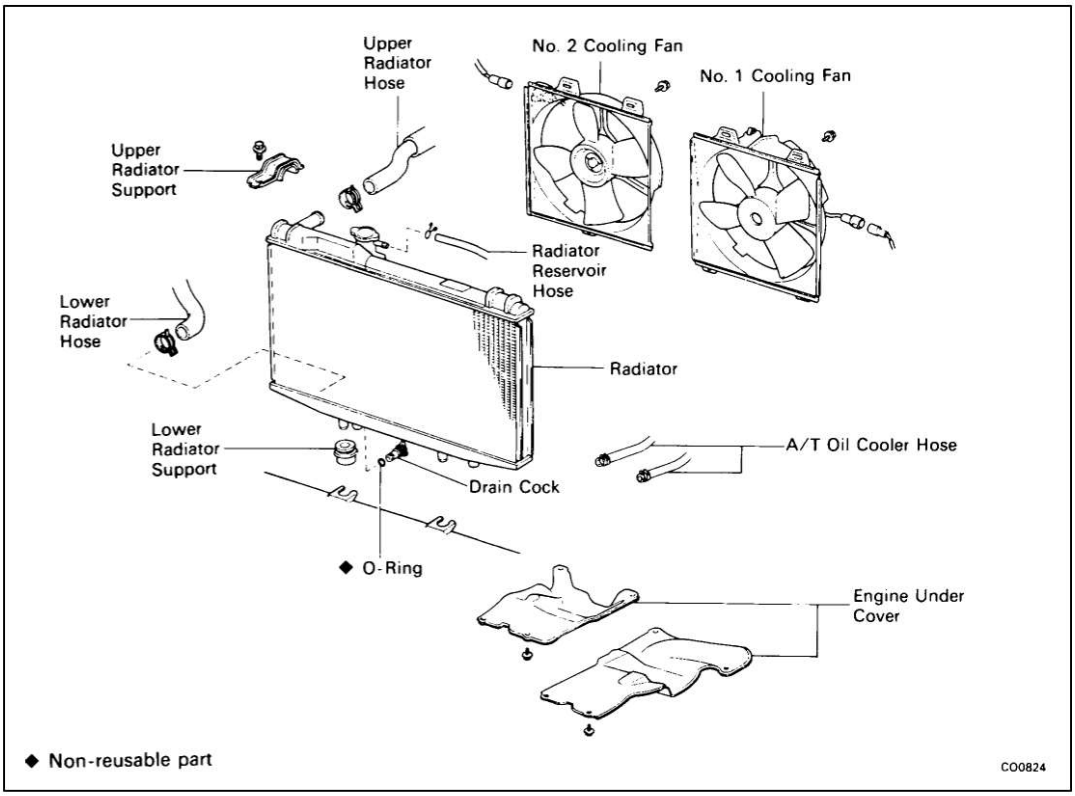
(a) Fill the radiator with coolant and attach a radiator cap tester.(b) Warm up the engine.

(c) Pump it to 1.2 kg/cm^2 (17.1 psi, 118 kPa), check that pressure does not drop.

If the pressure drops, check for leaks as the hoses, radiator or water pump. If no external leaks are found, check the heater core, cylinder block and head.

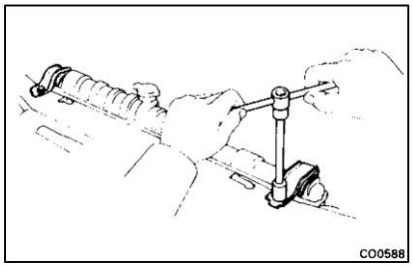
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REMOVAL OF RADIATOR

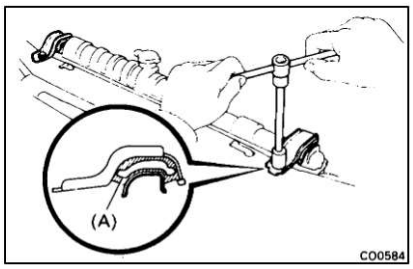


1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
   CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.
2. DRAIN ENGINE COOLANT (See page CO–5)
3. REMOVE BATTERY
4. REMOVE IGNITION COIL, IGNITER AND BRACKET ASSEMBLY (See step 8 on page EM–63)
5. DISCONNECT RADIATOR RESERVOIR HOSE
6. REMOVE ENGINE UNDER COVER
7. DISCONNECT RADIATOR HOSES
8. DISCONNECT COOLING FAN CONNECTORS
9. (A/T)
   DISCONNECT OIL COOLER HOSES

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10. **REMOVE RADIATOR AND ELECTRIC COOLING FANS**
    Remove the two bolts, supports and radiator.
11. **REMOVE ELECTRIC COOLING FANS FROM RADIATOR**



INSTALLATION OF RADIATOR

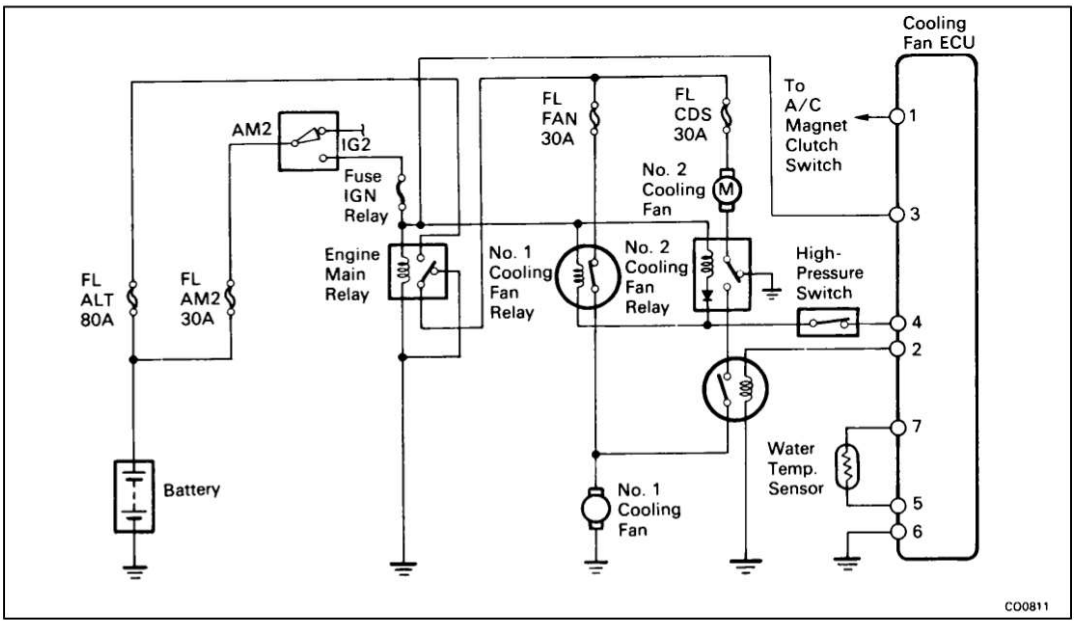
(See page CO–12)

1. **INSTALL ELECTRIC COOLING FANS TO RADIATOR**
2. **INSTALL RADIATOR**
   Place the radiator in position, and install the two supports with the two bolts.
   HINT: After installation, check that the rubber cushion (A) of the supports are not depressed.
3. **(A/T)**
   CONNECT OIL COOLER HOSES
4. **CONNECT COOLING FAN CONNECTORS**
5. **CONNECT RADIATOR HOSES**
6. **INSTALL ENGINE UNDER COVER**
7. **CONNECT RADIATOR RESERVOIR HOSE**
8. **INSTALL IGNITION COIL, IGNITER AND BRACKET ASSEMBLY (See step 34 on page EM–98)**
9. **INSTALL BATTERY**
   Connect the grand strap.
10. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
11. **FILL WITH ENGINE COOLANT (See page CO–5)**
12. **START ENGINE AND CHECK FOR LEAKS**
13. **(A/T)**
    CHECK AUTOMATIC TRANSMISSION (A/T) FLUID LEVEL (See page AT–138)
    NOTICE: Do not overfill.

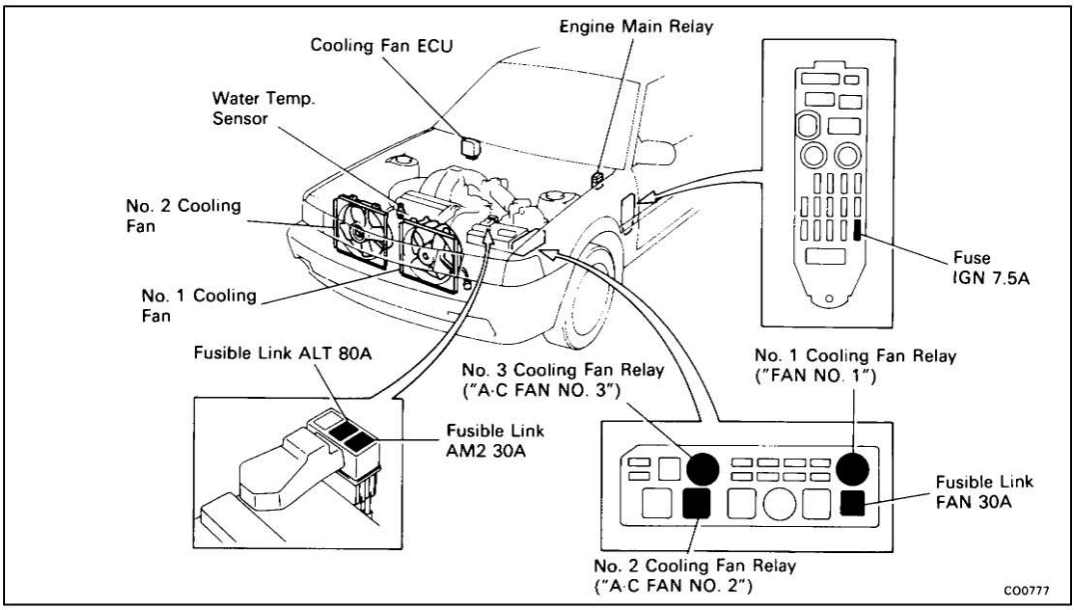
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ELECTRIC COOLING FANS

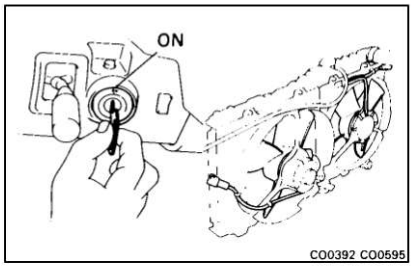
SYSTEM CIRCUIT



LOCATION OF ELECTRIC COOLING FAN COMPONENTS



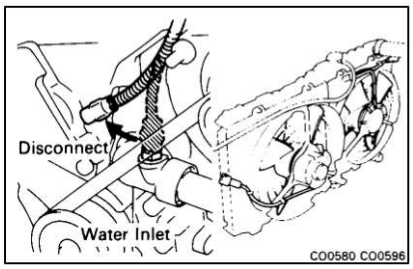
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ON–VEHICLE INSPECTION

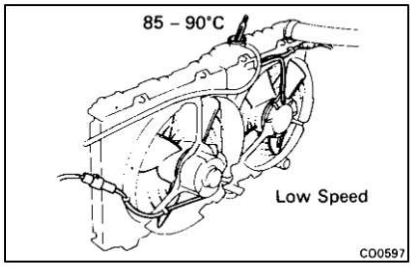
Low Temperature (Below 85°C (185°F))

1. **TURN IGNITION SWITCH "ON"**
   Check that the fan stops.
   If not, check the cooling fan relays and water temperature sensor, and check for a separated connector or severed wire between the cooling fan relay and water temperature sensor.



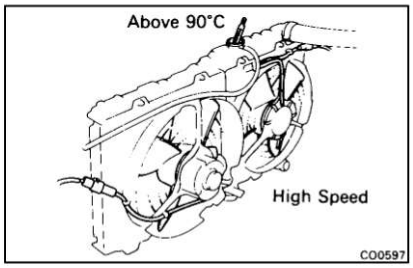
2. **DISCONNECT WATER TEMPERATURE SENSOR CONNECTOR**
   Check that the cooling fan rotates.
   If not, check the cooling fan relays, cooling fan, engine main relay and fuse, and check for a short circuit between the cooling fan relay and water temperature sensor.
3. **CONNECT WATER TEMPERATURE SENSOR CONNECTOR**

High Temperature (85–90°C (185–194°F))

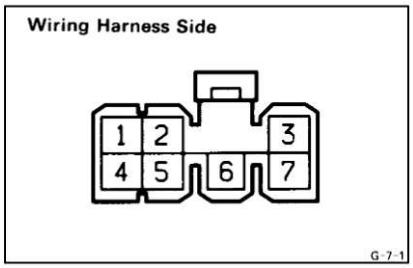


4. **START ENGINE**
   (a) Raise coolant temperature to 85–90°C (185–194°F).
   (b) Check that the cooling fan rotates. (at low speed)
   If not, replace the water temperature sensor.

High Temperature (Above 90°C (194°F))



5. **START ENGINE**
   (a) Raise coolant temperature to above 90°C (194°F).
   (b) Check that the cooling fan rotates. (at high speed)
   If not, replace the water temperature sensor.

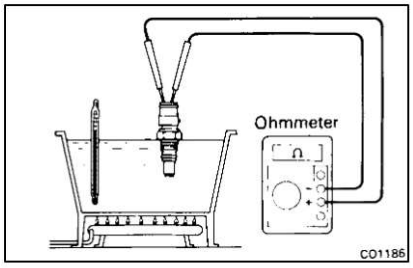


INSPECTION OF ELECTRIC COOLING FAN COMPONENTS

1. **INSPECT COOLING FAN ECU FOR CIRCUIT**
   Disconnect the cooling fan ECU, and check the connector on the wiring harness side as shown in the chart on the next page.

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Check for	Tester connection	Condition		Specified valve
Continuity	2–Ground	–		Continuity
Voltage	3–Ground	Ignition switch ON		Battery voltage
Voltage	4–Ground	Ignition switch ON		Battery voltage
Resistance	5–7	Coolant temp.	80°C (176°F)	Approx. 1.53 kΩ
			90°C (194°F)	Approx. 1.18 kΩ
			95°C (203°F)	Approx. 1.03 kΩ
Continuity	6–Ground	–		Continuity



2. INSPECT WATER TEMPERATURE SENSOR

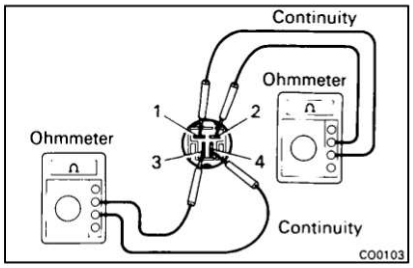
Using an ohmmeter, measure the resistance between the terminals.

Resistance:

Approx. 1.53 kΩ at 80°C (176°F)
Approx. 1.18 kΩ at 90°C (194°F)
Approx. 1.03 kΩ at 95°C (203°F)

If resistance is not as specified, replace the sensor.

3. INSPECT ENGINE MAIN RELAY (See page CH–17)

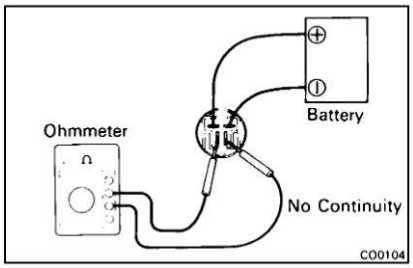


4. INSPECT NO.1 COOLING FAN RELAY ("FAN NO.1")

A. Inspect 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.

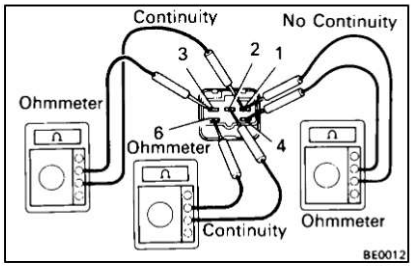


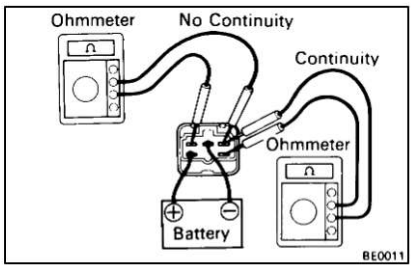
B. Inspect relay operation

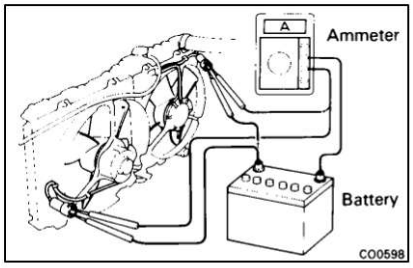
(a) Apply battery voltage across terminal 1 and 2.
(b) Using an ohmmeter, check that there is no continuity between terminals 3 and 4.

If operation is not as specified, replace the relay.

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5. INSPECT NO.2 COOLING FAN RELAY ("A.C FAN NO.2")

A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 2 and 6.

(b) Check that there is continuity between terminals 1 and 3.

(c) Check that there is no continuity between terminals 1 and 4.

If continuity is not as specified, replace the relay.

B. Inspect relay operation

(a) Apply battery voltage across terminal 2 and 6.

(b) Using an ohmmeter, check that there is no continuity between terminals 1 and 3.

(b) Check that there is continuity between terminals 1 and 4.

If operation is not as specified, replace the relay.

6. INSPECT NO.3 COOLING FAN RELAY ("A.C FAN NO.3")

(See procedure EFI Main Relay on page FI–47)

7. INSPECT COOLING FANS

(a) Connect battery and ammeter to the cooling fan connector.

(b) Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

Standard amperage: No.1 12.1–15.1 A
No.2 6.0–7.4 A

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SERVICE SPECIFICATIONS

SPECIFICATIONS

Engine coolant capacity		M/T	9.5 liters	10.0 US pts	8.4 Imp. qts
		A/T	9.4 liters	9.9 US qts	8.3 Imp. qts
Radiator	Relief valve opening pressure	STD	0.75–1.05 kg/cm^2 (10.7–14.9 psi, 74–103 kPa)		
		Limit	0.6 kg/cm^2	8.5 psi	59 kPa
Thermostat	Valve opening temperature		80–84°C	176–183°F	
	Valve lift at 95°C (203°F)		8.5 mm (0.35 in.) or more		

TORQUE SPECIFICATIONS

Part tightened	kg–cm	ft–lb	N·m
Cylinder block X Drain plug	300	22	29
Water pump X Cylinder block	200	14	20
Water inlet X Water pump	200	14	20
Water inlet pipe X Alternator belt adjusting bar	200	14	20

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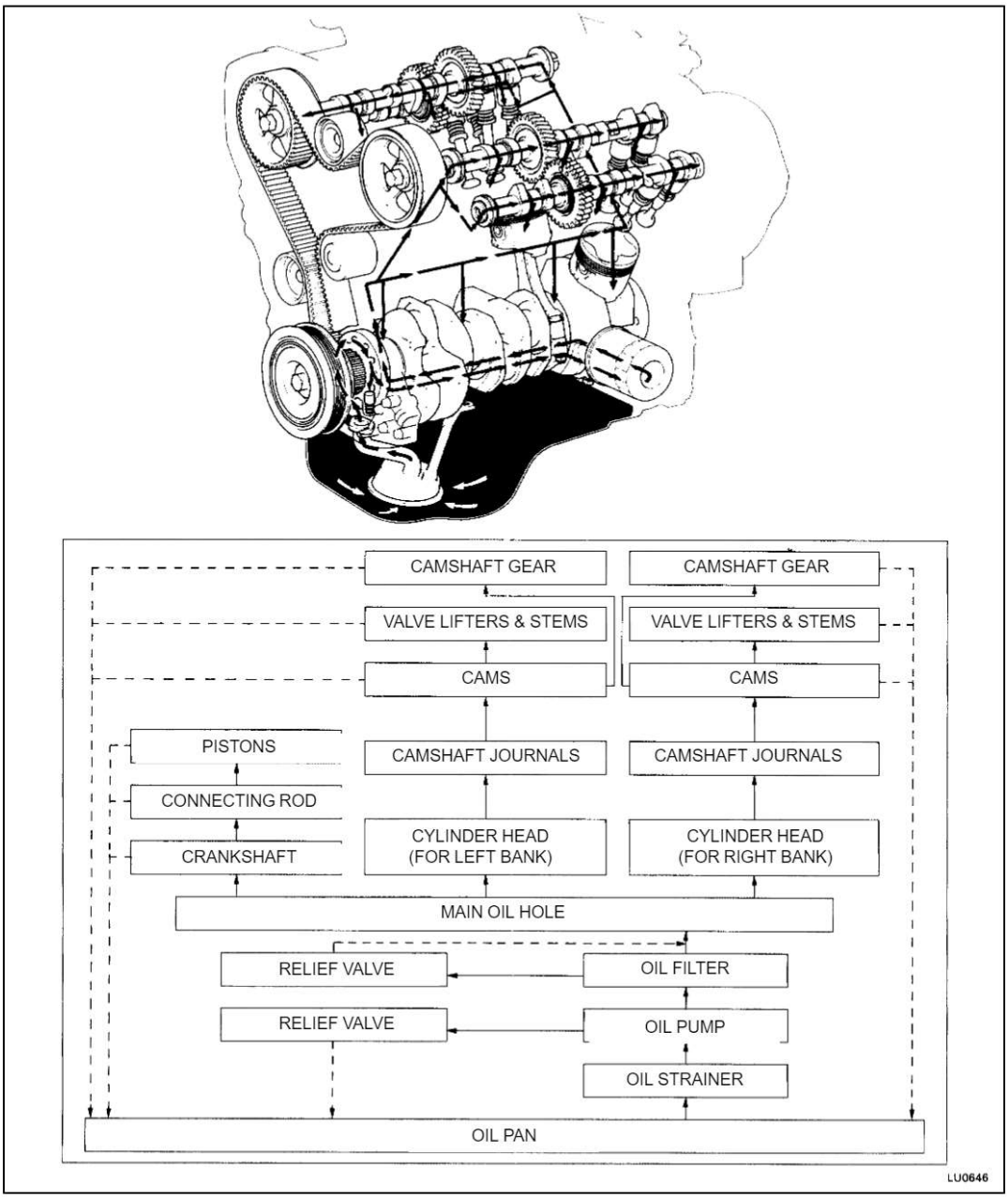
LUBRICATION SYSTEM

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DESCRIPTION

A fully pressurized, fully filtered lubrication system has been adopted for this engine.

OPERATION

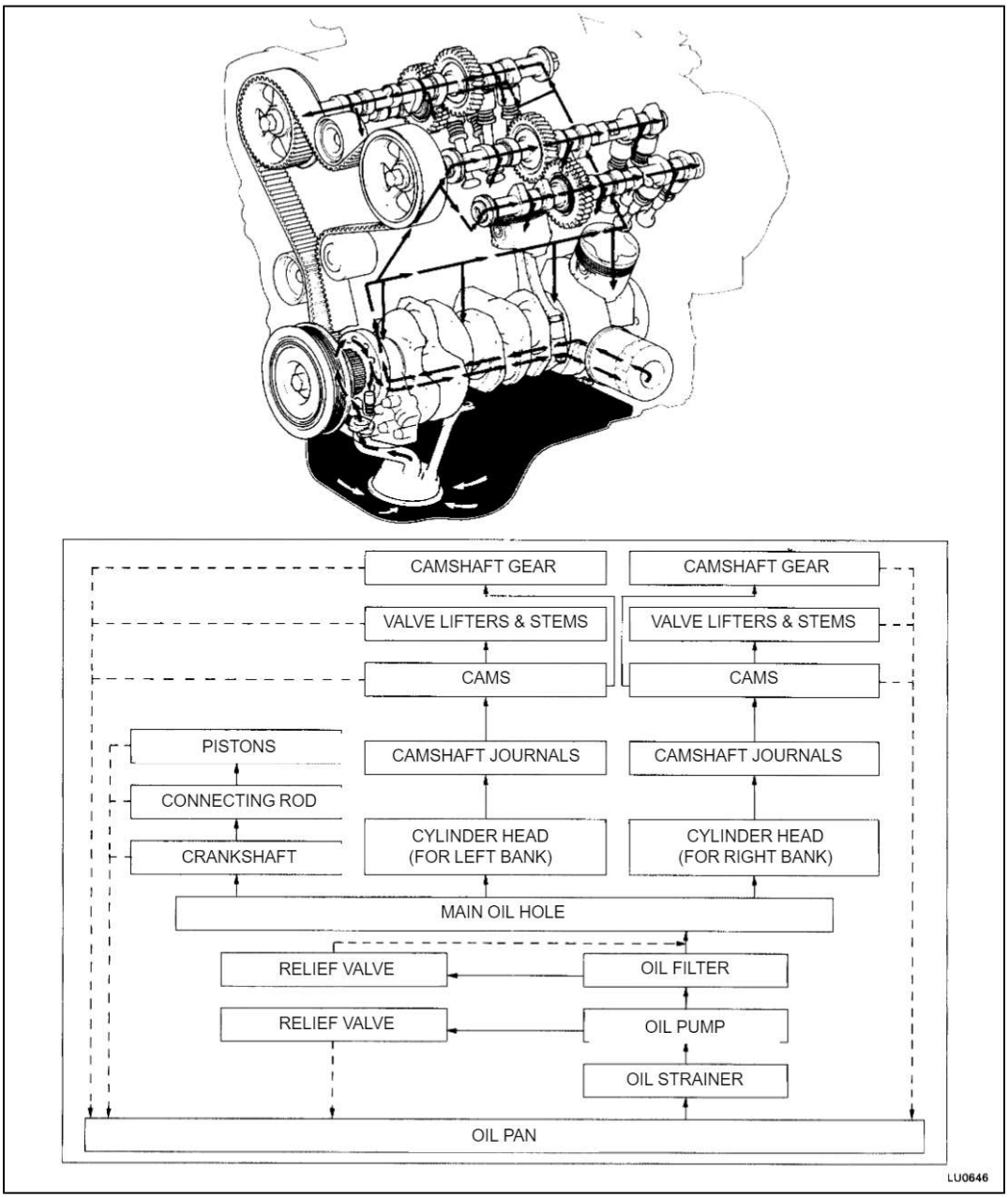


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DESCRIPTION

A fully pressurized, fully filtered lubrication system has been adopted for this engine.

OPERATION



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A Pressure feeding lubrication system has been adopted to supply oil to the moving parts of this engine. The lubrication system consists of an oil pan, oil pump, oil filter and other external parts which supply oil to the moving parts in the engine block. The oil circuit is shown in the illustration at the top of the previous page. Oil from the oil pan is pumped up by the oil pump. After it passes through the oil filter, it is fed through the various oil holes in the crankshaft and cylinder block. After passing through the cylinder block and performing its lubricating function, the oil is returned by gravity to the oil pan. A dipstick on the center left side of the cylinder block is provided to check the oil level.

OIL PUMP

The oil pump pumps up oil from the oil pan and sends it under pressure to the various parts of the engine. An oil strainer is mounted in front of the inlet to the oil pump. The oil pump itself is a trochoid type pump. inside of which there is a drive rotor and a driven rotor. When the drive rotor rotates, the driven rotor rotates in the same direction, and since the axis of the driven rotor shaft is different from the center of the driven rotor, the space between the two rotors is changed as they rotate. Oil is drawn in when the space is wide and is discharged when the space in narrow.

OIL PRESSURE REGULATOR

At high engine speeds, the engine oil supplied by the oil pump exceeds the capacity of the engine to utilize it. For that reason, the oil pressure regulator works to prevent an oversupply of oil. During normal oil supply, a coil spring and valve keep the bypass closed, but when too much oil is being fed, the pressure become extremely high, overpowering the force of the spring and opening the valves. This allows the excess oil to flow through the relief valve and return to the oil pan.

OIL FILTER

The oil filter is a full flow type filter with a built–in paper filter element. Particles of metal from wear, airborn dirt, carbon and other impurities can get into the oil during use and could cause accelerated wear or sizing if allowed to circulate through the engine. The oil filter, integrated into the oil line, removes these impurities as the oil passes through it. The filter is mounted outside the engine to simplify replacement of the filter element. A relief valve is also included ahead of the filter element to relieve the high oil pressure in case that the filter element becomes clogged with impurities. The relief valve opens when the oil pressure overpowers the force of the spring. Oil passing through the relief valve by–passes the oil filter and flows directly into the main oil hole in the engine.

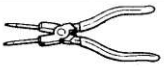
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PREPARATION

SST (SPECIAL SERVICE TOOLS)

Illustration	Part No.	Part Name	Note
	09032–00100	Oil Pan Seal Cutter	
	09228–07500	Oil Filter Wrench	

RECOMMENDED TOOLS

Illustration	Part No.	Part Name	Note
	09090–04000	Engine Sling Device	For suspending engine
	09200–00010	Engine Adjust Kit	
	09905–00013	Snap Ring Pliers	

EQUIPMENT

Part Name	Note
Feeler gauge	
Oil pressure gauge	
Precision straight edge	Oil pump
Torque wrench	

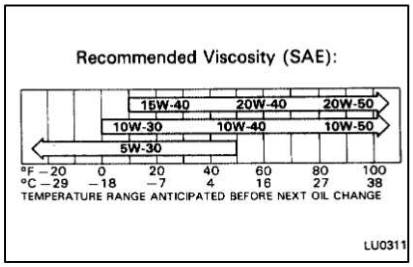
LUBRICANT

Item	Capacity			Classification
	Lifters	US qts	Imp. qts	
Engine oil Dry fill Drain and refill w/ Oil filter change w/o Oil filter change	 4.6 3.9 3.7	 4.8 4.1 3.9	 4.0 3.4 3.3	API grade SG multigrade. Recommended viscosity is as follows, with SAE 5W–30 being the perferred engine oil.

SSM (SPECIAL SERVICE MATERIALS)

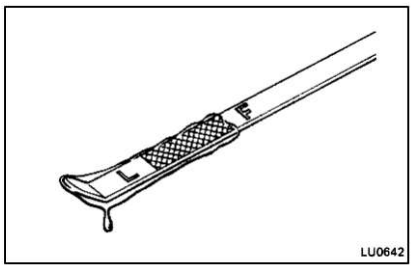
Part Name	Part No.	Use etc.
Seal packing or equivalent	08826–00080	Oil pump, Oil pan baffle plate, Oil pan
Adhesive 1344, Three bond 1344, Loctite 242 or equivalent	08833–00080	Oil pressure switch

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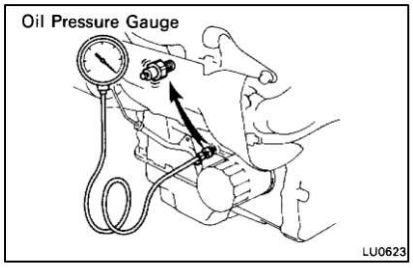


OIL PRESSURE CHECK

1. **CHECK ENGINE OIL QUALITY**
   Check the oil for deterioration, entry of water, discoloring or thinning.
   If the quality is poor, replace the oil.
   Oil grade: API grade SG, multigrade, fuel–efficient and recommended viscosity oil



2. **CHECK ENGINE OIL LEVEL**
   The oil level should be between the “L” and “F” marks on the dipstick.
   If low, check for the leakage and add oil up to “F” mark.



