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ENGINE MECHANICAL

DESCRIPTION

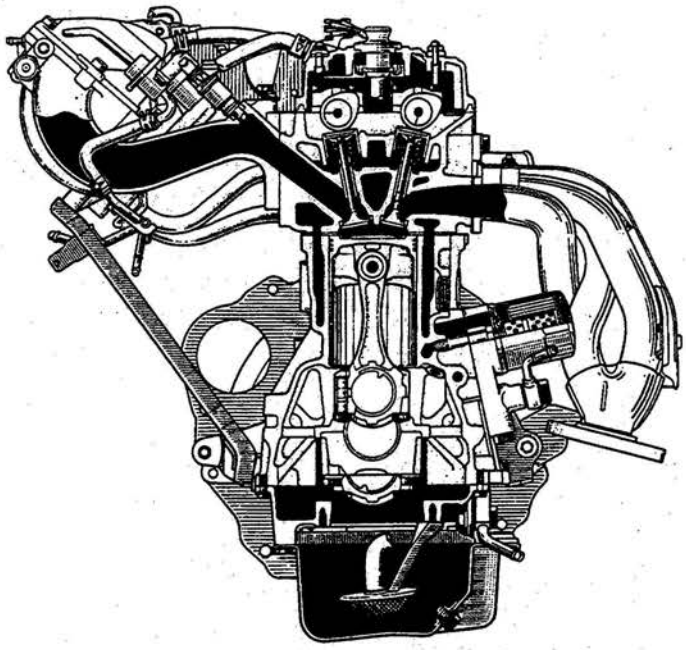
EG17L–02

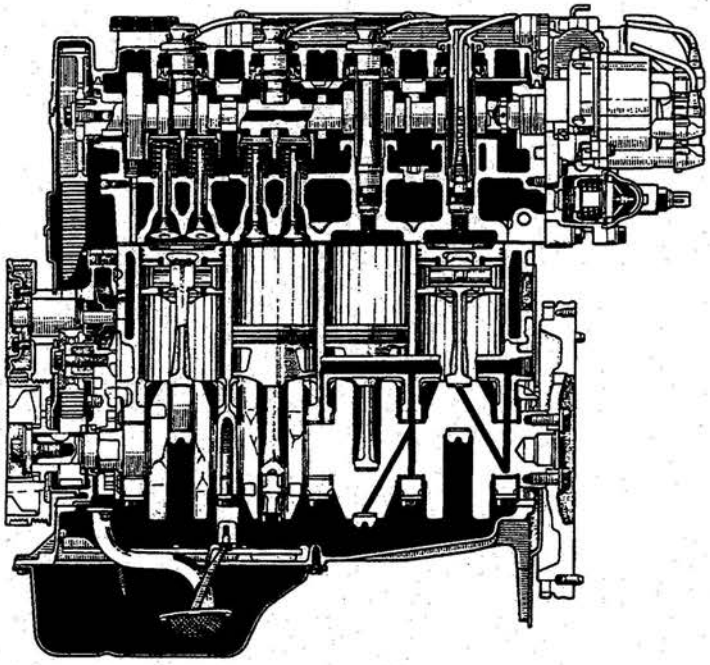
The 7A–FE engine is an in–line, 4–cylinder, 1.8 liter DOHC 16–valve engine.

OPERATION

EG

EG26D–01





P10242
P10354

Z05981

The 7A–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 aluminum 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 firing order is 1 – 3 – 4 – 2. The cylinder head is made of aluminum alloy, with a cross flow type intake and exhaust layout and with pent–roof type combustion chambers. The spark plugs are located in the center of the combustion chambers.

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 even pitch springs made of special valve spring carbon steel which are capable of functioning no matter what the engine speed.

The exhaust camshaft is driven by a timing belt, and a gear on the exhaust camshaft engages with a gear on the intake 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.

The resin timing belt cover is made of 3 pieces. A service hole is provided in the No.1 belt cover for adjusting the timing belt tension.

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

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

The No.1 compression ring is made of stainless steel and the No.2 compression ring is made of cast iron. The oil ring is made of a combination of steel and stainless steel. The outer diameter of each piston ring is sligthly 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.

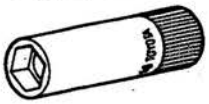
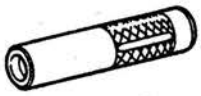
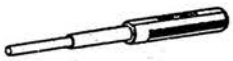
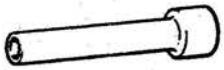
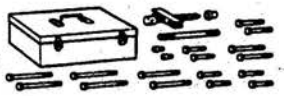
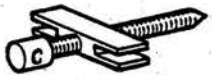
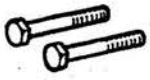
The oil pan is bolted onto the bottom of the cylinder block. The oil pan is an oil reservoir made of pressed steel sheet. A dividing plate is included inside the oil pan to keep sufficient oil in the bottom of the pan even when the vehicle is tilted. This dividing plate also prevents the oil from making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

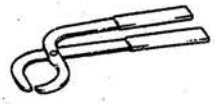
PREPARATION

B30AY-0F

SST (SPECIAL SERVICE TOOLS)

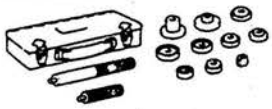
EG

	09032–00100	Oil Pan Seal Cutter	
	09155–16100	Spark Plug Wrench	
	09201–41020	Valve Stem Oil Seal Replacer	
	09201–70010	Valve Guide Bushing Remover & Replacer	
	09202–70010	Valve Spring Compressor	
	09205–16010	Cylinder Head Bolt Wrench	
	09213–54015	Crankshaft Pulley Holding Tool	
	09213–60017	Crankshaft Pulley & Gear Puller Set	
	(09213–00020)	Body With Bolt	
	(09213–00030)	Handle	
	(09213–00060)	Bolt Set	
	09216–00020	Belt Tension Gauge	
	09216–00030	Belt Tension Gauge Cable	

	09221—25024 Piston Pin Remover & Replacer	
	(09221—00020) Body	
	(09221—00030) Spring	
	(09221—00181) Bushing "E"	
	(09221—00190) Guide "K"	
	(09221—00200) Guide "L"	
	09223—41020 Crankshaft Rear Oil Seal Replacer	
	09223—46011 Crankshaft Front Oil Seal Replacer	Camshaft oil seal
	09228—06500 Oil Filter Wrench	
	09248—55020 Valve Clearance Adjust Tool Set	
	(09248—05011) Valve Lifter Press	
	(09248—05021) Valve Lifter Stopper	
	09309—37010 Transmission Bearing Replacer	Crankshaft front oil seal
	09330—00021 Companion Flange Holding Tool	Crankshaft pulley

EG

EG

	09816–30010	Oil Pressure Switch Socket	Oil pressure switch Knock sensor
	09843–18020	Diagnosis Check Wire	
	09550–10012	Replacer Set "B"	
	(09552–10010)	No. 2 Replacer Handle	Spark plug tube gasket
	(09556–10010)	Differential Drive Pinion Front Bearing Remover	Spark plug tube gasket

E00AZ–09

RECOMMENDED TOOLS

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

E0080–08

EQUIPMENT

Battery specific gravity 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	

EG091-0N

SSM (SERVICE SPECIAL MATERIALS)

08826—00080	Seal packing or equivalent	Camshaft bearing cap Cylinder head Cylinder head semi—circular plug
08826—00100	Seal Packing 1282B, Three Bond 1282B or equivalent	Water inlet housing
08833—00070	Adhesive 1324, THREE BOND 1324 or equivalent	Spark plug tube
08833—00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure switch Engine drain plug

TROUBLESHOOTING

EG082-06

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.

	See page	IG-4	IG-4	EG-231	EG-225	EG-226	EG-227	EG-209	EG-169	–	–	–	EG-178	EG-194	–	EG-197	EG-221 EG-222
	Suspect area	RPM Signal Circuit	Ignition Signal Circuit (Spark Test)	Oxygen Sensor Circuit	Water Temp. Sensor Circuit	Intake Air Temp. Sensor Circuit	Vacuum Sensor Circuit	Throttle Position Sensor Circuit	STA Signal Circuit	Knock Sensor	NSW Signal Circuit	A/C Signal Circuit	Fuel Pump	Fuel Pressure Regulator	Fuel Lines	Injectors	EFI Main Relay
	Symptom																
Does not start	Engine does not crank																
	Starter runs – engine does not crank																
	No initial combustion	11	2				5						6				3
	No complete combustion				3		1							2		8	
Difficult to start	Engine cranks slowly											2					
	Under normal condition	10	11		3	12							5	4	6	14	
	Cold engine				1	4			2				6	5	7	8	
	Hot engine				1	3							5	4	6	7	
Poor idling	Incorrect first idle				2												
	High engine idle speed				2	3		4			6	5				7	
	Low engine idle speed				1		2									3	
	Rough idling		15		2		10						6	5	7	14	
	Misfire		3		5		7									8	
Poor drivability	Hesitation/Poor acceleration			11	9	10	8	7					13	12	14	17	
	Backfire			5	2	6	4	3					8	7	9	10	
	Muffler explosion (after fire)			8	3	7	5	6						4		9	
	Surging													1		4	
	Knocking									1							
Engine stalls	Engine stalls soon after starting				7		6						3	2	4	8	
	After acceleration pedal depressed						1	2						4	5	6	
	After acceleration pedal released						1										
	During A/C operation											1					
	When shifting N to D										1						
Others	Poor fuel economy			18	13	19	15	14			16	17				12	
	Engine overheat									9							
	Engine overcool																
	Excessive oil consumption																
	Low oil pressure																
	High oil pressure																
	Starter keeps running																
	Battery often discharges																

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

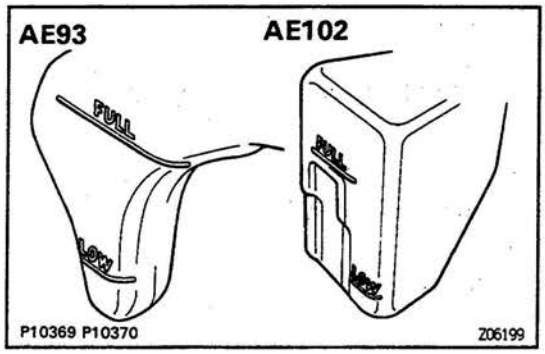
V02700

	See page	EG-223	EG-239	EG-235	–	–	–	–	–	ST-5 ST-18	IG-8	IG-10	–	–	EG-271	–	EG-32	EG-16
	Suspect area	Circuit Opening Relay	Fuel Cut System	Engine ECU	Fuel Quality	Fuel Leakage	Coolant Leakage	Oil Leakage	Neutral Start SW (only for AE93)	Starter	Spark Plug	IIA (Distributor)	Accelerator Pedal Link	Brakes drag even when released	Cooling Fan System	Clutch	Compression	Valve Clearance
	Symptom																	
Does not start	Engine does not crank								2	1								
	Starter runs – engine does not crank									1								
	No initial combustion	4		12	7							1					8	
	No complete combustion			9													4	
Difficult to start	Engine cranks slowly									1								
	Under normal condition			15	1						2	13					7	
	Cold engine			9	3													
	Hot engine			8	2													
Poor idling	Incorrect first idle			3									1					
	High engine idle speed			8									1					
	Low engine idle speed			4														
	Rough idling			16	1						3	4					8	12
	Misfire			9	1						2	4					6	
Poor drivability	Hesitation/Poor acceleration			18	3					4	5			2		1	6	15
	Backfire			11														
	Muffler explosion (after fire)		1	10														
	Surging			5							2	3						
	Knocking			9	2						3				6			
Engine stalls	Engine stalls soon after starting			9	1													
	After acceleration pedal depressed			7							3							
	After acceleration pedal released			2														
	During A/C operation			2														
	When shifting N to D			2														
Others	Poor fuel economy		6	20	2	1					7	8	3	5		4	9	
	Engine overheat						1				8				2			
	Engine overcool														1			
	Excessive oil consumption							1									3	
	Low oil pressure							1										
	High oil pressure																	
	Starter keeps running									1								
	Battery often discharges																	

EG

	See page	EG-42	EG-34	EG-249	EG-65	EG-286	EG-98	EG-101	EG-63	EG-107	–	EG-264	EG-262	EG-15	–	–	CH-9	EG-104
	Suspect area	Valve Timing	Timing Belt	Water Pump	Valve 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
	Symptom																	
Does not start	Engine does not crank																	
	Starter runs – engine does not crank										2							
	No initial combustion	9	10															
	No complete combustion	6	7							5								
Difficult to start	Engine cranks slowly						3	4										
	Under normal condition	9								8								
	Cold engine																	
	Hot engine																	
Poor idling	Incorrect first idle																	
	High engine idle speed																	
	Low engine idle speed																	
	Rough idling	13	14						18	9								
	Misfire																	
Poor drivability	Hesitation/Poor acceleration	16																
	Backfire	1																
	Muffler explosion (after fire)	2																
	Surging																	
	Knocking	4		8								5	7					
Engine stalls	Engine stalls soon after starting																	
	After acceleration pedal depressed																	
	After acceleration pedal released																	
	During A/C operation																	
	When shifting N to D																	
Others	Poor fuel economy	12								11								
	Engine overheat	7	5	6		10			11			3	4		13			12
	Engine overcool												2		3			
	Excessive oil consumption				2				5	4								6
	Low oil pressure					2	3	4								5		
	High oil pressure					1										2		
	Starter keeps running																	
	Battery often discharges													1			2	

V02702



TUNE—UP

ENGINE COOLANT INSPECTION

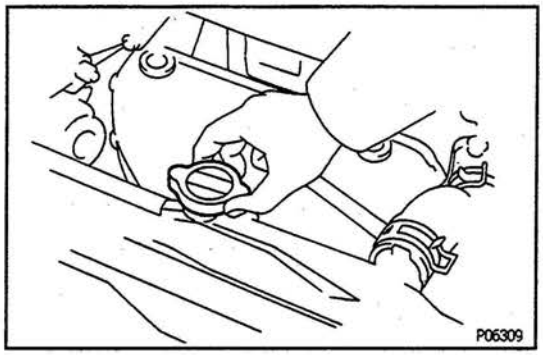
B010Z—06

1. CHECK ENGINE COOLANT LEVEL AT RESERVOIR TANK

The engine coolant level should be between the "LOW" and "FULL" lines.

If low, check for leaks and add engine coolant up to the "FULL" line.

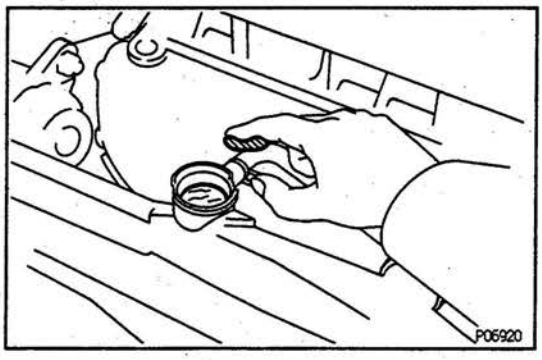
EG



2. CHECK ENGINE COOLANT QUALITY

(a) Remove the radiator cap.

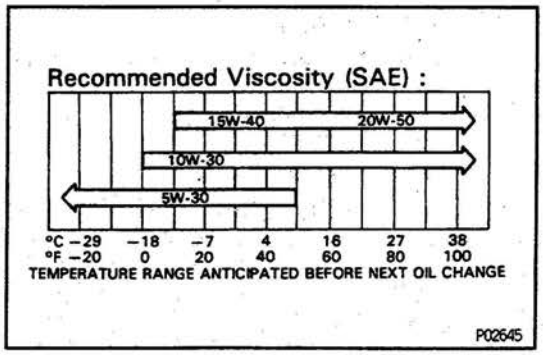
CAUTION: To avoid the danger of being burned, do not remove it while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.



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

If excessively dirty, replace the coolant.

(c) Reinstall the radiator cap.



ENGINE OIL INSPECTION

B0084—08

1. CHECK OIL QUALITY

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

If oil quality is poor, replace it.

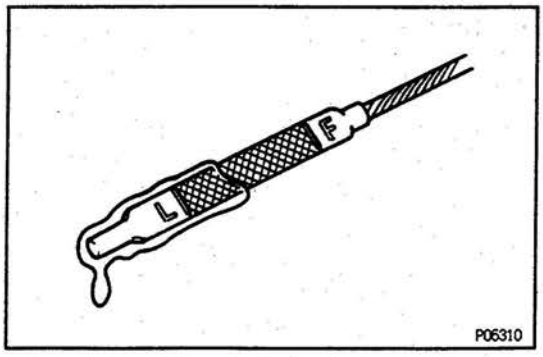
Oil grade:

API grade SG or better

If it is impossible to get SG or better you may use SF grade.

Recommended viscosity:

Refer to illustration

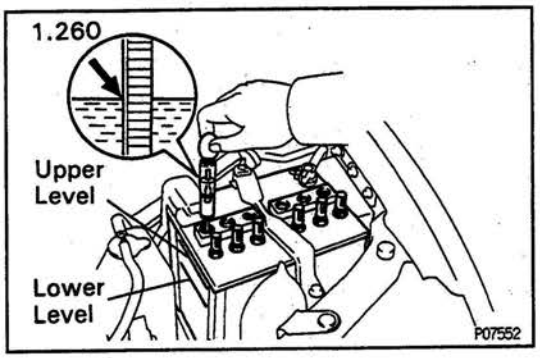


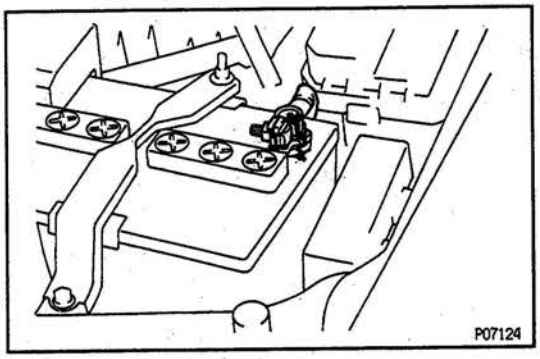
2. CHECK ENGINE OIL LEVEL

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.

EG





BATTERY INSPECTION

1. **CHECK BATTERY SPECIFIC GRAVITY AND ELECTROLYTE LEVEL**

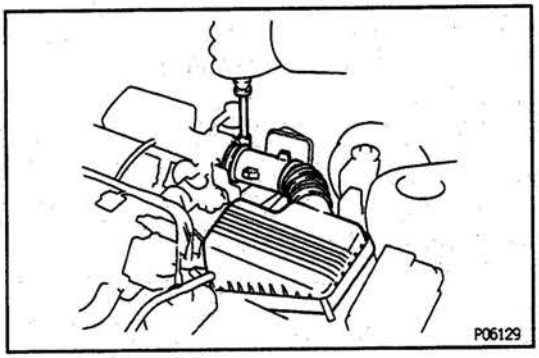
(a) Check the electrolyte quantity of each cell.
If insufficient, refill with distilled (or purified) water.

(b) Check the specific gravity of each cell.
Standard specific gravity at 20°C (68°F):
1.25 – 1.27
If not within specifications, charge the battery.

2. **CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES**

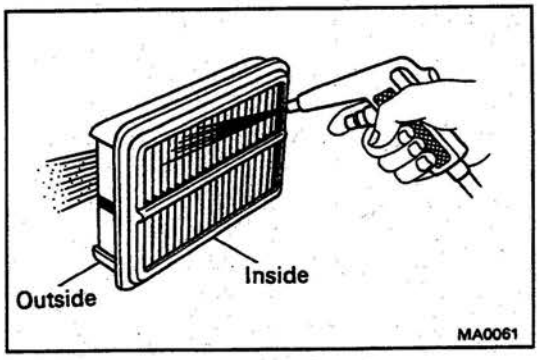
(a) Check that the battery terminals are not loose or corroded.

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



AIR FILTER INSPECTION AND CLEANING

1. **REMOVE AIR FILTER**
Remove the air cleaner cap and air filter.

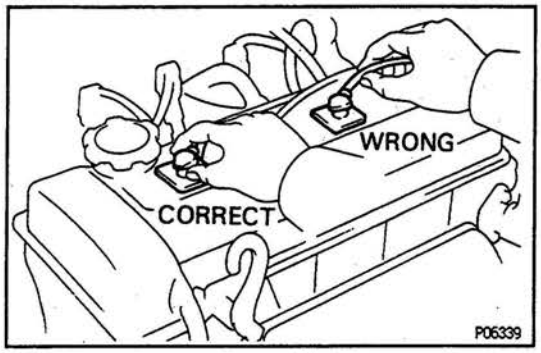


2. **INSPECT AND CLEAN AIR FILTER**

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

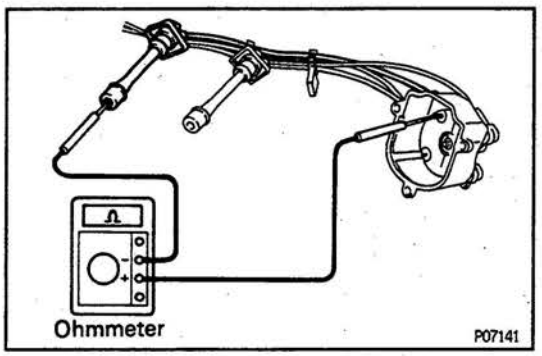
(b) Clean the air filter with compressed air.
First blow from the inside thoroughly, then blow off the outside of the air filter.

3. **REINSTALL AIR FILTER**

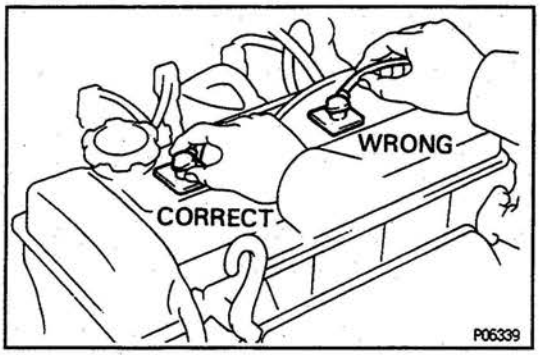


HIGH–TENSION CORDS INSPECTION

1. **DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS**
   Disconnect the high – tension cords at the rubber boot. Do not pull on the cords.
   NOTICE: Pulling on or bending the cords may damage the conductor inside.
2. **REMOVE DISTRIBUTOR CAP WITHOUT DISCONNECTING HIGH–TENSION CORDS**
3. **INSPECT HIGH–TENSION CORD RESISTANCE**
   Using an ohmmeter, measure the resistance without disconnecting the distributor cap.
   Maximum resistance:
   25 kΩ per cord
   If the resistance is greater than maximum, check the terminals. If necessary, replace the high–tension cord and/or distributor cap.

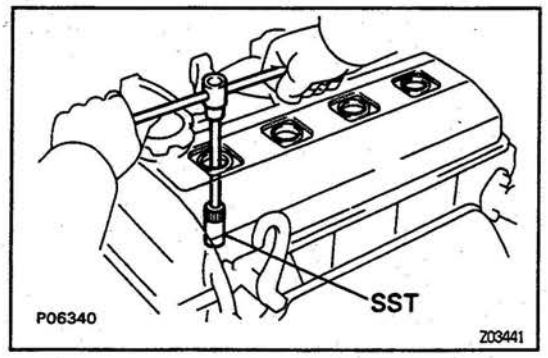


4. **REINSTALL DISTRIBUTOR CAP AND HIGH–TENSION CORDS**
5. **RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS**

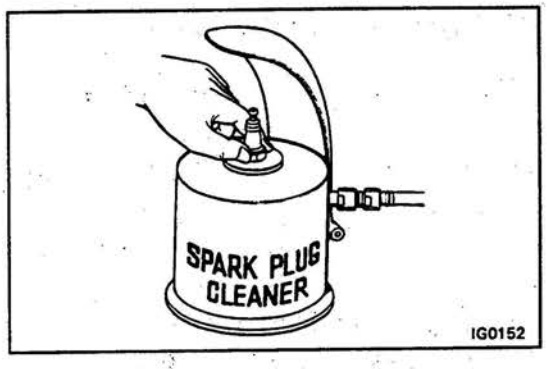


SPARK PLUGS INSPECTION

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

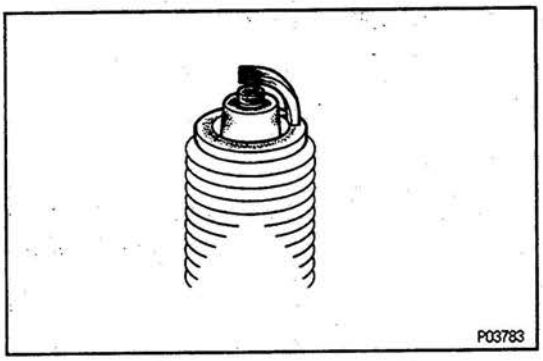


2. **REMOVE SPARK PLUGS**
   Using SST, remove the spark plugs.
   SST 09155–16100



3. CLEAN SPARK PLUGS

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



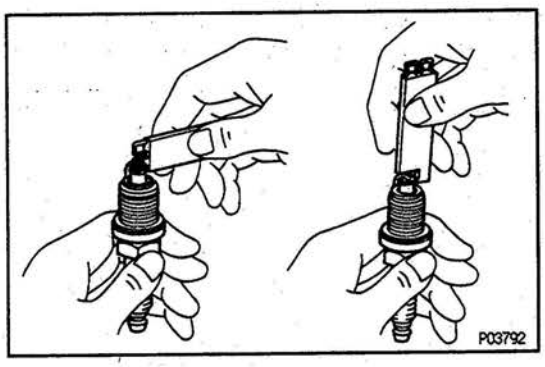
4. VISUALLY INSPECT SPARK PLUGS

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

If abnormal, replace the plugs.

Recommended spark plugs:

ND	**K20R—U for AE102**
NGK	**BKR6EYA for AE102**
ND	**K16R—U for AE93**
NGK	**BKR5EYA for AE93**

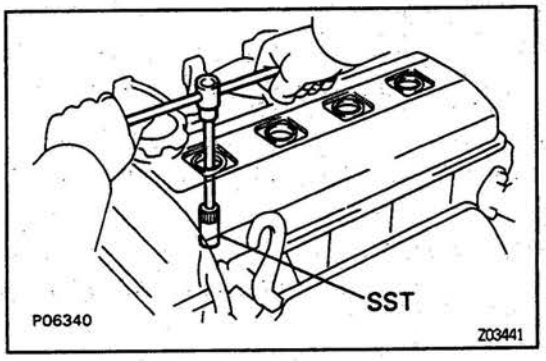


5. ADJUST ELECTRODE GAP

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

Correct electrode gap:

0.8 mm (0.031 in.)



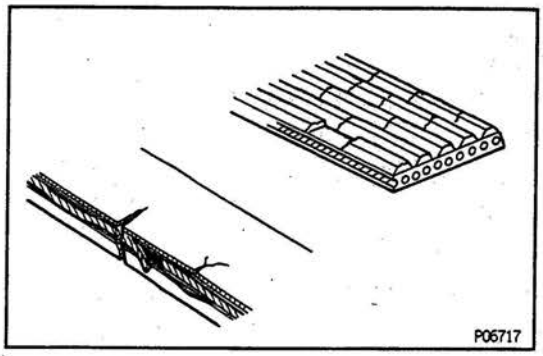
6. INSTALL SPARK PLUGS

Using SST, install the spark plugs.

SST 09155—16100

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

7. RECONNECT HIGH—TENSION CORDS TO SPARK PLUGS

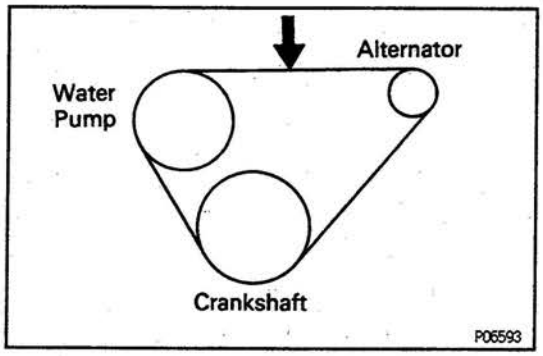


ALTERNATOR DRIVE BELT INSPECTION [8017W-02]

INSPECT DRIVE BELT

(a) Visually check the belt for excessive wear, frayed cords etc.
If necessary, replace the drive belt.
HINT: Cranks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.

EG



(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.

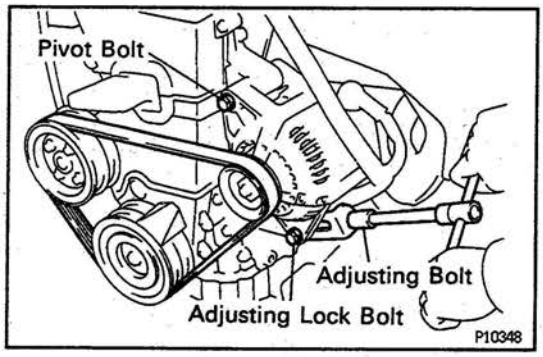
Deflection:

New belt

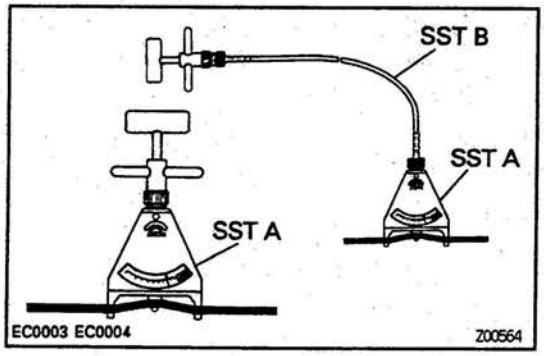
7 – 9 mm (0.28 – 0.35 in.)

Used belt

11.5 – 13.5 mm (0.453 – 0.531 in.)



If the deflection is not as specified, adjust it.



(Reference)

Using SST, check the drive belt tension.

SST A 09216–00020

SST B 09216–00030

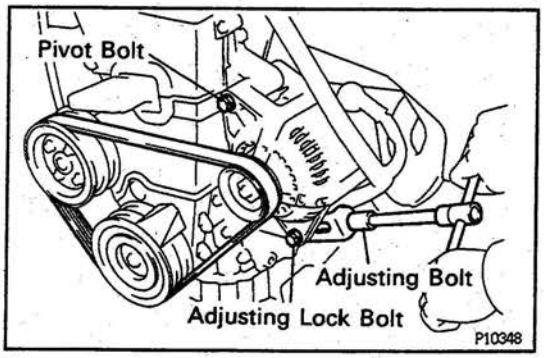
Drive belt tension:

New belt

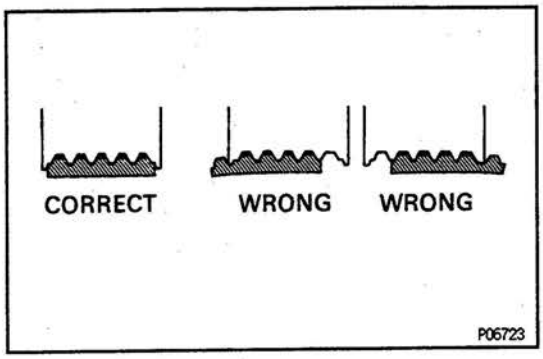
70 – 80 kgf

Used belt

30 – 45 kgf



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



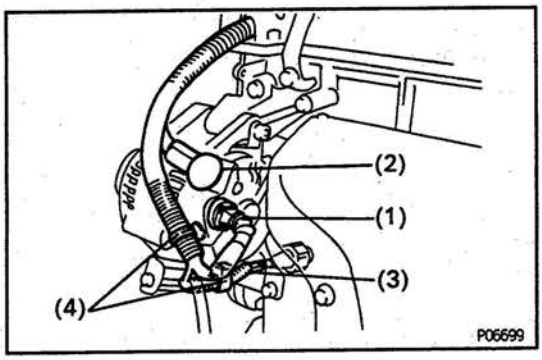
EG

HINT:

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

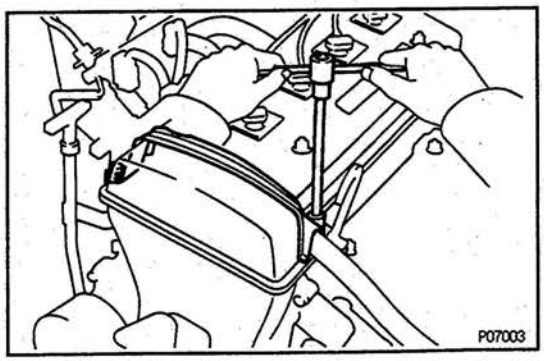
VALVE CLEARANCE INSPECTION AND ADJUSTMENT

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

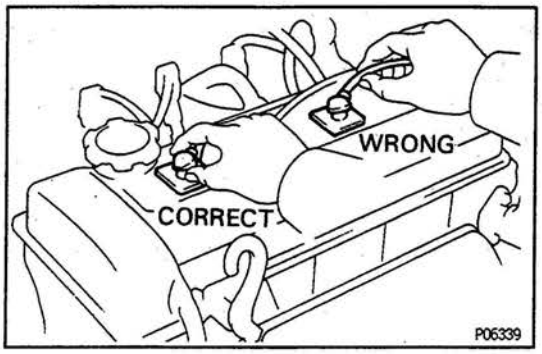


1. REMOVE CYLINDER HEAD COVER

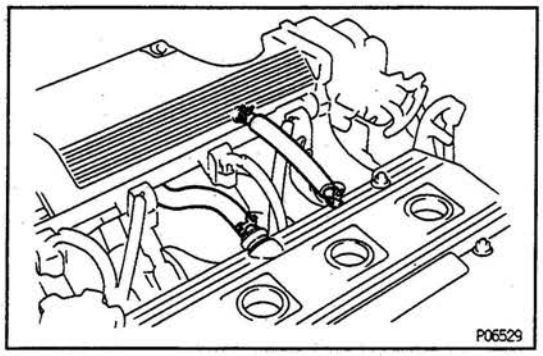
(a) Disconnect the following wires and clamps:
  (1) Alternator connector
  (2) Alternator wire
  (3) Oil pressure switch connector
  (4) Two wire clamps



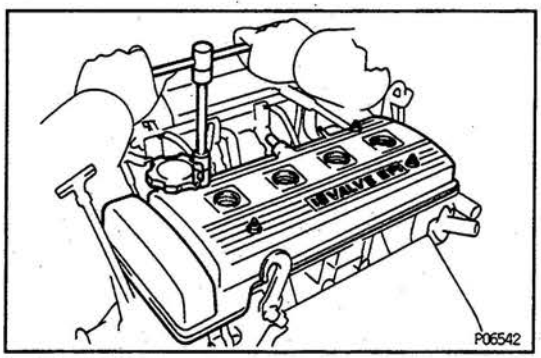
(b) Remove the two bolts and wire harness protector.
(c) Disconnect the wire harness from the cylinder head cover.



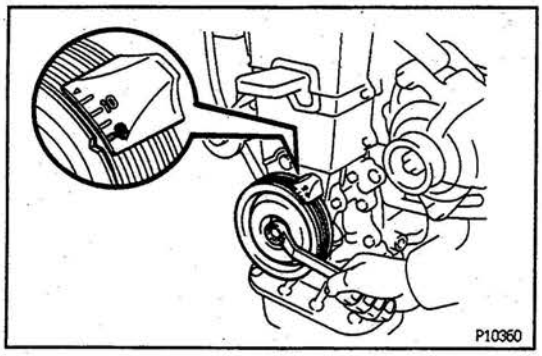
(d) Disconnect the high – tension cords at the rubber boot. Do not pull on the high–tension cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.



(e) Disconnect the PCV hoses from the cylinder head cover.

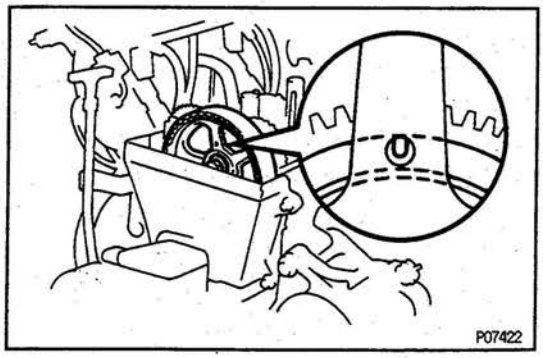


(f) Remove the four cap nuts, seal washers, cylinder head cover and gasket.

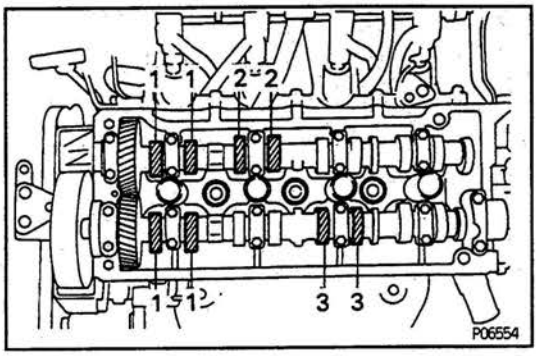


2. SET NO.1 CYLINDER TO TDC/COMPRESSION

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



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



EG

3. INSPECT VALVE CLEARANCE

(a) Check only the valves indicated.

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

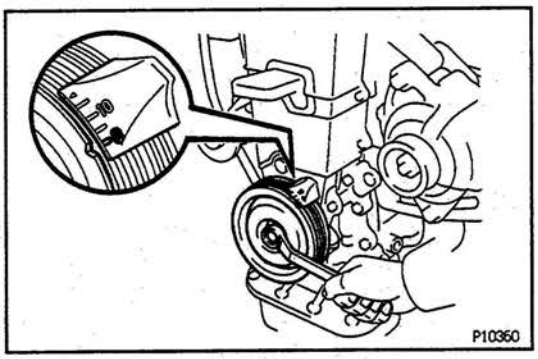
Valve clearance (Cold):

Intake

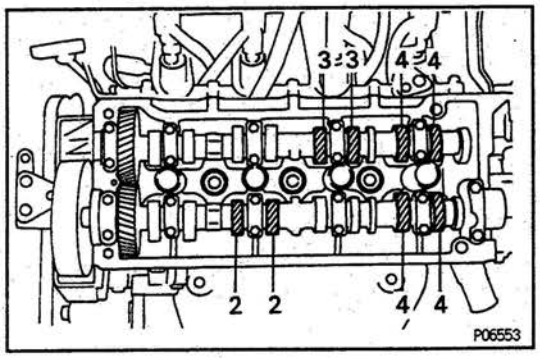
0.15 — 0.25 mm (0.006 — 0.010 in.)

Exhaust

0.25 — 0.35 mm (0.010 — 0.014 in.)



(b) Turn the crankshaft pulley one revolution (360°) and align the its groove with timing mark "0" of the No.1 timing belt cover.

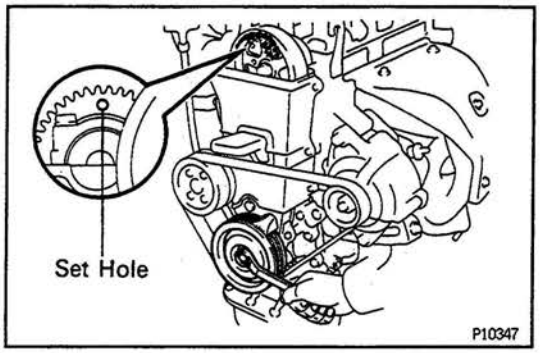


(c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure in step (a))

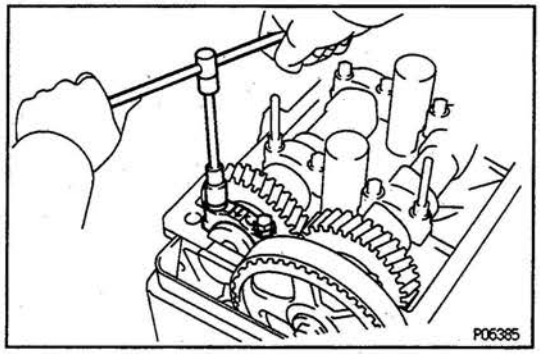
4. (Intake) ADJUST VALVE CLEARANCE

A. Remove intake camshaft

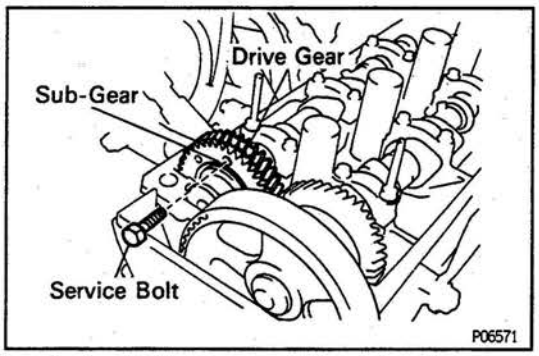
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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



(a) Turn the crankshaft pulley so that the hole in the sub –gear (which sets the sub–gear to the camshaft drive gear) comes up.
HINT: The above state allows the No.1 and No.3 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.



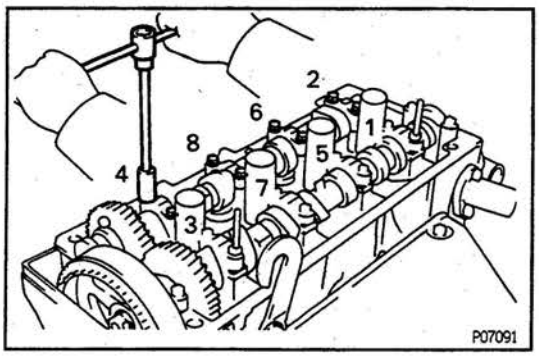
(b) Remove the two bolts and No.1 bearing cap.



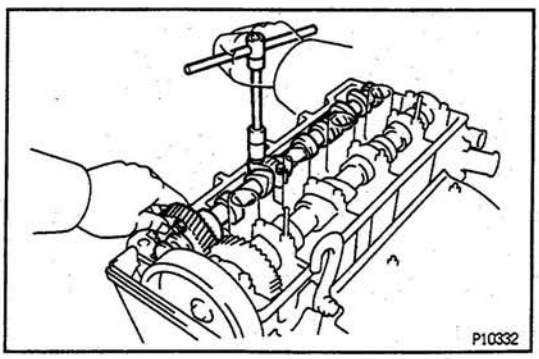
(c) Secure the intake camshaft sub–gear to the drive gear with a service bolt.
Recommended service bolt:

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

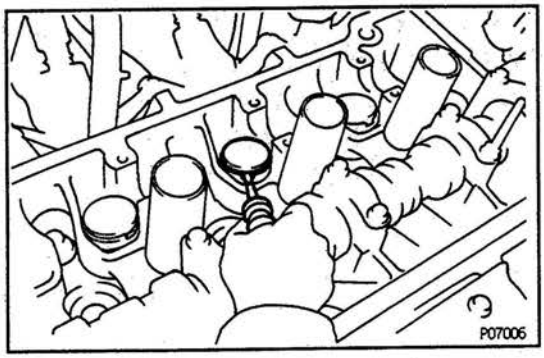
HINT: When removing the camshaft, make sure that the torsional spring force of the sub–gear has been eliminated by the above operation.



(d) Uniformly loosen and remove the eight bearing cap bolts in several passes, in the sequence shown.
(e) Remove the four bearing caps and camshaft.

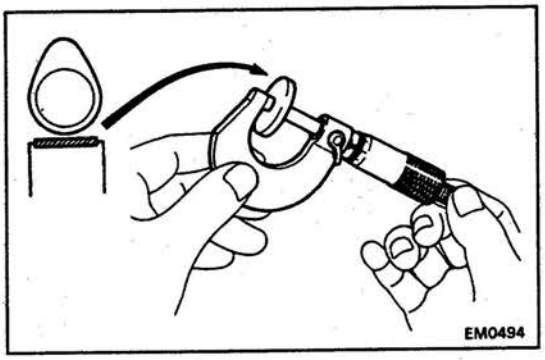


HINT: If the camshaft is not being lifted out straight and level, reinstall the No.3 bearing cap with the two bolts. Then alternately loosen and remove the bearing cap bolts with the camshaft gear pulled up.
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.



B. Remove adjusting shim

Remove the adjusting shim with a small screwdriver.



C. Determine the replacement adjusting shim size by following Formula or Charts:

(a) Using a micrometer, measure the thickness of the removed shim.

(b) Culculate the thickness of a new shim so that the valve clerance comes within specified value.

T ..... Thickness of removed shim

A ..... Measured valve clearance

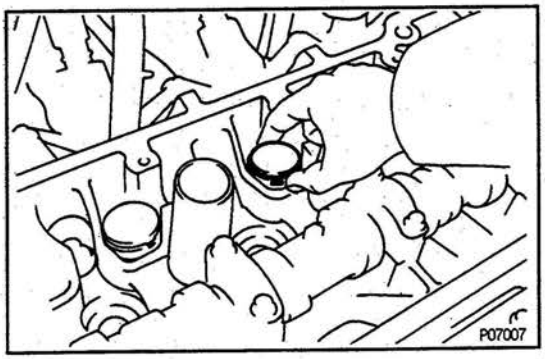
N ..... Thickness of new shim

Intake:

N = T + (A – 0.20 mm (0.008 in.))

(c) Select a new shim with a thickness as close as possible to the calculated value.

HINT: Shims are available in 16 sized in increments of 0.05 mm (0.0020 in.), from 2.55 mm (1.0039 in.) to 3.30 mm (0.1299 in.).

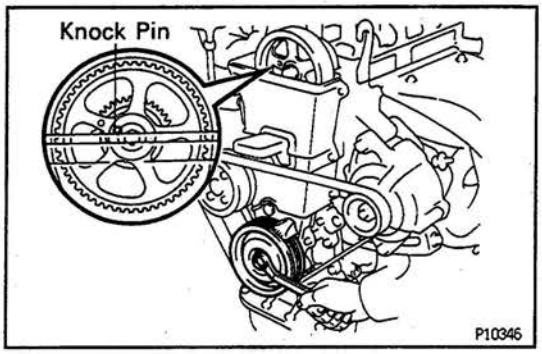


D. Install new adjusting shim

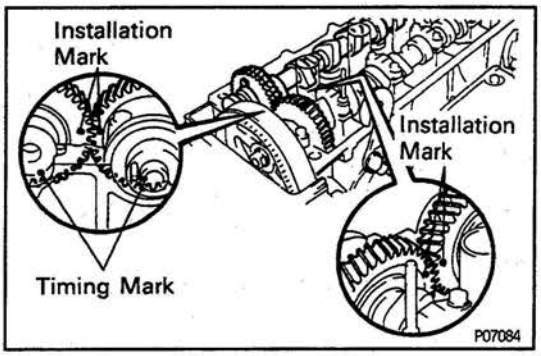
Place a new adjusting shim on the valve lifter.

E. Install intake camshaft

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) Turn the crankshaft pulley, set the intake camshaft so that the knock pin is slightly above the top of the cylinder head.



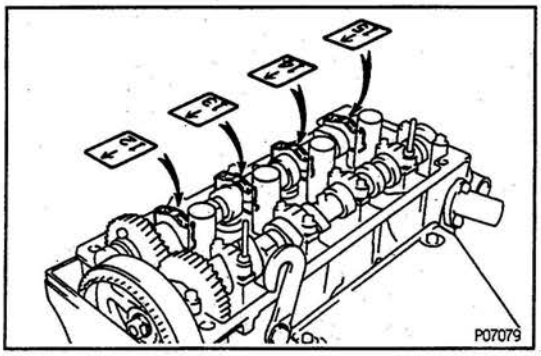
(b) Apply MP grease to the thrust portion of the camshaft.

(c) Engage the intake camshaft gear to the exhaust camshaft gear by matching the assembly installation mark on each gear.

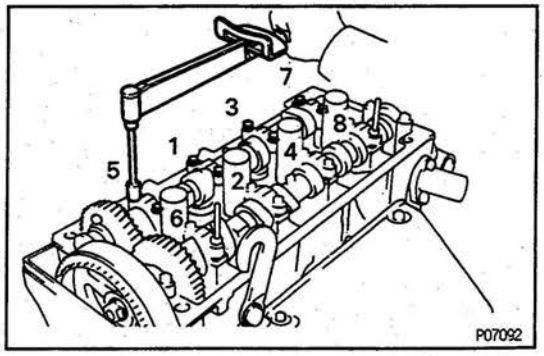
NOTICE: There are also timing marks (for TDC) on each gear as shown in the illustration. Do not use these marks.

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

HINT: The above angle allows the No.1 and No.3 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.



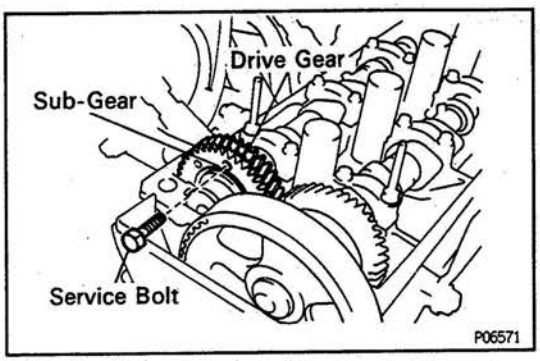
(e) Install the four bearing caps in their proper locations.



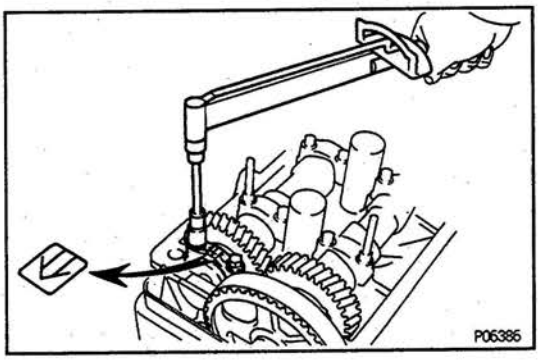
(f) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

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

Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)



(h) Remove the service bolt.

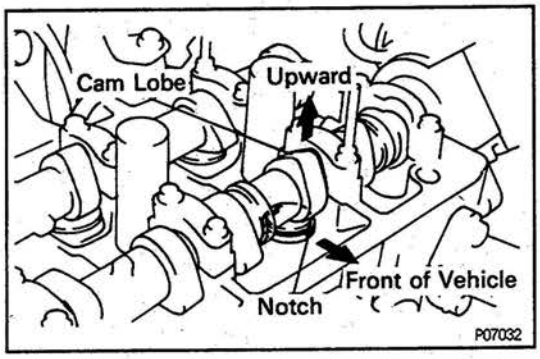


(i) Install the No.1 bearing cap with the arrow mark facing foward.
NOTICE: If the No.1 bearing cap does not fit properly, push the camshaft gear backwards by prying apart the cylinder head and camshaft gear with a screwdriver.

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

(k) Install and alternately tighten the two bearing cap bolts in several passes.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)

F. Recheck valve clearance

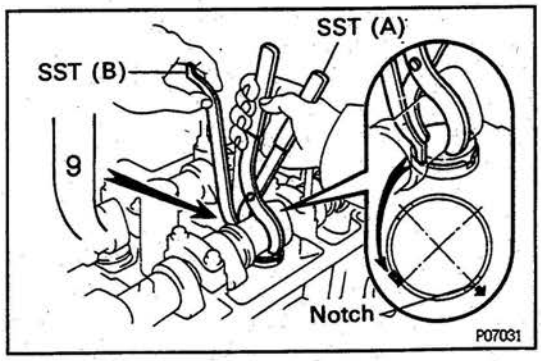


5. (Exhaust)
ADJUST VALVE CLEARANCE

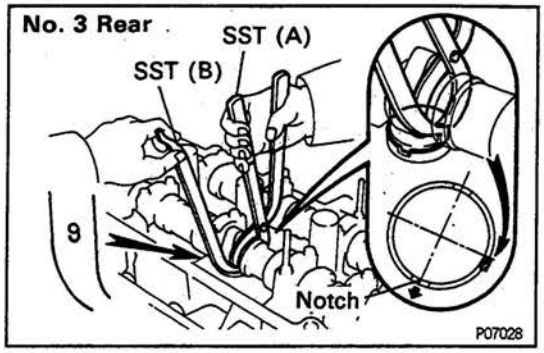
A. Remove adjusting shim

(a) Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve upward.

(b) Position the notch of the valve lifter facing the front of the vehicle.

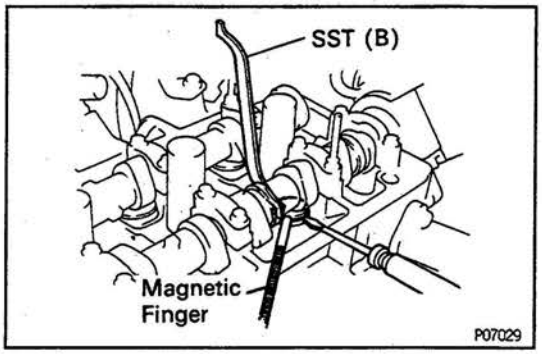


(c) Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).
SST 09248−55020 (09248−05011, 09248−05021)
HINT:
- Apply SST (B) at slight angle on the side marked with "9", at the position shown in the illustration.

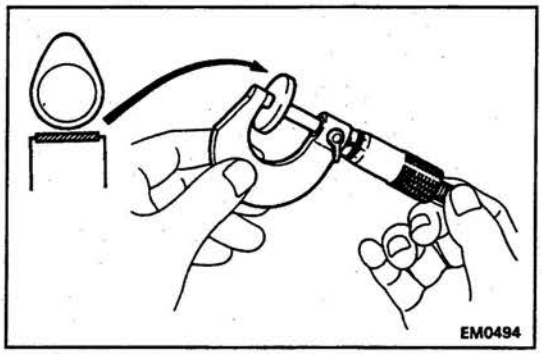


- When SST (B) is inserted too deeply, it will get pinched by the shim. To prevent it from being stuck, insert it shallowly from the intake side, at a slight angle.
- The shape of the cam makes it difficult to insert SST (B), from the intake side to the No.3 rear. For this shim, it is best approached from the exhaust side instead.

EG



(d) Remove the adjusting shim with a small screwdriver and magnetic finger.



B. Determine replacement adjusting shim size by following Formula or Charts:

(a) Using a micrometer, measure the thickness of the removed shim.

(b) Culculate the thickness of a new shim so that the valve clerance comes within specified value.

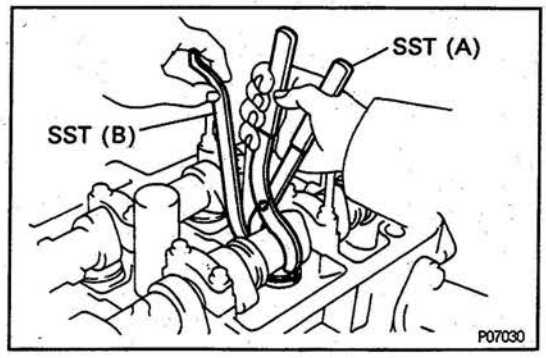
T ..... Thickness of removed shim
A ..... Measured valve clearance
N ..... Thickness of new shim

Exhaust:

$$N = T + (A - 0.30 \text{ mm } (0.012 \text{ in.}))$$

(c) Select a new shim with a thickness as close as possible to the calculated value.

HINT: Shims are available in 16 sized in increments of 0.05 mm (0.0020 in.), from 2.55 mm (1.0039 in.) to 3.30 mm (0.1299 in.).



C. Install new adjusting shim

(a) Place a new adjusting shim on the valve lifter.

(b) Using SST (A), press down the valve lifter and remove SST (B).

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

D. Recheck valve clearance

EG

Adjusting Shim Selection Chart (Intake)

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 (0.1018)	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 (0.1055)	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)	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)	2.060 (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)													1	1	1	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	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
0.021 – 0.040 (0.0008 – 0.0016)											1	1	1	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	5	6	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13
0.041 – 0.060 (0.0016 – 0.0024)									1	1	1	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	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
0.061 – 0.080 (0.0024 – 0.0031)								1	1	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	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
0.081 – 0.100 (0.0032 – 0.0039)							1	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	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
0.101 – 0.120 (0.0040 – 0.0047)						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	5	6	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
0.121 – 0.140 (0.0048 – 0.0055)					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	6	6	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
0.141 – 0.149 (0.0056 – 0.0059)					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	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
0.150 – 0.250 (0.0059 – 0.0098)																																																																	
0.251 – 0.260 (0.0099 – 0.0102)	1	2	2	2	2	3	3	4	4	4	4	5	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	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	14	14	14	14	15	15	16	16	16	16	16	
0.261 – 0.280 (0.0103 – 0.0110)	1	2	2	2	3	3	3	4	4	4	5	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	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	16	16	
0.281 – 0.300 (0.0111 – 0.0118)	2	2	3	3	3	3	4	4	5	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	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	14	14	15	15	15	15	16	16	16	16	16		
0.301 – 0.320 (0.0119 – 0.0126)	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	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	16	16				
0.321 – 0.340 (0.0126 – 0.0134)	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	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	16	16					
0.341 – 0.360 (0.0134 – 0.0142)	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	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	16	16						
0.361 – 0.380 (0.0142 – 0.0150)	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	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	16	16	16	16	16							
0.381 – 0.400 (0.0150 – 0.0157)	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	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	16	16	16	16	16								
0.401 – 0.420 (0.0158 – 0.0165)	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	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16										
0.421 – 0.440 (0.0166 – 0.0173)	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	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16											
0.441 – 0.460 (0.0174 – 0.0181)	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	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16												
0.461 – 0.480 (0.0181 – 0.0189)	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	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16													
0.481 – 0.500 (0.0189 – 0.0197)	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	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16														
0.501 – 0.520 (0.0197 – 0.0205)	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	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16																
0.521 – 0.540 (0.0205 – 0.0213)	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	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16																		
0.541 – 0.560 (0.0213 – 0.0220)	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	15	15	15	15	15	16	16	16	16	16	16	16	16																				
0.561 – 0.580 (0.0221 – 0.0228)	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	15	15	15	16	16	16	16	16	16	16	16																						
0.581 – 0.600 (0.0229 – 0.0236)	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	15	16	16	16	16	16	16	16	16																								
0.601 – 0.620 (0.0237 – 0.0244)	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	16	16	16	16	16	16	16																										
0.621 – 0.640 (0.0244 – 0.0252)	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	16	16	16	16	16																												
0.641 – 0.660 (0.0252 – 0.0260)	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	16	16	16																														
0.661 – 0.680 (0.0260 – 0.0268)	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	16	16	16																																
0.681 – 0.700 (0.0268 – 0.0276)	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	16	16	16																																		
0.701 – 0.720 (0.0276 – 0.0283)	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	16	16	16																																				
0.721 – 0.740 (0.0284 – 0.0291)	11	11	11	12	12	12	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16																																						
0.741 – 0.760 (0.0292 – 0.0299)	11	11	12	12	12	13	13	13	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16																																								
0.761 – 0.780 (0.0300 – 0.0307)	11	12	12	12	13	13	13	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16																																										
0.781 – 0.800 (0.0307 – 0.0315)	12	12	13	13	13	13	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16																																												
0.801 – 0.820 (0.0315 – 0.0323)	12	13	13	13	13	14	14	15	15	15	15	16	16	16	16	16	16	16	16																																																
0.821 – 0.840 (0.0323 – 0.0331)	13	13	13	14	14	14	15	15	15	16	16	16	16	16	16	16	16																																																		
0.841 – 0.860 (0.0331 – 0.0339)	13	13	14	14	14	15	15	15	16	16	16	16	16	16	16																																																						
0.861 – 0.880 (0.0339 – 0.0346)	13	14	14	14	15	15	15	16	16	16	16	16	16																																																										
0.881 – 0.900 (0.0347 – 0.0354)	14	14	15	15	15	15	16	16	16	16	16																																																												
0.901 – 0.920 (0.0355 – 0.0362)	14	15	15	15	15	16	16	16	16																																																																
0.921 – 0.940 (0.0363 – 0.0370) |15|15|15|16|16|16|16|16|																																																																	
0.941 – 0.960 (0.0370 – 0.0378)	15	15	16	16	16	16	16																																																																				
0.961 – 0.980 (0.0378 – 0.0386)	15	16	16	16	16	16																																																																						
0.981 – 1.000 (0.0386 – 0.0394)	16	16	16	16	16																																																																							
1.001 – 1.020 (0.0394 – 0.0402)	16	16	16																																																																									
1.021 – 1.040 (0.0402 – 0.0409)	16	16																																																																										
1.041 – 1.050 (0.0410 – 0.0413) |16|																																																																											

Intake valve clearance (Cold):
0.15 – 0.25 mm (0.006 – 0.010 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	2.55 (0.1004)	9	2.95 (0.1161)
2	2.60 (0.1024)	10	3.00 (0.1181)
3	2.65 (0.1043)	11	3.05 (0.1201)
4	2.70 (0.1063)	12	3.10 (0.1220)
5	2.75 (0.1083)	13	3.15 (0.1240)
6	2.80 (0.1102)	14	3.20 (0.1260)
7	2.85 (0.1122)	15	3.25 (0.1280)
8	2.90 (0.1142)	16	3.30 (0.1299)

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

V01421

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 (0.1018)	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 (0.1055)	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)
0.000 – 0.020 (0.0000 – 0.0008)																						
0.021 – 0.040 (0.0008 – 0.0016)																					1	1
0.041 – 0.060 (0.0016 – 0.0024)																			1	1	1	1
0.061 – 0.080 (0.0024 – 0.0031)																	1	1	1	1	1	1
0.081 – 0.100 (0.0032 – 0.0039)															1	1	1	1	1	1	1	1
0.101 – 0.120 (0.0040 – 0.0047)													1	1	1	1	1	1	1	1	1	2
0.121 – 0.140 (0.0048 – 0.0055)											1	1	1	1	1	1	1	1	1	2	2	2
0.141 – 0.160 (0.0056 – 0.0063)									1	1	1	1	1	1	1	1	1	2	2	2	2	2
0.161 – 0.180 (0.0063 – 0.0071)								1	1	1	1	1	1	1	1	2	2	2	2	2	3	3
0.181 – 0.200 (0.0071 – 0.0079)							1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3
0.201 – 0.220 (0.0079 – 0.0087)						1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4
0.221 – 0.240 (0.0087 – 0.0094)					1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4
0.241 – 0.249 (0.0095 – 0.0098)					1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	4	4
0.250 – 0.350 (0.0098 – 0.0138)																						
0.351 – 0.360 (0.0134 – 0.0142)	1	2	2	2	2	3	3	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7
0.361 – 0.380 (0.0142 – 0.0150)	1	2	2	2	3	3	3	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7
0.381 – 0.400 (0.0150 – 0.0157)	2	2	3	3	3	3	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7
0.401 – 0.420 (0.0158 – 0.0165)	2	3	3	3	3	4	4	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8
0.421 – 0.440 (0.0166 – 0.0173)	3	3	3	4	4	4	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8
0.441 – 0.460 (0.0174 – 0.0181)	3	3	4	4	4	5	5	5	6	6	6	6	7	7	7	7	7	8	8	8	8	8
0.461 – 0.480 (0.0181 – 0.0189)	3	4	4	4	5	5	5	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9
0.481 – 0.500 (0.0189 – 0.0197)	4	4	5	5	5	5	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9
0.501 – 0.520 (0.0197 – 0.0205)	4	5	5	5	5	6	6	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10
0.521 – 0.540 (0.0205 – 0.0213)	5	5	5	6	6	6	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10
0.541 – 0.560 (0.0213 – 0.0220)	5	5	6	6	6	7	7	7	8	8	8	8	9	9	9	9	9	10	10	10	10	10
0.561 – 0.580 (0.0221 – 0.0228)	5	6	6	6	7	7	7	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11
0.581 – 0.600 (0.0229 – 0.0236)	6	6	7	7	7	7	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11
0.601 – 0.620 (0.0237 – 0.0244)	6	7	7	7	7	8	8	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12
0.621 – 0.640 (0.0244 – 0.0252)	7	7	7	8	8	8	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12
0.641 – 0.660 (0.0252 – 0.0260)	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	11	11	12	12	12	12	12
0.661 – 0.680 (0.0260 – 0.0268)	7	8	8	8	9	9	9	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13
0.681 – 0.700 (0.0268 – 0.0276)	8	8	9	9	9	9	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13
0.701 – 0.720 (0.0276 – 0.0283)	8	9	9	9	9	10	10	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14
0.721 – 0.740 (0.0284 – 0.0291)	9	9	9	10	10	10	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14
0.741 – 0.760 (0.0292 – 0.0299)	9	9	10	10	10	11	11	11	12	12	12	12	13	13	13	13	13	14	14	14	14	14
0.761 – 0.780 (0.0300 – 0.0307)	9	10	10	10	11	11	11	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15
0.781 – 0.800 (0.0307 – 0.0315)	10	10	11	11	11	11	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15
0.801 – 0.820 (0.0315 – 0.0323)	10	11	11	11	11	12	12	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16
0.821 – 0.840 (0.0323 – 0.0331)	11	11	11	12	12	12	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16
0.841 – 0.860 (0.0331 – 0.0339)	11	11	12	12	12	13	13	13	14	14	14	14	15	15	15	15	15	16	16	16	16	16
0.861 – 0.880 (0.0339 – 0.0346)	11	12	12	12	13	13	13	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16
0.881 – 0.900 (0.0347 – 0.0354)	12	12	13	13	13	13	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16	
0.901 – 0.920 (0.0355 – 0.0362)	12	13	13	13	13	14	14	15	15	15	15	16	16	16	16	16	16	16	16			
0.921 – 0.940 (0.0363 – 0.0370)	13	13	13	14	14	14	15	15	15	15	16	16	16	16	16	16	16					
0.941 – 0.960 (0.0370 – 0.0378)	13	13	14	14	14	15	15	15	16	16	16	16	16	16	16							
0.961 – 0.980 (0.0378 – 0.0386)	13	14	14	14	15	15	15	16	16	16	16	16	16									
0.981 – 1.000 (0.0386 – 0.0394)	14	14	15	15	15	15	16	16	16	16	16											
1.001 – 1.020 (0.0394 – 0.0402)	14	15	15	15	15	16	16	16	16													
1.021 – 1.040 (0.0402 – 0.0409)	15	15	15	16	16	16	16	16														
1.041 – 1.060 (0.0410 – 0.0617)	15	15	16	16	16	16	16															
1.061 – 1.080 (0.0418 – 0.0425)	15	16	16	16	16	16																
1.081 – 1.100 (0.0425 – 0.0433)	16	16	16	16	16																	
1.101 – 1.120 (0.0433 – 0.0441)	16	16	16																			
1.121 – 1.140 (0.0441 – 0.0449)	16	16																				
1.141 – 1.150 (0.0449 – 0.0453)	16																					

Measured clearance mm (in.) / Installed shim thickness mm (in.)	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)	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)	2.060 (0.1165)	2.970 (0.1169)	2.980 (0.1173)	2.990 (0.1177)
0.000 – 0.020 (0.0000 – 0.0008)	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4
0.021 – 0.040 (0.0008 – 0.0016)	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4
0.041 – 0.060 (0.0016 – 0.0024)	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5
0.061 – 0.080 (0.0024 – 0.0031)	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5
0.081 – 0.100 (0.0032 – 0.0039)	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6
0.101 – 0.120 (0.0040 – 0.0047)	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6
0.121 – 0.140 (0.0048 – 0.0055)	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6
0.141 – 0.160 (0.0056 – 0.0063)	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7
0.161 – 0.180 (0.0063 – 0.0071)	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7
0.181 – 0.200 (0.0071 – 0.0079)	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8
0.201 – 0.220 (0.0079 – 0.0087)	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8
0.221 – 0.240 (0.0087 – 0.0094)	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8
0.241 – 0.249 (0.0095 – 0.0098)	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9
0.250 – 0.350 (0.0098 – 0.0138)																						
0.351 – 0.360 (0.0134 – 0.0142)	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11
0.361 – 0.380 (0.0142 – 0.0150)	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11
0.381 – 0.400 (0.0150 – 0.0157)	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12
0.401 – 0.420 (0.0158 – 0.0165)	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12
0.421 – 0.440 (0.0166 – 0.0173)	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12
0.441 – 0.460 (0.0174 – 0.0181)	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13
0.461 – 0.480 (0.0181 – 0.0189)	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13
0.481 – 0.500 (0.0189 – 0.0197)	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14
0.501 – 0.520 (0.0197 – 0.0205)	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14
0.521 – 0.540 (0.0205 – 0.0213)	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14
0.541 – 0.560 (0.0213 – 0.0220)	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15
0.561 – 0.580 (0.0221 – 0.0228)	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15
0.581 – 0.600 (0.0229 – 0.0236)	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16
0.601 – 0.620 (0.0237 – 0.0244)	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16
0.621 – 0.640 (0.0244 – 0.0252)	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16
0.641 – 0.660 (0.0252 – 0.0260)	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16
0.661 – 0.680 (0.0260 – 0.0268)	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16	
0.681 – 0.700 (0.0268 – 0.0276)	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16			
0.701 – 0.720 (0.0276 – 0.0283)	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16					
0.721 – 0.740 (0.0284 – 0.0291)	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16							
0.741 – 0.760 (0.0292 – 0.0299)	15	15	15	15	15	16	16	16	16	16	16	16	16									
0.761 – 0.780 (0.0300 – 0.0307)	15	15	15	16	16	16	16	16	16	16	16											
0.781 – 0.800 (0.0307 – 0.0315)	15	16	16	16	16	16	16	16	16													
0.801 – 0.820 (0.0315 – 0.0323)	16	16	16	16	16	16	16															
0.821 – 0.840 (0.0323 – 0.0331)	16	16	16	16	16																	
0.841 – 0.860 (0.0331 – 0.0339)	16	16	16																			
0.861 – 0.880 (0.0339 – 0.0346)	16																					
0.881 – 0.900 (0.0347 – 0.0354)																						
0.901 – 0.920 (0.0355 – 0.0362)																						
0.921 – 0.940 (0.0363 – 0.0370)																						
0.941 – 0.960 (0.0370 – 0.0378)																						
0.961 – 0.980 (0.0378 – 0.0386)																						
0.981 – 1.000 (0.0386 – 0.0394)																						
1.001 – 1.020 (0.0394 – 0.0402)																						
1.021 – 1.040 (0.0402 – 0.0409)																						
1.041 – 1.060 (0.0410 – 0.0617)																						
1.061 – 1.080 (0.0418 – 0.0425)																						
1.081 – 1.100 (0.0425 – 0.0433)																						
1.101 – 1.120 (0.0433 – 0.0441)																						
1.121 – 1.140 (0.0441 – 0.0449)																						
1.141 – 1.150 (0.0449 – 0.0453)																						

Measured clearance mm (in.) / Installed shim thickness mm (in.)	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)	4	4	5	5	5	5	5	6	6	7	7	7	7	8	8	9	9	9	9	10	10
0.021 – 0.040 (0.0008 – 0.0016)	5	5	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11
0.041 – 0.060 (0.0016 – 0.0024)	5	5	5	6	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11
0.061 – 0.080 (0.0024 – 0.0031)	5	6	6	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11
0.081 – 0.100 (0.0032 – 0.0039)	6	6	6	6	7	7	7	7	8	8	9	9	9	9	10	10	11	11	11	11	12
0.101 – 0.120 (0.0040 – 0.0047)	6	6	7	7	7	7	7	8	8	9	9	9	9	10	10	11	11	11	11	12	12
0.121 – 0.140 (0.0048 – 0.0055)	7	7	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13
0.141 – 0.160 (0.0056 – 0.0063)	7	7	7	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13
0.161 – 0.180 (0.0063 – 0.0071)	7	8	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13
0.181 – 0.200 (0.0071 – 0.0079)	8	8	8	8	9	9	9	9	10	10	11	11	11	11	12	12	13	13	13	13	14
0.201 – 0.220 (0.0079 – 0.0087)	8	8	9	9	9	9	9	10	10	11	11	11	11	12	12	13	13	13	13	14	14
0.221 – 0.240 (0.0087 – 0.0094)	9	9	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15
0.241 – 0.249 (0.0095 – 0.0098)	9	9	9	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15
0.250 – 0.350 (0.0098 – 0.0138)																					
0.351 – 0.360 (0.0134 – 0.0142)	11	11	12	12	12	12	12	13	13	14	14	14	14	15	15	16	16	16	16	16	
0.361 – 0.380 (0.0142 – 0.0150)	11	12	12	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	16	16	
0.381 – 0.400 (0.0150 – 0.0157)	12	12	12	12	13	13	13	13	14	14	15	15	15	15	16	16	16	16	16		
0.401 – 0.420 (0.0158 – 0.0165)	12	12	13	13	13	13	13	14	14	15	15	15	15	16	16	16	16				
0.421 – 0.440 (0.0166 – 0.0173)	13	13	13	13	13	14	14	14	15	15	15	16	16	16	16	16					
0.441 – 0.460 (0.0174 – 0.0181)	13	13	13	14	14	14	14	15	15	15	16	16	16	16	16						
0.461 – 0.480 (0.0181 – 0.0189)	13	14	14	14	14	14	15	15	15	16	16	16	16	16							
0.481 – 0.500 (0.0189 – 0.0197)	14	14	14	14	15	15	15	15	16	16	16	16	16								
0.501 – 0.520 (0.0197 – 0.0205)	14	14	15	15	15	15	15	16	16	16	16										
0.521 – 0.540 (0.0205 – 0.0213)	15	15	15	15	15	16	16	16	16	16											
0.541 – 0.560 (0.0213 – 0.0220)	15	15	15	16	16	16	16	16	16												
0.561 – 0.580 (0.0221 – 0.0228)	15	16	16	16	16	16	16	16													
0.581 – 0.600 (0.0229 – 0.0236)	16	16	16	16	16	16	16														
0.601 – 0.620 (0.0237 – 0.0244)	16	16	16	16	16																
0.621 – 0.640 (0.0244 – 0.0252)	16	16	16																		
0.641 – 0.660 (0.0252 – 0.0260)	16																				
0.661 – 0.680 (0.0260 – 0.0268)																					
0.681 – 0.700 (0.0268 – 0.0276)																					
0.701 – 0.720 (0.0276 – 0.0283)																					
0.721 – 0.740 (0.0284 – 0.0291)																					
0.741 – 0.760 (0.0292 – 0.0299)																					
0.761 – 0.780 (0.0300 – 0.0307)																					
0.781 – 0.800 (0.0307 – 0.0315)																					
0.801 – 0.820 (0.0315 – 0.0323)																					
0.821 – 0.840 (0.0323 – 0.0331)																					
0.841 – 0.860 (0.0331 – 0.0339)																					
0.861 – 0.880 (0.0339 – 0.0346)																					
0.881 – 0.900 (0.0347 – 0.0354)																					
0.901 – 0.920 (0.0355 – 0.0362)																					
0.921 – 0.940 (0.0363 – 0.0370)																					
0.941 – 0.960 (0.0370 – 0.0378)																					
0.961 – 0.980 (0.0378 – 0.0386)																					
0.981 – 1.000 (0.0386 – 0.0394)																					
1.001 – 1.020 (0.0394 – 0.0402)																					
1.021 – 1.040 (0.0402 – 0.0409)																					
1.041 – 1.060 (0.0410 – 0.0617)																					
1.061 – 1.080 (0.0418 – 0.0425)																					
1.081 – 1.100 (0.0425 – 0.0433)																					
1.101 – 1.120 (0.0433 – 0.0441)																					
1.121 – 1.140 (0.0441 – 0.0449)																					
1.141 – 1.150 (0.0449 – 0.0453)																					

Exhaust valve clearance (Cold):
0.25 – 0.35 mm (0.010 – 0.014 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.

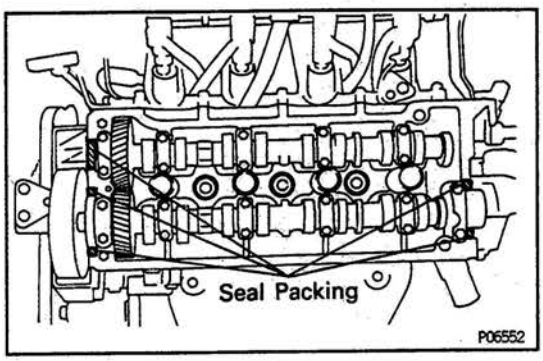
New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.55 (0.1004)	9	2.95 (0.1161)
2	2.60 (0.1024)	10	3.00 (0.1181)
3	2.65 (0.1043)	11	3.05 (0.1201)
4	2.70 (0.1063)	12	3.10 (0.1220)
5	2.75 (0.1083)	13	3.15 (0.1240)
6	2.80 (0.1102)	14	3.20 (0.1260)
7	2.85 (0.1122)	15	3.25 (0.1280)
8	2.90 (0.1142)	16	3.30 (0.1299)

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

V01422

EG



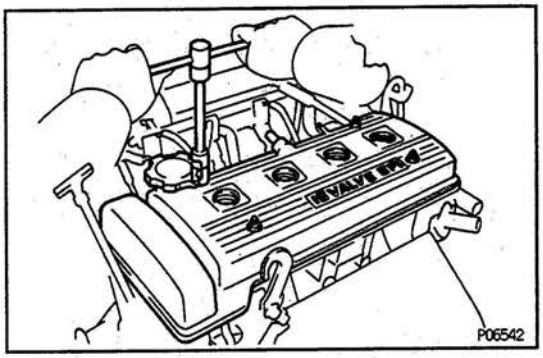
6. INSTALL CYLINDER HEAD COVER

(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

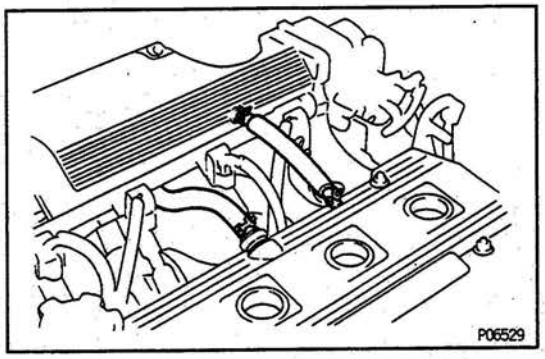


(c) Install the gasket to the cylinder head cover.

(d) Install the cylinder head cover with the four seal washers and cap nuts.

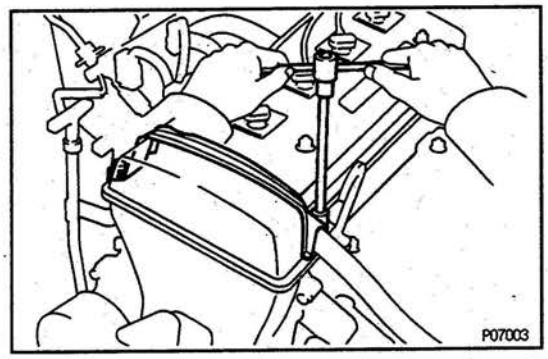
Uniformly tighten the cap nuts in several passes.

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

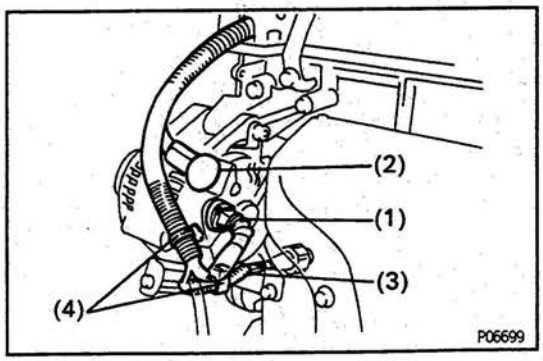


(e) Connect the PCV hoses to the cylinder head cover.

(f) Connect the four high—tension cords to the spark plugs.



(g) Install the engine wire harness and wiring harness protector with the two bolts.



(h) Connect the following wires and clamps:

(1) Alternator connector
(2) Alternator wire
(3) Oil pressure switch connector
(4) Two wire clamps

7. CHECK FOR OIL LEAKS

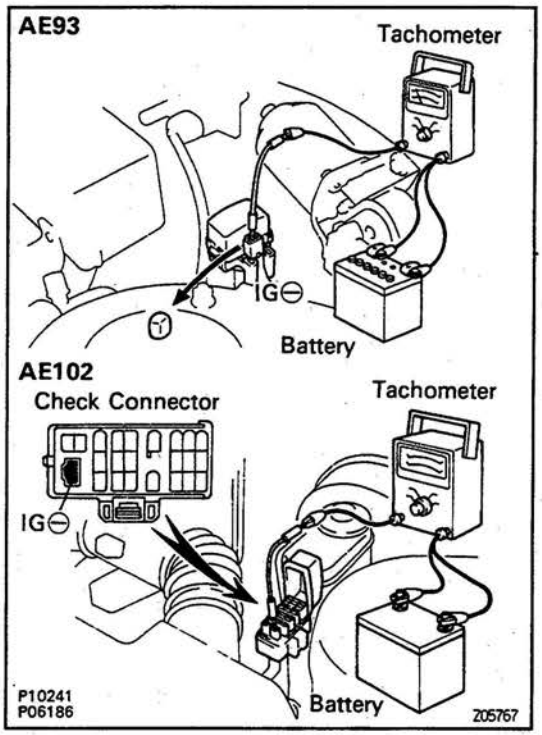
IGNITION TIMING INSPECTION AND ADJUSTMENT

B038H-01

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

EG

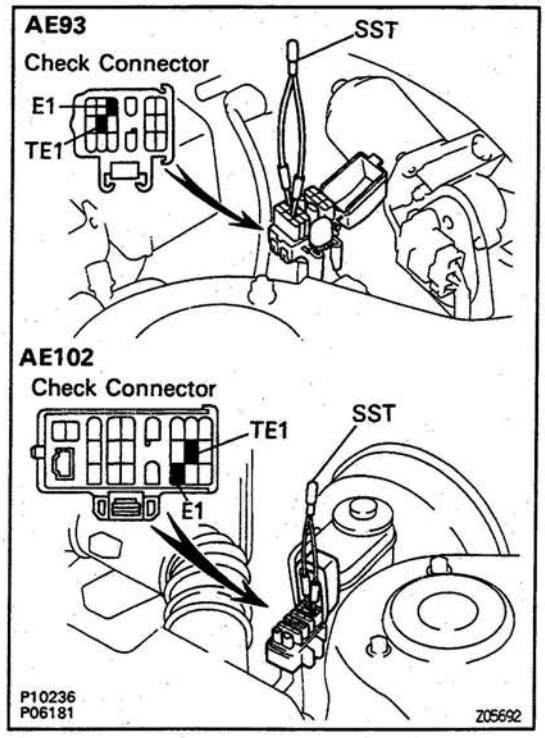


2. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

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

NOTICE:

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



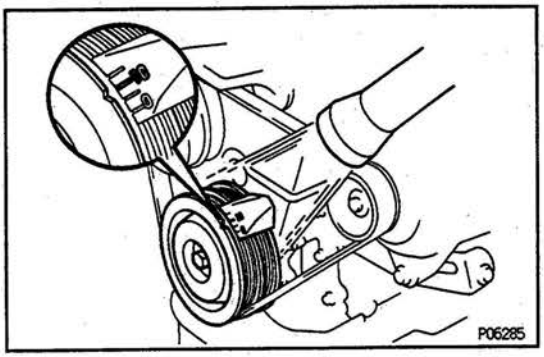
3. INSPECT AND ADJUST IGNITION TIMING

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

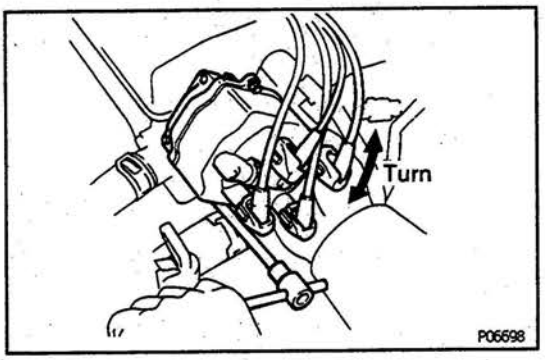
SST 09843–18020

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

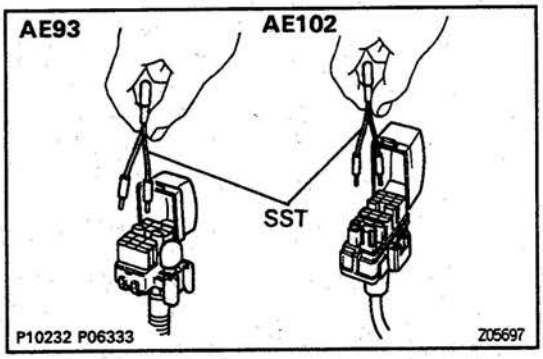
EG



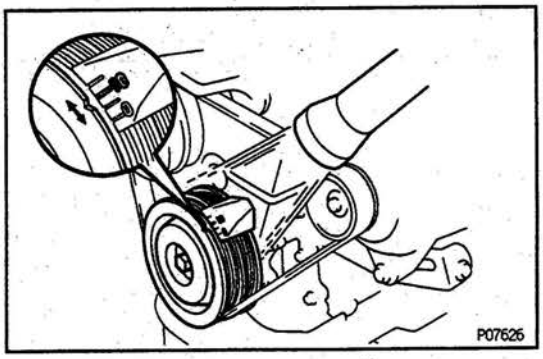
(b) Using a timing light, check the ignition timing.
Ignition timing:
10° BTDC @ idle
(Transmission in neutral position)



(c) Loosen the two hold—down bolts, and adjust by turning the IIA.
(d) Tighten the two hold—down bolts, and recheck the ignition timing.
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)



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



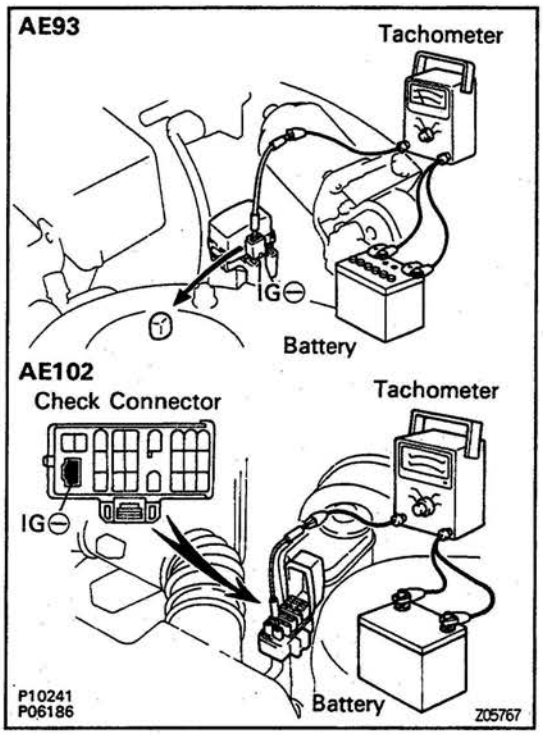
4. FURTHER CHECK IGNITION TIMING
Ignition timing:
5 — 15° BTDC @ idle
(Transmission in neutral position)
HINT: The timing mark moves in a range between 5° and 15°.

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

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 vacuum lines properly connected
(e) EFI system wiring connectors fully plugged
(f) All operating accessories switched OFF
(g) Ignition timing set correctly
(h) Transmission in neutral range

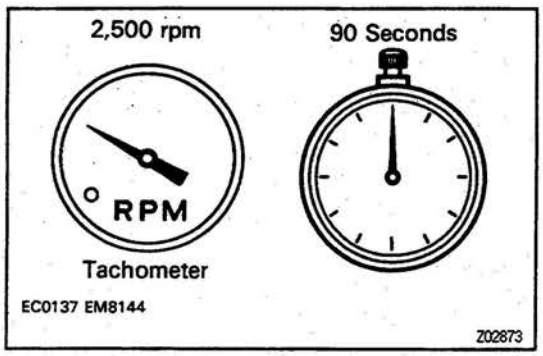


2. CONNECT TACHOMETER

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

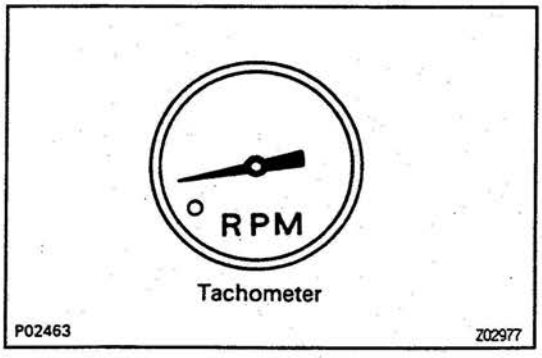
NOTICE:

- **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 IDLE SPEED

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



(b) Check the idle speed.

Idle speed (w/ Cooling fan OFF):

700 ± 50 rpm for AE93
750 ± 50 rpm for AE102

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

4. DISCONNECT TACHOMETER

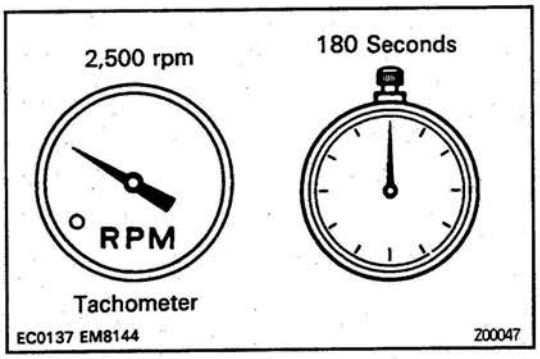
IDLE CO/HC CHECK

EG17Z-02

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

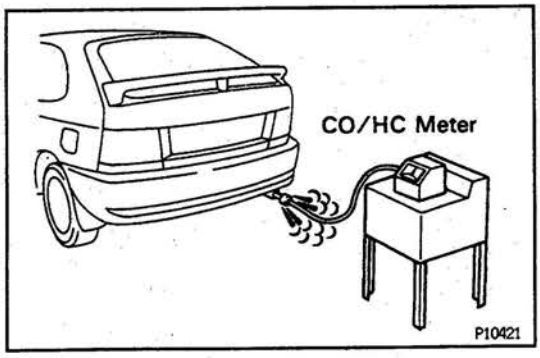
1. INITIAL CONDITIONS

(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/HC meter calibrated by hand



2. START ENGINE

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



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

5. CHECK CO/HC CONCENTRATION AT IDLE

Idle CO concentration:

0 — 0.5 %

Idle HC concentration:

Applicable local regulation

Troubleshooting

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

(a) Check oxygen sensor operation.
(See page EG–231)

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

CO	HC	Problems	Causes
Normal	High	Rough idle	1. Faulty ignitions: ● Incorrect timing ● Fouled, shorted or improperly gapped plugs ● Open or crossed high-tension cords ● Cracked IIA cap 2. Incorrect valve clearance 3. Leaky intake and exhaust valves. 4. Leaky cylinder
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: ● PCV hoses ● 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 ● Defective air temp. sensor ● Faulty engine ECU ● Faulty injectors ● Faulty throttle position sensor ● Defective vacuum sensor

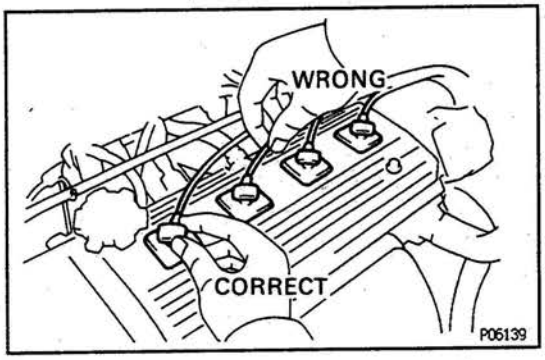
V02512

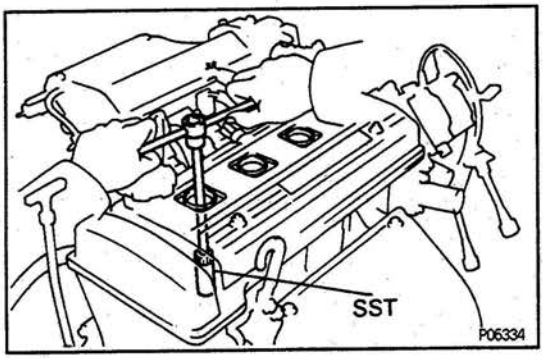
COMPRESSION CHECK

EG17N-02

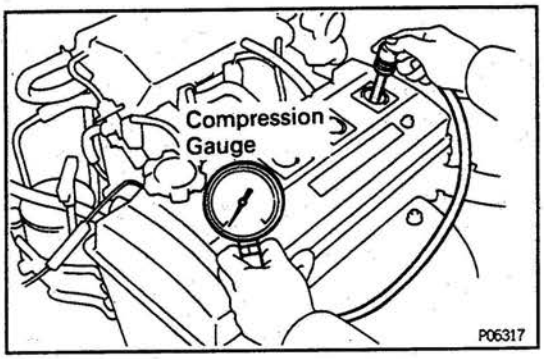
HINT: If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. **WARM UP AND STOP ENGINE**
Allow the engine to warm up to normal operating temperature.
2. **DISCONNECT IIA CONNECTORS**
3. **DISCONNECT HIGH—TENSION CORDS FROM SPARK PLUGS**
Disconnect the high — tension cords at the rubber boot. Do not pull on the cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.



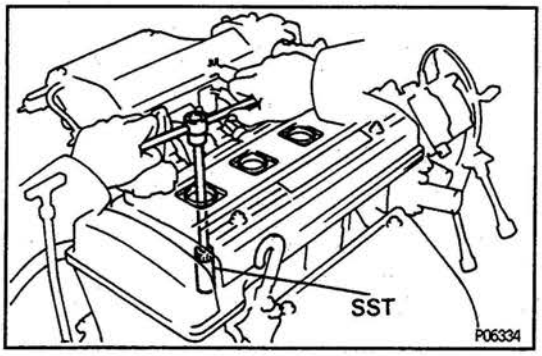


4. **REMOVE SPARK PLUGS**
Using SST, remove the four spark plugs.
SST 09155—16100



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:
1,320 kPa (13.5 kgf/cm², 191 psi) or more
Minimum pressure:
981 kPa (10.0 kgf/cm², 142 psi)
Difference between each cylinder:
98 kPa (1.0 kgf/cm², 14 psi) or less

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



6. REINSTALL SPARK PLUGS

Using SST, install the four spark plugs.

SST 09155–16100

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

7. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS

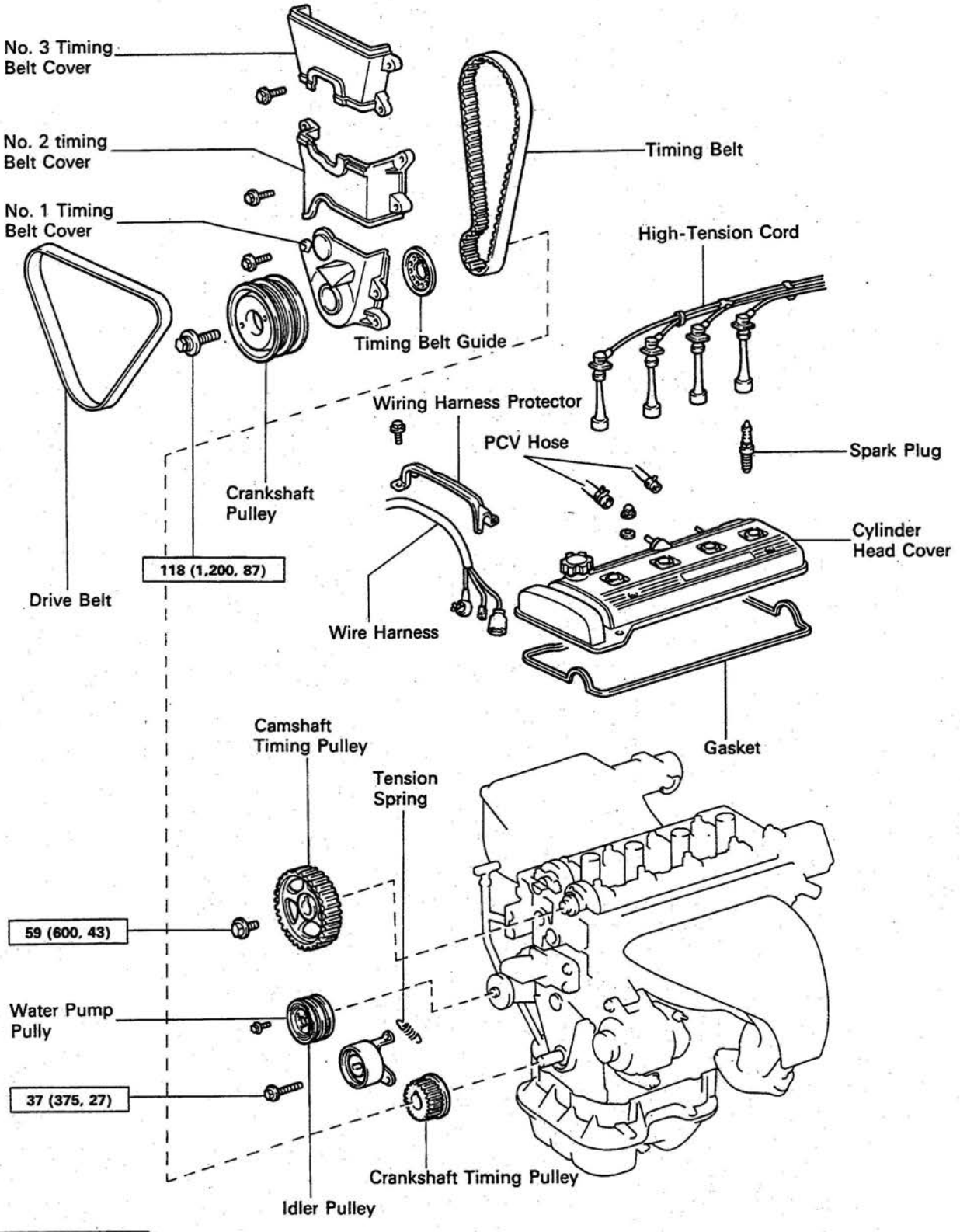
8. RECONNECT IIA CONNECTORS

TIMING BELT

COMPONENTS FOR REMOVAL AND INSTALLATION

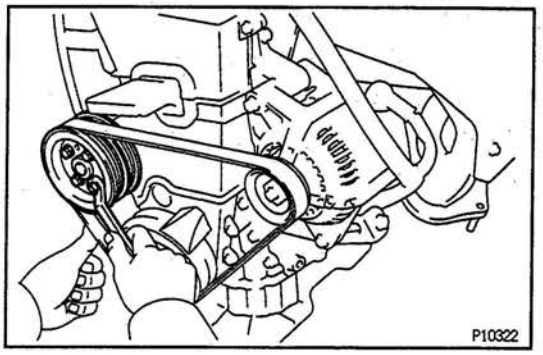
EG17F-02

EG



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

P10377



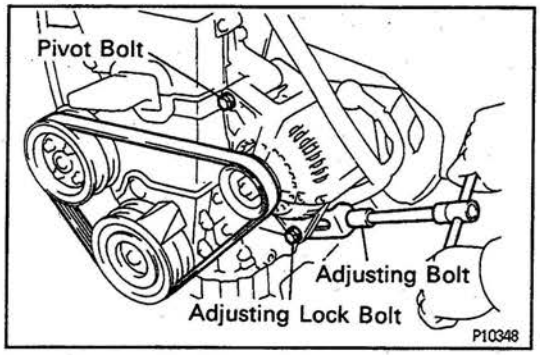
TIMING BELT REMOVAL

E0170-02

(See Components for Removal and Installation)

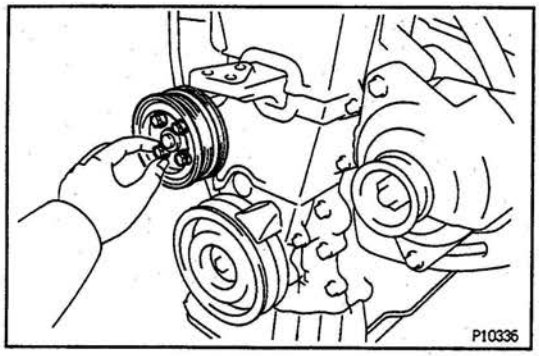
1. REMOVE ALTERNATOR DRIVE BELT AND WATER PUMP PULLEY

(a) Loosen the four water pump pulley bolts.

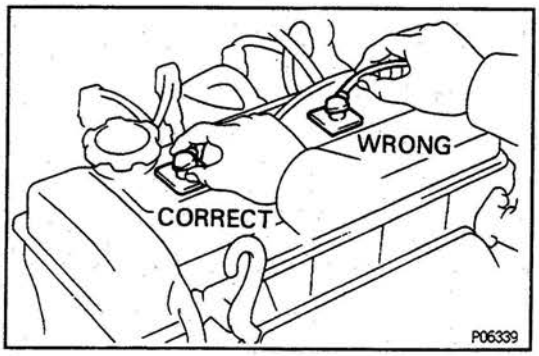


(b) Loosen the pivot bolt and adjusting lock bolt.

(c) Loosen the adjusting bolt, and remove the drive belt.



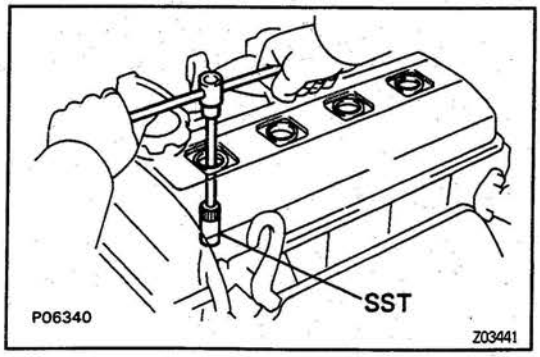
(d) Remove the four bolts and water pump pulley.



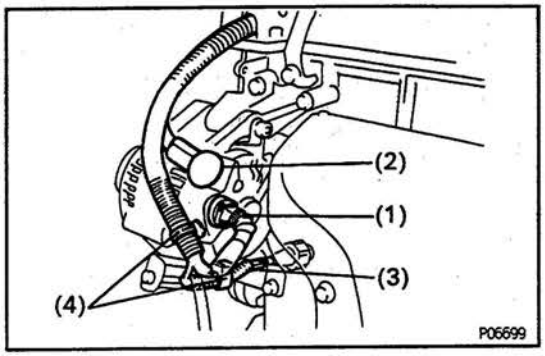
2. REMOVE SPARK PLUGS

(a) Disconnect the four high–tension cords at the rubber boot. Do not pull the cords.

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

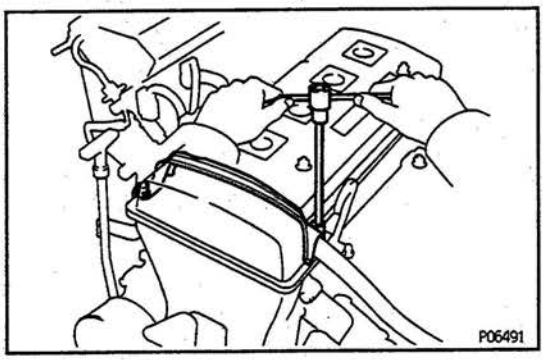


(b) Using SST, remove the four plugs.
SST 09155–16100



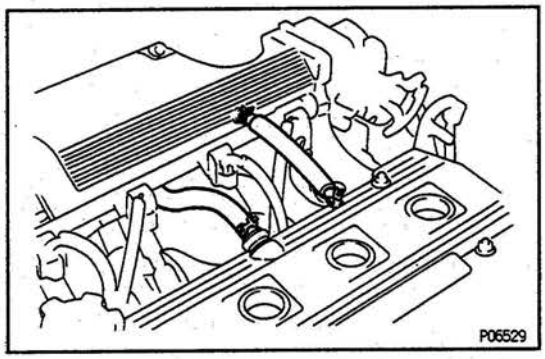
3. REMOVE CYLINDER HEAD COVER

(a) Disconnect the following wires and clamps:
- (1) Alternator connector
- (2) Alternator wire
- (3) Oil pressure switch connector
- (4) Two wire clamps

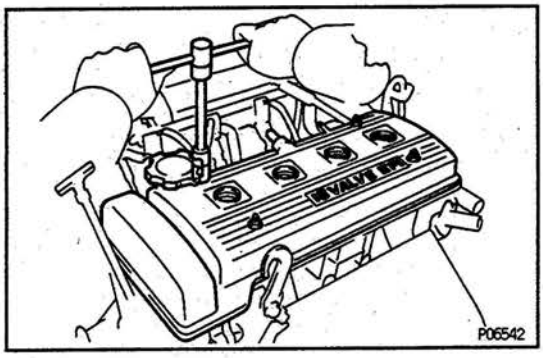


(b) Remove the two bolts and wiring harness protector.

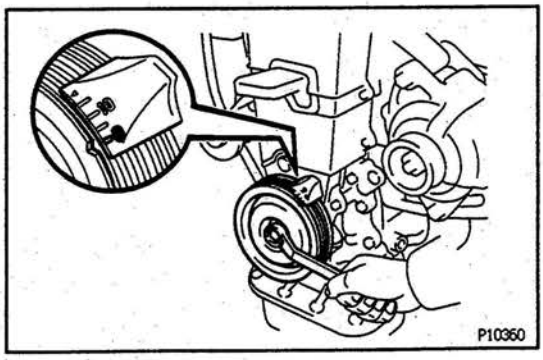
(c) Disconnect the engine wire harness from the cylinder head.



(d) Disconnect the PCV hoses from the cylinder head cover.

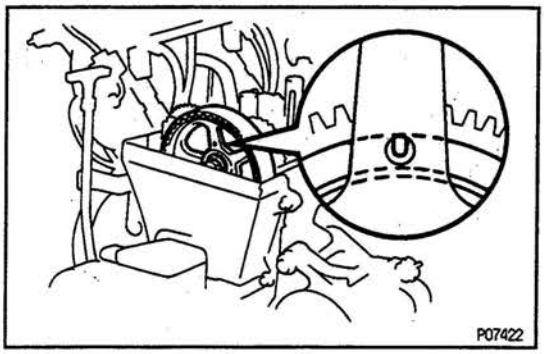


(e) Remove the four cap nuts, seal washers, cylinder head cover and gasket.

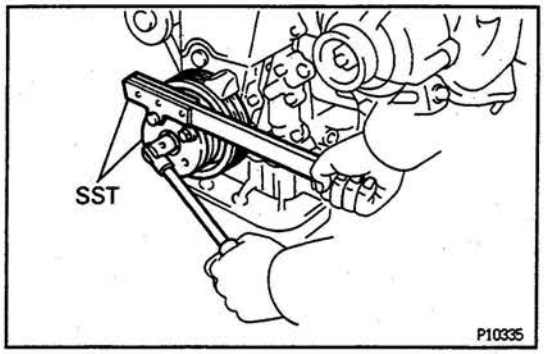


4. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

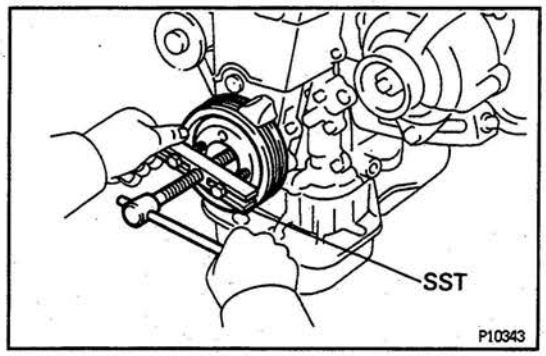


(b) Check that the hole of the camshaft timing pulley is aligned with the timing mark of the bearing cap.
If not, turn the crankshaft one revolution (360°).

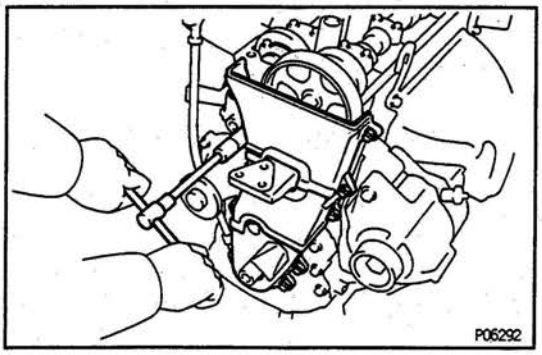


5. REMOVE CRANKSHAFT PULLEY

(a) Using SST, remove the pulley bolt.
SST 09213–54015, 09330–00021

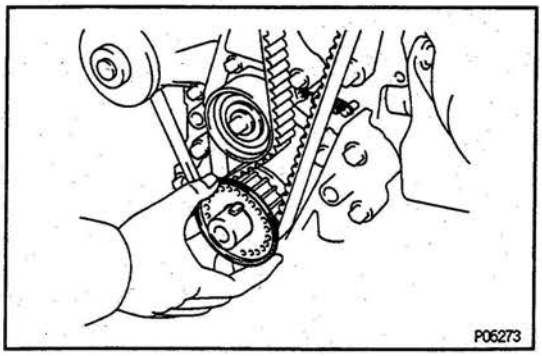


(b) Using SST, remove the pulley.
SST 09213–60017 (09213–00020, 09213–00030, 09213–00060)



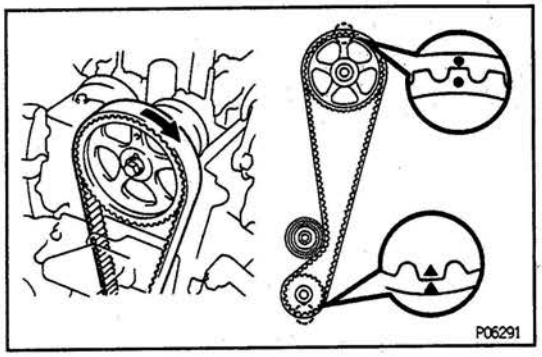
6. REMOVE TIMING BELT COVERS

Remove the nine bolts and timing belt covers.



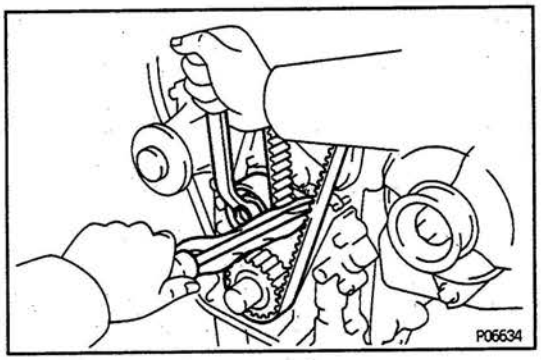
7. REMOVE TIMING BELT GUIDE

EG

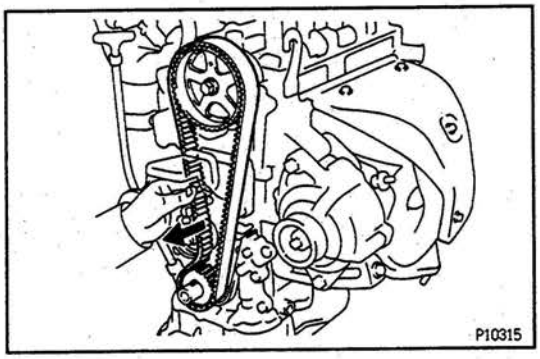


8. REMOVE TIMING BELT

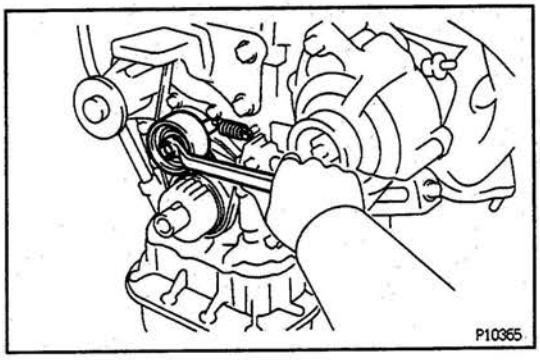
HINT: If reusing the timing belt, draw a direction arrow on the belt (in the direction of engine revolution), and place matchmarks on the pulleys and belt as shown in the illustration.



(a) Loosen the mounting bolt of the idler pulley and shift pulley toward the left as far as it will go and then temporarily tighten it.

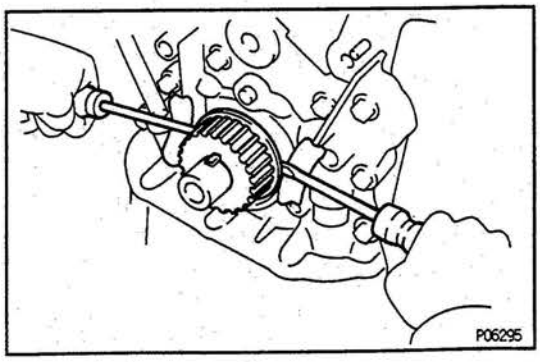


(b) Remove the belt.



9. REMOVE IDLER PULLEY AND TENSION SPRING

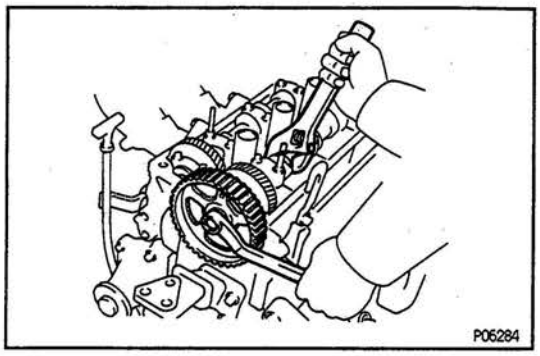
Remove the bolt, pulley and tension spring.



10. REMOVE CRANKSHAFT TIMING PULLEY

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

NOTICE: Position shop rags as shown to prevent damage.

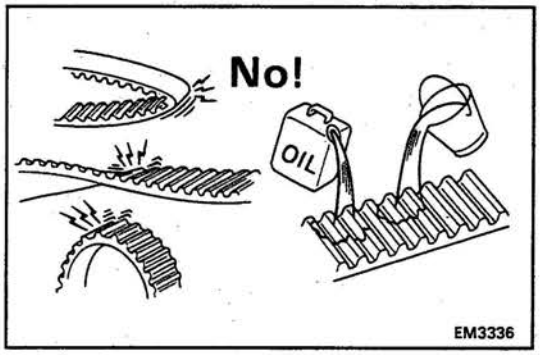


11. REMOVE CAMSHAFT TIMING PULLEY

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

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

TIMING BELT COMPONENTS INSPECTION EQOBH-06

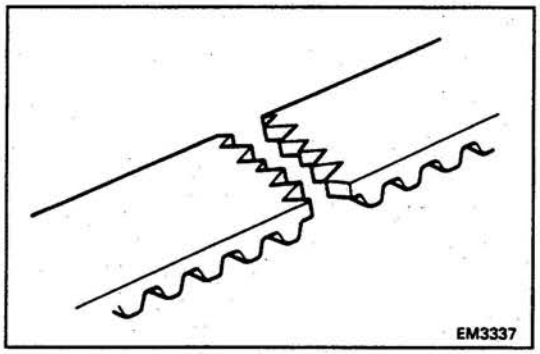


1. INSPECT TIMING BELT

NOTICE:

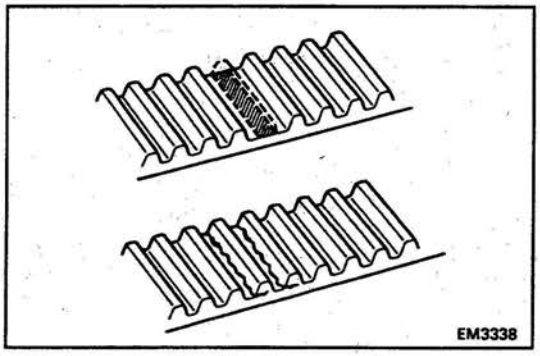
- **Do not bend, twist or turn the timing belt inside out.**
- **Do not allow the timing belt to come into contact with oil, water or steam.**
- **Do not utilize timing belt tension when installing or removing the mounting bolt of the camshaft timing pulley.**

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

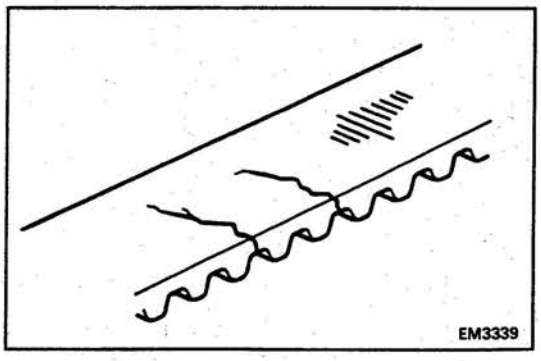


(a) Premature parting

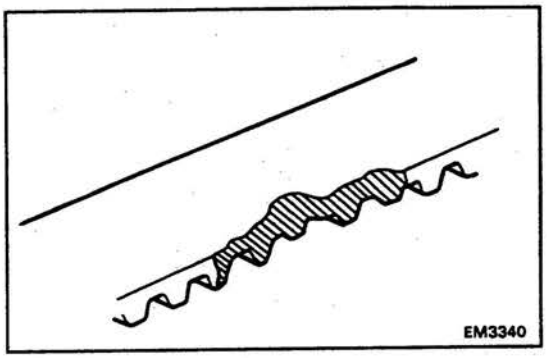
- Check the proper installation.
- Check the timing cover gasket for damage and proper installation.



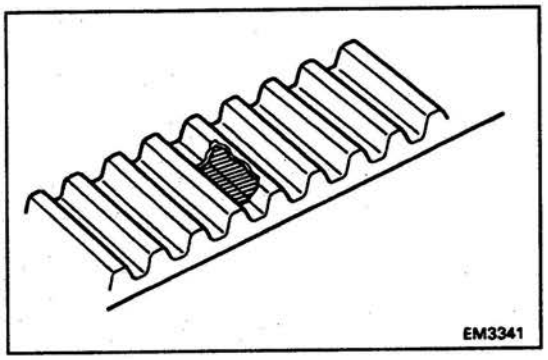
(b) If the belt teeth are cracked or damaged, check to see if either camshaft or water pump is locked.



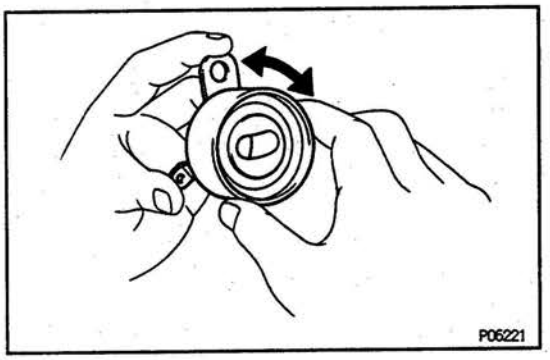
(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock.



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

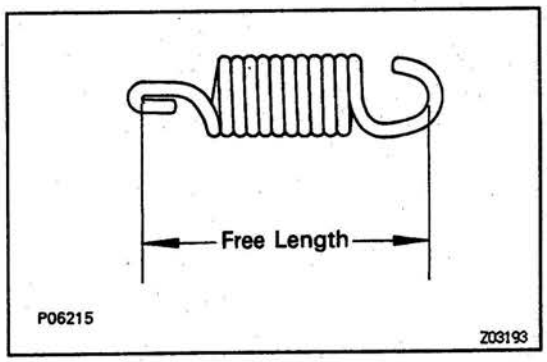


(e) If there is noticeable wear on the belt teeth, check the timing cover for damage, correct gasket installation, and for foreign material on the pulley teeth.
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEY

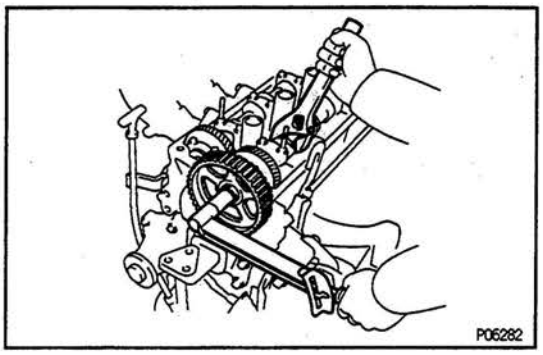
Check that the idler pulley turns smoothly.
If necessary, replace the idler pulley.



3. INSPECT TENSION SPRING

(a) Measure the free length of tension spring.
Free length:
31.8 mm (1.252 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:
47.5 – 51.5 N (4.85 – 5.25 kgf, 10.7 – 11.6 lbf) at 37.6 mm (1.480 in.)
If the installed tension is not as specified, replace the tension spring.



TIMING BELT INSTALLATION

B038J-01

(See Components for Removal and Installation)

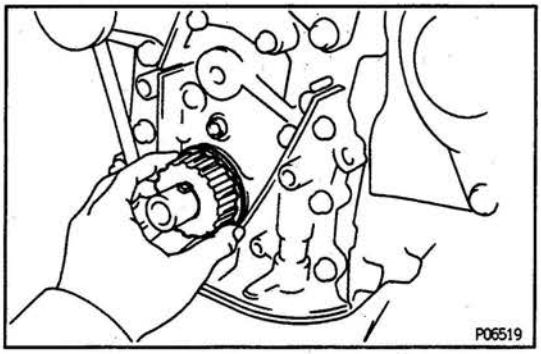
1. INSTALL CAMSHAFT TIMING PULLEY

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

(b) Temporarily install the timing pulley bolt.

(c) Hold the hexagon wrench head portion of the camshaft with a wrench, and tighten the timing pulley bolt.

