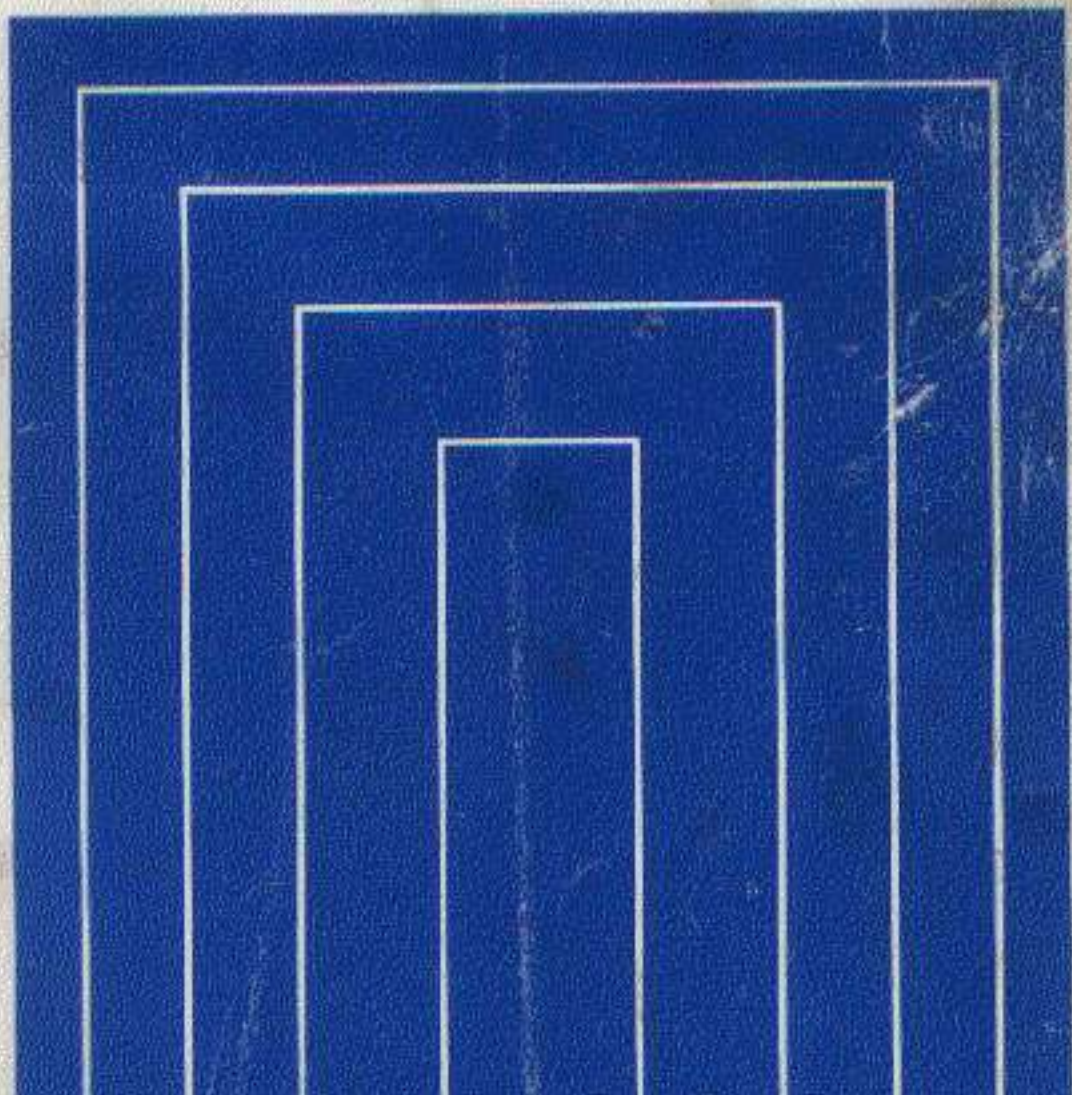
TOYOTA

3S-GTE ENGINE

REPAIR MANUAL SUPPLEMENT

Feb., 1994



NOTE: The following screen toning letters section refer to 3S-GE Engine Repair Manual (Pub.No.RM396E).

INTRODUCTION IN
ENGINE EG
IGNITION SYSTEM IG
STARTING SYSTEM ST
CHARGING SYSTEM CH

INTRODUCTION

HOW TO USE THIS MANUAL ..... IN- 2
IDENTIFICATION INFORMATION ..... IN- 4
GENERAL REPAIR INSTRUCTIONS ..... IN- 5
PRECAUTION ..... IN- 8
ABBREVIATIONS USED IN THIS MANUAL ..... IN- 9
STANDARD BOLT TORQUE SPECIFICATIONS ..... IN- 10

HOW TO USE THIS MANUAL

IN00F–01

INDEX

An INDEX is provided on the first page of each section to guide you to the item to be repaired. To assist you in finding your way through the manual, the Section Title and major heading are given at the top of every page.

IN00G–01

GENERAL DESCRIPTION

At the beginning of each section, a General Description (Precautions) is given that pertains to all repair operations contained in that section.
Read these precautions before starting any repair task.

IN00H–01

TROUBLESHOOTING

TROUBLESHOOTING tables are included for each system to help you diagnose the problem and find the cause.

IN00J–01

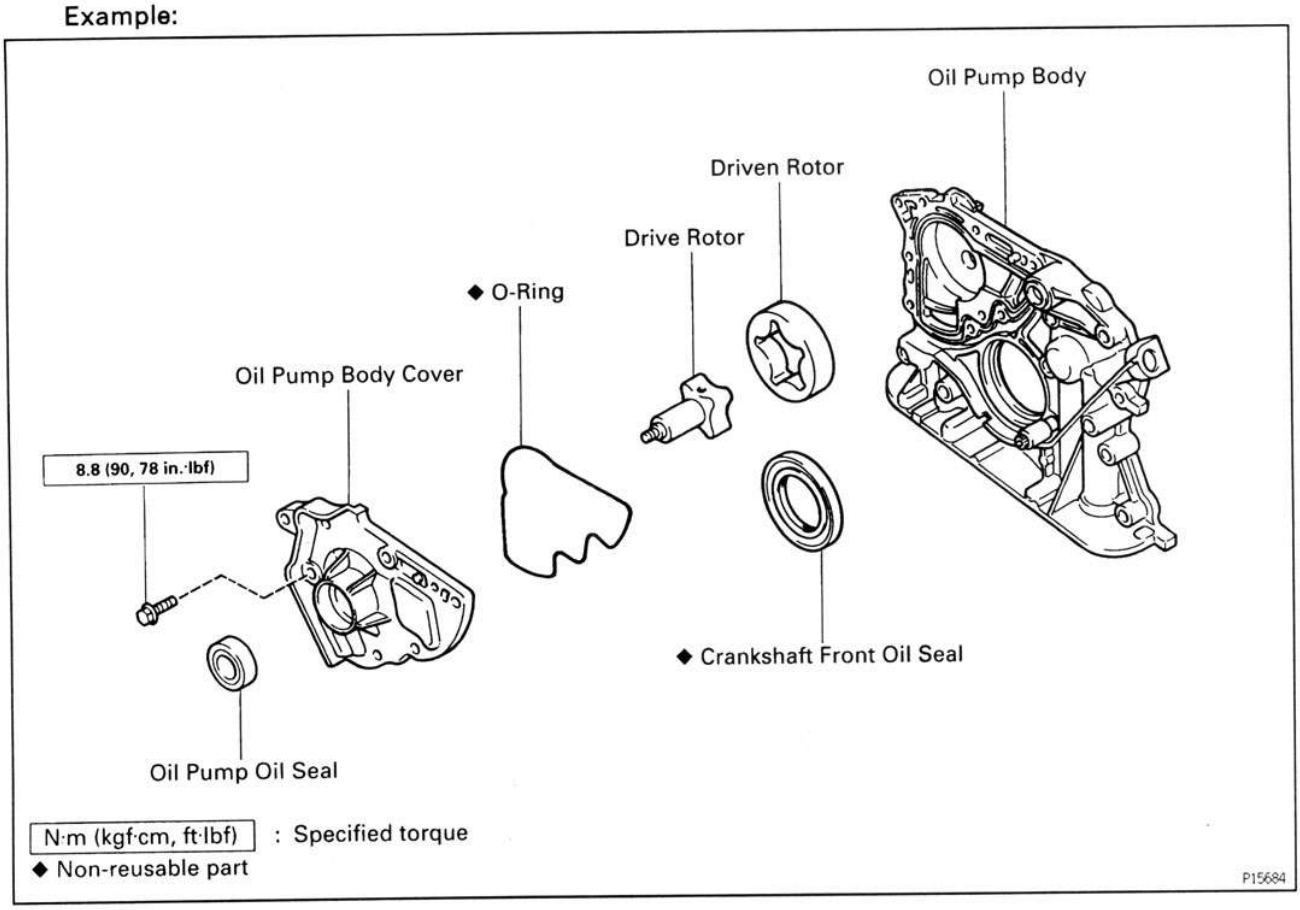
PREPARATION

Preparation lists the SST (Special Service Tools), recommended tools, equipment, lubricant and SSM (Special Service Materials) which should be prepared before beginning the operation and explains the purpose of each one.

IN00K–06

REPAIR PROCEDURES

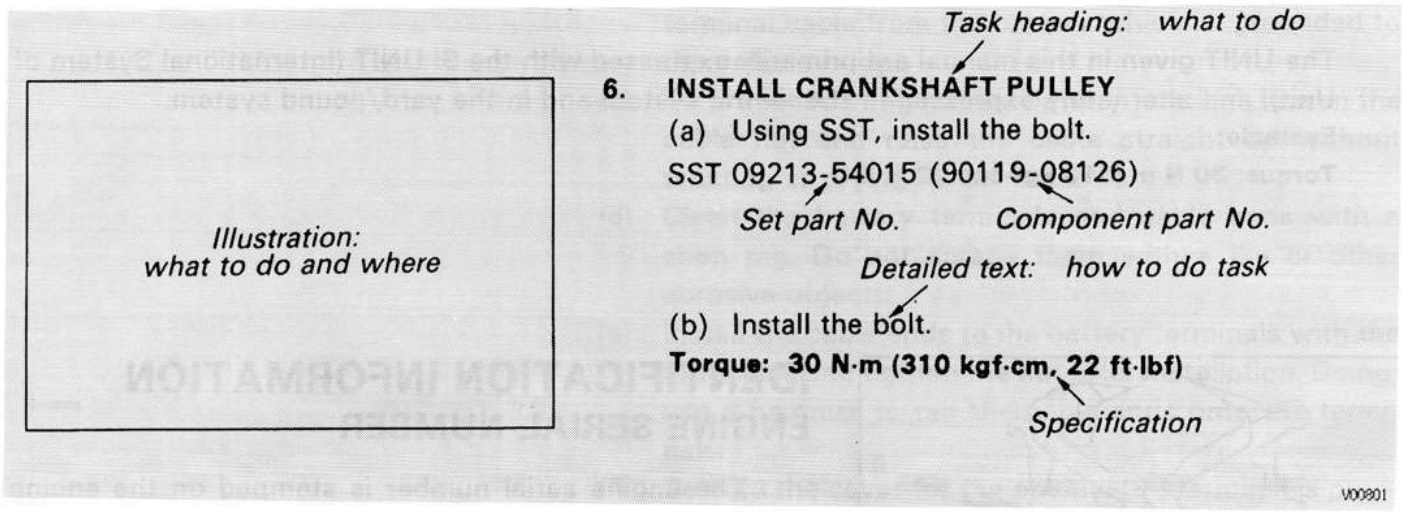
Most repair operations begin with an overview illustration. It identifies the components and shows how the parts fit together.
Example:



The procedures are presented in a step–by–step format:

- The illustration shows what to do and Where to do it.
- The task heading tells what to do.
- The detailed text tells how to perform the task and gives other information such as specifications and warnings.

Exapmle:



This format provides the experienced technician with a FAST TRACK to the information needed. The upper case task heading can be read at a glance when necessary, and the text below it provides detailed information. Important specifications and warnings always stand out in bold type.

REFERENCES

IN00L–01

References have been kept to a minimum. However, when they are required you are given the page to refer to.

SPECIFICATIONS

IN00M–01

Specifications are presented in bold type throughout the text where needed. You never have to leave the procedure to look up your specifications. They are also found at the end of each section, for quick reference.