3. **REMOVE OIL PRESSURE SWITCH**
4. **INSTALL OIL PRESSURE GAUGE**
5. **WARM UP ENGINE**
   Allow the engine to warm up to normal operating temperature.
6. **CHECK OIL PRESSURE**
   Oil pressure:

At idling	**0.3 kg/cm^2 (4.3 psi, 29 kPa) or more**
At 3,000 rpm	**3.0–5.5 kg/cm^2 (43–78 psi, 294–539 kPa)**

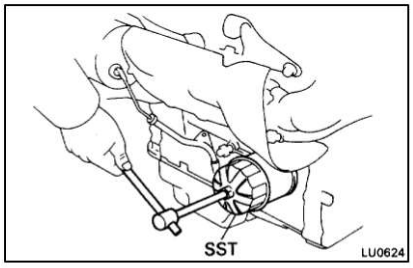
7. **REINSTALL OIL PRESSURE SWITCH**
   Apply adhesive to two or three threads.
   Adhesive: Part No.08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent
8. **START ENGINE AND CHECK FOR LEAKS**

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REPLACEMENT OF ENGINE OIL AND OIL FILTER

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 thorougthly washed with soap and water, or use waterless 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 only at designated disposal sites.**



1. DRAIN ENGINE OIL

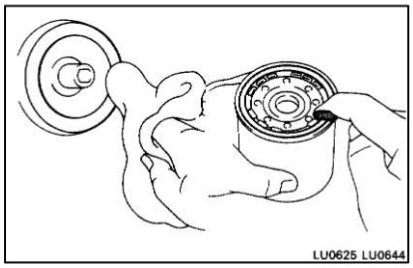
(a) Remove the oil filler cap.

(b) Remove the oil drain plug, and drain the oil into a container.

2. REPLACE OIL FILTER

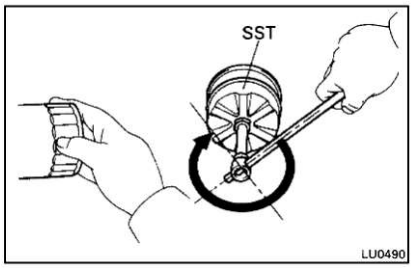
(a) Using SST, remove the oil filter.

SST 09228–07500



(b) Check and clean the oil filter installation surface.

(c) Apply clean engine oil to the gasket of a new oil filter.



(d) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.

(e) Using SST, tighten it an additional 3/4 turn.

SST 09228–07500

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3. **FILL WITH ENGINE OIL**

(a) Clean and install the oil drain plug with a new gasket.

Torque: 250 kg–cm (18 ft–lb, 25 N·m)

(b) Fill with new engine oil.

Oil grade: See page LU–5

Capacity:

Drain and refill

w/ Oil filter change

3.9 liters (4.1 US qts, 3.4 lmp. qts)

w/o Oil filter change

3.7 liters (3.9 US qts, 3.3 lmp. qts)

Dry fill 4.6 liters (4.8 US qts, 4.0 lmp. qts)

(c) Install the oil filler cap.

4. **START ENGINE AND CHECK FOR LEAKS**

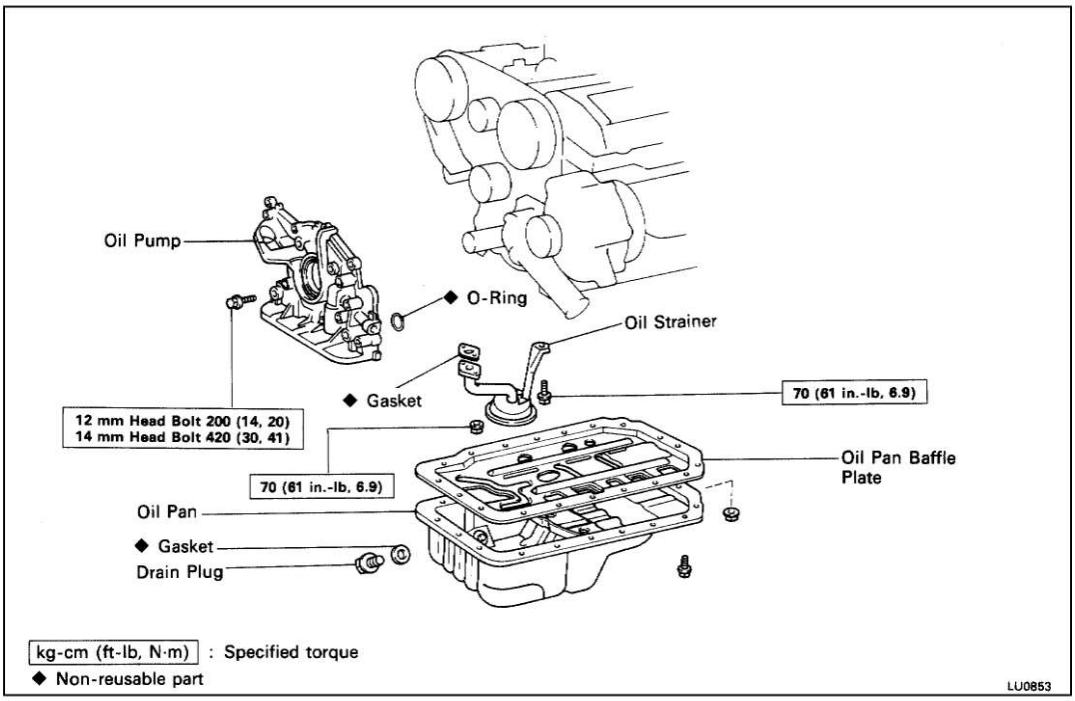
5. **RECHECK ENGINE OIL LEVEL (See page LU–5)**

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OIL PUMP

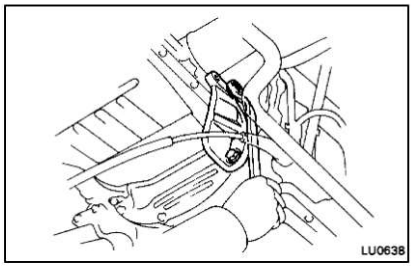
REMOVAL OF OIL PUMP

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



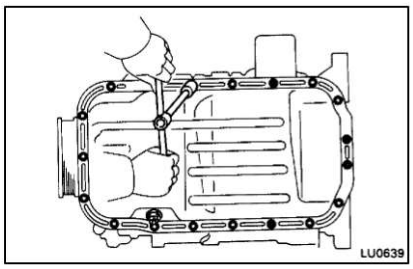
1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
   CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.
2. **REMOVE HOOD**
3. **REMOVE ENGINE UNDER COVERS**
4. **DRAIN ENGINE OIL (See page LU–6)**
5. **REMOVE SUSPENSION LOWER CROSSMEMBER (See step 27 on page EM–65)**
6. **DISCONNECT FRONT EXHAUST PIPE (See step 28 on page EM–66)**
7. **REMOVE ENGINE MOUNTING CENTER MEMBER (See step 32 on page EM–66)**
8. **REMOVE FRONT ENGINE MOUNTING INSULATOR AND BRACKET (See step 33 on page EM–66)**

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9. REMOVE STIFFENER PLATE

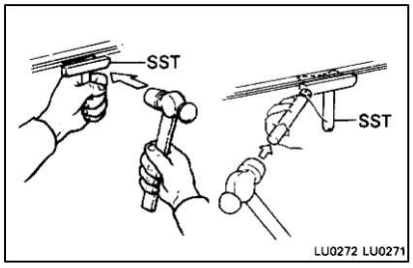
Remove the two bolts and stiffener plate.



10. REMOVE OIL PAN

(a) Remove the dipstick.

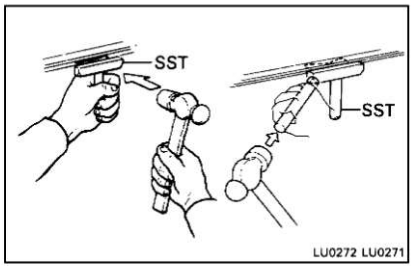
(b) Remove the fifteen bolts and four nuts.



(c) Insert the blade of SST between the cylinder block and oil pan, cut off applied sealer and remove the oil pan.

SST 09032–00100

NOTICE: Be careful not to damage the flanges of the oil pan and baffle plate.



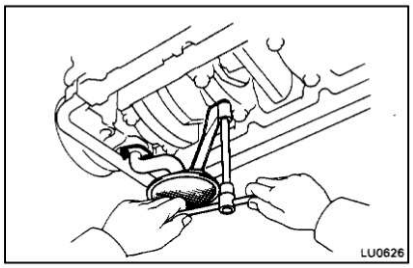
11. REMOVE OIL PAN BAFFLE PLATE

Insert the blade of SST between the cylinder block and baffle plate, cut off applied sealer and remove the baffle plate.

SST 09032–00100

NOTICE:

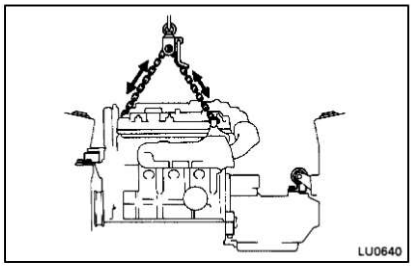
- **Do not use SST for the oil pump body side and rear oil seal retainer.**
- **Be careful not to damage the baffle plate flange.**



12. REMOVE OIL STRAINER

Remove the bolt, two nuts, oil strainer and gasket.

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13. **SUSPEND ENGINE WITH ENGINE HOIST CHAIN**

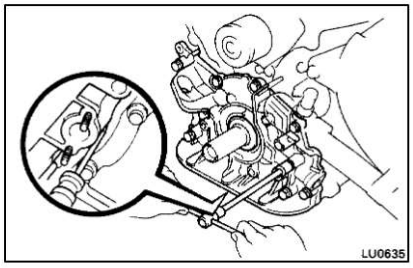
14. **REMOVE TIMING BELT, NO.1 IDLER AND CRANKSHAFT TIMING PULLEYS**
(See pages EM–15 to EM–20)

15. **REMOVE ALTERNATOR (See page CH–8)**

16. **REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES**
(See step 29 on page EM–66)

17. **REMOVE A/C COMPRESSOR BRACKET**

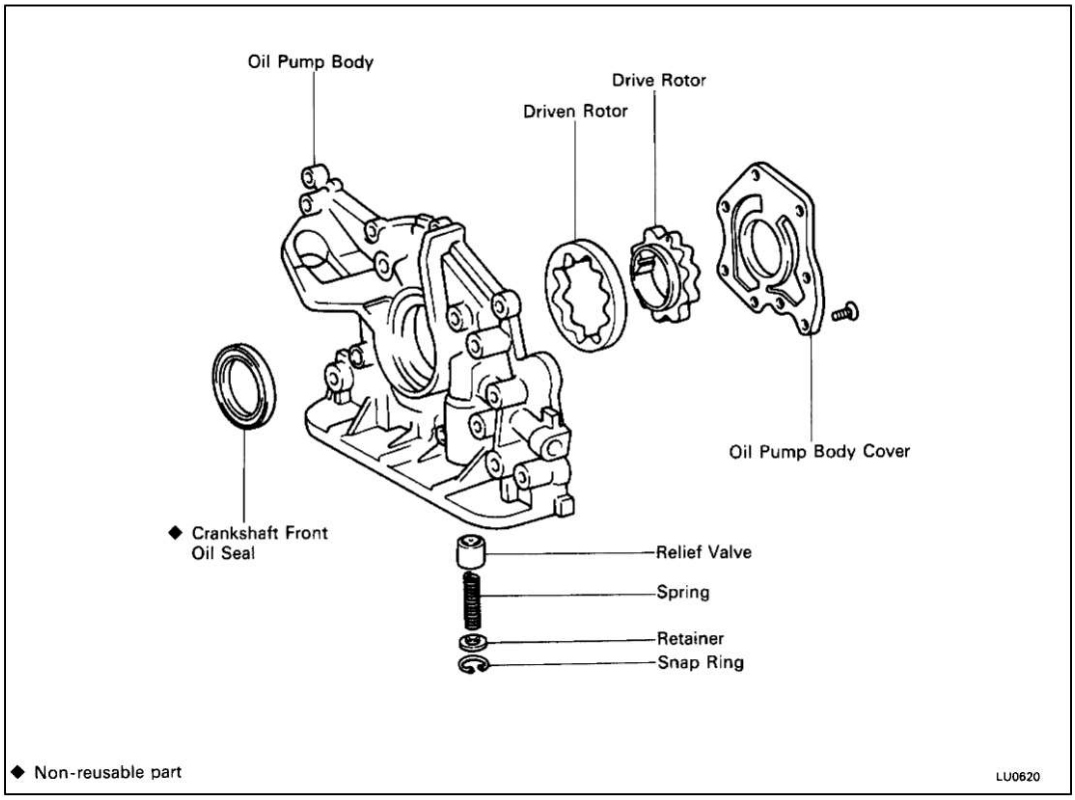
18. **REMOVE PS BELT ADJUSTING BAR**

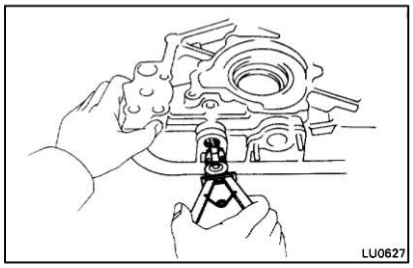


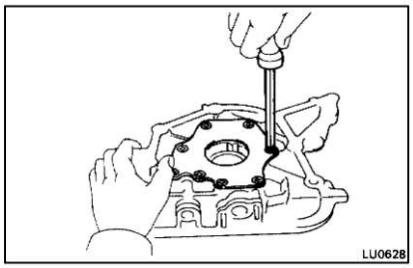
19. **REMOVE OIL PUMP**
(a) Remove the nine bolts.
(b) Remove the oil pump by prying a screwdriver between the oil pump and main bearing cap.
(c) Remove the O–ring.

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COMPONENTS





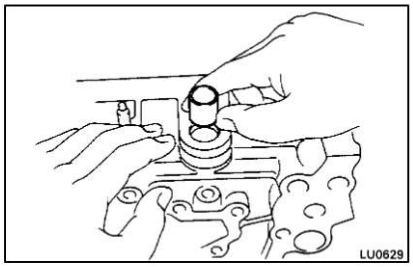


DISASSEMBLY OF OIL PUMP

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 eight screws, pump body cover, the drive and driven rotors.

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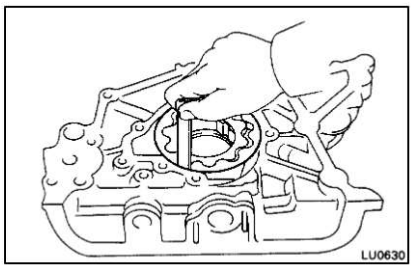


INSPECTION OF OIL PUMP

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 doesnt, replace the relief valve. If necessary, replace the oil pump assembly.



2. INSPECT DRIVE AND DRIVEN ROTORS

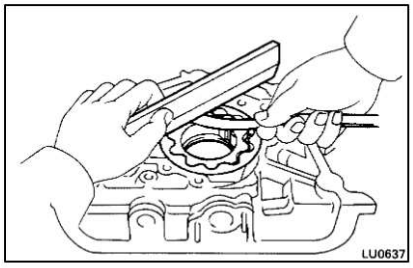
A. Inspect rotor body clearance

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

Standard body clearance: 0.100 – 0.175 mm (0.0039 – 0.0069 in.)

Maximum body clearance: 0.30 mm (0.0118 in.)

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



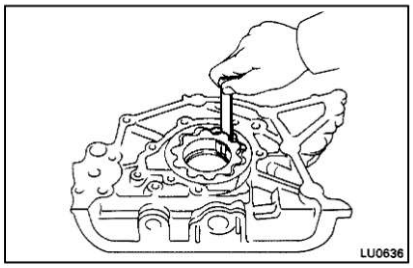
B. Inspect rotor side clearance

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

Standard side clearance: 0.030 – 0.090 mm (0.0012 – 0.0035 in.)

Maximum side clearance: 0.15 mm (0.0059 in.)

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



C. Inspect rotor tip clearance

Using a feeler gauge, measure the clearance between the drive and driven rotors.

Standard tip clearance: 0.110–0.240 mm (0.0043–0.0094 in.)

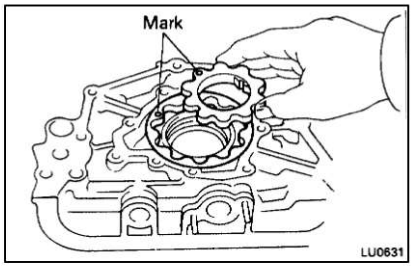
Maximum tip clearance: 0.35 mm (0.0138 in.)

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

REPLACEMENT OF CRANKSHAFT FRONT OIL SEAL

(See page EM–84)

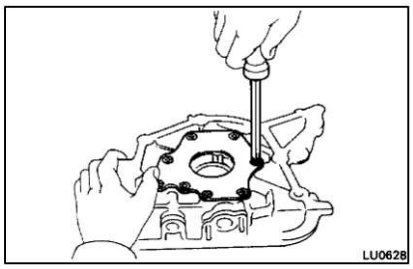
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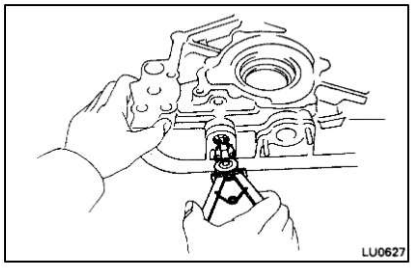
ASSEMBLY OF OIL PUMP

(See page LU–11)

1. **INSTALL DRIVE AND DRIVEN ROTORS**
   (a) Place the drive and driven rotors into pump body with the marks facing the pump body cover side.



   (b) Install the pump body cover with the eight screws.



2. **INSTALL RELIEF VALVE**
   (a) Insert the relief valve, spring and retainer into the pump body hole.
   (b) Using snap ring pliers, install the snap ring.

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INSTALLATION OF OIL PUMP

(See page LU–8)

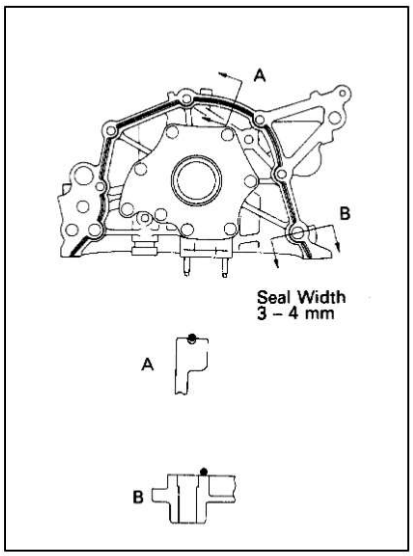
1. INSTALL OIL PUMP

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pump and cylinder block.
- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

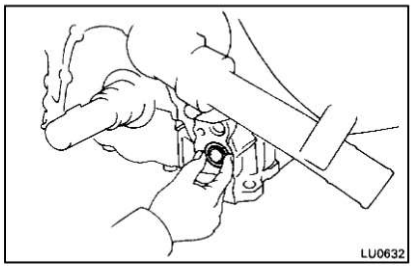
(b) Apply seal packing to the oil pump as shown in the figure.

Seal packing: Part No. 08826–00080 or equivalent
- Install a nozzle that has been cut to a 2–3 mm (0.08 – 0.12 in.) opening.

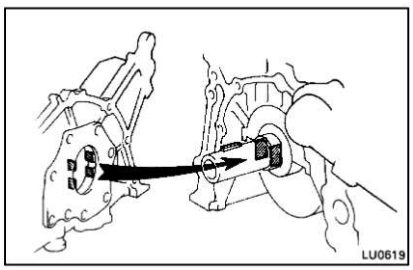
HINT: Avoid applying an excessive amount to the surface.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



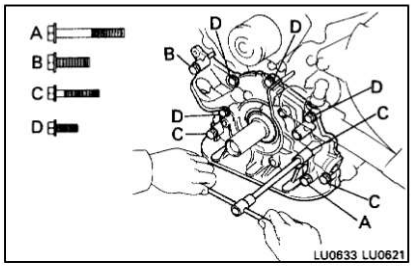
(c) Place a new O–ring in position on the cylinder block.



(d) Engage the spline teeth of the oil pump drive gear with the large teeth of the crankshaft, and slide.



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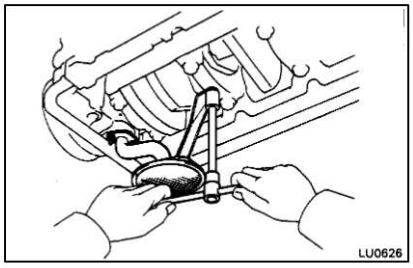
(e) Install the oil pump with the nine bolts.

Torque:

12 mm head bolt (C and D)
200 kg–cm (14 ft–lb, 20 N·m)
14 mm head bolt (A and B)
420 kg–cm (30 ft–lb, 41 N·m)

2. **INSTALL PS BELT ADJUSTING BAR**
3. **INSTALL A/C COMPRESSOR BRACKET**
4. **INSTALL ALTERNATOR (See page CH–8)**
5. **INSTALL A/C COMPRESSOR**
6. **INSTALL CRANKSHAFT TIMING PULLEY, NO.1 IDLER PULLEY AND TIMING BELT**

   (See pages EM–23 to EM–28)
7. **REMOVE ENGINE HOIST CHAIN FROM ENGINE**
8. **INSTALL OIL STRAINER**



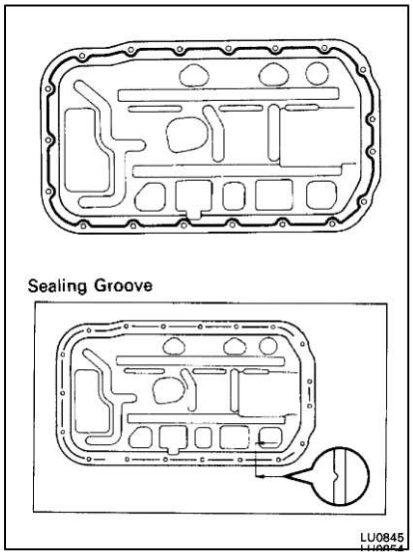
Install a new gasket and the oil strainer with the bolt and two nuts.

Torque: 70 kg–cm (61 in.–lb, 6.9 N·m)

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9. **INSTALL OIL PAN BAFFLE PLATE**
   (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the baffle plate and cylinder block.
   - Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces.
   - 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 baffle plate as shown in the figure.

Seal packing: Part No. 08826–00080 or equivalent

- Install a nozzle that has been cut to a 3–4 mm (0.12–0.16 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and re–install cap.

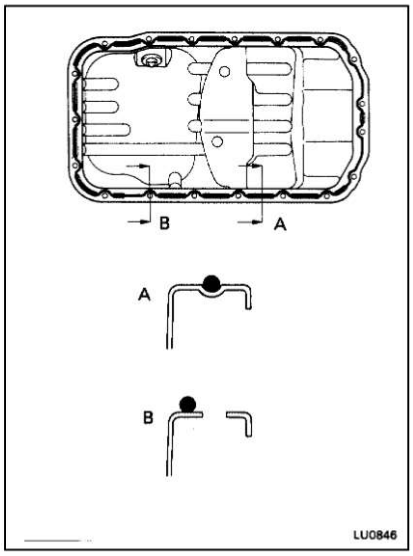
(c) Install the baffle plate.

10. 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 grooves.
- 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 figure.

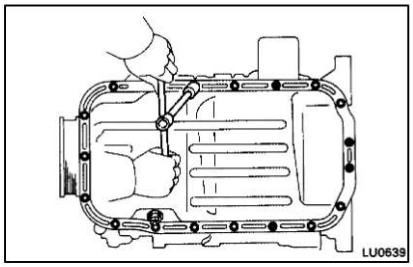
Seal packing: Part No. 08826–00080 or equivalent

- Install a nozzle that has been cut to a 3–4 mm (0.12–0.16 in.) opening.

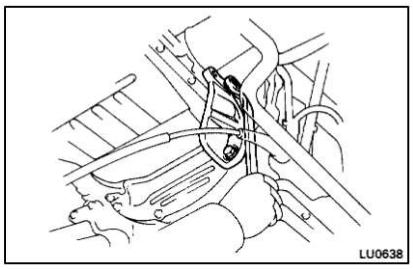
HINT: Avoid applying an excessive amount to the surface.

- 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.

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(c) Install the oil pan with the fifteen bolts and four nuts.
Torque: 60 kg–cm (52 in.–lb, 5.9 N·m)
(d) Install the dipstick.



11. **INSTALL STIFFENER PLATE**
Install the stiffener plate with the two bolts.
Torque: 380 kg–cm (27 ft–lb, 37 N·m)

12. **INSTALL FRONT ENGINE MOUNTING BRACKET AND INSULATOR (See step 7 on page EM–95)**
13. **INSTALL ENGINE MOUNTING CENTER MEMBER (See step 10 on page EM–95)**
14. **CONNECT FRONT EXHAUST PIPE**
(See step 14 on page EM–96)
15. **INSTALL SUSPENSION LOWER CROSSMEMBER**
(See step 15 on page EM–96)
16. **INSTALL ENGINE UNDER COVERS**
17. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
18. **FILL WITH ENGINE OIL (See page LU–7)**
19. **START ENGINE AND CHECK FOR LEAKS**
20. **RECHECK ENGINE OIL LEVEL (See page LU–5)**
21. **INSTALL HOOD**

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SERVICE SPECIFICATIONS

SPECIFICATIONS

Engine oil capacity					
Drain and refill	w/ Oil filter change		3.9 liters	4.1 US qts	3.4 Imp. qts
	w/o Oil filter change		3.7 liters	3.9 US qts	3.3 Imp. qts
Dry fill			4.6 liters	4.8 US qts	4.0 Imp. qts
Oil pressure		at idling	0.3 kg/cm^2 (4.3 psi, 29 kPa) or more		
		at 3,000 rpm	3.0 – 5.5 kg/cm^2 (43 – 78 psi, 294 – 539 kPa)		
Oil pump	Body clearance	STD	0.100 – 0.175 mm	0.0039 – 0.0069 in.	
		Limit	0.30 mm	0.0118 in.	
	Side clearance	STD	0.030 – 0.090 mm	0.0012 – 0.0035 in.	
		Limit	0.15 mm	0.0059 in.	
	Tip clearance	STD	0.110 – 0.240 mm	0.0043 – 0.0094 in.	
		Limit	0.35 mm	0.0138 in.	

TORQUE SPECIFICATIONS

Part tightened		kg-cm	ft-lb	N·m
Oil pan x Drain plug		250	18	25
Oil pump x Cylinder block	12 mm head bolt	200	14	20
	14 mm head bolt	420	30	41
Oil strainer x Main bearing cap		70	61 in.-lb	6.9
Oil strainer x Oil pump		70	61 in.-lb	6.9
Oil pan x Cylinder block		60	52 in.-lb	5.9
Oil pan x Oil pump		60	52 in.-lb	5.9
Oil pan x Rear oil seal retainer		60	52 in.-lb	5.9
Stiffener plate x Cylinder block		530	38	52
Stiffener plate x Transaxle case		380	27	37

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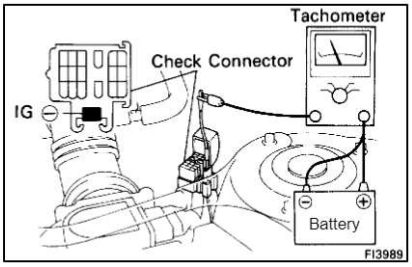
IGNITION SYSTEM

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GENERAL DESCRIPTION

PRECAUTIONS

1. Do not leave the ignition switch on for more than 10 minutes if the engine will not start.



2. When a tachometer is connected to the system, connect the test probe of the tachometer to terminal IG ⊖ of the check connector.

3. As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before use.

4. NEVER allow the tachometer test probe to touch the ground as this could damage the igniter and/or ignition coil.

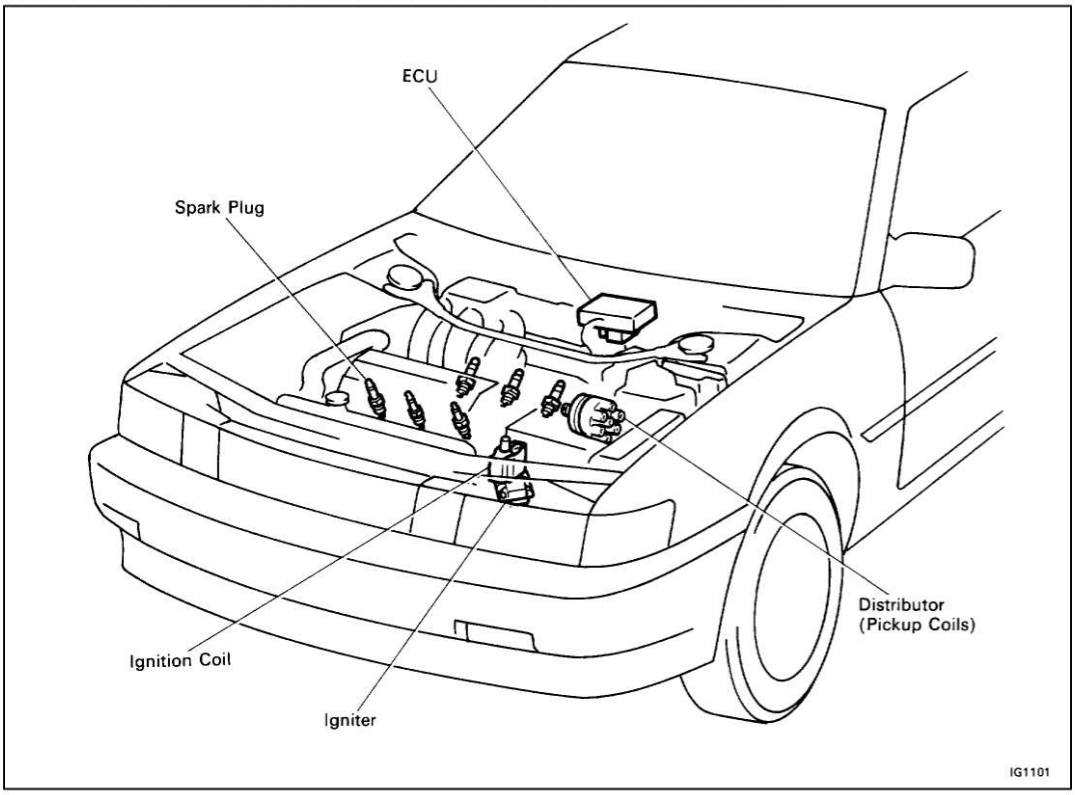
5. Do not disconnect the battery when the engine is running.

6. Check that the igniter is properly grounded to the body.

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DESCRIPTION

The ECU is programmed with data for optimum ignition timing under any and all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, intake air volume, eng, temperature, etc.), the microcomputer (ECU) triggers the spark at precisely the right instant.



The ECU monitors the engine condition by signals from each sensor, calculates the ignition timing and sends an ignition signal to the igniter. High voltage from the ignition is distributed to each spark plug in the appropriate order to generate a spark between the electrodes, which ignites the air–fuel mixture.

IGNITER

The igniter temporarily interrupts the primary current with the ignition signal (IGT signal) from the ECU and generates sparks at the spark plug. Also, as a fail–safe measure, when ignition occurs an ignition confirmation signal (IGF signal) is sent to the ECU.

IGNITION COIL

The ignition coil uses a closed core coil with the primary coil wrapped around the core and the secondary coil wrapped around the primary coil. This allows the generation of a high voltage sufficient to cause a spark to jump across the spark plug gap.

