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ENGINE MECHANICAL

DESCRIPTION

EG10Y–07

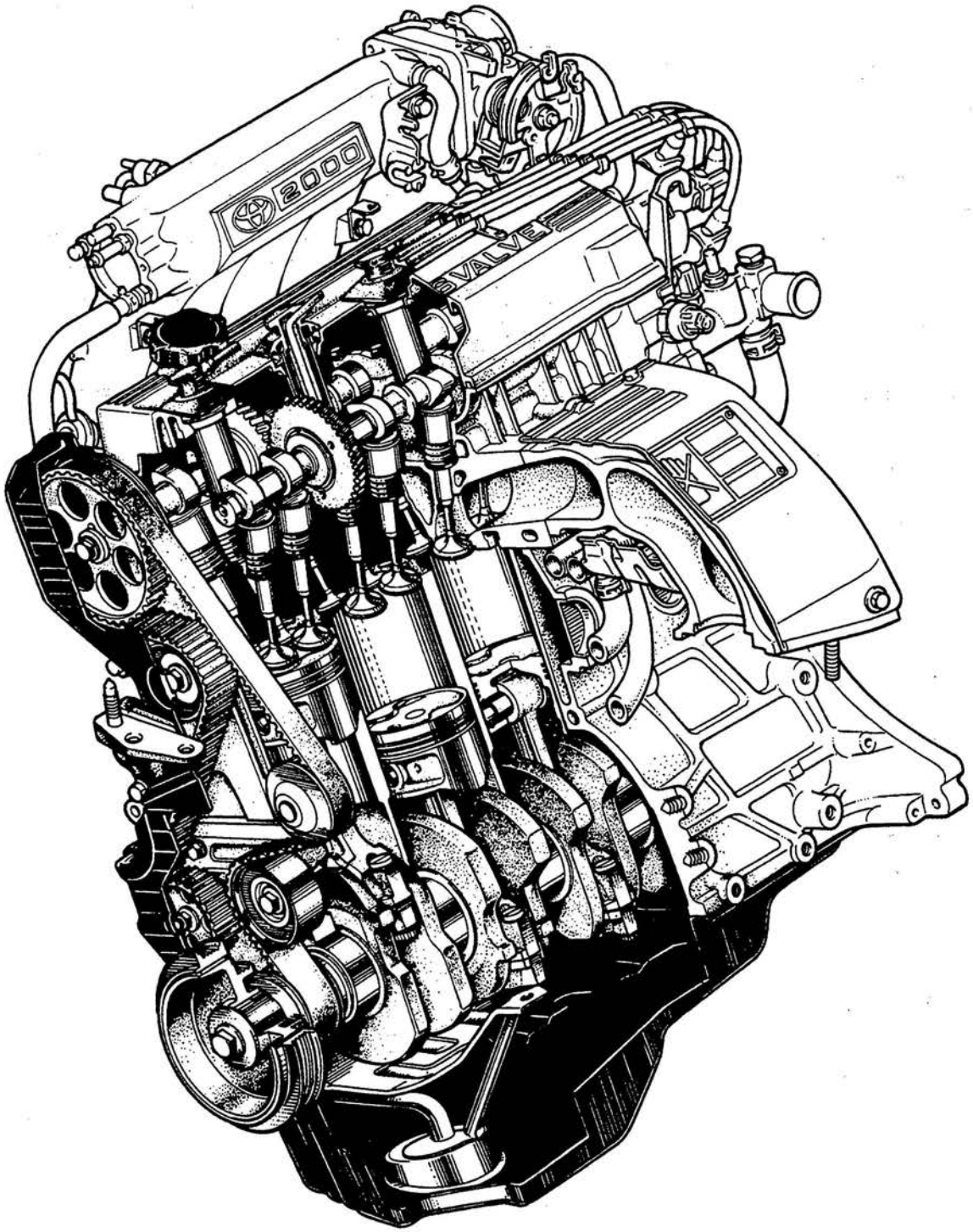
The 3S–FE engine is an in–line, 4 cylinder, 2.0 liter DOHC 16–valve engine.

OPERATION

EG

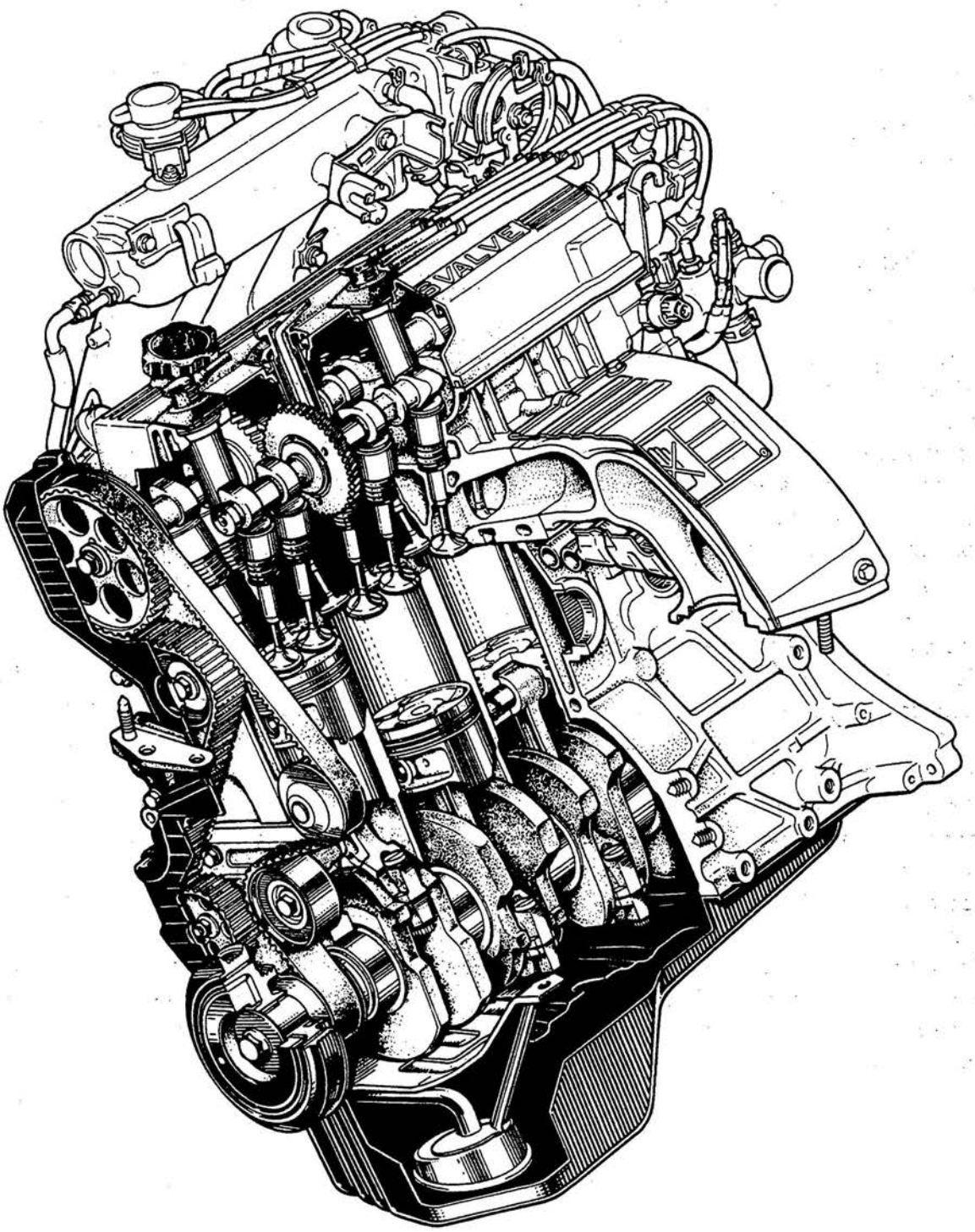
EG3UO–01

ST202



P17544

ST191



P17483

The 3S–FE engine is an in–line, 4 cylinder engine with the cylinders numbered 1 – 2 – 3 – 4 from the front. The crankshaft is supported by 5 bearings inside the crankcase. These bearings are made of aluminium alloy.

The crankshaft is integrated with 8 weights for balance. Oil holes are placed in the center of the crankshaft to supply oil to the connecting rods, bearing, pistons and other components.

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

The intake manifold has 4 independent long ports and utilizes the inertial supercharging effect to improve engine torque at low and medium speeds.

Exhaust and intake valves are equipped with irregular pitch springs made of special valve spring carbon steel which are capable of following the cam profile at all engine speeds.

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

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

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

Piston pins are the full–floating type, with the pins fastened to neither the piston boss nor the connecting rods. Instead, snap rings are fitted on both ends of the pins, preventing the pins from falling out.

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

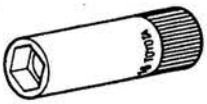
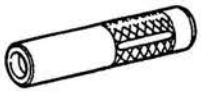
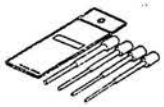
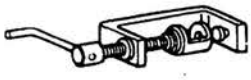
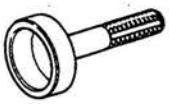
The cylinder block is made of cast iron. It has 4 cylinders which are approximately twice the length of the piston stroke. The top of each cylinder is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

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

PREPARATION

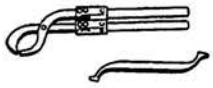
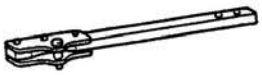
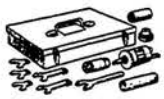
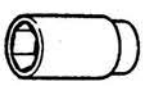
SST (SPECIAL SERVICE TOOLS)

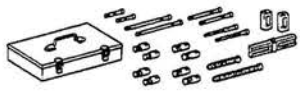
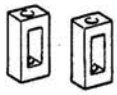
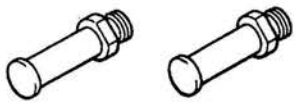
EQOAY–0Y

	09155–16100	Spark Plug Wrench	
	09201–41020	Valve Stem Oil Seal Replacer	
	09201–10000	Valve Guide Bushing Remover & Replacer Set	
	(09201–01060)	Valve Guide Bushing Remover & Replacer 6	
	09202–70010	Valve Spring Compressor	
	09213–54015	Crankshaft Pulley Holding Tool	
	(91651–60855)	Bolt	ST202 for Type A
	(09214–00030)	Bolt	ST191
	09216–00021	Belt Tension Gauge	
	09216–00030	Belt Tension Gauge Cable	
	09222–30010	Connecting Rod Bushing Remover & Replacer	
	09223–46011	Crankshaft Front Oil Seal Replacer	Camshaft oil seal
	09223–63010	Crankshaft Rear Oil Seal Replacer	

EG

EG

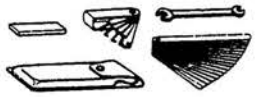
	09226–10010	Crankshaft Front & Rear Bearing Replacer	Crankshaft front oil seal
	09228–06500	Oil Filter Wrench	
	09243–00020	Idle Adjusting Screw Wrench	
	09248–55040	Valve Clearance Adjust Tool Set	
	(09248–05410)	Valve Lifter Press	
	(09248–05420)	Valve Lifter Stopper	
	09249–63010	Torque Wrench Adaptor	
	09330–00021	Companion Flange Holding Tool	Crankshaft pulley
	09608–30022	Front Hub Bearing Replacer Set	
	(09608–05010)	Handle	Valve guide bushing
	09612–24014	Steering Gear Housing Overhaul Tool Set	
	(09617–24011)	Steering Rack Wrench	ST191: Fuel inlet hose
	09816–30010	Oil Pressure Switch Socket	Knock sensor
	09843–18020	Diagnosis Check Wire	

	09950–50010 Puller C Set	Crankshaft pulley
	(09951–05010) Hanger 150	
	(09952–05010) Slide Arm	
	(09953–05010) Center Bolt 100	
	(09953–05020) Center Bolt 150	
	(09954–05010) Claw No.1	ST191 ST202 for Type B
	(09954–05020) Claw No.2	ST202 for Type A
	09960–10010 Variable Pin Wrench Set	
	(09962–01000) Variable Pin Wrench Arm Assy	Camshaft timing pulley Oil pump pulley
	(09963–01000) Pin 10	Camshaft timing pulley
	(09963–00500) Pin 5	Oil pump pulley

EG

EG0AZ–0K

RECOMMENDED TOOLS

	09200–00010 Engine Adjust Kit	
	09258–00030 Hose Plug Set	Plug for vacuum hose, fuel hose etc.
	09904–00010 Expander Set	

EG

EG080–0F

EQUIPMENT

Battery specific gravity gauge	
Belt tension gauge	
Caliper gauge	
CO/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	

EG12X-06

COOLANT

Item		Capacity	Classification
Engine coolant (w/ Heater)			Ethylene–glycol base
ST202	M/T (w/ Oil cooler)	7.0 liters (7.4 US qts, 6.2 Imp. qts)	
	M/T (w/o Oil cooler)	6.5 liters (6.9 US qts, 5.7 Imp. qts)	
	A/T	6.9 liters (7.3 US qts, 6.1 Imp. qts)	
ST191	M/T	6.6 liters (7.0 US qts, 5.8 Imp. qts)	
	A/T	7.0 liters (7.4 US qts, 6.2 Imp. qts)	

EG14X-0H

LUBRICANT

Item	Capacity	Classification
Engine oil		API grade SG, SH or ILSAC multigrade engine oil and recommended viscosity oil
Dry fill		
w/ Oil cooler	4.4 liters (4.7 US qts, 3.9 Imp. qts)	
w/o Oil cooler	4.3 liters (4.5 US qts, 3.8 Imp. qts)	
Drain and refill		
w/ Oil filter change	3.9 liters (4.1 US qts, 3.4 Imp. qts)	
w/o Oil filter change	3.7 liters (3.9 US qts, 3.3 Imp. qts)	

EG0S1-1P

SSM (SERVICE SPECIAL MATERIALS)

08826–00080	Seal packing or equivalent	Camshaft bearing cap Cylinder head cover Rear oil seal retainer
08833–00070	Adhesive 1324, THREE BOND 1324 or equivalent	Flywheel or drive plate bolt
08833–00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure switch

TROUBLESHOOTING

EG082–0C

You will find the source of the trouble more easily by correctly using the table shown below. In this table, each number shows the order of priority of the causes of the trouble. Check each part in the order shown. If nesessary, replace the part.

EG

	See page	IG-5	IG-5	EG-194	EG-271	EG-273	EG-275	EG-247	EG-190	–	–	–	EG-195	EG-208 EG-213	EG-155	EG-220 EG-234	EG-257
	Suspect area	RPM Signal Circuit	Ignition Circuit	Oxygen Sensor Circuit	Water Temp. Sensor Circuit	Intake Air Temp. Sensor Circuit	Vacuum Sensor Circuit	Throttle Position Sensor Circuit	STA Signal Circuit	Knock Sensor Circuit	NSW Signal Circuit	A/C Signal Circuit	Fuel Pump	Fuel Pressure Regulator	Fuel Lines	Injectors	Idle Speed Control Valve
Does not start	Engine does not crank																
	Starter runs – engine does not crank																
	No combustion	12	2				5						6				8
	No complete combustion				4		1							3		9	2
Difficult to start	Engine cranks slowly											2					
	Engine cranks normally	12	13		4	14							7	6	8	16	3
	Cold engine				1	5			2				7	6	8	9	4
	Hot engine				1	4							6	5	7	8	3
Poor idling	Incorrect first idle				2												3
	High engine idle speed				2	4		5			7	6				8	3
	Low engine idle speed				1		4									5	2
	Rough idling		17		2		12						7	6	8	16	9
	Misfire		4		6		8									9	
Poor drivability	Hesitant acceleration			12	10	11	9	8					14	13	15	18	
	Backfire			6	3	7	5	4					9	8	10	11	
	Muffler explosion (after fire)			8	3	7	5	6						4		9	
	Surging													1		4	
	Knocking									1							
Engine stall	Soon after starting				8		7						3	2	4	9	6
	After accelerator pedal depressed						1	3						5	6	7	
	After accelerator pedal released						3										1
	During A/C operation											1					2
	When shifting N to D										1						2
Others	Poor fuel economy			19	14	20	16	15			17	18				13	
	Engine overheat									9							
	Engine overcool																
	Excessive oil consumption																
	Low oil pressure																
	High oil pressure																
	Starter keeps running																
	Battery often discharges																

V05309

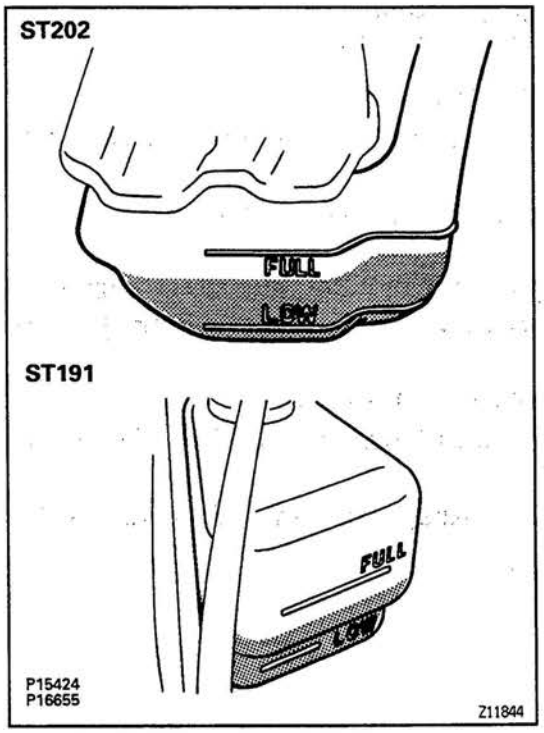
–	EG-32	EG-19	EG-46	EG-34	EG-301	EG-80	EG-343	EG-119	EG-122	EG-77	EG-130	–	EG-309	EG-306	CH-8	–	–	CH-9	EG-126
Clutch	Compression	Valve Clearance	Valve Timing	Timing Belt	Water Pump	Valve Stem Guide Bushing	Oil Pump	Connecting Rod Bearing	Crankshaft Bearing	Cylinder Head	Piston Ring	Flywheel or Drive Plate	Radiator and Radiator Cap	Thermostat	Drive Belt	Water Temp. Sender Gauge	Oil Pressure Switch	Alternator	Cylinder Block
												2							
	9		10	11															
	5		7	8							6								
								3	4										
	9		11								10								
	10	13	14	15						19	11								
	7																		
1	7	16	17																
			2																
			2																
			5		9								6	8					
4	10		12								11								
			7	5	6		10			11			3	4		13			12
														2		3			
	3					2				5	4								6
							2	3	4								5		
							1										2		
															1			2	

V05310

EG

	Suspect area / Symptom	See page	EFI Main Relay	Circuit Opening Relay	Fuel Cut System	Engine (& ECT) ECU	Fuel Quality	Fuel Leakage	Coolant Leakage	Oil Leakage	Starter Relay	Neutral Start SW	Starter	Spark Plug	Distributor	EGR System	Accelerator Pedal Link	Brakes drag even when released	Cooling Fan System
			EG-261 EG-262	EG-263	EG-291	EG-287	–	–	–	–	ST-22	–	ST-21	IG-8	IG-10	–	–	–	EG-316
Does not start	Engine does not crank										1	3	2						
	Starter runs – engine does not crank												1						
	No combustion		3	4		13	7								1				
	No complete combustion					10													
Difficult to start	Engine cranks slowly												1						
	Engine cranks normally					17	1							2	15	5			
	Cold engine					10	3												
	Hot engine					9	2												
Poor idling	Incorrect first idle					4											1		
	High engine idle speed					9											1		
	Low engine idle speed					6										3			
	Rough idling					18	1							4	5	3			
	Misfire					10	1							3	5	2			
Poor drivability	Hesitant acceleration					19	3							5	6	4		2	
	Backfire					12										1			
	Muffler explosion (after fire)				1	10													
	Surging					5								2	3				
	Knocking					10	2							3		4			7
Engine stall	Soon after starting					10	1									5			
	After accelerator pedal depressed					8								4		2			
	After accelerator pedal released					4										2			
	During A/C operation					3													
	When shifting N to D					3													
Others	Poor fuel economy				7	21	2	1						8	9	6	3	5	
	Engine overheat								1					8					2
	Engine overcool																		1
	Excessive oil consumption									1									
	Low oil pressure									1									
	High oil pressure																		
	Starter keeps running										1		2						
	Battery often discharges																		

V05311



TUNE—UP

ENGINE COOLANT INSPECTION

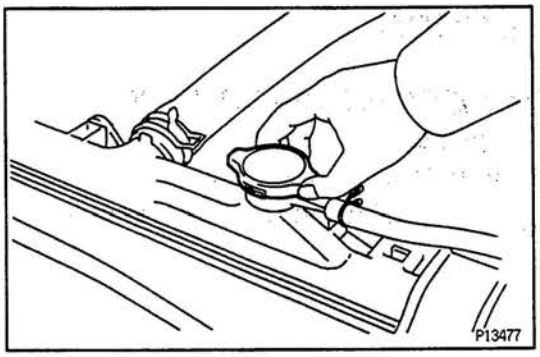
EG3V5—01

1. CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR

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.

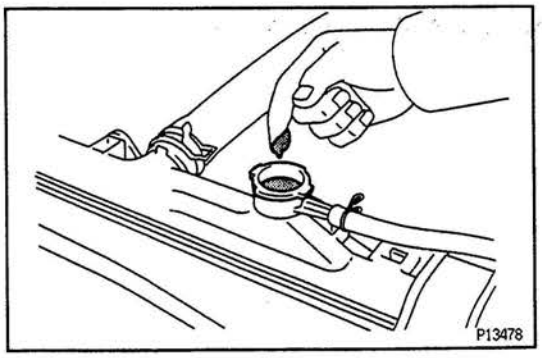
EG



2. CHECK ENGINE COOLANT QUALITY

(a) Remove the radiator cap.

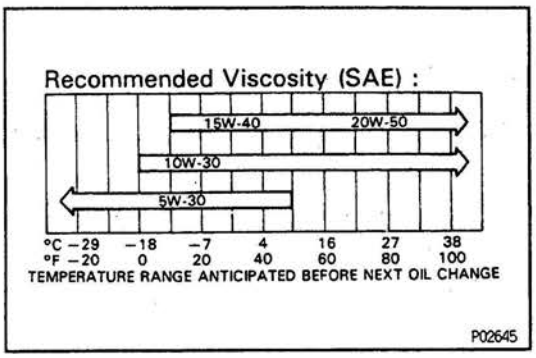
CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.



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

If excessively dirty, replace the coolant.

(c) Reinstall the radiator cap.



EG

ENGINE OIL INSPECTION

EG084-0U

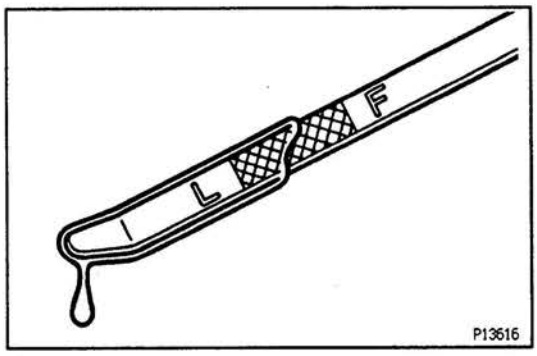
1. CHECK OIL QUALITY

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

If oil quality is visibly poor, replace the oil.

Oil grade:

API grade SG or SH, or ILSAC multigrade engine oil. Recommended viscosity is as shown in the illustration.



2. CHECK ENGINE OIL LEVEL

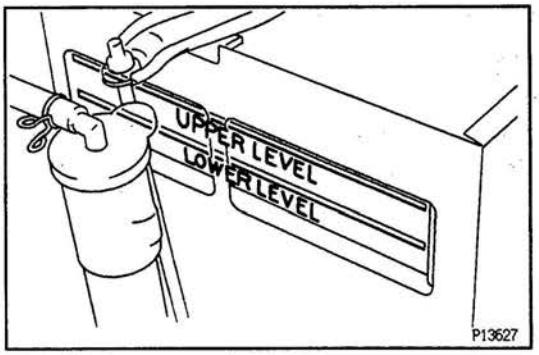
The oil level should be between the "L" and "F" marks on the dipstick.

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

BATTERY INSPECTION

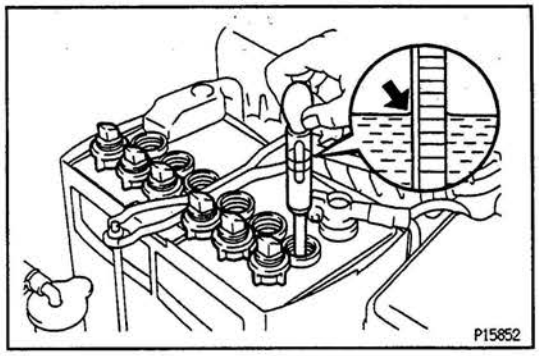
EG3PE-02

1. CHECK BATTERY SPECIFIC GRAVITY AND ELECTROLYTE LEVEL

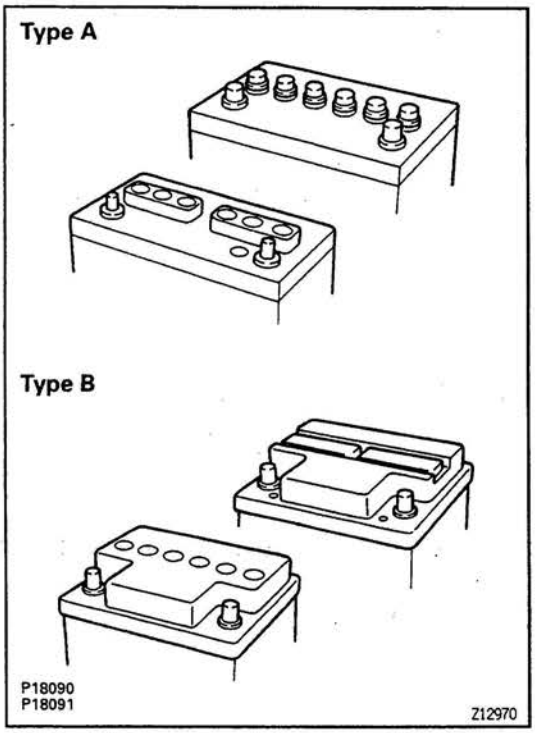


(a) Check the electrolyte level of each cell.

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



(b) Check the specific gravity of each cell.



The specific gravity of the battery varies according to whether the battery shape is Type A or Type B as shown in the illustration.

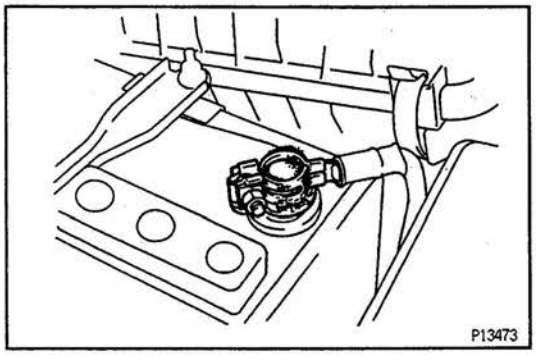
Standard specific gravity at 20°C (68°F):

Type A 1.25 — 1.27

Type B 1.26 — 1.29

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

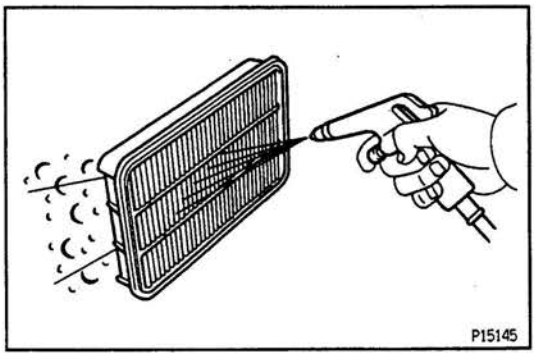
EG



2. CHECK BATTERY TERMINALS AND FUSES

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

(b) Check the fusible link, H—fuses, M—fuse and fuses for continuity.



AIR FILTER INSPECTION AND CLEANING EG3PF-01

1. REMOVE AIR FILTER

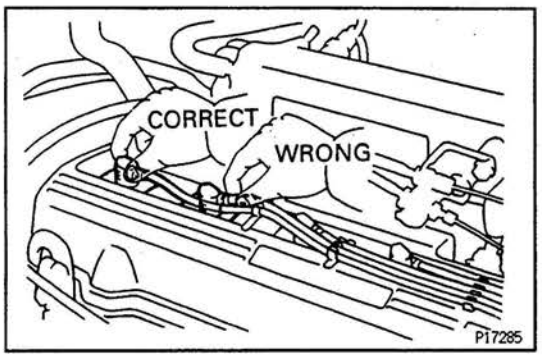
2. INSPECT AND CLEAN AIR FILTER

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

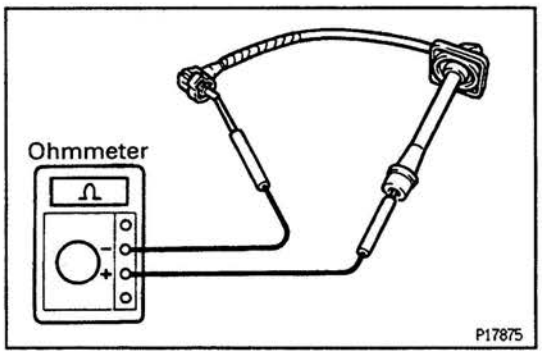
EG



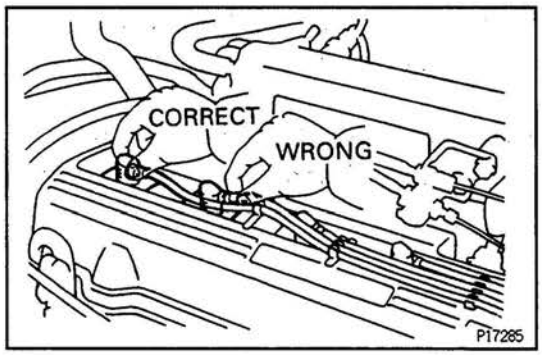
HIGH–TENSION CORDS INSPECTION

EG3V6–01

1. **REMOVE HIGH–TENSION CORDS**
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.



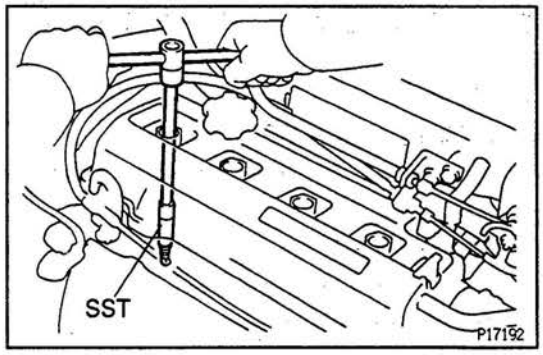
2. **INSPECT HIGH–TENSION CORD RESISTANCE**
Using an ohmmeter, measure the resistance.
Maximum resistance:
25 kΩ per cord
If the resistance is greater than maximum, replace the high–tension cord.
3. **REINSTALL HIGH–TENSION CORDS**



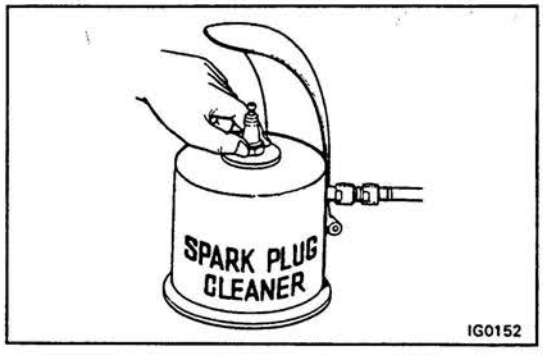
SPARK PLUGS INSPECTION

EG17V–03

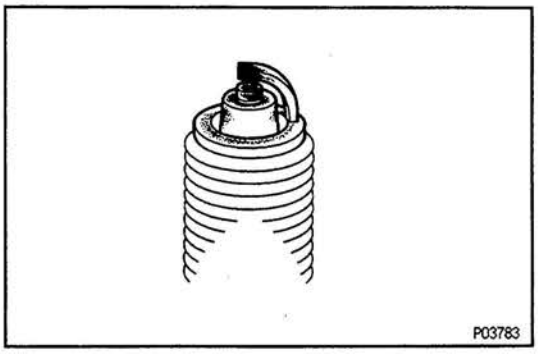
1. **DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS**
Disconnect the high – tension cords at the rubber boot. Do not pull on the high–tension cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.



2. **REMOVE SPARK PLUGS**
Using SST, remove the 4 spark plugs.
SST 09155–16100



3. **CLEAN SPARK PLUGS**
Using a spark plug cleaner or wire brush, clean the spark plug.



4. VISUALLY INSPECT SPARK PLUGS

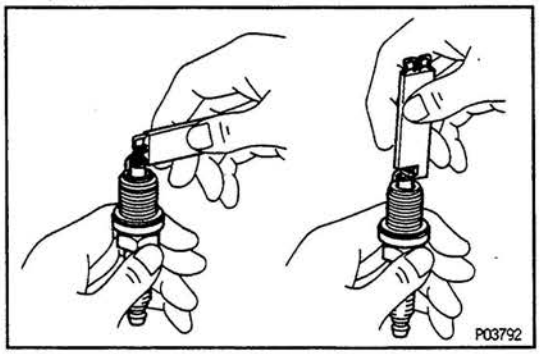
Check the spark plug for electrode wear, thread damage and insulator damage.

If abnormal, replace the spark plug.

Recommended spark plug:

K20R–U11 for ND

BKR6EYA11 for NGK

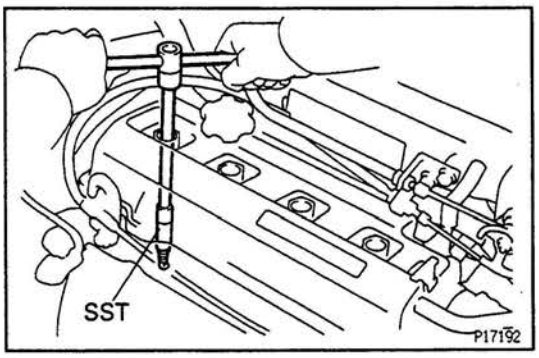


5. ADJUST ELECTRODE GAP

Carefully bend the outer electrode to obtain the correct electrode gap.

Electrode gap:

1.1 mm (0.043 in.)



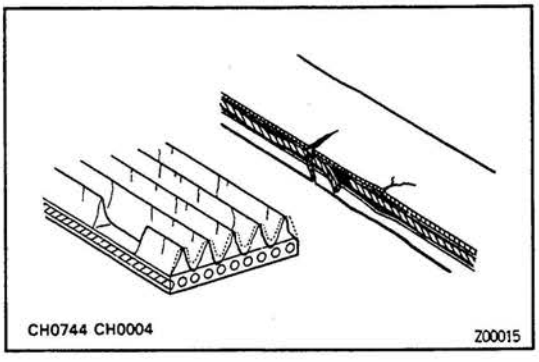
6. REINSTALL SPARK PLUGS

Using SST, install the 4 spark plugs.

SST 09155–16100

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

7. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS



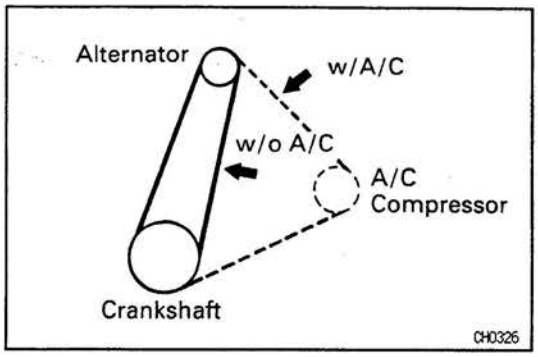
ALTERNATOR DRIVE BELT INSPECTION EG3V7–01

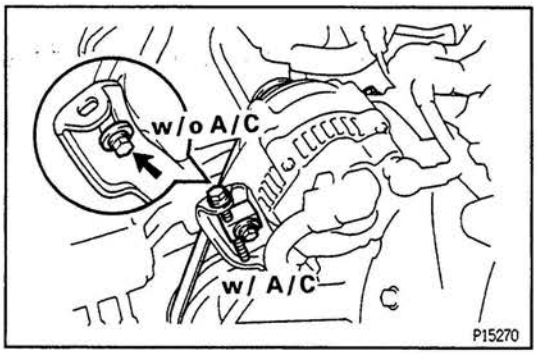
INSPECT DRIVE BELT

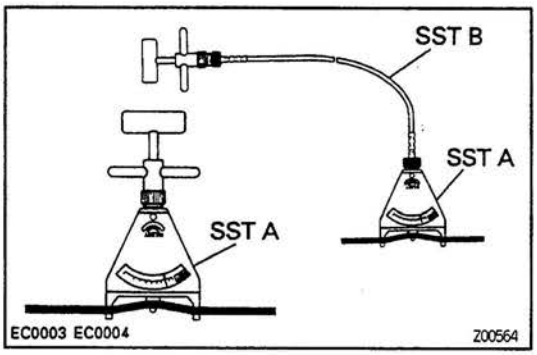
(a) Visually check the drive belt for excessive wear, frayed cords etc.

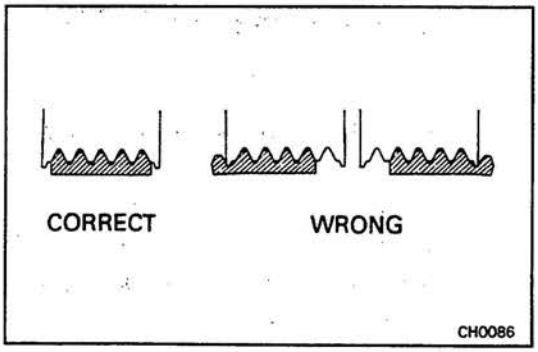
If any defect has been found, replace the drive belt.

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









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

Drive belt deflection:

w/ A/C

New belt

6 – 7 mm (0.24 – 0.35 in.)

Used belt

9 – 11 mm (0.35 – 0.43 in.)

w/o A/C

New belt

11 – 15 mm (0.43 – 0.59 in.)

Used belt

13 – 17 mm (0.51 – 0.67 in.)

If the belt deflection is not as specified, adjust it.

Reference:

Using SST, check the drive belt tension.

SST A 09216–00021

SST B 09216–00030

Drive belt tension:

w/ A/C

New belt

686 – 785 N (70 – 80 kgf)

Used belt

441 – 539 N (45 – 55 kgf)

w/o A/C

New belt

686 – 785 N (70 – 80 kgf)

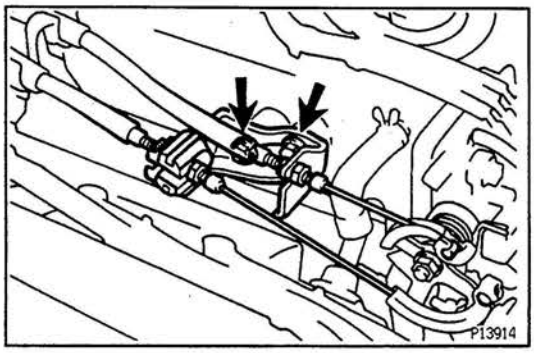
Used belt

196 – 343 N (20 – 35 kgf)

If the belt tension is not as specified, adjust it.

HINT:

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



VALVE CLEARANCE INSPECTION AND ADJUSTMENT

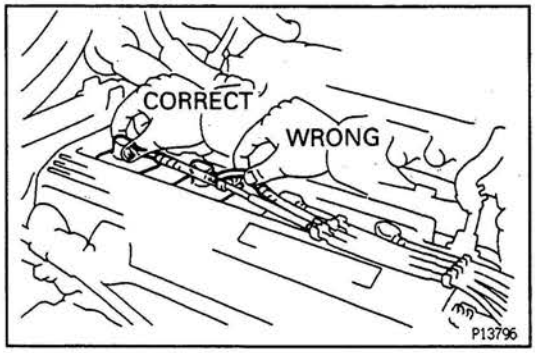
EG15J-05

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

1. REMOVE ACCELERATOR CABLE BRACKET

(a) Disconnect the control cables from the throttle linkage.

(b) Remove the 2 bolts and accelerator cable bracket.

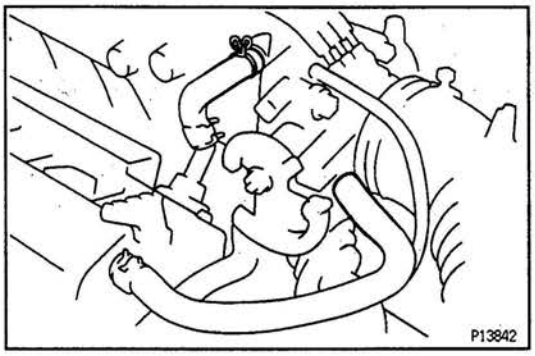


2. REMOVE CYLINDER HEAD COVER

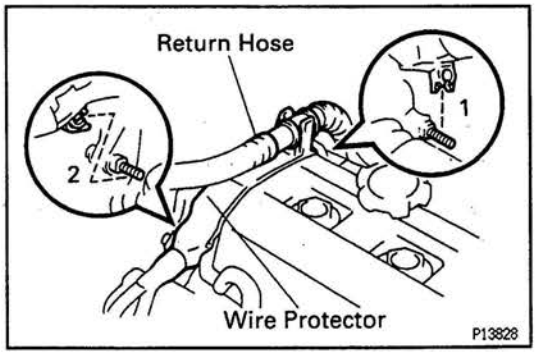
(a) Disconnect the 4 high–tension cords from the clamp on the cylinder head cover.

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

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

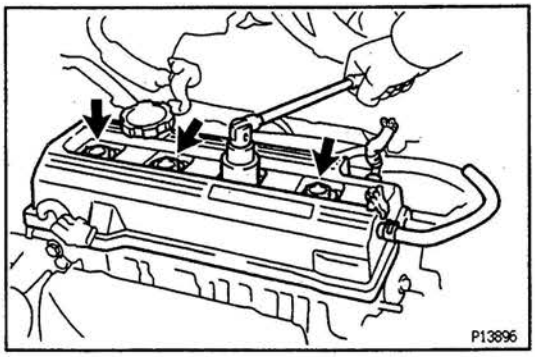


(c) Disconnect the 2 PCV hoses from the intake manifold and throttle body.

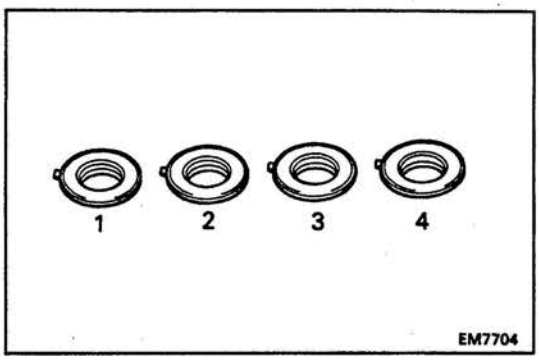


(d) ST191 only:
Disconnect the PS oil reservoir return hose from the engine wire protector.

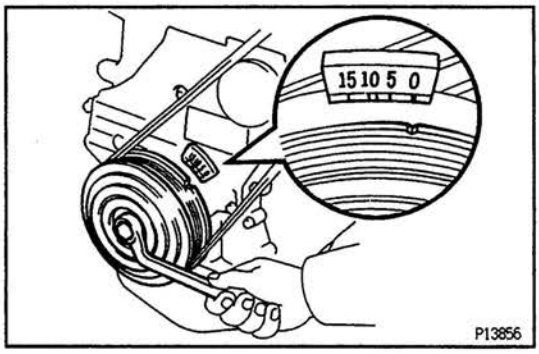
(e) Disconnect the engine wire protector from the 2 mounting bolts of the No.2 timing belt cover in the sequence shown.



(f) Remove the 4 nuts, grommets, cylinder head cover and gasket.



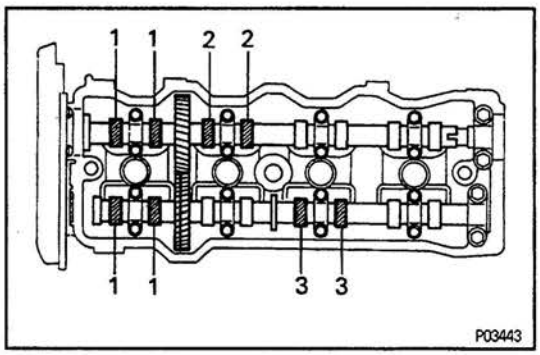
HINT: Arrange the grommets in the correct order, so that they can be reinstalled into their original positions. This minimizes any possibility of oil leakage due to reuse of the grommets in different positions.



3. 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 1 revolution (360°) and align the mark as above.



4. INSPECT VALVE CLEARANCE

(a) Check only the valves indicated.

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

Valve clearance (Cold):

Intake

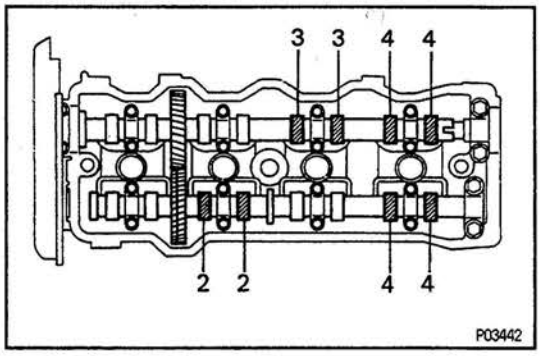
0.19 — 0.29 mm (0.007 — 0.011 in.)

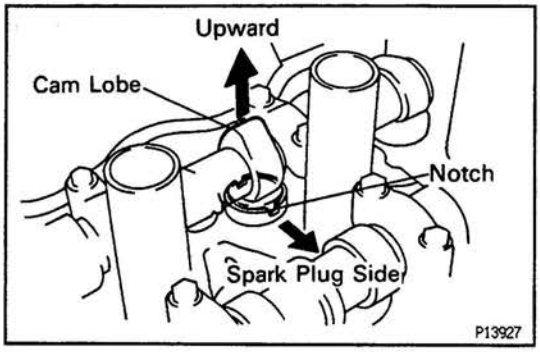
Exhaust

0.28 — 0.38 mm (0.011 — 0.015 in.)

(b) Turn the crankshaft 1 revolution (360°) and align the mark as above. (See procedure in step 3)

(c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure in step (a))

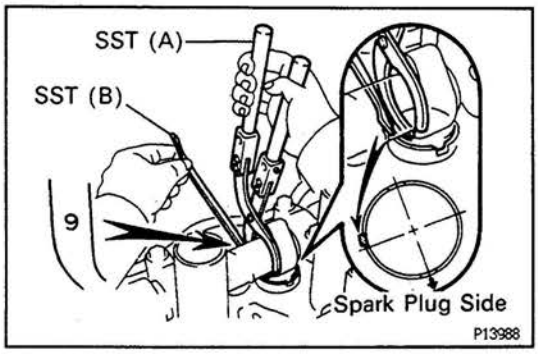




5. ADJUST VALVE CLEARANCE

(a) Remove the adjusting shim.

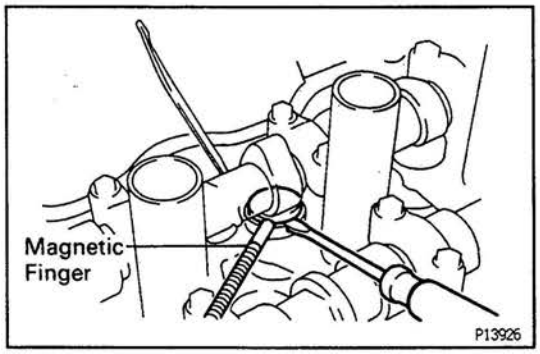
- Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve points upward.
- Position the notch of the valve lifter facing the spark plug side.



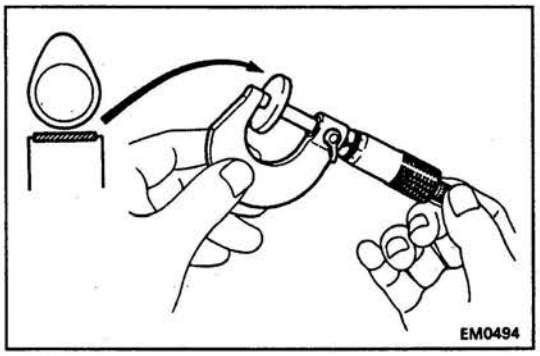
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

SST 09248−55040 (09248−05410, 09248−05420)

HINT: Apply SST (B) at slight angle on the side marked with "9", at the position shown in the illustration.



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



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

- Using a micrometer, measure the thickness of the removed shim.
- Calculate the thickness of a new shim so that the valve clearance comes within specified value.

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

Intake:

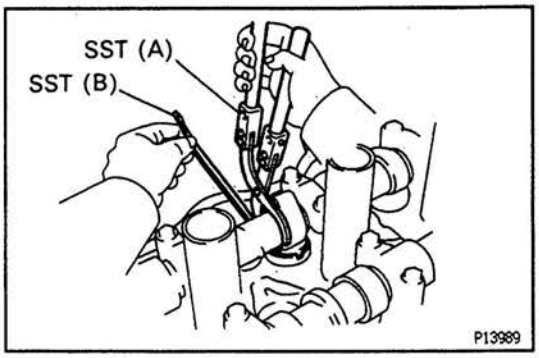
N = T + (A − 0.24 mm (0.009 in.))

Exhaust:

N = T + (A − 0.33 mm (0.013 in.))

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

HINT: Shims are available in 17 sizes in increments of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).



(c) Install a new adjusting shim.

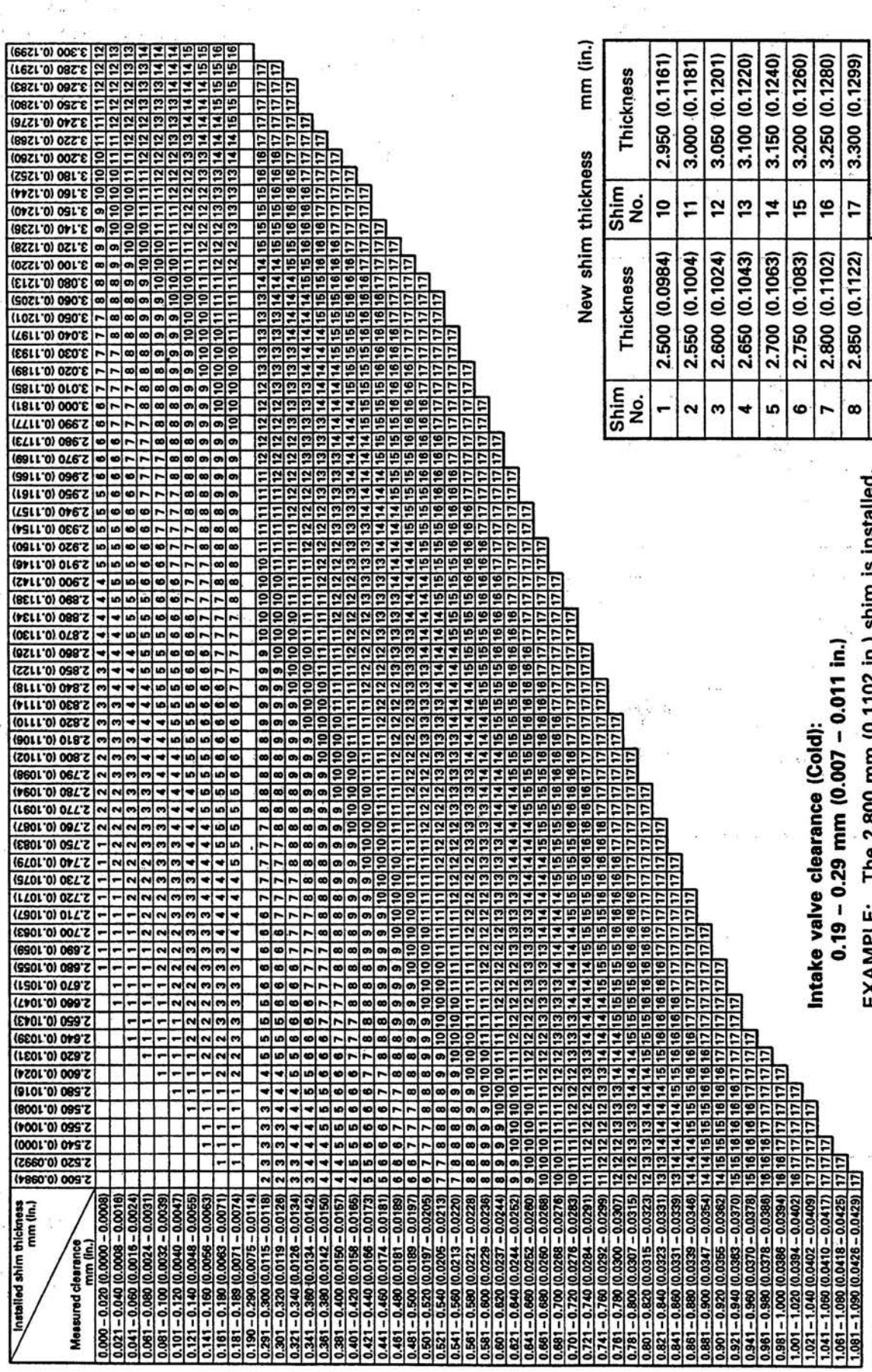
- Place a new adjusting shim on the valve lifter.
- Using SST (A), press down the valve lifter and remove SST (B).

SST 09248−55040 (09248−05410, 09248−05420)

(d) Recheck the valve clearance.

EG

Adjusting Shim Selection Chart (Intake)



P03440

Intake valve clearance (Cold):
0.19 – 0.29 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.11 shim.

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

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

Adjusting Shim Selection Chart (Exhaust)

Measured clearance mm (in.) / Installed shim thickness mm (in.)	2.500 (0.0984)	2.520 (0.0992)	2.540 (0.1000)	2.550 (0.1004)	2.560 (0.1008)	2.580 (0.1016)	2.600 (0.1024)	2.620 (0.1031)	2.640 (0.1039)	2.650 (0.1043)	2.660 (0.1047)	2.670 (0.1051)	2.680 (0.1056)	2.690 (0.1059)	2.700 (0.1063)	2.710 (0.1067)	2.720 (0.1071)	2.730 (0.1075)	2.740 (0.1079)	2.750 (0.1083)	2.760 (0.1087)	2.770 (0.1091)	2.780 (0.1094)	2.790 (0.1098)	2.800 (0.1102)	2.810 (0.1106)	2.820 (0.1110)	2.830 (0.1114)	2.840 (0.1118)	2.850 (0.1122)	2.860 (0.1126)	2.870 (0.1130)
0.000 – 0.020 (0.0000 – 0.0008)																						1	1	1	1	1	1	1	1	2	2	2
0.021 – 0.040 (0.0008 – 0.0016)																				1	1	1	1	1	1	1	1	2	2	2	2	2
0.041 – 0.060 (0.0016 – 0.0024)																		1	1	1	1	1	1	1	1	2	2	2	2	2	3	3
0.061 – 0.080 (0.0024 – 0.0031)																1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3
0.081 – 0.100 (0.0032 – 0.0039)														1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4
0.101 – 0.120 (0.0040 – 0.0047)												1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4
0.121 – 0.140 (0.0048 – 0.0055)										1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4
0.141 – 0.160 (0.0056 – 0.0063)									1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5
0.161 – 0.180 (0.0063 – 0.0071)								1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5
0.181 – 0.200 (0.0071 – 0.0079)							1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6
0.201 – 0.220 (0.0079 – 0.0087)						1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6
0.221 – 0.240 (0.0087 – 0.0094)				1	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6
0.241 – 0.260 (0.0095 – 0.0102)			1	1	1	1	1	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7
0.261 – 0.279 (0.0103 – 0.0110)		1	1	1	1	1	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7
0.280 – 0.380 (0.0110 – 0.0150)																																
0.381 – 0.400 (0.0150 – 0.0157)	2	3	3	3	3	4	4	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10
0.401 – 0.420 (0.0158 – 0.0165)	3	3	3	4	4	4	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10
0.421 – 0.440 (0.0166 – 0.0173)	3	3	4	4	4	5	5	5	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10
0.441 – 0.460 (0.0174 – 0.0181)	3	4	4	4	5	5	5	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11
0.461 – 0.480 (0.0181 – 0.0189)	4	4	5	5	5	5	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11
0.481 – 0.500 (0.0189 – 0.0197)	4	5	5	5	5	6	6	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12
0.501 – 0.520 (0.0197 – 0.0205)	5	5	5	6	6	6	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12
0.521 – 0.540 (0.0205 – 0.0213)	5	5	6	6	6	7	7	7	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12
0.541 – 0.560 (0.0213 – 0.0220)	5	6	6	6	7	7	7	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13
0.561 – 0.580 (0.0221 – 0.0228)	6	6	7	7	7	7	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13
0.581 – 0.600 (0.0229 – 0.0236)	6	7	7	7	7	8	8	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14
0.601 – 0.620 (0.0237 – 0.0244)	7	7	7	8	8	8	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14
0.621 – 0.640 (0.0244 – 0.0252)	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14
0.641 – 0.660 (0.0252 – 0.0260)	7	8	8	8	9	9	9	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15
0.661 – 0.680 (0.0260 – 0.0268)	8	8	9	9	9	9	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15
0.681 – 0.700 (0.0268 – 0.0276)	8	9	9	9	9	10	10	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16
0.701 – 0.720 (0.0276 – 0.0283)	9	9	9	10	10	10	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16
0.721 – 0.740 (0.0284 – 0.0291)	9	9	10	10	10	11	11	11	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16
0.741 – 0.760 (0.0292 – 0.0299)	9	10	10	10	11	11	11	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17
0.761 – 0.780 (0.0300 – 0.0307)	10	10	11	11	11	11	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17
0.781 – 0.800 (0.0307 – 0.0315)	10	11	11	11	11	12	12	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17
0.801 – 0.820 (0.0315 – 0.0323)	11	11	11	12	12	12	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17	17
0.821 – 0.840 (0.0323 – 0.0331)	11	11	12	12	12	13	13	13	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17	17		
0.841 – 0.860 (0.0331 – 0.0339)	11	12	12	12	13	13	13	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17	17				
0.861 – 0.880 (0.0339 – 0.0346)	12	12	13	13	13	13	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17	17						
0.881 – 0.900 (0.0347 – 0.0354)	12	13	13	13	13	14	14	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17	17								
0.901 – 0.920 (0.0355 – 0.0362)	13	13	13	14	14	14	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17	17										
0.921 – 0.940 (0.0363 – 0.0370)	13	13	14	14	14	15	15	15	16	16	16	16	17	17	17	17	17	17	17	17												
0.941 – 0.960 (0.0370 – 0.0378)	13	14	14	14	15	15	15	16	16	16	17	17	17	17	17	17	17	17														
0.961 – 0.980 (0.0378 – 0.0386)	14	14	15	15	15	15	16	16	17	17	17	17	17	17	17	17																
0.981 – 1.000 (0.0386 – 0.0394)	14	15	15	15	15	16	16	17	17	17	17	17	17	17																		
1.001 – 1.020 (0.0394 – 0.0402)	15	15	15	16	16	16	17	17	17	17	17	17																				
1.021 – 1.040 (0.0402 – 0.0409)	15	15	16	16	16	17	17	17	17	17																						
1.041 – 1.060 (0.0410 – 0.0417)	15	16	16	16	17	17	17	17																								
1.061 – 1.080 (0.0418 – 0.0425)	16	16	17	17	17	17	17																									
1.081 – 1.100 (0.0426 – 0.0433)	16	17	17	17	17	17																										
1.101 – 1.120 (0.0433 – 0.0441)	17	17	17	17	17																											
1.121 – 1.140 (0.0441 – 0.0449)	17	17	17	17																												
1.141 – 1.160 (0.0449 – 0.0457)	17	17																														
1.161 – 1.180 (0.0457 – 0.0465)	17																															

Measured clearance mm (in.) / Installed shim thickness mm (in.)	2.880 (0.1134)	2.890 (0.1138)	2.900 (0.1142)	2.910 (0.1146)	2.920 (0.1150)	2.930 (0.1154)	2.940 (0.1157)	2.950 (0.1161)	2.960 (0.1165)	2.970 (0.1169)	2.980 (0.1173)	2.990 (0.1177)	3.000 (0.1181)	3.010 (0.1185)	3.020 (0.1189)	3.030 (0.1193)	3.040 (0.1197)	3.050 (0.1201)	3.060 (0.1205)	3.080 (0.1213)	3.100 (0.1220)	3.120 (0.1228)	3.140 (0.1236)	3.150 (0.1240)	3.160 (0.1244)	3.180 (0.1252)	3.200 (0.1260)	3.220 (0.1268)	3.240 (0.1276)	3.250 (0.1280)	3.260 (0.1283)	3.280 (0.1291)	3.300 (0.1299)
0.000 – 0.020 (0.0000 – 0.0008)	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11
0.021 – 0.040 (0.0008 – 0.0016)	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11
0.041 – 0.060 (0.0016 – 0.0024)	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11
0.061 – 0.080 (0.0024 – 0.0031)	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	8	8	9	9	9	9	10	10	11	11	11	11	12
0.081 – 0.100 (0.0032 – 0.0039)	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	9	9	9	9	10	10	11	11	11	11	12	12
0.101 – 0.120 (0.0040 – 0.0047)	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13
0.121 – 0.140 (0.0048 – 0.0055)	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13
0.141 – 0.160 (0.0056 – 0.0063)	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13
0.161 – 0.180 (0.0063 – 0.0071)	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	10	10	11	11	11	11	12	12	13	13	13	13	14
0.181 – 0.200 (0.0071 – 0.0079)	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	11	11	11	11	12	12	13	13	13	13	14	14
0.201 – 0.220 (0.0079 – 0.0087)	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15
0.221 – 0.240 (0.0087 – 0.0094)	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15
0.241 – 0.260 (0.0095 – 0.0102)	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15	15
0.261 – 0.279 (0.0103 – 0.0110)	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	12	12	13	13	13	13	14	14	15	15	15	15	16
0.280 – 0.380 (0.0110 – 0.0150)																																	
0.381 – 0.400 (0.0150 – 0.0157)	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	15	15	15	15	16	16	17	17	17	17	17	
0.401 – 0.420 (0.0158 – 0.0165)	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	15	15	15	16	16	16	17	17	17	17	17		
0.421 – 0.440 (0.0166 – 0.0173)	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	15	15	15	16	16	16	17	17	17	17	17			
0.441 – 0.460 (0.0174 – 0.0181)	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	16	16	16	17	17	17	17					
0.461 – 0.480 (0.0181 – 0.0189)	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	16	16	17	17	17	17	17						
0.481 – 0.500 (0.0189 – 0.0197)	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	17	17	17	17	17							
0.501 – 0.520 (0.0197 – 0.0205)	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	17	17	17	17	17								
0.521 – 0.540 (0.0205 – 0.0213)	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	17	17	17	17	17									
0.541 – 0.560 (0.0213 – 0.0220)	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17											
0.561 – 0.580 (0.0221 – 0.0228)	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17												
0.581 – 0.600 (0.0229 – 0.0236)	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17													
0.601 – 0.620 (0.0237 – 0.0244)	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17														
0.621 – 0.640 (0.0244 – 0.0252)	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17	17															
0.641 – 0.660 (0.0252 – 0.0260)	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17	17																	
0.661 – 0.680 (0.0260 – 0.0268)	15	16	16	16	16	16	17	17	17	17	17	17	17	17																			
0.681 – 0.700 (0.0268 – 0.0276)	16	16	16	16	17	17	17	17	17	17	17	17																					
0.701 – 0.720 (0.0276 – 0.0283)	16	16	17	17	17	17	17	17	17	17																							
0.721 – 0.740 (0.0284 – 0.0291)	17	17	17	17	17	17	17	17																									
0.741 – 0.760 (0.0292 – 0.0299)	17	17	17	17	17	17																											
0.761 – 0.780 (0.0300 – 0.0307)	17	17	17	17																													
0.781 – 0.800 (0.0307 – 0.0315)	17	17																															

P03441

Exhaust valve clearance (Cold):
0.28 – 0.38 mm (0.011 – 0.015 in.)

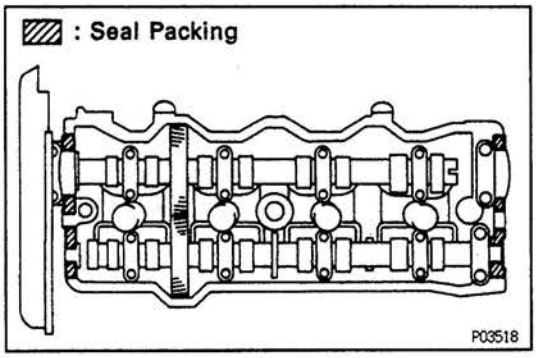
EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a new No.9 shim.

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

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

V00863



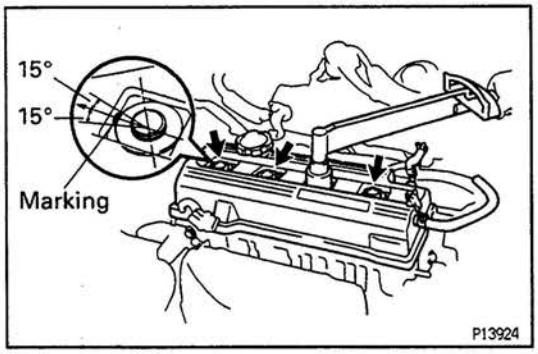
6. INSTALL CYLINDER HEAD COVER

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

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

Seal packing:

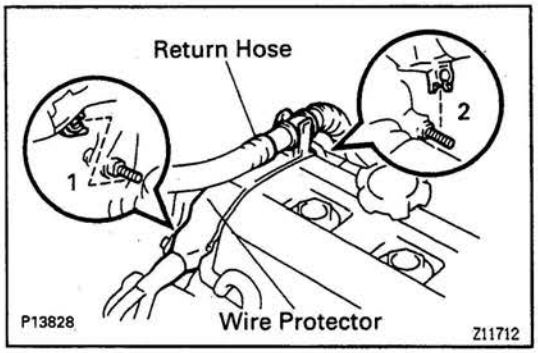
Part No. 08826—00080 or equivalent



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

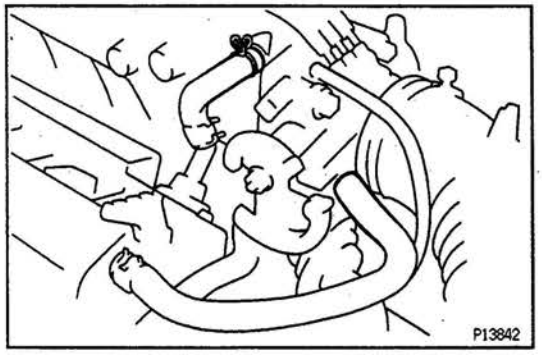
(d) Install the cylinder head cover with the 4 grommets and nuts.

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



(e) Install the engine wire protector to the 2 mounting bolts of the No.2 timing belt cover in the sequence shown.

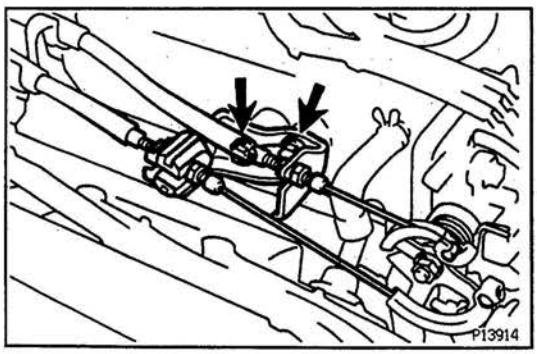
(f) ST191 only:
Install the PS oil reservoir return hose to the engine wire protector.



(g) Connect the 2 PCV hoses to the intake manifold and throttle body.

(h) Install the 4 high—tension cords to the clamp on the cylinder head cover.

(i) Connect the 4 high—tension cords to the spark plugs.



7. INSTALL ACCELERATOR CABLE BRACKET

(a) Install the accelerator cable bracket with the 2 bolts.

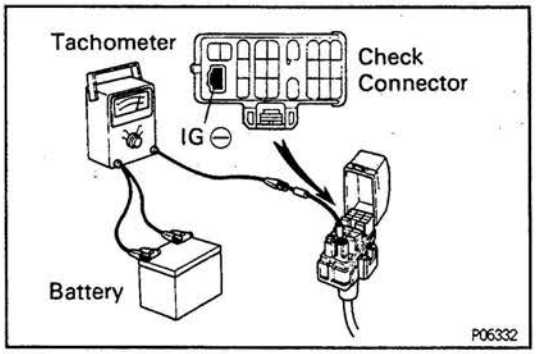
(b) Connect the control cables to the throttle linkage.

EG3V8–01

IGNITION TIMING INSPECTION AND ADJUSTMENT

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

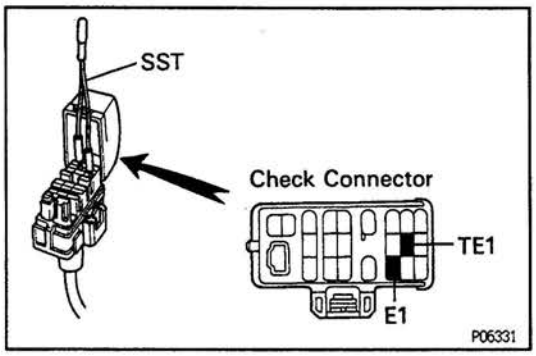


2. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

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

NOTICE:

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

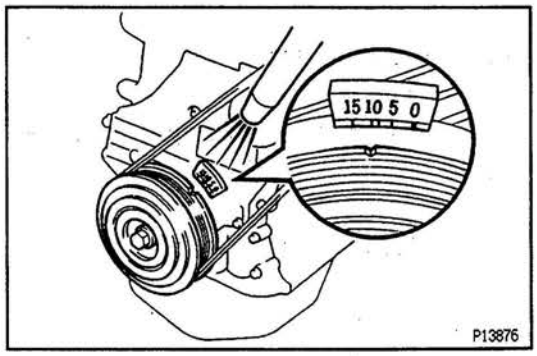


3. ADJUST IGNITION TIMING

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

SST 09843–18020

HINT: After engine rpm is kept at 1,000 – 1,300 rpm for 5 seconds, check that it returns to idle speed.

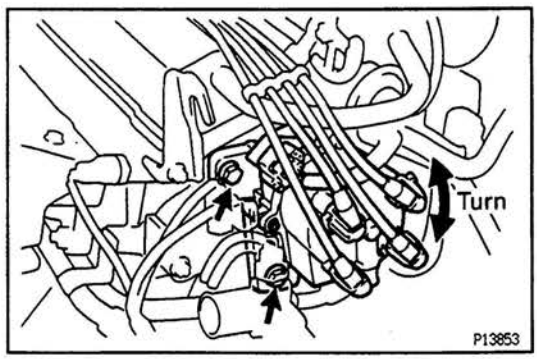


(b) Using a timing light, check the ignition timing.

Ignition timing:

10° BTDC @ idle

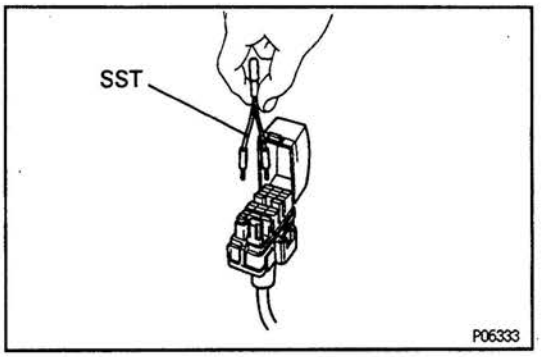
(Transmission in neutral position)



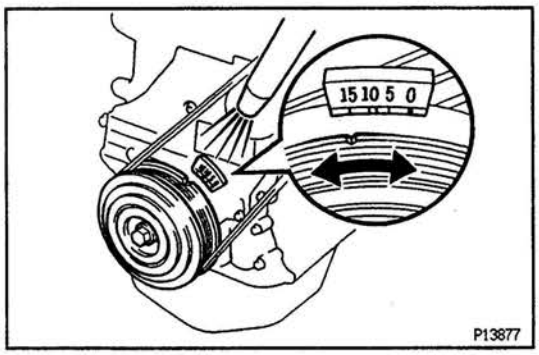
(c) Loosen the 2 bolts, and adjust by turning the distributor.

(d) Tighten the 2 bolts, and recheck the ignition timing.

Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



(e) Remove the SST from the check connector.
SST 09843–18020



4. RECHECK IGNITION TIMING

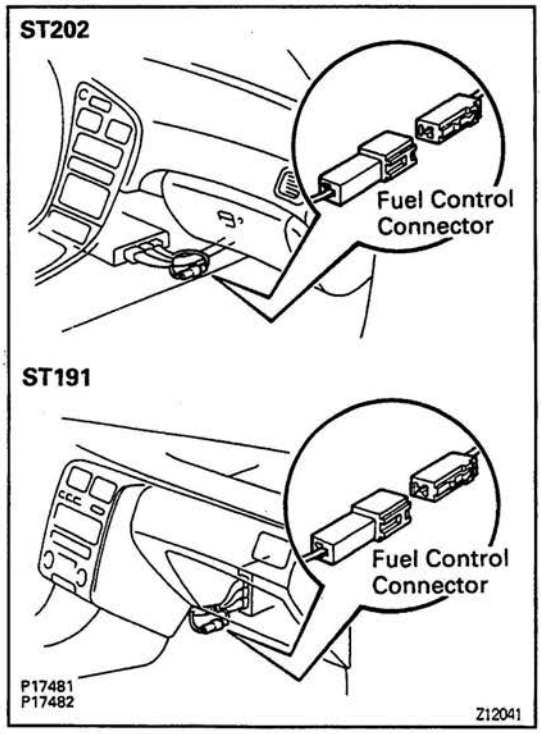
Ignition timing:

10 – 20° BTDC @ idle

(Transmission in neutral position)

HINT: The timing mark moves in a range between 10° and 20°.

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE



Reference for w/o TWC:
When the fuel control connector is unplugged, use gasoline of 95 RON or higher.
When the fuel control connector is plugged together, use gasoline from 90 up to 94 RON.
HINT:
ST202.... The fuel control connector is located in the console box.
ST191.... The fuel control connector is located behind the glove compartment door.

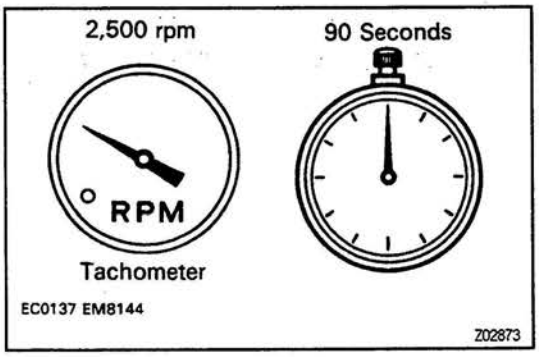
EG115–08

IDLE SPEED INSPECTION

1. INITIAL CONDITIONS

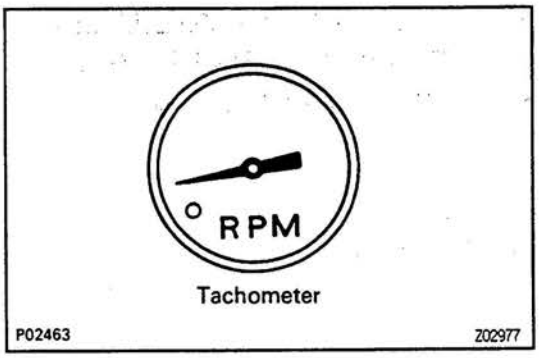
(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All accessories switched OFF
(e) All vacuum lines properly connected
HINT: All vacuum hoses for EGR system, etc. should be properly connected.
(f) EFI system wiring connectors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

2. CONNECT TACHOMETER
(See step 2 on page EG–25)



3. INSPECT IDLE SPEED

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



(b) Check the idle speed.
Idle speed:
700 ± 50 rpm
If the idle speed is not as specified, check the ISC valve.

4. DISCONNECT TACHOMETER

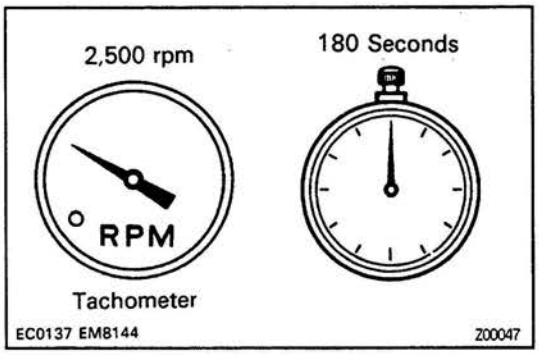
IDLE CO/HC CHECK (w/ TWC)

EG116-OF

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

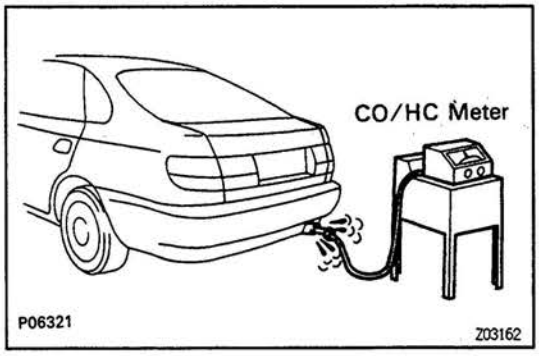
1. INITIAL CONDITIONS

(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 system, etc. should be properly connected.
(f) EFI system wiring connectors fully plugged
(g) Ignition timing set correctly
(h) Transmission in neutral position
(i) Tachometer and CO/HC meter calibrated by hand



2. START ENGINE

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



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

5. CHECK CO/HC CONCENTRATION AT IDLE

Idle CO concentration:

0 — 0.5 %

Idle HC concentration:

Applicable local regulation

Troubleshooting

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

(a) Check oxygen sensor operation.
(See page EG–284)

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

HC	CO	Problems	Causes
High	Normal	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
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: • PCV hose • EGR valve • Intake manifold • Throttle body • ISC valve • Brake booster line 2. Lean mixture causing misfire
High	High	Rough Idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty EFI systems: • Faulty pressure regulator • Clogged fuel return line • Defective water temp. sensor • Faulty ECU • Faulty injector • Faulty throttle position sensor • Faulty vacuum sensor

V05182

IDLE CO CHECK AND ADJUST (w/o TWC)

EG180-02

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

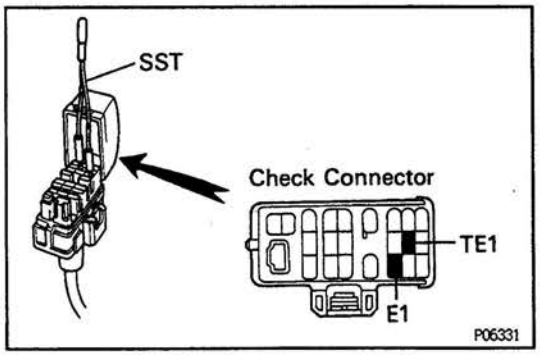
EG

1. INITIAL CONDITIONS

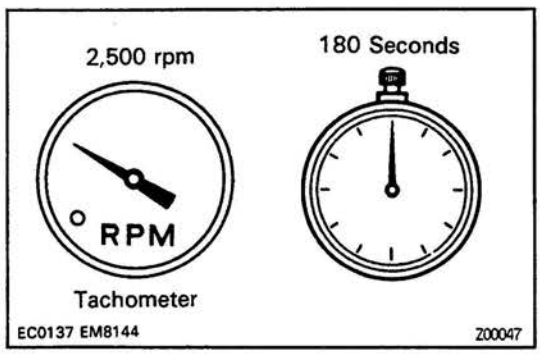
(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All accessories switched OFF
(e) All vacuum lines properly connected
(f) EFI system wiring connectors fully plugged
(g) Ignition timing set correctly
(h) Transmission in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

2. CHECK AND ADJUST CO CONCENTRATION AT IDLE

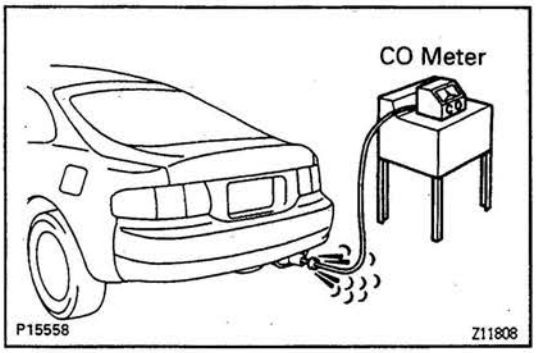
NOTICE: Always use a CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture screw in most vehicles if they are in good condition. If a CO meter is not available, DO NOT ATTEMPT TO ADJUST IDLE MIXTURE.



(a) Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843—18020



(b) Race the engine at 2,500 rpm for approx. 180 seconds.

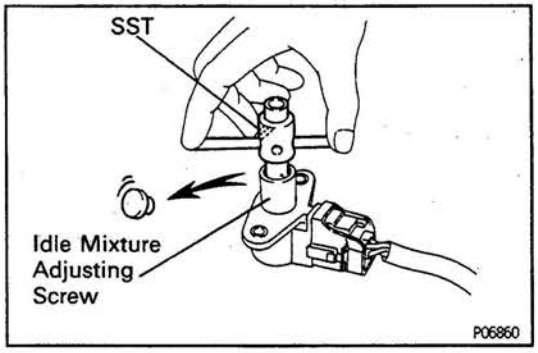


(c) Insert a tester probe at least 40 cm (1.3 ft) into the tailpipe.

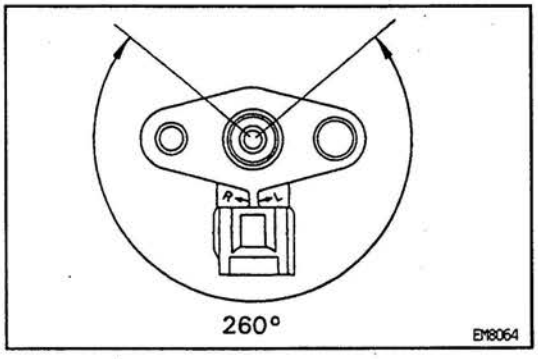
(d) Wait at least one minute before measuring to allow the concentration to stabilize. Complete the measuring within 3 minutes.

Idle CO concentration (w/ Cooling fan OFF):

1.5 ± 0.5 %

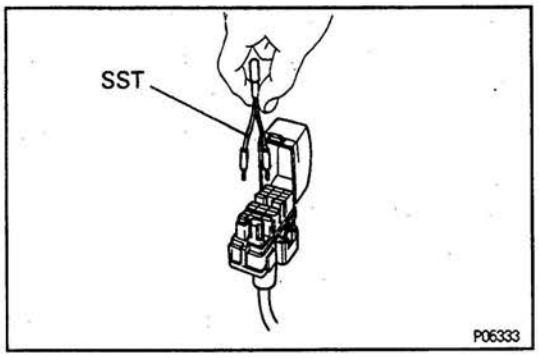


If the CO concentration does not conform to regulations, adjust by turning the IDLE MIXTURE ADJUSTING SCREW in the variable resistor with SST.
SST 09243−00020



HINT: The idle mixture adjusting screw can be tightened through on angle of 260°.

- If the CO concentration is within specification, this adjustment is complete.
- If the CO concentration cannot be corrected by idle mixture adjustment, see the table on the page EG−29 for other possible causes.



(e) Remove the SST.
SST 09843−18020

COMPRESSION CHECK

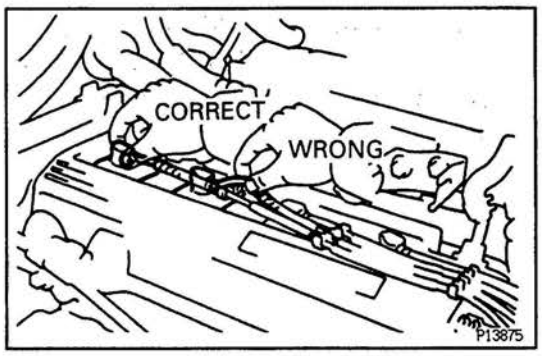
EG0BE-0A

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

1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

2. DISCONNECT DISTRIBUTOR CONNECTORS

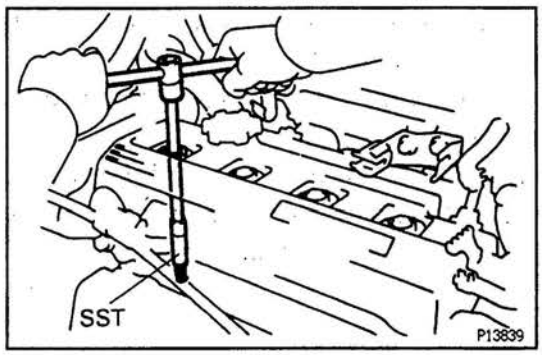


3. DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS

(a) Disconnect the 4 high–tension cords from the clamp on the cylinder head cover.

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

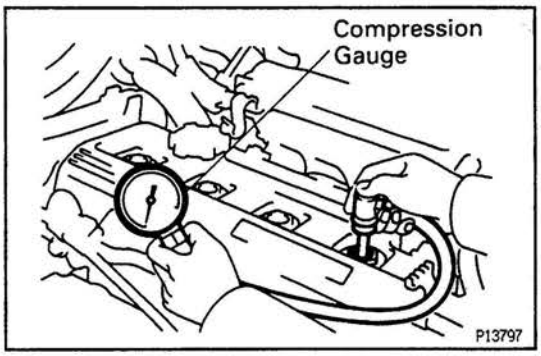
NOTICE: Pulling on or bending the cords may damage the conductor inside.



4. REMOVE SPARK PLUGS

Using SST, remove the 4 spark plugs.

SST 09155–16100



5. CHECK CYLINDER COMPRESSION PRESSURE

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

(b) Fully open the throttle.

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

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

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

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

Compression pressure:

w/ TWC:

1,275 kPa (13.0 kgf/cm², 185 psi) or more

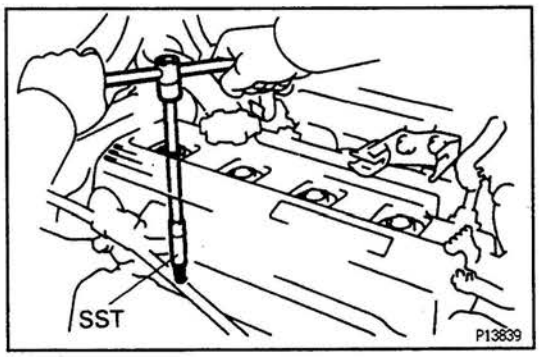
w/o TWC:

1,226 kPa (12.5 kgf/cm², 178 psi) or more

Minimum pressure:
w/ TWC:
932 kPa (9.5 kgf/cm², 135 psi)
w/o TWC:
883 kPa (9.0 kgf/cm², 128 psi)
Difference between each cylinder:
98 kPa (1.0 kgf/cm², 14 psi) or less

EG

(e) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.
- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.



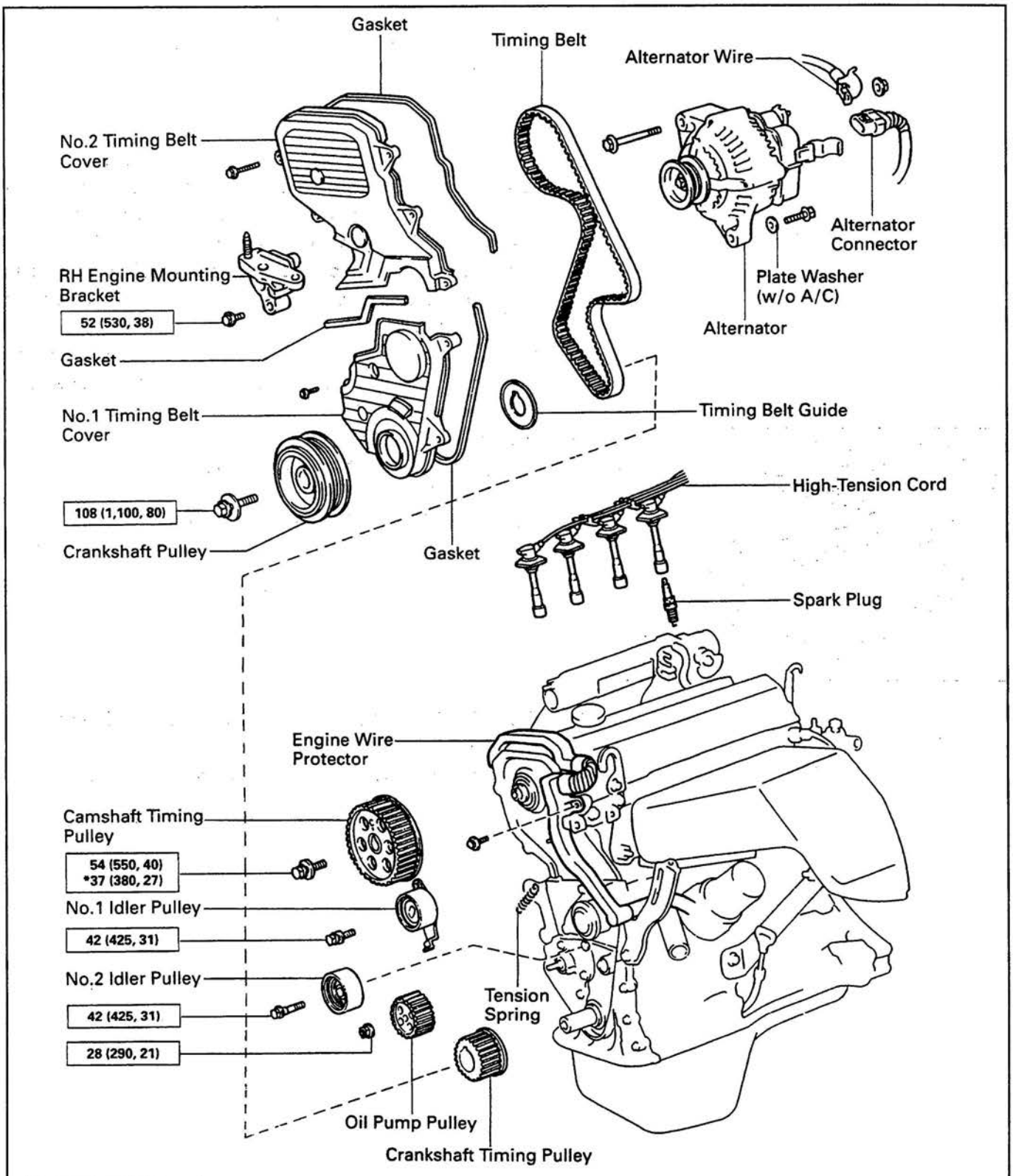
6. REINSTALL SPARK PLUGS
Using SST, install the 4 spark plugs.
SST 09155–16100
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)

7. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS
8. RECONNECT DISTRIBUTOR CONNECTORS

TIMING BELT

COMPONENTS FOR REMOVAL AND INSTALLATION

EG3V9—01



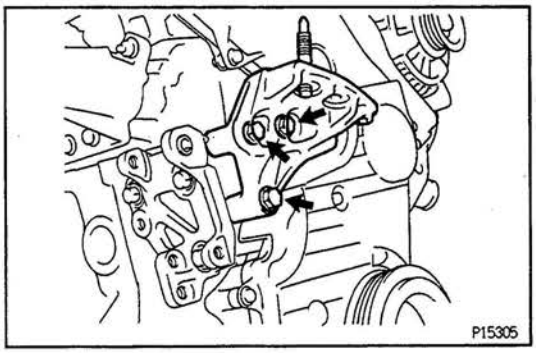
N·m (kgf·cm, ft·lbf) : Specified torque

* For use with SST

P17091

EG3VA-01

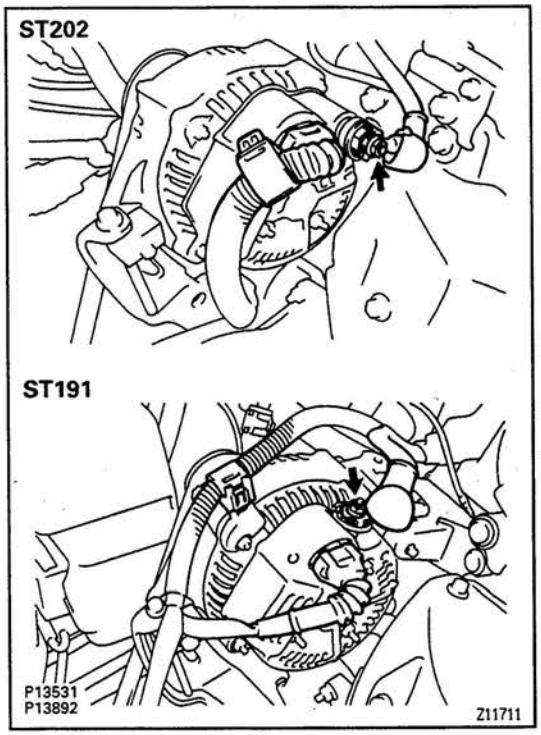
TIMING BELT REMOVAL



(See Components for Removal and Installation)

1. REMOVE RH ENGINE MOUNTING BRACKET

Remove the 3 bolts and mounting bracket.



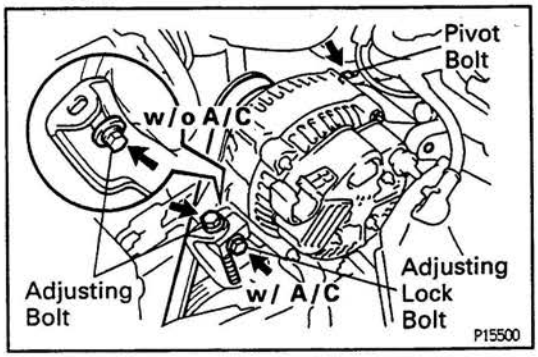
2. REMOVE ALTERNATOR

(a) ST202:
Disconnect the wire from the clamp on the rear end cover.

(b) ST191:
Disconnect the wire clamp from the clip on the alternator.

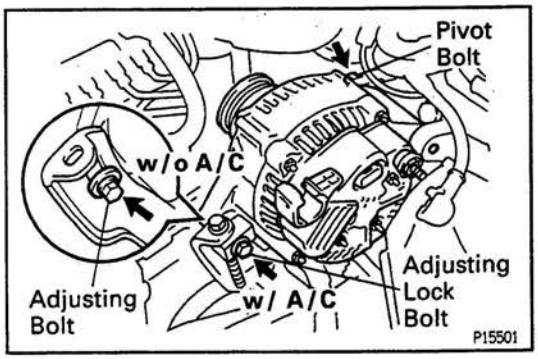
(c) Disconnect the alternator connector.

(d) Remove the rubber cap and nut, and disconnect the alternator wire.



(e) Loosen the adjusting lock bolt (w/ A/C), adjusting bolt and pivot bolt.

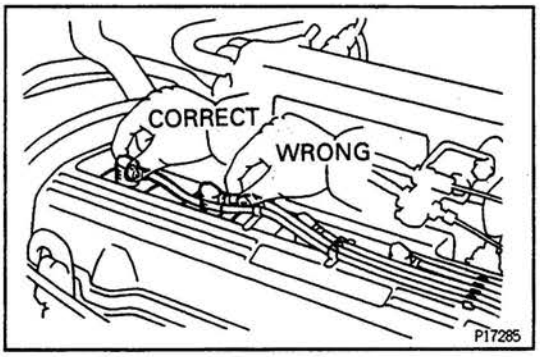
(f) Remove the drive belt.



(g) Remove the adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C) and pivot bolt.

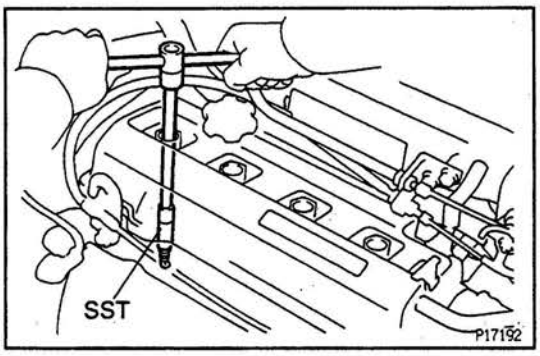
(h) Remove the alternator.

EG

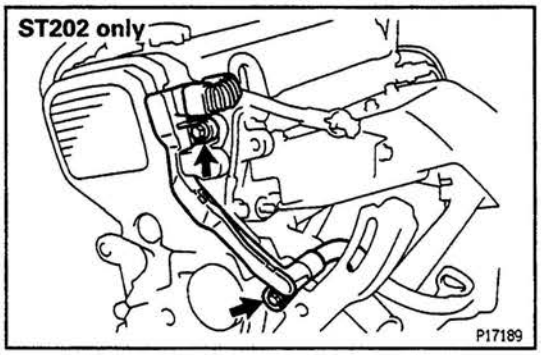


3. REMOVE SPARK PLUGS

(a) Disconnect the 4 high—tension cords at the rubber boot. Do not pull the cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.

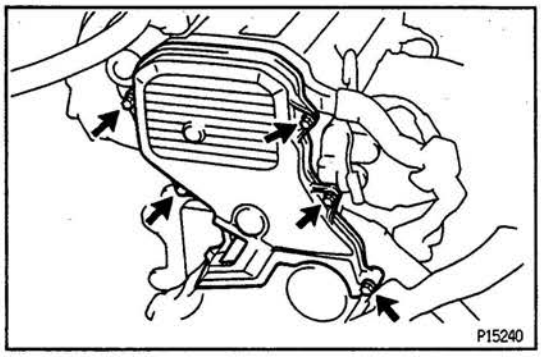


(b) Using SST, remove the 4 spark plugs.
SST 09155—16100

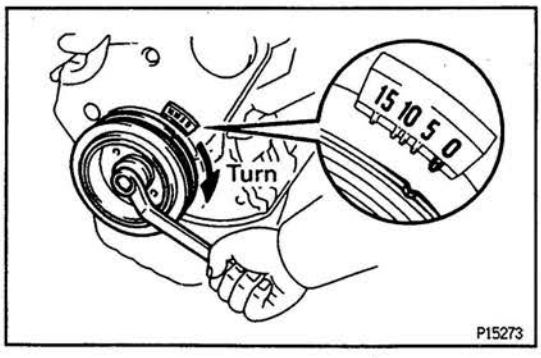


4. REMOVE NO.2 TIMING BELT COVER

(a) ST202 only:
Remove the 2 bolts, and disconnect the engine wire protector from the alternator bracket and adjusting bar.

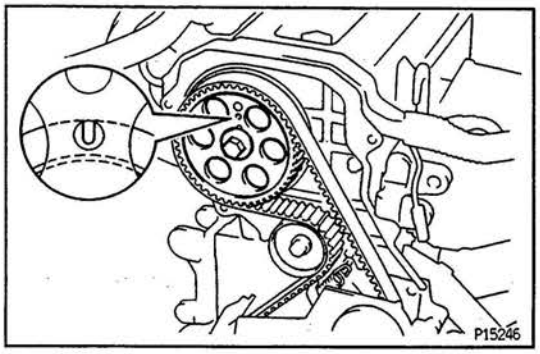


(b) Remove the 5 bolts, timing belt cover and 2 gaskets.

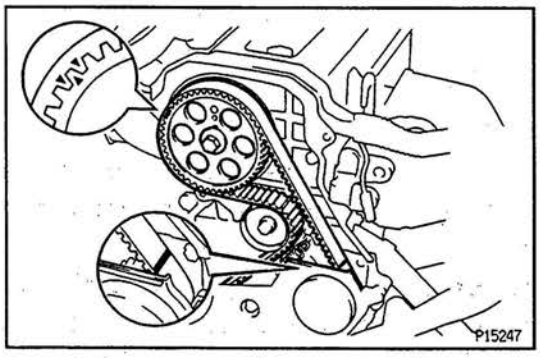


5. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

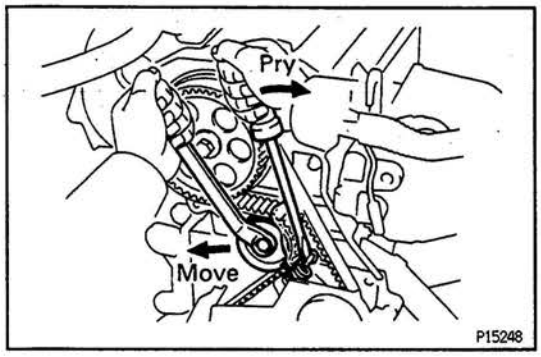


(b) Check that the hole of the camshaft timing pulley is aligned with the timing mark of the bearing cap.
If not, turn the crankshaft 1 revolution (360°).

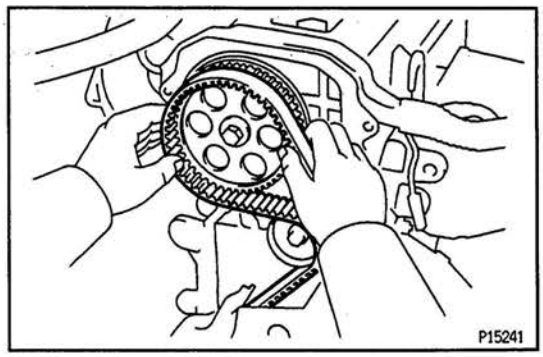


6. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

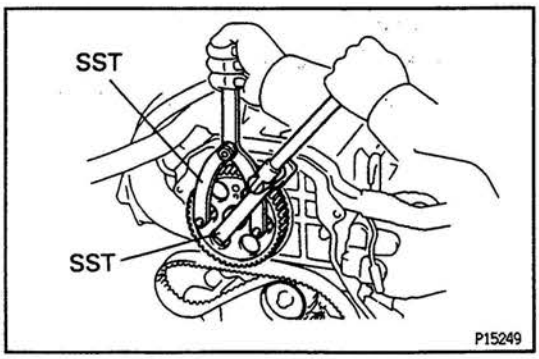
HINT (When re–using timing belt): Place the matchmarks on the timing belt and camshaft timing pulley, and place matchmark on timing belt to match the end of the No.1 timing belt cover.



(a) Loosen the mounting bolt of the No.1 idler pulley and shift the pulley toward the left as far as it will go, and temporarily tighten it.



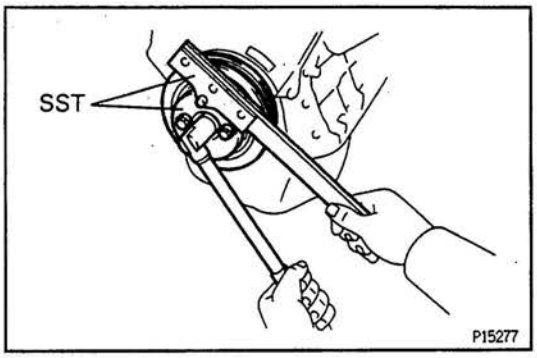
(b) Remove the timing belt from the camshaft timing pulley.

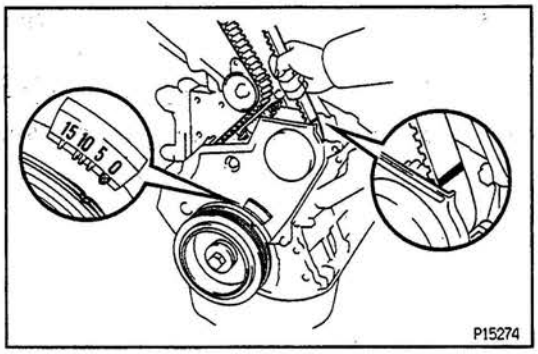


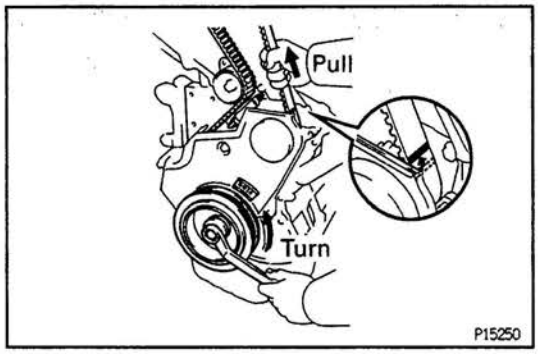
7. REMOVE CAMSHAFT TIMING PULLEY

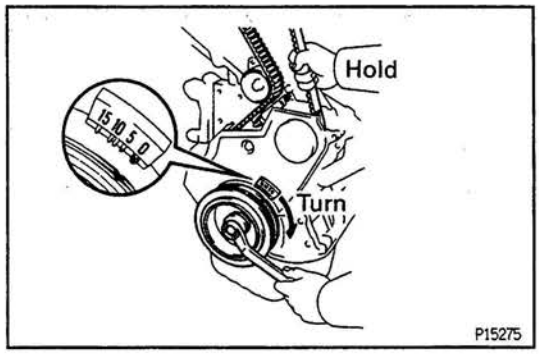
Using SST, remove the bolt and timing pulley.
SST 09249–63010, 09960–10010 (09962–01000, 09963–01000)

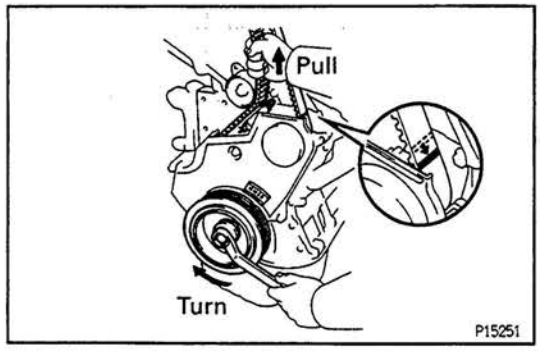
EG











8. REMOVE CRANKSHAFT PULLEY

(a) Using SST (and bolt), remove the pulley bolt.

SST (ST202)

09213—54015 (91651—60855 for Type A),
09330—00021

Bolt: Part No. 91121—40665 for Type B

HINT:

- Either of 2 types of pulley may be used, each with its own bolt size, Type A and Type B.
- When using bolt Type B, a plate washer must be inserted between the bolt and SST.

SST (ST191)

09213—54015 (09214—00030),
09330—00021

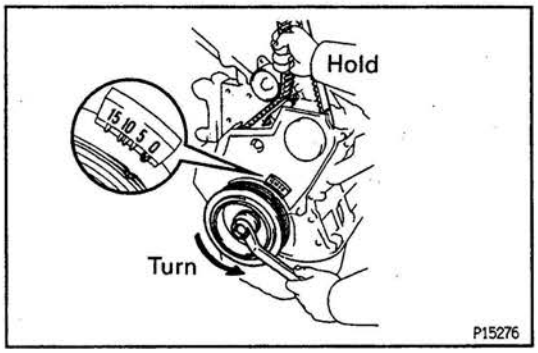
HINT (When re—using timing belt): After loosening the crankshaft pulley bolt, check that the timing belt matchmark aligns with the end of the No.1 timing belt cover when the crankshaft pulley groove is aligned with the timing mark "0" of the No.1 timing belt cover. If the matchmark does not align, align as follows:

When matchmark is misaligned clockwise:

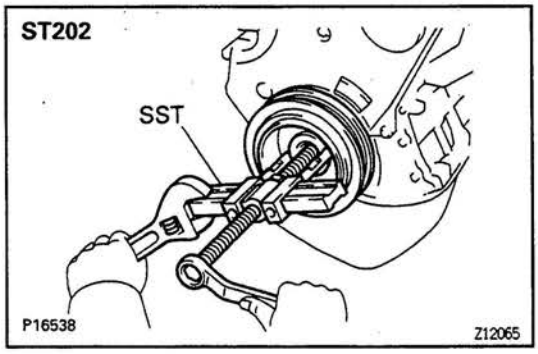
- Align the matchmark by pulling the timing belt up on the water pump pulley side while turning the crankshaft pulley counterclockwise.
- After aligning the matchmark, hold the timing belt. And turn the crankshaft pulley clockwise, and align its groove with timing mark "0" of the No.1 timing belt cover.

When matchmark is misaligned counterclockwise:

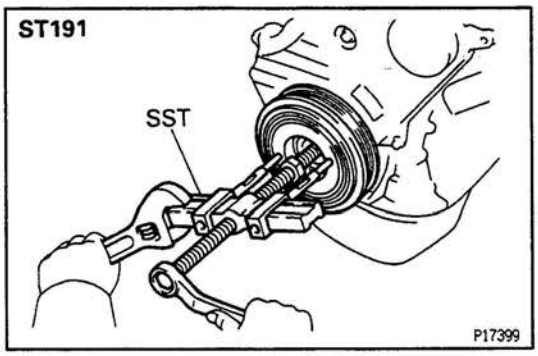
- Align the matchmark by pulling the timing belt up on the No.1 idler pulley side while turning the crankshaft pulley clockwise.



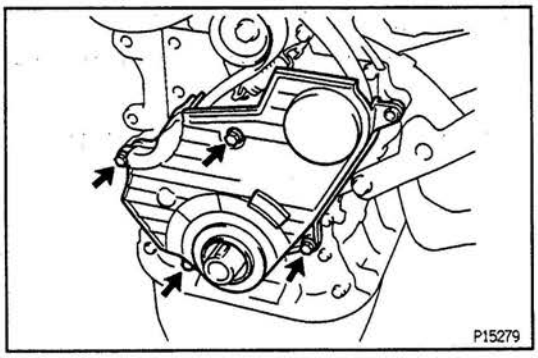
- After aligning the matchmark, hold the timing belt. And turn the crankshaft pulley counter-clockwise, and align its groove with timing mark "0" of the No.1 timing belt cover.



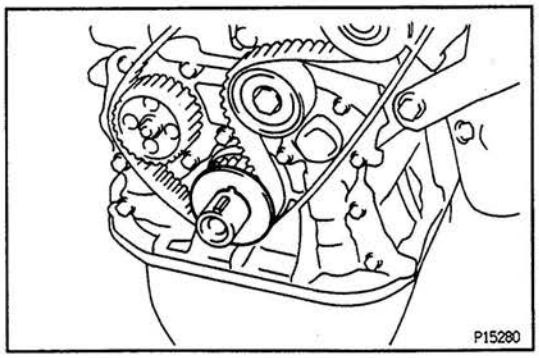
(b) ST202:
Using SST, remove the pulley.
SST 09950–50010 (09951–05010, 09952–05010, 09953–05010, 09953–05020, 09954–05020 for Type A, 09954–05010 for Type B)
HINT (When re–using timing belt): Remove the pulley without turning it.



(c) ST191:
Using SST, remove the pulley.
SST 09950–50010 (09951–05010, 09952–05010, 09953–05010, 09953–05020, 09954–05010)
HINT (When re–using timing belt): Remove the pulley without turning it.

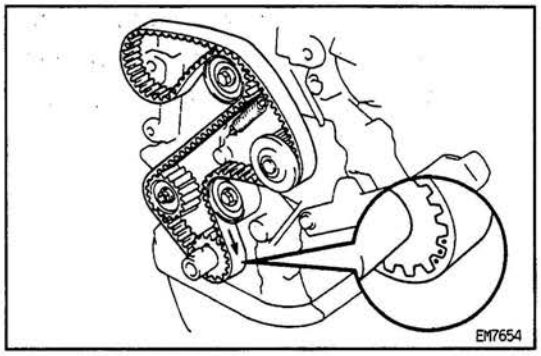


9. REMOVE NO.1 TIMING BELT COVER
Remove the 4 bolts, timing belt cover and gasket.



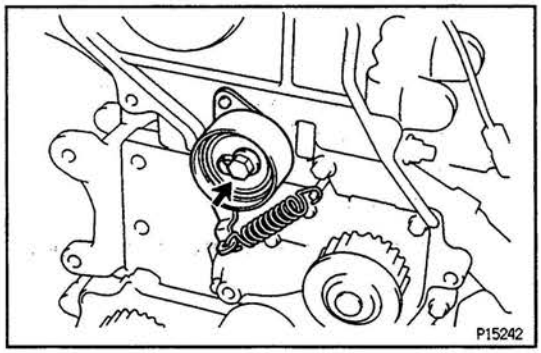
10. REMOVE TIMING BELT GUIDE

EG



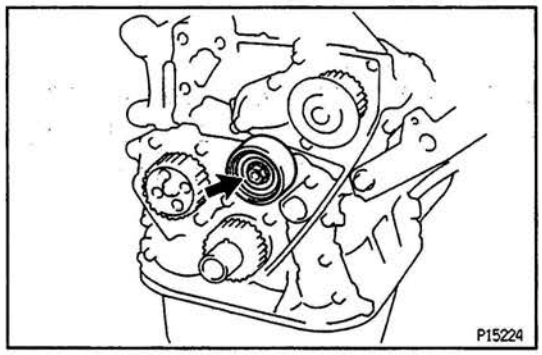
11. REMOVE TIMING BELT

HINT (When re—using timing belt): Draw a direction arrow on the timing belt (in the direction of engine revolution), and place matchmarks on the timing belt and crankshaft timing pulley.



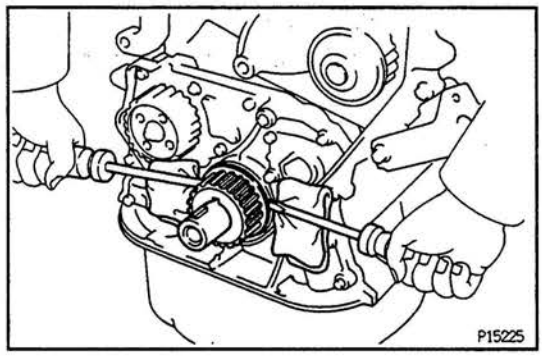
12. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING

Remove the bolt, pulley and tension spring.



13. REMOVE NO.2 IDLER PULLEY

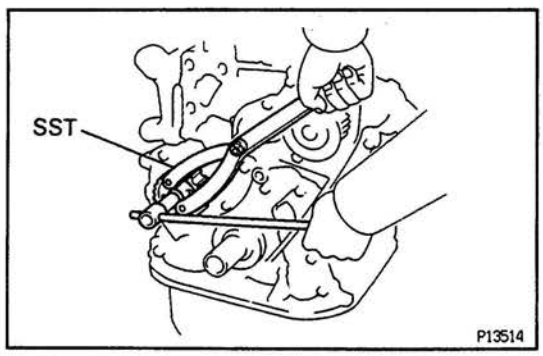
Remove the bolt and pulley.



14. REMOVE CRANKSHAFT TIMING PULLEY

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

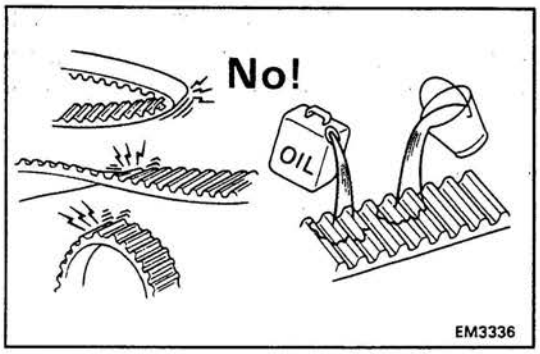
HINT: Position shop rags as shown to prevent damage.



15. REMOVE OIL PUMP PULLEY

Using SST, remove the nut and pulley.

SST 09960—10010 (09962—01000, 09963—00500)



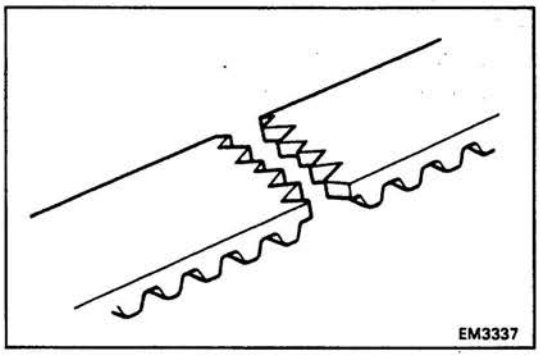
TIMING BELT COMPONENTS INSPECTION EQ08H-08

1. INSPECT TIMING BELT

NOTICE:

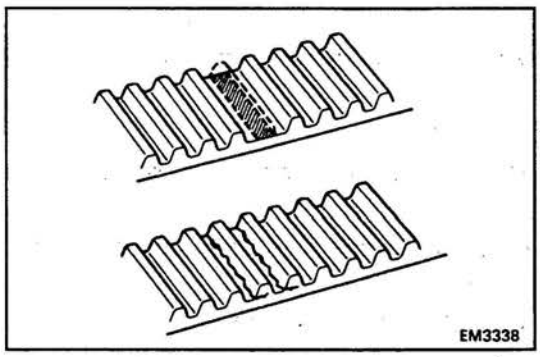
- **Do not bend, twist or turn the timing belt inside out.**
- **Do not allow the timing belt to come into contact with oil, water or steam.**
- **Do not utilize timing belt tension when installing or removing the mounting bolt of the camshaft timing pulley.**

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

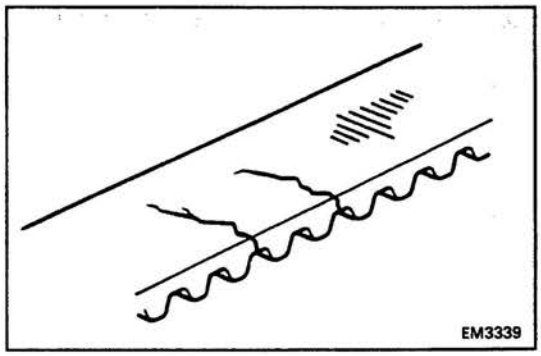


(a) Premature parting

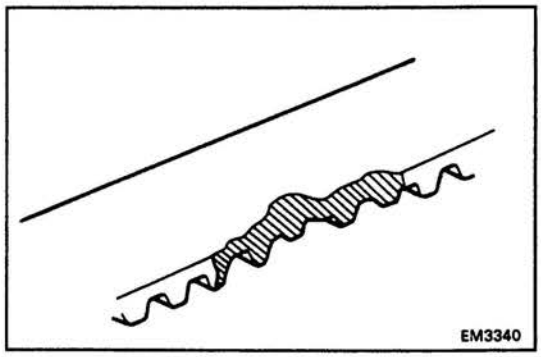
- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.



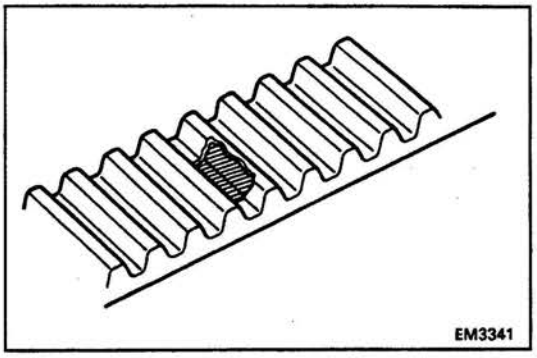
(b) If the belt teeth are cracked or damaged, check to see if either camshaft or water pump is locked.



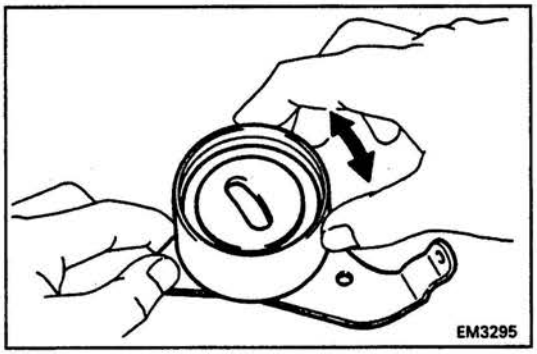
(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock.



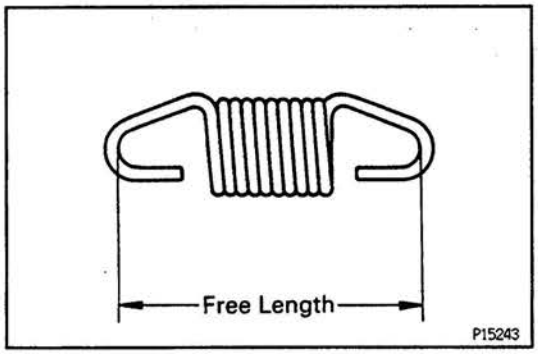
(d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.



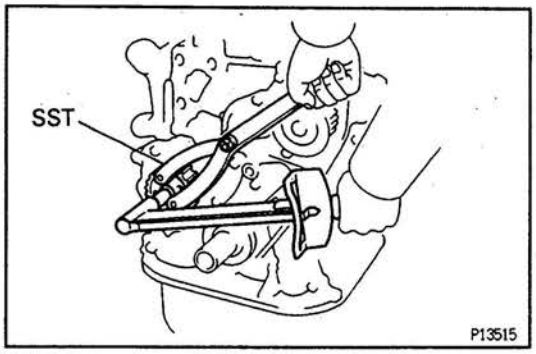
(e) If there is noticeable wear on the belt teeth, check the timing cover for damage and check gasket has been installed correctly and for foreign material on the pulley teeth.
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEYS
Check that the idler pulley turns smoothly.
If necessary, replace the idler pulley.



3. INSPECT TENSION SPRING
(a) Measure the free length of tension spring.
Free length:
46.0 mm (1.811 in.)
If the free length is not as specified, replace the tension spring.
(b) Measure the tension of the tension spring at the specified installed length.
Installed tension (at 50.5 mm (1.988 in.)):
32 — 37 N (3.25 — 3.75 kgf, 7.2 — 8.3 lbf)
If the installed tension is not as specified, replace the tension spring.



TIMING BELT INSTALLATION

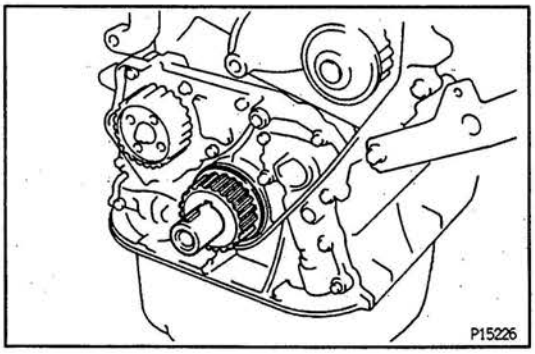
EQ3VB-01

(See Components for Removal and Installation)

1. INSTALL OIL PUMP PULLEY

(a) Align the cutouts of the pulley and shaft, and slide on the pulley.

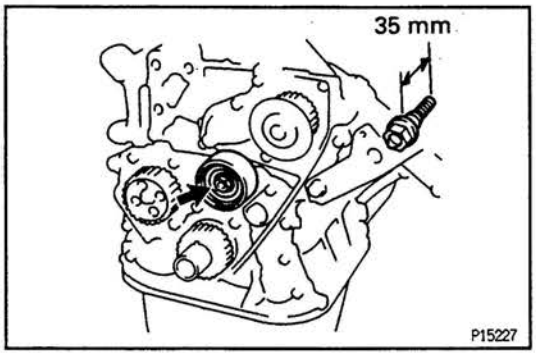
(b) Using SST, install the pulley nut.
SST 09960–10010 (09962–01000, 09963–00500)
Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)



2. INSTALL CRANKSHAFT TIMING PULLEY

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

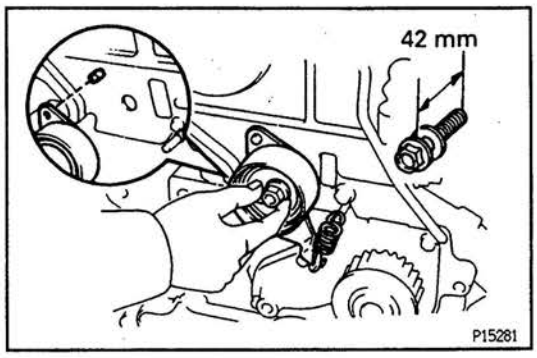
(b) Slide on the timing pulley, facing the flange side inward.



3. INSTALL NO.2 IDLER PULLEY

(a) Install the pulley with the bolt.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)
HINT: Use the 35 mm (1.38 in.) long bolt.

(b) Check that the idler pulley moves smoothly.

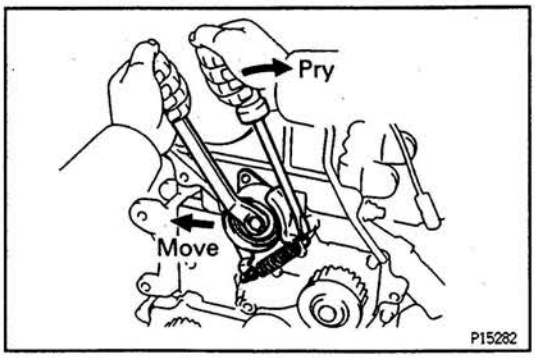


4. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING

(a) Align the bracket pin hole with the pivot pin.

(b) Install the pulley with the bolt. Do not tighten the bolt yet.
HINT: Use the 42 mm (1.65 in.) long bolt.

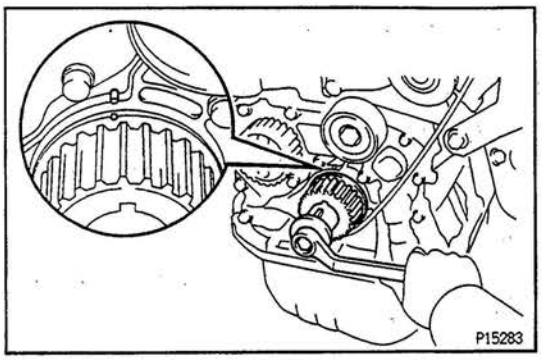
(c) Install the tension spring.



(d) Pry the pulley toward the left as far as it will go and tighten the bolt.

(e) Check that the idler pulley moves smoothly.

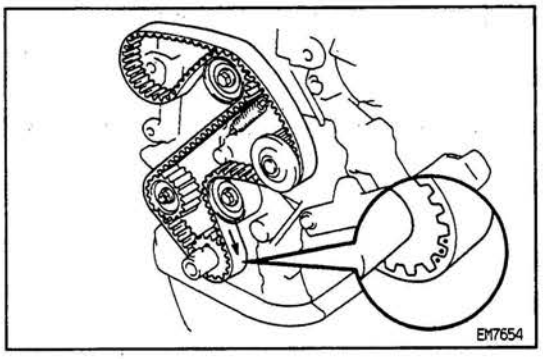
EG



5. TEMPORARILY INSTALL TIMING BELT

NOTICE: The engine should be cold.

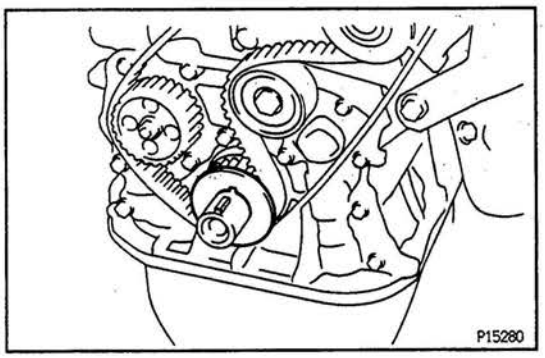
(a) Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.



(b) Remove any oil or water on the crankshaft pulley, oil pump pulley, water pump pulley, No.1 idler pulley and No.2 idler pulley, and keep them clean.

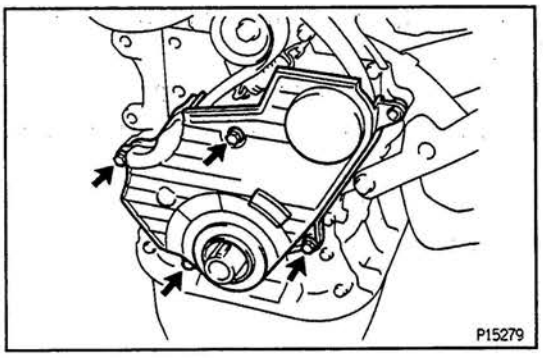
(c) Install the timing belt on the crankshaft timing pulley, oil pump pulley, No.1 idler pulley, water pump pulley and No.2 idler pulley.

HINT (When re—using timing belt): Align the points marked during removal, and install the belt with the arrow pointing in the direction of engine revolution.



6. INSTALL TIMING BELT GUIDE

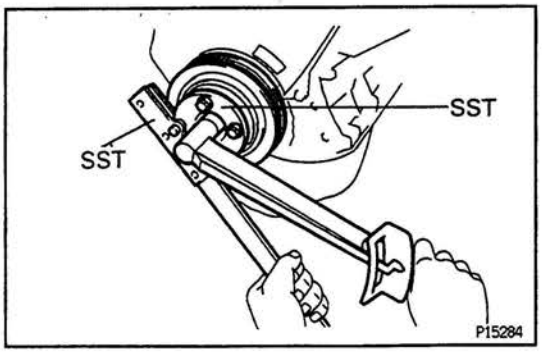
Install the guide, facing the cup side outward.



7. INSTALL NO.1 TIMING BELT COVER

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

(b) Install the timing belt cover with the 4 bolts.



8. INSTALL CRANKSHAFT PULLEY

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

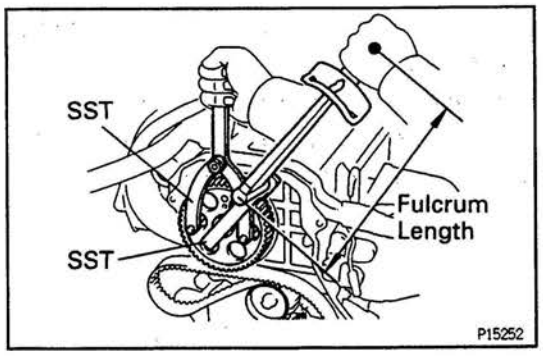
(b) Using SST (and bolt), install the pulley bolt.

SST (ST202)

09213—54015 (91651—60855 for Type A),
09330—00021

Bolt: Part No. 91121—40665 for Type B

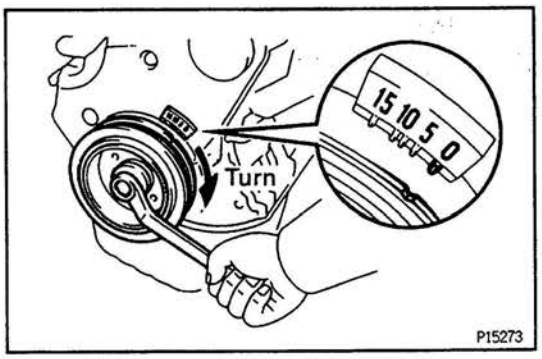
SST (ST191)
09213–54015 (09214–00030),
09330–00021
Torque: 108 N·m (1,100 kgf·cm, 80 ft·lbf)



9. INSTALL CAMSHAFT TIMING PULLEY

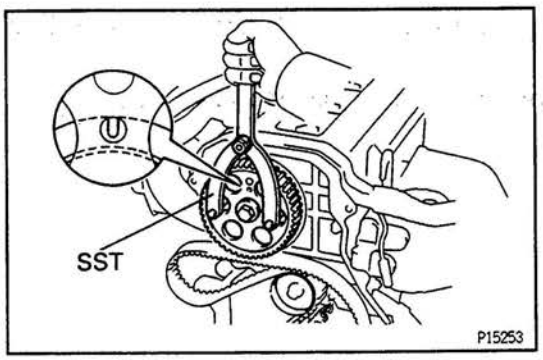
(a) Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the timing pulley.

(b) Using SST, install the pulley bolt.
SST 09249–63010, 09960–10010 (09962–01000, 09963–01000)
Torque:
54 N·m (550 kgf·cm, 40 ft·lbf)
37 N·m (380 kgf·cm, 27 ft·lbf) for SST
HINT: Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

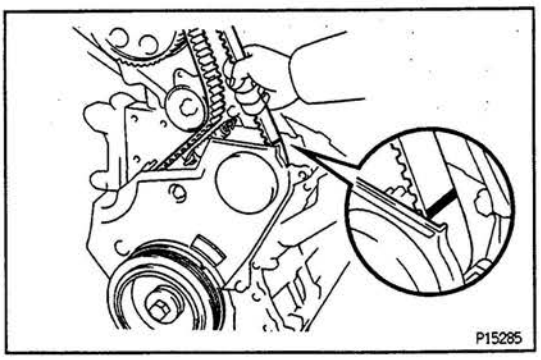


10. SET NO.1 CYLINDER TO TDC/COMPRESSION

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



(b) Using SST, turn the camshaft, and align the hole of the camshaft timing pulley with the timing mark of the bearing cap.
SST 09960–10010 (09962–01000, 09963–01000)



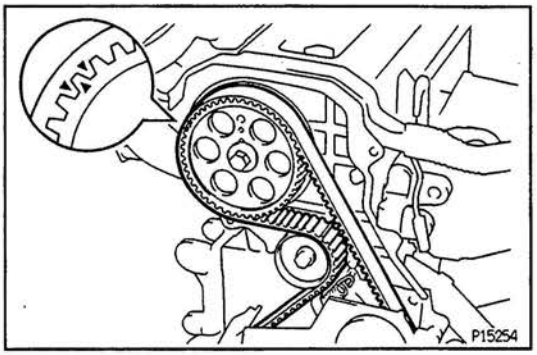
11. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEY

HINT (When re–using timing belt):

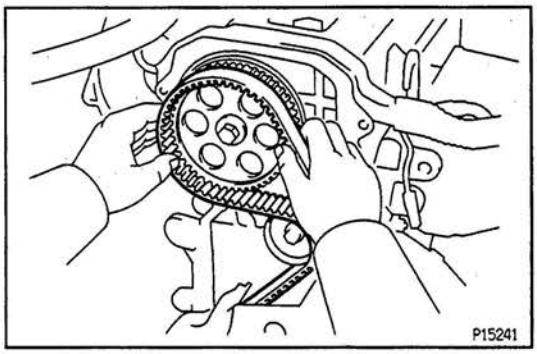
- Check that the matchmark on the timing belt matches the end of the No.1 timing belt cover.

If the matchmark does not align, shift the meshing of the timing belt and crankshaft timing pulley until they align. (See step 8 on page EG–38)

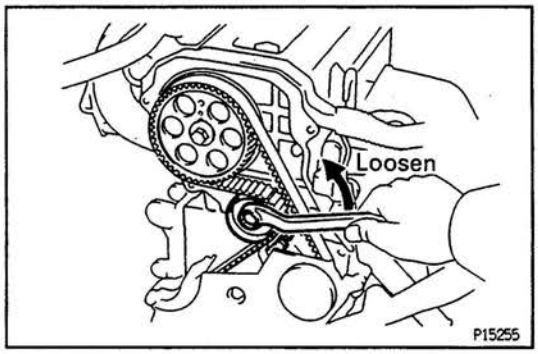
EG



- Align the matchmarks of the timing belt and camshaft timing pulley.

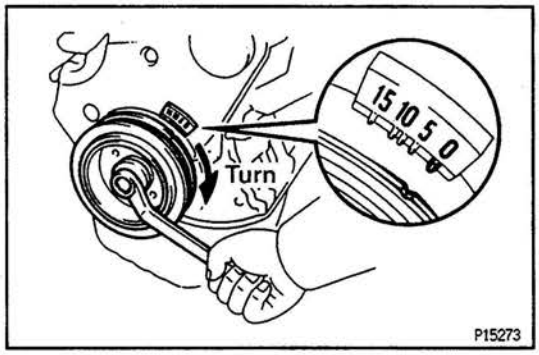


(a) Remove any oil or water on the camshaft timing pulley, and keep it clean.
(b) Connect the timing belt to the camshaft timing pulley, and checking the tension between the crankshaft timing pulley and camshaft timing pulley.

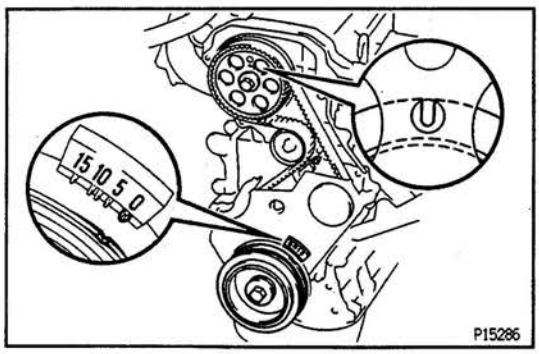


12. CHECK VALVE TIMING

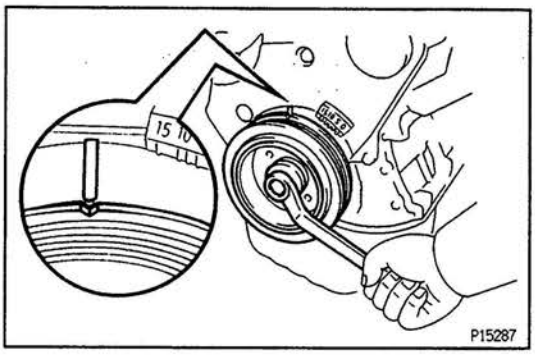
(a) Loosen the No.1 idler pulley bolt 1/2 turn.



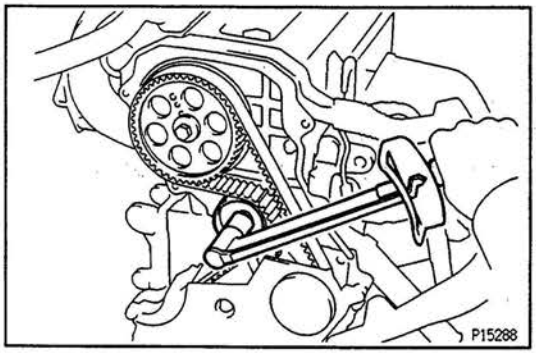
(b) Slowly turn the crankshaft pulley 2 revolutions TDC to TDC.
NOTICE: Always turn the crankshaft pulley clockwise.



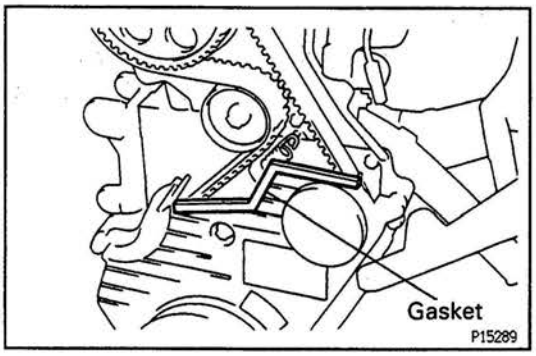
(c) Check that each pulley aligns with the timing marks as shown in the illustration.
If the timing marks do not align, remove the timing belt and reinstall it.



(d) Slowly turn the crankshaft pulley 1 and 7/8 revolutions, and align its groove with the mark at 45° BTDC (for No.1 cylinder) of the No.1 timing belt cover.
NOTICE: Always turn the crankshaft pulley clockwise.

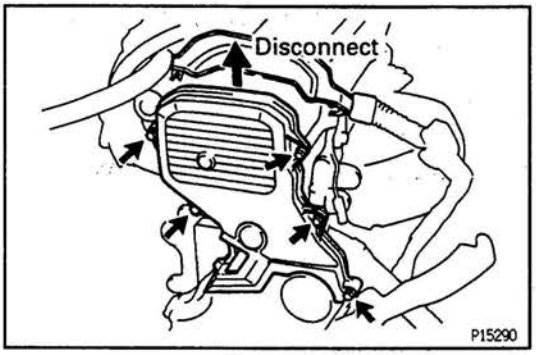


(e) Tighten the mounting bolt of the No.1 idler pulley.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)



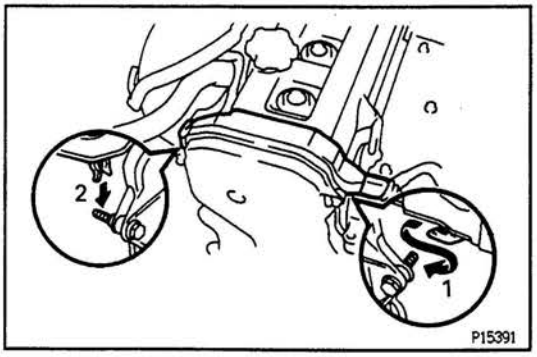
13. INSTALL NO.2 TIMING BELT COVER

(a) Install the gasket to the No.1 timing belt cover.

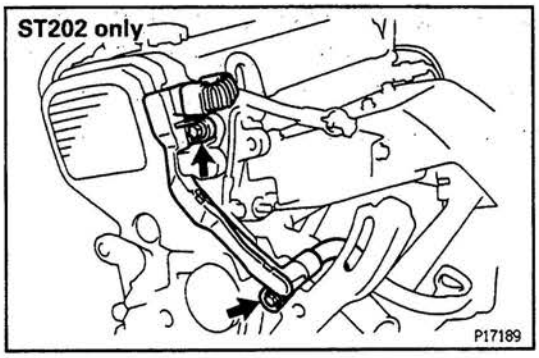


(b) Disconnect the engine wire protector between the cylinder head cover and No.3 timing belt cover.

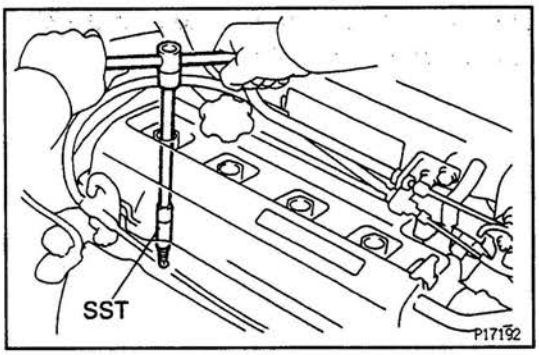
(c) Install the belt cover with the 5 bolts.



(d) Install the engine wire protector to the 2 mounting bolts of the No.2 timing belt cover in the sequence shown.



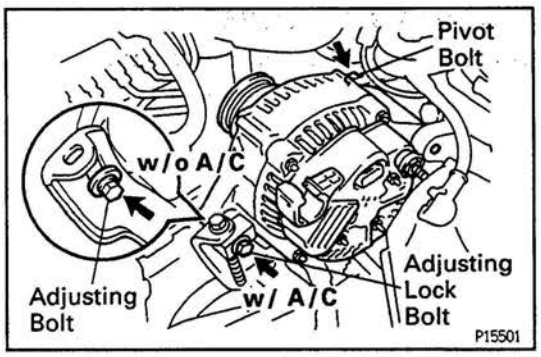
(e) ST202 only:
Install the engine wire protector to the alternator bracket and adjusting bar with the 2 bolts.



14. INSTALL SPARK PLUGS

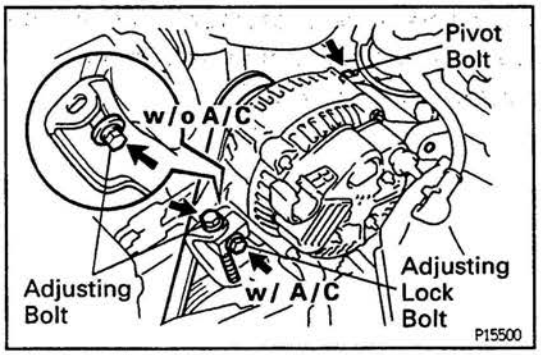
(a) Using SST, install the 4 spark plugs.
SST 09155—16100
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)

(b) Connect the 4 high—tension cords to the spark plugs.



15. INSTALL ALTERNATOR

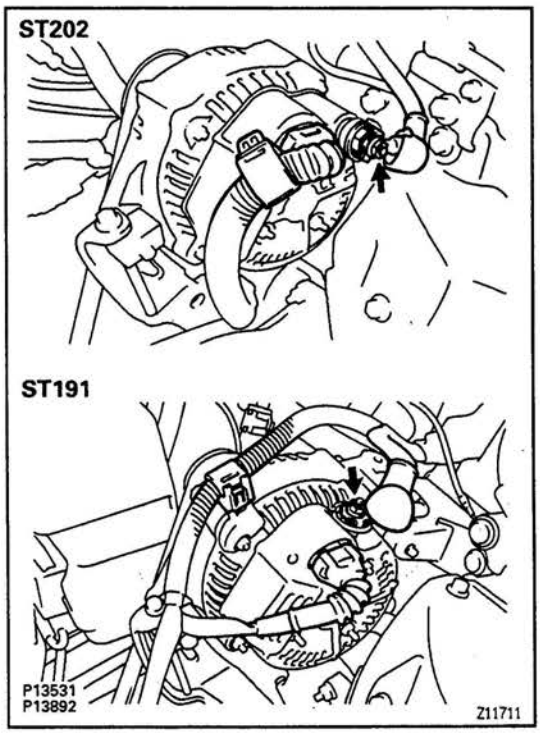
(a) Install the alternator with the pivot bolt and adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C). Do not tighten the bolts yet.



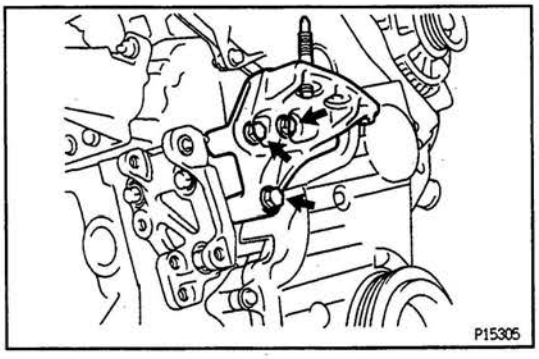
(b) Install the drive belt with the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt.

(c) Adjust the drive belt.
(See step 3 on page CH—8)

(d) Tighten the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt (w/o A/C).
Torque:
Pivot bolt
54 N·m (530 kgf·cm, 40 ft·lbf)
Adjusting lock bolt (w/ A/C), or
Adjusting bolt (w/o A/C)
19 N·m (185 kgf·cm, 14 ft·lbf)



(e) Connect the alternator connector.
(f) Connect the alternator wire with the nut and rubber cap.
(g) ST202:
Install the wire to the clamp on the rear end cover.
(h) ST191:
Install the wire clamp to the clip on the alternator.



