3VZ–E ENGINE

ENGINE MECHANICAL

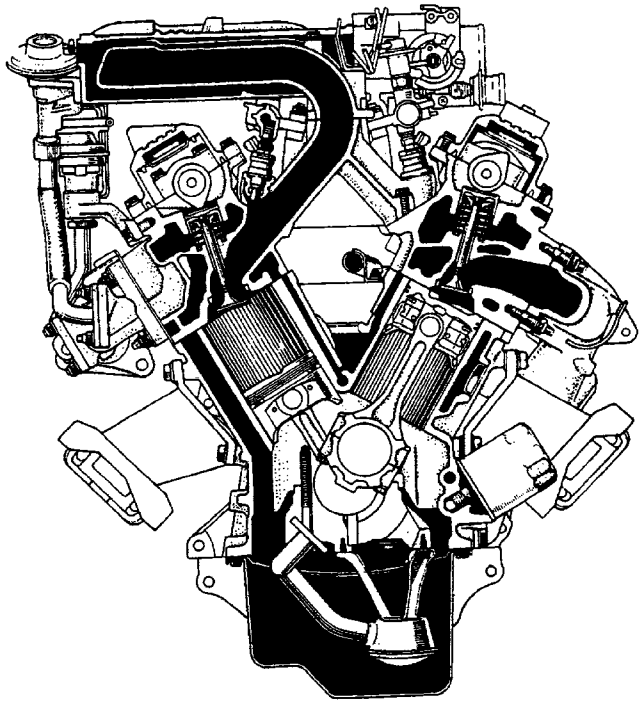
DESCRIPTION

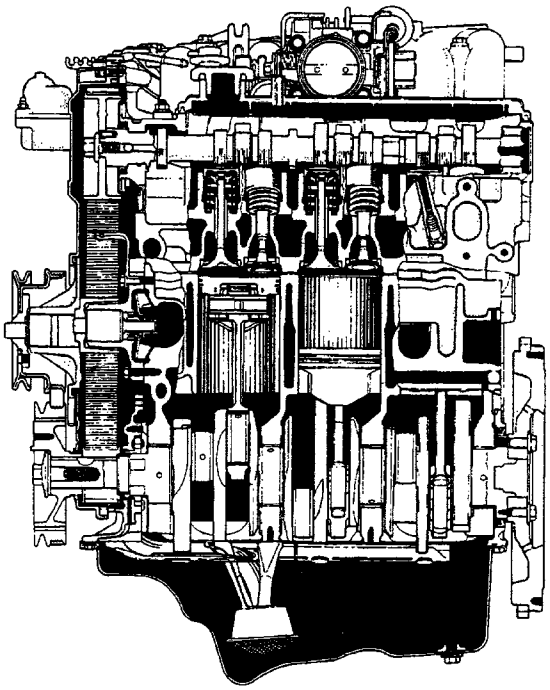
EG128–01

The 3VZ–E engine is a V–6 3.0 liter OHC 12–valve engine.

OPERATION

EGCAX–06





P02944
P03056

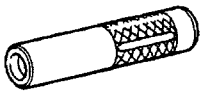
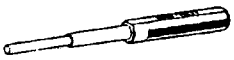
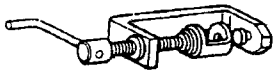
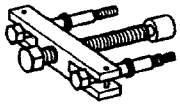
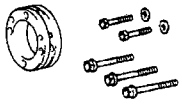
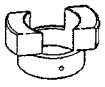
Z04875

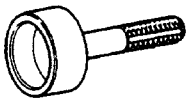
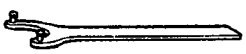
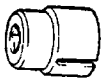
The 3VZ–E engine has 6–cylinders in a V arrangement at a bank angle of 60°. From the front of the right bank the cylinders are numbered 1 – 3 – 5, and from the front of the left bank the cylinders are numbered 2 – 4 – 6.
The crankshaft is supported by 4 bearings inside the crankcase. The bearings are made of aluminum alloy.
The crankshaft is integrated with 5 weights which are cast with it for balance. There are oil holes in the center of the crankshaft to supply oil to the connecting rods and bearings, etc.
The firing 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 semi–heron type combustion chambers.
At the front and rear of the intake port of the intake manifold, a water passage has been provided which connects the left and right cylinder heads.
Each intake exhaust valve is equipped with irregular pitch springs made of special valve spring carbon steel which are capable of following no matter what the engine speed.
The left and right camshafts are driven by a single timing belt. The cam journal is supported at 5 places, between the valve lifters of each cylinder and on the front end of the cylinder head.
The cam journal and the cam are lubricated by oil 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 with the valve adjusting shims located above the valve lifters so that the shims can be replaced without removing the camshafts.
The timing belt cover is composed of the resin type No.1 and No.2 above and below the fan bracket, and the No.3 and No.4, which are made of steel sheet to make removal of the intake manifold easier.
The pistons are made of high temperature resistant aluminum alloy, and the piston head is concaved to prevent interference with the valves.
The piston pins are the semi–floating type, with the connecting rods and pins pressure fitted so that the piston and pin float.
The No. 1 compression ring is made of stainless 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 when the piston ring is attached to the cylinder, the expansion of the piston ring produces a close fit with the cylinder walls.
The No.1 and No.2 compression rings work to prevent gas leakage, and the oil ring works to scrape oil off the cylinders and prevent it from entering the combustion chambers.
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 each cylinder is closed off by the cylinder head and the lower end becomes the crankcase where the crankshaft is installed. In addition, the cylinder block contains a water jacket 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 baffle plate has been installed between the oil pan and cylinder block to reduce oil stir from the crankshaft and connecting rod.
Plastic region tighten bolts are used for the cylinder head, main bearing cap and connecting rod.

PREPARATION

EG1DM–03

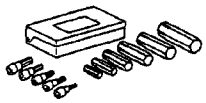
SST (SPECIAL SERVICE TOOLS)

	09032–00100 Oil Pan Sea! Cutter	Oil pan Oil pan baffle plate
	09201–41020 Valve Stem Oil Seal Replacer	
	09201–60011 Valve Guide Bushing Remover & Replacer	
	09202–43013 Valve Spring Compressor	
	09213–31021 Crankshaft Pulley Puller	
	09213–5$012 Crankshaft Pulley Holding Tool	
	(90201–08131) Washer	
	(91111–50845) Bolt	
	09214–60010 Crankshaft Pulley & Gear Replacer	Crankshaft timing pulley Camshaft oil seal
	09221–25024 Piston Pin Remover & Replacer	
	(09221–00020) Body	
	(09221 –00030) Spring	
	(09221–00181) B	

	(09221– 00190) Guide “K”	
 I01725	(09221 –00200) Guide “L”	
	09223–56010 Crankshaft Rear Oil Seal Replacer	
	09248–55020 Valve Clearance Adjust Tool Set	
	(09248–05011) Valve Lifter Press	
	(09248–05021) Valve Lifter Stopper	
	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	Oil pressure sender gauge
	09817–16011 Back–up Light Switch Toot	Knock sensor
	09843–18020 Diagnosis Check Wire	

RECOMMENDED TOOLS

EG1DN–01

	09040–00010 Hexagon Wrench Set	
	09090–04010 Engine Sling Device	For suspending engine
	09200–00010 Engine Adjust Kit	
	09258–00030 Hose Plug Set	Plug for the vacuum hose, fuel hose etc.
	09904–00010 Expander Set	

EQUIPMENT

EG1DP–02

Battery specific gravity gauge	
Belt tension gauge	
Caliper gauge	
CD/HC meter	
Compression gauge	
Connecting rod aligner	
Cylinder gauge	
Dial indicator	
Dye penetrant	
Engine tune–up tester	
Heater	
Magnetic finger	
Micrometer	
Piston ring compressor	
Piston ring expander	

Plastigage	
Precision straight edge	
Soft brush	
Spring tester	Valve spring
Steel square	Valve spring
Thermometer	
Torque wrench	
Valve seat cutter	
Vernier calipers	

COOLANT

EG0B1–0D

Item		Capacity	Classification
Engine coolant	2WD (M/T)	9.9 liters (10.5 US qts, 8.7 Imp. qts)	Ethylene–glycol base
	(A/T)	9.7 liters (10.3 US qts, 8.5 Imp. qts)	
	4WD (M/T)	10.0 liters (10.6 US qts, 8.8 Imp. qts)	
	(A/T)	9.8 liters (110.4 US qts, 8.6 Imp. qts)	

EG0B1–0E

LUBRICANT

Item	Capacity	Classification
Engine oil (2WD)		APIA grade SKAG Energy–Conserving II multigrade and recommended viscosity oil.
Dry fill	5.3 liters (5.6 US qts, 4.7 Imp. qts)	
Drain and refill		
w/o Oil filter change	4.3 liters (4.5 US qts, 3.8 Imp. qts)	
w/ Oil filter change	4.0 liters (4.2 US qts, 3.5 Imp. qts)	
Engine oil (4WD)		
Dry fill	5.4 liters (5.7 US qts, 4.8 Imp. qts)	
Drain and refill		
w/o Oil filter change	4.5 liters (4.8 US qts, 4.0 Imp. qts)	
w/ Oil filter change	4.2 liters (4.4 US qts, 3.7 Imp. qts)	

EG1DQ–02

SSM (SPECIAL SERVICE MATERIALS)

08826–00080 Seal packing or equivalent	Camshaft bearing cap Cylinder head cover Rear oil seal retainer Oil pump
08826–00080 Seal packing or equivalent	Oil pan baffle plate Oil pan Oil pressure sender gauge
08826–00100 Seal Packing 1282B, Three Bond 1282B or equivalent	Water outlet No.2 idler pulley Water pump No. 1 water by–pass pipe
08833–00070 Adhesive 1324, THREE BOND 1324 or equivalent	Flywheel bolt Drive plate bolt

TROUBLESHOOTING

When the malfunction code is not confirmed in the diagnostic code check and the problem still cannot be confirmed in the basic inspection, then proceed to this step and perform troublesh–ooting according to the numbers in the order given in the table below.

	See page	IG–16	IG–16	EG2–199	EG2–192	EG2–190	EG2–190	EG2–185	EG2–193	–	EG2–193	–	EG2–202	EG2–212	EG2–160	EG2–220	EG2–247	–
	Suspect area	RPM Signal Circuit	Ignition Circuit	Heated Oxygen Sensor Circuit	Engine Coolant Temp Sensor Circuit	Intake Air Temp. Sensor Circuit	Volume Air Flow Meter Circuit	Throttle Position Sensor Circuit	STA Signal Circuit	Knock Sensor Circuit	PNP Signal Circuit	A/C Signal Circuit	Fuel Pump	Fuel Pressure Regulator	Fuel Lines	injectors	Cold Start System	Idle Speed Control Valve
	Symptom																	
Does not start	Engine does not crank																	
	Starter runs – engine does not crank		.															
	No initial combustion	12	2				5						6				13	8
	(Vv complete combustion				4		1							3		9	10	2
Difficult to start	Engine cranks slowly											2						
	Under normal conditions	12	13		4	14							7	6	8	16	17	3
	Cold engine				1	6			2				8	7	9	10	5	4
	Hot engine				1	5							8	7	9	10	6	3
Poor idling	Incorrect first idle				3													4
	High engine idle speed				4	6		7			9	8				10	11	5
	Low engine idle speed				1		4									5		2
	Rough idling		18		2		12						7	6	8	16	17	9
	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 rafter fire			8	3	7	5	6						4		9	10	
	Surging													1		4		
	Knocking									1								
Engine stall	Engine stall soon after starting				8		7						3	2	4	9	10	6
	After accelerator pedal depressed						1	3						5	6	7		
	After accelerator pedal released						3											1
	During A/C operation											1						2
	When N to D shift										1							2
Others	Poor fuel economy			21	16	22	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																	

V01922

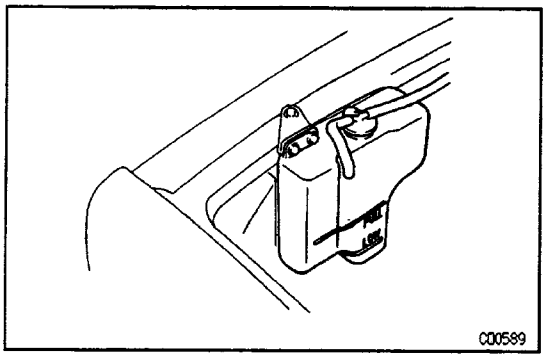
HINT: When inspecting a wire harness or circuit, the electrical wiring diagrams at the end of repair manual should be referred to and the circuits of related systems also should be checked.

EFI Main Relay EG2–245	Circuit Opening Relay EG2–246	Fuel Cut System EG2–257	Fuel Pressure Control System EG2–249	Engine Control Module EG2–254	Fuel Quality —	Fuel Leakage —	Engine Coolant Leakage —	Oil Leakage —	Starter Relay ST–13	PNP SW or Clutch Start SW AT 83,144 CL–4	Starter ST–2	Spark Plug IG–20	Distributor IG–23	EGR System EG2–148	Accelerator Pedal Link —	Brakes drag even when released —	Cooling Fan System —	Dash Pot EG2–237	Throttle Opener EG2–238	Clutch CL–1	Compression EG2–30	Valve Clearance EG2–18
									1	3	2											
											1											
3	4			14	7								1								9	
				11																	5	
											1											
				18	1							2	15	5							9	
				11	3																	
			4	11	2																	
				5											1			2	3			
				12											1			2				
				6										3								
				19	1							4	5	3							10	13
				11	1							3	5	2							7	
				20	3							5	6	4		2				1	7	16
				12										1								
		1		11																		
				5								2	3									
				10	2							3		4			7					
				11	1									5								
				8								4		2								
				4										2								
				3																		
				3																		
		8			2	1						9	10	7	3	6		4		5	11	
							1					8					2					
																	1					
								1													3	
								1														
									1		2											

V01923

	See page	EG2–46	EG2–38	EG2–265	EG2–65	EG2–280	EG2–99	EG2–102	EG2–64	EG2–110	–	EG2–269	EG2–268	CH–2	BE–36	BE–37	CH–5	EG2–106
	Suspect area / Symptom	Valve Timing	Timing Belt	Water Pump	Valve Stem Guide Bushing	Oil Pump	Connecting Rod Bearing	Crankshaft Bearing	Cylinder Head	Piston Ring	Flywheel or Drive Plate	Radiator and Radiator Cap	Thermostat	Dive Belt	Engine Coolant Temp. Sender Gauge	Oil Pressure Switch	Generator	Cylinder Block
Does not start	Engine does not crank																	
	Starter runs – engine does not crank										2							
	No initial combustion	10	11															
	No complete combustion	7	8							6								
Difficult to start	Engine cranks slowly						3	4										
	Under normal conditions	11								10								
	Cold engine																	
	Hot engine																	
Poor idling	incorrect first idle																	
	Nigh engine idle speed																	
	Low engine idle speed																	
	Rough idling	14	15						20	11								
	Misfire																	
Poor drivability	Hesitation Poor acceleration	17																
	Back fire	2																
	Muffler explosion (after fire)	2																
	Surging																	
	Knocking	5		9								6	8					
Engine stall	Engine stall soon after starting																	
	After accelerator pedal depressed																	
	After accelerator pedal released																	
	During A/C operation																	
	When N to D shift																	
Others	Poor fuel economy	13								12								
	Engine overheat	7	5	6		10			11			3	4		13			12
	Engine overcool												2		3			
	Excessive oil consumption				2				5	4								6
	Low oil pressure					2	3	4								5		
	High oil pressure					1										2		
	Starter keeps running																	
	Battery often discharge													1			2	

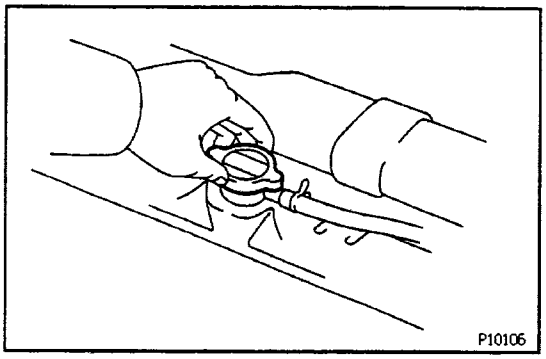
V01924



TUNE–UP

1. CHECK ENGINE COOLANT LEVEL AT RESERVOIR TANK

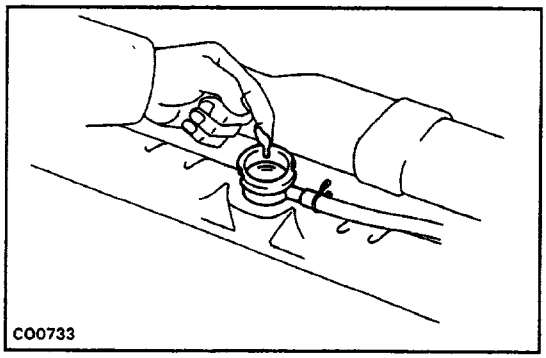
The engine coolant level should be between the ” LOW” and ”FULL” lines.
If low, check for leaks and add engine coolant up to the ”FULL” line.



2. CHECK ENGINE COOLANT QUALITY

(a) Remove the radiator cap.

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



(b) There should not be any excessive deposits of rust or scales around the radiator cap or radiator filler hole, and the hole, and the coolant should be free from oil.
If excessively dirty, clean the coolant passages and replace the coolant.

Capacity (w/ Heater):
9.9 liters (10.5 US qts, 8.7 Imp.qts) for 2WD M/T
9.7 liters (10.3 US qts, 8.5 Imp.qts) for 2WD A/T
10.0 liters (10.6 US qts, 8.8 Imp.qts) for 4WD M/T
9.8 liters (10.4 US qts, 8.6 Imp.qts) for 4WD A/T

HINT:

- Use a good brand of ethylene–glycol base cool–ant and mix it according to the manufacturer’s directions.
- Using coolant which includes more than 50% ethylene –glycol(but not more than 70%) is rec–ommended.

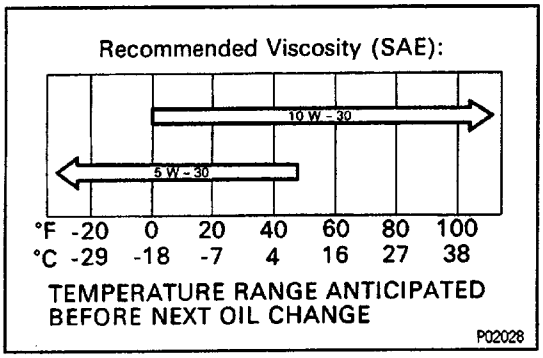
NOTICE:

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

(c) Reinstall the radiator cap.

EG1DT–02

ENGINE OIL INSPECTION



1. CHECK OIL QUALITY

Check the oil for deterioration, entry of water, dis–coloring or thinning.

If oil quality is poor, replace the oil.

Oil grade:

API grade SG Energy–Conserving II multigrade engine oil. Recommended viscosity is as shown,

Drain and refill capacity (2WD):

w/ Oil filter change

4.3 liters (4.5 US qts, 3.8 Imp. qts)

w/o Oil filter change

4.0 liters (4.2 US qts, 3.5 Imp. qts)

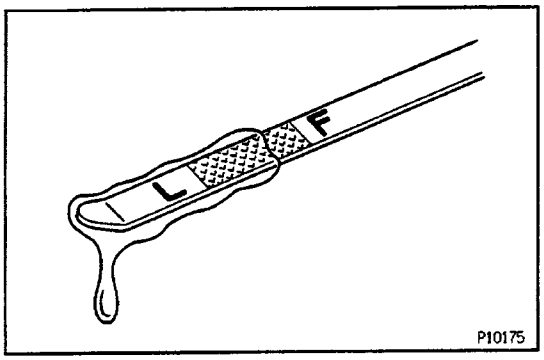
Drain and refill capacity (4WD):

w/ Oil filter change

4.5 liters (4.8 US qts. 4.0 Imp. qts)

w/o Oil filter change

4.2 liters (4.4 US qts, 3.7 Imp. qts)

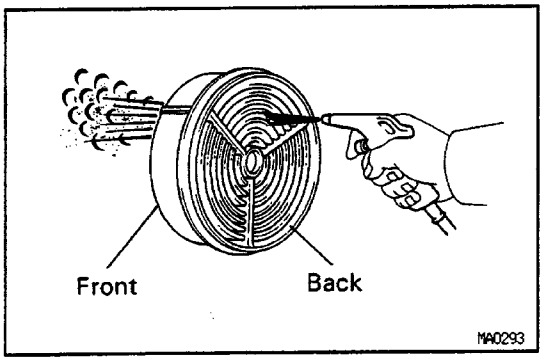


2. CHECK ENGINE OIL LEVEL

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

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

AIR FILTER INSPECTION AND CLEANING



1. REMOVE AIR FILTER

2. INSPECT AND CLEAN AIR FILTER

(a) Visually check that the air filter is not excessively damaged or only.

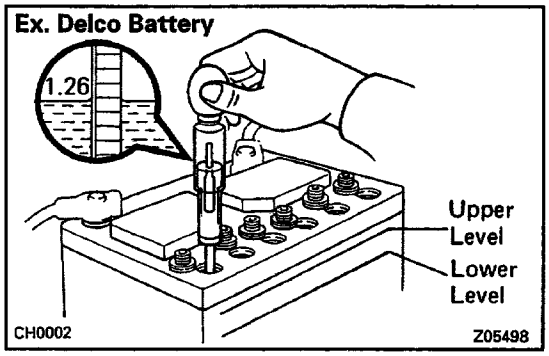
HINT: Oiliness may indicate a stuck PCV valve.

If necessary, replace the air filter.

(b) Clean the air filter with compressed air.

First blow from the inside thoroughly, then blow off the outside of the air filter.

3. REINSTALL AIR FILTER



BATTERY INSPECTION

1. (Ex. Delco Battery)

CHECK BATTERY SPECIFIC GRAVITY AND ELECTROLYTE LEVEL

(a) Check the electrolyte quantity of each cell.

If insufficient, refill with distilled (or purified) water.

(b) Check the specific gravity of each cell.

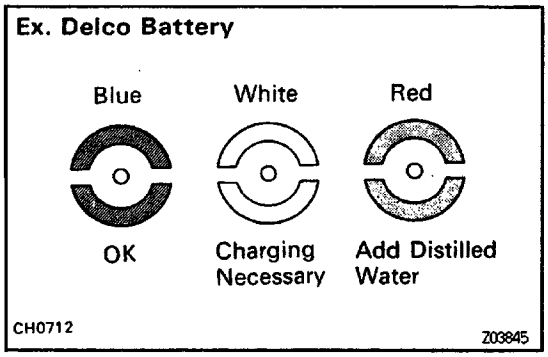
Standard specific gravity at 20˚C (68˚F):

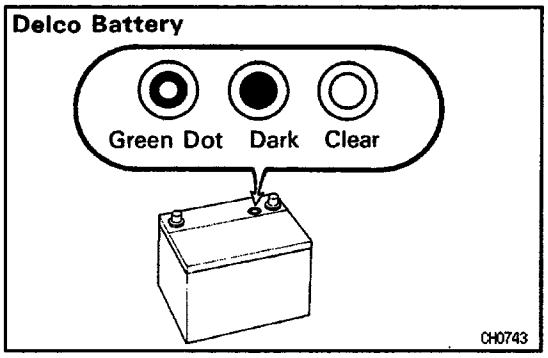
1.25 – 1.27 for 55D 23R type

1.27 – 1.29 for 80D 26R type

If not within specifications, charge the battery.

HINT: Check the indicator as shown in the illustration.





2. (Delco Battery)

CHECK HYDROMETER

Green Dot visible:

Battery is adequately charged.

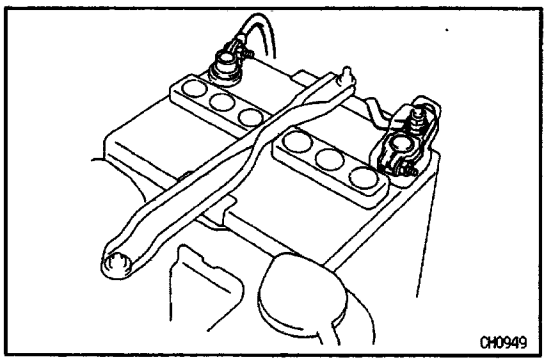
Dark (Green Dot not visible):

Battery must be charged.

Clear or Light Yellow:

Replace battery.

HINT: There is no need to add water during the entire service life of the battery.



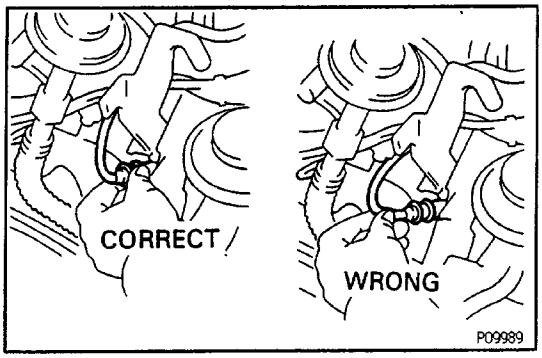
3. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

(a) Check that the battery terminals are not loose or corroded.

(b) Check the fusible link and fuses for continuity.

EG1Z8–01

HIGH–TENSION CORDS INSPECTION



1. DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS

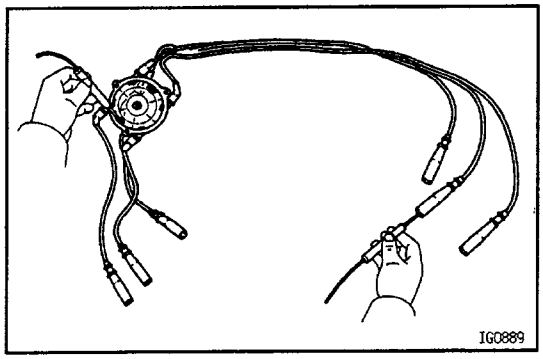
Disconnect the high – tension cords at the rubber boot. Do not pull on the curds.

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

2. REMOVE DISTRIBUTOR CAP WITH HIGH–TENSION CORDS

3. INSPECT HIGH–TENSION CORD TERMINALS

Check the terminals for corrosion, breaks or distor–tion. Replace cords as required.



4. INSPECT HIGH–TENSION CORD RESISTANCE

Using an ohmmeter, measure the resistance without disconnecting the distributor cap.

Maximum resistance:

25 kQ per cord

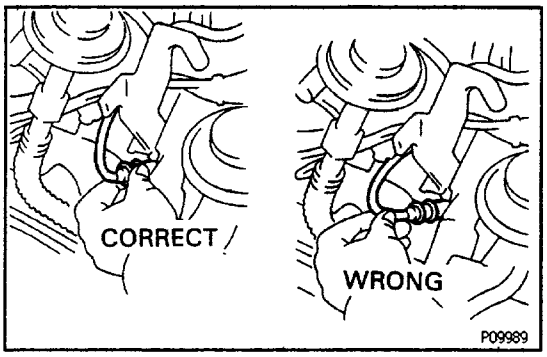
If the resistance is greater than maximum, check the terminals. If any defect has been found, replace the high–tension cord and/or distributor cap.

5. REINSTALL DISTRIBUTOR CAP AND HIGH–TENSION CORDS

6. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS

EG1ZC–01

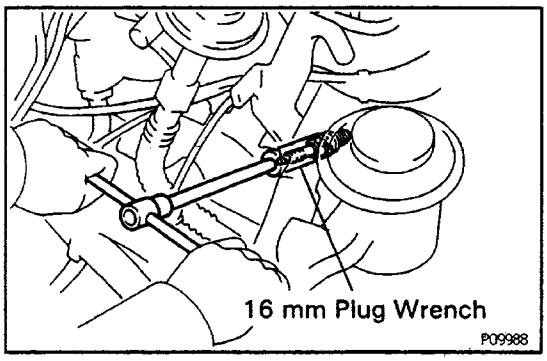
SPARK PLUGS INSPECTION



1. DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS

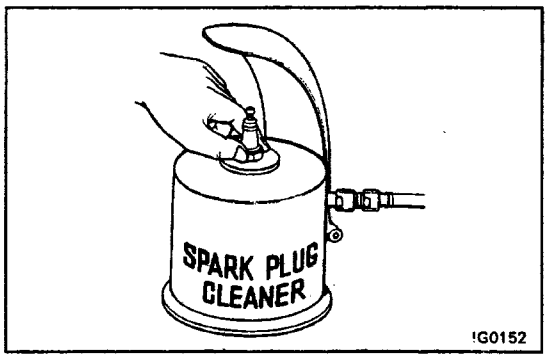
Disconnect the high – tension cords at the rubber boot. Do not pull on the cords.

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



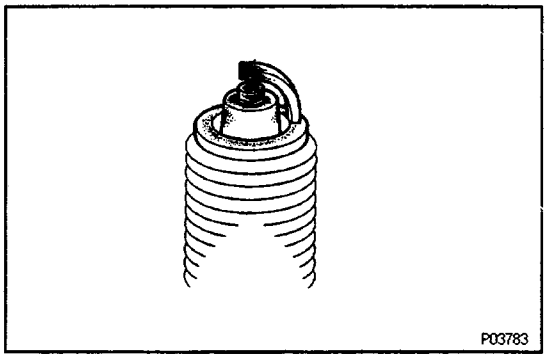
2. REMOVE SPARK PLUGS

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



3. CLEAN SPARK PLUGS

Using a spark plug cleaner or wire brush, clean the spark plug.



4. VISUALLY INSPECT SPARK PLUGS

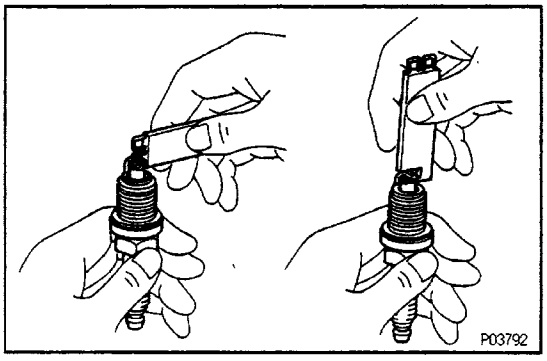
Check the spark plug for electrode wear, thread damage and insulator damage.

If abnormal, replace the spark plug.

Recommended spark plug:

K16R– U for ND

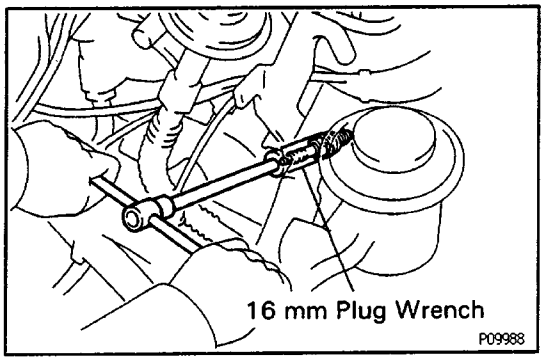
8KR5EYA for NGK



5. ADJUST ELECTRODE GAP

Carefully bend the outer electrode to obtain the cor–rect electrode gap.

Correct electrode gap: 0.8 mm (0.031 in.)

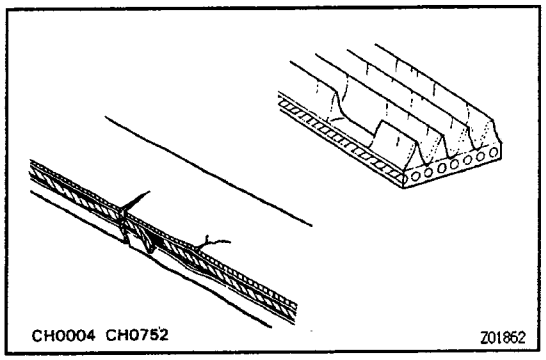


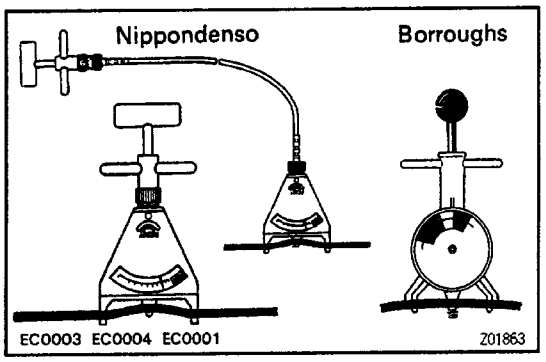
6. INSTALL SPARK PLUGS

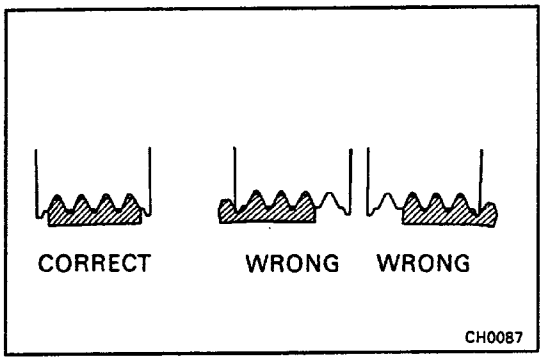
Using a 16 mm plug wrench, install the six spark plugs.

Torque: 18 N–m (18o kgf–cm, 13 ft–lbf)

7. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS







GENERATOR DRIVE BELT INSPECTION

INSPECT DRIVE BELTS

(a) Visually check the belt for excessive wear, frayed cords etc.

If necessary, replace the drive belt.

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

(b) Using a belt tension gauge, measure the belt tension.

Belt tension gauge:

BTG–20 (95506–00020) for nippondenso

No. BT–33–73F for borroughs

Drive belt tension:

New belt

160 ±20 lbf

Used belt

100 ±20 lbf

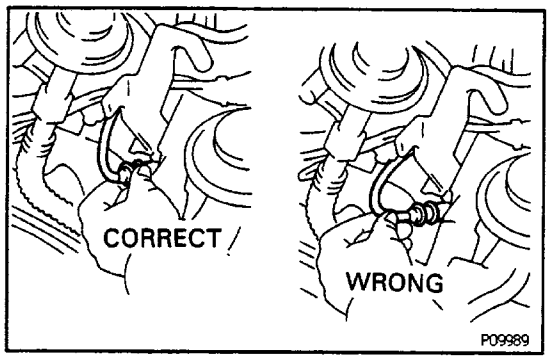
If necessary, adjust the belt tension.

HINT:

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

VALVE CLEARANCE INSPECTION AND ADJUSTMENT

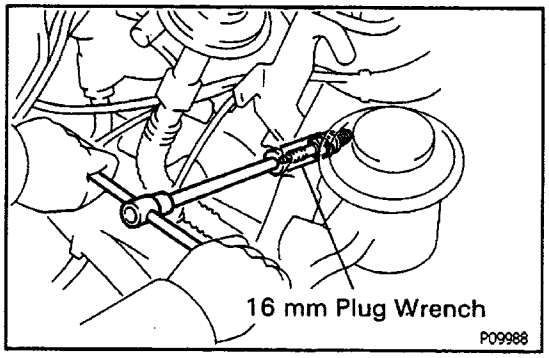
HINT: Inspect and adjust the valve clearance when the engine is cold.



1. DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS

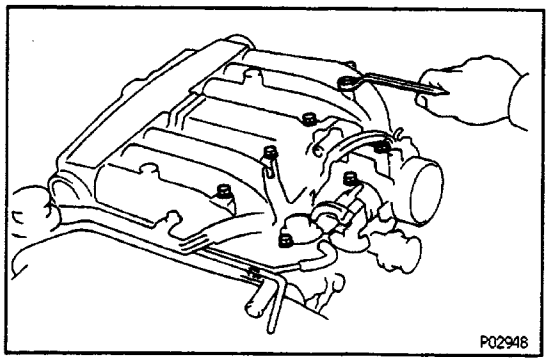
Disconnect the high – tension cords at the rubber boot. Do not pull on the cords.

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



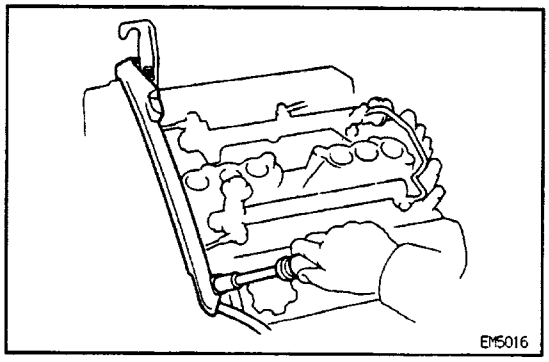
2. REMOVE SPARK PLUGS

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



3. REMOVE AIR INTAKE CHAMBER

(See step 18 on pages EG2–53 to 55)

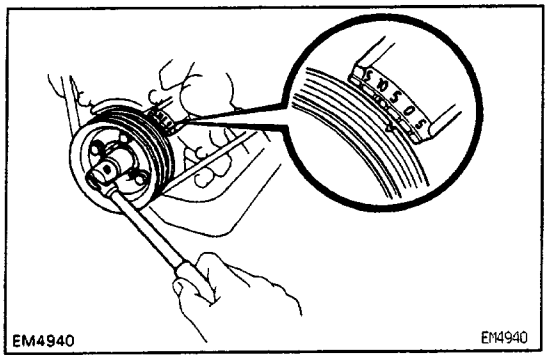


4. REMOVE ENGINE WIRE

Remove the two bolts and engine wire.

5. REMOVE CYLINDER HEAD COVERS

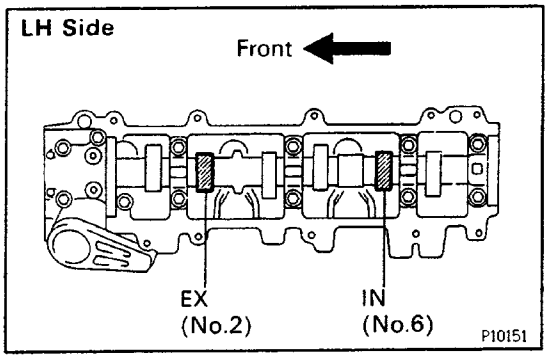
(See step 35 on page EG2–58)



6. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

(b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 are tight.
If not, turn the crankshaft one revolution (360°) and align the mark as above.



7. INSPECT VALVE CLEARANCE

(a) Check the clearance of the 1N (No.6) and EX (No.2) valves.
Using a feeler gauge, measure the clearance be–tween the valve lifter and camshaft.
Record the out– of –specification valve clear–ance measurements. They will be used later to determine the required replacement adjusting shim.

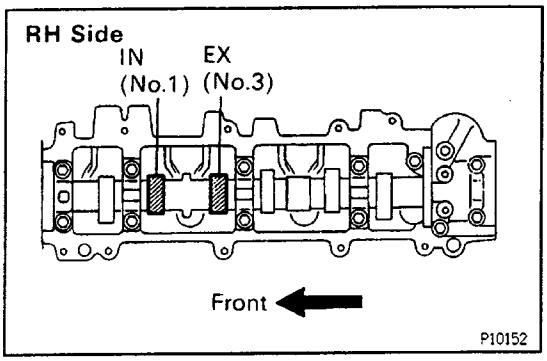
Valve clearance (Cold):

Intake

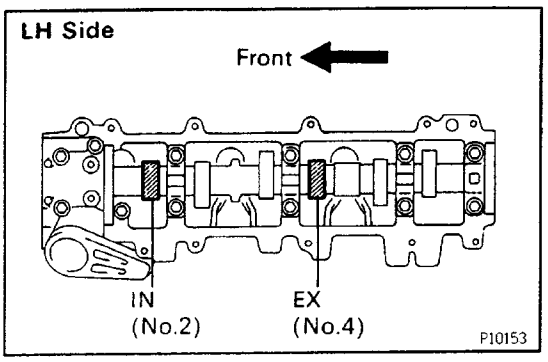
0.18 – 0.28 mm (0.007 – 0.011 in.)

Exhaust

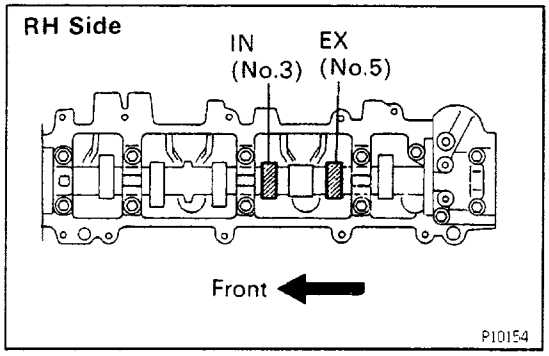
0.22 – 0.32 mm (0.009 – 0.013 in.)



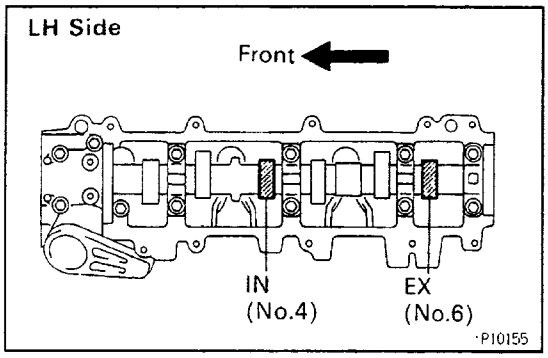
(b) Turn the crankshaft 1/3 revolution (120°), check the clearance of the IN (No. 1) and EX (No. 3) valves.
Measure the valve clearance.
(See procedure in step (a))



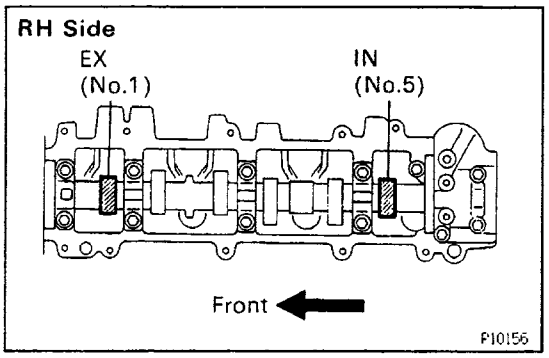
(c) Turn the crankshaft 1/3 revolution (120°), check the clearance of the IN (No. 2) and EX (No. 4) valves.
Measure the valve clearance.
(See procedure in step (a))



(d) Turn the crankshaft 1/3 revolution (120°), check the clearance of the IN (No. 3) and EX (No. 5) valves. Measure the valve clearance.
(See procedure in step (a))



(e) Turn the crankshaft 1/3 revolution (120°), check the clearance of the IN (No. 4) and EX (No. 6) valves. Measure the valve clearance.
(See procedure in step (a))

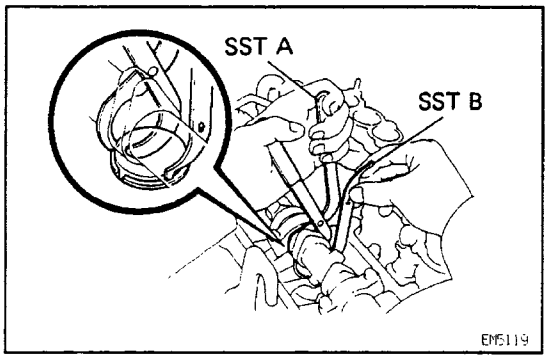


(f) Turn the crankshaft 1/3 revolution (120°), check the clearance of the IN (No. 5) and EX (No. 1) valves. Measure the valve clearance.
(See procedure in step (a))

8. ADJUST VALVE CLEARANCE

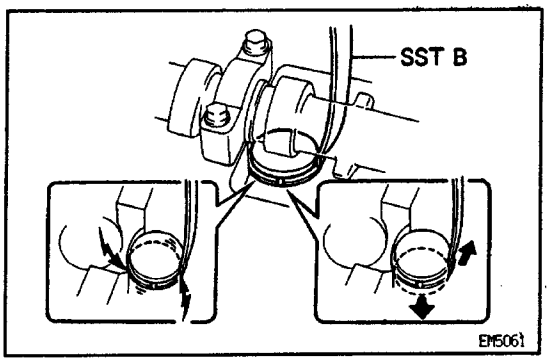
(a) Remove the adjusting shim.

- Turn the crankshaft so that the cam lobe of the camshaft on the adjusdting valve upward.
- Position the notch of the valve lifter facing the spark plug side.



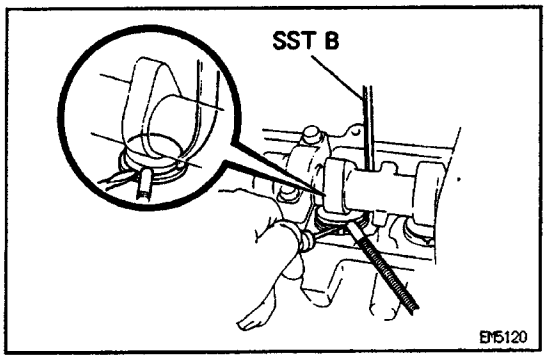
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

SST 09248–55020 (09248–05011, 09248–05021)



HINT: For easy removal of the shim, When setting SST 8, set it on the lifter so there is a wide space in the removal direction.*

- Remove the adjusting shim with a small screw–driver and magnetic finger.



(b) : Determine the replacement adjusting shim size by following–the Formula or Chart:

- Using a rnicrometer, measure – the thickness of the removed shim.
- Culculate the thickness of a new shim so that the valve clearance comes within specified value.
  T ..... Thickness of removed shim
  A ..... Measured valve clearance
  N ..... Thickness of new shim

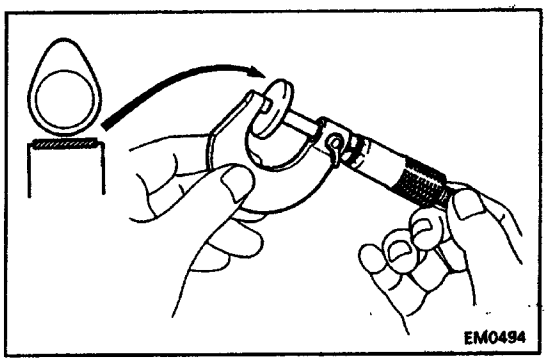
Intake:

N = T + (A – 0.23 mm (0.009 in.))

Exhaust:

N = T + (A – 0.27 mm (0.011 in.))

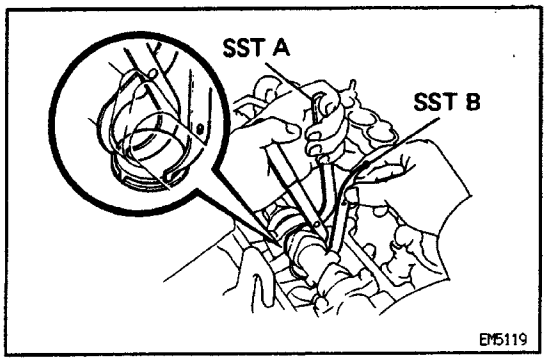
- Select a new shim with a thickness as close as possible to the calculated value.



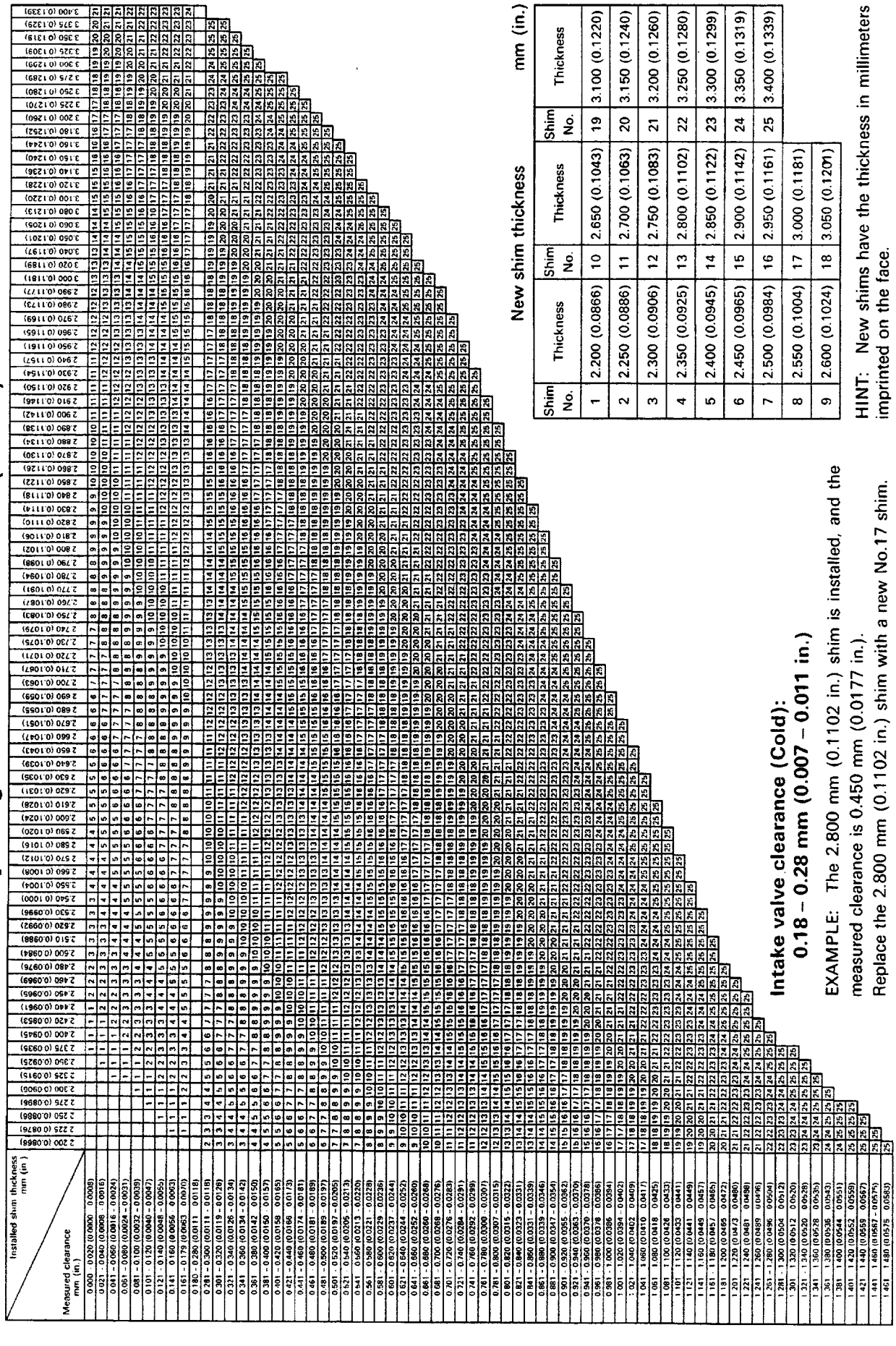
HINT: Shims are available in twenty–five sized in increments of 0.05 mm (0.0020 ire:), from 2.20 mm (0.09B4 in.) to 3.40 mm (0.1299 in.).

(c) Install a new adjusting shim.

- Place a new adjusting shim on the valve lifter.
- Using SST (A), press down the valve lifter and remove SST (B).
  SST 09248 – 55020 (09248–05011, 09248–05021)



Adjusting Shim Selection Chart (Intake)



Intake valve clearance (Cold):
0.18 – 0.28 mm (0.007 – 0.011 in.)

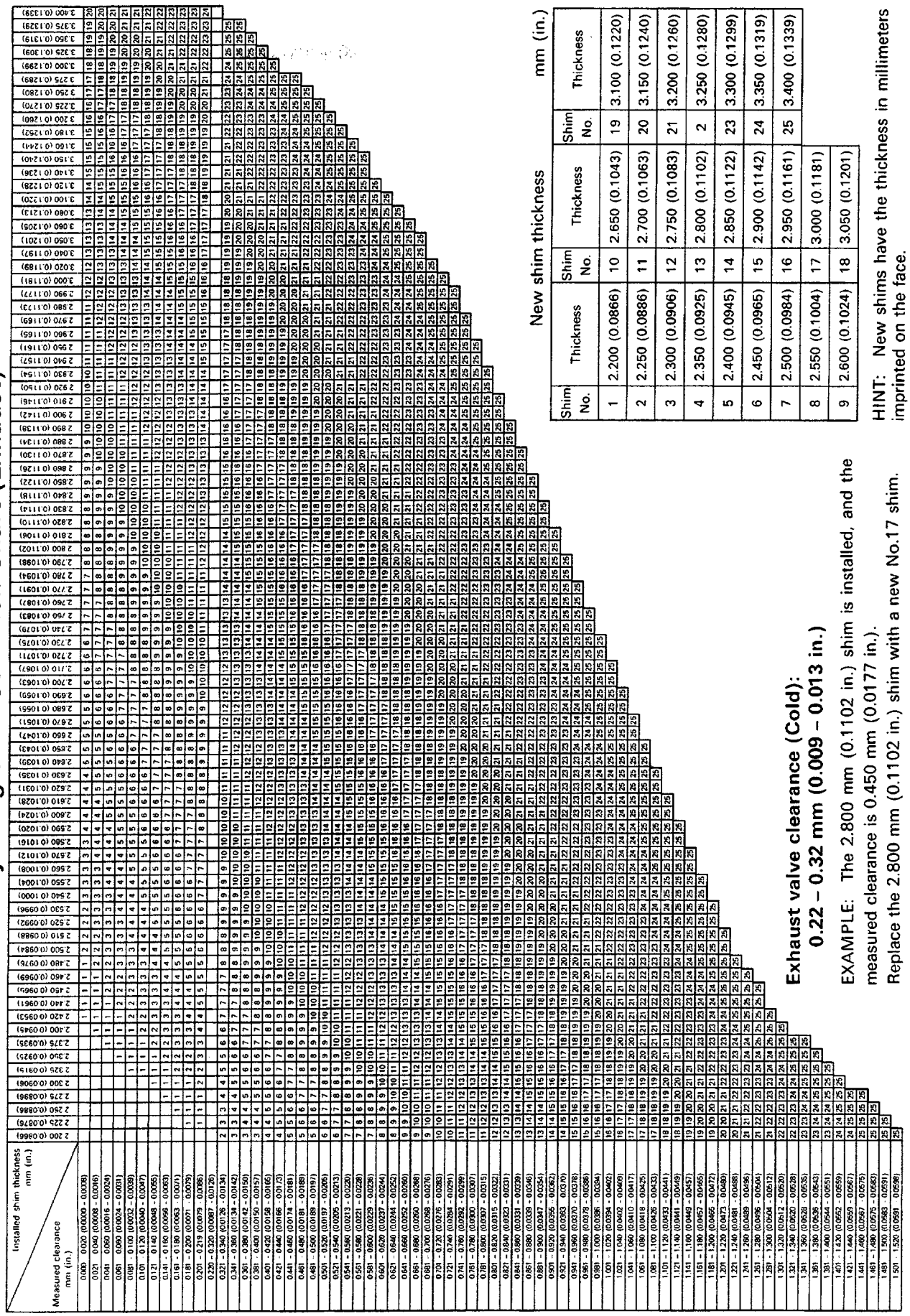
EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.).
Replace the 2.800 mm (0.1102 in.) shim with a new No.17 shim.

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness	Shim No.	Thickness
1	2.200 (0.0866)	10	2.650 (0.1043)	19	3.100 (0.1220)
2	2.250 (0.0886)	11	2.700 (0.1063)	20	3.150 (0.1240)
3	2.300 (0.0906)	12	2.750 (0.1083)	21	3.200 (0.1260)
4	2.350 (0.0925)	13	2.800 (0.1102)	22	3.250 (0.1280)
5	2.400 (0.0945)	14	2.850 (0.1122)	23	3.300 (0.1299)
6	2.450 (0.0965)	15	2.900 (0.1142)	24	3.350 (0.1319)
7	2.500 (0.0984)	16	2.950 (0.1161)	25	3.400 (0.1339)
8	2.550 (0.1004)	17	3.000 (0.1181)		
9	2.600 (0.1024)	18	3.050 (0.1201)		

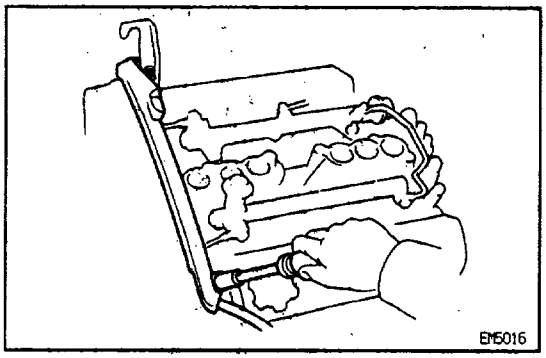
HINT: New shims have the thickness in millimeters imprinted on the face.

V02186

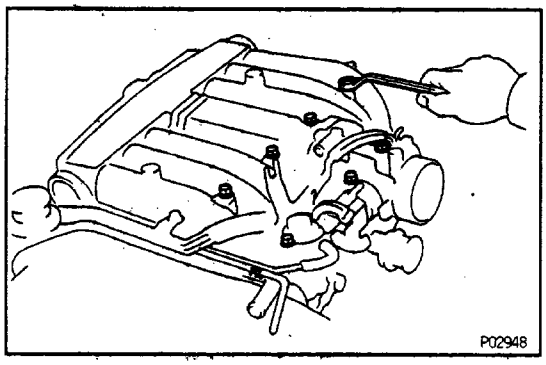


Shim No.	Thickness	Shim No.	Thickness	Shim No.	Thickness
1	2.200 (0.0866)	10	2.650 (0.1043)	19	3.100 (0.1220)
2	2.250 (0.0886)	11	2.700 (0.1063)	20	3.150 (0.1240)
3	2.300 (0.0906)	12	2.750 (0.1083)	21	3.200 (0.1260)
4	2.350 (0.0925)	13	2.800 (0.1102)	2	3.250 (0.1280)
5	2.400 (0.0945)	14	2.850 (0.1122)	23	3.300 (0.1299)
6	2.450 (0.0965)	15	2.900 (0.1142)	24	3.350 (0.1319)
7	2.500 (0.0984)	16	2.950 (0.1161)	25	3.400 (0.1339)
8	2.550 (0.1004)	17	3.000 (0.1181)		
9	2.600 (0.1024)	18	3.050 (0.1201)		

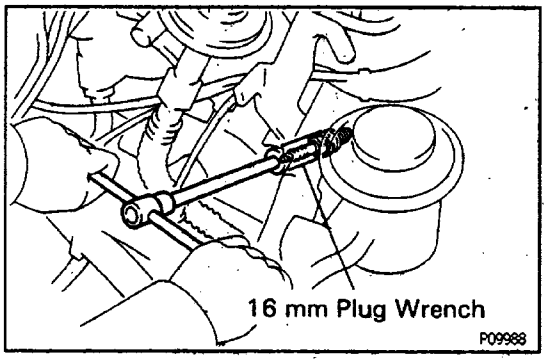
V02187



9. INSTILL CYLINDER HEAD COVERS
(See step 7 on page EG2–80)
10. INSTALL ENGINE WIRE
Install the engine wire with the two bolts.



11. INSTALL AIR INTAKE CHAMBER
(See step 24 on pages EG2–84 to 87)



12. INSTALL SPARK PLUGS
Using a 16 mm plug wrench, install the six spark plugs.

Torque: 18 N–m (18a kgf–cm, 13 ft–lbf)

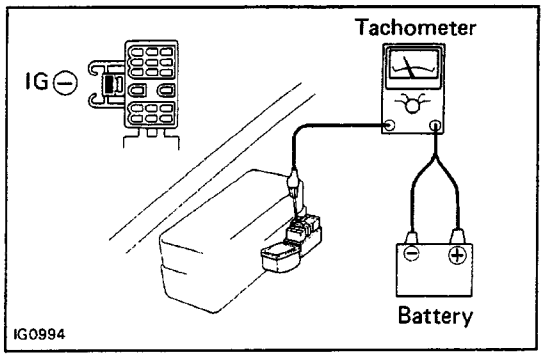
13. RECONNECT– HIGH –TENSION CORDS TO SPARK PLUGS

EG1ZF–01

IGNITION TIMING INSPECTION AND ADJUSTMENT

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

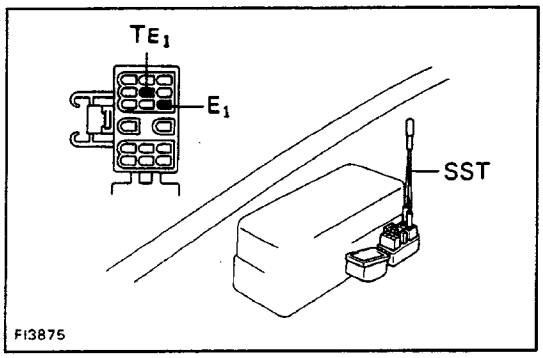


2. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

Connect the test probe of a tachometer to terminal IG (–) of the data link connector 1.

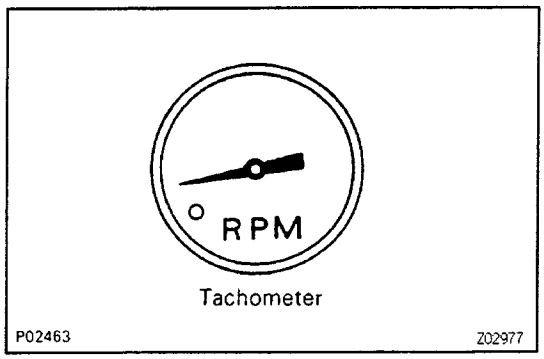
NOTICE:

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



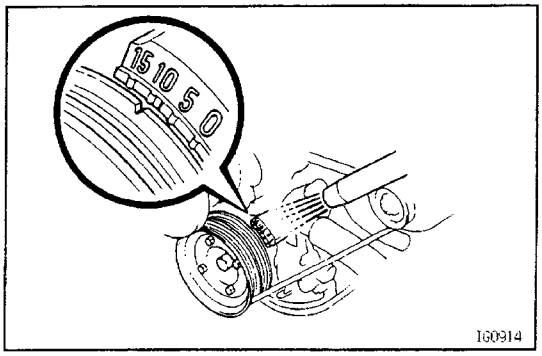
3. ADJUST IGNITION TIMING

(a) Using SST, connect terminals TE1 and E1 of the the data link connector 1.
SST 09843–18020



(b) Check the idle speed.

Idle speed:
800 ± 50 rpm

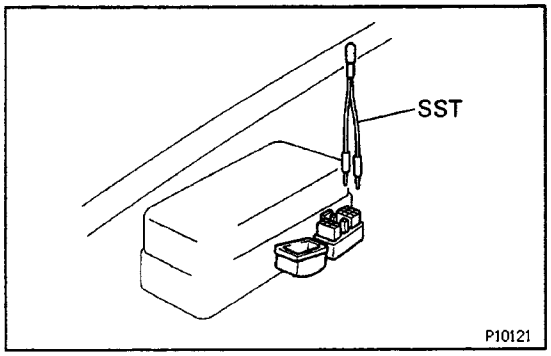


(c) Using a timing light, check the ignition timing.

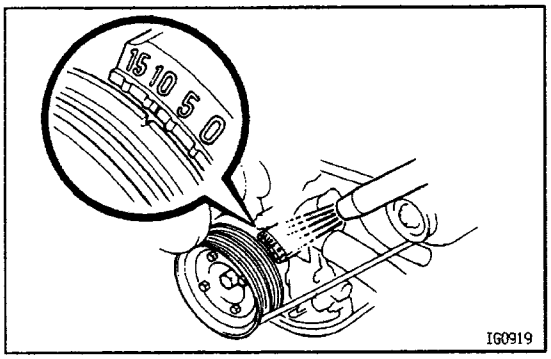
Ignition timing:
10 ° BTDC @ idle
(Transmission in neutral position)

(d) Loosen the hold–down bolt, and adjust by turning the distributor.

(e) Tighten the hold–down bolt, and recheck the ignition timing.
Torque: 18N–m (185 kgf–cm, 13 ft–lbf)



(f) Remove the SST from the data link connector 1.
SST 09843–18020



4. FURTHER CHECK IGNITION TIMING

Check that the ignition timing advances.
Ignition timing:
8° BTDC @ idle

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

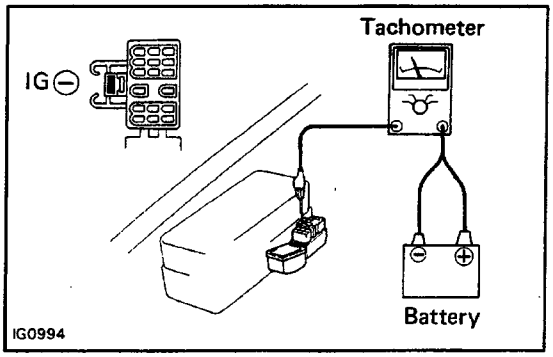
IDLE SPEED INSPECTION AND ADJUSTMENT

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 accessories switched OFF
(e) All vacuum lines properly connected
HINT: All vacuum hoses for EGR systems, etc. should be properly connected.
(f) MFI system wiring connectors fully plugged
(g) Ignition timing set correctly
(h) Transmission in neutral position

2. CONNECT TACHOMETER

Connect the test probe of a tachometer to terminal IG (–) of the data link connector 1.

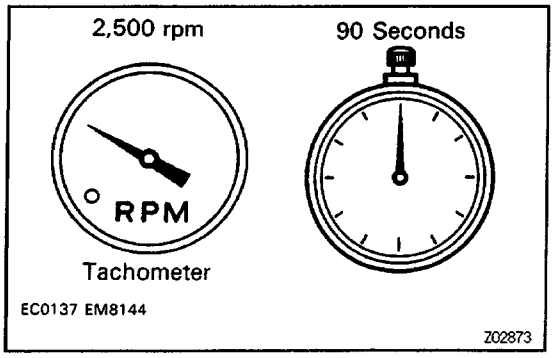


NOTICE:

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

3. ADJUST IDLE SPEED

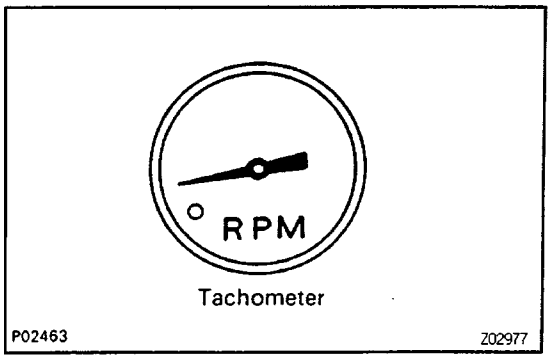
(a) Race the engine speed at 2,500 rpm for approx. 90 seconds.



(b) Check the idle speed.

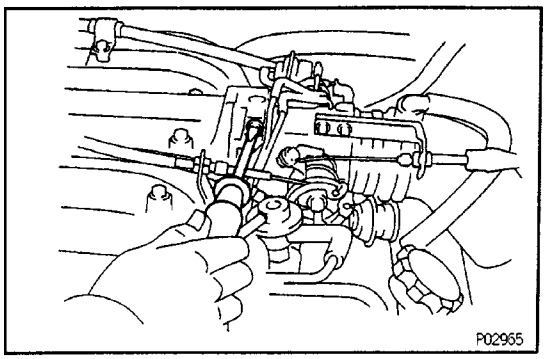
Idle speed:

800 ± 50 rpm



(c) Adjust the idle speed by turning the idle speed adjusting screw.

4. DISCONNECT TACHOMETER



IDLE AND OR 2500 RPM CO HC CHECK

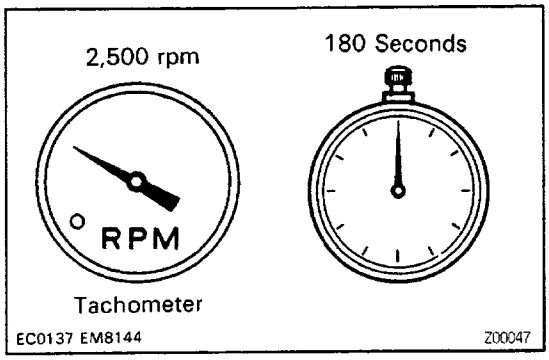
HINT: This check is used only to determine whether or not the idle CO/HC complies with regulations.

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 accessories switched OFF
(e) All vacuum lines properly connected

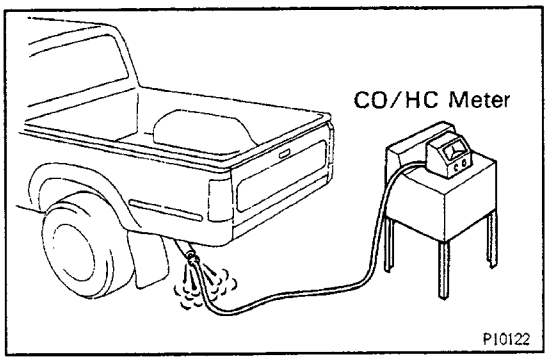
HINT: All vacuum hoses for EGR systems, etc. should be properly connected.

(f) MFI system wiring connectors fully plugged
(g) Ignition timing set correctly
(h) Idle speed set correctly
(i) Transmission in neutral position
(j) Tachometer and CO/HC meter calibrated by hand



2. START ENGINE

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



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

5. IMMEDIATELY CHECK CO/HC CONCENTRATION AT IDLE AND/OR 2,500 RPM

HINT: When performing the 2 mode (2,500 rpm and idle) test, follow the measurement order prescribed by the applicable local regulations.

Troubleshooting

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

(a) Check heated oxygen sensor operation.
(See MFI System on page EG2–252)

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

CO	HC	Problems	Causes
Normal	High	Rough idle	1. Faulty ignitions: • 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
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: • PCV hose • EGR valve • Intake manifold • Air intake chamber • Throttle body • Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. PAIR system problems 4. Faulty M F I systems: • Faulty pressure regulator • Clogged fuel return line • Defective ECT sensor • Defective intake air temperature sensor • Faulty ECM • Faulty injector • Faulty cold start injector • Faulty throttle position sensor • Faulty volume air flow meter

V02257

COMPRESSION CHECK

HINT: If there is lack of power, excessive oil con–sumptiom or poor fuel economy, measure the com–pression pressure.

1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

2. REMOVE AIR CLEANER HOSE

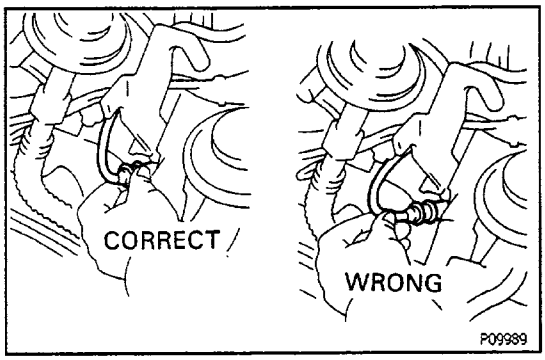
3. DISCONNECT COLD START INJECTOR CONNECTOR

4. DISCONNECT IGNITER CONNECTOR

5. DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS

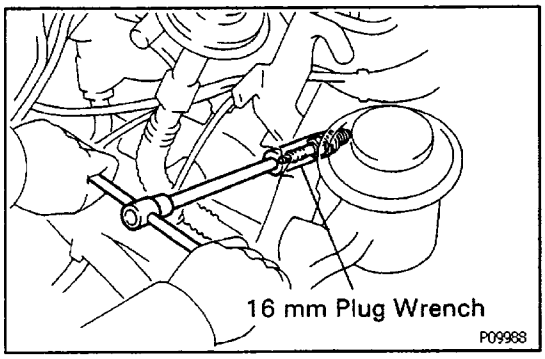
Disconnect the high – tension cords at the rubber boot. Do not pull on the cords.

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



6. REMOVE SPARK PLUGS

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



7. CHECK CYLINDER COMPRESSION PRESSURE

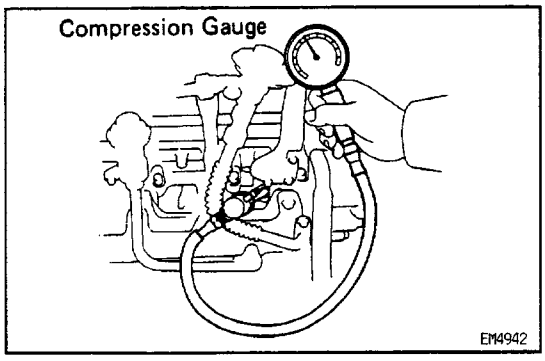
(a) Insert a compression gauge into the spark plug hole.

(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.

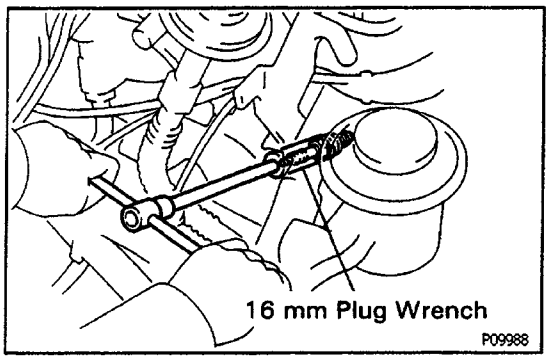


NOTICE: This measurement must be done in as short a time as possible.

Compression pressure:
1,177 kPa (12.0 kg f/cm^2, 171 psi) .
Minimum pressure:
981 kPa (10.0 kg f/cm^2, 142 psi)
Difference between each cylinder:
98 kPa (1.0 kg f/cm^2, 14 psi) or less

(e) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylin–der 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 damage.
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.



8. REINSTALL SPARK PLUGS

Using a 16 mm plug wrench, install the six spark plugs.

Torque: 18 N–m (780 kgf–cm, 13 ft–lbf)

9. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS

10. CONNECT IGNITER CONNECTOR

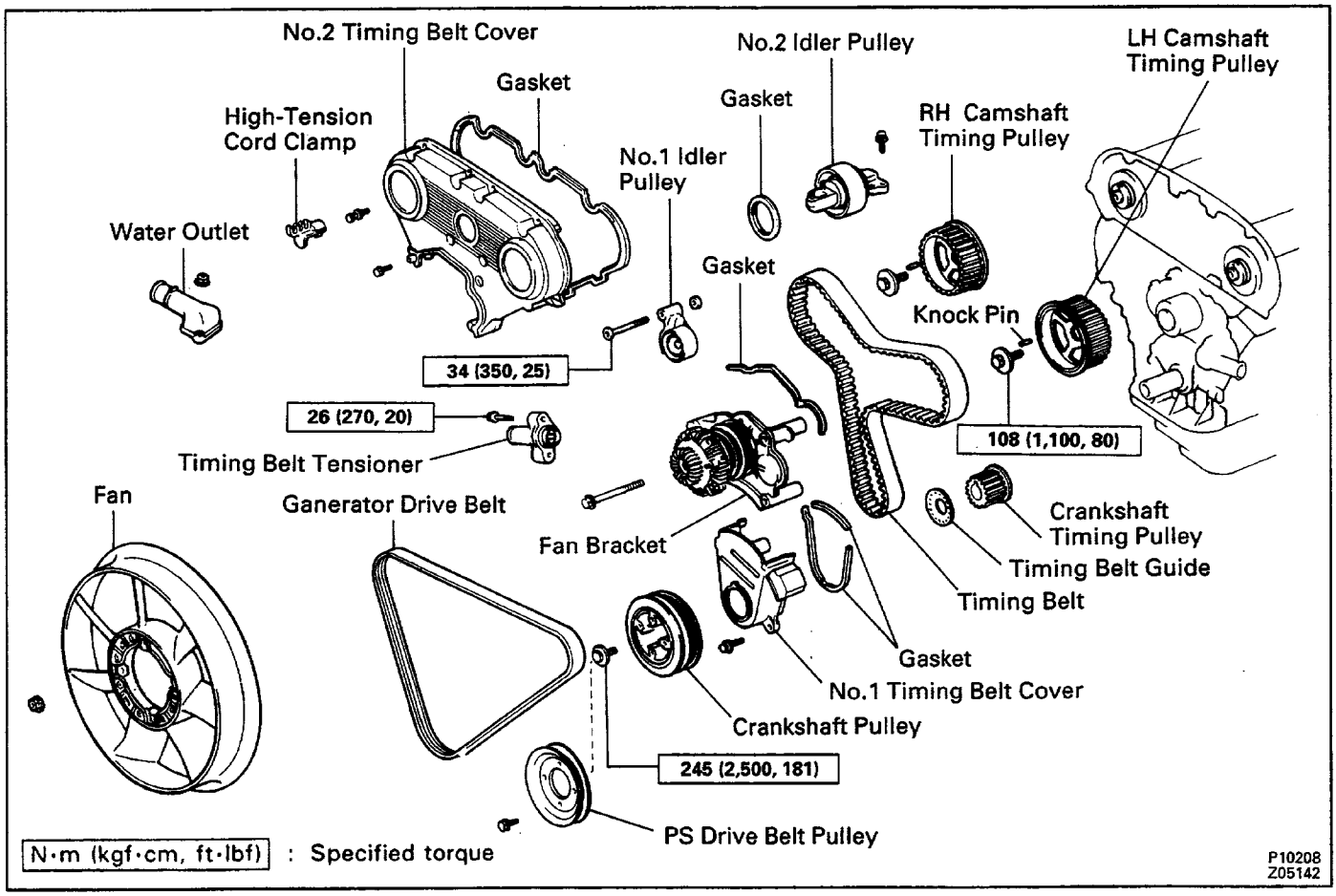
11. CONNECT COLD START INJECTOR CONNECTOR

12. INSTALL AIR CLEANER HOSE

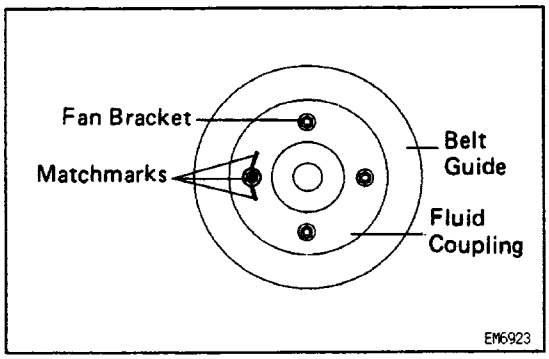
TIMING BELT

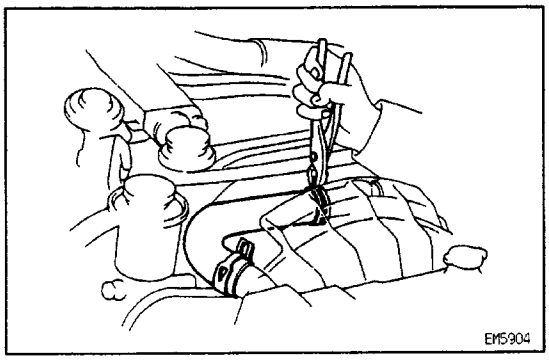
EG1E5–02

COMPONENTS



EG205–01





TIMING BELT REMOVAL

(See Components)

NOTICE: If removing and later reinstalling the fluid coupling from the fan bracket, place matchmarks on the fluid coupling and fan bracket so that the fluid coupling can be replaced exactly as before.

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

2. REMOVE ENGINE UNDER COVER

3. DRAIN ENGINE COOLANT

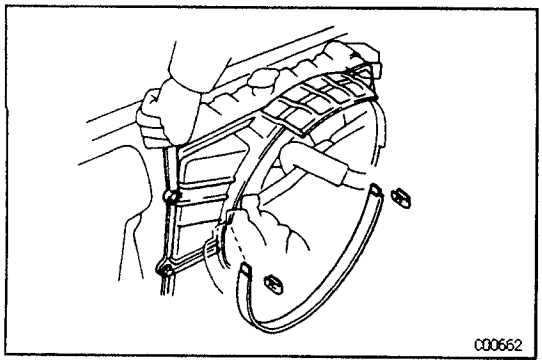
4. REMOVE RADIATOR

(a) Disconnect the reservoir hose.

(b) (A/T only)

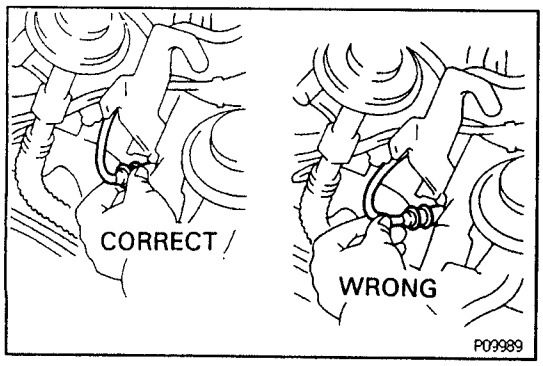
Disconnect the oil cooler hoses.

(c) Remove the radiator hoses.



(d) Remove the two clips and No.2 fan shroud.
(e) Remove the four bolts and No.1 fan shroud.
(f) Remove the four bolts and radiator.

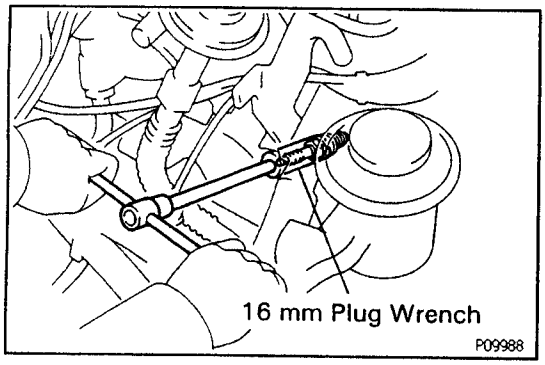
5. DISCONNECT N0.2 AND NO.3 AIR HOSES FROM AIR PIPE



6. DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS

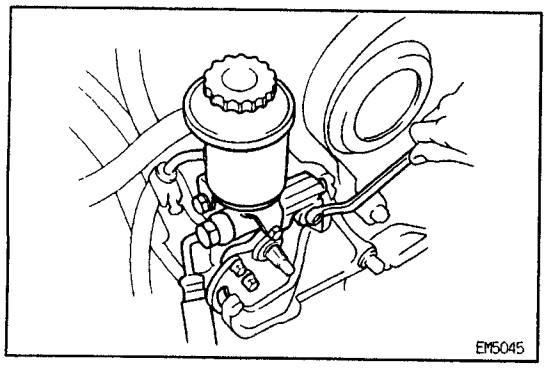
Disconnect the high – tension cords at the rubber boot. Do not pull on the cords.

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

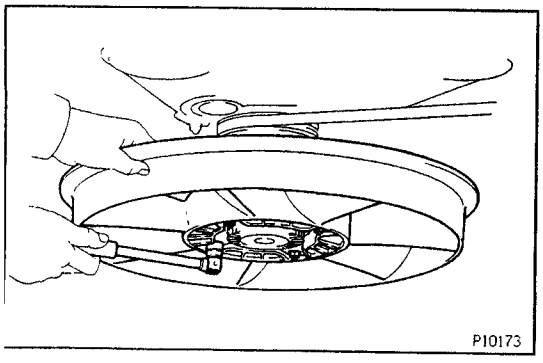


7. REMOVE SPARK PLUGS

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



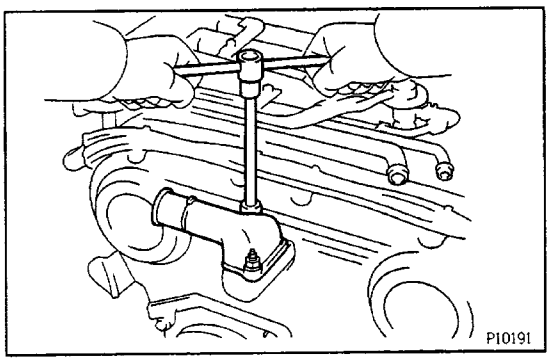
8. REMOVE PS DRIVE BELT AND PUMP PULLEY
9. DISCONNECT PS PUMP FROM ENGINE
10. REMOVE A/C DRIVE BELT



11. REMOVE COOLING FAN

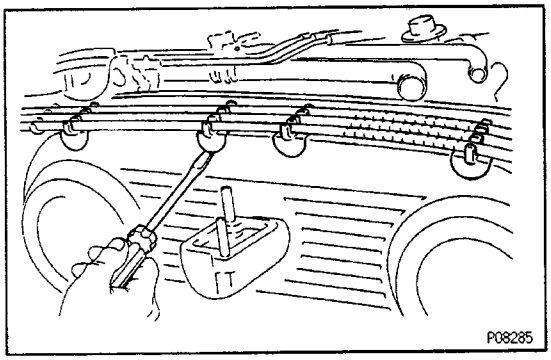
Remove the four nuts and cooling fan.

12. REMOVE GENERATOR DRIVE BELT



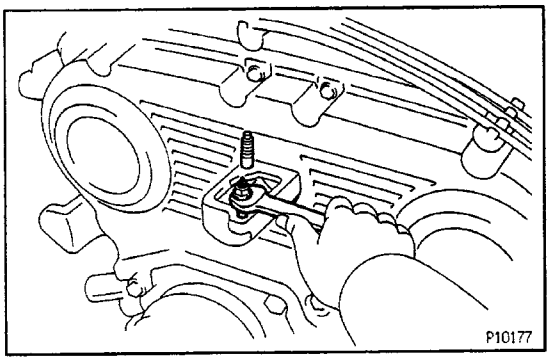
13. REMOVE WATER OUTLET

Remove the two nuts and water outlet.

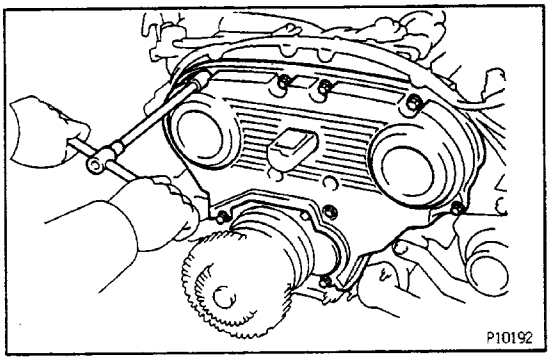


14. REMOVE NO.2 TIMING BELT COVER

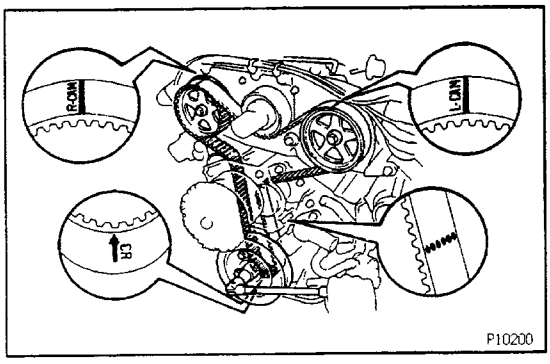
(a) Using a screwdriver, disconnect the four high–tension cord clamps from the mounting bolts of the No.2 timing belt cover.



(b) Using the two water inlet nuts, remove the two stud bolts.



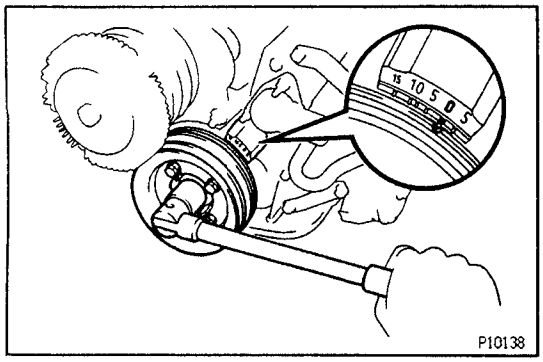
(c) Remove the eleven bolts, timing belt cover and three gaskets.



15. IF RE–USING TIMING BELT, CHECK INSTALLATION MARKS ON TIMING BELT

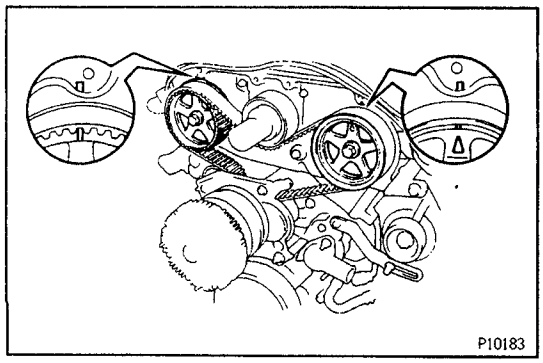
Check that there are four installation marks on the timing belt by turning the crankshaft pulley as shown in the illustration.

HINT: If the installation marks have disappeared, place a new installation mark on the timing belt before removing each part.

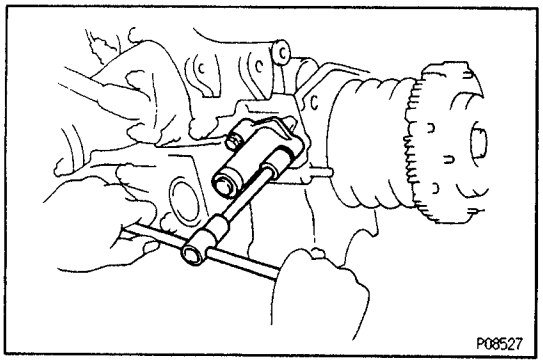


16. SET NO.1 CYLINDER AT TDC/COMPRESSION

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

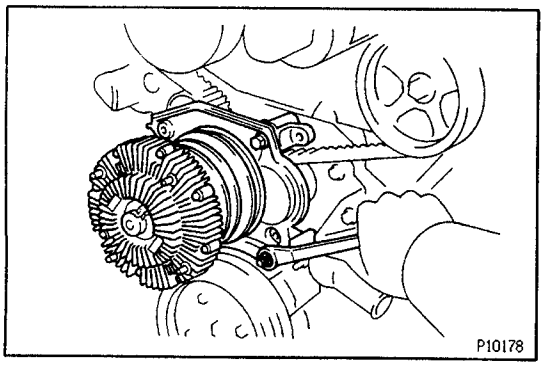


(b) Check that the timing marks of the camshaft timing pulleys and No.3 timing belt cover are aligned. If not, turn the crankshaft pulley one revolution (360°).



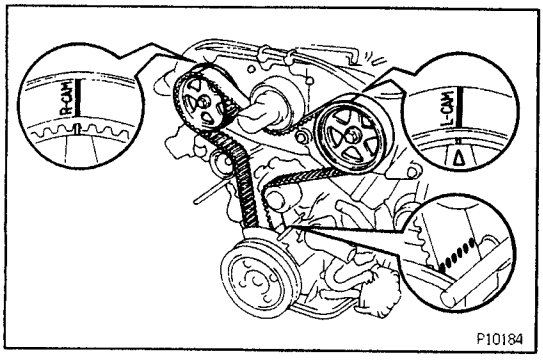
17. REMOVE TIMING BELT TENSION ER

Alternately loosen the two bolts, and remove them, the belt tensionet– and dust boot.



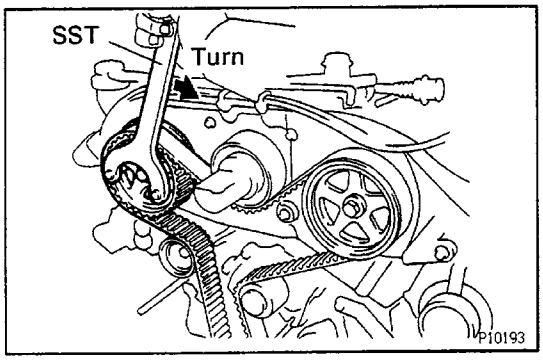
18. REMOVE FAN BRACKET

Remove the two bolts, nut, fan bracket and gasket.

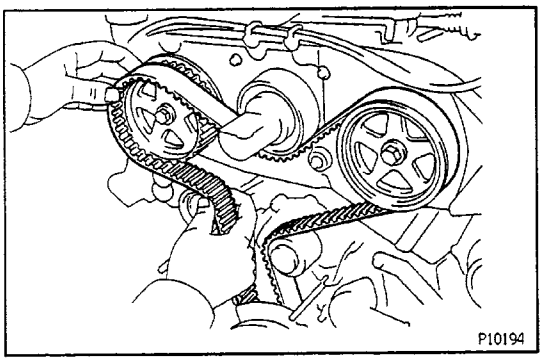


19. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEYS

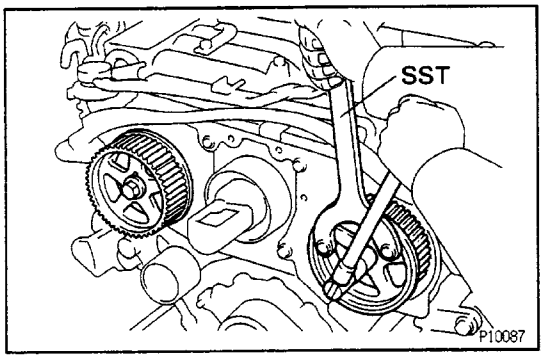
HINT (When re–using timing belt): If the installation marks have disappeared, before disconnect the timing belt from the camshaft timing pulleys, place new in–stallation marks on the timing belt to match the timing marks of the camshaft timing pulleys, and place the a new installation mark on the timing belt to match the end of the No. 1 timing belt. cover.



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

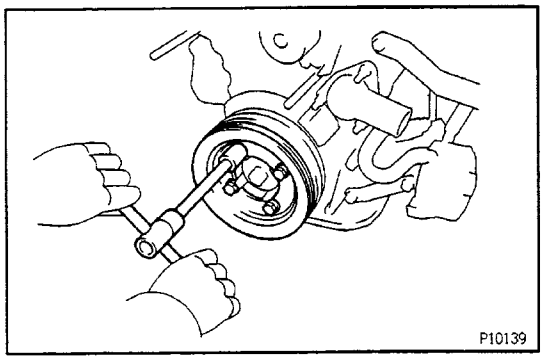


(b) Disconnect the timing belt from the camshaft timing pulleys.



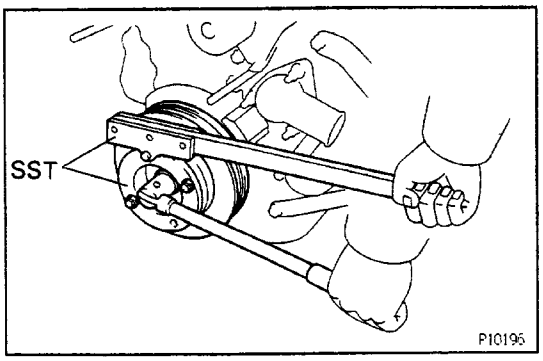
20. REMOVE CAMSHAFT TIMING PULLEYS

Using SST, remove the pulley bolt, timing pulley and knock pin. Remove the two timing pulleys.
SST 09278–54012



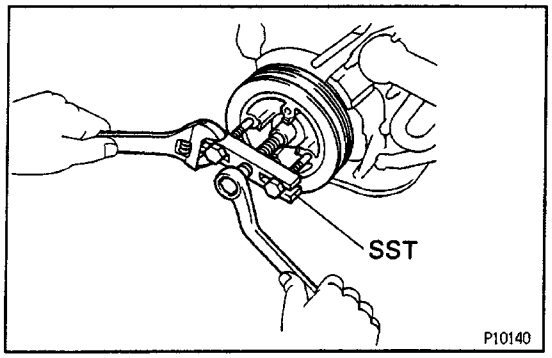
21. REMOVE CRANKSHAFT PULLEY

(a) Remove the four bolts and PS drive belt pulley.

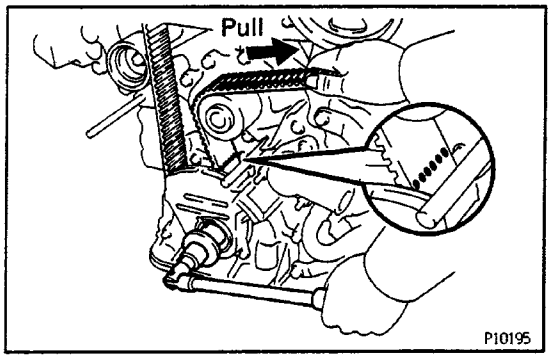


(b) Using SST, loosen the pulley bolt.
SST 09213–58012 (90201–08131, 91111–50845), 09330–00021

(c) Remove the SST and pulley bolt.

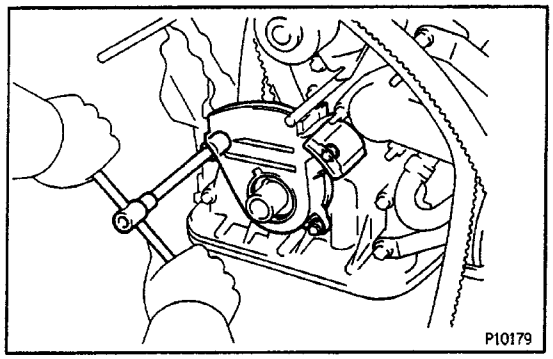


(d) Using SST, remove the pulley.
SST 09213–31021

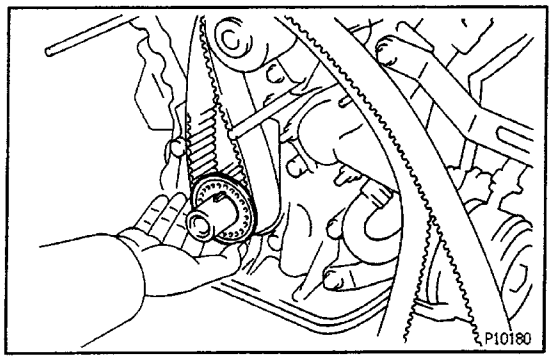


22. REMOVE N0.1 TIMING BELT COVER

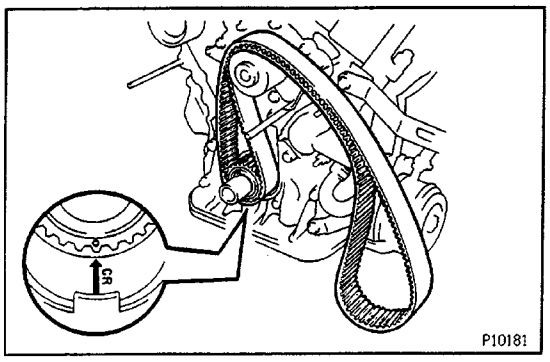
HINT (When re–using timing belt): Before removing the timing belt cover, using the crankshaft pulley bolt, turn the crankshaft and align the installation mark of the timing belt with the end of the timing belt cover.



Remove the three bolts, timing belt cover and gasket.

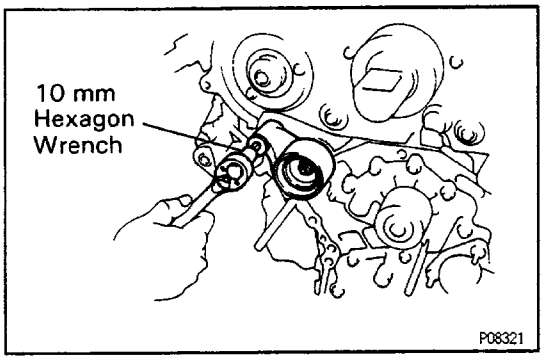


23. REMOVE TIMING BELT GUIDE



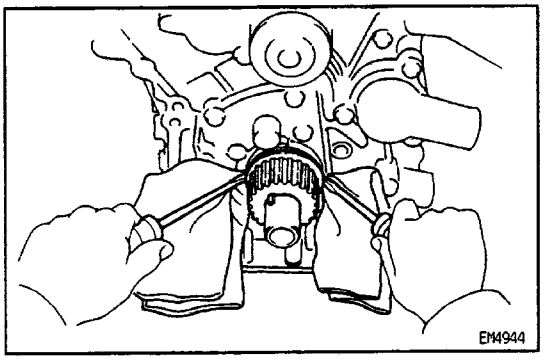
24. REMOVE TIMING BELT

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



25. REMOVE No.1 IDLER PULLEY

Using a 10 mm hexagon wrench, remove the pivot bolt, idler pulley and plate washer.

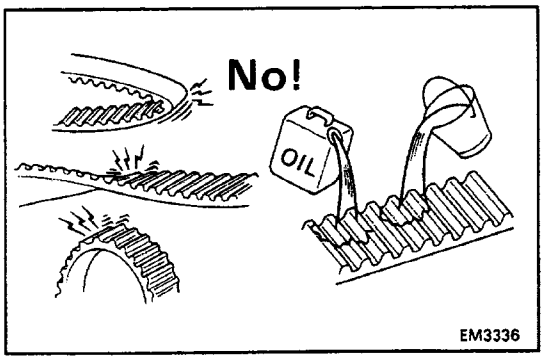


26. REMOVE CRANKSHAFT TIMING PULLEY

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

HINT: Position shop rags as shown to prevent damage.

TIMING BELT COMPONENTS INSPECTION



1. INSPECT TIMING BELT

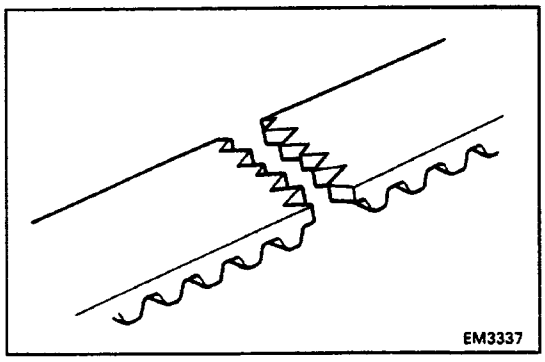
NOTICE:

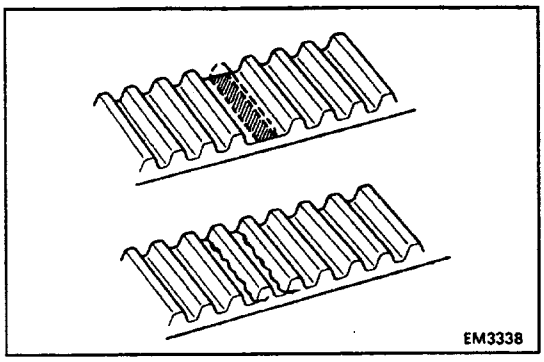
- **Do not bend, twist or turn the timing belt inside out. Do not allow the timing belt to come into contac with oil, water or steam.**
- **Do not utilize timing belt tension when installing or removing the mounting bolt of the camshaft timing pulley.**

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

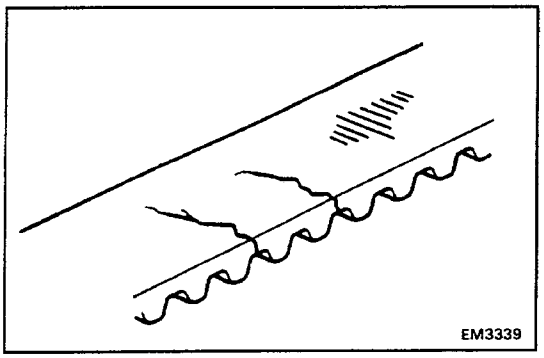
(a) Premature parting

- Check the proper installation.
- Check the timing cover gasket f6r damage and proper installation.

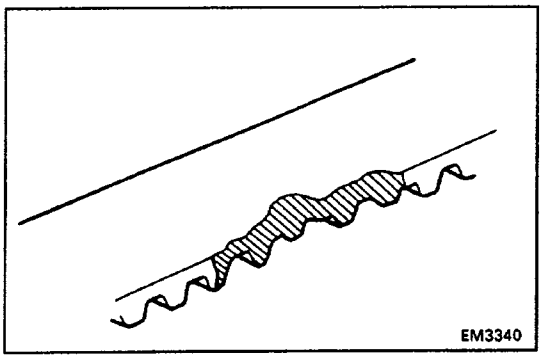




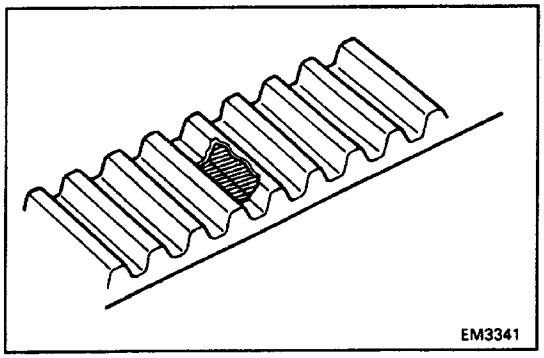
(b) If the belt teeth are cracked or damaged, check to see if either camshaft or water pump is locked.



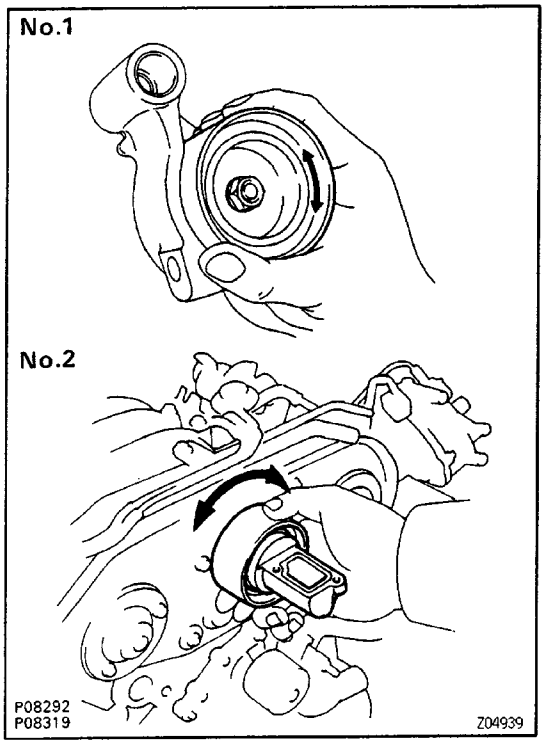
(c) If there is noticeable wear or cracks on the belt face; check to see if there are nicks on the side of the idle pulley lock.



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

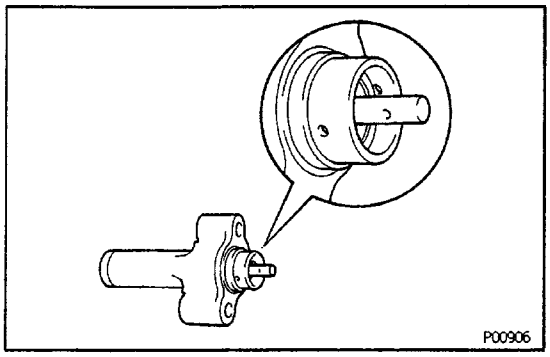


(e) If there is noticeable wear on the belt teeth, check the timing cover for damage, correct gasket installation, and foreign material on the pulley teeth.
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEYS

Check that the idler pulley turns smoothly.
If necessary, replace the idler pulley.

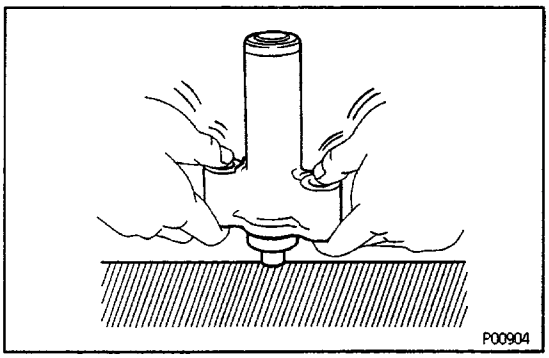


3. INSPECT TIMING BELT TENSIONER

(a) Visually check tensioner for oil leakage.

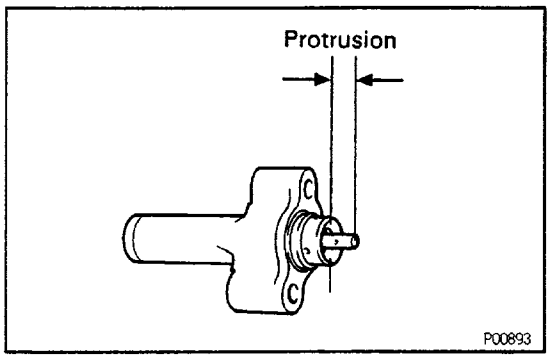
HINT: If there is only the faintest trace of oil on the seal on the push rod side, the tensioner is all right.

If leakage is found, replace the tensioner.



(b) Hold the tensioner with both hands, and push the push rod firmly 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.

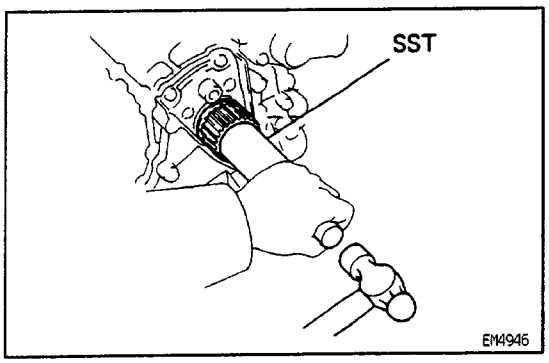
Protrusion:

10.0 – 10.5 mm (0.394 – 0.413 in.)

If the protrusion is not as specified, replace the ten–sioner.

EG20F–01

TIMING BELT INSTALLATION

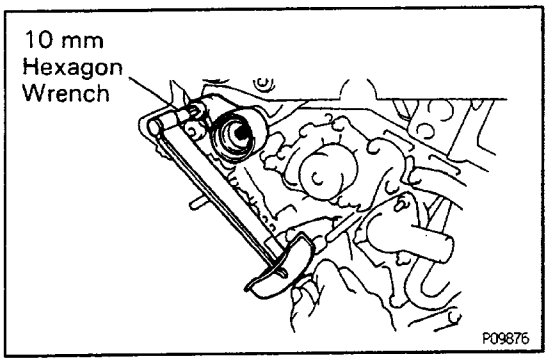


(See Components)

1. INSTALL CRANKSHAFT TIMING PULLEY

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

(b) Using SST and a hammer, tap in the timing pulley, facing the flange side inward.
SST 09214–60010

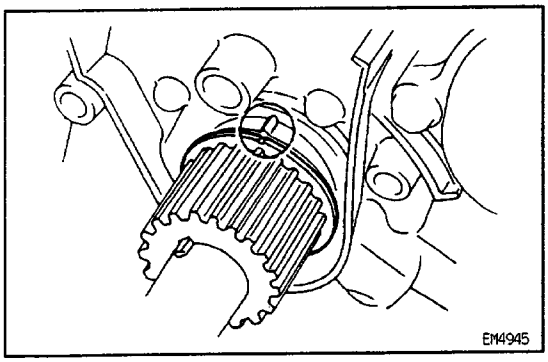


2. INSTALL NO.1 IDLER PULLEY

(a) Using a 10 mm hexagon wrench, install the plate washer and idler pulley with the pivot bolt.

Torque: 34 N–m (350 kgf–cm, 25 ft–lbf)

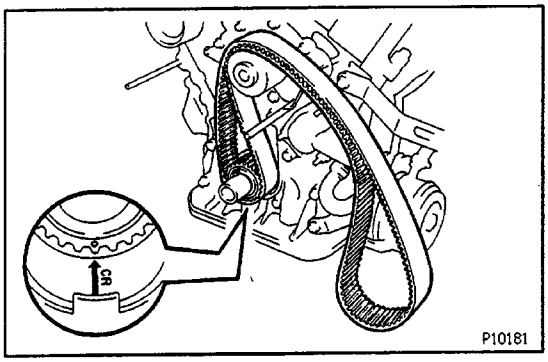
(b) Check that the pulley bracket moves smoothly.



3. TEMPORARILY INSTALL TIMING BELT

NOTICE: The engine should be cold.

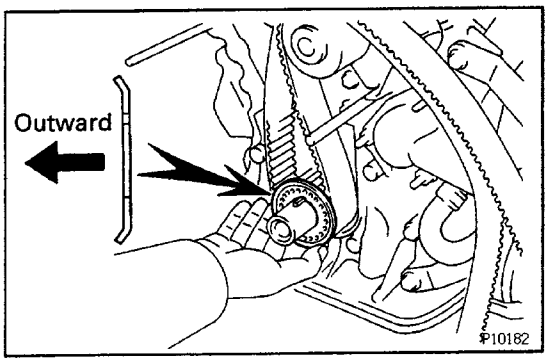
(a) Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.



(b) Remove any oil or water on the crankshaft timing pulley and water pump pulley, and keep them clean.

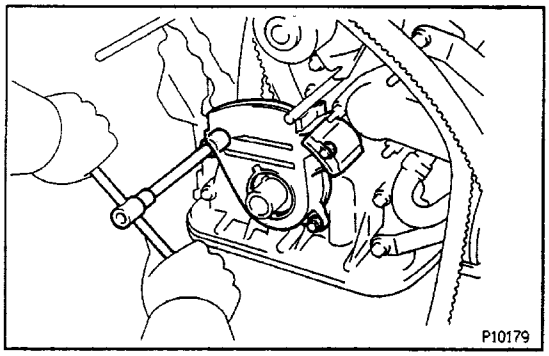
(c) Align the installation mark on the timing belt with the dot mark of the crankshaft timing pulley.

(d) Install the timing belt on the crankshaft timing pulley and water pump pulley.



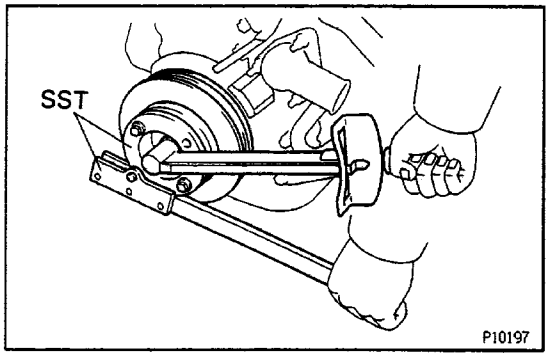
4. INSTALL TIMING BELT GUIDE

Install the belt guide, facing the cup side outward.



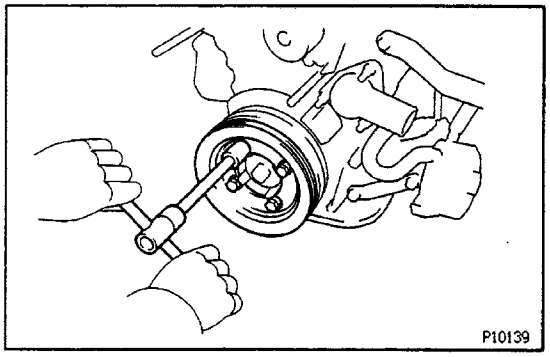
5. INSTALL NO.1 TIMING BELT COVER

(a) Install the gasket to the timing belt cover.
(b) Install the timing belt cover with the three bolts.

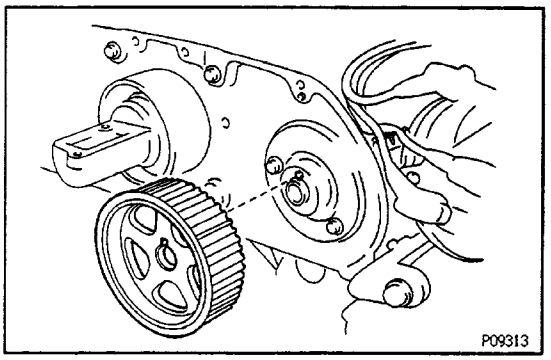


6. INSTALL CRANKSHAFT PULLEY

(a) Align the pulley set key with the key groove of the crankshaft pulley.
(b) Temporarily install the pulley bolt.
(c) Using SST, tighten the pulley bolt.
SST 09213–58012 (90201 –08131, 91111 –50845), 09330–00021
Torque: 245 N–m (2,500 kgf–cm, 181 ft–lbf)

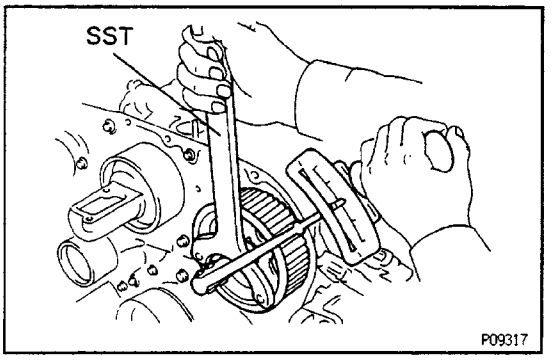


(d) Install the PS drive belt pulley with the four bolts.

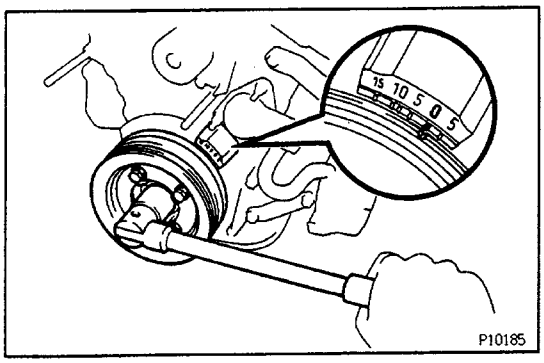


7. INSTALL LH CAMSHAFT TIMING PULLEY

(a) Install the knock pin to the camshaft.
(b) Align the knock pin hole of the camshaft with the knock pin groove of the timing pulley.
(c) Slide the timing pulley on the camshaft, facing the flange side outward.