DISTRIBUTOR

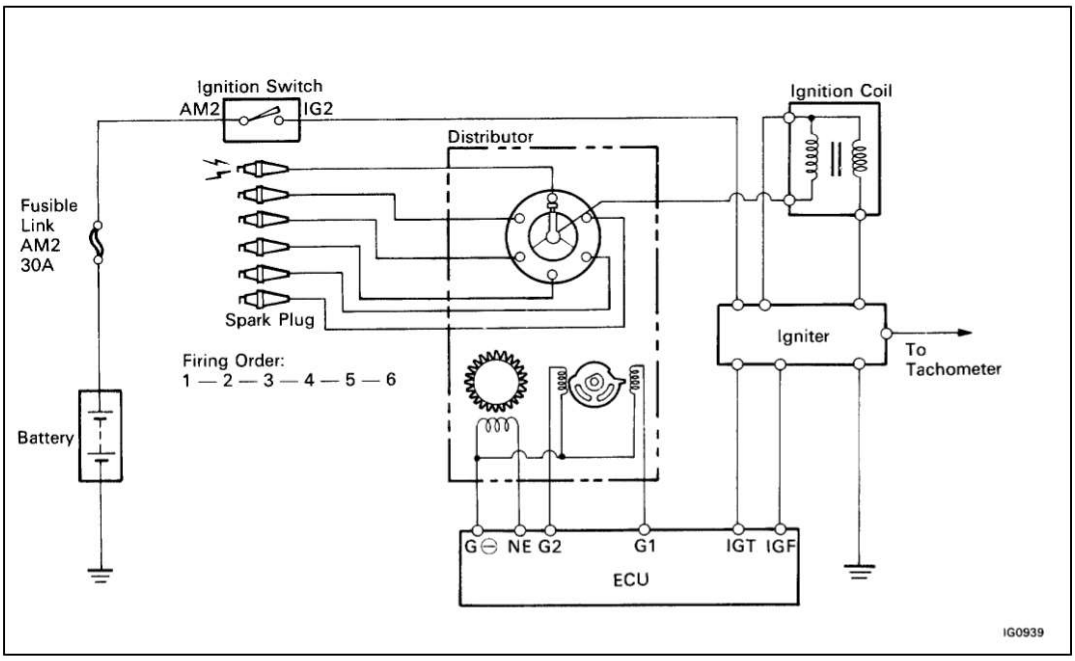
This correctly distributes high voltage to the spark plug of each cylinder in the specified ignition order.

PICKUP COILS

The NE coil detects the crank angle, and the G1 and G2 coils detect the cam angle.

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OPERATION



To maintain the most appropriate ignition timing, the ECU sends a control signal so that the igniter sends current to the ignition coil and the spark plugs produce a spark.

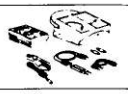
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PREPARATION

SST (SPECIAL SERVICE TOOLS)

Illustration	Part No.	Part Name	Note
	09843-18020	Diagnosis Check Wiring	

RECOMMENDED TOOLS

Illustration	Part No.	Part Name	Note
	09082-00015	TOYOTA Electrical Tester	
	09200-00010	Engine Adjust Kit	

EQUIPMENT

Part Name	Note
Timing light	Ignition timing
Tachometer	
Megger	Insulation resistance meter
Ohmmeter	
Spark plug cleaner	
16 mm plug wrench	

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ON–VEHICLE INSPECTION

SPARK TEST

CHECK THAT SPARK OCCURS

(a) Disconnect the high–tension cord from the distributor.
(b) Hold the end approx. 12.5 mm (0.50 in.) from body of vehicle.
(c) See if spark occurs while engine is being cranked.

HINT: To prevent gasoline from being injected from injectors during this test, crank the engine for no more than 1–2 seconds at time.

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

SPARK TEST

NO

CHECK CONNECTION OF IGNITION COIL, IGNITER AND DISTRIBUTOR CONNECTORS → BAD → Connect securely.

OK

CHECK RESISTANCE OF HIGH-TENSION CORDS (See page IG-7)
Maximum resistance: 25 kΩ per cord → BAD → Replace the cord (s),

OK

CHECK POWER SUPPLY TO IGNITION COIL
1. Ignition switch is turned to ON.
2. Check that there is battery voltage at ignition coil positive (+) terminal.

→ BAD → Check wiring between ignition switch and ignition coil.

OK

CHECK RESISTANCE OF IGNITION COIL (See page IG-9)
Resistance (Cold):
Primary 0.40 – 0.50Ω
Secondary 10.2 – 13.8 kΩ → BAD → Replace the ignition coil.

OK

CHECK RESISTANCE OF SIGNAL GENERATOR (PICKUP COIL) (See page IG-9)
Resistance: 205 – 255Ω → BAD → Replace the distribuitor housing.

OK

CHECK AIR GAP OF DISTRIBUTOR (See page IG-9)
Air gap: 0.2 – 0,4 mm (0.008 – 0.016 in.) → BAD → Replace the distribuitor housing.

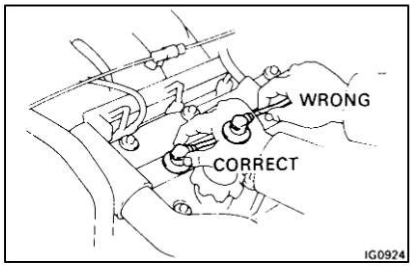
OK

CHECK IGT SIGNAL FROM ECU (See page TR-27) → BAD → Check wiring between ECU and distributor, only then try another ECU.

OK

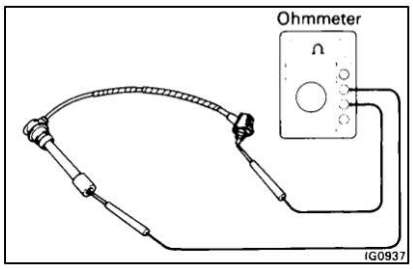
TRY ANOTHER IGNITER

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INSPECTION OF HIGH–TENSION CORDS

1. **CAREFULLY REMOVE HIGH–TENSION CORDS FROM SPARK PLUGS BY THEIR RUBBER BOOTS**
   NOTICE: Pulling on or bending the cords may damage the conductor inside.

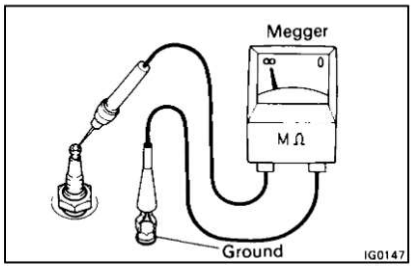


2. **INSPECT HIGH–TENSION CORD RESISTANCE**
   Using an ohmmeter, measure the resistance.
   Maximum resistance: 25 kΩ per cord
   If the resistance is greater than maximum, replace the high–tension cord.

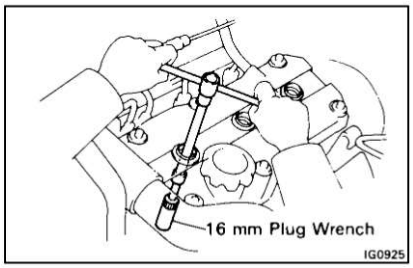
INSPECTION OF SPARK PLUGS

NOTICE:

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



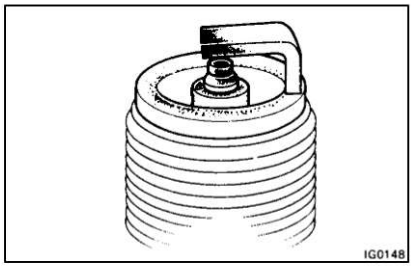
1. **INSPECT ELECTRODE**
   Using a megger (insulation resistance), measure the insulation resistance.
   Standard insulation resistance: More than 10 MΩ
   If less than 10 MΩ, proceed to step 2.
   HINT: If a megger is not available, the following simple method of inspection provides fairly accurate results.



[Simple method]

- Quickly race the engine to 4,000 rpm five times.
- Using a plug wrench (16 mm), remove the spark plug.

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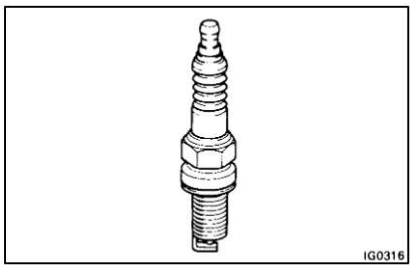


- Visually inspect the spark plugs.

If the electrode is dry . . . . Okay
If the electrode is wet . . . . Proceed to step 3.

2. REMOVE SPARK PLUGS

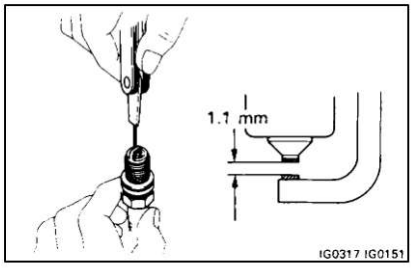
Using a 16 mm plug wrench, remove the spark plug.



3. VISUALLY INSPECT SPARK PLUGS

Check the spark plug for thread or insulation damage.
If abnormal, replace the spark plug.

Recommended spark plug: ND PQ20R
NGK BCPR6EP11



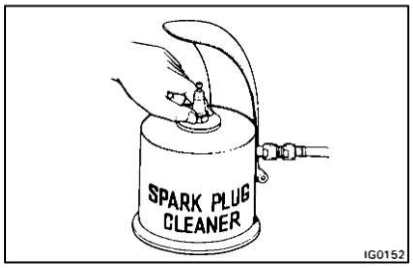
4. INSPECT ELECTRODE GAP

Maximum electrode gap: 1.3 mm (0.051 in.)

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

Correct electrode gap of new spark plug:
1.1 mm (0.043 in.)

If adjusting the gap of a new spark plug, bend only the base of the ground electrode. Do not touch the tip.

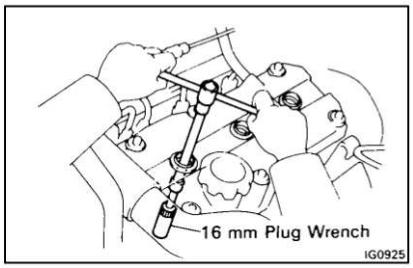


5. CLEAN SPARK PLUGS

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

Air pressure: Below 6 kg/cm^2 (85 psi, 588 kPa)
Duration: 20 seconds or less

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

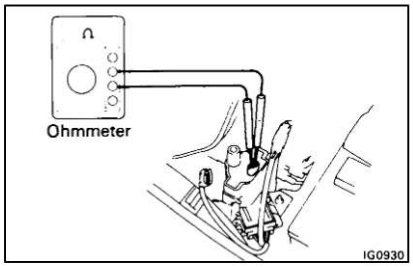


6. INSTALL SPARK PLUGS

Using a 16 mm plug wrench, install and torque the spark plug.

Torque: 180 kg–cm (13 ft–lb, 18 N·m)

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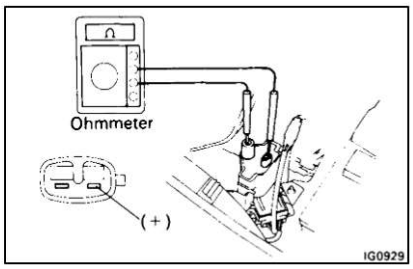
INSPECTION OF IGNITION COIL

1. **INSPECT PRIMARY COIL RESISTANCE**

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

Primary coil resistance (Cold): 0.40 – 0.50 Ω

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

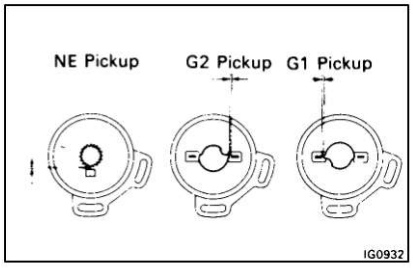


2. **INSPECT SECONDARY COIL RESISTANCE**

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

Secondary coil resistance (Cold): 10.2 – 13.8 kΩ

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



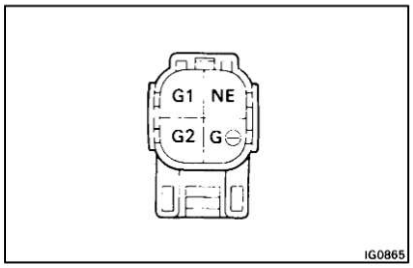
INSPECTION OF DISTRIBUTOR

1. **INSPECT AIR GAPS**

Using a thickness gauge, measure the gap between the signal rotor and pickup coil projection.

Air gap: 0.2 – 0.4 mm (0.008 – 0.016 in.)

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



2. **INSPECT SIGNAL GENERATOR (PICKUP COIL) RESISTANCE**

Using an ohmmeter, measure the resistance between the terminals.

G1 pickup coil resistance (G1 – G ×): 205 – 255 Ω
G2 pickup coil resistance (G2 – G ×): 205 – 255 Ω
NE pickup coil resistance (NE – G ×): 205 – 255 Ω

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

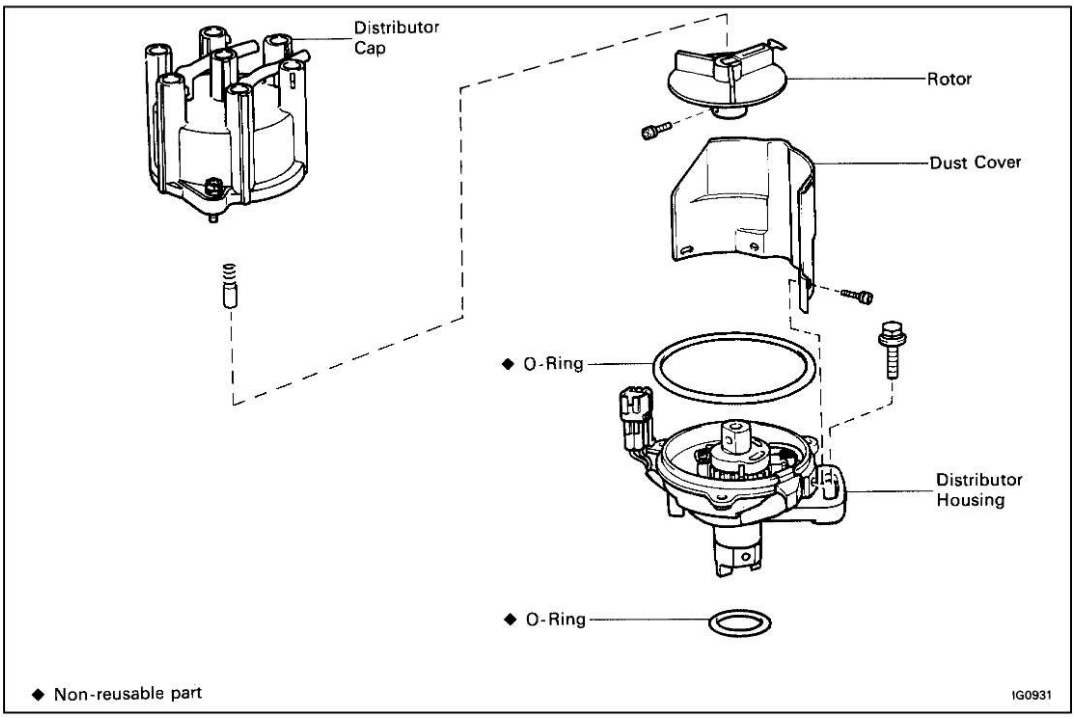
INSPECTION OF IGNITER

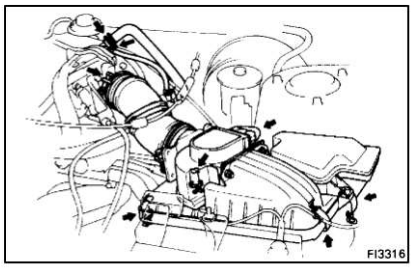
(See Spark Test procedure on page IG–6)

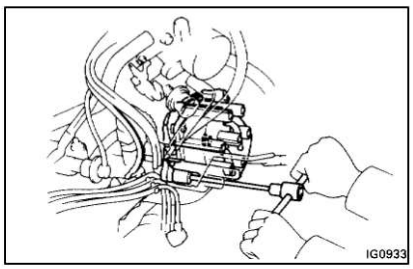
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DISTRIBUTOR

COMPONENTS



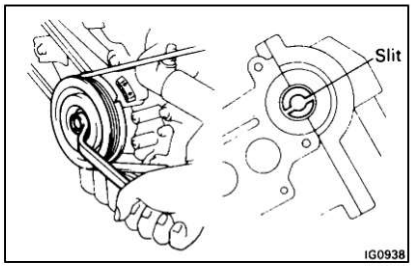




REMOVAL OF DISTRIBUTOR

1. **REMOVE UPPER BRACE**
2. **REMOVE AIR CLEANER CAP, AIR FLOW METER AND AIR CLEANER HOSE**
   (a) Disconnect the air flow meter connector.
   (b) Disconnect the air hoses.
   (c) Loosen the air cleaner hose clamp bolt.
   (d) Disconnect the air cleaner cap clips.
   (e) Remove the air cleaner cap and air flow meter together with air cleaner hose.
3. **DISCONNECT HIGH–TENSION CORDS FROM DISTRIBUTOR CAP**
4. **DISCONNECT DISTRIBUTOR CONNECTOR**
5. **REMOVE DISTRIBUTOR**
   Remove the two hold–down bolts, and pull out the distributor.
   Remove the O–ring.

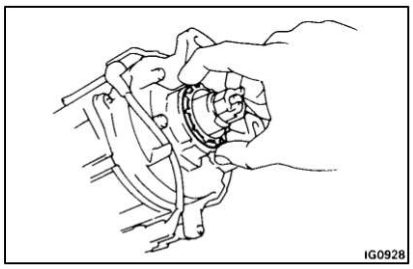
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INSTALLATION OF DISTRIBUTOR

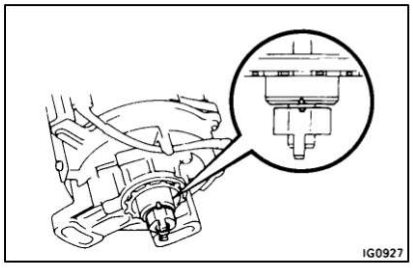
1. SET NO. 1 CYLINDER TO TDC/COMPRESSION

Turn the crankshaft clockwise, and position the slit of the intake camshaft (RH cylinder head) as shown. Look at the distributor attachment hole to set.

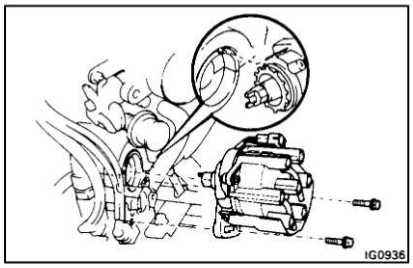


2. INSTALL DISTRIBUTOR

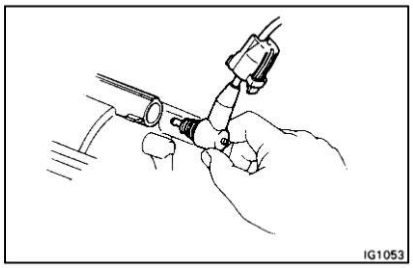
(a) Install a new O–ring to the housing.
(b) Apply a light coat of engine oil on the O–ring.



(c) Align the cutout marks of the coupling and housing.



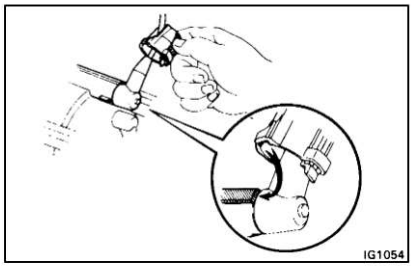
(d) Insert the distributor, aligning the line of the housing with the cutout of the distributor attachment bearing cap.
(e) Lightly tighten the two hold–down bolts.



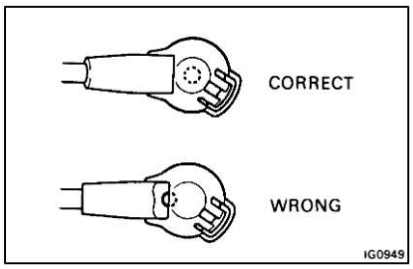
3. CONNECT HIGH–TENSION CORDS TO DISTRIBUTOR CAP

(a) (Ex. Center Cord)
First, insert the grommet part only.

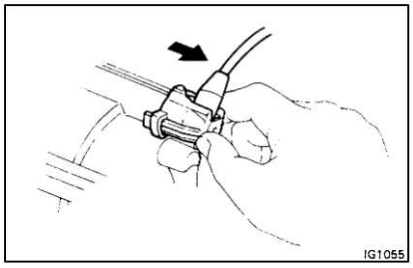
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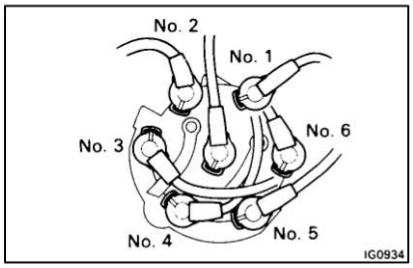
(b) (Ex. Center Cord)
Align the spline of the distributor cap with the spline groove of the holder, and slide the holder.



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

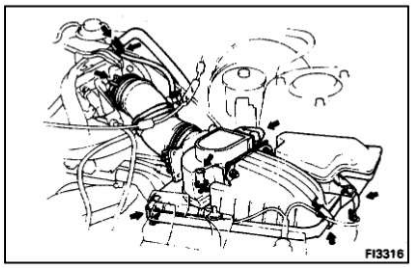


(c) Check that the claw of the holder is engaged by lightly pulling the holder.
(d) (Center Cord)
Insert the grommet and holder together.



(e) Connect the high–tension cords as shown in the illustration.

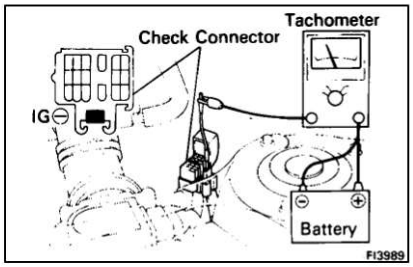
4. CONNECT DISTRIBUTOR CONNECTOR

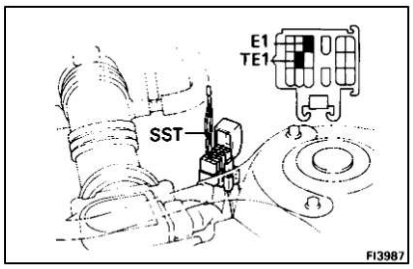


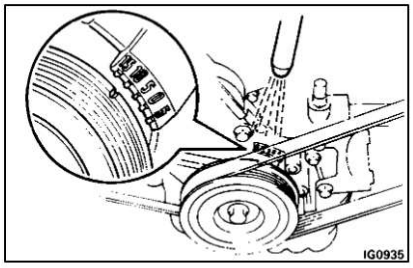
5. INSTALL AIR CLEANER CAP, AIR FLOW METER AND AIR CLEANER HOSE
(a) Connect the air cleaner hose, and install the air cleaner cap and air flow meter with the four clips.
(b) Tighten the air cleaner hose clamp bolt.
(c) Connect the air hoses.
(d) Connect the air flow meter connector.

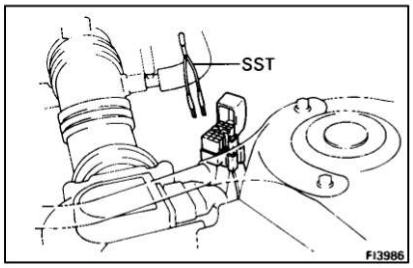
6. INSTALL UPPER BRACE

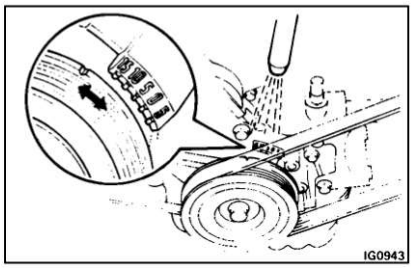
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7. **WARM UP ENGINE**
   Allow the engine to reach normal operating temperature.
8. **CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE**
   Connect the tachometer test probe to terminal IG ⊖ of the check connector.
   NOTICE:
   - **NEVER allow the tachometer test probe 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 recommended that you confirm the compatibility of your unit before use.**
9. **ADJUST IGNITION TIMING**
   (a) Check the idle speed.
   Idle speed: 700 ± 50 rpm
   (b) Using SST, connect terminals TE1 and E1 of the check connector.
   SST 09843–18020
   (c) Using a timing light, check the ignition timing.
   Ignition timing: 10° BTDC @ idle
   (Transmission in N range)
   (d) Loosen the two hold–down bolts, and adjust by turning the distributor.
   (e) Tighten the hold–down bolts, and recheck the ignition timing.
   Torque: 185 kg–cm (13 ft–lb, 18 N·m)
   (f) Remove SST.
10. **FURTHER CHECK IGNITION TIMING**
    Ignition timing: 13 – 27° BTDC @ idle
    HINT: The timing mark moves in a range between 13° and 27°
11. **DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE**

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SERVICE SPECIFICATIONS

Ignition timing			10° BTDC @ idle [w/ Terminals TE1 and E1 connected]	
Firing order			1 – 2 – 3 – 4 – 5 – 6	
High-tension cord	Resistance	Limit	25 kΩ per cord	
Spark plug	Type	ND NGK	PQ20R BCPR6EP11	
	Gap New plug	STD	1.1 mm	0.043 in.
	Gap Used plug	Limit	1.3 mm	0.051 in.
Ignition coil	Primary coil resistance		0.40 – 0.50 Ω	
	Secondary coil resistance		10.2 – 13.8 kΩ	
Distributor	Air gap G1, G2 and NE pickups		0.2 – 0.4 mm	0.008 – 0.016 in.
	Pickup coil resistance G1, G2 and NE pickups		205 – 255 Ω	

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ENGINE TROUBLESHOOTING

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HOW TO PROCEED WITH TROUBLESHOOTING

The Engine Control System broadly consists of the sensors, ECU and actuators. The ECU receives signals from various sensors, judges the operating conditions and determines the optimum injection duration, timing, ignition timing and idle speed.
In general, the Engine Control System is considered to be a very intricate system to troubleshoot when it occurred. But, the fact is that if you proceed to inspect the circuit one by one following the procedures directed in this manual, troubleshooting of this system is not complex.
This section explains the most ideal method of troubleshooting and tells how to carry out the necessary repairs.

[1] CUSTOMER PROBLEM ANALYSIS
Using the customer problem analysis check sheet for reference, ask the customer in as much details as possible about the problem.

[2] DIAGNOSTIC CODE CHECK, DIAGNOSTIC CODE CLEARANCE
Before confirming the problem symptom, first check the diagnostic code and make a note of any malfunction code displayed, then clear the code.
HINT: Output of the malfunction code indicates that there is a malfunction in the circuit indicated. However, it does not indicate whether the malfunction is still occurring or occured in the past but retured to normal. In order to determine this, the problem symptoms should be confirmed in [3] and the diagnostic code should be rechecked in [5].
Accordingly, if troubleshooting is begun based on the malfunction code only in the diagnostic code check in 2, it could result in a misdiagnosis, leading to troubleshooting of normally operating circuits and making it more difficult to locate the cause of the problem.

[3] PROBLEM SYMPTOM CONFIRMATION [4] SYMPTOM SIMULATION
Confirm the symptoms of the problem.
If the problem does not reappear, use the symptom simulation method to make sure the problem.

[5] DIAGNOSTIC CODE CHECK
Check the diagnostic code. If the malfunction code is output, proceed to step [6]. If the normal code is output, proceed to step [7].

[6] DIAGNOSTIC CODE CHART
If the malfunction code is confirmed in the diagnostic code check, proceed to the check procedure indicated by chart for each diagnostic code.

[7] BASIC INSPECTION
Carry out basic inspection such as the ignition spark check and fuel pressure check, etc.

[8] MATRIX CHART OF PROBLEM SYMPTOMS
If the problem is not confirmed in the basic inspection, perform troubleshooting according to the inspection order in the matrix chart of problem symptoms.

[9] COMPONENTS INSPECTION
When the matrix chart of problem symptoms instructs to check the components, proceed to the components inspection section included in this manual.

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[10] CIRCUIT INSPECTION

Proceed with diagnosis of each circuit in accordance with the inspection order confirmed in [6] and [8]. Determine whether the cause of the problem is in the sensors, actuators, wire harness and connectors, or the ECU.

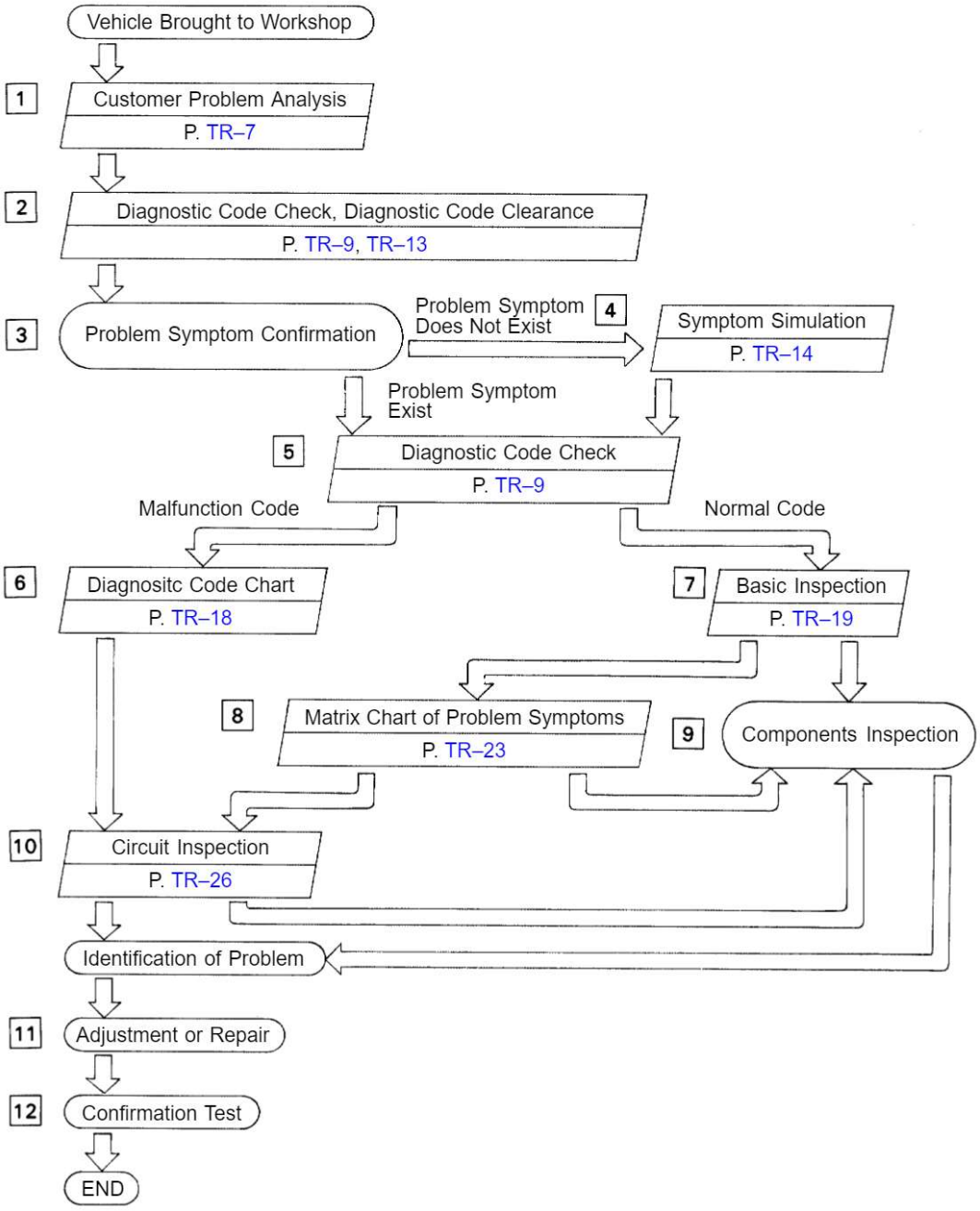
[11] REPAIRS

After the cause of the problem is located, perform repairs by following the inspection and replacement procedures in this manual.

[12] CONFIRMATION TEST

After completing repairs, confirm not only that the problem is eliminated, but also perform diagnostic code check etc. again to make sure the entire engine control system is operating correctly.

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How to Proceed with Troubleshooting Using Volt/Ohm Meter and TCCS Checker

For the explanation of steps [1] ~ [6] , [9] ~ [14] , see the explanation of steps with the same title on page TR–2.