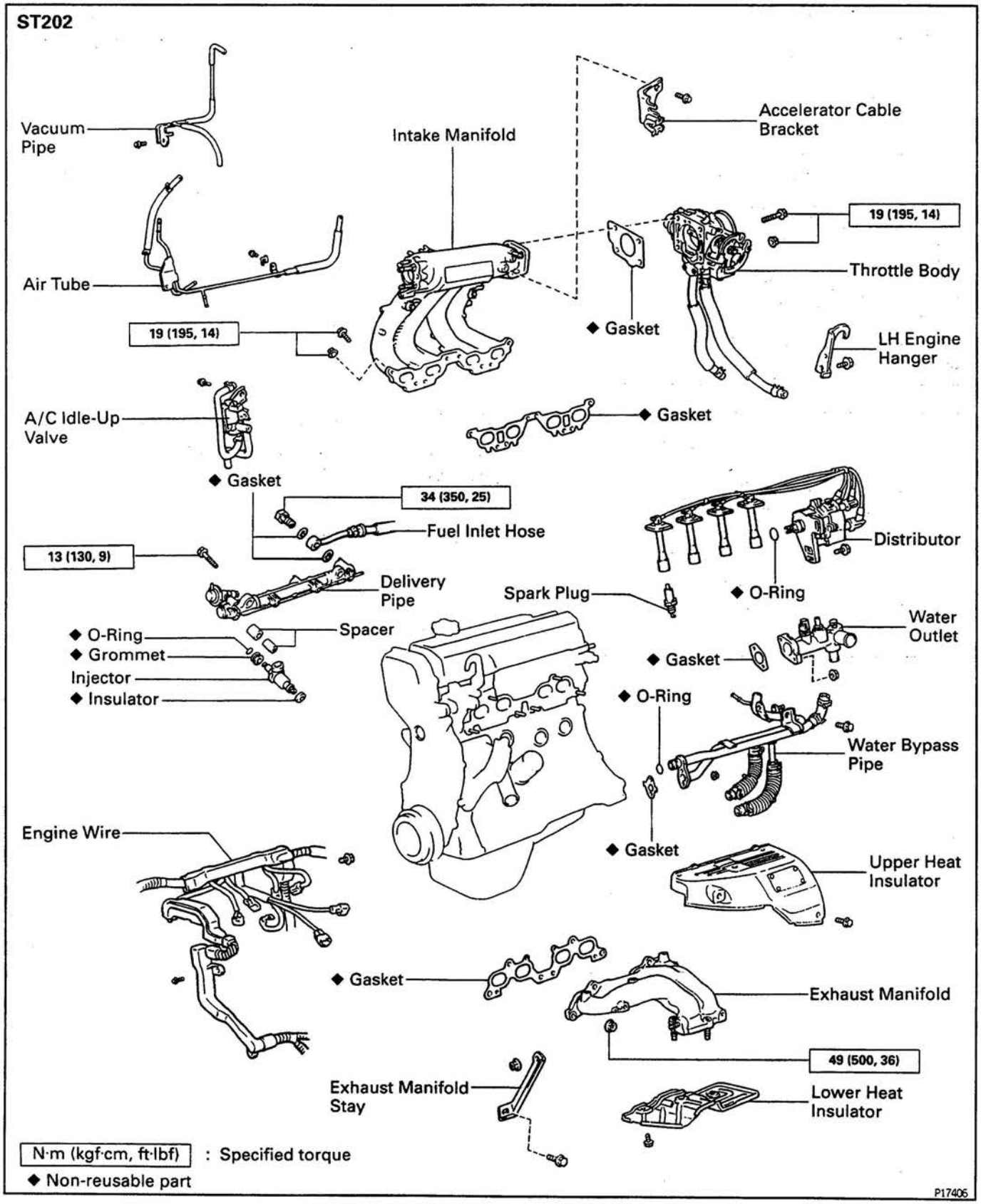
16. INSTALL RH ENGINE MOUNTING BRACKET
Install the bracket with the 3 bolts.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

CYLINDER HEAD

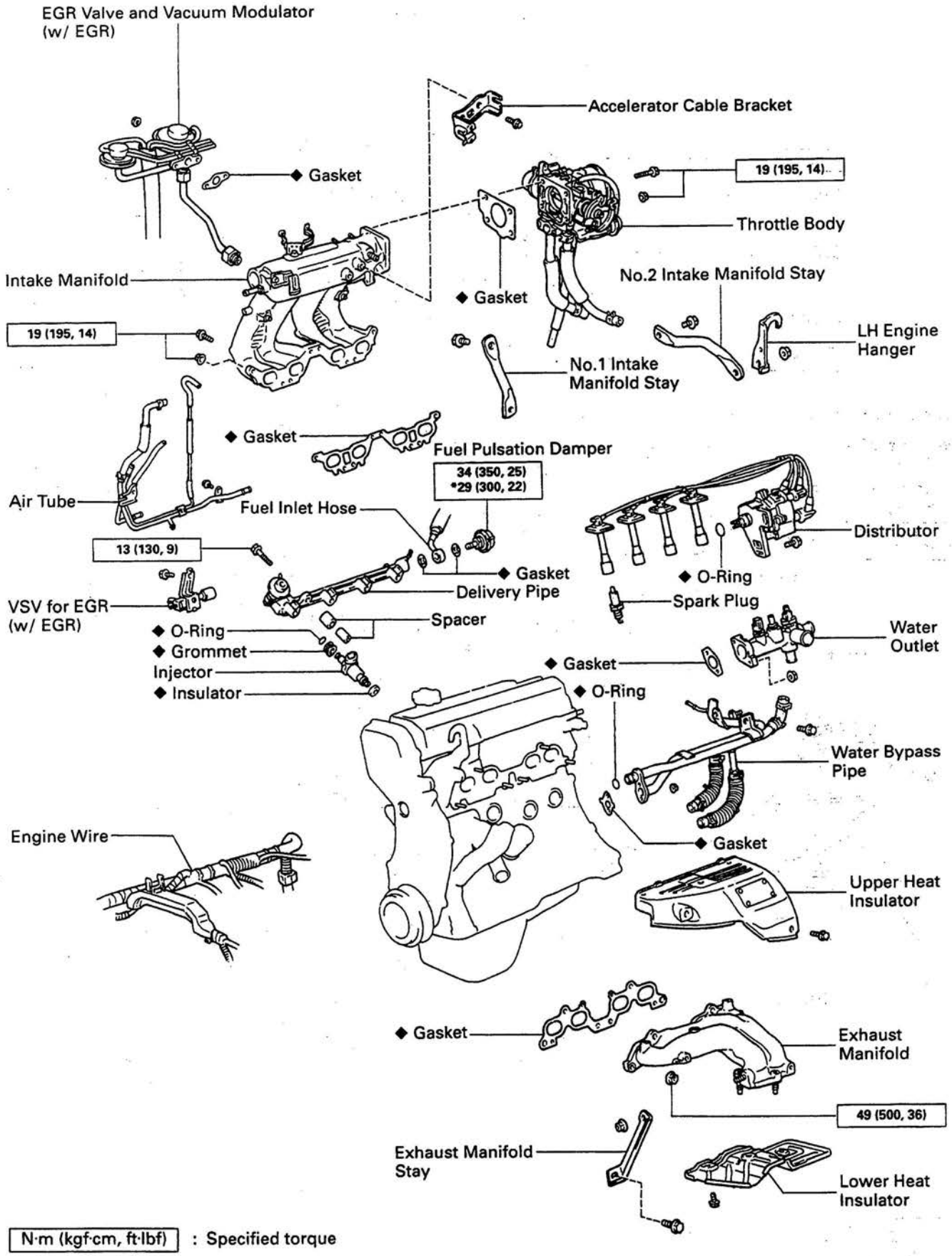
COMPONENTS FOR REMOVAL AND INSTALLATION

EG8W0-01

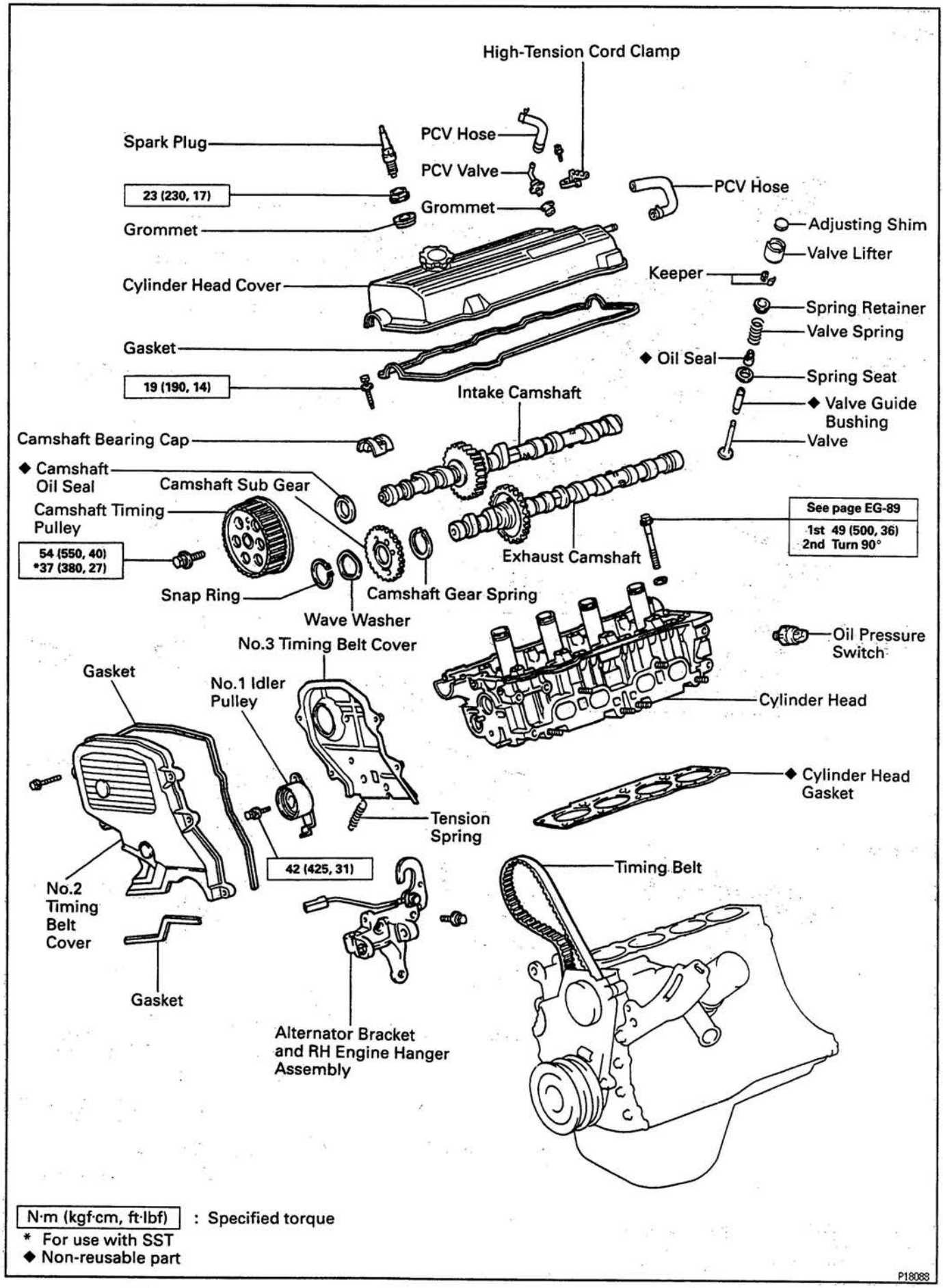
EG



ST191

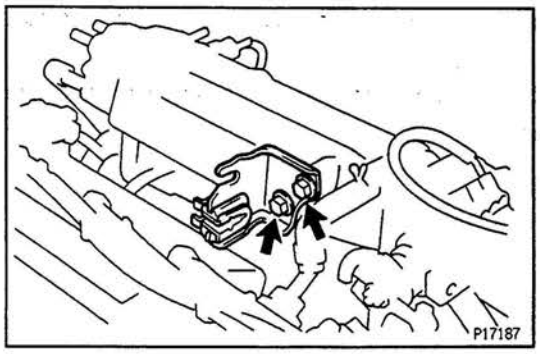

EGR Valve and Vacuum Modulator (w/ EGR)
Accelerator Cable Bracket
◆ Gasket
19 (195, 14)
Throttle Body
Intake Manifold
◆ Gasket
No.2 Intake Manifold Stay
19 (195, 14)
LH Engine Hanger
No.1 Intake Manifold Stay
◆ Gasket
Fuel Pulsation Damper
34 (350, 25)
*29 (300, 22)
Air Tube
Fuel Inlet Hose
Distributor
13 (130, 9)
◆ Gasket
◆ O-Ring
Delivery Pipe
Spark Plug
VSV for EGR (w/ EGR)
Spacer
Water Outlet
◆ O-Ring
◆ Grommet
Injector
◆ Gasket
◆ O-Ring
◆ Insulator
Water Bypass Pipe
Engine Wire
◆ Gasket
Upper Heat Insulator
◆ Gasket
Exhaust Manifold
49 (500, 36)
Exhaust Manifold Stay
Lower Heat Insulator
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
P17407

EG



N·m (kgf·cm, ft·lbf) : Specified torque
* For use with SST
◆ Non-reusable part

P18088

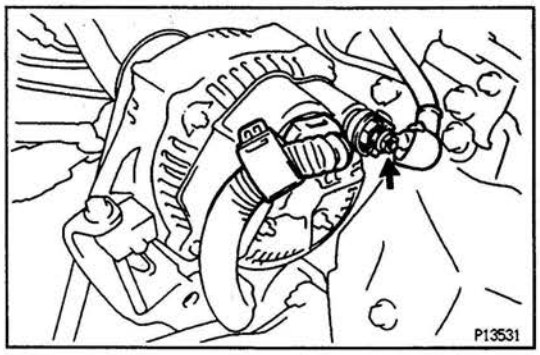


CYLINDER HEAD REMOVAL (ST202)

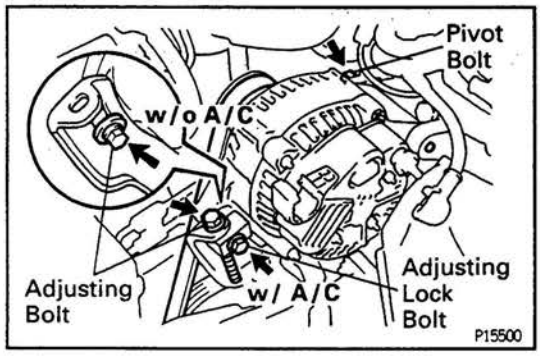
EG3W1-01

(See Components for Removal and Installation)

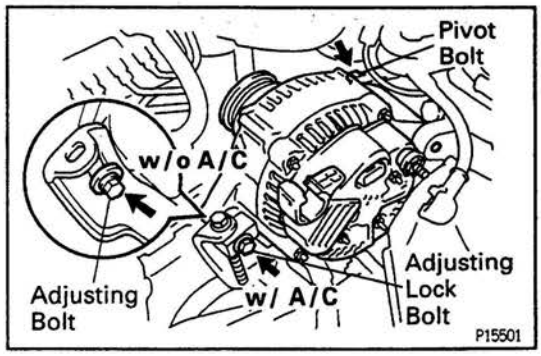
1. **DRAIN ENGINE COOLANT**
2. **REMOVE ACCELERATOR CABLE BRACKET**
   Remove the 2 bolts and accelerator cable bracket.



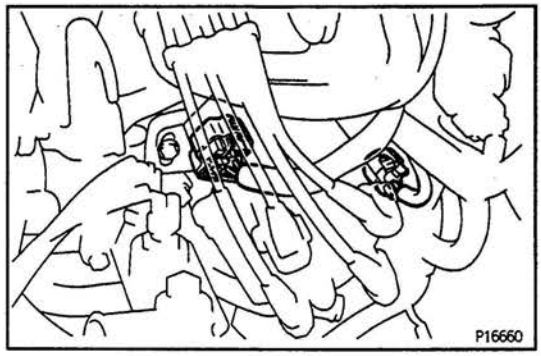
3. **REMOVE ALTERNATOR**
   (a) Disconnect the wire from the clamp on the rear end cover.
   (b) Disconnect the alternator connector.
   (c) Remove the rubber cap and nut, and disconnect the alternator wire.



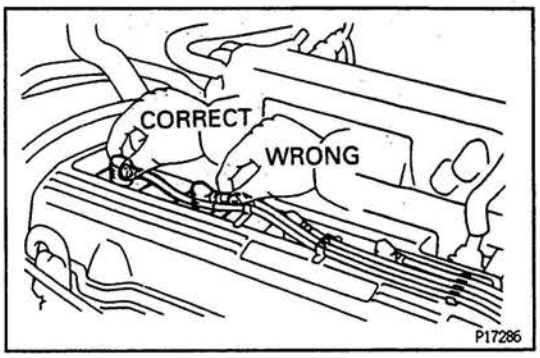
   (d) Loosen the adjusting lock bolt (w/ A/C), adjusting bolt and pivot bolt.
   (e) Remove the drive belt.



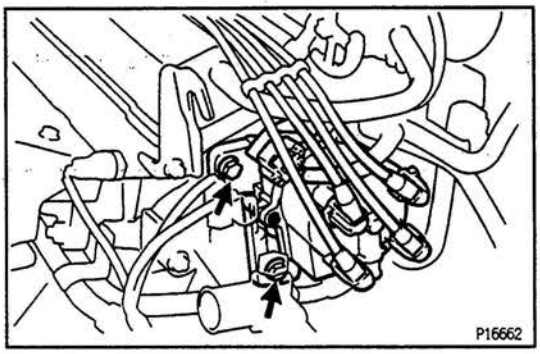
   (f) Remove the adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C) and pivot bolt.
   (g) Remove the alternator.



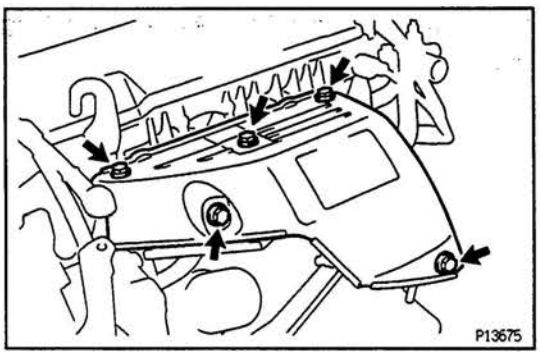
4. **REMOVE DISTRIBUTOR**
   (a) Disconnect the 2 distributor connectors.



(b) Disconnect the high–tension cords at rubber boot. Do not pull on the cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.

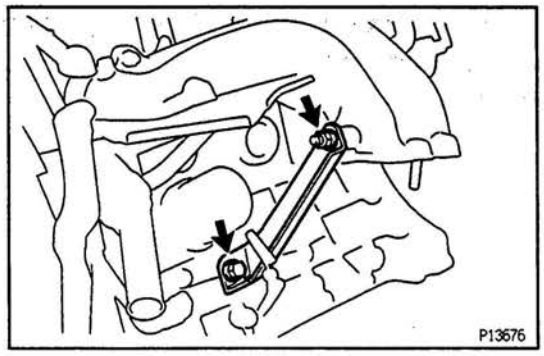


(c) Remove the 2 bolts, and pull out the distributor.

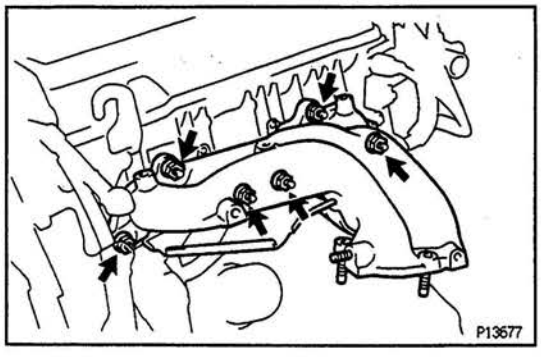


5. REMOVE EXHAUST MANIFOLD

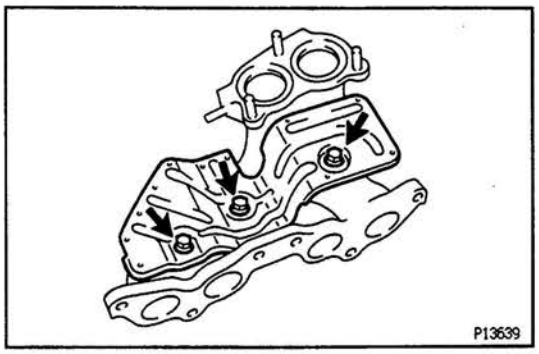
(a) Remove the 5 bolts and upper heat insulator.



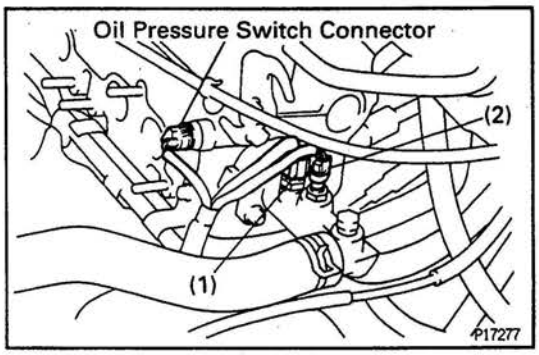
(b) Remove the bolt, nut and manifold stay.



(c) Remove the 6 nuts, exhaust manifold and gasket.



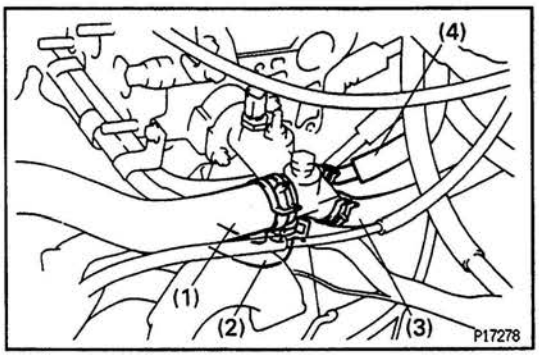
(d) Remove the 3 bolts and lower heat insulator.



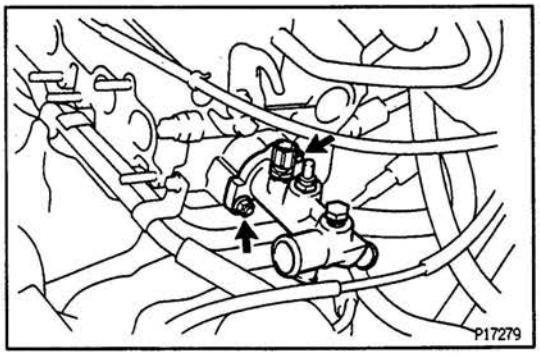
6. DISCONNECT OIL PRESSURE SWITCH CONNECTOR

7. REMOVE WATER OUTLET

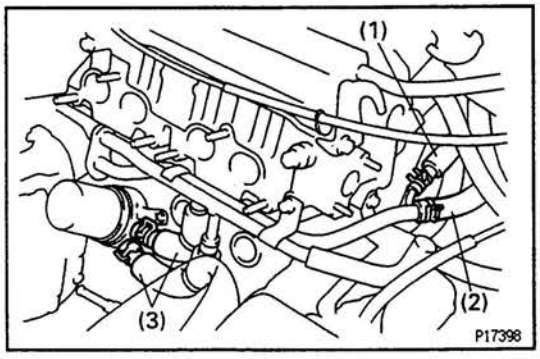
(a) Disconnect the following connectors:
- (1) Water temperature sensor connector
- (2) Water temperature sender gauge connector



(b) Disconnect the following hoses from the water outlet:
- (1) Radiator hose
- (2) Water bypass pipe hose
- (3) Heater water hose
- (4) ISC valve water bypass hose



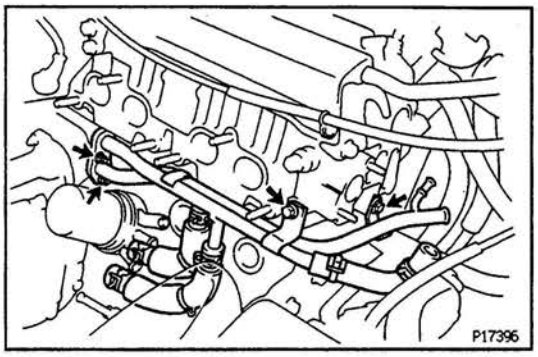
(c) Remove the 2 nuts, water outlet and gasket.



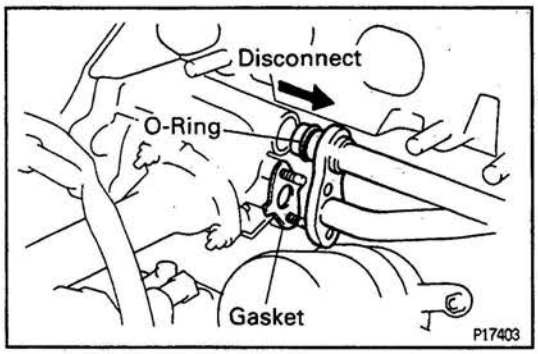
8. REMOVE WATER BYPASS PIPE

(a) Disconnect the following hoses:
- (1) ISC valve water bypass hose from water bypass pipe
- (2) Heater water hose from water bypass pipe
- (3) w/ Oil cooler:
  2 oil cooler water bypass hoses from oil cooler

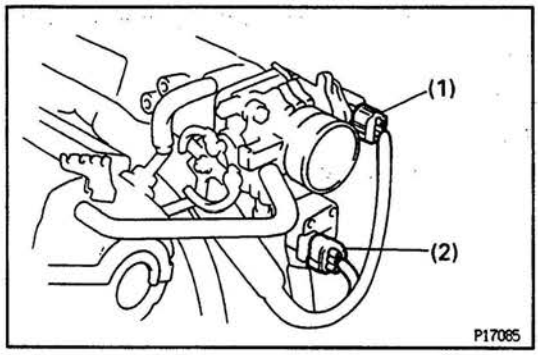
EG



(b) Remove the 2 bolts and 2 nuts.

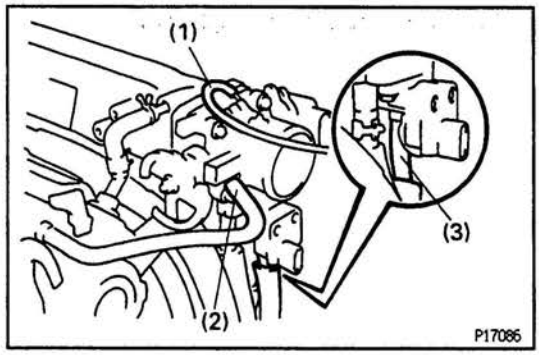


(c) Disconnect the water bypass pipe from the water pump cover, and remove the water bypass pipe.
(d) Remove the gasket and O—ring.

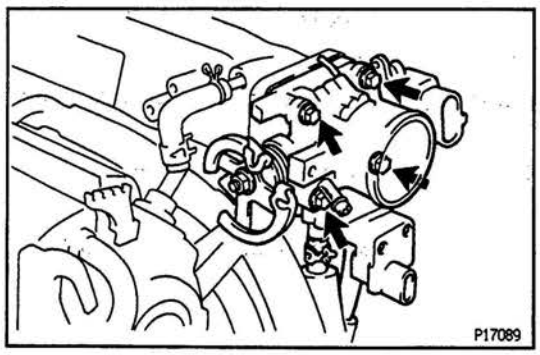


9. REMOVE THROTTLE BODY

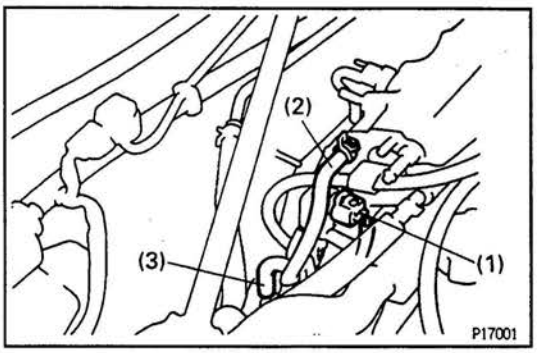
(a) Disconnect the following connectors:
(1) Throttle position sensor connector
(2) ISC valve connector



(b) Disconnect the following hoses:
(1) Vacuum hose (for EVAP) from throttle body
(2) PCV hose from throttle body
(3) Air hose (for A/C and PS idle—up) from ISC valve

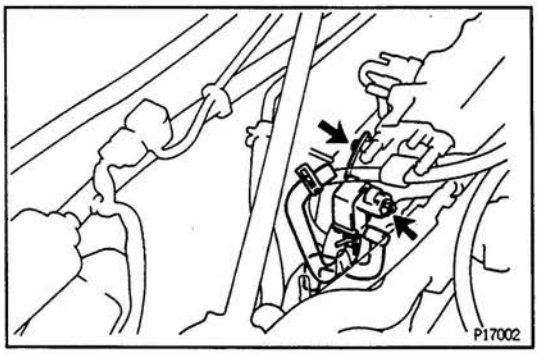


(c) Type A:
Remove the 4 bolts.
(d) Type B:
Remove the 2 bolts and 2 nuts.
(e) Disconnect the throttle body from the intake manifold.
(f) Remove the gasket.

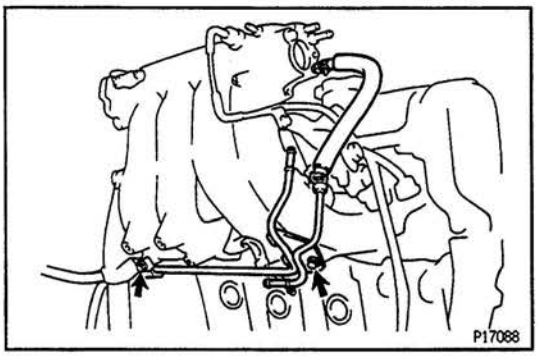


10. REMOVE A/C IDLE–UP VALVE

(a) Disconnect the following connector and hoses:
  (1) Idle–up valve connector
  (2) Air hose from intake manifold
  (3) Air hose from air tube

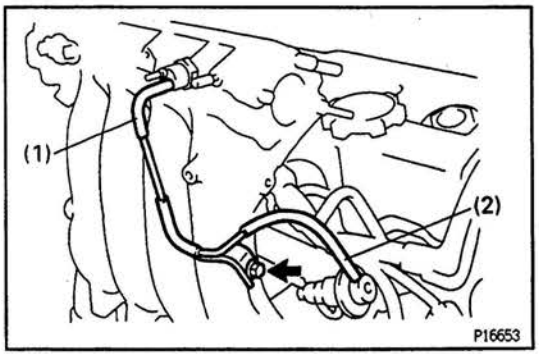


(b) Remove the 2 bolts and idle–up valve.



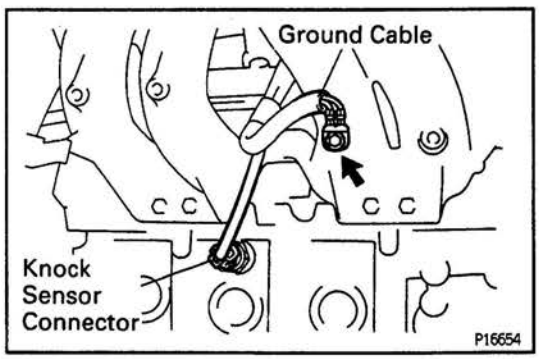
11. REMOVE AIR TUBE

(a) Disconnect the PS air hose from the intake manifold.
(b) Remove the 2 bolts and air tube.



12. REMOVE VACUUM PIPE

(a) Disconnect the following hoses:
  (1) Vacuum sensing hose from gas filter on intake manifold
  (2) Vacuum sensing hose from fuel pressure regulator
(b) Remove the bolt and vacuum pipe.

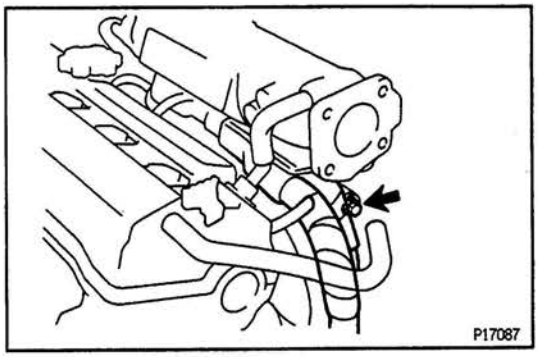


13. DISCONNECT KNOCK SENSOR CONNECTOR

14. DISCONNECT GROUND CABLE

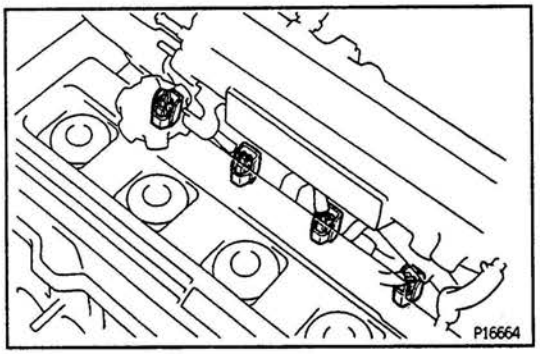
Remove bolt, and disconnect the ground cable from the intake manifold.

EG

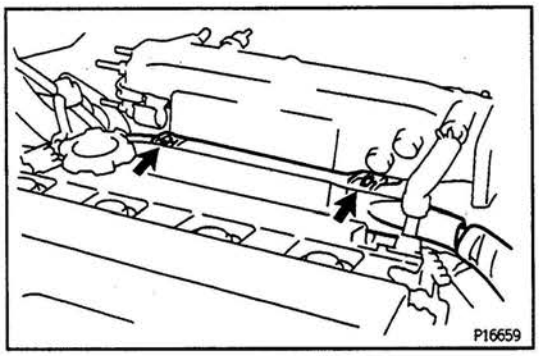


15. DISCONNECT ENGINE WIRE

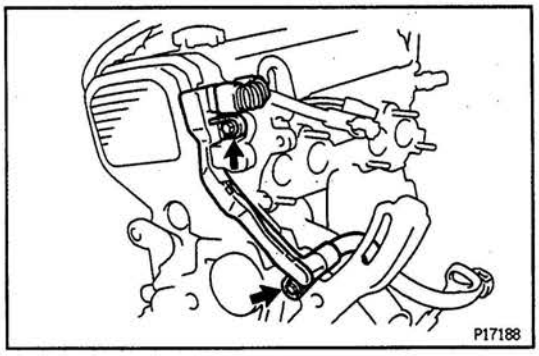
(a) Remove the bolt, and disconnect the engine wire protector from the LH side of the intake manifold.



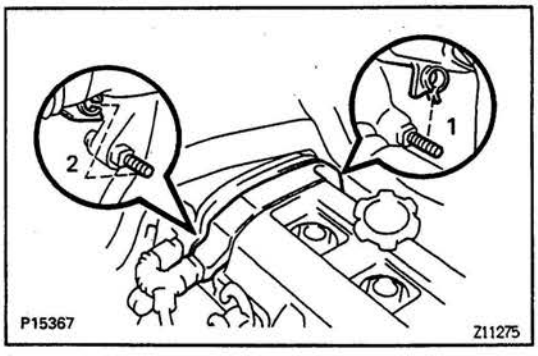
(b) Disconnect the 4 injector connectors.



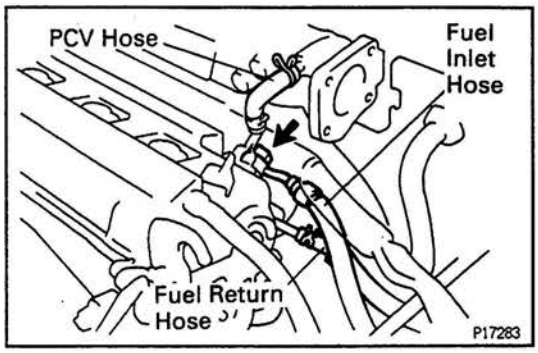
(c) Disconnect the engine wire protector from the 2 brackets on the front side of the intake manifold.



(d) Remove the 2 bolts, and disconnect the engine wire protector from the alternator bracket and adjusting bar.



(e) Disconnect the engine wire protector from the 2 mounting bolts of the No.2 timing belt cover in the sequence shown.

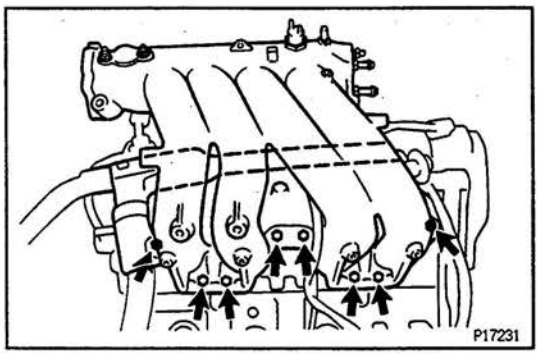


16. DISCONNECT FUEL INLET HOSE FROM DELIVERY PIPE

Remove the union bolt and 2 gaskets, and disconnect the inlet hose from the delivery pipe.

17. DISCONNECT FUEL RETURN HOSE FROM RETURN PIPE

18. DISCONNECT PCV HOSE FROM INTAKE MANIFOLD

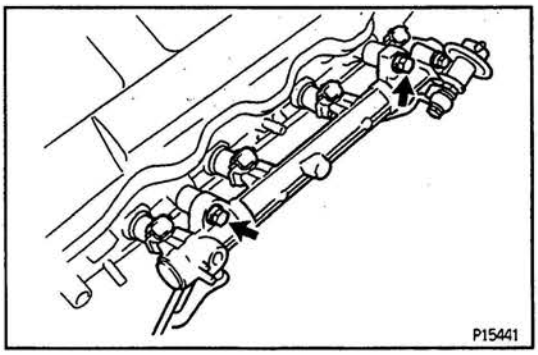


19. REMOVE INTAKE MANIFOLD

(a) Remove the 6 bolts and 2 nuts.

(b) Disconnect the engine wire between the intake manifold and cylinder head.

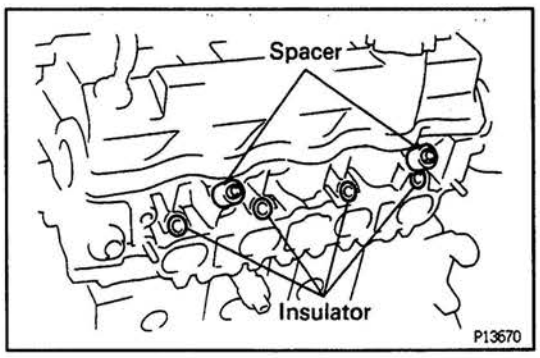
(c) Remove the intake manifold and gasket.



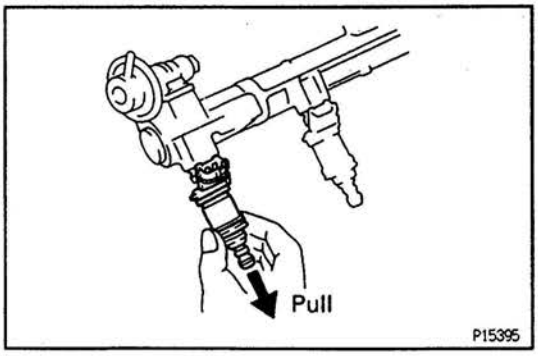
20. REMOVE DELIVERY PIPE AND INJECTORS

(a) Remove the 2 bolts and delivery pipe together with the 4 injectors.

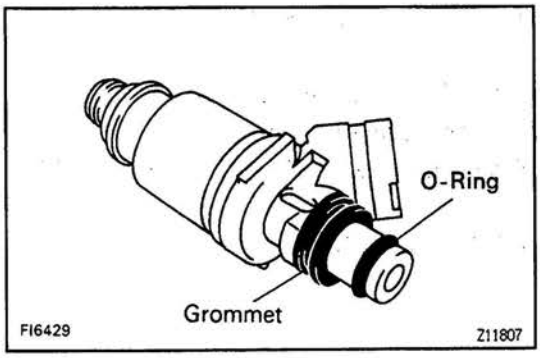
NOTICE: Be careful not to drop the injectors when removing the delivery pipe.



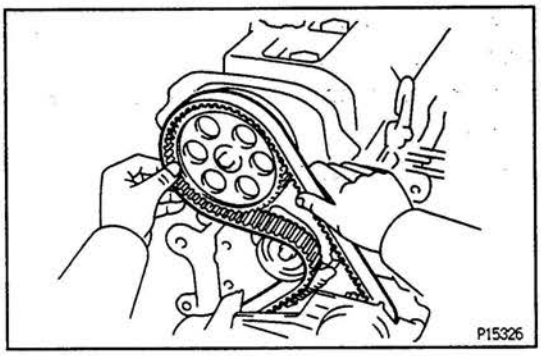
(b) Remove the 4 insulators and 2 spacers from the cylinder head.



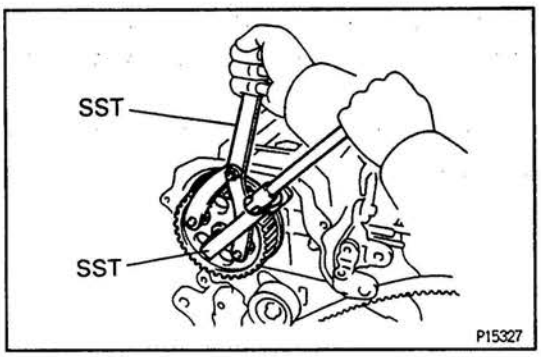
(c) Pull out the 4 injectors from the delivery pipe.



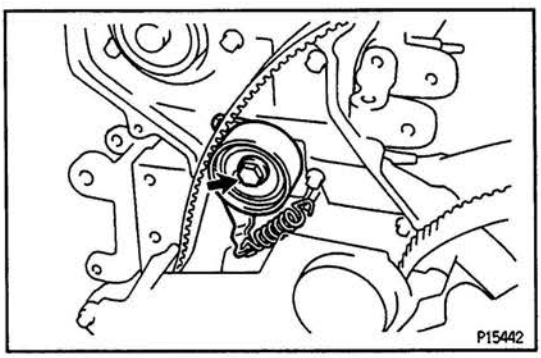
(d) Remove the O–ring and grommet from each injector.



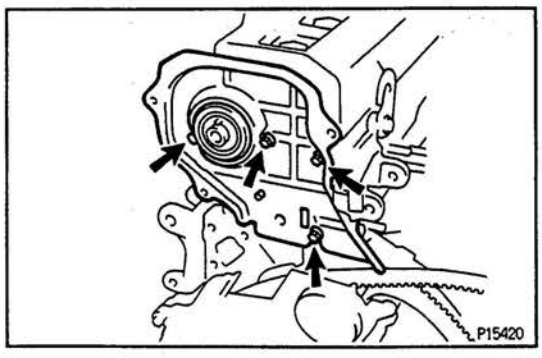
21. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEY
(See steps 4 to 6 on pages EG–36 and 37)



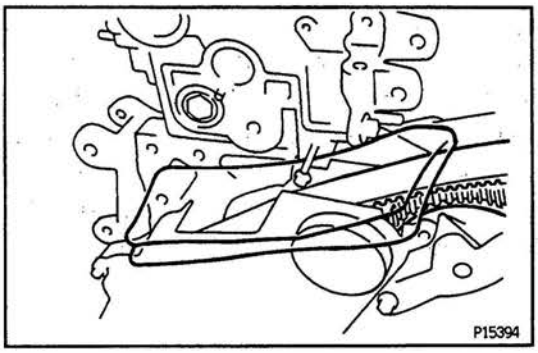
22. REMOVE CAMSHAFT TIMING PULLEY
Using SST, remove the bolt and timing pulley.
SST 09249–63010, 09960–10010 (09962–01000, 09963–01000)



23. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING
Remove the bolt, pulley and tension spring.



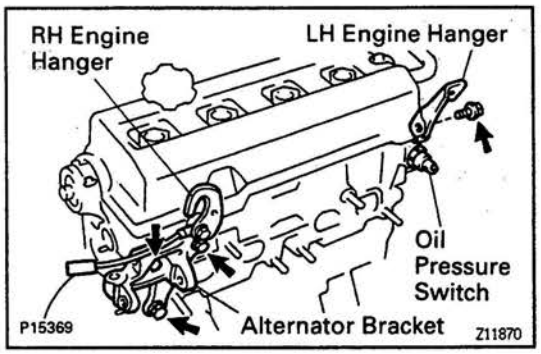
24. REMOVE NO.3 TIMING BELT COVER
Remove the 4 bolts and timing belt cover.



NOTICE:

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

EG

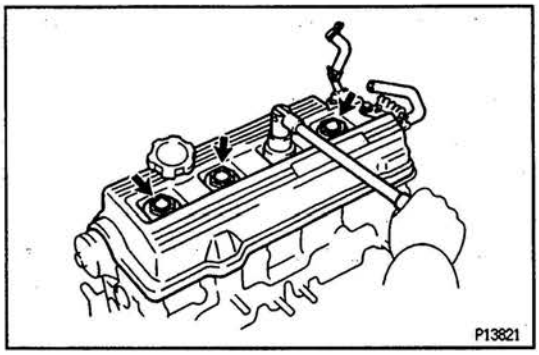


25. REMOVE ENGINE HANGERS AND ALTERNATOR BRACKET

(a) Remove the 3 bolts, the alternator bracket and RH engine hanger assembly.

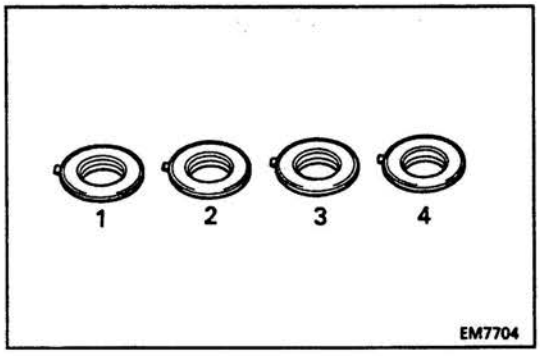
(b) Remove the bolt and LH engine hanger.

26. REMOVE OIL PRESSURE SWITCH

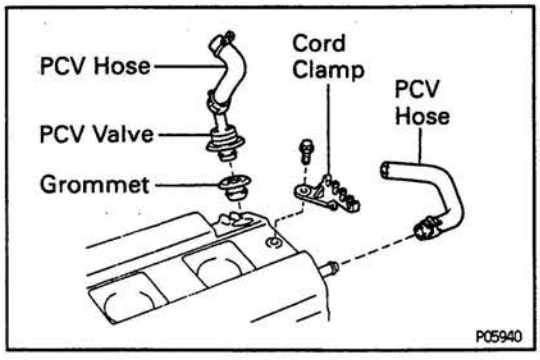


27. REMOVE CYLINDER HEAD COVER

Remove the 4 nuts, grommets, head cover and gasket.



HINT: Arrange the grommets in the correct order, so that they can be reinstalled into their original positions. This minimizes any possibility of oil leakage due to reuse of the grommets in different positions.



28. REMOVE HIGH—TENSION CORD CLAMP, PCV VALVE AND HOSES FROM CYLINDER HEAD COVER

(a) Remove the bolt and high—tension cord clamp.

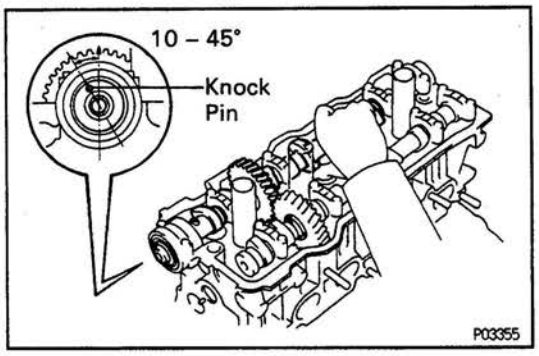
(b) Remove the PCV valve, hose assembly and grommet.

(c) Remove the PCV hose.

EG

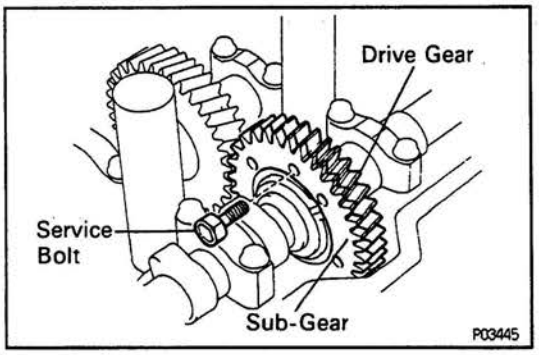
29. REMOVE CAMSHAFTS

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

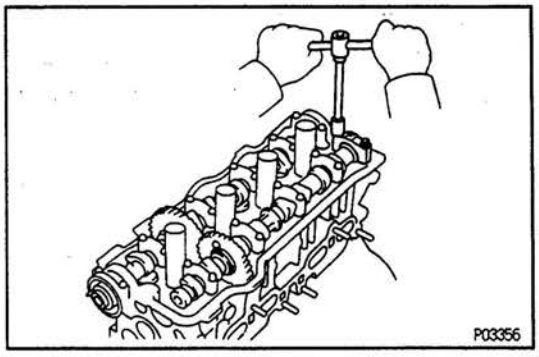


A. Remove exhaust camshaft

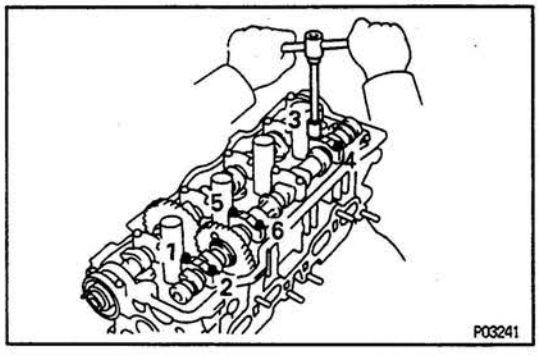
(a) Set the knock pin of the intake camshaft at 10 — 45° BTDC of camshaft angle.
HINT: The above angle allows No.2 and No.4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



(b) Secure the exhaust camshaft sub—gear to drive gear with a service bolt.
Recommended service bolt:
Thread diameter: 6 mm
Thread pitch: 1.0 mm
Bolt length: 16 — 20 mm (0.63 — 0.79 in.)
HINT: When removing the camshaft, make sure that the torsional spring force of the sub—gear has been eliminated by the above operation.

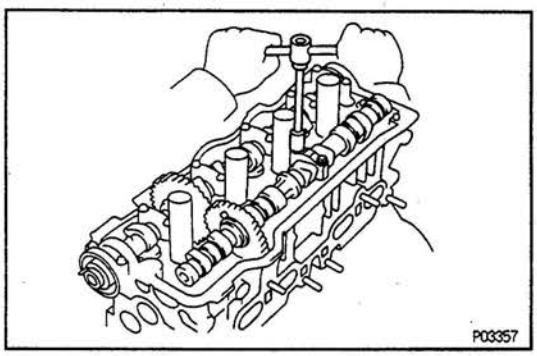


(c) Remove the 2 bolts and rear bearing cap.



(d) Uniformly loosen and remove the 6 bolts on the No.1, No.2 and No.4 bearing caps in several passes, in the sequence shown.
NOTICE: Do not remove the No.3 bearing cap bolts at this stage.

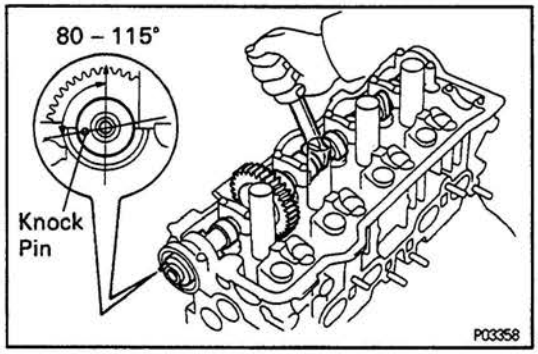
(e) Remove the No.1, No.2 and No.4 bearing caps.



(f) Alternately loosen and remove the 2 bolts on the No.3 bearing cap.
HINT:
- As the 2 No.3 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level.
- If the camshaft is not being lifted out straight and level, retighten the 2 No.3 bearing cap bolts. Then reverse the order of above steps from (f) to (a) and reset the knock pin of the intake camshaft at 10 — 45° BTDC, and repeat steps from (b) to (f) once again.

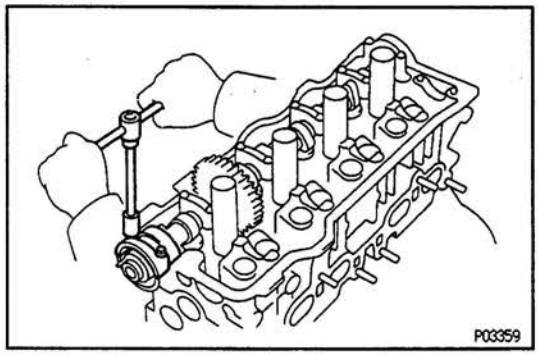
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.

(g) Remove the No.3 bearing cap and exhaust camshaft.

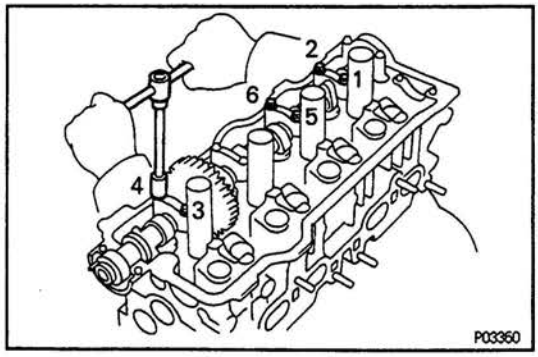


B. Remove intake camshaft

(a) Set the knock pin of the intake camshaft at 80 — 115° BTDC of camshaft angle.
HINT: The above angle allows the No.1 and No.3 cylinder cam lobes of intake camshaft to push their valve lifters evenly.



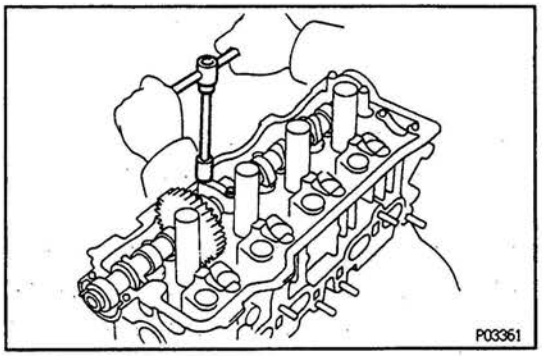
(b) Remove the 2 bolts, front bearing cap and oil seal.



(c) Uniformly loosen and remove the 6 bolts on the No.1, No.3 and No.4 bearing caps in several passes, in the sequence shown.
NOTICE: Do not remove the No.2 bearing cap bolts at this stage.

(d) Remove the No.1, No.3 and No.4 bearing caps.

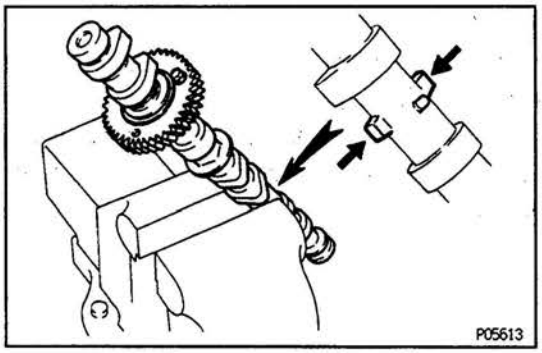
EG



(e) Alternately loosen and remove the 2 bolts on the No.2 bearing cap.
HINT:
- As the 2 No.2 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level, after breaking adhesion on the front bearing cap.
- If the camshaft is not being lifted out straight and level, retighten the 2 No.2 bearing cap bolts. Reverse the order of above steps from (e) to (a) and reset the knock pin of the intake camshaft at 80 — 115° BTDC, and repeat steps from (b) to (e) once again.

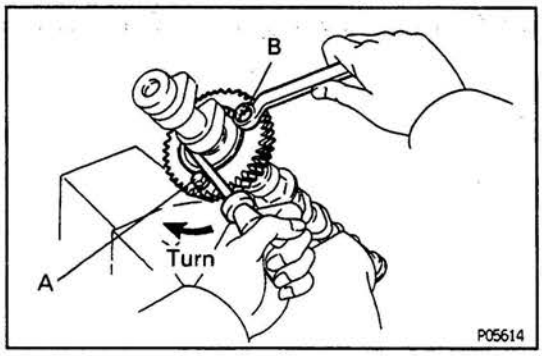
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.

(f) Remove the No.2 bearing cap and camshaft.



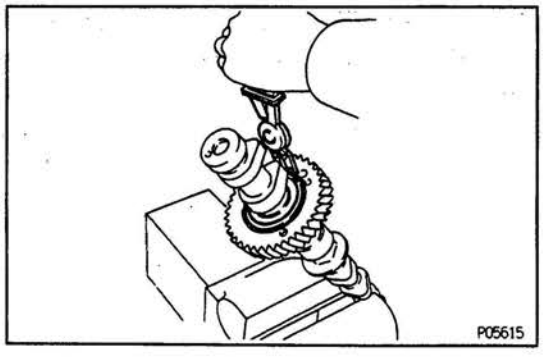
30. DISASSEMBLE EXHAUST CAMSHAFT

(a) Mount the camshaft in a vise.
NOTICE: Be careful not to damage the camshaft.

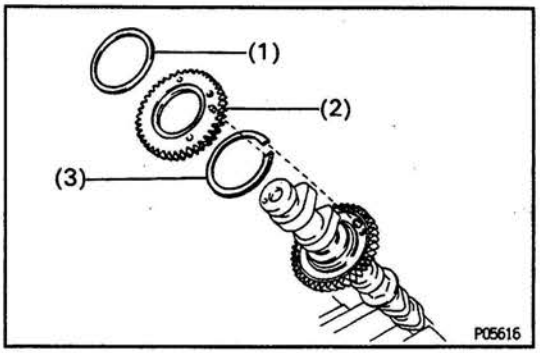


(b) Insert service bolt A into the service hole of the camshaft sub—gear.

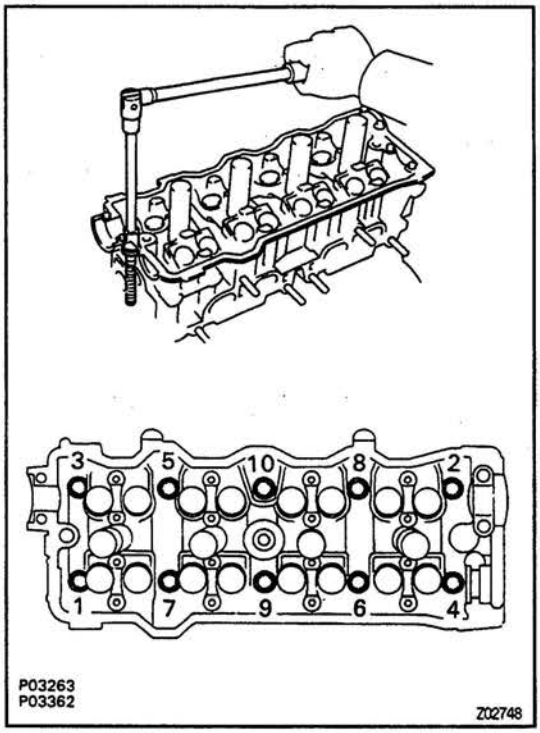
(c) Using a screwdriver, turn the sub—gear clockwise, and remove service bolt B.
NOTICE: Be careful not to damage the camshaft.



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

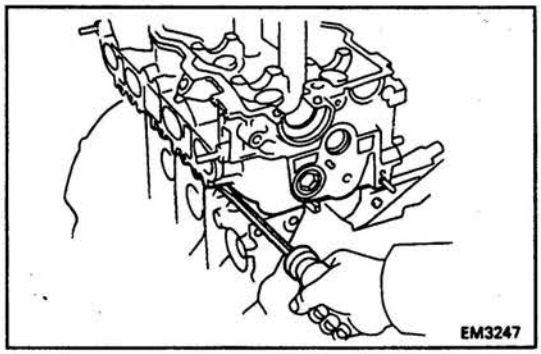


(e) Remove the following parts:
(1) Wave washer
(2) Camshaft sub–gear
(3) Camshaft gear spring



31. REMOVE CYLINDER HEAD

(a) Uniformly loosen and remove the 10 cylinder head bolts in several passes, in the sequence shown.
NOTICE: Cylinder head warpage or cracking could result from removing bolts in incorrect order.

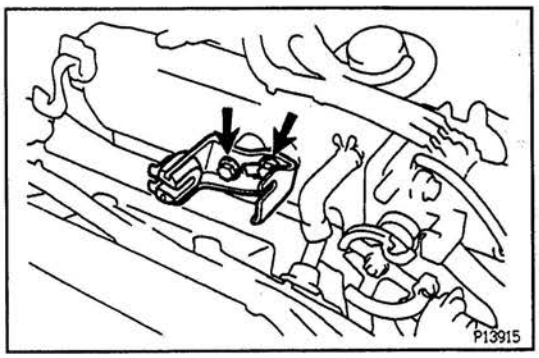


(b) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.
HINT: If the cylinder head is off, pry between the cylinder head and cylinder block with a screwdriver.
NOTICE: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

EG

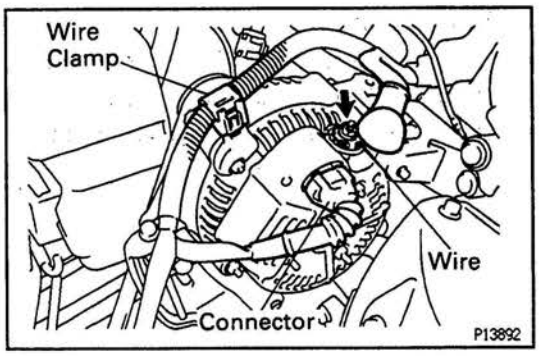
CYLINDER HEAD REMOVAL (ST191)

5G3W2-01

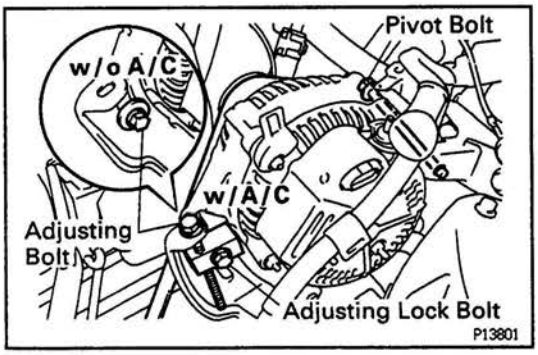


(See Components for Removal and Installation)

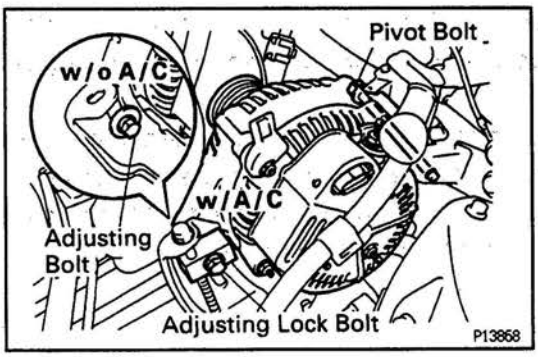
1. DRAIN ENGINE COOLANT
2. REMOVE ACCELERATOR CABLE BRACKET
   Remove the 2 bolts and accelerator cable bracket.



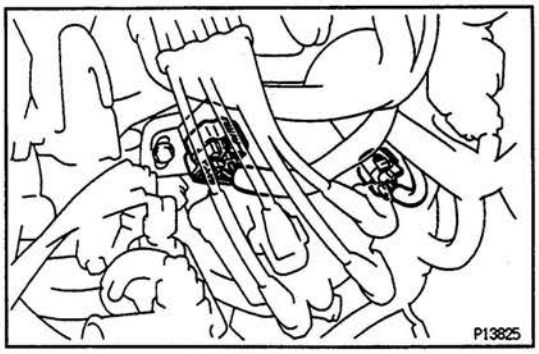
3. REMOVE ALTERNATOR
   (a) Disconnect the wire clamp from the clip on the alternator.
   (b) Disconnect the alternator connector.
   (c) Remove the rubber cap and nut, and disconnect the alternator wire.



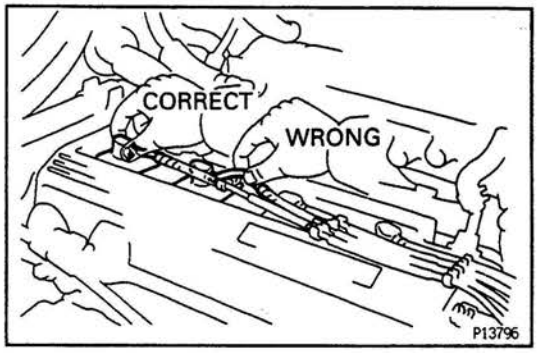
   (d) Loosen the adjusting lock bolt (w/ A/C), adjusting bolt and pivot bolt.
   (e) Remove the drive belt.



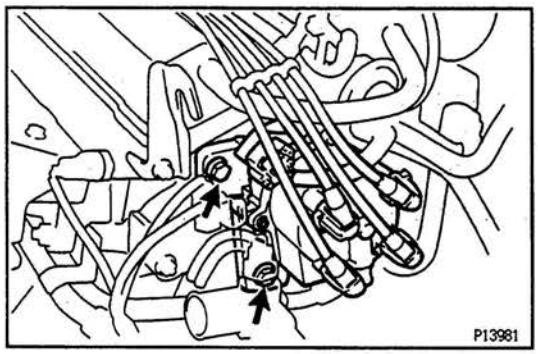
   (f) Remove the adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C) and pivot bolt.
   (g) Remove the alternator.



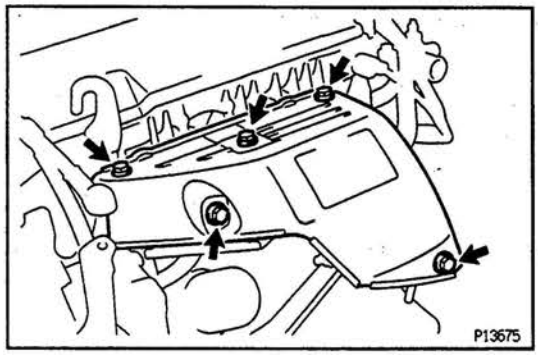
4. REMOVE DISTRIBUTOR
   (a) Disconnect the 2 distributor connectors.



(b) Disconnect the high–tension cords at rubber boot. Do not pull on the cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.

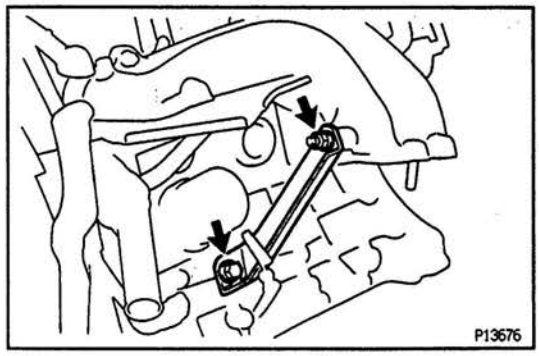


(c) Remove the 2 bolts, and pull out the distributor.

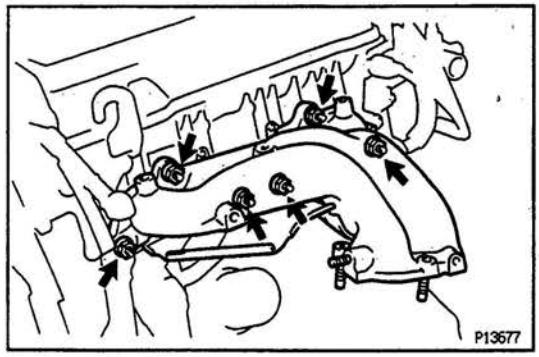


5. REMOVE EXHAUST MANIFOLD

(a) Remove the 5 bolts and upper heat insulator.

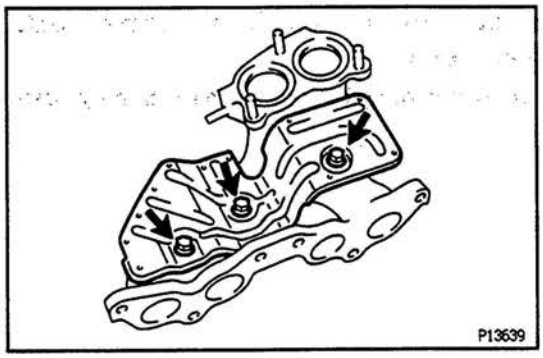


(b) Remove the bolt, nut and manifold stay.

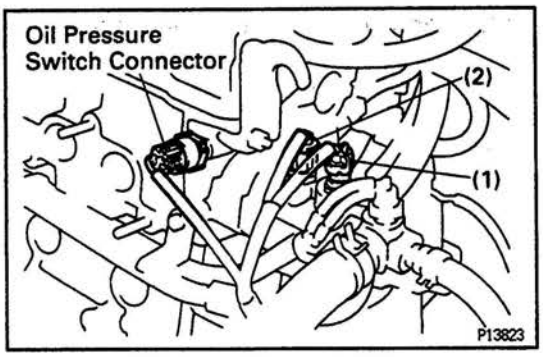


(c) Remove the 6 nuts, exhaust manifold and gasket.

EG



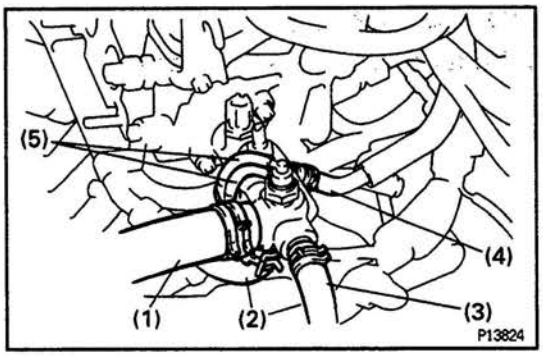
(d) Remove the 3 bolts and lower heat insulator.



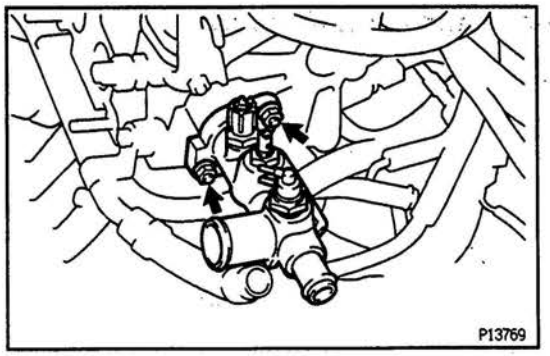
6. DISCONNECT OIL PRESSURE SWITCH CONNECTOR

7. REMOVE WATER OUTLET

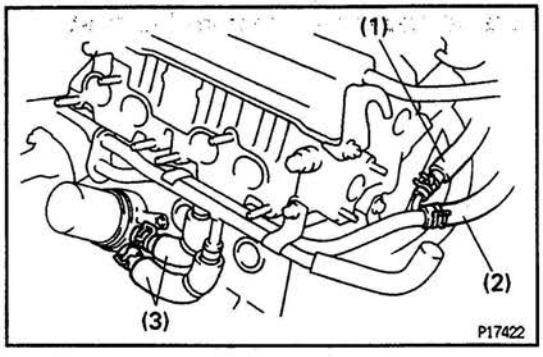
(a) Disconnect the following connectors:
(1) Water temperature sender gauge connector
(2) Water temperature sensor connector



(b) Disconnect the following hoses from the water outlet:
(1) Upper radiator hose
(2) Water bypass pipe hose
(3) Heater water hose
(4) ISC water bypass hose
(5) w/ EVAP:
2 BVSV vacuum hoses

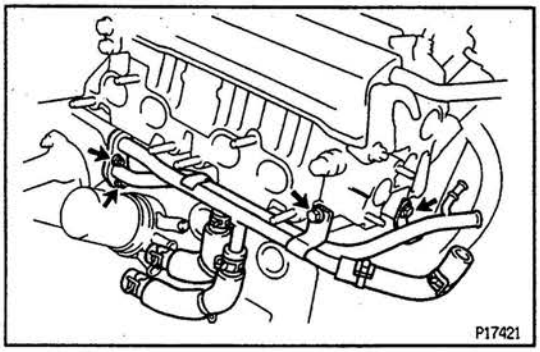


(c) Remove the 2 nuts, water outlet and gasket.

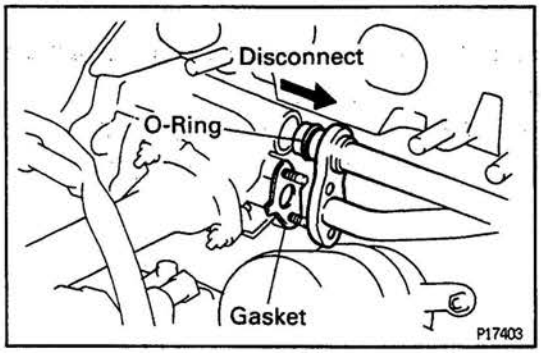


8. REMOVE WATER BYPASS PIPE

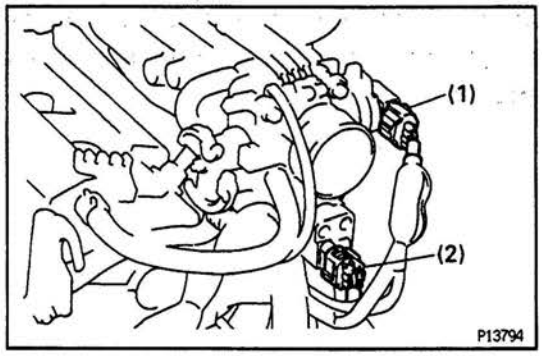
(a) Disconnect the following hoses:
(1) ISC valve water bypass hose from water bypass pipe
(2) Heater water hose from water bypass pipe
(3) w/ Oil cooler:
2 oil cooler water bypass hoses from oil cooler



(b) Remove the 2 bolts and 2 nuts.

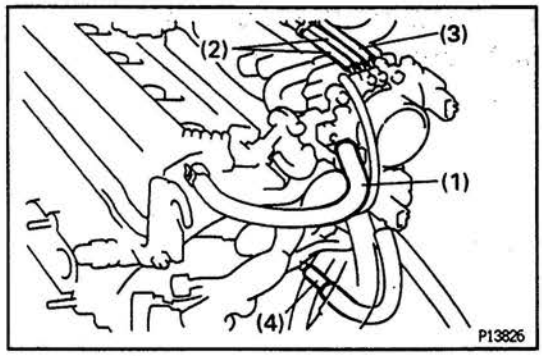


(c) Disconnect the water bypass pipe from the water pump cover, and remove the water bypass pipe.
(d) Remove the gasket and O—ring.

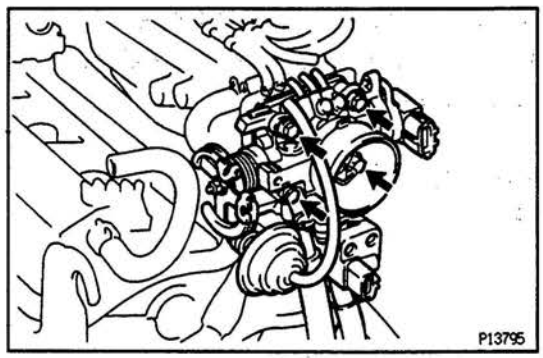


9. REMOVE THROTTLE BODY

(a) Disconnect the following connectors:
(1) Throttle position sensor connector
(2) ISC valve connector

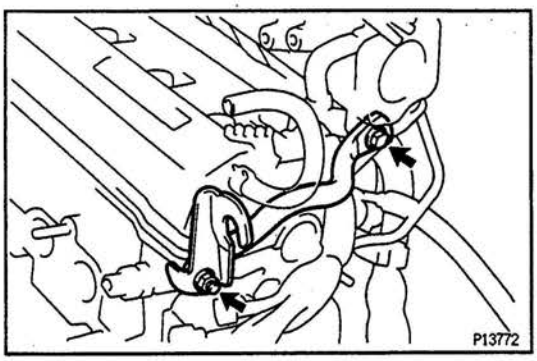


(b) Disconnect the following hoses:
(1) PCV hose from throttle body
(2) w/ EGR:
2 vacuum hoses from throttle body
(3) w/ EVAP:
Vacuum hose from throttle body
(4) Air hose from air tube



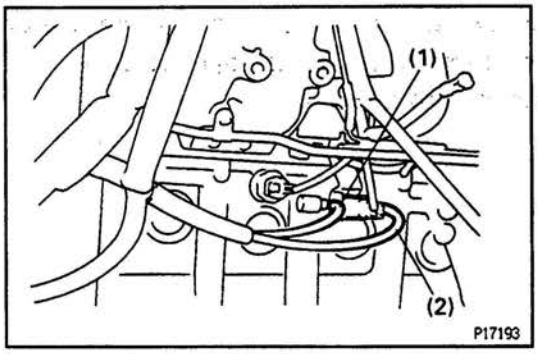
(c) Type A:
Remove the 4 bolts.
(d) Type B:
Remove the 2 bolts and 2 nuts.
(e) Remove the throttle body and gasket.

EG



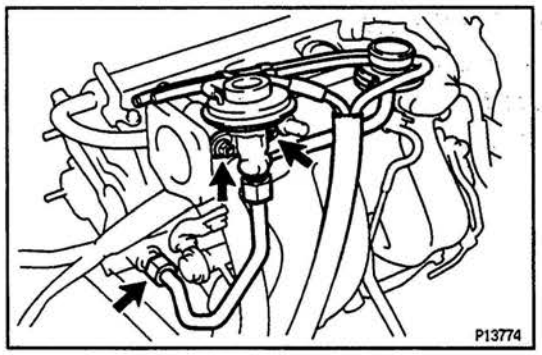
10. REMOVE LH ENGINE HANGER AND NO.2 INTAKE MANIFOLD STAY

Remove the bolt, nut, engine hanger and manifold stay.

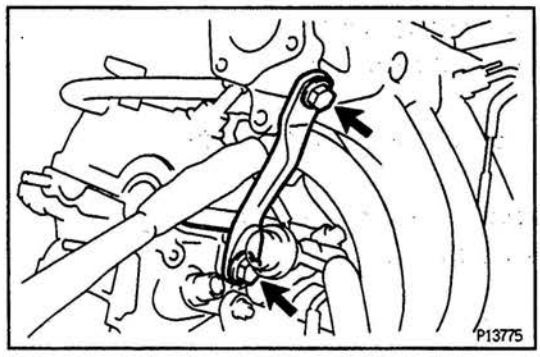


11. w/ EGR:
REMOVE EGR VALVE AND VACUUM MODULATOR

(a) Disconnect the following hoses:
(1) Vacuum hose from port E of VSV for EGR
(2) Vacuum hose from port G of VSV for EGR

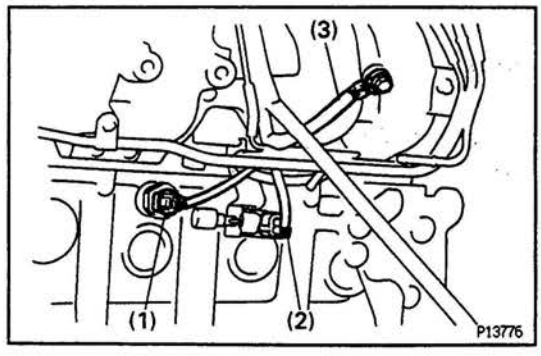


(b) Loosen the union nut of the EGR pipe, and remove the 2 nuts, EGR valve, vacuum modulator, vacuum hoses assembly and gasket.



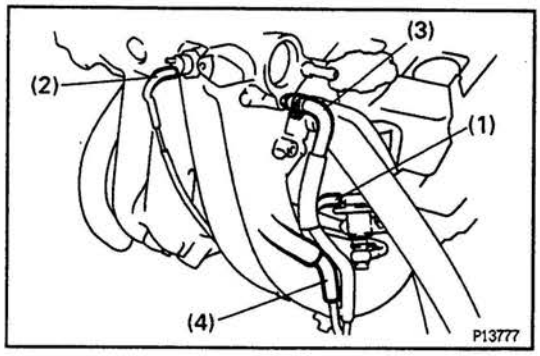
12. REMOVE NO.1 INTAKE MANIFOLD STAY

Remove the 2 bolts and manifold stay.



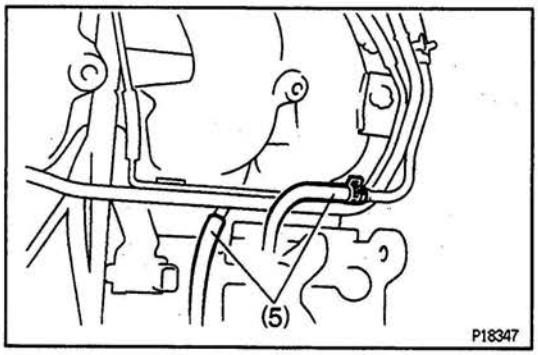
13. DISCONNECT CONNECTORS AND CABLE

Disconnect the following connectors and cable:
(1) Knock sensor connector
(2) w/ EGR:
VSV connector for EGR
(3) Ground cable

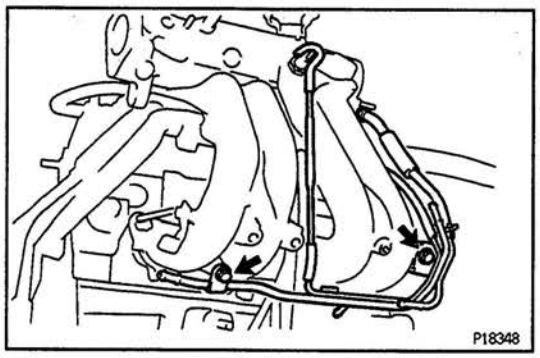


14. REMOVE AIR TUBE

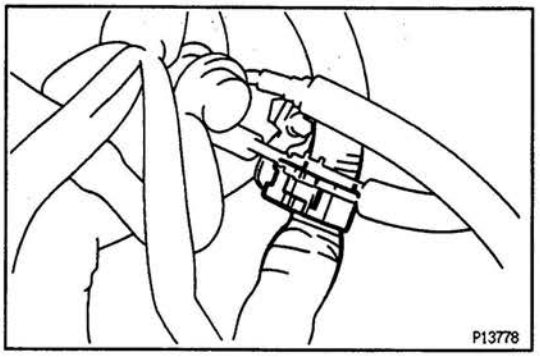
(a) Disconnect the following hoses:
- (1) Vacuum sensing hose from fuel pressure regulator
- (2) Vacuum sensing hose from gas filter
- (3) Air hose for PS air control valve from intake manifold
- (4) Air hose for A/C idle–up valve from air tube



- (5) 2 air hoses for PS air control valve from air tube

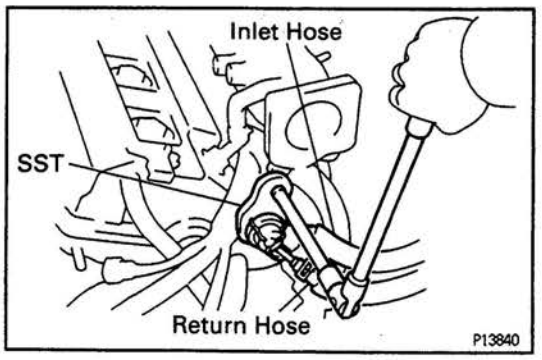


(b) Remove the 2 bolts and air tube.



15. DISCONNECT FUEL INLET HOSE FROM DELIVERY PIPE

(a) Disconnect the clamp of the engine wire from the wire bracket.

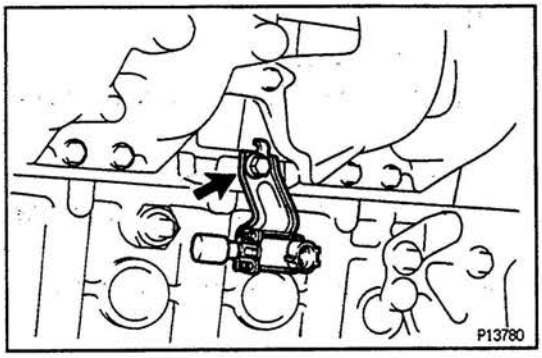


(b) Using SST, loosen the fuel pulsation damper.
SST 09612–24014 (09617–24011)

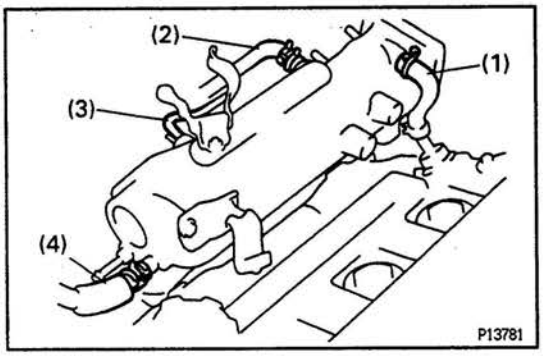
(c) Remove the fuel pulsation damper and 2 gaskets, and disconnect the fuel inlet hose from the delivery pipe.

16. DISCONNECT FUEL RETURN HOSE FROM RETURN PIPE

EG

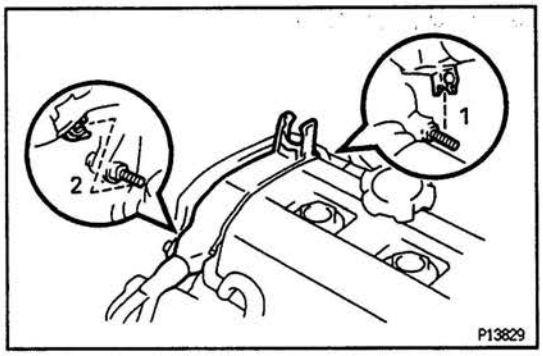


17. w/ EGR:
REMOVE VSV FOR EGR
Remove the bolt and VSV.

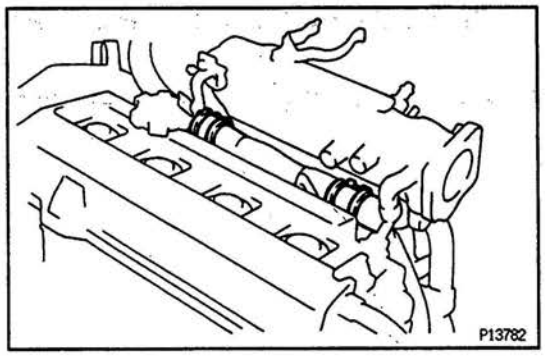


18. REMOVE INTAKE MANIFOLD

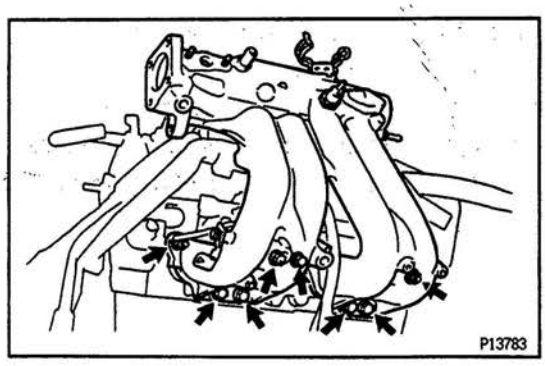
(a) Disconnect the following hoses:
(1) PCV hose from intake manifold
(2) Air hose for A/C idle—up valve from intake manifold
(3) Vacuum hose for vacuum sensor from gas filter
(4) Vacuum hose for brake booster from intake manifold



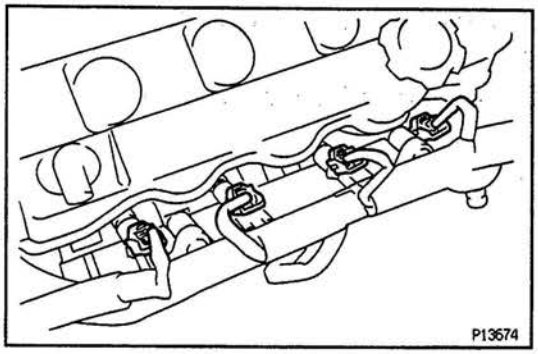
(b) Disconnect the 2 clamps of the engine wire protector from the mounting bolts of the No.2 timing belt cover in the sequence shown.



(c) Disconnect the 2 clamps of the engine wire from the wire brackets on the intake manifold.

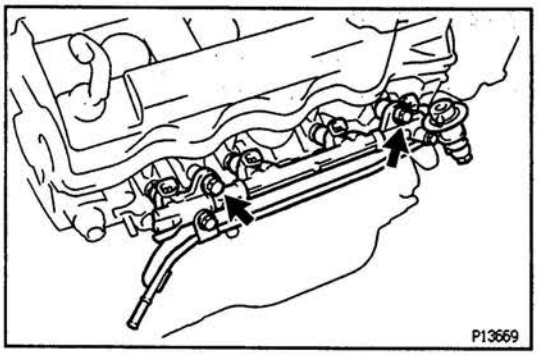


(d) Remove the 6 bolts, 2 nuts, intake manifold and gasket.



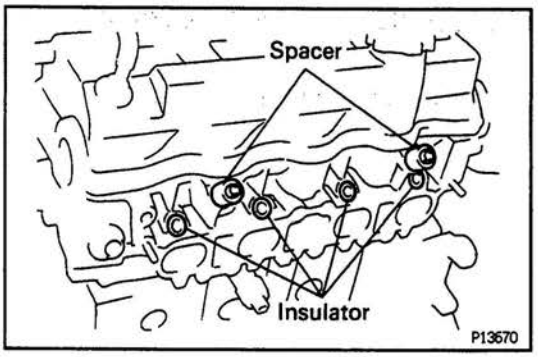
19. REMOVE DELIVERY PIPE AND INJECTORS

(a) Disconnect the 4 injector connectors.

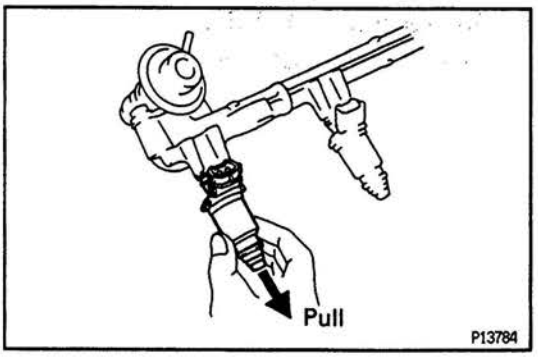


(b) Remove the 2 bolts and delivery pipe together with the 4 injectors.

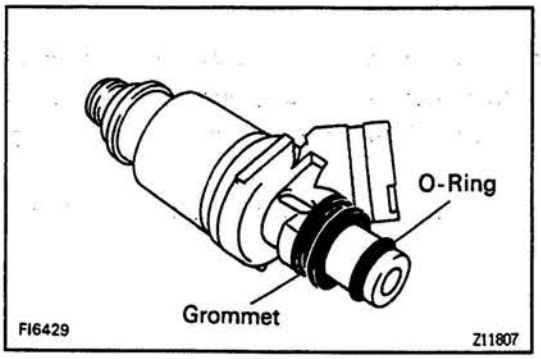
NOTICE: Be careful not to drop the injectors when removing the delivery pipe.



(c) Remove the 4 insulators and 2 spacers from the cylinder head.

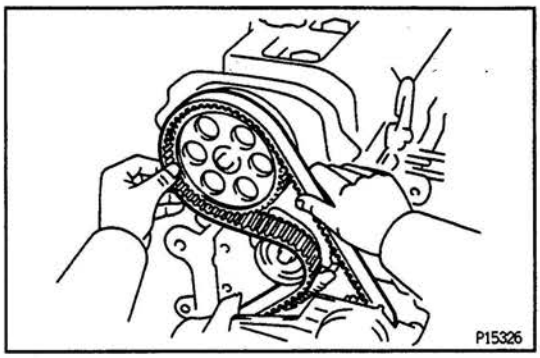


(d) Pull out the 4 injectors from the delivery pipe.

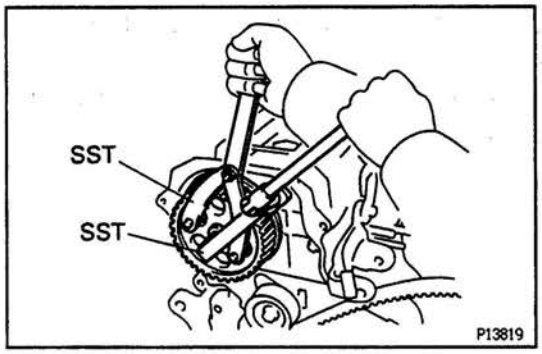


(e) Remove the O–ring and grommet from each injector.

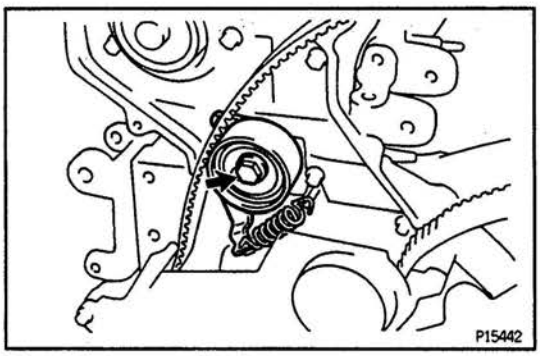
EG



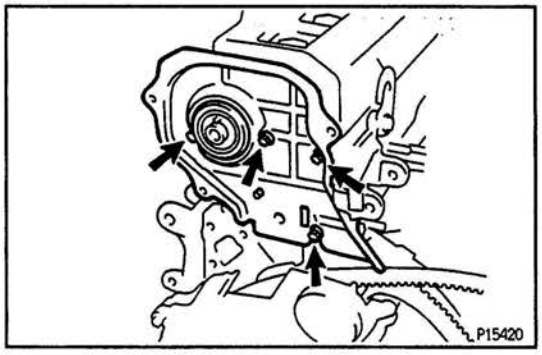
20. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEY
(See steps 4 to 6 on pages EG–36 and 37)



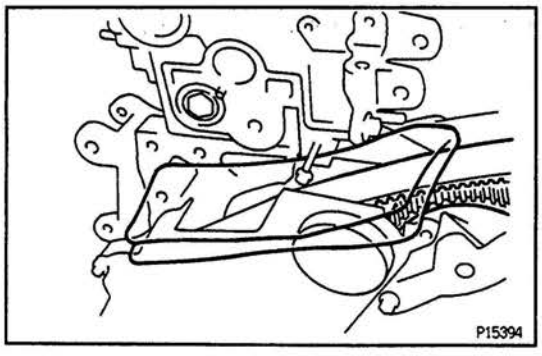
21. REMOVE CAMSHAFT TIMING PULLEY
Using SST, remove the bolt and timing pulley.
SST 09249–63010, 09960–10010 (09963–01000)



22. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING
Remove the bolt, pulley and tension spring.

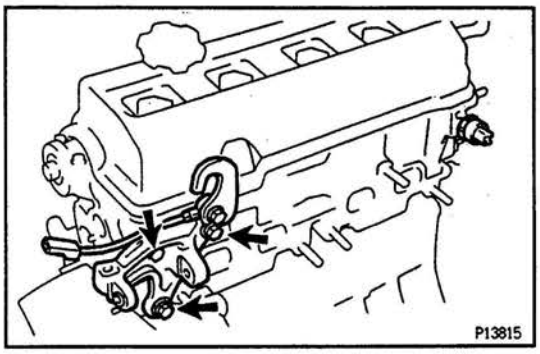


23. REMOVE NO.3 TIMING BELT COVER
Remove the 4 bolts and timing belt cover.



NOTICE:

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



24. REMOVE ALTERNATOR BRACKET AND RH ENGINE HANGER

Remove the 3 bolts, alternator bracket and engine hanger assembly.

25. REMOVE OIL PRESSURE SWITCH

26. REMOVE CYLINDER HEAD COVER
(See step 27 on page EG–61)

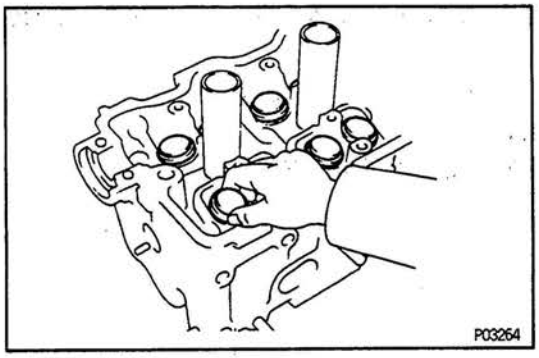
27. REMOVE HIGH – TENSION CORD CLAMP, PCV VALVE AND HOSE FROM CYLINDER HEAD COVER
(See step 28 on page EG–61)

28. REMOVE CAMSHAFTS
(See step 29 on page EG–62)

29. DISASSEMBLE EXHAUST CAMSHAFT
(See step 30 on page EG–64)

30. REMOVE CYLINDER HEAD
(See step 31 on page EG–65)

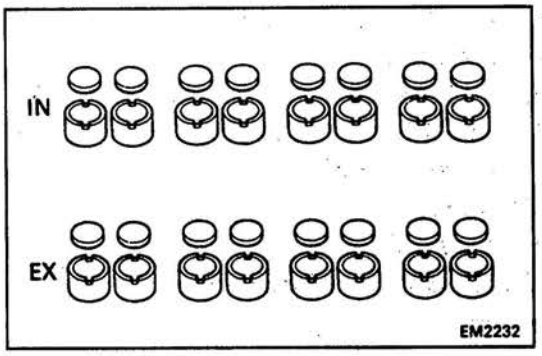
EG



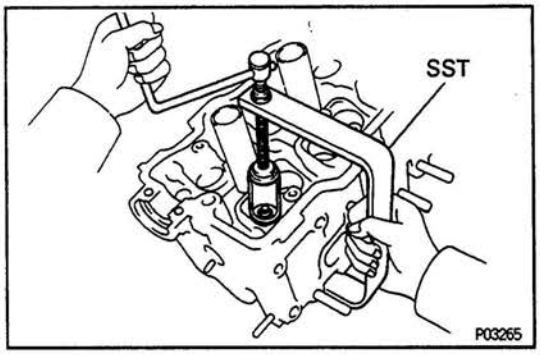
CYLINDER HEAD DISASSEMBLY

(See Components for Removal and Installation)

1. REMOVE VALVE LIFTERS AND SHIMS

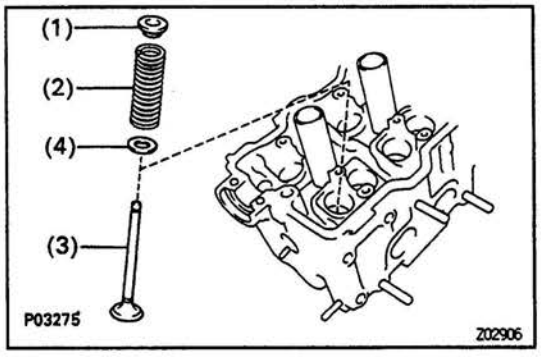


HINT: Arrange the valve lifters and shims in the correct order.

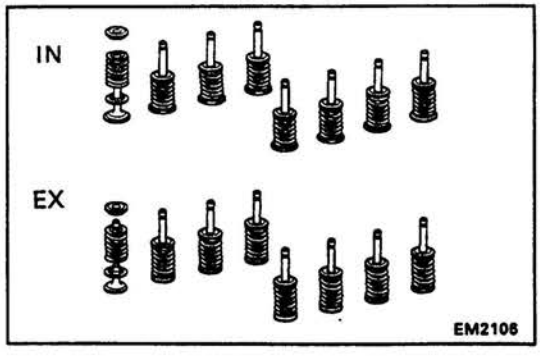


2. REMOVE VALVES

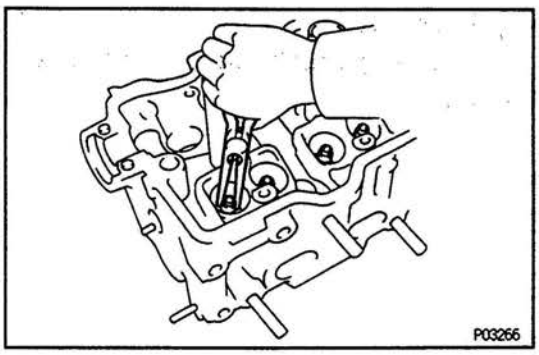
(a) Using SST, compress the valve spring and remove the 2 keepers.
SST 09202—70010



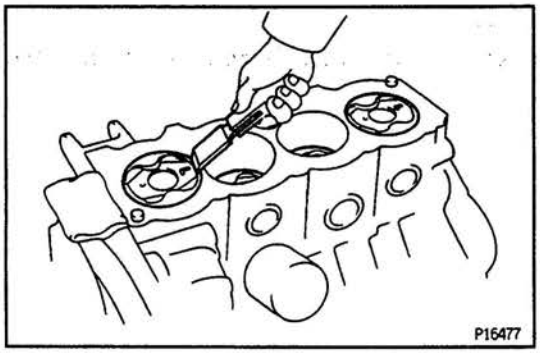
(b) Remove the following parts:
(1) Spring retainer
(2) Valve spring
(3) Valve
(4) Spring seat



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



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

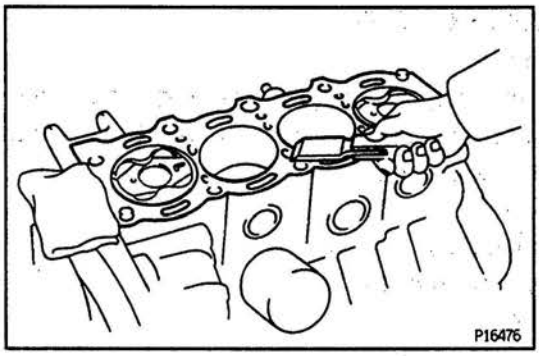


EG11D—07

CYLINDER HEAD COMPONENTS INSPECTION AND REPAIR

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

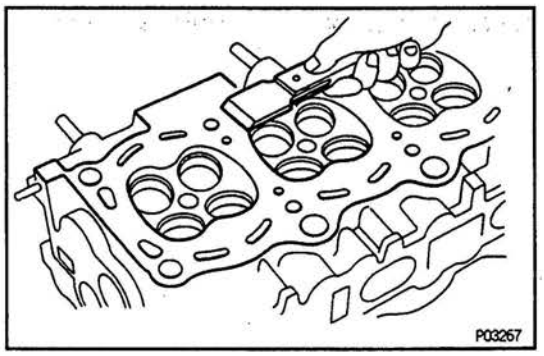
(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



(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—pressure compressed air.

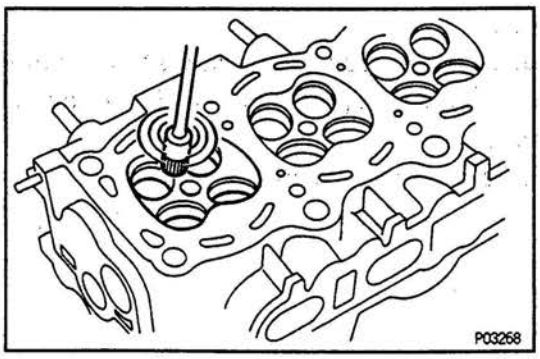


2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

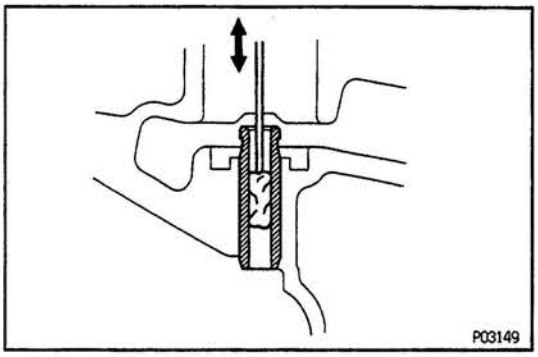
NOTICE: Be careful not to scratch the cylinder block contact surface.



B. Clean combustion chambers

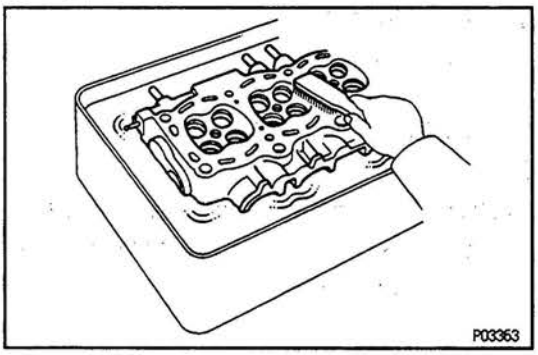
Using a wire brush, remove all the carbon from the combustion chamber.

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



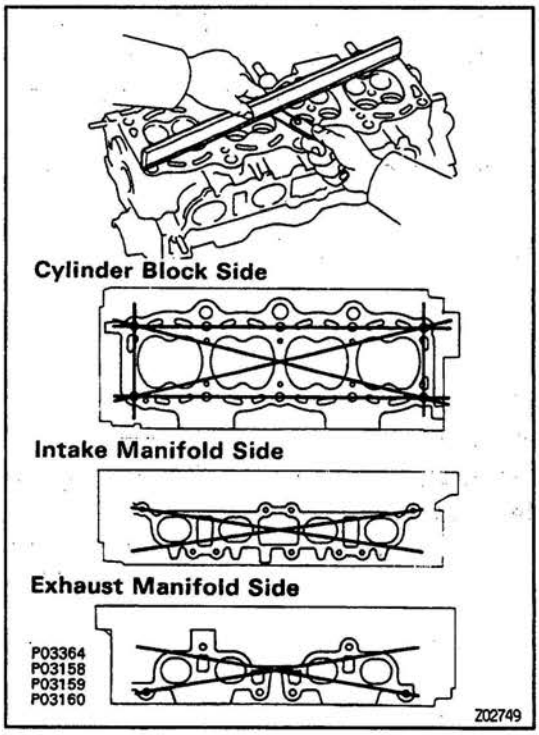
C. Clean valve guide bushings

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:

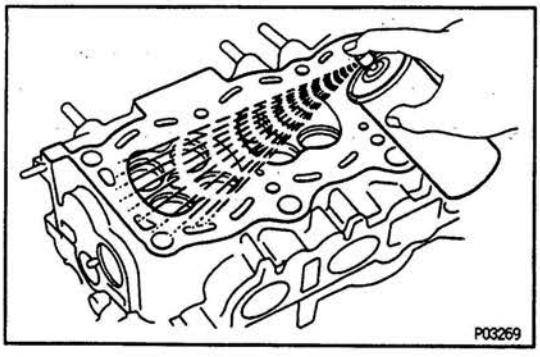
Cylinder block side

0.05 mm (0.0020 in.)

Manifold side

0.08 mm (0.0031 in.)

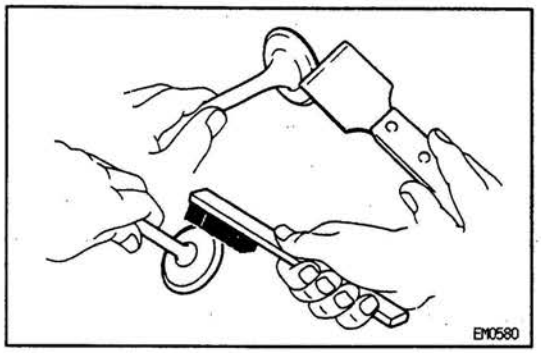
If warpage is greater than maximum, replace the cylinder head.



B. Inspect for cracks

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

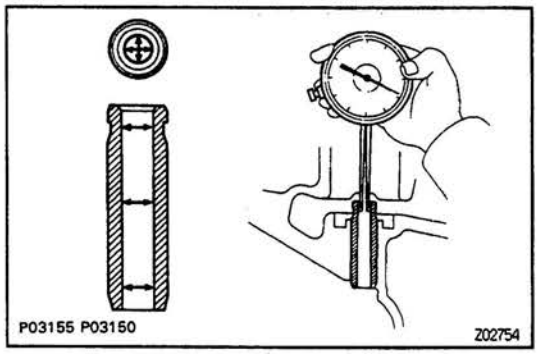
If cracked, replace the cylinder head.



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.

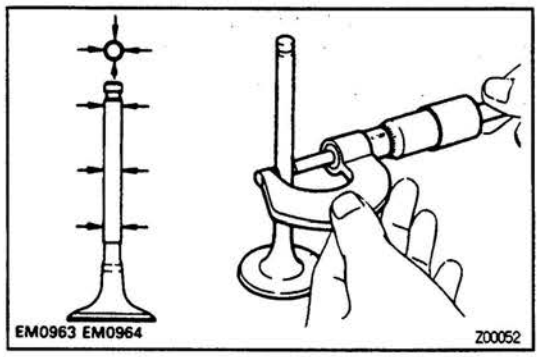


5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

6.010 – 6.030 mm (0.2366 – 0.2374 in.)



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

Valve stem diameter:

Intake

5.970 – 5.985 mm (0.2350 – 0.2356 in.)

Exhaust

5.965 – 5.980 mm (0.2348 – 0.2354 in.)

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

Standard oil clearance:

Intake

0.025 – 0.060 mm (0.0010 – 0.0024 in.)

Exhaust

0.030 – 0.065 mm (0.0012 – 0.0026 in.)

Maximum oil clearance:

Intake

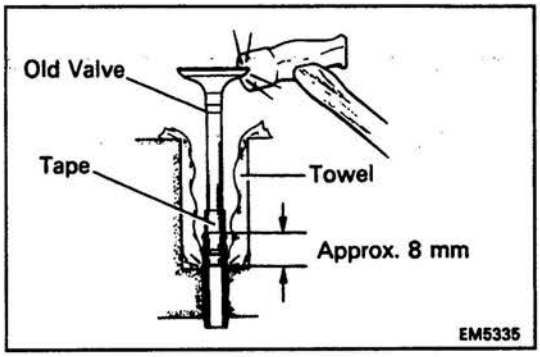
0.08 mm (0.0031 in.)

Exhaust

0.10 mm (0.0039 in.)

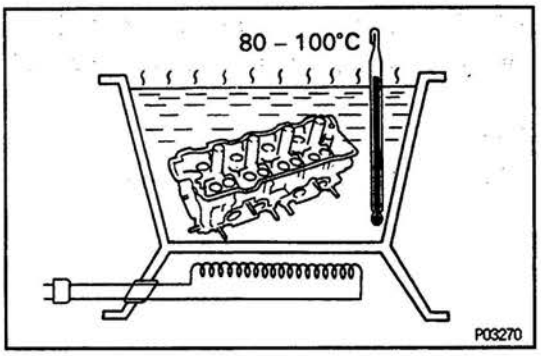
If the clearance is greater than maximum, replace the valve and guide bushing.

EG

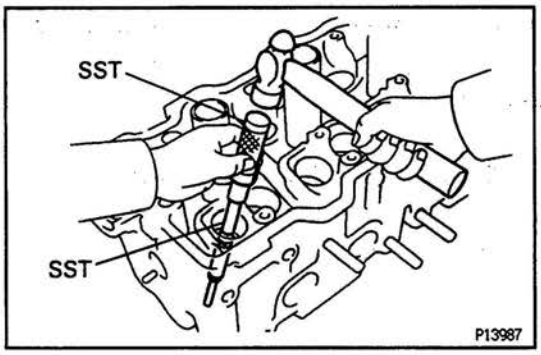


6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

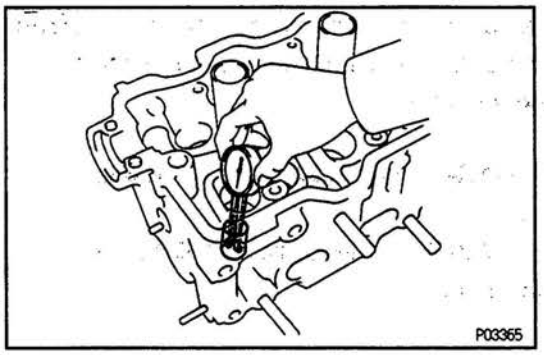
(a) Exhaust (w/ Snap Ring):
Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer. Remove the snap ring.
HINT: Wrap the tape approx. 8 mm (0.31 in.) from the valve stem end.
NOTICE: Be careful not to damage the valve lifter hole.



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



(c) Using SST and a hammer, tap out the guide bushing.
SST 09201—10000 (09201—01060),
09608—30022 (09608—05010)



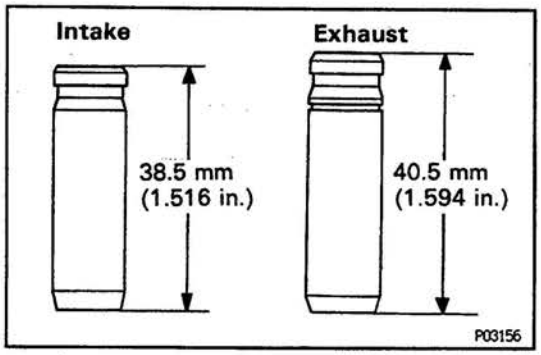
(d) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Both intake and exhaust

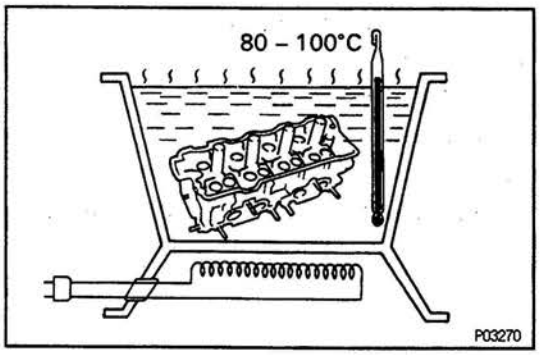
Bushing bore diameter mm (in.)	Bushing size
10.985 – 11.012 (0.4325 – 0.4335)	Use STD
11.035 – 11.062 (0.4344 – 0.4355)	Use O/S 0.05

V05053

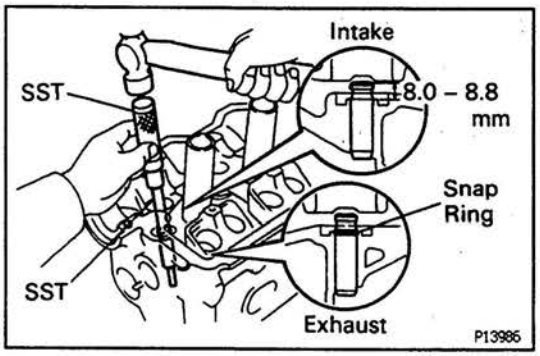
(e) Select a new guide bushing (STD or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 11.012 mm (0.4335 in.), machine the bushing bore to the following dimension:
11.035 — 11.062 mm (0.4344 — 0.4355 in.)
If the bushing bore diameter of the cylinder head is greater than 11.062 mm (0.4355 in.), replace the cylinder head.



HINT: Different bushings are used for the intake and exhaust.

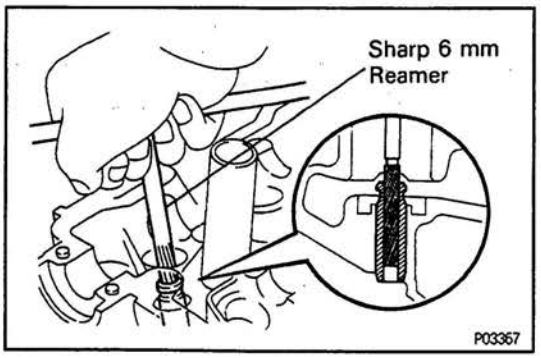


(f) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).



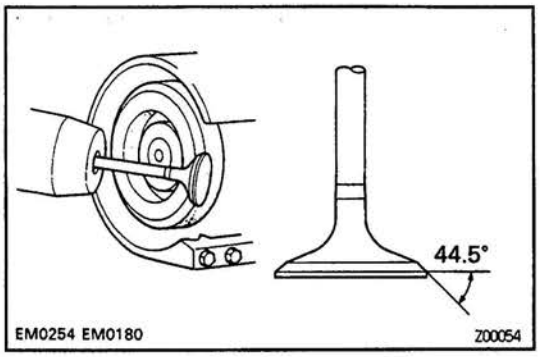
(g) Intake:
Using SST and a hammer, tap in a new guide bushing until there is 8.0 – 8.8 mm (0.315 – 0.346 in.) protruding from the cylinder head.
SST 09201–10000 (09201–01060),
09608–30022 (09608–05010)

(h) Exhaust:
Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.
SST 09201–10000 (09201–01060),
09608–30022 (09608–05010)



(i) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See step 5 on page EG–79) between the guide bushing and valve stem.

EG



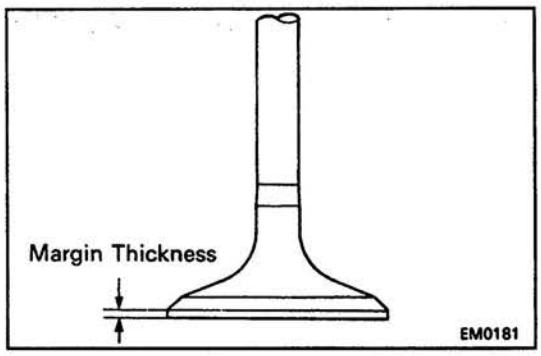
7. INSPECT AND GRIND VALVES

(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.

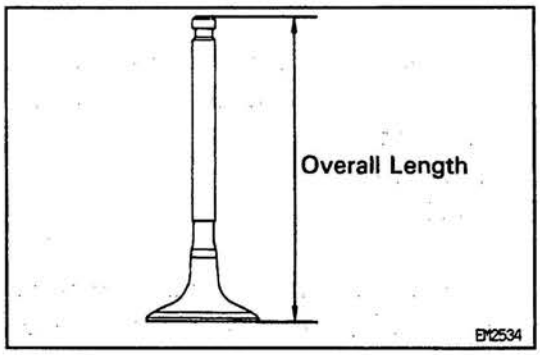
Standard margin thickness:

0.8 – 1.2 mm (0.031 – 0.047 in.)

Minimum margin thickness:

0.5 mm (0.020 in.)

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



(d) Check the valve overall length.

Standard overall length:

Intake

97.60 mm (3.8425 in.)

Exhaust

98.45 mm (3.8760 in.)

Minimum overall length:

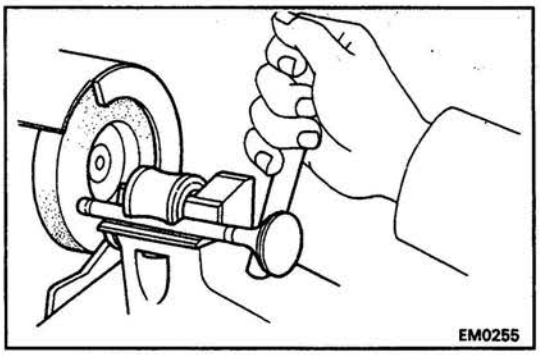
Intake

97.1 mm (3.823 in.)

Exhaust

98.0 mm (3.858 in.)

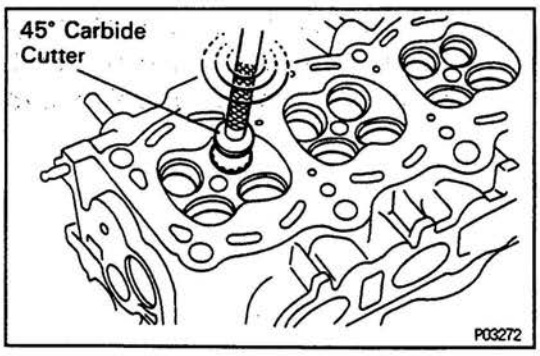
If the overall length is less than minimum, replace the valve.



(e) Check the surface of the valve stem tip for wear.

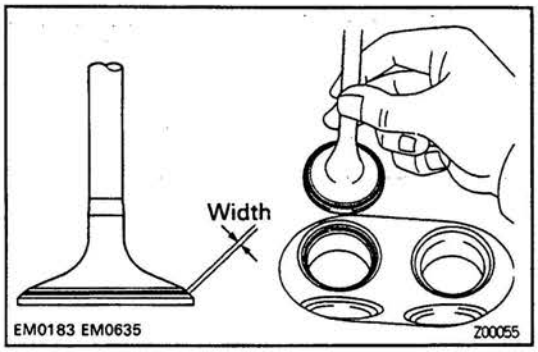
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTICE: Do not grind off more than the minimum length.



8. INSPECT AND CLEAN VALVE SEATS

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

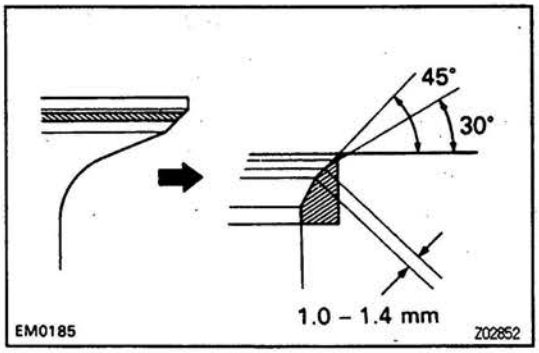


(b) Check the valve seating position.
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.

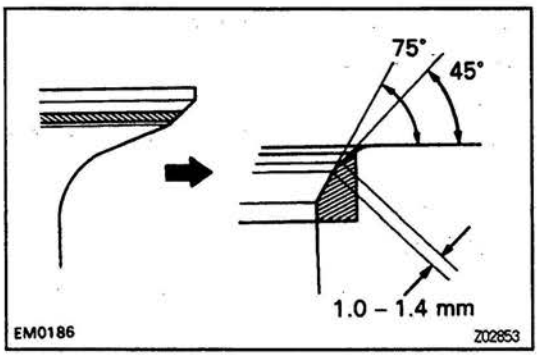
(c) Check the valve face and seat for the following:
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle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

If not, correct the valve seats as follows:

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

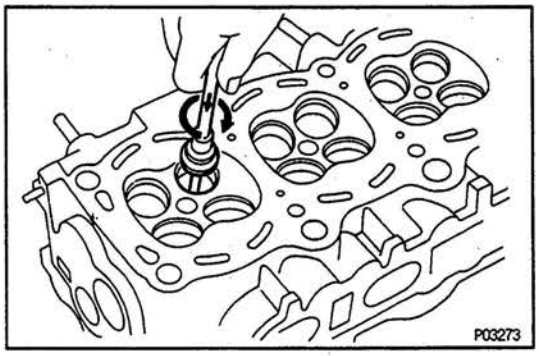


(2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



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

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



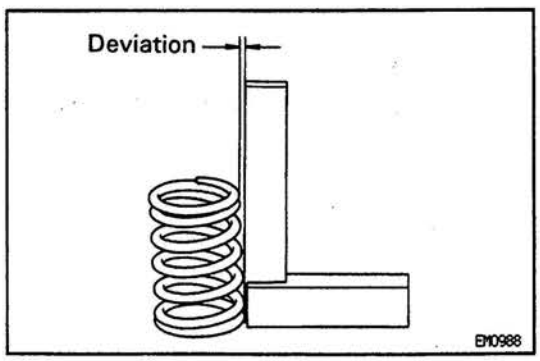
9. INSPECT VALVE SPRINGS

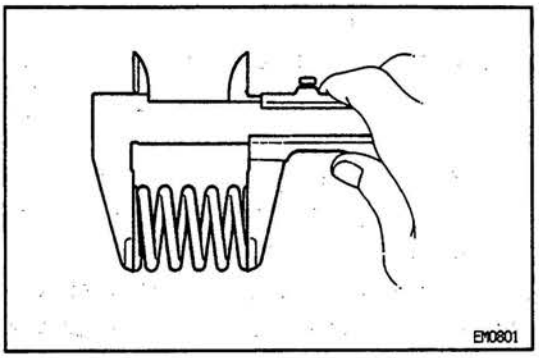
(a) Using a steel square, measure the deviation of the valve spring.

Maximum deviation:

2.0 mm (0.079 in.)

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



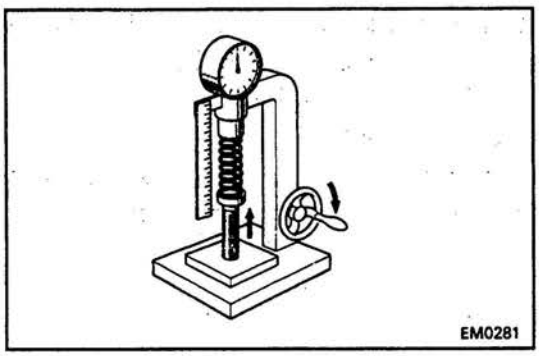


(b) Using a vernier caliper, measure the free length of the valve spring.

Free length:

41.96 – 41.99 mm (1.6520 – 1.6531 in.)

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

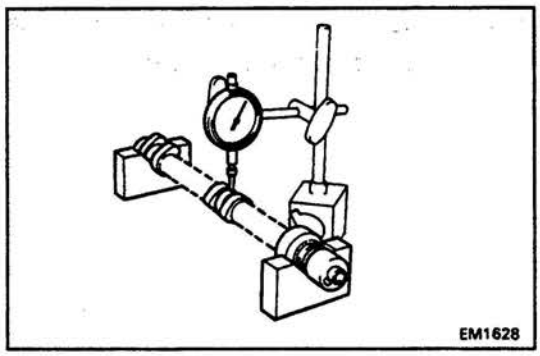


(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

164 – 189 N (16.7 – 19.3 kgf, 36.8 – 42.5 lbf)
at 34.7 mm (1.366 in.)

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



10. INSPECT CAMSHAFTS AND BEARINGS

A. Inspect camshaft for runout

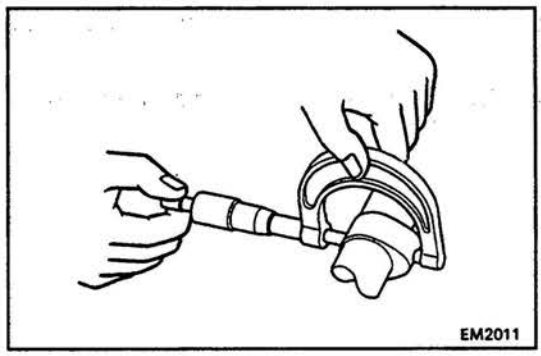
(a) Place the camshaft on V–blocks.

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

Maximum circle runout:

0.04 mm (0.0016 in.)

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



B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake

42.51 – 42.61 mm (1.6736 – 1.6776 in.)

Exhaust

40.36 – 40.46 mm (1.5890 – 1.5929 in.)

Minimum cam lobe height:

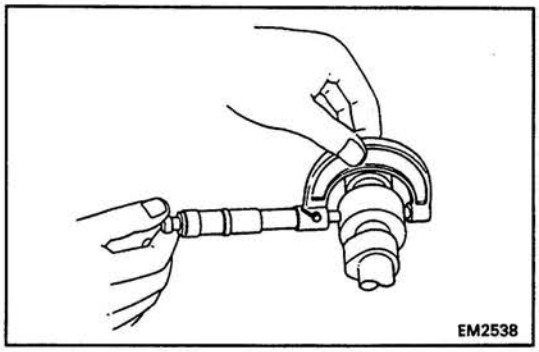
Intake

42.40 mm (1.6693 in.)

Exhaust

40.25 mm (1.5846 in.)

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



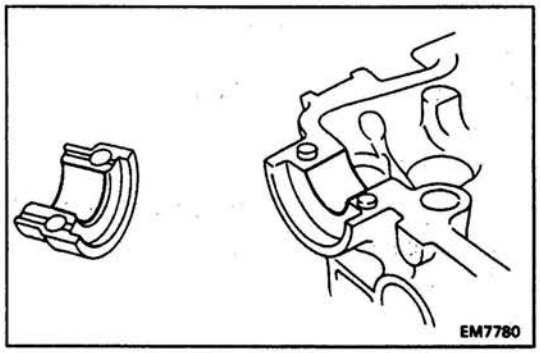
C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter:

26.959 – 26.975 mm (1.0614 – 1.0620 in.)

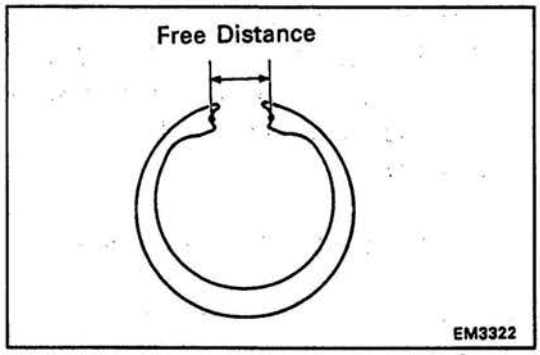
If the journal diameter is not as specified, check the oil clearance.



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.



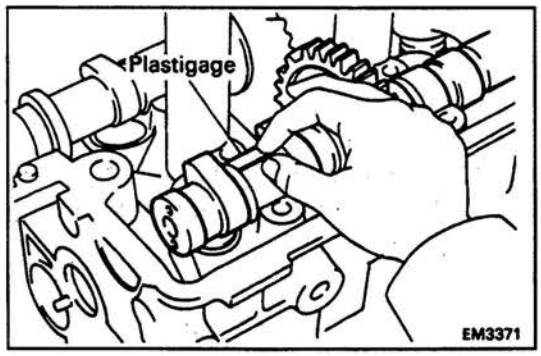
E. Inspect camshaft gear spring

Using a vernier caliper, measure the free distance between the spring ends.

Free distance:

22.5 – 22.9 mm (0.886 – 0.902 in.)

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

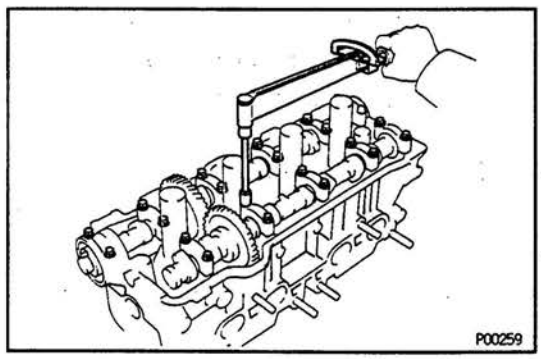


F. Inspect camshaft journal oil clearance

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

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

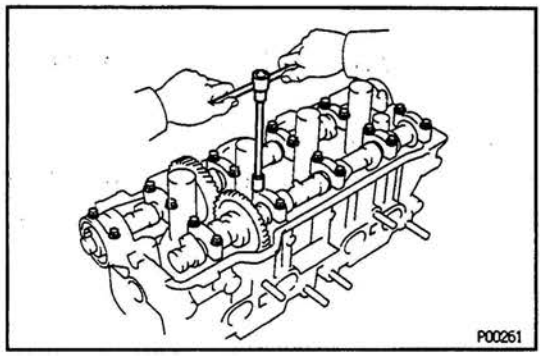


(d) Install the bearing caps.

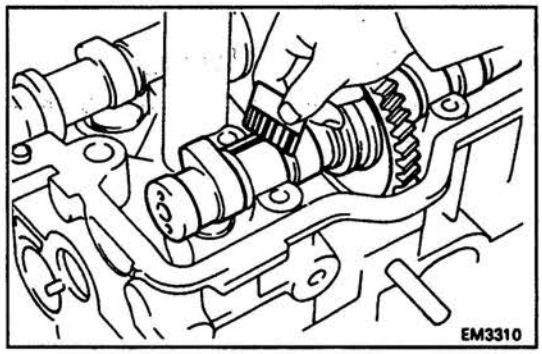
(See step 4 on page EG–91)

Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)

NOTICE: Do not turn the camshaft.



(e) Remove the bearing caps.



(f) Measure the Plastigage at its widest point.

Standard oil clearance:

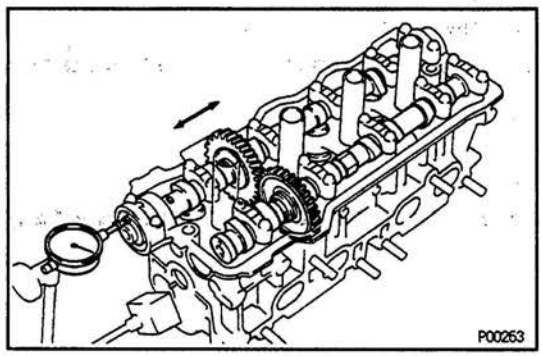
0.025 – 0.062 mm (0.0010 – 0.0024 in.)

Maximum oil clearance:

0.10 mm (0.0039 in.)

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

(g) Completely remove the Plastigage.



G. Inspect camshaft thrust clearance

(a) Install the camshaft. (See step 4 on page EG–91)

(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:

Intake

0.045 – 0.100 mm (0.0018 – 0.0039 in.)

Exhaust

0.030 – 0.085 mm (0.0012 – 0.0033 in.)

Maximum thrust clearance:

Intake

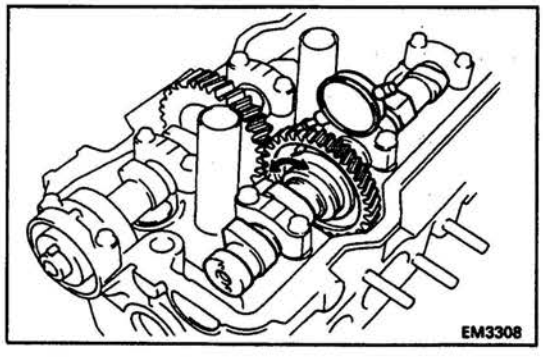
0.12 mm (0.0047 in.)

Exhaust

0.10 mm (0.0039 in.)

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

H. Inspect camshaft gear backlash



(a) Install the camshafts without installing the exhaust cam sub–gear. (See step 4 on page EG–91)

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

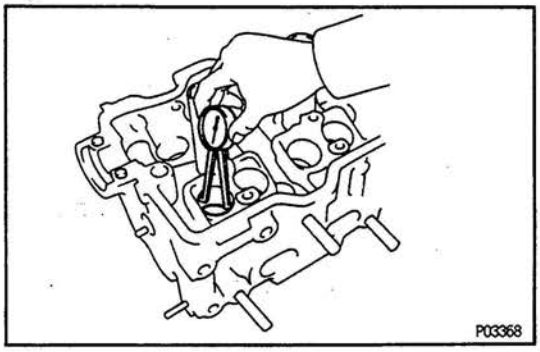
Standard backlash:

0.020 – 0.200 mm (0.0008 – 0.0079 in.)

Maximum backlash:

0.30 mm (0.0188 in.)

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

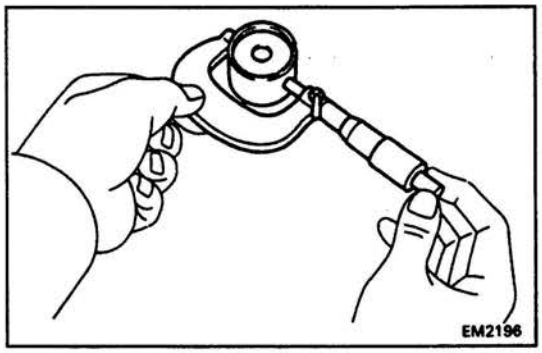


11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter:

31.000 – 31.018 mm (1.2205 – 1.2213 in.)



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

Lifter diameter:

30.966 – 30.976 mm (1.2191 – 1.2195 in.)

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

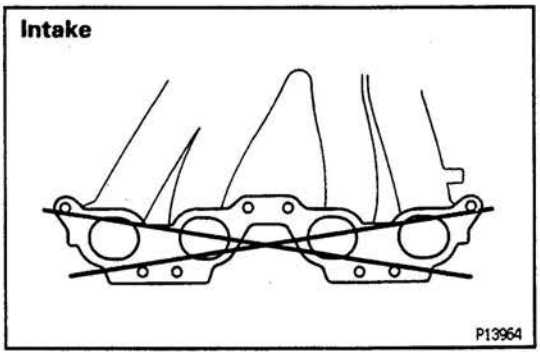
Standard oil clearance:

0.024 – 0.052 mm (0.0009 – 0.0020 in.)

Maximum oil clearance:

0.07 mm (0.0028 in.)

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



12. INSPECT MANIFOLDS

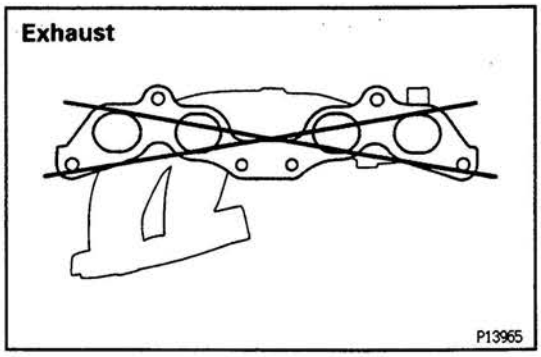
Intake:

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

Maximum warpage:

0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.



Exhaust:

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

Maximum warpage:

0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.

EG0BP–07

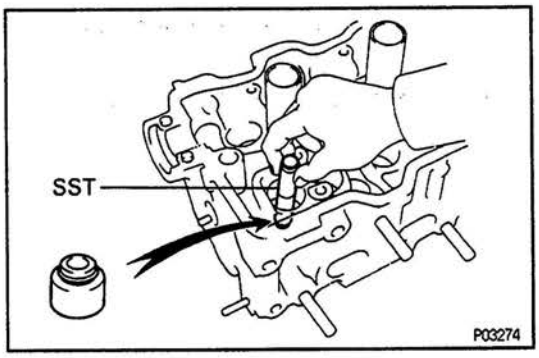
CYLINDER HEAD ASSEMBLY

(See Components for Removal and Installation)

HINT:

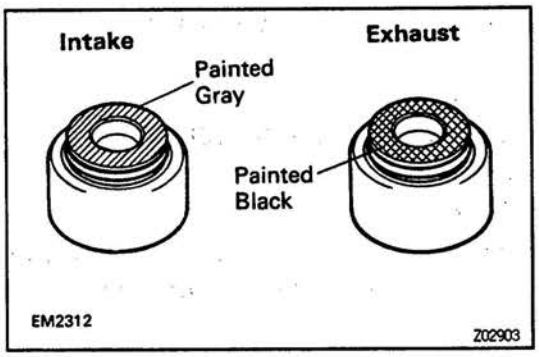
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.

EG

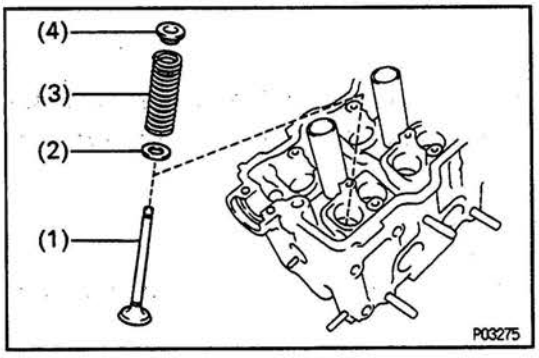


1. INSTALL VALVES

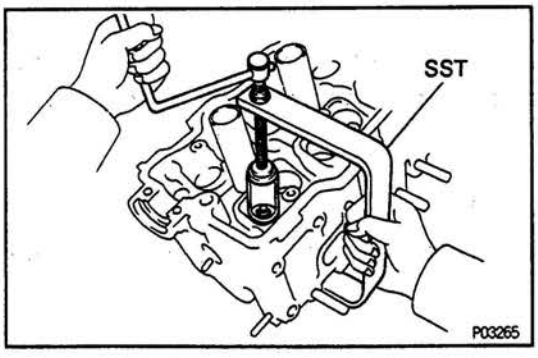
(a) Using SST, push in a new oil seal.
SST 09201–41020



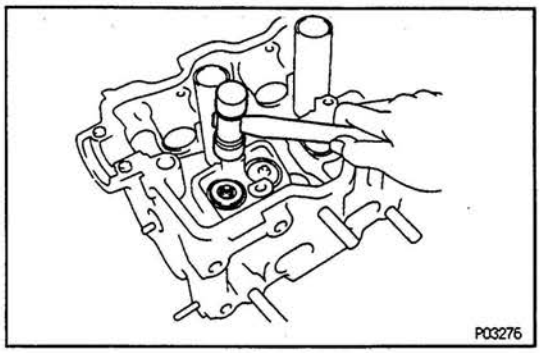
HINT: The intake valve oil seal is gray and the exhaust valve oil seal is black.



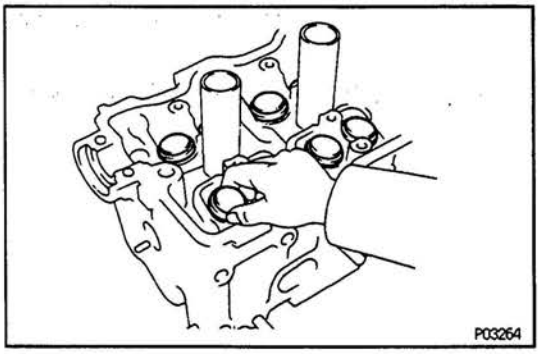
(b) Install the following parts:
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer



(c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202–70010



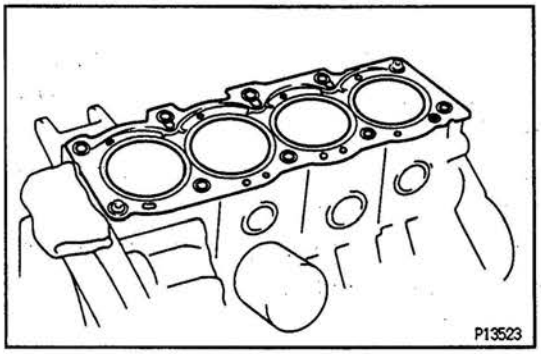
(d) Using a plastic–faced hammer, lightly tap the valve stem tip to assure a proper fit.



2. INSTALL VALVE LIFTERS AND SHIMS

(a) Install the valve lifter and shim.

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



CYLINDER HEAD INSTALLATION (ST202) EG2W3-01

(See Components for Removal and Installation)

1. INSTALL CYLINDER HEAD

A. Place cylinder head on cylinder block

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

NOTICE: Be careful of the installation direction.

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

B. Install cylinder head bolts

HINT:

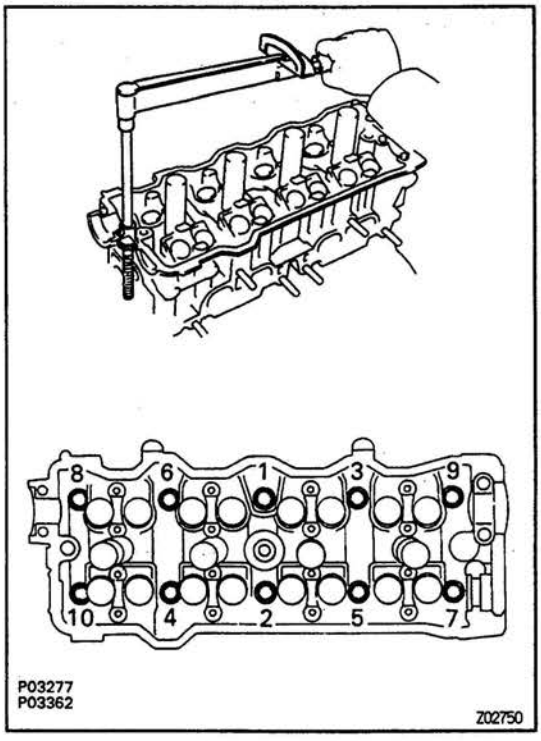
- The cylinder head bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any cylinder head bolt is broken or deformed, replace it.

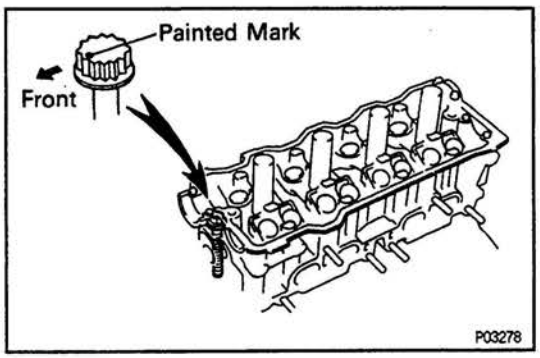
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

(b) Install and uniformly tighten the 10 cylinder head bolts and plate washers in several passes, in the sequence shown.

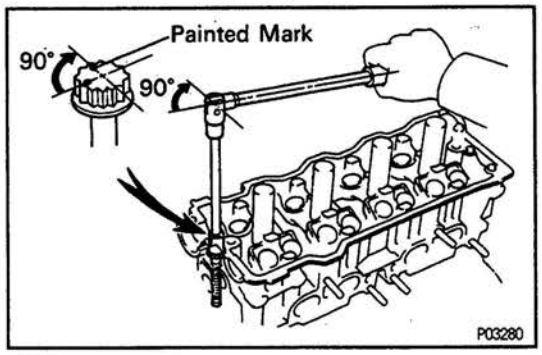
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

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



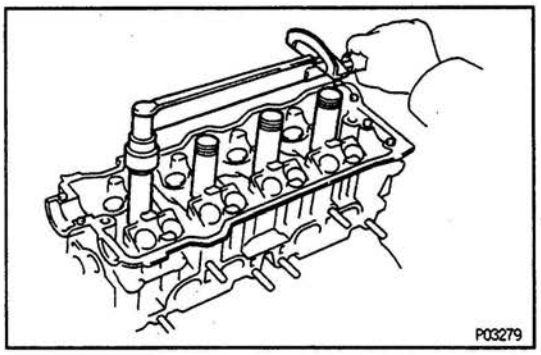


(c) Mark the front of the cylinder head bolt head with paint.



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

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

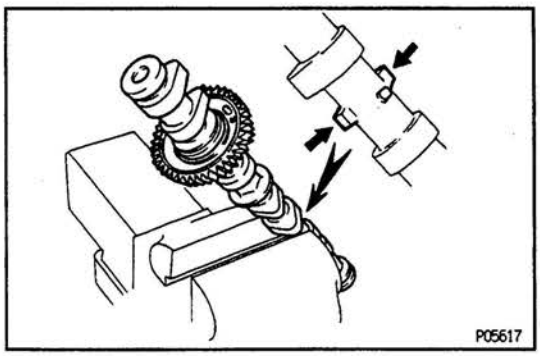


2. INSTALL SPARK PLUG TUBES

(a) Clean the cylinder head tube holes of any residual adhesive, oil or foreign particles. Remove any oil with kerosene or gasoline.

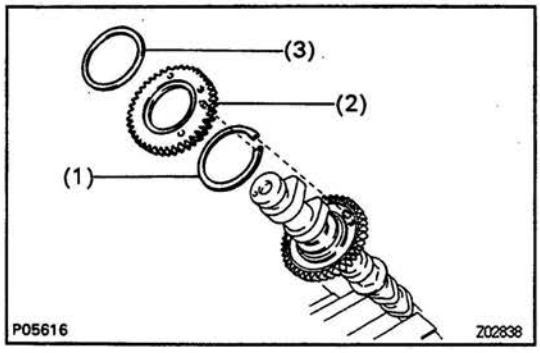
(b) Screw the threads of the spark plug tube coated with adhesive into the cylinder head.

(c) Using the spark plug tube nut and a 30 mm socket wrench, tighten the spark plug tubes.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

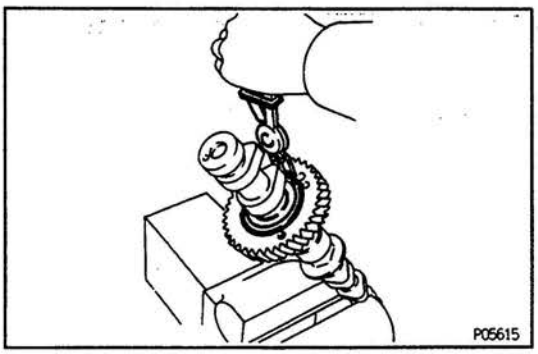


3. ASSEMBLE EXHAUST CAMSHAFT

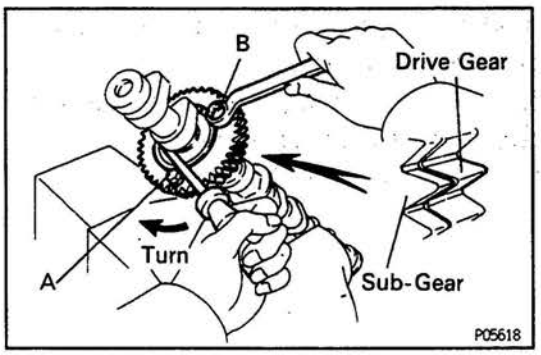
(a) Mount the camshaft in a vise.
NOTICE: Be careful not to damage the camshaft.



(b) Install the following parts:
(1) Camshaft gear spring
(2) Camshaft sub–gear
(3) Wave washer
HINT: Align the pins on the gears with the spring ends.



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



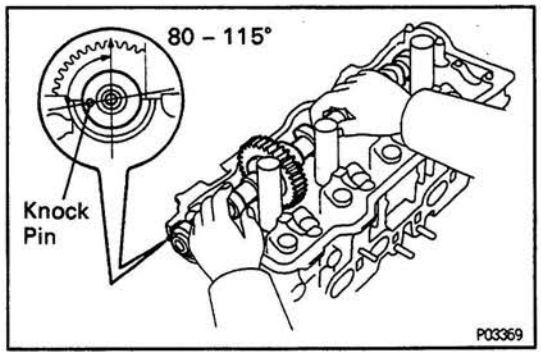
(d) Insert service bolt A into the service hole of the camshaft sub–gear.

(e) Using a screwdriver, align the holes of the camshaft drive gear and sub–gear by turning camshaft sub–gear clockwise, and install service bolt B.
NOTICE: Be careful not to damage the camshaft.

(f) Align the gear teeth of the drive gear and sub–gear, and tighten service bolt B.

4. INSTALL CAMSHAFTS

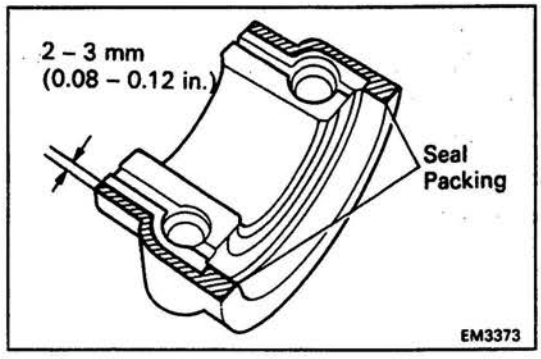
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the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



A. Install intake camshaft

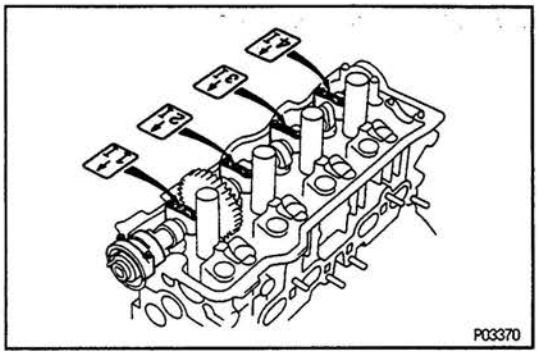
(a) Apply MP grease to the thrust portion of the camshaft.

(b) Place the intake camshaft at 80 – 115° BTDC of camshaft angle on the cylinder head.
HINT: The above angle arrows the No.1 and No.3 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.

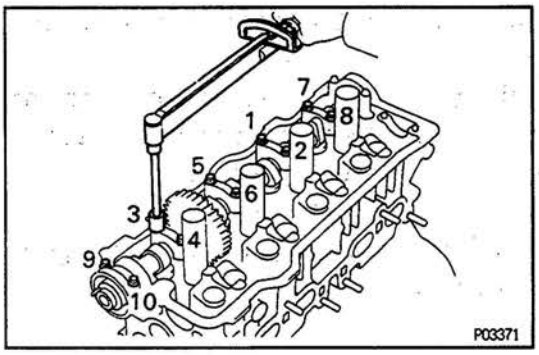


(c) Apply seal packing to the No.1 bearing cap as shown.
Seal packing:
Part No. 08826–00080 or equivalent

EG

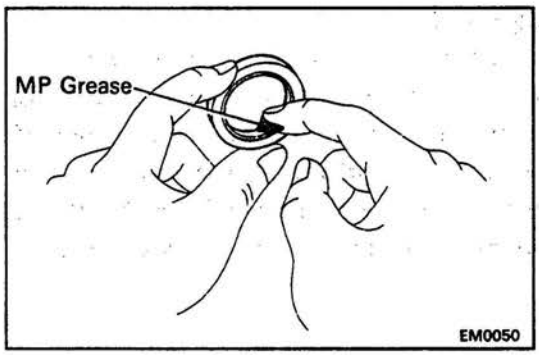


(d) Install the bearing caps in their proper locations.

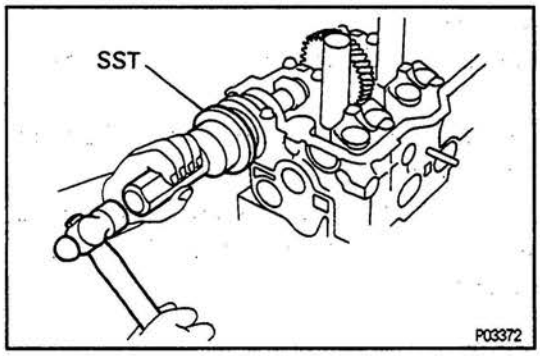


(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

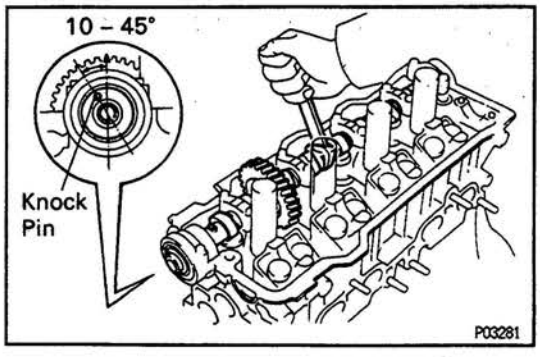
(f) Install and uniformly tighten the 10 bearing cap bolts in several passes, in the sequence shown.
Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)



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

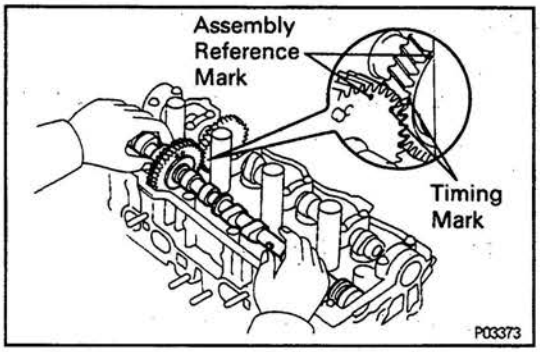


(h) Using SST and a hammer, tap in the oil seal.
SST 09223—46011



B. Install exhaust camshaft

(a) Set the knock pin of the intake camshaft at 10 — 45° BTDC of camshaft angle.
HINT: The above angle allows the No.2 and No.4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



(b) Apply MP grease to the thrust portion of the camshaft.

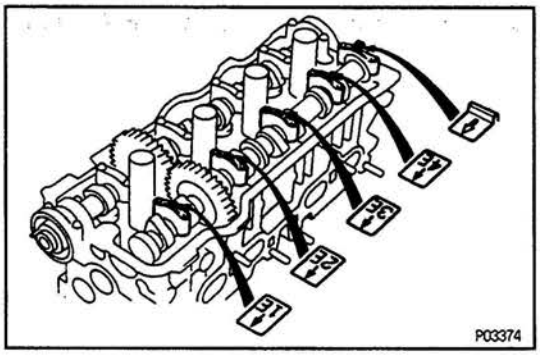
(c) Engage the exhaust camshaft gear to the intake camshaft gear by matching the timing marks on each gear.

(d) Roll down the exhaust camshaft onto the bearing journals while engaging gears with each other.