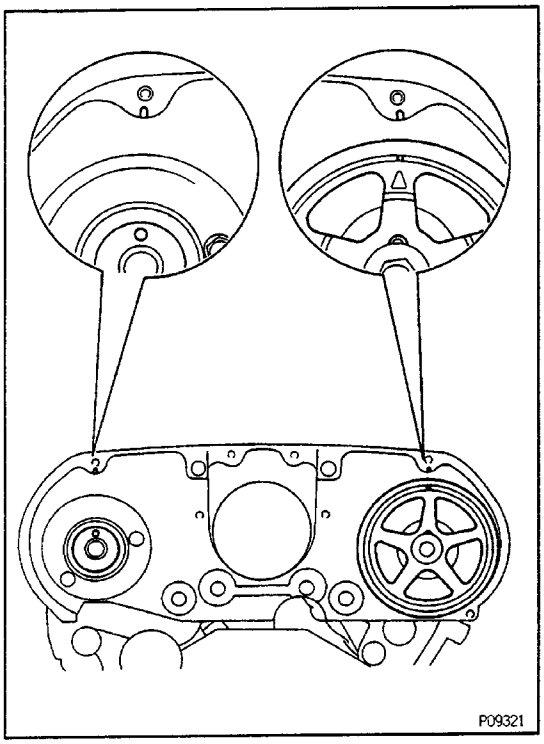
(d) Using SST, install the pulley bolt.
SST 09278–54012
Torque: 108 N–m (1,100 kgf–cm, 80 ft–lbf)



8. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) (Crankshaft Position)

Turn the crankshaft pulley, and align its groove with timing mark ”0” of the No.1 timing belt cover.

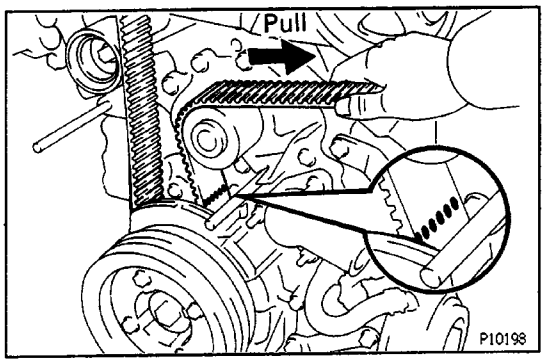


(b) (RH Camshaft Pulley Position)

Turn the camshaft, align the knock pin hole of the camshaft with the timing mark of the No.3 timing belt cover.

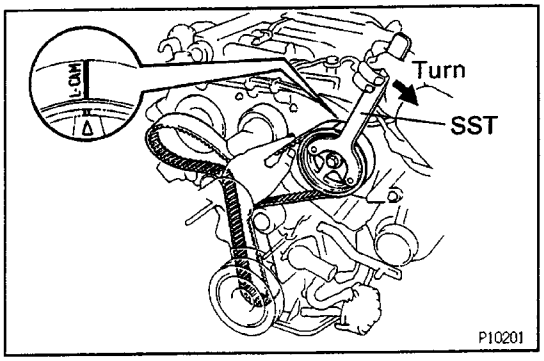
(c) (LH Camshaft Pulley Position)

Turn the camshaft timing pulley, align the timing marks of the camshaft timing pulley and No.3 timing belt cover.



9. CONNECT TIMING BELT TO LH CAMSHAFT TIMING PULLEY

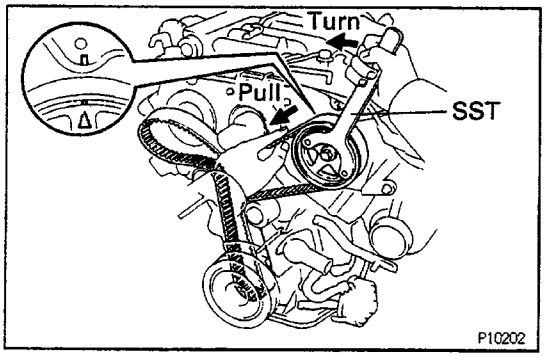
(a) Check that the installation mark on the timing belt is aligned with the end of the No.1 timing belt cover.



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

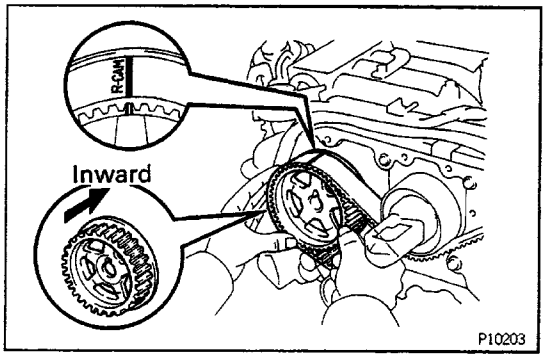
(c) Using SST, slightly turn the LH camshaft timing pulley clockwise. Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley, and hang the timing belt on the LH camshaft timing pulley.

SST 09278–54012



(d) Using SST, align the timing marks of the LH camshaft pulley and No.3 timing belt cover.
SST 09278–54012

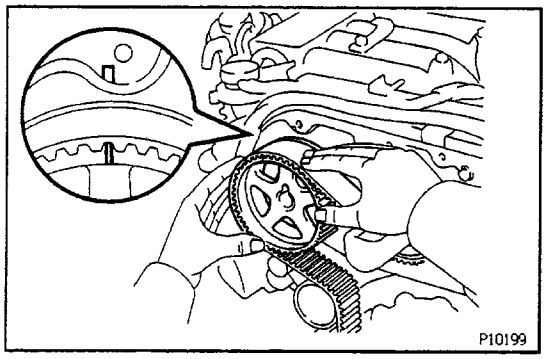
(e) Check that the timing belt has tension between the crankshaft timing pulley and LH camshaft timing pulley.



10. INSTALL RH CAMSHAFT TIMING PULLEY AND TIMING BELT

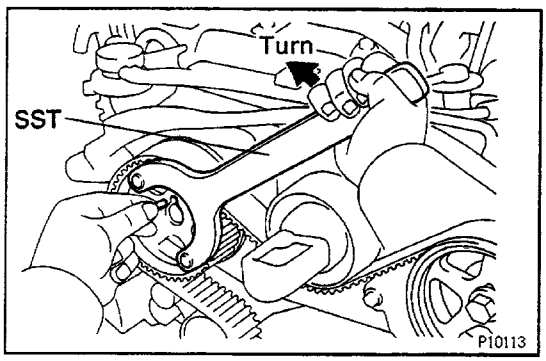
(a) Remove any oil or water on the RH camshaft timing pulley, No. 1 idler pulley and No.2 idler pulley, and keep them clean.

(b) Align the installation mark on the timing belt with the timing mark of the RH camshaft timing pulley, and hang the timing belt on the RH camshaft timing pulley, facing the flange side inward.

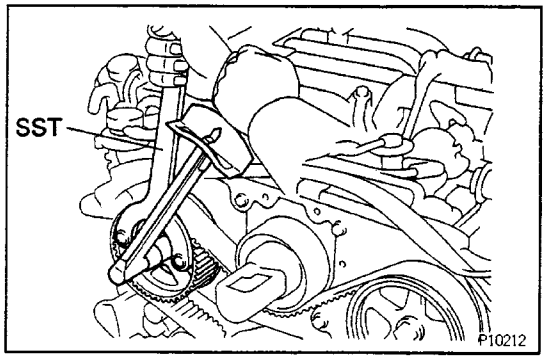


(c) Slide the RH camshaft timing pulley on the camshaft.

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

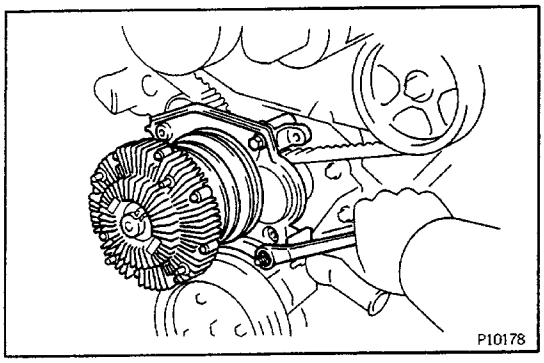


(e) Using SST, align the knock pin hole of the camshaft with the knock pin groove of the pulley and install the knock pin.
SST 08278–54012



(f) Using SST, install the pulley bolt.
SST 09278–54012

Torque: 108 N–m (1,100 kgf–cm, 80 ft–lbf)

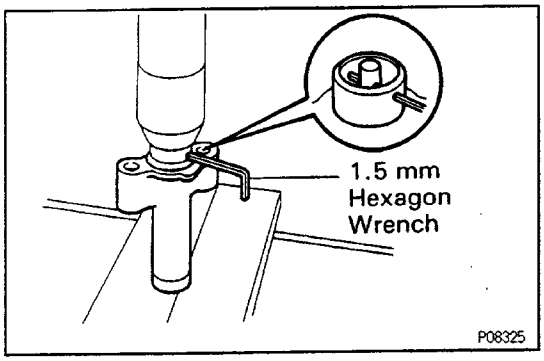


11. INSTALL FAN BRACKET

(a) Install the gasket to the fan pulley bracket.

(b) Install the fan bracket with the two bolts and nut.

Torque: 41 N–m (420 kgf–cm, 30 ft–lbf)

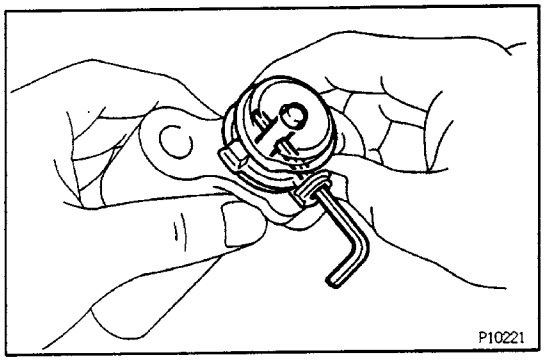


12. SET TIMING BELT TENSIONER

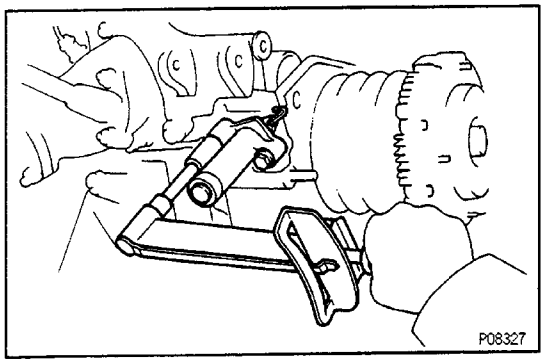
(a) Using a press, slowly press in the push rod using 981 – 9,807 N (100 – 1,000 kgf, 200 – 2,205 lbf) of force.

(b) Align the holes of the push rod and housing, pass a 1.5 mm hexagon wrench through the holes to keep the setting position of the push rod.

(c) Release the press.



(d) Install the dust boot to the tensioner.

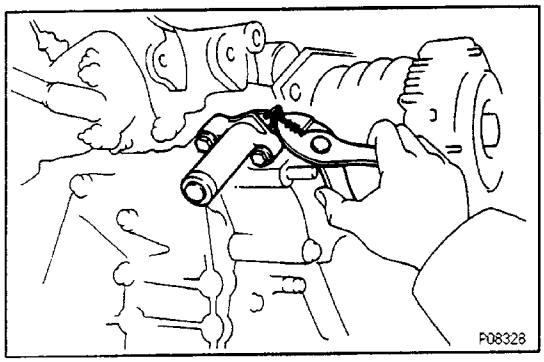


13. INSTALL TIMING BELT TENSIONER

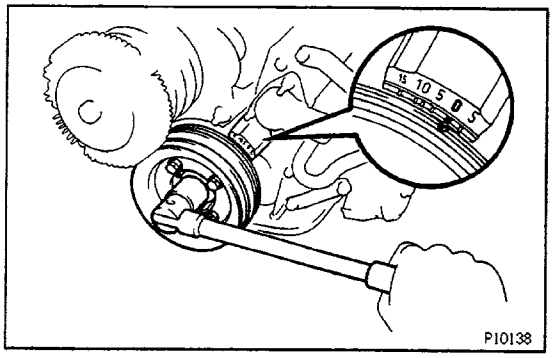
(a) Temporarily install the belt tensioner with the two bolts.

(b) Alternately tighten the two bolts.

Torque: 26 N–m (270 kgf–cm, 20 ft–lbf)



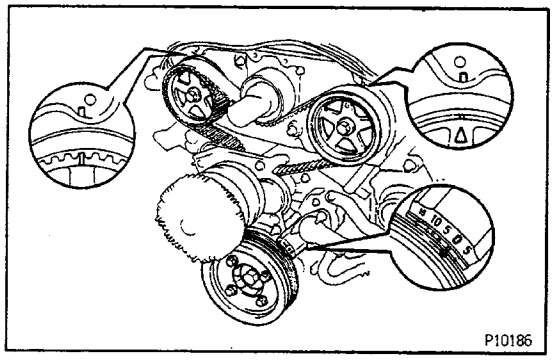
(c) Using pliers, remove the 1.5 mm hexagon wrench from the belt tensioner.



14. CHECK VALVE TIMING

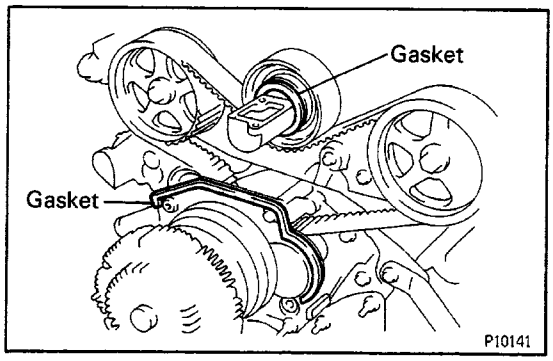
(a) Slowly turn the crankshaft pulley two revolutions from TDC to TDC.

NOTICE: Always turn the crankshaft pulley clockwise.



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

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

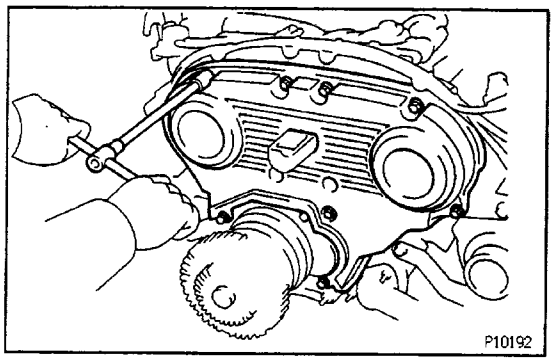


15. INSTALL NO.2 TIMING BELT COVER

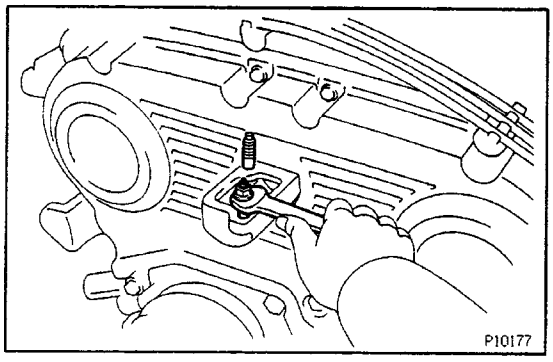
(a) Install the gasket to the No.2 idler pulley.

(b) Install the gasket to the fan bracket.

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



(d) Install the timing belt cover with the eleven bolts.



(e) Using the two water outlet nuts, install the two stud bolts.

(f) Connect the four clamps on the high–tension cords to the mounting bolts of the No.2 timing belt cover.

16. INSTALL WATER OUTLET

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the water outlet and the water outlet housing on the No.2 idler pulley.

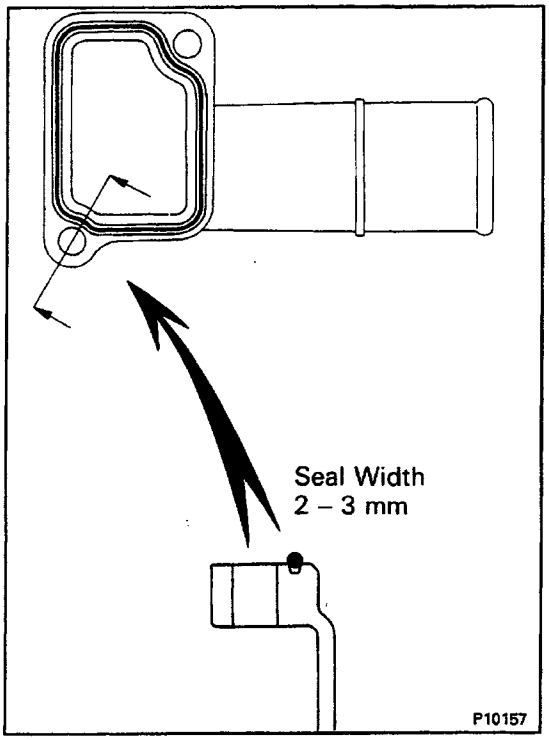
- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

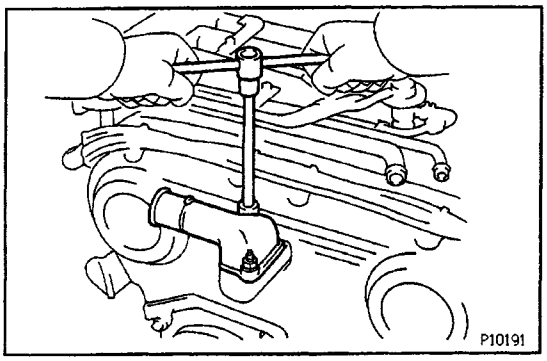
(b) Apply seal packing to the sealing groove of the water outlet as shown in the illustration.

Seat 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.
- 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.

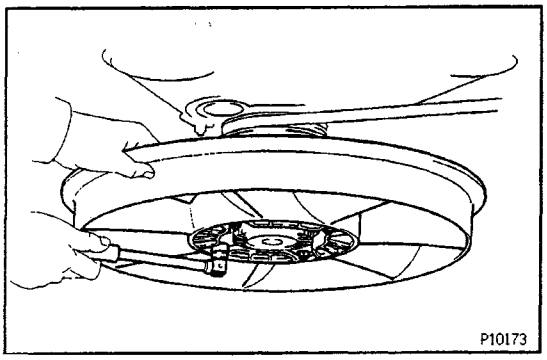




(c) Install the water outlet with the two bolts. Alternately tighten the bolts.

Torque: 8.3 N–m (85 kgf–cm, 73 in.–lbf)

17. INSTALL GENERATOR DRIVE BELT

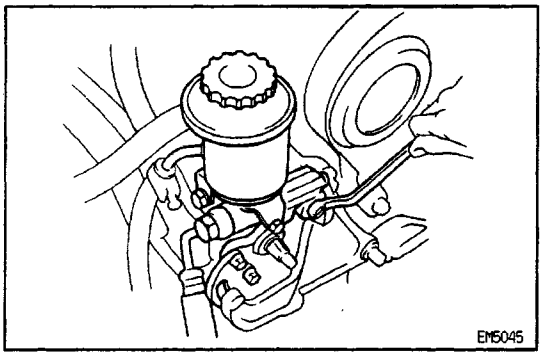


18. INSTALL COOLING FAN

Install the cooling fan with the four nuts.

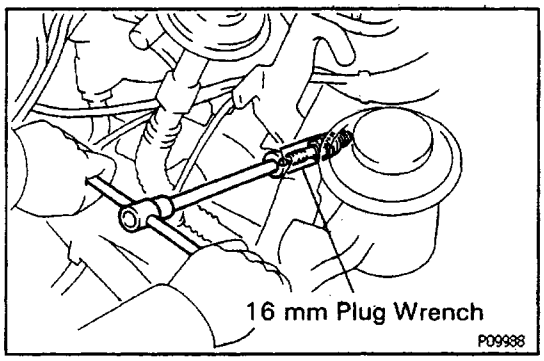
Torque: 5.4 N–m (55 kgf–cm, 48in.–lbf)

19. INSTALL A/C DRIVE BELT



20. INSTALL PS PUMP

21. INSTALL PS PUMP PULLEY AND DRIVE BELT



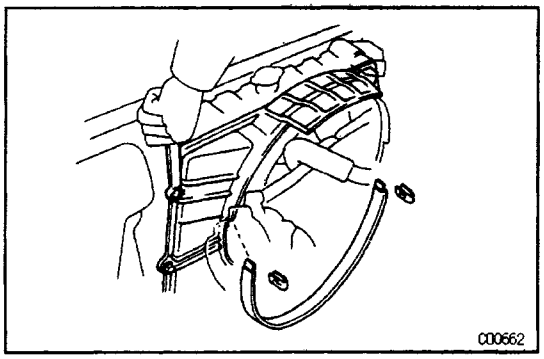
22. INSTALL SPARK PLUGS

Using a 16 mm plug wrench, install the six spark plugs.

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

23. CONNECT HIGH–TENSION CORDS TO SPARK PLUGS

24. CONNECT NO.2 AND NO.3 AIR HOSES TO AIR PIPE

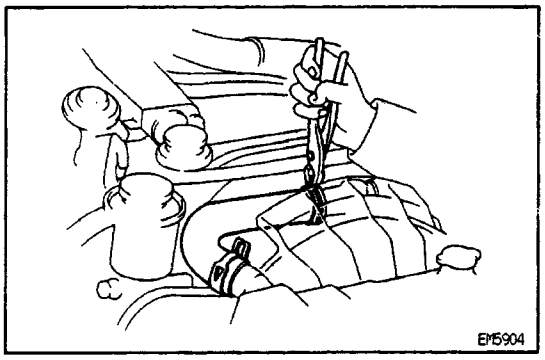


25. INSTALL RADIATOR

(a) Install the radiator with the four bolts.

(b) Install the No.1 fan shroud with the four bolts.

(c) Install the No.2 fan shroud with the two clips.



(d) Install the radiator hoses.

(e) (A/T only)
Connect the oil cooler hoses.

(f) Connect the reservoir tank hose.

26. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

27. FILL WITH ENGINE COOLANT

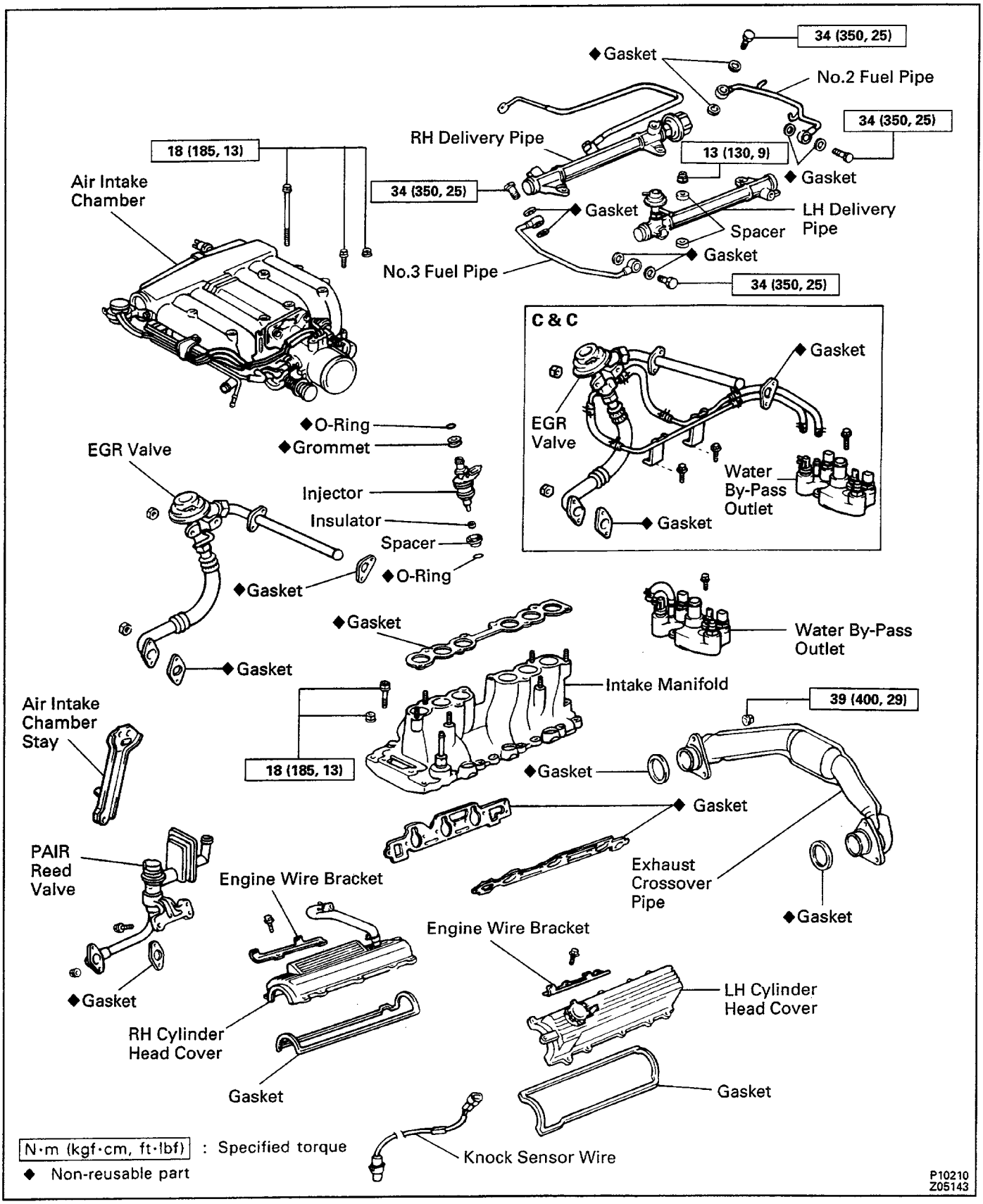
28. START ENGINE AND CHECK FOR LEAKS

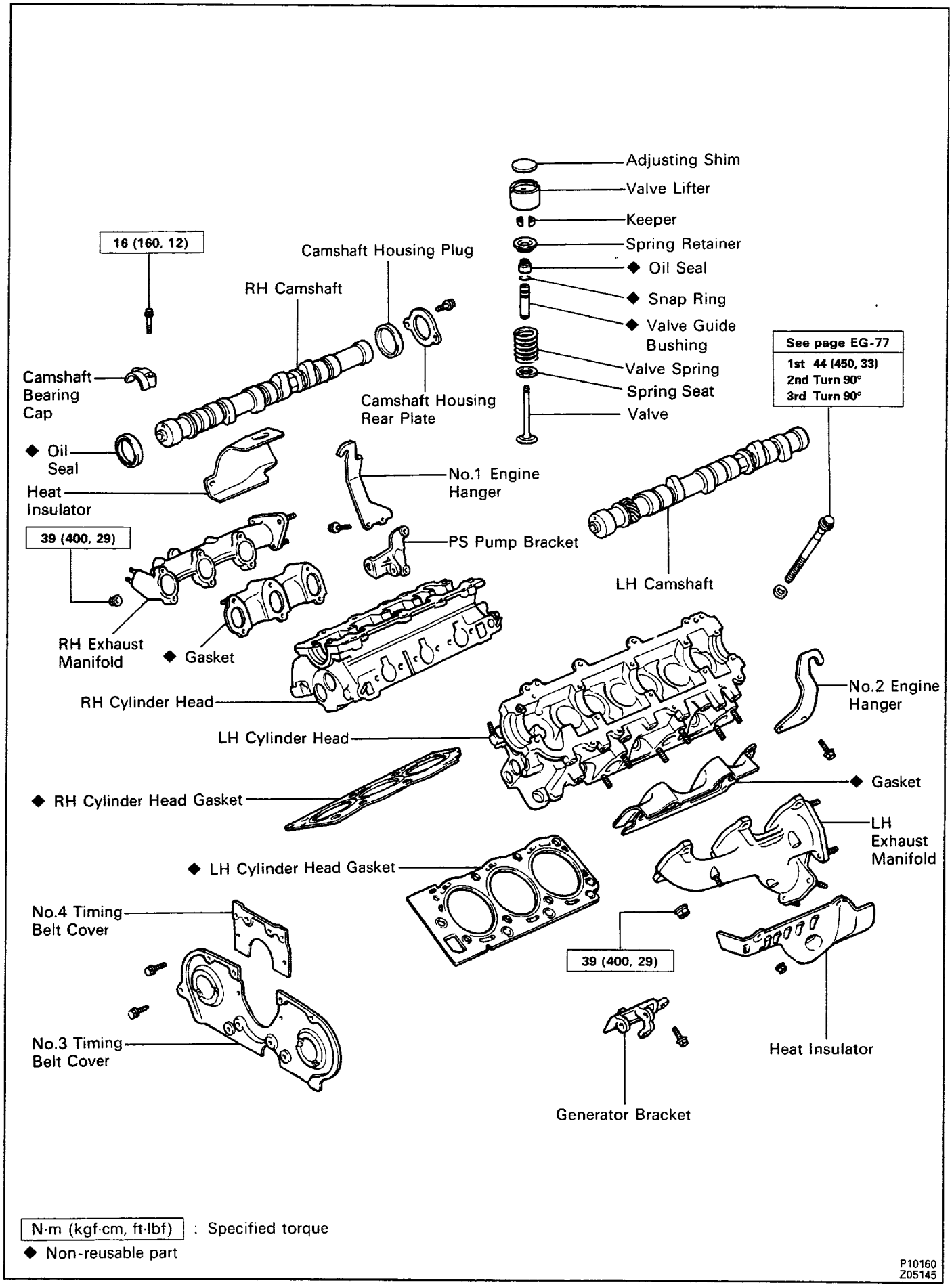
29. RECHECK ENGINE COOLANT LEVEL

CYLINDER HEAD

EG1E9–03

COMPONENTS





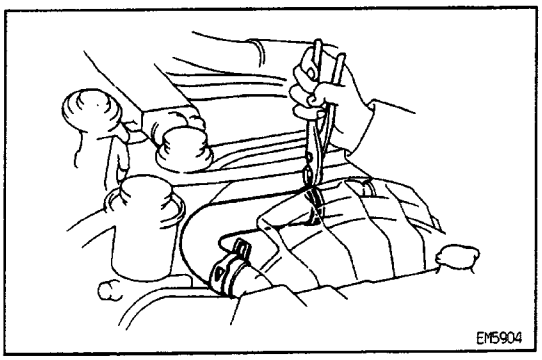
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part

P10160
Z05145

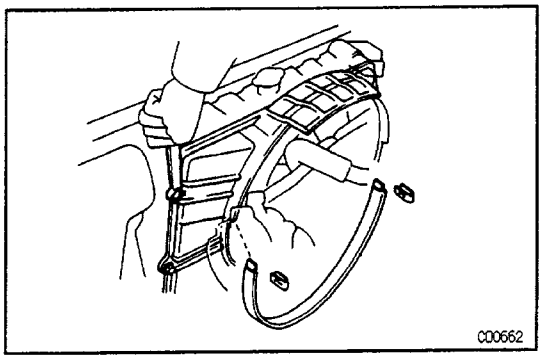
EG1ZW–01

CYLINDER HEADS REMOVAL

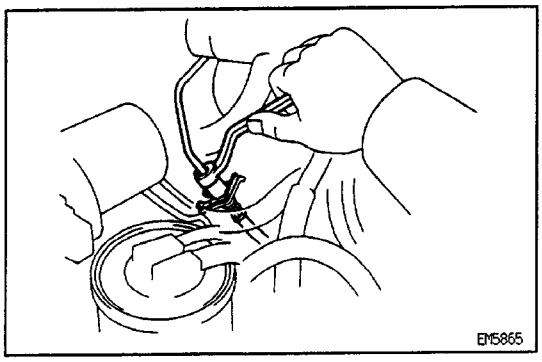
1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. REMOVE AIR CLEANER AND HOSE
3. DRAIN ENGINE COOLANT



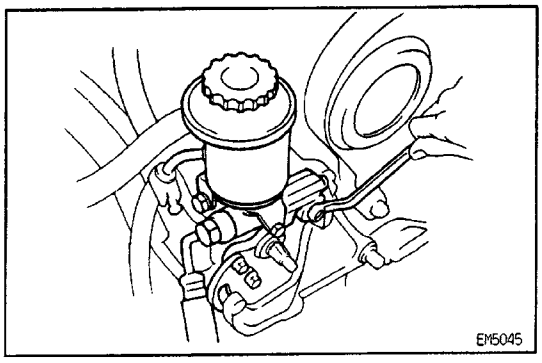
4. REMOVE RADIATOR
(a) Disconnect the reservoir hose.
(b) (A/T only)
Disconnect the oil cooler hoses.
(c) Remove the radiator hoses.



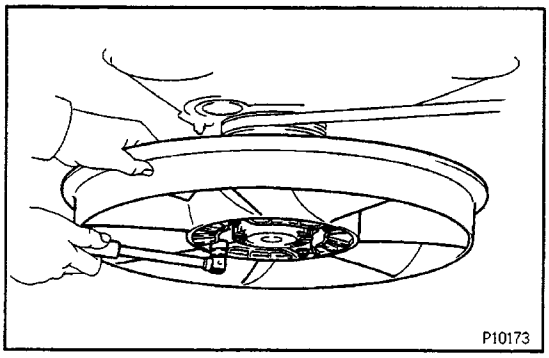
(d) Remove the two clips and No.2 fan shroud.
(e) Remove the four bolts and No.1 fan shroud.
(f) Remove the four bolts and radiator.



5. (M/T only)
DISCONNECT CLUTCH RELEASE CYLINDER HOSE



6. REMOVE PS DRIVE BELT AND PUMP PULLEY
7. DISCONNECT PS PUMP FROM ENGINE
8. REMOVE A/C DRIVE BELT



9. REMOVE COOLING FAN

Remove the four nuts and cooling fan.

10. REMOVE GENERATOR DRIVE BELT

11. DISCONNECT STRAP, WIRES, CONNECTORS. HOSES AND CABLES

(a) Disconnect the following strap, wires and connectors:

- Ground strap from LH fender apron
- Generator connector and wire
- Igniter connector
- Oil pressure sender gauge connector
- Ground strap from engine rear side
- ECM connectors
- VSV connectors
- A/C compressor connector
- (M/T only)
  Starter relay connector
- Solenoid resister connector
- Data link connector 1
  (w/ ADD)

ADD switch connector

(b) Disconnect the following hoses:

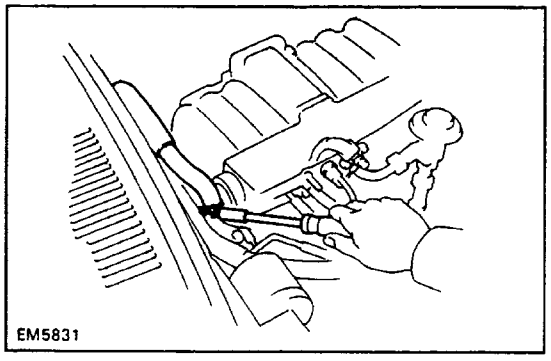
- PS air hoses from gas filter and air pipe
- Brake booster hose
- (w/ Cruise Control System)
  Cruise control vacuum hose
- Charcoal canister hose from canister
- VSV vacuum hoses

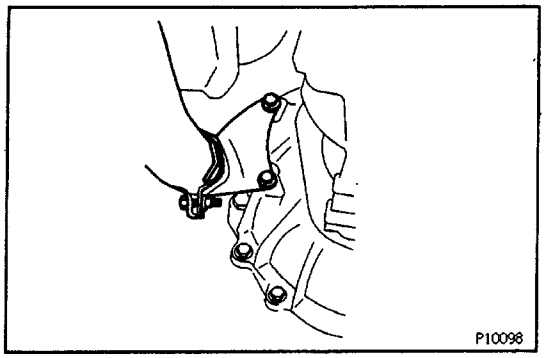
(c) Disconnect the following cables:

- Accelerator cable
- (A/T only)
  Throttle cable
- (w/ Cruise Control System)
  Cruise control cable

12. DISCONNECT HEATER HOSES

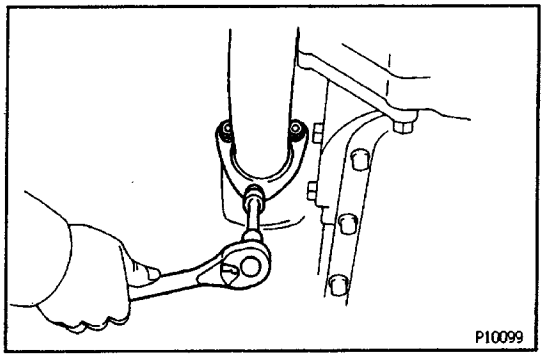
13. DISCONNECT FUEL INLET AND OUTLET HOSES



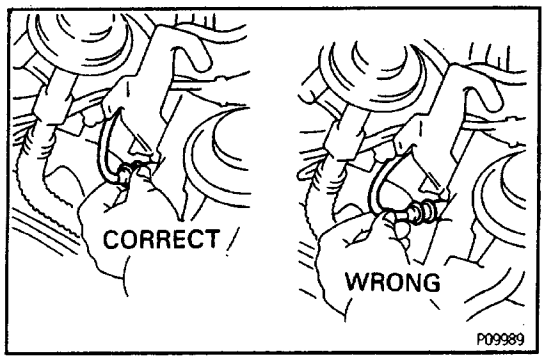


14. REMOVE FRONT EXHAUST PIPE

(a) Disconnect the heated oxygen sensor connector.
(b) Loosen the pipe clamp bolt. w
(c) Remove the two, bolts and pipe bracket.



(d) Remove the three nuts, and disconnect the exhaust pipe from the exhaust manifold. Remove the gasket.
(e) Remove the two bolts, joint retainer, exhaust pipe and gasket from the catalytic converter.



.

15. DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS

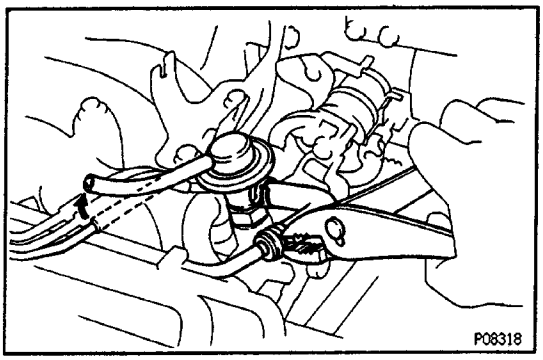
Disconnect the high – tension cords at the rubber boot. Do not pull on the cords.

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

16. REMOVE DISTRIBUTOR

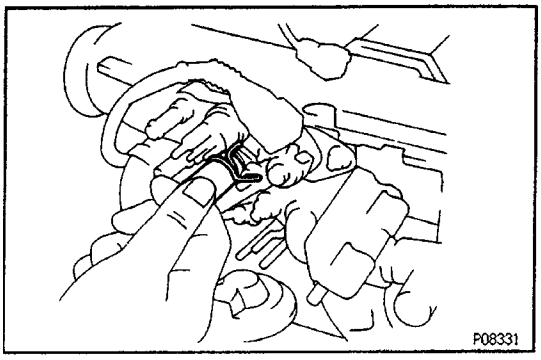
17. REMOVE TIMING BELT

(See steps 5 to 7, 13 to 20 and 25 on pages EG2–33 to 36 and 38)

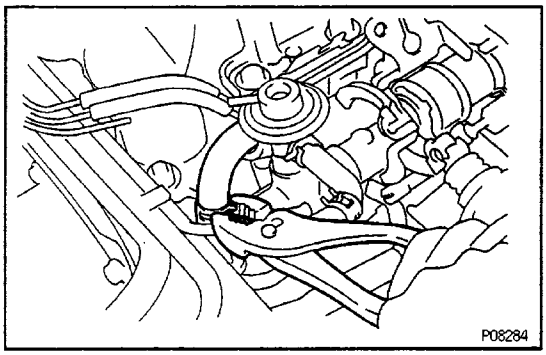


18. REMOVE AIR INTAKE CHAMBER

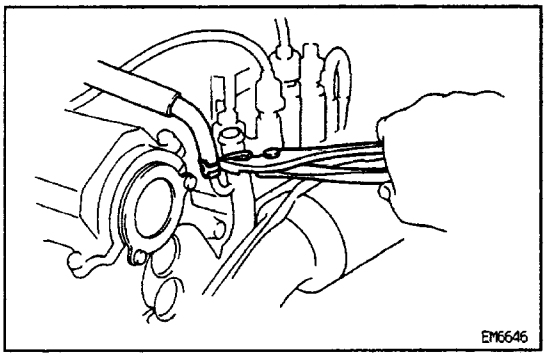
(a) Disconnect the throttle position sensor connector.
(b) Disconnect the charcoal canister vacuum hose from the throttle body.
(c) Disconnect the vacuum and fuel hoses from the pre–ssure regulator.



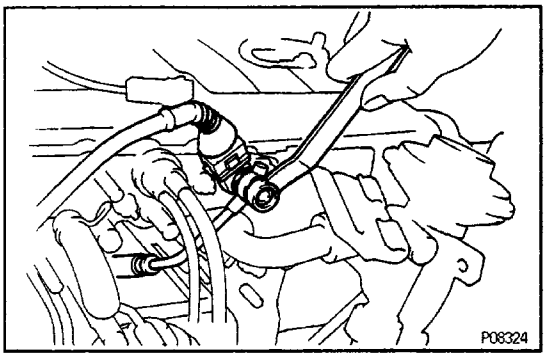
(d) Disconnect the PCV hose from the union.



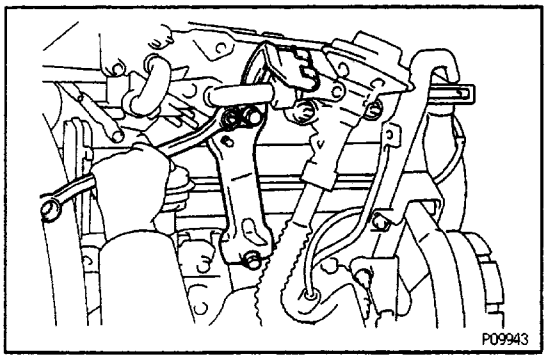
(e) Disconnect the No.4 water by–pass hose from the union of intake manifold.



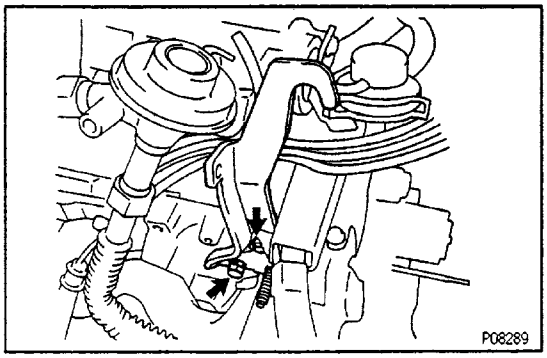
(f) Remove the No.5 water by–pass hose from the water by–pass pipe.



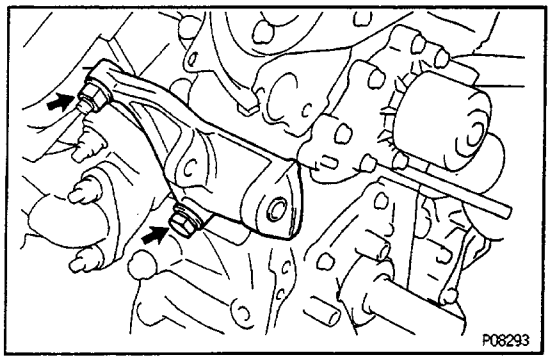
(g) Disconnect the cold start injector connector.
(h) Disconnect the vacuum hose from the gas filter.
(i) Remove the union bolt, two gaskets and cold start injector tube.
(j) (Calif. and C & C)
Disconnect the EGR gas temperature sensor con–nector.
(k) Disconnect the EGR vacuum hoses from the air pipe and EGR vacuum modulator.



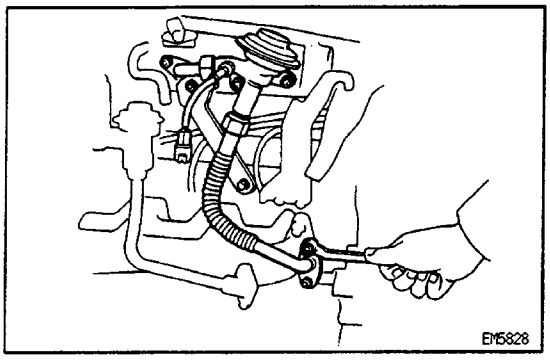
(i) Remove the nut, two bolts, intake chamber stay and throttle cable bracket.



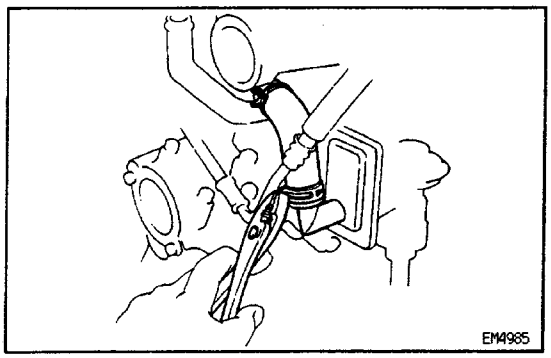
(m) Remove the two bolts and No. 1 engine hanger.



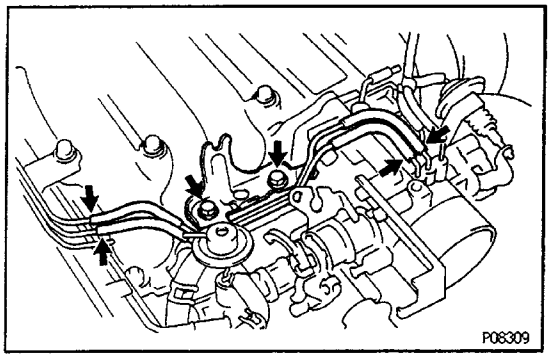
(n) Remove the nut, bolt and PS pump bracket.



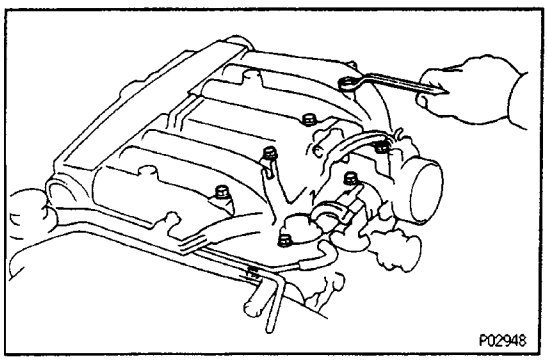
(o) (C & C only)
Disconnect the two water by–pass hoses from the EGR valve.
(p) Remove the five nuts, the EGR valve and pipes assembly and two gaskets.



(q) Disconnect the No.1 air hose from the PAIR reed valve.



(r) Disconnect the four vacuum hoses from the air pipes.
(s) Remove the two bolts and accelerator cable bracket.

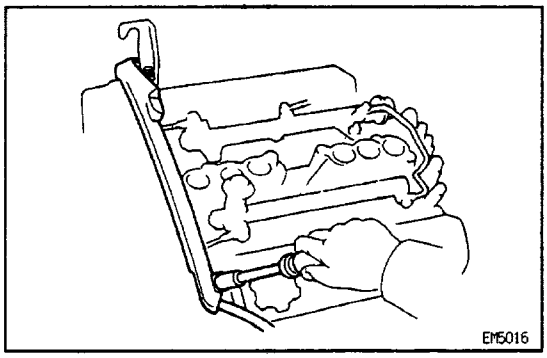


(t) Remove the six bolts, two nuts, intake chamber and gasket.

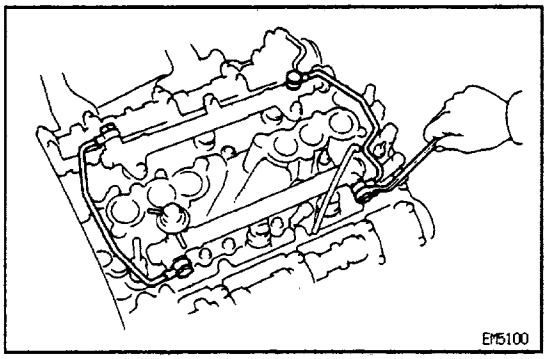
19. REMOVE ENGINE WIRE

(a) Disconnect the following:

- Knock sensor connector
- Cold start injector time switch connector
- ECT sensor connector
- ECT sender gauge connector
- No.1 ECT switch connector
- RH ground strap from No.3 camshaft bearing cap
- Injector connectors



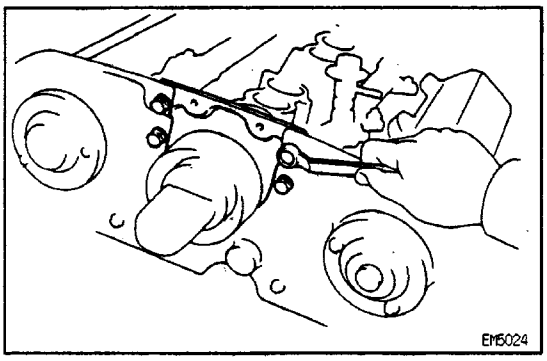
(b) Remove the two bolts and engine wire.



20. REMOVE NO.2 AND NO.3 FUEL PIPES

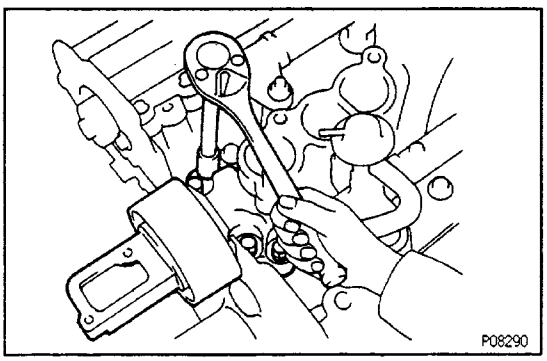
(a) Disconnect the vacuum hose from the TVV.

(b) Remove the four union bolts, eight gaskets, No.2 and No.3 fuel pipes.



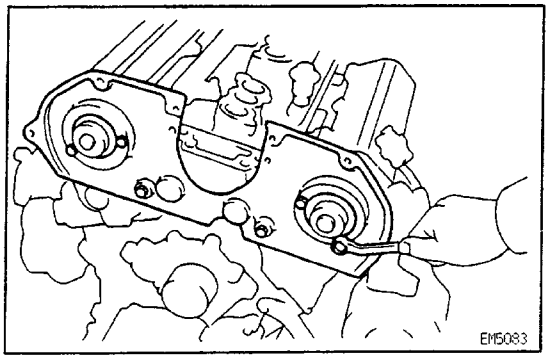
21. REMOVE NO.4 TIMING BELT COVER

Remove the four bolts and timing belt cover.



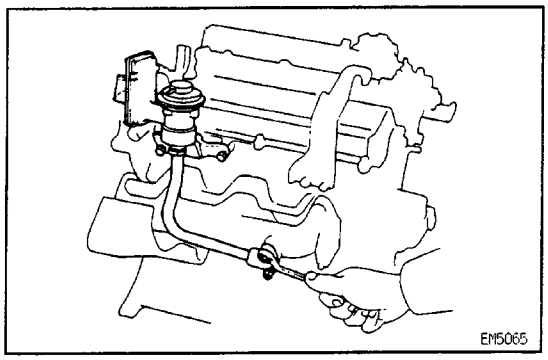
22. REMOVE NO.2 IDLER PULLEY

Remove the four bolts and idler pulley.



23. REMOVE No.3 TIMING BELT COVER

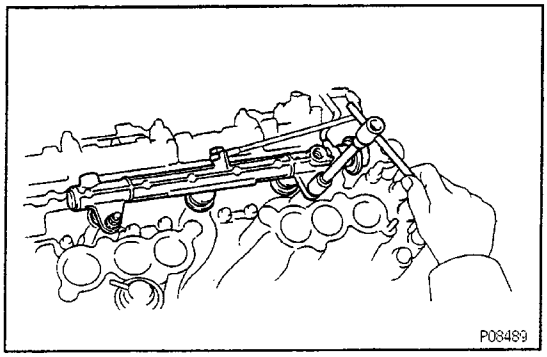
Remove the six bolts and timing belt cover.



24. REMOVE VSV BRACKET AND VSV FROM PAIR REED VALVE

25. REMOVE PAIR REED VALVE AND NO.1 AIR INJECTION MANIFOLD

Remove the two bolts, two nuts, the PAIR reed valve, injection manifold assembly and gasket.



26. REMOVE DELIVERY PIPES AND INJECTORS

(a) Remove the four nuts holding the delivery pipes to the intake manifold.

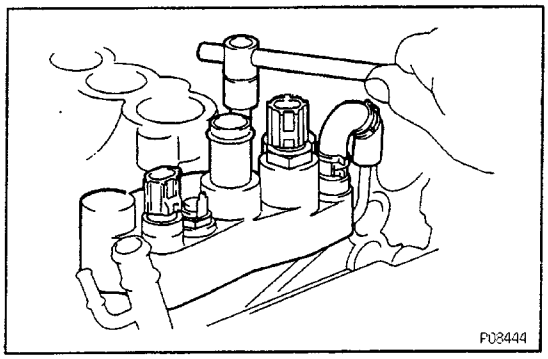
(b) Remove the the two delivery pipes and six injectors assemblies.

NOTICE: Be careful net to drop the injectors when removing the delivery pipes.

(c) Remove the four insulators, ten spacers and four 0–rings from the cylinder head.

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

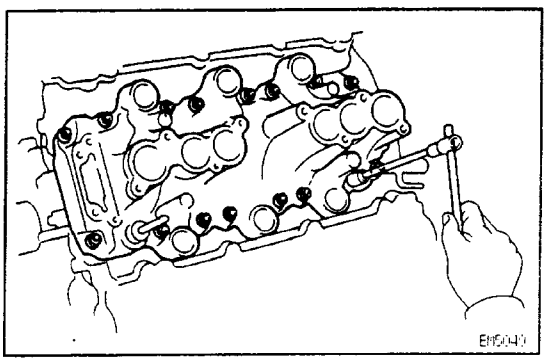
(e) Remove the O–ring and grommet from each injector.



27. REMOVE WATER BY–PASS OUTLET

(a) Disconnect the No.3 water hose from the No. 1 water by–pass pipe.

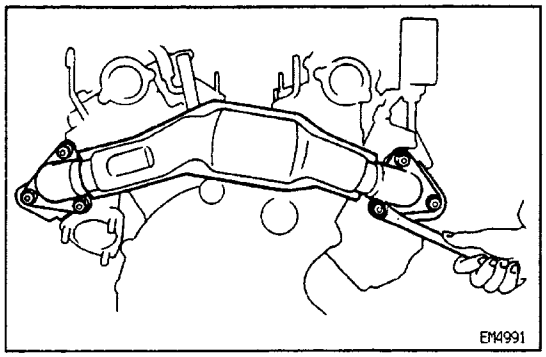
(b) Remove the two nuts, water by–pass outlet and gasket.



28. REMOVE INTAKE MANIFOLD

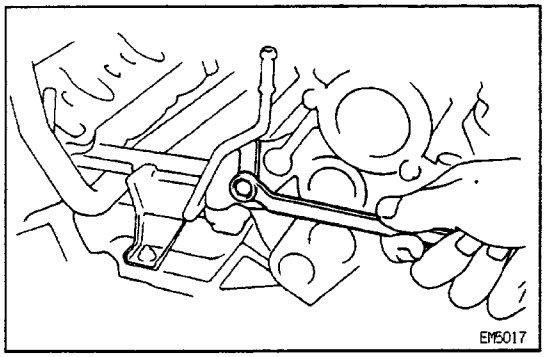
Remove the twelve bolts, four nuts, intake manifold and two gaskets.

29. REMOVE KNOCK SENSOR WIRE



30. REMOVE EXHAUST CROSSOVER PIPE

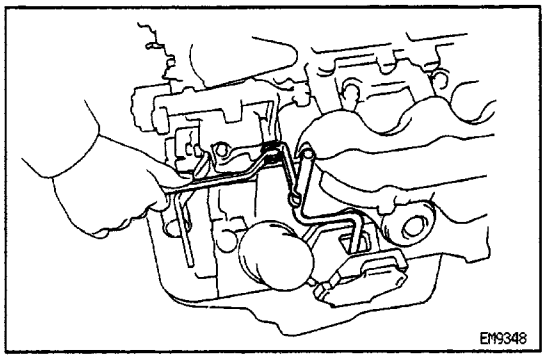
Remove the six nuts, crossover pipe and two gaskets.



31. DISCONNECT WATER BY–PASS PIPE FROM RH CYLINDER HEAD

Remove the bolt, and disconnect the water by–pass pipe from the RH cylinder head.

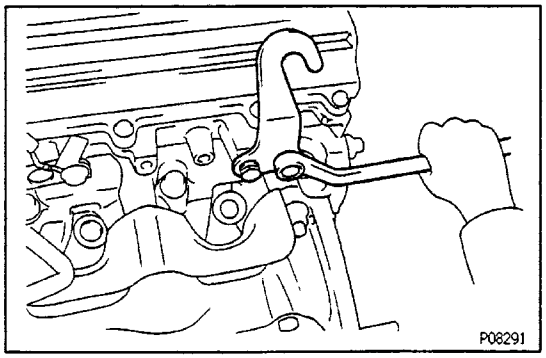
32. REMOVE GENERATOR



33. REMOVE OIL DIPSTICK GUIDE AND DIPSTICK

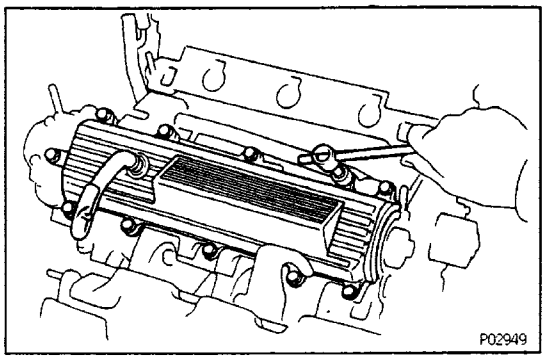
(a) Remove the oil dipstick.

(b) Remove the bolt and oil dipstick guide.



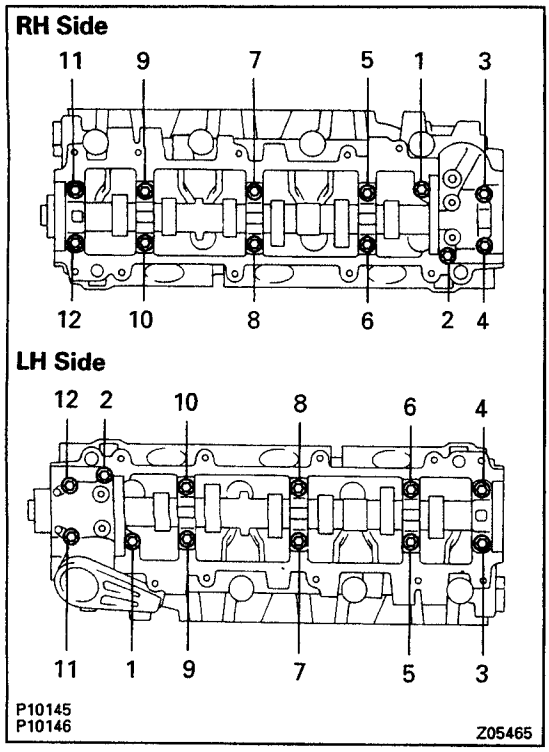
34. REMOVE NO.2 ENGINE HANGER FROM LH CYLINDER HEAD

Remove the two bolts and engine hanger.



35. REMOVE CYLINDER HEAD COVERS

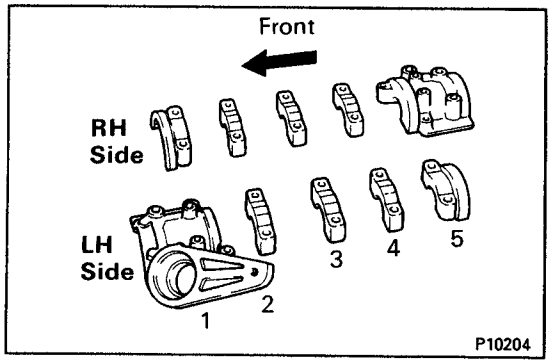
Remove the eleven bolts, engine wire bracket, cylin–der head cover and gasket. Remove the two cylinder head covers.



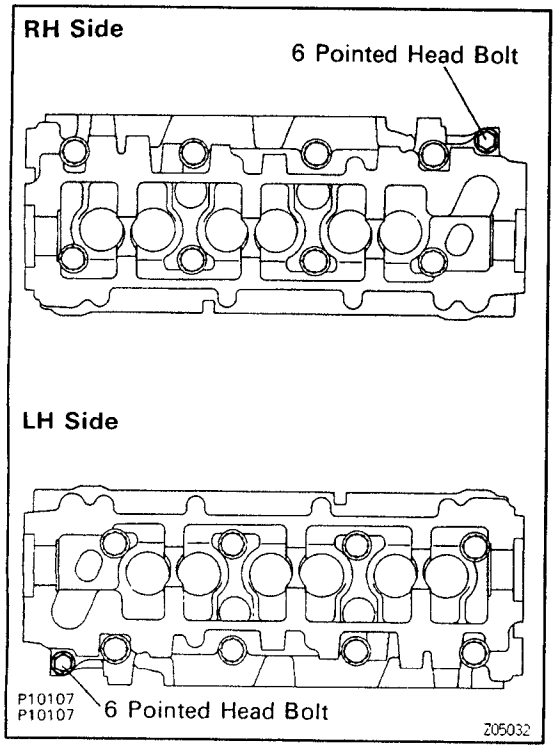
36. REMOVE CAMSHAFTS

(a) Uniformly loosen and remove the twelve bearing cap bolts one side of each cylinder head in several passes, in the sequence shown, then do the other side as shown.

(b) Remove the ten camshaft bearing caps, two oil seals and two camshafts.

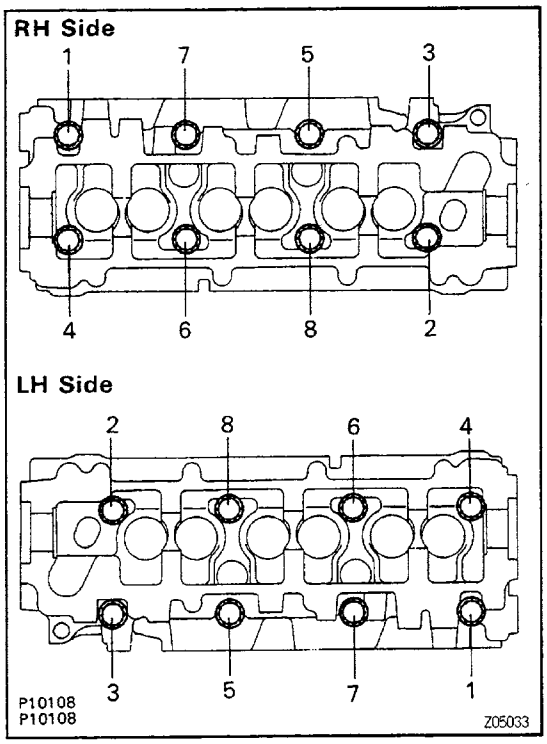


HINT: Arrange the bearing caps in correct order.



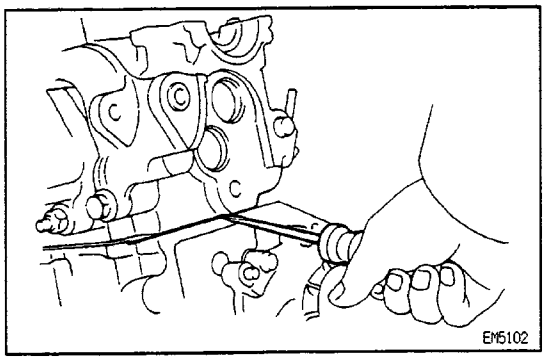
37. REMOVE CYLINDER HEADS

(a) Remove the cylinder head (6 pointed head) bolt from each cylinder head.



(b) Uniformly loosen the eight cylinder head bolts one side of each cylinder head in several passes, in the sequence shown, then do the other side as shown. Remove the eighteen cylinder head bolts and plate washers.

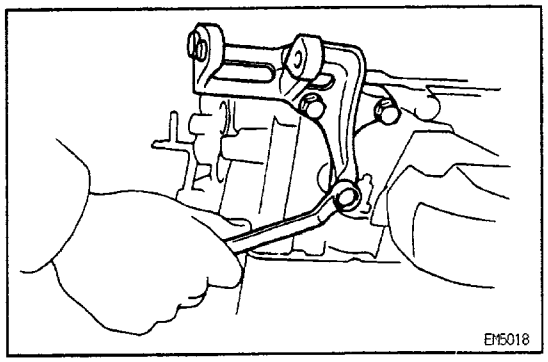
NOTICE: Head warpage or cracking could result from removing bolts in incorrect order.



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

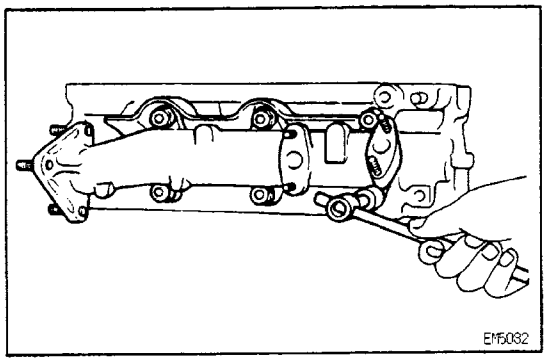
If the cylinder head is off, pry between the cylinder head and cylinder block with a screwdriver.

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



38. REMOVE GENERATOR BRACKET

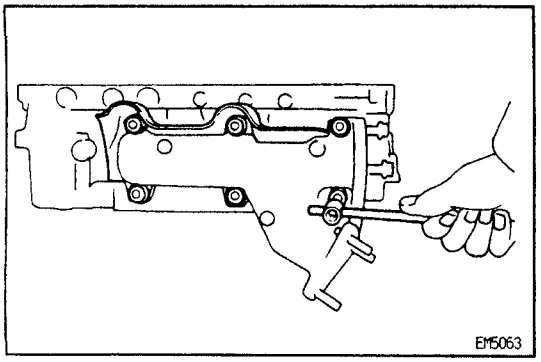
Remove the three bolts and brackets.



39. REMOVE EXHAUST MANIFOLD FROM RH CYLINDER HEAD

(a) Remove the bolt, nut and exhaust manifold heat insulator.

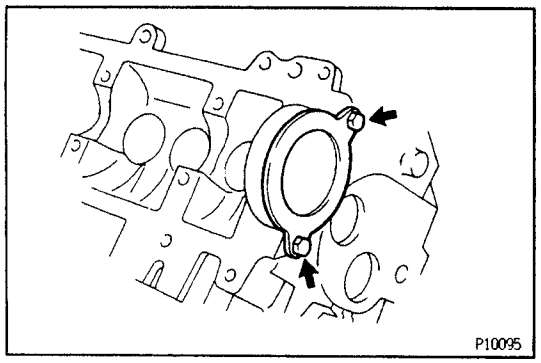
(b) Remove the six nuts, exhaust manifold and gasket.



40. REMOVE EXHAUST MANIFOLD FROM LH CYLINDER HEAD

(a) Remove the three nuts and exhaust manifold heat insulator.

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



CYLINDER HEADS DISASSEMBLY

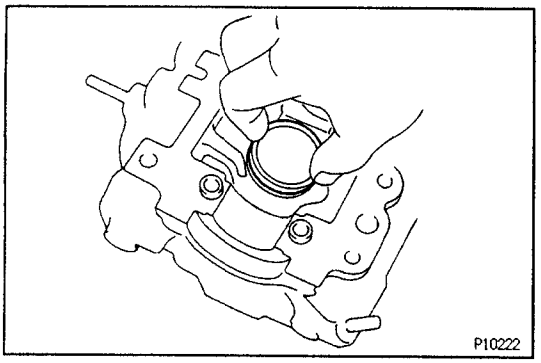
EG1ZX–01

(See Components)

1. REMOVE CAMSHAFT HOUSING PLUGS

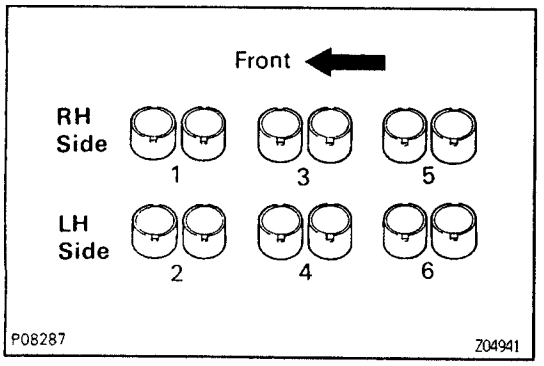
(a) Remove the two bolts and housing rear cover.

(b) Remove the housing plug.

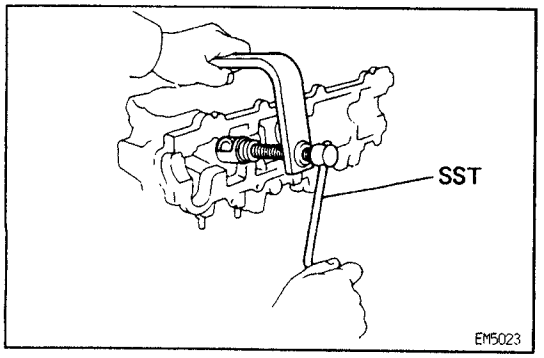


2. REMOVE VALVE LIFTERS AND SHIMS

Pull out the valve lifter and shim by hand.

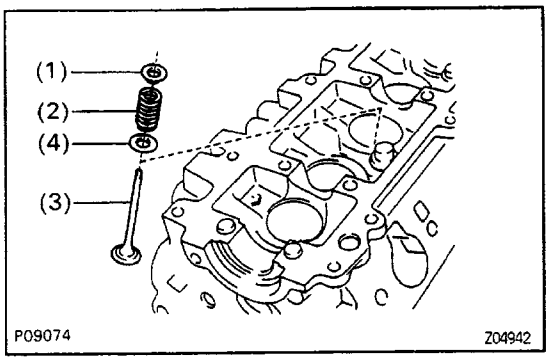


HINT: Arrange the valve lifters and shims in correct order.

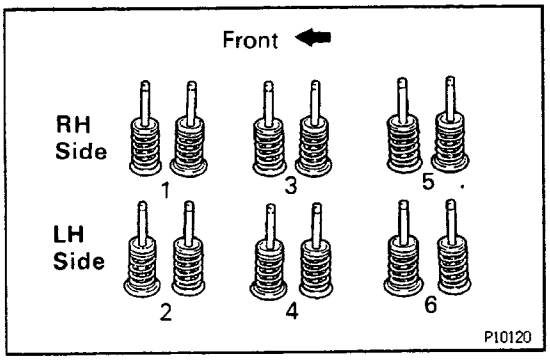


3. REMOVE VALVES

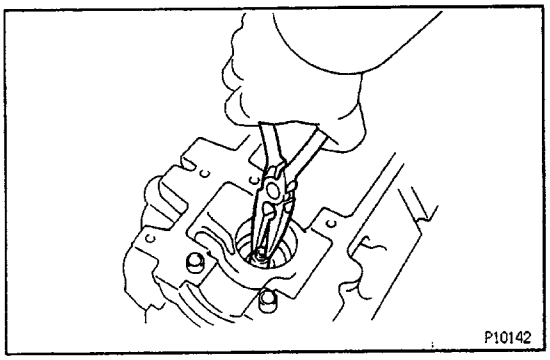
(a) Using SST, compress the valve spring and remove the two keepers.
SST 09202–43013



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



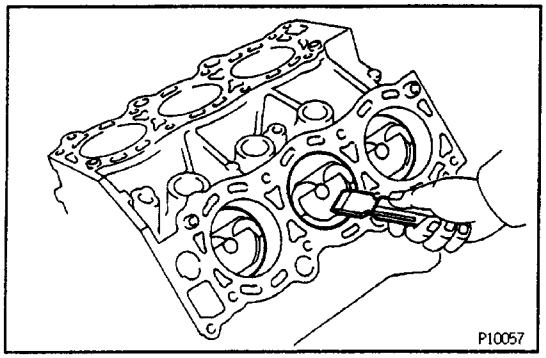
HINT: Arrange the valves, valve springs, spring seats and spring retainers incorrect order.



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

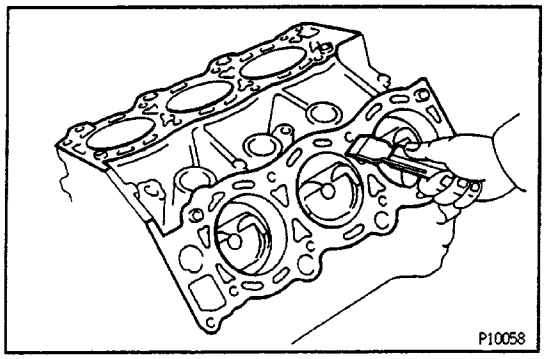
EG20E–01

CYLINDER HEAD COMPONENTS INSPECTION AND REPAIR



1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

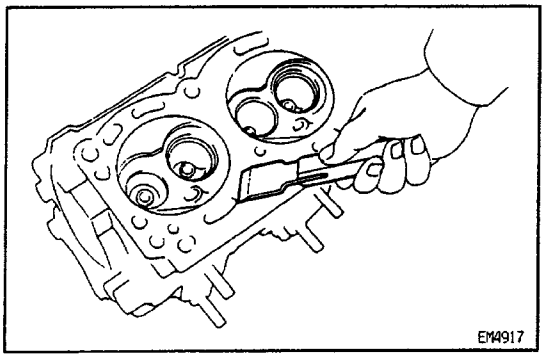
(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



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

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

CAUTION: Protect your eyes when using high compressed air.

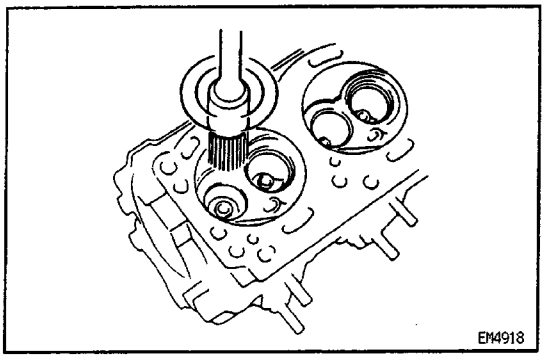


2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

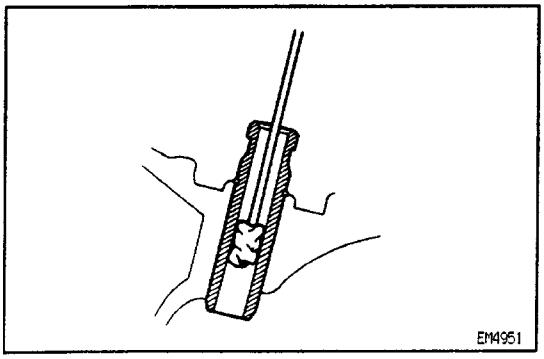
NOTICE: Be careful not to scratch the cylinder block contact surface.



B. Clean combustion chambers

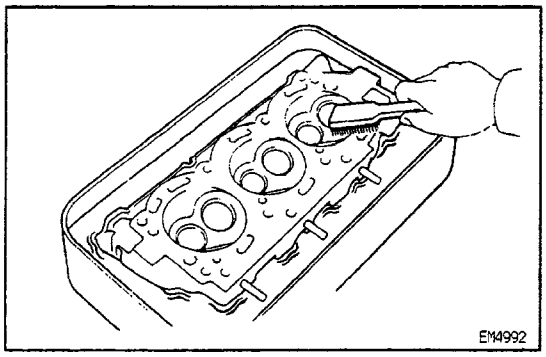
Using a wire brush, remove all the carbon from the combustion chambers.

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



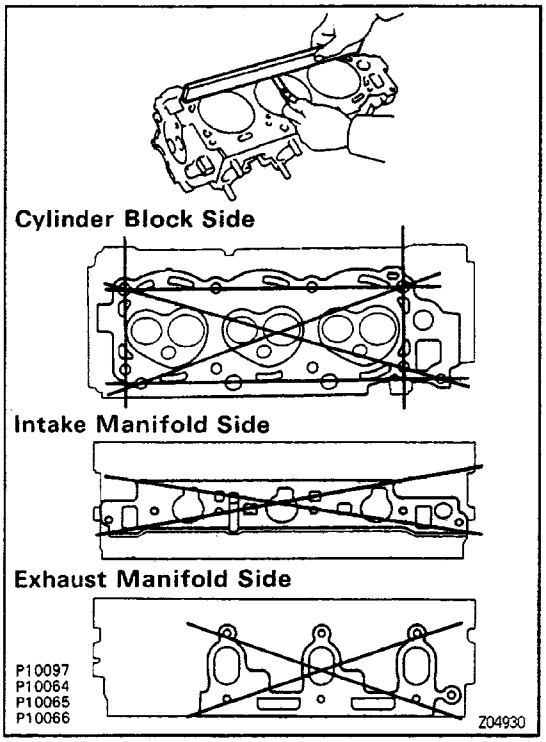
C. Clean valve guide bushings

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



D. Clean cylinder head

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



3. INSPECT CYLINDER HEAD

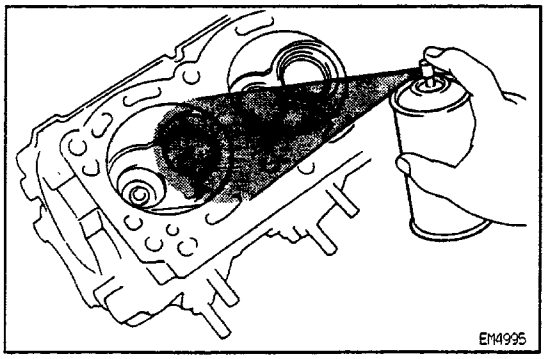
A. Inspect for flatness

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

Maximum warpage:

0.10 mm (0.0039 in.)

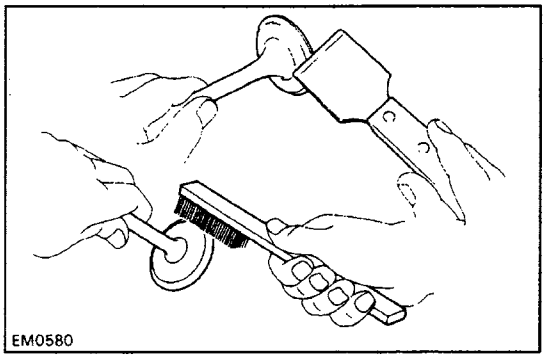
If warpage is greater than maximum, replace the cyl–inder head.



B. Inspect for cracks

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

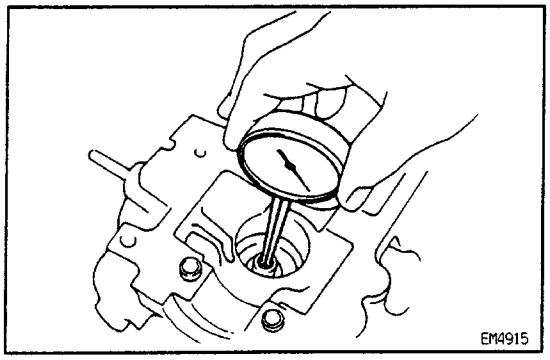
If cracked, replace the cylinder head.



4. CLEAN VALVES

(a) Using a gasket scraper, chip off any carbon from the valve head.

(b) Using a wire brush, thoroughly clean the valve.

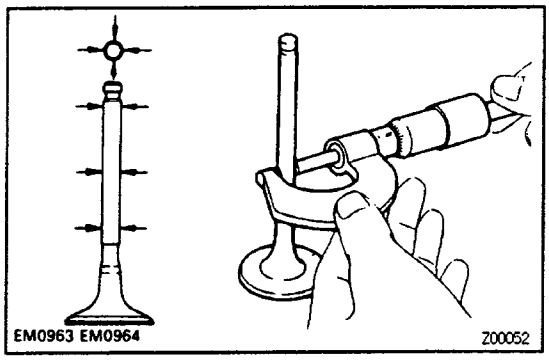


5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

8.010–8.030mm(0.3154–0.3161 in.)



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

Valve stem diameter:

Intake

7.970 – 7.985 mm (0.3138 – 0.3144 in.)

Exhaust .

7.965 – 7.980 mm (0.3136 – 0.3142 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:

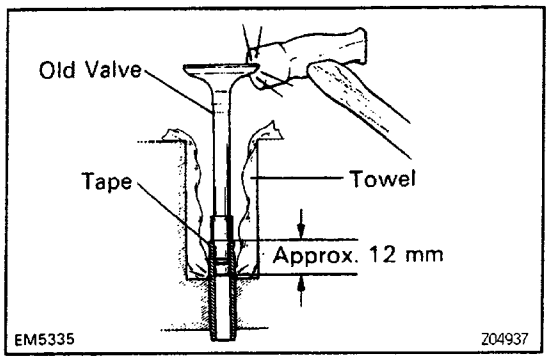
Intake

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.

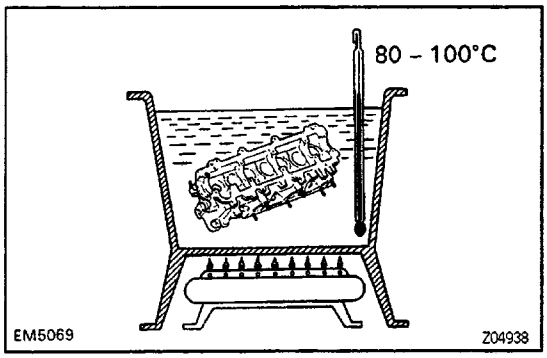


6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

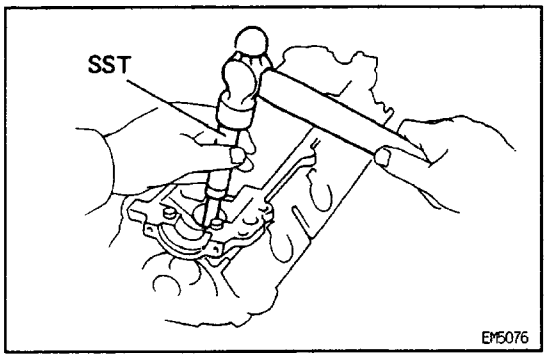
(a) Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer. Remove the snap ring.

HINT: Wrap the tape approx. 12 mm (0.47 in.) from the valve stem end.

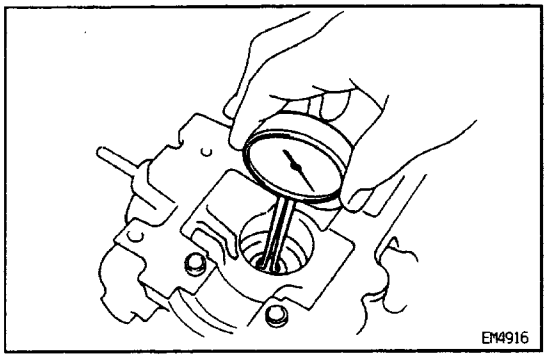
NOTICE: Be careful not to damage the valve lifter hole.



(b) Gradually heat the cylinder head to 80 – 100°C (176 – 2 12° F).



(c) Using SST and a 'hammer, tap out the guide bushing.
SST 09201–60011



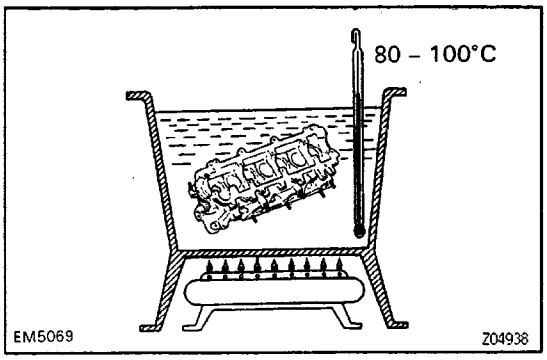
(d) Using a caliper gauge, measure the bushing bore di–ameter of the cylinder head.

Both intake and exhaust

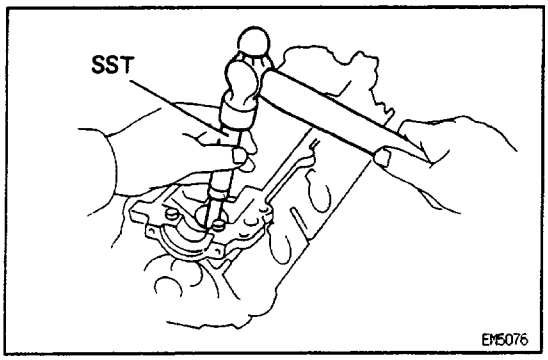
Bushing bore mm (in.)	Bushing size
13.000–13.027 (0.5118–0.5129)	Use STD
13.050 – 13.077 (0.5138 – 0.5148)	Use O/S 0.05

V02465

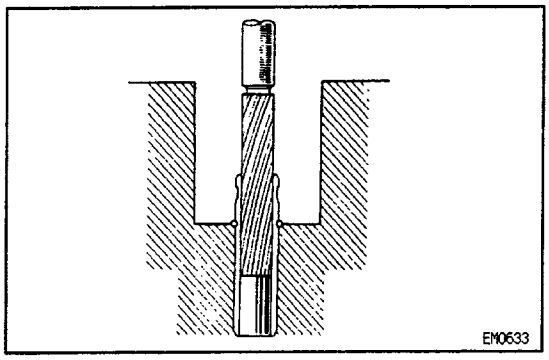
(e) Select a new guide bushing (STD or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 13.027 mm (0.5129 in.), machine the bushing bore to the following dimension:
13.050 – 13.077 mm (0.5138 – 0.5148 in.)
If the bushing bore diameter of the cylinder head is greater than 13.077 mm (0.5148 in.), replace the cylinder head.



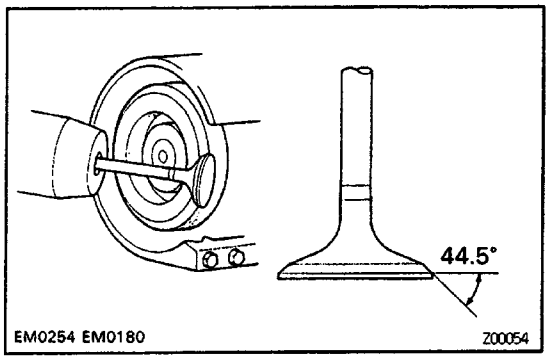
(f) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).



(g) Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.
SST 09201–60011



(h) Using a sharp 8 mm reamer, ream the guide bushing to the obtain standard specified clearance (See step 5 above) between the guide bushing and valve stem.

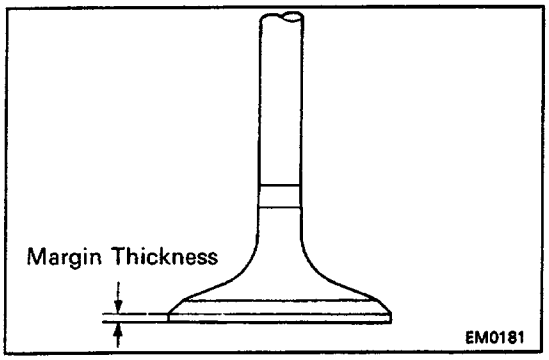


7. INSPECT AND GRIND VALVES

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

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

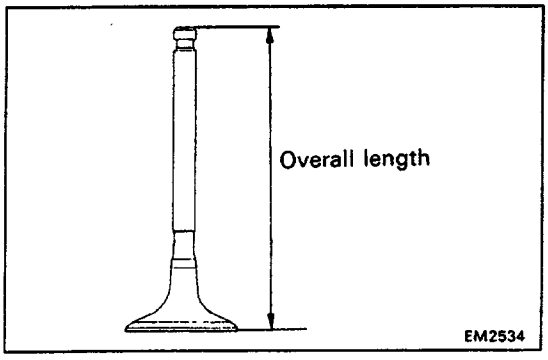
Valve face angle:
44.5°



(c) Check the valve head margin thickness.

Standard margin thickness:
1.3 – 1.7 mm (0.051 – 0.067 in.)
Minimum margin thickness:
1.0 mm (0.039 in.)

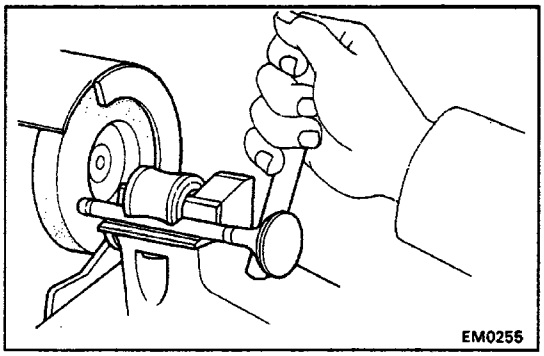
If the margin thickness is less than minimum, replace the valve.



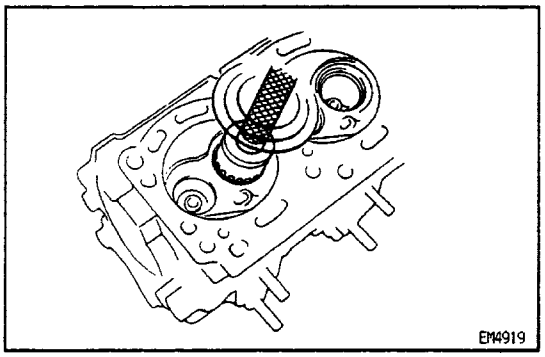
(d) Check the valve overall length.

Standard overall length:
104.3 mm (4.106 in.)
Minimum overall length:
103.8 mm (4.087 in.)

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

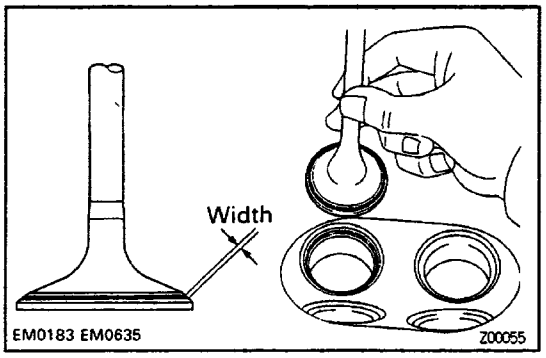


(e) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.
NOTICE: Do not grind off more than minimum.



8. INSPECT AND CLEAN VALVE SEATS

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

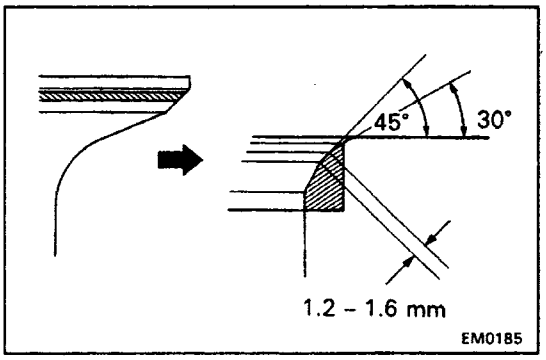


(b) Check the valve seating position.
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.

(c) Check the valve face and seat for the following:

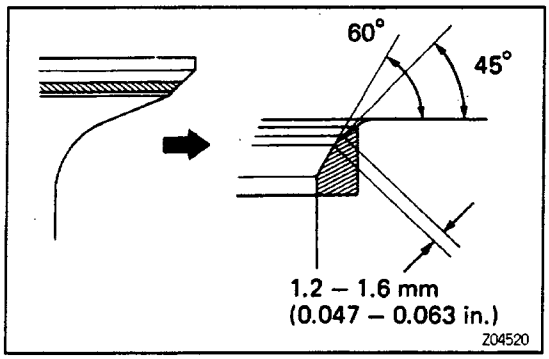
- If blue appears 360° around the face, the valve is concetric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:

1.2 – 1.6 mm (0.047 – 0.063 in.)

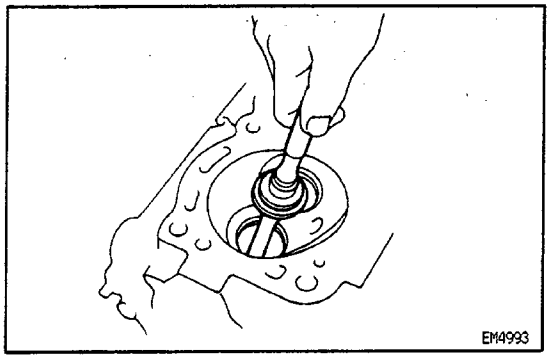


If not, correct the valve seats as follows:

(1) If the seating is too high on the valve face, use 3a° and 45° cutters to correct the seat.

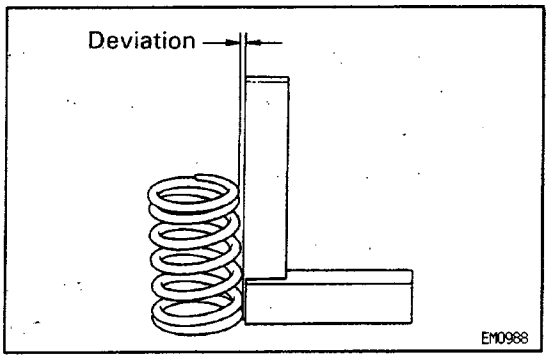


(2) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



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

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



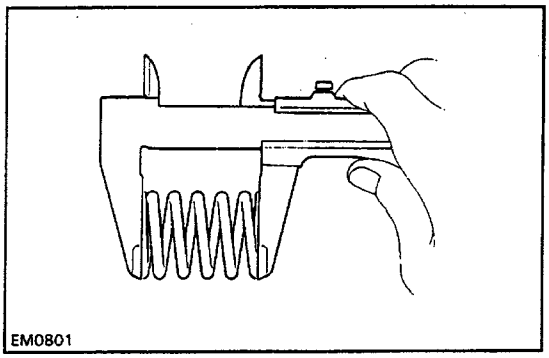
9. INSPECT VALVE SPRINGS

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

Maximum deviation:

1.23 mm (0.0484 in.)

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



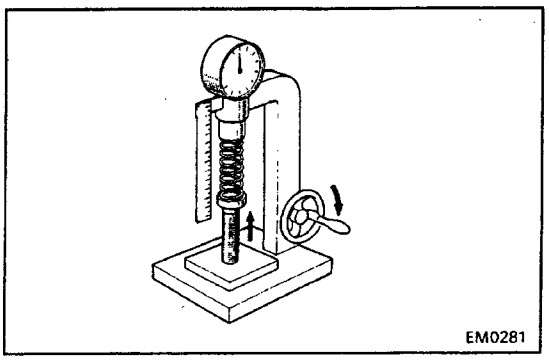
(b) Using a vernier caliper, measure the free length of the valve spring.

Free length:

46.50 mm (1.8307 in.) for white painted mark

47.01 mm (1.8508 in.) for green painted mark

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



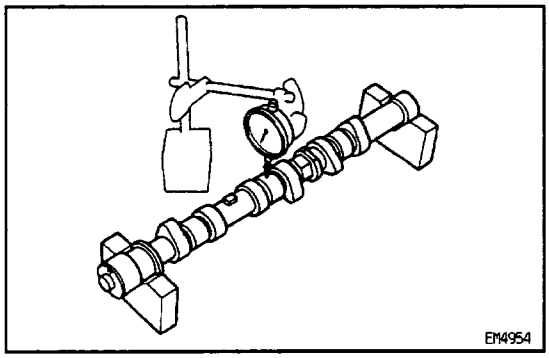
(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

242 – 268 N (24.7 – 27.3 kgf, 54.5 – 60.2 lbf)

at 40.0 mm (1.575 in.)

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



10. INSPECT CAMSHAFTS AND BEARINGS

A. Inspect camshaft for runout

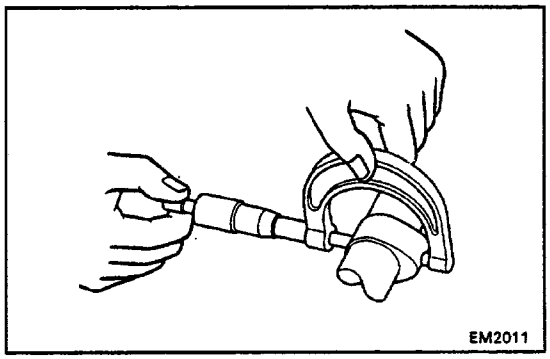
(a) Place the camshaft on V – blocks.

(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.

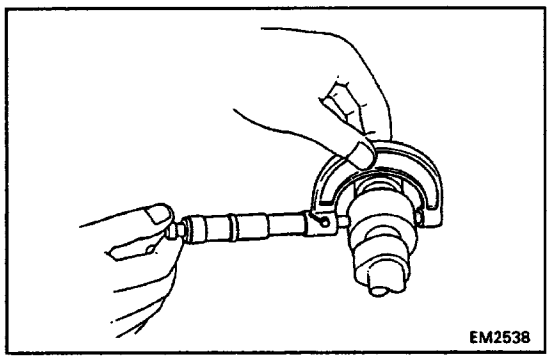
Standard cam lobe height:

47.830 – 47.930 mm (1.8830 – 1.8870 in.)

Minimum cam lobe height:

47.50 mm (1.8701 in.)

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



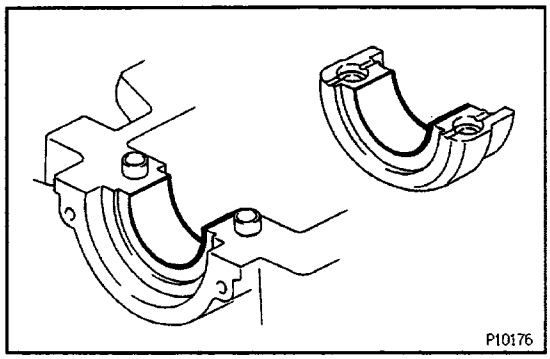
C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter:

33.959 – 33.975 mm (1.3370 – 1.3376 in.)

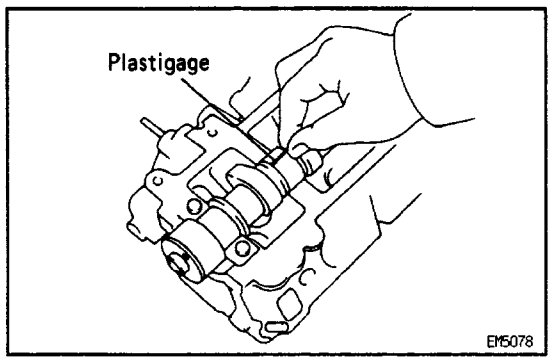
If the journal diameter is not as specified, check the oil clearance.



D. Inspect camshaft bearings

Check that bearings for flaking and scoring.

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



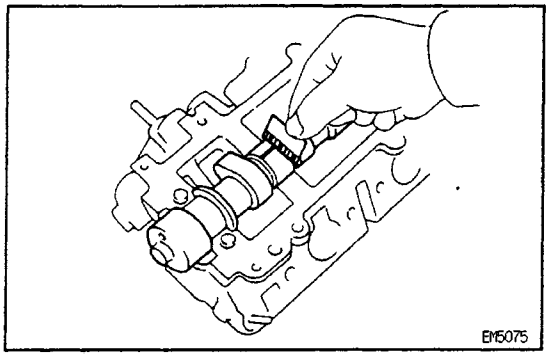
E. Inspect camshaft journal oil clearance

(a) Clean the bearing caps and camshaft journals.

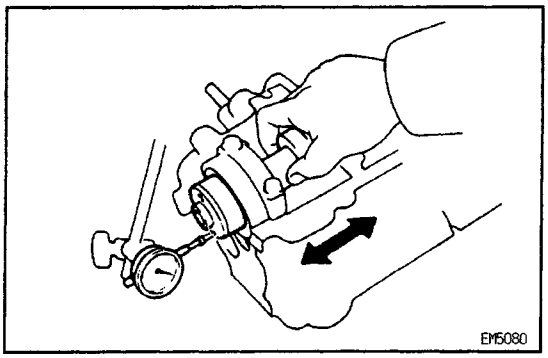
(b) Place the camshafts on the cylinder head.

(c) Lay a strip of Plastigage across each of the camshaft journals.

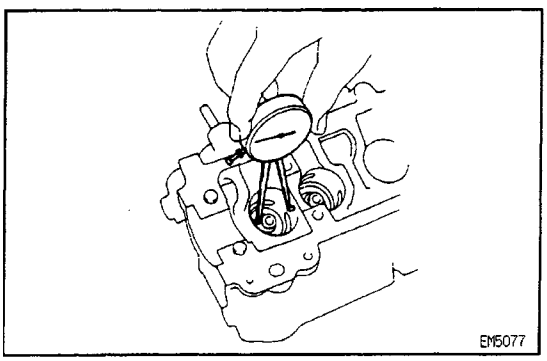
(d) Install the bearing caps.
(See step 5 on pages EG2–78 and 79)
Torque: 16 N–m (160 kgf–cm, 12 ft–lbf)
NOTICE: Do not turn the camshaft.
(e) Remove the bearing caps.



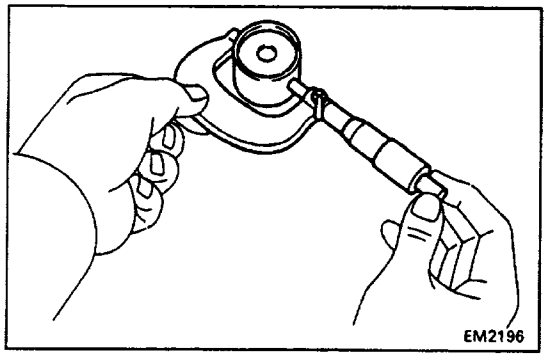
(f) Measure the Plastigage at its widest point.
Standard oil clearance:
0.025 – 0.066 mm (0.0010 – 0.0026 in.)
Maximum oil clearance:
0.10 mm (0.0039 in.)
If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.
(g) Completely remove the Plastigage.
(h) Remove the camshafts.



F. Inspect camshaft thrust clearance
(a) Install the camshaft.
(See step 5 on pages EG2–78 and 79)
(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.
Standard thrust clearance:
0.080 – 0.190 mm (0.0031 – 0.0075 in.)
Maximum thrust clearance:
0.25 mm (0.0098 in.)
If the thrust clearance is greater than maximum, re–place the camshaft. If necessary, replace the bearing caps and cylinder head as a set.
(c) Remove the camshafts.



11. INSPECT VALVE LIFTERS AND LIFTER BORES
(a) Using a caliper gauge, measure the lifter bore diame–ter of the clinder head.
Lifter bore diameter:
37.960 – 37.975 mm (1.4945 – 1.4951 in.)



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

Lifter diameter:

37.922 – 37.832 mm (1.4930 – 1.4934 in.)

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

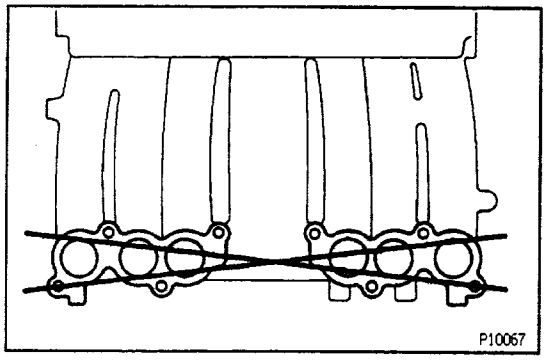
Standard oil clearance:

0.028 – 0.053 mm (0.0011 – 0.0021 in.)

Maximum oil clearance:

0.10 mm (0.0039 in.)

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



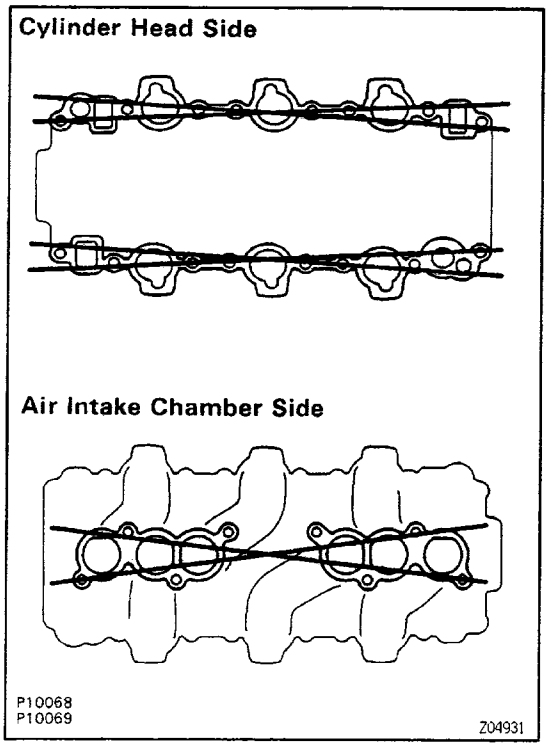
12. INSPECT AIR INTAKE CHAMBER

Using a precision straight edge and feeler gauge, measure the surface contacting the intake manifold for warpage.

Maximum warpage:

0.10 mm (0.0039 in.)

If warpage is greater than maximum, replace the chamber.



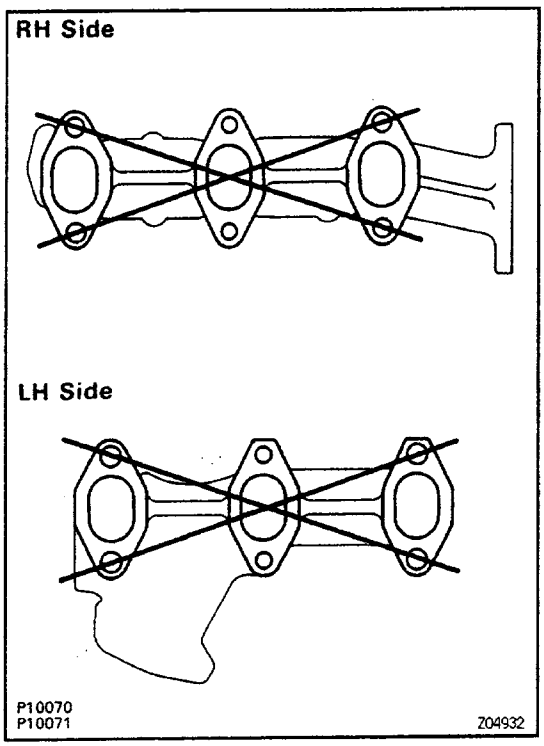
13. INSPECT INTAKE MANIFOLD

Using a precision straight edge and feeler gauge, measure the surface 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 manifold.



14. INSPECT EXHAUST MANIFOLD

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

Maximum warpage:

0.70 mm (0.0276 in.)

If warpage is greater than maximum, replace the manifold.

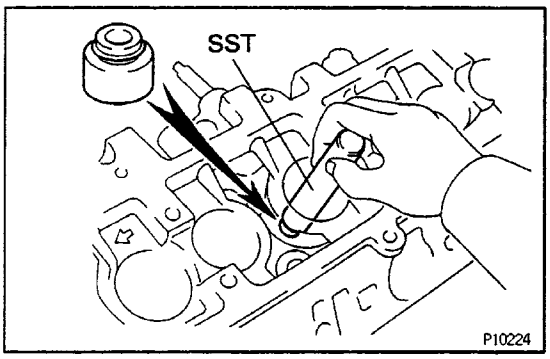
EG1ZY–01

CYLINDER HEADS ASSEMBLY

(See Components)

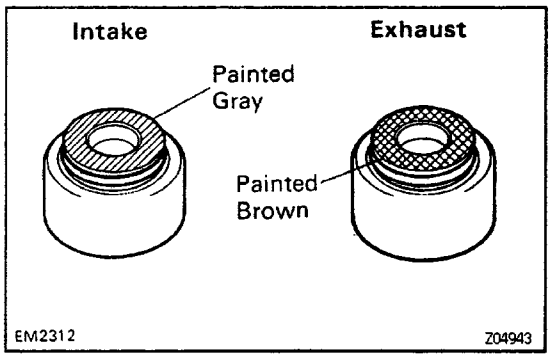
HINT:

- 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.

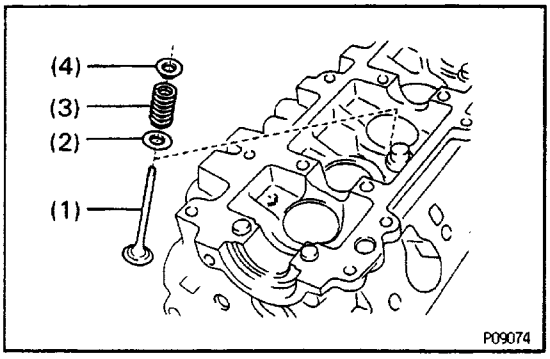


1. INSTALL VALVES

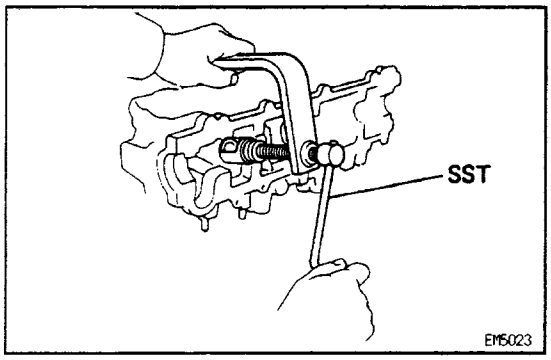
(a) Using SST, push in a new oil seal.
SST 09201 –41020



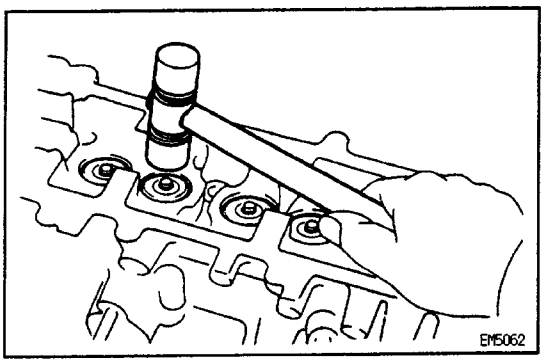
HINT: The intake valve oil seal is gray and the exhaust valve oil seal is brown.



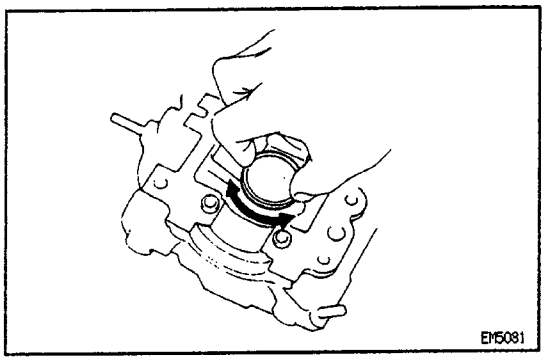
(b) Install the following parts:
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer



(c) Using SST, compress the valve spring and place the two keepers around the valve stem.
SST 09202–43013



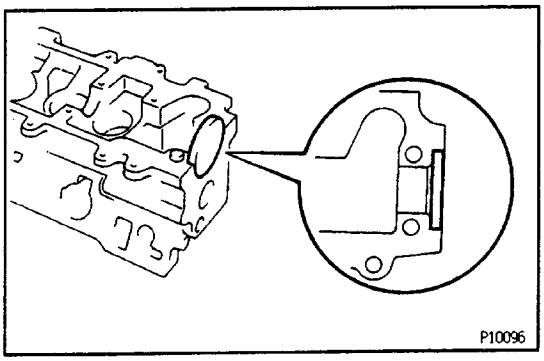
(d) Using a plastic–faced hammer, lightly tap the valve stem tip to assure proper fit.



2. INSTALL VALVE LIFTERS AND SHIMS

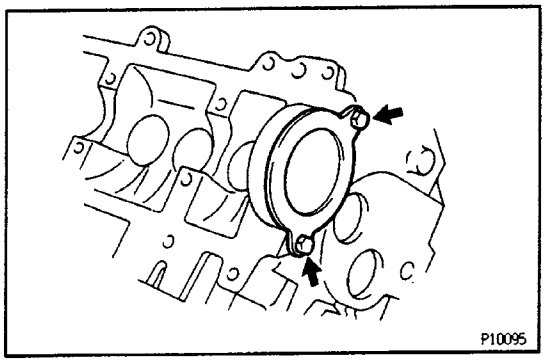
(a) Install the valve lifter– and shim.

(b) Check that the valve lifter rotates smoothly by hand.



3. INSTALL CAMSHAFT HOUSING PLUGS

(a) Place a new housing plug in position on the cylinder head, facing the cup side inward.

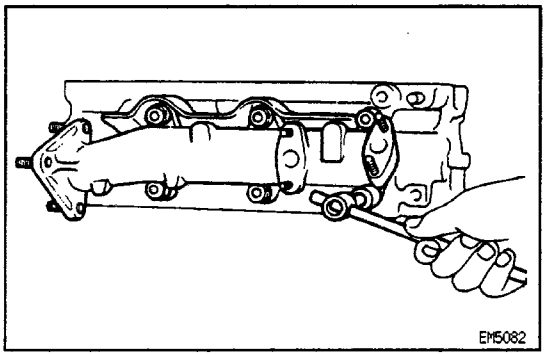


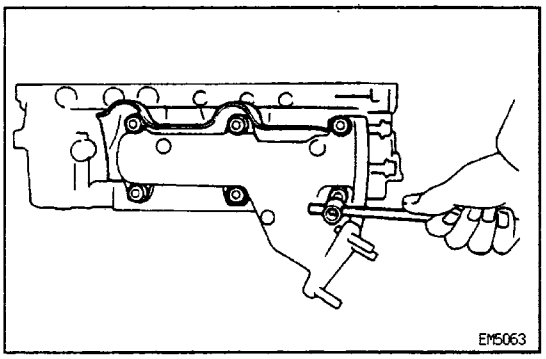
(b) Install the housing rear plate with the two bolts.

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

CYLINDER HEADS INSTALLATION

EG1ZZ–01





(See Components)

1. INSTALL RH EXHAUST MANIFOLD TO RH CYLINDER HEAD

(a) Install a new gasket and the exhaust manifold with the six nuts.

Torque: 38 N–m (400 kgf–cm, 29 ft–lbf)

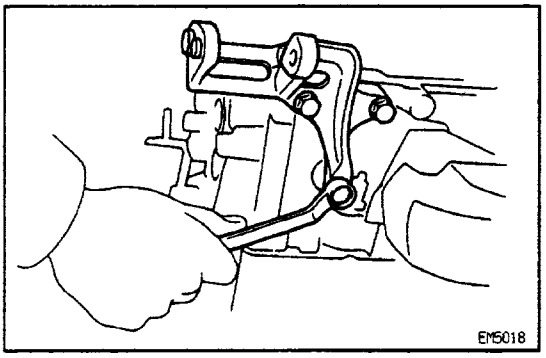
(b) Install the exhaust manifold heat insulator with the bolt and nut.

2. INSTALL RH EXHAUST MANIFOLD TO LH CYLINDER HEAD

(a) Install a new gasket and the exhaust manifold with the six nuts.

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

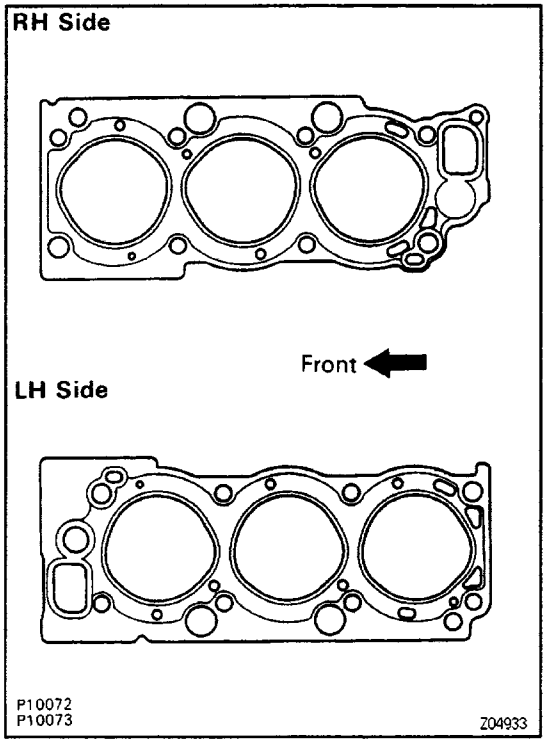
(b) Install the exhaust manifold heat insulator with the three bolts.



3. INSTALL GENERATOR BRACKET

Install the bracket with the three bolts.