[7] [8] CIRCUIT INSPECTION BY CHECKER

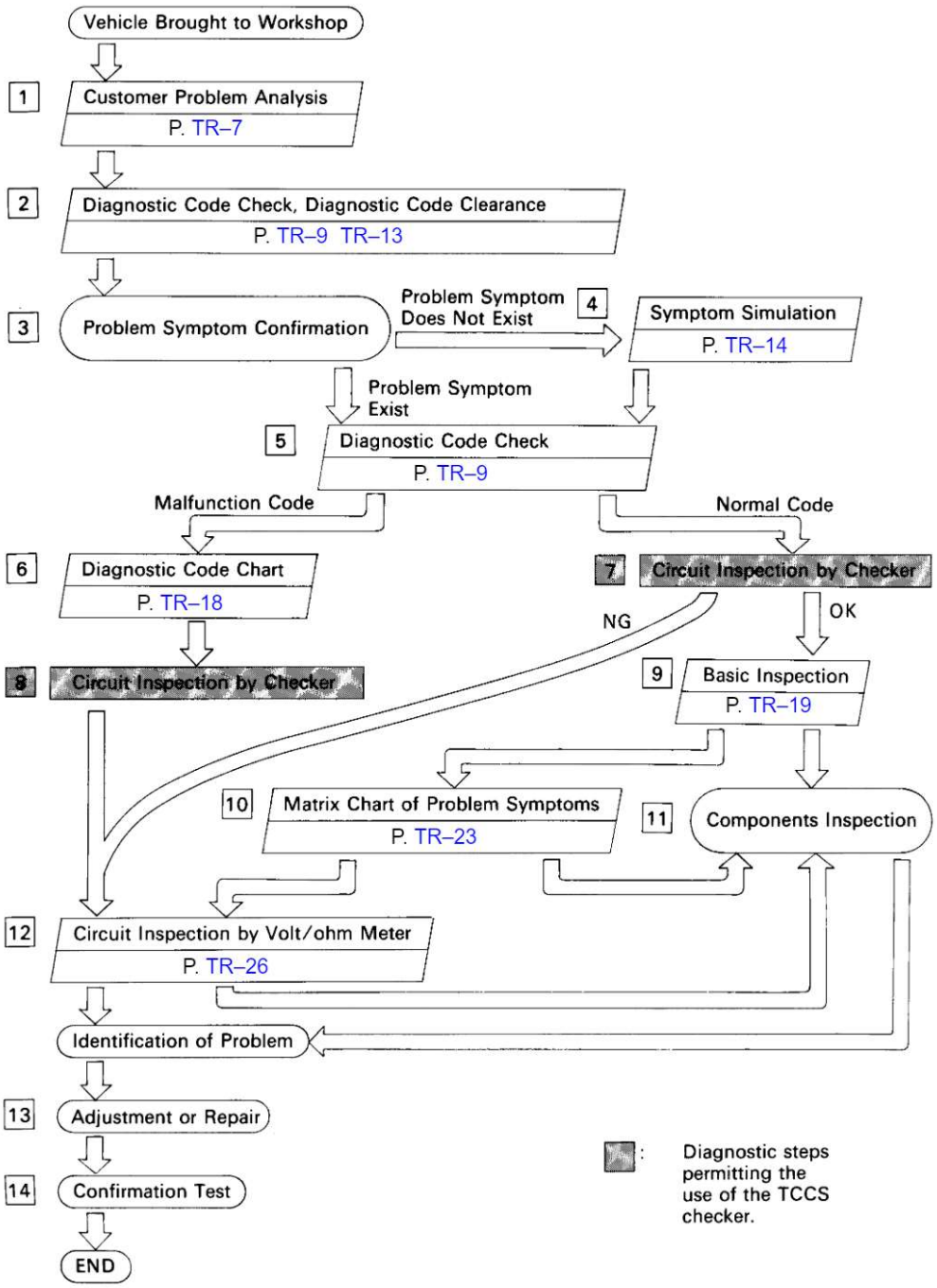
If the Normal code is displayed in the diagnostic code check, connect the checker to the vehicle and check all the circuits which can be inspected using the checker.

If a malfunctioning circuit is then detected, proceed to "Circuit Inspection by Volt/Ohm Meter" and check the applicable circuit using a volt/ohm meter. Determine if the malfunction is in the sensor, actuator, wire harness, connector or the ECU. If the malfunctioning circuit cannot be detected using the checker, proceed to "Basic Inspection" and perform troubleshooting.

If a malfunction code is displayed in the diagnostic code check, use the checker to inspect the circuit indicated by the diagnostic code chart for the displayed code.

For instructions on how to connect the checker to the vehicle and how to use the checker, please refer to the Instruction Manual for TCCS checker.

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CUSTOMER PROBLEM ANALYSIS CHECK SHEET

ENGINE CONTROL System Check Sheet

Inspector's Name:

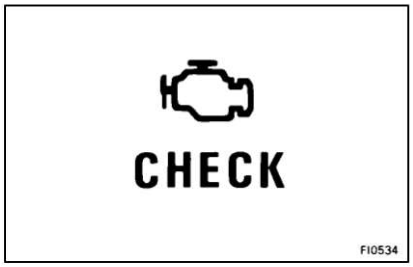
Customer's Name		Registration No.	
		Registration Year	/ /
		Frame No.	
Date Vehicle Brought In		Odometer Reading	Miles

Date of Problem Occurrence		
Frequency of Problem Occurrence		☐ Constant ☐ Sometimes (times/ per day/month) ☐ Once only ☐ Other ( )
Conditions at Time of Problem Occurrence	Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Other
	Outdoor Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold (Approx. °F (°C))
	Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Hill (☐ Up, ☐ Down) ☐ Rough Road ☐ Other ( )
	Engine Temp.	☐ Cold ☐ Warming up ☐ After warming up ☐ Normal ☐ Other
	Engine Operation	☐ Starting ☐ Just after starting ☐ Idling ☐ Racing without load ☐ Driving (☐ Constant Speed ☐ Acceleration ☐ Deceleration ☐ Other ( ))

Problem Symptoms	☐ Engine does not start	☐ Engine does not crank ☐ No initial combustion ☐ No complete combustion
	☐ Difficult to start	☐ Engine cranks slowly ☐ Others ( )
	☐ Poor Idling	☐ Incorrect first idle ☐ Idling rpm is abnormal [☐ High ☐ Low (rpm)] ☐ Rough idling ☐ Others ( )
	☐ Poor Driveability	☐ Hesitation ☐ Back fire ☐ Muffler explosion (after fire) ☐ Surging ☐ Knocking ☐ Others ( )
	☐ Engine stall	☐ Engine stall soon after starting ☐ After acceleration pedal depressed ☐ After acceleration pedal released ☐ During A/C operation ☐ When N to D shift ☐ Others ( )
	☐ Others	( )

Condition of "CHECK" Engine Warning Light		☐ Remains on ☐ Sometimes lights up ☐ Does not light up
Diagnostic Code Inspection	1st time	☐ Normal code ☐ Malfunction code [code]
	2nd time	☐ Normal code ☐ Malfunction code [code]

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DIAGNOSIS SYSTEM

DESCRIPTION

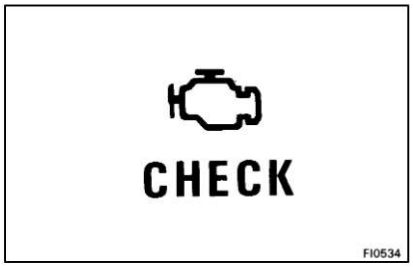
The ECU contains a built–in self–diagnosis system by which troubles with the engine signal network are detected and a "CHECK" engine warning light on the instrument panel lights up.

By analyzing various signals as shown in the table later on (See page TR–11) the Electronic Control Unit (ECU) detects system malfunctions relating to the sensors or actuators.

The self–diagnosis system monitors 19 (California specification vehicles) or 17 (Other than California specification vehicles) items, indicated by code No. as shown in TR–11. A "CHECK" engine warning light on the instrument panel informs the driver that a malfunction has been detected. The light goes off automatically when the malfunction has been repaired. But the diagnostic code(s) remains stored in the ECU memory (except for code Nos. 16, 51 and 53). The ECU stores the code(s) until it is cleared by removing the EFI fuse with the ignition switch off.

The diagnostic code can be read by the number of blinks of the "CHECK" engine warning light when TE1 and E1 terminals on the TDCL or check connector are connected. When 2 or more codes are indicated, the lowest number (code) will appear first.

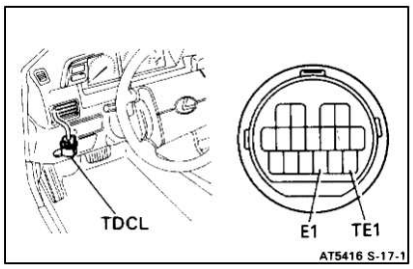
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Diagnosis Inspection

"CHECK" ENGINE WARNING LIGHT CHECK

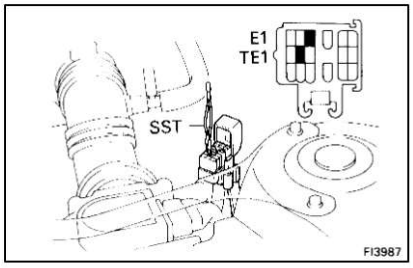
1. The "CHECK" engine warning light will come on when the ignition switch is turned ON and the engine is not running.
2. When the engine is started, the "CHECK" engine warning light should go off.
   If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.



DIAGNOSTIC CODE CHECK

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

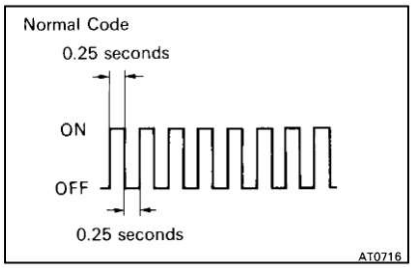
1. Initial conditions.
   (a) Battery voltage 11 V or more.
   (b) Throttle valve fully closed.
   (c) Transmission in neutral position.
   (d) Accessories switches turned OFF.



2. Turn ignition switch ON. Do not start the engine.
3. Using SST, connect terminals TE1 and E1 of the TDCL or check connector.
   SST 09843–18020



4. Read the diagnostic code as indicated by the number of flashes of the "CHECK" engine warning light.

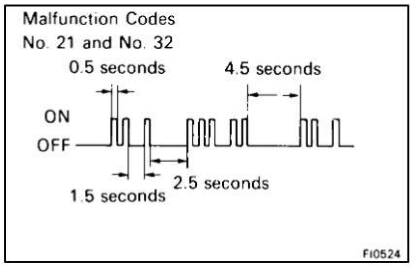


Diagnostic Codes (See page TR–11)

(a) Normal System Operation (no malfunction)

- The light will alternately blink ON and OFF 2 times per second.

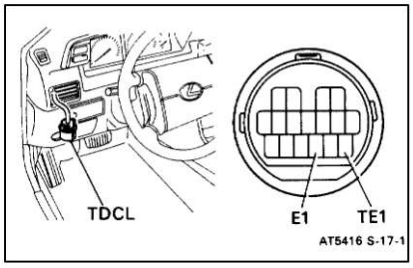
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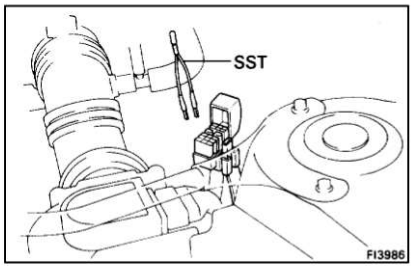
(b) Malfunction Code Indication

- In the event of a malfunction, the light will blink every 0.5 seconds. The first number of blinks will equal the first digit of a 2–digit diagnostic code and, after a 1.5 second pause, the 2nd number of blinks will equal the 2nd. If there are two or more codes, there will be a 2.5 second pause between each.
- After all the codes have been output there will be a 4.5 second pause and they will all be repeated as long as the terminals TE1 and E1 of the TDCL or check connector are connected.

HINT: In the event of 2 or more trouble codes, indication will begin from the smaller numbered code and continue in order to the larger.

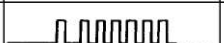


5. After the diagnostic code check, remove the SST.



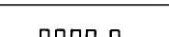
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DIAGNOSTIC CODES

Code No.	Number to blinks "CHECK" engine	System	*1 "CHECK" Engine Warning Light	Diagnosis	Trouble Areas	*2 Memory
—	 FI1401	Normal	–	Output when no other code is recorded	—	—
12	 FI1606	RPM Signal	ON	No G or NE signal is input to the ECU for 2 sec. or more after STA turns ON.	• Open or short in NE, G Circuit • Distributor • Open or short in STA circuit • ECU	O
13	 FI1607	RPM Signal	ON	NE signal not input to ECU for 50 msec. or more when engine speed is 1,000 rpm or more.	• Open or short in NE circuit • Distributor • ECU	O
14	 FI1608	Ignition Signal	ON	IGF signal from igniter is not input to ECU for 6 consecutive ignition.	• Open or short in IGF or IGT circuit from igniter to ECU • Igniter • ECU	O
16	 FI3600	ECT Control Signal	ON	Normal signal is not output from ECU of ECT.	• ECU	X
21	 FI1609	Main Oxygen Sensor Signal	ON	(1) Open or short in heater circuit of main oxygen sensor for 0.5 sec. or more. (HT) (2) At normal driving speed (below 60 mph and engine speed is above 1,500 rpm), amplitude of oxygen sensor signal (OX1) is reduced to between 0.35 – 0.70 V continuously for 60 sec. or more. (2 trip detection logic)*6	• Open or short in heater circuit of main oxygen sensor • Main oxygen sensor heater • ECU • Open or short in main oxygen sensor circuit • Main Oxygen sensor • ECU	O
22	 FI1610	Water Temp. Sensor Signal	ON	Open or short to water temp. sensor circuit for 0,5 sec. or more (THW).	• Open or short in water temp. sensor circuit • Water temp. sensor • ECU	O
24	 FI1611	Intake Air Temp. Sensor Signal	ON*3	Open or short in intake air temp. sensor circuit for 0,5 sec. or more (THA).	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor • ECU	O
25	FI2562	Air–fuel Ratio Lean Malfunction	ON	(1) Oxygen sensor ouput is less than 0.45 V for at least 90 sec. when oxygen sensor is warmed up (racing at 2,000 rpm). (2) *4 When air–fuel ratio feedback correction value or adaptive control value continues at the upper (lean) or lower (rich) limit for a certain period of time or adaptive control value is not renewed for a certain period of time. (3) *4 When marked variation is detected in engine revolutions for each cylinder during idle switch on and feedback condition. (2 trip detection logic)*6	• Engine ground bolt loose • Open in E1 circuit • Open in injector circuit • Fuel line pressure (Injector blockage, etc.) • Open or short in oxygen sensor circuit • Oxygen sensor • Ignition system • Water temp. sensor • Air flow meter (air intake) • Foreign object caught in valve • ECU	O
26	 FI2563	Air–fuel Ratio Rich Malfunction	ON		• Engine ground bolt loose • Open in E1 circuit • Short in injector circuit • Fuel line pressure (Injector blockage, etc.) • Open or short in cold start injector circuit • Cold start injector • Open or short in oxygen sensor circuit • Oxygen sensor • Water temp. sensor • Air flow meter • Compression pressure • Foreign object caught in valve • ECU	O

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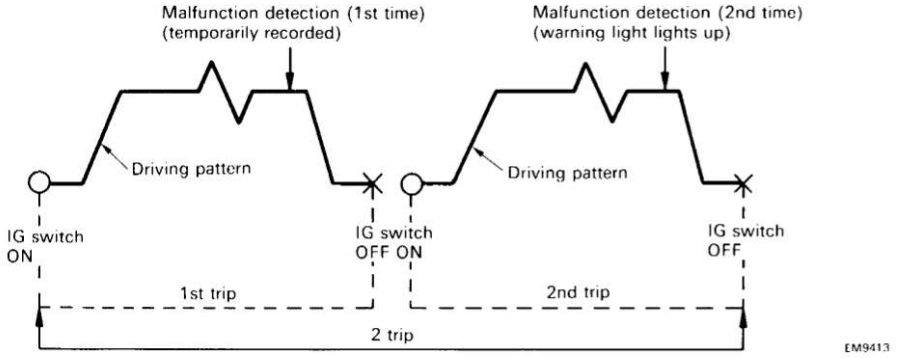
DIAGNOSTIC CODES (Cont'd)

Code No.	Number to blinks "CHECK" engine	System	*1 "CHECK" Engine Warning Light	Diagnosis	Trouble Areas	*2 Memory
27*5	 FI3294	Sub–oxygen Sensor Signal	ON	When sub–oxygen sensor is warmed up apply acceleration with the throttle fully open for 2 seconds, output of main oxygen sensor is 0.45 V or more (rich) and output of sub–oxygen sensor is 0.45 V or less (lean). (OX2) (2 trip detection logic) *6	• Short or open in sub–oxygen sensor circuit • Sub–oxygen sensor • ECU	O
31	 FI1612	Air Flow Meter Signal	ON	At idling, open or short detected continuously for 0.5 sec. or more in the air flow meter circuit.	• Open (VC) or short (VC–E2) in air flow meter circuit • Air flow meter • ECU	O
32	FI1613	Air Flow Meter Signal	ON	Open or short detected continously for 0.5 sec. or more in air flow meter circuit.	• Open (E2) or short (VS–VC) in air flow meter circuit • Air flow meter • ECU	O
41	 FI1614	Throttle Position Sensor Signal	ON *3	Open or short detected in throttle position sensor signal (VTA) for 0.5 sec. or more. IDL contact is ON and VTA output exceeds 1.45 V.	• Open or short in throttle position sensor circuit • Throttle position sensor • ECU	O
42	 FI1615	Vehicle Speed Sensor Signal	OFF	SPD signal is not input to the ECU for at least 8 seconds during high load driving with engine speed between 2,500 rpm and 4,500 rpm.	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECU	O
43	FI1616	Starter Signal	OFF	Starter signal (STA) is not input to ECU even once until engine reaches 800 rpm or more when cranking.	• Open or short in starter signal circuit • Open or short in IG SW circuit • ECU	O
52	FI1618	Knock Sensor Signal	ON	With engine speed between 1,600 rpm – 5,200 rpm, signal from knock sensor is not input to ECU for 6 revolution. (KNK)	• Open or short in knock sensor circuit • Knock sensor (looseness etc.) • ECU	O
53	 FI1619	Knock Control Signal	ON	Engine speed is between 650 rpm and 5,200 rpm and engine control computer (for knock control) malfunction is detected.	• ECU	X
71		EGR System Malfunction	ON	With engine warmed up and EGR operation possible, code is displayed when EGR gas temp. sensor is 55°C (131°F) for M/T, 60°C (140°F) for ECT or less when vehicle is driven for 90 seconds. (THG) (2 trip detection logic) *6	• Open in EGR gas temp. sensor circuit • EGR or BVSV vacuum hose disconnected, valve stuck • Clogged EGR gas passage • ECU	O
51		Switch Condition Signal	OFF	Displayed when A/C is ON, IDL contact OFF or shift position in "R", "D", "2" or "1" renges with the check terminals E1 and TE1 connected.	• A/C switch circuit • Throttle position sensor IDL circuit • Neutral start switch circuit • Accelerator pedal, cable • ECU	X

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" does not light up during malfunction diagnosis, even if a malfunction is detected.
*2: "O" in the memory column indicates that a diagnostic code is recorded in the ECU memory when a malfunction occurs.
"X" 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 IG switch ON.
*3: The "CHECK" Engine Warning Light light up only for California specifications if malfunction occurs.
*4: No. (2) and (3) in the diagnostic contents of codes No. 25 and 26 apply to California specification vehicles only, while (1) applies to all models.
*5: Codes 27 and 71 are used only for California specifications.

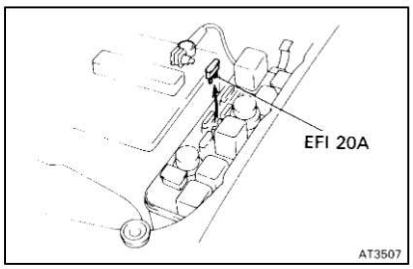
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*6: This indicates items for which "2 trip detection logic" is used. With this logic, when a logic malfunction is first detected, the malfunction is temporarily stored in the ECU memory. If the same case is detected again during the second drive test, this second detection causes the "CHECK" Engine Warning Light to light up.
The 2 trip repeats the same mode a 2nd time. (However, the IG switch must be turned OFF between the 1st trip and 2nd trip).



HINT:
- When 2 or more codes are indicated, the lowest number (code) will appear first.
- When there is no code display (the light does not blink), the ECU is faulty or open circuit in terminal TE1 of TDCL or check connector.
- If the light stays on, the wire harness is shorted.
- If a code not listed on the chart is displayed, then the ECU is faulty.

DIAGNOSTIC CODE CLEARANCE



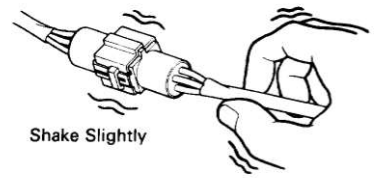
1. After repair of the trouble areas, the diagnostic code retained in the ECU memory must be cancelled out by removing the EFI fuse (20A) for 10 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch OFF.
   HINT:
   - Cancellation can also be done by removing the battery negative (–) terminal, but in this case, other memory systems (clock, radio etc.) will also be cancelled out.
   - If the diagnostic code is not cancelled out, it will be retained in memory 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.

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SYMPTOM SIMULATION

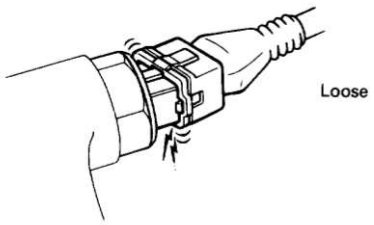
"Intermittent troubles or problems" are the malfunctions about which the customer has a complaint, but which do not occur and can not be confirmed in the workshop. The intermittent problems also include complaints about the "CHECK" engine warning light going on and off erratically.
The self–diagnostic system stores the circuit of the intermittent problem in memory even if the ignition switch is turned off.
And, for accurate diagnosis of the problems, ask the customer to obtain information as much as possible following the customer problem analysis check sheet (See page TR–7), and try to reproduce the intermittent problem.
The problem simulation methods described below are the effective ways for this nature of problem to produce the problem conditions by applying vibration, heat, and humidity.

1 VIBRATION METHOD: When vibration seems to be the major cause.



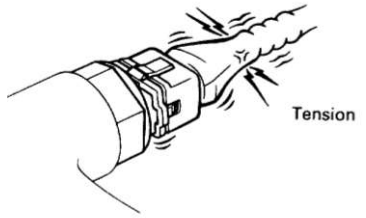
CONNECTORS

Slightly shake the connector vertically and horizontally.

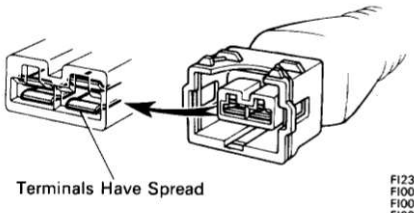


(Inspection of connectors)

(a) Is it loosely connected?



(b) Does the wire harness connecting with its corresponding part have insufficient slack?

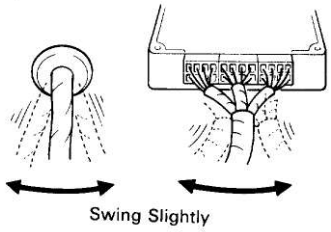


(c) Are the terminals dirty?

(d) Are the terminals making loose contact due to terminals spread?

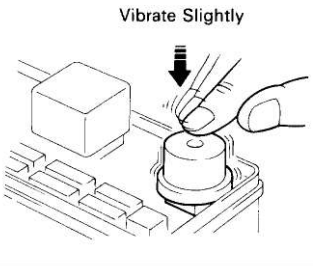
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1	**VIBRATION METHOD:**	**When vibration seems to be the major cause. (cont'd)**



WIRE HARNESS

Slightly shake the wire harness vertically and horizontally. The connector joint, fulcrum of the vibration, and body through portion are the major areas to be checked thoroughly.

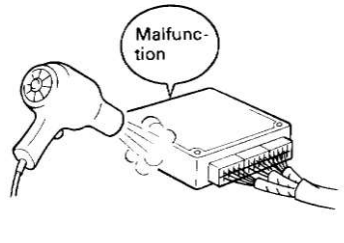


PARTS AND SENSORS

Apply vibration slightly by a finger to the part or sensor considered to be the problem cause and check if the malfunction will occur.

HINT: Strong vibration to the relays may result in open relays.

2	**HEAT METHOD:**	**When the problem seems to occur when the suspect area is heated.**



Heat the component that is likely the cause of the malfunction with a hair dryer or similar object. Check to see if the malfunction will occur.

NOTICE:

- **Do not heat to more than 605C (1405F) (Temperature limit that the component can be touched with a hand.).**
- **Do not apply heat directly to part in the ECU.**

3	**WATER SPRINKLING METHOD:**	**When the malfunction seems to occur on a rainy day or in a high–humidity condition.**



Sprinkle water onto the vehicle and check to see if the malfunction will occur.

NOTICE:

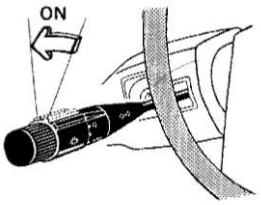
- **Never sprinkle water directly into the engine compartment, but indirectly change the temperature and humidity by applying water spray onto the radiator front surface.**
- **Never apply water directly onto the electronic components.**

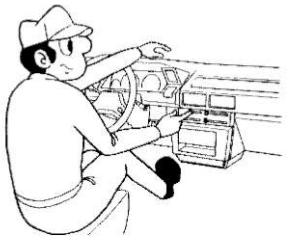
HINT:

- If a vehicle is subject to water leakage, the leaked water may contaminate the ECU. When testing a vehicle with a water leakage problem, special caution must be paid.

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4	OTHER:	When a malfunction seems to occur when electrical load is excessive.

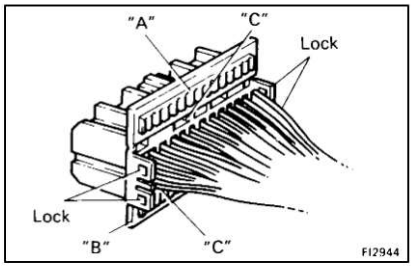




FI2336R
FI2337R

Turn on all electrical loads including the heater blower, head lamps, rear window defogger, etc. and check to see if the malfunction will occur.

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TERMINALS OF ECU

When measuring the voltage or resistance of the connector part of the ECU, remove the locks as required in the following procedure and always insert the test probe into the connector from the wire harness side.

PREPARATION

(a) Turn the ignition switch to LOCK position.
(b) Disconnect the connectors form the ECU.
(c) To remove section "A" and "B", carefully pull outward the lock on both sides as shown in the illustration.

NOTICE: Pay attention to section "C" in the illustration which can be easily broken.

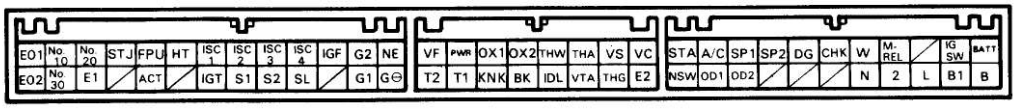
(d) Reconnect the connectors to the ECU.

TERMINALS OF ECU

Symbol	Terminal Name	Symbol	Terminal Name	Symbol	Terminal Name
E01	POWER GROUND	G2	DISTRIBUTOR	A/C	A/C COMPRESSOR
E02	POWER GROUND	G1	DISTRIBUTOR	*1OD1	CRUISE CONTROL ECU
No. 10	INJECTOR (No. 1 and 6)	NE	DISTRIBUTOR	SP1	No. 1 SPEED SENSOR (Meter side)
No. 30	INJECTOR (No. 4 and 5)	G (–)	DISTRIBUTOR	*1OD2	OD main switch
No. 20	INJECTOR (No. 2 and 3)	VF	CHECK CONNECTOR	*1SP2	No. 2 speed sensor (a/t SIDE)
E1	ECU GROUND	T2	CHECK CONNECTOR		–
STJ	COLD START INJECTOR	*1PWR	PATTERN SELECT SWITCH	*1DG	CHECK CONNECTOR
	–	T1	CHECK CONNECTOR		–
FPU	FUEL PRESSURE VSV	OX1	OXYGEN SENSOR	*2CHK	SUB–OXYGEN SENSOR
ACT	A/C AMPLIFIER	KNK	KNOCK CONTROL SENSOR		–
HT	OXYGEN SENSOR HEATER	*2OX2	SUB–OXYGEN SENSOR	W	CHECK ENGINE WARNING LIGHT
	–	*1BK	BRAKE SWITCH	*1N	SHIFT POSITION SWITCH
ISC1	ISC MOTOR NO. 1 COIL	THW	WATER TEMP. SENSOR	M–REL	EFI MAIN RELAY (COIL)
IGT	IGNITER	IDL	THROTTLE POSITION SENSOR	*12	SHIFT POSITION SWITCH
ISC2	ISC MOTOR NO. 2 COIL	THA	AIR TEMP. SENSOR		–
*1S1	ECT SOLENOID	VTA	THROTTLE POSITION SENSOR	*1L	SHIFT POSITION SWITCH
ISC3	ISC MOTOR NO. 3 COIL	VS	AIR FLOW METER	IG SW	IGNITION SWITCH
*1S2	ECT SOLENOID	*2THG	EGR GAS TEMP. SENSOR	B1	EFI MAIN RELAY
ISC4	ISC MOTOR NO. 4 COIL	VC	AIR FLOW METER THROTTLE POSITION SENSOR	BATT	BATTERY
*1SL	ECT SOLENOID	E2	SENSOR GROUND	B	EFI MAIN RELAY
IGF	IGNITER	STA	STARTER SWITCH		
	–	*1NSW	NEUTRAL START SWITCH		

*1 2/ECT
*2 CALIF. only

ECU Terminals



FI2796

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DIAGNOSTIC CODE CHART

After confirming the symptoms, check the diagnosis codes. If a trouble code is output, check the circuit corresponding to that circuit as found in the diagnostic code chart below.

Code No.	Inspection Circuit	Page
12	PRM Signal	TR–26
13	PRM Signal	TR–28
14	Ignition Signal	TR–29
16	ECT Control Signal	TR–35
21	Main Oxygen Sensor Signal	TR–36
	Main Oxygen Sensor Heater Signal	
22	Water Temp. Sensor Signal	TR–40
24	Intake Air Temp. Sensor Signal	TR–42
25	Air–fuel Ratio Lean Malfunction	TR–44
26	Air–fuel Ratio Rich Malfunction	TR–44
27	Sub–oxygen Sensor Signal (California Only)	TR–52
31	Air Flow Meter Signal	TR–59
32	Air Flow Meter Signal	TR–59
41	Throttle Position Sensor Signal	TR–63
42	Vehicle Speed Sensor Signal	TR–67
43	Starter Signal	TR–69
52	Knock Sensor Signal	TR–71
53	Knock Control Signal	TR–74
71	EGR System Malfunction (California Only)	TR–75
51	Switch Condition Signal	TR–81

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BASIC INSPECTION

When the normal code is displayed in the diagnostic code check, troubleshooting should be performed in the order for all possible circuits to be considered as the causes of the problems.
In many cases, by carrying out the basic engine check shown in the following flow chart, the location causing the problem can be found quickly and efficiently. Therefore, use of this check is essential in engine troubleshooting.

1 **Is Battery voltage 11 V or more when engine is stopped?**

YES

NO → **Change or replace battery.**

2 **Does engine crank?**

YES

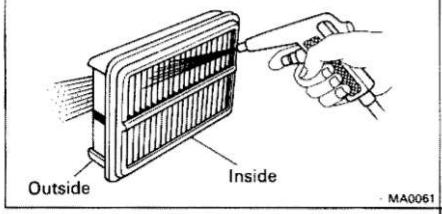
NO → **Go to Matrix Chart of Problem Symptoms (See page TR–21).**

3 **Does engine start?**

YES

NO → **Go to step [8].**

4 **Check air filter.**



P Remove air filter.