CAUTIONS, NOTICES, HINTS:

IN00N – 02

- CAUTIONS are presented in bold type, and indicate there is a possibility of injury to you or other people.
- NOTICES are also presented in bold type, and indicate the possibility of damage to the components being repaired.
- HINTS are separated from the text but do not appear in bold. They provide additional information to help you efficiently perform the repair.

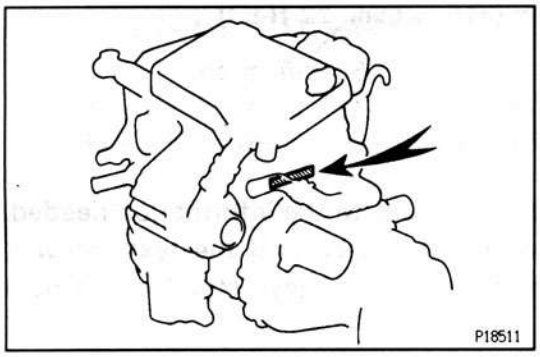
SI UNIT

IN00P – 03

The UNIT given in this manual are primarily expressed with the SI UNIT (International System of Unit), and alternately expressed in the metric system and in the yard/pound system.

Example:

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

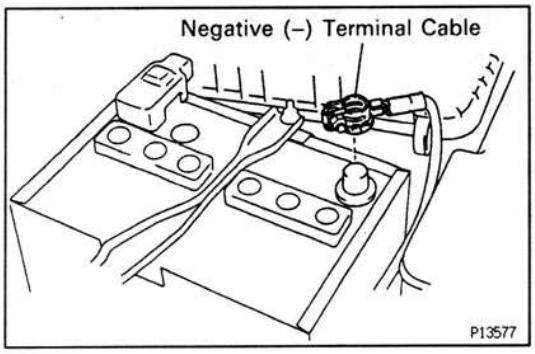


IDENTIFICATION INFORMATION

IN00Q – 07

ENGINE SERIAL NUMBER

The engine serial number is stamped on the engine block as shown.



GENERAL REPAIR INSTRUCTIONS

IN04A–03

1. Use fender, seat and floor covers to keep the vehicle clean and prevent damage.
2. During disassembly, keep parts in the appropriate order to facilitate reassembly.
3. Observe the following:

(a) Before performing electrical work, disconnect the negative (–) terminal cable from the battery.

(b) If it is necessary to disconnect the battery for inspection or repair, always disconnect the the negative (–) terminal cable from the battery which is grounded to the vehicle body.

(c) To prevent damage to the battery terminal, loosen the cable nut and raise the cable straight up without twisting or prying it.

(d) Clean the battery terminals and cable ends with a shop rag. Do not scrape them with a file or other abrasive objects.

(e) Install the cable ends to the battery terminals with the nut loose, and tighten the nut after installation. Do not use a hammer to tap the cable ends onto the terminals.

(f) Be sure the cover for the positive(+) terminal is properly in place.

4. Check hose and wiring connectors to make sure that they are secure and correct.
5. Non–reusable parts.

(a) Always replace cotter pins, gaskets, O–rings and oil seals etc. with new ones.

(b) Non–reusable parts are indicated in the component illustrations by the "◆" symbol.

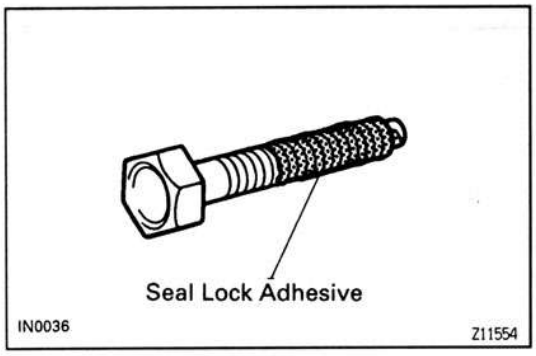
6. Precoated parts.
   Precoated parts are bolts and nuts, etc. that are coated with a seal lock adhesive at the factory.

(a) If a precoated part is retightened, loosened or caused to move in any way, it must be recoated with the specified adhesive.

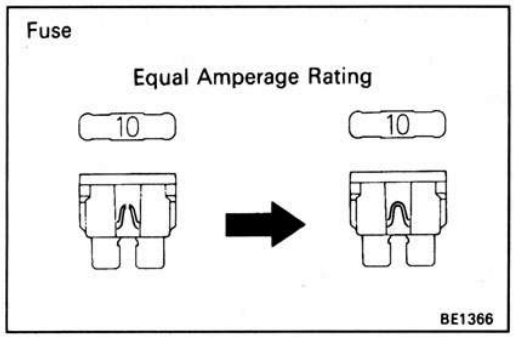
(b) When reusing precoated parts, clean off the old adhesive and dry with compressed air. Then apply the specified seal lock adhesive to the bolt, nut or threads.

(c) Precoated parts are indicated in the component illustrations by the "★" symbol.

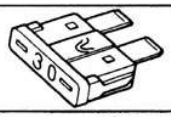
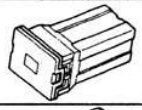
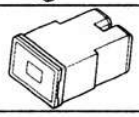
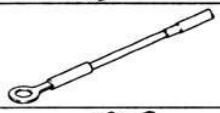
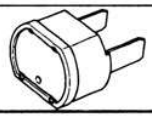
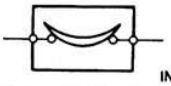
7. When necessary, use a sealer on gaskets to prevent leaks.
8. Carefully observe all specifications for bolt tightening torques. Always use a torque wrench.



9. Use of special service tools (SST) and special service materials (SSM) may be required, depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found in the preparation part at the front of each section in this manual.



10. When replacing fuses, be sure the new fuse has the correct amperage rating . DO NOT exceed the rating or use one with a lower rating.

Illustration	Symbol	Part Name	Abbreviation
 BE5594	 IN0365	FUSE	FUSE
 BE5595	 IN0366	MEDIUM CURRENT FUSE	M-FUSE
 BE5596	 IN0367	HIGH CURRENT FUSE	H-FUSE
 BE5597	 IN0367	FUSIBLE LINK	FL
 BE5598	 IN0368	CIRCUIT BREAKER	CB

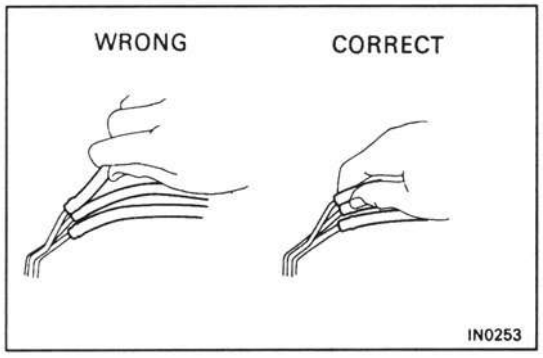
V00076

11. Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.
(a) If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels at the opposite end in order to ensure safety.

(b) After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on a vehicle raised on a jack alone, even for a small job that can be finished quickly.

12. Observe the following precautions to avoid damage to the parts:

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

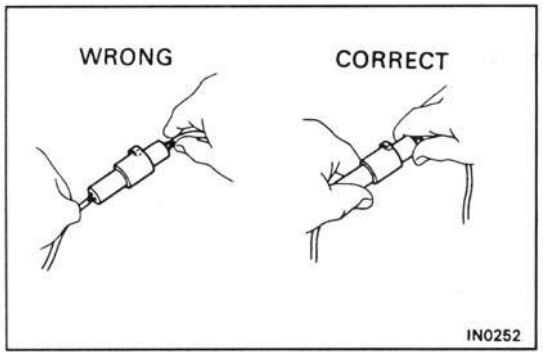


(b) To disconnect vacuum hoses, pull on the end, not the middle of the hose.

(c) To pull apart electrical connectors, pull on the connector itself, not the wires.

(d) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.

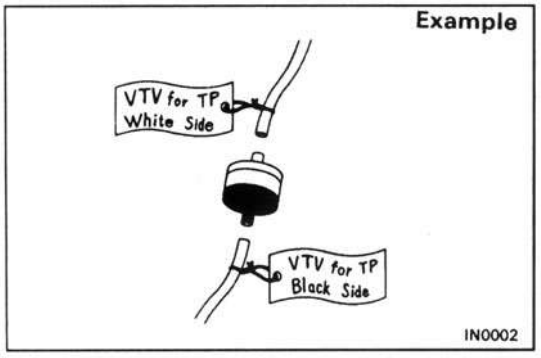
(e) When steam cleaning an engine, protect the distributor, igniter and air filter from water.



(f) Never use an impact wrench to remove or install temperature switches or temperature sensors.

(g) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.

(h) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step—down adapter instead. Once the hose has been stretched, it may leak.



13. Tag hoses before disconnecting them:

(a) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.

(b) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.

14. Unless otherwise stated, all resistance is measured at an ambient temperature of 20°C (68°F). Because the resistance may be outside specifications if measured at high temperatures immediately after the vehicle has been running, measurements should be made when the engine has cooled down.

PRECAUTION

FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER

IN00T–02

CAUTION: If large amounts of unburned gasoline flow into the converter, it may overheat and create a fire hazard. To prevent this, observe the following precautions and explain them to your customer.

IN

1. **Use only unleaded gasoline.**

2. **Avoid prolonged idling.**
   Avoid running the engine at idle speed for more than 20 minutes.

3. **Avoid spark jump test.**
(a) Perform spark jump test only when absolutely necessary. Perform this test as rapidly as possible.
(b) While testing, never race the engine.

4. **Avoid prolonged engine compression measurement.**
   Engine compression tests must be done as rapidly as possible.

5. **Do not run engine when fuel tank is nearly empty.**
   This may cause the engine to misfire and create an extra load on the converter.

6. **Avoid coasting with ignition turned off and prolonged braking.**

7. **Do not dispose of used catalyst along with parts contaminated with gasoline or oil.**

IF VEHICLE IS EQUIPPED WITH MOBILE COMMUNICATION SYSTEM

IN02R–06

For vehicles with mobile communication systems such as two–way radios and cellular telephones, observe the following precautions.

(1) Install the antenna as far as possible away from the ECU and sensors of the vehicle's electronic system.
(2) Install the antenna feeder at least 20 cm (7.87 in.) away from the ECU and sensors of the vehicle's electronics systems. For details about ECU and sensors locations, refer to the section on the applicable component.
(3) Do not wind the antenna feeder together with the other wiring. As much as possible, also avoid running the antenna feeder parallel with other wire harnesses.
(4) Confirm that the antenna and feeder are correctly adjusted.
(5) Do not install powerful mobile communications system.