Torque: 37 N–m (38o kgf–cm, 27 ft–!bf)



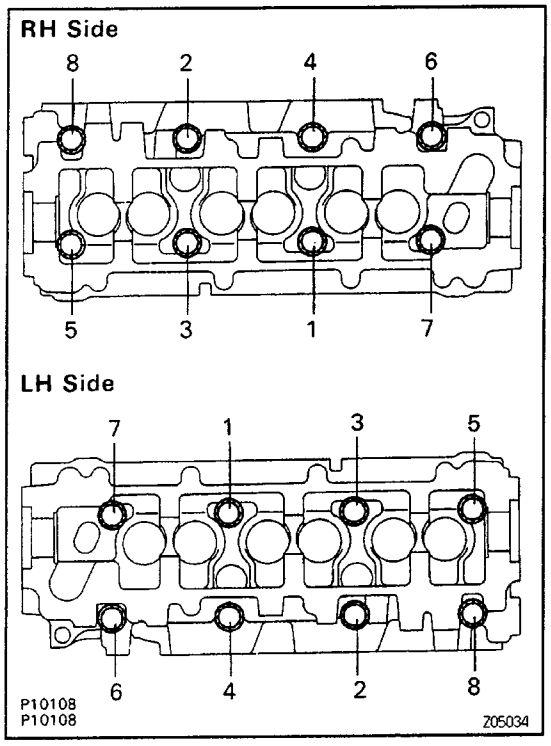
4. INSTALL CYLINDER HEADS

A. Place cylinder head on cylinder block

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

NOTICE: Be careful of the installation direction.

(b) Place the two cylinder heads in position on the cyl–inder head gasket.



B. Install cylinder head (12 pointed head) bolts

HINT:

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

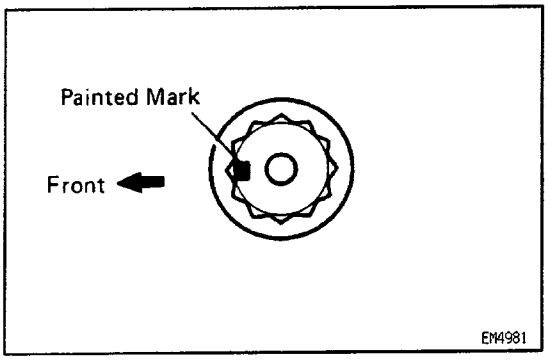
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

(b) Install the plate washer to the cylinder head bolt.

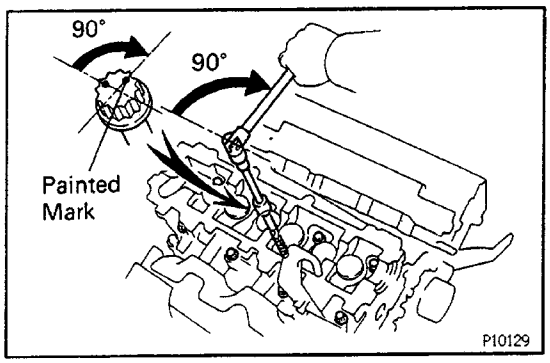
(c) Install and uniformly tighten the eight cylinder head bolts on one side of the cylinder head in several passes, in the sequence shown, then do the other side as shown.

Torque: 44 N–m (450 kgf–cm, 33 ft–lbf)

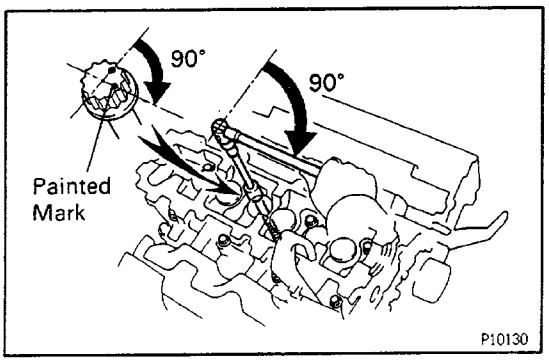
If any one of the bolts does not meet the torque specification, replace the bolt.



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

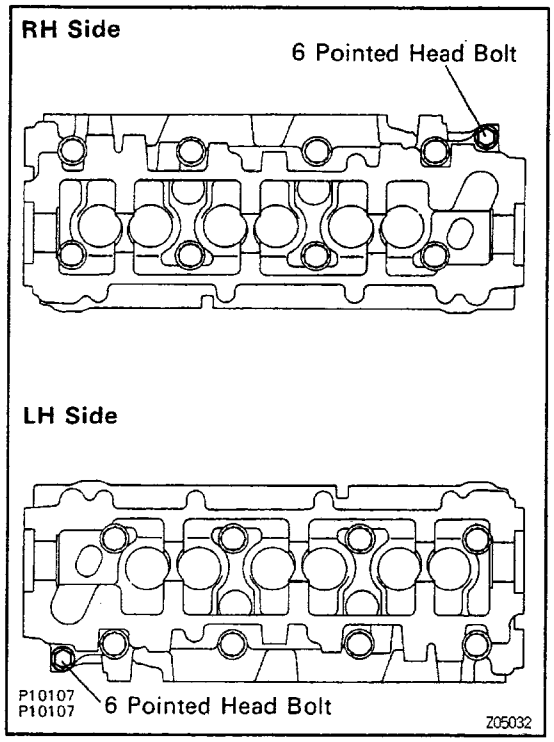


(e) Retighten the cylinder head bolts 90° in the numerical order shown.



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

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

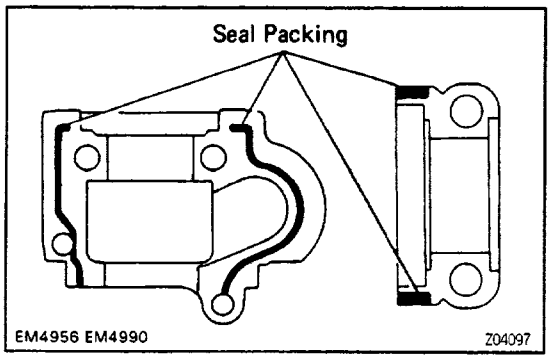


C. Install cylinder head (6 pointed head) bolts

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

(b) Install the cylinder head bolt to each cylinder head.

Torque: 41 N–m (420 kgf–cm, 30 ft–lbf)

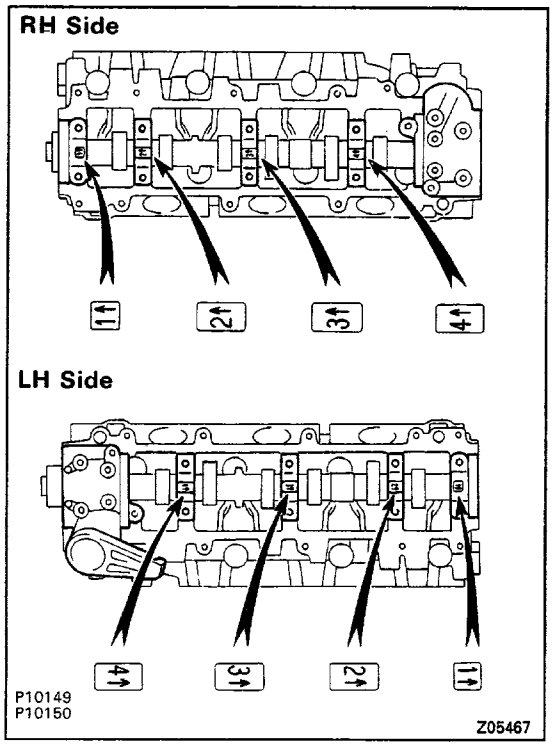


5. INSTALL CAMSHAFTS

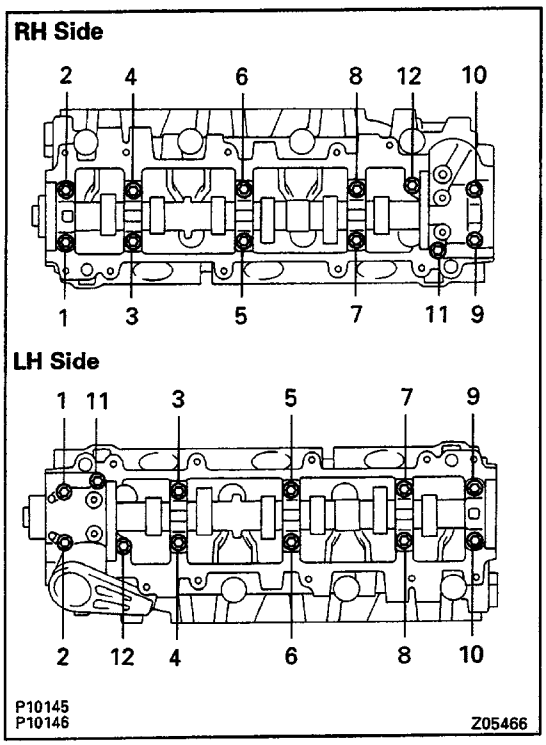
(a) Place the camshaft on the cylinder head.

(b) Apply seal packing to the No.1 and No.5 bearing caps as shown.

Seal packing: Part No. 08826–00080 or equivalent



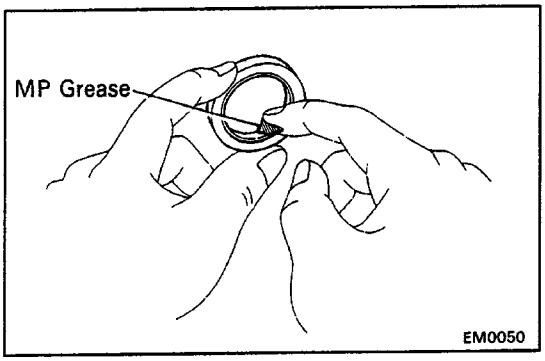
(c) Install the bearing caps in their proper locations.



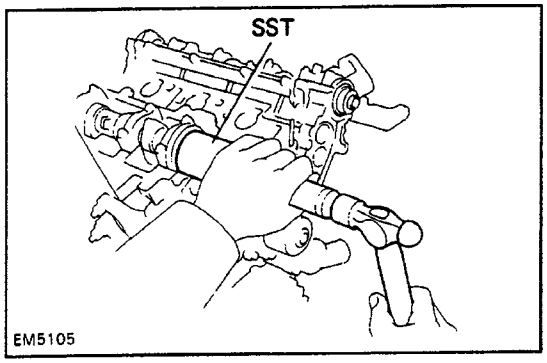
(d) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

(e) Install and uniformly tighten the twelve bearing cap bolts on one side in several passes, in the sequence shown, then do the other side as shown.

Torque: 16 N–m (160 kgf–cm, 12 ft–lbf)



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

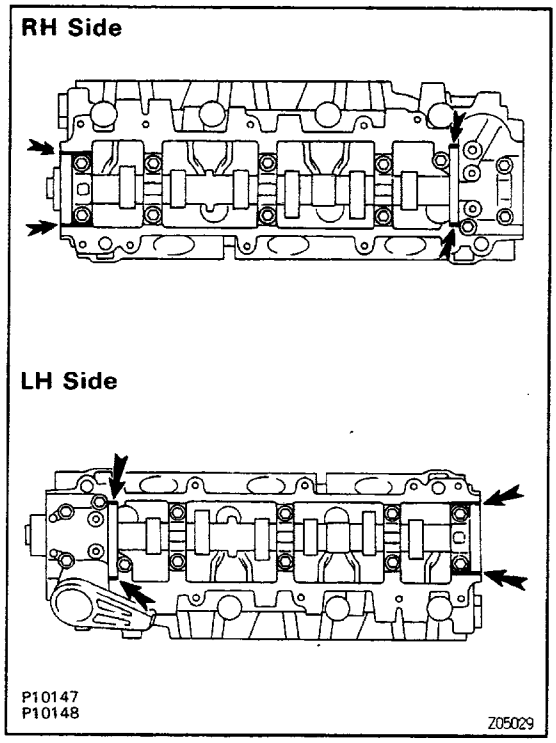


(g) Using SST, tap in the two camshaft oil seals.
SST 09214–60010

6. CHECK AND ADJUST VALVE CLEARANCE
(See Tune – Up, steps 7 and 8 on pages EG –19 to 21)

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

Valve clearance (Cold):
Intake
0.18 – 0.28 mm (0.007 – 0.011 in.)
Exhaust
0.22 – 0.32 mm (0.009 – 0.013 in.)



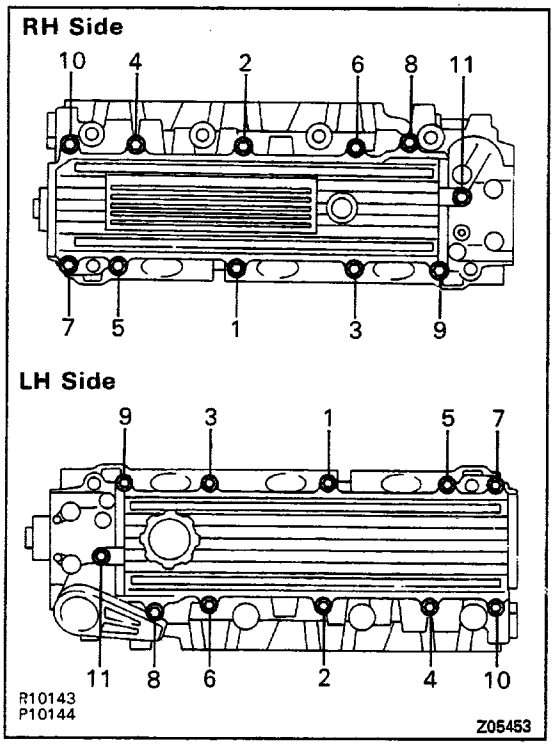
7. INSTALL CYLINDER HEAD COVERS

(a) Remove the old packing (FIPG) material.

(b) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing:

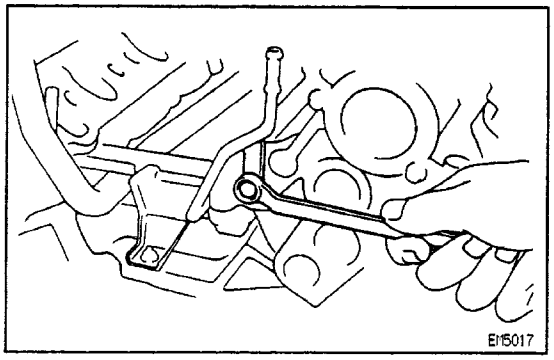
Part No. 08826–00080 or equivalent



(c) Install the gasket to the head cover.

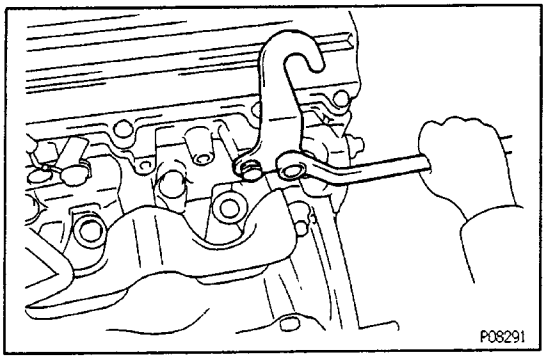
(d) Install the cylinder head cover with the eleven bolts. Uniformly tighten the bolts one side of the cylinder head cover in several passes, in the sequence shown, then do the other side as shown. Install the two cylinder head covers.

Torque: 5.4 N–m (55 kgf–cm, 48 in.–lbf)



8. INSTALL WATER BY–PASS PIPE TO RH CYLINDER HEAD .

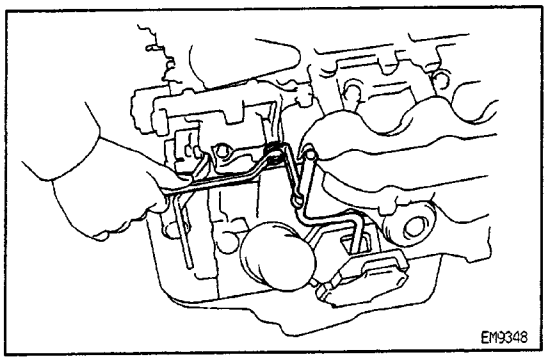
Install the water by– pass pipe with the bolt.



9. INSTALL NO.2 ENGINE HANGER

Install the engine hanger with the two bolts.

Torque: 40 N–m (410 kgf–cm, 30 ft–lbf)



10. INSTALL OIL DIPSTICK GUIDE AND DIPSTICK

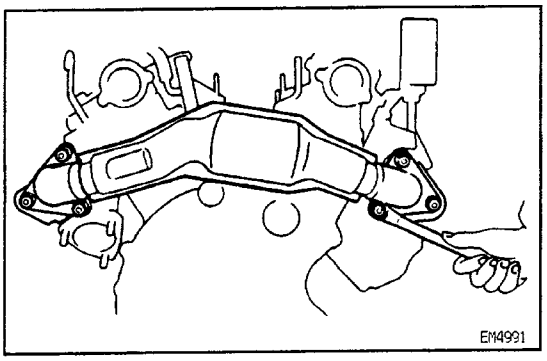
(a) Install a new 0–ring on the oil dipstick:

(b) Install the oil dipstick guide with the bolt.

Torque: 37 N–m (380 kgf–cm, 27 ft–lbf)

(c) Install the oil dipstick.

11. INSTALL GENERATOR

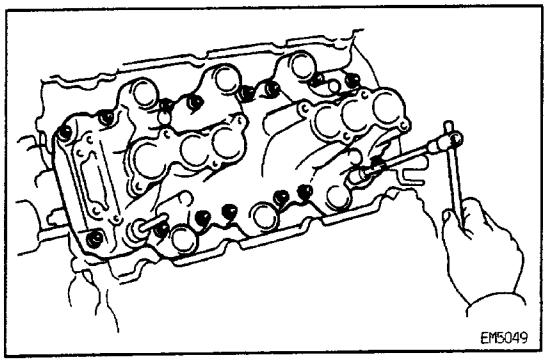


12. INSTALL EXHAUST CROSSOVER PIPE

Install two new gaskets and the crossover pipe with the six nuts.

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

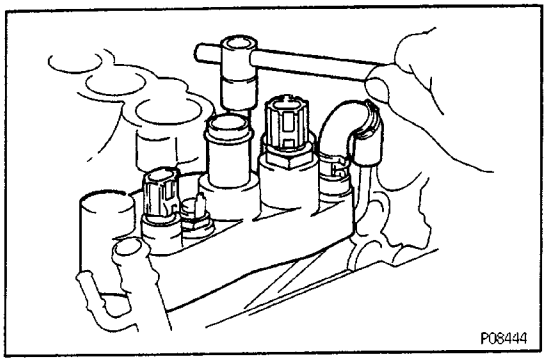
13. INSTALL KNOCK SENSOR WIRE



14. INSTALL INTAKE MANIFOLD

install two new gaskets and the intake manifold with the twelve bolts and four nuts.

Torque: 18 N–m (185 kgf–cm, 13 ft–lbf)

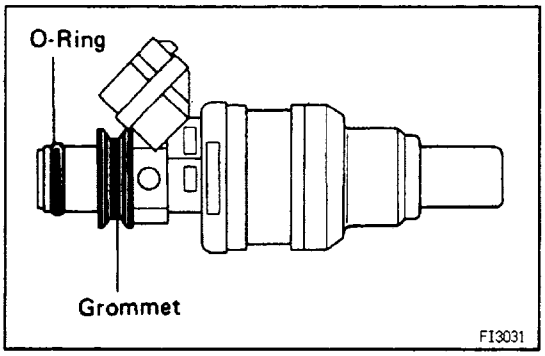


15. INSTALL WATER BY–PASS OUTLET

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

Torque: 18 N–m (185 kgf–cm, 13 ft–lbf)

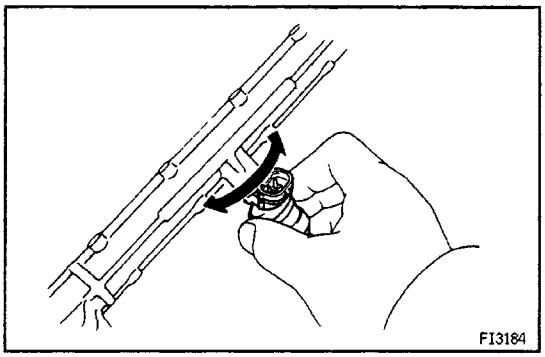
(b) Connect the No.3 water by–pass hose to the No.1 water by–pass pipe.



16. INSTALL INJECTORS AND DELIVERY PIPE

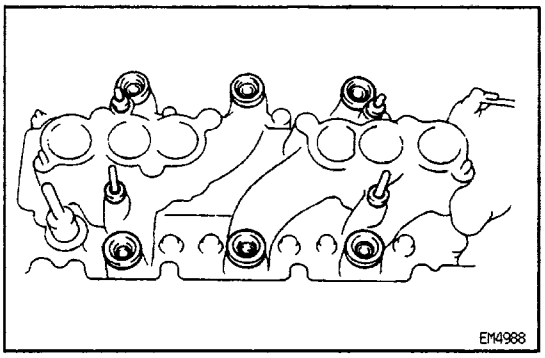
(a) Install a new grommet to the injector.

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



(c) While turning the injector clockwise and counter–clockwise, push it to the delivery pipe. Install the eight injectors.

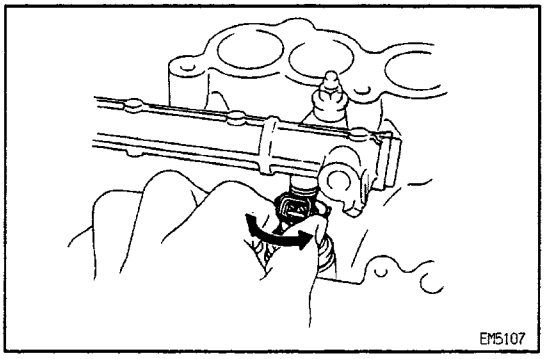
(d) Position the injector connector outward.



(e) Install a O–ring to the spacer.

(f) Place the six spacers and insulators into the injector holes.

(g) Place the four spacers on the stud bolts.



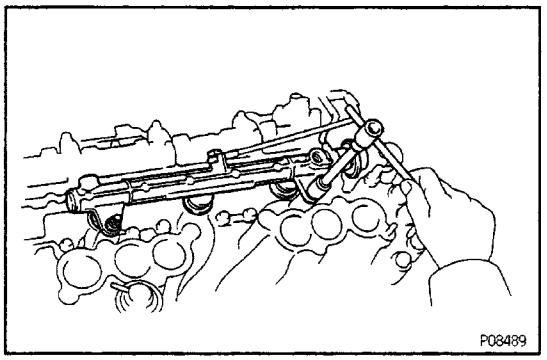
(h) Place the two delivery pipes together with the six injectors in position on the intake manifold.

(i) Temporarily install the four spacers and nuts.

(j) 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.

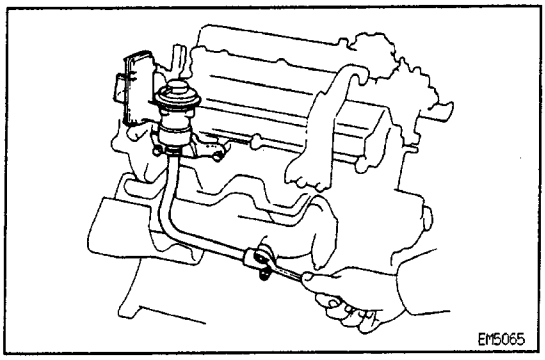
(k) Position the injector connector upward.



(l) Tighten the four nuts holding the delivery pipes to the intake manifold.

Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)

(m) Install the No. 1 fuel pipe to the No.3 bearing cap with the bolt.



17. INSTALL PAIR REED VALVE AND NO.1 INJECTION MANIFOLD

(a) Position a new gasket on the RH exhaust manifold.

(b) Install the PAIR reed valve and injection manifold assembly with the two nuts and two bolts.

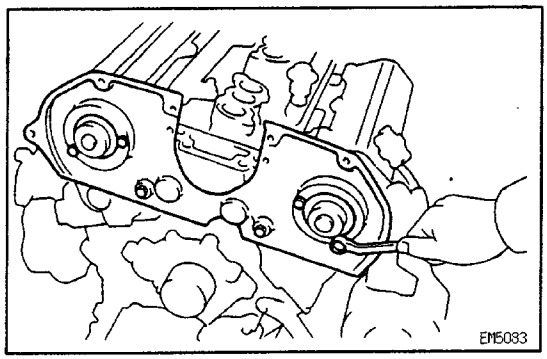
Torque:
37 N–m (380 kgf–cm, 27 ft–lbf) for bolt
29 N–m (300 kgf–cm, 22 ft–lbf) for nut

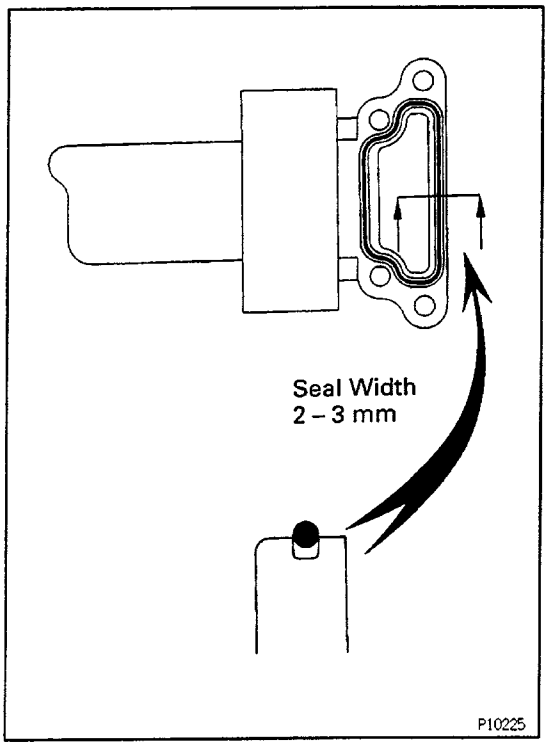
18. INSTALL VSV BRACKET AND VSV TO PAIR REED VALVE

19. INSTALL NO.3 TIMING BELT COVER

Install the timing belt cover with the six bolts.

Torque: 8.3 N–m (85 kgf–cm, 74 in.–lbf)





20. INSTALL NO.2 IDLER PULLEY

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the water outlet housing on the No.2 idler pulley and the intake manifold.

- 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.

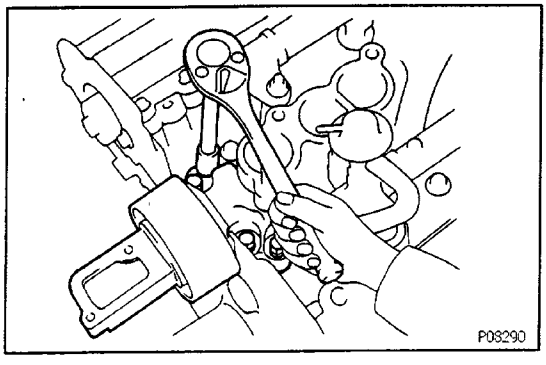
(b) Apply seal packing to the sealing groove of the water outlet housing on the idler pulley as shown in the illustration.

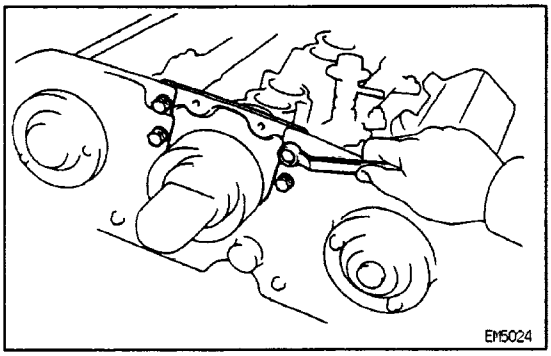
Seal packing:
Part No. 08826–00100 or equivalent

- Install a nozzle that has been cut to a 2 – 3 mm (0.08 – 0.12 in.) opening.
- 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 idler pulley with the four bolts. Uniformly tighten the bolts in several passes.

Torque: 18 N–m (185 kgf–cm, 13 ft–lbf)

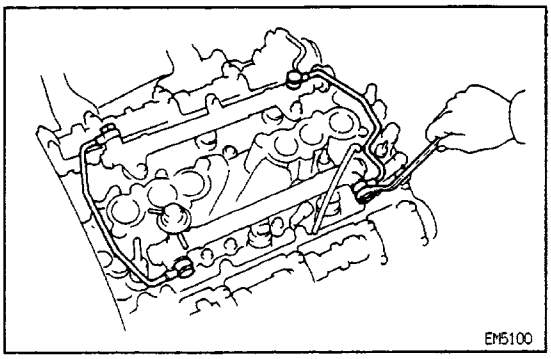




21. INSTALL NO.4 TIMING BELT COVER

Install the timing belt cover with the four bolts.

Torque: 8.3 N–m (85 kgf–em, 74 in.–lbf)



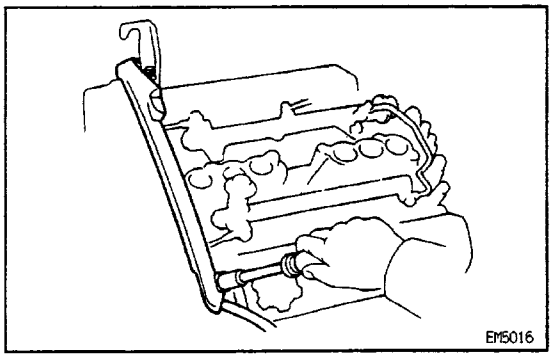
22. INSTALL NO.2 AND NO.3 FUEL PIPES

(a) Install the No.2 fuel pipe with four new gaskets and two union bolts.

Torque: 34 N–m (350 kgf–cm, 25 ft–lbf)

(b) Install the No.3 fuel pipe with four new gaskets and two union bolts.

Torque: 34 N–m (350 kgf–cm, 25 ft–lbf)

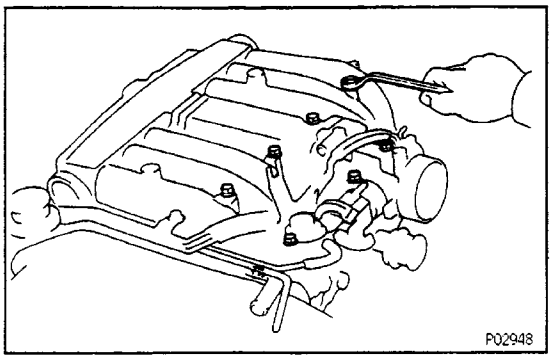


23. INSTALL ENGINE WIRE

(a) Install the engine wire with the two bolts.

(b) Connect the following connectors:

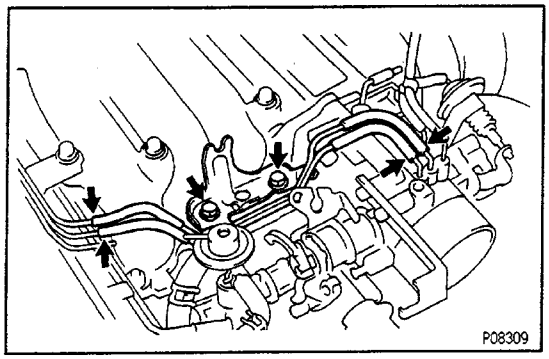
- Injector connectors
- RH ground strap
- ECT sender gauge connector
- ECT sensor connector
- No.2 ECT switch connector
- Cold start injector time switch connector
- Knock sensor connector



24. INSTALL AIR INTAKE CHAMBER

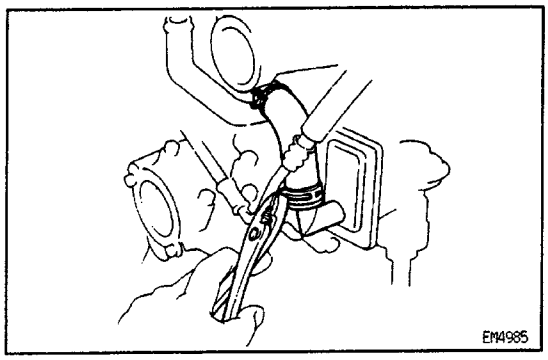
(a) Install a new gasket and the intake chamber with the six bolts and two nuts. .

Torque: 18 N–m (185 kgf–cm, 13 ft–lbf)

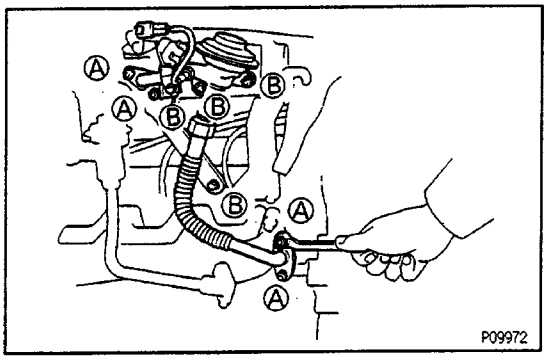


(b) Install the accelerator cable bracket with the two bolts.

(c) Connect the four vacuum hoses to the air pipes.



(d) Connect the No.1 air hose to the reed valve.



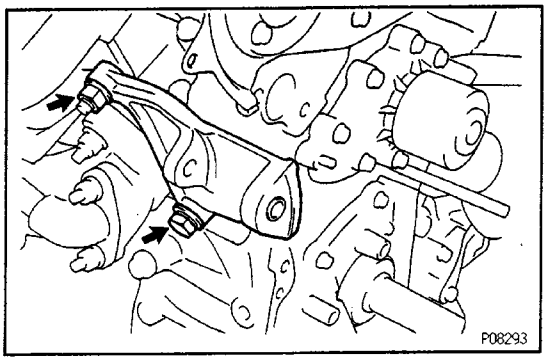
(e) Install two new gaskets, the EGR valve, pipes assembly, air intake chamber stay and throttle cable bracket with the six nuts and two bolts.

Torque:
29 N–m (300 kgf–cm, 22 ft–lbf) for (A)
18 N–m (185 kgf–cm, 13 ft–lbf) for (B)

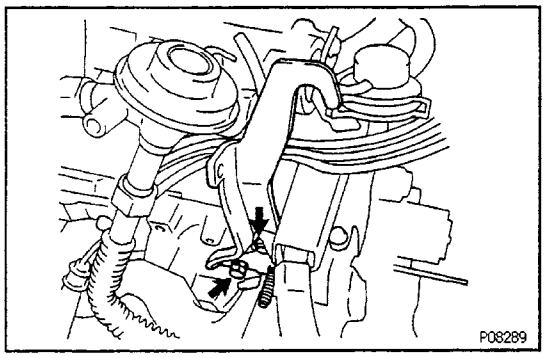
(f) (C & C only)
Disconnect the two water by–pass hoses from the EGR valve.

(g) Connect the EGR hoses to the air pipe and EGR vacuum modulator.

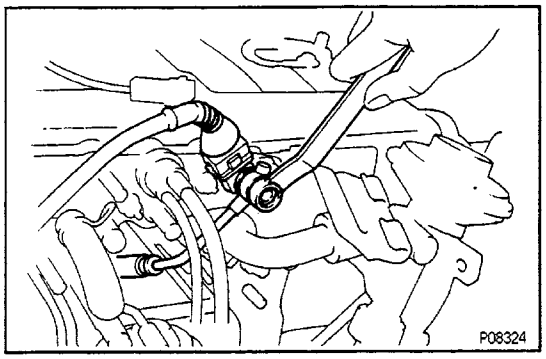
(h) (Calif. and C & C)
Connect the EGR gas temperature sensor connector.



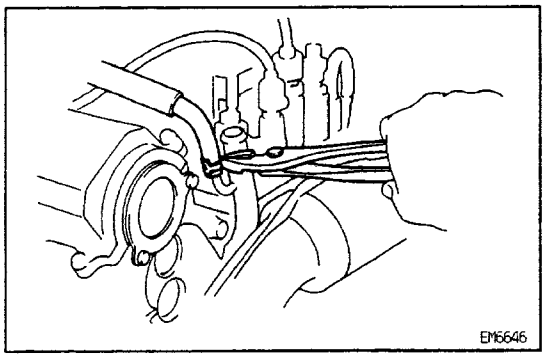
(i) Install the PS pump bracket with the bolt and nut.



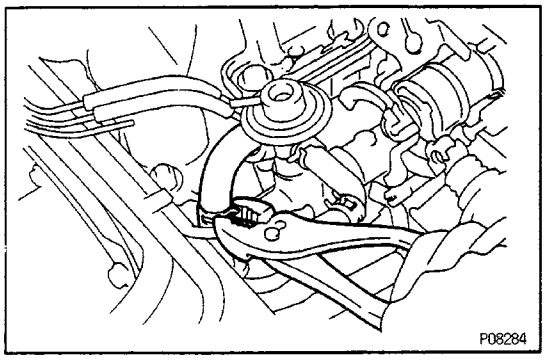
(j) Install No.1 engine hanger.
Torque: 40 N–m (410 kgf–cm, 30 ft–lbf)



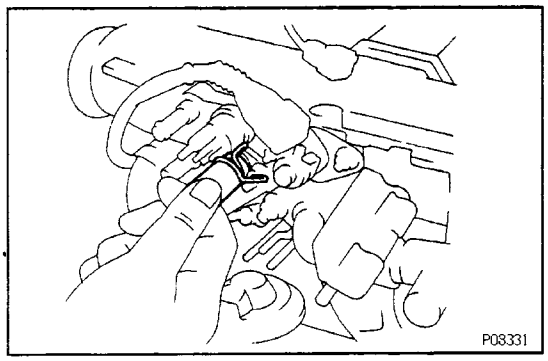
(k) Connect the cold start injector tube with two new gasket and the union bolt.
Torque: 15 N–m (150 kgf–cm, 11 ft–lbf)
(l) Connect the vacuum hose to the gas filter.
(m) Connect the cold start injector connector.



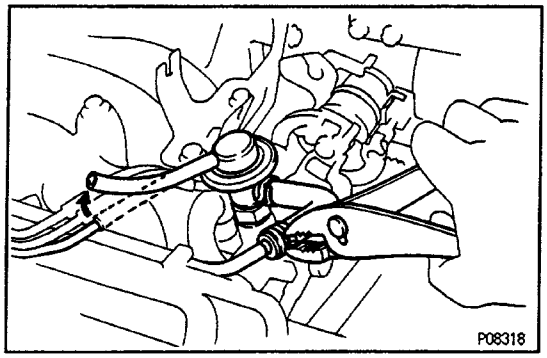
(n) Install the No.5 water by–pass hose to the water by –pass pipe.



(o) Connect the No.4 water by–pass hose to the union of intake manifold.

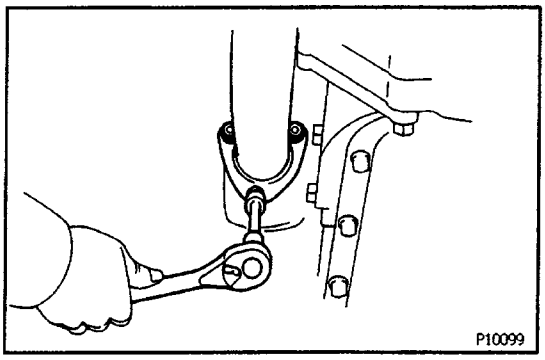


(p) Connect the PCV hose to the union.

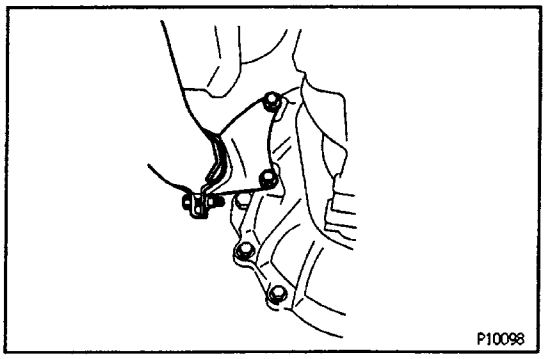


(q) Connect the vacuum and fuel hoses to the pressure regulator.
(r) Connect the charcoal canister vacuum hose to the throttle body.
(s) Connect the throttle position sensor connector.

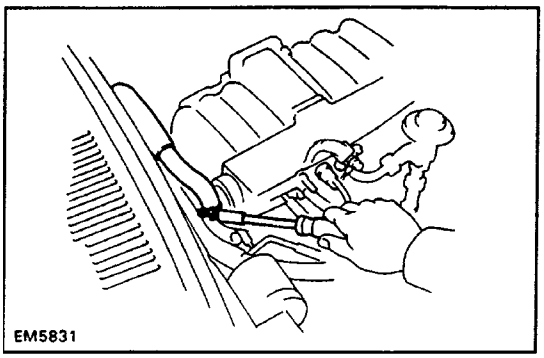
25.INSTALL TIMING BELT
See steps 2, 7 to 16, 22 and 24 on pages EG2–41 to 48)
26. INSTALL DISTRIBUTOR
(See steps 1 and 2 on pages IG–25 and 26)
27. CONNECT HIGH–TENSION CORDS TO SPARK PLUGS



28. INSTALL FRONT EXHAUST PIPE
(a) Connect the exhaust pipe to the LH exhaust manifold with new gasket and three new nuts.
Torque: 62 N–m (630 kgf–cm, 46 ft–lbf)
(b) Connect the exhaust pipe to the catalytic converter with new gasket and the two bolts.
Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)



(c) Install the pipe bracket to the transmission with the two bolts.
(d) Install the pipe bracket to the exhaust pipe with the pipe clamp.
(e) Connect the oxygen sensor connector–.



29. CONNECT FUEL INLET AND OUTLET HOSES
30. CONNECT HEATER HOSES

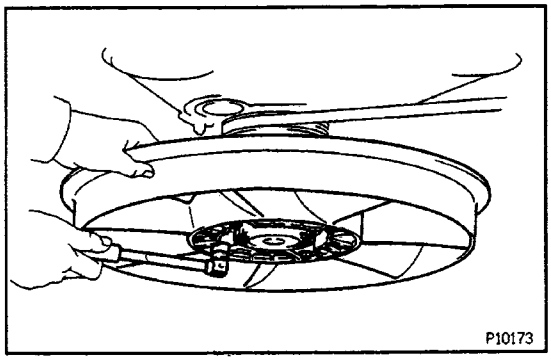
31. CONNECT CABLES, HOSES, CONNECTORS, STRAP AND WIRES

(a) Connect the following cables:
- Accelerator cable
- (A/T only)
  Throttle cable
- (w/ Cruise Control System)

Cruise control cable

(b) Connect the following hoses:
- PS air hoses to gas filter and air pipe
- Brake booster hose
  (w/ Cruise Control System)
- Cruise control vacuum hose
- Charcoal canister hose from canister
- VSV vacuum hoses

(c) Connect the following strap, wires and connectors:
- Ground strap to LH fender apron
- Generator connector and wire
- Igniter connector
- Oil pressure sender gauge connector
- Ground strap to engine rear side
- ECM connectors
- VSV connectors
- A/C compressor connector
- (M/T only)
  Starter relay connector
- Solenoid resister connector
- Data link connector 1
  (w/ ADD)
  ADD switch connector



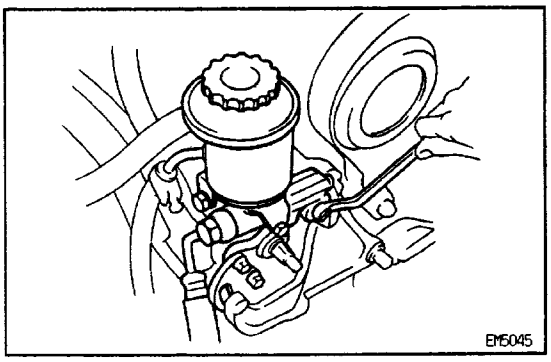
32. INSTALL GENERATOR DRIVE BELT

33. INSTALL COOLING FAN

Install the cooling fan with the four nuts.

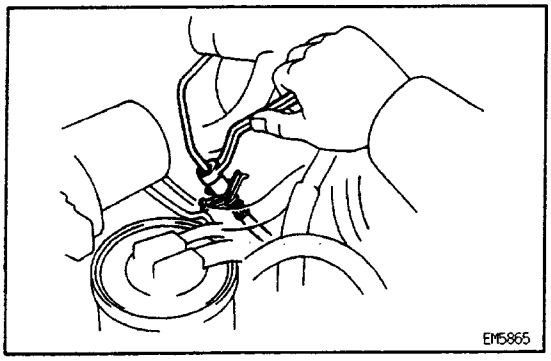
Torque: 5.4 N–m (55 kgf–cm, 48 in.–lbf)

34. INSTALL A/C DRIVE BELT

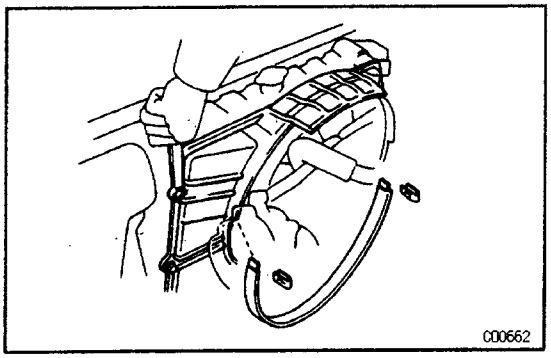


35. INSTALL PS PUMP

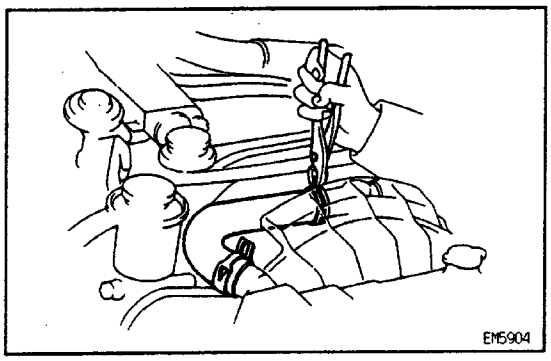
36. INSTALL PS PUMP PULLEY AND DRIVE BELT



37. (M/T only)
CONNECT CLUTCH RELEASE CYLINDER HOSE



38. INSTALL RADIATOR
(a) Install the radiator with the four bolts.
(b) Install the No. fan shroud with the four bolts.
(c) Install the No.2 fan shroud with the two clips.



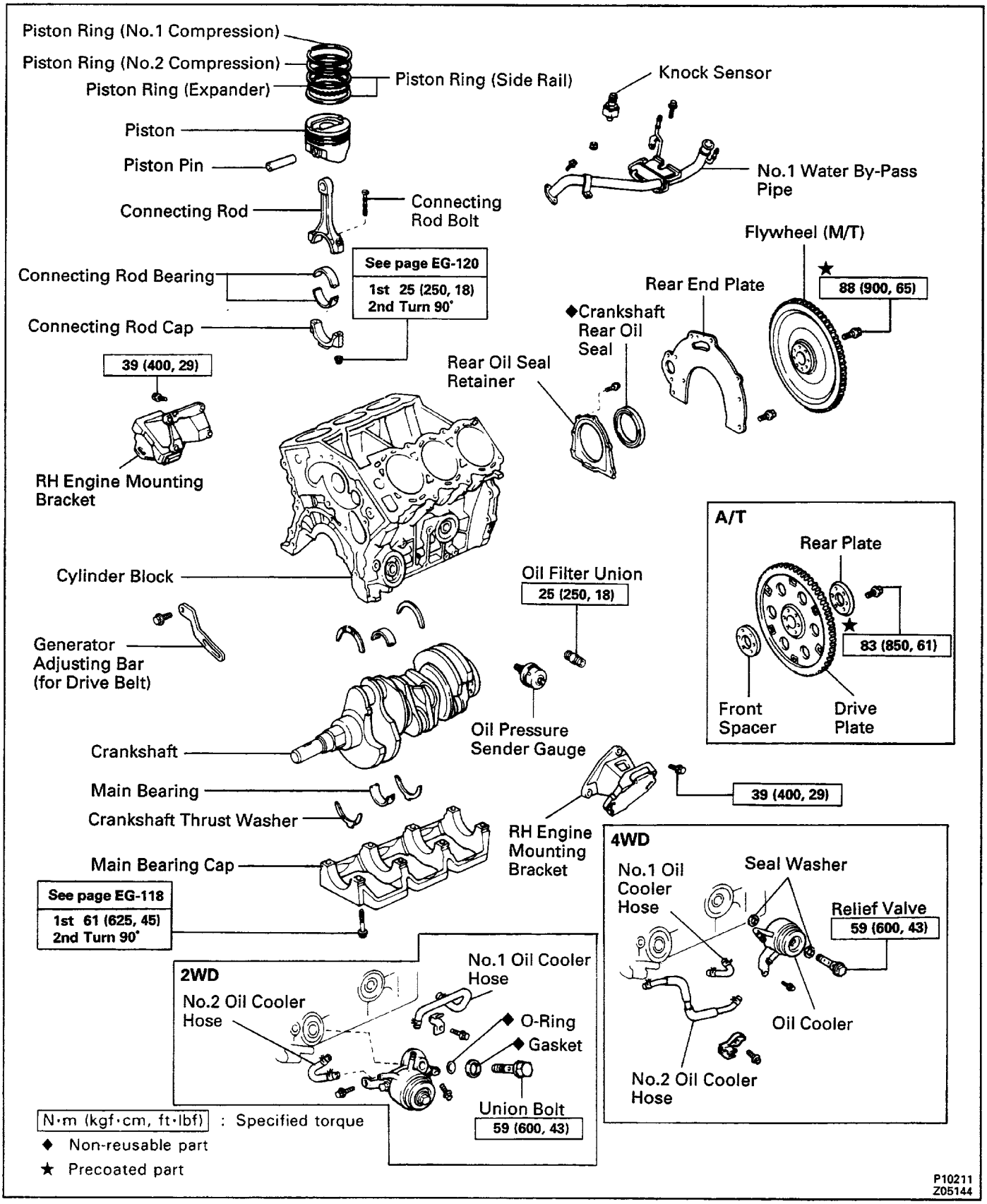
(d) Install the radiator hoses.
(e) (A/T only)
Connect the oil cooler hoses.
(f) Connect the reservoir tank hose.

39. INSTALL AIR CLEANER AND HOSE
40. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY
41. FILL WITH ENGINE COOLANT
42. START ENGINE AND CHECK FOR LEAKS
43. PERFORM ENGINE ADJUSTMENT
(See Tune – Up on pages EG2–12 to 27)
44. PERFORM ROAD TEST
Check for abnormal noise, shock, slipage, correct shift points and smooth operation.
45. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL

CYLINDER BLOCK

EG1EG–05

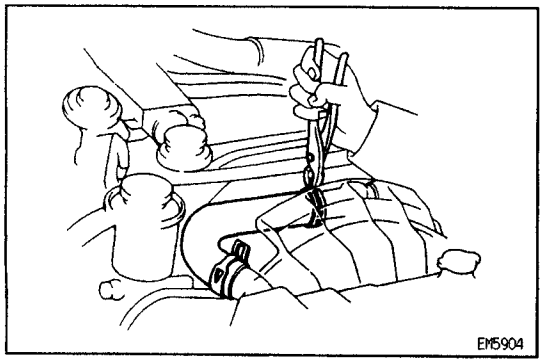
COMPONENTS



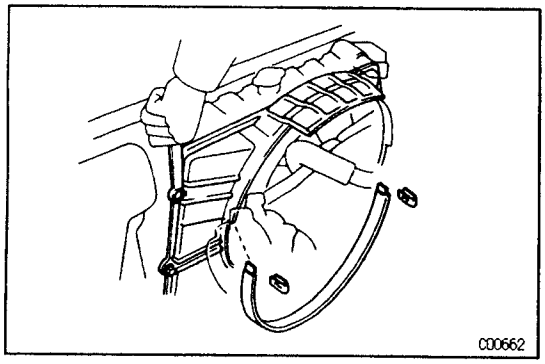
EG30W–01

ENGINE REMOVAL

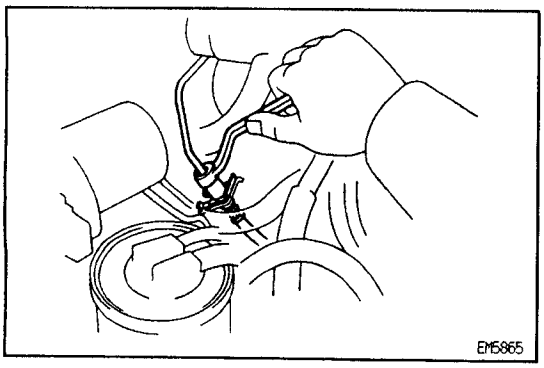
1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. REMOVE HOOD
3. REMOVE BATTERY
4. REMOVE ENGINE UNDER COVER
5. DRAIN ENGINE COOLANT
6. DRAIN ENGINE OIL
7. REMOVE AIR CLEANER AND HOSE
8. REMOVE RADIATOR



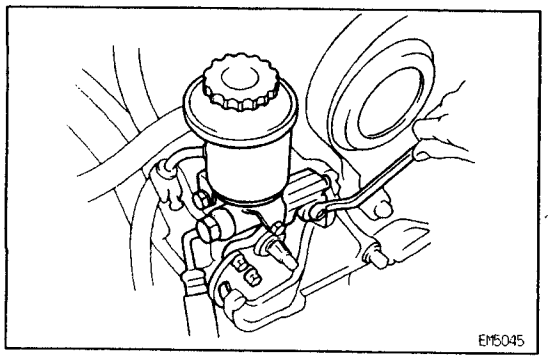
(a) Disconnect the reservoir hose.
(b) (A/T only)
Disconnect the oil cooler hoses.
(c) Remove the radiator hoses.



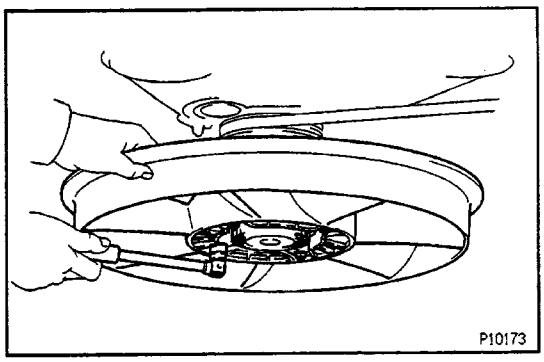
(d) Remove the two clips and No.2 fan shroud.
(e) Remove the four bolts and No.1 fan shroud.
(f) Remove the four bolts and radiator.



9. (M/T only)
DISCONNECT CLUTCH RELEASE CYLINDER HOSE



10. REMOVE PS DRIVE BELT AND PUMP PULLEY
11. DISCONNECT PS PUMP FROM ENGINE
12. REMOVE A/C DRIVE BELT



13. REMOVE COOLING FAN

Remove the four nuts and cooling fan.

14. REMOVE GENERATOR DRIVE BELT

15. DISCONNECT STRAP, WIRES. CONNECTORS, HOSES AND CABLES

(a) Disconnect the following strap, wires and connectors:

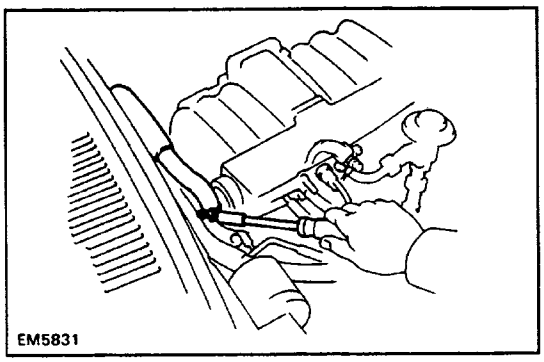
- Ground strap from LH fender apron
- Generator connector and wire
- Igniter connector
- Oil pressure sender gauge connector
- Ground strap from engine rear side
- ECM connectors
- VSV connectors
- A/C compressor connector
- (M/T only)
  Starter relay connector
- Solenoid resister connector
- Data link connector 1
- (w/ ADD)
  ADD switch connector

(b) Disconnect the following hoses:

- PS air hoses from gas filter and air pipe
- Brake booster hose
- (w/ Cruise Control System)
  Cruise control vacuum hose
- Charcoal canister hose from canister
- VSV vacuum hoses

(c) Disconnect the following cables:

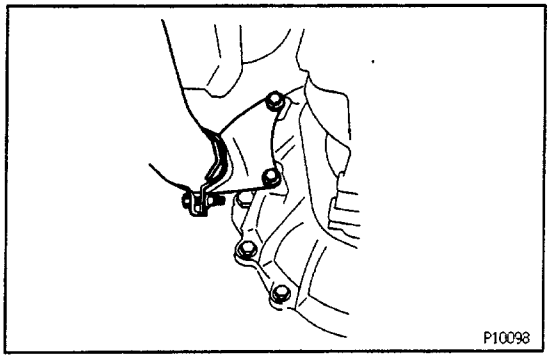
- Accelerator cable
- (A/T only)
  Throttle cable
- (w/ Cruise Control System)
  Cruise control cable



16. DISCONNECT HEATER HOSES

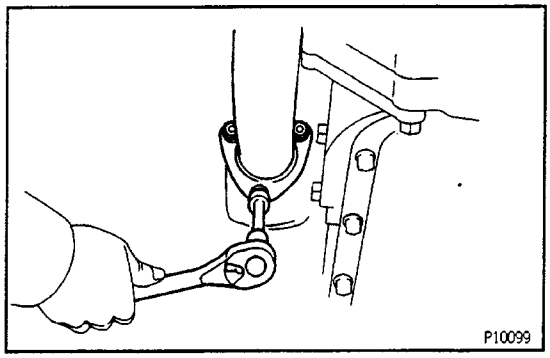
17. DISCONNECT FUEL INLET AND OUTLET HOSES

18. DISCONNECT A/C COMPRESSOR FROM ENGINE



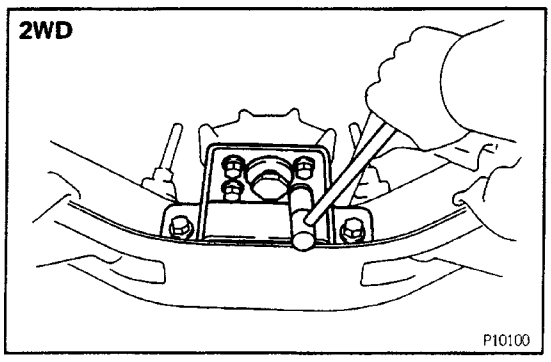
19. REMOVE FRONT EXHAUST PIPE

(a) Disconnect the heated oxygen sensor connector.
(b) Loosen the pipe clamp bolt.
(c) Remove the two bolts and pipe bracket.
(d) Remove the three nuts, and disconnect the exhaust pipe from the exhaust manifold. Remove the gasket.

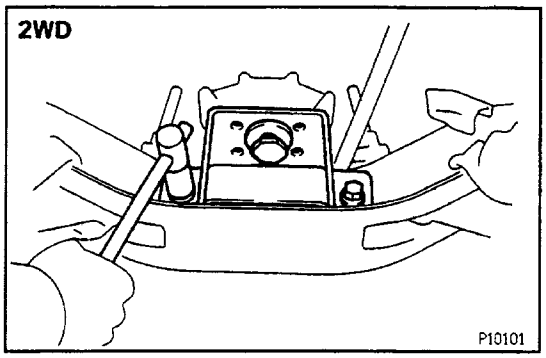


(e) Remove the two bolts, joint retainer, exhaust pipe and gasket from the catalytic converter.

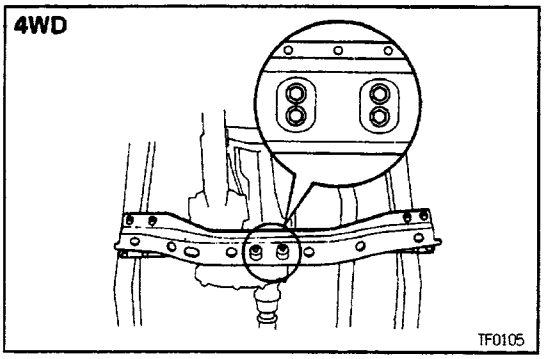
20. (M/T only)
REMOVE SHIFT LEVERS
21. REMOVE REAR PROPELLER SHAFT
(See page PR–5)
22. (4WD only)
REMOVE FRONT PROPELLER SHAFT
(See page PR–5)
23. (4WD A/T only)
DISCONNECT MANUAL SHIFT LINKAGE
24. DISCONNECT SPEEDOMETER CONNECTOR
NOTICE: Do not lose the felt dust protector and washers.
25. (4WD only)
REMOVE TRANSFER UNDER COVER
26. (4WD only)
REMOVE STABILIZER BAR
27. REMOVE NO.1 FRAME CROSSMEMBER
28. REMOVE N0.1 FRONT FLOOR HEAT INSULATOR AND BRAKE TUBE HEAT INSULATOR (4WD)



29. (2WD)
REMOVE ENGINE REAR MOUNTING BRACKET
(a) Remove the four bolts holding the mounting bracket to the mounting insulator.



(b) Raise the transmission slightly by raising the engine with a jack.
(c) Remove the four bolts holding the mounting bracket to the support member, and remove the mounting bracket.



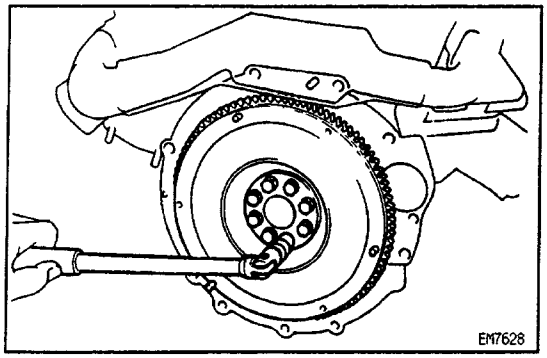
30. (4WD)
REMOVE NO.2 FRAME CROSSMEMBER
(a) Remove the four bolts holding the engine rear mou–nting insulator to the frame crossmember.
(b) Raise the transmission slightly with a jack.
(c) Remove the eight bolts holding the frame crossme–mber to the side frame. Remove the frame crossme–mber.

31. REMOVE ENGINE AND TRANSMISSION ASSEMBLY FROM VEHICLE
(a) Attach the engine chain hoist to the engine hangers.
(b) Remove the four bolts holding the RH and LH engine mounting insulators to the body mountings.
(c) Lift the engine and transmission assembly out of the vehicle slowly and carefully.
HINT: Make sure the engine is clear of all wiring, hoses and cables.
NOTICE: Be careful not hit the PNP switch.
(d) Place the engine and transmission assembly onto the stand.

32. REMOVE TRANSMISSION FROM ENGINE
33. (M/T only)
REMOVE CLUTCH COVER AND DISC

PREPARATION FOR DISASSEMBLY

EG20U–01



(See Components)

1. REMOVE FLYWHEEL OR DRIVE PLATE

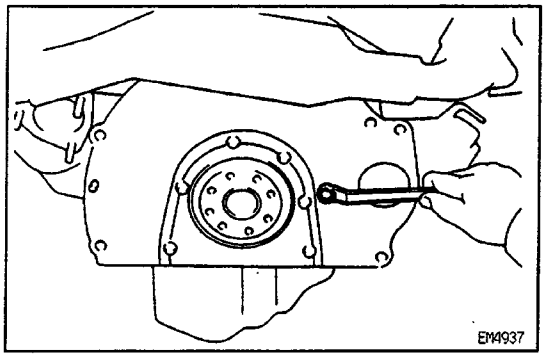
(a) Remove the eight bolts.

(b) (M/T)

Remove the flywheel.

(c) (A/T)

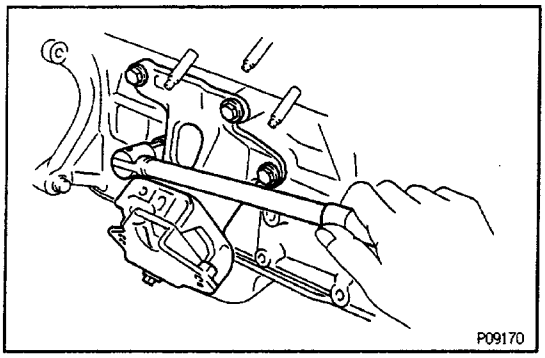
Remove the rear plate, drive plate and front spacer.



2. REMOVE REAR END PLATE

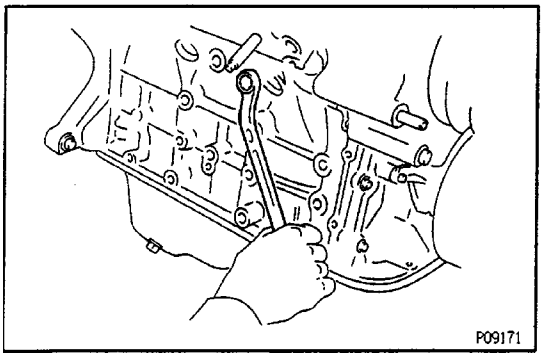
Remove the bolt and rear end plate.

3. INSTALL ENGINE STAND FOR DISASSEMBLY



4. REMOVE RH AND LH ENGINE MOUNTING BRACKETS

Remove the four bolts and mounting bracket. Remove the two mounting brackets.



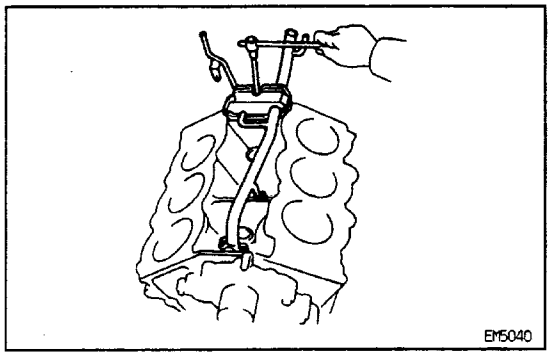
5. REMOVE ENGINE COOLANT DRAIN PLUGS

6. REMOVE TIMING BELT

(See pages EG2–33 to 38)

7. REMOVE CYLINDER HEADS

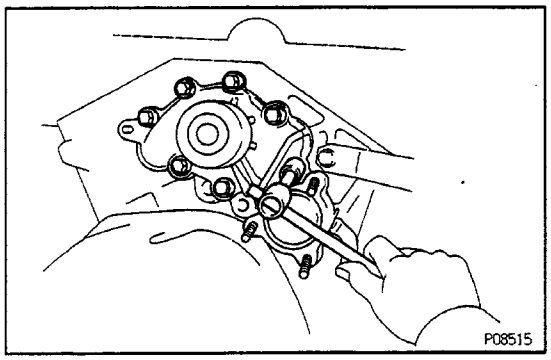
(See pages EG2–53 to60)



8. REMOVE No.1 WATER BY–PASS PIPE

Remove the two nuts, two bolts and water by–pass pipe.

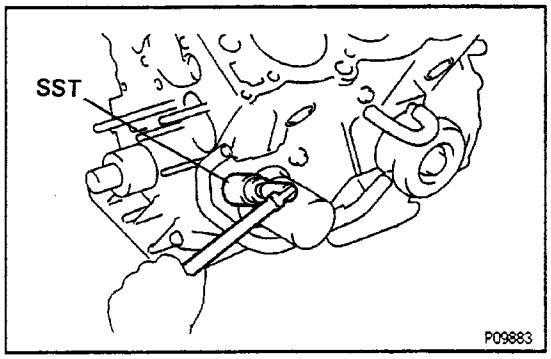
9. REMOVE THERMOSTAT



10. REMOVE WATER PUMP

Remove the seven bolts and water pump.

11. REMOVE GENERATOR ADJUSTING BAR

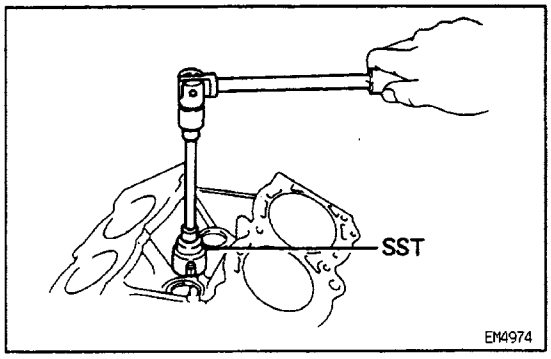


12. REMOVE OIL PRESSURE SENDER GAUGE

Using SST, remove the oil pressure sender gauge.

SST 09816 – 30010

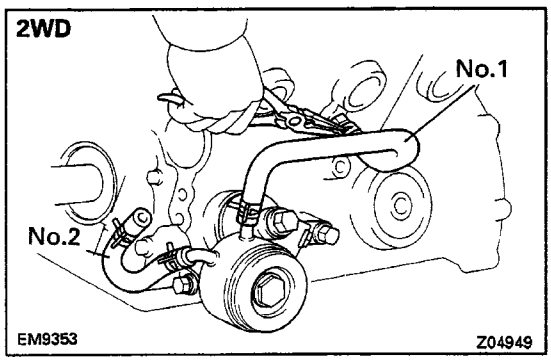
13. REMOVE OIL FILTER



14. REMOVE KNOCK SENSOR

Using SST, remove the knock sensor.

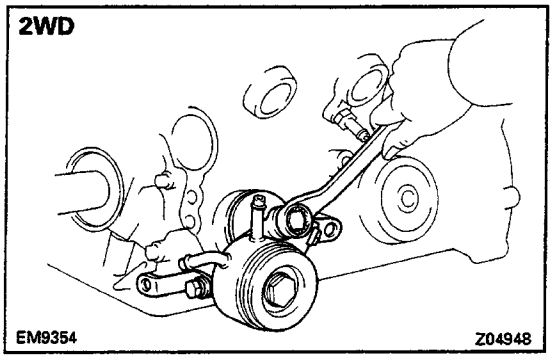
SST 09817–16011



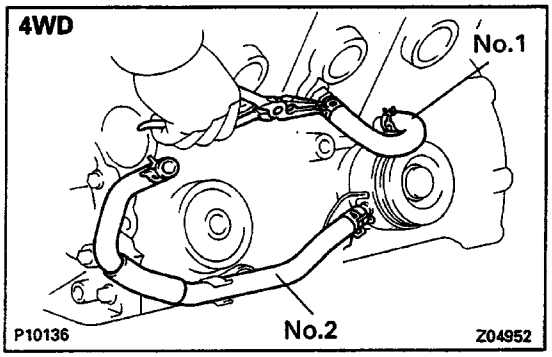
15. (2WD)

REMOVE OIL COOLER AND BRACKET ASSEMBLY

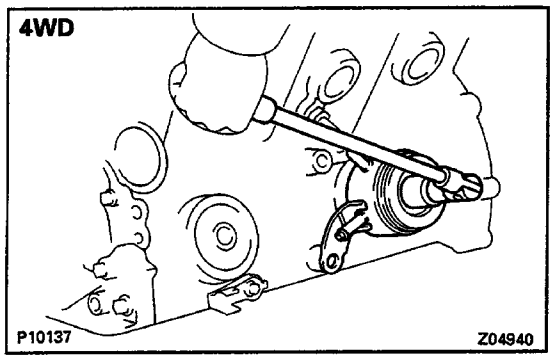
(a) Remove the No.1 and No.2 oil cooler hoses.



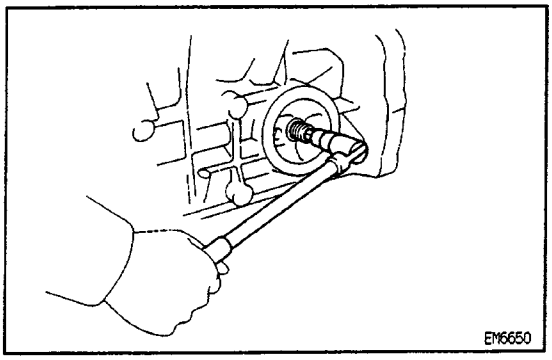
(b) Remove the two bolts holding the bracket to the cylinder block.
(c) Remove the union bolt, gasket, 0–ring, the oil cooler, bracket assembly and 0–ring.



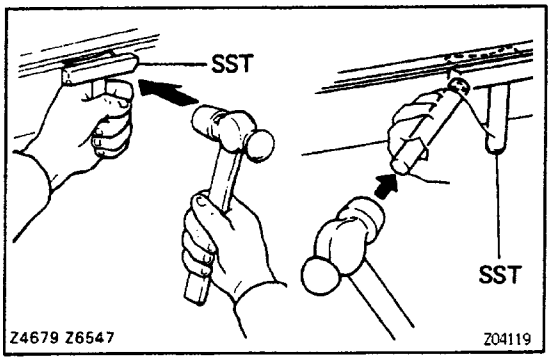
16. (4WD)
REMOVE OIL COOLER
(a) Remove the No.1 and No.2 oil cooler hoses.



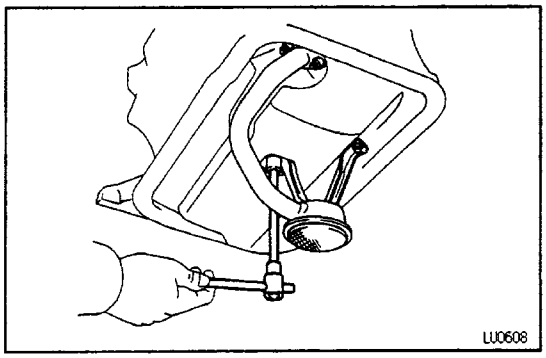
(b) Remove the bolt holding the bracket to the cylinder block.
(c) Remove the relief valve, seal washer, oil cooler and seal washer.
(d) Remove the O–ring and gasket from the oil cooler.



17. REMOVE OIL FILTER UNION
Using a 12 mm hexagon wrench, remove the oil filter union.

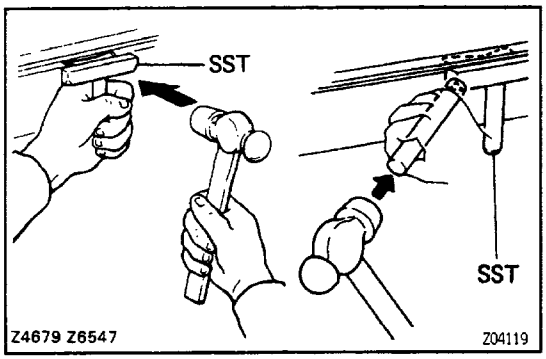


18. REMOVE OIL PAN
(a) Remove the seventeen bolts and two nuts.
(b) Insert the blade of SST between the baffle plate and oil pan, cut off applied sealer and remove the oil pan.
SST 09032–00100
NOTICE: Be careful not to damage the oil pan and baffle plate flanges.



19. REMOVE OIL STRAINER

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



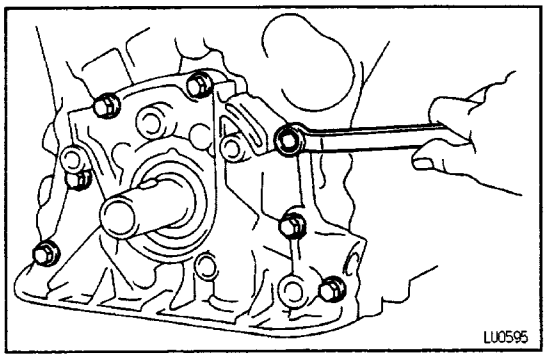
20. REMOVE OIL PAN BAFFLE PLATE

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 and rear oil seal retainer.**
- **Be careful not to damage the baffle plate flange.**

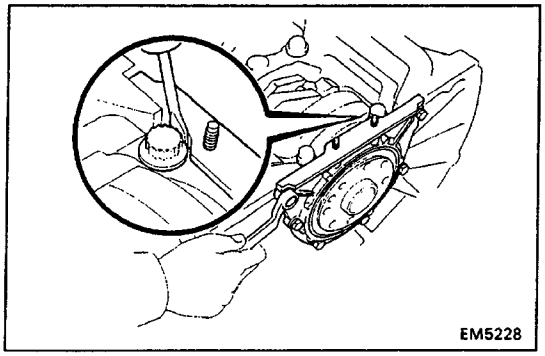


21. REMOVE OIL PUMP

(a) Remove the seven bolts.

(b) Using a plastic–faced hammer, carefully tap oft the oil pump.

(c) Remove the O–ring from the cylinder block.



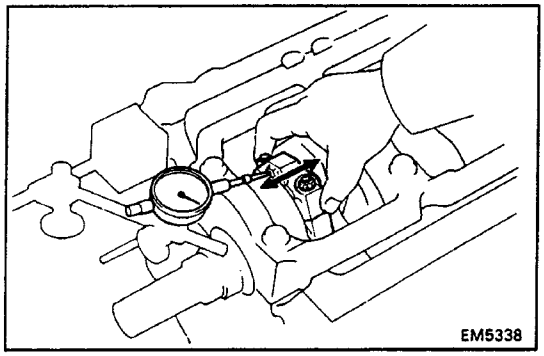
CYLINDER BLOCK DISASSEMBLY

EG1ZP–01

(See Components)

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.

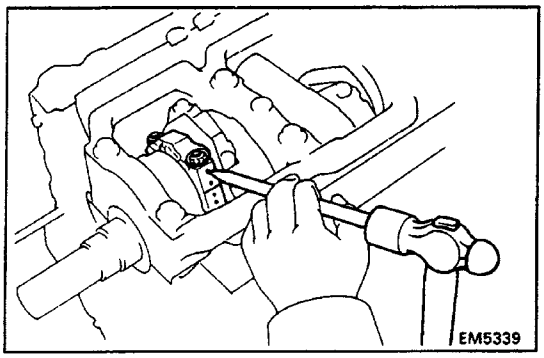
Standard thrust clearance:

0.150 – 0.330 mm (0.0059 – 0.0130 in.)

Maximum thrust clearance:

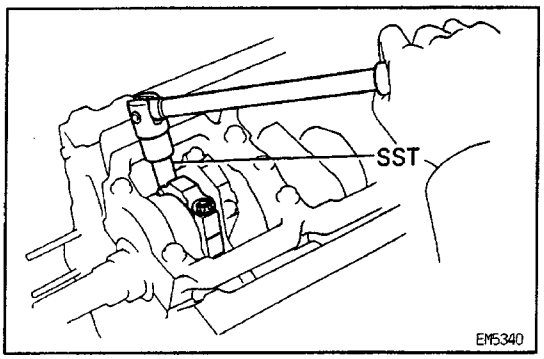
0.38 mm (0.0150 in.)

If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

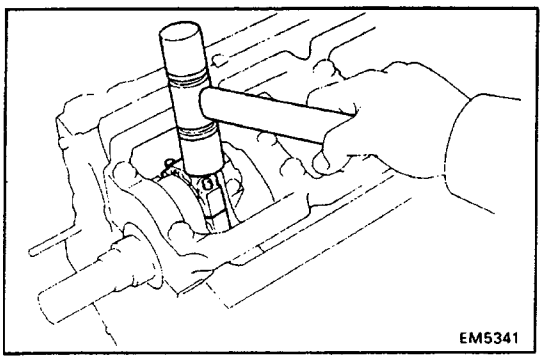


3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

(a) Using a punch or numbering stamp, mark the connecting rod and cap to ensure correct reassembly.

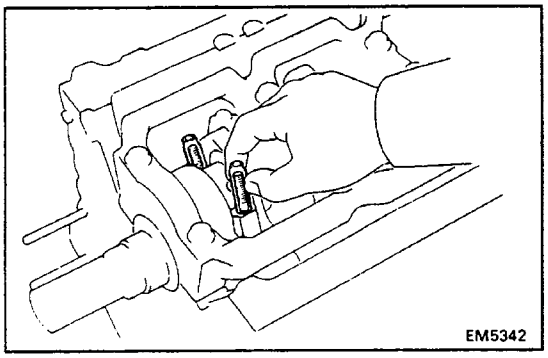


(b) Remove the connecting rod cap nuts.

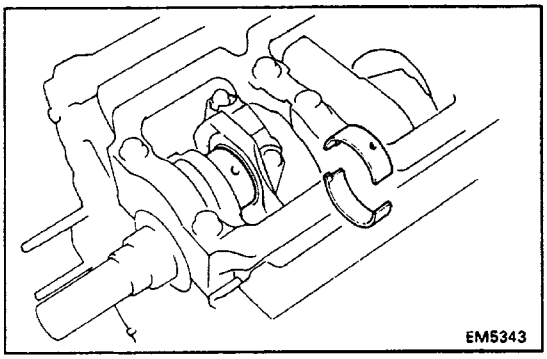


(c) Using a plastic–faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

HINT: Keep the lower bearing inserted with the connecting rod cap.



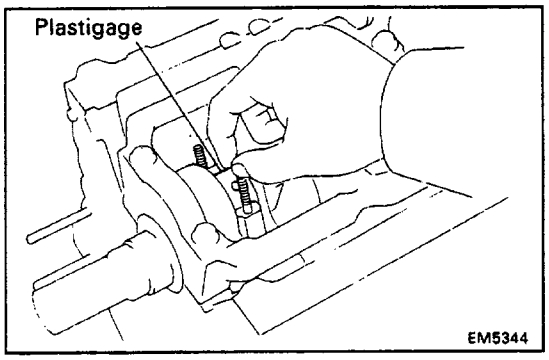
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



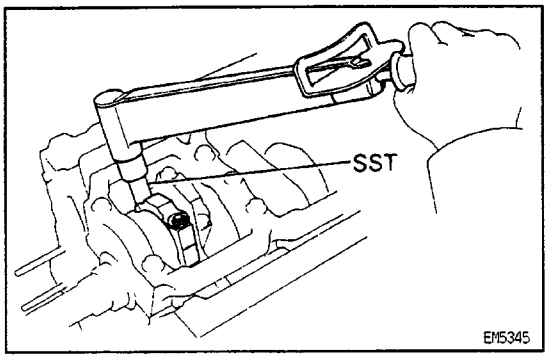
(e) Clean the crank pin and bearing.

(f) Check the crank pin and bearing for pitting and scr–atches.

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

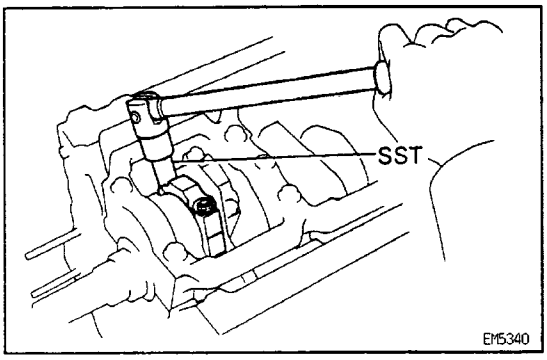


(g) Lay a strip of Plastigage across the crank pin.

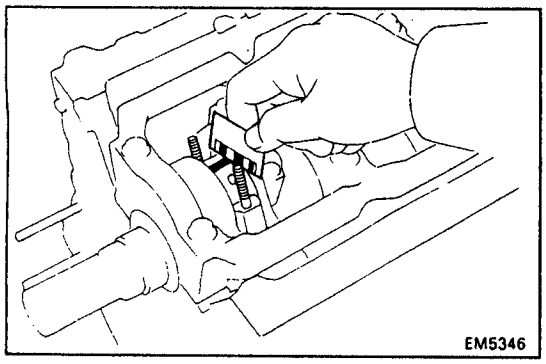


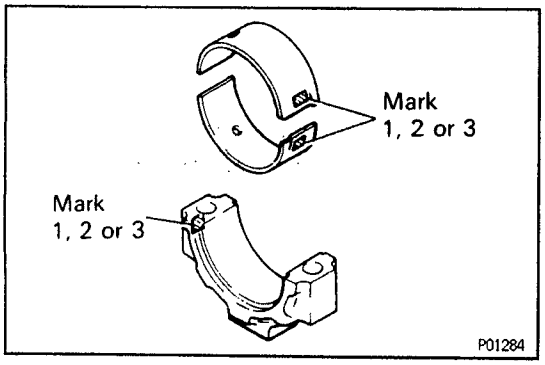
(h) Install the connecting rod cap with the two nuts.
(See step 7 on pages EG2–120)

Torque:
25 N–m (250 kgf–cm, 18 ft–lbf) for 1st
Turn 90° for 2nd
NOTICE: Do not turn the crankshaft.



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





Measure the Plastigage at its widest point.

Standard oil clearance:

STD

0.024 – 0.053 mm (0.0009 – 0.0021 in.)

U/S 0.25 and U/S 0.50

0.023 – 0.069 mm (0.0009 – 0.0027 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 cra–nkshaft.

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.)

Connecting rod big end inside diameter:

Mark '1'

58.000 – 58.008 mm (2.2835 – 2.2838 in.)

Mark '2"

58.008 – 58.016 mm (2.2838 – 2.2841 in.)

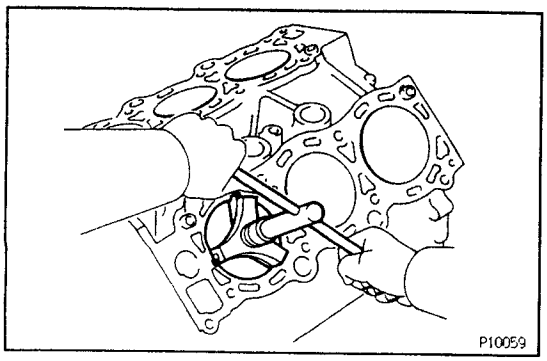
Mark "3"

58.016 – 58.024 mm (2.2841 – 2.2844 in.)

Crank pin diameter:

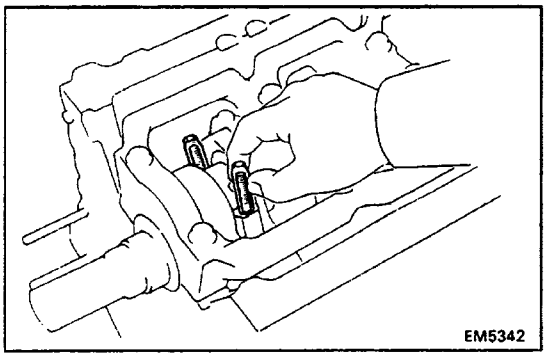
54.987 – 55.000 mm (2.1648 – 2.1654 in.)

(k) Completely remove the Plastigage.

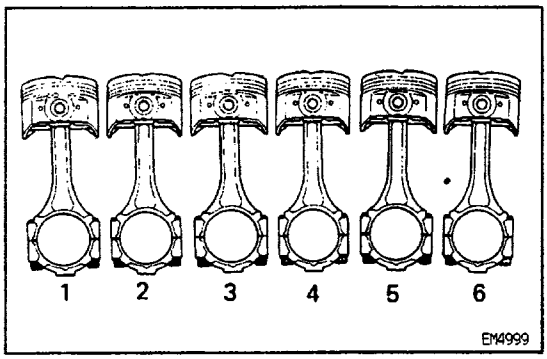


4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

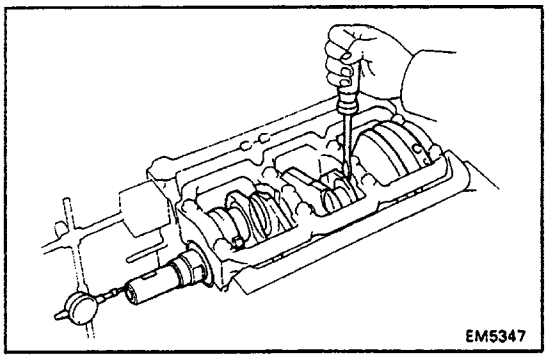
(a) Using a ridge reamer, remove the all carbon from the top of the cylinder.



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

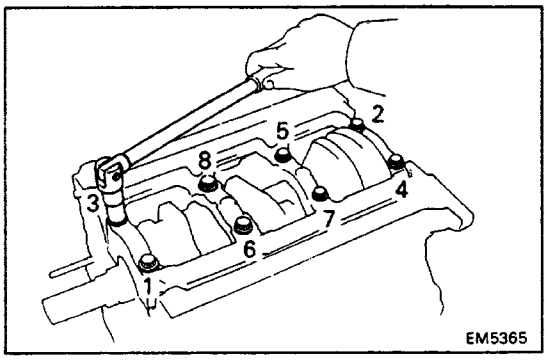
Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

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

Maximum thrust clearance:
0.30 mm (0.0118 in.)

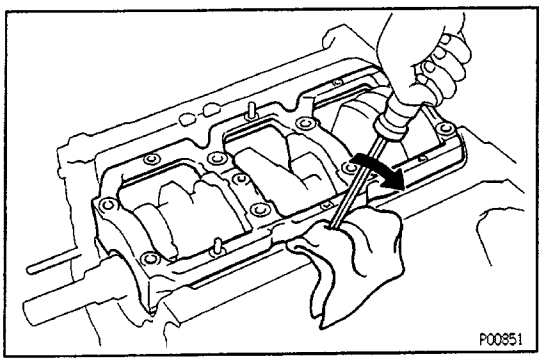
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:
2.440 – 2.490 mm (0.0961 – 0.0980 in.)

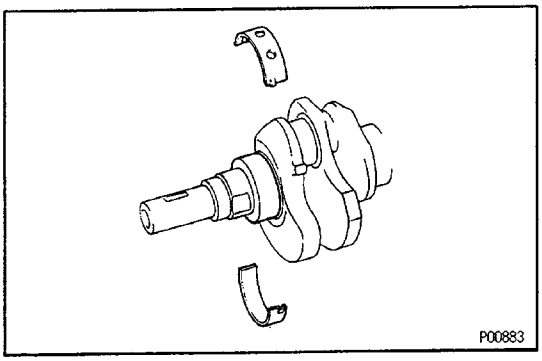


6. REMOVE MAIN BEARING CAP AND CHECK OIL CLEARANCE

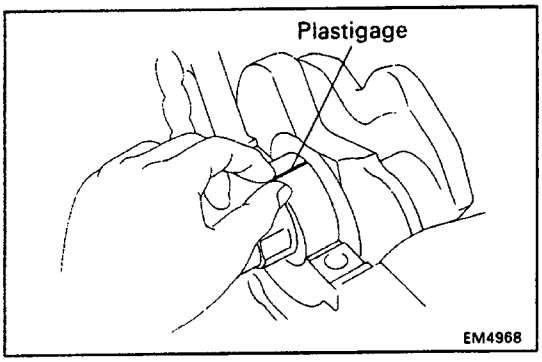
(a) Uniformly loosen and remove the main bearing cap bolts in several passes, in the sequence shown.



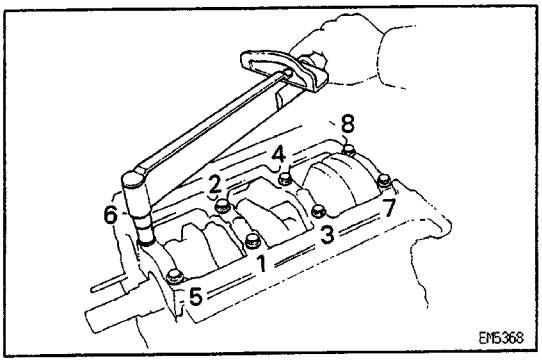
(b) Using a screwdriver, pry up the main bearing cap, and remove the main bearing cap, lower main bearings and lower thrust washers (No.2 journal position of main bearing cap only).
HINT: Keep the lower main bearings and lower thrust washers together with the main bearing cap.
(c) Lift out the crankshaft.
HINT: Keep the upper main bearings and upper thrust washers together with the cylinder block.



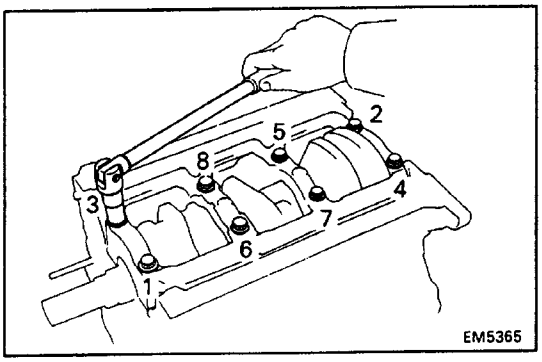
(d) Clean each main journal and bearing.
(e) Check each main journal and bearing for pitting and scratches.
If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



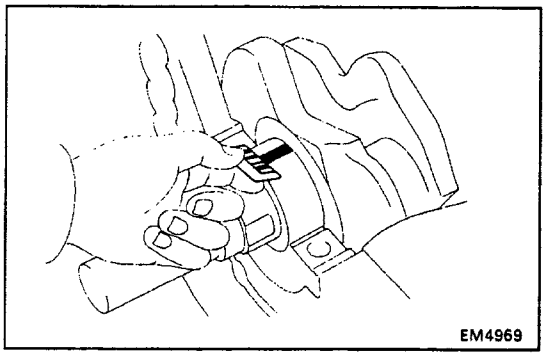
(f) Place the crankshaft on the cylinder block.
(g) Lay a strip of Plastigage across each journal.



(h) Install the main bearing cap with the eight bolts.
(See step 4 on page EG2–118)
Torque:
61 N–m (625 kgf–cm, 45 ft–lbf) for 1 at
Turn 90° for 2nd
NOTICE: Do not turn the crankshaft.



(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:

N o.1

STD

0.025 – 0.052 mm (0.0010 – 0.0020 in.)

U/S 0.25 and U/S 0.50

0.024 – 0.080 mm (0.0009 – 0.0031 in.)

others

STD

0.029 – 0.056 mm (0.0011 – 0.0022 in.)

U/S 0.25 and U/S 0.50

0.028 – 0.077 mm (0.0011 – 0.0030 in.)

Maximum clearance:

0.08 mm (0.0031 in.)

HINT: If replacing the cylinder block subassembly, the bearing standard clearance will be:

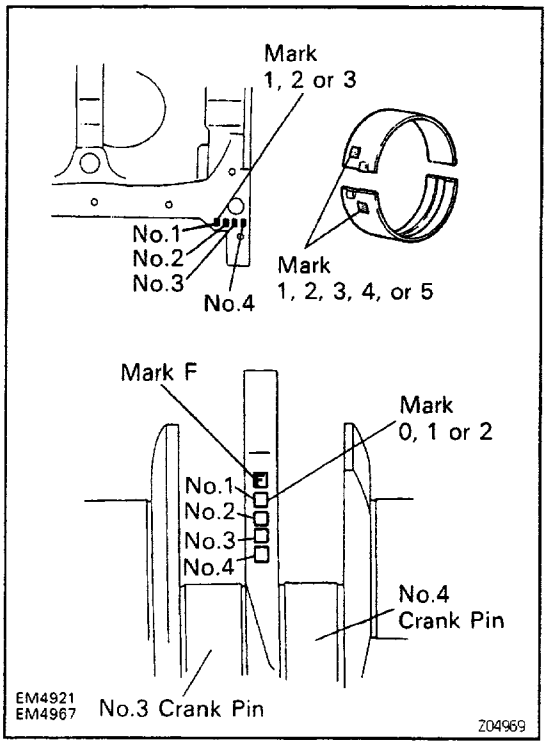
N o.1

0.027 – 0.063 mm (0.0011 – 0.0025 in.)

Others

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 cra–nkshaft.



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 cylin–der block and crankshaft, then selecting the bearing with the same number as the total. There are five sizes of standard bearings, marked ”i ”, ”2”, ”3”,”4” and ”5” accordingly.

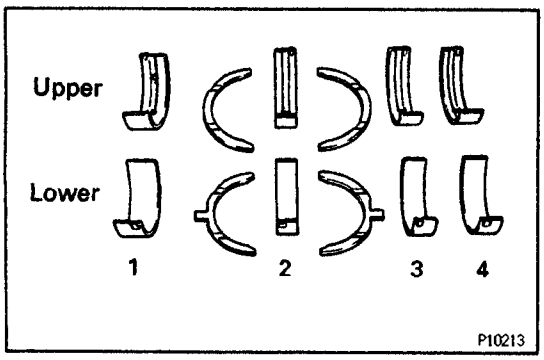
	Number marked								
Cylinder block	1			2			3		
Crankshaft	0	1	2	0	1	2	0	1	2
Use bearing	1	2	3	2	3	4	3	4	5

EXAMPLE: Cylinder block ”2” + Crankshaft ”’I”
= Total number 3 (Use bearing ”3”)

V00240

(Reference)
Standard sized bearing center wall thickness:
N o.1
Mark ”1 ”
1.991 – 1.994 mm (0.0784 – 0.0785 in.)
Mark ’2”
1.994 – 1.997 mm (0.0785 – 0.0786 in.)
Mark ’3’
1.997 – 2.000 mm (0.0786 – 0.0787 in.)
Mark ’4’
2.000 – 2.003 mm (0.0787 – 0.0789 in.)
Mark ’5’
2.003 – 2.006 mm (0.0789 – 0.0790 in.)
others
Mark ’11’
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.)
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 main 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.)

(k) Completely remove the Plastigage.



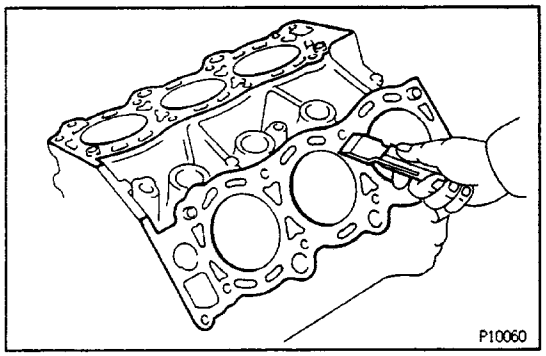
7. REMOVE CRANKSHAFT

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

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

EGOFC–02

CYLINDER BLOCK INSPECTION



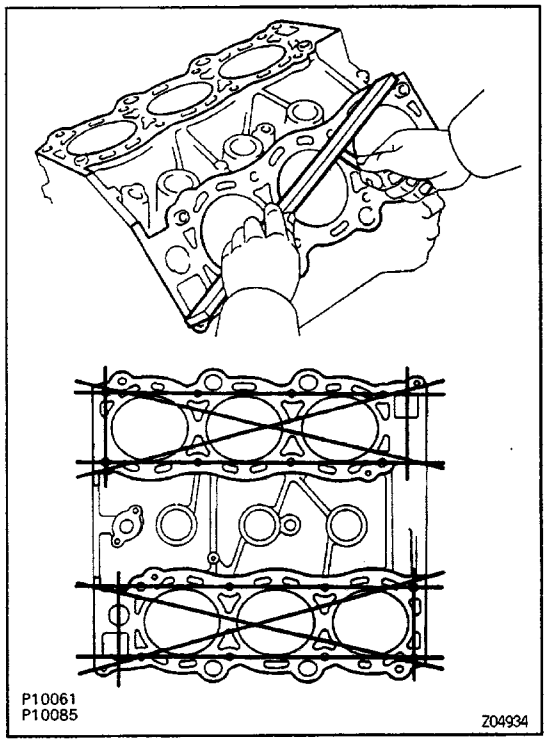
1. CLEAN CYLINDER BLOCK

A. Remove gasket material

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

B. Clean cylinder block

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



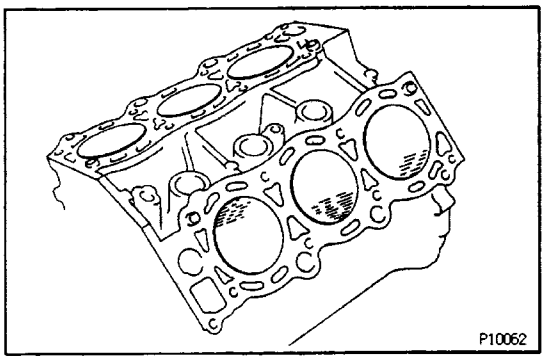
2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage:

0.05 mm (0.00020 in.)

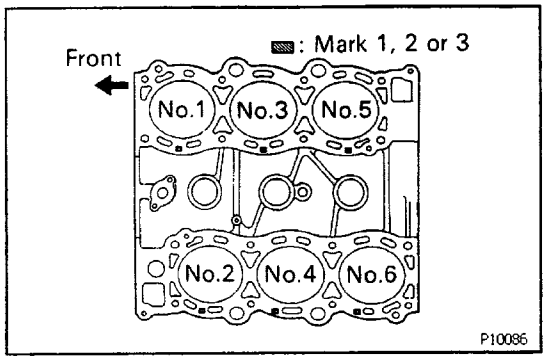
If warpage is greater than maximum, replace the cyl–inder block.



3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

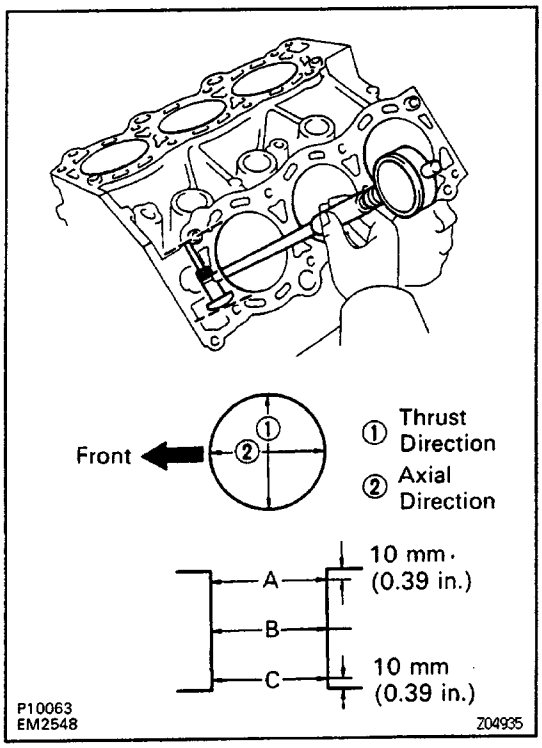
Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all the six cyl–inders. If necessary, replace the cylinder block.



4. 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 and axial directions.

Standard diameter:

STD

Mark '1'

87.500 – 87.510 mm (3.4449 – 3.4453 in.)

Mark "2"

87.510–87.520 m m (3.4453–3.4457 in.)

Mark "3"

87.520–87.530 mm (3.4457–3.4461 in.)

Maximum diameter:

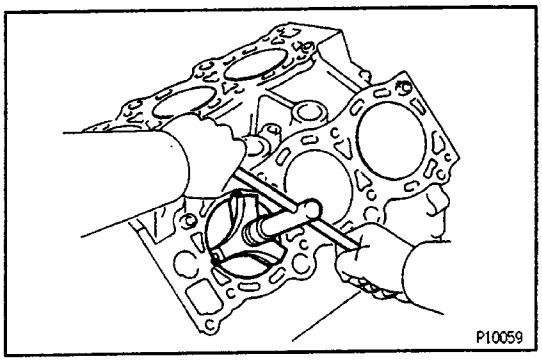
STD

87.73 mm (3.4539 in.)

0/S 0.50

88.23 mm (3.4736 in.)

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

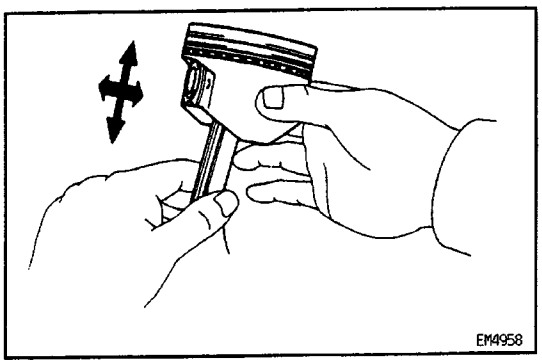


5. REMOVE CYLINDER RIDGE

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

EG1EL–02

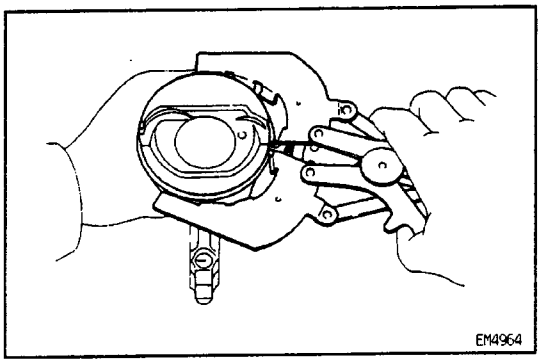
PISTON AND CONNECTING ROD DISASSEMBLY



1. CHECK FIT BETWEEN PISTON AND PISTON PIN

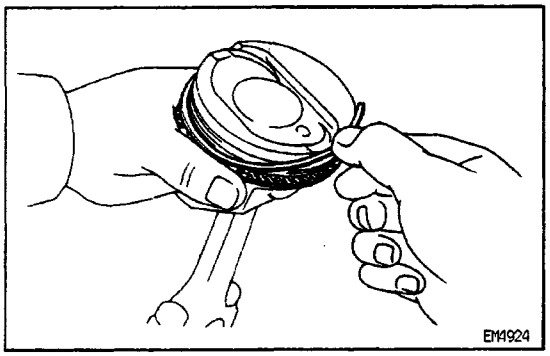
Try to move the piston back and forth on the piston pin.

If any movement is felt, replace the piston and pin as a set.

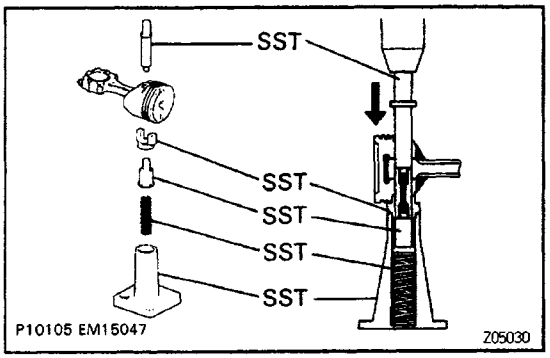


2. REMOVE PISTON RINGS

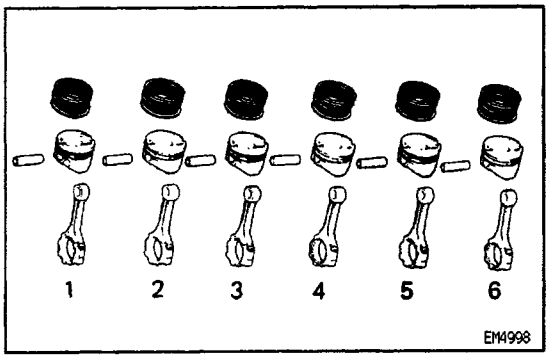
(a) Using a piston ring expander, remove the two compression rings.



(b) Remove the two side rails and oil ring by hand.
HINT: Arrange the piston rings in correct order only.



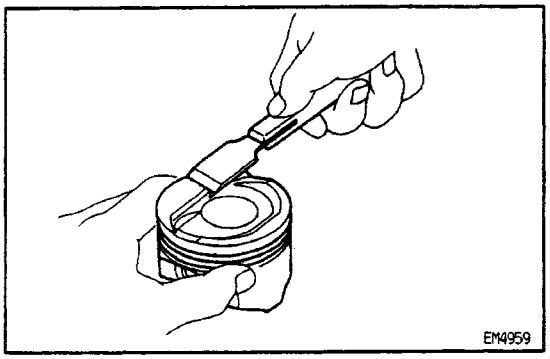
3. DISCONNECT CONNECTING ROD FROM PISTON
Using SST and a press, press out the piston pin from the piston. Remove the connecting rod.
SST 09221– 25024 (09221 –00020, 09221– 00030, 09221– 00181, 09221 –00190, 09221– 00200)



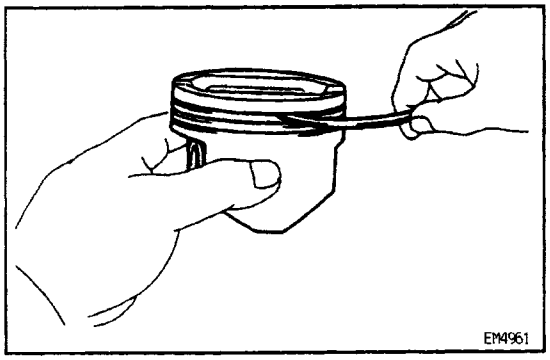
HINT:
The piston and pin are a matched set.
Arrange the pistons, pins, rings, connecting rods and bearings in correct order.

EG1ZQ–01

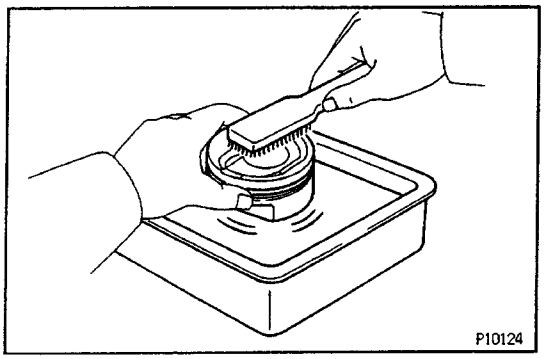
PISTON AND CONNECTING ROD INSPECTION



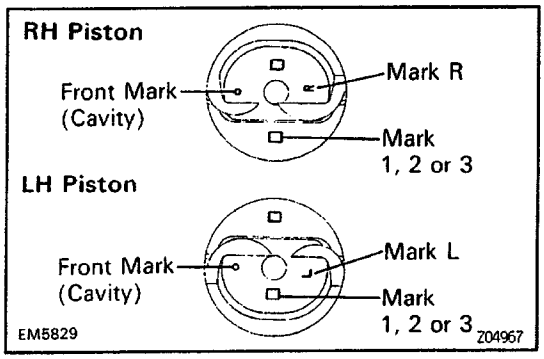
1. CLEAN PISTON
(a) Using a gasket scraper, remove the carbon from the piston top.



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



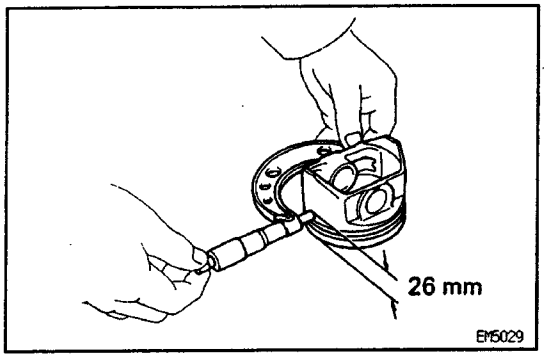
(c) Using solvent and a brush, thoroughly clean the piston.
NOTICE: Do not use a wire brush.



2. INSPECT PISTON

A. Inspect piston oil clearance

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



(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 26 mm (1.02 in.) from the piston head.

Piston diameter:

STD

Mark "1"

87.360 – 87.370 mm (3.4394 – 3.4398 in.)

Mark "2'

87.370 – 87.380 mm (3.4398 – 3.4402 in.)

Mark "3"

87.380 – 87.390 mm (3.4402 – 3.4405 in.)

0/S 0.50

87.860 – 87.890 mm (3.4590 – 3.4602 in.)

(b) Measure the cylinder bore diameter in the thrust di–rections. (See step 4 on page EG2–107)

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

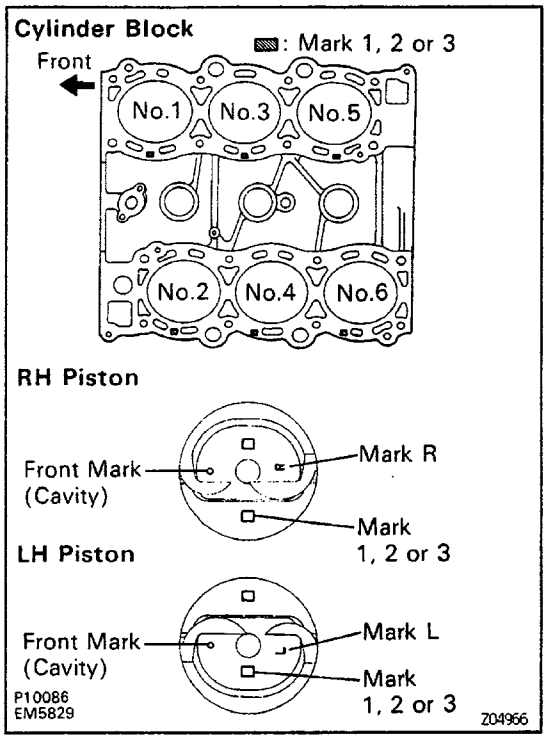
Standard oil clearance:

0.130 – 0.150 mm (0.0051 – 0.0059 in.)

Maximum oil clearance:

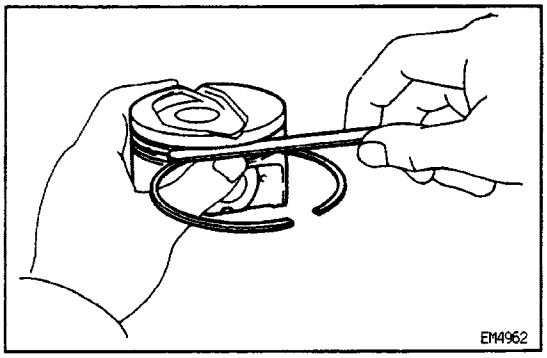
0.17 mm (0.0067 in.)

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.



HINT (Use new cylinder block):

- Use a piston with the same number mark as the cylinder diameter marked on the cylinder block.
- The shape of the piston varies for the RH and LH banks. The RH piston is marked with ”R”, the LH piston with ”L”.



B. Inspect piston ring groove clearance

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

Standard ring groove clearance:

No.1

0.020 – 0.060 mm (0.0008 – 0.0024 in.)

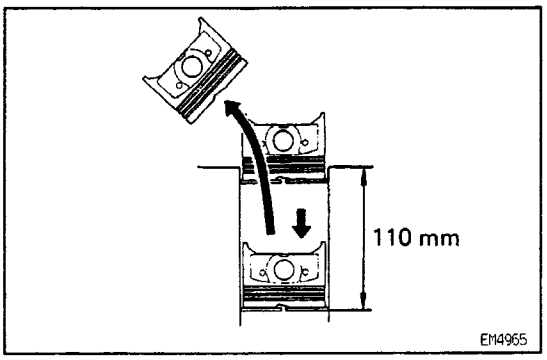
No.2

0.030 – 0.070 mm (0.0012 – 0.0028 in.)

Maximum ring groove clearance:

0.20 mm (0.0079 in.)

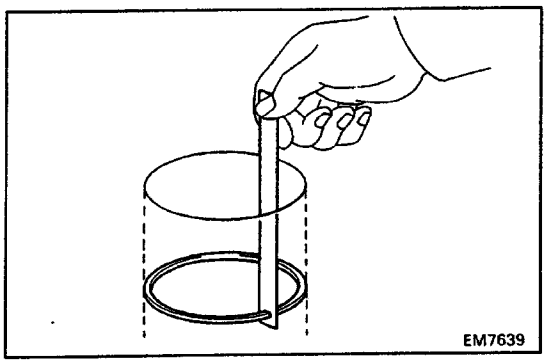
If the clearance is greater than maximum, replace the piston.



C. 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, 110 mm (4.33 in.) from the top of the cylinder block.



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

Standard ring end gap:

N o.1

0.280 – 0.500 mm (0.0110 – 0.0197 in.)

No.2

0.380 – 0.600 mm (0.0150 – 0.0236 in.)

Oil (Side rail)

0.150 – 0.500 mm (0.0059 – 0.0197 in.)

Maximum ring end gap:

N o.1

1.10 mm (0.0433 in.)

N o.2

1.20 mm (0.0472 in.)

Oil (Side rail)

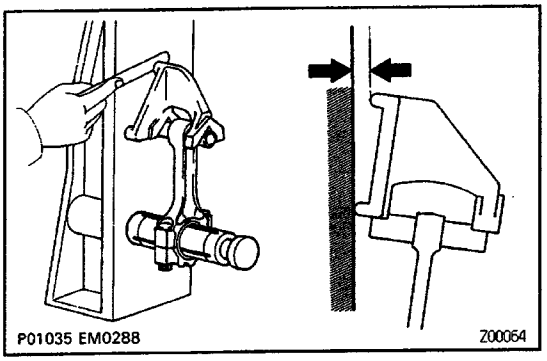
1.10 mm (0.0433 in.)

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 cylin–ders or replace the cylinder block.

3. INSPECT CONNECTING ROD

A. Inspect connecting rod alignment

Using a rod aligner and feeler gauge, check the con–necting rod alignment.

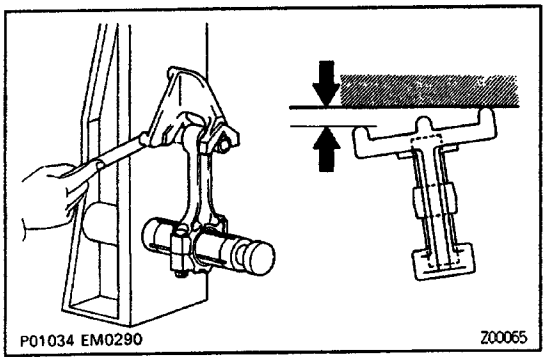


- Check for bend.

Maximum bend:

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

If bend is greater than maximum, replace the conne–cting rod assembly.

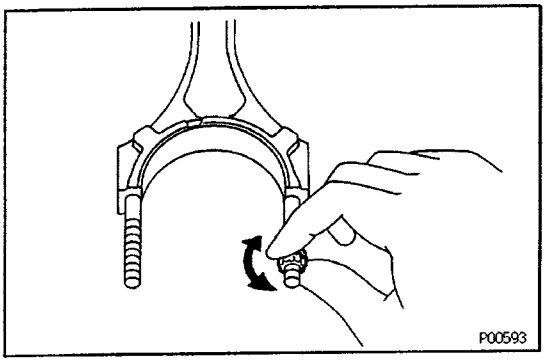


- Check for twist.