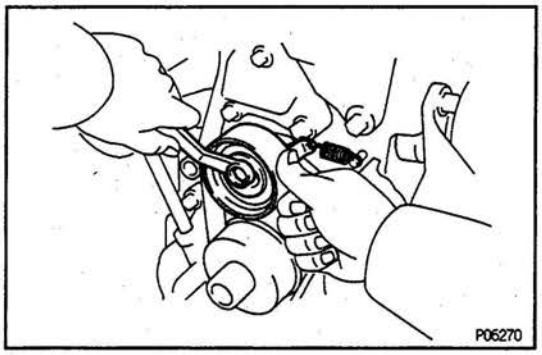
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)



2. INSTALL CRANKSHAFT TIMING PULLEY

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

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

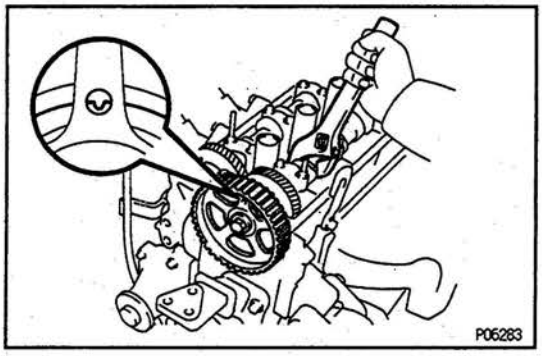


3. TEMPORARILY INSTALL IDLER PULLEY AND TENSION SPRING

(a) Install the idler pulley with the bolt. Do not tighten the bolt yet.

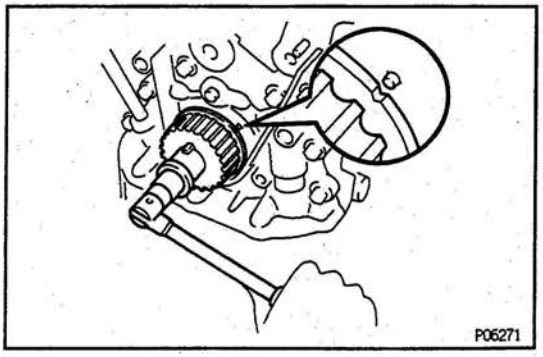
(b) Install the tension spring.

(c) Push the pulley toward the left as far as it will go and tighten the bolt.

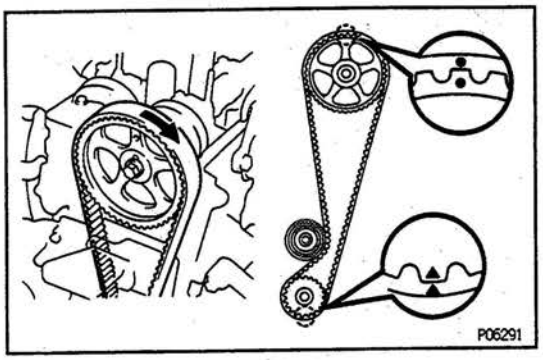


4. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the hexagonal wrench head portion of the camshaft, and align the hole of the camshaft timing pulley with the timing mark of the bearing cap.



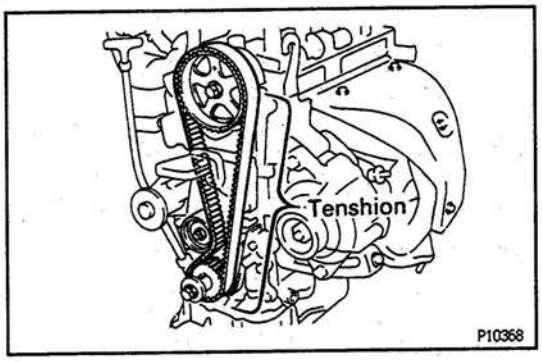
(b) Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.



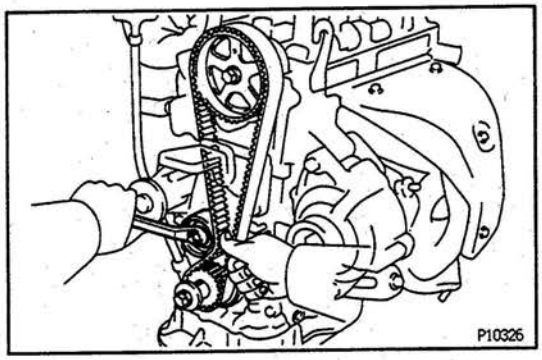
5. INSTALL TIMING BELT

NOTICE: The engine should be cold.

HINT: If reusing the timing belt, align the points marked during removal, and install the belt with the arrow pointing in the direction of engine revolution.

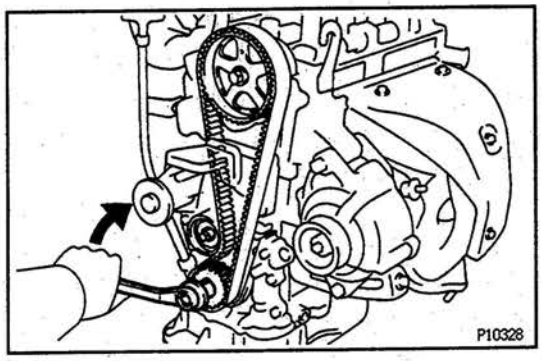


Install the timing belt, checking the tension between the crankshaft timing pulley and camshaft timing pulley.



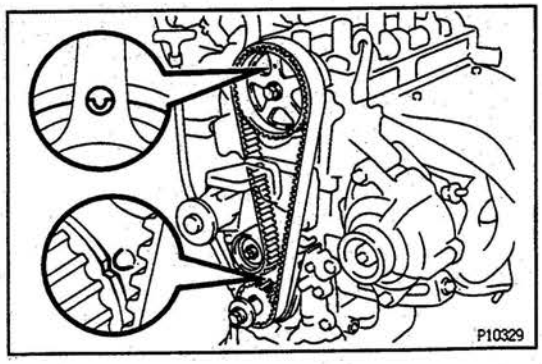
6. CHECK VALVE TIMING

(a) Loosen the idler pulley bolt.



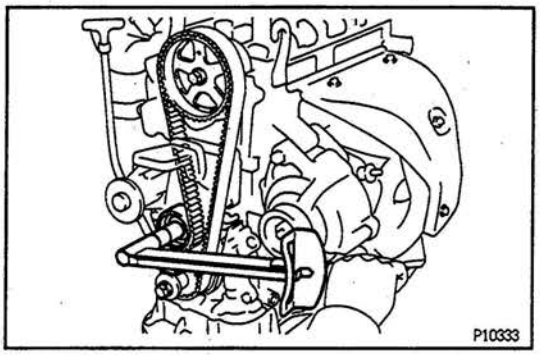
(b) Slowly turn the crankshaft two revolutions from TDC to TDC.

CAUTION: Always turn the crankshaft clockwise.

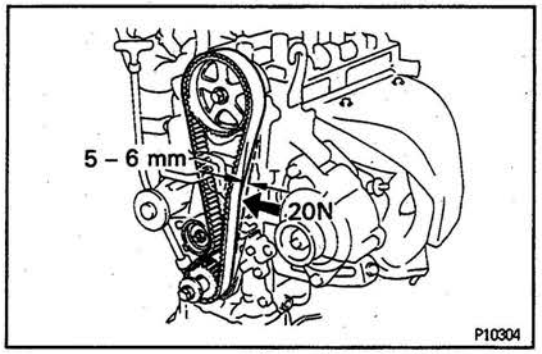


(c) Check the each pulley aligns with the timing marks as shown in the illustration.

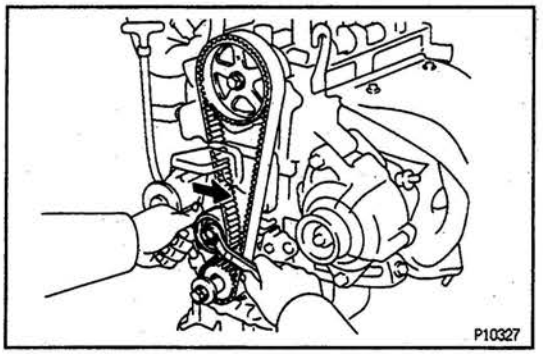
If the timing marks do not align, remove the timing belt and reinstall it.



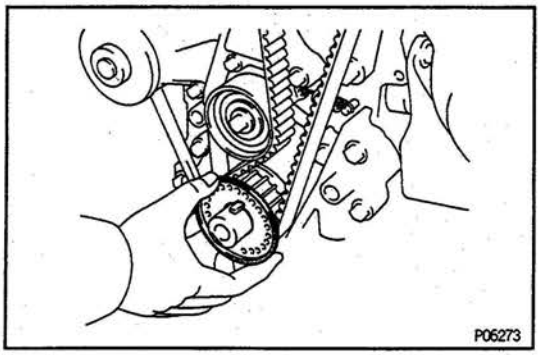
(d) Tighten the idler pulley bolt.
Torque: 37 N·m (375 kgf·cm, 27 ft·lbf)



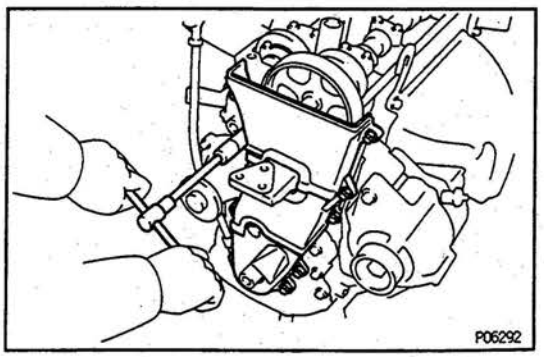
7. (Reference)
CHECK TIMING BELT DEFLECTION
Check that there is belt deflection at the position indicated in the illustration.
Deflection:
5 — 6 mm (0.20 — 0.24 in.) at 20 N (2 kgf, 4.4 lbf)



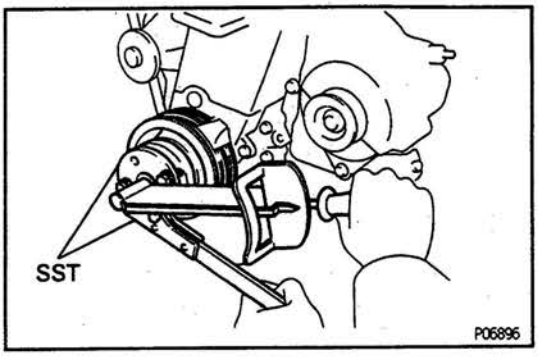
If the deflection is not as specified, readjust with the idler pulley.



8. INSTALL TIMING BELT GUIDE
(a) Remove the temporarily installed crankshaft pulley bolt.
(b) Install the guide, facing the cup side outward.



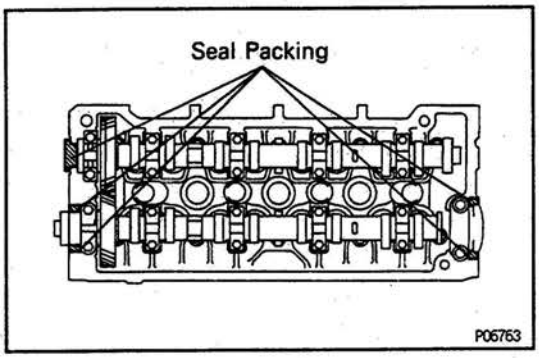
9. INSTALL TIMING BELT COVERS
(a) Install the No.1 timing belt cover with the three bolts.
(b) Install the No.2, and No.3 timing belt covers with the six bolts



10. INSTALL CRANKSHAFT PULLEY

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

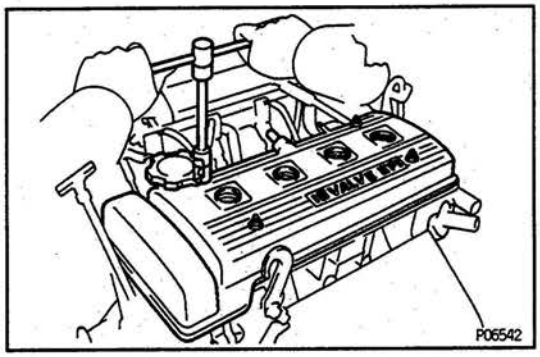
(b) Using SST, install the pulley bolt.
SST 09213–54015, 09330–00021
Torque: 118 N·m (1,200 kgf·cm, 87 ft·lbf)



11. INSTALL CYLINDER HEAD COVER

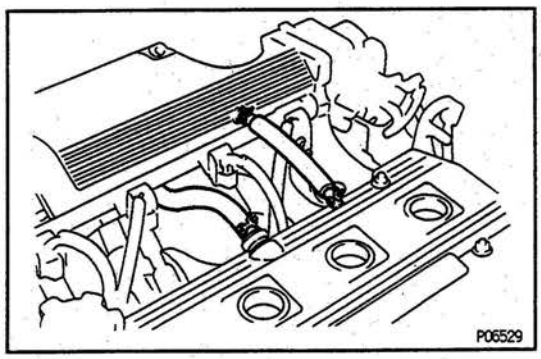
(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the cylinder head as shown in the illustration.
Seal packing:
Part No. 08826–00080 or equivalent

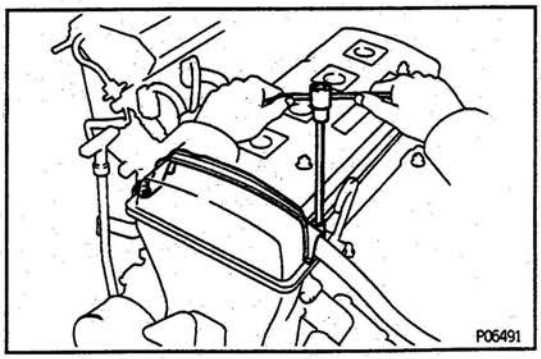


(c) Install the gasket to the cylinder head cover.

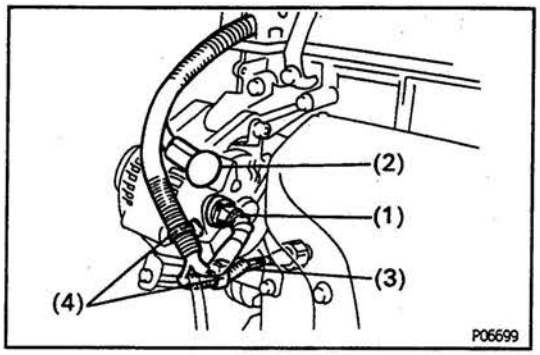
(d) Install the cylinder head cover with the four seal washers and cap nuts.
Uniformly tighten the cap nuts in several passes.
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)



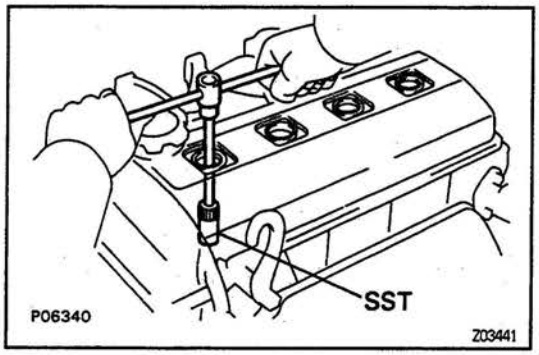
(e) Connect the PCV hoses to the cylinder head cover.



(f) Install the engine wire harness and wiring harness protector with the two bolts.



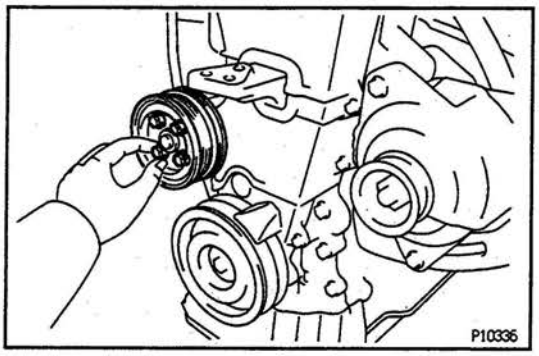
(g) Connect the following wires and clamps:
(1) Alternator connector
(2) Alternator wire
(3) Oil pressure switch connector
(4) Two wire clamps



12. INSTALL SPARK PLUGS

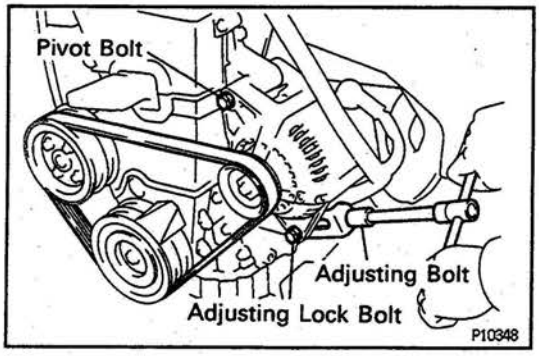
(a) Using SST, install the four spark plugs.
SST 09155–16100
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)

(b) Connect the four high–tension cords to the spark plugs.

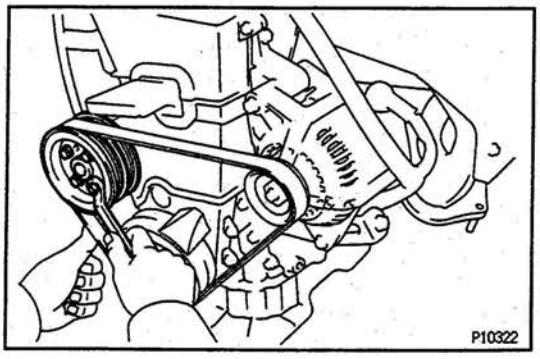


13. INSTALL WATER PUMP PULLEY AND ALTERNATOR DRIVE BELT

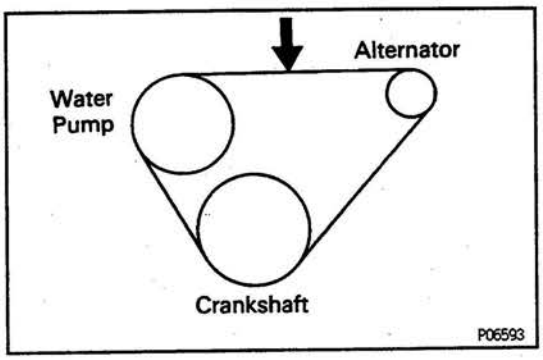
(a) Temporarily install water pump pulley with the four bolts.



(b) Install the drive belt with the adjusting bolt and pivot bolt.



(c) Tighten the four water pump pulley bolts.
Torque: 9.3 N·m (95 kgf·cm, 7 in.·lbf)

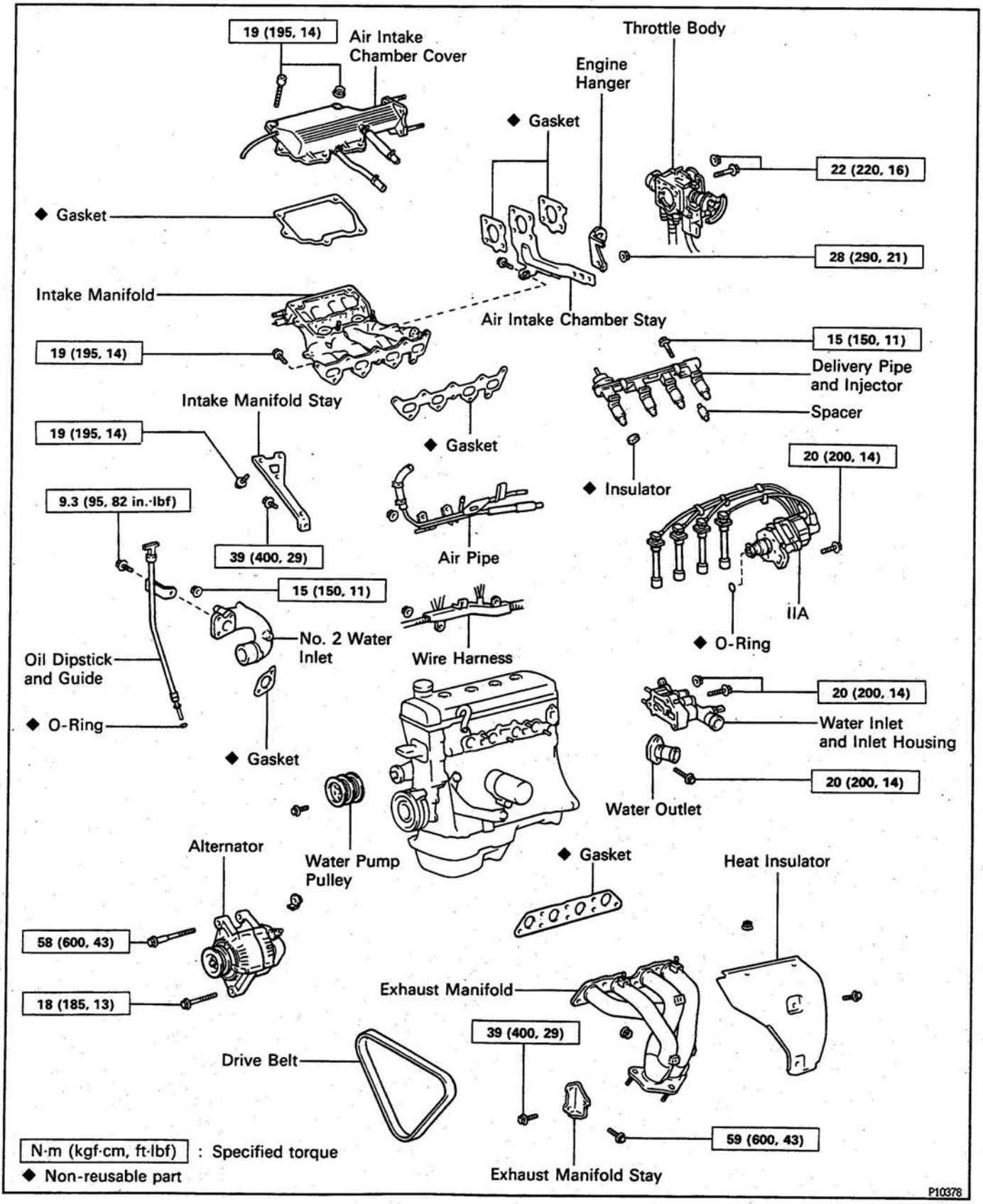


14. ADJUST DRIVE BELT
(See page EG−15)

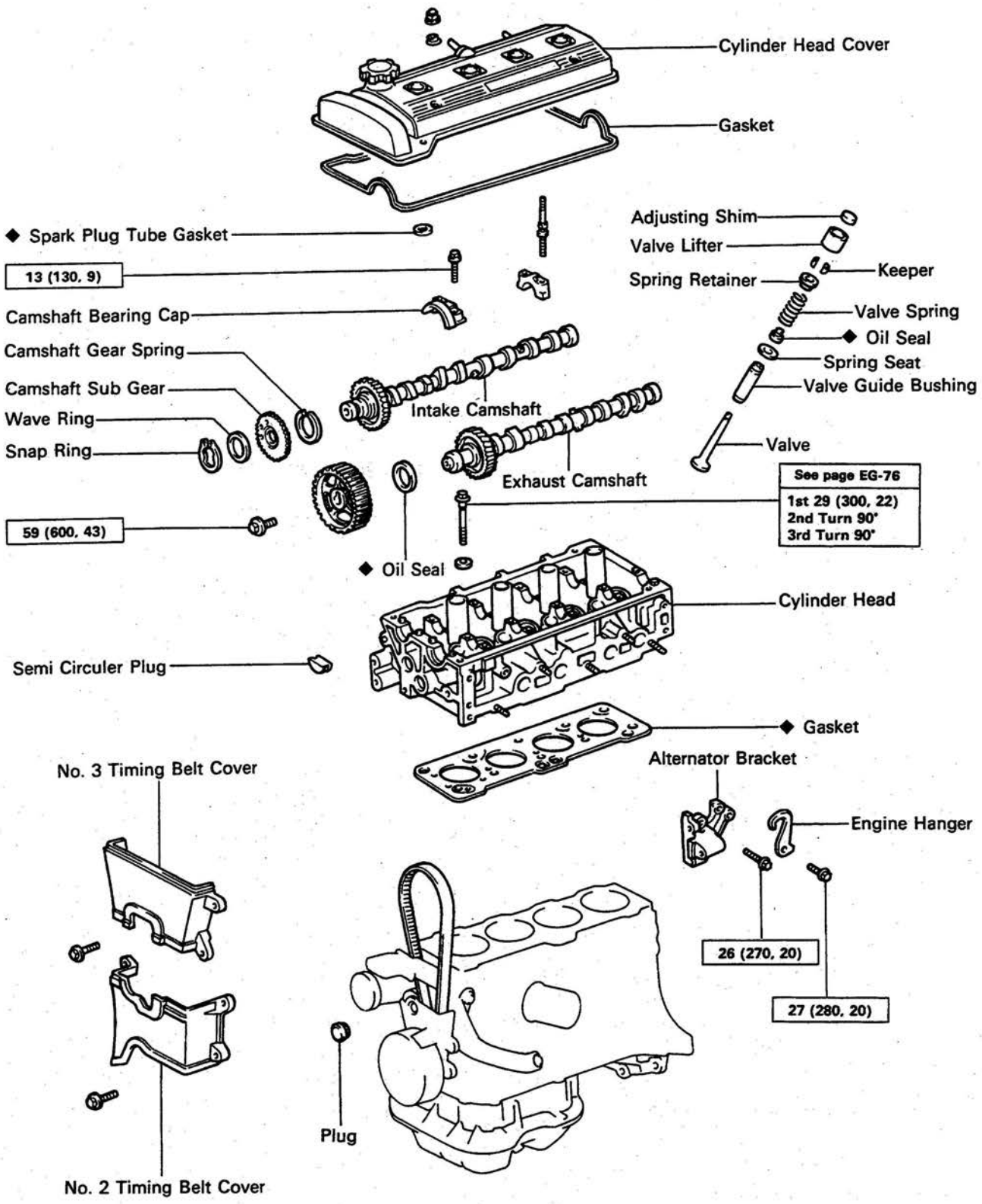
CYLINDER HEAD

COMPONENTS FOR REMOVAL AND INSTALLATION

EG181-02



EG



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

◆ Non-reusable part

P10379

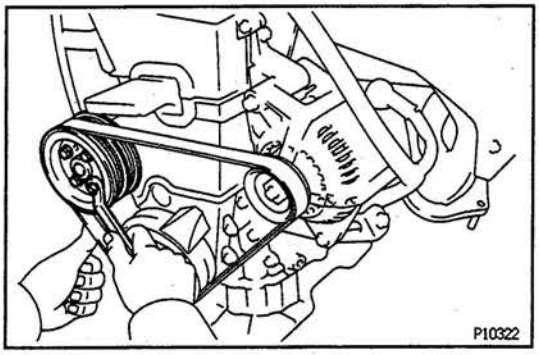
5938K–01

CYLINDER HEAD REMOVAL

(See Components for Removal and Installation)

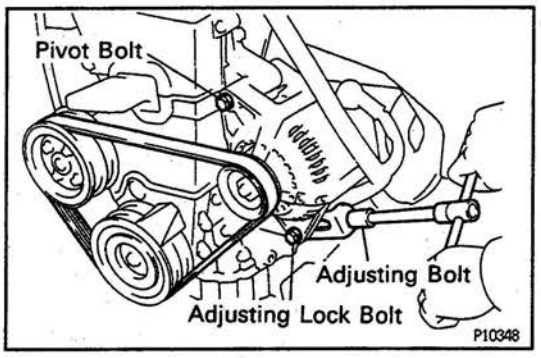
1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

2. DRAIN ENGINE COOLANT



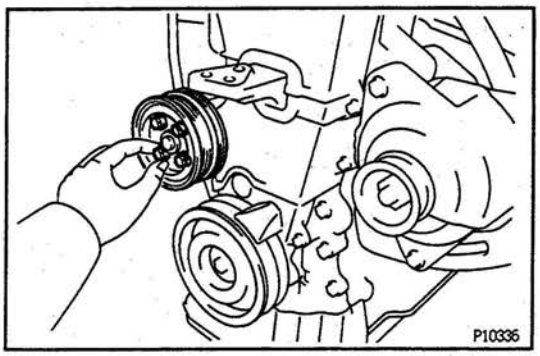
3. REMOVE ALTERNATOR DRIVE BELT AND WATER PUMP PULLEY

(a) Loosen the four water pump pulley bolts.

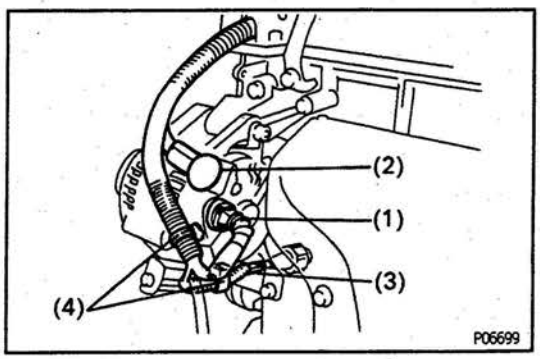


(b) Loosen the pivot bolt and adjusting lock bolt.

(c) Loosen the adjusting bolt, and remove the drive belt.



(d) Remove the four bolts and water pump pulley.



3. DISCONNECT ENGINE WIRE HARNESS

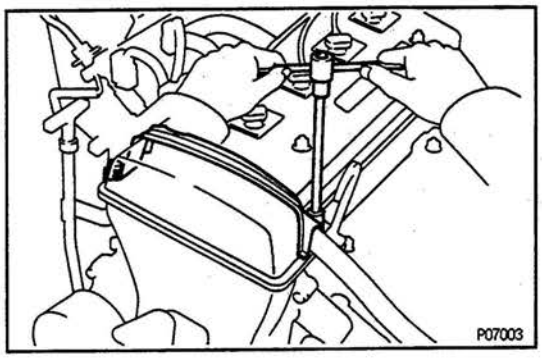
(a) Disconnect the following wires and clamps:

(1) Alternator connector

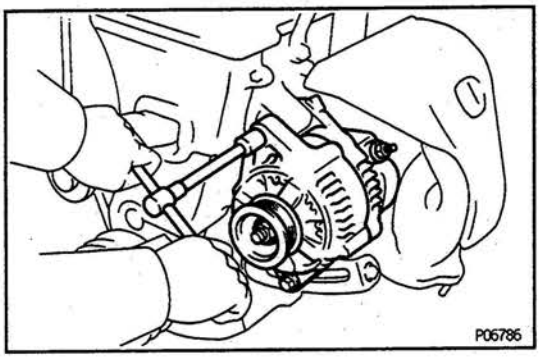
(2) Alternator wire

(3) Oil pressure switch connector

(4) Two wire clamps

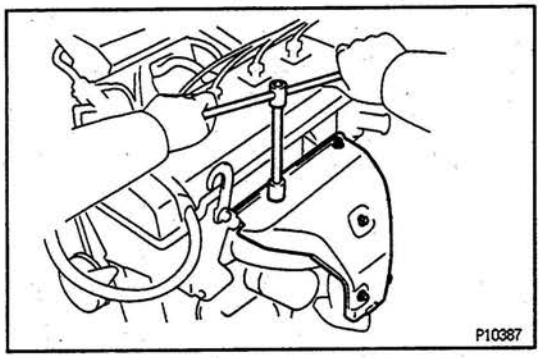


(b) Remove the two bolts and wiring harness protector.
(c) Disconnet the engine wire harness from the cylinder head.



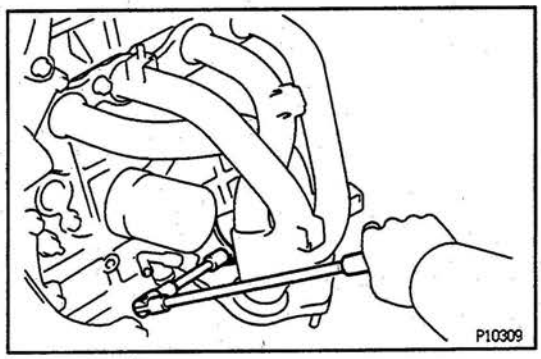
4. REMOVE ALTERNATOR

Remove the pivot bolt, nut, adjusting lock bolt and alternator.

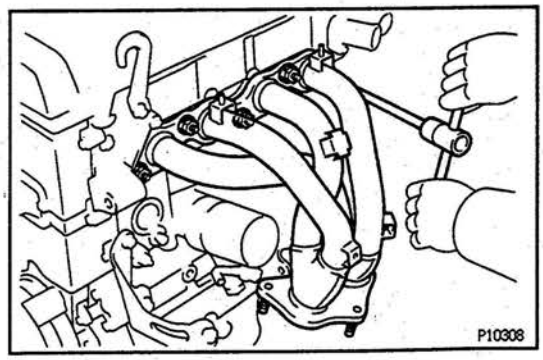


5. (AE102)
REMOVE EXHAUST MANIFOLD

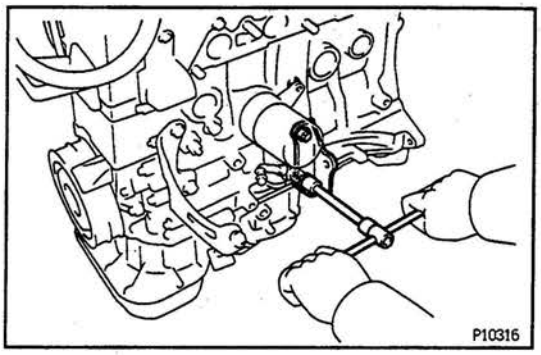
(a) Remove the three bolts, two nuts and heat insulator.



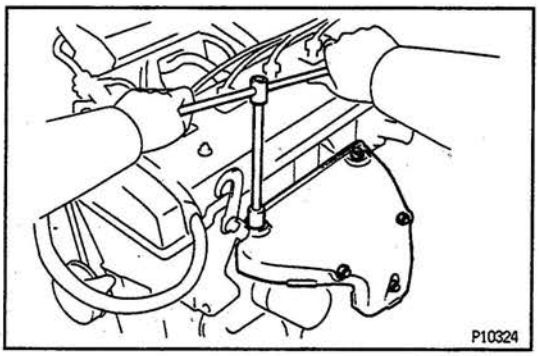
(b) Remove the bolt holding the manifold stay to the exhaust manifold.



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

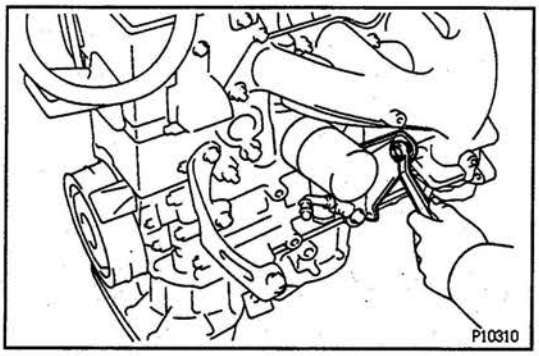


(d) Remove the two bolts and manifold stay.

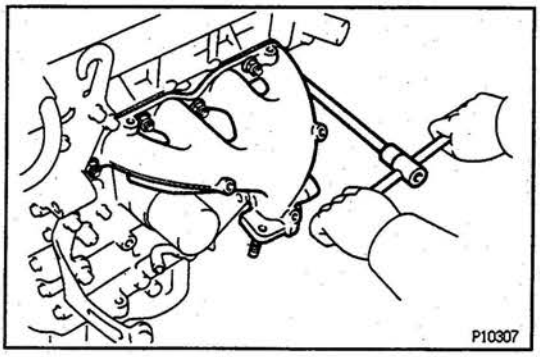


6. (AE93)
REMOVE EXHAUST MANIFOLD

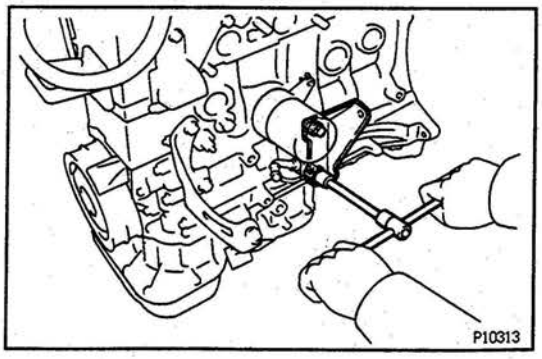
(a) Remove the five bolts and upper heat insulator.



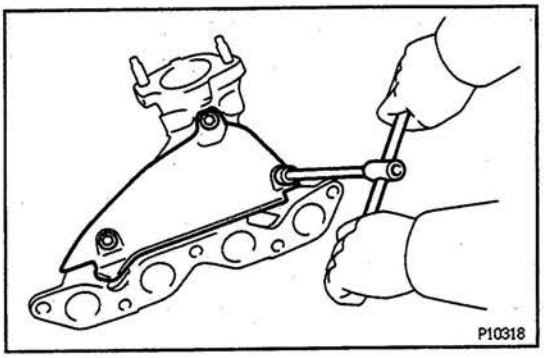
(b) Remove the bolt holding the manifold stay to the exhaust manifold.



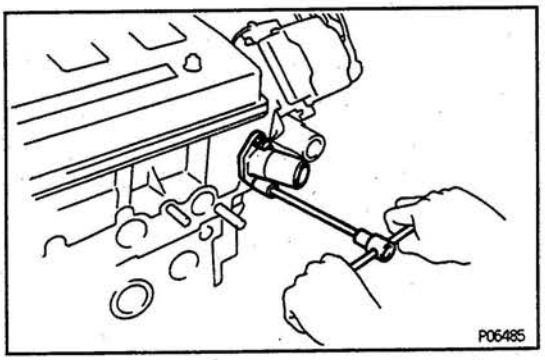
(c) Remove the five nuts, exhaust manifold and gasket.



(d) Remove the two bolts and manifold stay.

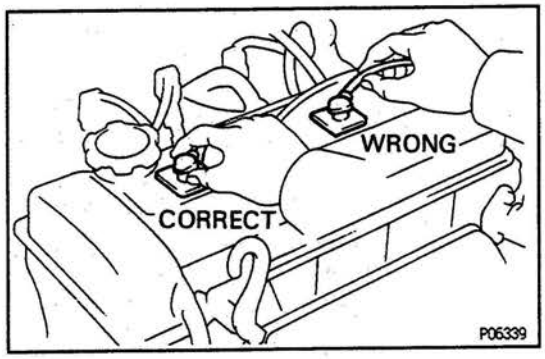


(e) Remove the three bolts and lower heat insulator from the exhaust manifold.



7. REMOVE WATER OUTLET

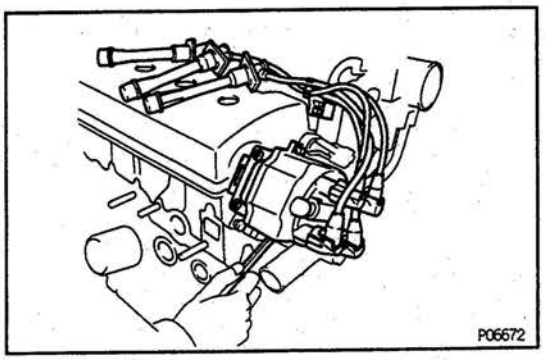
Remove the two bolts and water outlet.



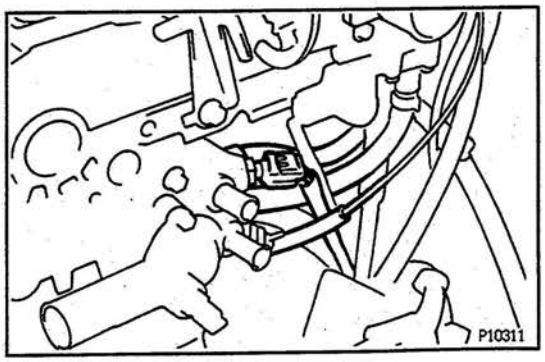
8. REMOVE IIA

(a) Disconnect the four high–tension cords at the rubber boot. Do not pull the cords.

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



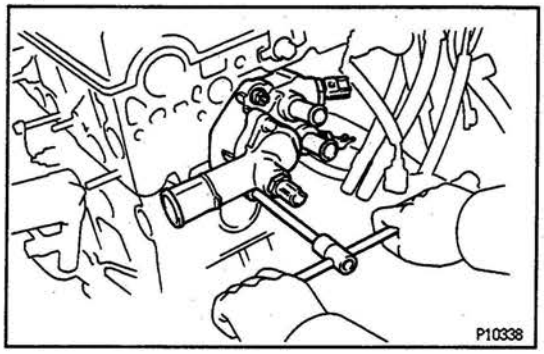
(b) Remove the two bolts and IIA.



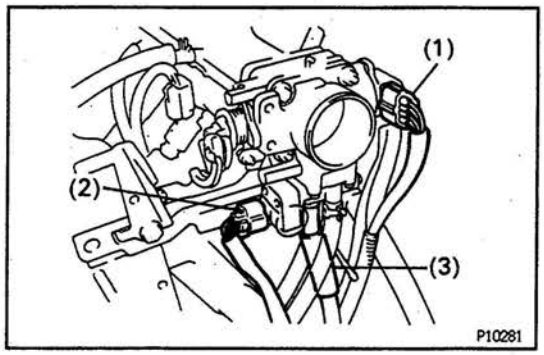
9. REMOVE WATER INLET AND INLET HOUSING

(a) Disconnect the water temperature sensor connector.

(b) Disconnect the two water by–pass hoses and EVAP BVSV vacuum hose.

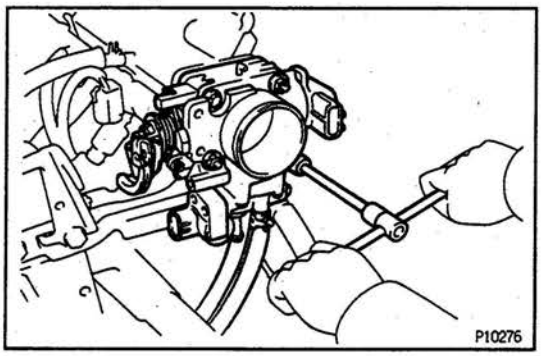


(c) Remove the bolt, two nuts, water inlet and inlet housing assembly.

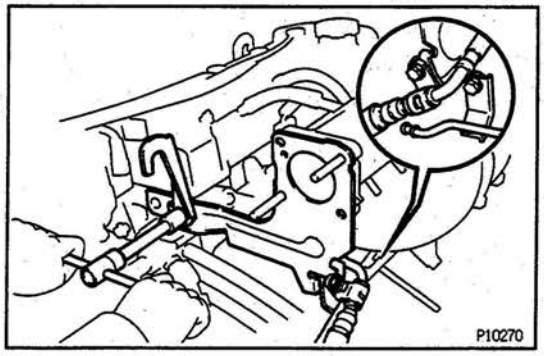


10. REMOVE THROTTLE BODY

(a) Disconnect the following connectors and hose:
- (1) TPS connector
- (2) ISC valve connector.
- (3) Air hose.



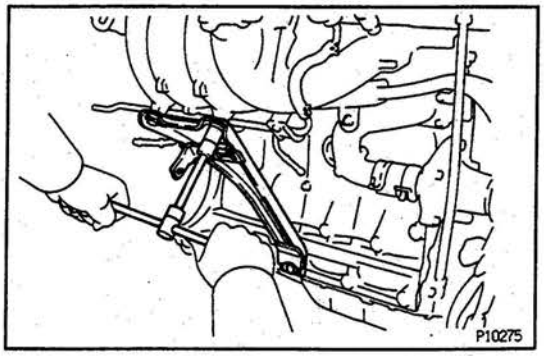
(b) Remove the two bolts, two nuts, throttle body and gasket.



11. REMOVE ENGINE HANGER AND AIR INTAKE CHAMBER STAY

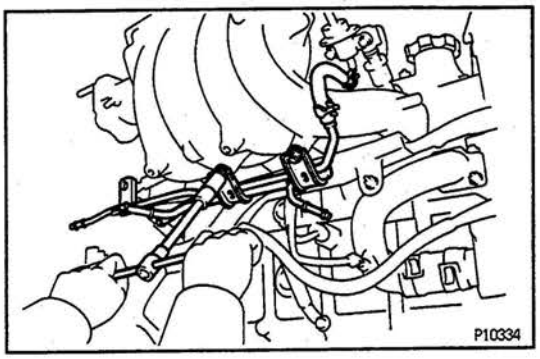
(a) Remove the two bolts, and disconnect the air pipe and fuel inlet hose.

(b) Remove the nut, engine hanger, air intake chamber stay and gasket.



12. REMOVE INTAKE MANIFOLD STAY

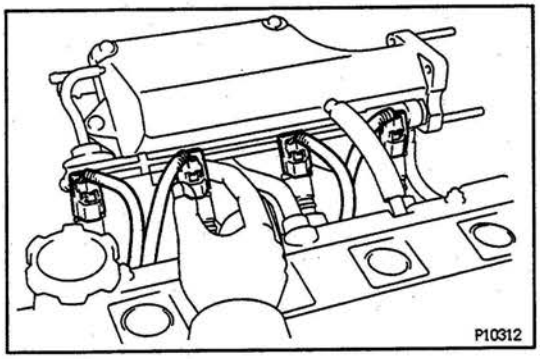
Remove the three bolts and intake manifold stay.



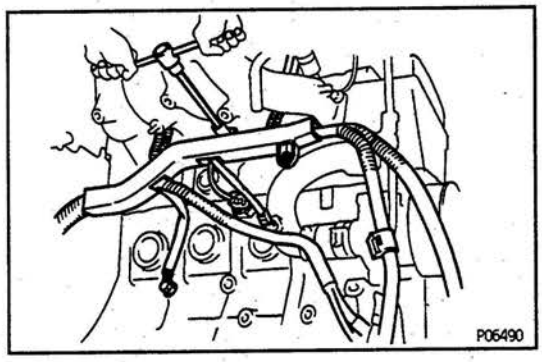
13. REMOVE AIR PIPE

(a) Disconnect the fuel return hose from the fuel pressure regulator.

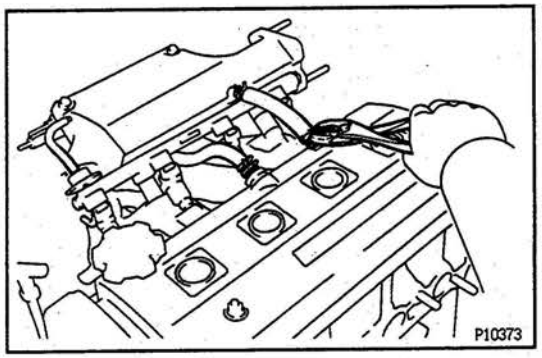
(b) Remove the bolt, nut and air pipe.



14. DISCONNECT INJECTOR CONNECTORS



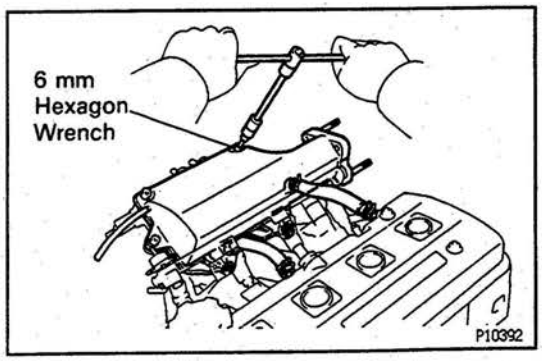
15. DISCONNECT ENGINE WIRE HARNESS



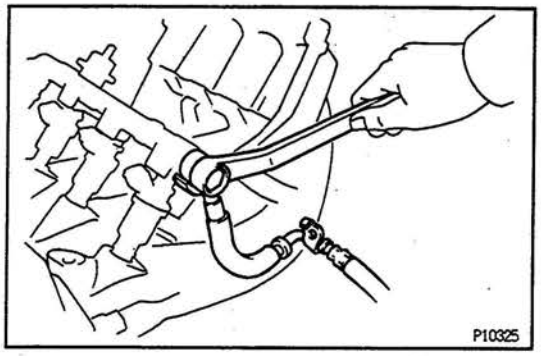
16. REMOVE AIR INTAKE CHAMBER COVER

(a) Disconnect the two PCV hoses.

(b) Disconnect the vacuum sensing hose.

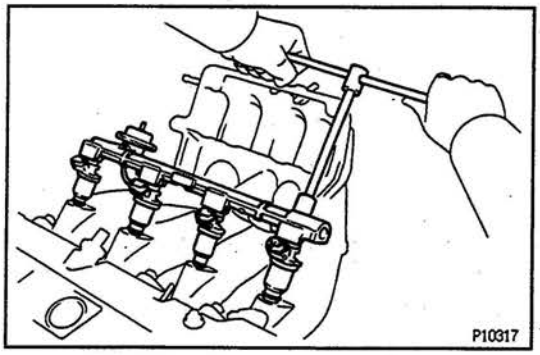


(c) Using a 6 mm hexagon wrench, remove the three bolts, two nuts, air intake chamber cover and gasket.



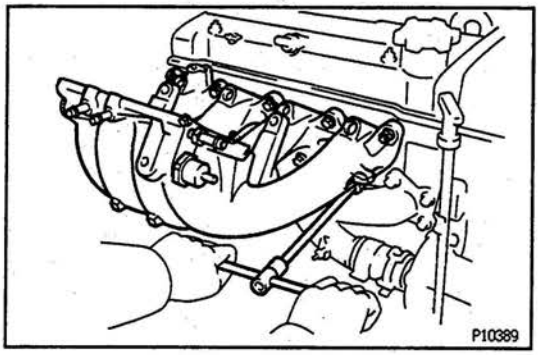
17. DISCONNECT FUEL INLET HOSE FROM DELIVERY PIPE

Remove the union bolt and two gaskets, and disconnect the inlet hose from the deliverly pipe.



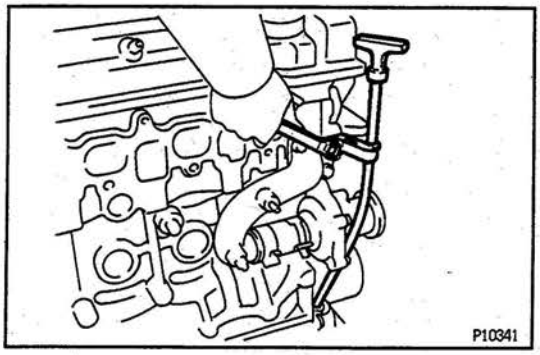
18. REMOVE DELIVERY PIPE AND INJECTOR

(a) Remove the two bolts and delivery pipe together with the four injectors.
NOTICE: Be careful not to drop the injectors when removing the delivery pipe.
(b) Remove the four insulators and two spacers from the intake manifold.
(c) Pull out the four injectors from the delivery pipe.
(d) Remove the O—ring and grommet from each injector.



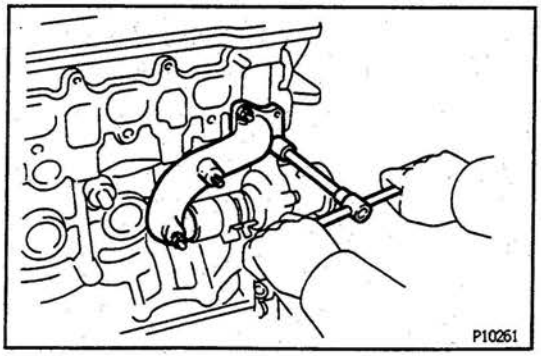
19. REMOVE INTAKE MANIFOLD

Remove the seven bolts, two nuts, intake manifold and gasket.



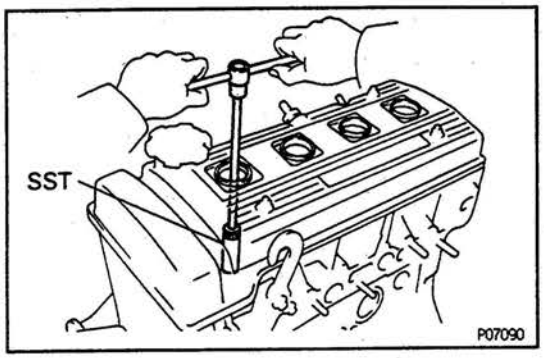
20. REMOVE OIL DIPSTICK AND GUIDE

(a) Remove the mounting bolt.
(b) Pull out the dipstick guide together with the dipstick.
(c) Remove the O—ring from the dipstick guide.



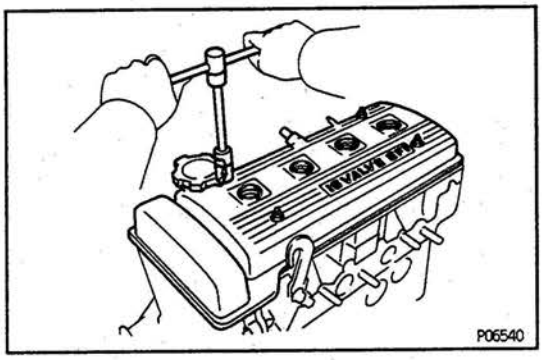
21. REMOVE NO.2 WATER INLET

Remove the two nuts and water inlet from the water inlet hose.



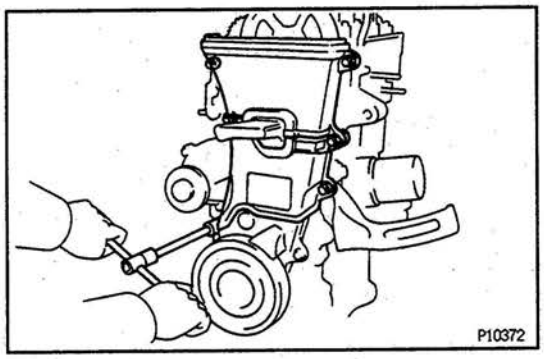
22. REMOVE SPARK PLUGS

Using SST, remove the four plugs.
SST 09155–16100



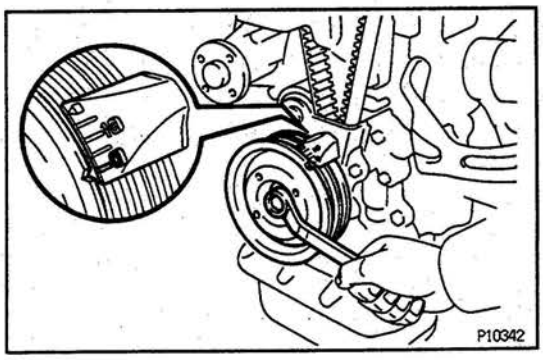
23. REMOVE CYLINDER HEAD COVER

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



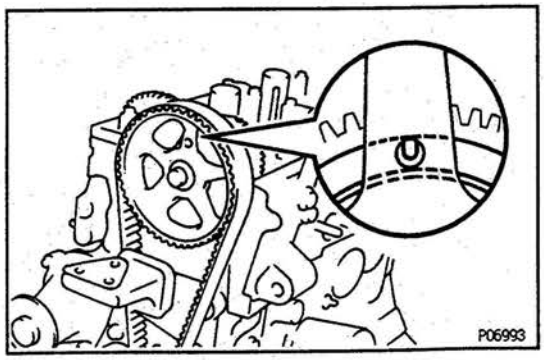
24. REMOVE NO.3 AND NO.2 TIMING BELT COVERS

Remove the six bolts and timing belt covers.

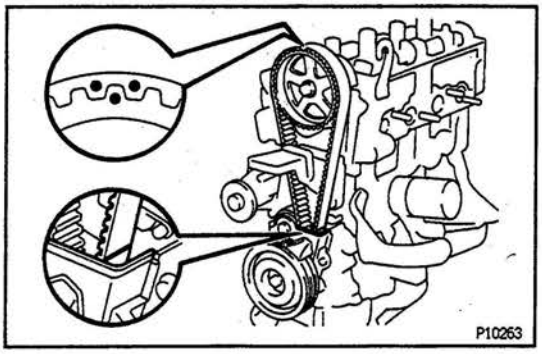


25. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

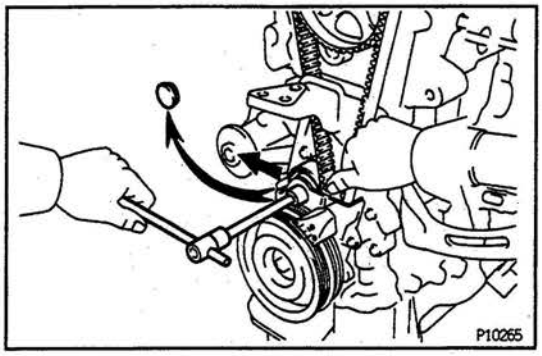


(b) Check that the hole of the camshaft timing pulley is aligned with the timing mark of the bearing cap.
If not, turn the crankshaft one revolution (360°).



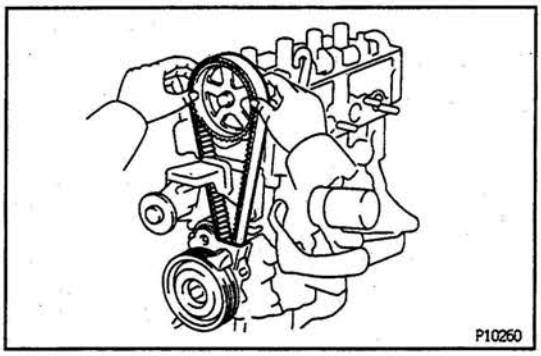
26. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEY

(a) Place matchmarks on the timing belt and camshaft timing pulley, and matchmarks on the timing belt to match the end of the No.1 timing belt cover.

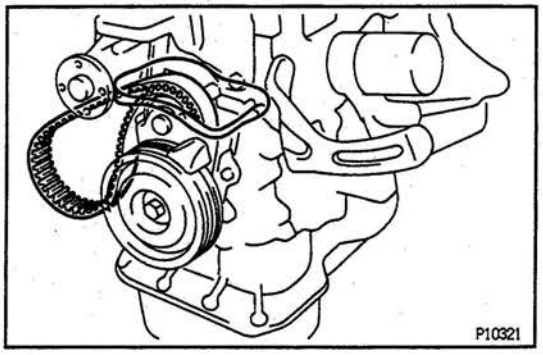


(b) Remove the grommet from the No.1 timing belt cover.

(c) Loosen the mount bolt of the idler pulley and shift pulley toward the left as far as it will go and then temporarily tighten it.

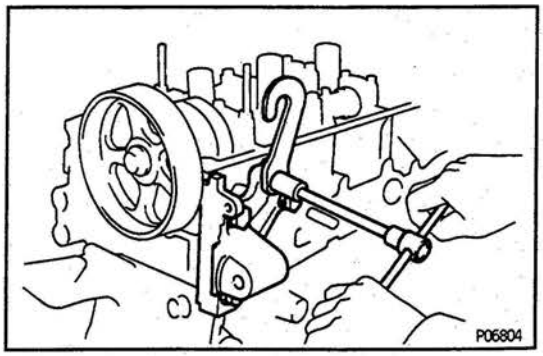


(d) Remove the belt from the camshaft timing pulley.



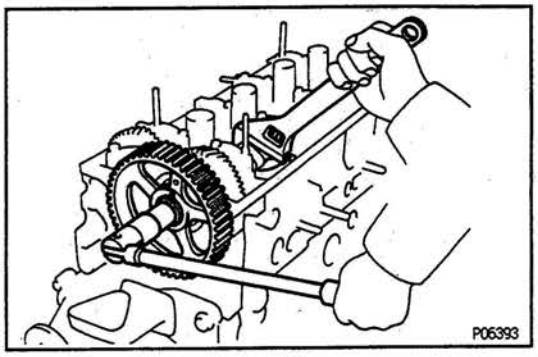
NOTICE:

- **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.**



27. REMOVE ENGINE HANGER AND ALTERNATOR BRAKET

Remove the four bolts, engine hanger and alternator bracket.



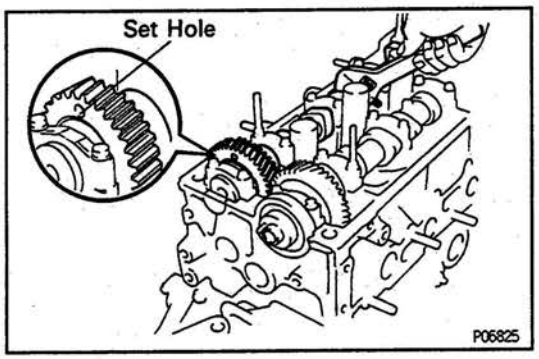
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28. REMOVE CAMSHAFT TIMING PULLEY

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

29. REMOVE CAMSHAFTS

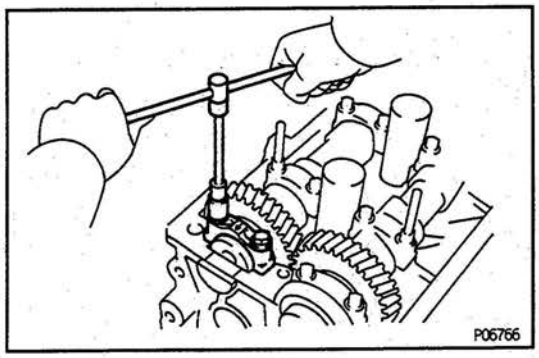
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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



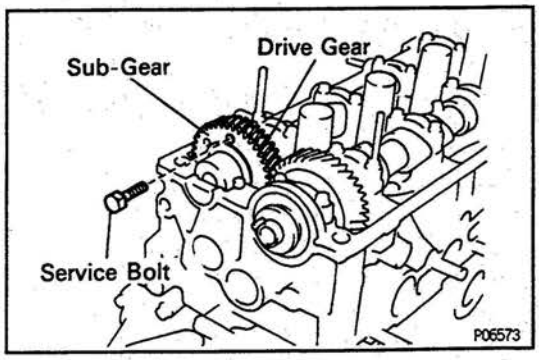
A. Remove intake camshaft

(a) Turn the camshaft pulley so that the hole in the sub—gear (which sets the sub—gear to the drive gear) comes up.

HINT: The above state allows the No.1 and No.3 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.



(b) Remove the two bolts and No.1 bearing cap.

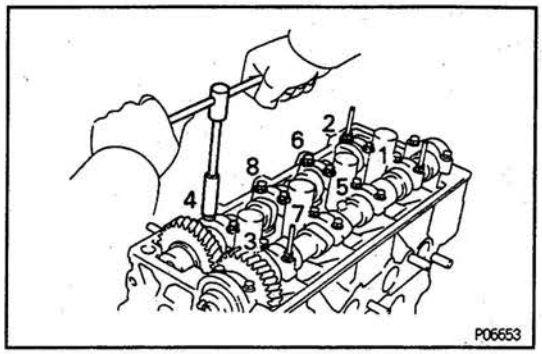


(c) Secure the intake camshaft sub—gear to the drive gear with a service bolt.

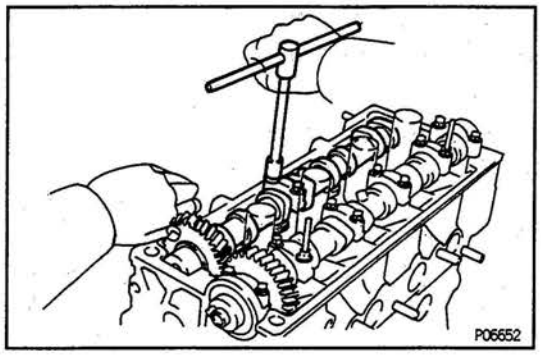
Recommended service bolt:

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

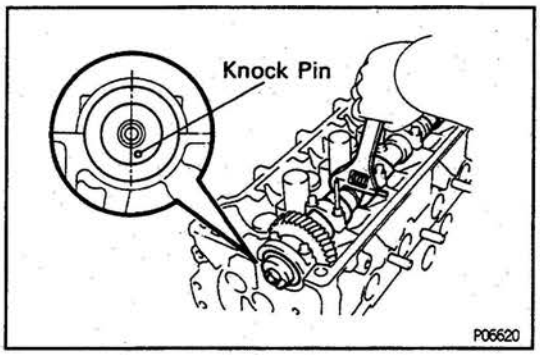
HINT: When removing the camshaft, make sure that the torsional spring force of the sub—gear has been eliminated by the above operation.



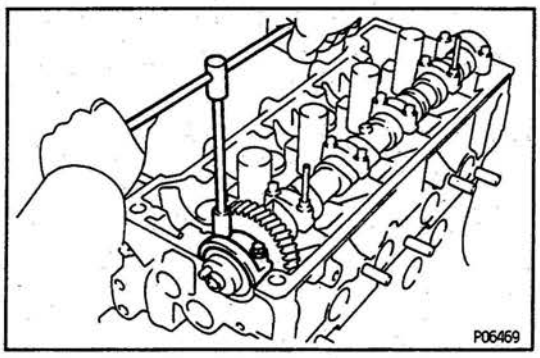
(d) Uniformly loosen and remove the eight bearing cap bolts in several passes, in the sequence shown.
(e) Remove the four bearing caps and camshaft.



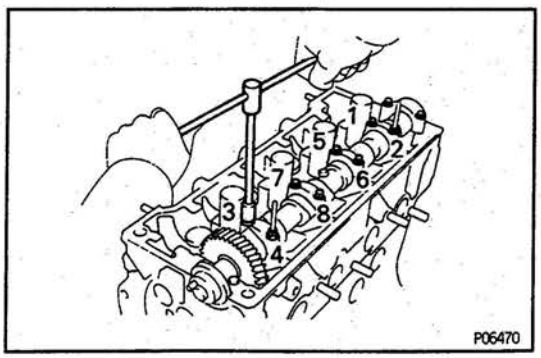
HINT: If the camshaft is not being lifted out straight and level, reinstall the No.3 bearing cap with the two bolts. Then alternately loosen and remove the bearing cap bolts with the camshaft gear pulled up.
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.



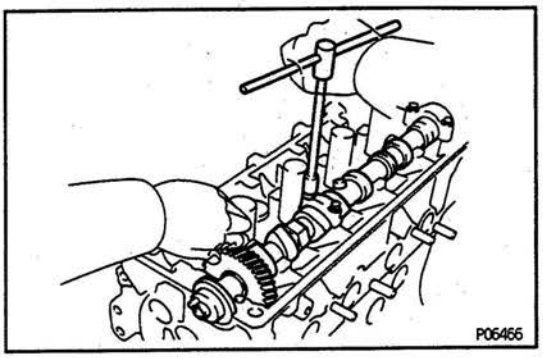
B. Remove exhaust camshaft
(a) Set the intake camshaft so that the knock pin is located slightly counterclockwise from the vertical axis of the camshaft.
HINT: The above angle allows the No.1 and No.3 cylinder cam lobes of exhaust camshaft to push their valve lifters evenly.



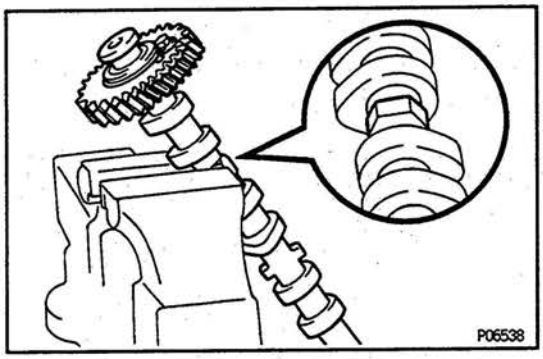
(b) Remove the two bolts, No.1 bearing cap and oil seal.
NOTICE: If the No.1 bearing cap is not removable by hand, do not try to remove by force but leave as it is without bolts.



(c) Uniformly loosen and remove eight bearing cap bolts in several passes, in the sequence shown.
(d) Remove the four bearing caps and camshaft.

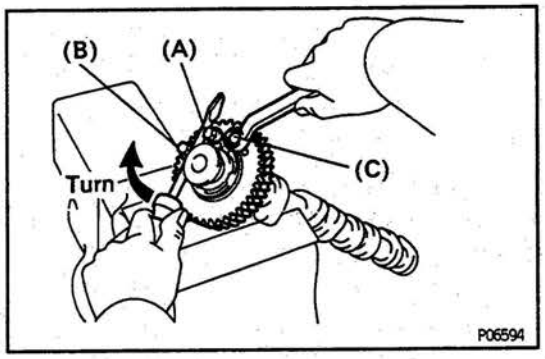


HINT: If the camshaft is not being lifted out straight and level, reinstall the No.3 bearing cap with the two bolts. Then alternately loosen and remove the two bearing cap bolts with the camshaft gear pulled up.
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.

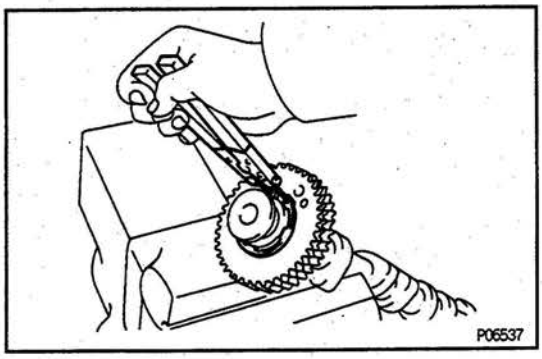


30. DISASSEMBLE INTAKE CAMSHAFT

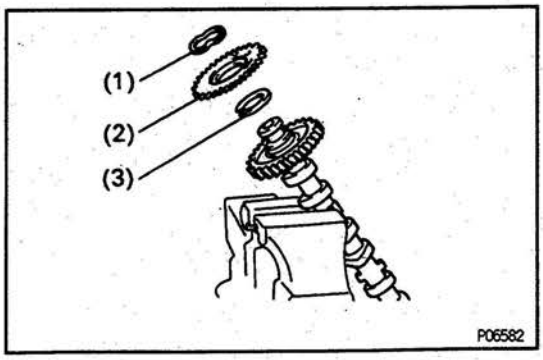
(a) Mount the hexagon wrench head portion of the camshaft in a vice.
NOTICE: Be careful not to damage the camshaft.



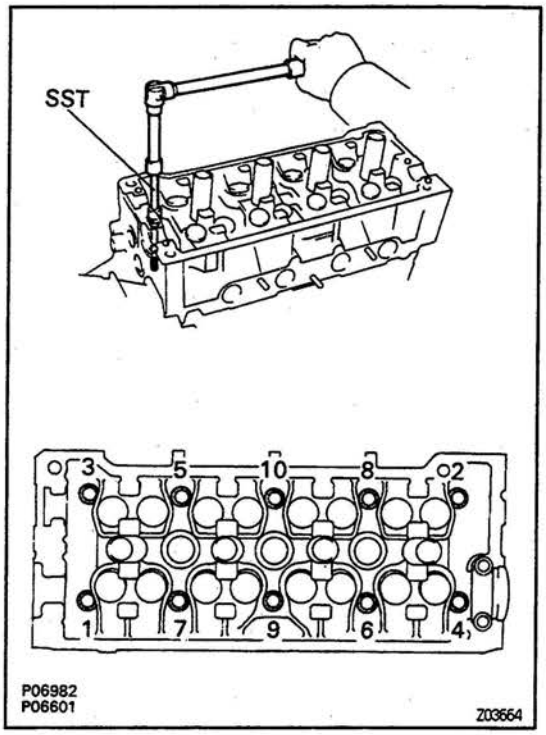
(b) Insert service bolts (A) and (B) into the service holes of the camshaft sub–gear.
(c) Using a screwdriver, turn the sub–gear clockwise, and remove the service bolt (C).
NOTICE: Be careful not to damage the camshaft.



(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 SEMI–CIRCULAR PLUG

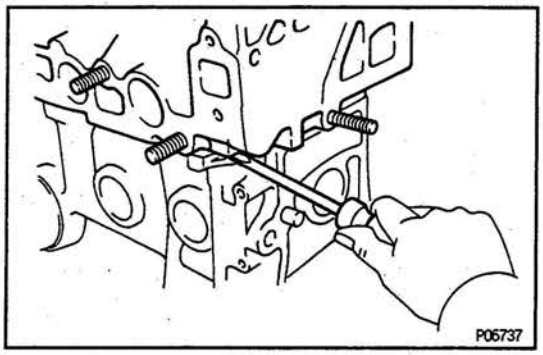
32. REMOVE CYLINDER HEAD

(a) Using SST, uniformly loosen and remove the ten cylinder head bolts in several passes, in the sequence shown.

SST 09205–16010

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

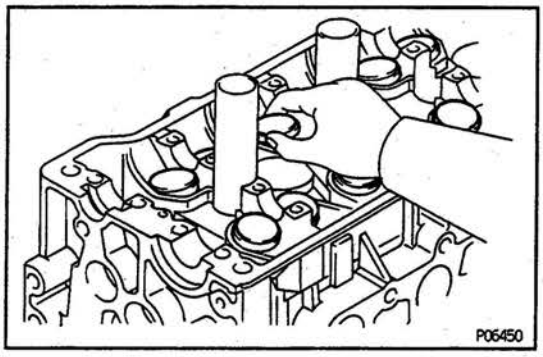
(b) Remove the ten plate washers.



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

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

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

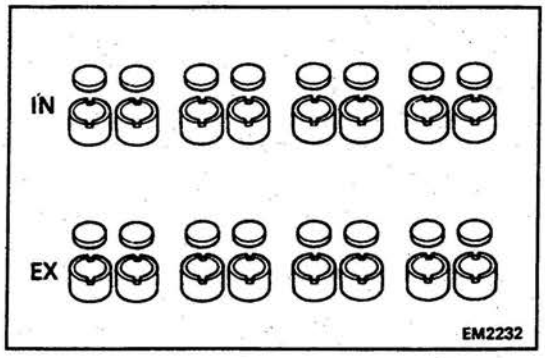


CYLINDER HEAD DISASSEMBLY

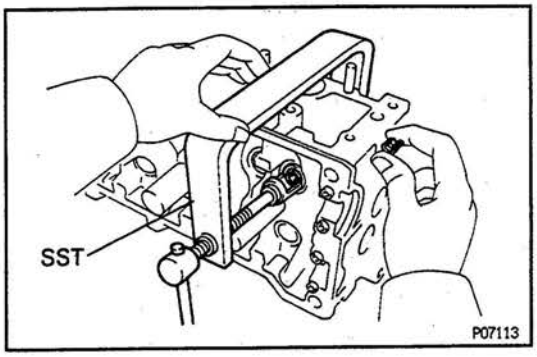
8211C–04

(See Components for Removal and Installation)

1. REMOVE VALVE LIFTERS AND SHIMS

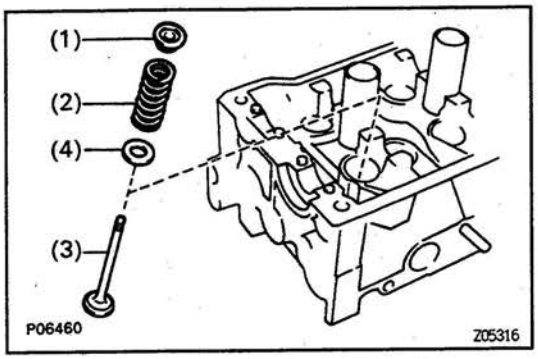


HINT: Arrange the valve lifters and shims in correct order.

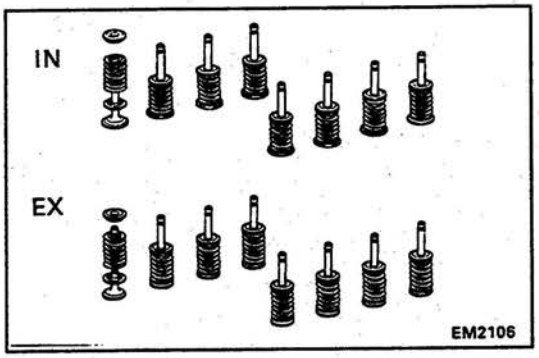


2. REMOVE VALVES

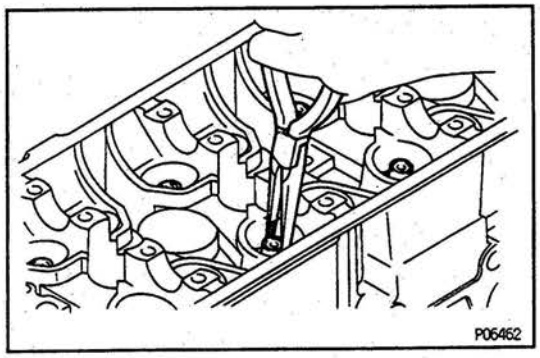
(a) Using SST, compress the valve spring and remove the two keepers.
SST 09202–70010



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



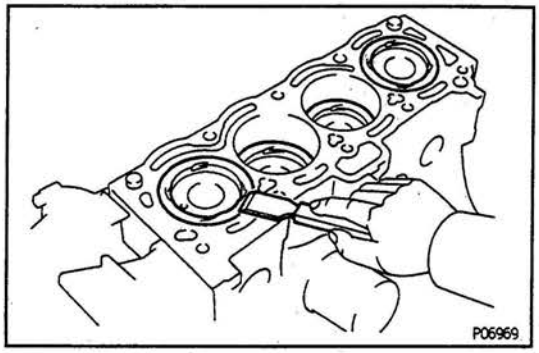
HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.



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

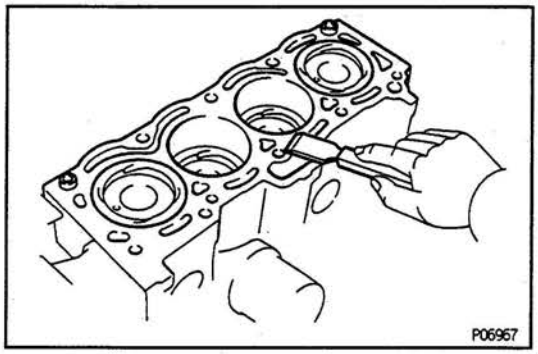
B038L-01

CYLINDER HEAD COMPONENTS INSPECTION AND REPAIR



1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

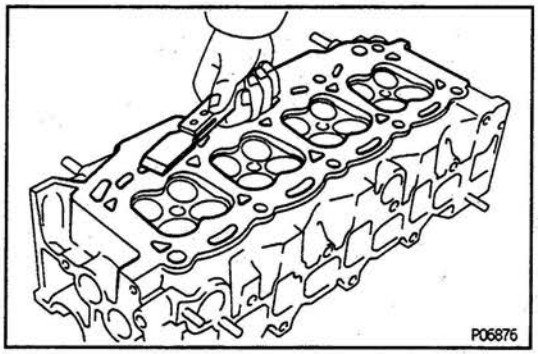
(a) Turn the crankshaft, and bring each piston to the top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



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

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

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

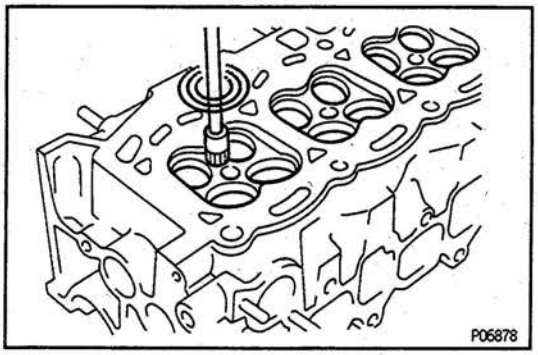


2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

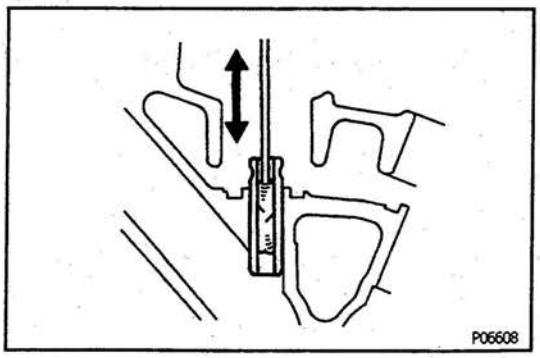
NOTICE: Be careful not to scratch the cylinder block contact surface.



B. Clean combustion chambers

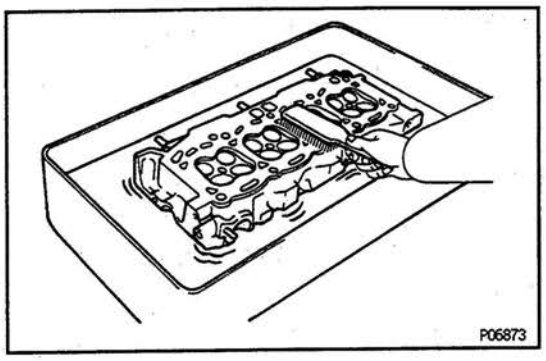
Using a wire brush, remove all the carbon from the combustion chambers.

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



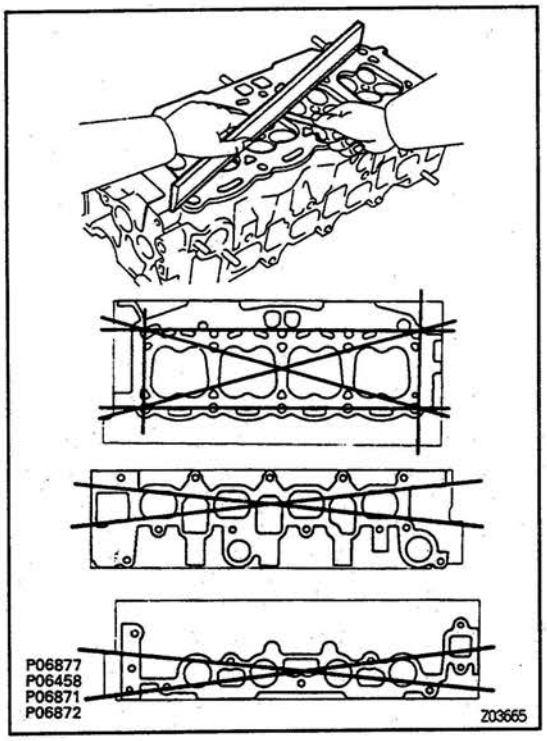
C. Clean valve guide bushings

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



D. Clean cylinder head

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



3. INSPECT CYLINDER HEAD

A. Inspect for flatness

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

Maximum warpage:

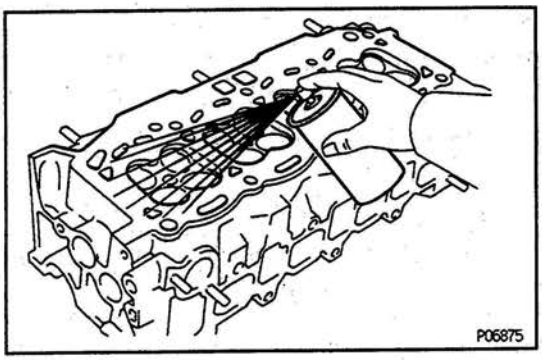
Cylinder block side

0.05 mm (0.0020 in.)

Manifold side

0.10 mm (0.0039 in.)

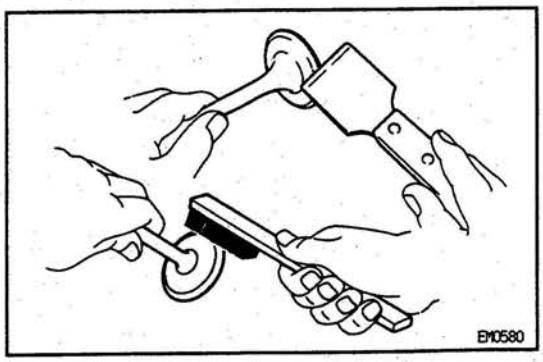
If warpage is greater than maximum, replace the cylinder head.



B. Inspect for cracks

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

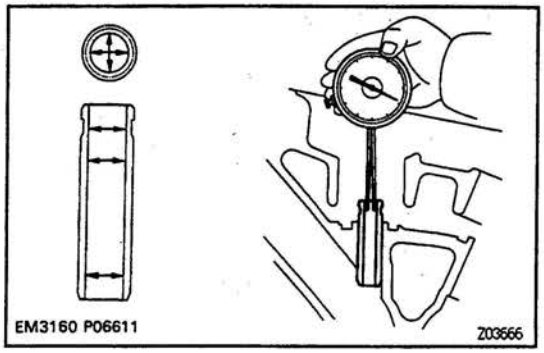
If cracked, replace the cylinder head.



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.

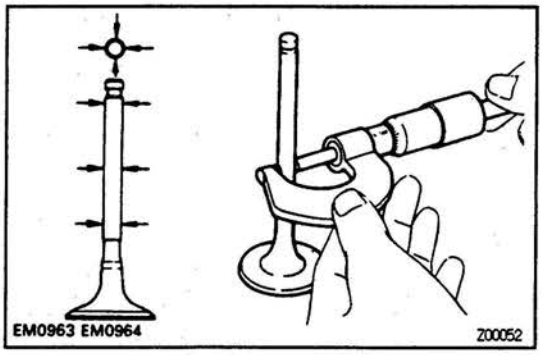


5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

(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:

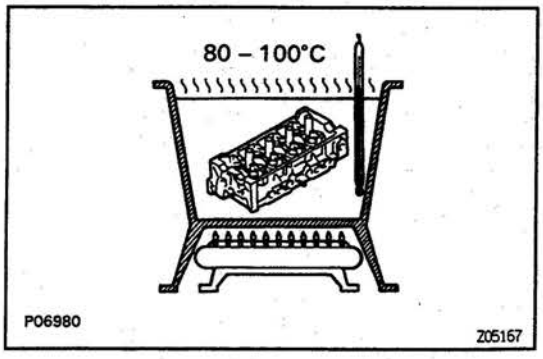
Intake

0.08 mm (0.0031 in.)

Exhaust

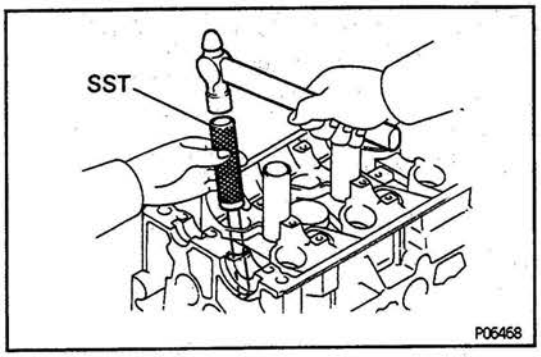
0.10 mm (0.0039 in.)

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

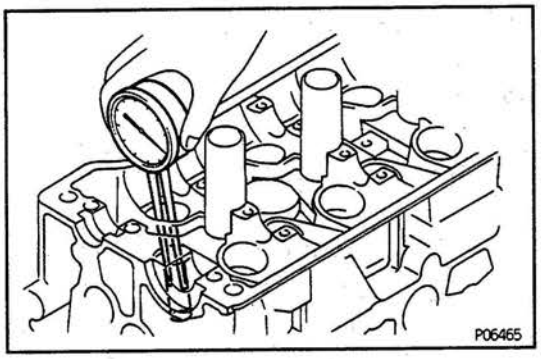


6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

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



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



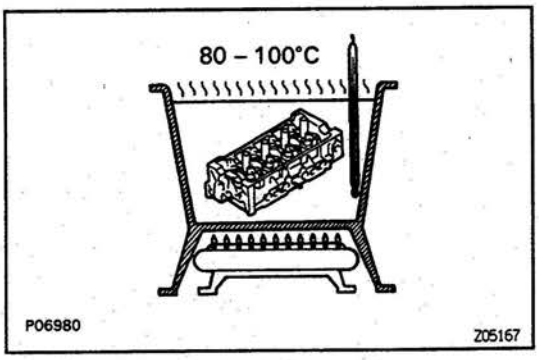
(c) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

(d) Select a new guide bushing (STD or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to the following dimension:
Rebored cylinder head bushing bore dimension:
11.050 — 11.077 mm (0.4350 — 0.4361 in.)
If the bushing bore diameter of the cylinder head is greater than 11.077 mm (0.4361 in.), replace the cylinder head.

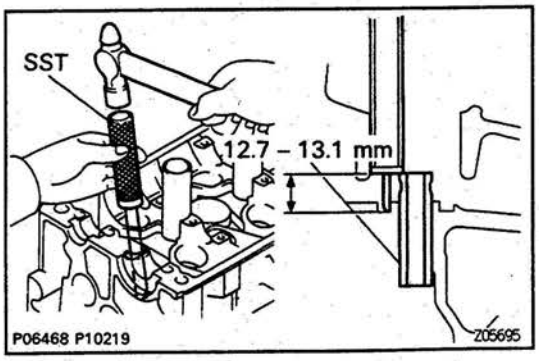
Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
11.000 – 11.027 (0.4331 – 0.4341)	Use STD
11.050 – 11.077 (0.4350 – 0.4361)	Use O/S 0.05

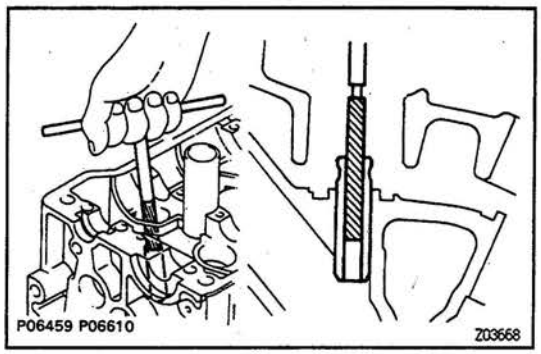
V02375



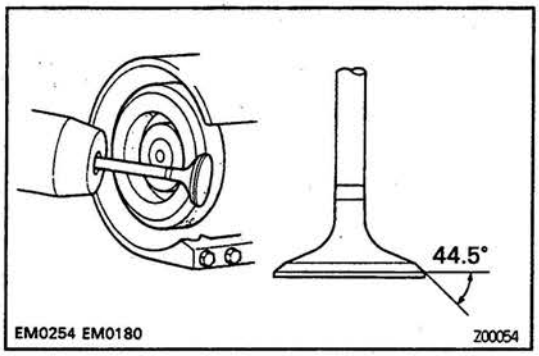
(e) Gradually heat the cylinder head to 80 — 100°C (176 — 212°F).



(f) Using SST and a hammer, tap in a new guide bushing until there is 12.7 — 13.1 mm (0.500 — 0.516 in.) protruding from the cylinder head.
SST 09201—70010



(g) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See step 5 on page EG–65) between the guide bushing and valve stem.



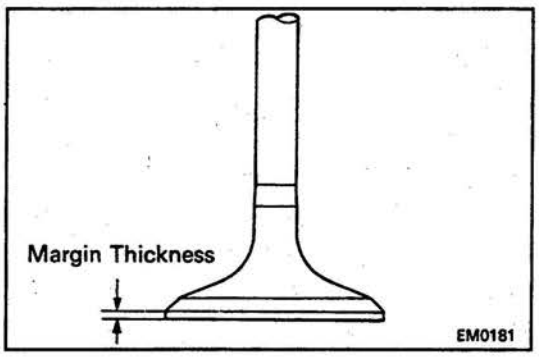
7. INSPECT AND GRIND VALVES

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

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

Valve face angle:

44.5°



(c) Check the valve head margin thickness.

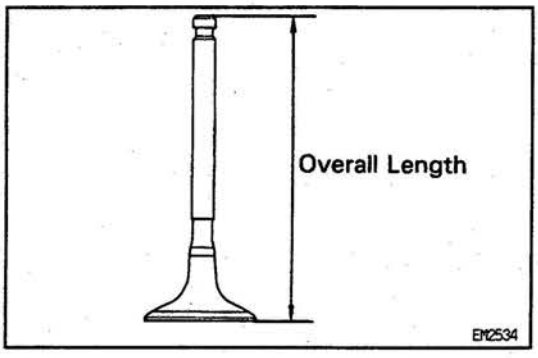
Standard margin thickness:

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

87.45 mm (3.4429 in.)

Exhaust

87.84 mm (3.4583 in.)

Minimum overall length:

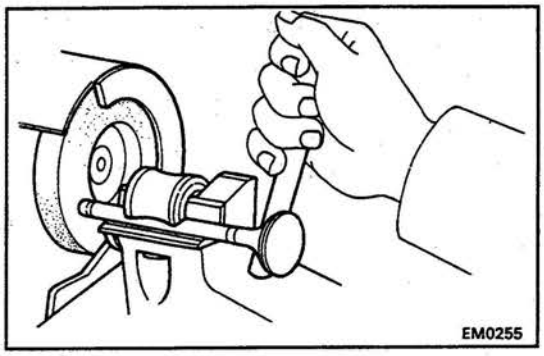
Intake

86.95 mm (3.4232 in.)

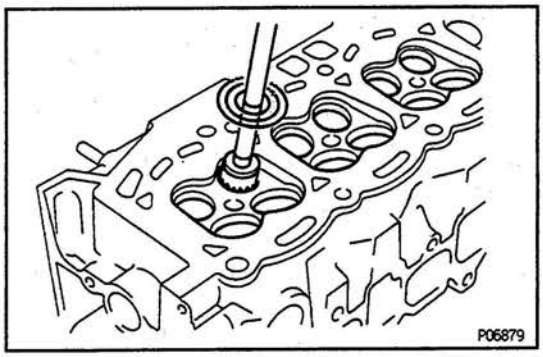
Exhaust

87.34 mm (3.4386 in.)

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

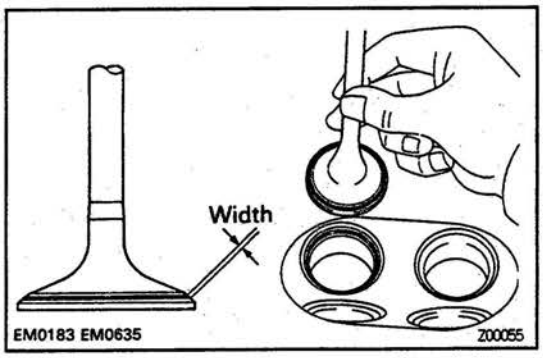


(e) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.
NOTICE: Do not grind off more than minimum.



8. INSPECT AND CLEAN VALVE SEATS

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

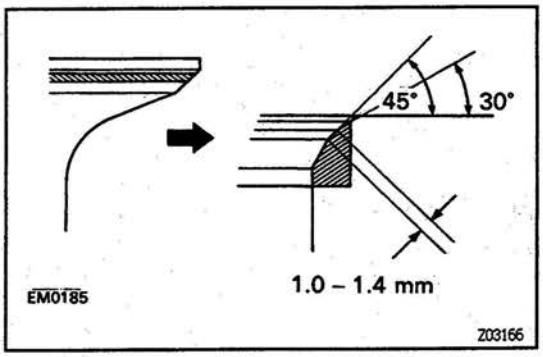


(b) Check the valve seating position.
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.

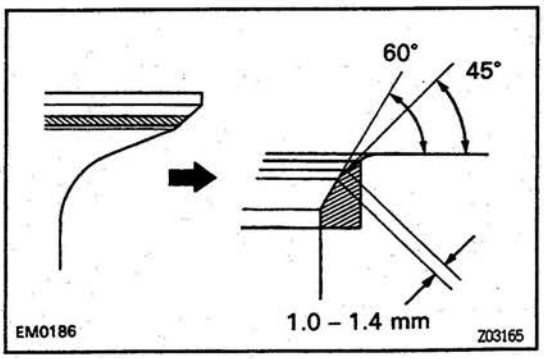
(c) Check the valve face and seat for the following:

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

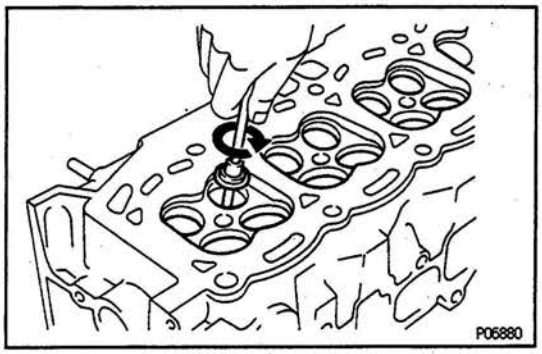
If not, correct the valve seats as follows:



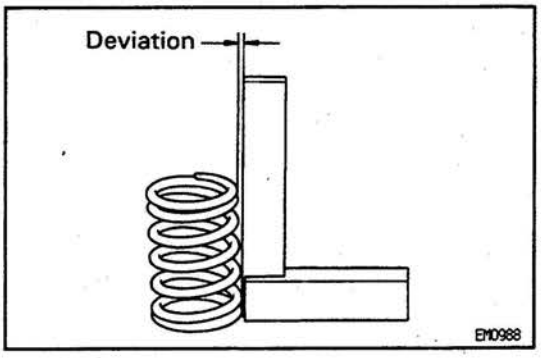
(1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



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



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



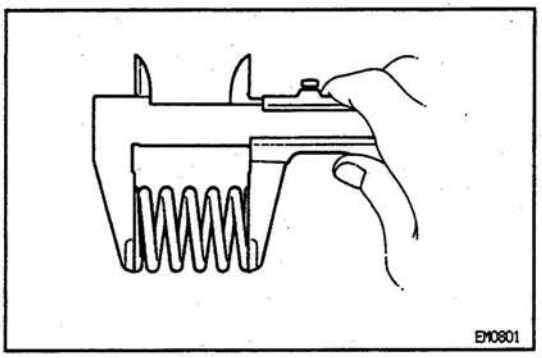
9. INSPECT VALVE SPRINGS

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

Maximum squareness:

2.0 mm (0.079 in.)

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

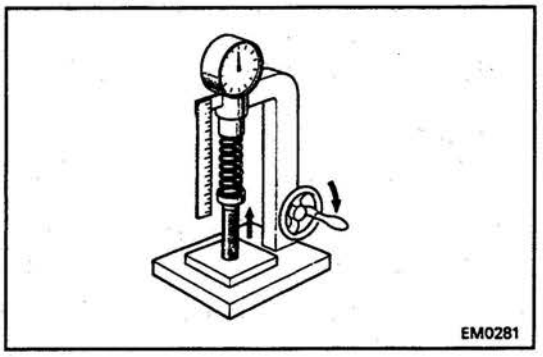


(b) Using a vernier caliper, measure the free length of the valve spring.

Free length:

38.57 mm (1.5185 in.)

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

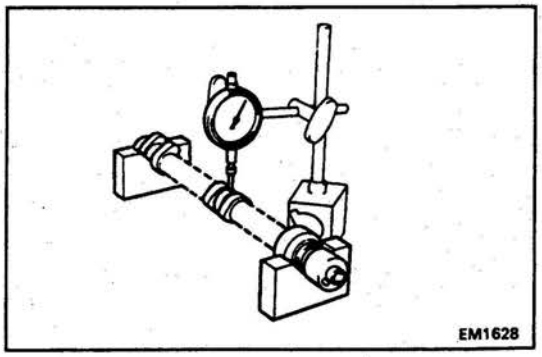


(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

166 N (16.9 kgf, 37.3 lbf) at 31.7 mm (1.248 in.)

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



10. INSPECT CAMSHAFTS AND BEARINGS

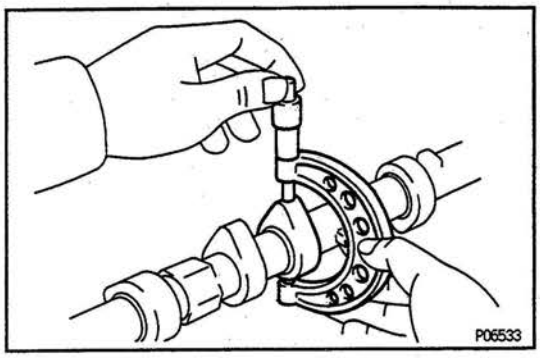
A. Inspect camshaft for runout

(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

41.910 — 42.010 mm (1.6450 — 1.6539 in.) for AE93

42.610 — 42.710 mm (1.6776 — 1.6815 in.) for AE102

Exhaust

41.960 — 42.060 mm (1.6520 — 1.6560 in.)

Minimum cam lobe height:

Intake

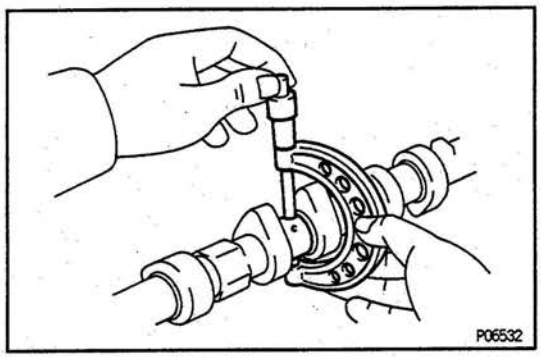
41.50 mm (1.6339 in.) for AE93

42.20 mm (1.6614 in.) for AE102

Exhaust

41.55 mm (1.6358 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:

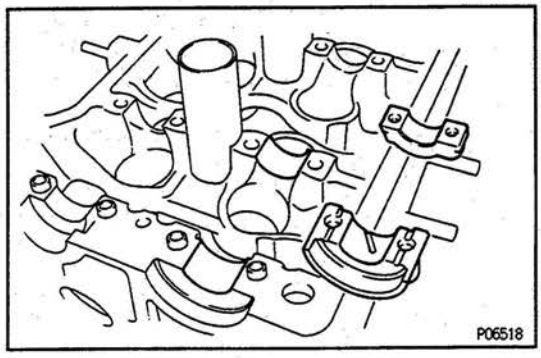
Exhaust No.1

24.949 — 24.965 mm (0.9822 — 0.9829 in.)

Others

22.949 — 22.965 mm (0.9035 — 0.9041 in.)

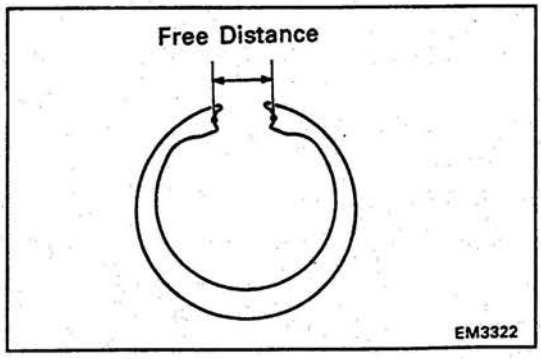
If the journal diameter is not as specified, check the oil clearance.



D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

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



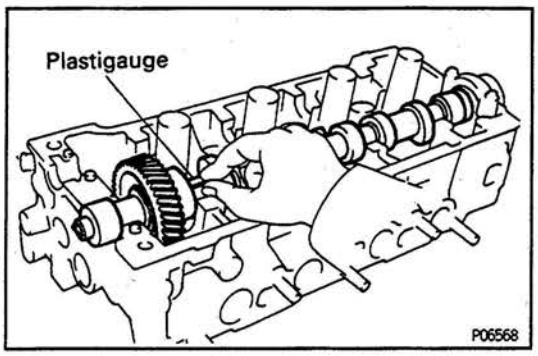
E. Inspect camshaft gear spring

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

Free distance:

17.0 — 17.6 mm (0.669 — 0.693 in.)

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

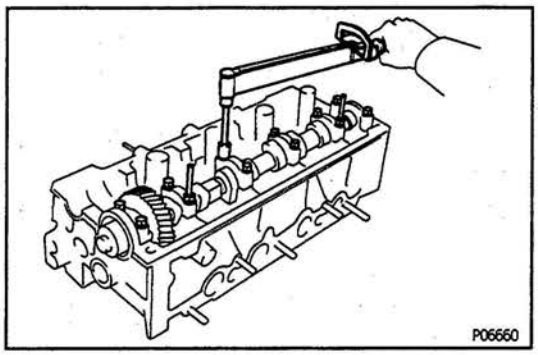


F. Inspect camshaft journal oil clearance

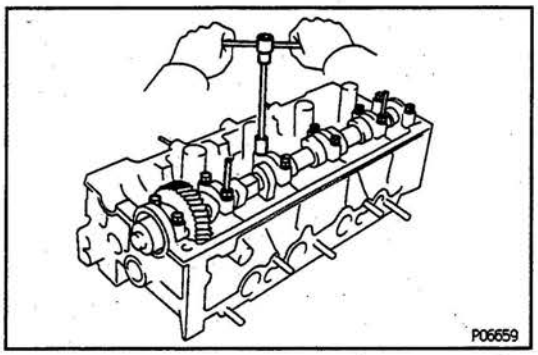
(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

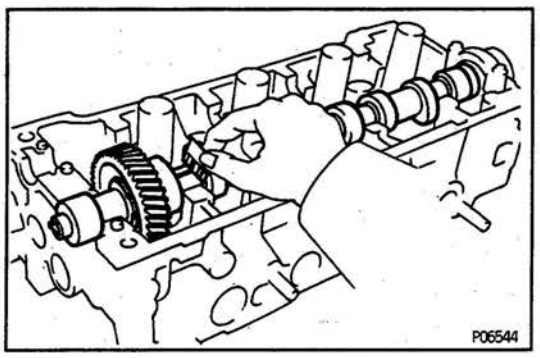
(c) Lay a strip of Plastigage across each of the camshaft journals.



(d) Install the bearing caps.
(See step 3 on page EG–77)
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)
NOTICE: Do not turn the camshaft.

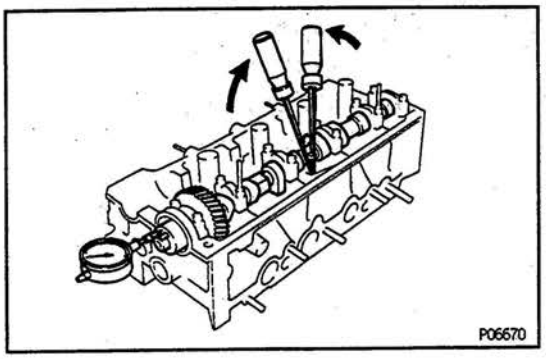


(e) Remove the bearing caps.



(f) Measure the Plastigage at its widest point.
Standard oil clearance:
0.035 – 0.072 mm (0.0014 – 0.0028 in.)
Maximum oil clearance:
0.10 mm (0.0039 in.)
If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(g) Completely remove the Plastigage.



G. Inspect camshaft thrust clearance

(a) Install the camshaft.
(See step 3 on page EG—77)

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

Standard thrust clearance:

Intake

0.030 — 0.085 mm (0.0012 — 0.0033 in.)

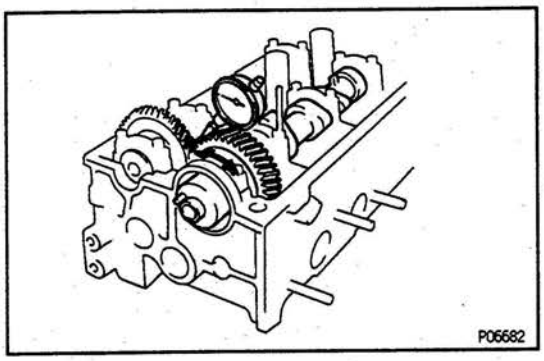
Exhaust

0.035 — 0.090 mm (0.0014 — 0.0035 in.)

Maximum thrust clearance:

0.11 mm (0.0043 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 intake camshaft sub—gear.
(See step 3 on page EG—77)

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

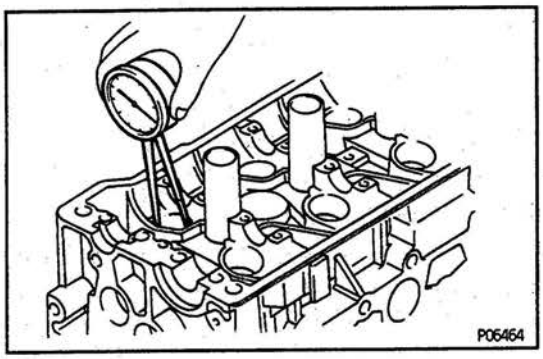
Standard backlash:

0.020 — 0.200 mm (0.0008 — 0.0079 in.)

Maximum backlash:

0.30 mm (0.0188 in.)

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

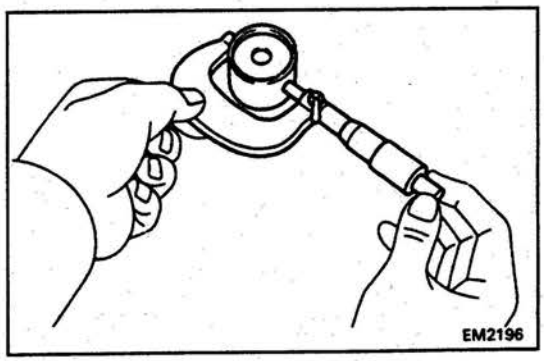


11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter:

31.000 — 31.025 mm (1.2205 — 1.2215 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.

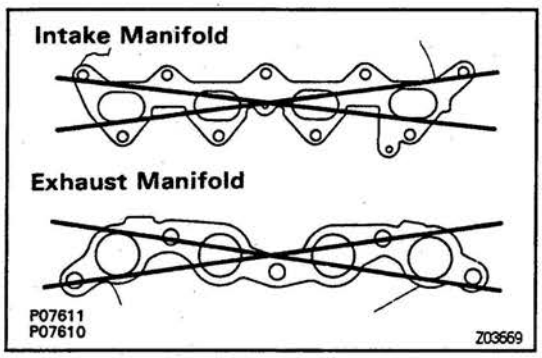
Standard oil clearance:

0.024 – 0.059 mm (0.0009 – 0.0023 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 INTAKE AND EXHAUST MANIFOLDS

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

Maximum warpage:

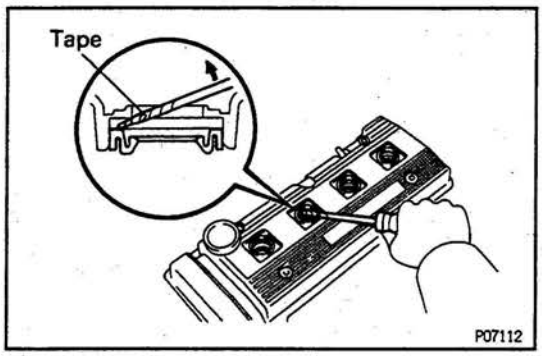
Intake manifold

0.20 mm (0.0079 in.)

Exhaust manifold

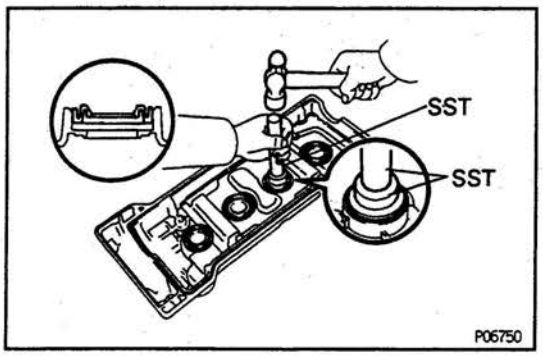
0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.



13. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKETS

(a) Using a screwdriver, pry out the tube gasket.



(b) Using SST and a hammer, tap in a new tube gasket until its surface is flush with the upper edge of the cylinder head cover.

SST 09550–10012 (09552–10010, 09556–10010)

(c) Apply a light coat of MP grease to the gasket lip.

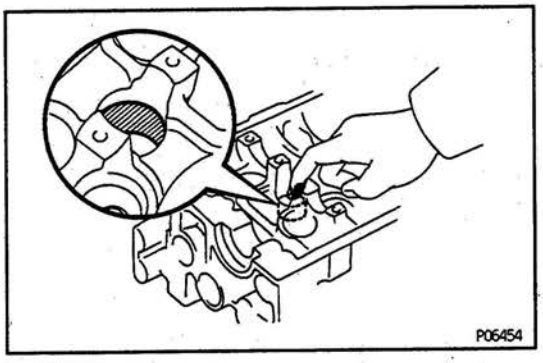
EG

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.



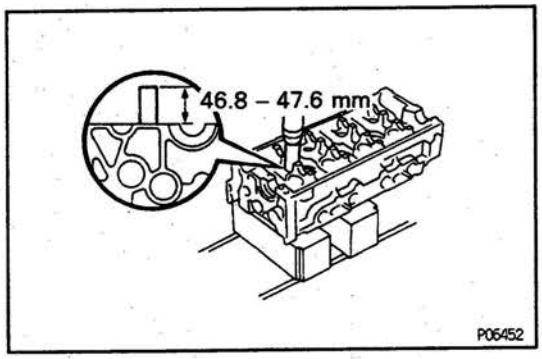
1. INSTALL SPARK PLUG TUBES

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

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

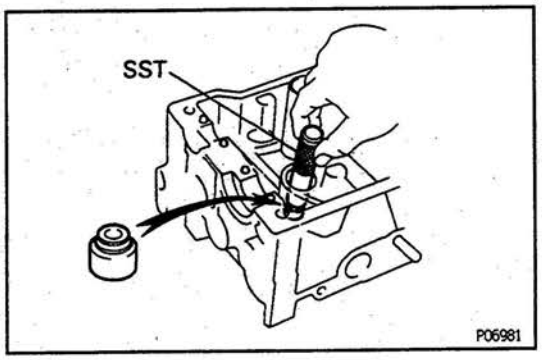
Adhesive:

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



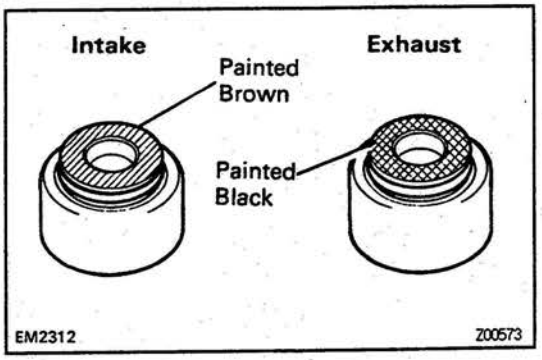
(b) Using a press, press in a new spark plug tube until there is 46.8–47.6 mm (1.843–1.874 in.) protruding from the cylinder head.

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

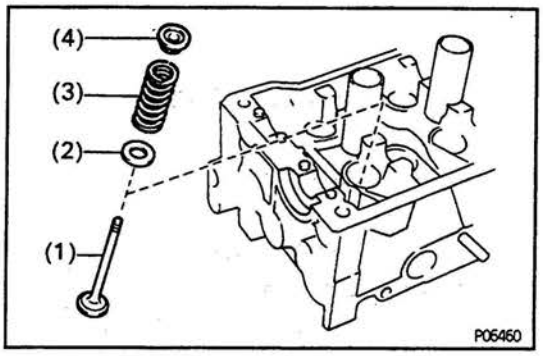


2. INSTALL VALVES

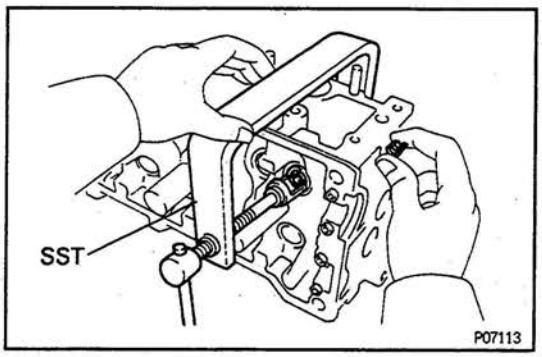
(a) Using SST, push in a new oil seal.
SST 09201–41020



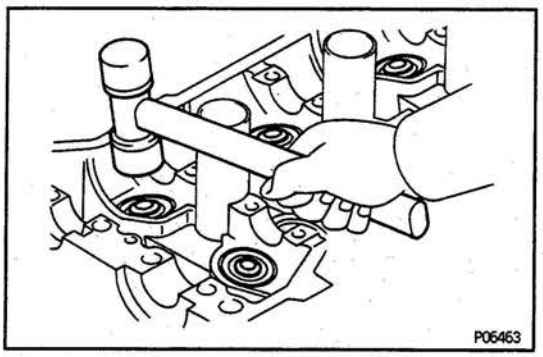
HINT: The intake valve oil seal is brown and the exhaust valve oil seal is black.



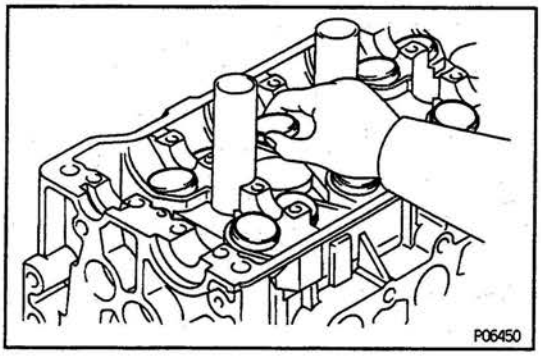
(b) Install the following parts:
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer



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



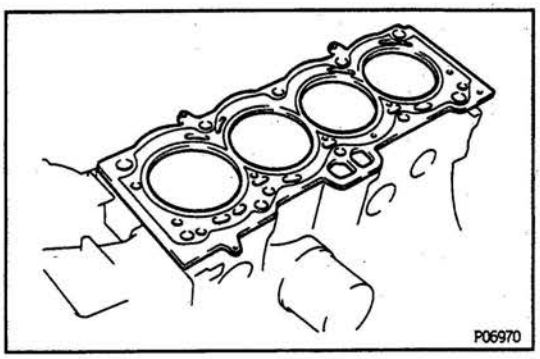
(d) Using a plastic–faced hammer, lightly tap the valve stem tip to assure proper fit.

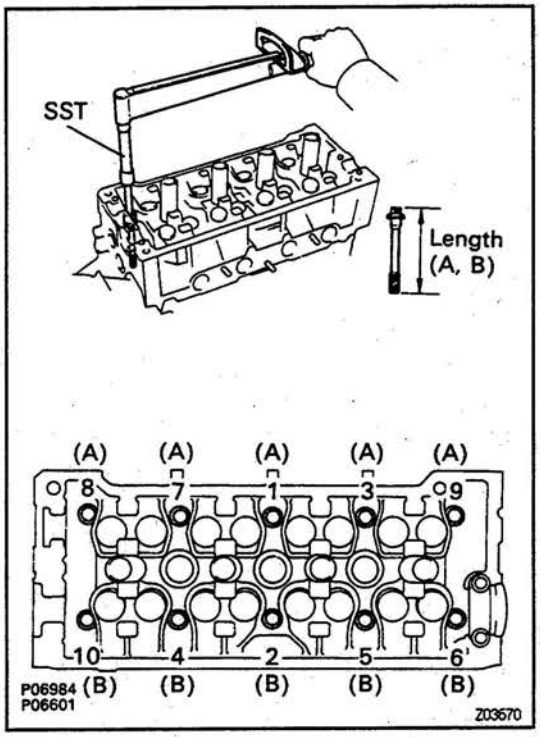


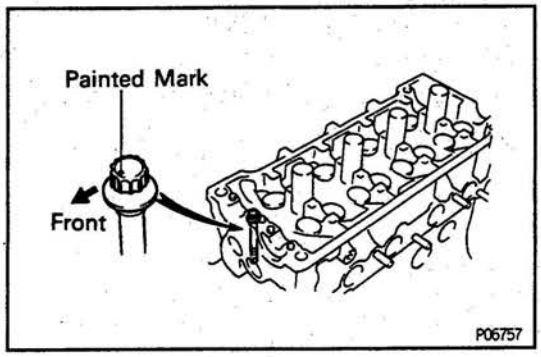
3. INSTALL VALVE LIFTERS AND SHIMS

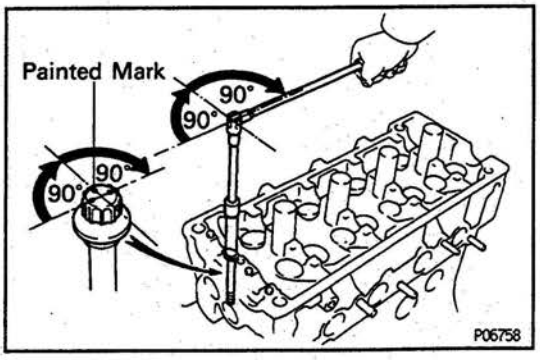
(a) Install the valve lifter and shim.
(b) Check that the valve lifter rotates smoothly by hand.

EG









CYLINDER HEAD INSTALLATION

E0288-01

(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 three progressive steps (steps (b), (d) and (e)).
- If any bolts is broken or deformed, replace it.

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

(b) Using SST, install and uniformly tighten the cylinder head bolts in several passes, in the sequence shown.

SST 09205−16010

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

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

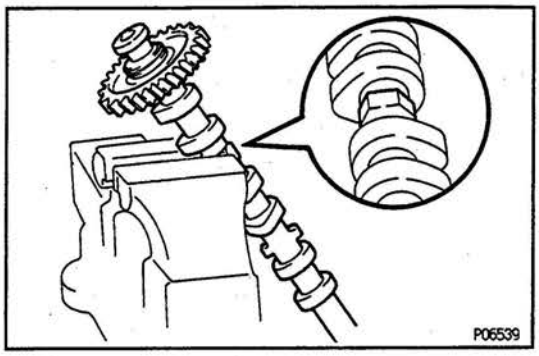
HINT: Cylinder head bolts are in length of 90 mm (3.54 in.) and 108 mm (4.25 in.). Install the 90 mm (3.54 in.) bolts (A) in intake manifold side positions. Install the 108 mm (4.25 in.) bolts (B) in exhaust manifold side positions.

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

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

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

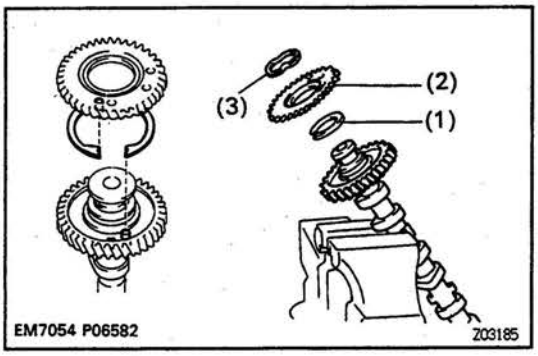
(f) Check that the painted mark is now facing rearward.