ABBREVIATIONS USED IN THIS MANUAL

IN031–08

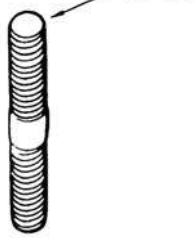
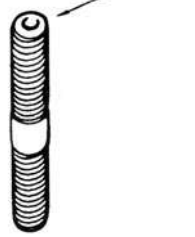
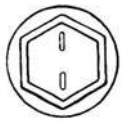
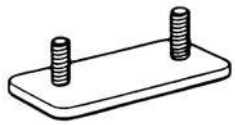
A/C	Air conditioner
BTDC	Before Top Dead Center
BVSV	Bimetallic Vacuum Switching Valve
CPU	Central Processing Unit
DOHC	Double Over Head Cam
ECU	Electronic Control Unit
EFI	Electronic Fuel Injection
ESA	Electronic Spark Advance
EGR	Exhaust Gas Recirculation
FIPG	Formed in Place Gasket
FL	Fusible Link
H–Fuse	High Current Fuse
IC	Integrated Circuit
IG	Ignition
ISC	Idle Speed Control
LH	Left–Hand
M–Fuse	Medium Current Fuse
MP	Multipurpose
PCV	Positive Crankcase Ventilation
PS	Power Steering
RH	Right–Hand
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch
TCCS	TOYOTA Computer controlled System
TDC	Top Dead Center
TEMP.	Temperature
TWC	Three–Way Catalyst
U/S	Undersize
VSV	Vacuum Switching Valve
w/	With
w/o	Without

STANDARD BOLT TORQUE SPECIFICATIONS

IN008-03

IN

HOW TO DETERMINE BOLT STRENGTH

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

SPECIFIED TORQUE FOR STANDARD BOLTS

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

ENGINE

ENGINE MECHANICAL ..... EG– 2
- DESCRIPTION ..... EG– 2
- OPERATION ..... EG– 2
- PREPARATION ..... EG– 4
- TUNE–UP ..... EG– 6
- IDLE CO/HC CHECK ..... EG– 34
- COMPRESSION CHECK ..... EG– 36
- CYLINDER HEAD ..... EG– 39
- CYLINDER BLOCK ..... EG– 71
- SERVICE SPECIFICATIONS ..... EG– 73

TURBOCHARGER SYSTEM ..... EG– 78
- DESCRIPTION ..... EG– 78
- SYSTEM CIRCUIT ..... EG– 79
- OPERATION ..... EG– 80
- PREPARATION ..... EG– 81
- PRECAUTION ..... EG– 82
- TROUBLESHOOTING ..... EG– 83
- TURBOCHARGER ..... EG– 85
- INTERCOOLER ..... EG– 96
- INTERCOOLER RELAY EG–104
- TURBO PRESSURE SENSOR EG–105
- VSV (For Turbocharging Pressure) EG–108
- SERVICE SPECIFICATIONS EG–109

EFI SYSTEM EG–110
- DESCRIPTION EG–110
- OPERATION EG–112
- PREPARATION EG–115
- DIAGNOSIS SYSTEM EG–117
- TROUBLESHOOTING w/ VOLT, OHMMETER EG–120
- FUEL PUMP EG–138
- PRESSURE REGULATOR EG–144
- INJECTOR EG–147
- THROTTLE BODY EG–160
- INTAKE AIR TEMPERATURE SENSOR EG–168
- SOLENOID RESISTOR EG–169
- FUEL PUMP RELAY AND RESISTOR EG–170
- SERVICE SPECIFICATIONS EG–172

COOLING SYSTEM EG–175
- OPERATION EG–175
- WATER PUMP EG–176
- SERVICE SPECIFICATIONS EG–178

LUBRICATION SYSTEM EG–179
- OPERATION EG–179
- OIL PUMP EG–180
- OIL COOLER EG–182
- SERVICE SPECIFICATIONS EG–183

REFER TO 3S-GE ENGINE REPAIR MANUAL (Pub. No. RM396E)

NOTE: The above pages contain only the points which differ from the above listed manual.

ENGINE MECHANICAL

DESCRIPTION

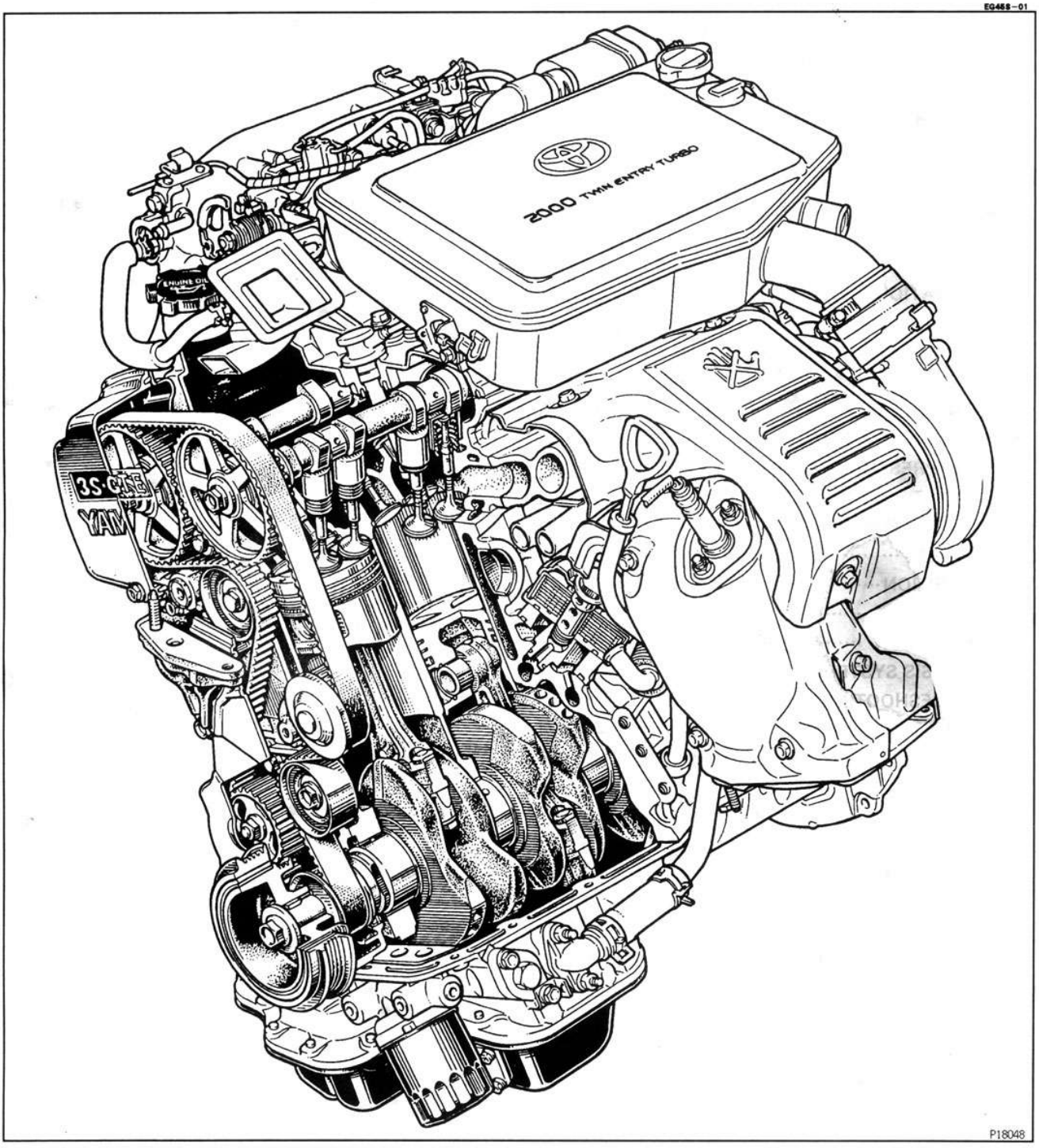
EG43D-01

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

EG

OPERATION

EG46S-01



P18048

The 3S—GTE 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 ignition order is 1 — 3 — 4 — 2. The cylinder head is made of 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.

Both the intake camshaft and the exhaust camshaft are driven by a single timing belt. The cam journal is supported at 5 places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journals and cams 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 inner shim type system, in which valve adjusting shims are located below the valve lifters. To replace the shims, the camshafts must be removed.

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

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

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

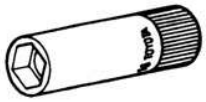
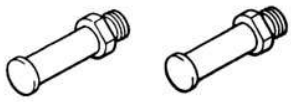
The top of each cylinder is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder contains a water jacket, through which coolant is pumped to cool the cylinders.

The No.1 and No.2 oil pans are bolted onto the bottom the cylinder block. The No.1 oil pan is made of alumimum alloy. The No.2 oil pan is an oil reservoir made of pressed sheet steel. The dividing plate also prevents the oil from shifting away from the oil pump suction pipe when the vehicle is stopped suddenly.

PREPARATION

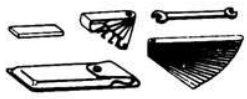
SST (SPECIAL SERVICE TOOLS)

EG45V-01

	09043—38100	Hexagon 10 mm Wrench	Cylinder head bolt
	09155—16100	Spark Plug Wrench	
	09216—00021	Belt Tension Gauge	
	09216—00030	Belt Tension Gauge Cable	
	09223—46011	Crankshaft Front Oil Seal Replacer	Camshaft oil seal
	09249—63010	Torque Wrench Adaptor	
	09843—18020	Diagnosis Check Wire	
	09960—10010	Variable Pin Wrench Set	
	(09962—01000)	Variable Pin Wrench Arm Assy	Camshaft timing pulley Oil pump pulley
	(09963—01000)	Pin 10	Camshaft timing pulley

EG45W-01

RECOMMENDED TOOLS

	09200—00010	Engine Adjust Kit	

EG45Y–01

EQUIPMENT

Battery specific gravity gauge	
CO/HC meter	
Dial indicator	
Engine tune–up tester	
Micrometer	
Precision straight edge	
Torque wrench	

EG46Z–01

COOLANT

Item	Capacity	Classification
Engine coolant	7.0 liters (7.4 US qts, 6.2 Imp. qts)	Ethylene–glycol base

EG14X–0M

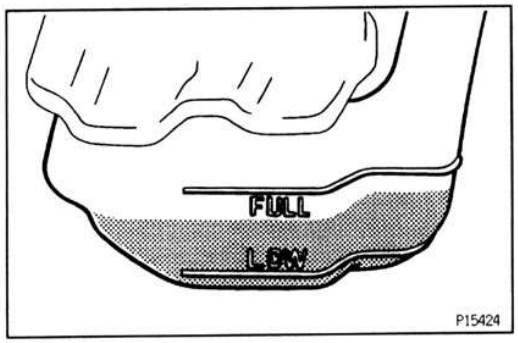
LUBRICANT

Item	Capacity	Classification
Engine oil		API grade SG or SH multigrade engine oil or ILSC multigrade engine oil and recommended viscosity oil
Dry fill	5.2 liters (5.5 US qts, 4.6 Imp. qts)	
Drain and refill		
w/ Oil filter change	4.5 liters (4.8 US qts, 4.0 Imp. qts)	
w/o Oil filter change	4.0 liters (4.2 US qts, 3.5 Imp. qts)	

EG460–01

SSM (SERVICE SPECIAL MATERIALS)

08826–00080	Seal Packing Black or equivalent (FIPG)	Camshaft bearing cap Cylinder head cover
08833–00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	No.1 idler pulley pivot bolt Oil pressure switch



TUNE–UP

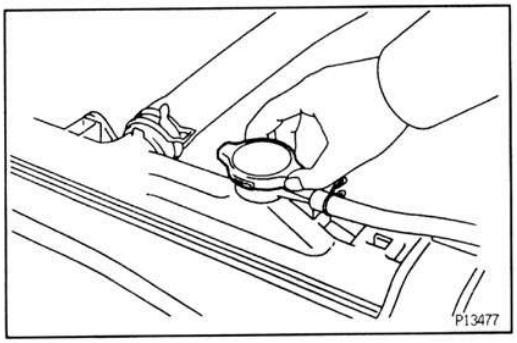
EG45X–01

ENGINE COOLANT INSPECTION

1. CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR

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

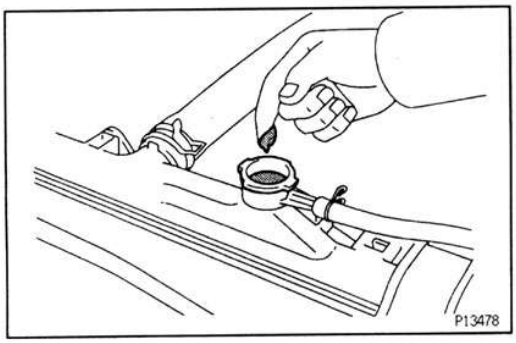
If low, check for leaks and add engine coolant up to the "FULL" line.



2. CHECK ENGINE COOLANT QUALITY

(a) Remove the radiator cap.

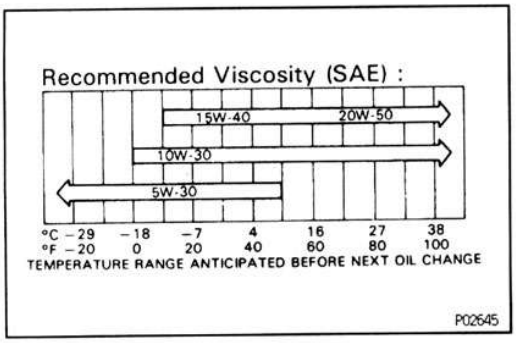
CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.



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

If excessively dirty, replace the coolant.

(c) Reinstall the radiator cap.