Maximum twist:

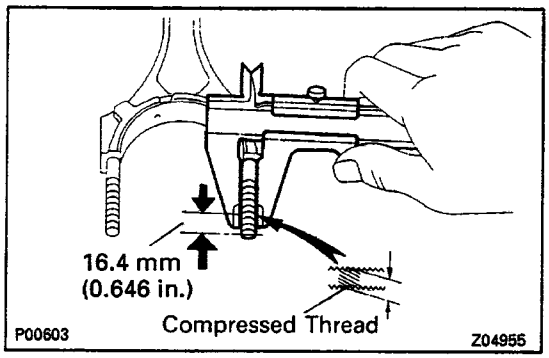
0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

If twist is greater than maximum, replace the conne–cting rod assembly.



B. Inspect connecting rod bolts

(a) Install the cap nut to the connecting rod bolt. Check that the rod 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 a vernier caliper.

Standard outer diameter:

7.860 – 8.000 mm (0.3034 – 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 rod cap nut as a set.

EG1ZR–01

CYLINDER BORING

HINT:

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

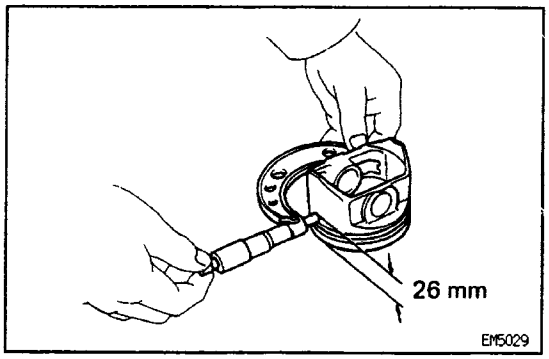
the oversized pistons.

1. KEEP OVERSIZED PISTONS

Oversized piston diameter:

O/S 0.50

87.860 – 87.890 mm (3.4590 – 3.4602 in.)



2. CALCULATE AMOUNT TO BORE CYLINDERS

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 26 mm (1.02 in.) from the piston head.

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

Size to be rebored = P + C – H

P = Piston diameter

C = Piston oil clearance

0.130 – 0.150 mm (0.0051 – 0.0059 in.)

H = Allowance for honing

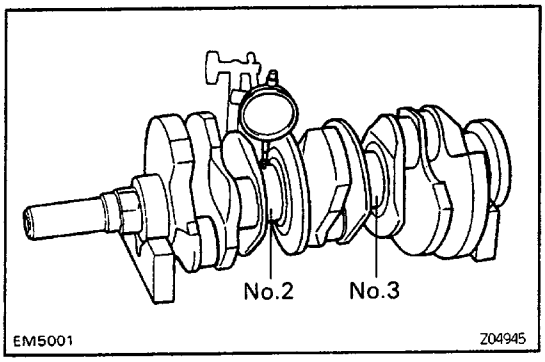
0.02 mm (0.0008 in.) or less

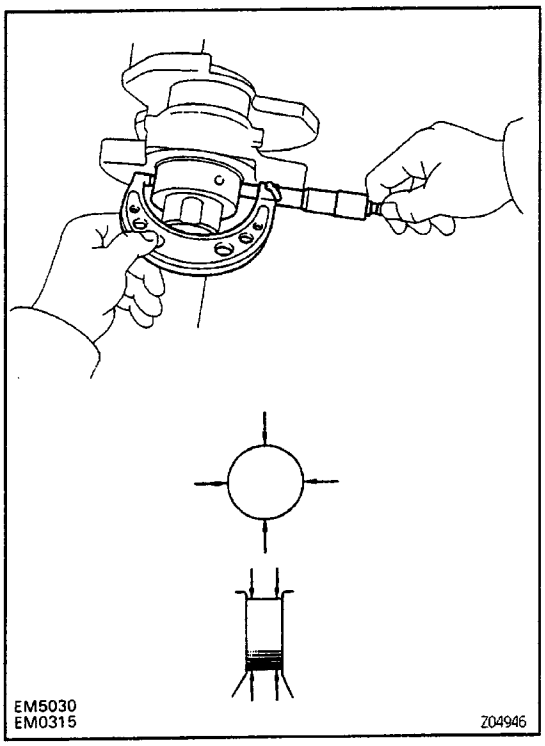
3. BORE AND HONE CYLINDER TO CALCULATED DIMENSIONS

Maximum honing:

0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.





eotts–01

CRANKSHAFT INSPECTION AND REPAIR

1. INSPECT CRANKSHAFT FOR RUNOUT

(a) Place the crankshaft on V–blocks.

(b) Using a dial indicator, measure the circle runout at the No.2 and No.3 journals.

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.)

U/S 0.50

63.495 – 63.505 mm (2.4998 – 2.5002 in.)

Crank pin diameter:

STD

54.987 – 55.000 mm (2.1648 – 2.1654 in.)

U/S 0.25

54.745 – 54.755 mm (2.1553 – 2.1557 in.)

U/S 0.50

54.495 – 54.505 mm (2.1455 – 2.1459 in.)

If the diameter is not as specified, check the oil clearance. (See 3 or 6 page EG2–99 or 102)

(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.

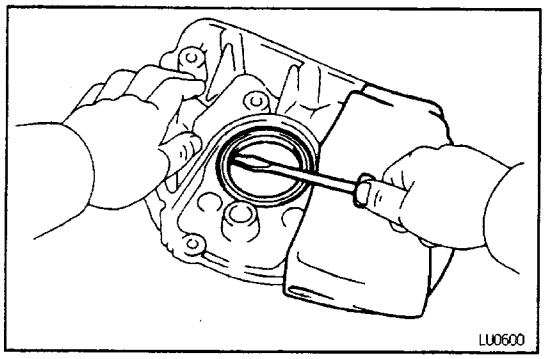
3. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

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.

CRANKSHAFT OIL SEALS REPLACEMENT

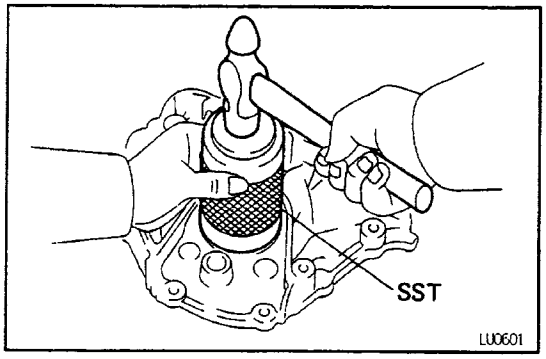
HINT: There are two methods (A and B) to replace the oil seal which are as follows:



1. REPLACE CRANKSHAFT FRONT OIL SEAL

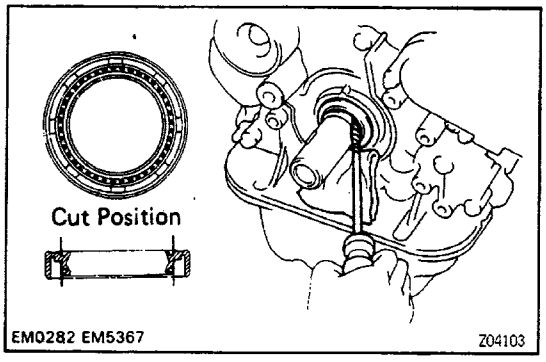
A. If oil pump is removed from cylinder block:

(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 body edge.
SST 09309–37010

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

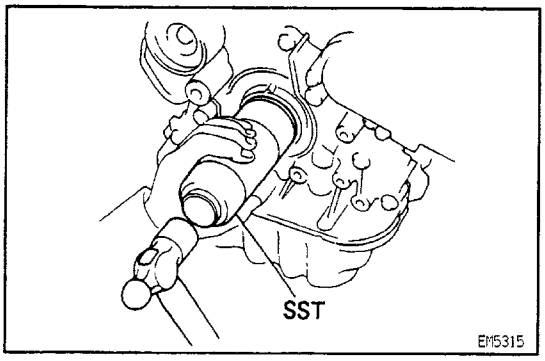


B. If oil pump is installed to the cylinder block:

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

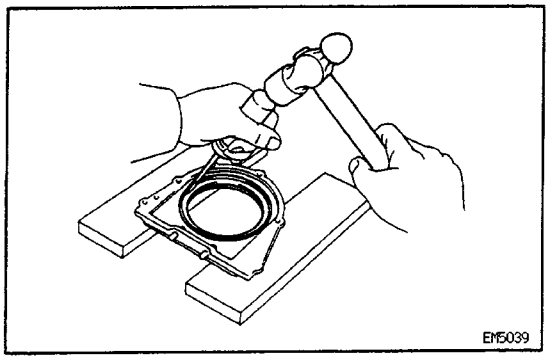
(b) Using a screwdriver, pry out the oil seal.

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



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

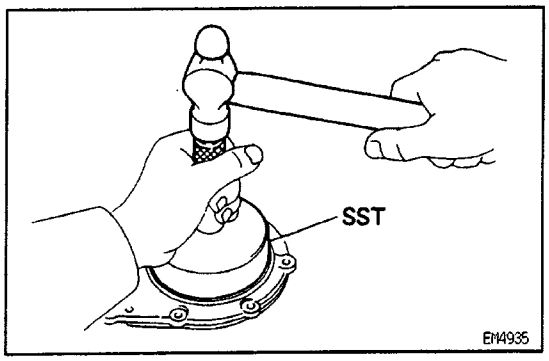
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump body edge.
SST 09306–37010



2. REPLACE CRANKSHAFT REAR OIL SEAL

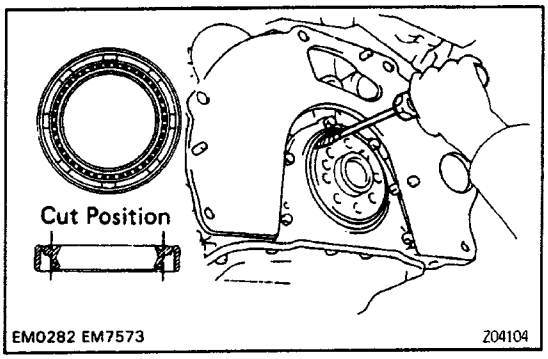
A. If rear oil seal retainer is removed from cylinder block:

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



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–56010

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

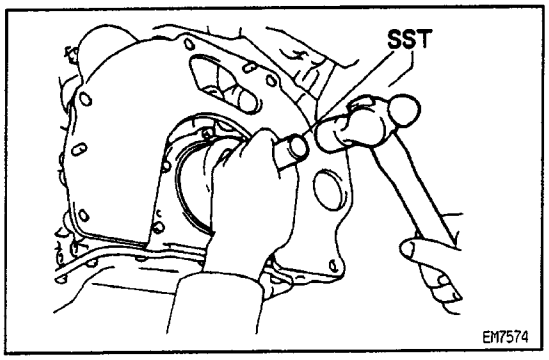


B. If rear oil seal retainer is installed to cylinder block:

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

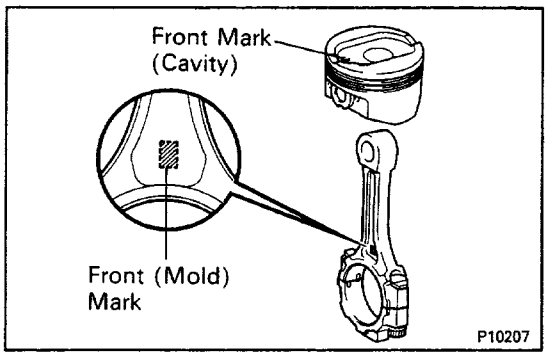
(b) Using a screwdriver, pry out the oil seal.

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 09223–56410



PISTONS AND CONNECTING RODS ASSEMBLY EG1ER–02

1. ASSEMBLE PISTON AND CONNECTING ROD

(a) Coat the piston pin and piston pin holes with engine oil.

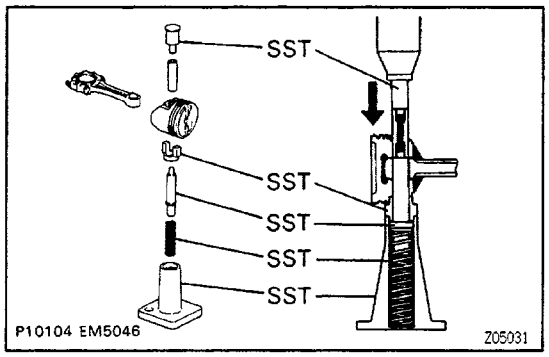
(b) Align the front marks of the piston and connecting rod.

Connecting rod front (mold) mark:

A1, 136, 1B, 8A, C3 or etc.

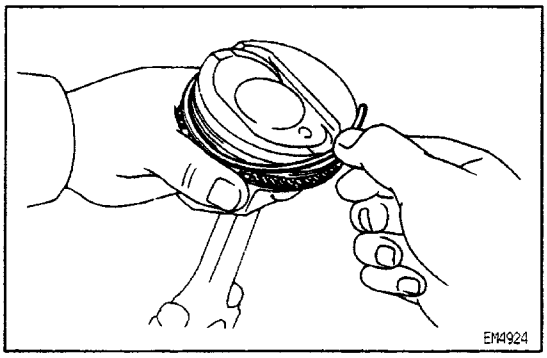
(c) Using SST, press in the piston pin.

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



2. INSTALL PISTON RINGS

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



(b) Using a piston ring expander, install the two com–pression rings with the code marks facing upward.

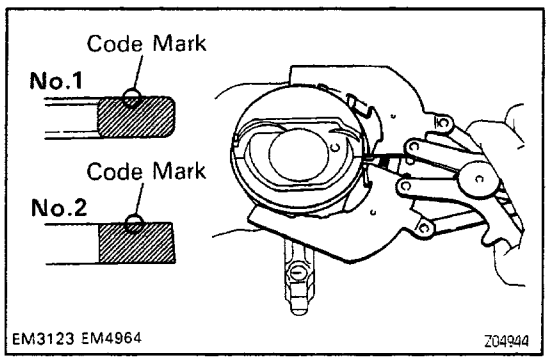
Code mark:

No.1

1 Ror T

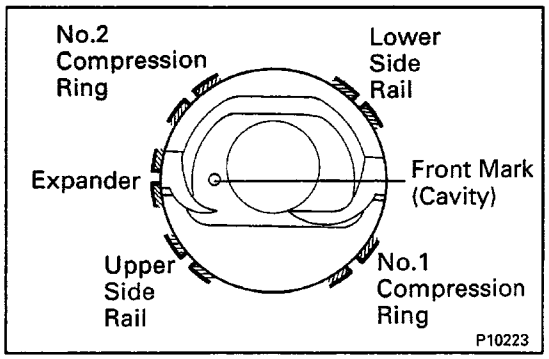
No.2

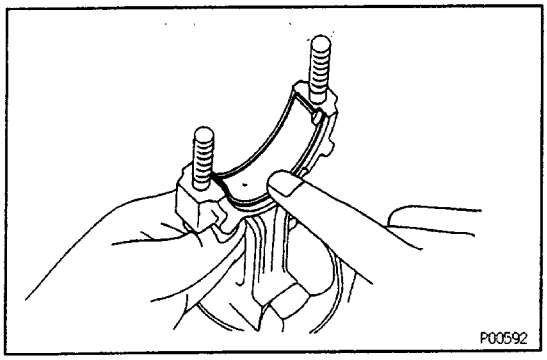
2R or T2



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

NOTICE: Do not align the ring ends.





3. INSTALL BEARINGS

(a) Align the bearing claw with the groove of the con–necting rod or connecting cap.

(b) Install the bearings in the connecting rod and conne–cting rod cap.

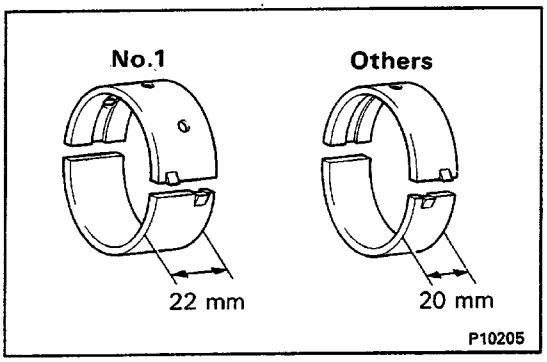
CYLINDER BLOCK ASSEMBLY

EG1ES–03

(See Components)

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, 0–rings and oil seals with new parts.



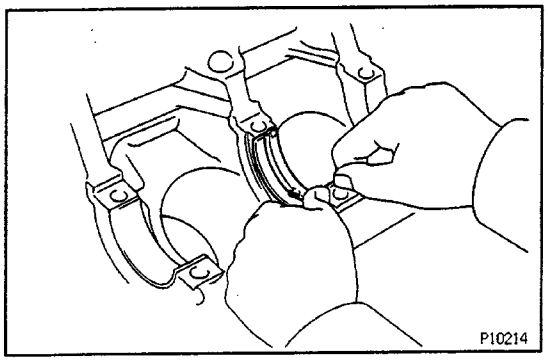
1. INSTALL MAIN BEARINGS

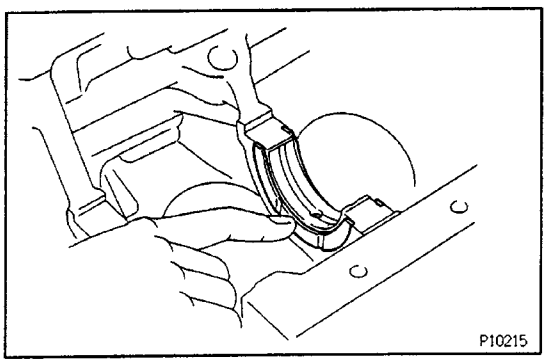
HINT:

- 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 posi–tion 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.

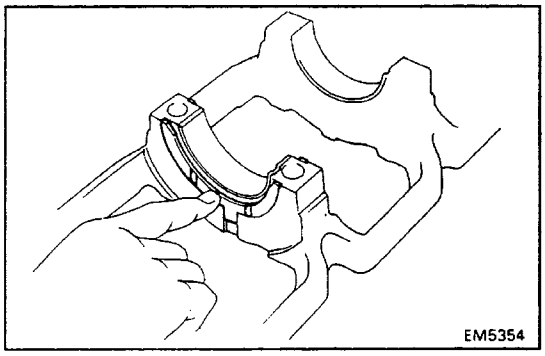




2. INSTALL UPPER THRUST WASHERS

Install the thrust washers under the No.2 journal po–sition of the cylinder block with the oil grooves facing outward.

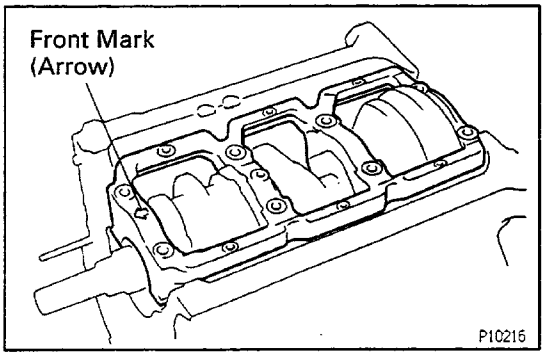
3. PLACE CRANKSHAFT ON CYLINDER BLOCK



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.

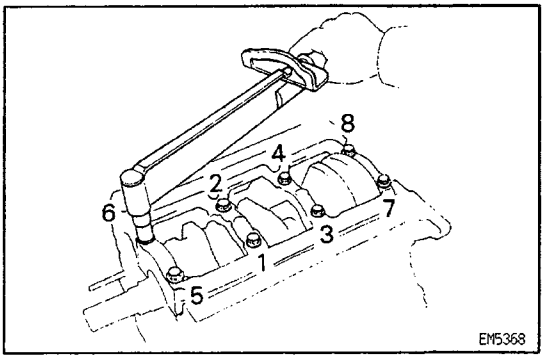


(b) Install the main bearing cap with the front mark facing forward.

B. Install main bearing cap bolts

HINT:

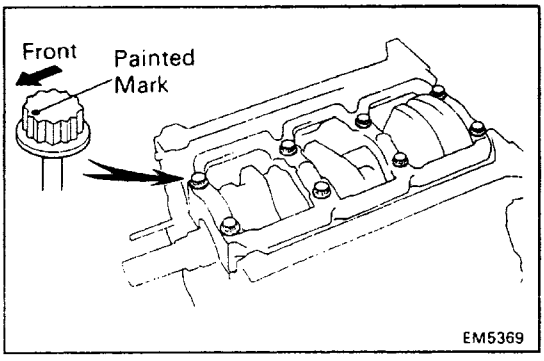
- The main bearing cap bolts are tightened in two progressive steps (steps (b) and (d)).
  If any main bearing cap bolt is broken or de–formed, replace it.



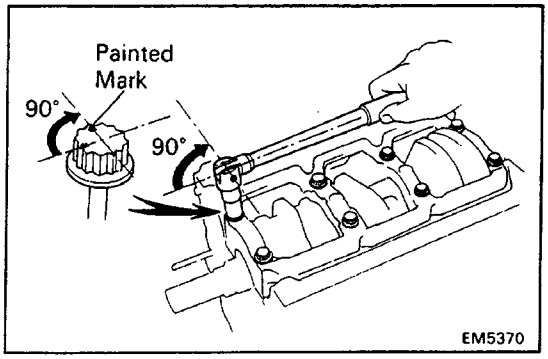
(a) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.

(b) Install and uniformly tighten the eight main bearing cap bolts in several passes, in the sequence shown.
Torque: 61 N–m (625 kgf–cm, 45 ft–lbf)

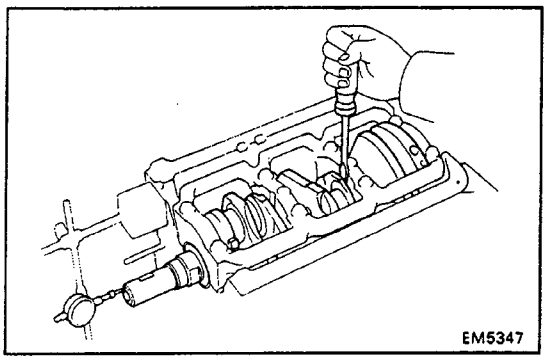
If any one of the main bearing cap bolts does not meet the torque specification, replace the cap bolt.



(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.



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 – 0Z20 mm (0.0008 – 0.0087 in.)

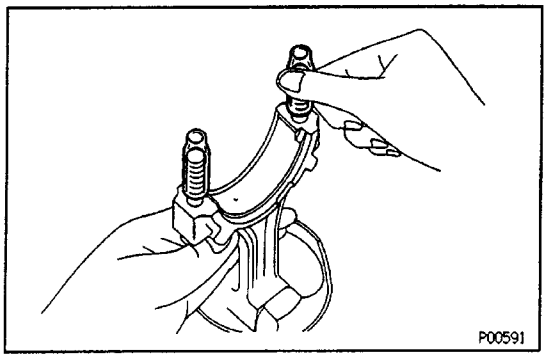
Maximum thrust clearance:

0.30 mm (0.0118 in.)

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

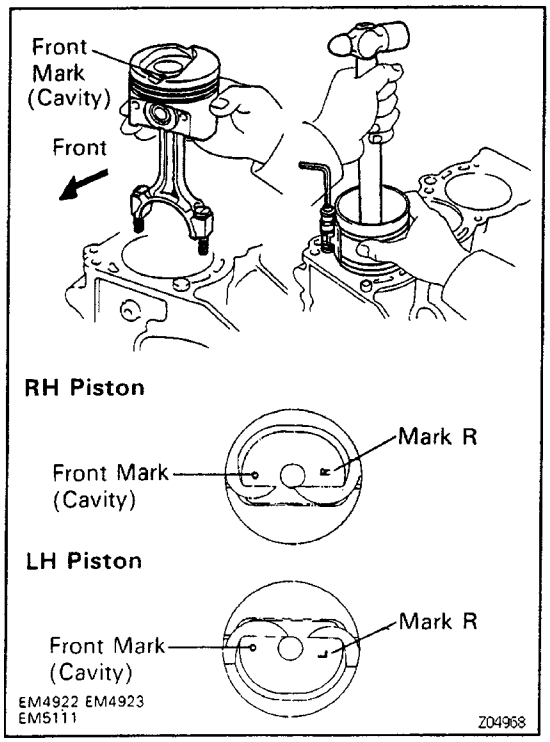
Thrust washer thickness:

2.440 – 2.490 mm (0.0961 – 0.0980 in.)



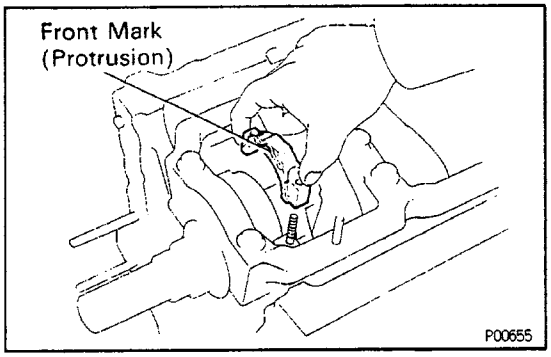
6. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

(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.

NOTICE: The shape of the piston varies for the RH and LH banks. The RH piston is marked with ”R”, The LH piston with ”L”.



7. 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.

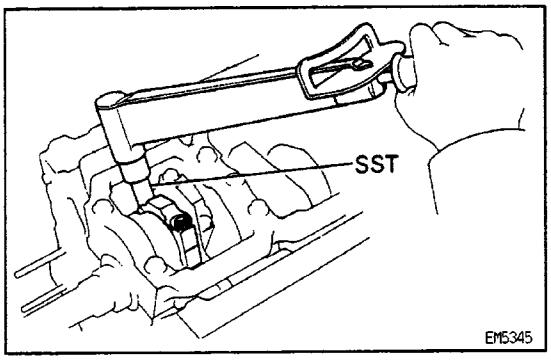
B. Install connecting rod cap nuts

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 it.

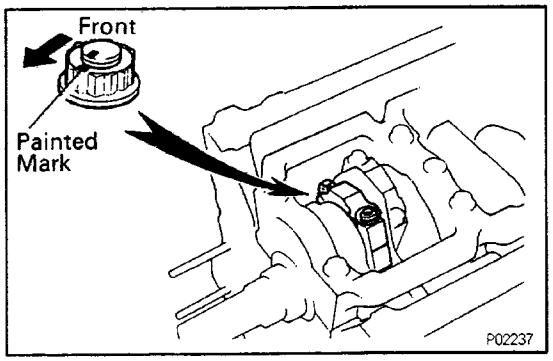


(a) Apply a light of engine oil on the threads and under the nuts of the connecting rod cap.

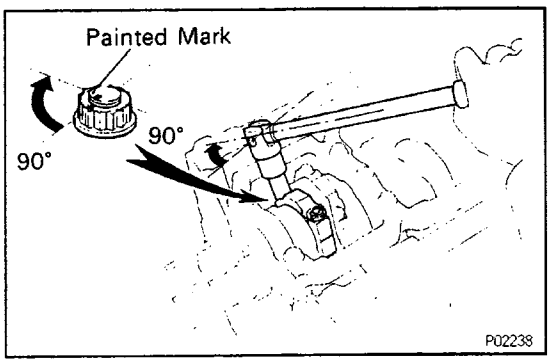
(b) Install and alternately tighten the nuts of the conne–cting rod cap in several passes.

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

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



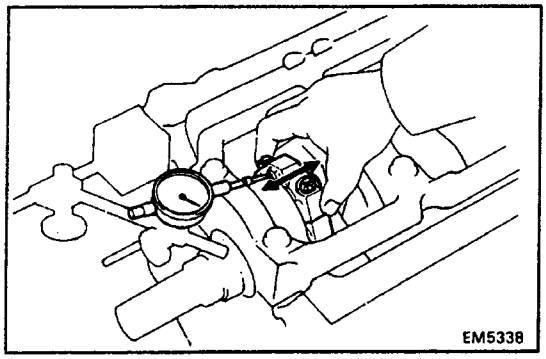
(c) Mark the front of the connecting rod cap nut and bolt with paint.



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

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

(f) Check that the crankshaft turns smoothly.



8. 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:

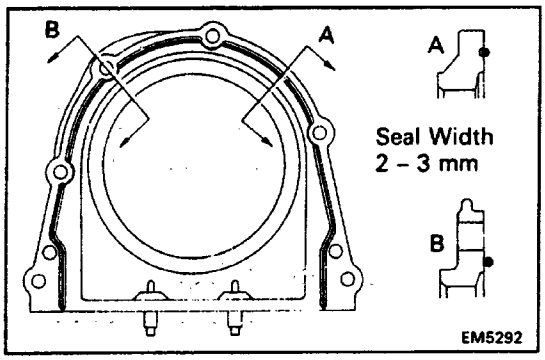
0.38 mm (0.0150 in.)

If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

9. 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.

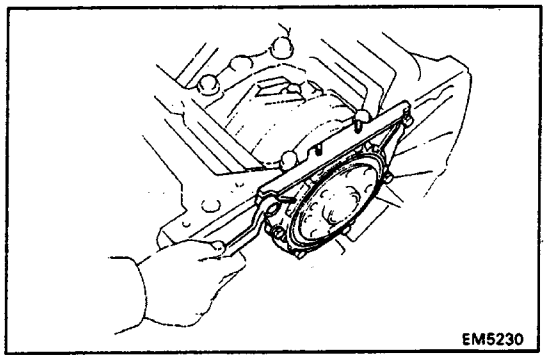


(b) Apply seal packing to the oil seal retainer as shown in the illustration.

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



(c) Install the oil seal retainer with the six bolts.

Torque: 7.8 N–m (80 kgf–cm, 69 in.–lbf)

EG1ZU–02

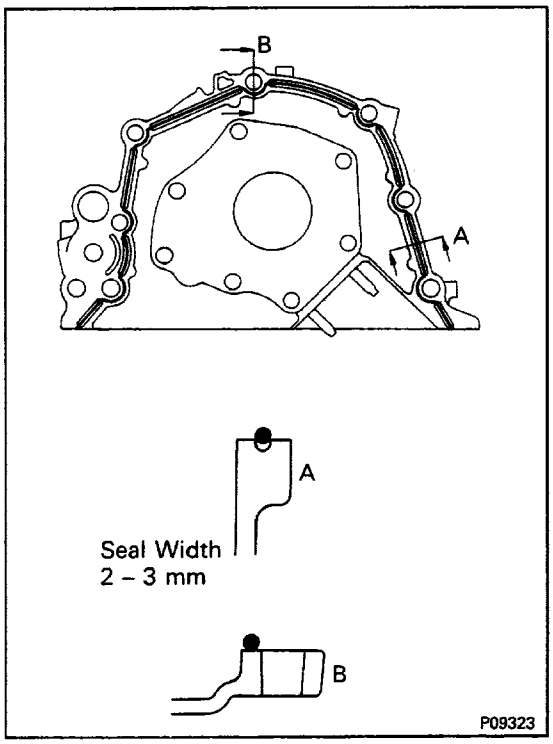
POST ASSEMBLY

(See Components)

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 groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.



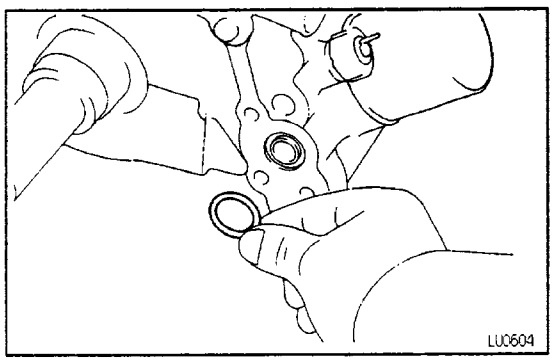
(b) Apply seal packing to the oil pump as shown in the illustration.

Seal packing:

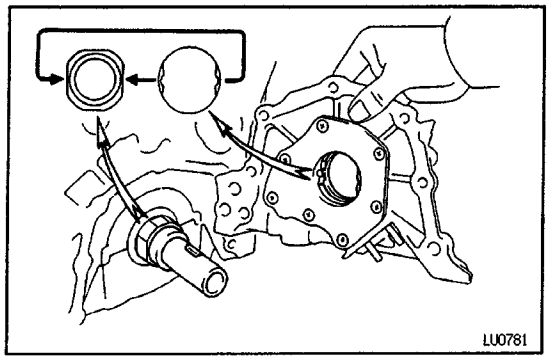
Part No. 08826–00080 or equivalent

NOTICE: Avoid applying en excessive amount to the surface. Be particularly careful near oil passage.

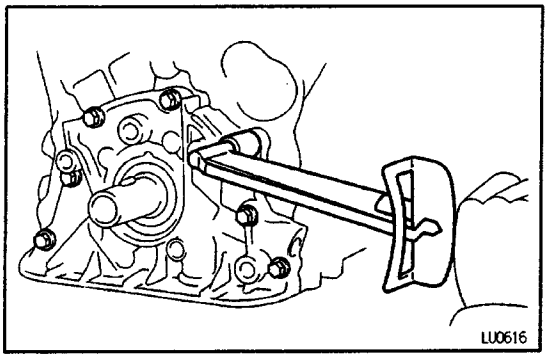
- Install a nozzle that has been cut to a 2 – 3 mm (0.08 – 4.12 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



(c) Install a new O–ring to the cylinder block.



(d) Engage the spline teeth of the oil pump drive gear with the large teeth of the crankshaft, and slide the oil pump on the crankshaft.

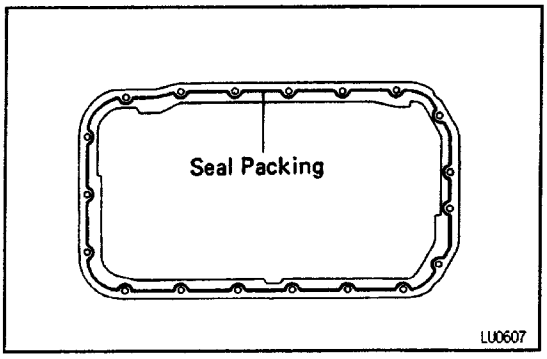


(e) Install the oil pump with the eight bolts. Uniformly tighten the bolts in several passes.
Torque: 20 N–m (200 kgf–cm, 14 ft–lbf)

2. 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 and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

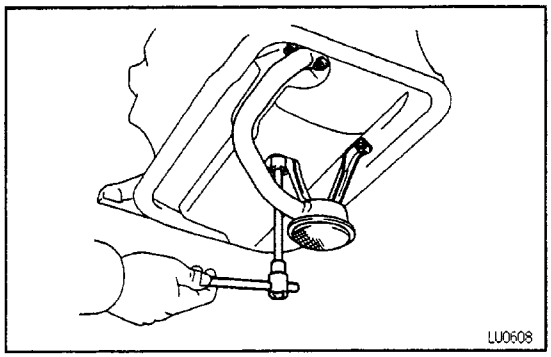


(b) Apply seal packing to the baffle plate as shown in the illustration.

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.
- 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) Attach the baffle plate to the cylinder block.



3. INSTALL OIL STRAINER

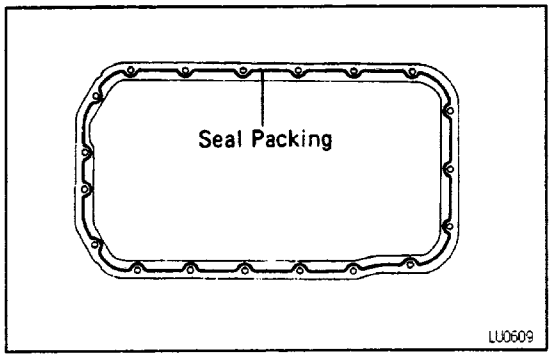
Install a new gasket and the oil strainer with the two nuts and two bolts.

Torque: 6.9 N–m (70 kgf–cm, 61 in. –lbf)

4. INSTALL OIL PAN

(a) Remove any old packing (FIPG) material and be ear–eful not to drop any oil on the contact surfaces of the oil pan and baffle plate.

- 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 oil pan as shown in the illustration.

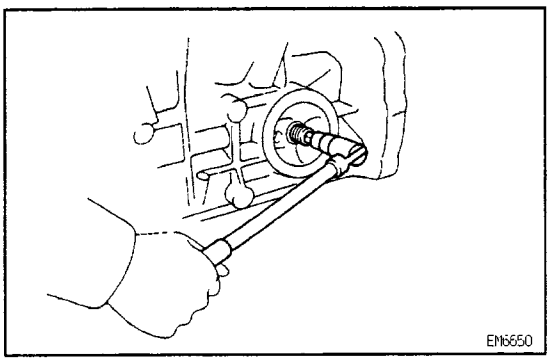
Seal packing:

Part No. 08826–00080 or equivalent

- Install a nozzle that has been cut to a 3 – 4 mm (0.12 – 0.16 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be re–moved and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

(c) Install the oil pan with the two nuts and seventeen bolts.

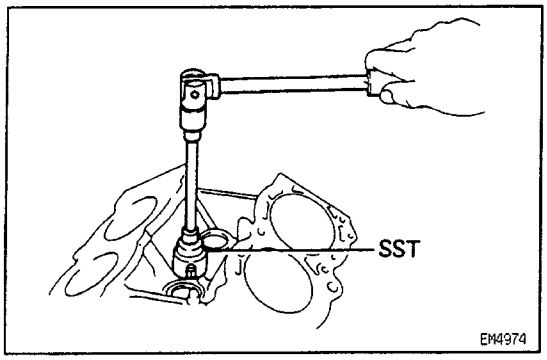
Torque: 5.9 N–m (60 kgf–cm, 52 in.–lbf)



5. INSTALL OIL FILTER UNION

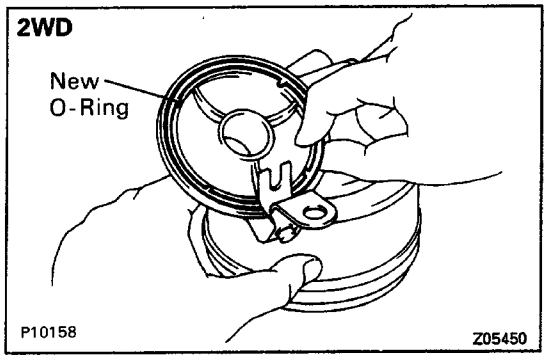
Using a 12 mm hexagon wrench, install and torque the oil filter union.

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



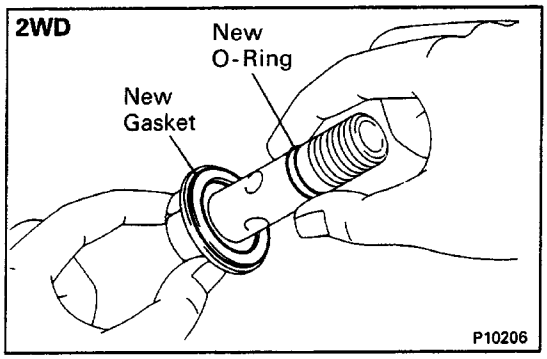
6. INSTALL KNOCK SENSOR

Using SST, install the knock sensor.
SST 09817–16011

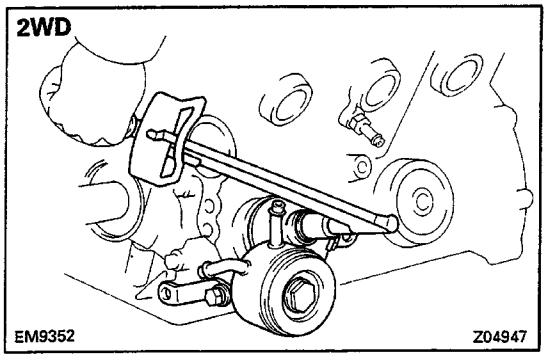


7. (2WD)
INSTALL OIL COOLER AND BRACKET ASSEMBLY

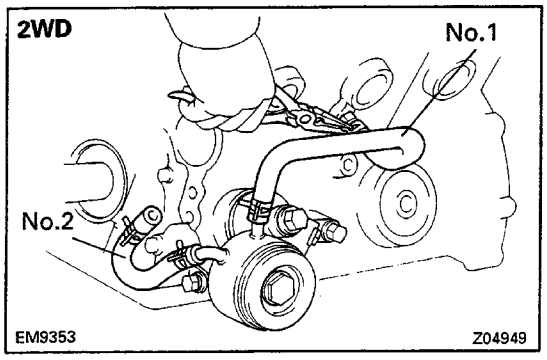
(a) Install a new 0–ring to the oil cooler bracket.



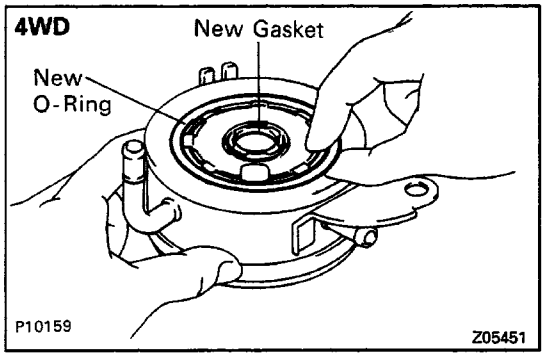
(b) Install new gasket and O–ring to the union bolt.
(c) Apply a light coat of engine oil on the O–ring.
(d) Apply a light coat of engine oil on the threads of the union bolt.



(e) Temporarily install the oil cooler and bracket assembly with the union bolt and two bolts.
(f) Tighten the union bolt.
Torque: 59 N–m (600 kgf–cm. 43 ft –lbf)
(g) Install the two bolts.
Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)

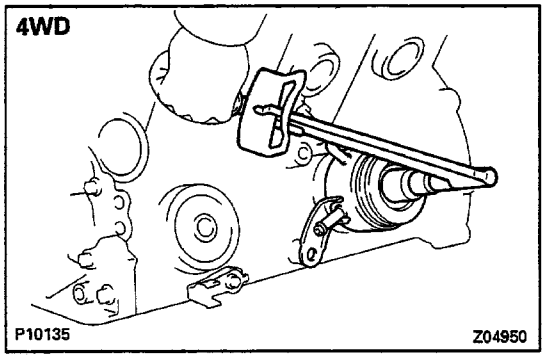


(h) install the No.1 and No.2 oil cooler hoses.

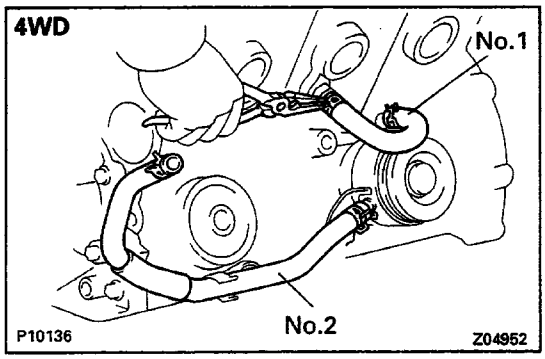


8. (4WD)
INSTALL OIL COOLER

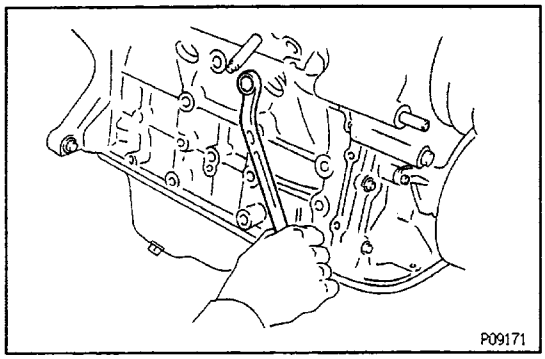
(a) Install new 0–ring and gasket to the oil cooler.
(b) Apply a light coat of engine oil on the threads of the relief valve.



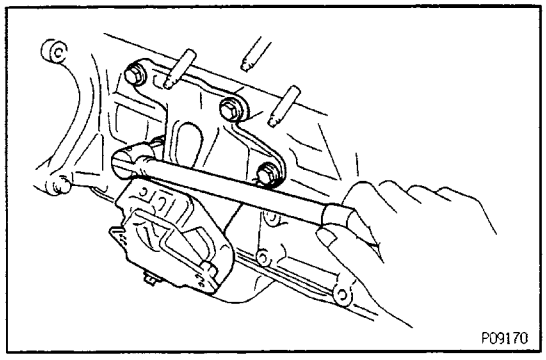
(c) Temporarily install the seal washer, oil cooler and seal washer with the relief valve and bolt.
(d) Tighten the relief valve.
Torque: 59 N–m (600 kgf–cm. 43 ft–lbf)
(e) Install the bolt.
Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)



(f) Install the No.1 and No.2 oil cooler hoses.



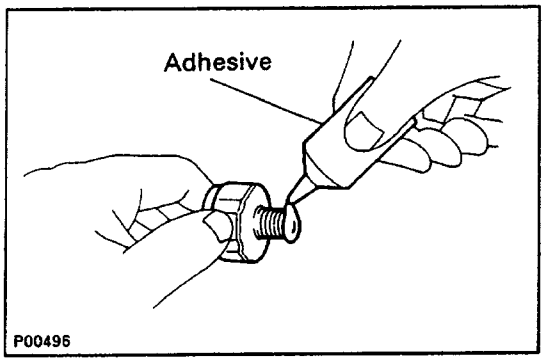
9. INSTALL ENGINE COOLANT DRAIN PLUGS
Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)



10. INSTALL LH AND RH ENGINE MOUNTING BRACKETS

Install the mounting bracket with the four bolts. Install the two mounting brackets.
Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)

11. INSTALL OIL FILTER

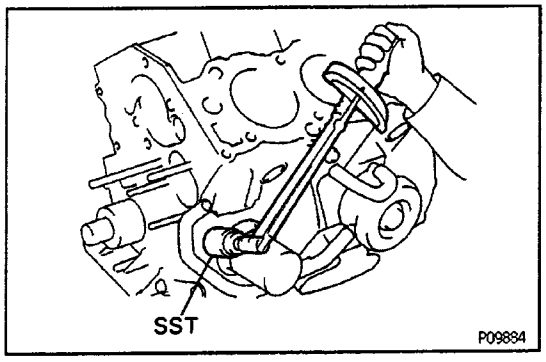


12. INSTALL OIL PRESSURE SENDER GAUGE

(a) Apply adhesive to two or three threads.

Adhesive:

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



(b) Using SST, install the oil pressure sender gauge.

SST 09816–30010

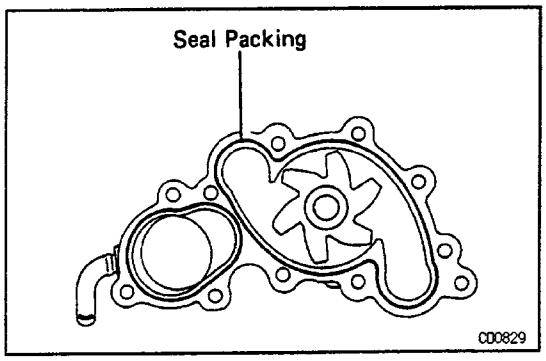
Torque: 15 N–m (150 kgf–cm. 11 ft–lbf)

13. INSTALL GENERATOR ADJUSTING BAR

14. 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.

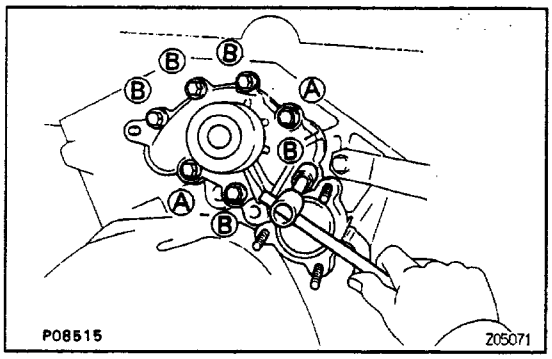


(b) Apply seal packing to the sealing groove of the water pump as shown in the illustration.

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.
- 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:
18 N–m (185 kgf–cm, 13 ft–lbf) for (A)
20 N–m (200 kgf–cm, 14 ft–lbf) for (B)

15. INSTALL THERMOSTAT AND WATER INLET

16. INSTALL NO.1 WATER BY–PASS PIPE

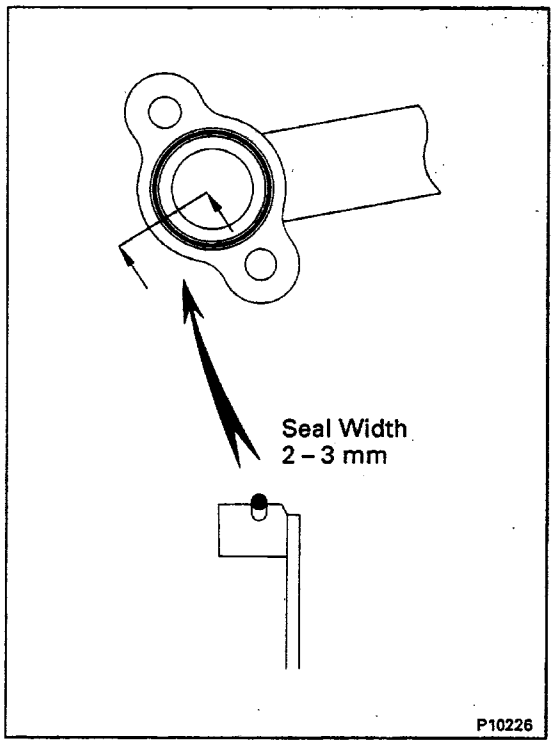
(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the water by–pass pipe and cylinder block.

- 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 sealing groove of the water by–pass pipe as shown in the illustration.

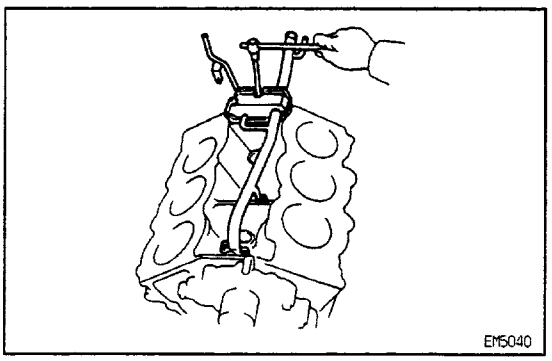
Seal packing:
Part No. 08826–00100 or equivalent

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

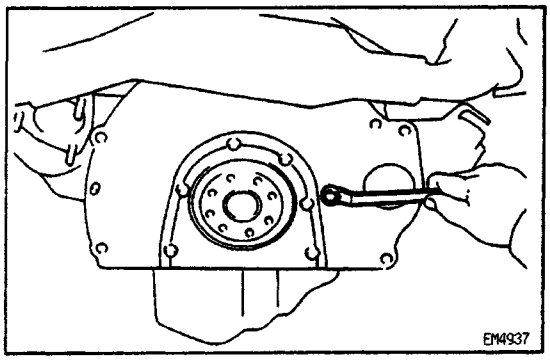


(c) Install the water by–pass pipe with the two bolts and two nuts.

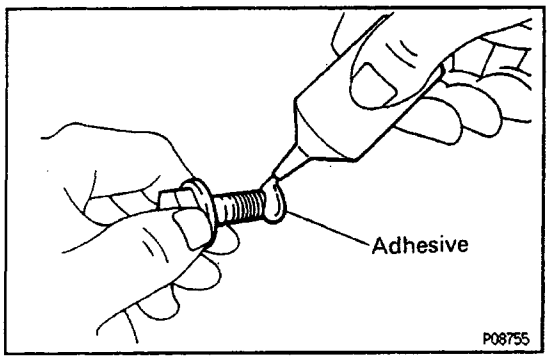
Torque:
4.9 N–m (50 kgf–cm, 43 in. –lbf) for bolt
6.9 N–m (70 kgf–cm, 61 in.–lbf) for nut



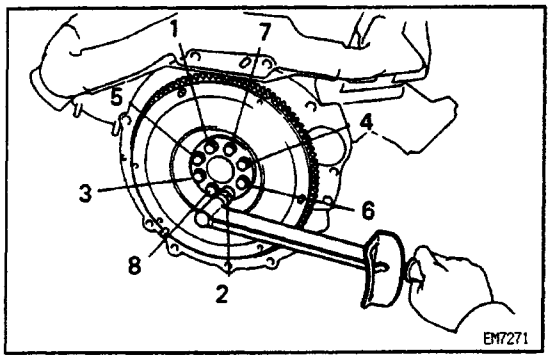
17. INSTALL CYLINDER HEADS
(See pages EG2–76 to 87)
18. INSTALL TIMING BELT
(See pages EG2–41 to 48)
19. REMOVE ENGINE STAND



20. INSTALL REAR END PLATE
Install the rear end plate with the bolt.
Torque: 7.4 N–m (75 kgf–cm, 65 in.–lbf)



21. INSTALL FLYWHEEL OR DRIVE PLATE
(a) Apply adhesive to two or three threads of the mou–nting bolt end.
Adhesive:
Pert No. 08833–00070, THREE BOND 1324 or equivalent



(b) (M /T)
Install the flywheel on the crankshaft.
(c) (A/T)
Install the front spacer, drive plate and rear plate on the crankshaft.
(d) Install and uniformly tighten the eight mounting bolts in several passes, in the sequence shown.
Torque:
88 N–m (900 kgf–cm, 65 ft–lbf) for M/T
83 N–m (850 kgf–cm, 61 ft–lbf) for A/T

EG20V–01

ENGINE INSTALLATION

1. (M/T only)
INSTALL CLUTCH DISC AND COVER

2. INSTALL TRANSMISSION TO ENGINE

3. INSERT ENGINE AND TRANSMISSION ASSEMBLY IN VEHICLE

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

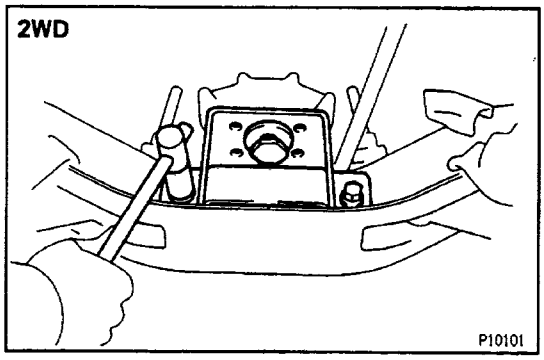
(b) Slowly lower the engine and transmission assembly into the engine compartment.

NOTICE: Be careful not to hit the PNP switch.

(c) Keep the engine level, and align the RH and LH mount–ings and body mountings.

(d) Attach the RH and LH mounting insulators to the body mountingssand temporarily install the four bolts.

(e) Jack up and put the transmission onto the member.

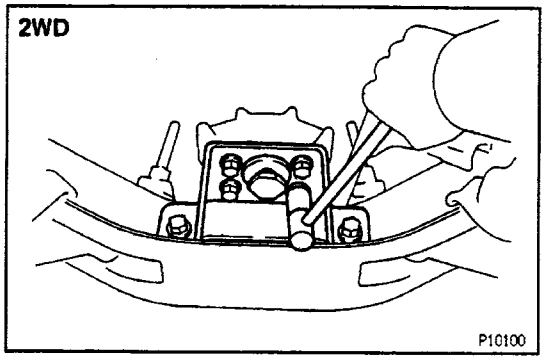


4. (2WD)
INSTALL ENGINE REAR MOUNTING BRACKET

(a) Raise the transmission slightly by raising the engine with a jack and a wooden block under the transmis–sion.

(b) Install the engine rear mounting bracket to the sup–port member.

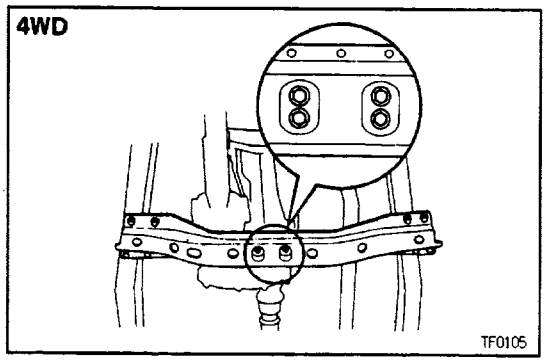
Torque: 25 N–m (260 kgf–cm. 19 ft–lbf)



(c) Lower the transmission and rest it on the extension housing.

(d) Install the mounting bracket to the mounting insula–tor.

Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)



5. (4WD)
INSTALL NO.2 FRAME CROSSMEMBER

(a) Raise the transmission slightly with a jack.

(b) Install the frame crossmember to the side frame with the eight bolts.

Torque: 95 N–m (970 kgf–cm, 70 ft–lbf)

(c) Lower the transmission and transfer.

(d) Install the frame crossmember to the engine rear mou–nting insulator.

Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)

6. TIGHTEN RH AND LH ENGINE MOUNTING INSULATOR BOLTS

Tighten the four bolts holding the mounting insulators to the body mountings.

Torque: 37 N–m (380 kgf–cm, 27 ft–lbf)

7. (4WD only)
INSTALL NO.1 FRONT FLOOR AND BRAKE TUBE HEAT INSULATOR

8. INSTALL NO.1 FRAME CROSSMEMBER

9. (4WD only)
INSTALL STABILIZER BAR

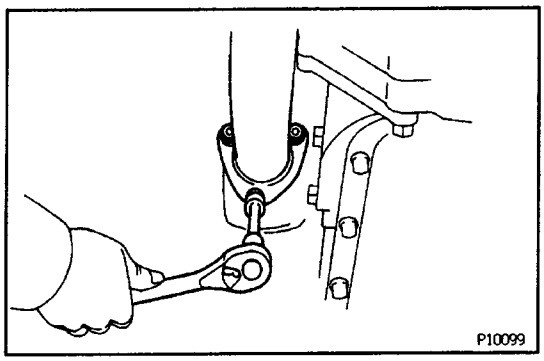
10. (4WD only)
INSTALL TRANSFER UNDER COVER

11. CONNECT SPEEDOMETER CONNECTOR

12. (4WD A/T only)
CONNECT MANUAL SHIFT LINKAGE

13. (4WD only)
INSTALL FRONT PROPELLER SHAFT
(See page PR–16)

14. INSTALL REAR PROPELLER SHAFT
(See page PR–15)



15. (M/T only)
INSTALL SHIFT LEVERS

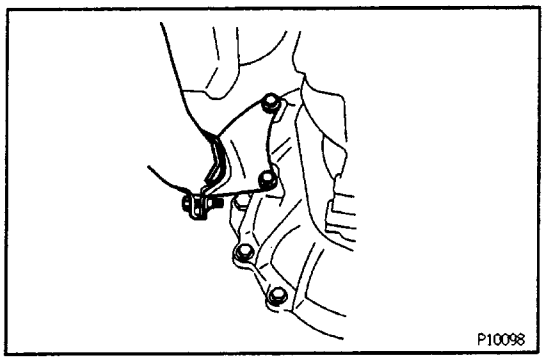
16. INSTALL FRONT EXHAUST PIPE

(a) Connect the exhaust pipe to the LH exhaust manifold with new gasket and three new nuts.

Torque: 62 N–m (630 kgf–cm, 46 ft–lbf)

(b) Connect the exhaust pipe to the catalytic converter with new gasket and the two bolts.

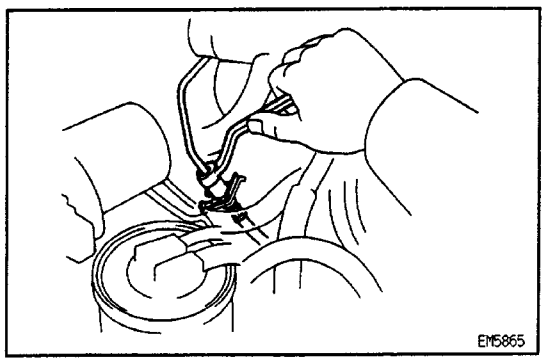
Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)



(c) Install the pipe bracket to the transmission with the two bolts.

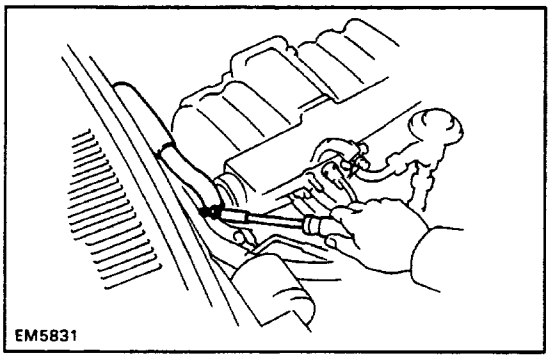
(d) Install the pipe bracket to the exhaust pipe with the pipe clamp.

(e) Connect the oxygen sensor connector.



17. (M/T only)
CONNECT CLUTCH RELEASE CYLINDER HOSE

18. INSTALL A/C COMPRESSOR



19. CONNECT HEATER HOSES

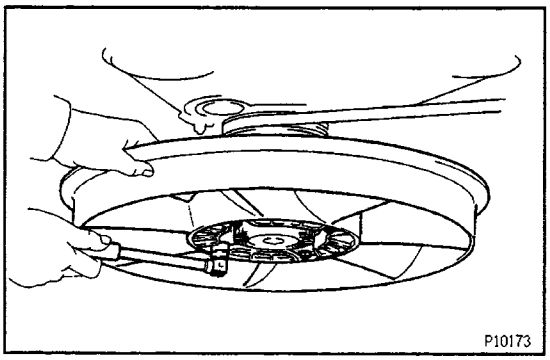
20. CONNECT FUEL INLET AND OUTLET HOSES

21. CONNECT STRAP, WIRES, CONNECTORS, HOSES AND CABLES

(a) Connect the following cables:
- Accelerator cable
- (A/T only)
  Throttle cable
- (w/ Cruise Control System)
  Cruise control cable

(b) Connect the following hoses:
- PS air hoses to gas filter and air pipe
- Brake booster hose
- (w/ Cruise Control System)
  Cruise control vacuum hose
- Charcoal canister hose to canister
- VSV vacuum hoses

(c) Connect the following strap, wires and connectors:
- Ground strap to LH fender apron
- Generator connector and wire
- Igniter connector
- Oil pressure sender gauge connector
- Ground strap to engine rear side
- ECM connectors
- VSV connectors
- A/C compressor connector
- (M/T only)
  Starter relay connector
- Solenoid resister connector
- Data link connector 1
- (w/ ADD)
  ADD switch connector



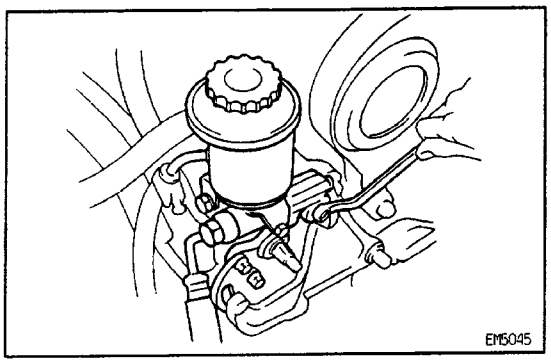
22. INSTALL GENERATOR DRIVE BELT

23. INSTALL COOLING FAN

Install the cooling fan with the four nuts.

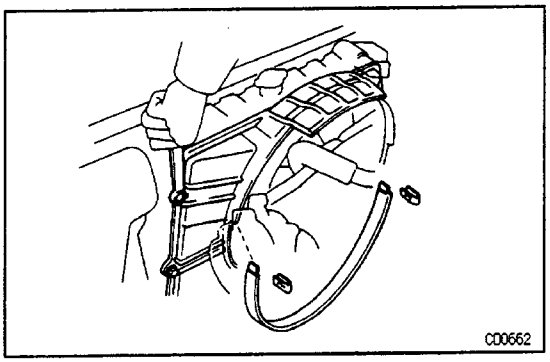
Torque: 5.4 N–m (55 kgf–cm, 48 in.–lbf)

24. INSTALL A/C DRIVE BELT



25. INSTALL PS PUMP

26. INSTALL PS PUMP PULLEY AND DRIVE BELT

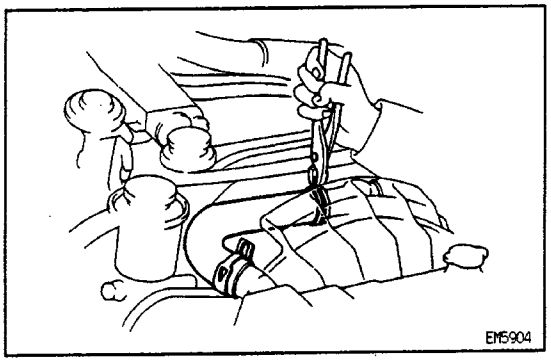


27. INSTALL RADIATOR

(a) Install the radiator with the four bolts.

(b) Install the No.1 fan shroud with the four bolts.

(c) Install the No.2 fan shroud with the two clips.



(d) Install the radiator hoses.

(e) (A/T)

Connect the oil cooler hoses.

(f) Connect the reservoir tank hose.

28. INSTALL AIR CLEANER AND HOSE

29. INSTALL BATTERY

30. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

31. FILL WITH ENGINE COOLANT

32. FILL WITH ENGINE OIL

33. START ENGINE AND CHECK FOR LEAKS

34. PERFORM ENGINE ADJUSTMENT

(See Tune – Up on pages EG2–12 to 27)

35. INSTALL ENGINE UNDER COVER

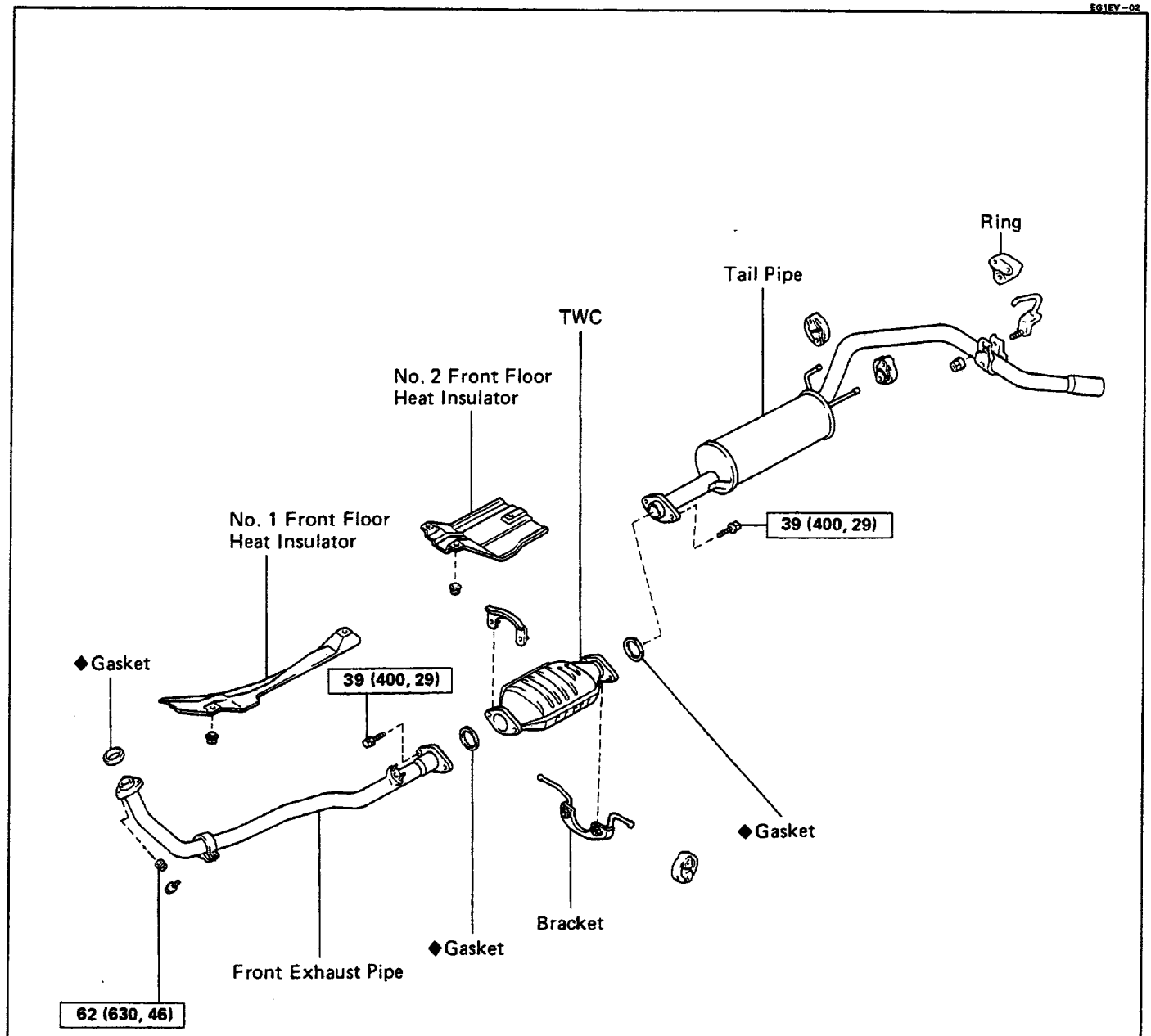
36. INSTALL HOOD

37. PERFORM ROAD TEST

Check for abnormal noise, shock slippage, correct shift points and smooth operation.

38. RECHECK ENGINE COOLANT AND OIL LEVELS

EXHAUST SYSTEM



SERVICE SPECIFICATIONS

EG1EW–02

SERVICE DATA

Tune – up	Battery specific gravity (Ex. Delco battery)	
	55D 23R type	1.25 – 1.27 (when fully charged at 20°C (68°F))
	80D 26R type	1.27 – 1.29 (when fully charged at 20°C (68°F))
	High–tension cord resistance Limit	25 kΩ per cord
	High–tension cord resistance	
	Spark plug	
	ND	K16R–U
	NGK	BKR5EYA
	Recommended spark plug	
	Correct electrode gap	0.8 mm (0.031 in.)
	Drive belt tension New belt	160 ± 20 lbf
	Used belt	100 ± 20 lbf
	Valve clearance (Cold) Intake	0.18 – 0.28 mm (0.007 – 0.011 in.)
	Exhaust	0.22 – 0.32 mm (0.009 – 0.013 in.)
	Valve clearance adjusting shim (for repair part)	
	Mark 2.200	2.200 mm (0.0866 in.)
	Mark 2.250	2.250 mm (0.0886 in.)
	Mark 2.300	2.300 mm (0.0906 in.)
	Mark 2.350	2.350 mm (0.0925 in.)
	Mark 2.400	2.400 mm (0.0945 in.)
	Mark 2.450	2.450 mm (0.0965 in.)
	Mark 2.500	2.500 mm (0.0984 in.)
	Mark 2.550	2.550 mm (0.1004 in.)
	Mark 2.600	2.600 mm (0.1024 in.)
	Mark 2.650	2.650 mm (0.1043 in.)
	Mark 2.700	2.700 mm (0.1063 in.)
	Mark 2.750	2.750 mm (0.1083 in.)
	Mark 2.800	2.800 mm (0.1102 in.)
	Mark 2.850	2.850 mm (0.1122 in.)
	Mark 2.900	2.900 mm (0.1142 in.)
	Mark 2.950	2.950 mm (0.1161 in.)
	Mark 3.000	3.000 mm (0.1181 in.)
	Mark 3.050	3.050 mm (0.1201 in.)
	Mark 3.100	3.100 mm (0.1220 in.)
	Mark 3.150	3.150 mm (0.1240 in.)
	Mark 3.200	3.200 mm (0.1260 in.)
	Mark 3.250	3.250 mm (0.1280 in.)
	Mark 3.300	3.300 mm (0.1299 in.)
	Mark 3.350	3.350 mm (0.1319 in.)
	Mark 3.400	3.400 mm (0.1339 in.)
	Ignition timing	10° BTDC @ idle (w/ Terminals TE1 and E1 connected of DLC1)
	Idle speed	800 ± 50 rpm
Compression pressure	at 250 rpm	
	STD	1,177 kPa (12.0 kgf/cm², 171 psi) or more
	Limit	981 kPa (10.0 kgf/cm², 142 psi)
	Difference of pressure between each cylinder	98 kPa (1.0 kgf/cm², 14 psi) or less
Timing belt tensioner	Protrusion from housing end	10.0 – 10.5 mm (0.394 – 0.413 in.)

Cylinder head	Warpage	Limit	0.10 mm (0.0039 in.)
	Valve seat		
	Refacing angle		30°, 45°, 60°
	Contacting angle		45°
	Contacting width		1.2 – 1.6 mm (0.047 – 0.063 in.)
Valve guide bushing	Inside diameter		8.010 – 8.030 mm (0.3154 – 0.3161 in.)
	Outside diameter	STD	13.040 – 13.051 mm (0.5134 – 0.5138 in.)
		O/S 0.05	13.090 – 13.101 mm (0.5154 – 0.5158 in.)
Valve	Valve overall length	STD	104.3 mm (4.106 in.)
		Limit	103.8 mm (4.087 in.)
	Valve face angle		44.5°
	Stem diameter	STD (Intake)	7.970 – 7.985 mm (0.3138 – 0.3144 in.)
		(Exhaust)	7.965 – 7.980 mm (0.3136 – 0.3142 in.)
	Stern 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.)
		Limit (Intake)	0.08 mm (0.0031 in.)
		(Exhaust)	0.10 mm (0.0039 in.)
	Margin thickness	STD	1.3 – 1.7 mm (0.051 – 0.067 in.)
		Limit	1.0 mm (0.039 in.)
Valve spring	Deviation Limit		1.23 mm (0.0484 in.)
	Free length White painted mark		46.50 mm (1.8307 in.)
	Green painted mark		47.01 mm (1.8508 in.)
	Installed tension at 40.0 mm (1.575 in.)		242 – 268 N (24.7 – 27.3 kgf, 54.5 – 60.2 lbf)
Camshaft	Thrust clearance	STD	0.080 – 0.190 mm (0.0031 – 0.0075 in.)
		Limit	0.25 mm (0.0098 in.)
	Journal oil clearance	STD	0.025 – 0.066 mm (0.0010 – 0.0026 in.)
		Limit	0.10 mm (0.0039 in.)
	Journal diameter		33.959 – 33.975 mm (1.3370 – 1.3376 in.)
	Circle runout	Limit	0.06 mm (0.0024 in.)
	Cam lobe height	STD	47.830 – 47.930 mm (1.8830 – 1.8870 in.)
		Limit	47.50 mm (1.8701 in.)
Valve lifter	Lifter diameter		37.922 – 37.932 mm (1.4930 – 1.4934 in.)
	Lifter bore diameter		37.960 – 37.975 mm (1.4945 – 1.4951 in.)
	Oil clearance	STD	0.028 – 0.053 mm (0.0011 – 0.0021 in.)
		Limit	0.10 mm (0.0039 in.)
Air intake chamber	Warpage	Limit	0.10 mm (0.0039 in.)
Intake Manifold	Warpage	Limit	0.10 mm (0.0039 in.)
Exhaust Manifold	Warpage	Limit	0.70 mm (0.0276 in.)

Cylinder block	Cylinder head surface warpage	Limit	0.05 mm (0.0020 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 (3.4539 in.)
		(O/S 0.50)	88.23 mm (3.4736 in.)
	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.)
Piston and piston ring	Piston diameter	STD (Mark 1)	87.360 – 87.370 mm (3.4394 – 3.4398 in.)
		(Mark 2)	87.370 – 87.380 mm (3.4398 – 3.4402 in.)
		(Mark 3)	87.380 – 87.390 mm (3.4402 – 3.4405 in.)
		O/S 0.50	87.860 – 87.890 mm (3.4590 – 3.4602 in.)
	Piston oil clearance	STD	0.130 – 0.150 mm (0.0051 – 0.0059 in.)
		Limit	0.17 mm (0.0067 in.)
	Piston ring groove clearance	STD (No.1)	0.020 – 0.060 mm (0.0008 – 0.0024 in.)
		(No.2)	0.030 – 0.070 mm (0.0012 – 0.0028 in.)
		Limit	0.20 mm (0.0079 in.)
	Piston ring end gap	STD (No.1)	0.280 – 0.500 mm (0.0110 – 0.0197 in.)
		(No.2)	0.380 – 0.600 mm (0.0150 – 0.0236 in.)
		(Oil)	0.150 – 0.500 mm (0.0059 – 0.0197 in.)
		Limit (No.1)	1.10 mm (0.0433 in.)
		(No.2)	1.20 mm (0.0472 in.)
		(Oil)	1.10 mm (0.0433 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 big end inner diameter (Reference)		
		STD (Mark 1)	58.000 – 58.008 mm (2.2835 – 2.2838 in.)
		(Mark 2)	58.008 – 58.016 mm (2.2838 – 2.2841 in.)
		(Mark 3)	58.016 – 58.024 mm (2.2841 – 2.2844 in.)
	Connecting rod bearing center wall thickness (Reference)		
		STD (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.)
	Connecting rod oil clearance	STD (STD)	0.024 – 0.053 mm (0.0009 – 0.0021 in.)
		(U/S 0.25, U/S 0.50)	0.023 – 0.069 mm (0.0009 – 0.0027 in.)
		Limit	0.08 mm (0.0031 in.)
	Rod bend	Limit per 100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Rod twist	Limit per 100 mm (3.94 in.)	0.15 mm (0.0059 in.)
	Connecting rod bolt thread outside 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.)
	Main journal oil clearance STD (No.1 for STD)	0.0025 – 0.0052 mm (0.0010 – 0.0020 in.)
	(No.1 for U/S 0.25, U/S 0.50)	0.0024 – 0.0080 mm (0.0009 – 0.0031 in.)
	(Others for STD)	0.0029 – 0.0056 mm (0.0011 – 0.0022 in.)
	(Others for U/S 0.25, U/S 0.50)	0.0028 – 0.0077 mm (0.0011 – 0.0030 in.)
	Limit	0.80 mm (0.0031 in.)
	Main journal diameter STD	63.985 – 64.000 mm (2.5190 – 2.5197 in.)
	U/S 0.25	63.745 – 63.755 mm (2.5096 – 2.5100 in.)
	U/S 0.50	63.495 – 63.505 mm (2.4998 – 2.5002 in.)
	Main journal diameter (Reference) STD (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.)
	Main bearing center wall thickness (Reference)	
	STD (No.1 for Mark 1)	1.991 – 1.994 mm (0.0784 – 0.0785 in.)
	(No.1 for Mark 2)	1.994 – 1.997 mm (0.0785 – 0.0786 in.)
	(No.1 for Mark 3)	1.997 – 2.000 mm (0.0786 – 0.0787 in.)
	(No.1 for Mark 4)	2.000 – 2.003 mm (0.0787 – 0.0789 in.)
	(No.1 for Mark 5)	2.003 – 2.006 mm (0.0789 – 0.0790 in.)
	(Others for Mark 1)	1.989 – 1.992 mm (0.0783 – 0.0784 in.)
	(Others for Mark 2)	1.992 – 1.995 mm (0.0784 – 0.0785 in.)
	(Others for Mark 3)	1.995 – 1.998 mm (0.0785 – 0.0787 in.)
	(Others for Mark 4)	1.998 – 2.001 mm (0.0787 – 0.0788 in.)
	(Others for Mark 5)	2.001 – 2.004 mm (0.0788 – 0.0789 in.)
	Crank pin diameter STD	54.987 – 55.000 mm (2.1648 – 2.1654 in.)
	U/S 0.25	54.745 – 54.755 mm (2.1553 – 2.1557 in.)
	U/S 0.50	54.495 – 54.505 mm (2.1455 – 2.1459 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 journal taper and out–of–round Limit	0.02 mm (0.0008 in.)

TORQUE SPECIFICATIONS

EG1EX–02

Part tightened		N·m	kgf·cm	ft·lbf
No.1 idler pulley x Cylinder head		34	350	25
Crankshaft pulley x Crankshaft		245	2,500	181
Camshaft timing pulley x Camshaft		108	1,100	80
Fan bracket x Cylinder block		41	420	30
Timing belt tensioner x Fan bracket		26	270	20
Cooling fan x Fluid coupling		5.4	55	48 in.·lbf
Water outlet x No.2 idler pulley		8.3	85	74 in.·lbf
Spark plug x Cylinder head		18	180	13
Exhaust manifold x Cylinder head		39	400	29
Generator bracket x Cylinder head		37	380	27
Cylinder head x Cylinder block	for 12 pointed head (l st)	44	450	33
	(2nd)	Turn 90°		
	(3rd)	Turn 90°		
	for 6 pointed head	41	420	30

Camshaft bearing cap x Cylinder head		16	160	12
Cylinder head cover x Cylinder head		5.4	55	48 in.·lbf
Engine hanger x Cylinder head		40	410	30
Oil dipstick guide x Cylinder head		37	380	27
Exhaust crossover pipe x Exhaust Manifold		39	400	29
Intake manifold x Cylinder head		18	185	13
Water by–pass outlet x Intake manifold		18	185	13
Delivery pipe x Cylinder head		13	130	9
No.1 injection manifold x Exhaust Manifold		29	300	22
PAIR reed valve x Cylinder head		37	380	27
No.3 timing belt cover x Cylinder head		8.3	85	74 in.·lbf
No.2 idler pulley x Intake manifold		18	185	13
No.4 timing belt cover x No.3 timing belt cover		8.3	85	74 in.·lbf
No.2 fuel pipe x Delivery pipe		34	350	25
No.3 fuel pipe x Delivery pipe		34	350	25
Air intake chamber x Intake manifold		18	185	13
EGR pipe x Exhaust manifold		29	300	22
EGR pipe x Air intake chamber		29	300	22
EGR valve x Air intake chamber		18	185	13
Air intake chamber stay x Air intake chamber		18	185	13
Air intake chamber stay x Cylinder head		18	185	13
Cold start injector tube x Cold start injector		15	150	13
Main bearing cap x Cylinder block	for 1st	61	625	45
	for 2nd	Turn 90°		
Connecting rod cap x Connecting rod	1st	25	250	18
	2nd	Turn 90°		
Rear oil seal retainer x Cylinder block		7.8	80	69 in.·lbf
Oil pump x Cylinder block		20	200	14
Oil strainer x Main bearing cap		6.9	70	61 in.·lbf
Oil strainer x Oil pump		6.9	70	61 in.·lbf
Oil pan x Cylinder block		5.9	60	52 in.·lbf
Oil pan x Oil pump		5.9	60	52 in.·lbf
Oil pan x Rear ail seal retainer		5.9	60	52 in.·lbf
Oil filter union x Cylinder block		25	250	18
Oil cooler x Cylinder block	for union bolt (2WD)	59	600	43
	for relief valve (4WD)	59	600	43
	for bolt	39	400	29
Engine coolant drain plug x Cylinder block		29	300	22
RH engine mounting bracket x Cylinder block		40	410	30
LH engine mounting bracket x Cylinder block		40	410	30
Oil pressure sender gauge x Cylinder block		15	150	11
Water pump x Cylinder block	for short bolt	20	200	14
	for long bolt	18	185	13
No.1 water by–pass pipe x Cylinder block	for bolt	4.9	50	43 in.·lbf
	for nut	6.9	70	61 in.·lbf
Rear end plate x Cylinder block		7.4	75	65 in.·lbf
Crankshaft x Flywheel (M/T)		88	900	65
Crankshaft x Drive plate (A/T)		83	850	61
Cylinder block x Oil cooler relief valve		59	600	43

Rear engine mounting bracket x Support member (2W0)	**25**	**260**	**19**
Rear engine mounting bracket x Mounting insulator (2WD)	**13**	**130**	**9**
No.2 frame crossmember x Side frame (4WD)	**95**	**970**	**70**
No.2 frame crossmember x Rear engine mounting insulator (4WD)	**13**	**130**	**9**
RH engine mounting insulator x Body	**37**	**380**	**27**
LH engine mounting insulator x Body	**37**	**380**	**27**
Front exhaust pipe x Exhaust manifold	**62**	**630**	**46**
Front exhaust pipe x Three –way catalytic converter	**39**	**400**	**29**
Tailpipe x Three–way catalytic converter	**39**	**400**	**29**

EMISSION CONTROL SYSTEMS

SYSTEM PURPOSE

EG1EY–02

System	Abbreviation	Purpose
Positive crankcase ventilation	PCV	Reduces blow–by gas (HC)
Evaporative emission control	EVAP	Reduces evaporative H C
Exhaust gas recirculation	EGR	Reduces NOx
Pulsed secondary air injection	PAIR	Reduces HC and CO
Three–way catalytic converter	TWC	Reduces HC, CO and NOx
Multiport fuel injection*	MFI	Regulates all engine conditions for reduction of exhaust emissions.

Remark: For inspection and repair of the MFI system, refer to the MFI section of this manual.

V02295

PREPARATION

RECOMMENDED TOOLS

EG1EZ–01

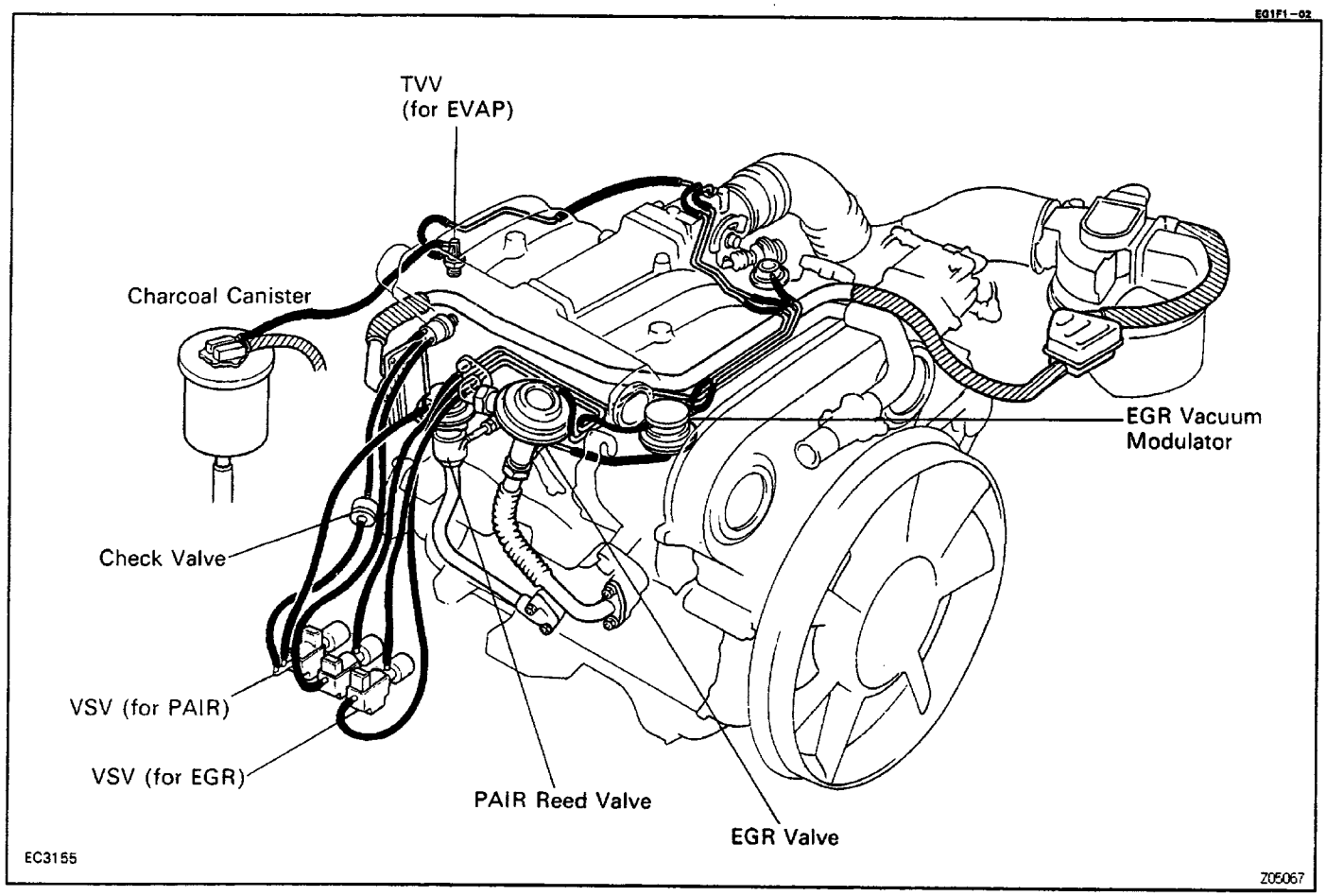
 09082–00015 TOYOTA Electrical Tester	
 09258–00030 Hose Plug Set	

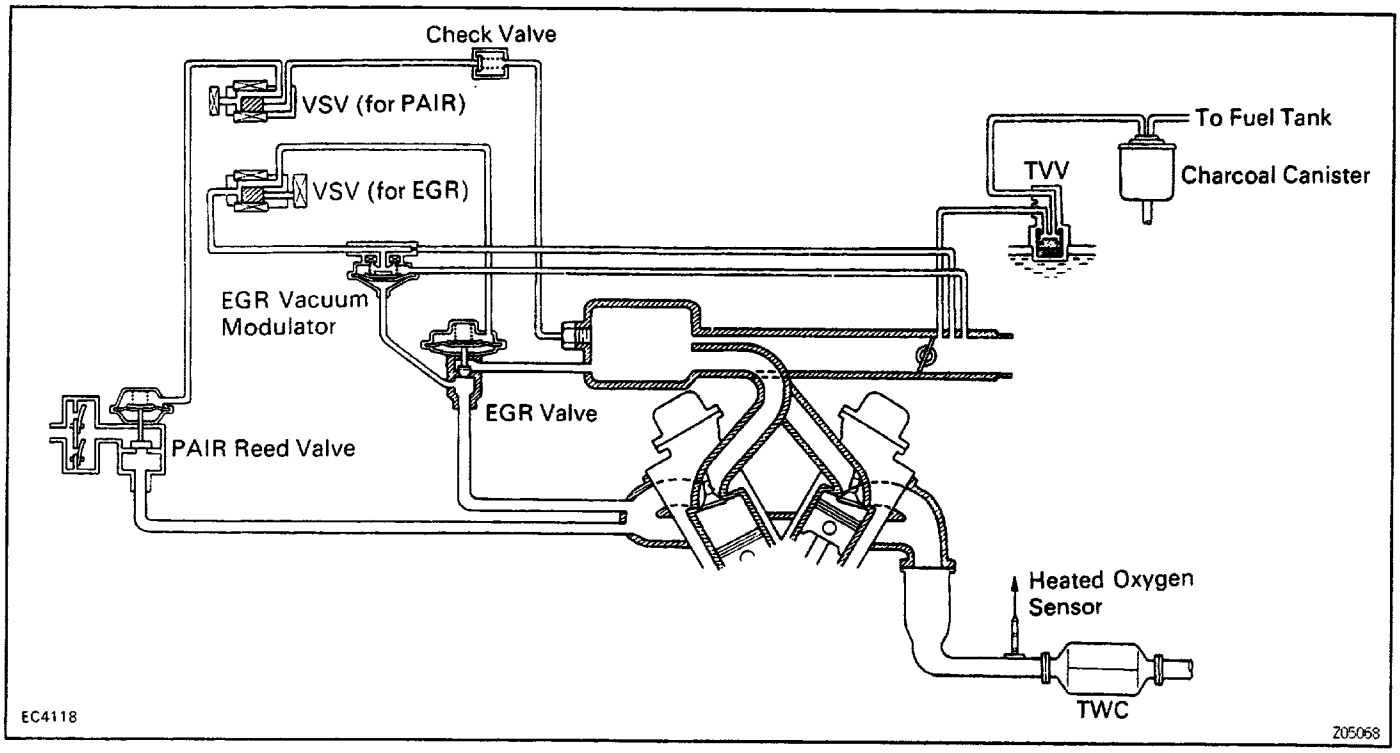
EG1F0–01

EQUIPMENT

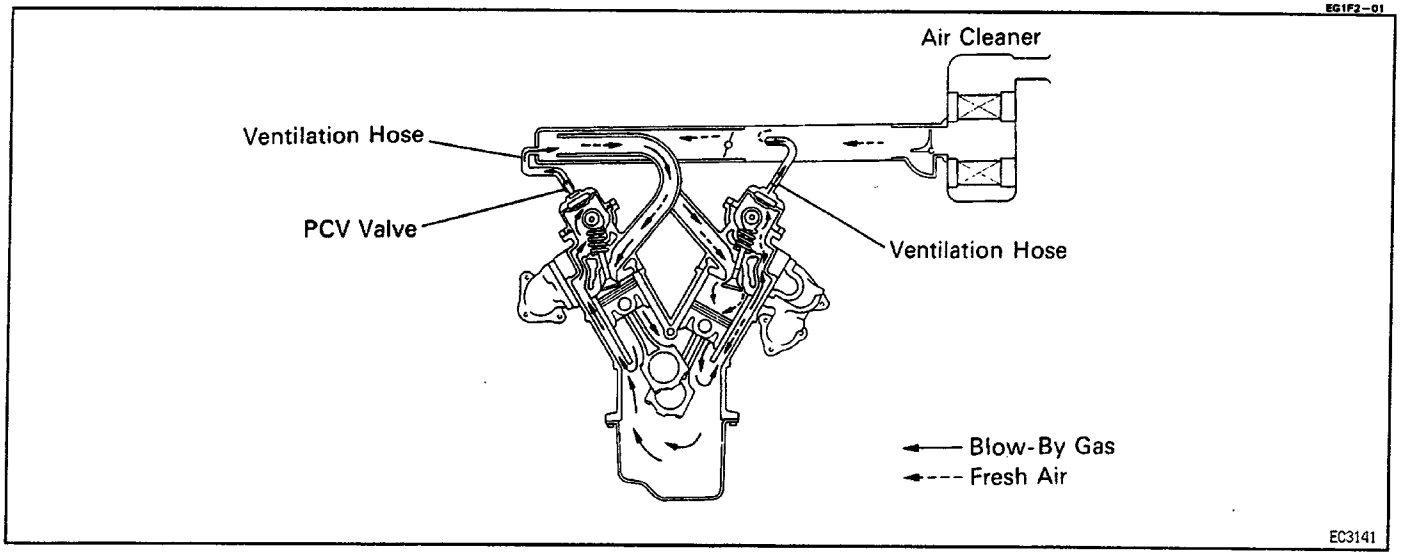
Torque wrench	
Vacuum gauge	

LAYOUT AND SCHEMATIC DRAWING



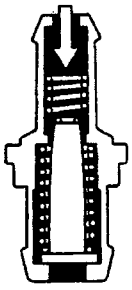


POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM



To reduce HC emission, crankcase blow–by gas (HC) is routed through the PCV valve to the intake manifold for combustion in the cylinders.

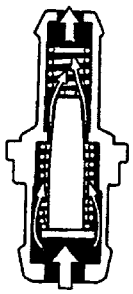
Engine not Running or Backfiring



○ PCV VALVE IS CLOSED.

EC1001

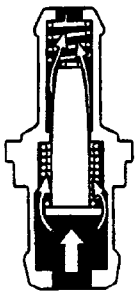
Normal Operation



○ PCV VALVE IS OPEN.
○ VACUUM PASSAGE IS LARGE.

EC1002

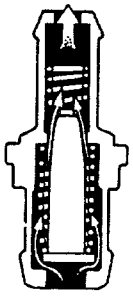
Idling or Decelerating



○ PCV VALVE IS OPEN.
○ VACUUM PASSAGE IS SMALL.

EC1003

Acceleration or Heavy Load



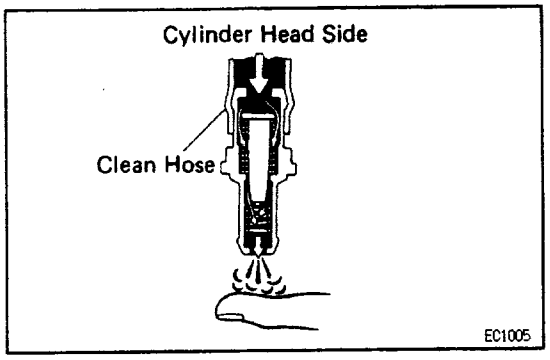
○ PCV VALVE IS FULLY OPEN.

EC1004

V01597

EG1F3–01

PCV VALVE INSPECTION



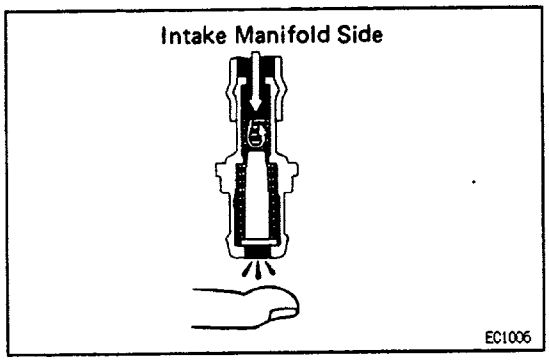
1. REMOVE PCV VALVE

2. ATTACH 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 INTAKE MANIFOLD SIDE

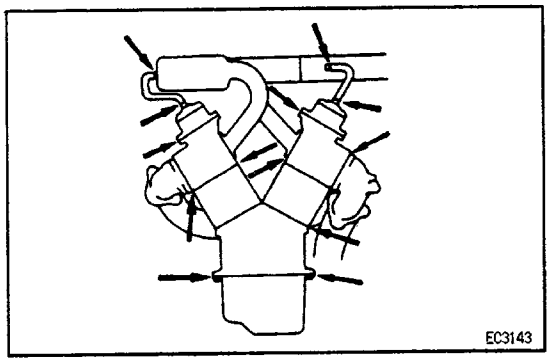
Check that air passes through with difficulty.

If the PCV valve fails either check, replace it.

5. REINSTALL PCV VALVE

EG1F4–01

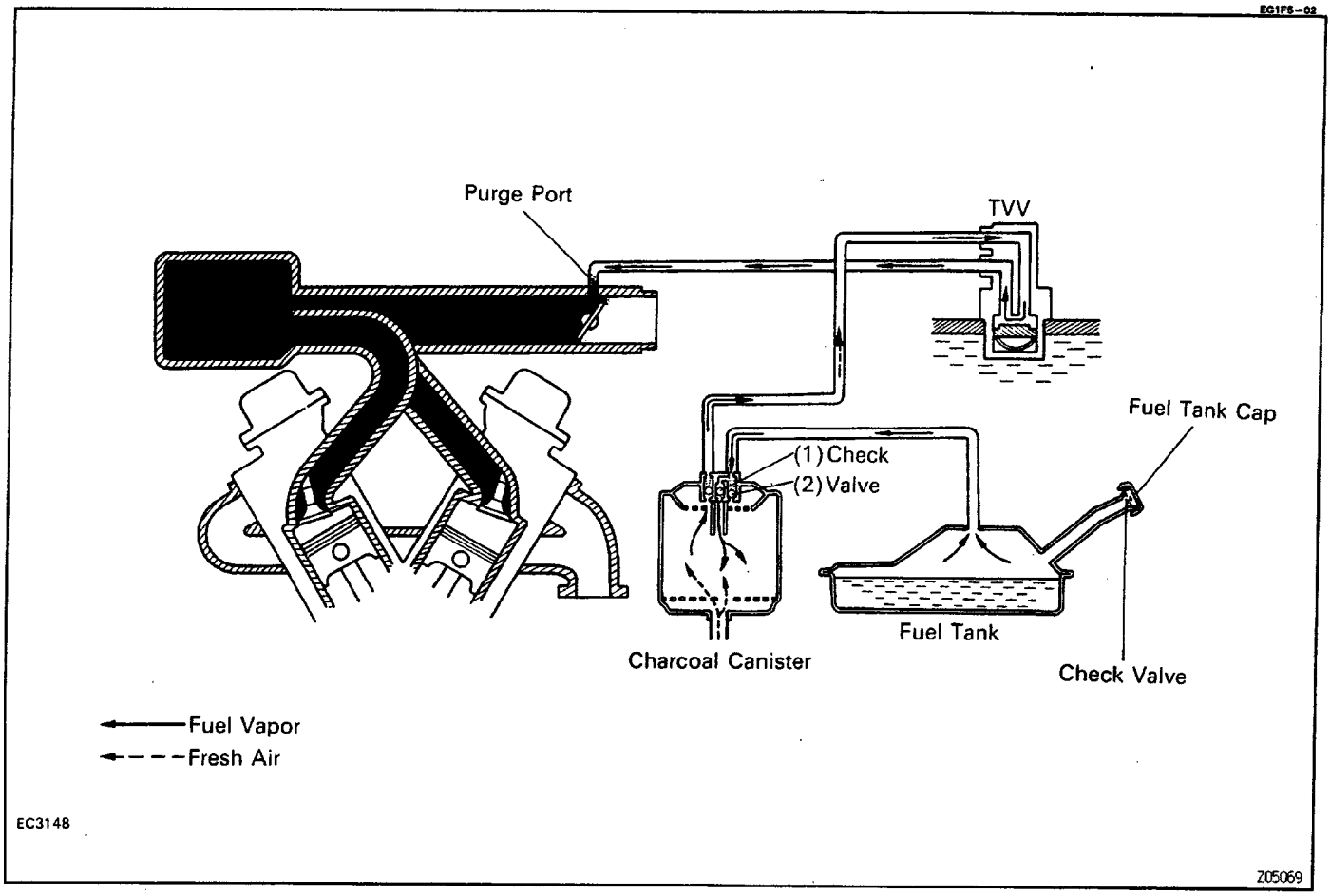
PCV HOSES AND CONNECTIONS INSPECTION



VISUALLY INSPECT HOSES, CONNECTIONS AND GASKETS

Check for cracks, leaks or damage.

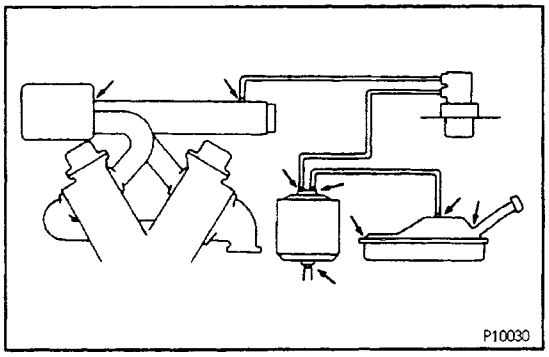
EVAPORATIVE (EVAP) EMISSION CONTROL SYSTEM



To reduce HC emission, evaporated fuel from the fuel tank is routed through the charcoal canister to the intake manifold for combustion in the cylinders. '

Engine Coolant Temp.	TVV	Throttle Valve Opening	Check Valve is Charcoal Canister (1)	(2)	(3)	Check Valve in Cap	Evaporated Fuel (HC)
Below 35°C (95°F)	CLOSED	–	–	–	–	–	HC from tank is absorbed in the canister.
Above 54°C (129°F)	OPEN	Positioned below purge port	CLOSED	–	–	–	
		Positioned above purge port	OPEN	–		–	HC from canister is led into air intake manifold.
High pressure in tank	–	–	–	OPEN	CLOSED	CLOSED	HC from tank is absorbed in the canister.
High vacuum in tank	–	–	–	CLOSED	OPEN	OPEN	(Air is led into the fuel tank.)

V02190



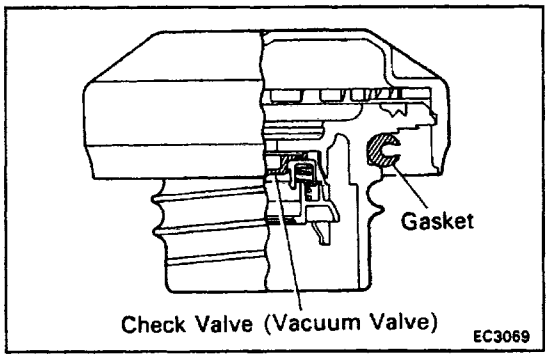
FUEL VAPOR LINES, FUEL TANK AND TANK CAP INSPECTION EG1F6-02

1. VISUALLY INSPECT LINES AND CONNECTIONS

Look for loose connections, sharp bends or damage.

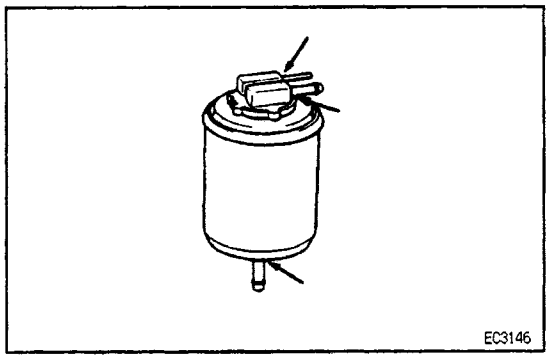
2. VISUALLY INSPECT FUEL TANK

Look for deformation, cracks or fuel leakage.



3. VISUALLY INSPECT FUEL TANK CAP

Look for a damaged or deformed gasket and cap.
If necessary, repair or replace the cap.

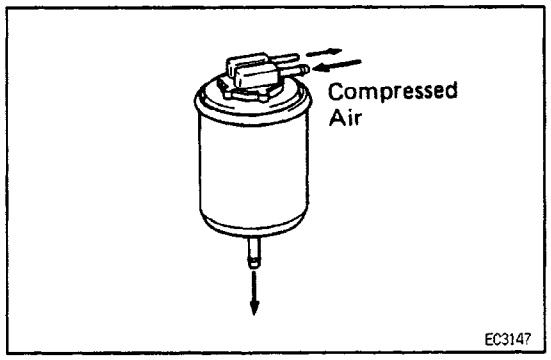


CHARCOAL CANISTER INSPECTION EG1F7-01

1. REMOVE CHARCOAL CANISTER

2. VISUALLY INSPECT CHARCOAL CANISTER CASE

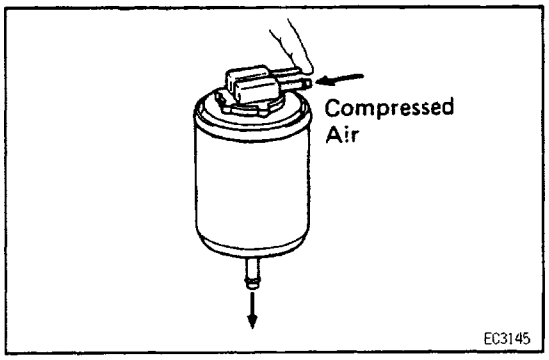
Look for cracks or damage.



3. CHECK FOR CLOGGED FILTER AND STUCK CHECK VALVE

(a) Using low pressure compressed air, blow air into the tank pipe and check that air flows without resistance from the other pipes.

(b) Blow air into the purge pipe and check that air does not flow from the other pipes.
If a problem is found, replace the charcoal canister.



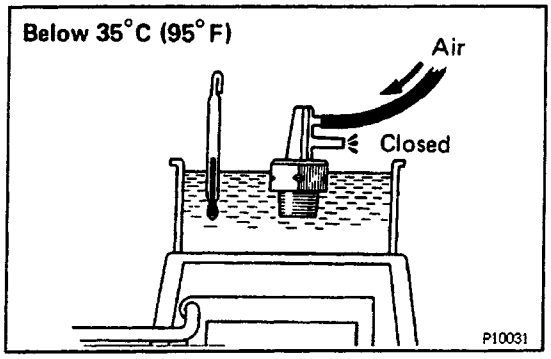
4. CLEAN FILTER IN CANISTER

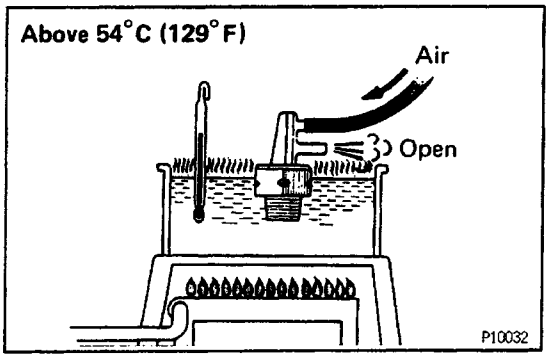
Clean the filter by blowing 294 kPa (3 kgf/cm2, 43 psi) of compressed air into the tank pipe, while holding the purge pipe closed.

HINT:

- Do not attempt to wash the canister.
- No activated carbon should come out.

5. INSTALL CHARCOAL CANISTER





EG210–01

TVV INSPECTION

CHECK TVV BY BLOWING AIR INTO PIPE

(a) Drain the coolant from the radiator into a suitable container.
(b) Remove the TVV from the intake manifold.
(c) Cool the TVV to below 35°C (95°F) with cool water.
(d) Blow air into a pipe and check that the TVV is closed.
(e) Heat the TVV to above 54°C (129°F) with hot water.
(f) Blow air into a pipe and check that the TVV is open.
If a problem is found, replace the TVV.
(g) Apply adhesive to two or three threads of the TVV, and reinstall it.

Adhesive:

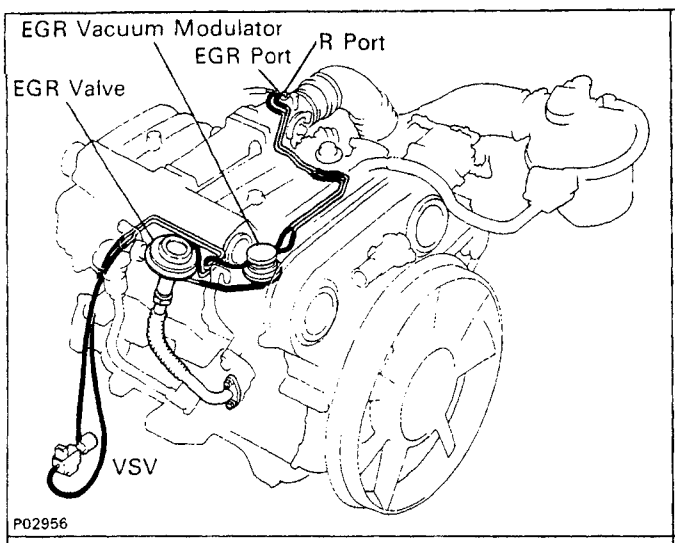
Part No. 08833–00070. THREE BOND 1324 or equivalent

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

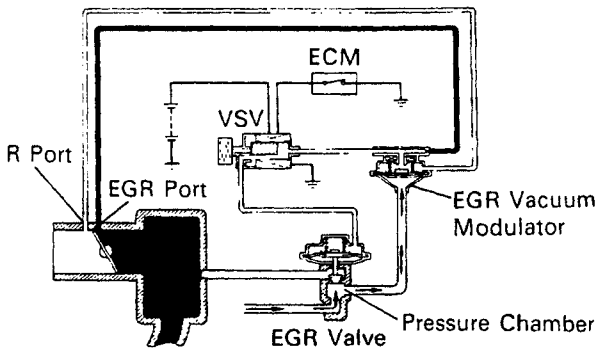
(h) Fill the radiator with engine coolant.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

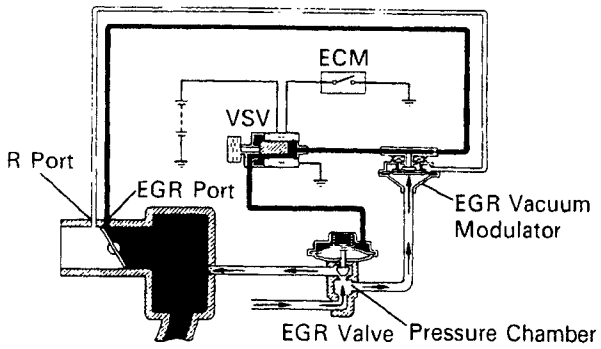
EG211–01



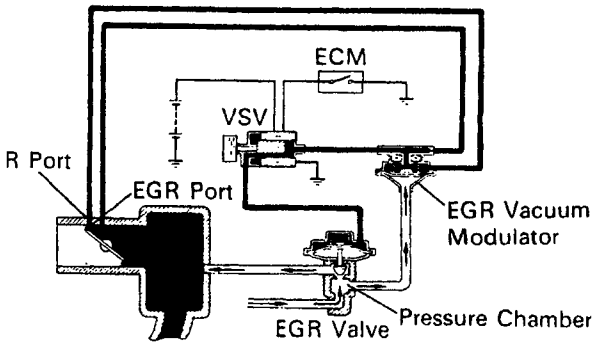
(1)



(2)



(3)



To reduce NOx emissions, part of the exhaust gases are recirculated through the EGR valve to the intake manifold to lower the maximum combustion temperature.

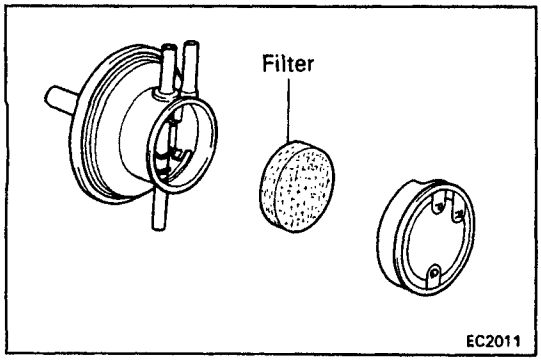
Engine Coolant Temp.	VSV	Throttle Valve Opening Angle	Pressure in the EGR Valve Pressure Chamber		EGR Vacuum Modulator	EG R Valve	Exhaust Gas
Below 48°C (118°F)	CLOSED					CLOSED	Not recirculated
Above 52°C (126°F)	OPEN	Positioned below EGR port	-		-	CLOSED	Note Recirculated
		Positioned between EGR port and R port	(1) LOW	*Pressure constantly alternating between low and high	OPENS passage to atmosphere	CLOSED	Note Recirculated
			(2) HIGH		CLOSES passage to atmosphere	OPEN	Recirculated
		Positioned above R port	(3) HIGH	**	CLOSES passage to atmosphere	OPEN	Recirculated (increase)

Remarks: *Pressure increases → Modulator closes → .EGR valve opens → Pressure drops
EGR Valve closes ← Modulator opens

** When the throttle valve is positioned above the R port, 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.

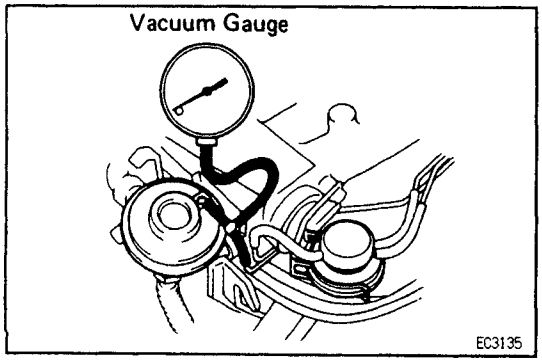
EG1FA–01

EGR SYSTEM INSPECTION



1. CHECK AND CLEAN FILTER !N EGR VACUUM MODULATOR

(a) Check the filter for contamination or damage.
(b) Using compressed air, clean the filter.

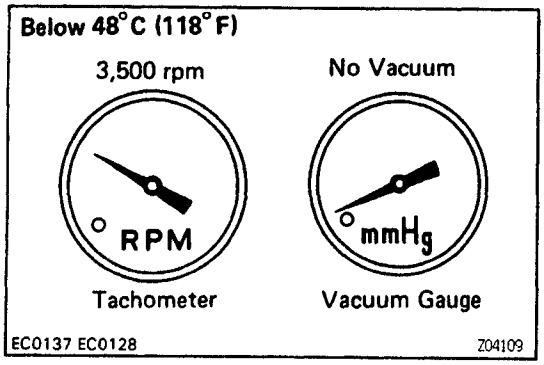


2. PREPARATION

Disconnect the vacuum hose from the EGR valve and using a three–way union, connect a vacuum gauge to it.

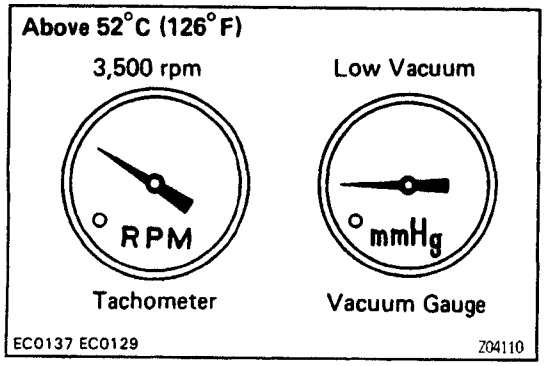
3. CHECK SEATING OF EGR VALVE

Start the engine and check that the engine starts and runs at idle.



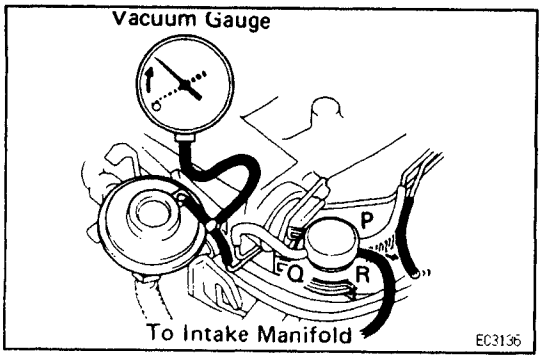
4. CHECK VSV WITH COLD ENGINE

(a) The engine coolant temperature should be below 48°C(118°F).
(b) Check that the vacuum gauge indicates zero at 3,500 rpm.