2. ASSEMBLE INTAKE CAMSHAFT

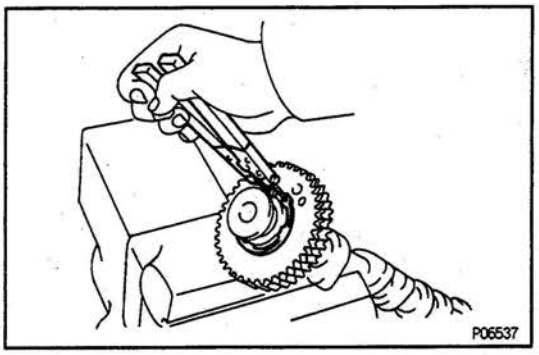
(a) Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE: Be careful not to damage the camshaft.

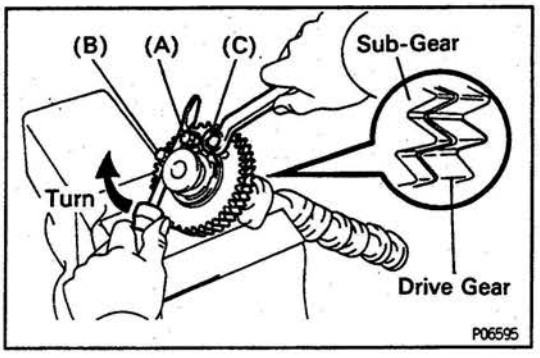


(b) Install the following parts:
(1) Camshaft gear spring
(2) Camshaft sub–gear
(3) Wave washer

HINT: Align the pins on the gears with the gear spring ends.



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



(d) Insert service bolts (A) and (B) into the service hole of the camshaft sub–gear.

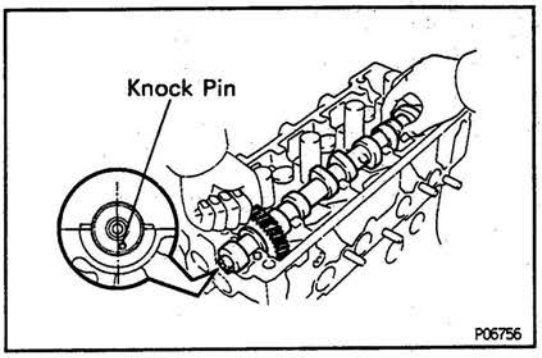
(e) Using a screwdriver, align the holes of the camshaft drive gear and sub–gear by turning camshaft sub–gear clockwise, and install a service bolt (C).

NOTICE: Be careful not to damage the camshaft.

(f) Remove service bolts (A) and (B).

3. INSTALL CAMSHAFTS

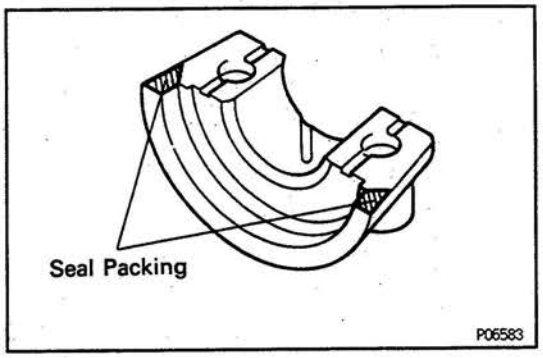
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the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



A. Install exhaust camshaft

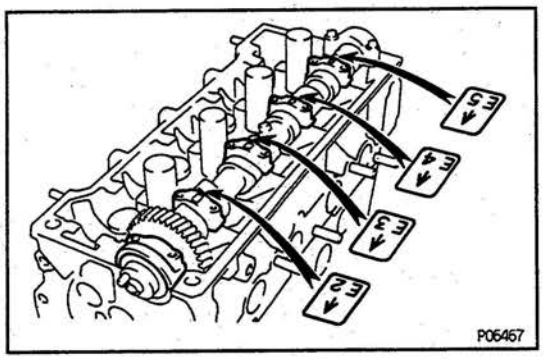
(a) Apply MP grease to the thrust portion of the camshaft.

(b) Place the intake camshaft so that the knock pin is located slightly counterclockwise from the vertical axis of the camshaft.
HINT: The above angle allows the No.1 and No.3 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.

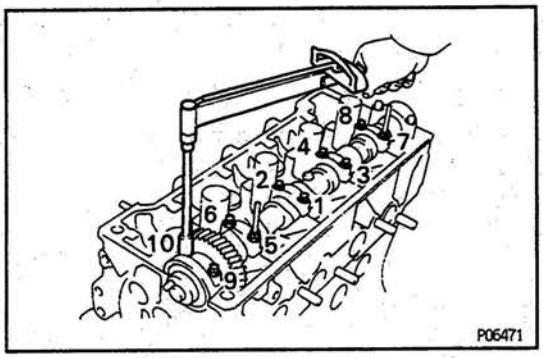


(c) Remove any old packing (FIPG) material.

(d) Apply seal packing to the cylinder head as shown in the illustration.
Seal packing:
Part No. 08826–00080 or equivalent

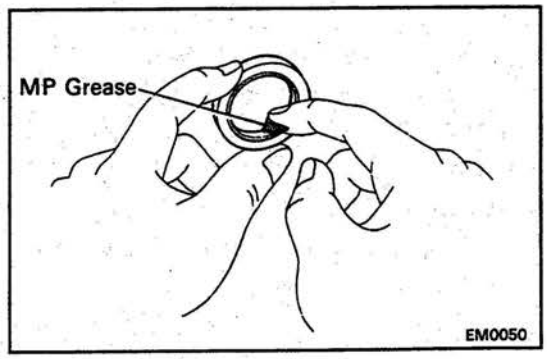


(e) Install the five bearing caps in their proper locations.

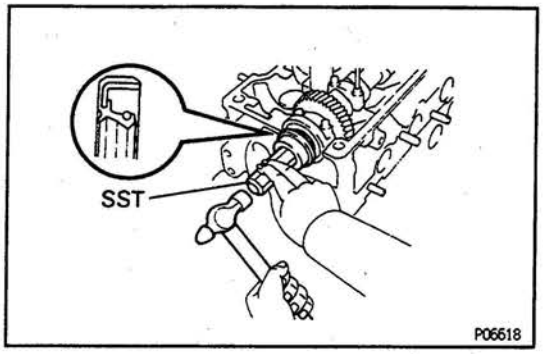


(f) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

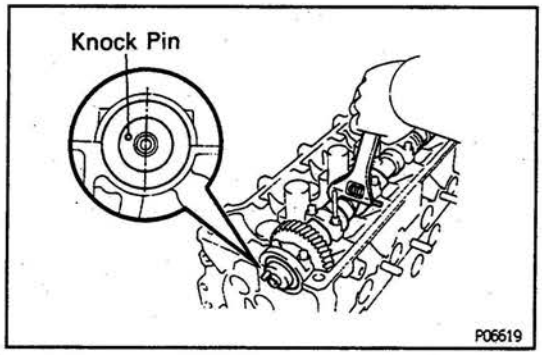
(g) Install and uniformly tighten the ten bearing cap bolts in several passes, in the sequence shown.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)



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

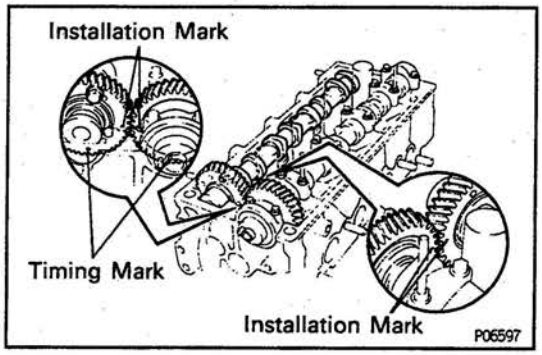


(i) Using SST, tap in the oil seal.
SST 09223–46011
HINT:
- Do not install the oil seal with the lip facing the wrong direction.
- Insert the oil seal into the deepest part of the cylinder head.



B. Install intake camshaft

(a) Set the intake camshaft so that the knock pin is slightly above the top of the cylinder head.

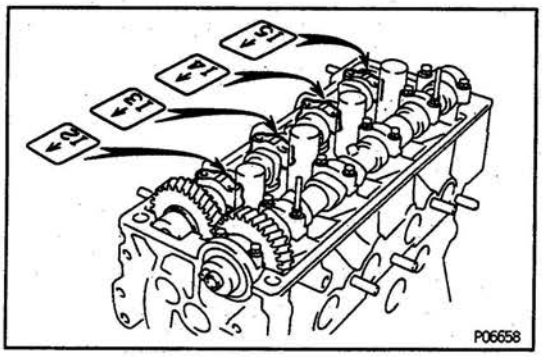


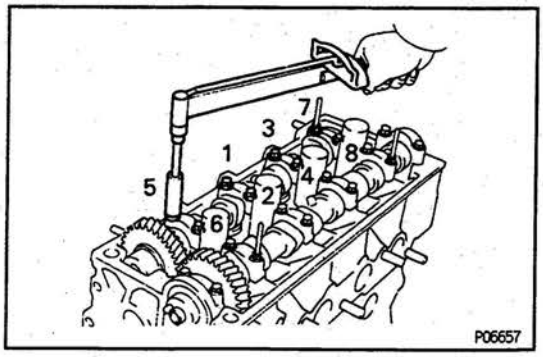
(b) Apply MP grease to the thrust portion of the camshaft.

(c) Engage the intake camshaft gear to the exhaust camshaft gear by matching the assembly installation marks on each gear.
NOTICE: There are also timing marks (for TDC) on each gear as shown in the illustration. Do not use these marks.

(d) Roll down the intake camshaft onto the bearing journals while engaging gears with each other.
HINT: The above angle allows the No.1 and No.3 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.

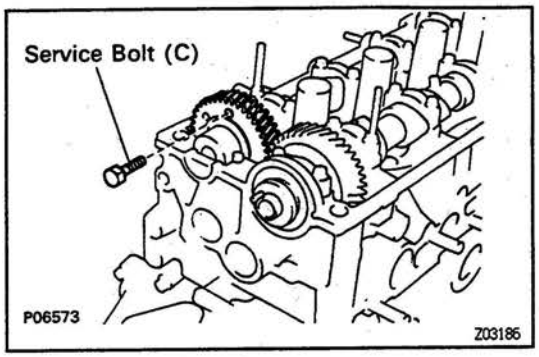
(e) Install the four bearing caps in their proper locations.



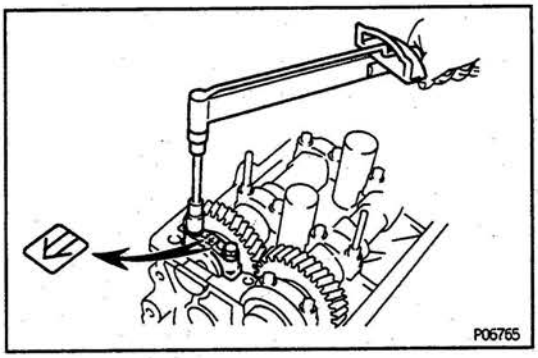


(f) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

(g) Install and uniformly tighten the eight bearing cap bolts in several passes, in the sequence shown.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)



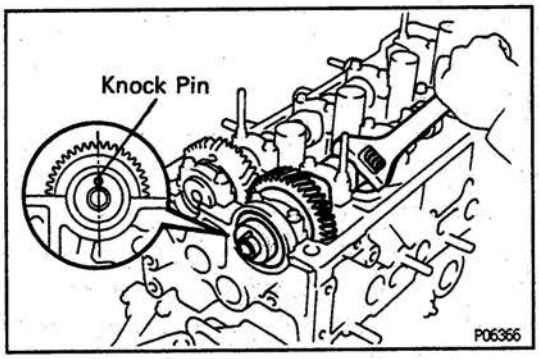
(h) Remove the service bolt (C).



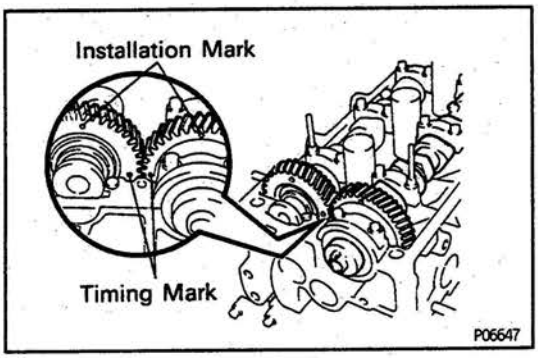
(i) Install the No.1 bearing cap with the arrow mark facing forward.
NOTICE: If the No.1 bearing cap does not fit properly, push the camshaft gear backwards by prying apart the cylinder head and camshaft gear with a screwdriver.

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

(k) Install and alternately tighten the two bolts in several passes.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)

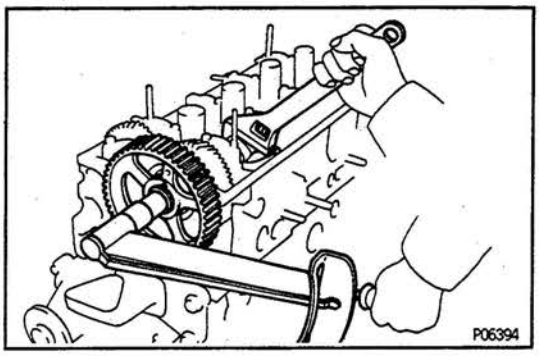


(l) Turn the exhaust camshaft clockwise, and set it with knock pin facing upward.



(m) Check that the timing marks of the camshaft gears are aligned.
HINT: The assembly installation marks are on the upside.

4. CHECK AND ADJUST VALVE CLEARANCE
(See page EG–16)
Turn the camshaft and position the cam lobe upward, and check and adjust the valve clearance.
Valve clearance (Cold):
Intake
0.15 – 0.25 mm (0.006 – 0.010 in.)
Exhaust
0.25 – 0.35 mm (0.010 – 0.014 in.)



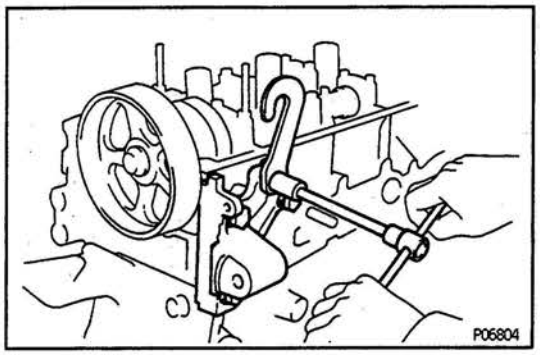
5. INSTALL CAMSHAFT TIMING PULLEY

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

(b) Temporarily install the timing pulley bolt.

(c) Hold the hexagon wrench head portion of the camshaft with a wrench, and tighten the timing pulley bolt.

Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)

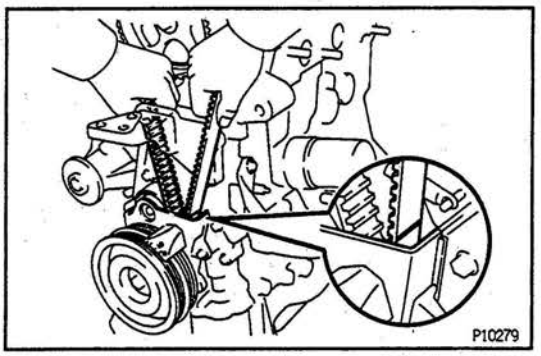


6. INSTALL ALTERNATOR BRACKET AND ENGINE HANGER

Install the alternator braket and engine hanger with the four bolts.

Torque: 26 N·m (270 kgf·cm, 20 ft·lbf) for bracket

Torque: 27 N·m (280 kgf·cm, 20 ft·lbf) for hanger

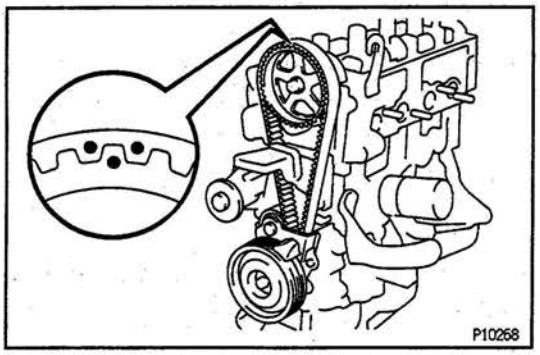


7. INSTALL TIMING BELT

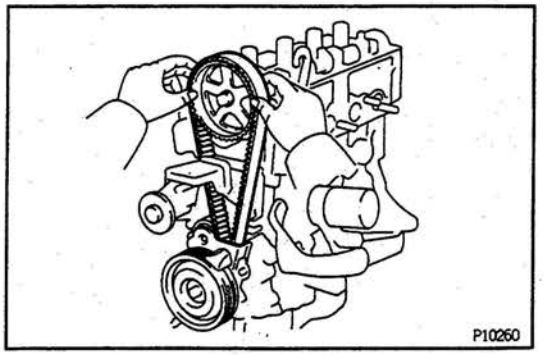
HINT (When re–using timing belt):

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

If the matchmarks does not align, shift meshing of the timing pulley until they align.

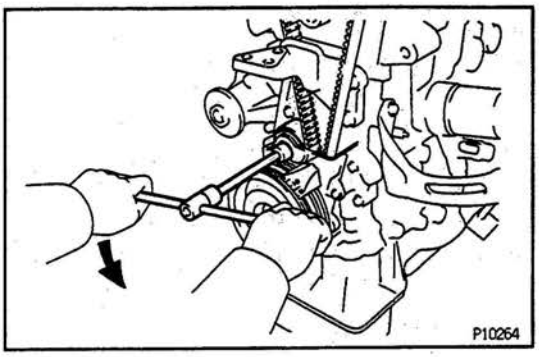


- Align the matchmarks of the timing belt and camshaft timing pulley.



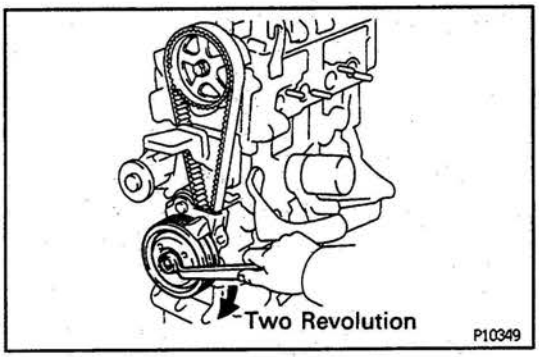
(a) Remove any oil or water on the camshaft timing pulley, and keep it clean.

(b) Install the timing belt, checking the tension between the crankshaft timing pulley and camshaft timing pulley.

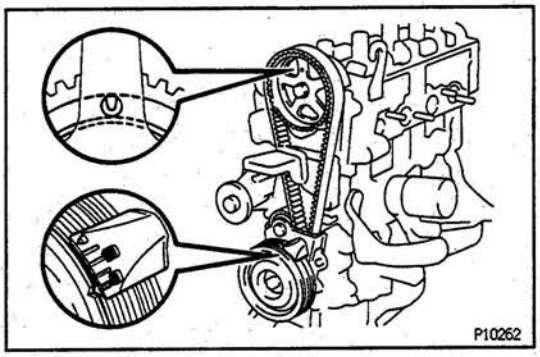


8. CHECK VALVE TIMING

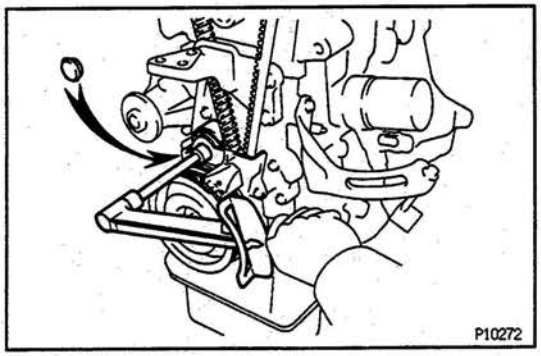
(a) Loosen the idler pulley bolt.



(b) Slowly turn the crankshaft two revolutions from TDC to TDC.
HINT: Always turn the crankshaft clockwise.

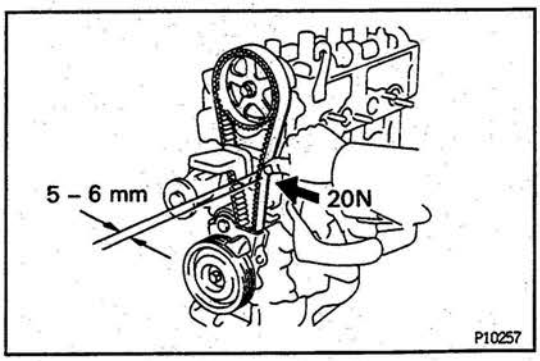


(c) Check the each pulley aligns with the timing marks as shown in the illustration.
If the timing marks do not align, remove the timing belt and reinstall it.



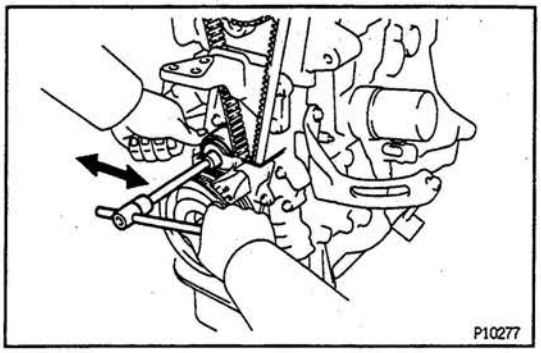
(d) Tighten the idler pulley bolt.
Torque: 37 N·m (375 kgf·cm, 27 ft·lbf)

(e) Install the grommet to the No.1 timing belt cover.

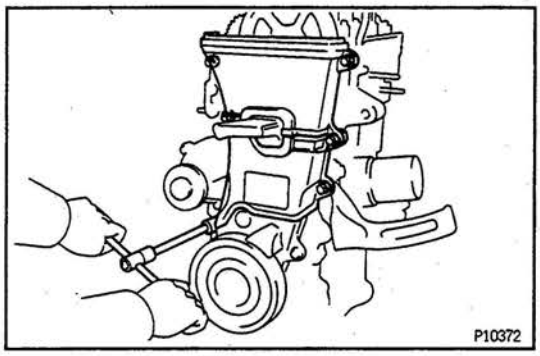


9. (Reference)
CHECK TIMING BELT DEFLECTION

Check that there is belt deflection at the position indicated in the illustration.
Deflection:
5 — 6 mm (0.20 — 0.24 in.) at 20 N (2 kgf, 4.4 lbf)

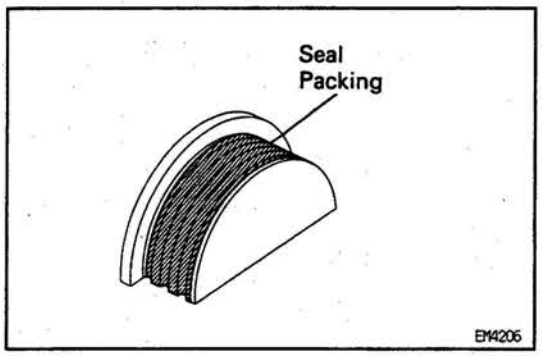


If the deflection is not as specified, readjust with the idler pulley.



10. INSTALL NO.2 AND NO.3 TIMING BELT COVERS

Install the No.2, and No.3 timing belt covers with the six bolts.



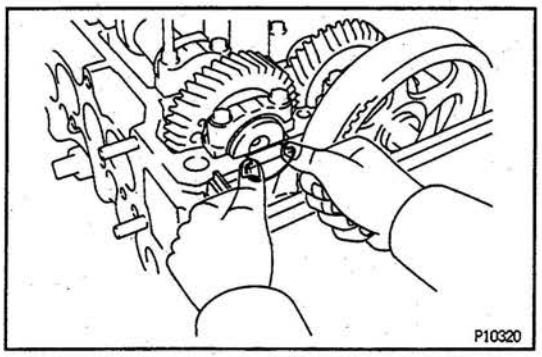
11. INSTALL SEMI—CIRCULAR PLUG

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

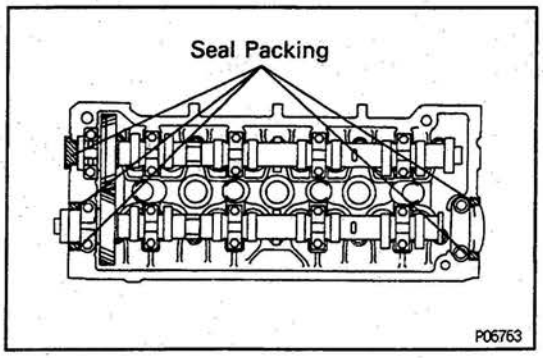
(b) Apply seal packing to the circular plug.

Seal packing:

Part No. 08826—00080 or equivalent



(c) Install the semi—circular plug to the cylinder head.



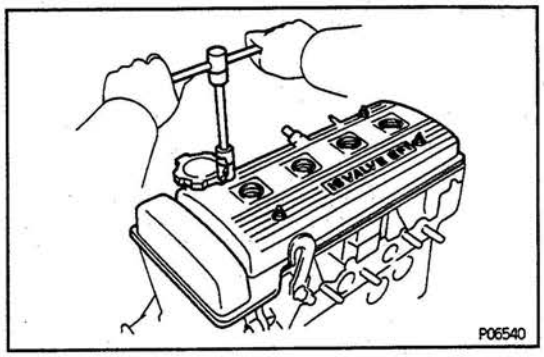
12. INSTALL CYLINDER HEAD COVER

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

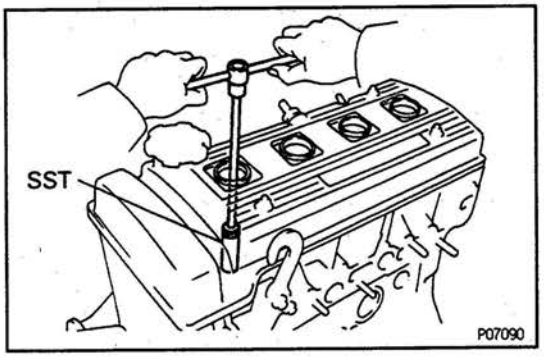
(b) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing:

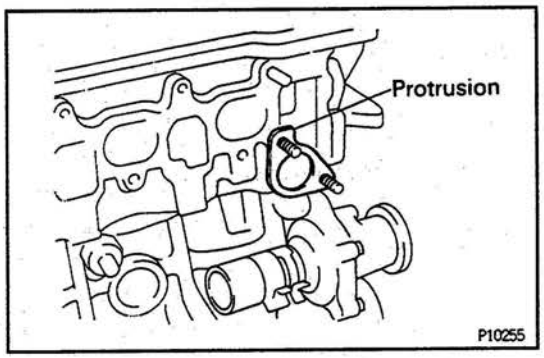
Part No. 08826—00080 or equivalent



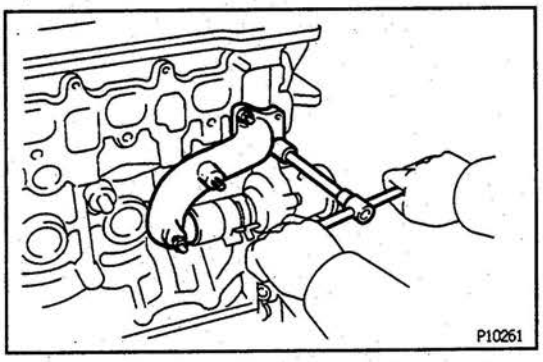
(c) Install the gasket to the cylinder head cover.
(d) Install the cylinder head cover with the four seal washers and cap nuts.
Uniformly tighten the cap nuts in several passes.
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)



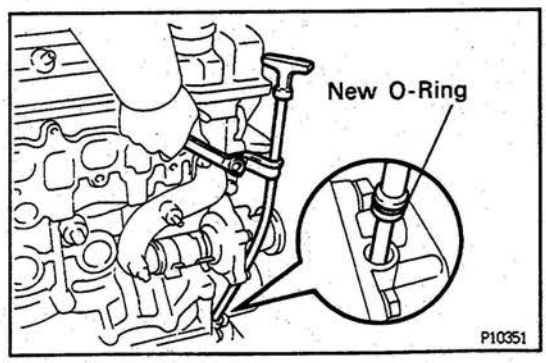
13. INSTALL SPARK PLUGS
(a) Using SST, install the four plugs.
SST 09155–16100
(b) Connect the four high–tension cords to the spark plugs.



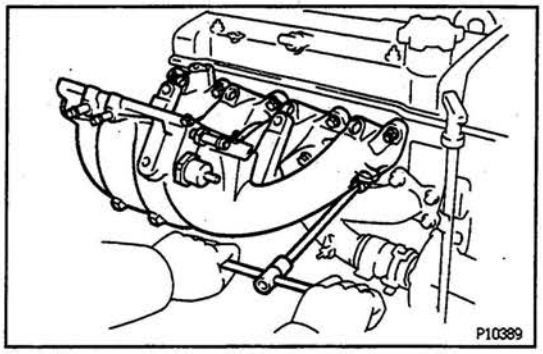
14. INSTALL NO.2 WATER INLET
(a) Place a new gasket to the cylinder head, facing the protrusion upward.



(b) Connect the water inlet to the water inlet hose.
(c) Install the water inlet with the two nuts.
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)



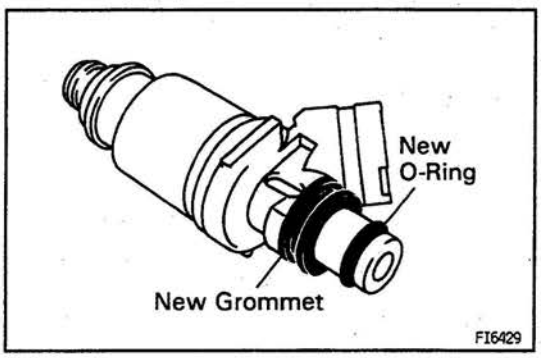
15. INSTALL OIL DIPSTICK GUIDE AND DIPSTICK
(a) Install a new O–ring to the dipstick guide.
(b) Apply a small amount of engine oil to the O–ring.
(c) Push in the dipstick guide together with the dipstick, and install them with the bolt.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



16. INSTALL INTAKE MANIFOLD

Install a new gasket and the intake manifold with the seven bolts and two nuts. Uniformly tighten the bolts and nuts in several passes.

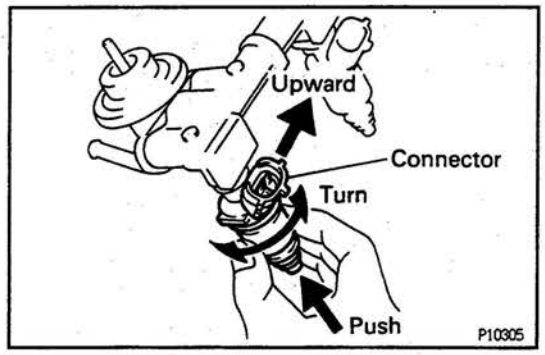
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



17. INSTALL INJECTORS AND DELIVERY PIPE

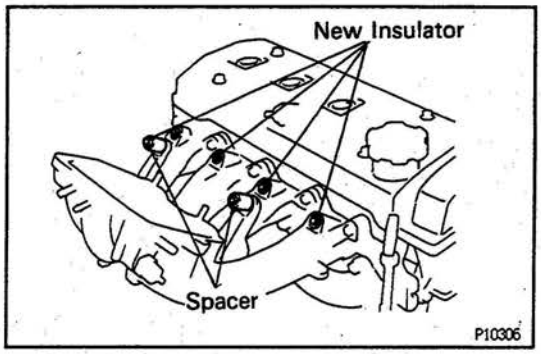
(a) Install a new grommet to the injector.

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

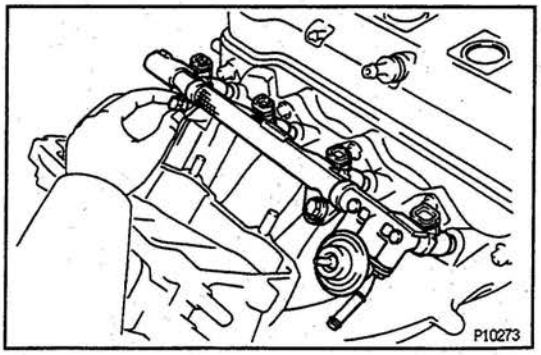


(c) While turning the injector left and right, install it to the delivery pipe. Install the four injectors.

(d) Position the injector connector upward.

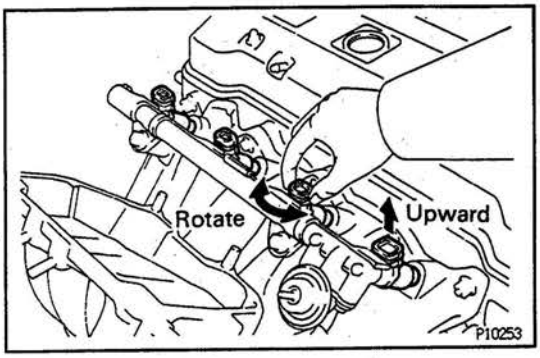


(e) Place four new insulators and the two spacers in position on the intake manifold.



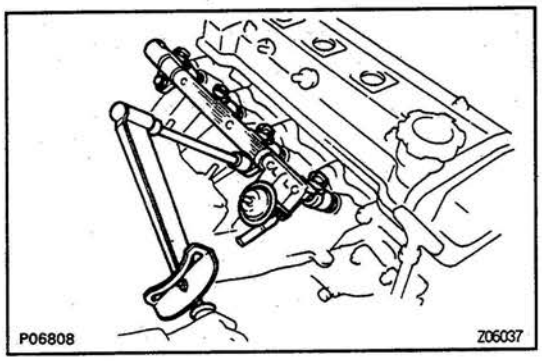
(f) Place the four injectors together with the delivery pipe in position on the intake manifold.

(g) Temporarily install the two bolts holding the delivery pipe to the intake manifold.

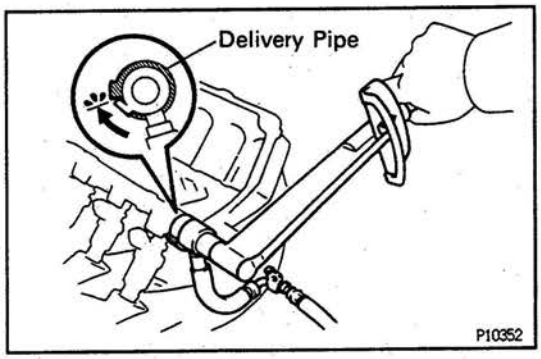


(h) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O–rings. Replace the O–rings.

(i) Position the injector connector upward.

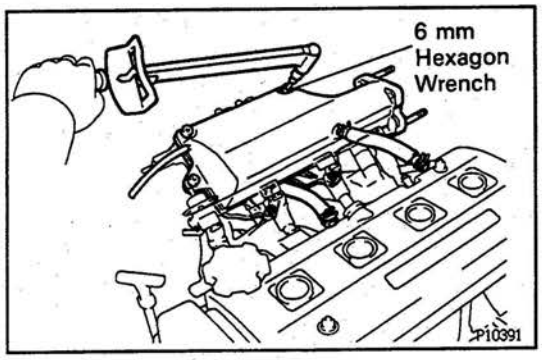


(j) Tighten the two bolts holding the delivery pipe to the intake manifold.
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)



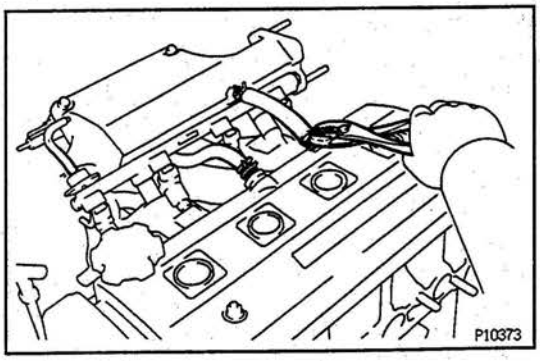
18. CONNECT FUEL INLET HOSE TO DELIVERY PIPE

Connect the inlet hose with two new gaskets and the union bolt.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)



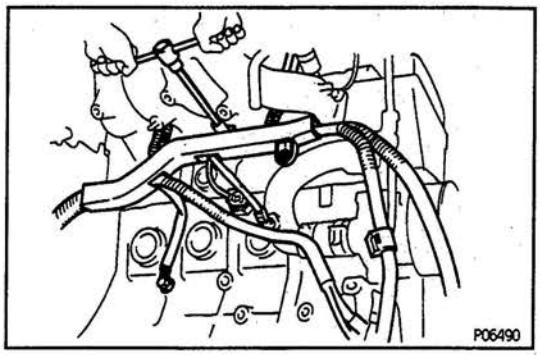
19. INSTALL AIR INTAKE CHAMBER COVER

(a) Using a 6 mm hexagon wrench, install a new gasket and air intake chamber cover with the three bolts and two nuts in the sequence shown.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)

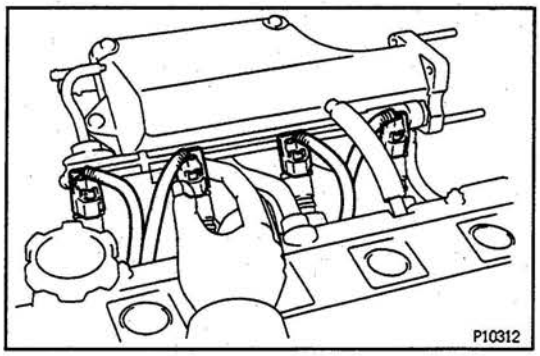


(b) Connect the two PCV hoses.

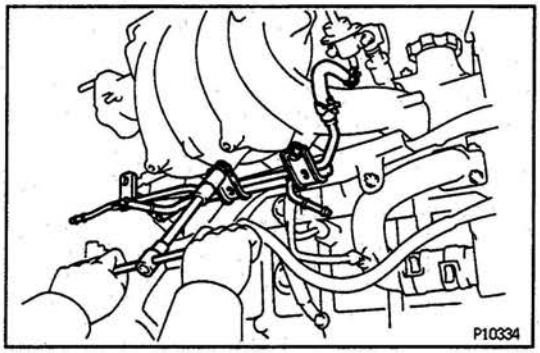
(c) Connect the vaccum sensing hose.



20. CONNECT ENGINE WIRE HARNESS



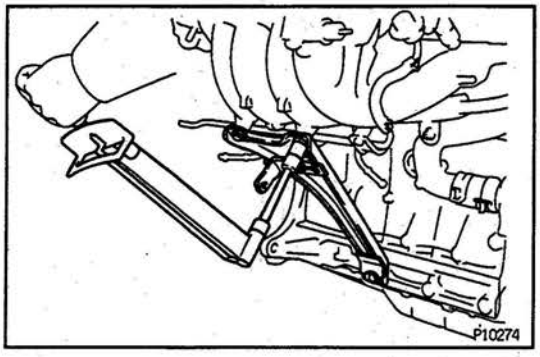
21. CONNECT INJECTOR CONNECTORS



22. INSTALL AIR PIPE

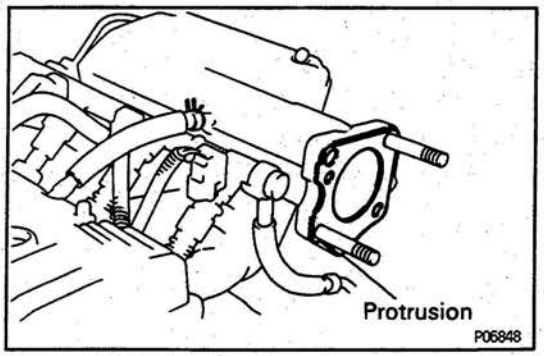
(a) Install the air pipe with the bolt and nut.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)

(b) Connect the fuel return hose to the fuel pressure regulator.



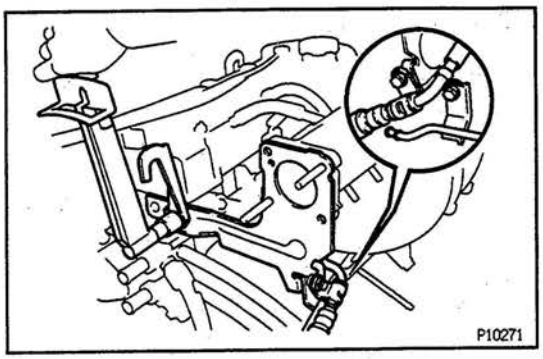
23. INSTALL INTAKE MANIFOLD STAY

Install the manifold stay with the three bolts.
Torque:
19 N·m (195 kgf·cm, 14 ft·lbf) for 12 mm bolt head
39 N·m (400 kgf·cm, 29 ft·lbf) for 14 mm bolt head



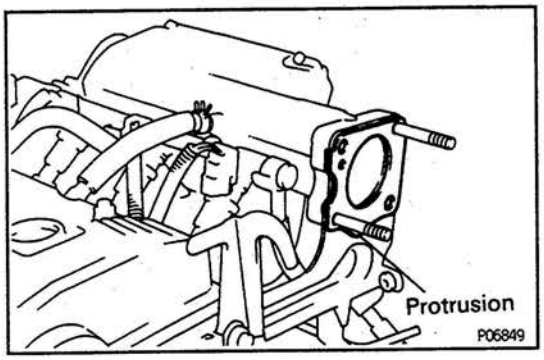
24. INSTALL AIR INTAKE CHAMBER STAY AND ENGIN HANGER

(a) Place a new gasket to the air intake chamber, facing the protrusion downward.



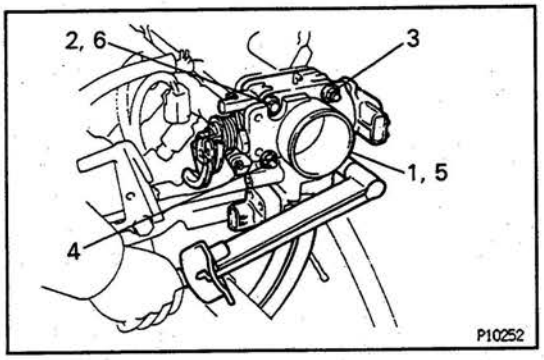
(b) Install the air intake chamber stay and engine hanger with the nut.
Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)

(c) Connect the air pipe and fuel inlet hose with the two bolts.

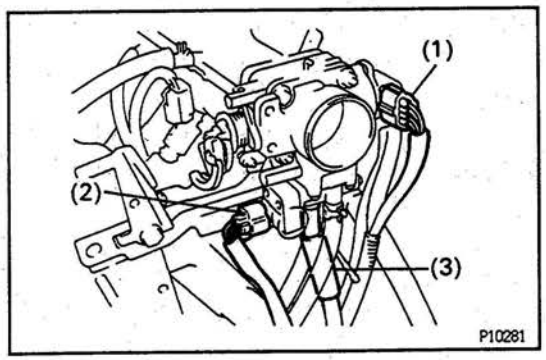


25. INSTALL THROTTLE BODY

(a) Place a new gasket to the air intake chamber, facing the protrusion downward.



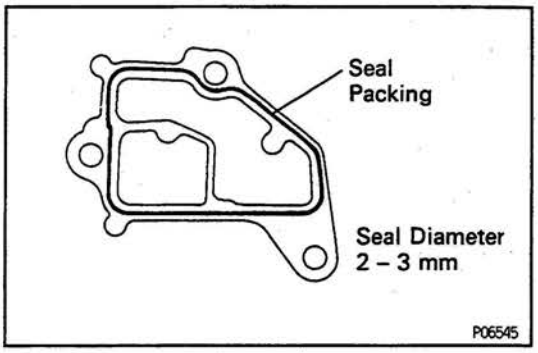
(b) Install the throttle body with the two bolts and two nuts in the sequence shown.
Torque: 22 N·m (220 kgf·cm, 16 ft·lbf)



(c) Connect the following connectors and hose:
(1) TPS connector
(2) ISC valve connector
(3) Air hose.

26. INSTALL WATER INLET AND INLET HOUSING

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the inlet housing and cylinder head.
- Using a razor blade and gasket scraper, remove all the oil packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.



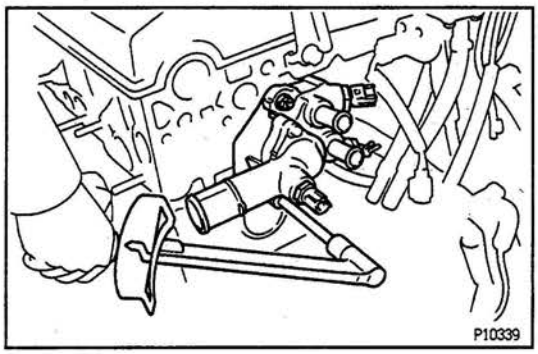
- Using a non–residue, clean both sealing surfaces.

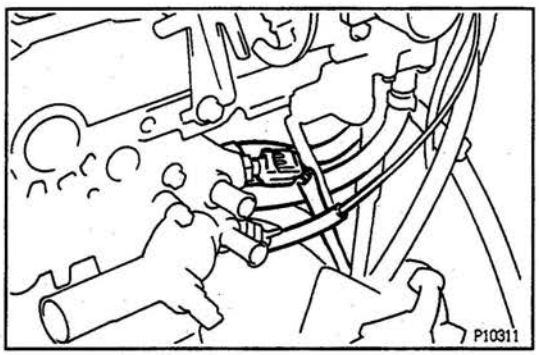
(b) Apply seal packing to the inlet housing groove.
Seal packing:
Part No. 08826–00100 or equivalent
- Install a nozzle that has been cut to a 2 – 3 mm (0.08 – 0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

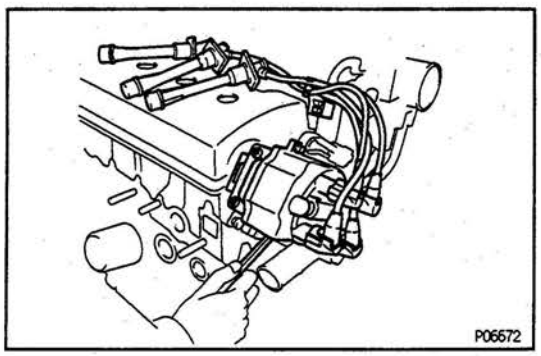
- Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

(c) Install the water inlet and inlet housing assembly with the bolt and two nuts.
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)





(d) Connect the water by–pass hose and EVAP BVSV vacuum hose (from port P of throttle body).

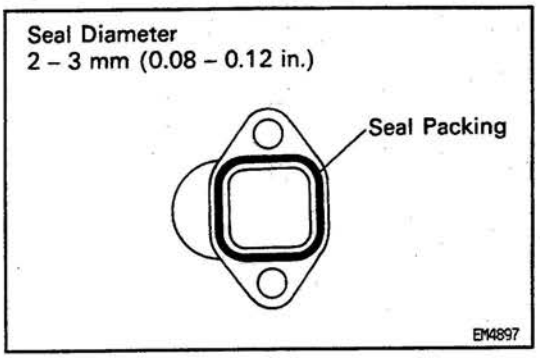


27. INSTALL IIA
(See page IG–19)

(a) Install the two bolts and IIA.
(b) Connect the four high–tension cords.

28. INSTALL WATER OUTLET

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the water outlet and cylinder head.
- Using a razor blade and gasket scraper, remove all the oil packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.

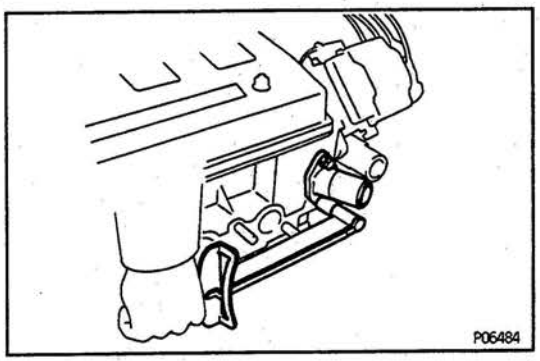


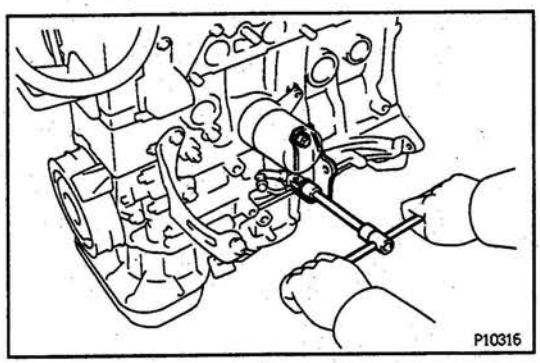
- Using a non—residue, clean both sealing surfaces.

(b) Apply seal packing to the water outlet groove.
Seal packing:
Part No. 08826—00100 or equivalent
- Install a nozzle that has been cut to a 2 — 3 mm (0.08 — 0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.
- Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

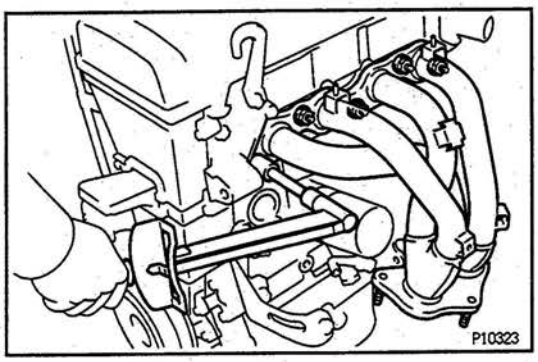
(c) Install the water outlet with the two bolts.
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)



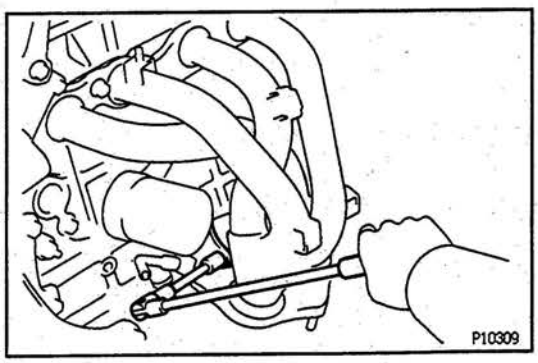


29. (AE102)
INSTALL EXHAUST MANIFOLD

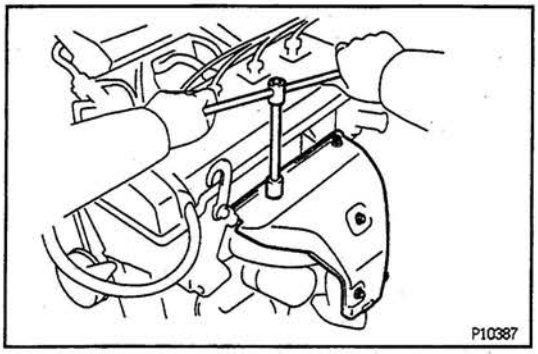
(a) Install the manifold stay with the two bolts.
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)



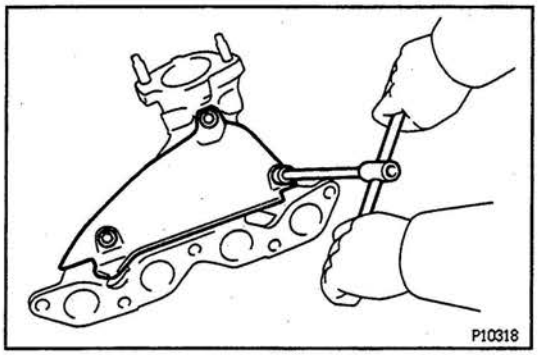
(b) Install a new gasket and the exhaust manifold with the five nuts. Uniformly tighten the nuts in several passes.
Torque: 34 N·m (350 kgf·cm, 25 ft·lbf)



(c) Install the bolt holding the manifold stay to the exhaust manifold.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

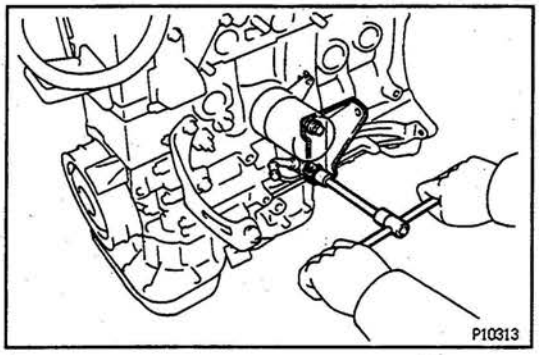


(d) Install the heat insulator with the three bolts and two nuts.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)

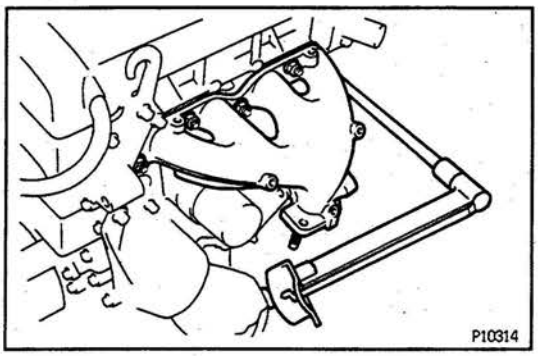


30. (AE93)
INSTALL EXHAUST MANIFOLD

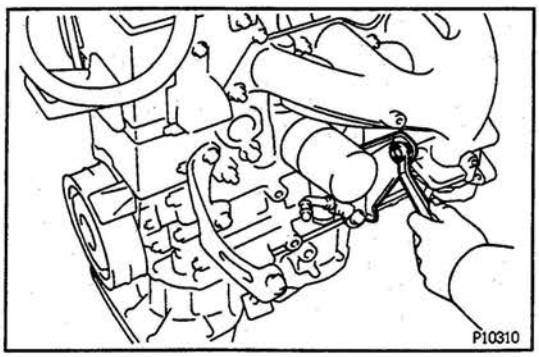
(a) Install the lower heat insulator to the exhaust manifold with the three bolts.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



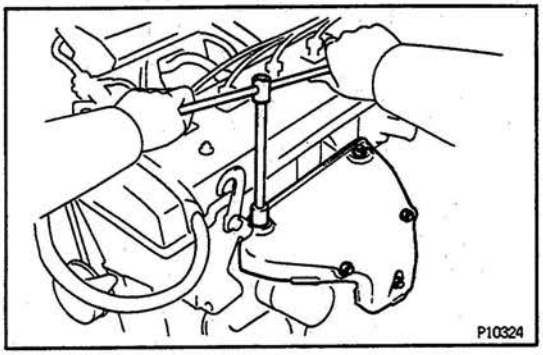
(b) Install the manifold stay with the two bolts.
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)



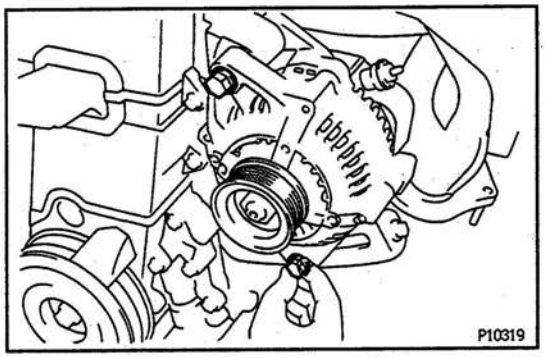
(c) Install a new gasket and the exhaust manifold with the five nuts. Uniformly tighten the nuts in several passes.
Torque: 34 N·m (350 kgf·cm, 25 ft·lbf)



(d) Install the bolt holding the manifold stay to the exhaust manifold.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

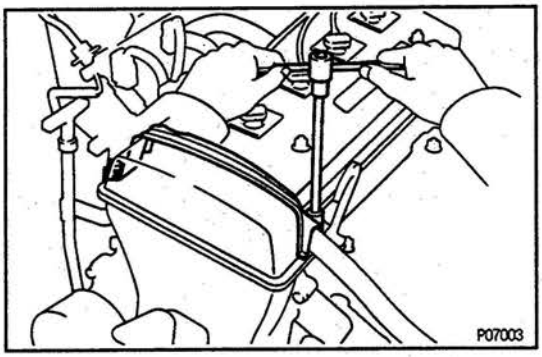


(e) Install the upper heat insulator with the five bolts.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



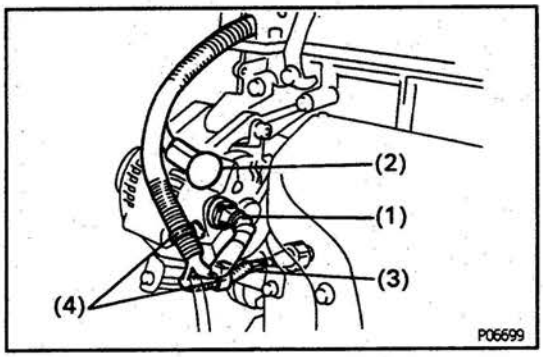
31. INSTALL ALTERNATOR

Mount the alternator on the alternator brackets with the pivot bolt and adjusting bolt. Do not tighten the bolts yet.

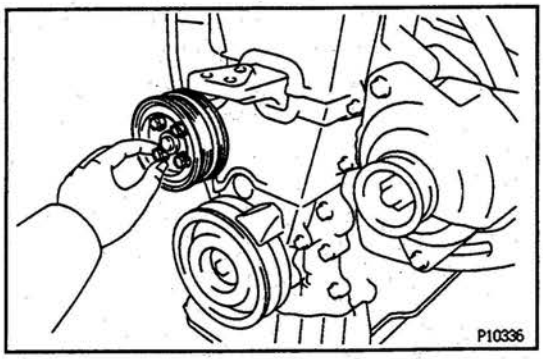


32. CONNECT ENGINE WIRE HARNESS

(a) Install the engine wire harness and wiring harness protector with the two bolts.

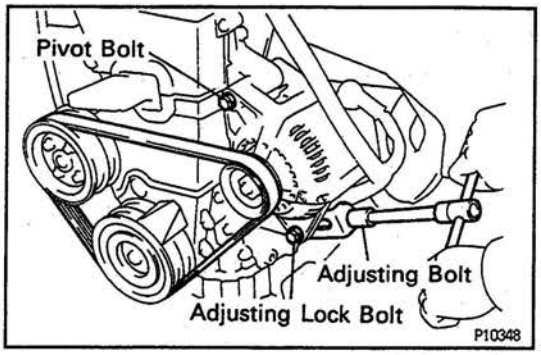


(b) Connect the following wires and clamps:
(1) Alternator connector
(2) Alternator wire
(3) Oil pressure switch connector
(4) Two wire clamps

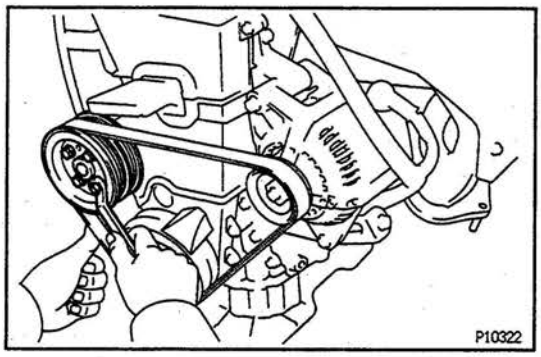


33. INSTALL WATER PUMP PULLEY AND ALTERNATOR DRIVE BELT

(a) Temporarily install water pump pulley with the four bolts.



(b) Install the drive belt with the adjusting bolt and pivot bolt.



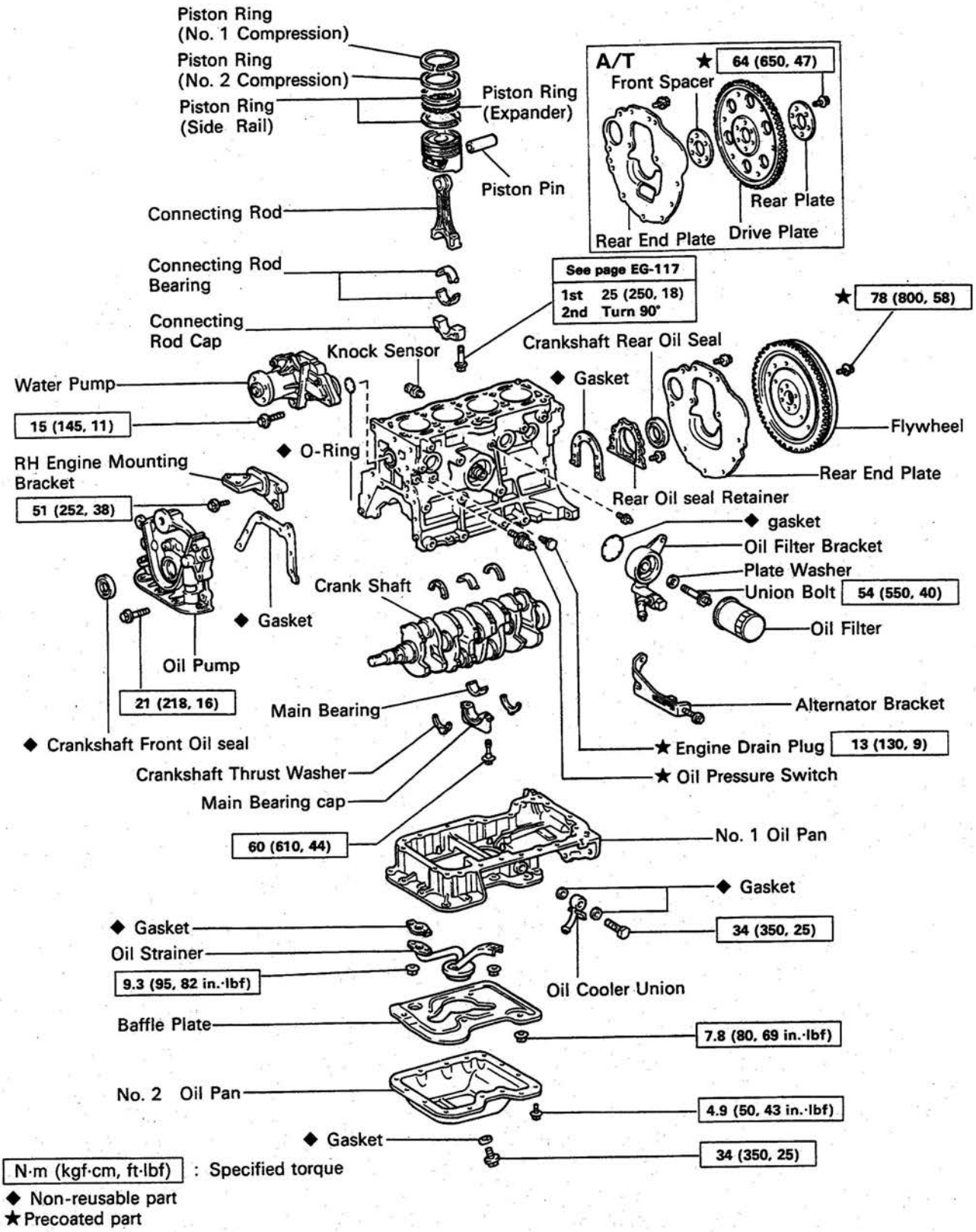
(c) Tighten the four water pump pulley bolts.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)

34. ADJUST DRIVE BELT (See page EG—15)
35. FILL WITH ENGINE COOLANT
36. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

CYLINDER BLOCK

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EG0088-02



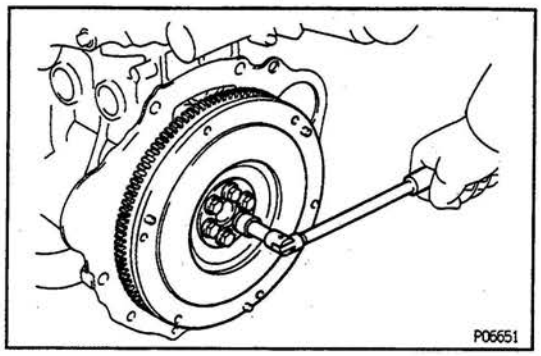
N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

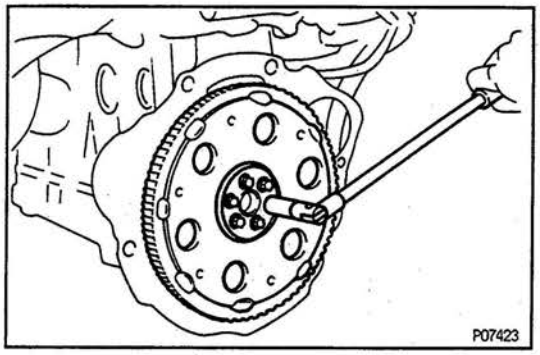
★ Precoated part

P10397

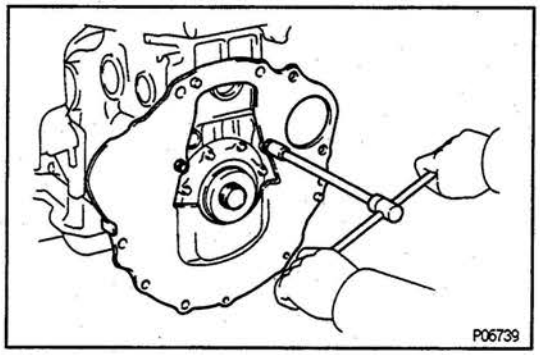
PREPARATION FOR DISASSEMBLY



1. (M/T)
   REMOVE FLYWHEEL
   Remove the six bolts and flywheel.

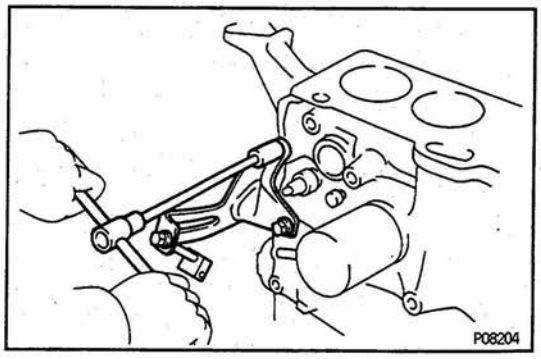


2. (A/T)
   REMOVE DRIVE PLATE
   Remove the six bolts, front spacer, drive plate and rear spacer.

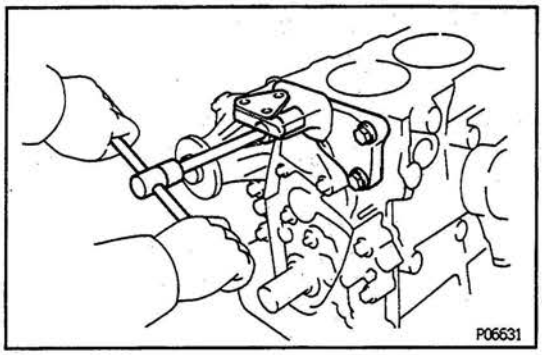


3. **REMOVE REAR END PLATE**
   Remove the two bolts and end plate.

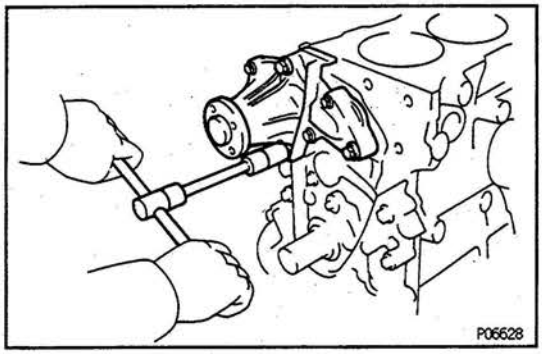
4. **INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY**
5. **REMOVE TIMING BELT AND PULLEYS**
   (See page EG–35)
6. **REMOVE CYLINDER HEAD**
   (See page EG–49)



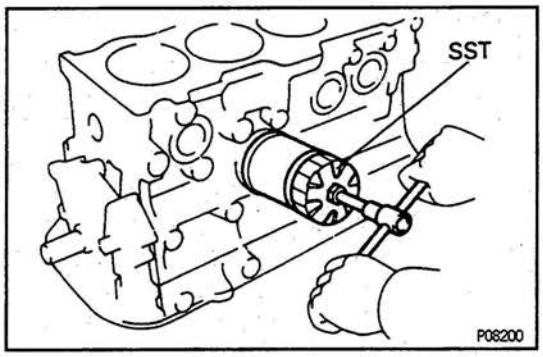
7. **REMOVE ALTERNATOR ADJUSTING BAR**
   Remove the two bolts and alternator adjusting bar.



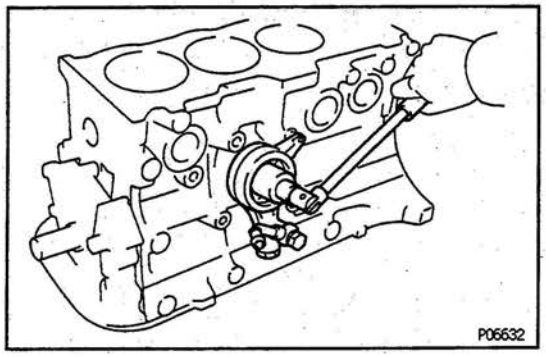
8. REMOVE RH ENGINE MOUNTING BRACKET
Remove the three bolts and mounting bracket.



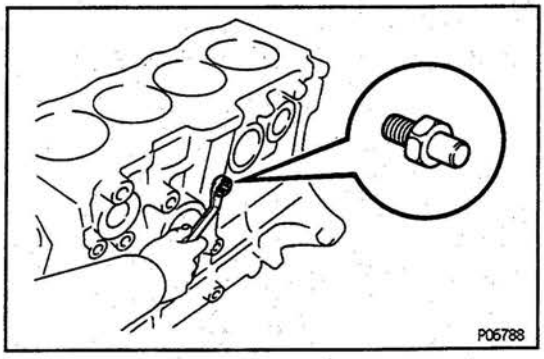
9. REMOVE WATER PUMP
(a) Remove the three bolts and water pump.
(b) Remove the O–ring.



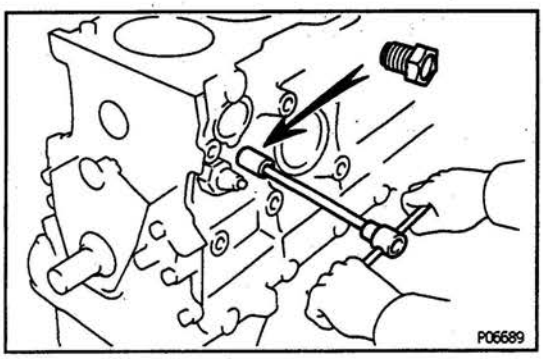
10. REMOVE OIL FILTER
Using SST, remove the oil filter.
SST 09228–06500



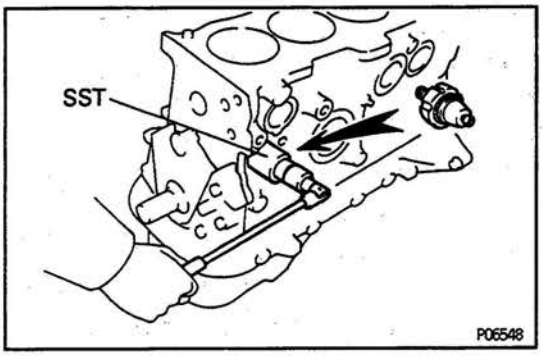
11. (W/ OIL COOLER)
REMOVE OIL FILTER BRACKET
(a) Remove the union bolt, plate washer and oil filter bracket.
(b) Remove the O–ring from the oil filter bracket.



(c) Remove the guide bolt.

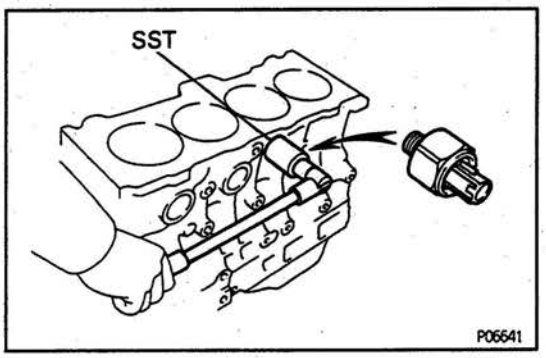


12. REMOVE ENGINE COOLANT DRAIN PLUG



13. REMOVE OIL PRESSURE SWITCH

Using SST, remove the oil pressure switch.
SST 09816–30010



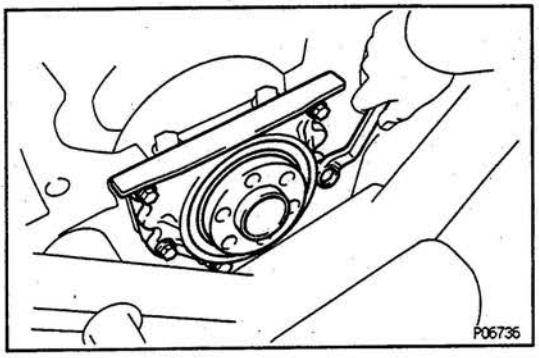
14. REMOVE KNOCK SENSOR

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

15. REMOVE OIL PAN AND OIL PUMP

(See page EG–287)

EG



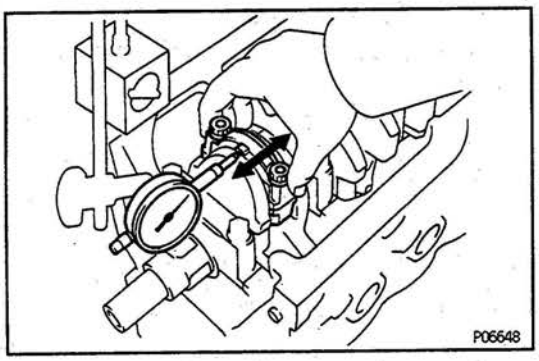
E0280-01

CYLINDER BLOCK DISASSEMBLY

(See Components for Disassembly and Assembly)

1. REMOVE REAR OIL SEAL RETAINER

Remove the six bolts, retainer and gasket.



2. CHECK CONNECTING ROD OIL CLEARANCE

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

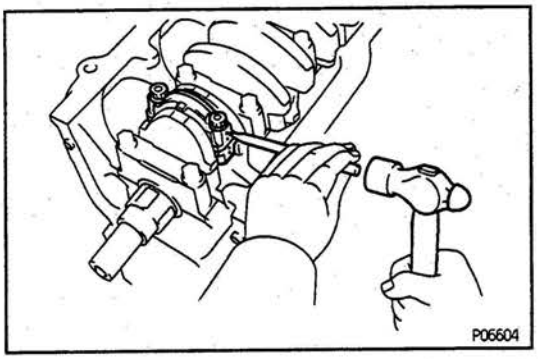
Standard thrust clearance:

0.15 — 0.25 mm (0.0059 — 0.0098 in.)

Maximum thrust clearance:

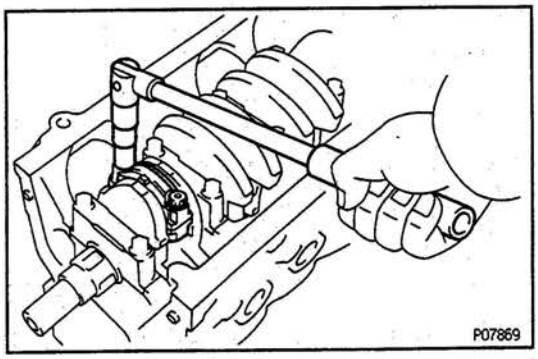
0.30 mm (0.0118 in.)

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

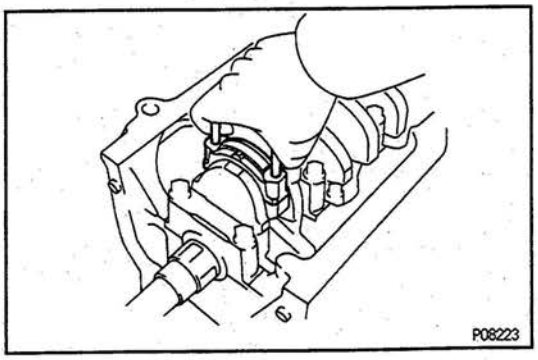


3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

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

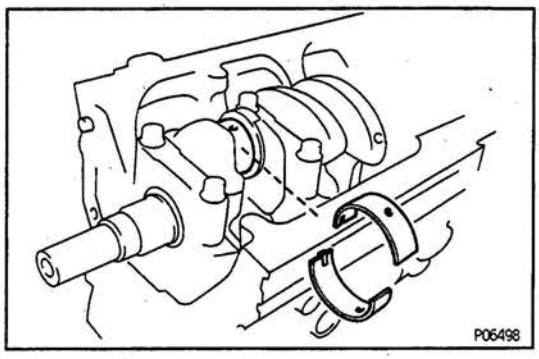


(b) Remove the connecting rod cap bolts.



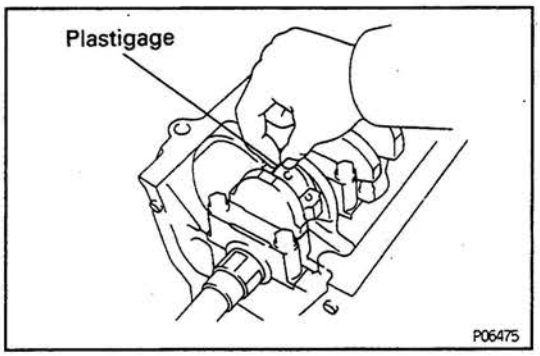
(c) Using the two removed connecting rod bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

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

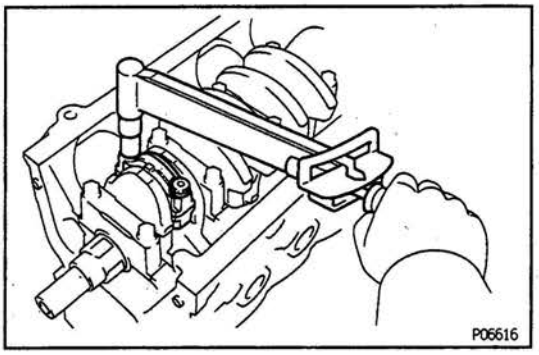


(d) Clean the crank pin and bearing.

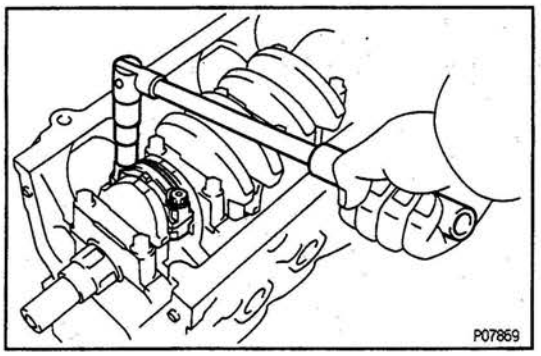
(e) Check the crank pin and bearing for pitting and scratches.
If the crank pin or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



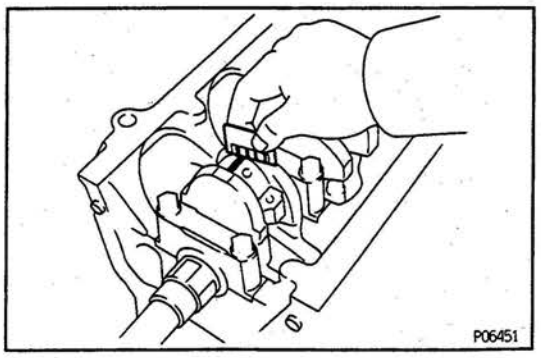
(f) Lay a strip of Plastigage across the crank pin.



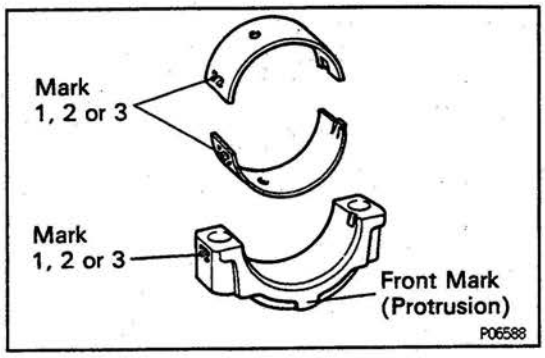
(g) Install the connecting rod cap with the two bolts.
(See step 6 on page EG−117)
1st
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)
2nd Turn 90°
NOTICE: Do not turn the crankshaft.



(h) Remove the two bolts, connecting rod cap and lower bearing.
(See procedure (b) and (c) above)



(i) Measure the Plastigage at its widest point.
Standard oil clearance:
STD
0.020 — 0.048 mm (0.0008 — 0.0019 in.)
U/S 0.25
0.019 — 0.058 mm (0.0007 — 0.0022 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 three sizes of standard bearings, marked "1", "2" and "3" accordingly.

Standard sized bearing center wall thickness:

Mark "1"

1.486 — 1.490 mm (0.0585 — 0.0587 in.)

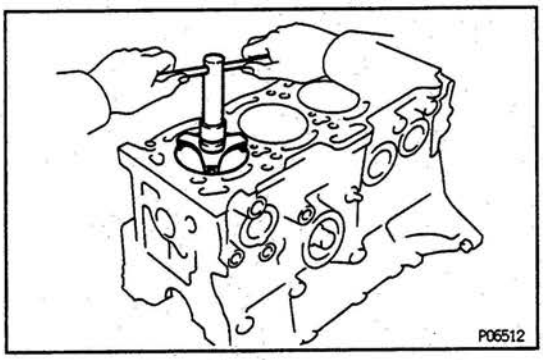
Mark "2"

1.490 — 1.494 mm (0.0587 — 0.0588 in.)

Mark "3"

1.494 — 1.498 mm (0.0588 — 0.0590 in.)

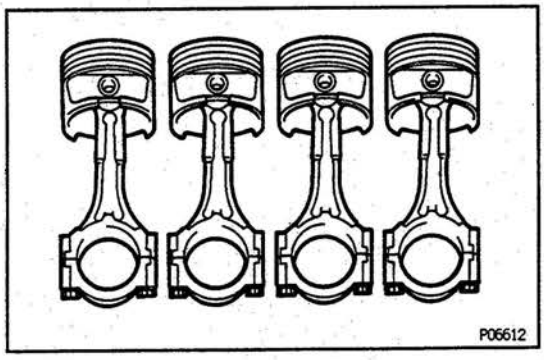
(j) Completely remove the Plastigage.



4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

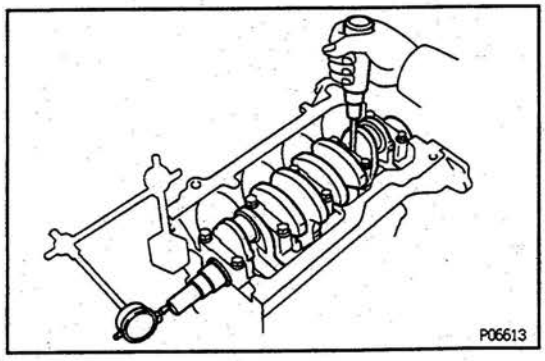
(a) Using a ridge reamer, remove all the carbon from the top of the cylinder.

(b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.



HINT:

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



5. CHECK CRANKSHAFT THRUST CLEARANCE

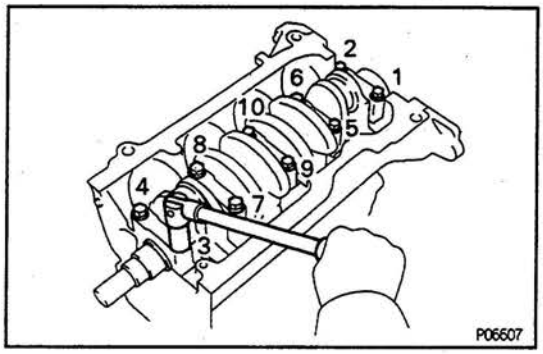
Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:

0.015 — 0.220 mm (0.0006 — 0.0087 in.)

Maximum thrust clearance:

0.30 mm (0.0118 in.)



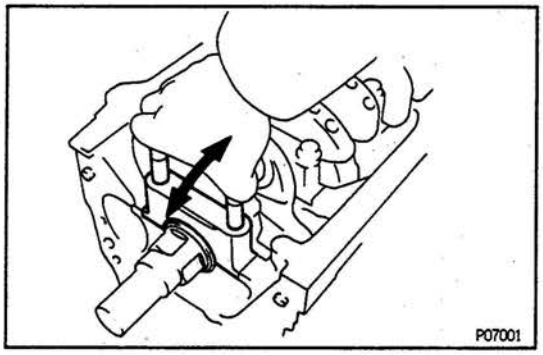
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:

2.440 — 2.490 mm (0.0961 — 0.0980 in.)

6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

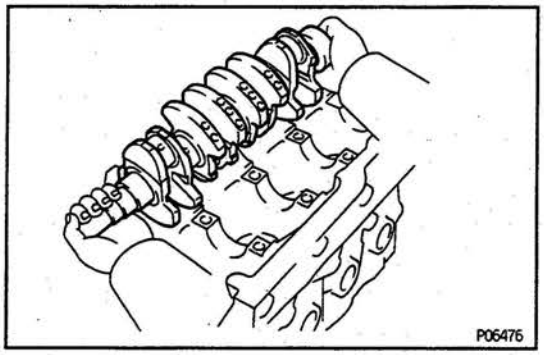
(a) Uniformly loosen and remove the main bearing cap bolts in several passes, in the sequence shown.



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

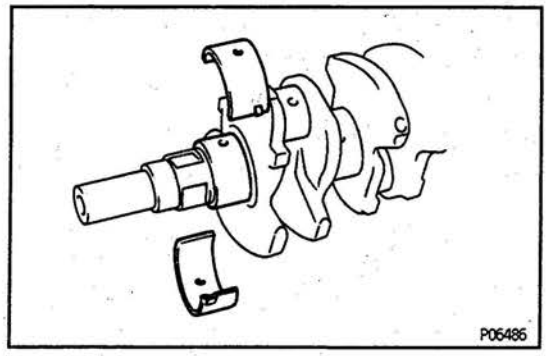
HINT:

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



(c) Lift out the crankshaft.

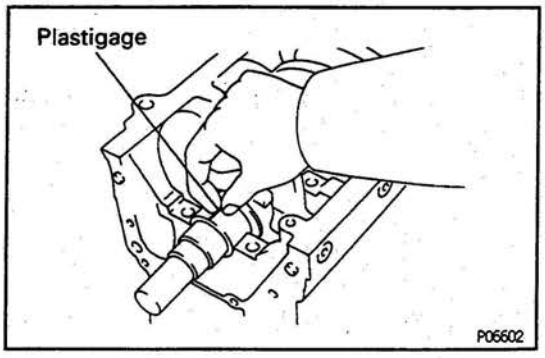
HINT: Keep the upper bearings and upper thrust washers together with the cylinder block.



(d) Clean each main journal and bearing.

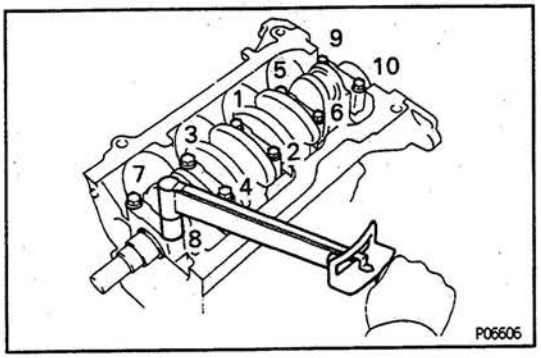
(e) Check each main journal and bearing for pitting and scratches.

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

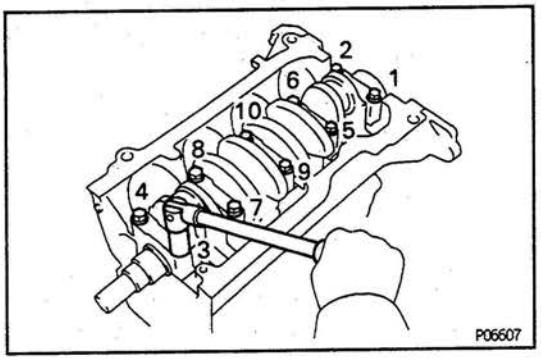


(f) Place the crankshaft on the cylinder block.

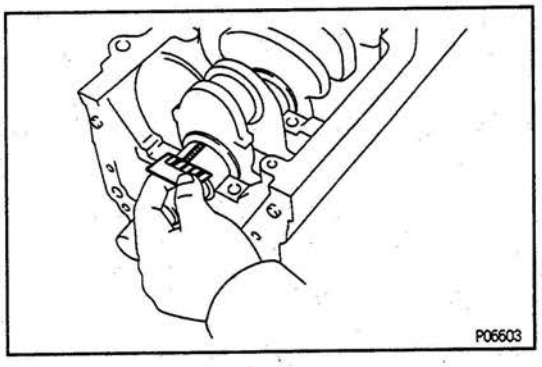
(g) Lay a strip of Plastigage across each journal.



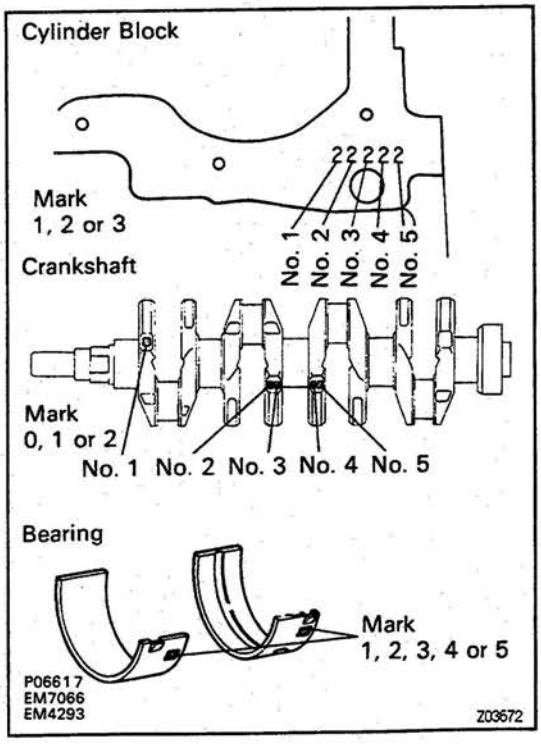
(h) Install the main bearing caps.
(See step 4 on page EG—116)
Torque: 60 N·m (610 kgf·cm, 44 ft·lbf)
NOTICE: Do not turn the crankshaft.



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



(j) Measure the Plastigage at its widest point.
Standard clearance:
STD
0.015 — 0.033 mm (0.0006 — 0.0013 in.)
U/S 0.25
0.016 — 0.056 mm (0.0006 — 0.0022 in.)
Maximum clearance:
0.08 mm (0.0031 in.)



HINT: If replacing the cylinder block subassembly, the bearing standard clearance will be:
0.015 — 0.045 mm (0.0006 — 0.0018 in.)
If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.
HINT: If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then selecting the bearing with the same number as the total. There are five sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

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

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

EG

V00240

(Reference)

Cylinder block main journal bore diameter:

Mark "1"

52.025 – 52.031 mm (2.0482 – 2.0485 in.)

Mark "2"

52.031 – 52.037 mm (2.0485 – 2.0487 in.)

Mark "3"

52.037 – 52.043 mm (2.0487 – 2.0489 in.)

Crankshaft journal diameter:

Mark "0"

47.994 – 48.000 mm (1.8895 – 1.8898 in.)

Mark "1"

47.988 – 47.994 mm (1.8893 – 1.8895 in.)

Mark "2"

47.982 – 47.988 mm (1.8891 – 1.8893 in.)

Standard sized bearing center wall thickness:

Mark "1"

2.002 – 2.005 mm (0.0788 – 0.0789 in.)

Mark "2"

2.005 – 2.008 mm (0.0789 – 0.0791 in.)

Mark "3"

2.008 – 2.011 mm (0.0791 – 0.0792 in.)

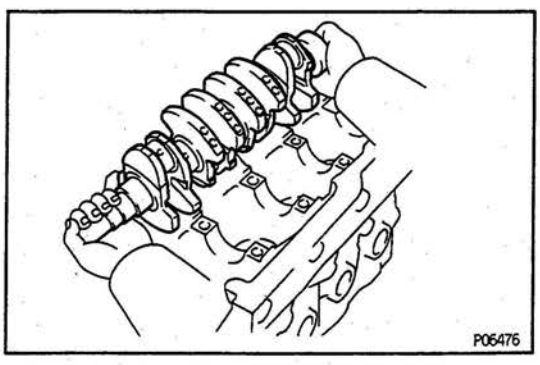
Mark "4"

2.011 – 2.014 mm (0.0792 – 0.0793 in.)

Mark "5"

2.014 – 2.017 mm (0.0793 – 0.0794 in.)

(k) Completely remove the Plastigage.

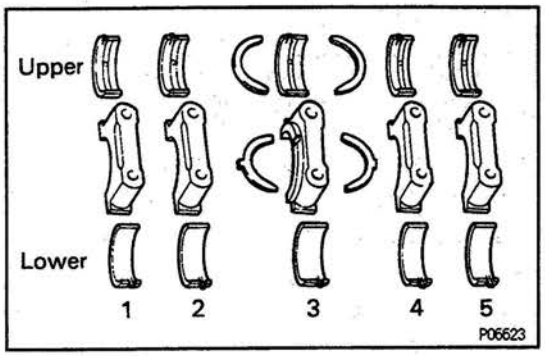


P06476

7. REMOVE CRANKSHAFT

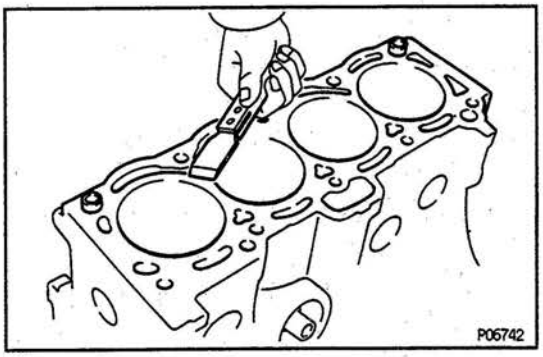
(a) Lift out the crankshaft.

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



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

EG



EG08U–07

CYLINDER BLOCK INSPECTION

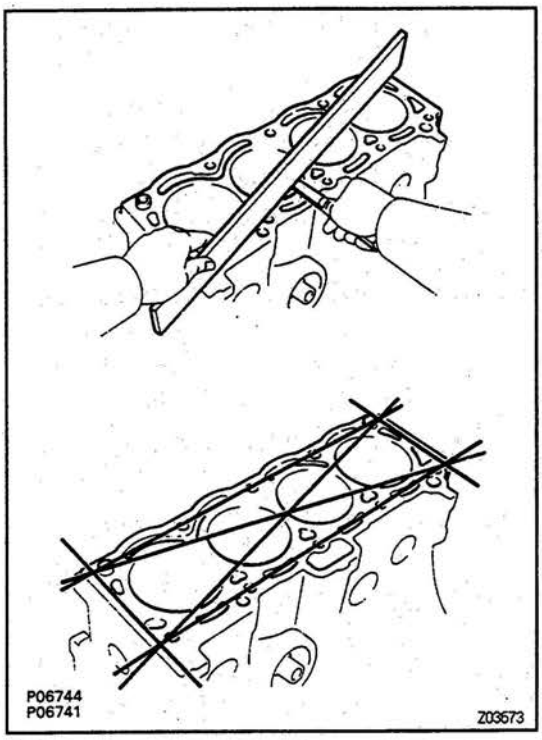
1. CLEAN CYLINDER BLOCK

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.



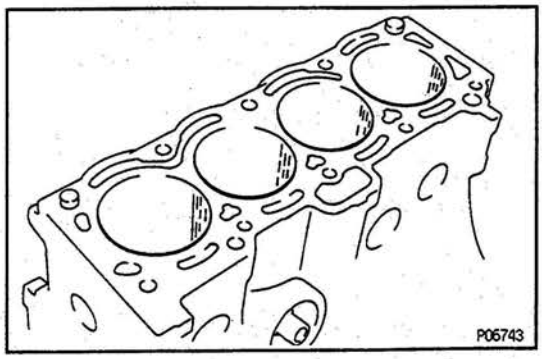
2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage:

0.05 mm (0.0020 in.)

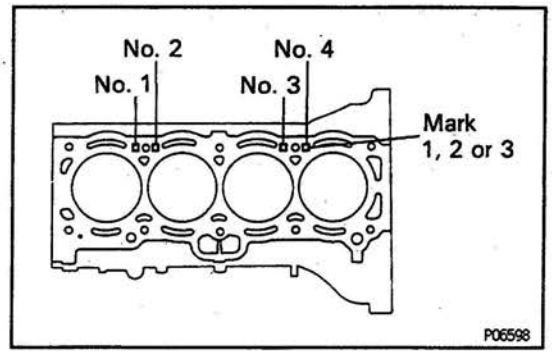
If warpage is greater than maximum, replace the cylinder block.



3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

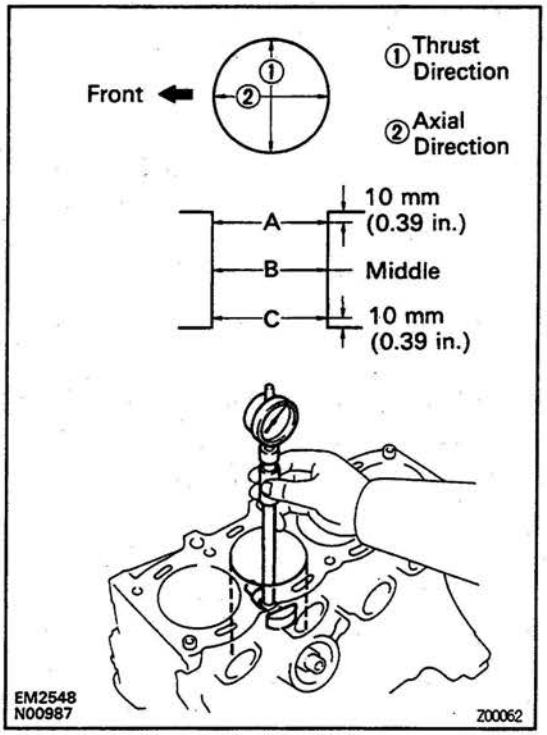
Visually check the cylinder for vertical scratches.

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



4. INSPECT CYLINDER BORE DIAMETER

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



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

Standard diameter:

STD

Mark "1"

81.000 – 81.010 mm (3.1890 – 3.1894 in.)

Mark "2"

81.010 – 81.020 mm (3.1894 – 3.1898 in.)

Mark "3"

81.020 – 81.030 mm (3.1898 – 3.1902 in.)

Maximum diameter:

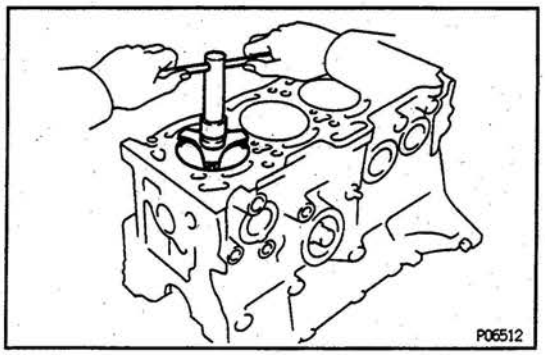
STD

81.23 mm (3.1982 in.)

O/S 0.50

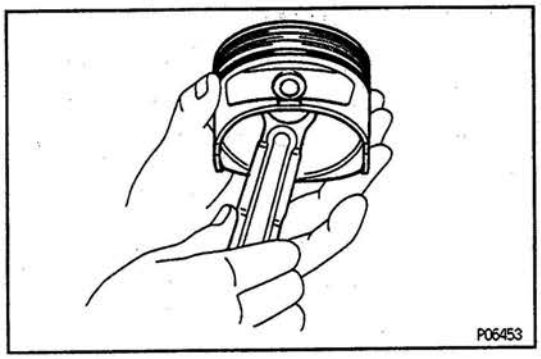
81.73 mm (3.2177 in.)

If the diameter is greater than maximum, rebore all the four 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.

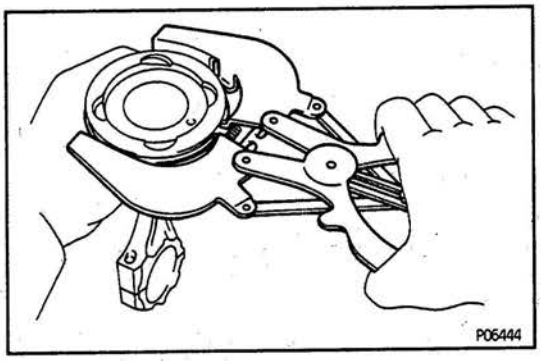


PISTON AND CONNECTING ROD DISASSEMBLY

1. CHECK FIT BETWEEN PISTON AND PISTON PIN

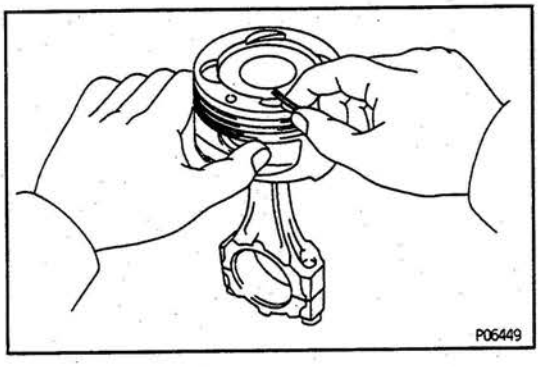
Try to move the piston back and forth on the piston pin.

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

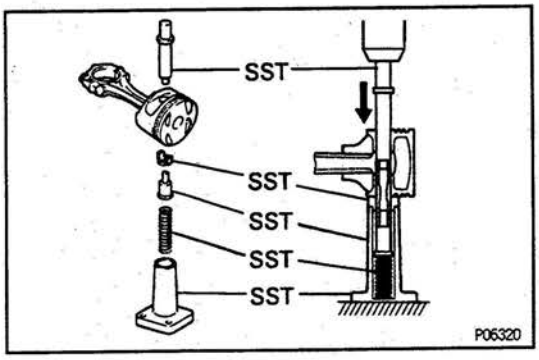


2. REMOVE PISTON RINGS

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



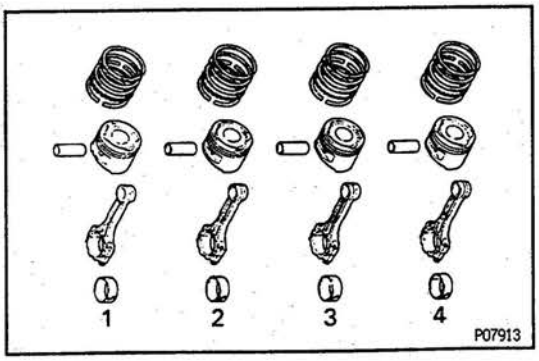
(b) Remove the two side rails and oil ring by hand.
HINT: Arrange the piston rings in correct order only.



3. DISCONNECT CONNECTING ROD FROM PISTON

Using SST, press out the piston pin from the piston. Remove the connecting rod.

SST 09221–25024 (09221–00020, 09221–00030, 09221–00130, 09221–00140, 09221–00200)

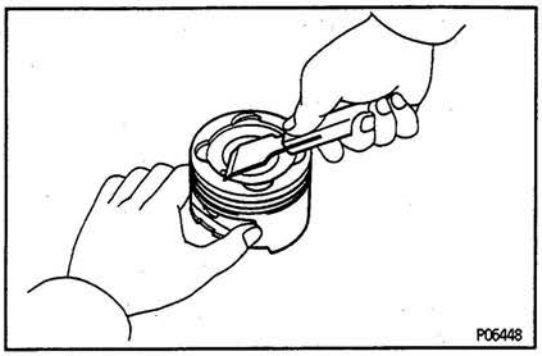


HINT:

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

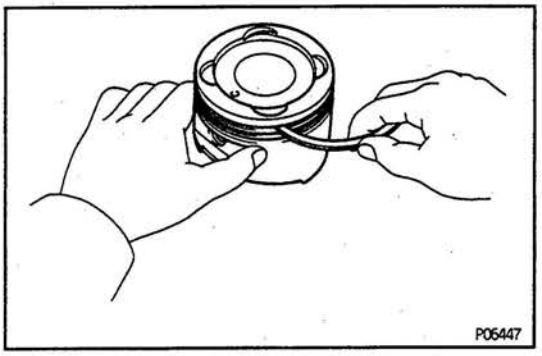
E0358R-01

PISTON AND CONNECTING ROD INSPECTION

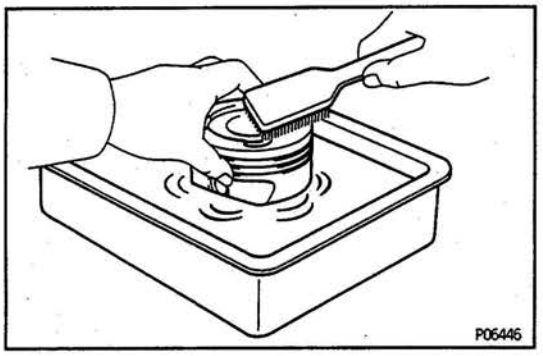


1. CLEAN PISTON

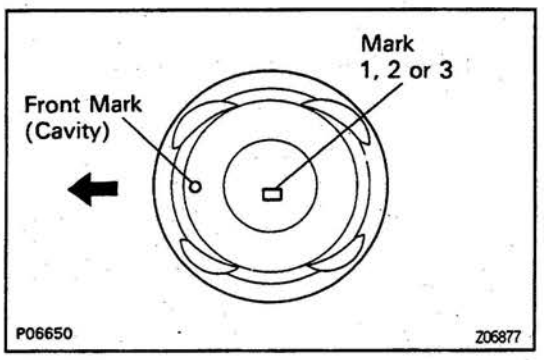
(a) Using a gasket scraper, remove the carbon from the piston top.



(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.

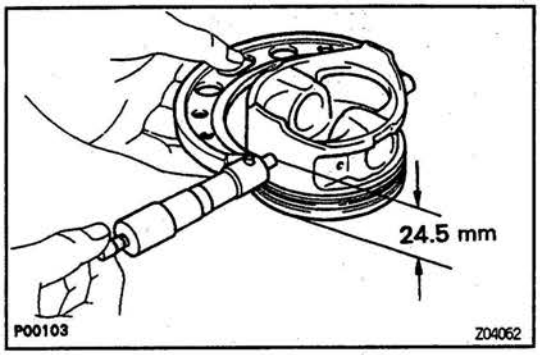


2. INSPECT PISTON AND PISTON RING

A. Inspect piston oil clearance

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

EG



(a) Using a micrometer, measure the piston diameter at ring angles to the piston pin center line, 24.5 mm (0.965 in.) from the piston head.

Piston diameter:

STD

Mark "1"

80.905 — 80.915 mm (3.1852 — 3.1856 in.)

Mark "2"

80.915 — 80.925 mm (3.1856 — 3.1860 in.)

Mark "3"

80.925 — 80.935 mm (3.1860 — 3.1864 in.)

O/S 0.50

81.405 — 81.435 mm (3.2049 — 3.2061 in.)

(b) Measure the cylinder bore diameter in the thrust directions. (See step 4 on page EG—105)

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

Standard oil clearance:

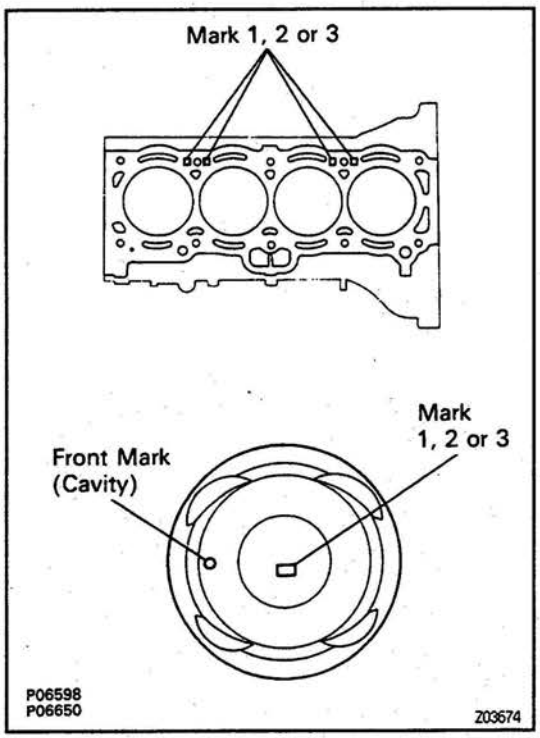
0.085 — 0.105 mm (0.0033 — 0.0041 in.)

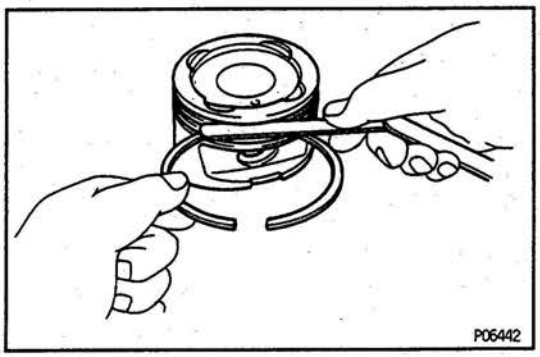
Maximum oil clearance:

0.20 mm (0.0079 in.)

If the oil clearance is greater than maximum, replace all the four pistons and rebore all the four 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 thickness gauge, measure the clearance between new piston ring and the wall of the ring groove.

Ring groove clearance:

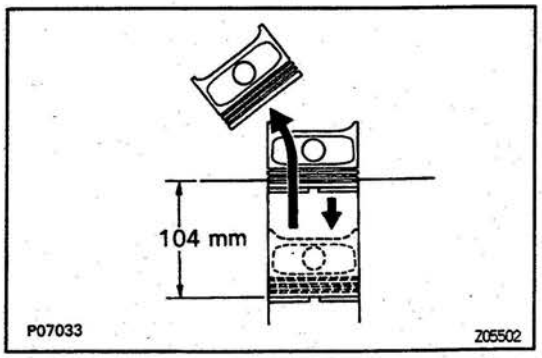
No.1

0.045 — 0.085 mm (0.0018 — 0.0033 in.)

No.2

0.030 — 0.070 mm (0.0012 — 0.0028 in.)

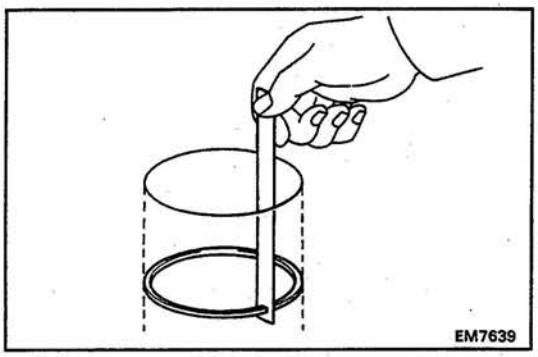
If the clearance is greater than maximum, replace the piston.



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, 104 mm (4.09 in.) from the top of the cylinder block.



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

Standard end gap:

No.1

0.250 – 0.350 mm (0.0098 – 0.0138 in.)

No.2

0.350 – 0.500 mm (0.0138 – 0.0197 in.)

Oil (Side rail)

0.150 – 0.450 mm (0.0059 – 0.0177 in.)

Maximum end gap:

No.1

1.05 mm (0.0413 in.)

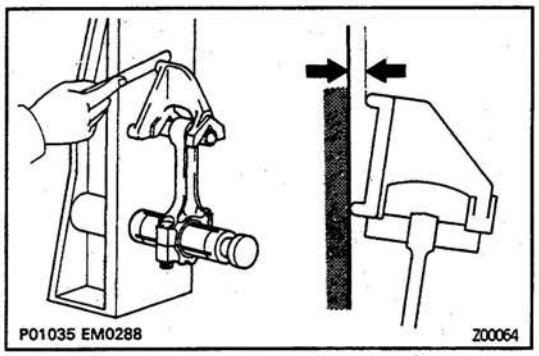
No.2

1.20 mm (0.0472 in.)

Oil (Side rail)

1.10 mm (0.0433 in.)

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



3. INSPECT CONNECTING ROD

A. Inspect connecting rod alignment

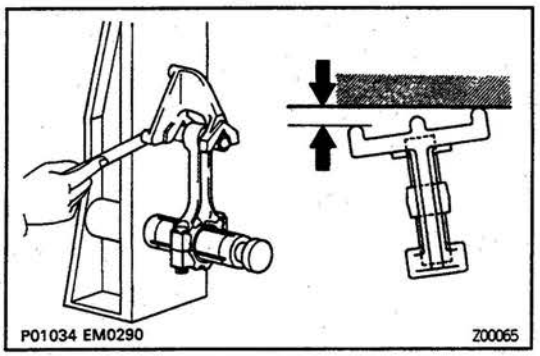
Using a rod aligner and thickness gauge, check the connecting rod alignment.

- 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.

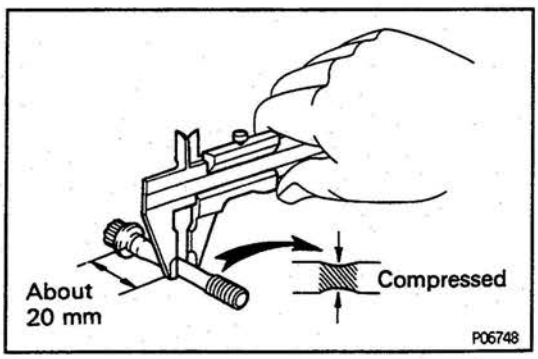


- Check for twist

Maximum twist:

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

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



B. Inspect connecting rod bolts

Using vernier calipers, measure the minimum diameter of the compressed bolt at the measuring point.

Standard diameter:

8.860 – 9.000 mm (0.3488 – 0.3543 in.)

Minimum diameter:

8.60 mm (0.3386 in.)

If the diameter is less than minimum, replace the connecting rod bolt.

E0388-01

CYLINDER BORING

HINT:

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

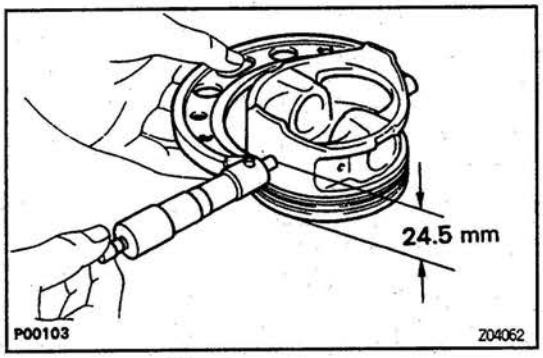
EG

1. KEEP OVERSIZED PISTONS

Oversized piston diameter:

O/S 0.50

81.405 — 81.435 mm (3.2049 — 3.2061 in.)



2. CALCULATE AMOUNT TO BORE CYLINDERS

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 24.5 mm (0.965 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 clearance

0.085 — 0.105 mm (0.0031 — 0.0041 in.)

H = Allowance for honing

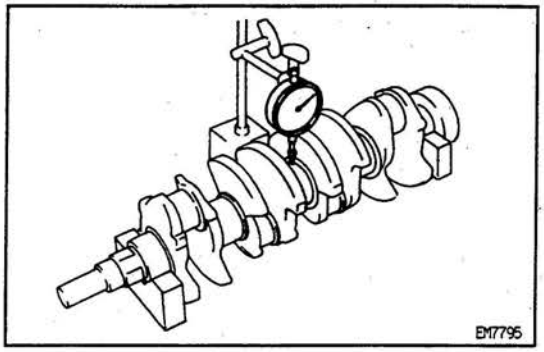
0.02 mm (0.0008 in.) or less

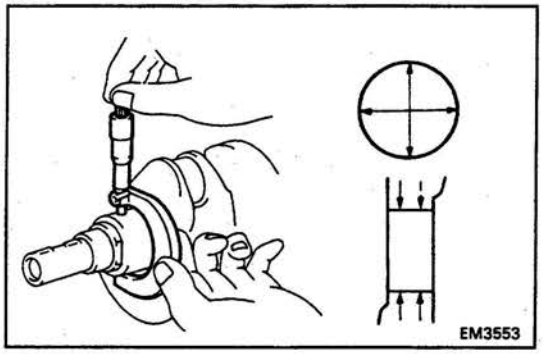
3. BORE AND HONE CYLINDER TO CALCULATED DIMENSIONS

Maximum honing:

0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.





CRANKSHAFT INSPECTION AND REPAIR

1. INSPECT CRANKSHAFT FOR RUNOUT

(a) Place the crankshaft on V–blocks.

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

Maximum circle runout:

0.03 mm (0.0012 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

47.982 – 48.000 mm (1.8891 – 1.8898 in.)

U/S 0.25

47.745 – 47.555 mm (1.8797 – 1.8801 in.)

Crank pin diameter:

STD

47.988 – 48.000 mm (1.8893 – 1.8898 in.)

U/S 0.25

47.745 – 47.555 mm (1.8797 – 1.8801 in.)

If the diameter is not as specified, check the oil clearance (See steps 3 and 6 on pages EG–98 and EG –101) If necessary, grind or replace the crankshaft.

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

Maximum taper and out–of–round:

0.005 mm (0.0002 in.)

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

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

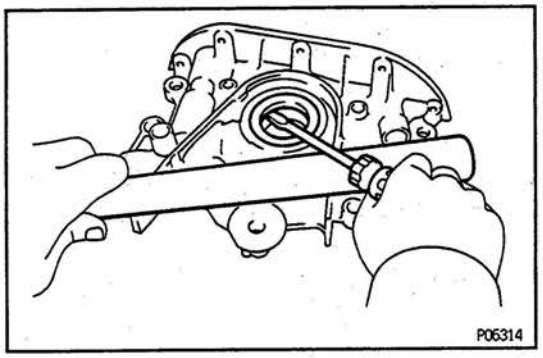
Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure in step 2).

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

CRANKSHAFT OIL SEALS REPLACEMENT E0OC8-QD

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

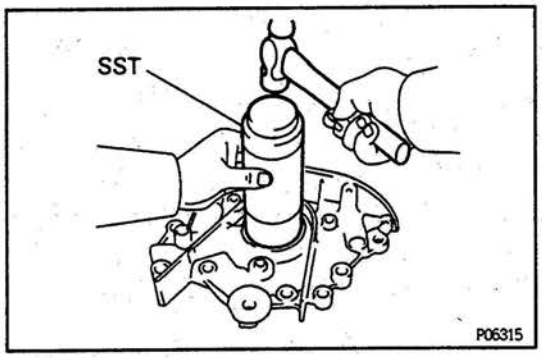
EG



1. REPLACE CRANKSHAFT FRONT OIL SEAL

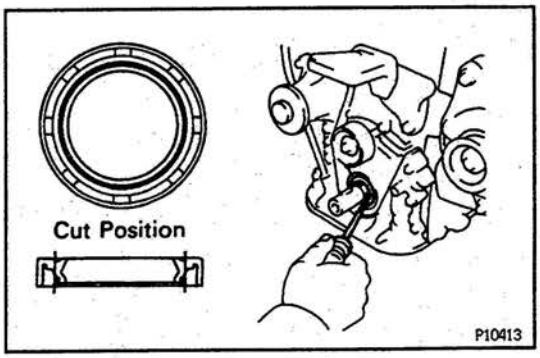
A. If oil pump is removed from cylinder block:

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



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump case edge.
SST 09309–37010

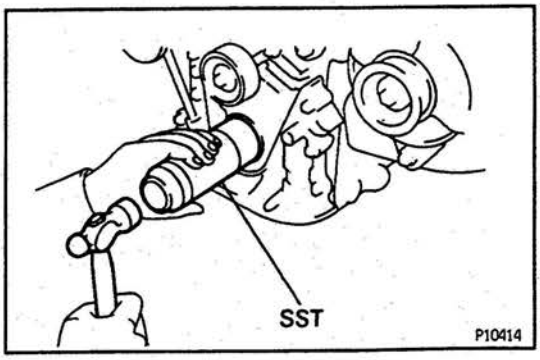
(c) Apply MP grease to the oil seal lip.



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

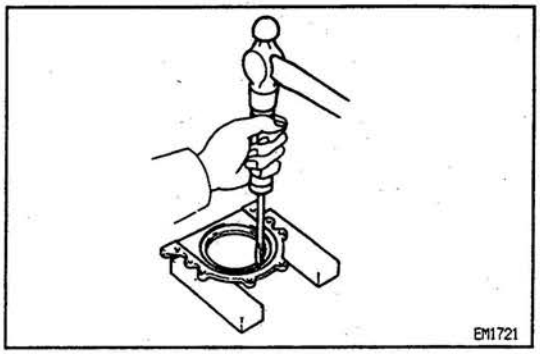
(a) Using a knife, cut off the oil seal lip.