EG084–0Y

ENGINE OIL INSPECTION

1. CHECK ENGINE OIL QUALITY

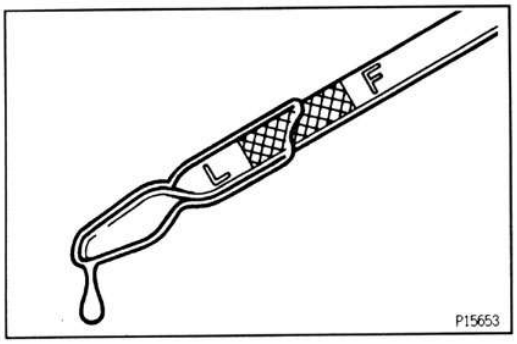
Check the oil for deterioration, entry of water, discoloring or thinning.

If the quality is visibly poor, replace the oil.

Oil grade:

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

Recommended viscosity is as shown in the illustration.



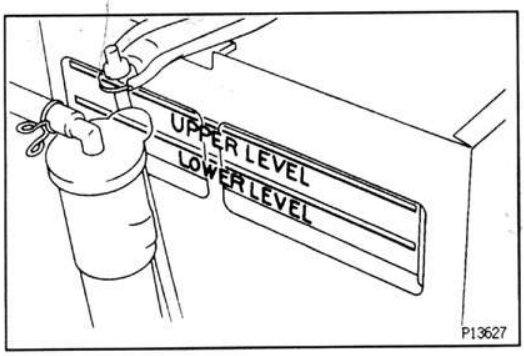
2. CHECK ENGINE OIL LEVEL

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

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

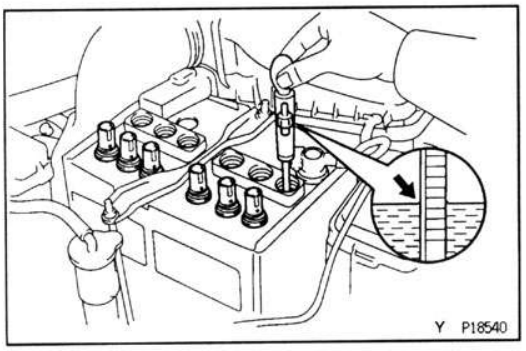
EG085-09

BATTERY INSPECTION

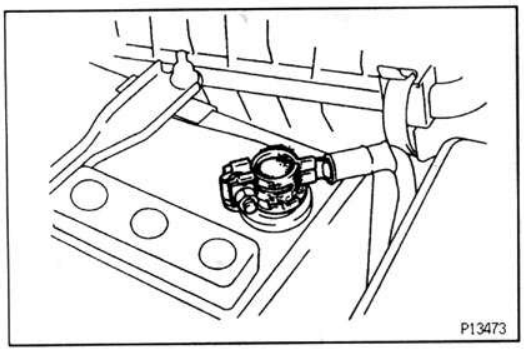


1. CHECK BATTERY SPECIFIC GRAVITY AND ELECTROLYTE LEVEL

(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 the gravity is less than specification, charge the battery.



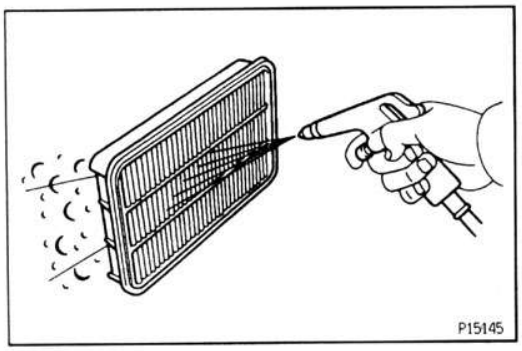
2. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

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

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

EG42V-02

AIR FILTER INSPECTION AND CLEANING



1. REMOVE AIR FILTER

2. INSPECT AND CLEAN AIR FILTER

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

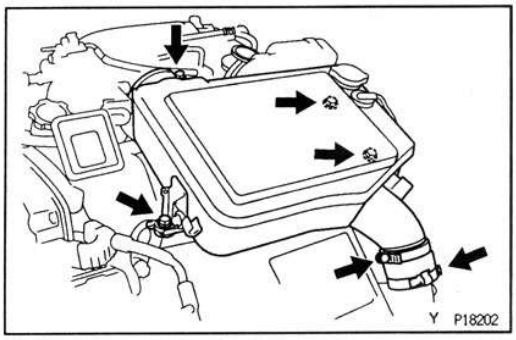
(b) Clean the air filter with compressed air.
First blow from the inside thoroughly, then blow off the outside of the air filter.

3. REINSTALL AIR FILTER

EG

HIGH–TENSION CORDS INSPECTION

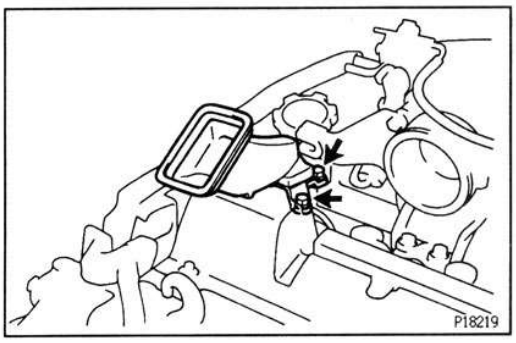
EG44X–01



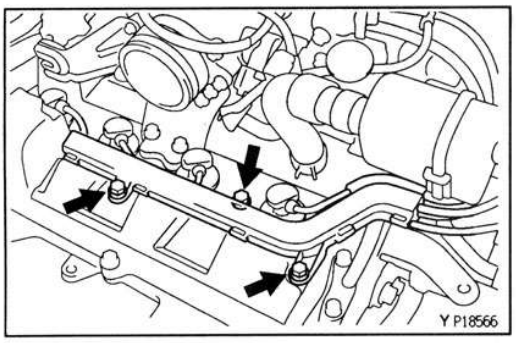
1. **DRAIN INTERCOOLER COOLANT**
   (See page EG–97)
2. **REMOVE INTERCOOLER**

(a) Remove the 3 bolts.

(b) Disconnect the intercooler from the turbocharger and intake air connector, and remove the intercooler and air hose.

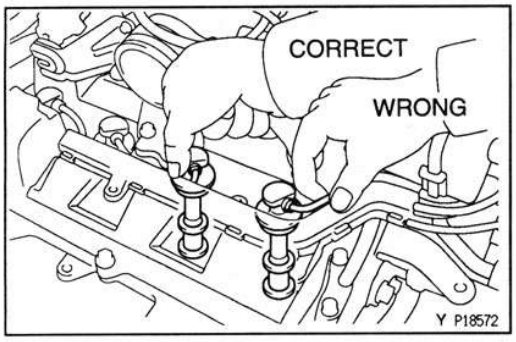


3. **REMOVE COOL AIR INLET**
   Remove the 2 bolts and cool air inlet.

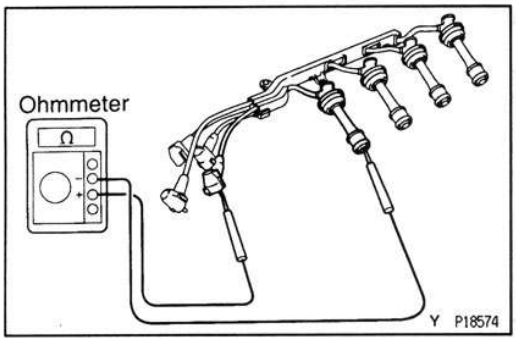


4. **DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS**

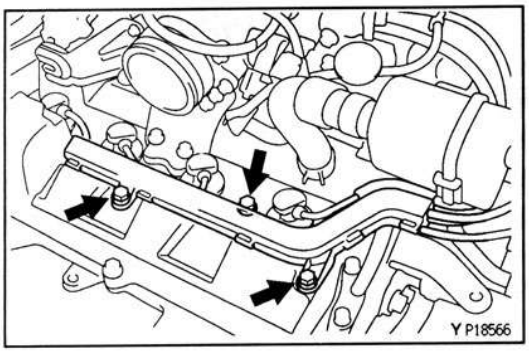
(a) Remove the 3 bolts, and disconnect the high–tension cord clamp from the cylinder head cover.



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



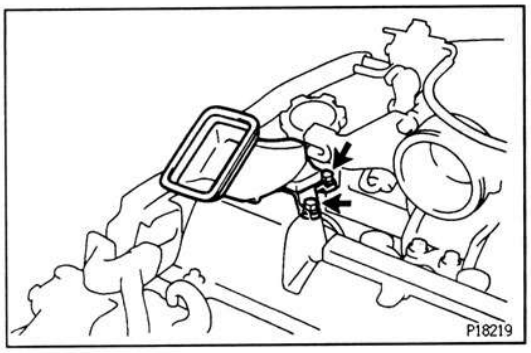
5. **INSPECT HIGH–TENSION CORD RESISTANCE**
   Using an ohmmeter, measure the resistance.
   Maximum resistance:
   25 kΩ per cord
   If the resistance is greater than maximum, replace the high–tension cord.



6. REINSTALL HIGH–TENSION CORDS

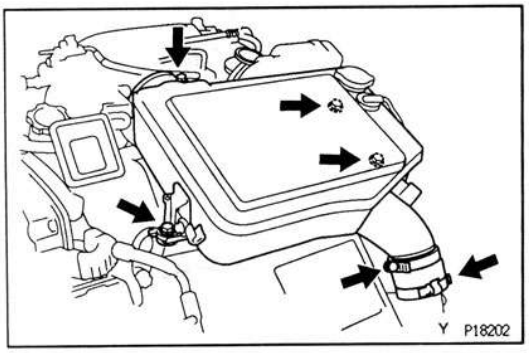
(a) Connect the 4 high–tension cords to the spark plugs.

(b) Install the high–tension cord clamp with the 3 bolts.



7. REINSTALL COOL AIR INLET

Install the cool air inlet with the 2 bolts.



8. REINSTALL INTERCOOLER

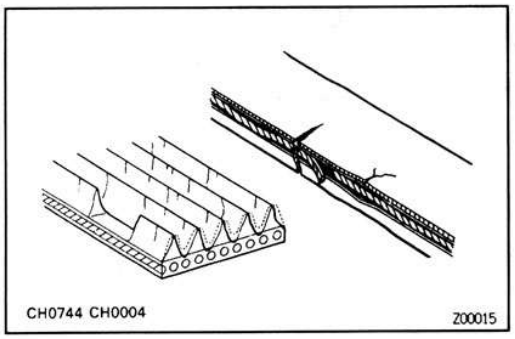
Connect the intercooler to the turbocharger and intake air connector, and install the intercooler with the 3 bolts.

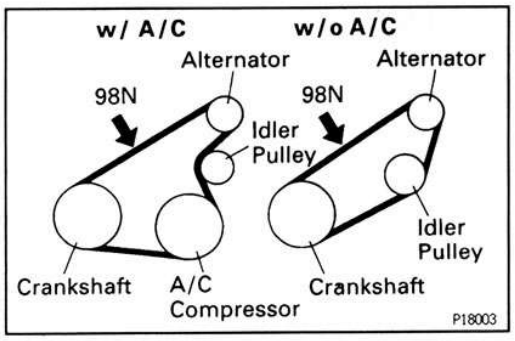
9. REFILL INTERCOOLER WITH COOLANT

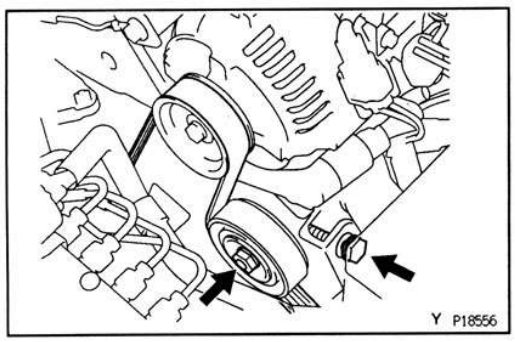
(See page EG–97)

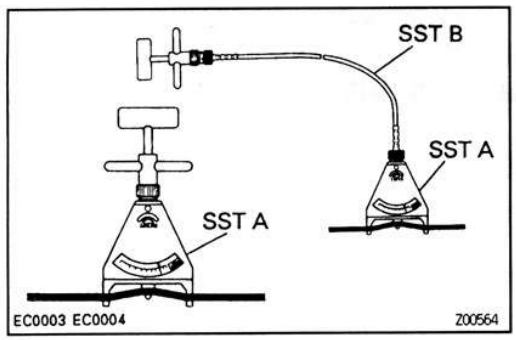
10. START ENGINE AND CHECK FOR LEAKS

EG









ALTERNATOR DRIVE BELT INSPECTION

EG461-01

INSPECT DRIVE BELT

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

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

Drive belt deflection:

w/ A/C

New belt

10 — 11 mm (0.39 — 0.43 in.)