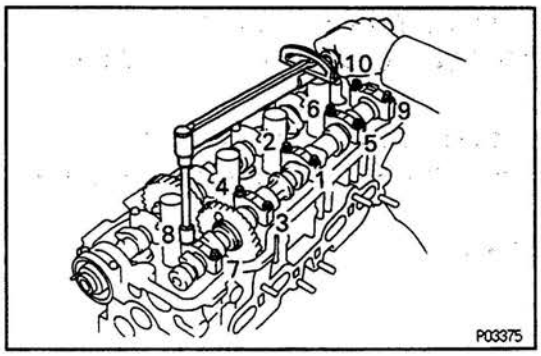
NOTICE: There are also assembly reference marks on each gear as shown in the illustration. Do not use these marks.

(e) Turn the intake camshaft clockwise or counterclockwise a little until the exhaust camshaft sits in the bearing journals evenly without rocking the camshaft on the bearing journals.

NOTICE: It is very important to replace the camshaft in the bearing journals evenly while tightening bearing caps in the subsequent steps.



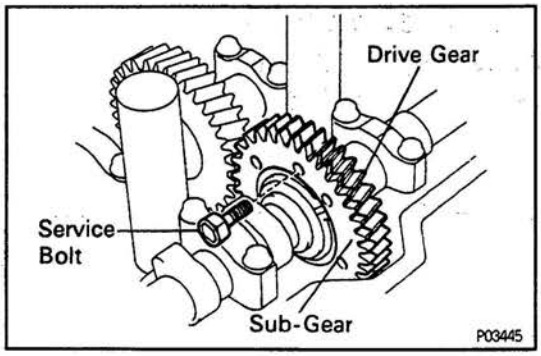
(f) Install the bearing caps in their proper locations.



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

(h) Install and uniformly tighten the 10 bearing cap bolts in several passes, in the sequence shown.

Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)



(i) Remove service bolt B.

EG

5. CHECK AND ADJUST VALVE CLEARANCE
(See page EG–19)

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

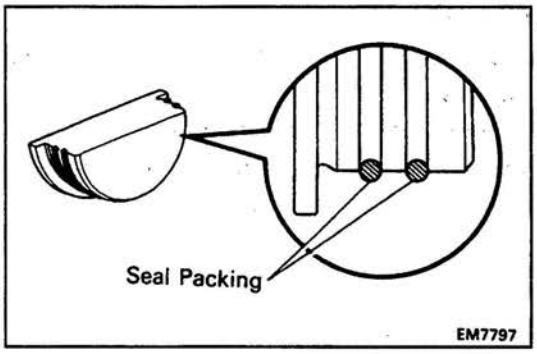
Valve clearance (Cold):

Intake

0.19 – 0.29 mm (0.007 – 0.011 in.)

Exhaust

0.28 – 0.38 mm (0.011 – 0.015 in.)



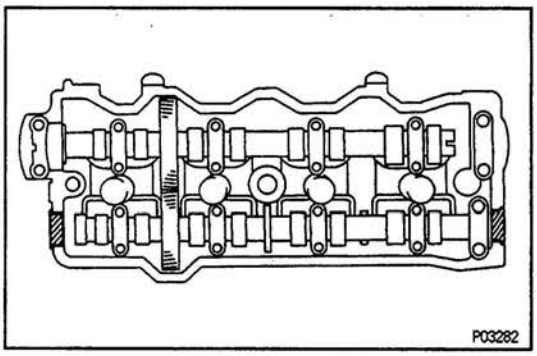
6. INSTALL SEMI–CIRCULAR PLUGS

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

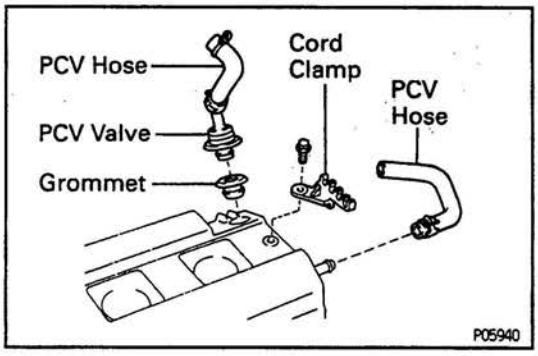
(b) Apply seal packing to the semi–circular plug grooves.

Seal packing:

Part No. 08826–00080 or equivalent



(c) Install the 2 semi–circular plugs to the cylinder head.

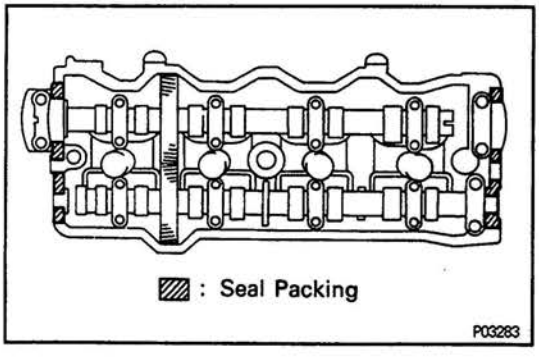


7. INSTALL PCV VALVE, PCV HOSE AND HIGH–TENSION CORD CLAMP TO CYLINDER HEAD

(a) Install the high–tension cord clamp with the bolt.

(b) Install the grommet, the PCV valve and hose assembly.

(c) Install the PCV hose.



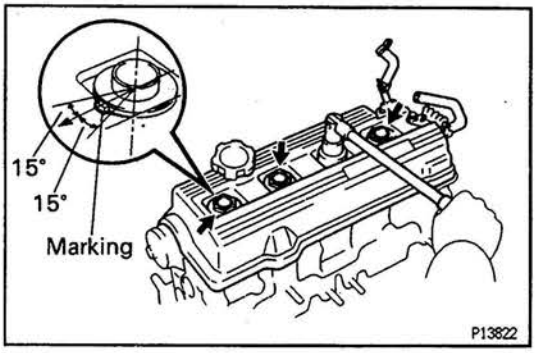
8. INSTALL CYLINDER HEAD COVER

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

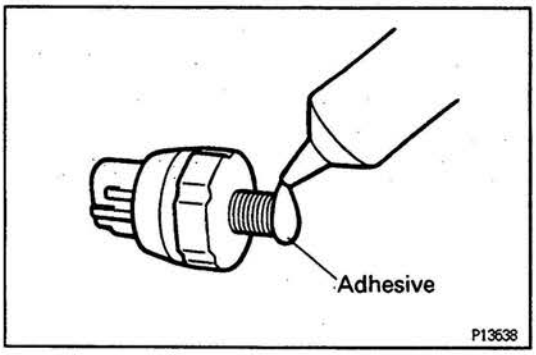
(b) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing:

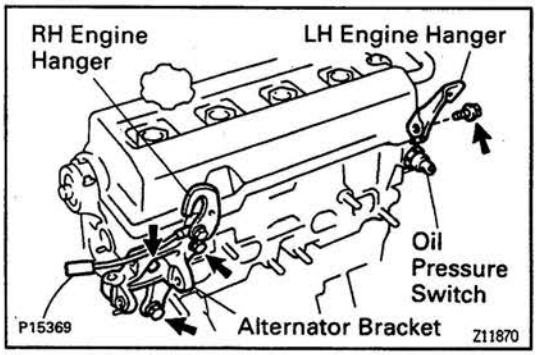
Part No. 08826–00080 or equivalent



(c) Install the gasket to the head cover.
(d) Install the head cover with the 4 grommets and nuts. Uniformly tighten the nuts in several passes.
Torque: 23 N·m (230 kgf·cm, 17 ft·lbf)
HINT: Install the grommets so that their markings are as shown in the illustration.

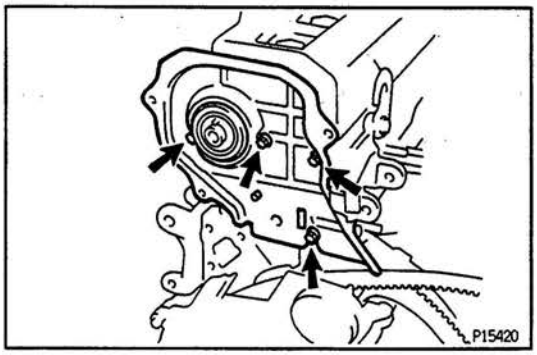


9. INSTALL OIL PRESSURE SWITCH
(a) Apply adhesive to 2 or 3 threads.
Adhesive:
Part No. 08833–00080, THREE BOND 1324 or equivalent

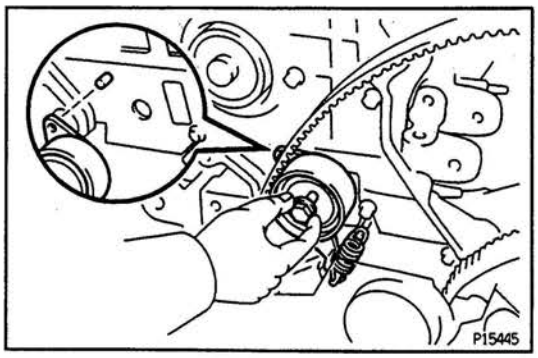


(b) Install the oil pressure switch.

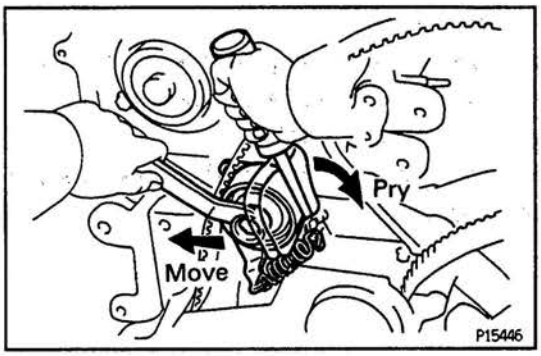
10. INSTALL ENGINE HANGERS AND ALTERNATOR BRACKET
(a) Install the alternator bracket and RH engine hanger assembly with the 3 bolts.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)
(b) Install the LH engine hanger with the bolt.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)



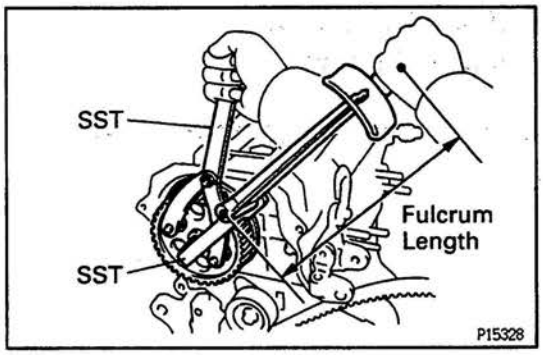
11. INSTALL NO.3 TIMING BELT COVER
Install the timing belt cover with the 4 bolts.
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)



12. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING
(a) Align the bracket pin hole with the pivot pin.
(b) Install the pulley with the bolt. Do not tighten the bolt yet.
(c) Install the tension spring.

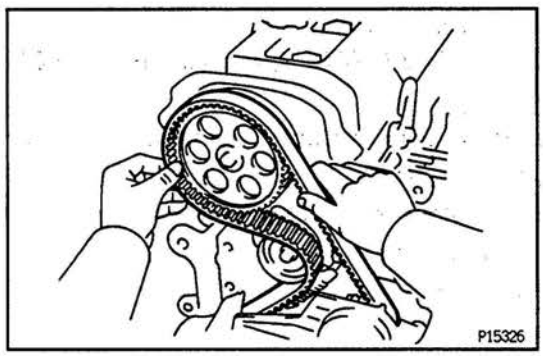


(d) Pry the pulley toward the left as far as it will go and tighten the bolt.
(e) Check that the idler pulley moves smoothly.

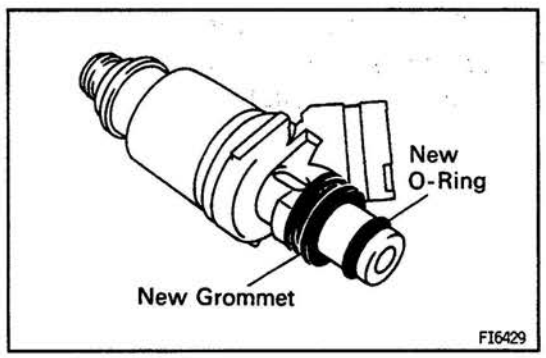


13. INSTALL CAMSHAFT TIMING PULLEY

(a) Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the timing pulley.
(b) Using SST, install the pulley bolt.
SST 09249–63010, 09960–10010 (09962–01000, 09963–01000)
Torque:
54 N·m (550 kgf·cm, 40 ft·lbf)
37 N·m (380 kgf·cm, 27 ft·lbf) for SST
HINT: Use a torque wrench with a fulcrum length of 340 mm (13.39 in.)

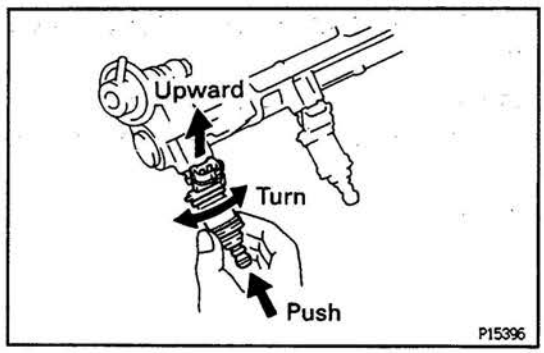


14. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEY
(See steps 10 to 13 on pages EG–45 to 47)

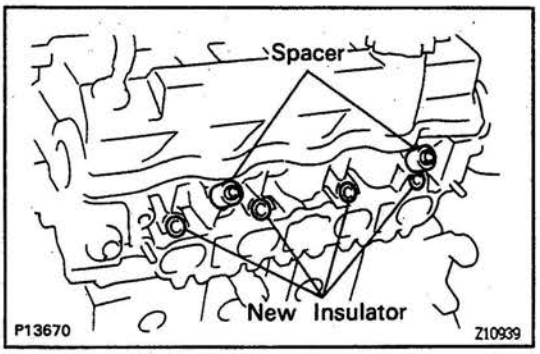


15. INSTALL INJECTORS AND DELIVERY PIPE

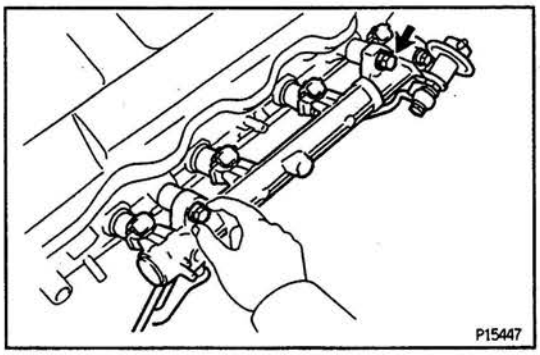
(a) Install a new grommet to each injector.
(b) Apply a light coat of gasoline onto a new O–ring, and install it to each injector.



(c) While turning the injector clockwise and counter-clockwise, push it to the delivery pipe. Install the 6 injectors.
(d) Position the injector connector upward.

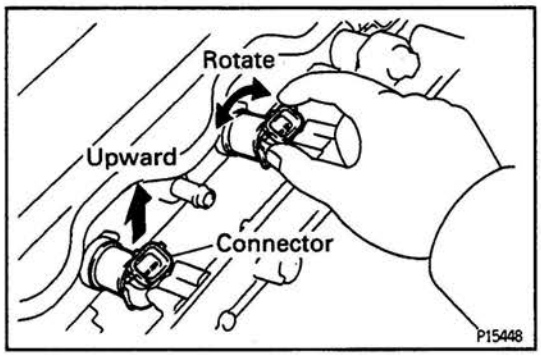


(e) Place 4 new insulators and the 2 spacers in position on the cylinder head.



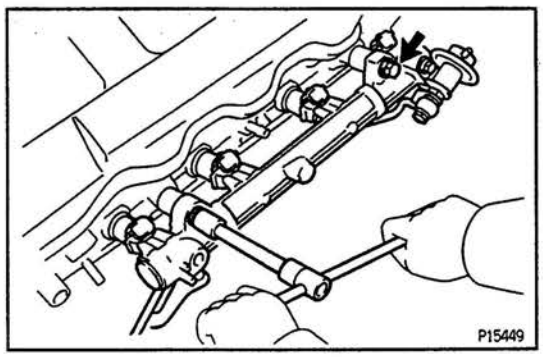
(f) Attach the 4 injectors together with the delivery pipe to the cylinder head.

(g) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.

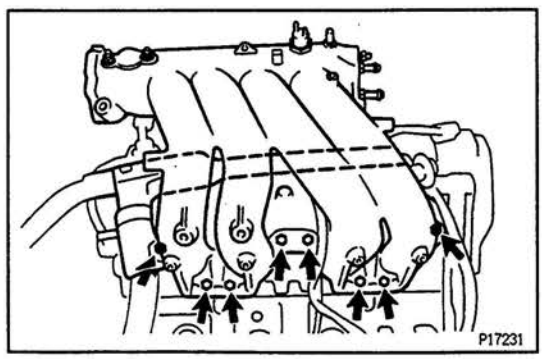


(h) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O–rings. Replace the O–rings.

(i) Position the injector connector upward.



(j) Tighten the 2 bolts holding the delivery pipe to the cylinder head.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)



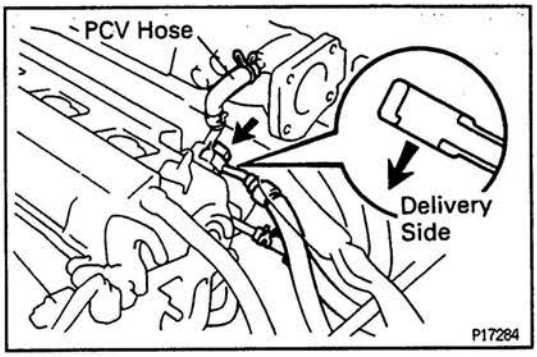
16. INSTALL INTAKE MANIFOLD

(a) Insert the intake manifold between the cylinder head and dash panel.

(b) Insert the engine wire between the cylinder head and intake manifold.

(c) Install a new gasket and the intake manifold with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)

EG



17. CONNECT PCV HOSE TO INTAKE MANIFOLD

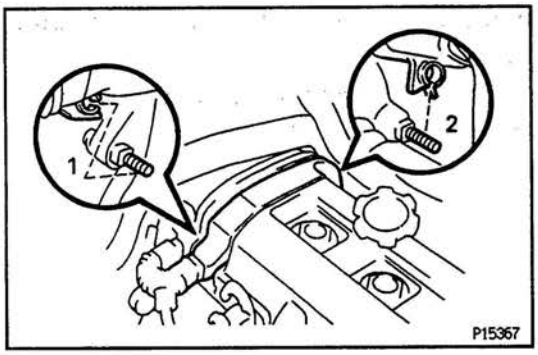
18. CONNECT FUEL INLET HOSE TO DELIVERY PIPE

Connect the fuel inlet pipe to the delivery pipe with 2 new gaskets and the union bolt.

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

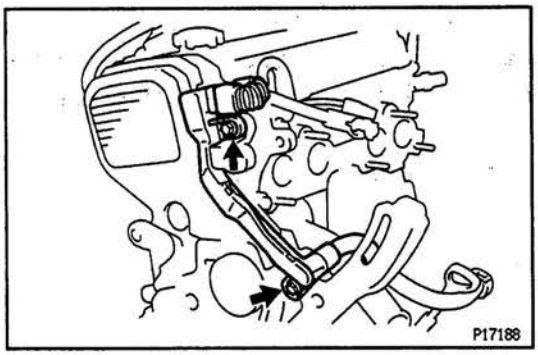
NOTICE: Be careful of the fuel inlet hose installation direction.

19. CONNECT FUEL RETURN HOSE TO RETURN HOSE

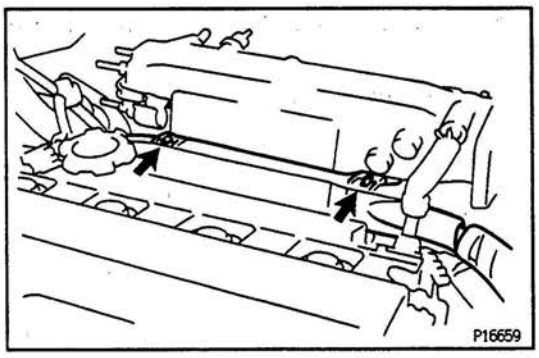


20. INSTALL ENGINE WIRE

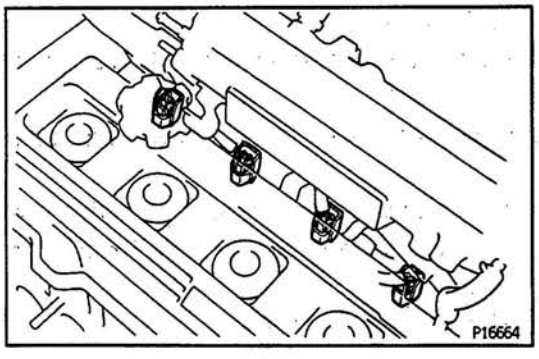
(a) Install the engine wire protector to the 2 mounting bolts of the No.2 timing belt cover in the sequence shown.



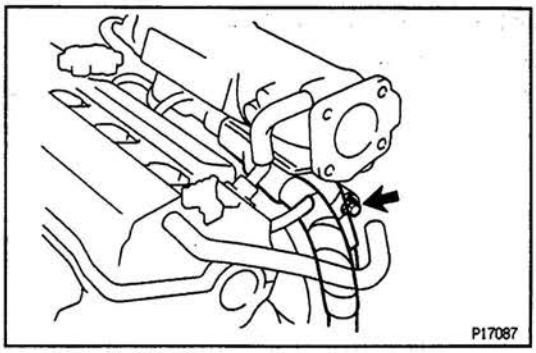
(b) Install the engine wire protector to the alternator bracket and adjusting bar with the 2 bolts.



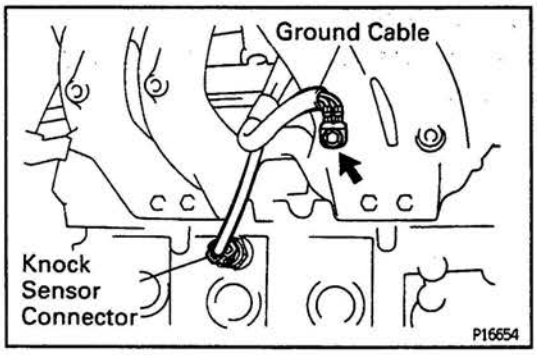
(c) Install the engine wire protector to the 2 brackets on the front side of the intake manifold.



(d) Connect the 4 injector connectors.



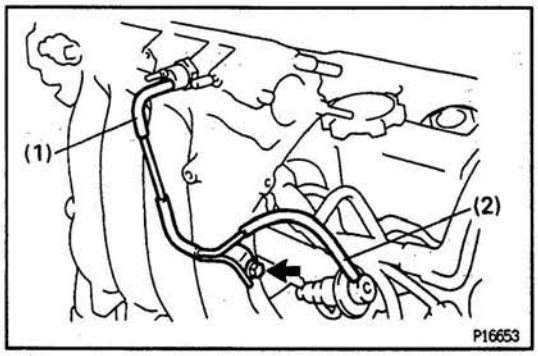
(e) Install the engine wire protector to the LH side of the intake manifold with the bolt.



21. CONNECT KNOCK SENSOR CONNECTOR

22. INSTALL GROUND CABLE

Install the ground cable with the bolt.



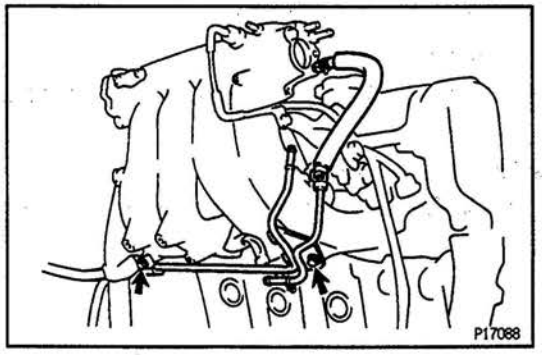
23. INSTALL VACUUM PIPE

(a) Install the vacuum pipe with the bolt.

(b) Connect the following hoses:

(1) Vacuum sensing hose to gas filter on intake manifold

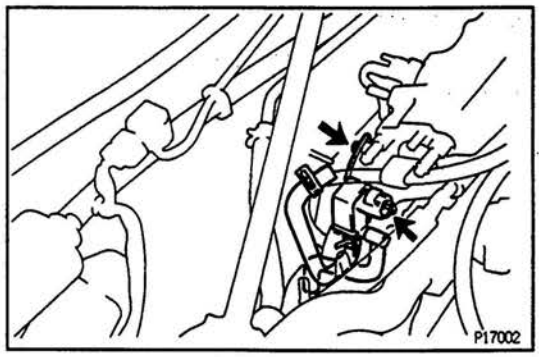
(2) Vacuum sensing hose to fuel pressure regulator



24. INSTALL AIR TUBE

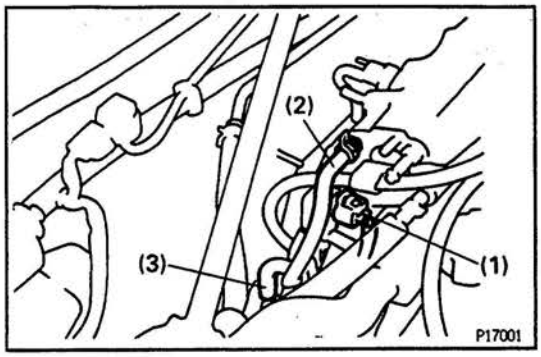
(a) Install the air tube with the 2 bolts.

(b) Connect the PS air hose to the intake manifold.

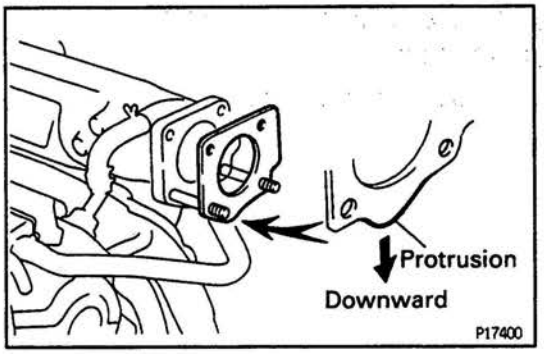


25. INSTALL A/C IDLE-UP VALVE

(a) Install the idle-up valve with the 2 bolts.

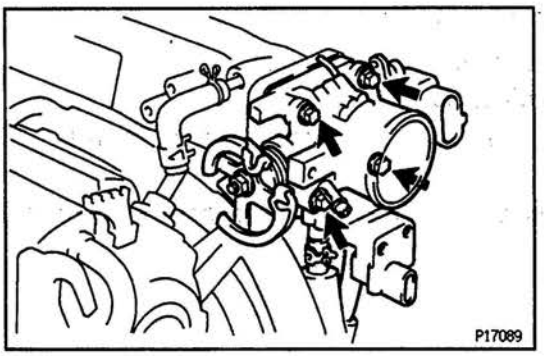


(b) Connect the following connector and hoses:
(1) Idle–up valve connector
(2) Air hose to intake manifold
(3) Air hose to air tube



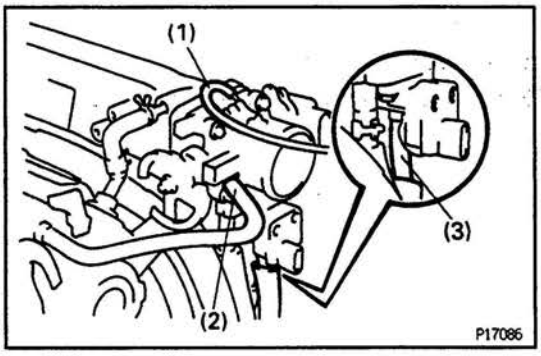
26. INSTALL THROTTLE BODY

(a) Place a new gasket on the intake manifold, facing the protrusion downward.

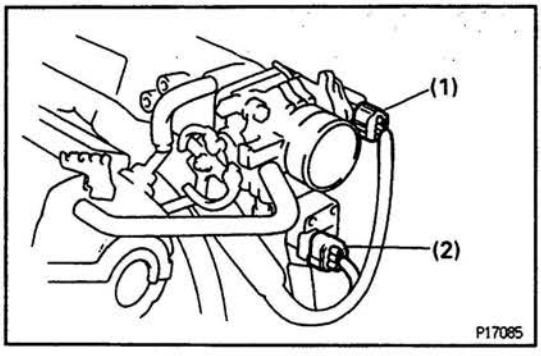


(b) Type A:
Install the throttle body with the 4 bolts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)
HINT: Different bolt lengths are used for the upper and lower sides.
Bolt length:
Upper side: 40 mm (1.57 in.)
Lower side: 55 mm (2.17 in.)

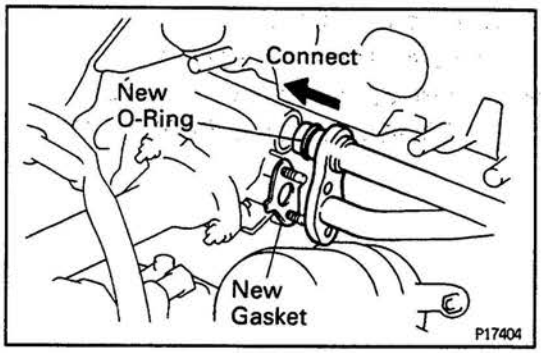
(c) Type B:
Install the throttle body with the 2 bolts and 2 nuts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



(d) Connect the following hoses:
(1) Vacuum hose (from charcoal canister) to throttle body
(2) PCV hose to throttle body
(3) Air hose (for A/C and PS idle–up) to ISC valve

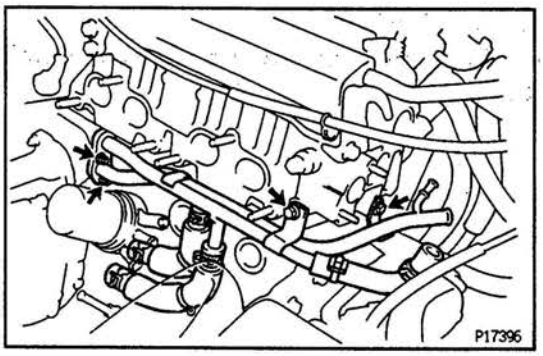


(e) Connect the following connectors:
(1) Throttle position sensor connector
(2) ISC valve connector

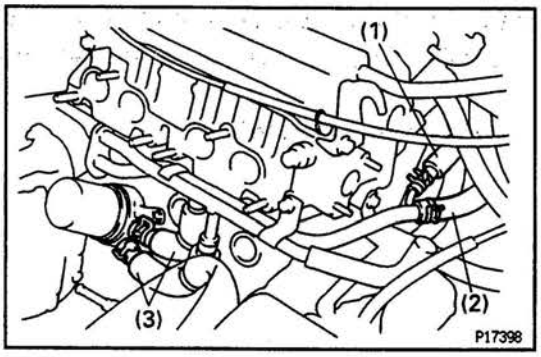


27. INSTALL WATER BYPASS PIPE

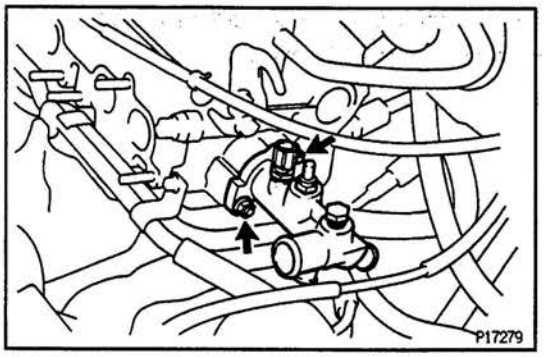
(a) Install a new gasket to the water pump cover.
(b) Install a new O—ring to the bypass pipe.
(c) Apply soapy water on the O—ring.
(d) Connect the water bypass pipe to the water pump cover.



(e) Install the bypass pipe with the 2 nuts and 2 bolts.
Torque:
Nut: 9.3 N·m (95 kgf·cm, 82 in.·lbf)
Bolt: 19 N·m (195 kgf·cm, 14 ft·lbf)

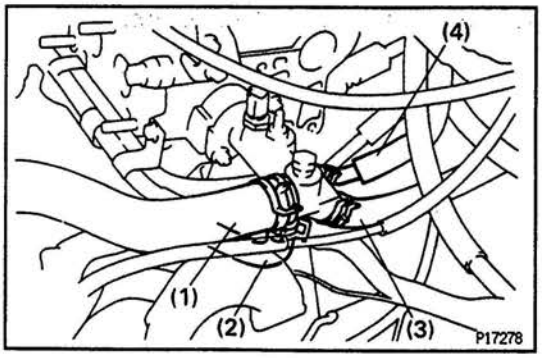


(f) Connect the following hoses:
(1) ISC valve water bypass hose to water bypass pipe
(2) Heater water hose to water bypass pipe
(3) w/ Oil cooler:
2 oil cooler water bypass hoses to oil cooler

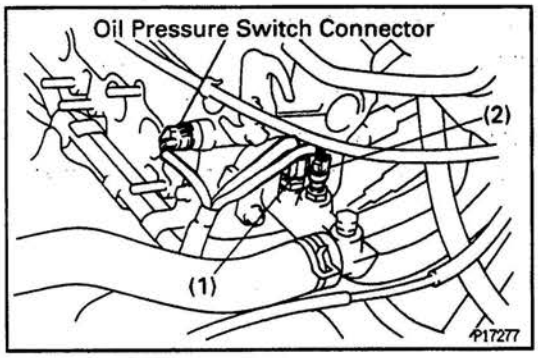


28. INSTALL WATER OUTLET

(a) Install a new gasket and the water outlet with the 2 nuts.
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)

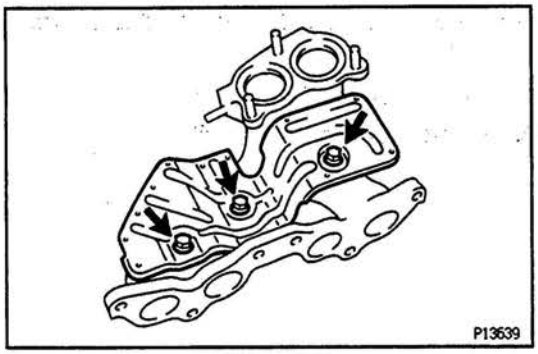


(b) Connect the following hoses to the water outlet:
(1) Radiator hose
(2) Water bypass pipe hose
(3) Heater water hose
(4) ISC valve water bypass hose



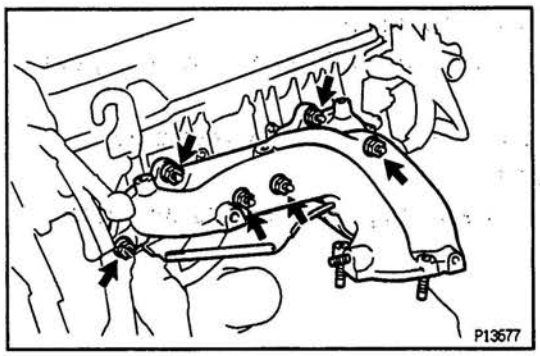
(c) Connect the following connectors:
(1) Water temperature sensor connector
(2) Water temperature sender gauge connector

29. CONNECT OIL PRESSURE SWITCH CONNECTOR

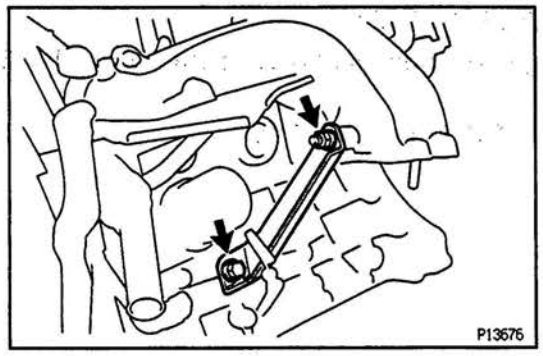


30. INSTALL EXHAUST MANIFOLD

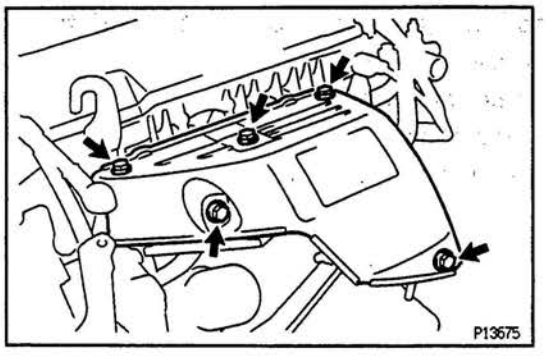
(a) Install the lower heat insulator to the exhaust manifold with the 3 bolts.



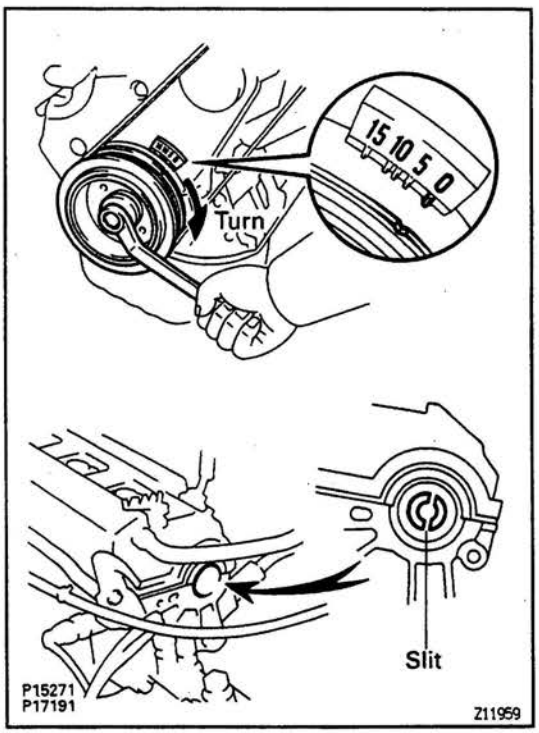
(b) Install a new gasket and the exhaust manifold with 6 new nuts. Uniformly tighten the nuts in several passes.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)



(c) Install the manifold stay with the bolt and nut.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

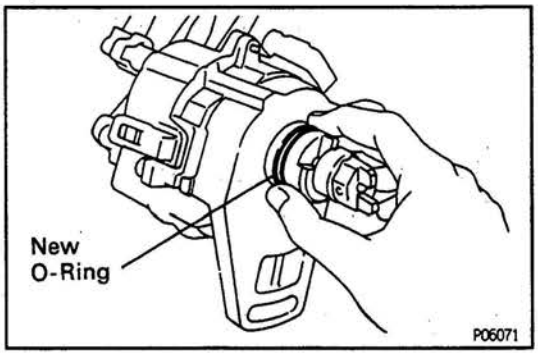


(d) Install the upper heat insulator with 5 bolts.

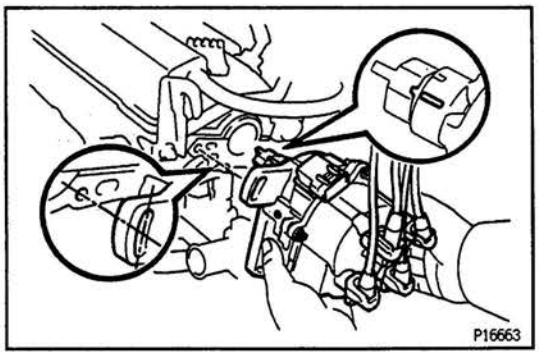


31. INSTALL DISTRIBUTOR

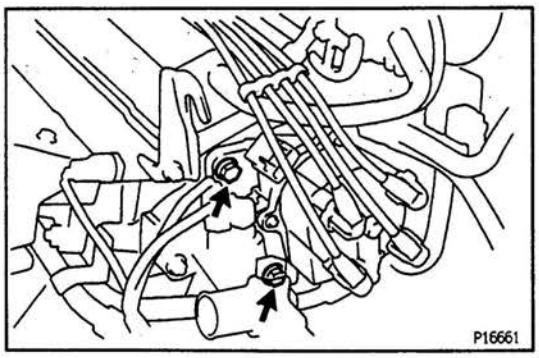
(a) Turn the crankshaft clockwise, and position the slit of the intake camshaft as shown in the illustration.



(b) Install a new O–ring to the housing.
(c) Apply a light coat of engine oil on the O–ring.

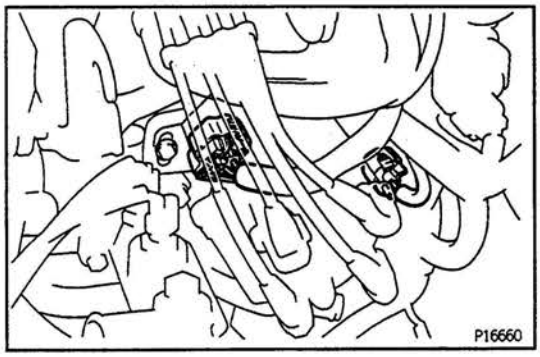


(d) Align the cutout portion of the coupling with the protrusion of the housing.
(e) Insert the distributor, aligning the center of the flange with that of the bolt hole on the cylinder head.

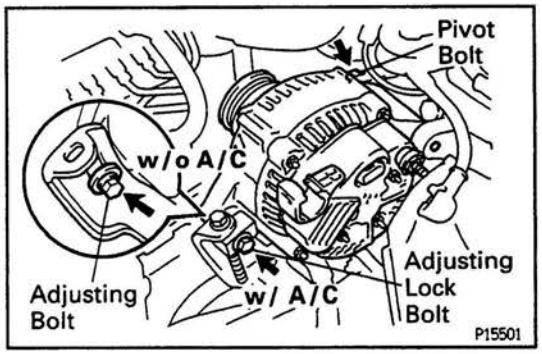


(f) Lightly tighten the 2 bolts.
(g) Connect the 4 high–tension cords to the spark plugs.

EG

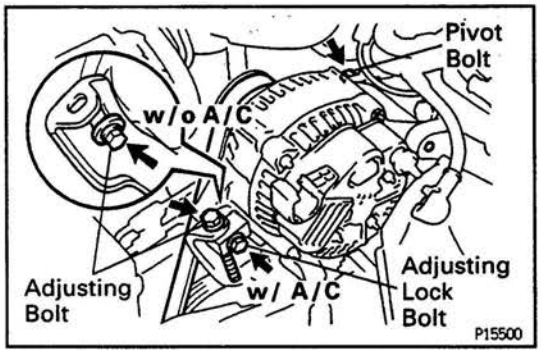


(h) Connect the 2 distributor connectors.



32. INSTALL ALTERNATOR

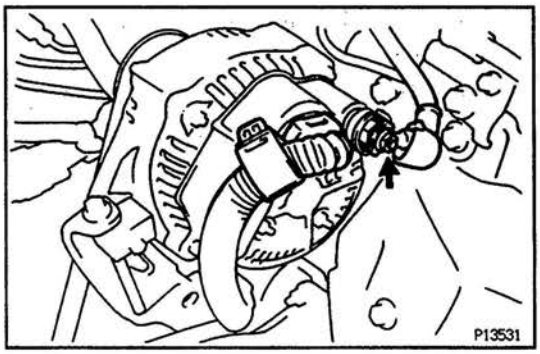
(a) Install the alternator with the pivot bolt and adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C). Do not tighten the bolts yet.



(b) Install the drive belt with the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt.

(c) Adjust the drive belt.
(See step 3 on page CH−8)

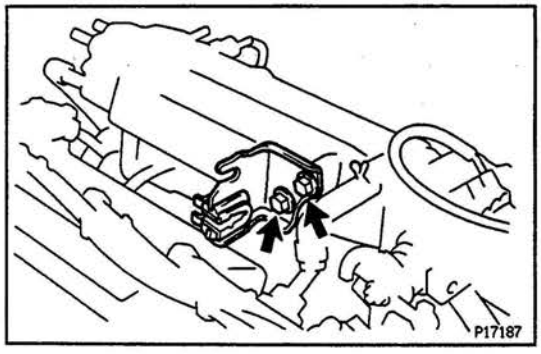
(d) Tighten the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt (w/o A/C).
Torque:
Pivot bolt
54 N·m (530 kgf·cm, 40 ft·lbf)
Adjusting lock bolt (w/ A/C), or
Adjusting bolt (w/o A/C)
19 N·m (185 kgf·cm, 14 ft·lbf)



(e) Connect the alternator connector.

(f) Connect the alternator wire with the nut and rubber cap.

(g) Install the wire to the clamp on the rear end cover.



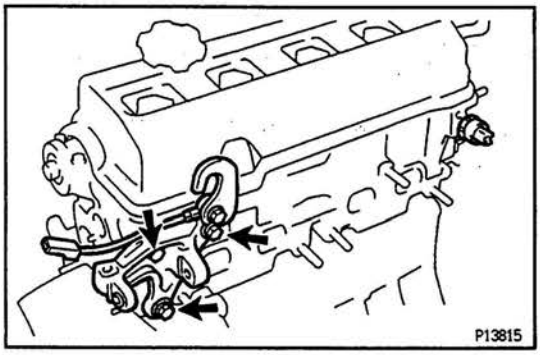
33. INSTALL ACCELERATOR CABLE BRACKET
Install the accelerator cable bracket with the 2 bolts.

34. FILL RADIATOR WITH ENGINE COOLANT

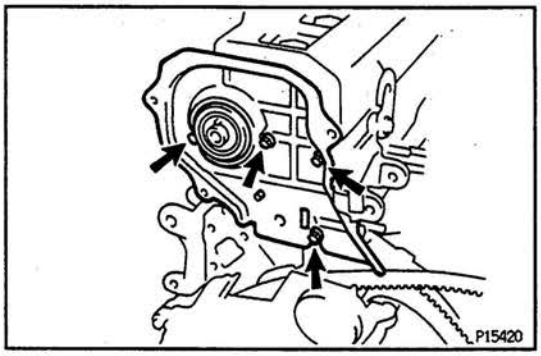
CYLINDER HEAD INSTALLATION (ST191) E03W4-01

(See Components for Removal and Installation)

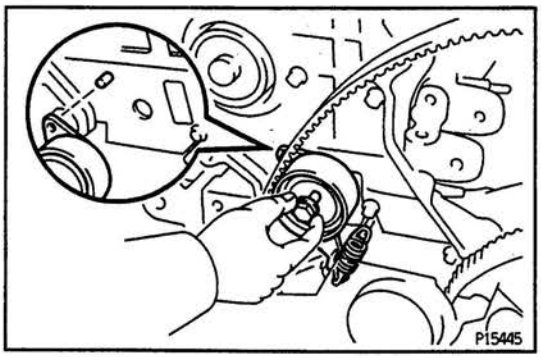
1. INSTALL CYLINDER HEAD
   (See step 1 on page EG–89)
2. INSTALL SPARK PLUG TUBES
   (See step 2 on page EG–90)
3. ASSEMBLE EXHAUST CAMSHAFT
   (See step 3 on page EG–90)
4. INSTALL CAMSHAFTS
   (See step 4 on page EG–91)
5. CHECK AND ADJUST VALVE CLEARANCE
   (See page EG–19)
6. INSTALL SEMI–CIRCULAR PLUGS
   (See step 6 on page EG–94)
7. INSTALL PCV VALVE, PCV HOSE AND HIGH–TENSION CORD CLAMP TO CYLINDER HEAD
   (See step 7 on page EG–94)
8. INSTALL CYLINDER HEAD COVER
   (See step 8 on page EG–94)
9. INSTALL OIL PRESSURE SWITCH
   (See step 9 on page EG–95)
10. INSTALL ALTERNATOR BRACKET AND RH ENGINE HANGER
    Install the alternator bracket and engine hanger assembly with the 3 bolts.
    Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)



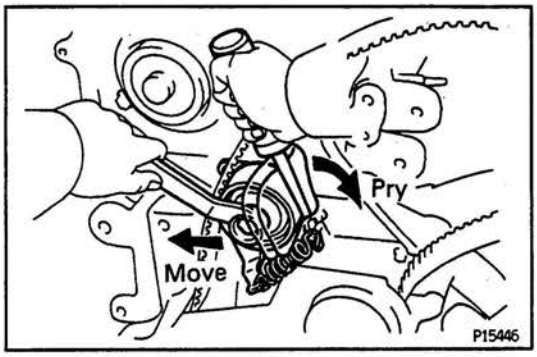
11. INSTALL NO.3 TIMING BELT COVER
    Install the timing belt cover with the 4 bolts.
    Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)



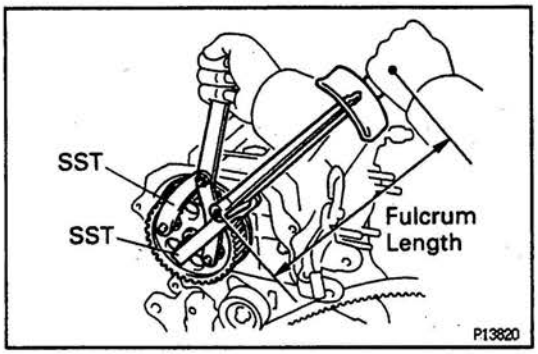
12. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING
    (a) Align the bracket pin hole with the pivot pin.
    (b) Install the pulley with the bolt. Do not tighten the bolt yet.
    (c) Install the tension spring.



EG

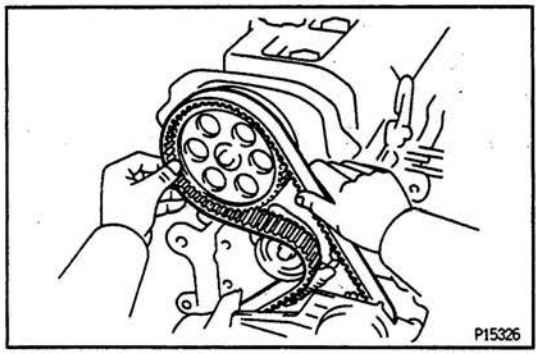


(d) Pry the pulley toward the left as far as it will go and tighten the bolt.
(e) Check that the idler pulley moves smoothly.

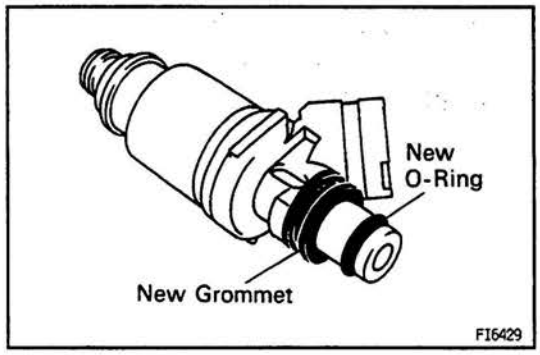


13. INSTALL CAMSHAFT TIMING PULLEY

(a) Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the timing pulley.
(b) Using SST, install the pulley bolt.
SST 09249–63010, 09960–10010 (09962–01000, 09963–01000)
Torque:
54 N·m (550 kgf·cm, 40 ft·lbf)
37 N·m (380 kgf·cm, 27 ft·lbf) for SST
HINT: Use a torque wrench with a fulcrum length of 340 mm (13.39 in.)

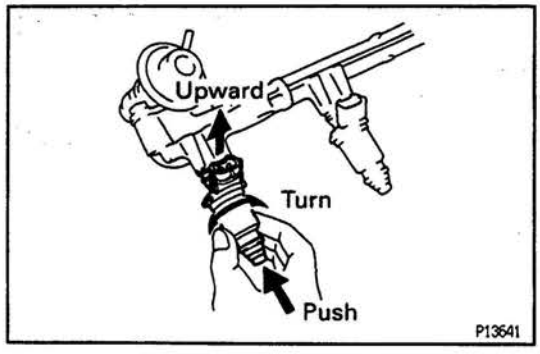


14. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEY
(See steps 10 to 13 on pages EG–45 to 47)

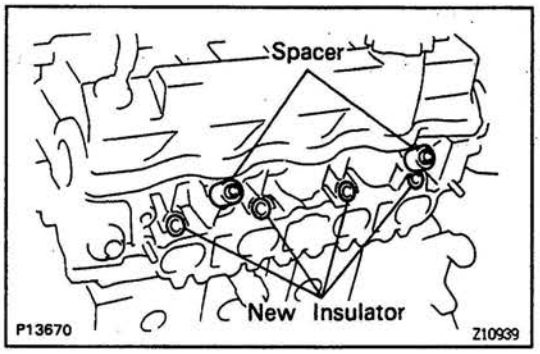


15. INSTALL INJECTORS AND DELIVERY PIPE

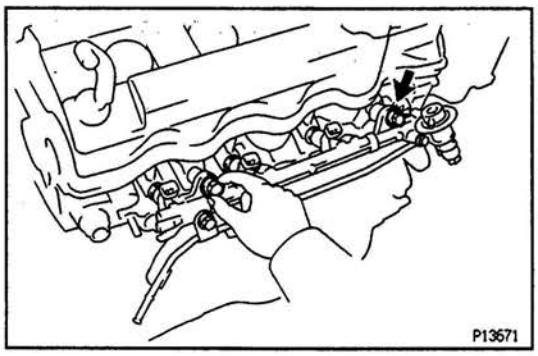
(a) Install a new grommet to each injector.
(b) Apply a light coat of gasoline onto a new O–ring, and install it to each injector.



(c) While turning the injector clockwise and counter-clockwise, push it to the delivery pipe. Install the 4 injectors.
(d) Position the injector connector upward.

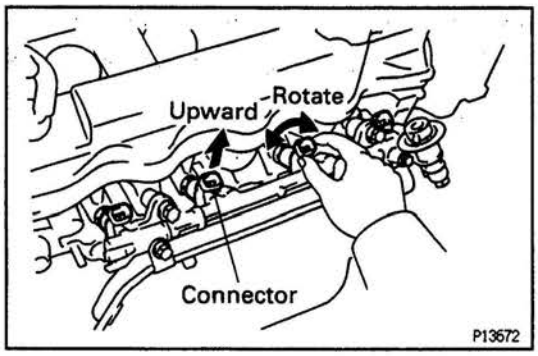


(e) Place 4 new insulators and the 2 spacers in position on the cylinder head.



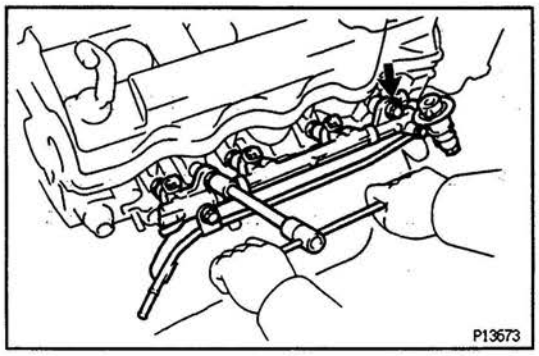
(f) Place the 4 injectors together with the delivery pipe in position on the cylinder head.

(g) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.

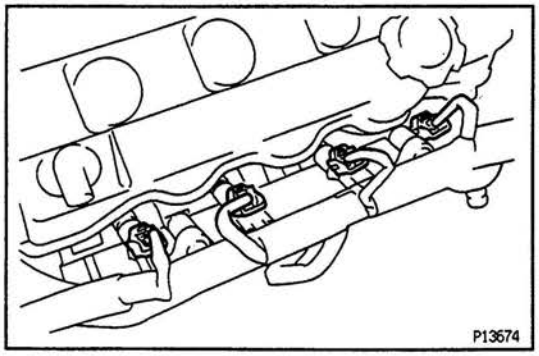


(h) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O—rings. Replace the O—rings.

(i) Position the injector connector upward.

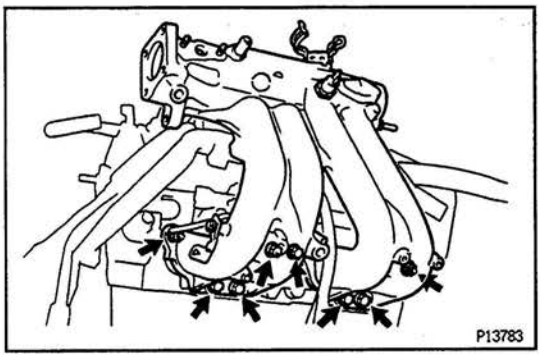


(j) Tighten the 2 bolts holding the delivery pipe to the cylinder head.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)



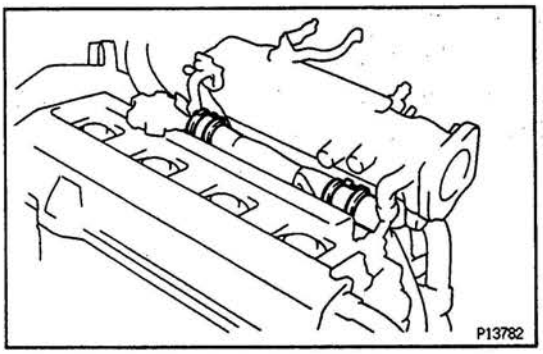
(k) Connect the 4 injector connectors.

EG

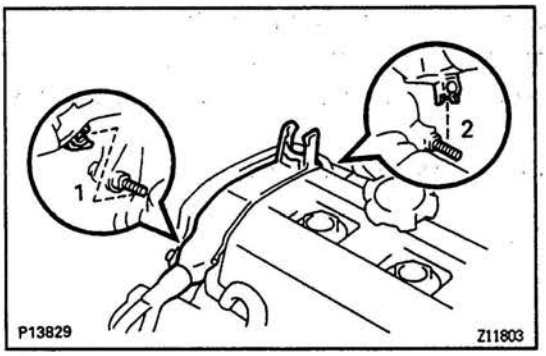


16. INSTALL INTAKE MANIFOLD

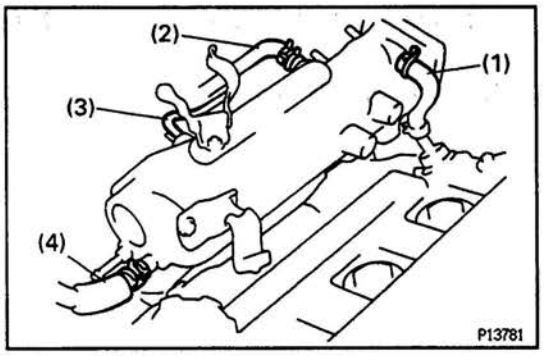
(a) Install a new gasket and the intake manifold with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



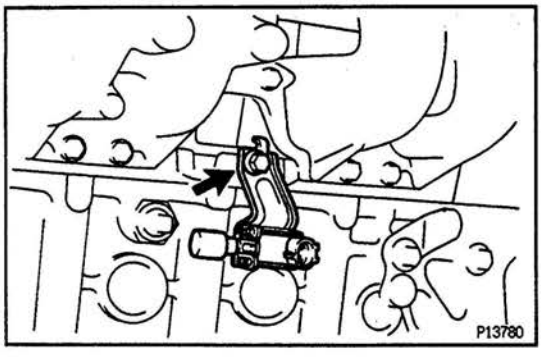
(b) Install the 2 clamps of the engine wire to the wire brackets on the intake manifold.



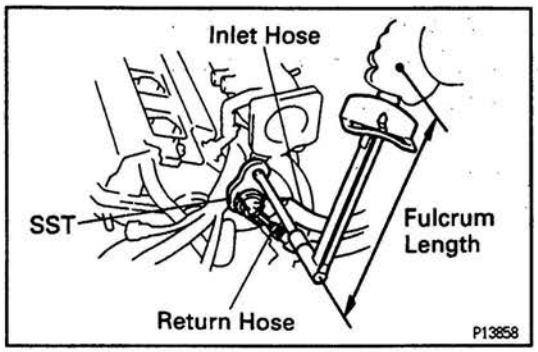
(c) Install the 2 clamps of the engine wire protector to the mounting bolts of the No.2 timing belt cover in the sequence shown.



(d) Connect the following hoses:
(1) PCV hose to intake manifold
(2) Air hose for A/C idle–up valve to intake manifold
(3) Vacuum hose for vacuum sensor to gas filter
(4) Vacuum hose for brake booster to intake manifold



17. w/ EGR:
INSTALL VSV FOR EGR
Install the VSV with the bolt.



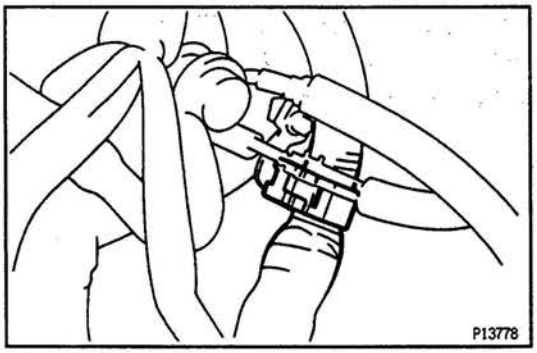
18. CONNECT FUEL RETURN HOSE TO RETURN PIPE

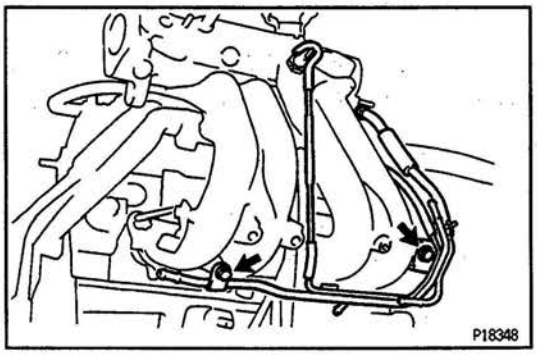
19. CONNECT FUEL INLET HOSE TO DELIVERY PIPE

(a) Temporarily connect the fuel inlet hose with 2 new gaskets and fuel pulsation damper.

(b) Using SST, tighten the fuel pulsation damper.
SST 09612−24014 (09617−24011)
Torque:
34 N·m (350 kgf·cm, 25 ft·lbf)
29 N·m (300 kgf·cm, 22 ft·lbf) for SST
HINT: Use a torque wrench with a fulcrum length of 30 cm (1.181 in.).

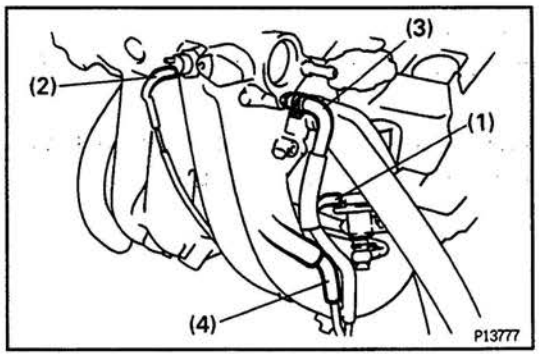
(c) Install the clamp of the engine wire to the wire clamp.



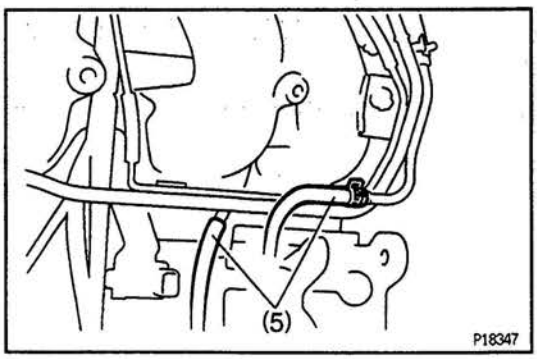


20. INSTALL AIR TUBE

(a) Install the air tube with the 2 bolts.



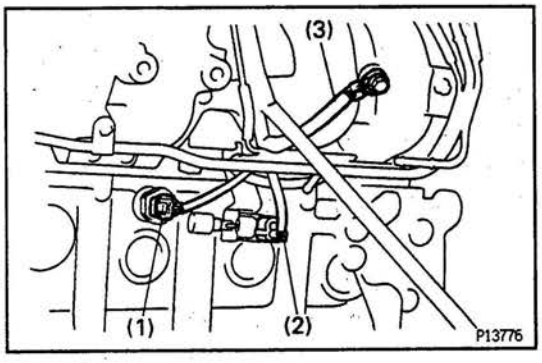
(b) Connect the following hoses:
(1) Vacuum sensing hose (from gas filter) to fuel pressure regulator
(2) Vacuum sensing hose (from fuel pressure regulator) to gas filter
(3) Air hose for PS air control valve to intake manifold
(4) Air hose for A/C idle−up valve to air tube



(5) 2 air hoses for PS air control valve to air tube

EG

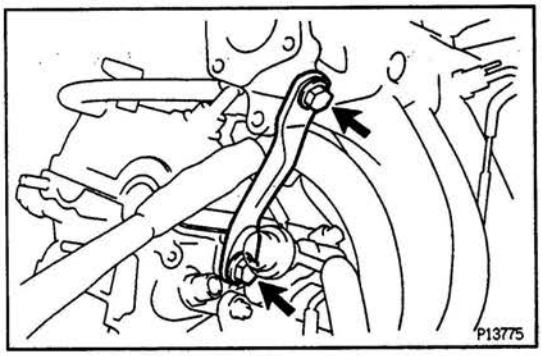
EG



21. CONNECT CONNECTORS AND CABLE

Connect the following connectors and cable:

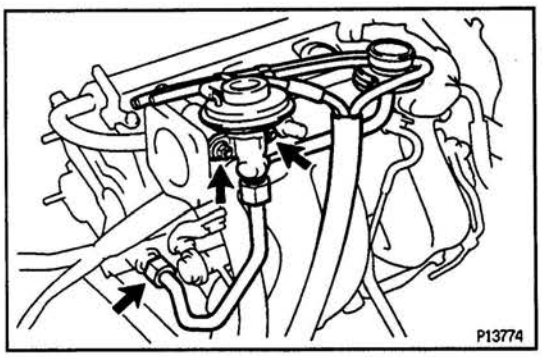
(1) Knock sensor connector
(2) w/ EGR:
VSV connector for EGR
(3) Ground cable



22. INSTALL NO.1 INTAKE MANIFOLD STAY

Install the manifold stay with the 2 bolts.

Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

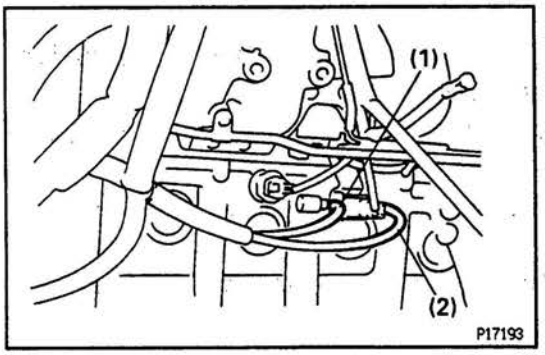


23. w/ EGR:
INSTALL EGR VALVE AND VACUUM MODULATOR

(a) Install a new gasket and the EGR valve with the union nut and 2 nuts.

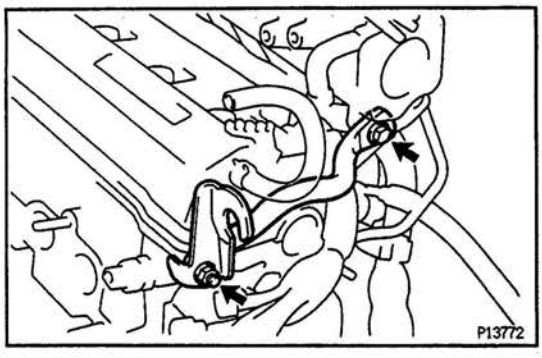
Torque:

Nut:	**13 N·m (130 kgf·cm, 9 ft·lbf)**
Union nut:	**59 N·m (600 kgf·cm, 43 ft·lbf)**



(b) Connect the following hoses:

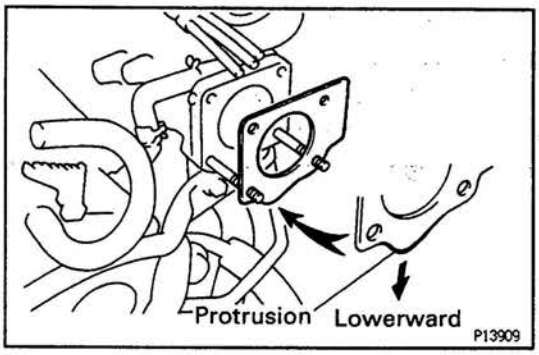
(1) Vacuum hose (from EGR valve) to port E of VSV for EGR
(2) Vacuum hose (from port "Q" of EGR vacuum modulator) to port G of VSV for EGR



24. INSTALL NO.2 INTAKE MANIFOLD STAY AND LH ENGINE HANGER

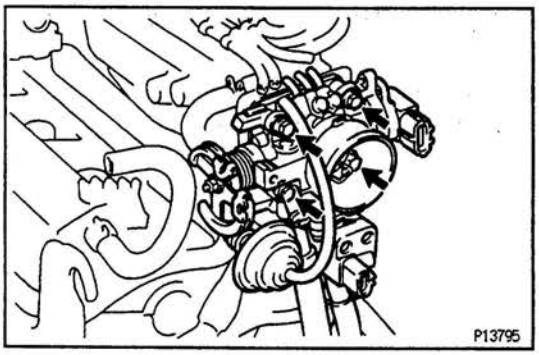
Install the manifold stay and engine hanger with the bolt and nut.

Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)



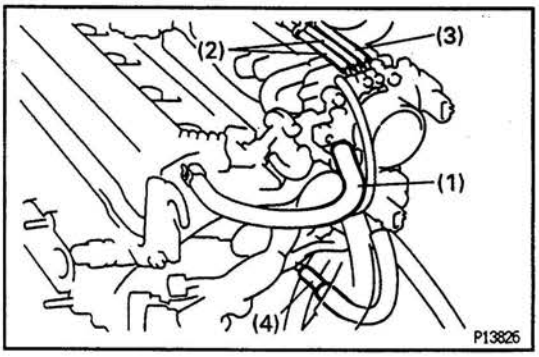
25. INSTALL THROTTLE BODY

(a) Place a new gasket on the intake manifold, facing the protrusion downward.

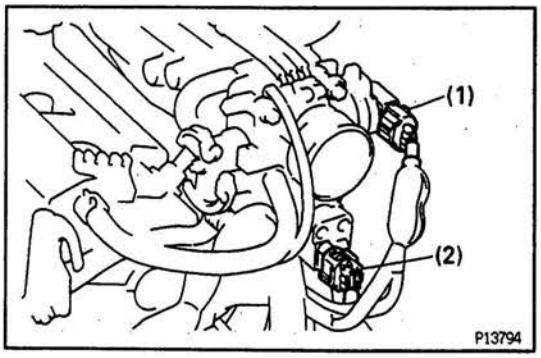


(b) Type A:
Install the throttle body with the 4 bolts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)
HINT: Different bolt lengths are used for the upper and lower sides.
Bolt length:
Upper side: 40 mm (1.57 in.)
Lower side: 55 mm (2.17 in.)

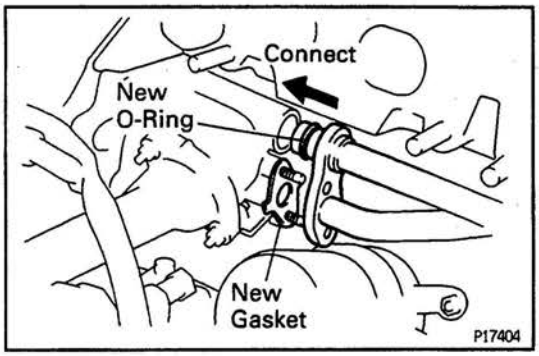
(c) Type B:
Install the throttle body with the 2 bolts and 2 nuts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



(d) Connect the following hoses:
(1) PCV hose to throttle body
(2) w/ EGR:
2 vacuum hoses (from EGR vacuum modulator) to throttle body
(3) w/ EVAP:
Vacuum hose (from BVSV for EVAP) to throttle body
(4) Air hose (from ISC valve) to air tube

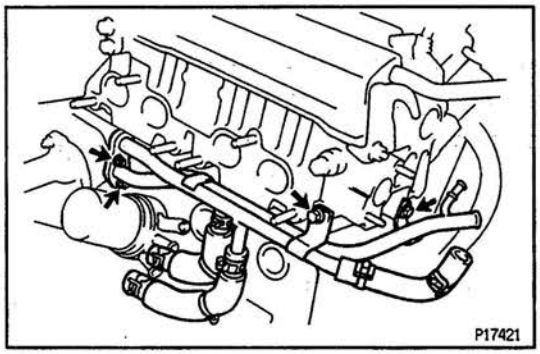


(e) Connect the following connectors:
(1) Throttle position sensor connector
(2) ISC valve connector

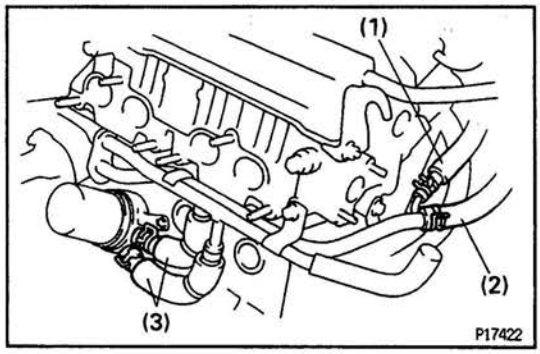


26. INSTALL WATER BYPASS PIPE

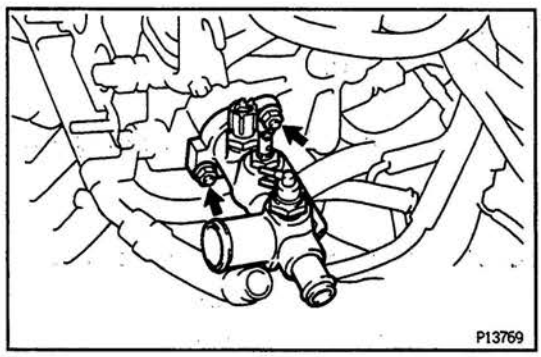
(a) Install a new gasket to the water pump cover.
(b) Install a new O–ring to the bypass pipe.
(c) Apply soapy water on the O–ring.
(d) Connect the water bypass pipe to the water pump cover.



(e) Install the bypass pipe with the 2 nuts and 2 bolts.
Torque:
Nut: 9.3 N·m (95 kgf·cm, 82 in.·lbf)
Bolt: 19 N·m (195 kgf·cm, 14 ft·lbf)

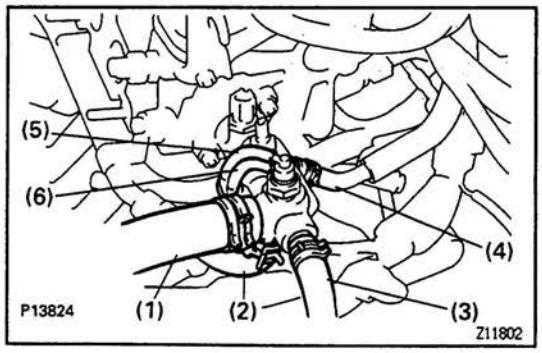


(f) Connect the following hoses:
(1) ISC valve water bypass hose to water bypass pipe
(2) Heater water hose to water bypass pipe
(3) w/ Oil cooler:
2 oil cooler water bypass hoses to oil cooler

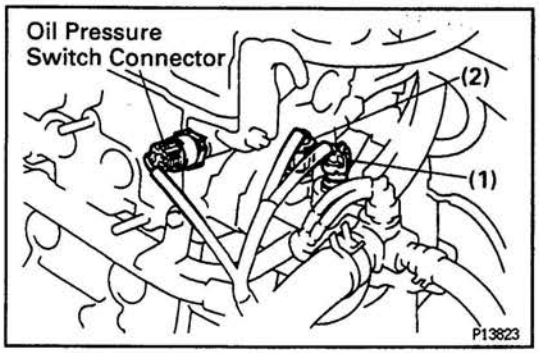


27. INSTALL WATER OUTLET

(a) Install a new gasket, and the water outlet with the 2 nuts.
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)

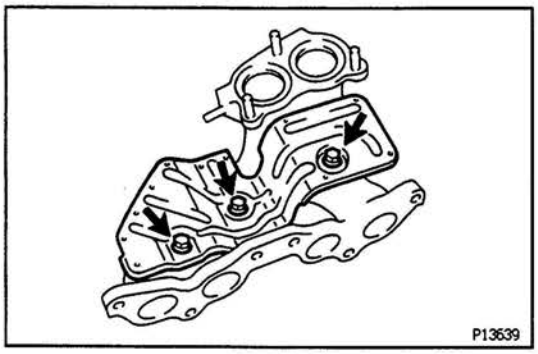


(b) Connect the following hoses:
(1) Upper radiator hose
(2) Water bypass pipe hose
(3) Heater water hose
(4) ISC water bypass hose
(5) w/ EVAP:
BVSV vacuum hose (from port P of throttle body)
(6) w/ EVAP:
BVSV vacuum hose (from charcoal canister)



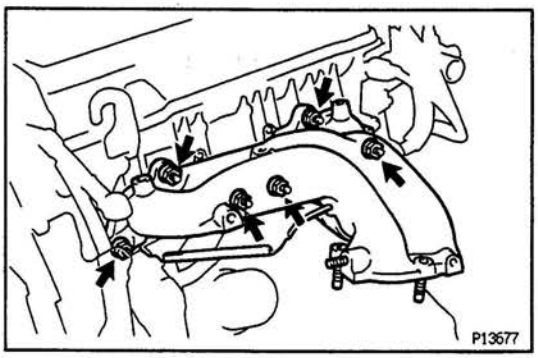
(c) Connect the following connectors:
(1) Water temperature sender gauge connector
(2) Water temperature sensor connector

28. CONNECT OIL PRESSURE SWITCH CONNECTOR

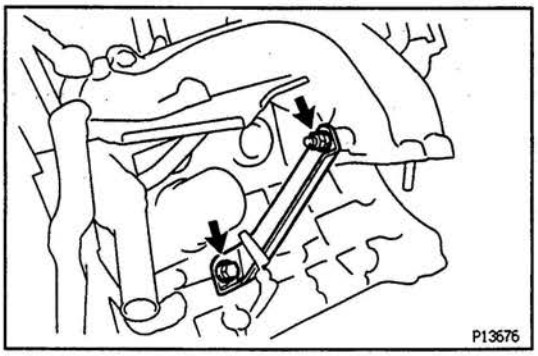


29. INSTALL EXHAUST MANIFOLD

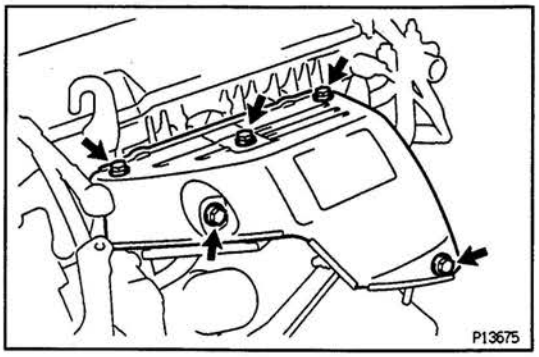
(a) Install the lower heat insulator to the exhaust manifold with the 3 bolts.



(b) Install a new gasket and the exhaust manifold with 6 new nuts. Uniformly tighten the nuts in several passes.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

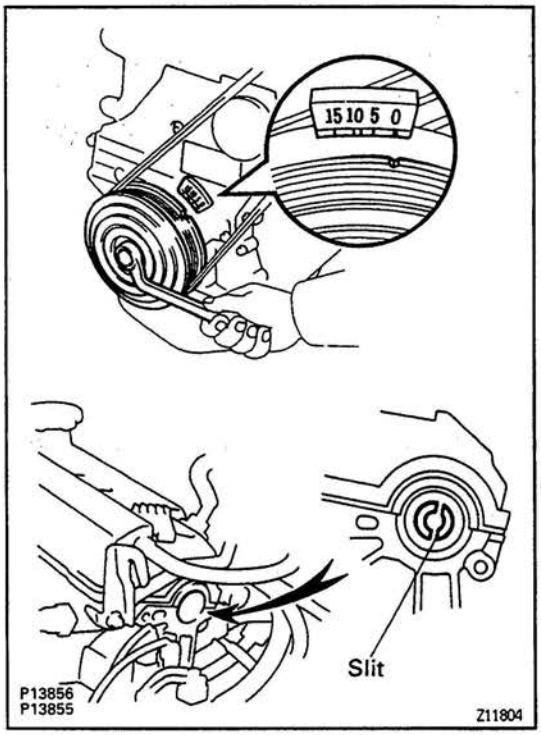


(c) Install the manifold stay with the bolt and nut.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)



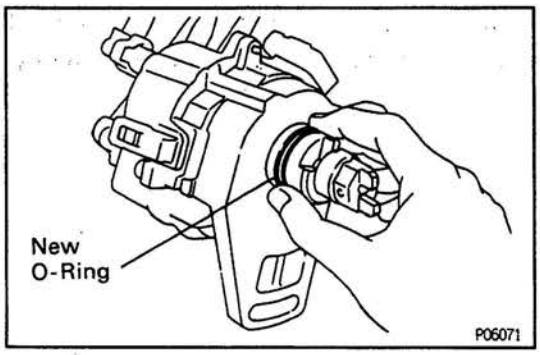
(d) Install the upper heat insulator with 5 bolts.

EG

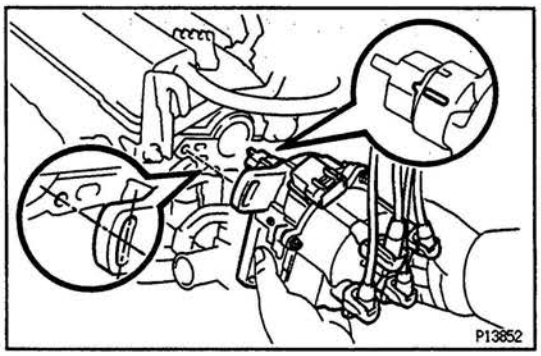


30. INSTALL DISTRIBUTOR

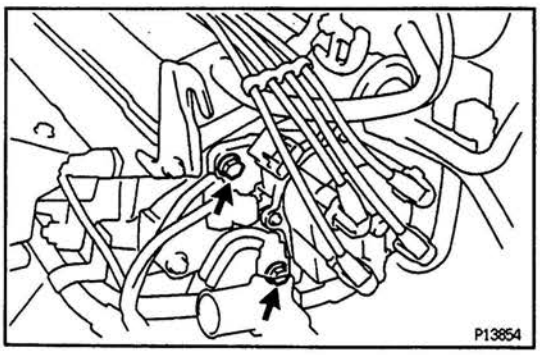
(a) Turn the crankshaft clockwise, and position the slit of the intake camshaft as shown in the illustration.



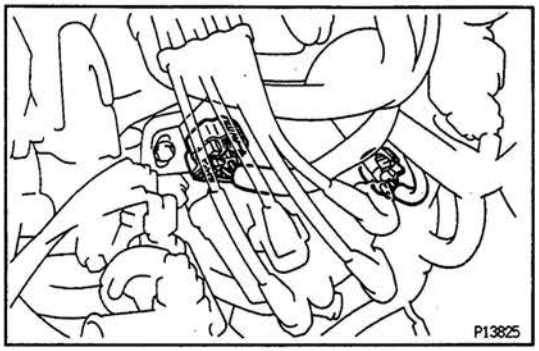
(b) Install a new O—ring to the housing.
(c) Apply a light coat of engine oil on the O—ring.



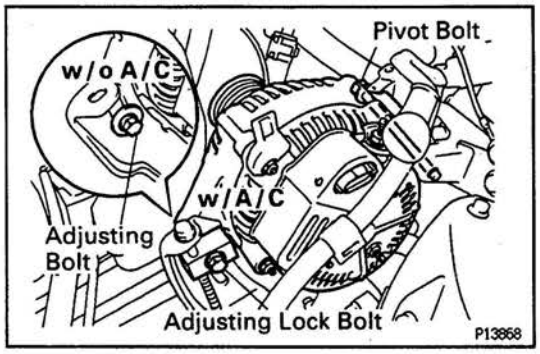
(d) Align the cutout portion of the coupling with the protrusion of the housing.
(e) Insert the distributor, aligning the center of the flange with that of the bolt hole on the cylinder head.



(f) Lightly tighten the 2 bolts.
(g) Connect the 4 high—tension cords to the spark plugs.

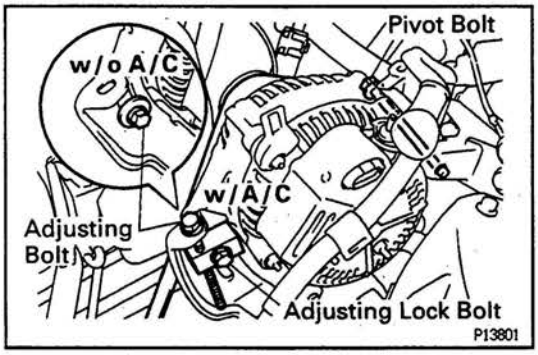


(h) Connect the 2 distributor connectors.



31. INSTALL ALTERNATOR

(a) Install the alternator with the pivot bolt and adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C). Do not tighten the bolts yet.



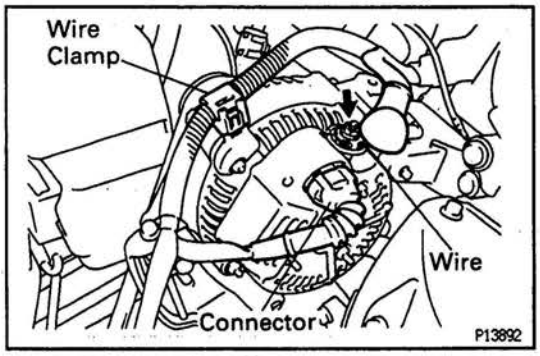
(b) Install the drive belt with the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt.

(c) Adjust the drive belt.
(See step 3 on page CH—8)

(d) Tighten the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt (w/o A/C).

Torque:

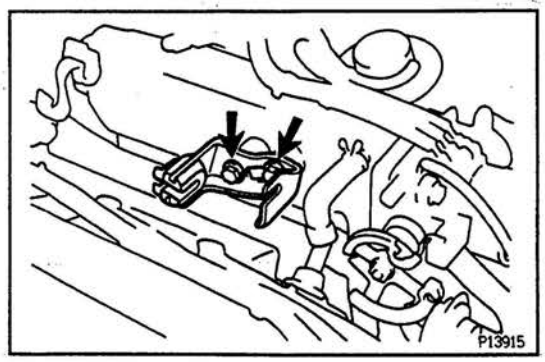
Pivot bolt
54 N·m (530 kgf·cm, 40 ft·lbf)
Adjusting lock bolt (w/ A/C), or
Adjusting bolt (w/o A/C)
19 N·m (185 kgf·cm, 14 ft·lbf)



(e) Connect the alternator connector.

(f) Connect the alternator wire with the nut and rubber cap.

(g) Install the wire clamp to the clip on the alternator.



32. INSTALL ACCELERATOR CABLE BRACKET

Install the accelerator cable bracket with the 2 bolts.

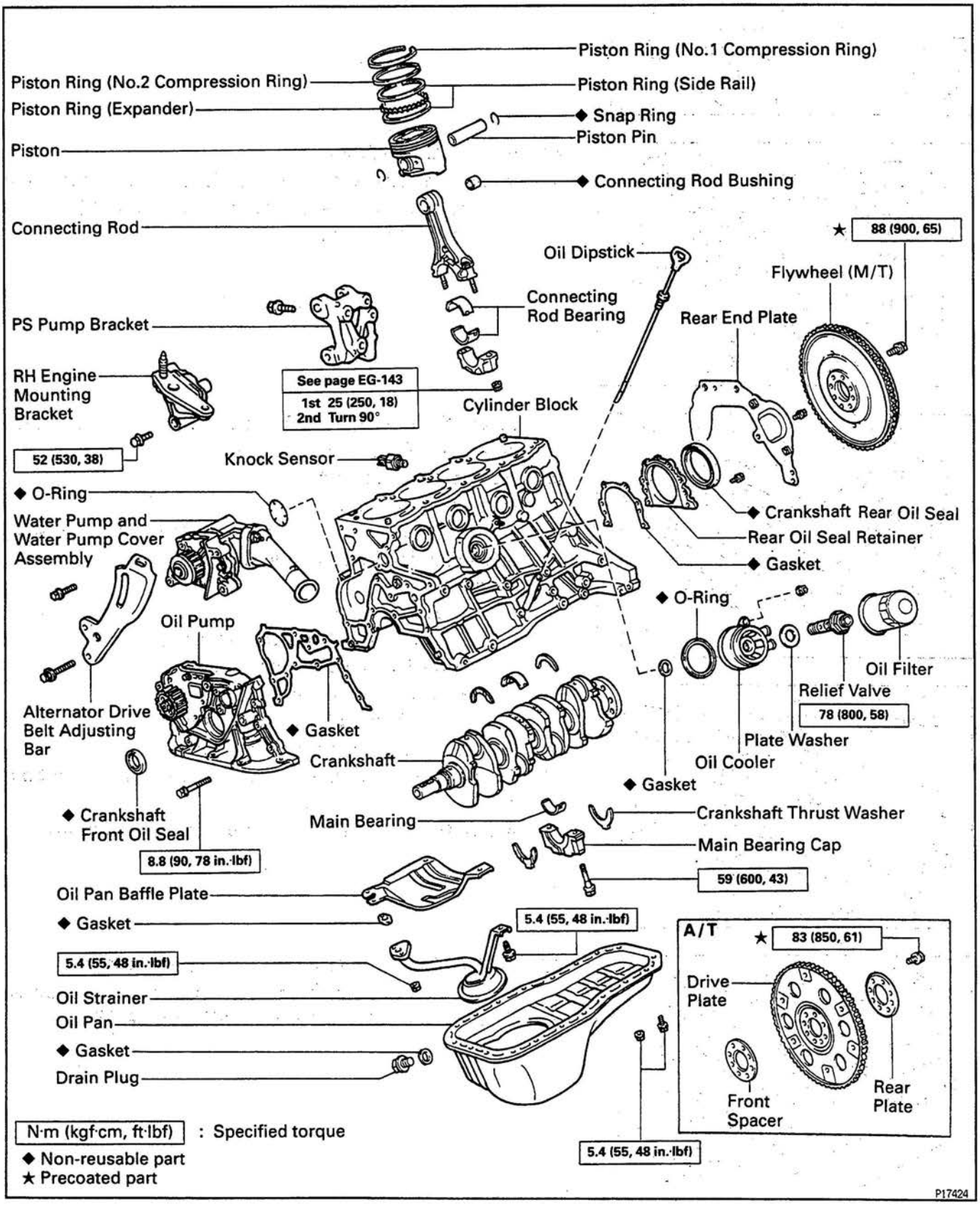
33. FILL RADIATOR WITH ENGINE COOLANT

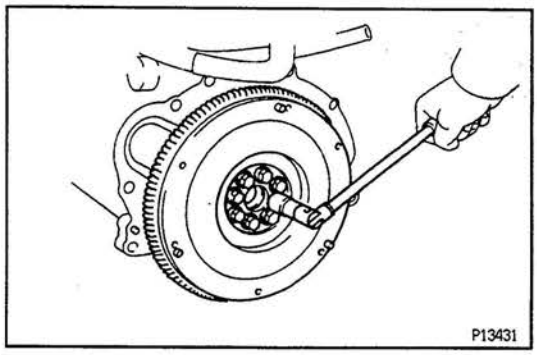
CYLINDER BLOCK

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EG0SS-0V

EG



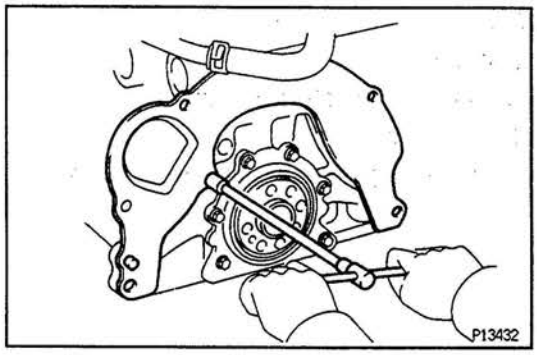


PREPARATION FOR DISASSEMBLY

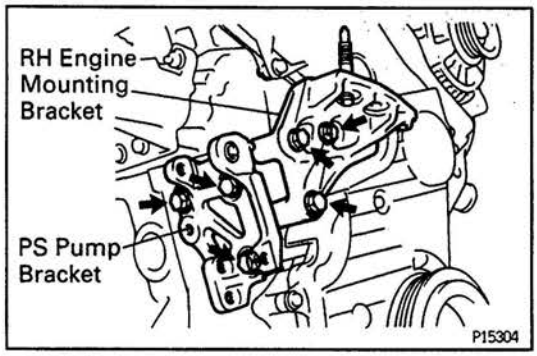
BG3VC-01

(See Components for Disassembly and Assembly)

1. **M/T:**
   REMOVE FLYWHEEL
2. **A/T:**
   REMOVE DRIVE PLATE

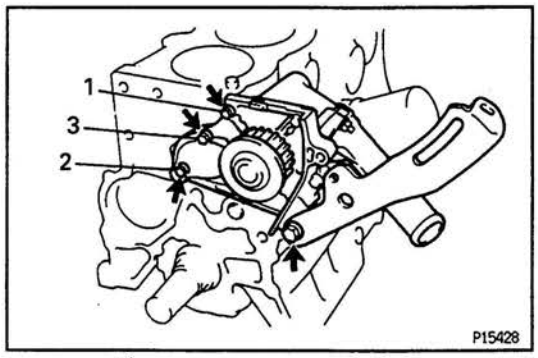


3. **REMOVE REAR END PLATE**
   Remove the bolt and end plate.
4. **INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY**



5. **REMOVE RH ENGINE MOUNTING BRACKET**
   Remove the 3 bolts and mounting bracket.
6. **REMOVE PS PUMP BRACKET**
   Remove the 3 bolts and PS pump bracket.

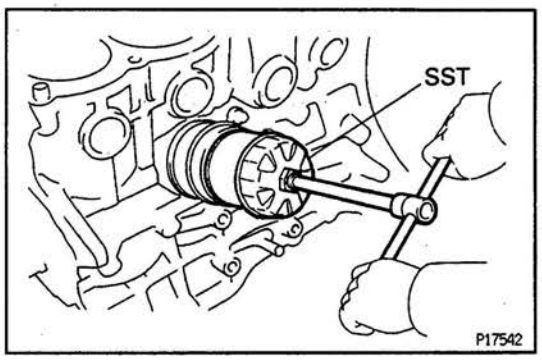
7. **REMOVE TIMING BELT AND PULLEYS**
   (See pages EG–35 to 40)
8. **REMOVE CYLINDER HEAD**
   (See pages EG–53 to 75)
9. **REMOVE OIL PAN AND OIL PUMP**
   (See pages EG–344 and 345)



10. **REMOVE ALTERNATOR DRIVE BELT ADJUSTING BAR, WATER PUMP AND WATER PUMP COVER ASSEMBLY**

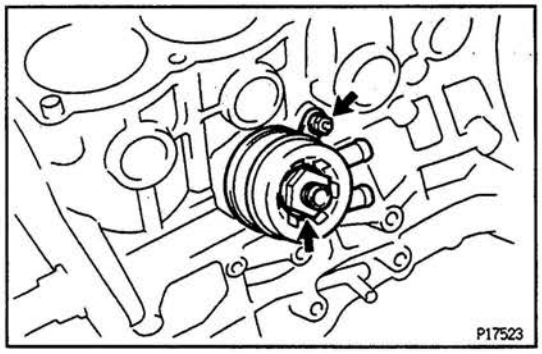
(a) Remove the bolt and adjusting bar.

(b) Remove the 3 bolts in the sequence shown, remove the water pump, water pump cover assembly and O–ring.



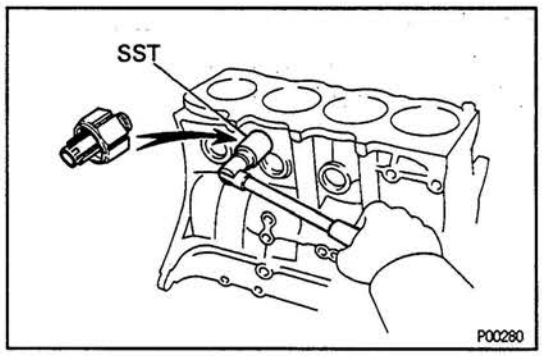
11. REMOVE OIL FILTER

Using SST, remove the oil filter.
SST 09228–06500



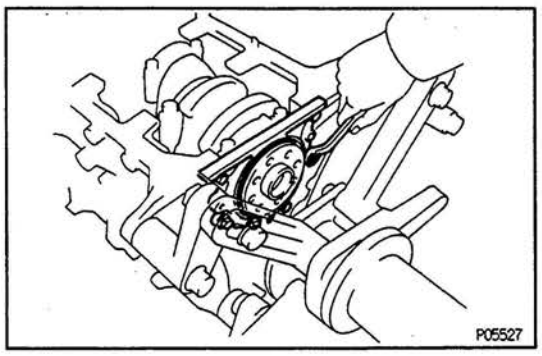
12. w/ OIL COOLER:
REMOVE OIL COOLER

(a) Remove the relief valve and plate washer.
(b) Remove the nut and oil cooler.
(c) Remove the O–ring and gasket from the oil cooler.



13. REMOVE KNOCK SENSOR

Using SST, remove the knock sensor.
SST 09816–30010



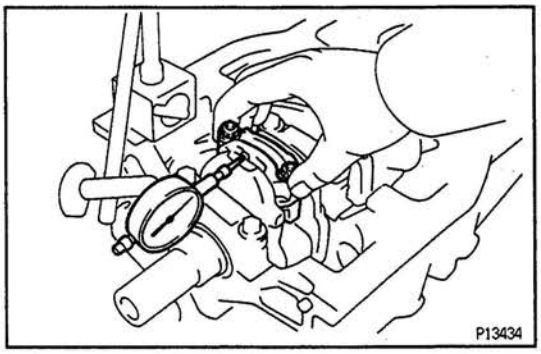
CYLINDER BLOCK DISASSEMBLY

EG11L-06

(See Components for Disassembly and Assembly)

1. REMOVE REAR OIL SEAL RETAINER

Remove the 6 bolts, retainer and gasket.



2. CHECK CONNECTING ROD THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

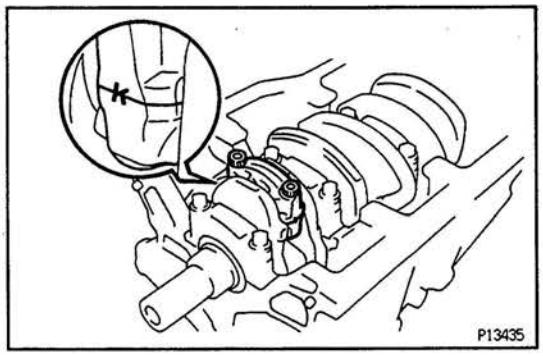
Standard thrust clearance:

0.160 – 0.312 mm (0.0063 – 0.0123 in.)

Maximum thrust clearance:

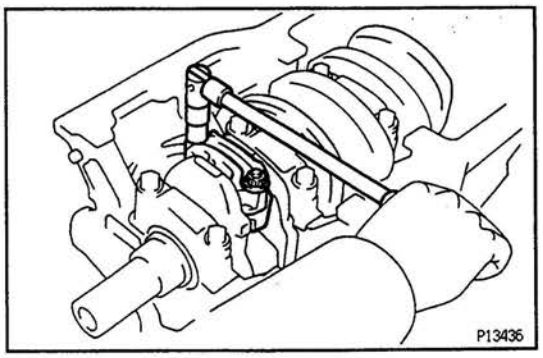
0.35 mm (0.0138 in.)

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

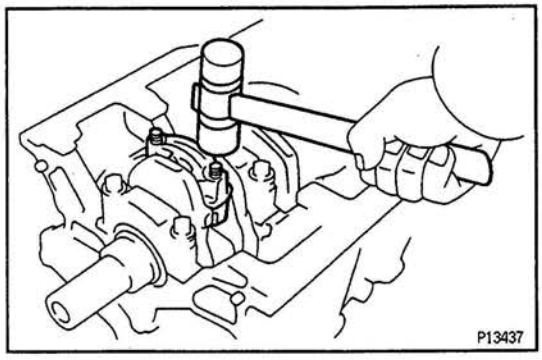


3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

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

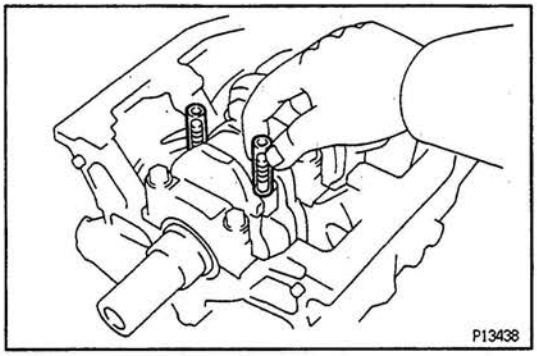


(b) Remove the 2 connecting rod cap nuts.

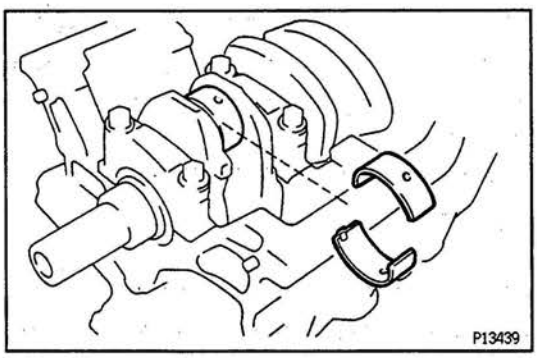


(c) Using a plastic–faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.
HINT: Keep the lower bearing inserted with the connecting rod cap.

EG



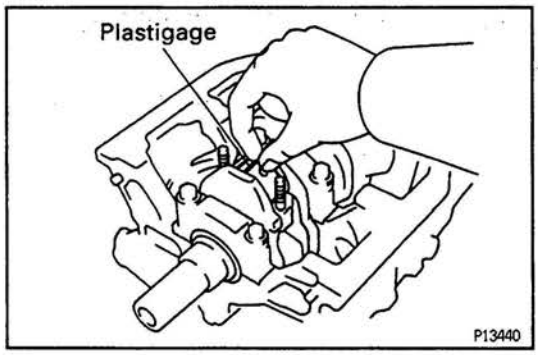
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



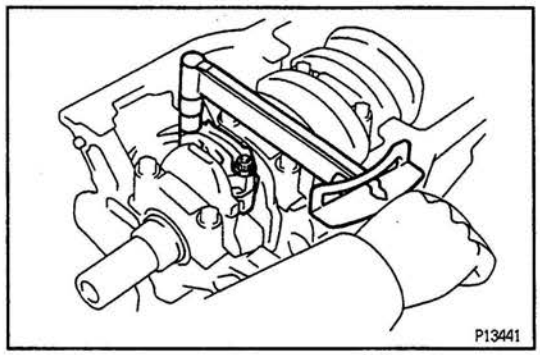
(e) Clean the crank pin and bearing.

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

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



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



(h) Install the connecting rod cap.
(See step 6 on pages EG–143 and 144)

Torque:

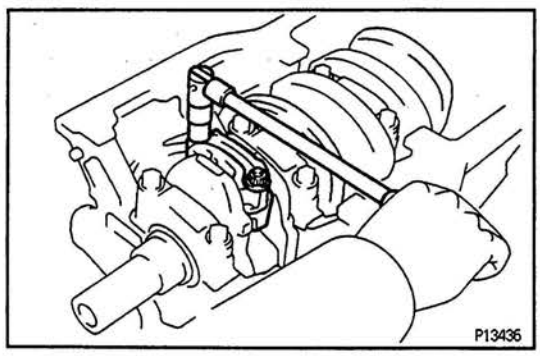
1st

25 N·m (250 kgf·cm, 18 ft·lbf)

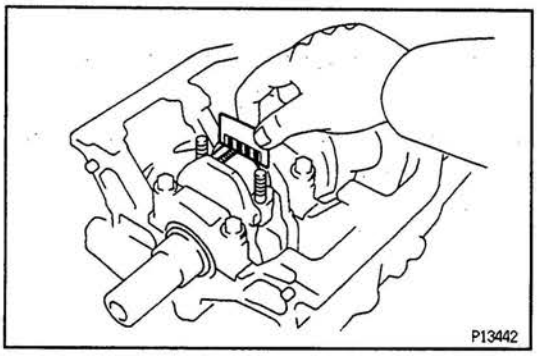
2nd

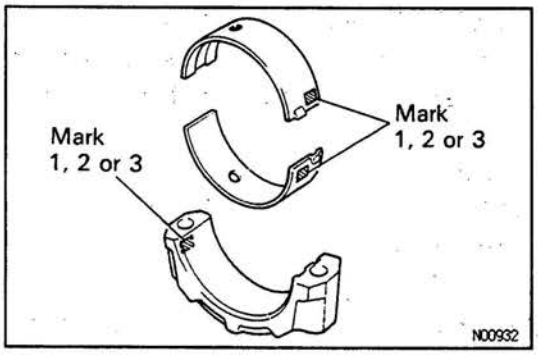
Turn 90°

NOTICE: Do not turn the crankshaft.



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





(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD

0.024 – 0.055 mm (0.0009 – 0.0022 in.)

U/S 0.25

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 crankshaft.

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

Standard sized bearing center wall thickness:

Mark "1"

1.484 – 1.488 mm (0.0584 – 0.0586 in.)

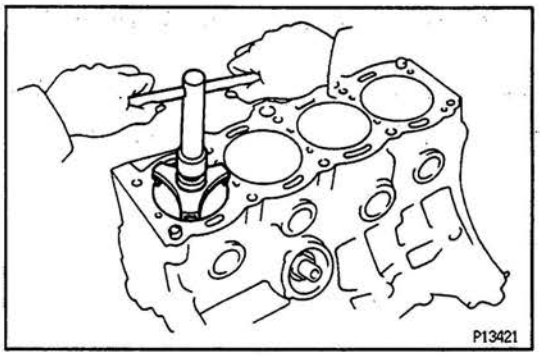
Mark "2"

1.488 – 1.492 mm (0.0586 – 0.0587 in.)

Mark "3"

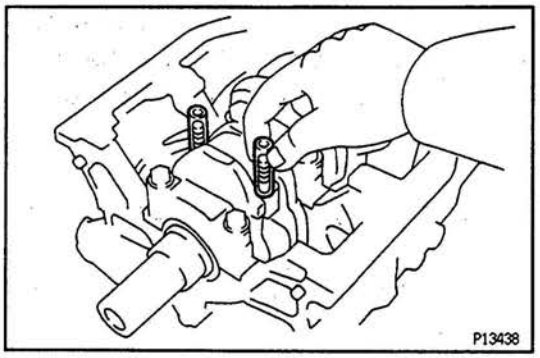
1.492 – 1.496 mm (0.0587 – 0.0589 in.)

(k) Completely remove the Plastigage.



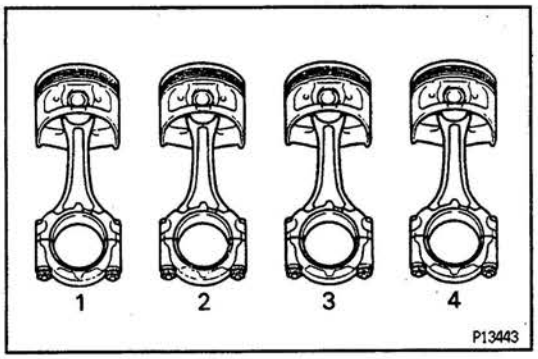
4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

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



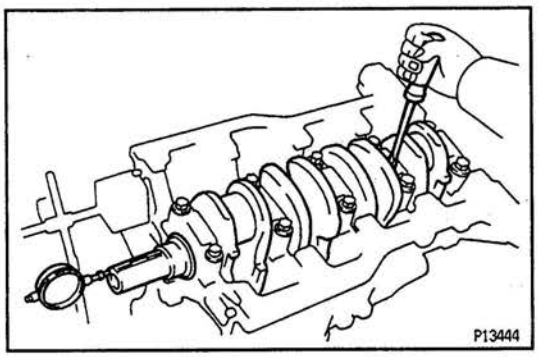
(b) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

(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 the 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.)

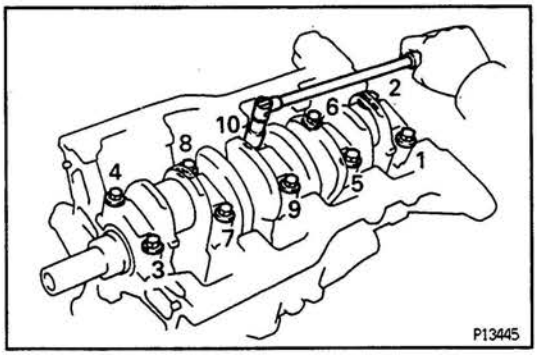
Maximum thrust clearance:

0.30 mm (0.0118 in.)

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

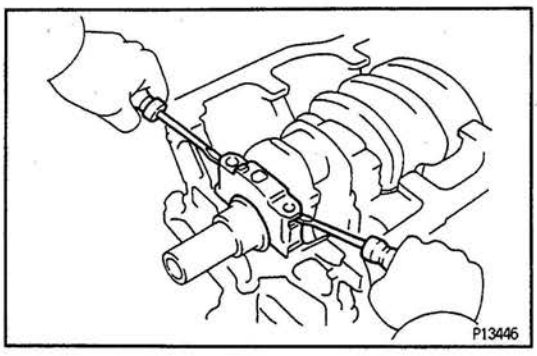
Thrust washer thickness:

2.440 — 2.490 mm (0.0961 — 0.0980 in.)



6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

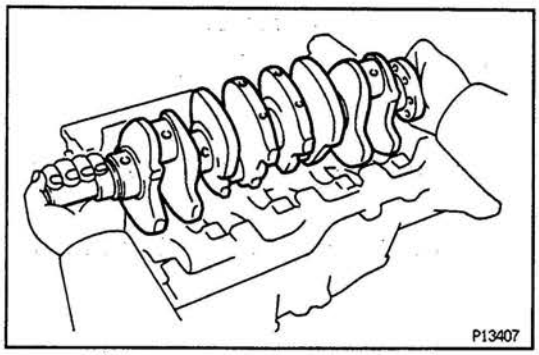
(a) Uniformly loosen and remove the 10 main bearing cap bolts in several passes, in the sequence shown.



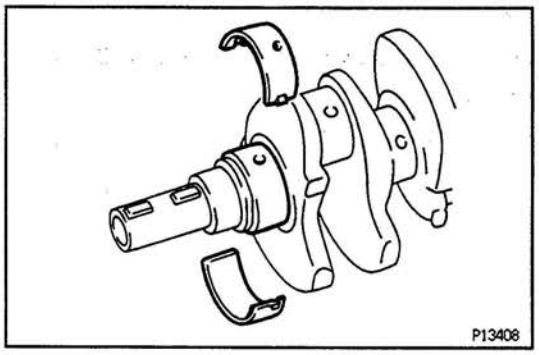
(b) Using 2 screwdrivers, pry out the main bearing cap, and remove the 5 main bearing caps, 5 lower bearings and 2 lower thrust washers (No.3 main bearing cap only).

HINT:

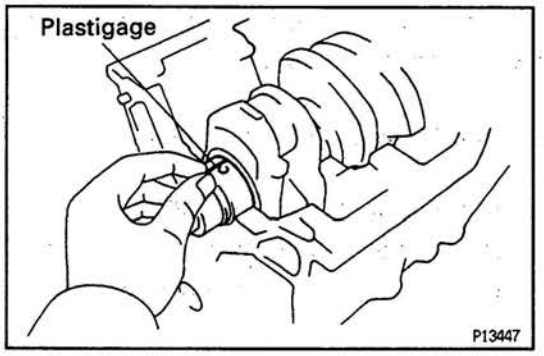
- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in the correct order.



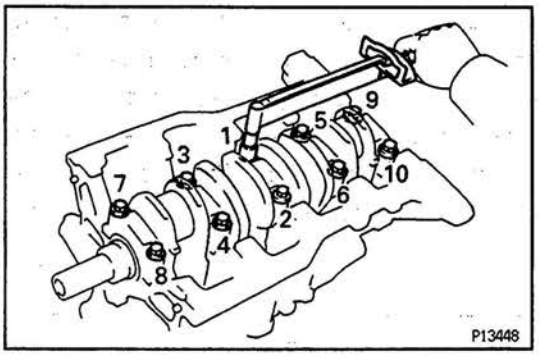
(c) Lift out the crankshaft.
HINT: Keep the upper bearing and upper thrust washers together with the cylinder block.



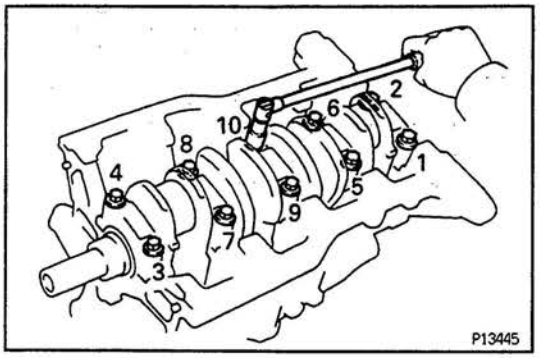
(d) Clean each main journal and bearing.
(e) Check each main journal and bearing for pitting and scratches.
If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



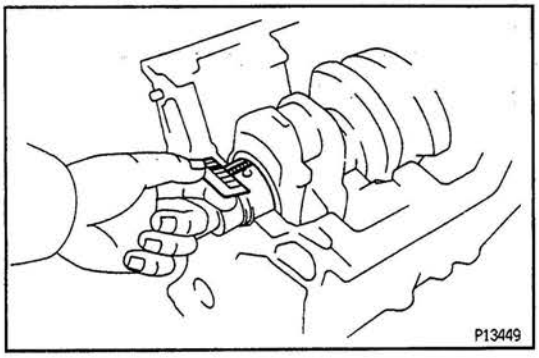
(f) Place the crankshaft on the cylinder block.
(g) Lay a strip of Plastigage across each journal.



(h) Install the main bearing caps.
(See step 4 on page EG–142)
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)
NOTICE: Do not turn the crankshaft.



(i) Remove the main bearing caps.
(See procedure (a) and (b) above)



(j) Measure the Plastigage at its widest point.

Standard clearance:

No.3

STD

0.025 – 0.044 mm (0.0010 – 0.0017 in.)

U/S 0.25

0.027 – 0.067 mm (0.0011 – 0.0026 in.)

Others

STD

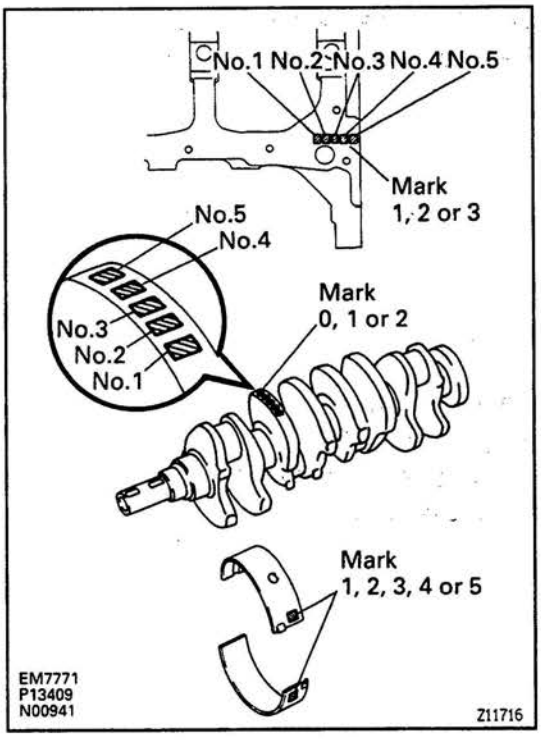
0.015 – 0.034 mm (0.0006 – 0.0013 in.)

U/S 0.25

0.019 – 0.059 mm (0.0007 – 0.0023 in.)

Maximum clearance:

0.08 mm (0.0031 in.)



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

No.3

0.027 – 0.054 mm (0.0011 – 0.0021 in.)

Others

0.017 – 0.044 mm (0.0007 – 0.0017 in.)

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

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

	Number marked								
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 "1"
= Total number 3 (Use bearing "3")

V00240

Reference

Cylinder block main journal bore diameter:

Mark "1"

59.020 – 59.026 mm (2.3236 – 2.3239 in.)

Mark "2"

59.026 – 59.032 mm (2.3239 – 2.3241 in.)

Mark "3"

59.032 – 59.038 mm (2.3241 – 2.3243 in.)

Crankshaft journal diameter:

Mark "0"

54.998 – 55.003 mm (2.1653 – 2.1655 in.)

Mark "1"

54.993 – 54.998 mm (2.1651 – 2.1653 in.)

Mark "2"

54.988 – 54.993 mm (2.1649 – 2.1651 in.)

Standard sized bearing center wall thickness:

No.3

Mark "1"

1.992 – 1.995 mm (0.0784 – 0.0785 in.)

Mark "2"

1.995 – 1.998 mm (0.0785 – 0.0787 in.)

Mark "3"

1.998 – 2.001 mm (0.0787 – 0.0788 in.)

Mark "4"

2.001 – 2.004 mm (0.0788 – 0.0789 in.)

Mark "5"

2.004 – 2.007 mm (0.0789 – 0.0790 in.)

Others

Mark "1"

1.997 – 2.000 mm (0.0786 – 0.0787 in.)

Mark "2"

2.000 – 2.003 mm (0.0787 – 0.0789 in.)

Mark "3"

2.003 – 2.006 mm (0.0789 – 0.0790 in.)

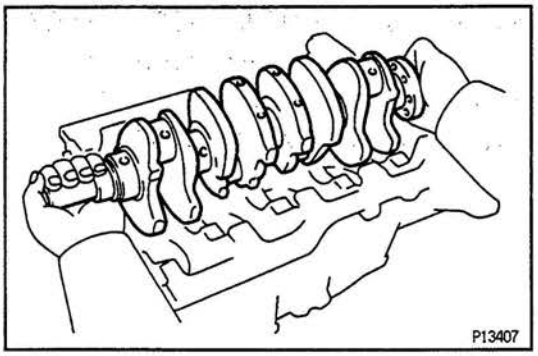
Mark "4"

2.006 – 2.009 mm (0.0790 – 0.0791 in.)

Mark "5"

2.009 – 2.012 mm (0.0791 – 0.0792 in.)

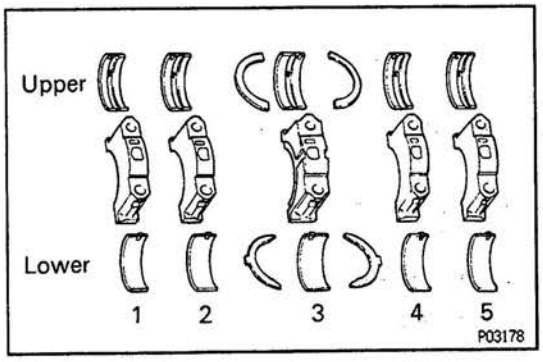
(k) Completely remove the Plastigage.



7. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

(b) Remove the 5 upper bearings and 2 upper thrust washers from the cylinder block.

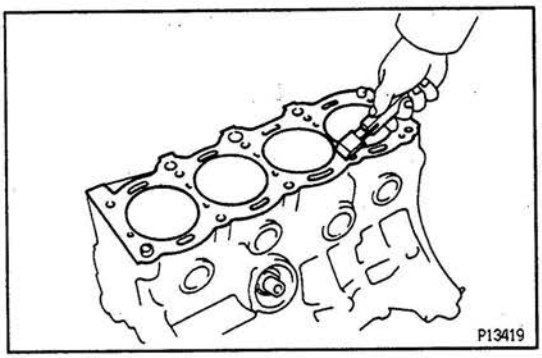


HINT: Arrange the main bearing caps, bearings and thrust washers in the correct order.

EG

EG0BU-0E

CYLINDER BLOCK INSPECTION



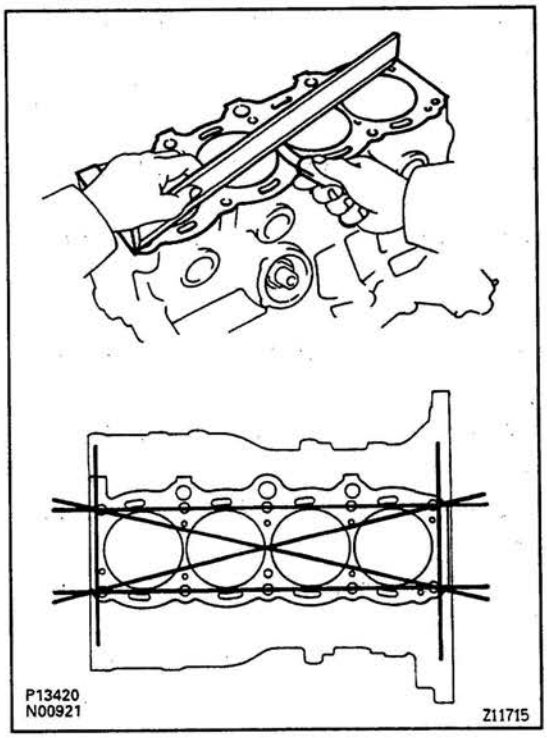
1. CLEAN CYLINDER BLOCK

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.



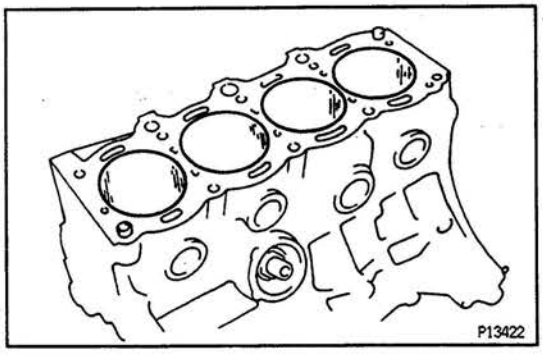
2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage:

0.05 mm (0.0020 in.)

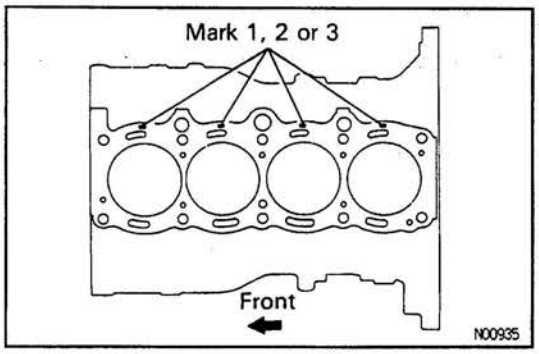
If warpage is greater than maximum, replace the cylinder block.



3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

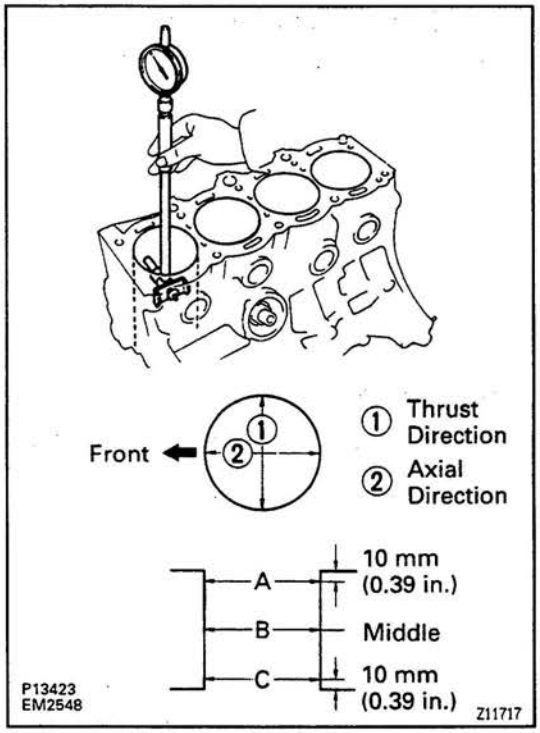
Visually check the cylinder for vertical scratches.

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



4. INSPECT CYLINDER BORE DIAMETER

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



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

Standard diameter:

STD

Mark "1"

86.000 — 86.010 mm (3.3858 — 3.3862 in.)

Mark "2"

86.010 — 86.020 mm (3.3862 — 3.3866 in.)

Mark "3"

86.020 — 86.030 mm (3.3866 — 3.3870 in.)

Maximum diameter:

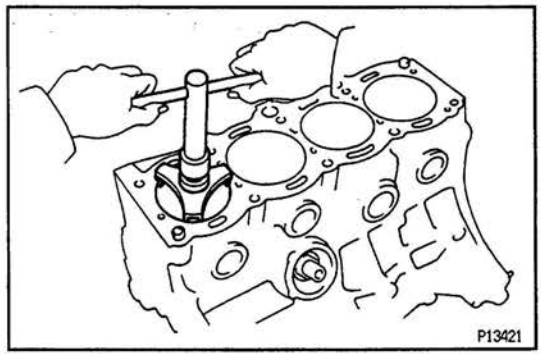
STD

86.23 mm (3.3949 in.)

O/S 0.50

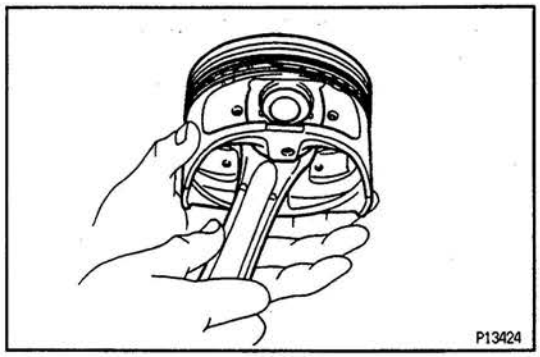
86.73 mm (3.4146 in.)

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



5. REMOVE CYLINDER RIDGE

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



EG0BV-0M

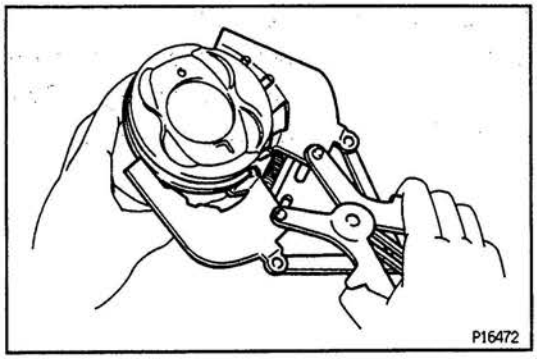
PISTON AND CONNECTING ROD DISASSEMBLY

1. CHECK FIT BETWEEN PISTON AND PISTON PIN

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

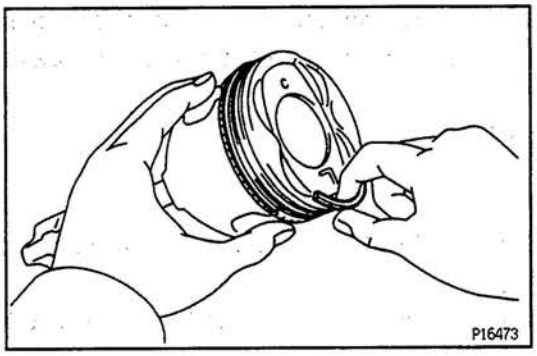
If any movement is felt, replace the piston and pin as a set.

EG

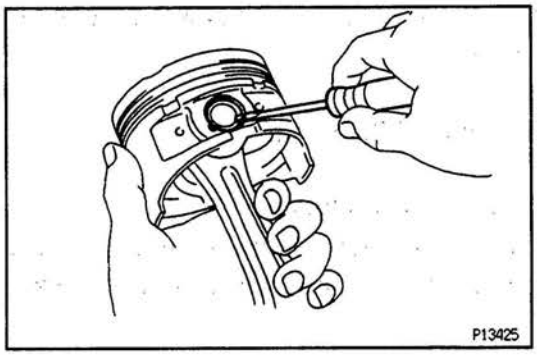


2. REMOVE PISTON RINGS

(a) Using a piston ring expander, remove the 2 compression rings.

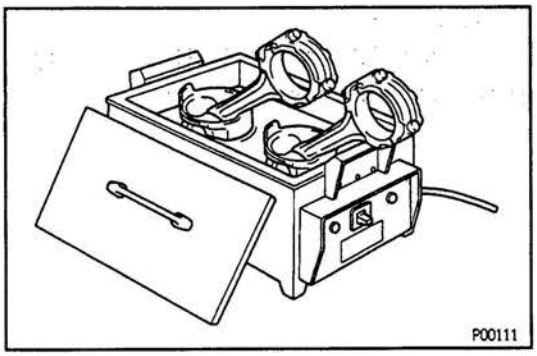


(b) Remove the 2 side rails and oil ring by hand.
HINT: Arrange the piston rings in correct order only.

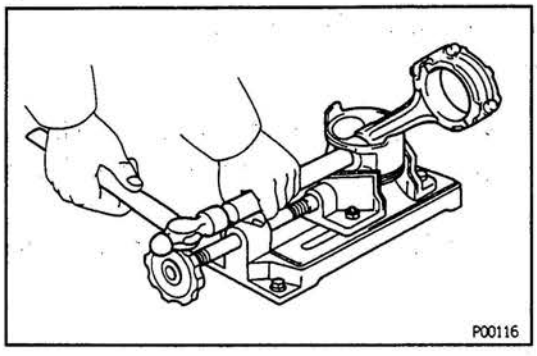


3. DISCONNECT CONNECTING ROD FROM PISTON

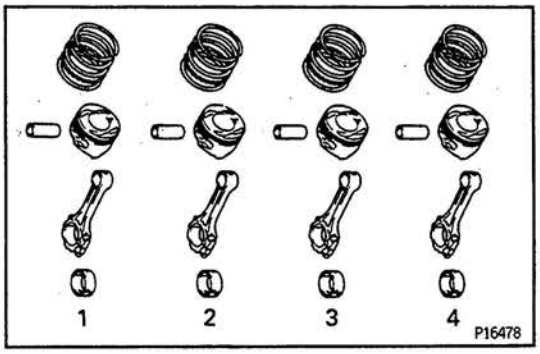
(a) Using a small screwdriver, pry out the 2 snap rings.



(b) Gradually heat the piston to 80 – 90°C (176 – 194°F).

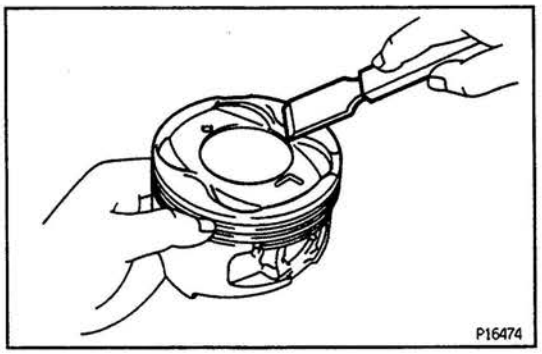


(c) Using a plastic–faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.



HINT:

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

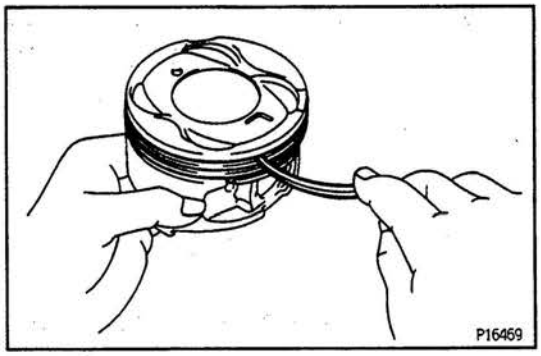


EG3VD-01

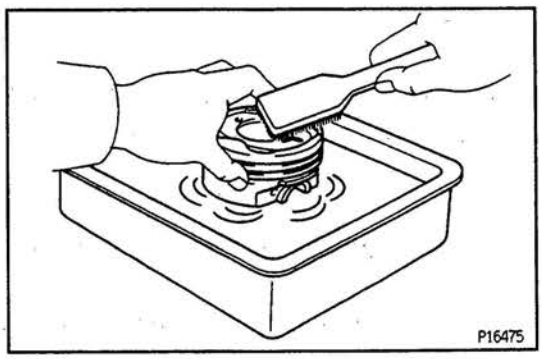
PISTON AND CONNECTING ROD INSPECTION

1. CLEAN PISTON

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

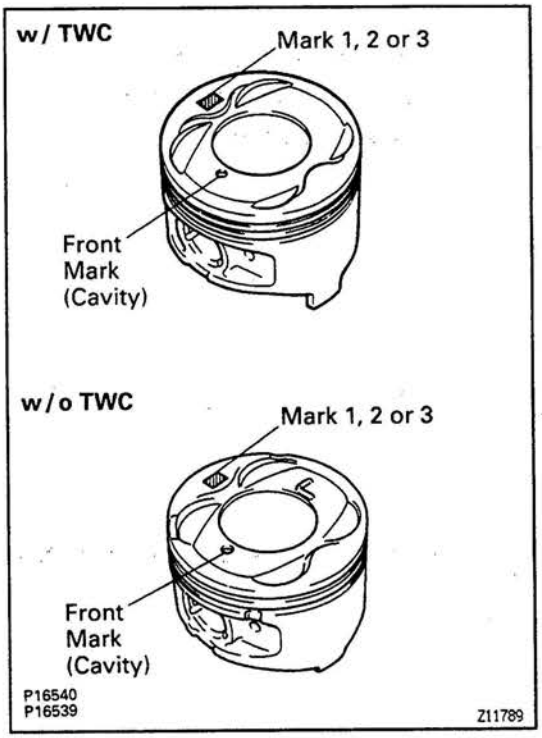


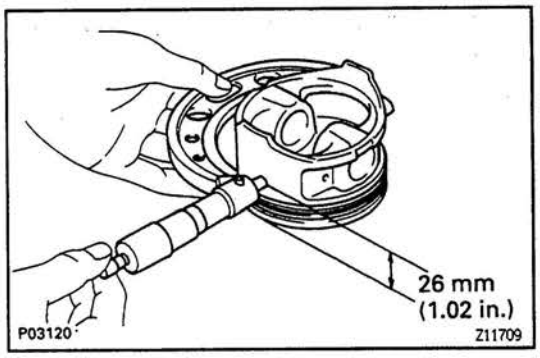
(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



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

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

Piston diameter (w/ TWC):

STD

Mark "1"

85.865 — 85.875 mm (3.3805 — 3.3809 in.)

Mark "2"

85.875 — 85.885 mm (3.3809 — 3.3813 in.)

Mark "3"

85.885 — 85.895 mm (3.3813 — 3.3817 in.)

O/S 0.50

86.365 — 86.395 mm (3.4002 — 3.4014 in.)

Piston diameter (w/o TWC):

STD

Mark "1"

85.870 — 85.880 mm (3.3807 — 3.3811 in.)

Mark "2"

85.880 — 85.890 mm (3.3811 — 3.3815 in.)

Mark "3"

85.890 — 85.900 mm (3.3815 — 3.3819 in.)

O/S 0.50

86.370 — 86.400 mm (3.4004 — 3.4016 in.)

(b) Measure the cylinder bore diameter in the thrust directions. (See step 4 on page EG—127)

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

Standard oil clearance:

w/ TWC

0.125 — 0.145 mm (0.0049 — 0.0057 in.)

w/o TWC

0.120 — 0.140 mm (0.0047 — 0.0055 in.)

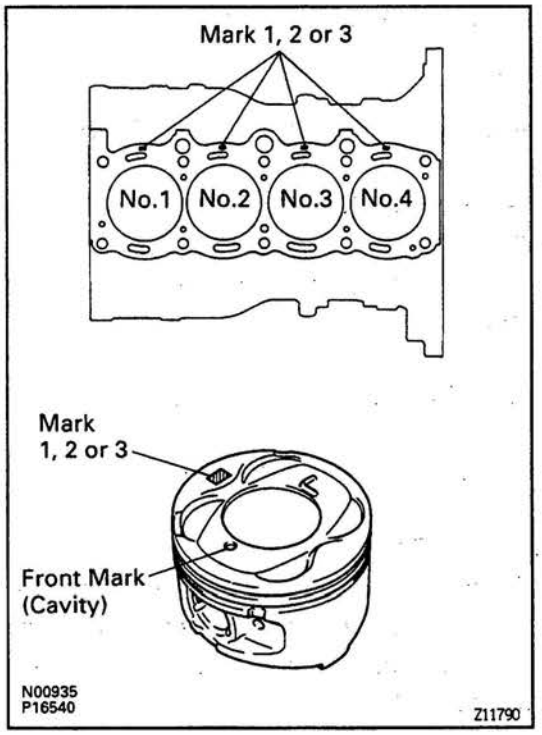
Maximum oil clearance:

w/ TWC

0.165 mm (0.0065 in.)

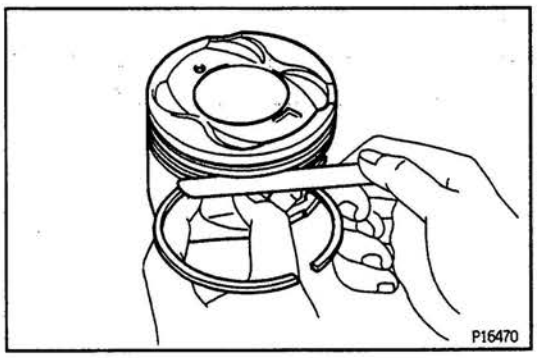
w/o TWC

0.160 mm (0.0063 in.)



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

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



B. Inspect piston ring groove clearance

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

Ring groove clearance:

No.1

w/ TWC

0.040 — 0.080 mm (0.0016 — 0.0031 in.)

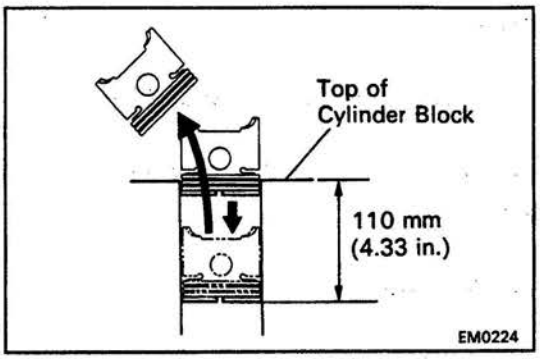
w/o TWC

0.030 — 0.070 mm (0.0012 — 0.0028 in.)

No.2

0.030 — 0.070 mm (0.0012 — 0.0028 in.)

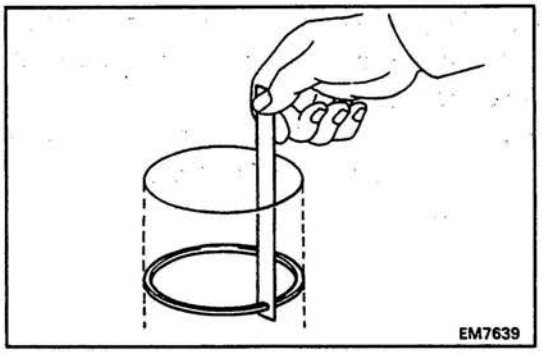
If the clearance is greater than maximum, replace the piston.



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 end gap.

Standard end gap:

No.1

0.270 — 0.500 mm (0.0106 — 0.0197 in.)

No.2

0.270 — 0.510 mm (0.0106 — 0.0201 in.)

Oil (Side rail)

0.200 — 0.550 mm (0.0079 — 0.0217 in.)

Maximum end gap:

No.1

1.10 mm (0.0433 in.)

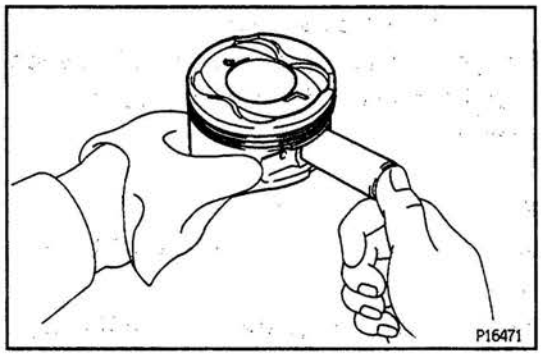
No.2

1.11 mm (0.0437 in.)

Oil (Side rail)

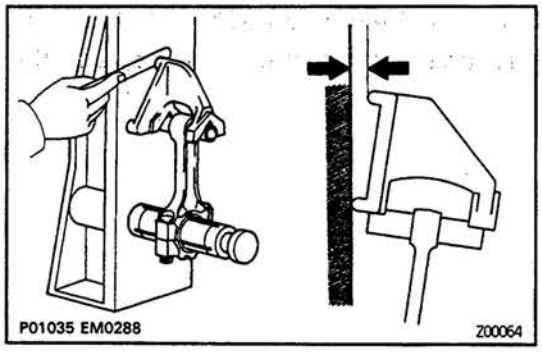
1.15 mm (0.0453 in.)

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



D. Inspect piston pin fit

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



3. INSPECT CONNECTING ROD

A. Inspect connecting rod alignment

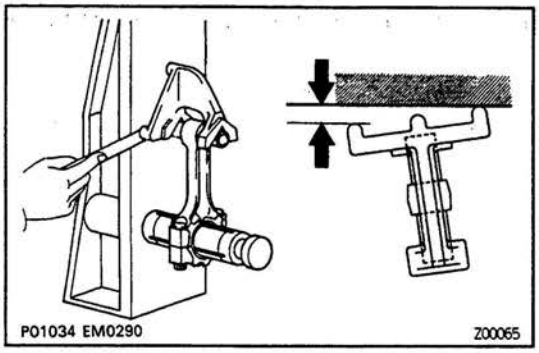
Using a rod aligner and feeler gauge, check the connecting rod alignment.

- 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 connecting rod assembly.

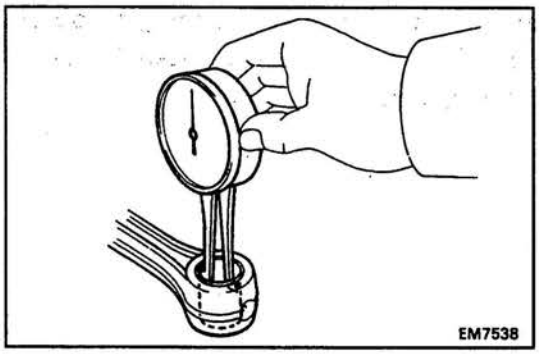


- Check for twist

Maximum twist:

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

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

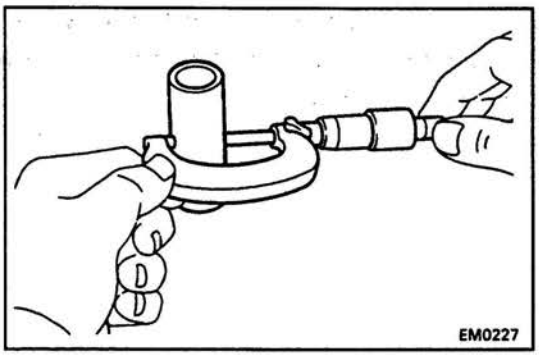


B. Inspect piston pin oil clearance

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

Bushing inside diameter:

22.005 – 22.017 mm (0.8663 – 0.8668 in.)



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

Piston pin diameter:

21.997 – 22.009 mm (0.8660 – 0.8665 in.)

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

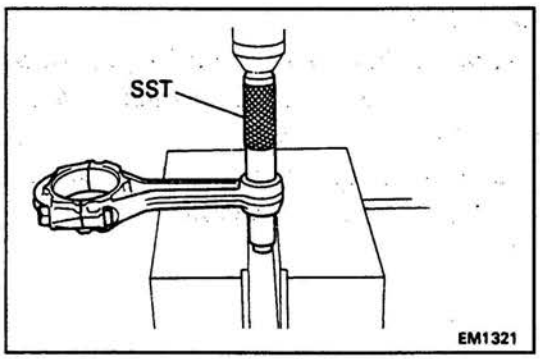
Standard oil clearance:

0.005 – 0.011 mm (0.0002 – 0.0004 in.)

Maximum oil clearance:

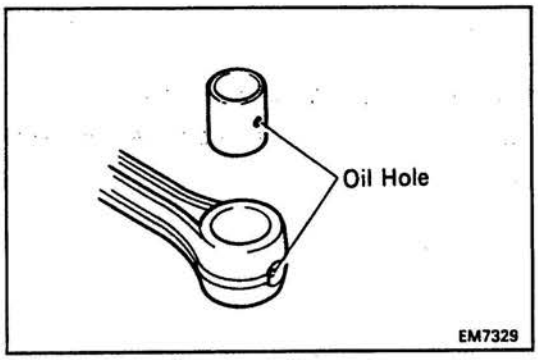
0.05 mm (0.0020 in.)

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



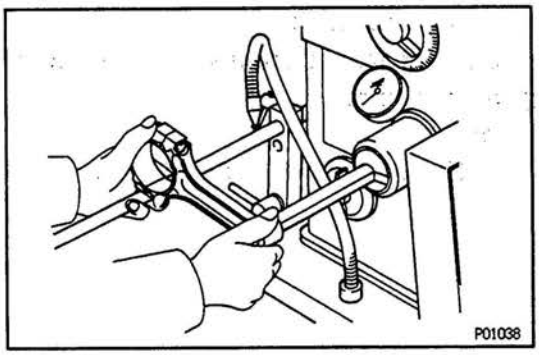
C. If necessary, replace connecting rod bushing

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

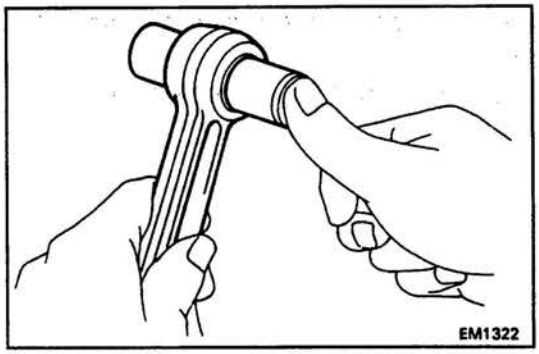


(b) Align the oil holes of a new bushing and the connecting rod.

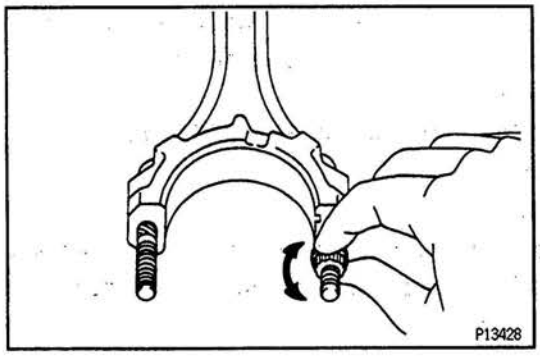
(c) Using SST and a press, press in the bushing.
SST 09222–30010



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



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



D. Inspect connecting rod bolts

(a) Install the cap nut to the connecting rod bolt. Check that the cap nut can be turned easily by hand to the end of the thread.

(b) If the cap nut cannot be turned easily, measure the outside diameter of the connecting rod bolt with a vernier caliper.

Standard diameter:

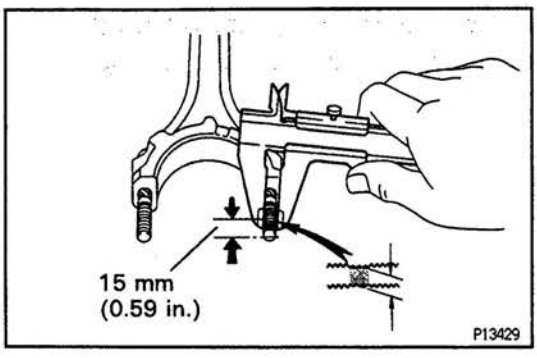
7.860 – 8.000 mm (0.3094 – 0.3150 in.)

Minimum diameter:

7.60 mm (0.2992 in.)

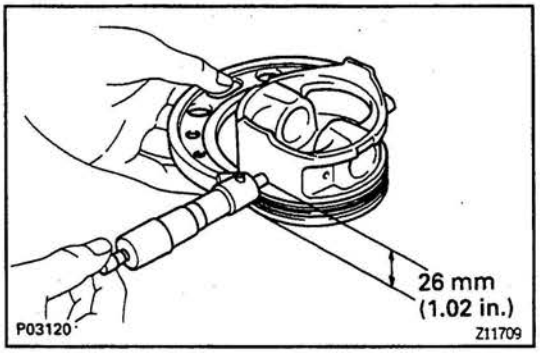
HINT: If the location of this area cannot be judged by visual inspection, measure the outer diameter at the location shown in the illustration.

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



EG11M-03

CYLINDER BORING



HINT:

- Bore all the 4 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

w/ TWC

86.365 – 86.395 mm (3.4002 – 3.4014 in.)

w/o TWC

86.370 – 86.400 mm (3.4004 – 3.4016 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

w/ TWC

0.125 – 0.145 mm (0.0049 – 0.0057 in.)

w/o TWC

0.120 – 0.140 mm (0.0047 – 0.0055 in.)

H = Allowance for honing

0.02 mm (0.0008 in.) or less

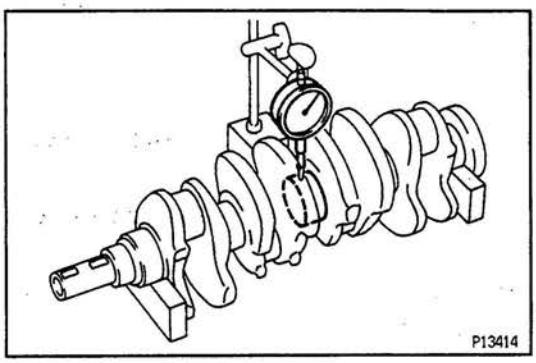
3. BORE AND HONE CYLINDER TO CALCULATED DIMENSIONS

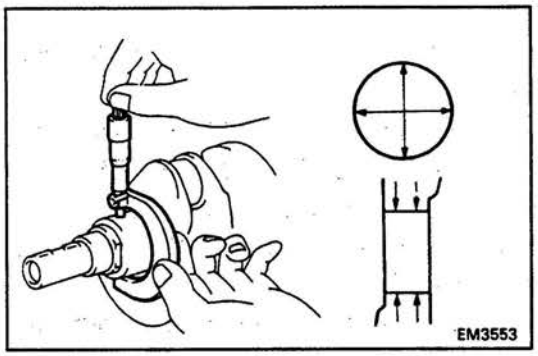
Maximum honing:

0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.

EG





CRANKSHAFT INSPECTION AND REPAIR

EQOBY-01

1. INSPECT CRANKSHAFT FOR CIRCLE RUNOUT

(a) Place the crankshaft on V—blocks.

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

Maximum circle runout:

0.06 mm (0.0024 in.)

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

2. INSPECT MAIN JOURNALS AND CRANK PINS

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

Main journal diameter:

STD

54.988 — 55.003 mm (2.1653 — 2.1655 in.)

U/S 0.25

54.745 — 54.755 mm (2.1553 — 2.1557 in.)

Crank pin diameter:

STD

51.985 — 52.000 mm (2.0466 — 2.0472 in.)

U/S 0.25

51.745 — 51.755 mm (2.0372 — 2.0376 in.)

If the diameter is not as specified, check the oil clearance (See steps 3 and 6 on pages EG—119 to 124). If necessary, grind or replace the crankshaft.

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

Maximum taper and out—of—round:

0.02 mm (0.0008 in.)