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



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

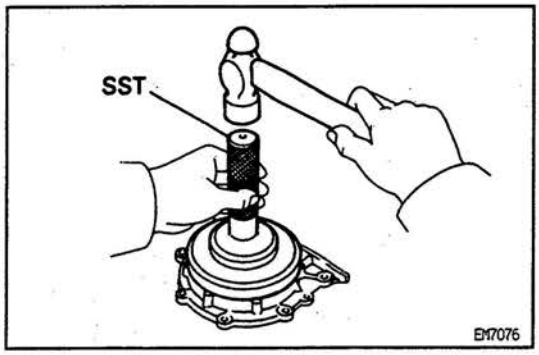
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.
SST 09309–37010



2. REPLACE CRANKSHAFT REAR OIL SEAL

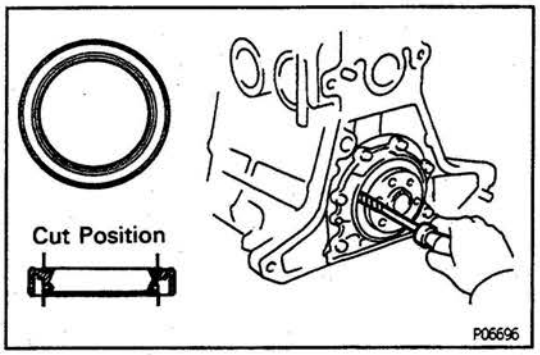
A. If rear oil seal retainer is removed from cylinder block:

(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 09223–41020

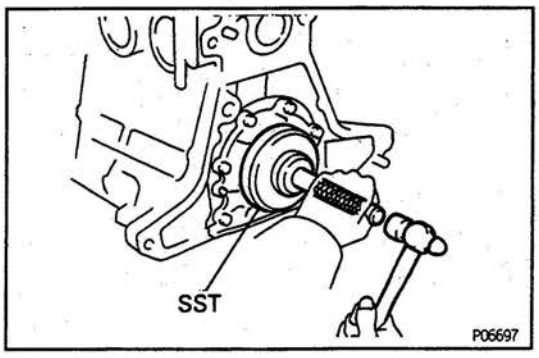
(c) Apply MP grease to the oil seal lip.



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.

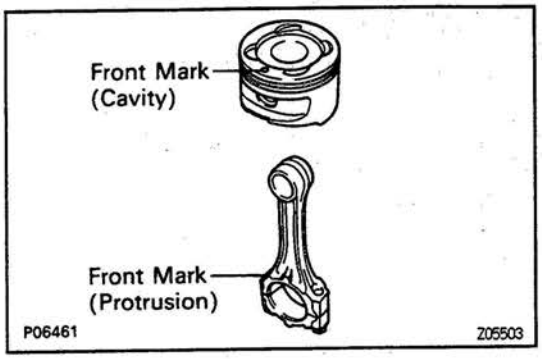


(c) Apply MP grease to a new oil seal lip.

(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–41020

EG36T-01

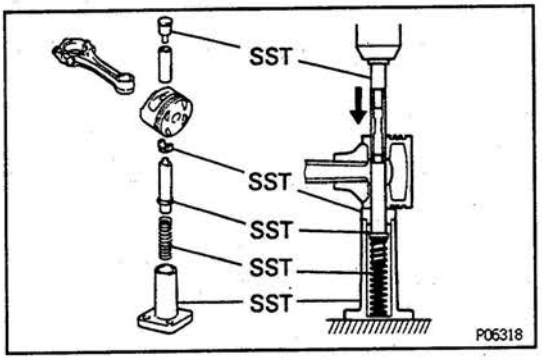
PISTON AND CONNECTING ROD ASSEMBLY



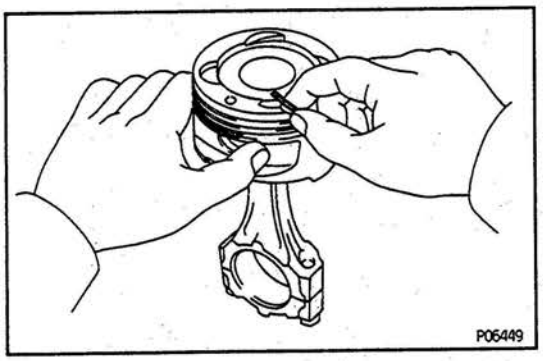
1. ASSEMBLE PISTON AND CONNECTING ROD

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

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

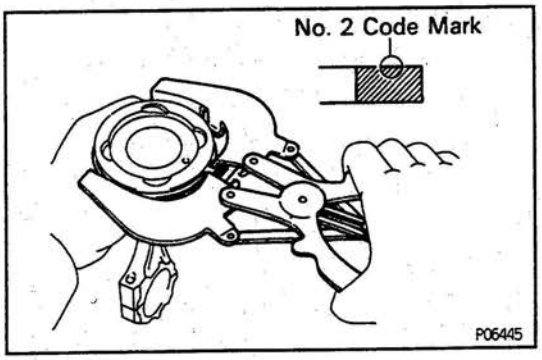


(c) Using SST, press in the piston pin.
SST 09221−25024 (09221−00020, 09221−00030, 09221−00181, 09221−00190, 09221−00200)

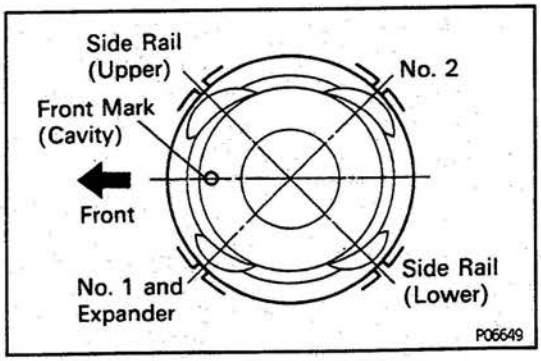


2. INSTALL PISTON RINGS

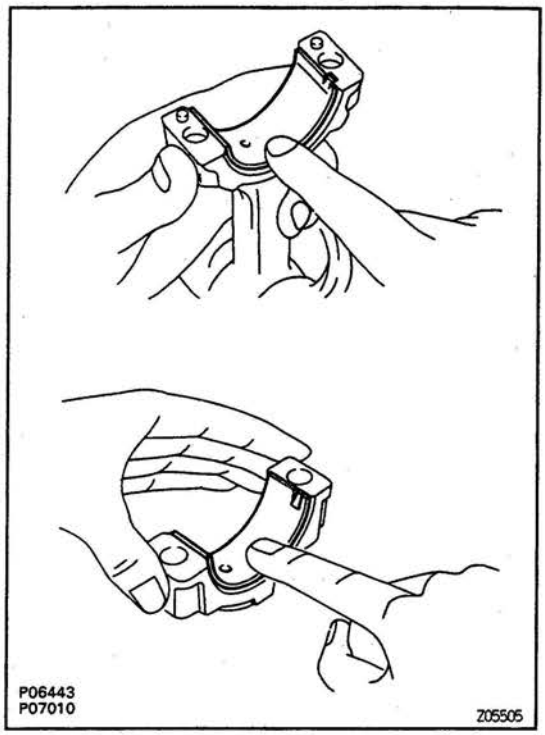
(a) Install the oil ring expander and two side rails by hand.



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



(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.

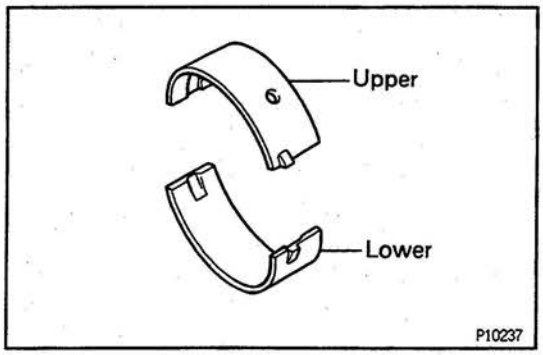
CYLINDER BLOCK ASSEMBLY

EG38U-01

(See Components for Disaseembly and Assembly)

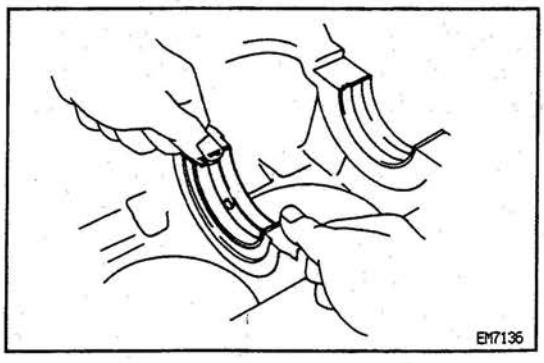
HINT:

- 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.

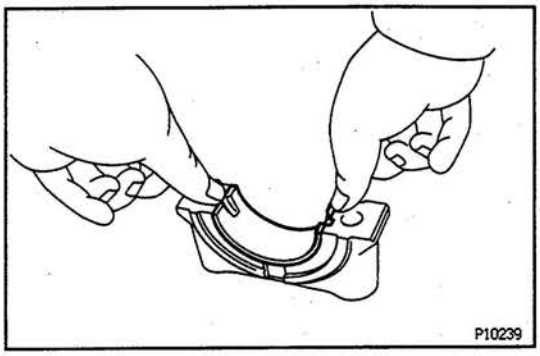


1. INSTALL MAIN BEARINGS

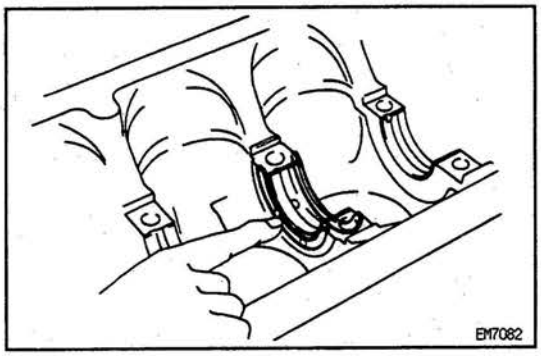
HINT: Upper bearings have an oil groove and oil holes; lower bearings do not.



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

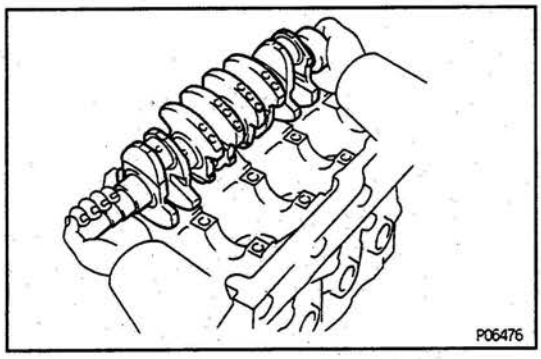


(b) Align the bearing claw with the claw groove of the main bearing cap, and push in the five lower bearings.

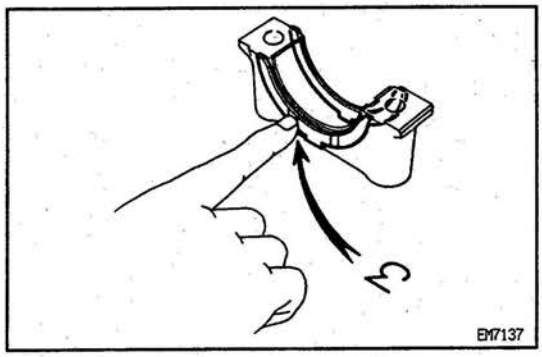


2. INSTALL UPPER THRUST WASHERS

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

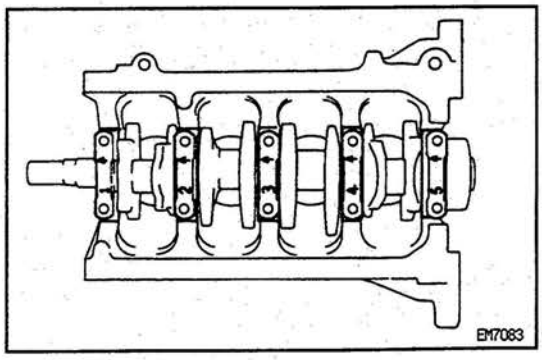


3. PLACE CRANKSHAFT ON CYLINDER BLOCK



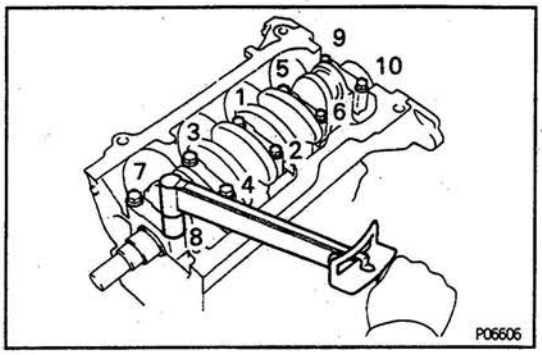
4. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

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



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

HINT: Each bearing cap has a number and front mark.

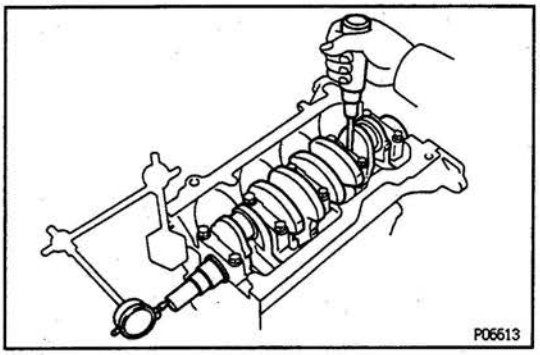


(c) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.

(d) Install and uniformly tighten the ten bolts of the main bearing cap bolts in several passes, in the sequence shown.

Torque: 60 N·m (610 kgf·cm, 44 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 and forth with a screwdriver.

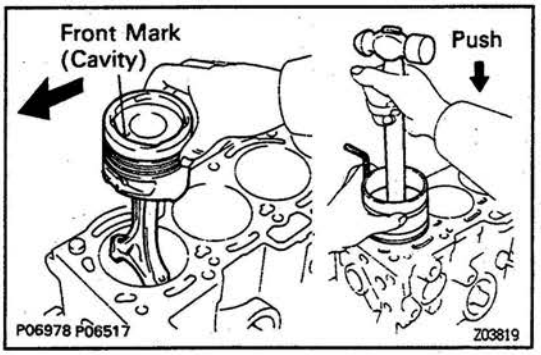
Standard thrust clearance:

0.015 — 0.220 mm (0.0006 — 0.0087 in.)

Maximum thrust clearance:

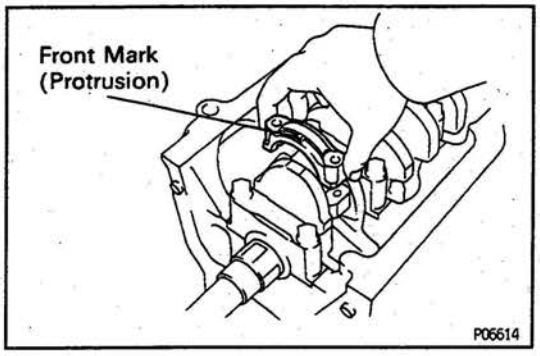
0.30 mm (0.0118 in.)

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



5. INSTALL PISTON AND CONNECTING ROD ASSEMBLES

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

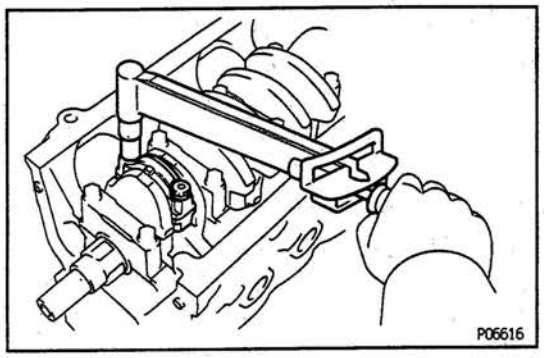
(a) Match the numbered connecting rod cap with the connecting rod.

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

B. Install connecting rod cap bolts

HINT:

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

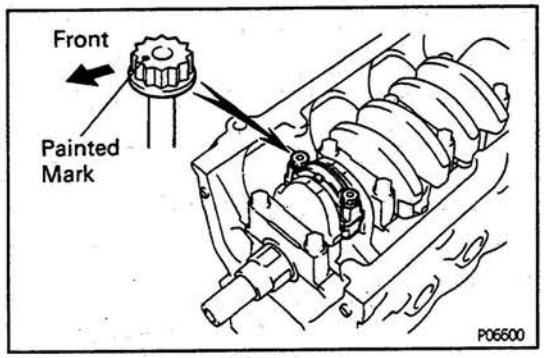


(a) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.

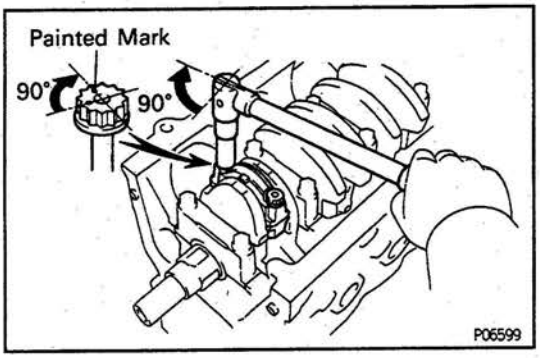
(b) At first, install and alternately tighten the bolts of the connecting rod cap in several passes.

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

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



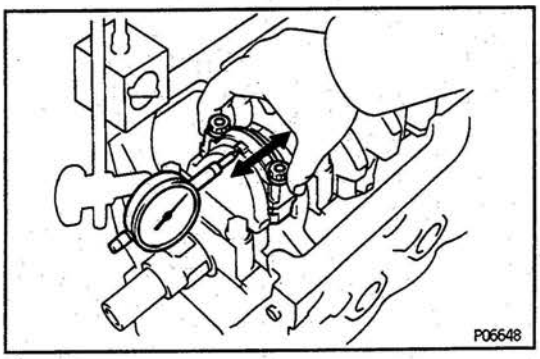
(c) Mark the front of the connecting rod cap bolt with paint.



(d) Retighten the connecting rod cap bolts 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.

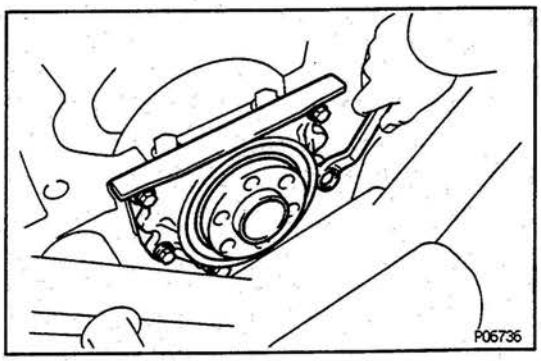
Standard thrust clearance:

0.15 — 0.25 mm (0.0059 — 0.0098 in.)

Maximum thrust clearance:

0.30 mm (0.0118 in.)

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



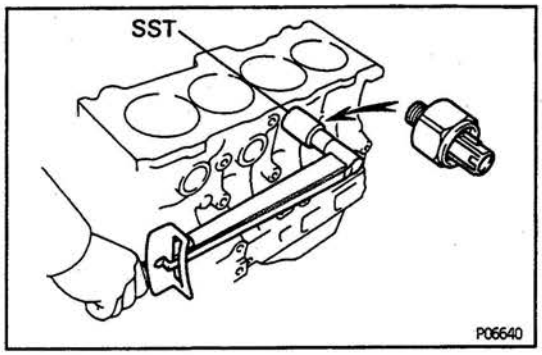
7. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the six bolts.

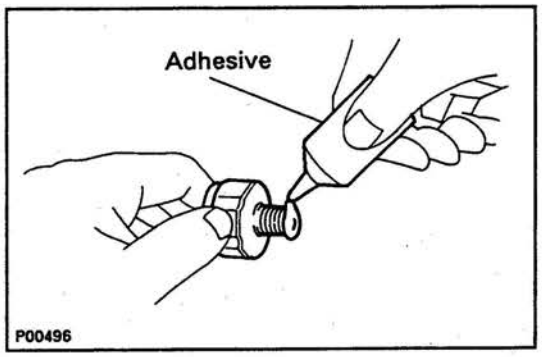
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)

B038V–01

POST ASSEMBLY

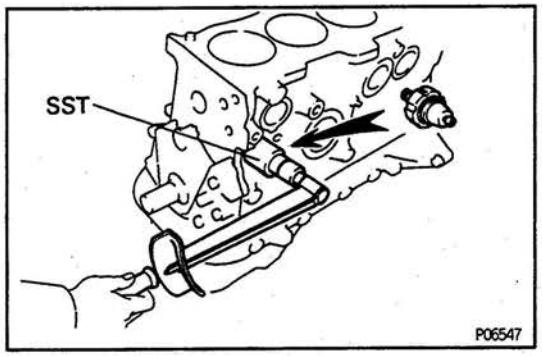


1. **INSTALL OIL PAN AND OIL PUMP**
   (See page EG–294)
2. **INSTALL KNOCK SENSOR**
   Using SST, install the knock sensor.
   SST 09816–30010
   Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)

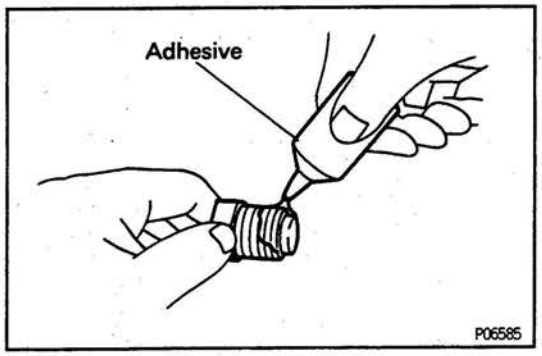


3. **INSTALL OIL PRESSURE SWITCH**

(a) Apply adhesive to two or three threads of the oil pressure switch.
Adhesive:
Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent

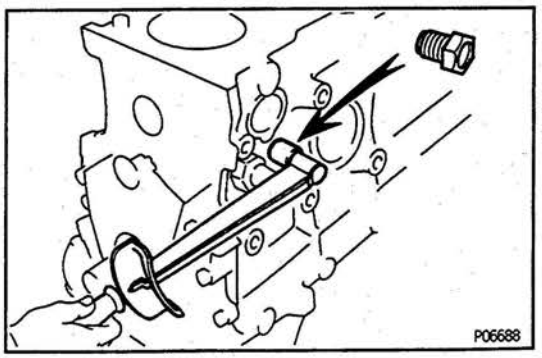


(b) Using SST, install the oil pressure switch.
SST 09816–30010

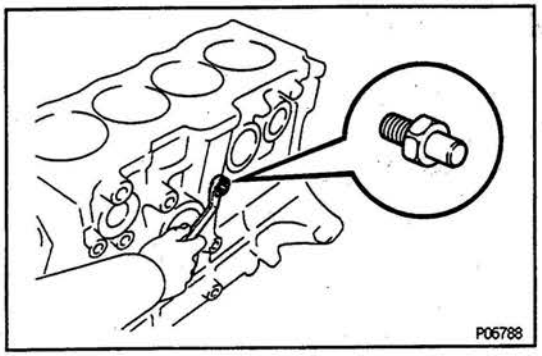


4. **INSTALL ENGINE COOLANT DRAIN PLUG**

(a) Apply adhesive to two or three threads of the engine coolant drain plug.
Adhesive:
Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent

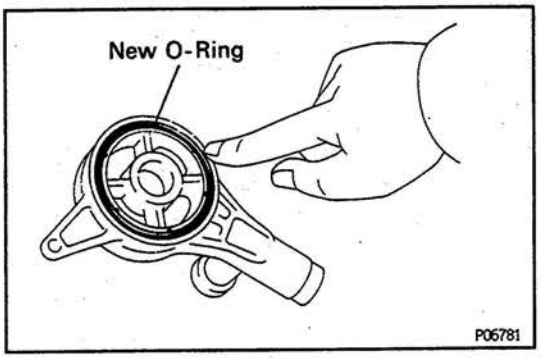


(b) Install the drain plug.
Torque: 34 N·m (350 kgf·cm, 25 ft·lbf)

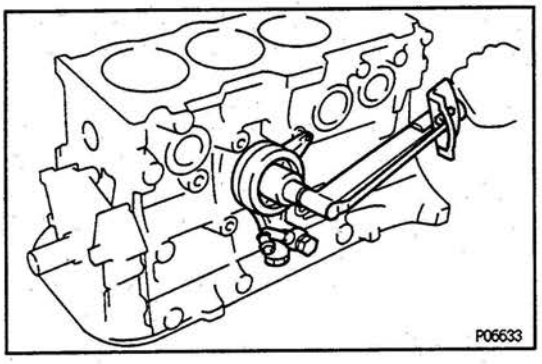


5. (w/ OIL COOLER)
INSTALL OIL FILTER BRACKET

(a) Install the bracket guide bolt.

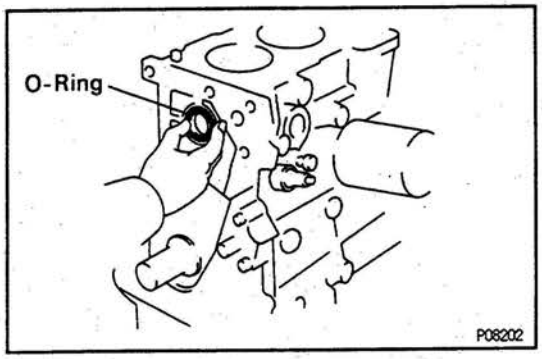


(b) Install a new gasket to the oil filter bracket.



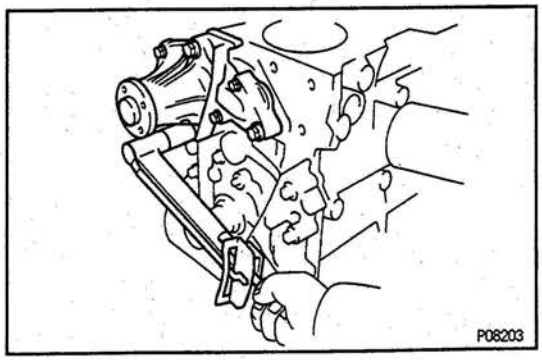
(c) Install the oil filter bracket with the plate washer and union bolt.
Torque: 54 N·m (550 kgf·cm, 40 ft·lbf)

6. INSTALL OIL FILTER

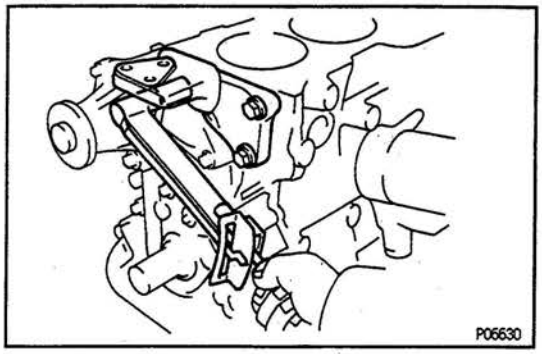


7. INSTALL WATER PUMP

(a) Place a new O—ring in positiotn on the cylinder block.



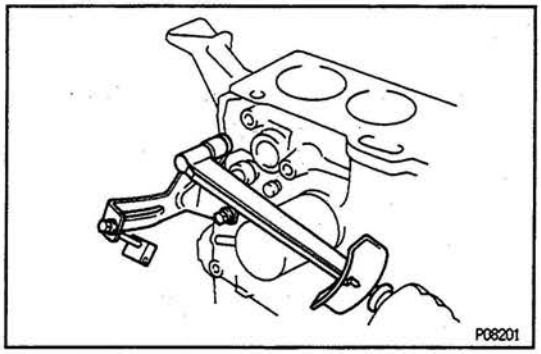
(b) Install the water pump with the three bolts.
Torque: 14 N·m (145 kgf·cm, 11 ft·lbf)



8. INSTALL RH ENGINE MOUNTING BRACKET

Install the mounting bracket with the three bolts.

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



9. INSTALL ALTERNATOR ADJUSTING BAR

Install the alternator adjusting bar with the two bolts.

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

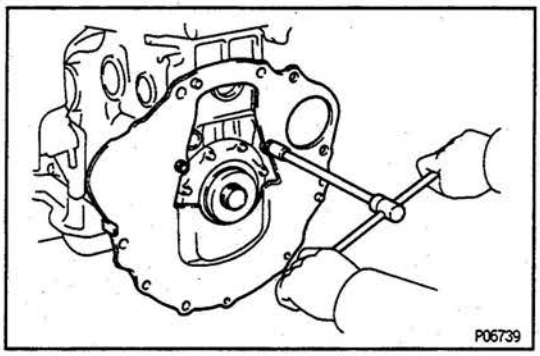
10. INSTALL CYLINDER HEAD

(See page EG–76)

11. INSTALL TIMING BELT AND PULLEYS

(See page EG–41)

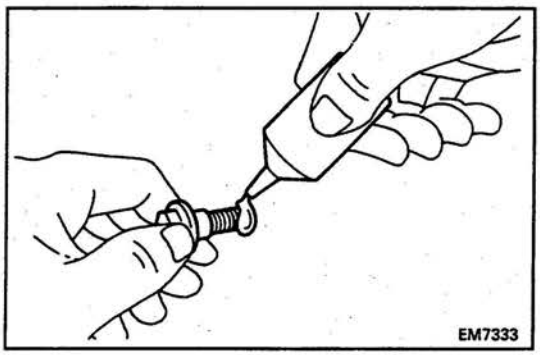
12. DISCONNECT ENGINE FROM ENGINE STAND



13. INSTALL REAR END PLATE

Install the rear end plate with the two bolts.

Torque: 5.6 N·m (55 kgf·cm, 48 in.·lbf)



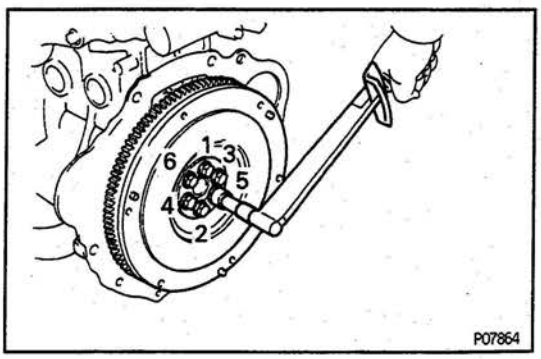
14. (M/T)

INSTALL FLYWHEEL

(a) Apply adhesive to two or three threads of the mounting bolt end.

Adhesive:

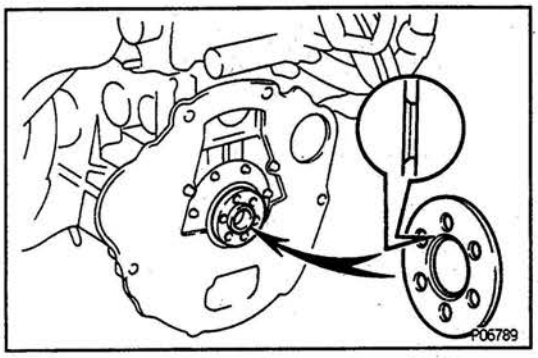
Part No. 08833–00070, THREE BOND 1324, or equivalent



(b) Install the flywheel on the crankshaft.

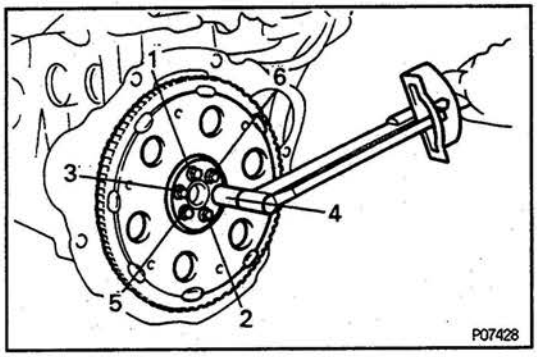
(c) Install and uniformly tighten the mounting bolts in several passes, in the sequence shown.

Torque: 78 N·m (800 kgf·cm, 58 ft·lbf)



15. (A/T)
INSTALL DRIVE PLATE

(a) Install the front spacer on the crankshaft with the chamfered end facing the shaft.



(b) Install the drive plate and rear spacer on the crankshaft.

(c) Install and uniformly tighten the mounting bolts in several passes, in the sequence shown.
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)

SERVICE SPECIFICATIONS

SERVICE DATA

E00CB–0C

Tune–up	Engine oil API grade		SG or better
	Battery specific gravity		1.25 – 1.27 (when fully charged at 20°C (68°F))
	High–tension cord resistance	Limit	25 kΩ per cord
	Spark plug (Ex. Platinum tipped type)		
	Recommended spark plug	AE93 (ND)	K16R–U
		(NGK)	BKR5EYA
		AE102 (ND)	K20R–U
		(NGK)	BKR6EYA
	Correct electrod gap		0.8 mm (0.031 in.)
	Alternator drive belt deflection		
	with 98 N (10 kgf, 22.0 lbf)	New belt	7 – 9 mm (0.28 – 0.35 in.)
		Used belt	11.5 – 13.5 mm (0.453 – 0.531 in.)
	Alternator drive belt tension with SST	New belt	70 – 80 kgf
		Used belt	30 – 45 kgf
	Valve clearance (Cold)	Intake	0.15 – 0.25 mm (0.006 – 0.010 in.)
		Exhaust	0.25 – 0.35 mm (0.010 – 0.014 in.)
	Valve clearance adjusting shim	Mark 2.550	2.55 mm (0.1004 in.)
		Mark 2.600	2.60 mm (0.1024 in.)
		Mark 2.650	2.65 mm (0.1043 in.)
		Mark 2.700	2.70 mm (0.1063 in.)
		Mark 2.750	2.75 mm (0.1083 in.)
		Mark 2.800	2.80 mm (0.1102 in.)
		Mark 2.850	2.85 mm (0.1122 in.)
		Mark 2.900	2.90 mm (0.1142 in.)
		Mark 2.950	2.95 mm (0.1161 in.)
		Mark 3.000	3.00 mm (0.1181 in.)
		Mark 3.050	3.05 mm (0.1201 in.)
		Mark 3.100	3.10 mm (0.1220 in.)
		Mark 3.150	3.15 mm (0.1240 in.)
		Mark 3.200	3.20 mm (0.1260 in.)
		Mark 3.250	3.25 mm (0.1280 in.)
		Mark 3.300	3.30 mm (0.1299 in.)
	Ignition timing		10° BTDC @ idle
	Idle speed	AE93	700 ± 50 rpm
		AE102	750 ± 50 rpm
Idle CO	Concentration		0 – 0.5 %
Intake manifold vacuum	at idle speed		43 kPa (320 mmHg, 12.6 in.Hg) or less
Compression pressure	at 250 rpm	STD	1,320 kPa (13.5 kgf/cm², 191 psi) or more
		Limit	981 kPa (10.0 kgf/cm², 142 psi)
	Difference of pressure between each cylinder		98 kPa (1.0 kgf/cm², 14 psi) or less
Idler pulley tension spring	Free length		31.8 mm (1.252 in.)
	Installed load at 37.6 mm (1.480 in.)		47.5 – 51.5 N (4.85 – 5.25 kgf, 10.7 – 11.6 lbf)

EG

Cylinder head	Warpage		
	Cylinder block side	Limit	0.05 mm (0.020 in.)
	Manifold side	Limit	0.10 mm (0.039 in.)
	Valve seat		
	Refacing angle		30°, 45°, 60°
	Contacting angle		45°
	Contacting width		1.0 — 1.4 mm (0.039 — 0.055 in.)
Valve guide bushing	Inside diameter		6.010 — 6.030 mm (0.2366 — 0.2374 in.)
	Outside diameter (for repair part)	STD	11.000 — 11.027 mm (0.4331 — 0.4341 in.)
		O/S 0.05	11.050 — 11.077 mm (0.4350 — 0.4361 in.)
Valve	Valve overall length	STD (Intake)	87.45 mm (3.4429 in.)
		(Exhaust)	87.84 mm (3.4583 in.)
		Limit (intake)	86.95 mm (3.4232in.)
		(Exhaust)	87.34 mm (3.4386 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	Squareness	Limit	2.0 mm (0.079 in.)
	Free length		38.57 mm (1.5185 in.)
	Installed tension at 31.7 mm (1.248 in.)		166 N (16.9 kgf, 37.3 lbf)
Camshaft	Thrust clearance	STD (Intake)	0.030 — 0.085 mm (0.0012 — 0.0033 in.)
		(Exhaust)	0.035 — 0.090 mm (0.0014 — 0.0035 in.)
		Limit	0.11 mm (0.0043 in.)
	Journal oil clearance	STD	0.035 — 0.072 mm (0.0014 — 0.0028 in.)
		Limit	0.10 mm (0.0039 in.)
	Journal diameter	Exhaust No.1	24.949 — 24.965 mm (0.9822 — 0.9829 in.)
		Others	22.949 — 22.965 mm (0.9035 — 0.9041 in.)
	Circle runout	Limit	0.04 mm (0.0016 in.)
	Cam lobe height	STD (Intake for AE93)	41.910 — 42.010 mm (1.6450 — 1.6539 in.)
		(Intake for AE102)	42.610 — 42.710 mm (1.6776 — 1.6815 in.)
		(Exhaust)	41.960 — 42.060 mm (1.6520 — 1.6560 in.)
		Limit (Intake for AE93)	41.50 mm (1.6339 in.)
		(Intake for AE102)	42.20 mm (1.6614 in.)
		(Exhaust)	41.55 mm (1.6358 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		17.0 — 17.6 mm (0.669 — 0.693 in.)
Valve lifter	Lifter diameter		30.966 — 30.976 mm (1.2191 — 1.2195 in.)
	Lifter bore diameter		31.000 — 31.025 mm (1.2205 — 1.2215 in.)
	Oil clearance	STD	0.024 — 0.059 mm (0.0009 — 0.0023 in.)
		Limit	0.07 mm (0.0028 in.)
Manifold	Warpage	Limit (Intake)	0.20 mm (0.0079 in.)
		(Exhaust)	0.30 mm (0.0118 in.)

Spark plug tube	Protrusion		46.8 – 47.6 mm (1.843 – 1.874 in.)
Cylinder block	Cylinder head surface warpage	Limit	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD (Mark 1)	81.000 – 81.010 mm (3.1890 – 3.1894 in.)
		(Mark 2)	81.010 – 81.020 mm (3.1894 – 3.1898 in.)
		(Mark 3)	81.020 – 81.030 mm (3.1898 – 3.1902 in.)
		Limit (STD)	81.23 mm (3.1982 in.)
		(O/S 0.50)	81.73 mm (3.2177 in.)
Piston and piston ring	Piston diameter	STD (Mark 1)	80.905 – 80.915 mm (3.1852 – 3.1856 in.)
		(Mark 2)	80.915 – 80.925 mm (3.1856 – 3.1860 in.)
		(Mark 3)	80.925 – 80.935 mm (3.1860 – 3.1864 in.)
		O/S 0.50	81.405 – 81.435 mm (3.2049 – 3.2061 in.)
	Piston oil clearance	STD	0.085 – 0.105 mm (0.0033 – 0.0041 in.)
		Limit	0.20 mm (0.0079 in.)
	Piston ring groove clearance	No.1	0.045 – 0.085 mm (0.0018 – 0.0033 in.)
		No.2	0.030 – 0.070 mm (0.0012 – 0.0028 in.)
	Piston ring end gap	STD (No.1)	0.250 – 0.350 mm (0.0098 – 0.0138 in.)
		(No.2)	0.350 – 0.500 mm (0.0138 – 0.0197 in.)
		(Oil)	0.150 – 0.450 mm (0.0059 – 0.0177 in.)
		Limit (No.1)	1.05 mm (0.0413 in.)
		(No.2)	1.20 mm (0.0472 in.)
		(Oil)	1.10 mm (0.0433 in.)
Connecting rod	Thrust clearance	STD	0.15 – 0.25 mm (0.0059 – 0.0098 in.)
		Limit	0.30 mm (0.0118 in.)
	Connecting rod bearing center wall thickness (Reference)	STD (Mark 1)	1.486 – 1.490 mm (0.0585 – 0.0587 in.)
		(Mark 2)	1.490 – 1.494 mm (0.0587 – 0.0588 in.)
		(Mark 3)	1.494 – 1.498 mm (0.0588 – 0.0590 in.)
	Connecting rod oil clearance	STD (STD)	0.020 – 0.048 mm (0.0008 – 0.0019 in.)
		(U/S 0.25)	0.019 – 0.058 mm (0.0007 – 0.0022 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.)	0.05 mm (0.0020 in.)
	Connecting rod bolt outside diameter	STD	8.860 – 9.000 mm (0.3488 – 0.3543 in.)
		Limit	8.60 mm (0.3386 in.)

EG

Crankshaft	Thrust clearance	STD	0.015 — 0.220 mm (0.0006 — 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 (STD)	0.015 — 0.033 mm (0.0006 — 0.0013 in.)
		(U/S 0.25)	0.016 — 0.056 mm (0.0006 — 0.0022 in.)
		Limit	0.08 mm (0.0031 in.)
	Main journal diameter	STD	47.982 — 48.000 mm (1.8891 — 1.8898 in.)
		U/S 0.25	47.745 — 47.755 mm (1.8797 — 1.8801 in.)
	Main bearing center wall thickness (Reference)		
		STD (Mark 1)	2.002 — 2.005 mm (0.0788 — 0.0789 in.)
		(Mark 2)	2.005 — 2.008 mm (0.0789 — 0.0791 in.)
		(Mark 3)	2.008 — 2.011 mm (0.0791 — 0.0792 in.)
		(Mark 4)	2.011 — 2.014 mm (0.0792 — 0.0793 in.)
		(Mark 5)	2.014 — 2.017 mm (0.0793 — 0.0794 in.)
	Crank pin diameter	STD	47.988 — 48.000 mm (1.8893 — 1.8898 in.)
		U/S 0.25	47.745 — 47.555 mm (1.8797 — 1.8801 in.)
	Circle runout	Limit	0.03 mm (0.0012 in.)
	Main journal taper and out—of—round	Limit	0.005 mm (0.0002 in.)
	Crank pin taper and out—of—round	Limit	0.005 mm (0.0002 in.)

EG0C8—0D

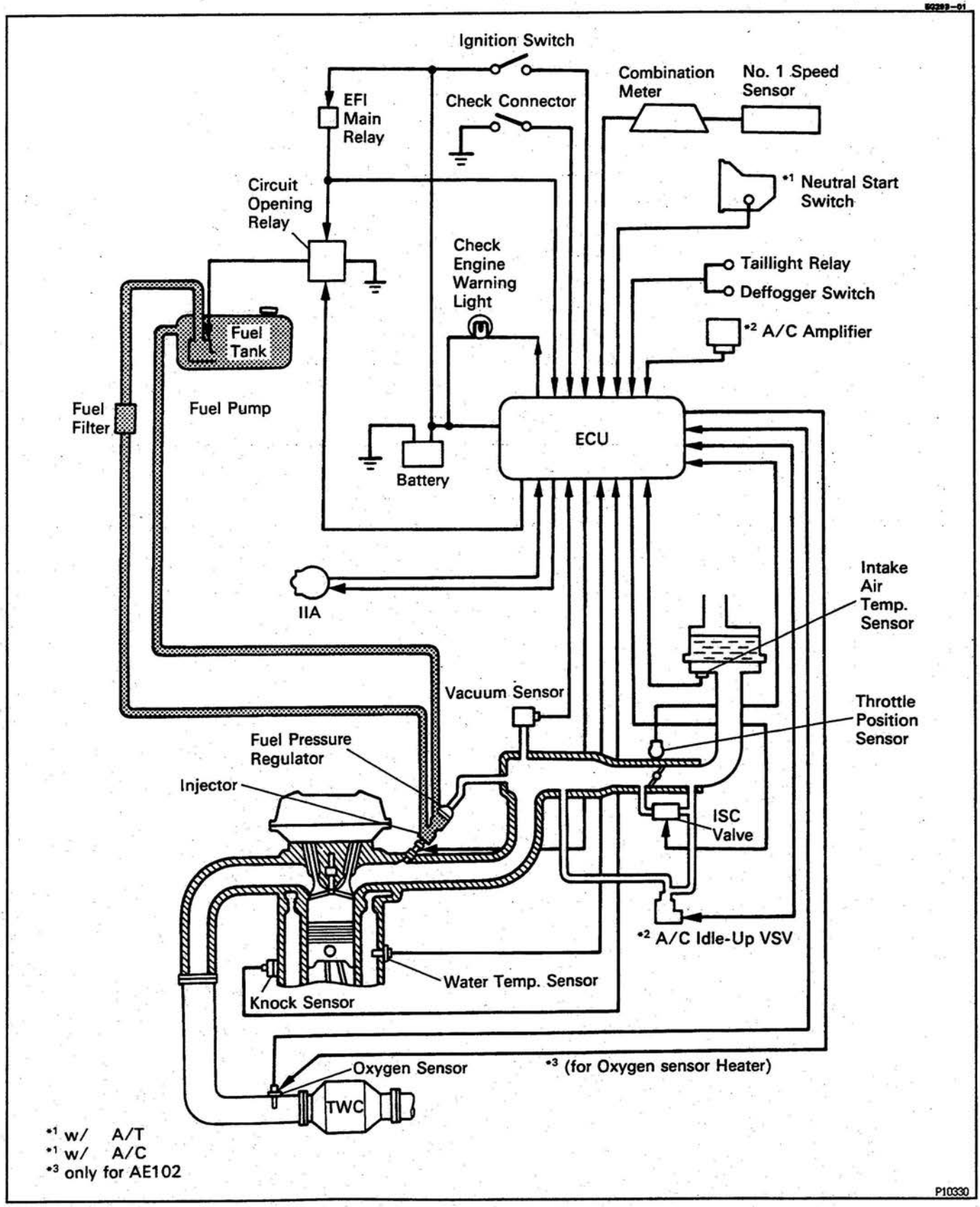
TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Spark plug x Cylinder head		18	180	13
Camshaft bearing cap x Cylinder head		13	130	9
Cylinder head cover x Cylinder head		5.9	60	52 in.·lbf
IIA x Cylinder head		20	200	14
Camshaft timing pulley x Camshaft		59	600	43
Idler pulley x Cylinder block		37	375	27
Crankshaft pulley x Crankshaft		118	1,200	87
Cylinder head x Cylinder block	1st	29	300	22
	2nd	Turn 90°		
	3rd	Turn 90°		
Alternator bracket x Cylinder head		26	270	20
Engine hanger (LH) x Cylinder head	for bolt	27	280	20
No.2 water inlet x Cylinder head		15	150	11
Oil dipstick guide x No.2 water inlet		9.3	95	82 in.·lbf
Intake manifold x Cylinder head		19	195	14
Delivery pipe x Cylinder head		15	150	11
Fuel inlet hose x Delivery pipe		29	300	22
Air intake chamber cover x Intake manifold		19	195	14
Air pipe x Intake manifold		9.3	95	82 in.·lbf
Intake manifold stay x Intake manifold		19	195	14
Intake manifold stay x Cylinder block		39	400	29
Air intake chamber stay x Cylinder head		28	290	21
Engine hanger (RH) x Cylinder head	for nut	28	290	21
Throttle body x Intake manifold		22	220	16
Water inlet housing x Cylinder head		20	200	14
Water outlet x Cylinder head		20	200	14
Exhaust manifold stay x Cylinder block		59	600	43

Exhaust manifold x Cylinder head		34	350	25
Exhaust manifold stay x Exhaust manifold		39	400	29
Heat insulator x Exhaust manifold		9.3	95	82 in.·lbf
Water pump pulley x Water pump		9.3	95	82 in.·lbf
Main bearing cap x Cylinder block		60	610	44
Connecting rod cap x Connecting rod	1st	25	250	18
	2nd	Turn 90°		
Rear oil seal retainer x Cylinder block		9.3	95	82 in.·lbf
Oil pump x Cylinder block		21	218	16
Oil strainer x Cylinder block		9.3	95	82 in.·lbf
No.1 oil pan x Cylinder block		16	165	12
No.2 oil pan x No.1 oil pan		4.9	50	43 in.·lbf
Oil pan x Oil pump		7.8	80	69 in.·lbf
Oil pan x Rear oil seal retainer		7.8	80	69 in.·lbf
Oil cooler union x No.1 oil pan		34	350	25
Knock sensor x Cylinder block		37	380	27
Engine coolant drain plug x Cylinder block		34	350	25
Oil filter bracket x Cylinder block	for union bolt	54	550	40
Water pump x Cylinder block		14	145	11
RH engine mounting bracket x Cylinder block		51	525	38
Alternator adusting bar x Cylinder block		39	400	29
Rear end plate x Cylinder block		5.6	55	48 in.·lbf
Flywheel x Crankshaft (M/T)		78	800	58
Drive plate x Crankshaft (A/T)		64	650	47

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 port in accordance with signals from the ECU (Electronic Control Unit).

AIR INDUCTION SYSTEM

The air induction system provides sufficient air for engine operation.

ELECTRONIC CONTROL SYSTEM

The 7A–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 Electronic Control Unit (ECU–formaly EFI computer) employing a microcomputer.

The ECU controls the following functions:

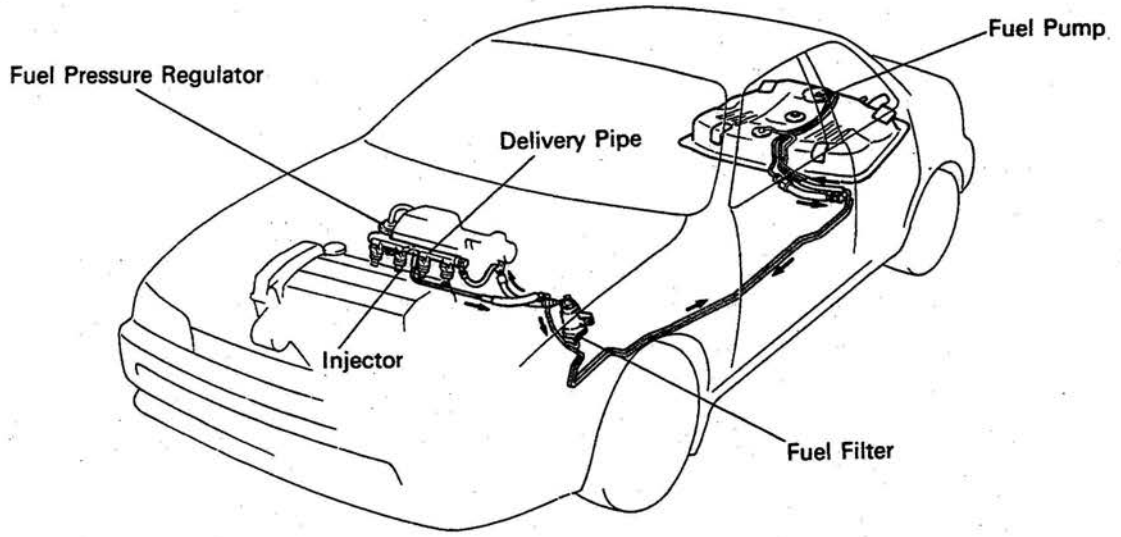
1. Electronic Fuel Injection (EFI)
   The ECU receives signals from various sensors indicating changing engine operation conditions such as:
   Intake manifold pressure
   Intake air temperature
   Coolant temperature
   Engine speed
   Throttle valve opening angle
   Exhaust oxygen content etc.
   The 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 programmed with data for optimum ignition timing under any and all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, coolant temperature, etc.), the microcomputer (ECU) triggers the spark at precisely the right instant.
3. Idle Speed Control (ISC)
   The ECU is programmed with target idling speed values to respond to different engine conditions (coolant temperature, air conditioner ON/OFF, etc.) Sensors transmit signals to the ECU which controls the flow of air through the by–pass of the throttle valve and adjust idle speed to the target value.
4. Diagnosis
   The ECU detects any malfunctions and abnormalties in the sensor network and lights a check engine warning light on the combination meter. At the same time, trouble is identified and a diagnostic code is recorded by the ECU. The diagnostic code can be read by the number of blinks of the check engine warning light when terminals TE1 and E1 are connected. The diagnostic codes are referred to the later page. (See page EG–147)
5. Fail–Safe Function
   In the event of the sensor malfunction, a back–up circuit will take over to provide minimal drivability, and the check engine warning light will illuminate.

OPERATION
FUEL SYSTEM

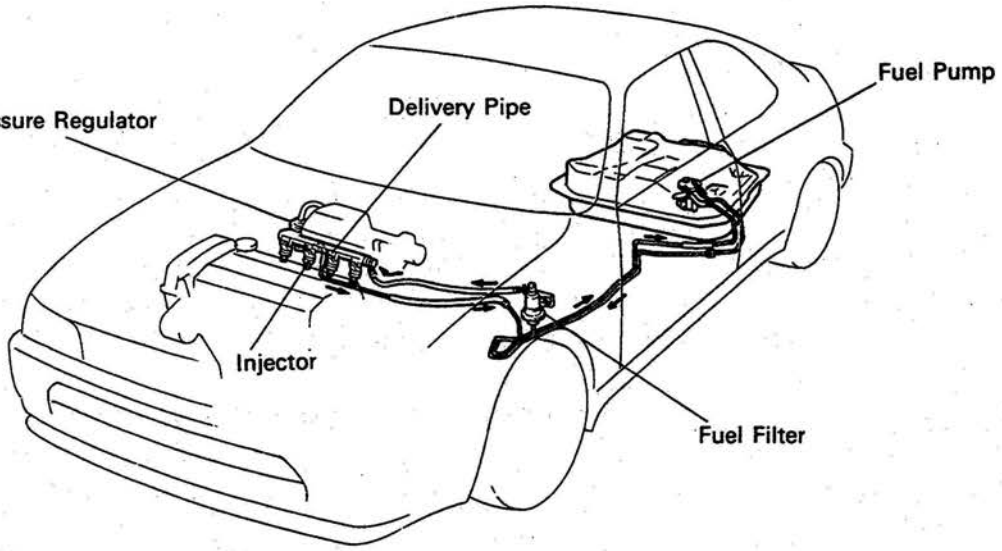
E20CC-08

EG

AE93



AE102

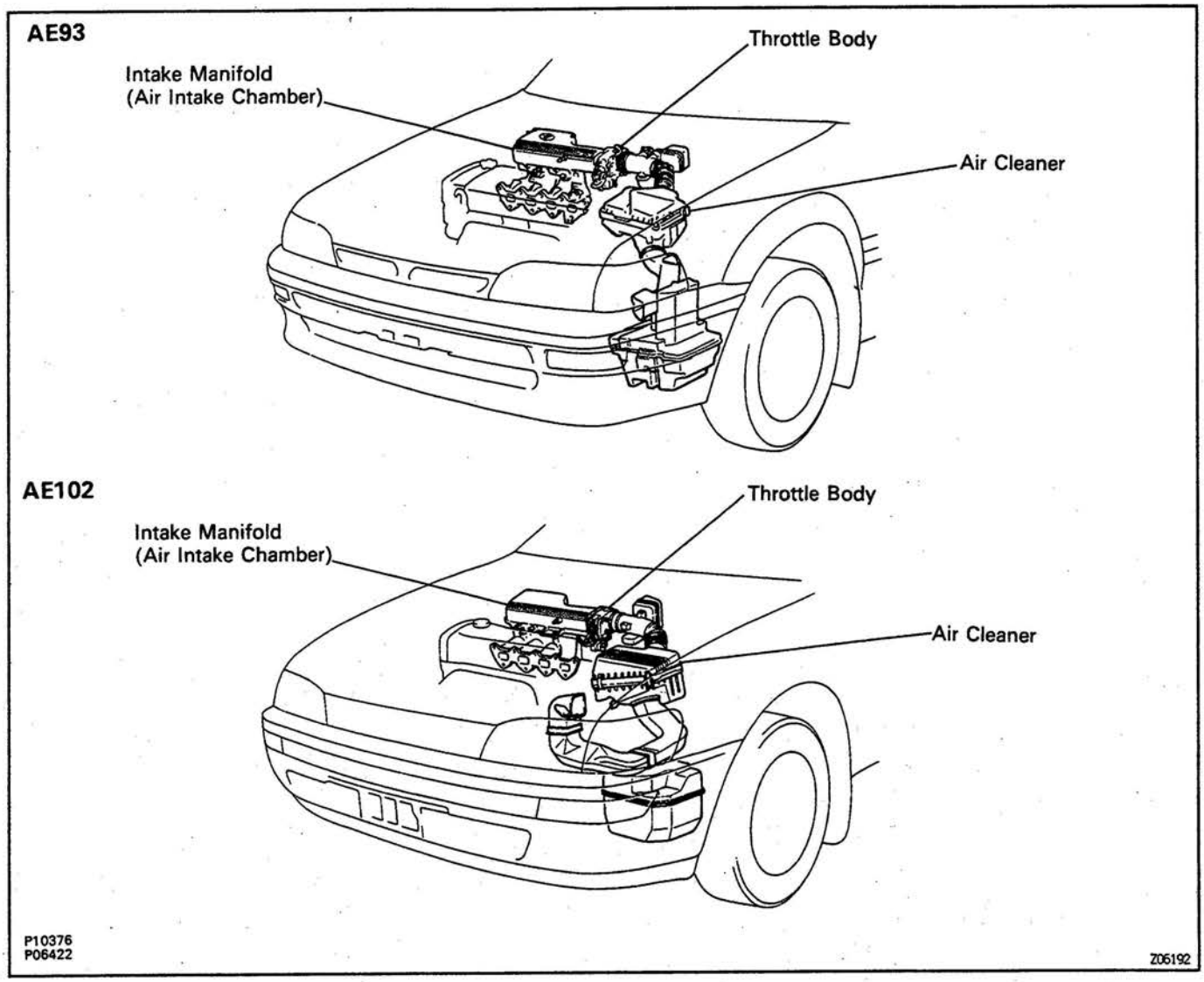


P10393
P10375

Z06180

Fuel is pumped up by the fuel pump, flows through the fuel filter and is distributed to each injector at a set pressure maintained by the pressure regulator.
The fuel pressure regulator adjusts the pressure of the fuel from the fuel line (high pressure side) to a pressure 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 hose and pipe.
The injectors operate on input of injection signals from the ECU and inject fuel into the intake manifold.

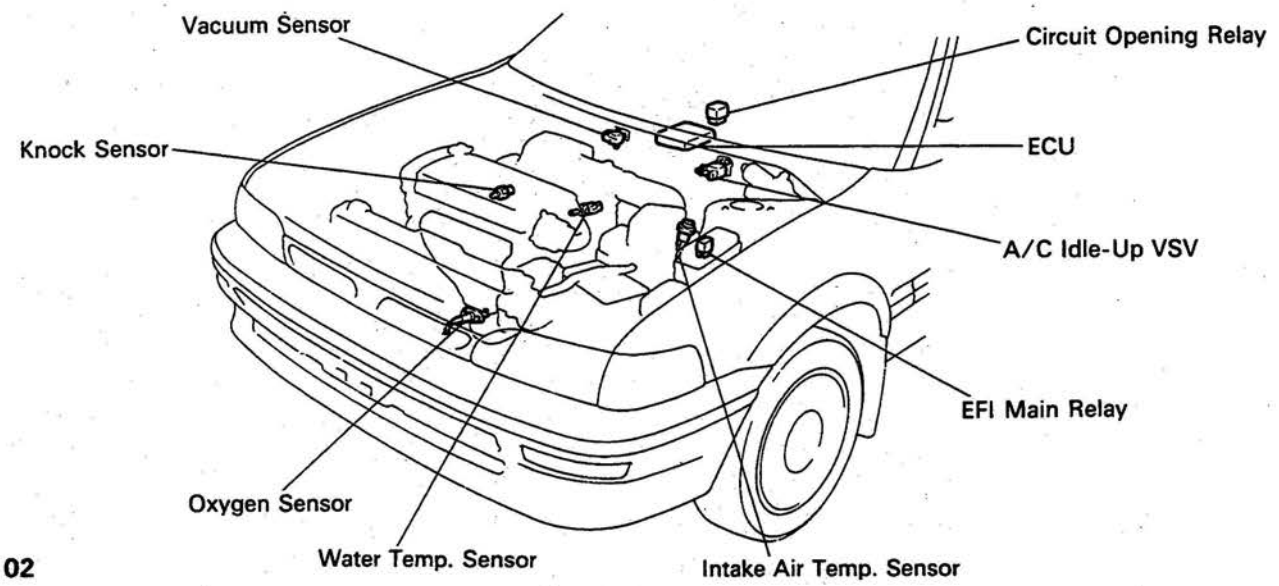
AIR INDUCTION SYSTEM



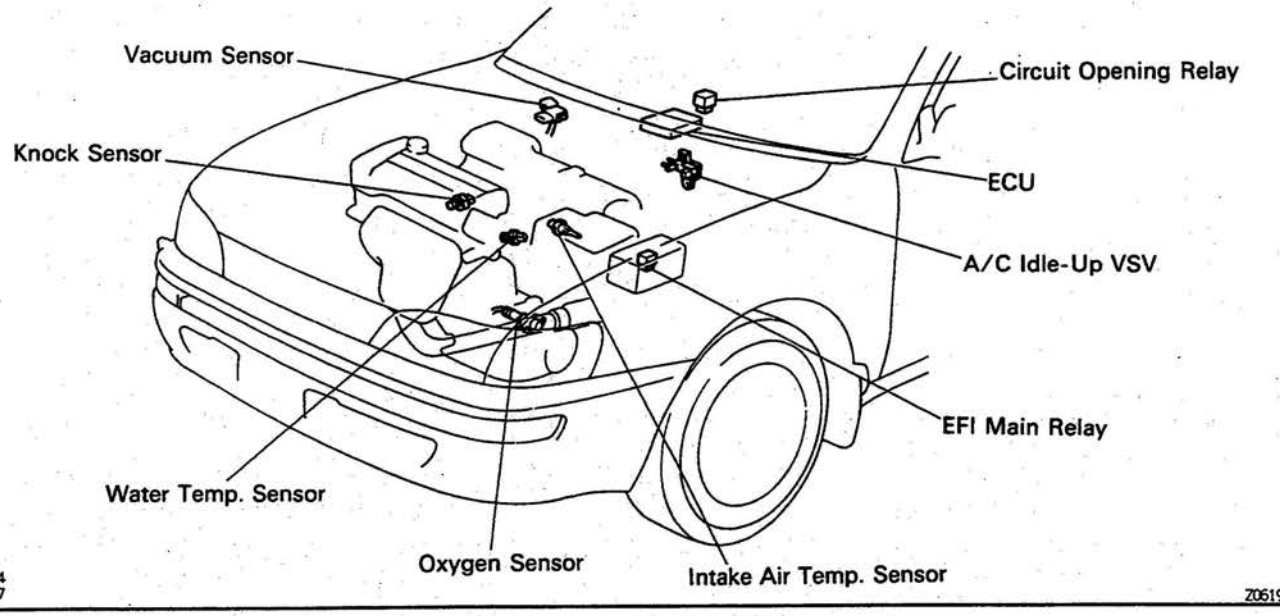
Air is filtered through the air cleaner and the amount flowing to the air intake chamber is determined according to the throttle valve opening in the throttle body and the engine speed.
Intake air controlled by the throttle valve opening is distributed from the air intake chamber to the manifold of each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

ELECTRONIC CONTROL SYSTEM

AE93



AE102



P10374
P10227

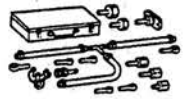
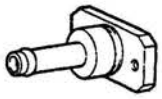
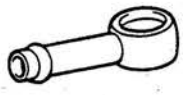
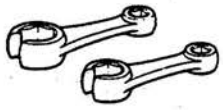
Z06193

The control system consists of sensors which detect various engine conditions, and a ECU which determines the injection volume (time) based on the signals from the sensors.
The various sensors detect the intake air pressure, engine rpm, oxygen density in the exhaust gas, coolant temperature, intake air temperature and atmospheric pressure etc. and convert the information into an electrical signal which is sent to the ECU. Based on these signals, the ECU calculates the optimum injection time 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 and idle rpm control.

PREPARATION

SST (SPECIAL SERVICE TOOLS)

E90CF-04

	09268–41045	Injection Measuring Tool Set	
	(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
	09842–30070	Wiring "F" EFI Inspection	
	09843–18020	Diagnosis Check Wire	

RECOMMENDED TOOLS

E90CG-01

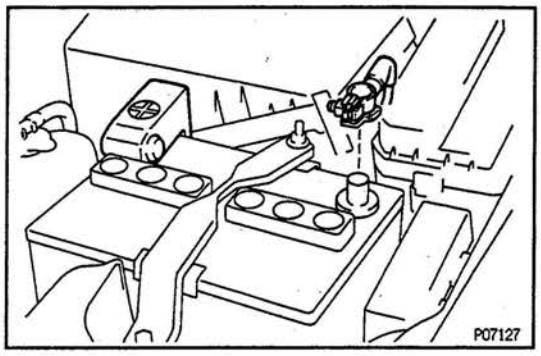
	09082–00015	TOYOTA Electrical Tester	
	09200–00010	Engine Adjust Kit	
	09258–00030	Hose Plug Set	Plug for the vacuum hose, fuel hose etc.

EG

B90CH-01

EQUIPMEMT

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



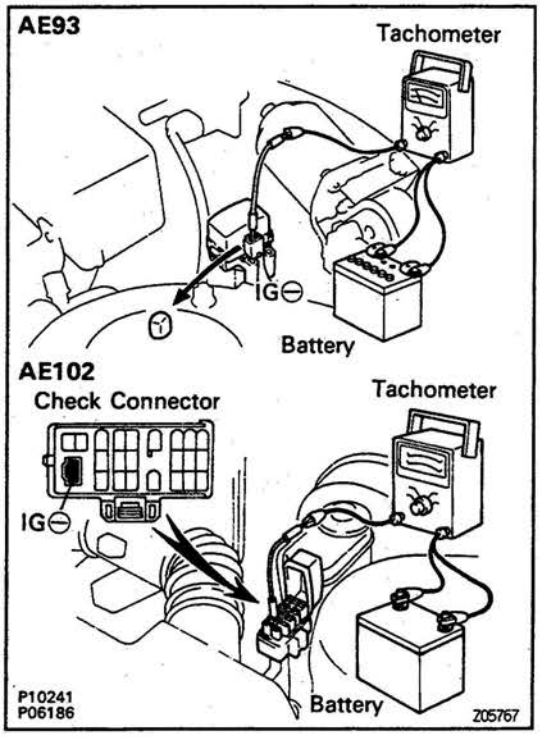
PRECAUTION

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

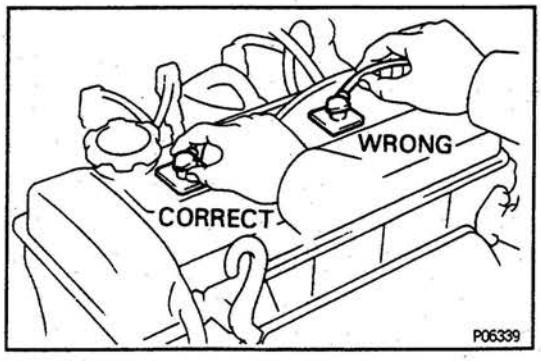
EG

MAINTENANCE PRECAUTIONS

1. **CHECK CORRECT ENGINE TUNE−UP**
   (See page EG−11)



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.

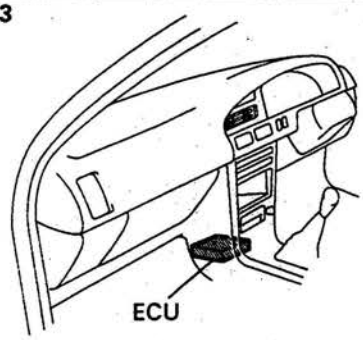
4. **PRECAUTIONS WHEN HANDLING OXYGEN SENSOR**

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

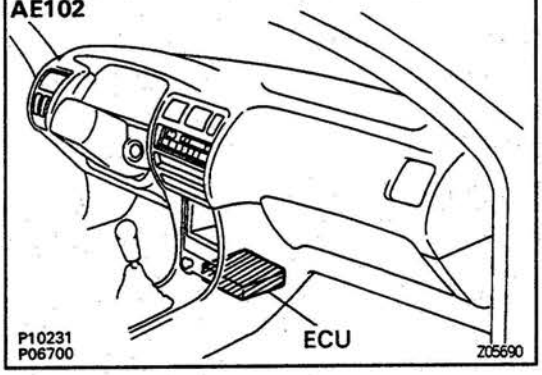
(b) Do not allow the sensor to come into contact with water.

EG

AE93



AE102



P10231
P06700

Z05690

IF VEHICLE IS EQUIPPED WITH MOBILE RADIO SYSTEM (HAM, CB, ETC.) E029C-01

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

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

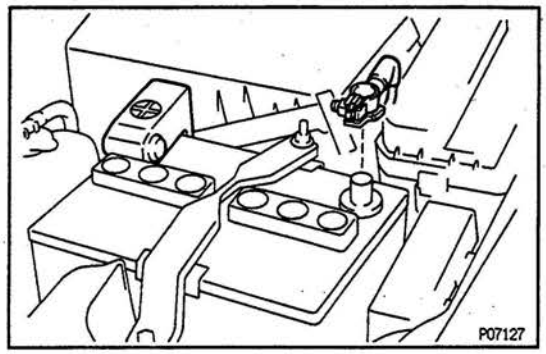
Therefore, observe the following precautions:

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

AIR INDUCTION SYSTEM E900M-07

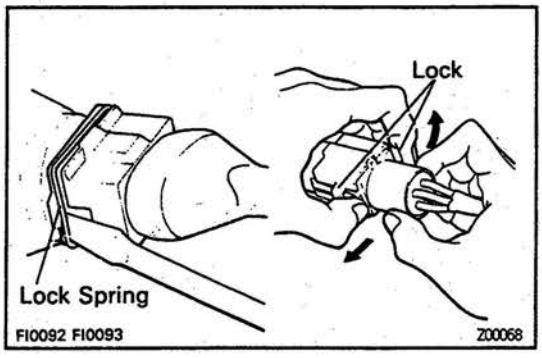
1. Separation of the engine oil dipstick, oil filler cap, PCV hose, etc. may cause the engine to run out of tune.

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



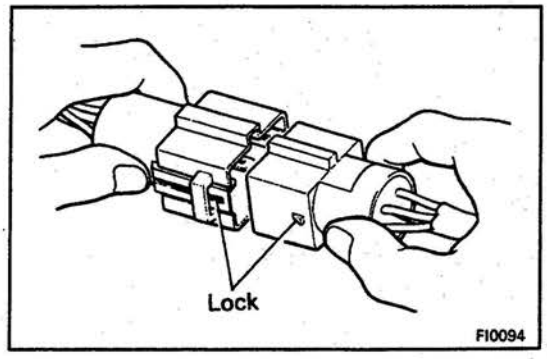
ELECTRONIC CONTROL SYSTEM

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

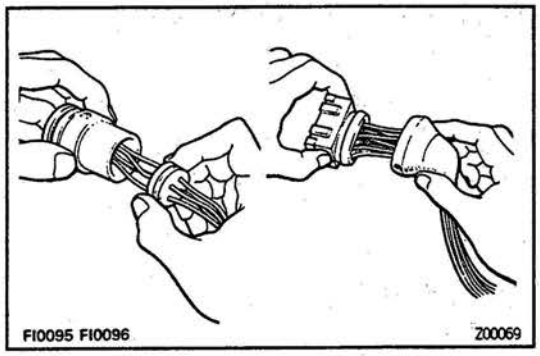


8. Care is required when pulling out and inserting wiring connectors.

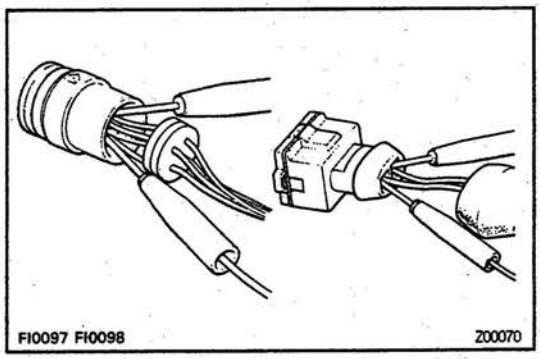
(a) Release the lock and pull out the connector, pulling on the connectors.



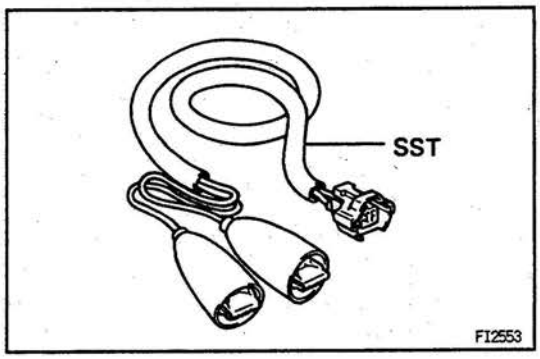
(b) Fully insert the connector and check that it is locked.



9. When inspecting a connector with a volt/ohmmeter.
(a) Carefully take out the water–proofing rubber if it is a water–proof type connector.

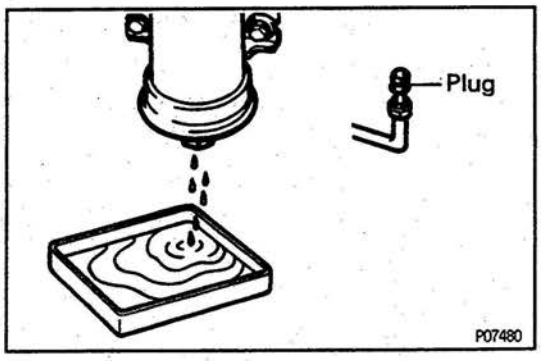


(b) Insert the test probe into the connector from the wiring side when checking the continuity, amperage or voltage.
(c) Do not apply unnecessary force to the terminal.
(d) After the check, install the water–proofing rubber on the connector securely.

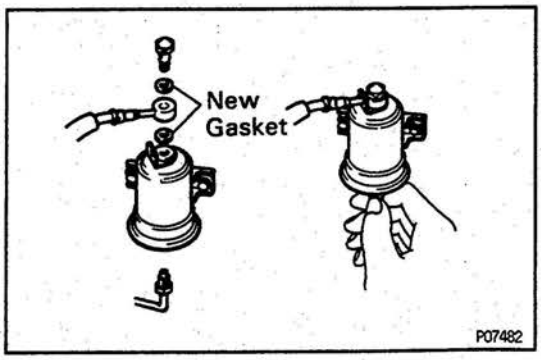


10. Use SST for inspection or test of the injector or its wiring connector.
SST 09842–30070

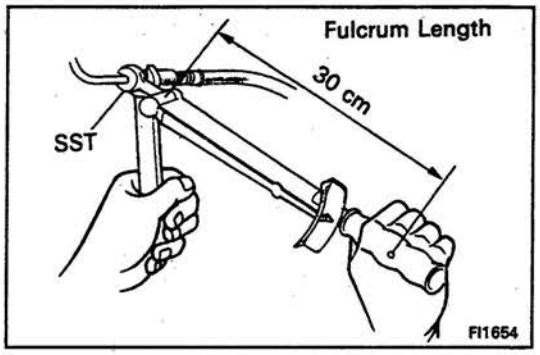
FUEL SYSTEM



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



2. When connecting the flare nut or union bolt on the high pressure pipe union, observe the following procedures:
(Union Bolt Type)
(a) Always use a new gasket.
(b) Tighten the union bolt by hand.
(c) Tighten the union bolt to the specefied 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 and tighten the flare nut by hand.

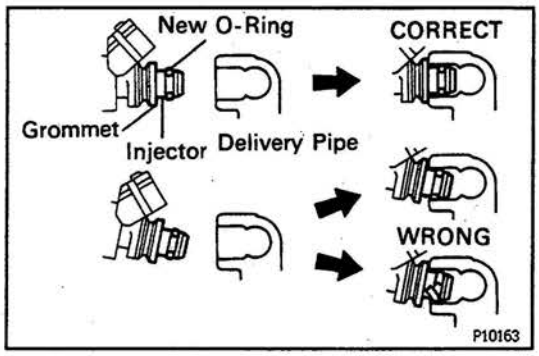
(b) Using SST, tighten the flare nut to the specified torque.

SST 09631–22020

Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)

HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

EG

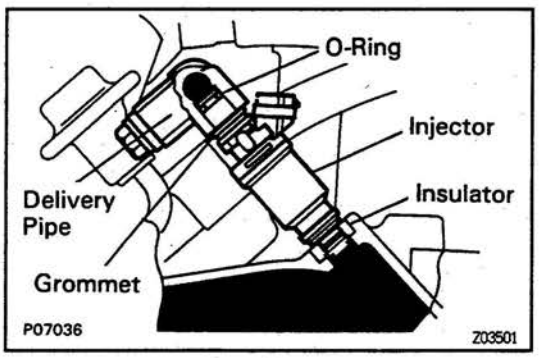


3. Observe the following precautions when removing and installing the injectors.

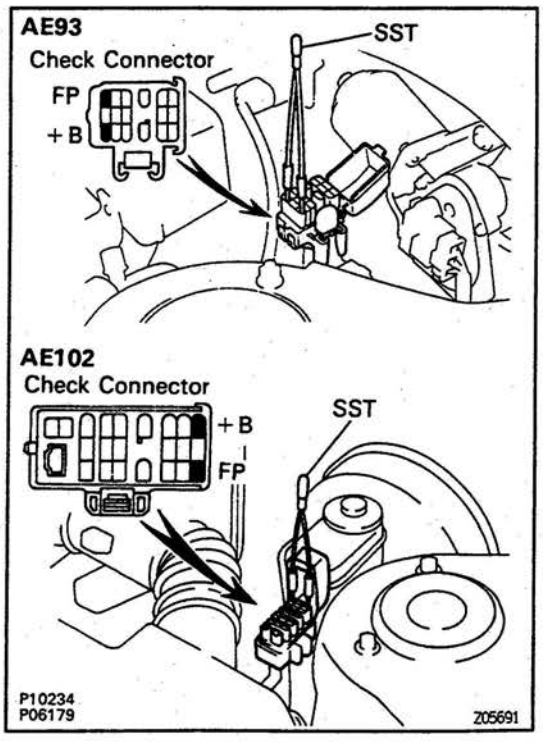
(a) Never reuse the O–ring.

(b) When placing a new O–ring on the injector, take care not to damage it in any way.

(c) Coat a new O–ring with spindle oil or gasoline before installing–never use engine, gear or brake oil.



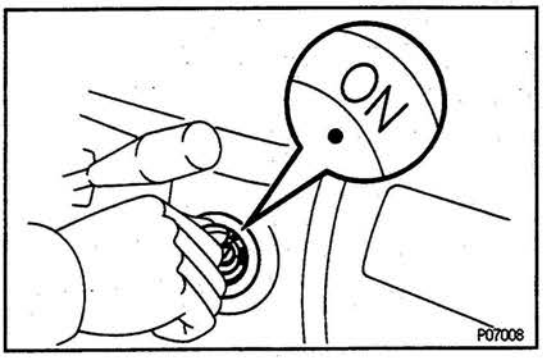
4. Install the injector to delivery pipe and cylinder head as shown in the illustration.



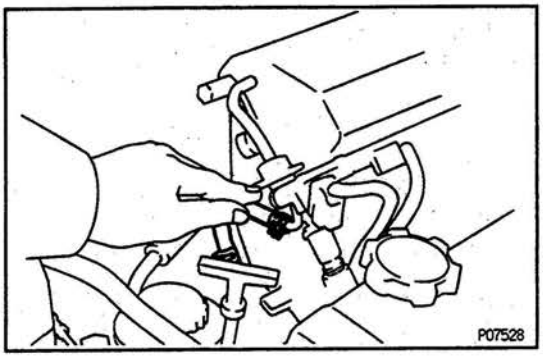
5. Check that there are no fuel leaks after performing any maintenance on the fuel system.

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

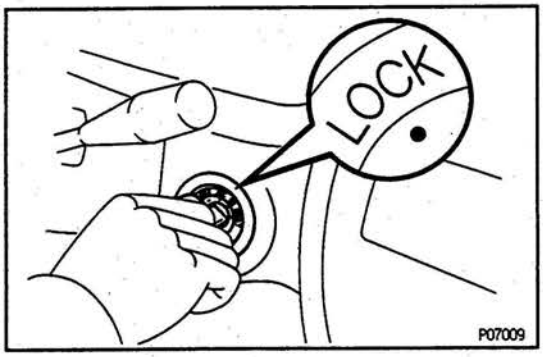
SST 09843–18020



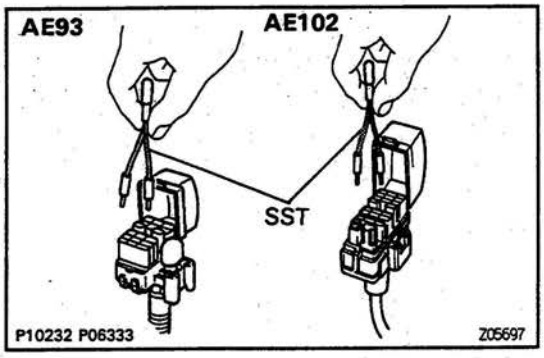
(b) Turn the ignition switch ON.
NOTICE: Do not start the engine.



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



(d) Turn the ignition switch OFF.



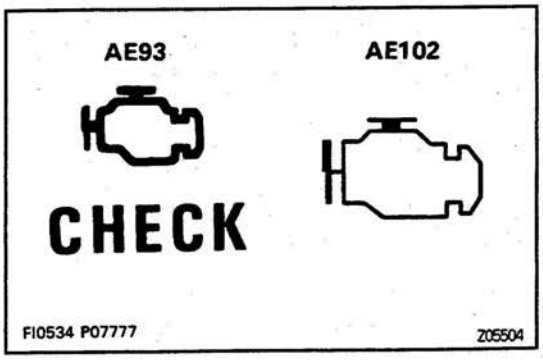
(e) Remove the SST from the check connector.
SST 09843–18020

DIAGNOSIS SYSTEM

DESCRIPTION

B011Z-06

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–147) the ECU detects system malfunctions relating to the sensors or actuators.
The self–diagnosis system has two modes, a normal mode and a test mode.
If a malfunction is detected when in the normal mode, the 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–144).
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–144)
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–144)



CHECK ENGINE WARNING LIGHT CHECK

B0121-04

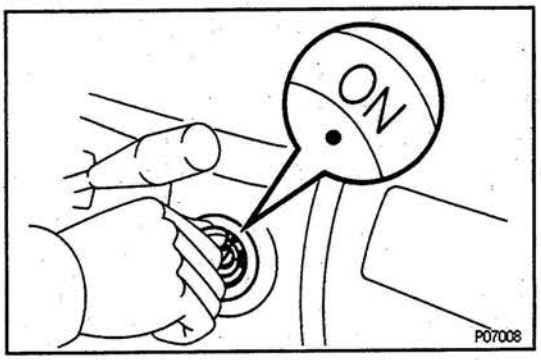
1. The check engine warning light will come on when the ignition switch is placed at ON and the engine is not running.
2. When the engine is started, the check engine warning light should go off.
   If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.

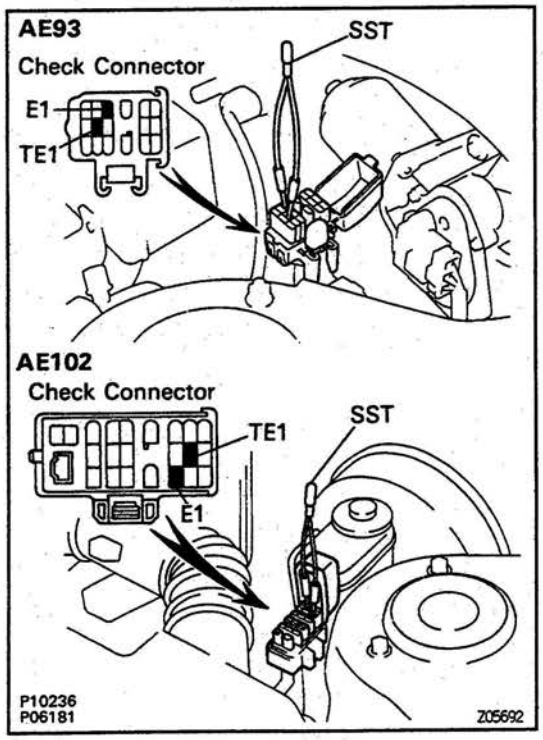
EG

DIAGNOSTIC CODES OUTPUT (Normal mode)

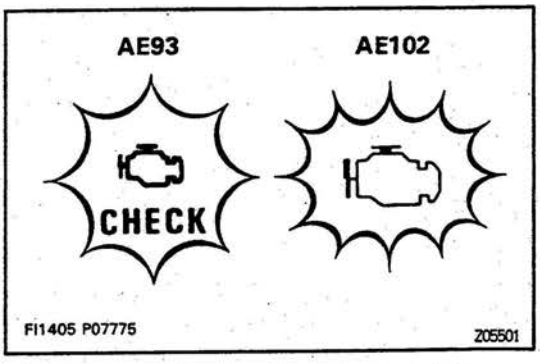
To obtain an output of diagnostic codes, proceed as follows:

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.

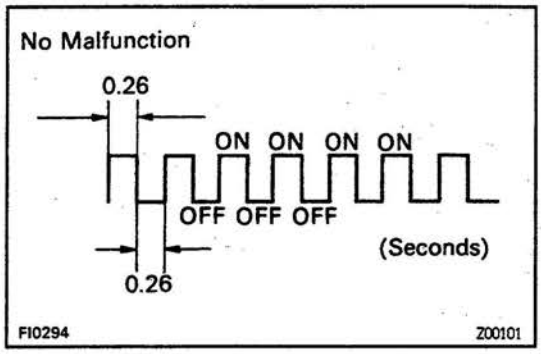




3. Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843–18020



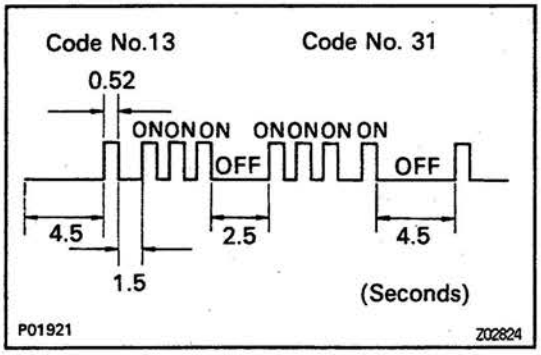
4. Read the diagnostic code as indicated by the number of flashes of the check engine warning light.



Diagnostic Codes (See page EG–147)

(a) Normal System Operation (no malfunction)

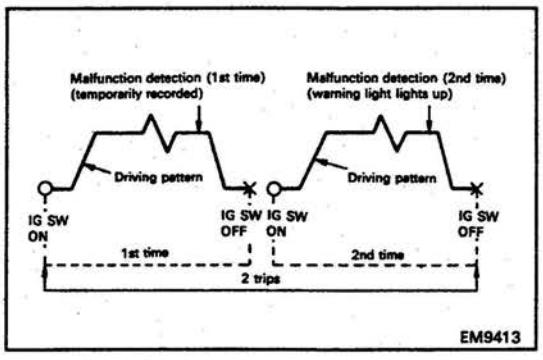
- The light will alternately blink ON and OFF at 0.26–second intervals.



(b) Malfunction Code Indication

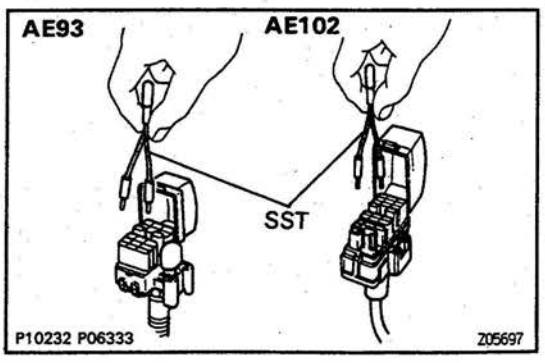
- In the event of a malfunction, the light will blink every 0.52–seconds. The first number of blinks will equal the first digit of a 2–digit diagnostic code and, after a 1.5–second pause, the 2nd number of blinks will equal the 2nd. If there are two or more codes, there will be a 2.5–second pause between 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

(Test mode)

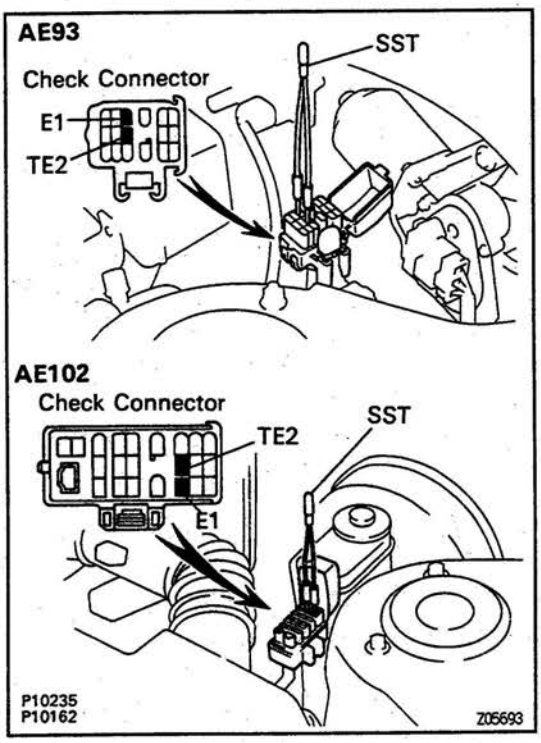
HINT:

- 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.

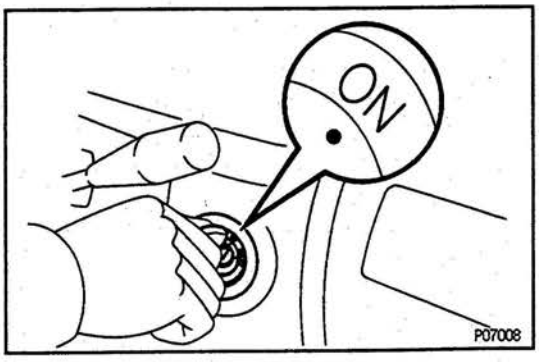
To obtain an output of diagnostic codes, proceed as follows:

1. Initial conditions

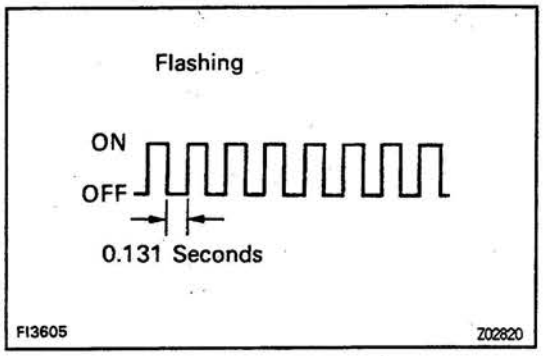
(a) Battery voltage 11 V or more
(b) Transmission in neutral range
(c) Accessories switched OFF
(d) Engine at normal operating temperature



2. First, using SST, connect terminals TE2 and E1 of the check connector.
   SST 09843–18020

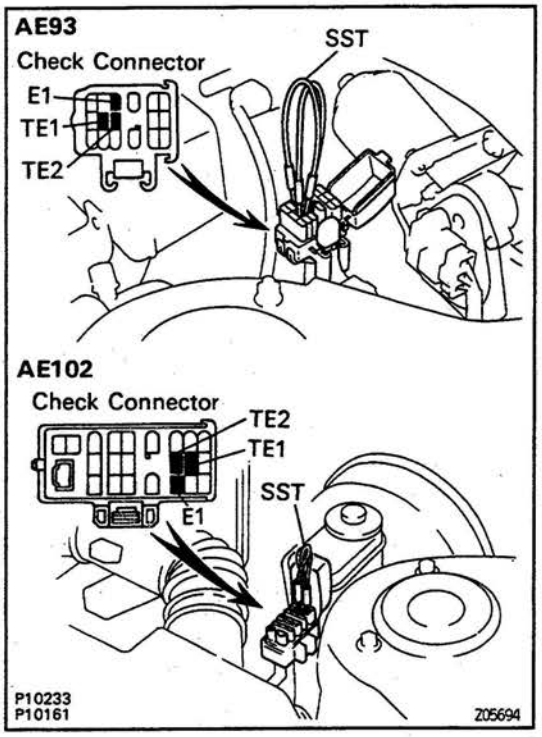


3. Turn the ignition switch ON to begine the diagnosis in the test mode.

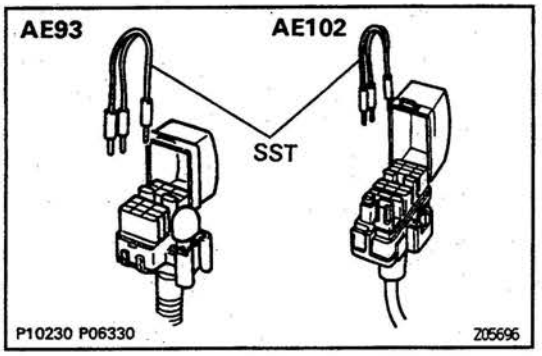


HINT: To confirm that the test mode is operating, check that the check engine warning light flashes when the ignition switch is turned ON.

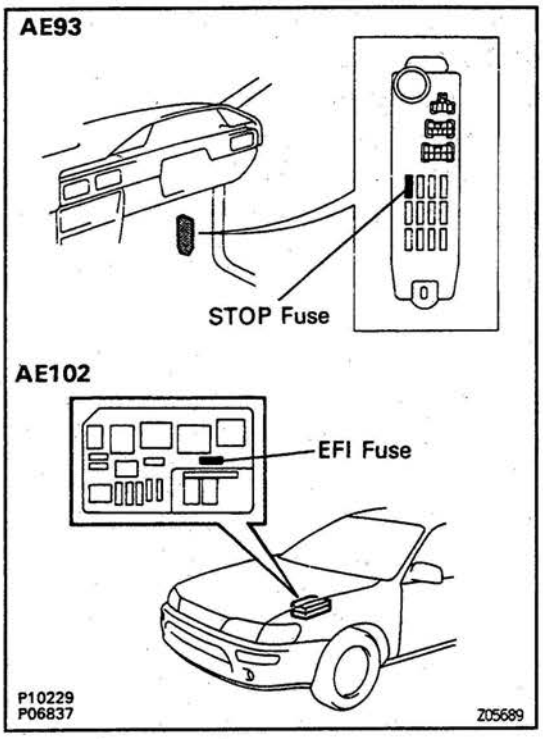
4. Start the engine and drive the vehicle at a speed of 10 km/h (6 mph) or higher.
5. Simulate the conditions of the malfunction described by the customer.



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–147)



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.



DIAGNOSTIC CODE CANCELLATION

1. After repair of the trouble area, the diagnostic code retained in memory by the ECU must be cancelled out by removing the STOP fuse 15A (for AE93) or EFI fuse 15A (for AE102) for 10 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch OFF.
   HINT:
   - Cancellation can also be done by removing the battery negative (–) terminal, but in this case, other memory systems (clock, 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.

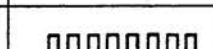
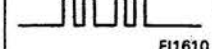
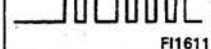
DIAGNOSIS INDICATION

1. When 2 or more codes are indicated, the lowest number (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).

DIAGNOSTIC CODES (AE93)

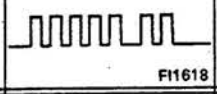
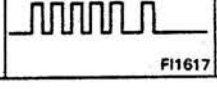
HINT:

- 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 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 secs. or more.	• Open or short in NE, G circuit • IIA • Open or short in STA circuit • ECU	○	IG-4
13	 FI1607	RPM Signal	ON	ON	NE signal is not input to ECU for 0.3 sec. or more when engine speed is 1,500 rpm more.	• Open or short in NE circuit • IIA • ECU	○	IG-4
14	 FI1608	Ignition Signal	ON	N.A.	IGF signal from igniter is not input to ECU for 4 – 5 consecutive ignition.	• Open or short in IGF or IGT circuit from igniter to ECU • Igniter • ECU	○	IG-4
21	 FI1609	Oxygen Sensor Circuit	ON	ON	At normal driving speed below 100 km/h (60 mph) and engine speed is above 1,500 rpm, amplitude of oxygen sensor signal (OX) is reduced to between 0.35 – 0.70 V continuously for 60 sec. or more. *3 (2 trip detection logic)	• Open or short in oxygen sensor circuit • Oxygen sensor • ECU	○	EG-176
22	 FI1610	Water Temp. Sensor Signal	ON	ON	Open or short in water temp. sensor circuit for 0.5 sec. or more. (THW)	• Open or short in water temp. sensor circuit • Water temp. sensor • ECU	○	EG-168
24	 FI1611	Intake Air Temp. Sensor Signal	ON	ON	Open or short in intake air temp. sensor circuit for 0.5 sec. or more. (THA)	• Open or short in intake air temp. circuit • Intake air temp. sensor • ECU	○	EG-167
25	 FI2562	Air-Fuel Ratio Lean Malfunction	ON	ON	Oxygen sensor output is less than 0.45 V for at least 90 secs. or more 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	○	EG-176
31	 FI1612	Vacuum Sensor Signal	ON	ON	Open or short detected continuously for 0.5 sec. or more in vacuum sensor circuit. (PIM)	• Open or short in vacuum sensor circuit • Vacuum sensor • ECU	○	EG-164
41	 FI1614	Throttle Position Sensor Signal	OFF	ON	Open or short detected continuously for 0.5 sec. or more in throttle position sensor (VTA) circuit.	• Open or short in throttle position sensor circuit • Throttle position sensor • ECU	○	EG-162
42	 FI1615	Vehicle Speed Sensor Signal	ON	OFF	SPD signal is not input to ECU for 8 secs. or more during high load driving with engine speed 3,000 rpm or more.	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECU	○	–
43	 FI1616	Starter Signal	N.A.	OFF	Starter signal (STA) is not input to ECU even once until engine reaches 800 rpm or more when cranking.	• Open or short in starter signal circuit • Open or short in IG SW or main relay circuit • ECU	X	EG-169

V02452

DIAGNOSTIC CODES (AE93) (Cont'd)

Code No.	Number of blinks Check Engine Warning Light	System	Check Engine*1 Warning Light		Diagnosis	Trouble Area	Memory*2	See page
			Normal Mode	Test Mode				
52	 FI1618	Knock Sensor Signal	ON	N.A.	With engine speed between 1,200 rpm and 6,000 rpm, signal from knock sensor is not input to ECU for certain period. (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 or IDL contact OFF and STA is OFF with the check terminals E1 and TE1 connected.	• A/C switch system • Throttle position sensor IDL circuit • Accelerator pedal, cable • ECU	X	EG-162

EG

REMARKS:

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

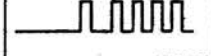
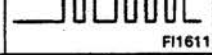
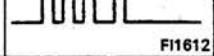
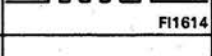
*3 "2 trip detection logic" (See page EG-143)

V02453

DIAGNOSTIC CODES (AE102)

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 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 secs. or more.	• Open or short in NE, G circuit • IIA • Open or short in STA circuit • ECU	○	IG-4
13	 FI1607	RPM Signal	ON	ON	NE signal is not input to ECU for 0.3 sec. or more when engine speed is 1,500 rpm more.	• Open or short in NE circuit • IIA • ECU	○	IG-4
14	 FI1608	Ignition Signal	ON	N.A.	IGF signal from igniter is not input to ECU for 4 – 5 consecutive ignition.	• Open or short in IGF or IGT circuit from igniter to ECU • Igniter • ECU	○	IG-4
21	 FI1609	Oxygen Sensor Circuit	OFF	N.A.	Open or short in heater circuit of oxygen sensor for 0.5 sec. or more. (HT)	• Open or short in heater circuit of oxygen sensor • Oxygen sensor heater • ECU	○	EG-176
				ON	At normal driving speed below 100 km/h (60 mph) and engine speed is above 1,500 rpm, amplitude of oxygen sensor signal (OX) is reduced to between 0.35 – 0.70 V continuously for 60 sec. or more. *3 (2 trip detection logic)	• Open or short in oxygen sensor circuit • Oxygen sensor • ECU		
22	 FI1610	Water Temp. Sensor Signal	ON	ON	Open or short in water temp. sensor circuit for 0.5 sec. or more. (THW)	• Open or short in water temp. sensor circuit • Water temp. sensor • ECU	○	EG-168
24	 FI1611	Intake Air Temp. Sensor Signal	OFF	ON	Open or short in intake air temp. sensor circuit for 0.5 sec. or more. (THA)	• Open or short in intake air temp. circuit • Intake air temp. sensor • ECU	○	EG-167
25	 FI2562	Air-Fuel Ratio Lean Malfunction	OFF	ON	Oxygen sensor output is less than 0.45 V for at least 90 secs. or more 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	○	EG-176
31	 FI1612	Vacuum Sensor Signal	ON	ON	Open or short detected continuously for 0.5 sec. or more in vacuum sensor circuit. (PIM)	• Open or short in vacuum sensor circuit • Vacuum sensor • ECU	○	EG-164
41	 FI1614	Throttle Position Sensor Signal	OFF	ON	Open or short detected continuously for 0.5 sec. or more in throttle position sensor (VTA) circuit.	• Open or short in throttle position sensor circuit • Throttle position sensor • ECU	○	EG-162
42	 FI1615	Vehicle Speed Sensor Signal	OFF	OFF	SPD signal is not input to ECU for 8 secs. or more during high load driving with engine speed 3,000 rpm or more.	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECU	○	–

V02454

DIAGNOSTIC CODES (AE102) (Cont'd)

Code No.	Number of blinks Check Engine Warning Light	System	Check Engine*1 Warning Light		Diagnosis	Trouble Area	Memory*2	See page
			Normal Mode	Test Mode				
43	 FI1616	Starter Signal	N.A.	OFF	Starter signal (STA) is not input to ECU even once until engine reaches 800 rpm or more when cranking.	• Open or short in starter signal circuit • Open or short in IG SW or main relay circuit • ECU	X	EG-169
52	 FI1618	Knock Sensor Signal	ON	N.A.	With engine speed between 1,200 rpm and 6,000 rpm, signal from knock sensor is not input to ECU for certain period. (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 or IDL contact OFF and STA is OFF with the check terminals E1 and TE1 connected.	• A/C switch system • Throttle position sensor IDL circuit • Accelerator pedal, cable • ECU	X	EG-162

REMARKS:

*1 "ON" displayed in the diagnosis mode column indicates that the check engine warning light is lighted up when a malfunction is detected. "OFF" indicates that the check engine warning light does not light up during malfunction diagnosis, even if a malfunction is detected. "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-143)

V02455

DIAGNOSTIC CODE DETECTION DRIVING PATTERN

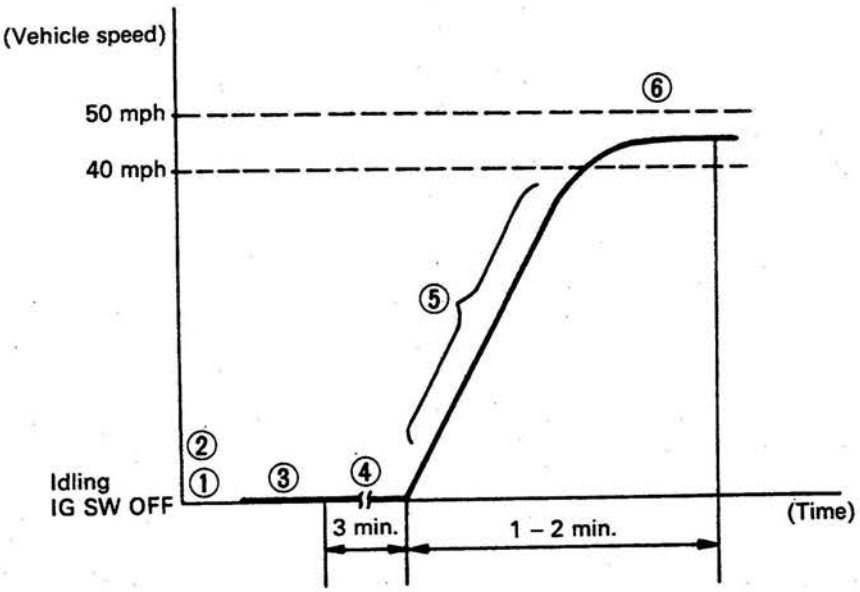
Purpose of the driving pattern.

(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 no longer detected.

Code No.	21	Oxygen Sensor Circuit

Malfunction: Deterioration of Oxygen Sensor



P01713

① Disconnect the STOP fuse 15A (for AE93) or EFI fuse 15A (for AE102) for 10 seconds or more, with ignition switch OFF.

② Initiate test model: Connect terminals TE2 and E1 of check connector with ignition switch OFF.

③ Start the engine and warm the engine up with all accessory switches OFF.

④ After the engine is warmed up, let it idle for 3 minutes.

⑤ Accelerate gradually and maintain at approximately 1,500 rpm, or within the 1,300 to 1,700 rpm range. Turn the A/C on, and drive in "D" for automatic, or in case of manual transmission, upshift appropriately. Shift carefully so that the engine speed would not fall below 1,200 rpm. Depress the accelerator pedal gradually and maintain a steady speed to avoid engine braking.

⑥ Maintain the vehicle speed at 40 – 50 mph.
Keep the vehicle running for 1 – 2 minutes after starting acceleration.

HINT: If any malfunction is detected, the check engine warning light will light up during step ⑥ .

NOTICE: If this procedure is not strictly followed, you cannot detect the malfunction.

V02402

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

Purpose of the driving pattern.

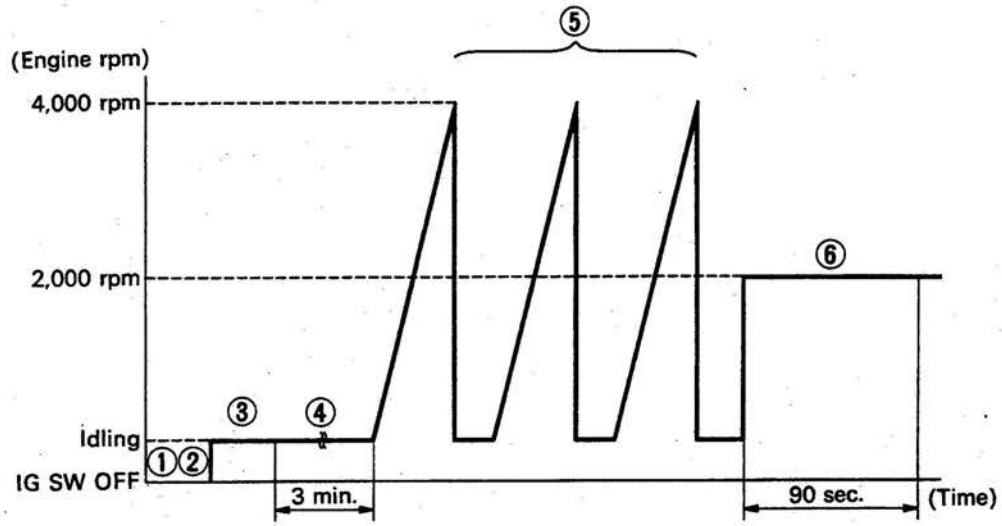
(a) To simulate diagnostic code detecting condition after diagnostic code is recorded.

(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 Ratio Lean Malfunction

Malfunction: Open or Short in Oxygen Sensor



P02491

① Disconnect the STOP fuse 15A (for AE93) or EFI fuse 15A (for AE102) for 10 seconds or more, with ignition switch OFF.

② Initial test mode: Connect terminal TE2 and E1 of check connector with ignition switch OFF.

③ Start the engine and warm the engine up, with all accessory switches OFF.

④ After the engine is warmed up, let it idle for 3 minutes.

⑤ Accelerate rapidly to 4,000 rpm three times.

⑥ Maintain at 2,000 rpm for 90 seconds.

HINT: If any malfunction is detected, the check engine warning light will light up during step ⑥ .

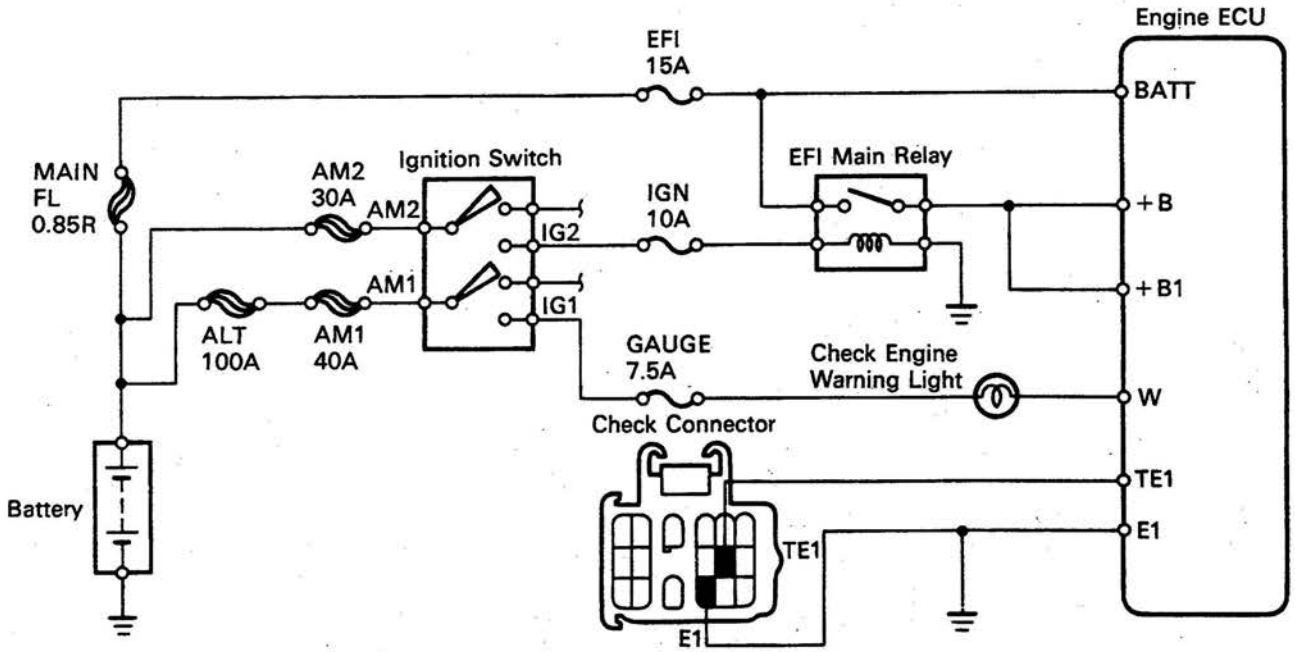
NOTICE: If this procedure is not strictly followed, you cannot detect the malfunction.

V02403

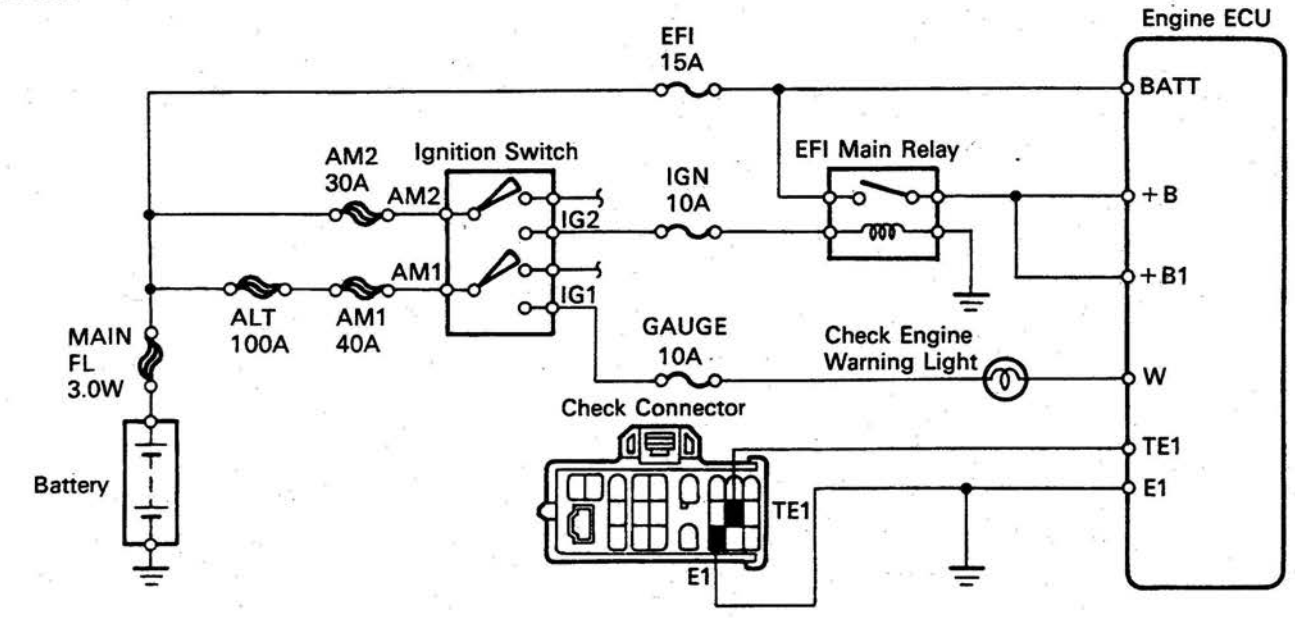
B015W-02

DIAGNOSIS CIRCUIT INSPECTION

AE93



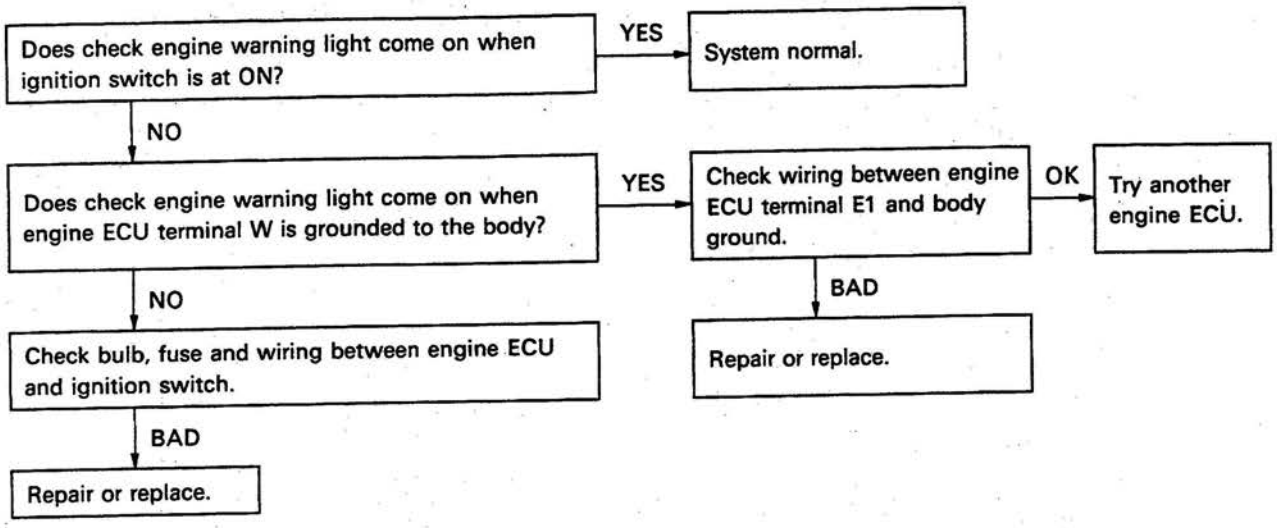
AE102



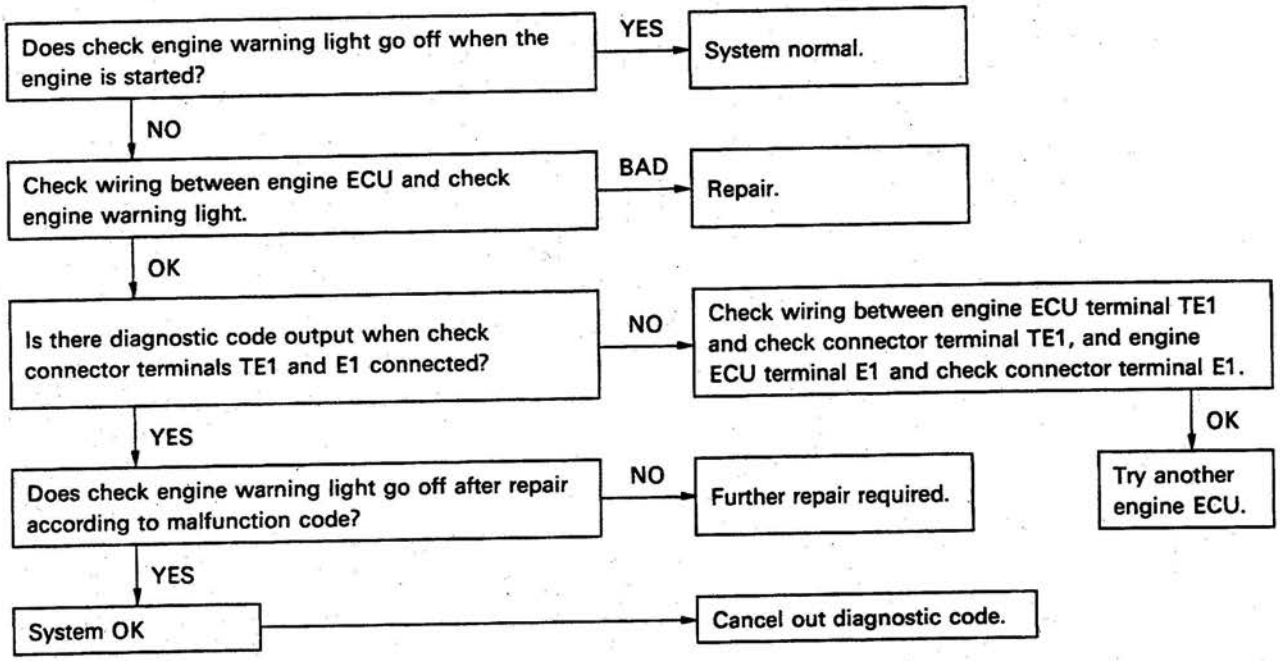
P10220
P07163

Z05774

1.


Does check engine warning light come on when ignition switch is at ON?
YES
System normal.
NO
Does check engine warning light come on when engine ECU terminal W is grounded to the body?
YES
Check wiring between engine ECU terminal E1 and body ground.
OK
Try another engine ECU.
BAD
Repair or replace.
NO
Check bulb, fuse and wiring between engine 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 engine ECU and check engine warning light.
BAD
Repair.
OK
Is there diagnostic code output when check connector terminals TE1 and E1 connected?
NO
Check wiring between engine ECU terminal TE1 and check connector terminal TE1, and engine ECU terminal E1 and check connector terminal E1.
OK
Try another engine ECU.
YES
Does check engine warning light go off after repair according to malfunction code?
NO
Further repair required.
YES
System OK
Cancel out diagnostic code.

V02511

TROUBLESHOOTING W/ VOLT, OHMMETER

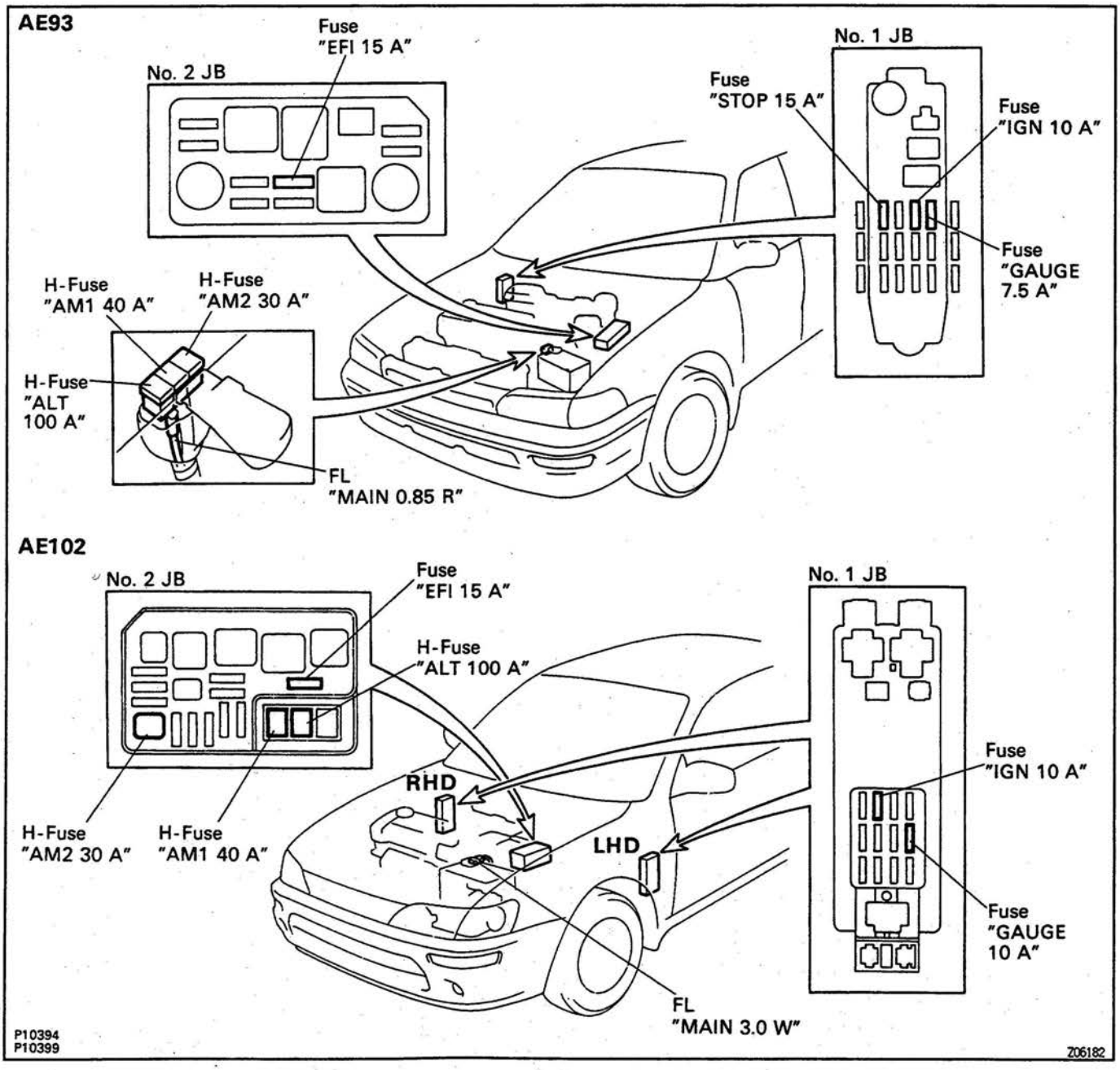
EG128-02

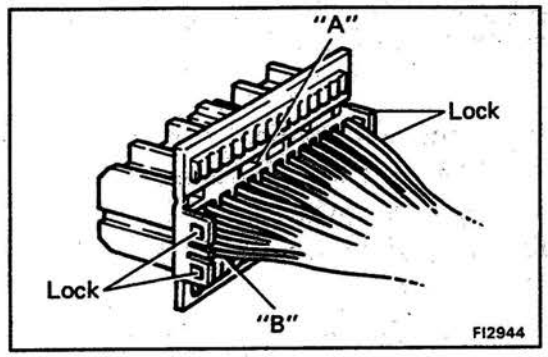
HINT:

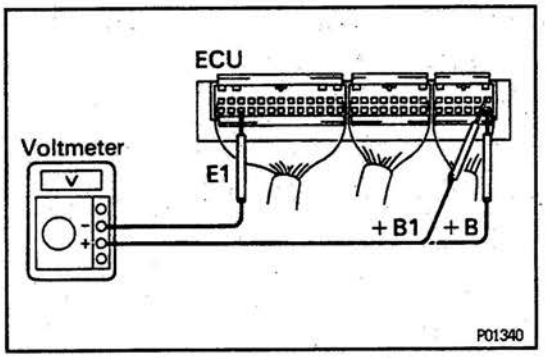
- The following troubleshooting procedures are designed for inspection of each separate system, and therefore the actual procedure may vary somewhat. However, troubleshooting should be performed while referring to the inspection methods described in this manual.
- Before beginning inspection, it is best to first make a simple check of the fuses, H–fuses, fusible link and the condition of the connectors.
- The following troubleshooting procedures are based on the supposition that the trouble lies in either a short or open circuit within the computer.
- If engine trouble occurs even though proper operating voltage is detected in the computer connector, then it can be assumed that the ECU is faulty and should be replaced.