Used belt

13 — 16 mm (0.51 — 0.63 in.)

w/o A/C

New belt

11 — 14 mm (0.43 — 0.55 in.)

Used belt

12 — 18 mm (0.47 — 0.71 in.)

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

Reference:

Using SST, check the drive belt tension.
SST 09216—00021 (A),
09216—00030 (B)

Drive belt tension:

w/ A/C

New belt

686 — 785 N (70 — 80 kgf)

Used belt

294 — 441 N (30 — 45 kgf)

w/o A/C

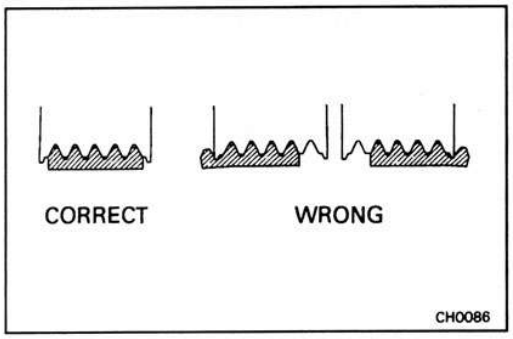
New belt

461 — 706 N (47 — 72 kgf)

Used belt

353 — 610 N (36 — 62 kgf)

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



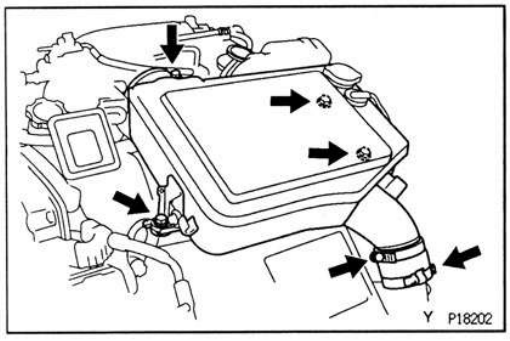
HINT:

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

VALVE CLEARANCE INSPECTION AND ADJUSTMENT EG482-01

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

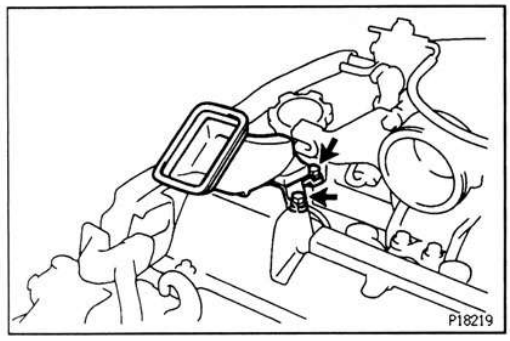
1. DRAIN INTERCOOLER COOLANT
(See page EG–97)



2. REMOVE INTERCOOLER

(a) Remove the 3 bolts.

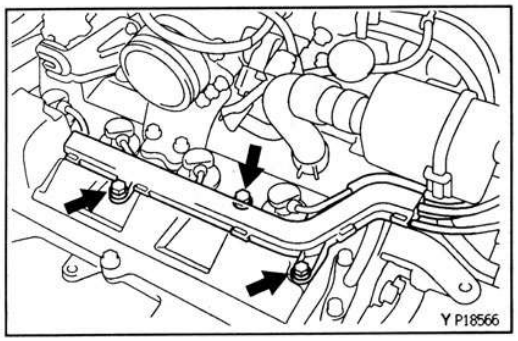
(b) Disconnect the intercooler from the turbocharger and intake air connector, and remove the intercooler and air hose.



3. REMOVE COOL AIR INLET

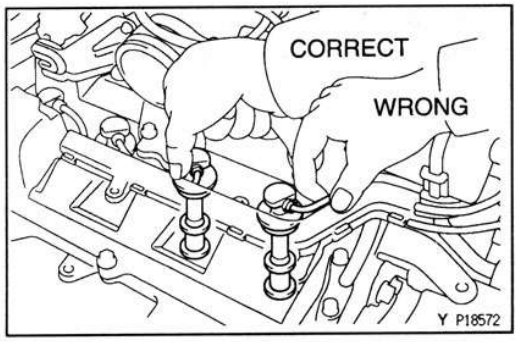
Remove the 2 bolts and cool air inlet.

EG



4. DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS

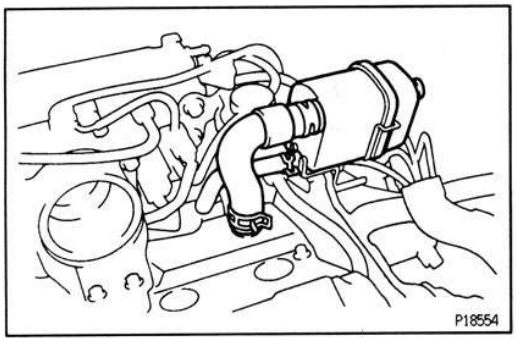
(a) Remove the 3 bolts, and disconnect the high–tension cord clamp from the cylinder head cover.



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



5. DISCONNECT NO.1 PCV HOSE

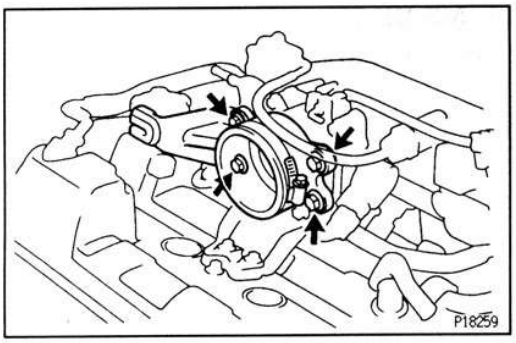


6. REMOVE VENTILATION CASE

(a) Disconnect the No.2 PCV hose from the cylinder head cover.

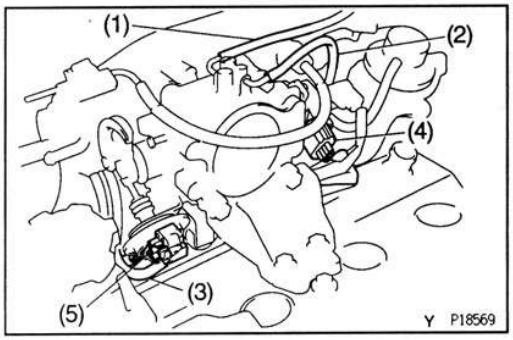
(b) Disconnect the No.3 water bypass hose (for PCV hose) from the ventilation case.

(c) Remove the ventilation case from the bracket.

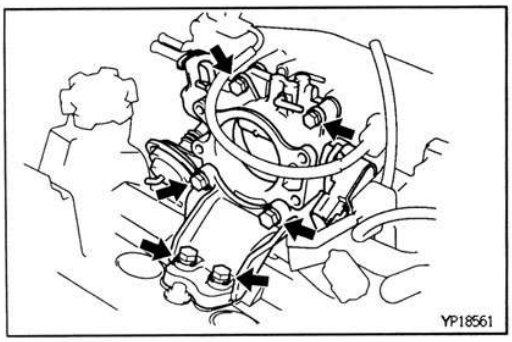


7. REMOVE THROTTLE BODY

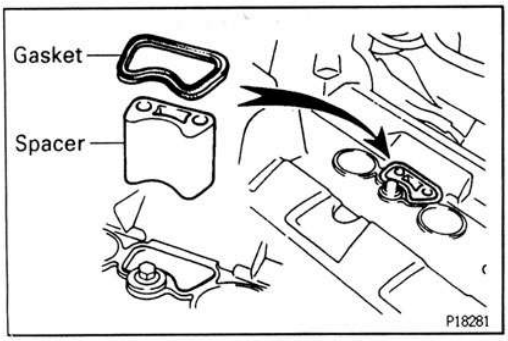
(a) Remove the 4 bolts, accelerator cable bracket and intake air connector.



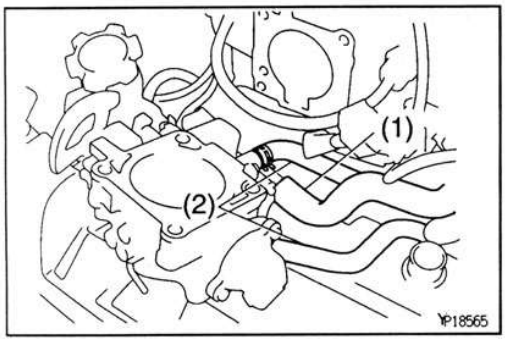
(b) Disconnect the following hoses and connectors:
(1) Vacuum hose from "P" port of throttle body
(2) Vacuum hose from "E" port of throttle body
(3) Vacuum hose from throttle opener
(4) Throttle position sensor connector
(5) ISC valve connector



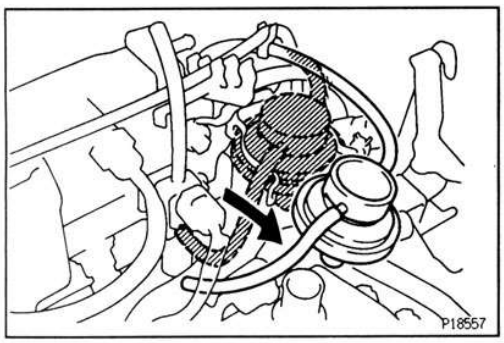
(c) Remove the 6 bolts and air connector stay, and disconnect the throttle body from the intake manifold.
(d) Remove the throttle body gasket.



(e) Remove the No.3 cylinder head cover gasket and spacer.

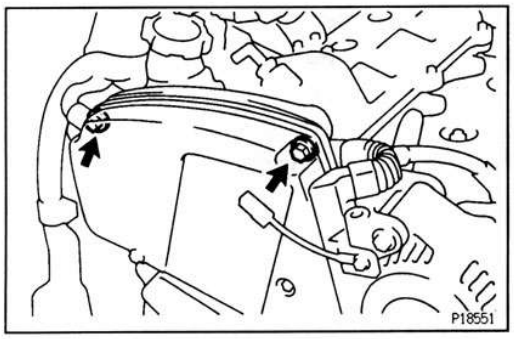


(f) Disconnect the following hoses from the throttle body, and remove the throttle body:
(1) Air hose from No.1 air tube
(2) 2 ISC water bypass hoses from No.1 air tube

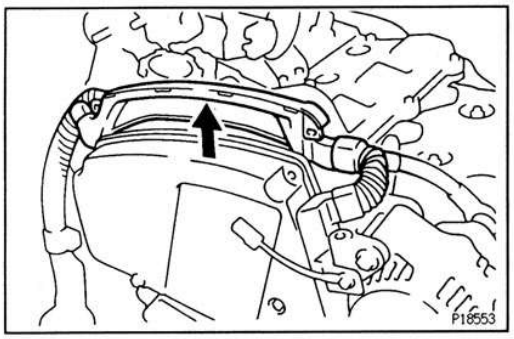


8. REMOVE CYLINDER HEAD COVER

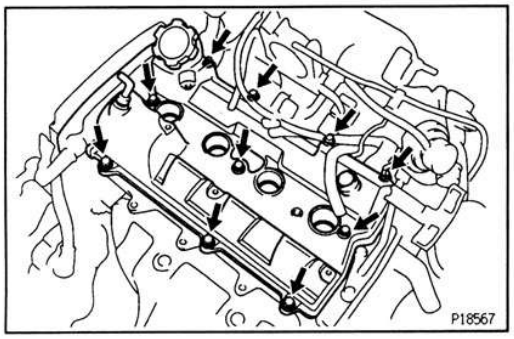
(a) Disconnect the vacuum hose from the VSV.
(b) Disconnect the EGR vacuum modulator from the bracket.



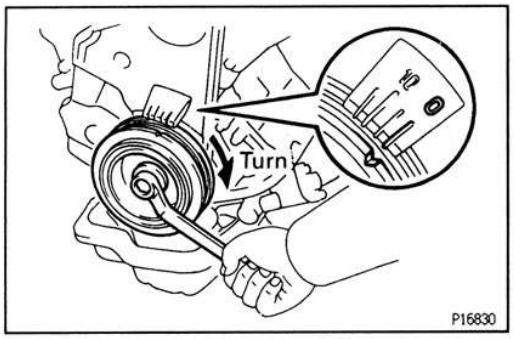
(c) Remove the 2 bolts holding the No.2 timing belt cover to the No.4 timing belt cover.