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

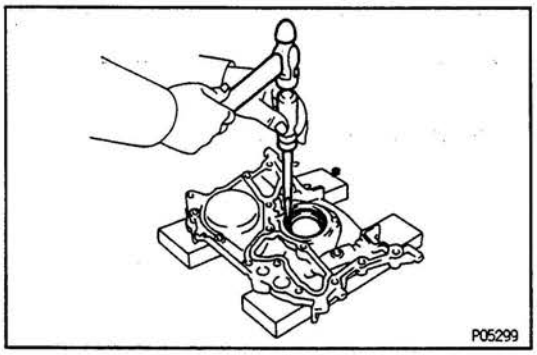
3. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

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

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

CRANKSHAFT OIL SEALS REPLACEMENT EGGC0-0U

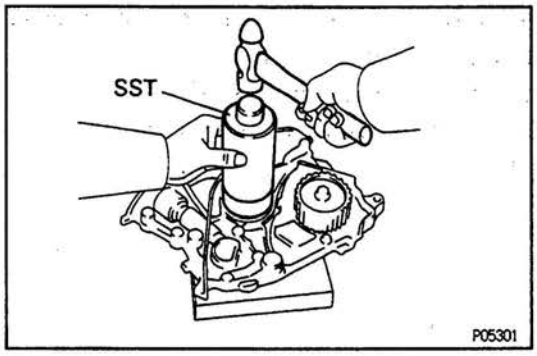
HINT: There are 2 methods (A and B) to replace the oil seal which are as follows:



1. REPLACE CRANKSHAFT FRONT OIL SEAL

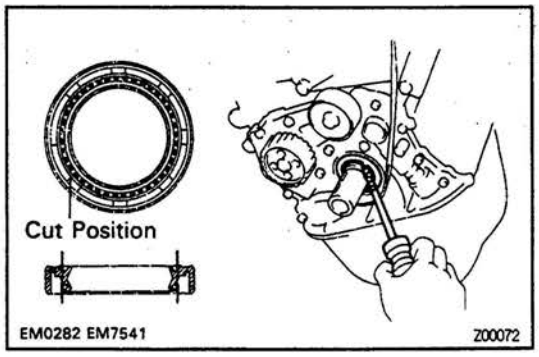
A. If oil pump is removed from cylinder block:

(a) Using a screwdriver 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 oil pump body edge.
SST 09226–10010

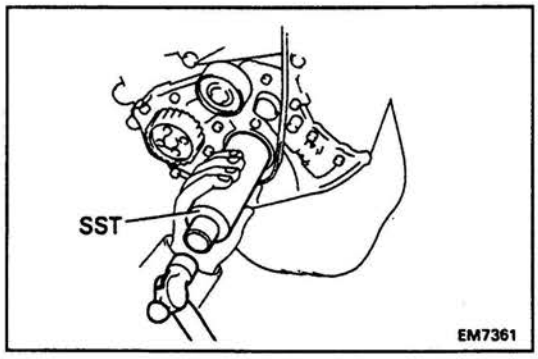
(c) Apply MP grease to the oil seal lip.



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

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

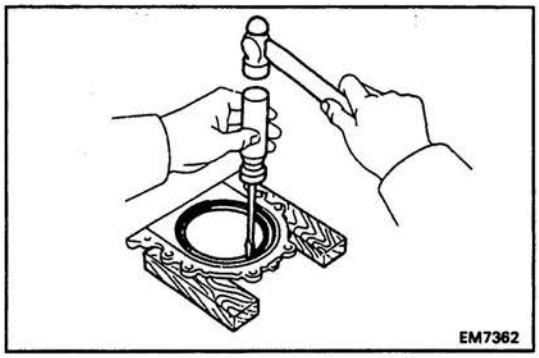
(b) Using a screwdriver, pry out the oil seal.
NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.



(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 09226–10010

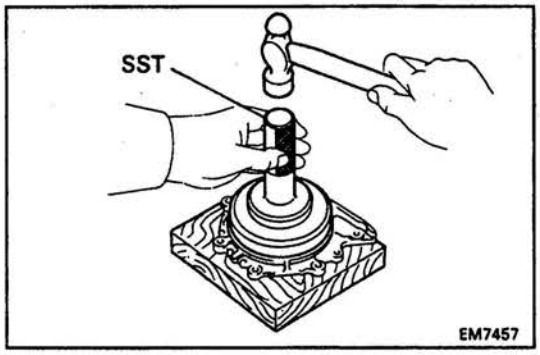
EG



2. REPLACE CRANKSHAFT REAR OIL SEAL

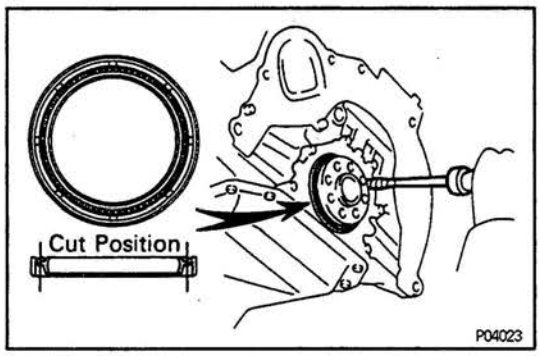
A. If rear oil seal retainer is removed from cylinder block:

(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 09223–63010

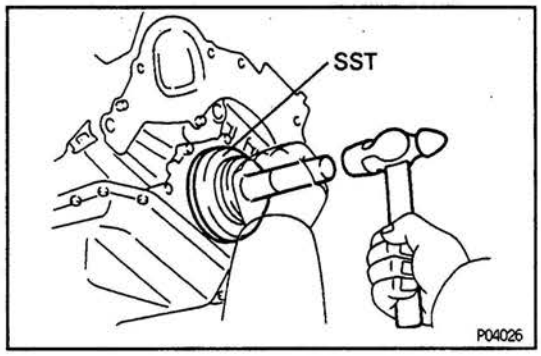
(c) Apply MP grease to the oil seal lip.



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.

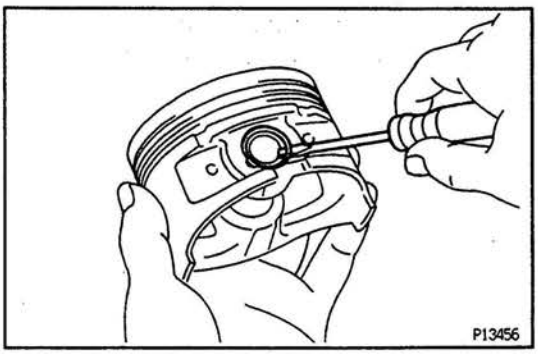


(c) Apply MP grease to a new oil seal lip.

(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–63010

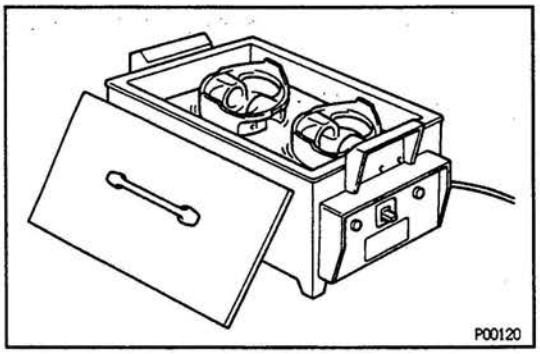
EG0C1-0L

PISTON AND CONNECTING ROD ASSEMBLY

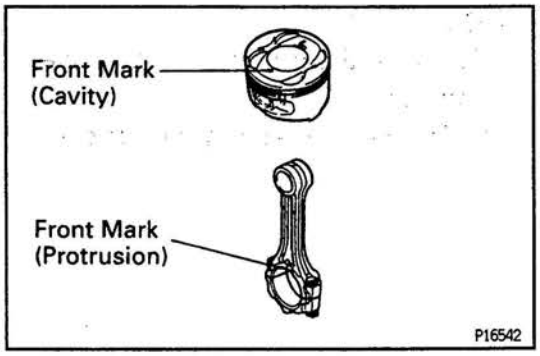


1. ASSEMBLE PISTON AND CONNECTING ROD

(a) Using a small screwdriver, install a new snap ring on one side of the piston pin hole.

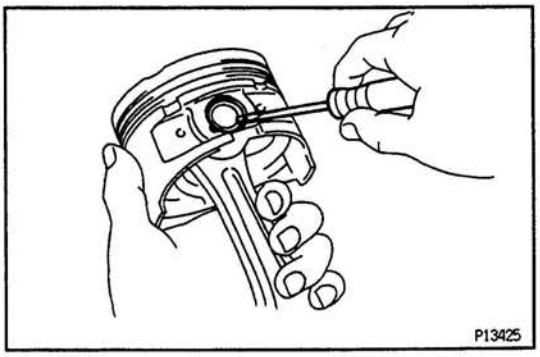


(b) Gradually heat the piston to 80 – 90°C (176 – 194°F).



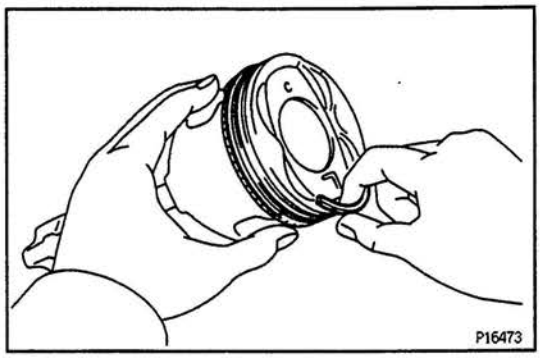
(c) Coat the piston pin with engine oil.

(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.

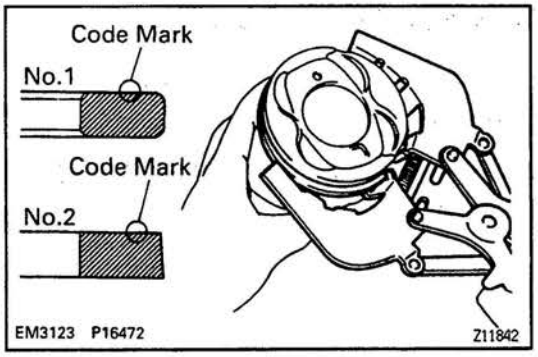


(e) Using a small screwdriver, install a new snap ring on the other side of the piston pin hole.

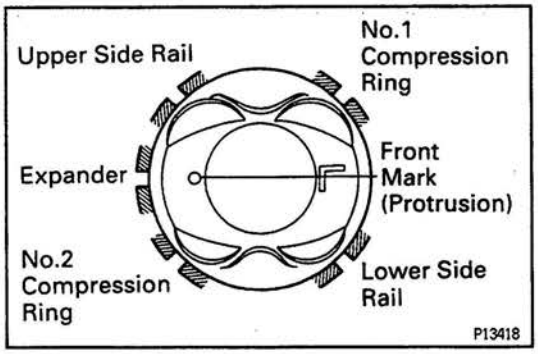
2. INSTALL PISTON RINGS



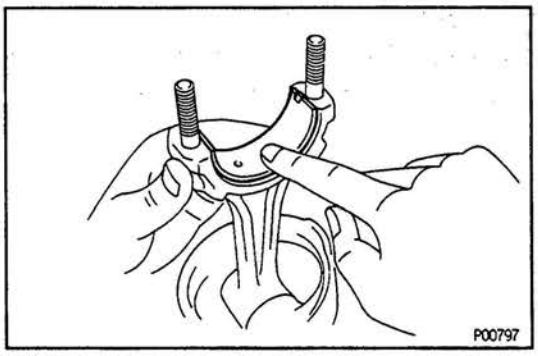
(a) Install the oil ring expander and 2 side rails by hand.



(b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
Code mark:
No.1
1N or T1
No.2
2N or 2T



(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 connecting rod or connecting cap.
(b) Install the bearings in the connecting rod and connecting rod cap.

EG11N-08

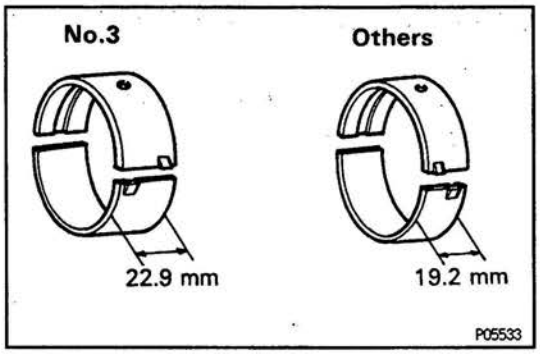
CYLINDER BLOCK ASSEMBLY

(See Components for Disassembly and Assembly)

HINT:

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

EG

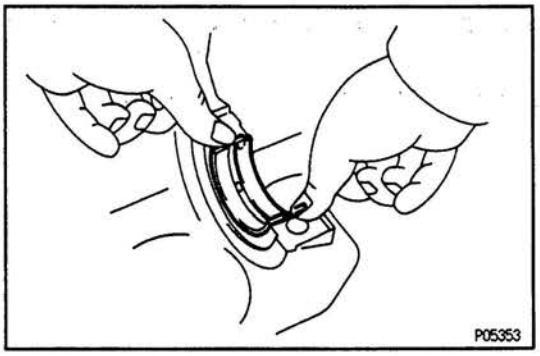


1. INSTALL MAIN BEARINGS

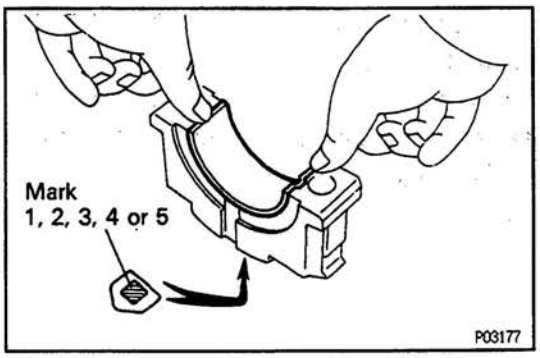
HINT:

- Main bearings come in widths of 19.2 mm (0.756 in.) and 22.9 mm (0.902 in.). Install the 22.9 mm (0.902 in.) bearings in the No.3 cylinder block journal position with the main bearing cap. Install the 19.2 mm (0.756 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.

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

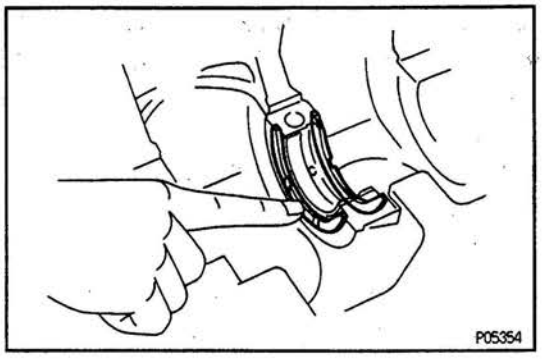


(b) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.
HINT: A number is marked on each main bearing cap to indicate the installation position.

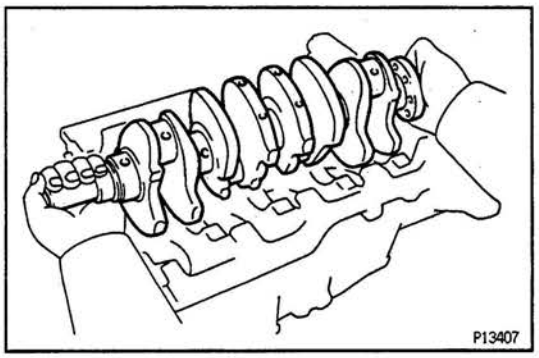


2. INSTALL UPPER THRUST WASHERS

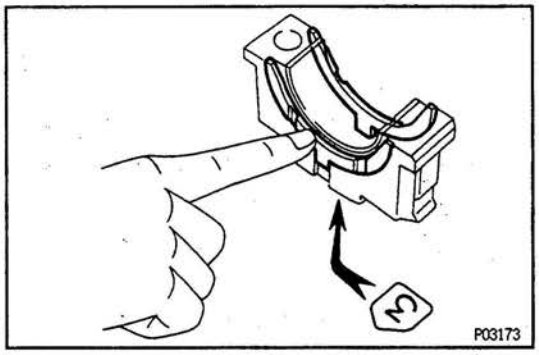
Install the 2 thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.



EG

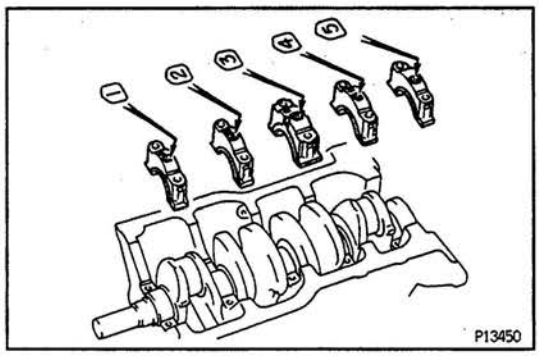


3. PLACE CRANKSHAFT ON CYLINDER BLOCK

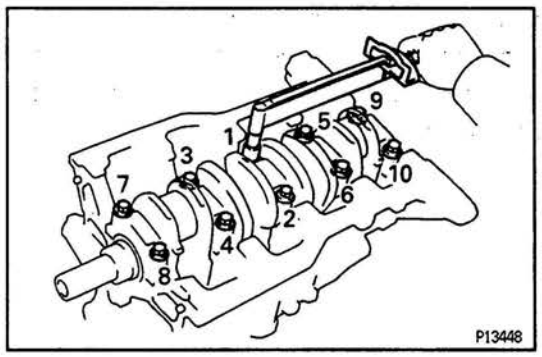


4. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

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



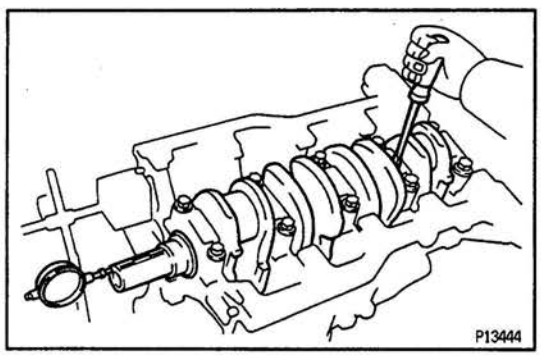
(b) Install the 5 main bearing caps in their proper locations.
HINT: Each bearing cap has a number and front mark.



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

(d) Install and uniformly tighten the 10 bolts of the main bearing cap in several passes, in the sequence shown.
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)

(e) Check that the crankshaft turns smoothly.



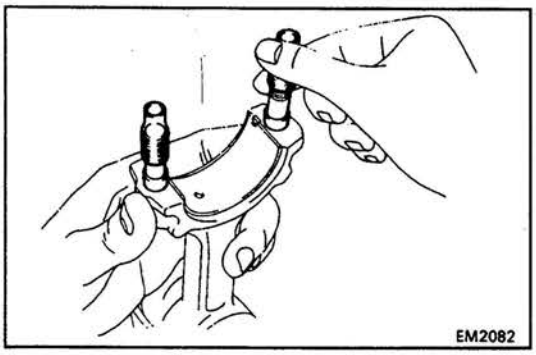
(f) Check the crankshaft thrust clearance.

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

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

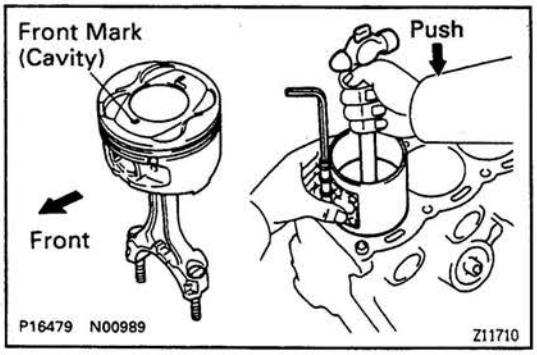
Maximum thrust clearance:
0.30 mm (0.0118 in.)

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

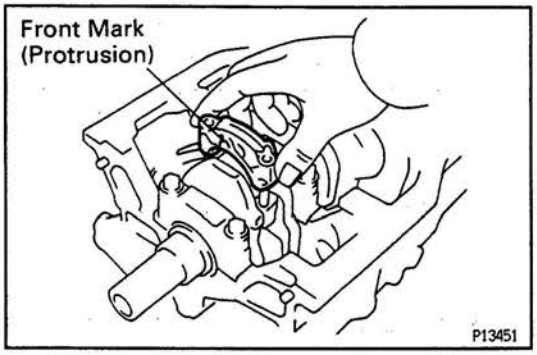


5. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

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



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



6. INSTALL CONNECTING ROD CAPS

A. Place connecting rod cap on connecting rod

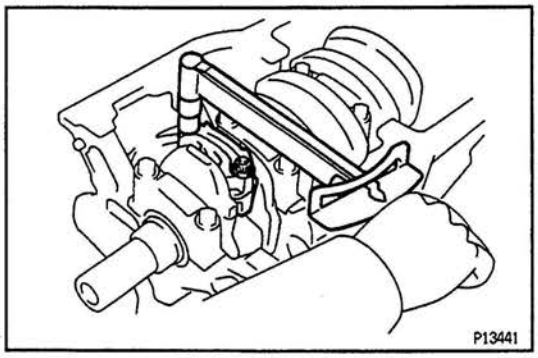
(a) Match the numbered connecting rod cap with the connecting rod.

(b) Install the connecting rod cap with the front mark facing forward.

B. Install connecting rod cap nuts

HINT:

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



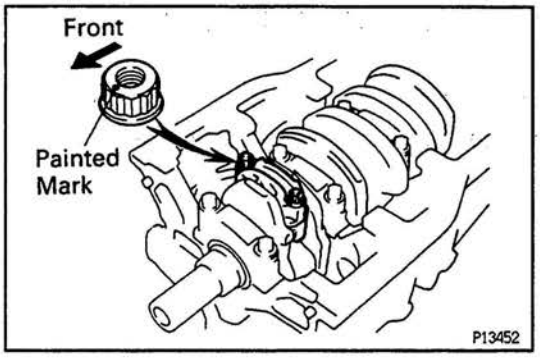
(a) Apply a light coat of engine oil on the threads and under the nuts of the connecting rod cap.

(b) Using SST, install and alternately tighten the 2 cap nuts in several passes.

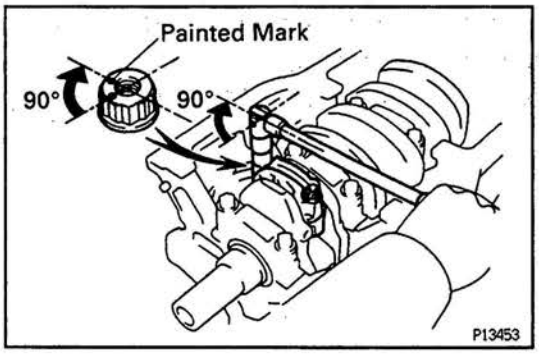
SST 09011—38121

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

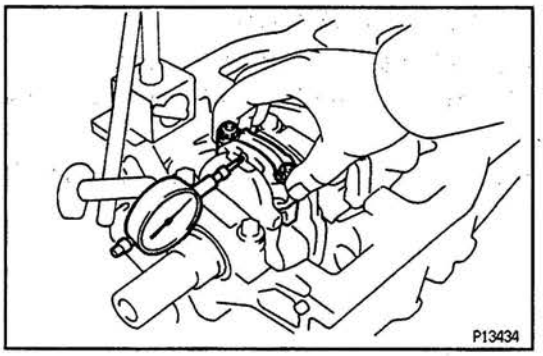
If any one of the cap nuts does not meet the torque specification, replace the connecting rod bolt and cap nut as a set.



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



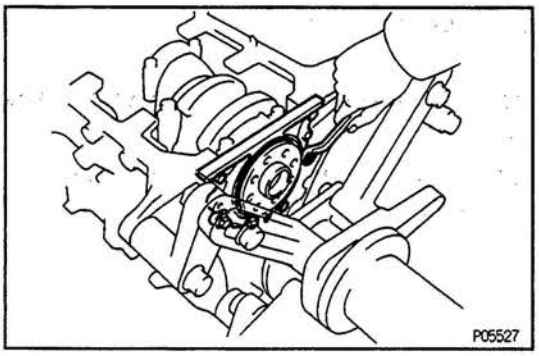
(d) Retighten the cap nuts 90° as shown.
(e) Check that the painted mark is now at a 90° angle to the front.
(f) Check that the crankshaft turns smoothly.



(g) Check the connecting rod thrust clearance.
- Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

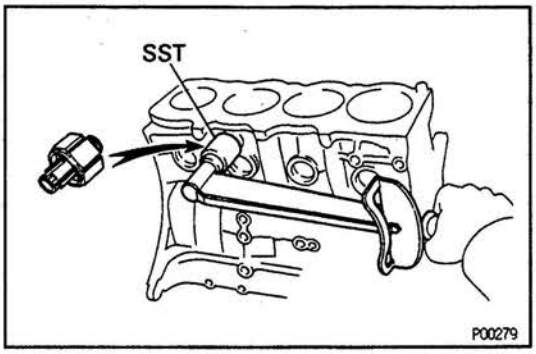
Standard thrust clearance:
0.160 – 0.312 mm (0.0063 – 0.0123 in.)
Maximum thrust clearance:
0.35 mm (0.0138 in.)

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



7. INSTALL REAR OIL SEAL RETAINER

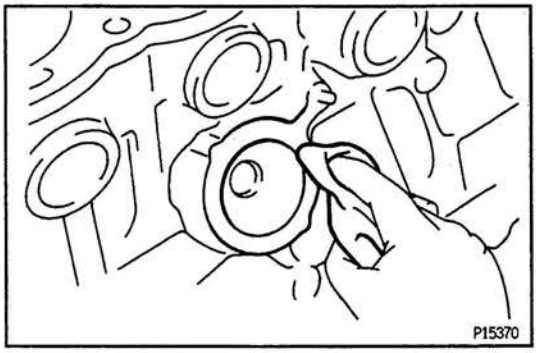
Install a new gasket and the retainer with the 6 bolts.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)



POST ASSEMBLY

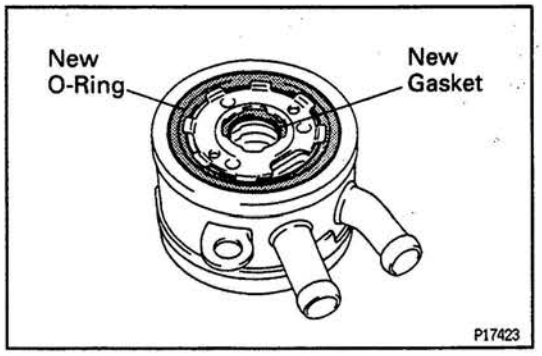
(See Components for Disassembly and Assembly)

1. **INSTALL KNOCK SENSOR**
   Using SST, install the knock sensor.
   SST 09816—30010
   Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)

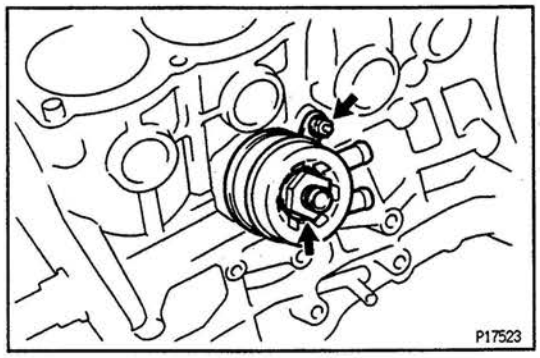


2. **w/ OIL COOLER:**
   INSTALL OIL COOLER

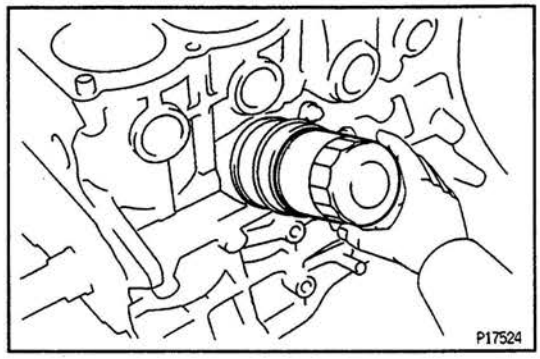
(a) Clean the oil cooler contact surface on the oil cooler mounting.



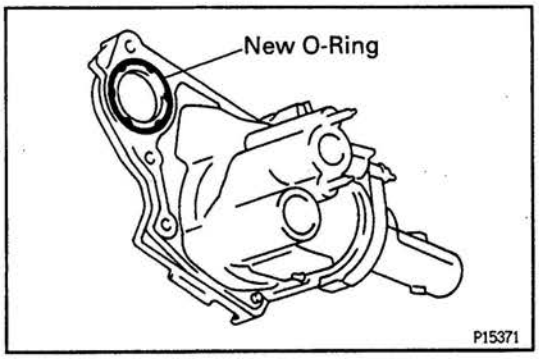
(b) Install new O—ring and gasket to the oil cooler.



(c) Apply a light coat of engine oil on the threads and under the head of the relief valve.
(d) Temporarily install the oil cooler with the nut.
(e) Install the plate washer and relief valve.
Torque: 78 N·m (800 kgf·cm, 58 ft·lbf)
(f) Tighten the nut.
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)

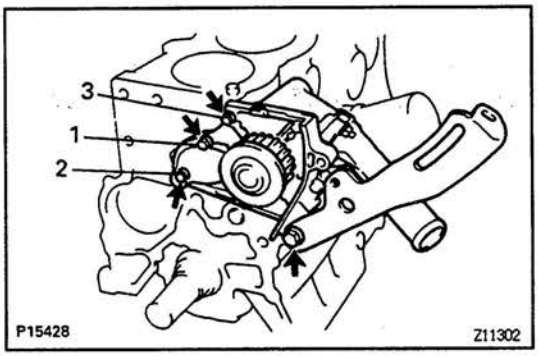


3. **INSTALL OIL FILTER**
   (See page EG—341)



4. INSTALL WATER PUMP, WATER PUMP COVER ASSEMBLY AND ALTERNATOR DRIVE BELT ADJUSTING BAR

(a) Install a new O—ring to the water pump cover.



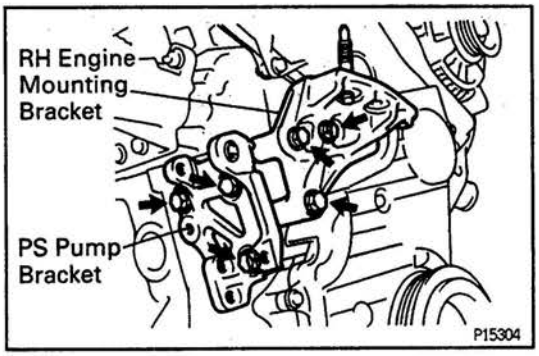
(b) Install the water pump with the 3 bolts. Tighten the bolts in the sequence shown.
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)

(c) Install the adjusting bar with the bolt.
Torque: 27 N·m (275 kgf·cm, 20 ft·lbf)

5. INSTALL OIL PUMP AND OIL PAN
(See pages EG—349 to 351)

6. INSTALL CYLINDER HEAD
(See pages EG—89 to 115)

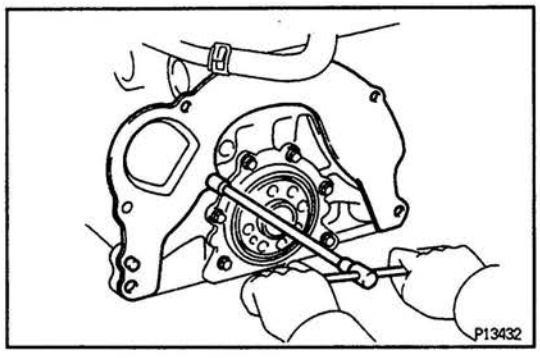
7. INSTALL TIMING BELT AND PULLEYS
(See pages EG—43 to 49)



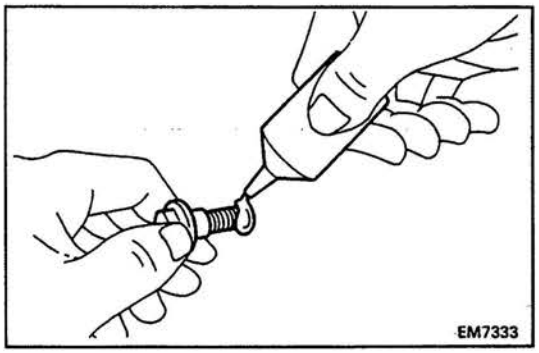
8. INSTALL RH ENGINE MOUNTING BRACKET
Install the mounting bracket with the 3 bolts.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

9. INSTALL PS PUMP BRACKET
Install the PS pump bracket with the 3 bolts.
Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

10. DISCONNECT ENGINE FROM ENGINE STAND

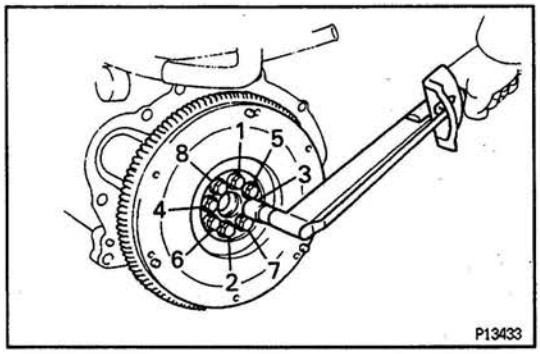


11. INSTALL REAR END PLATE
Install the rear end plate with the bolt.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



12. M/T:
INSTALL FLYWHEEL

(a) Apply adhesive to 2 or 3 threads of the bolt end.
Adhesive:
Part No. 08833–00070, THREE BOND 1324 or equivalent



(b) Install the flywheel on the crankshaft.
(c) Install and uniformly tighten the 8 bolts in several passes, in the sequence shown.
Torque: 88 N·m (900 kgf·cm, 65 ft·lbf)

13. A/T:
INSTALL DRIVE PLATE (See procedure in step 12)
Torque: 83 N·m (850 kgf·cm, 61 ft·lbf)

SERVICE SPECIFICATIONS

SERVICE DATA

EGOCS-07

EG

Tune—up	Battery specific gravity	at 20°C (68°F)	1.25 — 1.27
	High—tension cord resistance	Limit	25 kΩ per cord
	Spark plug		
	Recommended spark plug	ND	K20R—U11
		NGK	BKR6EYA11
	Electrode gap		1.1 mm (0.043 in.)
	Alternator drive belt		
	Deflection	with 98 N (10 kgf, 22 lbf)	
	w/ A/C	New belt	6 — 7 mm (0.24 — 0.35 in.)
		Used belt	9 — 11 mm (0.35 — 0.43 in.)
	w/o A/C	New belt	11 — 15 mm (0.43 — 0.59 in.)
		Used belt	13 — 17 mm (0.51 — 0.67 in.)
	Tension	with SST	
	w/ A/C	New belt	686 — 785 N (70 — 80 kgf)
		Used belt	441 — 539 N (45 — 55 kgf)
	w/o A/C	New belt	686 — 785 N (70 — 80 kgf)
		Used belt	196 — 343 N (20 — 35 kgf)
	Valve clearance (Cold)	Intake	0.19 — 0.29 mm (0.007 — 0.011 in.)
		Exhaust	0.28 — 0.38 mm (0.011 — 0.015 in.)
	Ignition timing		10° BTDC @ idle (w/ Terminals TE1 and E1 of check connector connected)
	Idle speed		700 ± 50 rpm
Idle CO (w/ TWC)	Concentration		0 — 0.5 %
Idle CO (w/o TWC)	Concentration		1.5 ± 0.5 %
Intake manifold vacuum	at idle speed		60 kPa (450 mmHg, 17.7 in.Hg)
Compression pressure	at 250 rpm (w/ TWC)	STD	1,275 kPa (13.0 kgf/cm², 185 psi) or more
		Limit	932 kPa (9.5 kgf/cm², 135 psi)
	at 250 rpm (w/o TWC)	STD	1,226 kPa (12.5 kgf/cm², 178 psi) or more
		Limit	883 kPa (9.0 kgf/cm², 128 psi)
	Difference of pressure between each cylinder		98 kPa (1.0 kgf/cm², 14 psi) or less
Idler pulley tension spring	Free length		46.0 mm (1.811 in.)
	Installed load at 50.5 mm (1.988 in.)		32 — 37 N (3.25 — 3.75 kgf, 7.2 — 8.3 lbf)
Cylinder head	Warpage		
	Cylinder block side	Limit	0.05 mm (0.020 in.)
	Manifold side	Limit	0.08 mm (0.031 in.)
	Valve seat		
	Refacing angle		30°, 45°, 75°
	Contacting angle		45°
	Contacting width		1.0 — 1.4 mm (0.039 — 0.055 in.)
Valve guide bushing	Inside diameter		6.010 — 6.030 mm (0.2366 — 0.2374 in.)
	Outside diameter (for repair part)	STD	11.000 — 11.027 mm (0.4331 — 0.4342 in.)
		O/S 0.05	11.050 — 11.077 mm (0.4350 — 0.4361 in.)

Valve	Valve overall length	STD Intake	97.60 mm (3.8425 in.)
		Exhaust	98.45 mm (3.8760 in.)
		Limit Intake	97.1 mm (3.823 in.)
		Exhaust	98.0 mm (3.858 in.)
	Vale face angle		44.5°
	Stem diameter	Intake	5.970 — 5.985 mm (0.2350 — 0.2356 in.)
		Exhaust	5.965 — 5.980 mm (0.2348 — 0.2354 in.)
	Stem oil clearance	STD Intake	0.025 — 0.060 mm (0.0010 — 0.0024 in.)
		Exhaust	0.030 — 0.065 mm (0.0012 — 0.0026 in.)
		Limit Intake	0.08 mm (0.0031 in.)
		Exhaust	0.10 mm (0.0039 in.)
	Margin thickness	STD	0.8 — 1.2 mm (0.031 — 0.047 in.)
		Limit	0.5 mm (0.020 in.)
Valve spring	Deviation	Limit	2.0 mm (0.079 in.)
	Free length		41.96— 41.99 mm (1.6520 — 1.6531 in.)
	Installed tension at 34.7 mm (1.366 in.)		164 — 189 N (16.7 — 19.3 kgf, 36.8 — 42.5 lbf)
Valve lifter	Lifter diameter		30.966 — 30.976 mm (1.2191 — 1.2195 in.)
	Lifter bore diameter		31.000 — 31.018 mm (1.2205 — 1.2213 in.)
	Oil clearance	STD	0.024 — 0.052 mm (0.0009 — 0.0020 in.)
		Limit	0.07 mm (0.0028 in.)
Manifold	Warpage	Limit	0.30 mm (0.0118 in.)
Camshaft	Thrust clearance	STD Intake	0.045 — 0.100 mm (0.0018 — 0.0039 in.)
		Exhaust	0.030 — 0.085 mm (0.0012 — 0.0033 in.)
		Limit Intake	0.12 mm (0.0047 in.)
		Exhaust	0.10 mm (0.0039 in.)
	Journal oil clearance	STD	0.025 — 0.062 mm (0.0010 — 0.0024 in.)
		Limit	0.10 mm (0.0039 in.)
	Journal diameter		26.959 — 26.975 mm (1.0614 — 1.0620 in.)
	Circle runout	Limit	0.04 mm (0.0016 in.)
	Cam lobe height	STD Intake	42.51 — 42.61 mm (1.6736 — 1.6776 in.)
		Exhaust	40.36 — 40.46 mm (1.5890 — 1.5929 in.)
		Limit Intake	42.40 mm (1.6693 in.)
		Exhaust	40.25 mm (1.5846 in.)
	Camshaft gear backlash	STD	0.020 — 0.200 mm (0.0008 — 0.0079 in.)
		Limit	0.30 mm (0.0188 in.)
	Camshaft gear spring end free distance		22.5 — 22.9 mm (0.886 — 0.902 in.)
Cylinder block	Cylinder head surface warpage	Limit	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD Mark 1	86.000 — 86.010 mm (3.3858 — 3.3862 in.)
		Mark 2	86.010 — 86.020 mm (3.3862 — 3.3866 in.)
		Mark 3	86.020 — 86.030 mm (3.3866 — 3.3870 in.)
		Limit STD	86.23 mm (3.3949 in.)
		O/S 0.50	86.73 mm (3.4146 in.)

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EG

Piston and piston ring	Piston diameter			
	w/ TWC	STD	Mark 1	85.865 — 85.875 mm (3.3805 — 3.3809 in.)
			Mark 2	85.875 — 85.885 mm (3.3809 — 3.3813 in.)
			Mark 3	85.885 — 85.895 mm (3.3813 — 3.3817 in.)
			O/S 0.50	86.365 — 86.395 mm (3.4002 — 3.4014 in.)
	w/o TWC	STD	Mark 1	85.870 — 85.880 mm (3.3807 — 3.3811 in.)
			Mark 2	85.880 — 85.890 mm (3.3811 — 3.3815 in.)
			Mark 3	85.890 — 85.900 mm (3.3815 — 3.3819 in.)
			O/S 0.50	86.370 — 86.400 mm (3.4004 — 3.4016 in.)
	Piston oil clearance			
	w/ TWC		STD	0.125 — 0.145 mm (0.0049 — 0.0057 in.)
			Limit	0.165 mm (0.0065 in.)
	w/o TWC		STD	0.120 — 0.140 mm (0.0047 — 0.0055 in.)
			Limit	0.160 mm (0.0063 in.)
	Piston ring groove clearance			
	w/ TWC		No.1	0.040 — 0.080 mm (0.0016 — 0.0031 in.)
			No.2	0.030 — 0.070 mm (0.0012 — 0.0028 in.)
	w/o TWC		No.1	0.030 — 0.070 mm (0.0012 — 0.0028 in.)
			No.2	0.030 — 0.070 mm (0.0012 — 0.0028 in.)
	Piston ring end gap	STD	No.1	0.270 — 0.500 mm (0.0106 — 0.0197 in.)
			No.2	0.270 — 0.510 mm (0.0106 — 0.0201 in.)
			Oil	0.200 — 0.550 mm (0.0079 — 0.0217 in.)
		Limit	No.1	1.10 mm (0.0433 in.)
			No.2	1.11 mm (0.0437 in.)
			Oil	1.15 mm (0.0453 in.)
Connecting rod	Thrust clearance		STD	0.160 — 0.312 mm (0.0063 — 0.0123 in.)
			Limit	0.35 mm (0.0138 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 — 0.055 mm (0.0009 — 0.0022 in.)
			U/S 0.25	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.)
	Bushing inside diameter			22.005 — 22.017 mm (0.8663 — 0.8668 in.)
	Piston pin diameter			21.997 — 22.009 mm (0.8660 — 0.8665 in.)
	Piston pin oil clearance		STD	0.005 — 0.011 mm (0.0002 — 0.0004 in.)
			Limit	0.05 mm (0.0020 in.)
	Connecting rod bolt 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.3	STD	0.025 – 0.044 mm (0.0010 – 0.0017 in.)
		U/S 0.25	0.027 – 0.067 mm (0.0011 – 0.0026 in.)
		Others STD	0.015 – 0.034 mm (0.0006 – 0.0013 in.)
		U/S 0.25	0.019 – 0.059 mm (0.0007 – 0.0023 in.)
		Limit	0.08 mm (0.0031 in.)
	Main journal diameter	STD	54.988 – 55.003 mm (2.1653 – 2.1655 in.)
		U/S 0.25	54.745 – 54.755 mm (2.1553 – 2.1557 in.)
	Main bearing center wall thickness (Reference)		
	STD No.3	Mark 1	1.992 – 1.995 mm (0.0784 – 0.0785 in.)
		Mark 2	1.995 – 1.998 mm (0.0785 – 0.0787 in.)
		Mark 3	1.998 – 2.001 mm (0.0787 – 0.0788 in.)
		Mark 4	2.001 – 2.004 mm (0.0788 – 0.0789 in.)
		Mark 5	2.004 – 2.007 mm (0.0789 – 0.0790 in.)
	Others	Mark 1	1.997 – 2.000 mm (0.0786 – 0.0787 in.)
		Mark 2	2.000 – 2.003 mm (0.0787 – 0.0789 in.)
		Mark 3	2.003 – 2.006 mm (0.0789 – 0.0790 in.)
		Mark 4	2.006 – 2.009 mm (0.0790 – 0.0791 in.)
		Mark 5	2.009 – 2.012 mm (0.0791 – 0.0792 in.)
	Crank pin diameter	STD	51.985 – 52.000 mm (2.0466 – 2.0472 in.)
		U/S 0.25	51.745 – 51.755 mm (2.0372 – 2.0376 in.)
	Circle runout	Limit	0.06 mm (0.0024 in.)
	Main journal taper and out–of–round	Limit	0.02 mm (0.0008 in.)
	Crank pin taper and out–of–round	Limit	0.02 mm (0.0008 in.)

EG0C6–0W

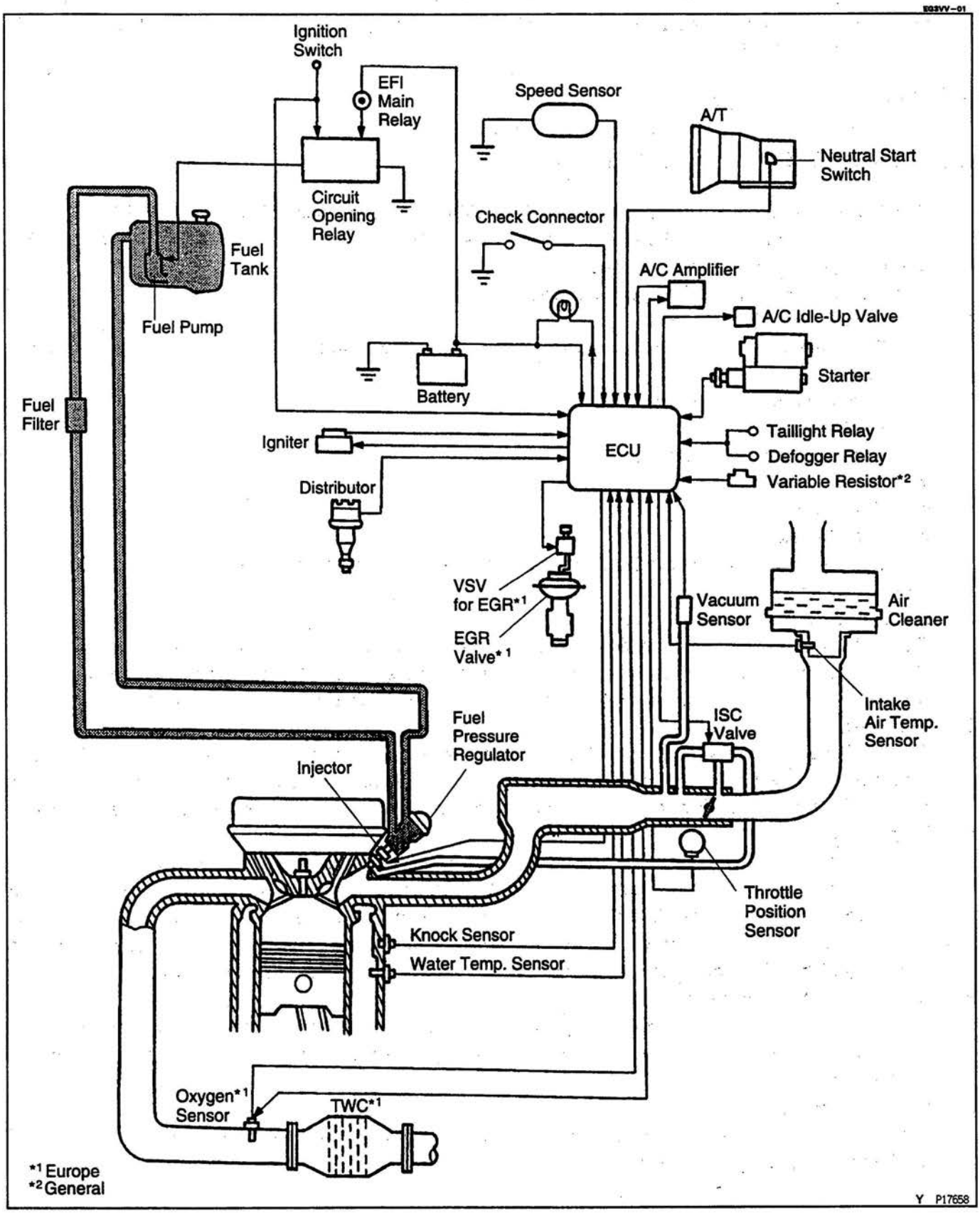
TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Oil pump pulley x Oil pump drive shaft		28	290	21
No.2 idler pulley x Cylinder block		42	425	31
Crankshaft pulley x Crankshaft		108	1,100	80
Camshaft timing pulley x Camshaft		54	550	40
	for SST	37	380	27
No.1 idler pulley x Cylinder head		42	425	31
Spark plug x Cylinder head		18	180	13
Alternator x Alternator bracket		54	530	40
Alternator x Alternator drive belt adjusting bar		19	185	14
RH engine mounting bracket x Cylinder block		52	530	38
Cylinder head x Cylinder block	1st	49	500	36
	2nd	Turn 90°		
Spark plug tube x Cylinder head		39	400	29
Camshaft bearing cap x Cylinder head		19	190	14
Cylinder head cover x Cylinder head		23	230	17
Alternator bracket x Cylinder head		42	425	31
LH engine hanger x Cylinder head (ST202)		25	250	18
No.3 timing belt cover x Cylinder head		7.8	80	69 in.·lbf
Delivery pipe x Cylinder head		13	130	9

Intake manifold x Cylinder head		19	195	14
Fuel inlet pipe x Delivery pipe (ST202)		34	350	25
Fuel pulsation damper x Delivery pipe (ST191)		34	350	25
	for SST	29	300	22
No.1 intake manifold stay x Intake manifold (ST191)		42	425	31
No.1 intake manifold stay x Cylinder head (ST191)		42	425	31
EGR valve x intake manifold (ST191)		13	130	9
EGR pipe x Cyllinder head (ST191)		59	600	43
No.2 intake manifold stay x Intake manifold (ST191)		42	425	31
No.2 intake manifold stay x Cylinder head (ST191)		42	425	31
Throttle body x Intake manifold		19	195	14
Water bypass pipe x Water pump cover		9.3	95	82 in.-lbf
Water bypass pipe x Cylinder head		19	195	14
Water outlet x Cylinder head		15	150	11
Exhaust manifold x Cylinder head		49	500	36
Exhaust manifold stay x Exhaust manifold		42	425	31
Exhaust manifold stay x Cylinder block		42	425	31
Main bearing cap x Cylinder block		59	600	43
Connecting rod cap x Connecting rod	1st	25	250	18
	2nd	Turn 90°		
Rear oil seal retainer x Cylinder block		13	130	9
Knock sensor x Cylinder block		37	380	27
Oil cooler x Cylinder block	Relief valve	78	800	58
	Nut	7.8	80	69 in.-lbf
Water pump x Cylinder block		7.8	80	69 in.-lbf
Alternator drive belt adjusting bar x Cylinder block		27	275	20
PS pump bracket x Cylinder block		43	440	32
Rear end plate x Cylinder block		9.3	95	82 in.-lbf
Flywheel x Crankshaft (M/T)		88	900	65
Drive plate x Crankshaft (A/T)		83	850	61

EFI SYSTEM

DESCRIPTION



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

FUEL SYSTEM

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

EG

AIR INDUCTION SYSTEM

The air induction system provides sufficient air for engine operation.

ELECTRONIC CONTROL SYSTEM

The 3S–FE engine is equipped with a TOYOTA Computer Controlled System (TCCS) which centrally controls the EFI, ESA, ISC, Diagnosis systems etc. by means of an ECU–formerly EFI computer employing a microcomputer.

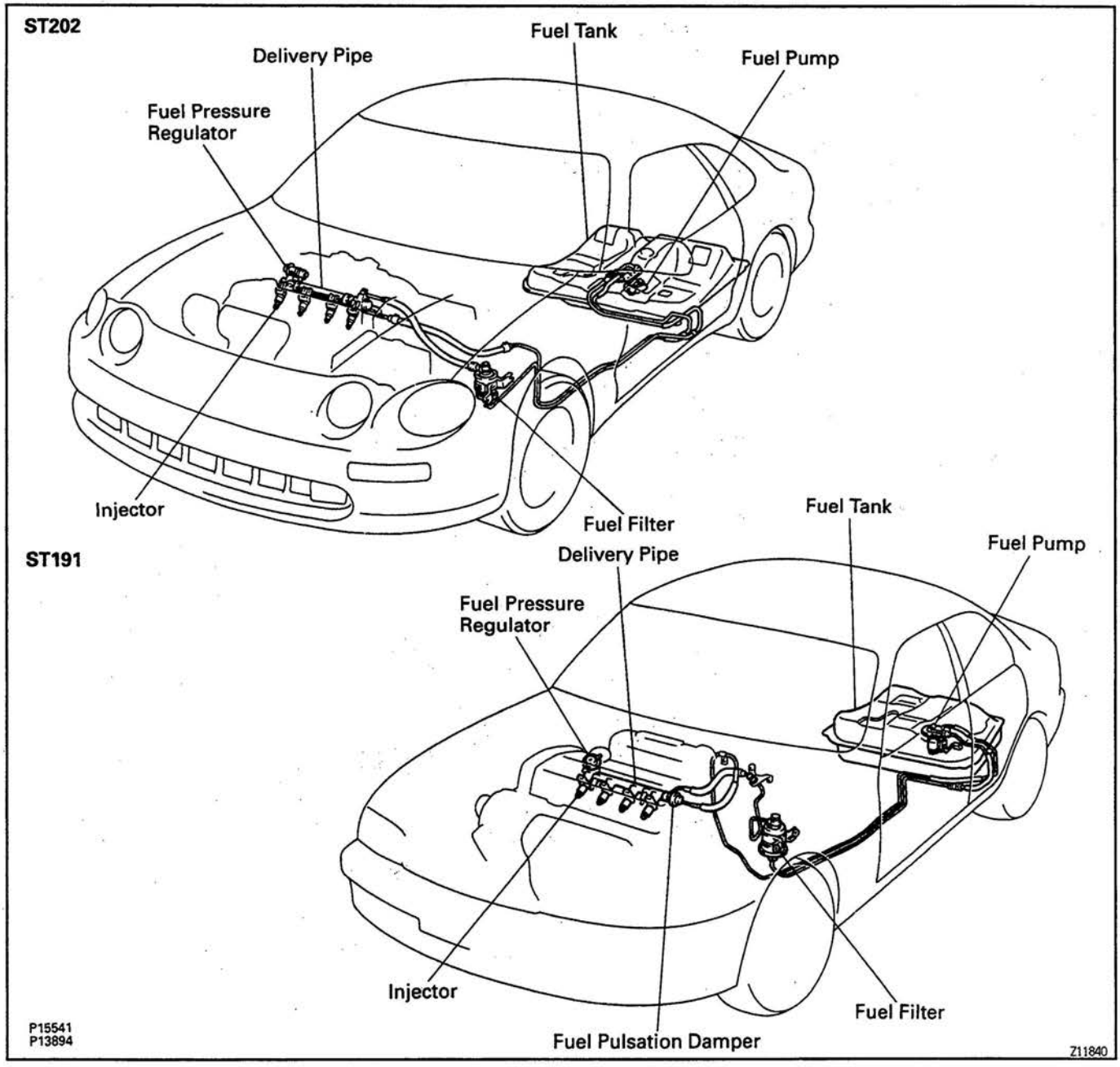
The ECU controls the following functions:

1. Electronic Fuel Injection (EFI)
   The ECU receives signals from various sensors indicating changing engine operating conditions such as:
   - Intake manifold pressure
   - Intake air temperature
   - Engine coolant temperature
   - Engine speed
   - Throttle valve opening angle
   - Exhaust oxygen content etc.

   The signals are utilized by the ECU to determine the injection duration necessary for an optimum air–fuel ratio.
2. Electronic Spark Advance (ESA)
   The ECU is programmed with data for optimum ignition timing under all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, coolant temperature, etc.), the microcomputer (ECU) triggers the spark at precisely the right instant.
3. Idle Speed Control (ISC)
   The ECU is programmed with target idling speed values to respond to different engine conditions (coolant temperature, air conditioning ON/OFF, etc.). Sensors transmit signals to the ECU which control the flow of air through the throttle valve bypass and adjust idle speed to the target value.
4. Diagnosis
   The ECU detects any malfunctions and abnormalities in the sensor network and lights a check engine warning light in the combination meter. At the same time, trouble is identified and a diagnostic code is recorded by the ECU. The diagnostic corde can be read by the number of blinks of the check engine warning light when terminals TE1 and E1 of the check connector are connected.The diagnistic code are referred to in a later page. (See page EG–171)
5. Self–Correction Function
   If any sensor malfunctions, an average value recorded in the back–up circuit is substituted to make driving possible. If danger is predicted, the engine is stopped and the check engine warning light will light up.
6. Fail–Safe Function
   In the event of the sensor malfunctioning, a back–up circuit will take over to provide minimal driveability, and the check engine warning light will illuminate.

OPERATION
FUEL SYSTEM

EGOCC-01



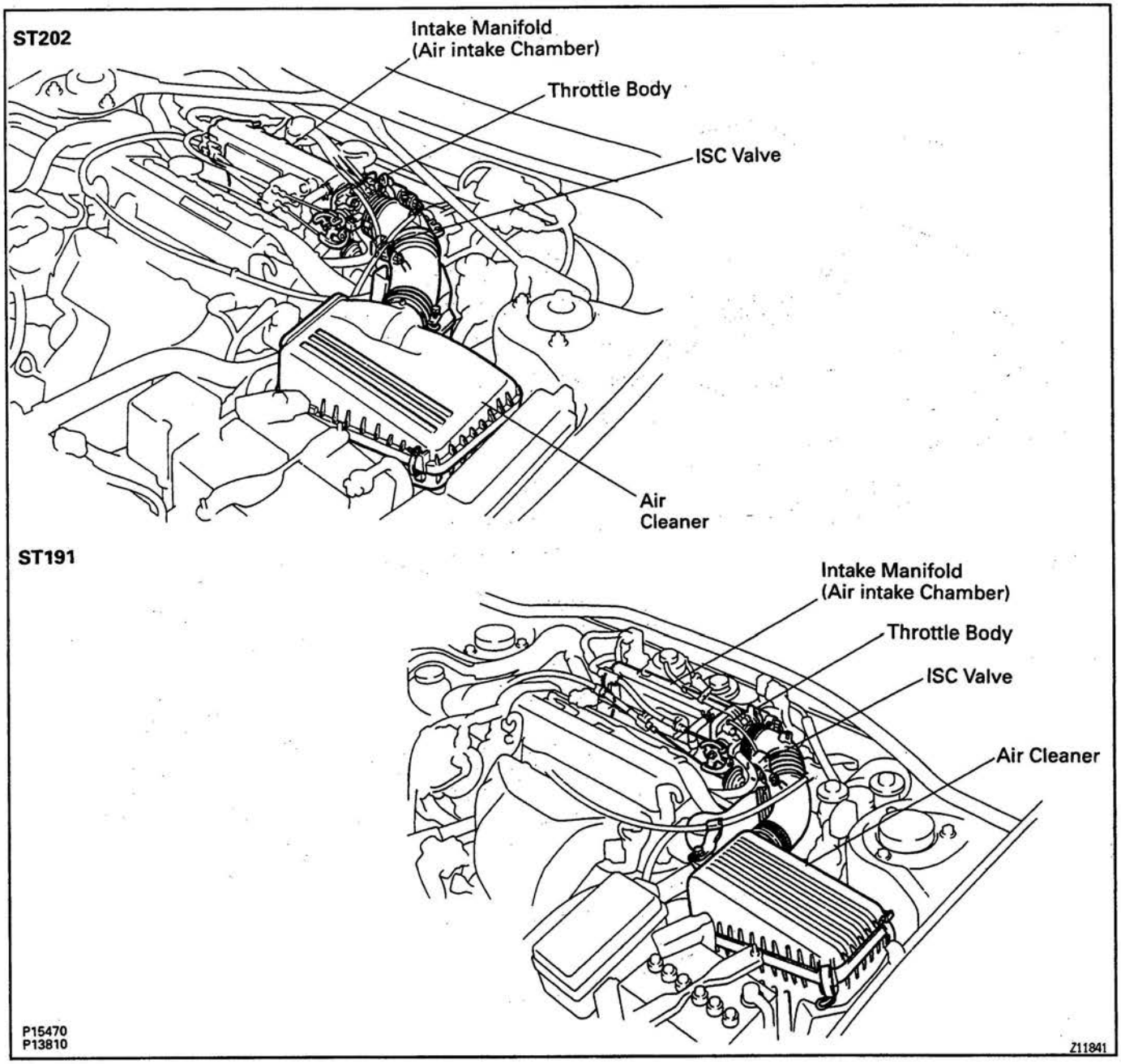
Fuel pumped up by the fuel pump, flows through the fuel filter and is distributed to each injector at a set pressure maintained by the fuel pressure regulator.

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/cm^2, 41 psi) higher than the pressure inside the intake manifold, and excess fuel is returned to the fuel tank through the return pipe.

Fuel is injected into the intake manifold according to signals from the ECU.

E00CD-08

AIR INDUCTION SYSTEM

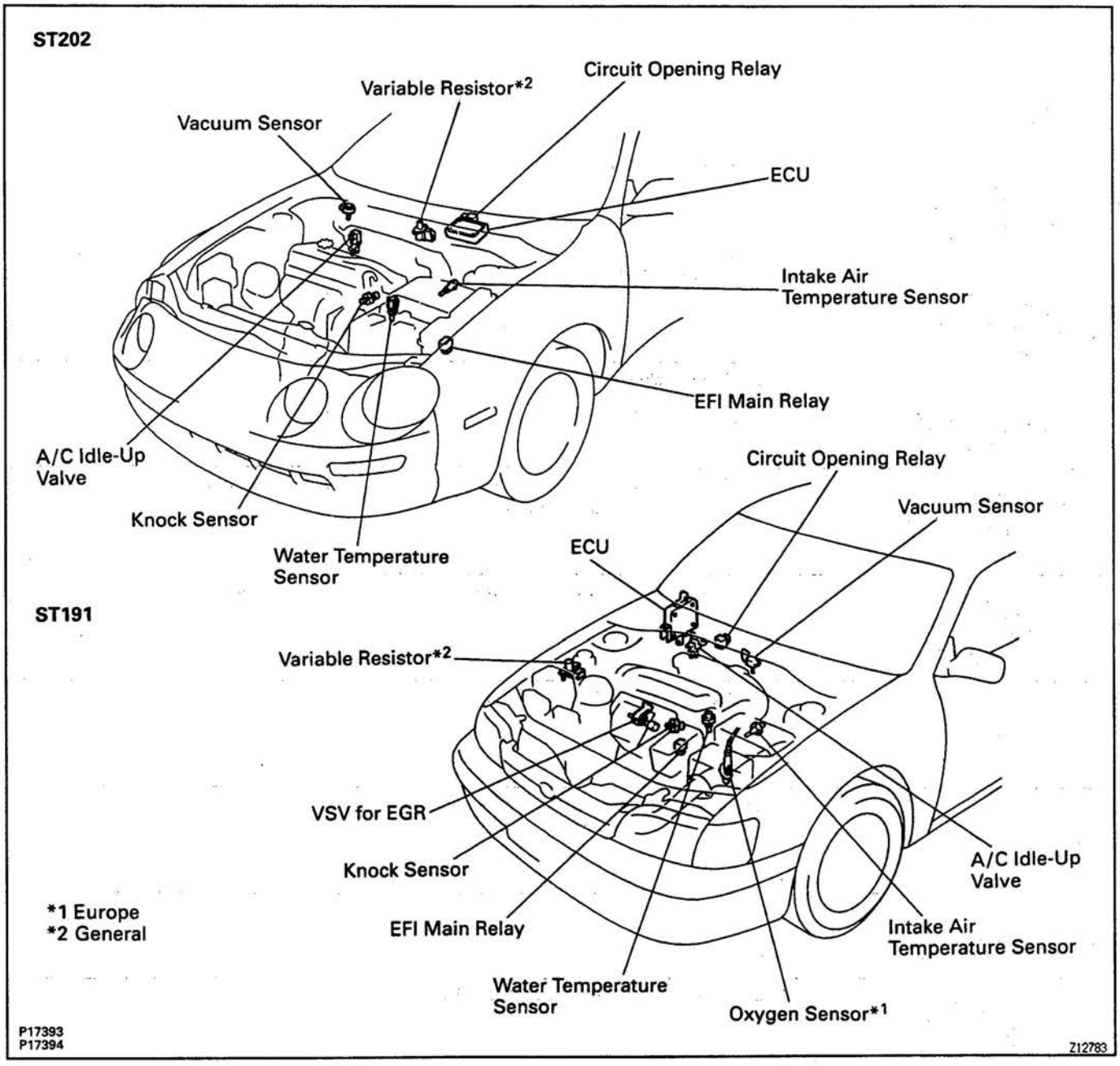


Air is filtered through the air cleaner and the amount flowing to the air intake chamber is determined according to the throttle valve opening in the throttle body and the engine speed. Intake air controlled by the throttle valve opening is distributed from the air intake chamber to the manifold of each cylinder and is drawn into the combustion chamber.

At low temperatures the ISC valve opens and air flows through the ISC valve and the throttle body, into the air intake chamber. During engine warming up, even if the throttle valve is completely closed, air flows to the air intake chamber, thereby increasing the idle speed (first idle operation). The air intake chamber prevents pulsation of the intake air. It also prevents intake air interference in each cylinder.

EG0CE-0X

ELECTRONIC CONTROL SYSTEM



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

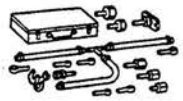
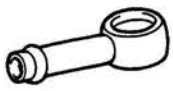
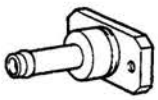
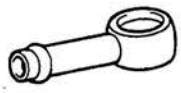
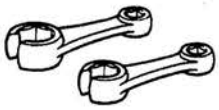
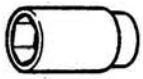
The various sensors detect the intake air pressure, engine speed, oxygen density in the exhaust gas, engine coolant temperature, intake air temperature and atmospheric pressure etc. and convert the information into an electrical signal which is sent to the ECU. Based on these signals, the ECU calculates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

PREPARATION

SST (SPECIAL SERVICE TOOLS)

B90CF-0N

EG

	09268–41045 Injection Measuring Tool Set	
	(09268–41080) No.6 Union	
	(09268–41090) No.7 Union	
	(90405–09015) No.1 Union	
	09268–45012 EFI Fuel Pressure Gauge	
	09631–22020 Power Steering Hose Nut 14 x 17 mm Wrench Set	Fuel line flare nut
	09816–30010 Oil Pressure Switch Socket	Knock sensor
	09842–30070 Wiring "F" EFI Inspection	
	09843–18020 Diagnosis Check Wire	

RECOMMENDED TOOLS

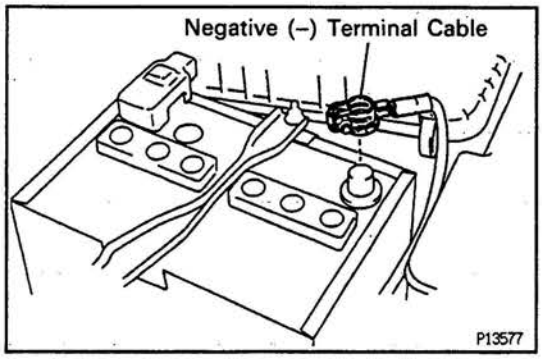
B90C8-01

	09082–00050 TOYOTA Electrical Tester Set	
	09200–00010 Engine Adjust Kit	
	09258–00030 Hose Plug Set	Plug for vacuum hose, fuel hose etc.

EG0CH-01

EQUIPMEMT

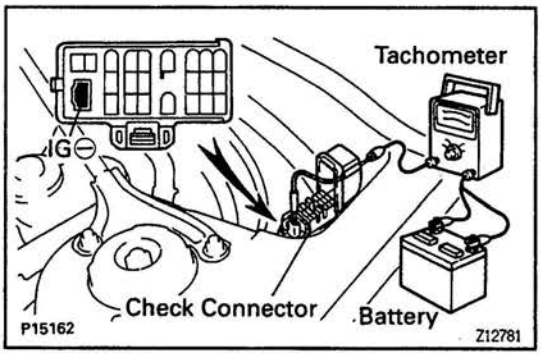
Carburetor cleaner	Throttle body
Graduated cylinder	Injector
Soft brush	Throttle body
Sound scope	Injector
Tachometer	
Torque wrench	
Vacuum gauge	



PRECAUTION

EG1A2–0J

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



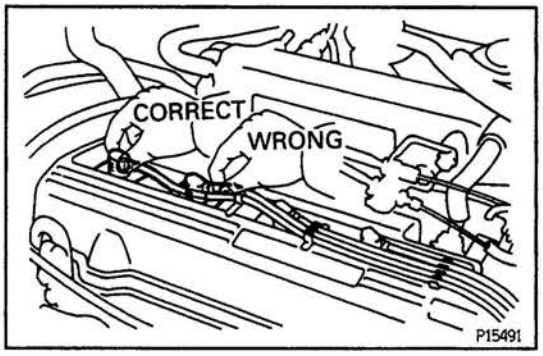
MAINTENANCE PRECAUTIONS

EG11U–0M

1. **CHECK CORRECT ENGINE TUNE−UP**
   (See page EG−13)
2. **PRECAUTION WHEN CONNECTING GAUGE**

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

(b) Connect the tester probe of a tachometer to the terminal IG⊖ of the check connector.



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

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

(b) Handle high−tension cords carefully.

(c) After repair work, check that the ignition coil terminals and all other ignition system lines are reconnected securely.

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

4. **PRECAUTIONS WHEN HANDLING OXYGEN SENSOR**

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

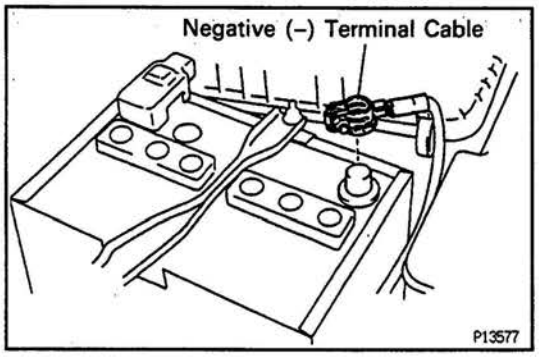
(b) Do not allow the sensor to come into contact with water.

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

If the vehicle is equipped with a mobile communication system, refer to the preaution in the IN section.

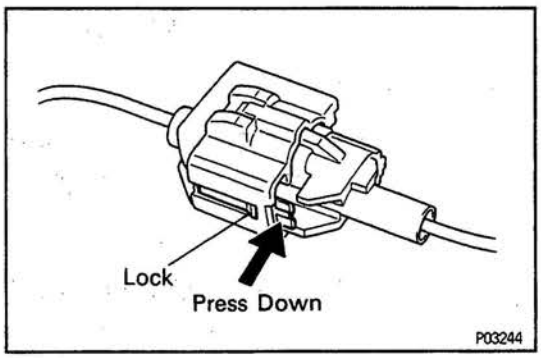
AIR INDUCTION SYSTEM

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

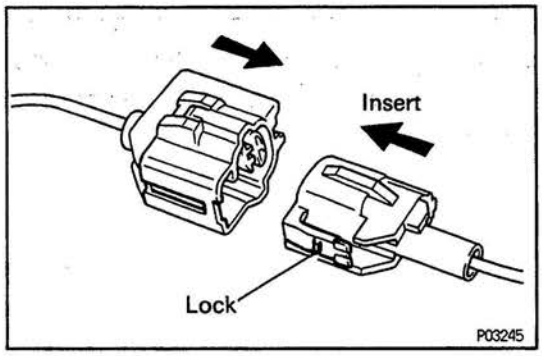


ELECTRONIC CONTROL SYSTEM

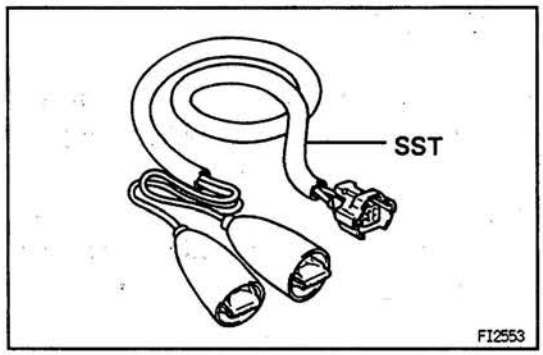
1. Before removing EFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch OFF or disconnecting the negative (–) terminal cable from the battery.
   HINT: Always check the diagnostic code before disconnecting the negative (–) terminal cable from the battery.
2. When installing the battery, be especially careful not to incorrectly connect the positive (+) and negative (–) cables.
3. Do not permit parts to receive a severe impact during removal or installation. Handle all EFI parts carefully, especially the ECU.
4. Do not be careless during troubleshooting as there are numerous transistor circuits and even slight terminal contact can cause further troubles.
5. Do not open the ECU cover.
6. When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on the EFI parts and wiring connectors.
7. Parts should be replaced as an assembly.



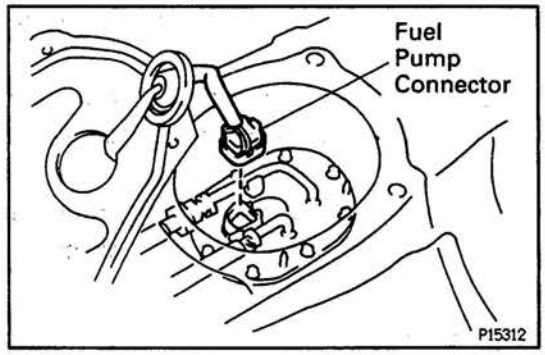
8. Care is required when pulling out and inserting wiring connectors.
(a) Release the lock and pull out the connector, pulling on the connectors.



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

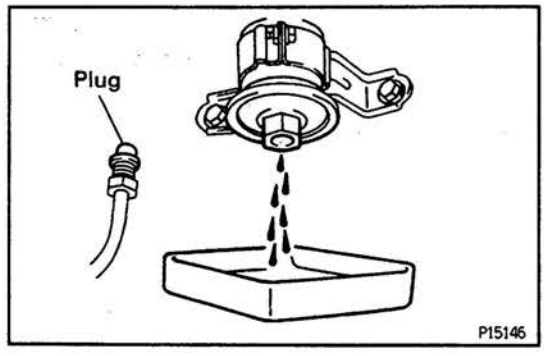


9. Use SST for inspection or test of the injector or its wiring connector.
SST 09842–30070

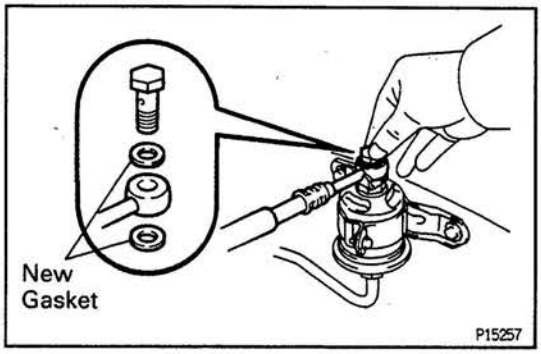


FUEL SYSTEM

1. When disconnecting the high pressure fuel line, a large amount of gasoline will spill out, so observe the following procedures:
(a) Disconnect the fuel pump connector.
(b) Start the engine. After the engine has stopped on its own, turn the ignition switch OFF.



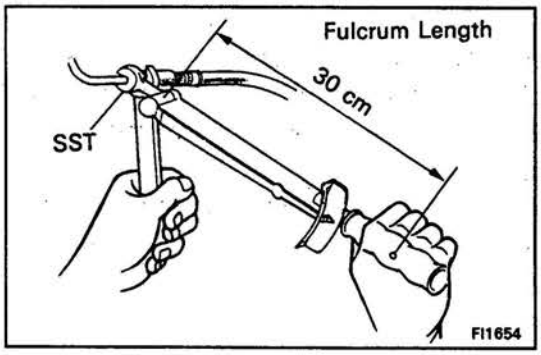
(c) Put a container under the connection.
(d) Slowly loosen the connection.
(e) Disconnect the connection.
(f) Plug the connection with a rubber plug.
(g) Reconnect the fuel pump connector.



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

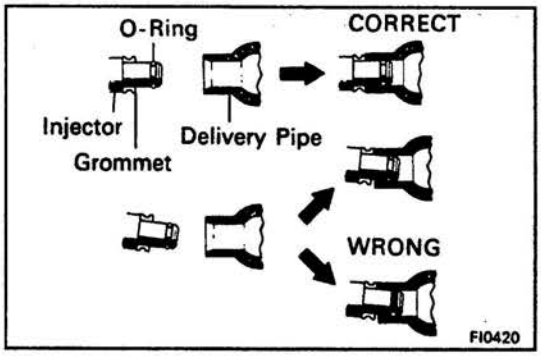
Union Bolt Type:

(a) Always use a new gasket.
(b) Tighten the union bolt by hand.
(c) Tighten the union bolt to the specified torque.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

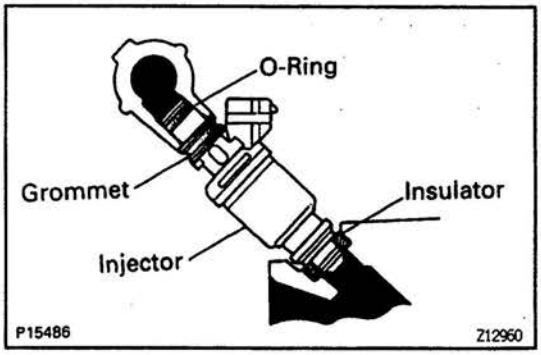


Flare Nut Type:

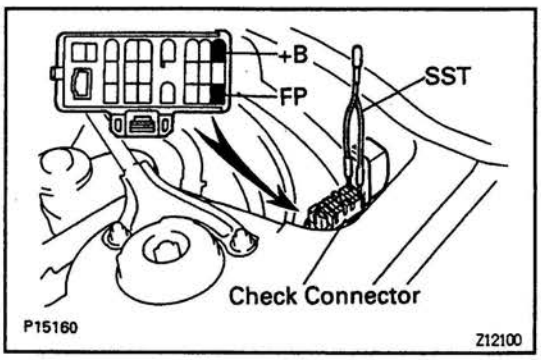
(a) Apply a light coat of engine oil to the flare nut, and tighten the flare nut by hand.
(b) Using SST, tighten the flare nut to specified torque.
SST 09631–22020
Torque:
Fuel pump side: 24 N·m (240 kgf·cm, 18 ft·lbf)
Others: 30 N·m (310 kgf·cm, 22 ft·lbf)
HINT: Use a torque wrench with a fulcrum length 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) Coat a new O–ring with spindle oil or gasoline before installing–never use engine, gear or brake oils.

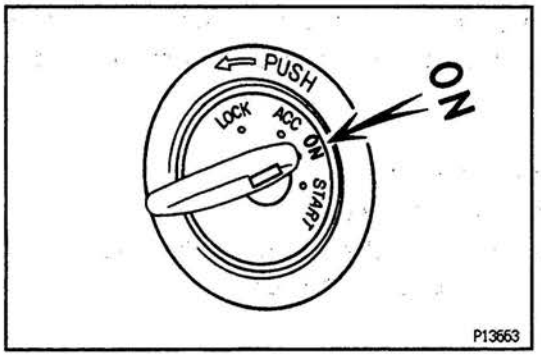


4. Install the injector to the delivery pipe and intake manifold as shown in the illustration.

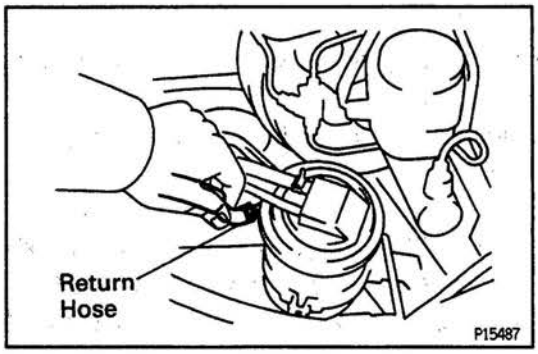


5. Check that there are no fuel leaks after performing maintenance anywhere on the fuel system.
(a) Using SST, connect terminals +B and FP of the check connector.
SST 09843–18020

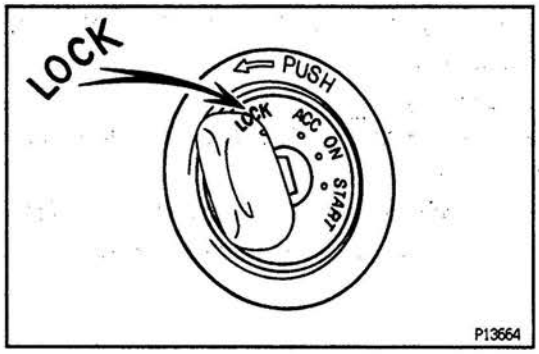
EG



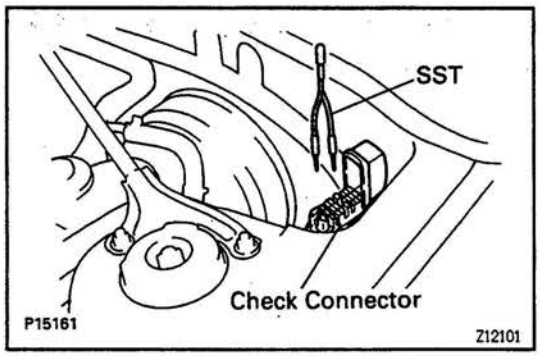
(b) Turn the ignition switch ON.
NOTICE: Do not start the engine.



(c) Pinch the fuel return hose.
The pressure in the high pressure line will rise to approx. 392 kPa (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 as it may cause the hose to crack.



(d) Turn the ignition switch to LOCK.



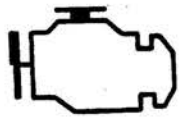
(e) Remove the SST from the check connector.
SST 09843–18020

DIAGNOSIS SYSTEM

DESCRIPTION

B811Z-09

The ECU contains a built–in self–diagnosis system by which troubles with the engine signal network are detected and the check engine warning light on the combination meter lights up.
By analyzing various signals as shown in the later table (See page EG–171) the ECU detects system malfunctions relating to the sensors or actuators.
The self–diagnosis system has 2 modes, a normal mode and a test mode.
If a malfunction is detected when in the normal mode, the ECU lights up the check engine warning light 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 code(s) remains stored in the ECU memory (except for code No.16). The ECU stores the code(s) until it is cleared by removing the EFI fuse with the ignition switch OFF.
The diagnostic code can be read by the number of blinks of the check engine warning light when TE1 and E1 terminals on the check connector 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 ECU lights up the check engine warning light 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 check connector should be connected as shown later. (See page EG–168).
In the test mode, even if the malfunction is corrected, the malfunction code is stored in the ECU memory even when the ignition switch is OFF (except code Nos. 42, 43 and 51). This also applies in the normal mode. The diagnostic mode (normal or test) and the output of the check engine warning light can be selected by connecting the TE1, TE2 and E1 terminals on the check connector, as shown later. (See page EG–166)
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 contact, which are difficult to detect in the normal mode. This function fills up the self–diagnosis system. The test mode can be implemented by the technician following the appropriate procedures of check terminal connection and operation described later. (See page EG–168)



"CHECK" Engine Warning Light

P07777

CHECK ENGINE WARNING LIGHT CHECK

B8121-07

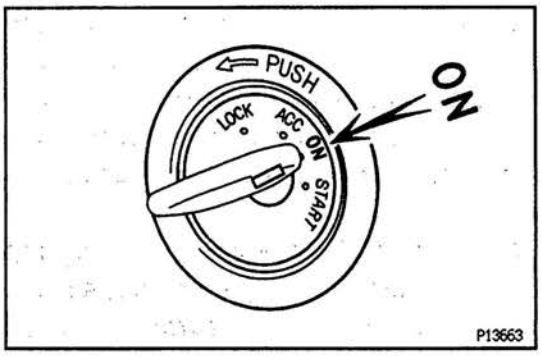
1. The check engine warning light will come on when the ignition switch is turned ON and the engine is not running.
2. When the engine is started, the check engine warning light should go off.
   If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.

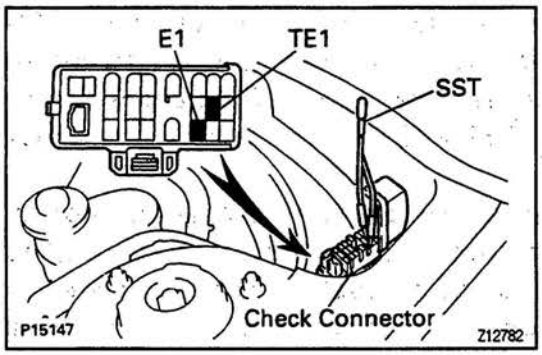
EG

DIAGNOSTIC CODES OUTPUT
(Normal mode)

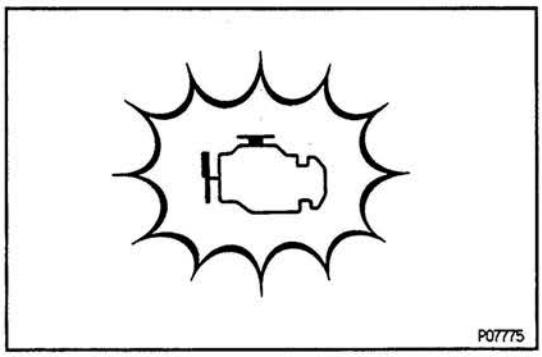
To obtain an output of diagnostic codes, proceed as follows:

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

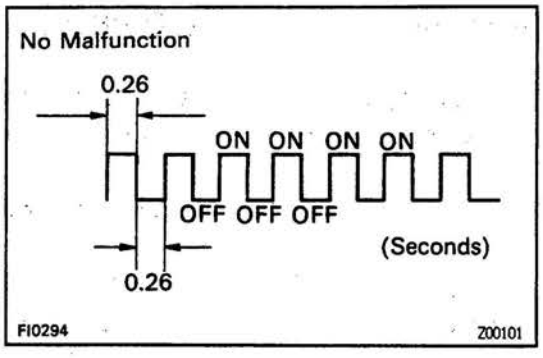




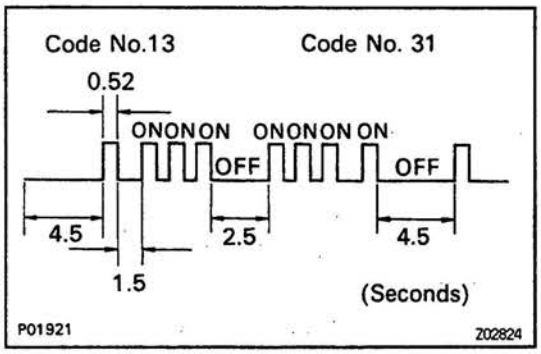
3. Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843–18020



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



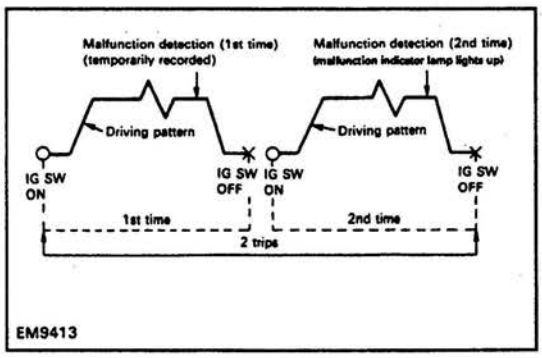
Diagnostic Codes (See page EG–171)
(a) Normal System Operation (no malfunction)
- The light will alternately blink ON and OFF at 0.26 second intervals.



(b) Malfunction Code Indication

- In the event of a malfunction, the light will blink every 0.52 seconds. The first number of blinks will equal the first digit of a 2 digit diagnostic code and, after a 1.5 second pause, the 2nd number of blinks will equal the 2nd. If there are 2 or more codes, there will be a 2.5 second pause between each code.
- After all the codes have been output, there will be a 4.5 second pause and they will all be repeated as long the terminals TE1 and E1 of the check connector are connected.

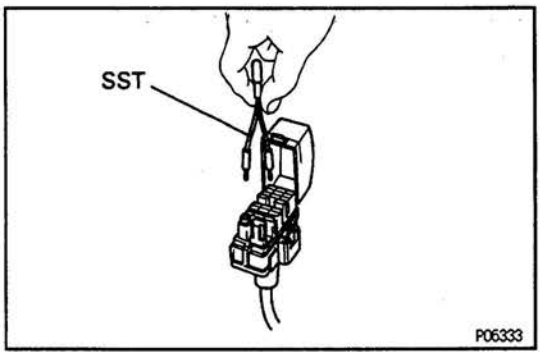
HINT: In the event of a number of codes, indication will begin from the smaller value and continue to the larger.



(c) 2 Trip Detection Logic

Diagnostic codes 21 and 25 use "2 trip detection logic". With this logic, when a malfunction is first detected, the malfunction is temporarily stored in the ECU memory. If the same case is detected again during the second drive test, this second detection causes the check engine warning light to light up. The 2 trip repeats the same mode a 2nd time. (However, the ignition switch must be turned OFF between the 1st time and 2nd time.) In the Test Mode, the check engine warning light lights up the 1st time a malfunction is detected.

5. After the diagnosis check, remove the SST from the check connector.
   SST 09843–18020



EG

(Test mode)

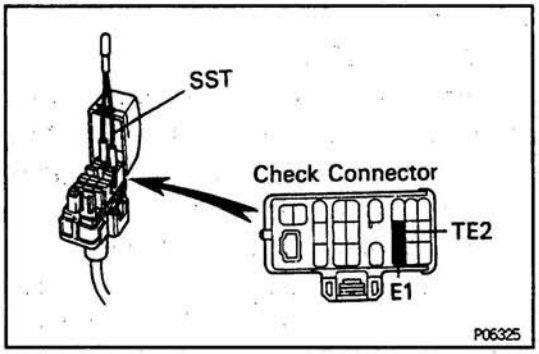
HINT:

- 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 conditioner signal and neutral start switch signal.
- Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the test mode.

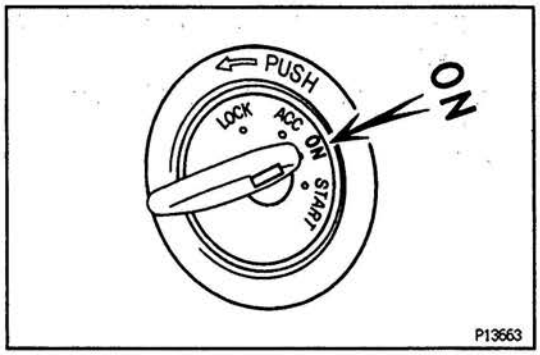
To obtain an output of diagnostic codes, proceed as follows:

1. Initial conditions

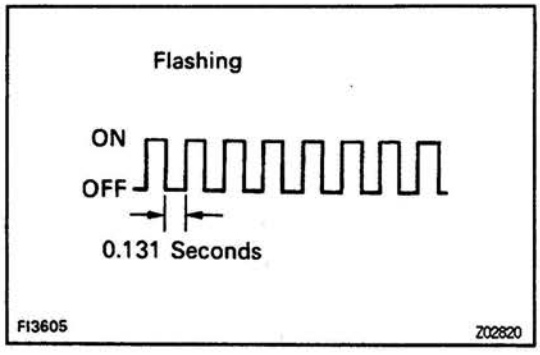
(a) Battery voltage 11 V or more
(b) Transmission in neutral range
(c) Accessories switched OFF
(d) Engine at normal operating temperature



2. First, using SST, connect terminals TE2 and E1 of the check connector.
   SST 09843–18020

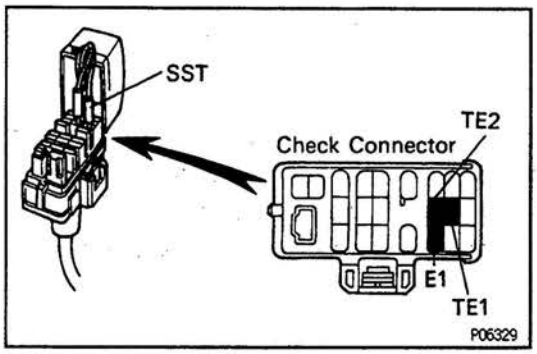


3. Turn the ignition switch ON to begin the diagnosis in the test mode.

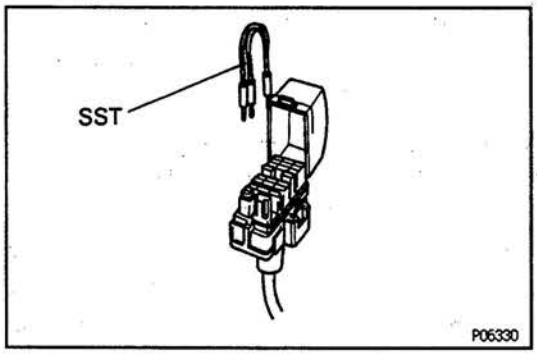


HINT: To confirm that the test mode is operating, check that the check engine warning light flashes when the ignition switch is turned ON.

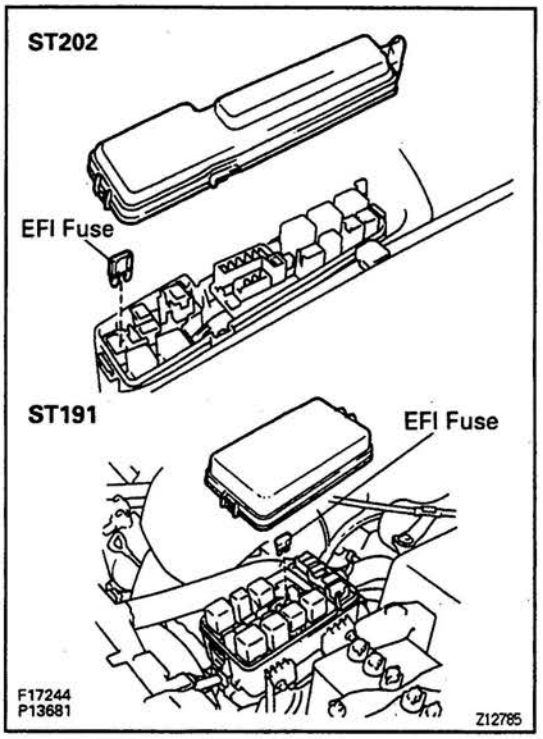
4. Start the engine and drive the vehicle at a speed of 10 km/h (6 mph) or higher.
5. Simulate the conditions of the malfunction described by the customer.



6. Using SST, connect terminals TE1 and E1 of the check connector.
   SST 09843–18020
7. Read the diagnostic code as indicated by the number of flashes of the check engine warning light. (See page EG–171)



8. After the diagnosis check, remove the SST from the check connector.
   SST 09843–18020
   HINT:
   - The test mode will not start if terminals TE2 and E1 are connected after the ignition switch is turned on.
   - The starter signal and vehicle speed signal will be diagnosed by the ECU as malfunctions, and code Nos. 42, and 43 will be output, if the operation in step 4 is not performed.
   - When the automatic transmission shift lever is in the "D", "2", "L" or "R" shift position, or when the air conditioner is ON or when the accelerator pedal is depressed, code No. 51 (Switch Condition Signal) is output, but this is not abnormal.



EG

DIAGNOSTIC CODE CANCELLATION

EG29F-02

1. After repair of the trouble area, the diagnostic code retained in memory by the ECU must be cancelled out by removing the EFI fuse 15A for 10 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch OFF.
   HINT:
   - Cancellation can also be done by removing the negative (−) terminal cable from the battery, but in this case, other memory systems (clock, etc.) will also be cancelled out.
   - If the diagnostic code is not cancelled out, it will be retained by the ECU and appear along with a new code in the event of future trouble.
   - If it is necessary to work on engine components requiring removal of the battery terminal, a check must first be made to see if a diagnostic code has been recorded.
2. After cancellation, perform road test of the vehicle to check that a normal code is now read on the check engine warning light.
   If the same diagnostic code appears, it indicates that the trouble area has not been repaired thoroughly.

DIAGNOSIS INDICATION

EG15U-03

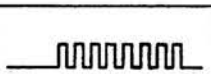
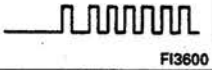
1. When 2 or more codes are indicated, the lowest numbered code will appear first.
2. All detected diagnostic codes, except code Nos. 16, 43, 51 and 42 under the test mode will be retained in memory by the ECU from the time of detection until cancelled out.
3. Once malfunction is cleared, the check engine warning light on the combination meter will go off but the diagnostic code(s) remains stored in ECU memory (except for code Nos. 16, 43, 51 and 42 under the test mode).

BG3VY-01

DIAGNOSTIC CODES

HINT:

- If a malfunction is detected during the diagnostic 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 of Check Engine Warning Light	System	Check Engine*1 Warning Light		Diagnosis	Trouble Area	Memory*2	See page
			Normal Mode	Test Mode				
–	 FI1401	Normal	–	–	Output when no other code is recorded.	–	–	–
12	 FI1606	RPM Signal	ON	N.A.	NE signal is not input to ECU for 2 secs. or more after STA turns ON. G signal is not input to ECU for 3 sec. or more.	• Open or short in NE, G circuit • Distributor • Open or short in STA circuit • ECU	O	IG-5
13	 FI1607	RPM Signal	ON	ON	NE signal is not input to ECU for 300 msec. or more when engine speed is 1,500 rpm or more.	• Open or short in NE circuit • Distributor • ECU	O	IG-5
14	 FI1608	Ignition Signal	ON	N.A.	IGF signal from igniter is not input to ECU for 4 – 5 consecutive ignitions.	• Open or short in IGF or IGT circuit from igniter to ECU • Igniter • ECU	O	IG-5
*4 16	 FI3600	ECT Control Signal	ON	N.A.	Normal signal is not output from ECU CPU.	• ECU	X	–
*5 21	 FI1609	Oxygen Sensor Circuit	OFF	N.A.	(1) Open or short in heater circuit of oxygen sensor for 500 msec. or more. (HT) (2) At normal driving speed (below 100 km/h (60 mph) and engine speed is above 1,500 rpm), amplitude of oxygen sensor signal (OX1) is reduced to between 0.35 – 0.70 V continuously for 60 sec. or more. *3 (2 trip detection logic) (only for (2))	• Open or short in heater circuit of oxygen sensor • Oxygen sensor heater • ECU • Open or short in oxygen sensor circuit • Oxygen sensor • ECU	O	EG-194 EG-284
22	 FI1610	Water Temp. Sensor Signal	ON	ON	Open or short in water temp. sensor circuit for 500 msec. or more. (THW)	• Open or short in water temp. sensor circuit • Water temp. sensor • ECU	O	EG-189
24	 FI1611	Intake Air Temp. Sensor Signal	OFF	ON	Open or short in intake air temp. sensor circuit for 500 msec. or more. (THA)	• Open or short in intake air temp. circuit • Intake air temp. sensor • ECU	O	EG-188
*5 25	 FI2562	Air-Fuel Ratio Lean Malfunction	OFF	ON	Oxygen sensor output is less than 0.45 V for at least 90 secs. for others when oxygen sensor is warmed up (racing at 2,000 rpm) *3 (2 trip detection logic)	• Engine ground bolt loose • Open in E1 circuit • Open in injector circuit • Fuel line pressure (Injector blockage, etc.) • Open or short in oxygen sensor circuit • Oxygen sensor • Ignition system	O	EG-194 EG-284
31	 FI1612	Vacuum Sensor Signal	ON	ON	Open or short detected continuously for 500 msec. or more in vacuum sensor sensor circuit. (PIM)	• Open or short in vacuum sensor circuit • Vacuum sensor • ECU	O	EG-186

EG

DIAGNOSTIC CODES (Cont'd)

Code No.	Number of blinks of Check Engine Warning Light	System	Check Engine*1 Warning Light		Diagnoisis	Trouble Area	Memory*2	See page
			Normal Mode	Test Mode				
41	 FI1614	Throttle Position Sensor Signal	OFF	ON	Open or short detectd continuously for 500 msec. or more in throttle position sensor (VTA) circuit.	• Open or short in throttle Position sensor circuit • Throttle position sensor • ECU	○	EG-184
42	 FI1615	Vehicle Speed Sensor Signal	OFF	OFF	SPD signal is not input to ECU for at least 8 seconds during high load driving with engine speed 3,000 rpm or more.	• Open or short in vehicle speed senor circuit • Vehicle speed sensor • ECU	○	-
43	 FI1616	Starter Signal	N.A.	OFF	Starter signal (STA) is not input to ECU.	• Open or short in starter signal circuit • Open or short in IG SW or main relay circuit • ECU	X	EG-190
52	 FI1618	Knock Sensor Signal	ON	N.A.	With engine speed between 2,000 rpm and 6,000 rpm, signal from knock sensor is not input to ECU for 6 revolutions. (KNK)	• Open or short in knock sensor circuit • Knock sensor (looseness, etc.) • ECU	○	-
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 "1" ranges with the check terminals E1 and TE1 connected.	• A/C switch system • Throttle position sensor IDL circuit • Neutral start switch circuit • Accelerator pedal, cable • ECU	X	EG-184

REMARKS:

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

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

*3 "2" trip detection logic" (See page EG-167)

*4 A/T

*5 w/ Oxygen Sensor

DIAGNOSTIC CODE DETECTION DRIVING PATTERN

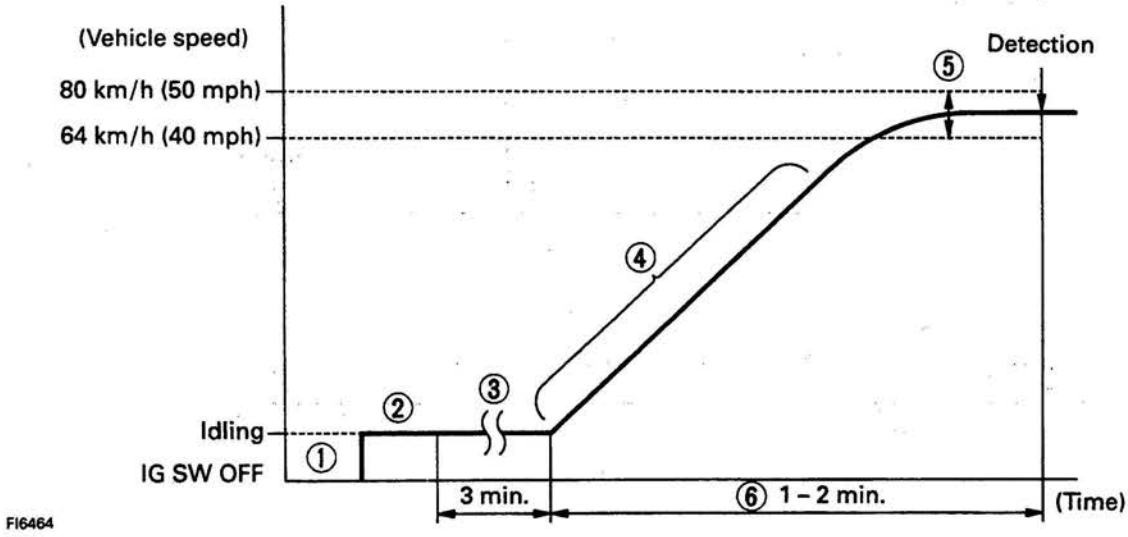
Purpose of the driving pattern.

(a) To simulate diagnostic code detecting condition after diagnostic code is recorded.

(b) To check that the malfunction is corrected when the repair is completed, confirming that diagnostic code is not longer detected.

Code No.	21	Oxygen Sensor Circuit

Malfunction: Deterioration of Oxygen Sensor



It is vital that test routine is adhered to detect the malfunction:

① Disconnect the EFI fuse (15A) for 10 sec. or more, with IG switch OFF.
Initiate test mode (Connect terminals TE2 and E1 of check connector with IG switch OFF).

② Start the engine and warm up with all ACC switched OFF.

③ Idle the engine for 3 minutes.

④ With A/C switched ON, A/T in D range (M/T in 5th gear), accelerate gradually within the range 1,300 – 1,700 rpm centered around 1,500 rpm.

HINT:
- Ensure engine speed does NOT fall below 1,200 rpm.
- Gradually depress the accelerator pedal at a suitable rate to comply with the test requirements on the above graph.
- Never allow engine speed to drop at any time during the test.

⑤ Maintain the vehicle speed at 64 – 80 km/h (40 – 50 mph).

⑥ Keep the vehicle running for 1 – 2 min. after starting acceleration.

HINT: If a malfunction exists, the check engine warning light will light up after approx. 60 sec. from the start of acceleration.

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

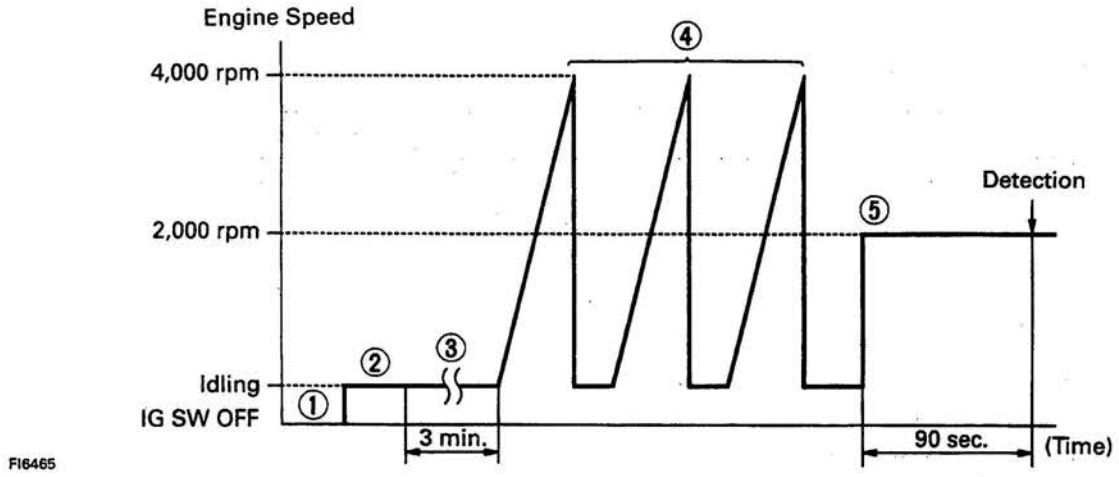
Purpose of the driving pattern.

(a) To simulate diagnostic code detecting condition after diagnostic code is recorded.

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

EG

Code No.	25	Air-Fuel Radio Lean Malfunction



HINT: Before this test, check the feedback voltage for oxygen sensor.

① Disconnect the EFI fuse (15A) for 10 sec. or more, with IG switch OFF. Initiate test mode (Connect terminals TE2 and E1 of check connector with IG switch OFF).

② Start the engine and warm up.

③ Idle the engine for 3 minutes.

④ Quickly race the engine to 4,000 rpm 3 times using the accelerator pedal.

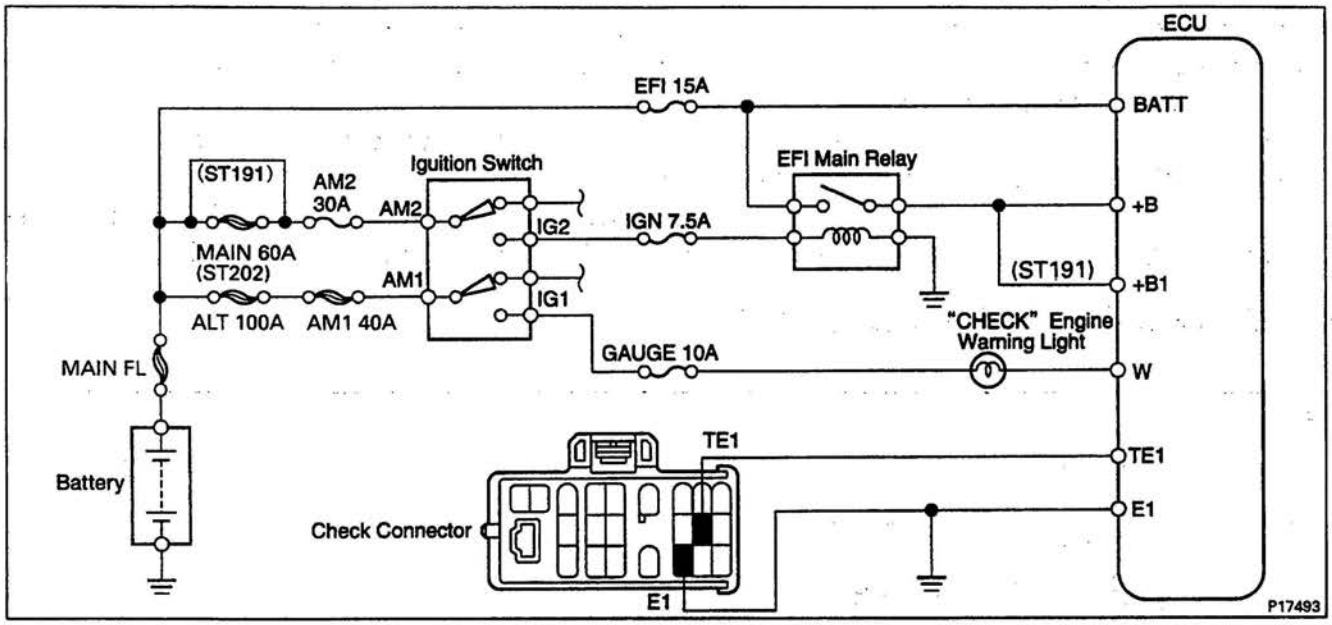
⑤ Race the engine at 2,000 rpm for 90 secs.

HINT: If a malfunction exists, the check engine warning light 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.

8G3VZ–01

DIAGNOSIS CIRCUIT INSPECTION



1.

Does "CHECK" engine warning light come on when ignition switch is ON? — YES → System Normal.

NO ↓

Does "CHECK" engine warning light come on when ECU terminal W is grounded to the body? — YES → Check wiring between ECU terminal E1 and body ground. — OK → Try another ECU.

NO ↓ — BAD ↓ Repair or replace.

Check bulb, fuse, and wiring between ECU and ignition switch.

BAD ↓

Repair or replace.

2.

Does "CHECK" engine warning light go off when the engine is started? — YES → System Normal.

NO ↓

Check wiring between ECU and "CHECK" engine warning light. — BAD → Repair.

OK ↓

Is there diagnostic code output when check connector terminals TE1 and E1 are connected? — NO → Check wiring between ECU terminal TE1 and check connector terminal TE1, and ECU terminal E1 and check connector terminal E1.

YES ↓ — OK ↓ Try another ECU.

Does "CHECK" engine warning light go off after repair according to malfunction code? — NO → Further repair required.

YES ↓

System OK → Cancel out diagnostic code.

V05370

TROUBLESHOOTING w/ VOLT, OHMMETER

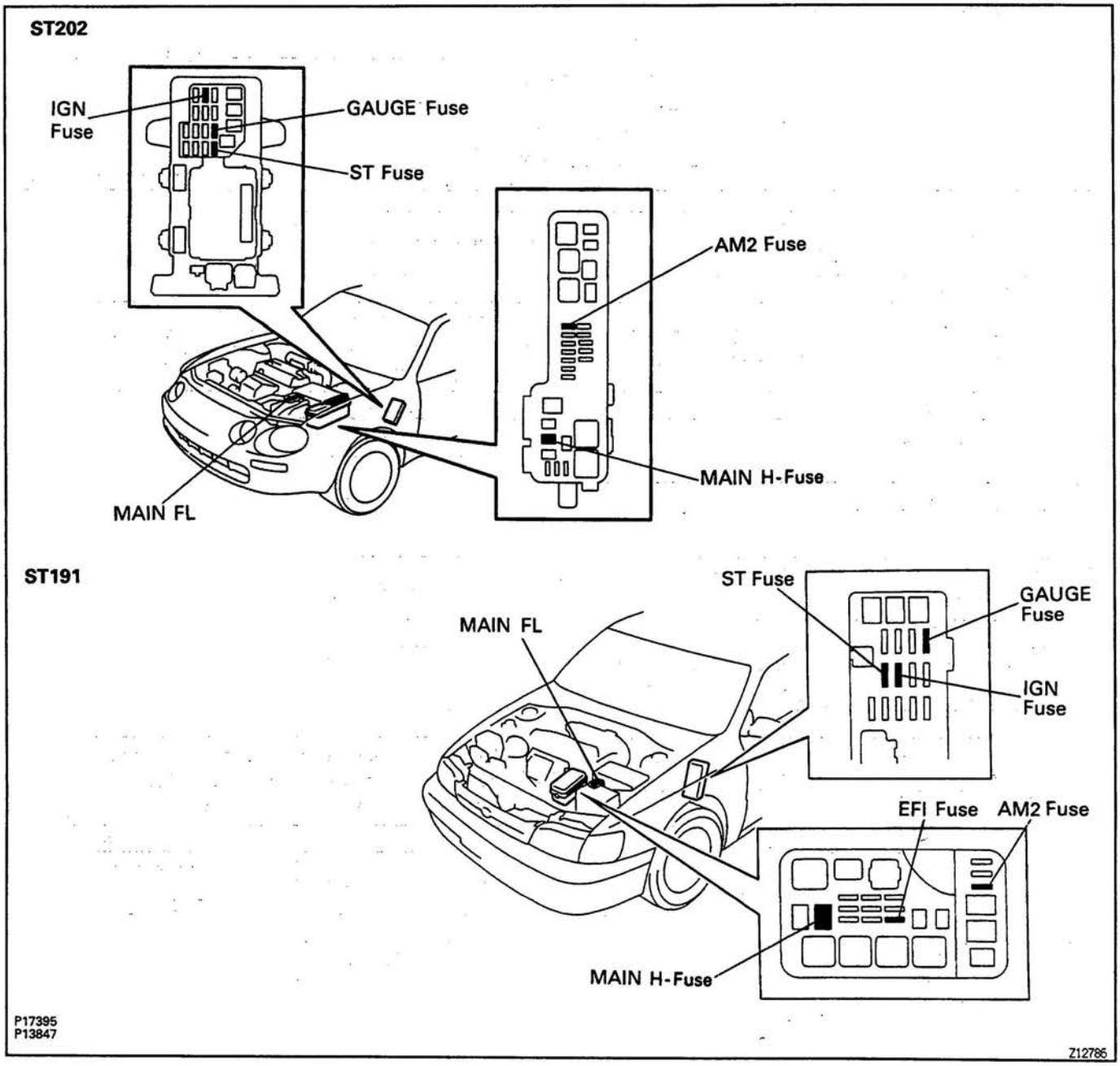
EG129–04

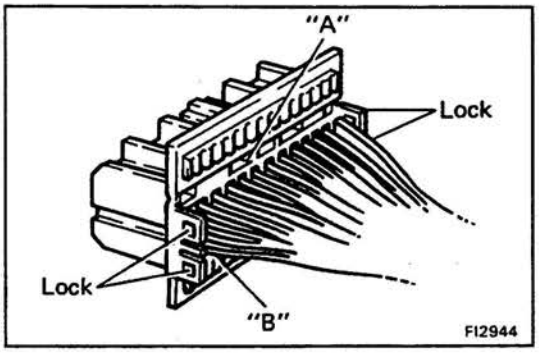
HINT:

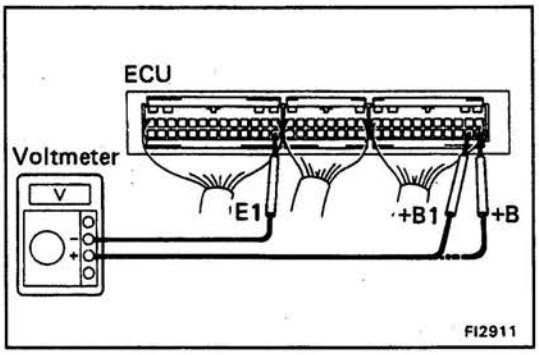
- The following troubleshooting procedures are designed for inspection of each separate system, and therefore the actual procedure may vary somewhat. However, troubleshooting should be performed while referring to the inspection methods described in this manual.
- Before beginning inspection, it is best to first make a simple check of the fuses, fusible link and the condition of the connectors.
- The following troubleshooting procedures are based on the supposition that the trouble lies in either a short or open circuit within the computer.
- If engine trouble occurs even though proper operating voltage is detected in the computer connector, then it can be assumed that the ECU is faulty and should be replaced.

FUSES AND FUSIBLE LINK LOCATION

BG139–04







EFI SYSTEM CHECK PROCEDURE

BG3VW-01

PREPARATION

(a) Disconnect the connectors from the ECU.

(b) Remove the locks as shown in the illustration so that the tester probe(s) can easily come in.

NOTICE: Pay attention to sections "A" and "B" in the illustration which can be easily broken.

(c) Reconnect the connectors to the ECU.

HINT:

- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11 V or more when the ignition switch is in the "ON" position.

Using a voltmeter with high impedance (10 kΩ/V minimum), measure the voltage at each terminal of the wiring connectors.

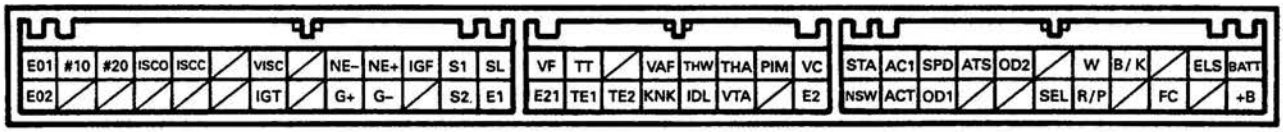
NOTICE: The ECU shown in the illustrations for measuring the voltage at each terminal of the wiring connectors, on pages EG–182 to EG–194, is the ECU used for the ST191 (A/T) and ST202. For the ECU of the ST191 (M/T), refer to EG–179 or EG–181.

ECU Terminals
(ST202)

EG

Symbol	Terminal Name	Symbol	Terminal Name	Symbol	Terminal Name
E01	POWER GROUND	S1	ECT SOLENOID	AC1	A/C AMPLIFIER
E02	POWER GROUND	S2	ECT SOLENOID	ACT	A/C AMPLIFIER
#10	INJECTOR	SL	ECT SOLENOID	SPD	SPEED SENSOR
	–	E1	ENGINE GROUND	OD1	CRUISE CONTROL ECU
#20	INJECTOR	VF	CHECK CONNECTOR	ATS	A/C AMPLIFIER
	–	E21	SENSOR GROUND	L	NEUTRAL START SWITCH
ISCO	ISC VALVE	TT	CHECK CONNECTOR	OD2	O/D SWITCH
	–	TE1	CHECK CONNECTOR	2	NEUTRAL STRAT SWITCH
ISCC	ISC VALVE		–		–
	–	TE2	CHECK CONNECTOR	SEL	GROUND
	–	VAF	VARIABLE RESISTOR	W	WARNING LIGHT
	–	KNK	KNOCK SENSOR	R/P	FUEL CONTROL CONNECTOR
VISC	A/C IDLE-UP VSV	THW	WATER TEMP. SENSOR	B/K	STOP LIGHT SWITCH
IGT	IGNITER	IDL	THROTTLE POSITION SENSOR		–
	–	THA	INTAKE AIR TEMP. SENSOR		–
	–	VTA	THROTTLE POSITION SENSOR	FC	CIRCUIT OPENING RELAY
NE–	DISTRIBUTOR	PIM	VACUUM SENSOR	ELS	TAILLIGHT RELAY, DEFOGGER RELAY
G+	DISTRIBUTOR		–		–
NE+	DISTRIBUTOR	VC	VACUUM SENSOR, THROTTLE POSITION SENSOR	BATT	BATTERY
G–	DISTRIBUTOR	E2	SENSOR GROUND	+B	EFI MAIN RELAY
IGF	IGNITER	STA	STARTER SWITCH		
	–	NSW	NEUTRAL START SWITCH		

ECU Terminals



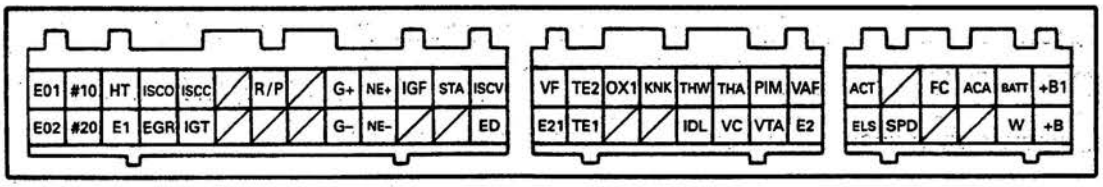
FI2796

V05372

ECU Terminals (Cont'd)
(ST191 M/T)

Symbol	Terminal Name	Symbol	Terminal Name	Symbol	Terminal Name
E01	POWER GROUND	NE+	DISTRIBUTOR	THA	INTAKE AIR TEMP. SENSOR
E02	POWER GROUND	NE–	DISTRIBUTOR	VC	VACUUM SENSOR, THROTTLE POSITION SENSOR
#10	INJECTOR	IGF	IGNITER	PIM	VACUUM SENSOR
#20	INJECTOR		–	VTA	THROTTLE POSITION SENSOR
HT*1	OXYGEN SENSOR HEATER	STA	STARTER RELAY	VAF*2	VARIABLE RESISTOR
E1	ENGINE GROUND		–	E2	SENSOR GROUND
ISCO	ISC VALVE	ISCV	A/C IDLE-UP VSV	ACT	A/C AMPLIFIER
EGR*1	EGR VSV	ED*1	ED MONITOR	ELS	TAILLIGHT RELAY, DEFOGGER SWITCH
ISCC	ISC VALVE	VF	CHECK CONNECTOR		–
IGT	IGNITER	E21	SENSOR GROUND	SPD	SPEED SENSOR
	–	TE2	CHECK CONNECTOR	FC	CIRCUIT OPENING RELAY
	–	TE1	CHECK CONNECTOR		–
R/P*2	FUEL CONTROL CONNECTOR	OX1	OXYGEN SENSOR	AC1	A/C AMPLIFIER
	–		–		–
	–	KNK	KNOCK SENSOR	BATT	BATTERY
	–		–	W	WARNING LIGHT
G+	DISTRIBUTOR	THW	WATER TEMP. SENSOR	+B1	EFI MAIN RELAY
G–	DISTRIBUTOR	IDL	THROTTLE POSITION SENSOR	+B	EFI MAIN RELAY

ECU Terminals



P01821

*1 Europe
*2 General

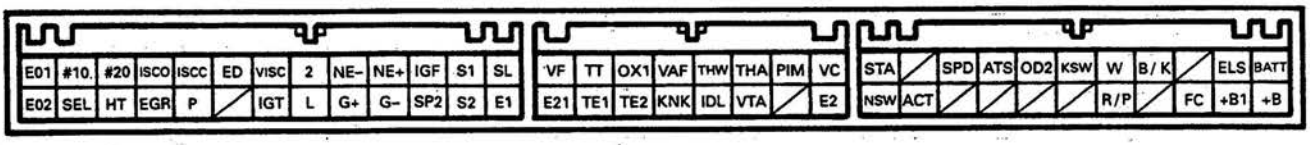
V05371

ECU Terminals (Cont'd)
(ST191 A/T)

EG

Symbol	Terminal Name	Symbol	Terminal Name	Symbol	Terminal Name
E01	POWER GROUND	S1	ECT SOLENOID		–
E02	POWER GROUND	S2	ECT SOLENOID	ACT	A/C AMPLIFIER
#10	INJECTOR	SL	ECT SOLENOID	SPD	SPEED SENSOR
SEL*2	GROUND	E1	ENGINE GROUND		–
#20	INJECTOR	VF	CHECK CONNECTOR	ATS	A/C AMPLIFIER
HT*2	OXYGEN SENSOR HEATER	E21	SENSOR GROUND		–
ISCO	ISC VALVE	TT	CHECK CONNECTOR	OD2	O/D SWITCH
EGR*2	EGR VSV	TE1	CHECK CONNECTOR		–
ISCC	ISC VALVE	OX1*2	OXYGEN SENSOR	KSW*2	KICK-DOWN SWITCH
P	PATTERN SELECT SWITCH	TE2	CHECK CONNECTOR		–
ED*2	ED MONITOR	VAF*1	VARIABLE RESISTOR	W	WARNING LIGHT
	–	KNK	KNOCK SENSOR	R/P*1	FUEL CONTROL CONNECTOR
VISC	A/C IDLE-UP VSV	THW	WATER TEMP. SENSOR	B/K	STOP LIGHT SWITCH
IGT	IGNITER	IDL	THROTTLE POSITION SENSOR		–
2	NEUTRAL START SWITCH	THA	INTAKE AIR TEMP. SENSOR		–
L	NEUTRAL START SWITCH	VTA	THROTTLE POSITION SENSOR	FC	CIRCUIT OPENING RELAY
NE–	DISTRIBUTOR	PIM	VACUUM SENSOR	ELS	TAILLIGHT RELAY, DEFOGGER RELAY
G+	DISTRIBUTOR		–	+B1	EFI MAIN RELAY
NE+	DISTRIBUTOR	VC	VACUUM SENSOR, THROTTLE POSITION SENSOR	BATT	BATTERY
G–	DISTRIBUTOR	E2	SENSOR GROUND	+B	EFI MAIN RELAY
IGF	IGNITER	STA	STARTER SWITCH		
SP2	SPEED SENSOR	NSW	NEUTRAL START SWITCH		

ECU Terminals



FI2796

*1 General
*2 Europe

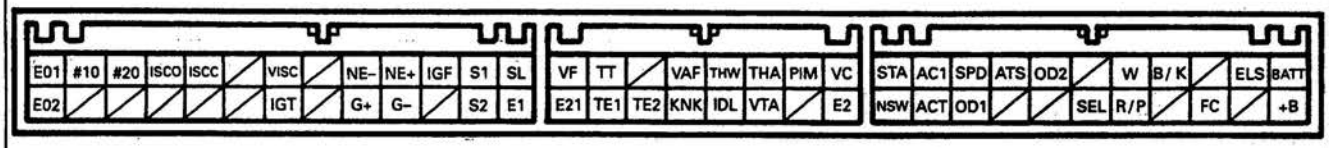
V05402

ECU Wiring Connectors Voltage

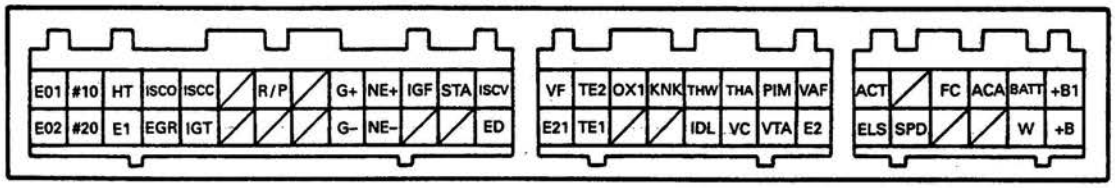
No.	Terminals	Condition		STD voltage (V)	See page
1	+B, +B1 – E1	IG SW ON		9 – 14	EG-182
2	BATT – E1	–		9 – 14	EG-183
3	IDL – E2	IG SW ON	Throttle valve open	9 – 14	EG-184
	VC – E2		–	4.5 – 5.5	
	VTA – E2		Throttle valve fully closed	0.3 – 0.8	
			Throttle valve fully open	3.2 – 4.9	
4	PIM – E2	IG SW ON		3.3 – 3.9	EG-186
	VC – E2			4.5 – 5.5	
5	#10, #20 – E01, E02			9 – 14	EG-187
6	THA – E2	IG SW ON	Intake air temp. 20 °C (68°F)	0.5 – 3.4	EG-188
7	THW – E2		Coolant temp. 80°C (176°F)	0.2 – 1.0	EG-189
8	STA – E1	Cranking		6 or more	EG-190
9	IGT – E1	Cranking or idling		Pulse generation	EG-191
10	ISCC, ISCO – E1	IG SW ON	ECU connectors disconnected	9 – 14	EG-192
11	W – E1	No trouble (Check engine warning light off) and engine running		9 – 14	EG-193

ECU Terminals

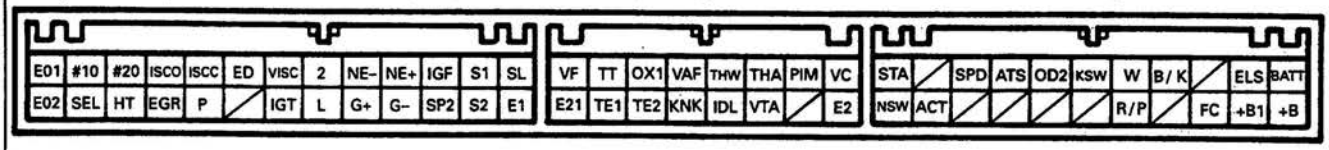
ST202



ST191 (M/T)



ST191 (A/T)

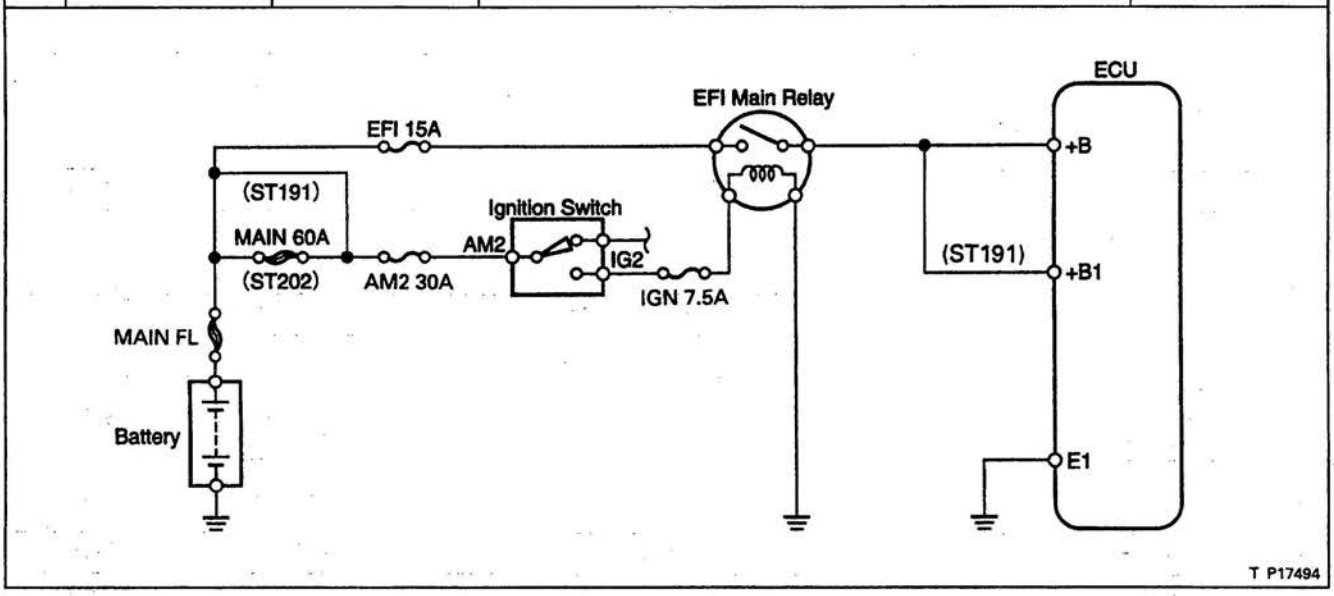


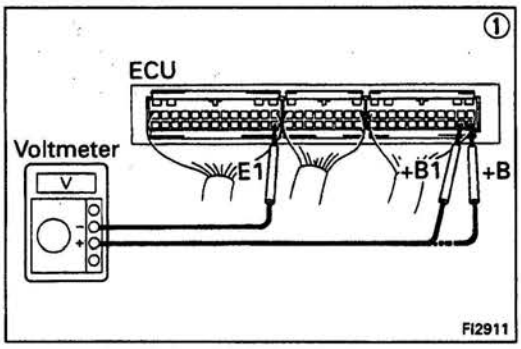
FI2796
P01821
FI2796

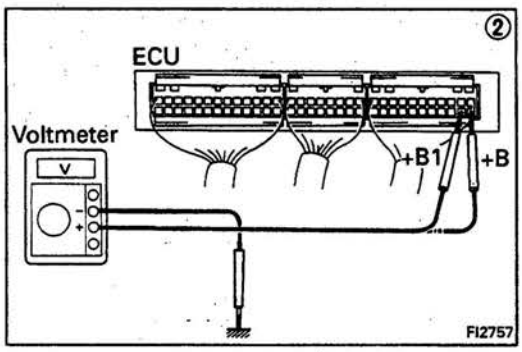
V05373

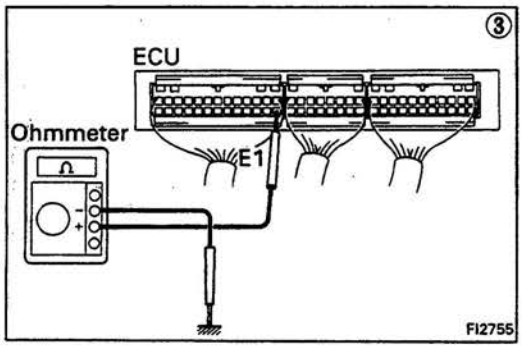
EG

No.	Terminals	Trouble	Condition	STD Voltage
1	+B +B1 – E1	No voltage	IG SW ON	9 – 14 V









① There is no voltage between ECU terminals +B or +B1 and E1. **(IG SW ON)**

↓

② Check that there is voltage between ECU terminal +B or +B1 and body ground. **(IG SW ON)**

NO → ③ Check wiring between ECU terminal E1 and body ground.
- OK → Try another ECU.
- BAD → Repair or replace.

OK ↓

Check fuses, fusible links and ignition switch. — BAD → Repair or replace.

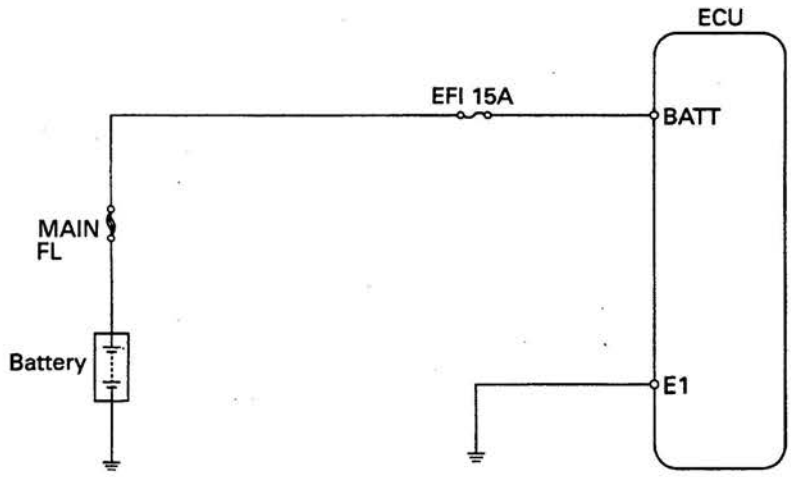
OK ↓

Check EFI main relay. (See page EG-261 or 262) — BAD → Replace.

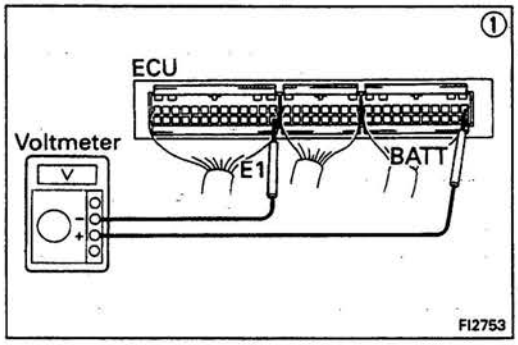
OK ↓

Check wiring between EFI main relay and battery. — BAD → Repair or replace.

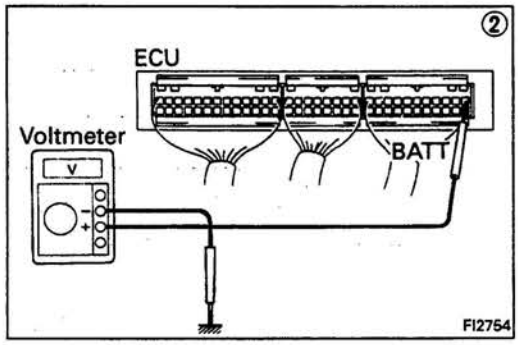
No.	Terminals	Trouble	Condition	STD Voltage
2	BATT – E1	No voltage	–	9 – 14 V



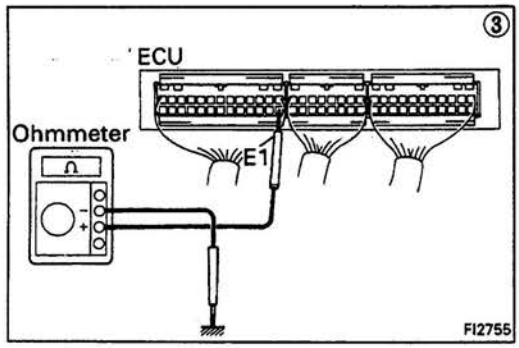
P17814



FI2753



FI2754



FI2755

① There is no voltage between ECU terminals BATT and E1.

② Check that there is voltage between ECU terminal BATT and body ground.

NO → OK

③ Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

Check fuse and fusible link. BAD → Replace.

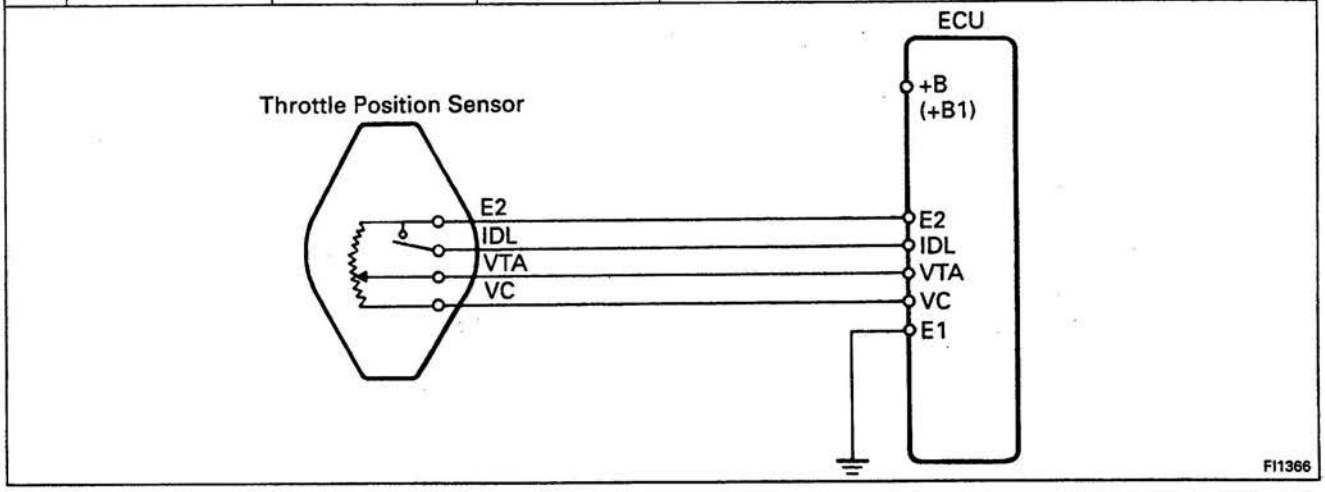
OK

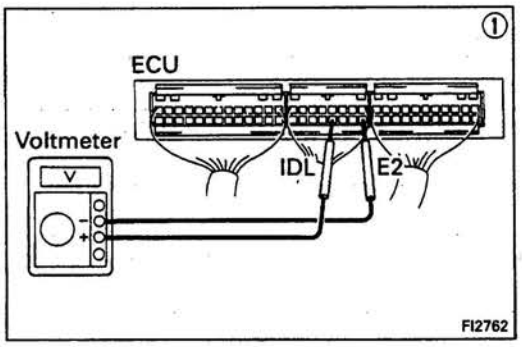
Check wiring between ECU terminal and battery. BAD → Repair or replace.

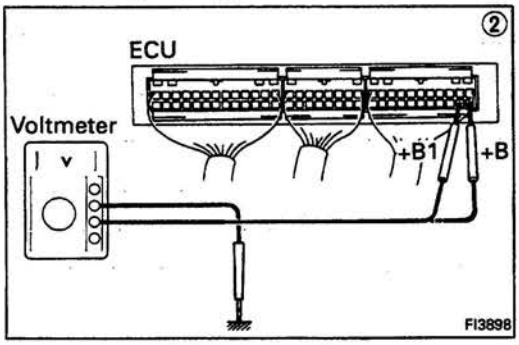
V05375

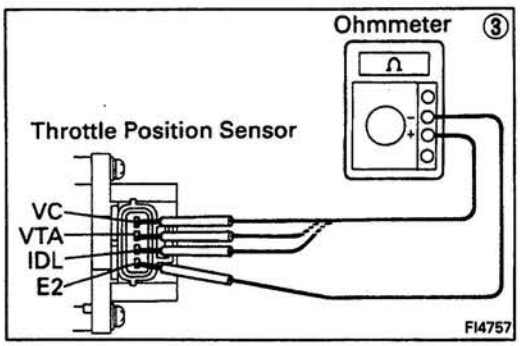
EG

No.	Terminals	Trouble	Condition		STD Voltage
3	IDL – E2	No voltage	Ignition switch ON	Throttle valve open	9 – 14 V
	VC – E2			–	4.5 – 5.5 V
	VTA – E2			Throttle valve fully closed	0.3 – 0.8 V
				Throttle valve fully open	3.2 – 4.9 V









• **IDL – E2**

① There is no voltage between ECU terminals IDL and E2. **(IG SW ON) (Throttle valve open)**

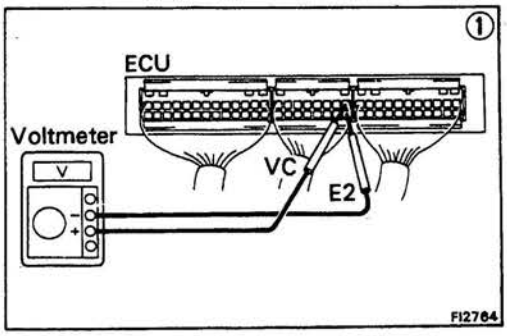
② Check that there is voltage between ECU terminal +B or +B1 and body ground. **(IG SW ON)**

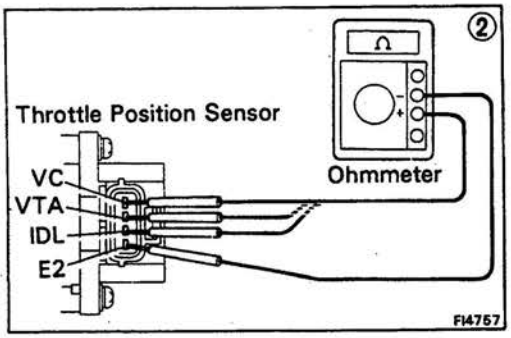
NO → Check wiring between ECU terminal E1 and body ground.
- OK → Try another ECU.
- BAD → Repair or replace.

OK → Refer to +B – E1 trouble section (No.1). (See page EG-182)
- BAD → Repair or replace.

③ Check throttle position sensor. (See page EG-248)
- BAD → Repair or replace throttle position sensor.
- OK → Check wiring between ECU and throttle position sensor.
  - BAD → Repair or replace.
  - OK → Try another ECU.

V05376





• **VC – E2**

① No voltage between ECU terminals VC and E2. **(IG SW ON)**

↓

Check that there is voltage between ECU terminal +B or +B1 and body ground. **(IG SW ON)**

↓ OK

② Check throttle position sensor. (See page EG-248)

↓ BAD

Repair or replace.

↓ OK

Check wiring between ECU and throttle position sensor.

↓ OK

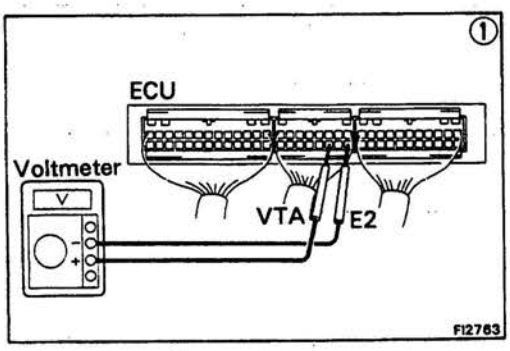
Try another ECU.

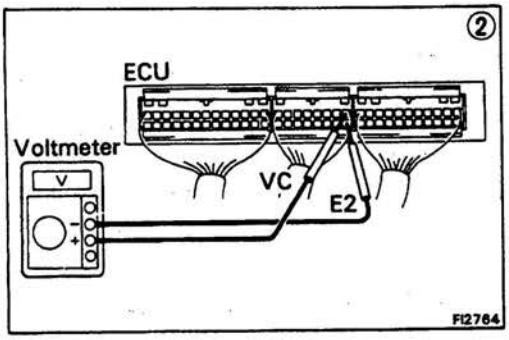
NO

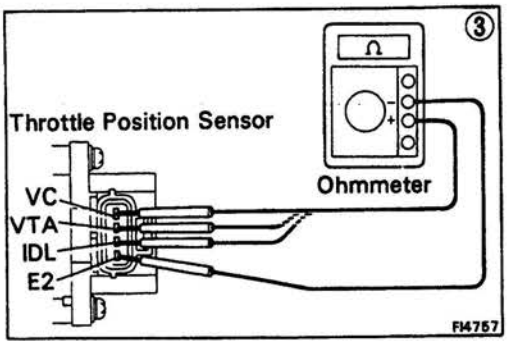
Refer to +B – E1 trouble section (No.1). (See page EG-182)

↓ BAD

Repair or replace.







• **VTA – E2**

① No specified voltage at ECU terminals VTA and E2. **(IG SW ON)**

↓

② Check that there is voltage between ECU terminals VC and E2. **(IG SW ON)**

↓ NO

Refer to VC – E2 trouble section.

↓ OK

③ Check throttle position sensor. (See page EG-248)

↓ BAD

Repair or replace.

↓ OK

Check wiring between ECU and throttle position sensor.

↓ BAD

Repair or replace.

↓ OK

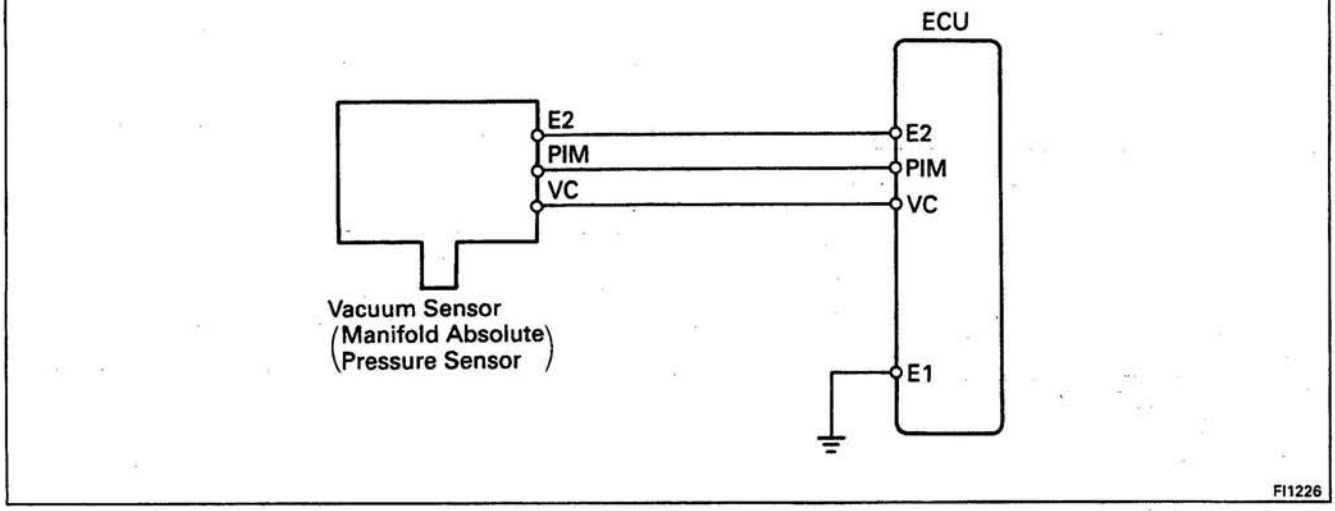
Try another ECU.

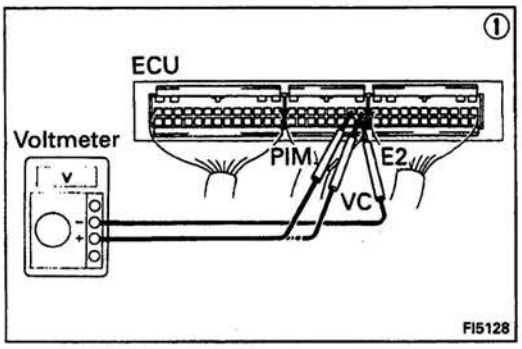
OK

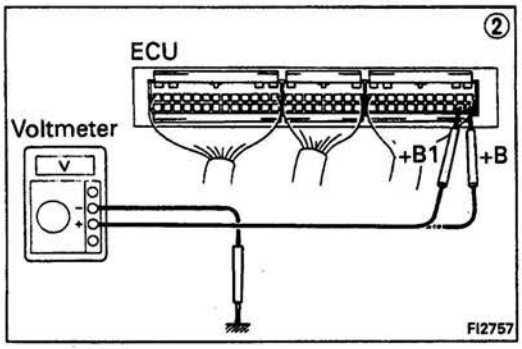
EG

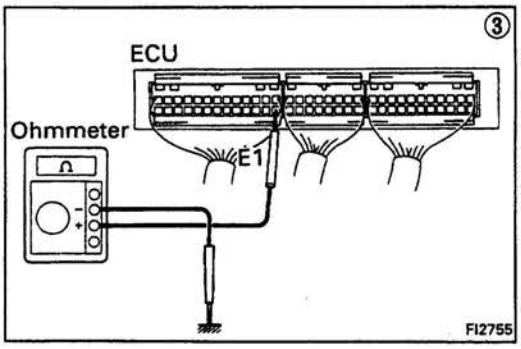
V03310

No.	Terminals	Trouble	Condition	STD voltage
4	PIM – E2	No voltage	IG SW ON	3.3 – 4.9 V
	VC – E2			4.5 – 5.5 V









① There is no voltage between ECU terminals PIM or VC and E2. **(IG SW ON)**

↓

② Check that there is voltage between ECU terminal +B or +B1 and body ground. **(IG SW ON)**

OK ↓

NO → Refer to +B – E1 trouble section (No.1). (See page EG-182)

③ Check wiring between ECU terminal E1 and body ground.

OK ↓

BAD → Repair or replace.

Check vacuum sensor. (See page EG-275)

BAD ↓

Replace vacuum sensor.

OK → Check wiring between ECU and vacuum sensor.