C Visually check if the air cleaner element is not excessively damaged or oily.

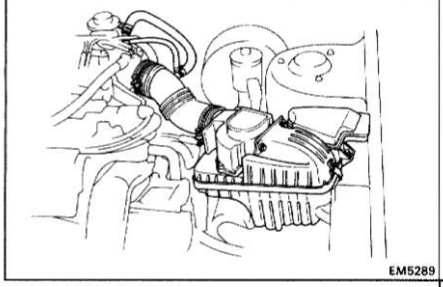
Hint If necessary, clean the element with compressed air. First blow from inside thoroughly, then blow off outside of element.

OK

NG → **Replace air cleaner element.**

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5 Is air leaking into intake air system?



C Is air leaking into air intake system?

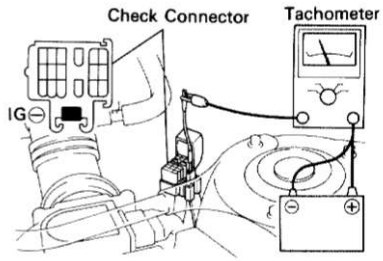
Hint Loose or missing engine oil dipstick, oil filler cap, PCV hose, etc., can allow air to leak into air intake system, causing mixture to become too lean.

OK No air leaking into air intake system between air flow meter and cylinder head.

OK

NG → **Repair air leakage.**

6 Check idle speed.



P
(1) Shift transmission into “N” range.
(2) Warm up engine at normal operating temperature.
(3) Switch off all accessories
(4) Switch off air conditioner.
(5) Connect tachometer test probe to terminal IG (–) of check connector.

C Check idle speed.

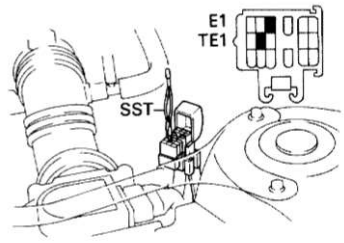
OK Idle speed: 700 ± 50 rpm

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

OK

NO → **Go to Matrix Chart of Problem Symptoms (See page TR–21).**

7 Check ignition timing.

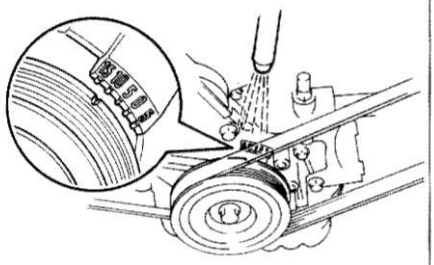


P
(1) Connect timing light to engine.
(2) Keep engine at idle.
(3) Using SST, connect terminals TE1 and E1 of check connector.

SST 09843–18020

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7 Check ignition timing (Cont'd).

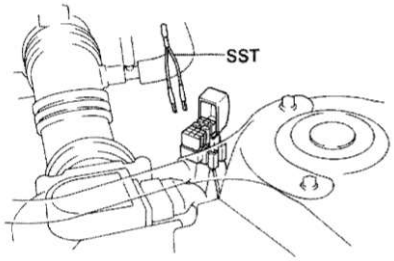


C Check ignition timing using a timing light.

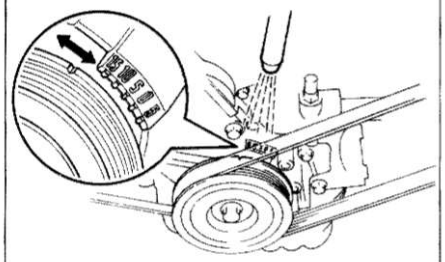
OK Ignition timing: 10° BTDC at idle.

Hint Transmission into "N" range.

FURTHER CHECK



P Disconnect SST.



C Check if the ignition timing advances using a timing light.

OK Ignition timing: The timing mark moves in a range between 13° and 27°.

Hint Transmission into "N" range.

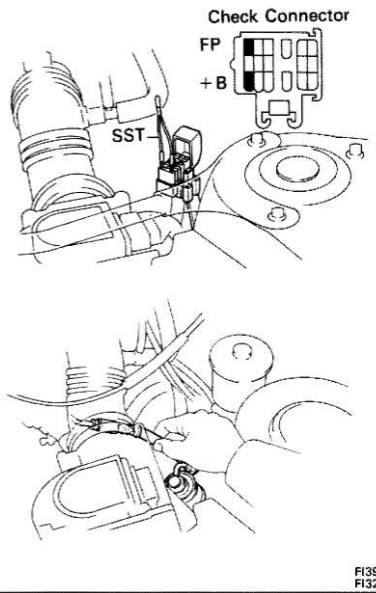
IG0935
FI3986
IG0943

NG > **Adjust ignition timing (See page IG–12).**

Go to Matrix Chart of Problem Symptoms (See page TR–21).

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8 Check fuel pressure.



FI3988
FI3214

P (1) Be sure that fuel is enough in tank.
(2) Turn ignition switch ON.
(3) Using SST, connect terminals +B and FP of check connector.
SST 09843–18020

C Check if there is a pressure in hose from fuel filter by pinching hose by fingers.

Hint At this time, you will hear fuel return noise.

OK Fuel pressure can be felt.

OK

NG → Go to EFI SYSTEM (See page FI–15).

9 Check for spark.

OK

NG → Go to IGNITION SYSTEM (See page IG–1).

Go to Matrix Chart of Problem Symptoms (See page TR–21).

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MATRIX CHART OF PROBLEM SYMPTOMS

When the malfunction code is not confirmed in the diagnostic code check and the problem still can not be confirmed in the basic inspection, then proceed to this step and perform troubleshooting according to the number in order given in the table below.

The circuits indicated by * on the matrix chart can be inspected using the TCCS checker.

HINT: Before proceeding with troubleshooting using this matrix chart of problem symptoms, basic inspection on page TR–19 should be performed first.

	See page	TR–26	TR–29	TR–44	TR–40	TR–42	TR–52	TR–59	TR–63 TR–86	TR–69	TR–71	TR–81	TR–81	FI–15	FI–25	FI–35	FI–27	FI–22 FI–48
	Suspect area	※ RPM Signal Circuit	Ignition Circuit	※ Main Oxygen Sensor Circuit	※ Water Temp. Sensor Circuit	Intake Air Temp. Sensor Circuit	Sub-oxygen Sensor Circuit	※ Air Flow Meter Circuit	※ Throttle Position Sensor Circuit	※ STA Signal Circuit	Knock Sensor Circuit	※ NSW Signal Circuit	A/C Signal Circuit	Fuel Pump	Fuel Pressure Regulator	Fuel Lines	Injectors	Cold Start System
	Symptom																	
Does not start	Engine does not crank																	
	Starter runs – engine does not crank																	
	No initial combusion	12	2					5						6				13
	No complete combusion				4			1							3		9	10
Difficult to start	Engine cranks slowly												2					
	Difficult to start ordinaly	12	13		4	14								7	6	8	16	17
	Difficult to start in cold				1	6				2				8	7	9	10	5
	Difficult to start in hot				1	5								8	7	9	10	6
Poor idling	Incorrect first idle				3													
	High engine idle speed				3	5			6			8	7				9	10
	Low engine idle speed				1			4									5	
	Rough idling		18		2			12						7	6	8	16	17
	Misfire		4		6			8									9	10
Poor drivability	Hesitation Poor acceleration			12	10	11		9	8					14	13	15	18	19
	Back fire			6	3	7		5	4					9	8	10	11	
	Muffler explosion (after fire)			8	3	7		5	6						4		9	10
	Serging														1		4	
	Knocking										1							
Engine stall	Engine stall soon after starting				8			7						3	2	4	9	10
	After acceleration pedal depressed							1	3						5	6	7	
	After acceleration pedal released							3										
	During A/C operation												1					
	When N to D shift											1						
Others	Poor fuel economy			21	16	22	23	18	17			19	20				14	15
	Engine overheat										9							
	Engine overcool																	
	Excessive oil consumption																	
	Low oil pressure																	
	High oil pressure																	
	Starter keeps running																	
	Battery often discharge																	

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	See page	FI–43	FI–46	FI–47	FI–60	FI–51	FI–56	BE–117	–	–	CO–1	LU–1	ST–18	AT–155 ST–18	ST–1	IG–6	IG–9	EC–10
	Parts Name	Idle Speed Control Valve	EFI Main Relay	Circuit Opening Relay	Fuel Cut System	Fuel Pressure Control System	Engine and ECT ECU	Theft Deterrent ECU	Fuel Quality	Fuel Leakage	Coolant Leakage	Oil Leakage	Starter Relay	Neutral Start SW or Clutch Start SW	Starter	Spark Plug	Distributor	EGR System
	Trouble																	
Does not start	Engine does not crank							4					1	3	2			
	Starter runs–engine does not crank														1			
	No initial combusion	8	3	4			14		7								1	
	No complete combusion	2					11											
Difficult to start	Engine cranks slowly														1			
	Difficult to start ordinaly	3					18		1							2	15	5
	Difficult to start in cold	4					11		3									
	Difficult to start in hot	3				4	11		2									
Poor idling	Incorrect first idle	4					5											
	High engine idle speed	4					11											
	Low engine idle speed	2					6											3
	Rough idling	9					19		1							4	5	3
	Misfire						11		1							3	5	2
Poor drivability	Hesitation Poor acceleration						20		3							5	6	4
	Back fire						12											1
	Muffler explosion (after fire)				1		11											
	Serging						5									2	3	
	Knocking						10		2							3		4
Engine stall	Engine stall soon after starting	6					11		1									5
	After acceleration pedal depressed						8									4		2
	After acceleration pedal released	1					4										2	
	During A/C operation	2					3											
	When N to D shift	2					3											
Others	Poor fuel economy				8		24		2	1						9	10	7
	Engine overheat										1					8		
	Engine overcool																	
	Excessive oil consumption											1						
	Low oil pressure											1						
	High oil pressure																	
	Starter keeps running												1		2			
	Battery often discharge																	

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							3														1	1									Accelerator Pedal Link	–
							6										2														Brakes drag even when released	–
					1	2							7																		Cooling Fan System	CO–19
							4														2	2									Dash Pot	EC–8
							5										1														Clutch	CL–1
				3			11										7	7	10						9		5	9			Compression	EM–14
																	16		13												Valve Clearance	EM–8
						7	13						5		2	2	17		14						11		7	10			Valve Timing	EM–27
						5													15								8	11			Timing Belt	EM–15
						6							9																		Water Pump	CO–6
				2																											Valve Stem Guide Bushing	EM–39
		1	2			10																									Oil Pump	LU–8
			3																							3					Connecting Rod Bearing	EM–86
			4																							4					Crankshaft Bearing	EM–69
				5		11													20												Cylinder Head	EM–29
				4			12												11						10		6				Piston Ring	EM–78
																													2		Flywheel or Drive Plate	–
						3							6																		Radiator and Radiator Cap	CO–11
					2	4							8																		Thermostat	CO–9
1																															Drive Belt	CH–5
					3	13																									Water Temp. Sender Gauge	BE–47
		2	5																												Oil Plessure Switch	BE–48
2																															Alternator	CH–8
				6		12																									Cylinder Block	EM–61

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CIRCUIT INSPECTION

Diag. Code	12	RPM Signal

CIRCUIT DESCRIPTION

The distributor in the Engine Control System contains three pick–up coils (G1, G2 and Ne).
The G1, G2 signals inform the ECU of the standard crankshaft angle.
The Ne signals inform the ECU of the crankshaft angle and the engine speed.

Code No.	Diagnosis	Trouble Area
12	No NE or G signal is sent to the ECU for 2 sec. or more after STA turns ON.	· Open or short in NE, G circuit · Distributor · Open or short in STA circuit · ECU

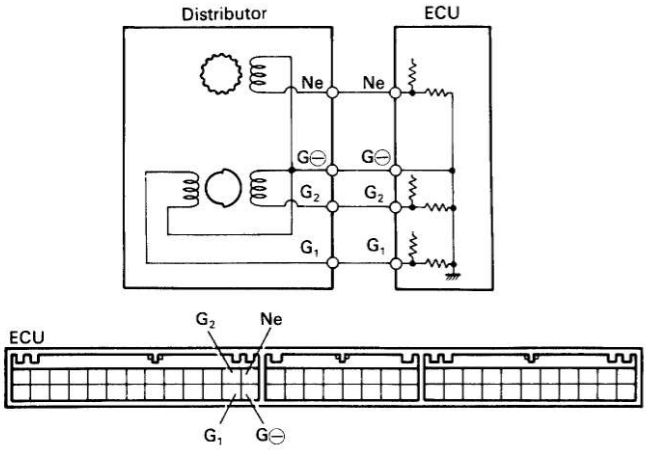
DIAGNOSTIC CHART

1. Does engine crank?
   - NG → Go to Matrix Chart of Problem Symptom (See page TR–23).
   - OK ↓
2. Check air gap.
   - NG → Replace distributor.
   - OK ↓
3. Check pickup coils in distributor.
   - NG → Replace distributor.
   - OK ↓
4. Check resistance of pickup coils at ECU connector.
   - NG → Check and repair harness and connector between ECU and distributor.
   - OK ↓

Replace ECU.

* When diag code 12 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–23).

WIRING DIAGRAM AND ECU CONNECTORS



FI4768
FI4614

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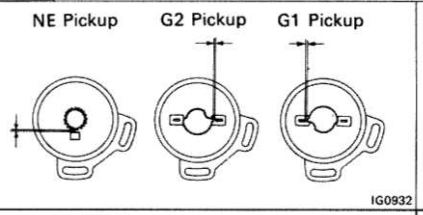
INSPECTION PROCEDURE

1 Does engine crank?

OK

NG → Go to Matrix Chart of Problem Symptom (See page TR–21).

2 Check air gap.



P Remove distributor cap.

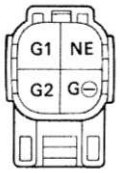
C Using a thickness gauge, measure the gap between signal rotor projection and pickup coil.

OK Air gap: 0.2 mm (0.008 in) or more

OK

NG → Replace distributor.

3 Check pickup coils in distributor.



P Disconnect distributor connector.

C Using an ohmmeter, measure resistance between each terminal shown in table below.

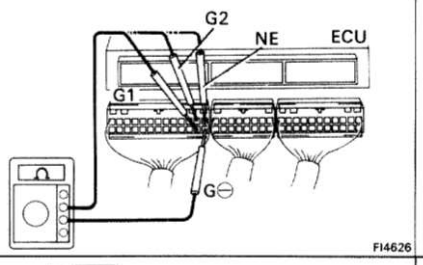
OK

Coil	Terminals	Resistance
G1 pickup coil	G1 – G⊖	140 – 180Ω
G2 pickup coil	G2 – G⊖	140 – 180Ω
NE pickup coil	NE – G⊖	140 – 180Ω

OK

NG → Replace distributor.

4 Check resistance of pickup coils at ECU connector.



P (1) Connect distributor connector.
(2) Turn ignition switch LOCK.
(3) Disconnect ECU wiring connectors from ECU.

C Using an ohmmeter, measure resistance between each terminal shown in table below:

OK

Coil	Terminals	Resistance
G1 pickup coil	G1 – G⊖	140 – 180Ω
G2 pickup coil	G2 – G⊖	140 – 180Ω
NE pickup coil	NE – G⊖	140 – 180Ω

OK

NG → Check and repair harness and connector between ECU and distributor.

Replace ECU. *

* However, when diag. code 12 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–21).

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Diag. Code	13	RPM Signal

CIRCUIT DESCRIPTION

The distributor in the Engine Control System contains three pick–up coils (G1, G2 and Ne).
The G1, G2 signals inform the ECU of the standard crankshaft angle.
The Ne signals inform the ECU of the crankshaft angle and the engine speed.

Code No.	Diagnosis	Trouble Area
13	NE signal not input to ECU for 50 msec. or more when engine speed is 1,000 rpm or more.	· Open or short in NE circuit · Distributor · ECU

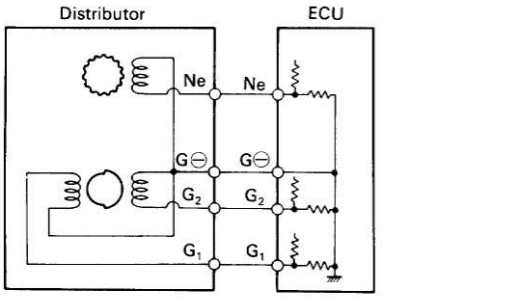
DIAGNOSTIC CHART

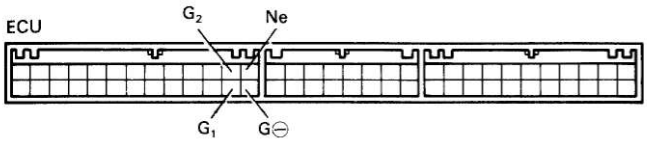
This code indicates that a momentary interruption of the RPM signal from the distributor to the ECU has occurred, but that it is returned to normal. Note that although this problem may not necessarily appear at the time of inspection, it cannot be ignored because this diagnostic code is output, indicating that there is or was a malfunction in the RPM signal circuit; this “malfunction” is usually a loose connector.
The distributor connector and the Ne terminal of the ECU connector must therefore be checked for the following:

1. Loose connectors
2. Dirty connector terminals
3. Loose connector terminals

(See page TR–12)

WIRING DIAGRAM AND ECU CONNECTORS



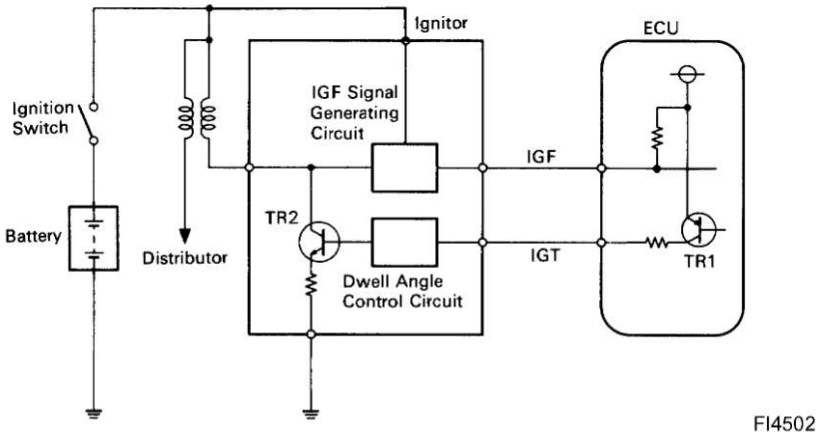


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Diag. Code	14	Ignition Signal

CIRCUIT DESCRIPTION

The ECU determines the ignition timing, turns on TR1 at a predetermined angle before the desired ignition timing, and outputs an ignition signal (IGT) "1" to the ignitor. Since the length of the IGT signal is constant, the dwell angle control circuit in the ignitor determines the time the control circuit starts primary current flow to the ignition coil based on the engine rpm and ignition timing in one revolution ago, that is, the time the TR2 turns on. When it reaches the ignition timing, the ECU turns TR1 off and outputs the IGT signal "0". This turns TR2 off, interrupting the primary current flow and generating a high voltage in the secondary coil which causes the spark plug to spark.
Also, by the counter electromotive force generated when the primary current is interrupted, the ignitor sends an ignition confirmation signal (IGF) to the ECU.
The ECU stops fuel injection as a fail safe function when the IGF signal is not input to the ECU.

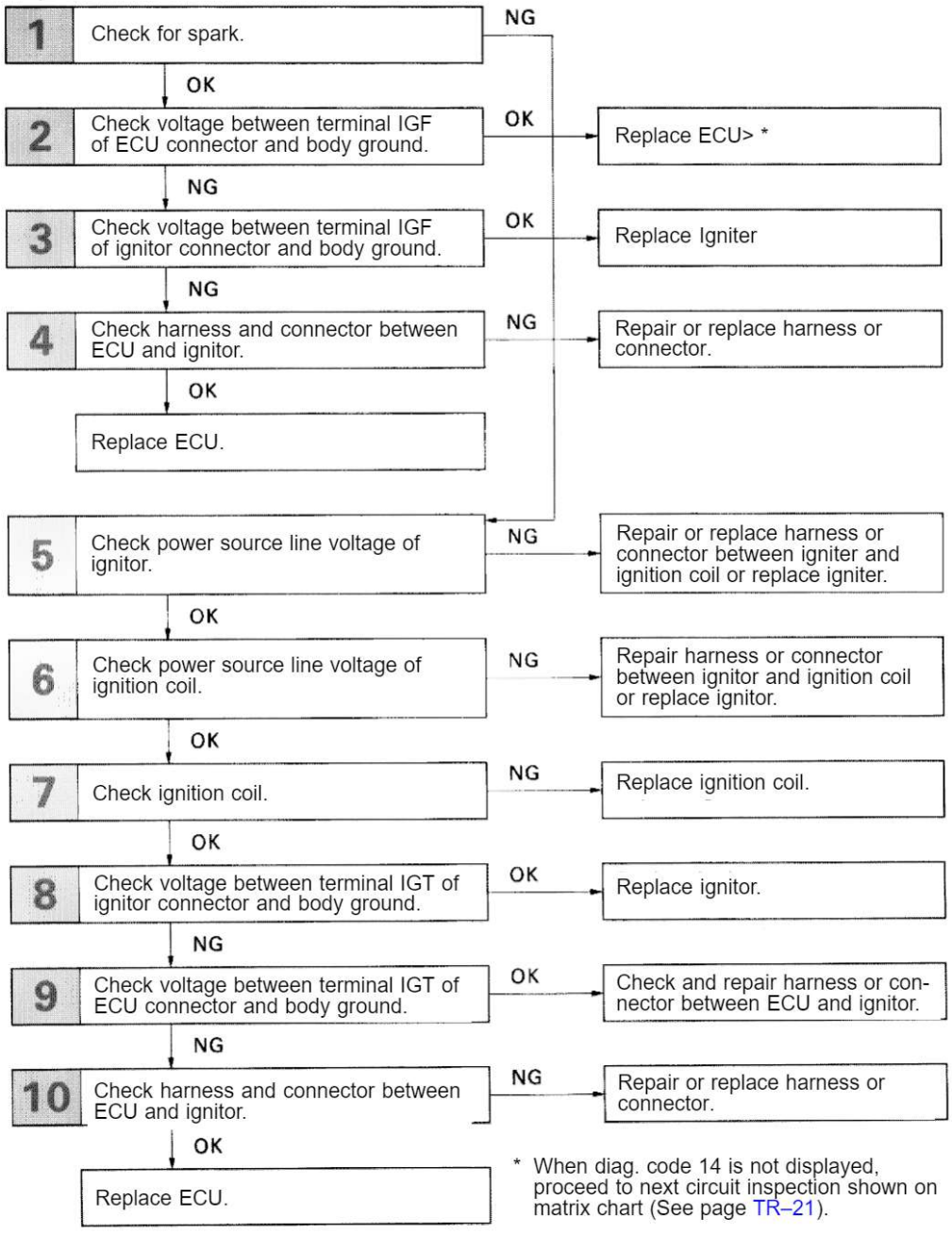


FI4502

Code No.	Diagnosis	Trouble Area
14	IGF signal from igniter is not input to ECU for 6 consecutive ignition.	· Open or short in IGF or IGT circuit from igniter to ECU. · Igniter · ECU

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DIAGNOSTIC CHART

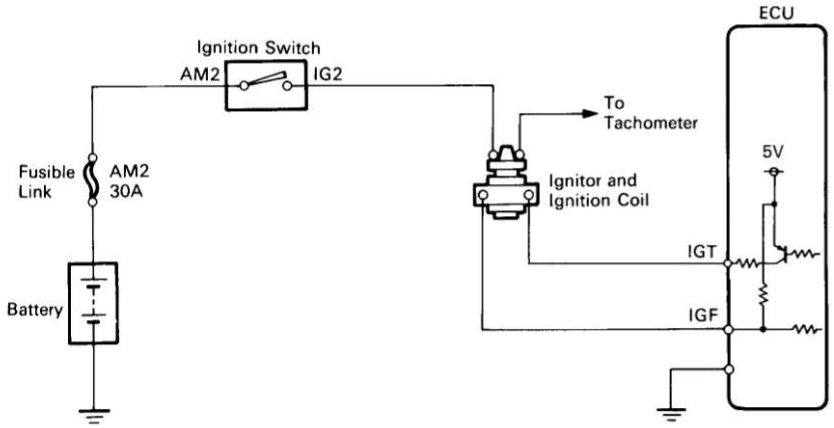


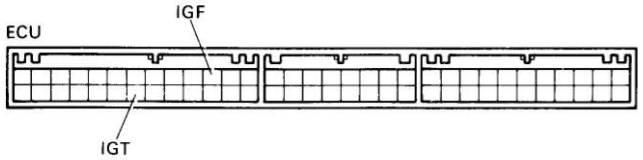
* When diag. code 14 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–21).

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DIAGNOSTIC CHART

WIRING DIAGRAM AND ECU CONNECTORS





FI4769
FI4614

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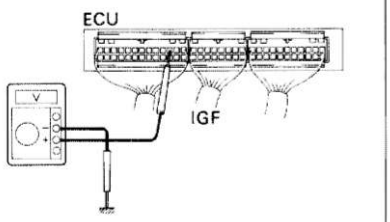
INSPECTION PROCEDURE

1 Check for spark.

OK → Go to step [5].

NG

2 Check voltage between terminal IGF of ECU connector and body ground.

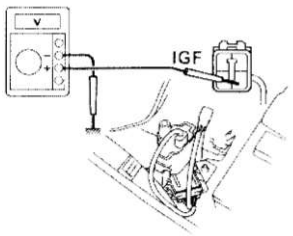


C Measure voltage between terminal IGF of ECU connector and body ground, both with ignition switch ON but engine not cranking, and with engine cranking.

OK Voltage: Approx. 1.0V for both conditions

NG → OK → Replace ECU. *

3 Check voltage between terminal IGF of ignitor connector and body ground.



P (1) Disconnect ignitor connector.
(2) Turn ignition switch ON.

C Measure voltage between terminal IGF of ignitor connector and body ground.

OK Voltage: 5V

NG → OK → Replace ignitor.

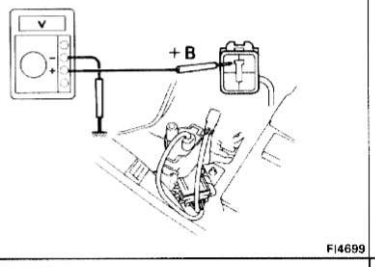
4 Check harness and connector between ECU and ignitor.

OK → NG → Repair or replace harness or connector.

Replace ECU.

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5 Check power source line voltage of ignitor.



P (1) Disconnect ignitor connector.
(2) Turn ignition switch ON.

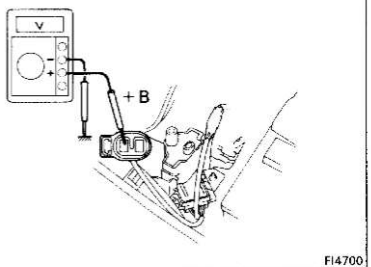
C Measure voltage between terminal +B of ignitor connector and body ground.

OK Voltage: Battery voltage

OK

NG **Repair or replace harness or connector between ignitor and ignition switch.**

6 Check power source line voltage of ignition coil.



P (1) Connect ignitor connector.
(2) Disconnect ignition coil connector.
(3) Turn ignition switch ON.

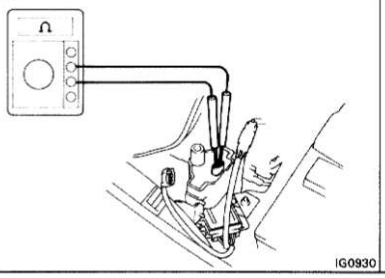
C Measure voltage between terminal +B of ignition coil connector and body ground.

OK Voltage: Battery voltage

OK

NG **Repair harness or connector between ignitor and ignition coil or replace ignitor.**

7 Check ignition coil.



CHECK PRIMARY COIL RESISTANCE

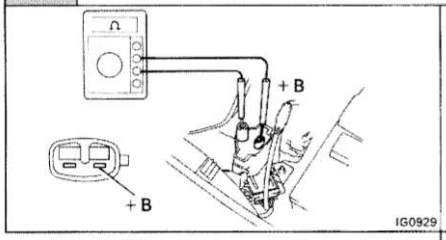
C Measure voltage between terminal +B and E of ignition coil connector.

OK Primary coil resistance (cold): 0.41 – 0.50 Ω

* However, when diag. code 14 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–23).

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7 Check ignition coil. (cont'd)



CHECK SECONDARY COIL RESISTANCE

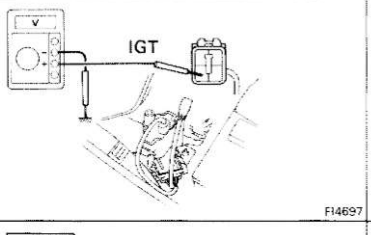
C Measure resistance between terminal +B and high tension terminal of ignition coil.

OK Secondary coil resistance (cold): 10.2 – 13.8 Ω

OK

NG → Replace ignition coil.

8 Check voltage between terminal IGT of ignitor connector and body ground.



P (1) Connect ignition coil connector.
(2) Disconnect ignitor connector.

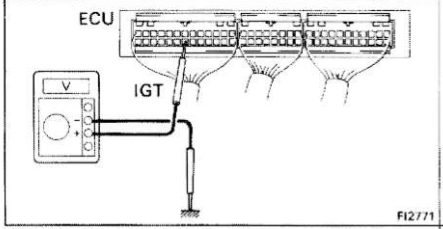
C Measure voltage between terminal IGT of ignitor connector and body ground when engine is cranked.

OK Voltage: Approx. 1.0V
(Neither 0V nor 5V)

NG

OK → Replace ignitor.

9 Check voltage between terminal IGT of ECU connector and body ground.



C Measure voltage between terminal IGT of ECU connector and body ground when engine is cranked.

OK Voltage: Approx. 1.0V
(Neither 0V nor 5V)

NG

OK → Check and repair harness or connector between ECU and ignitor.

10 Check harness and connector between ECU and ignitor.

OK

NG → Repair or replace harness or connector.

Replace ECU.

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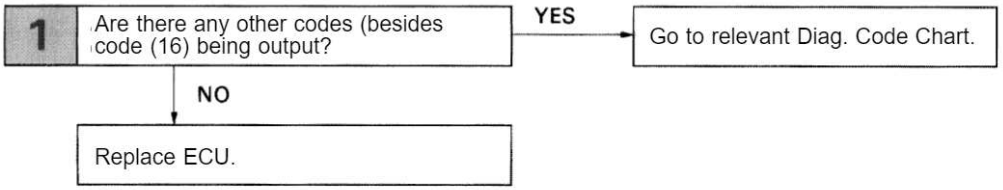
Diag. Code	16	ECT Control Signal

CIRCUIT DESCRIPTION

Code No.	Diagnosis	Trouble Area
16	Normal signal is not output from ECU of ECT.	• ECU

When the ECU stores diagnostic code 16 in memory, torque control which performs smooth gear shifting is prohibited.

DIAGNOSTIC CHART



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Diag. Code	21	Main Oxygen Sensor and Heater Signal

CIRCUIT DESCRIPTION

The main oxygen sensor is located in the exhaust manifold. It indirectly determines whether the fuel mixture is rich or lean by detecting the concentration of oxygen present in the exhaust gas.
The main oxygen sensor is provided with a heater. The heater is controlled by the ECU. When the intake air volume is low (the temperature of the exhaust gas is low) current flows to the heater to heat the sensor for accurate detection.