(d) Pull up the engine wire protector as shown in the illustration.

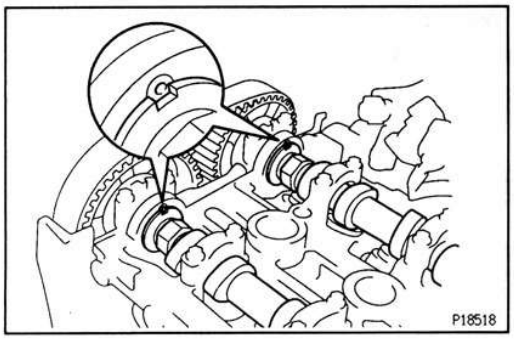


(e) Remove the 10 bolts, seal washers, cylinder head cover and 2 gaskets.

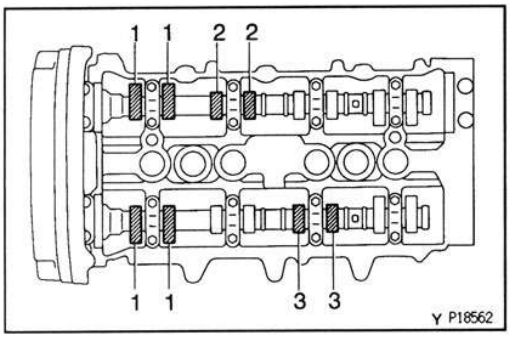


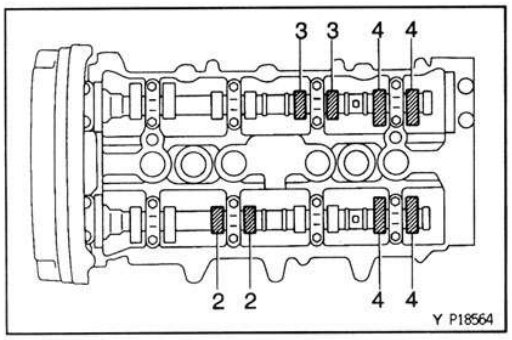
9. SET NO.1 CYLINDER TO TDC/COMPRESSION

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



(b) Check that the grooves of the camshafts are aligned with the dot marks of the No.1 camshaft bearing caps. If not, turn the crankshaft 1 revolution (360°) and align the mark as above.





10. INSPECT VALVE CLEARANCE

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

Valve clearance (Cold):

Intake

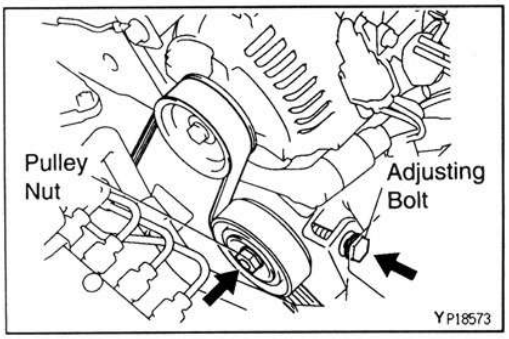
0.15 – 0.25 mm (0.006 – 0.010 in.)

Exhaust

0.28 – 0.38 mm (0.011 – 0.015 in.)

(b) Turn the crankshaft 1 revolution (360°) and align the mark as above. (See procedure in step 9)

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

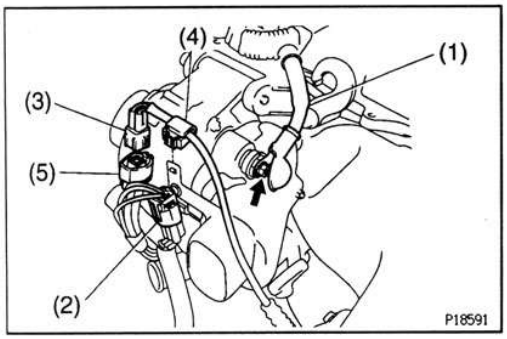


11. ADJUST VALVE CLEARANCE

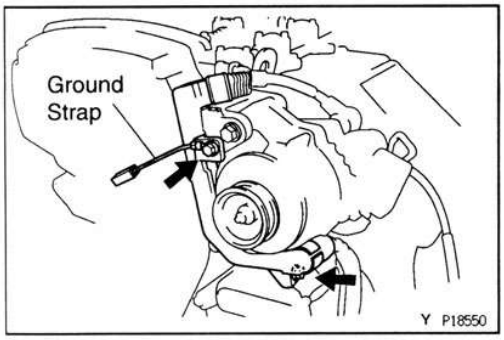
A: Remove alternator

(a) Loosen the pulley nut and adjusting bolt.

(b) Remove the drive belt.

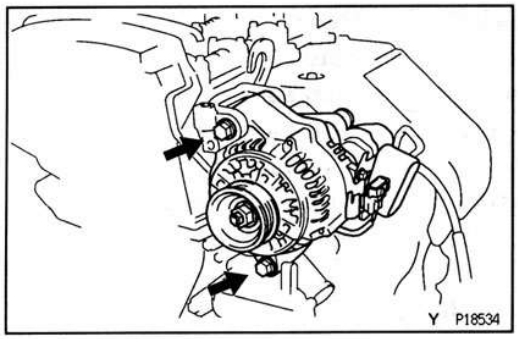


(c) Disconnect the following wires and connectors:
(1) Alternator wire
(2) Alternator connector
(3) Oxygen sensor connector
(4) Oxygen sensor wire clamp from bracket
(5) Oxygen sensor connector from bracket

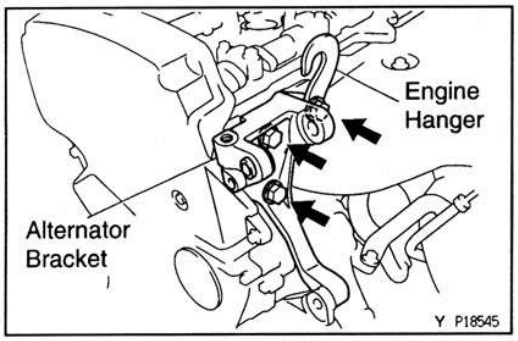


(d) Remove the 2 bolts and ground strap, and disconnect the engine wire protector from the brackets.

EG

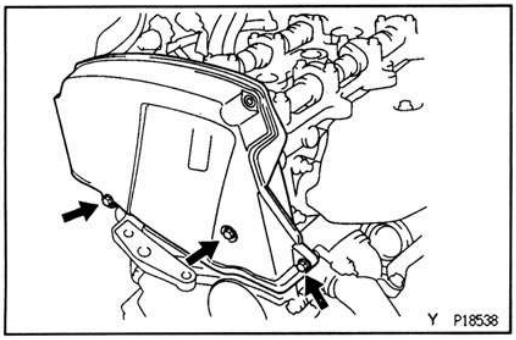


(e) Remove the 2 bolts and alternator.



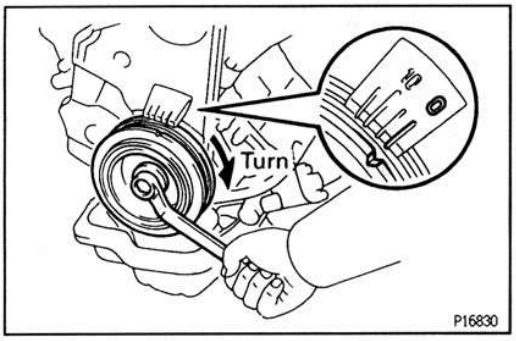
B. RH front engine hanger and alternator bracket

Remove the 3 bolts, engine hanger and alternator bracket.



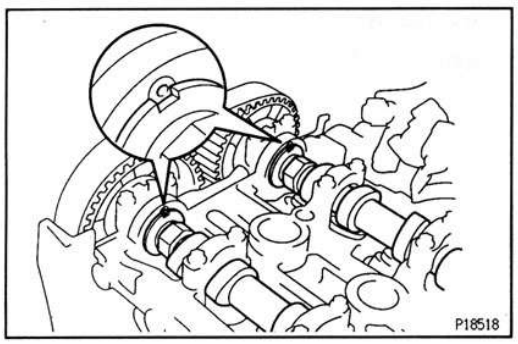
C. Remove No.2 timing belt cover

Remove the 3 bolts, timing belt cover and gasket.

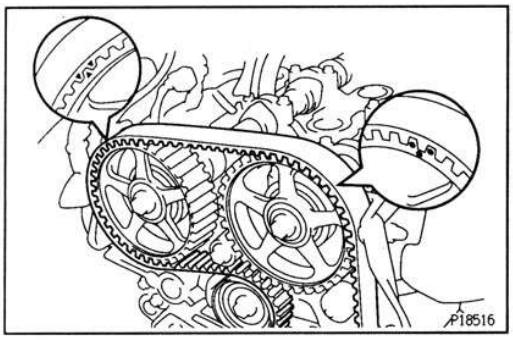


D. Set No.1 cylinder to TDC/compression

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

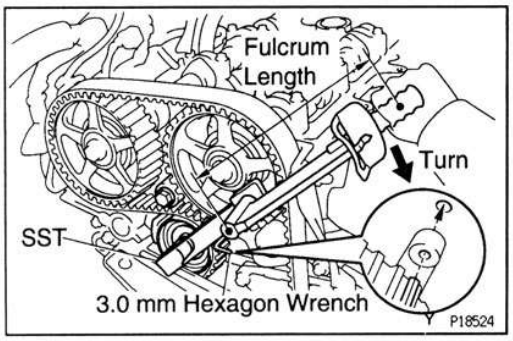


(b) Check that the grooves of the camshafts are aligned with the dot marks of the No.1 camshaft bearing caps. If not, turn the crankshaft 1 revolution (360°).



E. Disconnect timing belt from camshaft timing pulleys

(a) Place matchmarks on the timing belt and camshaft timing pulleys.



(b) Turn the No.1 idler pulley bolt to obtain the specified torque or less, and align the holes of the pulley bracket and cylinder head, pass a 3.0 mm hexagon wrench through the holes to keep the setting position of the pulley bracket.

Torque:

69 N·m (700 kgf·cm, 51 ft·lbf)

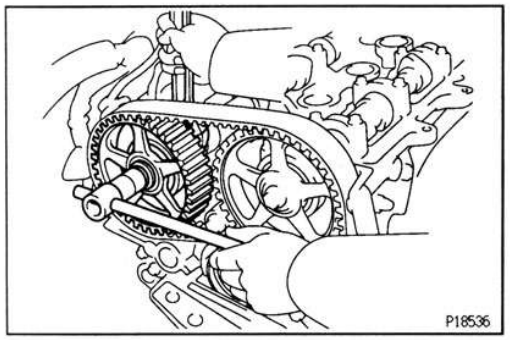
48 N·m (490 kgf·cm, 35 ft·lbf) for SST

HINT (On vehicle):

- Use SST.

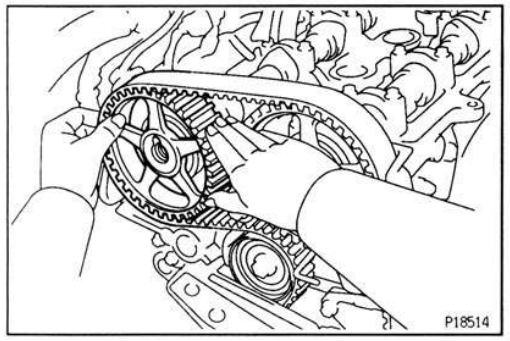
SST 09249–63010

- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

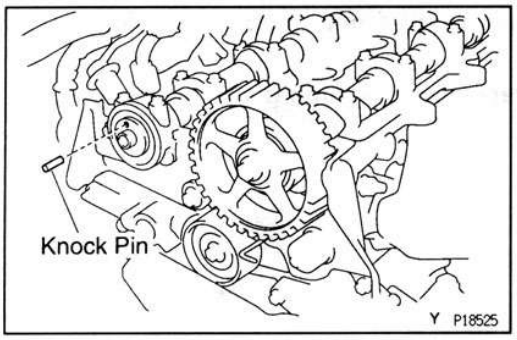


(c) Hold the hexagon wrench head portion of the camshaft with a wrench, and loosen the intake camshaft timing pulley bolt.