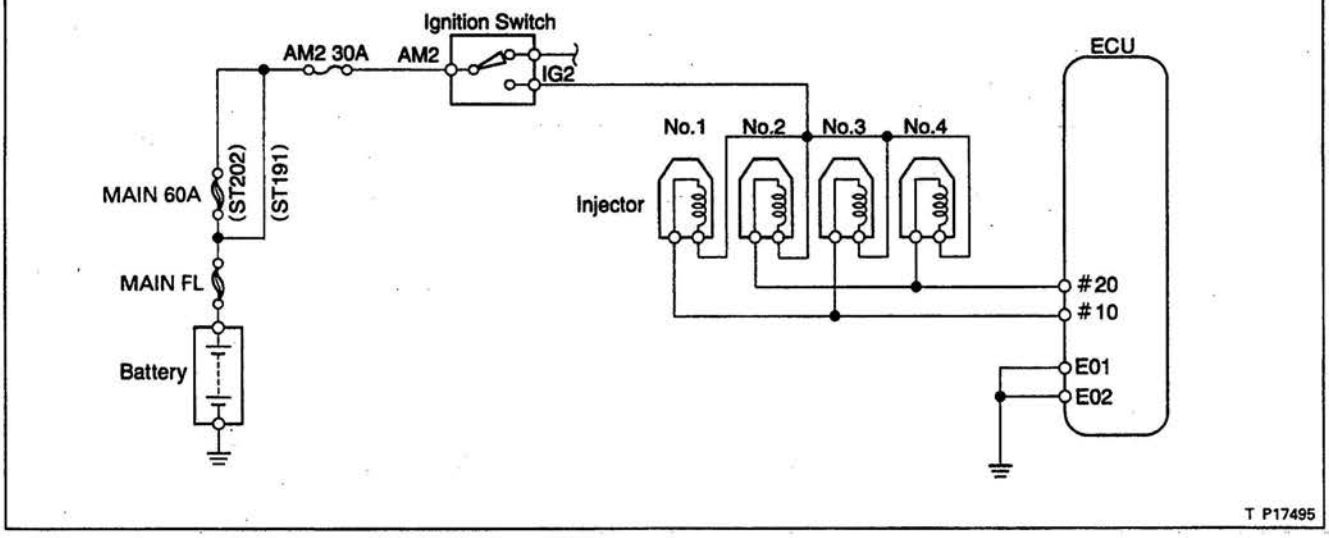
OK ↓

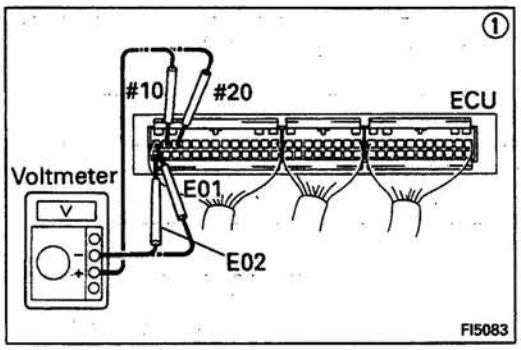
BAD → Repair or replace.

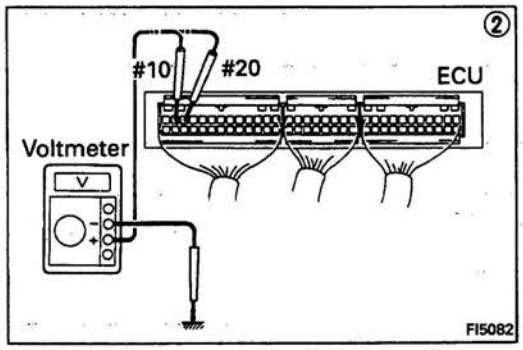
Try another ECU.

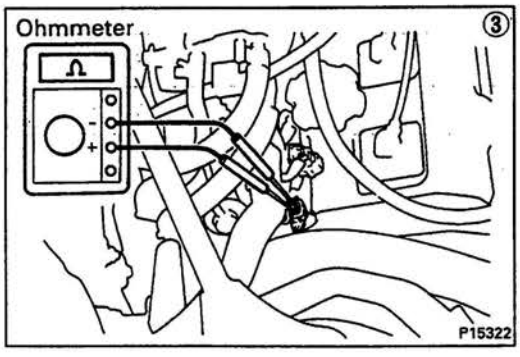
V05377

No.	Terminals	Trouble	Condition	STD voltage
5	#10 – E01 #20 – E02	No voltage	IG SW ON	9 – 14 V









① There is no voltage between ECU terminals #10 and/or #20 and E01 and/or E02. **(IG SW ON)**

↓

② Check that there is voltage between ECU terminal #10 and/or #20 and body ground.

NO → OK

Check wiring between ECU terminal E01 and/or E02 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

Check fuse, fusible links and ignition switch. → BAD → Repair or replace.

OK ↓

③ Check resistance of each injector.
STD resistance: Approx 13.8 Ω

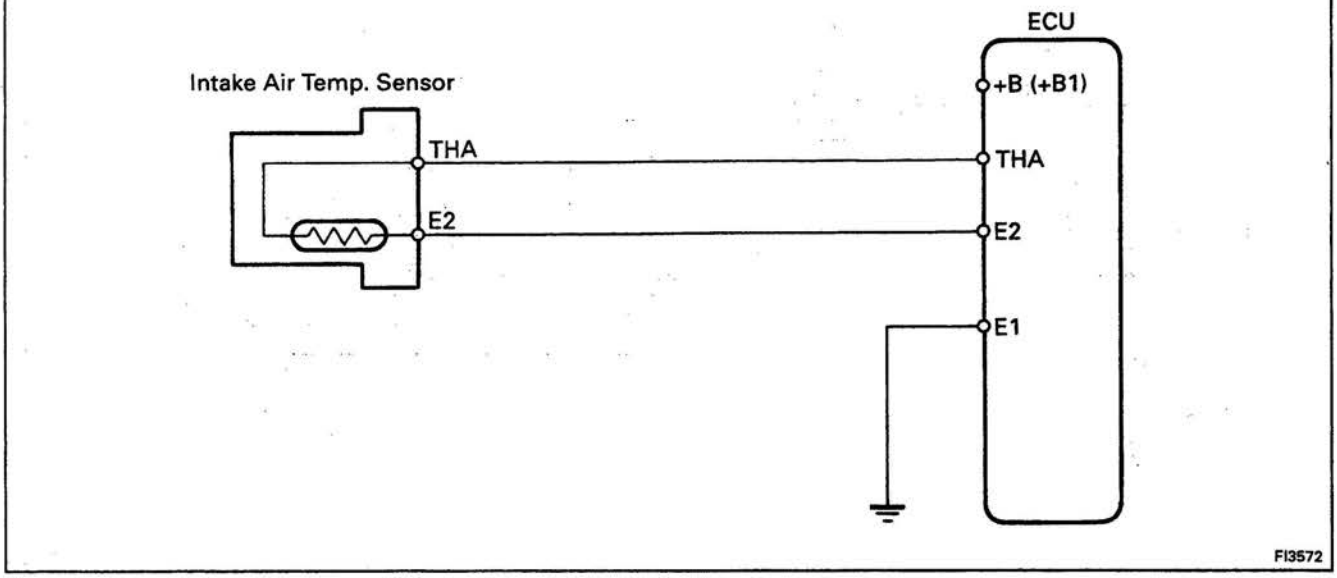
OK ↓

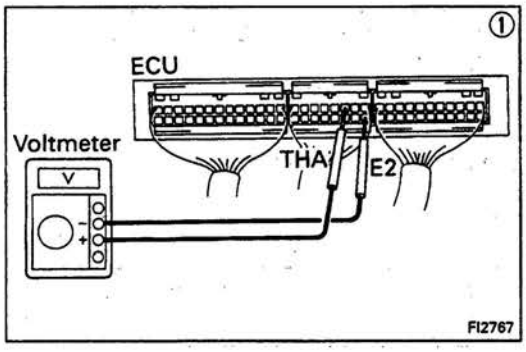
BAD → Replace injector.

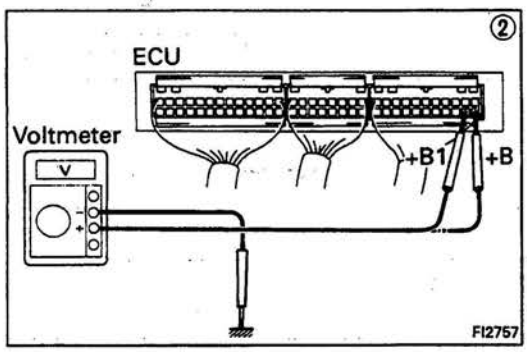
Check wiring between ECU terminal #10 and/or #20 and battery. → BAD → Repair or replace.

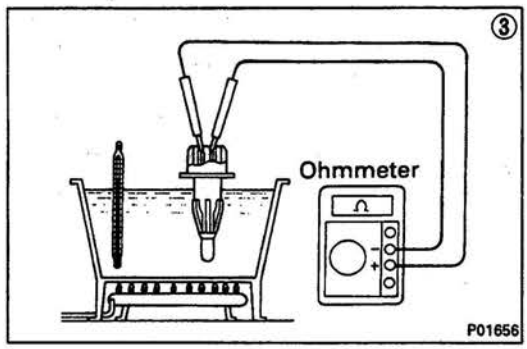
V05378

No.	Terminals	Trouble	Condition		STD voltage
6	THA – E2	No voltage	IG SW ON	Intake air temperature 20°C (68°F)	0.5 – 3.4 V









① There is no voltage between ECU terminals THA and E2. **(IG SW ON)**

↓

② Check that there is voltage between ECU terminal +B or +B1 and body ground. **(IG SW ON)**

OK ↓ / NO → Refer to +B – E1 trouble section No.1. (See page EG-182)

↓

Check wiring between ECU terminal E1 and body ground.

OK ↓ / BAD → Repair or replace.

↓

③ Check intake air temp. sensor. (See page EG-273)

BAD → Repair intake air temp. sensor.

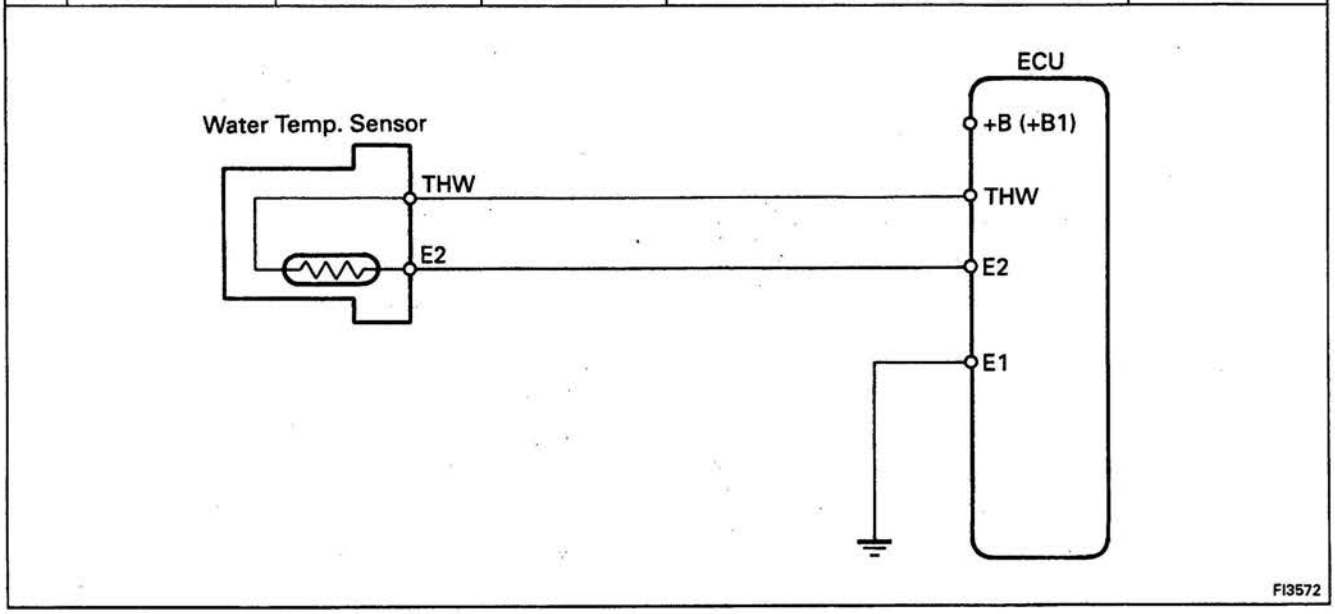
OK → Check wiring between ECU and intake air temp. sensor.

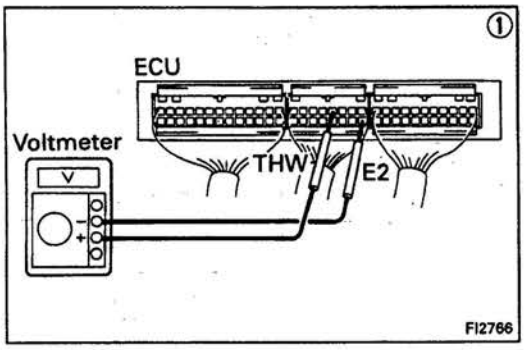
OK → Try another ECU.

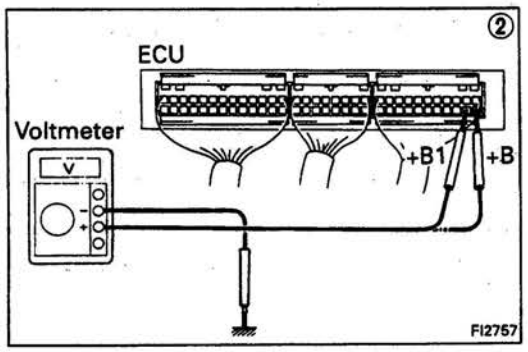
BAD → Repair or replace.

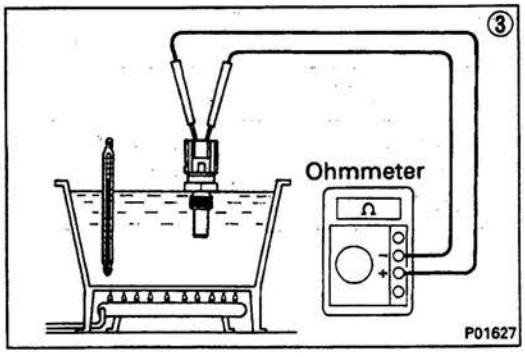
V05379

No.	Terminals	Trouble	Condition		STD voltage
7	THW – E2	No voltage	IG SW ON	Coolant temperature 80°C (176°F)	0.2 – 1.0 V









① There is no voltage between ECU terminals THW and E2. **(IG SW ON)**

↓

② Check that there is voltage between ECU terminal +B or +B1 and body ground. **(IG SW ON)**

OK → ↓

NO → Refer to +B – E1 trouble section (No.1). (See page EG-182)

↓

Check wiring between ECU terminal E1 and body ground.

OK → ↓

BAD → Repair or replace.

↓

③ Check water temp. sensor. (See page EG-271)

BAD → Replace water temp. sensor.

OK → ↓

Check wiring between ECU and water temp. sensor.

OK → ↓

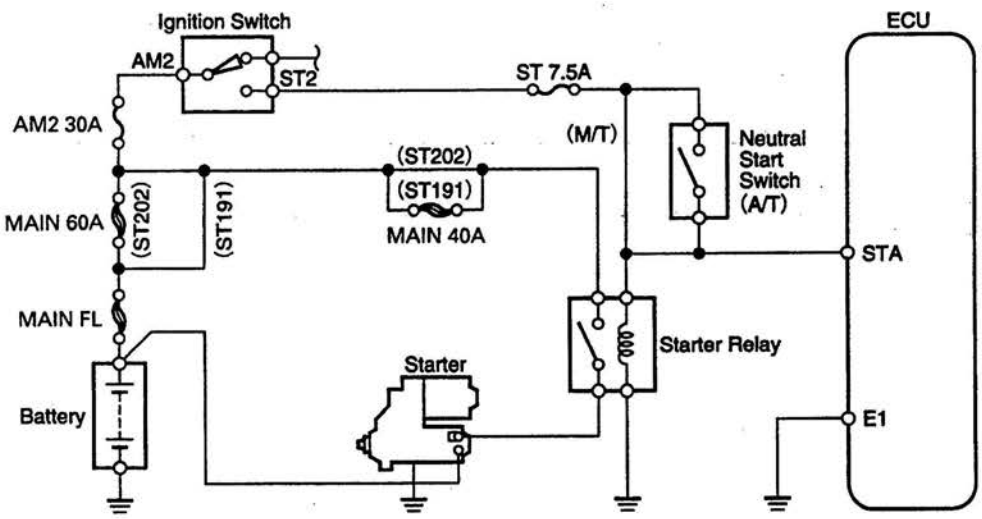
Try another ECU.

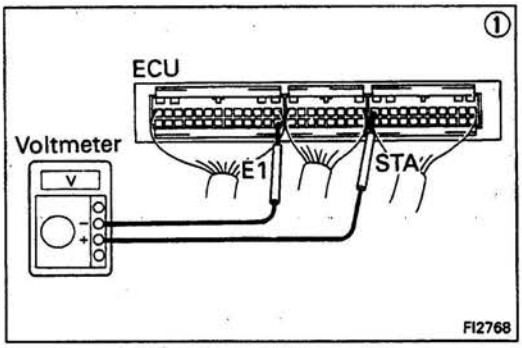
BAD → Repair or replace.

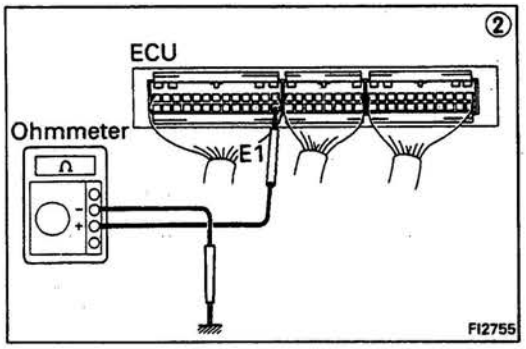
V05380

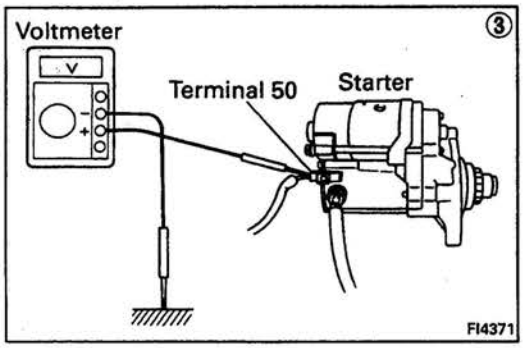
EG

No.	Terminals	Trouble	Condition	STD voltage
8	STA – E1	No voltage	Cranking	6 V or more









① There is no voltage between ECU terminals STA and E1. **(IG SW START)**

Check starter operation. — OK → Check wiring between ECU terminal STA and ignition switch terminal ST2. — OK → ② Check wiring between ECU terminal E1 and body ground. — OK → Try another ECU. / BAD → Repair or replace.

ST2 — BAD → Repair or replace.

BAD

Check fuse, fusible links, battery, wiring, starter relay and ignition switch. — BAD → Repair or replace.

OK

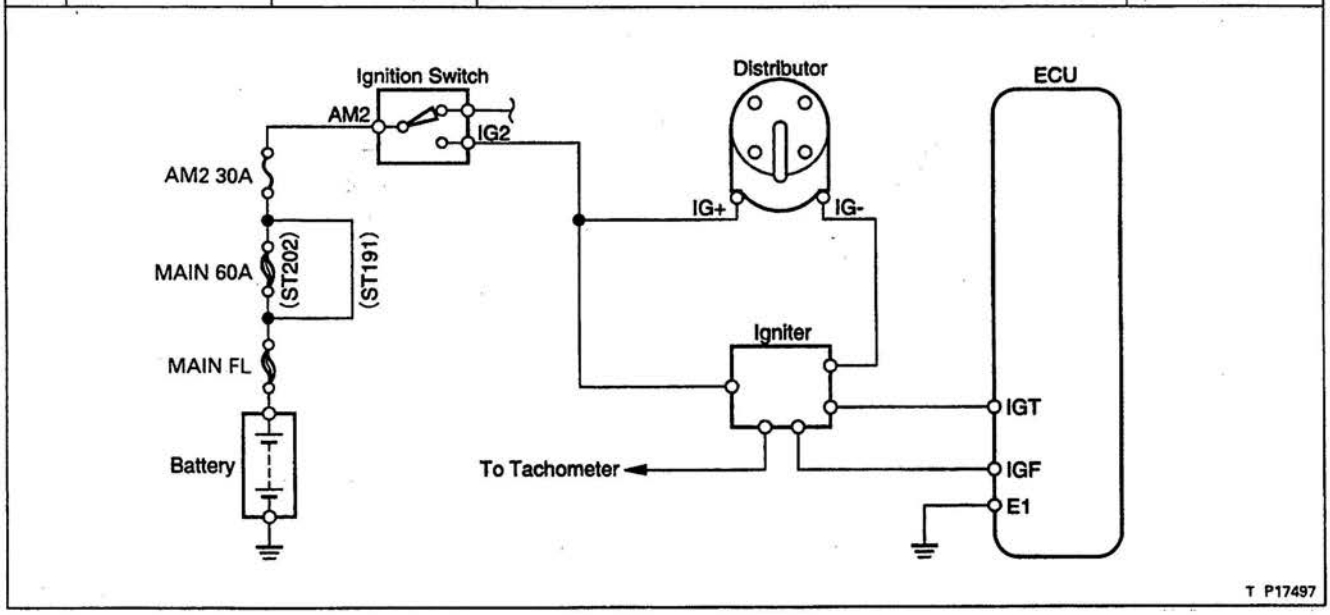
③ Check that there is voltage at terminal 50 of starter. **(IG SW START) STD voltage: 6 V or more**

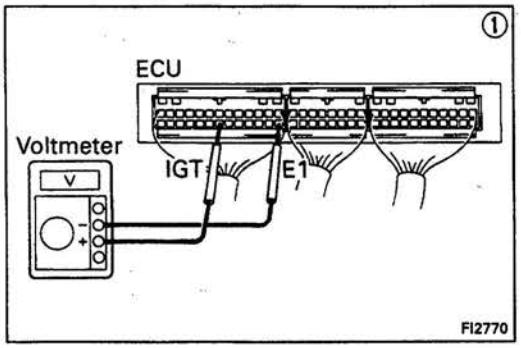
OK → Check starter.

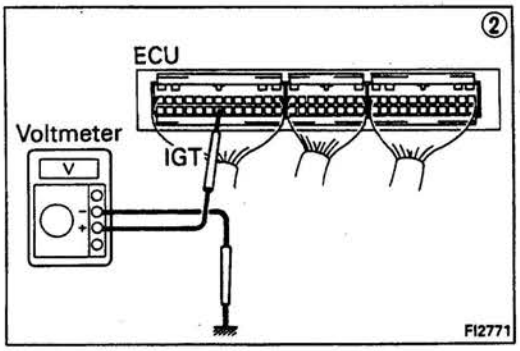
NO → Check wiring between 1). ST2 and starter relay, and 2). battery and starter terminal 50.

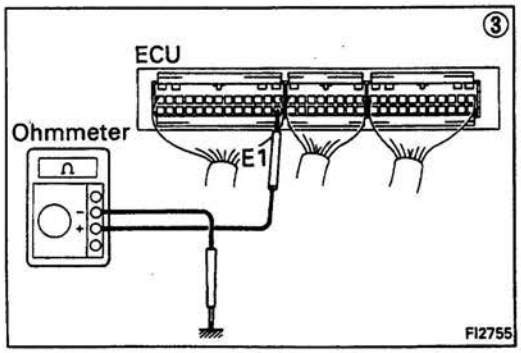
V05381

No.	Terminals	Trouble	Condition	STD voltage
9	IGT – E1	No voltage	Idling	Pulse generation









① There is no voltage between ECU terminals IGT and E1. **(Idling)**

↓

② Check that there is voltage between ECU terminal IGT and body ground. **(Idling)**

NO → OK

③ Check wiring between ECU terminal E1 and body ground. → BAD → Repair or replace.

OK → Try another ECU.

↓

Check fusible links and ignition switch. → BAD → Repair or replace.

OK ↓

Check distributor. (See page IG-10) → BAD → Repair or replace.

OK ↓

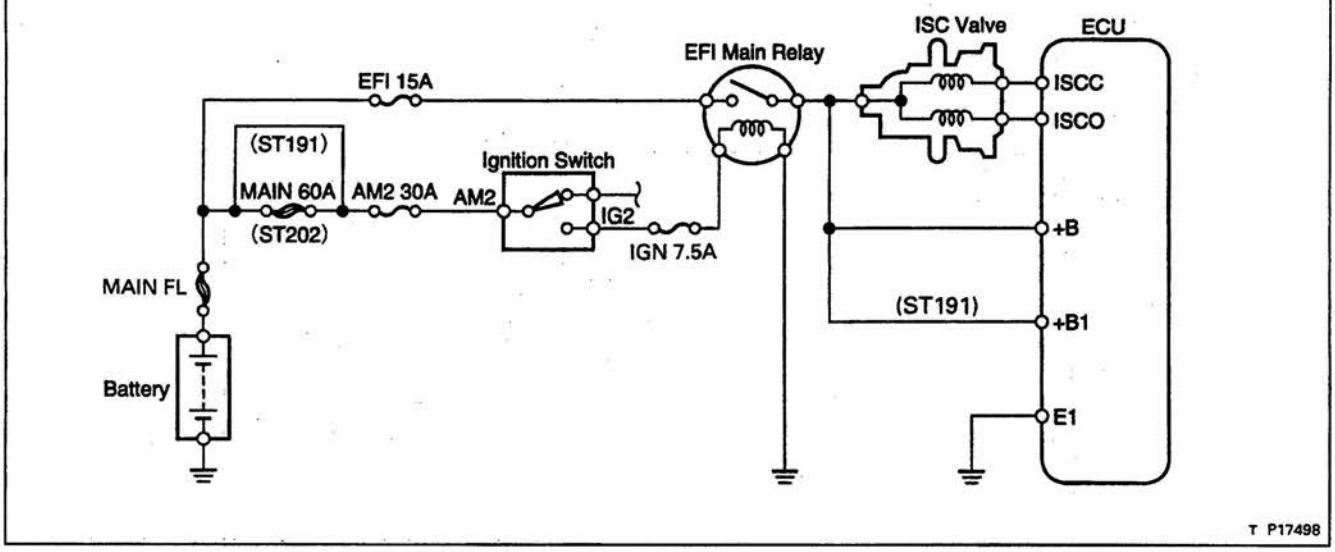
Check wiring between ECU and battery. → BAD → Repair or replace.

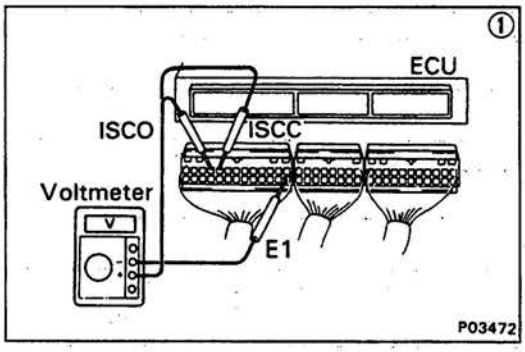
OK ↓

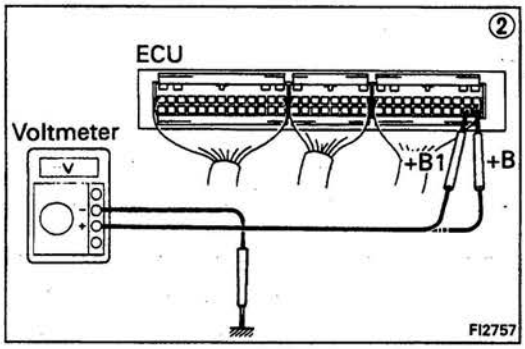
Check igniter. (See page IG-11) → BAD → Repair or replace.

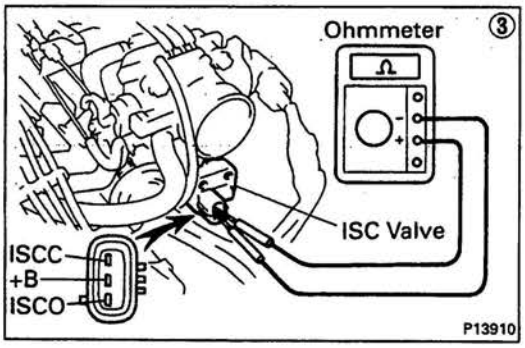
V05382

No.	Terminals	Trouble	Condition		STD voltage
10	ISCC ISCO – E1	No voltage	IG SW ON	ECU connectors disconnected	9 – 14 V









① There is no voltage between ECU terminals ISCC or ISCO and E1. **(IG SW ON)**

↓

② Check that there is voltage between ECU terminal +B or +B1 and body ground. **(IG SW ON)**

OK ↓

NO → Refer to +B – E1 trouble section (No.1). (See page EG-182)

③ Check resistance between ISC valve terminals +B and ISCC or ISCO.
STD resistance:
Aprox. 19.3 – 22.3 Ω

BAD → Replace ISC valve.

OK ↓

Check wiring between ECU and ISC valve.

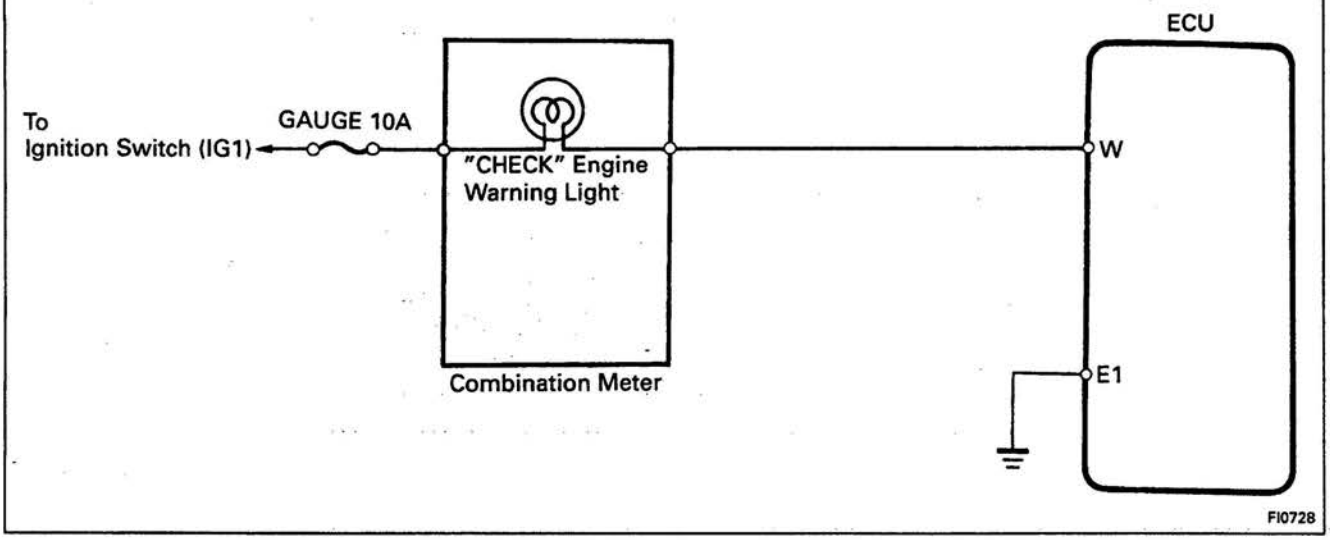
BAD → Repair or replace.

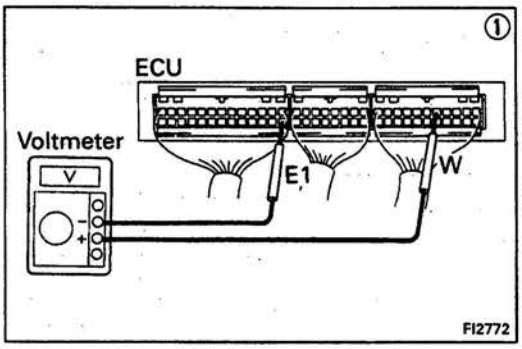
OK ↓

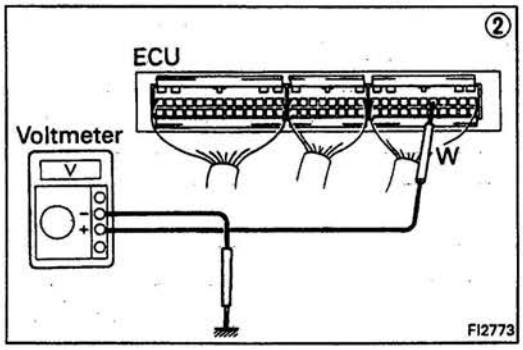
Try another ECU.

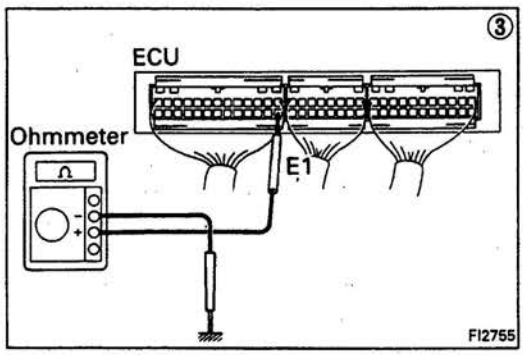
V05383

No.	Terminals	Trouble	Condition	STD voltage
11	W – E1	No voltage	No trouble ("CHECK" engine warning light off) and engine running.	9 – 14 V









① There is no voltage between ECU terminals W and E1. **(Idling)**

② Check that there is voltage between ECU terminal W and body ground.

NO → Check GAUGE fuse (10 A) and "CHECK" engine warning light.

OK → ③ Check wiring between ECU terminal E1 and body ground.

③ OK → Try another ECU.

③ BAD → Repair or replace.

Check GAUGE fuse (10 A) and "CHECK" engine warning light.

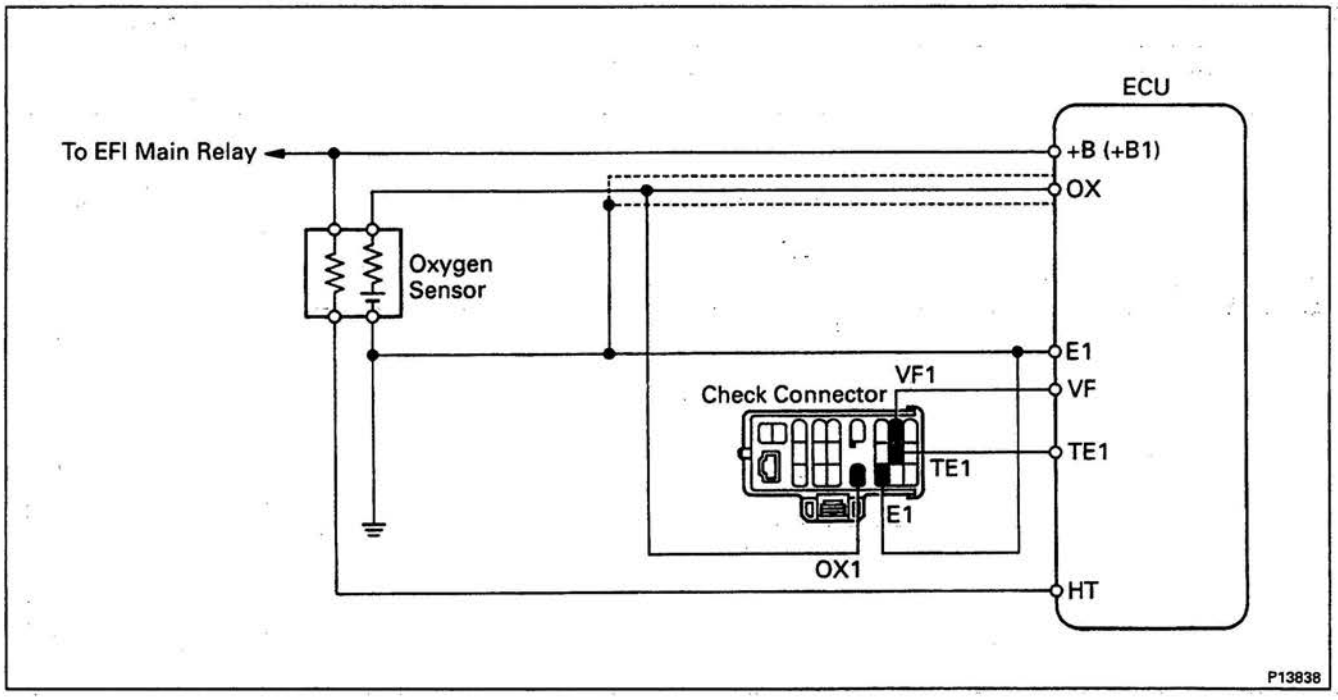
OK → Check wiring between ECU terminal W and fuse.

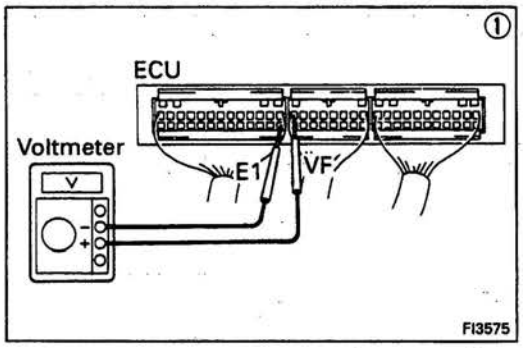
BAD → Repair or replace.

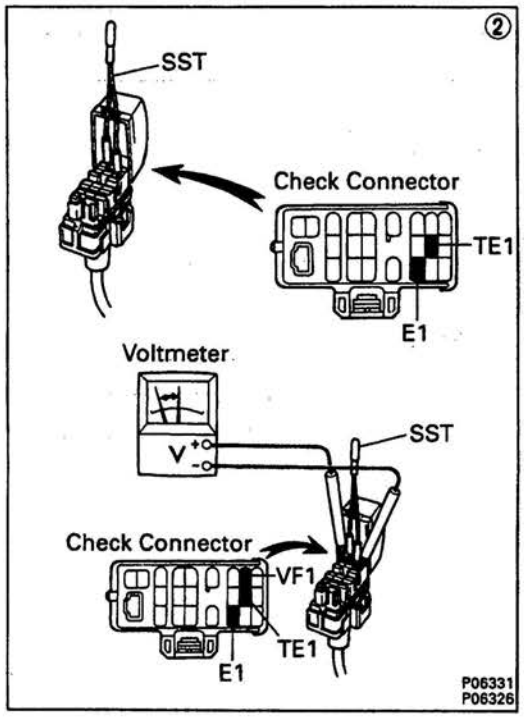
Fuse blows again → Check wiring between ECU terminal W and fuse.

Check wiring between ECU terminal W and fuse. BAD → Repair or replace.

EG







① There is no voltage between ECU terminals VF and E1.

Check that there is voltage between ECU terminal VF and body ground.

NO → OK: Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU. BAD → Repair or replace.

BAD → Repair or replace.

Is air leaking into air induction system? BAD → Repair or replace.

OK → Check spark plugs. (See page IG-8) BAD → Repair or replace.

OK → Check distributor and ignition system. (See page IG-7) BAD → Repair or replace.

OK → Check fuel pressure. (See page EG-195) BAD → Repair or replace.

OK → Check injectors. (See page EG-220 or 234) BAD → Repair or replace.

OK → Check vacuum sensor. (See page EG-275) BAD → Repair or replace.

OK → ② Check operation of oxygen sensor. (See page EG-284) OK → System normal.

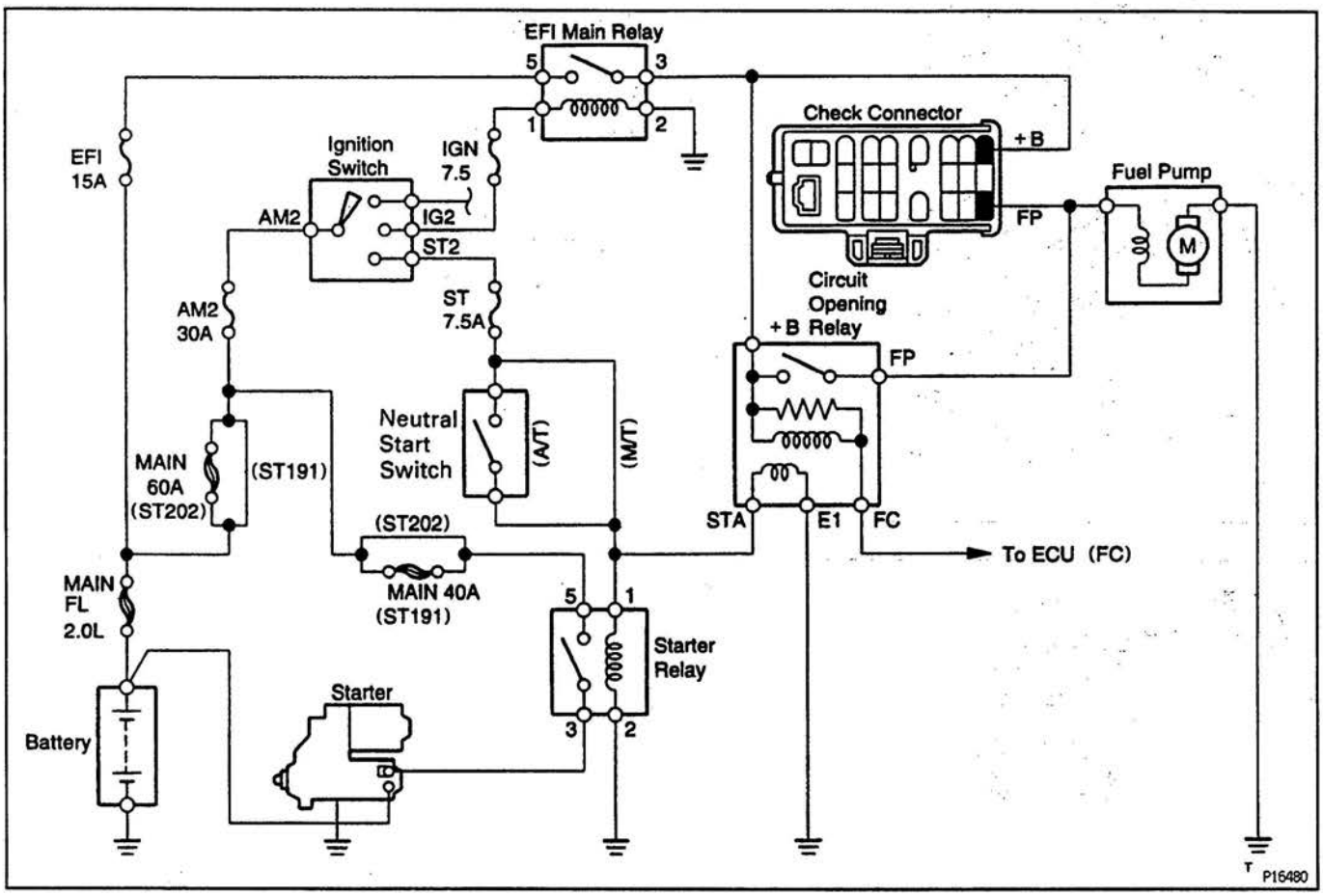
BAD → Check wiring between oxygen sensor and ECU. BAD → Repair wiring.

OK → Replace oxygen sensor.

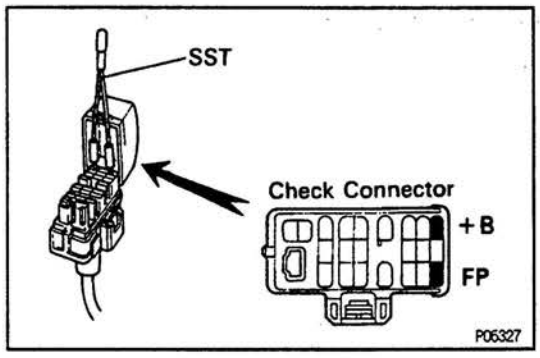
V05385

FUEL PUMP
SYSTEM CIRCUIT

EGOCY-0M



EG

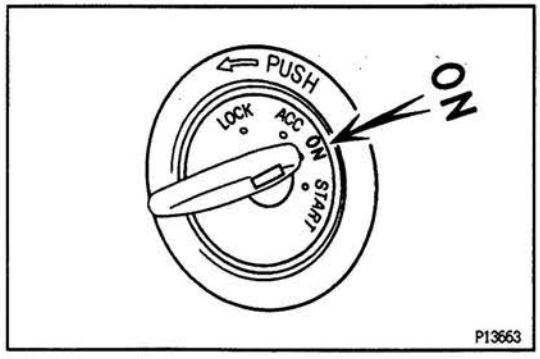


EG3UR-01

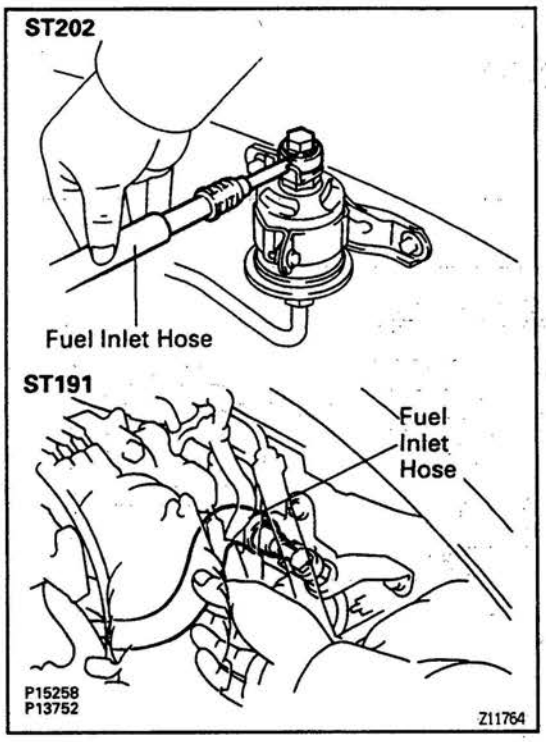
ON–VEHICLE INSPECTION

1. CHECK FUEL PUMP OPERATION

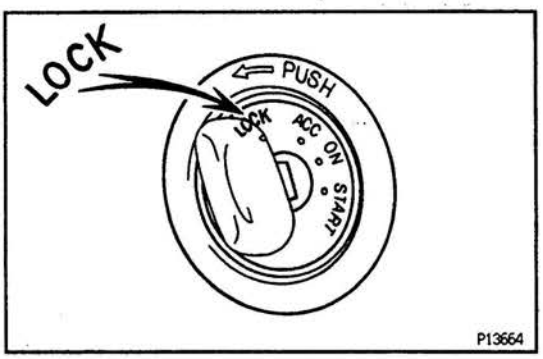
(a) Using SST, connect terminals +B and FP of the check connector.
SST 09843–18020



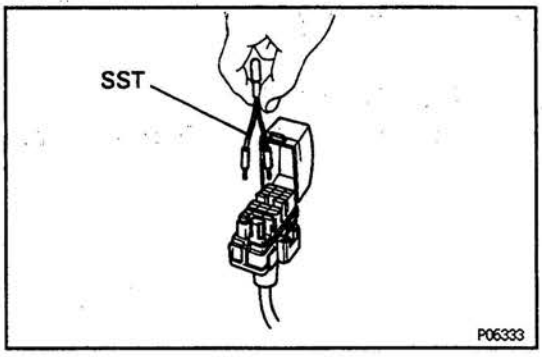
(b) Turn the ignition switch ON.
NOTICE: Do not start the engine.



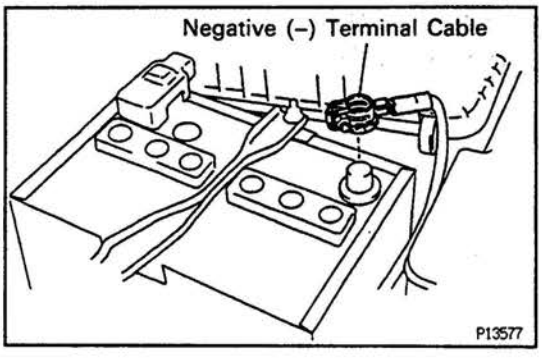
(c) Check that there is pressure in the fuel inlet hose from the fuel filter.
HINT: If there is fuel pressure, you will hear the sound of fuel flowing.
If there is no pressure, check the following parts:
- Fusible link
- H–fuse
- Fuses
- EFI main relay
- Neutral start switch
- ECU
- Fuel pump
- Wiring connections



(d) Turn the ignition switch to LOCK.



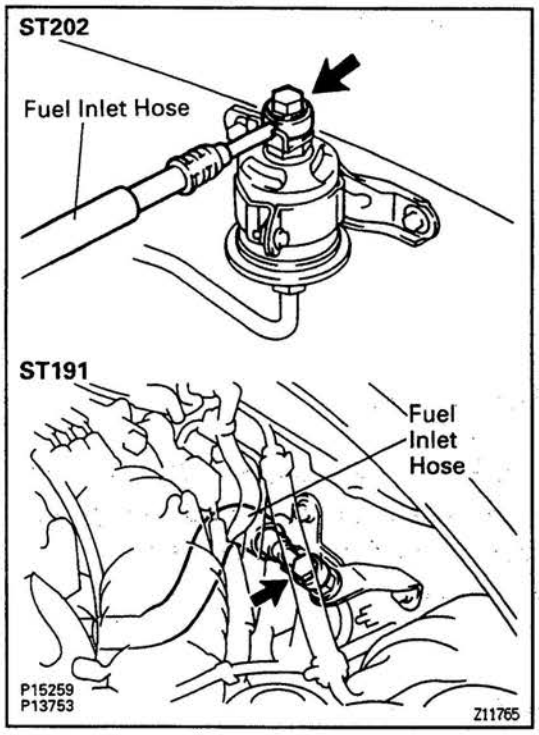
(e) Remove the SST from the check connecter.
SST 09843–18020



2. CHECK FUEL PRESSURE

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

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



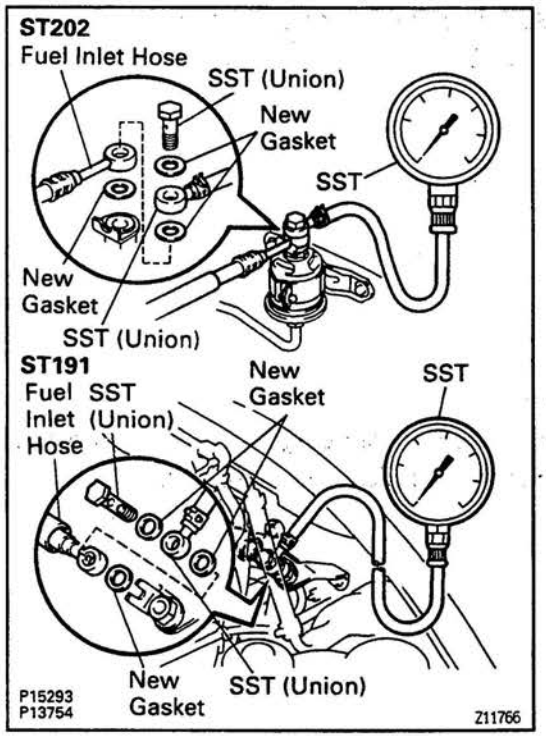
(c) ST202:
Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel filter outlet.

(d) ST191:
Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel inlet pipe.

CAUTION:

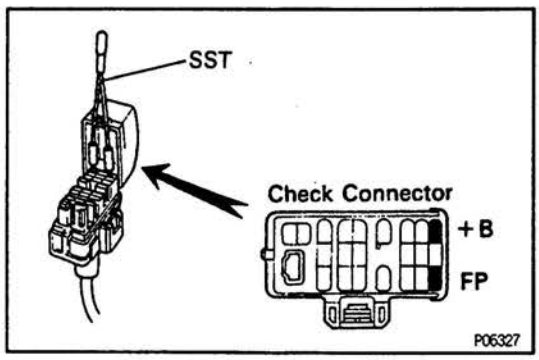
- **Put a suitable container or shop rag under the fuel filter or fuel inlet pipe.**
- **Slowly loosen the union bolt.**
- **When removing the union bolt, fix the fuel filter in place using a spanner.**

EG



(e) ST202:
Install the fuel inlet hose and SST (pressure gauge) to the fuel filter with 3 new gaskets and SST (union bolt).
ST191:
Install the fuel inlet hose and SST (pressure gauge) to the fuel inlet pipe with 3 new gaskets and SST (union bolt).
SST 09268–45012
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

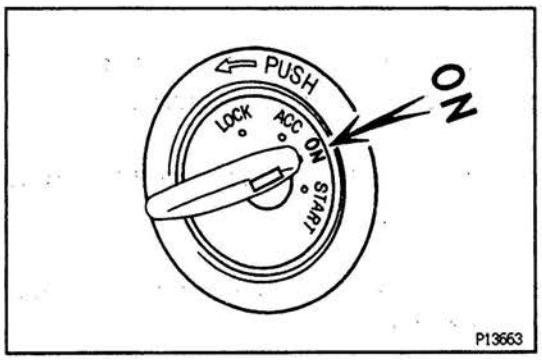
(f) Wipe off any splattered gasoline.



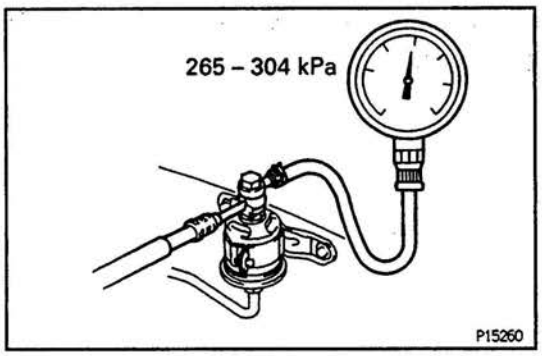
(g) Using SST, connect terminals +B and FP of the check connector.
SST 09843–18020

(h) Reconnect the negative (–) terminal cable to the battery.

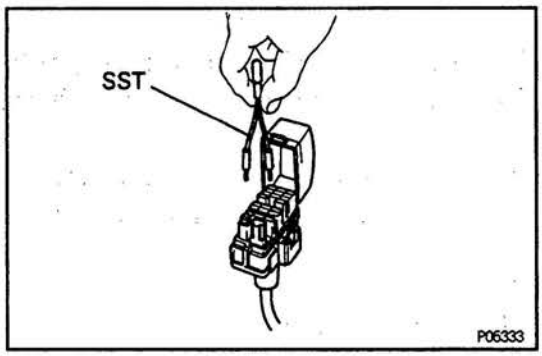
EG



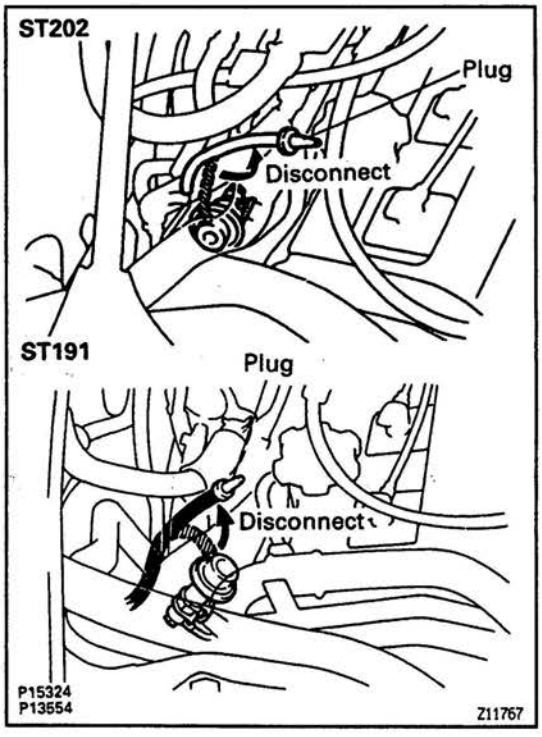
(i) Turn the ignition switch ON.



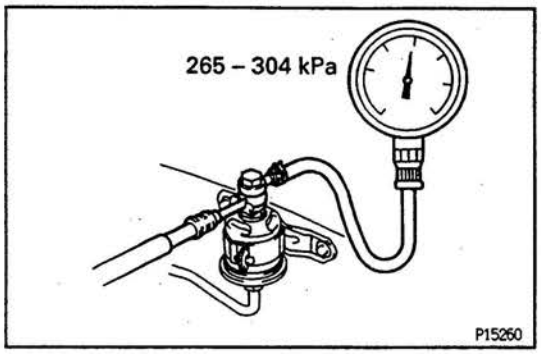
(j) Measure the fuel pressure.
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi)
If pressure is high, replace the fuel pressure regulator.
If pressure is low, check the following parts:
- Fuel hoses and connections
- Fuel pump
- Fuel filter
- Fuel pressure regulator



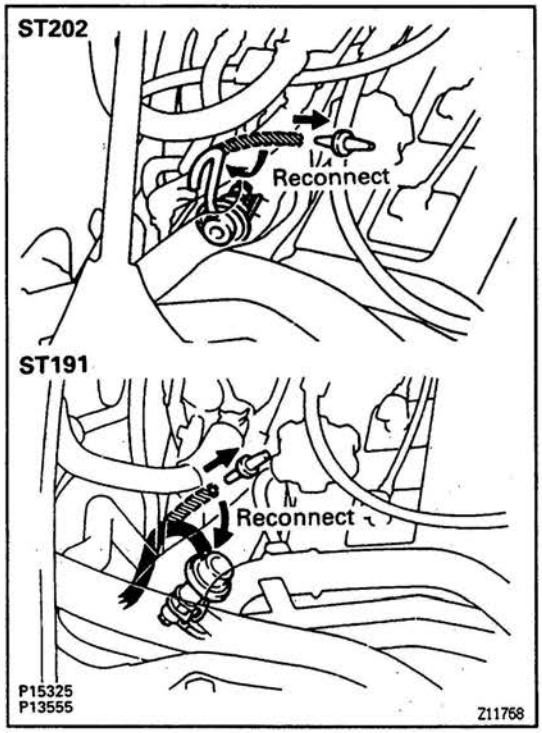
(k) Remove the SST from the check connector.
SST 09483–18020



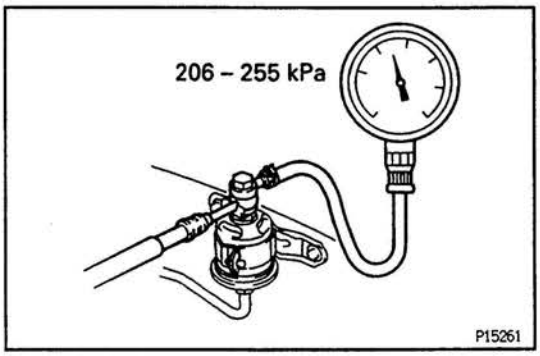
(l) Start the engine.
(m) Disconnect the vacuum sensing hose from the fuel pressure regulator, and plug the hose end.



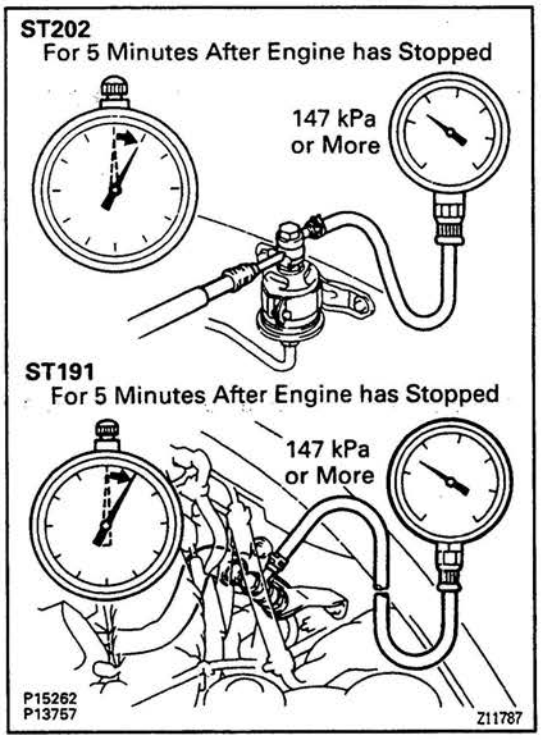
(n) Measure the fuel pressure at idle.
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi)



(o) Reconnect the vacuum sensing hose to the fuel pressure regulator.



(p) Measure the fuel pressure at idle.
Fuel pressure:
206 – 255 kPa (2.1 – 2.6 kgf/cm², 31 – 37 psi)
If pressure is not as specified, check the vacuum sensing hose and fuel pressure regulator.



(q) Stop the engine.

(r) Check that the fuel pressure remains as specified for 5 minutes after the engine has stopped.

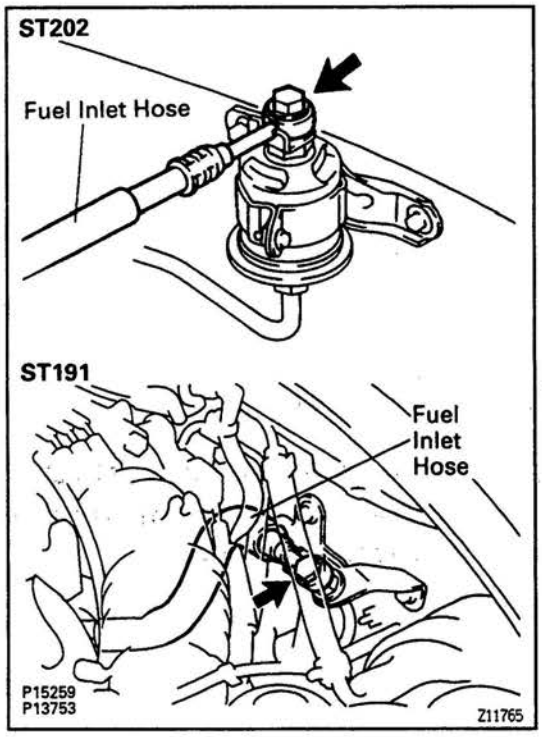
Fuel pressure:

147 kPa (1.5 kgf/cm², 21 psi) or more

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

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

SST 09268−45012



(t) ST202:

Reconnect the fuel inlet hose to the fuel filter with 2 new gaskets and the union bolt.

ST191:

Reconnect the fuel inlet hose to the fuel inlet pipe with with 2 new gaskets and the union bolt.

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

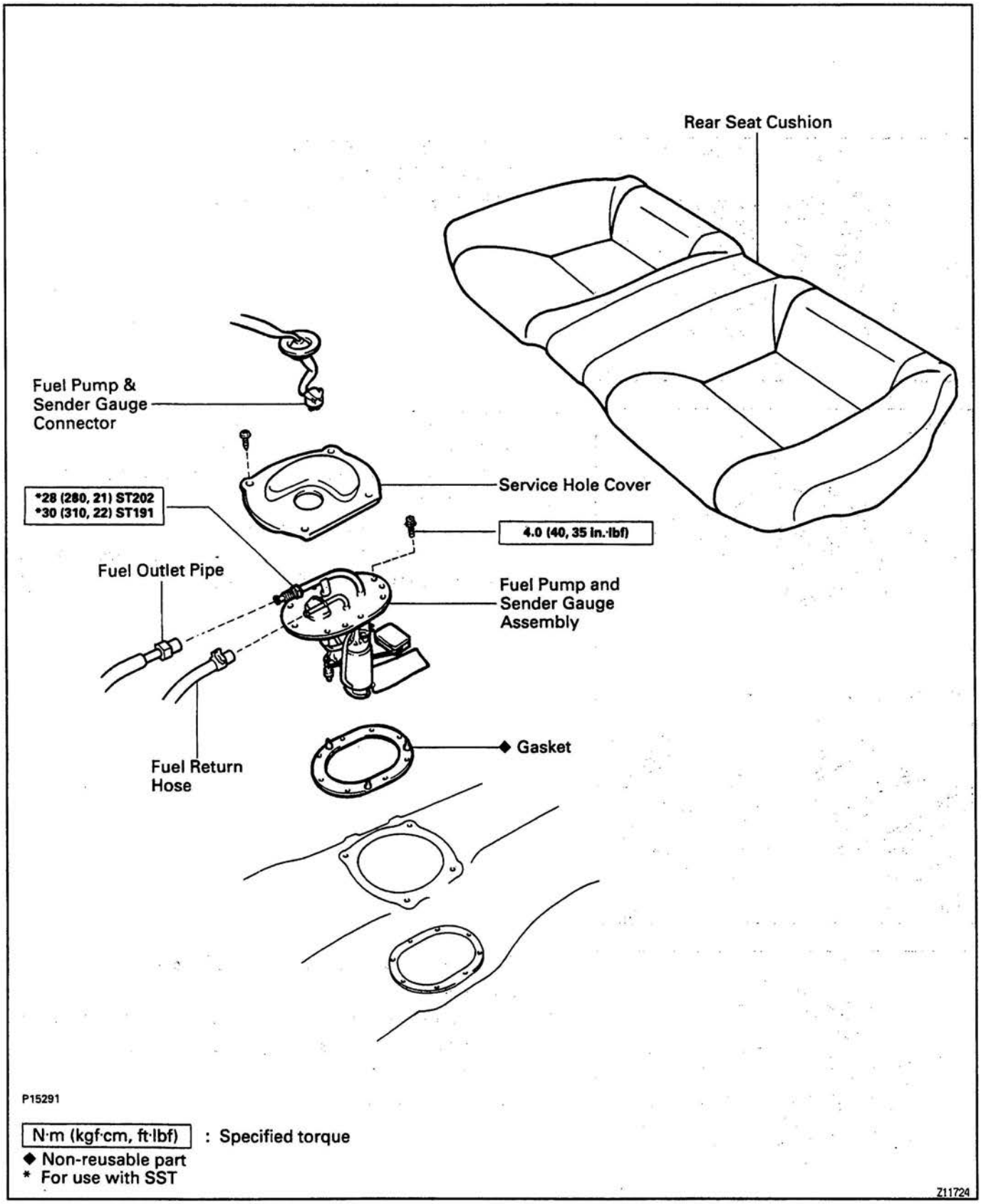
CAUTION: When installing the union bolt, fix the fuel filter in place using a spanner.

(u) Reconnect the negative (−) terminal cable to the battery.

(v) Check for fuel leaks. (See page EG−163)

EG3MJ–02

COMPONENTS FOR REMOVAL AND INSTALLATION



N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
* For use with SST

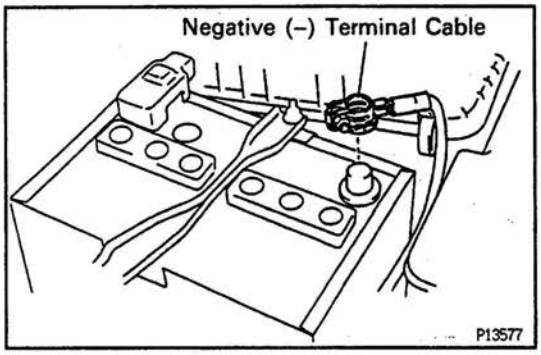
Z11724

FUEL PUMP REMOVAL

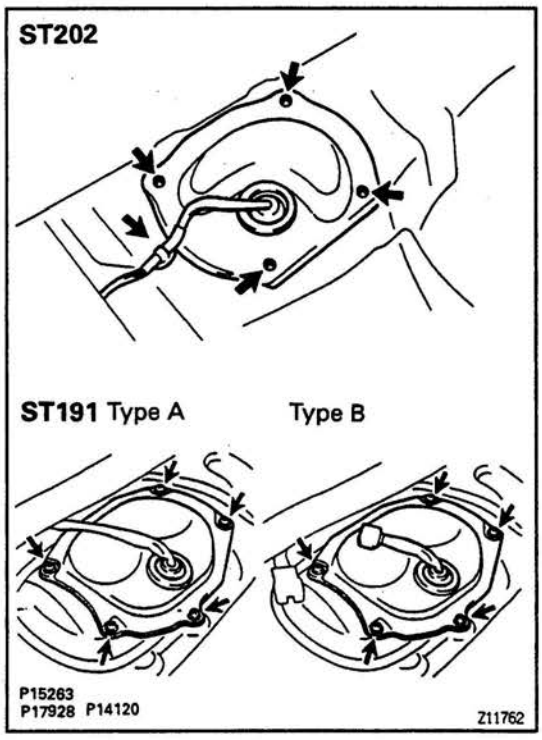
(See Components for Removal and Installation)

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

EG



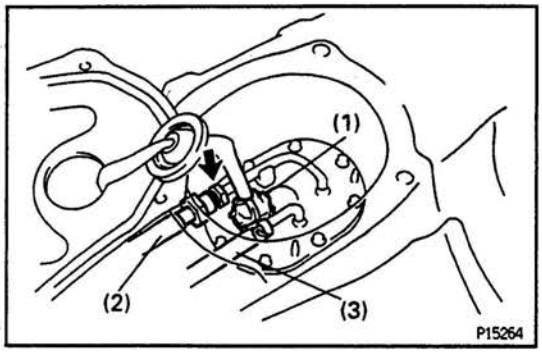
1. **DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**
2. **REMOVE REAR SEAT CUSHION**



3. **REMOVE SERVICE HOLE COVER**

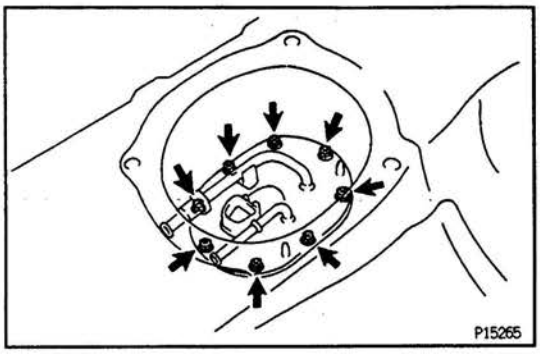
(a) ST202:
Remove the 4 screws, service hole cover and clamp.

(b) ST191:
Type A: Remove the 5 screws and service hole cover.
Type B: Disconnect the sub–wire harness. Remove the 5 screws and service hole cover.

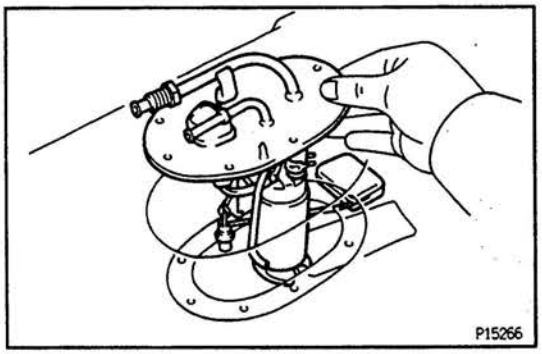


4. **REMOVE FUEL PUMP AND SENDER GAUGE ASSEMBLY**

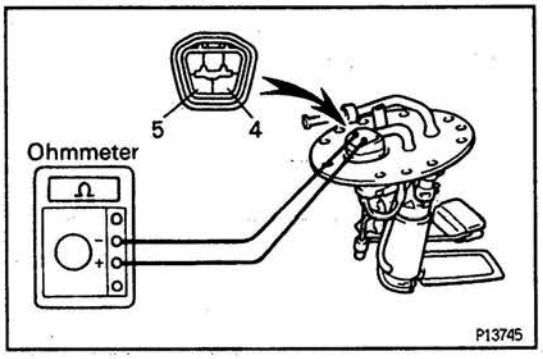
(a) Disconnect the following connector, pipe and hose:
(1) Fuel pump & sender gauge connector
(2) Fuel outlet pipe
(3) Fuel return hose



(b) Remove the 8 bolts.



(c) Remove the fuel pump, sender gauge assembly and gasket.



FUEL PUMP INSPECTION

EG1LY-0C

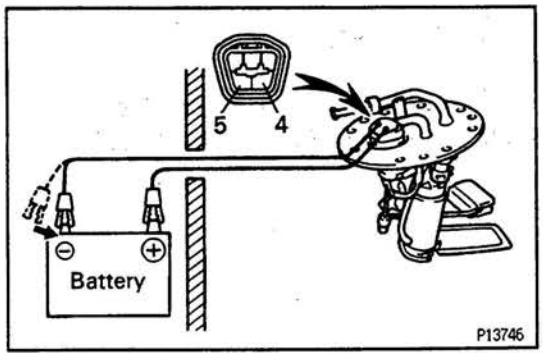
1. INSPECT FUEL PUMP RESISTANCE

Using an ohmmeter, measure the resistance between terminals 4 and 5.

Resistance:

0.2 – 3.0 Ω at 20°C (68°F)

If the resistance is not as specified, replace the fuel pump, lead wire or connector.



2. INSPECT FUEL PUMP OPERATION

Connect a tester lead from terminal 4 of the connector to the positive (+) terminal of the battery; connect another tester lead from terminal 5 of the connector to the negative (–) terminal of the battery.

NOTICE:

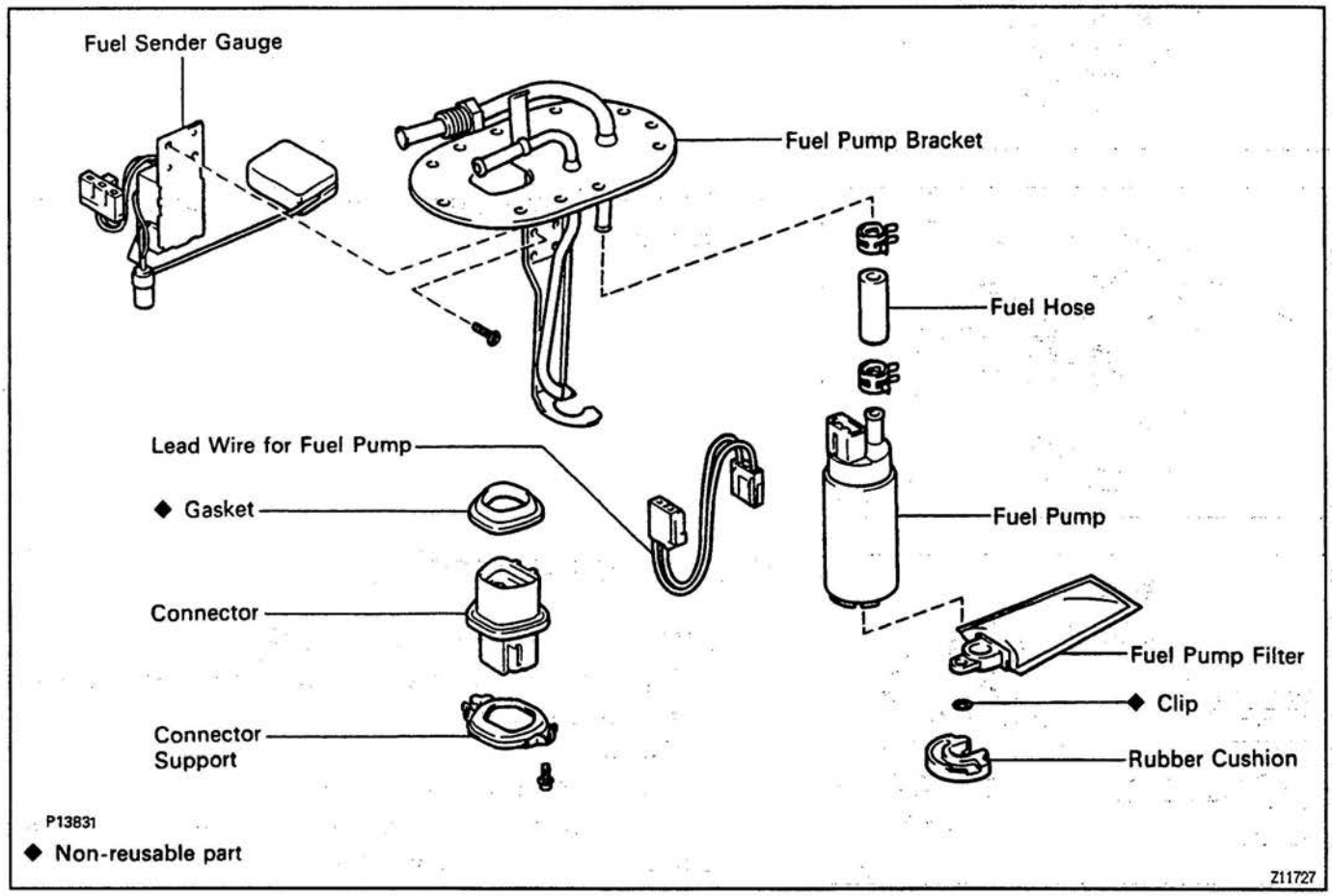
- **These tests must be performed quickly (within 10 seconds) to prevent the coil from burning out.**
- **Keep the fuel pump as far away from the battery as possible.**
- **Always connect or disconnect at the battery.**

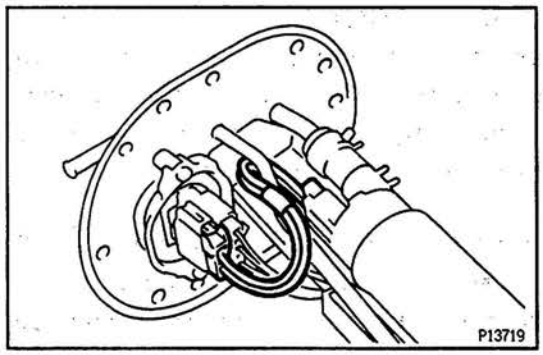
If operation is not as specified, replace the fuel pump, lead wire or connector.

EG

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EG0D1-0J





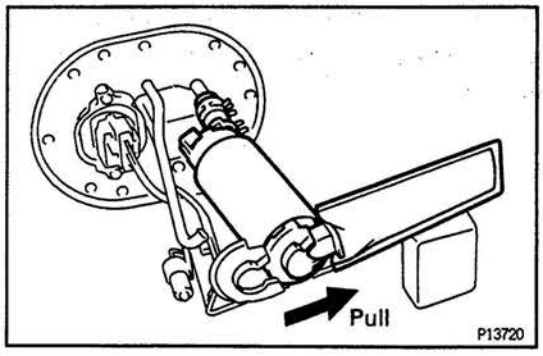
FUEL PUMP DISASSEMBLY

B03H8-02

(See Components for Disassembly and Assembly)

1. REMOVE FUEL PUMP FROM PUMP BRACKET

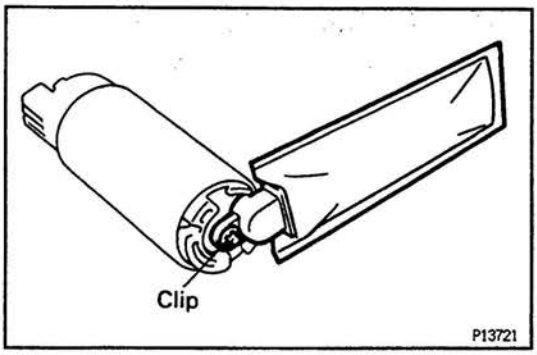
(a) Disconnect the lead wire from the connector.



(b) Pull out the lower side of the fuel pump from the pump bracket.

(c) Remove the rubber cushion from the fuel pump.

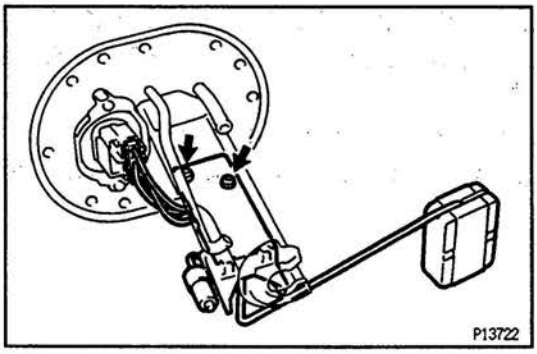
(d) Disconnect the fuel hose from inlet port of the fuel pump, and remove the fuel pump.



2. REMOVE FUEL PUMP FILTER FROM FUEL PUMP

(a) Remove the clip.

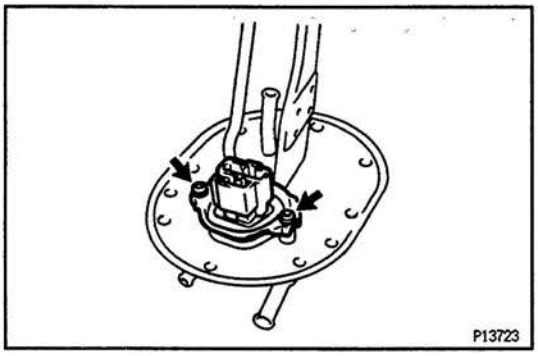
(b) Pull out the fuel pump filter.



3. REMOVE FUEL SENDER GAUGE FROM FUEL PUMP BRACKET

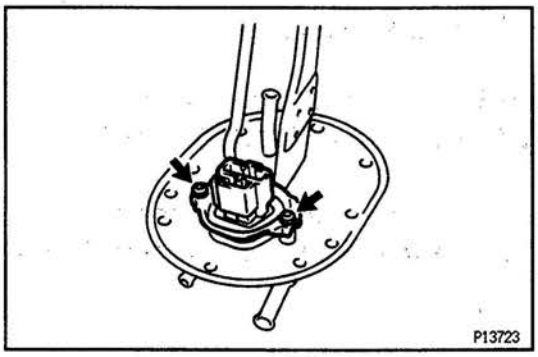
(a) Disconnect the fuel sender gauge connector from the connector.

(b) Remove the 2 screws and sender gauge.



4. REMOVE CONNECTOR

Remove the 2 screws, connector support, connector and gasket.



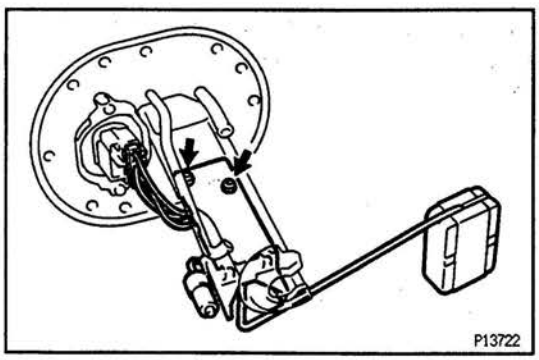
FUEL PUMP ASSEMBLY

EG3MK–02

(See Components for Disassembly and Assembly)

1. INSTALL CONNECTOR

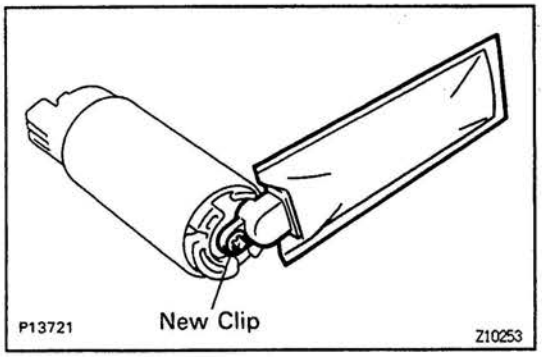
Install a new gasket, the connector and connector support with the 2 screws.



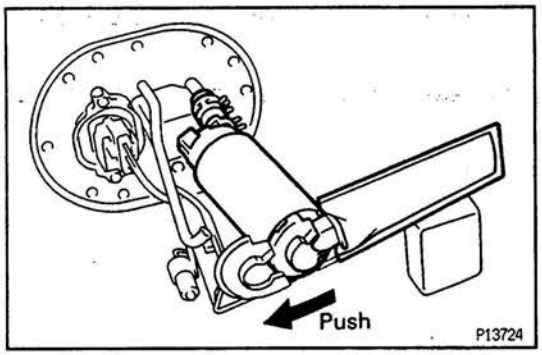
2. INSTALL FUEL SENDER GAUGE TO FUEL PUMP BRACKET

(a) Install the sender gauge with the 2 screws.

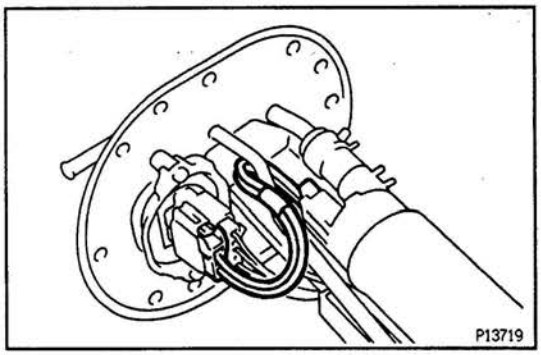
(b) Connect the fuel sender gauge connector to the connector.



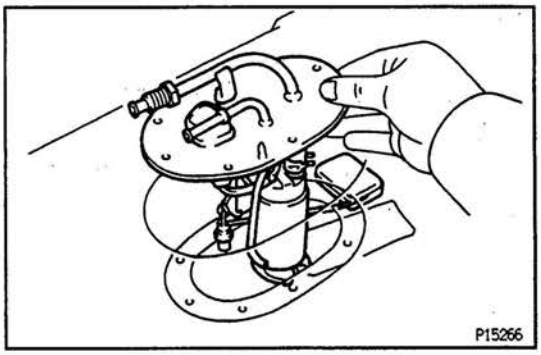
3. INSTALL FUEL PUMP FILTER TO FUEL PUMP
Install the fuel pump filter with a new clip.



4. INSTALL FUEL PUMP TO FUEL PUMP BRACKET
(a) Connect the fuel hose to the outlet port of the fuel pump.
(b) Install the rubber cushion to the fuel pump.
(c) Install the fuel pump by pushing the lower side of the fuel pump.



(d) Connect the lead wire to the connector.

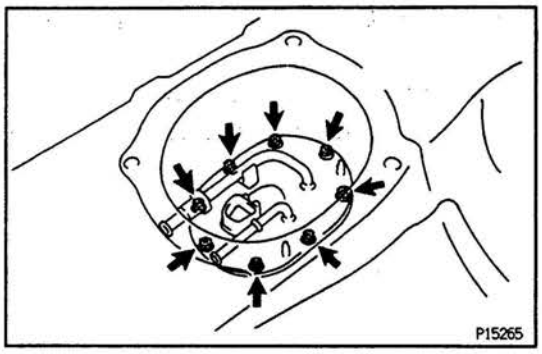


FUEL PUMP INSTALLATION

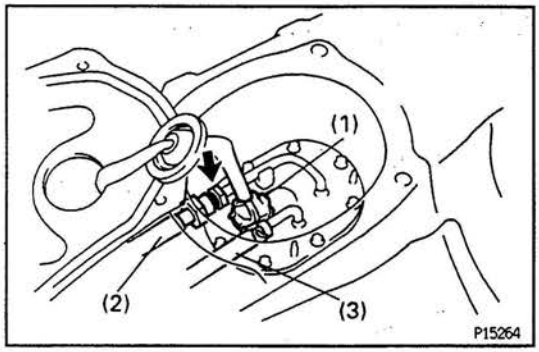
EG3ML–02

(See Components for Removal and Installation)

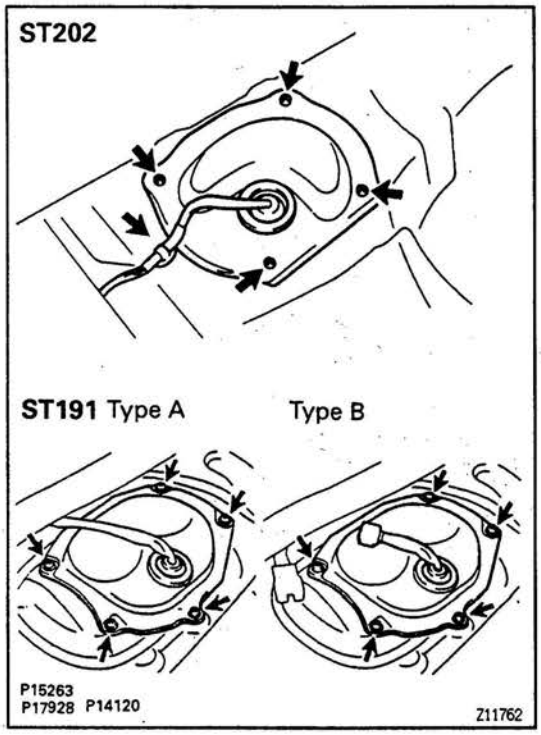
1. INSTALL FUEL PUMP AND SENDER GAUGE ASSEMBLY
(a) Install a new gasket to the fuel pump bracket.
(b) Insert the fuel pump and sender gauge assembly into the fuel tank.



(c) Install the fuel pump bracket with the 8 bolts.
Torque: 4.0 N·m (40 kgf·cm, 35 in.·lbf)



(d) Connect the following connector, pipe and hose:
(1) Fuel pump & sender gauge connector
(2) Fuel outlet pipe
HINT: Use SST. (See page EG–163)
SST 09631–22020
Torque:
ST202: 28 N·m (280 kgf·cm, 21 ft·lbf)
ST191: 30 N·m (310 kgf·cm, 22 ft·lbf)
(3) Fuel return hose



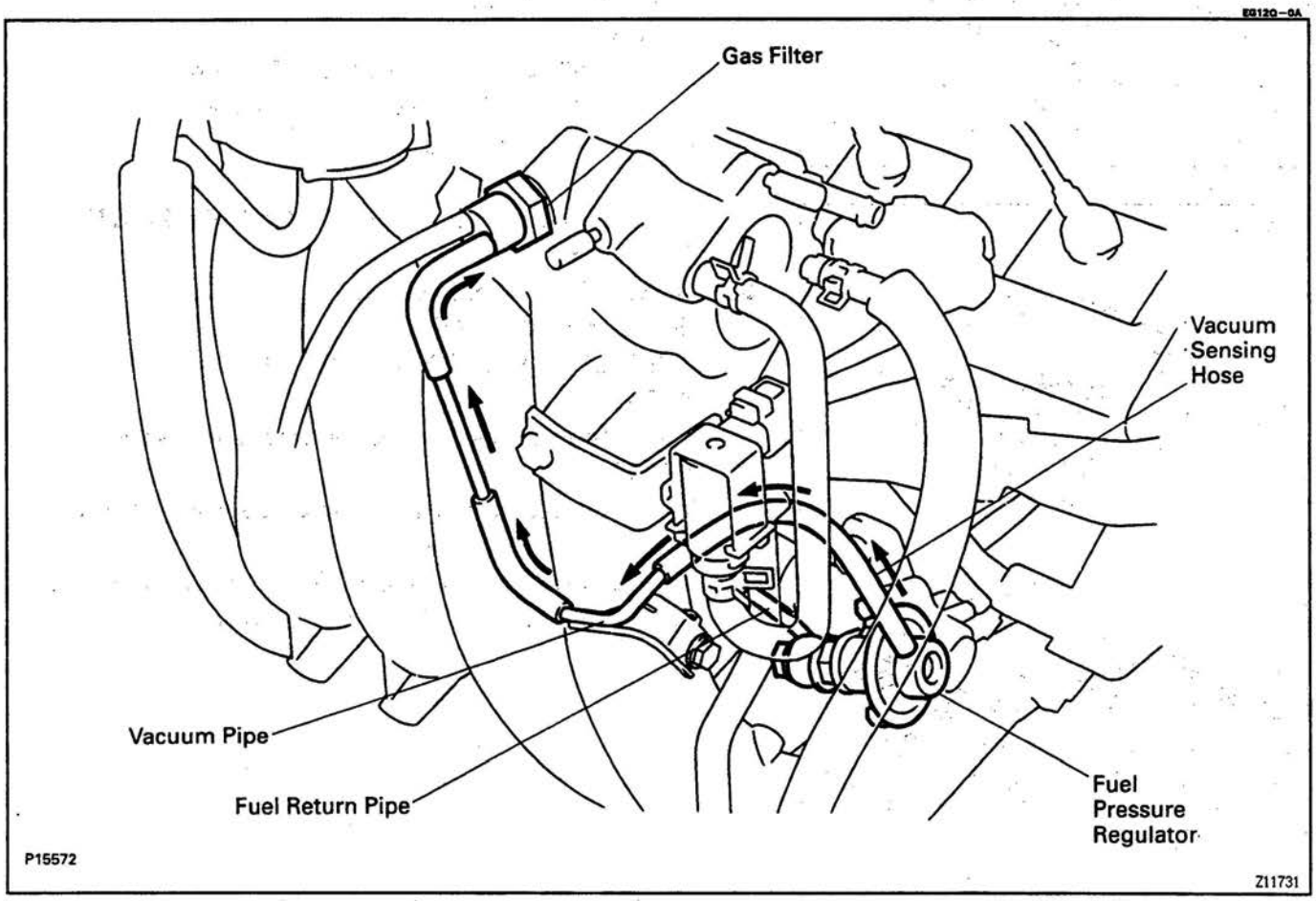
2. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

3. CHECK FOR FUEL LEAKS
(See page EG–163)
INSTALL SERVICE HOLE COVER
ST202:
Install the service hole cover with the 4 screws.
ST191:
Type A: Install the service hole cover with the 5 screws.
Type B: Connect the sub–wire haness, Install the service hole cover with the 5 screws.

4. INSTALL REAR SEAT CUSHION

FUEL PRESSURE REGULATOR (ST202)

EG120–0A



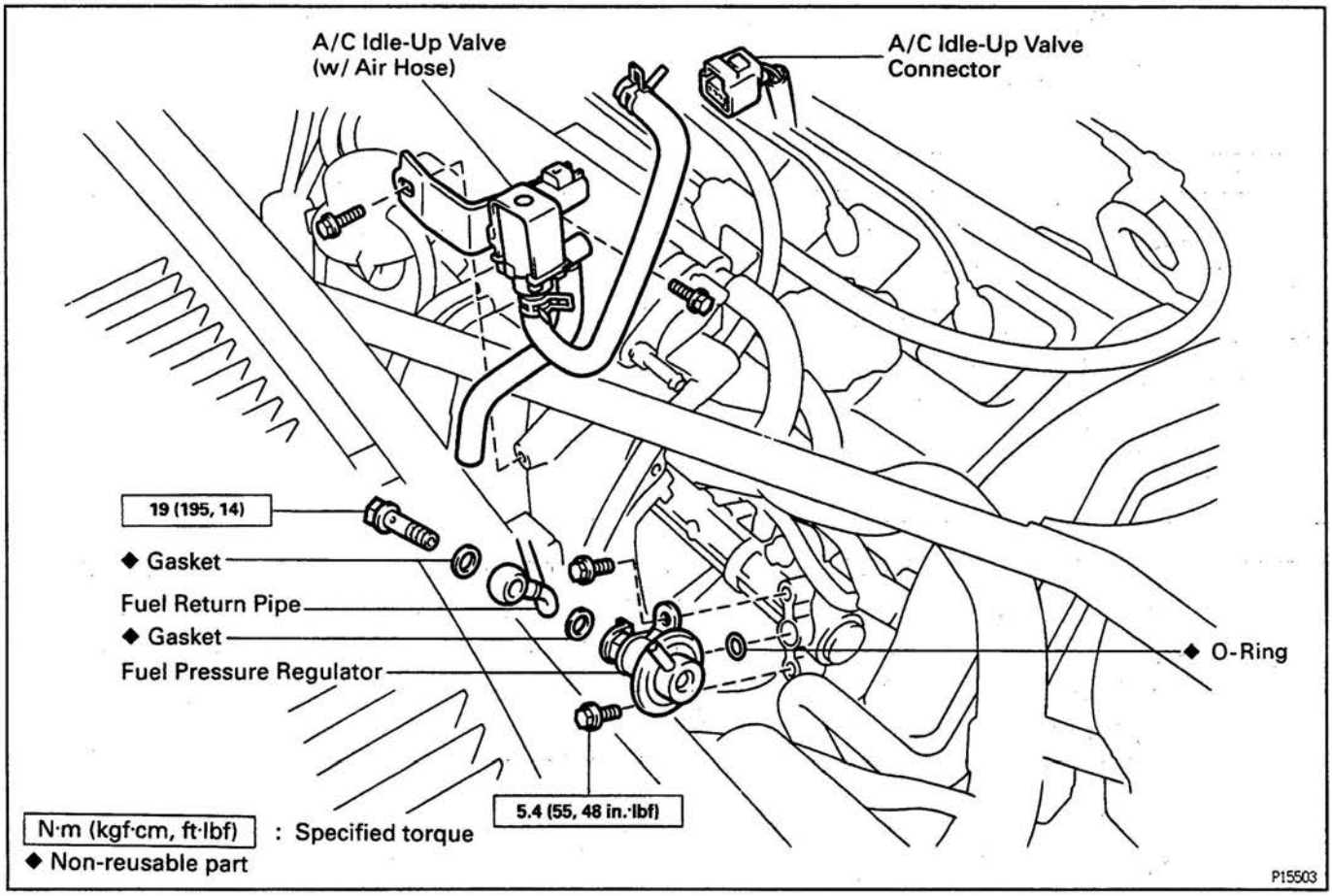
EG0D6–0Q

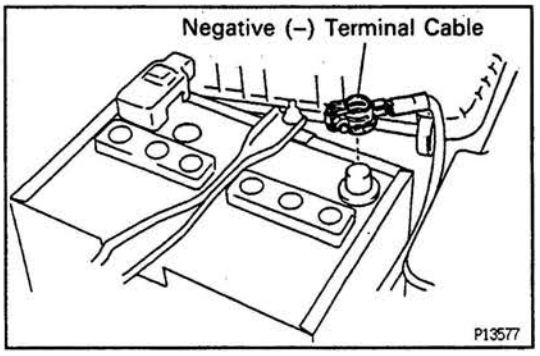
ON–VEHICLE INSPECTION

INSPECT FUEL PRESSURE
(See page EG–196)

EG12R-06

COMPONENTS FOR REMOVAL AND INSTALLATION



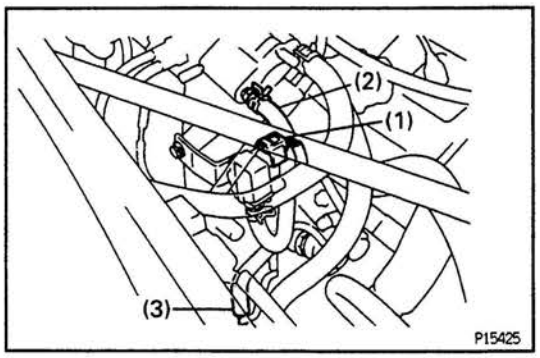


EG3MM-02

FUEL PRESSURE REGULATOR REMOVAL

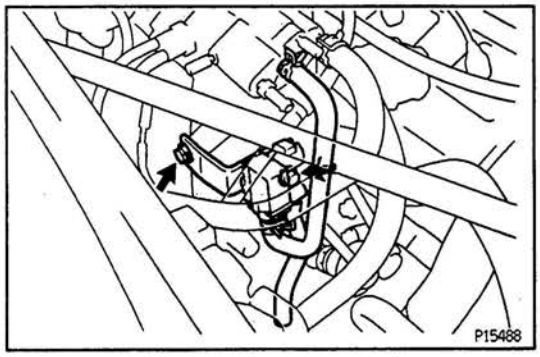
(See Components for Removal and Installation)

1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY



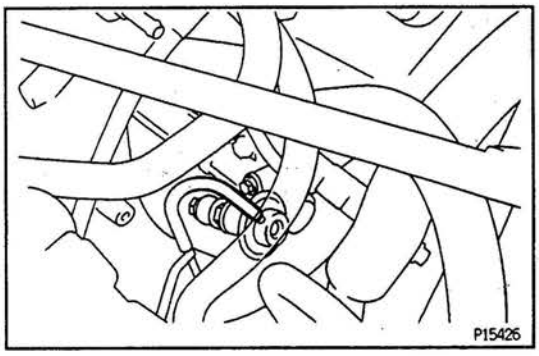
2. REMOVE A/C IDLE–UP VALVE

(a) Disconnect the following connector and hoses:
- (1) A/C Idle–up valve connector
- (2) Air hose from intake manifold
- (3) Air hose from air tube

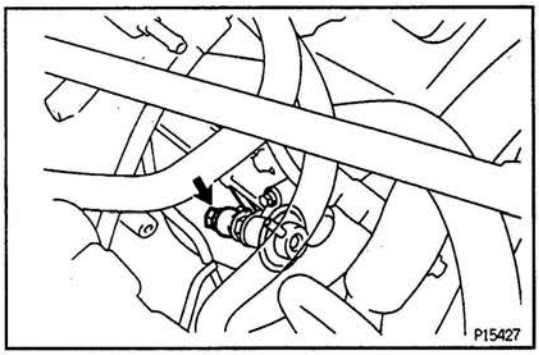


(b) Remove the 2 bolts and idle–up valve.

EG



3. DISCONNECT VACUUM SENSING HOSE FROM FUEL PRESSURE REGULATOR

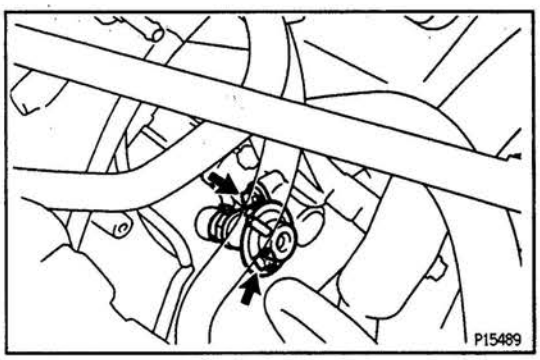


4. DISCONNECT FUEL RETURN PIPE FROM FUEL PRESSURE REGULATOR

Remove the union bolt and 2 gaskets, and disconnect the return pipe from the pressure regulator.

CAUTION:

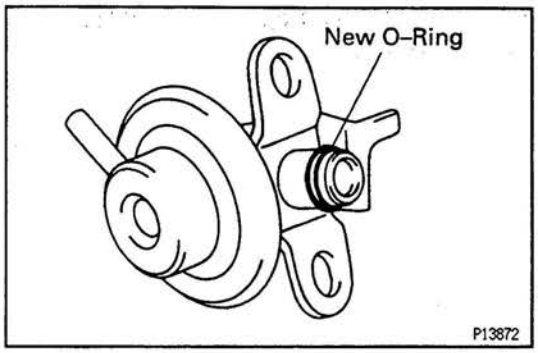
- **Put a suitable container or shop rag under the pressure regulator.**
- **Slowly loosen the union bolt.**



5. REMOVE FUEL PRESSURE REGULATOR

(a) Remove the 2 bolts, and pull out the pressure regulator.

(b) Remove the O–ring from the pressure regulator.



EG3MN-03

FUEL PRESSURE REGULATOR INSTALLATION

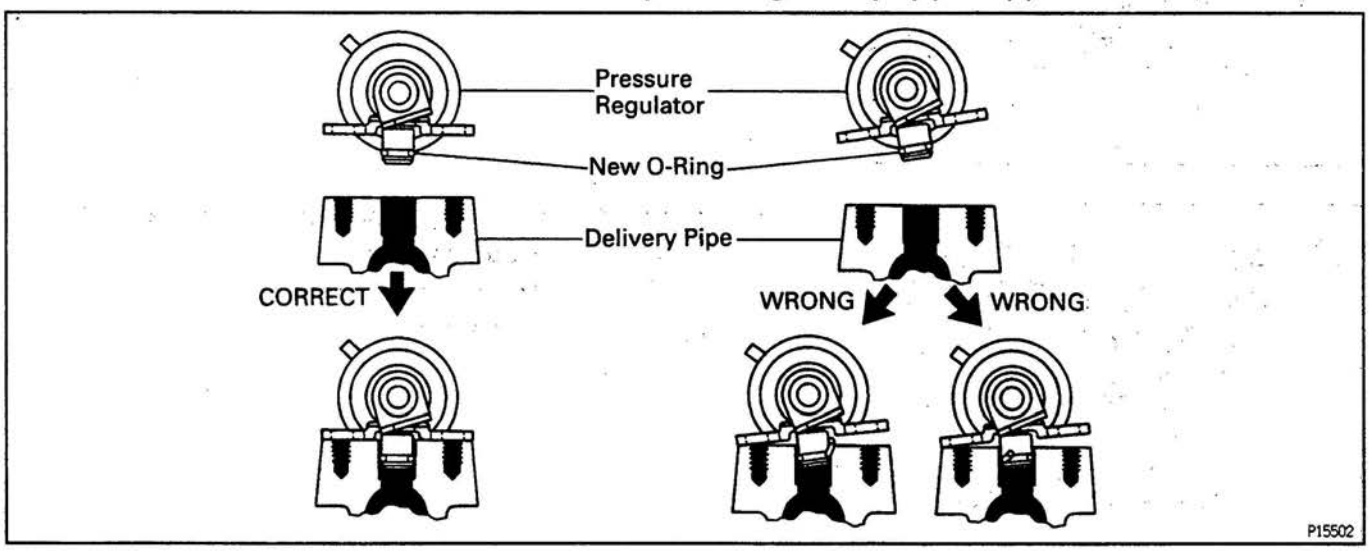
(See Components for Removal and Installation)

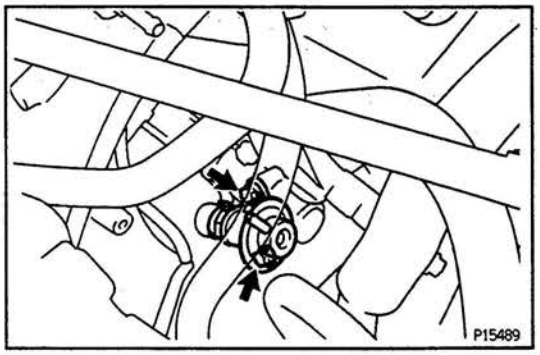
1. INSTALL FUEL PRESSURE REGULATOR

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

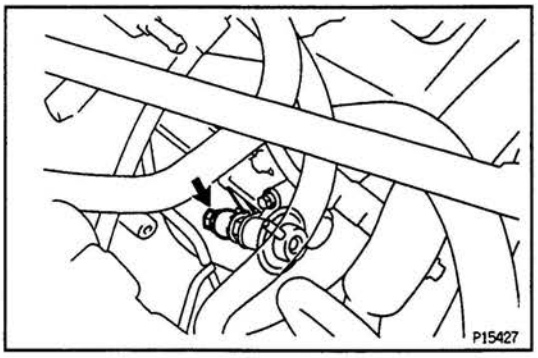
(b) Attach the pressure regulator to the delivery pipe.

(c) Check that the pressure regulator rotates smoothly.
NOTICE: If it does not rotate smoothly, the O–ring may be pinched, so remove the pressure regulator and perform again steps (b) and (c) above.



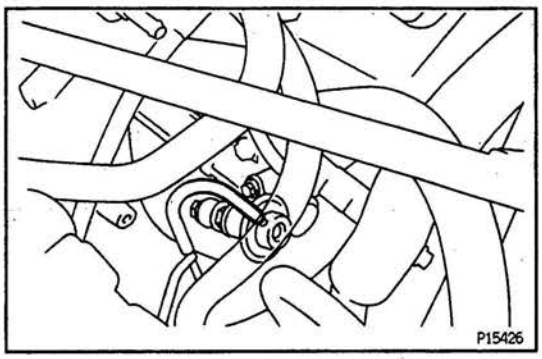


(d) Install the pressure regulator with the 2 bolts.
Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)

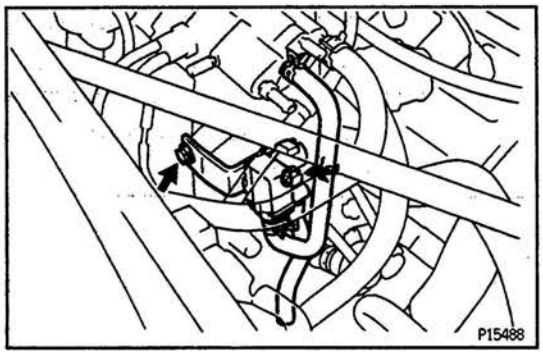


2. CONNECT FUEL RETURN PIPE TO FUEL PRESSURE REGULATOR

Install the return pipe with 2 new gaskets and the union bolt.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)

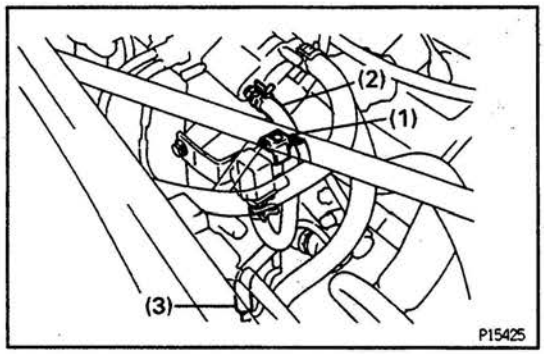


3. CONNECT VACUUM SENSING HOSE TO FUEL PRESSURE REGULATOR



4. INSTALL A/C IDLE–UP VALVE

(a) Install the A/C idle–up valve with the 2 bolts.



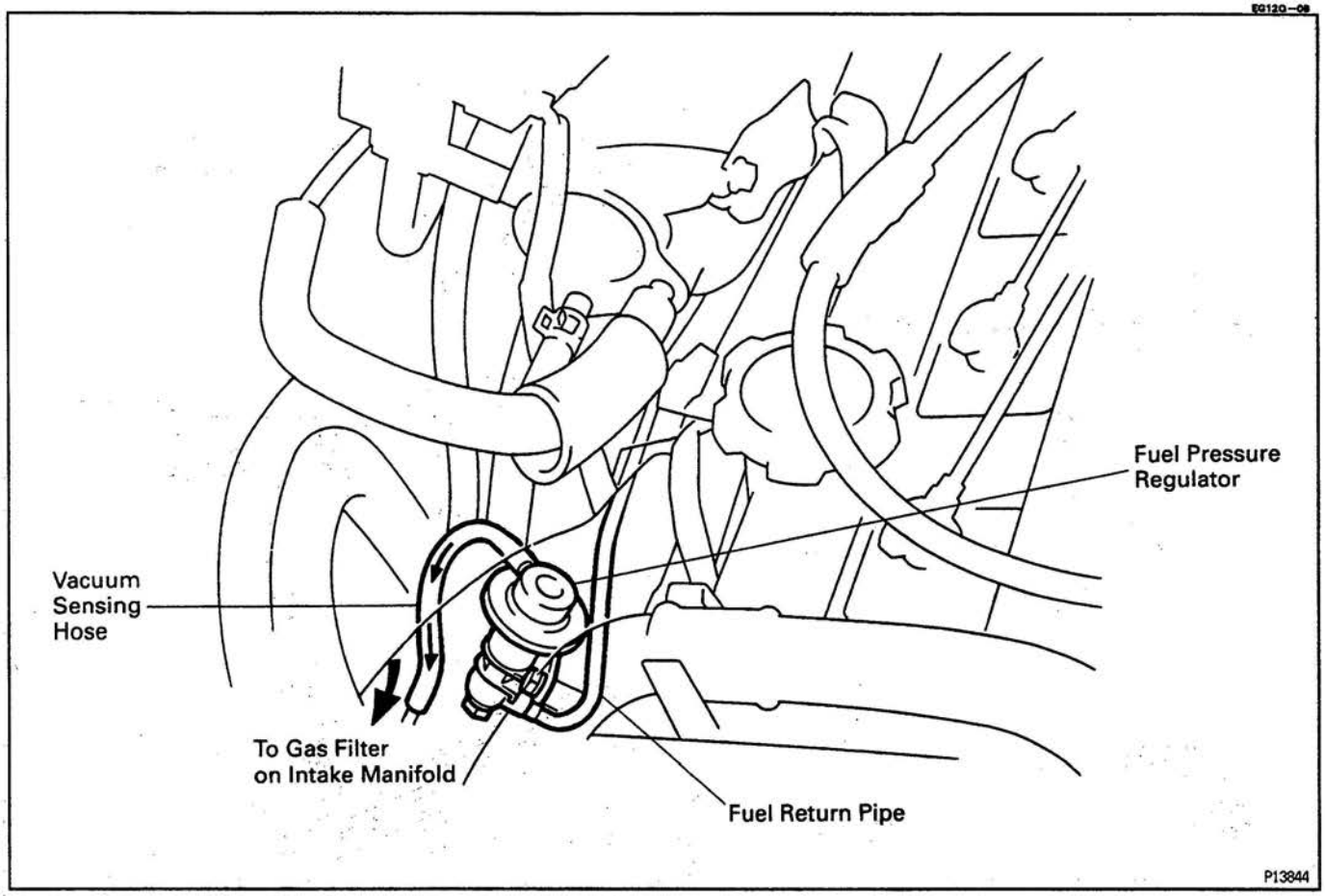
(b) Connect the following connector and hoses:
(1) A/C idle–up valve connector
(2) Air hose to intake manifold
(3) Air hose to air tube

5. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

6. CHECK FOR FUEL LEAKS

(See page EG–163)

FUEL PRESSURE REGULATOR (ST191)

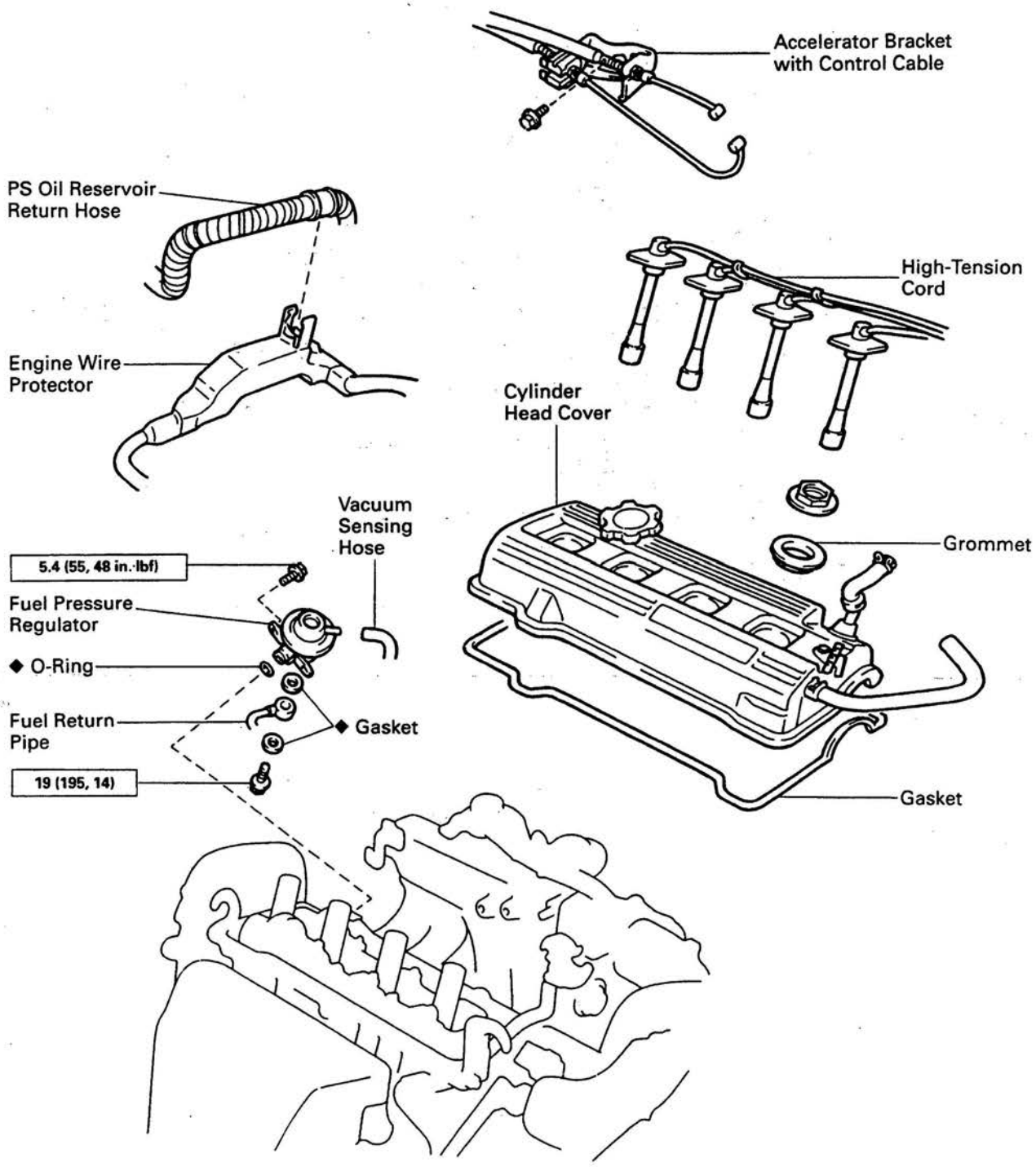


ON–VEHICLE INSPECTION

INSPECT FUEL PRESSURE
(See page EG–196)

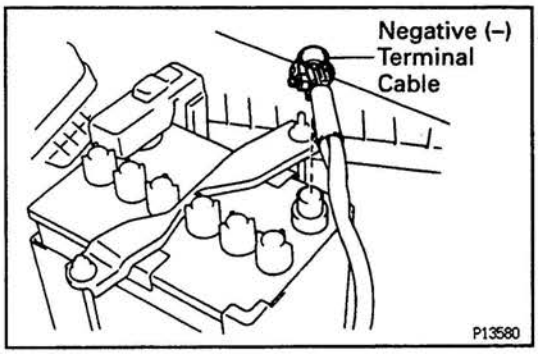
EG12R-07

COMPONENTS FOR REMOVAL AND INSTALLATION



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

P13984

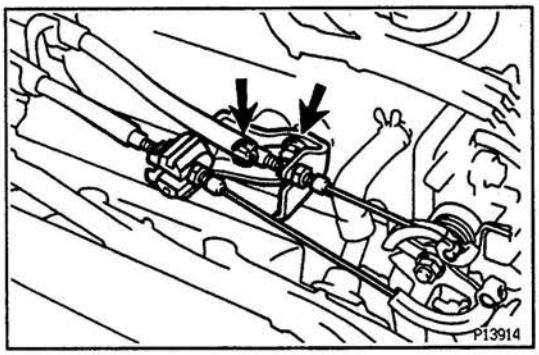


FUEL PRESSURE REGULATOR REMOVAL

EG3U8–01

(See Components for Removal and Installation)

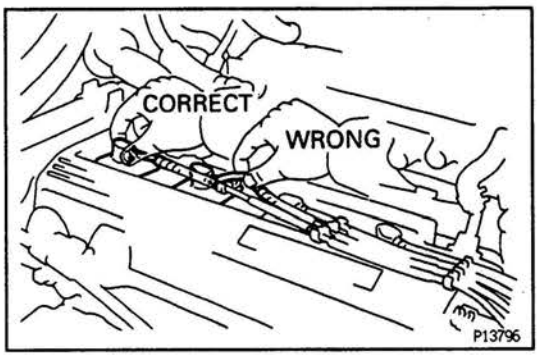
1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY



2. REMOVE ACCELERATOR CABLE BRACKET

(a) Disconnect the control cables from the throttle linkage.

(b) Remove the 2 bolts and accelerator bracket.

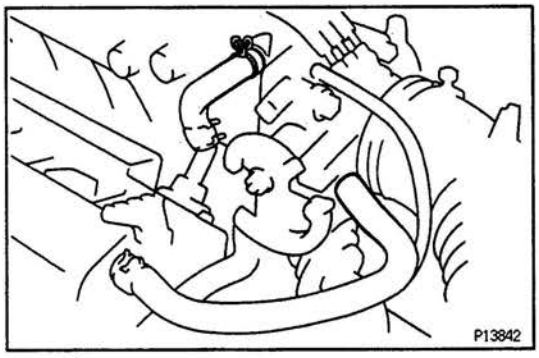


3. REMOVE CYLINDER HEAD COVER

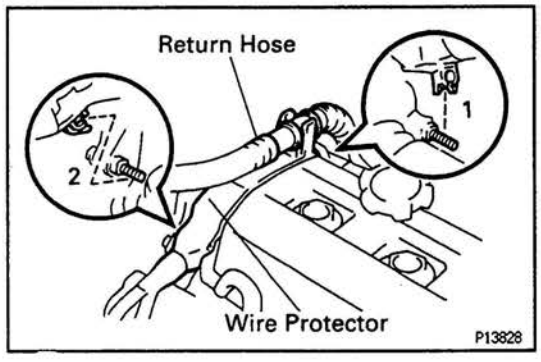
(a) Disconnect the high – tension cords at the rubber boot.

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

Do not pull on the high–tension cords.

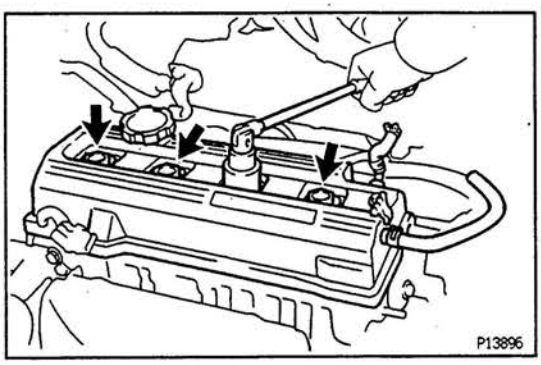


(b) Disconnect the 2 PCV hoses from the intake manifold and throttle body.

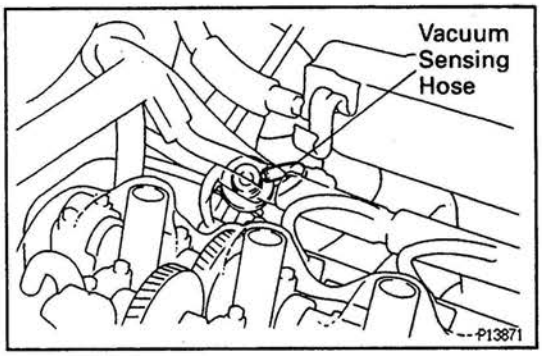


(c) Disconnect the PS oil reservoir return hose from the engine wire protecter.

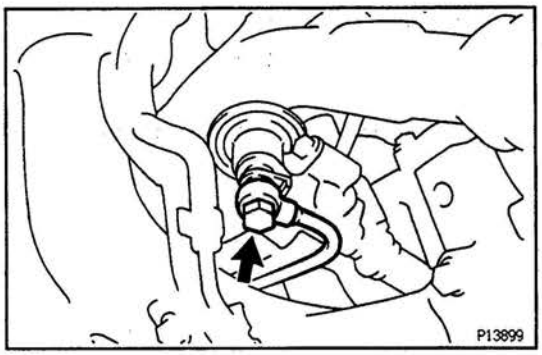
(d) Disconnect the 2 clamps of the engine wire protector from the mounting bolts of the No.2 timing belt cover in the sequence shown.



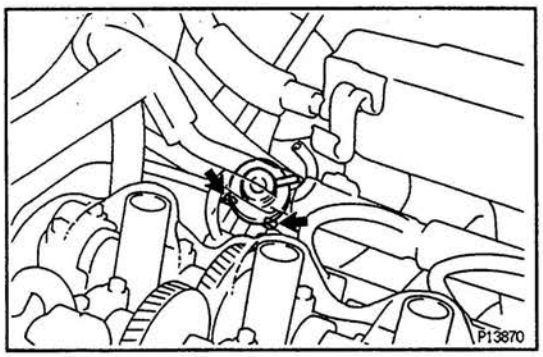
(e) Remove the 4 nuts, grommets, cylinder head cover and gasket.
NOTICE: Cover the cylinder head with a clean cloth to prevent dirt, etc. getting into the cylinder head.



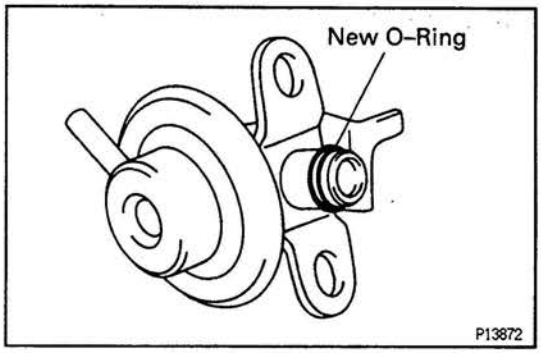
4. DISCONNECT VACUUM SENSING HOSE FROM FUEL PRESSURE REGULATOR



5. DISCONNECT FUEL RETURN PIPE FROM FUEL PRESSURE REGULATOR
Remove the union bolt and 2 gaskets, and disconnect the return pipe from the pressure regulator.
CAUTION:
- **Put a suitable container or shop rag under the pressure regulator.**
- **Slowly loosen the union bolt.**



6. REMOVE FUEL PRESSURE REGULATOR
(a) Remove the 2 bolts, and pull out the pressure regulator.
(b) Remove the O–ring from the pressure regulator.



EG3UT-01

FUEL PRESSURE REGULATOR INSTALLATION

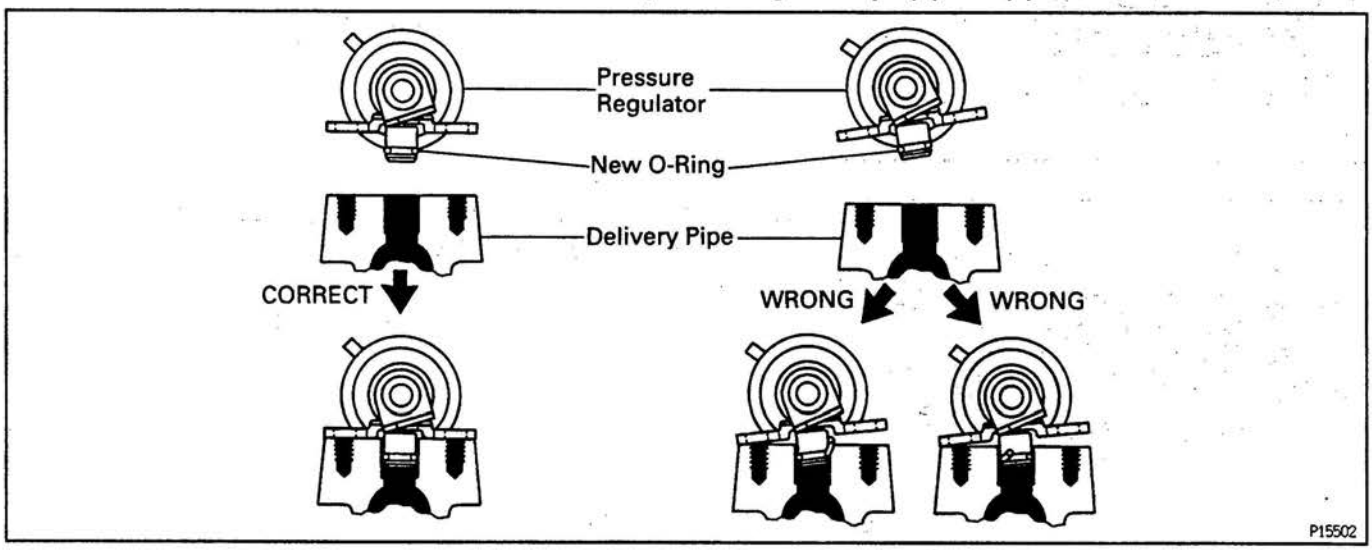
(See Components for Removal and Installation)

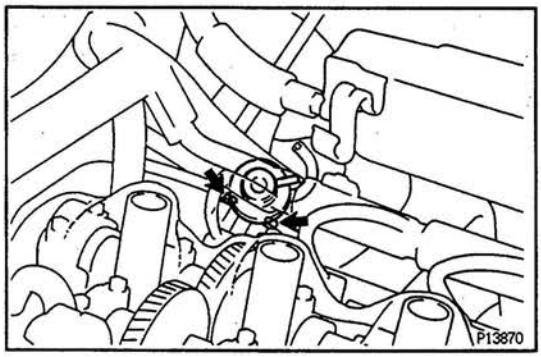
1. INSTALL FUEL PRESSURE REGULATOR

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

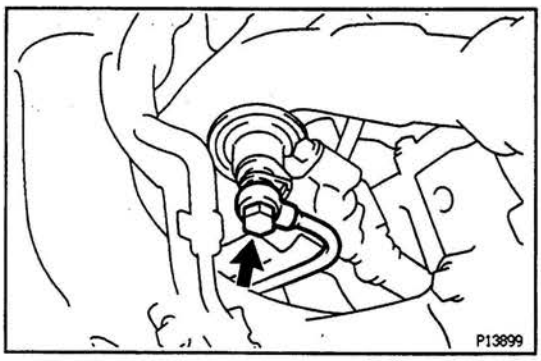
(b) Attach the pressure regulator to the delivery pipe.

(c) Check that the pressure regulator rotates smoothly.
NOTICE: If it does not rotate smoothly, the O–ring may be pinched, so remove the pressure regulator and perform again steps (b) and (c) above.



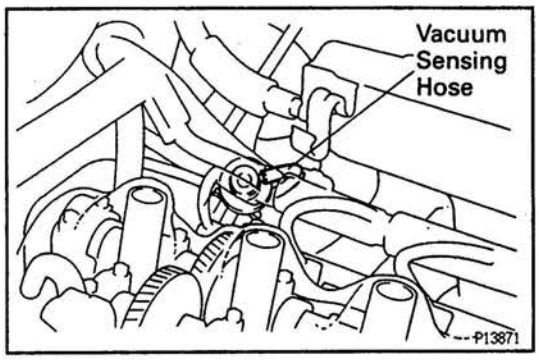


(d) Install the pressure regulator with the 2 bolts.
Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)

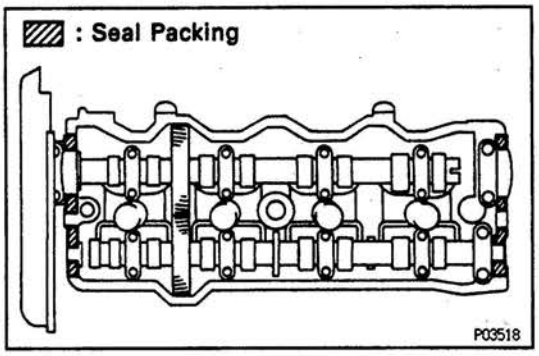


2. CONNECT FUEL RETURN PIPE TO FUEL PRESSURE REGULATOR

Install the return pipe with 2 new gaskets and the union bolt.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



3. CONNECT VACUUM SENSING HOSE TO FUEL PRESSURE REGULATOR



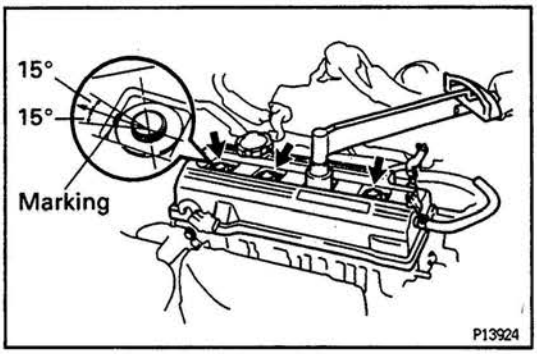
4. INSTALL CYLINDER HEAD COVER

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

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

Seal packing:

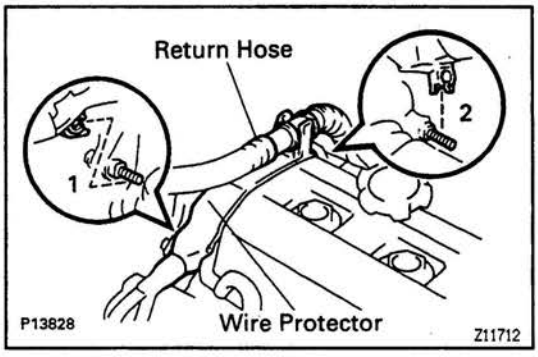
Part No. 08826–00080 or equivalent



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

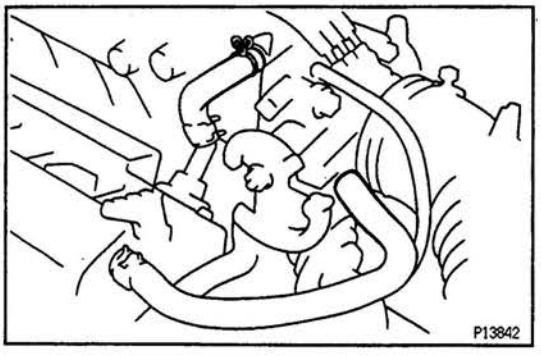
(d) Install the cylinder head cover with the 4 grommets and nuts.

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



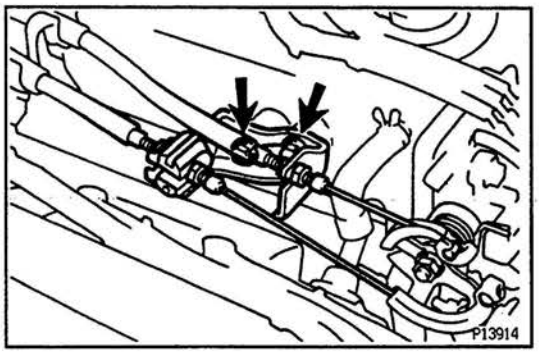
(e) Install the 2 clamps of the engine wire protecter to the mounting bolts of the No.2 timing belt cover in the sequence shown.

(f) Install the PS oil reservoir return hose to the engine wire protector.



(g) Connect the 2 PCV hoses to the intake manifold and throttle body.

(h) Connect the 4 high–tension cords to the spark plugs.



5. INSTALL ACCELERATOR CABLE BRACKET

(a) Install the accelerator cable bracket with the 2 bolts.

(b) Connect the control cables to the throttle linkage.

6. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

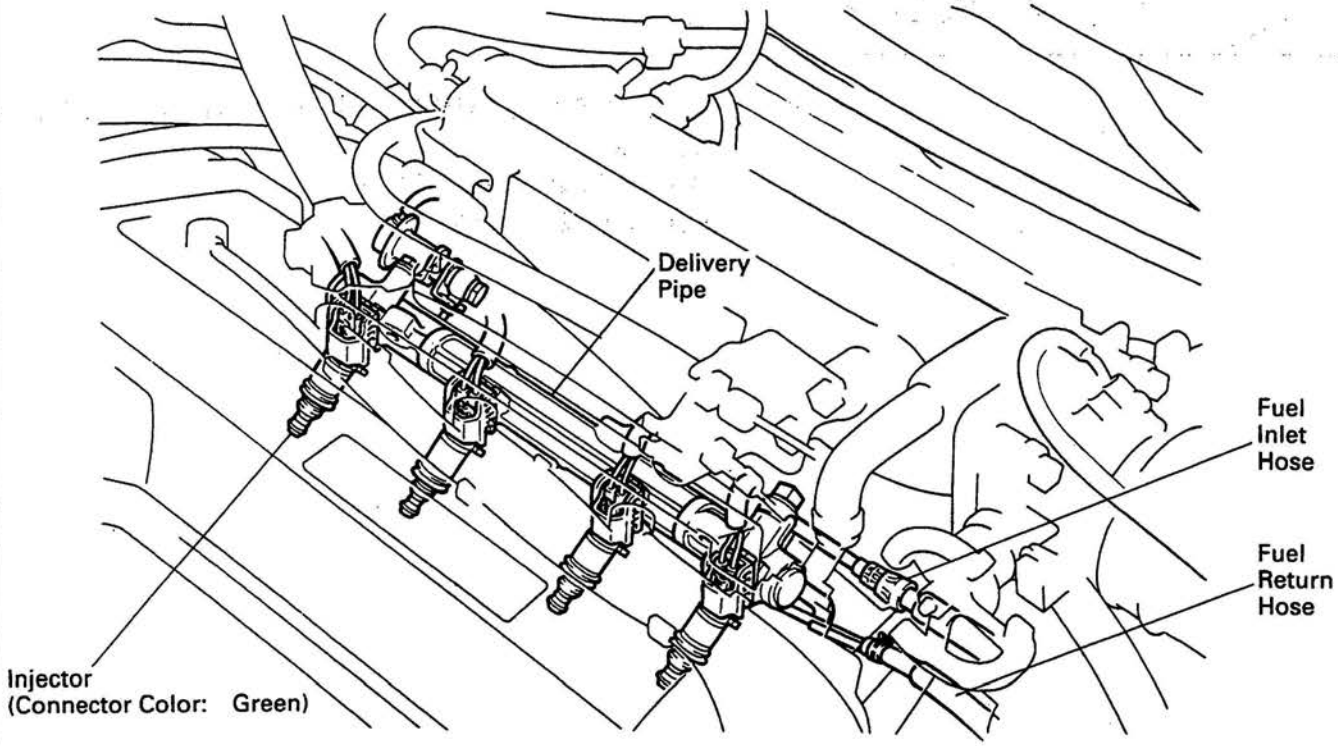
7. CHECK FOR FUEL LEAKS

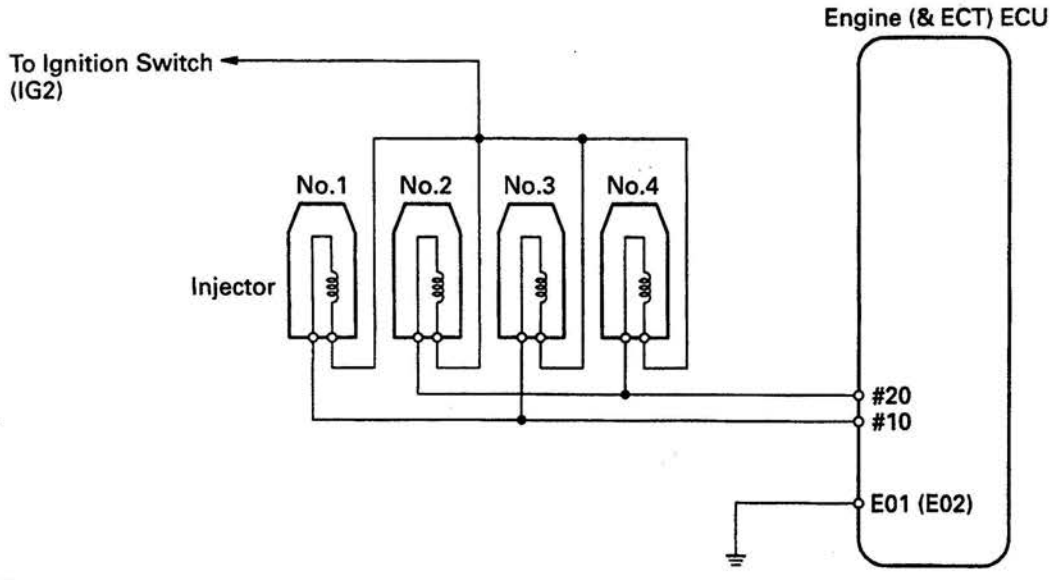
(See page EG–163)

INJECTOR
(ST202)

EG12Y-05

EG





P16546
P13867

Z11759

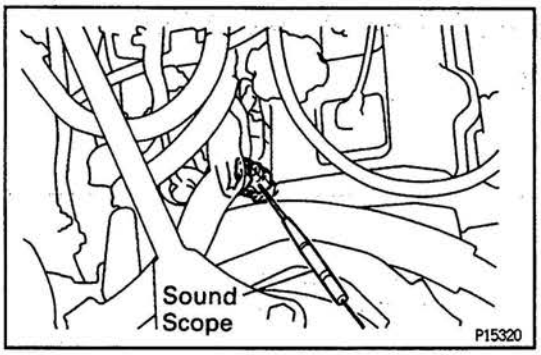
EQ0D6-0J

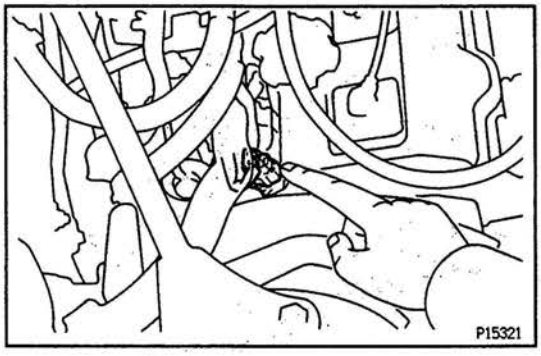
ON–VEHICLE INSPECTION

1. INSPECT INJECTOR OPERATION

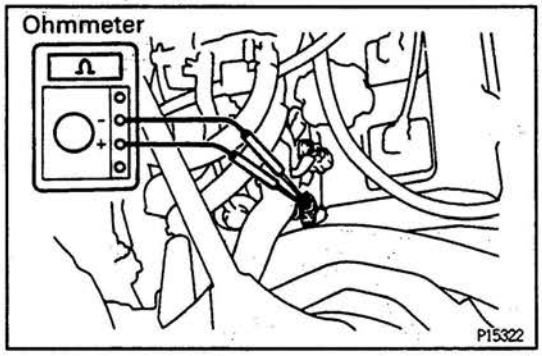
Check operation sound from each injector.

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





(b) If you have no sound scope, you can check the injector transmission operation with your finger.
If no sound or unusual sound is heard, check the wiring connector, injector or injection signal from the ECU.



2. INSPECT INJECTOR RESISTANCE

(a) Disconnect the injector connector.

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

Resistance:

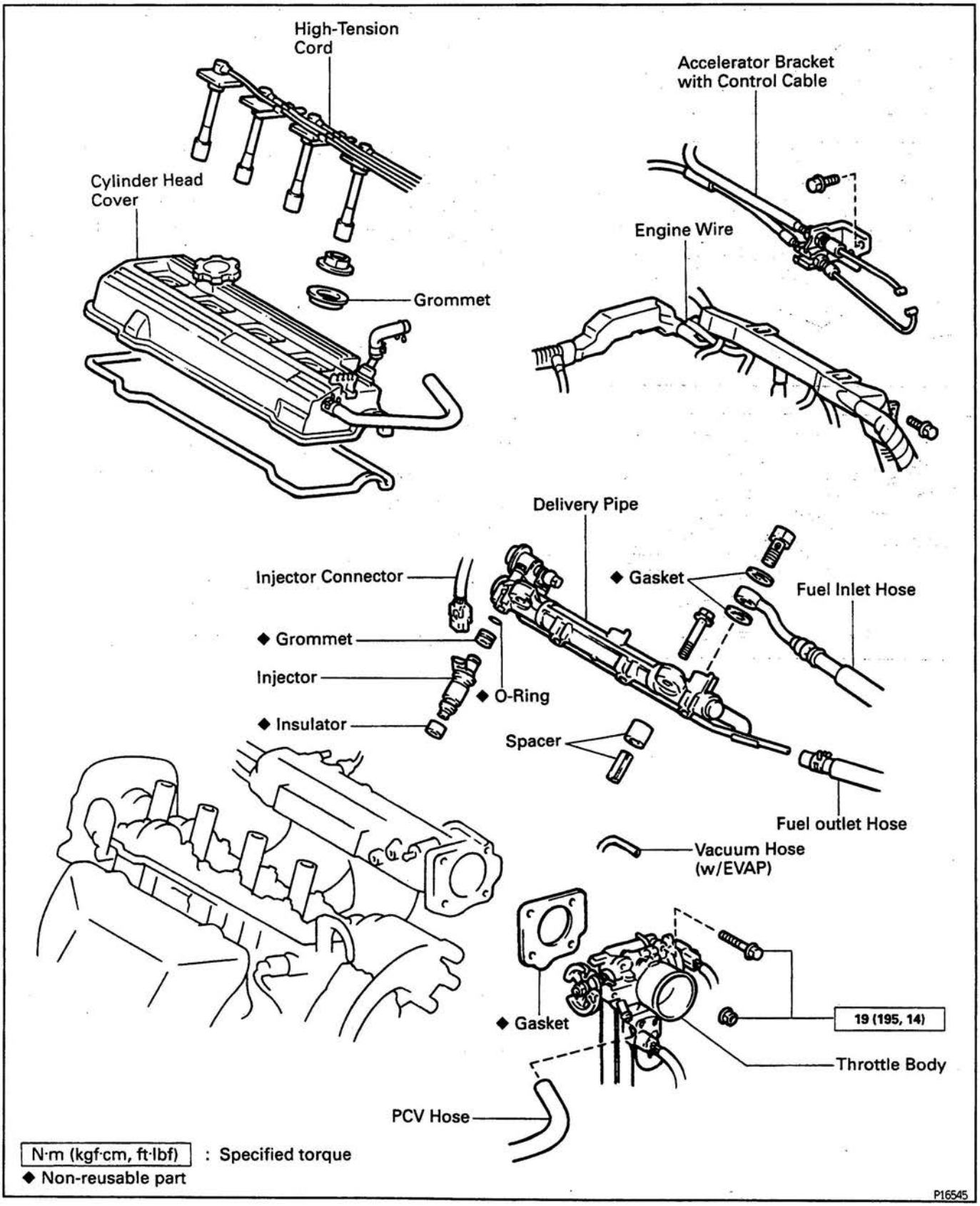
13.4 – 14.2 Ω at 20°C (68°F)

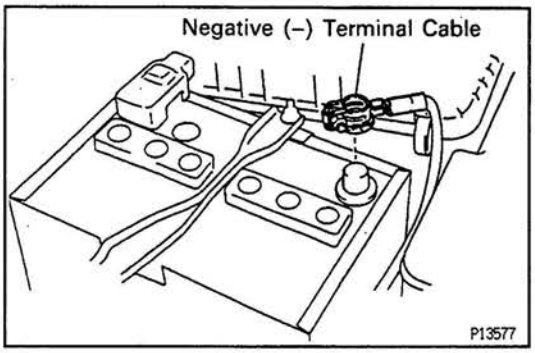
If the resistance is not as specified, replace the injector.

(c) Reconnect the injector connector.

EG130-0C

COMPONENTS FOR REMOVAL AND INSTALLATION





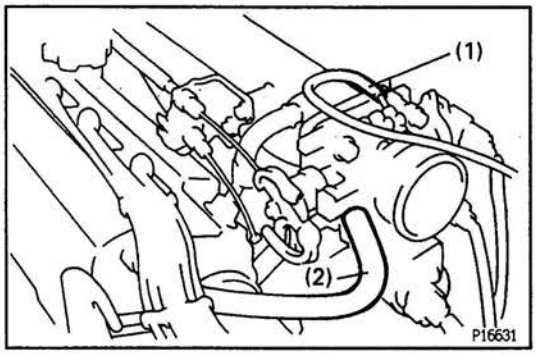
EG3UU–01

INJECTORS REMOVAL

(See Components for Removal and Installation)

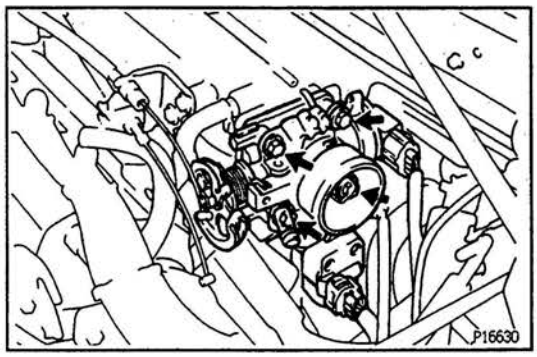
1. **DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

2. **DISCONNECT INTAKE AIR TEMPERATURE SENSOR FROM AIR CLEANER CAP**
3. **REMOVE AIR CLEANER CAP**
4. **DISCONNECT ACCELEARTOR CABLE FROM THOTTLE BODY**
5. **A/T:**
   DISCONNECT A/T THOTTLE CABLE FROM THOTTLE BODY



6. **DISCONNECT THROTTLE BODY FROM INTAKE MANIFOLD**

(a) Disconnect the following hoses:
   (1) w/ EVAP:
   Vacuum hose
   (2) PCV hose

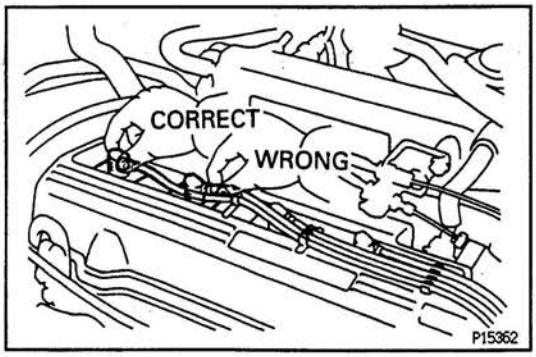


(b) Type A:
Remove the 4 bolts.

(c) Type B:
Remove the 2 bolts and 2 nuts.

(d) Disconnect the throttle body from the intake manifold.

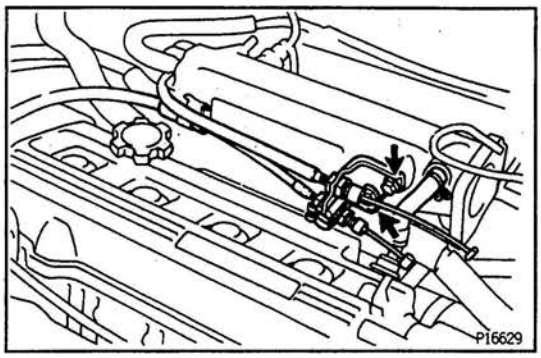
(e) Remove the gasket.



7. **REMOVE CYLINDER HEAD COVER**

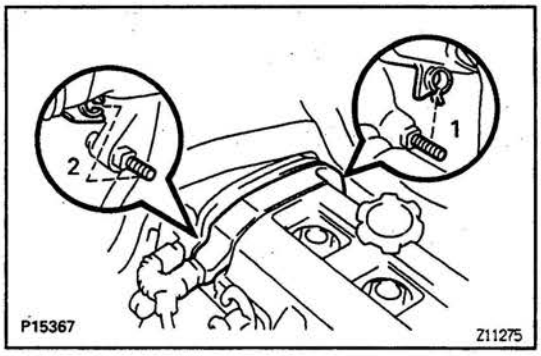
(a) Disconnect the 4 high–tension cords from the clamp on the cylinder head cover.

(b) Disconnect the high – tension cords at the rubber boot. Do not pull on the high–tension cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.

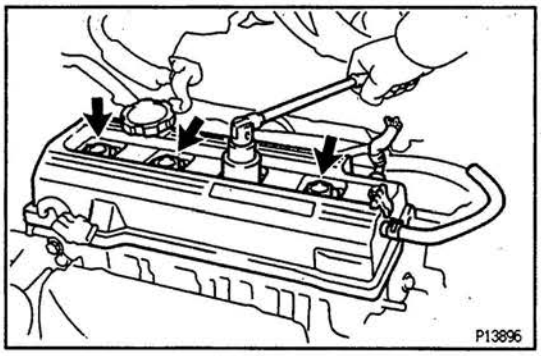


(c) Remove the 2 bolts, and disconnect the accelerator cable bracket from the intake manifold.

(d) Disconnect the PCV hose from the intake manifold.

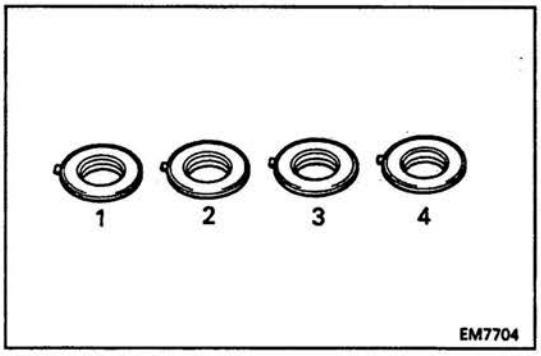


(e) Disconnect the engine wire protector from the 2 mounting bolts of the No.2 timing belt cover in the sequence shown.