Code No.	Diagnosis	Trouble Area
21	(1) Open or short in heater circuit of main oxygen sensor for 0.5 sec. or more (HT).	• Open or short in heater circuit of main oxygen sensor • Main oxygen sensor heater • ECU
	(2) At normal driving speed (below 60 mph and engine speed is above 1,500 rpm), amplitude of oxygen sensor signal (OX1) is reduced to between 0.35–0.70 V continuously for 60 sec. or more (2 trip detection logic)*	• Open or short in main oxygen sensor circuit • Main oxygen sensor • ECU

*: See page TR–13.

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CIRCUIT DESCRIPTION (Cont'd)

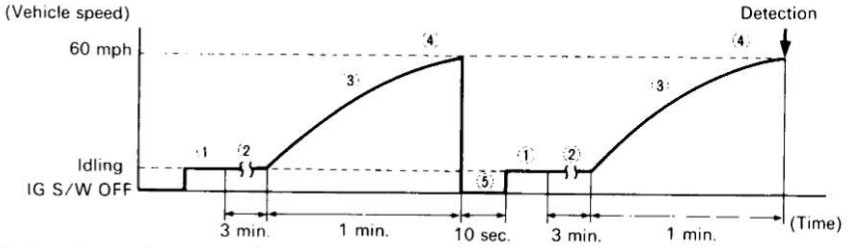
DIAGNOSIS CODE DETECTION DRIVING PATTERN

Purpose of the driving patten.

(a) After the diag. code is erased, the malfunction is reproduced and the diag. code is recorded again.
(b) To check that the malfunction is cleared once the repair is completed (confirm that diag. code is no longer detected).

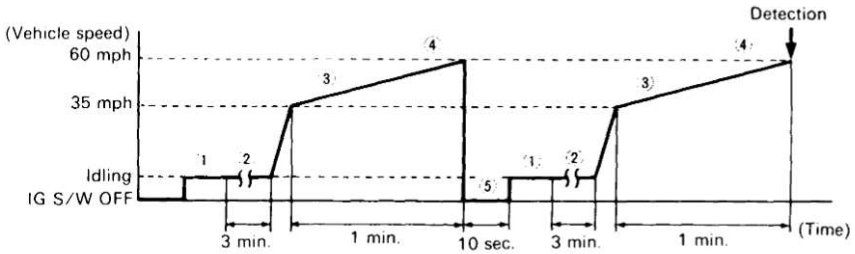
Malfunction: Deterioration of Main Oxygen Sensor

For A/T Vehicle



(1) Start engine and warm engine up.
(2) After engine is warmed up, let it idle for 3 min.
(3) With the A/C ON and the transmission in D range (O/D ON), perform gradual acceleration with in the range 1,800–2,200 rpm (Centered around 2,000 rpm).
(Take care that the engine speed does not fall below 1,200 rpm when shifting. Gradually depress the accelerator pedal and kept it. Steady so that engine braking does not occur.)
(4) Keep vehicle speed below 60 mph.
(5) Stop the vehicle, then 10 sec. or more after turning IG switch to OFF (not Acc), perform (1), (2), (3), (4) again.

For M/T Vehicle



(1) Start engine and warm engine up.
(2) After engine is warmed up, let it idle for 3 min.
(3) With the A/C ON and vehicle speed approx. 35 mph, shift into 4th gear and gradually accelerate so that engine speed does not drop below, 1,500 rpm (Keep the accelerator pedal position constant to avoid engine braking).
(4) Keep vehicle speed below 60 mph.
(5) Stop the vehicle, then 10 sec. or more after turning IG switch to OFF (not Acc), perform (1), (2), (3), (4) again.

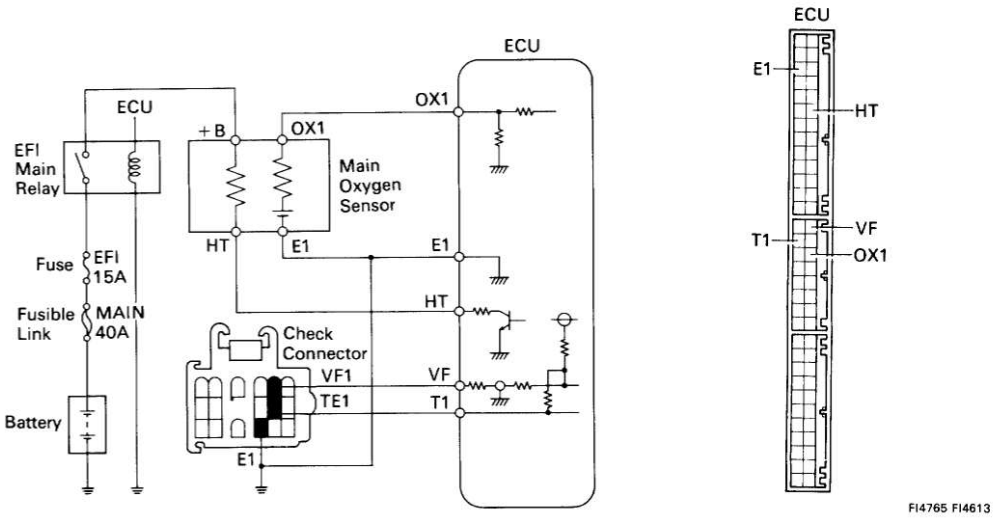
NOTICE: If the conditions in this test are not strictly observed, detection of the malfunction will not be possible.

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DIAGNOSTIC CHART

1	Check main oxygen sensor.	NG	Replace main oxygen sensor.
	OK		
2	Disconnect ECU connector and check voltage between terminal HT ECU connector and body ground.	NG	Check and repair harness and connector between ECU and EFI main relay.
	OK		
3	Check voltage between terminal HT of ECU connector and body ground.	NG	Replace ECU.
	OK		
	Replace main oxygen sensor.		

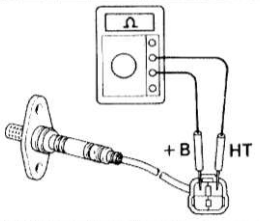
WIRING DIAGRAM AND ECU CONNECTORS



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INSPECTION PROCEDURE

1 Check main oxygen sensor heater.



P Disconnect main oxygen sensor connector.

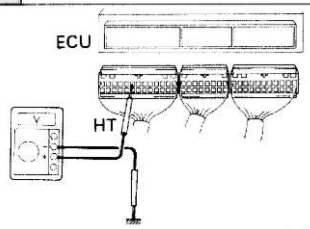
C Measure resistance between terminals +B and HT of main oxygen sensor connector.

OK Resistance: 5.1 – 6.3 Ω at 20°C (68°F)

OK

NG Replace main oxygen sensor.

2 Disconnect ECU connector and check voltage between terminal HT of ECU connector and body ground.



P (1) Connect main oxygen sensor connector.
(2) Disconnect ECU connector.
(3) Turn ignition switch ON.

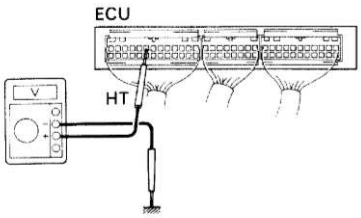
C Measure voltage between terminal HT of ECU connector and body ground.

OK Voltage: Battery voltage

OK

NG Check and repair harness and connector between ECU and EFI main relay.

3 Check voltage between terminal HT of ECU connector and body ground.



P (1) Turn ignition switch LOCK.
(2) Connect ECU connector.
(3) Warm up engine at normal operating temperature.

C Measure voltage between terminal HT of ECU connector and body ground, when engine is idling and racing at 4000 rpm.

OK

Engine rpm	Voltage
Idling	Approx. 0 V
4000 rpm	Battery voltage

Hint In the above check, continue racing engine at 4000 rpm for approx. 20 seconds or more.

OK

NG Replace ECU.

Replace main oxygen sensor.

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Diag. Code	22	Water Temp. Sensor Signal

CIRCUIT DESCRIPTION

The water temperature sensor senses the coolant temperature. The resistance value of a thermistor built in the sensor changes according to the coolant temperature. The lower the coolant temperature, the larger the resistance value becomes.
If diagnostic code 22 is recorded in memory, the fail safe function operates and fixes the coolant temperature at a constant 80°C (176°F).

Code No.	Diagnosis	Trouble Area
22	Open or short in water temp. sensor circuit for 0.5 sec. or more (THW).	• Open or short in water temp. sensor circuit. • Water temp. sensor • ECU

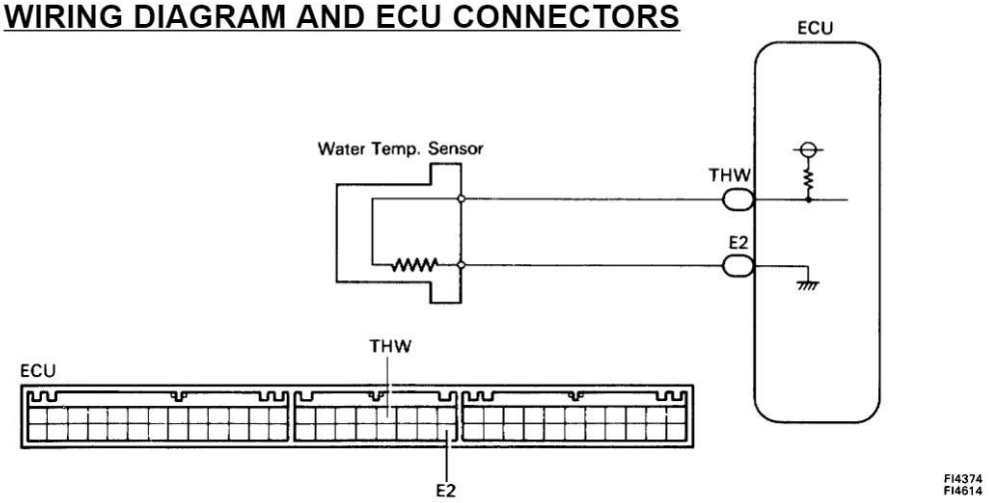
DIAGNOSTIC CHART

1. Check water temp. sensor. — NG → Replace water temp. sensor.
   OK ↓
2. Check voltage between terminals THW and E2 of ECU connector. — OK → Replace ECU. *
   NG ↓
3. Check harness and connector between ECU and water temp. sensor. — NG → Repair or replace harness or connector.
   OK ↓

Replace ECU.

* When diag. code 22 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–23).

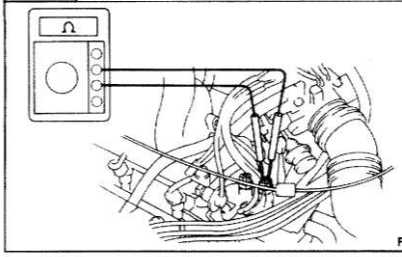
WIRING DIAGRAM AND ECU CONNECTORS



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INSPECTION PROCEDURE

1 Check water temp sensor.



P Disconnect water temp. sensor connector.

C Using an ohmmeter, measure resistance between both terminals.

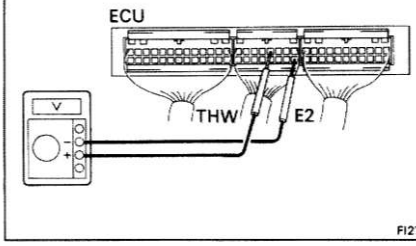
OK

Water temp. °C (°F)	Resistance
20 (68)	2 – 3 kΩ
80 (176)	0.2 – 0.4 kΩ

OK

NG → Replace water temp. sensor.

2 Check voltage between terminals THW and E2 of ECU connector.



P (1) Connect water temp. sensor connector.
(2) Turn ignition switch ON.

C Measure voltage between terminals THW and E2 of ECU connector.

OK Voltage: Neither 0V nor 5V

NG

OK → Replace ECU. *

3 Check harness and connector between ECU and water temp. sensor.

OK

NG → Repair or replace harness or connector.

Replace ECU.

* When diag. code 22 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–21).

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Diag. Code	24	Intake Air Temp. Sensor Signal

CIRCUIT DESCRIPTION

The intake air temperature sensor is built in the air flow meter and senses the intake air temperature. The resistance value of a thermistor built in sensor changes according to the intake air temperature. The lower the intake air temperature, the larger the resistance value becomes.
If diagnostic code 24 is recorded in memory, the fair safe function operates and fixes the intake air temperature at a constant 20˚C (68˚F).

Code No.	Diagnosis	Trouble Area
24	Open or short in intake air temp. sensor circuit for 0.5 sec. or more (THW).	• Open or short in intake air temp. circuit. • Water temp. sensor • ECU

DIAGNOSTIC CHART

1 Check intake air temp. sensor.
NG → Replace air flow meter.
OK ↓

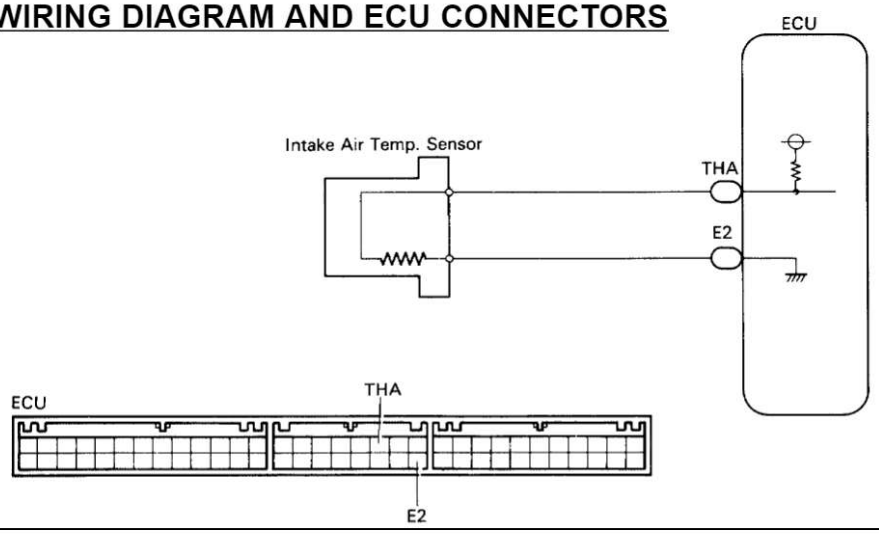
2 Check voltage between terminals THA and E2 of ECU connector.
OK → Replace ECU. *
NG ↓

3 Check harness and connector between ECU and intake air temp. sensor.
NG → Repair or replace harness or connector.
OK ↓

Replace ECU.

* When diag. code 24 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–21).

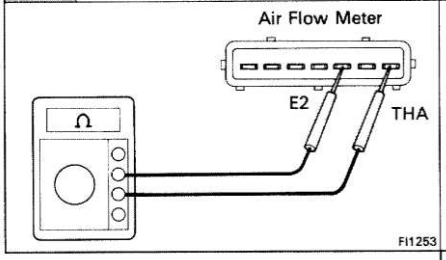
WIRING DIAGRAM AND ECU CONNECTORS



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INSPECTION PROCEDURE

1 Check intake air temp. sensor.



P Disconnect air flow meter connector.

C Using an ohmmeter, measure resistance between terminals THA and E2.

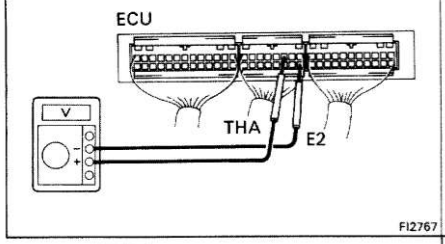
OK

Air temp. °C (°F)	Resistance
0 (32)	4 – 7 kΩ
20 (68)	2 – 3 kΩ

OK

NG → Replace air flow meter.

2 Check voltage between terminals THA and E2 of ECU connector.



P (1) Connect air flow meter connector.
(2) Turn ignition switch ON.

C Measure voltage between terminals THA and E2 of ECU connector.

OK Voltage: Neither 0V nor 5V

NG

OK → Replace ECU. *

3 Check harness and connector between ECU and intake air temp. sensor.

OK

NG → Repair or replace harness or connector.

Replace ECU.

* When diagnostic code 24 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–21).

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Diag. Code	25	Air–fuel Ratio Lean Malfunction
	26	Air–fuel Ratio Rich Malfunction

CIRCUIT DESCRIPTION

The main oxygen sensor is located in the exhaust manifold. It indirectly determines whether the fuel mixture is rich or lean by detecting the concentration of oxygen present in the exhaust gas.

Code No.	Diagnosis	Trouble Area
25	(1) Oxygen sensor output is less than 0.45 V for at least 90 sec. When oxygen sensor is warmed up (racing at 2,000 rpm). *1 (2) When air–fuel ratio feed–back correction value or adaptive control value continues at the upper (lean) or lower (rich) limit for a certain period of time or adaptive control value is not renewed for a certain period of time.	• Engine ground bolt loose • Open in E1 circuit • Open in injector circuit • Fuel line pressure (Injector blockage, etc.) • Open or short in oxygen sensor circuit • Oxygen sensor • Ignition system • Water temp. sensor • Air flow meter (air intake) • Foreign object caught in valve • ECU
26	*1 (3) When marked variation is detected in engine revolutions for each cylinder during idle switch on and feedback condition. (2 trip detection logic)*	• Engine ground bolt loose • Open in E1 circuit • Short in injector circuit • Fuel line pressure (Injector leakage, etc.) • Open or short in cold start injector circuit • Cold start injector • Open or short in oxygen sensor circuit • Oxygen sensor • Water temp. sensor • Air flow meter • Compression pressure • Foreign object caught in valve • ECU

*: See page TR–13.
*1: No. (2) and (3) in the diagnostic contents of codes No. 25 and 26 apply to California specification vehicles only, while (1) applies to all models.

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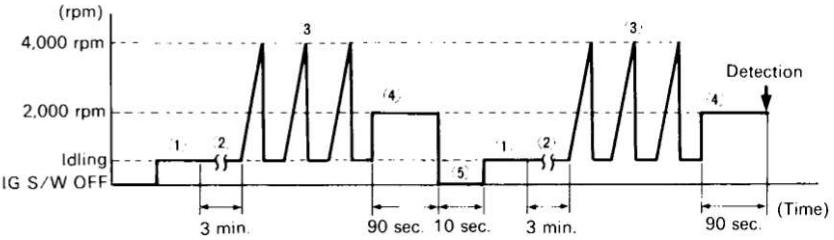
CIRCUIT DESCRIPTION (Cont'd)

DIAGNOSIS CODE DETECTION DRIVING PATTERN

Purpose of the driving patten.

(a) After the diag. code is erased, the malfunction is reproduced and the diag. code is recorded again.
(b) To check that the malfunction is cleared once the repair is completed (confirm that diag. code is no longer detected).

Malfunction: Open or Short in Main Oxygen Sensor



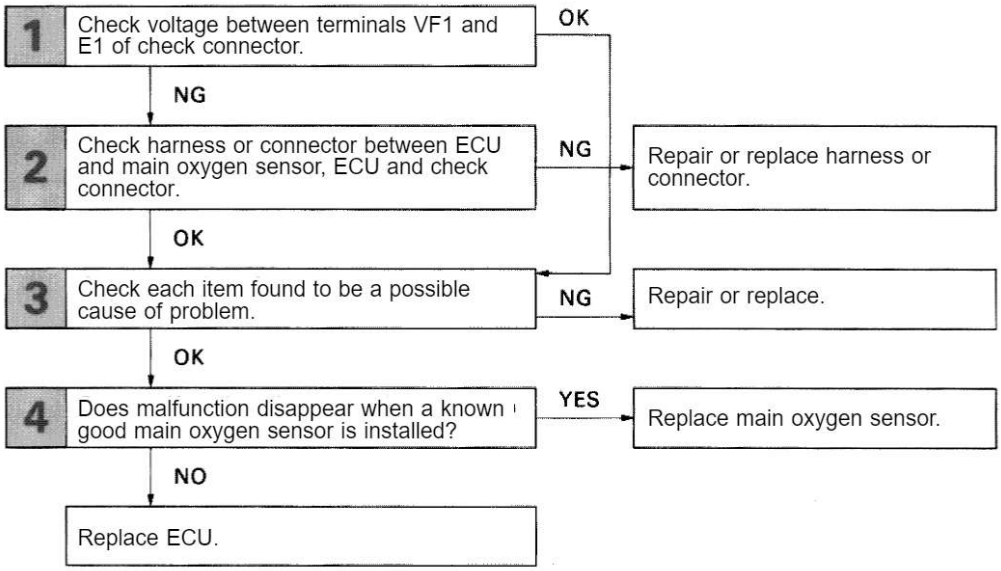
(1) Start engine and warm engine up.
(2) After engine is warmed up, let it idle for 3 min.
(3) Perform sudden racing to 4,000 rpm three times.
(Rapidly depress the accelerator pedal, then remove your foot from the pedal at 4,000 rpm.)
(4) After performing the racing in , perform racing at 2,000 rpm for 90 sec.
(5) Keep the IG switch at OFF (not Acc) for at least 10 sec., then perform (1), (2), (3), (4) again.

NOTICE: If the conditions in this test are not strictly observed, detection of the malfunction will not be possible.

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DIAGNOSTIC CHART

(For vehicles other than for California)



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DIAGNOSTIC CHART

(California specification vehicles)

1 Check voltage between terminals VF1 and E1 of check connector.

- OK → When code 25 is displayed, go to step [**3**].
- OK → When code 26 is displayed, go to step [**5**].
- OK → When codes 25 and 26 are displayed, go to step [**3**].
- NG → When the voltage stays at 5 V, go to step [**5**].
- NG → When needle fluctuates to less than 8 times for every 10 seconds, replace main oxygen sensor.
- NG (Voltage stays at 0 V.)

2 Check harness or connector between ECU and main oxygen sensor, ECU and check connector.

- NG → Repair or replace harness or connector.
- OK

3 Check each item found to be a possible cause of problem.

- NG → Repair or replace.
- OK

4 Does malfunction disappear when a known good main oxygen sensor is installed?

- YES → Replace main oxygen sensor.
- NO → Replace ECU.

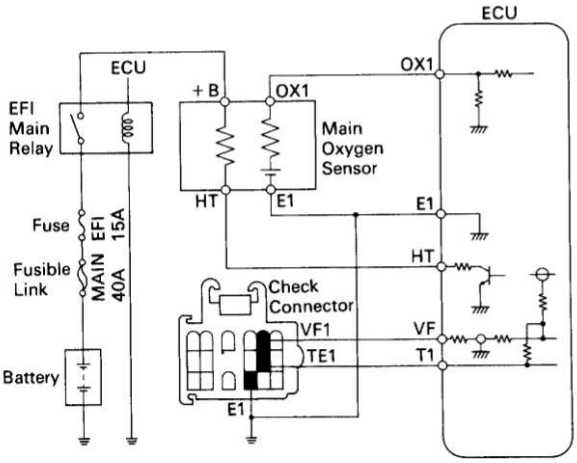
5 Check each item found to be a possible cause of problem.

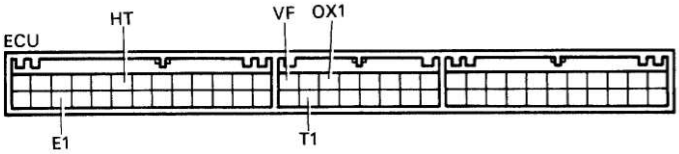
- NG → Repair or replace.
- OK → Replace ECU.

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DIAGNOSTIC CHART

WIRING DIAGRAM AND ECU CONNECTORS



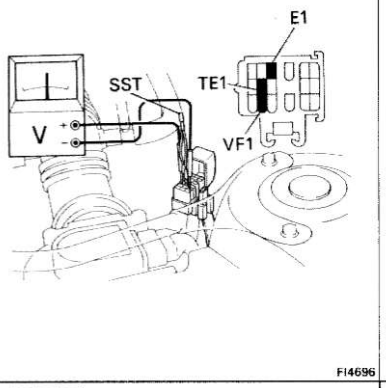


FI4765
FI4614

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INSPECTION PROCEDURE (Vehicles other than for California)

1 Check voltage between terminals THW and E1 of ECU connector.



P Warm up engine at normal operating temperature.

C
(1) Using SST, connect terminals TE1 and E1 of check connector.
SST 09843–18020
(2) Using an analog voltmeter, connect positive prove to VF1 terminal and negative prove to E1 terminal of check connector, and set it to 5–20 V range.
(3) Warm up oxygen sensor by running engine at 2,500 rpm for about 2 minutes.
(4) Then, maintaining engine at 2,500 rpm, count how many times needle of voltmeter fluctuates between 0 and 5 V.

OK Needle fluctuates a minimum of 8 times for every 10 seconds.

NG

OK → Go to step [3].

2 Check harness or connector between ECU and main oxygen sensor, ECU and check connector.

OK

NG → Repair or replace harness or connector.

3 Check each item found to be a possible cause of problem.

Check each item found to be a possible cause of problem.

Check item	See page
Check air leakage.	–
Check installation of main oxygen sensor.	–
Check ignition system (misfire).	IG–1
Check fuel system.	FI–15
Check water temp. sensor (characteristics deviation).	FI–49
Check air flow meter (characteristics deviation).	FI–37
Check intake air temp. sensor (characteristics deviation).	FI–37
Check valve timing (characteristics deviation).	EM–15

OK

NG → Repair or replace.

4 Does malfunction disappear when a known good main oxygen sensor installed?

NO

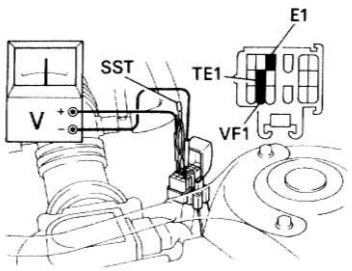
YES → Replace main oxygen sensor.

Replace ECU.

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(California specification vehicles)

1 Check voltage between terminals VF1 and E1 of ECU connector.



P Warm up engine at normal operating temperature.

C
(1) Using SST, connect terminals TE1 and E1 of check connector.
SST 09843–18020
(2) Using an analog voltmeter, connect positive prove to VF1 terminal and negative prove to E1 terminal of check connector, and set it to 5–20 V range.
(3) Warm up oxygen sensor by running engine at 2,500 rpm for about 2 minutes.
(4) Then, maintaining engine at 2,500 rpm, count how many times needle of voltmeter fluctuates between 0 and 5 V.

OK Needle fluctuates a minimum of 8 times for every 10 seconds.

OK → **When code 25 is displayed, go to step [3].**

OK → **When code 26 is displayed, go to step [5].**

OK → **When codes 25 and 26 are displayed, go to step [3].**

NG → **When voltage stays at 5 V, go to step [5].**

NG → **When needle fluctuates less than 8 times for every 10 seconds, replace main oxygen sensor.**

NG (Voltage stays at 0 V)

2 Check harness or connector between ECU and main oxygen sensor, ECU and check connector.

OK

NG → **Repair or replace harness or connector.**

3 Check each item found to be a possible cause of problem.

Check each item found to be a possible cause of problem.

Check item	See page
Check air leakage.	–
Check installation of main oxygen sensor.	–
Check ignition system (misfire).	IG–1
Check fuel system.	FI–15
Check water temp. sensor (characteristics deviation).	FI–49
Check air flow meter (characteristics deviation).	FI–37
Check intake air temp. sensor (characteristics deviation).	FI–37
Check valve timing (characteristics deviation).	EM–15

OK

NG → **Repair or replace.**

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4 **Does malfunction disappear when a known good main oxygen sensor is installed?**

NO

YES → Repair or replace.

Replace ECU

5 **Check each item found to be a possible cause of problem.**

Check each item found to be a possible cause of problem.

Check item	See page
Check fuel system.	FI–15
Check water temp. sensor (characteristics deviation).	FI–49
Check air flow meter (characteristics deviation).	FI–37
Check intake air temp. sensor (characteristics deviation).	FI–37

OK

NG → Repair or replace.

Replace ECU

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Diag. Code	27	Sub–oxygen Sensor Signal (California Only)

CIRCUIT DESCRIPTION

The sub–oxygen sensor is located in the exhaust pipe behind the TWC. It rechecks the exhaust emission level after it is purified by the TWC and feeds the results back to the ECU.

Code No.	Diagnosis	Trouble Area
27	When sub–oxygen sensor is warmed up and apply acceleration with the throttle fully open for 2 seconds, output of main oxygen sensor is 0.45 V or more (rich) and output of sub–oxygen sensor is 0.45 V or less (lean). (OX2) (2 trip detection logic)*	· Short or open in sub–oxygen sensor circuit. · Sub–oxygen sensor · ECU

*: See page TR–13.

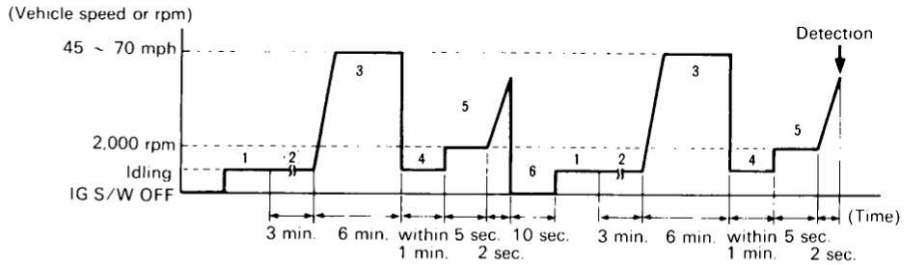
DIAGNOSIS CODE DETECTION DRIVING PATTERN

Purpose of the driving patten.

(a) After the diag. code is erased, the malfunction is reproduced and the diag. code is recorded again.
(b) To check that the malfunction is cleared once the repair is completed (confirm that diag. code is no longer detected).

Malfunction: Open or Short in Sub–Oxygen Sensor

For A/T Vehicle



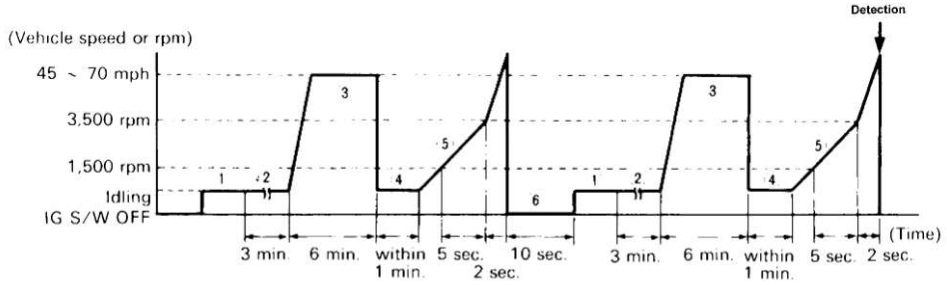
(1) Start engine and warm engine up.
(2) After engine is warmed up, let it idle for 3 min.
(3) With the A/C ON and the transmission in D range (O/D OFF), drive at 45–70 mph for 6 min.
(4) After the driving in , stop the vehicle.
(5) Within 1 min. of stopping the vehicle, shift into 2 range and gradually accelerate for 5 sec. while gradually increasing the engine speed approx. 2,000 rpm. Then, without releasing the accelerator pedal at all accelerate with throttle wide open for 2 sec.
(6) Stop the vehicle, then 10 sec. or more after turning IG switch to OFF (not Acc), perform (1), (2), (3), (4), (5) again.