FUSES, H–FUSES AND FUSIBLE LINK LOCATION

EG128-03







EFI SYSTEM CHECK PROCEDURE

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.

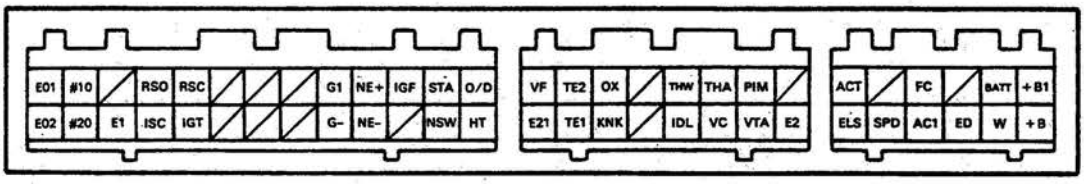
Using a voltmeter with high impedance (10 kΩ/V minimum), measure the voltage at each terminal of the wiring connectors.

Engine ECU Terminals

Symbol	Terminal Name	Symbol	Terminal Name	Symbol	Terminal Name
E01	POWER GROUND	NE+	IIA (DISTRIBUTOR)	THA	INTAKE AIR TEMP. SENSOR
E02	POWER GROUND	NE–	IIA (DISTRIBUTOR)	VC	VACUUM SENSOR THROTTLE POSITION SENSOR
#10	INJECTOR	IGF	IGNITER	PIM	VACUUM SENSOR
#20	INJECTOR		–	VTA	THROTTLE POSITION SENSOR
	–	STA	STARTER RELAY		–
E1	ENGINE GROUND	NSW	NEUTRAL START SWITCH	E2	SENSOR GROUND
RSO	ISC VALVE	*1O/D	OVER DRIVE SOLENOID	ACT	A/C AMPLIFIER
ISC	A/C IDLE-UP VSV	*2HT	OXYGEN SENSOR HEATER	ELS	TAILLIGHT RELAY DEFOGGER SWITCH
RSC	ISC VALVE	VF	CHECK CONNECTOR		–
IGT	IGNITER	E21	SENSOR GROUND	SPD	SPEED SENSOR
	–	TE2	CHECK CONNECTOR	FC	CIRCUIT OPENING RELAY
	–	TE1	CHECK CONNECTOR	AC1	A/C AMPLIFIER
	–	OX	OXYGEN SENSOR		–
	–	KNK	KNOCK SENSOR	*3ED	ED MONITOR
	–		–	BATT	BATTERY
	–		–	W	WARNING LIGHT
G1	IIA (DISTRIBUTOR)	THW	WATER TEMP. SENSOR	+B1	EFI MAIN RELAY
G–	IIA (DISTRIBUTOR)	IDL	THROTTLE POSITION SENSOR	+B	EFI MAIN RELAY

Engine ECU Terminals

*1 only for AE93
*2 only for AE102
*3 only for AE102 LHD



P01821

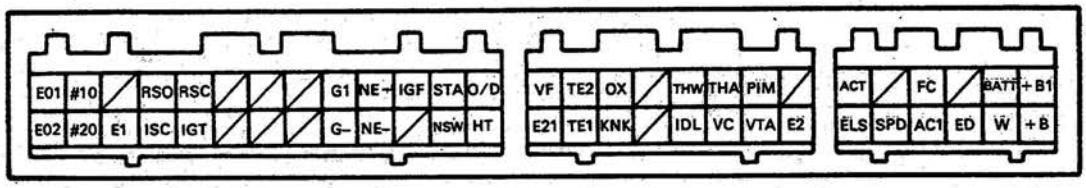
V02456

EG

Engine ECU Wiring Connectors Voltage

No.	Terminals	Condition		STD voltage (V)	See page
1	+B, +B1 – E1	IG SW ON		9 – 14	EG-159
2	BATT – E1	–		9 – 14	EG-161
3	IDL – E2	IG SW ON	Throttle valve open	9 – 14	EG-162
	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-164
	VC – E2			4.5 – 5.5	
5	#10, #20 – E01, E02			9 – 14	EG-165
6	THA – E2	IG SW ON	Intake air temp. 20°C (68°F)	0.5 – 3.4	EG-167
7	THW – E2		Coolant temp. 80°C (176°F)	0.2 – 1.0	EG-168
8	STA – E1	Cranking		6 or more	EG-169
9	IGT – E1	Cranking or idling		Pulse generation	EG-171
10	RSC, RSO – E1	IG SW ON	Engine ECU connectors disconnected	9 – 14	EG-173
11	W – E1	No trouble (Check engine warning light off) and engine running		9 – 14	EG-175

Engine ECU Terminals



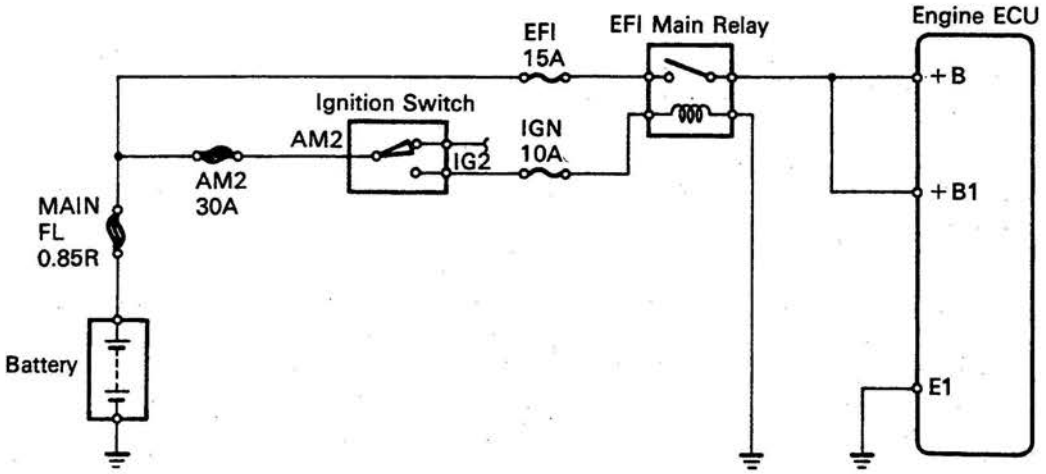
P01821

V02514

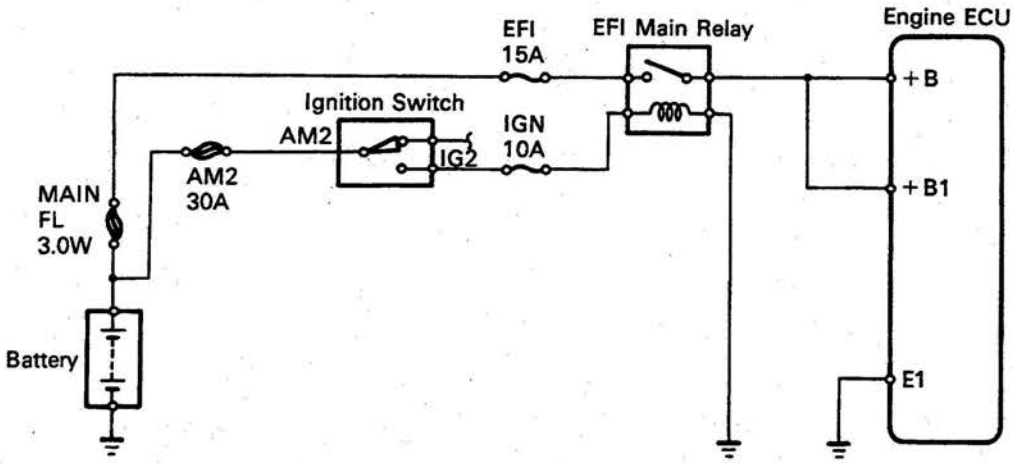
No.	Terminals	Trouble	Condition	STD voltage
1	+B +B1 – E1	No voltage	IG SW ON	9 – 14 V

EG

AE93

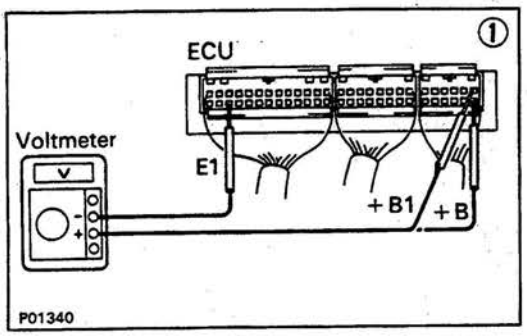


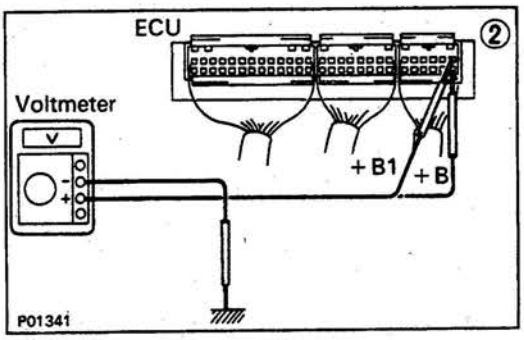
AE102

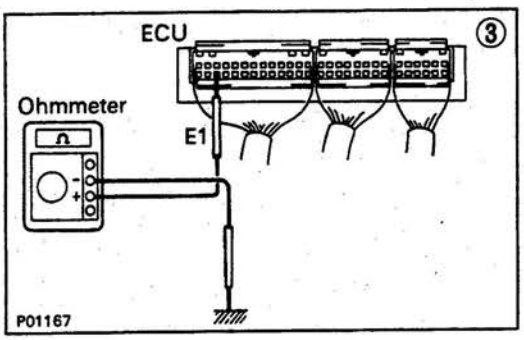


P07143
P10165

V02476







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

OK

③ Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

Check fuses, H-fuse, fusible link and ignition switch. → BAD → Repair or replace.

OK

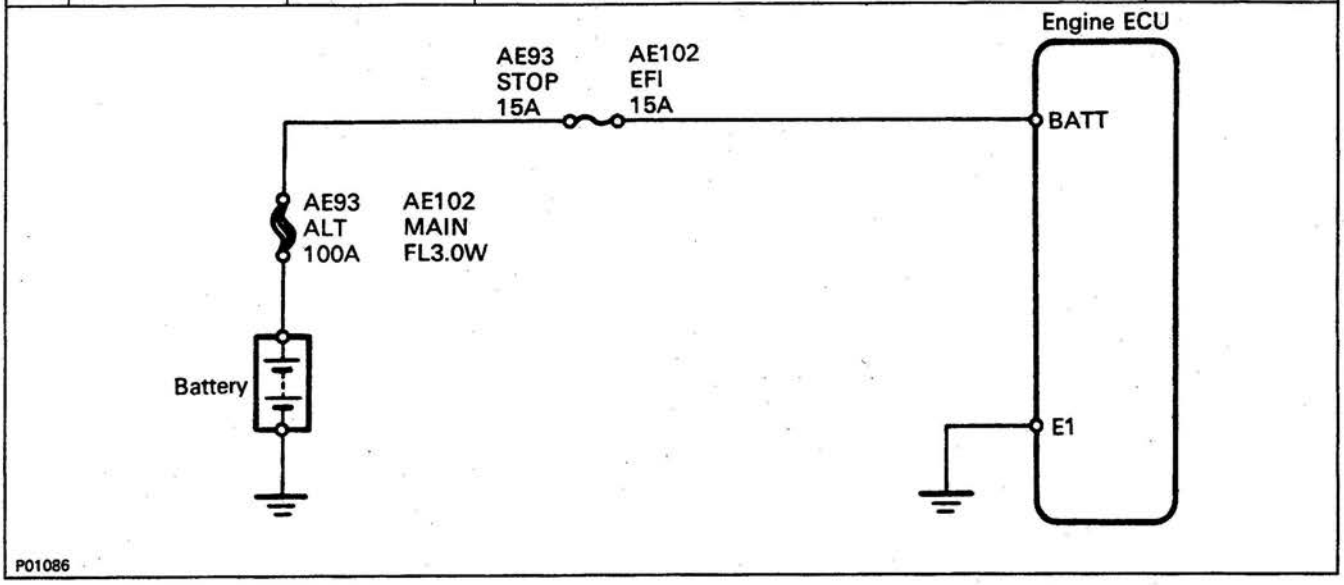
Check EFI main relay. (See page EG-221) → BAD → Replace.

OK

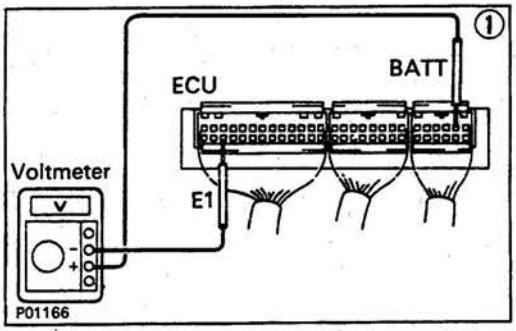
Check wiring between EFI main relay and battery. → BAD → Repair or replace.

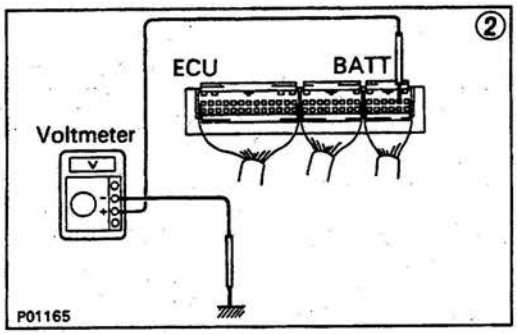
V02477

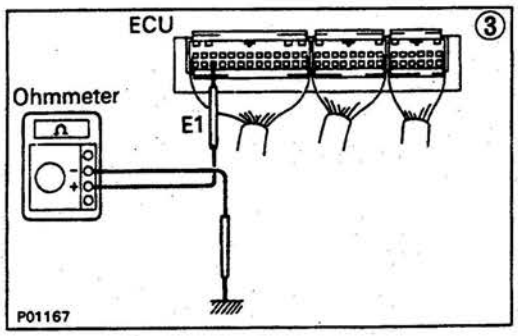
No.	Terminals	Trouble	Condition	STD voltage
2	BATT – E1	No voltage	–	9 – 14V



V02394







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 H-fuse or fusible link. → BAD → Replace.

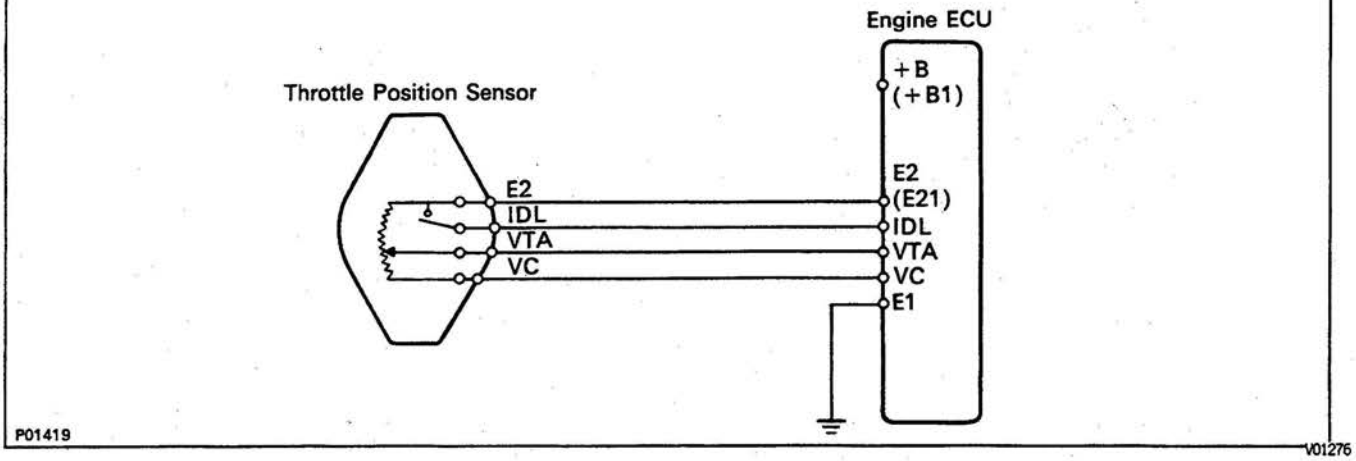
OK

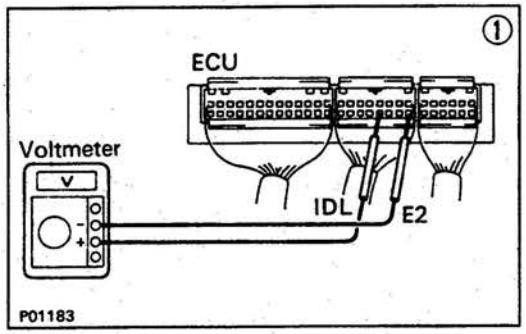
Check wiring between ECU terminal and battery. → BAD → Repair or replace.

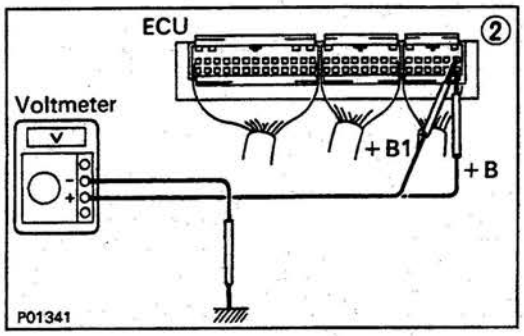
V02398

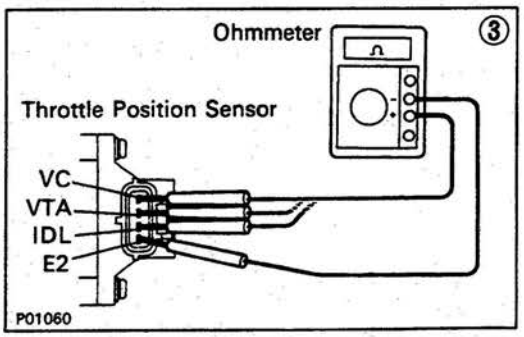
EG

No.	Terminals	Trouble	Condition		STD voltage
3	IDL – E2	No voltage	IG SW 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 (+B1) and body ground. **(IG SW ON)**

NO → ↓ OK

Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

↓

Refer to No.1. (See page EG-159) — BAD → Repair or replace.

↓ OK

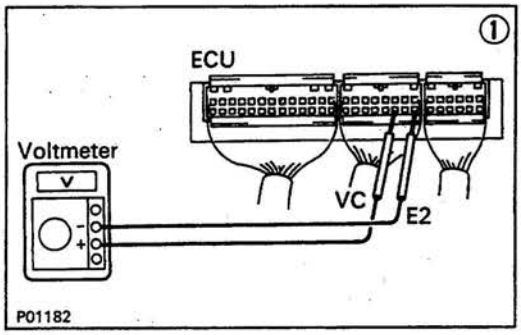
③ Check throttle position sensor. (See page EG-210) — BAD → Repair or replace throttle position sensor.

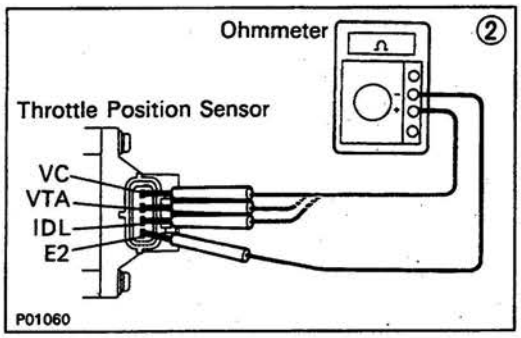
OK → Check wiring between ECU and throttle position sensor. — BAD → Repair or replace.

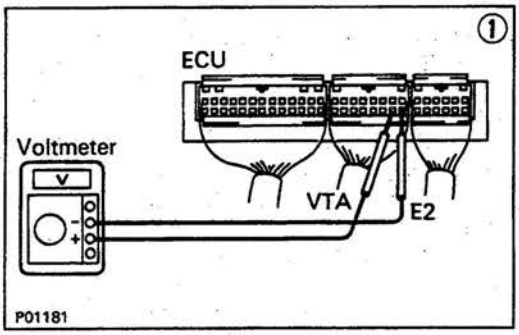
↓ OK

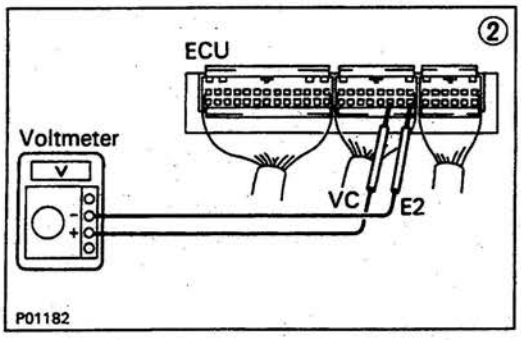
Try another ECU.

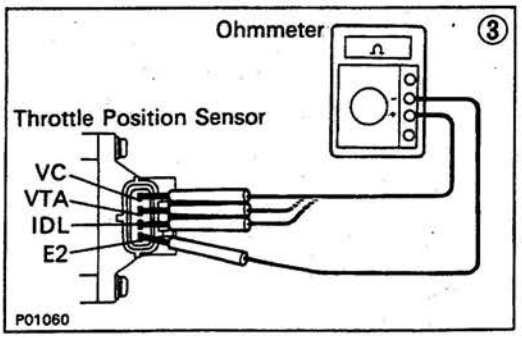
V02478











• VC – E2

① There is no voltage between ECU terminals VC and E2. **(IG SW ON)**

↓

Check that there is voltage between ECU terminal +B (+B1) and body ground. **(IG SW ON)**

↓ OK

② Check throttle position sensor. (See page EG-210)

↓ BAD

Repair or replace.

↓ OK

Check wiring between ECU and throttle position sensor.

↓ OK

Try another ECU.

NO → Refer to No.1. (See page EG-159)

BAD → Repair or replace wiring.

• VTA – E2

① There is no specified voltage at ECU terminals VTA and E2. **(IG SW ON)**

↓

② Check that there is voltage between ECU terminals VC and E2. **(IG SW ON)**

↓ NO

Refer to VC – E2 trouble section.

↓ OK

③ Check throttle position sensor. (See page EG-210)

↓ OK

Check wiring between ECU and throttle position sensor.

↓ OK

Try another ECU.

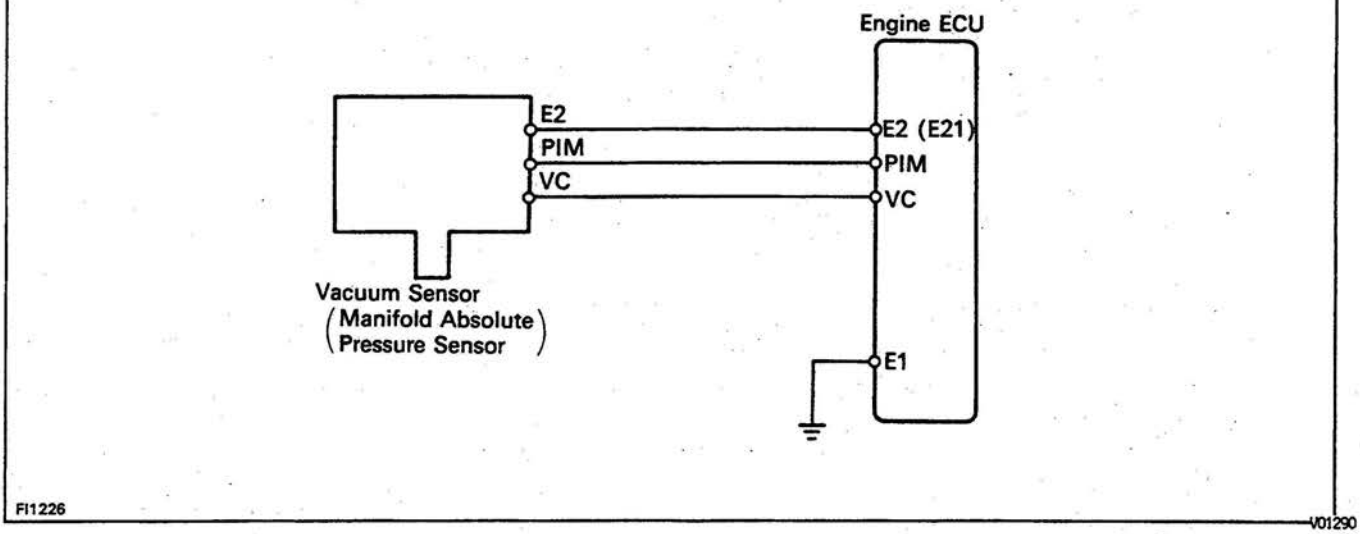
OK → ③ Check throttle position sensor. (See page EG-210)

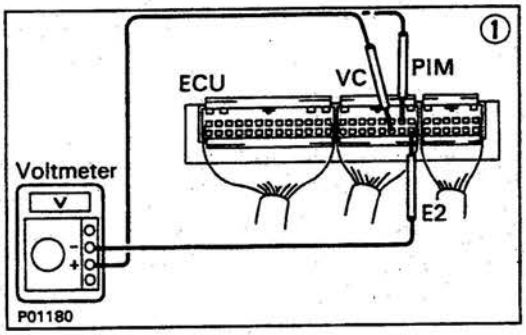
BAD → Repair or replace.

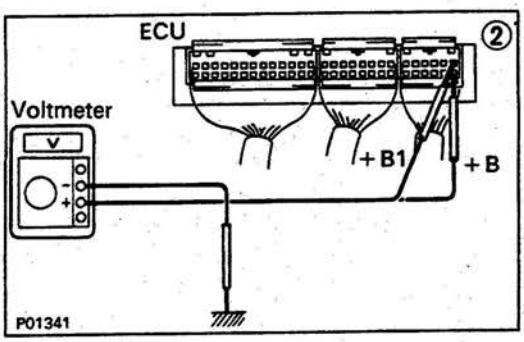
Check wiring between ECU and throttle position sensor. BAD → Repair or replace.

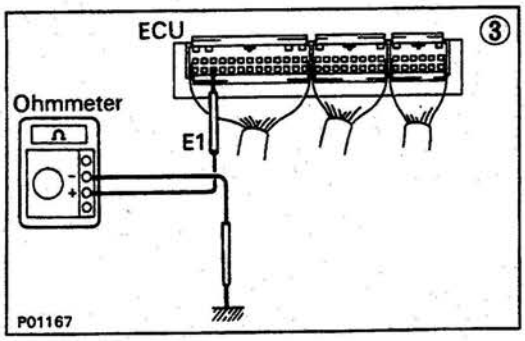
V02479

No.	Terminals	Trouble	Condition	STD voltage
4	PIM – E2	No voltage	IG SW ON	3.3 – 3.9 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 (+B1) and body ground. **(IG SW ON)**

OK ↓

NO → Refer to No. 1. (See page EG-159)

↓

③ Check wiring between ECU terminal E1 and body ground.

OK ↓

BAD → Repair or replace.

Check vacuum sensor. (See page EG-227)

BAD → Replace vacuum sensor.

OK → Check wiring between ECU and vacuum sensor.

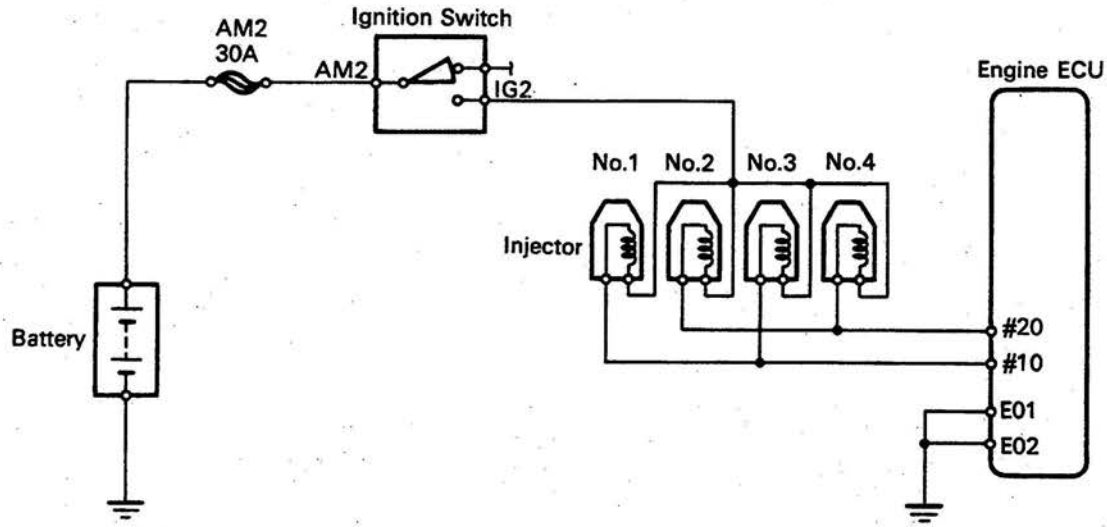
OK → Try another ECU.

BAD → Repair or replace.

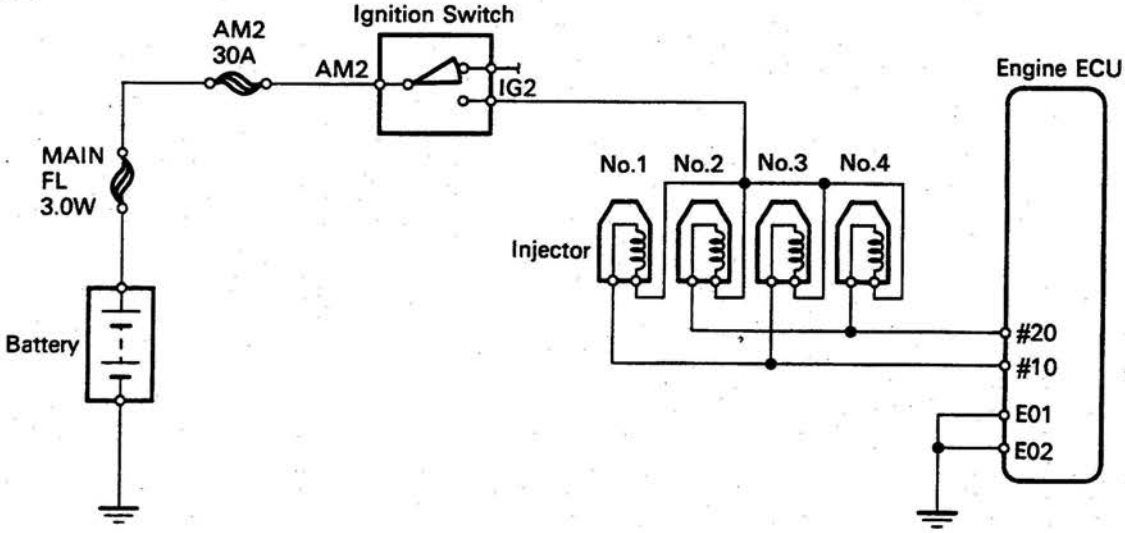
V02480

No.	Terminals	Trouble	Condition	STD voltage
5	#10 – E01 #20 – E02	No voltage	IG SW ON	9 – 14 V

AE93



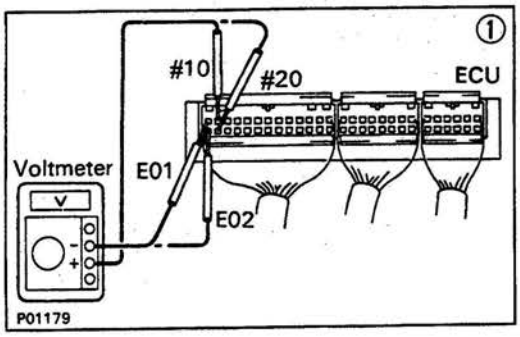
AE102

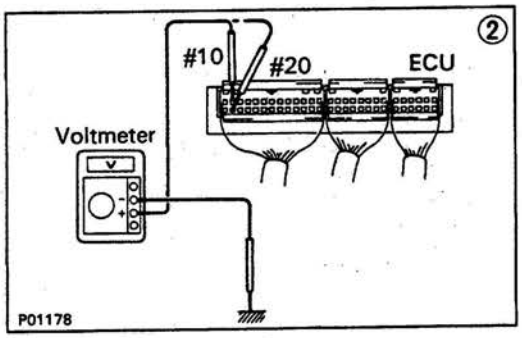


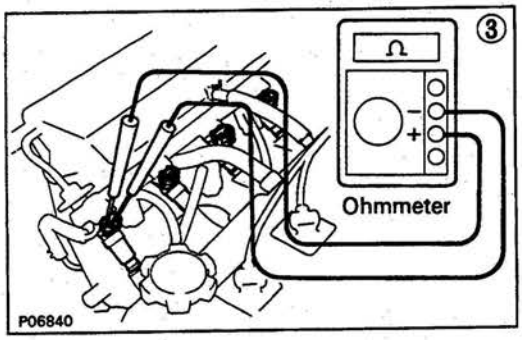
P10167
P07432

V02481

EG







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 H-fuse, fusible link and ignition switch.

BAD → Repair or replace.

OK

③ Check resistance of each injector.
STD resistance: Approx. 13.8 Ω

OK

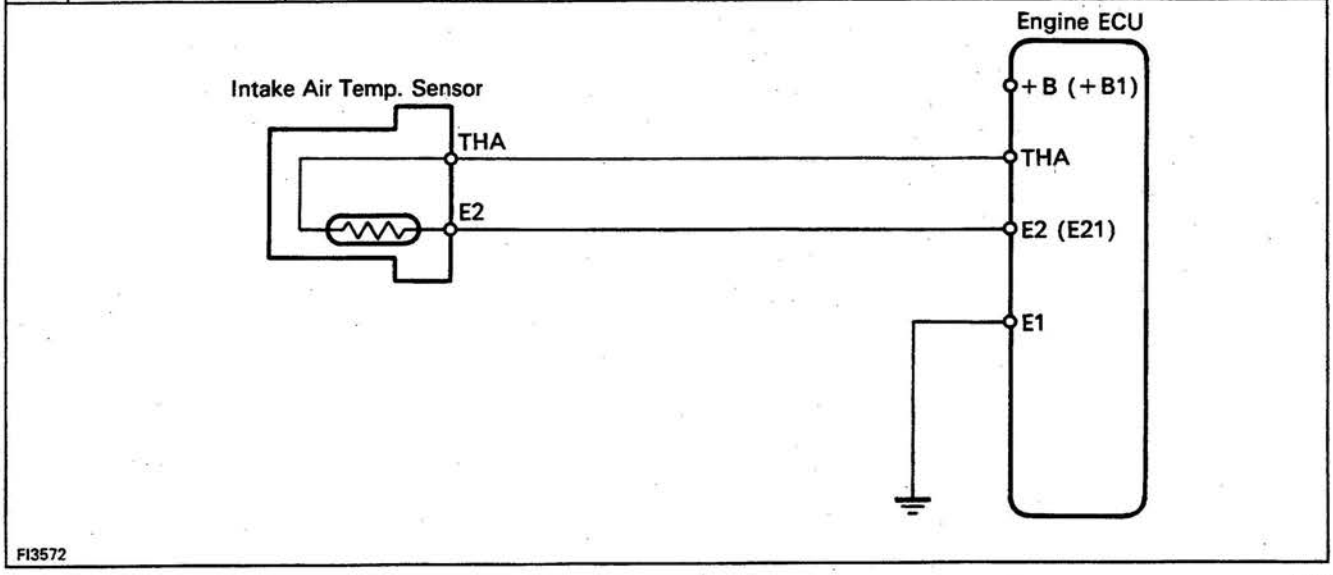
BAD → Replace injector.

Check wiring between ECU terminal #10 and/or #20 and battery.

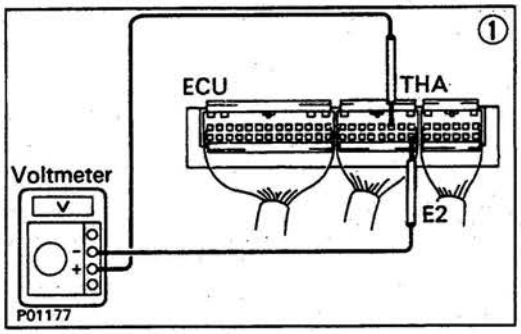
BAD → Repair or replace.

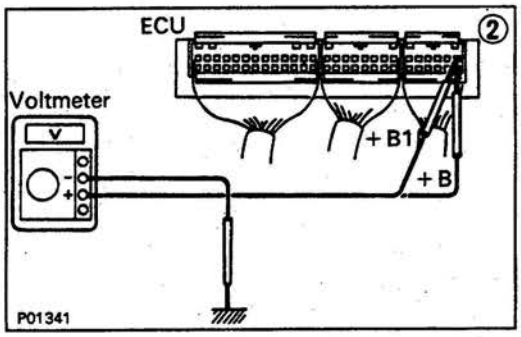
V02482

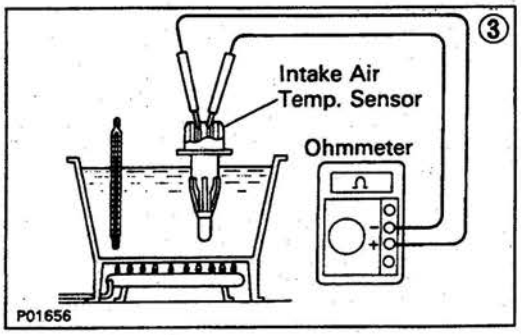
No.	Terminals	Trouble	Condition		STD voltage
6	THA – E2	No voltage	IG SW ON	Intake air temperature 20°C (68°F)	0.5 – 3.4 V



V02395







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 No.1. (See page EG-159)

↓

Check wiring between ECU terminal E1 and body ground.

OK ↓ / BAD → Repair or replace.

↓

③ Check intake air temp. sensor. (See page EG-226)

BAD → Replace intake air temp. senor.

OK ↓

Check wiring between ECU and air temp. sensor.

OK ↓ / BAD → Repair or replace.

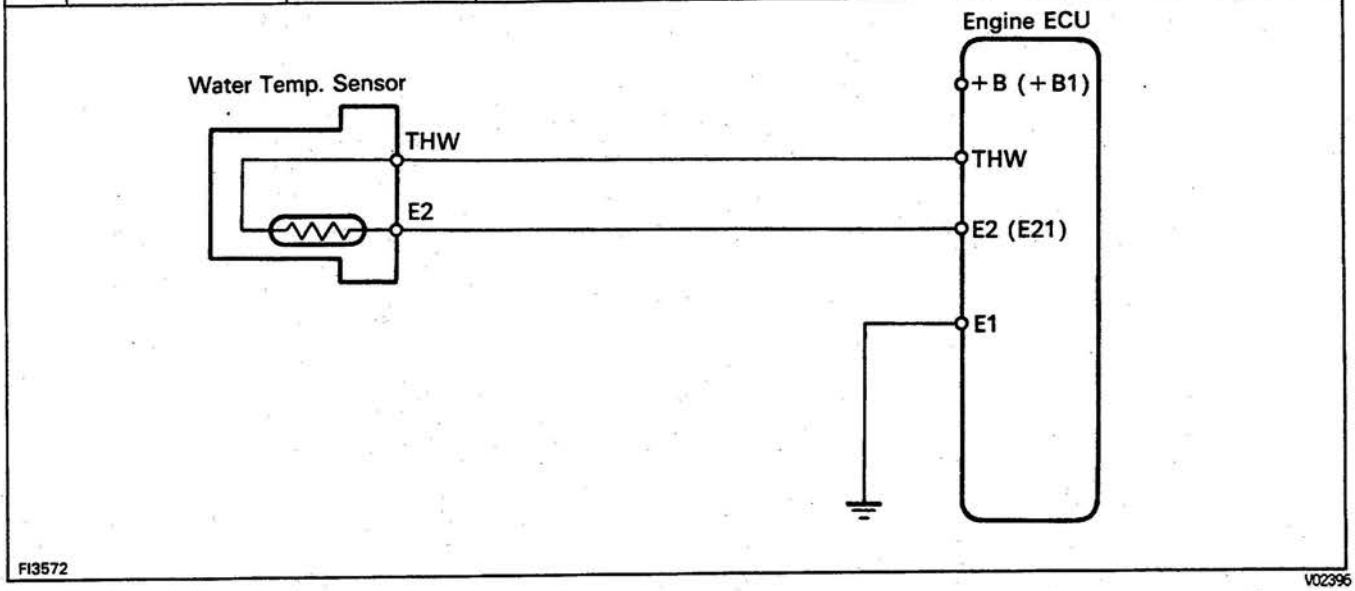
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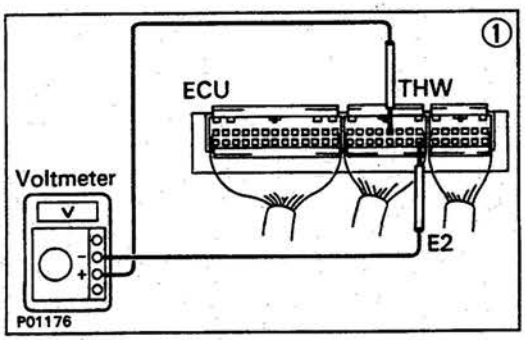
Try another ECU.

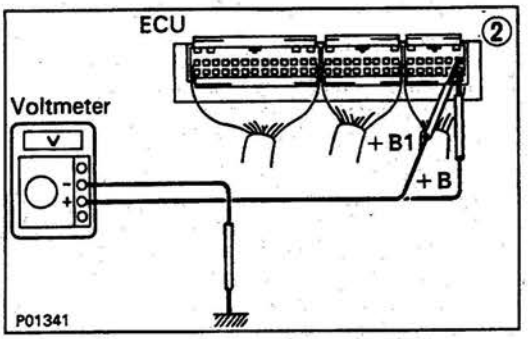
V02399

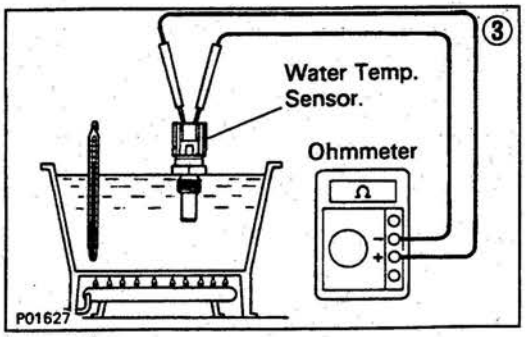
EG

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 → Check wiring between ECU terminal E and body ground.

NO → Refer to No.1 (See page EG-159)

OK → ③ Check water temp. sensor. (See page EG-225)

BAD → Repair or replace.

BAD → Replace water temp. sensor.

OK → Check wiring between ECU and water temp. sensor.

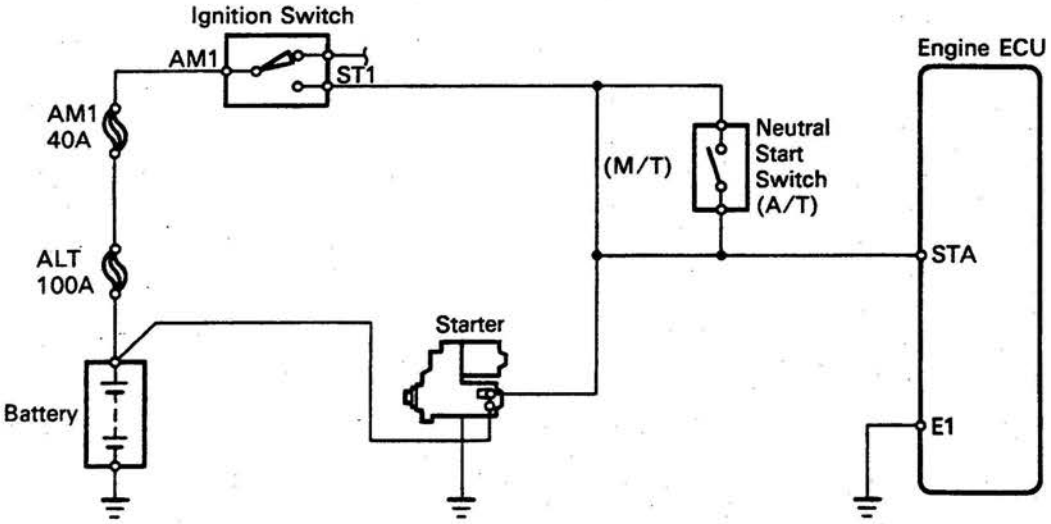
OK → Try another ECU.

BAD → Repair or replace.

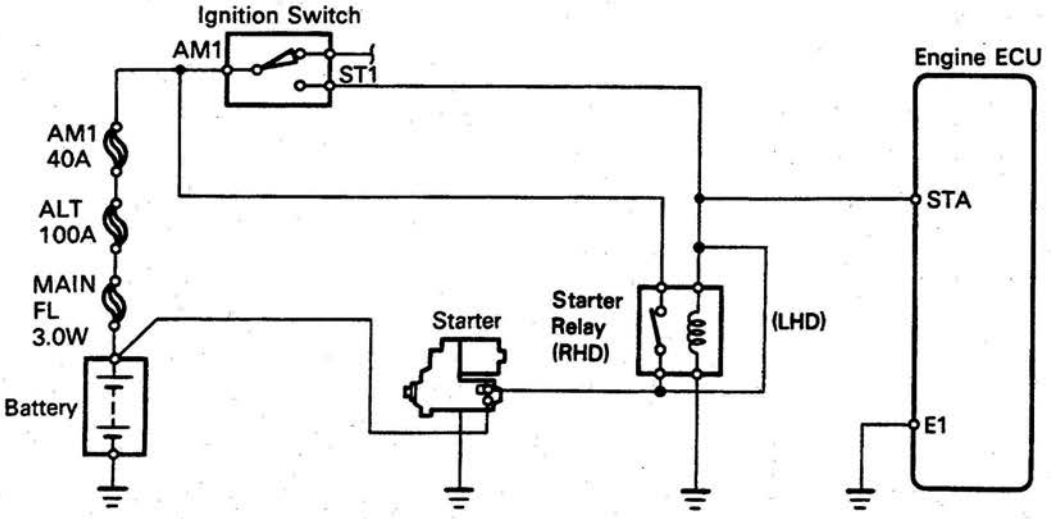
V02400

No.	Terminals	Trouble	Condition	STD voltage
8	STA – E1	No voltage	Cranking	6 V or more

AE93

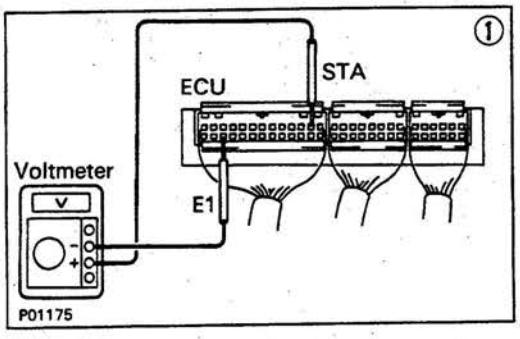


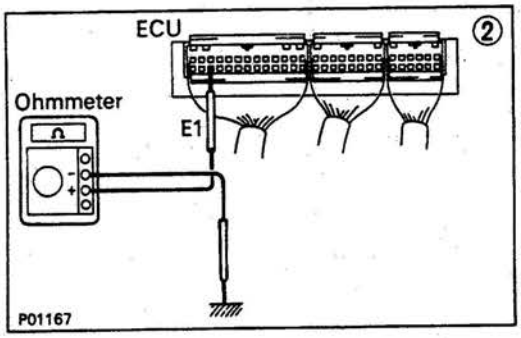
AE102

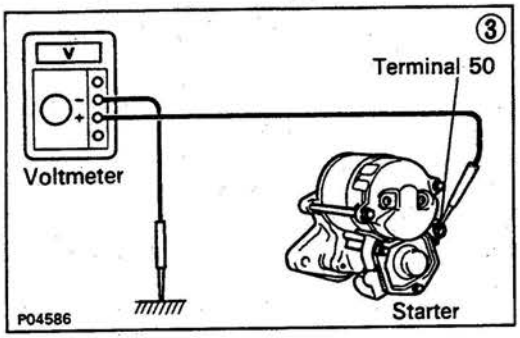


P10172
P10171

V02483







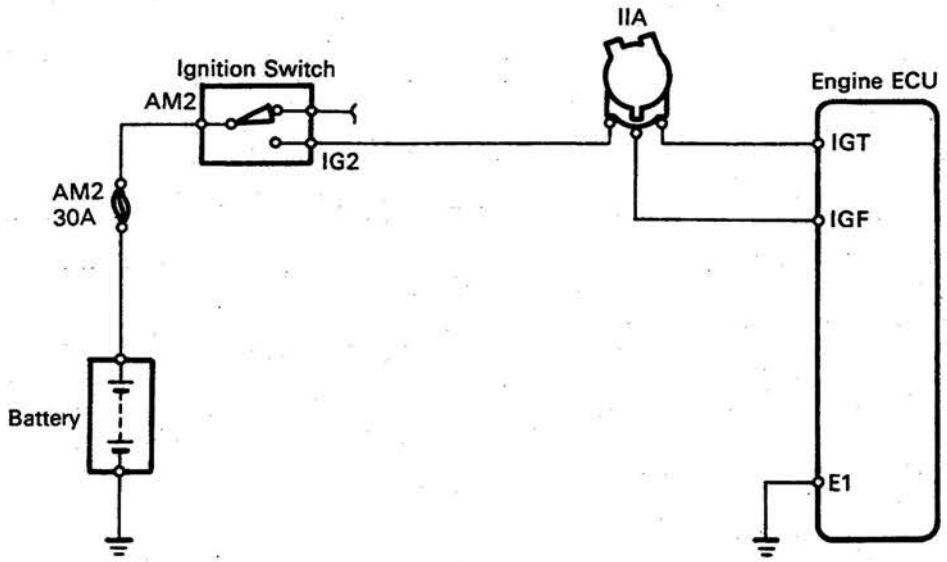
① There is no voltage between ECU terminals STA and E1. **(IG SW START)**

Check starter operation.
- OK → Check wiring between ECU terminal STA and ignition switch terminal ST1.
  - BAD → Repair or replace.
  - OK → ② Check wiring between ECU terminal E1 and body ground.
    - OK → Try another ECU.
    - BAD → Repair or replace.
- BAD → Check H-fuses, fusible link, battery, wiring, ignition switch, neutral start switch and starter relay.
  - BAD → Repair or replace.
  - OK → ③ Check that there is voltage at starter terminal 50. **(IG SW START) STD voltage: 6 – 14 V**
    - OK → Check starter.
    - NO → Check wiring between ignition switch terminal ST1 and starter terminal 50.

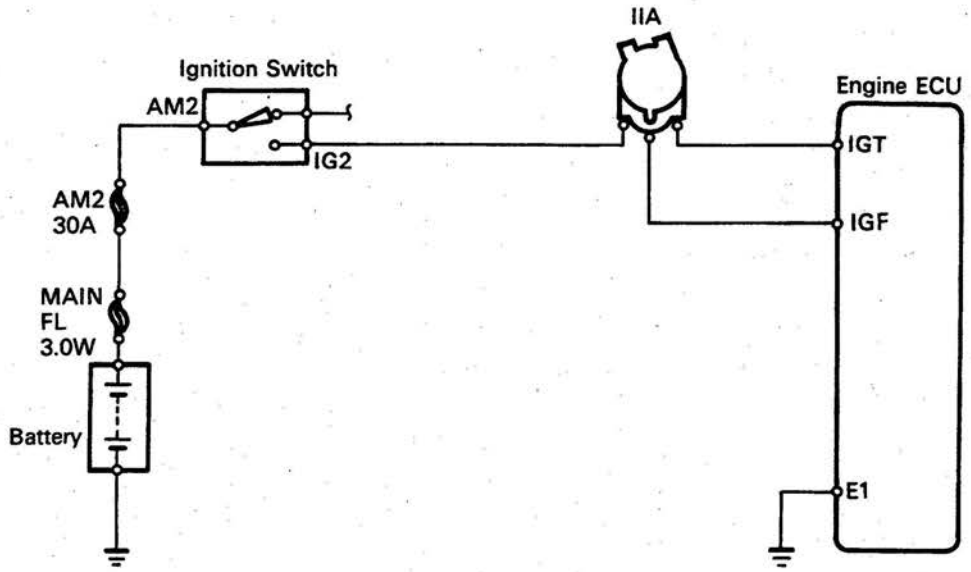
V02484

No.	Terminals	Trouble	Condition	STD voltage
9	IGT – E1	No voltage	Idling	Pulse generation

AE93



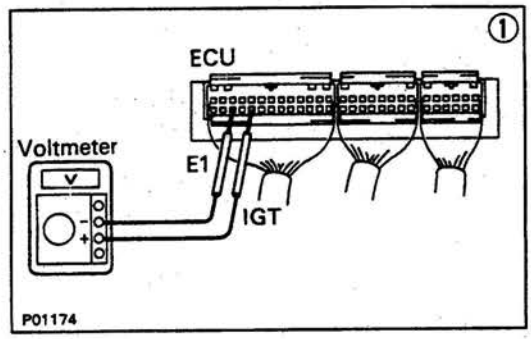
AE102

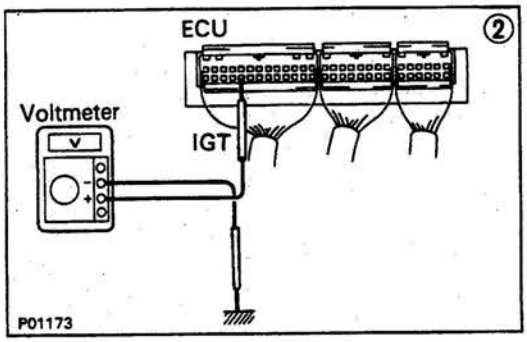


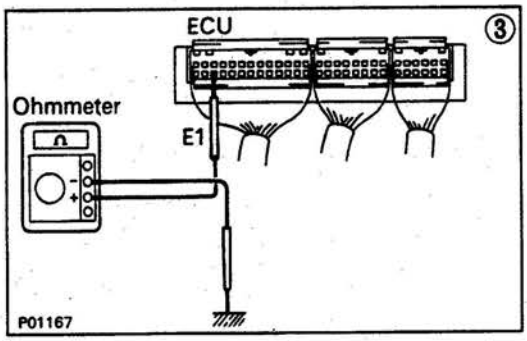
P10170
P07147

V02485

EG







① There is no voltage between ECU terminals IGT and E1.

② Check that there is voltage between ECU terminal IGT and body ground.

NO

OK

③ Check wiring between ECU Terminal E1 and body ground. — BAD → Repair or Replace.

OK

Try another ECU.

Check H-fuse, fusible link and Ignition switch. — BAD → Repair or replace.

OK

Check IIA (for distributor) (See page IG-10) — BAD → Repair or replace

OK

Check wiring between ECU and battery. — BAD → Repair or replace.

OK

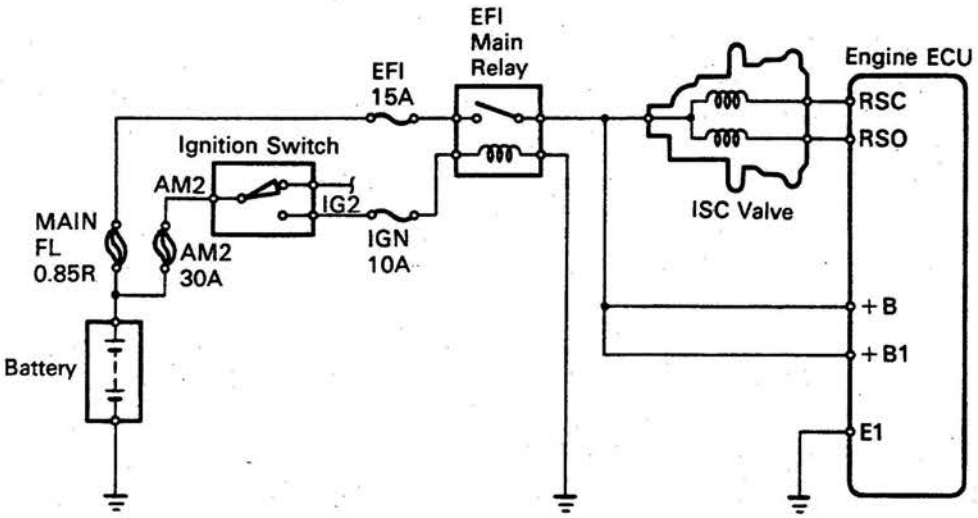
Check IIA (for igniter) (See page IG-11) — BAD → Repair or replace.

V02486

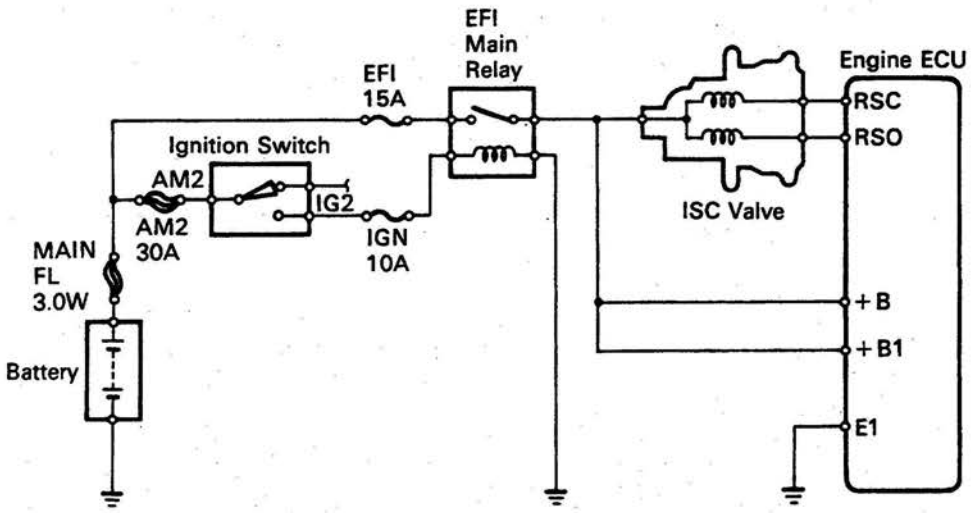
No.	Terminals	Trouble	Condition		STD voltage
10	RSC RSO – E1	No voltage	IG SW ON	Engine ECU connecters disconnected	9 – 14 V

EG

AE93



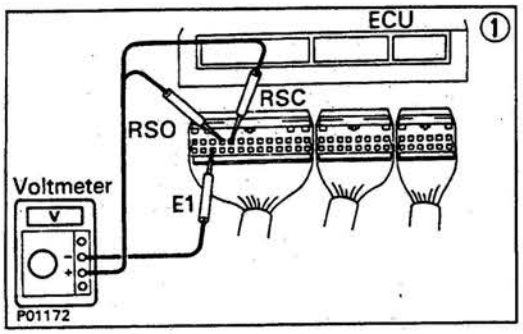
AE102

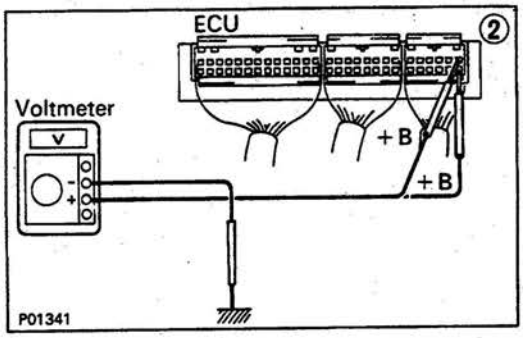


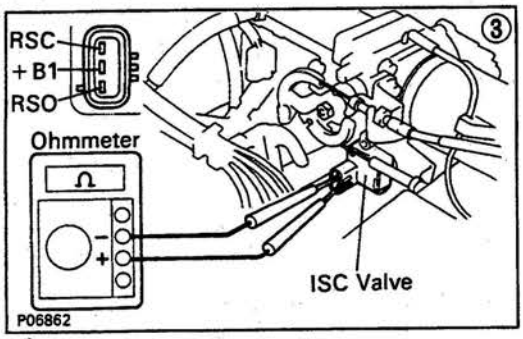
P10166
P07152

V02487

EG







There is no voltage between terminals RSC or RSO and E1 of ECU connector. (①)
(IG SW ON, Engine ECU connectors disconnected)

↓

Check that there is voltage between ECU terminal +B or +B1 and body ground. (②) **(IG SW ON)**

OK ↓

NO → Refer to No.1. (See page EG-159)

↓

Check resistance between ISC valve terminals +B and RSC or RSO. (③)
STD resistance: 19.3 – 22.3 Ω

BAD → Replace ISC valve.

OK ↓

Check wiring between ECU and ISC valve.

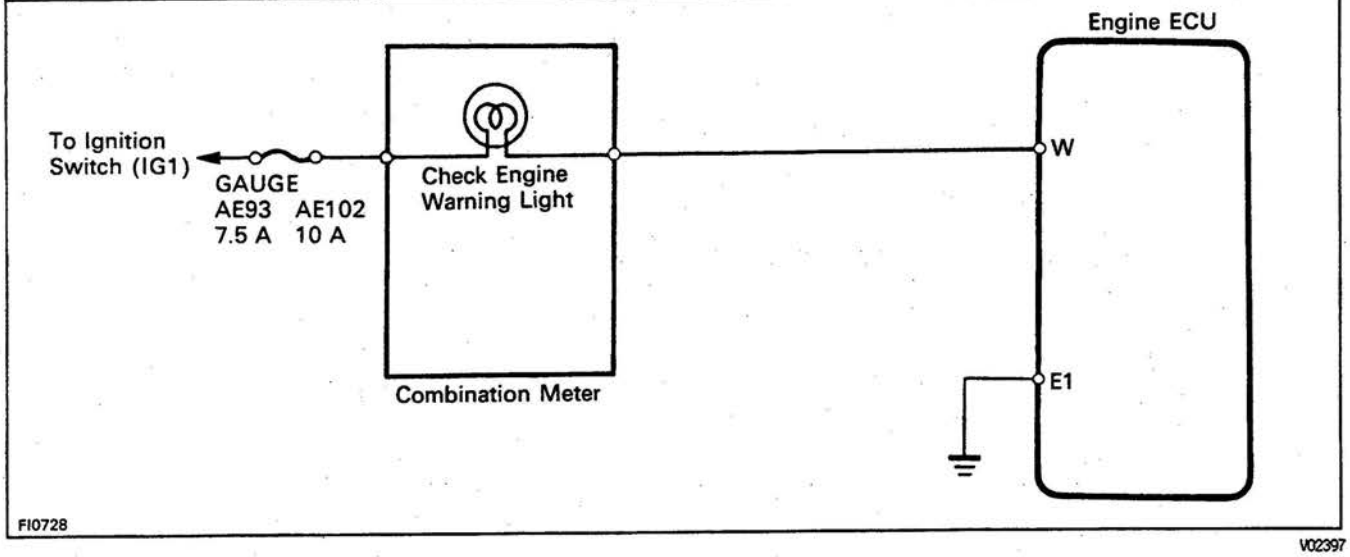
BAD → Repair or replace wiring.

OK ↓

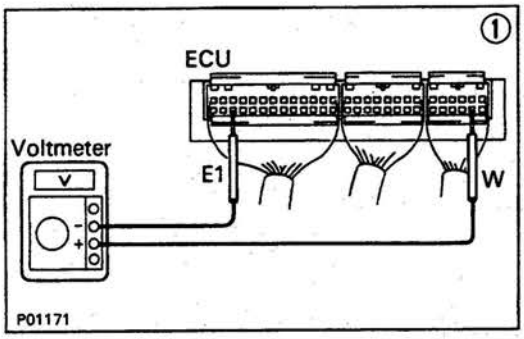
Try another ECU.

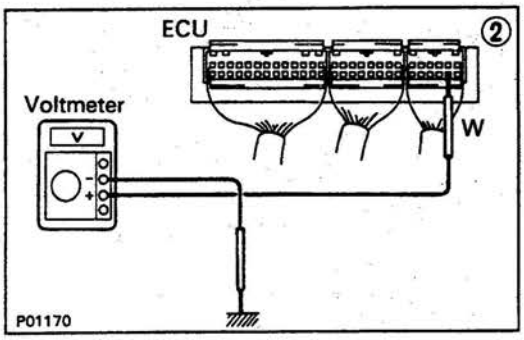
V02488

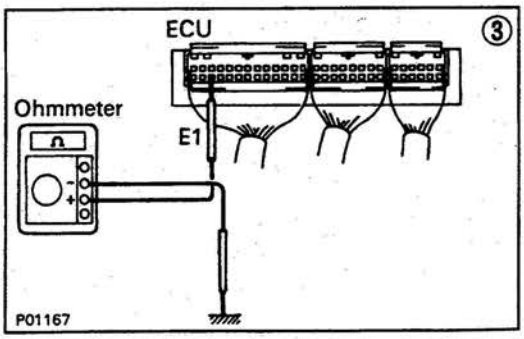
No.	Terminals	Trouble	Condition	STD voltage
11	W – E1	No voltage	No trouble (Check engine warning light off) and engine running.	9 – 14 V



V02397







① There is no voltage between ECU terminals W and E1. **(Idling)**

↓

② Check that there is voltage between ECU terminal W and body ground.

NO → OK

OK → ③ Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

NO → Check GAUGE fuse and check engine warning light.

OK → Check wiring between ECU terminal W and fuse.

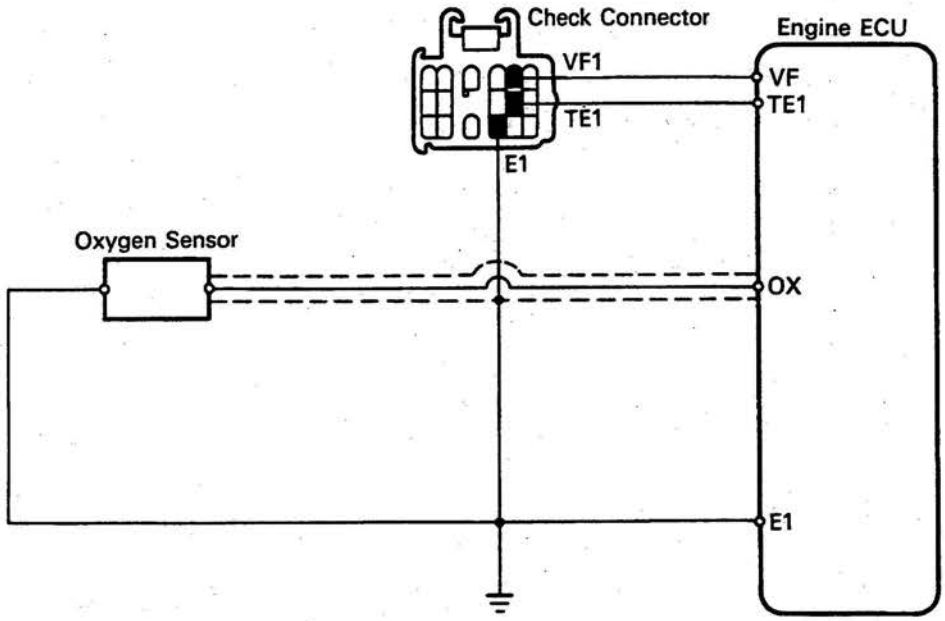
BAD → Repair or replace.

BAD → Fuse blows again → Repair or replace.

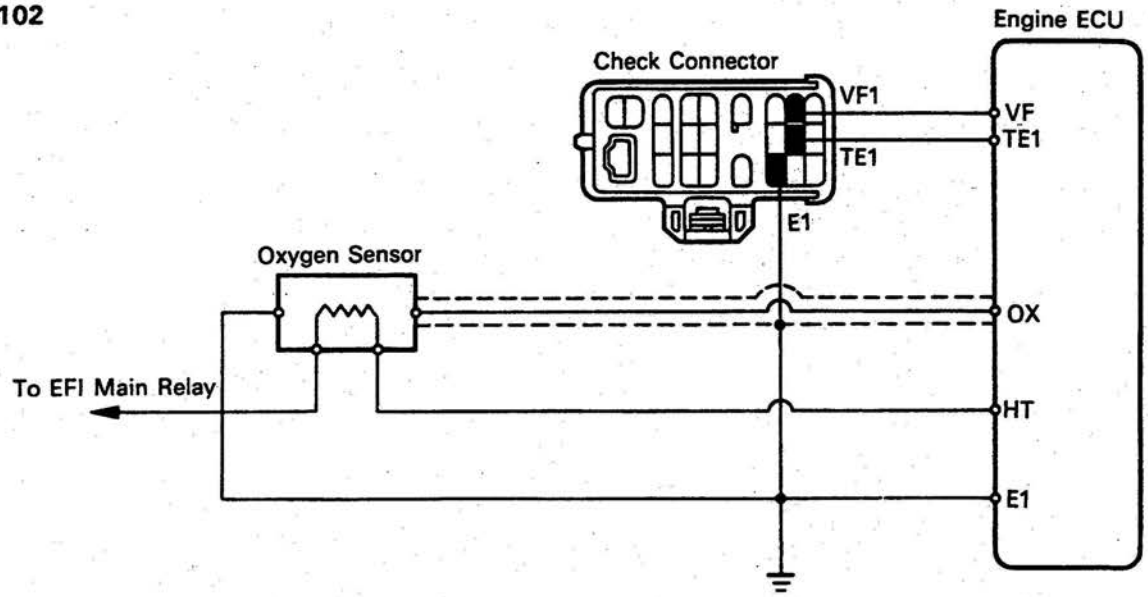
V02401

EG

AE93

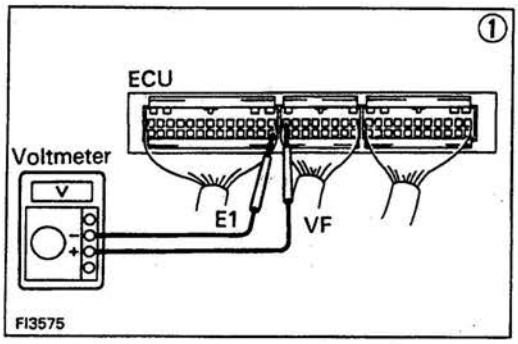


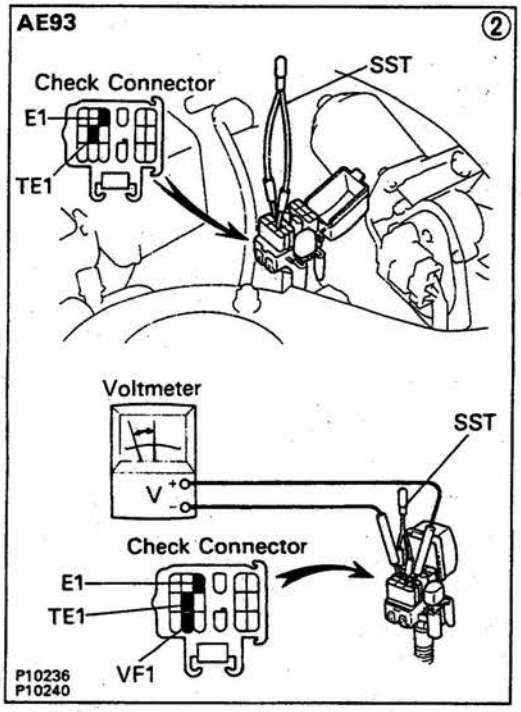
AE102

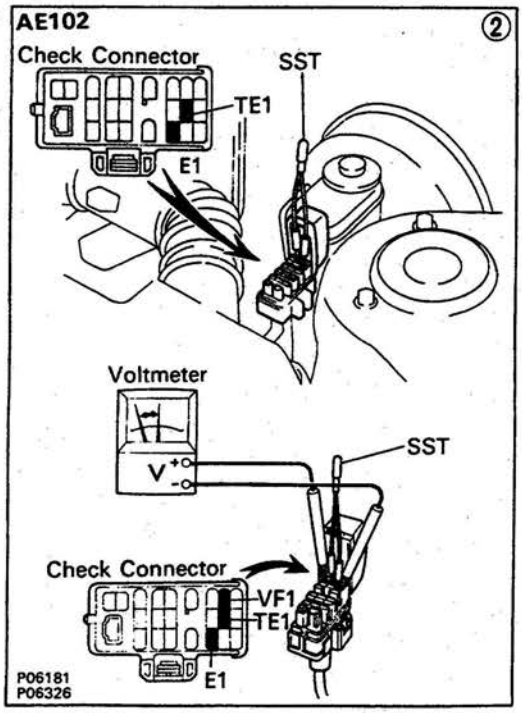


P10169
P10168

Z05508







① There is no voltage between ECU terminals VF and E1.

Check that there is specified voltage between ECU terminals VF and body ground.

NO → Check wiring between ECU terminal E1 and body ground.
- OK → Try another ECU.
- BAD → Repair or replace.

OK → Check for suction of air into exhaust system.
- BAD → Repair air suction.

OK → Check for air leak from air intake system.
- BAD → Repair air leak.

OK → Check spark plugs. (See page IG-8)
- BAD → Repair or replace.

OK → Check ignition system. (See page IG-4)
- BAD → Repair or replace.

OK → Check fuel pressure. (See page EG-179)
- BAD → Repair or replace.

OK → Check injectors. (See page EG-198)
- BAD → Repair or replace.

OK → Check vacuum sensor. (See page EG-227)
- BAD → Repair or replace.

OK → ② Check operation of oxygen sensor.
- BAD → System normal.

OK → Check wiring between oxygen sensor and ECU connectors.
- BAD → Repair wiring.

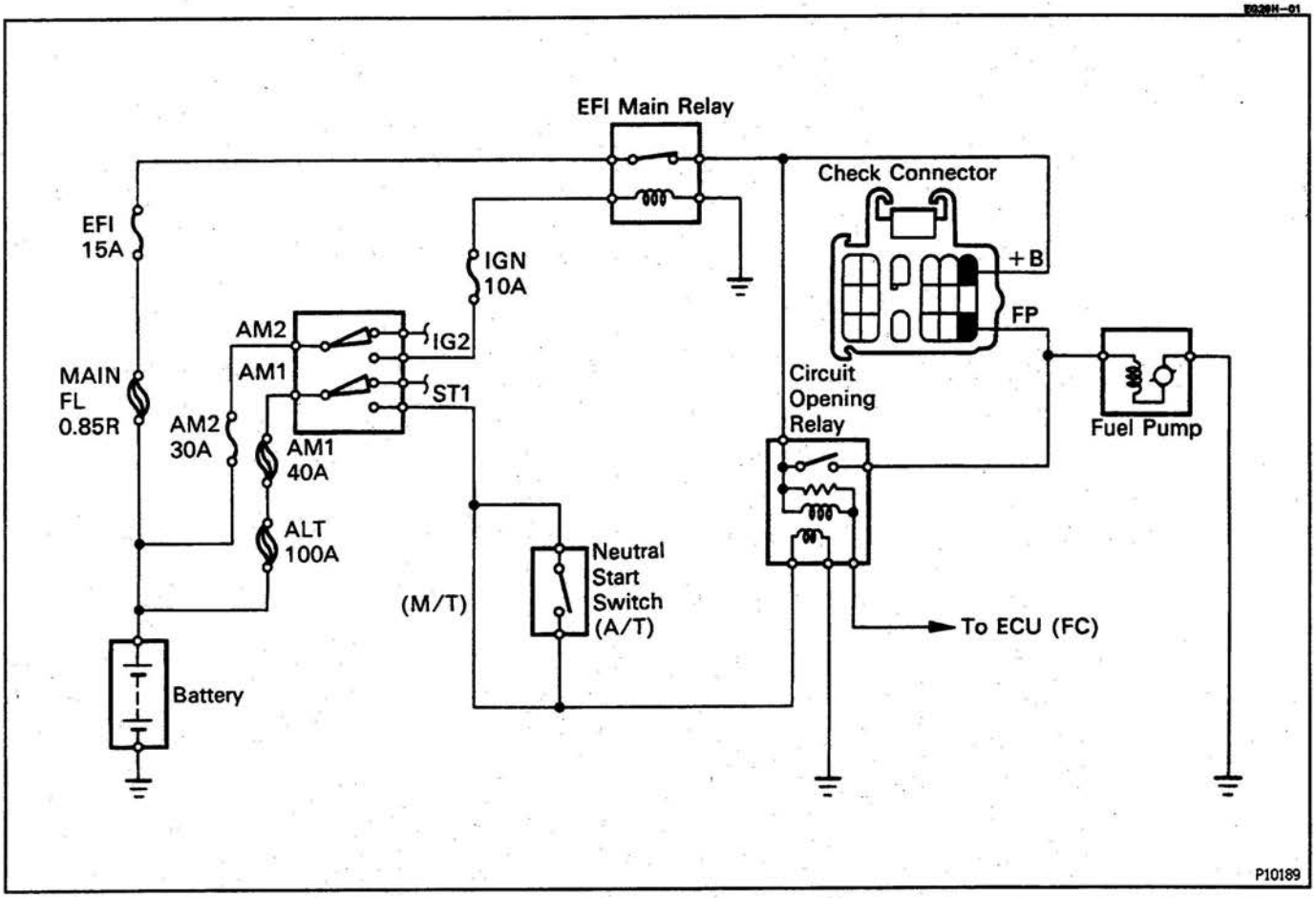
OK → Replace oxygen sensor.

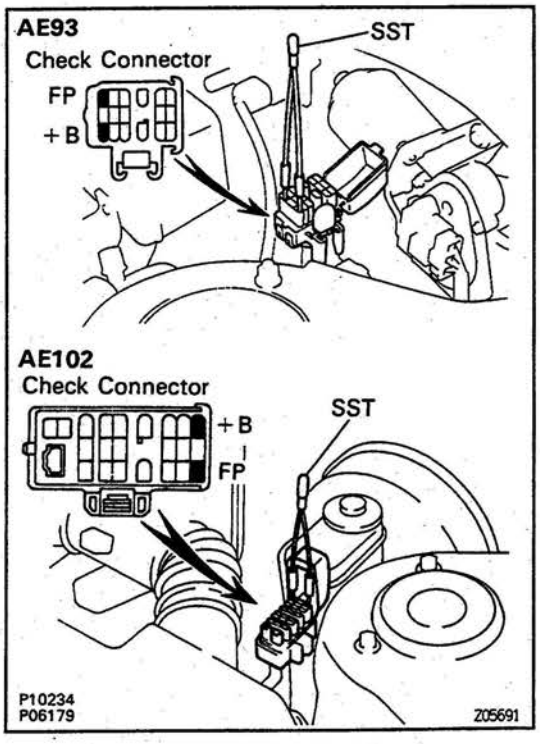
EG

V02562

FUEL PUMP (AE93)

EG

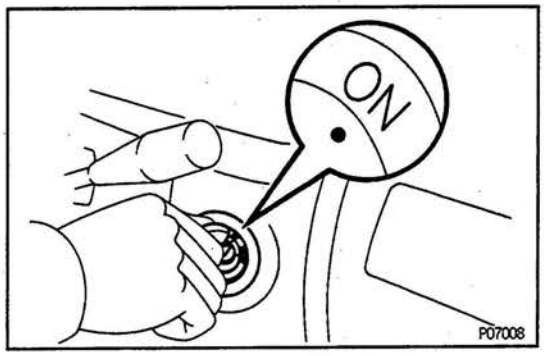




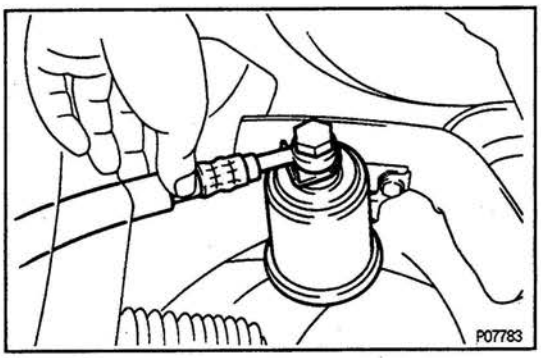
ON–VEHICLE INSPECTION

1. CHECK FUEL PUMP OPERATION

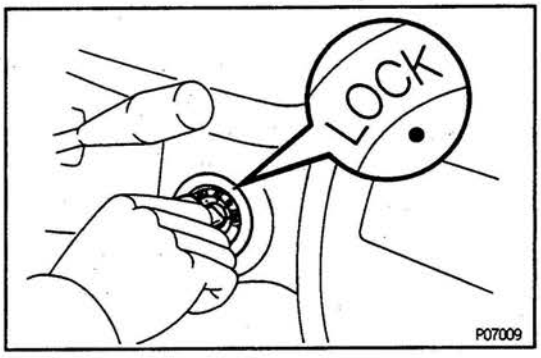
(a) Using SST, connect terminals +B and FP of the check connector.
SST 09843–18020



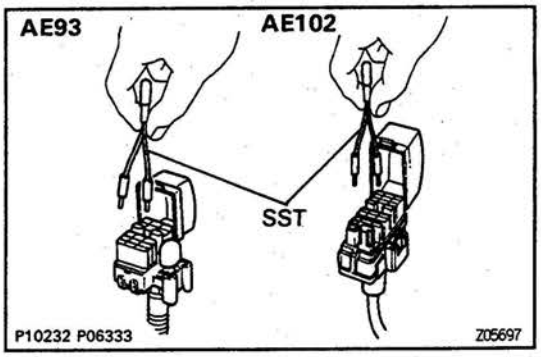
(b) Turn the ignition switch ON.
NOTICE: Do not start the engine.



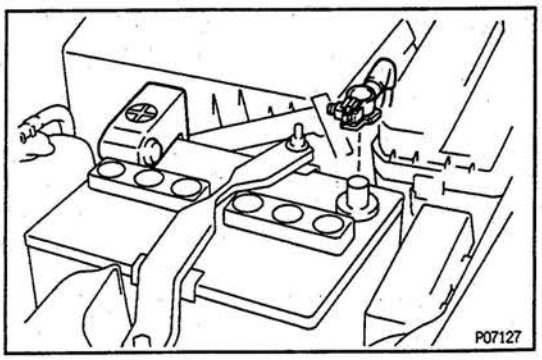
(c) Check that there is pressure in the hose from the fuel filter.
HINT: At this time, you will hear fuel return noise.
If there is no pressure, check the following parts:
- Fusible link
- H–fuse
- Fuses
- EFI main relay
- Fuel pump
- Wiring connections



(d) Turn the ignition switch OFF.

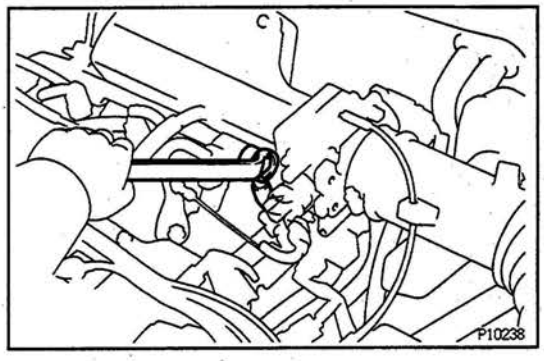


(e) Remove the SST from the check connector.
SST 09843–18020

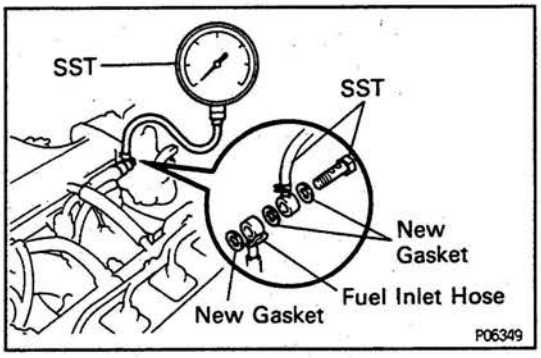


2. CHECK FUEL PRESSURE

(a) Check that the battery voltages is above 12 V.
(b) Disconnect the cable from the negative (–) terminal of the battery.

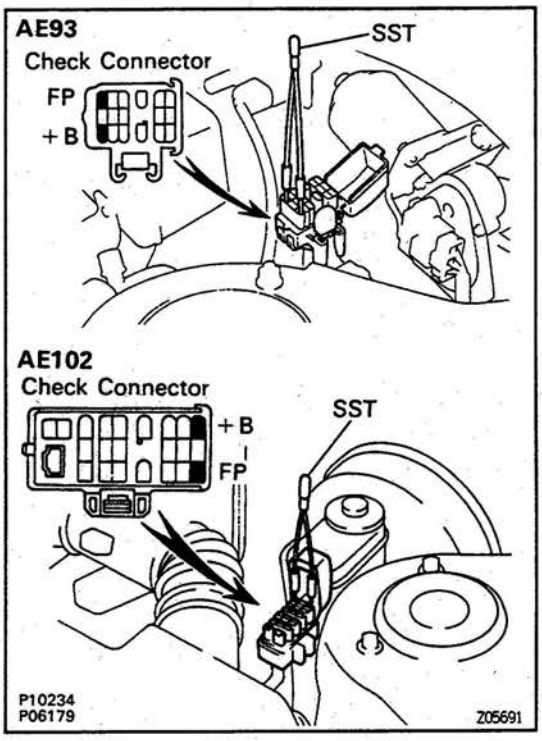


(c) Remove the union bolt and two gaskets, and disconnect the fuel inlet hose from the delivery pipe.
HINT:
- Put a suitable container or shop towel under the deliverly pipe.
- Slowly loosen the union bolt.



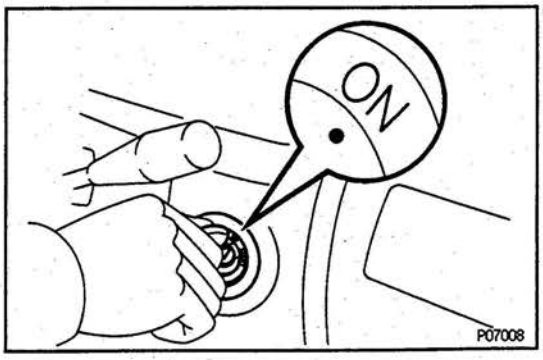
(d) Install the fuel inlet hose and SST (pressure gauge) to the delivery pipe with three new gaskets and SST (union bolt).
SST 09268–45012
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

(e) Wipe off any splattered gasoline.

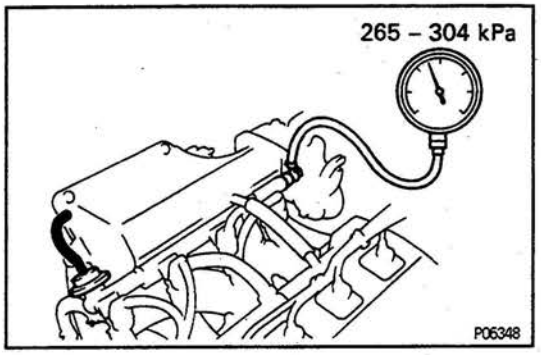


(f) Using SST, connect terminals +B and FP of the check connector.
SST 09843–18020

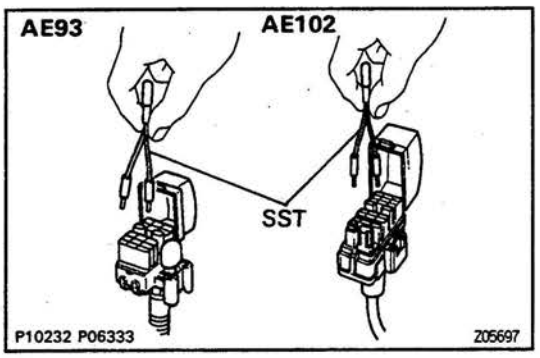
(g) Reconnect the battery negative (–) cable.



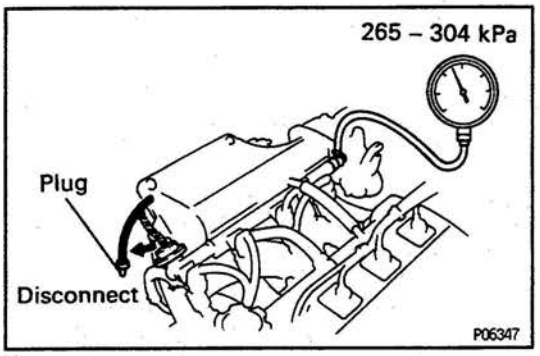
(h) Turn the ignition switch ON.



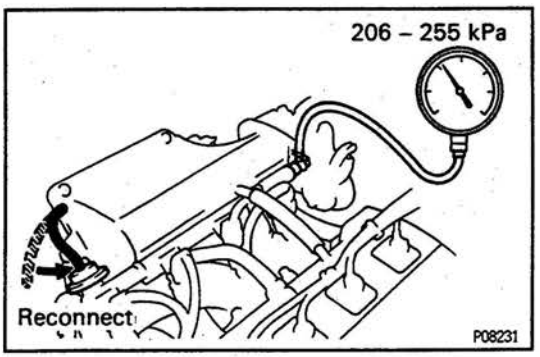
(i) Measure the fuel pressure.
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi)
If pressure is high, replace the fuel pressure regulator.
If pressure is low, check the following parts:
- Fuel hoses and connections
- Fuel pump
- Fuel filter
- Fuel pressure regulator



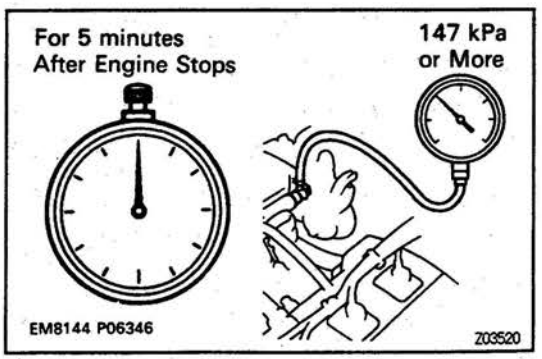
(j) Remove the SST from the check connector.
SST 09483–18020



(k) Start the engine.
(l) Disconnect the vacuum sensing hose from the fuel pressure regulator and plug the hose end.
(m) Measure the fuel pressure at idle.
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi)

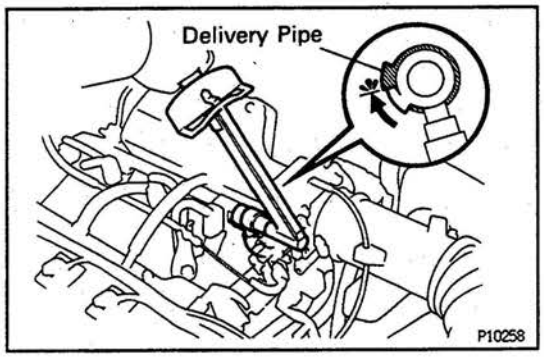


(n) Reconnect the vacuum sensing hose to the fuel pressure regulator.
(o) Measure the fuel pressure at idle.
Fuel pressure:
206 – 255 kPa (2.1 – 2.6 kgf/cm², 31 – 37 psi)
If pressure is not as specified, check the vacuum sensing hose and fuel pressure regulator.



(p) Stop the engine.
(q) Check that the fuel pressure remains as specified for 5 minuites after the engine stops.
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.

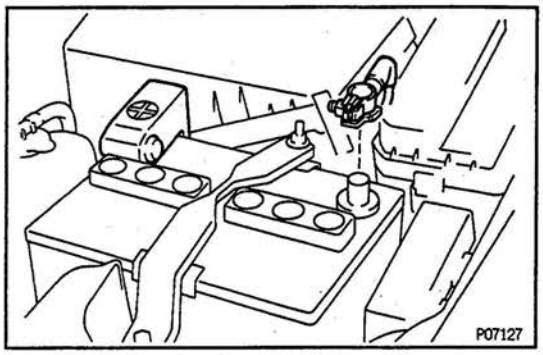
(r) After checking fuel pressure, disconnect the battery negative (–) cable and carefully remove the SST to prevent gasoline from splashing.
SST 09268–45012



(s) Connect the fuel inlet hose to the deliverly pipe with two new gaskets and the union bolt.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

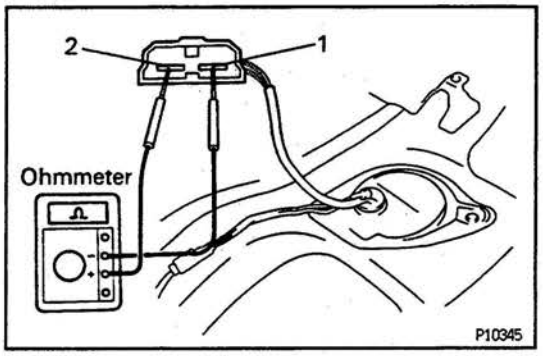
(t) Reconnect the cable to the negative (–) terminal of the battery.

(u) Check for fuel leaks.



FUEL PUMP INSPECTION

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. REMOVE REAR SEAT CUSHION
3. DISCONNECT FUEL PUMP CONNECTOR



4. INSPECT FUEL PUMP

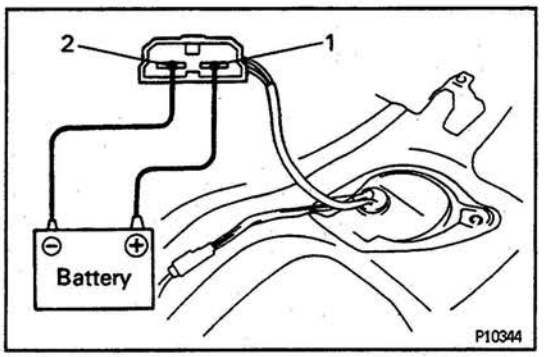
A. Inspect fuel pump resistance

Using an ohmmeter, measure the resistance between the terminals 1 and 2.

Resistance (Cold):

0.2 – 3.0 Ω

If the resistance is not as specified, replace the fuel pump.



B. Inspect fuel pump operation

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

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

NOTICE:

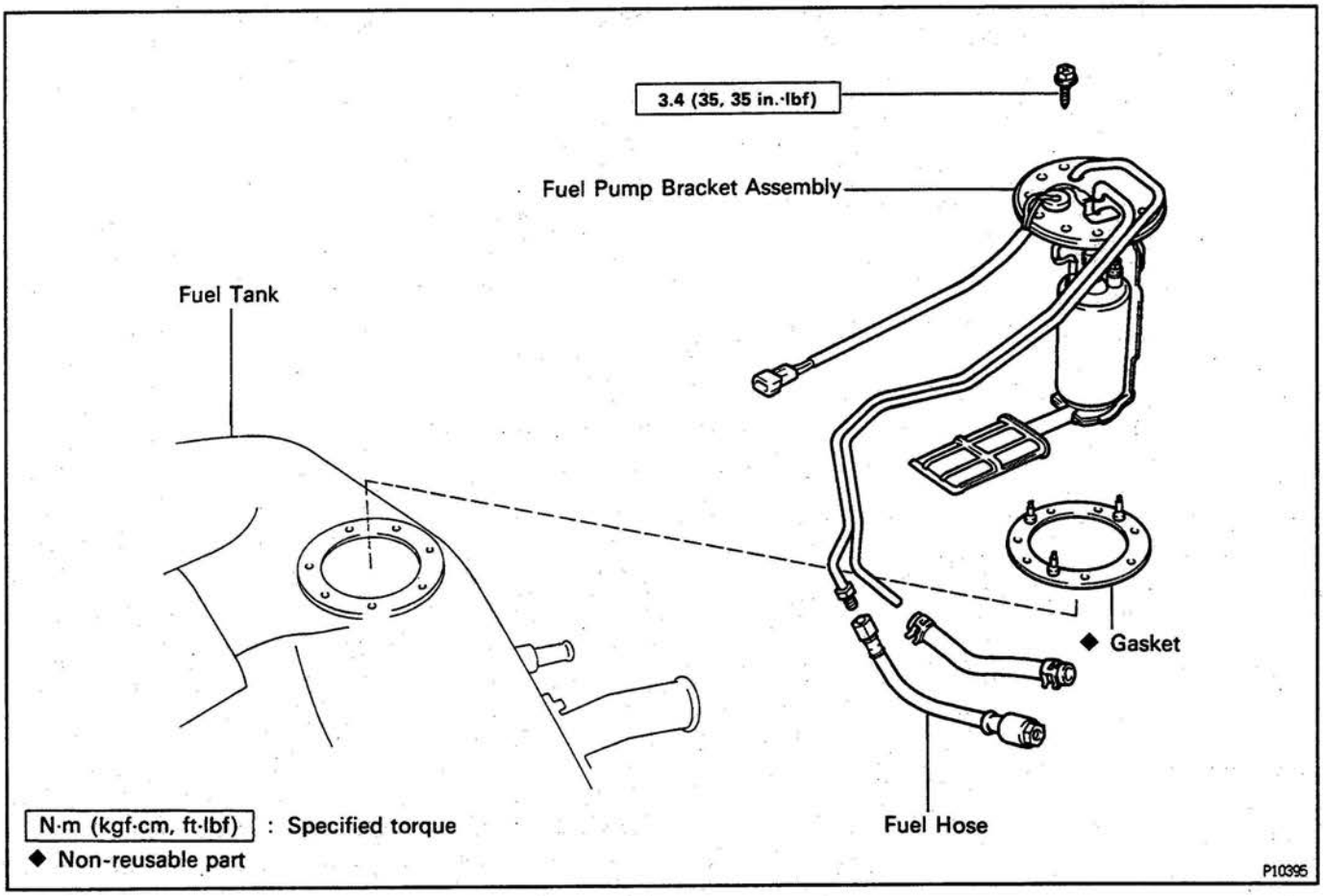
- **These tests must be performed quickly (within 10 seconds) to prevent the coil from burning out.**
- **Keep the fuel pump as far away from the battery as possible.**
- **Always perform switching at the battery side.**

5. RECONNECT FUEL PUMP CONNECTOR
6. INSTALL REAR SEAT CUSION
7. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

E0329L-01

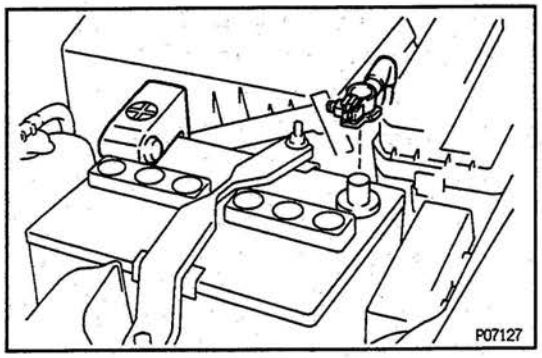
COMPONENTS FOR REMOVAL AND INSTALLATION

EG



E0329M-01

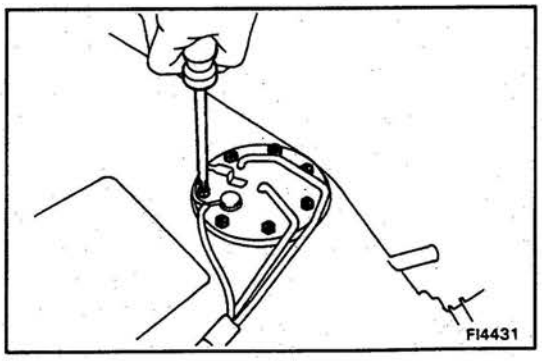
FUEL PUMP REMOVAL



(See Components for Removal and Installation)

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

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **DRAIN GASOLINE FROM FUEL TANK**
3. **REMOVE FUEL TANK**

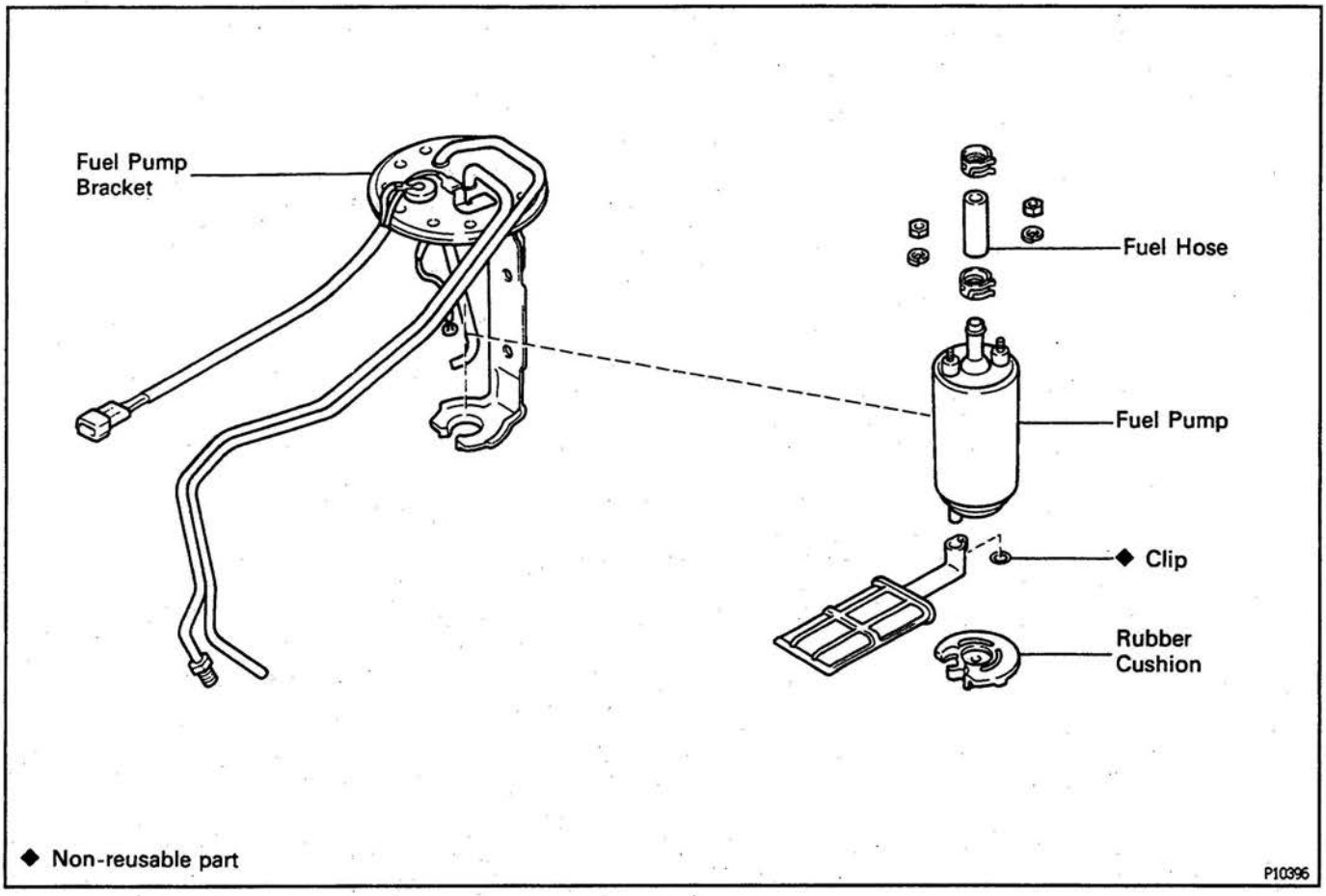


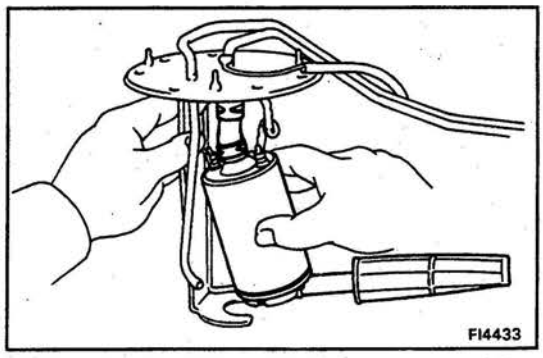
4. **REMOVE FUEL PUMP BRACKET FROM FUEL TANK**

(a) Remove the seven bolts.

(b) Pull out the fuel pump bracket.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

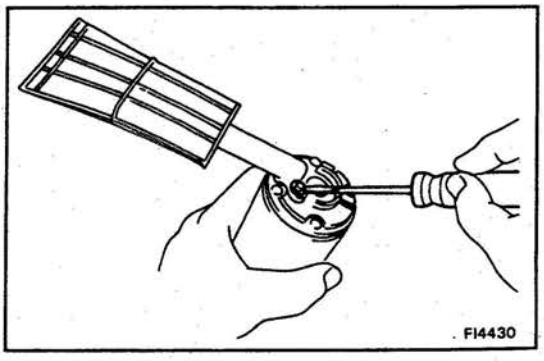




FUEL PUMP DISASSEMBLY

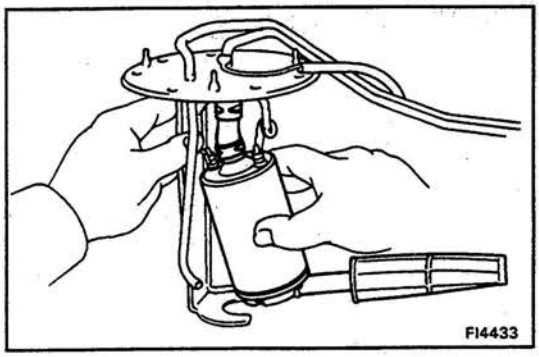
1. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET

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



2. REMOVE FUEL PUMP FILTER FROM FUEL PUMP

(a) Remove the rubber cushion.
(b) Remove the clip and pull out the filter.



FUEL PUMP ASSEMBLY

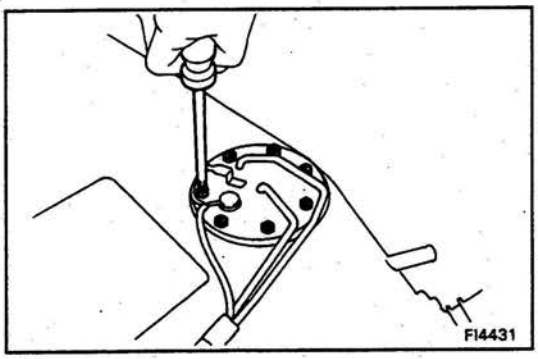
(See Components for Disassembly and Assembly)

1. INSTALL FUEL PUMP FILTER TO FUEL PUMP
2. INSTALL FUEL PUMP TO FUEL PUMP BRACKET

(a) Insert the outlet port of the fuel pump into the fuel hose.

(b) Install the rubber cushion to the lower side of the fuel pump.

(c) Push the lower side of the fuel pump, together with the rubber cushion, into the fuel pump bracket.



FUEL PUMP INSTALLATION

(See Components for Removal and Installation)

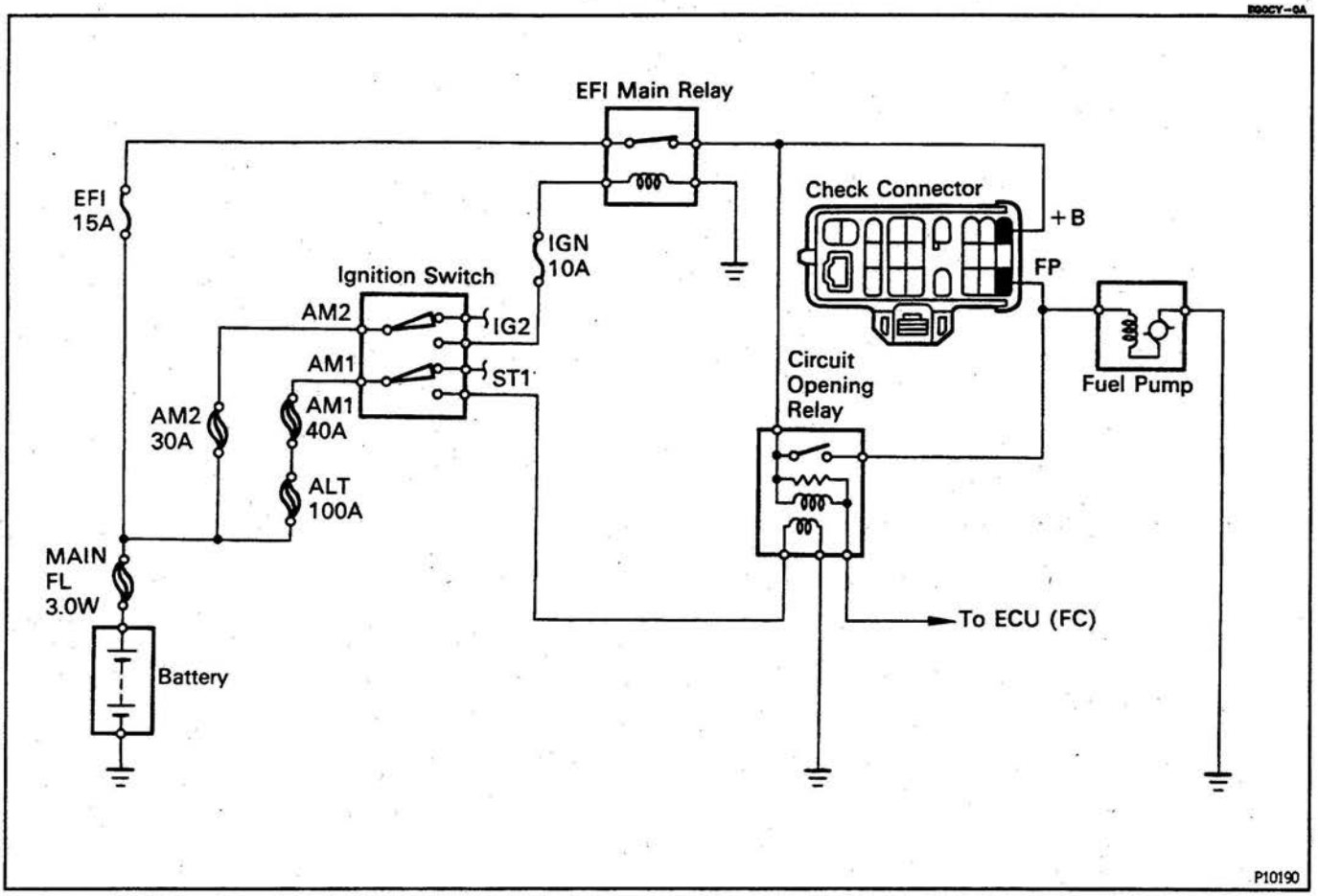
1. INSTALL FUEL PUMP BRACKET

(a) Place the bracket with a new gasket on the fuel tank.

(b) Install and torque the seven bolts.
Torque: 3.4 N·m (35 kgf·cm, 30 in.·lbf)

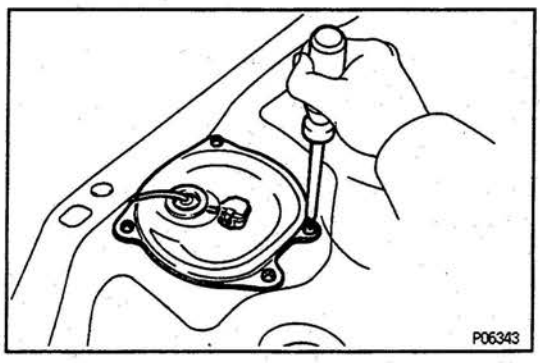
2. INSTALL FUEL TANK
3. REFILL GASOLINE
4. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY
5. CHECK FOR FUEL LEAKAGE

FUEL PUMP (AE102)



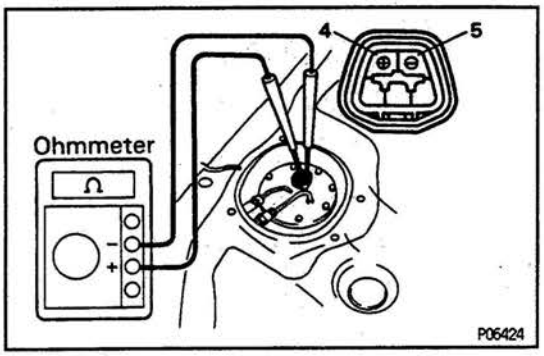
ON–VEHICLE INSPECTION

(See page EG–178)



FUEL PUMP INSPECTION

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. REMOVE REAR SEAT CUSHION
3. REMOVE FLOOR SERVICE HOLE COVER
   Remove the four screws and service hole cover.
4. DISCONNECT FUEL PUMP & SENDER GAUGE CONNECTOR



5. INSPECT FUEL PUMP

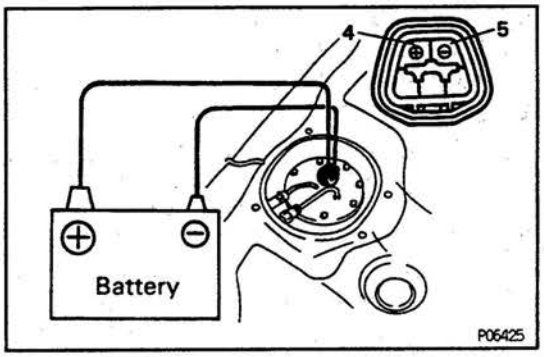
A. Inspect fuel pump resistance

Using an ohmmeter, measure the resistance between the terminals 4 and 5.

Resistance (Cold):

0.2 – 3.0 Ω

If the resistance is not as specified, replace the fuel pump.



B. Inspect fuel pump operation

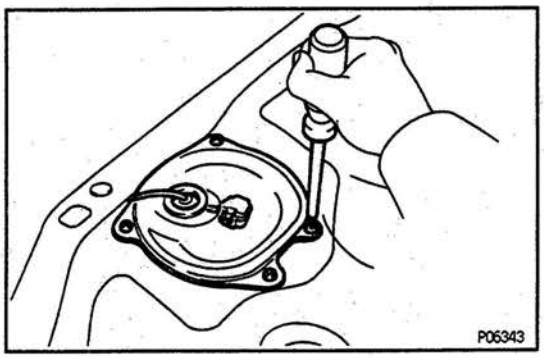
Connect the positive (+) lead from the battery to terminal 4 of the connector, and the negative (–) lead to terminal 5. Check that the fuel pump operates.

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

NOTICE:

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

6. RECONNECT FUEL PUMP & SENDER GAUGE CONNECTOR



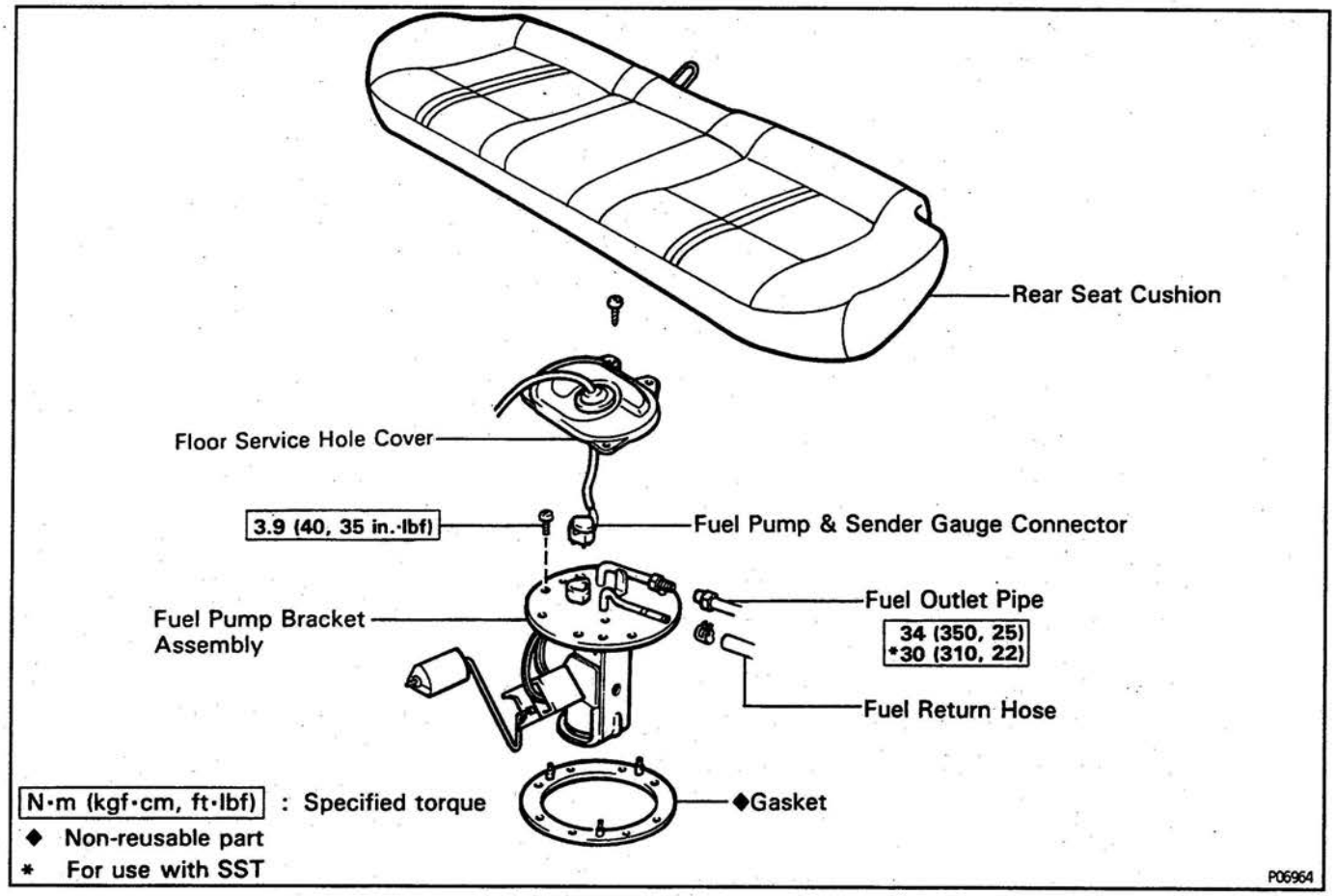
7. INSTALL FLOOR SERVICE HOLE COVER

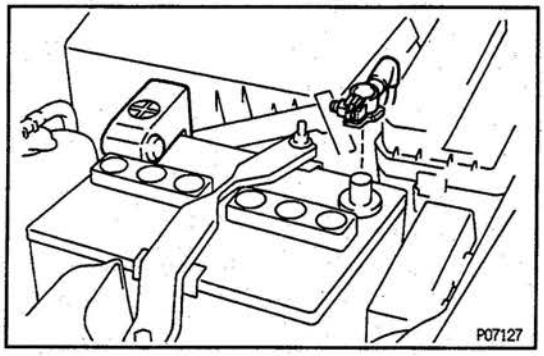
Install the service hole cover with the four screws.