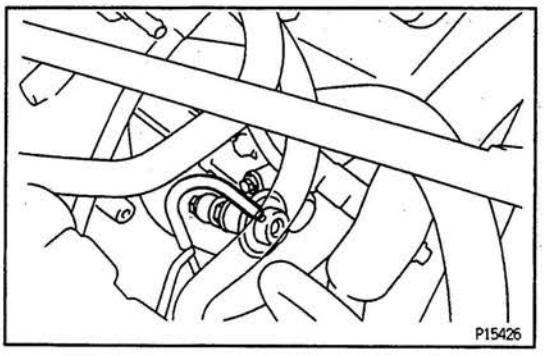


(f) Remove the 4 nuts, grommets, cylinder head cover and gasket.

NOTICE: Cover the cylinder head with a clean cloth to prevent dirt, etc. getting into the cylinder head.

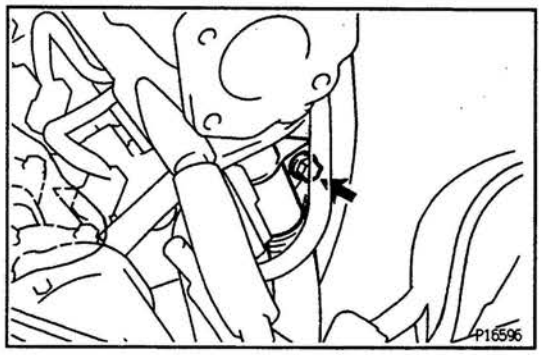


HINT: Arrange the grommets in the correct order, so that they can be reinstalled into their original positions. This minimizes any possibility of oil leakage due to reuse of the grommets in different positions.

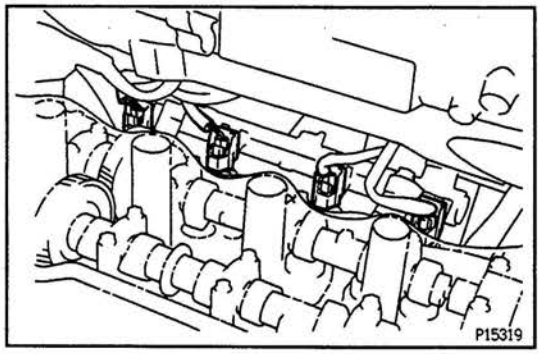


8. REMOVE DELIVERY PIPE AND INJECTORS

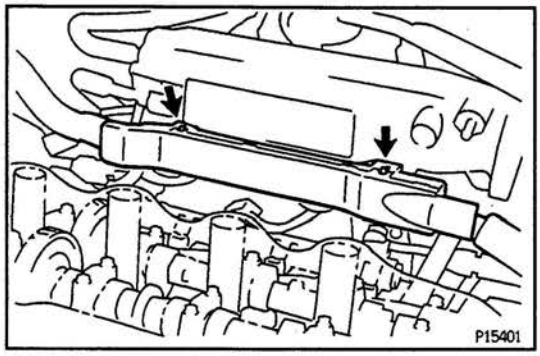
(a) Disconnect the vacuum sensing hose from the fuel pressure regulator.



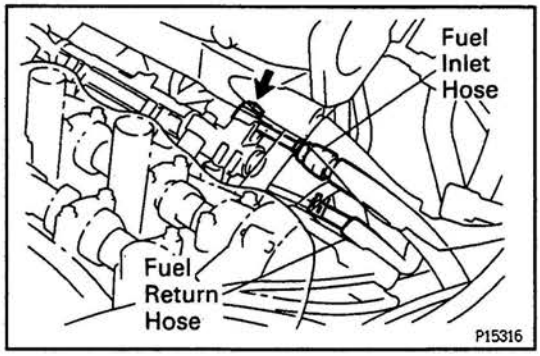
(b) Remove the bolt, and disconnect the engine wire protector from the LH side of the intake manifold.



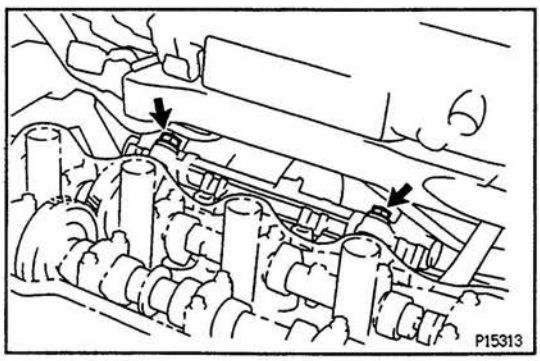
(c) Disconnect the 4 injector connectors.



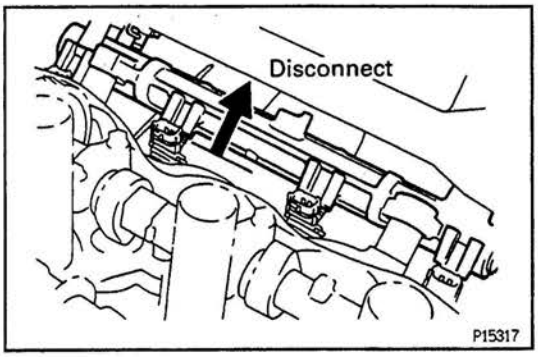
(d) Disconnect the engine wire protector from the 2 brackets on the front side of the intake manifold.



(e) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the delivery pipe.
(f) Disconnect the fuel return hose from the return pipe.



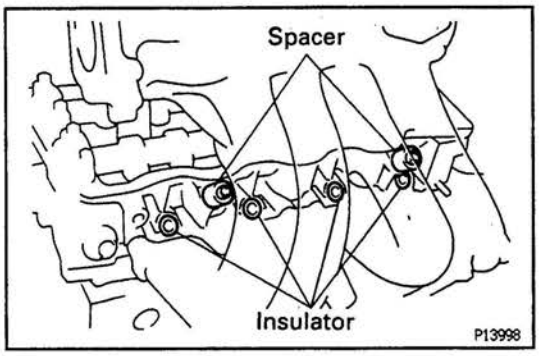
(g) Remove the 2 bolts holding the delivery pipe to the cylinder head.



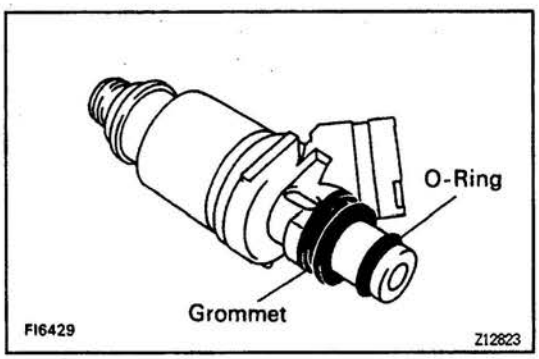
(h) Remove the delivery pipe from the 4 injectors, and remove the delivery pipe.

(i) Pull out the 4 injectors.

NOTICE: Be careful not to drop the injectors.



(j) Remove the 4 insulators and 2 spacers from the intake manifold.



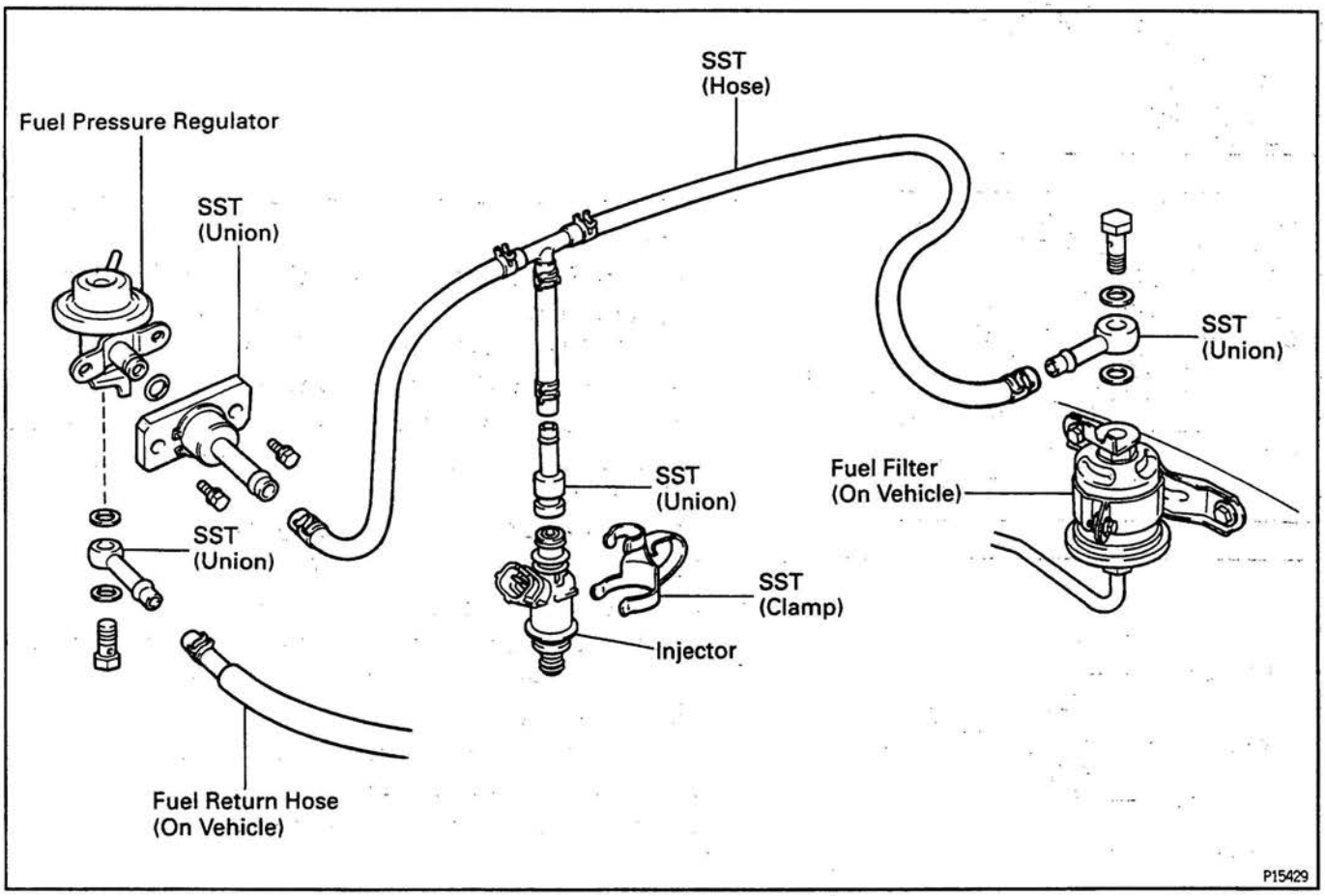
(k) Remove the O—ring and grommet from each injector.

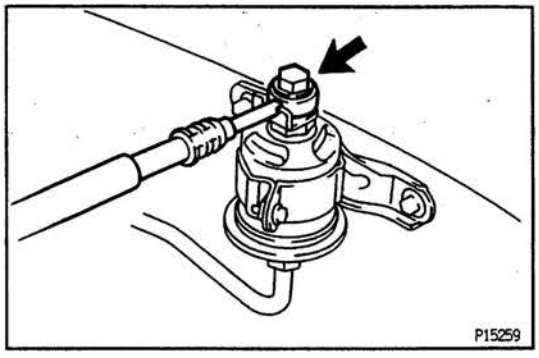
EG3MQ–02

INJECTORS INSPECTION

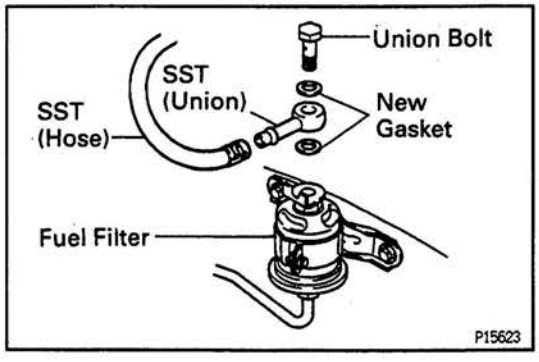
1. INSPECT INJECTOR INJECTION

CAUTION: Keep injector clear of sparks during the test.



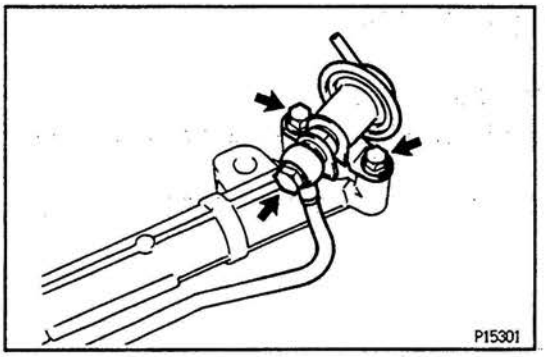


(a) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel filter outlet.
CAUTION: When removing or installing the union bolt, fix the fuel filter in place using a spanner.

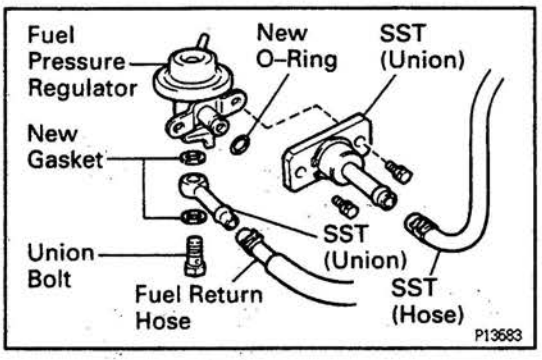


(b) Connect SST (union and hose) to the fuel filter outlet with 2 new gaskets and union bolts.
SST 09268–41045 (90405–09015)
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

EG



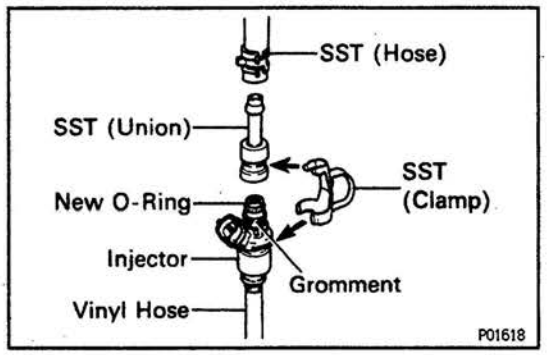
(c) Remove the pressure regulator from the delivery pipe. (See step 5 on page EG–210)



(d) Install a new O–ring to the fuel pressure regulator inlet.

(e) Connect SST (hose) to the fuel inlet of the pressure regulator with SST (union) and the 2 bolts.
SST 09268–41045 (09268–41090)
Torque: 5.4 N·m (55 kgf·cm, 48 ft·lbf)

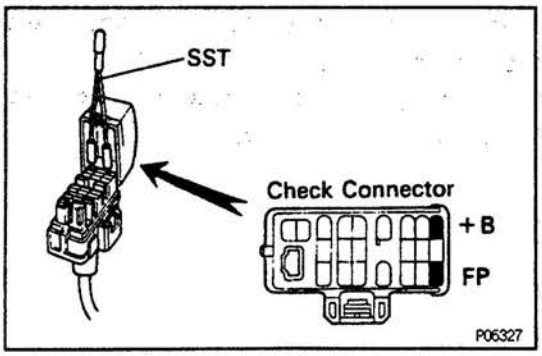
(f) Connect the fuel return hose to the fuel pressure regulator outlet with SST (union), 2 new gaskets and union bolt.
SST 09268–41045 (09268–41080)
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)



(g) Install the grommet and a new O–ring to the injector.

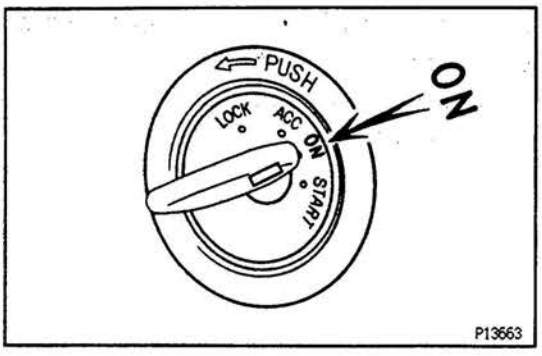
(h) Connect SST (union and hose) to the injector, and hold the injector and union with SST (clamp).
SST 09268–41045

(i) Put the injector into a graduated cylinder.
CAUTION: Install a suitable vinyl hose onto the injector to prevent gasoline from splashing out.

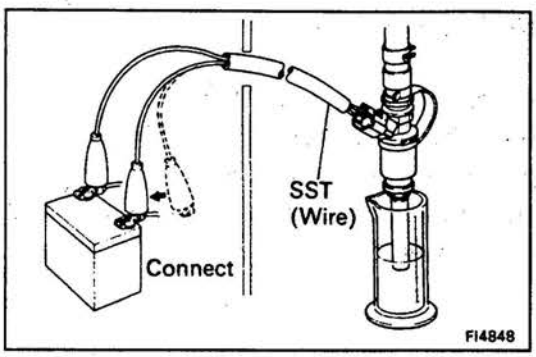


(j) Using SST, connect terminals +B and FP of the check connector.
SST 09843–18020

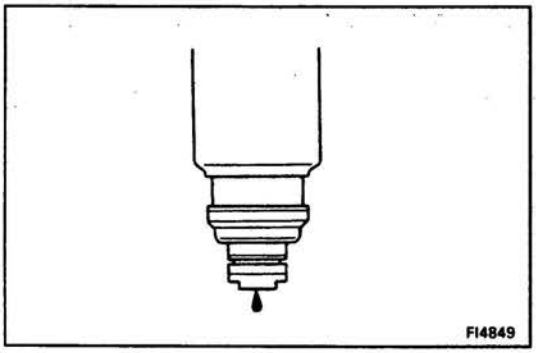
(k) Reconnect the negative (–) terminal cable to the battery.



(l) Turn the ignition switch ON.
NOTICE: Do not start the engine.

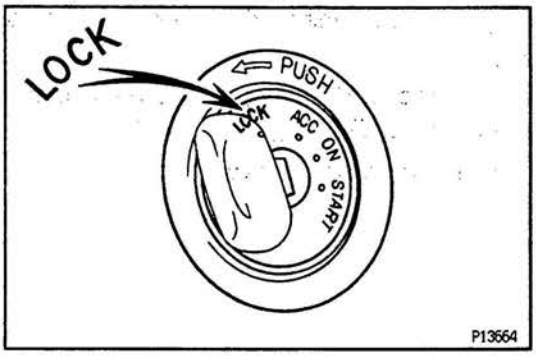


(m) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.
SST 09842–30070
Volume:
49 – 59 cm³ (3.0 – 3.6 cu in.) per 15 sec.
Difference between each injector:
5 cm³ (0.3 cu in.) or less
If the injection volume is not as specified, replace the injector.

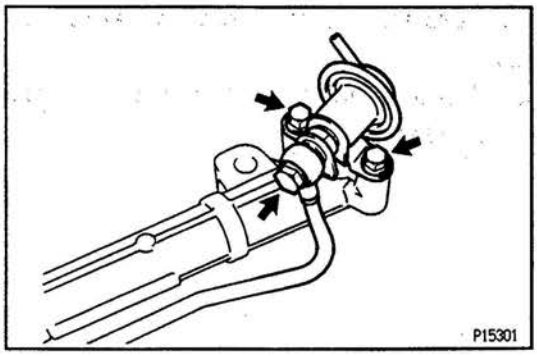


2. INSPECT LEAKAGE

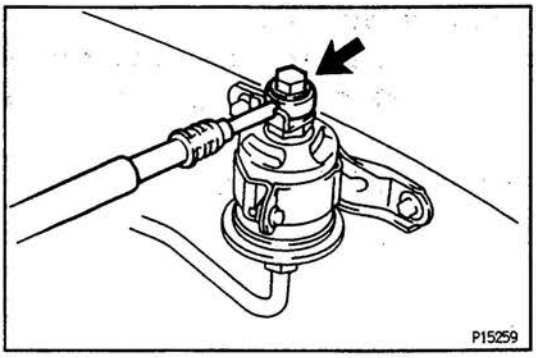
(a) In the condition above, disconnect the tester probes of SST (wire) from the battery and check the fuel leakage from the injector.
SST 09842–30070
Fuel drop:
One drop or less per minute



(b) Turn the ignition switch to LOCK.
(c) Disconnect the negative (–) terminal cable from the battery.
(d) Remove the SST.
SST 09268–41045, 09842–30070, 09843–18020



(e) Reinstall the pressure regulator to the delivery pipe. (See step 1 on page EG–211)

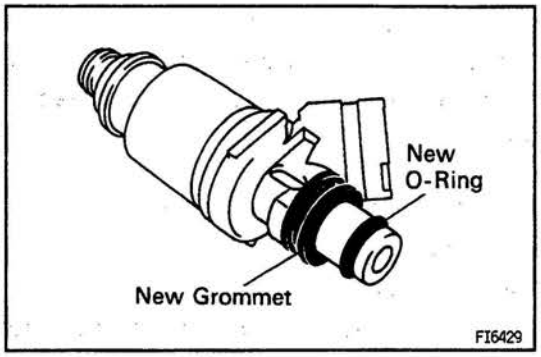


(f) Reconnect the fuel inlet hose to the fuel filter outlet with 2 new gaskets and the union bolt.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)
CAUTION: When removing or installing the union bolt, fix the fuel filter in place using a spanner.

EG

EG3UV-01

INJECTORS INSTALLATION

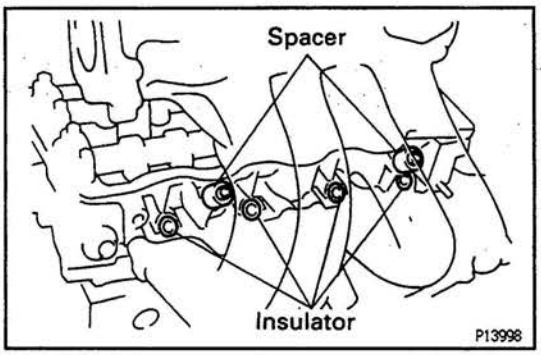


(See Components for Removal and Installation)

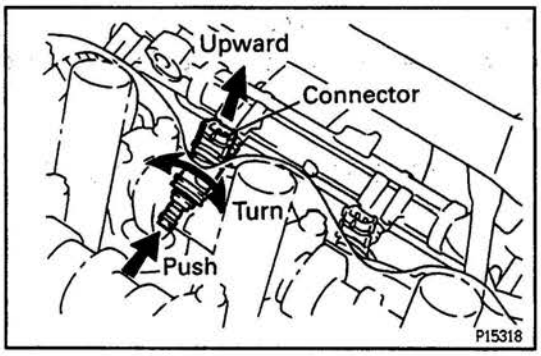
1. INSTALL INJECTORS AND DELIVERY PIPE

(a) Install a new grommet to each injector.

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



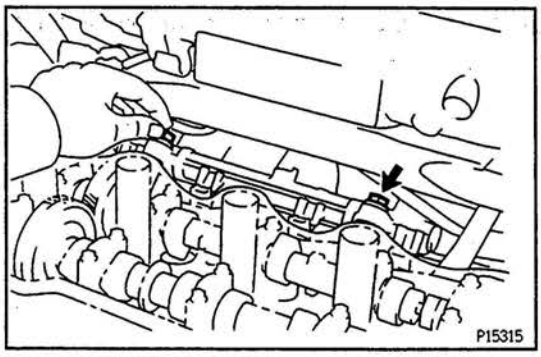
(c) Install the following parts to the intake manifold:
   (1) 2 spacers
   (2) 4 new insulators



(d) Place the delivery pipe between the intake manifold and cylinder head.

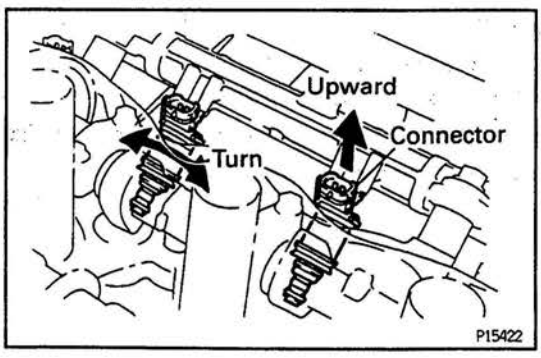
(e) While turning the injector left and right, install it to the delivery pipe. Install the 4 injectors.

(f) Position the injector connector upward.



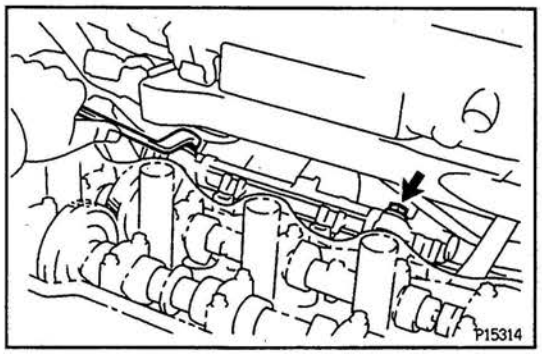
(g) Attach the 4 injectors and delivery pipe assembly to the cylinder head.

(h) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.

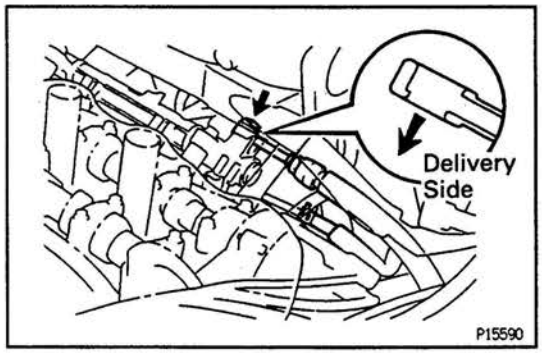


(i) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O–rings. Replace the O–rings.

(j) Position the injector connector upward.

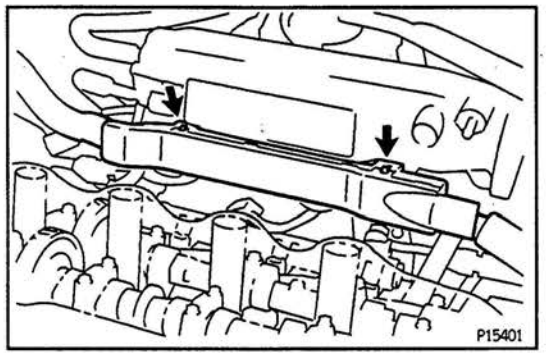


(k) Tighten the 2 bolts holding the delivery pipe to the cylinder head.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)

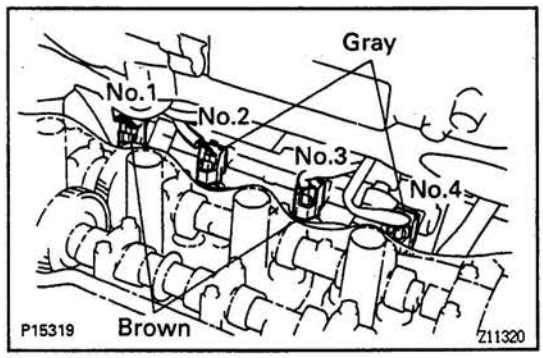


(l) Connect the fuel inlet hose to the delivery pipe with 2 new gaskets and the union bolt.
Torque: 34 N·m (350 kgf·cm, 25 ft·lbf)
NOTICE: Be careful of the fuel inlet hose installation direction.

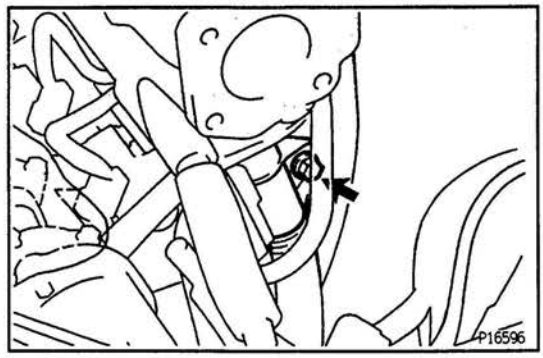
(m) Connect the fuel return hose to the return pipe.



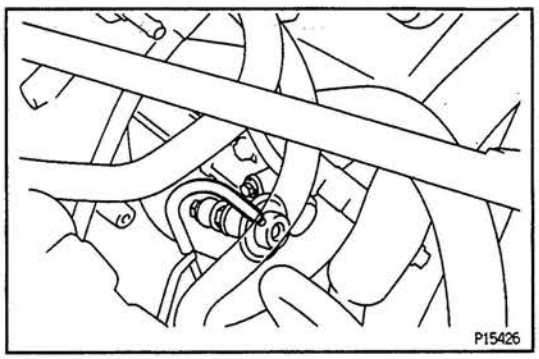
(n) Install the the engine wire protector to the 2 brackets on the front side of the intake manifold.



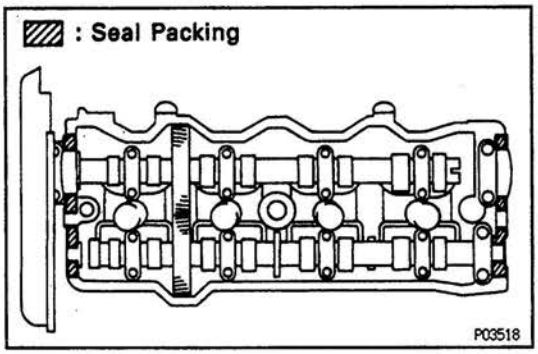
(o) Connect the 4 injector connectors.
HINT: The No.1 and No.3 injector connectors are brown, and the No.2 and No.4 injector connectors are gray.



(p) Install the engine wire protector to LH side of the intake manifold with the bolt.



(q) Connect the vacuum sensing hose to the fuel pressure regulator.



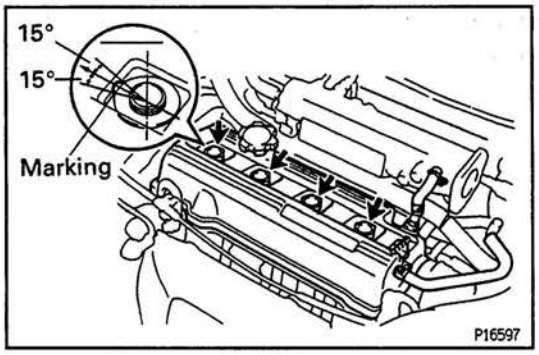
2. INSTALL CYLINDER HEAD COVER

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

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

Seal packing:

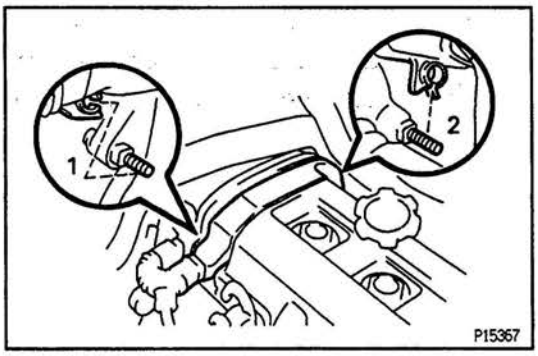
Part No. 08826–00080 or equivalent



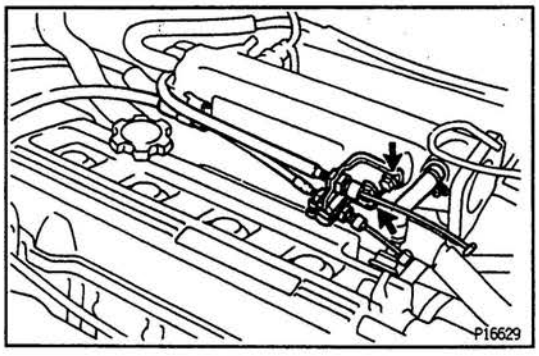
(c) Install the gasket to the cylinder head cover.

(d) Install the cylinder head cover with the 4 grommets and nuts.

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



(e) Install the engine wire protector to the 2 mounting bolts of the No.2 timing belt cover in the sequence shown.

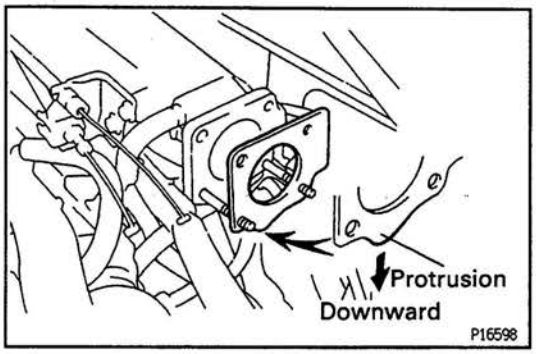


(f) Connect the PCV hose to the intake manifold.

(g) Install the cable bracket with the 2 bolts.

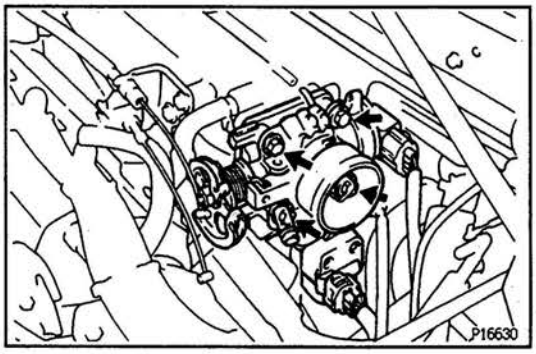
(h) Connect the 4 high–tension cords to the spark plugs.

(i) Install the 4 high–tension cords to the clamp on the cylinder head cover.



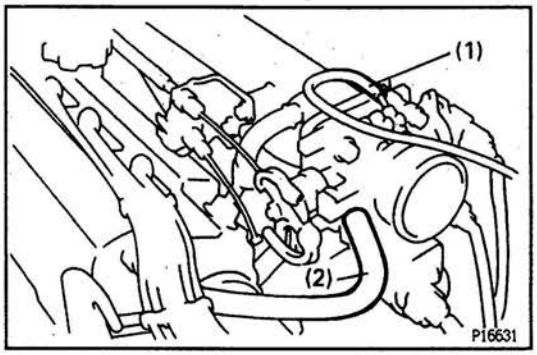
3. INSTALL THROTTLE BODY

(a) Attach a new gasket to the intake manifold, facing the protrusion downward.



(b) Type A:
Install the throttle body with the 4 bolts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)
HINT: Different bolt lengths are used for the upper and lower sides.
Bolt length:
Upper side: 40 mm (1.59 in.)
Lower side: 55 mm (2.17 in.)

(c) Type B:
Install the throttle body with the 2 bolts and 2 nuts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



(d) Connect the following hoses:
(1) w/ EVAP:
Vacuum hose
(2) PCV hose

4. A/T:
CONNECT A/T THROTTLE CABLE TO THROTTLE BODY

5. CONNECT ACCELERTOR CABLE TO THROTTLE BODY

6. INSTALL AIR CLEANER CAP

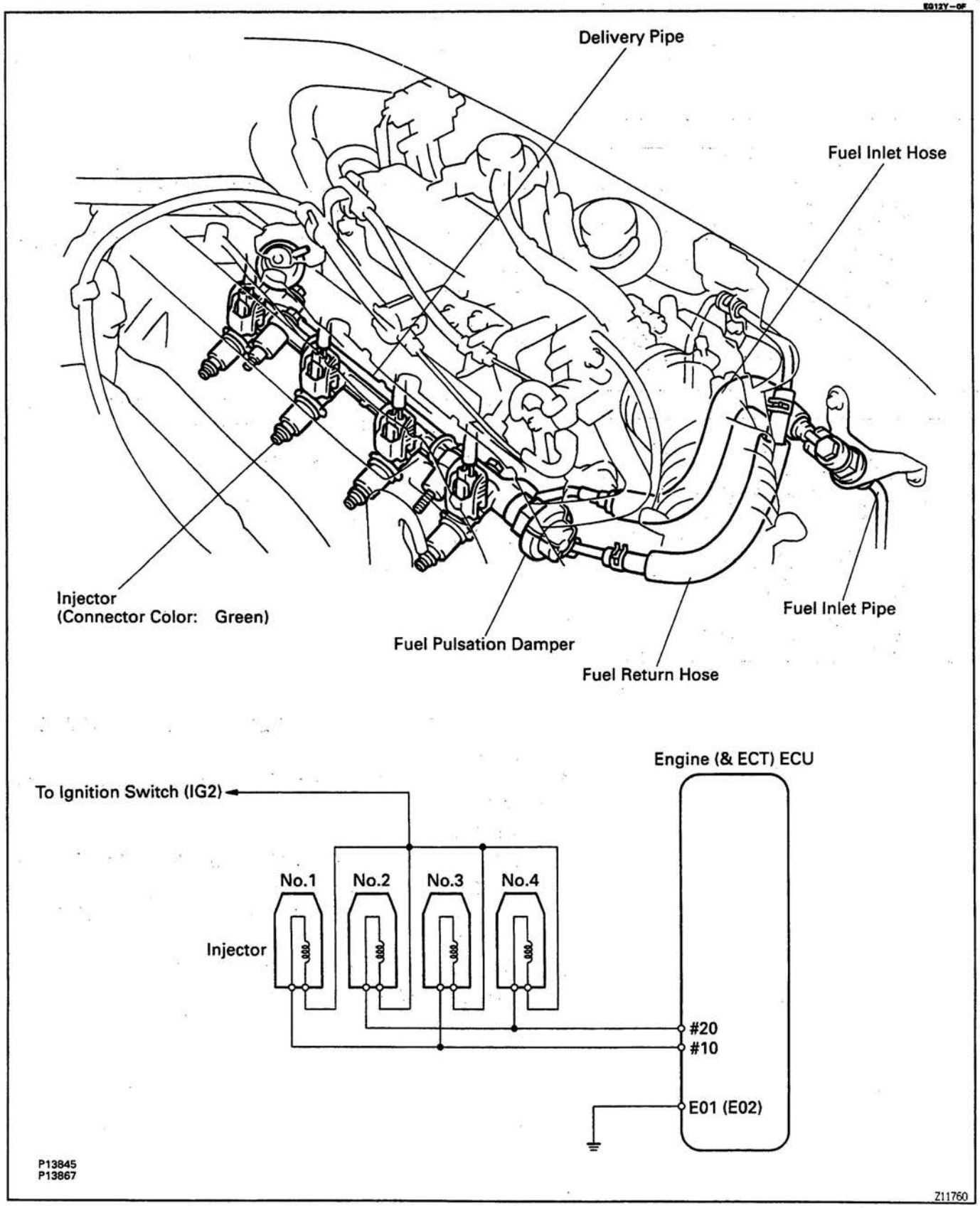
7. CONNECT INTAKE AIR TEMPERATURE SENSOR TO AIR CLEANER CAP

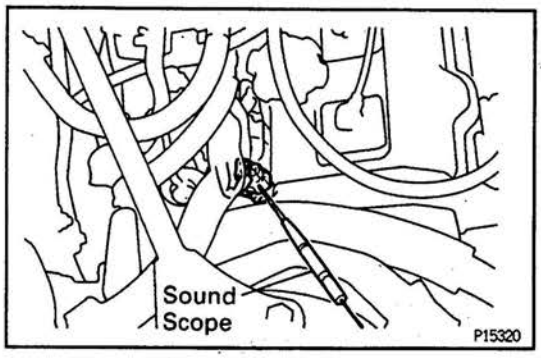
8. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

9. CHECK FOR FUEL LEAKS
(See page EG–163)

INJECTOR
(ST191)

EG





ON–VEHICLE INSPECTION

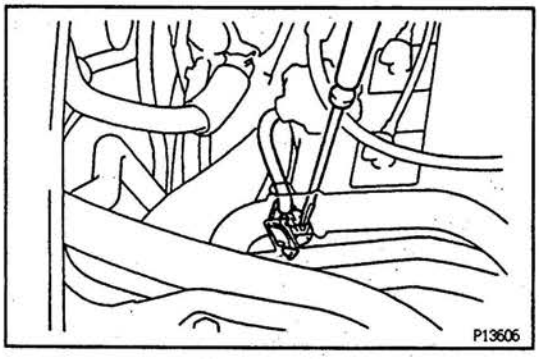
EGCD8–0H

1. INSPECT INJECTOR OPERATION

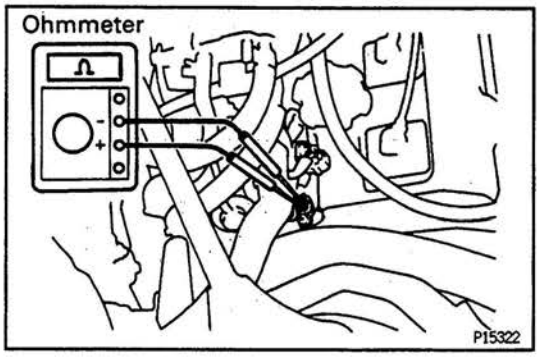
Check operation sound from each injector.

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

EG



(b) If you have no sound scope, you can check the injector transmission operation with a screwdriver.
If no sound or unusual sound is heard, check the wiring connector, injector or injection signal from the ECU.



2. INSPECT INJECTOR RESISTANCE

(a) Disconnect the injector connector.

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

Resistance:

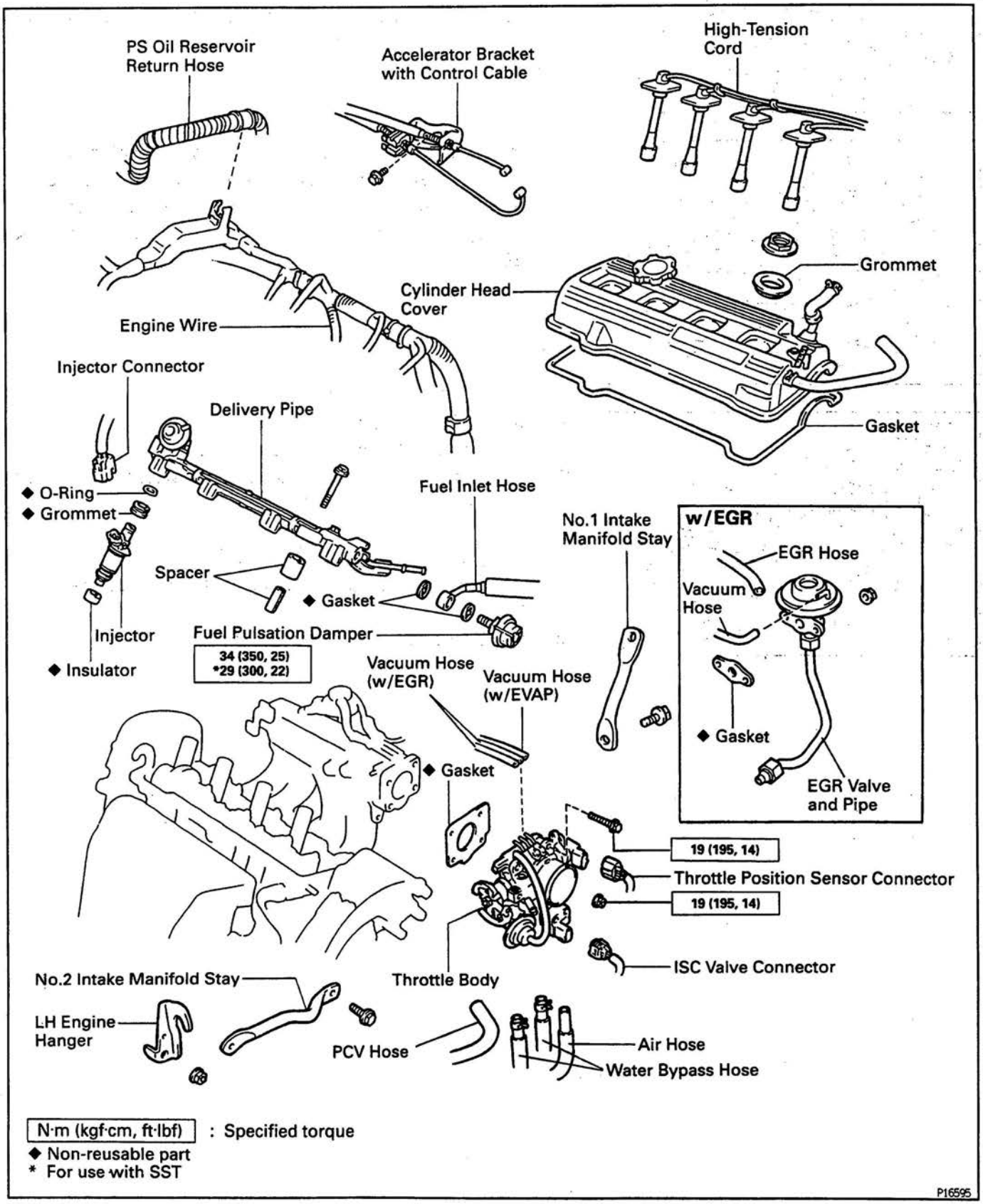
13.4 – 14.2 Ω at 20°C (68°F)

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

(c) Reconnect the injector connector.

EG

COMPONENTS FOR REMOVAL AND INSTALLATION

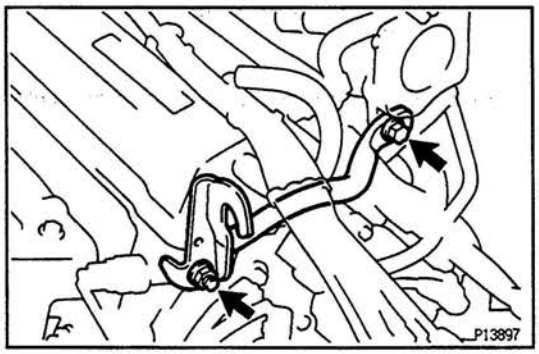


SQ3UW-01

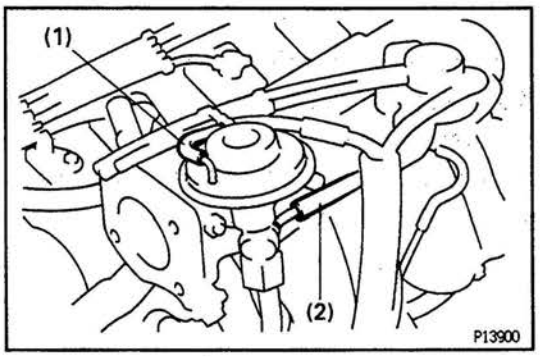
INJECTORS REMOVAL

(See Components for Removal and Installation)

1. REMOVAL THROTTLE BODY
(See page EG–251)

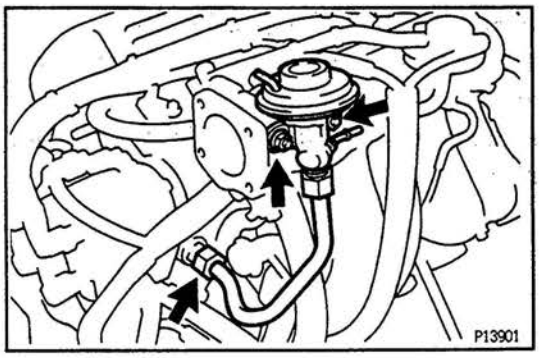


2. REMOVE LH ENGINE HANGER AND No.2 INTAKE MANIFOLD STAY
Remove the bolt, nut, engine hanger and manifold stay.

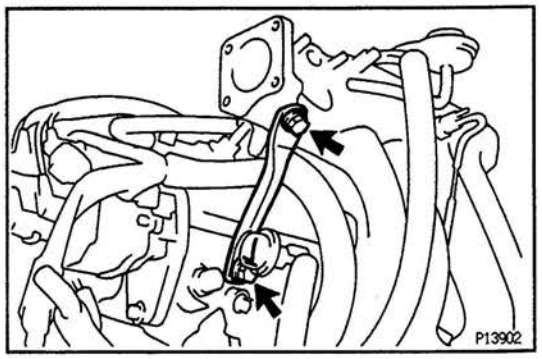


3. w/ EGR:
REMOVE EGR VALVE AND PIPE

(a) Disconnect the following hoses from the EGR valve:
(1) Vacuum hose (from port E of VSV)
(2) EGR hose (from vacuum modulator)

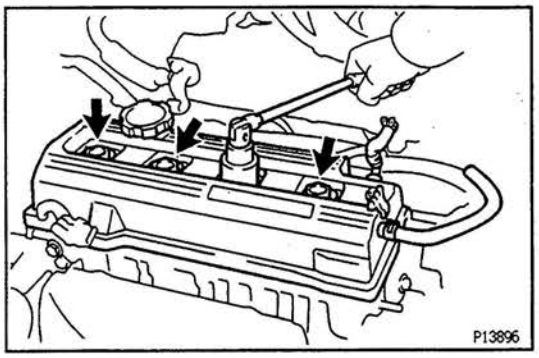


(b) Loosen the cylinder head side of the EGR pipe union nut.
(c) Remove the 2 nuts, the EGR valve, pipe assembly and gasket.

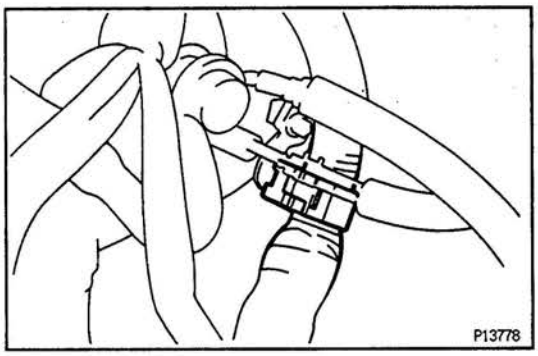


4. REMOVE NO.1 INTAKE MANIFOLD STAY
Remove the 2 bolts and manifold stay.

EG

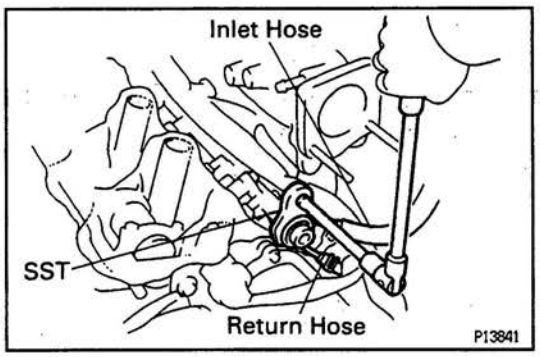


5. REMOVE CYLINDER HEAD COVER
(See steps 1 and 2 on page EG–19)

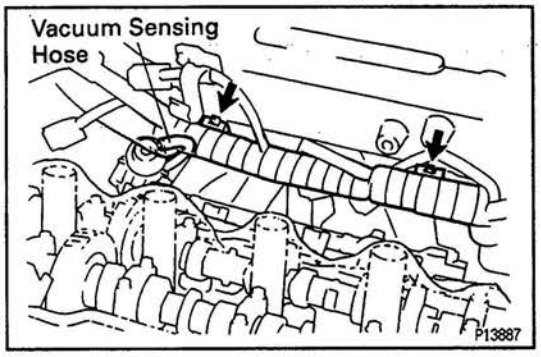


6. DISCONNECT FUEL INLET HOSE AND FUEL RETURN HOSE

(a) Disconnect the clamp of the engine wire from the wire bracket.

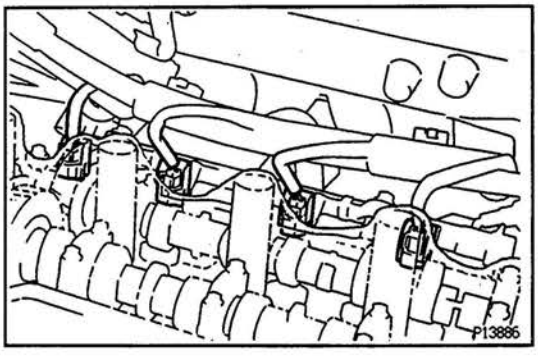


(d) Using SST, loosen the fuel pulsation damper.
SST 09612–24014 (09617–24011)
(c) Remove the fuel pulsation damper and 2 gaskets, and disconnect the fuel inlet hose from the delivery pipe.
(d) Disconnect fuel return hose from return pipe.

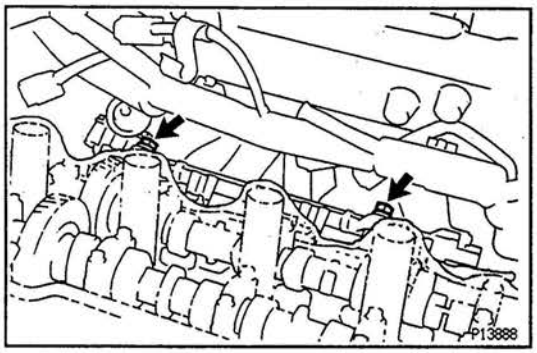


7. REMOVE DELIVERY PIPE AND INJECTORS

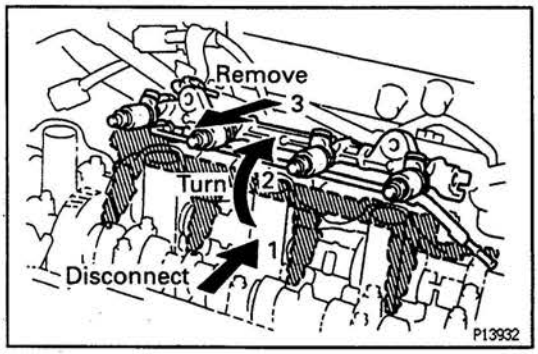
(a) Disconnect the 2 clamps of the engine wire from the wire brackets on the intake manifold.
(b) Disconnect the vacuum sensing hose from the fuel pressure regulator.



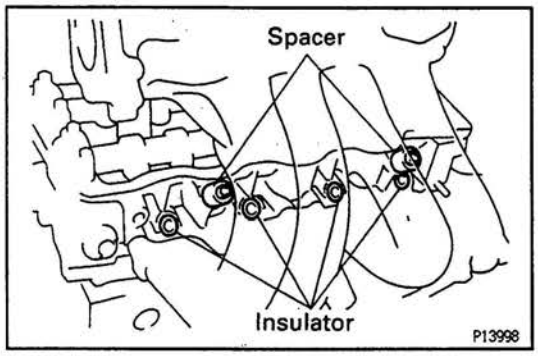
(c) Disconnect the 4 injector connectors.



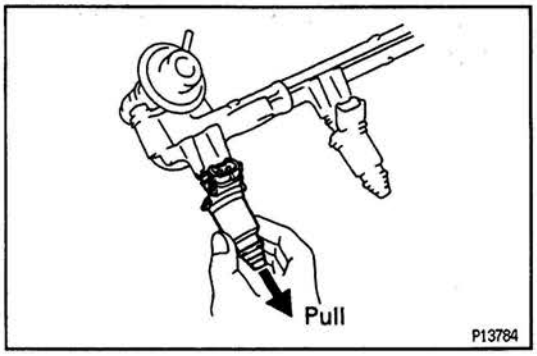
(d) Remove the 2 bolts holding the delivery pipe to the cylinder head.



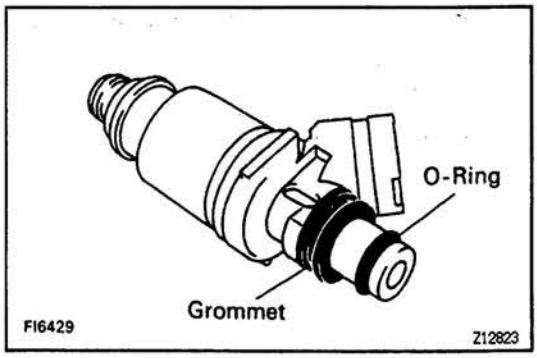
(e) Remove the delivery pipe together with the 4 injectors by following the instructions as shown in the illustrations.
NOTICE: Be careful not to drop the injectors when removing the delivery pipe.



(f) Remove the 4 insulators and 2 spacers from the cylinder head.



(g) Pull out the 4 injectors from the delivery pipe.



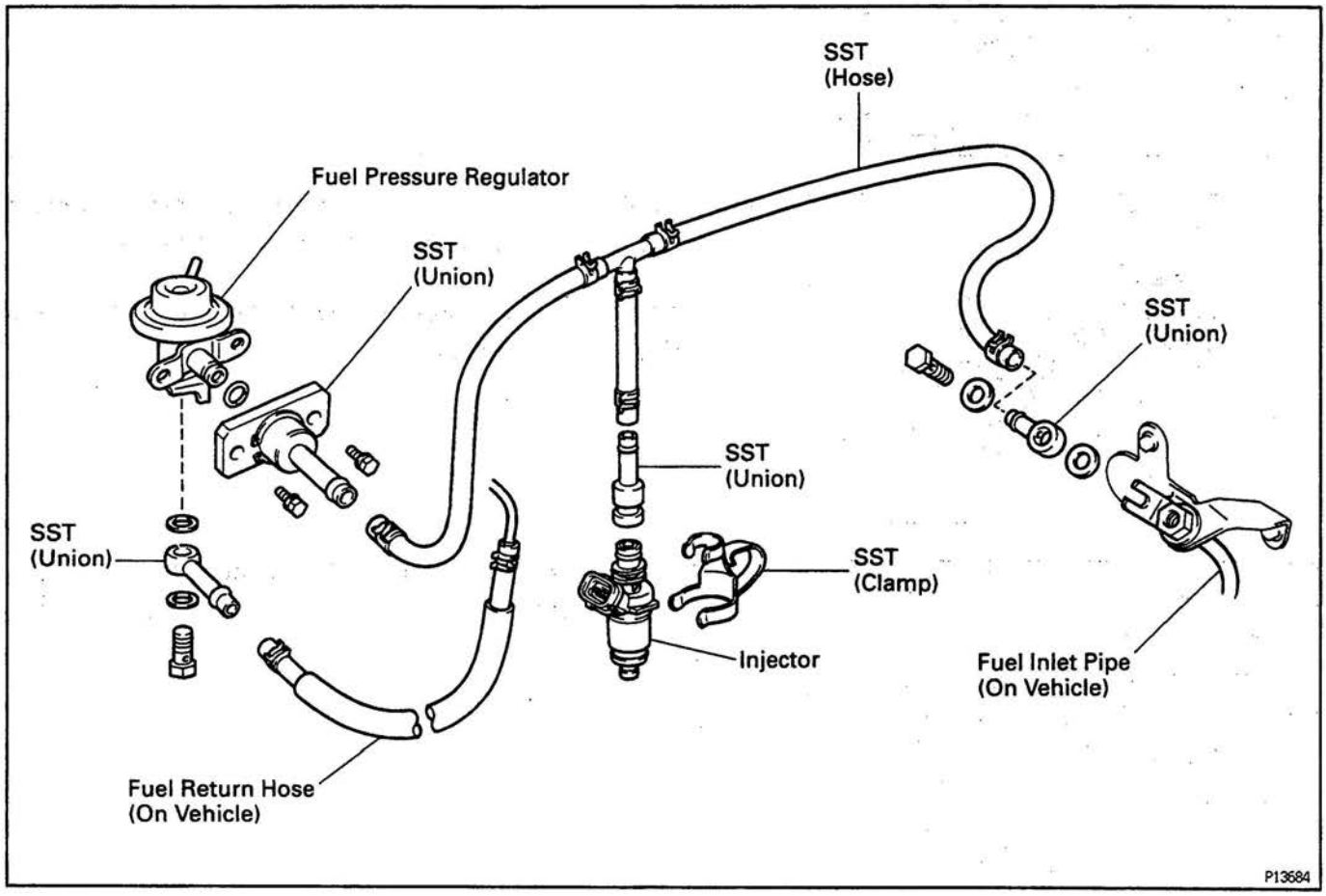
(h) Remove the O–ring and grommet from each injector.

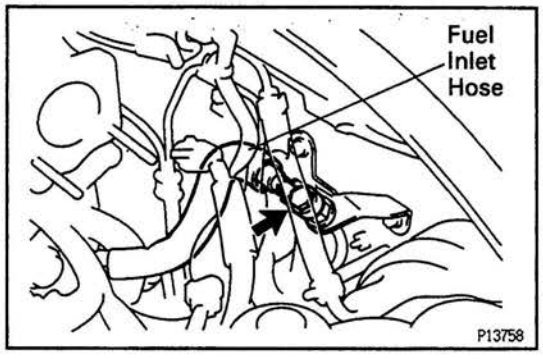
EG3MQ–03

INJECTORS INSPECTION

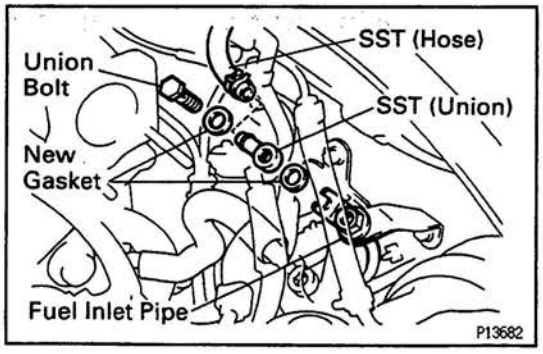
1. INSPECT INJECTOR INJECTION

CAUTION: Keep injector clear of sparks during the test.

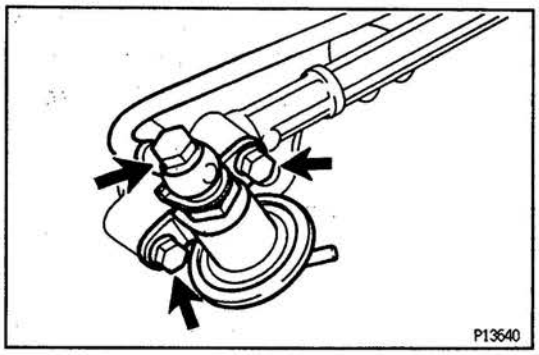




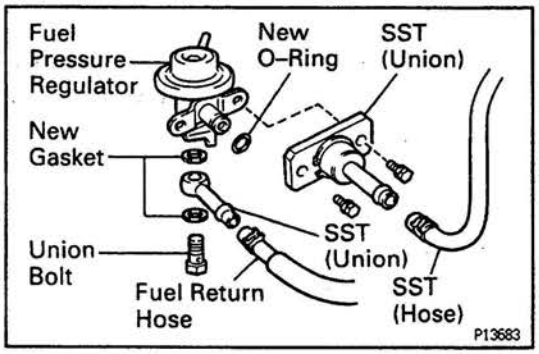
(a) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel inlet pipe.



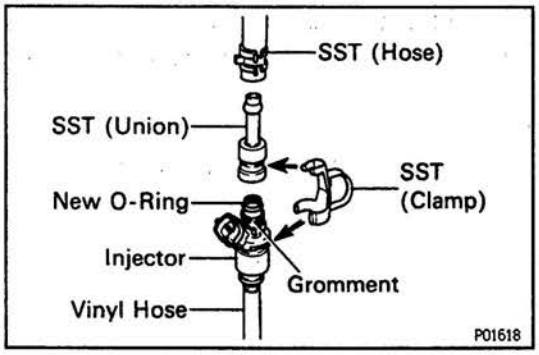
(b) Connect SST (union and hose) to the fuel inlet pipe with 2 new gaskets and union bolts.
SST 09268–41045 (90405–09015)
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)



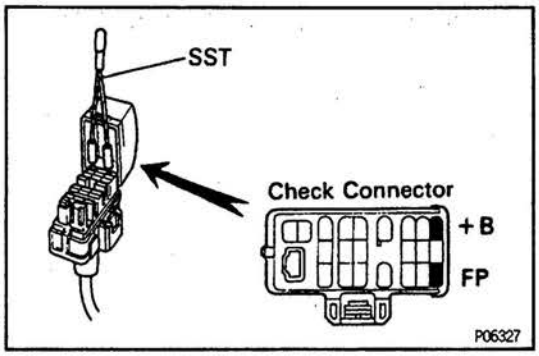
(c) Remove the fuel pressure regulator from the delivery pipe.
(See step 4 on page EG–216)



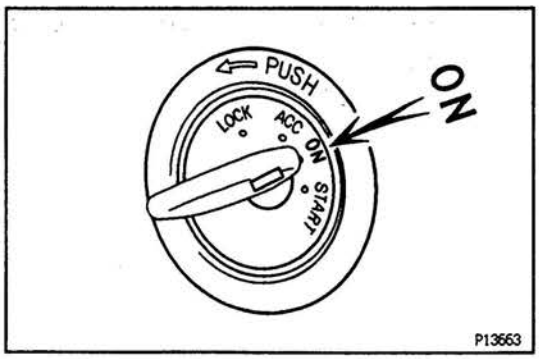
(d) Install a new O–ring to the fuel pressure regulator inlet.
(e) Connect SST (hose) to the fuel pressure regulator inlet with SST (union) and the 2 bolts.
SST 09268–41045 (09268–41090)
Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)
(f) Connect the fuel return hose to the pressure regulator outlet with SST (union), 2 new gaskets and union bolt.
SST 09268–41045 (09268–41080)
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)



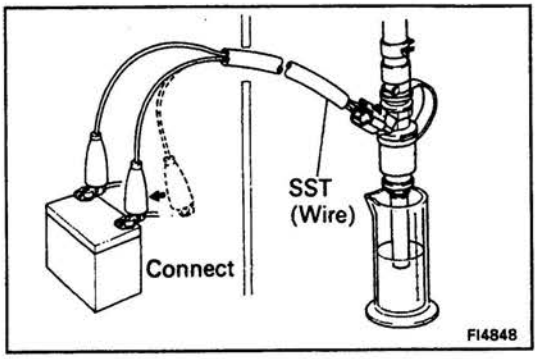
(g) Install the grommet and a new O–ring to the injector.
(h) Connect SST (union and hose) to the injector, and hold the injector and union with SST (clamp).
SST 09268–41045
(i) Put the injector into the graduated cylinder.
CAUTION: Install a suitable vinyl hose onto the injector to prevent gasoline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



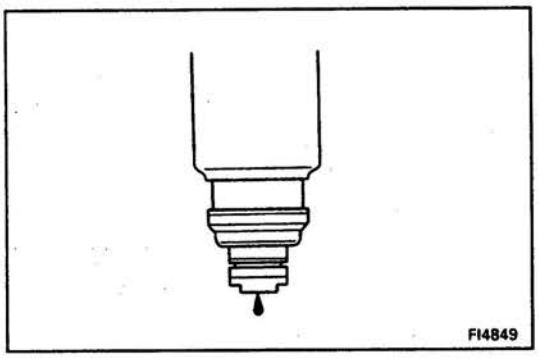
(j) Using SST, connect terminals +B and FP of the check connector.
SST 09843–18020
(k) Reconnect the negative (–) terminal cable to the battery.



(l) Turn the ignition switch ON.
NOTICE: Do not start the engine.

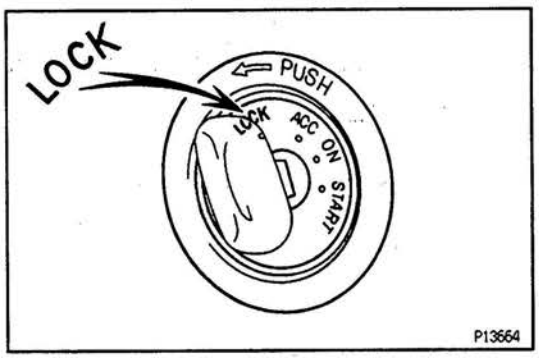


(m) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.
SST 09842–30070
Volume:
49 – 59 cm³ (3.0 – 3.6 cu in.) per 15 sec.
Difference between each injector:
5 cm³ (0.3 cu in.) or less
If the injection volume is not as specified, replace the injector.

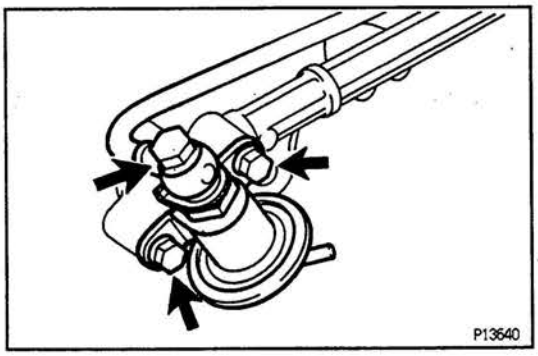


2. INSPECT LEAKAGE

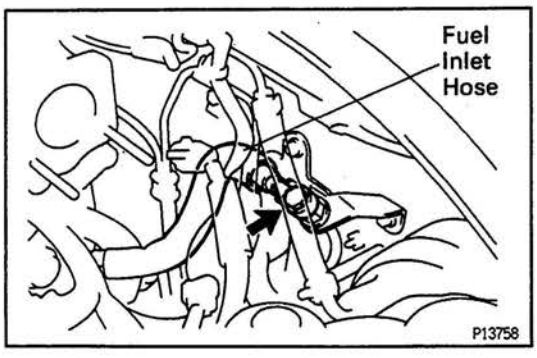
(a) In the condition above, disconnect the tester probes of SST (wire) from the battery and check the fuel leakage from the injector.
SST 09842–30070
Fuel drop:
One drop or less per minute



(b) Turn the ignition switch to LOCK.
(c) Disconnect the negative (–) terminal cable from the battery.
(d) Remove the SST.
SST 09268–41045, 09842–30070, 09843–18020



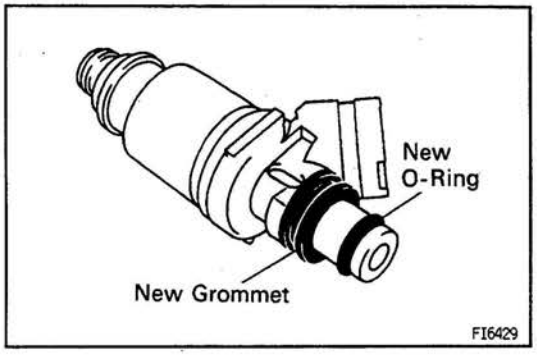
(e) Reinstall the fuel pressure regulator to the delivery pipe.
(See step 1 on page EG–217)



(f) Reconnect the fuel inlet hose to the fuel inlet pipe with 2 new gaskets and the union bolt.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

EG3UX-01

INJECTORS INSTALLATION

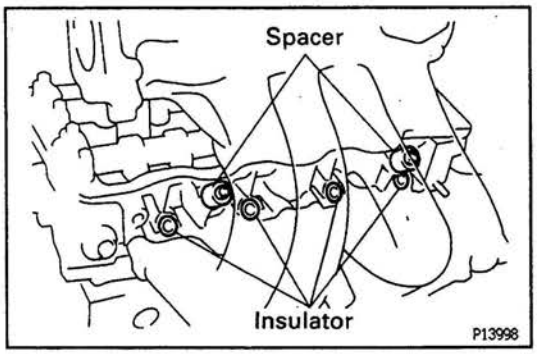


(See Components for Removal and Installation)

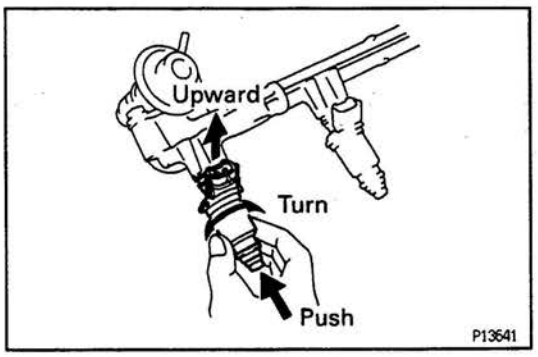
1. INSTALL INJECTORS AND DELIVERY PIPE

(a) Install a new grommet to the injector.

(b) Apply a light coat of gasoline onto a new O—ring, and install it to each injector.

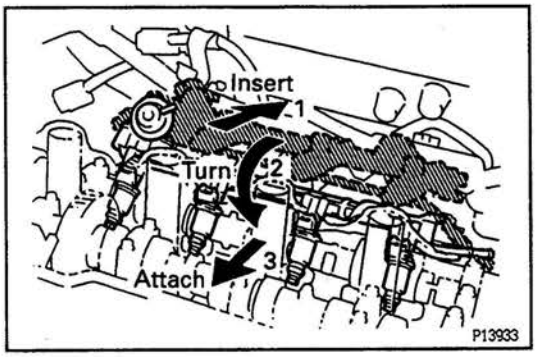


(c) Place 4 new insulators and the 2 spacers in position on the cylinder head.

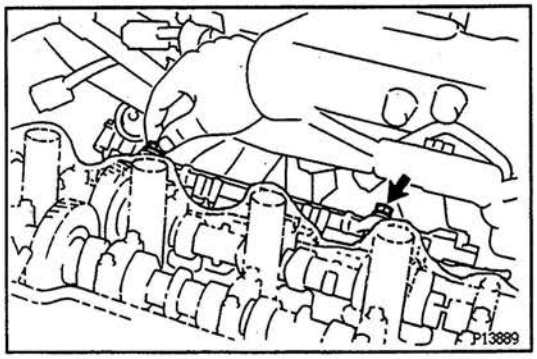


(d) While turning the injector left and right, install it to the delivery pipe. Install the 4 injectors.

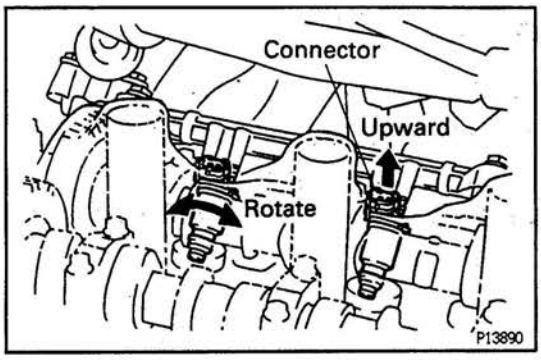
(e) Position the injector connector upward.



(f) Install the 4 injectors and delivery pipe assembly to the cylinder head by following the instructions as shown in the illustration.

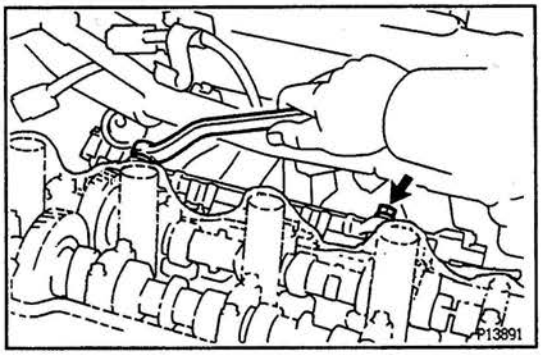


(g) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.

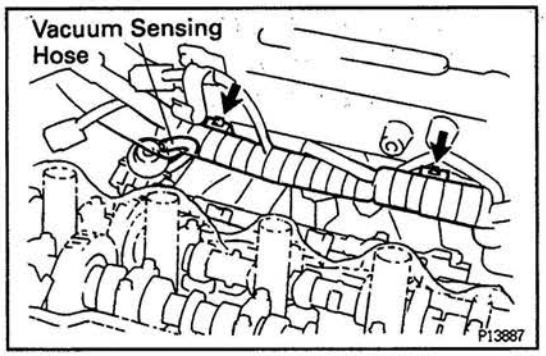


(h) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O–rings. Replace the O–rings.

(i) Position the injector connector upward.

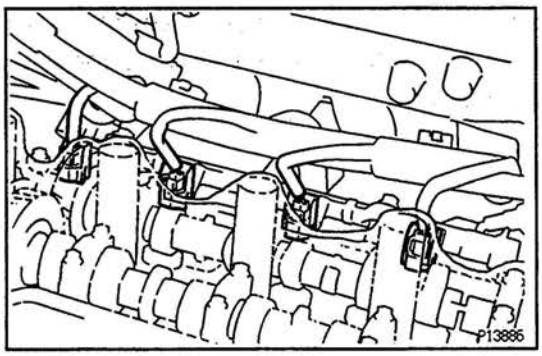


(j) Tighten the 2 bolts holding the delivery pipe to the cylinder head.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)

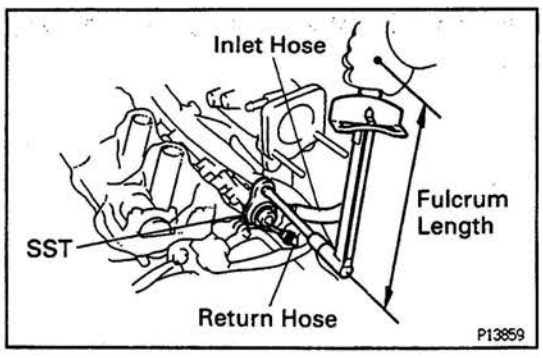


(k) Connect the vacuum sensing hose to the fuel pressure regulator.

(l) Install the 2 clamps of the engine wire to the wire brackets on the intake manifold.



(m) Connect the 4 injector connectors.

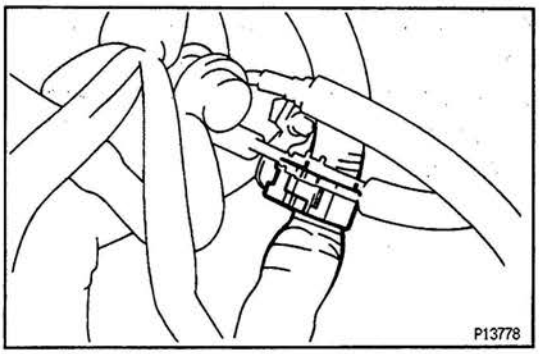


2. CONNECT FUEL RETURN HOSE TO RETURN PIPE

3. CONNECT FUEL INLET HOSE TO DELIVERY PIPE

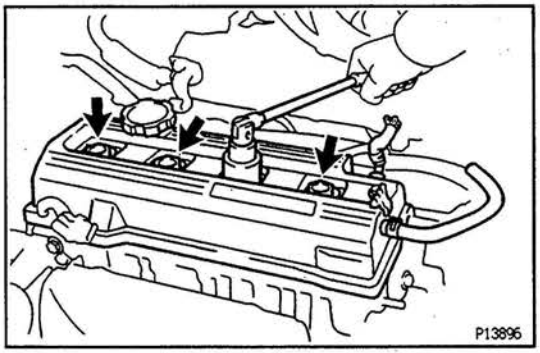
(a) Temporarily connect the fuel inlet hose with 2 new gaskets and fuel pulsation damper.

(b) Using SST, tighten the fuel pulsation damper.
SST 09612–24014 (09617–24011)
Torque:
34 N·m (350 kgf·cm, 25 ft·lbf)
29 N·m (300 kgf·cm, 22 ft·lbf) for use with SST

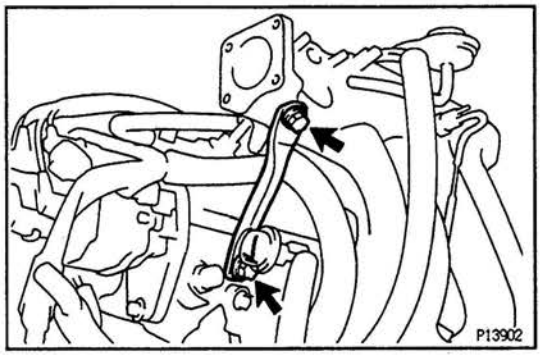


HINT:Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

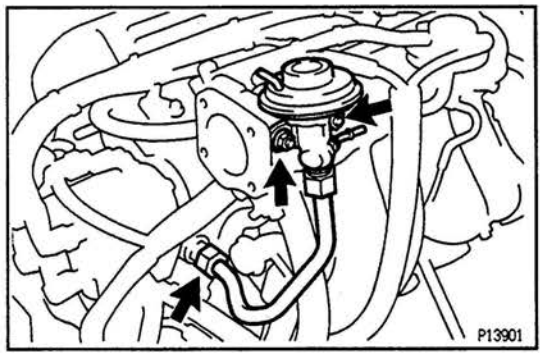
(c) Install the clamp of the engine wire to the wire clamp.



4. INSTALL CYLINDER HEAD COVER
(See step 6 on page EG–24)

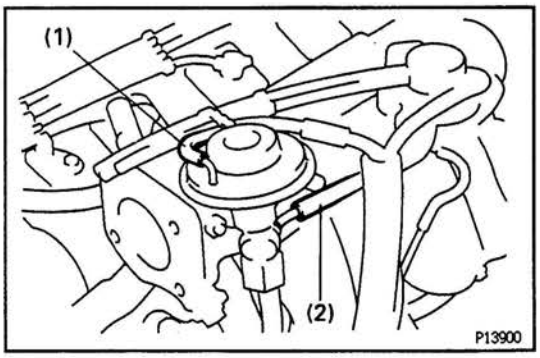


5. INSTALL NO.1 INTAKE MANIFOLD STAY
Install the manifold stay with the 2 bolts.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

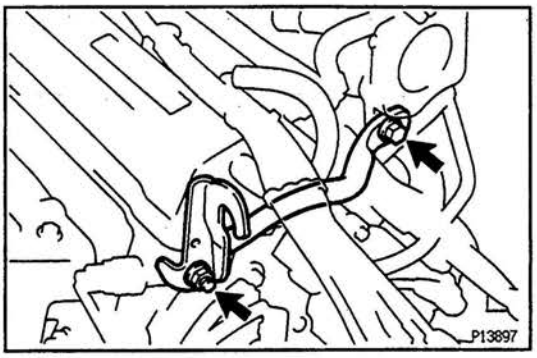


6. w/ EGR:
INSTALL EGR VALVE AND PIPE

(a) Install a new gasket, the EGR valve and pipe assembly with the union nut and 2 nuts.
Torque:
Nut: 13 N·m (130 kgf·cm, 9 ft·lbf)
Union nut: 59 N·m (600 kgf·cm, 43 ft·lbf)



(b) Connect the following hoses to the EGR valve:
(1) Vacuum hose (from port E of VSV)
(2) EGR hose (from vacuum modulator)



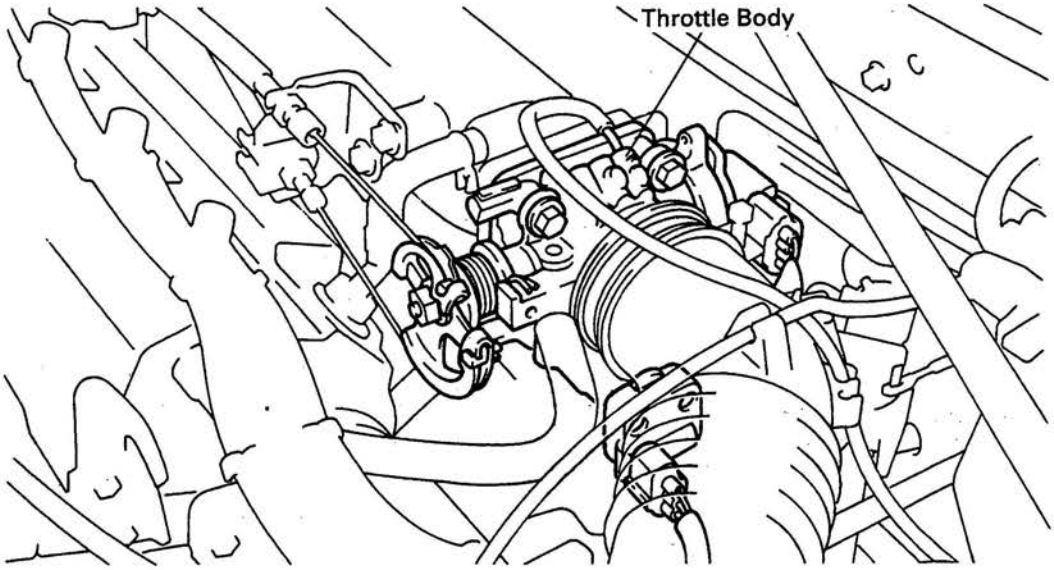
7. **INSTALL NO.2 INTAKE MANIFOLD STAY AND LH ENGINE HANGER**
Install the No.2 intake manifold stay and LH engine hanger with the bolt and nut.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

8. **INSTALL THROTTLE BODY**
(See page EG–255)

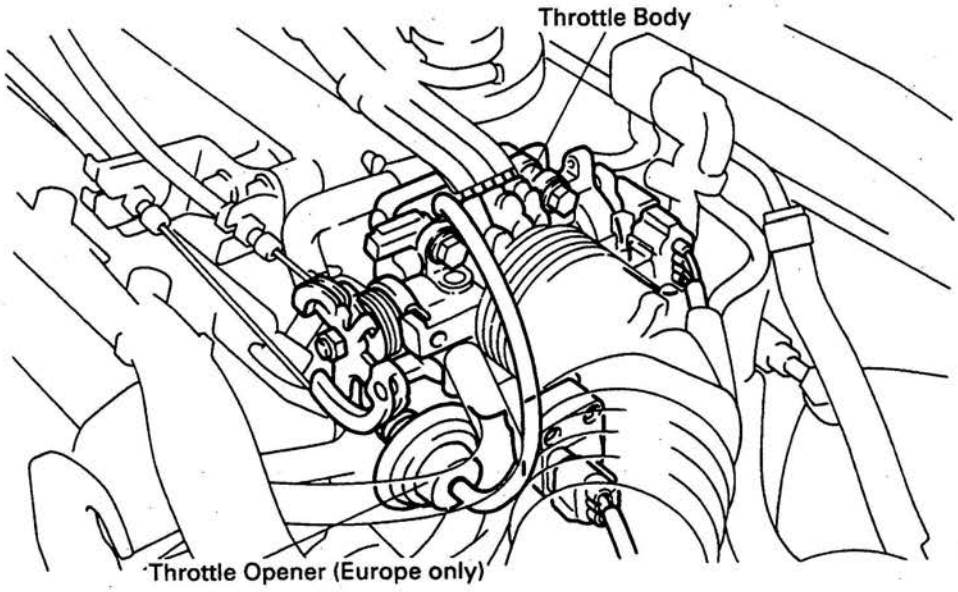
THROTTLE BODY

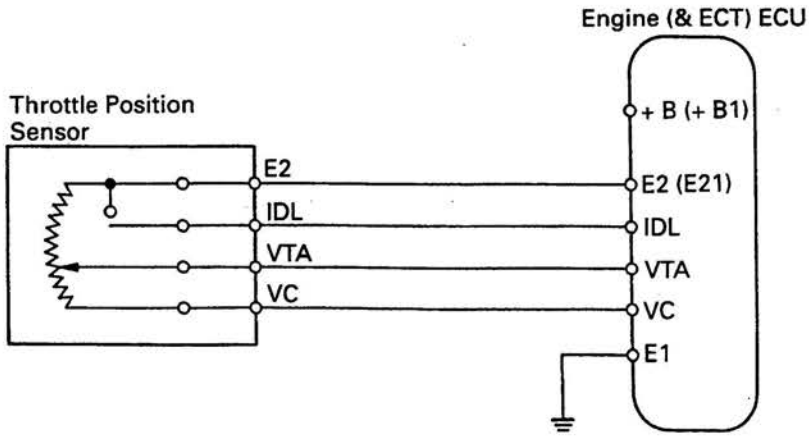
EG13C–05

ST202



ST191





P17024
P13882
P17113

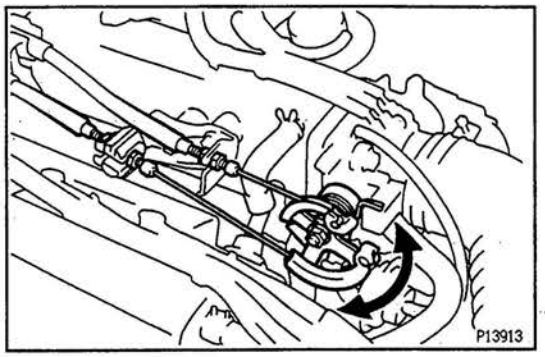
Z11820

EG

EG13E–06

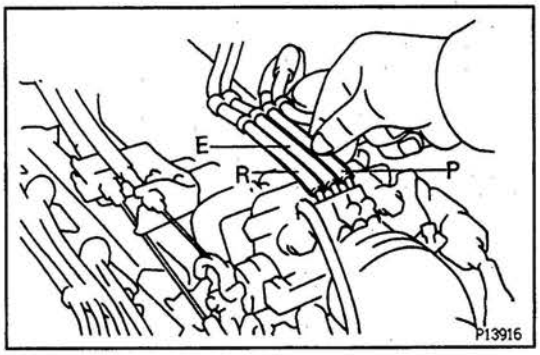
ON–VEHICLE INPSECTION

Throttle Body



INSPECT THROTTLE BODY

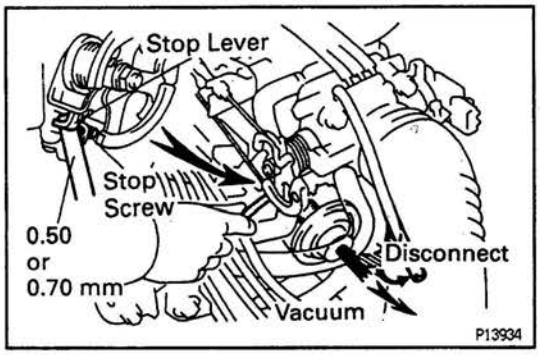
(a) Check that the throttle linkage moves smoothly.

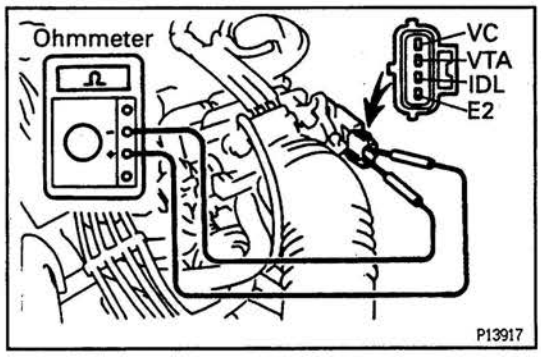


(b) Check the vacuum at each port.
- Start the engine.
- Check the vacuum with the vacuum hoses pick your finger.

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

Throttle Position Sensor





INSPECT THROTTLE POSITION SENSOR

(a) Disconnect the sensor connector.

(b) w/ Throttle Opener:
- Disconnect the vacuum hose from the throttle opener.
- Apply vacuum to the throttle opener.

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

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

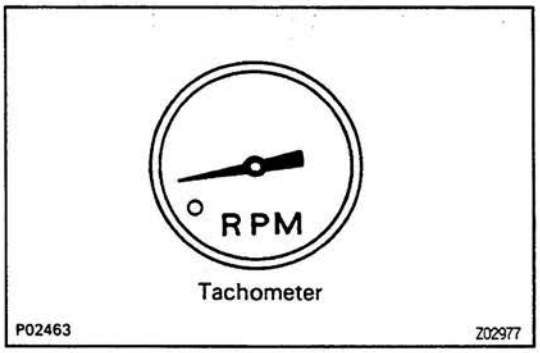
Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
0.50 mm (0.020 in.)	IDL – E2	2.3 kΩ or less
0.70 mm (0.028 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ

(e) w/ Throttle Opener:
Reconnect the vacuum hose to the throttle opener.

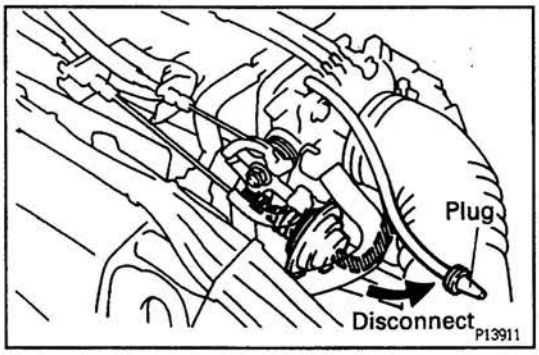
(f) Reconnect the sensor connector.

Throttle Opener

1. **WARM UP ENGINE**
   Allow the engine to warm up to normal operating temperature.
2. **CONNECT TACHOMETER**
   (See step 2 on page EG−25)

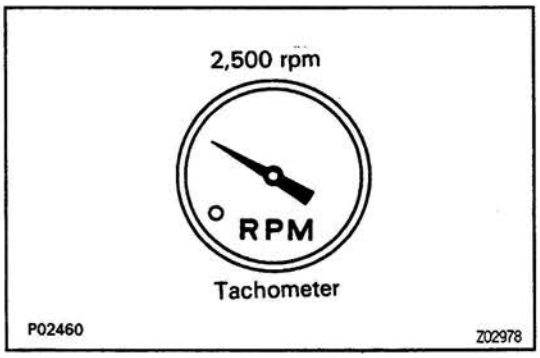


3. **CHECK IDLE SPEED (See page EG−27)**
   Idle speed:
   700 ± 50 rpm

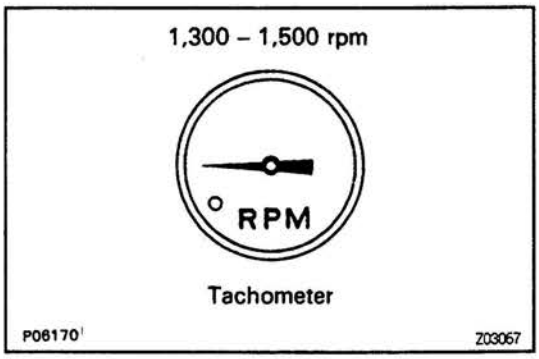


4. **CHECK AND ADJUST THROTTLE OPENER SETTING SPEED**

(a) Disconnect the vacuum hose from the throttle opener, and plug the hose end.

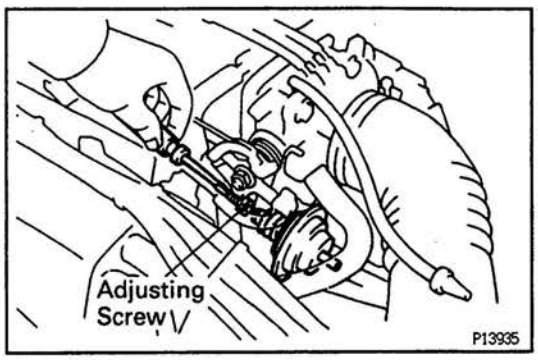


(b) Maintain the engine speed at 2,500 rpm.

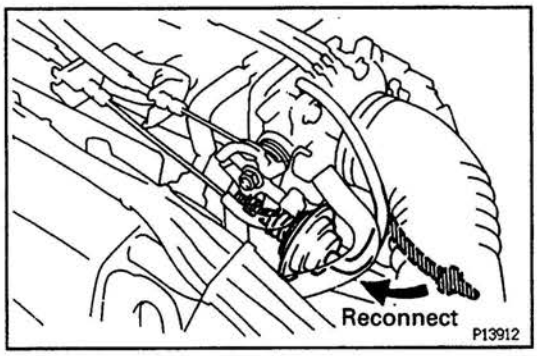


(c) Release the throttle valve.

(d) Check that the throttle opener is set.
Throttle opener setting speed:
1,300 − 1,500 rpm (w/ Cooling fan OFF)
If setting is not as specified, adjust the throttle valve.



(e) Adjust the throttle opener setting speed by turning the throttle opener adjusting screw.
Throttle opener setting speed:
1,400 rpm (w/ Cooling fan OFF)

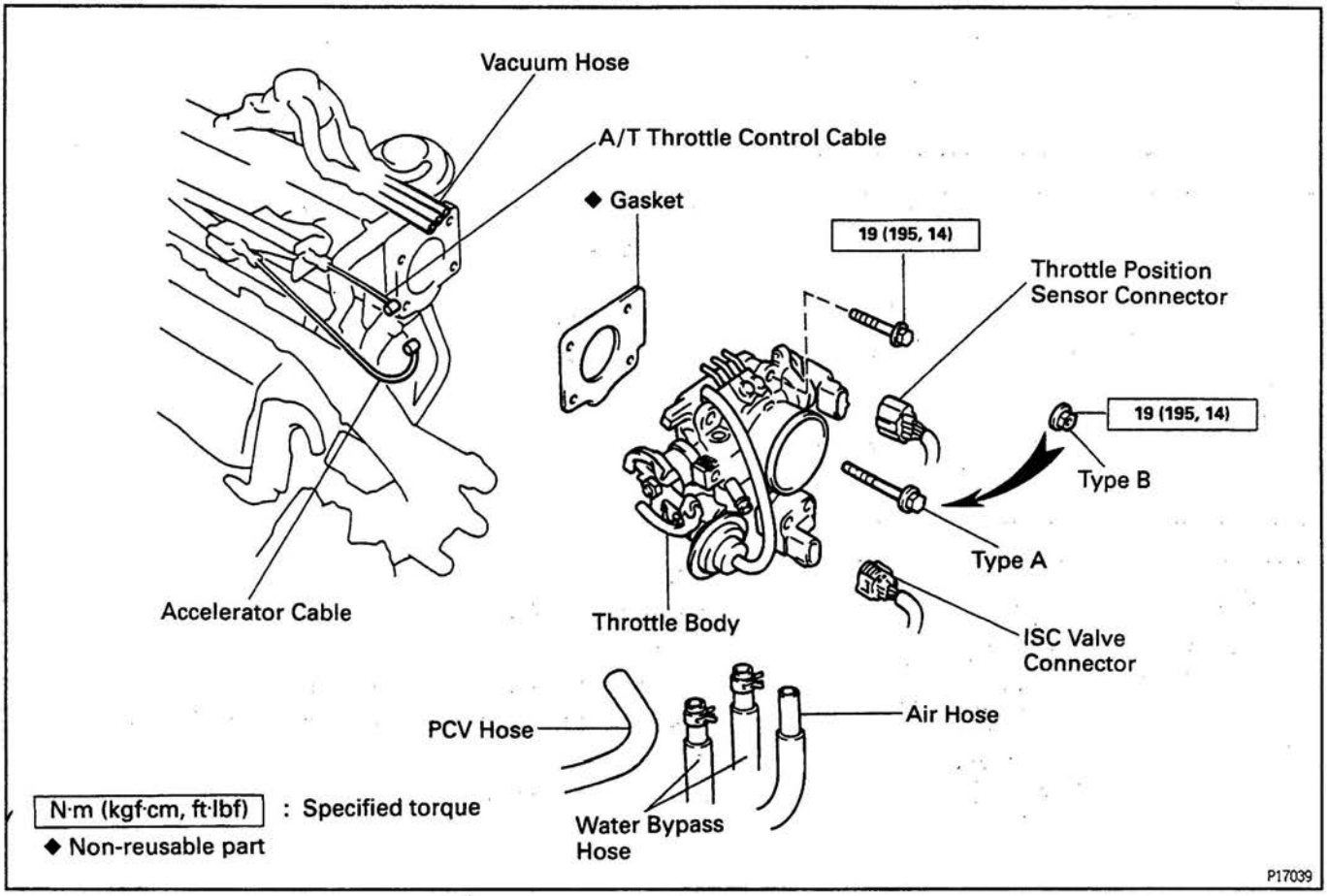


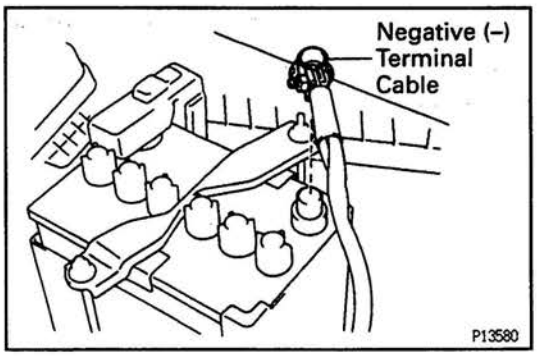
(f) Reconnect the vacuum hose to the throttle opener.

5. DISCONNECT TACHOMETER

EG13Q-0K

COMPONENTS FOR REMOVAL AND INSTALLATION





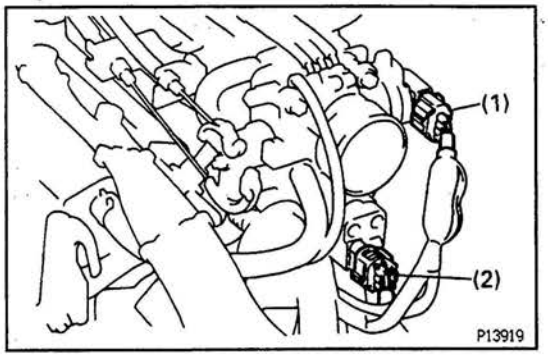
EG3UY-01

THROTTLE BODY REMOVAL

(See Components for Removal and Installation)

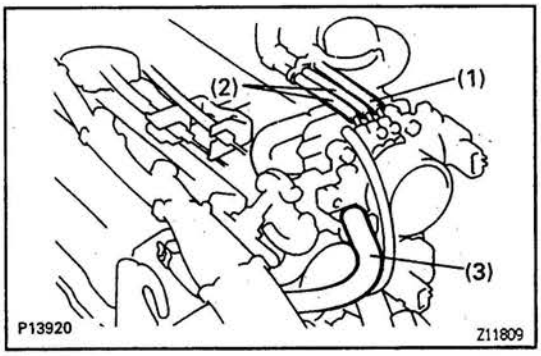
1. **DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**
2. **DRAIN ENGINE COOLANT**
3. **DISCONNECT INTAKE AIR TEMPERATURE SENSOR FROM AIR CLEANER CAP**
4. **REMOVE AIR CLEANER CAP**
5. **DISCONNECT ACCELERTOR CABLE FROM THOTTLE BODY**
6. **A/T:**
   DISCONNECT A/T THOTTLE CABLE FROM THOTTLE BODY

EG

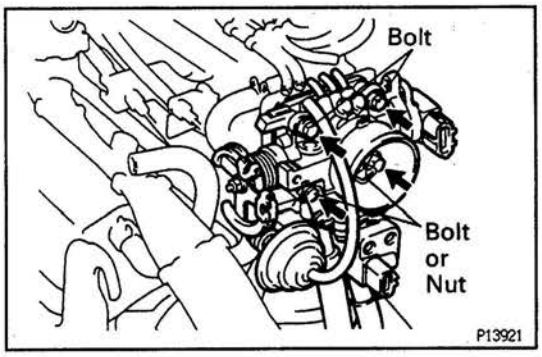


7. DISCONNECT THROTTLE BODY FROM INTAKE MANIFOLD

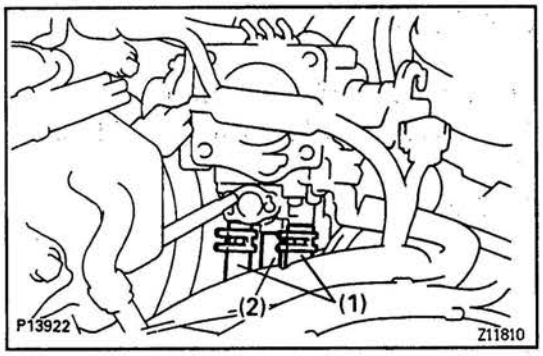
(a) Disconnect the following connectors:
(1) Throttle position sensor connector
(2) ISC valve connector



(b) Disconnect the following hoses:
(1) w/ EVAP:
Vacuum hose
(2) w/ EGR:
Vacuum hoses
(3) PCV hose



(c) Type A:
Remove the 4 bolts.
(d) Type B:
Remove the 2 bolts and 2 nuts.
(e) Disconnect the throttle body from the intake manifold.
(f) Remove the gasket.

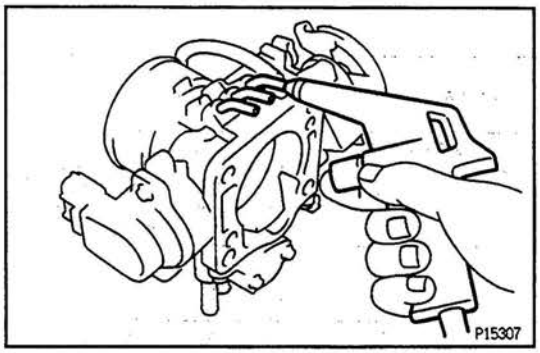


(g) Disconnect the following hoses from the throttle body, and remove the throttle body:
(1) Water bypass hoses
(2) Air hose

EG3UZ-01

THROTTLE BODY INSPECTION

Throttle Body

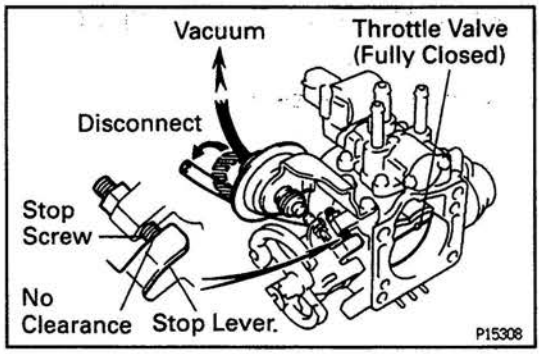


1. CLEAN THROTTLE BODY

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

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

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



2. INSPECT THROTTLE VALVE

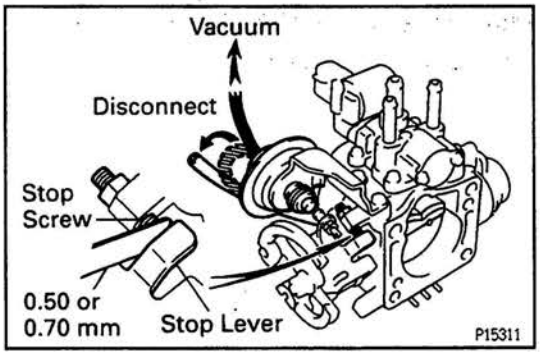
(a) w/ Throttle Opener:

- Disconnect the throttle opener vacuum hose from the throttle body.
- Apply vacuum to the throttle opener.

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

(c) w/ Throttle Opener:
Reconnect the throttle opener vacuum hose to the throttle body.

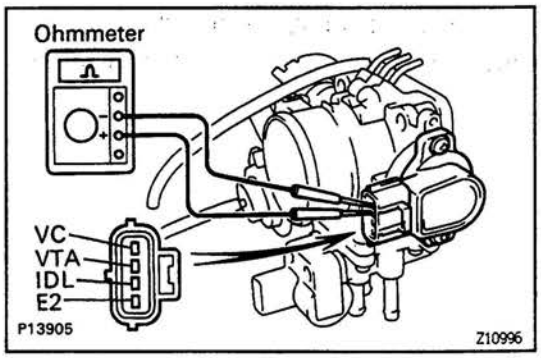
Throttle Position Sensor



1. INSPECT THROTTLE POSITION SENSOR

(a) w/ Throttle Opener:
Apply vacuum to the throttle opener.

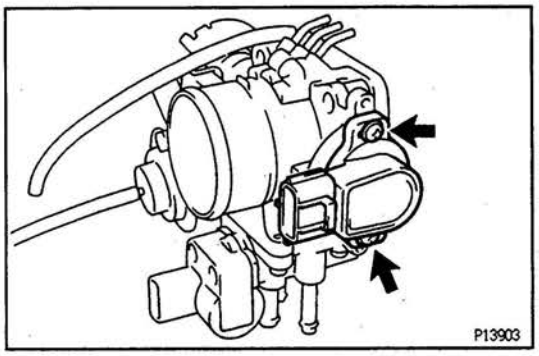
(b) Insert a 0.50 mm (0.020 in.) or 0.70 mm (0.028 in.) feeler gauge between the throttle stop screw and stop lever.



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

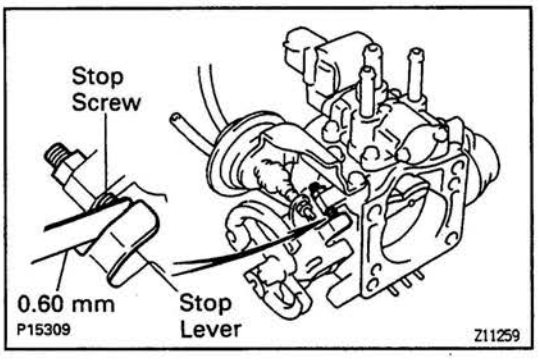
EG

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
0.50 mm (0.020 in.)	IDL – E2	2.3 kΩ or less
0.70 mm (0.028 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ

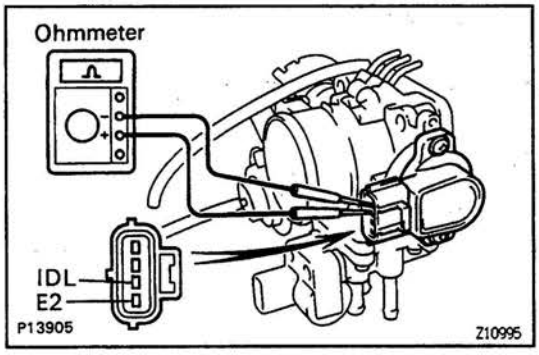


2. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

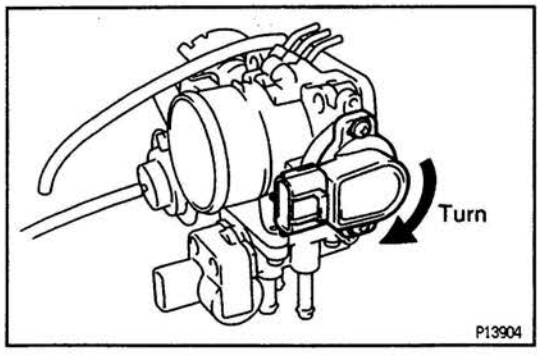
(a) Loosen the 2 set screws of the sensor.



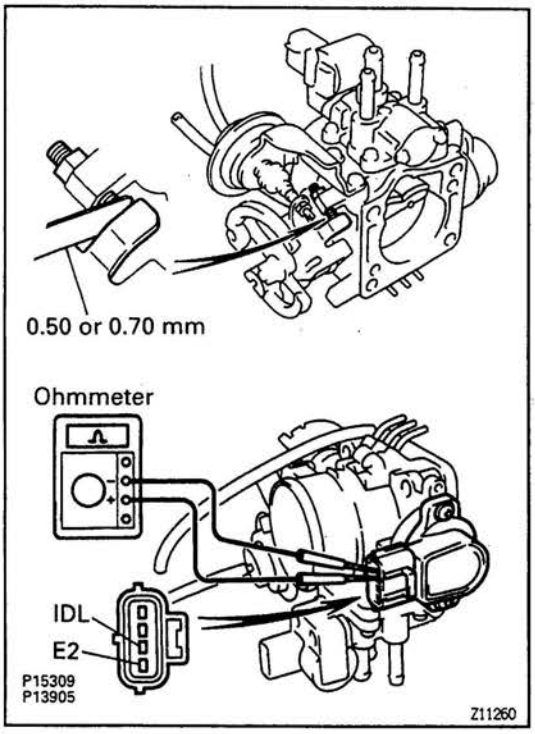
(b) Insert a 0.60 mm (0.024 in.) feeler gauge between the throttle stop screw and stop lever.



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



(d) Gradually turn the sensor clockwise until the ohmmeter deflects, and secure it with the 2 set screws.

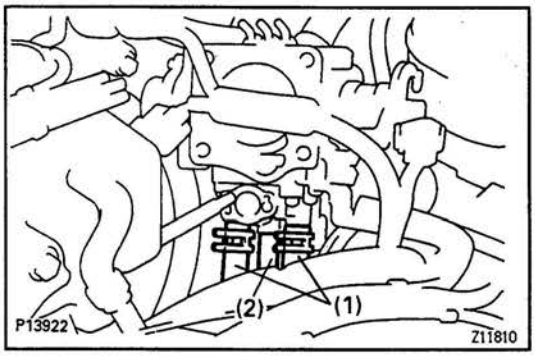


(e) Recheck the continuity between terminals IDL and E2.

Clearance between lever and stop screw	Continuity (IDL – E2)
0.50 mm (0.020 in.)	Continuity
0.70 mm (0.028 in.)	No continuity

(f) w/ Throttle Opener:
Reconnect the throttle opener vacuum hose to the throttle body.

EG



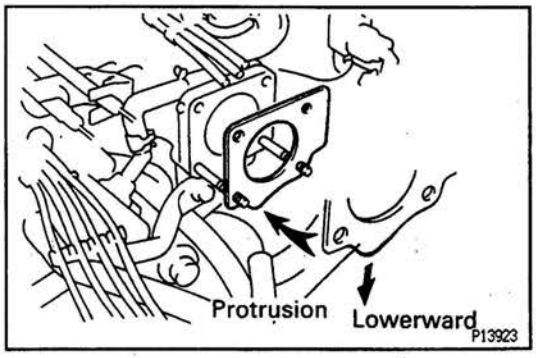
THROTTLE BODY INSTALLATION

EG3M8-02

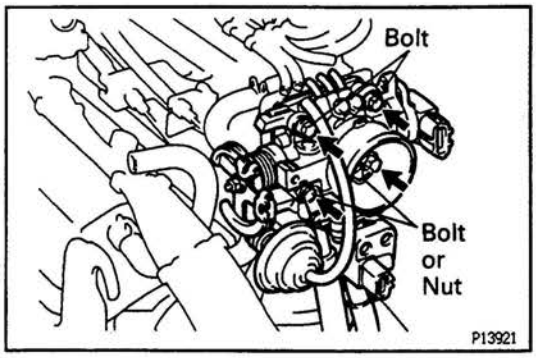
(See Components for Removal and Installation)

1. INSTALL THROTTLE BODY

(a) Connect the following hoses to the throttle body:
(1) Water bypass hoses
(2) Air hose



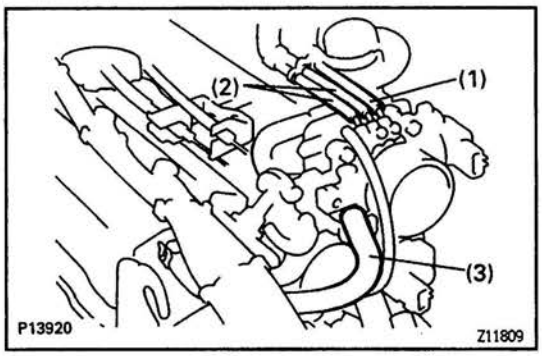
(b) Place a new gasket on the intake manifold, facing the protrusion lowerward.



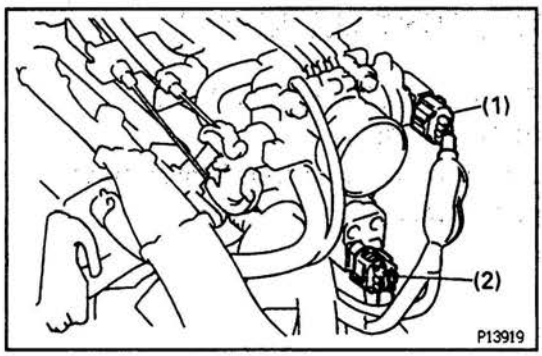
(c) Type A:
Install the throttle body with the 4 bolts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)
HINT: Different bolt lengths are used for the upper and lower sides.

Bolt length:
Upper side: 40 mm (1.59 in.)
Lower side: 55 mm (2.17 in.)

(d) Type B:
Install the throttle body with the 2 bolts and 2 nuts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



(e) Connect the following hoses:
(1) w/ EVAP:
Vacumm hose
(2) w/ EGR:
Vacumm hoses
(3) PCV hose



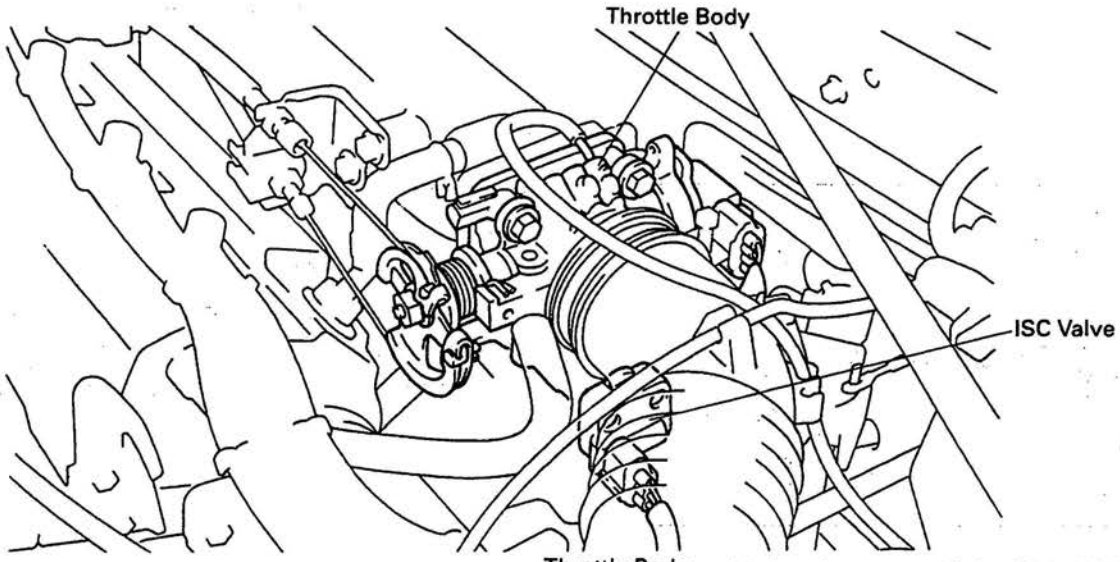
(f) Connect the following connectors:
(1) Throttle position sensor connector
(2) ISC valve connector

2. A/T:
CONNECT A/T THROTTLE CABLE FROM THROTTLE BODY
3. CONNECT ACCELERTOR CABLE FROM THROTTLE BODY
4. INSTALL AIR CLEANER CAP
5. CONNECT INTAKE AIR TEMPERATURE SENSOR TO AIR CLEANER CAP
6. FILL WITH ENGINE COOLANT
7. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

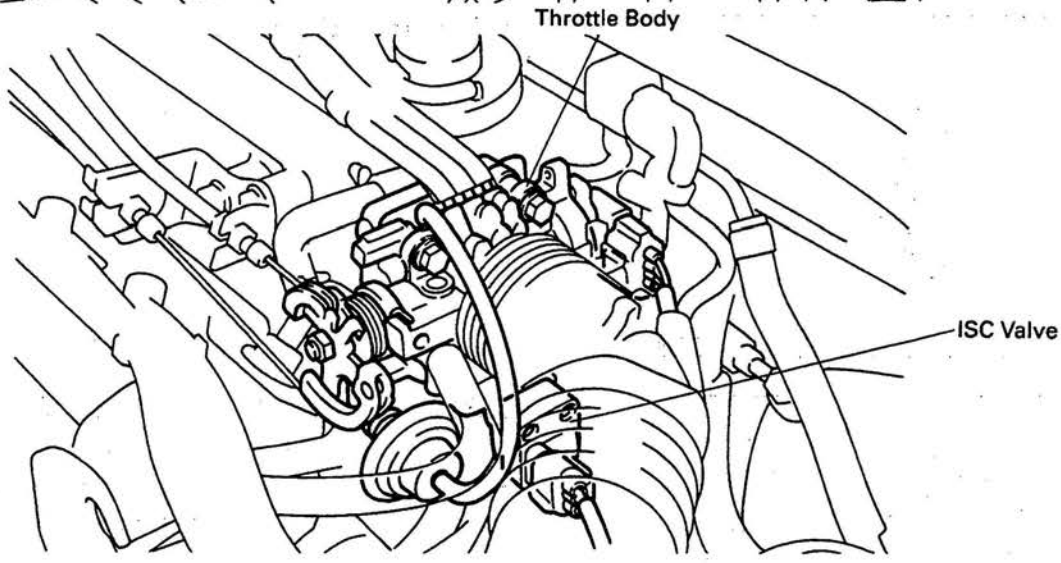
ISC VALVE

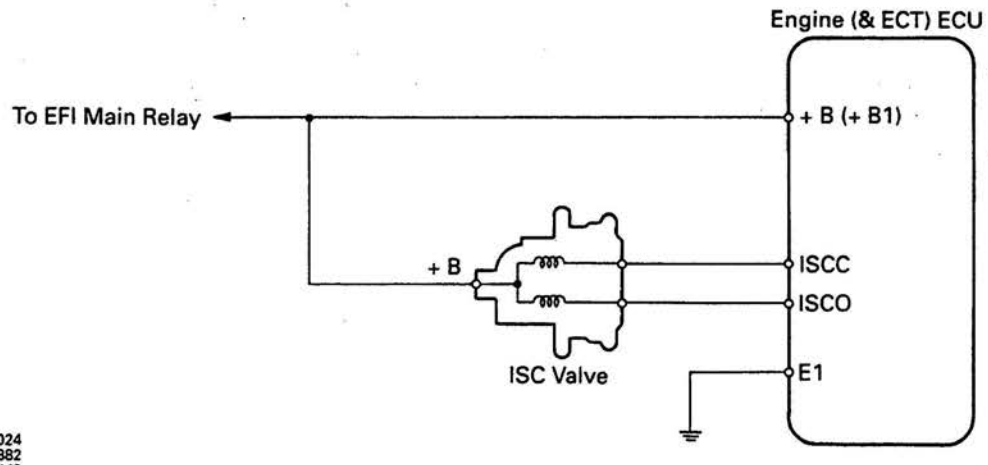
EG

ST202



ST191





P17024
P13882
P14449

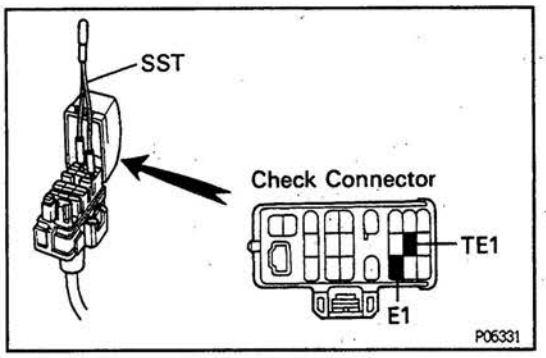
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EG00L-00

ON–VEHICLE INSPECTION

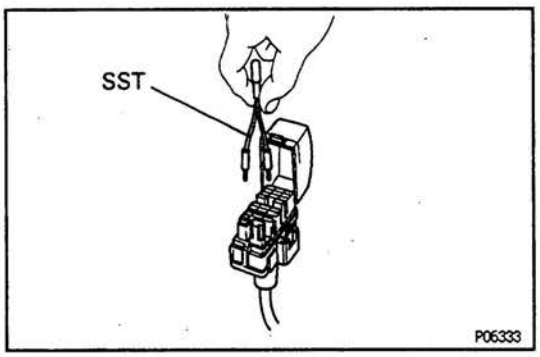
1. INSPECT ISC VALVE OPERATION

(a) Initial conditions:
- Engine at normal operating temperature
- Idle speed set correctly
- Transmission in neutral position

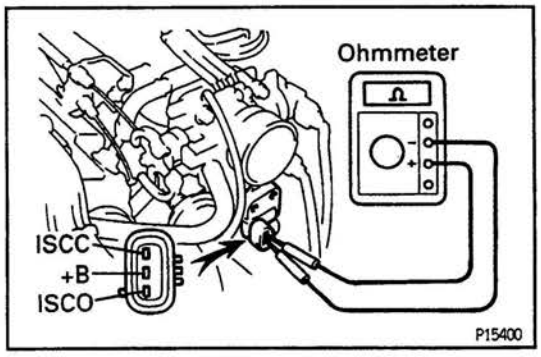


(b) Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843–18020

(c) After engine rpm is kept at 900 – 1,300 rpm for 5 seconds, check that it returns to idle speed.
If the rpm operation is not as specified, check the ISC valve, wiring and ECU.



(d) Remove the SST form the check connector.
SST 09843–18020



2. INSPECT ISC VALVE RESISTANCE

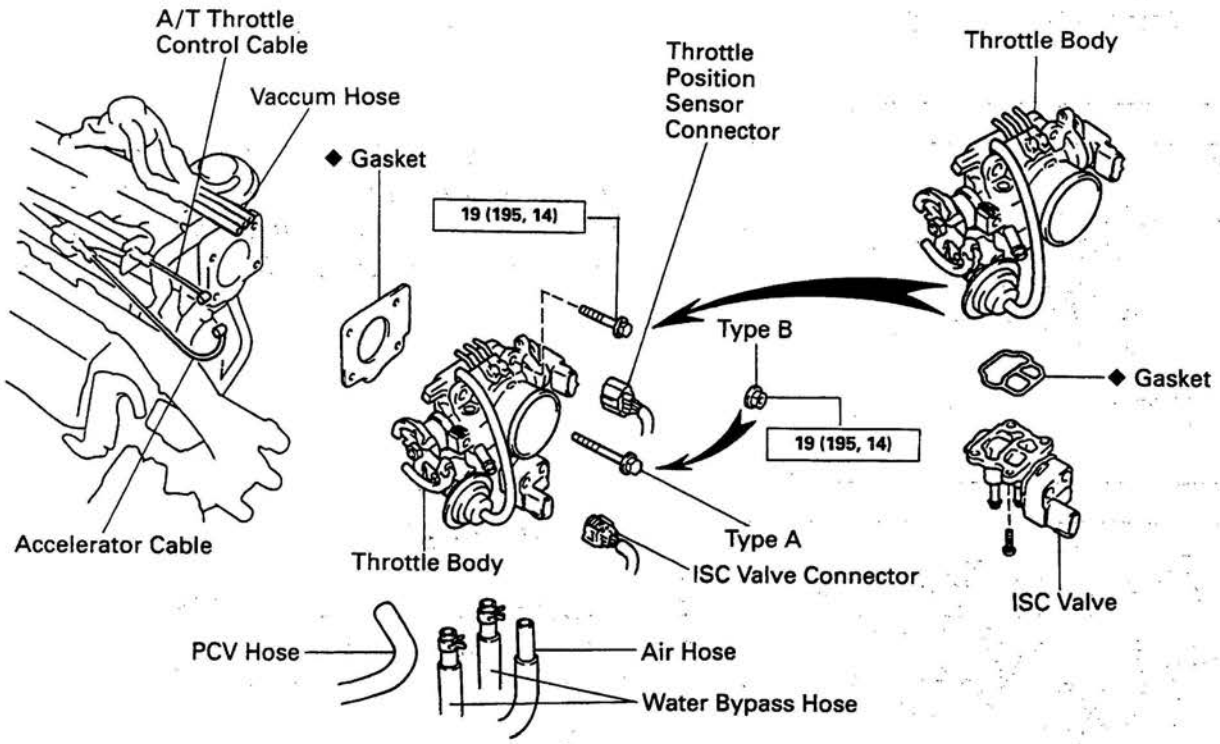
(a) Disconnect the ISC valve connector.

(b) Using an ohmmeter, measure the resistance between terminal +B and other terminals (ISCC, ISCO).
Resistance:
19.3 – 22.3 Ω at 20°C (68°F)
If resistance is not as specified, replace the ISC valve.

(c) Reconnect the ISC valve connector.

EG13R-0A

COMPONENTS FOR REMOVAL AND INSTALLATION



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

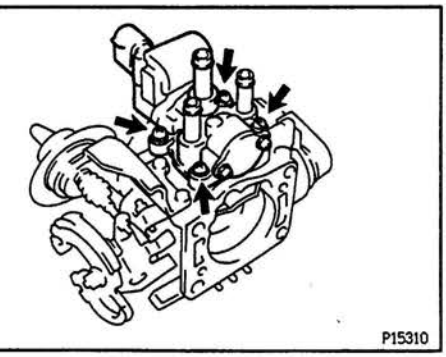
P17025

EG3V0-01

ISC VALVE REMOVAL

(See Components for Removal and Installation)

1. **REMOVE THROTTLE BODY**
   (See page EG–251)



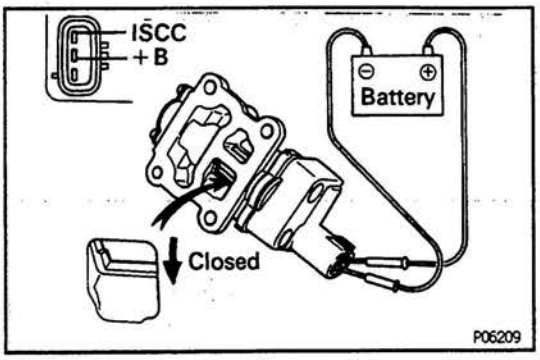
P15310

2. **REMOVE ISC VALVE**
   Remove the 4 screws, ISC valve and gasket.

EG

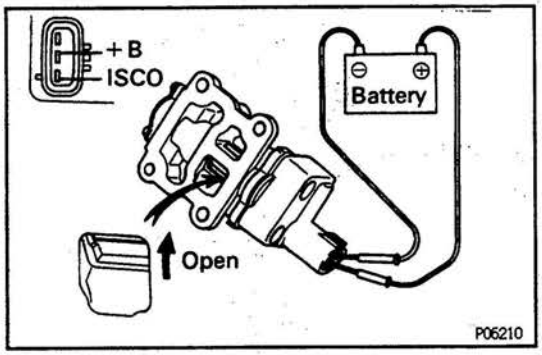
EGODN-0E

ISC VALVE INSPECTION



INSPECT ISC VALVE OPERATION

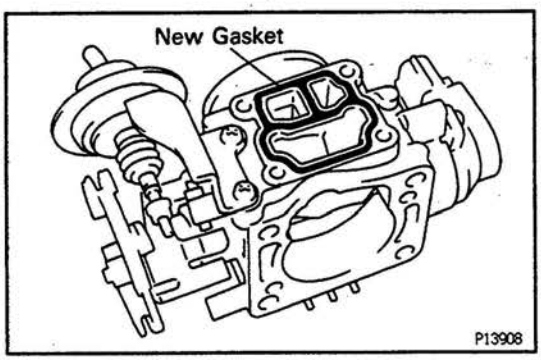
(a) Connect the positive (+) lead from the battery to terminal +B and negative (–) lead to terminal ISCC, and check that the valve is closed.



(b) Connect the positive (+) lead from the battery to terminal +B and negative (–) lead to terminal ISCO, and check that the valve is open.
If operation is not as specified, replace the ISC valve.

EG3V1-01

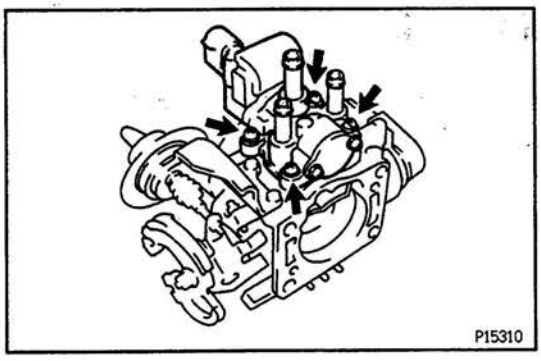
ISC VALVE INSTALLATION



(See Components for Removal and Installation)

1. INSTALL ISC VALVE

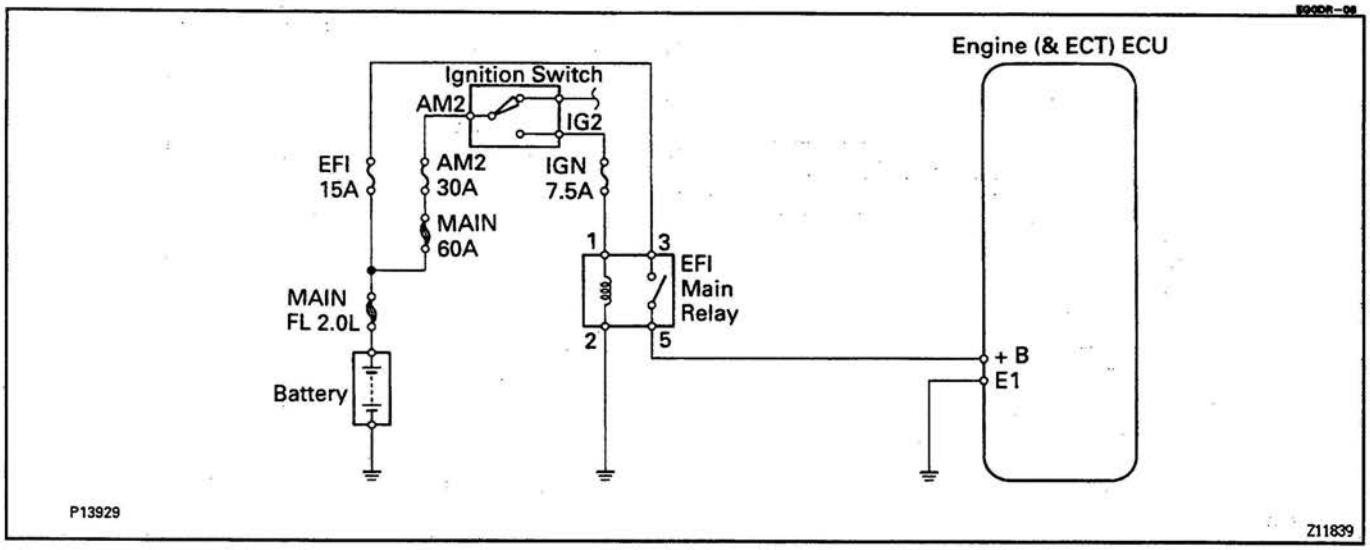
(a) Place a new gasket on the throttle body.

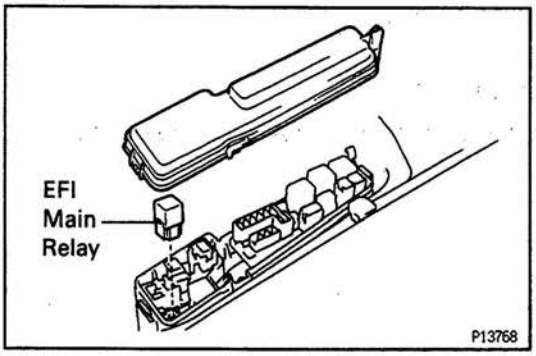


(b) Install the ISC valve with the 4 screws.

2. INSTALL THROTTLE BODY
(See page EG–255)

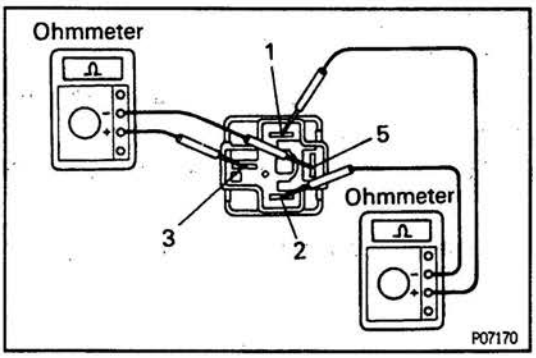
EFI MAIN RELAY (ST202)





EFI MAIN RELAY INSPECTION

1. **REMOVE EFI MAIN RELAY**
   LOCATION: In the engine compartment relay box.



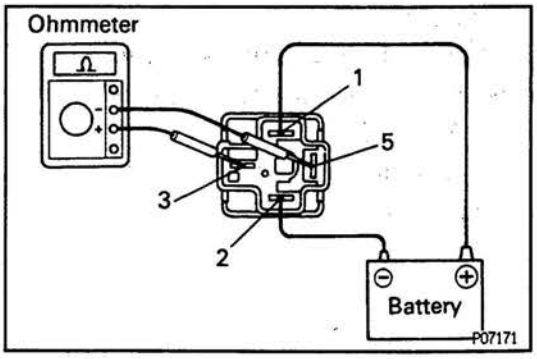
2. **INSPECT EFI MAIN RELAY**

A. 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.

If continuity is not as specified, replace the relay.



B. Inspect relay operation

(a) Apply battery voltage across terminals 1 and 2.

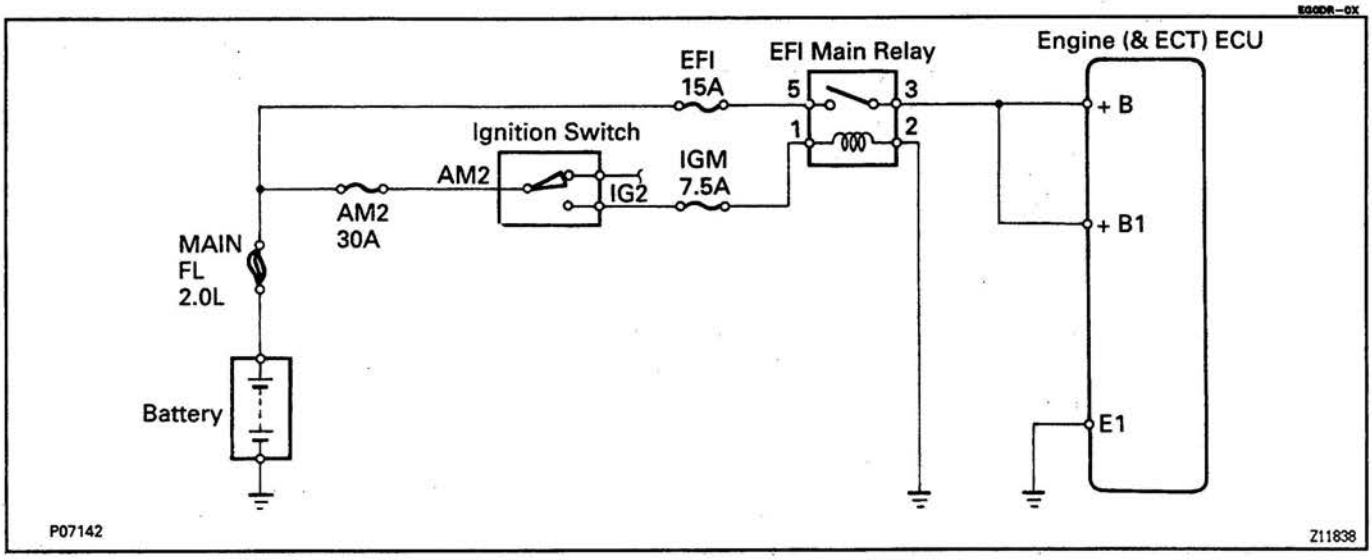
(b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

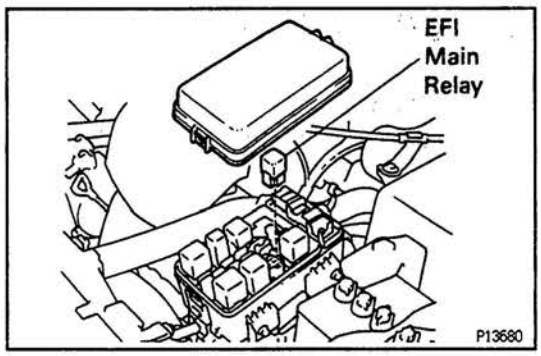
If operation is not as specified, replace the relay.

3. **REINSTALL EFI MAIN RELAY**

EFI MAIN RELAY (ST191)

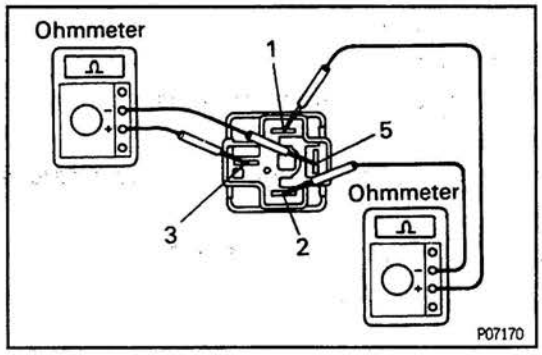
EG





EFI MAIN RELAY INSPECTION

1. **REMOVE EFI MAIN RELAY**
   LOCATION: In the engine compartment relay box.



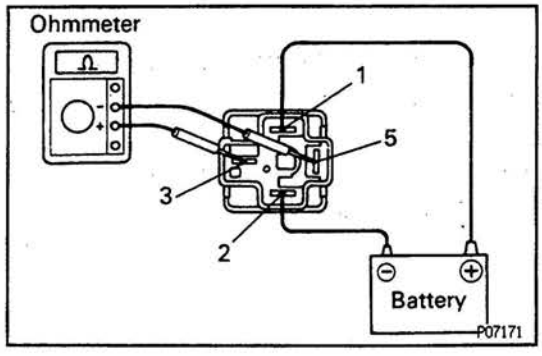
2. **INSPECT EFI MAIN RELAY**

A. 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.

If continuity is not as specified, replace the relay.



B. Inspect relay operation

(a) Apply battery voltage across terminals 1 and 2.

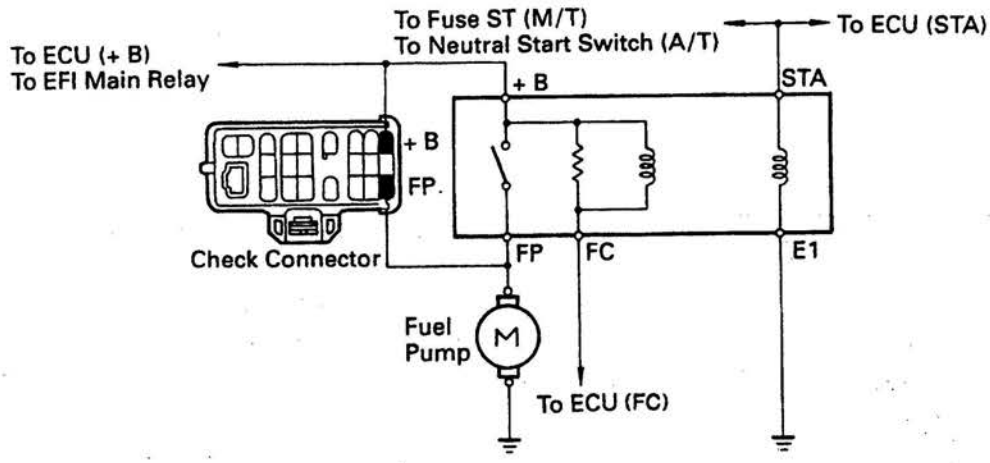
(b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If operation is not as specified, replace the relay.

3. **REINSTALL EFI MAIN RELAY**

CIRCUIT OPENING RELAY

EG00T-0H

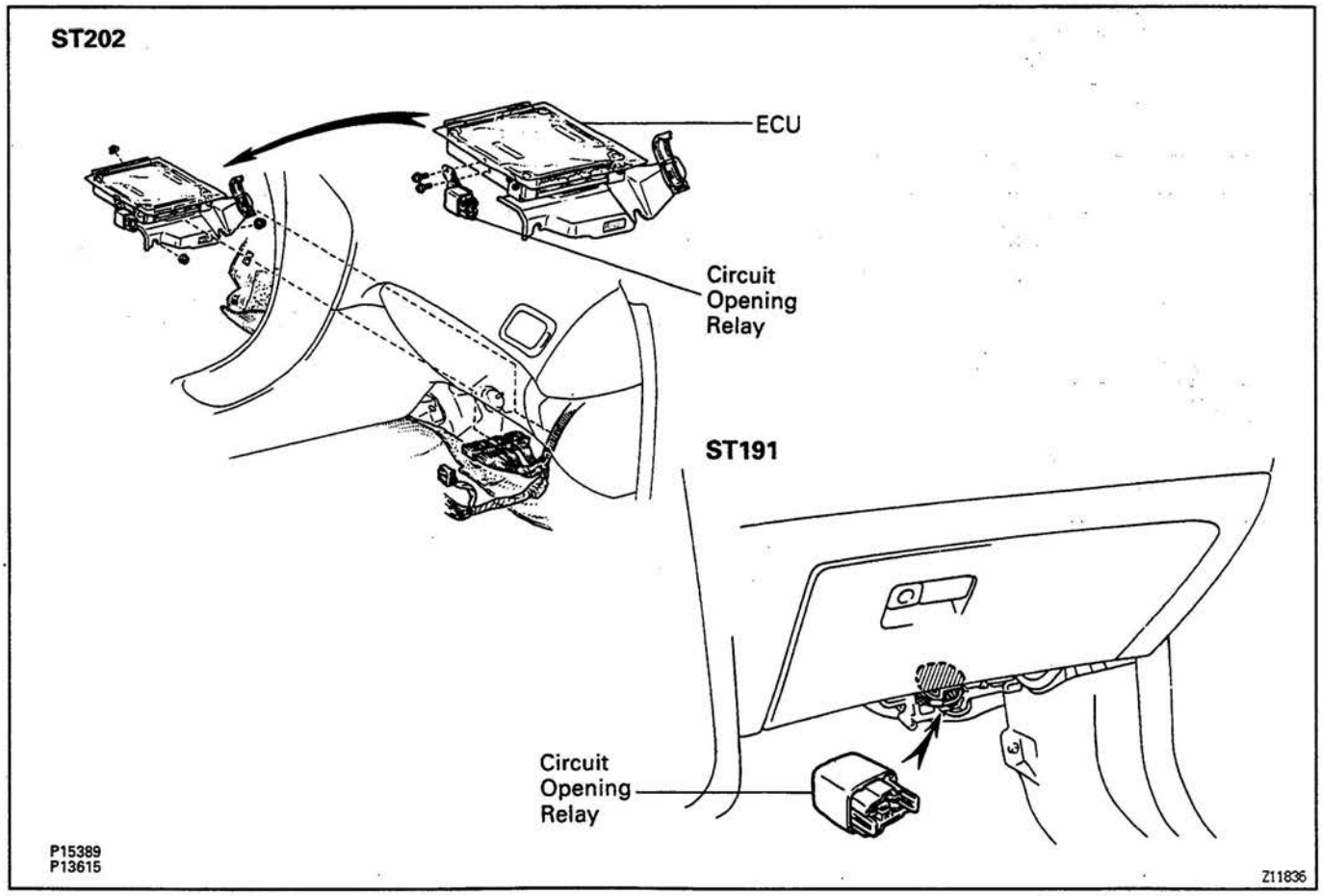


P07157

Z11871

EG14F-0D

COMPONENTS FOR REMOVAL AND INSTALLATION



P15389
P13615

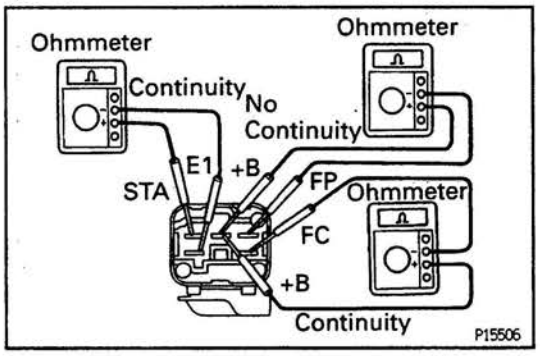
Z11836

CIRCUIT OPENING RELAY INSPECTION E03JF-02

(See Components for Removal and Installation)

1. REMOVE CIRCUIT OPENING RELAY

EG



2. INSPECT CIRCUIT OPENING RELAY

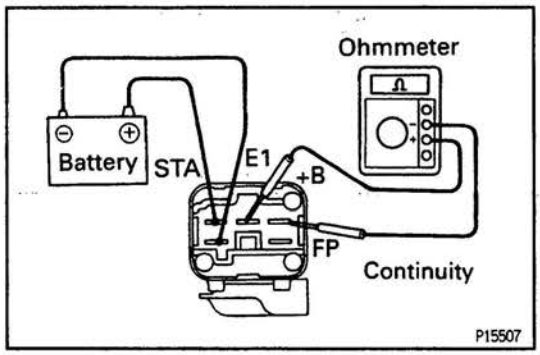
A. Inspect relay continuity

(a) Using and 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.

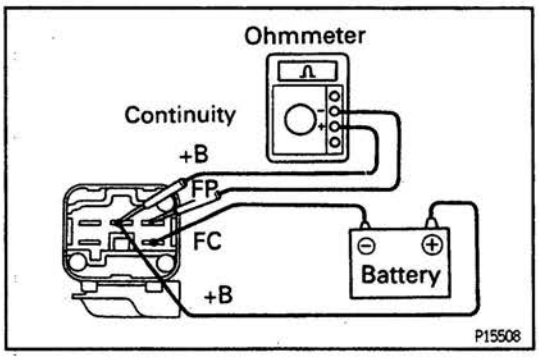
If continuity is not as specified, replace the relay.



B. Inspect relay operation

(a) Apply battery voltage across terminals STA and E1.

(b) Using an ohmmeter, check that there is continuity between terminals +B and FP.



(c) Apply battery voltage across terminals +B and FC.

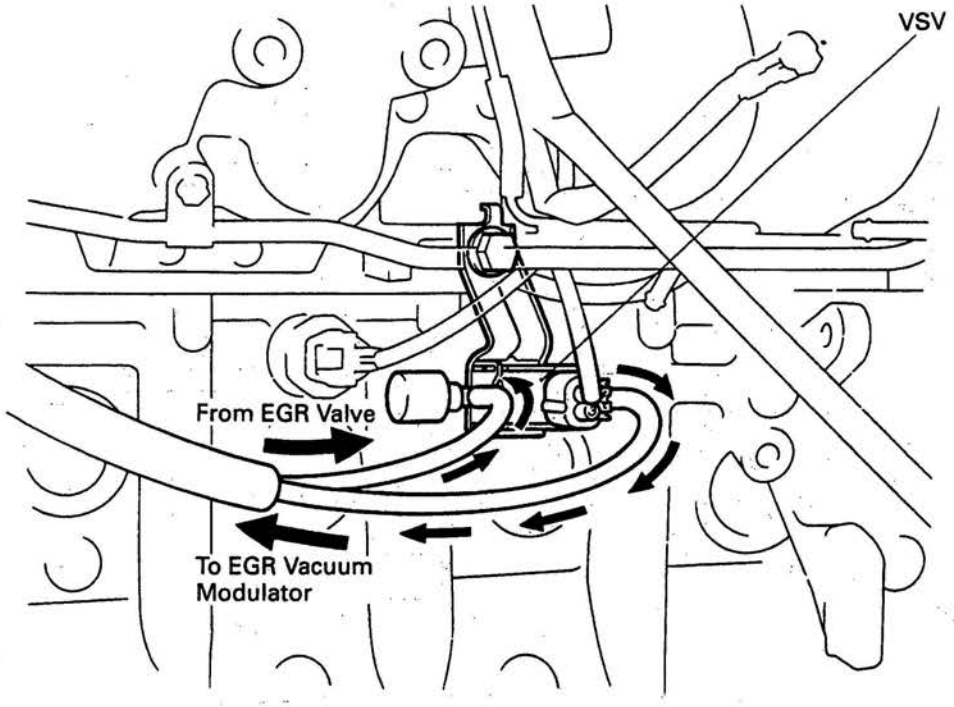
(d) Check that there is continuity between terminals +B and FP.

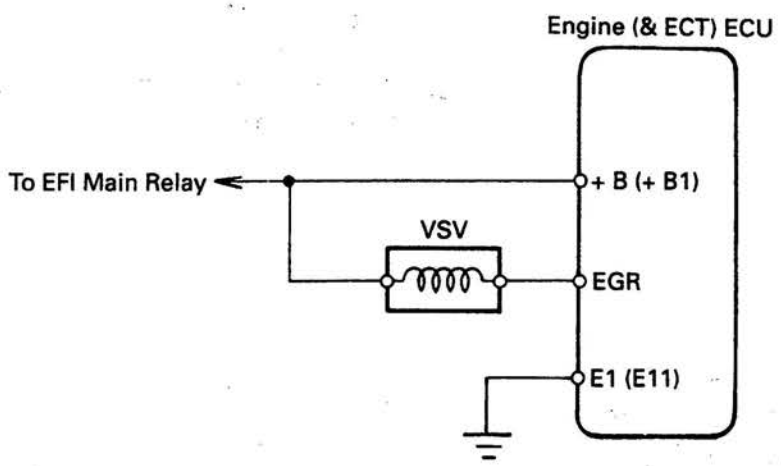
If operation is not as specified, replace the relay.