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CIRCUIT DESCRIPTION (Cont'd)

DIAGNOSIS CODE DETECTION DRIVING PATTERN

For M/T Vehicle

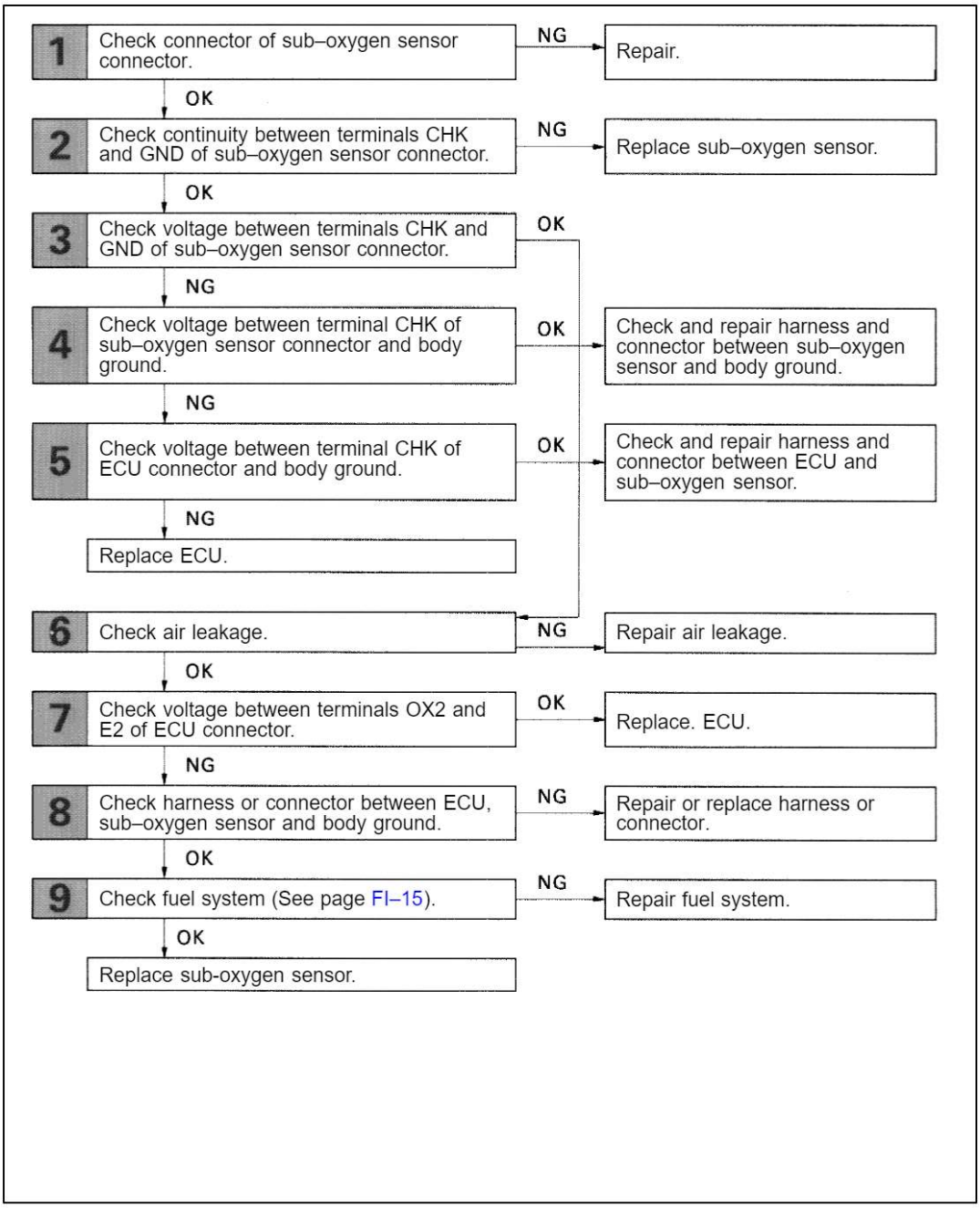


(1) Start engine and warm engine up.
(2) After engine is warmed up, let it idle for 3 min.
(3) With the A/C ON and the transmission in 4th gear, drive at 45–70 mph for 6 min.
(4) After the driving in , stop the vehicle.
(5) Within 1 min. of stopping the vehicle, shift into 2nd gear and gradually accelerate for 5 sec. while gradually increasing the engine speed from 1,500 rpm up to 3,500 rpm. Then, without releasing the accelerator pedal at all, accelerate with throttle wide open for 2 sec.

NOTICE: If the conditions in this test are not strictly observed, detection of the malfunction will not be possible.

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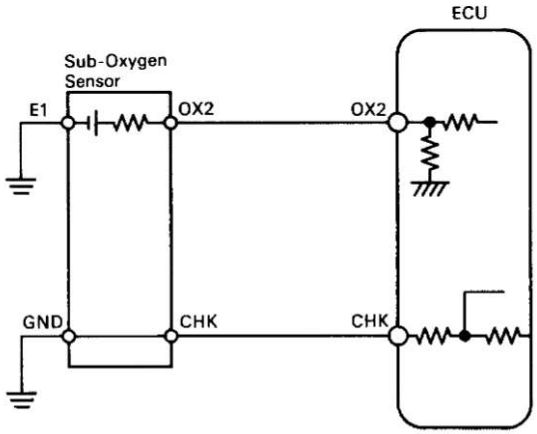
DIAGNOSTIC CHART

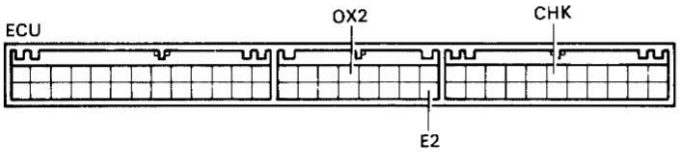


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DIAGNOSTIC CHART

WIRING DIAGRAM AND ECU CONNECTORS





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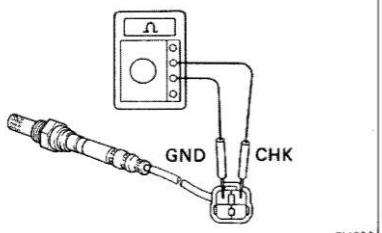
INSPECTION PROCEDURE

HINT: If other codes are output at the same time code No. 27 is output, check the other codes first.

1 Check connection of sub–oxygen sensor connector.

OK → NG: Repair.

2 Check continuity between terminals CHK and GND of sub–oxygen sensor connector.



P Disconnect sub–oxygen sensor connector.

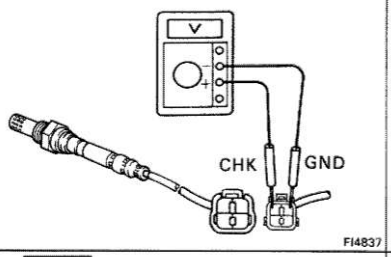
C Check continuity between terminals CHK and GND of sub–oxygen sensor connector.

OK Continuity.

OK

NG: Replace sub–oxygen sensor.

3 Check voltage between terminals CHK and GND of sub–oxygen sensor connector.



P Turn ignition switch ON.

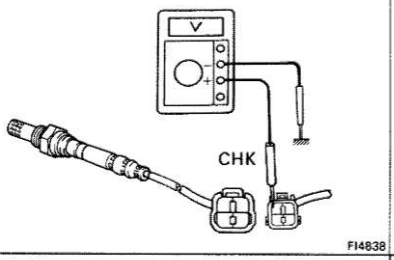
C Measure voltage between terminals CHK and GND of sub–oxygen sensor connector.

OK Voltage: 12V

NG

OK: Go to step [6].

4 Check voltage between terminal CHK of sub–oxygen sensor connector and body ground.



C Measure voltage between terminal CHK of sub–oxygen sensor connector and body ground.

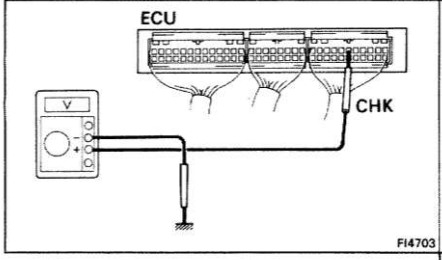
OK Voltage: 12V

NG

OK: Check and repair harness and connector between sub–oxygen sensor and body ground.

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5 Check voltage between terminals CHK of ECU connector and body ground.



P (1) Disconnect sub–oxygen sensor connector.
(2) Turn ignition switch ON.

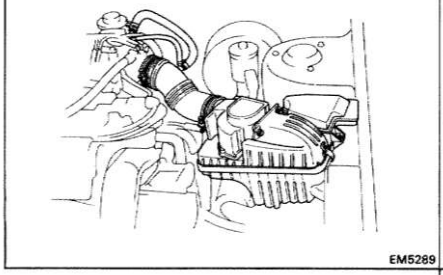
C Measure voltage between terminals CHK of ECU connector and body ground.

OK Voltage: 12V

NG → Replace ECU.

OK → **Check and repair harness and connector between ECU and sub–oxygen sensor.**

6 Check air leakage.



C Check air leakage.

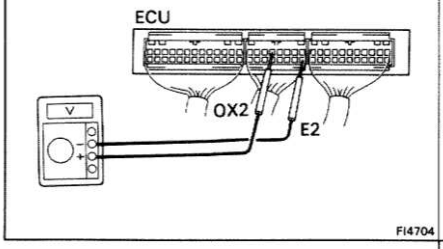
Hint Loose or missing engine oil dipstick, oil filler cap, PCV hose, etc., can allow air to leak into air intake system, causing mixture to become too lean.

OK No air leaking into air intake system between air flow meter and cylinder head.

OK →

NG → **Repair air leakage.**

7 Check voltage between terminals OX2 and E2 of ECU connector.



P (1) Warm up engine at normal operating temperature.
(2) Engine continue racing at 4,000 rpm to approx. 3 minutes.

C Measure voltage between terminals OX2 and E2 of ECU connector when engine is suddenly raced to full throttle.

OK Voltage should be 0.5 V or higher at least once.

NG →

OK → **Replace ECU.**

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8	Check harness or connector between ECU, sub–oxygen sensor, and body ground.		
OK		NG	Repair or replace harness or connector.
9	Check fuel system (See page FI–15).		
OK		NG	Repair fuel system
Replace sub–oxygen sensor.			

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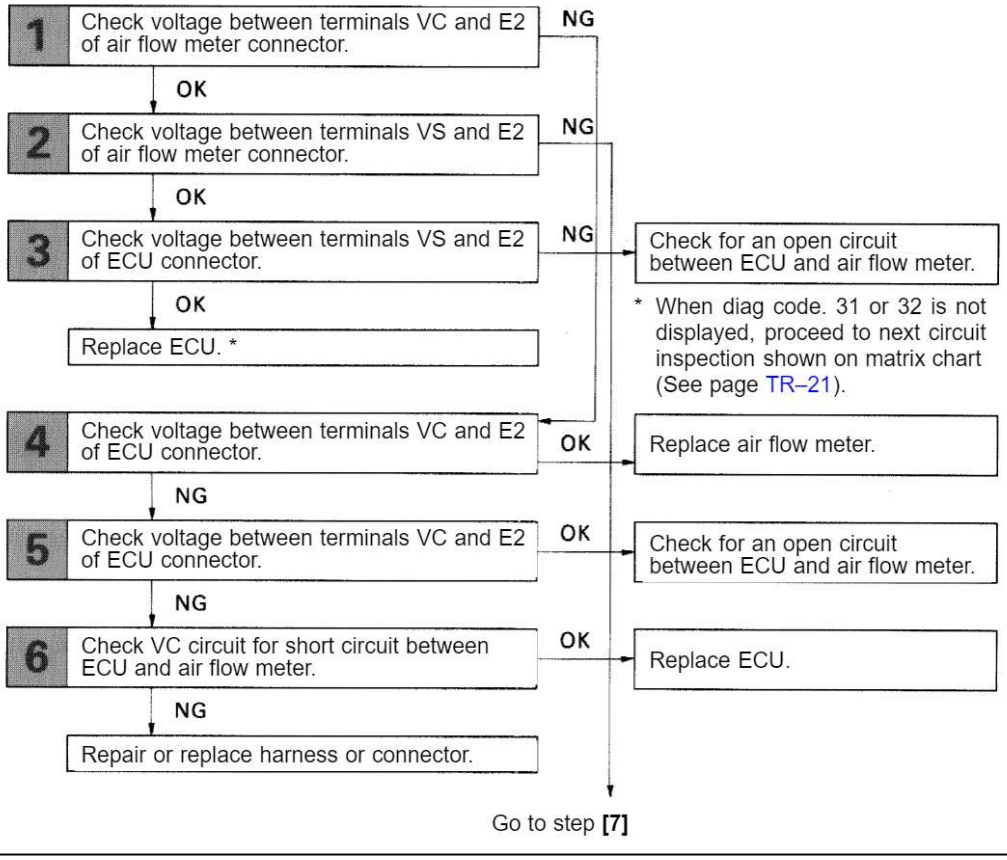
Diag. Code	31 or 32	Air Flow Meter Signal

CIRCUIT DESCRIPTION

The air flow meter is located directly behind the air cleaner, and detects the intake air volume. It converts the intake air readings into a voltage signal by means of a potentiometer. Intake air volume signal is used to calculate the basic injection duration and basic ignition advance angle.

Code No.	Diagnosis	Trouble Area
31	Open circuit in VC signal or short circuit between VS and E2 when idle contacts are closed.	· Open (VC) or short · Sub–oxygen sensor · ECU
32	Open circuit in E2 or short circuit between VC and VS.	· Short or open in sub–oxygen sensor circuit. · Sub–oxygen sensor · ECU

DIAGNOSTIC CHART



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DIAGNOSTIC CHART

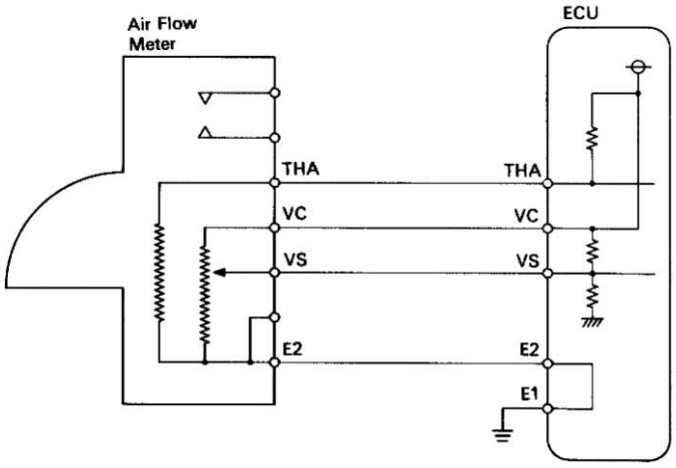
From step 2

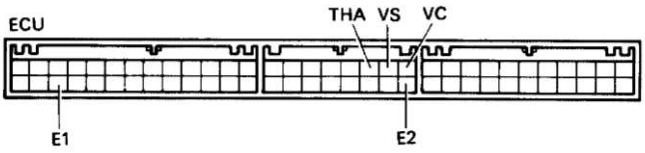
7 Check VS circuit for short circuit between ECU and air flow meter.	OK	Replace ECU.

NG

Repair or replace harness or connector.

WIRING DIAGRAM AND ECU CONNECTORS



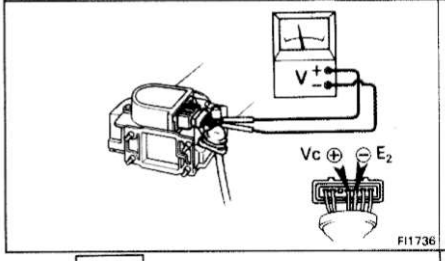


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FI4614

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INSPECTION PROCEDURE

1 Check voltage between terminals VC and E2 of air flow meter connector.



P (1) Carefully remove water–proofing rubber cover of air flow meter connector.
(2) Turn ignition switch ON.

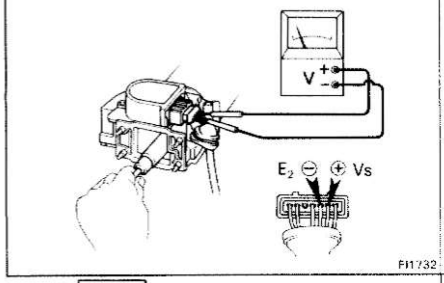
C Measure voltage between terminals Vc and E_2 of air flow meter connector.

OK Voltage: 5V

OK

NG → Go to step [4].

2 Check voltage between terminals VS and E2 of air flow meter connector.



P (1) Turn ignition switch LOCK.
(2) Remove the air cleaner case.
(3) Turn ignition switch ON.

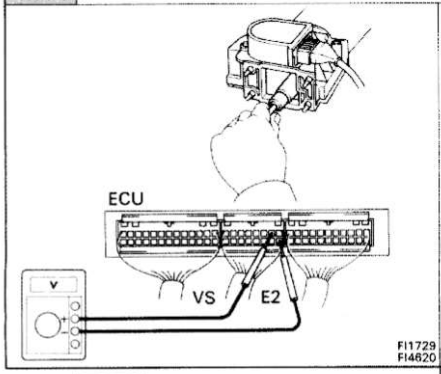
C Check change in voltage between terminals Vs and E_2 of air flow meter connector while slowly pushing air flow meter measuring plate from closed to open position with a screwdriver or similar object.

OK Voltage changes smoothly from about 5V to about 0V; i.e., does not suddenly jump up to 5V or down to 0V.

OK

NG → Go to step [7].

3 Check voltage between terminals VS and E2 of ECU connector.



C Check change in voltage between terminals Vs and E_2 of ECU connector while slowly pushing air flow meter measuring plate from closed to open position with a screwdriver or similar object.

OK Voltage changes smoothly from about 5V (when closed) to about 0V (when open); i.e., does not suddenly jump up to 5V or down to 0V.

OK

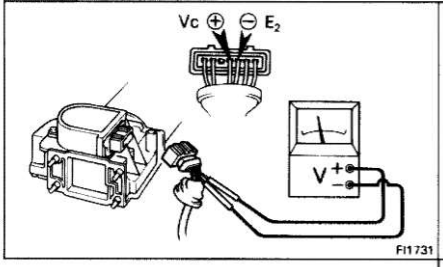
NG → Check for open circuit between ECU and air flow meter.

Replace ECU.*

* When diag. code 31 or 32 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–23).

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4 Check voltage between terminals VC and E2 of air flow meter connector.



P (1) Turn ignition switch LOCK.
(2) Disconnect air flow meter connector.
(3) Turn ignition switch ON.

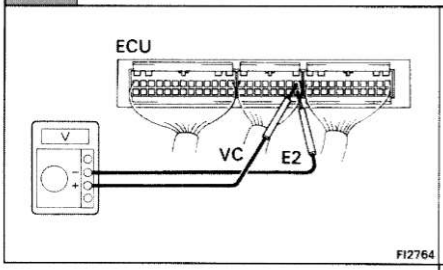
C Measure voltage between terminals Vc and E_2 of air flow meter connector.

OK Voltage: 5V

NG

OK → Replace air flow meter.

5 Check voltage between terminals VC and E2 of ECU connector.



C Measure voltage between terminals Vc and E_2 of ECU connector.

OK Voltage: 5V

NG

OK → Check for open circuit between ECU and air flow meter.

6 Check VC circuit for short circuit between ECU and air flow meter

NG

OK → Replace ECU.

Repair or replace harness or connector.

7 Check VS circuit for short circuit between ECU and air flow meter.

NG

OK → Replace ECU.

Repair or replace harness or connector.

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Diag. Code	41	Throttle Position Sensor Signal

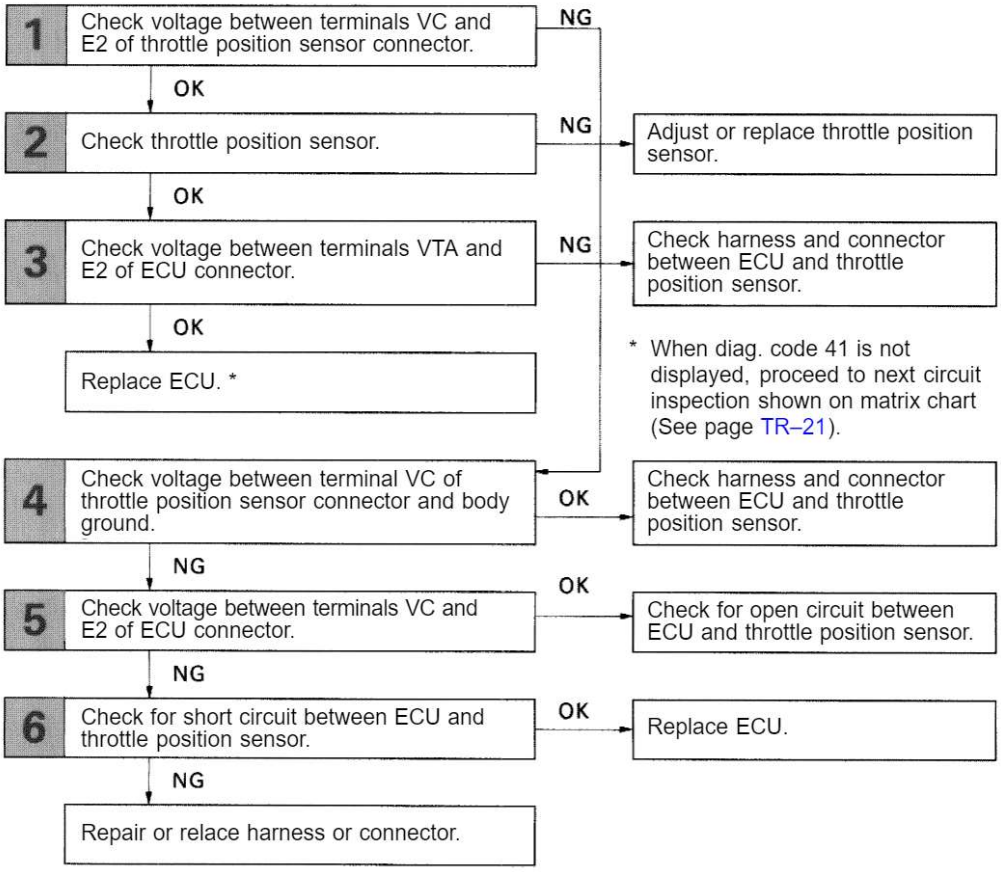
CIRCUIT DESCRIPTION

The throttle position sensor is provided to the throttle body and detects the opening angle of the throttle valve.
The ECU judges the vehicle driving conditions from the signals input from the terminal VTA of the throttle position sensor.

Code No.	Diagnosis	Trouble Area
41	Open or short circuit in throttle position sensor signal (VTA).	· Open or short in throttle position sensor circuit.
	IDL contact is ON and VTA output exceeds 1.45 V.	· Throttle position sensor · ECU

HINT: When the connector for the throttle position sensor is disconnected, diagnostic code 41 is not output. Diagnostic code 41 is output only when there is an open or short in the VTA signal circuit of the throttle position sensor.

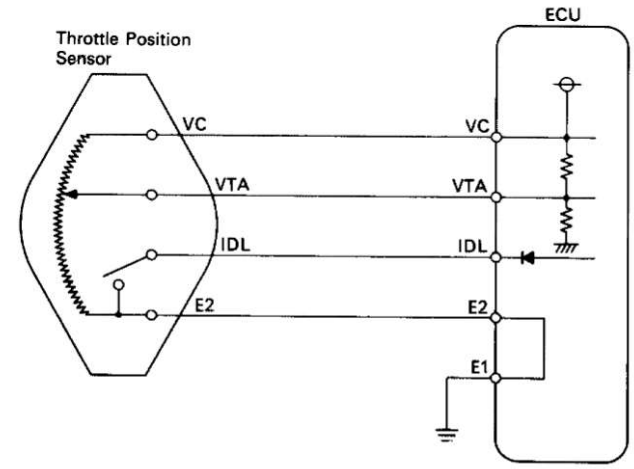
DIAGNOSTIC CHART

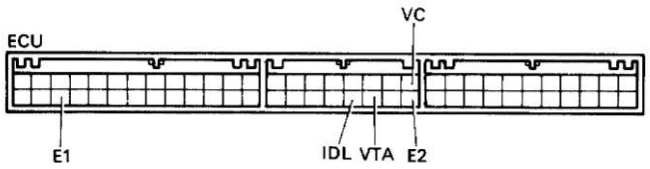


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DIAGNOSTIC CHART

WIRING DIAGRAM AND ECU CONNECTORS



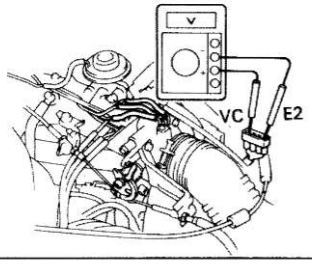


FI4764
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INSPECTION PROCEDURE

1 Check voltage between terminals VC and E2 of throttle position sensor connector.



P (1) Disconnect throttle position sensor connector.
(2) Turn ignition switch ON.

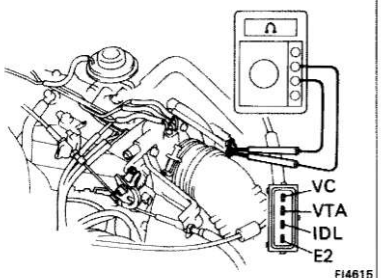
C Measure voltage between terminals Vc and E_2 of throttle position sensor connector.

OK Voltage: 5V

OK

NG → Go to step [4].

2 Check throttle position sensor.



P Turn ignition switch LOCK.

C Measure resistance between each terminal shown below:

OK

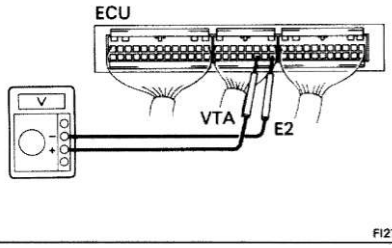
Terminals		Resistance
VC – E2		4.25 – 8.25 kΩ
VTA – E2	Throttle valve fully closed	0.3 – 6.3 kΩ
	Throttle valve full open	3.5 – 10.3 kΩ

- Resistance changes smoothly from 0.3 – 6.3 kΩ (when closed) to 3.5 – 10.3 kΩ (when open).

OK

NG → Adjust or replace throttle position sensor.

3 Check voltage between terminals VTA and E2 of ECU connector.



P (1) Connect throttle position sensor connector.
(2) Turn ignition switch ON.

C Check change in voltage between terminals VTA and E_2 of ECU connector while slowly opening throttle valve from closed to open position.

OK Voltage changes smoothly from 0.1V (when closed) to about 5V (when open); i.e., does not suddenly jump up to 5V or down to 0.1V.

OK

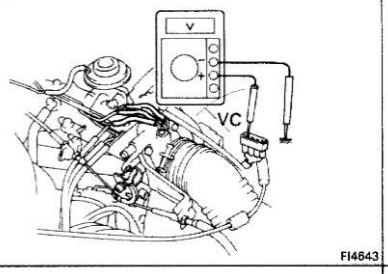
NG → Check harness and connector between ECU and throttle position sensor.

Replace ECU. *

* When diag. code 41 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–23).

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4 Check voltage between terminal VC of throttle position sensor connector and body ground.



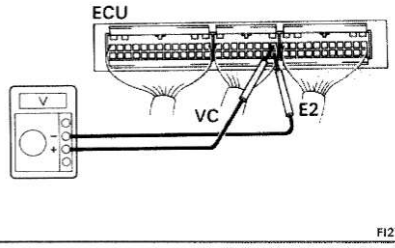
C Measure voltage between terminal Vc of throttle position sensor connector and body ground.

OK Voltage: 5V

NG

OK → Check harness and connector between ECU and throttle position sensor.

5 Check voltage between terminals VC and E2 of ECU connector.



C Measure voltage between terminals Vc and E_2 of ECU connector.

OK Voltage: 5V

NG

OK → Check for an open circuit between ECU and throttle position sensor.

6 Check for short circuit between ECU and throttle position sensor.

NG

OK → Replace ECU.

Repair or replace harness or connector.

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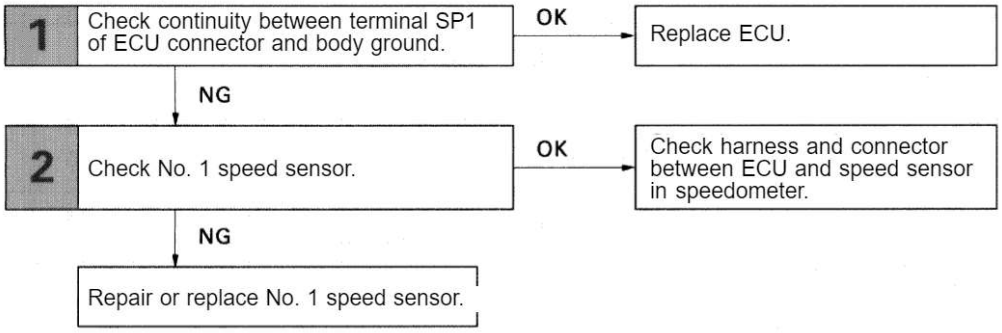
Diag. Code	42	Vehicle Speed Sensor Signal

CIRCUIT DESCRIPTION

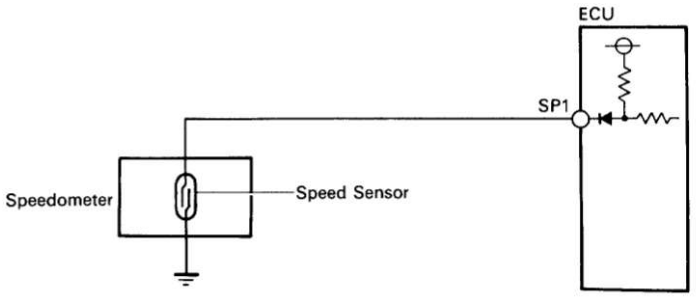
The speed sensor is located inside the speedometer, and outputs four–pulse signals for each revolution of the speedometer cable.

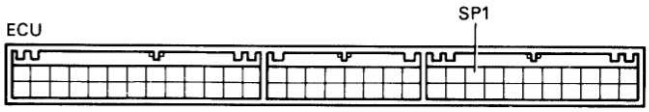
Code No.	Diagnosis	Trouble Area
42	SPD signal is not input to the ECU for at least 8 seconds during high load driving with engine speed between 2,500 rpm and 4,500 rpm.	· Open or short in vehicle speed sensor circuit · Vehicle speed sensor · ECU

DIAGNOSTIC CHART



WIRING DIAGRAM AND ECU CONNECTORS

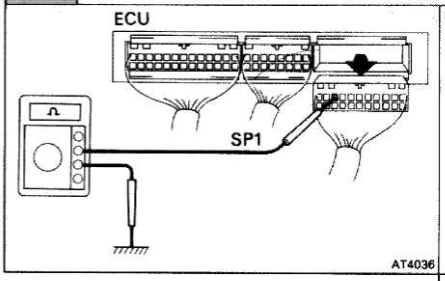




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INSPECTION PROCEDURE

1 Check continuity between terminal SP1 of ECU connector and body ground.



P (1) Disconnect ECU connector.
(2) Jack up a front wheel on one side.

C Check continuity between terminal SP1 of ECU connector and body ground while turning wheel slowly by hand.

OK Resistance changes from ∞Ω to ∞Ω.

NG

OK > **Replace ECU.**

2 Check No. 1 speed sensor.

NG

OK > **Check harness and connector between ECU and speed sensor in speedometer.**

Repair or replace No. 1 speed sensor.

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Diag. Code	43	Starter Signal

CIRCUIT DESCRIPTION

When the engine is cranked, the intake air flow is slow, so fuel vaporization is poor. A rich–mixture is therefore necessary in order to achieve good startability. While the engine is being cranked, the battery voltage is applied to terminal STA of the ECU. The STA signal is mainly used to increase the fuel injection volume for the starting injection control and after–start injection control.