8. INSTALL REAR SEAT CUSHION

9. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

COMPONENTS FOR REMOVAL AND INSTALLATION



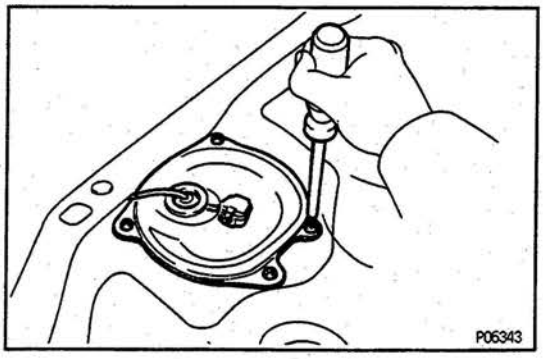


FUEL PUMP REMOVAL

(See Components for Removal and Installation)

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

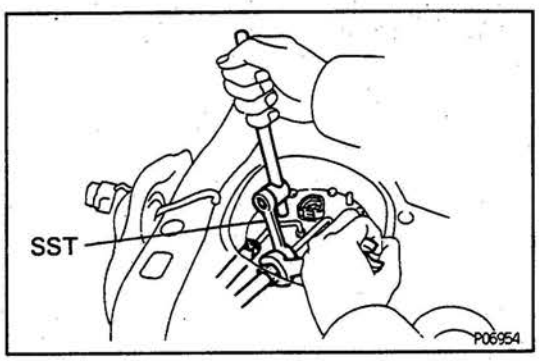
1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **REMOVE REAR SEAT CUSHION**



3. **REMOVE FLOOR SERVICE HOLE COVER**

(a) Remove the four screws and service hole cover.

(b) Disconnect the fuel pump & sender gauge connector.

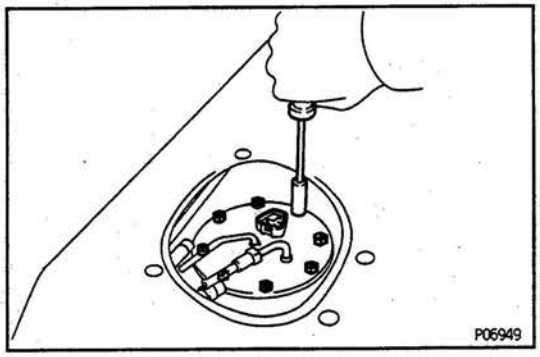


4. DISCONNECT FUEL PIPE AND HOSE FROM FUEL PUMP BRACKET

CAUTION: Remove the fuel filter cap to prevent the fuel from flowing out.

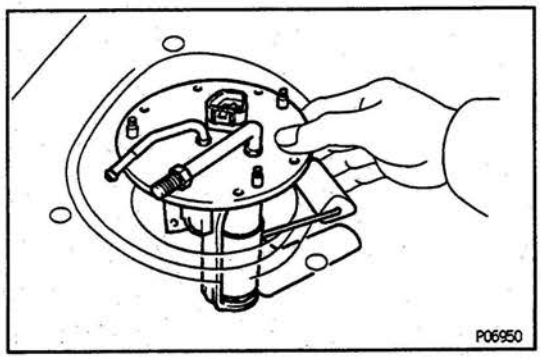
(a) Using SST, disconnect the outlet pipe from the pump bracket.
SST 09631–22020

(b) Disconnect the return hose from the pump bracket.



5. REMOVE FUEL PUMP BRACKET ASSEMBLY FROM FUEL TANK

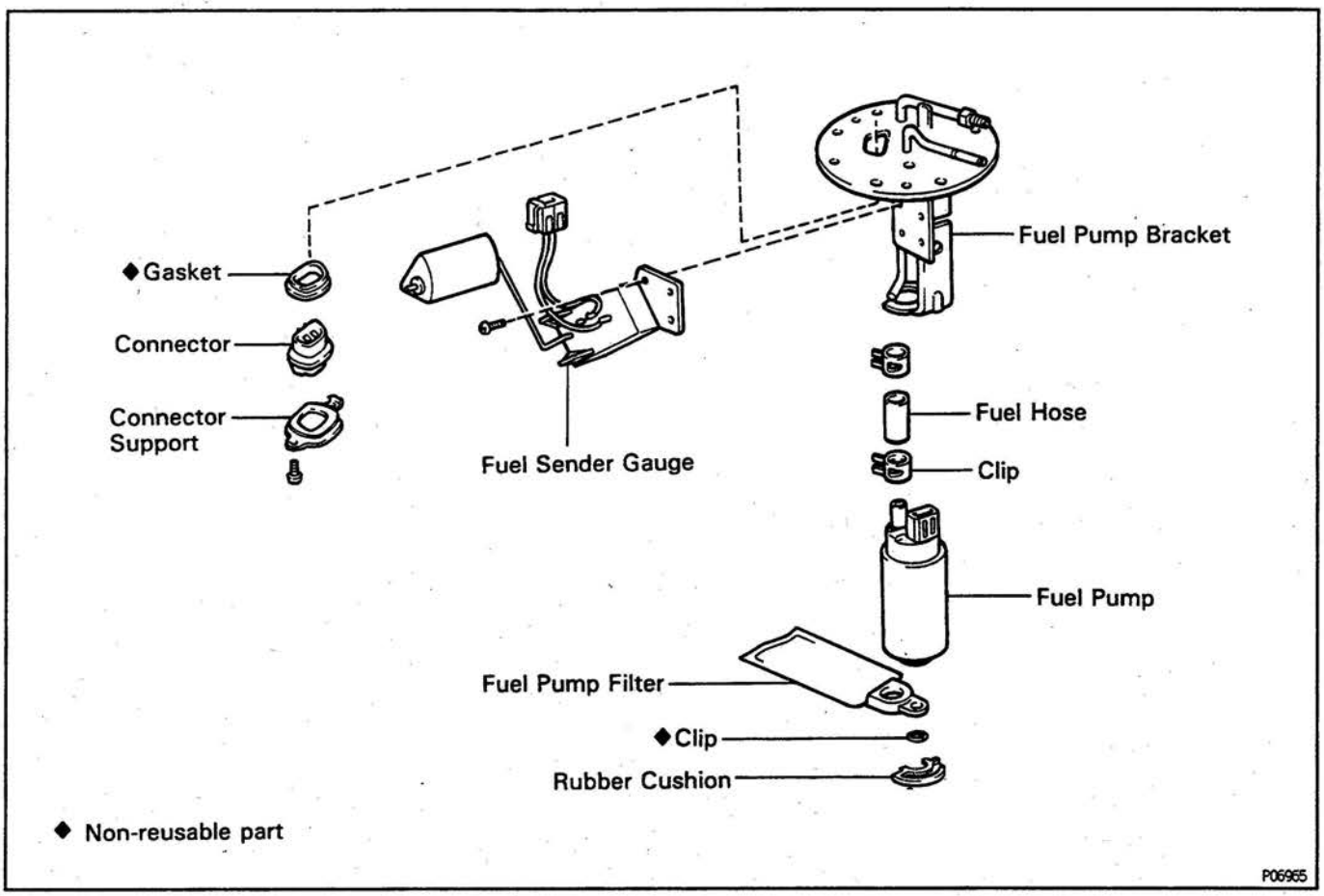
(a) Remove the eight bolts.

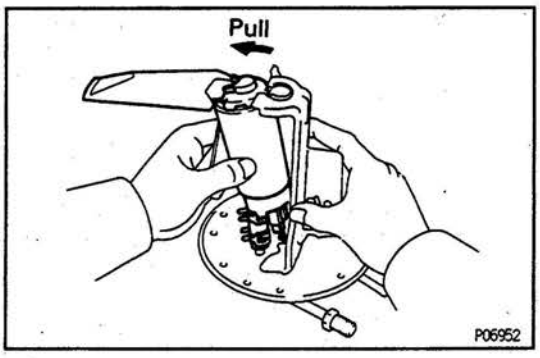


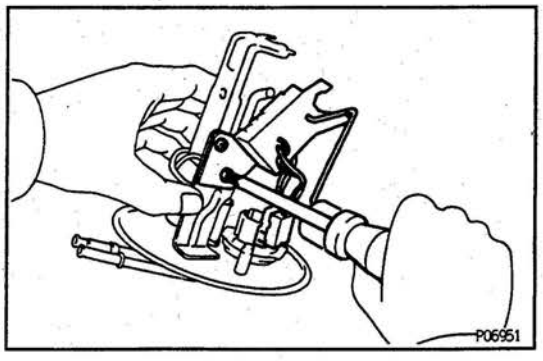
(b) Pull out the pump bracket assembly.

(c) Remove the gasket from the pump bracket.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY







FUEL PUMP DISASSEMBLY

(See Components for Disassembly and Assembly)

1. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET

(a) Disconnet the fuel pump connector from the fuel pump.

(b) Pull off the lower side of the fuel pump from the pump bracket.

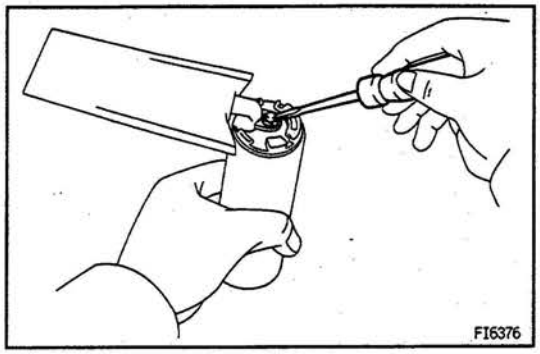
(c) Disconnect the fuel hose from the fuel pump, and remove the fuel pump.

(d) Remove the rubber cushion from the fuel pump.

2. REMOVE FUEL SENDER GAUGE FROM FUEL PUMP BRACKET

(a) Disconnect the fuel sender gauge connector.

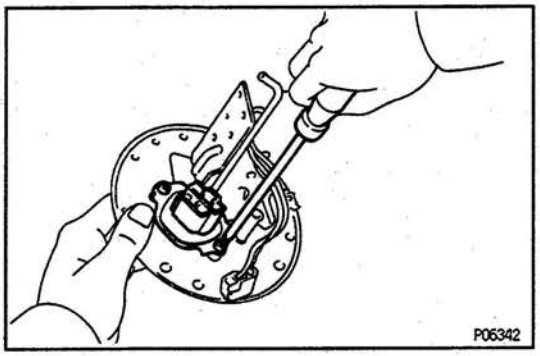
(b) Remove the two screws and sender gauge.



3. REMOVE FUEL PUMP FILTER FROM FUEL PUMP

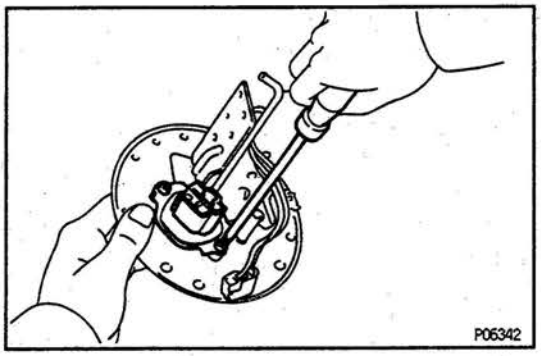
(a) Using a small screwdriver, remove the clip.

(b) Pull out the pump filter.



4. REMOVE CONNECTOR

Remove the two screws, connector support, connector and gasket.



FUEL PUMP ASSEMBLY

EG164-02

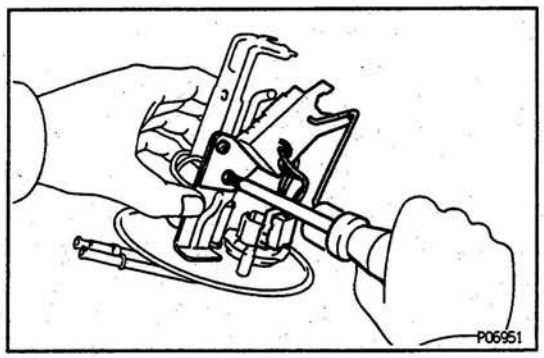
(See Components for Disassembly and Assembly)

1. INSTALL CONNECTOR

Install the gasket, connector and connector support with the two screws.

2. INSTALL FUEL PUMP FILTER TO FUEL PUMP

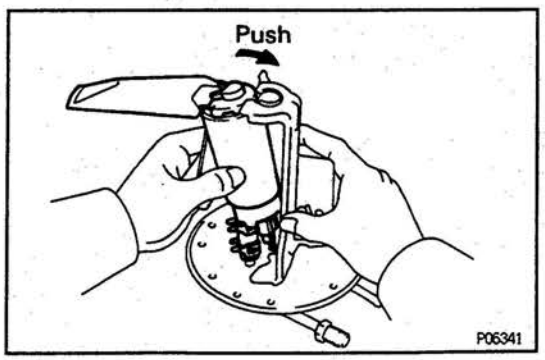
Install the pump filter with a new clip.



3. INSTALL FUEL SENDER GAUGE TO FUEL PUMP BRACKET

(a) Install the sender gauge with the two screws.

(b) Connect the fuel sender gauge connector.



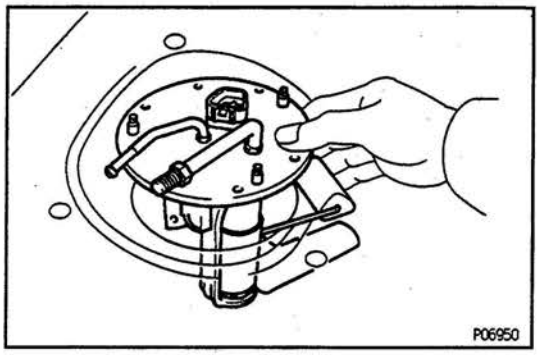
4. INSTALL FUEL PUMP TO FUEL PUMP BRACKET

(a) Install the rubber cushion to the fuel pump.

(b) Connect the fuel hose to the outlet port of the fuel pump.

(c) Install the fuel pump by pushing the lower side of the fuel pump.

(d) Install the fuel pump connector.



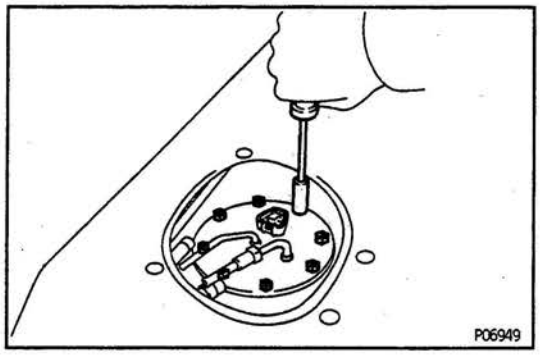
FUEL PUMP INSTALLATION

(See Components for Removal and Installation)

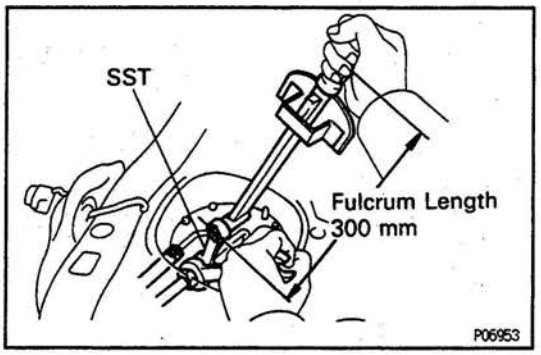
1. **INSTALL FUEL PUMP BRACKET ASSEMBLY TO FUEL TANK**

(a) Install a new gasket to the pump bracket.

(b) Insert the pump bracket assembly into the fuel tank.



(c) Install the pump bracket with the eight screws.
Torque: 3.9 N·m (40 kgf·cm, 35 in.·lbf)



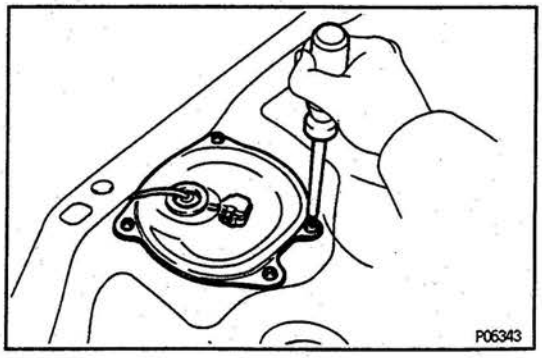
2. **CONNECT FUEL PIPE AND HOSE TO FUEL PUMP BRACKET**

(a) Using SST, connect the outlet pipe to the pump bracket.
SST 09631–22020
Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)

(b) Connect the return hoses to the pump bracket.

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

4. **CHECK FOR FUEL LEAKAGE**



5. **INSTALL FLOOR SERVICE HOLE COVER**

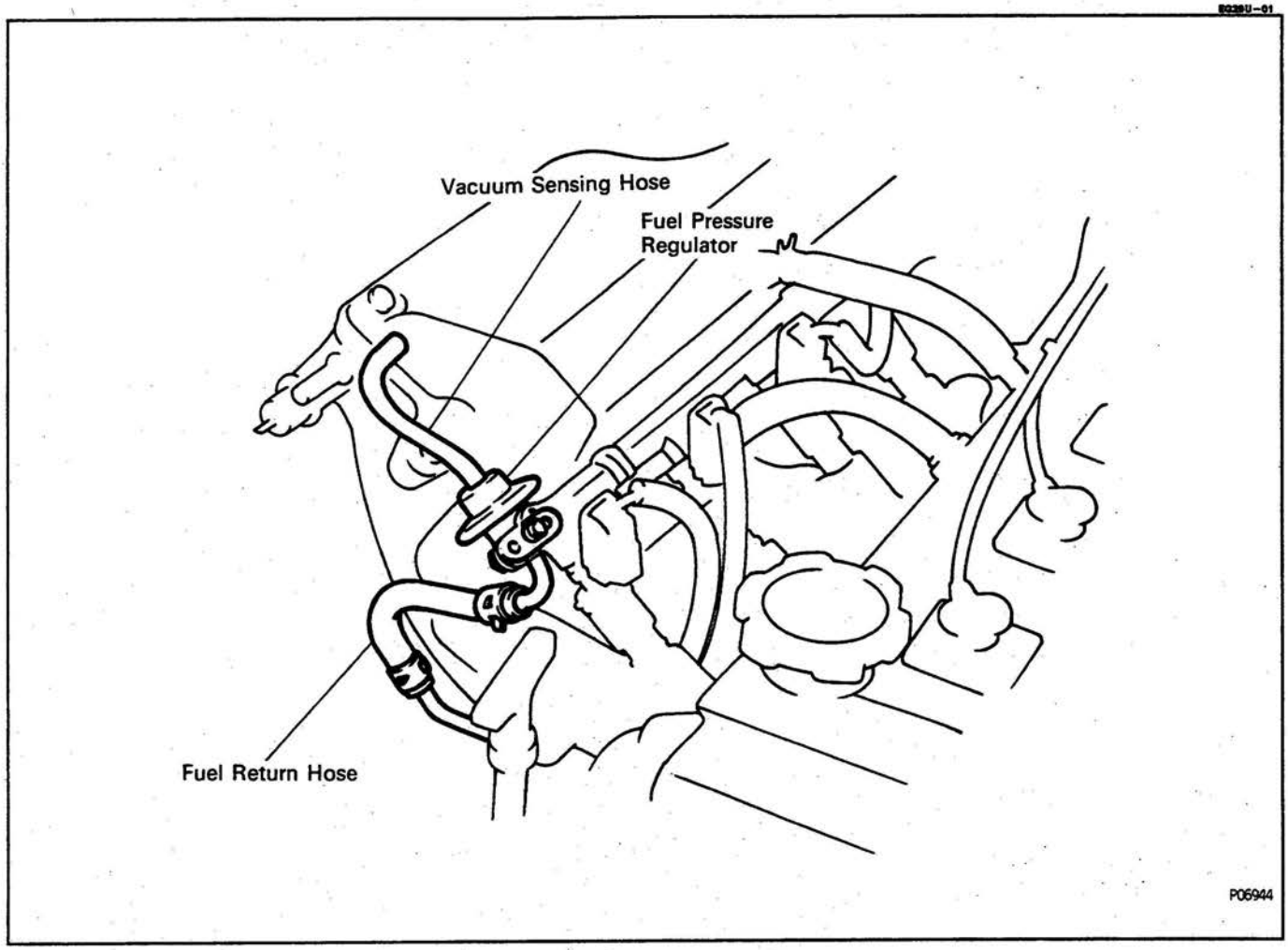
(a) Connect the fuel pump & fuel sender gauge connector.

(b) Install the service hole cover with the four screws.

6. **INSTALL REAR SEAT CUSHION**

FUEL PRESSURE REGULATOR

E0389U-01



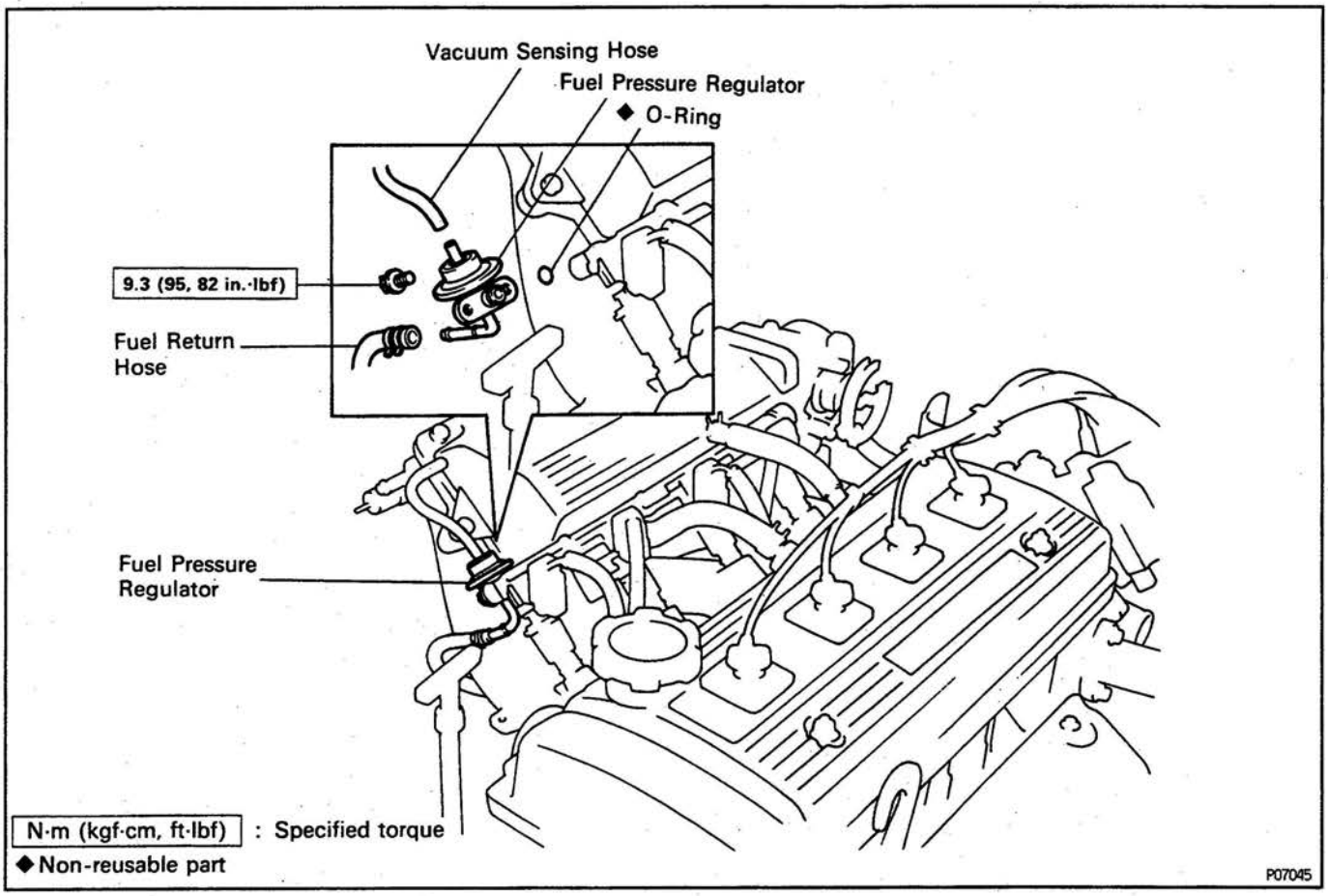
E0006-03

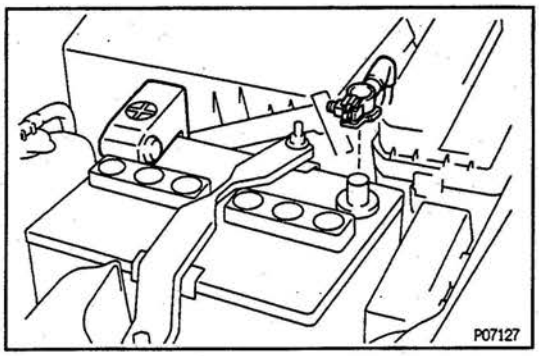
ON–VEHICLE INSPECTION

INSPECT FUEL PRESSURE
(See step 2 on page EG–179)

E0128–04

COMPONENTS FOR REMOVAL AND INSTALLATION



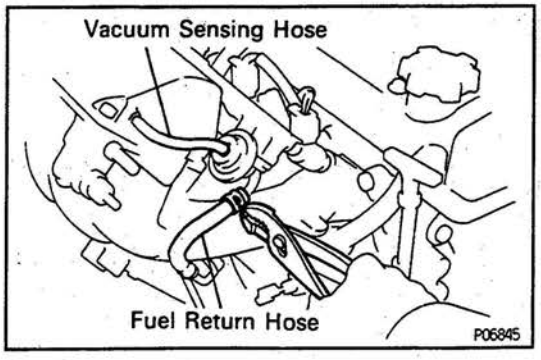


E0166–02

FUEL PRESSURE REGULATOR REMOVAL

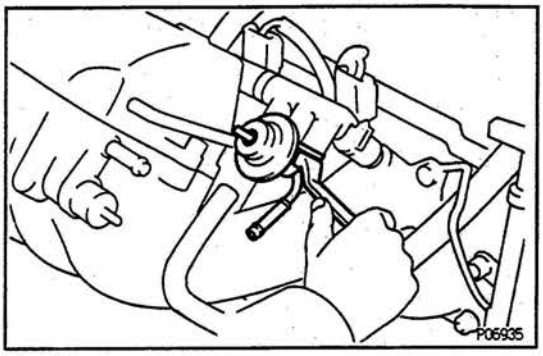
(See Components for Removal and Installation)

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



2. **DISCONNECT VACUUM SENSING HOSE FROM FUEL PRESSURE REGULATOR**
3. **DISCONNECT FUEL RETURN HOSE FROM FUEL PRESSURE REGULATOR**

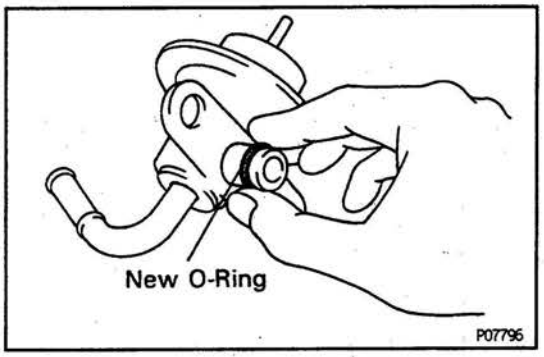
   HINT: Put a suitable container or shop towel under the pressure regulator.



4. REMOVE FUEL PRESSURE REGULATOR

(a) Remove the two bolts, and pull out the pressure regulator.

(b) Remove the O–ring from the pressure regulator.



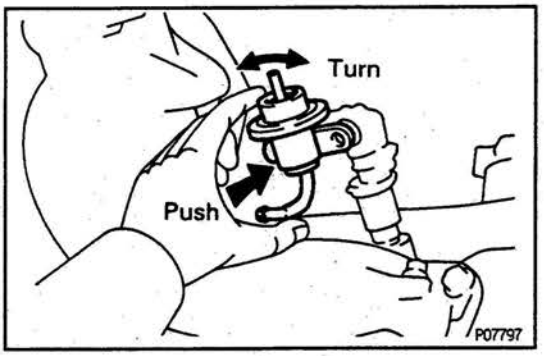
B6167–02

FUEL PRESSURE REGULATOR INSTALLATION

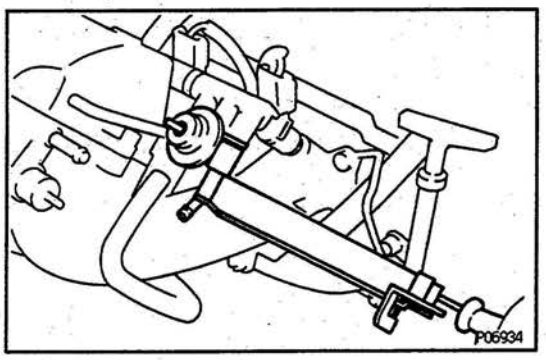
(See Components for Removal and Installation)

1. INSTALL FUEL PRESSURE REGULATOR

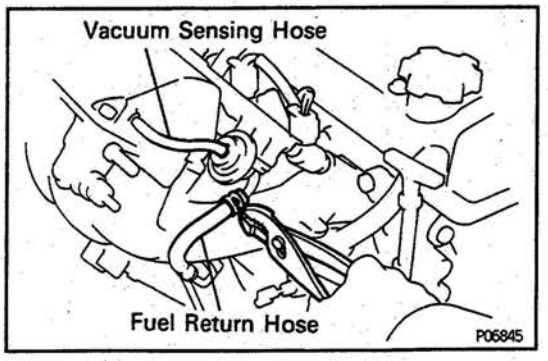
(a) Apply a light coat of gasoline to a new O–ring, and install it to the pressure regulator.



(b) While turning the pressure regulator left and right, install it to the delivery pipe.



(c) Install the pressure regulator with the two bolts.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



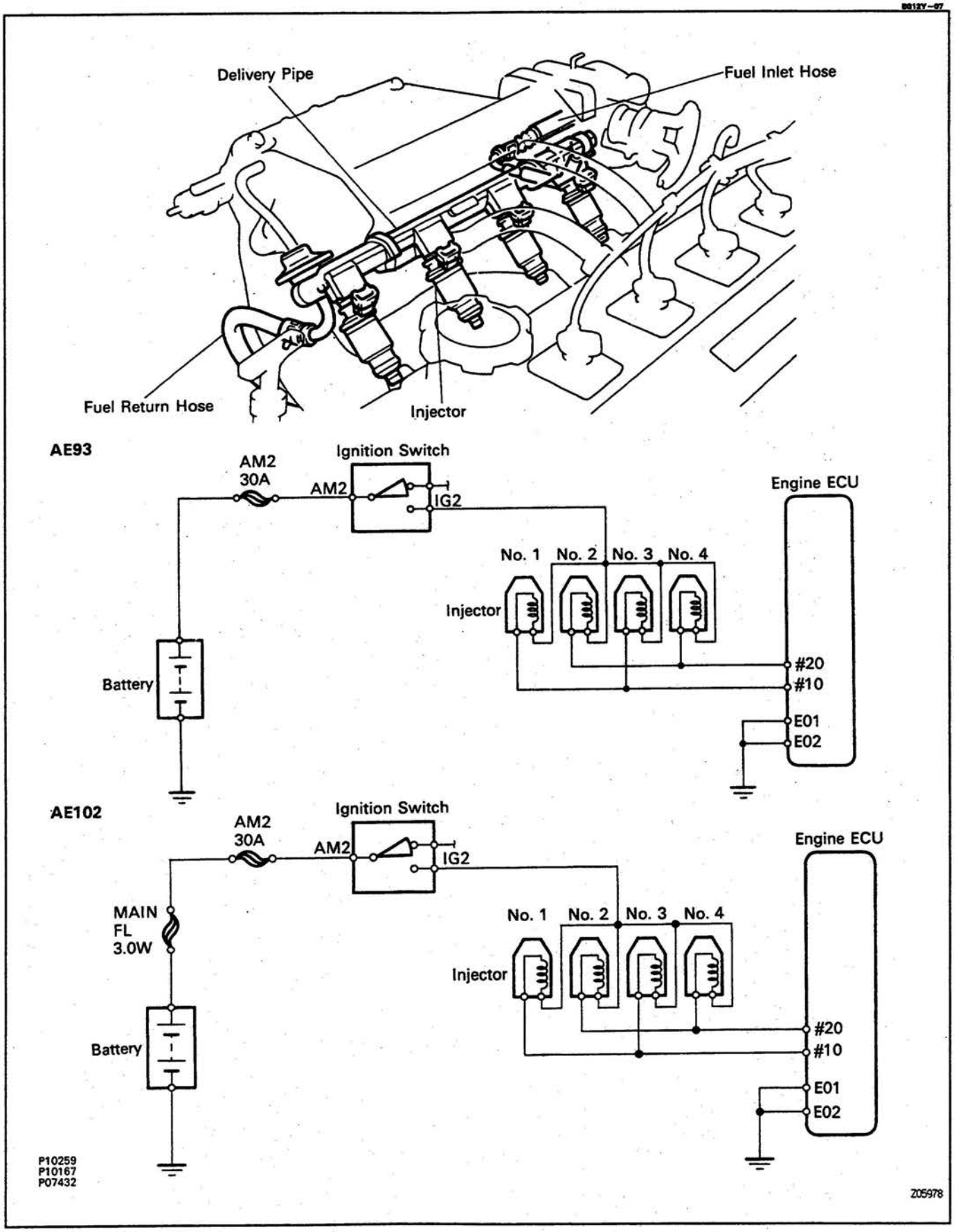
2. CONNECT FUEL RETURN HOSE TO FUEL PRESSURE REGULATOR

3. CONNECT VACUUM SENSING HOSE TO FUEL PRESSURE REGULATOR

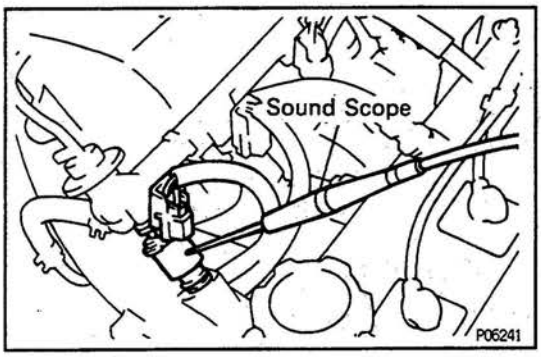
4. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

5. START ENGINE AND CHECK FOR FUEL LEAKAGE

INJECTOR


Delivery Pipe
Fuel Inlet Hose
Fuel Return Hose
Injector
AE93
AM2
30A
Ignition Switch
AM2
IG2
Engine ECU
No. 1
No. 2
No. 3
No. 4
Injector
Battery
#20
#10
E01
E02
AE102
AM2
30A
Ignition Switch
AM2
IG2
Engine ECU
MAIN
FL
3.0W
No. 1
No. 2
No. 3
No. 4
Injector
Battery
#20
#10
E01
E02
P10259
P10167
P07432
Z05978

EG

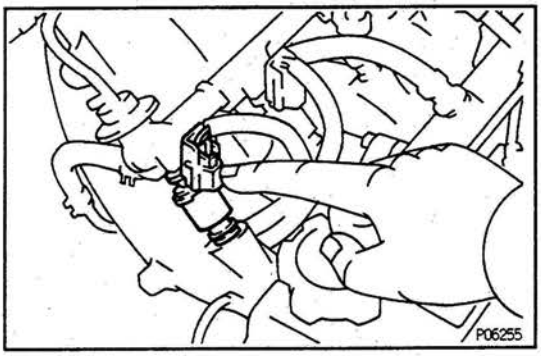


ON–VEHICLE INSPECTION

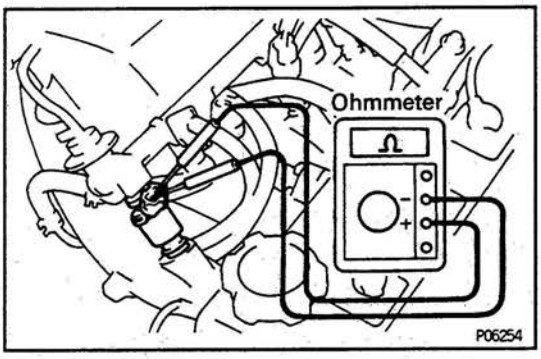
1. INSPECT INJECTOR OPERATION

Check operation sound from each injector.

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



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

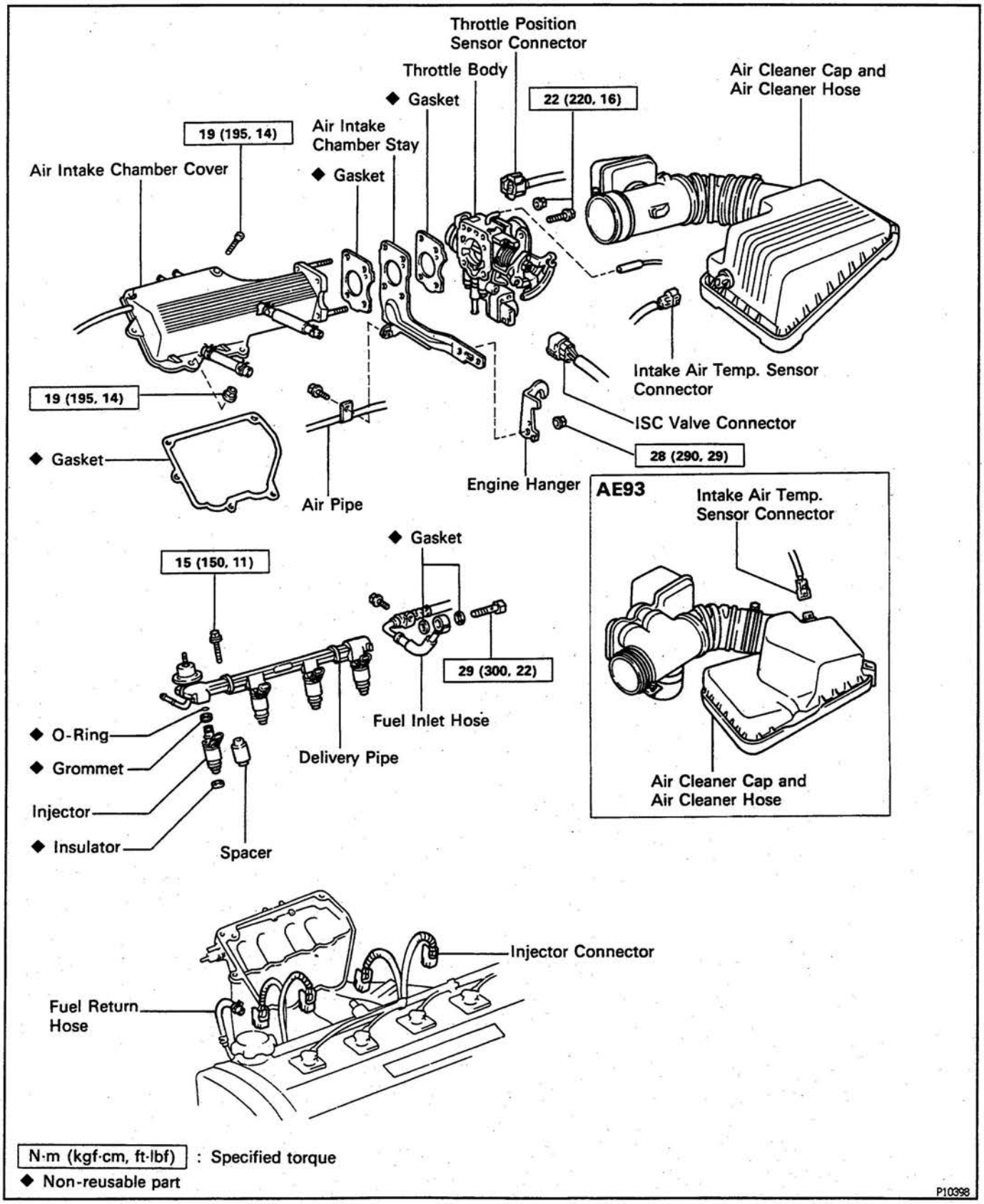
Approx. 13.8 Ω

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

(c) Reconnect the injector connector.

B2190-07

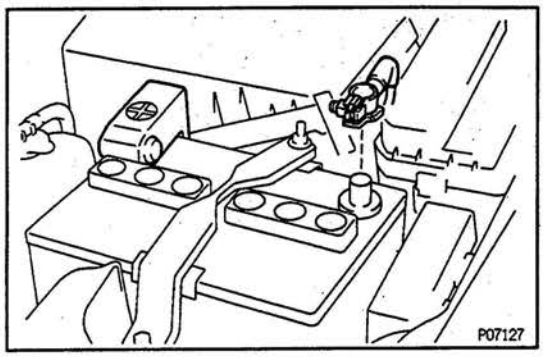
COMPONENTS FOR REMOVAL AND INSTALLATION



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

◆ Non-reusable part

P10398

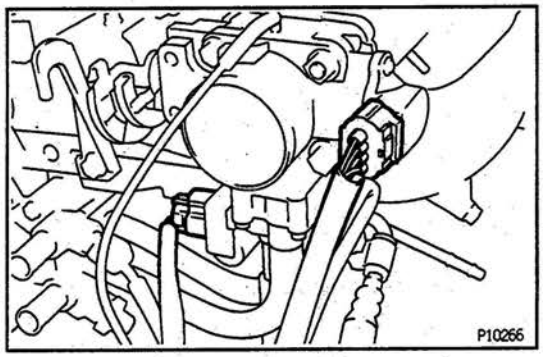


INJECTORS REMOVAL

(See Components for Removal and Installation)

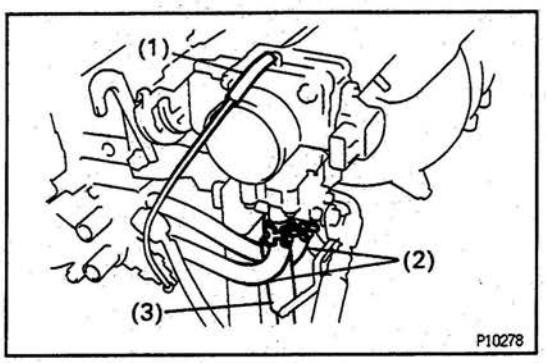
1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

2. **DRAIN ENGINE COOLANT**
3. **REMOVE AIR CLEANER HOSE**
4. **DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY**
5. **(A/T)**
   DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

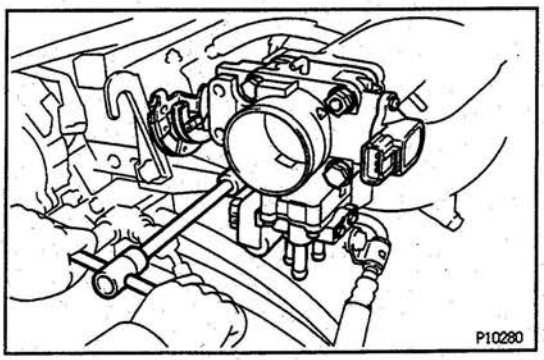


6. **REMOVE THROTTLE BODY**

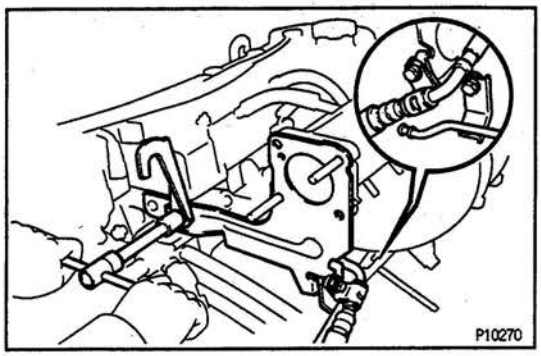
(a) Disconnect the following connector:
- Throttle position sensor connector
- ISC valve connector



(b) Disconnect the following hoses:
(1) Vacuum hose
(2) Two water by–pass hoses
(3) Air hose



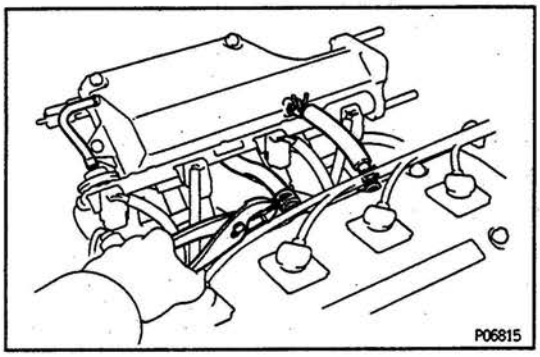
(c) Remove the two bolts, two nuts, throttle body and gasket.



7. REMOVE ENGINE HANGER AND AIR INTAKE CHAMBER STAY

(a) Remove the two bolts, and disconnect the air pipe and fuel inlet hose.

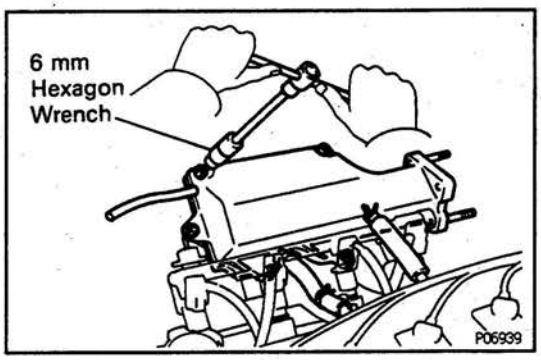
(b) Remove the nut, engine hanger, air intake chamber stay and gasket.



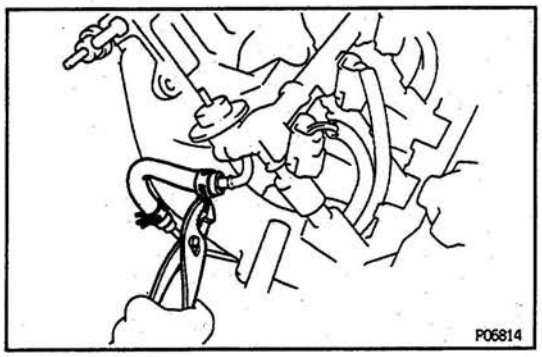
8. REMOVE AIR INTAKE CHAMBER COVER

(a) Disconnect the two PCV hoses.

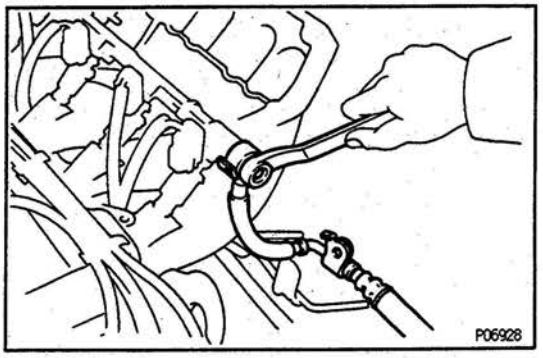
(b) Disconnect the vacuum sensing hose.



(c) Using a 6 mm hexagon wrench, remove the three bolts, two nuts, air intake chamber cover and gasket.



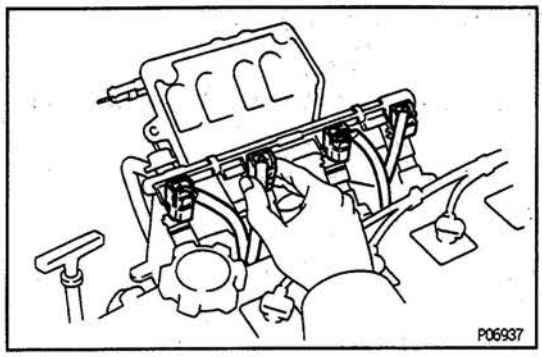
9. DISCONNECT FUEL RETURN HOSE FROM FUEL PRESSURE REGULATOR



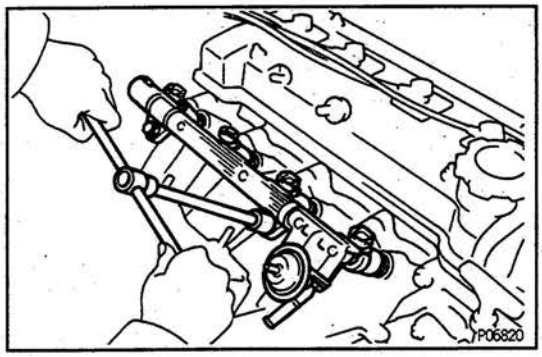
10. DISCONNECT FUEL INLET HOSE FROM DELIVERY PIPE

Remove the union bolt and two gasket, and disconnect the inlet hose from the deliverly pipe.

EG



11. DISCONNECT INJECTOR CONNECTORS



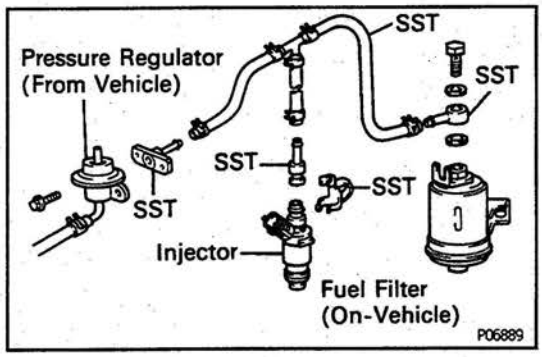
12. REMOVE DELIVERY PIPE AND INJECTOR

(a) Remove the two bolts and delivery pipe together with the four injectors.
NOTICE: Be careful not to drop the injectors when removing the delivery pipe.

(b) Remove the four insulators and two spacers from the intake manifold.

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

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

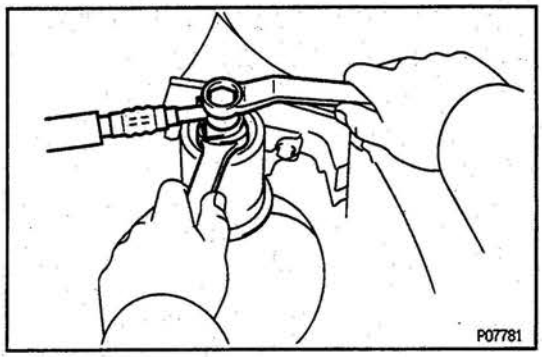


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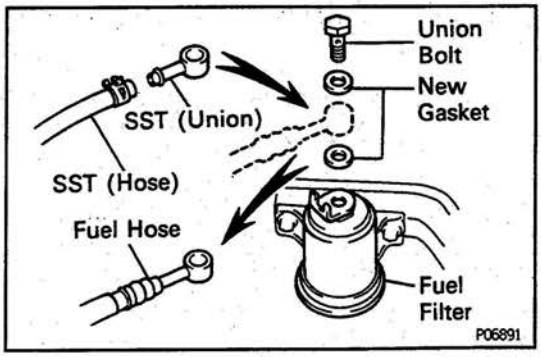
INJECTORS INSPECTION

1. INSPECT INJECTOR INJECTION

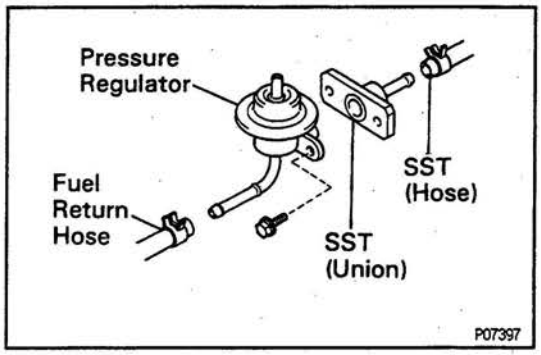
CAUTION: Keep injector clear of sparks during the test.



(a) Remove the union bolt and two gaskets, and disconnect the fuel inlet hose from the fuel filter outlet.

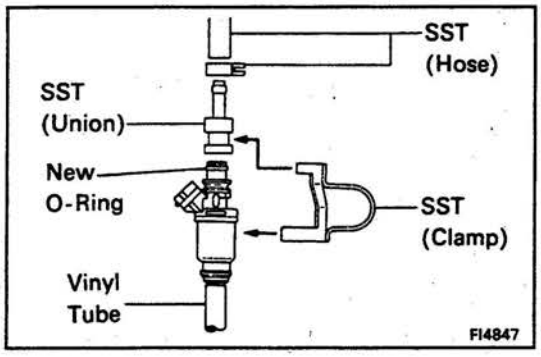


(b) Connect SST (union and hose) to the fuel filter outlet with two new gaskets and union bolt.
SST 09268–41045 (90405–09015)
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

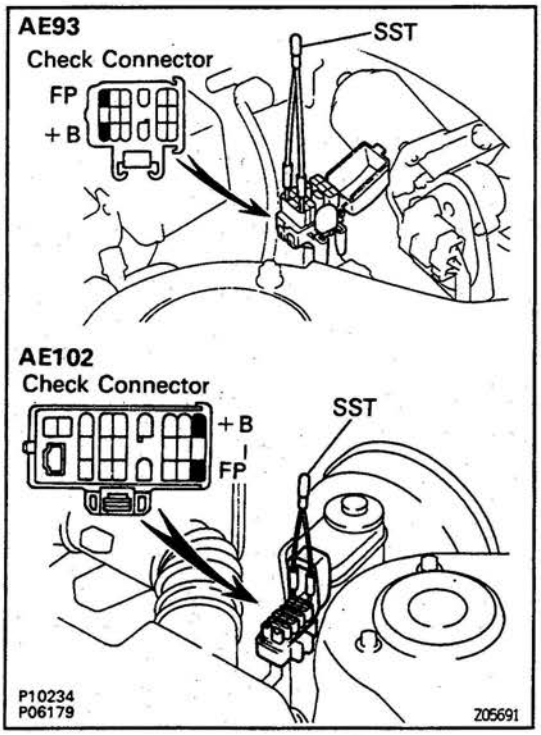


(c) Remove the pressure regulator from the delivery pipe.
(d) Install a new O–ring to the fuel inlet of pressure regulator.
(e) Connect SST (hose) to the fuel inlet of the pressure regulator with SST (union) and the two bolts.
SST 09268–41045 (09268–41090)
Torque: 9.3 N·m (95 kgf·cm, 82 ft·lbf)
(f) Connect the fuel return hose to the fuel outlet of the pressure regulator.

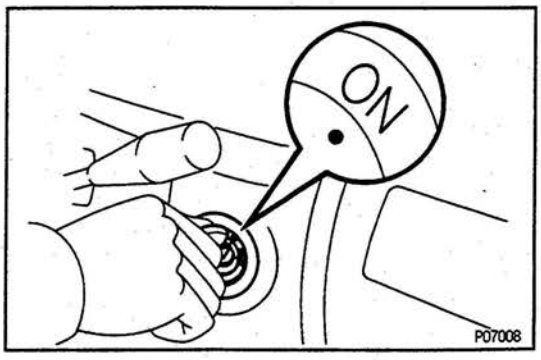
EG



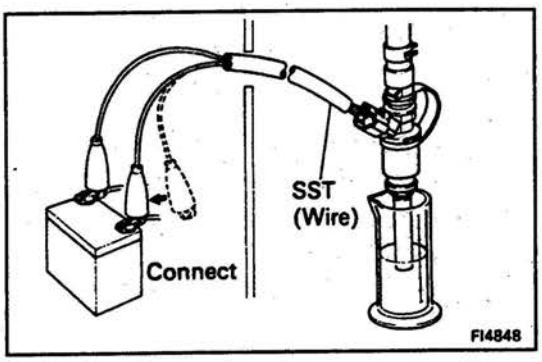
(g) Install the grommet and a new O–ring to the injector.
(h) Connect SST (union and hose) to the injector, and hold the injector and union with SST (clamp).
SST 09268–41045
(i) Put the injector into the graduated cylinder.
HINT: Install a suitable vinyl hose onto the injector to prevent gasoline from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



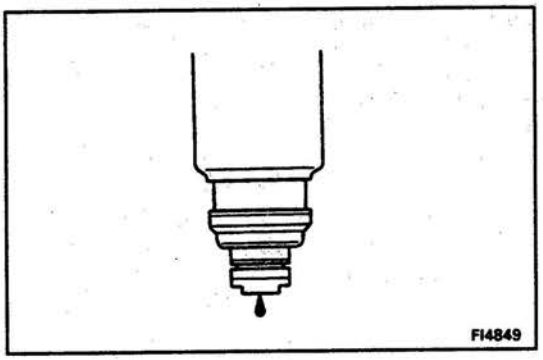
(j) Using SST, connect terminals +B and FP of the check connector.
SST 09843–18020
(k) Reconnect the battery negative (–) cable.



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

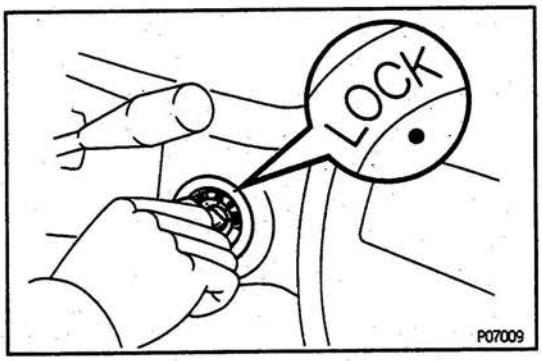


(m) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector two or three times.
SST 09842–30070
Volume:
40 – 50 cm³ (2.4 – 3.1 cu in.) per 15 sec.
Difference between each injector:
5 cm³ (0.3 cu in.) or less
If the injection volume is not as specified, replace the injector.

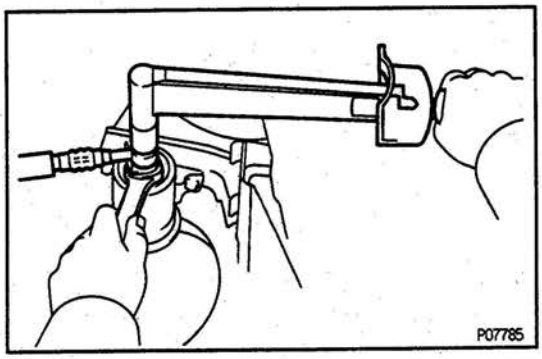


2. INSPECT LEAKAGE

(a) In the condition above, disconnect the test probes of SST (wire) from the battery and check the fuel leakage from the injector.
SST 09842–30070
Fuel drop:
One drop or less per minute

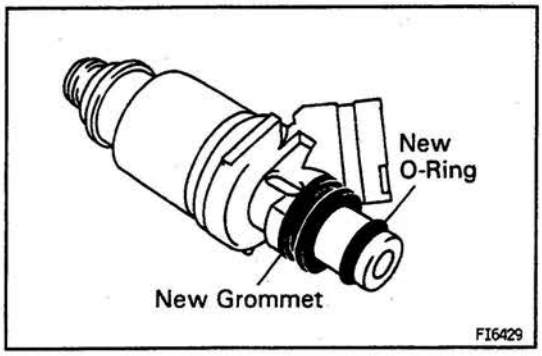


(b) Turn the ignition switch OFF.
(c) Disconnect the battery negative (–) cable.
(d) Remove the SST.
SST 09268–41045, 09843–18020



(e) Reinstall the fuel inlet hose to the fuel filter outlet with two new gaskets and the union bolt.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

INJECTORS INSTALLATION

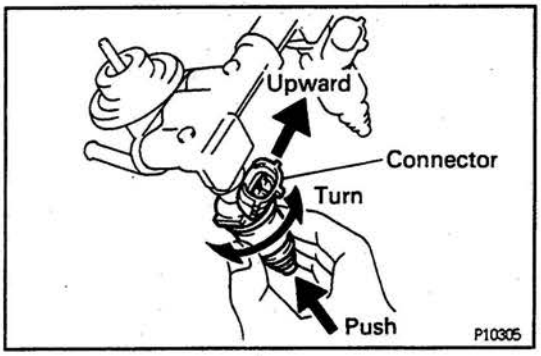


(See Components for Removal and Installation)

1. INSTALL INJECTORS AND DELIVERY PIPE

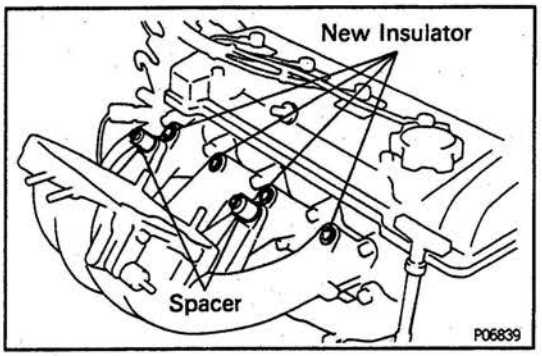
(a) Install a new grommet to the injector.

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

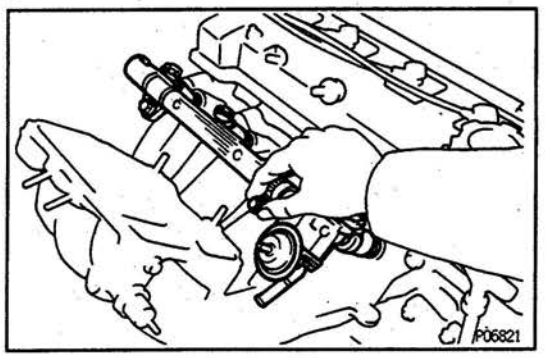


(c) While turning the injector left and right, install it to the delivery pipe. Install the four injectors.

(d) Position the injector connector upward.

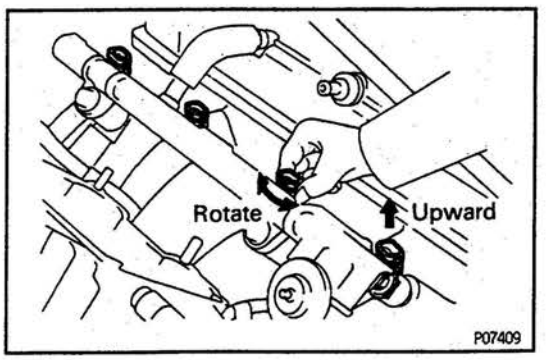


(e) Place four new insulators and the two spacers in position on the intake manifold.



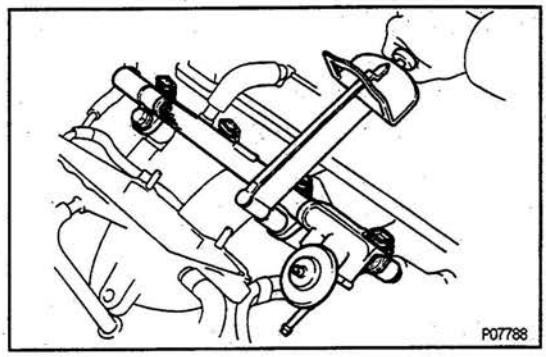
(f) Place the four injectors and delivery pipe assembly in position on the intake manifold.

(g) Temporarily install the two bolts holding the delivery pipe to the intake manifold.

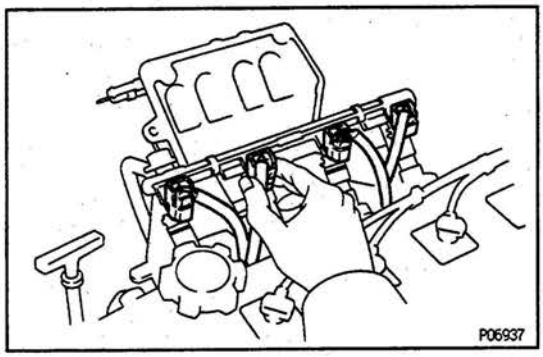


(h) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O–rings. Replace the O–rings.

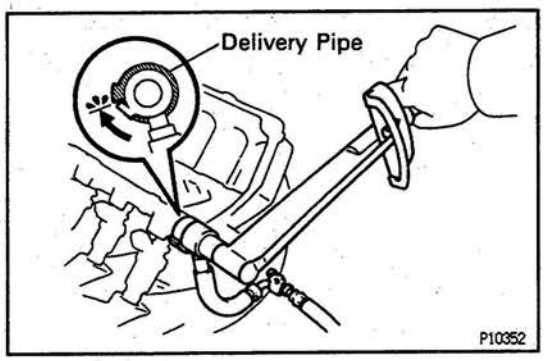
(i) Position the injector connector upward.



(j) Tighten the two bolts holding the delivery pipe to the intake manifold
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)

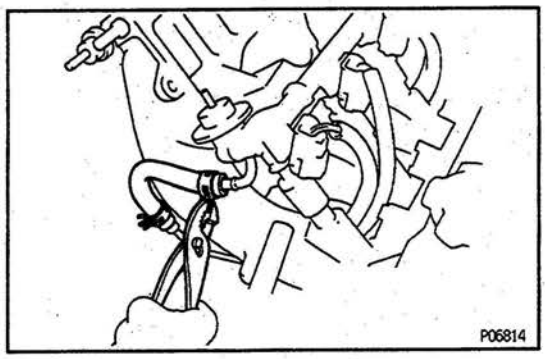


2. CONNECT INJECTOR CONNECTORS

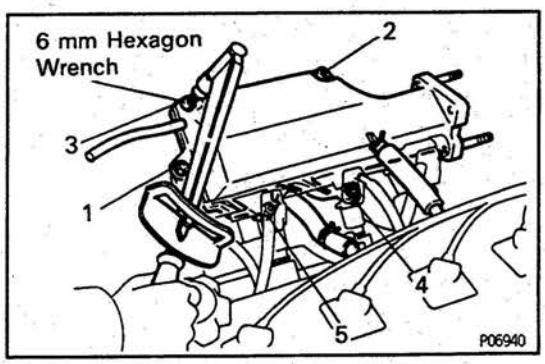


3. CONNECT FUEL INLET HOSE TO DELIVERY PIPE

Connect the inlet hose with two new gaskets and the union bolt.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

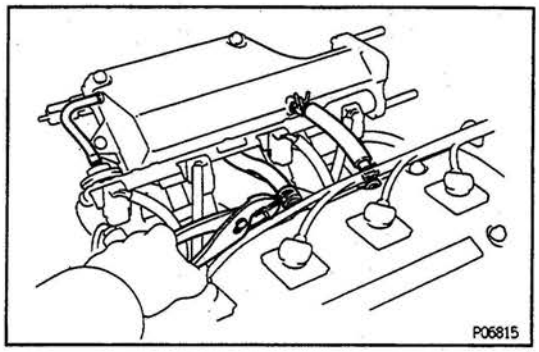


4. CONNECT FUEL RETURN HOSE TO FUEL PRESSURE REGULATOR

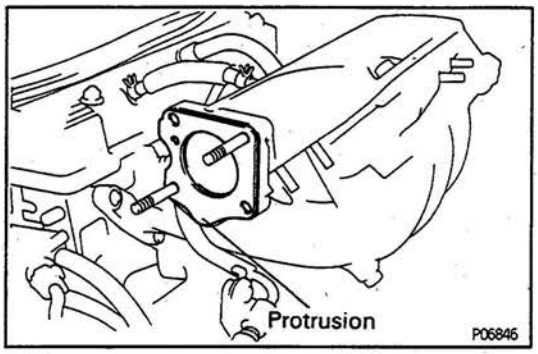


5. INSTALL AIR INTAKE CHAMBER COVER

(a) Using a 6 mm hexagon wrench, install a new gasket and air intake chamber cover with the three bolts and two nuts in the sequence shown.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)

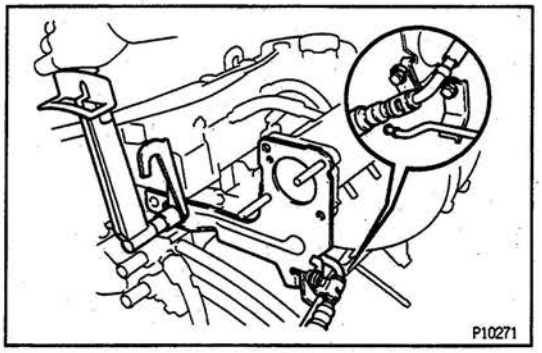


(b) Connect the two PCV hoses.
(c) Connect the vaccum sensing hose.

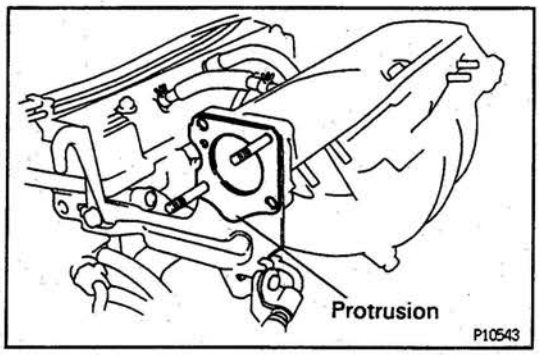


6. INSTALL AIR INTAKE CHAMBER STAY AND ENGINE HANGER

(a) Place a new gasket to the air intake chamber, facing the protrusion downward.

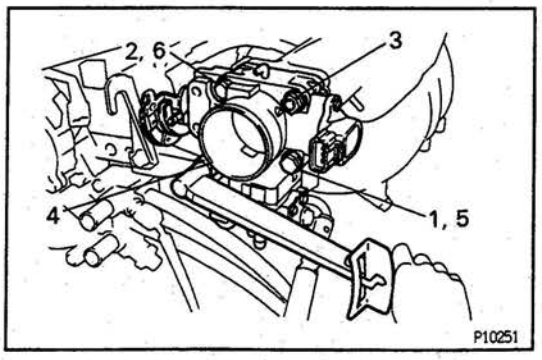


(b) Install the air intake chamber stay and engine hanger with the nut.
Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)
(c) Connect the air pipe and fuel inlet hose with the two bolts.

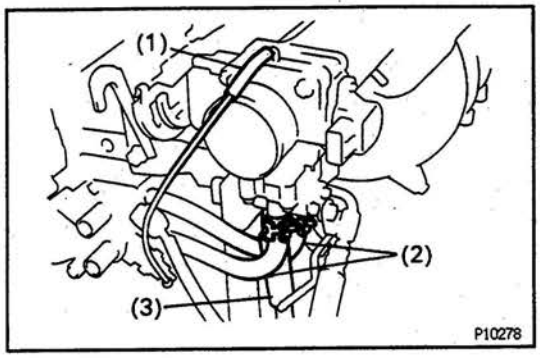


7. INSTALL THROTTLE BODY

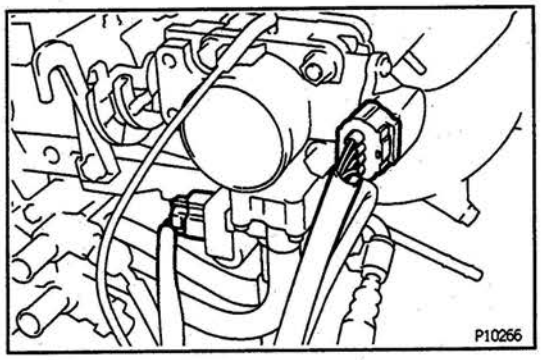
(a) Install a new gasket on the air intake chamber, facing the protrusion downward.



(b) Install the throttle body with the two bolts and two nuts in the sequence shown.
Torque: 22 N·m (220 kgf·cm, 16 ft·lbf)



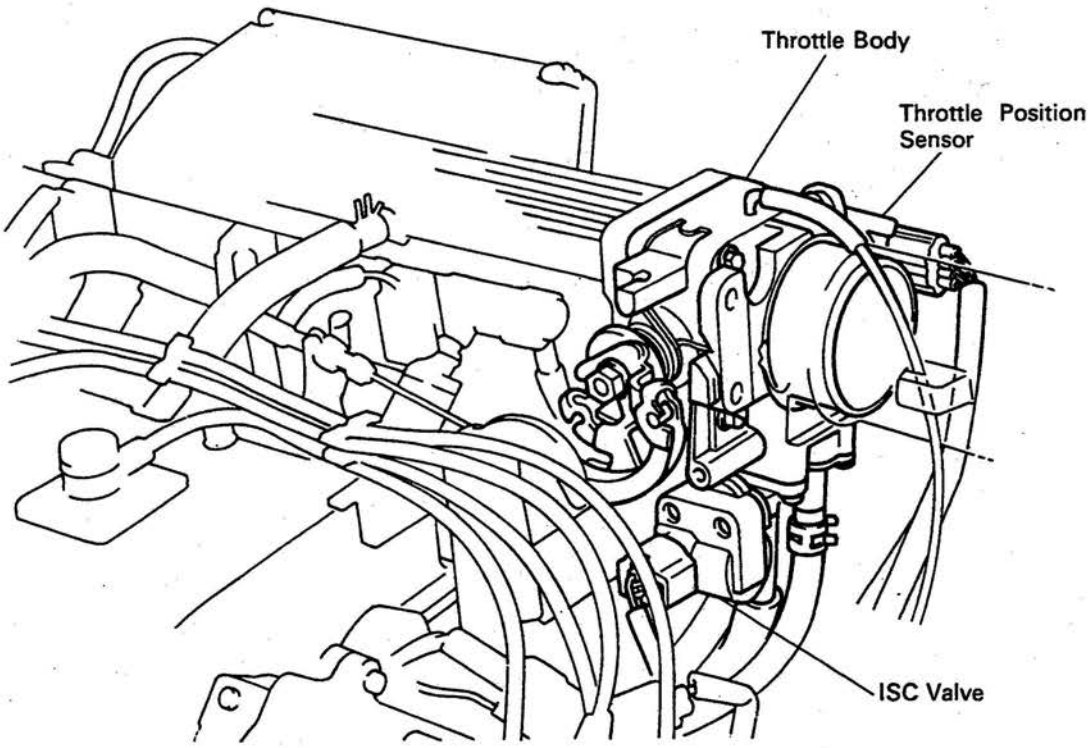
(c) Reconnect the following hoses to the throttle body:
(1) Vacuum hose
(2) Two water by–pass hoses
(3) Air hose

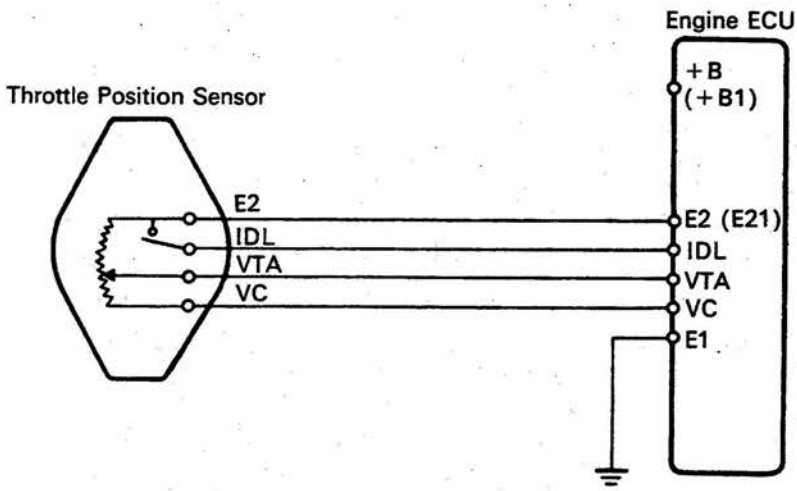


(d) Reconnect the following connector:
- Throttle position sensor connector
- ISC valve connector

8. **CONNECT ACCELERATOR CABLE TO THROTTLE BODY**
9. **(A/T)**
CONNECT THROTTLE CABLE TO THROTTLE BODY
10. **INSTALL AIR CLEANER HOSE**
11. **FILL WITH ENGINE COOLANT**
12. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

THROTTLE BODY

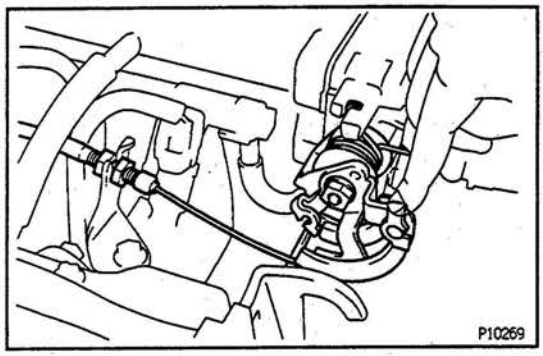




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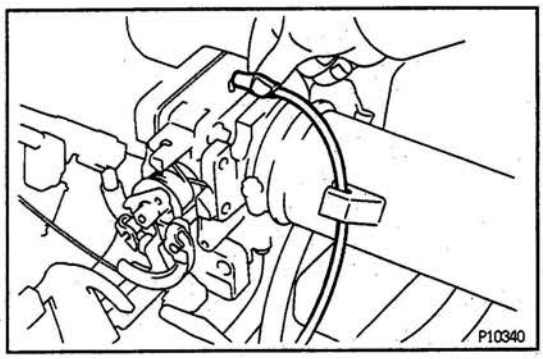
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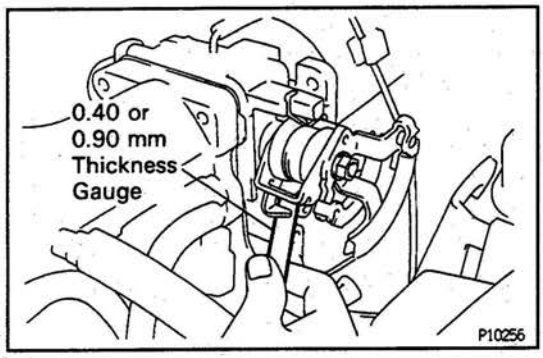
ON–VEHICLE INPSECTION

1. INSPECT THROTTLE BODY

(a) Check that the throttle linkage moves smoothly.



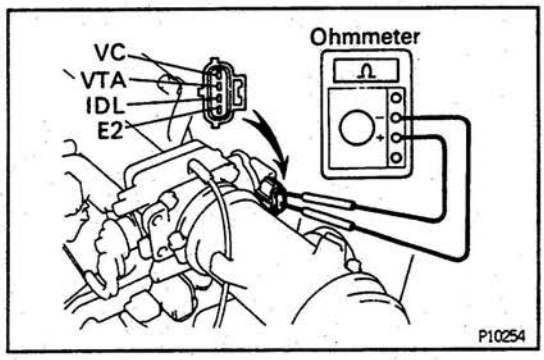
(b) Check the vacuum at the purge port.
- Start the engine.
- Check the vacuum with your finger.



2. INSPECT THROTTLE POSITION SENSOR

(a) Disconnect the sensor connector.

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

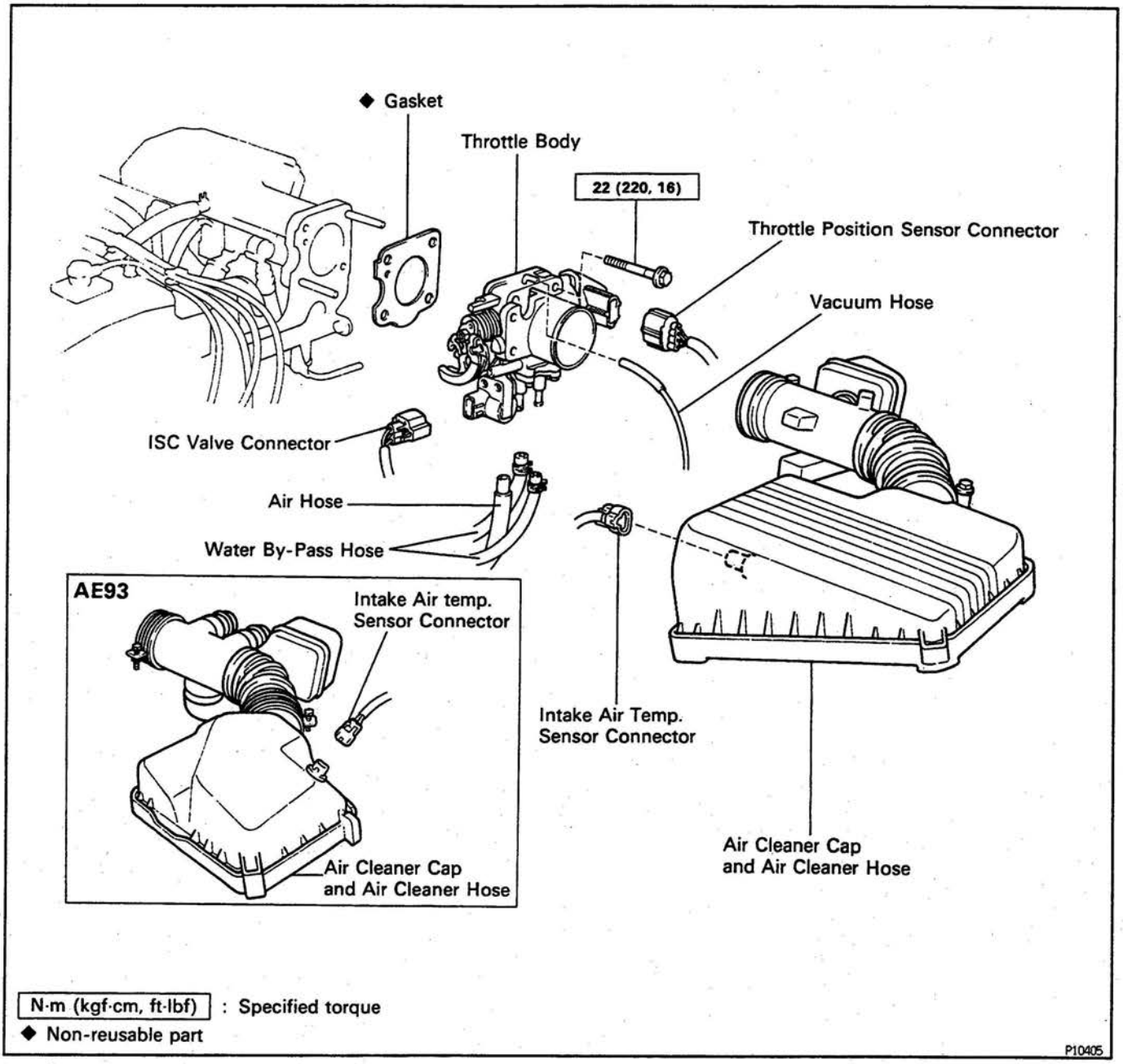


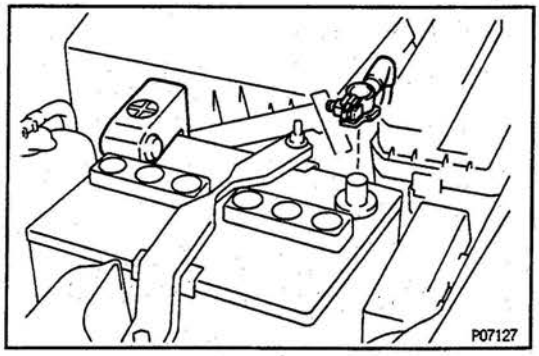
(c) Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 6.0 kΩ
0.40 mm (0.016 in.)	IDL – E2	2.3 kΩ or less
0.90 mm (0.035 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	3.3 – 10.0 kΩ
–	VC – E2	4.0 – 8.5 kΩ

(d) Reconnect the sensor connector.

COMPONENTS FOR REMOVAL AND INSTALLATION





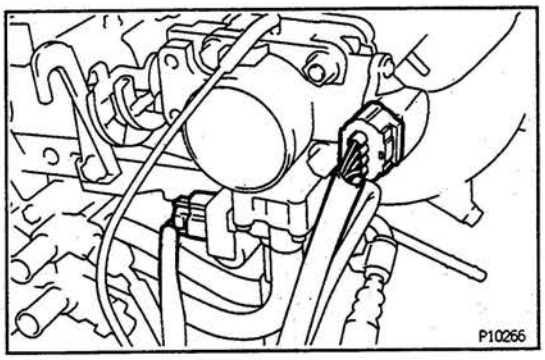
THROTTLE BODY REMOVAL

(See Components for Removal and Installation)

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

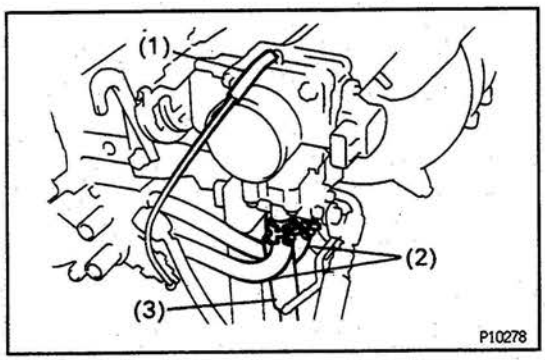
2. **DRAIN ENGINE COOLANT**
3. **REMOVE AIR CLEANER HOSE**
4. **DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY**
5. **(A/T) DISCONNECT THROTTLE CABLE FROM THROTTLE BODY**

EG

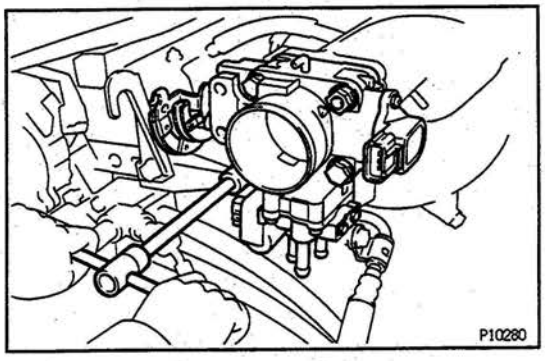


6. **REMOVE THROTTLE BODY**

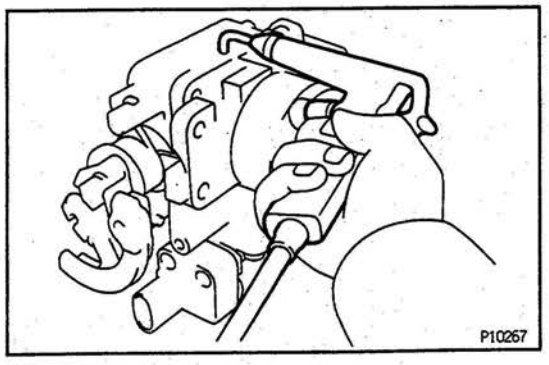
(a) Disconnect the following connector:
- Throttle position sensor connector
- ISC valve connector



(b) Disconnect the following hoses:
(1) Vacuum hose
(2) Two water by–pass hoses
(3) Air hose



(c) Remove the two bolts, two nuts, throttle body and gasket.



THROTTLE BODY INSPECTION

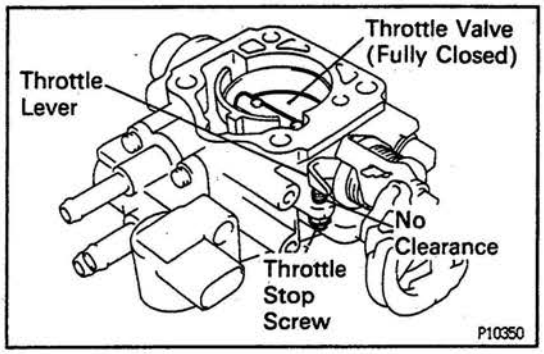
EGCDH–06

1. **CLEAN THROTTLE BODY**

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

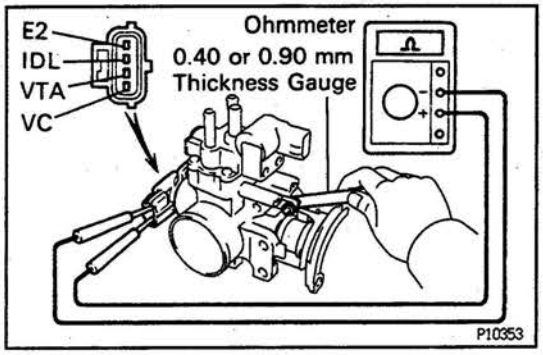
(b) Using compressed air, clean all the passages and apertures.

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



2. INSPECT THROTTLE VALVE

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

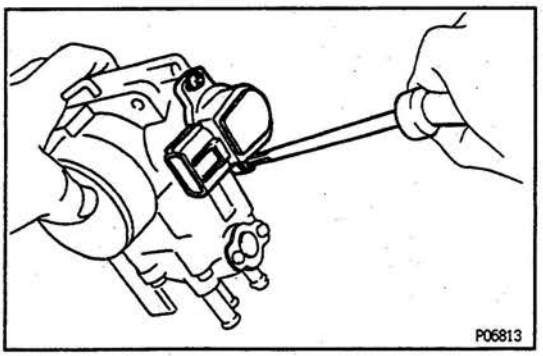


3. INSPECT THROTTLE POSITION SENSOR

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

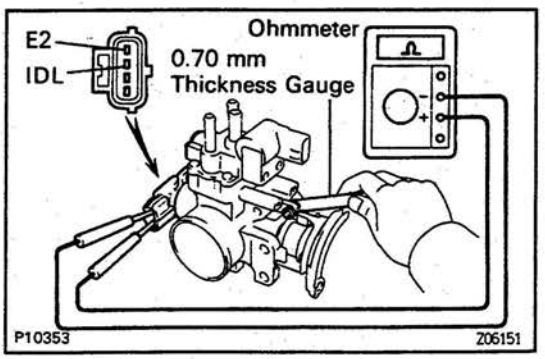
(b) Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 6.0 kΩ
0.40 mm (0.016 in.)	IDL – E2	2.3 kΩ or less
0.90 mm (0.035 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	3.3 – 10.0 kΩ
–	VC – E2	4.0 – 8.5 kΩ



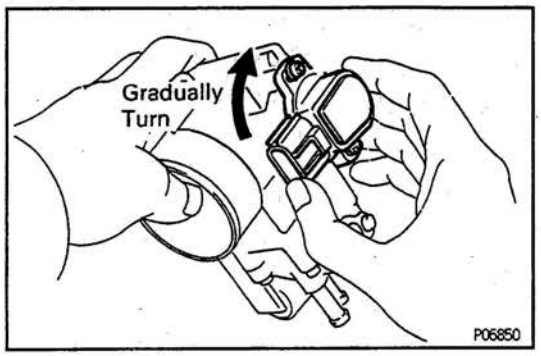
4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

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

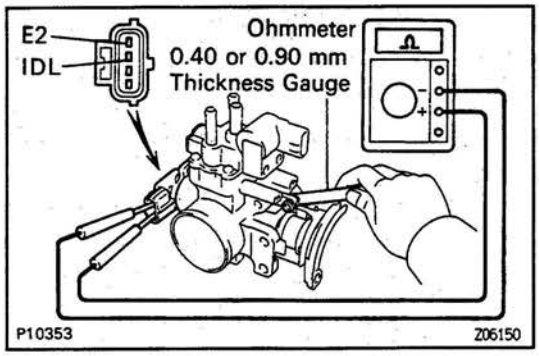


(b) Insert a 0.70 mm (0.028 in.) thickness gauge between the throttle stop screw and stop lever.

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

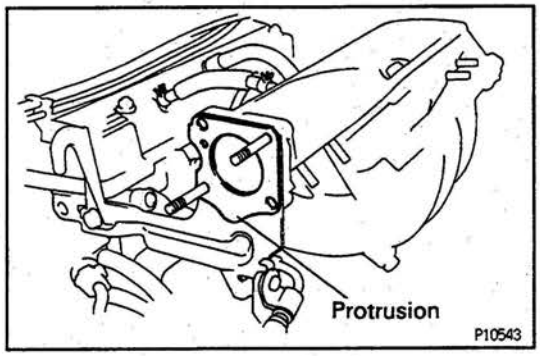


(d) Gradually turn the sensor clockwise until the ohmmeter deflects, and secure it with the two set screws.



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

Clearance between lever and stop screw	Continuity (IDL — E2)
0.40 mm (0.016 in.)	Continuity
0.90 mm (0.035 in.)	No continuity



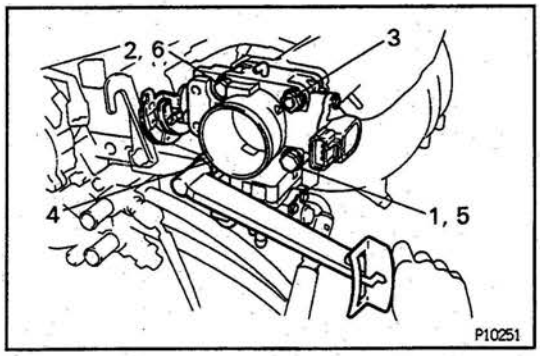
THROTTLE BODY INSTALLATION

B028X-01

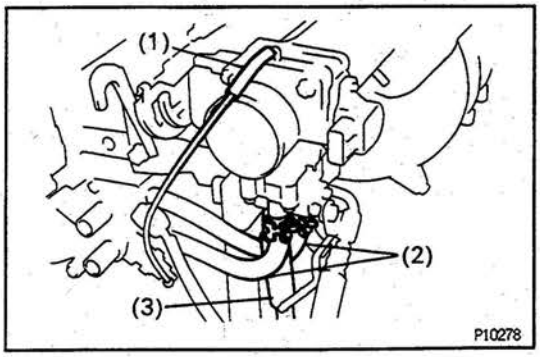
(See Components for Removal and Installation)

1. INSTALL THROTTLE BODY

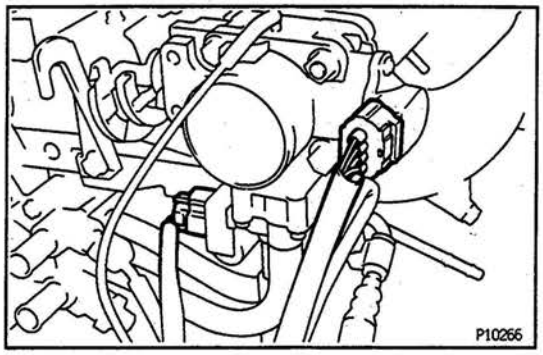
(a) Install a new gasket on the air intake chamber, facing the protrusion downward.



(b) Install the throttle body with the two bolts and two nuts in the sequence shown.
Torque: 22 N·m (220 kgf·cm, 16 ft·lbf)



(c) Reconnect the following hoses to the throttle body:
(1) Vacuum hose
(2) Water by—pass hoses
(3) Air hose

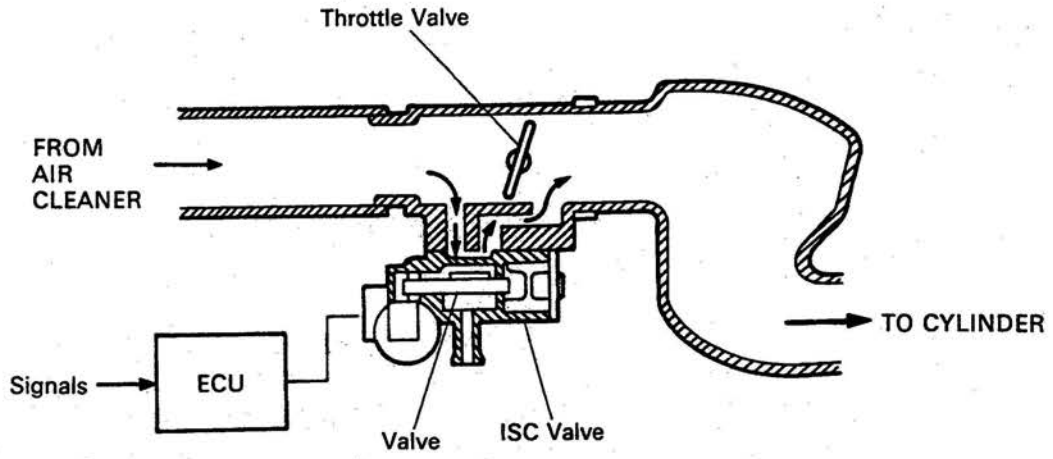


(d) Reconnect the following connector:
- Throttle position sensor connector
- ISC valve connector

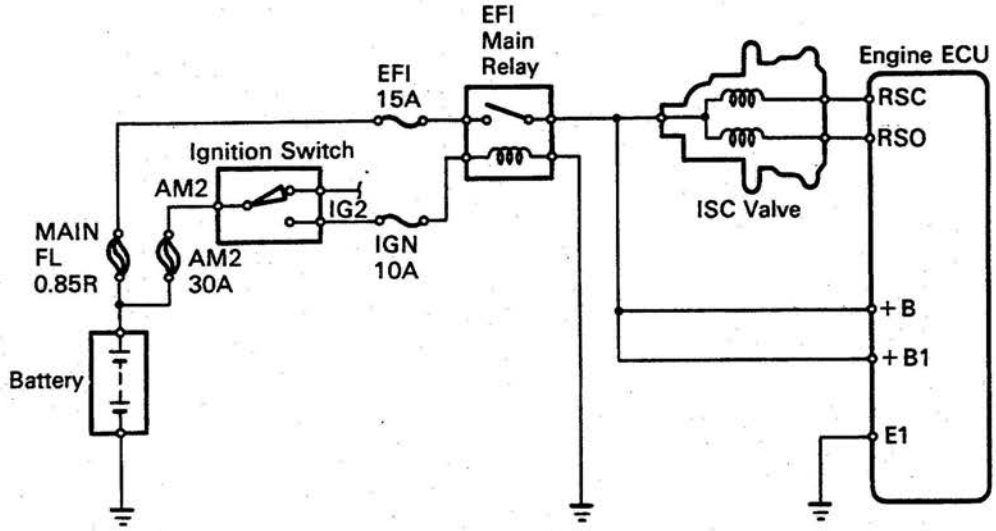
2. **CONNECT ACCELERATOR CABLE TO THROTTLE BODY**
3. **(A/T)**
   CONNECT THROTTLE CABLE TO THROTTLE BODY
4. **INSTALL AIR CLEANER HOSE**
5. **FILL WITH ENGINE COOLANT**
6. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

ISC VALVE

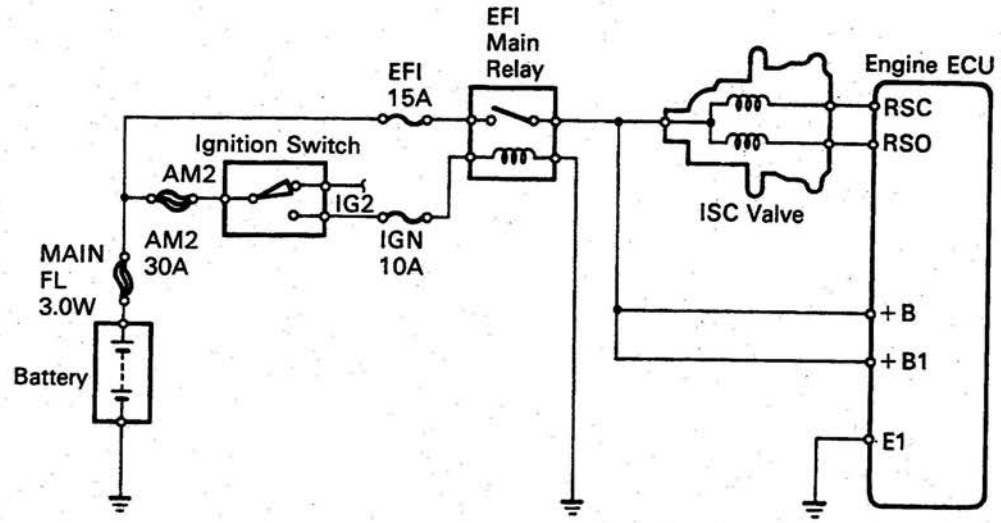
EG



AE93



AE102



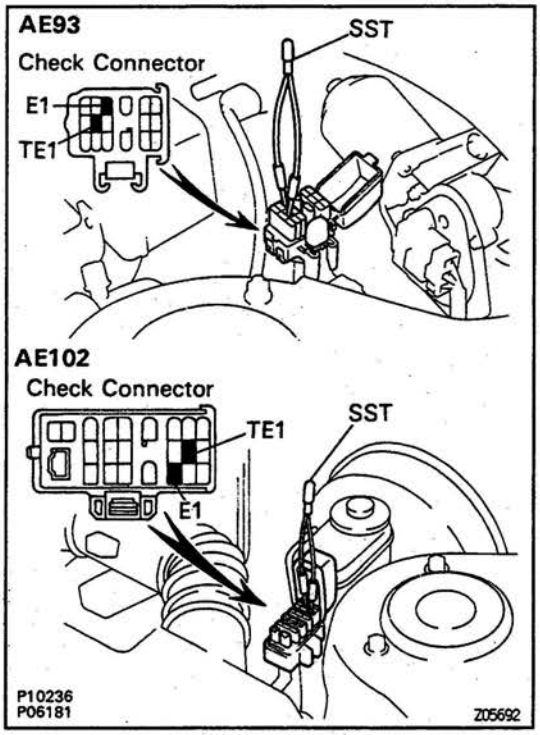
P08198
P10166
P07152

Z05507

ON–VEHICLE INSPECTION

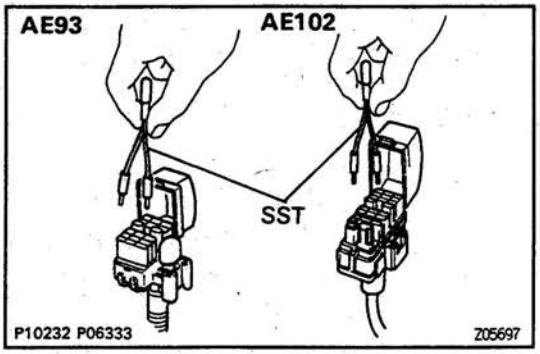
1. INSPECT ISC VALVE OPERATION

(a) Initial conditions:
- Engine at normal operating temperature
- Idle speed set correctly
- Transmission in neutral range

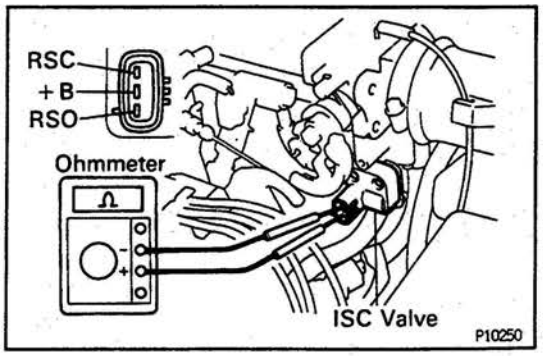


(b) Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843–18020

(c) After engine rpm are kept at 1,000–1,500 rpm for 5 second, check that they return to idle speed.
If the rpm operation is not as specified, check the ISC valve, wiring and ECU.



(d) Remove SST.
SST 09843–18020



2. INSPECT ISC VALVE RESISTANCE

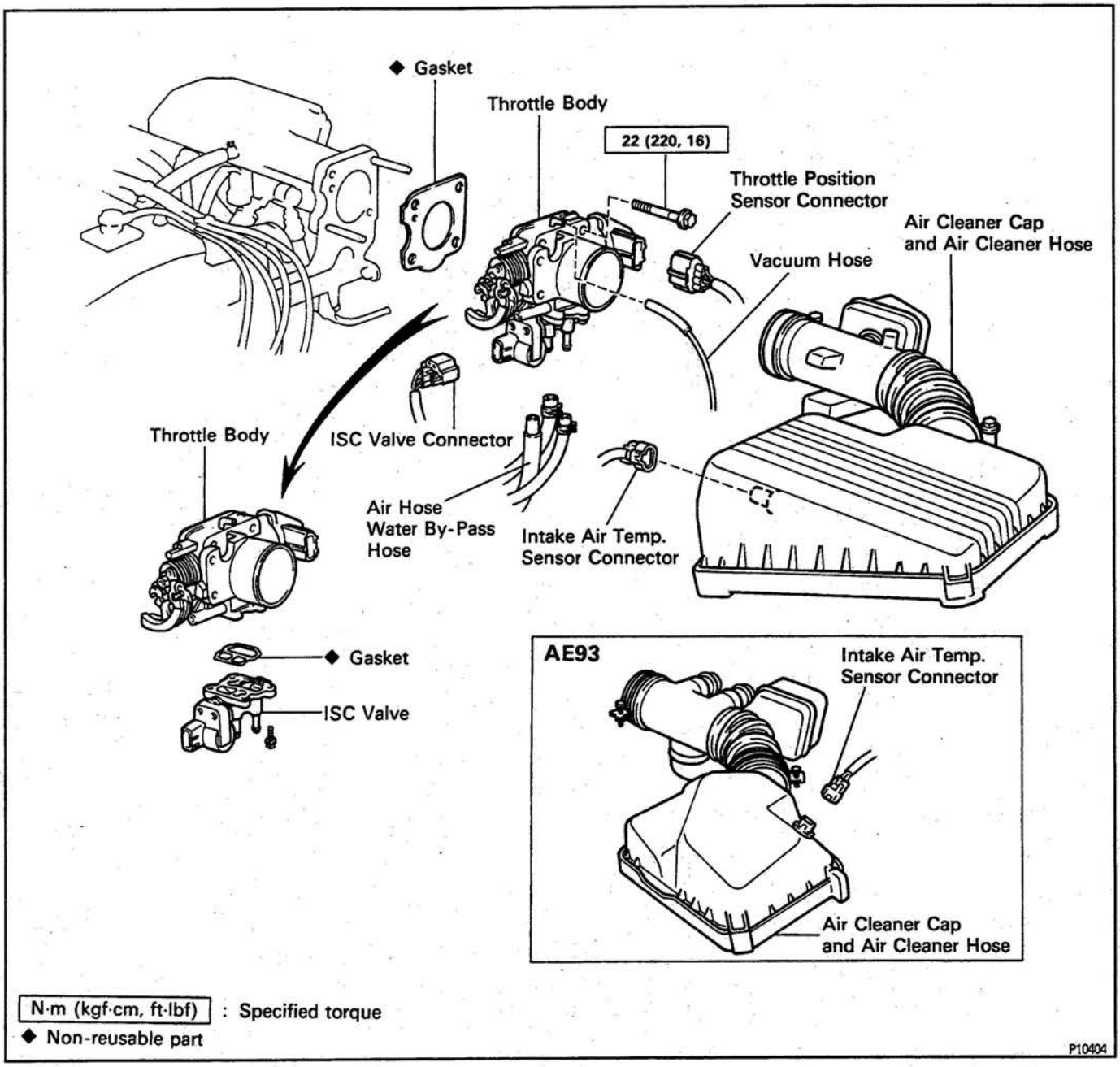
(a) Disconnect the ISC valve connector.

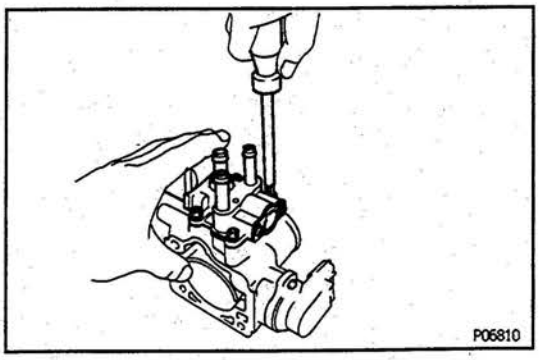
(b) Using an ohmmeter, measure the resistance between terminal +B and other terminals (RSC, RSO).
Resistance:
19.3 – 22.3 Ω
If resistance is not as specified, replace the ISC valve.

(c) Reconnect the ISC valve connector.

EG

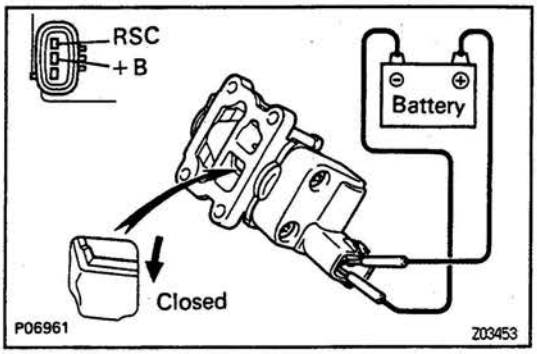
COMPONENTS FOR REMOVAL AND INSTALLATION





ISC VALVE REMOVAL

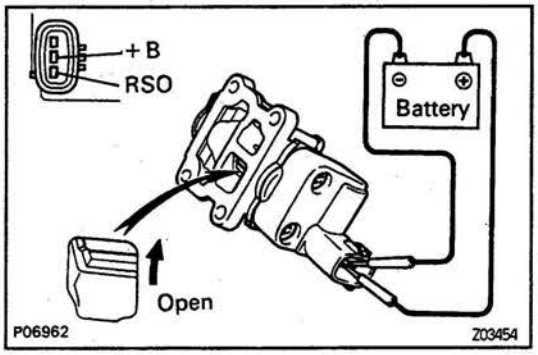
1. **REMOVE THROTTLE BODY**
   (See page EG–211)
2. **REMOVE ISC VALVE**
   Remove the four screws, ISC valve and gasket.



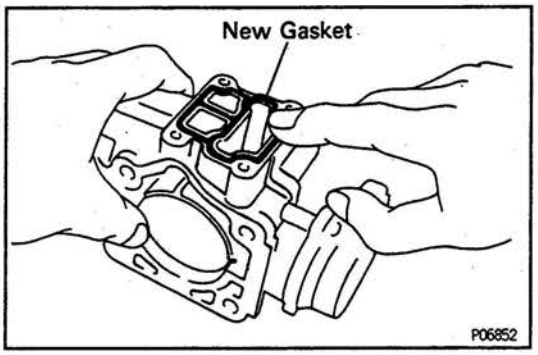
ISC VALVE INSPECTION

INSPECT ISC VALVE OPERATION

(a) Connect the positive (+) lead from the battery to terminal +B and negative (–) lead to terminal RSC, and check that the valve is closed.



(b) Connect the positive (+) lead from the battery to terminal +B and negative (–) lead to terminal RSO, and check that the valve is open.

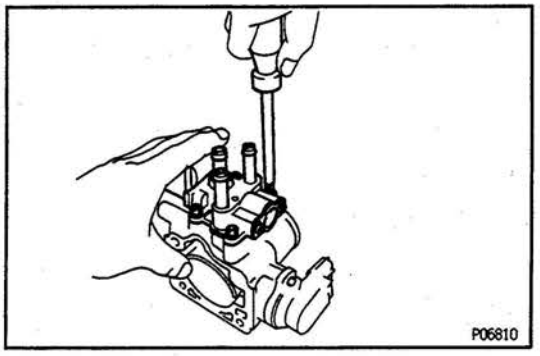


ISC VALVE INSTALLATION

(See Components for Removal and Installation)

1. INSTALL ISC VALVE

(a) Place a new gasket on the throttle body.



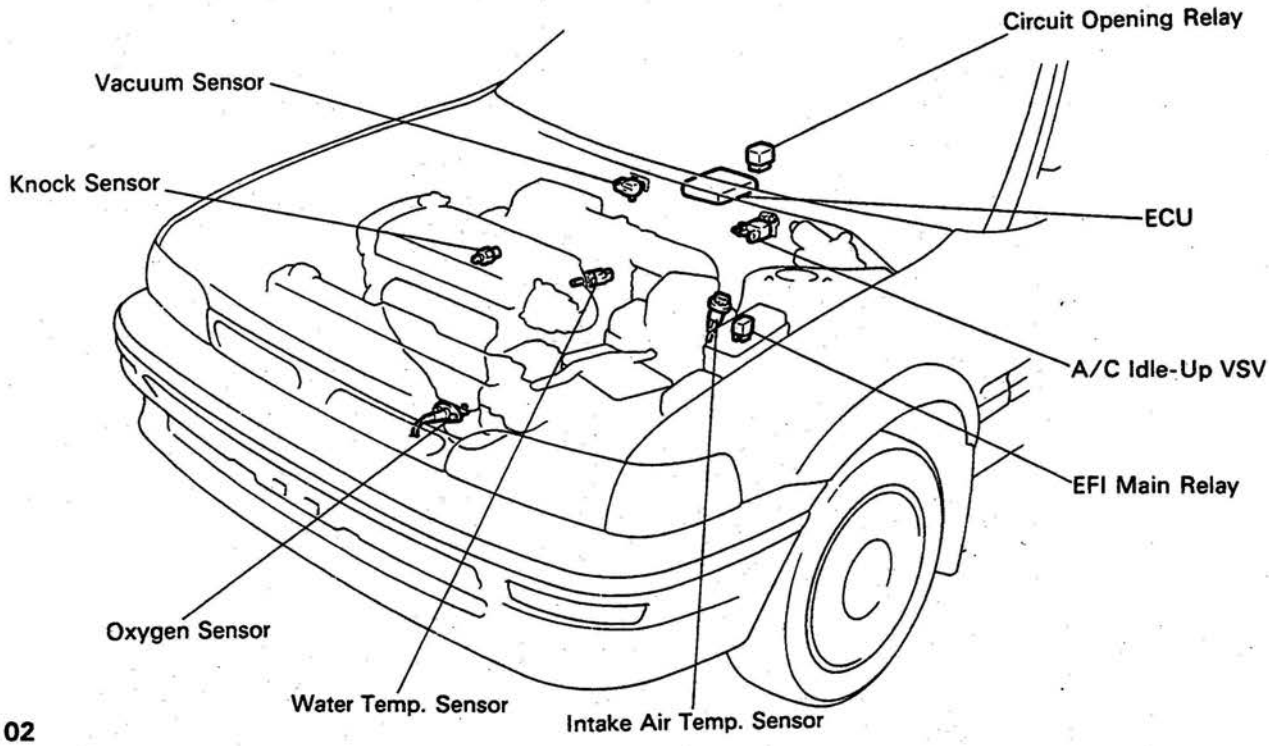
(b) Install the ISC valve with the four screws.

2. INSTALL THROTTLE BODY

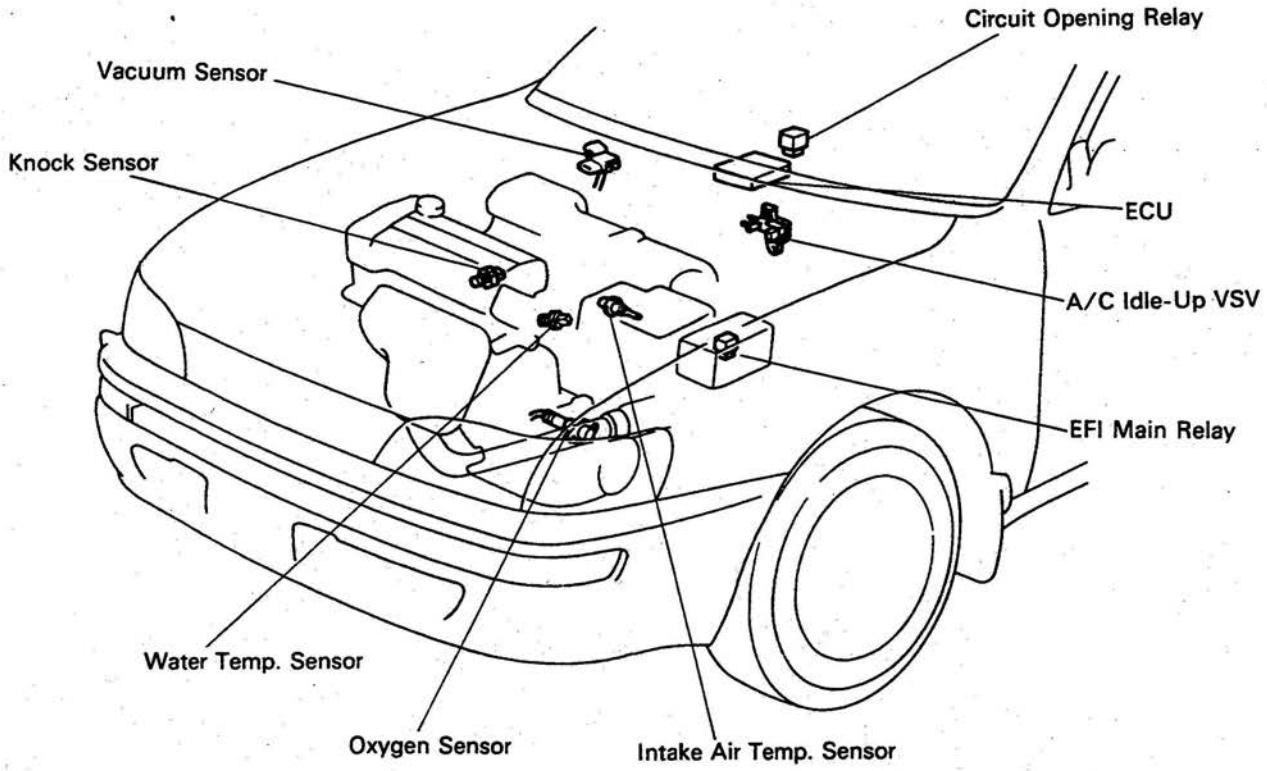
(See page EG–214)

ELECTRONIC PARTS LOCATION

AE93



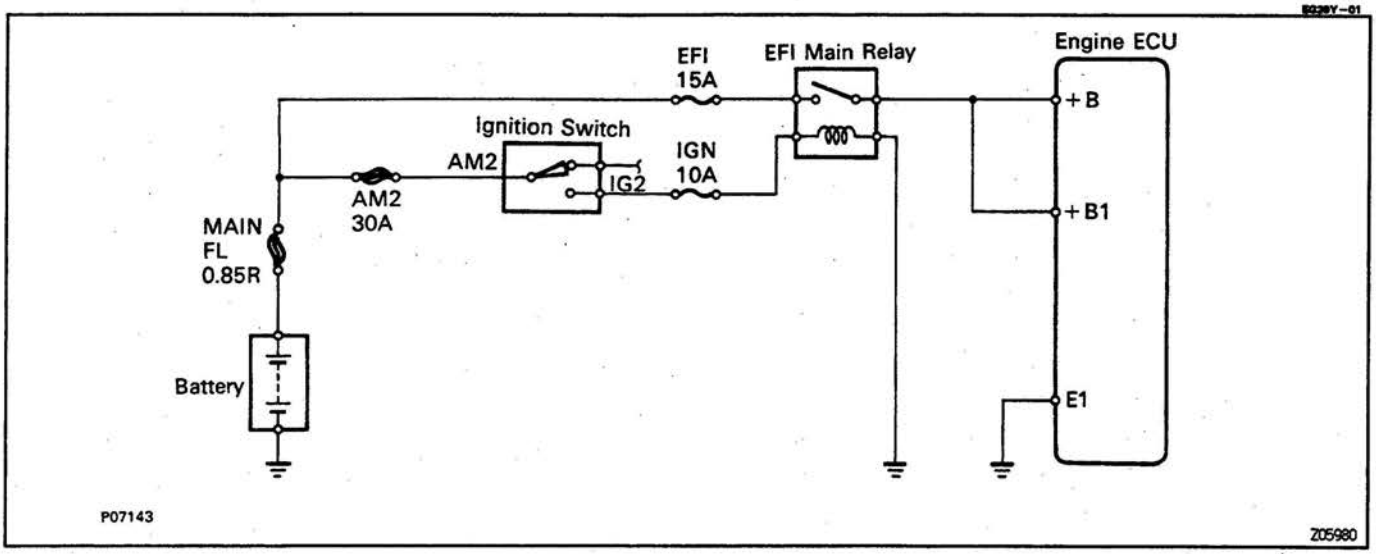
AE102



P10374
P10277

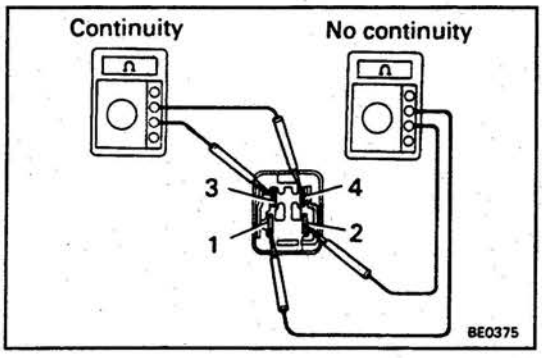
Z05197

EFI MAIN RELAY (AE93)



EFI MAIN RELAY INSPECTION

1. **REMOVE EFI MAIN RELAY**



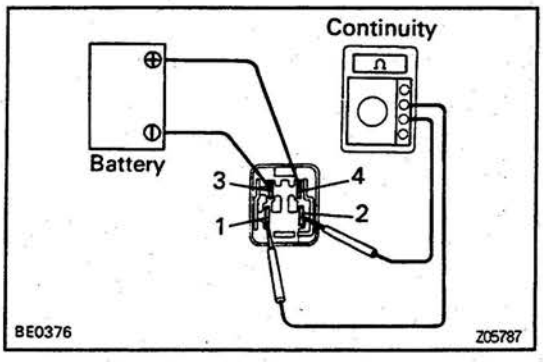
2. **INSPECT EFI MAIN RELAY**

A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 3 and 4.

(b) 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 4.

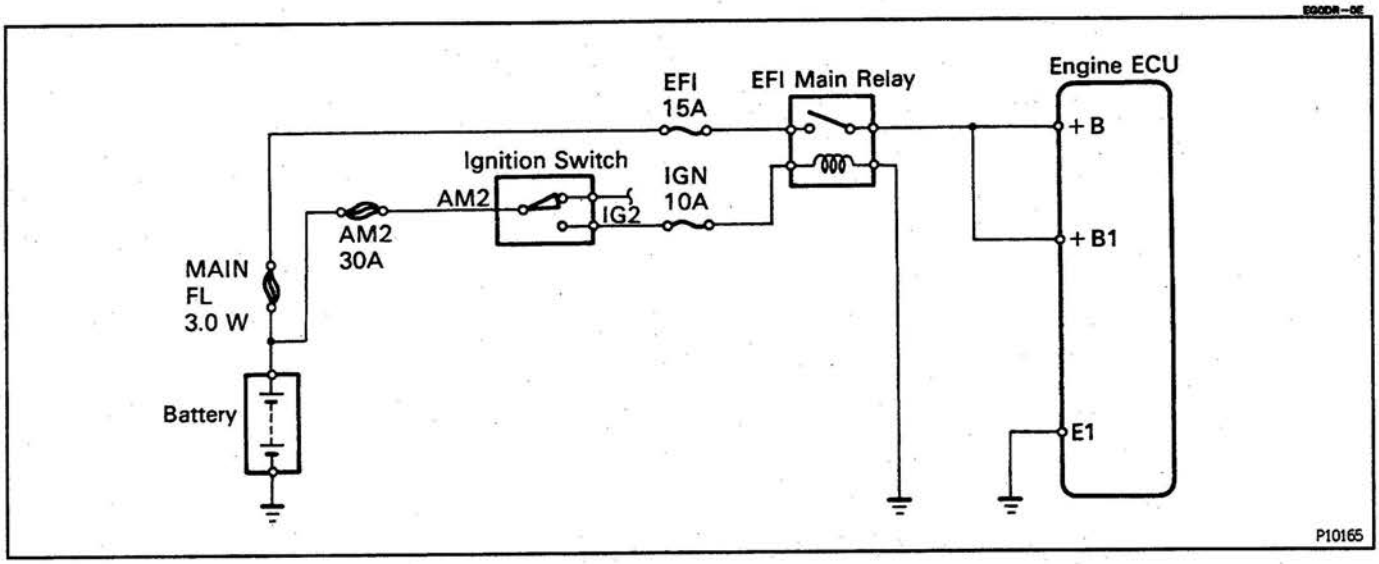
(b) Using an ohmmeter, check that there is continuity between the 1 and 2.