3. REINSTALL CIRCUIT OPENING RELAY

VSV FOR EGR

EGOU0-01





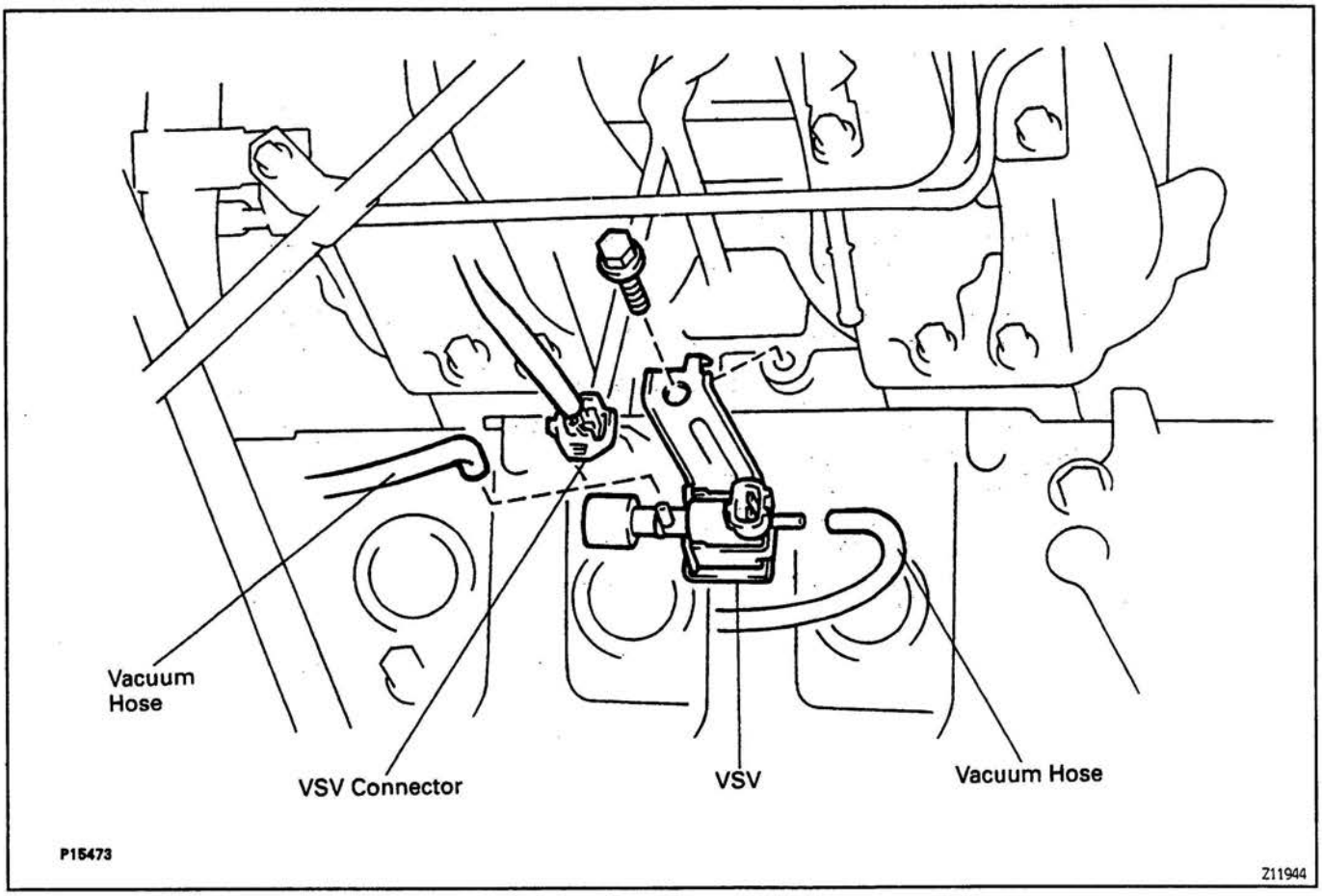
P13883
P01447

Z11843

EG

EG0E2-1V

COMPONENTS FOR REMOVAL AND INSTALLATION

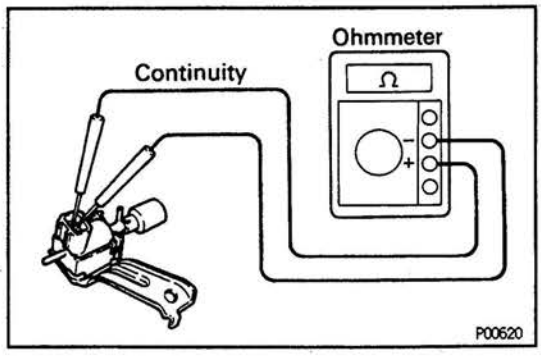


EG2Z4-08

VSV INSPECTION

(See Components for Removal and Installation)

1. REMOVE VSV



2. INSPECT VSV

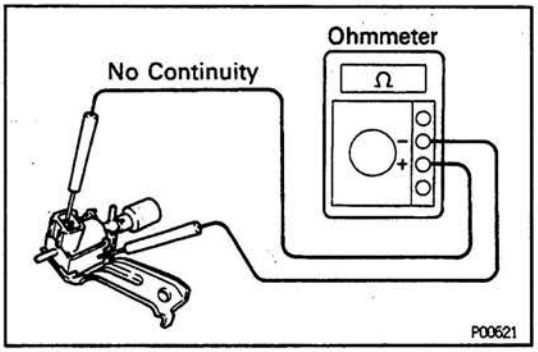
A. Inspect VSV for open circuit

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

Resistance:

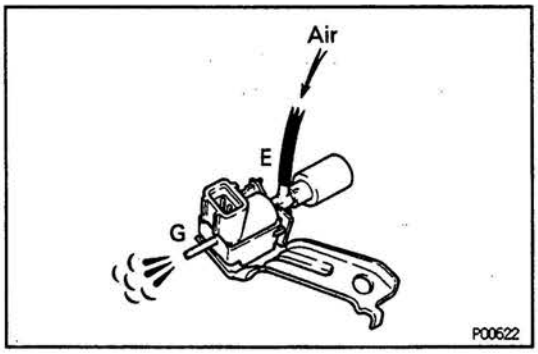
33 – 39 Ω at 20°C (68°F)

If there is no continuity, replace the VSV.



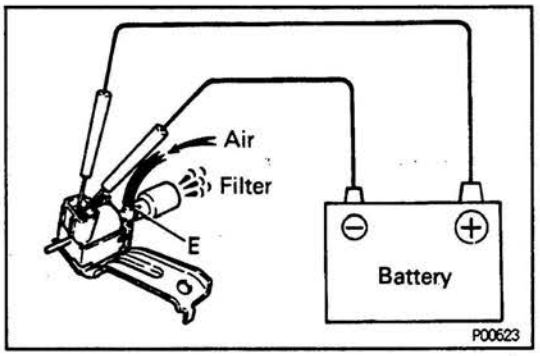
B. Inspect VSV for ground

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



C. Inspect VSV operation

(a) Check that air does not flow from ports E to G.



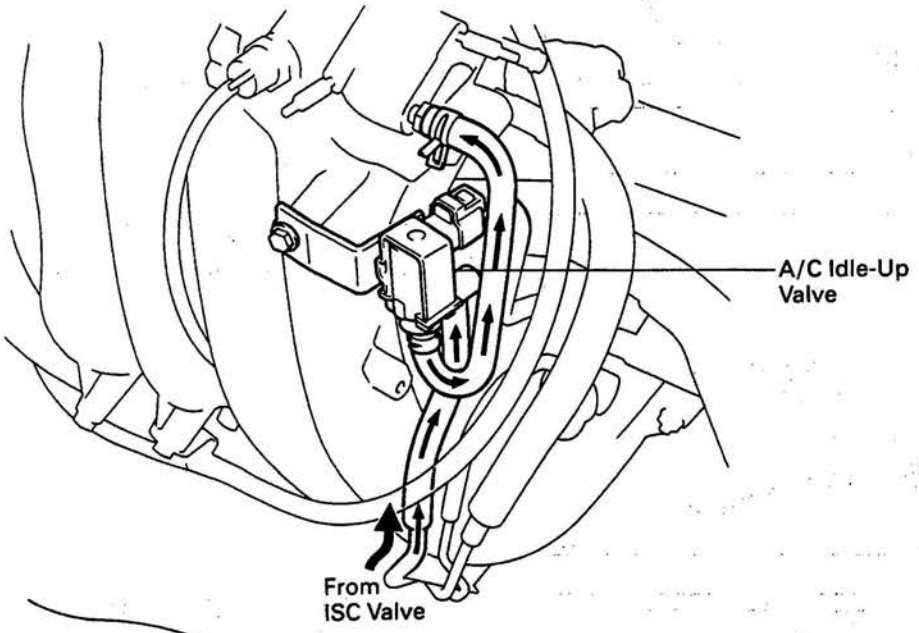
(b) Apply battery voltage across the terminals.
(c) Check that air flows from port E to the filter.
If operation is not as specified, replace the VSV.

3. REINSTALL VSV

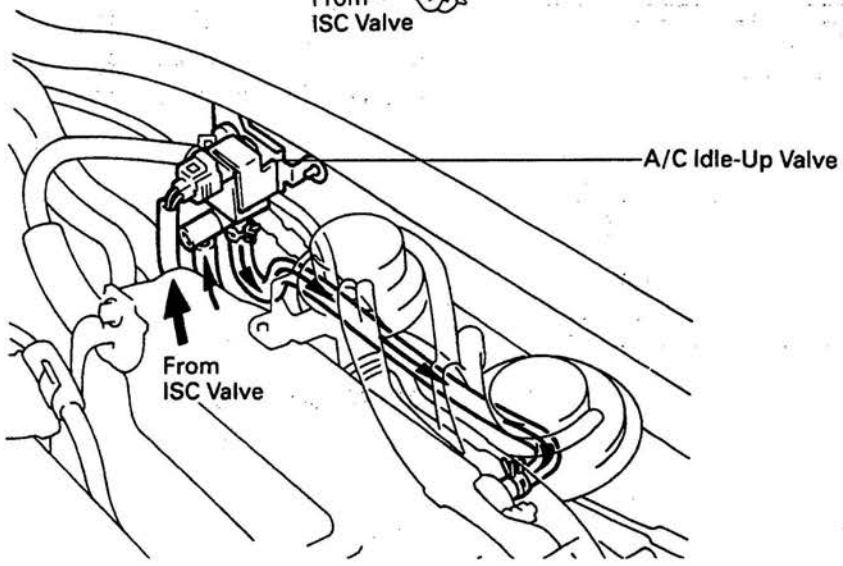
A/C IDLE–UP VALVE

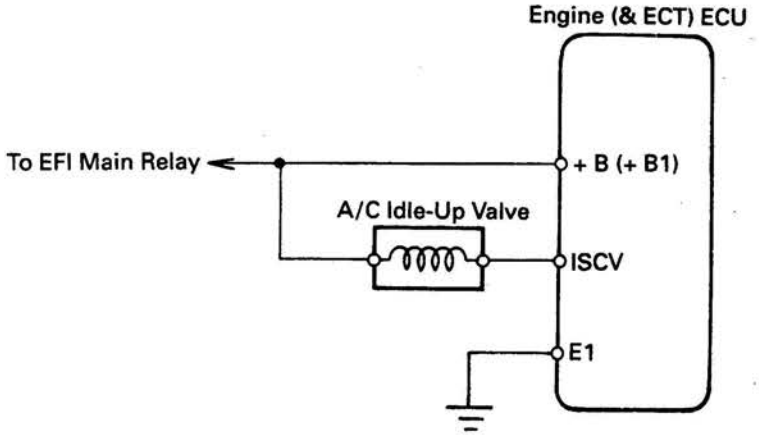
EG

ST202



ST191





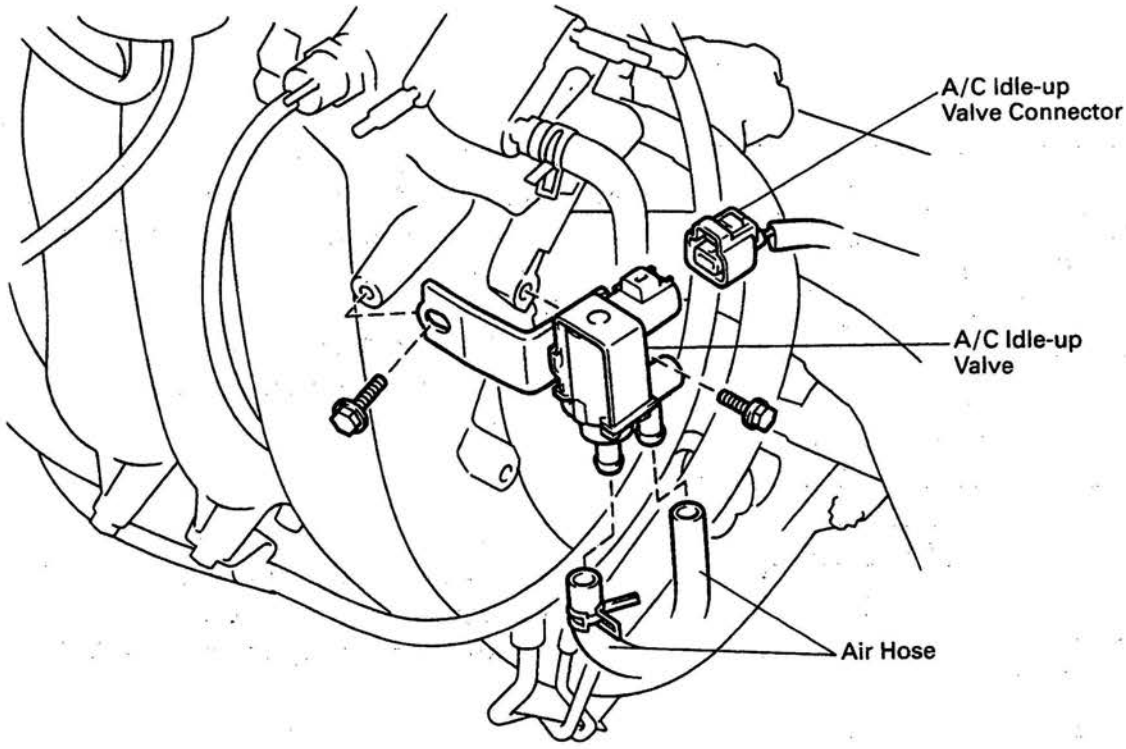
P17134
P17137
P01447

Z11846

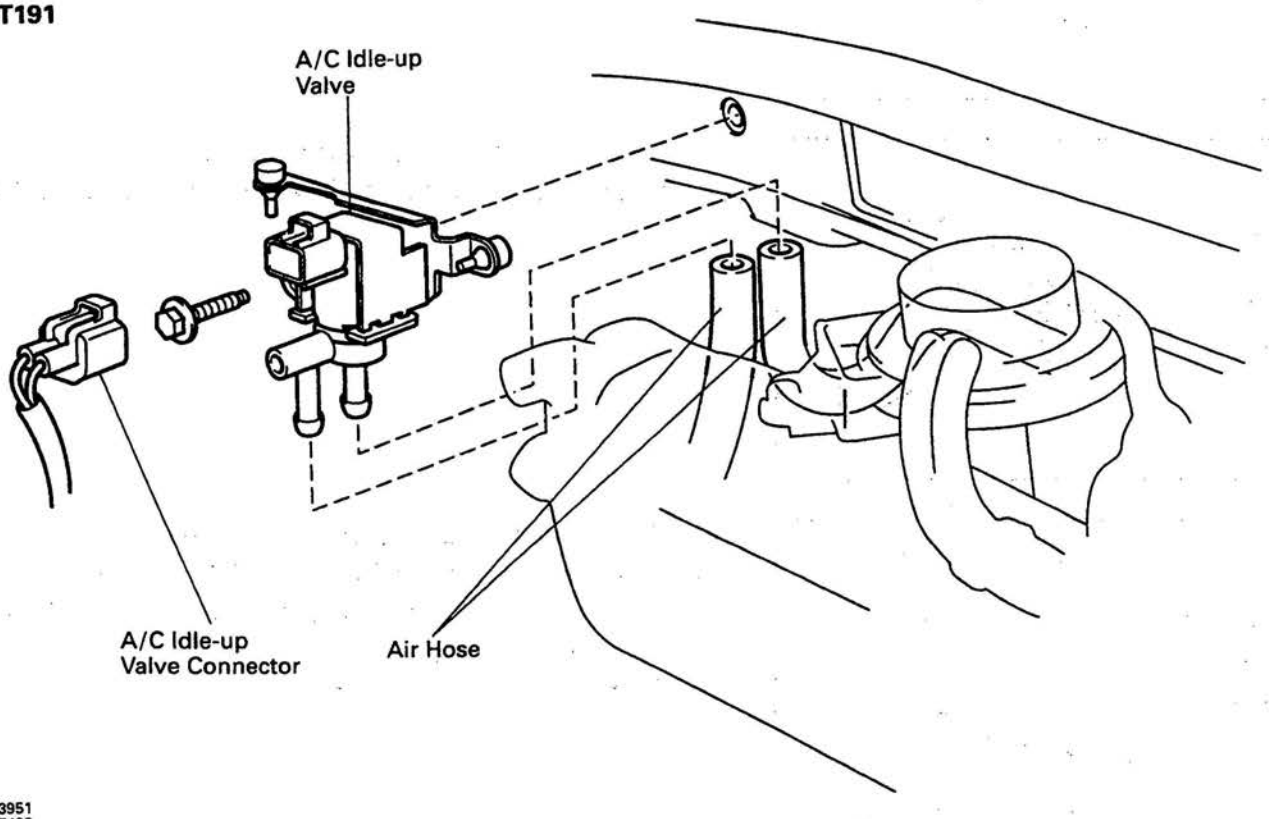
B90E2-1X

COMPONENTS FOR REMOVAL AND INSTALLATION

ST202



ST191



P13951
P17499

Z12005

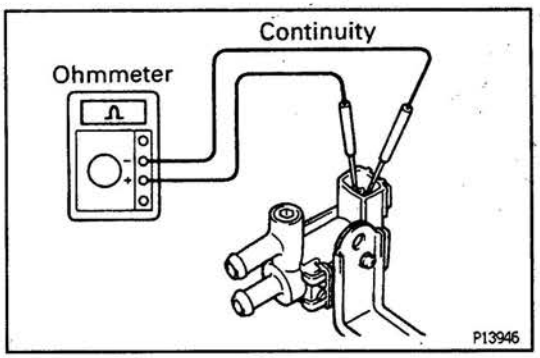
EG3V2-01

A/C IDLE–UP VALVE INSPECTION

(See Components for Removal and Installation)

1. REMOVE A/C IDLE–UP VALVE

EG



2. INSPECT A/C IDLE–UP VALVE

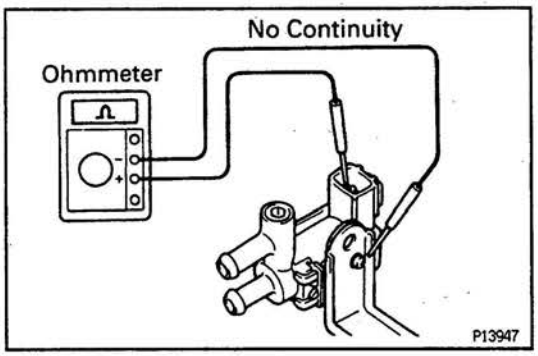
A. Inspect A/C idle–up valve for open circuit

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

Resistance:

30 – 34 Ω at 20°C (68°F)

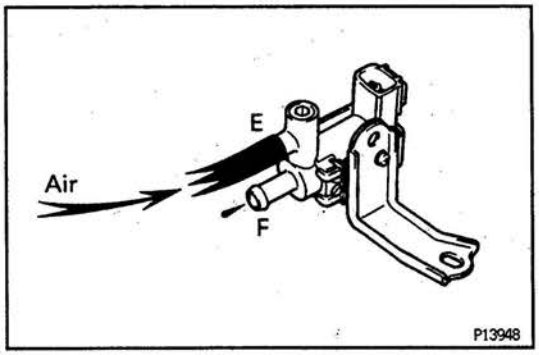
If there is no continuity, replace the A/C idle–up valve.



B. Inspect A/C idle–up valve for ground

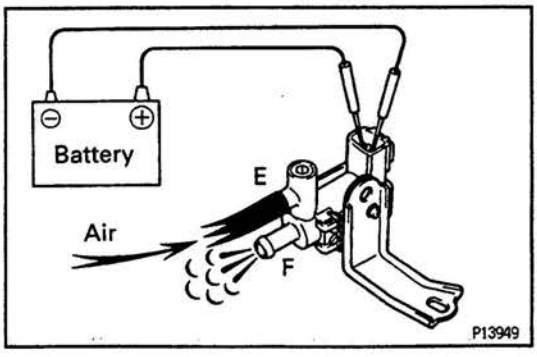
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the A/C idle–up valve.



C. Inspect A/C idle–up valve operation

(a) Check that air does not flow from port E to port F.



(b) Apply battery voltage across the terminals.

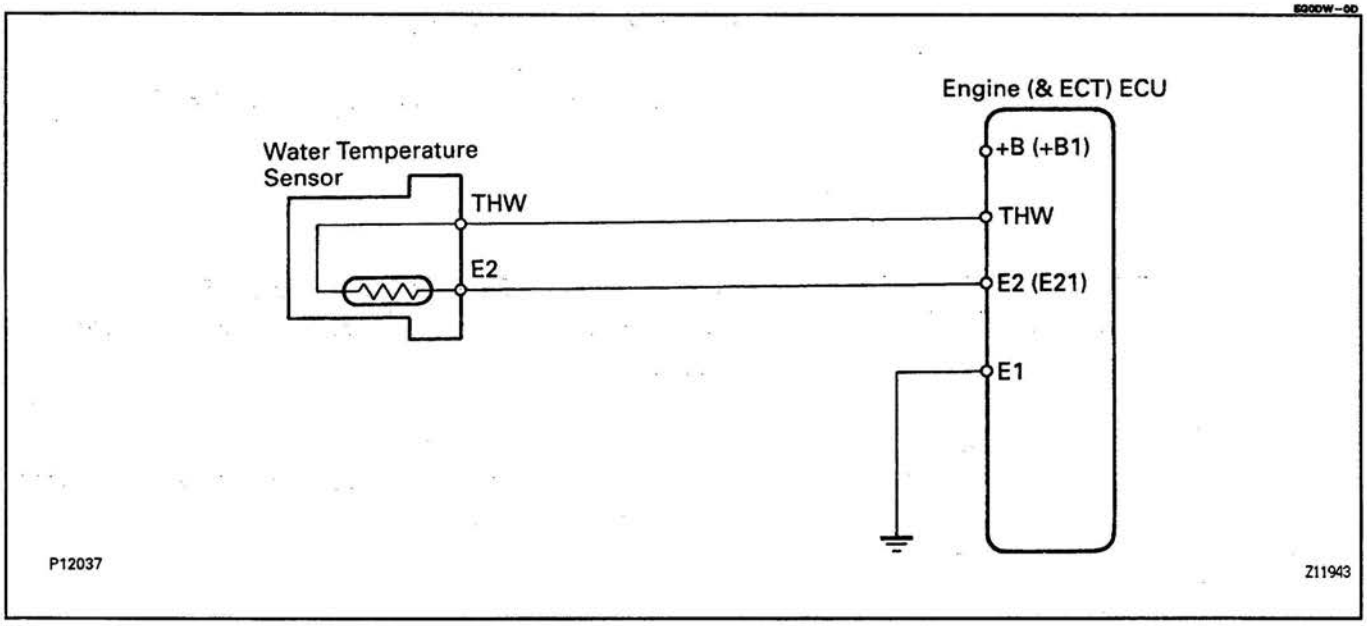
(c) Check that air flows from port E to port F.

If operation is not as specified, replace the A/C idle–up valve.

3. REINSTALL A/C IDLE–UP VALVE

WATER TEMPERATURE SENSOR

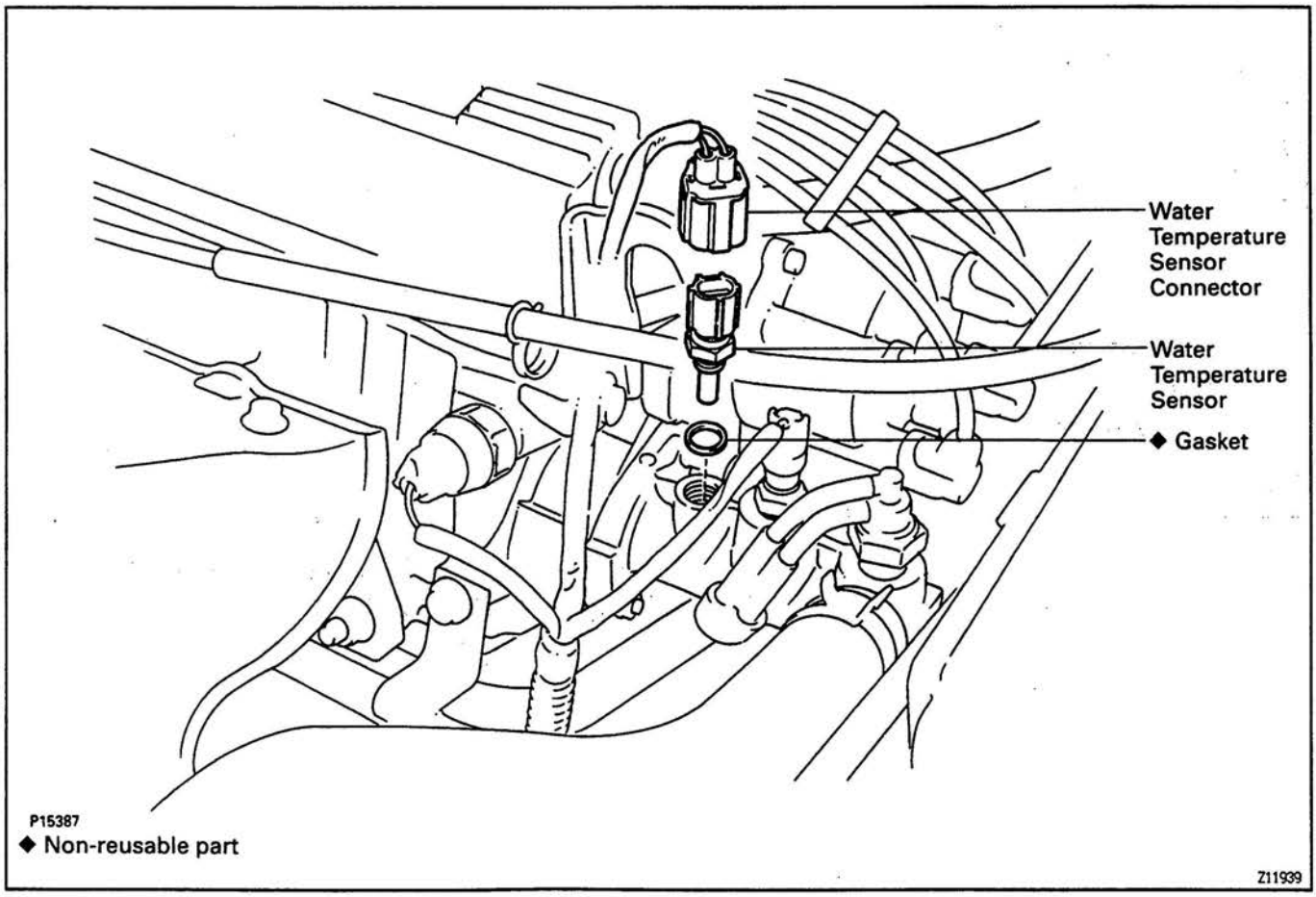
EG00DW–0D



EG

EG0YY–0R

COMPONENTS FOR REMOVAL AND INSTALLATION



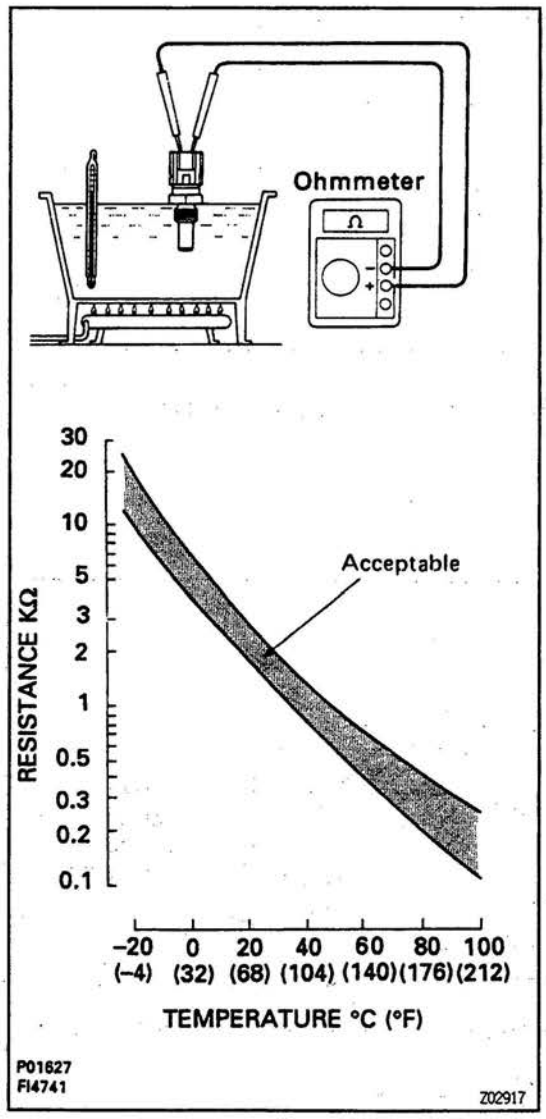
5G3MV-02

WATER TEMPERATURE SENSOR INSPECTION

(See Components for Removal and Installation)

1. **DRAIN ENGINE COOLANT**
2. **REMOVE WATER TEMPERATURE SENSOR**

EG

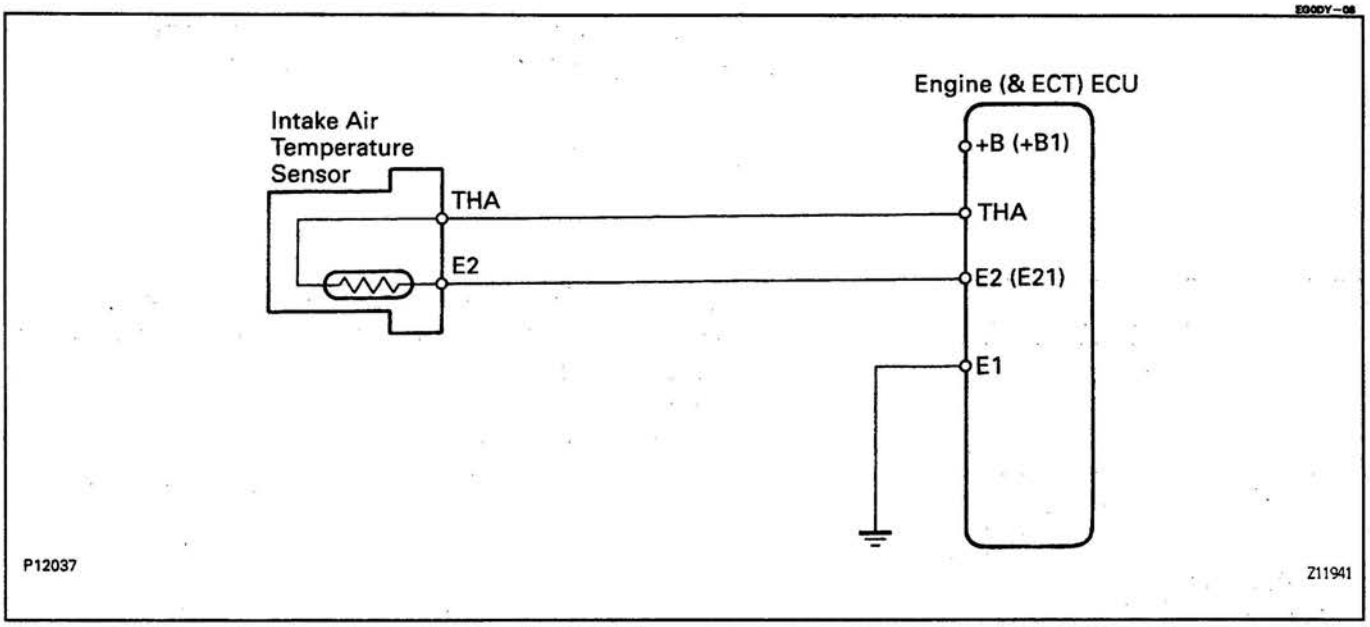


3. **INSPECT WATER TEMPERATURE SENSOR**
   Using an ohmmeter, measure the resistance between the terminals.
   Resistance:
   Refer to the graph
   If the resistance is not as specified, replace the water temperature sensor.

4. **REINSTALL WATER TEMPERATURE SENSOR**
5. **REFILL WITH ENGINE COOLANT**

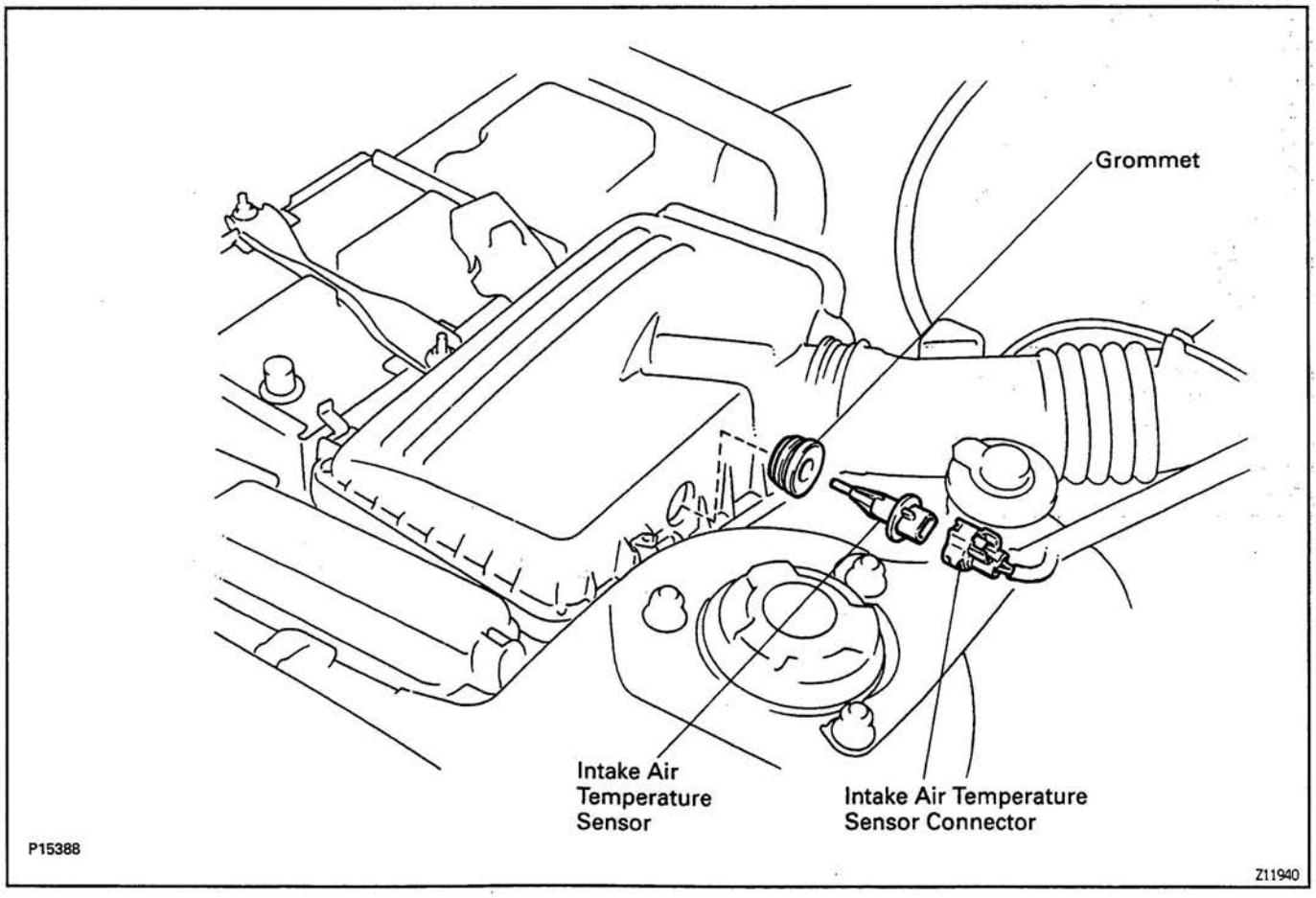
INTAKE AIR TEMPERATURE SENSOR

EG00Y–08



EG14F–0E

COMPONENTS FOR REMOVAL AND INSTALLATION



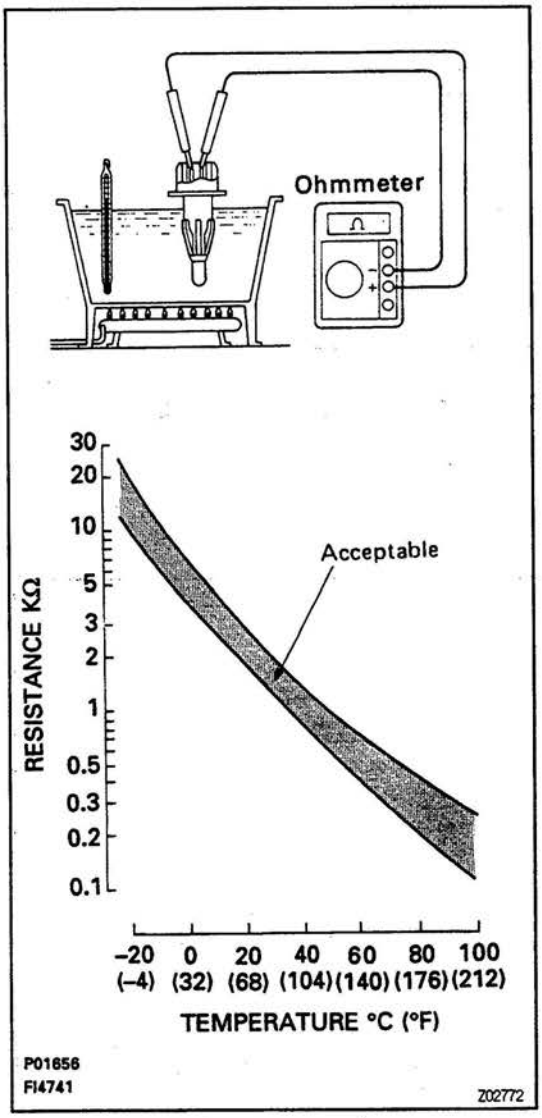
EG3MW-02

INTAKE TEMPERATURE SENSOR INSPECTION

(See Components for Removal and Installation)

1. REMOVE INTAKE TEMPERATURE SENSOR

EG



2. INSPECT INTAKE TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

Refer to the graph

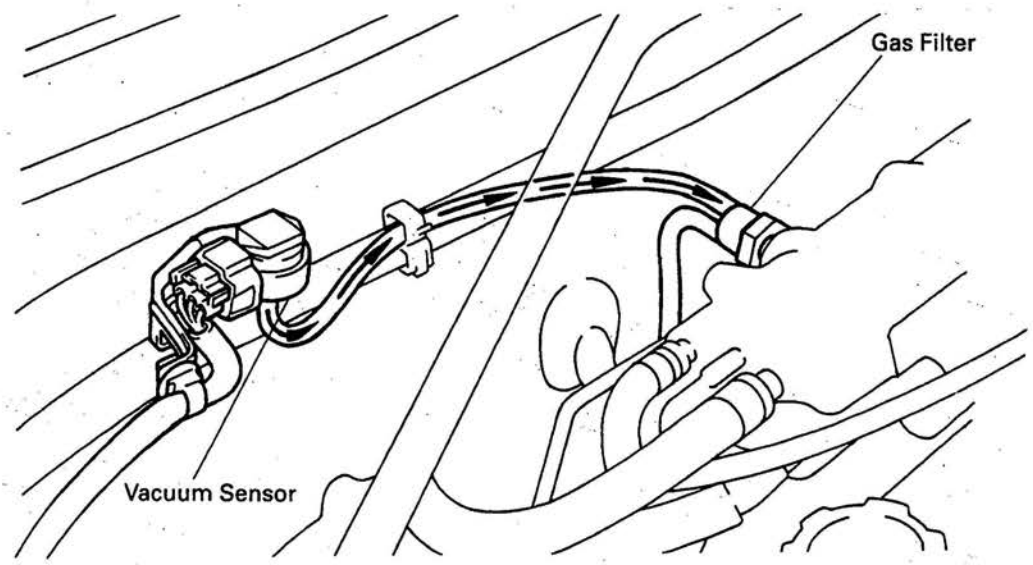
If the resistance is not as specified, replace the sensor.

3. REINSTALL INTAKE TEMPERATURE SENSOR

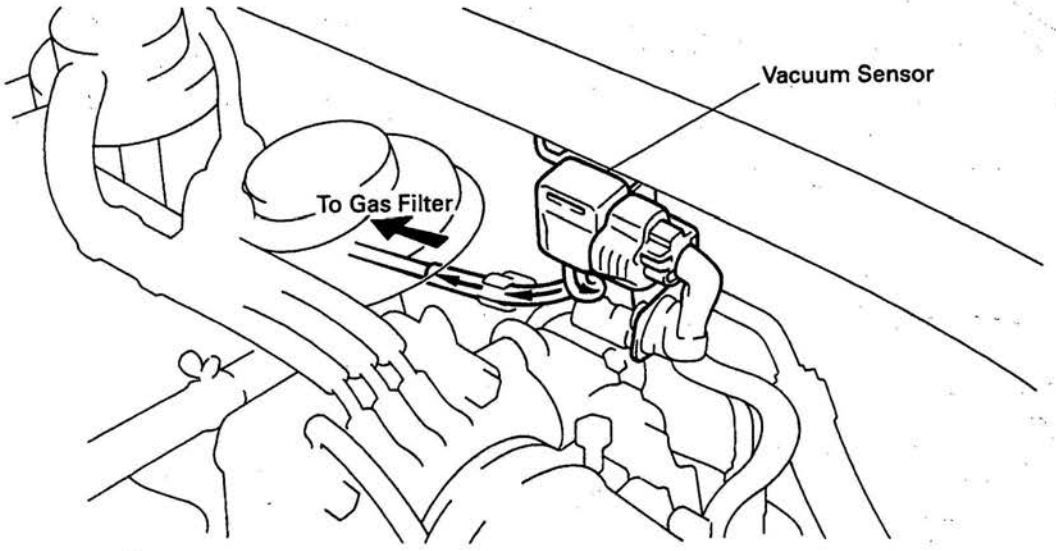
VACUUM SENSOR

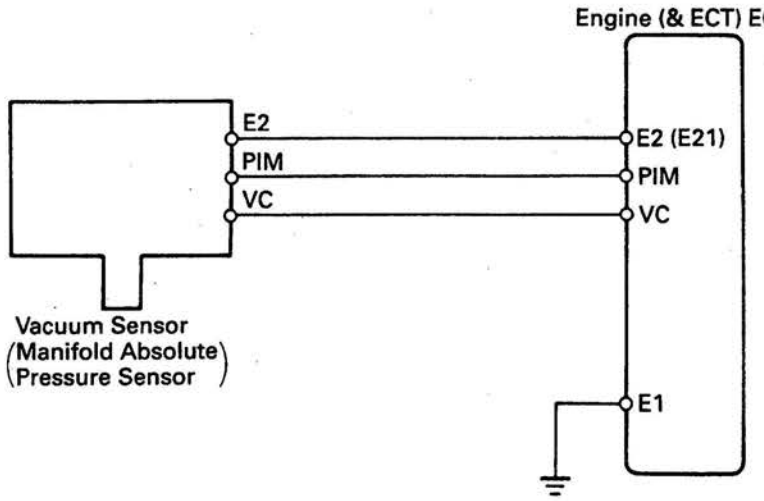
EG0E9—0G

ST202



ST191





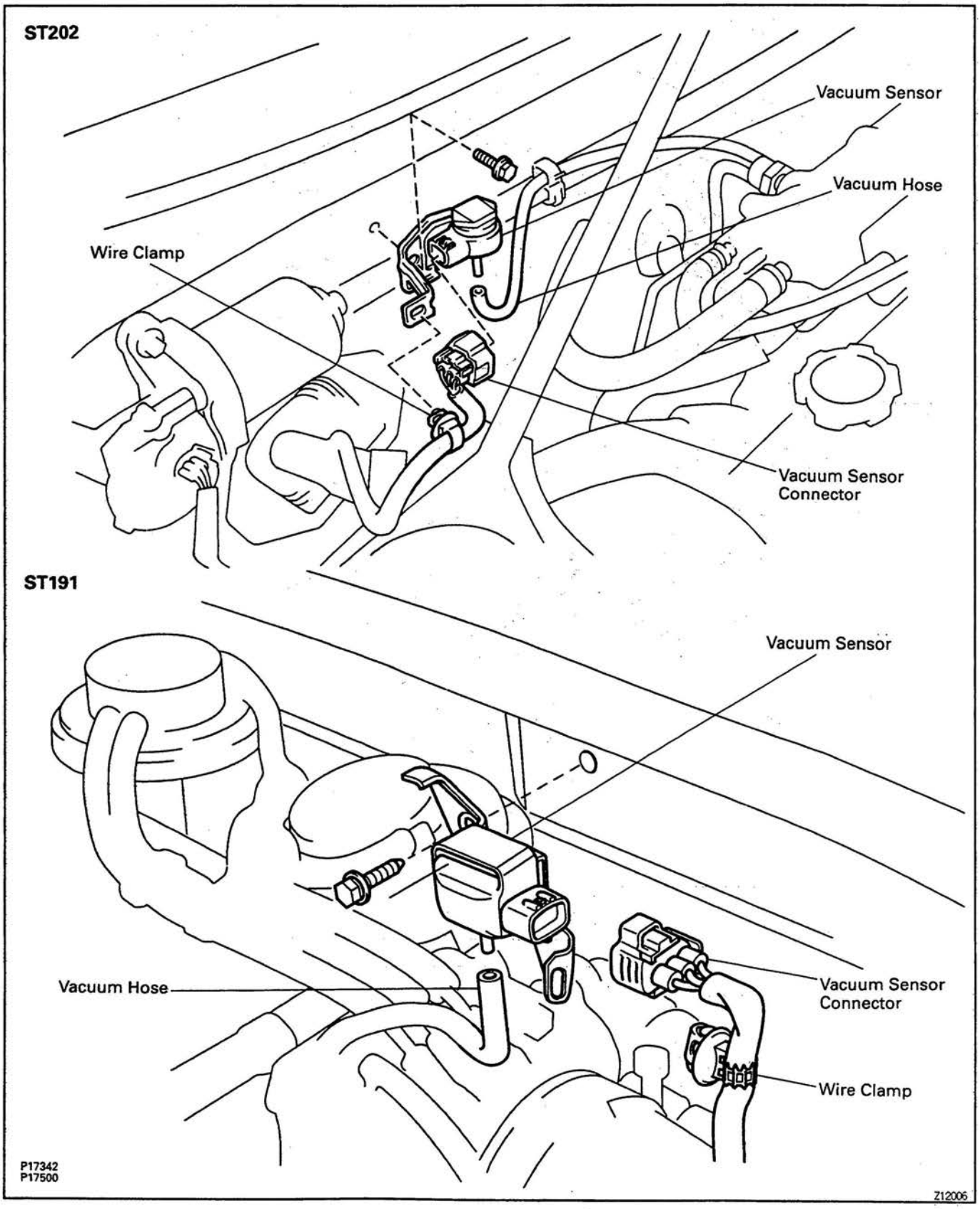
P17135
P13866
FI1226

Z11847

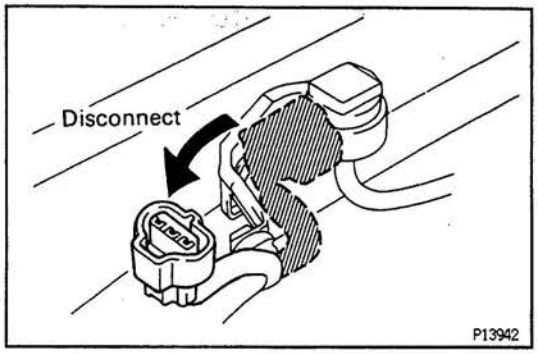
EG

EG14F-0F

COMPONENTS FOR REMOVAL AND INSTALLATION



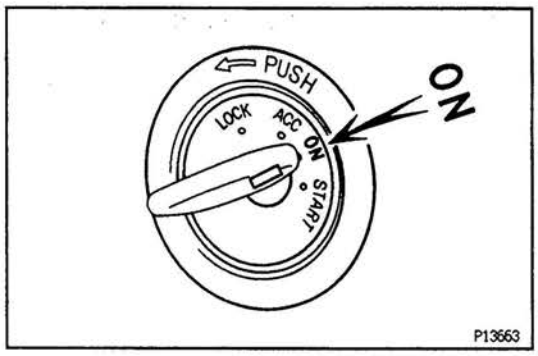
VACUUM SENSOR INSPECTION



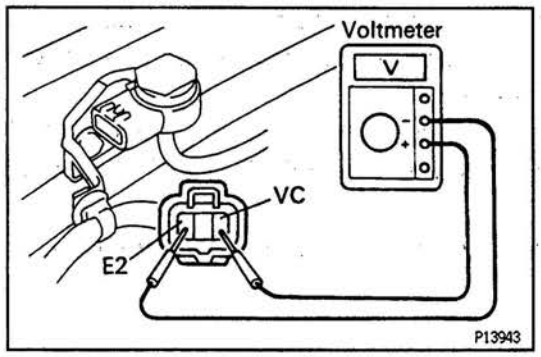
(See Components Removal and Installation)

1. INSPECT POWER SOURCE VOLTAGE OF VACUUM SENSOR

(a) Disconnect the vacuum sensor connector.



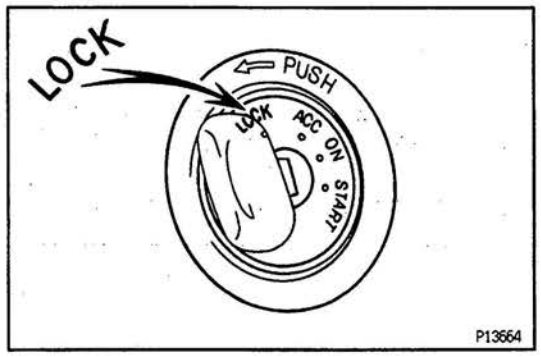
(b) Turn the ignition switch ON.



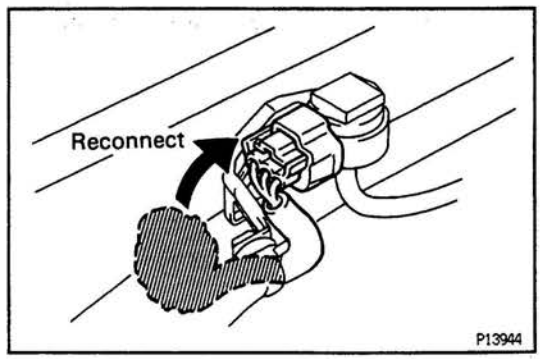
(c) Using a voltmeter, measure the voltage between connector terminals VC and E2 of the wiring harness side.

Voltage:

4.5 – 5.5 V

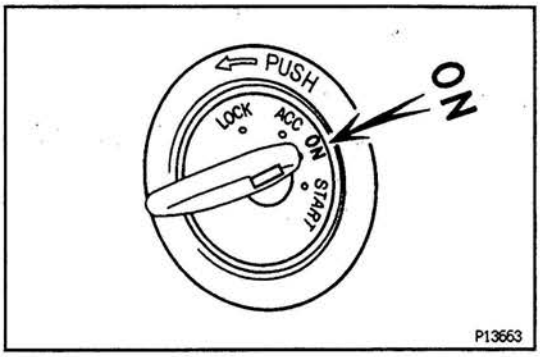


(d) Turn the ignition switch to LOCK.



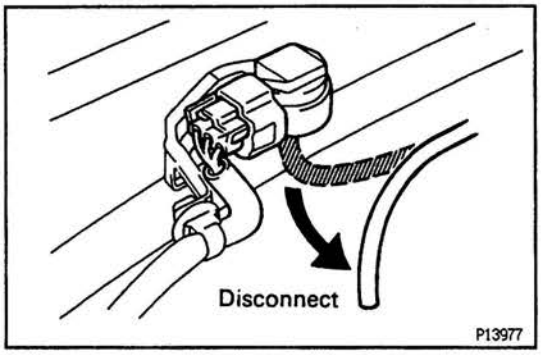
(e) Reconnect the vacuum sensor connector.

EG

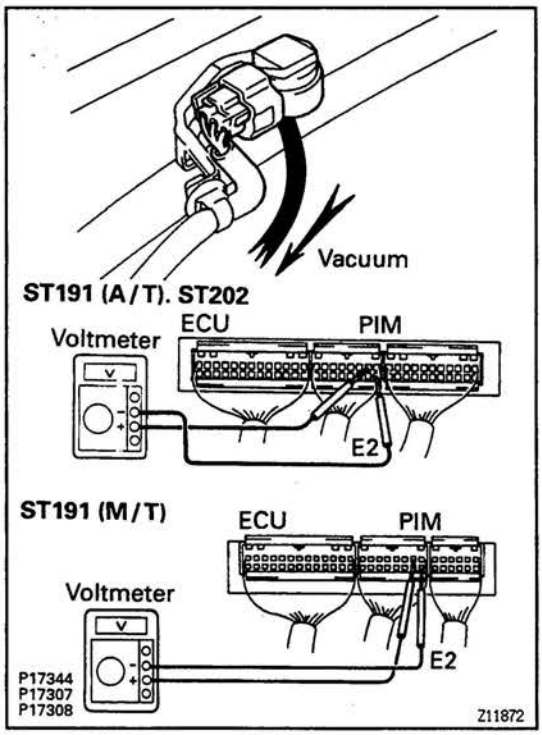


2. INSPECT POWER OUTPUT OF VACUUM SENSOR

(a) Turn the ignition switch ON.



(b) Disconnect the vacuum hose from the vacuum sensor.



(c) Connect a voltmeter to terminals PIM and E2 of the ECU, and measure the output voltage under ambient atmospheric pressure.

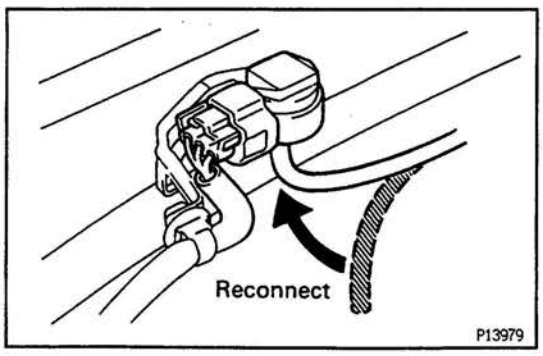
(d) Apply vacuum to the vacuum sensor in 13.3 kPa (100 mmHg, 3.94 in.Hg) segments to 66.7 kPa (500 mmHg, 19.69 in.Hg).

(e) Measure the voltage drop from step (c) above for each segment.

Voltage drop

Applied Vacuum kPa (mmHg, in.Hg)	13.3 (100, 3.94)	26.7 (200, 7.87)	40.0 (300, 11.81)	53.5 (400, 15.75)	66.7 (500, 19.69)
Voltage drop V	0.3 – 0.5	0.7 – 0.9	1.1 – 1.3	1.5 – 1.7	1.9 – 2.1

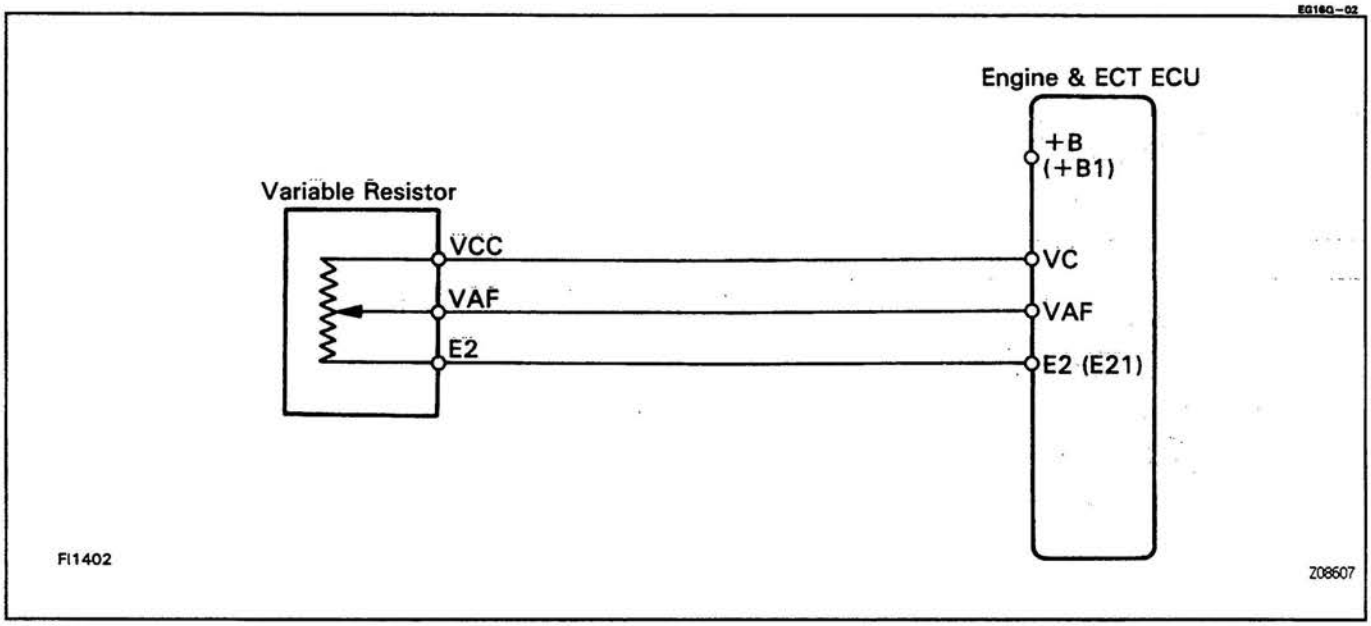
V00494



(f) Reconnect the vacuum hose to the vacuum sensor.

VARIABLE RESISTOR

EG16Q-02

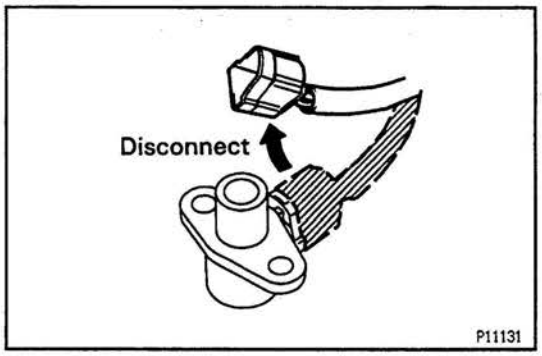


EG2Y1-02

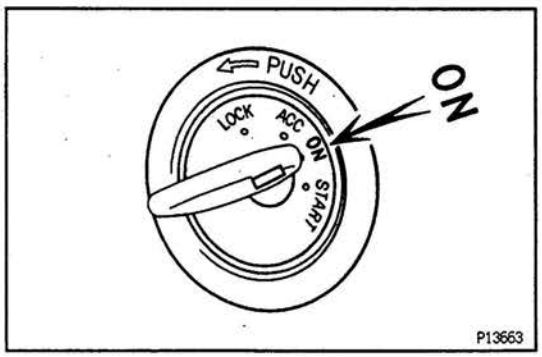
VARIABLE RESISTOR INSPECTION

1. INSPECT POWER SOURCE VOLTAGE OF VARIABLE RESISTOR

(a) Disconnect the variable resistor connector.



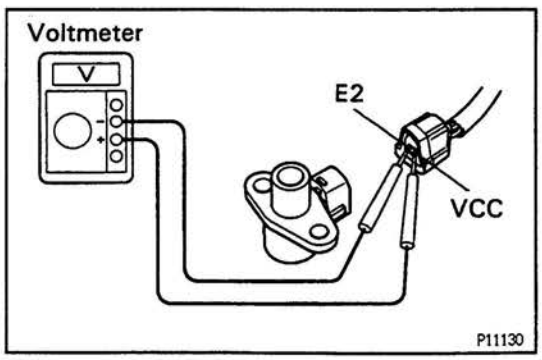
(b) Turn the ignition switch ON.



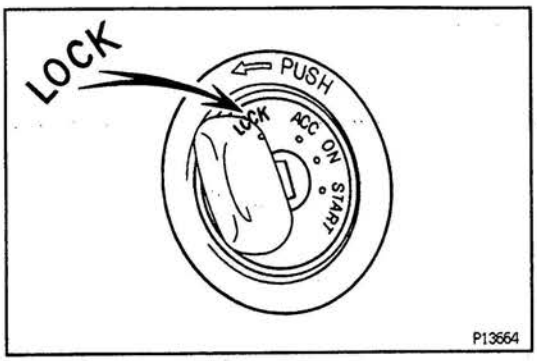
(c) Using a voltmeter, measure the voltage between connector terminals VCC and E2 of the wiring harness side.

Voltage:

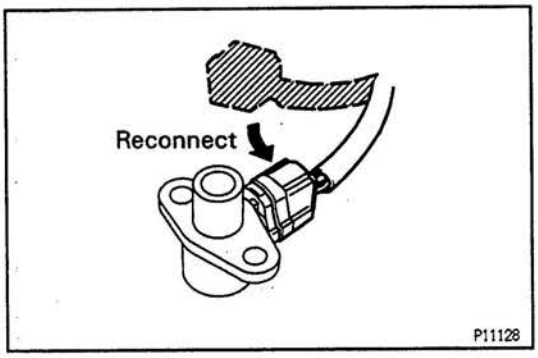
4.5 – 5.5 V



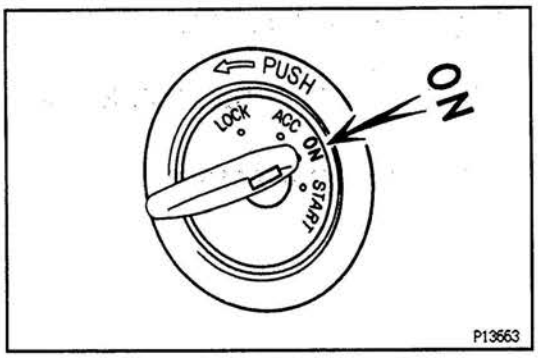
EG



(d) Turn the ignition switch to LOCK.

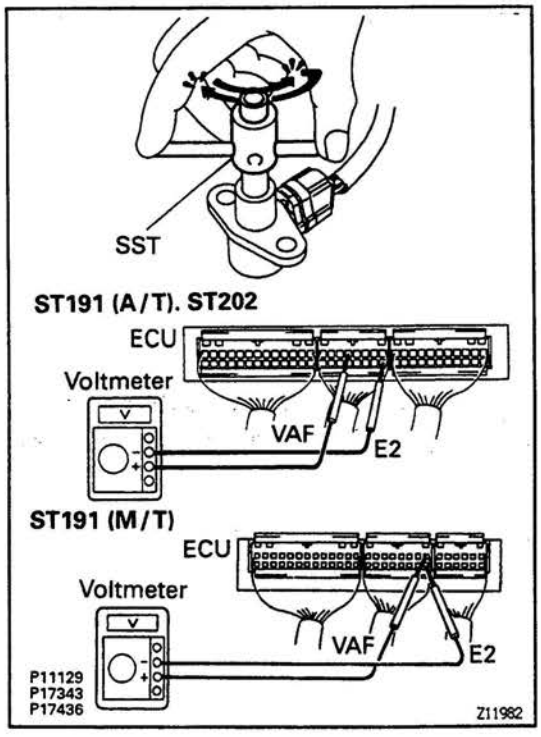


(e) Reconnect the variable resistor connector.



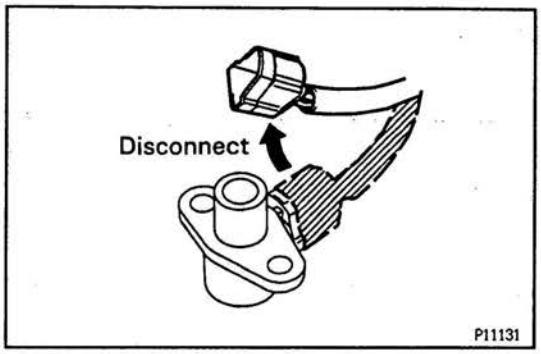
2. INSPECT POWER OUTPUT OF VARIABLE RESISTOR

(a) Turn the ignition switch ON.



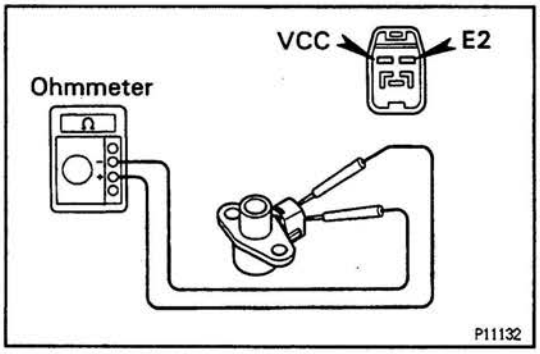
(b) Connect a voltmeter to terminals VAF and E2 of the ECU, and measure the voltage while slowly turning the idle mixture adjusting screw first fully counter—clockwise, and then fully clockwise using SST.
SST 09243—00020

(c) Check that voltage changes smoothly from 0 V to approx. 5 V.
HINT: There is no sudden jump up to 5 V or down to 0 V.



3. INSPECT RESISTANCE OF VARIABLE RESISTOR

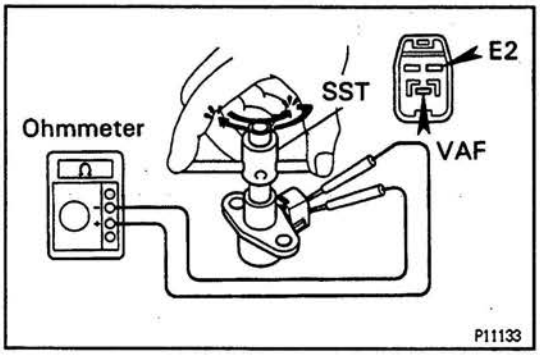
(a) Disconnect the variable resistor connector.



(b) Using an ohmmeter, measure the resistance between terminals VCC and E2 of the variable resistor.

Resistance:

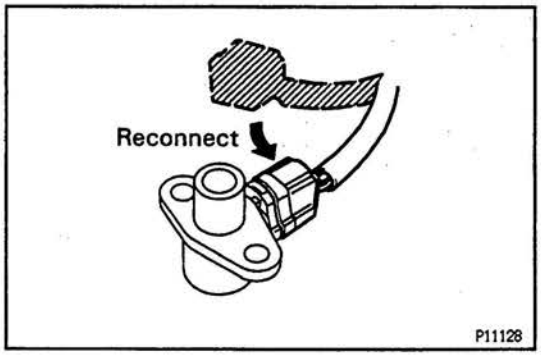
4 — 6 kΩ



(c) Using SST, turn the idle mixture adjusting screw fully cunterclockwise.

SST 09243—00020

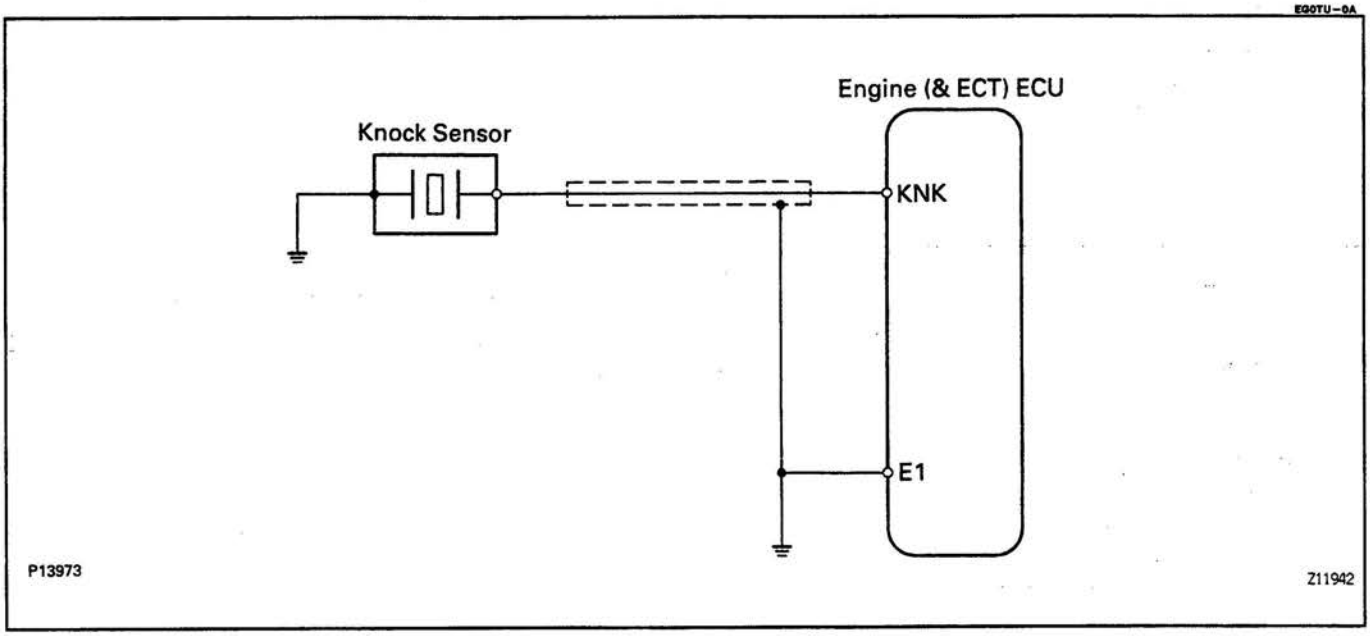
(d) Connect the ohmmeter to terminals VAF and E2 of the variable resistor, and turn the idle mixture adjusting screw fully clockwise and check that the resistance value changes from approx. 5 kΩ to 0 kΩ accordingly.



(e) Reconnect the variable resistor connector.

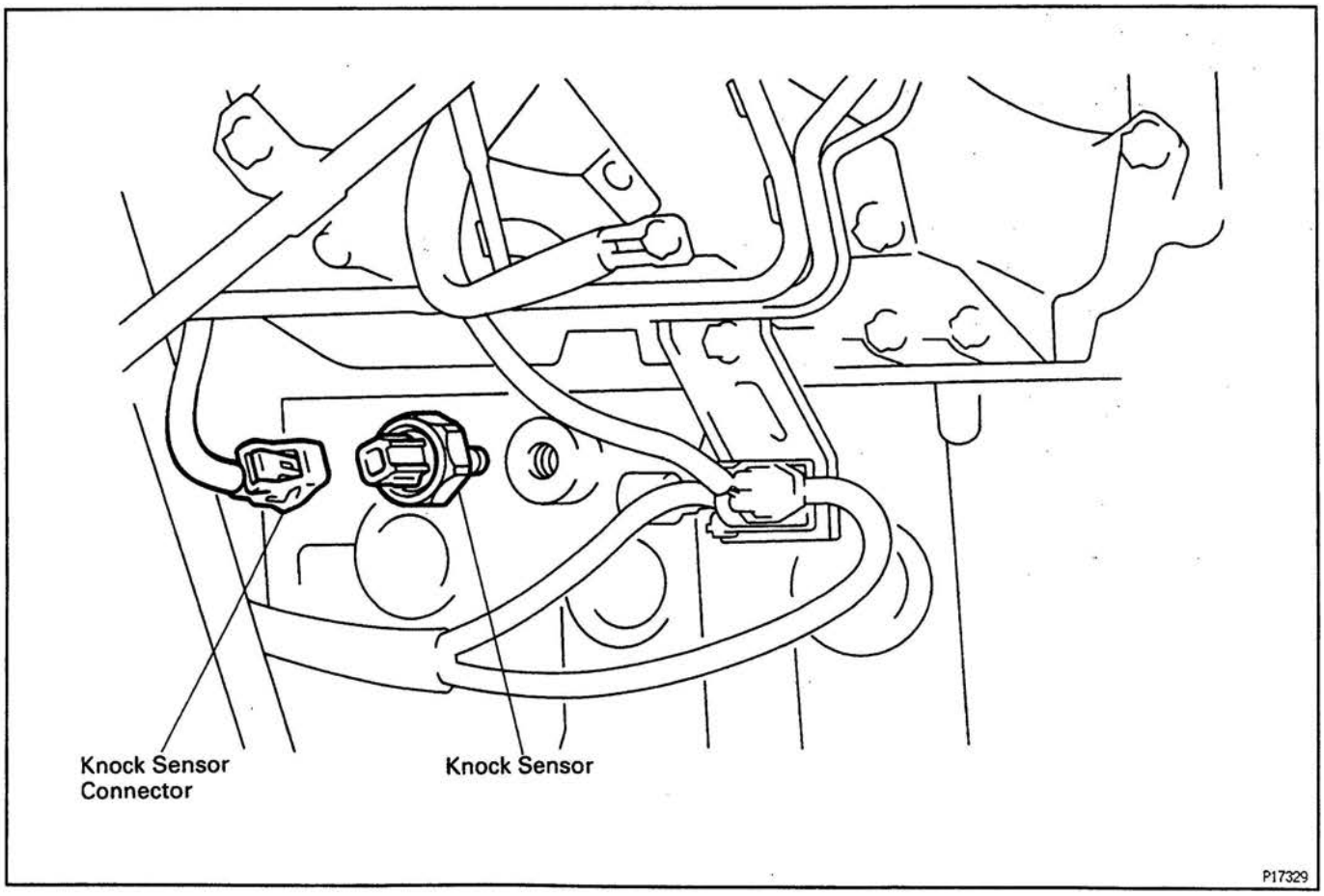
KNOCK SENSOR

EG0TU-0A



EG0YY-0B

COMPONENTS FOR REMOVAL AND INSTALLATION

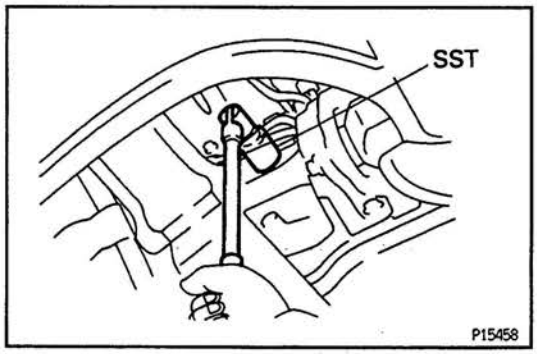


EG3MZ–02

KNOCK SENSORS INSPECTION

(See Components for Removal and Installation)

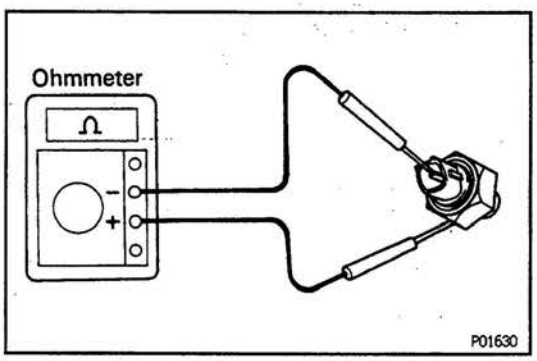
1. **DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**



2. **REMOVE KNOCK SENSORS**

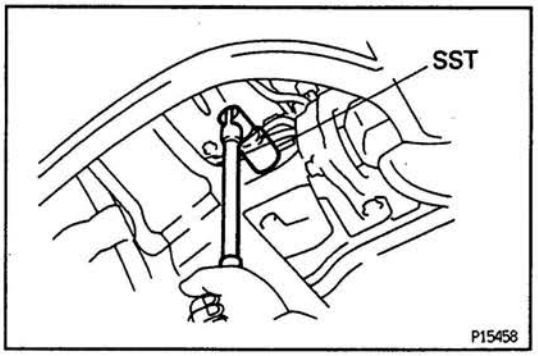
(a) Disconnect the knock sensor connector.

(b) Using SST, remove the knock sensor.
SST 09816–30010



3. **INSPECT KNOCK SENSORS**

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

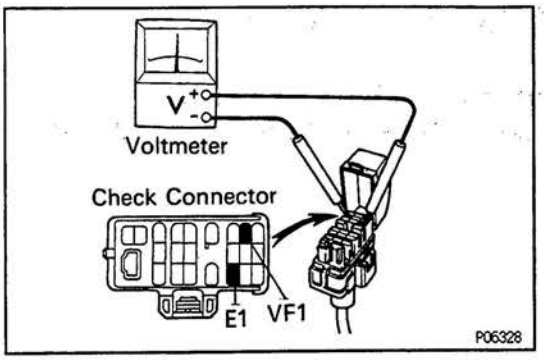


4. **REINSTALL KNOCK SENSORS**

(a) Using SST, install the knock sensor.
SST 09816–30010
Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)

(b) Connect the knock sensor connector.

5. **RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**



OXYGEN SENSOR

EG2U9-02

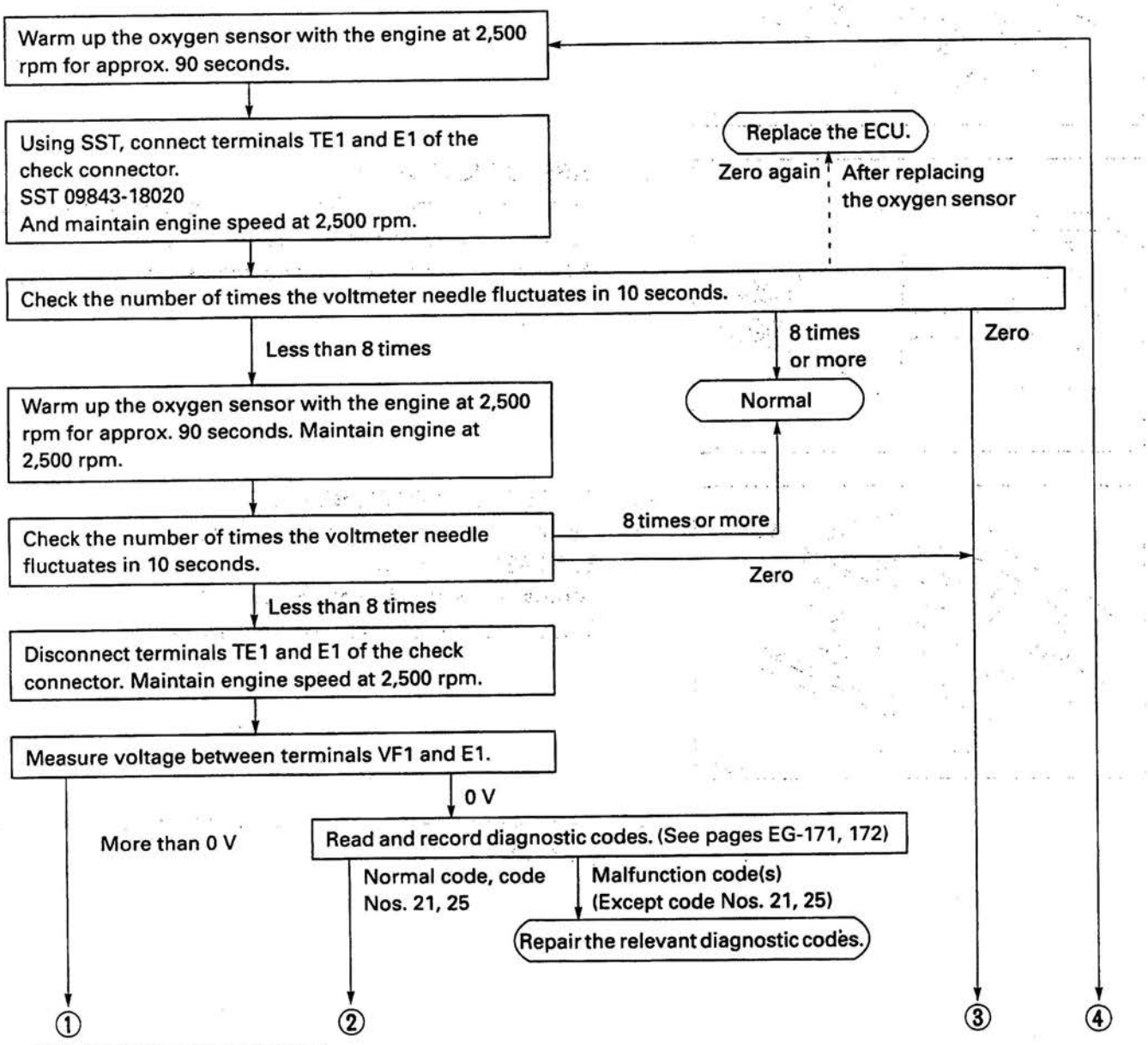
OXYGEN SENSOR INSPECTION

1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

2. INSPECT FEEDBACK VOLTAGE

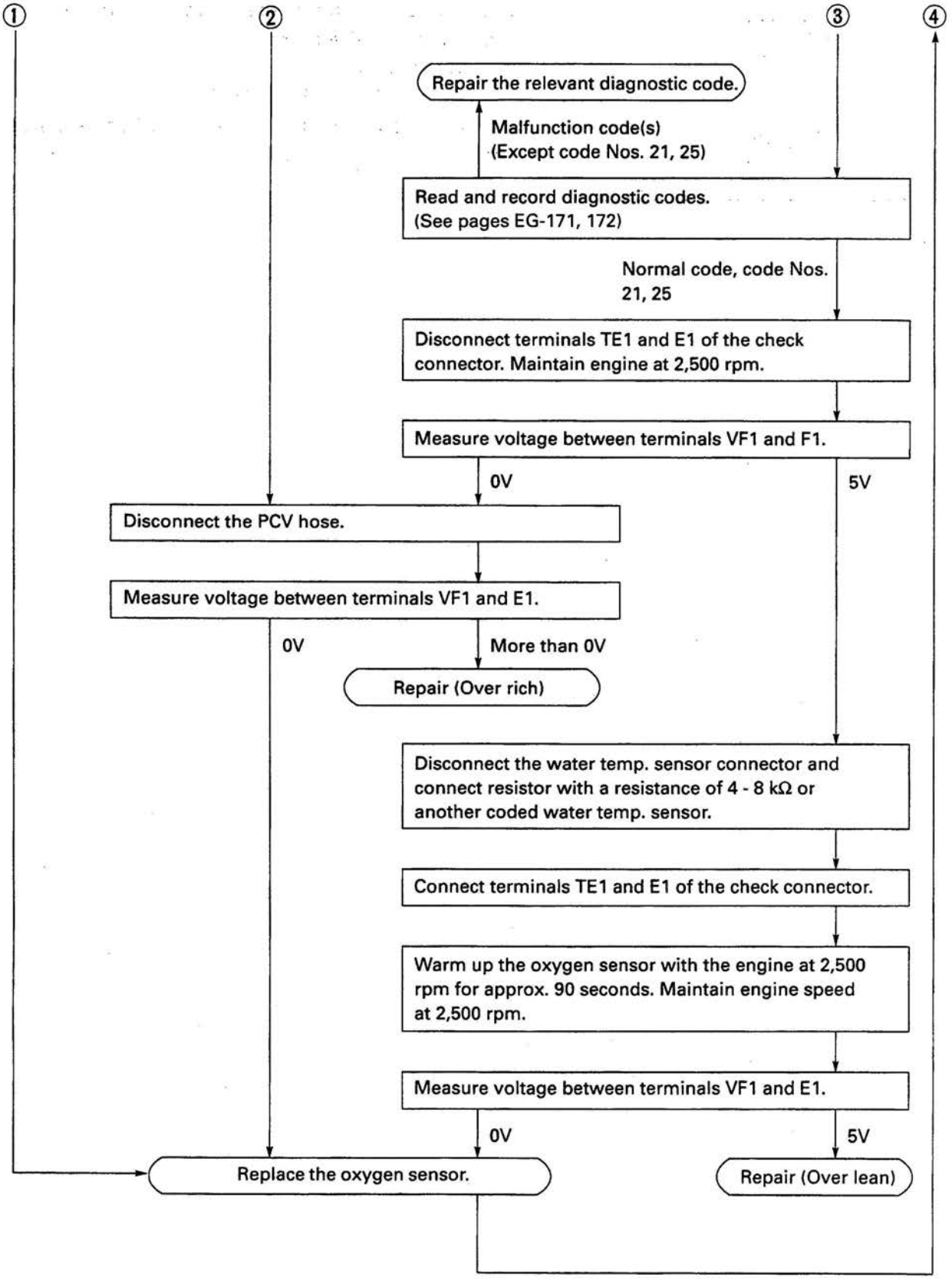
Connect the positive (+) probe of a voltmeter to terminal VF1 of the check connector, and negative (−) probe to terminal E1. Perform the test as follows:



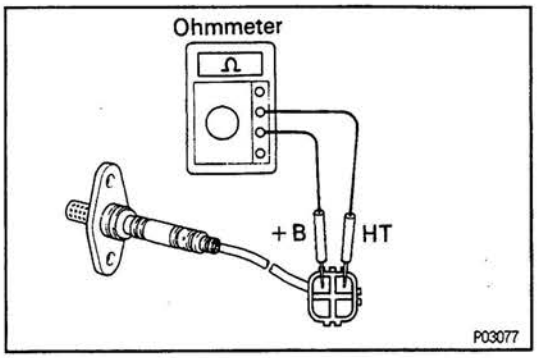
CONTINUED ON PAGE EG-285

V05386

CONTINUED FROM PAGE EG-284



V05387



3. INSPECT HEATER RESISTANCE OF OXYGEN SENSOR

Using an ohmmeter, measure the resistance between the terminal +B and HT.

Resistance (Cold):

5.1 – 6.3 Ω at 20°C(68°F)

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

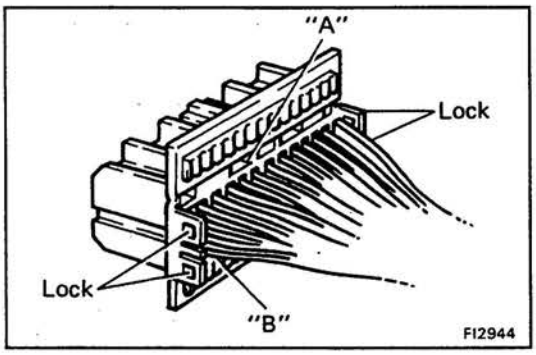
ECU

ECU INSPECTION

EG18H-05

HINT: The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the ECU.

EG



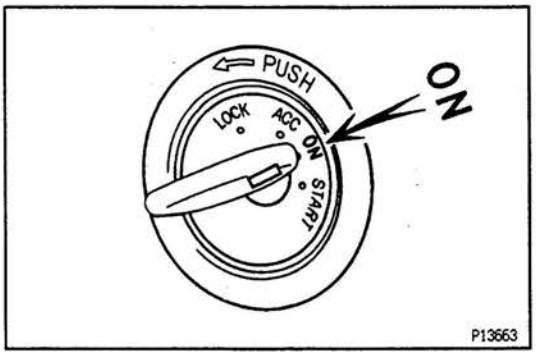
1. PREPARATION

(a) Disconnect the 3 connectors from the ECU.

(b) Remove the locks as shown in the illustration so that the tester probe(s) can easily come in.

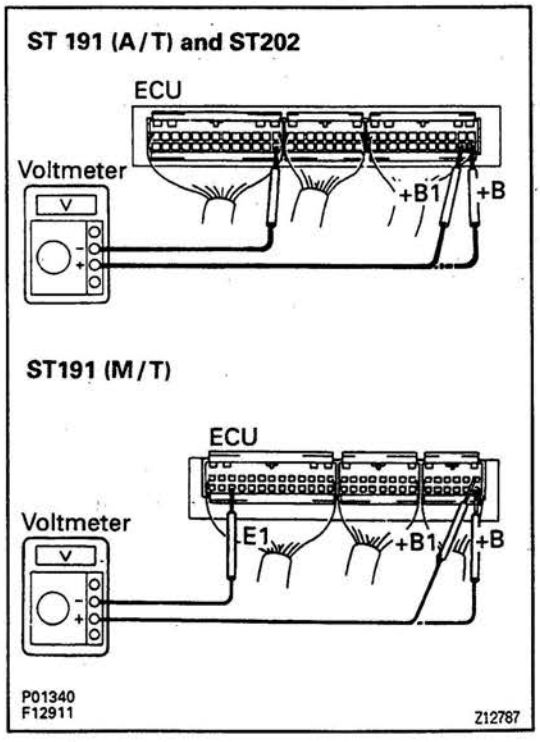
NOTICE: Pay attention to sections A and B in the illustration which can easily broken.

(c) Reconnect the 3 connectors to the ECU.



2. INSPECT VOLTAGE OF ECU

(a) Turn the ignition switch ON.



(b) Measure the voltage between each terminal of the wiring connectors.

HINT:

- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11 V or more when the ignition switch is ON.

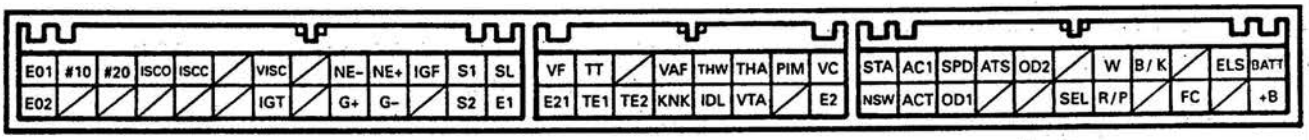
ECU Wiring Connectors Voltage

EG

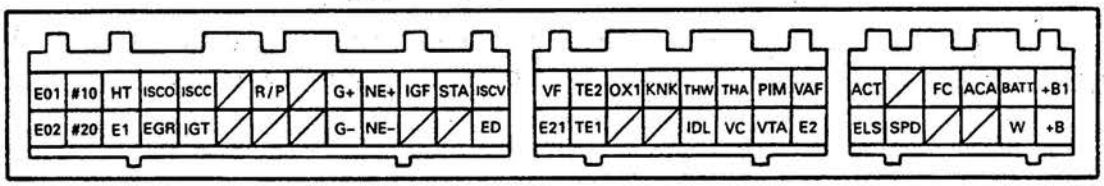
Terminals	Condition		STD voltage (V)
+B, +B1 – E1	IG SW ON		9 – 14
BATT – E1	–		9 – 14
IDL – E2	IG SW ON	Throttle valve open	9 – 14
VTA – E2		Throttle valve fully closed	0.3 – 0.8
		Throttle valve fully open	3.2 – 4.9
PIM – E2	IG SW ON		3.3 – 3.9
VC – E2			4.5 – 5.5
#10, #20 – E01, E02			9 – 14
THA – E2	IG SW ON	Intake air temp. 20°C (68°F)	0.5 – 3.4
THW – E2		Engine coolant temp. 80°C (176°F)	0.2 – 1.0
STA – E1	Cranking		6 or more
IGT – E1	Idling		Pulse generation
ISCC, ISCO – E1	IG SW ON	ECU connectors disconnected	9 – 14
W – E1	No trouble (check engine warning light off) and engine running		9 – 14
TE1, TE2 – E1	IG SW ON	Check connector TE1 – E1 not connected	9 – 14
		Check connector TE1 – E1 connected	0 – 3
NSW – E1 (A/T only)		Neutral start switch P or N position	0 – 2
		Except neutral start switch P or N position	9 – 14

ECU Terminals

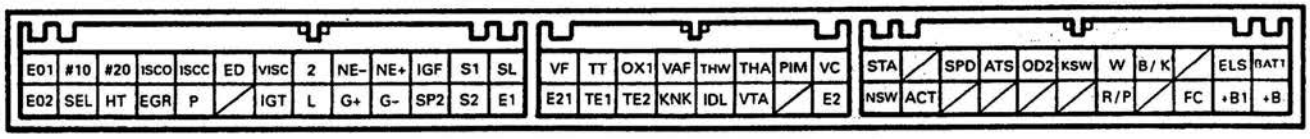
ST202



ST191 (M/T)

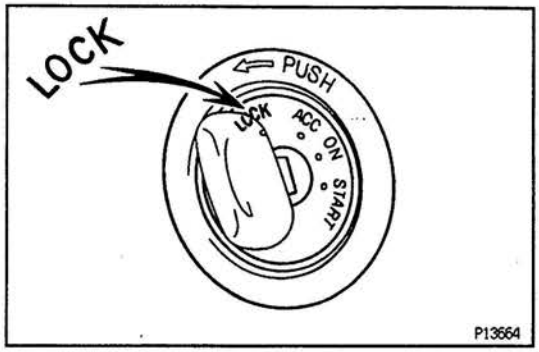


ST191 (A/T)



FI2796
P01821
FI2796

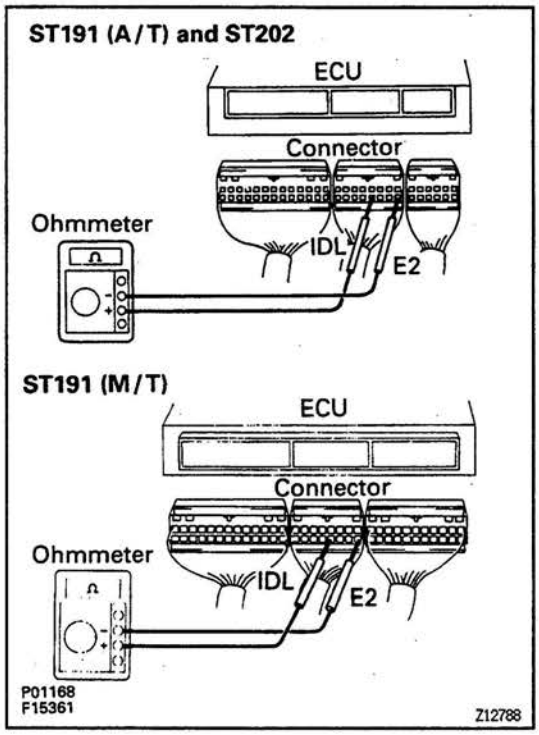
V05388



3. INSPECT RESISTANCE OF ECU

(a) Turn the ignition switch OFF.

(b) Disconnect the 3 connectors from the ECU.



(c) Measure the resistance between each terminal of the wiring connectors.

NOTICE:

- **Do not touch the ECU terminals.**
- **The tester probe should be inserted in the wiring connector from the wiring side.**

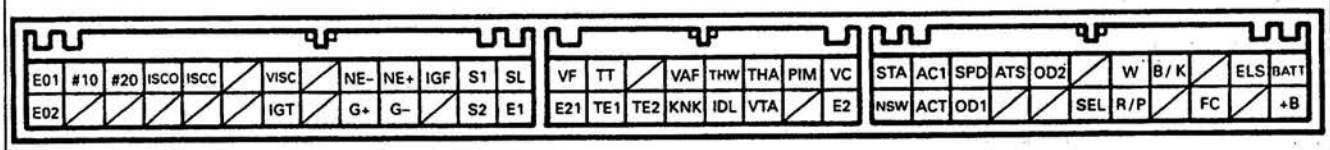
ECU Wiring Connectors Resistance

EG

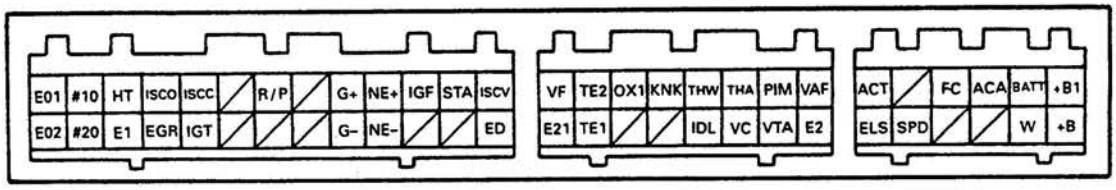
Terminals	Condition	STD Resistance (Ω)
IDL – E2	Throttle valve fully open	Infinity
	Throttle valve fully closed (Throttle opener must be cancelled first)	2,300 or less
VTA – E2	Throttle valve fully open	2,000 – 10,200
	Throttle valve fully closed Throttle opener must be cancelled first)	200 – 5,700
VC – E2	–	2,500 – 5,900
THA – E2	Intake air temp. 20°C (68°F)	2,000 – 3,000
THW – E2	Coolant temp. 80°C (176°F)	200 – 400
G+ – G–	Cold (-10°C (14°F) to 50°C (122°F))	185 – 275
	Hot (50°C (122°F) to 100°C (212°F))	240 – 325
NE+ – NE–	Cold (-10°C (14°F) to 50°C (122°F))	370 – 550
	Hot (50°C (122°F) to 100°C (212°F))	475 – 650
ISCC – +B ISCO – +B1	–	19.3 – 22.3
EGR* – +B +B1	–	33 – 39

ECU Terminals

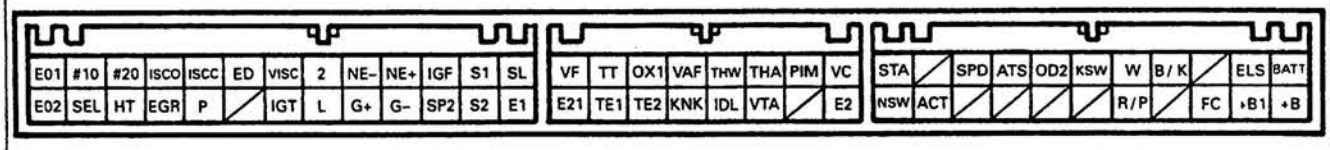
ST202



ST191 (M/T)



ST191 (A/T)



FI2796
P01821
FI2796

* Europe

V05389

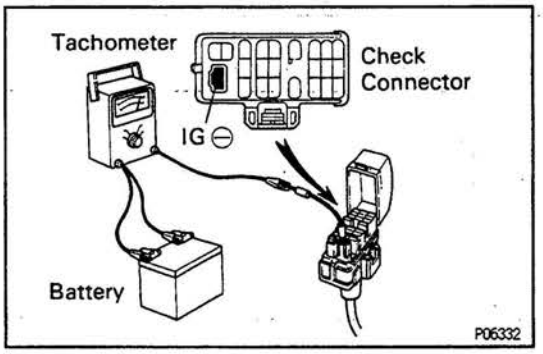
FUEL CUT RPM

EG3VX-01

FUEL CUT PRM INSPECTION

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

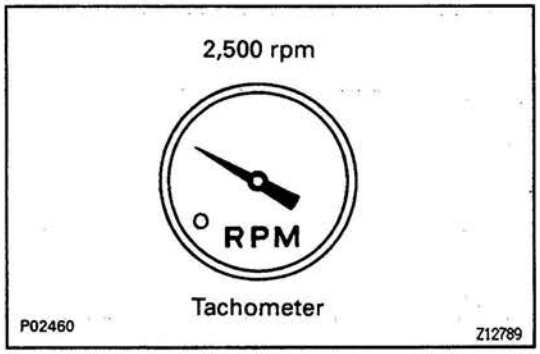


2. CONNECT TACHOMETER TO ENGINE

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

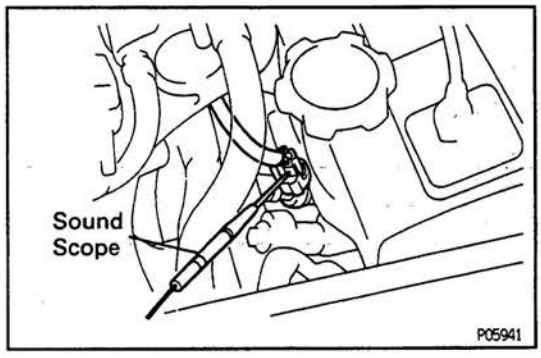
NOTICE:

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



3. INSPECT FUEL CUT RPM

(a) Increase the engine speed to at least 2,500 rpm.



(b) Using a sound scope, check for injector operating noise.

(c) Check that when the throttle lever is released, injector operation noise stops momentarily and then resumes.

HINT: Measure with the A/C OFF.

Fuel return rpm:

1,500 rpm

4. DISCONNECT TACHOMETER

SERVICE SPECIFICATIONS

SERVICE DATA

EQ1S3—0F

EG

Fuel pressure regulator	Fuel pressure	at no vacuum	265 — 304 kPa (2.7 — 3.1 kgf/cm², 38 — 44 psi)
Fuel pump	Resistance	at 20°C (68°F)	0.2 — 3.0 Ω
Injector	Resistance		13.4 — 14.2 Ω
	Injection volume		49 — 59 cm³ (3.0 — 3.6 cu in.) per 15 sec.
	Difference between each cylinder		5 cm³ (0.3 cu in.) or less
	Fuel leakage		One drop or less per minute
Throttle body	Throttle body fully closed angle		6°
	Throttle opener setting speed		1,300 — 1,500 rpm (w/ Cooling fan OFF)
Throttle position sensor	Clearance between stop screw and lever		
	0 mm (0 in.)	VTA — E2	0.2 — 5.7 kΩ
	0.50 mm (0.020 in.)	IDL — E2	2.3 kΩ or less
	0.70 mm (0.028 in.)	IDL — E2	Infinity
	Throttle valve fully open	VTA — E2	2.0 — 10.2 kΩ
	—	VC — E2	2.5 — 5.9 kΩ
ISC valve	Resistance (+B — ISCC or ISCO)	at 20°C (68°F)	19.3 — 22.3 Ω
VSV for EGR	Resistance		33 — 39 Ω
A/C idle—up valve	Resistance		30 — 34 Ω
Water Temp. sensor	Resistance	at −20°C (−4°F)	10 — 20 kΩ
		at 0°C (32°F)	4 — 7 kΩ
		at 20°C (68°F)	2 — 3 kΩ
		at 40°C (104°F)	0.9 — 1.3 kΩ
		at 60°C (140°F)	0.4 — 0.7 kΩ
		at 80°C (176°F)	0.2 — 0.4 kΩ
Intake Air Temp. sensor	Resistance	at −20°C (−4°F)	10 — 20 kΩ
		at 0°C (32°F)	4 — 7 kΩ
		at 20°C (68°F)	2 — 3 kΩ
		at 40°C (104°F)	0.9 — 1.3 kΩ
		at 60°C (140°F)	0.4 — 0.7 kΩ
		at 80°C (176°F)	0.2 — 0.4 kΩ
Oxygen sensor	Heater coil resistance		5.1 — 6.3 Ω
Fuel cut rpm	Fuel return rpm		1,500 rpm

SERVICE DATA (Cont'd)

ECU	Voltage		
	+B – E1	IG SW ON	9 – 14 V
	+B1 – E1	IG SW ON	9 – 14 V
	BATT – E1		9 – 14 V
	IDL – E2	IG SW ON (Throttle valve open)	9 – 14 V
	VTA – E2	IG SW ON (Throttle valve fully closed)	0.3 – 0.8 V
		IG SW ON (Throttle valve fully open)	3.2 – 4.9 V
	PIM – E2	IG SW ON	3.3 – 3.9 V
	VC – E2	IG SW ON	4.5 – 5.5 V
	#10 or #20 – E01	IG SW ON	9 – 14 V
	#10 or #20 – E02	IG SW ON	9 – 14 V
	THA – E2	IG SW ON (Intake air temp. 20°C (68°F))	0.5 – 3.4 V
	THW – E2	IG SW ON (Coolant temp. 80°C (176°F))	0.2 – 1.0 V
	STA – E1	Cranking	6 V or more
	IGT – E1	Idling	Pulse generation
	ISCC – E1	IG SW ON(ECU connectors disconnected)	9 – 14 V
	ISCO – E1	IG SW ON(ECU connectors disconnected)	9 – 14 V
	W – E1	No trouble (Check engine warning light off) and engine running	9 – 14 V
	TE1 – E1	IG SW ON (Check connector terminals TE1 – E1 not connected)	9 – 14 V
		IG SW ON (Check connector terminals TE1 – E1 connected)	0 – 3 V
	Resistance		
	IDL – E2	at throttle valve open	Infinity
		at throttle valve fully closed	2,300 Ω or less
	VTA – E2	at throttle valve fully open	2,000 – 10,200 Ω
		at throttle valve fully closed	200 – 5,700 Ω
	VC – E2		2,500 – 5,900 Ω
	THA – E2	at intake air temp. 20°C (68°F)	2,000 – 3,000 Ω
	THW – E2	at coolant temp. 80°C (176°F)	200 – 400 Ω
	G+ – G–	at cold (–10°C (14°F) to 50°C (122°F))	185 – 275 Ω
		at hot (50°C (122°F) to 100°C (212°F))	240 – 325 Ω
	NE+ – NE–	at cold (–10°C (14°F) to 50°C (122°F))	370 – 550 Ω
		at hot (50°C (122°F) to 100°C (212°F))	475 – 650 Ω
	+B or +B1 – ISCC or ISCO		19.3 – 22.3 Ω

EG

EQOEE–OW

TORQUE SPECIFICATIONS

Part tightened		N·m	kgf·cm	ft·lbf
Fuel line				
Union bolt type		29	300	22
Flare nut type	Fuel pump side ST202 for SST	28	280	21
	ST191 for SST	30	310	22
	Others	30	310	22
Fuel pump x Fuel tank		4.0	40	35 in.·lbf
Fuel pressure regulator x Delivery pipe		5.4	55	48 in.·lbf
Fuel return pipe x Fuel pressure regulator		19	195	14
Delivery pipe x Cylinder head		13	130	9
Cylinder head x Grommet		23	230	17
Fuel inlet pipe x Delivery pipe		34	350	25
Pulsation damper x Delivery pipe	ST191	34	350	25
	ST191 for SST	29	300	22
Throttle body x Intake manifold		19	195	14
No.1 Intake manifold stay x Intake manifold	ST191	42	425	31
No.2 Intake manifold stay x Cylinder head	ST191	42	425	31
EGR valve x Intake manifold	ST191 for Nut	13	130	9
	ST191 for Union nut	59	600	43
Knock sensor x Cylinder block		44	450	33
Oxygen sensor x Exhaust manifold		20	200	14

COOLING SYSTEM

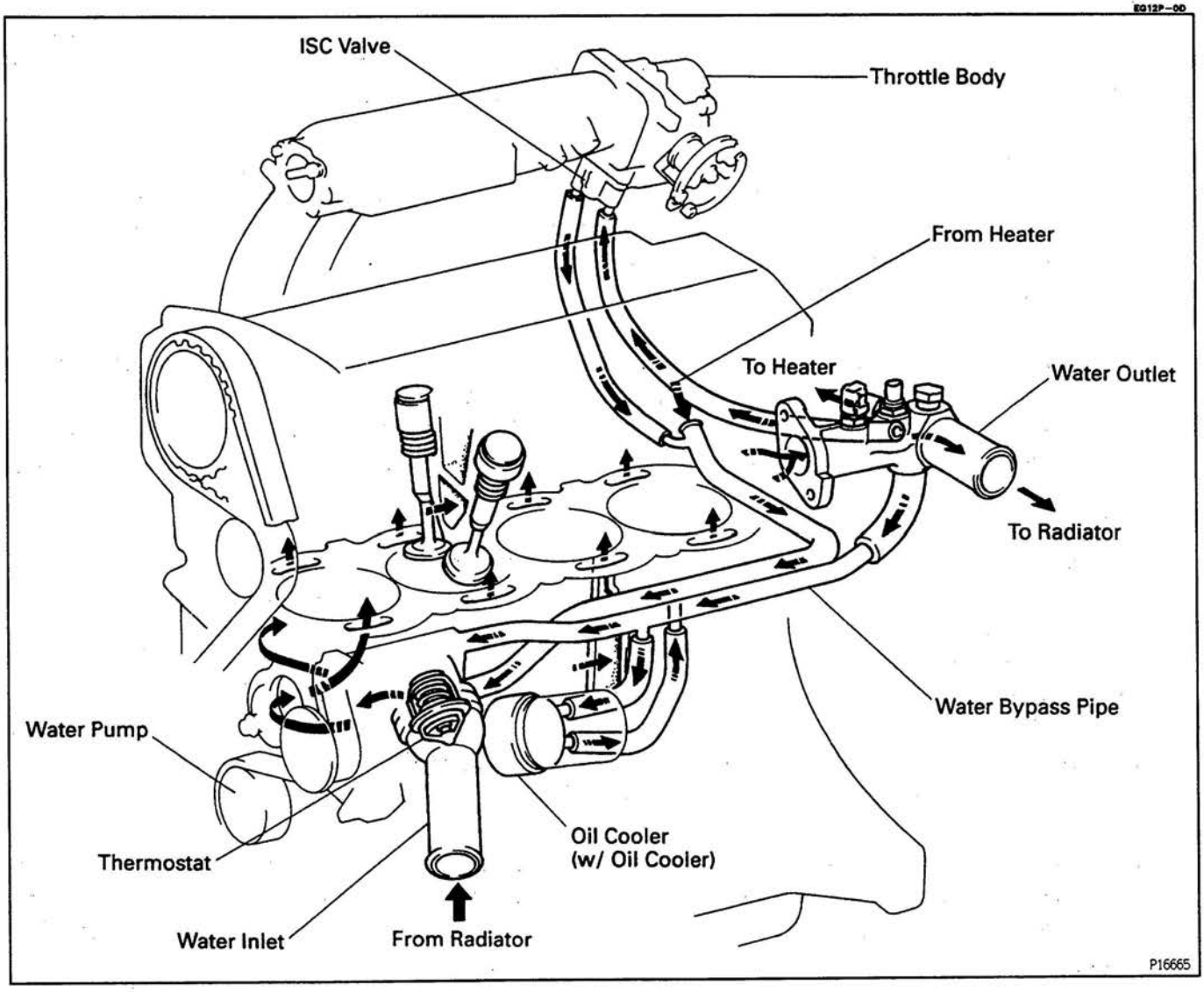
DESCRIPTION

EG12N-0B

This engine utilizes a pressurized forced circulation cooling system which includes a thermostat equipped with a bypass valve mounted on the inlet side.

OPERATION

EG12P-0D



The cooling system is composed of the water jacket (inside the cylinder block and cylinder head), radiator, water pump, thermostat, electric fan, hoses and other components.

Coolant which is heated in the water jacket is pumped to the radiator, through which the electric fan draws air to cool the coolant as it passes through. Coolant which has been cooled is then sent back to the engine by the water pump, where it cools the engine.

The water jacket is a network of channels in the shell of the cylinder block and cylinder head through which coolant passes. It is designed to provide adequate cooling of the cylinders and combustion chambers which become heated during engine operation.

RADIATOR

The radiator performs the function of cooling the coolant which has passed through the water jacket and become hot, and it is mounted in the front of the vehicle. The radiator consists of an upper tank and lower tank, and a core which connects the two tanks. The upper tank contains the inlet for coolant from the water jacket and the filler inlet. It also has a hose attached through which excess coolant or steam can flow. The lower tank has an outlet and drain cock for the coolant. The core contains many tubes through which coolant flows from the upper tank to the lower tank as well as cooling fins which radiate heat away from the coolant in the tubes. The air drawn through the radiator by the electric fan, as well as the wind generated by the vehicle's travel, passes through the radiator, cooling the coolant. Models with automatic transmission include an automatic transmission fluid cooler built into the lower tank of the radiator. A fan with an electric motor is mounted behind the radiator to assist the flow of air through the radiator. The fan operates when the engine coolant temperature becomes high in order to prevent it from becoming too high.

RADIATOR CAP

The radiator cap is a pressure type cap which seals the radiator resulting in pressurization of the radiator as the coolant expands. The pressurization prevents the coolant from boiling even when the coolant temperature exceeds 100°C (212°F). A relief valve (pressurization valve) and a vacuum valve (negative pressure valve) are built into the radiator cap. The relief valve opens and lets steam escape through the overflow pipe when the pressure generated inside the cooling system exceeds the limit (coolant temperature: 110 — 120°C (230 — 248°F), pressure; 59 — 103 kPa (0.60 — 1.05 kgf/cm^2, 8.5 — 14.9 psi). The vacuum valve opens to alleviate the vacuum which develops in the coolant system after the engine is stopped and the coolant temperature drops. The valve's opening allows the coolant in the reservoir tank to return to the cooling system.

RADIATOR RESERVOIR

The reservoir is used to catch coolant which overflows the cooling system as a result of volumetric expansion when the coolant is heated. The coolant in the reservoir returns to the radiator when the coolant temperature drops, thus keeping the radiator full at all times and avoiding needless coolant loss.

Check the reservoir level to learn if the coolant needs to be replenished.

WATER PUMP

The water pump is used for forced circulation of coolant through the cooling system. It is mounted on the front of the cylinder block and driven by a timing belt.

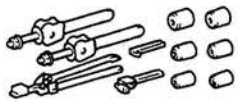
THERMOSTAT

The thermostat has a wax type bypass valve and is mounted in the water inlet housing. The thermostat includes a type of automatic valve operated by fluctuations in the coolant temperature. This valve closes when the coolant temperature drops, preventing the circulation of coolant through the engine and thus permitting the engine to warm up rapidly. The valve opens when the coolant temperature has risen, allowing the circulation of coolant. Wax inside the thermostat expands when heated and contracts when cooled. Heating the wax thus generates pressure which overpowers the force of the spring which keeps the valve closed, thus opening the valve. When the wax cools, its contraction 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

SST (SPECIAL SERVICE TOOLS)

EG12S–06

	09230–01010 Radiator Service Tool Set	ST191

RECOMMENDED TOOLS

EG12V–0A

EG

	09082–00050 TOYOTA Electrical Tester Set	

EQUIPMENT

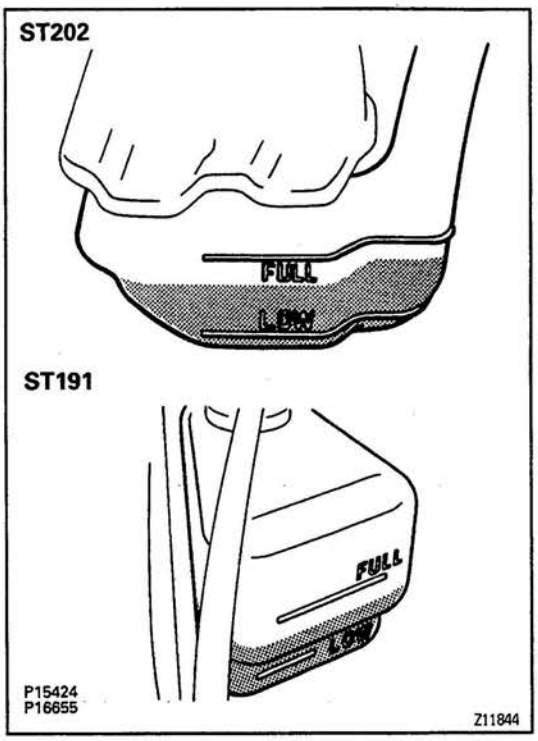
EG12W–07

Heater	
Radiator cap tester	
Thermometer	
Torque wrench	

COOLANT

EG12X–09

Item		Capacity	Classification
Engine coolant (w/ Heater)			Ethylene–glycol base
ST202	M/T (w/ Oil cooler)	7.0 liters (7.4 US qts, 6.2 Imp. qts)	
	M/T (w/o Oil cooler)	6.5 liters (6.9 US qts, 5.7 Imp. qts)	
	A/T	6.9 liters (7.3 US qts, 6.1 Imp. qts)	
ST191	M/T	6.6 liters (7.0 US qts, 5.8 Imp. qts)	
	A/T	7.0 liters (7.4 US qts, 6.2 Imp. qts)	



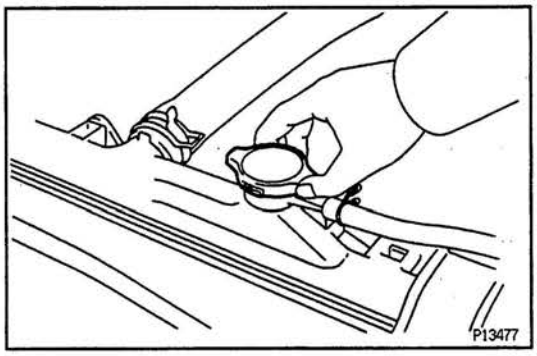
COOLANT CHECK

1. CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR

EQ3N7-02

The engine coolant level should be between the "LOW" and "FULL" lines.

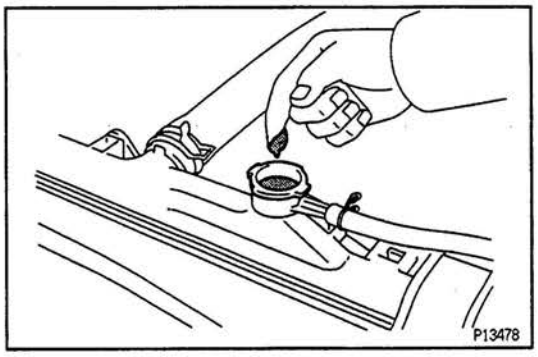
If low, check for leaks and add engine coolant up to the "FULL" line.



2. CHECK ENGINE COOLANT QUALITY

(a) Remove the radiator cap.

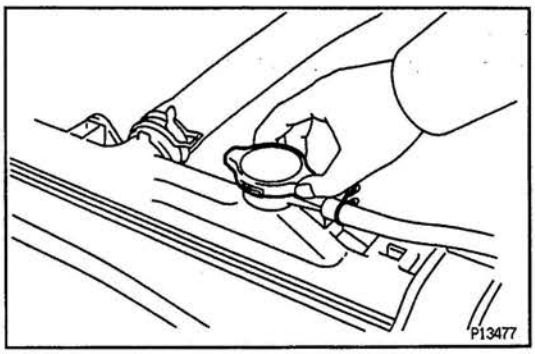
CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.



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

If excessively dirty, replace the coolant.

(c) Reinstall the radiator cap.



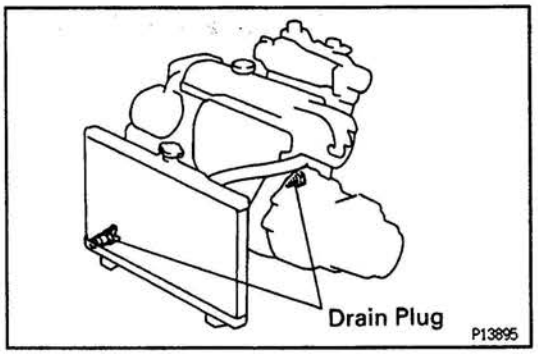
COOLANT REPLACEMENT

EG321-04

1. DRAIN ENGINE COOLANT

(a) Remove the radiator cap.

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

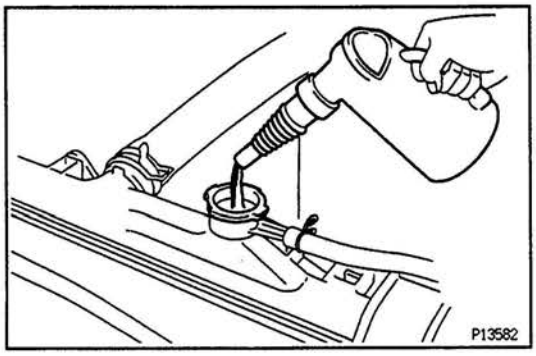


(b) Loosen the radiator drain plug (on the right side of the radiator lower tank) and engine drain plug (on the left rear of the cylinder block), and drain the coolant.

(c) Close the drain plugs.

Torque:

25 N·m (250 kgf·cm, 18 ft·lbf) for engine



2. FILL ENGINE COOLANT

(a) Slowly fill the system with coolant.

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

NOTICE:

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

Capacity (w/ Heater):

ST202

M/T (w/ Oil cooler)

7.0 liters (7.4 US qts, 6.2 Imp. qts)

M/T (w/o Oil cooler)

6.5 liters (6.9 US qts, 5.7 Imp. qts)

A/T

6.9 liters (7.3 US qts, 6.1 Imp. qts)

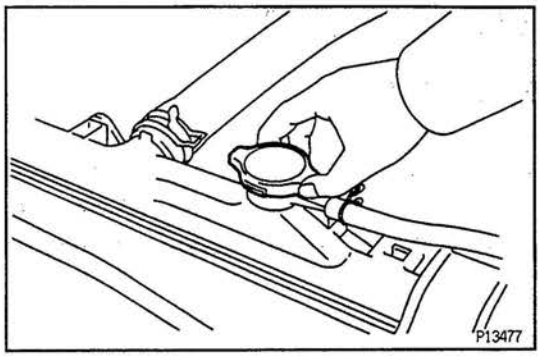
ST191

M/T

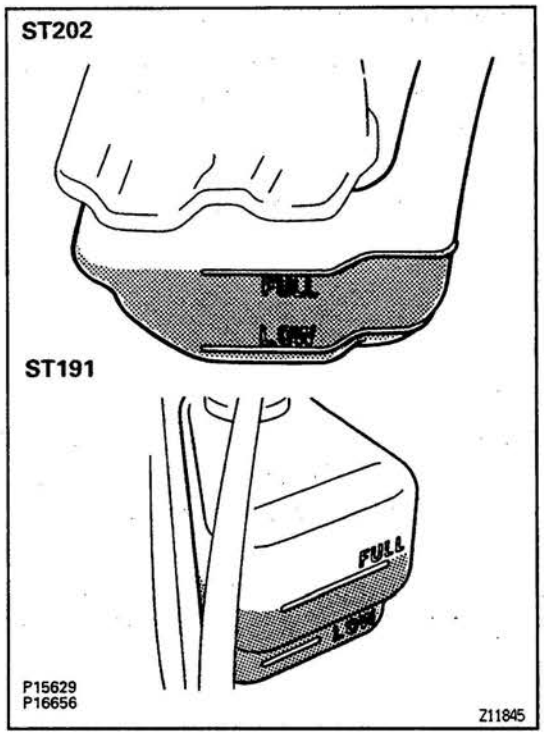
6.6 liters (7.0 US qts, 5.8 Imp. qts)

A/T

7.0 liters (7.4 US qts, 6.2 Imp. qts)



(b) Install the radiator cap.
(c) Start the engine, and bleed the cooling system.



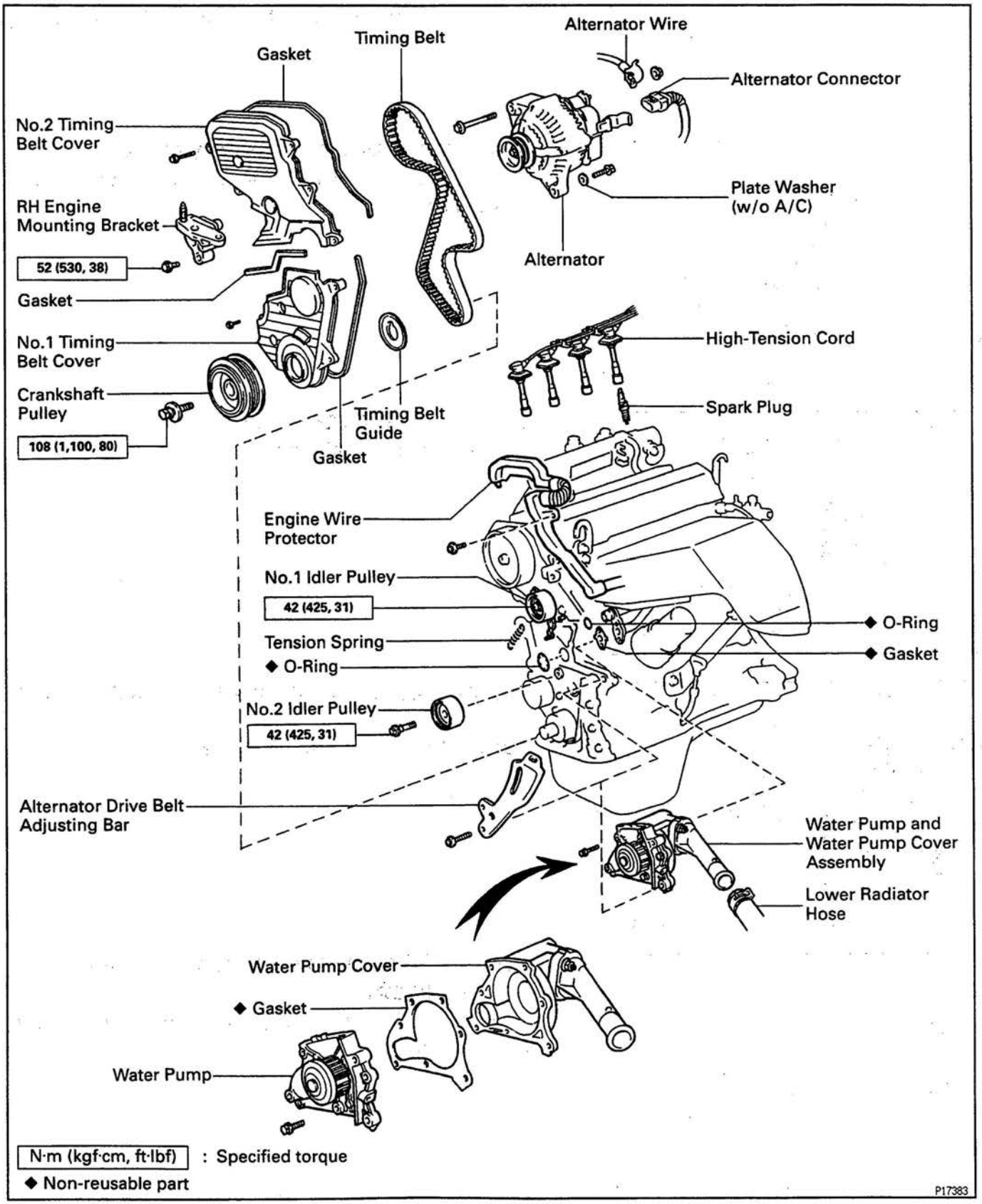
(d) Refill the radiator reservoir with coolant until it reaches the "FULL" line.

3. CHECK ENGINE COOLANT FOR LEAKS

WATER PUMP

COMPONENTS FOR REMOVAL AND INSTALLATION

EG3VE-01



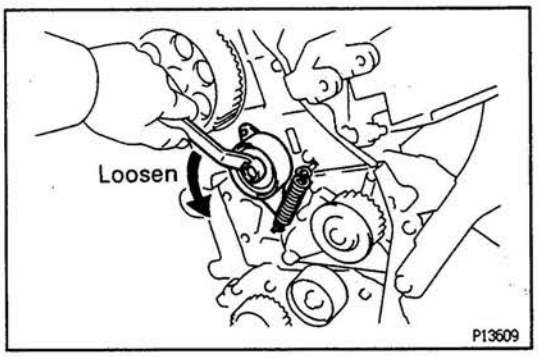
EG3VF-01

WATER PUMP REMOVAL

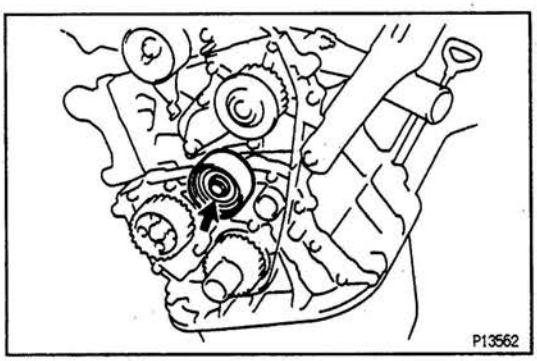
(See Components for Removal and Installation)

1. **DRAIN ENGINE COOLANT**
2. **REMOVE TIMING BELT**
   (See steps 1 to 6 and 8 to 11 on pages EG–35 to 40)

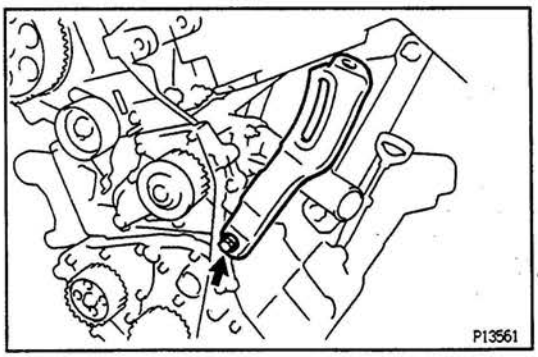
EG



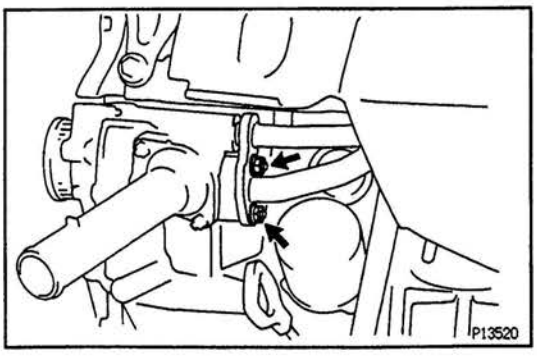
3. **REMOVE TIMING BELT TENSION SPRING**
   Loosen the No.1 idler pulley bolt, and remove the tension spring.



4. **REMOVE NO.2 IDLER PULLEY**
   Remove the bolt and pulley.

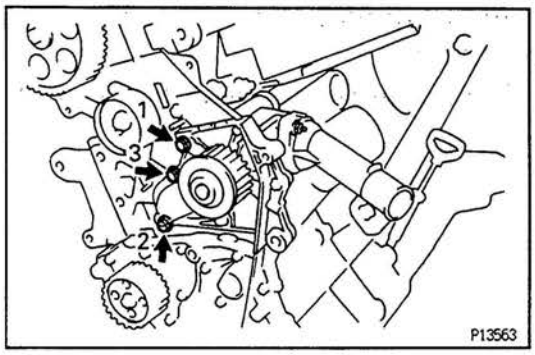


5. **REMOVE ALTERNATOR DRIVE BELT ADJUSTING BAR**
   Remove the bolt and adjusting bar.

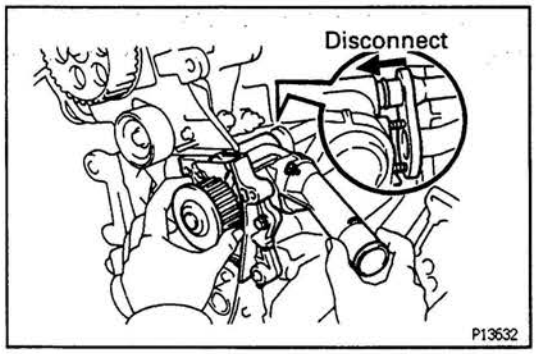


6. **REMOVE WATER PUMP AND WATER PUMP COVER ASSEMBLY**

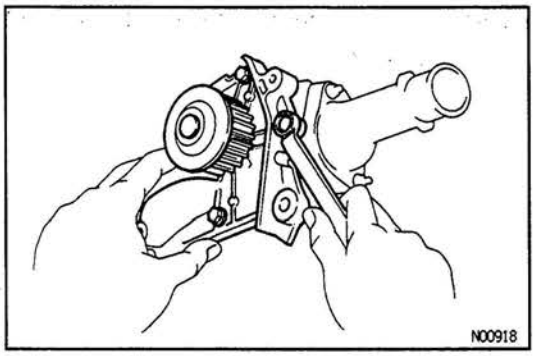
(a) Remove the 2 nuts holding the water pump to the water bypass pipe.



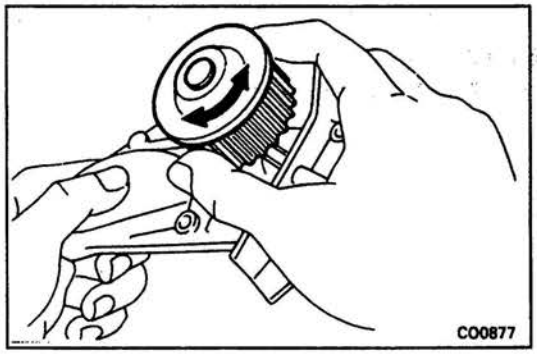
(b) Remove the 3 bolts in the sequence shown.



(c) Disconnect the water pump cover from the water bypass pipe, and remove the water pump and water pump cover assembly.
(d) Remove the gasket and 2 O—rings from the water pump and water bypass pipe.



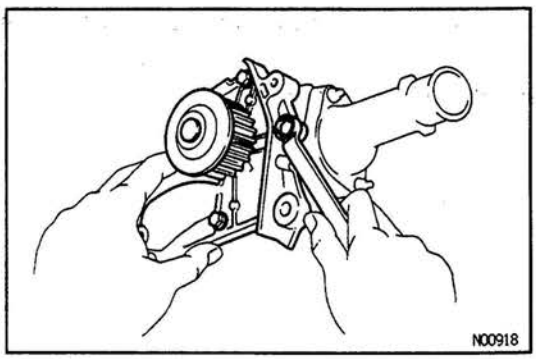
7. REMOVE WATER PUMP FROM WATER PUMP COVER
Remove the 3 bolts, water pump and gasket.



EG13A—07

WATER PUMP INSPECTION

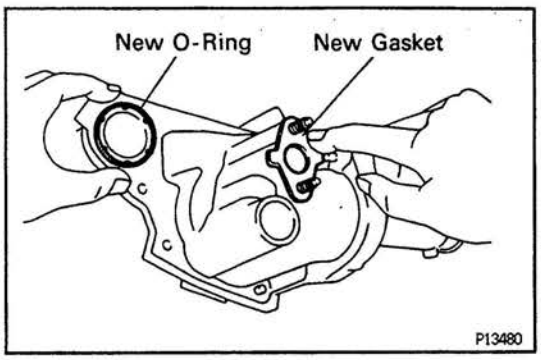
INSPECT WATER PUMP
Turn the pulley and check that the water pump bearing moves smoothly and quietly.



EG3N4—02

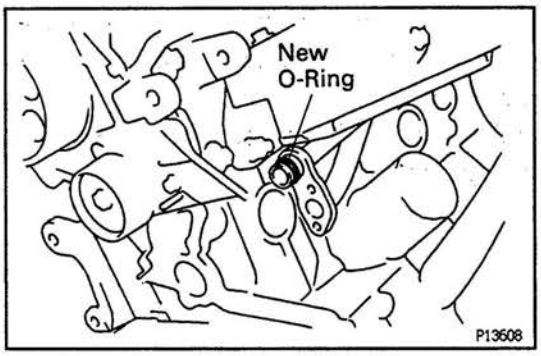
WATER PUMP INSTALLATION

(See Components for Removal and Installation)
1. INSTALL WATER PUMP TO WATER PUMP COVER
Install a new gasket and the water pump with the 3 bolts.
Torque: 8.8 N·m (90 kgf·cm, 78 in.·lbf)



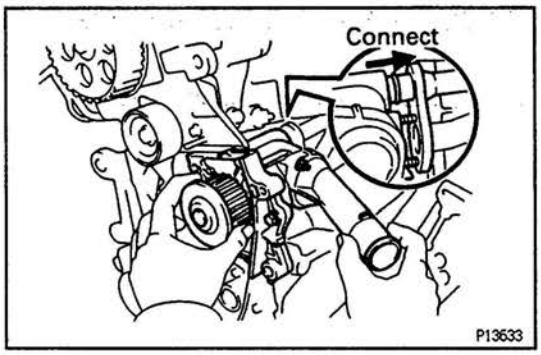
2. INSTALL WATER PUMP AND WATER PUMP COVER ASSEMBLY

(a) Install new O–ring and gasket to water pump cover.

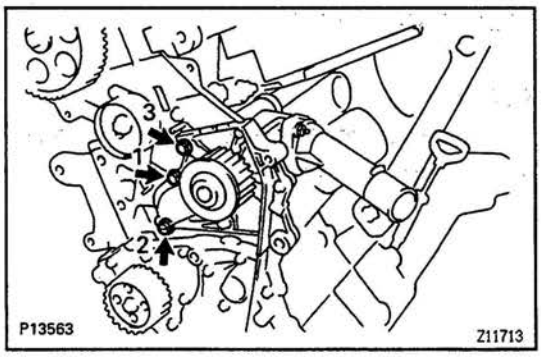


(b) Install a new O–ring to the water bypass pipe.

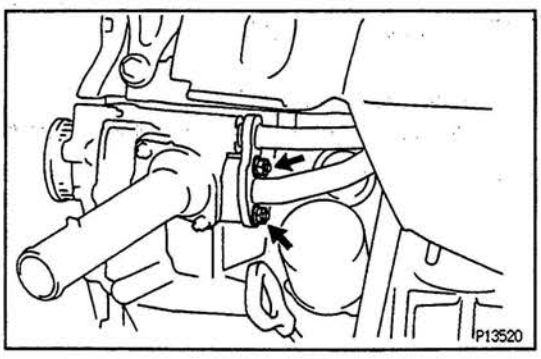
(c) Apply soapy water to the O–ring on the water bypass pipe.



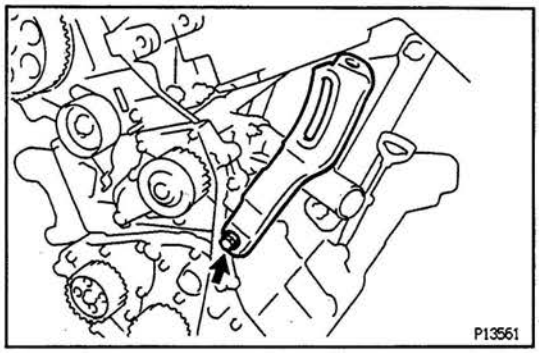
(d) Connect the water pump cover to the water bypass pipe. Do not install the nuts yet.



(e) Install the water pump with the 3 bolts. Tighten the bolts in the sequence shown.
Torque: 8.8 N·m (90 kgf·cm, 78 in.·lbf)



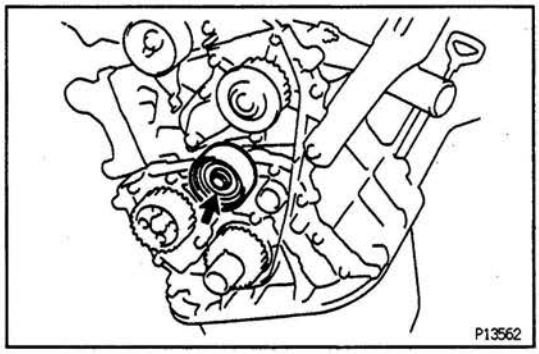
(f) Install the 2 nuts holding the water pump cover to the water bypass pipe.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



3. INSTALL ALTERNATOR DRIVE BELT ADJUSTING BAR

Install the adjusting bar with the bolt.

Torque: 27 N·m (275 kgf·cm, 20 ft·lbf)

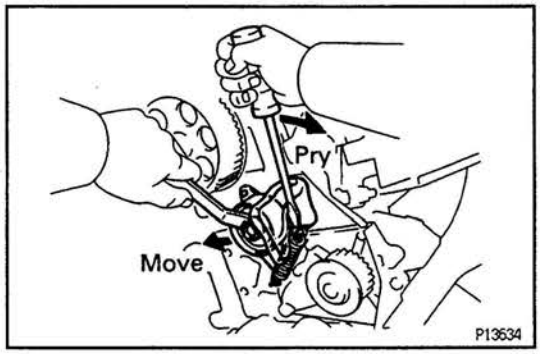


4. INSTALL NO.2 IDLER PULLEY

(a) Install the pulley with the bolt.

Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

(b) Check that the idler pulley moves smoothly.



5. INSTALL TIMING BELT TENSION SPRING

(a) Install the tension spring.

(b) Pry the No.1 pulley toward the left as far as it will go, and tighten the pulley bolt.

6. INSTALL TIMING BELT

(See steps 5 to 8 and 10 to 16 on pages EG–44 to 49)

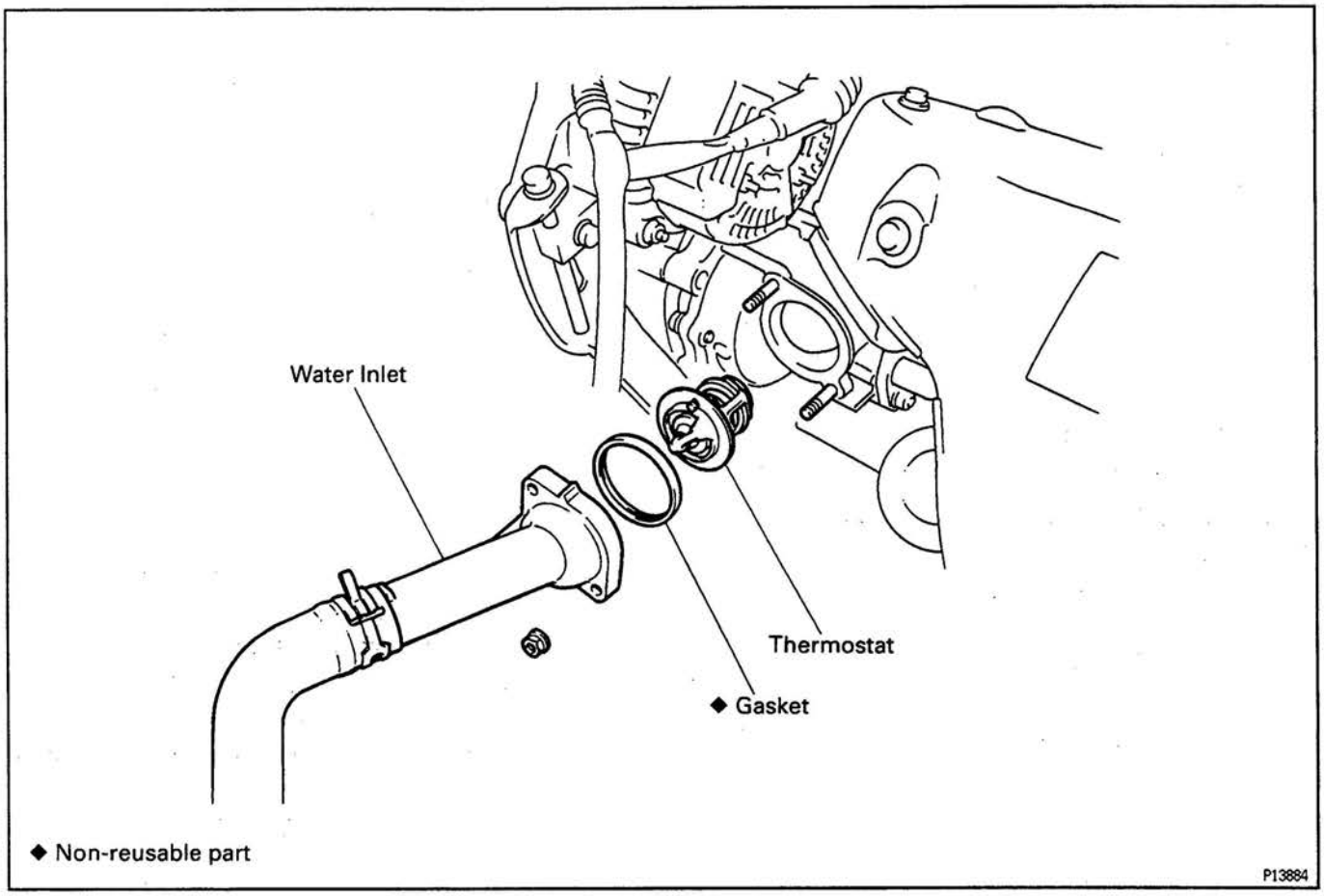
7. FILL RADIATOR WITH ENGINE COOLANT

THERMOSTAT

EG13D–0M

COMPONENTS FOR REMOVAL AND INSTALLATION

EG



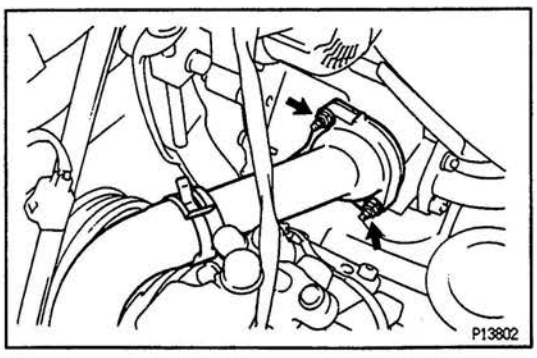
EG3VG–01

THERMOSTAT REMOVAL

(See Components for Removal and Installation)

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

1. DRAIN ENGINE COOLANT

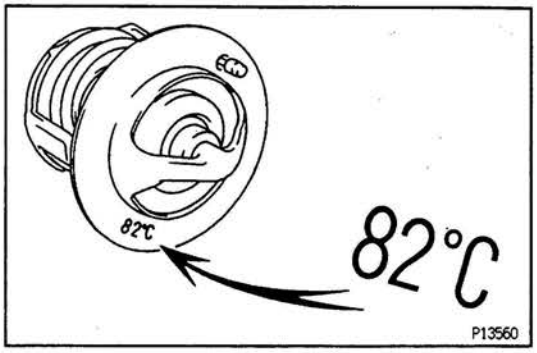


2. REMOVE WATER INLET AND THERMOSTAT

(a) Remove the 2 nuts, and disconnect the water inlet from the water pump cover.

(b) Remove the thermostat.

(c) Remove the gasket from the thermostat.

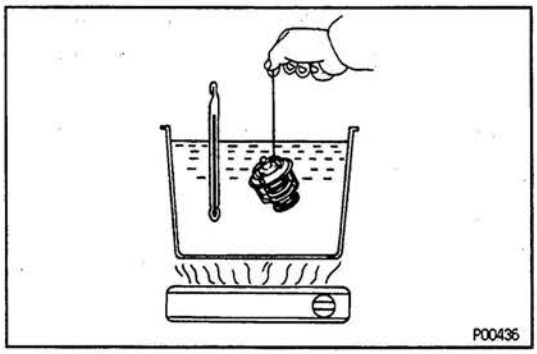


EG13H-07

THERMOSTAT INSPECTION

INSPECT THERMOSTAT

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



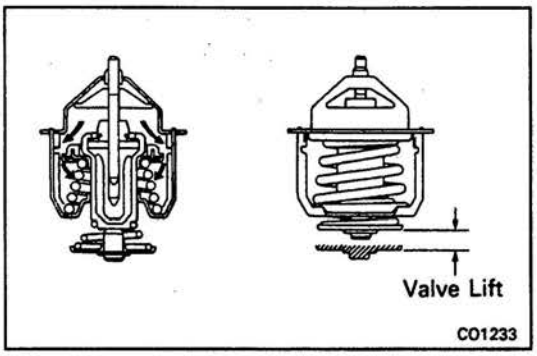
(a) Immerse the thermostat in water and gradually heat the water.

(b) Check the valve opening temperature.

Valve opening temperature:

80 – 84°C (176 – 183°F)

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



(c) Check the valve lift.

Valve lift:

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

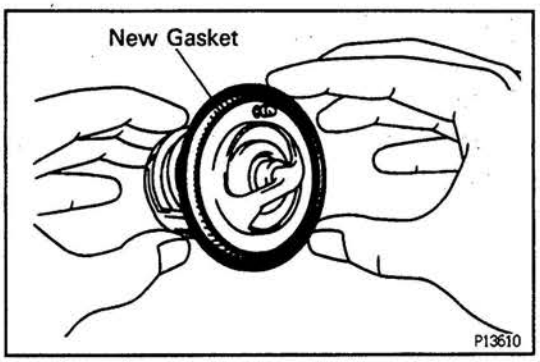
If the valve lift is not as specified, replace the thermostat.

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

If not closed, replace the thermostat.

EG3VH-01

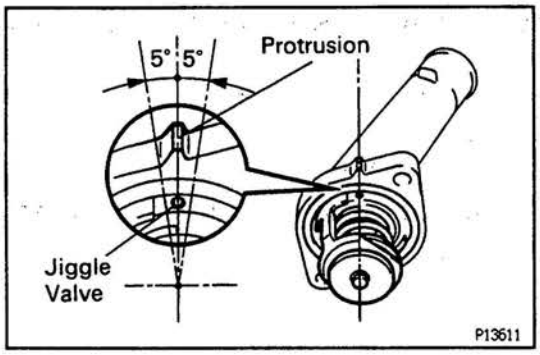
THERMOSTAT INSTALLATION



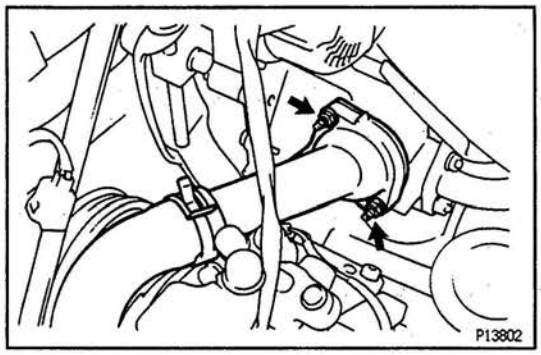
(See Components for Removal and Installation)

1. PLACE THERMOSTAT IN WATER PUMP

(a) Install a new gasket to the thermostat.



(b) Align the jiggle valve of the thermostat with the protrusion of the water inlet, and insert the thermostat in the water inlet.
HINT: The jiggle valve may be set within 5° of either side of the prescribed position.



2. INSTALL WATER INLET AND THERMOSTAT
Install the water inlet and thermostat with the 2 nuts.
Torque: 8.8 N·m (90 kgf·cm, 78 in.·lbf)

3. FILL RADIATOR WITH ENGINE COOLANT

4. START ENGINE AND CHECK FOR LEAKS

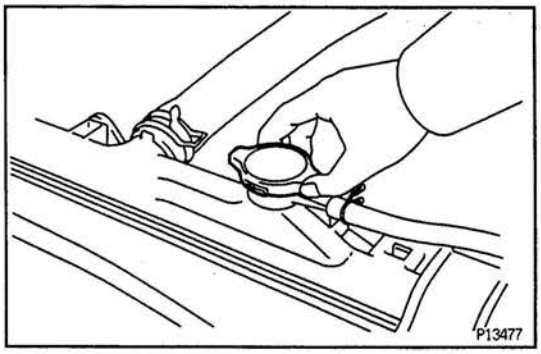
RADIATOR

RADIATOR CLEANING

EG2UP-03

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

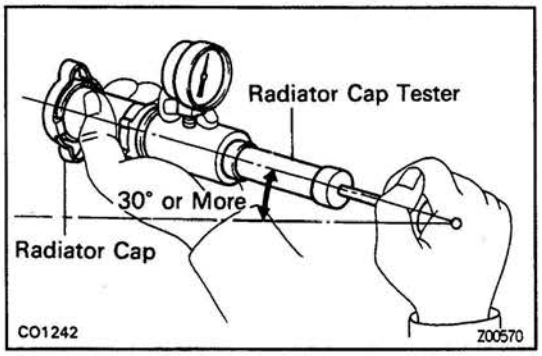
NOTICE: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. If the cleaner nozzle pressure is 2,942 – 3,432 kPa (30 – 35 kgf/cm², 427 – 498 psi), keep a distance of at least 40 – 50 cm (15.75 – 19.69 in.) between the radiator core and cleaner nozzle.



RADIATOR INSPECTION

1. REMOVE RADIATOR CAP

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



2. INSPECT RADIATOR CAP

NOTICE: When performing steps (a) and (b) below, keep the radiator pump tester at an angle of over 30° above the horizontal.