5. CHECK VSV AND EGR VACUUM MODULATOR WITH WARM ENGINE

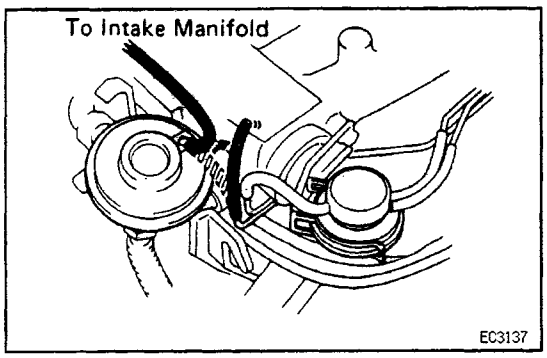
(a) Warm up the engine.
(b) Check that the vacuum gauge indicates zero at idle.
(c) Check that the vacuum gauge indicates low vacuum at 3,500 rpm.



(d) Disconnect the vacuum hose from R port of the EGR vacuum modulator and connect R port directly to the intake manifold with another hose.
(e) Check that the vacuum gauge indicates high vacuum at 3,500 rpm.

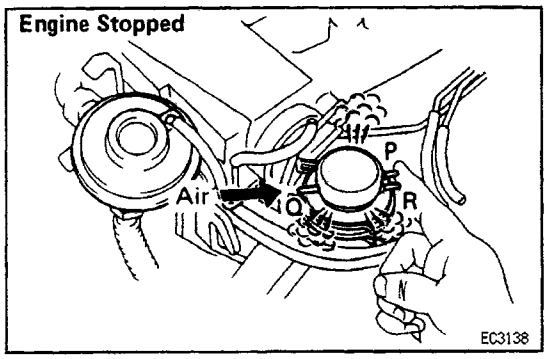
HINT: As a large amount of EGR gas enters, the engine will misfire slightly.

(f) Disconnect the vacuum gauge and reconnect the vacuum hoses to the proper locations.



6. CHECK EGR VALVE

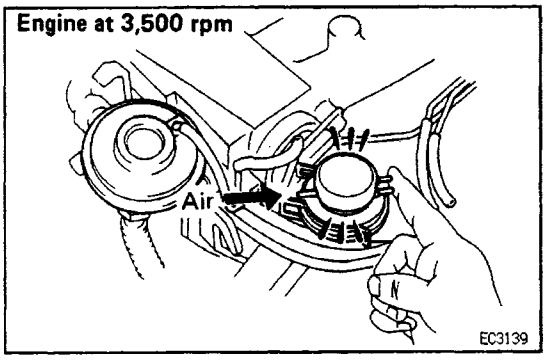
(a) Apply vacuum directly to the EGR valve with the engine idling.
(b) Check that the engine runs rough or dies.
(c) Reconnect the vacuum hoses to the proper locations.
If no problem is found with this inspection, the system is okay; otherwise inspect each part.



EGR VACUUM MODULATOR INSPECTION

CHECK EGR VACUUM MODULATOR OPERATION

(a) Disconnect the vacuum hoses from ports P, Q and R of the EGR vacuum modulator.
(b) Plug ports P and R with your finger.
(e) Blow air into port Q. Check that the air passes through to the air filter side freely.



(d) Start the engine and maintain speed at 3,500rpm.
(e) Repeat the above test. Check that there is a strong resistance to air flow.
(f) Reconnect the vacuum hoses to the proper locations.
If a problem is found, replace the EGR vacuum mod–ulator. ”

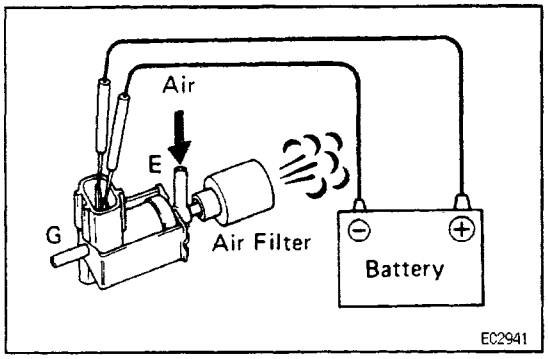
EG1FC–01

EGR VALVE INSPECTION

1. REMOVE EGR VALVE

Check the valve for sticking and heavy carbon de–posits.
If a problem is found, replace it.

2. INSTALL EGR VALVE WITH NEW GASKET

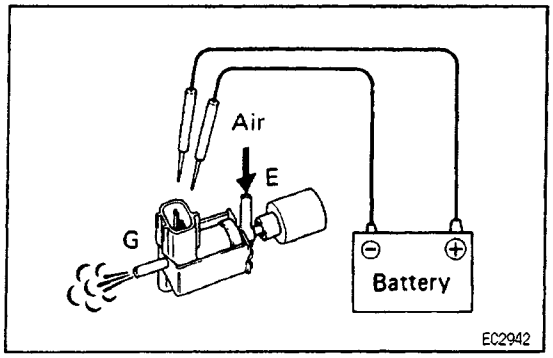


EG1FD–01

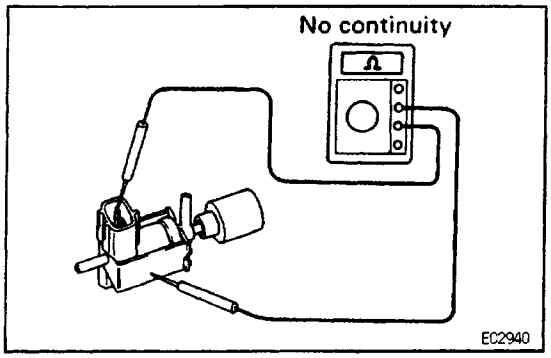
VSV INSPECTION

1. CHECK VACUUM CIRCUIT CONTINUITY IN VSV BY BLOWING AIR INTO PIPE

(a) Connect the VSV terminals to the battery terminals as illustrated.
(b) Blow air into a pipe E and check that air comes out of air filter.

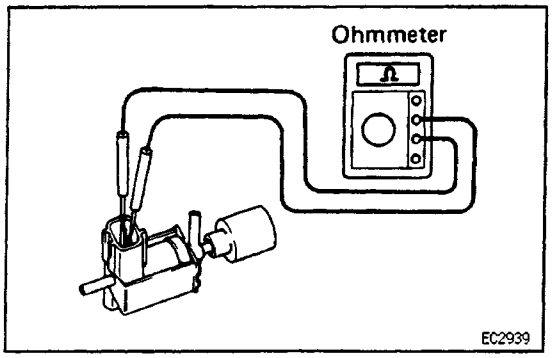


(c) Disconnect the battery.
(d) Blow air into a pipe E and check that air comes out of pipe G.
If a problem is found, replace the VSV.



2. CHECK FOR SHORT CIRCUIT

Using an ohmmeter, check that there is no continuity between the terminals and the VSV body.
If there is continuity, replace the VSV.



3. CHECK FOR OPEN CIRCUIT

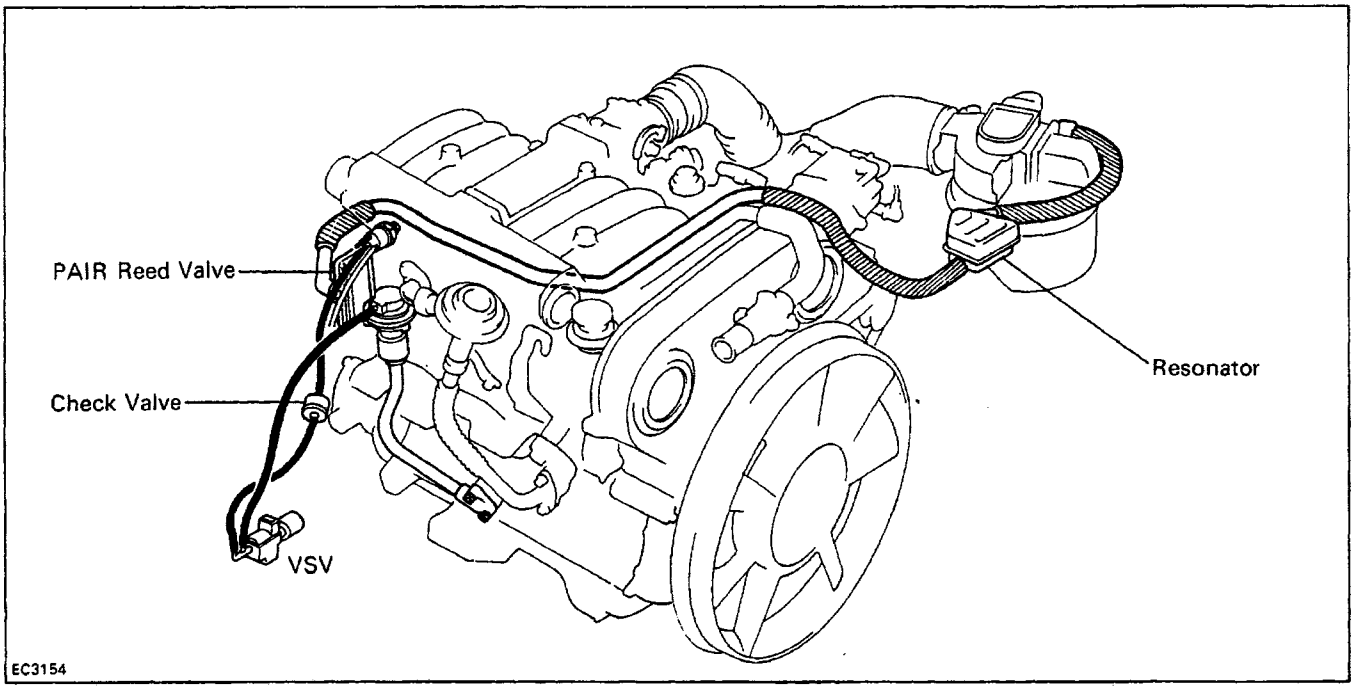
Using an ohmmeter, measure the resistance between. the terminals.
Specified resistance: 30 – 50Ω at 20 °C (68 °F)
If the resistance is not within specification, replace the VSV.

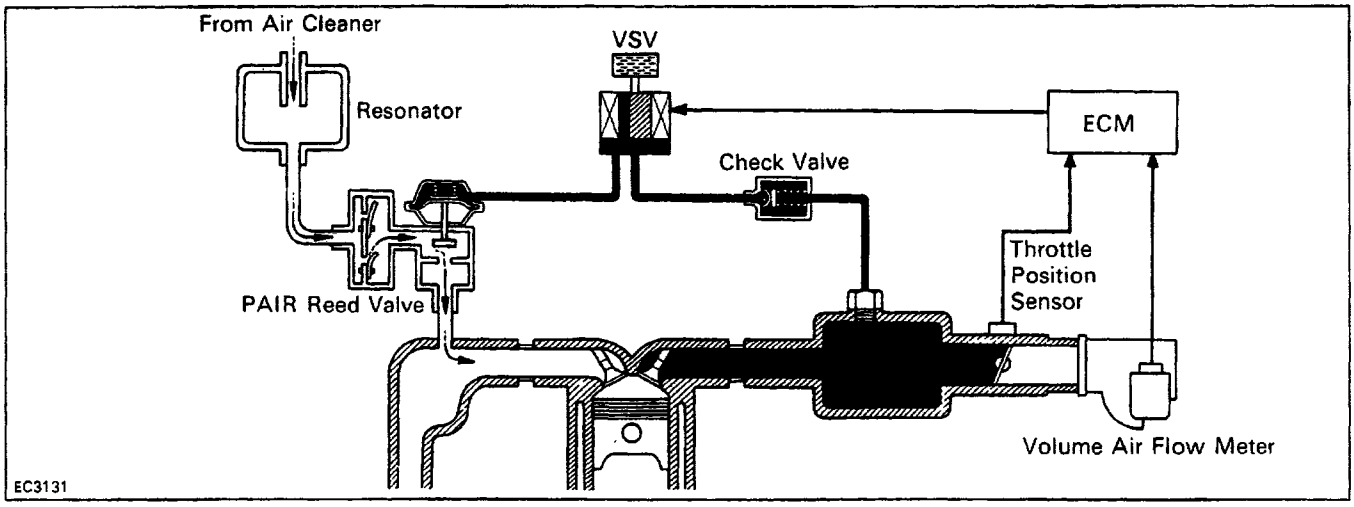
ENGINE COOLANT TEMP. SENSOR INSPECTION ecIFe–01

(See page EG2–348)

PULSED SECONDARY AIR INJECTION (PAIR) SYSTEM

EG212–01





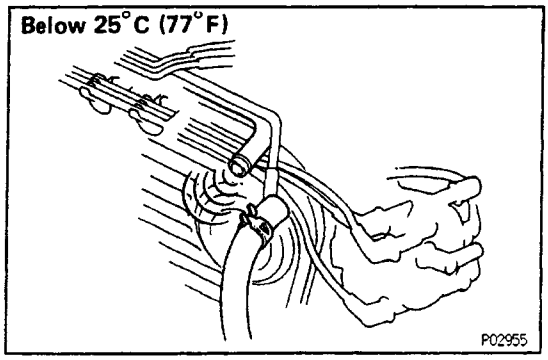
To reduce HC and CO emissions, this system draws in air into exhaust ports to accelerate oxidation, using vacuum generated by the exhaust pulsation in the exhaust manifold.

Condition	Engine Coolant Temp.	Throttle Valve Position	Engine RPM	VSV	PAIR
Normal driving	Below 25°C (77°F)		–	ON	ON
Deceleration	Above 35°C (95°F)	Idling	Below 1,000 rpm	OFF	OFF
			Between 1,200 – 3,200 rpm	ON	ON

V02188

EG1FG–01

PAIR SYSTEM INSPECTION



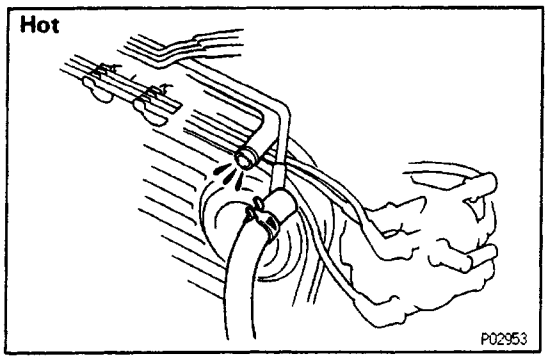
1. VISUALLY CHECK HOSES AND TUBES FOR CRACKS, KINKS, DAMAGE OR LOOSE CONNEC– TIONS

2. CHECK PAIR SYSTEM WITH COLD ENGINE

(a) The engine coolant temperature should be below 25 ° C (77 °F).

(b) Disconnect the No.2 air hose from the air pipe.

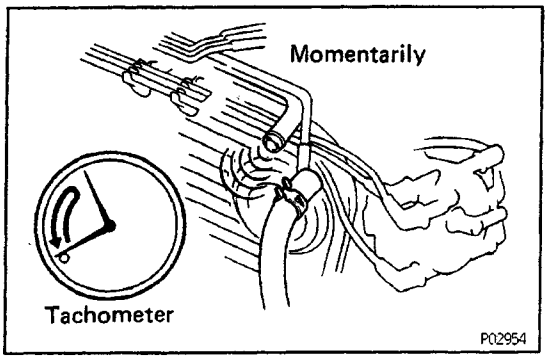
(c) Check that a bubbling noise is heard from the air pipe at idle.



3. CHECK PAIR SYSTEM WITH WARM ENGINE

(a) Warm up the engine.

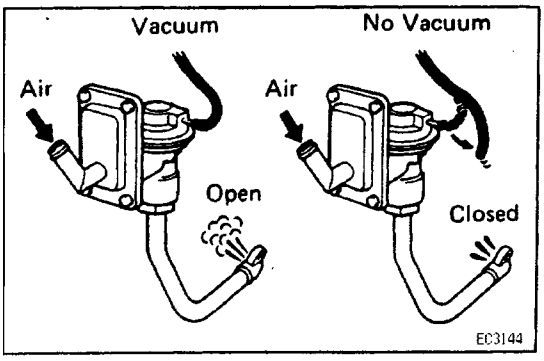
(b) With the engine idling, check that a bubbling noise is not heard from the air pipe.



(c) Race the engine above 2,000 rpm and quickly close the throttle valve. Check that a bubbling noise stops momentarily.

EG1FH–01

PAIR REED VALVE INSPECTION



CHECK REED VALVE BY BLOWING AIR INTO PIPE

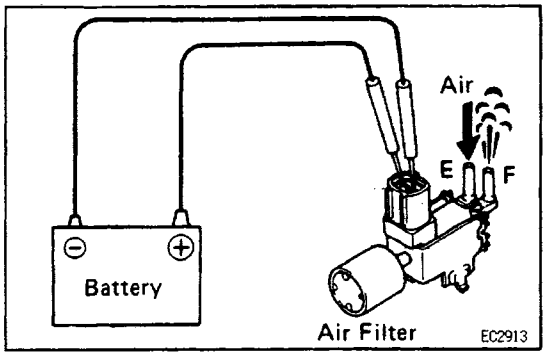
(a) Apply vacuum to the reed valve diaphragm.

(b) Blow air into a pipe and check that the reed valve is open.

(c) Release the vacuum and check that the reed valve is closed.

EG1FJ–01

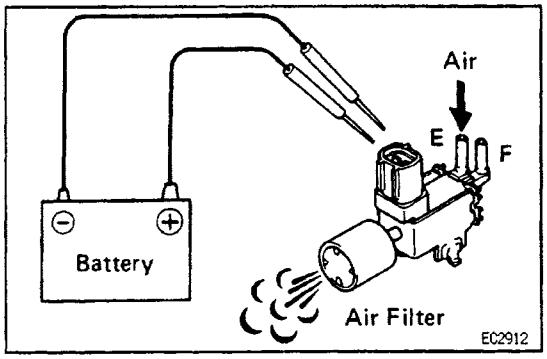
VSV INSPECTION



1. CHECK VACUUM CIRCUIT CONTINUITY IN VSV BY BLOWING AIR INTO PIPE

(a) Connect the VSV terminals to the battery terminals as illustrated.

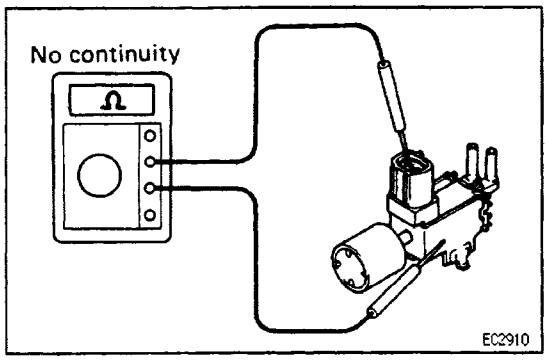
(b) Blow air into pipe E and check that air comes out of pips F.



(c) Disconnect the battery.

(d) Blow air into pipe E and check that air comes out of air filter.

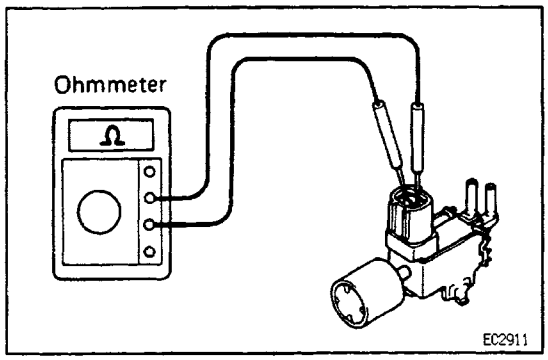
If a problem is found, replace the VSV.



2. CHECK FOR SHORT CIRCUIT

Using an ohmmeter, check that there is no continuity between the terminals and the VSV body.

If there is continuity, replace the VSV.



3. CHECK FOR OPEN CIRCUIT

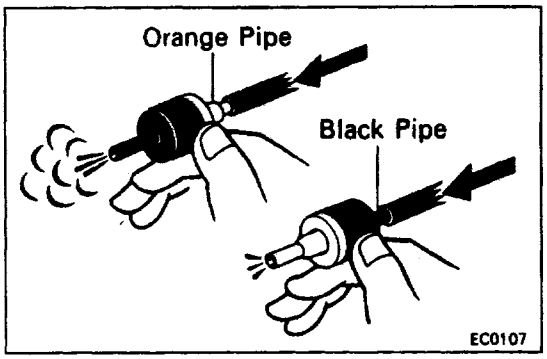
Using an ohmmeter, measure the resistance between the terminals.

Specified resistance: 30 – 50Ω at 20 °C (68 °F)

If the resistance is not within specification, replace the VSV.

EG1FK–01

CHECK VALVE INSPECTION



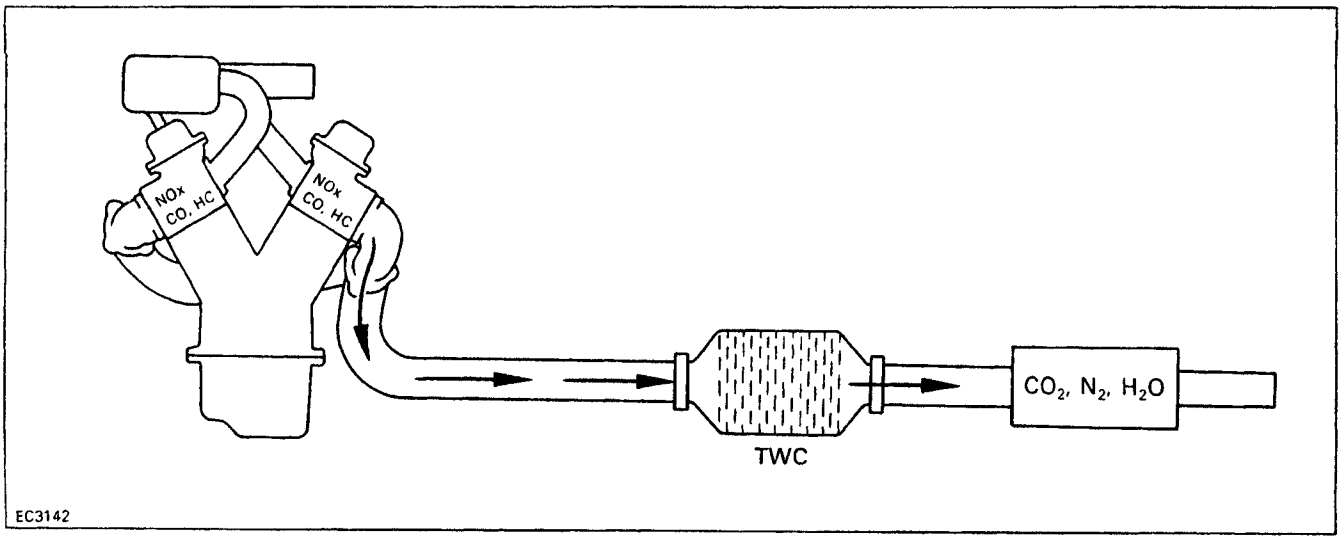
CHECK VALVE BY BLOWING AIR INTO EACH PIPE

(a) Check that air flows from the orange pipe to the black pipe.

(b) Check that air does not flow fron the black pipe to the orange pipe.

THREE–WAY CATALYTIC CONVERTER (TWC) SYSTEM

EG214–01



To reduce HC, CO and NOx emissions, they are oxidized, reduced and converted to nitrogen (N_2), carbon dioxide (CO_2) and water (H_2) by the catalyst.

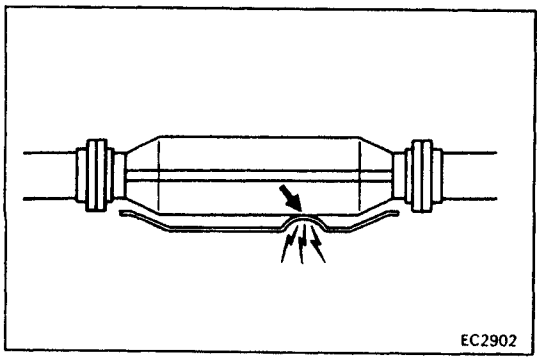
Exhaust Port		TW C		Exhaust Gas
HC, CO and NOx	→	Oxidation and reduction	→	CO_2 H_20 N_2

V01947

EXHAUST PIPE ASSEMBLY INSPECTION

1. CHECK CONNECTIONS FOR LOOSENESS OR DAMAGE

2. CHECK CLAMPS FOR WEAKNESS. CRACKS OR DAMAGE

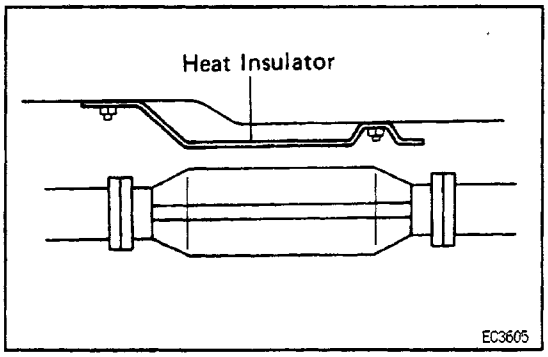


EG1FU–01

CATALYTIC CONVERTER INSPECTION

CHECK FOR DENTS OR DAMAGE

If any part of the protector is damaged or dented to the extent that it contacts the catalyst, repair or re–place it.

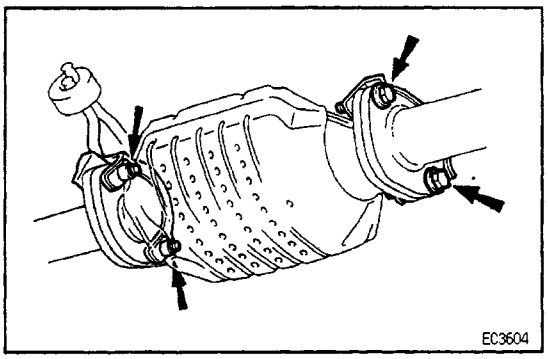


EG1FP–01

HEAT INSULATOR INSPECTION

1. CHECK HEAT INSULATOR FOR DAMAGE

2. CHECK FOR ADEQUATE CLEARANCE BETWEEN CATALYTIC CONVERTER AND HEAT INSULATOR



CATALYTIC CONVERTER REPLACEMENT

1. REMOVE CONVERTER

(a) Jack up the vehicle.

(b) Check that the converter is cool.

(c) Remove the bolts at the front and rear of the converter.

(d) Remove the converter and gasket.

2. INSTALL CONVERTER

(a) Place new gaskets on the converter front and rear pipes, and connect the converter to the exhaust pipes.

(b) Torque the bolts.

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

(c) Reinstall the bracket bolts and tighten them.

SERVICE SPECIFICATIONS

SERVICE DATA

EG213–01

VSV for EG R	Resistance (at 20°C (68°F))	30 – 50 Ω
VSV for PAIR	Resistance (at 20°C (68°F))	30 – 50 Ω

TORQUE SPECIFICATIONS

EG1FR–01

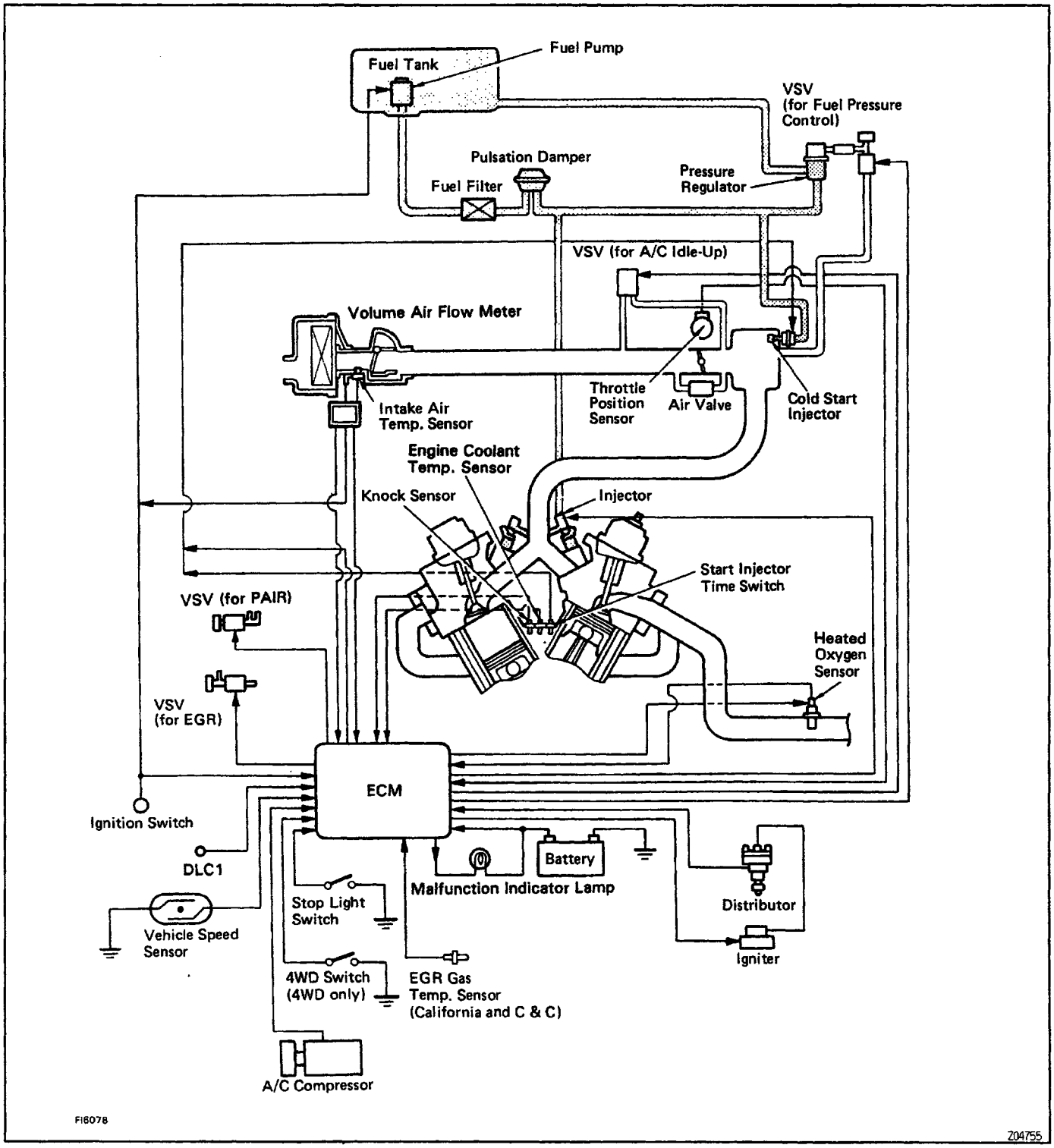
Part tightened	N·m	kgf·cm	ft·lbf
EGR valve x Air intake chamber	18	185	13
TWC x Exhaust pipe	39	400	29

MFI SYSTEM

DESCRIPTION

SYSTEM CIRCUIT

EG1F8–02



FUEL SYSTEM

An electric fuel pump supplies sufficient fuel, under a constant pressure, to the MFI injectors.
In accordance with signals from the ECM, these injectors inject the most appropriate quantity of fuel for the engine condition into the intake manifold. EG1FU–01

AIR INDUCTION SYSTEM

The air induction system provides just the right amount of air for the engine operating condition.

EG1FV–01

ELECTRONIC CONTROL SYSTEM

The 3VZ–E engine is equipped with a Toyota Computer Controlled System (TCCS) which centrally controls the MFI, ESA, Diagnosis systems, etc. by means of an Engine Control Module (ECM, formerly the MFI computer) employing a microcomputer. By means of the ECM, the TCCS controls the following functions.: EG1FW–02

1. Multiport Fuel Injection (MFI)

The ECM receives signals from various sensors indicating changing engine operating conditions such as:
Intake air volume
Intake air temperature
Engine coolant temperature
Engine speed
Acceleration/deceleration
Exhaust oxygen content etc.
These signals are utilized by the ECM to determine the injection duration necessary for an optimum air–fuel ratio.

2. Electronic Spark Advance (ESA)

The ECM is programmed with data for optimum ignition timing under all operating conditions. Using data provided by sensors which monitor various engine functions (RPM, intake air volume, engine coolant temperature, etc.), the microcomputer (ECM) triggers the spark at precisely the right instant.

3. Diagnosis Function .

When the ECM detects malfunction or abnormalities in the sensor network, it lights the mal–function indicator lamp in the combination meter. At the same time, the trouble is identified and a diagnostic trouble code is recorded by the ECM. The diagnostic trouble code can be read by the number of blinks of the malfunction indicator lamp when terminals TE1 and E1 are connected. The diagnostic trouble codes are explained on pages EG2–17S and 177.

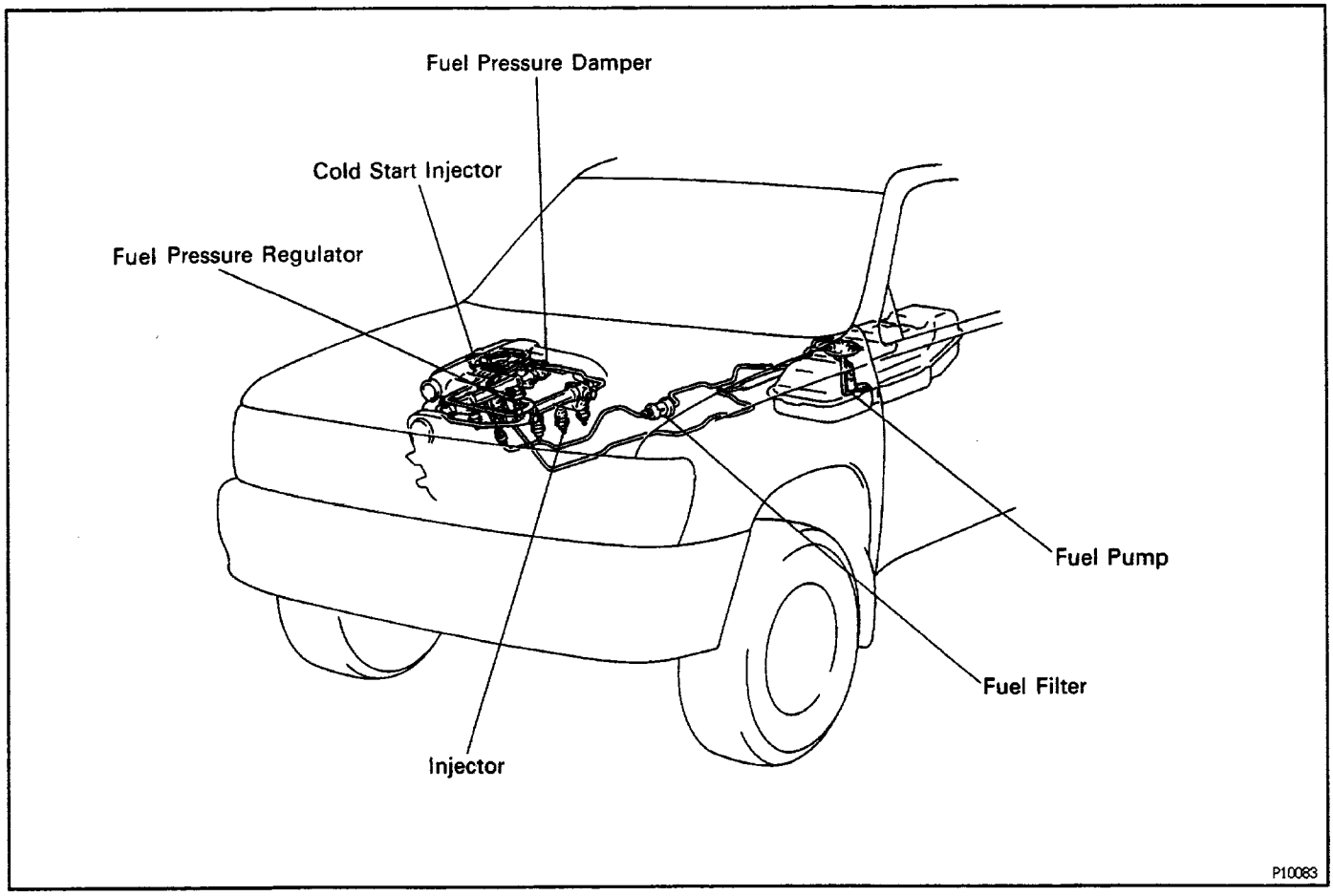
Fail–Safe Function

In the event of a sensor malfunction, a backup circuit will take over to provide minimal driveability, and the malfunction indicator lamp will light up.

OPERATION

EG1FX–02

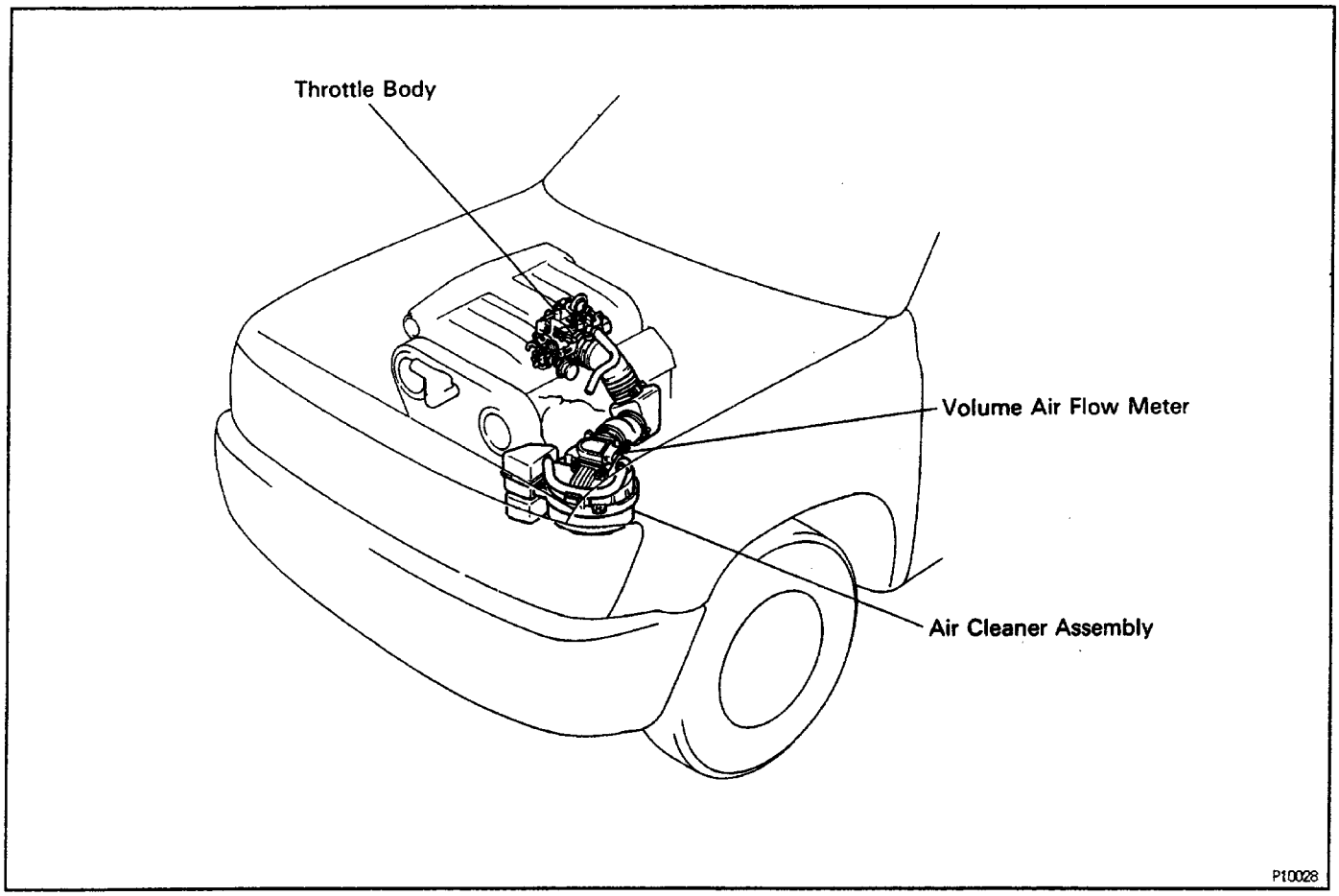
FUEL SYSTEM



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 fuel pressure regulator.
The fuel pressure regulator adjusts the pressure of the fuel from the fuel line (high pressure side) to a pressure 284 kPa (2.9 kgf/crn2, 41 psi) 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 signals from the ECM and inject fuel into the intake manifold.
When starting, the cold start injector operates when engine coolant temperature is less than 70° C, injecting fuel into the air intake chamber to improve startability.

EG1FY–02

AIR INDUCTION SYSTEM



Air filtered through the air cleaner passes through the volume 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 speed.

The volume 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.

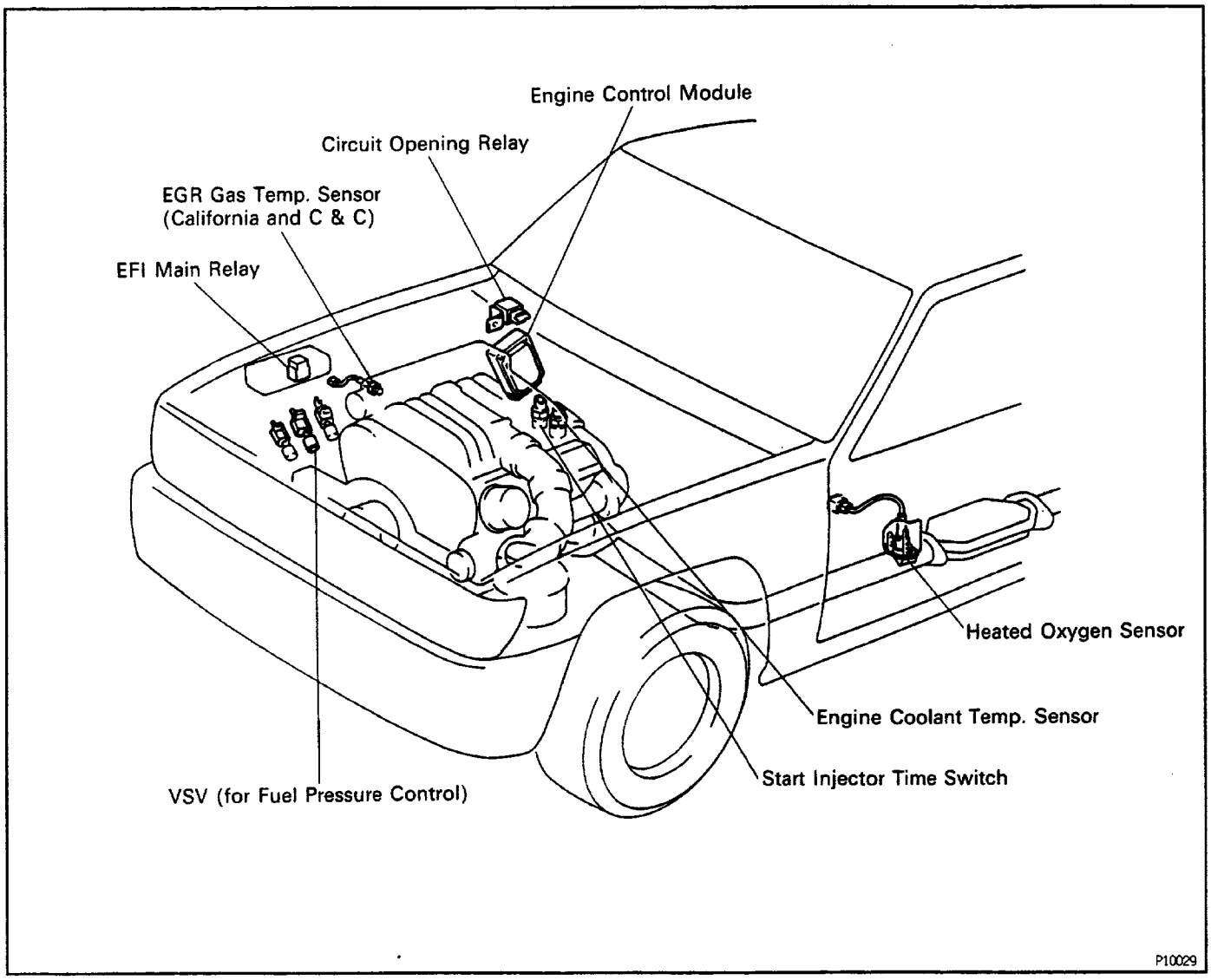
Located in the throttle body is the throttle valve, which regulates the volume of intake air to the engine. Intake air controlled by the throttle valve opening is distributed from the air intake chamber to the manifold of each cylinder and is drawn into the combustion chamber.

At low temperatures the air valve opens and the air flows through the air valve and the throttle body, into the air intake chamber. During engine warning 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 volume air flow meter and increases the accuracy of the measurement of the intake air volume. It also prevents intake air interference in each cylinder.

EG1FZ–02

ELECTRONIC CONTROL SYSTEM

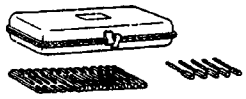
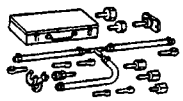
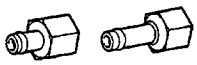
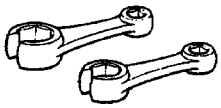


The control system consists of sensors which detect various engine conditions, and an ECM which determines the injection volume (timing) based on the signals from the sensors.
The various sensors detect the intake air volume, engine speed, oxygen density in the exhaust gas, engine coolant temperature, intake air temperature and atmospheric pressure etc. and convert the information into an electrical signal which is sent to the ECM. Based on these signals, the ECM calculates the optimum ignition timing for the current conditions and operates the injectors.
The ECM not only controls the fuel injection timing, but also the self diagnostic function which records the occurrence of a malfunction, ignition timing control, idle speed control, fuel pressure control and fuel pump control.

PREPARATION

EG1G0–02

SST (SPECIAL SERVICE TOOLS)

	09240–00020 Wire Gauge set	Throttle body
	09268–41045 Injection Measuring Tool Set	
	(09268–52010) Injection Measuring Attachment	
	09268–45012 EFi Fuel Pressure Gauge	
	09631 –22020 Power Steering Hose Nut 14 x 17 mm Wrench Set	Fuel line flare nut
	09842–30050 Wire 'A' EFI Inspection	
	09842–30070 Wiring "F" EFI Inspection	
	09843–18020 Diagnosis Check Wire	

EG1G1–01

RECOMMENDED TOOLS

	09082–00015 TOYOTA Electrical Tester	
	09200–00010 Engine Adjust Kit	
	09258–00030 Hose Plug Set	Plug for the vacuum hose, fuel hose etc.

E01G2-02

EQUIPMENT

Graduated cylinder	Injector
Carburetor cleaner	Throttle body
Tachometer	
Soft brush	Throttle body

PRECAUTIONS

1. Before working on the fuel system, disconnect the negative terminal from the battery.

HINT: Any diagnostic trouble 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.

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

3. Keep gasoline away from rubber or leather parts.

EG1G4–03

MAINTENANCE PRECAUTIONS

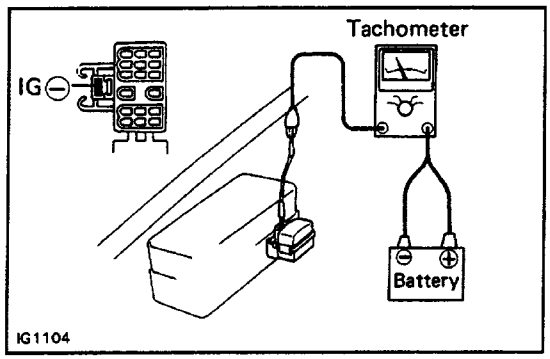
1. CHECK CORRECT ENGINE TUNE–UP

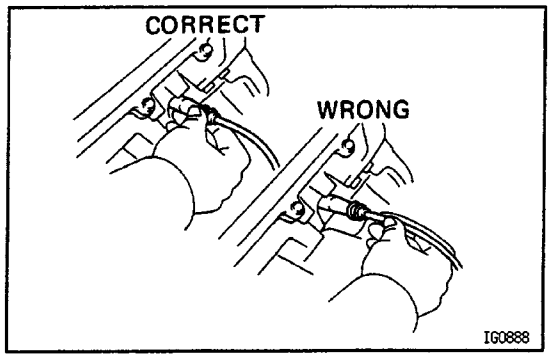
(See page EG2–12)

2. PRECAUTIONS WHEN CONNECTING GAUGE

(a) Connect the tachometer positive terminal to the IG E) terminal of the DLC1.

(b) Use the battery as the power source for the timing light, tachometer, etc.





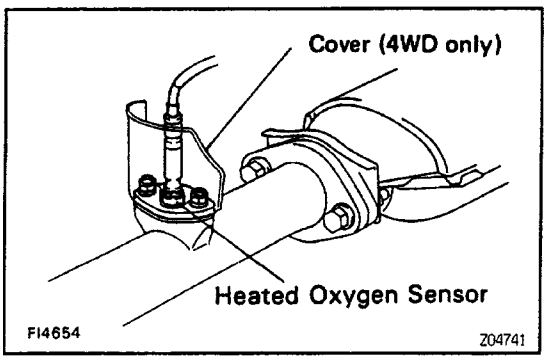
3. IN EVENT OF ENGINE MISFIRE, THE FOLLOWING PRECAUTIONS SHOULD BE TAKEN

(a) Check proper connection of battery terminals, etc.

(b) Handle high–tension cords carefully.

(c) After repair work, check that the ignition coil termi–nals and all other ignition system lines are reconne–cted securely.

(d) When clearing the engine compartment, be especially careful to protect the electrical system from water.



4. PRECAUTIONS WHEN HANDLING HEATED OXYGEN SENSOR

(a) Do not allow the heated oxygen sensor to drop or hit against an object.

(b) Do not allow the sensor come into contact with water.

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

The ECM has been designed so that it will not be affected by outside interference.
However, if your vehicle is equipped with a amateur radio transceiver, etc. (even one with approx. 10 W output), it may, at times, have an effect upon ECM operation, especially if the antenna and feeder are installed nearby.
Therefore, observe the following precautions:

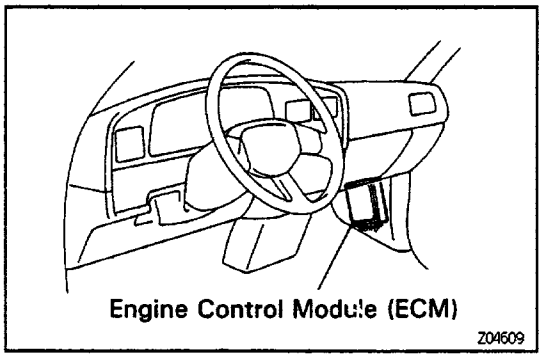
(a) Install the antenna as far away as possible from the ECM. The ECM is located in the right side kick panel so the antenna should be installed at the rear, left side of the vehicle.
If installing on the bumper, do so on the right side, if possible.

(b) Keep the antenna feeder as far away as possible from the ECM wires – at least 20 cm (7.87 in.) – and, especially, do not wind them together.

(c) Check that the feeder and antenna are properly adj–usted.

(d) Do not equip your vehicle with a powerful mobile radio system.

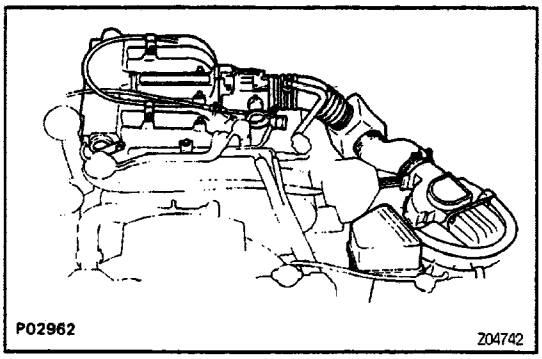
(e) Do not open the cover or the case of the ECM unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)


Engine Control Module (ECM)
Z04609

EG1G6–03

AIR INDUCTION SYSTEM

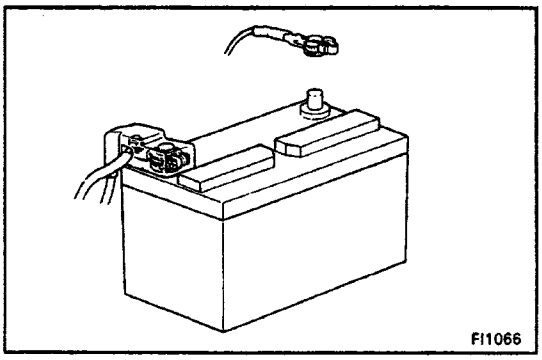
1. Separation of the engine oil dipstick, oil filler cap, PCV hose, etc. may cause the engine to run out of tune.
2. Disconnection, looseness or cracks in the parts of the air induction system between the volume air flow meter and cylinder head will cause air suction and cause bad engine tuning.


P02962
Z04742

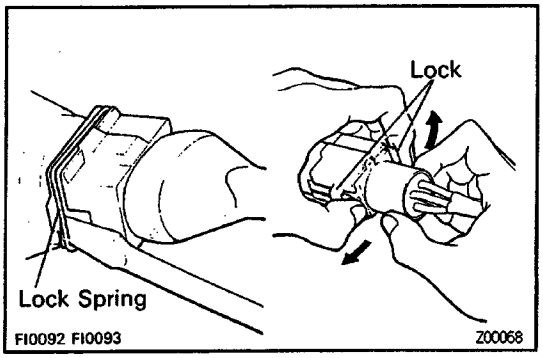
EG1G7–03

ELECTRONIC CONTROL SYSTEM

1. Before removing MFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch OFF or disconnecting the battery ter–minals.
2. When installing a battery, be especially careful not to incorrectly connect the positive and negative cables.

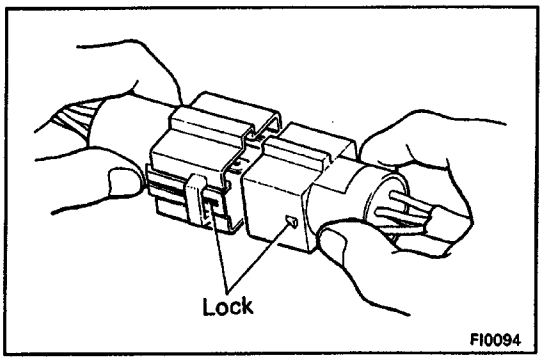

FI1066

3. Do not permit parts to receive a severe impact during removal or installation. Handle all MFI parts carefully, especially the ECM.
4. Take great care during troubleshooting as there are numerous transistor circuits and even slight terminal contact can cause further troubles.
5. Do not open the ECM 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 MFI parts and wiring connectors.
7. Parts should be replaced as an assembly.

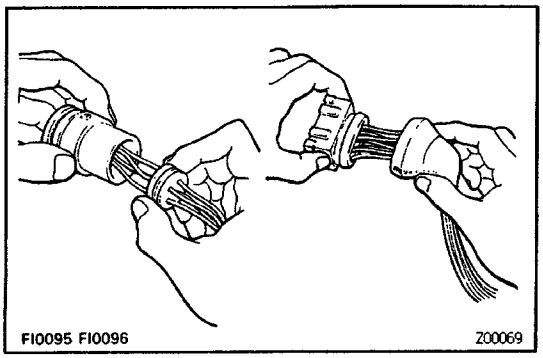


8. Care is required when pulling out the inserting wiring connectors.

(a) To pull the connector out, release the lock and pull on the connector.

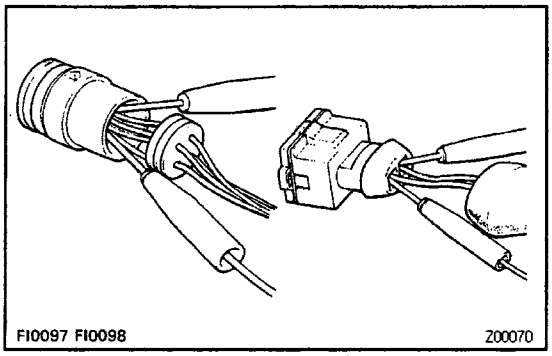


(b) Fully insert the connector and check that it is locked:

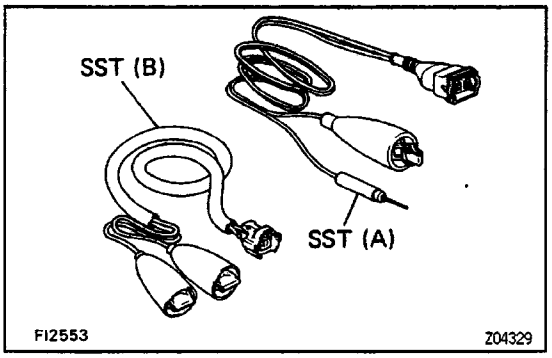


9. When inspecting a connector with a volt/ohmmeter.

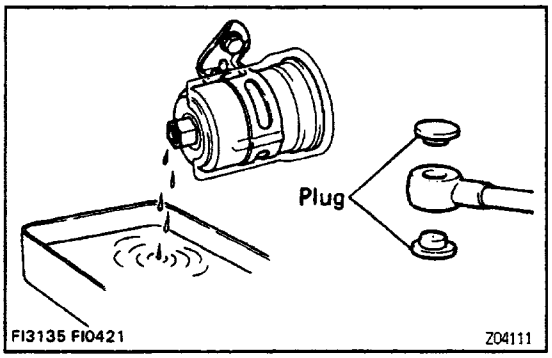
(a) Carefully take out the water–proofing rubber if it is a water–proof type connector.



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



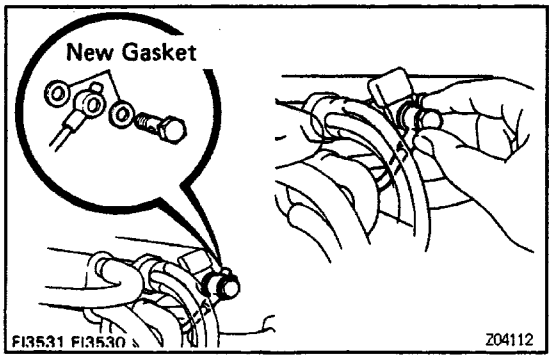
10. Use SST for inspection or testing of the injector, cold start injector or their wiring connectors.
SST 09842–30050 (A)
09842–30070 (B)

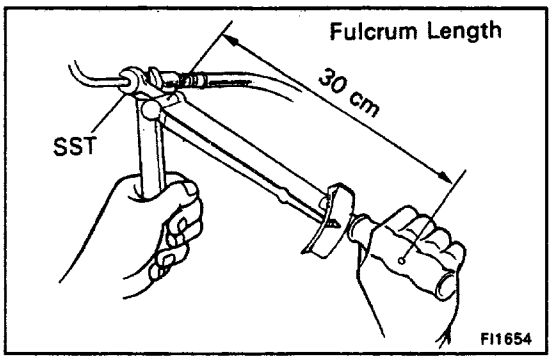


EG1TA–02

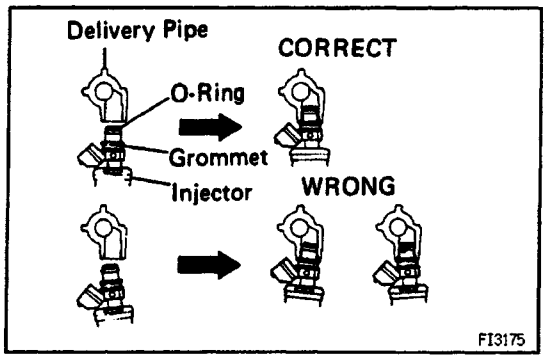
FUEL SYSTEM

1. When disconnecting the connection of the high fuel pressure line, a large amount of gasoline may come out so observe the following procedure:
(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 pro–cedure:
(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: 15 N–m(150 kgf–cm, 11 ft–lbf)

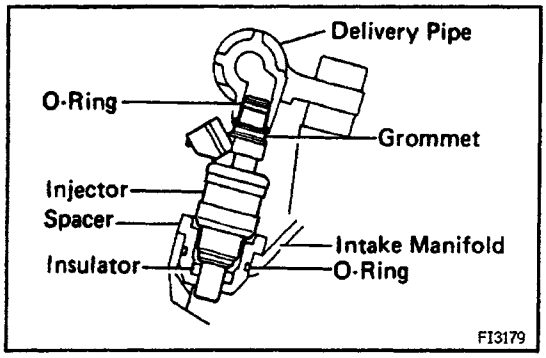




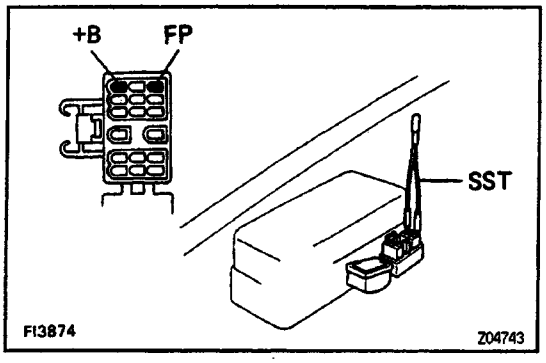
(Flare nut type)
(a) Apply a light coat of engine oil to the flare and tighten the flare nut by hand.
(b) Then using SST, tighten the flare nut to the specified torque.
SST 09631– 22020
Torque: 27 N–m (280 kgf–cm, 20 ft–lbf)
HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.)



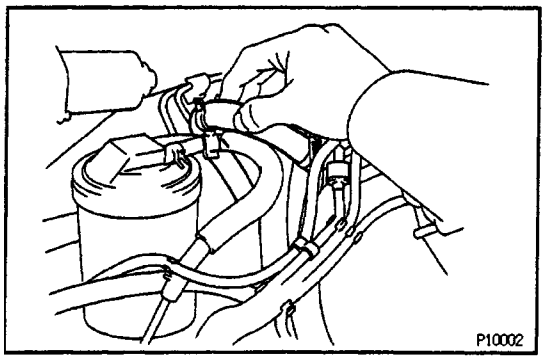
3. Observe the following precautions when removing and installing the injectors.
(a) Never reuse the O–ring.
(b) When placing a new O–ring on the injector, take care not to damage it in any way.
(c) Lubricate the new 0–ring with spindle oil or gasoline before installing – never use engine, gear or brake oil.



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



5. Confirm that there are no fuel leaks after performing any maintenance on the fuel system
(a) With engine stopped, turn the ignition switch ON.
(b) Using SST, connect terminals FP and +B of the DLC 1.
SST 09843–18020



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

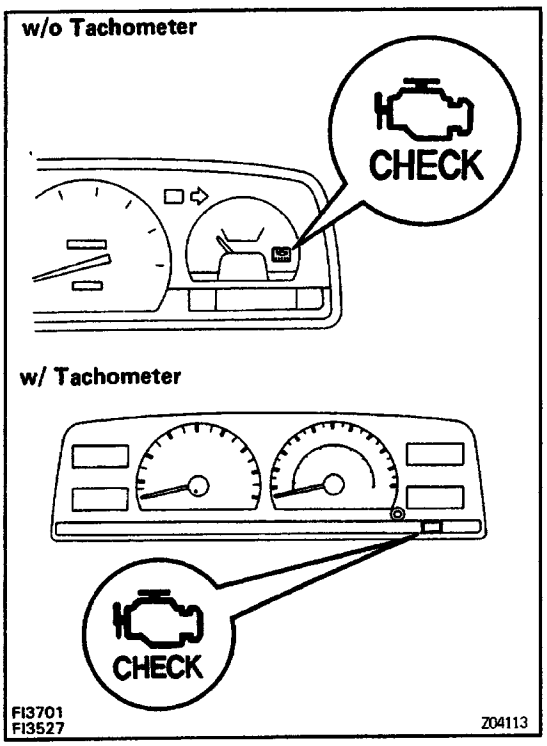
(d) Turn the ignition switch OFF.
(e) Remove SST
SST 09843–18020

DIAGNOSIS SYSTEM

EG1G9–03

DESCRIPTION

The ECM contains a built–in self diagnosis system by which troubles with the engine signal network are detected and a malfunction indicator lamp on the combination meter lights up.
By analyzing various signals as shown in the later table (See pages EG2–176 and 177) the ECM detects system malfunctions relating to the sensors of actuator.The self–diagnosis system has two modes, a normal mode and a test mode.
If a malfunction is detected when in the normal mode, the ECM lights up the malfunction indicator lamp to inform the driver of the occurrence of a malfunction. (For some codes the light does not come on.) The light goes off automatically when the malfunction has been repaired. But the diagnostic trouble code(s) remains stored in the ECM memory (except for code Nos. 43, 51 and 53). The ECM stores the code(s) until it is cleared by removing the EFI fuse with the ignition switch off.
The diagnostic trouble code(s) can be read by the number of blinks of the malfunction indicator lamp when TE1 and E1 terminals on the DLC1 are connected. When 2 or more codes are indicated, the lowest number (code) will appear first.
If a malfunction is detected when in the test mode, the ECM lights up the malfunction indicator lamp to inform the technician of the occurrence of a malfunction (except for code Nos. 42, 43 and 51). In this case, TE2 and E1 terminals on the DLC1 should be connected as shown later. (See page EG2–173)
In the test mode, even if the malfunction is corrected, the malfunction code is stored in the ECM memory even when the ignition switch is off (except code Nos. 42, 43, 51 and 53). This also applies in the normal mode. The diagnostic mode (normal or test) and the output of the malfunction indicator lamp can be selected by connecting the TE 1, TE2 and E 1 terminals on the DLC1, as shown later.
A test mode function has been added to the functions of the self –diagnosis system of the normal mode for the purpose of detecting malfunctions such as poor contacts, which are difficult to detect in the normal mode. This function fills up the self diagnosis system. The test mode can be implemented if technicians follow the procedure described later.
(See page EG2–173).



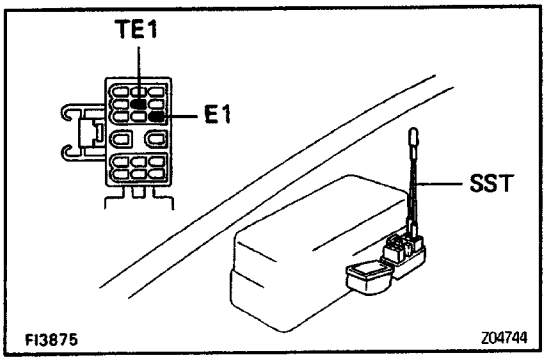
MALFUNCTION INDICATOR LAMP CHECK

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

DIAGNOSTIC TROUBLE CODES OUTPUT (Normal mode)

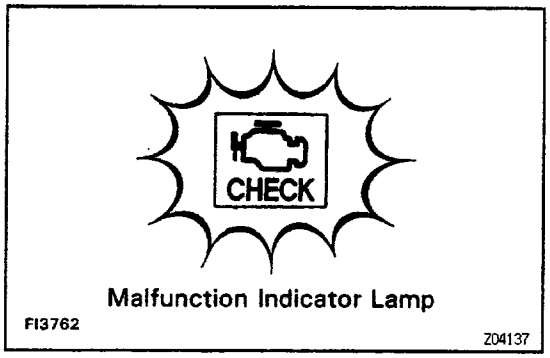
To obtain an output of diagnostic trouble codes, proceed as follows:

1. Initial conditions
(a) Battery voltage above 11 volts or more.
(b) Throttle valve fully closed (throttle position sensor IDL points closed).
(c) Transmission in neutral position.
(d) Accessories switched OFF.
(e) Engine at normal operating temperature.
2. Turn the ignition switch ON. Do not start the engine.

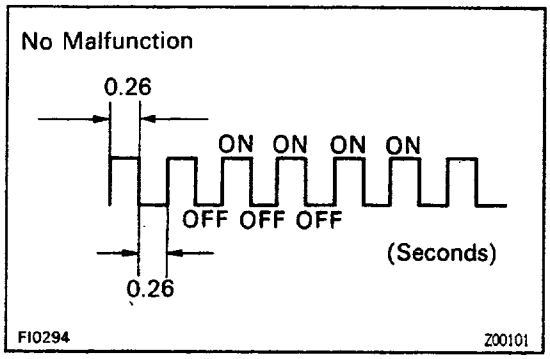


3. Using SST, connect terminals TE1 and E1 of the DLC 1.
   SST 09843–18020

HINT: The DLC1 is located near the No.2 relay block.

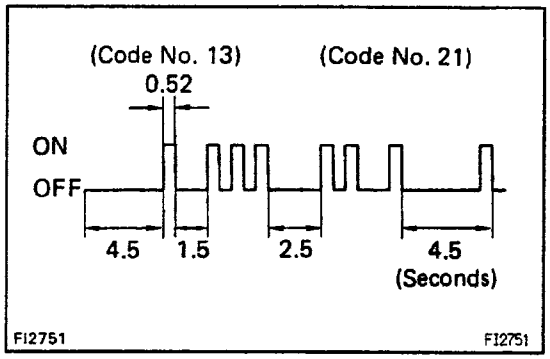


4. Read the diagnostic trouble code as indicated by the number of flashes of the malfunction indicator lamp. Diagnostic trouble code (See pages EG2–176 and 177)



(a) Normal System Operation (no malfunction)

- The light will alternately blink ON and OFF at 0.26 seconds intervals.



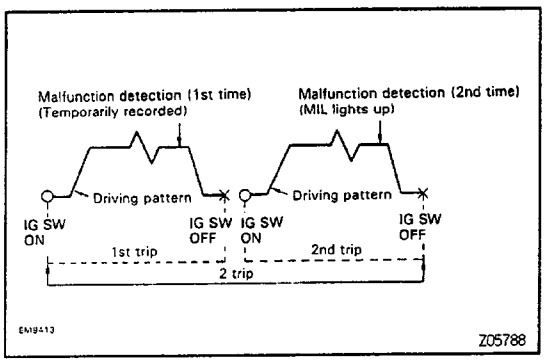
(b) Malfunction Code Indication

- The light will blink a number of times equal to the malfunction code with pauses as follows:

1. Between the first digit and second digit, 1.5 seconds.
2. Between code and code 2.5 seconds.
3. Between all malfunction codes 4.5 seconds.

The diagnostic trouble code series will be repeated as long as the DLC1 terminals TE1 and E1 are connected.

HINT: In the event of a number of trouble codes, indication will begin from the smallest value and continue to the largest in order.



(c) (2 trip detection logic)

The diagnostic trouble codes 21, 25, 26 and 71 are used ”2 trip detection logic” is used. With this logic, when a logic malfunction is first detected, the mal–function is temporarily stored in the ECM memory. If the same case is detected again during the second drive test, this second detection causes the malfunc–tion indicator lamp to light up.

The 2 trip repeats the same mode a 2nd time. (However, the IG SW must be turned OFF between the 1 st time and 2nd time).

5. After the diagnosis check, remove SST.

SST 09843–18020

(Test mode)

HINT:

- Compared to the normal mode, the test mode has high sensing ability to detect malfunctions.
- It can also detect malfunctions in the starter signal circuit, air conditioning signal and park/ neutral position switch signal.
- Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in test mode.

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

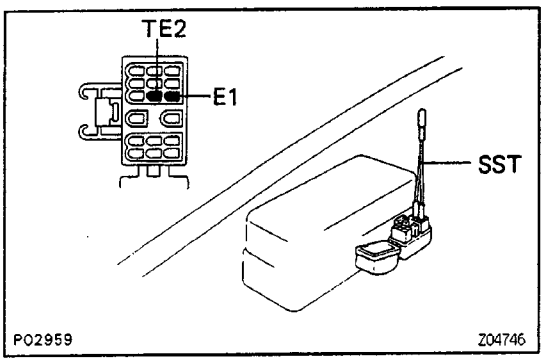
1. Initial conditions

(a) Battery voltage 11 volts or more

(b) Transmission in neutral position

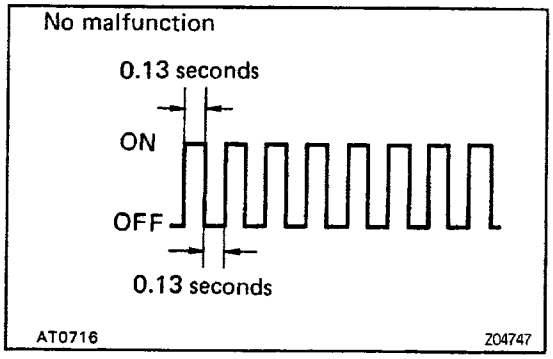
(c) Accessories switched OFF

(d) Engine at normal operating temperature



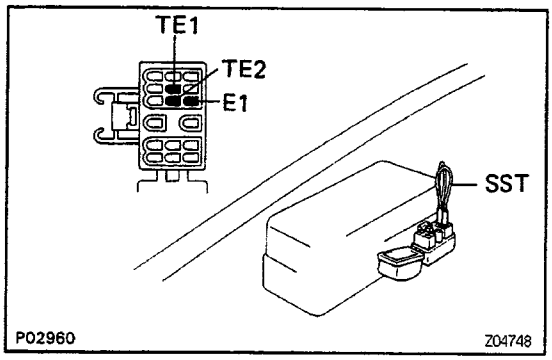
2. First using SST, connect terminals TE2 and El of the DLC1, then turn the ignition switch on to begin the diagnosis in the test mode. :

SST 09843 –18020



HINT: To confirm that the test mode is operating, check that the malfunction indicator lamp flashes when the ignition switch is turned ON.

3. Start the engine and drive the vehicle at a speed of 10 km/h or higher.
4. Simulate the conditions of the malfunction described by the customer.

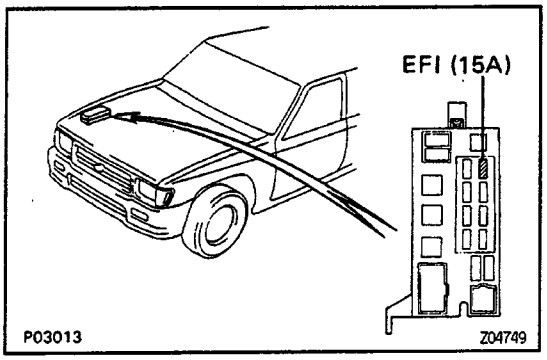


5. Connect terminals TE1 and E1 of the DLC1.
   SST 09843–18020

6. Read the diagnostic trouble code as indicated by the number of flashes of the malfunction indicator lamp. (See pages EG2–176 and 177)
7. After the diagnosis check, remove SST.
   SST 09843–18020

HINT:

- The test mode will not start if terminals TE2 and Ell are connected after the ignition switch is turned on.
- The starter signal and vehicle speed signal will be diagnosed by the ECM as malfunctions, and code Nos. 42 and 43 will be output, if the operation in step 3 is not performed.
- When the automatic transmission shift lever is in the ”D”, ”2”, ”L” or ”R” shift position, or when the air conditioning is on or when the accelerator pedal is depressed, code ”51 ” (Switch condition signal) is output, but this is not abnormal.



EG1GC–03

DIAGNOSTIC TROUBLE CODE CANCELLATION

1. After repairing the trouble, the diagnostic trouble code retained in memory by the ECM must be can–celed out by removing the EFI fuse (15A) for 30 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 (radio ETR, clock etc.) will also be canceled out.
- If the diagnostic trouble code is not canceled out, it will be retained by the ECM 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 trouble code has been recorded.

2. After cancellation, perform road test of the vehicle to check that a normal code is now read on the mal–function indicator lamp.
If the same diagnostic trouble code appears, it indi–cates that the trouble area has not been repaired thoroughly.

EG1GD–03

DIAGNOSIS INDICATION

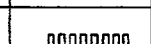
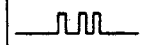
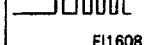
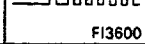
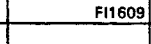
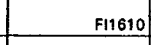
1. When 2 or more codes are indicated, the lowest number (code) will appear first.
2. All detected diagnostic trouble codes, except for code No.51 and No.53 will be retained in memory by the ECM from the time of detection until canceled out.
3. Once the malfunction is cleared, the malfunction in–dicator lamp on the combination meter will go oft but the diagnostic trouble code(s) remain stored in ECM memory (except for code Nos.16, 43. 51 and 53).

DIAGNOSTIC TROUBLE CODES

EG1TC–01

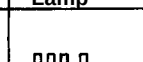
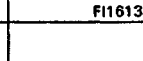
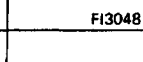
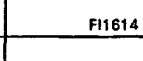
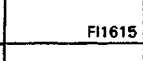
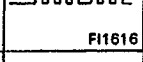
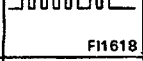
HINT:

- If a malfunction is detected during the diagnostic trouble code check, refer to the circuit indicated in the table, and turn to the corresponding page.
- Your readings may vary from the parameters listed in the table, depending on the instruments used.

Code No.	Number of blinks Malfunction Indicator Lamp	System	*1 Mal–function Indicator Lamp		Diagnosis	Trouble Area	*2 Memory	See Page
			Normal Mode	Test Mode				
–	 FI1401	Normal	–	–	Output when no other code is recorded.		–	–
12	 FI1606	RPM Signal	ON	N.A.	No G or NE signal –is input to the ECM for 2 secs. or more after STA turns 4N.	• Open or short in NE, G circuit • Distributor • Open or short in STA circuit • ECM	○	EG2–193
13	 FI1607	RPM Signal	ON	ON	NE signal is not input to ECM for 0.1 sec. or more when engine speed is 1,000 rpm or more.	• Open or short in NE circuit • Distributor • ECM	○	IG–1 6
14	 FI1608	Ignition Signal	ON	N.A.	IGF signal from igniter is not input to ECM for 6 consecutive ignition.	• Open or short in IGF or IGT circuit from igniter to ECM • Igniter • ECM	○	EG2–195
16	 FI3600	A/T Control Signal	ON	N.A.	Normal signal is not output from ECM CPU.	• ECM	X	–
21	 FI1609	Heated Oxygen Sensor Signal	ON	N.A.	(1) Open or short in heater circuit of heated 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 heated oxygen sensor signal (OX) is reduced to between 0.35 – 0.70 V continuously for 60 secs. or more. *6 (2 trip detection logic) (2)	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater • ECM	○	EG2–199
				*7 ON		• Open or short in heated oxygen sensor circuit • Heated oxygen sensor • ECM		
22	 FI1610	Engine Coolant Temp. Sensor Signal	ON	ON	Open or short in engine coolant temp. sensor circuit for 0.5 sec. or more. (THW)	• . Open or short in engine coolant temp. sensor circuit • Engine coolant temp. sensor • ECM	○	EG2–192
24	 FI1611	Intake Air Temp. Sensor Signal	*3 ON	ON	Open or short in intake air temp. sensor circuit for 0.5 sec. or more. (THA)	• Open or short in intake air temp. circuit . Intake air temp. sensor • ECM	○	EG2–190
25	 FI2562	Air–Fuel Ratio Lean Mal–function	ON	ON	(1) Heated oxygen sensor output is less than 0.45 V for at least 90 sacs. when heated oxygen sensor is warmed up (racing at 2.000 rpm) and drive at 50 – 100 km/h *4 (2) When the engine speed varies by more than15 rpm over the preceding crankshaft position period during a period of 50 seconds during idling with the engine coolant temp. 75°C (167°F) or more. *6 (2 trip detection logic) (1) and (2)	• Engine ground bolt loose • Open in E1 circuit • Open in injector circuit • Fuel line pressure (Injector blockage, etc.) • Open or short in heated oxygen sensor circuit • Heated oxygen sensor • Ignition system • Engine coolant temp. sensor • Volume air flow meter (Air intake) • ECM	○	EG2–197 EG2–199
26	 FI2563	Air– Fuel Ratio Rich Mal–function	ON	ON		• 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 heated oxygen sensor circuit • Heated oxygen sensor • Engine coolant temp. sensor • Volume air flow meter • Compression pressure • ECM	○	

V02183

DIAGNOSTIC TROUBLE CODES (Cont'd)

Code No.	Number of blinks Malfunction Indicator Lamp	System	*1 Mal–function Indicator Lamp		Diagnosis	Trouble Area	*2 Memory	See Page
			Normal Mode	Test Mode				
31	 FI1612	Volume Air Flow Meter Signal	ON	ON	At idling, open or short detected continuously for 0.5 sec. or more in volume air flow meter circuit. • Open – VC • Short – VC – E2	• open or short in volume air flow meter circuit • Volume air flow meter • ECM	O	EG2–190
32	 FI1613	Volume Air Flow Meter Signal	ON	ON	Open or short detected continuously for 0.5 sec: or more in volume air flow meter circuit. • Open – E2 • short – VS – VC		O	EG2–190
35	 FI3048	6ARO Sensor Signal (only C&C)	ON	ON	Open or short detected in BARO sensor circuit for 0.5 sec. or more.	• ECM	O	–
41	 FI1614	Throttle Position Sensor Signal	*3 ON	ON	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 posi-tionsensor circuit • Throttle position sensor • ECM	O	EG2–188
42	 FI1615	Vehicle Speed Sensor Signal	ON	OFF	SPD signal is not input to the ECM for at least 8 seconds during high load driving with engine speed between 2,750 rpm and 4,000 rpm.	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECM	O	–
43	 FI1616	Starter Signal	N.A.	OFF	Starter signal (STA) is not input to ECM even once until engine reaches 800 rpm or more when cranking.	• Open or short in starter signal circuit • Open or short in IG SW or main relay circuit • ECM	X	EG2–193
52	 FI1618	Knock Sensor Signal	ON	N.A.	With engine speed between 1,600 rpm – 5,200 rpm, signal from knock sensor is not input to ECM for 6 revolution. (KNK)	• Open or short in knock sensor circuit • Knock sensor (looseness, etc.) • ECM	O	–
53	 FI1619	Knock Control signal	ON	N.A.	Engine speed is between 650 rpm and 5,200 rpm and engine control module (for knock control) malfunction is detected.	• ECM	X	–
*5 71	 FI2622	EGR System Mal–function	ON	ON	With the engine coolant temp. at 60°C (140°F) or more, 240 seconds from start of EGR operation. The EGR gas temp. is less than 55°C (131°F) and the EGR gas temp. has risen less than 20°C (36°C) during the 240 seconds. *6 (2 trip detection logic)	• Open in EGR gas temp. sen-sor circuit • Open in VSV circuit for EG R • EGR vacuum hose discon-nected, valve stuck • Clogged in EGR gas passage • ECM	O	EG2–251
51	 FI1617	Switch Condition Signal	N.A.	OFF	Displayed when A/C is ON, IDL contact OFF or shift position in "R", "D", "2", or "L" positions with the DLC1 terminals E1 and TE1 connected	• A/C switch circuit • Throttle position sensor 1 D L cir-cuit • Park/Neutral position switch circuit • Accelerator pedal, cable • ECM	X	EG2–188

REMARKS
*1: "ON' displayed in the diagnosis mode column indicates that the malfunction indicator lamp 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. "N.A." indicates that the item is not included in malfunction
diagnosis.
*2: "O" in the memory column indicates that a diagnostic trouble code is recorded in the ECM memory when a malfunction occurs. "X" indicates that a diagnostic
trouble code is not recorded in the ECM memory even if a malfunction occurs. Accordingly, output of diagnostic results is performed with the IG SW ON.
*3: The malfunction indicator lamp comes on if malfunction occurs only for California specifications,
*4: No. (2) in the diagnostic contents of codes No.25 and 26 apply to California and C&C specification vehicles only, while (1) applies to all models.
*5: Code 71 is used only for California specifications and C&C.
*6: "2 trip detection logic" (See page EG2–173.)
*7: Except for California 2WD.

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN

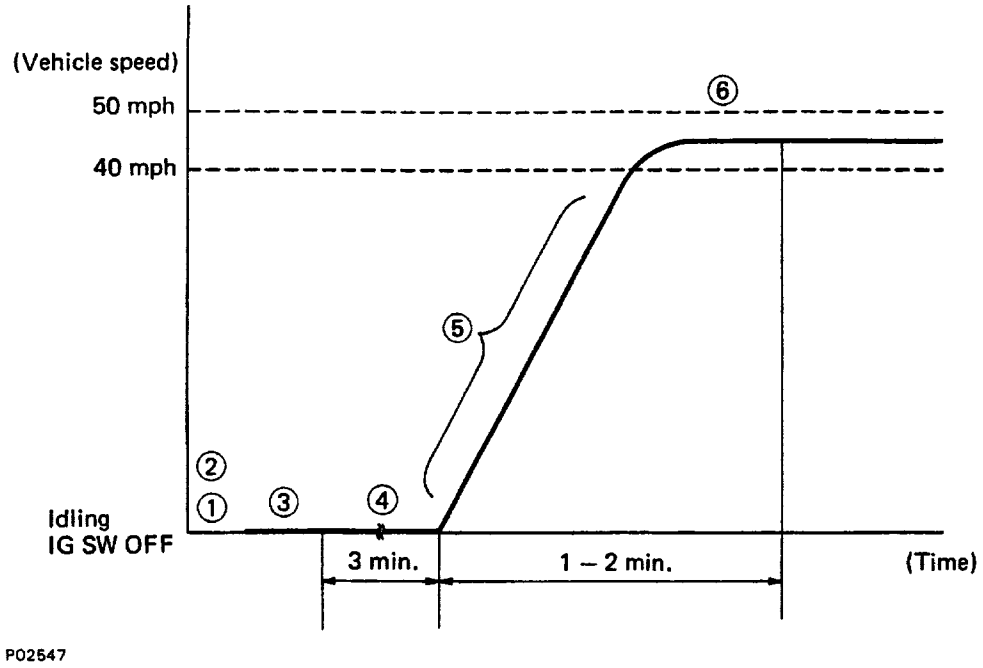
Purpose of the driving pattern.

(a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.

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

DTC 12 Heated Oxygen Sensor Circuit

Malfunction: Heated Oxygen Sensor Deterioration



(1) Disconnect the fuse EFI (1 5 A) for 10 sec. or more, with iG switch OFF.

(2) Initiate test mode (Connect terminal TE2 and E 1 of DLC 1) with IG switch OFF.

(3) Start the engine and warm the engine up with all ACC switch OFF. .

(4) After the engine is warmed up, let it idle for 3 min.

(5)Accelerate gradually and maintain at approximately 1, 500 rpm, or within the 1, 300 to 1,700 rpm range. Turn the A/C on, and drive in ”D” for AIT, or in case of M/T, upshift appropri– ately shift carefully so that the engine speed would not fall below 1,200 rpm. depress the accelerator pedal gradually and maintain a steady speed to avoid engine braking.

(6) Maintain the vehicle speed at 40 – 50 mph.

Keep the vehicle running for 1 – 2 min. after starting acceleration.

HINT: If a malfunction is detected the malfunction indication lamp will light up during step(6) .

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

V02216

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

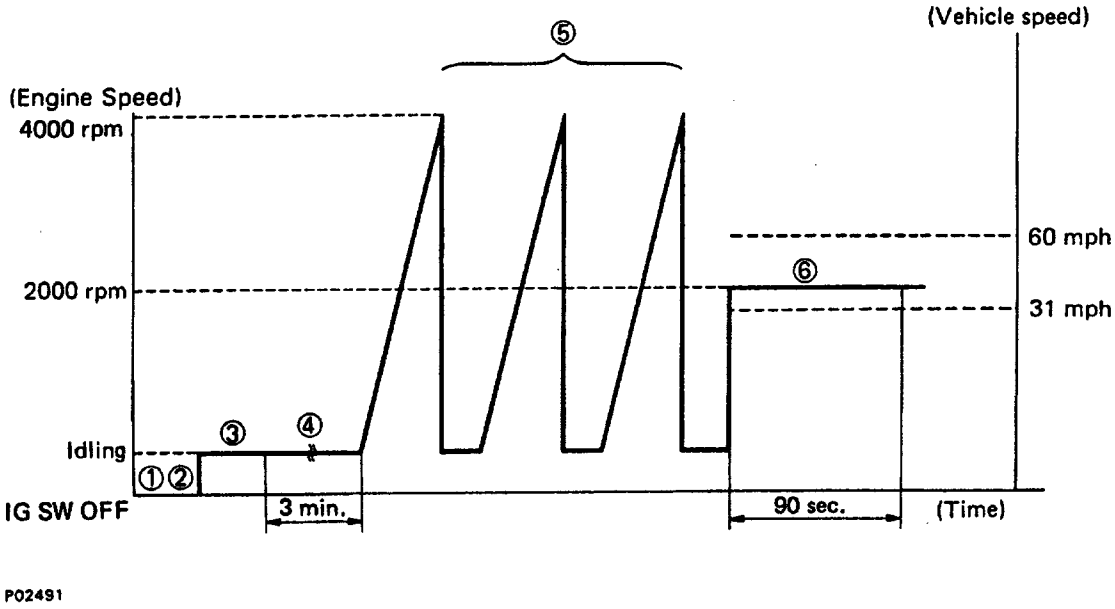
Purpose of the driving pattern.

(a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.

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

DTC	25	Air–Fuel Ratio Lean Malfunction
	26	Air–Fuel Ratio Lean Malfunction

Malfunction: Open or Short in Heated Oxygen Sensor.



(1) Disconnect the fuse EEI (1 5 A) for 10 sec. or more, with iG switch OFF.

(2) Initiate test mode (Connect terminal TE2 and E1 of DLC 1) with IG switch OFF.

(3) Start the engine and warm the engine up, with all ACC switch OFF.

(4) After the engine is warmed up, !et it idle for 3 min.

(5) After perform idling in @, perform sudden racing to 4,000 rpm three times.

(6) After perform sudden racing in @, perform driving at 31 – 60 mph (Engine speed 2,000 rpm) for 90 sec.

HINT: If a malfunction is detected the malfunction indication lamp will light up during step (6)

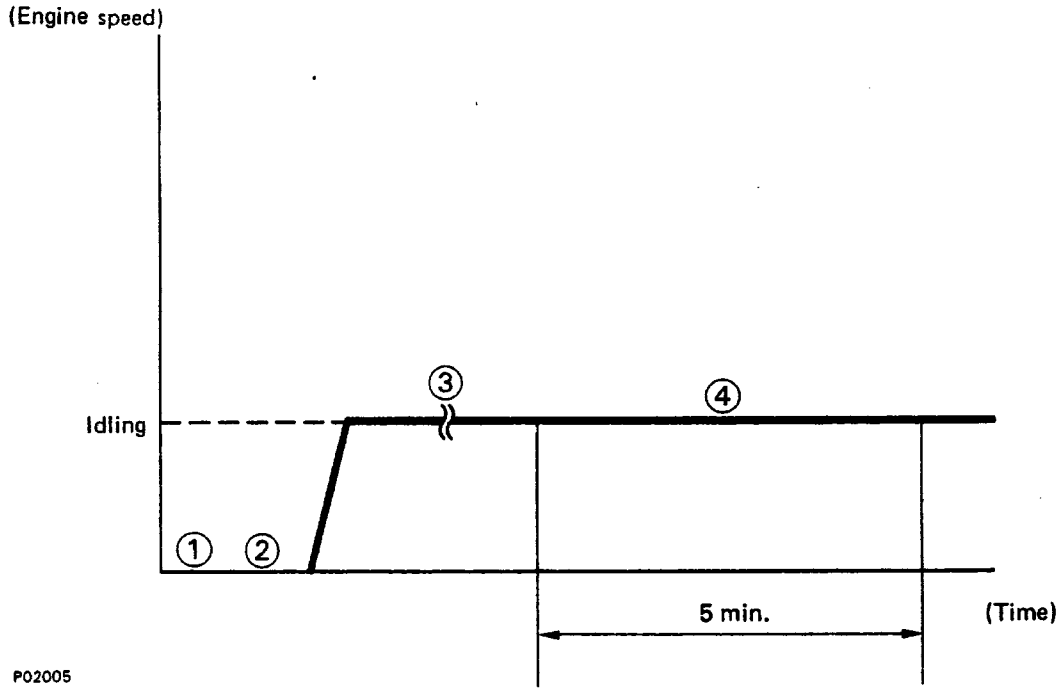
NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

Purpose of the driving pattern.
(a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.
(b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

DTC	25	Air–Fuel Ratio Lean Malfunction(CALIFORNIA,C&C)
	26	Air–Fuel Ratio Rich Malfunction(CALIFORNIA,C&C)

Malfunction: Open or Short in Injector Leak, Blockage



HINT: When start this test, engine coolant temp. is 40°C (104°F) or less.
Before this test, check the feedback voltage for heated oxygen sensor.
(1) Disconnect the fuse EFI (15 A) for 10 sec. or more, with IG switch OFF.
(2) Initiate test mode (Connect terminal TE2 and Ell of DLC 1) with IG switch OFF.
(3) Start the engine and warm the engine up, with all ACC switch OFF.
(4) After the engine is warmed up, let it idle for 5 min. '
HINT: If a malfunction is detected the malfunction indicator lamp will light up during step(4).

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

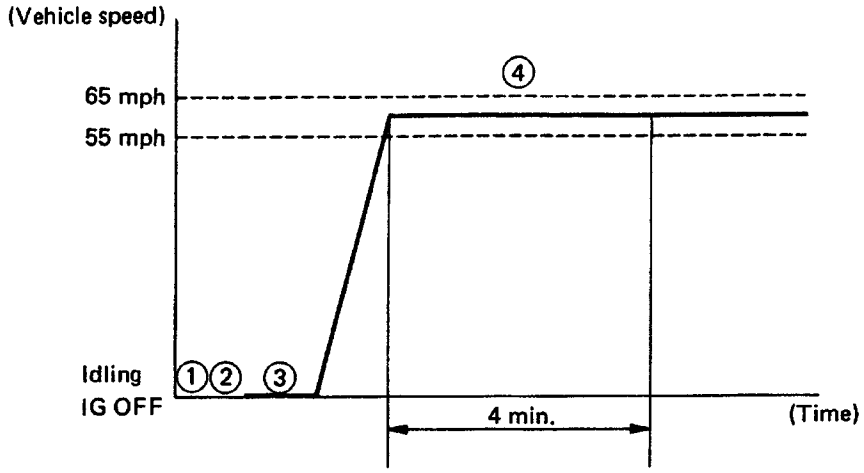
Purpose of the driving pattern.

(a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.

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

DTC	71	EGR System Malfunction

Malfunction: Short in VSV Circuit for EGR, Loose EGR Hose– Valve Stuck



P02545

HINT: When start this test, engine coolant temp. is 40°C (104°F) or less.

(1) Disconnect the fuse EFI (15 A) for 10 sec. or more, with IG switch OFF.

(2) Initiate test mode (Connect terminal TE2 and E 1 of DLC 1) with IG switch OFF.

(3) Start the engine and warm the engine up with all ACC switch OFF.

(4) With the transmission in 4th gear ("D" position and 0I¿ ON for A/T), drive 55 – 65 mph for 4 min.

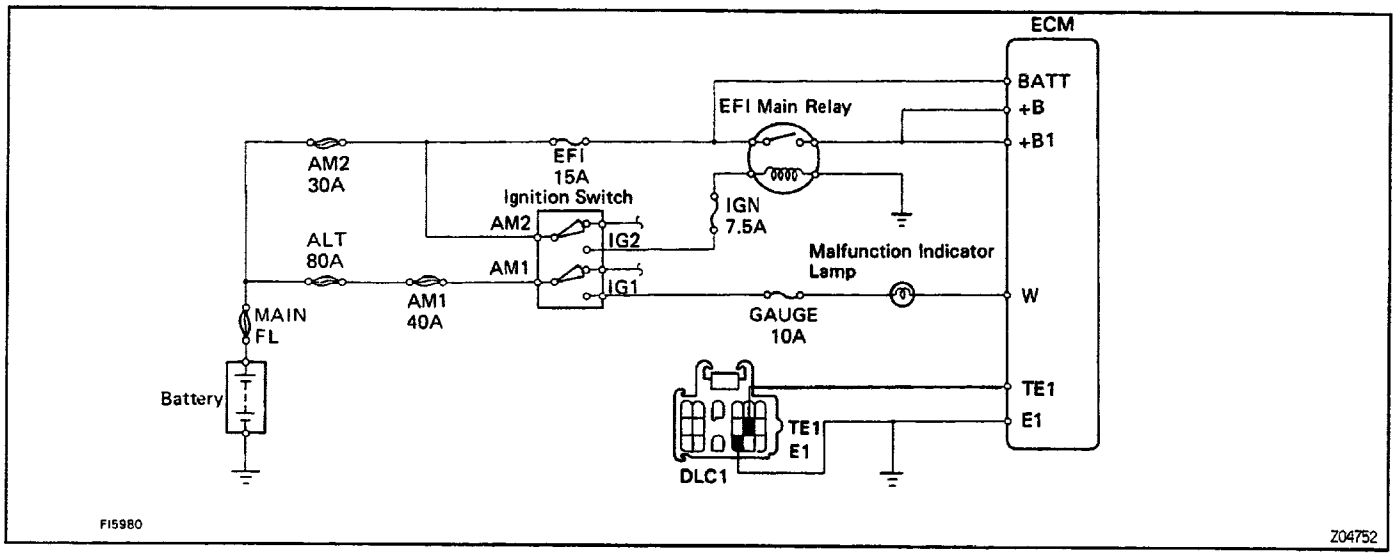
HINT: 1f a malfunction is detected the malfunction indication lamp will light up during step (4) .

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

V01709

DIAGNOSIS CIRCUIT INSPECTION

EG1GF–03



1. Does malfunction, indicator lamp come on when ignition switch is at ON?
   - YES → System Normal
   - NO → Does malfunction indicator lamp come on when ECM terminal W is grounded to the body?
     - YES → Check wiring between ECM terminal E1 and body ground.
       - OK → Try another ECM.
       - BAD → Repair or replace.
     - NO → Check bulb, fuse and wiring between ECM and ignition switch.
       - BAD → Repair or replace.

2. Does malfunction indicator lamp go off when the engine is started?
   - YES → System Normal
   - NO → Check wiring between ECM and malfunction Indicator lamp.
     - BAD → Repair.
     - OK → Is there diagnostic trouble code output when DLC1 and terminals TE1 and E1 are connected?
       - NO → Check wiring between ECM terminal TE1 and D LC1 terminal TE1, and ECM terminal E1 and DLC1 terminal E1.
         - OK → Try another ECM.
       - YES → Does malfunction indicator lamp go off after repair according to malfunction code?
         - NO → Further repair required.
         - YES → System 0K → Cancel out diagnostic trouble code.

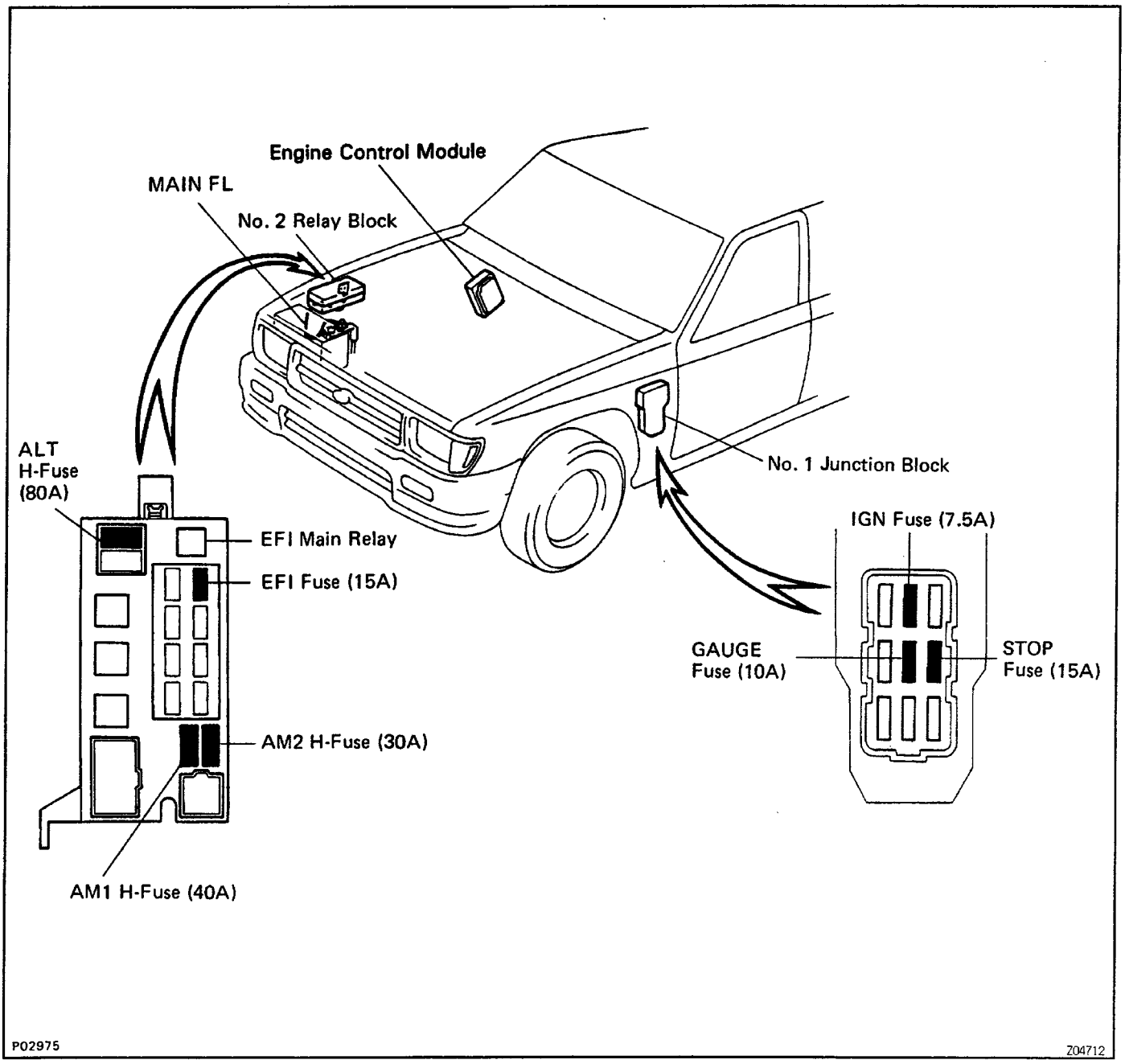
V02236

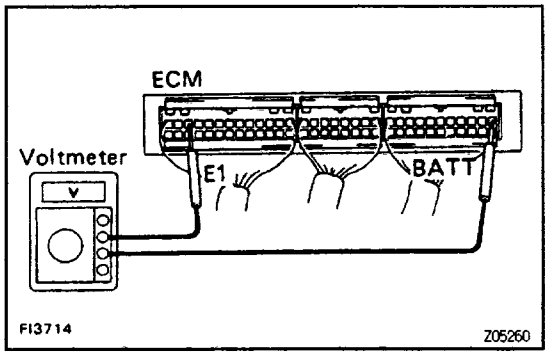
TROUBLESHOOTING WITH VOLT OHMMETER

HINT: Because the following troubleshooting procedures are designed for inspection of each separate system, the actual troubleshooting procedure may vary somewhat.
However, please refer to these procedures and perform actual troubleshooting, conforming to the inspection methods described.
For example, it is better to first make a simple check of the fuses, fusible links and connecting condition of the connectors before making your inspection according to the procedures listed.
The following troubleshooting procedures are based on the supposition that the trouble lies in either a short or open circuit in a component outside the –computer or a short circuit within the computer. If engine trouble occurs even though proper operating voltage is detected in the computer connector, then the engine control module is faulty and should be replaced.

FUSES AND FUSIBLE LINK LOCATION

EG1GH–02





MFI SYSTEM CHECK PROCEDURE

EG1GJ–02

HINT:

- Perform all voltage measurements with the con–nectors connected.
- Verify that the battery voltage is 11 V or more when the ignition switch is in ”ON” position. Using a voltmeter with high impedance (110 kΩ/V minimum), measure the voltage at each terminal of the wiring connectors.

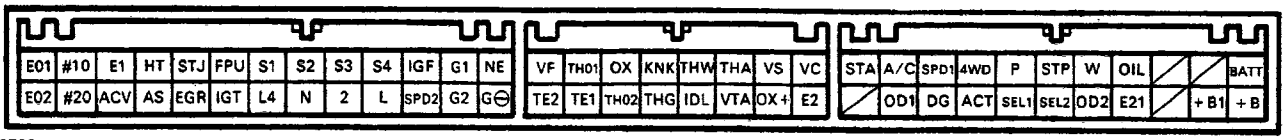
EG1GK–03

Engine Control Module (ECM) Terminals

Symbol	Terminal Name	Symbol	Terminal Name	Symbol	Terminal Name
NE	DISTRIBUTOR	VC	VOLUME AIR FLOW METER	BATT	BATTERY B+
G⊖	DISTRIBUTOR	E2	SENSOR GROUND	+B	EFI MAIN RELAY
G1	DISTRIBUTOR	VS	VOLUME AIR FLOW METER		–
G2	DISTRIBUTOR	*5 OX+	HEATED OXYGEN SENSOR	+B1	EFI MAIN RELAY
IGF	IGNITER	THA	INTAKE AIR TEMP. SENSOR		
*1 SPD2	VEHICLE SPEED SENSOR	VTA	THROTTLE POSITION SENSOR		–
*2 S4	TCM SOLENOID	THW	ENGINE COOLANT TEMP. SENSOR	*1 OIL	A/T OIL TEMP. WARNING LIGHT
*1 L	PARK/NEUTRAL POSITION SWITCH	IDL	THROTTLE POSITION SENSOR	E21	SENSOR GROUND
*1 S3	TCM SOLENOID	KNK	KNOCK SENSOR	W	MALFUNCTION INDICATOR LAMP
*1 2	PARK/NEUTRAL POSITION SWITCH	*3 THG	EGR GAS TEMP. SENSOR	*1 OD2	O/D MAIN SWITCH
*1 S2	TCM SOLENOID	OX	HEATED OXYGEN SENSOR	STP	STOP LIGHT SWITCH
*1 N	PARK/NEUTRAL POSITION SWITCH	*2 TH02	T/F FLUID TEMP. SENSOR	SEL2	–
*1 S1	TCM SOLENOID	*2 TH01	4WD OIL TEMP. SENSOR	*1 P	PATTERN SELECT SWITCH
*2 L4	TRANSFER POSITION SWITCH	TE1	D LC1	SEL1	–
FPU	VSV (for EG R)	VF	D LC 1	*4 4WD	4WD SWITCH
IGT	IGNtTER	TE2	DLC1	ACT	A/C AMPLIFIER
STJ	COLD START INJECTOR		–	SPD1	VEHICLE SPEED SENSOR
EGR	VSV (for EG R)		–	*1 DG	DLC1
HT	HEATED OXYGEN SENSOR			A/C	A/C MAGNET SWITCH
AS	VSV (for PAIR)		–	*1 OD1	CRUISE CONTROL ECU
E1	ENGINE GROUND		–	STA	STARTER SWITCH
ACV	VSV (for A/C)		–		–
#10	INJECTOR		–		–
#20	INJECTOR		–		–
E01	ENGINE GROUND		–		–
E02	ENGINE GROUND		–		–

*1: A/T only *2: 4WD A/T only *3: California only *3: California and C & C *4: 4WD only *5: California 2WD only

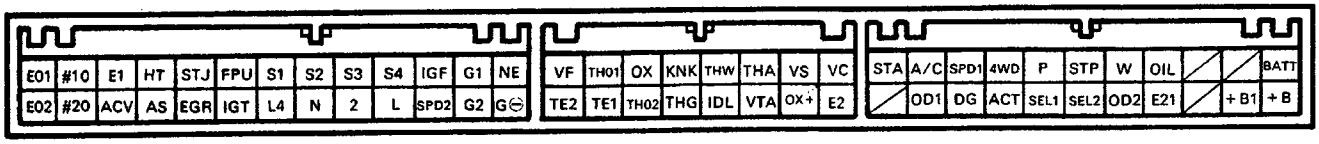
Engine Control Module (ECM) Terminals



Engine Control Module (ECM) Wiring Connectors Voltage

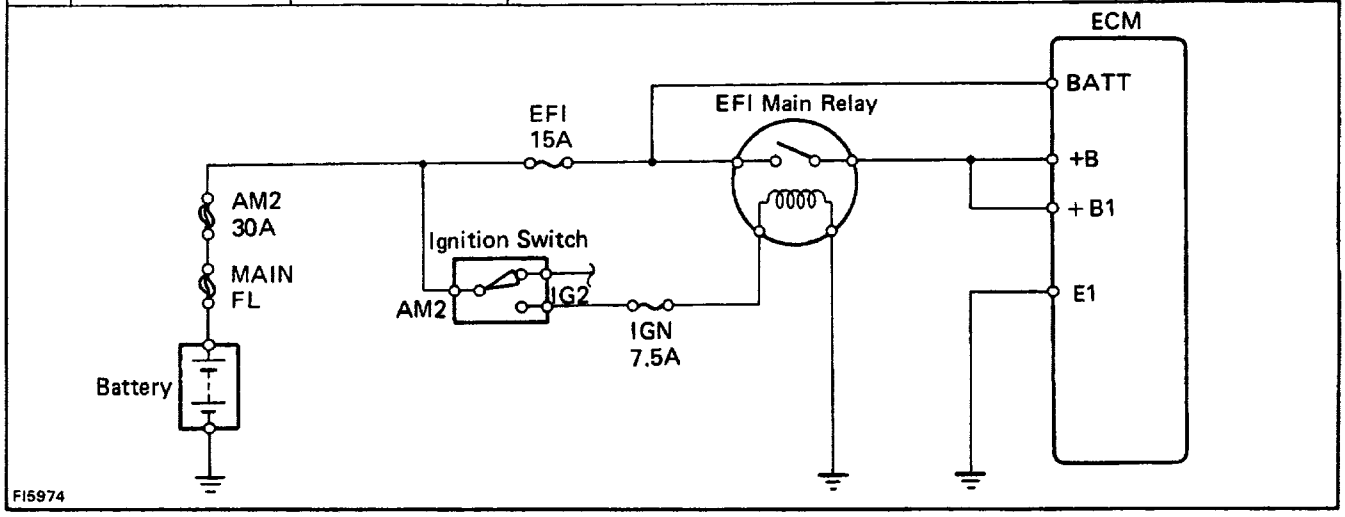
No.	Terminals	Condition		STD voltage	See page
1	BATT – E1	–		9 – 14	EG2–186
	+B – E1	Ignition SW ON			
	+B1 – E2				
2	IDL – E2 (E21)	Ignition SW ON	Throttle valve open	9 – 14	EG2–188
	VC – E2 (E21)		–	4.5 – 5.5	
	VTA – E2 (E21)		Throttle valve fully closed (Throttle opener must be cancelled first)	0.3 – 0.8	
			Throttle valve fully open	3.2 – 4.9	
3	VC – E2 (E21)	Ignition SW ON	–	4.5 – 5.5	EG2–190
	VS – E2 (E21)		Measuring plate fully closed	4.0 – 5.5	
			Measuring plate fully open	0.2 – 0.5	
		Idling		2.3 – 2.8	
		3,000 rpm		0.3 – 1.0	
	THA – E2 (E21)	Ignition SW ON	Intake air temperature 20°C (68°F)	0.5 – 3.4	
4	THW – E2 (E21)	Ignition SW O N	Engine coolant temperature 80°C (176°F)	0.2 – 1.0	EG2–192
5	STA – E1	Cranking		6 V or more	EG2–193
6	#10 – E01 #20 – E02	Ignition SW ON		9 – 14	EG2–194
7	IGT – E1	Idling		Pulse generation	EG2–195
8	W – E1	No trouble (malfunction indicator lamp off) and engine running		9 – 14	EG2–196
9	STJ – E1	Cranking	Engine coolant temperature 80°C (176°F)	6 V or more	EG2–197
10	STP – E1	Stop light switch ON		7.5 – 14	EG2–198

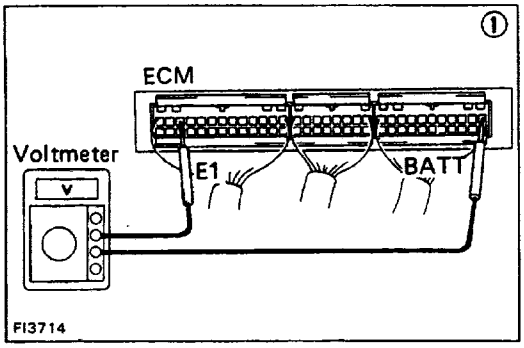
Engine Control Module (ECM) Terminals

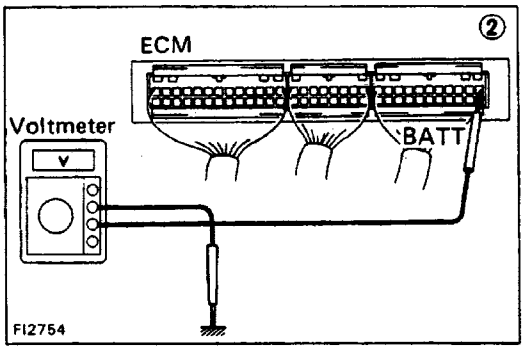


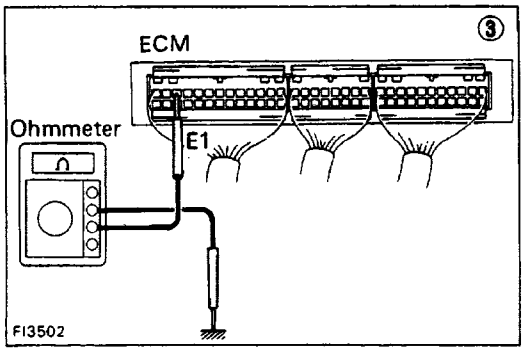
FI2796

No.	Terminals	Trouble	Condition	STD Voltage
1	BATT – E1	No voltage	–	9 – 14 V
	+B – E1		Ignition switch 4N	
	+B1 – E1			









- **BATT– EI**

(1) There is no voltage between ECM terminals BATT and E1.

(2) Check that there is voltage between ECM terminal BATT and body ground.

NO → OK

(3) Check wiring between ECM terminal E1 and body ground.

OK → Try another ECM.

BAD → Repair or replace.

Check fuse and fusible link.

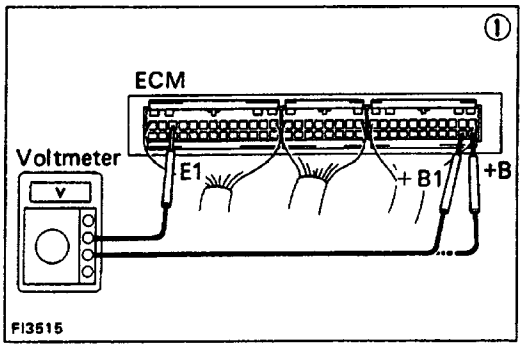
BAD → Replace.

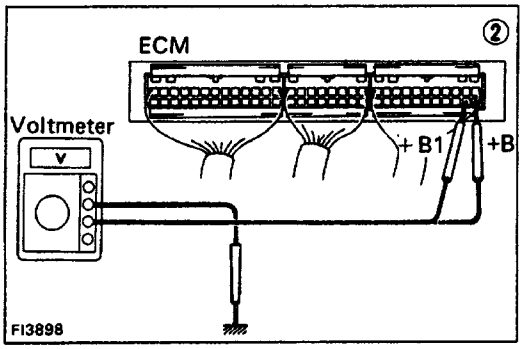
OK

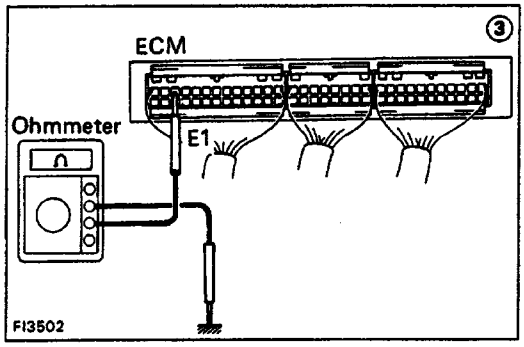
Check wiring between fuse and ECM.

BAD → Repair or replace.

V02191







- **+B (+B1) –E1**

(1) There is no voltage between ECM terminals + B (+ B1) and E1. **(IG SW ON) .**

(2) Check that there is voltage between ECM terminal + B (+ B1) and body ground. (**IG SW ON)**

NO

OK

(3) Check wiring between ECM terminal El and body ground.

OK → Try another ECM.

SAD → Repair or replace.

Check fuse, fusible link and ignition switch. — BAD → Repair or replace.

OK

Check EF 1 main relay. — BAD → Replace.