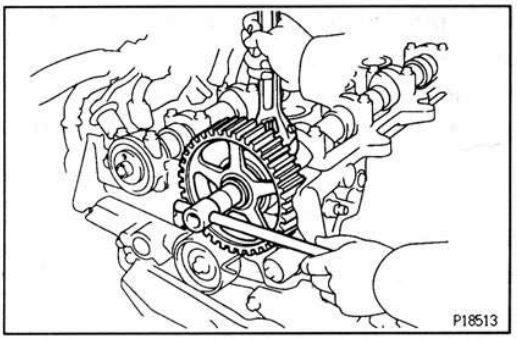
(d) Remove the intake camshaft timing pulley bolt.



(e) Disconnect the intake camshaft timing pulley together with the timing belt from the camshaft, and remove the intake camshaft timing pulley.



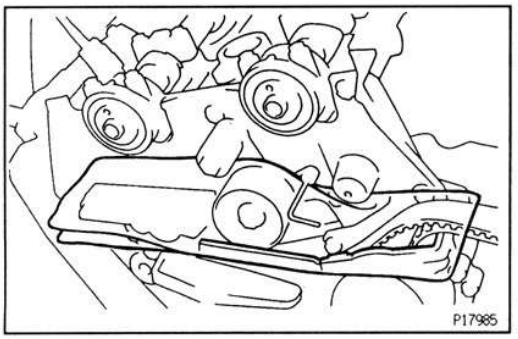
(f) Remove the knock pin from the intake camshaft.



F. Remove exhaust camshaft timing pulley

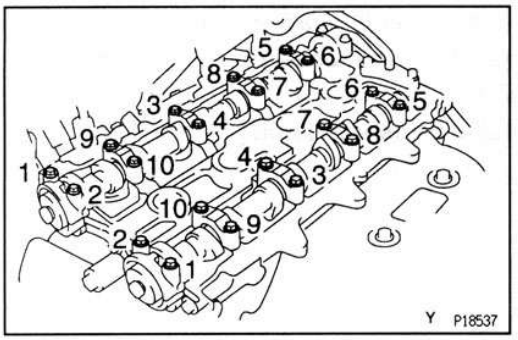
(a) Hold the hexagon wrench head portion of the camshaft with a wrench, and loosen the pulley bolt.

(b) Remove the bolt, timing pulley and knock pin.



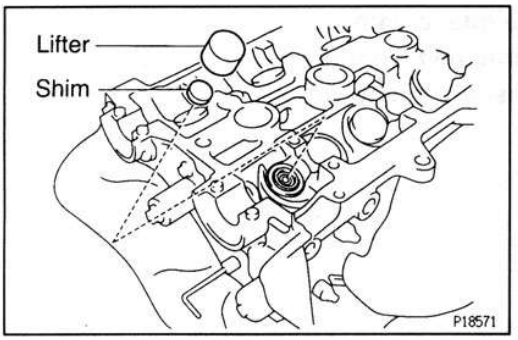
NOTICE:

- **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.**



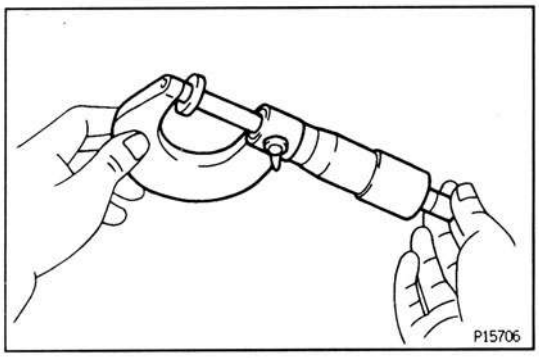
G. Remove camshafts

Uniformly loosen and remove the 10 bearing cap bolts in several passes, in the sequence shown, and remove the 5 bearing caps, oil seal and camshaft. Remove the intake and exhaust camshafts.



H. Remove adjusting shims

Remove the valve lifter and adjusting shim.



I. Replace adjusting shims

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

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

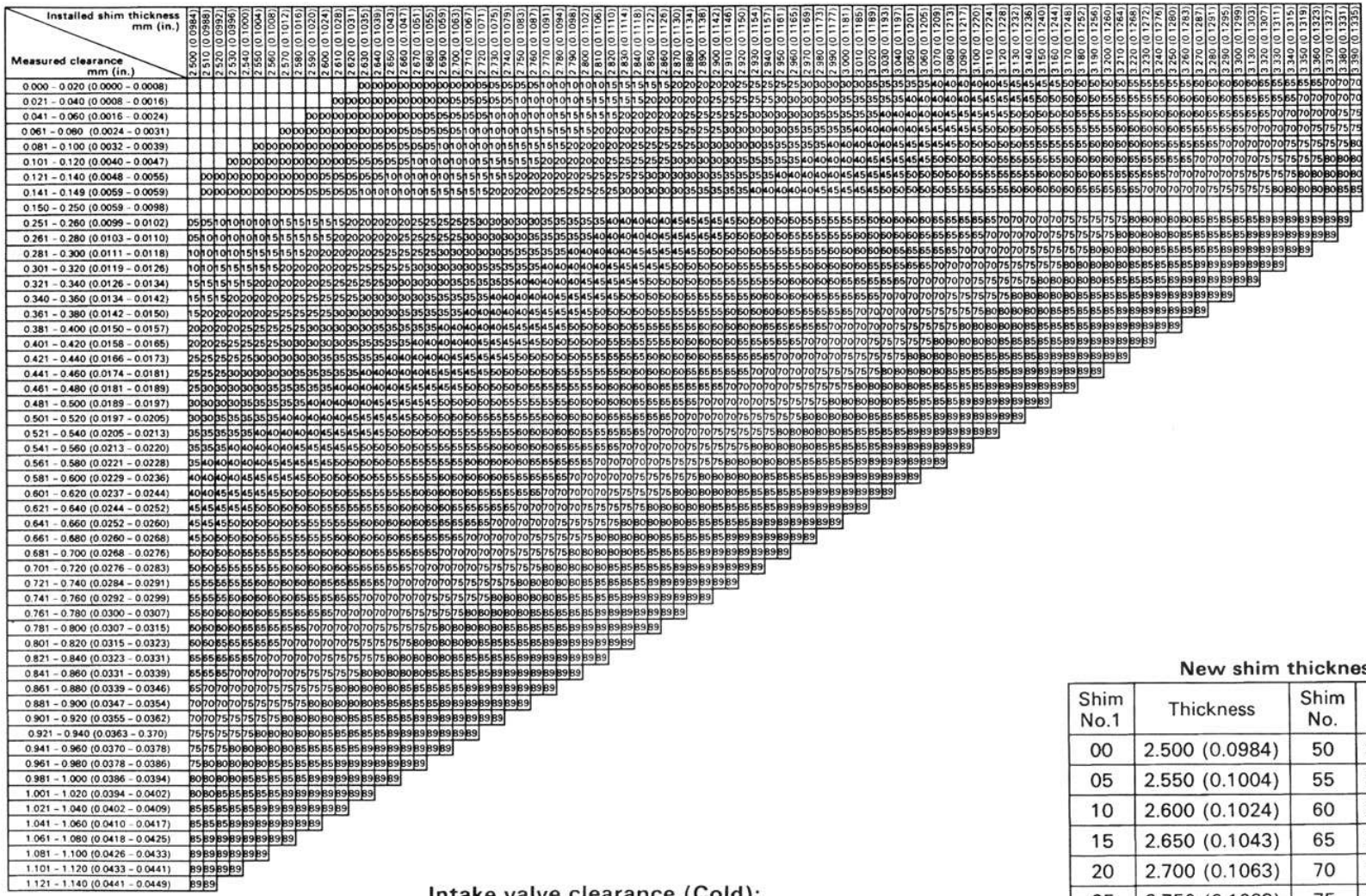
Exhaust:

N = T + (A − 0.33 mm (0.013 in.))

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

HINT: Shims are available in 19 sizes. 18 sizes are available in equal increments of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.35 mm (0.1319 in.). The largest shim size available is 3.39 mm (0.1335 in.).

Adjusting Shim Selection Chart (Intake)



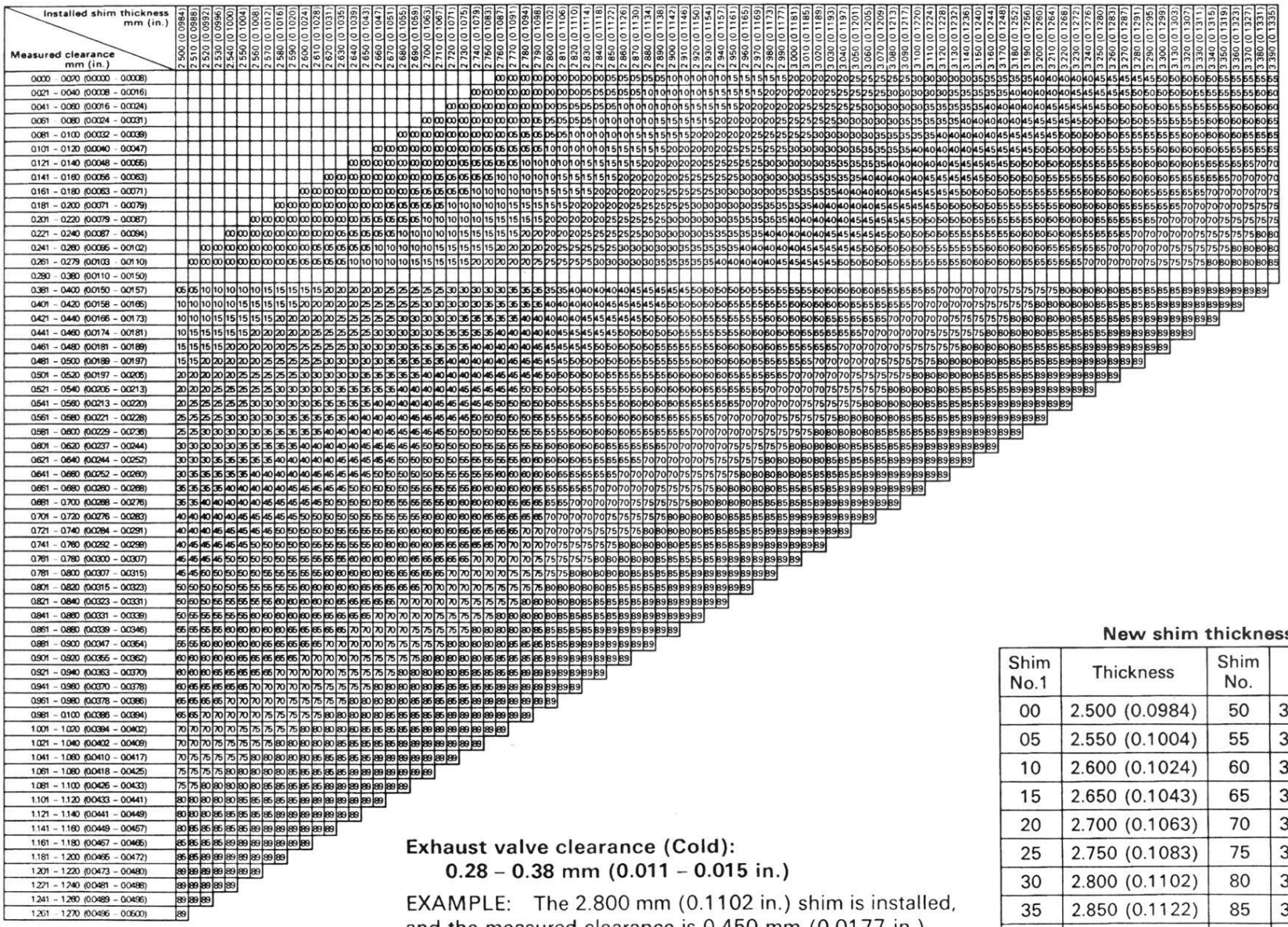
Intake valve clearance (Cold):
0.15 – 0.25 mm (0.006 – 0.010 in.)

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.55 shim.

New shim thickness mm (in.)