(a) Using a radiator cap tester, slowly pump the tester and check that air is coming from the relief valve.

Pump speed:

1 push/3 seconds or more

NOTICE: Push the pump at a constant speed.

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

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

Pump speed:

1st time

1 push/1 second or less

2nd time or more

Any speed

Standard opening pressure:

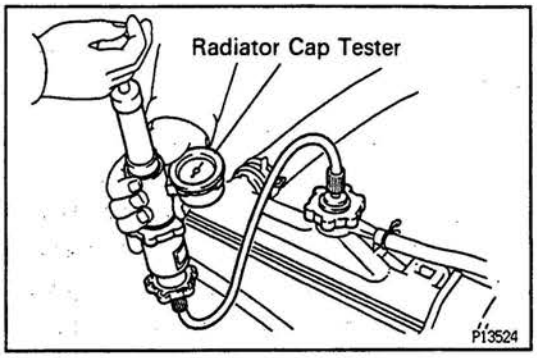
74 – 103 kPa

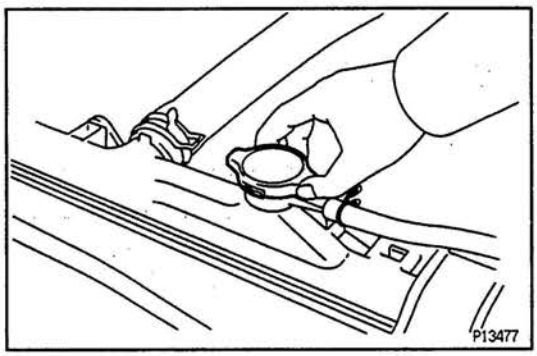
(0.75 – 1.05 kgf/cm², 10.7 – 14.9 psi)

Minimum opening pressure:

59 kPa (0.6 kgf/cm², 8.5 psi)

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





3. INSPECT COOLING SYSTEM FOR LEAKS

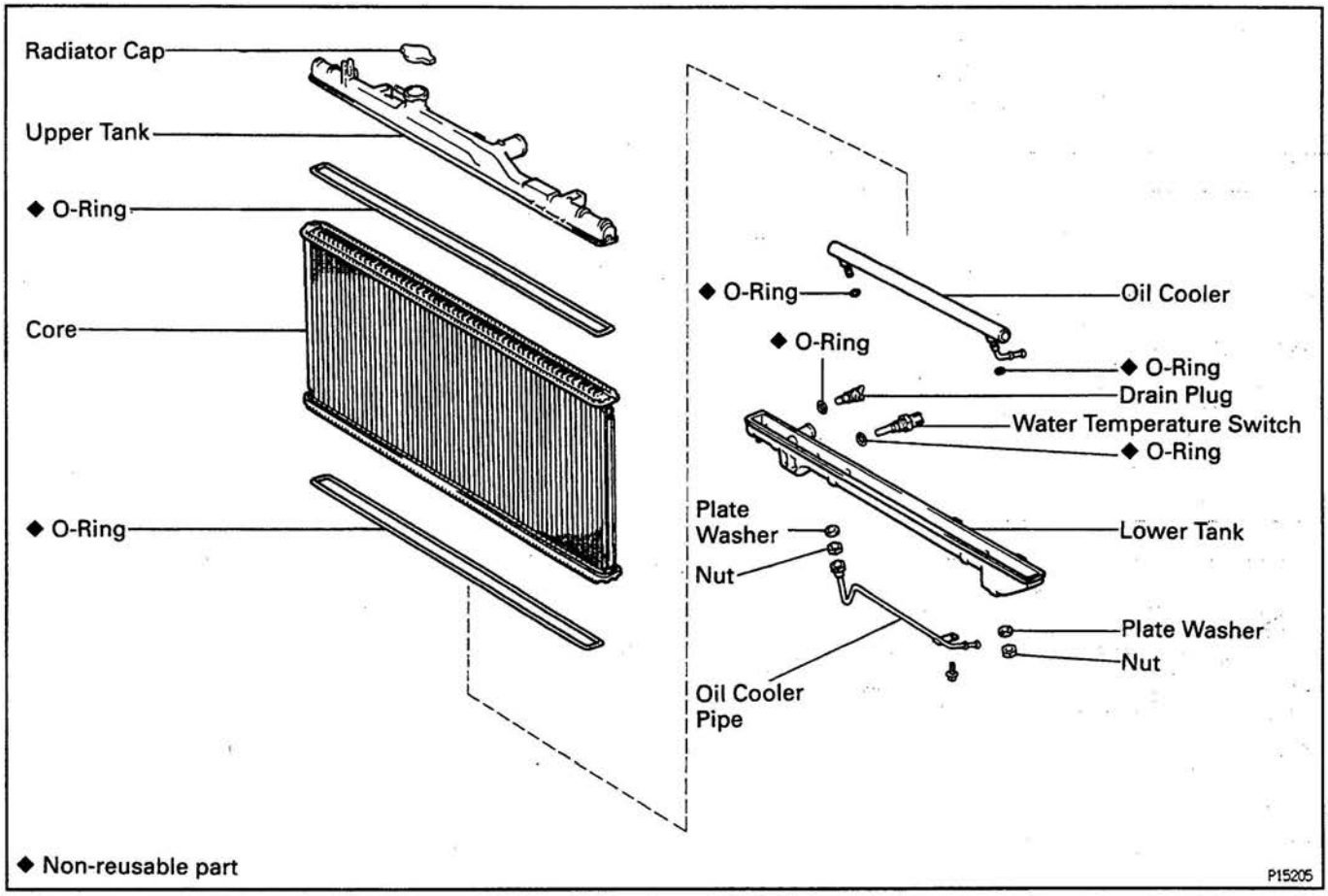
(a) Fill the radiator with coolant and attach a radiator cap tester to the water filler.

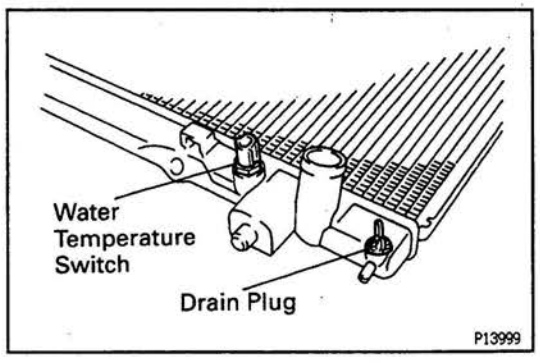
(b) Warm up the engine.

(c) Pressurise the radiator to 118 kPa (1.2 kgf/cm², 17.1 psi), and check that the pressure does not drop.
If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, cylinder block and cylinder head.

4. REINSTALL RADIATOR CAP

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY (ST191 only) EG1C2-05





RADIATOR DISASSEMBLY (ST191 only) EG3K3-03

(See Components for Disassembly and Assembly)

1. REMOVE WATER TEMPERATURE SWITCH

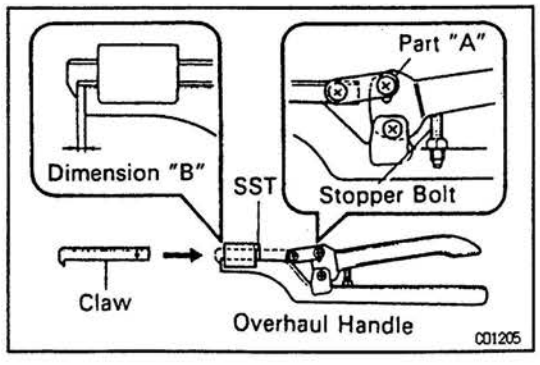
(a) Remove the water temperature switch.

(b) Remove the O−ring.

2. REMOVE DRAIN PLUG

(a) Remove the drain plug.

(b) Remove the O−ring.



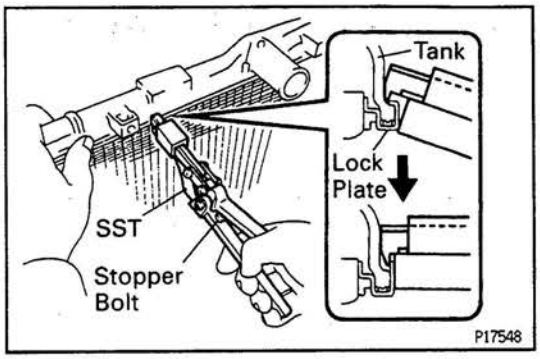
3. ASSEMBLY OF SST

SST 09230−01010

(a) Install the claw to the overhaul handle, inserting it in the hole in part "A" as shown in the diagram.

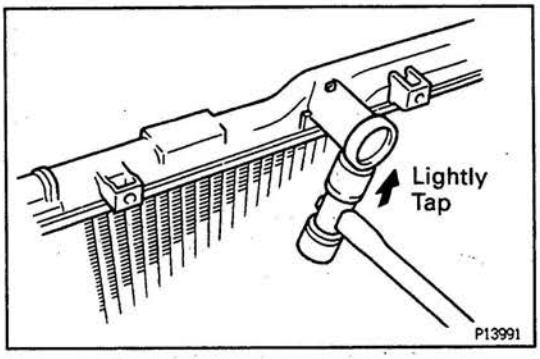
(b) While gripping the handle, adjust the stopper bolt so that dimension "B" shown in the diagram is 0.2−0.5 mm (0.008−0.020 in.).

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



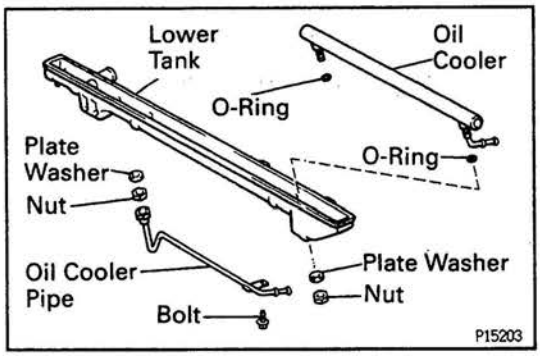
4. UNCAULK LOCK PLATES

Using SST to release the caulking, squeeze the handle until stopped by the stopper bolt.
SST 09230–01010



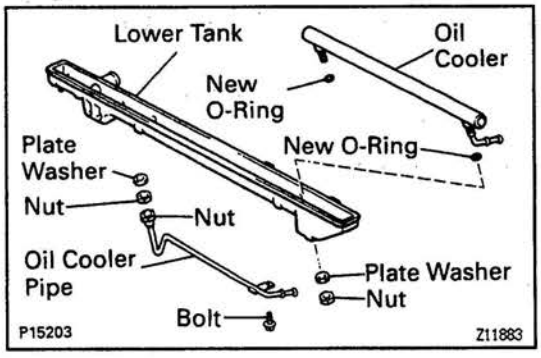
5. REMOVE TANKS AND O–RINGS

(a) Lightly tap the bracket of the radiator (or radiator hose inlet or outlet) with a soft–faced hammer and remove the tank.
(b) Remove the O–ring.



6. A/T:
REMOVE OIL COOLER FROM LOWER TANK

(a) Loosen the nut, and remove the bolt and oil cooler pipe.
(b) Remove the 2 nuts and plate washers.
(c) Remove the oil cooler and 2 O–rings.



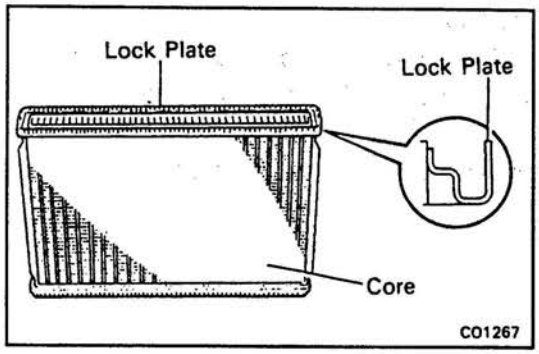
RADIATOR ASSEMBLY (ST191 only)

EG3VJ–01

(See Components for Disassembly and Assembly)

1. A/T:
INSTALL OIL COOLER TO LOWER TANK

(a) Clean the O–ring contact surface of the lower tank and oil cooler.
(b) Install 2 new O–rings to the oil cooler.
(c) Install the oil cooler with the O–rings to the lower tank.
(d) Install the 2 plate washers and nuts.
Torque: 8.3 N·m (85 kgf·cm, 74 in.·lbf)
(e) Install the cooler pipe with the nut and bolt.
Torque: 14.7 N·m (150 kgf·cm, 11 ft·lbf) for nut

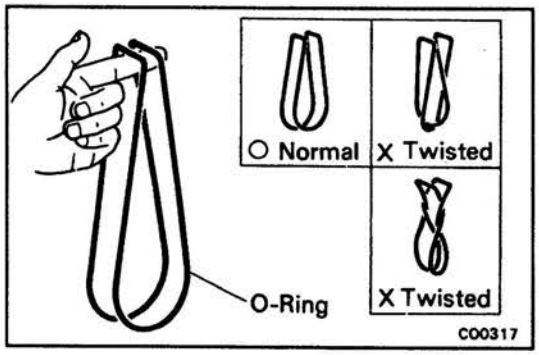


2. INSPECT LOCK PLATE

Inspect the lock plate for damage.

HINT:

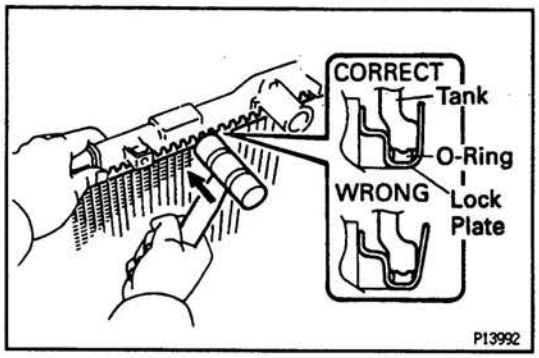
- If the sides of the lock plate groove are deformed, reassembly of the tank will be impossible.
- Therefore, first correct any deformation with pliers or similar object. Water leakage will result if the bottom of the lock plate groove is damaged or dented. Therefore, repair or replace if necessary.



3. INSTALL NEW O–RINGS AND TANKS

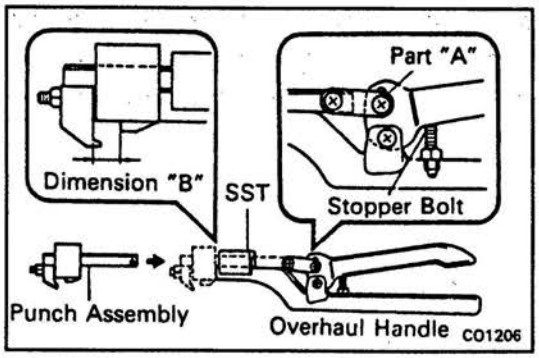
(a) After checking that there are no foreign objects in the lock plate groove, install the new O–ring without twisting it.

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



(b) Install the tank without damaging the O–ring.

(c) Tap the lock plate with a soft–faced hammer so that there is no gap between it and the tank.



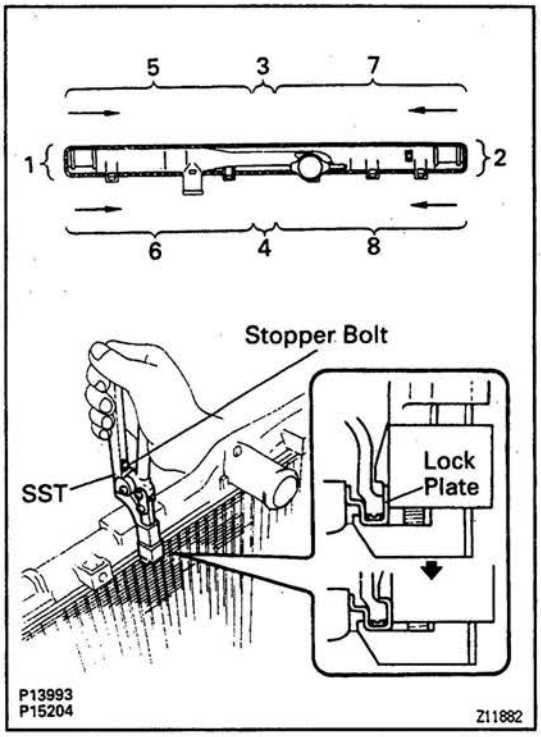
4. ASSEMBLY OF SST

SST 09230–01010

(a) Install the punch assembly to the overhaul handle, inserting it in the hole in part "A" as shown in the illustration.

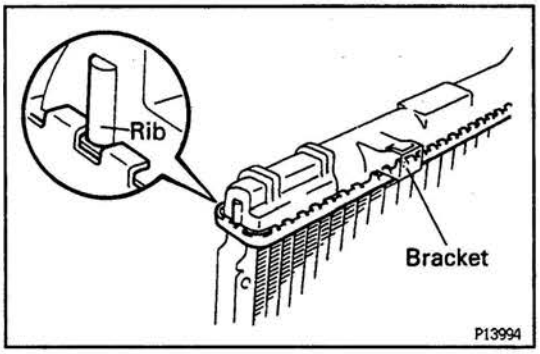
(b) While gripping the handle, adjust the stopper bolt so that dimension "B" shown in the diagram is 7.7 mm (0.30 in.).

EG



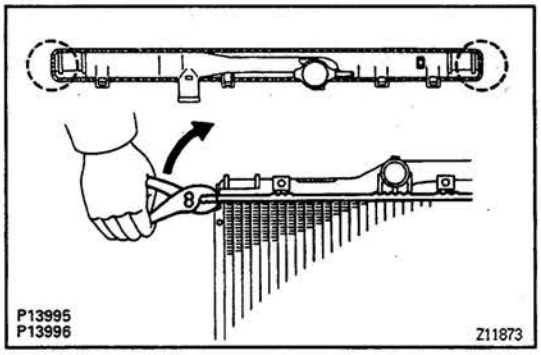
5. CAULK LOCK PLATE

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

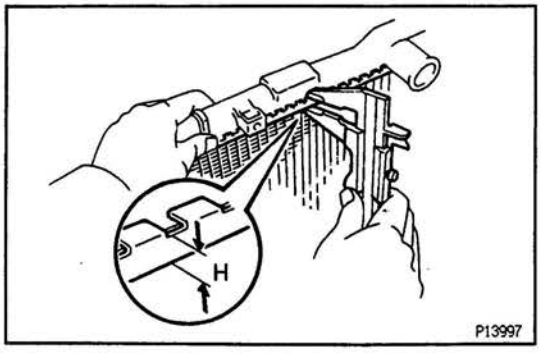


HINT:

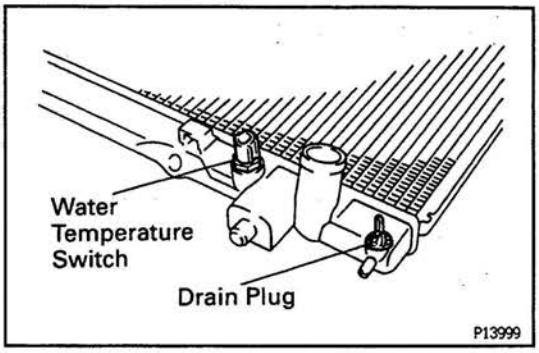
- Do not stake the areas protruding around the pipes, brackets or tank ribs.



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



(b) Check the lock plate height (H) after completing the caulking.
Plate height:
7.75 – 8.25 mm (0.3051 – 0.3248 in.)
If not within the specified height, adjust the stopper bolt of the handle again and perform the caulking again.



6. INSTALL WATER TEMPERATURE SWITCH

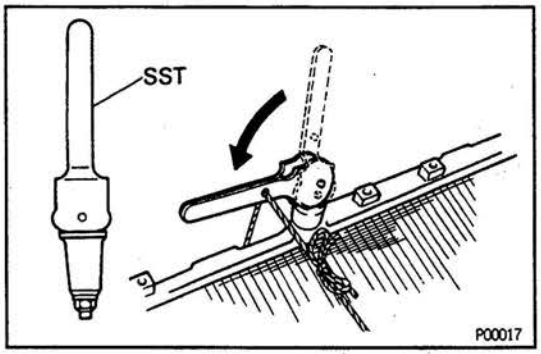
(a) Install a new O–ring to the water temperature switch.

(b) Install the water temperature switch.

7. INSTALL DRAIN PLUG

(a) Install a new O–ring to the drain plug.

(b) Install the drain plug.



8. INSPECT FOR WATER LEAKS

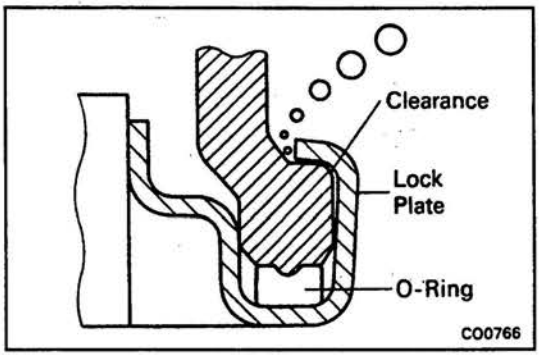
(a) Tighten the drain plug.

(b) Plug the inlet and outlet pipes of the radiator with SST.

SST 09230–01010

(c) Using a radiator cap tester, apply pressure to the radiator.

Test pressure: 177 kPa (1.8 kgf/cm², 26 psi)



(d) Inspect for water leaks.

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

9. PAINT TANK PLATE

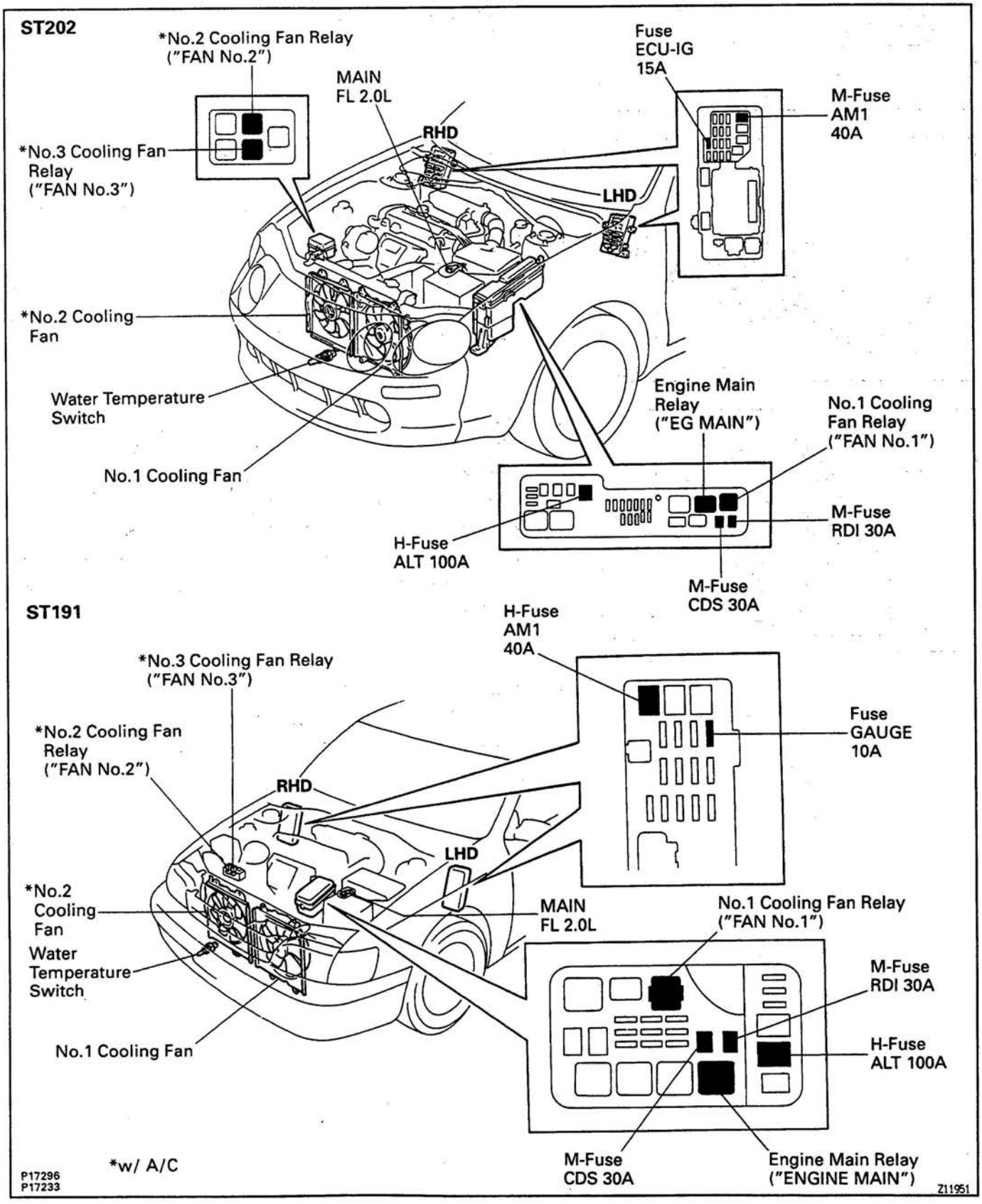
HINT: If the water leak test checks out okay, allow the radiator to completely dry and then paint the lock plates.

ELECTRIC COOLING FAN

EG078-0Z

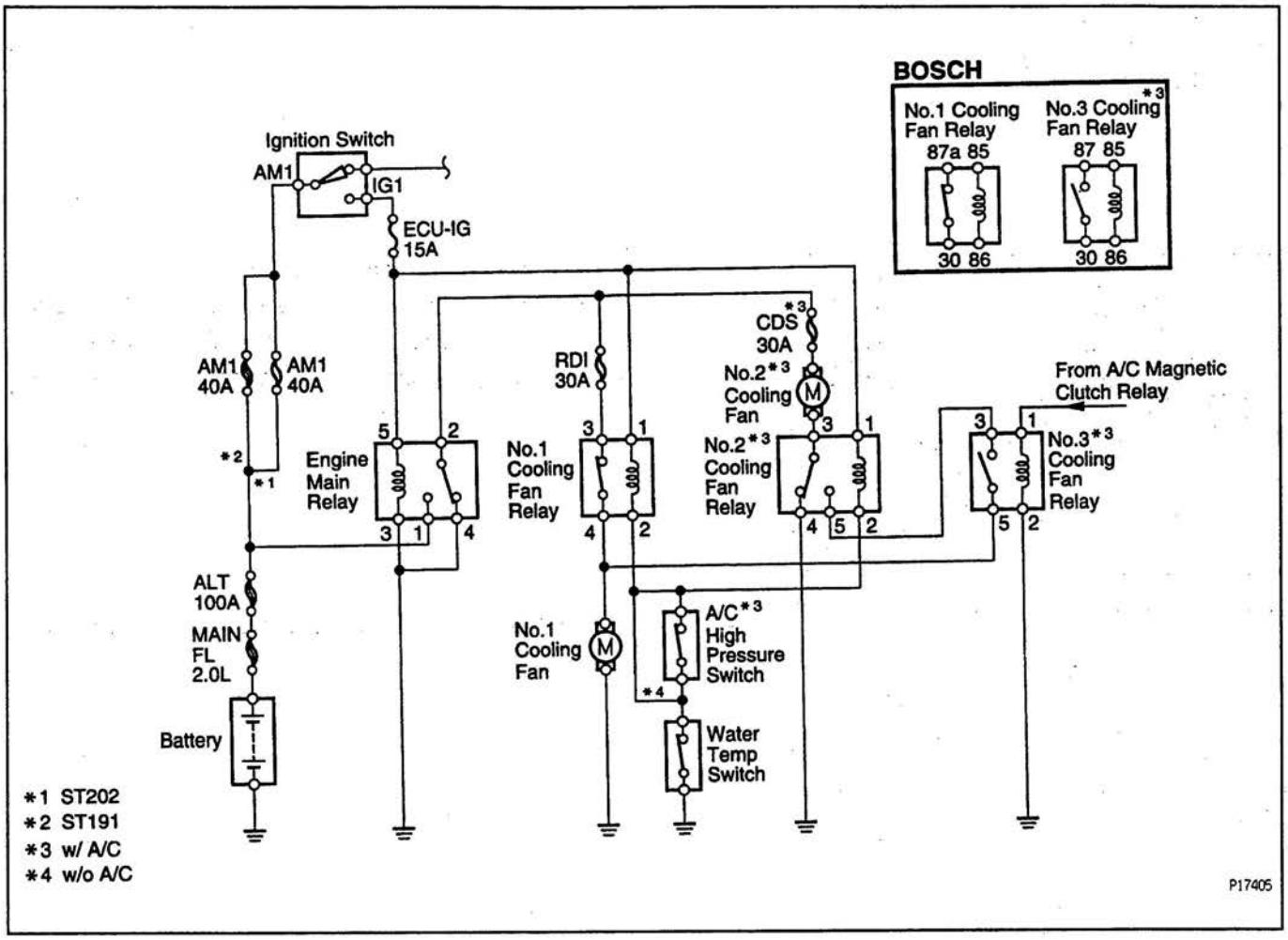
Part Location

EG

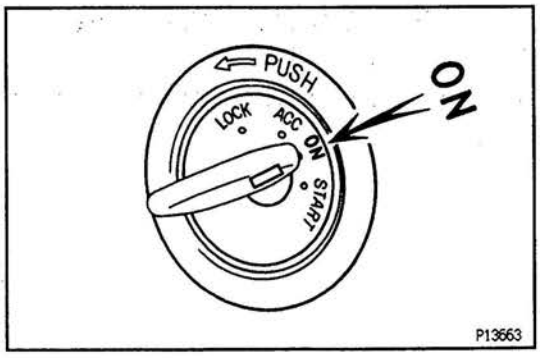


EG07C–0V

System Circuit



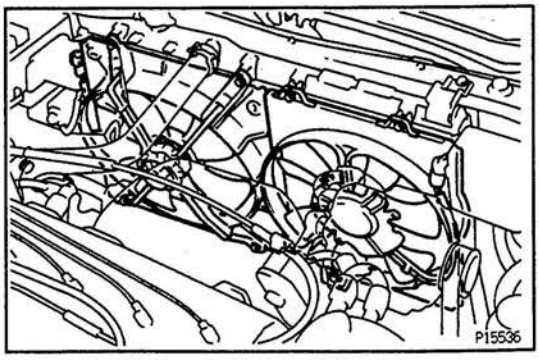
EG148–07



On–Vehicle Inspection

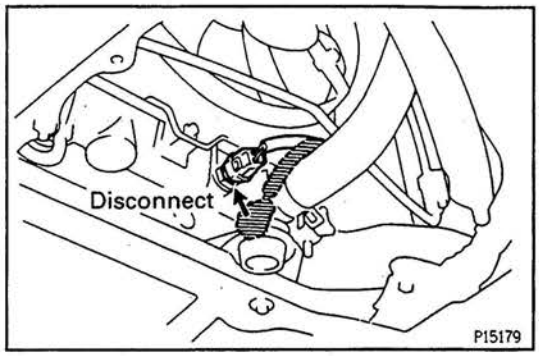
1. CHECK COOLING FAN OPERATION WITH LOW TEMPERATURE (Below 83°C (181°F))

(a) Turn the ignition switch ON.

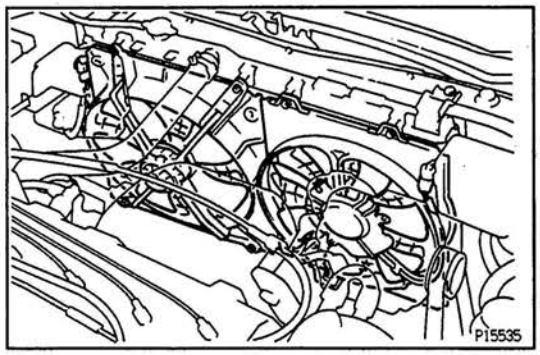


(b) Check that the cooling fan stops.
If not, check the cooling fan relay and water temperature switch, and check for a separated connector or severed wire between the cooling fan relay and water temperature switch.

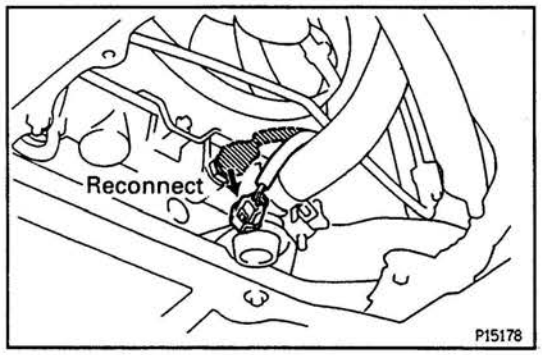
EG



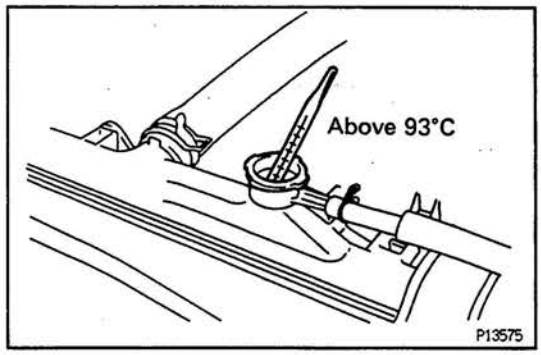
(c) Disconnect the water temperature switch connector.



(d) Check that the cooling fan rotates.
If not, check the fan main relay, cooling fan relay, cooling fan, fuses, and check for short circuit between the cooling fan relay and water temperature switch.

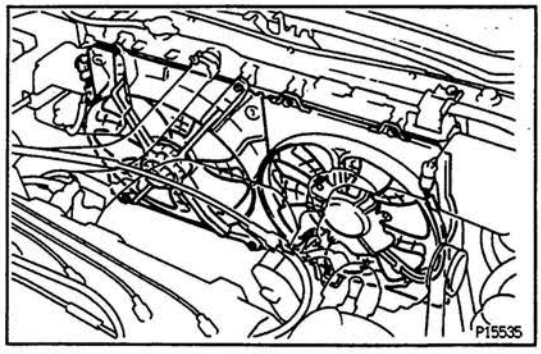


(e) Reconnect the water temperature switch connector.



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

(a) Start the engine, and raise coolant temperature to above 93°C (199°F).



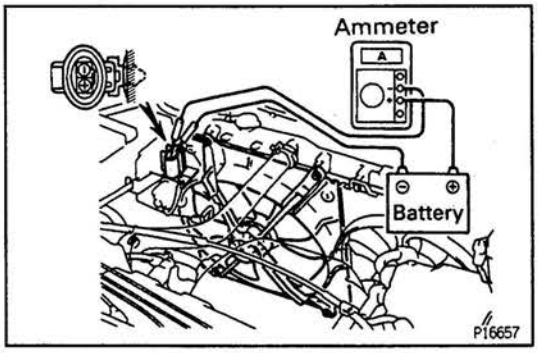
(b) Check that the cooling fan rotates.
If not, replace the water temperature switch.

EG3VX-01

No.1 Cooling Fan

NO.1 COOLING FAN INSPECTION

1. DISCONNECT COOLING FAN CONNECTOR



2. INSPECT NO.1 COOLING FAN

(a) Connect battery and ammeter to the cooling fan connector.

(b) Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

Standard amperage (NIPPONDENSO):

ST202

6.0 — 7.4 A

ST191

Europe

3.2 — 4.4 A

Others (M/T)

6.0 — 7.4 A

Others (A/T)

9.1 — 11.1 A

Standard amperage (BOSCH):

2.9 — 4.1 A

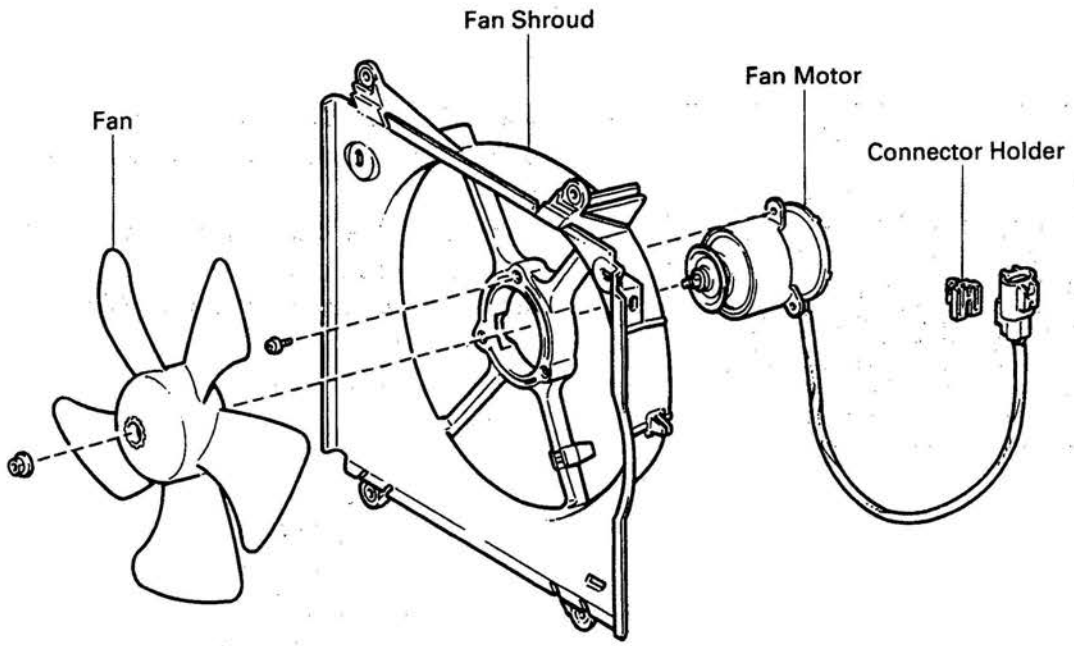
3. RECONNECT COOLING FAN CONNECTOR

EG078-10

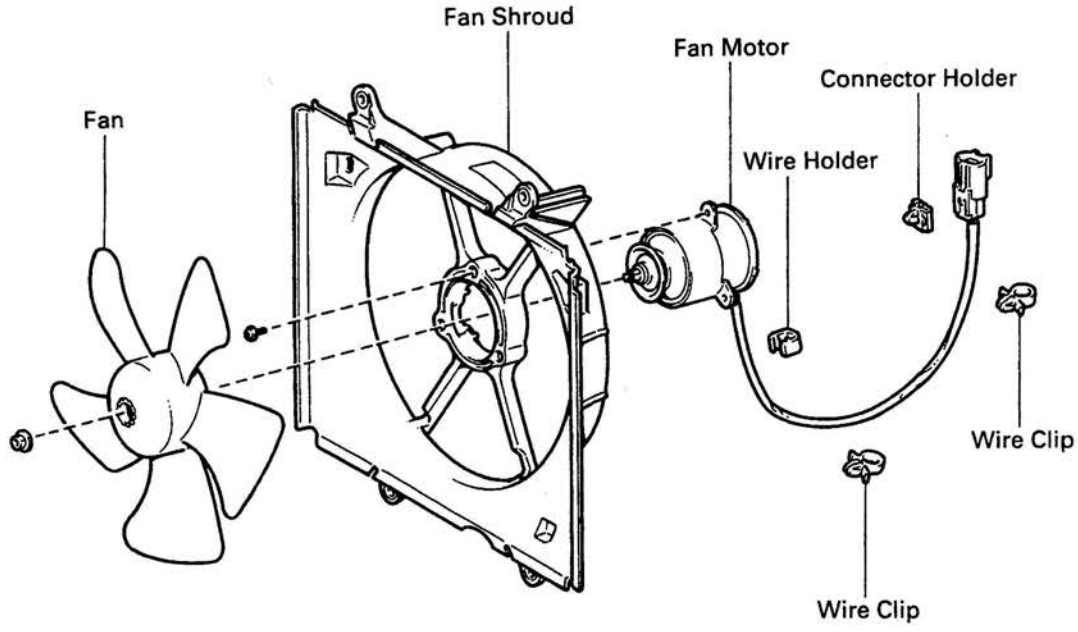
COMPONENTS FOR DISASSEMBLY AND ASSEMBLY (NIPPONDENSO)

EG

ST202

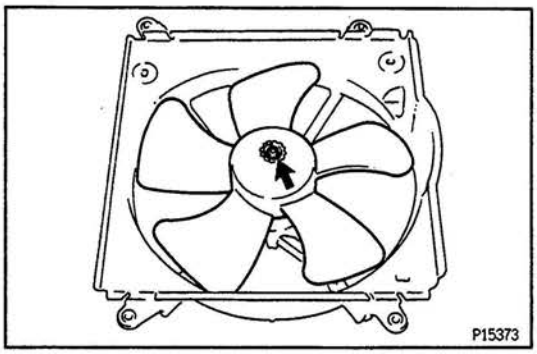


ST191



P15385
P13595

Z11706



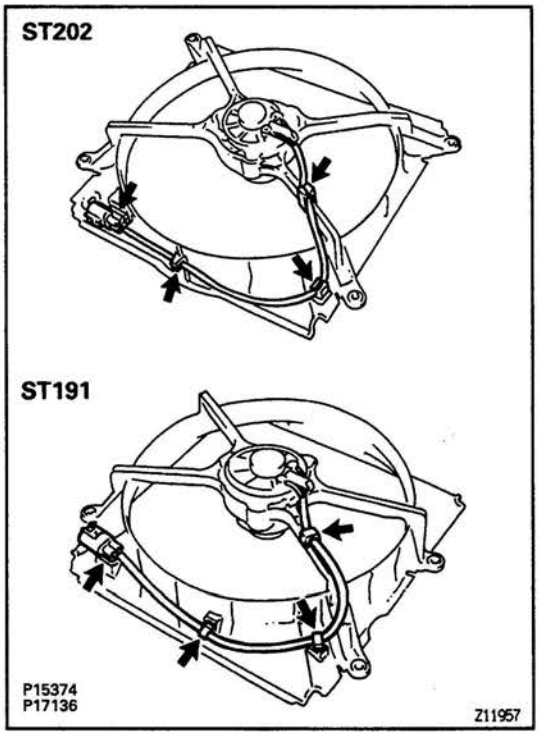
NO.1 COOLING FAN DISASSEMBLY (NIPPONDENSO)

EG13X-04

(See Components for Disassembly and Assembly)

1. REMOVE FAN

Remove the nut and fan.

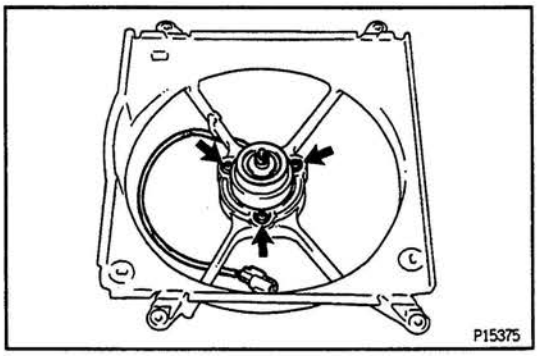


2. REMOVE FAN MOTOR

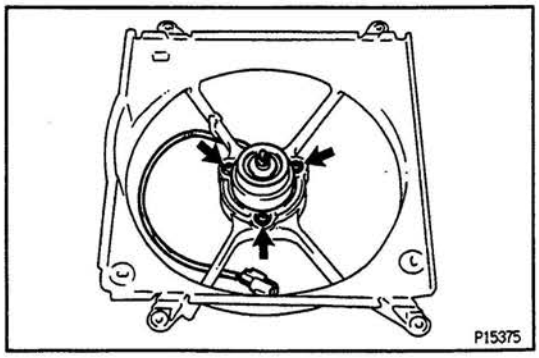
(a) ST202:
Disconnect the wire and connector from the fan shroud.

(b) ST191:
Remove the holder and 2 clips, disconnect the wire from the fan shroud.

(c) Disconnect the connector from the holder.



(d) Remove the 3 screws and fan motor.



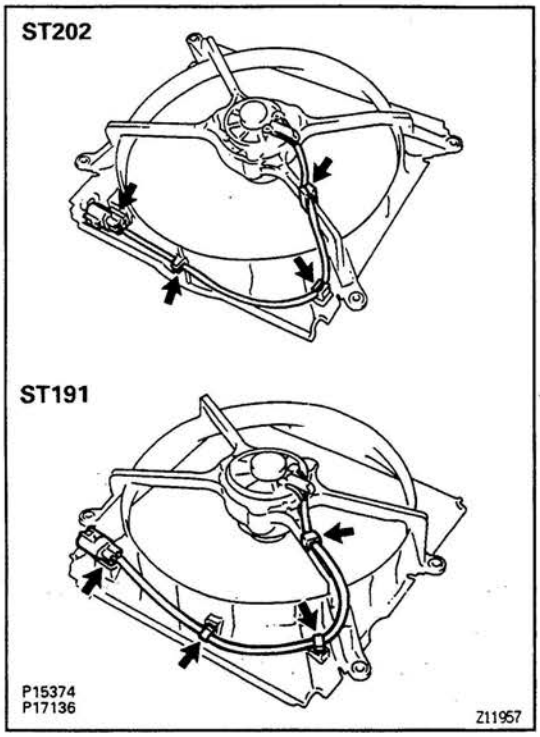
NO.1 COOLING FAN ASSEMBLY (NIPPONDENSO)

EG13Y-04

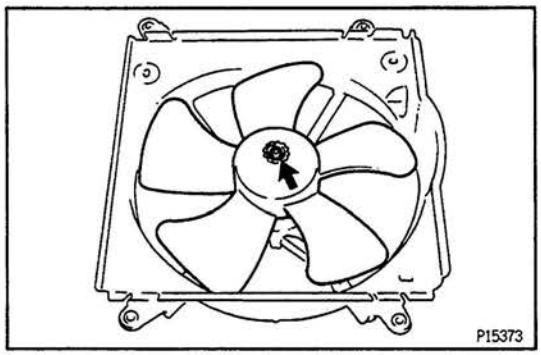
(See Components for Disassembly and Assembly)

1. INSTALL FAN MOTOR

(a) Install the fan motor with the 3 screws.



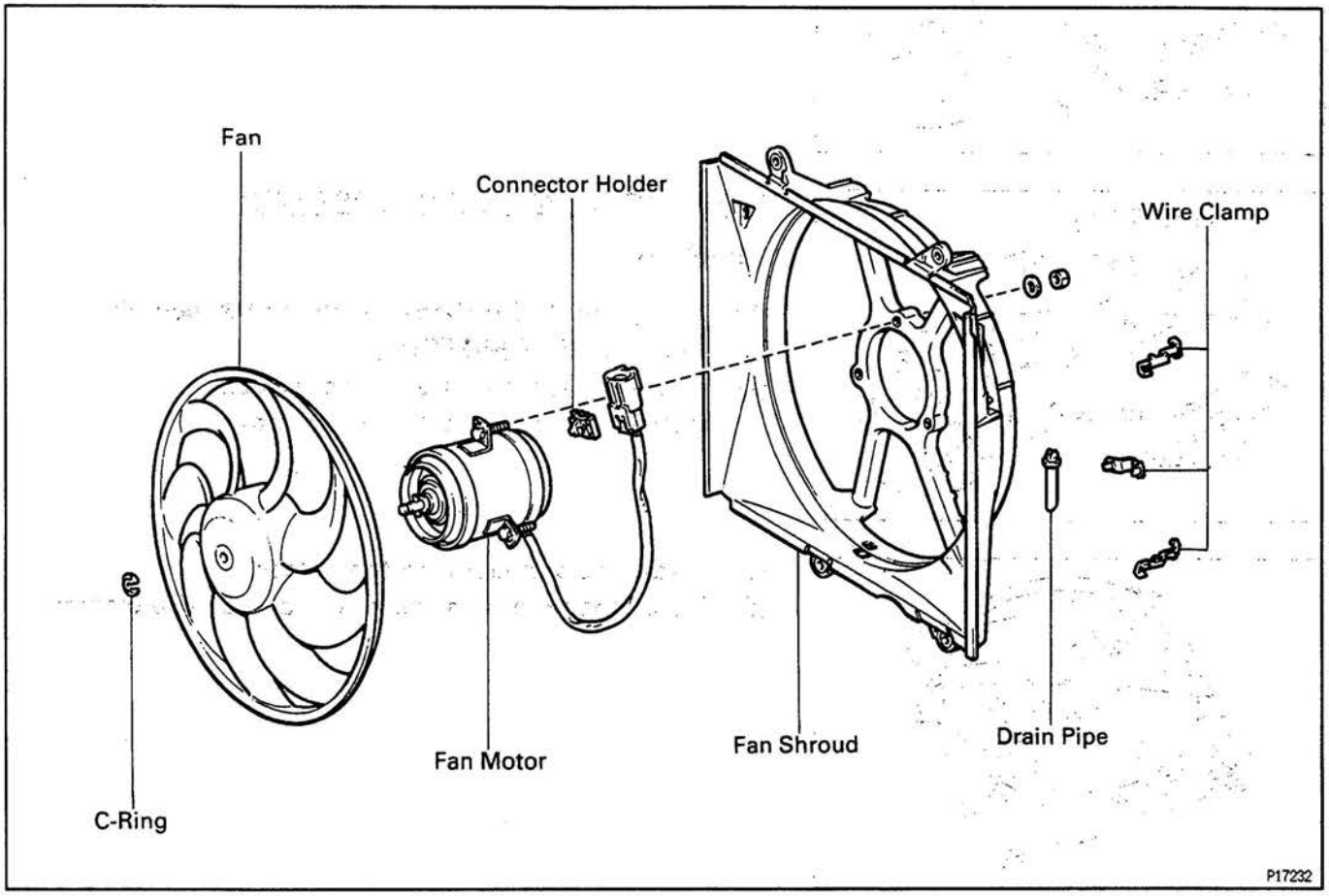
(b) Install the connector to the holder.
(c) ST202:
Install the wire and connector to the fan shroud.
(d) ST191:
Install the wire with the holder and 2 clips.

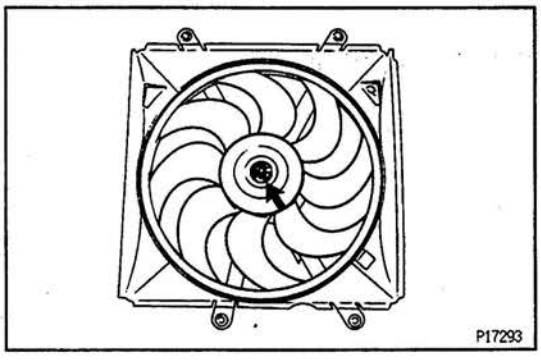


2. INSTALL FAN
Install the fan with the nut.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY (BOSCH)

EG078-11





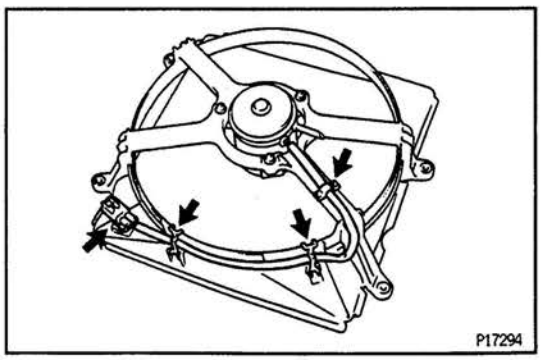
NO.1 COOLING FAN DISASSEMBLY (BOSCH)

EG13X-06

(See Components for Disassembly and Assembly)

1. REMOVE FAN

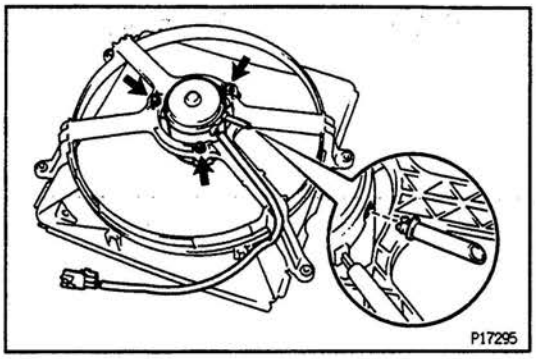
Remove the C—ring and fan.



2. REMOVE FAN MOTOR

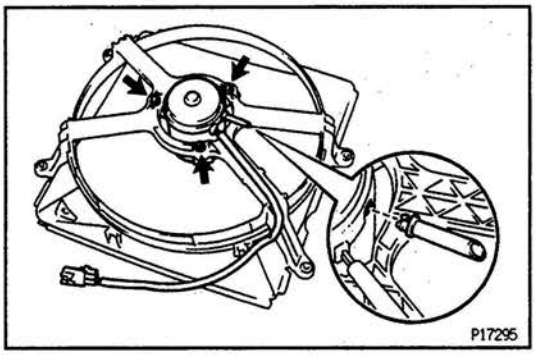
(a) Remove the holder and 3 wire clamps, disconnect the wire from the fan shroud.

(b) Disconnect the connector from the holder.



(c) Remove the drain pipe from the fan motor.
(d) Remove the 3 nuts and fan motor.

EG



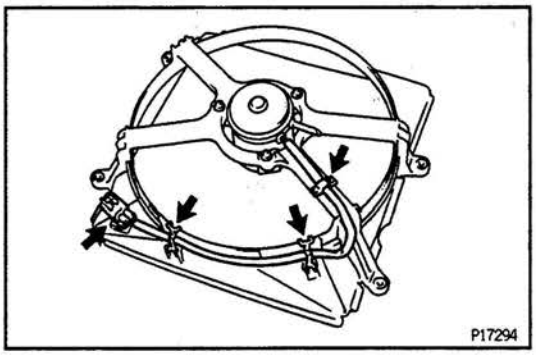
NO.1 COOLING FAN ASSEMBLY (BOSCH)

EG13Y–05

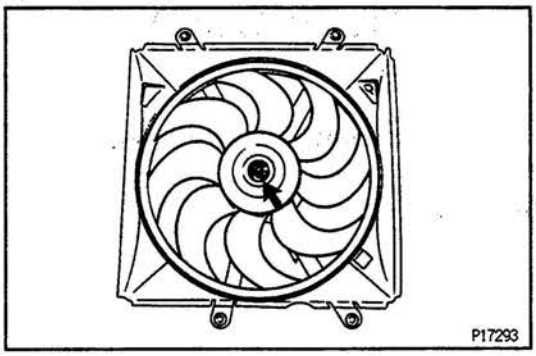
(See Components for Disassembly and Assembly)

1. INSTALL FAN MOTOR

(a) Install the fan motor with the 3 nuts.
(b) Install the drain pipe to the fan motor.



(c) Install the connector to the holder.
(d) Install the wire with the holder and 3 wire clamps.



2. INSTALL FAN

Install the fan with the C–ring.

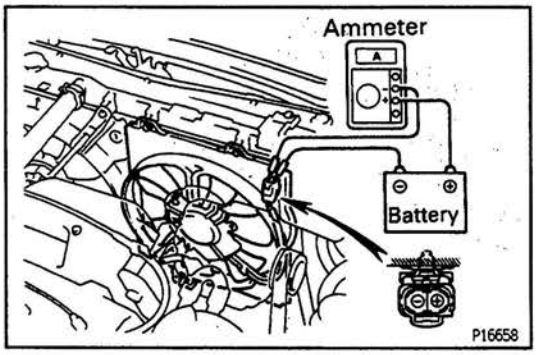
EG3VL-01

w/ A/C:

No.2 Cooling Fan

NO.2 COOLING FAN INSPECTION

1. **DISCONNECT COOLING FAN CONNECTOR**



2. **INSPECT NO.2 COOLING FAN**

(a) Connect battery and ammeter to the cooling fan connector.

(b) Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

Standard amperage:

ST202

6.0 – 7.4 A

ST191

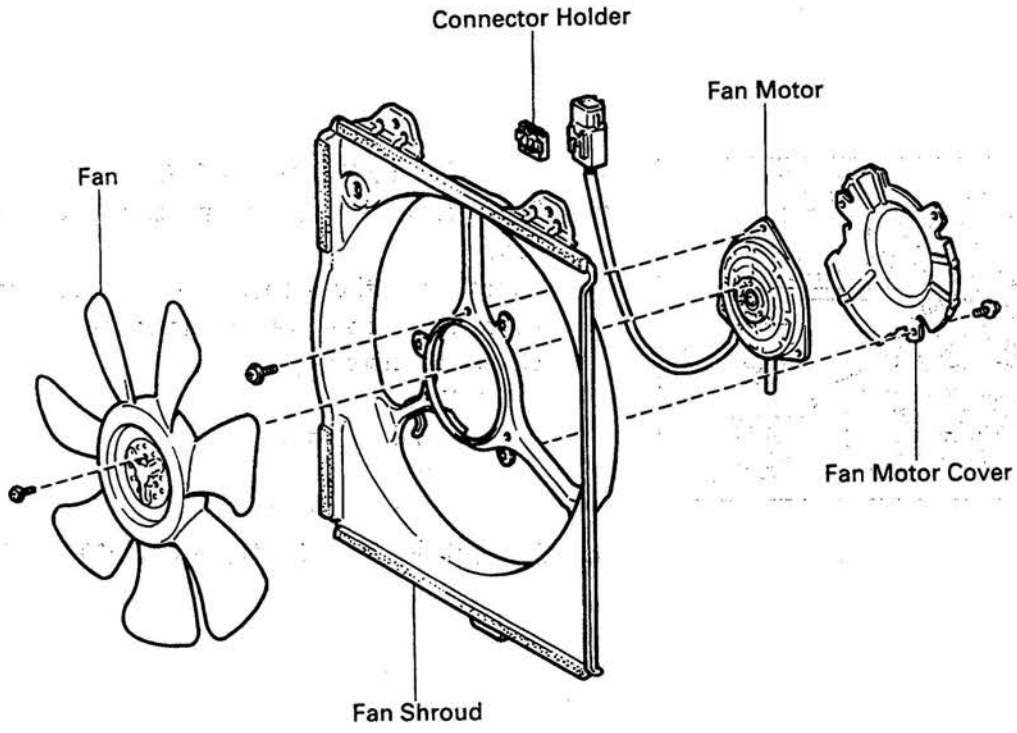
5.8 – 7.4 A

3. **RECONNECT COOLING FAN CONNECTOR**

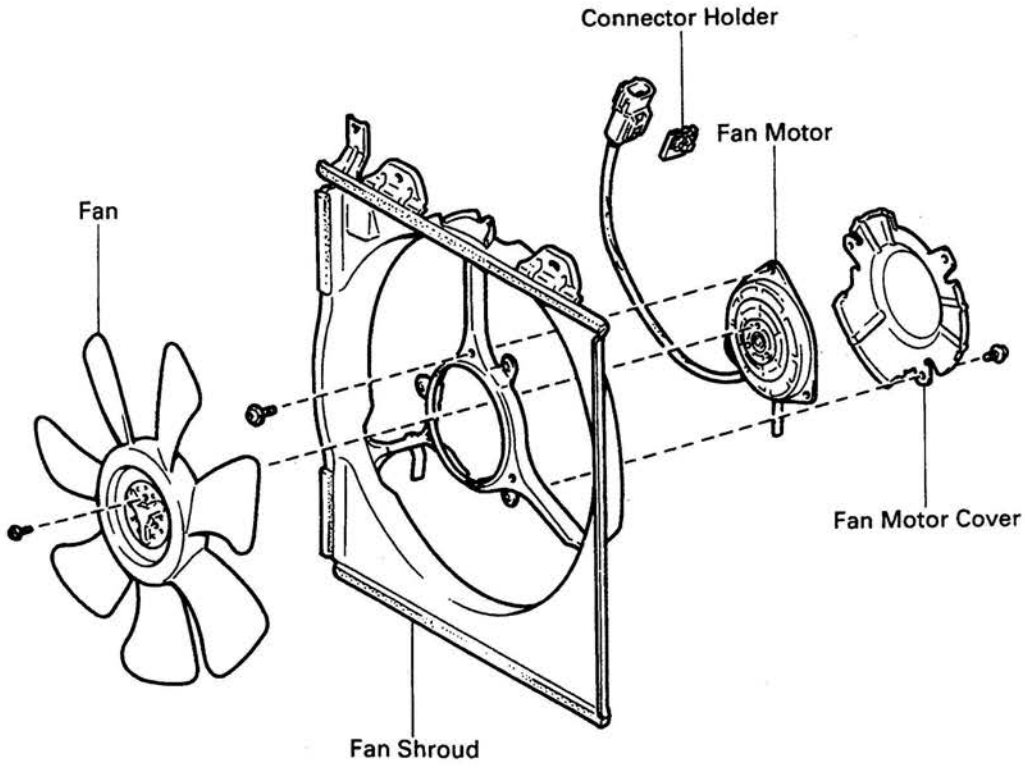
EG07G-0D

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

ST202

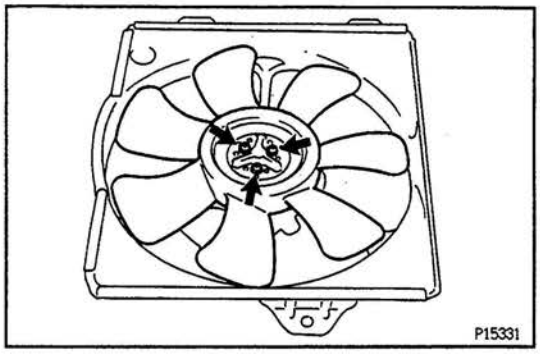


ST191



P15386
P13596

Z11707



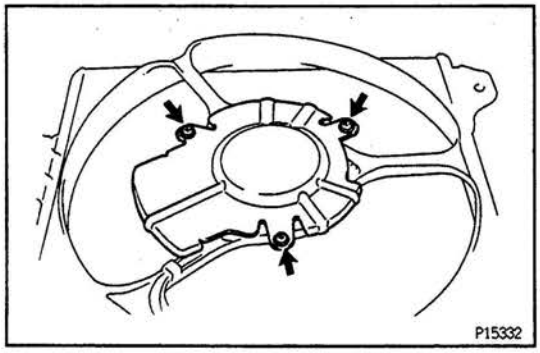
NO.2 COOLING FAN DISASSEMBLY

EG3NB-02

(See Components for Disassembly and Assembly)

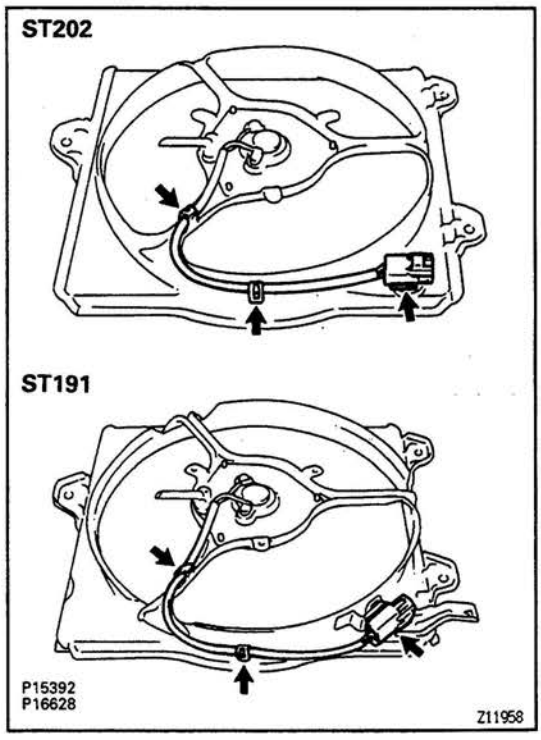
1. REMOVE FAN

Remove the 3 screws and fan.



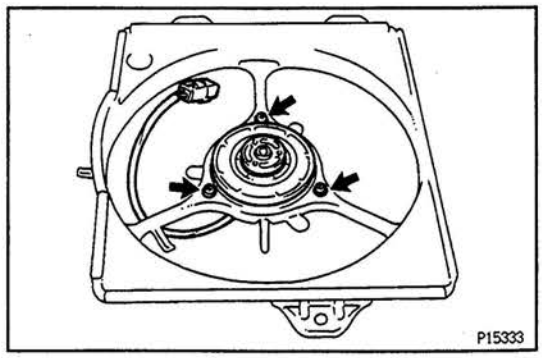
2. REMOVE FAN MOTOR COVER

Remove the 3 screws and motor cover.



3. REMOVE FAN MOTOR

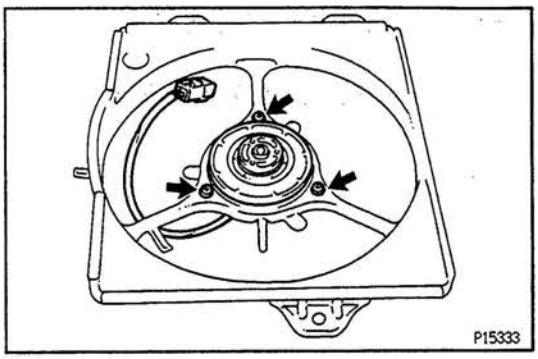
(a) Disconnect the wire and connector from the fan shroud.



(b) Remove the 3 screws and fan motor.

EG3NC-02

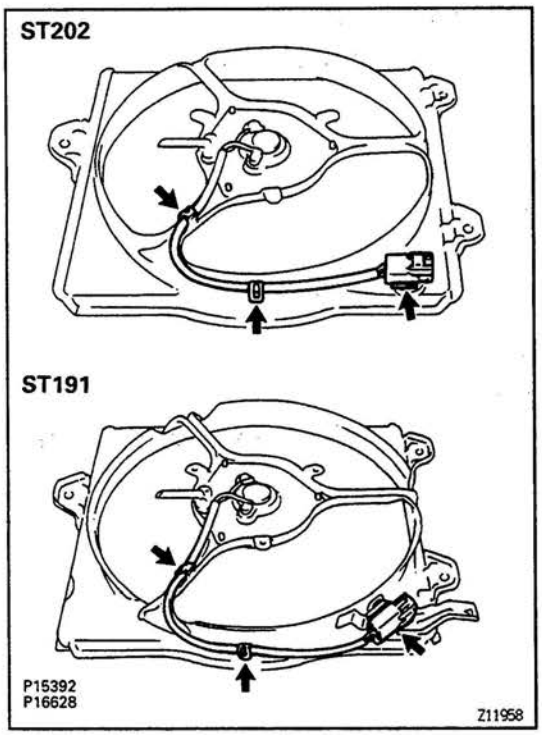
NO.2 COOLING FAN ASSEMBLY



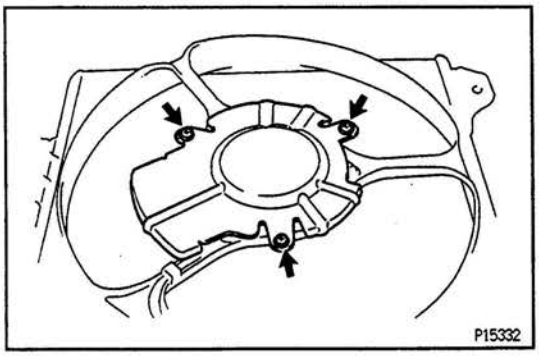
(See Components for Disassembly and Assembly)

1. INSTALL FAN MOTOR

(a) Install the fan motor with the 3 screws.

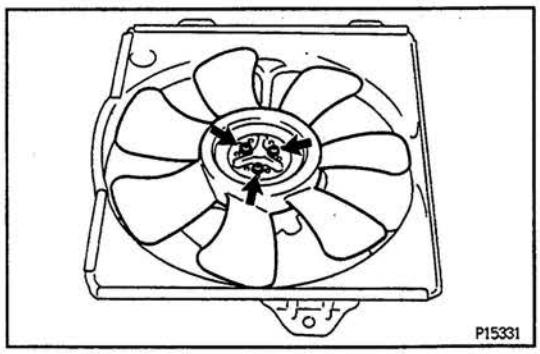


(b) Install the wire and connector to the fan shroud.



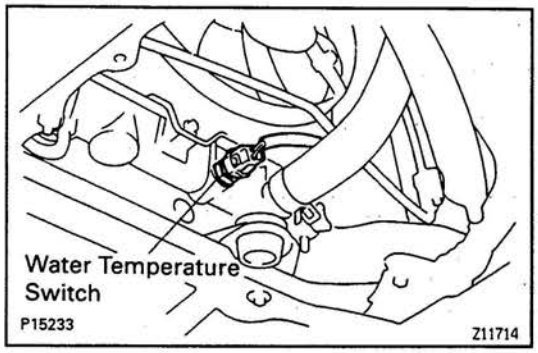
2. INSTALL FAN MOTOR COVER

Install the motor cover with the 3 screws.



3. INSTALL FAN

Install the fan with the 3 screws.



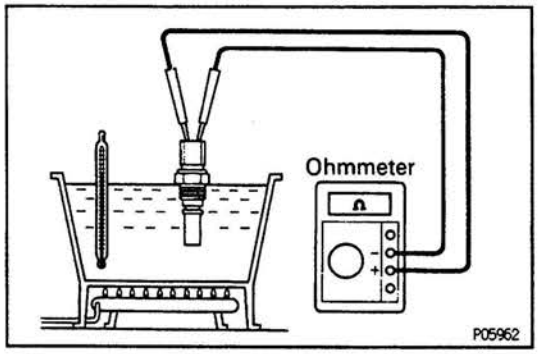
EG14J-06

Water Temperature Switch

WATER TEMPERATURE SWITCH

INSPECTION

1. **DRAIN ENGINE COOLANT**
2. **REMOVE WATER TEMPERATURE SWITCH**



3. **INSPECT WATER TEMPERATURE SWITCH**

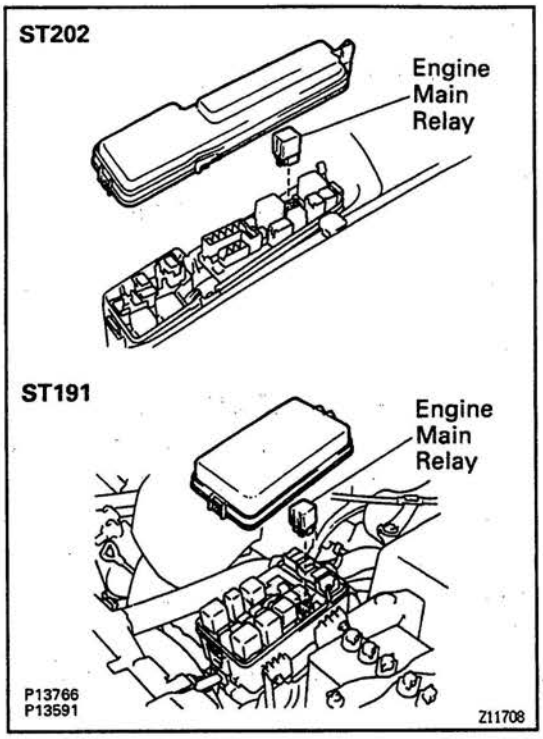
(a) Using an ohmmeter, check that there is no continuity between the terminals when the coolant temperature is above 93°C (199°F).

(b) Using an ohmmeter, check that there is continuity between the terminals when the coolant temperature is below 83°C (181°F).

If continuity is not as specified, replace the switch.

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

EG

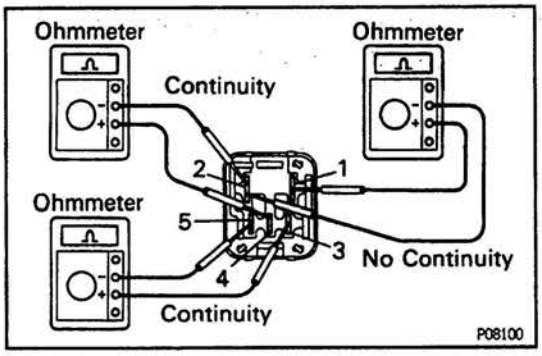


BG3NE-02

Engine Main Relay ("EG MAIN" for ST202) ("ENGINE MAIN" for ST191)

ENGINE MAIN RELAY INSPECTION

1. REMOVE RELAY BOX COVER
2. REMOVE ENGINE MAIN RELAY



3. INSPECT ENGINE MAIN RELAY

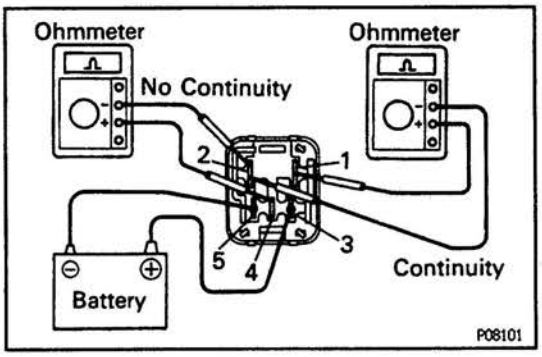
A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

(b) Check that there is continuity between terminals 2 and 4.

(c) Check that there is no continuity between terminals 1 and 2.

If continuity is not as specified, replace the relay.



B. Inspect relay operation

(a) Apply battery voltage across terminals 3 and 5.

(b) Using an ohmmeter, check that there is no continuity between terminals 2 and 4.

(c) Check that there is continuity between terminals 1 and 2.

If operation is not as specified, replace the relay.

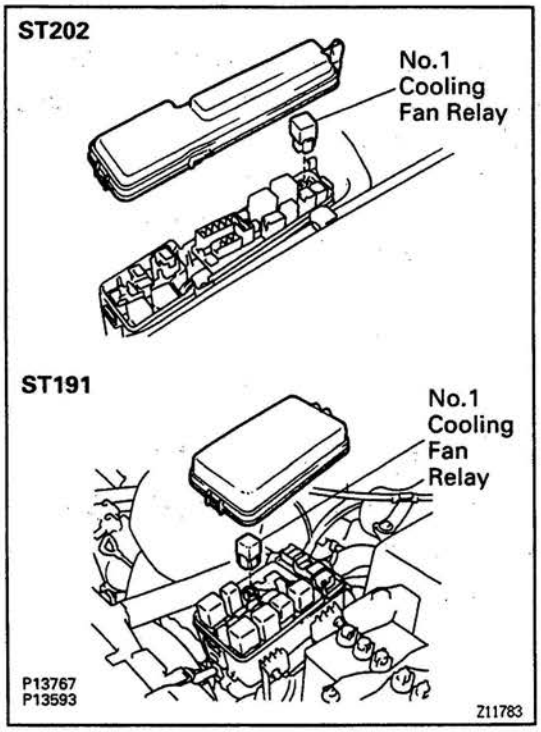
4. REINSTALL ENGINE MAIN RELAY
5. REINSTALL RELAY BOX COVER

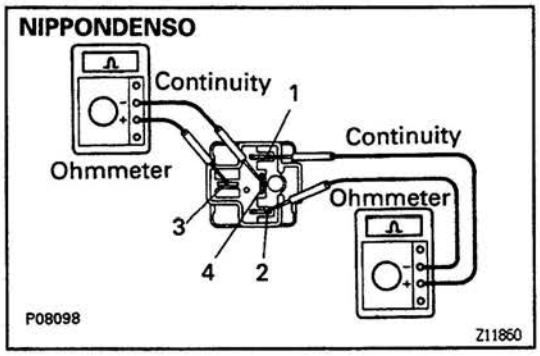
EG3VM-01

No.1 Cooling Fan Relay ("FAN NO.1")

NO.1 COOLING FAN RELAY INSPECTION

1. REMOVE RELAY BOX COVER
2. REMOVE NO.1 COOLING FAN RELAY





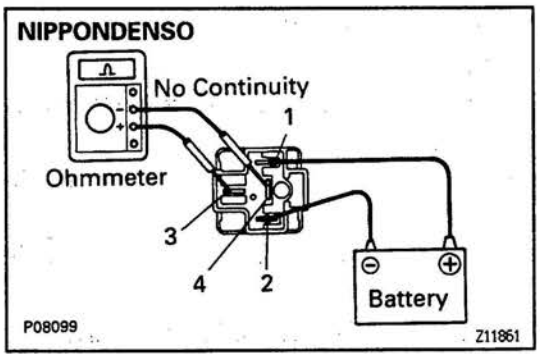
3. INSPECT NO.1 COOLING FAN RELAY (NIPPONDENSO)

A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

(b) Check that there is continuity between terminals 3 and 4.

If continuity is not as specified, replace the relay.

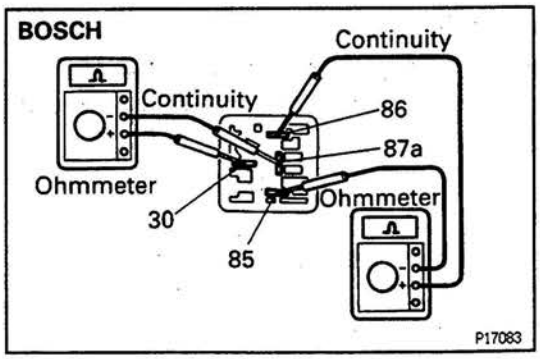


B. Inspect relay operation

(a) Apply battery voltage across terminals 1 and 2.

(b) Using an ohmmeter, check that there is no continuity between terminals 3 and 4.

If operation is not as specified, replace the relay.



4. INSPECT NO.1 COOLING FAN RELAY (BOSCH)

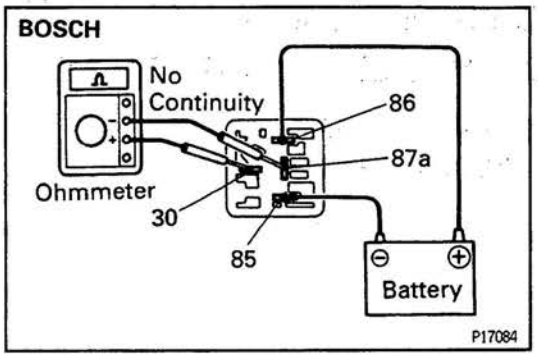
A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 86 and 85.

(b) Check that there is continuity between terminals 30 and 87a.

If continuity is not as specified, replace the relay.

EG



B. Inspect relay operation

(a) Apply battery voltage across terminals 86 and 85.

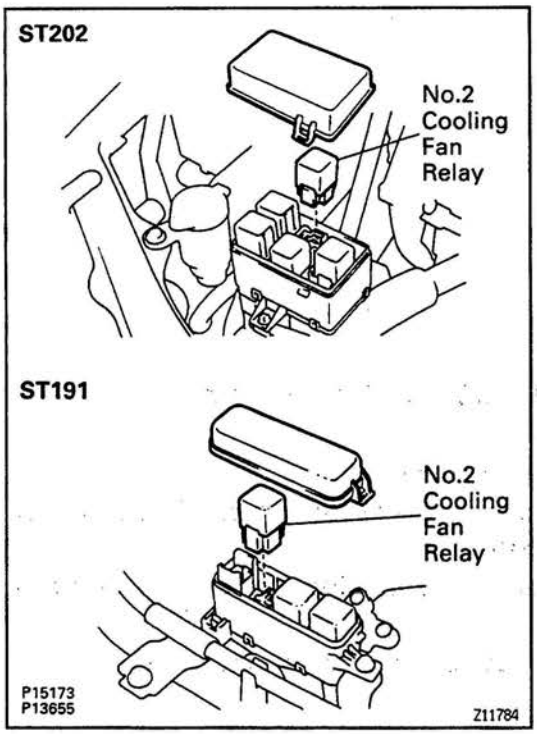
(b) Using an ohmmeter, check that there is no continuity between terminals 30 and 87a.

If operation is not as specified, replace the relay.

5. REINSTALL NO.1 COOLING FAN RELAY

6. REINSTALL RELAY BOX COVER

EG



EG3VN-01

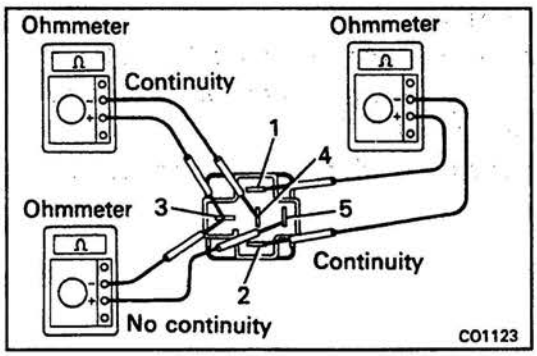
w/ A/C:

No.2 Cooling Fan Relay ("FAN NO.2")

NO.2 COOLING FAN RELAY INSPECTION

1. REMOVE RELAY BOX COVER

2. REMOVE NO.2 COOLING FAN RELAY



3. INSPECT NO.2 COOLING FAN RELAY

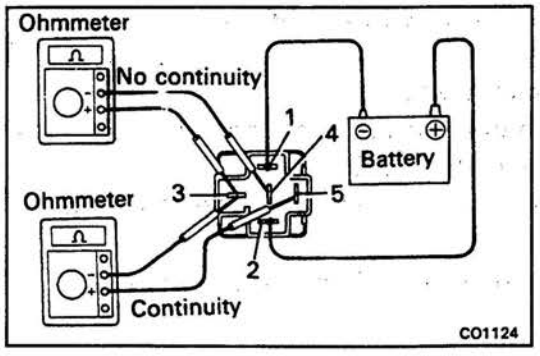
A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

(b) Check that there is continuity between terminals 3 and 4.

(c) Check that there is no continuity between terminals 3 and 5.

If continuity is not as specified, replace the relay.



B. Inspect relay operation

(a) Apply battery voltage across terminals 1 and 2.

(b) Using an ohmmeter, check that there is no continuity between terminals 3 and 4.

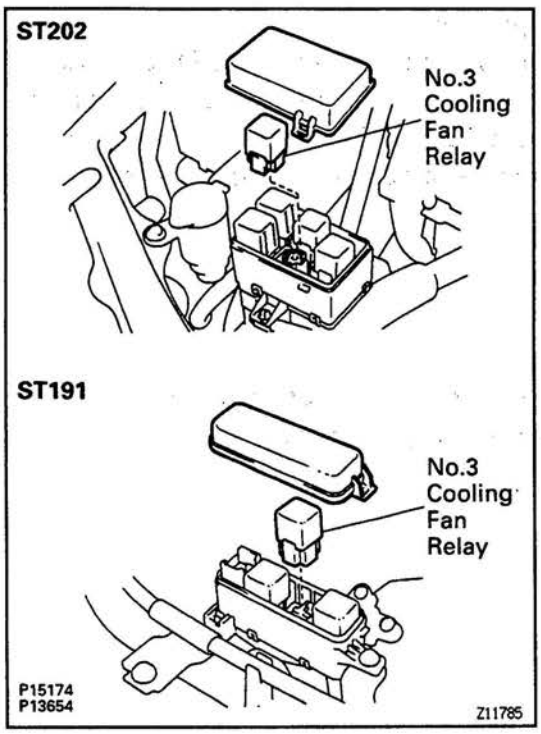
(c) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If operation is not as specified, replace the relay.

4. REINSTALL NO.2 COOLING FAN RELAY

5. REINSTALL RELAY BOX COVER

EG3VP–01

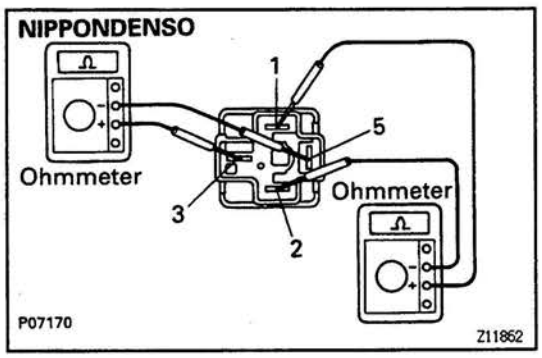


w/ A/C:

No.3 Cooling Fan Relay ("FAN NO.3")

NO.3 COOLING FAN RELAY INSPECTION

1. **REMOVE RELAY BOX COVER**
2. **REMOVE NO.3 COOLING FAN RELAY**



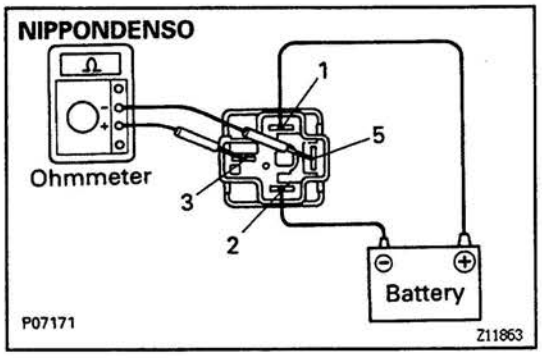
3. **INSPECT NO.3 COOLING FAN RELAY (NIPPONDENSO)**

A. 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.

If continuity is not as specified, replace the relay.

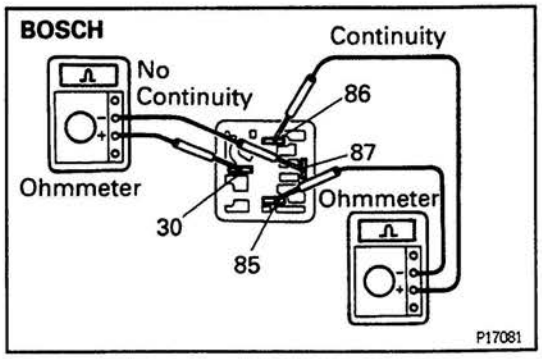


B. Inspect relay operation

(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.



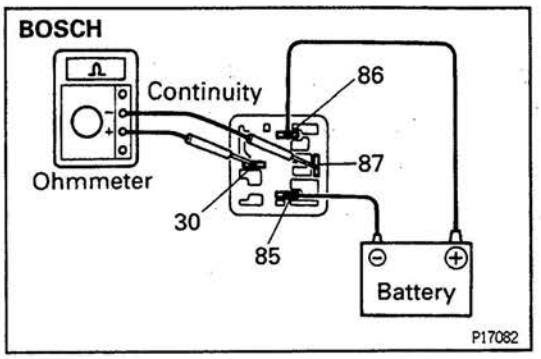
4. **INSPECT NO.3 COOLING FAN RELAY (BOSCH)**

A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 86 and 85.

(b) Check that there is no continuity between terminals 30 and 87.

If continuity is not as specified, replace the relay.



B. Inspect relay operation

(a) Apply battery voltage across terminals 86 and 85.

(b) Using an ohmmeter, check that there is continuity between terminals 30 and 87.

If operation is not as specified, replace the relay.

5. REINSTALL NO.3 COOLING FAN RELAY

6. REINSTALL RELAY BOX COVER

SERVICE SPECIFICATIONS

SERVICE DATA

EG07L–0P

Thermostat	Valve opening temperature		80 – 84°C (176 – 183°F)
	Valve lift	at 95°C (203°F)	8 mm (0.31 in.) or more
Radiator cap	Relief valve opening pressure	STD	74 – 103 kPa (0.75 – 1.05 kgf/cm², 10.7 – 14.9 psi)
		Limit	59 kPa (0.6 kgf/cm², 8.5 psi)
No.1 electric cooling fan	Rotating amperage (NIPPONDENSO)		
	ST202		6.0 – 7.4 A
	ST191	Europe	3.2 – 4.4 A
		Others (M/T)	6.0 – 7.4 A
		Others (A/T)	9.1 – 11.1 A
	Rotating amperage (BOSCH)		2.9 – 4.1 A
No.2 electric cooling fan	Rotating amperage	ST202	6.0 – 7.4 A
		ST191	5.8 – 7.4 A

EG

TORQUE SPECIFICATIONS

EG07M–06

Part tightened	N·m	kgf·cm	ft·lbf
Cylinder block x Drain plug	25	250	18
Water pump x Water pump cover	8.8	90	78 in.·lbf
Water pump x Cylinder block	8.8	90	78 in.·lbf
Water bypass pipe x Water pump cover	9.3	95	82 in.·lbf
Alternator drive belt adjusting bar x Cylinder block	27	275	20
No.2 idler pulley x Cylinder block	42	425	31
Water inlet x Water pump cover	8.8	90	78 in.·lbf

LUBRICATION SYSTEM

DESCRIPTION

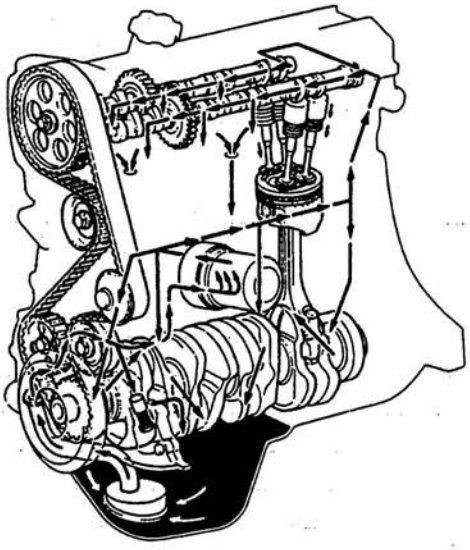
EG140-06

A fully pressurized, fully filtered lubrication system has been adopted for this engine.

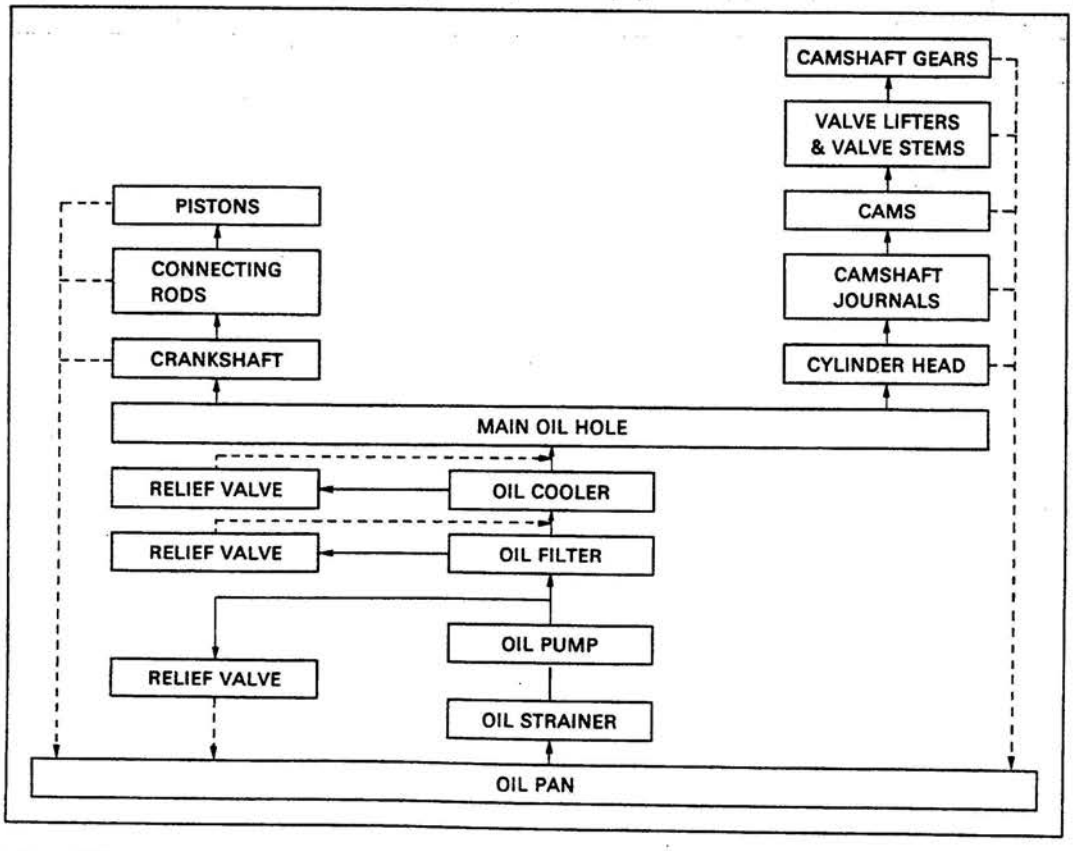
OPERATION

EG

EG145-0H



LU0910



Z02934

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 on the previous page. Oil from the oil pan is pumped up by the oil pump. After it passes through the oil filter, it is fed through the various oil holes in the crankshaft and cylinder block. After passing through the cylinder block and performing its lubricating function, the oil is returned by gravity to the oil pan. A dipstick on the center left side of the cylinder block is provided to check the oil level.

OIL PUMP

The oil pump pumps up oil from the oil pan and feeds it under pressure to the various parts of the engine. An oil strainer is mounted in front of the inlet to the oil pump to remove impurities. The oil pump itself is a trochoid type pump, inside of which is a drive rotor and a driven rotor. When the drive rotor rotates, the driven rotor rotates in the same direction, and since the axis of the drive rotor shaft is different from the center of the driven rotor, the space between the two rotors changes as they rotate. Oil is drawn in when the space widens and discharged when the space becomes narrow.

OIL PRESSURE REGULATOR (RELIEF VALVE)

At high engine speeds, the engine oil supplied by the oil pump exceeds the capacity of the engine to utilize it. For that reason, the oil pressure regulator works to prevent an oversupply of oil. During normal oil supply, a coil spring and valve keep the bypass closed, but when too much oil is being fed, the pressure becomes extremely high, overpowering the force of the spring and opening the valves. This allows the excess oil to flow through the valve and return to the oil pan.

OIL FILTER

The oil filter is a full flow type filter with a relief valve built into the paper filter element. Particles of metal from wear, airborne dirt, carbon and other impurities can get into 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 also included ahead of the filter element to relieve the high oil pressure in case the filter element becomes clogged with impurities. The relief valve opens when the oil pressure overpowers the force of the spring. Oil passing through the relief valve bypass the oil filter and flows directly into the main oil hole in the engine.

PREPARATION

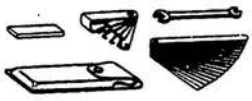
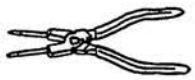
BQ14U-0A

SST (SPECIAL SERVICE TOOLS)

	09032–00100 Oil Pan Seal Cutter	
	09226–10010 Crankshaft Front & Rear Bearing Replacer	Crankshaft front oil seal
	09228–06500 Oil Filter Wrench	
	09620–30010 Steering Gear Box Replacer Set	
	(09627–30010) Steering Sector Shaft Bushing Replacer	Oil pump oil seal
	(09631–00020) Handle	Oil pump oil seal
	09960–10010 Variable Pin Wrench Set	
	(09962–01000) Variable Pin Wrench Arm Assy	Oil pump pulley
	(09963–00500) Pin 5	Oil pump pulley

BQ14V-07

RECOMMENDED TOOLS

	09200–00010 Engine Adjust Kit	
	09905–00013 Snap Ring Pliers	

EQUIPMENT

EQ14W-0A

Oil pressure gauge	
Torque wrench	

LUBRICANT

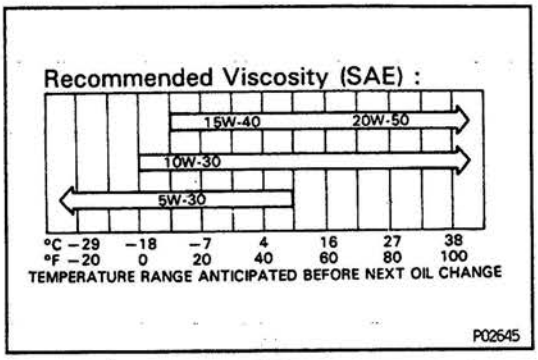
EQ14X-0J

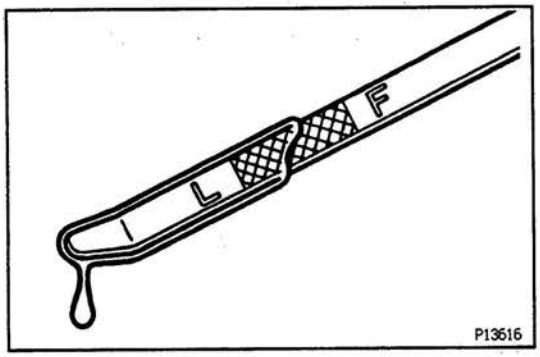
Item	Capacity	Classification
Engine oil		API grade SG, SH or ILSAC multigrade engine oil and recommended viscosity oil
Dry fill		
w/ Oil cooler	4.4 liters (4.7 US qts, 3.9 Imp. qts)	
w/o Oil cooler	4.3 liters (4.5 US qts, 3.8 Imp. qts)	
Drain and refill		
w/ Oil filter change	3.9 liters (4.1 US qts, 3.4 Imp. qts)	
w/o Oil filter change	3.7 liters (3.9 US qts, 3.3 Imp. qts)	

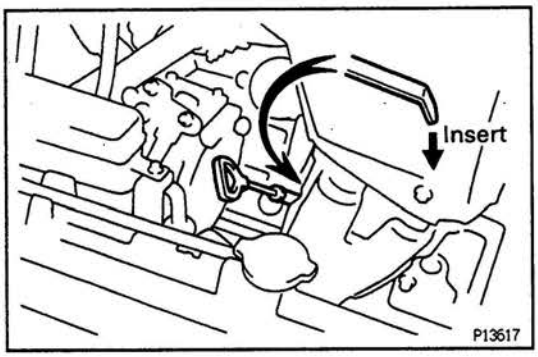
SSM (SPECIAL SERVICE MATERIALS)

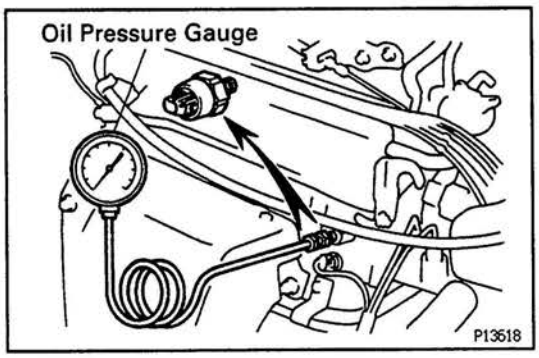
EQ14Y-0A

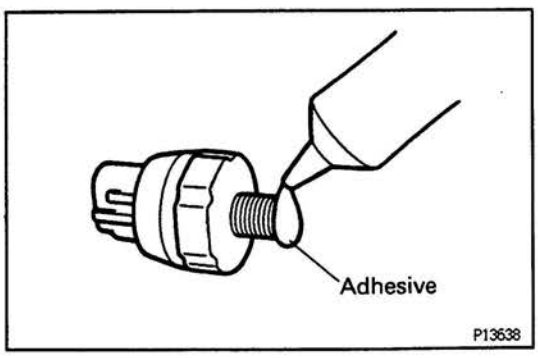
08826–00080	Seal packing or equivalent	Oil pan
08833–00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure switch











OIL PRESSURE CHECK

EG2PZ-02

1. CHECK ENGINE OIL QUALITY

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

If the quality is visibly poor, replace the oil.

Oil grade:

API grade SG, SH or ILSAC multigrade engine oil.
Recommended viscosity is as shown in the illustration.

2. CHECK ENGINE OIL LEVEL

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

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

NOTICE:

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

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

4. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

5. CHECK OIL PRESSURE

Oil pressure:

At idle

29 kPa (0.3 kgf/cm², 4.3 psi) or more

At 3,000 rpm

245 – 490 kPa
(2.5 – 5.0 kgf/cm², 36 – 71 psi)

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

(a) Remove the oil pressure gauge.

(b) Apply adhesive to 2 or 3 threads of the oil pressure switch.

Adhesive:

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

(c) Reinstall the oil pressure switch.

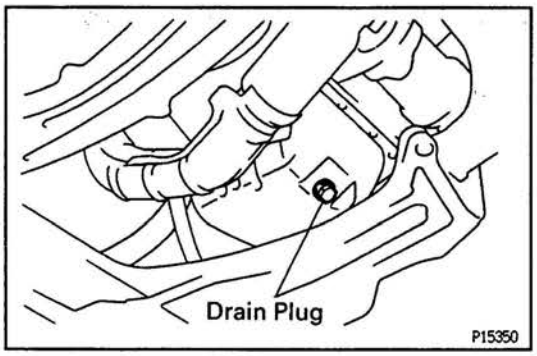
7. START ENGINE, AND CHECK FOR OIL LEAKS

OIL AND FILTER REPLACEMENT

EG150-04

CAUTION:

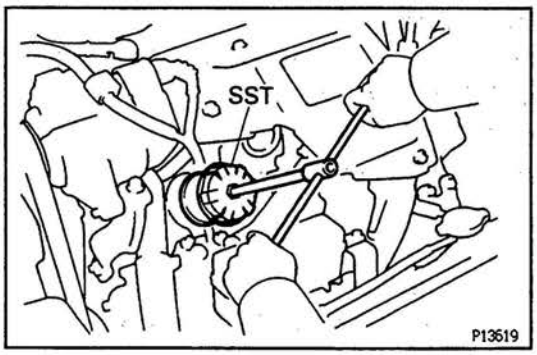
- **Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.**
- **Care should be taken, therefore, when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



1. DRAIN ENGINE OIL

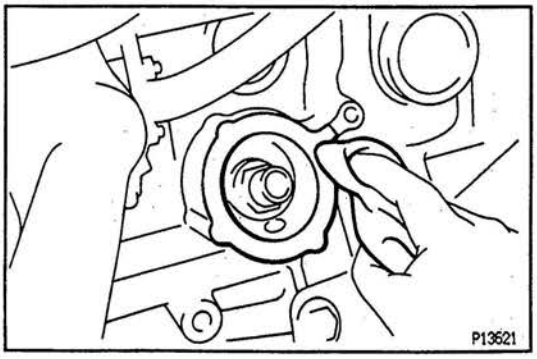
(a) Remove the oil filler cap.

(b) Remove the oil drain plug, and drain the oil into a container.

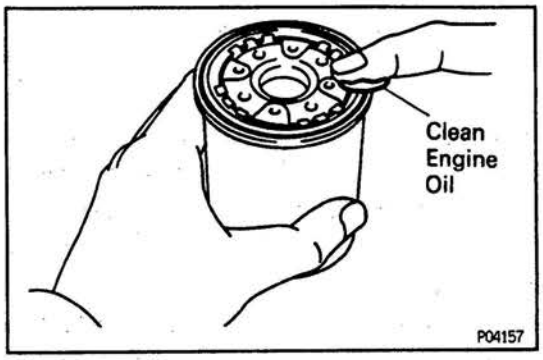


2. REPLACE OIL FILTER

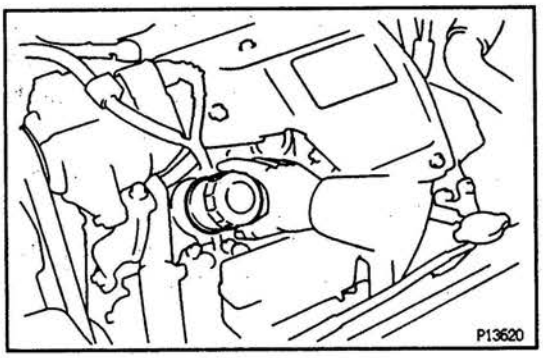
(a) Using SST, remove the oil filter.
SST 09228–06500



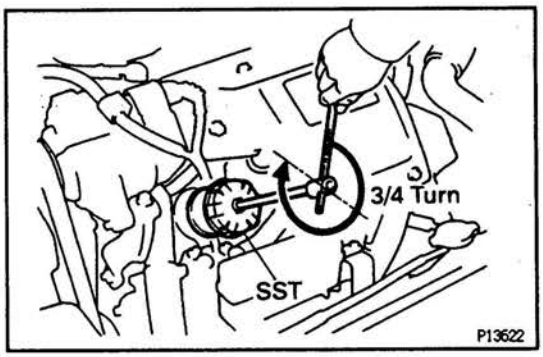
(b) Clean the oil filter contact surface on the oil filter mounting.



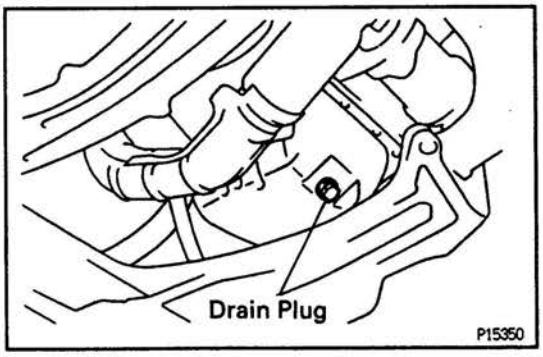
(c) Lubricate the filter rubber gasket with clean engine oil.



(d) Tighten the oil filter by hand until the rubber gasket contacts the seat of the filter mounting.



(e) Using SST, give it an additional 3/4 turn to seat the filter.
SST 09228–06500



3. FILL WITH ENGINE OIL

(a) Clean and install the oil drain plug with a new gasket.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

(b) Fill with new engine oil.
Oil grade: See step 1 on page EG–340
Capacity:

Drain and refill
w/ Oil filter change
3.9 liters (4.1 US qts, 3.4 Imp. qts)
w/o Oil filter change
3.7 liters (3.9 US qts, 3.3 Imp. qts)
Dry fill
w/ Oil cooler
4.4 liters (4.7 US qts, 3.9 Imp. qts)
w/o Oil cooler
4.3 liters (4.5 US qts, 3.8 Imp. qts)

(c) Reinstall the oil filler cap.

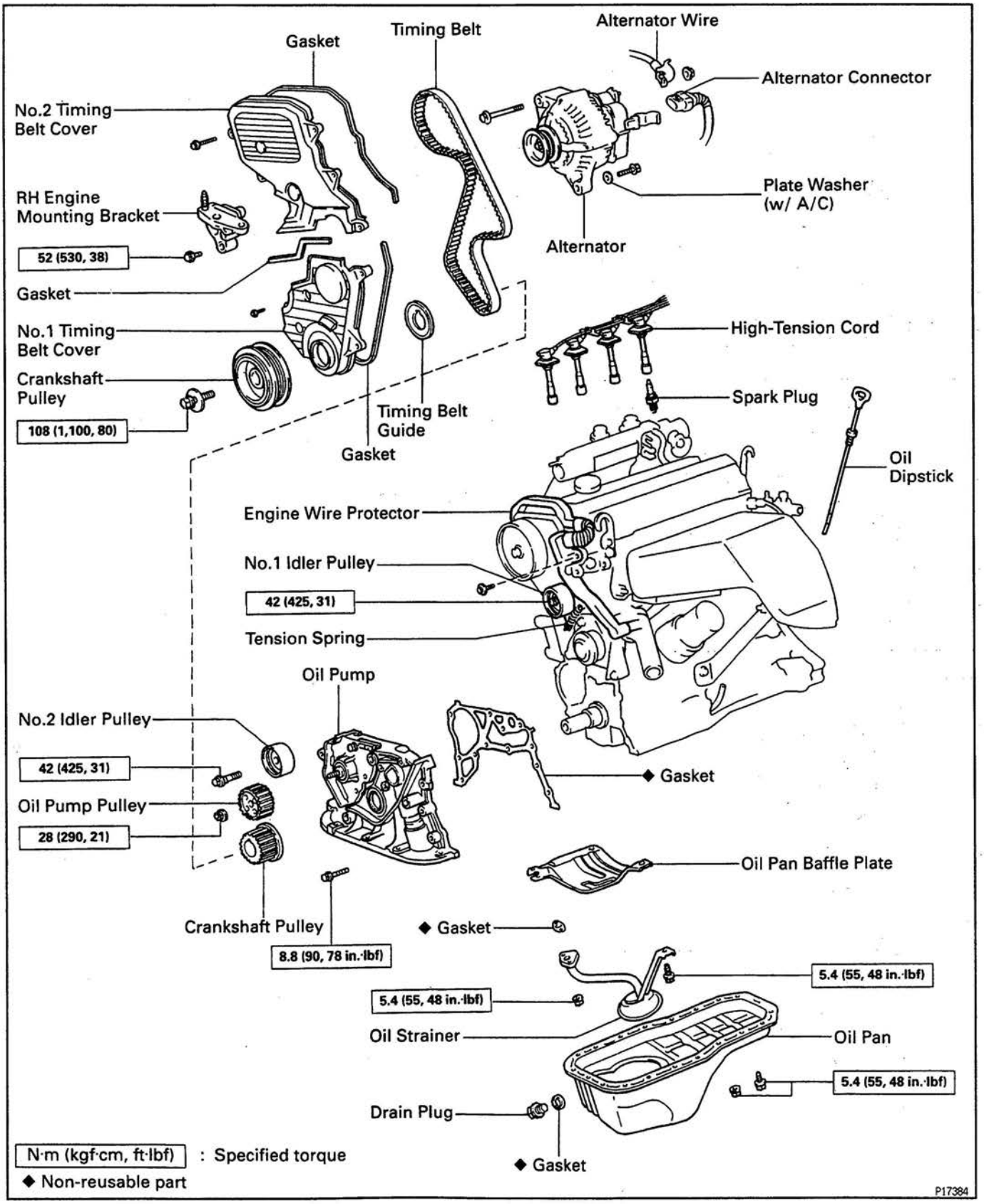
4. START ENGINE AND CHECK FOR OIL LEAKS

5. RECHECK ENGINE OIL LEVEL

OIL PUMP

COMPONENTS FOR REMOVAL AND INSTALLATION

EQ3VQ-01



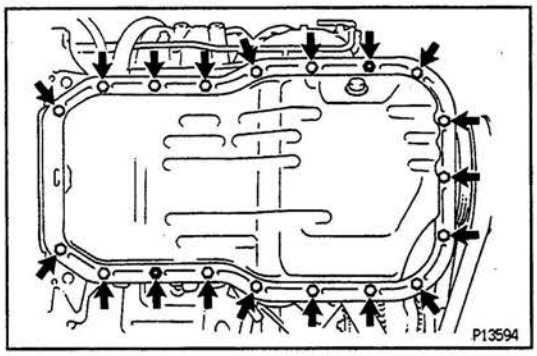
EG3VR-01

OIL PUMP REMOVAL

(See Components for Removal and Installation)

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

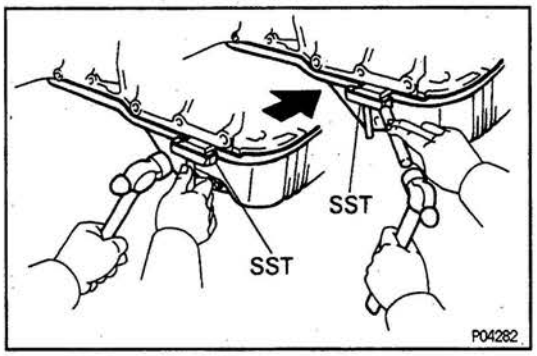
1. DRAIN ENGINE OIL



2. REMOVE OIL PAN

(a) Remove the oil dipstick.

(b) Remove the 17 bolts and 2 nuts.

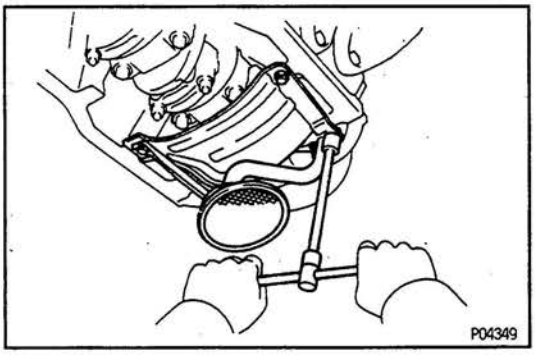


(c) Insert the blade of SST between the cylinder block and oil pan, and cut off applied sealer and remove the oil pan.

SST 09032–00100

NOTICE:

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

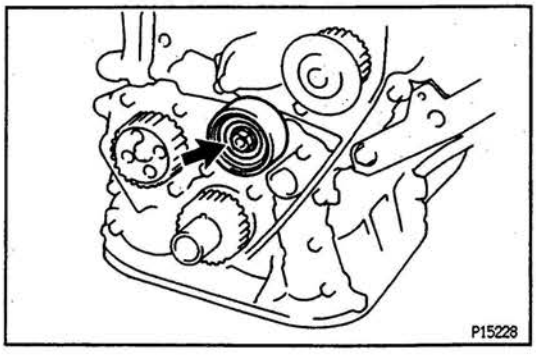


3. REMOVE OIL STRAINER AND OIL PAN BAFFLE PLATE

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

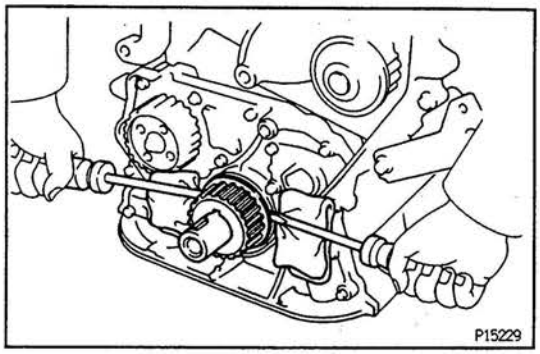
4. REMOVE TIMING BELT

(See steps 1 to 6 and 8 to 12 on pages EG–35 to 40)



5. REMOVE NO.2 IDLER PULLEY

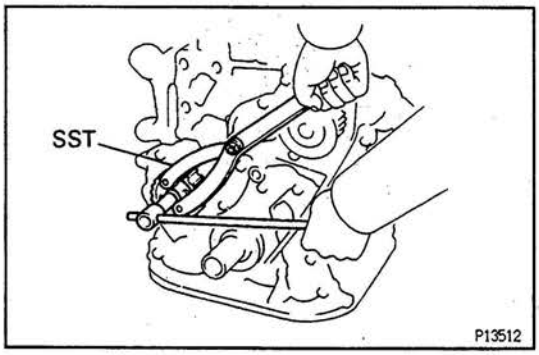
Remove the bolt and pulley.



6. REMOVE CRANKSHAFT TIMING PULLEY

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

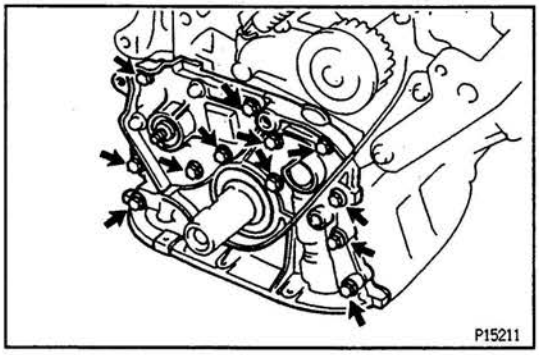
HINT: Position shop rags as shown to prevent damage.



7. REMOVE OIL PUMP PULLEY

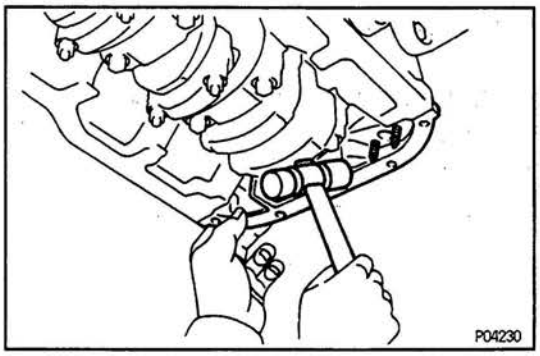
Using SST, remove the nut and pulley.

SST 09960—10010 (09962—01000, 09963—00500)



8. REMOVE OIL PUMP

(a) Remove the 12 bolts.



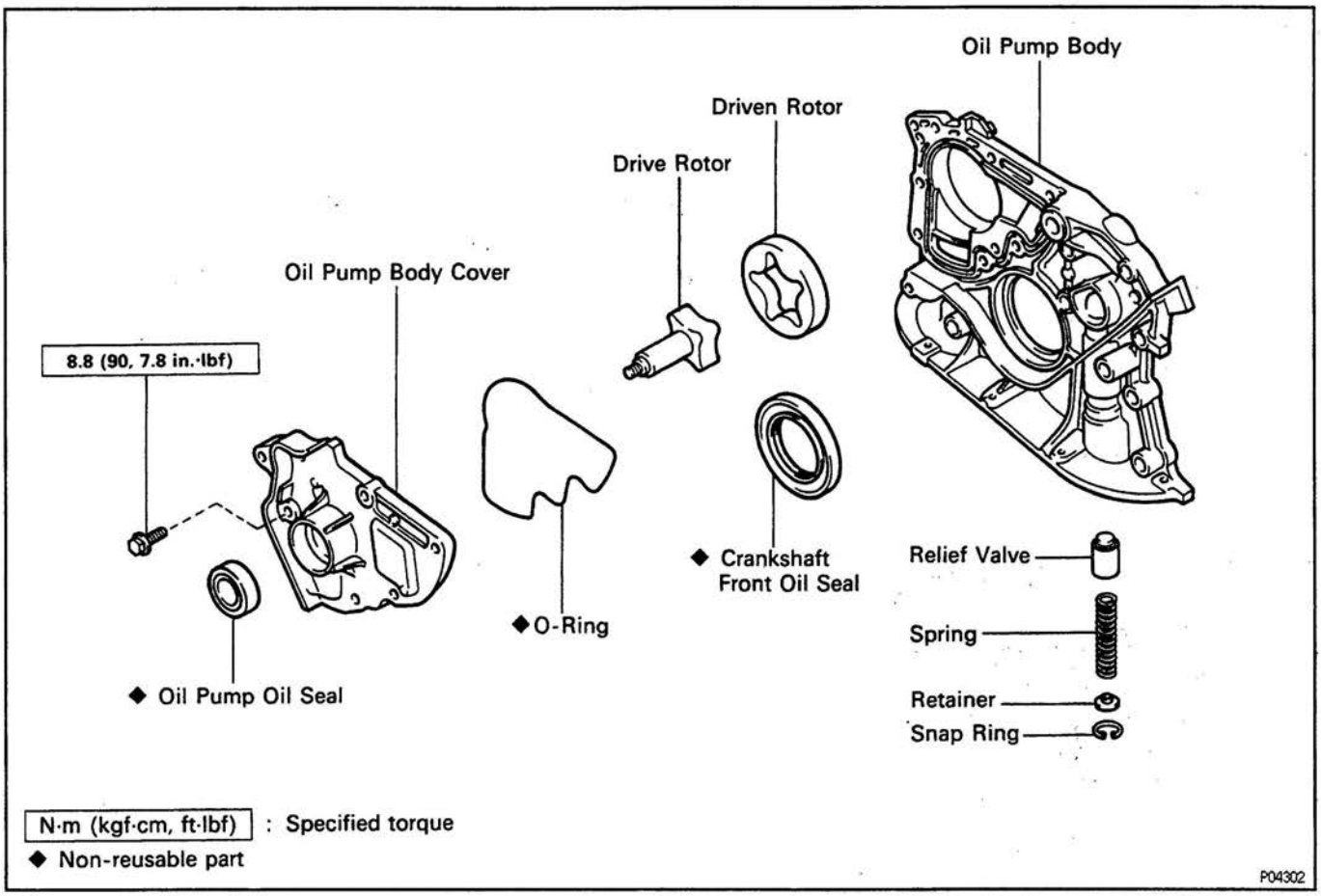
(b) Using a plastic—faced hammer, remove the oil pump by carefully tapping the oil pump body.

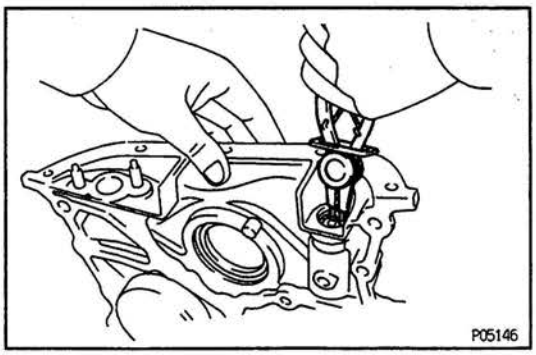
(c) Remove the gasket.

EG

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EG156-0C





OIL PUMP DISASSEMBLY

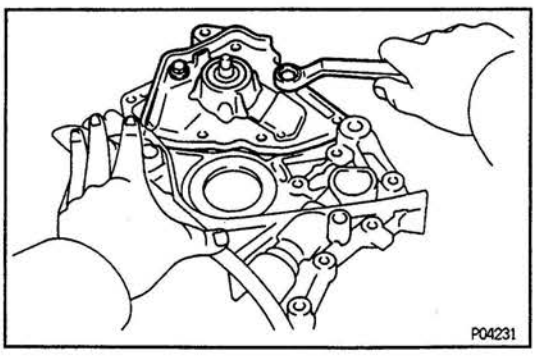
EG156-0C

(See Components for Disassembly and Assembly)

1. REMOVE RELIEF VALVE

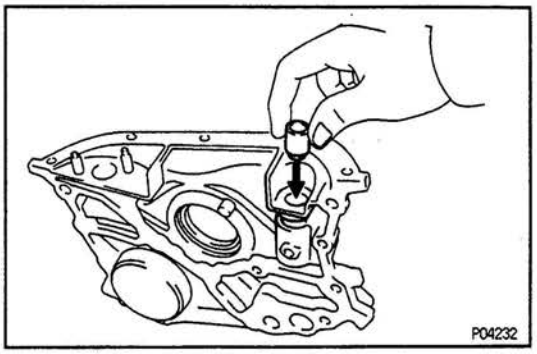
(a) Using snap ring pliers, remove the snap ring.

(b) Remove the retainer, spring and relief valve.



2. REMOVE DRIVE AND DRIVEN ROTORS

Remove the 2 bolts, pump body cover, O–ring, the drive and driven rotors.

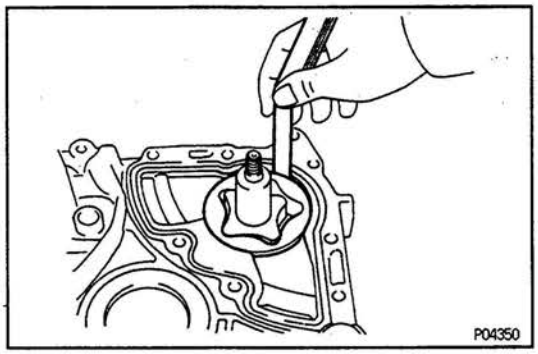


OIL PUMP INSPECTION

EG157-02

1. INSPECT RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.
If it doesn't, replace the relief valve. If necessary, replace the oil pump assembly.



2. INSPECT DRIVE AND DRIVEN ROTORS

A. Inspect rotor body clearance

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

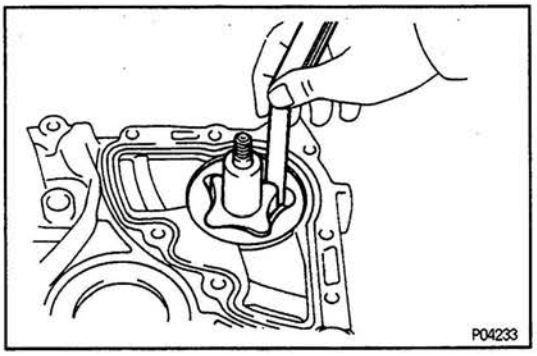
Standard body clearance:

0.10 — 0.16 mm (0.0039 — 0.0063 in.)

Maximum body clearance:

0.20 mm (0.0079 in.)

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



B. Inspect rotor tip clearance

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

Standard tip clearance:

0.04 — 0.16 mm (0.0016 — 0.0063 in.)

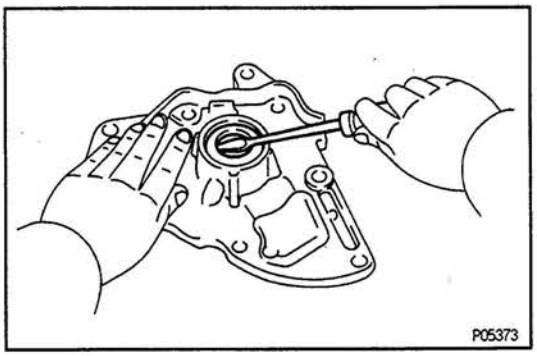
Maximum tip clearance:

0.20 mm (0.0079 in.)

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

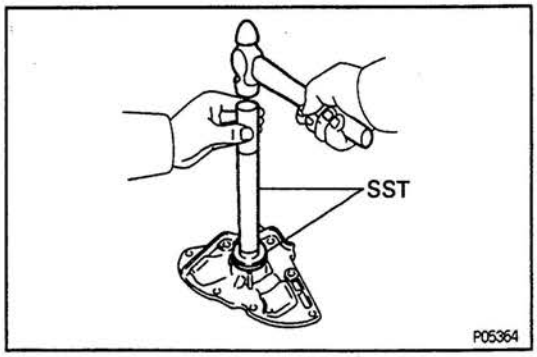
OIL PUMP OIL SEAL REPLACEMENT

EG158-02



1. REMOVE OIL SEAL

Using a screwdriver, pry out the oil seal.



2. INSTALL OIL SEAL

(a) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump cover edge.
SST 09620—30010 (09627—30010, 09631—00020)

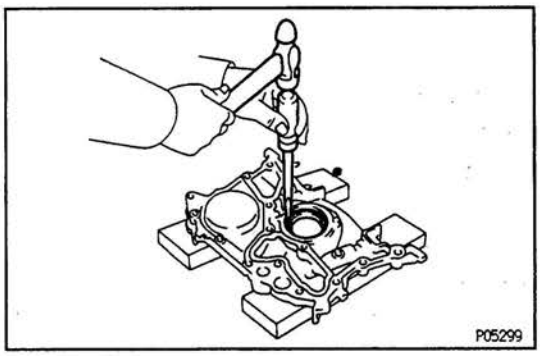
(b) Apply MP grease to the oil seal lip.

EG1S9–04

CRANKSHAFT FRONT OIL SEAL REPLACEMENT

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

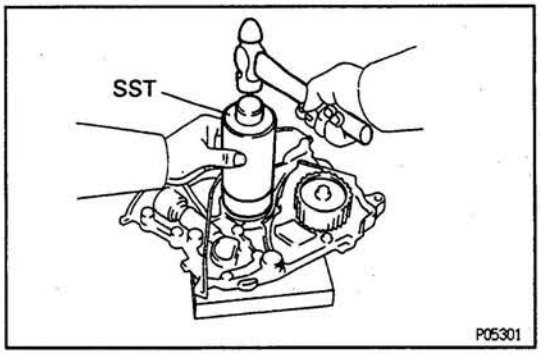
EG



REPLACE CRANKSHAFT FRONT OIL SEAL

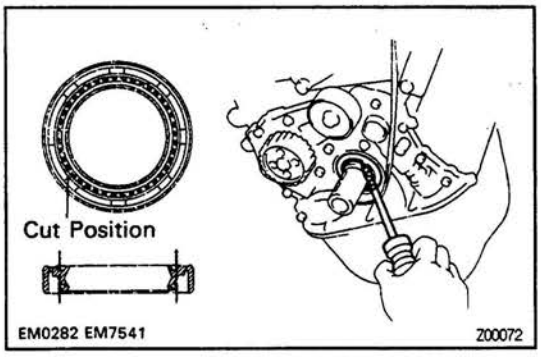
A. If oil pump is removed from cylinder block:

(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 oil pump body edge.
SST 09226–10010

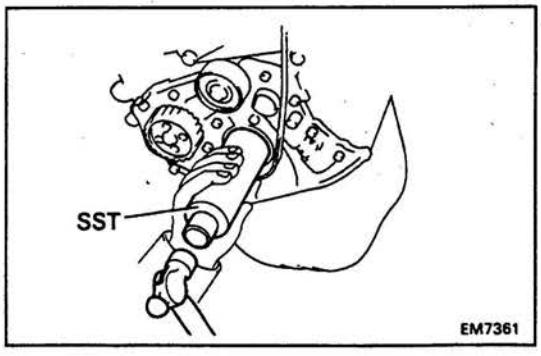
(c) Apply MP grease to the oil seal lip.



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

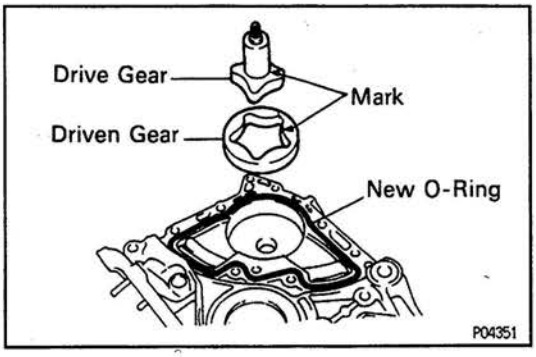
(a) Using a knife, cut off the oil seal lip.

(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 09226–10010



EG1SS-0C

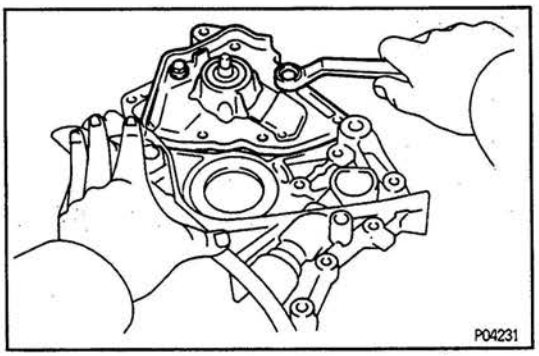
OIL PUMP ASSEMBLY

(See Components for Disassembly and Assembly)

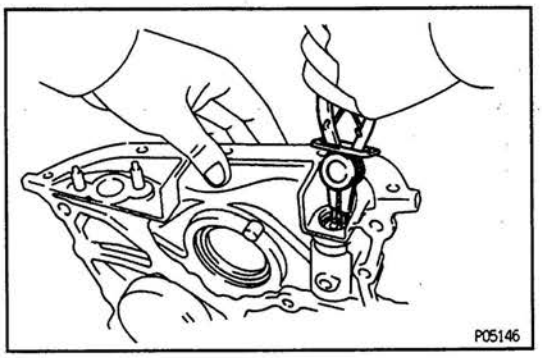
1. INSTALL DRIVE AND DRIVEN ROTORS

(a) Place the drive and driven rotors into pump body with the marks facing the pump body cover side.

(b) Install a new O—ring to the oil pump body.



(c) Install the oil pump body cover with the 2 bolts.
Torque: 8.8 N·m (90 kgf·cm, 78 in.·lbf)



2. INSTALL RELIEF VALVE

(a) Insert the relief valve, spring and retainer into the oil pump body hole.

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

EG3V8-01

OIL PUMP INSTALLATION

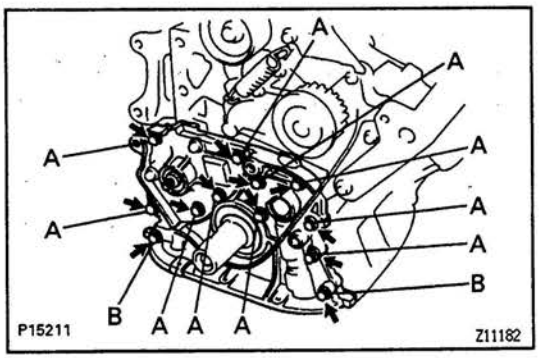
(See Components for Removal and Installation)

1. INSTALL OIL PUMP

Install a new gasket and the oil pump with the 12 bolts. Uniformly tighten the bolts in several passes.
Torque: 8.8 N·m (90 kgf·cm, 78 in.·lbf)

HINT: Each bolt length is indicated in the illustration.
Bolt length:

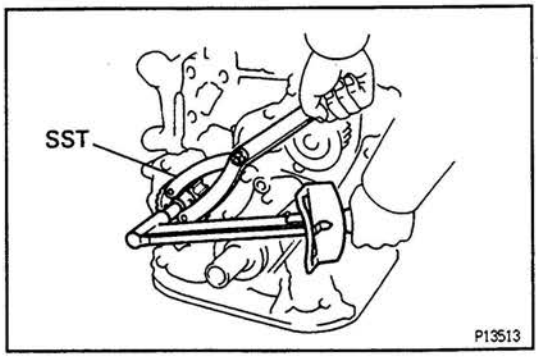
A: 25 mm (0.98 in.)
B: 35 mm (1.38 in.)

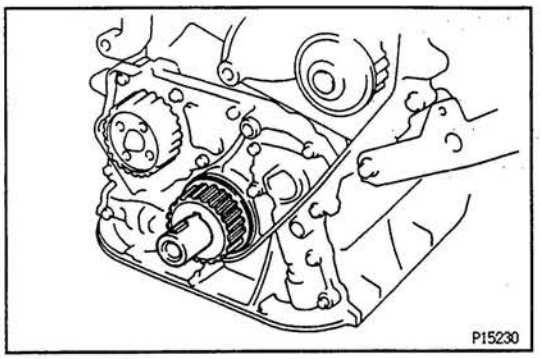


2. INSTALL OIL PUMP PULLEY

(a) Align the cutouts of the pulley and shaft, and slide on the pulley.

(b) Using SST, install the pulley nut.
SST 09960—10010 (09962—01000, 09963—00500)
Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)

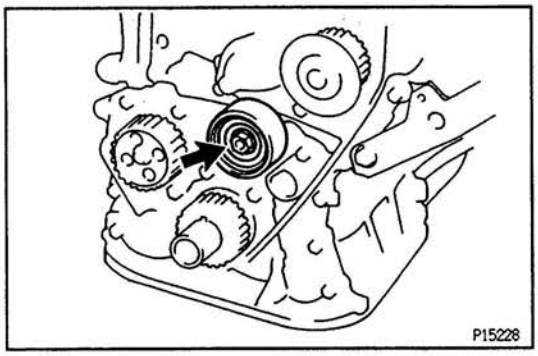




3. INSTALL CRANKSHAFT TIMING PULLEY

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

(b) Slide on the timing pulley, facing the flange side inward.

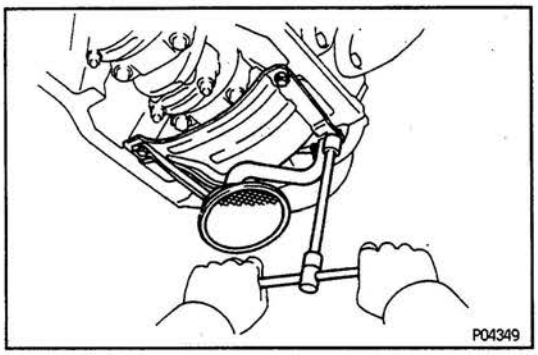


4. INSTALL NO.2 IDLER PULLEY

(a) Install the pulley with the bolt.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

(b) Check that the idler pulley moves smoothly.

5. INSTALL TIMING BELT
(See steps 5 to 8 and 10 to 16 on pages EG−44 to 49)



6. INSTALL OIL PAN BAFFLE PLATE AND OIL STRAINER

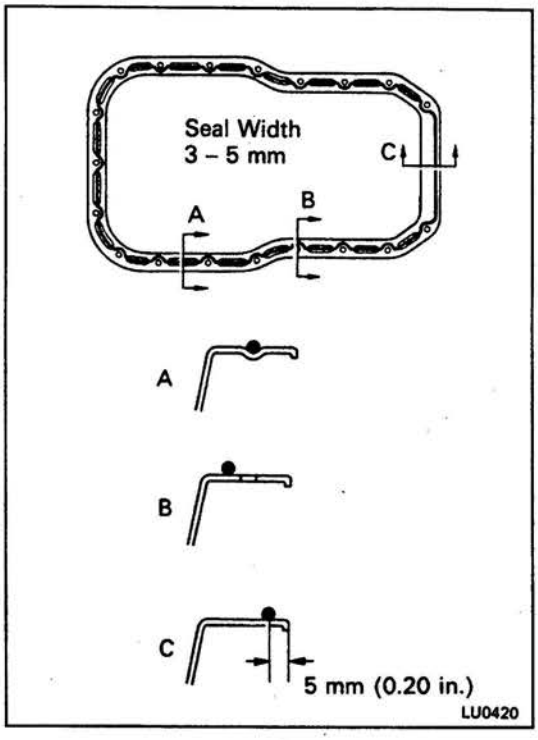
Install a new gasket, the oil strainer and baffle plate with the 2 bolts and 2 nuts.
Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)

7. INSTALL OIL PAN

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

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

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



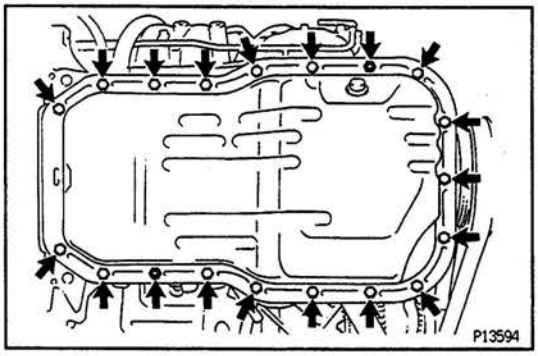
(b) Apply seal packing to the oil pan as shown in the illustration.

Seal packing:

Part No. 08826–00080 or equivalent

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

EG



(c) Install the oil pan with the 17 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.
Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)

(d) Install the dipstick.

8. FILL WITH ENGINE OIL

9. START ENGINE AND CHECK FOR OIL LEAKS

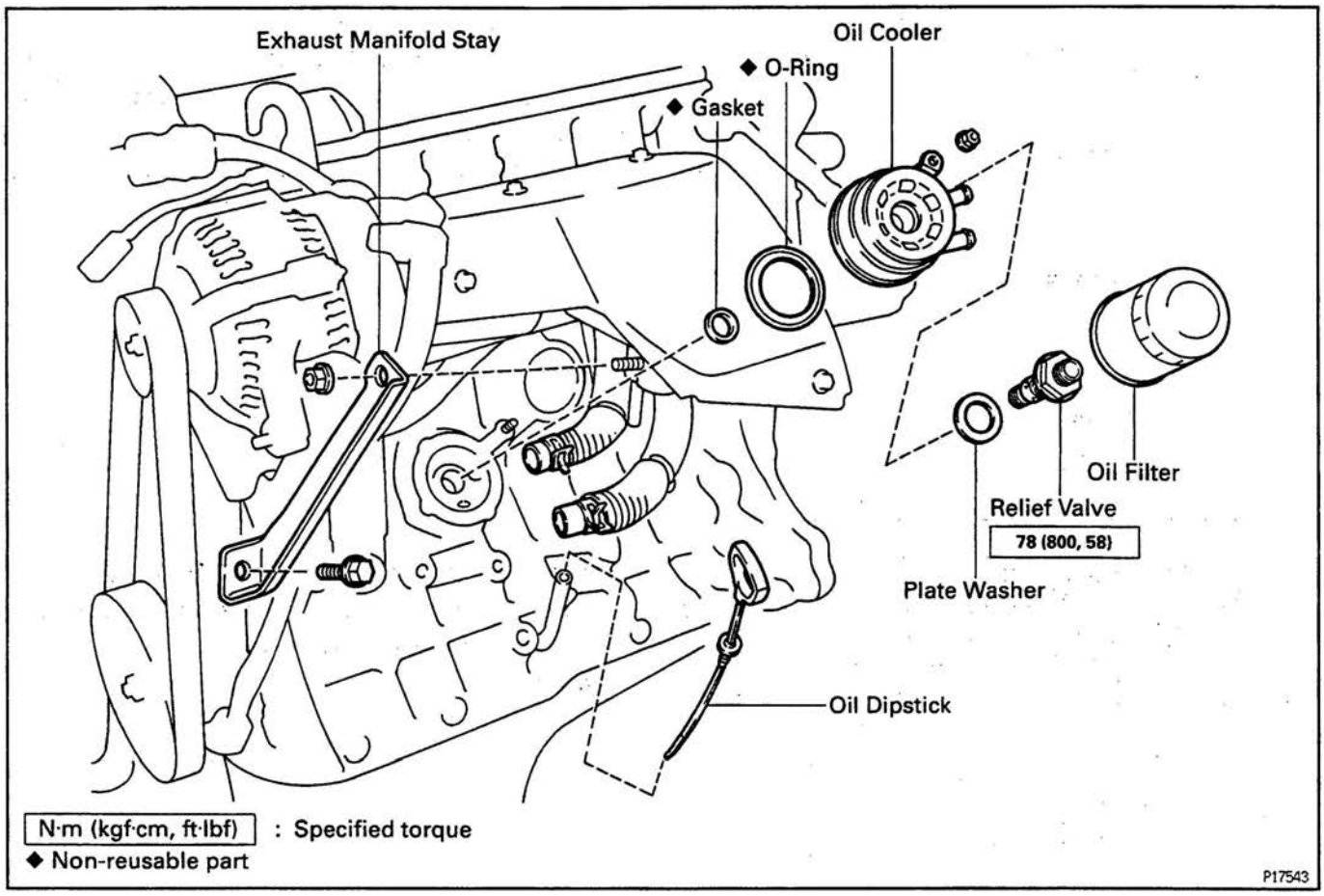
10. RECHECK ENGINE OIL LEVEL

EG

OIL COOLER

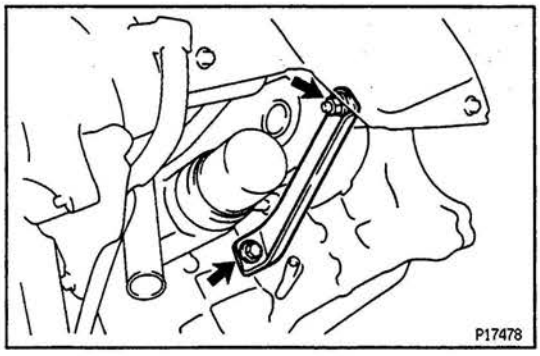
EG3OS-02

COMPONENTS FOR REMOVAL AND INSTALLATION



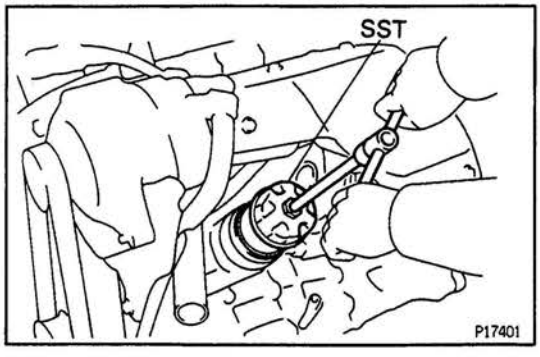
EG3VT-01

OIL COOLER REMOVAL

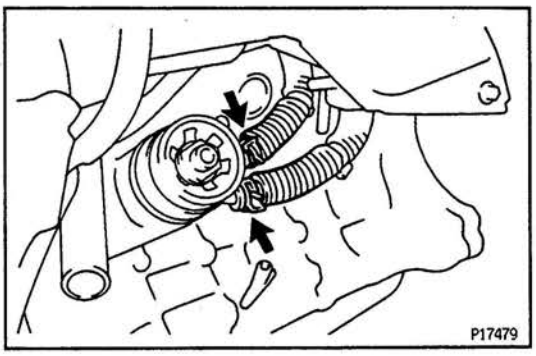


(See Components for Removal and Installation)

1. **DRAIN ENGINE COOLANT**
2. **REMOVE OIL DIPSTICK**
3. **REMOVE EXHAUST MANIFOLD STAY**
   Remove the bolt, nut and manifold stay.

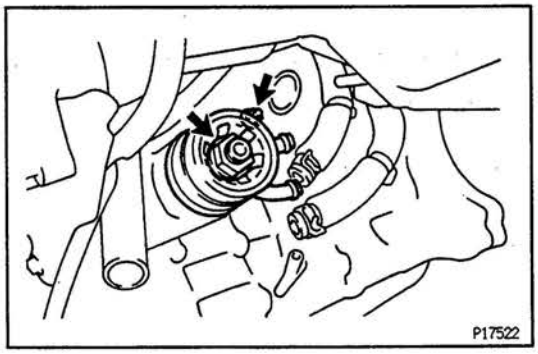


4. **REMOVE OIL FILTER**
   Using SST, remove the oil filter.
   SST 09228—06500



5. REMOVE OIL COOLER

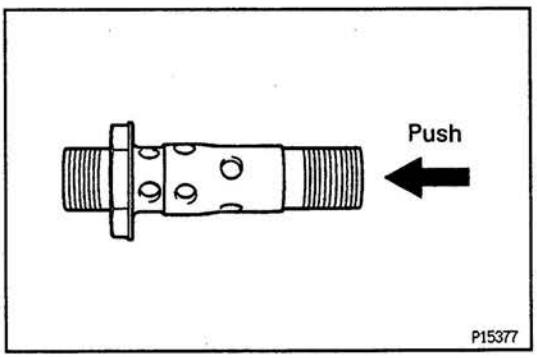
(a) Disconnect the 2 water bypass hoses from the oil cooler.



(b) Remove the relief valve and plate washer.
(c) Remove the nut and oil cooler.
(d) Remove the O–ring and gasket from the oil cooler.

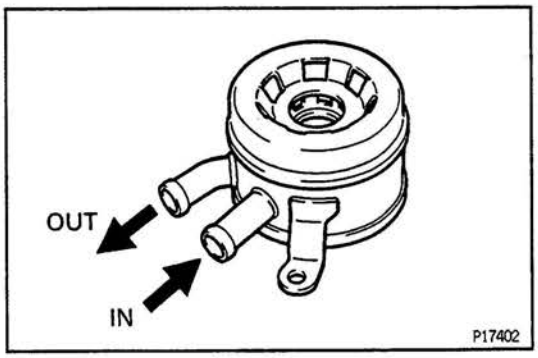
OIL COOLER INSPECTION

EG096–06



1. INSPECT RELIEF VALVE

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

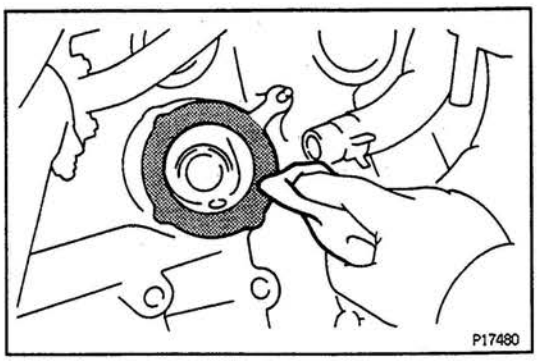


2. INSPECT OIL COOLER

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

OIL COOLER INSTALLATION

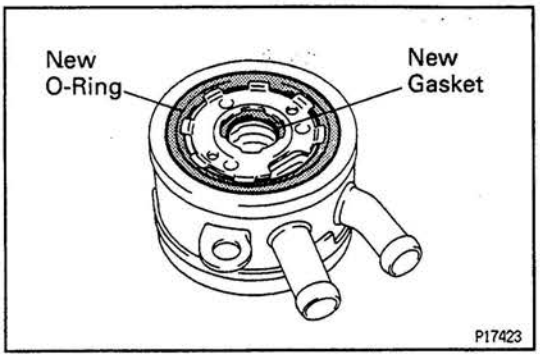
EG3VU–01



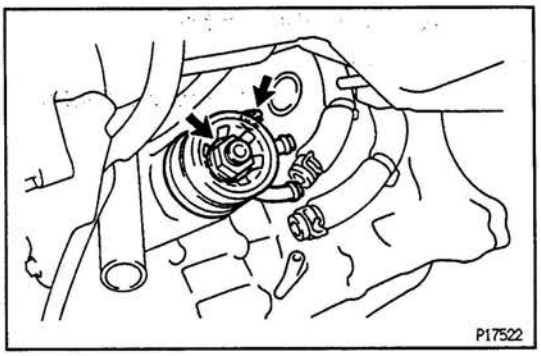
(See Components for Removal and Installation)

1. INSTALL OIL COOLER

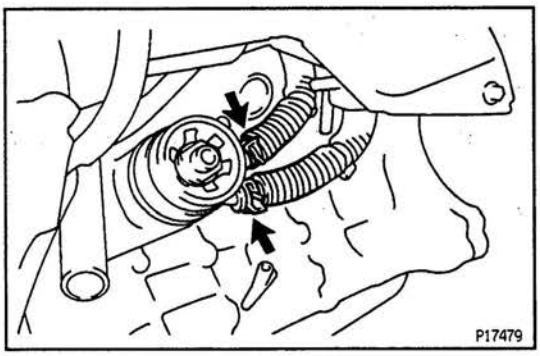
(a) Clean the oil cooler contact surface on the oil cooler mounting.



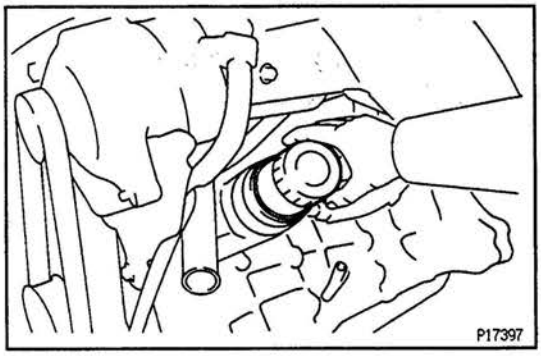
(b) Install new O–ring and gasket to the oil cooler.



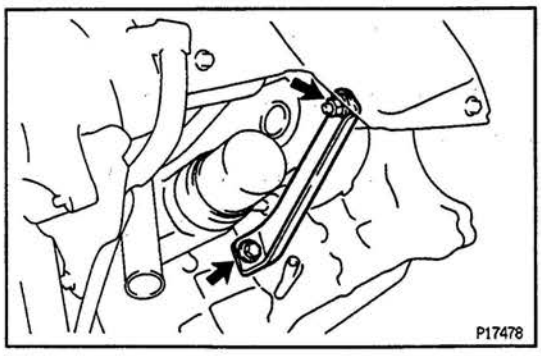
(c) Temporarily install the oil cooler with the nut.
(d) Apply a light coat of engine oil on the threads and under the head of the relief valve.
(e) Install the plate washer and relief valve.
Torque: 78 N·m (800 kgf·cm, 58 ft·lbf)
(f) Tighten the nut.
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)



(g) Connect the 2 water bypass hoses to the oil cooler.



2. INSTALL OIL FILTER
(See page EG–341)



3. INSTALL EXHAUST MANIFOLD STAY
Install the manifold stay with the bolt and nut.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)
4. FILL RADIATOR WITH ENGINE COOLANT
5. START ENGINE AND CHECK FOR LEAKS
6. CHECK ENGINE OIL LEVEL

SERVICE SPECIFICATIONS

SERVICE DATA

EG15A–0A

Oil pressure		at idle speed	29 kPa (0.3 kgf/cm², 43 psi) or more
		at 3,000 rpm	245 – 490 kPa (2.5 – 5.0 kgf/cm², 36 – 71 psi)
Oil pump	Body clearance	STD	0.10 – 0.16 mm (0.0039 – 0.0063 in.)
		Limit	0.20 mm (0.0079 in.)
	Tip clearance	STD	0.04 – 0.16 mm (0.0016 – 0.0063 in.)
		Limit	0.20 mm (0.0079 in.)

EG

TORQUE SPECIFICATIONS

EG15C–0E

Part tightened		N·m	kgf·cm	ft·lbf
Oil pan x Drain plug		39	400	29
Oil pump body cover x Oil pump body		8.8	90	78 in.·lbf
Oil pump x Cylinder block		8.8	90	78 in.·lbf
Oil pump pulley x Oil pump drive rotor		28	290	21
No.2 idler pulley x Oil pump		42	425	31
Oil strainer x Cylinder block		5.4	55	48 in.·lbf
Oil strainer x Oil pump		5.4	55	48 in.·lbf
Oil pan x Cylinder block		5.4	55	48 in.·lbf
Oil pan x Oil pump		5.4	55	48 in.·lbf
Oil cooler x Cylinder block	Relief valve	78	800	58
	Nut	7.8	80	69 in.·lbf
Exhaust manifold stay x Exhaust manifold		42	425	31
Exhaust manifold stay x Cylinder block		42	425	31

–MEMO–