OK

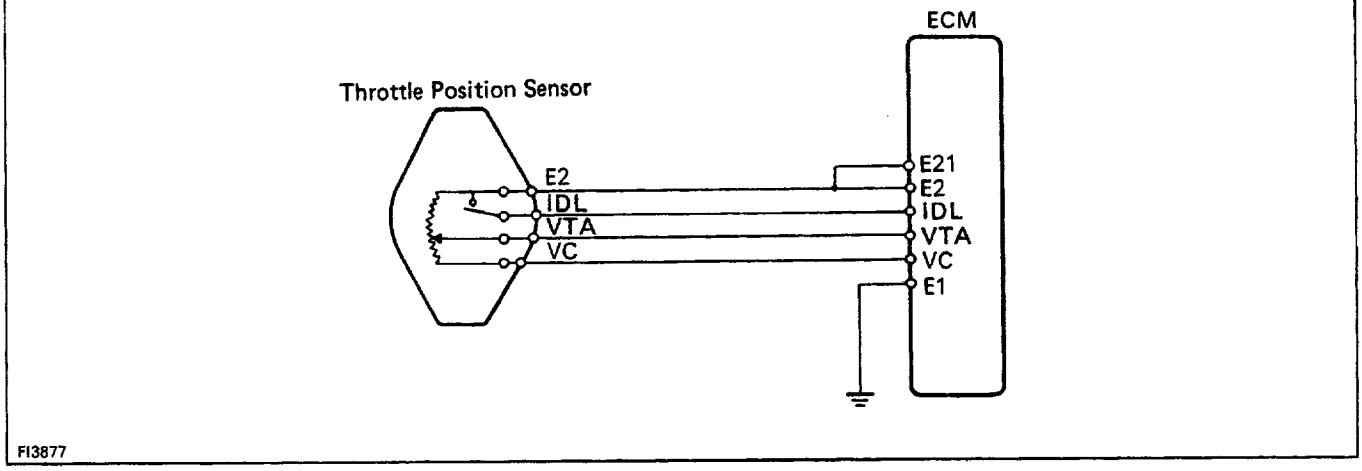
Check wiring between E F I main relay and battery. — BAD → Repair or replace.

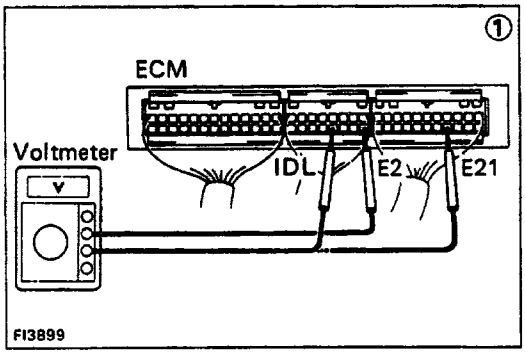
OK

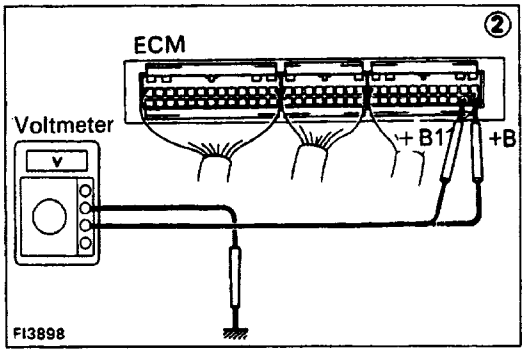
Check wiring between EFI main relay and ECM terminal + B (+B1). — BAD → Repair or replace.

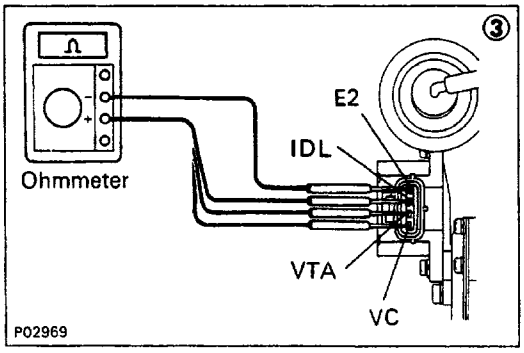
V02192

No.	Terminals	Trouble	Condition	STD Voltage
2	IDL – E2 (E21)	No voltage	Ignition switch O N	Throttle valve open	9 – 14 V
	VC – E2 (E21)			–	4.5 – 5.5 V
	VTA – E2 (E21)			Throttle valve fully closed (Throttle opener must be cancelled first)	0.3 – 0.8 V
				Throttle valve fully open	3.2 – 4.9 V









- **IDL – E2 (E21)**

(1) There is no voltage between ECM terminals IDl. and E2 (E21). **(IG SW ON) (Throttle valve open)**

↓

(2) Check that there is voltage between ECM terminal + 131 (+ B) and body ground. **(IG SW ON)**

NO → Refer to No. 1. → BAD → Replace or repair.

OK → Check wiring between ECM terminal E1 and body ground.

OK → **(3)** Check throttle position sensor.

BAD → Replace or repair throttle position sensor.

OK → Check wiring between ECM and throttle position sensor.

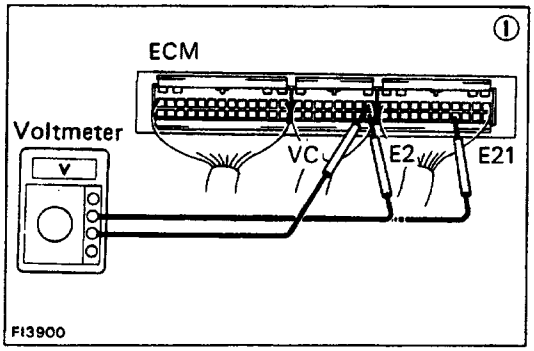
OK → Try another ECM.

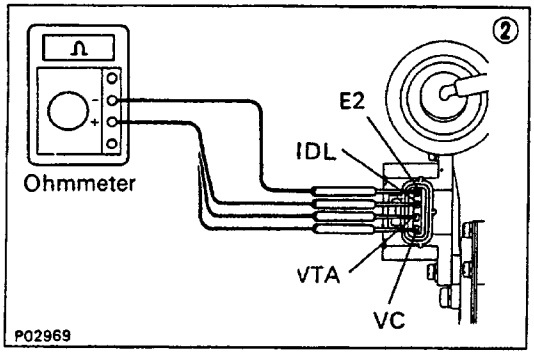
BAD → Replace or repair.

BAD → Replace or repair.

OK → Check wiring between ECM and throttle position sensor.

V02193





- **VC – E2 (E21)**

(1) There is no voltage between ECM terminals VC and E2 (E21).
(IG SW ON)

↓

Check that there is voltage between ECM terminals + B1(+ B) and E1.
(IG SW ON)

OK → ↓ | **NO** → Refer to No. 1.

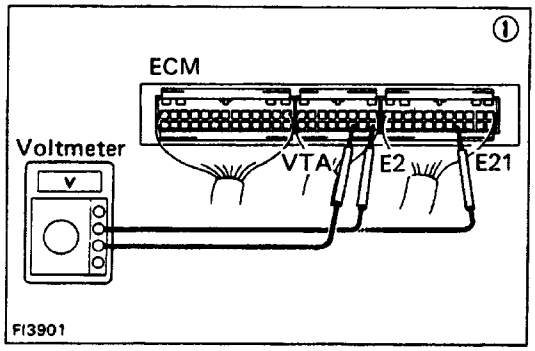
(2) Check throttle position sensor.

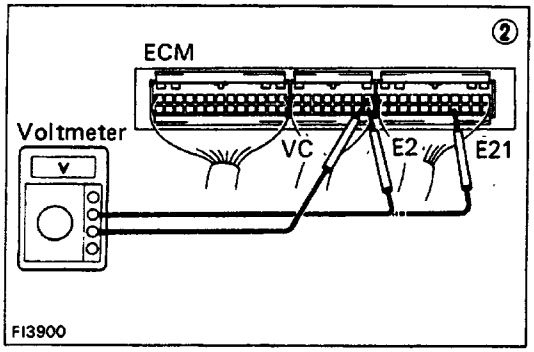
BAD → Repair or replace.

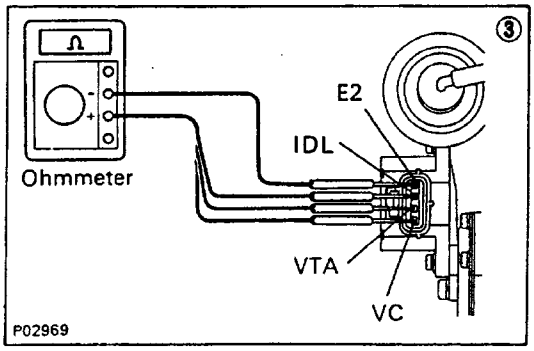
OK → Check wiring between ECM and throttle position

OK → Try another ECM.

BAD → Repair or replace wiring.







- **VTA – E2 (E21)**

(1) There is no voltage between ECM terminals VTA and E2 (E21).
(IG SW ON)

↓

(2) Check that there is voltage between ECM terminals VC and E2 (E21).
(IG SW ON)

OK → ↓ | **NO** → Perform inspection of VC – E2 (E21).

(3) Check throttle position sensor.

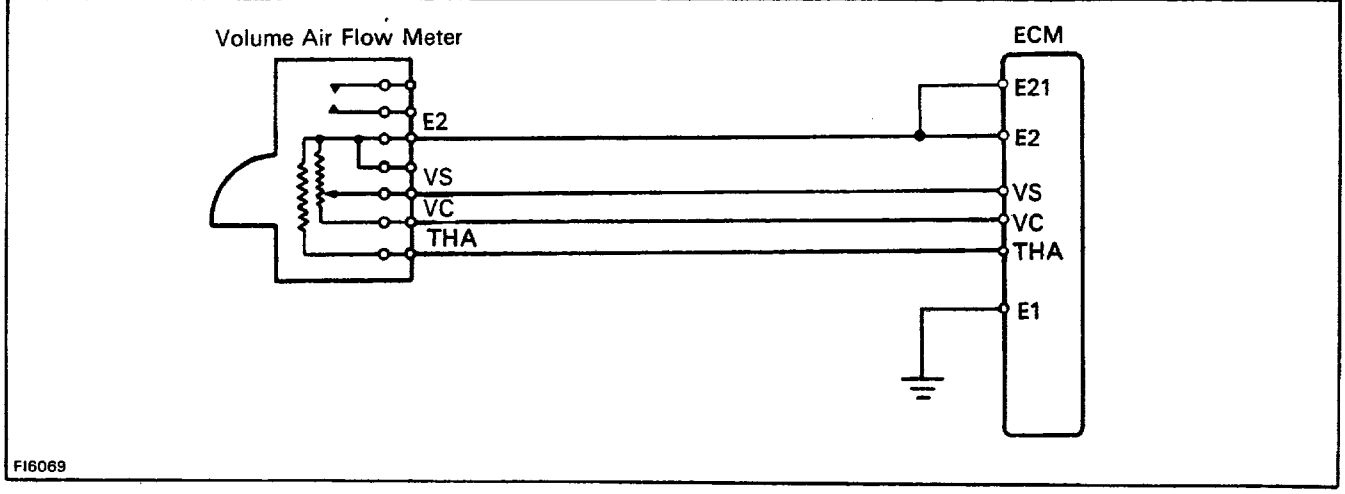
BAD → Repair or replace.

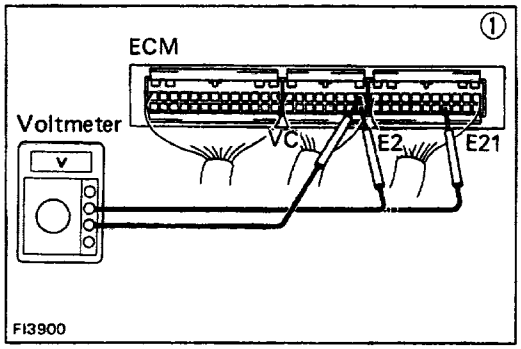
OK → Check wiring between ECM and throttle position sensor.

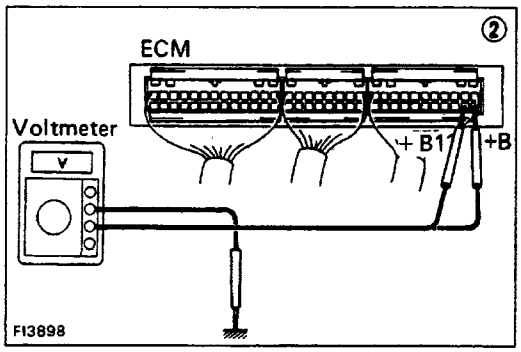
BAD → Repair or replace.

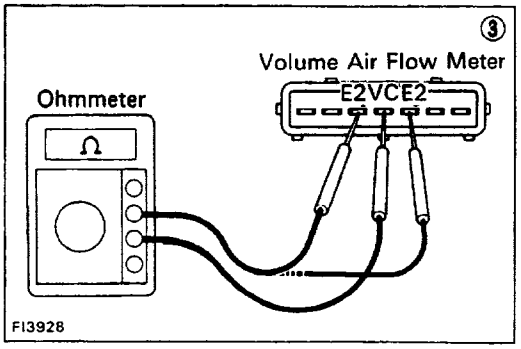
OK → Try another ECM.

No.	Terminals	Trouble	Condition		STD Voltage
3	VC – E2 (E21)	No voltage	Ignition SW ON	–	4.5 – 5.5 V
	VS – E2 (E21)			Measuring plate fully dosed	4.0 – 5.5 V
				Measuring plate fully open	0.2 – 0.5 V
			Idling		2.3 – 2.8 V
	THA – E2 (E21)		IG SW ON	Intake air temperature 20°C (68°F	0.5 – 3.4 V









- **VC – E2 (E21)**

(1) There is no voltage between ECM terminals VC and E2 (E21). **(I G SW ON)**

↓

(2) Check that there is voltage between ECM terminal + B (+ 131) and body ground. **(IG SW ON)**

OK → ↓

NO → Refer to No. 1.

(3) Check volume air flow meter.

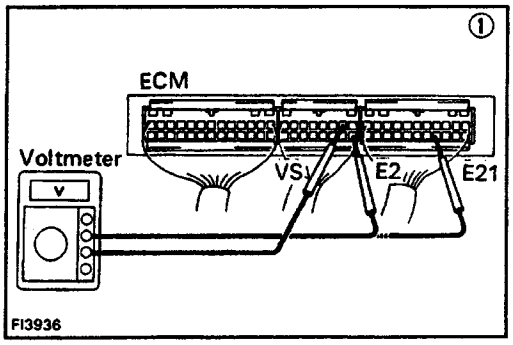
BAD → Replace or repair volume air flow meter.

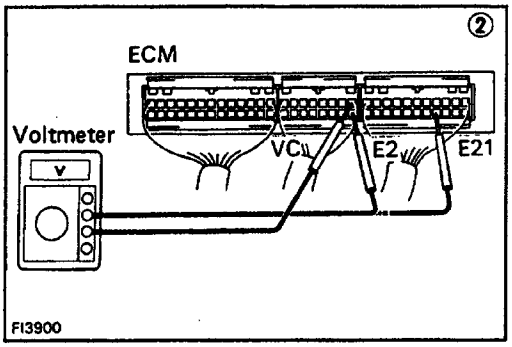
OK → Check wiring between ECM and volume air flow meter.

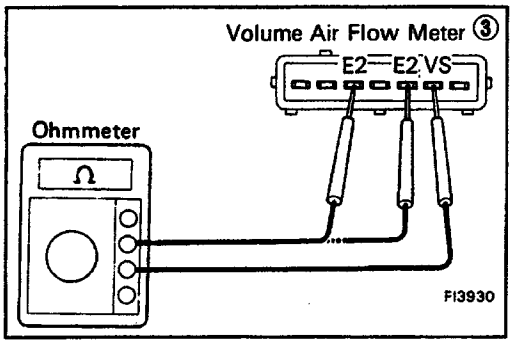
OK → Try another ECM.

BAD → Replace or repair wiring.

V02195







- **VS – E2 (E21)**

(1) There is no voltage between ECM terminals VS and E2 (E21). **(IG SW ON)**

↓

(2) Check that there is voltage between ECM terminals VC and E2 (E21). **(IG SW ON)**

↓ OK / NO → Refer to VC – E2 (E21). → BAD → Repair or replace.

↓ OK

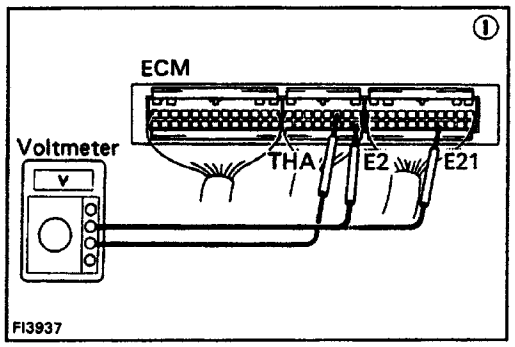
b Check volume air flow meter. → BAD → Repair or replace.

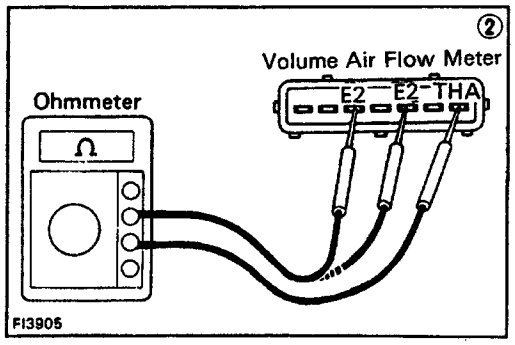
↓ OK

Check wiring between ECM and volume air flow meter. → BAD → Repair or replace.

↓ OK

Try another ECM.





- **THA – E2 (E21)**

(1) There is no voltage between ECM terminals THA and E2 (E21). **(IG SW ON)**

↓

Check that there is voltage between ECM terminal + B (+ B1) and body ground. **(IG SW ON)**

↓ OK / NO → Refer to No. 1.

↓ OK

(2) Check intake air temp. sensor.

↓ BAD → Replace volume air flow meter.

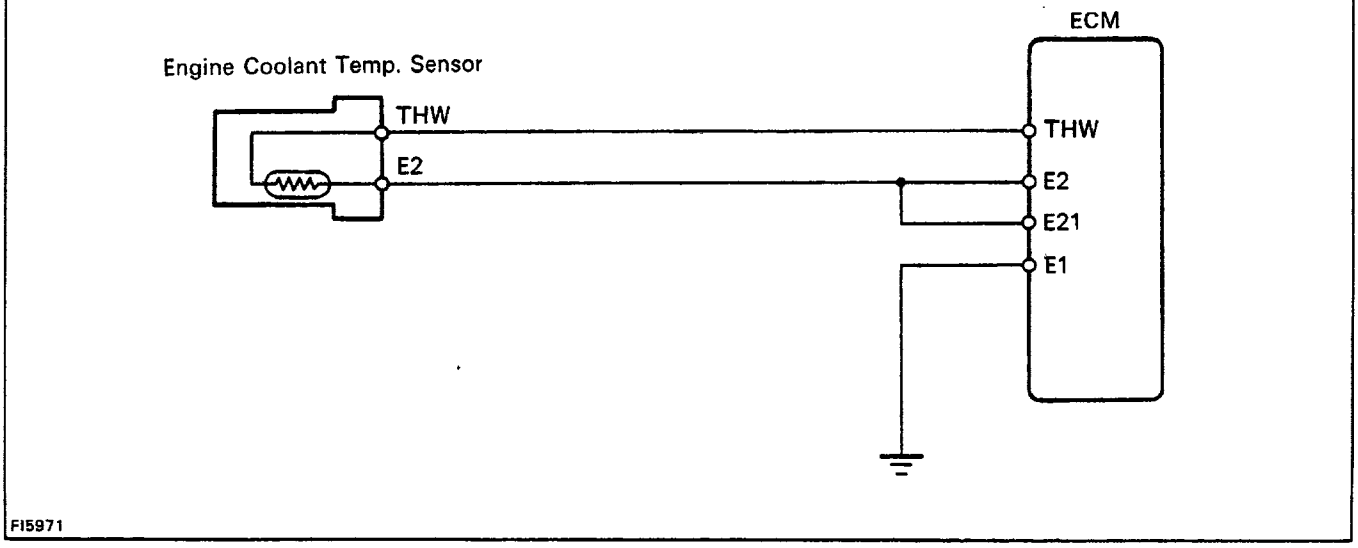
↓ OK

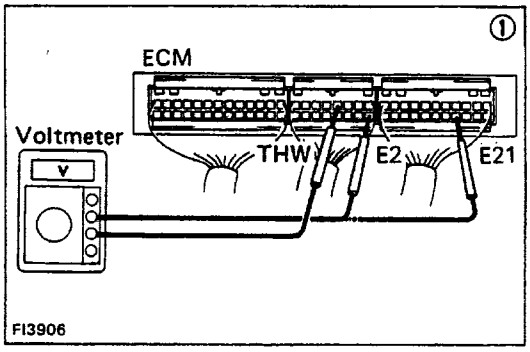
Check wiring between ECM and volume air flow meter.

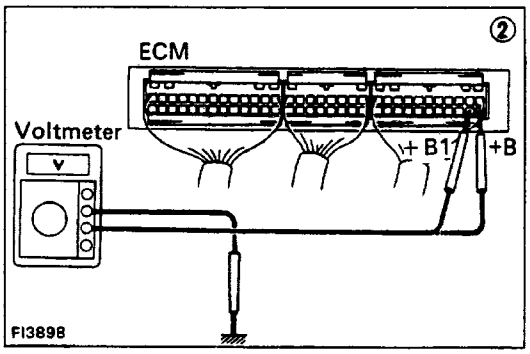
↓ OK → Try another ECM.

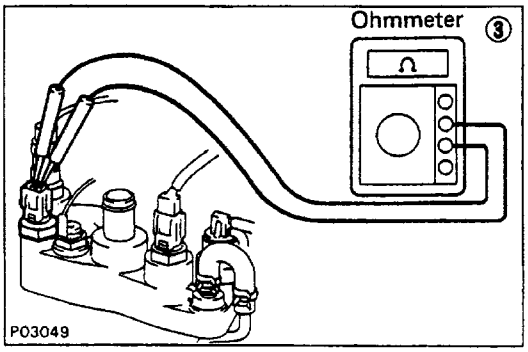
↓ BAD → Repair or replace wiring.

No.	Terminals	Trouble	Condition		STD Voltage
4	THW – E2 (E21)	No voltage	Ignition switch ON	Engine coolant temperature 80°C (176°F)	0.2 – 1.0 V









(1) There is no voltage between ECM terminals THW and E2 (E21). (IG SW ON)

↓

(2) Check that there is voltage between ECM terminal +B (+ B1) and body ground. **(IG SW ON)**

OK → ↓

NO → Refer to No. 1.

↓

Check wiring between ECM terminal E1 and body ground.

OK → ↓

BAD → Repair or replace.

(3) Check engine coolant temp. sensor.

BAD → Replace engine coolant temp. sensor.

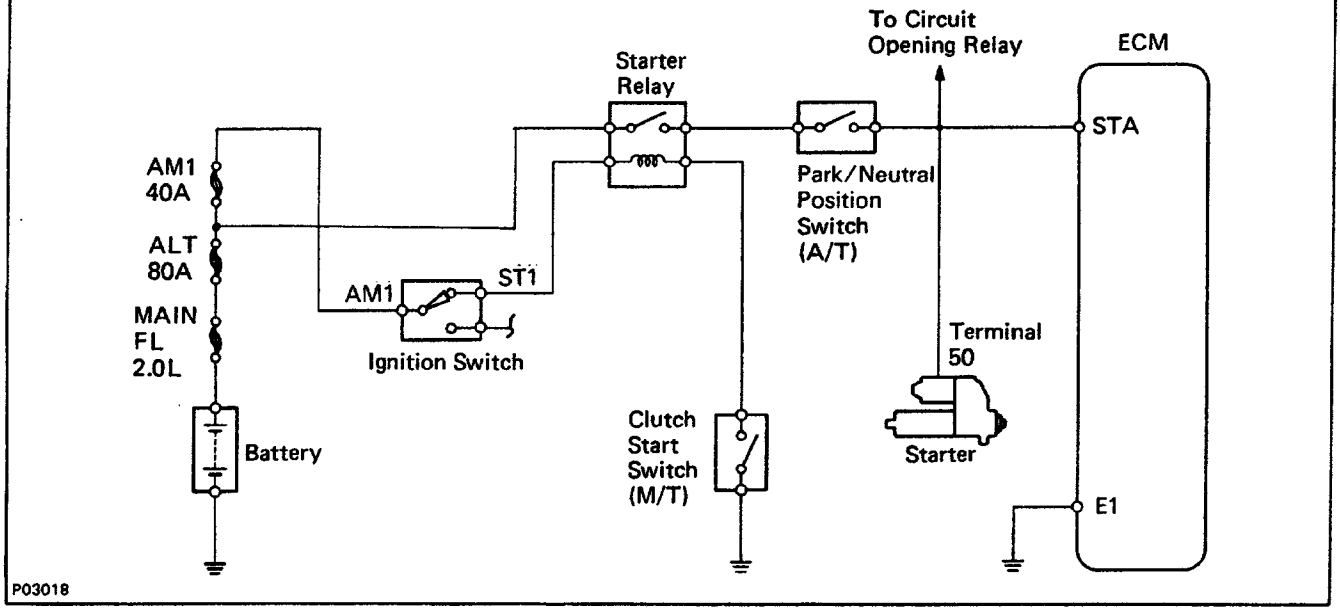
OK → Check wiring between ECM and engine coolant temp. sensor.

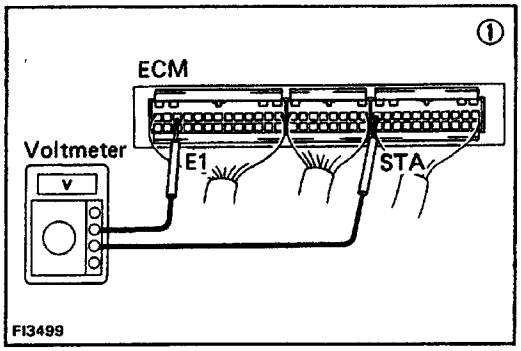
OK → Try another ECM.

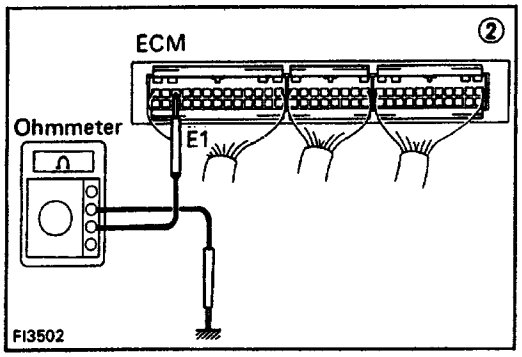
BAD → Repair or replace.

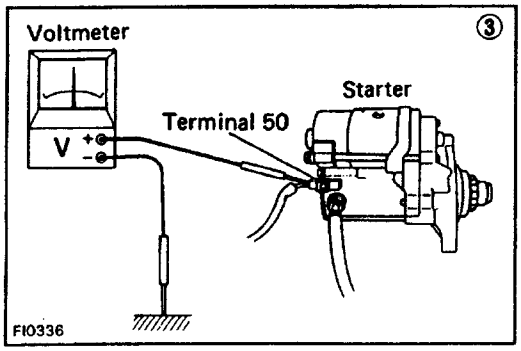
V02197

No.	Terminals	Trouble	Condition	STD Voltage
5	STA – E1	No voltage	Cranking	6 V or more









(1) There is no voltage between ECM terminals STA and E1. **(IG SW START)**

Check starter operation. — OK → Check wiring between . ECM terminal STA and starter terminal 50.

BAD

OK

BAD → Repair or replace.

(2) Check wiring between ECM terminal E1 and body ground..

BAD → Repair or replace.

Check fusible link, battery, wiring and ignition switch. — BAD → Repair or replace.

OK

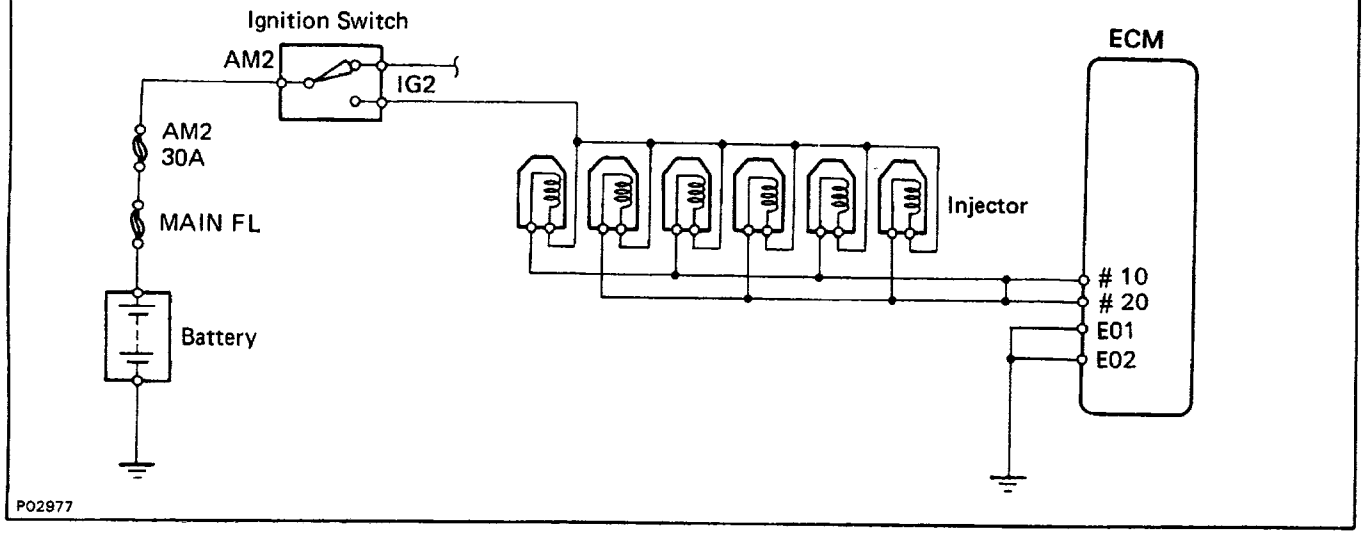
(3) Check that there is voltage at terminal 50 of starter. **(IG SW START) STD voltage: 6 V or more**

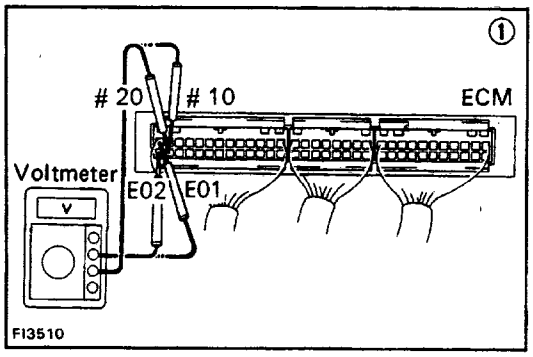
OK → Check starter.

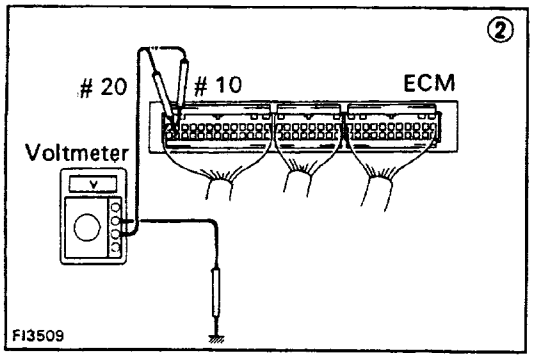
NO → Check wiring between ignition switch ST1 terminal and starter terminal 50.

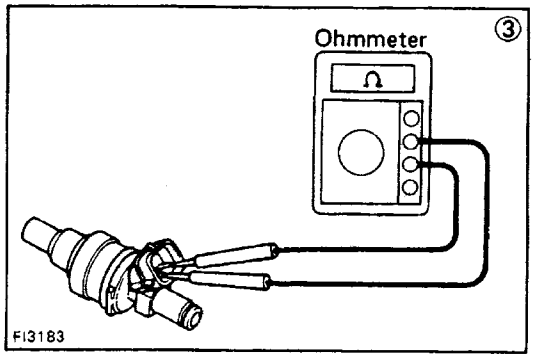
V02198

No.	Terminals	Trouble	Condition	STD Voltage
6	# 10 _ E01 # 20 _ E02	No voltage	Ignition switch ON	9 – 14 V









(1) There is no voltage between ECM terminals # 10 and/or # 20 and E01 and/or E02. **(IG SW ON)**

↓

(2) Check that there is voltage between ECM terminal # 10 and/or # 20 and body ground,

NO → OK

OK → Check wiring between ECM terminal E01 and/or E02 and body ground.

OK → Try another ECM.

BAD → Repair or replace.

NO → Check fusible link and ignition switch.

BAD → Repair or replace.

OK → Check resistance of magnetic coil in each injector.
STD resistance: 13.4 – 14.2 Ω

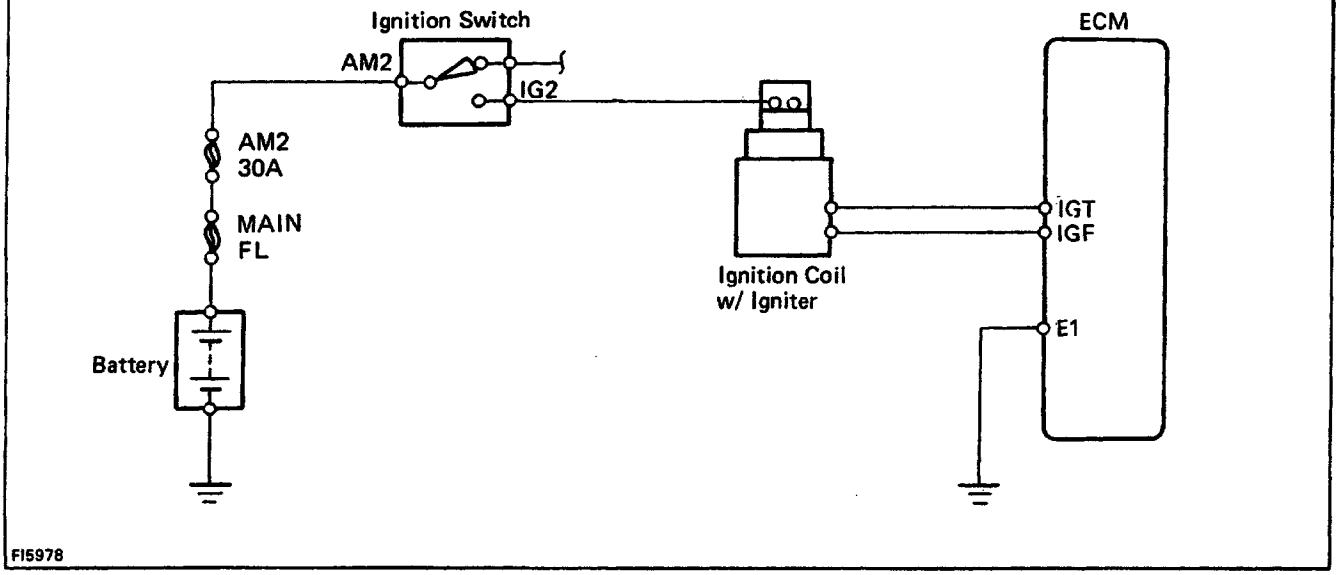
OK → Check wiring between ECM terminal # 10 and/or # 20 and battery.

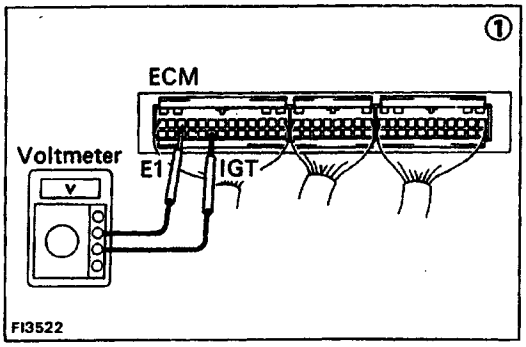
BAD → Repair or replace.

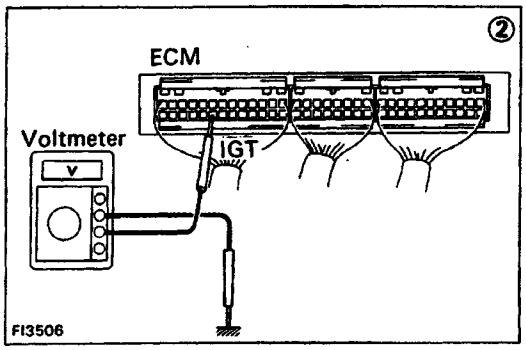
NO → Replace injector.

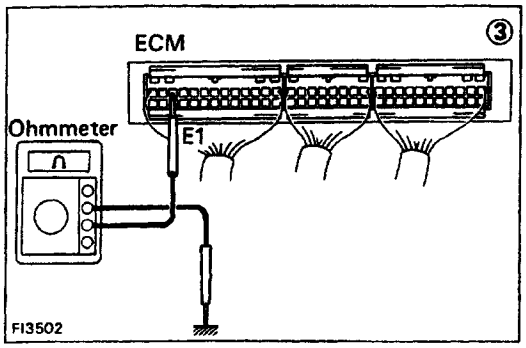
V02199

No.	Terminals	Trouble	Condition	STD Voltage
7	IGT – E1	No voltage	Idling	Pulse generation









(1) There is no voltage between ECM terminals IGT and El. **(idling)**

(2) Check that there is voltage between ECM terminal IGT and body ground. (idling)

OK

(3) Check wiring between ECM terminal E1 and body ground.

BAD

Refer to No. 1. — BAD → Repair or replace.

OK

Check wiring between igniter and distributor. — BAD → Repair or replace.

OK

Check distributor. — BAD → Replace.

OK

Check wiring between ECM and igniter. — BAD → Repair or replace.

OK

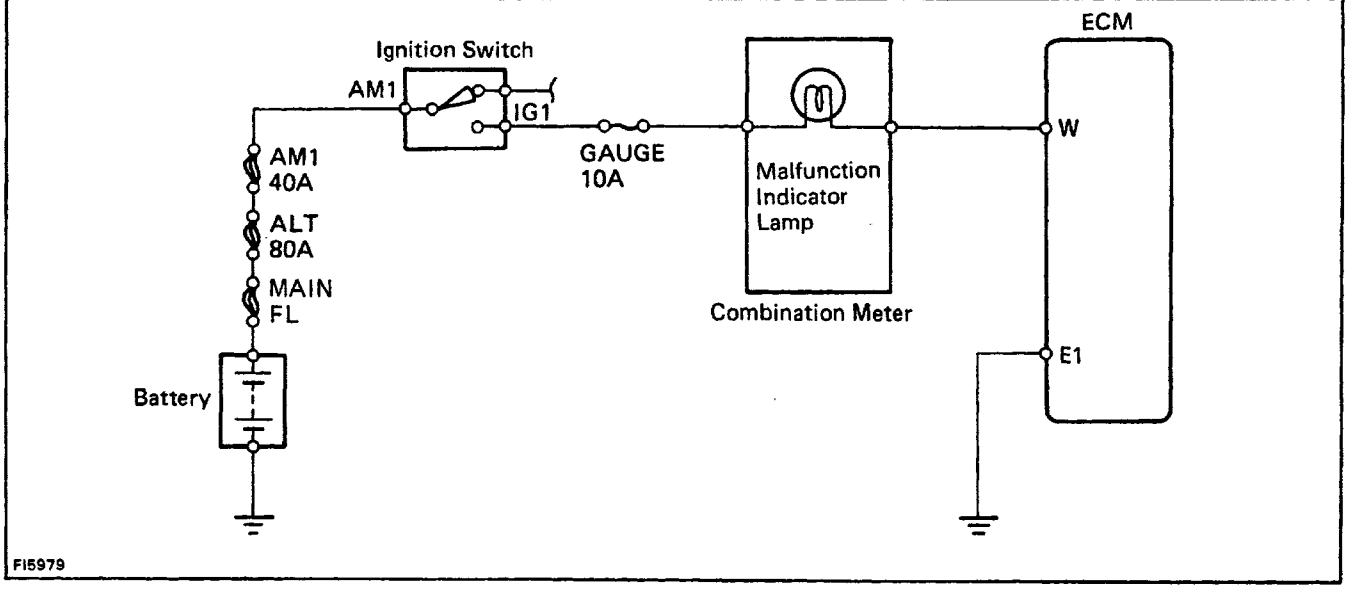
Check igniter. — BAD → Repair or replace.

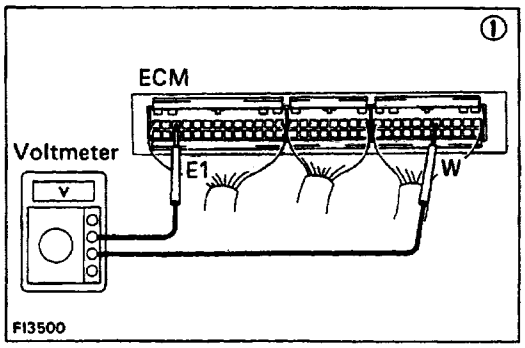
OK

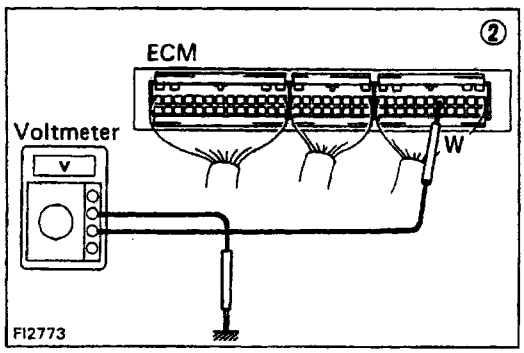
Try another ECM.

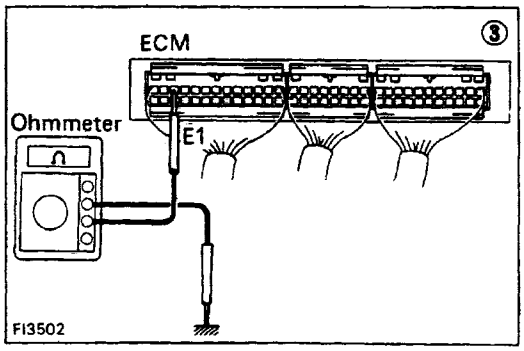
V02200

No.	Terminals	Trouble	Condition	STD Voltage
8	W – E1	No voltage	No trouble (malfunction indicator lamp off) and engine running	9 – 14 V









(1) There is no voltage between ECM terminals W and El. **(idling)**

↓

(2) Check that there is voltage between ECM terminal W and body ground.

NO → ↓

OK → **(3)** Check wiring between ECM terminal E1 and body ground.

OK → Try another ECM.

BAD → Repair or replace.

↓

Check GAUGE fuse (10A) and malfunction indicator lamp.

OK → ↓

BAD → Repair or replace.

Fuse blows again

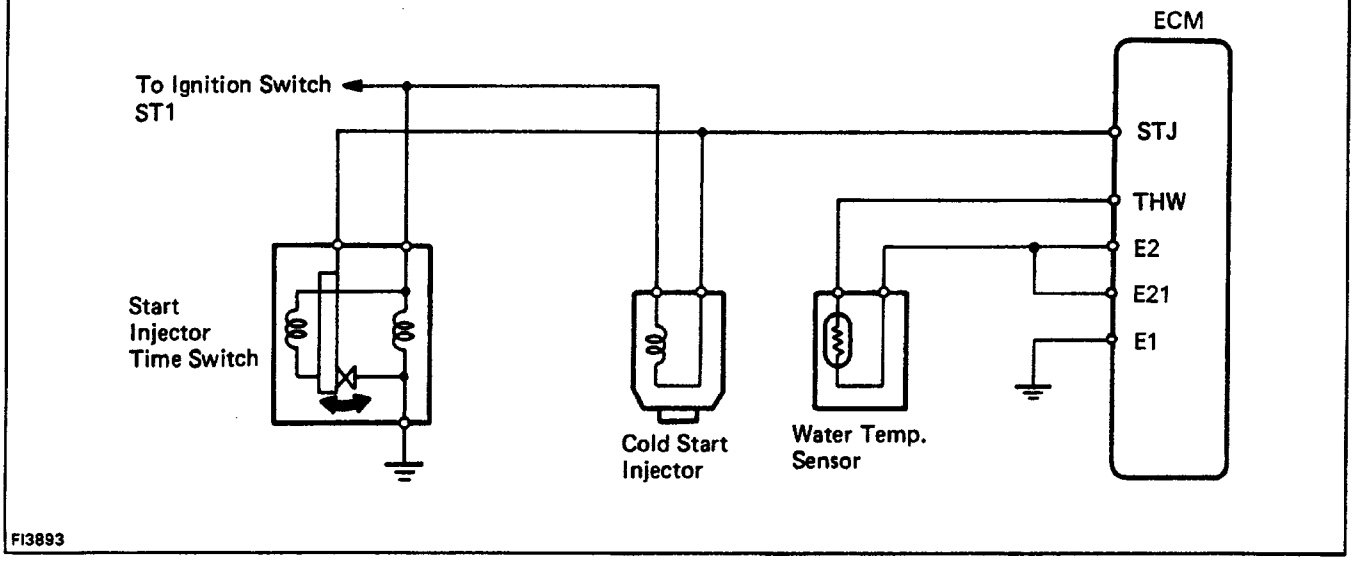
↓

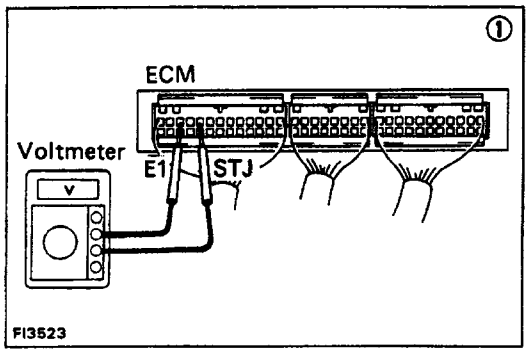
Check wiring between ECM terminal W and fuse.

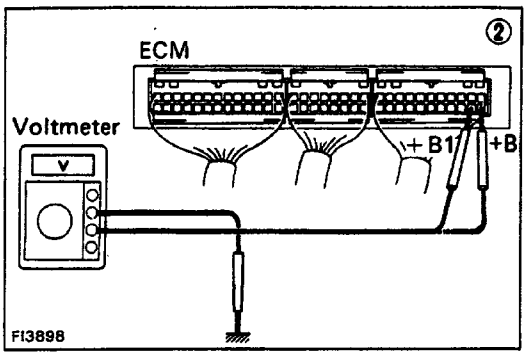
BAD → Repair or replace.

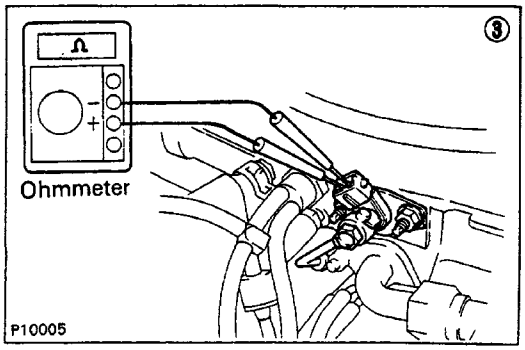
V02201

No.	Terminals	Trouble	Condition		STD Voltage
9	STJ – E1	No voltage	Cranking	Engine coolant temperature 80° (176° F)	6 V or more









(1) There is no voltage between ECM terminals STJ and E1. **(IG SW START)**

↓

(2) Check that there is voltage between ECM terminal + B (+ B1) and body ground. (IG SW ON)

OK → **(3)** Check cold start injector.

NO → Refer to No. 1.

BAD → Replace cold start injector.

OK → Check wiring between ECM and cold start injector.

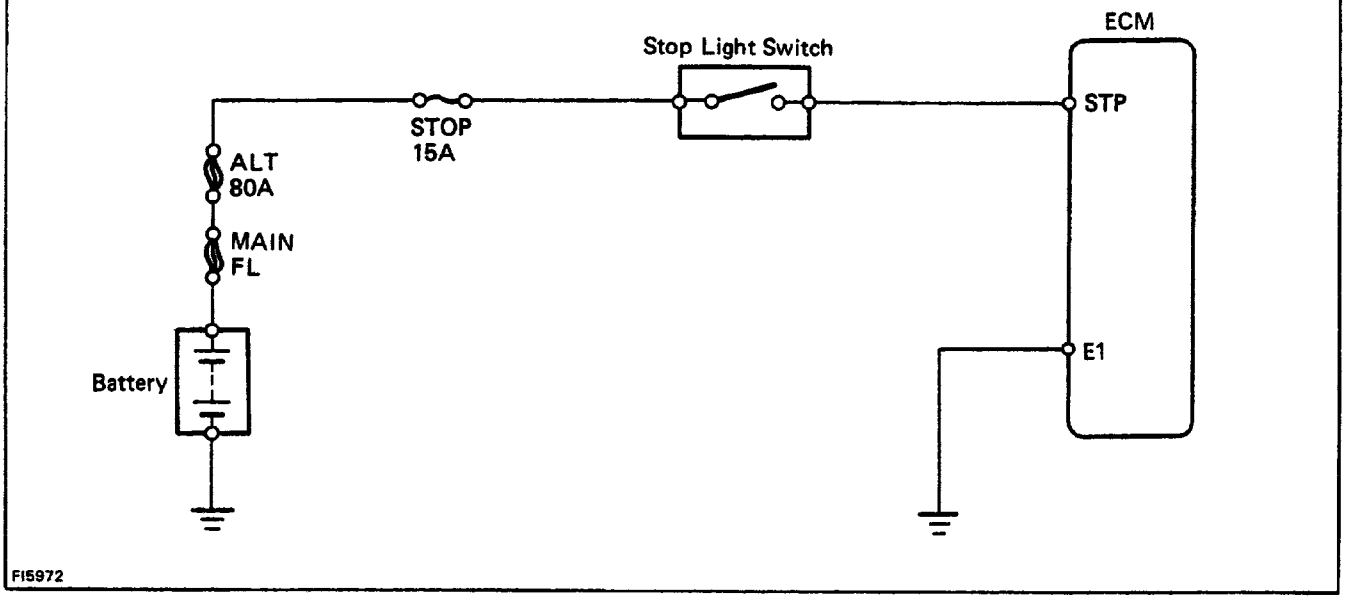
OK → Check wiring between ECM terminal E1 and body ground.

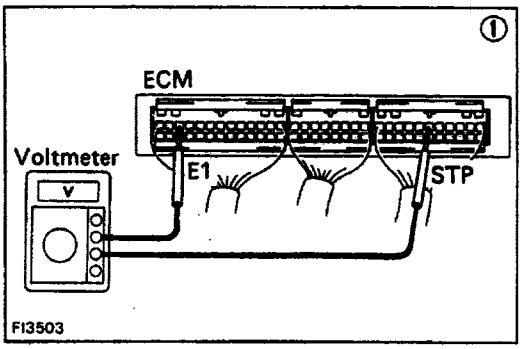
OK → Try another ECM.

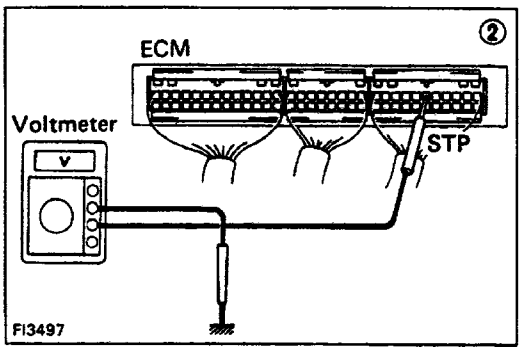
BAD → Repair or replace wiring.

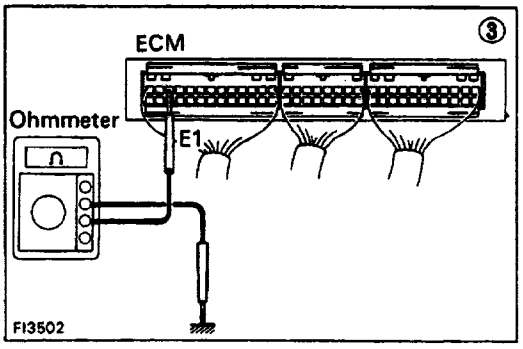
V02202

No.	Terminals	Trouble	Condition	STD Voltage
10	STP – E1	No voltage	Stop light switch ON	7.5 – 14 V









(1) There is no voltage between ECM terminals STP and E1.

(2) Check that there is voltage between ECM terminal STP and body ground when the brake pedal is depressed.

NO

OK

(3) Check wiring between ECM terminal E1 and body ground,

OK

BAD

Try another ECM.

Repair or replace.

Check STOP fuse 15A) and stop light switch.

BAD

Repair or replace.

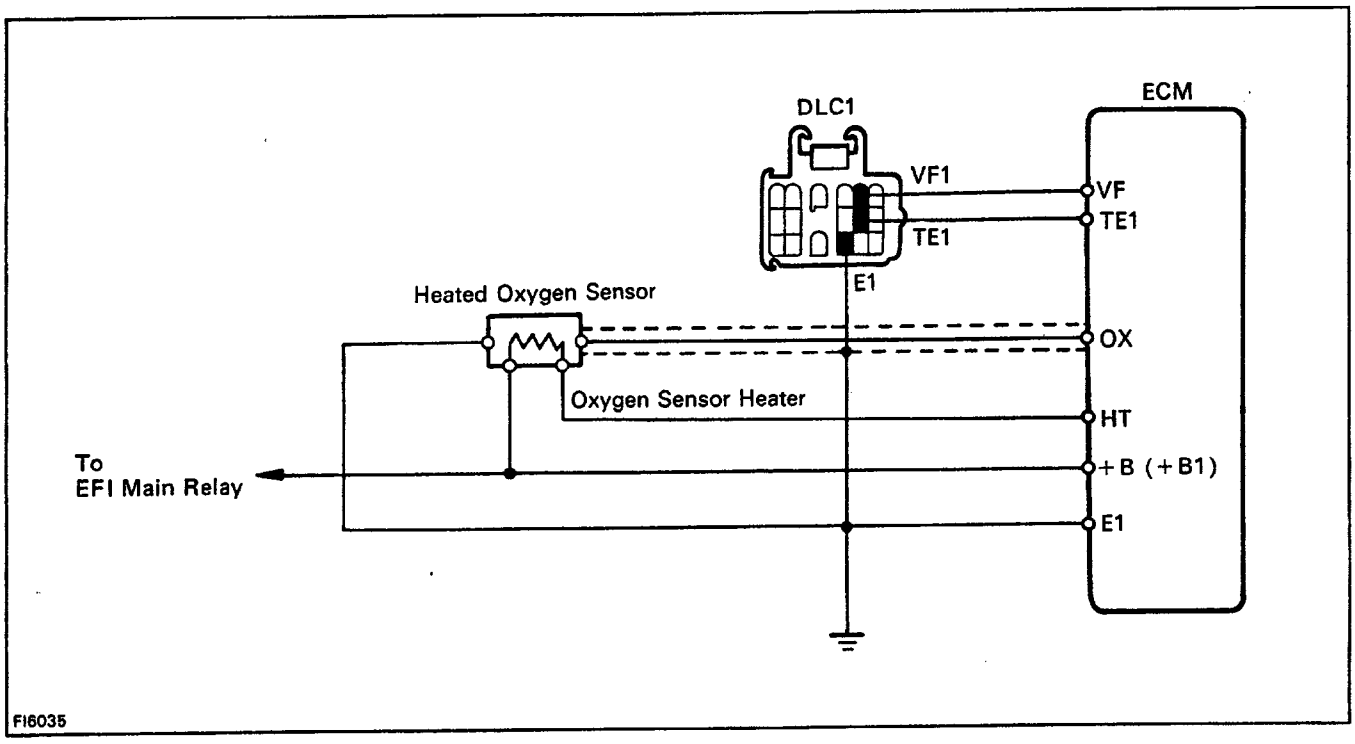
OK

Check wiring between ECM terminal STP and battery.

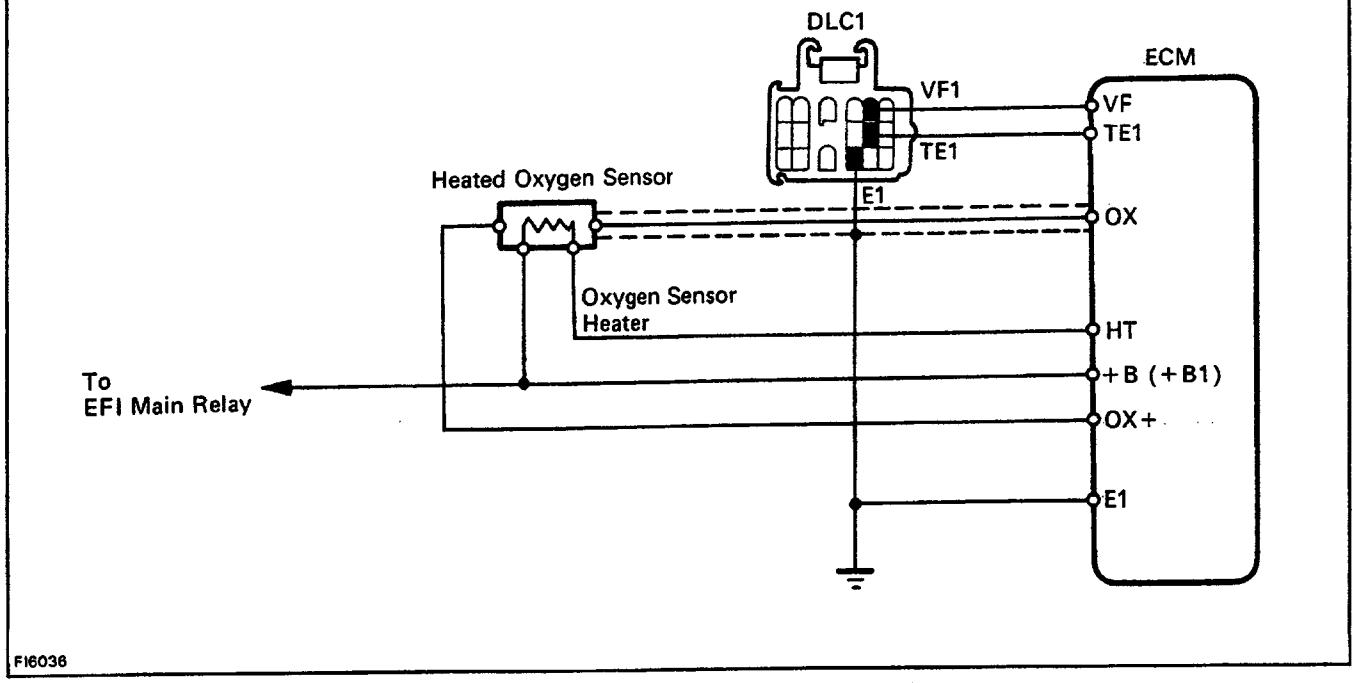
BAD

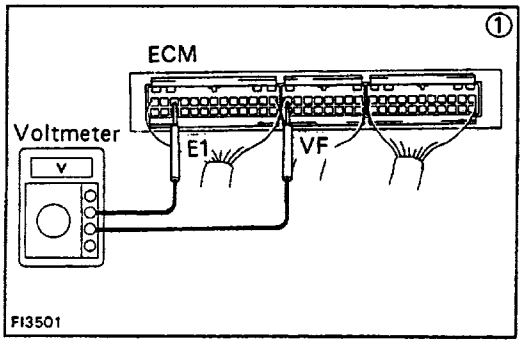
Repair or replace.

V02203



(California 2WD only)





(1) There is no voltage between ECM terminals 11F and E1.

Check that there is voltage between ECM terminal VF and body ground.

NO

OK

Check wiring between ECM terminal E1 and body ground.

OK

BAD

Try another ECM.

Repair or replace.

Is air leaking into air induction system? YES → Repair air leak.

NO

Check spark plugs. BAD → Repair or replace.

OK

Check distributor and ignition system. BAD → Repair or replace.

OK

Check fuel pressure. BAD → Repair or replace.

OK

Check injector. BAD → Repair or replace.

OK

Check cold start injector.* BAD → Repair or replace.

OK

Check volume air flow meter. BAD → Repair or replace.

OK

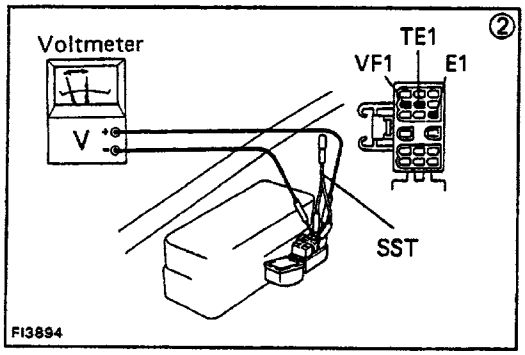
Check operation of heated oxygen sensor. OK → System normal.

BAD

Check wiring between heated oxygen sensor and ECM connector. BAD → Repair wiring.

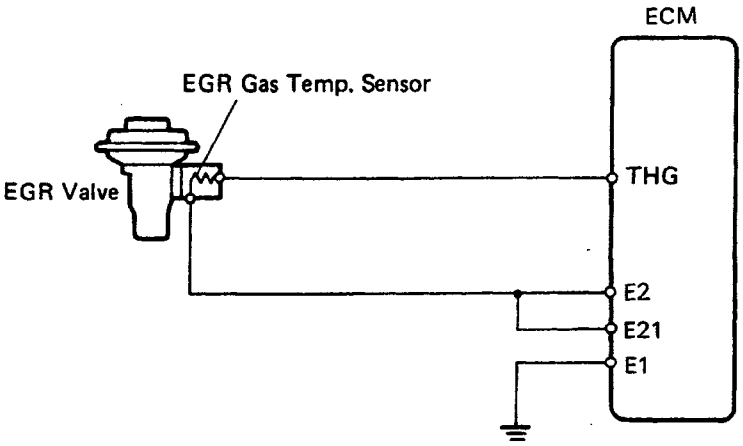
OK

Replace heated oxygen sensor.

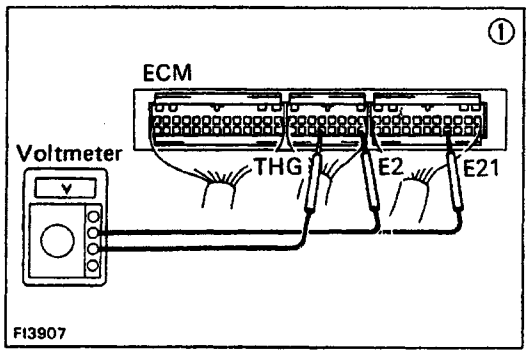


*Rich malfunction only

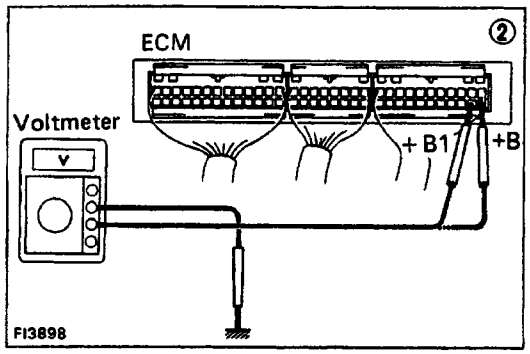
(California Vehicles and C & C)



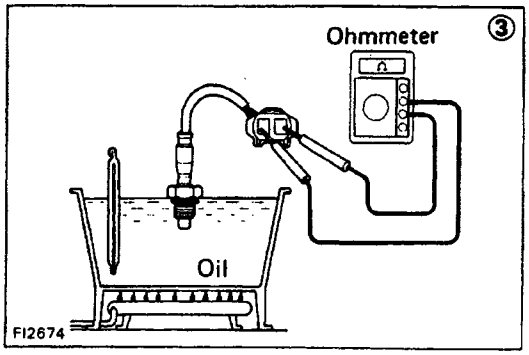
FI3895



FI3907



FI3898



FI2674

(1) There is no voltage between ECM terminals THG and E2 (E21). **(Engine running at 2,000 rpm)**

↓

(2) Check that there is voltage between ECM terminal + B (+ B1) and body ground. **(IG SW ON)**

OK ↓ / NO → Refer to No. 1.

↓

Check wiring between ECM terminal E1 and body ground.

OK ↓ / BAD → Repair or replace.

↓

Check EGR system. — BAD → Repair or replace.

OK ↓

Check EGR gas temp. sensor.

BAD ↓ / OK →

Replace EGR gas temp. sensor.

Check wiring between ECM and EG R gas temp. sensor.

OK ↓ / BAD →

Try another ECM.

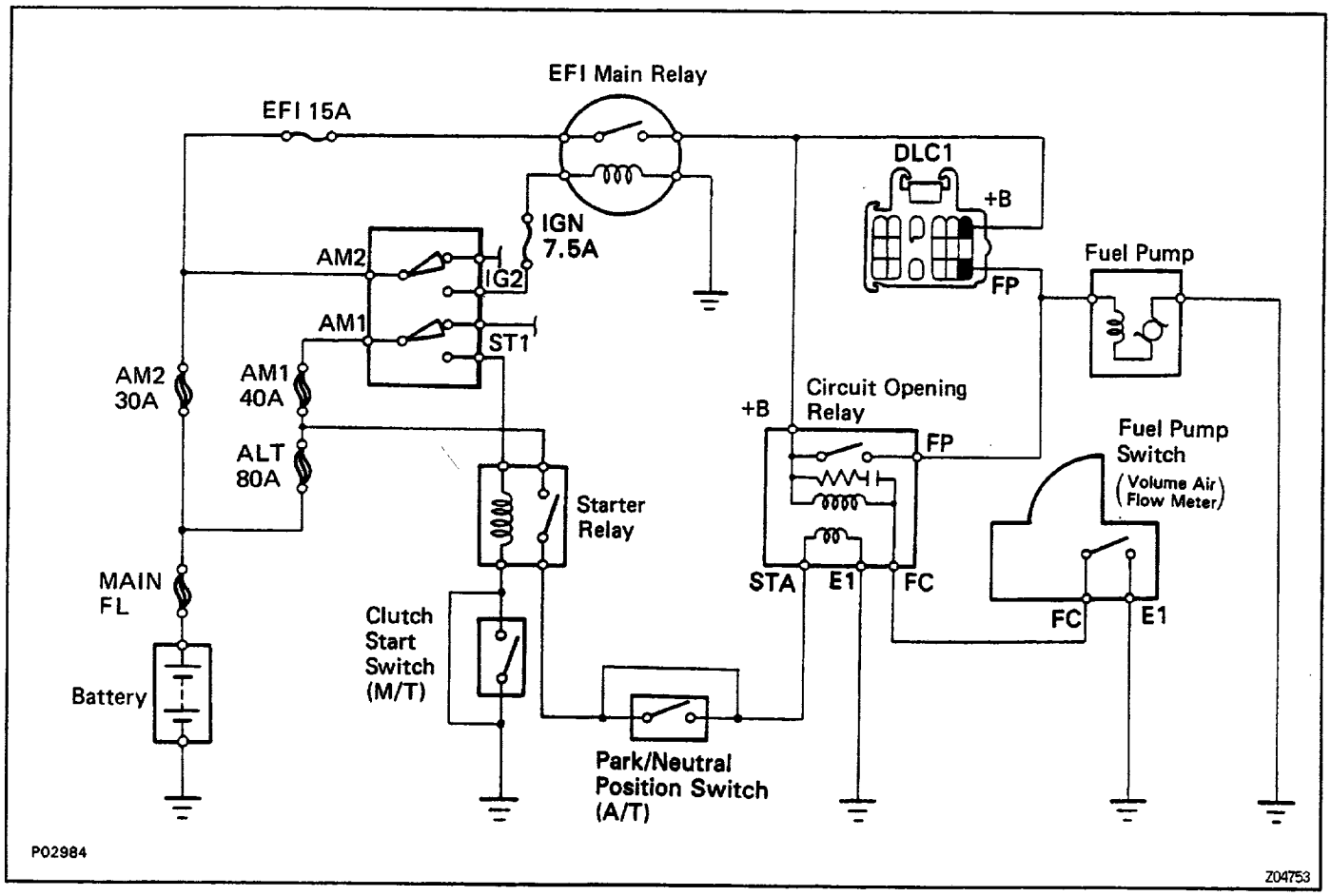
Repair or replace.

V02206

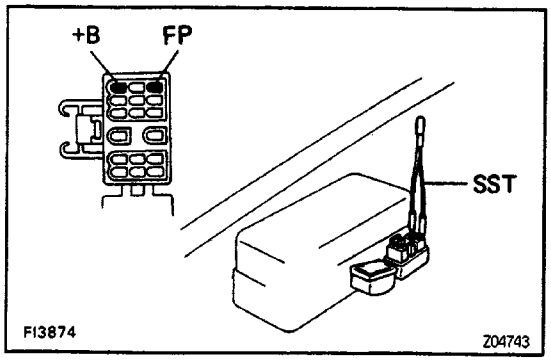
FUEL PUMP

EG1GM–02

SYSTEM CIRCUIT



EG1TE–02



ON–VEHICLE INSPECTION

1. CHECK FUEL PUMP OPERATION

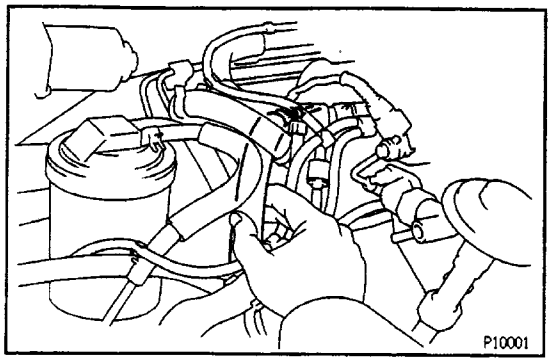
(a) Turn the ignition switch ON.

HINT: Do not start the engine.

(b) Using SST, connect terminals FP and +B of the DLC 1.

SST 09843–18020

HINT: The DLC1 is located near the No.2 relay block.



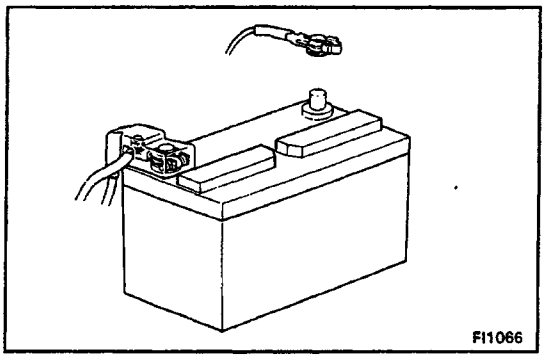
(c) Check that there is pressure in the fuel inlet hose.

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

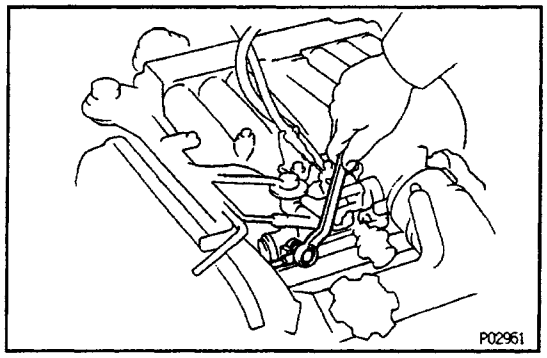
(d) Remove SST from the DLC1. ,
SST 09843–18020
(e) Turn the ignition switch OFF.
If there is no pressure, check the following parts:

- Fusible link
- Fuses (EFI 15A, IGN 7.5A)
- EFI main relay
- Circuit opening relay
- Fuel pump
- Wiring connections

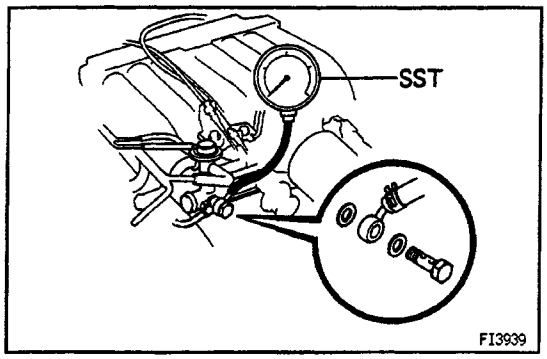
2. CHECK FUEL PRESSURE



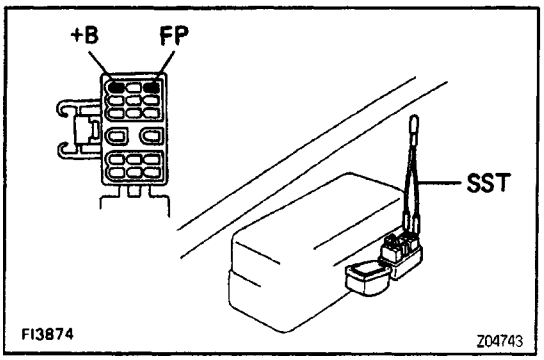
(a) Check that the battery voltage is above 12V.
(b) Disconnect the negative terminal of the battery.



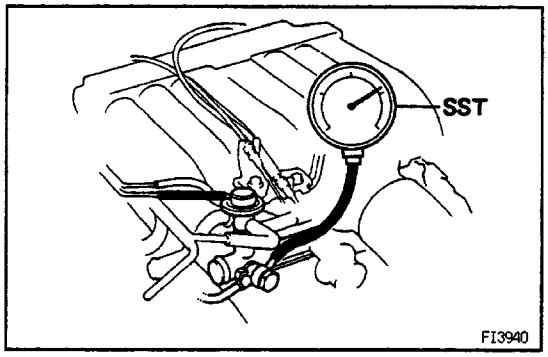
(c) Place a suitable container or shop towel under the LH delivery pipe.
(d) Slowly loosen the union bolt of the No.3 fuel pipe and remove the union bolt and two gaskets from the delivery pipe.
(e) Drain fuel in the LH delivery pipe.



(f) Install the No.3 fuel pipe and SST (pressure gauge) to the LH delivery pipe with three new gaskets and SST (union bolt) as shown in the illustration.
SST 09268–45012
Torque: 34 N–m (350 kgf–cm, 25 ft–lbf)
(g) Wipe off any splattered gasoline.
(h) Reconnect the battery negative terminal.



(i) Using SST, connect terminals FP and +B of the DLC 1.
SST 09843–18020
(j) Turn the ignition switch ON.



(k) Measure the fuel pressure.

Fuel pressure:

265 – 304 kPa (2.7 – 3.1 kgf/cm^2, 38 – 44 psi)

If pressure is high, replace the fuel pressure regulator.

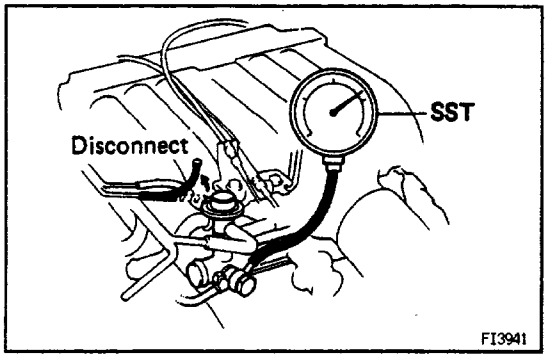
If pressure is low, check the following parts:

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

(l) Remove SST from the DLC 1.

SST 09843–18020

(m) Start the engine.

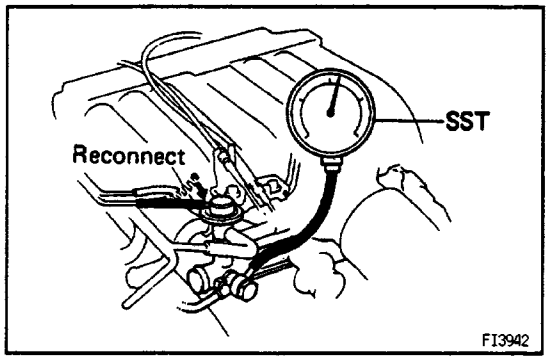


(n) Disconnect the vacuum hose from the fuel pressure regulator and plug it closed.

(o) Measure the fuel pressure at idling.

Fuel pressure:

265 – 304 kPa (2.7 – 3.1 kgf/cm^2, 38 – 44 psi)



(p) Reconnect the vacuum hose to the fuel pressure regulator.

(q) Measure the fuel pressure at idling.

Fuel pressure:

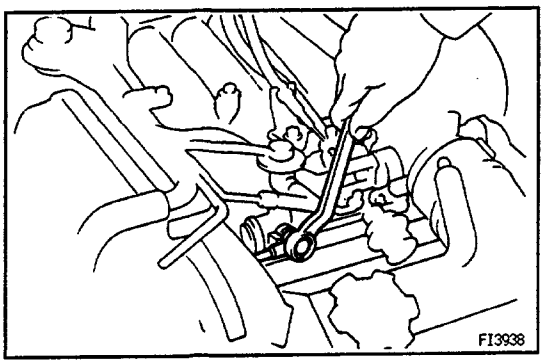
226 – 255 kPa (2.3 – 2.6 kgf/cm^2, 33 – 37 psi)

If not within the specified pressure, check the vacuum hose and fuel pressure regulator.

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

If not within specification, check the fuel pump, fuel pressure regulator and/or injectors.

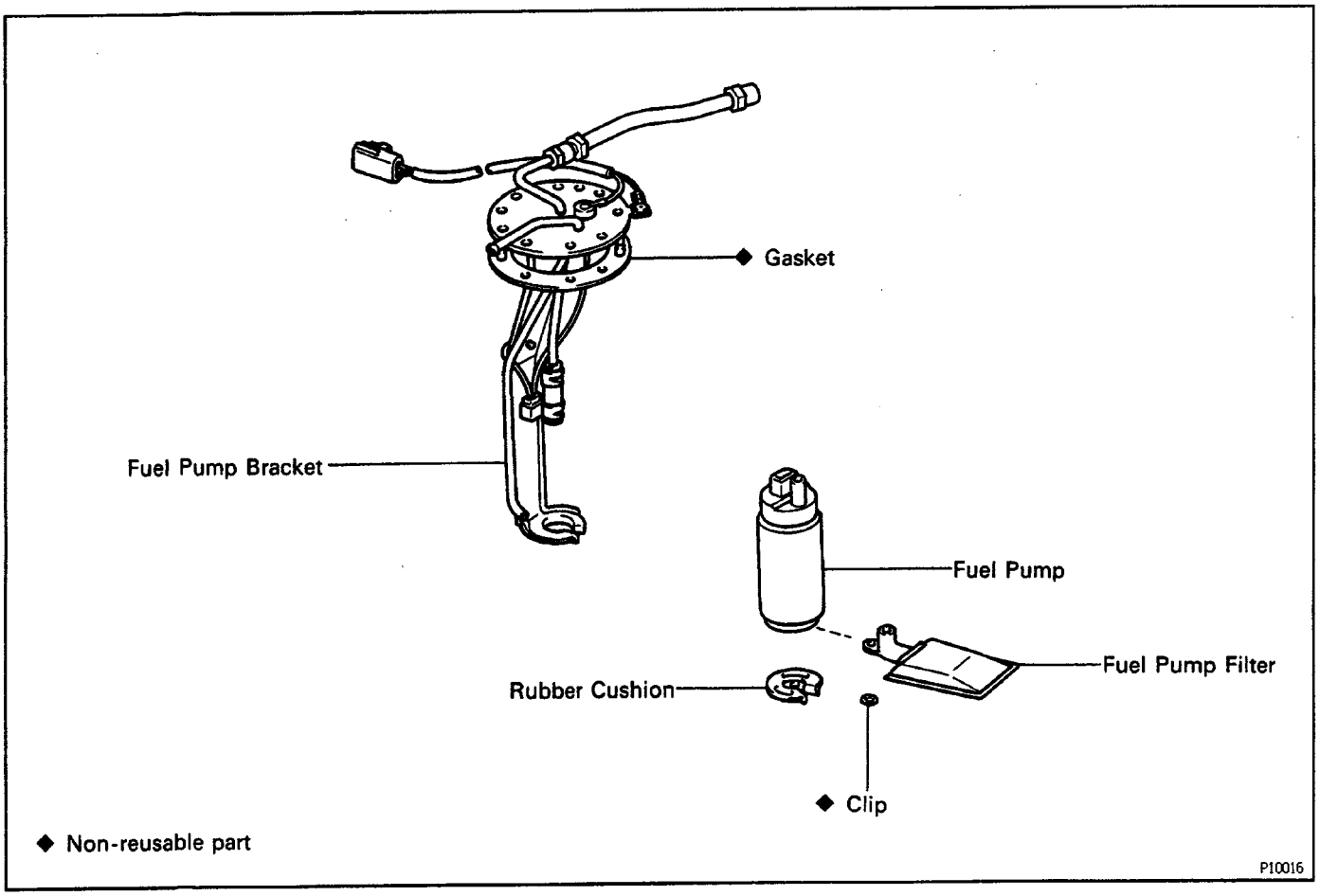
(s) After checking fuel pressure, disconnect the battery negative terminal and carefully remove the SST to prevent gasoline from splashing.



(t) Using two new gaskets, reconnect the No.3 fuel pipe to the delivery pipe.
Torque: 34 N–m (350 kgf–cm. 25 ft–lbf)
(u) Reconnect the battery negative terminal.
(v) Start the engine and check for fuel leakage.

COMPONENTS FOR REMOVAL AND INSTALLATION

EG1TF–01



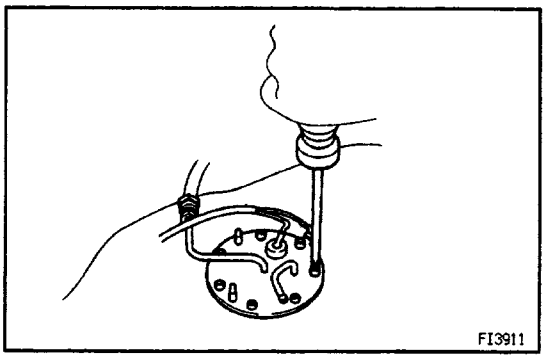
FUEL PUMP REMOVAL

EG1GP–02

1. DRAIN FUEL FROM FUEL TANK

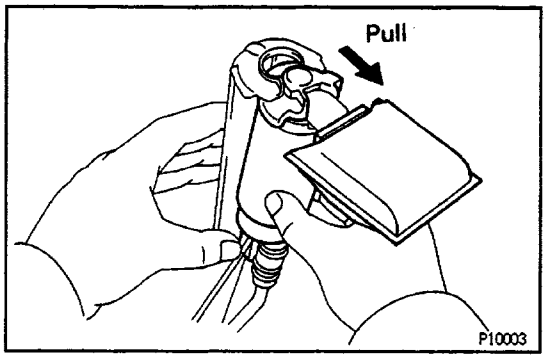
CAUTION: Do not smoke or work near an open flame when working on the fuel pump.

2. REMOVE FUEL TANK



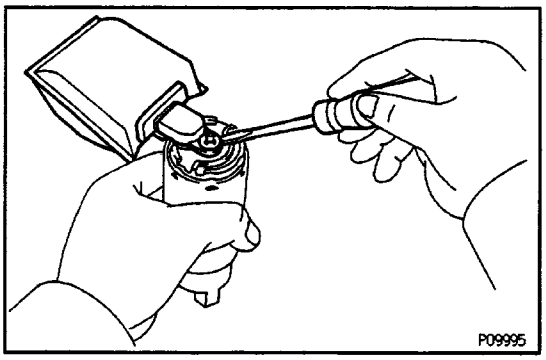
3. REMOVE FUEL PUMP BRACKET

(a) Remove the seven bolts.
(b) Pull out the fuel pump bracket.



4. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET

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



5. REMOVE FUEL PUMP FILTER FROM FUEL PUMP

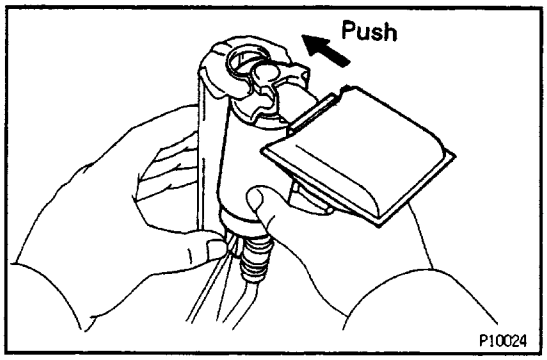
(a) Using a small screwdriver, remove the clip.
(b) Pull out the pump filter.

FUEL PUMP INSTALLATION

(See Components for Removal and Installation)

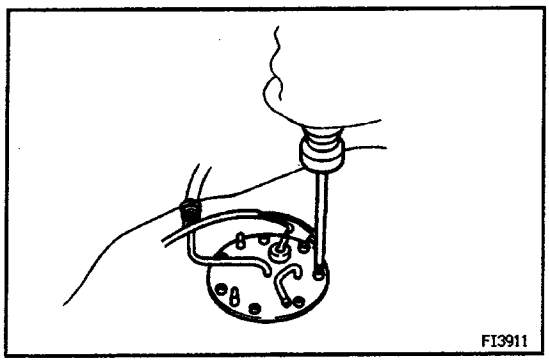
1. INSTALL FUEL PUMP FILTER TO FUEL PUMP

Install the pump filter with a new clip.



2. INSTALL FUEL PUMP TO FUEL PUMP BRACKET

(a) Install the rubber cushion to the fuel–pump.
(b) Connect the fuel hose to the outlet port of the fuel pump.
(c) Install the fuel pump connector.
(d) Install the fuel pump by pushing the lower side of the fuel pump.



3. INSTALL FUEL PUMP BRACKET

(a) Place the bracket with a new gasket on the fuel tank.

(b) Install and tighten the seven bolts.

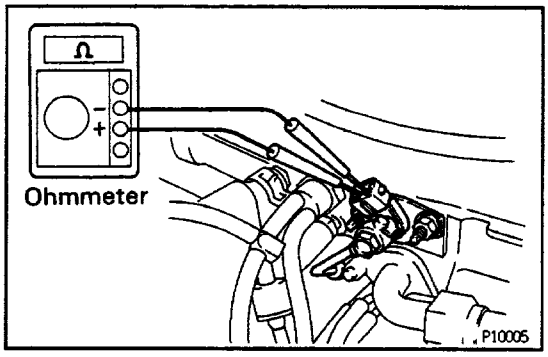
Torque: 3.9 N–m (40 kgf–cm, 34 in.–lbf)

4. INSTALL FUEL TANK

NOTICE:

- **Tighten the pipe and flare nut type hose to the specified torque.**
- **Push in the pipe and insert–type hose to the specified position, and install the clip to the specified location.**
- **If reusing the hose, reinstall the clip at the original location.**

5. REFILL WITH FUEL



COLD START INJECTOR

EG1GR–03

ON–VEHICLE INSPECTION

INSPECT RESISTANCE OF COLD START INJECTOR

(a) Disconnect the cold start injector connector.

(b) Using an ohmmeter, check the resistance of the injector.

Resistance:

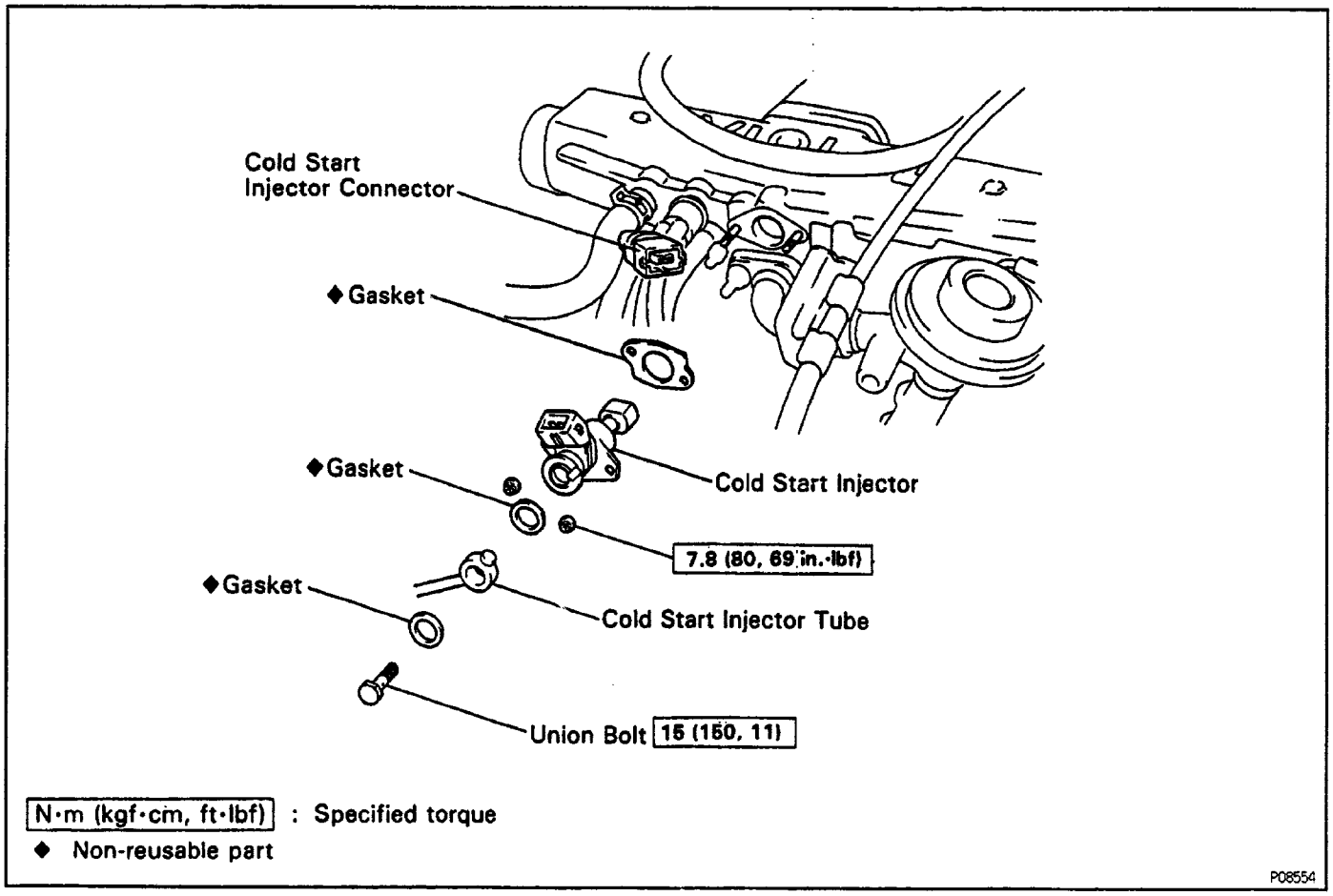
2–4Ω

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

(c) Connect the cold start injector connector.

EG1TH–01

COMPONENTS FOR REMOVAL AND INSTALLATION



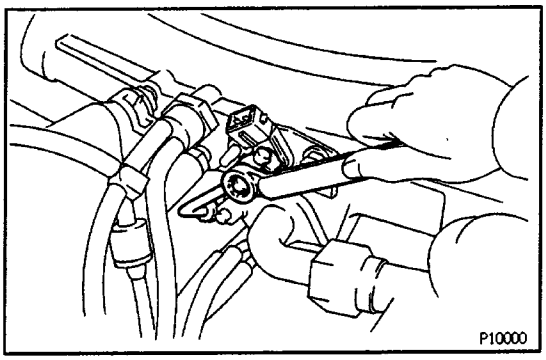
COLD START INJECTOR REMOVAL

EG1TJ–02

(See Components for Removal and Installation)

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

2. DISCONNECT COLD START INJECTOR CONNECTOR

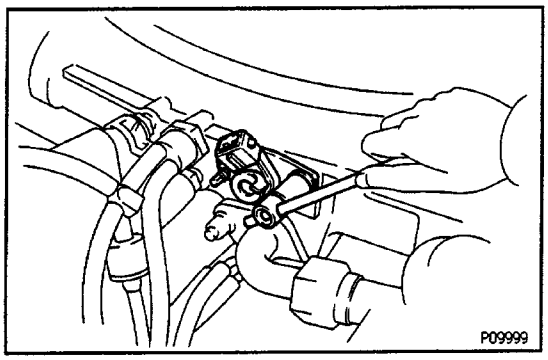


3. REMOVE COLD START INJECTOR

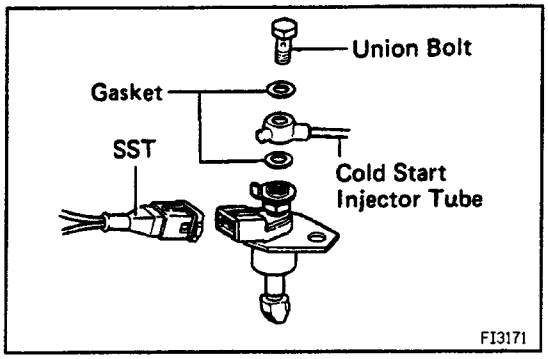
(a) Put a suitable container or shop towel under the cold start injector tube.

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

HINT: Slowly loosen the union bolt.



(c) Remove the two nuts and cold start injector with the gasket.



COLD START INJECTOR INSPECTION

EG1GT–02

1. CHECK INJECTION OF COLD START INJECTOR

(a) Install cold start injector tube, two new gaskets and union bolt to the injector.

Torque: 15 N–m (150 kgf–cm. 11 ft–lbf)

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

SST 09842–30050

CAUTION: Position the injector as far away from the battery as possible.

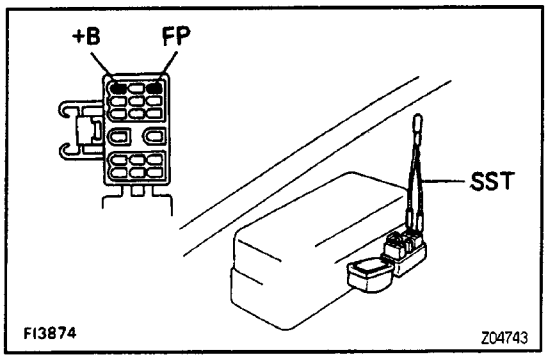
(c) Put a container under the injector.

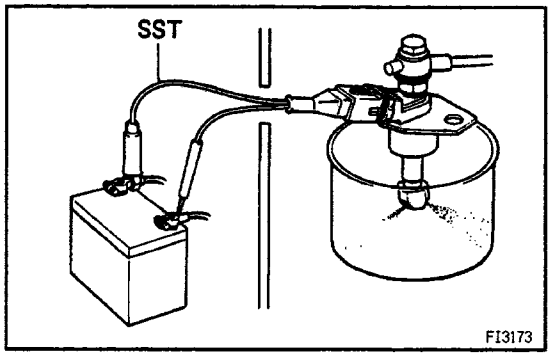
(d) Turn the ignition switch ON.

HINT: Do not start the engine.

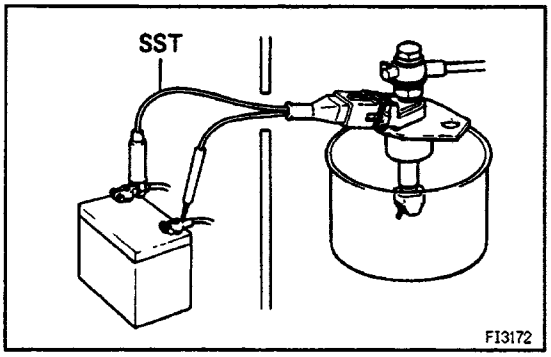
(e) Using SST, connect terminals FP and +B of the DLC 1.

SST 09843–18020





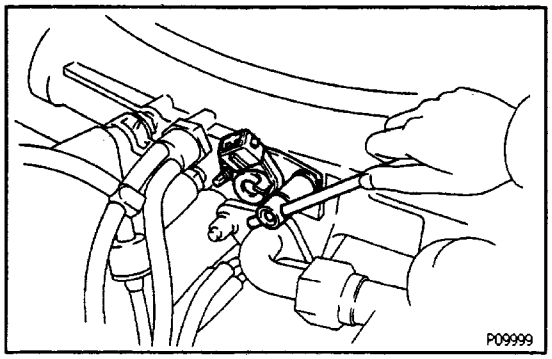
(f) Connect the test probes of the SST to the battery and check that the fuel injection is as shown.
SST 09842–30050
NOTICE: Perform this check within the shortest possible time.

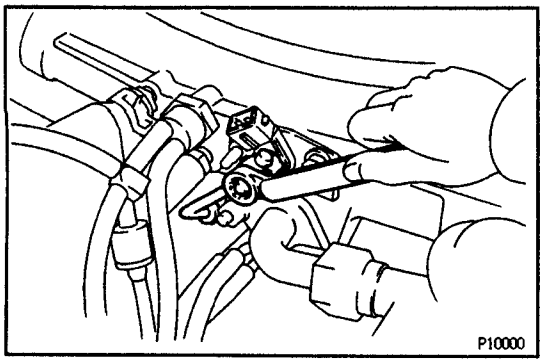


2. INSPECT LEAKAGE
(a) Disconnect the test probes of SST from the battery and check fuel leakage from the injector.
SST 09842–30050
Fuel drop:
One drop or less per minute
(b) After checking, remove SST and restore the following parts to their original positions.
- DLC1
- Ignition switch OFF
- Cold start injector
- Injector connector

COLD START INJECTOR INSTALLATION

(See Components for Removal and Installation)
1. INSTALL COLD START INJECTOR
(a) Apply sealant to 2 or 3 threads of the bolt end.
Sealant: Part No. 08833–00070, THREE BOND 1324 or equivalent
HINT: This adhesive will not harden while exposed to air.
It will act as a sealant or binding agent only when applied to threads, etc., where air is cut off.
(b) Place a new gasket and install the cold start injector with the two nuts.
Torque: 7.8 N–m (80 kgf–cm, 69 in.–lbf)





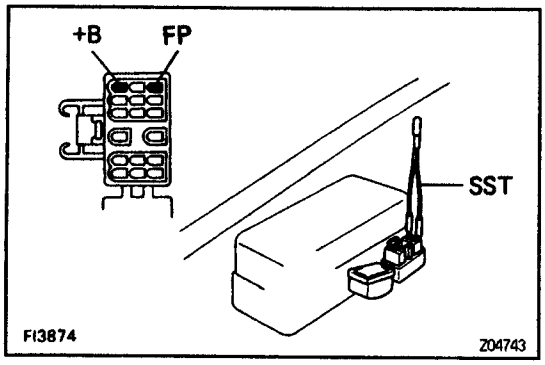
2. INSTALL COLD START INJECTOR TUBE

Using new gaskets, connect the cold start injector tube with the union bolts.

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

3. CONNECT COLD START INJECTOR CONNECTOR

4. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY



5. CHECK FOR FUEL LEAKAGE

(a) With the ignition switch ON, use SST to connect terminals FP and +B of the DLC1.
SST 09843–18020

(b) Check for fuel leakage.

(c) Remove SST from the DLC1.

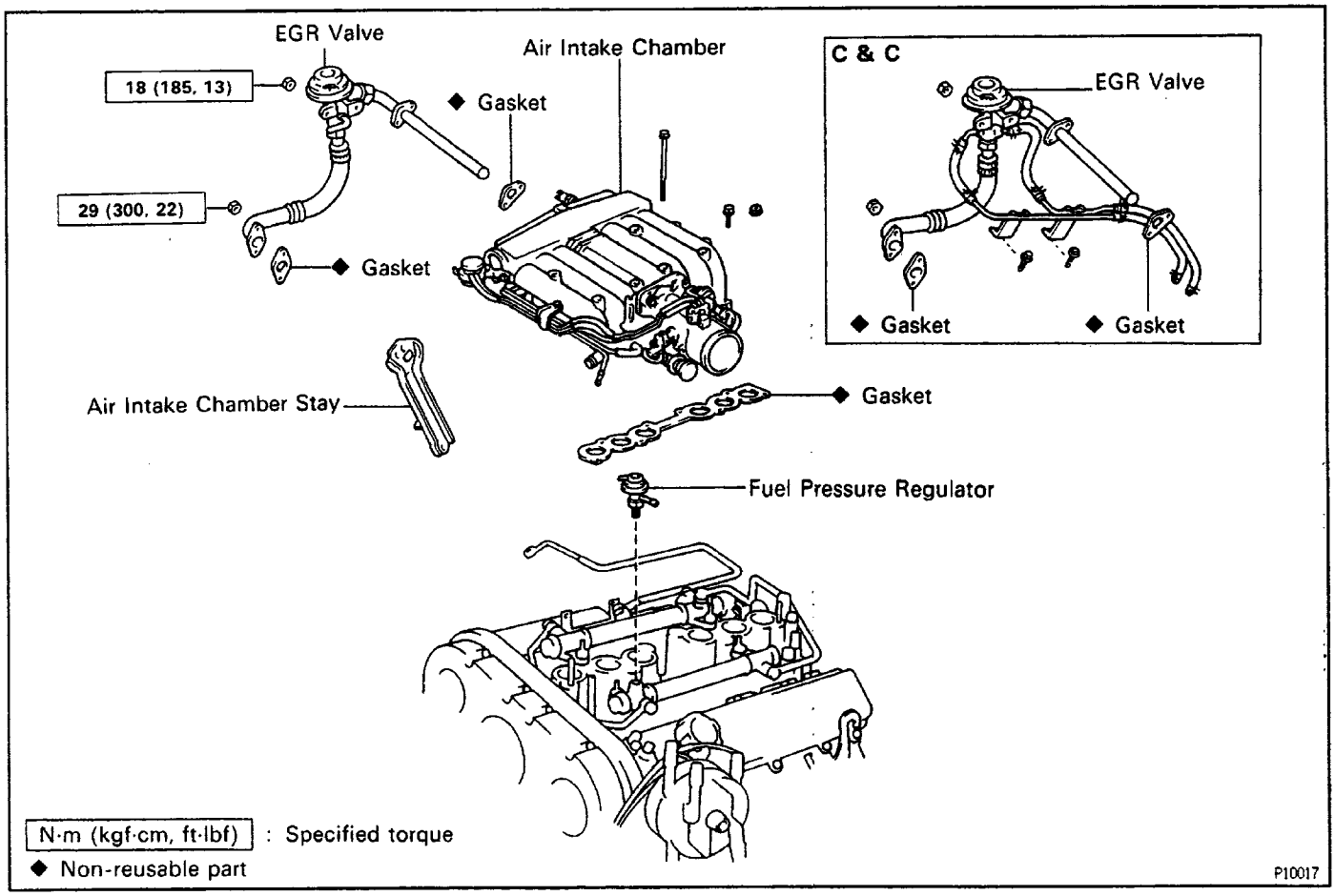
FUEL PRESSURE REGULATOR EG1TL–01

ON–VEHICLE INSPECTION

CHECK FUEL–PRESSURE

(See step 2 on page EG2–203)

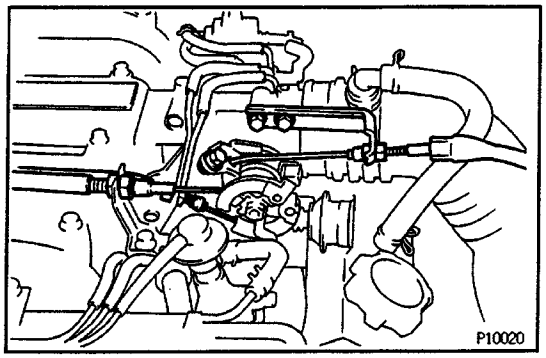
COMPONENTS FOR REMOVAL AND INSTALLATION EG1TM–01



FUEL PRESSURE REGULATOR REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

2. DRAIN ENGINE COOLANT



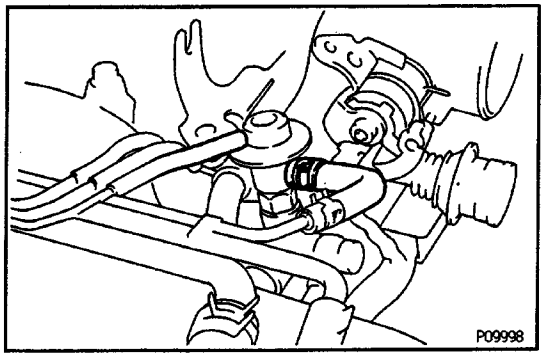
3. DISCONNECT FOLLOWING CABLES:

(a) (w/ Cruise control)
Actuator cable with bracket

(b) Accelerator cable

(c) (A/T)
Throttle cable

4. DISCONNECT AIR CLEANER HOSE



5. DISCONNECT VACUUM SENSING HOSE

6. DISCONNECT FUEL RETURN HOSE

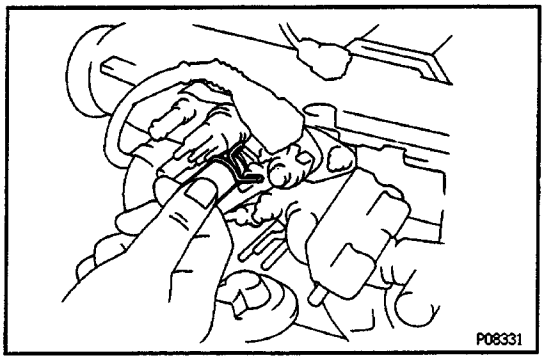
(a) Place a suitable container or shop towel under the fuel pressure regulator.

(b) Disconnect the fuel return hose from the fuel pressure regulator.

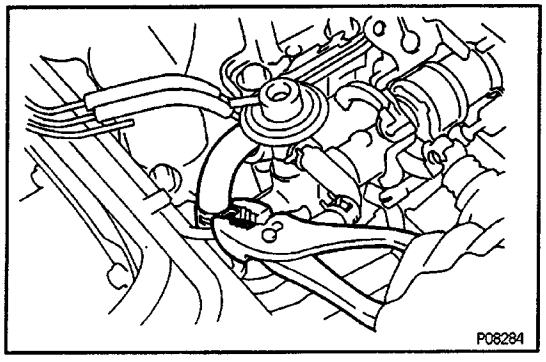
7. REMOVE AIR INTAKE CHAMBER

(a) Disconnect the throttle position sensor connector.

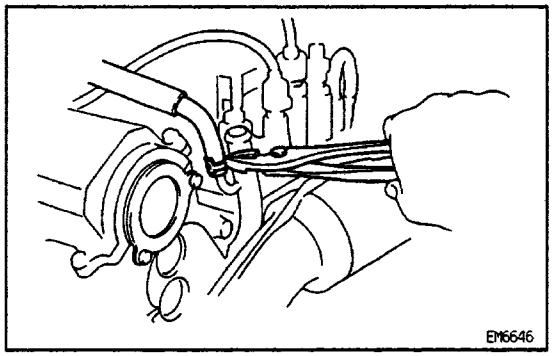
(b) Disconnect the canister vacuum hose from the throttle body.



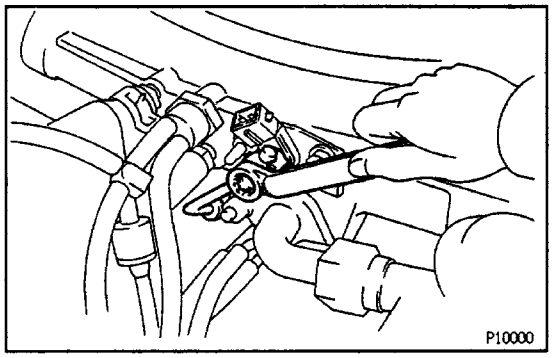
(c) Disconnect the PCV hose from the union.



(d) Disconnect the No.4 water by–pass hose from the union of the intake manifold.

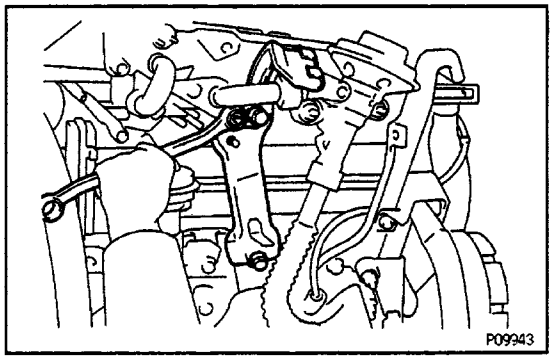


(e) Disconnect the No.5 water by–pass hose from the water by–pass pipe.

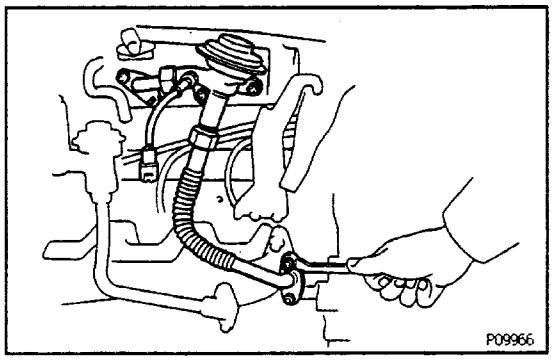


(f) Disconnect the cold start injector connector.
(g) Remove the union bolt, two gaskets and cold start injector tube.

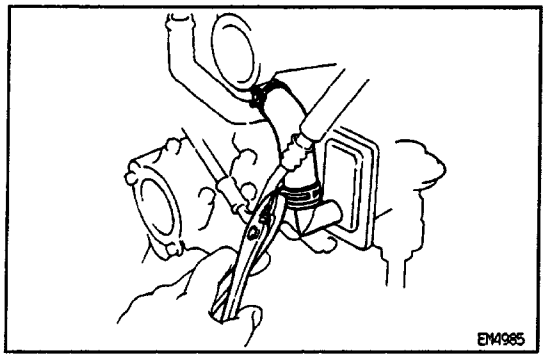
(h) Disconnect the vacuum hose from the gas filter.
(i) (California and C & C)
Disconnect the EGR gas temp. sensor connector.
(j) Disconnect the EGR vacuum hoses from the air pipe and EGR vacuum modulator.



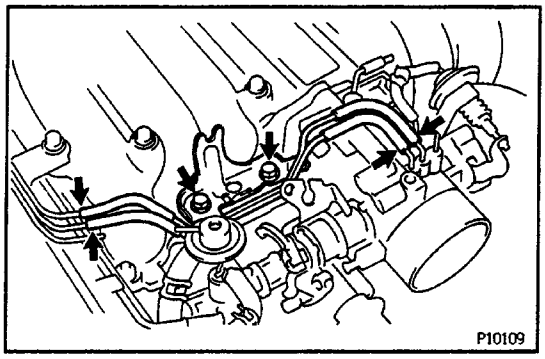
(k) Remove the nut, two bolts, intake chamber stay and throttle cable bracket.



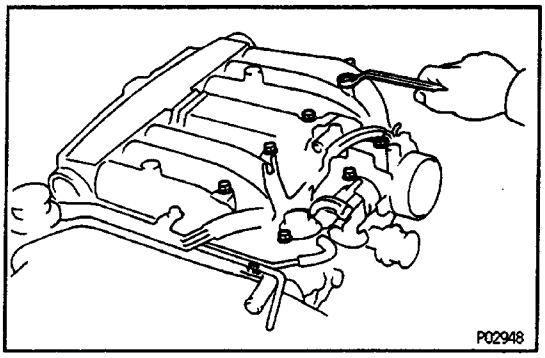
(l) (C & C only)
Disconnect the two water by–pass hoses from the EGR valve.
(m) Remove the five nuts, EGR valve with the pipes and two gaskets.



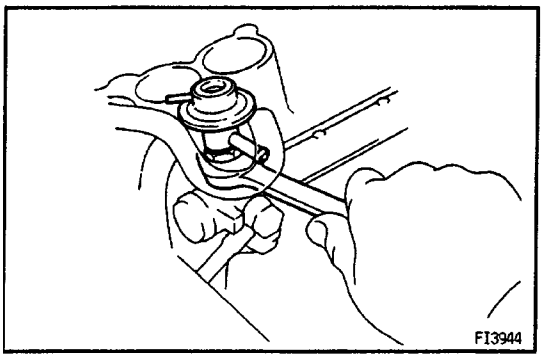
(n) Disconnect the No.1 air hose from the PAIR reed valve.



(o) Disconnect the four vacuum hoses from the air pipes.
(p) Remove the two bolts and accelerator cable bracket.

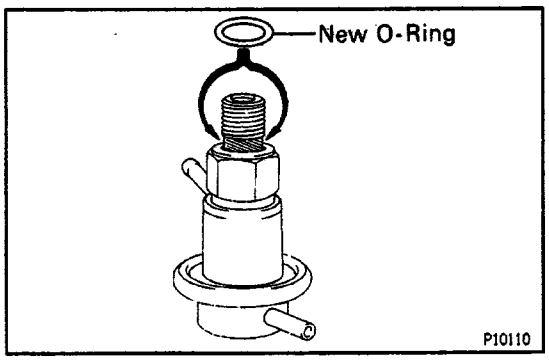


(q) Remove the six bolts, two nuts, intake chamber and gasket.



8. REMOVE FUEL PRESSURE REGULATOR

Loosen the lock nut, and remove the fuel pressure regulator.



FUEL PRESSURE REGULATOR INSTALLATION

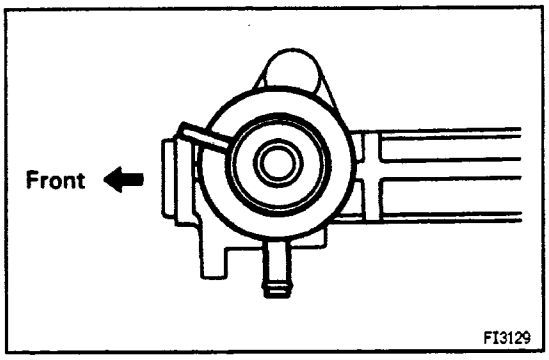
(See Components for Removal and Installation)

1. INSTALL FUEL PRESSURE REGULATOR

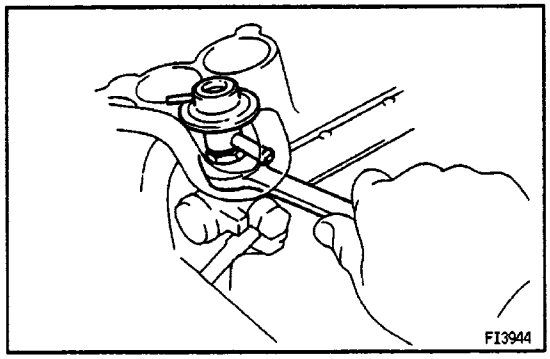
(a) Fully loosen the lock nut of the fuel pressure regula–tor.

(b) Apply a light coat of gasoline to a new 0–ring and install it to the fuel pressure regulator.

(c) Thrust the fuel pressure regulator completely into the delivery pipe by hand.

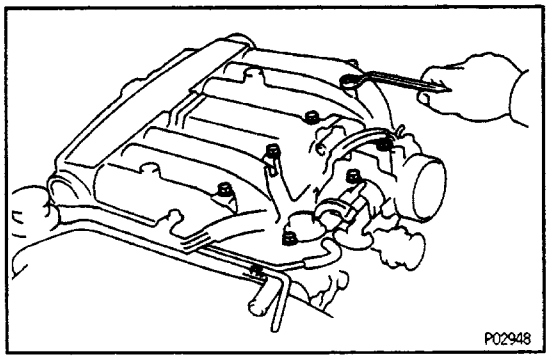


(d) Turn the fuel pressure regulator counterclockwise until the outlet faces in the direction indicated in the illustration.



(e) Torque the lock nut.

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

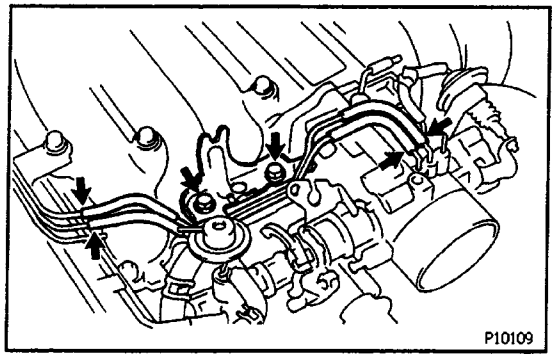


2. INSTALL AIR INTAKE CHAMBER

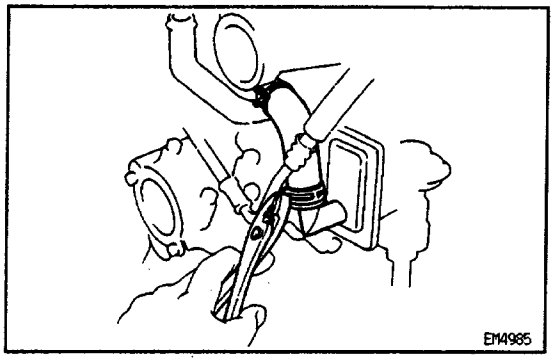
(a) Position a new gasket on the intake manifold.

(b) Install the intake chamber with the six bolts and two nuts.