If operation is not as specified, replace the relay.

3. **REINSTALL EFI MAIN RELAY**

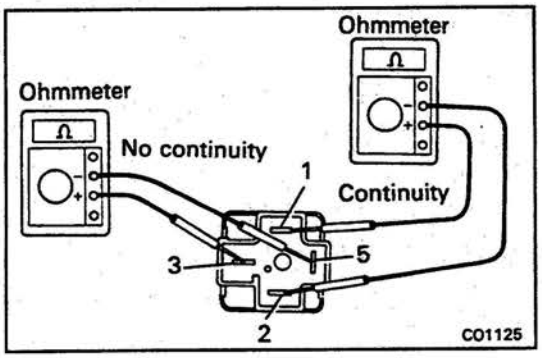
EFI MAIN RELAY (AE102)

EG



EFI MAIN RELAY INSPECTION

1. **REMOVE EFI MAIN RELAY**



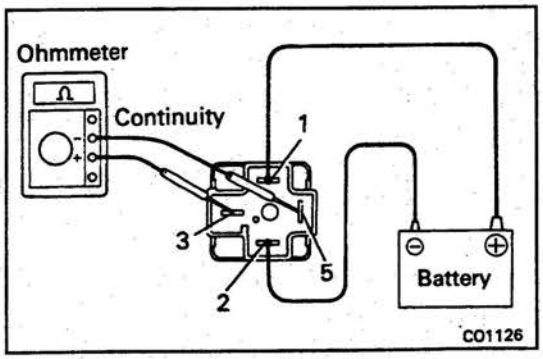
2. **INSPECT EFI MAIN RELAY**

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 the 3 and 5.

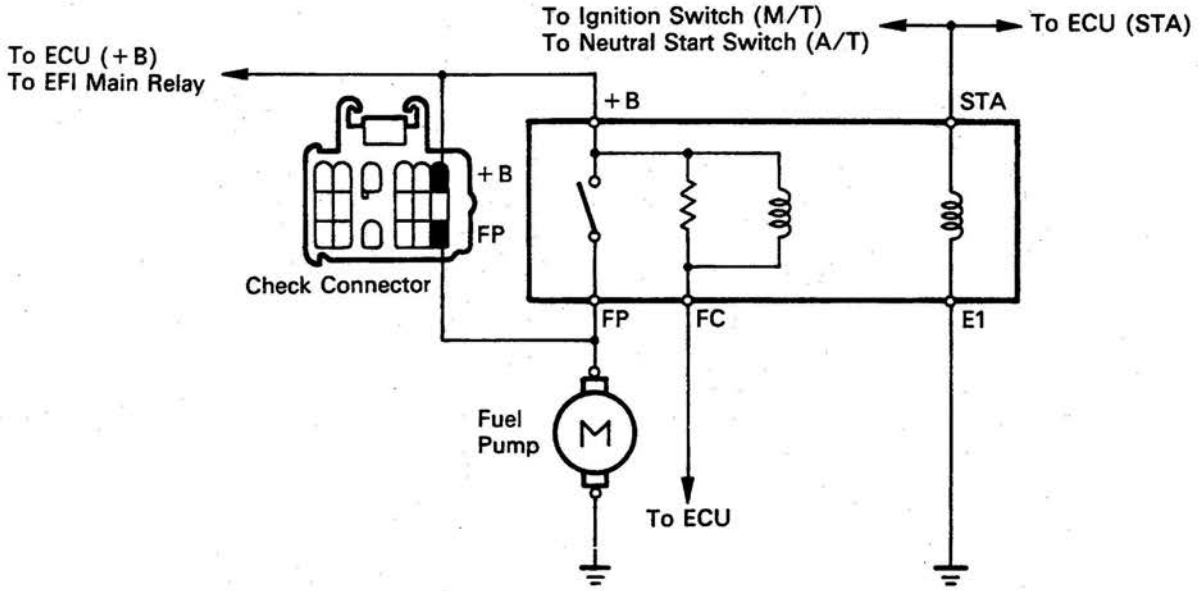
If operation is not as specified, replace the relay.

3. **REINSTALL EFI MAIN RELAY**

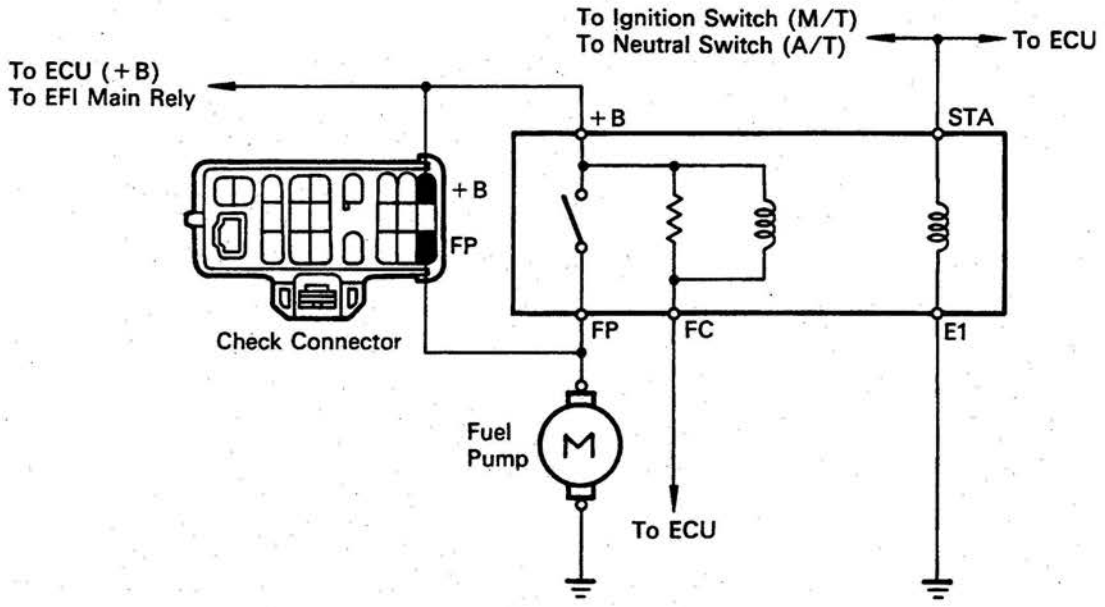
CIRCUIT OPENING RELAY

EG00T-0A

AE93



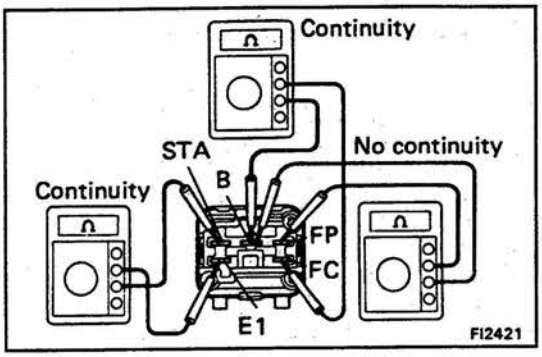
AE102



P10164
P07157

Z05780

CIRCUIT OPENING RELAY INSPECTION 903A0-01



1. **REMOVE CIRCUIT OPENING RELAY**
2. **INSPECT RELAY CONTINUITY**

(a) Using an ohmmeter, check that there is continuity between terminals STA and E1.

(b) Check that there is continuity between terminals B and FC.

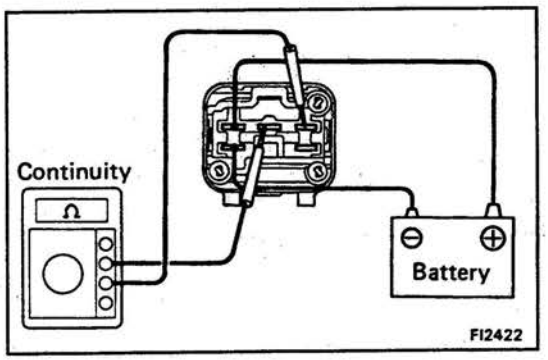
(c) Check that there is no continuity between terminals B and FP.

If continuity is not specified, replace the relay.

3. **INSPECT RELAY OPERATION**

(a) Apply battery voltage across terminals STA and E1.

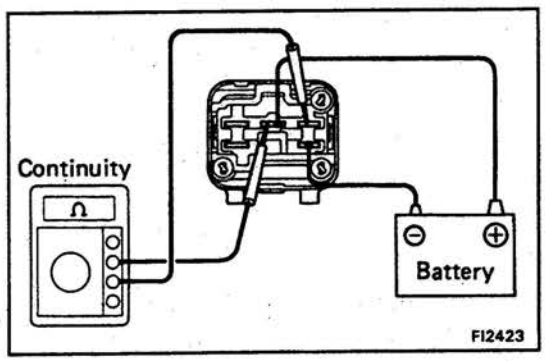
(b) Using an ohmmeter, check that there is continuity between terminals B and FP.



(c) Apply battery voltage across terminals B and FC.

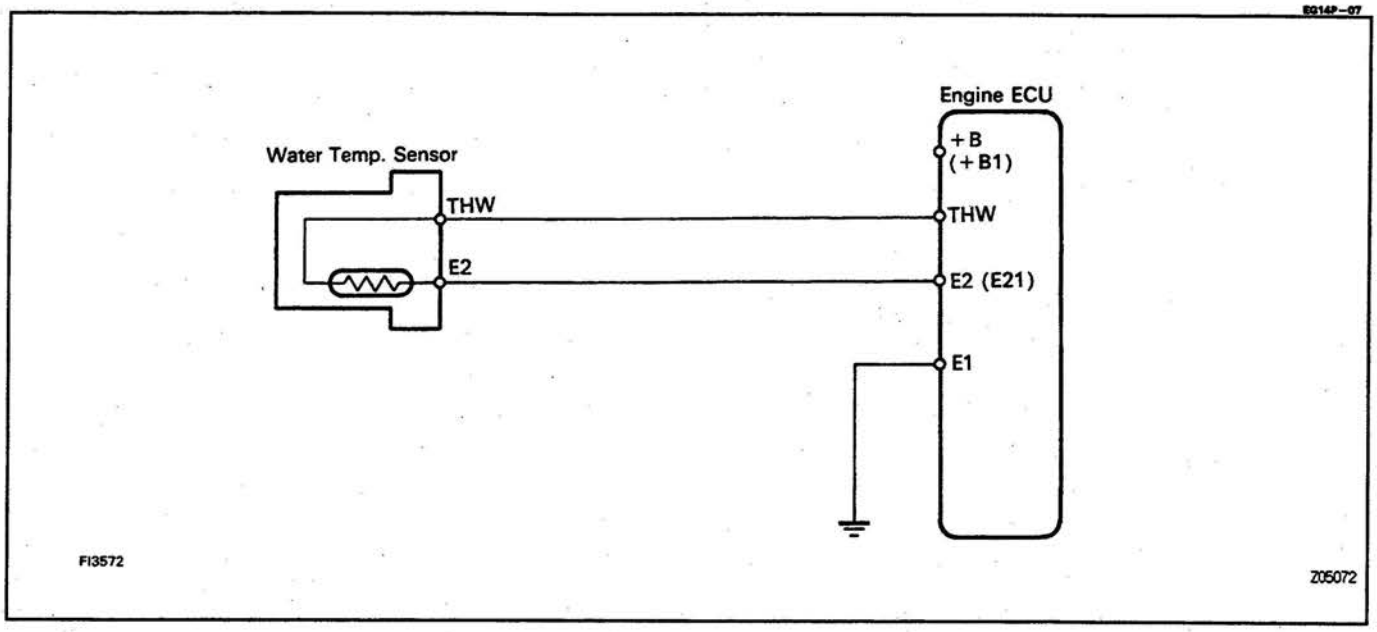
(d) Check that there is continuity between terminals B and FP.

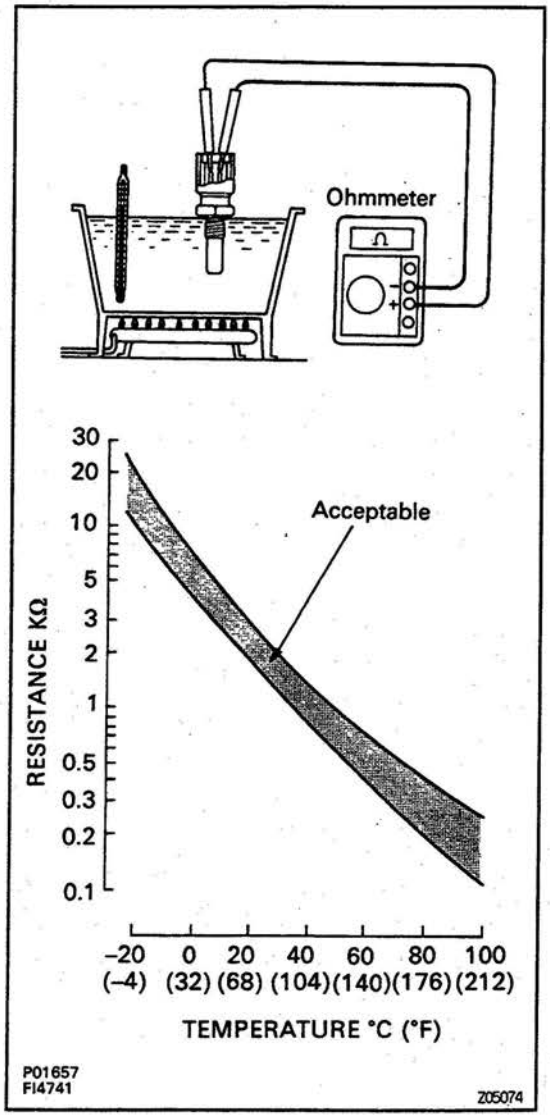
If operation is not as specified, replace the relay.



4. **REINSTALL CIRCUIT OPENING RELAY**

WATER TEMPERATURE SENSOR



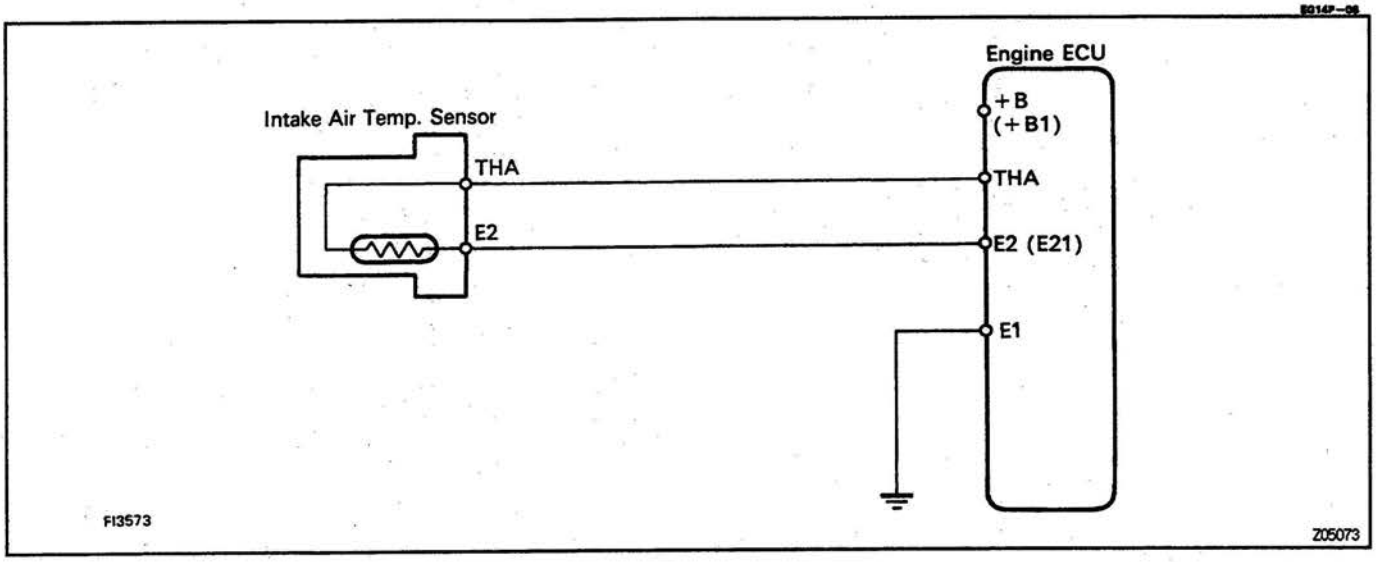


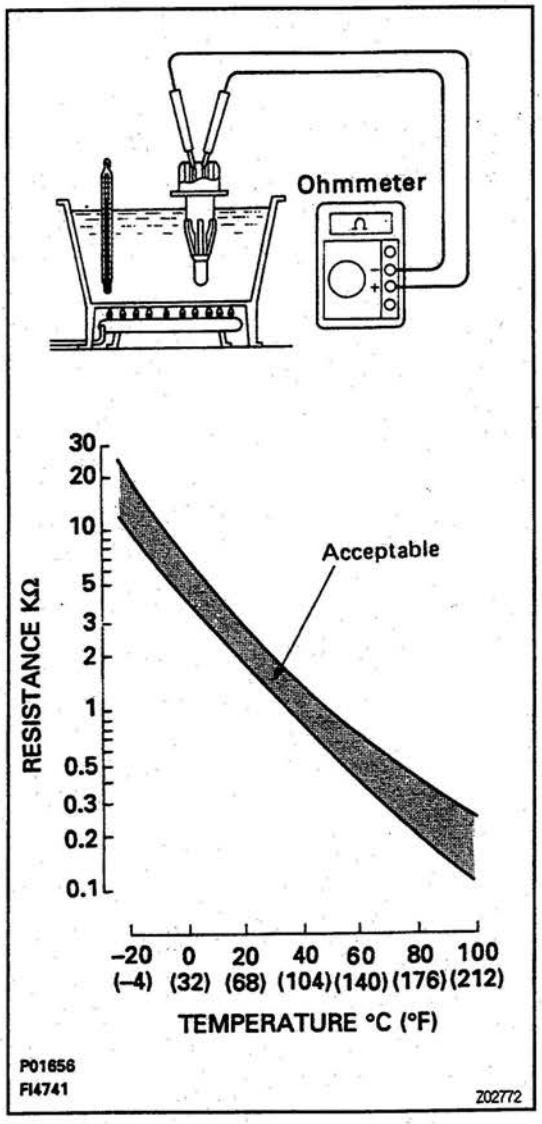
WATER TEMPERATURE SENSOR INSPECTION

1. **REMOVE WATER TEMPERATURE SENSOR**
2. **INSPECT WATER TEMPERATURE SENSOR**
   Using an ohmmeter, measure the resistance between the terminals.
   Resistance:
   Refer to the chart graph
   If the resistance is not as specified, replace the water temperature sensor.
3. **REINSTALL WATER TEMPERATURE SENSOR**

INTAKE AIR TEMPERATURE SENSOR (IATS)

EG



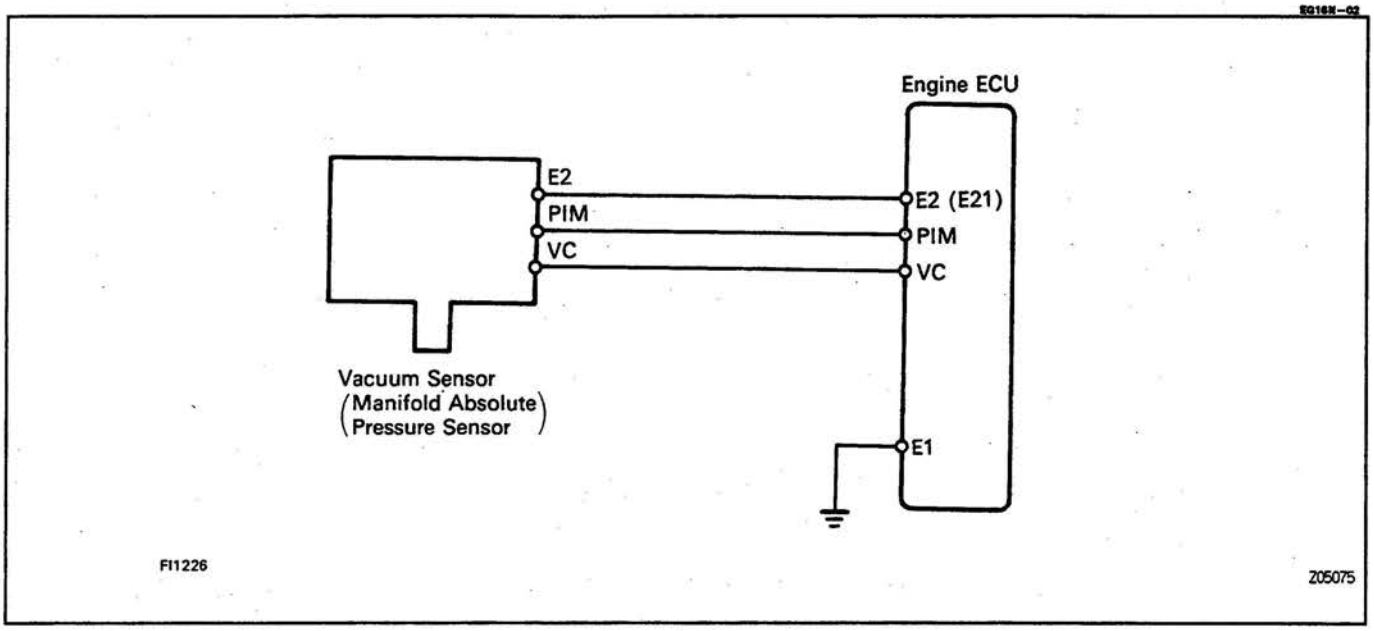


IATS INSPECTION

1. **REMOVE IATS**
2. **INSPECT IATS**
   Using an ohmmeter, measure the resistance between the terminals.
   Resistance:
   Refer to the chart graph
   If the resistance is not as specified, replace the IATS.
3. **REINSTALL IATS**

VACUUM SENSOR

EG16N–02

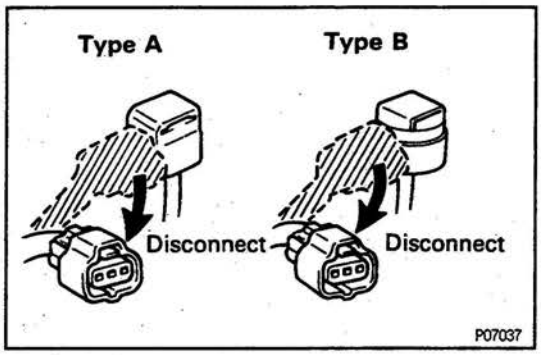


EG16P–02

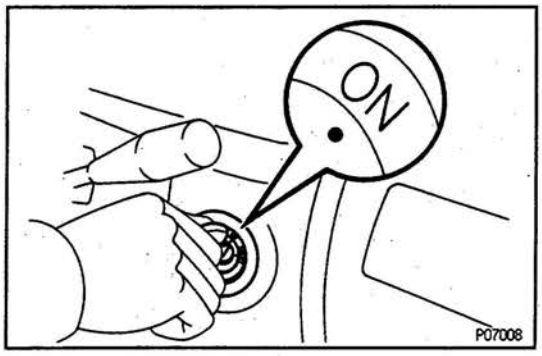
VACUUM SENSOR INSPECTION

1. INSPECT POWER SOURCE VOLTAGE OF VACUUM SENSOR

(a) Disconnect the vacuum sensor connector.



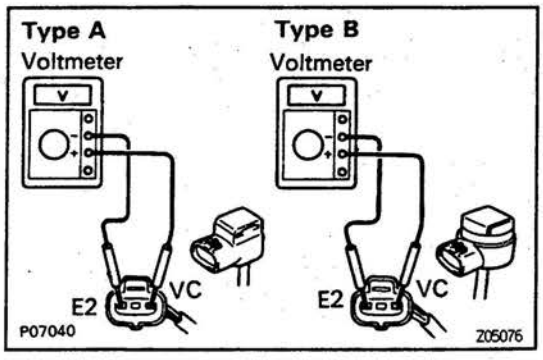
(b) Turn the ignition switch ON.

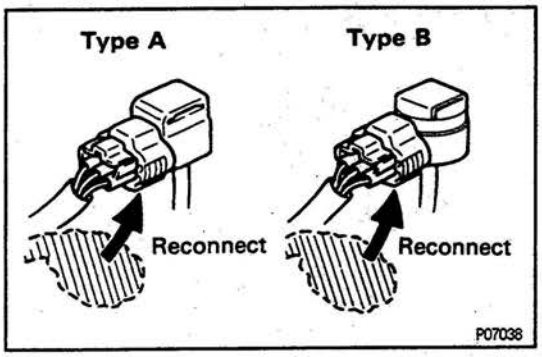


(c) Using a voltmeter, measure the voltage between connector terminals VCC and E2 of the wiring harness side.

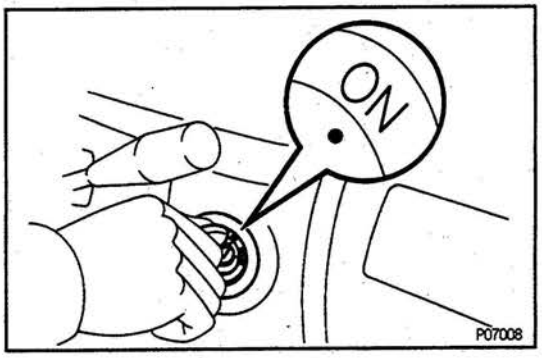
Voltage:

4.5 – 5.5 V



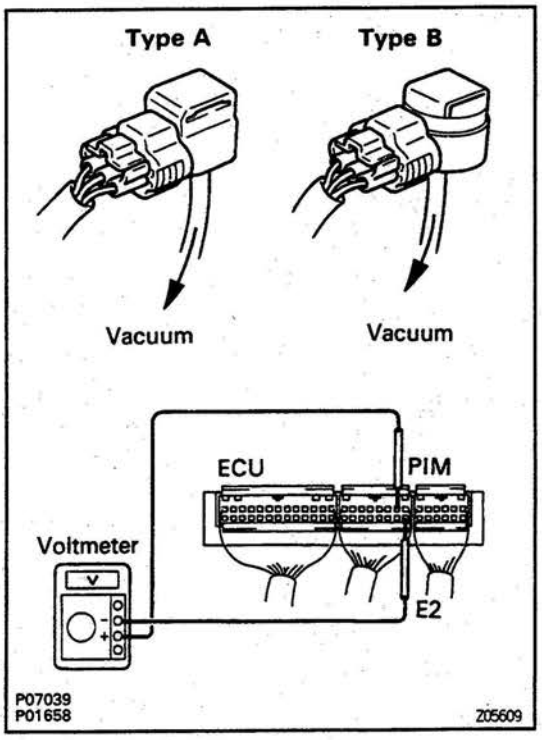


(d) Turn the ignition switch OFF.
(e) Reconnect the vacuum sensor connector.



2. INSPECT POWER OUTPUT OF VACUUM SENSOR

(a) Turn the ignition switch ON.



(b) Disconnect the vacuum hose on the air intake manifold side.
(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.

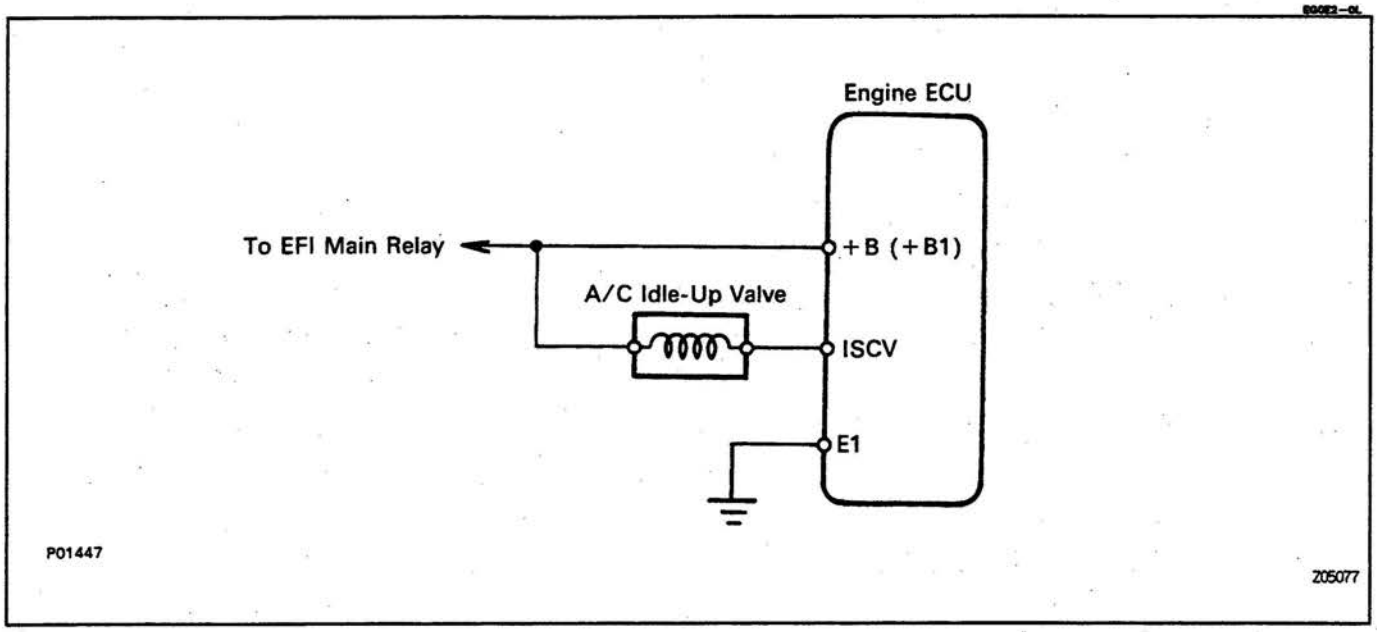
Voltage drop:

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

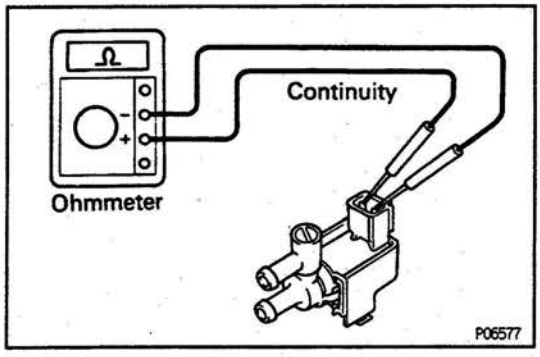
(f) Reconnect the vacuum hose to the intake manifold.

A/C IDLE–UP VALVE



A/C IDLE–UP VALVE INSPECTION

1. REMOVE IDLE–UP VALVE



2. INSPECT IDLE–UP VALVE

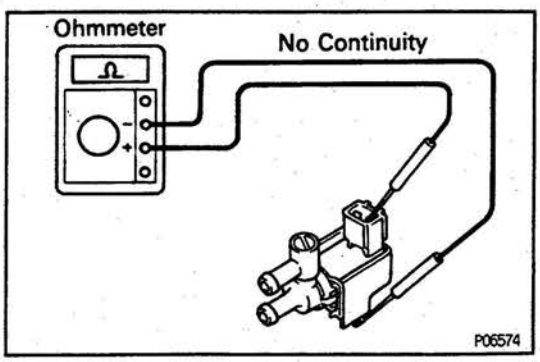
A. Inspect idle–up valve for open circuit

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

Resistance (Cold):

30 – 34 Ω

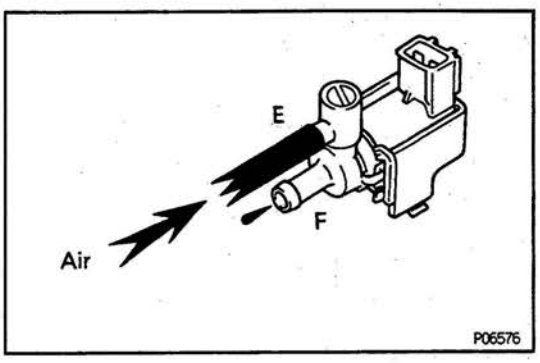
If there is no continuity, replace the idle–up valve.



B. Inspect idle–up valve for ground

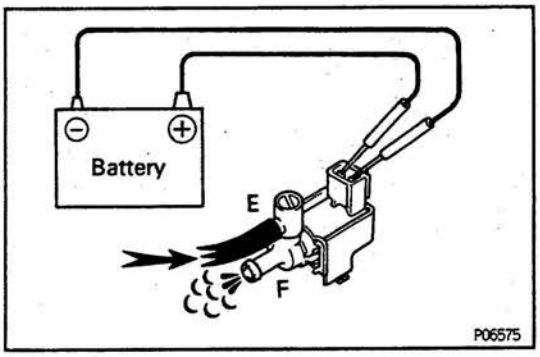
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the idle–up valve.



C. Inspect idle–up valve operation

(a) Check that the air does not flow from port E to port F.



(b) Apply battery voltage across the terminals.

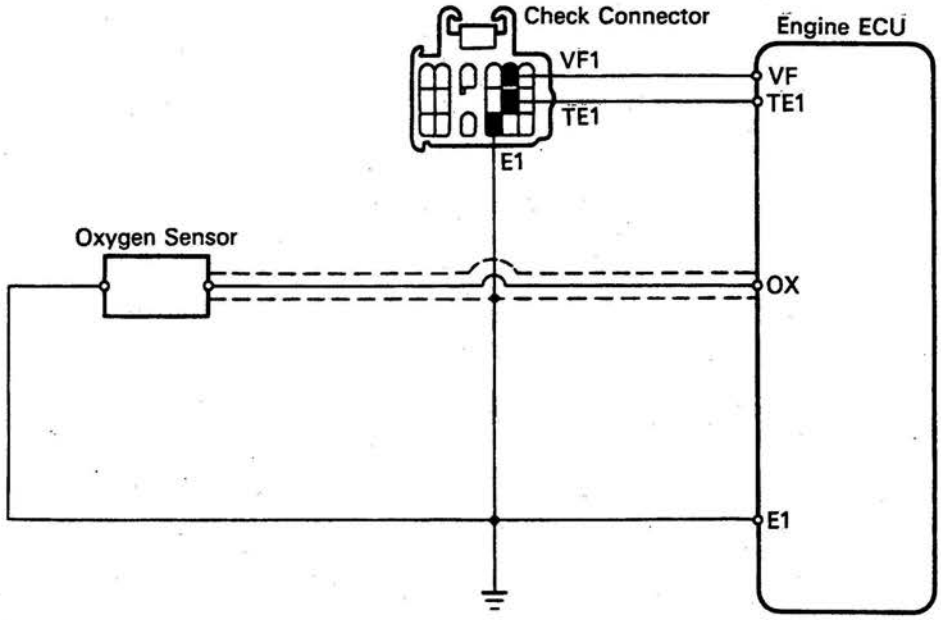
(c) Check that the air flows from port E to port F.

If operation is not as specified, replace the idle–up valve.

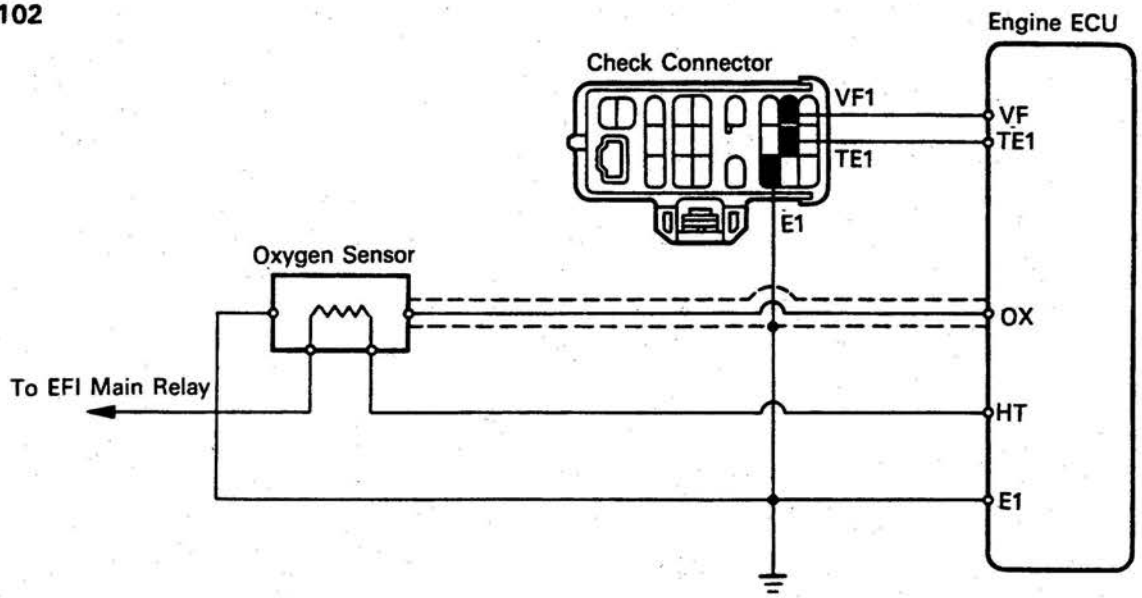
3. REINSTALL IDLE–UP VALVE

OXYGEN SENSOR

AE93

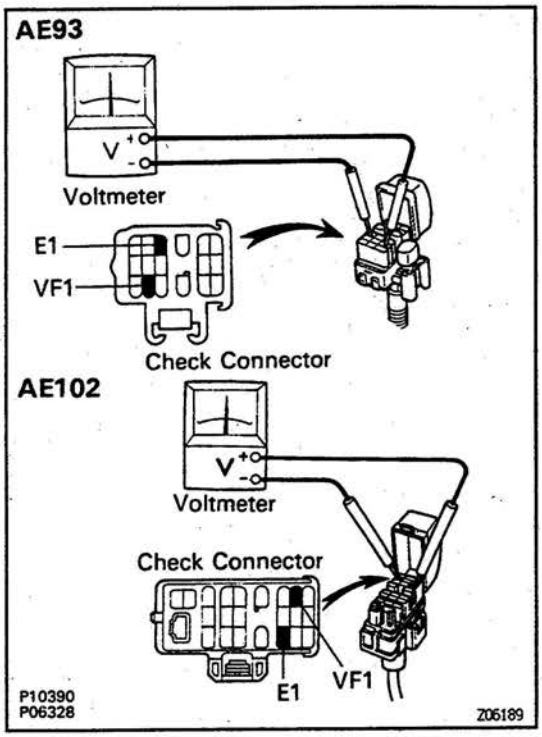


AE102



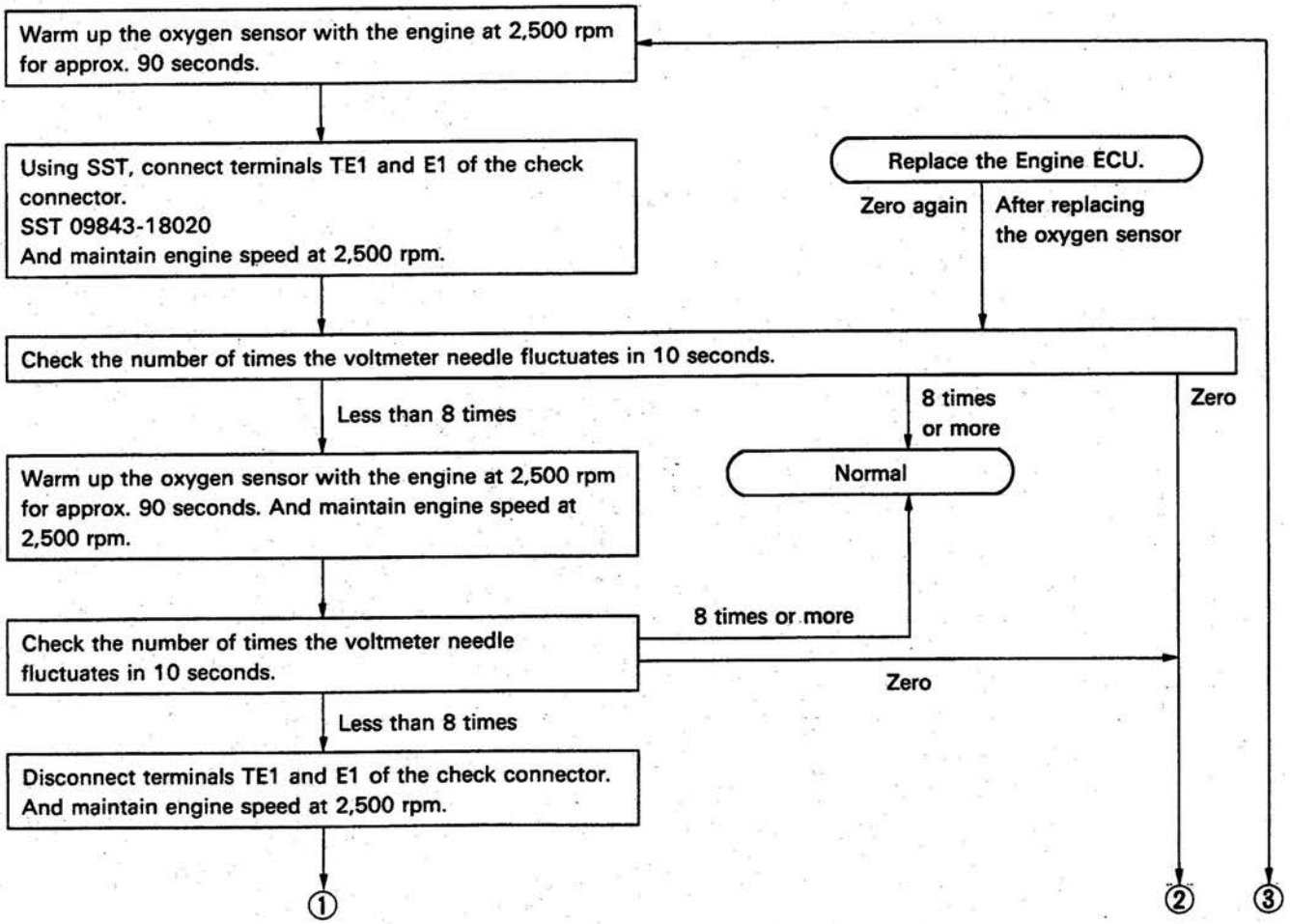
P10169
P10168

Z05979



OXYGEN SENSOR INSPECTION

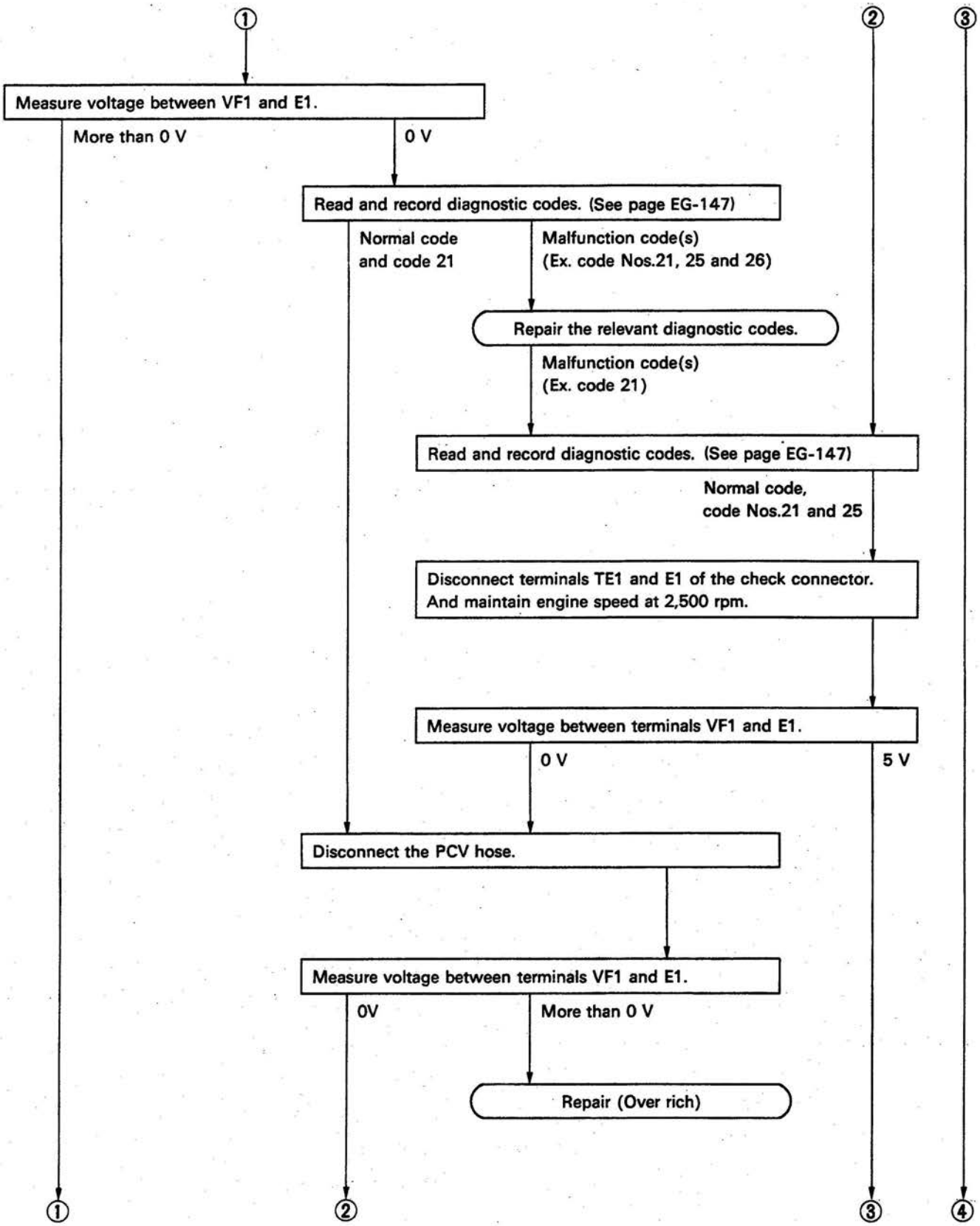
1. **WARM UP ENGINE**
   Allow the engine to warm up to normal operating temperature.
2. **INSPECT FEEDBACK VOLTAGE**
   Connect the positive (+) probe of a voltmeter to terminal VF1 of the check connector, and negative (−) probe to terminal E1. Perform the test as follows:



CONTINUED ON PAGE EG-233

V02508

CONTINUED FROM PAGE EG-232

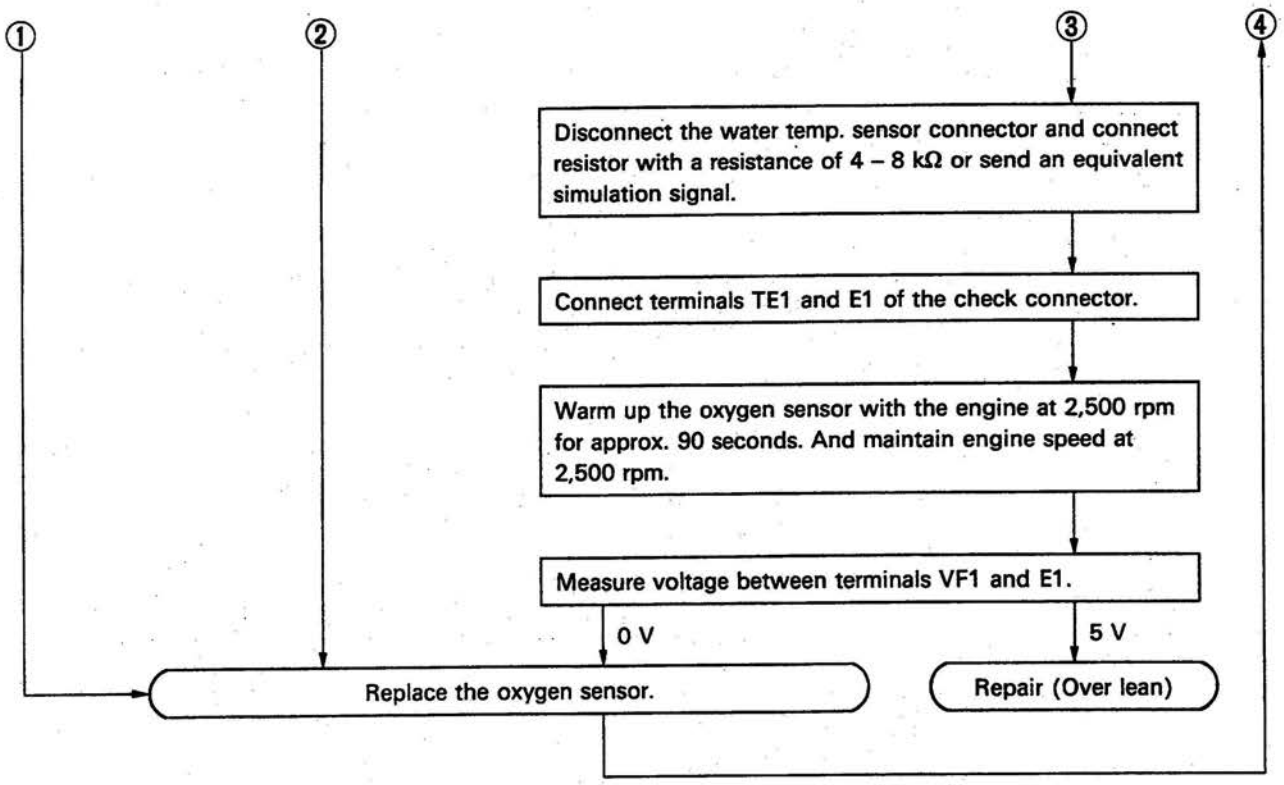


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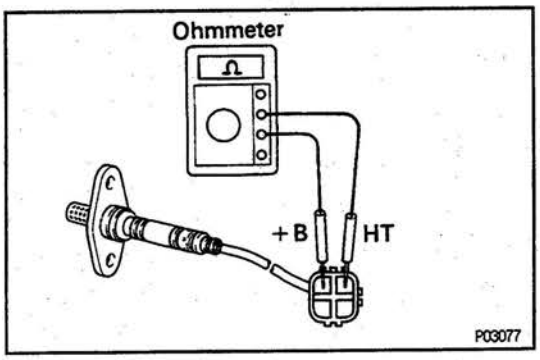
V02509

CONTINUED FROM PAGE EG-233

EG



V02510



3. (AE102)

INSPECT HEATER RESISTANCE OF OXYGEN SENSOR

Using an ohmmeter, measure the resistance between terminals +B and HT.

Resistance:

5.1 – 6.3 kΩ at 20°C (68°F)

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

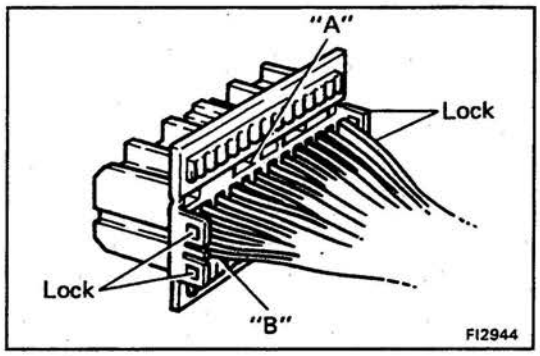
ENGINE ECU

ENGINE ECU INSPECTION

E015H–03

HINT: The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the ECU.

EG



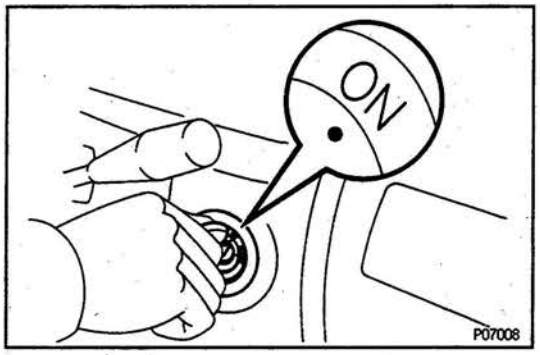
1. PREPARATION

(a) Disconnect the three connectors from the ECU.

(b) Remove the locks as shown in the illustration so that the tester probe(s) can easily come in.

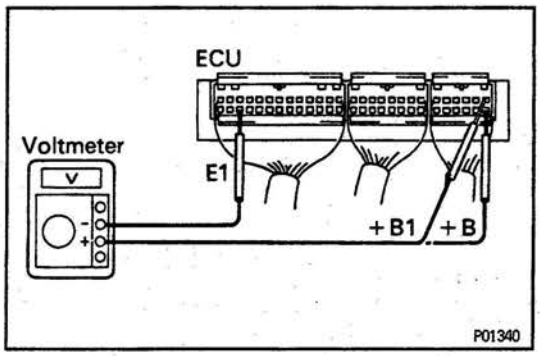
NOTICE: Pay attention to sections A and B in the illustration which can easily broken.

(c) Reconnect the three 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:

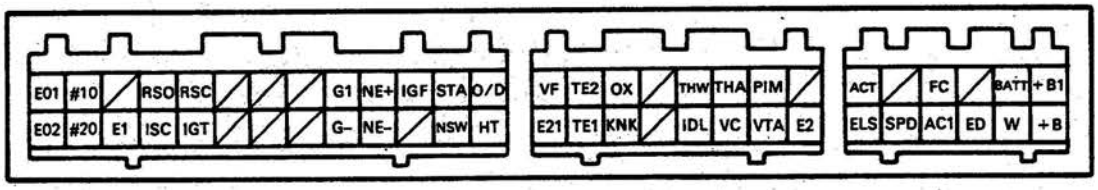
- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11 V or more when the ignition switch is ON.

EG

Engine ECU Wirning Connectors Voltage

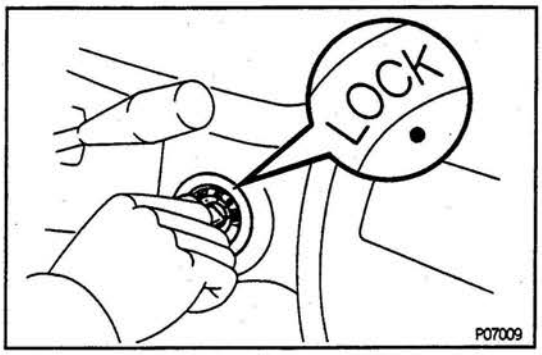
Terminals	Condition		STD voltage (V)
+B, +B1 – E1	IG SW ON		9 – 14
BATT – E1	–		9 – 14
IDL – E2	IG SW ON	Throttle valve open	9 – 14
VTA – E2		Throttle valve fully closed	0.3 – 0.8
		Throttle valve fully open	3.2 – 4.9
PIM – E2	IG SW ON		3.3 – 3.9
VC – E2			4.5 – 5.5
#10 – E01, #20 – E02			9 – 14
THA – 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		Palse generation
RSO, RSC – E1	IG SW ON		9 – 14
W – E1	No trouble (check engine warning light off) and engine running		9 – 14
AC1 – E1	IG SW ON	Air conditioning ON	1.5 or less
ACT – E1		Air conditioning ON	4.5 – 5.5
TE1 – E1, TE2		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
		Ex. Neutral start switch P or N position	9 – 14

Engine ECU Terminals



P01821

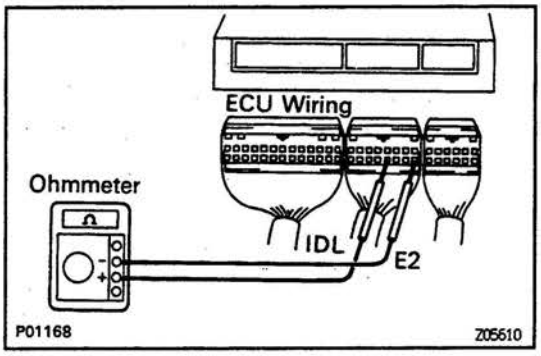
V02515



3. INSPECT RESISTANCE OF ECU

(a) Turn the ignition switch OFF.

(b) Disconnect the three connectors from the ECU.



(c) Measure the resistance between each terminal of the wiring connectors.

NOTICE:

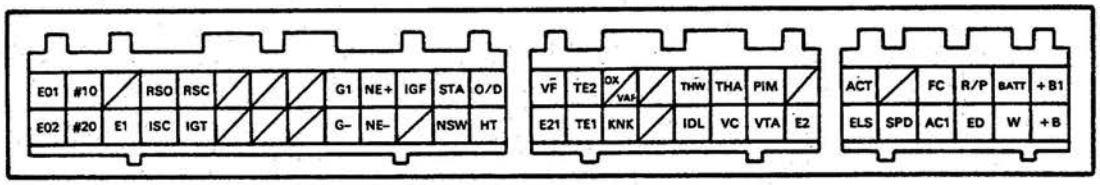
- **Do not touch the ECU terminals.**
- **The tester probe should be inserted in the wiring connector from the wiring side.**

Engine ECU Wiring Connectors Resistance

EG

Terminals	Condition	STD resistance (Ω)
IDL – E2	Throttle valve open	Infinity
	Throttle valve fully closed	2,300 or less
VTA – E2	Throttle valve fully open	3,300 – 10,000
	Throttle valve fully closed	200 – 6,000
VC – E2	–	4,000 – 8,500
THA – E2	Intake air temp. 20°C (68°F)	2,000 – 3,000
THW – E2	Coolant temp. 80°C (176°F)	200 – 400
G1 – G–	Cold (–10°C (14°F) to 50°C (104°F))	185 – 275
	Hot (50°C (104°F) to 100°C (212°F))	240 – 325
NE+ – NE–	Cold (–10°C (14°F) to 50°C (104°F))	370 – 550
	Hot (50°C (104°F) to 100°C (212°F))	475 – 650
G1, G2 – G–	Cold (–10°C (14°F) to 50°C (104°F))	125 – 200
	Hot (50°C (104°F) to 100°C (212°F))	160 – 235
NE – G–	Cold (–10°C (14°F) to 50°C (104°F))	155 – 250
	Hot (50°C (104°F) to 100°C (212°F))	190 – 290
RSC, RSO – +B, +B1	–	19.3 – 22.3

Engine ECU Terminals



P01821

V02473

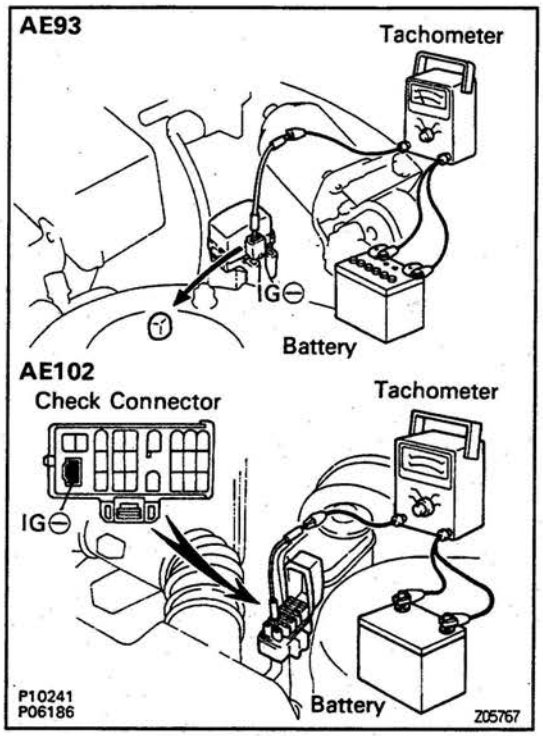
FUEL CUT RPM

FUEL CUT PRM INSPECTION

EG2A2–01

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

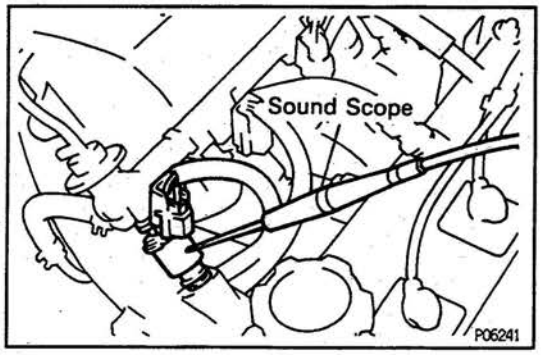


2. CONNECT TACHOMETER TO ENGINE

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:

1,400 rpm

4. DISCONNECT TACHOMETER

SERVICE SPECIFICATIONS

SERVICE DATA

EG0153-06

Fuel pressure regulator	Fuel pressure	at no vacuum	265 — 304 kPa (2.7 — 3.1 kgf/cm², 38 — 44 psi)
Fuel pump	Resistance		0.2 — 3.0 Ω
Injector	Resistance		Approx. 13.8 Ω
	Injection volume		40 — 50 cm³ (2.4 — 3.1 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°
Throttole position sensor	Resistance		
	Clearance between stop screw and lever		
	0 mm (0 in.)	VTA — E2	0.2 — 6.0 kΩ
	0.40 mm (0.016 in.)	IDL — E2	2.3 kΩ or less
	0.90 mm (0.035 in.)	IDL — E2	Infinity
	Throttle valve fully open	VTA — E2	3.3 — 10.0 kΩ
	—	VC — E2	4.0 — 8.5 kΩ
ISC valve	Resistance	+B — RSC or RSO	19.3 — 22.3 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
IATS	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
Vacuum sensor	Power source voltage		4.5 — 5.5 V
A/C idle—up valve	Resistance	at cold	30 — 34 Ω
Oxygen sensor	Heater coil resistance	5.1 — 6.3 Ω	5.1 — 6.3 Ω

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. 20°C (68°F))	0.2 — 1.0 V
	STA — E1	Cranking	6 V or more
	IGT — E1	Idling	Pulse generation
	RSC — E1	IG SW ON	9 — 14 V
	RSO — E1	IG SW ON	9 — 14 V
	W — E1	No trouble (check engine warning light off) and engine running	9 — 14 V
	AC1 — E2	IG SW ON (Air conditioning ON)	0 — 3 V
	ACT — E2	IG SW ON (Air conditioning ON)	4.5 — 5.5 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)	3 V or less
	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	3,300 — 10,000 Ω
		at throttle valve fully closed	200 — 6,000 Ω
	VC — E2		4,000 — 8,500 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
	G1 — 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 — RSC or RSO		19.3 — 22.3 Ω
Fuel cut rpm	Fuel return rpm		1,400 rpm

EG

E0065E–0A

TORQUE SPECIFICATIONS

Part tightened		N·m	kgf·cm	ft·lbf
Fuel line	for union bolt	29	300	22
	for nut (w/ SST)	30	310	22
	(w/o SST)	35	350	25
Fuel pump x Fuel tank	AE93	3.4	35	30 in.·lbf
	AE102	3.9	40	35 in.·lbf
Fuel pressure regulator x Delivery pipe		9.3	95	82 in.·lbf
Delivery pipe x Cylinder head		15	150	11
Fuel inlet hose x Delivery pipe		29	300	22
Air intake chamber cover x Intake manifold		19	195	14
Air intake chamber stay x Cylinder head		28	290	21
Engine hanger x Cylinder head		28	290	21
Throttle body x Intake manifold		22	220	16

COOLING SYSTEM

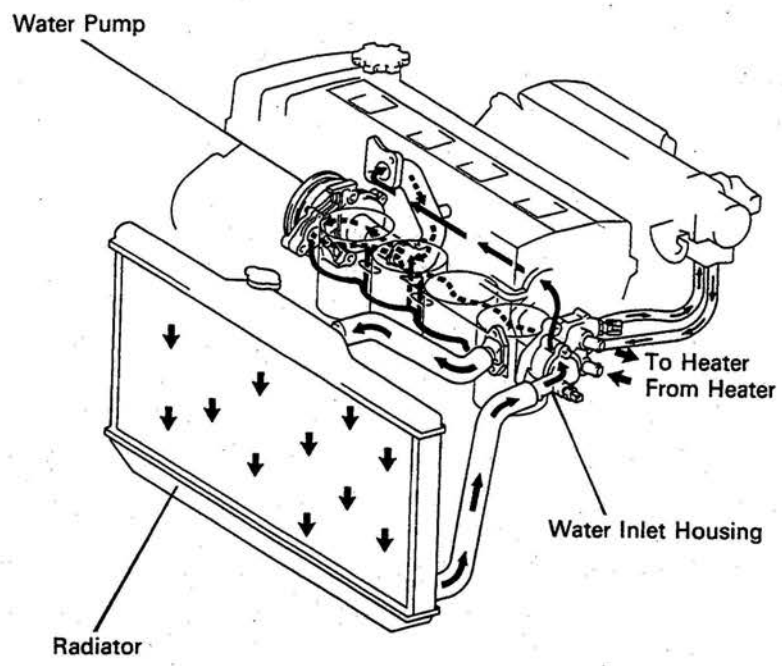
DESCRIPTION

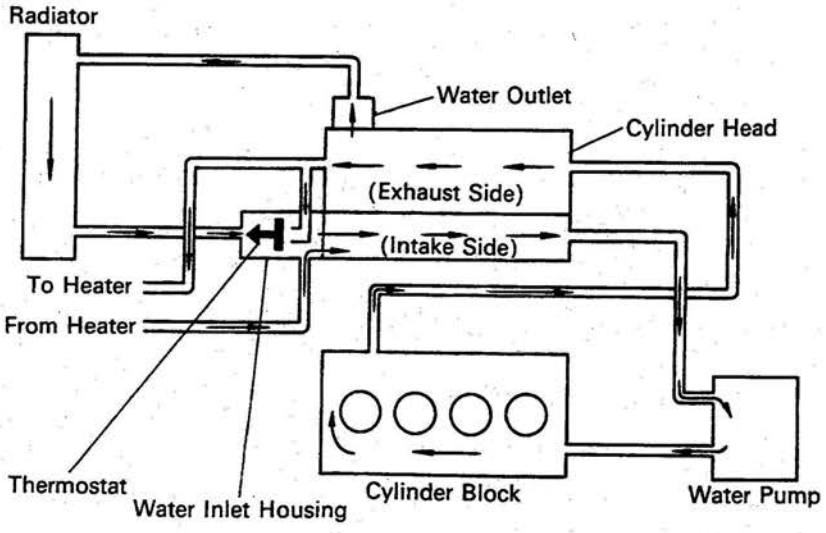
EG12N–02

This engine utilizes a pressurized forced circulation cooling system which includes a thermostat equipped with a by–pass valve mounted on the inlet side.

OPERATION

EG12P–04





P06421
P06173

Z03167

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 and electric fan blows air to cool the coolant as it passes through. Coolant which has been cooled is then sent back to the engine by the water pump, where it cools the engine.
The water jacket is a network of channels in the shell of the cylinder block and cylinder head through which coolant passes. It is designed to provide adequate cooling of the cylinders and combustion chambers which become heated during engine operation.

RADIATOR

The radiator cools 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 to cooling fins which radiate heat away from the coolant in the tubes. The air sucked through the radiator by the electric fan, as well as the wind generated by the vehicle's travel, passes through the radiator, cooling the coolant. Models with automatic transmission include an automatic transmission fluid cooler built into the lower tank of the radiator. A fan with an electric motor is mounted behind the radiator to assist the flow of air through the radiator. The fan operates when the coolant temperature becomes high in order to prevent it from becoming too high.

RADIATOR CAP

The radiator cap is a pressure type cap which seals the radiator, resulting in pressurization of the radiator as the coolant expands. The pressurization prevents the coolant from boiling even when the coolant temperature exceeds 100°C (212°F). A relief valve (pressurization valve) and a vacuum valve (negative pressure valve) are built into the radiator cap. The relief valve opens and lets steam escape through the overflow pipe when the pressure generated inside the cooling system exceeds the limit (coolant temperature: 110 – 120°C (230 – 248°F), pressure; 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.

RESERVOIR TANK

The reservoir tank is used to catch coolant which overflows the cooling system as a result of volumetric expansion when the coolant is heated. The coolant in the reservoir tank returns to the radiator when the coolant temperature drops, thus keeping the radiator full at all times and avoiding needless coolant loss.
Check the reservoir tank level to learn if the coolant needs to be replenished.

WATER PUMP

The water pump is used for forced circulation of coolant through the cooling system. It is mounted on the front of the cylinder block and driven by a alternator drive belt.

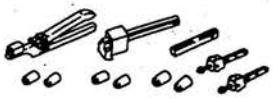
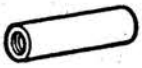
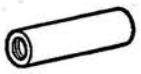
THERMOSTAT

The thermostat has a wax type by–pass valve and is mounted in the water inlet housing. The thermostat includes a type of automatic valve operated by fluctuations in the coolant temperature. This valve closes when the coolant temperature drops, preventing the circulation of coolant through the engine and thus permitting the engine to warm up rapidly. The valve opens when the coolant temperature has risen, allowing the circulation of coolant. Wax inside the thermostat expands when heated and contracts when cooled. Heating the wax thus generates pressure which overpowers the force of the spring which keeps the valve closed, thus opening the valve. When the wax cools, its contraction causes the force of the spring to take effect once more, closing the valve. The thermostat in this engine operates at a temperature of 82°C (180°F).

PREPARATION

SST (SPECIAL SERVICE TOOLS)

EG122–02

	09216–00020 Belt Tension Gauge	
	09216–00030 Belt Tension Gauge Cable	
	09230–01010 Radiator Service Tool Set	
	09236–00101 Water Pump Overhaul Tool Set	
	(09236–15010) Bearing Stay	
	(09237–00010) Water Pump Bearing Remover & Replacer	
	(09237–00020) Bearing Stay	
	(09237–00050) Shaft "B"	

RECOMMENDED TOOLS

EG12V–02

	09082–00015 TOYOTA Electrical Tester	

EG12W-02

EQUIPMENT

Heater	
Radiator cap tester	
Thermometer	
Torque wrench	

EG

EG12X-04

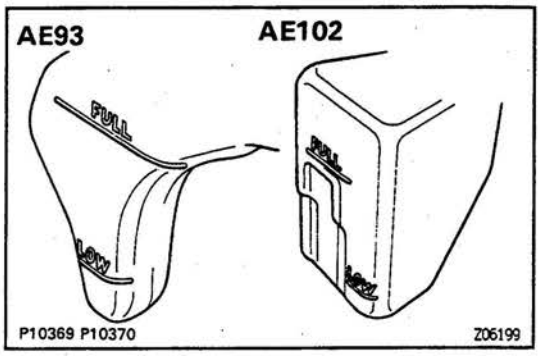
COOLANT

Item	Capacity	Classification
Engine coolant (w/ Heater)		Ethylene—glycol base
AE93 series		
M/T	6.0 liters (6.3 US qts, 5.3 Imp. qts)	
A/T	6.2 liters (6.6 US qts, 5.5 Imp. qts)	
AE102 series		
Radiator size 526 x 350 x 16	5.2 liters (5.5 US qts, 4.6 Imp. qts)	
Radiator size 642 x 350 x 16	5.5 liters (5.8 US qts, 4.8 Imp. qts)	

EG16X-01

SSM (SPECIAL SERVICE MATERIALS)

08826—00100	Seal Packing 1282B, Three Bond 1282B or equivalent	Water pump seal
08833—00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Engine drain plug



COOLANT CHECK AND REPLACEMENT

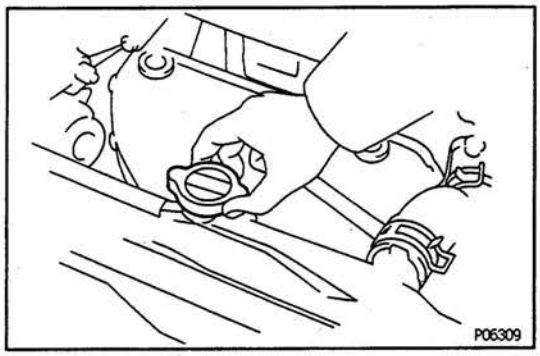
1. CHECK ENGINE COOLANT LEVEL AT RESERVOIR TANK

EG16Y-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.

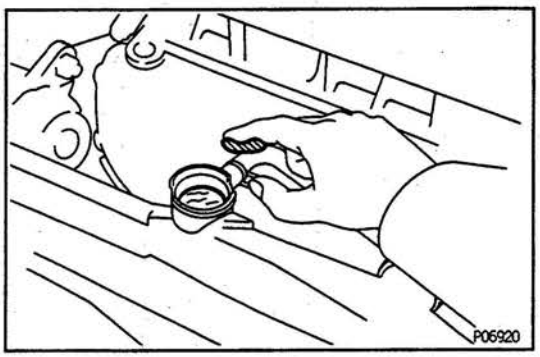
EG



2. CHECK ENGINE COOLANT QUALITY

(a) Remove the radiator cap.

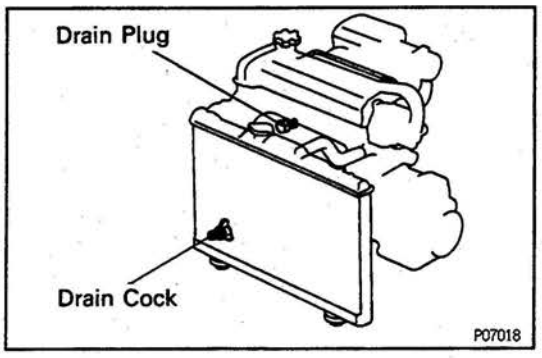
CAUTION: To avoid the danger of being burned, do not remove it while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.



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

If excessively dirty, replace the coolant.

(c) Reinstall the radiator cap.

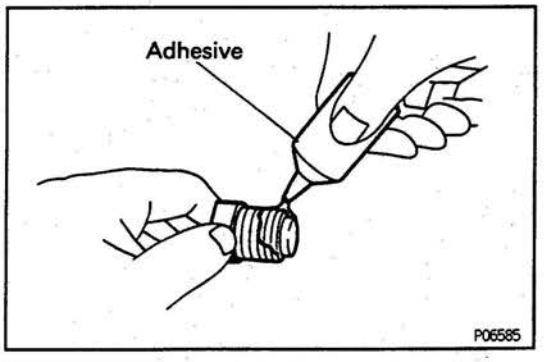


3. REPLACE ENGINE COOLANT

(a) Remove the radiator cap.

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

(b) Drain the coolant from the radiator drain cock and engine drain plug. (The engine drain plug is the front right of engine block.)



(c) Apply adhesive to two or three threads of the engine drain plug

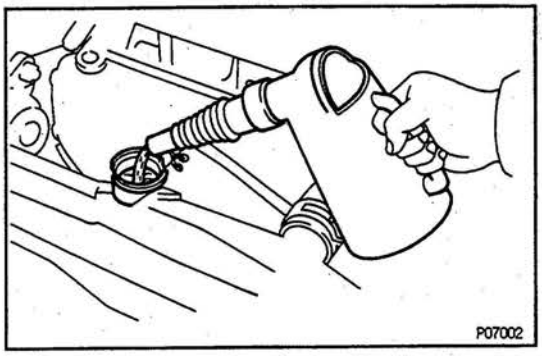
Adhesive:

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

(d) Close the drain cock and plug.

Torque (Engine drain plug):

29 N·m (300 kgf·cm, 22 ft·lbf)



(e) 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 a alcohol type coolant.**
- **The coolant should be mixed with demineralized water or distilled water.**

Capacity (w/ Heater):

AE93 series

M/T

6.0 liters (6.3 US qts, 5.3 Imp. qts)

A/T

6.2 liters (6.6 US qts, 5.5 Imp. qts)

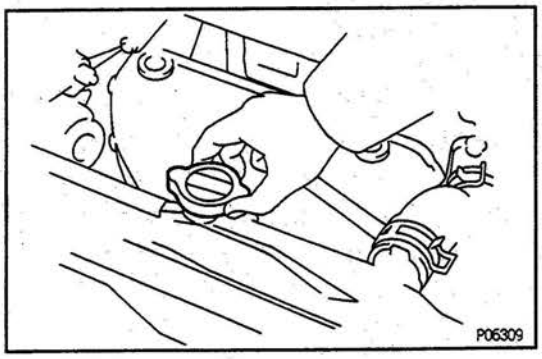
AE102 series

Radiator size 526 x 350 x 16

5.2 liters (5.5 US qts, 4.6 Imp. qts)

Radiator size 642 x 350 x 16

5.5 liters (5.8 US qts, 4.8 Imp. qts)



(f) Reinstall the radiator cap.

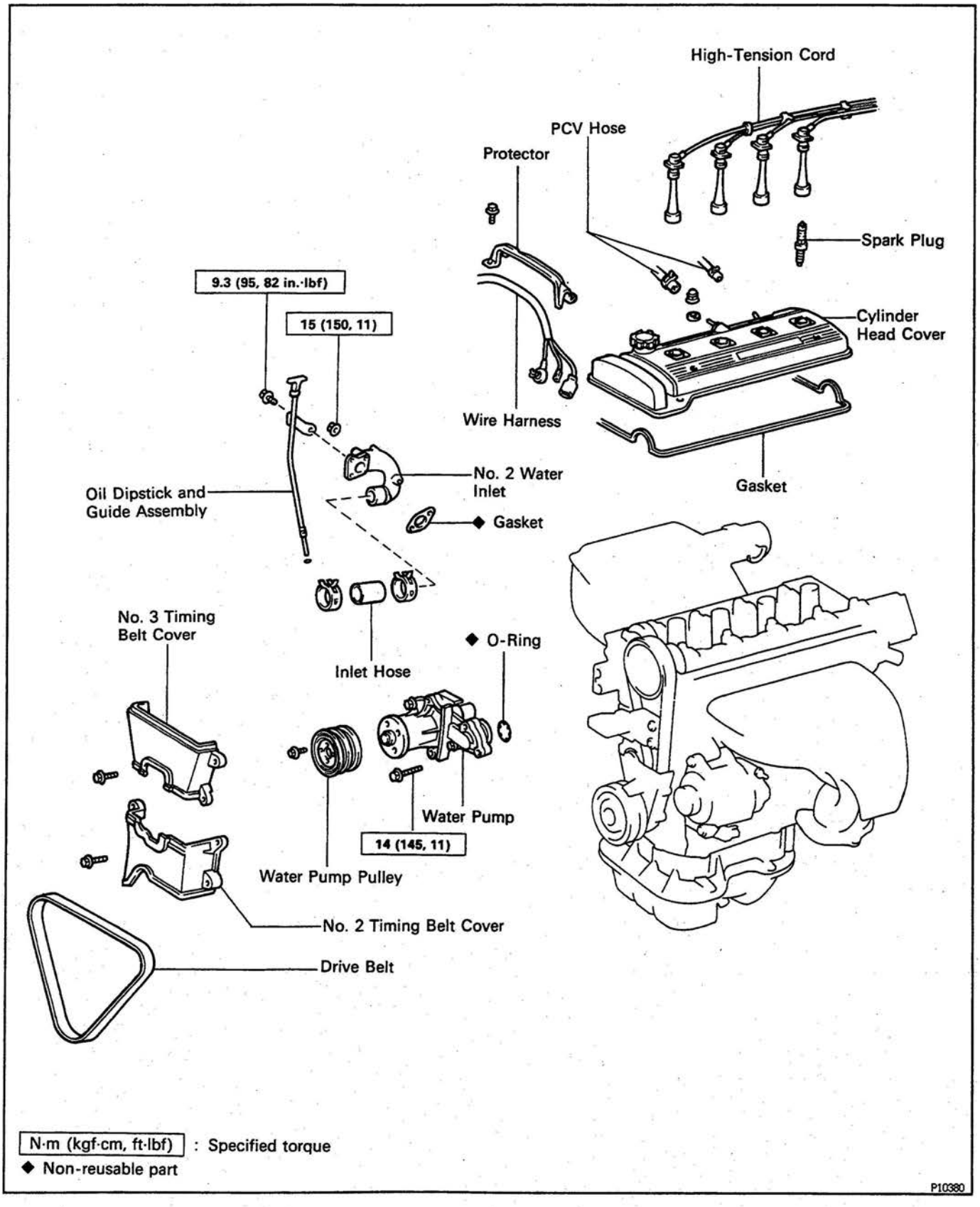
(g) Warm up the engine and check for leaks.

(h) Recheck the coolant level and refill as necessary.

WATER PUMP

COMPONENTS FOR REMOVAL AND INSTALLATION

EG16Z–02



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

◆ Non-reusable part

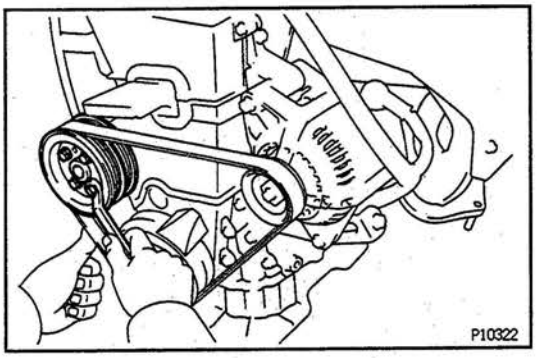
P10380

S0170-02

WATER PUMP REMOVAL

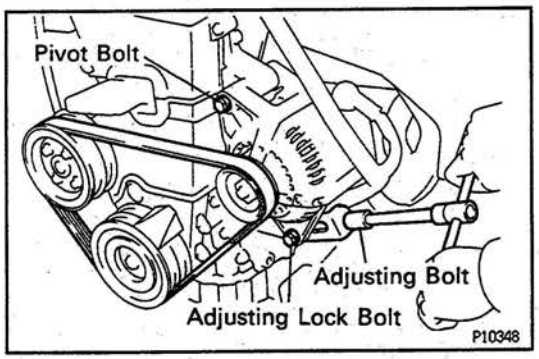
1. DRAIN ENGINE COOLANT

EG

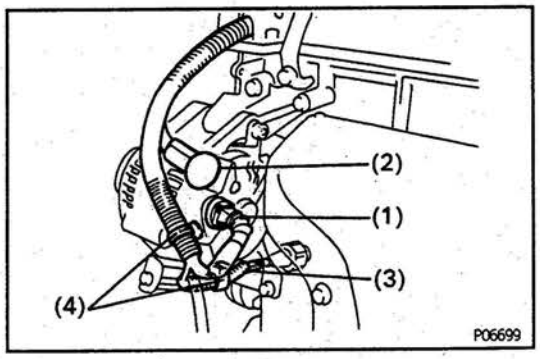


2. REMOVE ALTERNATOR DRIVE BELT AND WATER PUMP PULLEY

(a) Loosen the four water pump pulley bolts.

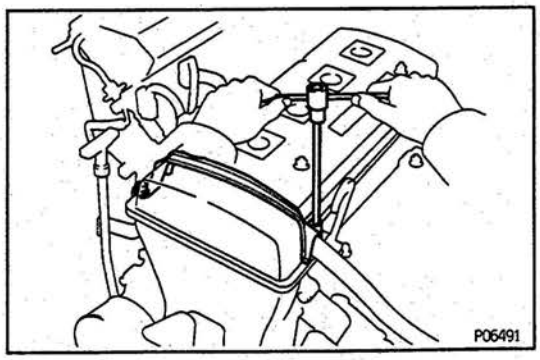


(b) Loosen the pivot bolt and adjusting lock bolt.
(c) Loosen the adjusting bolt, and remove the drive belt.

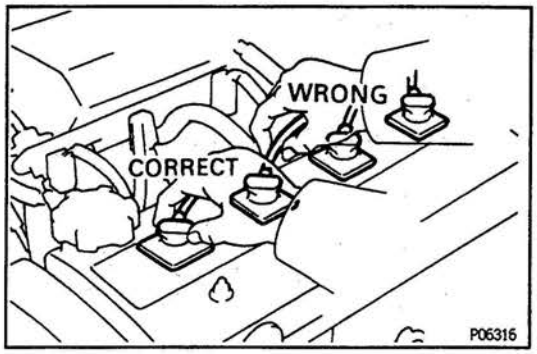


3. REMOVE CYLINDER HEAD COVER

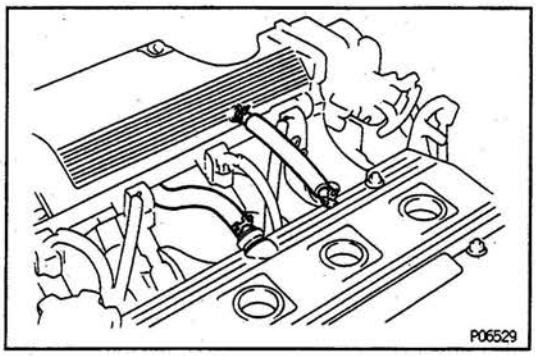
(a) Disconnect the following wires and clamps:
  (1) Alternator connector
  (2) Alternator wire
  (3) Oil pressure switch connector
  (4) Two wire clamps



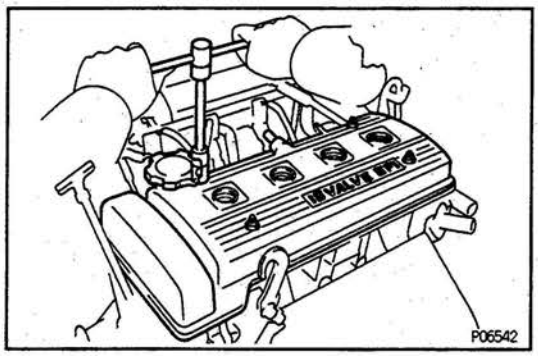
(b) Remove the two bolts and wire harness protector.
(c) Disconnect the engine wire harness from the cylinder head cover.



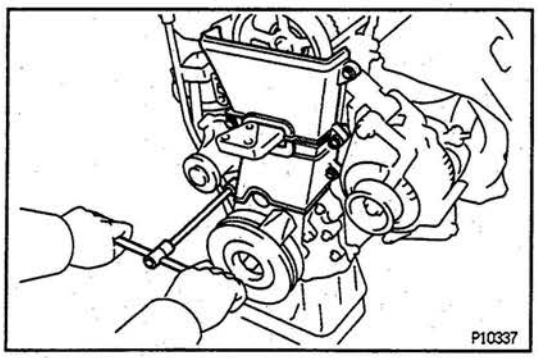
(d) Disconnect the high — tension cords at the rubber boot. Do not pull on the high—tension cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.



(e) Disconnect the PCV hoses from the cylinder head cover.

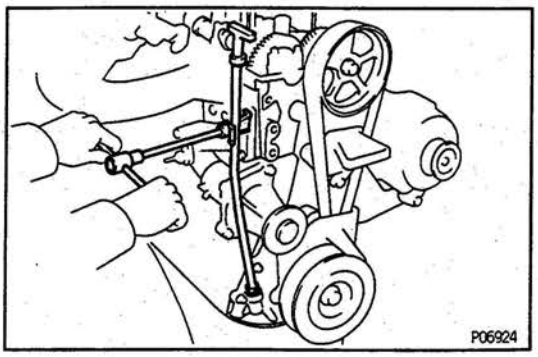


(f) Remove the four cap nuts, seal washers, cylinder head cover and gasket.

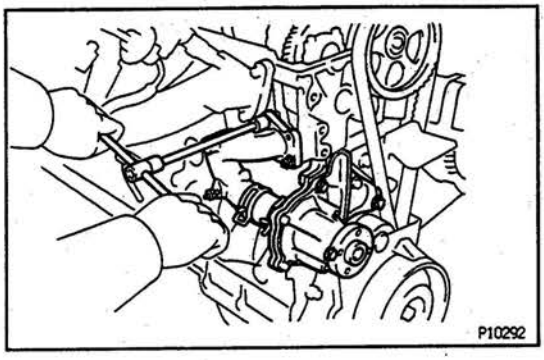


4. REMOVE NO.3 AND NO.2 TIMING BELT COVERS
Remove the six bolts, No.3, and No.2 timing belt covers.

5. DISCONNECT WIRE HARNESS PROTECTOR



6. REMOVE OIL DIPSTICK AND GUIDE
(a) Remove the mounting bolt.
(b) Pull out the dipstick guide together with the dipstick.
(c) Remove the O—ring from the dipstick guide.



EG

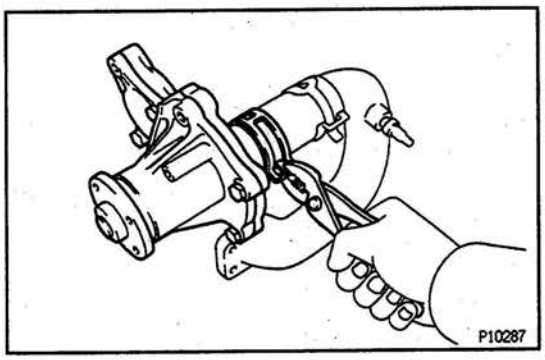
7. REMOVE WATER PUMP AND NO.2 WATER INLET

(a) Disconnect the water temperature sender gauge connector.

(b) Remove the two nuts holding the No.2 water inlet to the cylinder head.

(c) Remove the three bolts and water pump together with the No.2 water inlet.

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



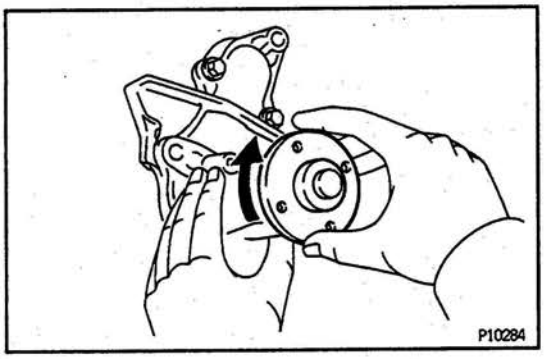
8. SEPARATE WATER PUMP AND NO.2 WATER INLET

EG13A–05

WATER PUMP INSPECTION

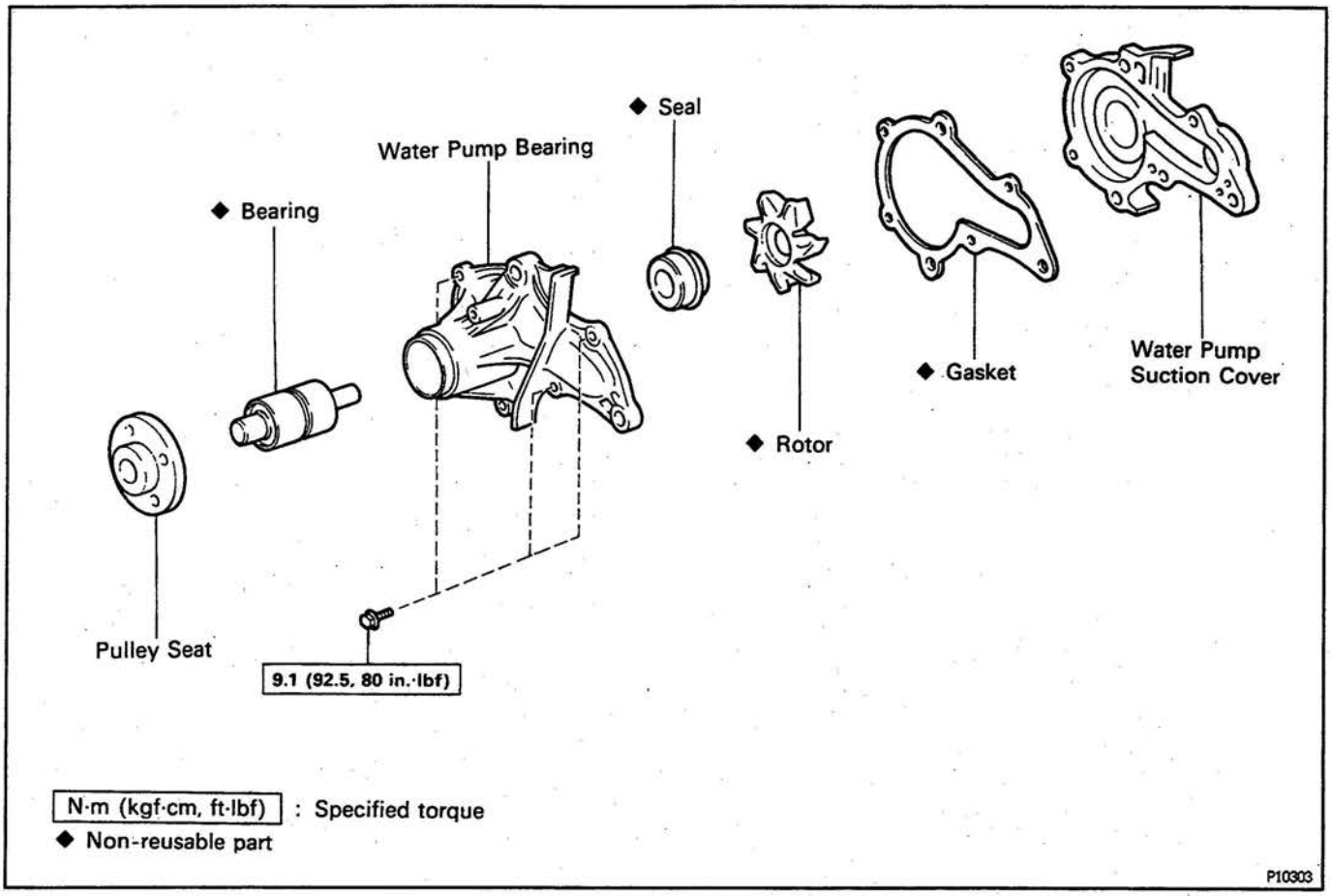
INSPECT WATER PUMP

Turn the pulley and check that the water pump bearing moves smoothly and quietly.



COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EG155–00



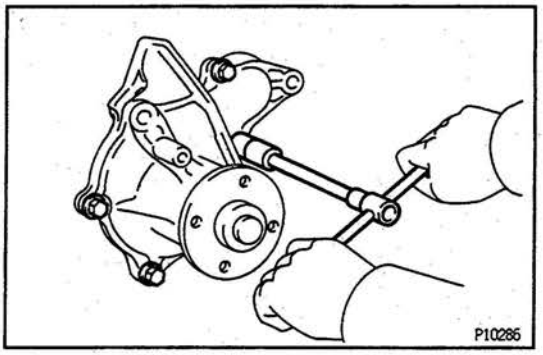
EG171–02

WATER PUMP DISASSEMBLY

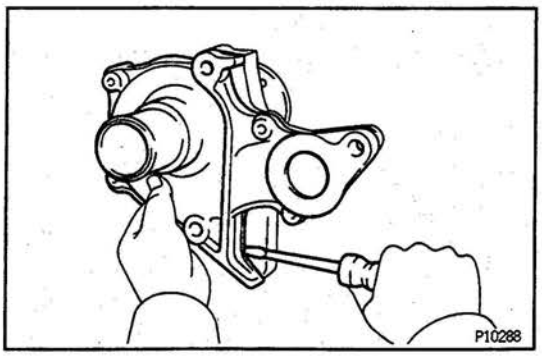
(See Components for Disassembly and Assembly)

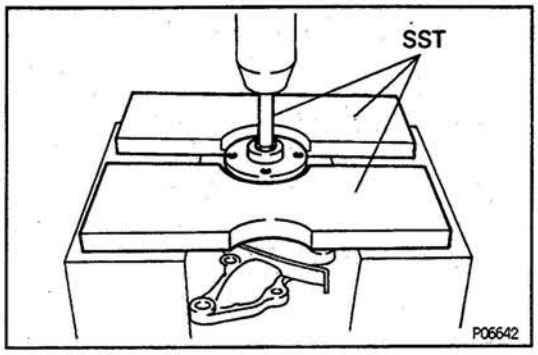
1. REMOVE WATER PUMP SUCTION COVER

(a) Remove the four bolts.



(b) Using a screwdriver, pry off the water pump suction cover.

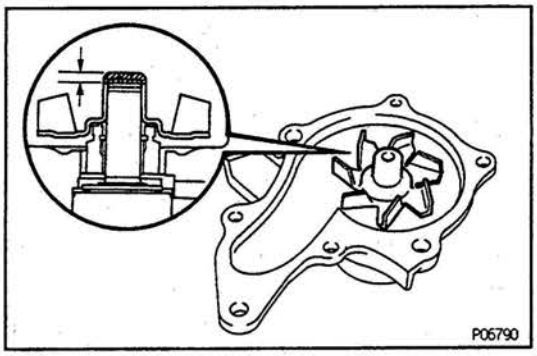




2. REMOVE PULLEY SEAT

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

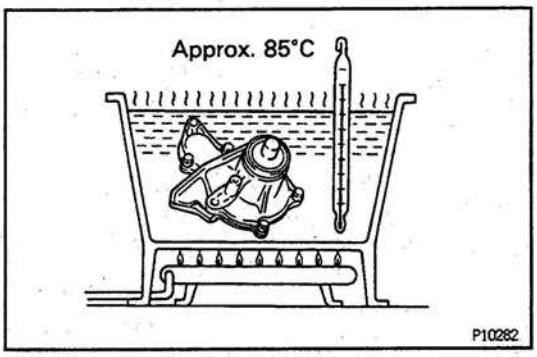
SST 09236–00101 (09237–00010, 09237–00050)



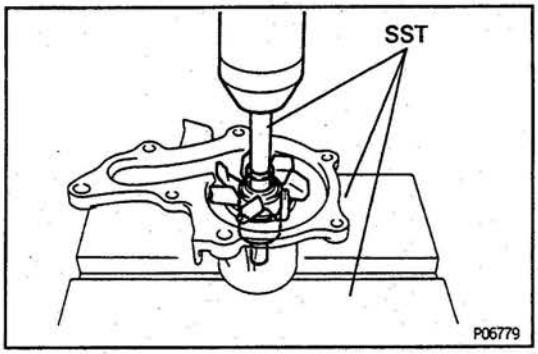
3. REMOVE WATER PUMP BEARING

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

NOTICE: Do not grind water pump bearing shaft.



(b) Gradually heat the water pump body to approx. 85°C (185°F).

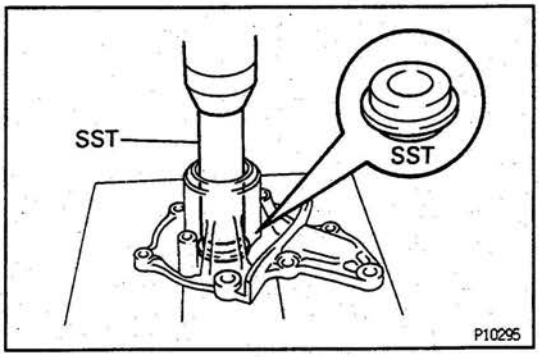


(c) Using SST and a press, press the shaft of the bearing and remove the rotor and bearing.

SST 09236–00101 (09237–00010, 09237–00050)

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

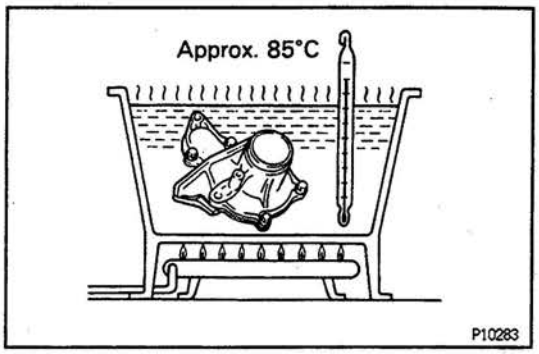
NOTICE: Do not damage the water pump body.



4. REMOVE SEAL

Using SST and a press, prsss out the seal.

SST 09236–00101 (09236–15010)



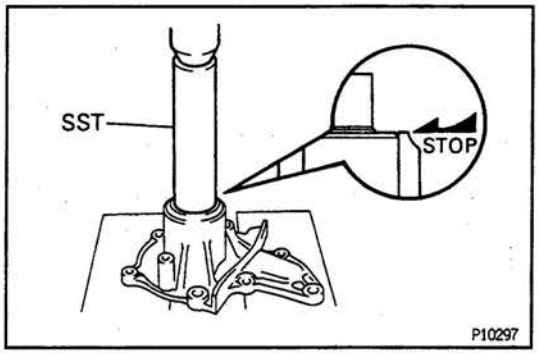
WATER PUMP ASSEMBLY

(See Components for Disassembly and Assembly)

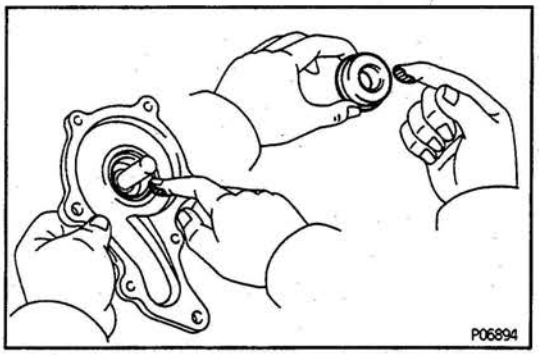
HINT: Always assemble the water pump with a new seal set, a new rotor and a new bearing.

1. INSTALL WATER PUMP BEARING

(a) Gradually heat the water pump body to approx. 85°C (185°F).

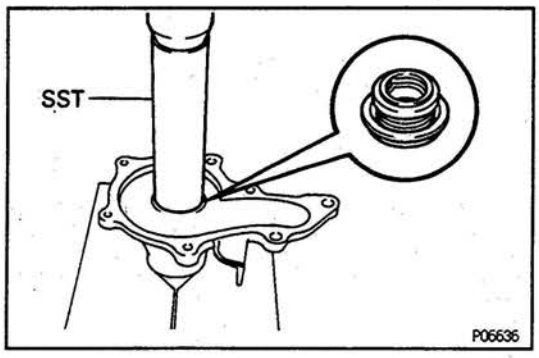


(b) Using SST and a press, press the outer race of the bearing until its surface with the water pump body surface.
SST 09236–00101 (09237–00020)

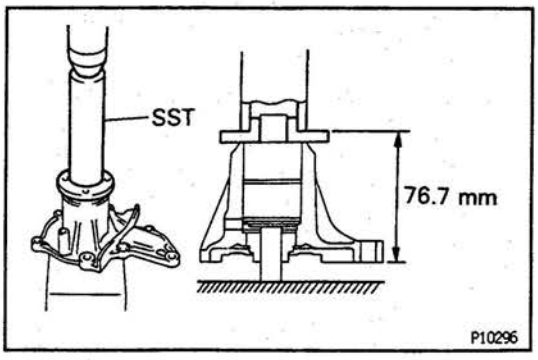


2. INSTALL SEAL

(a) Apply a seal packing to a new seal and pump body.
Seal packing:
Part No. 08826–00100 or equivalent

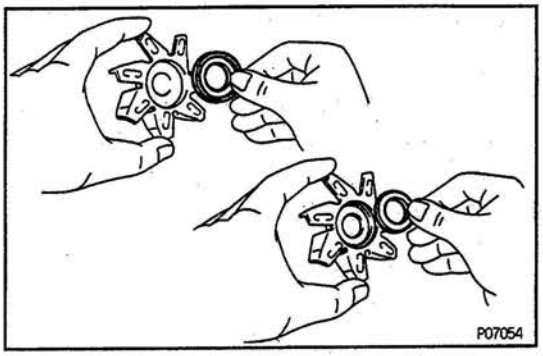


(b) Using SST and a press, press in the seal.
SST 09236–00101 (09237–00020)



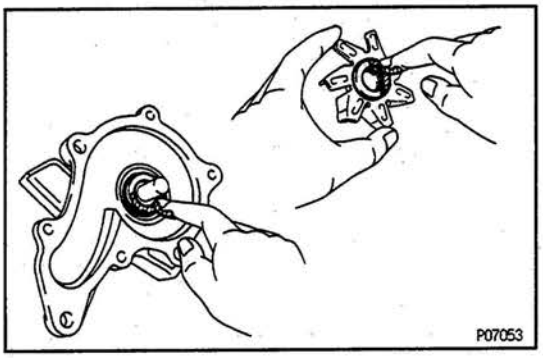
3. INSTALL PULLEY SEAT

Using SST and a press, prss in the pulley seat on the water pump bearing shaft to 76.7 mm (3.020 in.) from the installation surface of the pump body.
SST 09236–00101 (09237–00020)

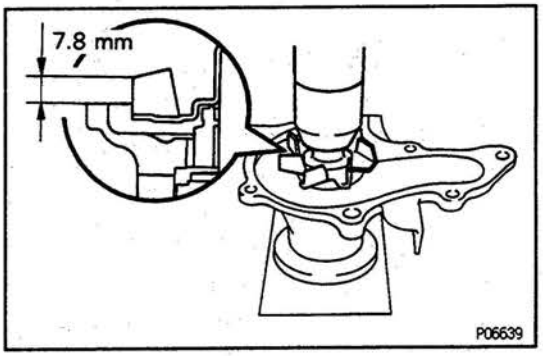


4. INSTALL ROTOR

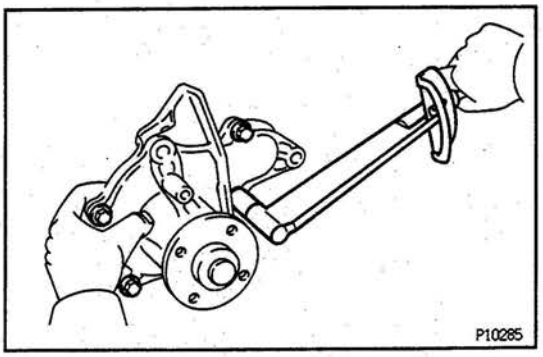
(a) Install a new packing and seat into the rotor.



(b) Apply a little silicon oil to the seal and rotor contact surface.



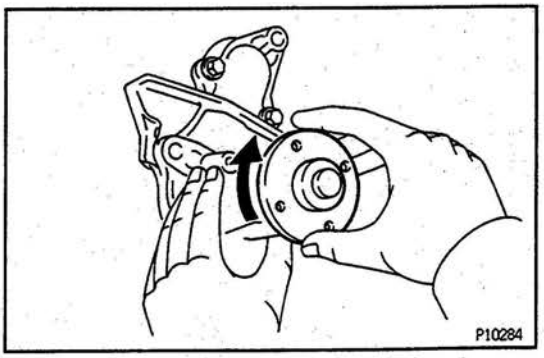
(c) Using a press, prss in a new rotor on the water pump bearing shaft to 7.8 mm (0.307 in.) from the installation surface of the pump body.



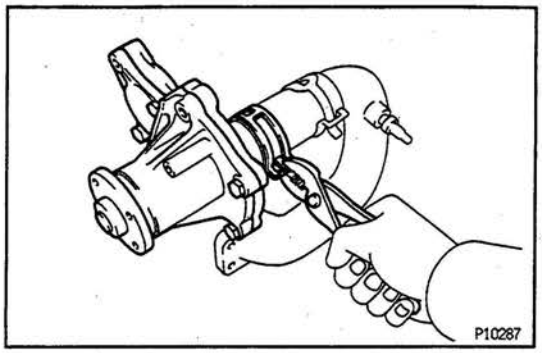
5. INSTALL WATER PUMP SUCTION COVER

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

Torque: 9.1 N·m (92.5 kgf·cm, 80 in.·lbf)



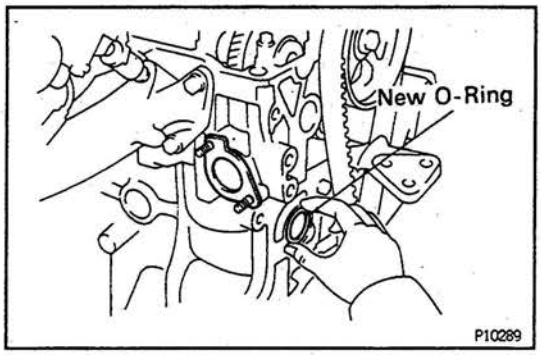
6. CHECK THAT WATER PUMP ROTATES SMOOTHLY



WATER PUMP INSTALLATION

(See Components for Removal and Installation)

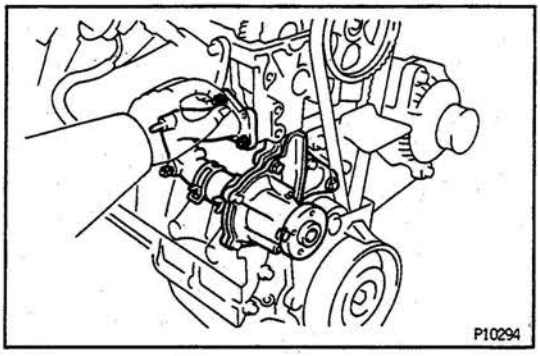
1. ASSEMBL WATER PUMP AND NO.2 WATER INLET



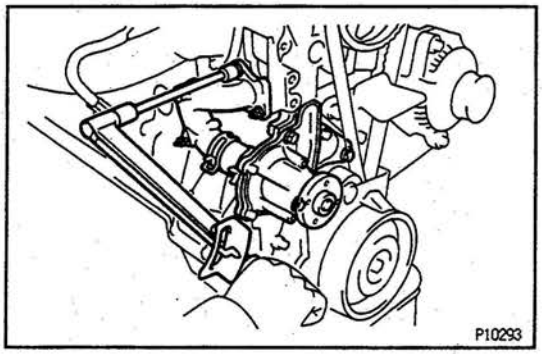
2. INSTALL WATER PUMP AND NO.2 WATER INLET

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

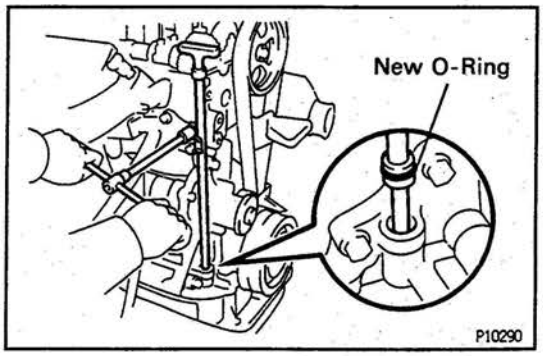
(b) Place a new gasket in position on the cylinder head so that the upper mark is toward the upper side.



(c) Temporarily install the water pump and No.2 water inlet with the three bolts and two nuts.



(d) Tighten the bolts and nuts.
Torque: 14 N·m (145 kgf·cm, 11 ft·lbf) for bolt
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf) for nut



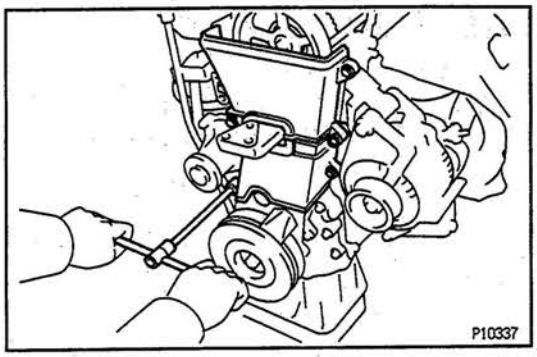
3. INSTALL OIL DIPSTICK GUIDE AND DIPSTICK

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

(b) Apply soapy water to the O–ring.

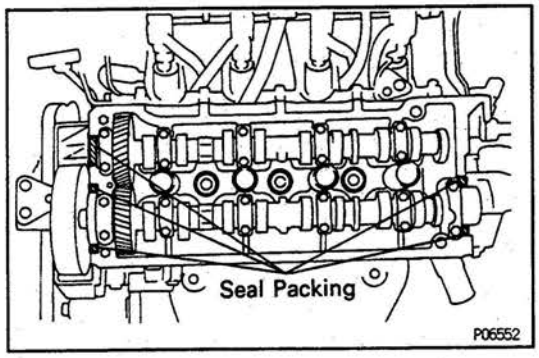
(c) Push in the dipstick guide together with the dipstick, and install it with the bolt.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)

4. CONNECT WIRE HARNESS PROTECTOR



5. INSTALL NO.2 AND NO.3 TIMING BELT COVERS

Install the No.2 and No.3 timing belt covers with the six bolts.



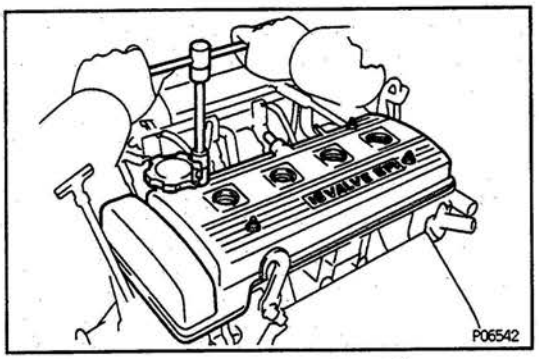
6. INSTALL CYLINDER HEAD COVER

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

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

Seal packing:

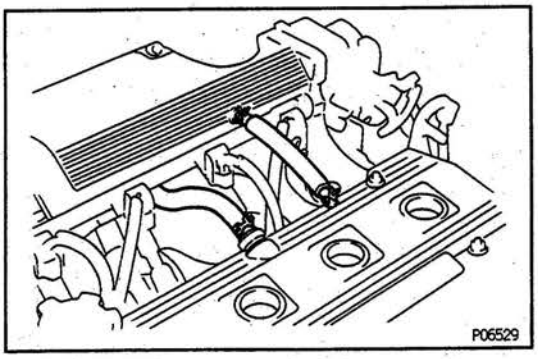
Part No. 08826–00080 or equivalent



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

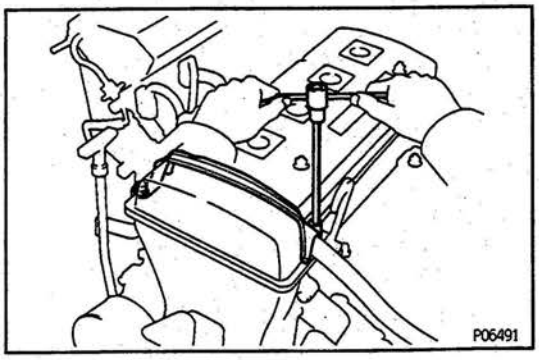
(d) Install the cylinder head cover with the four seal washers and cap nuts.

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

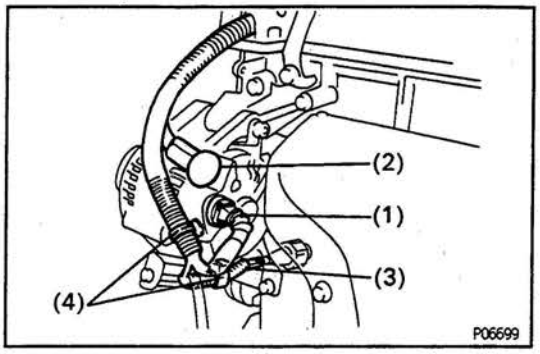


(e) Connect the PCV hoses to the cylinder head cover.

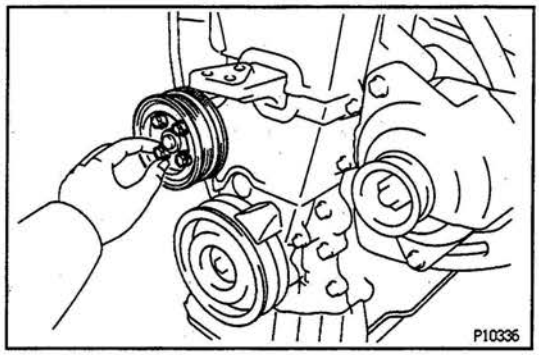
(f) Connect the four high–tension cords to the spark plugs.



(g) Install the engine wire harness and protector with the two bolts.

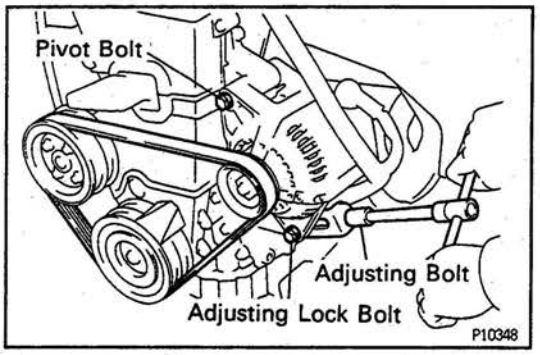


(h) Connect the following wires and clamps:
(1) Alternator connector
(2) Alternator wire
(3) Oil pressure switch connector
(4) Two wire clamps

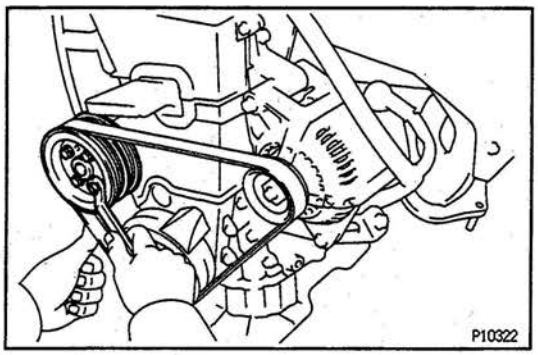


7. INSTALL WATER PUMP PULLEY AND ALTERNATOR DRIVE BELT

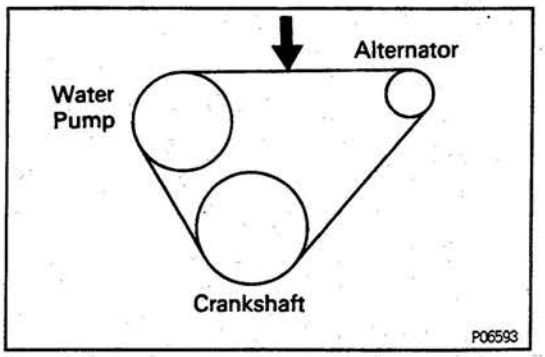
(a) Temporarily install water pump pulley with the four bolts.



(b) Install the drive belt with the ajusting bolt and pivot bolt.



(c) Tighten the four water pump pulley bolts.



8. ADJUST DRIVE BELT

Adjust 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.

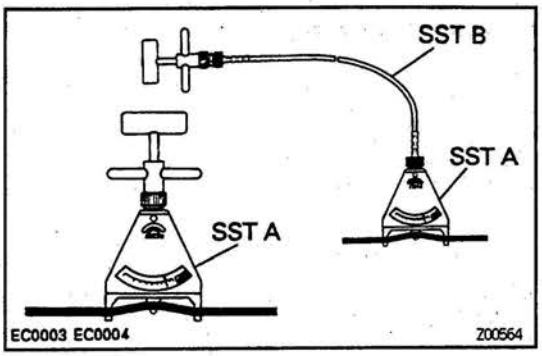
Drive belt deflection:

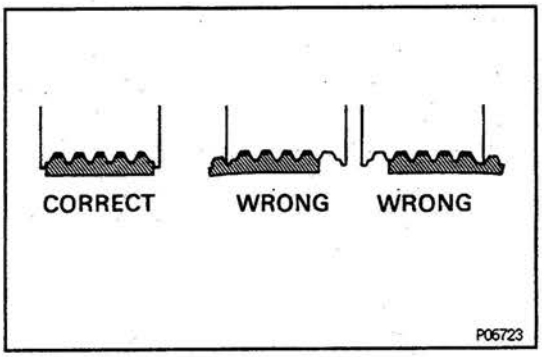
New belt

7 — 9 mm (0.28 — 0.35 in.)

Used belt

11.5 — 13.5 mm (0.453 — 0.531 in.)





[Reference]

Using SST, check the drive belt tension.