Code No.	Diagnosis	Trouble Area
43	No STA signal to ECU until engine speed reaches 800 rpm with vehicle not moving.	· Open or short in starter signal circuit. · Open or short in IG switch circuit · ECU

DIAGNOSTIC CHART

1 Check starter operation. — NG → Check starter circuit.

OK

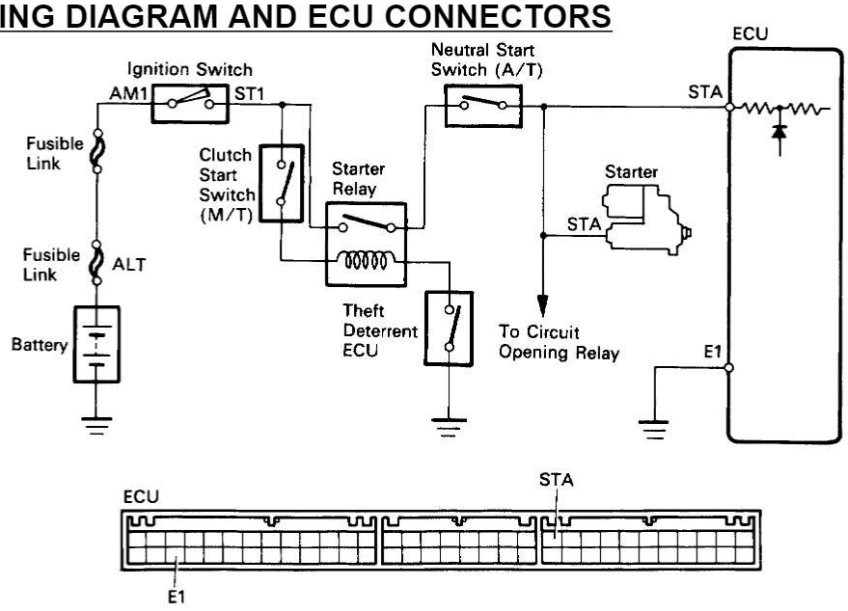
2 Check voltage between terminals STA and E1 of ECU connector. — NG → Check harness and connector between ECU and terminal STA (50) of starter.

OK

Replace ECU. *

* When diag. code 43 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–23).

WIRING DIAGRAM AND ECU CONNECTORS



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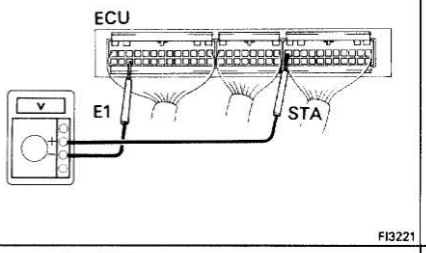
INSPECTION PROCEDURE

1 **Check starter operation.**

OK

NG → **Check starter circuit.**

2 **Check voltage between terminals STA and E1 of ECU circuit.**



P Turn ignition switch STA.

C Measure voltage between terminals STA and E1 of ECU connector.

OK Voltage: 6 V or more

OK

NG → **Check harness and connector between ECU and terminal STA (50) of starter.**

Replace ECU. *

* When diag. code 43 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–23).

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Diag. Code	52	Knock Sensor Signal

CIRCUIT DESCRIPTION

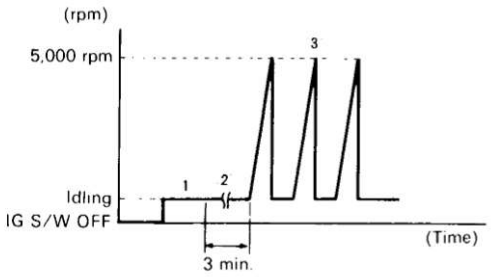
The knock sensor is located on the cylinder block.
If knocking develops in the engine, the knock sensor, by resonating with the knocking vibration, generates a voltage which corresponds to the knocking strength and sends a signal to the ECU.

Code No.	Diagnosis	Trouble Area
52	With engine speed between 1,600 rpm–5,200 rpm, Signal from knock sensor is not input to ECU for Revolution. (KNK)	● Open or short in knock sensor circuit. ● Knock sensor (looseness etc.) ● ECU

DIAGNOSIS CODE DETECTION DRIVING PATTERN

Purpose of the driving patten.
(a) After the diag. code is erased, the malfunction is reproduced and the diag. code is recorded again
(b) To check that the malfunction is cleared once the repair is completed (confirm that diag. code is no longer detected).

Malfunction: Open or Short in Knock Sensor



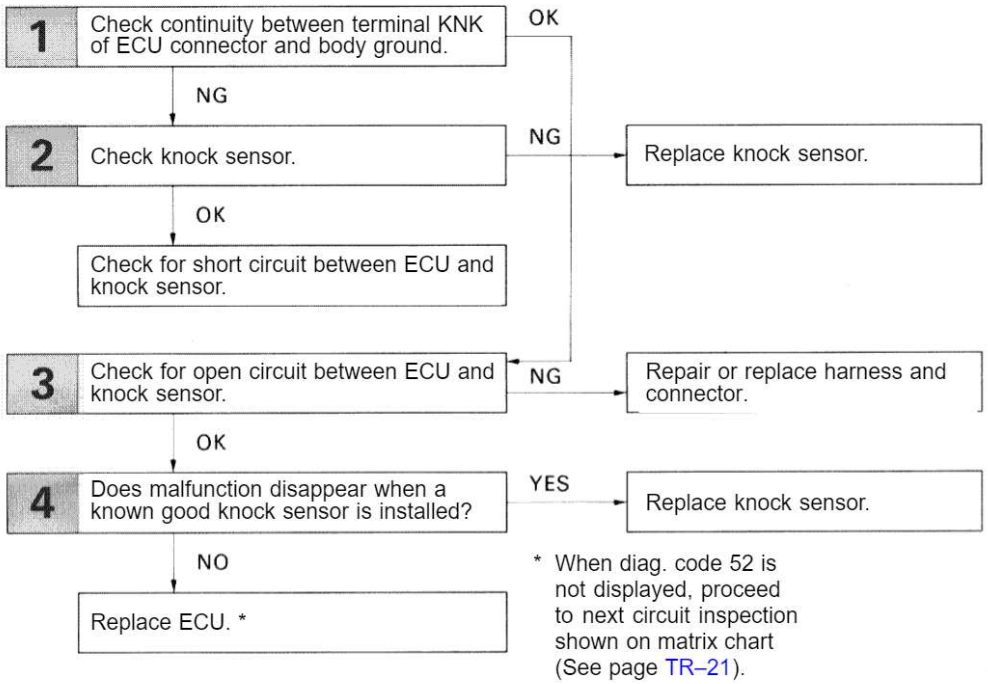
① Start engine and warm engine up.
② After engine is warmed up, let it idle for 3 min.
③ With the A/C ON, perform sudden racing (5,000 rpm) three times.
(Rapidly depress the accelerator pedal and suddenly release it.)

HINT: If a malfunction exists, the "CHECK" engine warning light will light up when sudden racing is performed.

NOTICE: If the conditions in this test are not strictly observed, detection of the malfunction will not be possible.

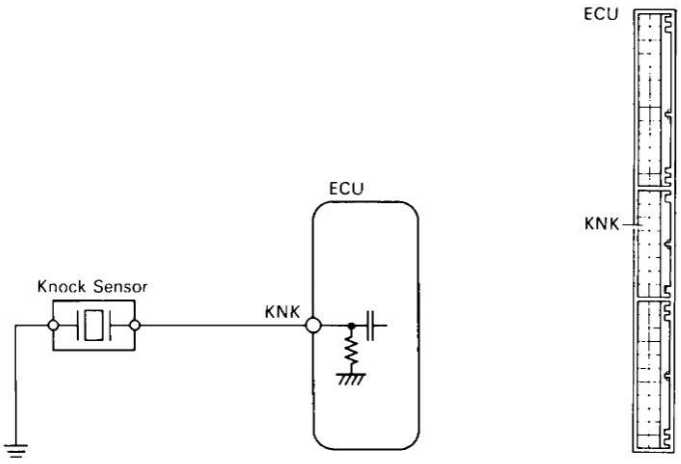
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DIAGNOSTIC CHART



* When diag. code 52 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–21).

WIRING DIAGRAM AND ECU CONNECTORS

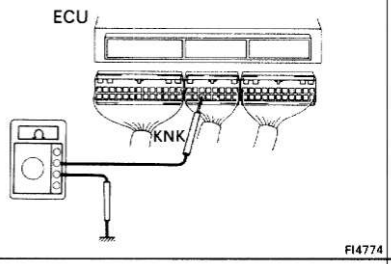


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INSPECTION PROCEDURE

1 Check continuity between terminal KNK of ECU connector and body ground.



P Disconnect ECU connector.

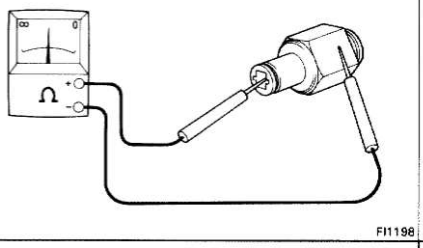
C Check continuity between terminal KNK of ECU connector and boy ground.

OK Open

NG

OK → Go to step [3].

2 Check knock sensor.



P Disconnect knock sensor connector.

C Check continuity between knock sensor terminal and body.

OK Open

OK

NG → Replace knock sensor.

Check for short circuit between ECU and knock sensor.

3 Check for open circuit between ECU and knock sensor.

OK

NG → Repair or replace harness or connector.

4 Does malfunction disappear when a known good knock sensor is installed?

NO

YES → Replace knock sensor.

Replace ECU. *

* When diag. code 52 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–21).

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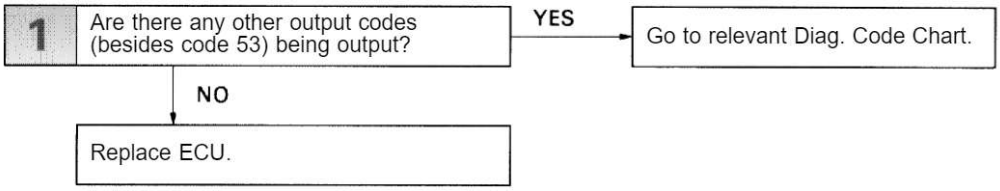
Diag. Code	53	Knock Control Signal

CIRCUIT DESCRIPTION

The knock sensor generates a voltage when the cylinder block vibrates due to knocking and sends a signal to the ECU.
If engine knocking occurs, ignition timing is retarded to reduce it.

Code No.	Diagnosis	Trouble Area
53	Engine speed is between 650 rpm and 5,200 rpm and engine control computer (for knock control) Malfunction is detected.	• ECU

DIAGNOSTIC CHART



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Diag. Code	71	EGR System Malfunction (California Only)

CIRCUIT DESCRIPTION

To reduce NOx emission, part of the exhaust gases are recirculated through the EGR valve to the intake manifold to lower the maximum combustion temperature.

Code No.	Diagnosis	Trouble Area
71	With engine warmed up and EGR operation possible, code is displayed when EGR gas temp. sensor is 55°C (131°F) for M/T, 60 °C (140°F) for ECT or less when vehicle is driven for 90 seconds (THG). (2 trip detection logic)*	● Open in EGR gas temp. sensor circuit ● EGR or BVSV vacuum hose disconnected, valve stuck ● Clogged EGR gas passage ● ECU

*: See page TR–13.

DIAGNOSIS CODE DETECTION DRIVING PATTERN

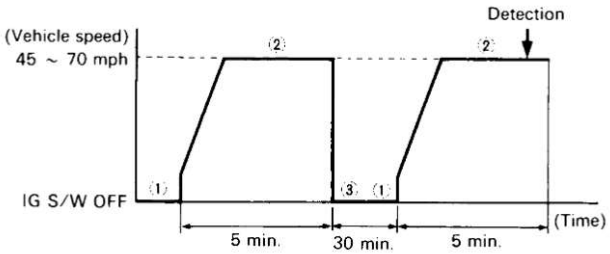
Purpose of the driving patten.

(a) After the diag. code is erased, the malfunction is reproduced and the diag. code is recorded again.

(b) To check that the malfunction is cleared once the repair is completed (confirm that diag. code is no longer detected).

Malfunction: Open in EGR Gas Temp. Sensor, Loose EGR or BVSV Vacuum Hose, Valve Stuck Clogged EGR Gas Passage

For A/T Vehicle



② Start engine.

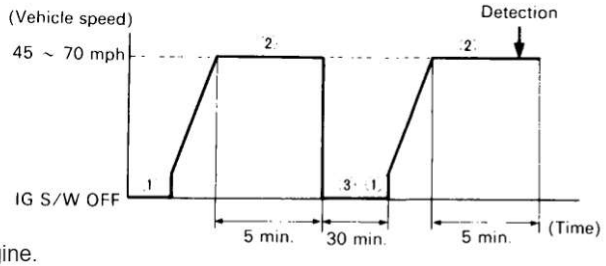
③ Soon after starting the engine (no warming up), drive for 5 min. at 45–70 mph in D range (O/D OFF) with the air conditioner ON.
(Keep the accelerator pedal position constant).
Turn the IG switch to OFF (not Acc) when you finish driving, then 30 min. later (to cool the engine) perform , again.

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CIRCUIT DESCRIPTION (Cont'd)

DIAGNOSIS CODE DETECTION DRIVING PATTERN

For M/T Vehicle



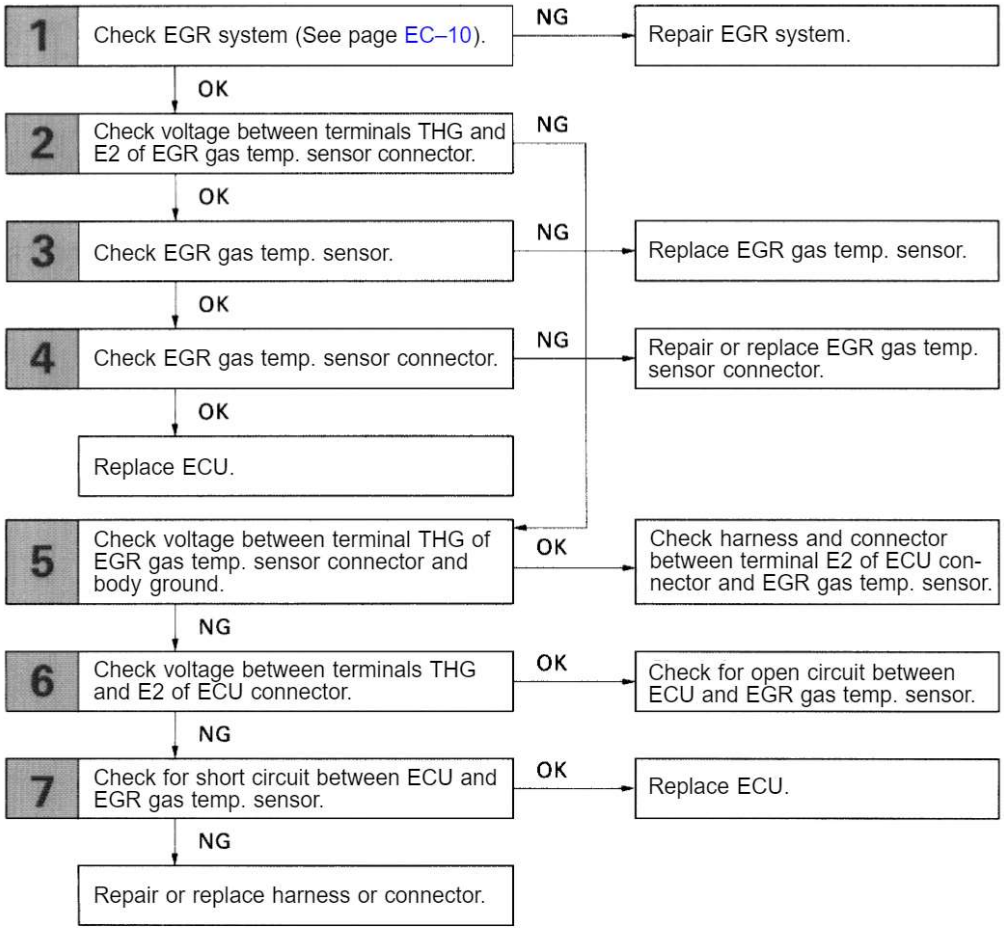
② Start engine.

③ Soon after starting the engine (no warming up), drive for 5 min. at 45–70 mph in 4th gear with air conditioner ON. (Keep the accelerator pedal position constant). Turn the IG switch to OFF (not Acc) when you finish driving, then 30 min. later (to cool the engine) perform ②, ③ again.

NOTICE: If the conditions in this test are not strictly observed, detection of the malfunction will not be possible.

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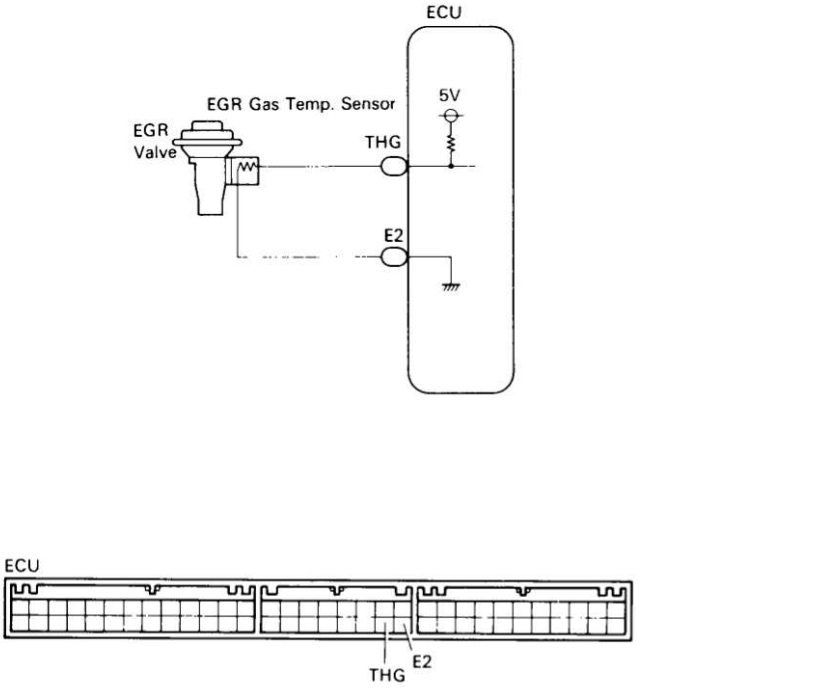
DIAGNOSTIC CHART



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DIAGNOSTIC CHART

WIRING DIAGRAM AND ECU CONNECTORS



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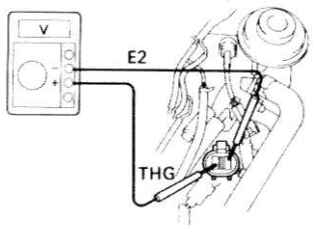
INSPECTION PROCEDURE

1 Check EGR system (See page EC–10).

OK

NG > Repair EGR system.

2 Check voltage between terminals THG and E2 of EGR gas temp. sensor connector.



P (1) Disconnect EGR gas temp. sensor connector.
(2) Turn ignition switch ON.

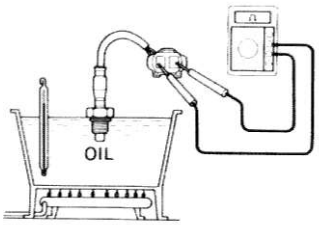
C Measure voltage between terminals THG and E2 of EGR gas temp. sensor connector on harness side.

OK Voltage: 5 V

OK

NG > Go to step [5].

3 Check EGR gas temp. sensor.



P Remove EGR gas temp. sensor.

C Measure resistance between terminals of EGR gas temp. sensor connector.

OK

Oil temp.	Resistance
50°C (122°F)	69.40 – 88.50 kΩ
100°C (212°F)	11.89 – 14.37 kΩ
150°C (302°F)	2.79 – 3.59 kΩ

OK

NG > Replace EGR gas temp. sensor.

4 Check EGR gas temp. sensor connector.

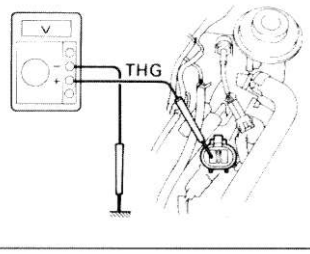
OK

NG > Repair or replace EGR gas temp. sensor connector.

Replace ECU.

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5 Check voltage between terminal THG of EGR gas temp. sensor connector and body ground.



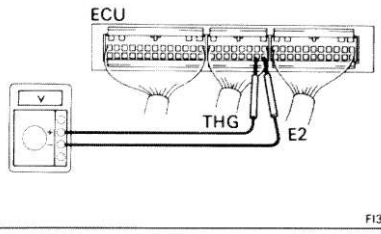
C Measure voltage between terminal THG of EGR gas temp. sensor connector and body ground.

OK Voltage: 5V

NG

OK → **Check harness and connector between terminal E2 of ECU connector and EGR gas temp. sensor.**

6 Check voltage between terminals THG and E2 of ECU connector.



P (1) Disconnect EGR gas temp. sensor connector.
(2) Turn ignition switch ON.

C Measure voltage between terminals THG and E2 of ECU connector.

OK Voltage: 5 V

NG

OK → **Check for open circuit between ECU and EGR gas temp. sensor.**

7 Check for short circuit between ECU and EGR gas temp. sensor.

NG

OK → **Replace ECU.**

Repair or replace harness or connector.

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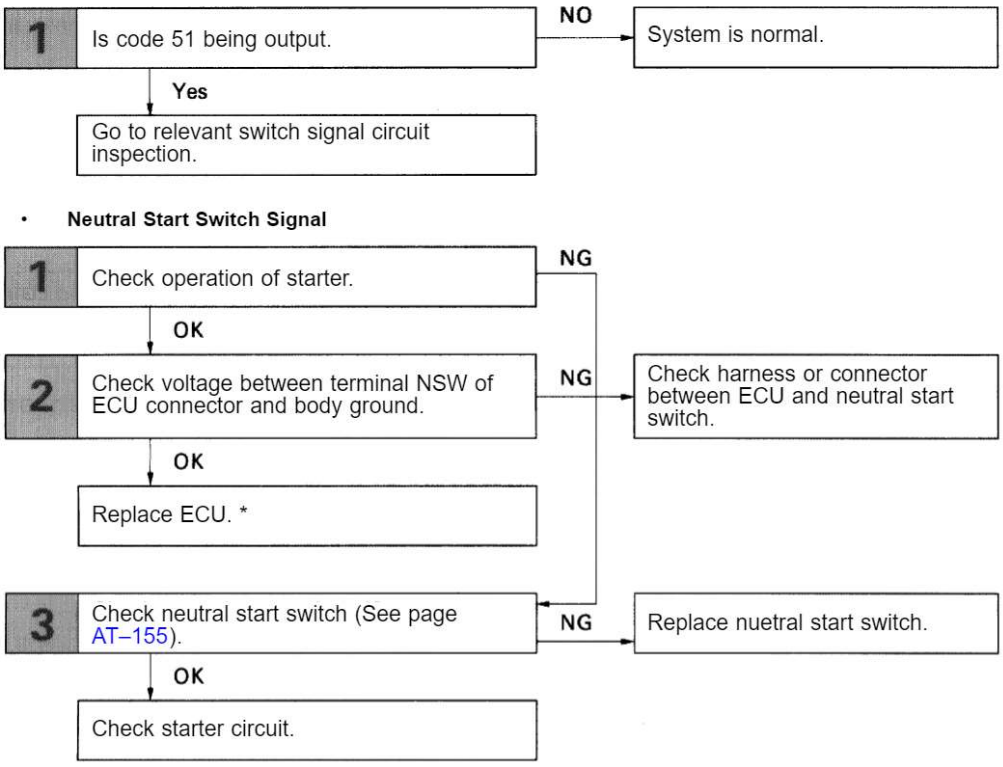
Diag. Code	51	Switch Condition Signal

CIRCUIT DESCRIPTION

Neutral Start Switch Signal
The ECU uses the signals from the neutral start switch to determine whether the transmission is in park or neutral, or in some other gear.
Air Conditioner Switch Signal
The ECU uses the signal from the air conditioner switch to determine whether or not the air conditioner is operating, and increases the idling speed of the engine.
Throttle Position Sensor IDL Signal
The IDL contacts are provided in the throttle position sensor, and detects the idle condition.

Code No.	Diagnosis	Trouble Area
51	Displayed when A/C is ON, IDL contact OFF or shift position in "R", "D", "2", or "1" renges with the check terminals E1 and TE1 connected.	· A/C switch circuit · Throttle position sensor IDL circuit · Neutral start switch circuit · Accelerator pedal, cable · ECU

DIAGNOSTIC CHART



· **Neutral Start Switch Signal**

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DIAGNOSTIC CHART

- **Air Conditioner Switch Signal**

1. Check operation of A/C system.
   - NG → Repair A/C system.
   - OK →
2. Check voltage between terminal A/C of ECU connector and body ground.
   - NG → Check harness or connector between ECU and A/C amplifier.
   - OK →

Replace ECU. *

- **Throttle Position Sensor IDL Signal**

1. Check voltage between terminals IDL and E2 of throttle position sensor connector.
   - NG →
   - OK →
2. Check throttle position sensor.
   - NG → Replace throttle position sensor.
   - OK →

Replace ECU. *

3. Check voltage between terminal IDL of throttle position sensor connector and body ground.
   - OK → Check harness and connector between ECU and throttle position sensor.
   - NG →
4. Check voltage between terminals IDL and E2 of ECU connector.
   - OK → Check for open circuit between ECU and throttle position sensor.
   - NG →
5. Check for short circuit between ECU and throttle position sensor.
   - OK → Replace ECU.
   - NG →

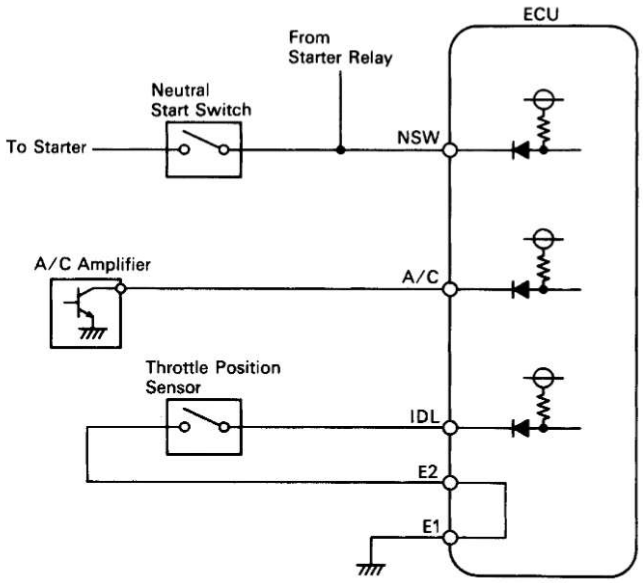
Repair or replace harness or connector.

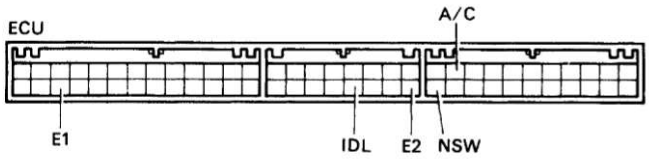
* When diag. code 51 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–23).

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DIAGNOSTIC CHART

WIRING DIAGRAM AND ECU CONNECTORS





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INSPECTION PROCEDURE

1 Is code 51 being output?

P (1) Shift automatic transmission into "P" or "N" range.
(2) Turn air conditioner switch OFF.
(3) Set throttle valve to fully closed (throttle position sensor IDL contacts closed).
C Is code 51 being output?

YES

NO: System is normal.

Go to relevant switch signal circuit inspection.

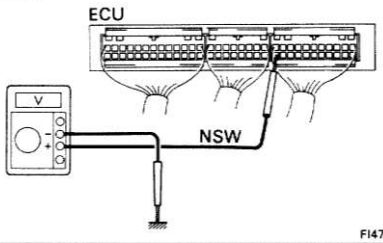
Neutral Start Switch Signal

1 Check operation of starter.

OK

NG: Go to step [3].

2 Check voltage between terminal NSW of ECU connector and body ground.



P Turn ignition switch ON.

C Measure voltage between terminal NSW of ECU connector and body ground.

OK

Switch condition	Voltage
"P" or "N" range	0V
"D", "2", "1" or "R" range	12V

OK

NG: Check harness or connector between ECU and neutral start switch.

Replace ECU. *

* When diag. code 51 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–23).

3 Check neutral start switch (See page AT–155).

OK

NG: Replace neutral start switch.

Check starter circuit.

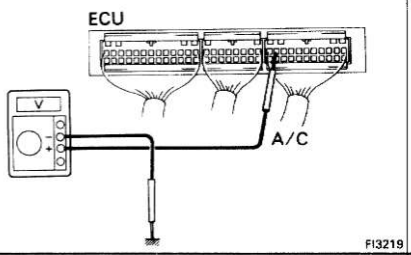
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Air Conditioner Switch Signal

1 Check operation of A/C system.

- NG → Repair A/C system.
- OK

2 Check voltage between terminal A/C of ECU connector and body ground.



P Turn ignition switch ON.

C Measure voltage between terminal A/C of ECU connector and body ground.

OK

Switch condition	Voltage
A/C switch ON	0V
A/C switch OFF	12V

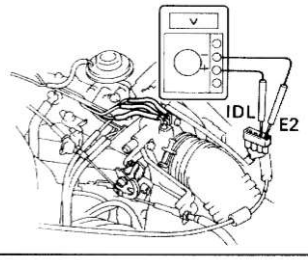
- NG → Check harness and connector between ECU and A/C amplifier.
- OK → Replace ECU. *

* When diag. code 51 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–23).

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Throttle Position Sensor IDL Signal

1 Check voltage between terminals IDL and E2 of throttle position sensor connector.



P (1) Disconnect throttle position sensor connector.
(2) Turn ignition switch ON.

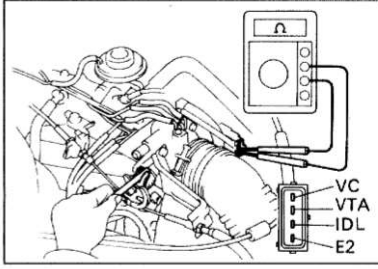
C Measure voltage between terminals IDL and E2 of throttle position sensor connector.

OK Voltage: 5 V

OK

NG → **Go to step [3].**

2 Check throttle position sensor.



P (1) Turn ignition switch LOCK.
(2) Insert a feeler gauge between the throttle stop screw and stop lever.

C Measure voltage between terminals IDL and E2 of throttle position sensor connector.

OK

Clearance between stop lever and stop screw	Resistance
0.30 mm (0.012 in.)	2.3 kΩ or less
0.70 mm (0.028 in.)	∞ (Infinity)

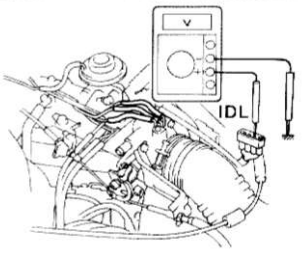
OK

NG → **Adjust or replace throttle position sensor.**

Replace ECU. *

* When diag. code 51 is not displayed, proceed to next circuit inspection shown on matrix chart (See page TR–21).

3 Check voltage between terminal IDL of throttle position sensor connector and body ground.



C Measure voltage between terminal IDL of throttle position sensor connector and body ground.

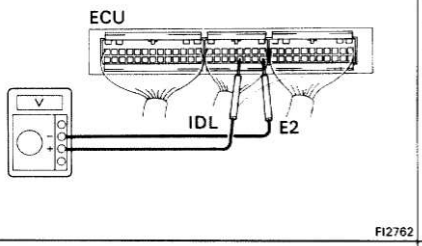
OK Voltage: 5 V

NG

OK → **Check harness and connector between ECU and throttle position sensor.**

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4 Check voltage between terminals IDL and E2 of ECU connector.



P Connect throttle position sensor connector.

C Measure voltage between terminals IDL and E2 of ECU connector.

OK

Condition	Voltage
Acceleration pedal released	0V
Acceleration pedal depressed	5V

NG

OK → Check for open circuit between ECU and throttle position sensor.

5 Check for short circuit between ECU and throttle position sensor.

NG

OK → Replace ECU.

Repair or replace harness or connector.

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