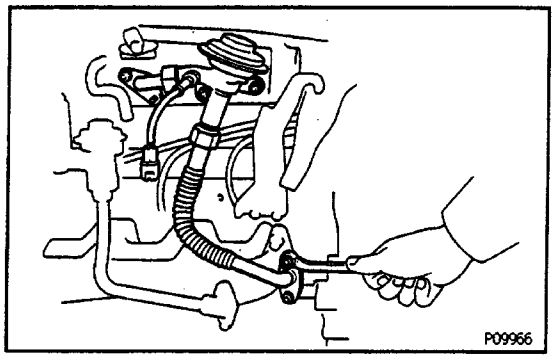
Torque: 18 N–m (185 kgf–cm, 13 ft–lbf)



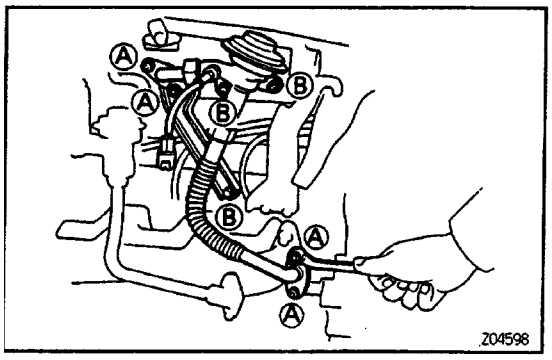
(c) Install the accelerator cable bracket with the two bolts.
(d) Connect the four vacuum hoses to the air pipes.



(e) Connect the No. 1 air hose to the reed valve.

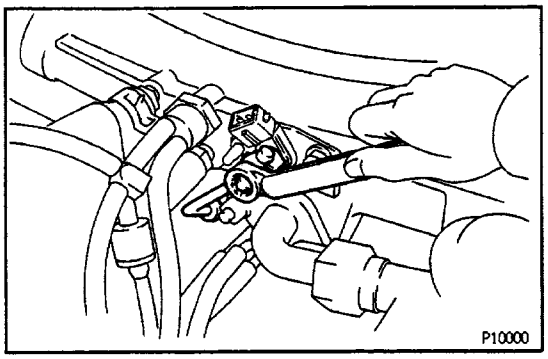


(f) Position two new gaskets to the intake chamber and RH exhaust manifold.
(g) Install the EGR valve with the pipes to the intake chamber and RH exhaust manifold.
(h) (C & C only)
Connect the two water by–pass hoses to the EGR valve.

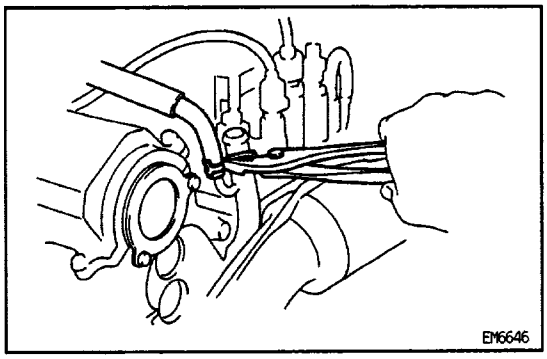


(i) Install the air intake chamber stay and throttle cable bracket. Install and torque the six nuts and two bolts.
Torque:
(A) 29 N–m (300 kgf–cm, 22 ft–lbf)
(B) 18 N–m (185 kgf–cm, 13 ft–lbf)

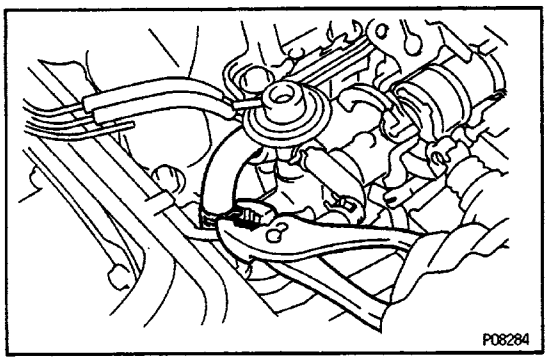
(j) Connect the EGR hoses to the air pipe and EGR vacuum modulator.
(k) (California and C & C)
Connect the EGR gas temp. sensor connector.
(l) Connect the vacuum hose to the gas filter.



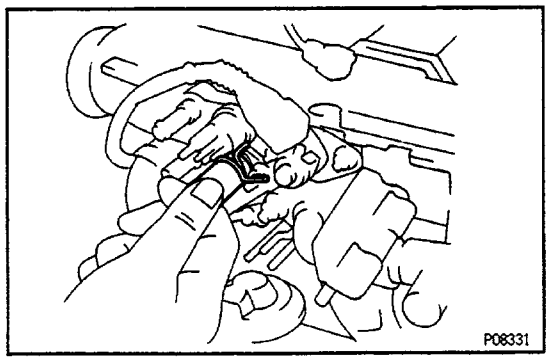
(m) Connect the cold start injector tube with new a gasket and the union bolt.
Torque: 15 N–m (150 kgf–cm, 13 ft–lbf)
(n) Connect the cold start injector connector.



(o) install the No.5 Water by–pass hose to the water by –pass pipe.

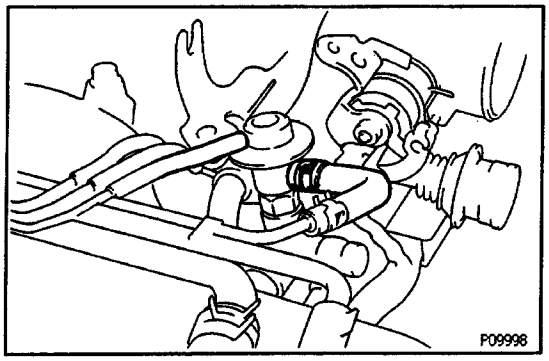


(p) Connect the No.4 water by–pass hose to the union of the intake manifold.

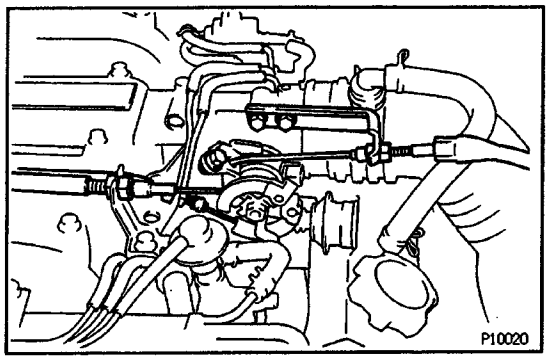


(q) Connect the PCV hose to the union.

(r) Connect the canister vacuum hose to the throttle body.
(s) Connect the throttle position sensor connector.

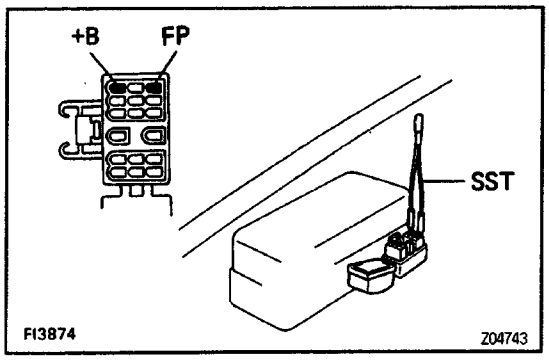


3. CONNECT FUEL RETURN HOSE
4. CONNECT VACUUM SENSING HOSE
5. CONNECT AIR CLEANER HOSE



6. CONNECT FOLLOWING CABLES:
(a) (A/T)
Throttle cable
(b) Accelerator cable
(c) (w/ Cruise control)
Actuator cable with bracket

7. REFILL WITH ENGINE COOLANT
8. CONNECT CABLE TO NEGATIVE TERMINAL CF BATTERY

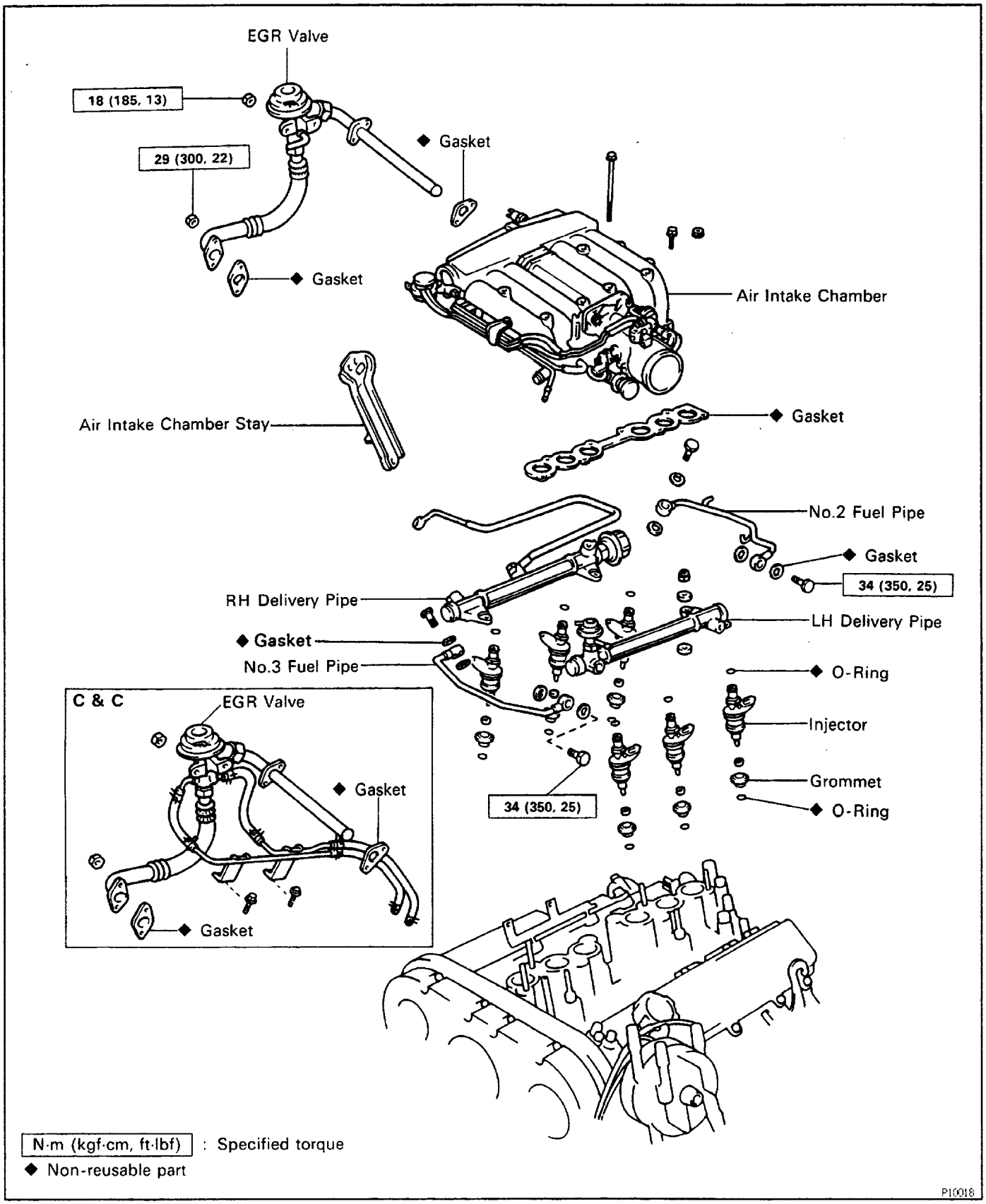


9. CHECK FOR FUEL LEAKAGE
(a) With the ignition switch ON, use SST to connect terminals FP and +B of the DLC1.
SST 09843–18020
(b) Check for fuel leakage.
(c) Remove SST from the DLC1.

INJECTOR

EG1TQ–01

COMPONENTS FOR REMOVAL AND INSTALLATION



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

◆ Non-reusable part

P10018

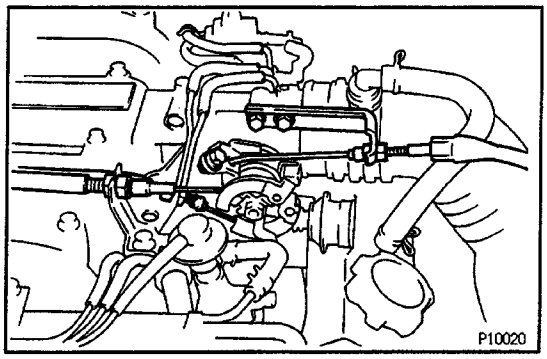
EG306–01

INJECTORS REMOVAL

(See Components for Removal and Installation)

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

2. DRAIN ENGINE COOLANT



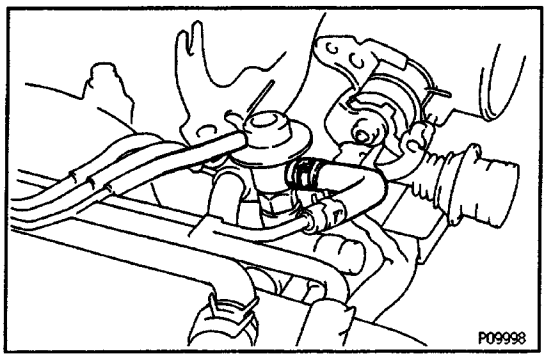
3. DISCONNECT FOLLOWING CABLES:

(a) (w/ Cruise control)
Actuator cable with bracket

(b) Accelerator cable

(c) (A/T)
Throttle cable

4. DISCONNECT AIR CLEANER HOSE



5. DISCONNECT VACUUM SENSING HOSE

6. DISCONNECT FUEL RETURN HOSE

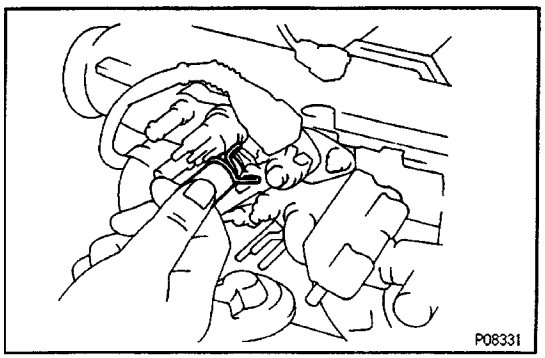
(a) Place a suitable container or shop towel under the fuel pressure regulator.

(b) Disconnect the fuel return hose from the fuel pressure regulator.

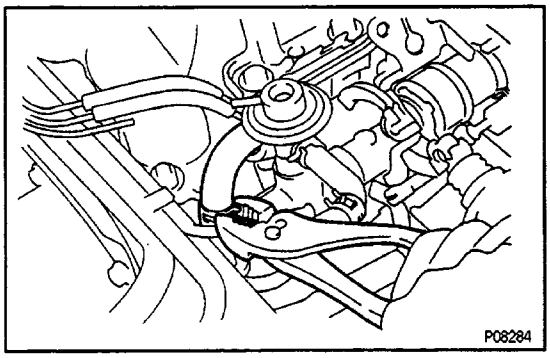
7. REMOVE AIR INTAKE CHAMBER

(a) Disconnect the throttle position sensor connector.

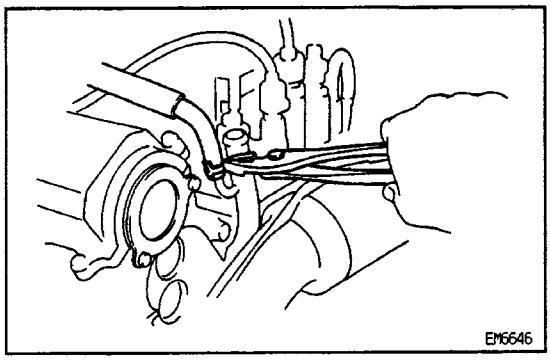
(b) Disconnect the canister vacuum hose from the throttle body.



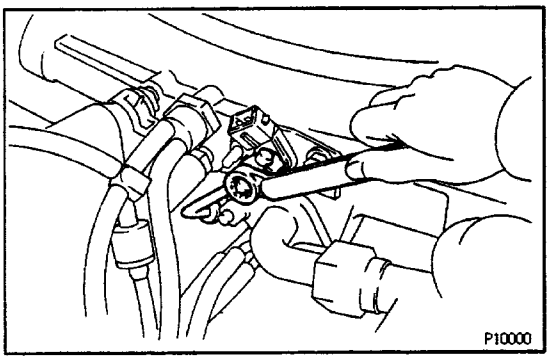
(c) Disconnect the PCV hose from the union.



(d) Disconnect the No.4 water by–pass hose from the union of the intake manifold.

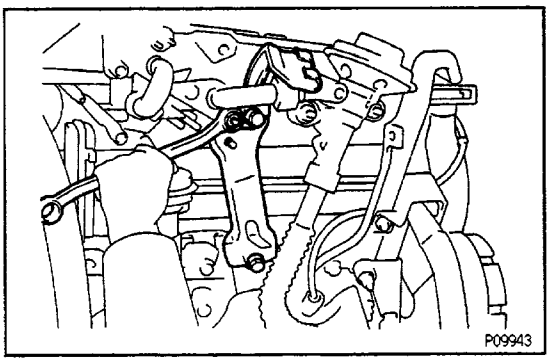


(e) Disconnect the No.5 water by–pass hose from the water by–pass pipe.

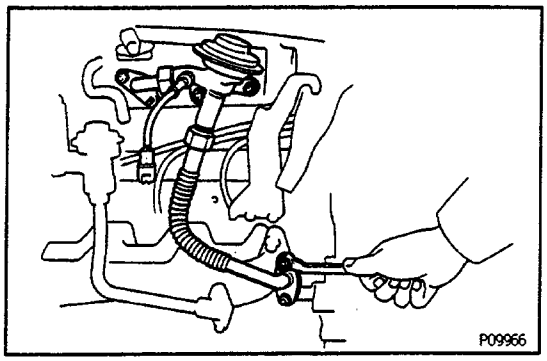


(f) Disconnect the cold start injector connector.
(g) Disconnect the vacuum hose from the gas filter.
(h) Remove the union bolt, two gaskets and cold start injector tube.

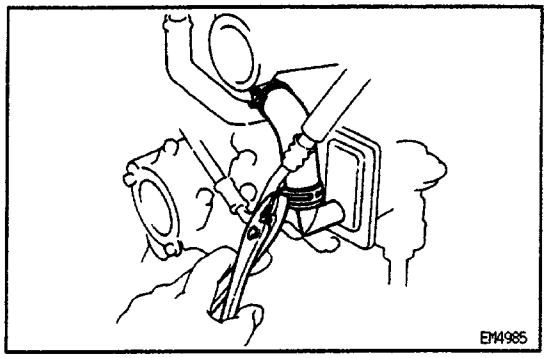
(i) (California and C & C)
Disconnect the EGR gas temp. sensor connector.
(j) Disconnect the EGR vacuum hoses from the air pipe and EGR vacuum modulator.



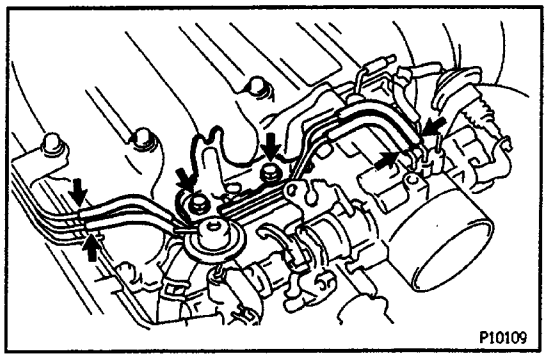
(k) Remove the nut, two bolts, intake chamber stay and throttle cable bracket.



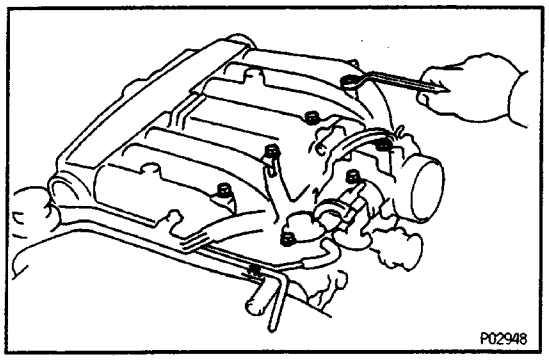
(l) (C & C only)
Disconnect the two water by–pass hoses from the EGR valve.
(m) Remove the five nuts, EGR valve with the pipes and two gaskets.



(n) Disconnect the No.1 air hose from the PAIR reed valve.



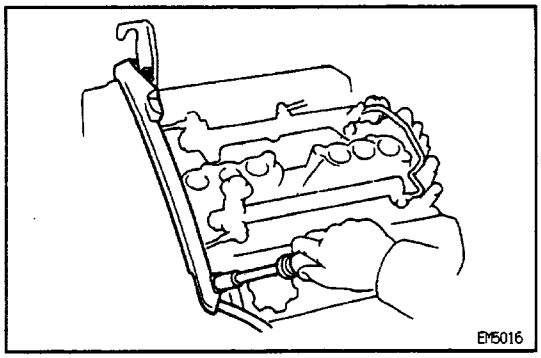
(o) Disconnect the four vacuum hoses from air pipes.
(p) Remove the two bolts and accelerator cable bracket.



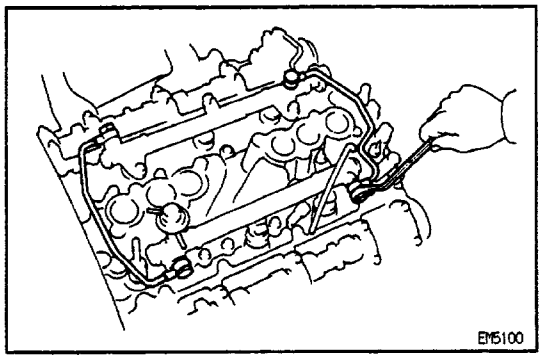
(q) Remove the six bolts, two nuts, intake chamber and gasket.

8. REMOVE ENGINE WIRE

(a) Disconnect–the following connectors:
- Knock sensor connector
- Cold start injector time switch connector
- Engine coolant temp. sensor connector
- Engine coolant temp. sender gauge connector
- RH ground strap from No.3 camshaft bearing cap
- Injector connectors

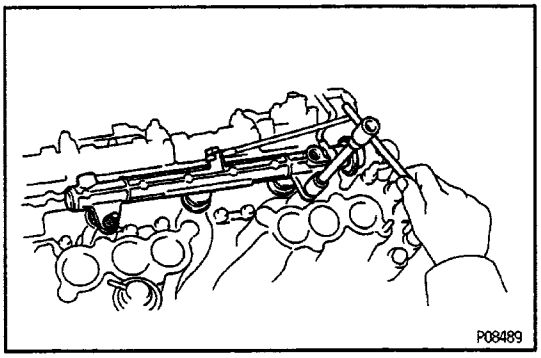


(b) Remove two bolts and engine wire.



9. REMOVE NO.2 AND NO.3 FUEL PIPES

Remove the four union bolts, No.2, No.3 fuel pipes and eight gaskets.



10. REMOVE DELIVERY PIPES AND INJECTORS

(a) Remove the four nuts holding the delivery pipes to the intake manifold.

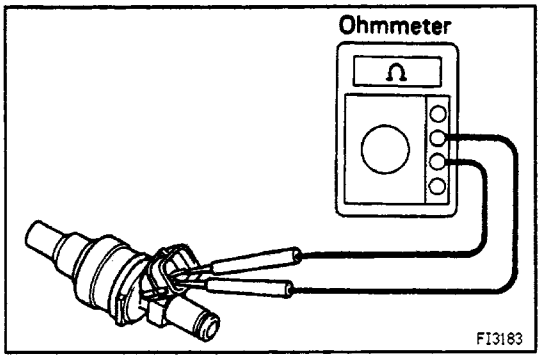
(b) Remove the the two delivery pipes and six injectors assemblies.

NOTICE: Be careful not to drop the injectors when rem–oving the delivery pipes.

(c) Remove the four insulators, ten spacers and four O–rings from the cylinder head.

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

(e) Remove the O–ring and grommet from each injector.



EG1T8–01

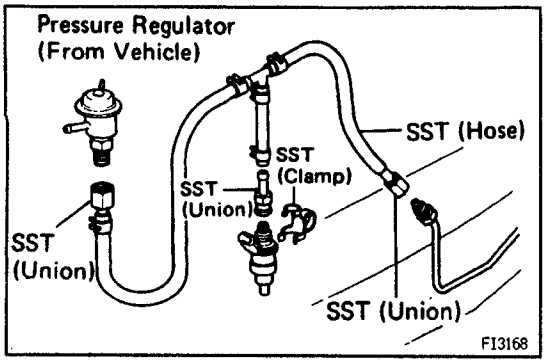
INJECTORS INSPECTION

1. MEASURE RESISTANCE OF INJECTOR

Using an ohmmeter, check the resistance of both terminals.

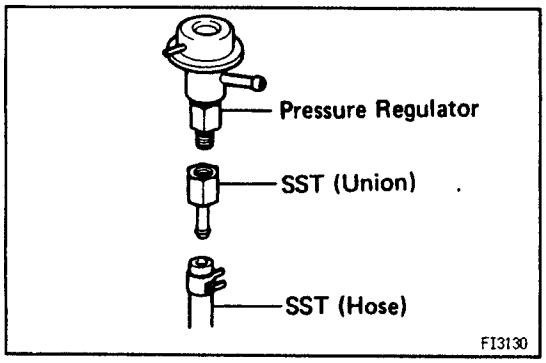
Resistance:

13.4–14.2 Ω

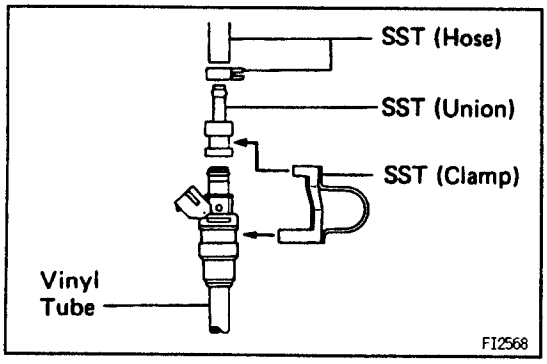


2. TEST INJECTION OF INJECTOR

CAUTION: Keep injectors clear of sparks during the test.

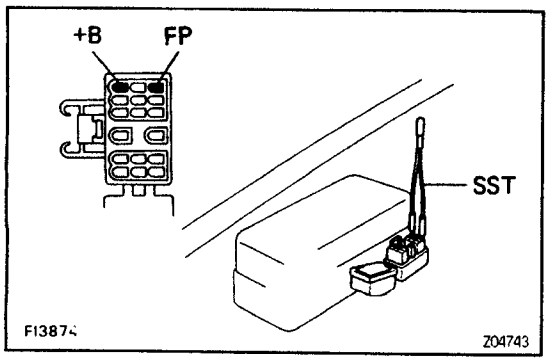


(a) Disconnect the No.1 fuel hose from the fuel tube.
(b) Connect SST (hose and union) to the fuel tube.
SST 09268–41045 (09268–52010)
(c) Remove the fuel pressure regulator.
(d) Connect SST (hose) to the fuel pressure regulator with SST (union).
SST 09268–41045 (09268–52010)

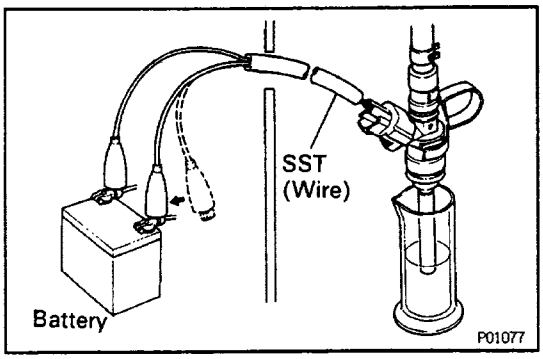


(e) Install SST (union) to the injector and hold the injector and union with SST (clamp).
SST 09268–41045
(f) Put the injector into the graduated cylinder.
HINT: Install a suitable vinyl tube onto the injector to prevent gasoline from splashing out.

(g) Connect the battery negative cable.
(h) Turn the ignition switch ON.
HINT: Do not start the engine.



(i) Using SST, connect terminals FP and +B of the DLC1.
SST 09843–18020
HINT: Fuel pump will operate.



(j) 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 cm^3/15 sec. (2.7 – 3.4 cu in.)

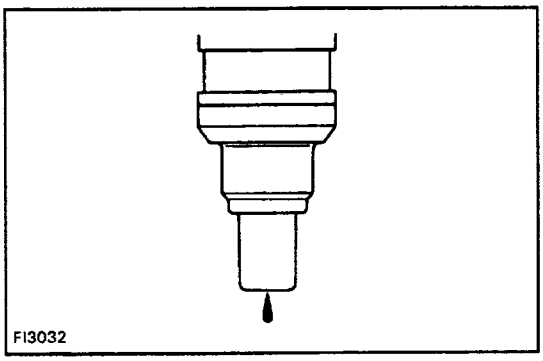
Difference between each injector:
6 cm^3 (0.4 cu in.) or less

If not within specified volume, replace the injector.

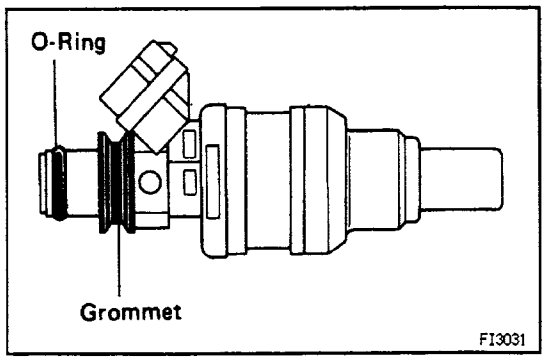
3. CHECK LEAKAGE

(a) In the condition above, disconnect SST from the battery and check for fuel leakage from the injector nozzle.
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



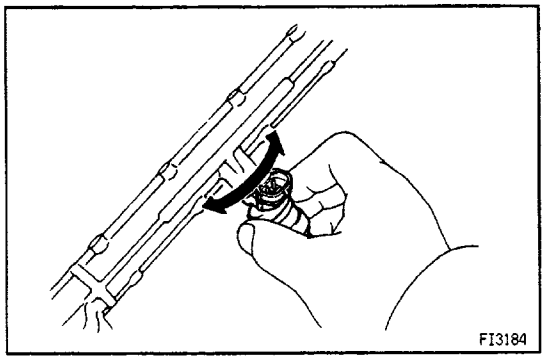
INJECTORS INSTALLATION

EG2O9–01

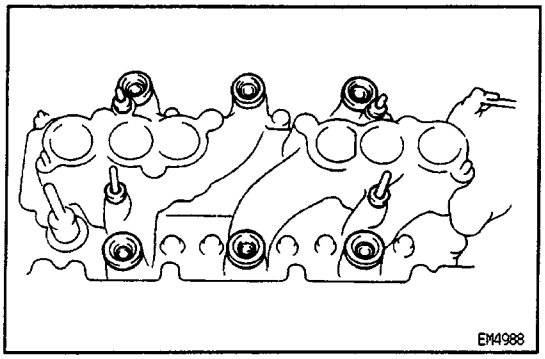
(See Components for Removal and Installation)

1. INSTALL INJECTORS AND DELIVERY PIPES

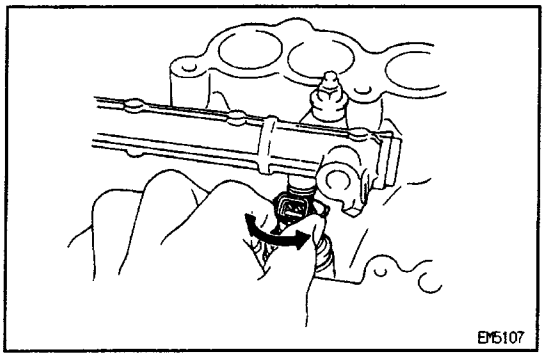
(a) Install a new grommet to the injector.
(b) Apply a light coat of gasoline to a new O–ring, and install it to the injector.



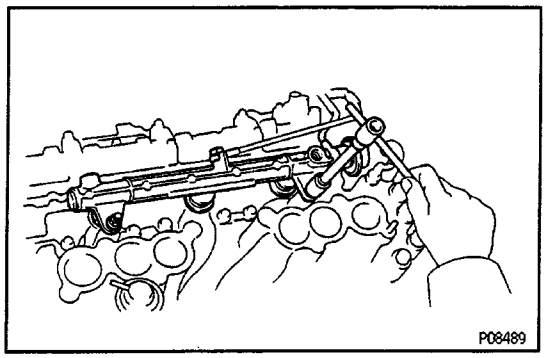
(c) While turning the injector clockwise and counter–clockwise, push it to the delivery pipe. Install the eight injectors.
(d) Position the injector connector outward.



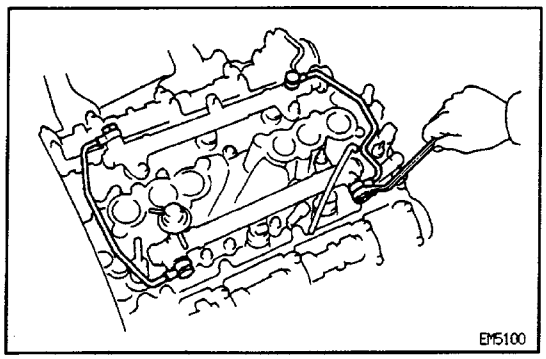
(e) Install a O–ring to the spacer.
(f) Place the six spacers and insulators into the injector holes.
(g) Place the four spacers on the stud bolts.



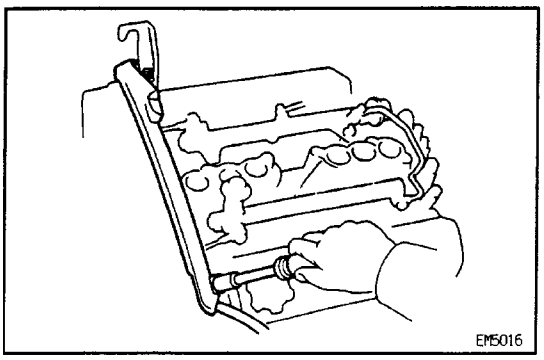
(h) Place the two delivery pipes together with the six injectors in position on the intake manifold.
(i) Temporarily install the four spacers and nuts.
(j) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of 0– rings. Replace the O–rings.
(k) Position the injector connector upward.



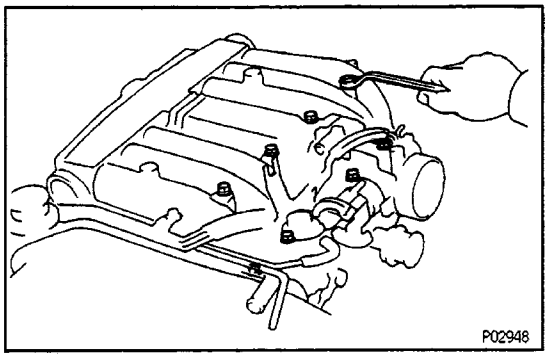
(l) Tighten the four nuts holding the delivery pipes to the intake manifold.
Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)
(m) Install the No. 1 fuel pipe to the No.3 bearing cap with the bolt.



2. INSTALL NO.2 AND NO.3 FUEL PIPES
(a) Install the No.2 fuel pipe with four new gaskets and two union bolts.
Torque: 34 N–m (350 kgf–cm, 25 ft–lbf)
(b) Install the No.3 fuel pipe with four new gaskets and two union bolts.
Torque: 34 N–m (350 kgf–cm, 25 ft–lbf)



3. INSTALL ENGINE WIRE
(a) Install the engine wire with the two bolts.
(b) Connect the following connectors:
- Injector connectors
- RH ground strap
- Engine coolant temp. sender gauge connector
- Engine coolant temp. sensor connector
- Cold start injector time switch connector
- Knock sensor connector

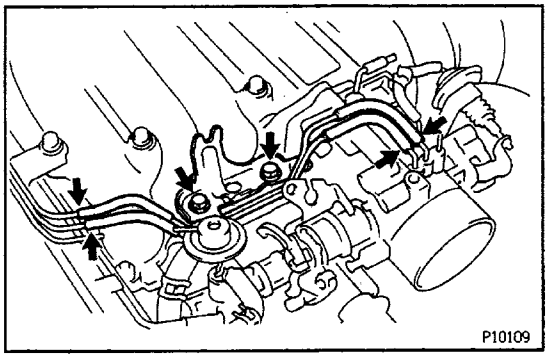


4. INSTALL AIR INTAKE CHAMBER

(a) Position a new gasket on the intake manifold.

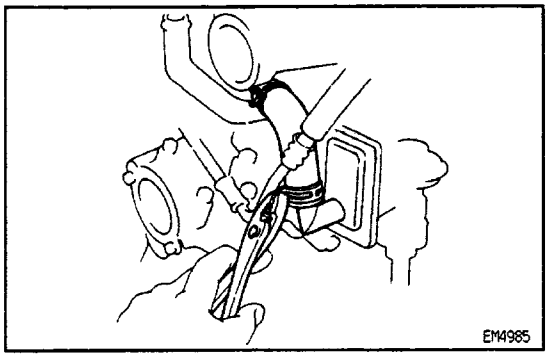
(b) Install the intake chamber with the six bolts and two nuts.

Torque: 18 N–m (185 kgf–cm, 13 ft–lbf)

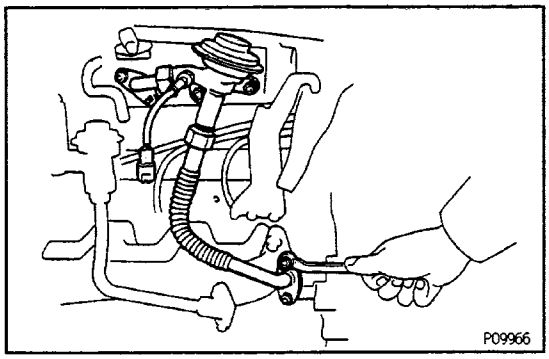


(c) Install the accelerator cable bracket with the two bolts.

(d) Connect the four vacuum hoses to the air pipes.



(e) Connect the No.1 air hose to the reed valve.

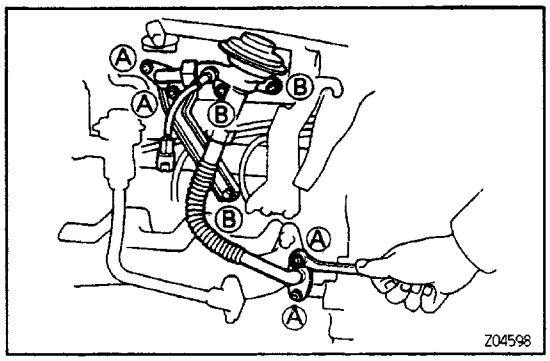


(f) Position two new gaskets to the intake chamber and RH exhaust manifold.

(g) Install the EGR valve with the pipes to the intake chamber and RH exhaust manifold.

(h) (C & C only)

Connect the two water by–pass hose to the EGR valve.



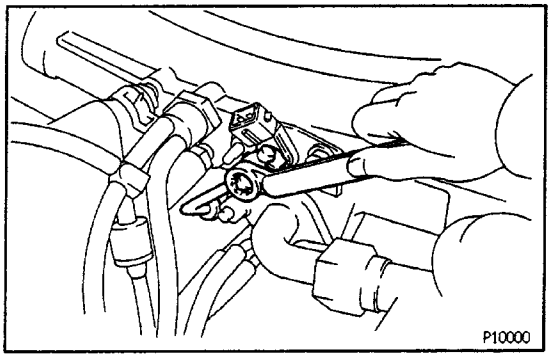
(i) Install the air intake chamber stay and throttle cable bracket. Install and torque the six nuts and two bolts.

Torque:

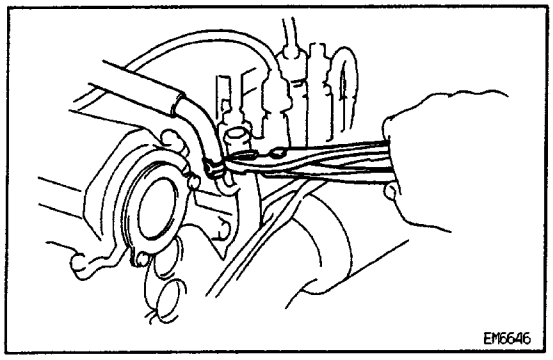
(A) 29 N–m (300 kgf–cm, 22 ft–lbf)

(B) 18 N–m (185 kgf–cm, 13 ft–lbf)

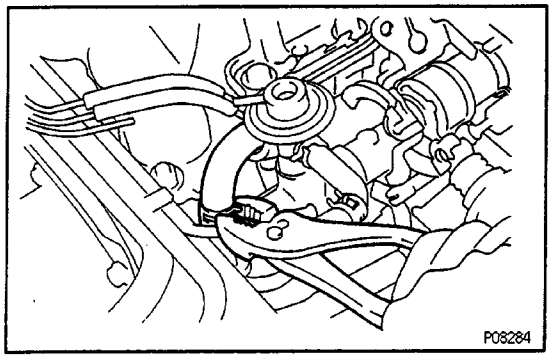
(j) Connect the EGR hoses to the air pipe and EGR vacuum modulator.
(k) (California and C & C)
Connect the EGR gas temp. sensor connector.
(l) Connect the vacuum hose to the gas filter.



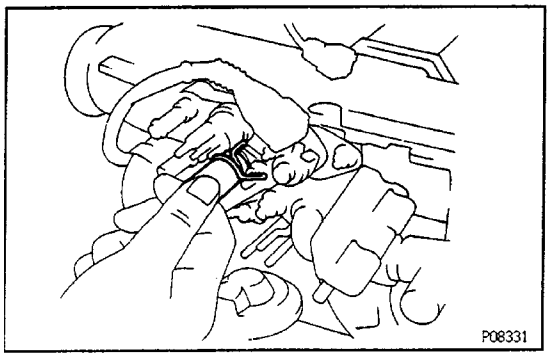
(m) Connect the cold start injector tube with a new gasket and the union bolt.
Torque: 15 N–m (150 kgf–cm, 13 ft–lbf)
(n) Connect the cold start injector connector.



(o) Install the No.5 water by–pass hose to the water by –pass pipe.

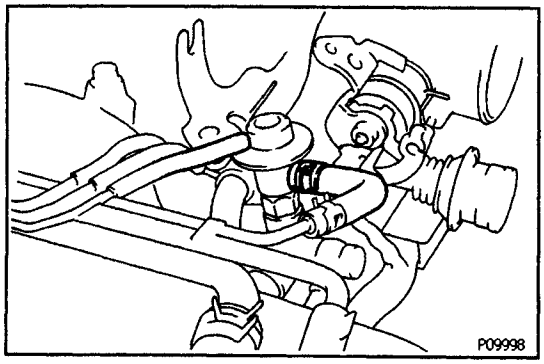


(p) Connect the No.4 water by–pass hose to the union of the intake manifold.

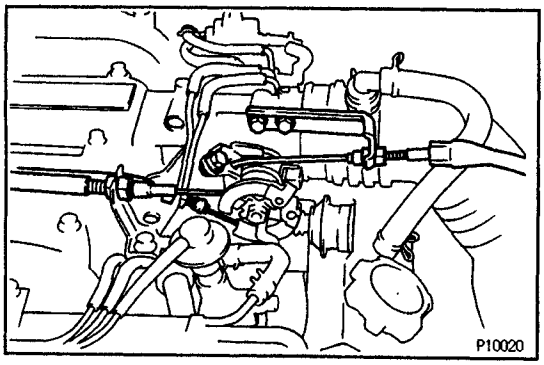


(q) Connect the PCV hose to the union.

(r) Connect the canister vacuum hose to the throttle body.
(s) Connect the throttle position sensor connector.

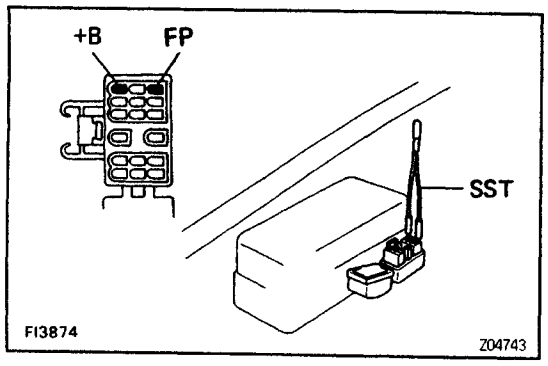


5. CONNECT FUEL RETURN HOSE
6. CONNECT VACUUM SENSING HOSE
7. CONNECT AIR CLEANER HOSE



8. CONNECT FOLLOWING CABLES:
(a) (A/T)
Throttle cable
(b) Accelerator cable
(c) (w/ Cruise control)
Actuator cable with bracket

9. REFILL WITH ENGINE COOLANT
10. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

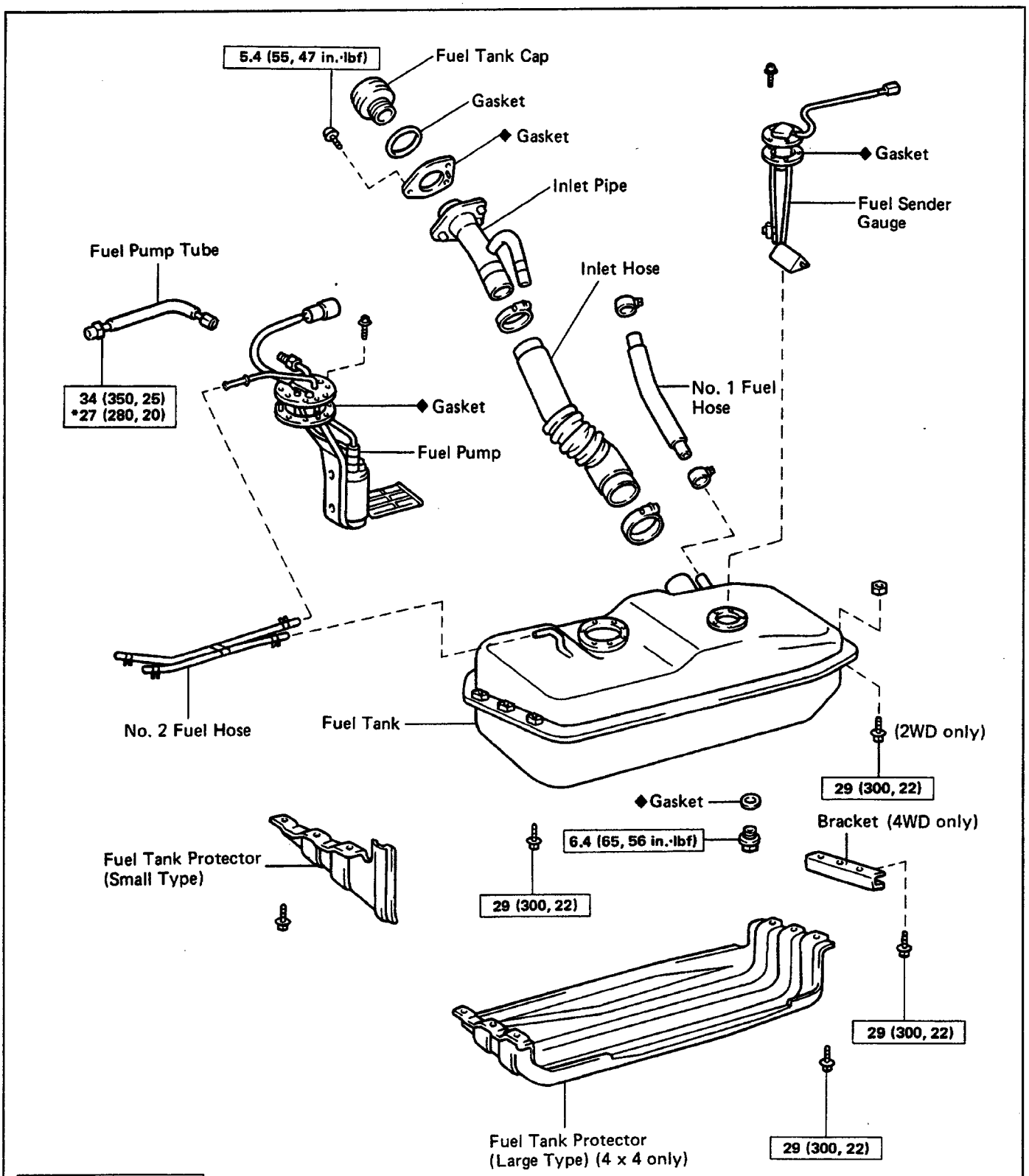


11. CHECK FOR FUEL LEAKAGE
(a) With the ignition switch ON, use SST to connect terminals FP and +B of the DLC1.
SST 09843–18020
(b) Check for fuel leakage.
(c) Remove SST from the DLC1.

FUEL TANK AND LINE

EG1H1–02

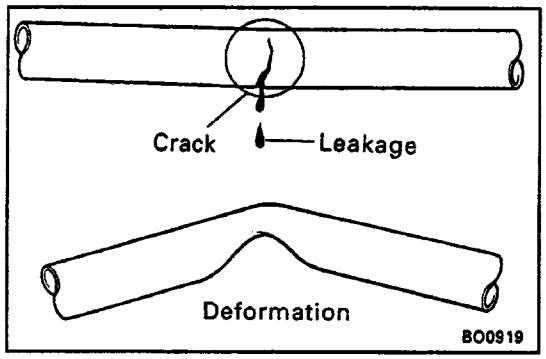
COMPONENTS

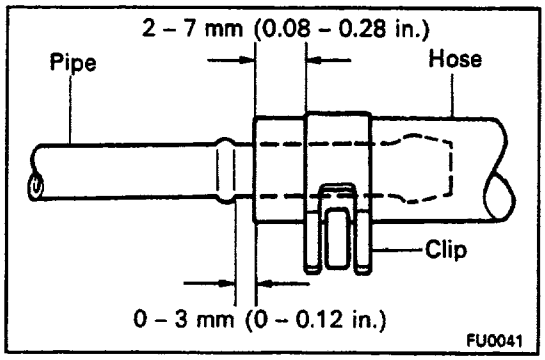


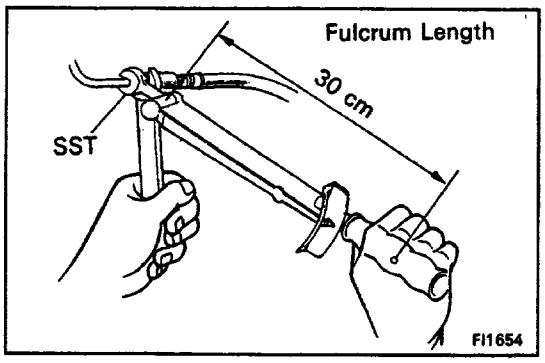
EG1H2–01

PRECAUTIONS

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



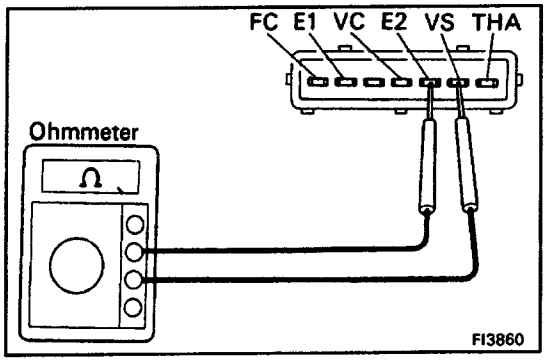


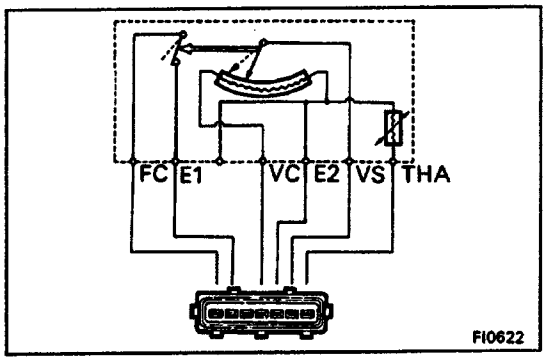


EG1H3–01

FUEL LINES AND CONNECTIONS INSPECTION

(a) Inspect the fuel lines for cracks or leakage, and all connections for deformations.
(b) Inspect the fuel tank vapor vent system hoses and connections for looseness, sharp bends or damage.
(c) Inspect the fuel tank for deformations, cracks or fuel leakage.
(d) Inspect the filler neck for damage or fuel leakage.
(e) Hose and tube connections are as shown in the il–lustration.
If a problem is found, repair or replace the parts as necessary.





VOLUME AIR FLOW (VAF) METER EG1TU–02

ON–VEHICLE INSPECTION

MEASURE RESISTANCE OF VOLUME AIR FLOW METER

(a) Disconnect the connector from the volume air flow meter.

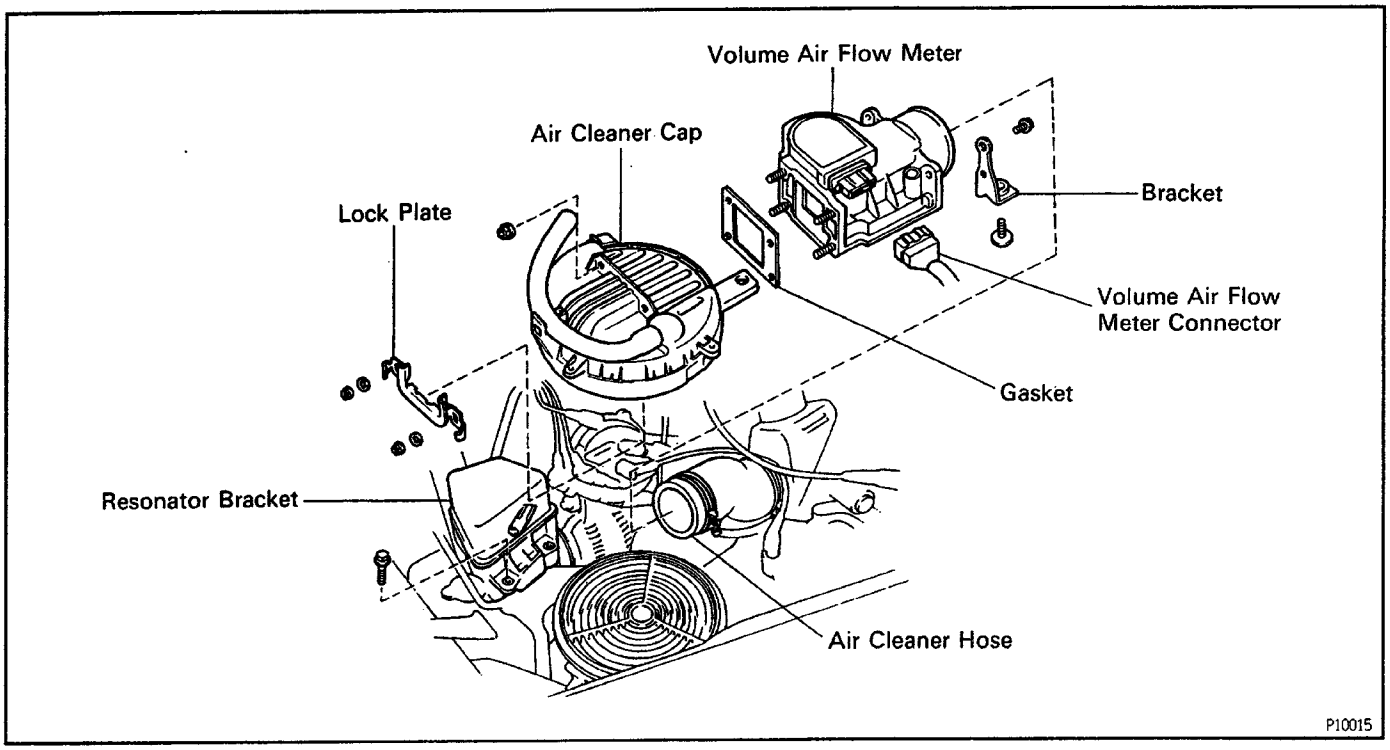
(b) Using an ohmmeter, measure the resistance between each terminal.

Between terminals	Resistance	Temperature
VS – e2	200–600C)	–
VC – e2	200–400C)	–
THA – E2	10–20kΩ	–20°C (4°F)
THA – E2	4 –7kΩ	O° C (32°F)
THA – E2	2 –3kΩ	20°C (68°F)
THA – E2	0.9 – 1.3 kΩ	46°C (104° F)
THA – E2	0.4–0.7kΩ	60°C (140°F)
FC–E1	Infinity	–

If not within specification, replace the volume air flow meter.

(c) Reconnect the volume air flow meter connector.

COMPONENTS FOR REMOVAL AND INSTALLATION EG1TV–01

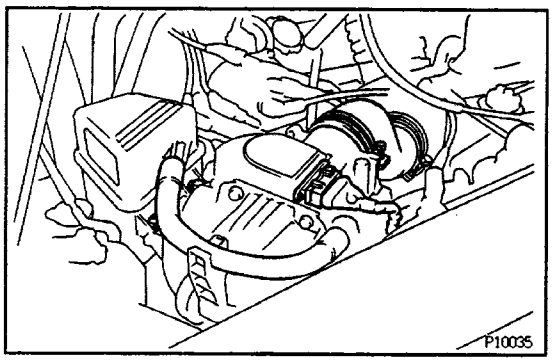


VOLUME AIR FLOW METER REMOVAL

EG1MS–02

(See Components for Removal Installation)

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY



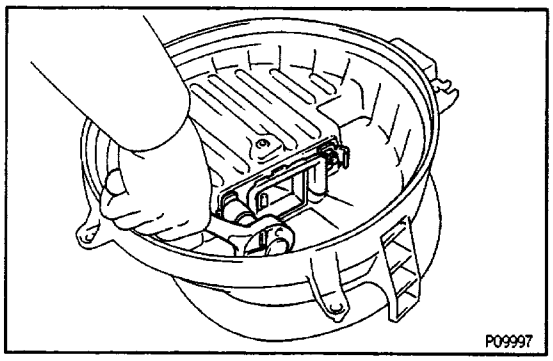
2. DISCONNECT RESONATOR BRACKET

(a) Disconnect the air hose.

(b) Remove the two bolts and resonator bracket.

3. DISCONNECT VOLUME AIR FLOW METER CONNECTOR

4. DISCONNECT AIR CLEANER HOSE

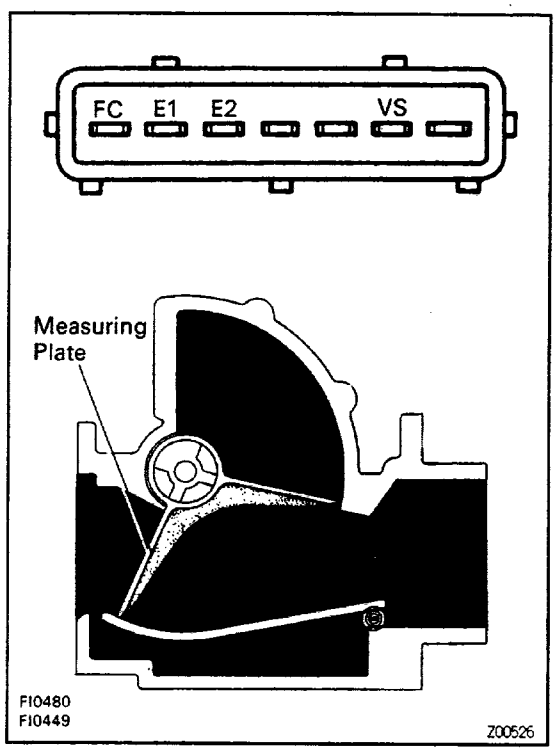


5. REMOVE AIR CLEANER CAP WITH VOLUME AIR FLOW METER ASSEMBLY

6. REMOVE VOLUME AIR FLOW METER FROM AIR CLEANER CAP

(a) Remove the bolt, two screws and bracket.

(b) Pry oft the lock plate, and remove the four nuts and washers, lock plate, volume air flow meter and gasket.



VOLUME AIR FLOW METER INSPECTION

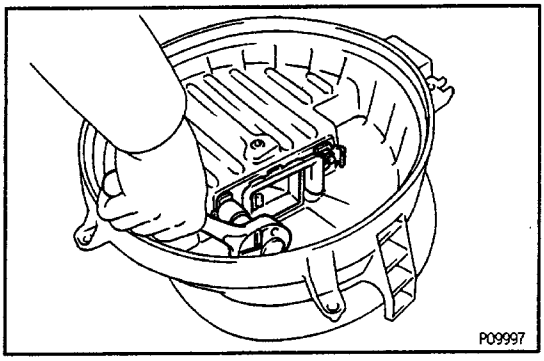
MEASURE RESISTANCE OF VOLUME AIR FLOW METER

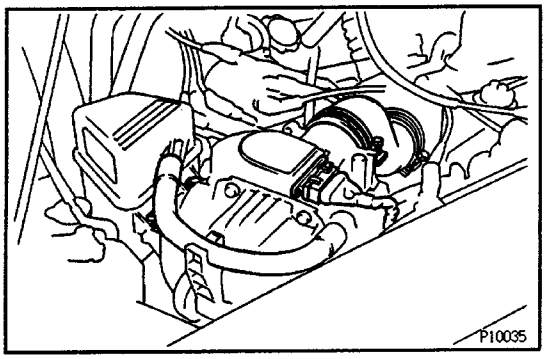
Using an ohmmeter, measure the resistance between each terminal by moving the measuring plate.

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

HINT: Resistance between terminals E2 and VS will change in a wave pattern as the measuring plate slowly opens.

If not within specification, replace the volume air flow meter.





EG1H7–02

VOLUME AIR FLOW METER INSTALLATION

(See Components for Removal and Installation)

1. INSTALL VOLUME AIR FLOW METER TO AIR CLEANER CAP

(a) Install the volume air flow meter with the gasket, lock plate, washers and four nuts. Pry the lock plate on the nut.

(b) Install the bracket with the bolt and two screws.

2. INSTALL AIR CLEANER CAP AND VOLUME AIR FLOW METER ASSEMBLY

3. INSTALL AIR CLEANER HOSE

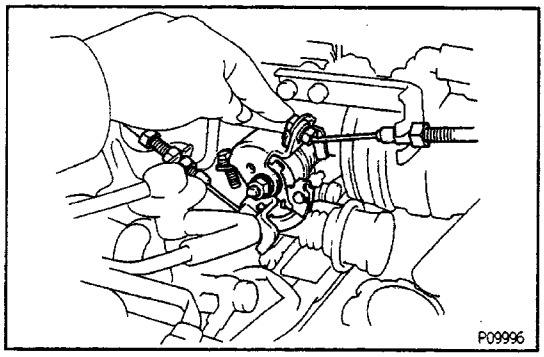
4. CONNECT VOLUME AIR FLOW METER CONNEC–TOR

5. INSTALL RESONATOR BRACKET

(a) Install the resonator bracket with the two bolts.

(b) Connect the air hose.

6. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY



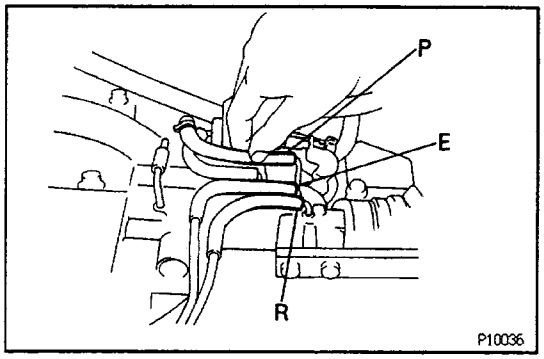
THROTTLE BODY

EG1TX–02

ON–VEHICLE INSPECTION

1. INSPECT THROTTLE BODY

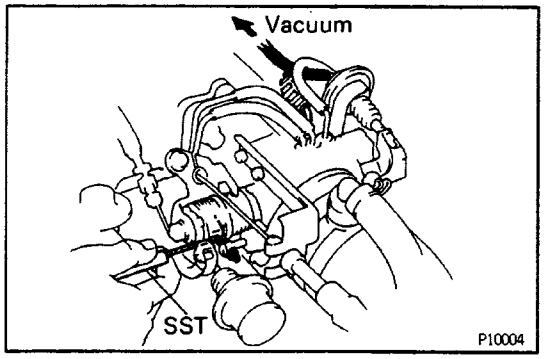
(a) Check that the throttle linkage moves smoothly.



(b) Check the vacuum at each port.

- Start the engine.
- Check the vacuum with your finger.

Port name	At idling	At 3,500 rpm
E	No vacuum	Vacuum
R	No vacuum	Vacuum
P	No vacuum	Vacuum

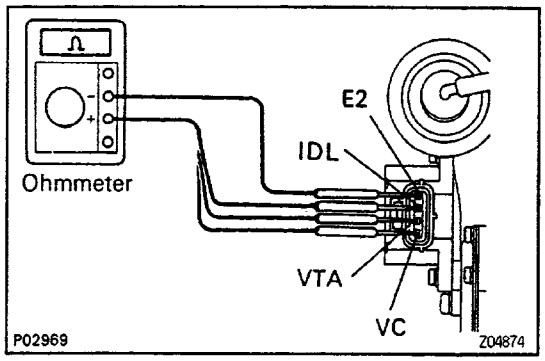


2. INSPECT THROTTLE POSITION SENSOR

(a) Apply vacuum to the throttle opener.

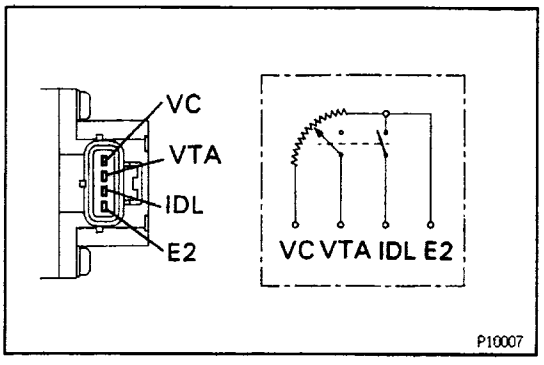
(b) Disconnect the sensor connector.

(c) Insert SST between the throttle stop screw and stop lever.
SST 09240–00020

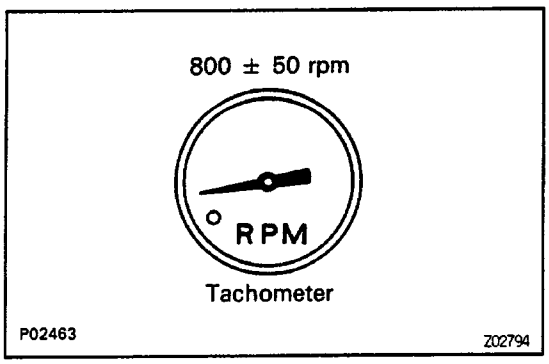


(d) Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.47 – 6.1 k 0
0.50 mm (0.020 in.)	!DL – E2	2.3 kΩ or less
0.80 mm (0.031 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	3.1 – 12.1 kΩ
–	VC – e2	3.9 – 9.0 kΩ



(e) Reconnect the sensor connector.



3. INSPECT DASHPOT (DP)

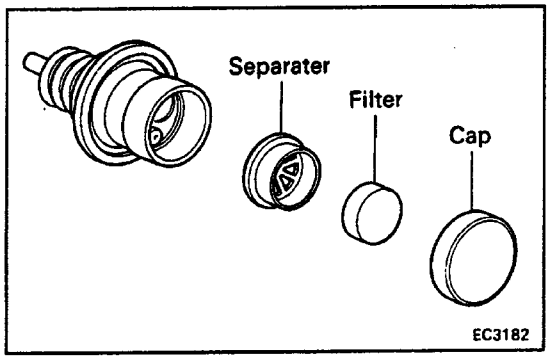
A. Warm up engine

Allow the engine to warm up to normal operating temperature.

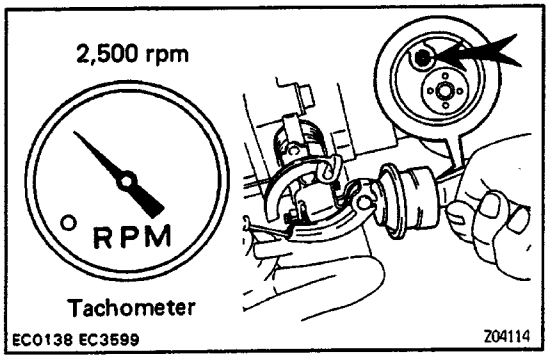
B. Check idle speed and adjust, if necessary (See page EG2–27)

Idle speed:

800 ± 50 rpm



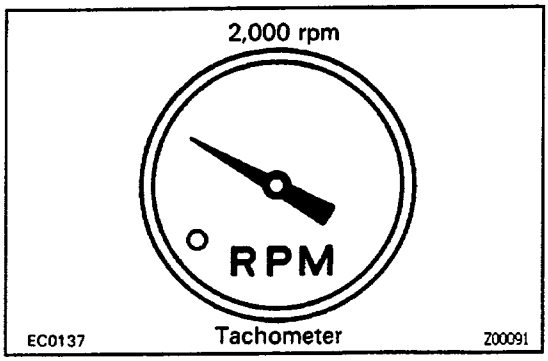
C. Remove cap, filter and separator from DP



D. Check and adjust DP setting speed

(a) Maintain engine speed at 2,500 rpm or more.

(b) Plug the VTV hole with your finger.

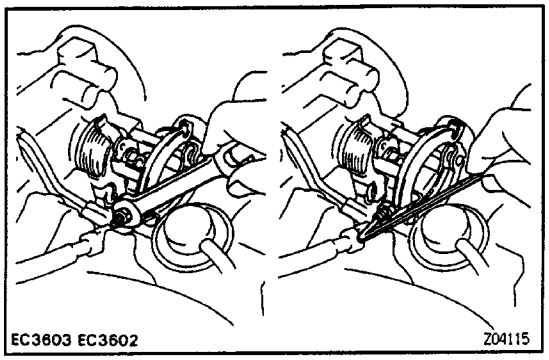


(c) Release the throttle valve.

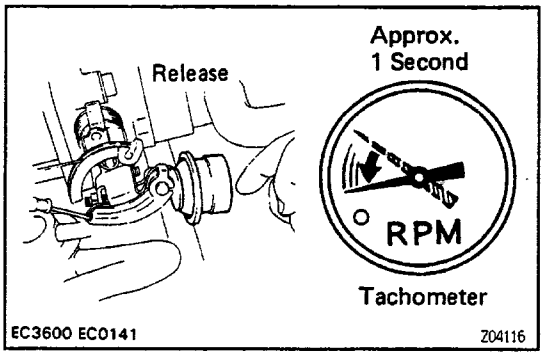
(d) Check the DP is set.

DP setting speed:

2,000 ± 200 rpm



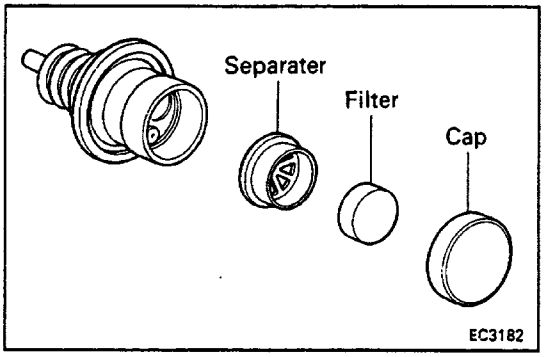
(e) If not as specified, adjust with the DP adjusting screw.



E. Check operation of VTV

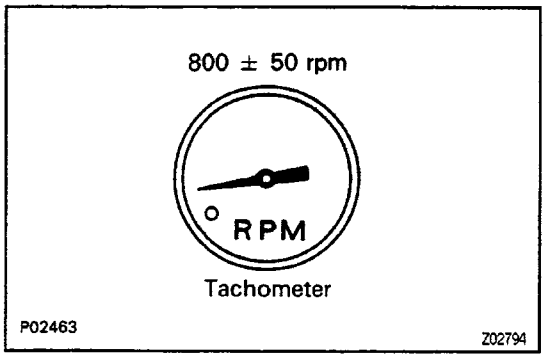
(a) Set the DP setting speed in the same procedure as above: (a) to (c).

(b) Remove your finger from the hole and check that the engine returns to idle speed in approx. 1 second.



F. Reinstall DP separator, filter and cap

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



4. INSPECT THROTTLE OPENER

A. Warm up engine

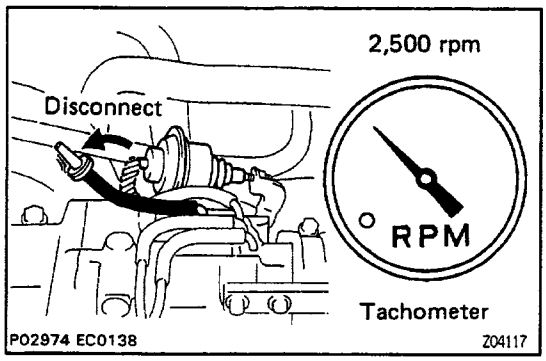
Allow the engine to warm up to normal operating temperature.

B. Check idle speed

(See page EG2–27)

Idle speed:

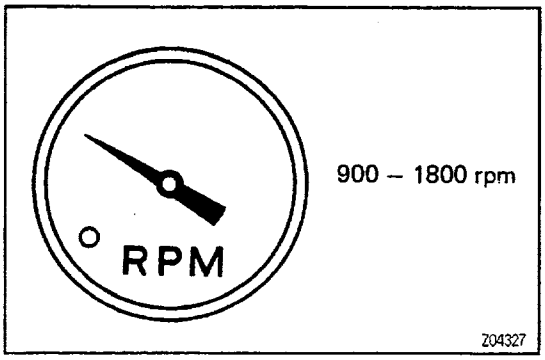
800 ± 50 rpm



C. Check throttle opener setting speed

(a) Disconnect the vacuum hose from the throttle opener, and plug the hose end.

(b) Maintain the engine at 2,500 rpm.



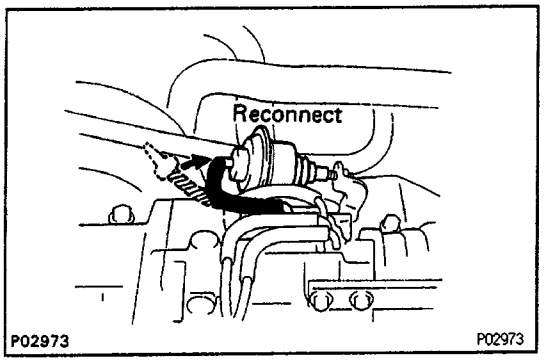
(c) Release the throttle valve.

(d) Check that the throttle opener is set.

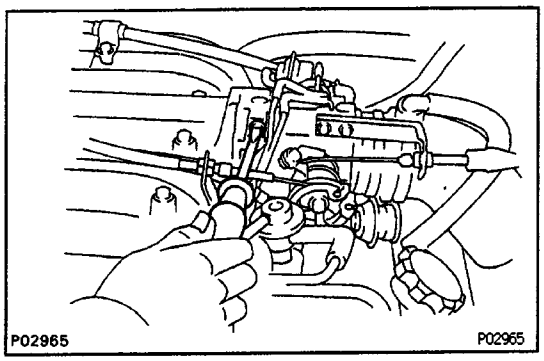
Throttle opener setting speed:

900 – 1,800 rpm

if not as specified, replace the throttle body assembly.



(e) Reconnect the vacuum hose to the throttle opener.



5. INSPECT AIR VALVE OPERATION

Check the engine speed by fully screwing in the idle speed adjusting screw.

At low temp.

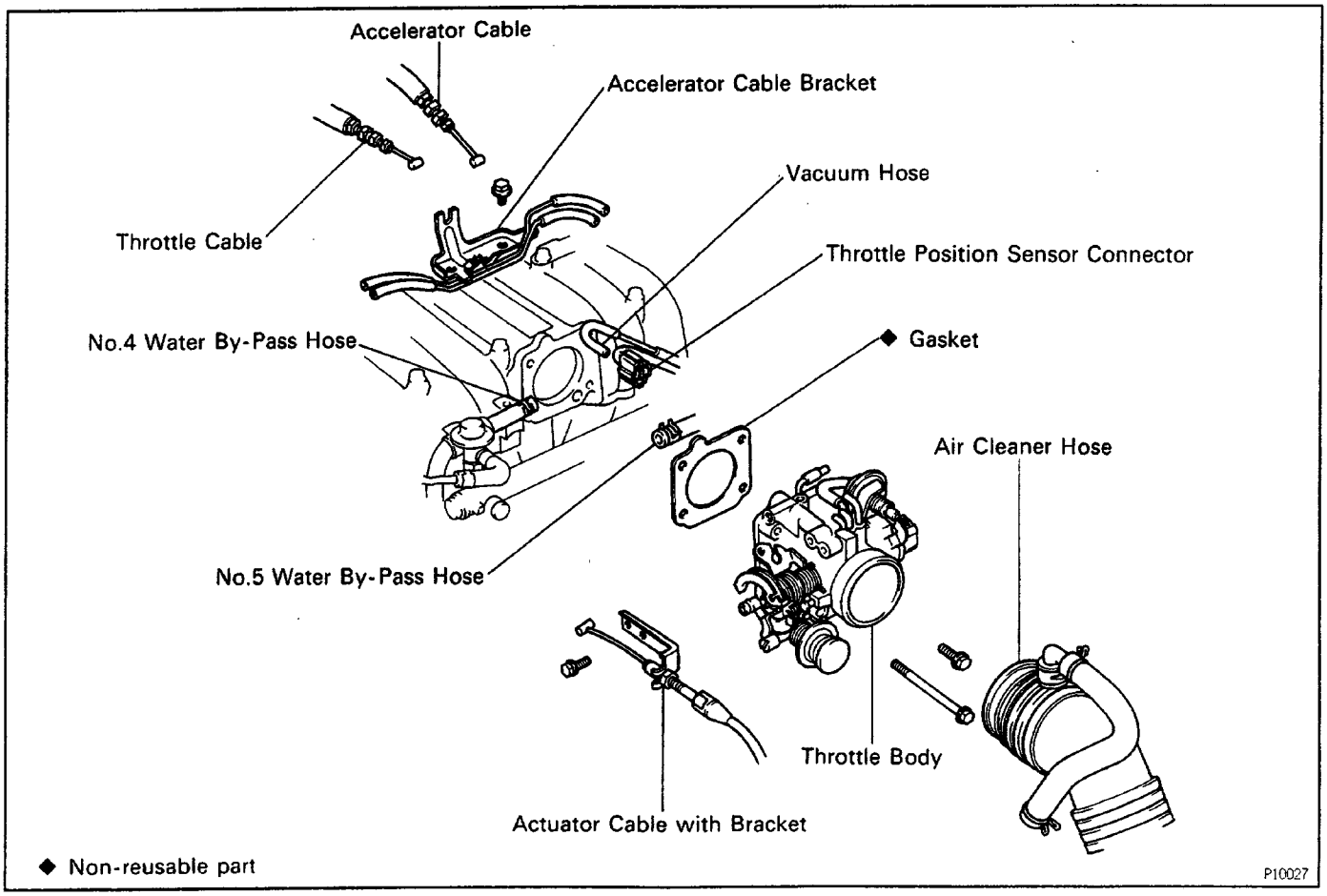
Engine coolant temp.: below 80°C (176°F)

When the idle speed adjusting screw is in, the engine speed should drop.

After warm –up

When the idle speed adjusting screw is in, the engine speed should drop below idle speed stop.

COMPONENTS FOR REMOVAL AND INSTALLATION



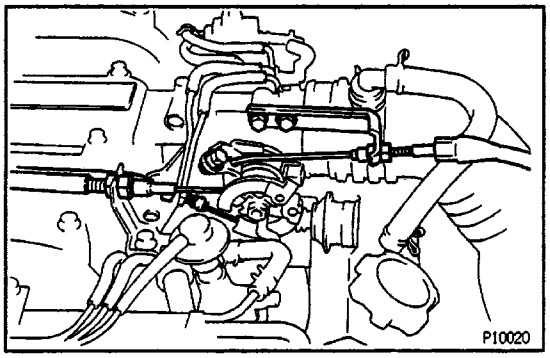
EG1TY–02

THROTTLE BODY REMOVAL

(See Components for Removal and Installation)

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

2. DRAIN ENGINE COOLANT FROM THROTTLE BODY

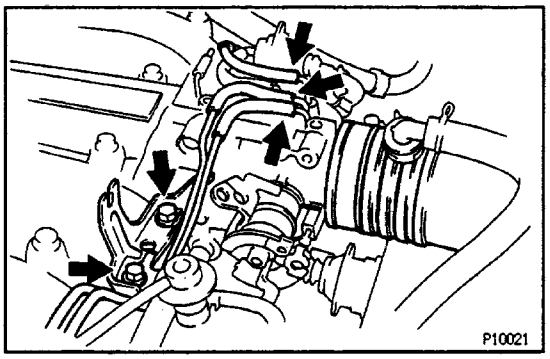


3. DISCONNECT FOLLOWING CABLES:

(a) (w/ Cruise control)
Actuator cable with bracket

(b) Accelerator cable

(c) (A/T)
Throttle cable

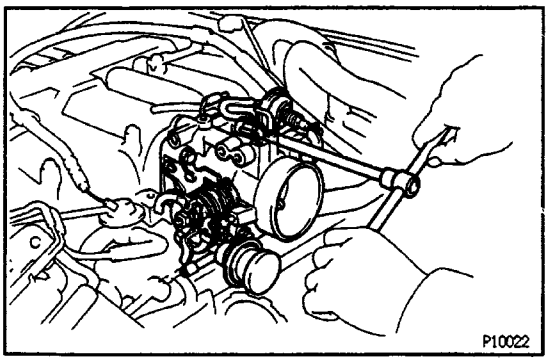


4. DISCONNECT AIR CLEANER HOSE

6. DISCONNECT VACUUM HOSES

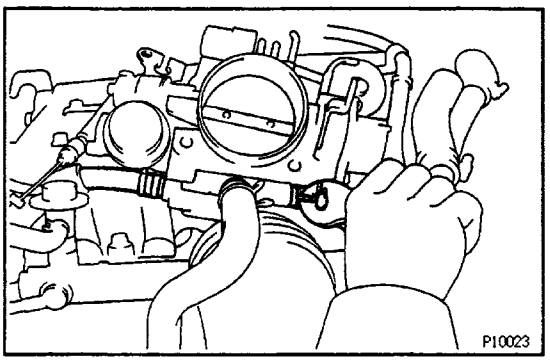
6. REMOVE ACCELERATOR CABLE BRACKET

7. DISCONNECT THROTTLE POSITION SENSOR CONNECTOR



8. REMOVE THROTTLE BODY

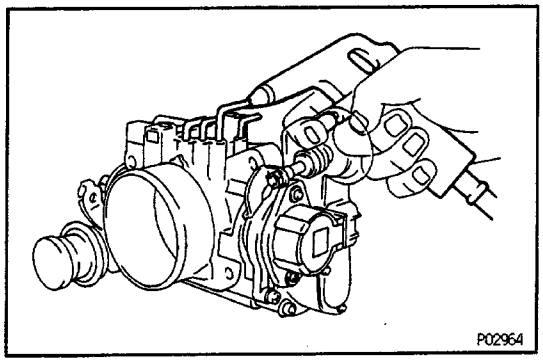
(a) Remove the four bolts, throttle body and the gasket.



(b) Disconnect the No.4 and No.5 water by–pass hoses from the throttle body.

EG20D–01

THROTTLE BODY INSPECTION

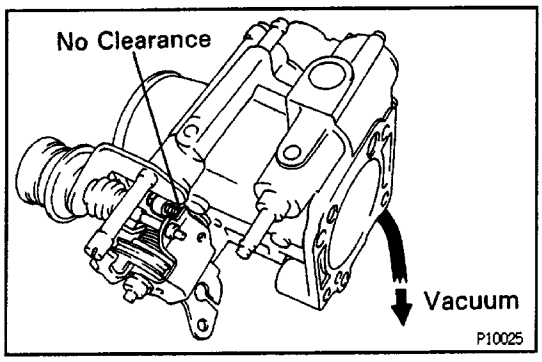


1. CLEAN THROTTLE BODY BEFORE INSPECTION

(a) Wash and clean the cast parts with a soft brush and carburetor cleaner.

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

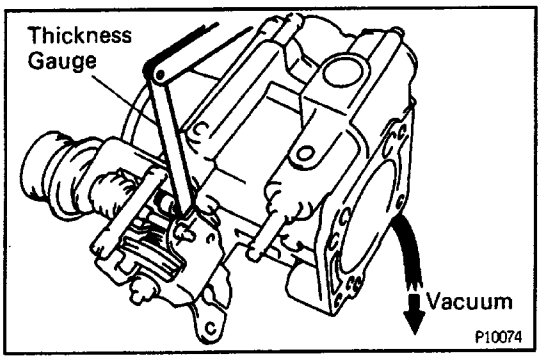
NOTICE: To prevent deterioration, do not clean the throttle position sensor and dash pot.



2. CHECK THROTTLE VALVE

(a) Apply vacuum to the throttle opener.

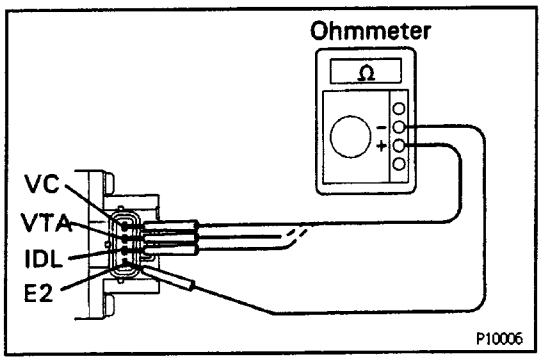
(6) Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.



3. INSPECT THROTTLE POSITION SENSOR

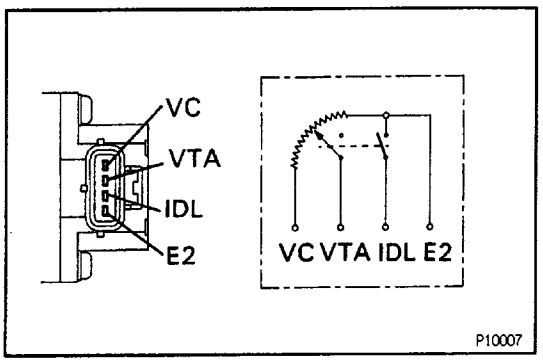
(a) Apply vacuum to the throttle opener.

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

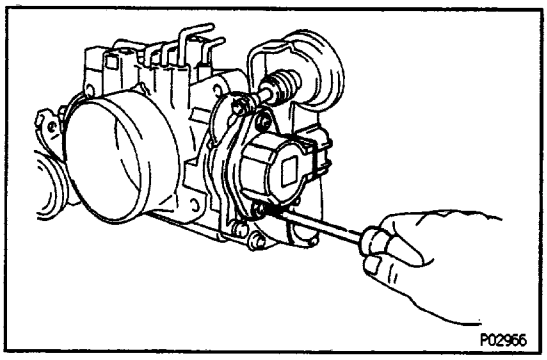


(c) Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.47–6.1 kΩ
0.50 mm (0.020 in.)	IDL – E2	2.3 kΩ or less
0.80 mm (0.031 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	3.1 – 12.1 kΩ
–	VC – E2	3.9 – 9.0 kΩ

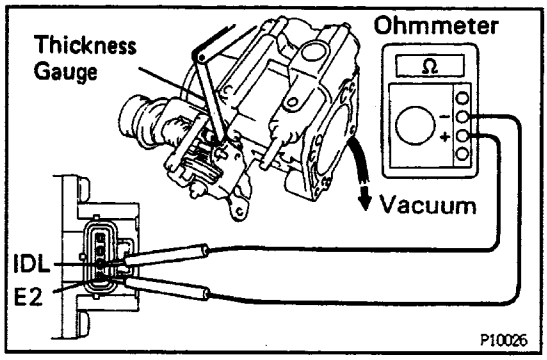


(d) Reconnect the sensor connector.



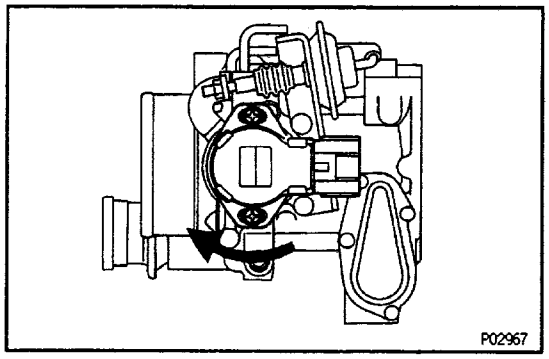
4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

(a) Loosen the two screws of the sensor.

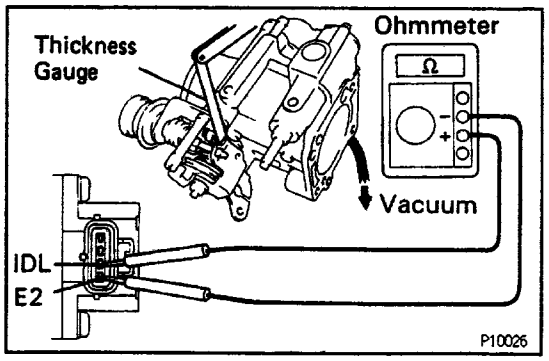


(b) Apply vacuum to the throttle opener.

(c) Insert a thickness gauge (0.60 mm or 0.024 in.) between the throttle stop screw and lever, and connect the ohmmeter to terminals IDL and E2.



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



(e) Using a thickness gauge, recheck the continuity between terminals IDL and E2.

Clearance between lever and stop screw	Continuity (IDL–E2)
0.50 mm (0.020 in.)	Continuity
0.80 mm (0.031 in.)	No continuity

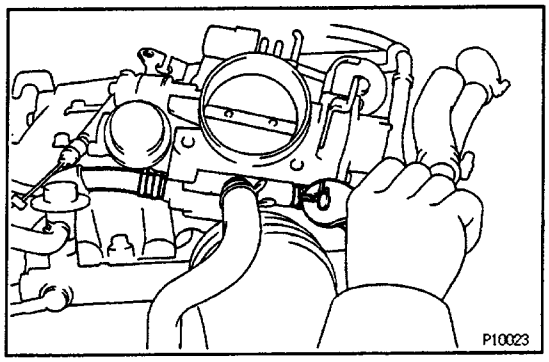
EG1TZ–02

THROTTLE BODY INSTALLATION

(See Components for Removal and Installation)

1. INSTALL THROTTLE BODY

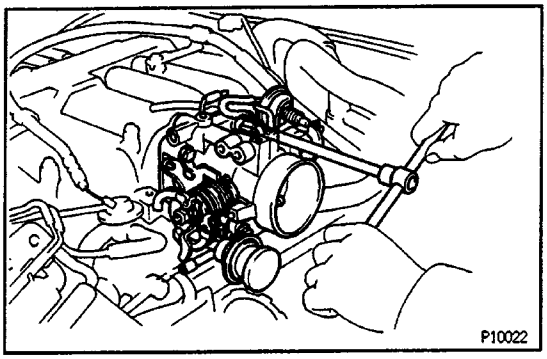
(a) Connect the No.4 and No.5 water by–pass hoses to throttle body.



(b) Place anew gasket and install the throttle body with the four bolts.

Torque: 18 N–m (185 kgf–cm, 13 ft–lbf)

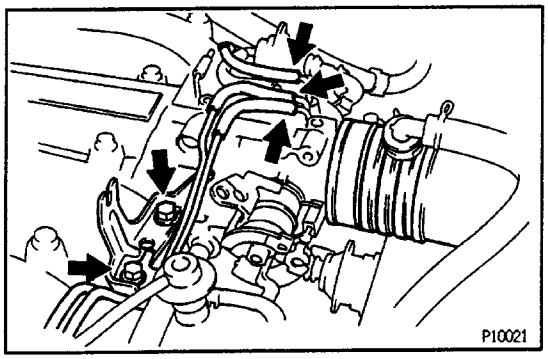
2. CONNECT THROTTLE POSITION SENSOR CONNECTOR



3. INSTALL ACCELERATOR CABLE BRACKET

4. CONNECT VACUUM HOSES

5. CONNECT AIR CLEANER HOSE

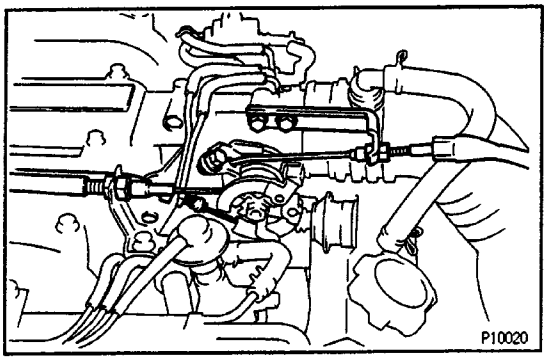


6. CONNECT FOLLOWING CABLES:

(a) (A/T)
Throttle cable

(b) Accelerator cable

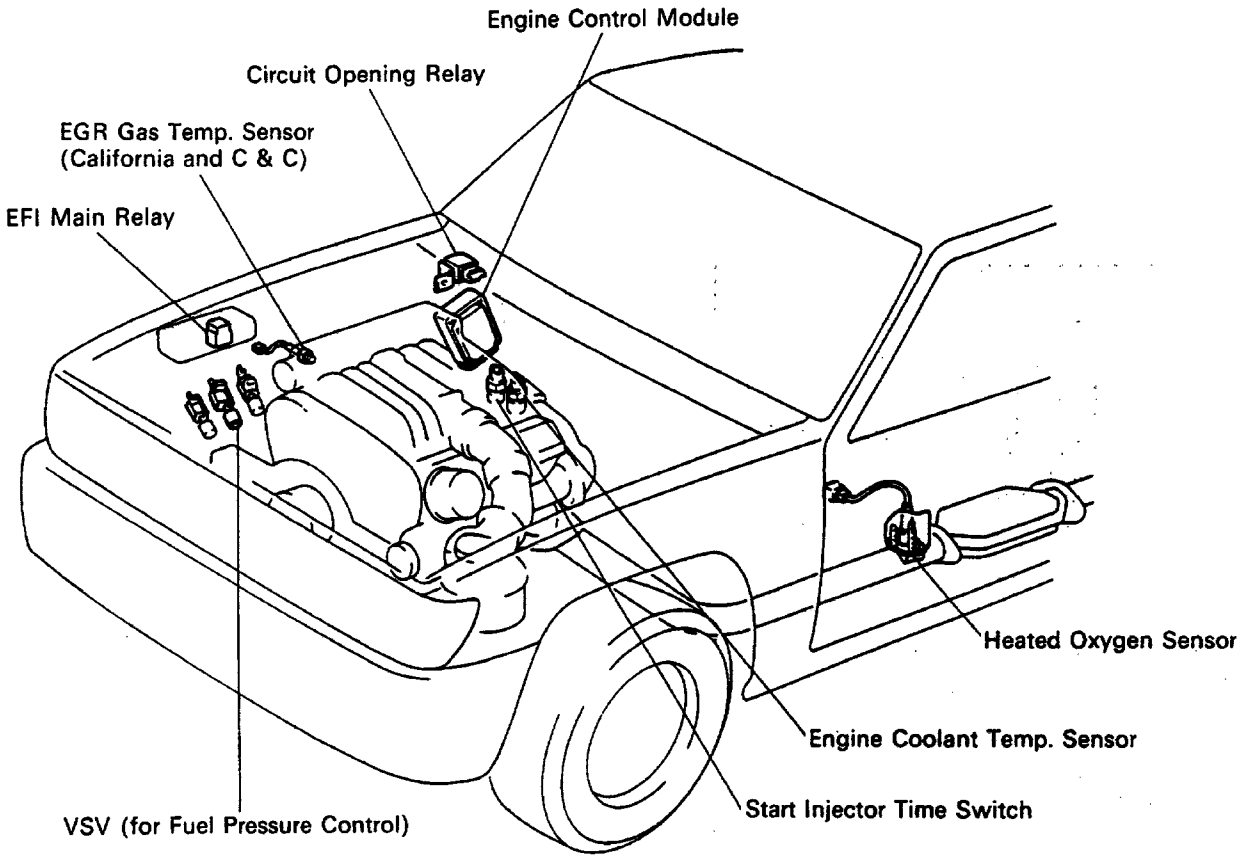
(c) (w/ Cruise control)
Actuator cable with bracket



7. REFILL WITH ENGINE COOLANT

8. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

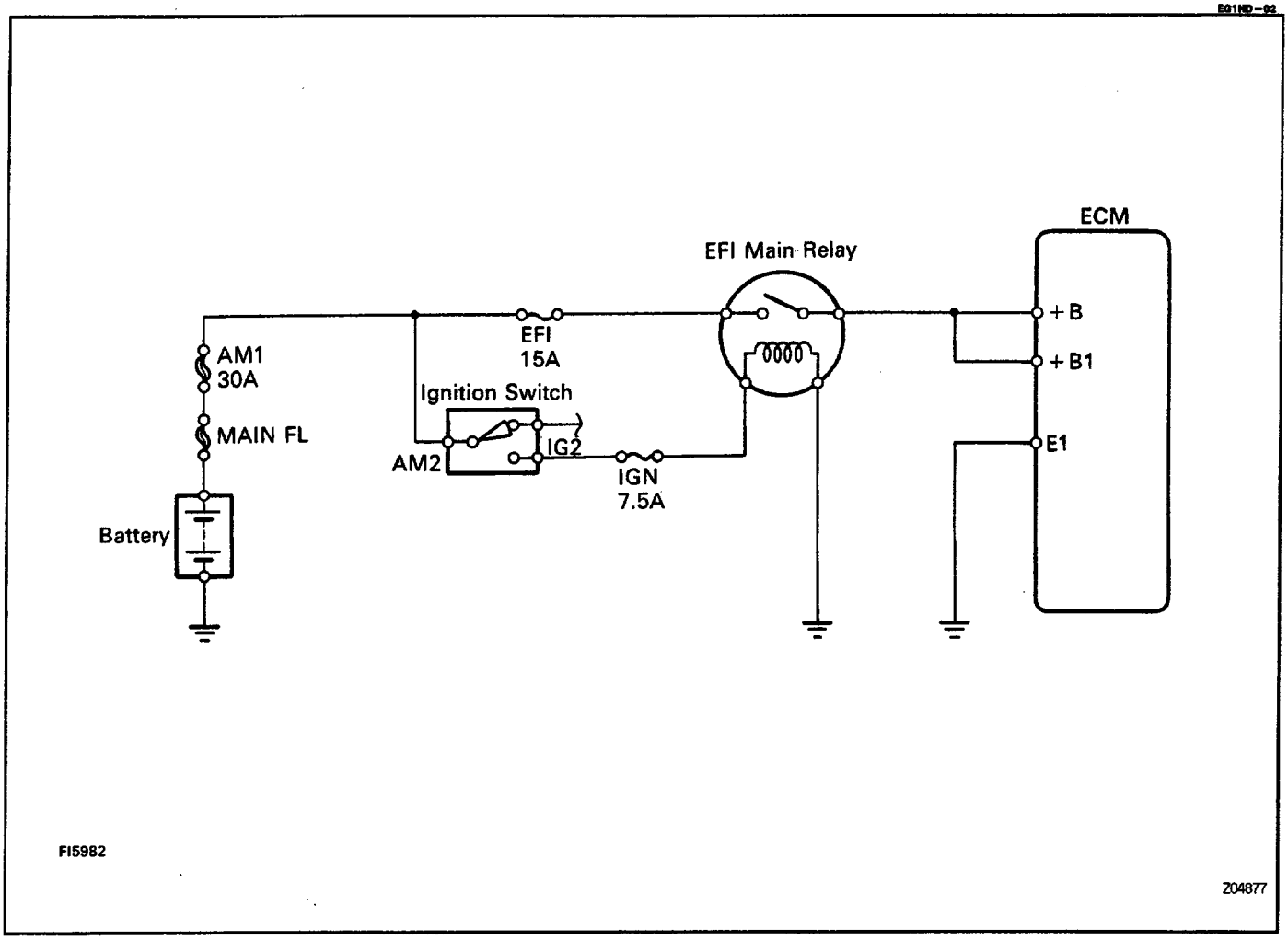
ELECTRONIC PARTS LOCATION

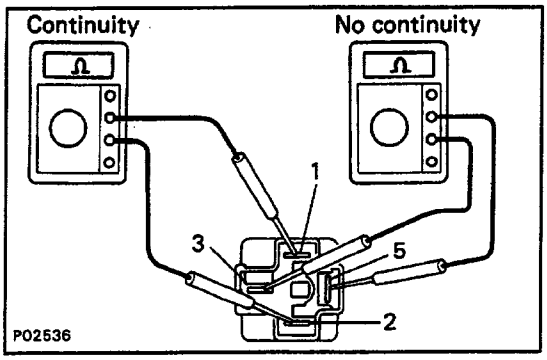


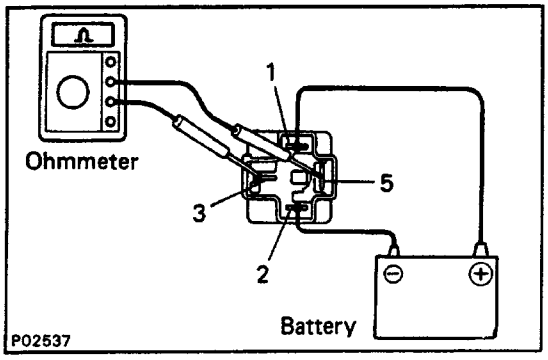
P10029

Z04713

EFI MAIN RELAY







EFI MAIN RELAY INSPECTION

EG1HE–01

1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

(b) Check that there is no continuity between terminals 3 and 5.

(c) Check that there is no continuity between terminals 2 and 5.

If continuity is not as specified, replace the relay.

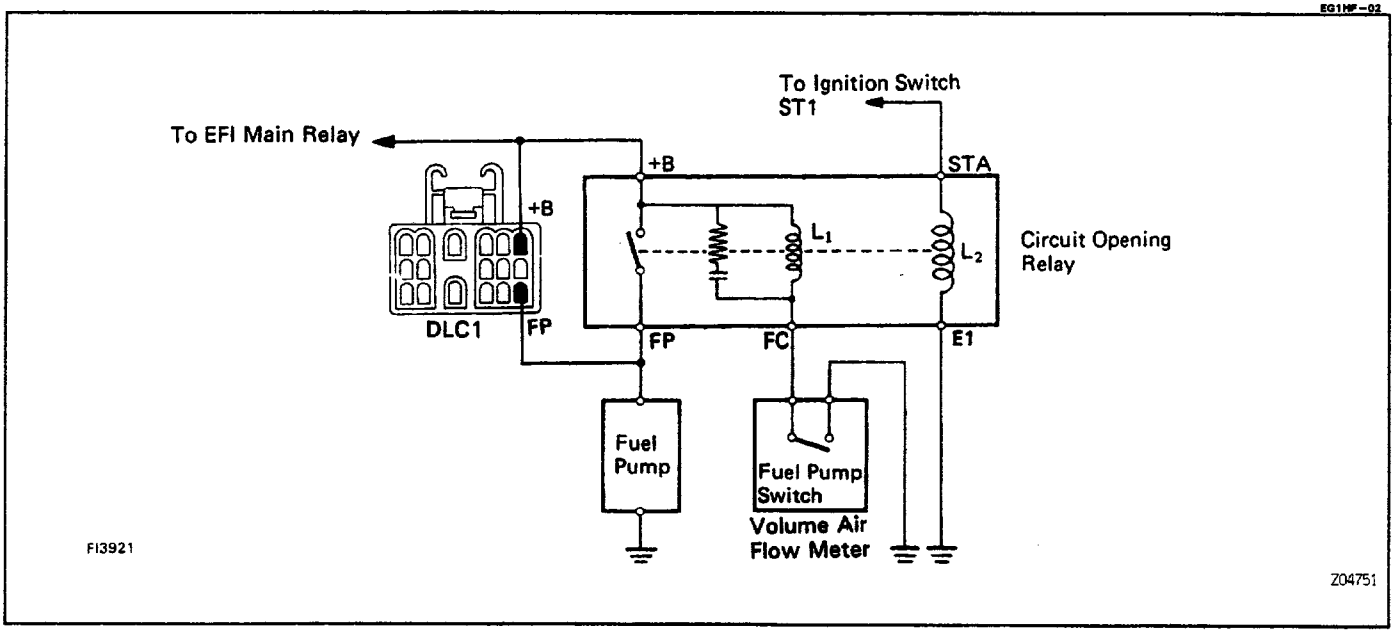
2. INSPECT RELAY OPERATION

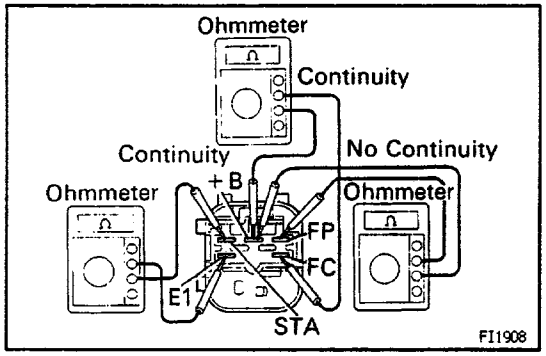
(a) Apply battery voltage across terminals 1 and 2.

(b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If operation is not as specified, replace the relay.

CIRCUIT OPENING RELAY





CIRCUIT OPENING RELAY INSPECTION

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.

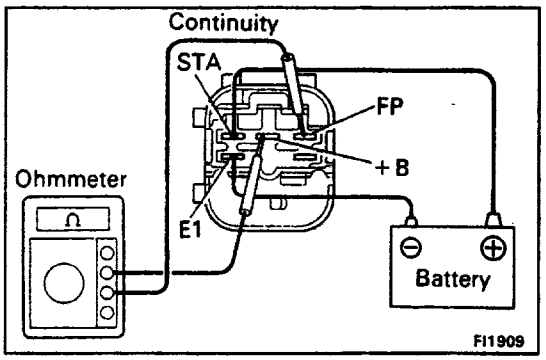
(c) Check that there is no continuity between terminals +B and FP.

If continuity is not as specified, replace the relay.

2. INSPECT RELAY OPERATION

(a) Apply battery voltage across terminals STA and E1.

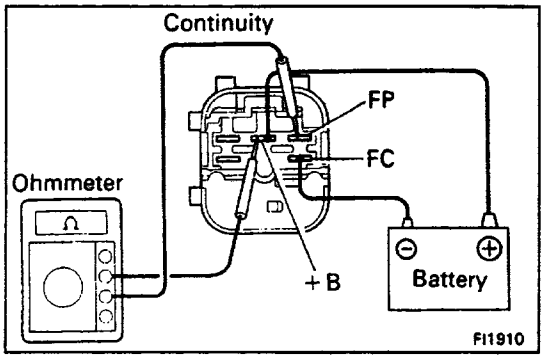
(b) Using an ohmmeter, check that there is continuity between terminals +B and FP.



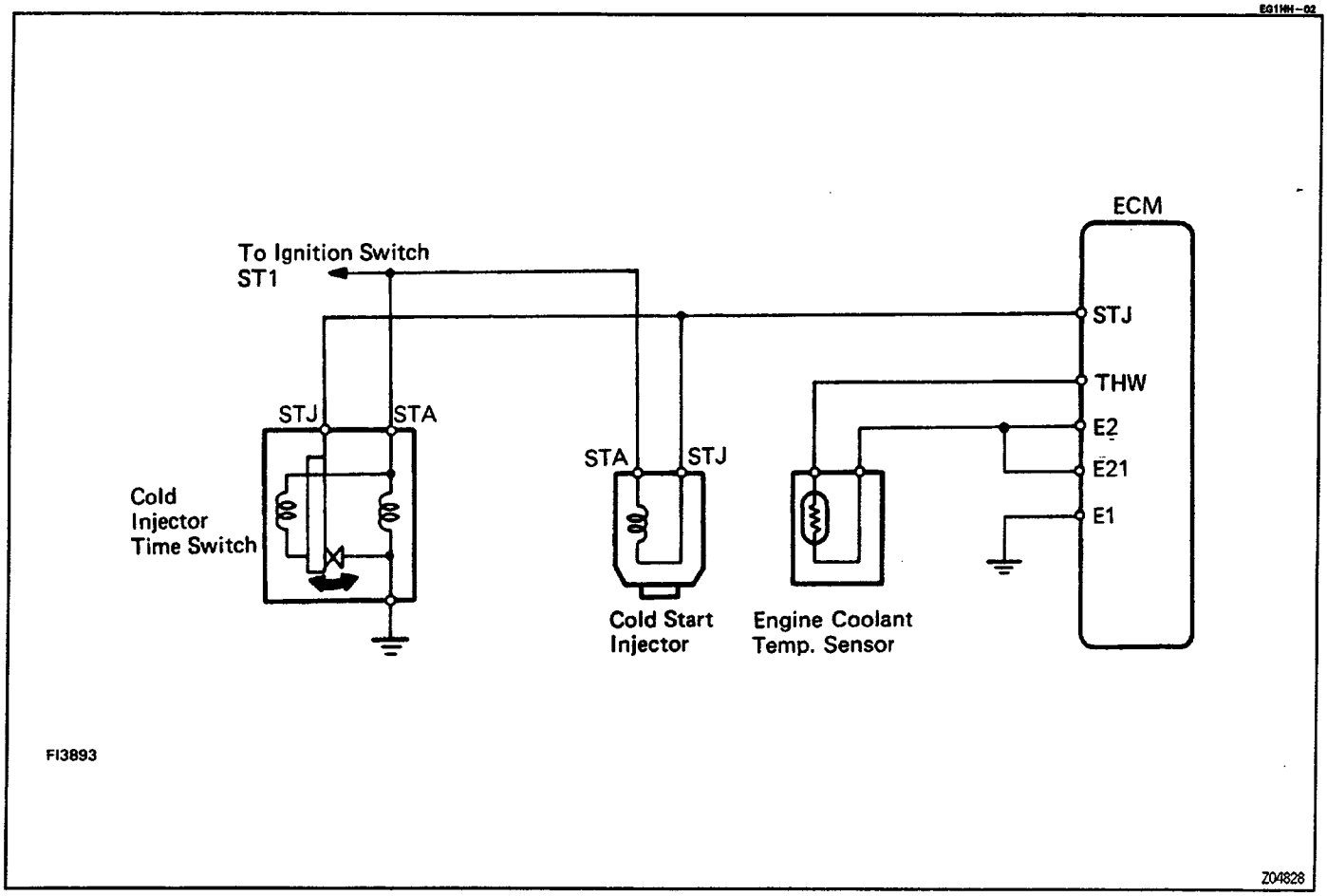
(c) Apply battery voltage across terminals +B and FC.

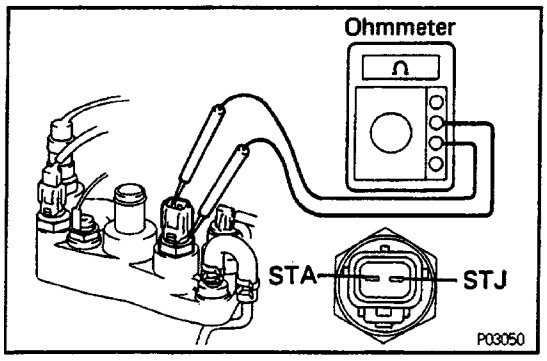
(d) Check that there is continuity between terminals +13 and FP.

If operation is not as specified, replace the relay.



COLD START INJECTOR TIME SWITCH





COLD START INJECTOR TIME SWITCH INSPECTION

MEASURE RESISTANCE OF COLD START INJEC–TOR TIME SWITCH

(a) Disconnect the connector.

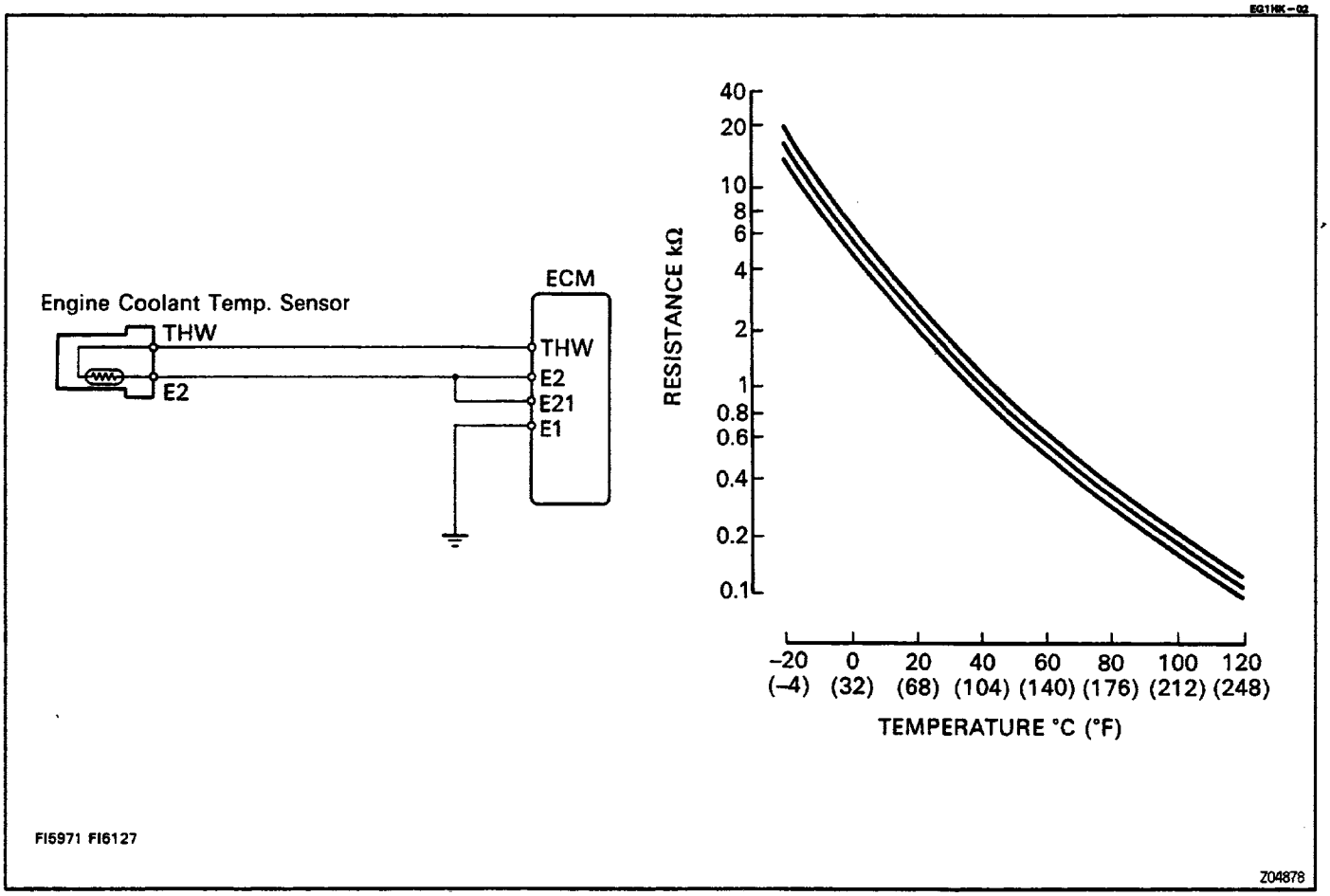
(b) Using an ohmmeter, measure the resistance between terminals.

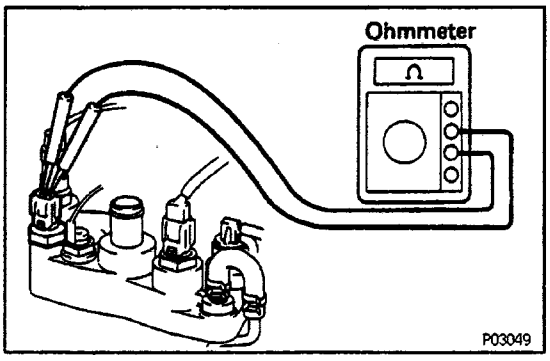
Between terminals	Resistance (Ω)	Engine coolant temperature
STA–STJ	30–50	Below 10° C (50° F)
STA–STJ	70–90	Above 25° C (77° F)
STA–Ground	30–90	–

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

(c) Reconnect the connector.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR





ENGINE COOLANT TEMP. SENSOR INSPECTION

EG1HL–02

MEASURE RESISTANCE OF ENGINE COOLANT TEMP. SENSOR

(a) Disconnect the connector.