SST A 09216–00020,

SST B 09216–00030

Drive belt tension:

New belt

70 – 80 kgf

Used belt

30 – 45 kgf

HINT:

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

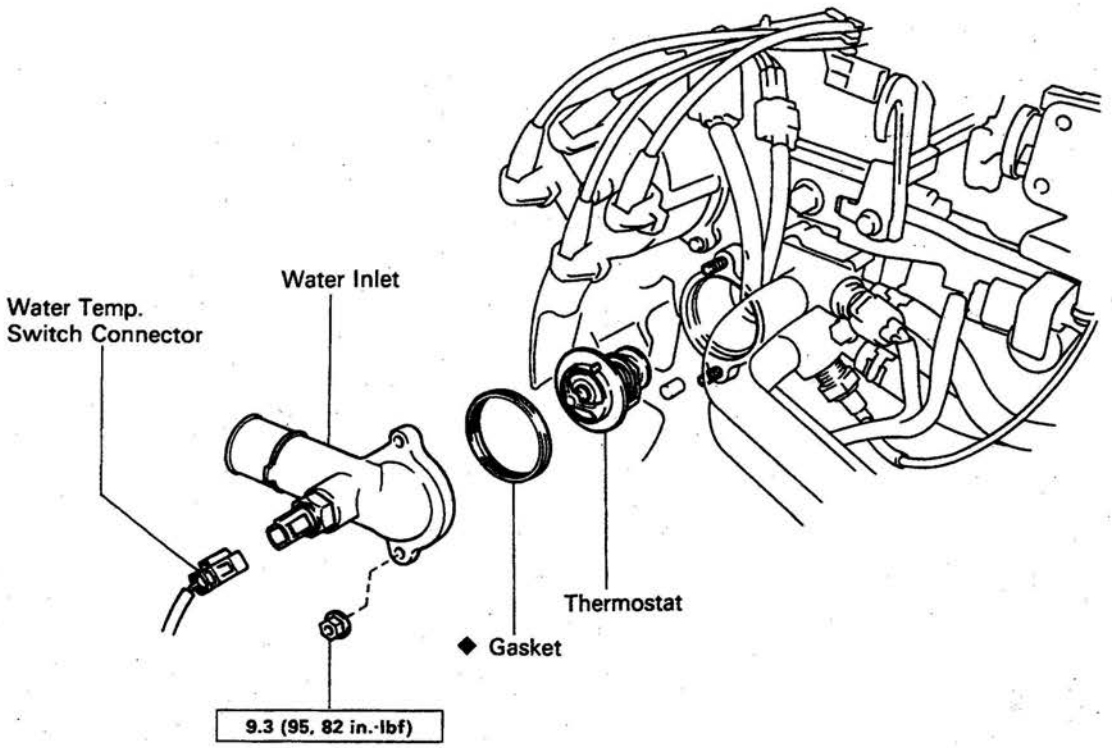
9. FILL WITH ENGINE COOLANT

10. START ENGINE AND CHECK FOR COOLANT LEAKS

THERMOSTAT

COMPONENTS FOR REMOVAL AND INSTALLATION

EG13D-02



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

P07096

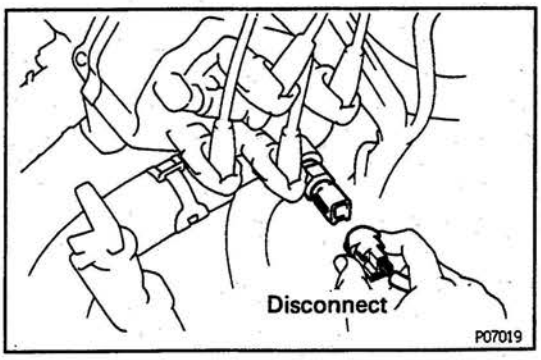
EG173-02

THERMOSTAT REMOVAL

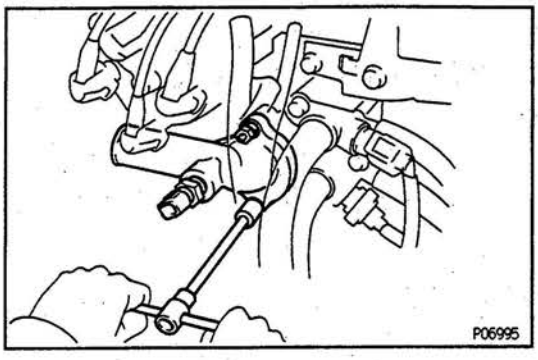
(See Components for Removal and Installation)

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**

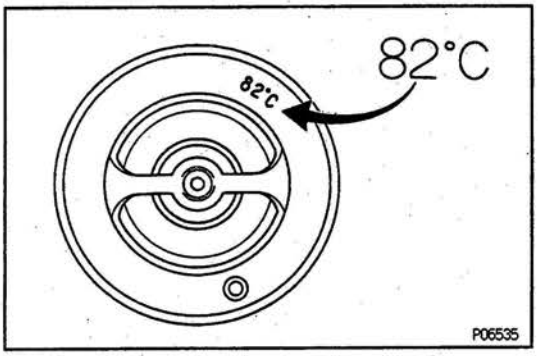


2. **DISCONNECT WATER TEMPERATURE SWITCH CONNECTOR**



3. REMOVE WATER INLET AND THERMOSTAT

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

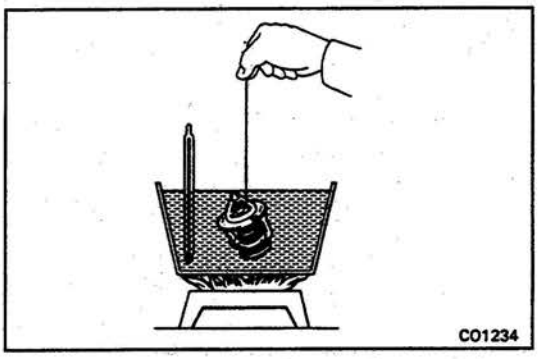


THERMOSTAT INSPECTION

EG13H-02

INSPECT THERMOSTAT

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

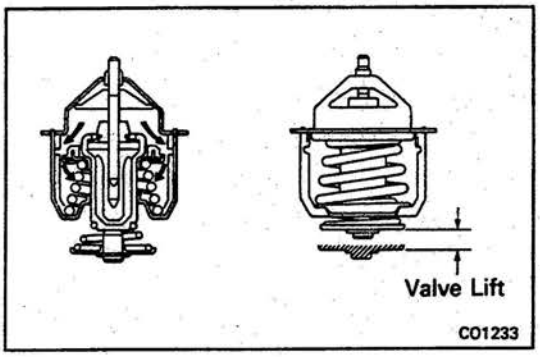


(a) Immerse the thermostat in water and gradually heat the water.
(b) Check the valve opening temperature.

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)

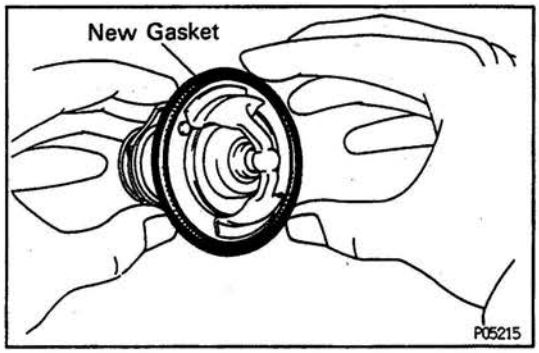
If the valve lift is not as specified, replace the thermostat.

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

If not closed, replace the thermostat.

EG174-01

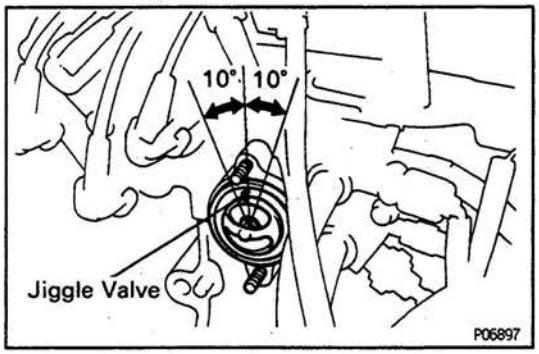
THERMOSTAT INSTALLATION



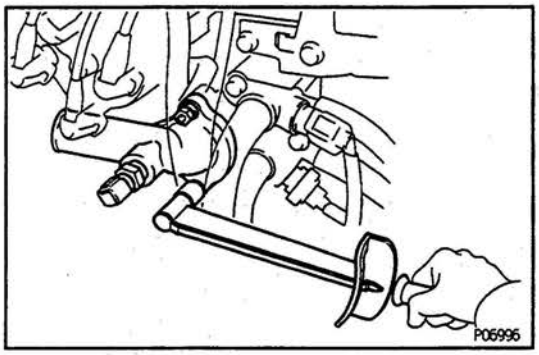
(See Components for Removal and Installation)

1. PLACE THERMOSTAT IN WATER INLET HOUSING

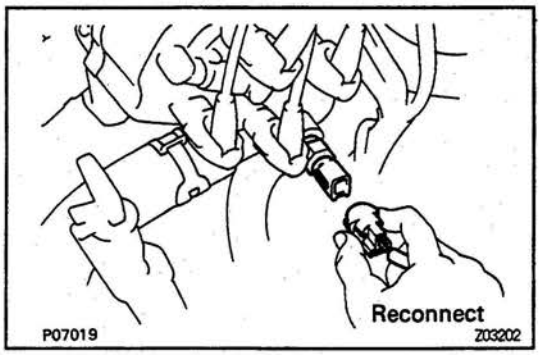
(a) Install a new gasket to the thermostat.



(b) Align the jiggle valve of the thermostat with the upper side of the stud bolt, and insert the thermostat in the water inlet housing.
HINT: The jiggle valve may be set within 10° of either side of the prescribed position.



2. INSTALL WATER INLET
Install the water inlet with the two nuts.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



3. CONNECT WATER TEMPERATURE SWITCH CONNECTOR

4. FILL WITH ENGINE COOLANT

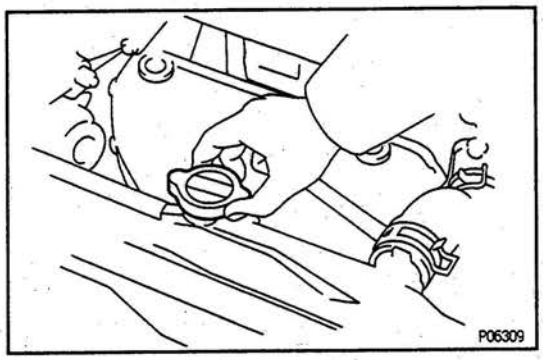
5. START ENGINE AND CHECK FOR COOLANT LEAKS

RADIATOR

RADIATOR CLEANING

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

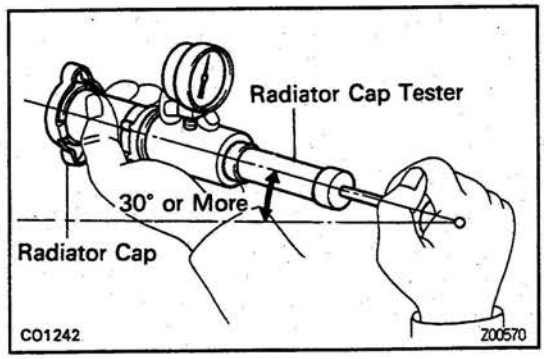
NOTICE: If using a high pressure type cleaner, be careful not to de form the fins of the radiator core. If the cleaner nozzle pressure is 2,942 – 3,432 kPa (30 – 35 kgf/cm², 427 – 498 psi), keep a distance of at least 40 – 50 cm (15.75 – 19.69 in.) between the radiator core and cleaner nozzle.



RADIATOR INSPECTION

1. REMOVE RADIATOR CAP

CAUTION: To avoid the danger of being burned, do not remove it 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:

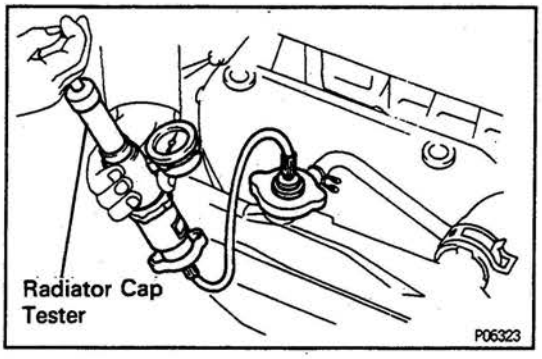
74 — 103 kPa

(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.



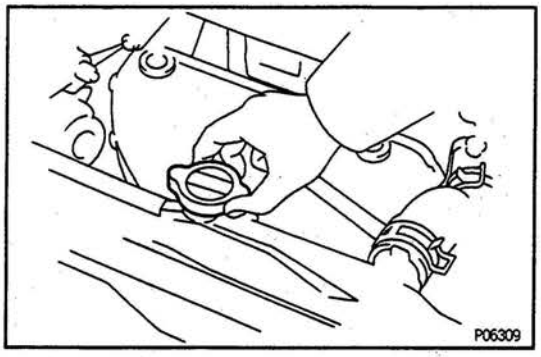
3. INSPECT COOLING SYSTEM FOR LEAKS

(a) Fill the radiator with coolant and attach a radiator cap tester to the water filler.

(b) Warm up the engine.

(c) Pump it to 118 kPa (1.2 kgf/cm², 17.1 psi), and check that the pressure does not drop.

If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, cylinder block and head.

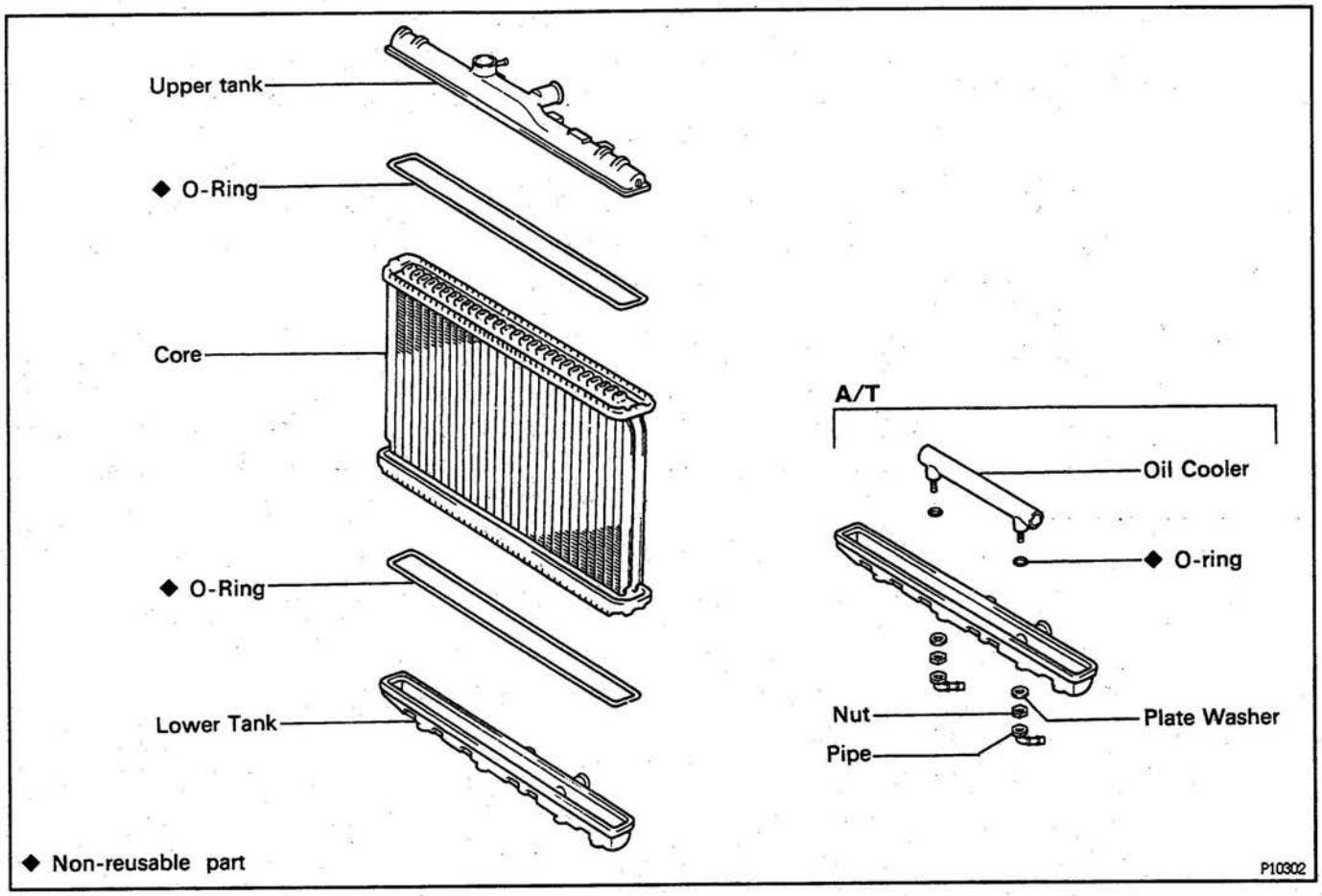


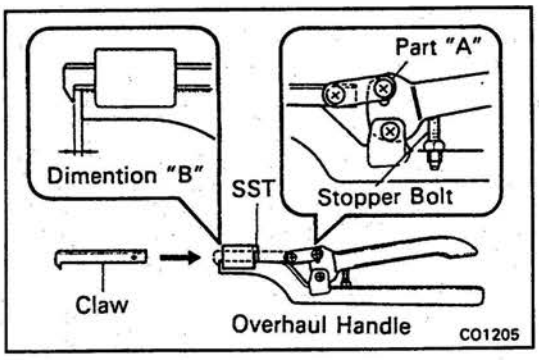
4. REINSTALL RADIATOR CAP

EG

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

E20A3-03





E20A4-03

RADIATOR DISASSEMBLY

(See Components for Disassembly and Assembly)

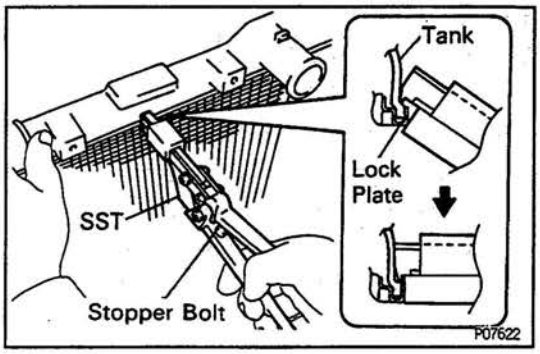
1. ASSEMBLY OF SST

SST 09230–01010

(a) Install the claw to the overhaul handle, inserting it in the hole in part "A" as shown in the diagram.

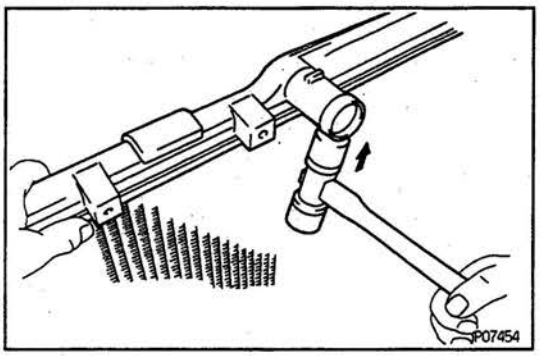
(b) While gripping the handle, adjust the stopper bolt so that dimension "B" shown in the diagram is 0.2–0.5 mm (0.008–0.020 in.).

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



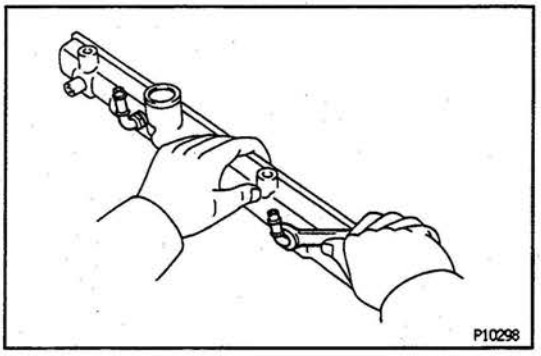
2. UNCAULK LOCK PLATES

Using SST to release the caulking, squeeze the handle until stopped by the stopper bolt.
SST 09230–01010



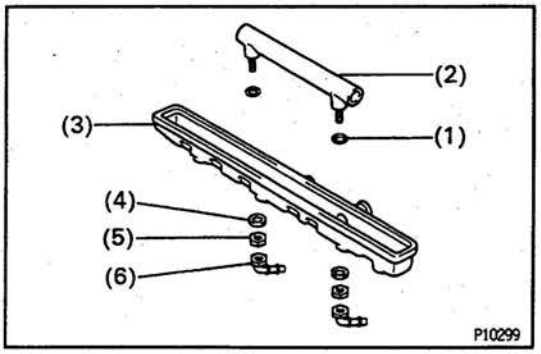
3. REMOVE TANKS AND O–RINGS

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



4. (A/T)
REMOVE OIL COOLER FROM LOWER TANK

(a) Remove the pipes.
HINT: Make a note of the direction to face the pipes.
(b) Remove the nuts, and plate washers.
(c) Remove the oil cooler and O–rings.



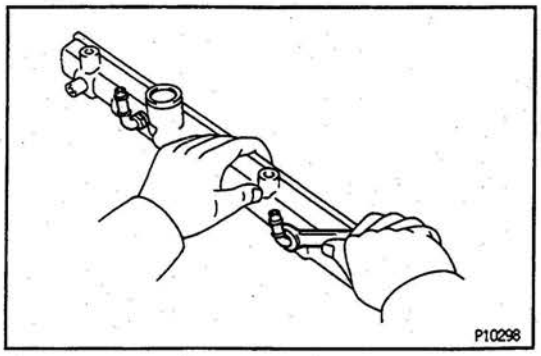
RADIATOR ASSEMBLY

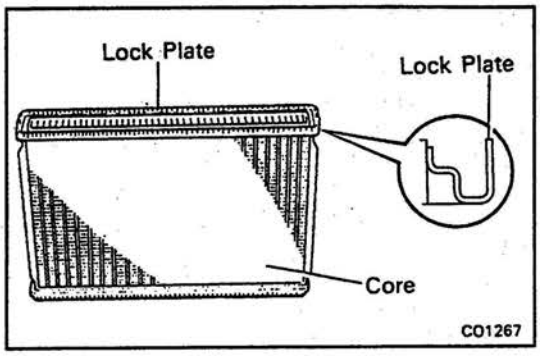
EGGAS–03

(See Conponents for Disassemby 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 new O–rings (1) to the oil cooler (2).
(c) Install the oil cooler (2) with the O–rings (1) to the lower tank (3).
(d) Install the plate washers (4), and nuts (5). Torque the nuts (5).
Torque: 8.3 N·m (85 kgf·cm, 74 in.·lbf)
(e) Install the pipes (6).
Torque: 22 N·m (220 kgf·cm, 16 ft·lbf)
HINT: Face the pipes in the same direction as before disassembly.





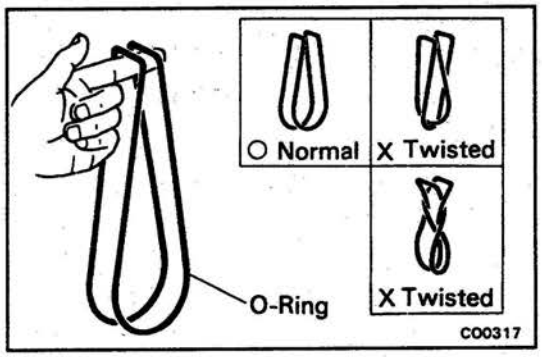
EG

2. INSPECT LOCK PLATE

Inspect the lock plate for damage.

HINT:

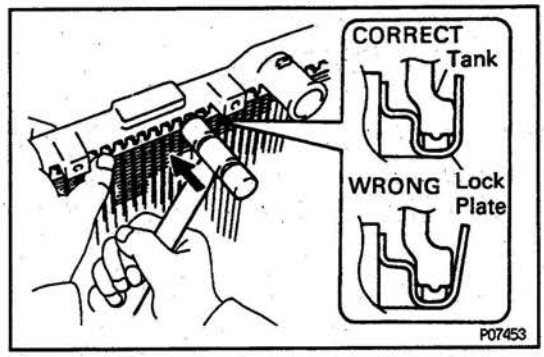
- If the sides of the lock plate groove are deformed, reassembly of the tank will be impossible.
- Therefore, first correct any deformation with pliers or like object. Water leakage will result if the bottom of the lock plate groove is damaged or dented, Therefore, repair or replace if necessary.



3. INSTALL NEW O–RINGS AND TANKS

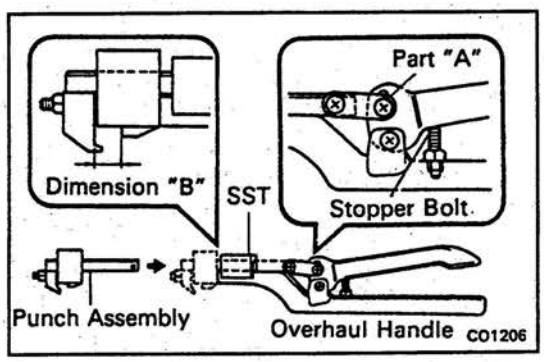
(a) After checking that there are no foreign objects in the lock plate groove, install the new O–ring without twisting it.

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.

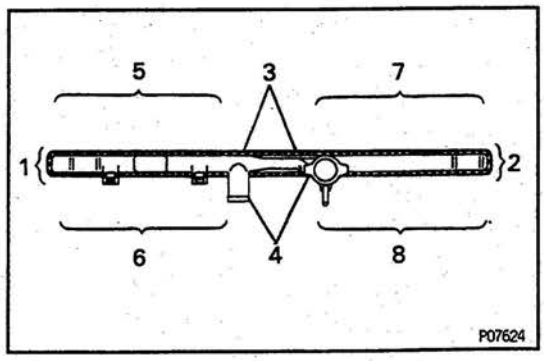


4. ASSEMBLY OF SST

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.

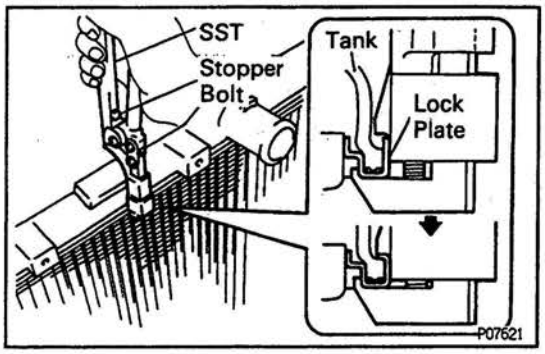
(b) While gripping the handle, adjust the stopper bolt so that dimension "B" shown in the diagram is 7.7 mm (0.30 in.).

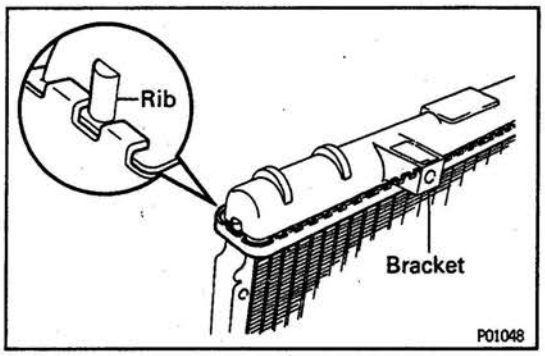


5. CAULK LOCK PLATE

(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.

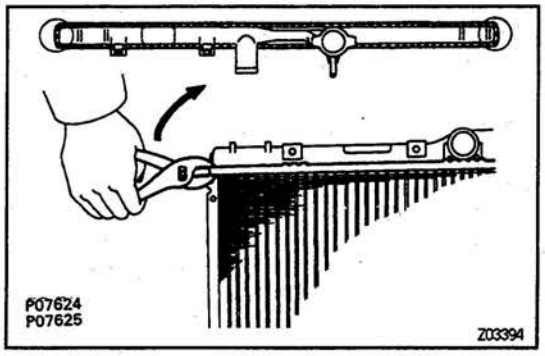
SST 09230–01010



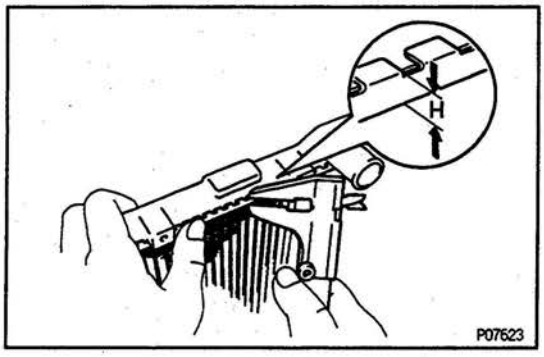


HINT:

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



- The points shown in the illustration and oil cooler near hear (A/T) cannot be staked with the SST. Use a plier or like object and be careful not to damage the core plates.

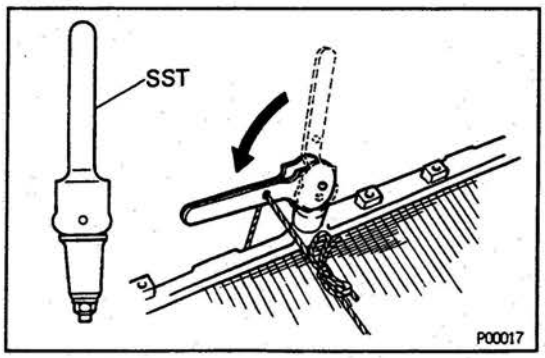


(b) Check the lock plate height (H) after completing the caulking.

Plate height:

7.75 – 8.25 mm (0.305 – 0.325 in.)

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



6. INSPECT FOR WATER LEAKS

(a) Tighten the drain plug.

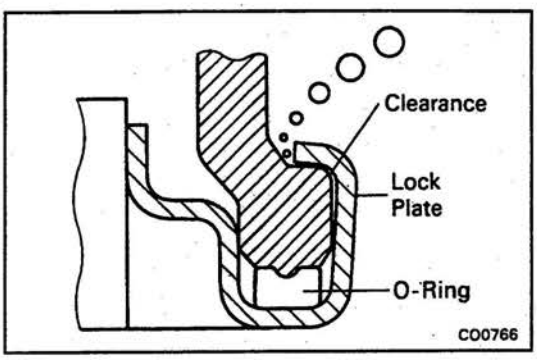
(b) Plug the inlet and outlet pipes of the radiator with SST.

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.



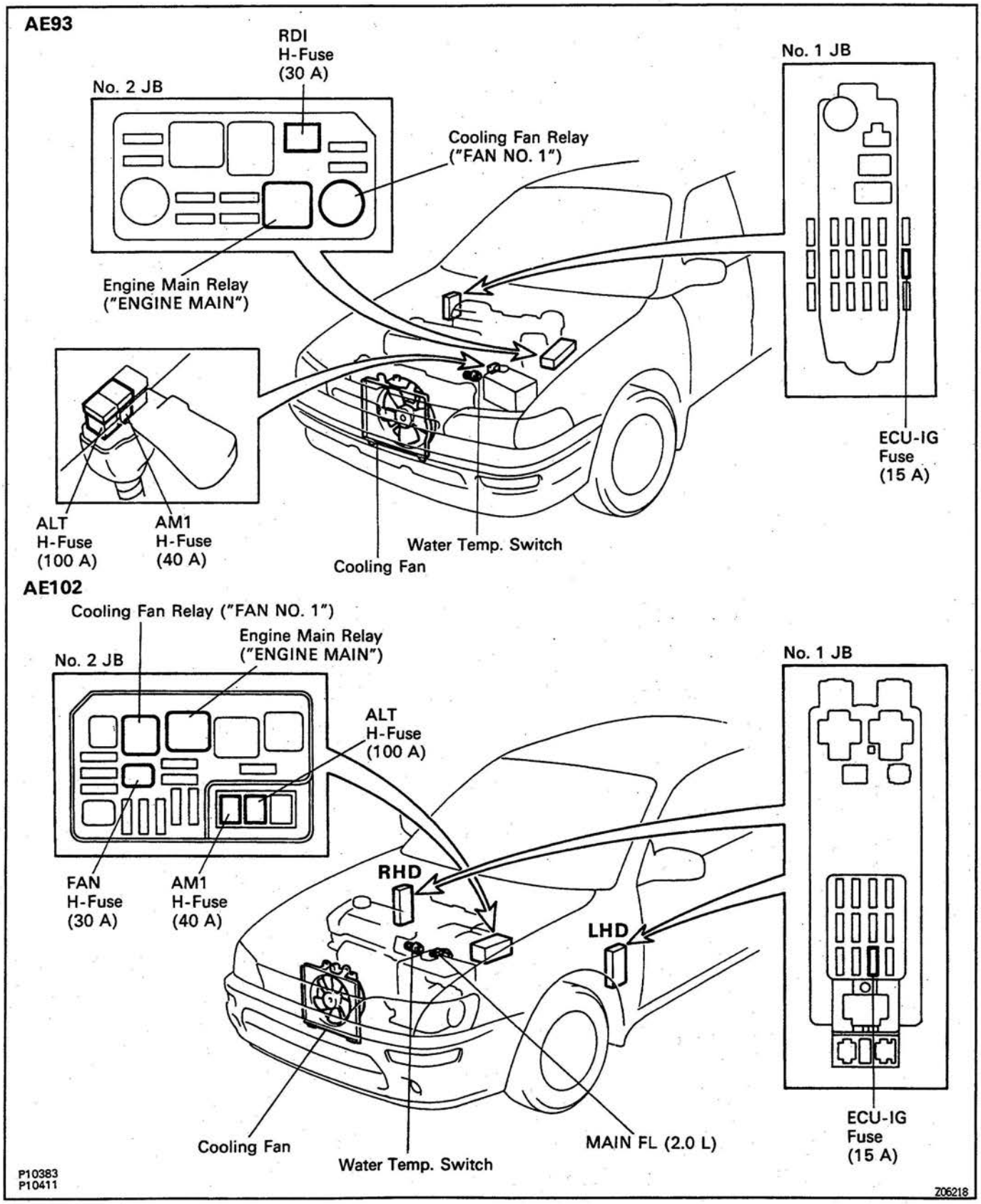
HINT: On radiators with resin tanks, there is a clearance between the tank and lock plate where a minute amount of air will remain, giving the appearance of an or leak when the radiator is submerged in water. Therefore, before performing the water leak test, first switch the radiator around in the water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

7. PAINT LOCK PLATES

HINT: If the water leak test checks out okay, allow the radiator to completely dry and then paint the lock plates.

ELECTRIC COOLING FAN
PART LOCATION

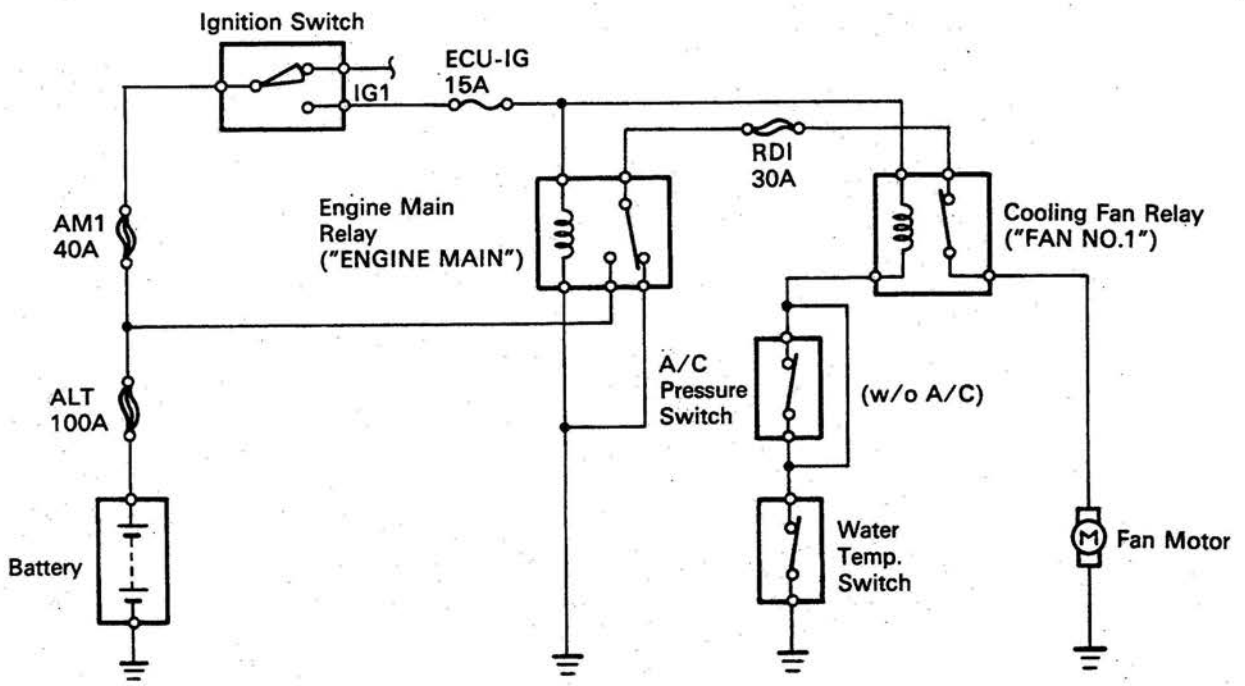
EG0078-00



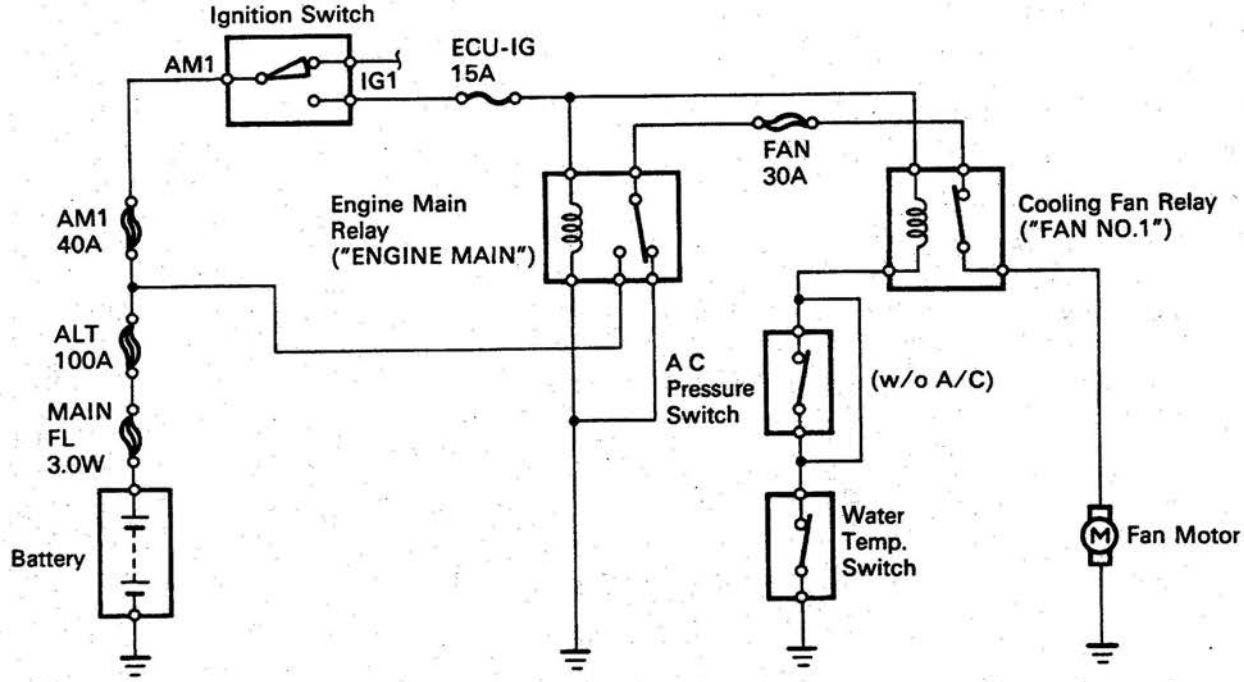
EG007C-05

SYSTEM CIRCUIT

AE93

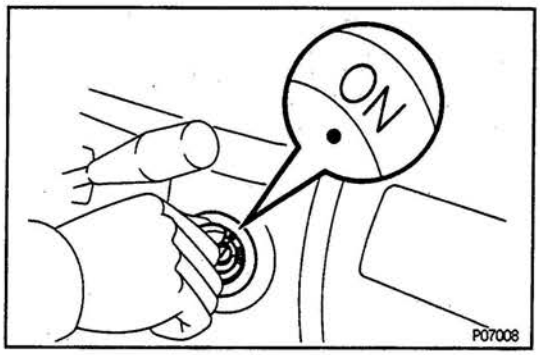


AE102



P10245
P07159

Z06149

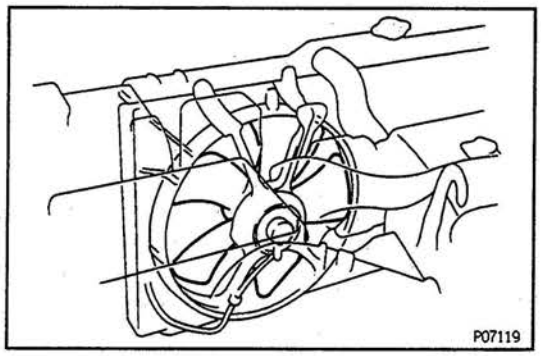


On–Vehicle Inspection

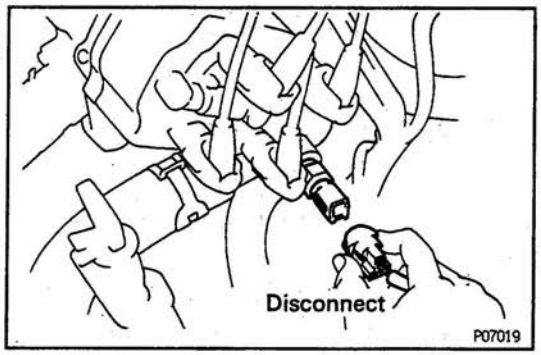
EG175–01

1. INSPECT COOLING FAN OPERATION AT LOW TEMPERATURE (Below 83°C (181°F))

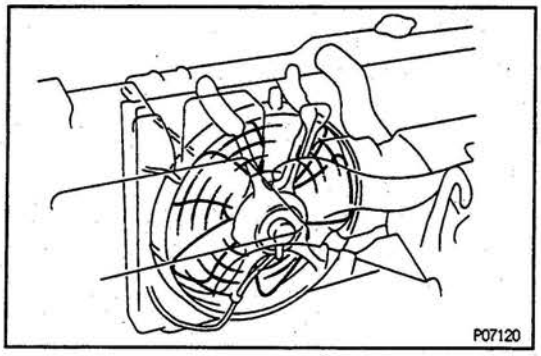
(a) Turn the ignition switch ON.



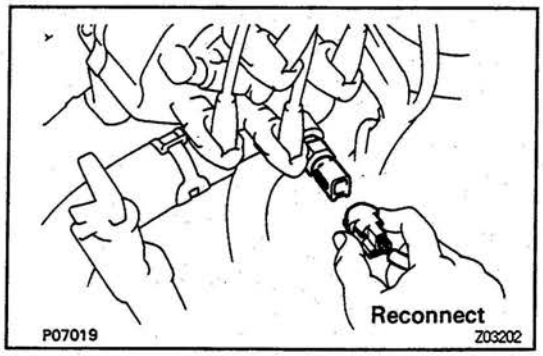
(b) Check that the cooling fan stops.
If not, check the cooling fan relay and water temperature switch, and check for a separated connector or severed wire between the cooling fan relay and water temperature switch.



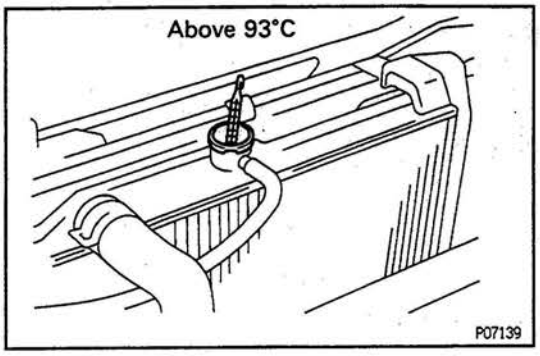
(c) Disconnect the water temperature switch connector.



(d) Check that the cooling fans rotates.
If not, check the fuses, engine main relay, cooling fan relay, cooling fan, and check for a short circuit between the cooling fan relay and water temperature switch.

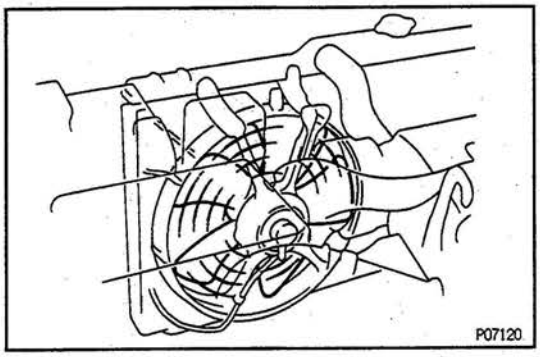


(e) Reconnect the water temperature switch connector.

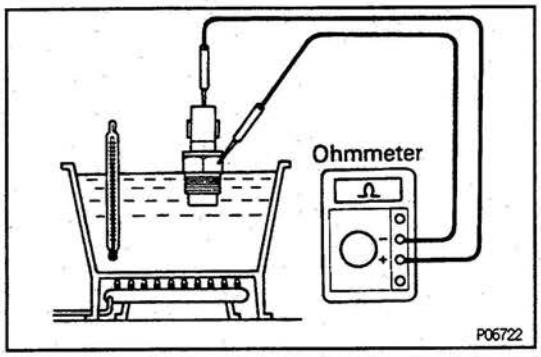


2. INSPECT COOLING FAN OPERATION AT HIGH TEMPERATURE (Above 93°C (199°F))

(a) Start the engine, and raise coolant temperature to above 93°C (199°F).



(b) Check that the cooling fans rotates.
If not, replace the water temperature switch.

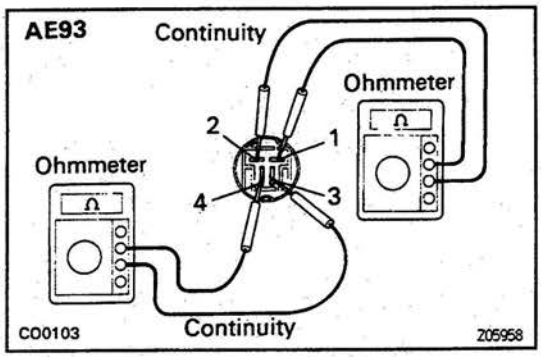


ELECTRIC COOLING FAN COMPONENTS INSPECTION EG297-01

1. 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.

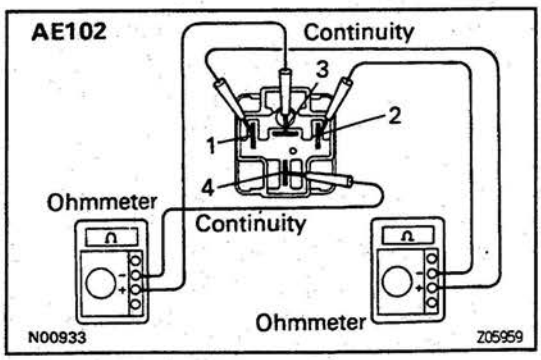


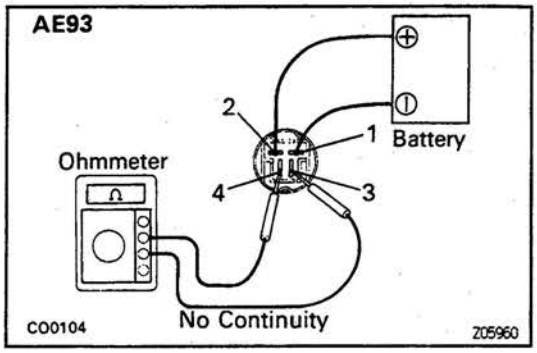
2. INSPECT COOLING FAN RELAY ("FAN NO.1")

A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

(b) Check that there is continuity between terminals 3 and 4.
If continuity is not as specified, replace the relay.



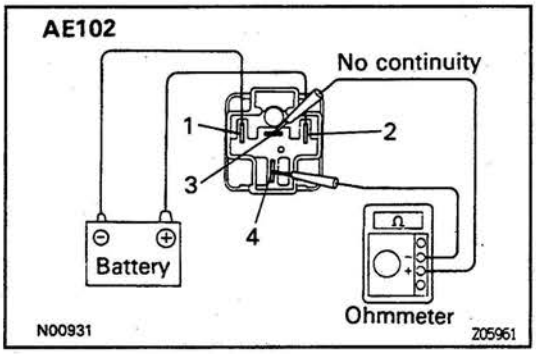


B. Inspect relay operation

(a) Apply battery voltage across 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.



3. INSPECT ENGINE MAIN RELAY ("ENGINE MAIN")

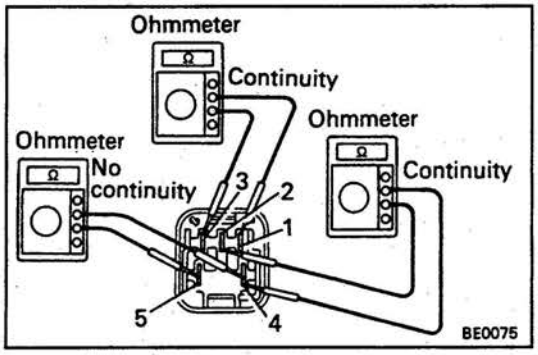
A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 3.

(b) Check that there is continuity between terminals 2 and 4.

(c) Check that there is no continuity between terminals 4 and 5.

If continuity is not as specified, replace the relay.



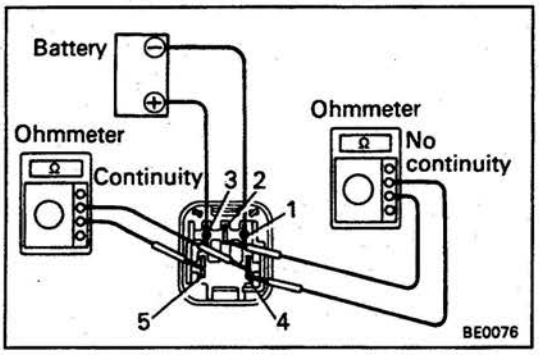
B. Inspect relay operation

(a) Apply battery voltage across terminals 1 and 3.

(b) Using an ohmmeter, check that there is no continuity between terminals 2 and 4.

(c) Check that there is continuity between terminals 4 and 5.

If operation is not as specified, replace the relay.



4. INSPECT COOLING FAN

(a) Disconnect the cooling fan connector.

(b) Connect battery and ammeter to the cooling fan connector.

(c) Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

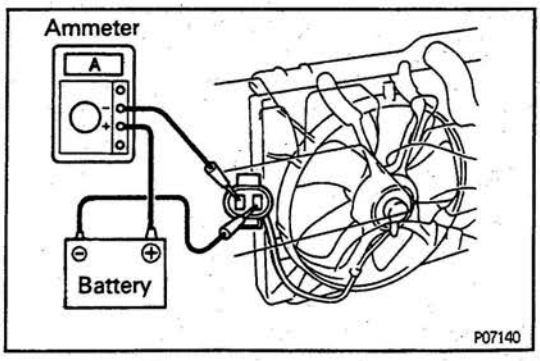
Standard amperage:

AE93

5.7 – 7.7 A

AE102

5.8 – 7.4 A

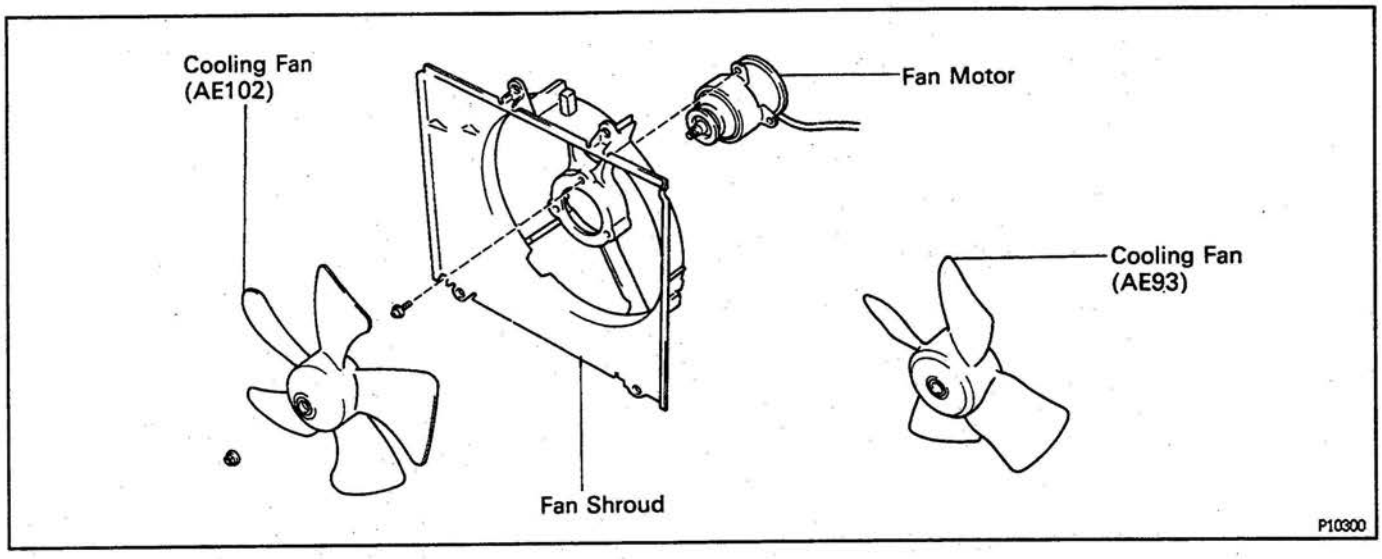


(d) Reconnect the cooling fan connector.

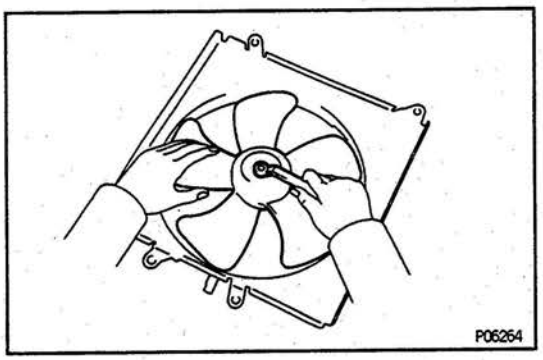
EG

EG

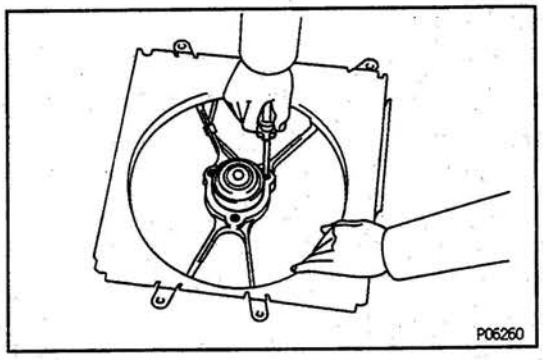
COMPONENTS FOR DISASSEMBLY AND ASSEMBLY



ELECTRIC COOLING FAN DISASSEMBLY



1. REMOVE FAN
Remove the nut and fan.



2. REMOVE FAN MOTOR
Remove the screws and fan motor.

ELECTRIC COOLING FAN ASSEMBLY

1. INSTALL FAN MOTOR
2. INSTALL FAN

SERVICE SPECIFICATIONS

SERVICE DATA

EG07L–0A

Drive belt	Deflection with 98 N (10 kgf, 22.0 lbf)	
	— New belt	7 — 9 mm (0.28 — 0.35 in.)
	— Used belt	11.5 — 13.5 mm (0.453 — 0.531 in.)
	Tension with SST	
	— New belt	70 — 80 kgf
	— Used belt	30 — 45 kgf
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)
	Relief valve opening pressure (Limit)	59 kPa (0.6 kgf/cm², 8.5 psi)
Radiator	Plate height	7.75 — 8.25 mm (0.3051 — 0.3248 in.)
Electric cooling fan	Rotating amperage (AE93)	5.7 — 7.7 A
	Rotating amperage (AE102)	5.8 — 7.4 A

TORQUE SPACIFICATIONS

EG07M–0C

Part tightened	N·m	kgf·cm	ft·lbf
Cylinder block x Drain plug	29	300	22
Water pump body x Water pump suction cover	9.1	92.5	80 in.·lbf
Water pump x Cylinder block	14	145	11
Oil dipstick guide x No.2 water inlet	9.3	95	82 in.·lbf
No.2 water inlet x Cylinder head	15	150	11
Water inlet x Water inlet housing	9.3	95	82 in.·lbf
Cylinder head cover x Cylinder head	5.9	60	52 in.·lbf
Radiator pipe x Lower tank	22	220	16
Oil cooler (Radiator) x Lower tank	8.3	85	74 in.·lbf

LUBRICATION SYSTEM

DESCRIPTION

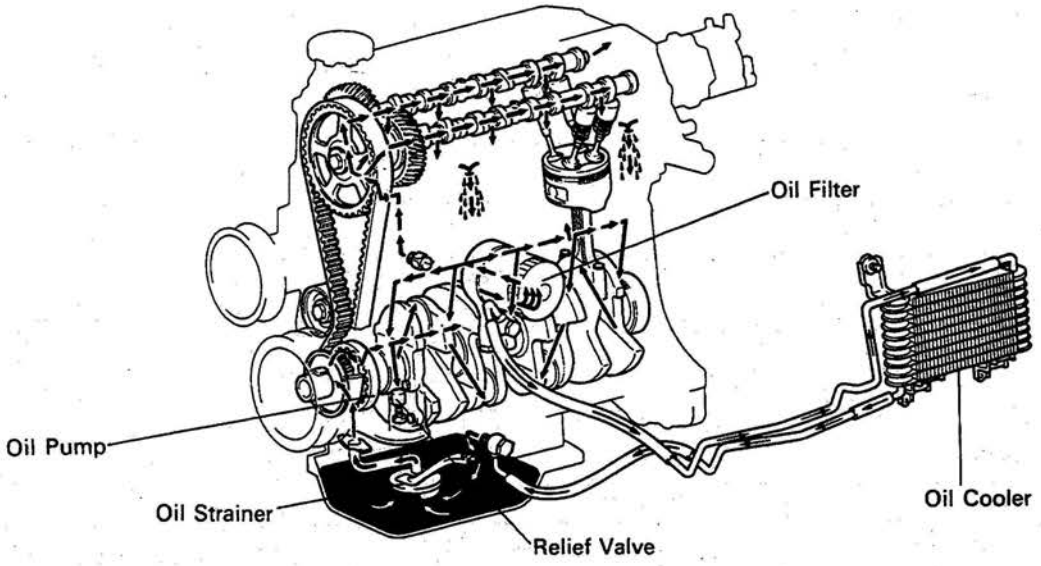
EG140-02

A fully pressurized, fully filtered lubrication system has been adopted for this engine.

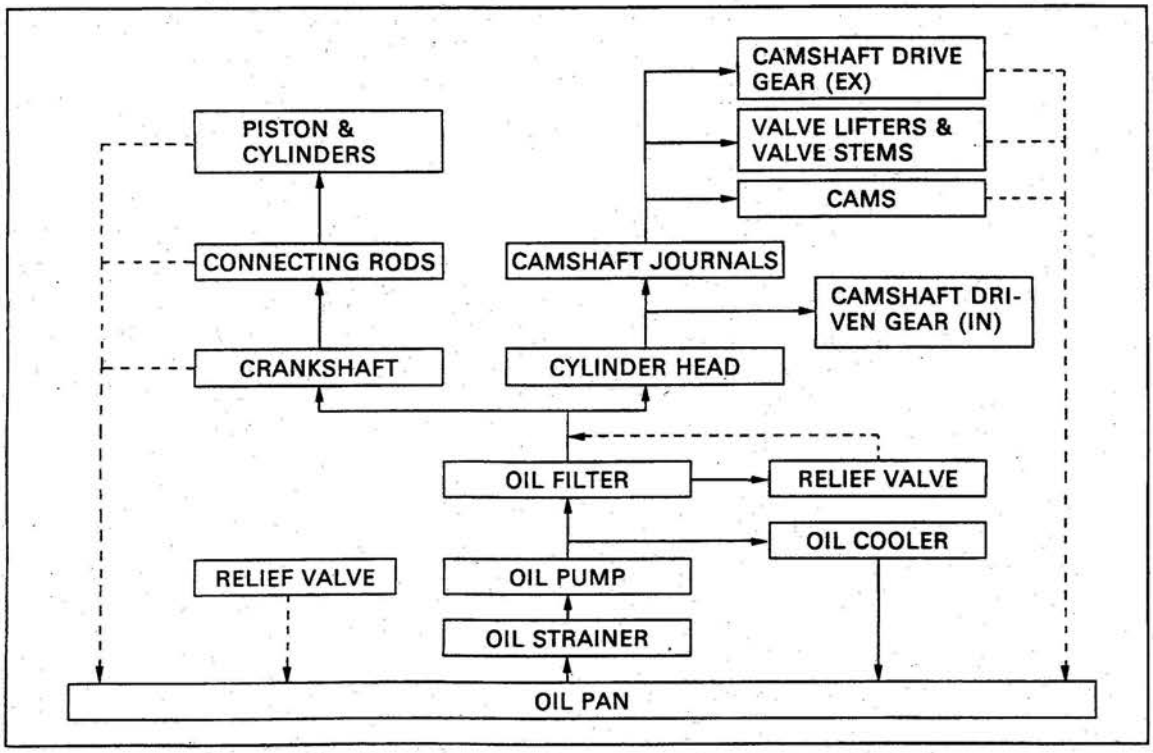
OPERATION

EG

EG148-05



P10362



V02742

A pressure feeding lubrication system has been adopted to supply oil to the moving parts of this engine. The lubrication system consists of an oil pan, oil pump, oil filter and other external parts which supply oil to the moving parts in the engine block. The oil circuit is shown in the illustration at the top of the previous page. Oil from the oil pan is pumped up by the oil pump. After it passes through the oil filter, it is 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 side of the oil pump 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 is changed as they rotate. Oil is drawn in when the space widens and is discharged when the space becomes narrow.

OIL PRESSURE REGULATOR (RELIEF VALVE)

At high engine speeds, the 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 by–pass 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 it 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 by–passes the oil filter and flows directly into the main oil hole in the engine.

PREPARATION

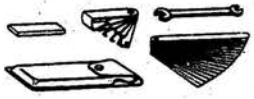
E0141U-02

SST (SPECIAL SERVICE TOOLS)

	09032–00100	Oil Pan Seal Cutter	
	09223–41020	Crankshaft Rear Oil Seal Replacer	
	09309–37010	Transmission Bearing Replacer	Crankshaft front oil seal
	09228–06500	Oil Filter Wrench	
	09816–30010	Oil Pressure Switch Socket	

E0141V-02

RECOMMENDED TOOLS

	09200–00010	Engine Adjust Kit	
	09905–00013	Snap Ring Pliers	

E0141W-02

EQUIPMENT

Oil pressure gauge	
Torque wrench	

LUBRICANT

EG14X-05

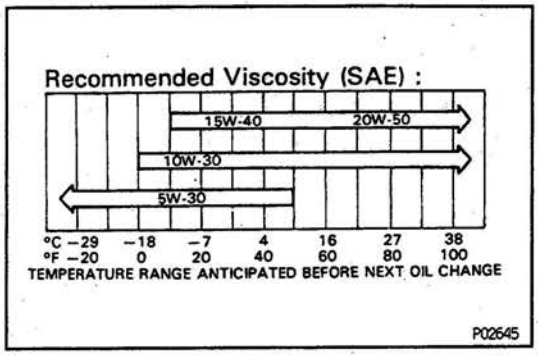
Item	Capacity	Classification
Engine oil (w/ Oil cooler)		API grade SG or better
Dry fill	4.7 liters (5.0 US qts, 4.1 Imp. qts)	
Drain and refill		
w/ Oil filter change	3.7 liters (3.9 US qts, 3.3 Imp. qts)	
w/o Oil filter change	3.5 liters (3.7 US qts, 3.1 Imp. qts)	
Engine oil (w/o Oil cooler)		
Dry fill	4.3 liters (4.5 US qts, 4.0 Imp. qts)	
Drain and refill		
w/ Oil filter change	3.7 liters (3.9 US qts, 3.3 Imp. qts)	
w/o Oil filter change	3.5 liters (3.7 US qts, 3.1 Imp. qts)	

EG

SSM (SPECIAL SERVICE MATERIALS)

EG14Y-02

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

E0176-01

1. CHECK ENGINE OIL QUALITY

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

If the quality is poor, replace the oil.

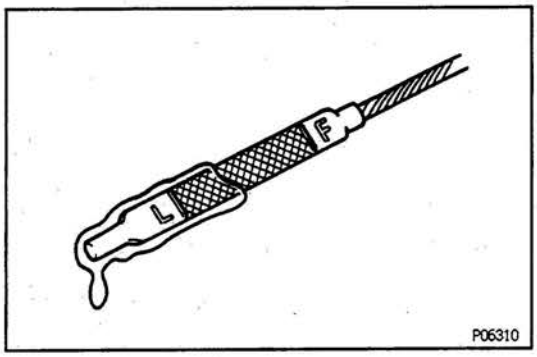
Oil grade:

API grade SG or better

If it is impossible to get SG or better, you may use SF grade.

Recommended viscosity:

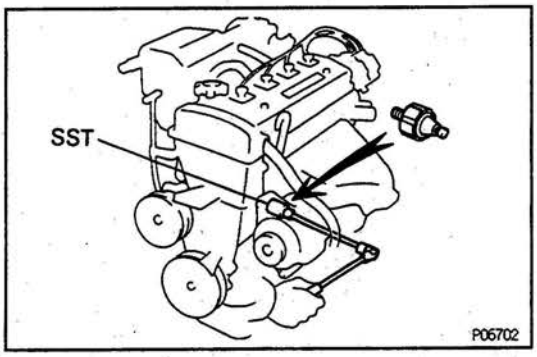
Refer to illustration



2. CHECK ENGINE OIL LEVEL

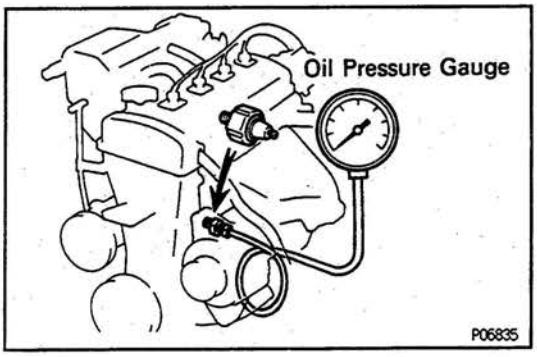
The oil level should be between the "L" and "F" marks on the dipstick.

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



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

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



(b) Install the oil pressure gauge.

4. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

5. CHECK OIL PRESSURE

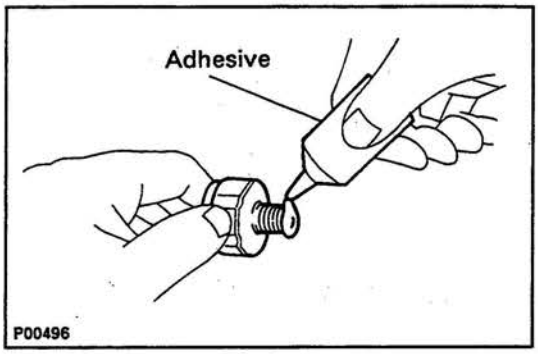
Oil pressure:

At idle

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)



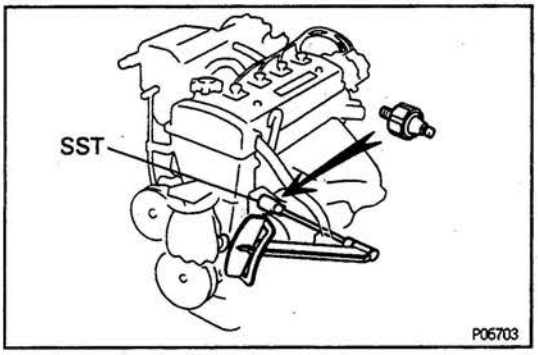
6. REMOVE OIL PRESSURE GAUGE, AND REINSTALL OIL PRESSURE SWITCH

(a) Remove the oil pressure gauge.

(b) Apply adhesive to two or three threads of the oil pressure switch.

Adhesive:

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



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

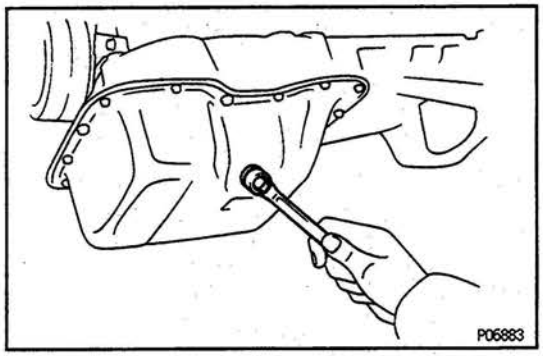
7. START ENGINE, AND CHECK FOR OIL LEAKS

OIL AND FILTER REPLACEMENT

BG177-02

CAUTION:

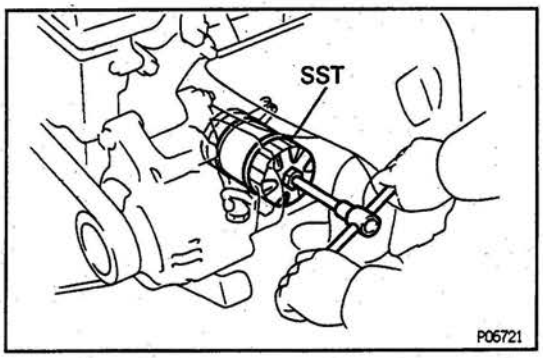
- **Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.**
- **Care should be taken, therefore, when 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 thoroughthly 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

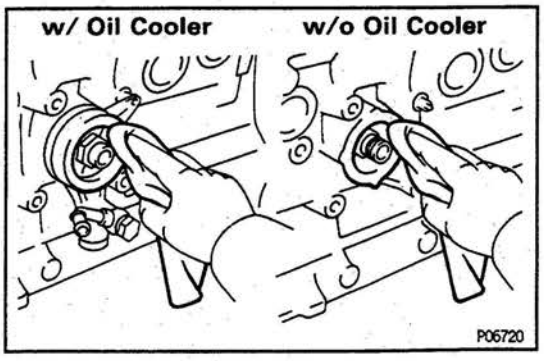
(a) Remove the oil filler cap.

(b) Remove the oil drain plug, and drain the oil into a container.

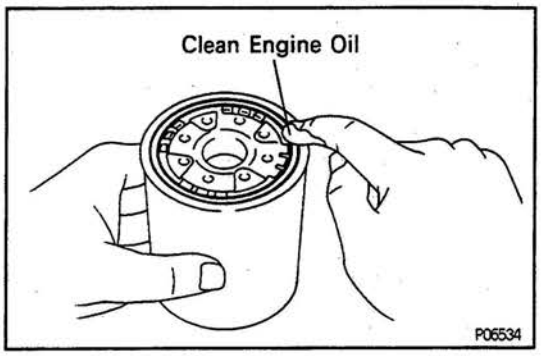


2. REPLACE OIL FILTER

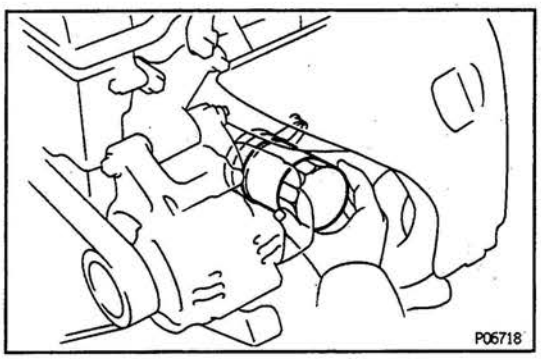
(a) Using SST, remove the oil filter.
SST 09228—06500



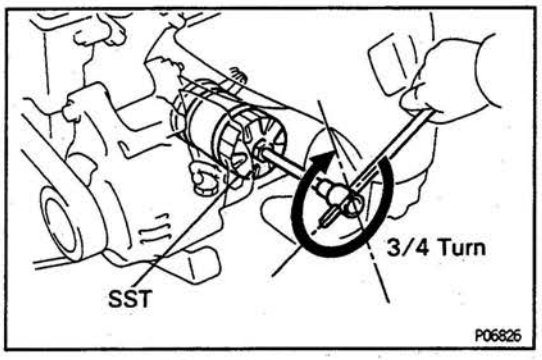
(b) Clean the oil filter contact surface on the oil filter mounting.



(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: 34 N·m (350 kgf·cm, 25 ft·lbf)

(b) Fill with new engine oil.
Oil grade: (See step 1 Oil Pressure Check)
Capacity (w/ Oil cooler):
Drain and refill
w/ Oil filter change
3.7 liters (3.9 US qts, 3.3 Imp. qts)
w/o Oil filter change
3.5 liters (3.7 US qts, 3.1 Imp. qts)
Dry fill
4.7 liters (5.0 US qts, 4.1 Imp. qts)
Capacity (w/o Oil cooler):
Drain and refill
w/ Oil filter change
3.7 liters (3.9 US qts, 3.3 Imp. qts)
w/o Oil filter change
3.5 liters (3.7 US qts, 3.1 Imp. qts)
Dry fill
4.3 liters (4.5 US qts, 4.0 Imp. qts)

(c) Reinstall the oil filler cap.

4. START ENGINE AND CHECK FOR OIL LEAKS

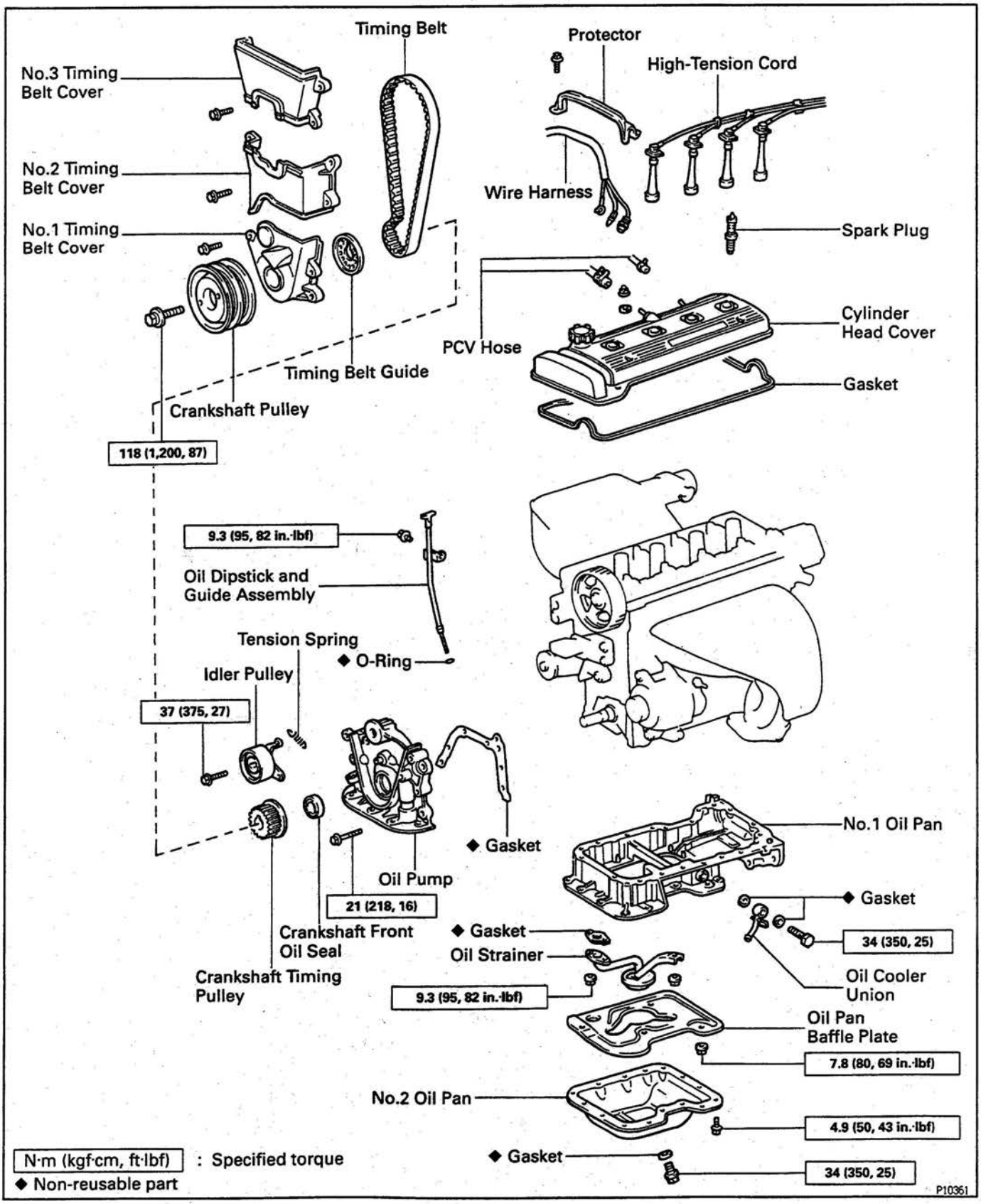
5. RECHECK ENGINE OIL LEVEL

EG

OIL PUMP

COMPONENTS FOR REMOVAL AND INSTALLATION

EG178-02



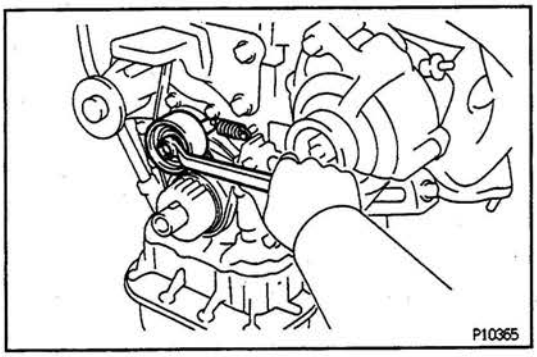
BG2A3-01

OIL PUMP REMOVAL

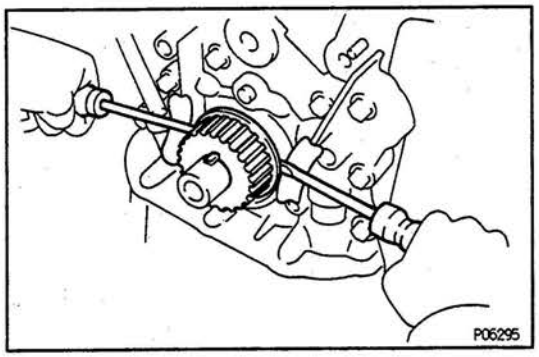
(See Components for Removal and Installation)

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

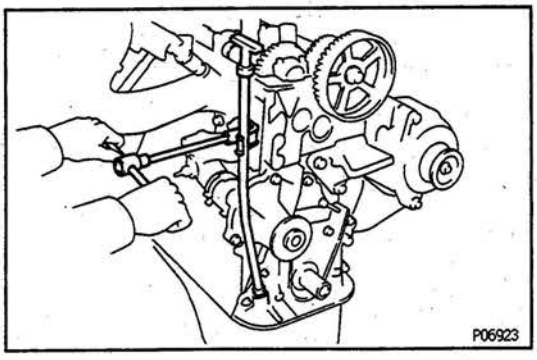
1. **DRAIN ENGINE OIL**
2. **REMOVE TIMING BELT**
   (See steps 1 to 8 on pages EG—35 to 38)



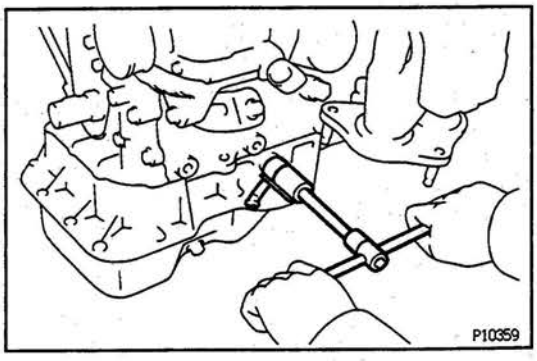
3. **REMOVE IDLER PULLEY AND TENSION SPRING**
   Remove the bolt, pulley and tension spring.



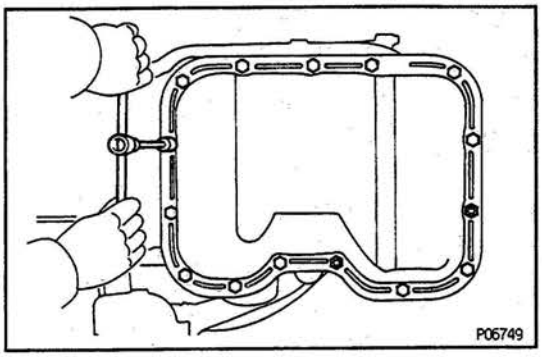
4. **REMOVE CRANKSHAFT TIMING PULLEY**
   If the pulley cannot be removed by hand, use two screwdrivers.
   HINT: Position shop rags as shown to prevent damage.



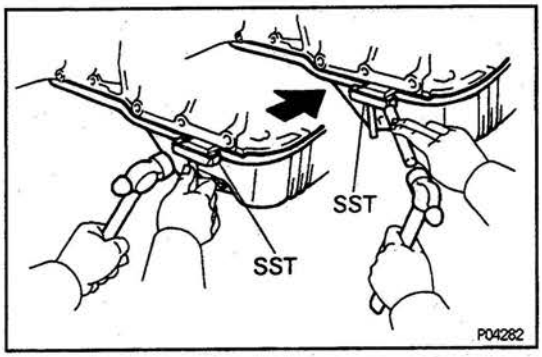
5. **REMOVE OIL DIPSTICK AND GUIDE**
   (a) Remove the mounting bolt.
   (b) Pull out the dipstick guide together with the dipstick.
   (c) Remove the O—ring from the dipstick guide.



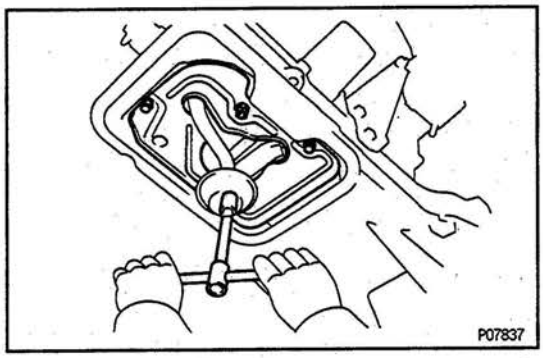
6. **REMOVE OIL PAN**
   (a) (w/ Oil cooler)
   Remove the union bolt, two gaskets and oil cooler union.



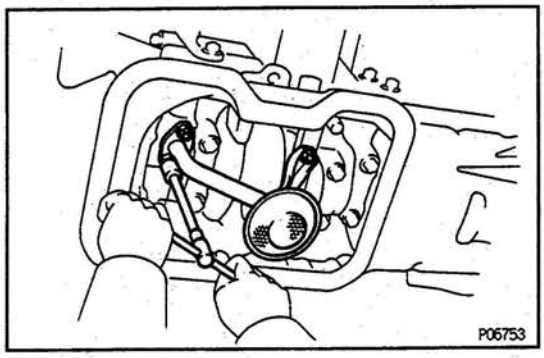
(b) Remove the 13 bolts, two nuts and No.2 oil pan.



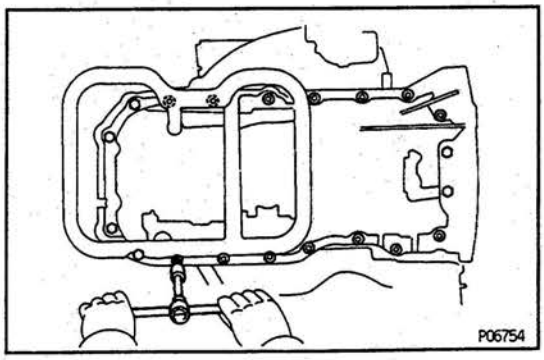
(c) Insert the blade of SST between the cylinder block and oil pan, and cut off applied sealer and remove the oil pan.
SST 09032–00100
NOTICE:
- **Do not use SST for the oil pump body side and rear oil seal retainer.**
- **Be careful not to damage the oil pan flange.**



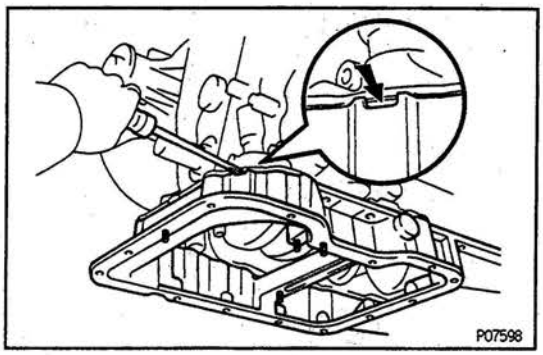
7. REMOVE OIL PAN BAFFLE PLATE
Remove the two bolts, two nuts and buffle plate.



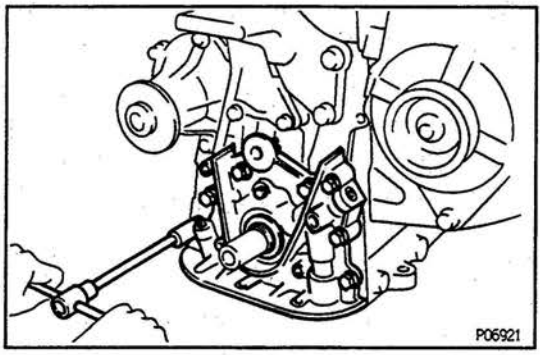
8. REMOVE OIL STRAINER
Remove the three nuts, oil strainer and gasket.



9. REMOVE NO.1 OIL PAN
(a) Remove the six bolts.
(b) Using 5 mm hexagon wrench, remove the 14 bolts and No.1 oil pan.

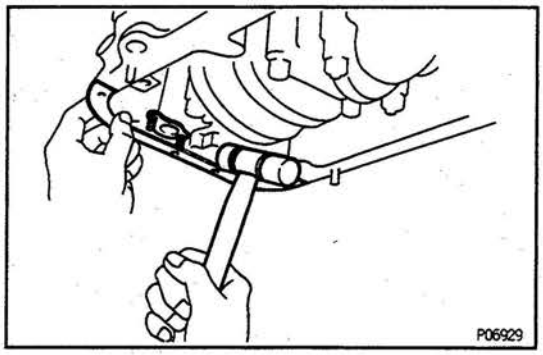


(c) Remove the No.1 oil pan by prying the portions between the clinder block and No.1 oil pan with a screwdriver.
NOTICE: Be careful not to damage the contact surfaces of the cylinder block and No.1 oil pan.



10. REMOVE OIL PUMP

(a) Remove the seven bolts.



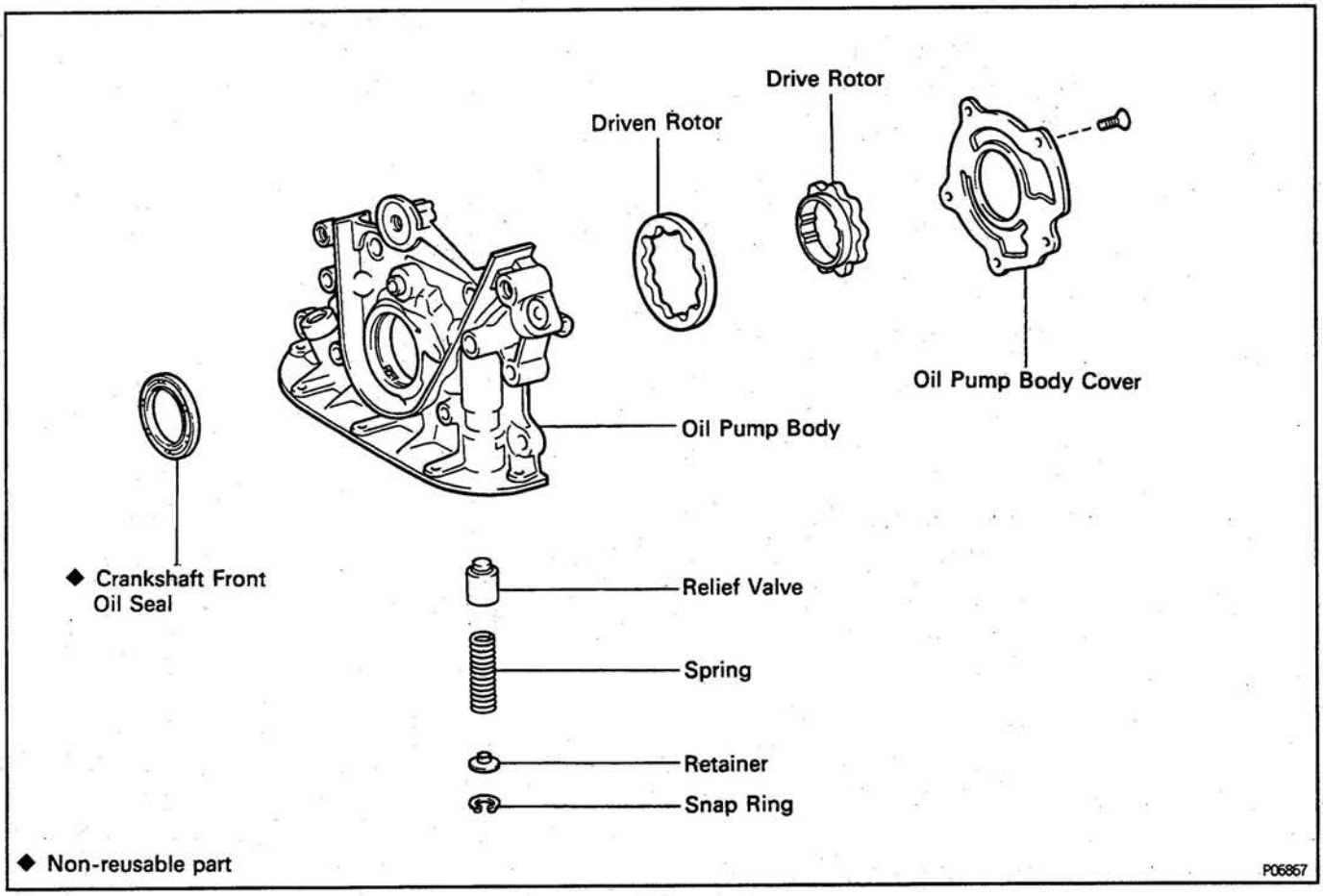
(b) Using a plastic–faced hammer, remove the oil pump by carefully tapping the oil pump body.

(c) Remove the gasket.

EG

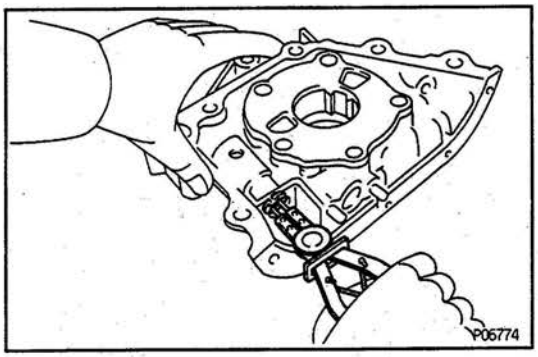
COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

E0156-03



E0156-02

OIL PUMP DISASSEMBLY

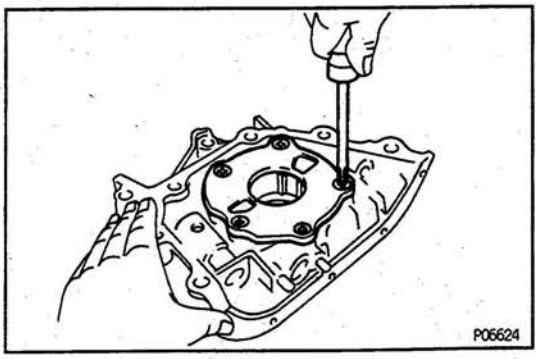


(See Components for Disassembly and Assembly)

1. REMOVE RELIEF VALVE

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

(b) Remove the retainer, spring and relief valve.

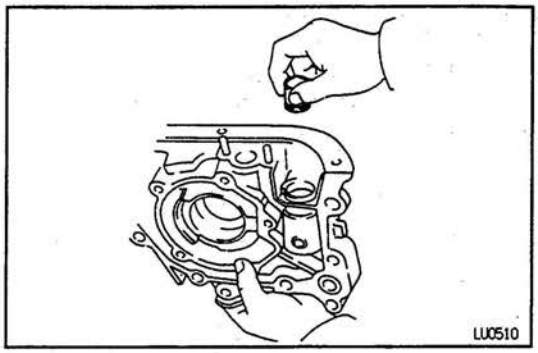


2. REMOVE DRIVE AND DRIVEN ROTORS

Remove the five screws, pump body cover, O–ring, the drive and driven rotors.

EG17A–02

OIL PUMP INSPECTION

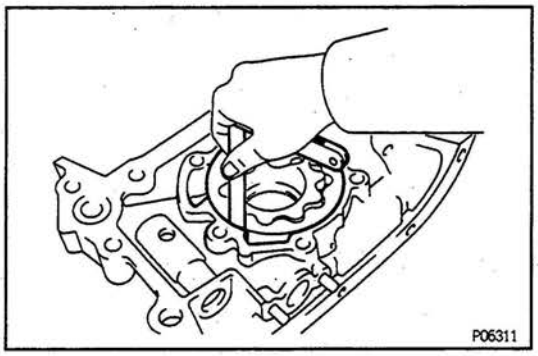


1. **INSPECT RELIEF VALVE**

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

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

2. **INSPECT DRIVE AND DRIVEN ROTORS**



A. Inspect rotor body clearance

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

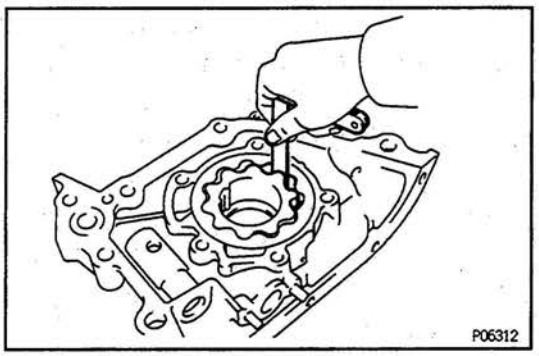
Standard body clearance:

0.080 – 0.180 mm (0.0031 – 0.0071 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 thickness gauge, measure the clearance between the drive and driven rotor tips.

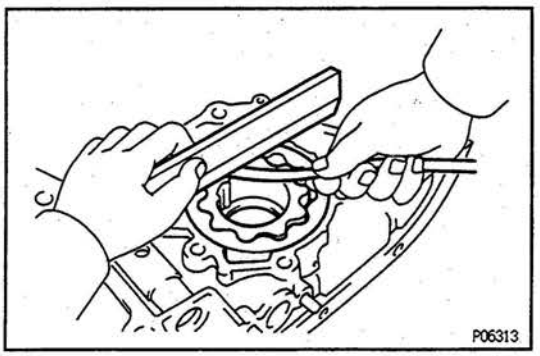
Standard tip clearance:

0.025 – 0.085 mm (0.0010 – 0.0033 in.)

Maximum tip clearance:

0.35 mm (0.0138 in.)

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



C. Inspect rotor side clearance

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

Standard side clearance:

0.025 – 0.085 mm (0.0010 – 0.0033 in.)

Maximum side clearance:

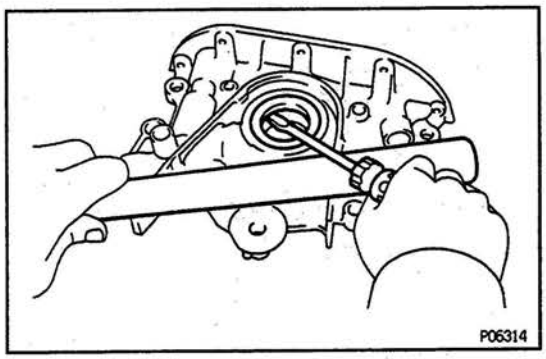
0.10 mm (0.0039 in.)

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

EG

CRANKSHAFT OIL SEALS REPLACEMENT EG178-02

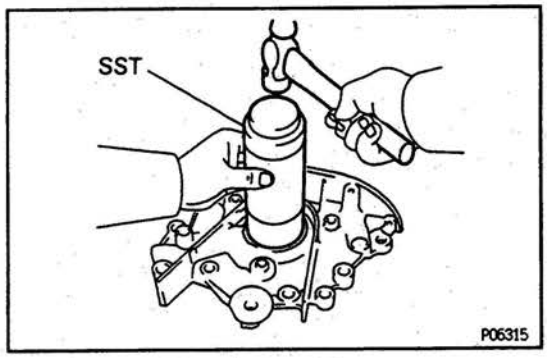
HINT: There are two methods (A and B) to replace the oil seal which are as follows:



1. REPLACE CRANKSHAFT FRONT OIL SEAL

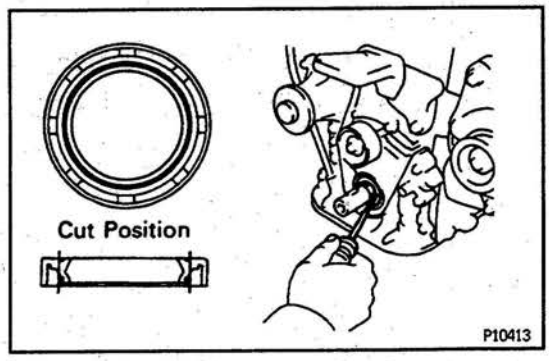
A. If oil pump is removed from cylinder block:

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



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump case edge.
SST 09309–37010

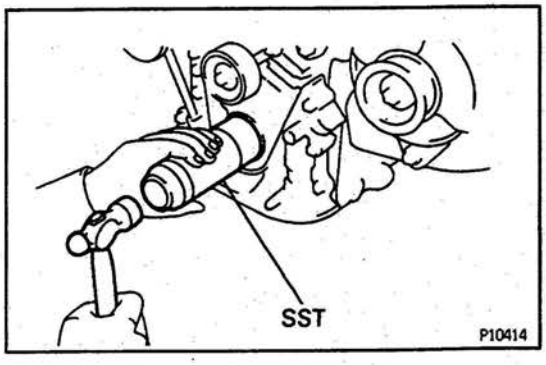
(c) Apply MP grease to the oil seal lip.



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

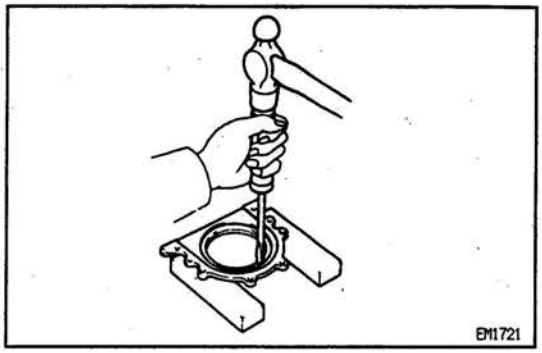
(a) Using a knife, cut off the oil seal lip.

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



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

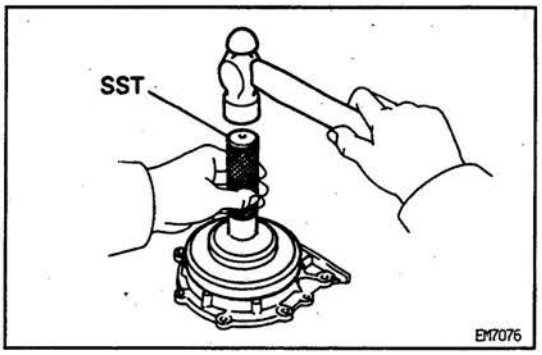
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.
SST 09309–37010



2. REPLACE CRANKSHAFT REAR OIL SEAL

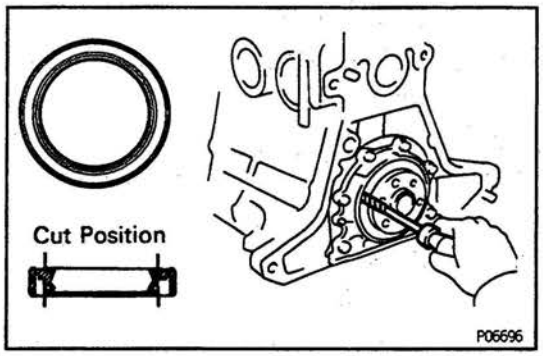
A. If rear oil seal retainer is removed from cylinder block:

(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 edge.
SST 09223–41020

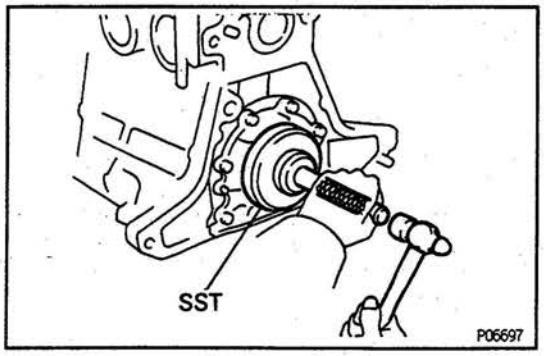
(c) Apply MP grease to the oil seal lip.



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

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

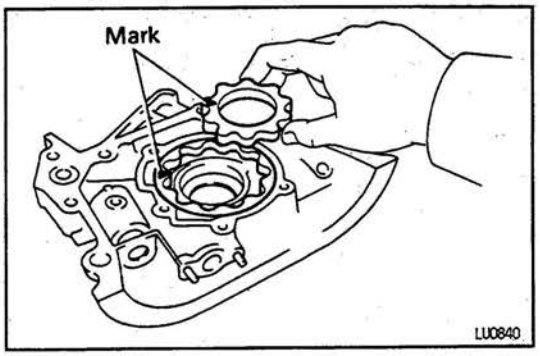
(b) Using a screwdriver, pry out the oil seal.
NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.



(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 09223–41020

EG

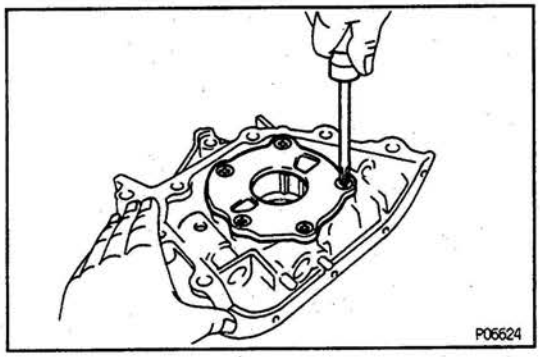


OIL PUMP ASSEMBLY

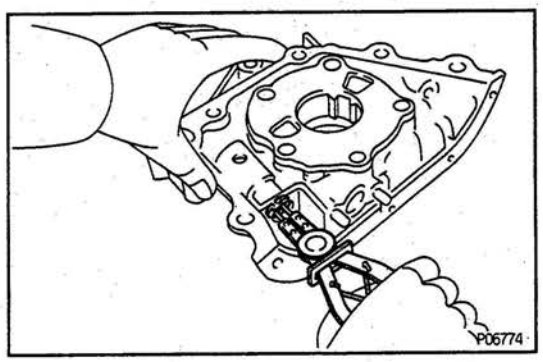
(See Components for Disassembly and Assembly)

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.



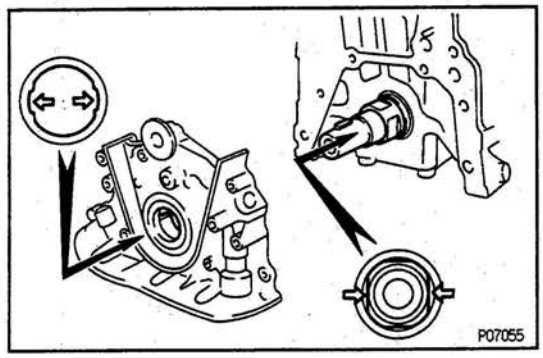
(b) Install the oil pump body cover with the five screws.
Torque: 10 N·m (105 kgf·cm, 8 ft·lbf)



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.



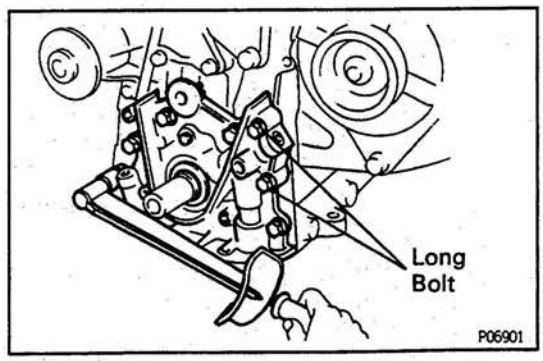
OIL PUMP INSTALLATION

(See Components for Removal and Installation)

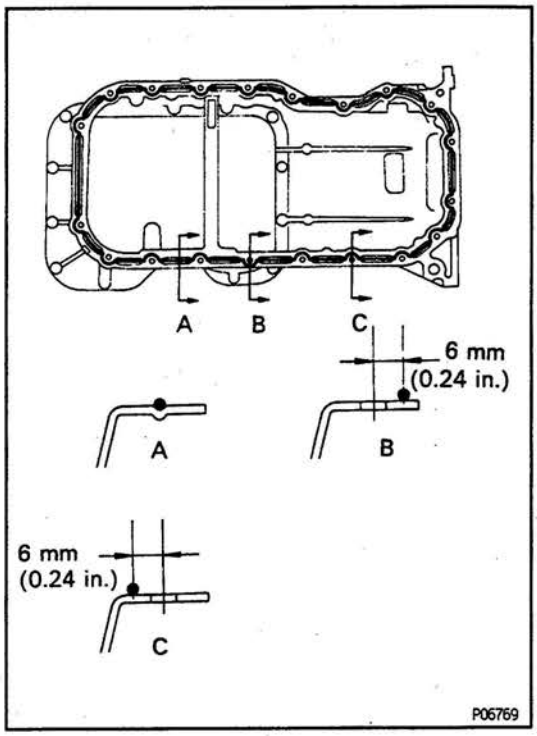
1. **INSTALL OIL PUMP**

(a) Place a new gasket on the cylinder block.

(b) Engage the spline teeth of the oil pump drive rotor with the large teeth of the crankshaft, and slide the oil pump.



(c) Install the oil pump with the seven bolts.
Torque: 21 N·m (218 kgf·cm, 16 ft·lbf)
Bolt length:
35 mm (1.38 in.) for long bolt
25 mm (0.98 in.) for other bolt



2. INSTALL NO.1 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.

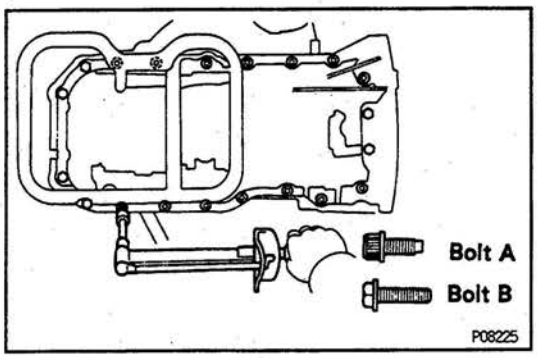
NOTICE: Do not use a solvent which will affect the painted surfaces.

(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 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



(c) Using 5 mm hexagon wrench, install the No.1 oil pan with the new 14 bolts. Torque the botls.

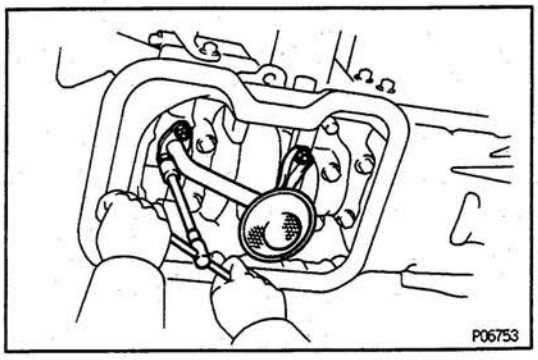
Bolt A

Torque: 16 N·m (165 kgf·cm, 12 ft·lbf)

(d) Install the six bolts. Torque the bolts.

Bolts B

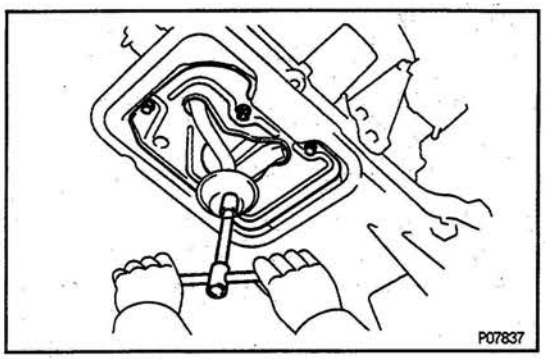
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)



3. INSTALL OIL STRAINER

Install a new gasket and the oil strainer with the three nuts.

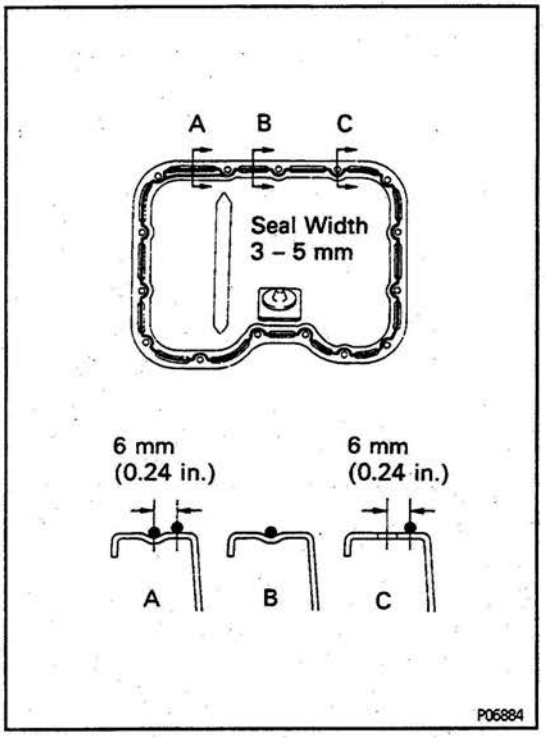
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



EG

4. INSTALL OIL PAN BAFFLE PLATE

Install the baffle plate with the two bolts and nuts.
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)



5. INSTALL NO.2 OIL PAN

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

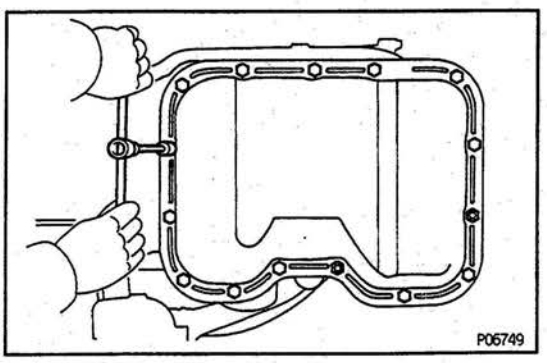
- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

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

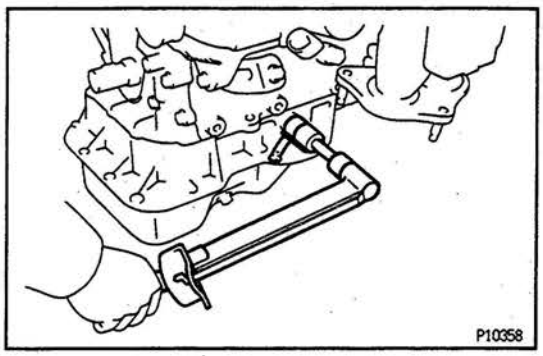
(b) Apply seal packing to the oil pan as shown in the illustration.

Seal packing:
Part No. 08826–00080 or equivalent

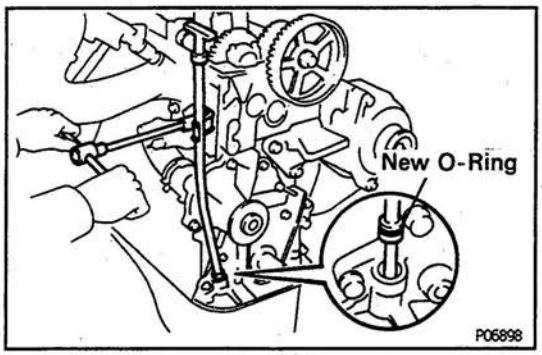
- Install a nozzle that has been cut to a 3 – 5 mm (0.12 – 0.20 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



(c) Install the No.2 oil pan with the 13 bolts and two nuts.
Torque: 4.9 N·m (50 kgf·cm, 43 in.·lbf)

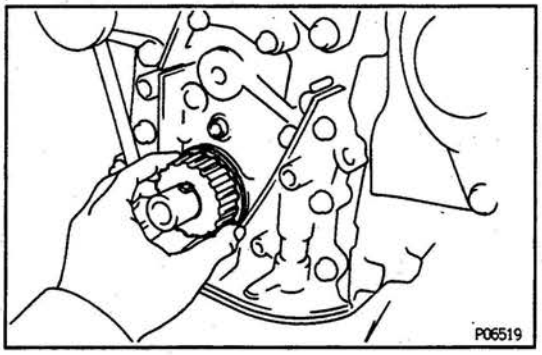


(d) (w/ Oil cooler)
Install the oil cooler union with two new gaskets and the union bolt.
Torque: 34 N·m (350 kgf·cm, 25 ft·lbf)



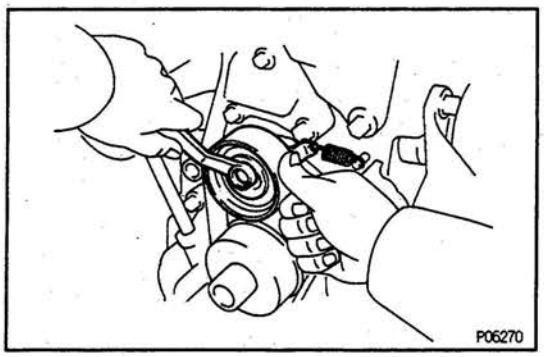
6. INSTALL OIL DIPSTICK GUIDE AND DIPSTICK

(a) Install a new O–ring to the dipstick guide.
(b) Apply soapy water to the O–ring.
(c) Push in the dipstick guide together with the dipstick, and install them with the bolt.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



7. 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.



8. TEMPORARILY INSTALL IDLER PULLEY AND TENSION SPRING

(a) Install the idler pulley with the bolt. Do not tighten the bolt yet.
(b) Install the tension spring.
(c) Push the pulley toward the left as far as it will go and tighten the bolt.

9. INSTALL TIMING BELT
(See steps 4 to 14 on pages EG–41 to 46)
10. FILL WITH ENGINE OIL
11. START ENGINE AND CHECK FOR OIL LEAKS
12. RECHECK ENGINE OIL LEVEL

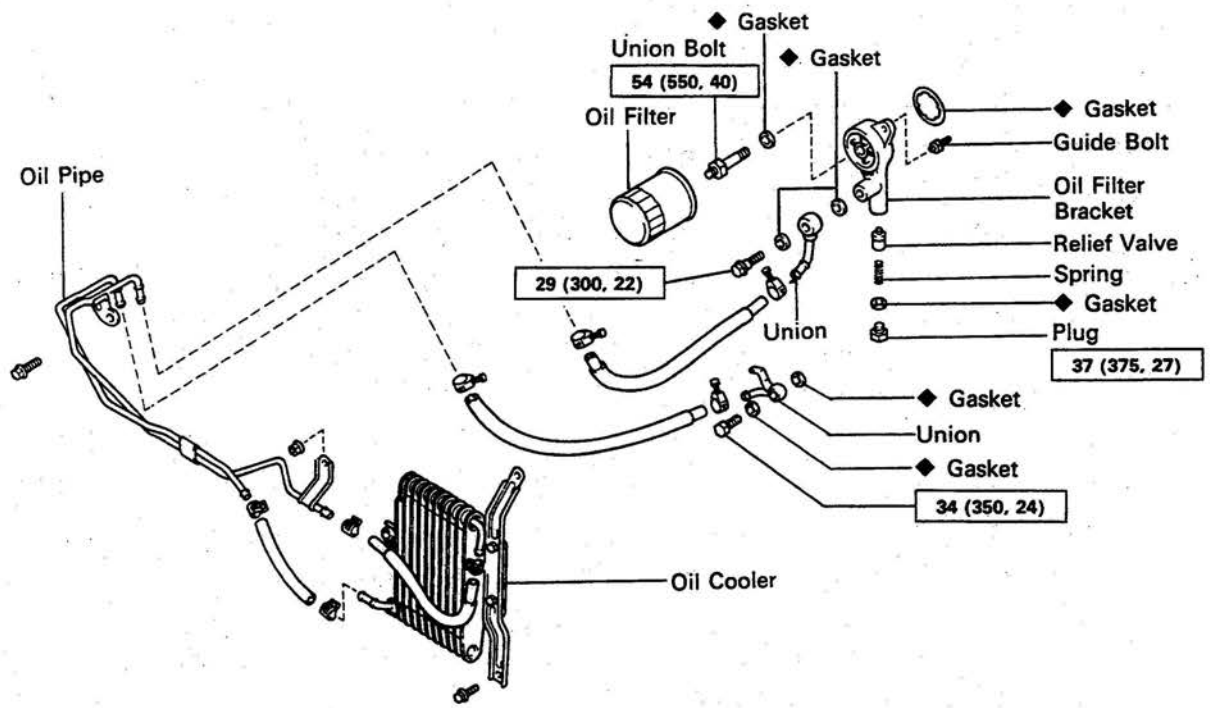
OIL COOLER

COMPONENTS FOR REMOVAL AND INSTALLATION

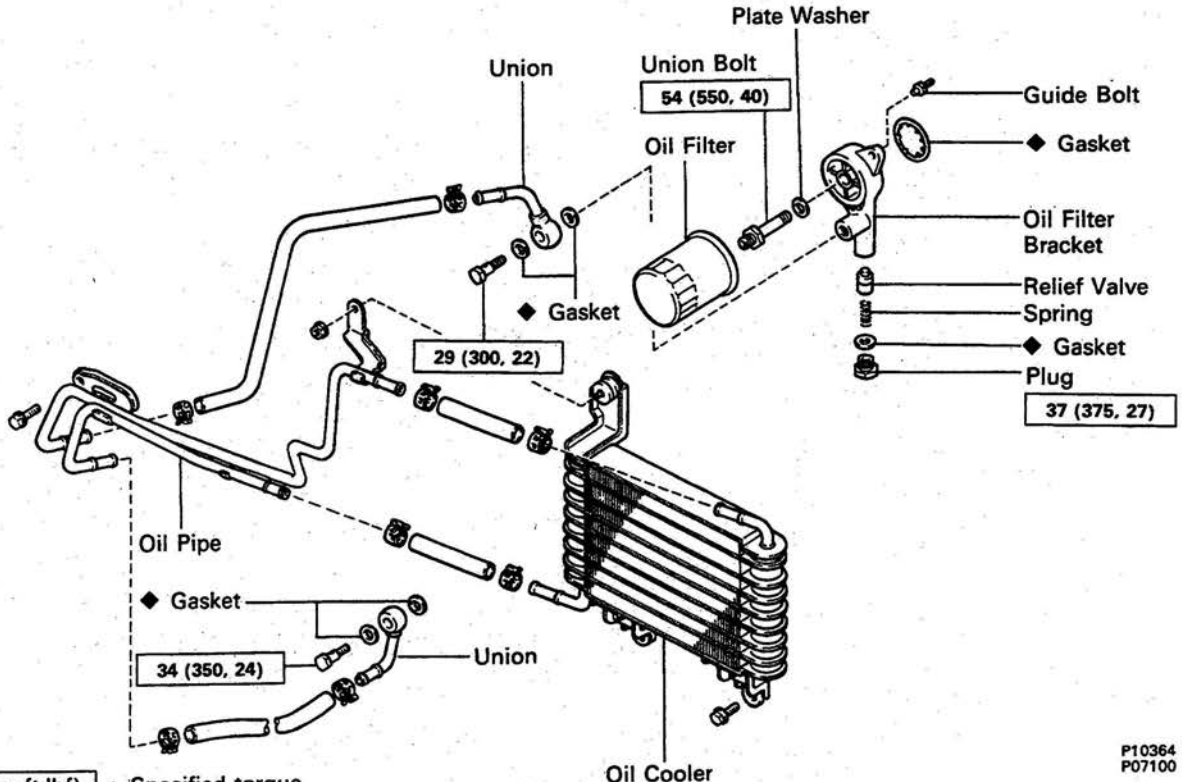
B0170-02

EG

AE93



AE102



P10364
P07100

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

◆ Non-reusable part

Z05991

SERVICE SPECIFICATIONS

SERVICE DATA

EG15A–05

Oil presuure	At idle speed (normal operating temperature)	29 kPa (0.3 kgf/cm², 43 psi) or more
	At 3,000 rpm (normal operating temperature)	245 — 490 kPa (2.5 — 5.0 kgf/cm², 36 — 71 psi)
Oil pump	Body clearance (STD)	0.080 — 0.180 mm (0.0031 — 0.0071 in.)
	Body clearance Maximum)	0.20 mm (0.0079 in.)
	Tip clearance (STD)	0.025 — 0.085 mm (0.0010 — 0.0033 in.)
	Tip clearance (Maximum)	0.35 mm (0.0138 in.)
	Side clearance (STD)	0.025 — 0.085 mm (0.0010 — 0.0033 in.)
	Side clearance (Maximum)	0.10 mm (0.0039 in.)

TORQUE SPECIFICATIONS

EG15C–05

Part tightened	N·m	kgf·cm	ft·lbf
Oil pan x Drain plug	34	350	25
Oil pump body cover x Oil pump body	10	105	8
Oil pump x Cylinder block	21	218	16
No.1 Oil pan x Cylinder block	16	165	12
No.1 Oil pan x Oilpump	7.8	80	69in.·lbf
No.1 Oil pan x Rear oil seal retainer	7.8	80	69in.·lbf
Oil strainer x Cylinder block	9.3	95	82 in.·lbf
Oil strainer x Oil pump	9.3	95	82 in.·lbf
Oil pan baffle plate x No.1 Oil pan	7.8	80	69 in.·lbf
No.2 Oil pan x No.1 Oil pan	4.9	50	43 in.·lbf
Dipstick guide x Water inlet No.2	9.3	95	82 in.·lbf