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

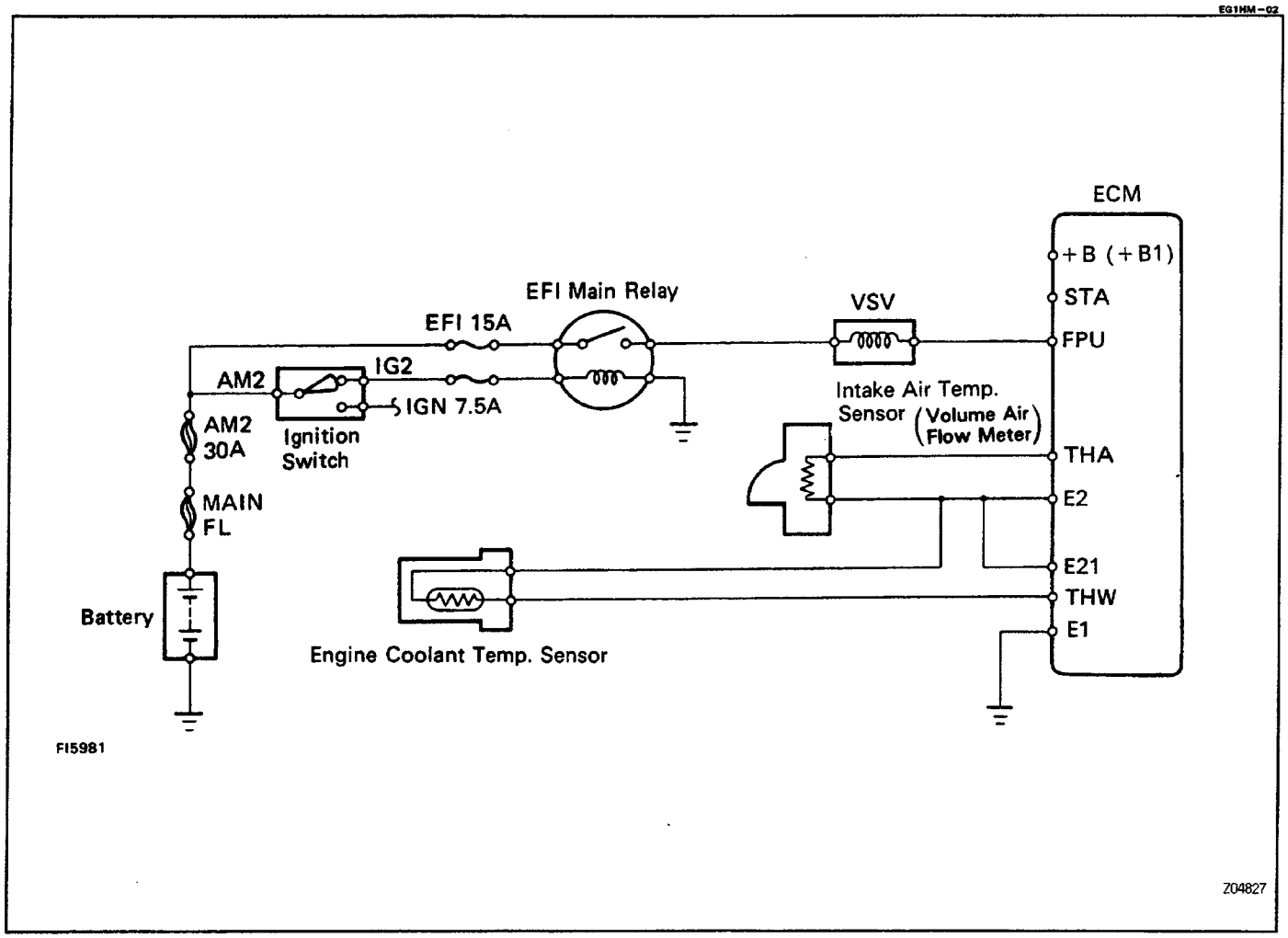
Resistance:

Refer to the chart above.

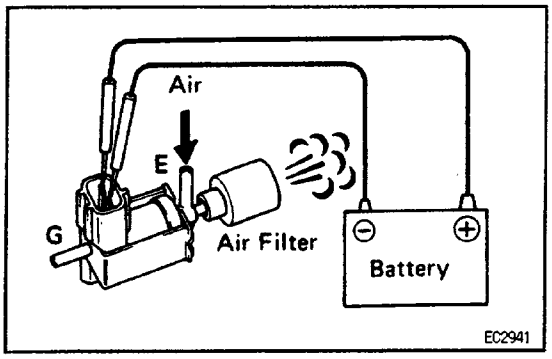
If the resistance is not as specified, replace the sensor.

(c) Reconnect the connector.

FUEL PRESSURE CONTROL SYSTEM



EG1HN–03

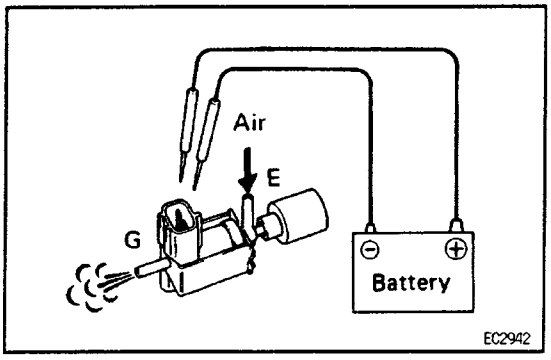


FUEL PRESSURE VSV INSPECTION

1. CHECK VSV OPERATION

(a) Connect the VSV terminals to the battery terminals as illustrated.

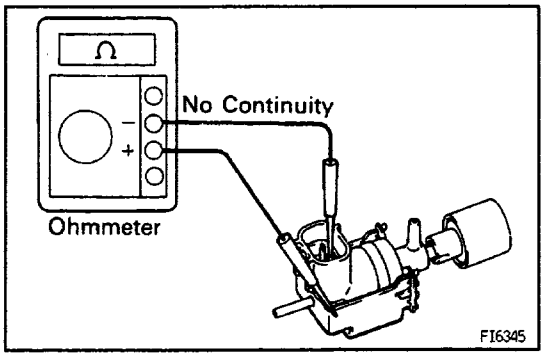
(b) Blow into pipe E and check that air comes out of air filter.



(c) Disconnect the battery.

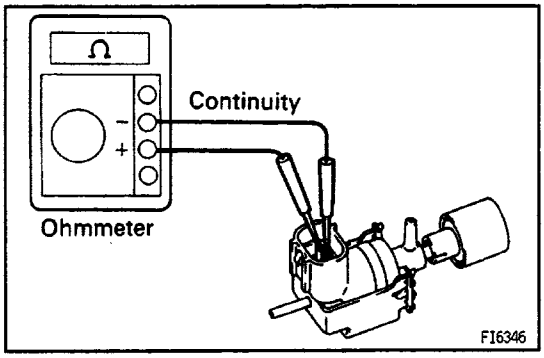
(d) Blow into pipe E and check that air comes out of pipe G.

If a problem is found, repair or replace the VSV.



2. CHECK FOR SHORT CIRCUIT

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



3. CHECK FOR OPEN CIRCUIT

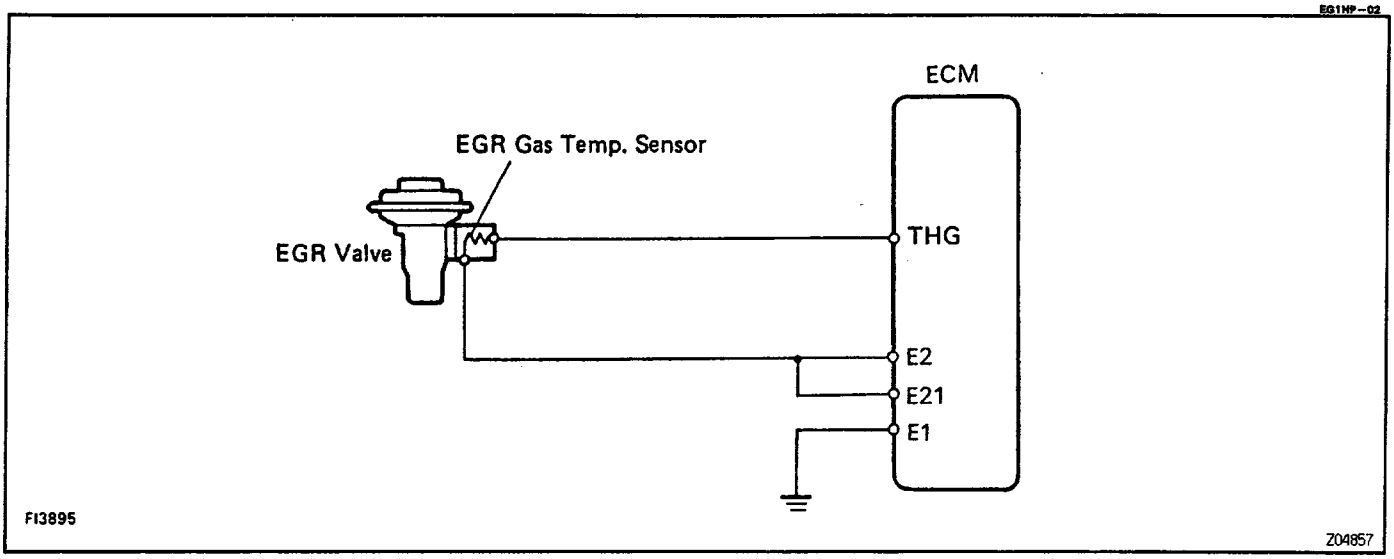
Using an ohmmeter, measure the resistance between both terminals as illustrated.

Specified resistance:

30 – 50 Ω at 20° C (68° F)

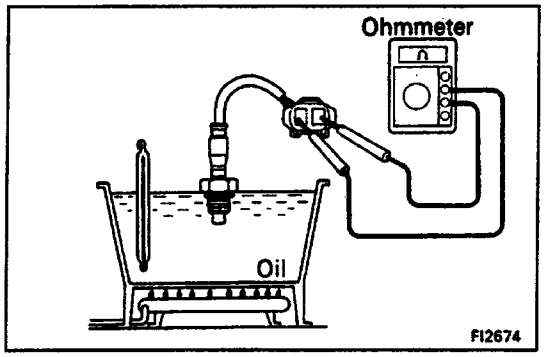
EGR GAS TEMPERATURE SENSOR (California and C & C)

EG1HP–02



EG1HQ–02

EGR GAS TEMP. SENSOR INSPECTION



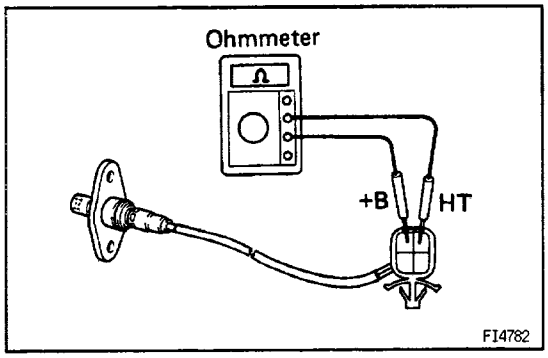
MEASURE RESISTANCE OF EGR GAS TEMP. SENSOR

Using an ohmmeter, measure the resistance between both terminals.

Resistance:

69 – 89 kΩ 50°C (122°F)
11 – 15 kΩ 100°C (212°F)
2 – 4 kΩ 150°C (302°F)

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



HEATED OXYGEN SENSOR

HEATED OXYGEN SENSOR INSPECTION

1. INSPECT HEATER RESISTANCE OF HEATED OXYGEN SENSOR

Using an ohmmeter, measure the resistance between the terminals +B and HT.

Resistance:

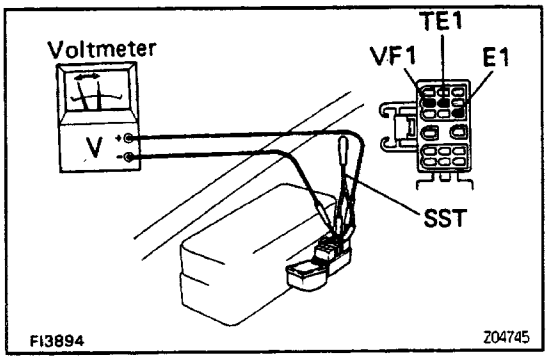
California 2WD only

4.5 – 6.0 Ω at 23°C (73°F)

Others

5.1 – 6.3 Ω at 20°C (68° F)

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



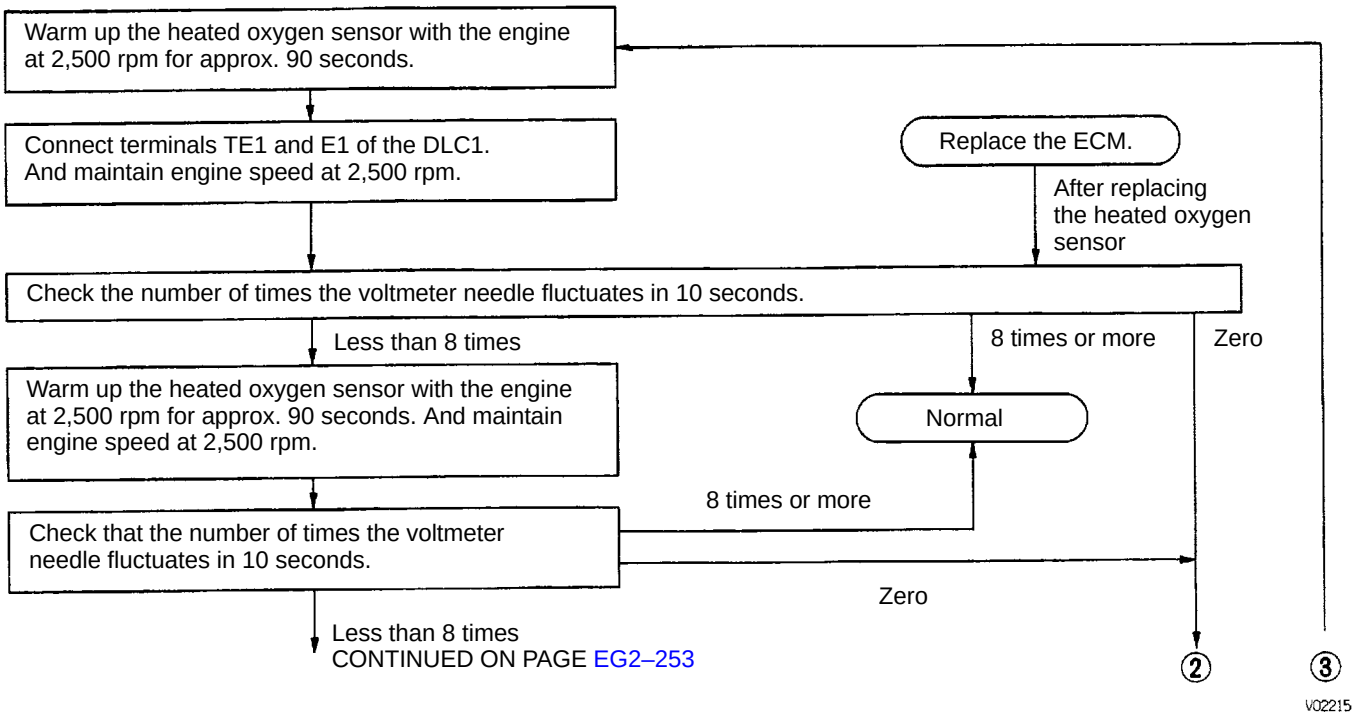
2. INSPECTION OF FEEDBACK VOLTAGE (VF1)

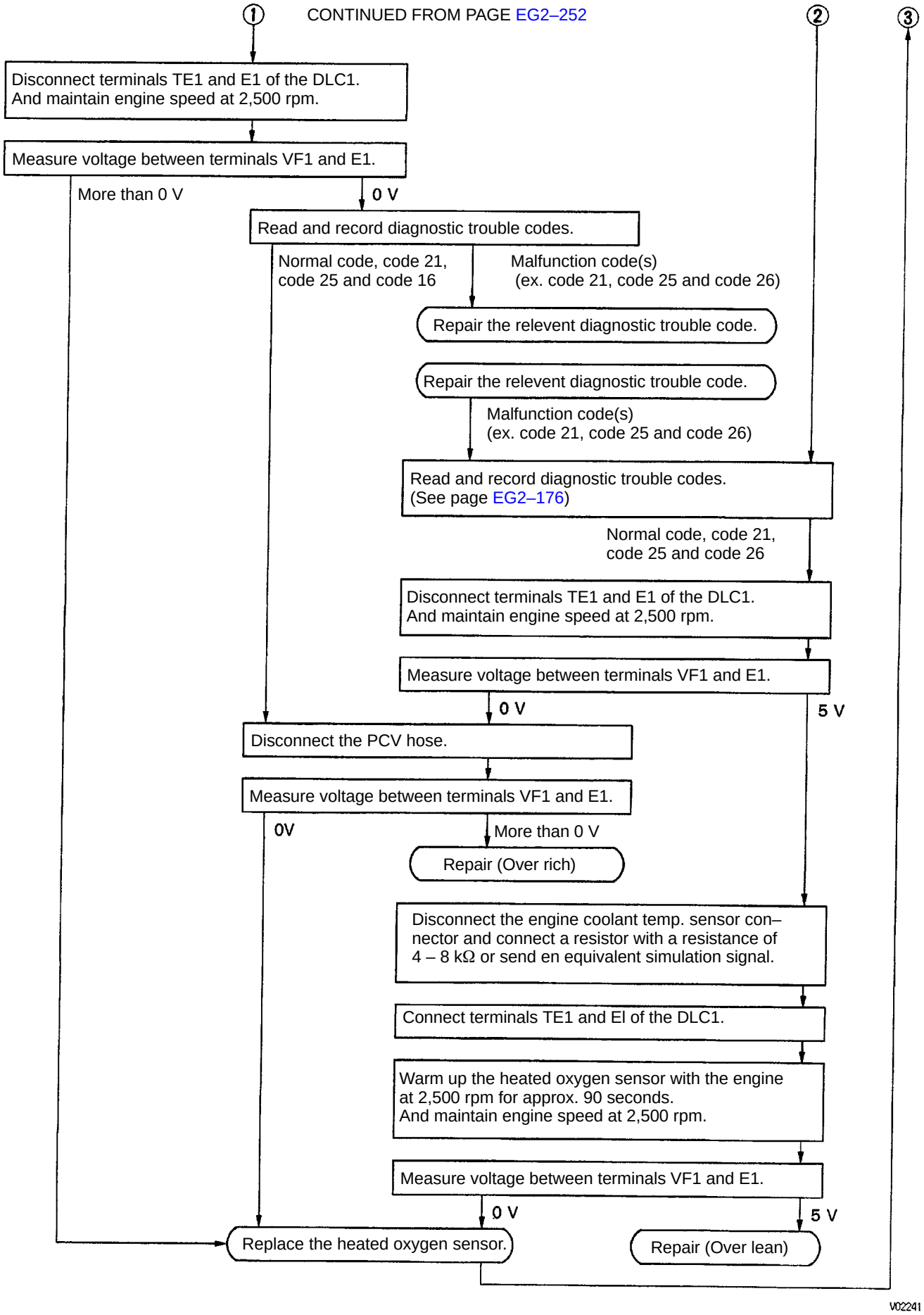
(a) Warm up the engine.

(b) Connect the voltmeter to the DLC1 terminals VF1 and E1.

HINT: Use SST when connecting between terminals TE1 and E1 of the DLC1.

SST 09843–18020

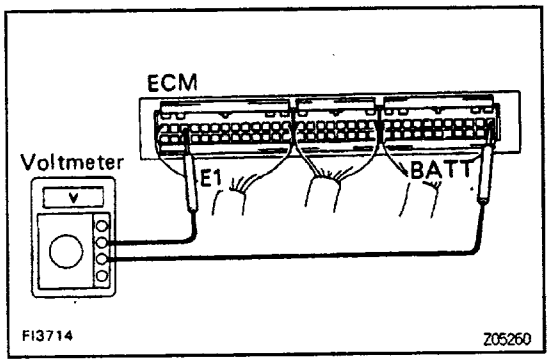



1
CONTINUED FROM PAGE EG2–252
2
3
Disconnect terminals TE1 and E1 of the DLC1.
And maintain engine speed at 2,500 rpm.
Measure voltage between terminals VF1 and E1.
More than 0 V
0 V
Read and record diagnostic trouble codes.
Normal code, code 21,
code 25 and code 16
Malfunction code(s)
(ex. code 21, code 25 and code 26)
Repair the relevent diagnostic trouble code.
Repair the relevent diagnostic trouble code.
Malfunction code(s)
(ex. code 21, code 25 and code 26)
Read and record diagnostic trouble codes.
(See page EG2–176)
Normal code, code 21,
code 25 and code 26
Disconnect terminals TE1 and E1 of the DLC1.
And maintain engine speed at 2,500 rpm.
Measure voltage between terminals VF1 and E1.
0 V
5 V
Disconnect the PCV hose.
Measure voltage between terminals VF1 and E1.
0V
More than 0 V
Repair (Over rich)
Disconnect the engine coolant temp. sensor con–
nector and connect a resistor with a resistance of
4 – 8 kΩ or send en equivalent simulation signal.
Connect terminals TE1 and El of the DLC1.
Warm up the heated oxygen sensor with the engine
at 2,500 rpm for approx. 90 seconds.
And maintain engine speed at 2,500 rpm.
Measure voltage between terminals VF1 and E1.
0 V
5 V
Replace the heated oxygen sensor.
Repair (Over lean)
V02241

ENGINE CONTROL MODULE (ECM)

ENGINE CONTROL MODULE (ECM) INSPECTION

HINT: The MFI circuit can be checked by measuring the voltage and resistance at the wiring connectors of the engine control module (ECM).



1. INSPECT VOLTAGE OF ENGINE CONTROL MODULE (ECM)

Check the voltage between each terminal of the wiring connectors.

- Turn the ignition switch ON.
- Measure the voltage at each terminal.

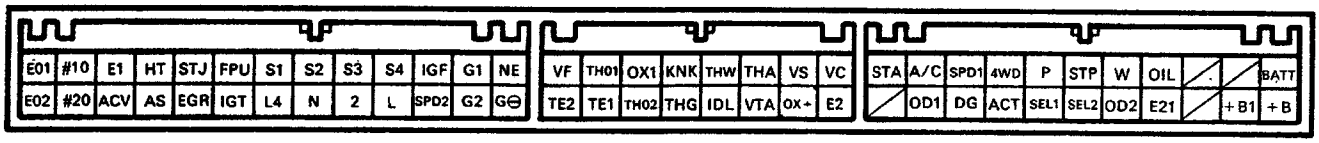
HINT:

- Perform all voltage measurements with the con–nectors connected.
- Verify that the battery voltage is 11 V or more when the ignition switch is ON.

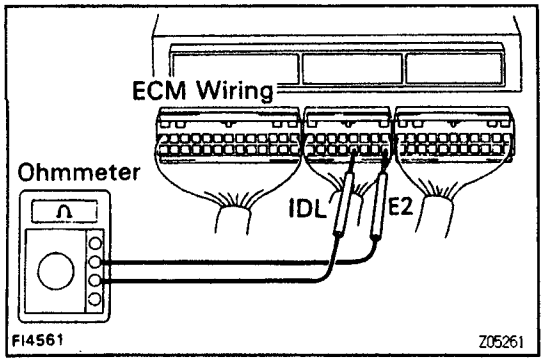
Engine Control Module (ECM) Wiring Connectors Voltage

Terminals	Condition		STD voltage
BATT – E1	–		9 – 14
+B – E1	Ignition SW ON		
+B1 – E1			
IDL – E2 (E21)	Ignition SW ON	Throttle valve open	9 – 14
VC – E2 (E21)		–	4.5 – 5.5
VTA – E2 (E21)		Throttle vaive¿fully closed (Throttle opener must be cancelled first)	0.3 – 0.8
		Throttle valve fully open	3.2 – 4.9
VC – E2 (E21)	Ignition SW ON	–	4.5 – 5.5
VS – E2 (E21)		Measuring plate fully closed	4.0 – 5.5
		Measuring plate fully open	0.2 – 0.5
	Idling		2.3 – 2.8
	3,000 rpm		0.3 – 1.0
THA – E2 (E21)	Ignition SW ON	Intake air temperature 20°C (68°F)	0.5 – 3.4
THW – E2 (E21)	Ignition SW ON	Engine coolant temperature 80°C (176°F)	0.2 – 1.0
STA – E1	Cranking		6 V or more
#10 – E01 #20 – E02	Ignition SW ON		9 – 14
IGT – E1	Idling		Pulse generation
W – E1	No trouble (malfunction indicator lamp off) and engine running)		9 – 14
STJ – E1	Cranking	Engine coolant temperature 80°C (176°F)	6 V or more
STP – E1	Stop light switch ON		7.5 – 14

Engine Control Module (ECM) Terminals



FI2796



2. INSPECT RESISTANCE OF ENGINE CONTROL MODULE (ECM)

NOTICE:

- **Do not touch the engine control module (ECM) terminals.**
- **The tester probe should be inserted into the wiring connector from the wiring side.**

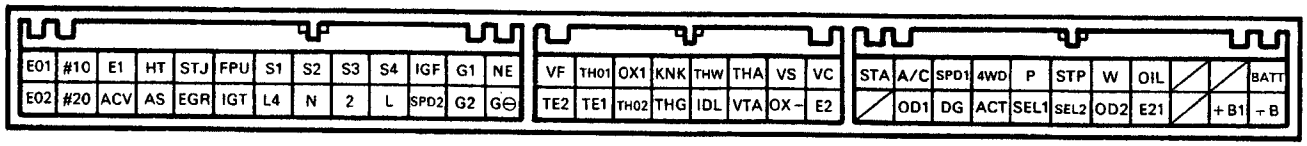
Check the resistance between each terminal of the wiring connectors.

- Disconnect the connectors from the engine control module (ECM).
- Measure the resistance at each terminal.

Engine Control Module (ECM) Wiring Connectors Resistance

Terminals	Condition	Resistance (kΩ)
IDL – E2 (E21)	Throttle valve open	Infinity
	Throttle valve fully closed (Throttle opener must be cancelled first)	2.3 or less
VTA – E2 (E21)	Throttle valve fully open	3.1 – 12.1
	Throttle valve fully closed (Throttle opener must be cancelled first)	0.47 – 6.1
VC – E2 (E21)	Intake air temperature 20°C (68°F)	3.9 – 9.0
THA – E2 (E21)	Volume air flow meter connector disconnected	2 – 3
THW – E2 (E21)	Engine coolant temperature 80°C (176°F)	0.2 – 0.4
+B – E1	–	0.2 – 0.4
VC – E2 (E21)	Throttle position sensor connector disconnected	0.2 – 0.4
VS – E2 (E21)	Measuring plate fully closed	0.2 – 0.6
	Measuring plate fully open	0.02 – 1.20
G1, G2 – G⊖	Cold (–10 ~ 50°C, 14 ~122°F)	0.125 – 0.200
	Hot (50~100°C, 122~212°F)	0.160 – 0.235
NE – G⊖	Cold (–10 ~ 50°C, 14 ~122°F)	0.155 – 0.250
	Hot (50~100°C, 122~212T)	0.190 – 0.290

Engine Control Module (ECM) Terminals



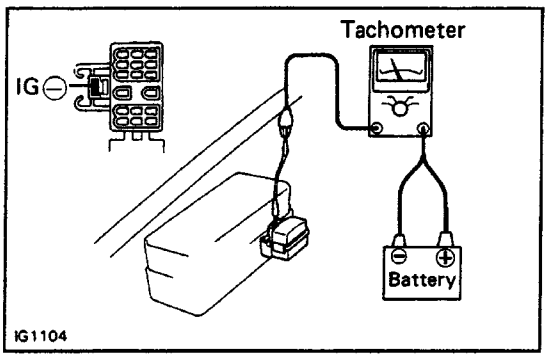
FUEL CUT RPM

EG1HU–02

FUEL CUT RPM INSPECTION

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.



2. CONNECT TACHOMETER

Connect the test probe of a tachometer to terminal IG (–) of the DLC1.

NOTICE:

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

3. INSPECT FUEL CUT OPERATION

(a) Increase the engine speed to at least 2,500 rpm.

(b) Check for injector operating sound.

(c) Check that when the throttle lever is released, injector operation sound stops momentarily and then res–umes.

HINT:

- The vehicle should be stopped.
- Accessories switched OFF.

Fuel return rpm:

M/T 1.300 rpm

A/T 1,500 rpm

4. DISCONNECT TACHOMETER

SERVICE SPECIFICATIONS

EG1U6-02

SERVICE DATA

Fuel pressure regulator	Fuel pressure	at no vacuum	265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi)
Cold start injector	Resistance Fuel leakage		2 – 4 Ω One drop or less per minute
Injector	Resistance Injection volume Difference between each cylinder Fuel leakage		13.4 – 14.2 Ω 45 – 55 cm³ (2.7 – 3.4 cu in.) per 15 sec. 6 cm³ (0.4 cu in.) or less One drop or less per minute
Volume air flow meter	Resistance	Terminals	Resistance
		VS – E2	200 – 600 Ω (Measuring plate fully closed)
		VS – E2	20 – 1,200 Ω (Measuring plate fully open)
		VC – E2	200 – 400 Ω
		FC – E1	Infinity
		THA – E2	10 – 20 kΩ at −20°C (−4°F)
		THA – E2	4 – 7 kΩ at 0°C (32°F)
		THA – E2	2 – 3 kΩ at 20°C (68°F)
		THA – E2	0.9 – 1.3 kΩ at 40°C (104°F)
		THA – E2	0.4 – 0.7 kΩ at 60°C (140°F)
Throttle body	Throttle body fully closed angle Dashpot setting speed Throttle opener setting speed		6° 2,000 ± 200 rpm 900 – 1,800 rpm
Throttle position sensor	Clearance between stop screw and lever	Terminals	Resistance
	0 mm (0 in.)	VTA – E2	0.47 – 6.1 kΩ
	0.50 mm (0.020 in.)	IDL – E2	2.3 kΩ or less
	0.80 mm (0.031 in.)	IDL – E2	Infinity
	Throttle valve fully open	VTA – E2	3.1 – 12.1 kΩ
		VC – E2	3.9 – 9.0 kΩ
Cold start injector time switch	Resistance	STA – STJ	30 – 50 Ω below 10°C (50°F)
		STA – STJ	70 – 90 Ω above 25°C (77°F)
		STA – Ground	30 – 90 Ω
Engine coolant temp. sensor	Resistance		10 – 20 kΩ at −20°C (−4°F) 4 – 7 kΩ at 0°C (32°F) 2 – 3 kΩ at 20°C (68°F) 0.9 – 1.3 kΩ at 40°C (104°F) 0.4 – 0.7 kΩ at 60°C (140°F) 0.2 – 0.4 kΩ at 80°C (176°F)
VSV (Fuel pressure control)	Resistance		30 – 50 Ω at 20°C (68°F)
EGR gas temp. sensor (Calif. and C&C)	Resistance		69 – 89 kΩ at 50°C (122°F) 11 – 15 kΩ at 100°C (212°F) 2 – 4 kΩ at 150°C (302°F)
Heated oxygen sensor	Heater coil resistance	California 2WD only Others	4.5 – 6.0 Ω at 23°C (73°F) 5.1 – 6.3 Ω at 20°C (68°F)

ECM	Condition	Terminals	Voltage
	IG SW ON	+B–E1	9 – 14 V
	IG SW ON	+B1 – E1	9 – 14 V
	–	BATT – E1	9 – 14 V
	IG SW ON – Throttle valve open	IDL – E2 (E21)	9 – 14 V
	IG SW ON – Throttle valve fully closed (Throttle opener must be cancelled first)	VTA – E2 (E21)	0.3 – 0.8 V
	IG SW ON – Throttle valve fully open	VTA – E2 (E21)	3.2 – 4.9 V
	IG SW ON	VC – E2 (E21)	4.5 – 5.5 V
	IG SW ON – Measuring plate fully closed	VS – E2 (E21)	4.0 – 5.5 V
	IG SW ON – Measuring plate fully open	VS – E2 (E21)	0.2 – 0.5 V
	Idling	VS – E2 (E21)	2.3 – 2.8 V
	3,000 rpm	VS – E2 (E21)	0.3 – 1.0 V
	IG SW ON	#10 or #20 – E01	9 – 14 V
	IG SW ON	#10 or #20 – E02	9 – 14 V
	IG SW ON – Intake air temp. 20°C (68*F)	THA – E2 (E21)	0.5 – 3.4 V
	IG SW ON – Engine coolant temp. 80° C (176° F)	THW – E2 (E21)	0.2 – 1.0 V
	Cranking	STA – E1	6 V or more
	Idling	IGT – E1	Pulse generation
	No trouble (malfunction indicator lamp off) and engine running	W – E1	9 – 14 V
	Cranking – Engine coolant temp. 80° C (176° F)	STJ – E1	6 V or more
	Stop light switch ON	STP	7.5 – 14 V

ECM	Condition	Terminals	Resistance
	Throttle valve open Throttle valve fully closed (Throttle opener– must be cancelled first)	IDL – E2 (E21)	Infinity
		IDL – E2 (E21)	2,300 Ω or less
	Throttle valve fully open Throttle valve fully closed (Throttle opener must be cancelled first)	VTA – E2 (E21)	3,100 – 12,100 Ω
		VTA – E2 (E21)	470 – 6,100 Ω
	Measuring plate fully closed	VC – E2 (E21)	3,900 – 9,000 Ω
	Measuring plate fully open	VS – E2 (E21)	200 – 600 Ω
	Intake air temp. 20°C (68°F) Coolant temp. 80° C (176° F)	VS – E2 (E21)	20 – 1,200 Ω
		THA – E2 (E21)	2,000 – 3,000 Ω
		THW – E2 (E21)	200 – 400 Ω
	Cold (–10°C (14°F) to 50°C (122°F))		
		G1 or G2 – G⊖	125 – 200 Ω
	Hot (50°C (122°F) to 100°C (212°F))		
		G1 or G2 – G⊖	160 – 235 Ω
	Cold (–10°C (14°F) to 50°C (122°F))	NE – G⊖	155 – 250 Ω
	Hot (50°C (122°F) to 100°C (212°F))	NE – G⊖	190 – 290 Ω
Fuel cut rpm	Fuel return rpm	M/T	1,300 rpm
		A/T	1,500 rpm

TORQUE SPECIFICATIONS

EG1HW–02

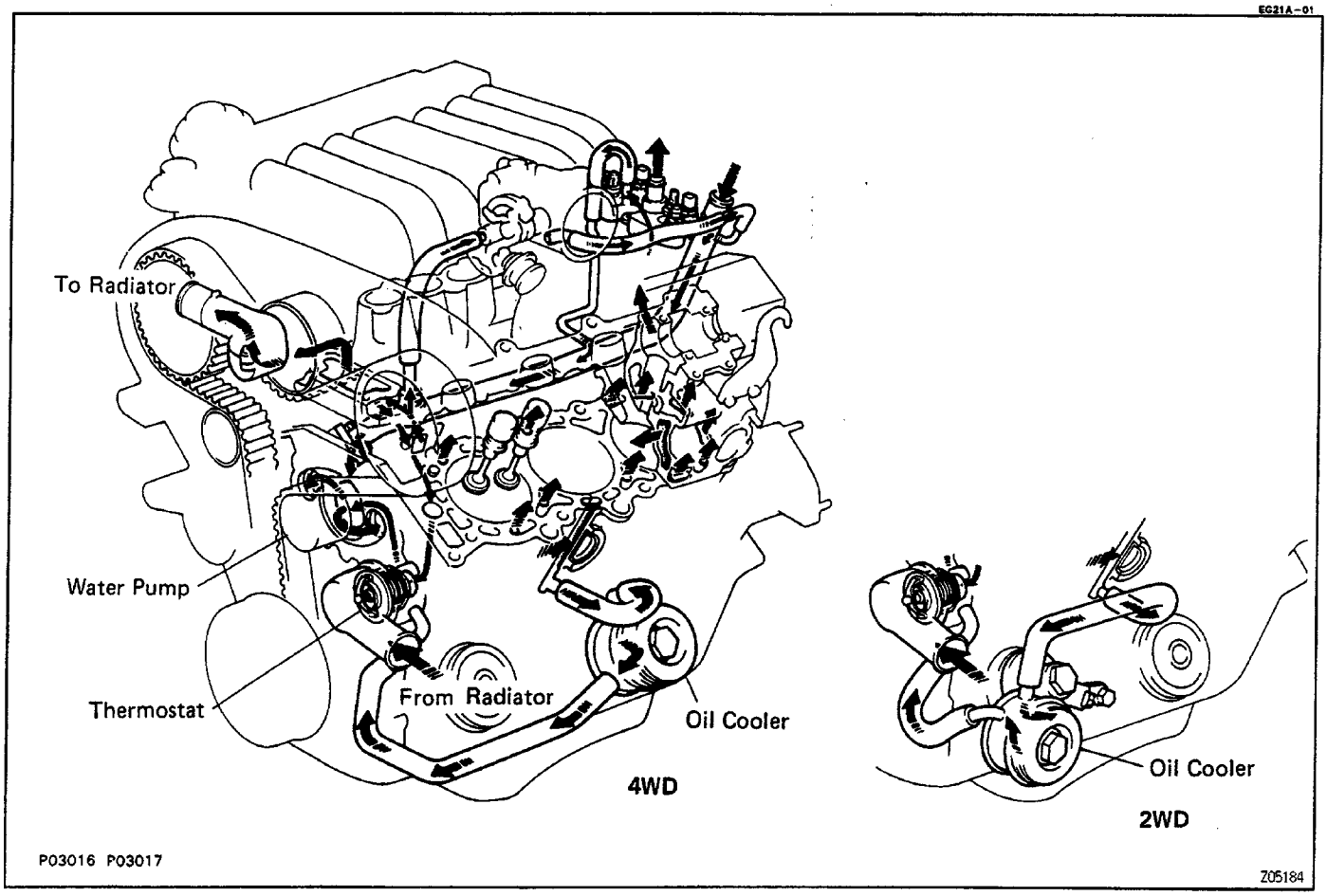
Part tightened	N·m	kgf·cm	ft·lbf
Cold start injector x Air intake chamber	7.8	80	69 in.·lbf
Delivery pipe x Pulsation damper	29	300	22
Delivery pipe x Fuel pressure regulator	29	300	22
Delivery pipe x Cold start injector tube	15	150	11
Delivery pipe x No.3 fuel pipe	34	350	25
Delivery pipe x No.2 fuel pipe	34	350	25
Delivery pipe x Intake manifold	13	130	9
Fuel line	30	310	22
Fuel pump	3.9	40	35 in.·lbf
Fuel drain plug	6.4	65	56 in.·lbf

COOLING SYSTEM

DESCRIPTION

This engine is cooled by a pressurized water forced circulation cooling system equipped with a thermostatically controlled by – pass valve mounted on the inlet side.

OPERATION



The cooling system is composed of the water jacket (inside the cylinder block and cylinder head), radiator, water pump, thermostat, cooling fan, fluid coupling, hoses and other components.
Engine coolant, which has been heated in the water jacket, is drawn into the radiator by the water pump. The radiator is cooled by air drawn in by the cooling fan and by the air flow from the vehicle's forward motion. This in turn cools the coolant in the radiator. The coolant is then drawn into the water pump and then discharged back to the cylinder block.
The water jacket is a network of channels in the outer area of the cylinder block and cylinder head. It is designed so that the engine coolant flowing through it can provide adequate cooling to the areas subjected to the highest thermal stresses, in particular, the cylinders and combustion chambers, during engine operation.

RADIATOR

The radiator, mounted at the front of vehicle, consists of an upper and lower tank and a core connecting the two tanks.
The core contains many tubes through which engine coolant flows from the upper tank to the

lower tank. Air passing over the radiator fins cools the heated engine coolant flowing through the radiator.

The upper tank has an inlet for engine coolant from the water jacket and it has a filler inlet. It also has a hose attached through which excess engine coolant or steam can flow. The lower tank has an outlet for the engine coolant and a drain cock. Automatic transmission models include an automatic transmission fluid cooler.

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 engine coolant from boiling even when the engine 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 out of the overflow pipe when the pressure generated in the cooling system exceeds the limit (engine coolant temperature: 110 – 120 ° C 230 – 248 ”F, pressure: 58.8 – 103.0 kPa, 0.6 – 1.05 kgf/cm2, 8.5 – 14.9 psi). The vacuum valve opens to allow engine coolant to enter in order to alleviate the vacuum which develops in the engine coolant system after the engine has stopped and the engine coolant temperature drops.

RESERVOIR TANK

The reservoir tank is used to catch engine coolant which–overflows the cooling system as a result of volumetric expansion when the engine coolant is heated. When the engine coolant temper–ature drops, engine coolant in the reservoir tank returns to the radiator, thus keeping the radiator full at all times and avoiding needless engine coolant loss. To find out if the engine coolant needs to be replenished, check the reservoir tank level.

WATER PUMP

The water pump is used for forced circulation of engine coolant through the cooling system. It is mounted on the front of the engine block and driven by the timing belt.

THERMOSTAT

The thermostat has a wax type by–pass valve and is mounted in the water inlet housing. The thermostat includes a type of automatic valve operated by fluctuations in the engine coolant temperature. When the engine coolant temperature is low, the valve closes to prevent the engine coolant flowing to the radiator, thus permitting the engine to warm up rapidly. When the by–pass valve opens the by–pass circuit, the engine coolant continues to circulate inside the engine, quickly and uniformly warming up to the operating temperature.

When the engine coolant temperature is high, the valve opens and the engine coolant flows to the radiator where it is cooled. When the wax inside the thermostat is heated, it expands and thus creates pressure which overpowers the force of the spring which keeps the valve closed. When the wax cools, its contraction allows 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).

PREPARATION

EG1D3–01

EQUIPMENT

Heater	
Radiator cap tester	
Thermometer	
Torque wrench	

EG1D4–02

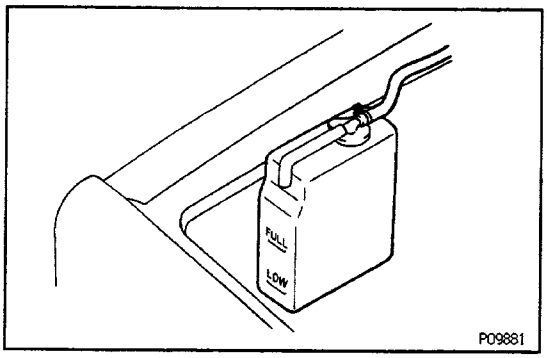
ENGINE COOLANT

Item	Capacity	Classification
2WD M /T A/T 4WD M/T A/T	9.9 liters (110.5 US qts, 8.7 Imp. qts) 9.7 liters (10.3 US qts, 8.5 Imp. qts) 10.0 liters (10.6 US qts, 8.8 Imp. qts) 9.8 liters (10.4 US qts, 8.6 Imp. qts)	Ethylene–glycol base

EG1D5–01

SSM (SPECIAL SERVICE MATERIALS)

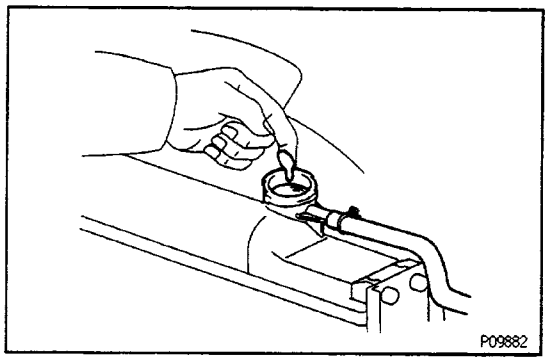
08826–00100 Seal Packing 1282B, Three Bond 1282B or equivalent	Water pump



COOLANT CHECK AND REPLACEMENT

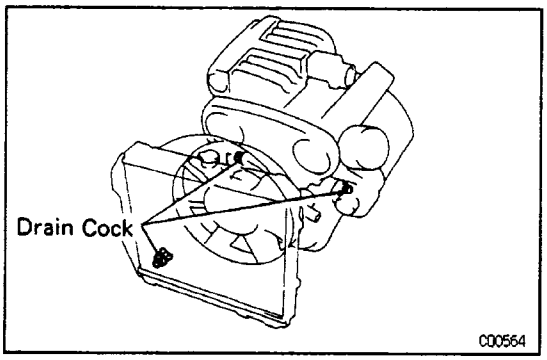
1. CHECK ENGINE COOLANT LEVEL IN RESERVOIR TANK

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



2. CHECK ENGINE COOLANT QUALITY

There should not be any excessive deposits of rust or scale around the radiator cap or radiator filler hole, and the engine coolant should be free from oil.
If excessively dirty, replace the engine coolant.



3. REPLACE ENGINE COOLANT

(a) Remove the radiator cap.
(b) . Drain the engine coolant from the radiator and engine drain cocks.
(c) Close the drain cocks.
(d) Fill the system with engine coolant.
HINT:

- Use a good brand of ethylene – glycol base engine coolant, mixed according to the manufacturer's instructions.
- Using engine coolant which has more than 50% ethylene–glycol (but not more than 70%) is recommended.

NOTICE:

- **Do not use an alcohol type engine coolant.**
- **The engine coolant should be mixed with deminer–alized water or distilled water.**

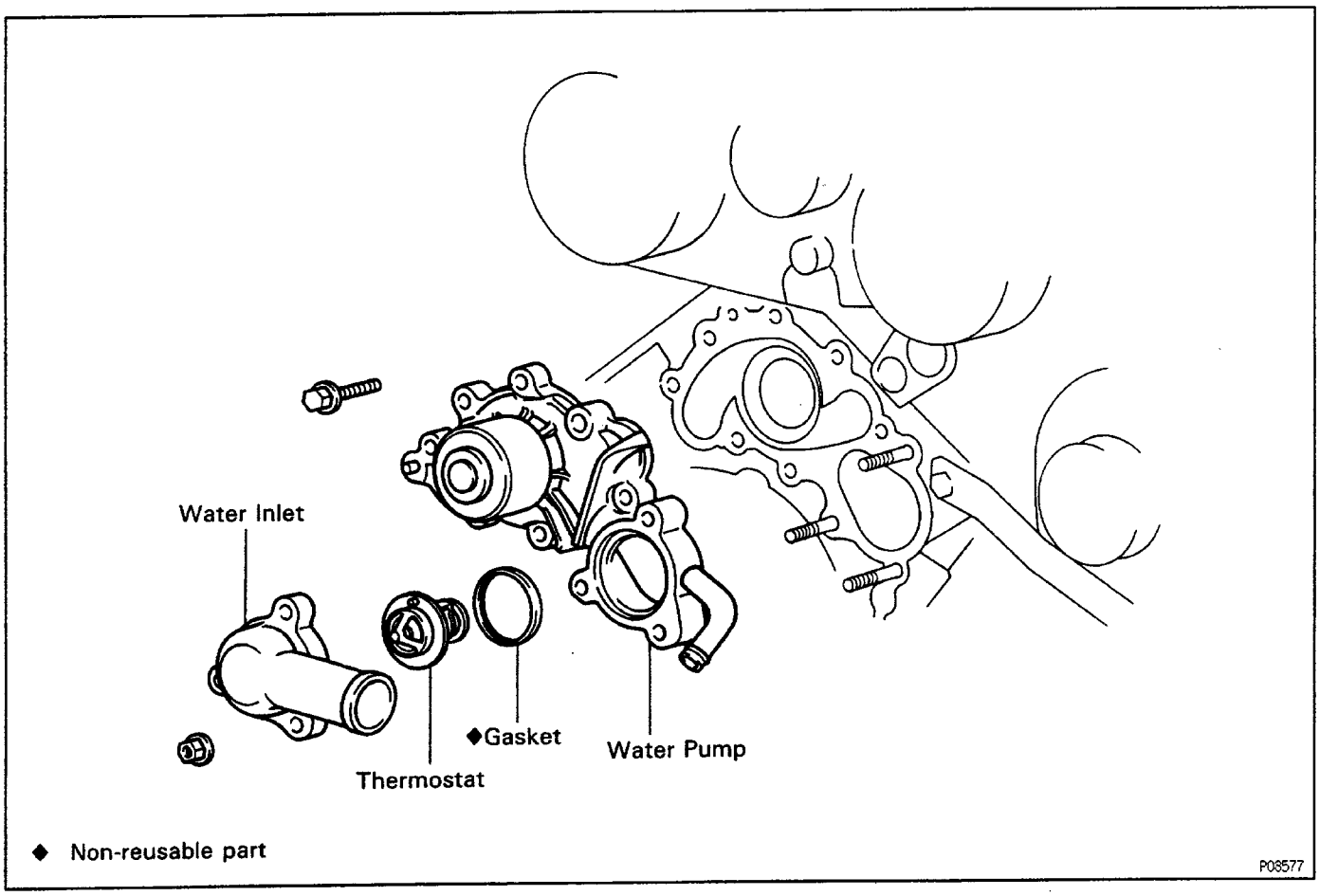
Engine coolant capacity (w/ heater or air conditioner):
2WD
M/T 9.9 liters (10.5 US qts, 8.7 Imp. qts)
A/T 9.7 liters (10.3 US qts, 8.5 Imp. qts)
4WD
M/T 10.0 liters (10.6 US qts, 8.8 Imp. qts)
A/T 9.8 liters (10.4 US qts, 8.6 Imp. qts)

(e) Install the radiator cap.
(f) Start the engine and check for leaks.
(g) Recheck the engine coolant level and refill as neces–sary.

WATER PUMP

EG1D7–01

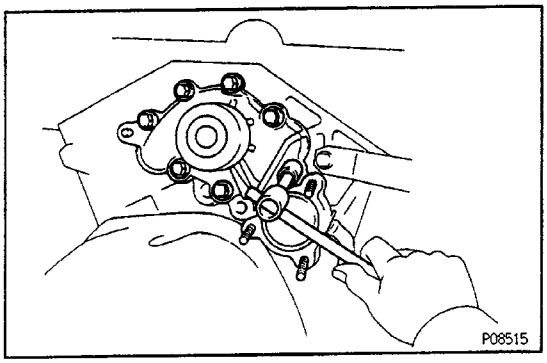
COMPONENTS



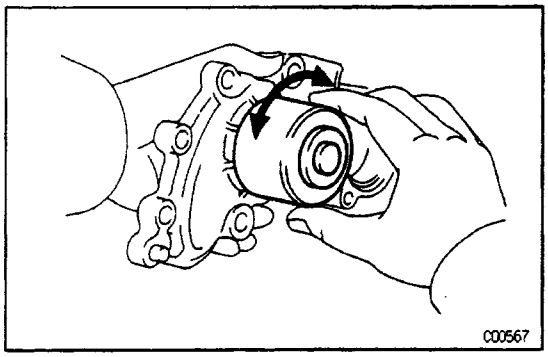
EG1D8–01

WATER PUMP REMOVAL

1. REMOVE TIMING BELT
(See page EG2–32)
2. REMOVE THERMOSTAT
3. DISCONNECT NO. 2 OIL COOLER HOSE FROM WATER PUMP



4. REMOVE WATER PUMP
Remove the seven bolts and water– pump.

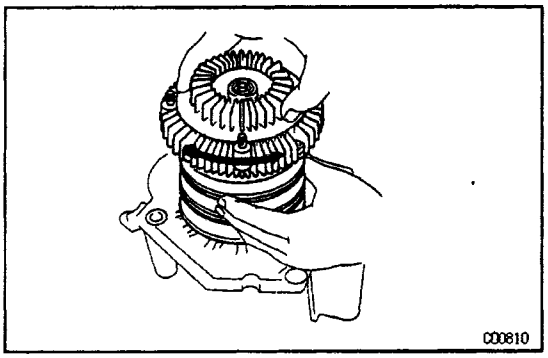


EG1D9–01

WATER PUMP INSPECTION

1. INSPECT WATER PUMP BEARING

Check that the water pump bearing moves smoothly and quietly.

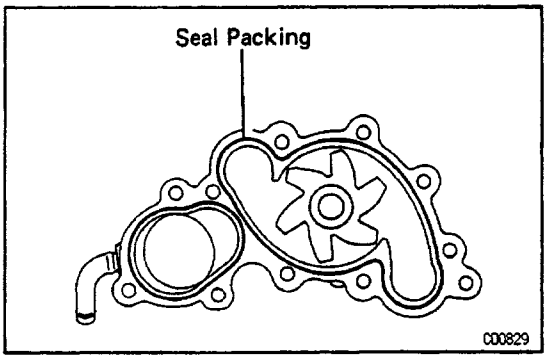


2. INSPECT FLUID COUPLING

Check the fluid coupling for damage and silicone oil leakage.

3. INSPECT FAN PULLEY BRACKET

Check the turning smoothness of the fan pulley. If necessary, replace the pulley bracket.



EG20X–01

WATER PUMP INSTALLATION

(See components)

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.

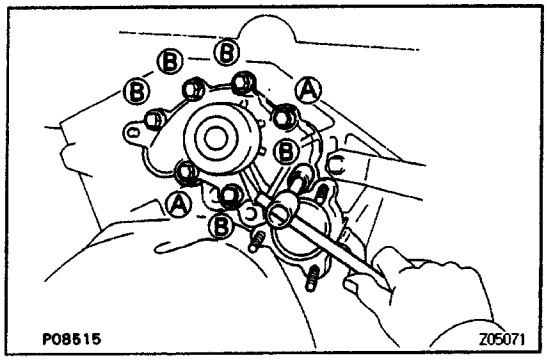
Seal packing:

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:

Bolt (A) 18 N–m (185 kgf–cm. 13 ft–lbf)

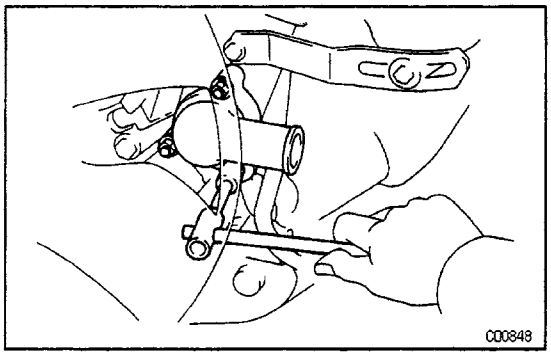
Bolt (B) 20 N–m (200 kgf–cm, 14 ft–lbf)

2. CONNECT NO.2 OIL COOLER HOSE

3. INSTALL THERMOSTAT

4. INSTALL TIMING BELT

(See page EG2–41)



THERMOSTAT

EG1DB–01

THERMOSTAT REMOVAL

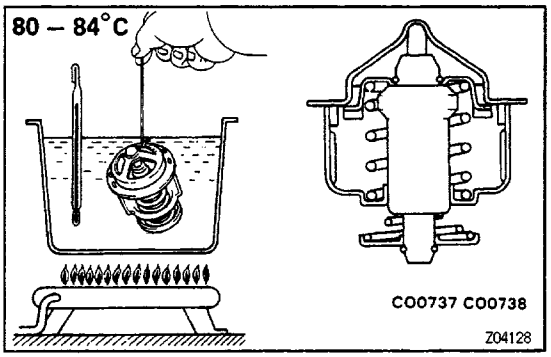
1. DRAIN ENGINE COOLANT

2. DISCONNECT RADIATOR OUTLET HOSE

3. REMOVE THERMOSTAT

(a) Remove the three nuts, water inlet and thermostat with gasket from the water pump.

(b) Remove the gasket from the thermostat.



EG1DC–01

THERMOSTAT INSPECTION

HINT: Thermostat is numbered according to the valve opening temperature.

(a) Immerse the thermostat in water and heat the water gradually.

(b) Check the valve opening temperature and valve lift.

Valve opening temperature:

80 – 84 °C (176 – 183 °F)

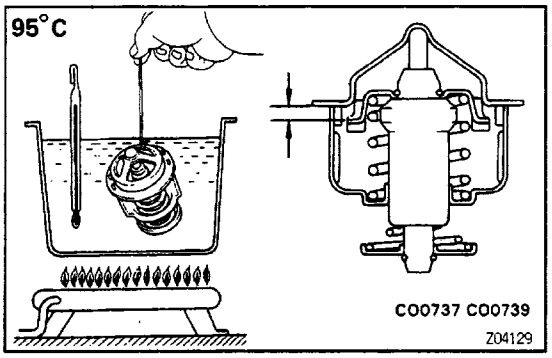
Valve lift:

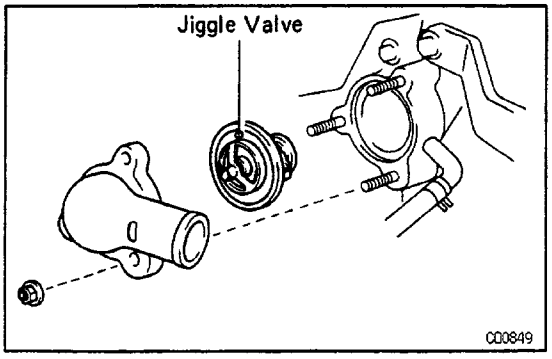
8 mm (0.31 in.) or more at 95 °C (203 °F)

If the valve opening temperature and valve lift are not within specifications, replace the thermostat.

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

If not tight, replace the thermostat.





EG20Y–01

THERMOSTAT INSTALLATION

1. INSTALL THERMOSTAT

(a) Place a new gasket to the thermostat.

(b) Install the thermostat with the jiggle valve upward.

2. INSTALL WATER INLET

Install the water inlet with the three nuts.

Torque: 20 N–m (200 kgf–cm, 14 ft–lbf)

3. CONNECT RADIATOR OUTLET HOSE

4. FILL WITH ENGINE COOLANT

5. START ENGINE AND CHECK FOR LEAKS

RADIATOR

EG1DE–01

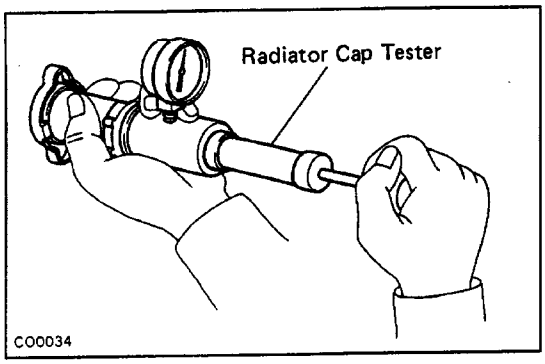
RADIATOR CLEANING

Using water or a steam cleaner, remove 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. For example, keep a distance of more than 40 – 50 cm (15.75 – 19.69 in.) between the radiator core and cleaner nozzle when the cleaner nozzle pressure is 2,942 – 3,432 kPa (30 – 35 kgf/cm^2, 427 – 498 psi).

EG1DF–01

RADIATOR INSPECTION

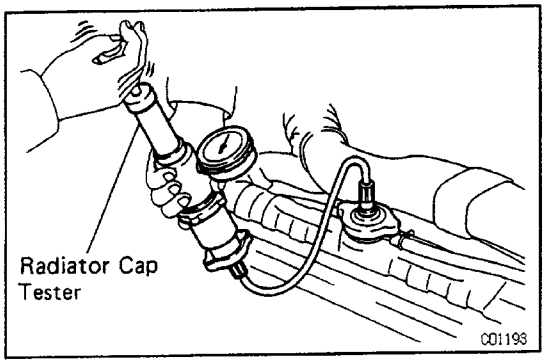


1. CHECK RADIATOR CAP

(a) Using radiator cap tester, pump the tester until relief valve opens. Check that the valve opens between 74 kPa (0.75 kgf/cm^2, 10.7 psi) and 103 kPa (1.05 kgf/cm^2, 14.9 psi).

(b) Check that pressure gauge does not drop rapidly when pressure on cap is below 59 kPa (0.6 kgf/cm^2, 8.5 psi).

If either check is not within limit, replace the radiator cap.



2. CHECK COOLING SYSTEM FOR LEAKS

(a) Fill the radiator with engine coolant and attach a radiator cap tester.

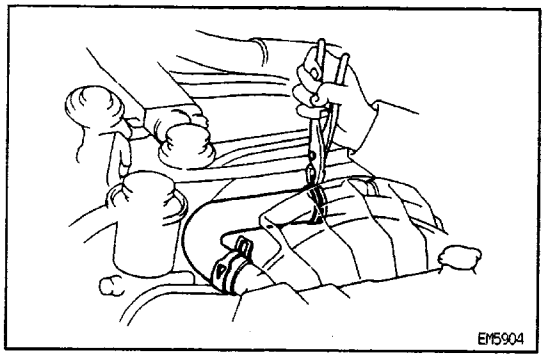
(b) Warm up the engine.

(c) Pump it to 118 kPa (1.2 kgf/cm^2, 17.1 psi), and check that the pressure does not drop.

If the pressure drops, check for leaks from the hoses, radiator or water pump. If no external leaks are found, check the heater core, block and intake manifold.

EG1DG–01

RADIATOR REMOVAL



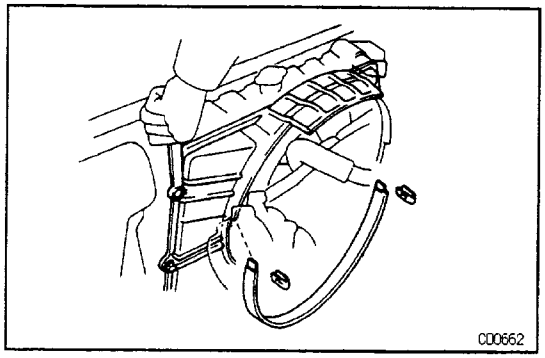
1. DRAIN ENGINE COOLANT

2. REMOVE ENGINE UNDER COVER

3. REMOVE RADIATOR

(a) Disconnect the reservoir hose.

(b) Remove the radiator hoses.



(c) Remove the No.2 fan shroud.

(d) Remove the No.1 fan shroud.

(e) Disconnect the oil cooler hoses.

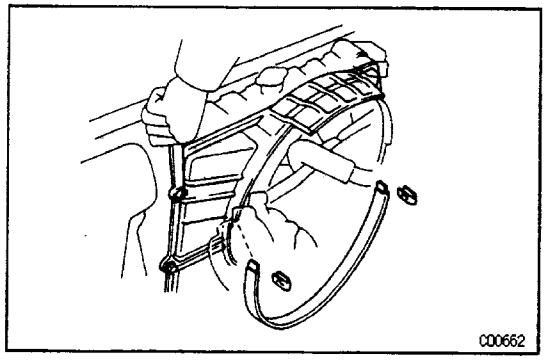
HINT:

- Be careful as some oil will leak out. Catch it in a suitable container.
- Plug the hose to prevent oil from escaping.

(f) Remove the four bolts and radiator.

EG30Z–01

RADIATOR INSTALLATION



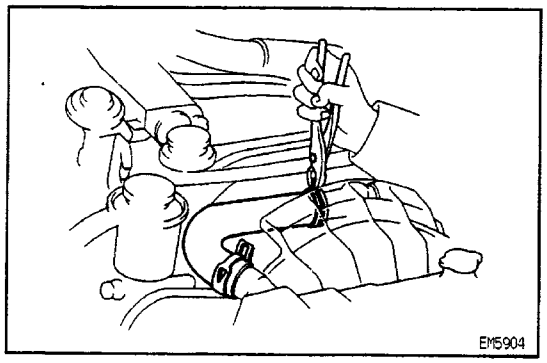
1. INSTALL RADIATOR

(a) Install the radiator with the four bolts.

(b) Connect the oil cooler hoses.

(c) Install the No.1 fan shroud

(d) Install the No.2 fan shroud



(e) Install the radiator hoses.

(d) Connect the reservoir hoses.

2. INSTALL ENGINE UNDER COVER

3. FILL WITH ENGINE COOLANT

4. START ENGINE AND CHECK FOR LEAKS

SERVICE SPECIFICATIONS

EG1DJ–01

SERVICE DATA

Radiator cap	Relief valve opening pressure	STD Limit	74 – 103 kPa (0.75 – 1.05 kgf/cm², 10.7 – 14.9 psi) 59 kPa (0.6 kgf/cm², 8.5 psi)
Thermostat	Valve opening temperature Valve lift	Start to open Fully open	82 °C (180 °F) 95 °C (203 °F) 8 mm (0.31 in.) or more

EG1DK–01

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
Cylinder block x Drain plug	29	300	22
Water pump x Cylinder block – Short bolt	20	200	14
Water pump x Cylinder block – Long bolt	18	185	13
Water inlet x Water pump	20	200	14

LUBRICATION SYSTEM

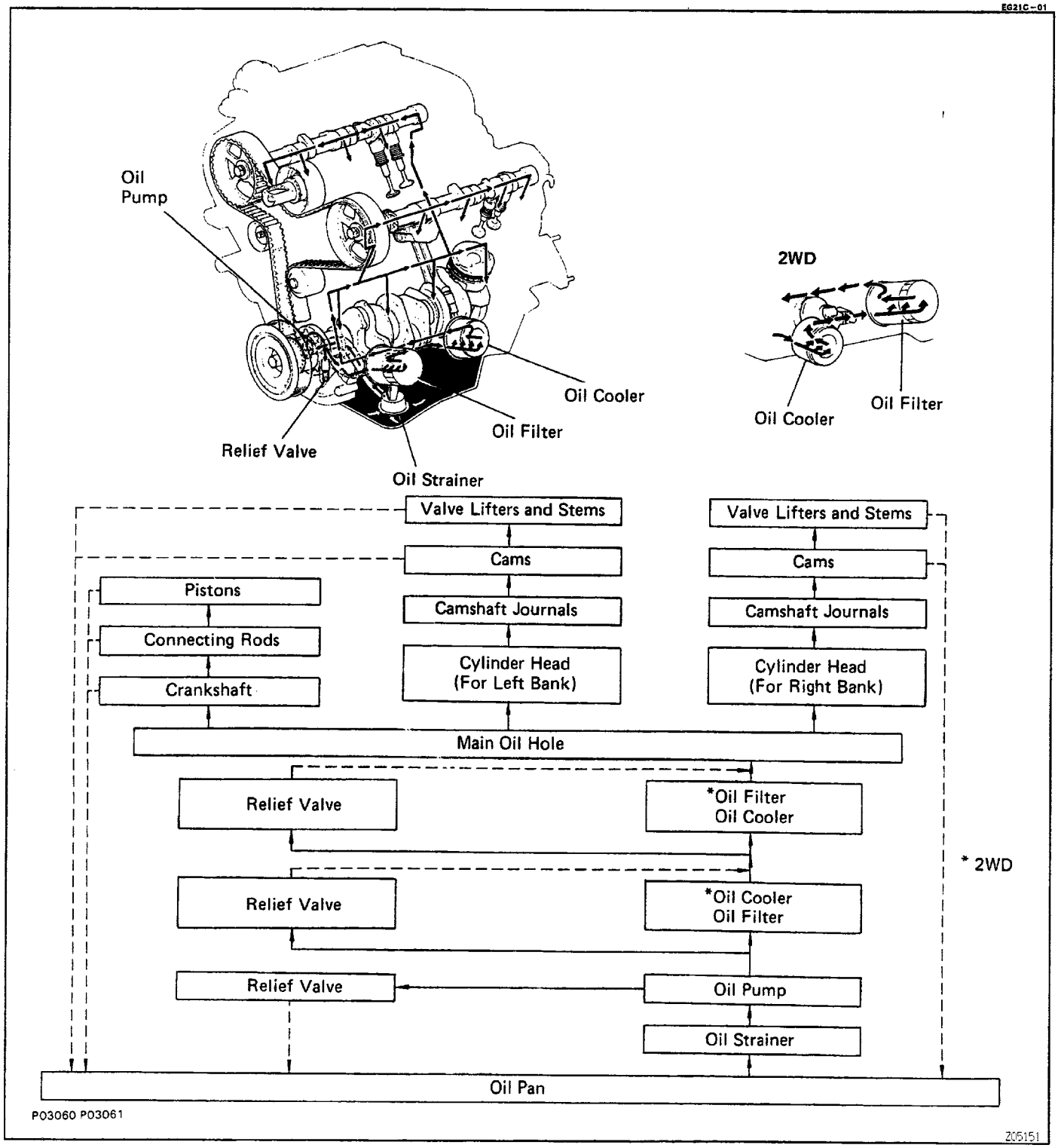
DESCRIPTION

EG21B–01

A fully pressurized, fully filtered lubrication system is used in this engine.

OPERATION

EG21C–01



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, cylinder block and cylinder head. 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 side of the oil pump body 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 the front of the inlet to the oil pump. The oil pump itself is a trochoid type pump, inside of which is a drive rotor and a driven rotor. When the crankshaft causes the drive rotor to rotate, the driven rotor rotates in the same direction, and since the axis of the drive 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 widens, and is discharged when the space becomes narrow.

OIL PRESSURE REGULATOR (RELIEF VALVE)

At high engine speeds, the oil pump supplies more oil to each part than it is necessary. For this reason, an oil pressure regulator which works to prevent an oversupply of oil is installed on the oil pump. During normal oil supply, a coil spring and valve keep the by–pass closed, but when too much oil is being supplied, the pressures become extremely high, overpowering the force of the spring and opening the valve. 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 paper filter element and built–in relief valve. Particles of metal from wear, airborne dirt, carbon and other impurities can get in the oil during use and could cause accelerated wear or seizing if allowed to circulate through the engine. The oil filter, integrated into the oil line, removes these impurities as the oil passes through it.

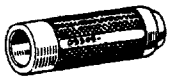
The filter is mounted outside the engine to simplify replacement of the filter element.

A relief valve is included in front of the filter element to relieve the high oil pressure in case the filter element becomes clogged with impurities. The by–pass valve opens when the difference in the oil pressure of the inlet and outlet ports exceeds a specified value. Oil passing through the relief valve by–passes the oil filter and flows directly into the main oil hole in the engine.

PREPARATION

EG1CR–01

SST (SPECIAL SERVICE TOOLS)

	09032–00100 Oil Pan Seal Cutter	
	09228–07500 Oil Filter Wrench	
	09309–37010 Transmission Bearing Replacer	Camshaft front oil seal
	09816–30010 Oil Pressure Switch Socket	

EG1CS–01

RECOMMENDED TOOLS

	09200–00010 Engine Adjust Kit	

EG1CT–01

EQUIPMENT

Oil pressure gauge	
Precision straight edge	Oil pump
Torque wrench	

EG1CU–02

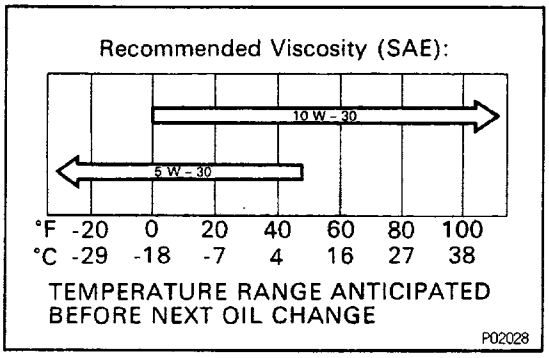
LUBRICANT

Item	Capacity	Classification
Engine oil Dry fill 2WD 4WD Drain and refill w/o Oil filter change 2WD 4WD w/ Oil filter change 2WD 4WD	 5.3 liters (5.6 US qts, 4.7 Imp. qts) 5.4 liters (5.7 US qts, 4.8 Imp. qts) 4.0 liters (4.2 US qts, 3.5 Imp. qts) 4.2 liters (4.4 US qts, 3.7 Imp. qts) 4.3 liters (4.5 US qts, 3.8 Imp. qts) 4.5 liters (4.8 US qts, 4.0 Imp. qts)	API grade SG Energy – Conserving II multigrade and recommended viscosity oil.

EG1CV–01

SSM (SPECIAL SERVICE MATERIALS)

08826–00080 Seal packing or equivalent	Oil pump, Oil pan baffle plate, Oil pan
08833–00080 Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure sender gauge



OIL PRESSURE CHECK

1. CHECK OIL QUALITY EG20G–01

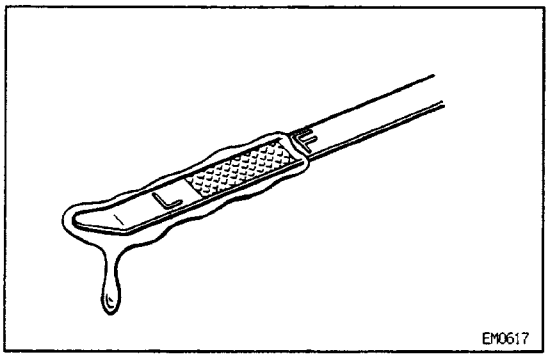
Check the oil for deterioration, entry of water, disco–loring or thinning.

If oil quality is poor, replace.

Oil grade:

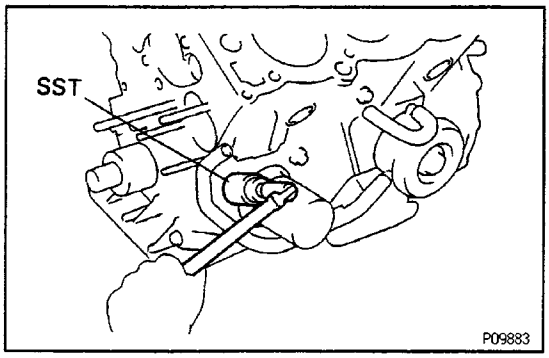
API grade SG Energy – Conserving 11 multigrade engine oil.

Recommended viscosity is as shown.



2. CHECK OIL LEVEL

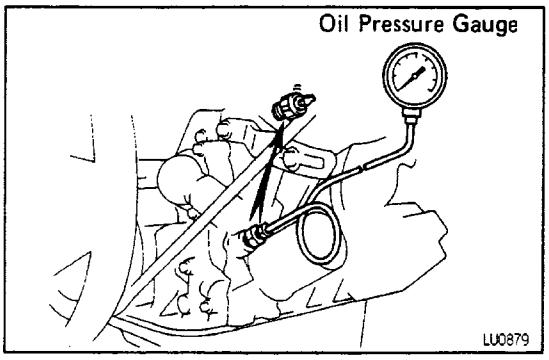
The oil level should be between the ”L” and ”F” marks on the level gauge. If low, check for leakage and add oil up to the ”F” mark.



3. REMOVE OIL PRESSURE SENDER GAUGE

Using SST, remove the oil pressure sender gauge.

SST 09816 – 30010



4. INSTALL OIL PRESSURE GAUGE

5. START ENGINE

Start the engine and warm it up to normal operating temperature.

6. MEASURE OIL PRESSURE

Oil pressure:

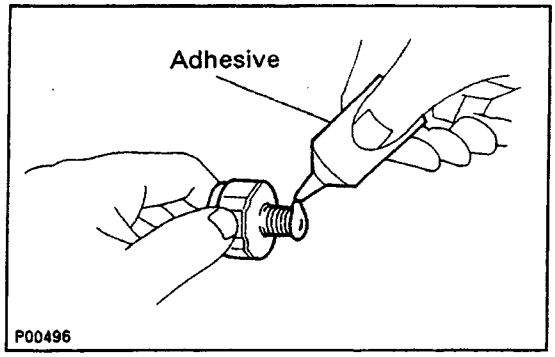
At idle speed

29 kPa (0.3 kgf/cm^2, 4.3 psi) or more

At 3,000 rpm

245 – 520 kPa (2.5 – 5.3 kgf/cm^2, 36 – 75 psi)

7. REMOVE 41L PRESSURE GAUGE

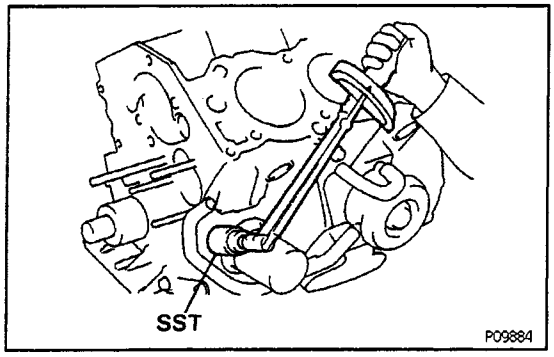


8. INSTALL OIL PRESSURE SENDER GAUGE

(a) Apply adhesive to two or three threads.

Adhesive:

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



(b) Using SST, install the oil pressure sender gauge.

SST 09818 – 30010

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

9. START ENGINE AND CHECK FOR LEAKS

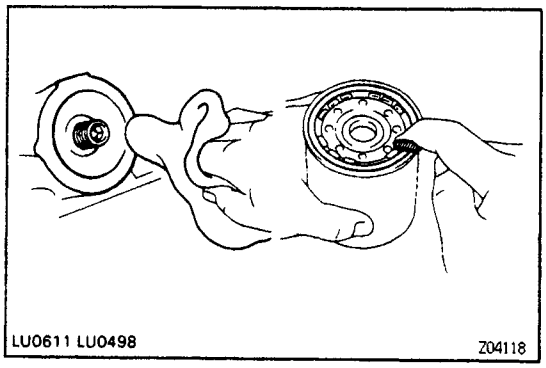
OIL AND FILTER REPLACEMENT

NOTICE: EG1CX–02

- **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. Adequate means of skin protection and washing facilities should be provided.**
- **Care should be taken, therefore, when changing engine oil, to minimize the frequency and length of time your skin is exposed to used engine oil. Protective clothing and gloves, that cannot be penetrated by oil, should be worn. The skin should be thoroughly washed with soap and water, or use 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 of only at designated disposal sites.**

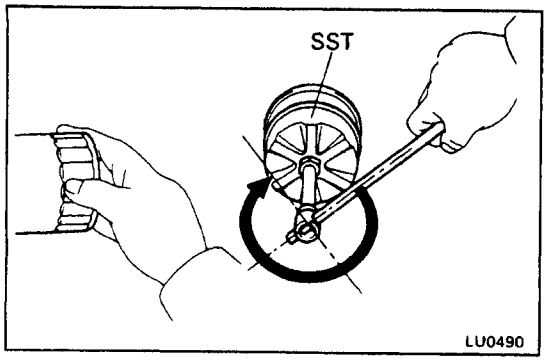
1. DRAIN ENGINE OIL

(a) Remove the oil filler cap.
(b) Remove the oil dipstick.
(c) Remove the oil drain plug and drain the oil into a container.



2. REPLACE OIL FILTER

(a) Using SST, remove the oil filter (located on left side of the cylinder block).
SST 09228–07500
(b) Clean the filter contact surface on the filter mounting.
(c) Apply clean engine oil to the gasket of a new oil filter.

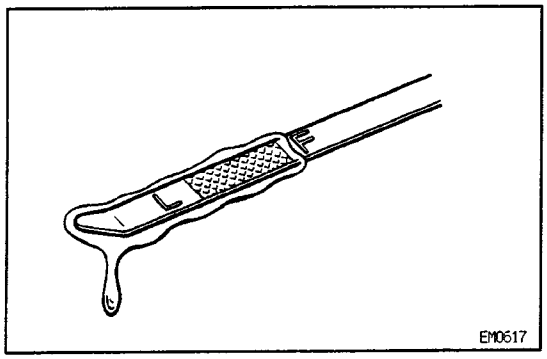


(d) Tighten the filter by hand until the gasket contacts the seat of the filter mounting. Then using SST, give it an additional 3/4 turn to seat the filter.
SST 09228–07500

3. FILL WITH ENGINE OIL

(a) Clean and install the oil drain plug with a new gasket.
(b) Fill the engine with new oil, API grade SG Energy – Conserving ll multigrade and recommended viscosity oil.

Oil capacity (2WD):
Drain and refill
w/o Oil filter change
4.0 liters (4.2 U S qts, 3.5 Imp. qts)
w/ Oil filter change
4.3 liters (4.5 US qts, 3.8 Imp. qts)
Dry fill
5.3 liters (5.6 US qts, 4.7 Imp. qts)
Oil capacity (4WD):
Drain and refill
w/o Oil filter change
4.2 liters (4.4 US qts, 3.7 Imp. qts)
w/ Oil filter change .
4.5 liters (4.8 US qts, 4.0 Imp. qts)
Dry fill
5.4 liters (5.7 US qts, 4.8 Imp. qts)

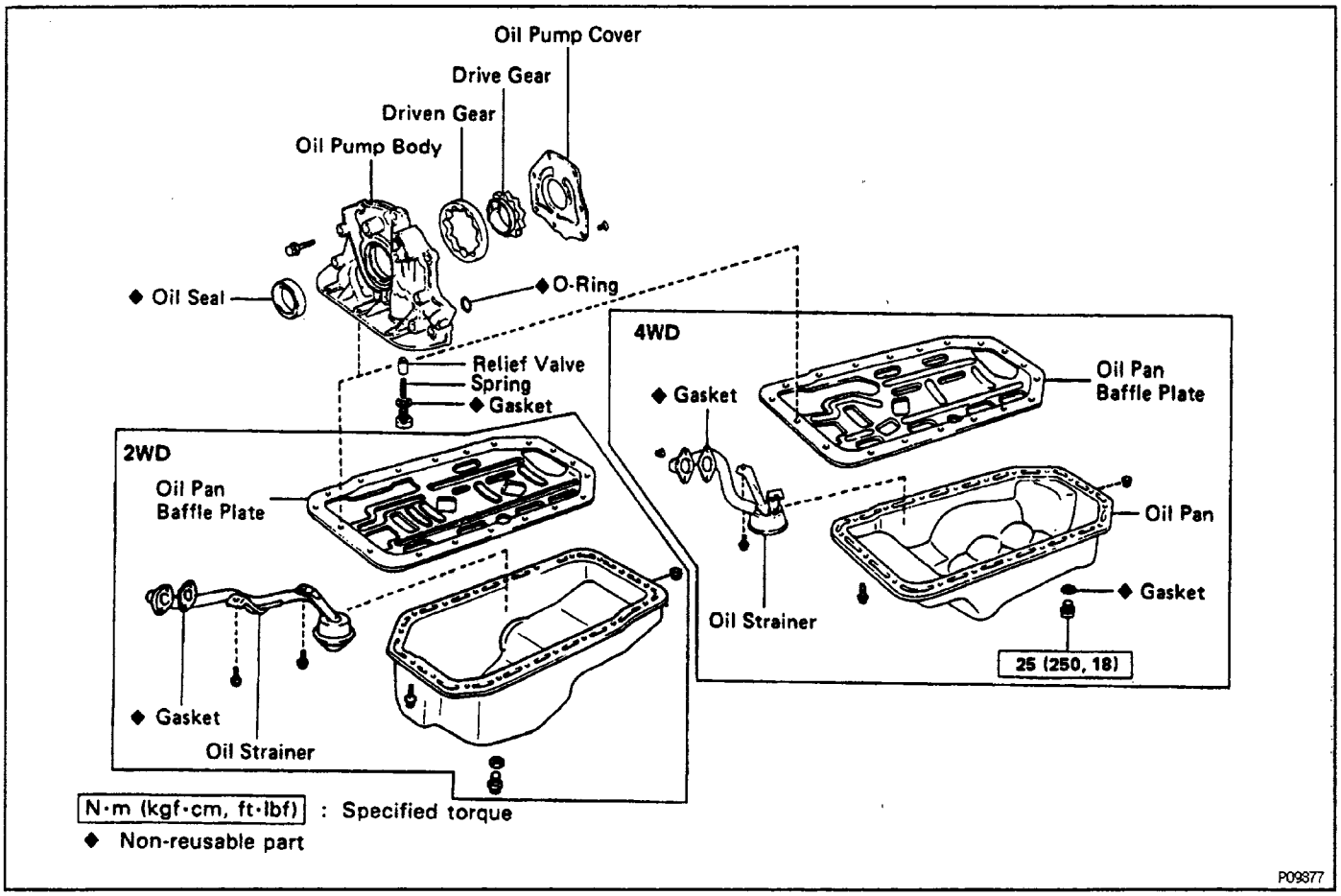


4. START ENGINE AND CHECK FOR LEAKS
5. RECHECK ENGINE LEVEL
Recheck the engine oil level and refill as necessary.

OIL PUMP

EG20H–01

COMPONENTS



EG20J–01

OIL PUMP REMOVAL

1. REMOVE ENGINE UNDER COVER

2. (4WD)

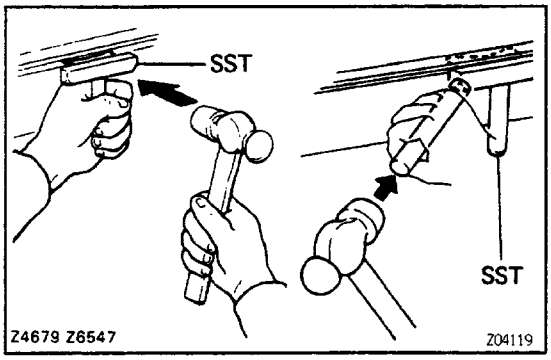
REMOVE FRONT DIFFERENTIAL

(See page SA–57)

3. DRAIN ENGINE OIL

4. REMOVE TIMING BELT

(See page EG2–32)



5. REMOVE CRANKSHAFT TIMING PULLEY

(See step 21 on page EG2–36)

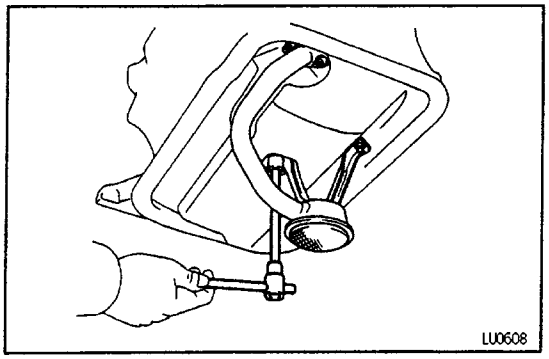
6. REMOVE OIL PAN

(a) Remove the seventeen bolts and two nuts.

(b) Using SST and a brass bar, separate the oil pan from the baffle plate.

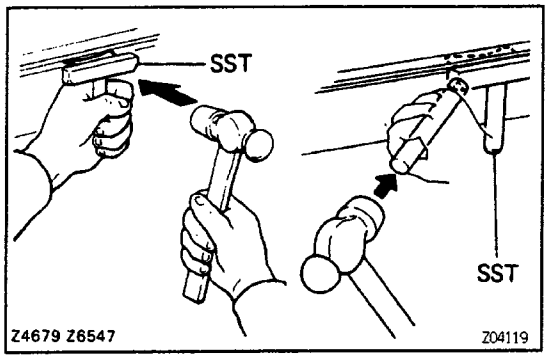
SST 09032–00100

HINT: When removing the oil pan, be careful not to damage the oil pan flange.



7. REMOVE OIL STRAINER

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

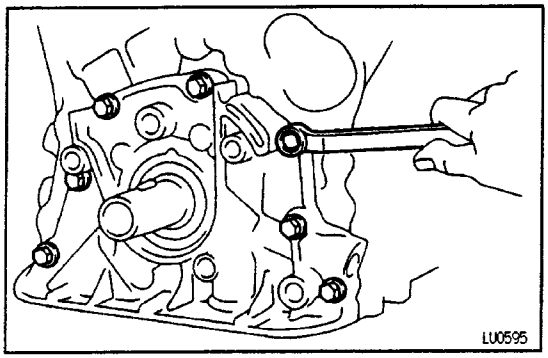


8. REMOVE OIL PAN BAFFLE PLATE

Insert the blade of SST between the cylinder block and baffle plate, cut off applied sealer and remove the baffle plate.

SST 09032 – 00100

HINT: When removing the baffle plate, be careful not to damage the baffle plate flange.



9. REMOVE OIL PUMP

(a) Remove the seven bolts and oil pump.

(b) Using a plastic–faced hammer, carefully tap the oil pump body.

(c) Remove the O–ring from the cylinder block.

EG20K–01

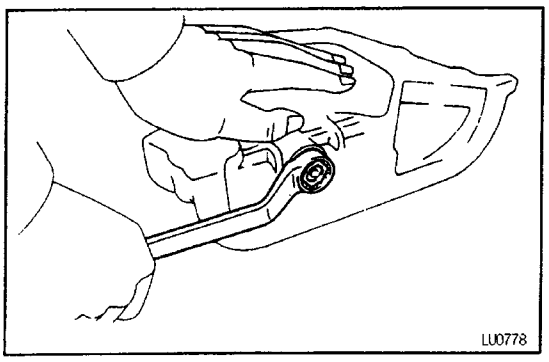
OIL PUMP DISASSEMBLY

(See components)

1. REMOVE DRIVEN AND DRIVE ROTORS

(a) Remove the seven screws and pump body cover.

(b) Remove the drive and driven rotors.



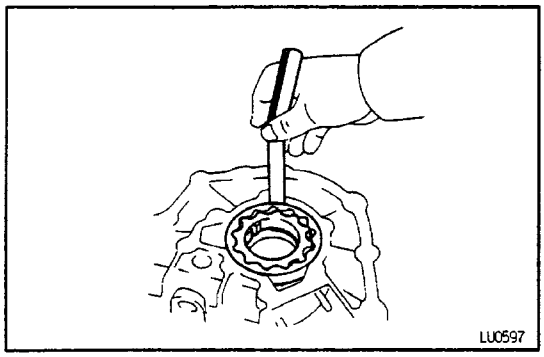
2. REMOVE RELIEF VALVE

(a) Unscrew the relief valve plug and gasket.

(b) Remove the spring and relief valve.

EG1CL–01

OIL PUMP INSPECTION



1. INSPECT BODY CLEARANCE

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

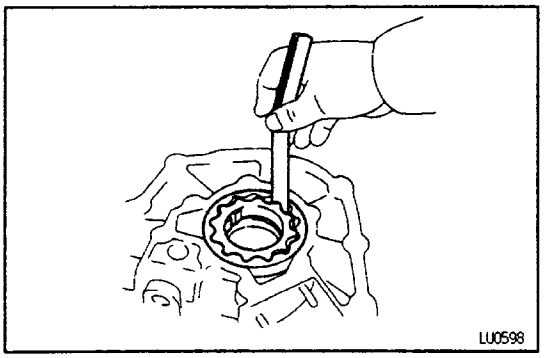
Standard clearance:

0.10 –0.13 mm (0.0039 – 0.0051 in.)

Maximum clearance:

0.30 mm (0.0118 in.)

If the clearance is greater than maximum, replace the oil pump rotor set and/or pump body.



2. INSPECT TIP CLEARANCE

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

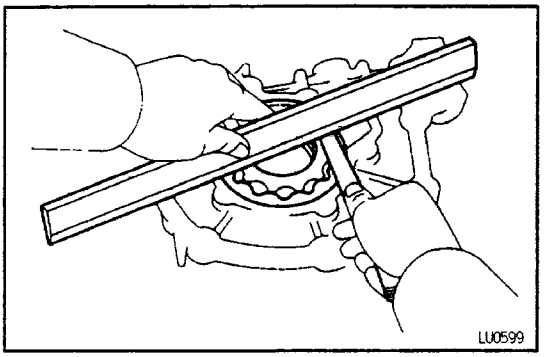
Standard clearance:

0.11 – 0.24 mm (0.0043 – 0.0094 in.)

Maximum clearance:

0.35 mm (0.0138 in.)

If the clearance is greater than maximum, replace the oil pump rotor set.



3. INSPECT SIDE CLEARANCE

Using a thickness gauge and precision straight edge, measure the side clearance as shown.

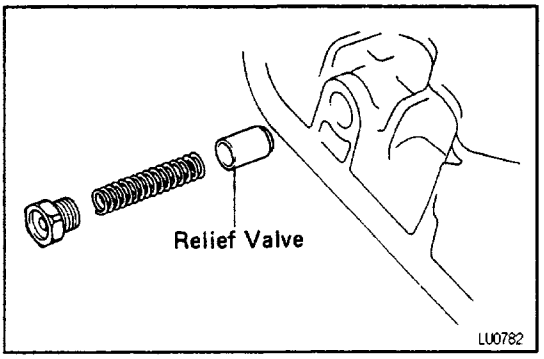
Standard clearance:

0.03 – 0.09 mm (0.0012 – 0.0035 in.) .

Maximum clearance:

0.15 mm (0.0059 in.)

If the clearance is greater than maximum, replace the oil pump rotor set and/or pump body.



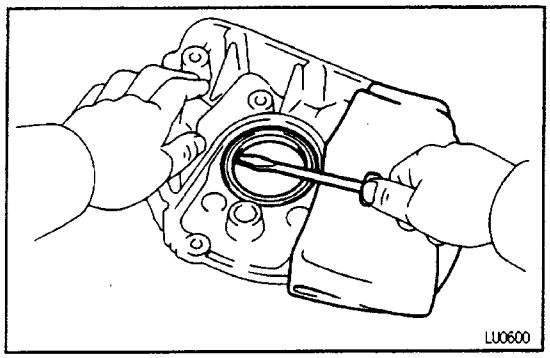
4. INSPECT RELIEF VALVE

Coat the relief valve with engine oil and check that it falls smoothly into the valve hole by its own weight.
If the valve does not fall smoothly, replace the valve and/or oil pump assembly.

EG20L–01

CRANKSHAFT FRONT OIL SEAL REPLACEMENT

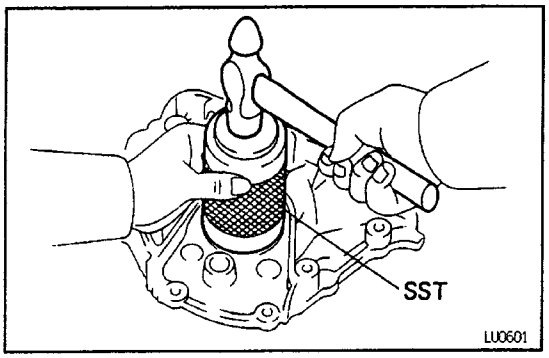
HINT: There are two methods (A and B) to replace the oil seal which are as follows:



REPLACE CRANKSHAFT FRONT OIL SEAL

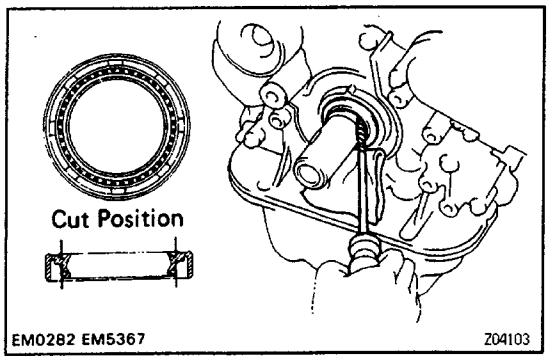
A. If oil pump is removed from cylinder block:

(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 body edge.
SST 09309–37010

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

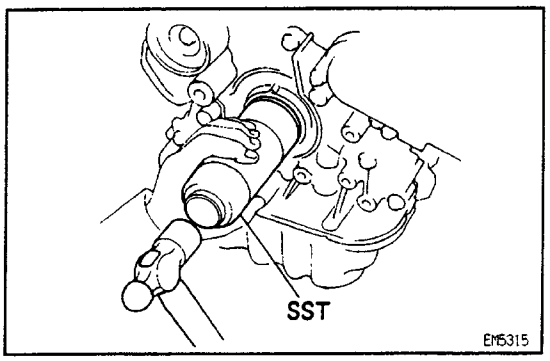


B. If oil pump is installed to the cylinder block:

(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 body edge.
SST 09306–37010

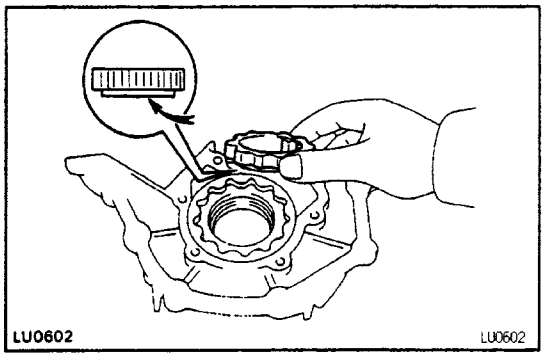
EG1CN–02

OIL PUMP ASSEMBLY

(See components)

1. INSTALL DRIVE AND DRIVEN ROTORS

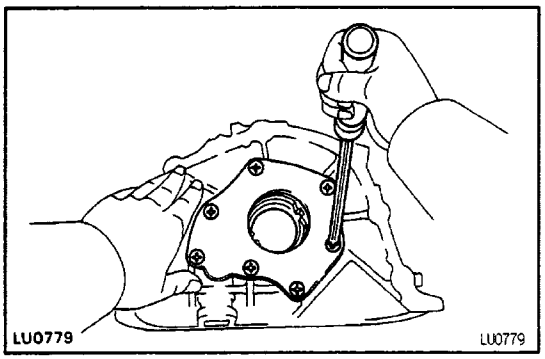
Put the drive and driven rotors in the pump body.



2. INSTALL PUMP BODY COVER

Install the pump body cover with the seven screws.

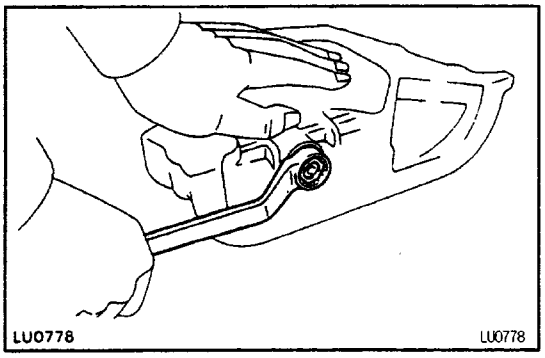
Torque: 10 N–m (105 kgf–cm, 8 ft–lbf)



3. INSTALL RELIEF VALVE

Install relief valve and the spring in the body, and screw on the relief valve plug with a new gasket.

Torque: 37 N–m (375 kgf–cm, 37 ft–lbf)



EG1CP–02

OIL PUMP INSTALLATION

(See components)

1. INSTALL OIL PUMP

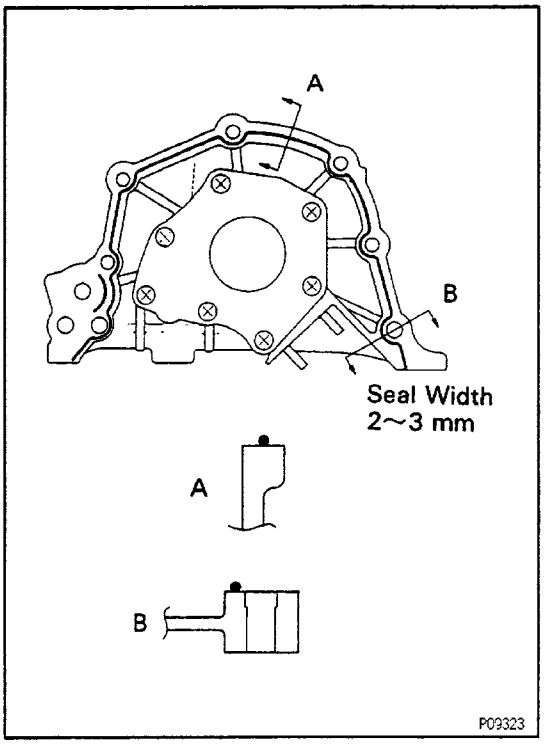
(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pump and cylinder block.

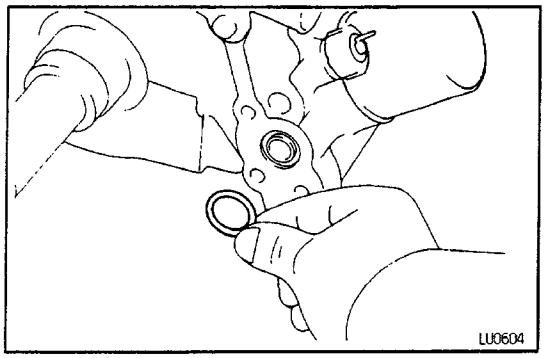
- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.
- Throughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

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

Seal packing:

Part No. 08826–00080 or equivalent





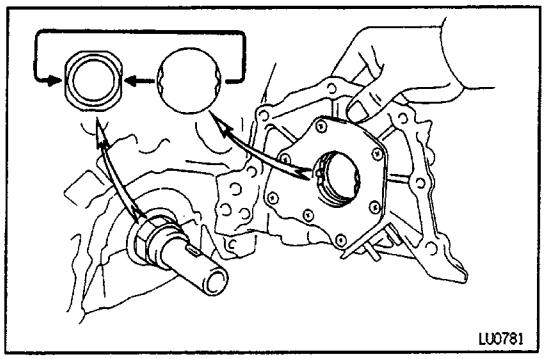
- Install nozzle that has been cut out to a 2–3 mm (0.08–0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

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

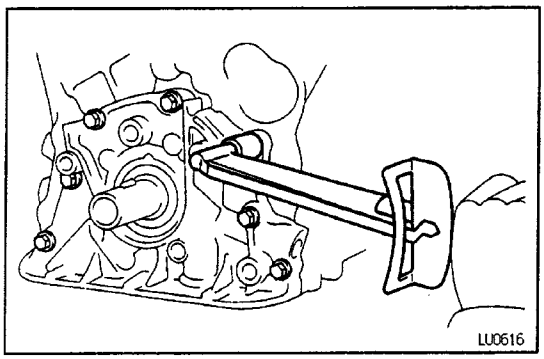
(c) Place a new O–ring into the groove of cylinder block.

(d) Install the oil pump to the crankshaft with the spline teeth of the drive rotor engaged with the large teeth of the crankshaft.



(e) Install the oil pump with the seven bolts.

Torque: 20 N–m (200 kgf–cm, 14 ft–lbf)

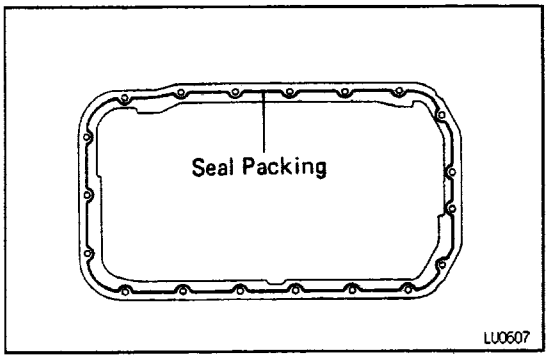


2. CLEAN OIL PAN BAFFLE PLATE AND OIL PAN

Remove any old packing (FIPG) material and be car–eful not to drop any oil on the contacting surfaces of the oil pan baffle plate, oil pan, cylinder block and sealing grooves.

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

NOTICE: Do not use a solvent which will affect the pai–nted surfaces.



3. INSTALL OIL PAN BAFFLE PLATE

Apply seal packing to the baffle plate as shown in the illustration.

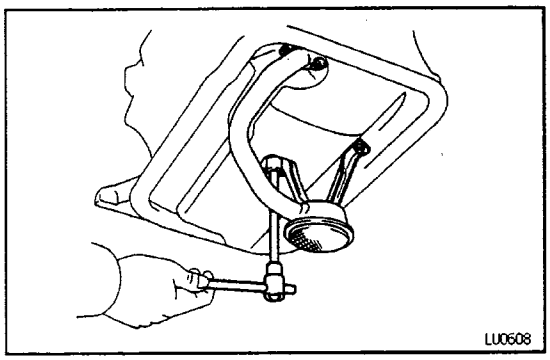
Seal packing:

Part No. 08826–00080 or equivalent

- Install a nozzle that has been cut to a 3 – 4 m m A 12 – 0.16 in.) opening.

HINT: Avoid applying an excess amount to the sur–face.

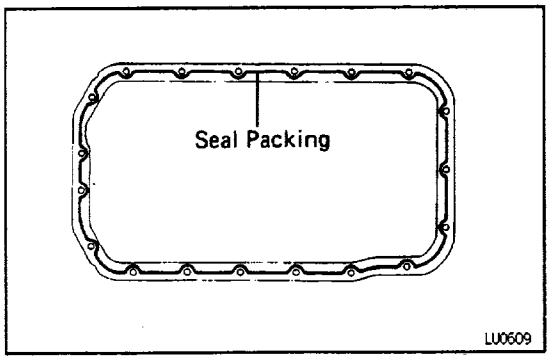
- If parts are not assembled within 5 minutes of applying the seal packing, the effectiveness of the seal packing is lost and the seal packing must be removed and reapplied.
- Immediately remove the nozzle from the tube and reinstall the cap after using the seal packing.



4. INSTALL OIL STRAINER

Place a new gasket and install the oil strainer with the two nuts and two bolts.

Torque: 6.9 N–m (70 kgf–cm, 61 in.–lbf)



5. INSTALL OIL PAN

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

Seal packing:

Part No. 08826–00080 or equivalent

- Install a nozzle that has been cut to a 3 – 4 mm (0.12 – 0.16 in.) opening.

HINT: Avoid applying an excess amount to the sur–face.

- If parts are not assembled within 5 minutes of applying the seal packing, the effectiveness of the seal packing is lost and the seal packing must be removed and reapplied.
- Immediately remove the nozzle from the tube and reinstall the cap after using the seal packing.

(b) Install the oil pan with the two nuts and seventeen bolts.

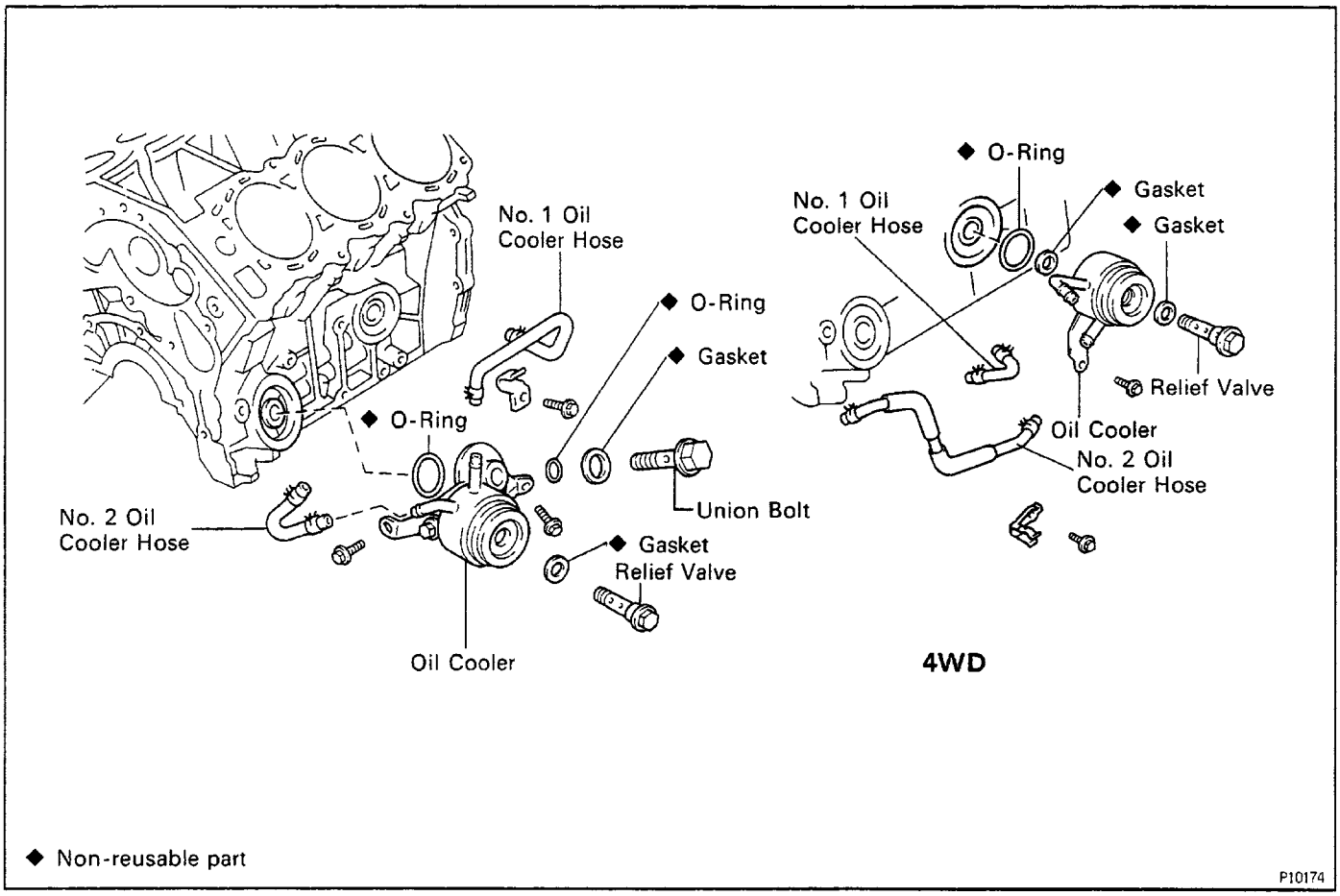
Torque: 5.9 N–m (60 kgf–cm, 52 in.–M)

6. INSTALL CRANKSHAFT TIMING PULLEY
(See step 6 on page EG2–42)
7. INSTALL TIMING BELT
(See page EG2–41)
8. (4WD)
INSTALL FRONT DIFFERENTIAL
(See page SA–106)
9. ENGINE UNDER COVER
10. FILL WITH ENGINE OIL
11. START ENGINE AND CHECK FOR LEAKS
12. RECHECK ENGINE OIL LEVEL

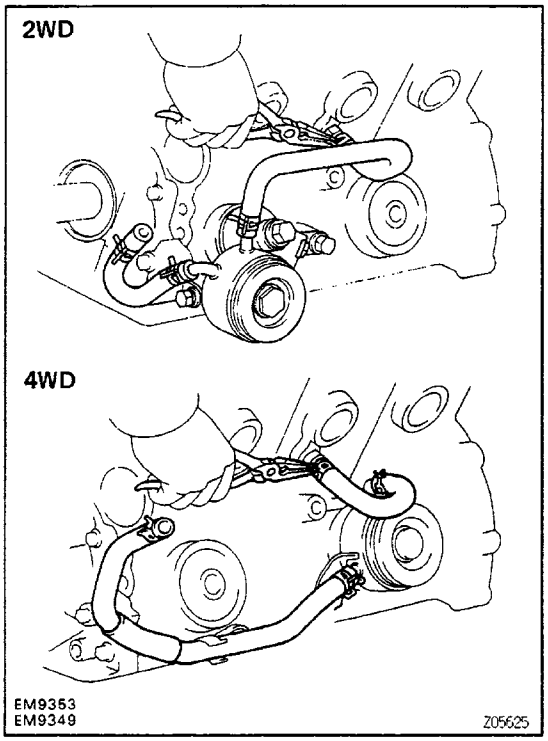
OIL COOLER

EG20M–03

COMPONENTS



EG20N–03

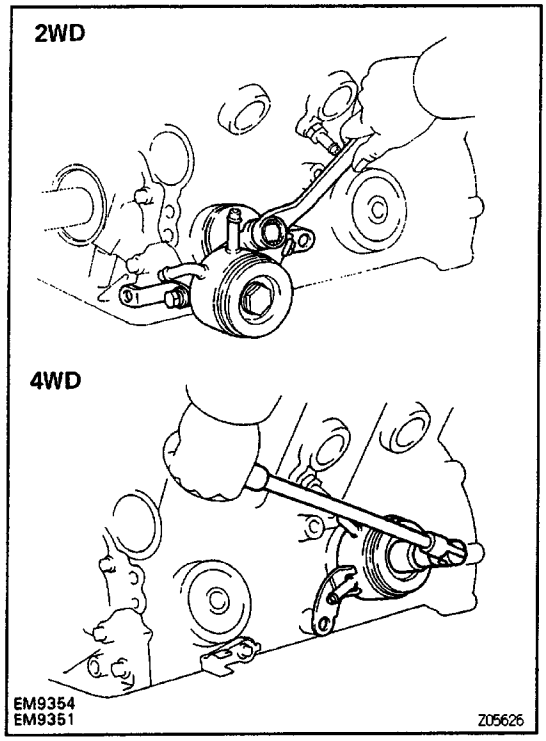


OIL COOLER REMOVAL

1. DRAIN ENGINE COOLANT

2. DISCONNECT OIL COOLER HOSES

Disconnect the No.1 and No.2 oil cooler hoses.



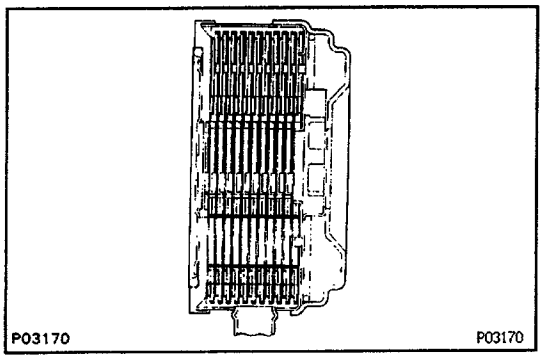
3. REMOVE OIL COOLER

(2WD)

Remove the two bolts, union bolt, relief valve, gaskets and oil cooler.

(4W D)

Remove the bolt, relief valve, gaskets and oil cooler.



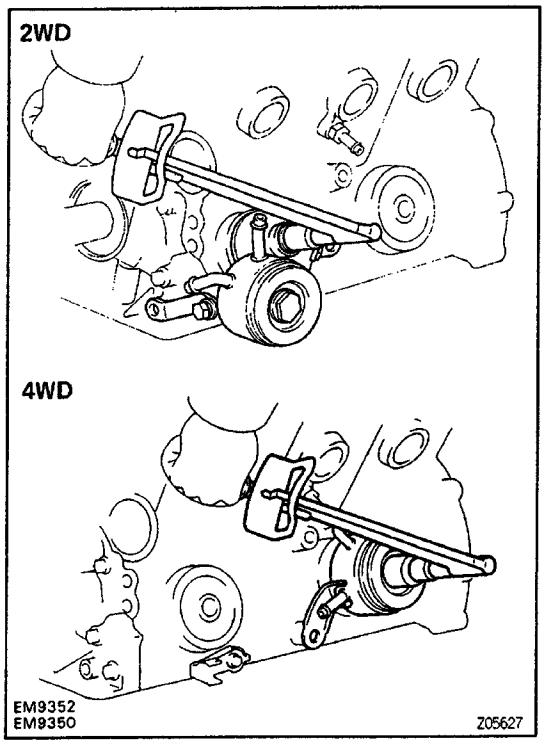
EG1CZ–01

OIL COOLER INSPECTION

INSPECT OIL COOLER

Check the oil cooler for damage or clogging.

If necessary, replace the oil cooler.



EG20P–03

OIL COOLER INSTALLATION

(See components)

1. INSTALL OIL COOLER

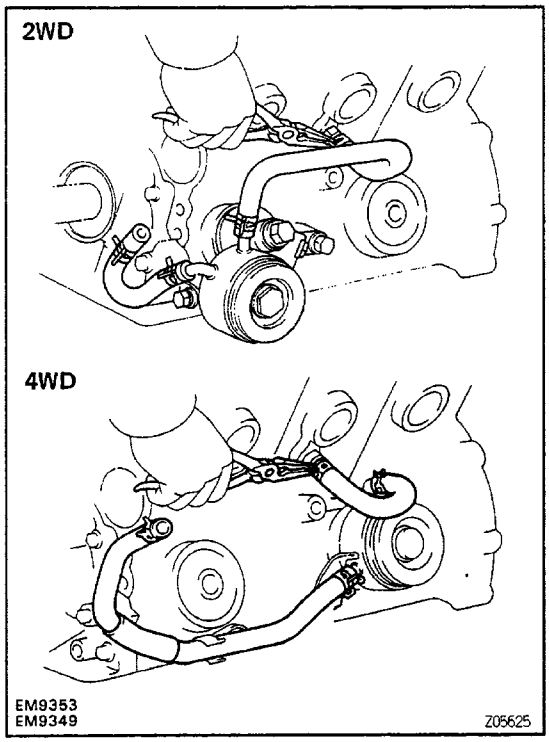
(a) Replace the O–ring(s) with a new part.

(b) (2WD)

- Install the oil cooler with the relief valve, union bolt and three new gaskets.
  Torque: 59 N–m (600 kgf–cm, 43 ft–lbf)
- Install and torque the two bolts.
  Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)

(4WD)

- Install the oil cooler with the relief valve and two new gaskets.
  Torque: 59 N–m (600 kgf–cm, 43 ft–lbf)
- Install and torque the two bolts.
  Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)



2. CONNECT OIL COOLER HOSES

Connect the No.1 and No.2 oil cooler hoses.

3. FILL WITH ENGINE COOLANT

4. START ENGINE AND CHECK FOR LEAKS

5. RECHECK ENGINE OIL LEVEL

SERVICE SPECIFICATIONS

EG1D1–01

SERVICE DATA

Oil pressure	At idle speed (normal operating temperature) At 3,000 rpm (normal operating temperature)		29 kPa (0.3 kgf/cm², 4.3 psi) or more 245 – 520 kPa (2.5 – 5.3 kgf/cm², 36 – 75 psi)
Oil pump	Body clearance	STD Limit	0.10 – 0.13 mm (0.0039 – 0.0051 in.) 0.30 mm (0.0118 in.)
	Tip clearance	STD Limit	0.11 – 0.24 mm (0.0043 – 0.0094 in.) 0.35 mm (0.0138 in.)
	Side clearance	STD Limit	0.03 – 0.09 mm (0.0012 – 0.0035 in.) 0.15 mm (0.0059 in.)
	Relief valve operating pressure		451 – 530 kPa (4.6 – 5.4 kgf/cm², 65 – 77 psi)

EG1D2–01

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
Oil pressure sender gauge x Cylinder block	15	150	11
Oil pump x Cylinder block	20	200	14
Oil pump x Relief valve	37	375	27
Oil pump x Oil pump body cover	10	105	8
Oil strainer x Cylinder block	6.9	70	61 in.·lbf
Oil pan x Cylinder block	5.9	60	52 in.·lbf
Oil cooler x Relief valve	59	600	43
Oil cooler x Cylinder block	39	400	29