Shim No.1	Thickness	Shim No.	Thickness
00	2.500 (0.0984)	50	3.000 (0.1181)
05	2.550 (0.1004)	55	3.050 (0.1201)
10	2.600 (0.1024)	60	3.100 (0.1220)
15	2.650 (0.1043)	65	3.150 (0.1240)
20	2.700 (0.1063)	70	3.200 (0.1260)
25	2.750 (0.1083)	75	3.250 (0.1280)
30	2.800 (0.1102)	80	3.300 (0.1299)
35	2.850 (0.1122)	85	3.350 (0.1319)
40	2.900 (0.1142)	89	3.390 (0.1335)
45	2.950 (0.1161)		

Adjusting Shim Selection Chart (Exhaust)



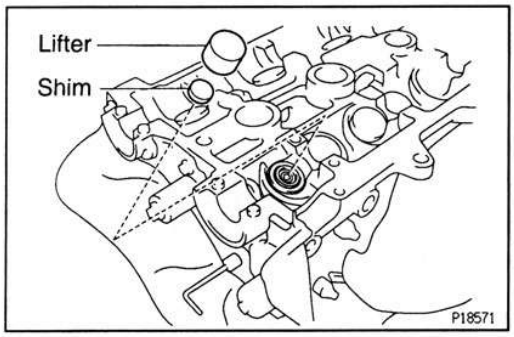
Exhaust valve clearance (Cold):
0.28 – 0.38 mm (0.011 – 0.015 in.)

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a new No.40 shim.

New shim thickness mm (in.)

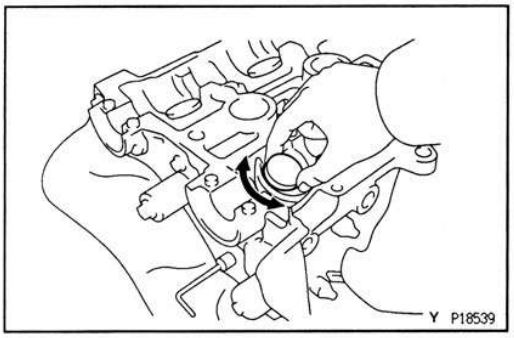
Shim No.1	Thickness	Shim No.	Thickness
00	2.500 (0.0984)	50	3.000 (0.1181)
05	2.550 (0.1004)	55	3.050 (0.1201)
10	2.600 (0.1024)	60	3.100 (0.1220)
15	2.650 (0.1043)	65	3.150 (0.1240)
20	2.700 (0.1063)	70	3.200 (0.1260)
25	2.750 (0.1083)	75	3.250 (0.1280)
30	2.800 (0.1102)	80	3.300 (0.1299)
35	2.850 (0.1122)	85	3.350 (0.1319)
40	2.900 (0.1142)	89	3.390 (0.1335)
45	2.950 (0.1161)		

W5515

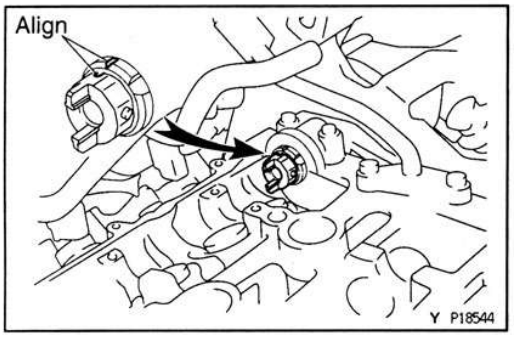


J. Reinstall adjusting shims

(a) Install the adjusting shim and valve lifter.

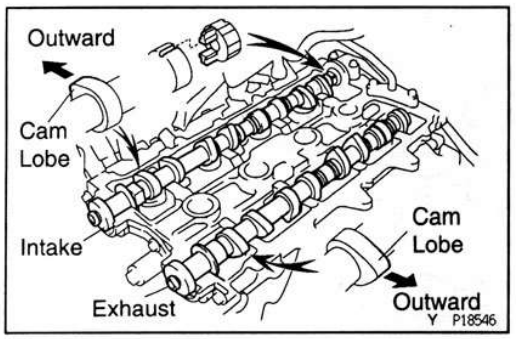


(b) Check that the valve lifter rotates smoothly by hand.



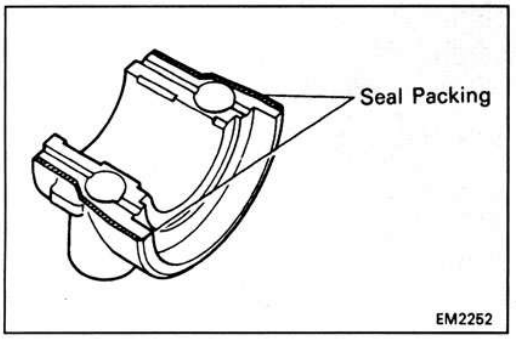
K. Reinstall camshafts

(a) Align the cutout portion of the coupling with the groove of the distributor housing.

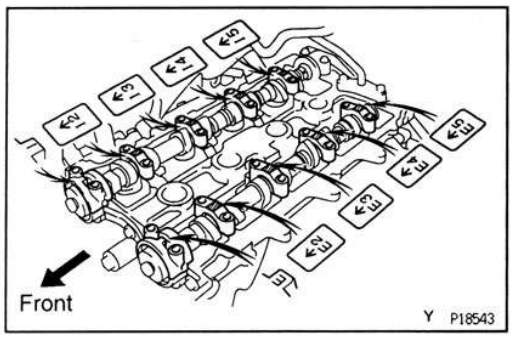


(b) Attach the slit of the intake camshaft to the coupling of the distributor.

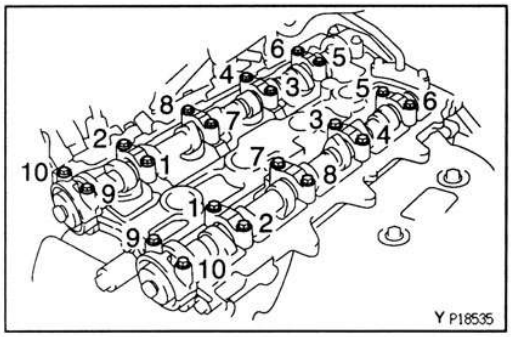
(c) Place the camshafts on the cylinder head with the No.1 cam lobes facing outward as shown.
HINT: Intake camshaft have an slit; exhaust camshaft do not.



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



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



(f) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(g) Install and uniformly tighten the 10 bearing cap bolts on one side in several passes, in the sequence shown.
Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)

L. Check valve clearance

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

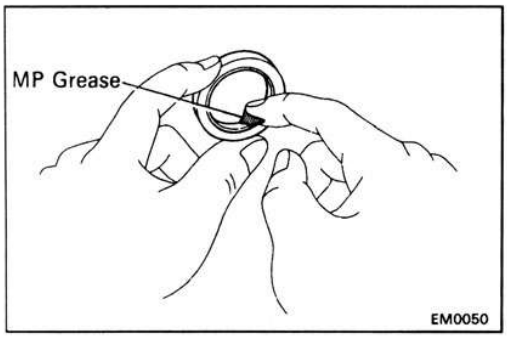
Valve clearance (Cold):

Intake

0.15 – 0.25 mm (0.006 – 0.010 in.)

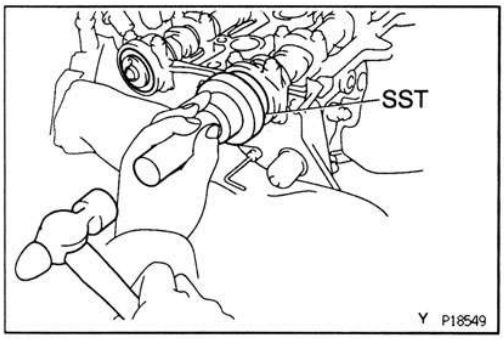
Exhaust

0.28 – 0.38 mm (0.011 – 0.015 in.)

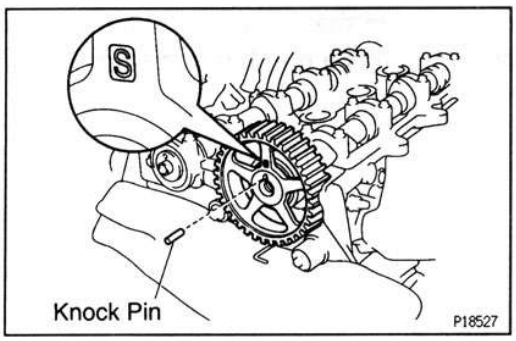


M. Reinstall camshaft oil seals

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



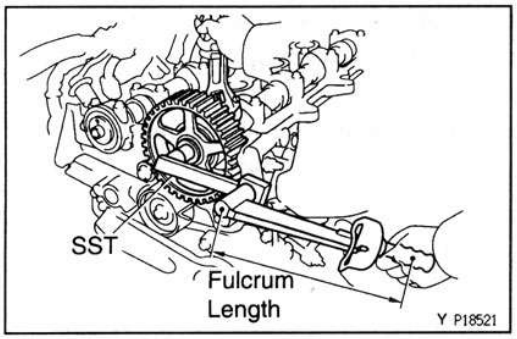
(b) Using SST, tap in the 2 camshaft oil seals.
SST 09223–46011



N. Reinstall exhaust camshaft timing pulley

(a) Slide the timing pulley onto the camshaft, facing mark "S" outward.

(b) Align the pin holes of the camshaft and timing pulley, and insert the knock pin.



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

Torque:

59 N·m (600 kgf·cm, 43 ft·lbf)

41 N·m (420 kgf·cm, 30 ft·lbf) for SST

HINT (On vehicle):

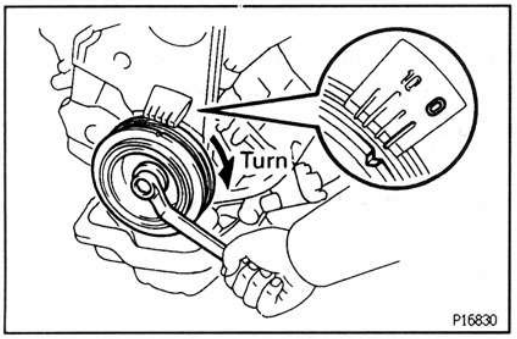
- Use SST.

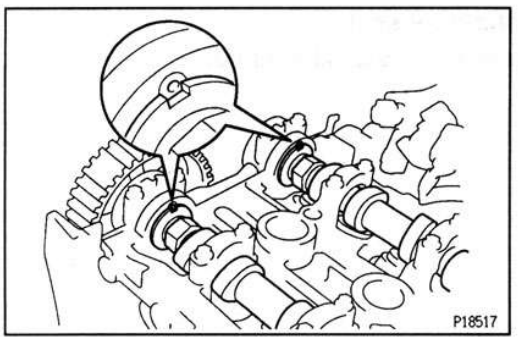
SST 09249–63010

- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

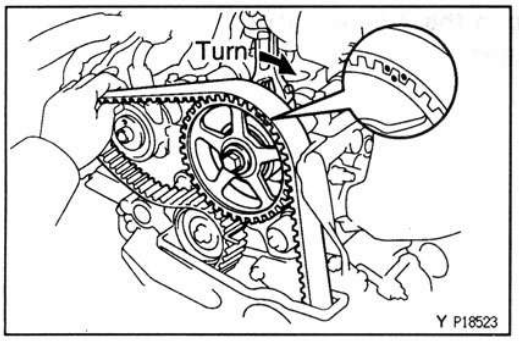
O. Set No.1 cylinder to TDC/compression

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





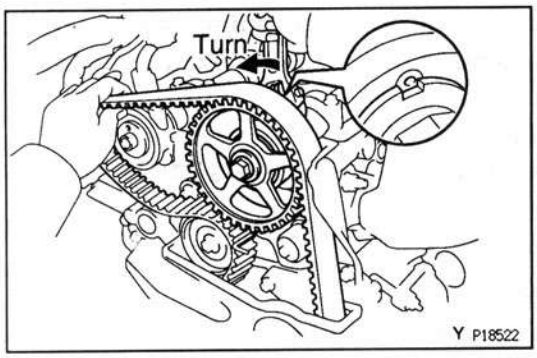
(b) Turn the hexagon head portion of the camshaft, align the groove of the camshaft with the dot mark of the No.1 camshaft bearing cap.



P. Reconnect timing belt to camshaft timing pulleys

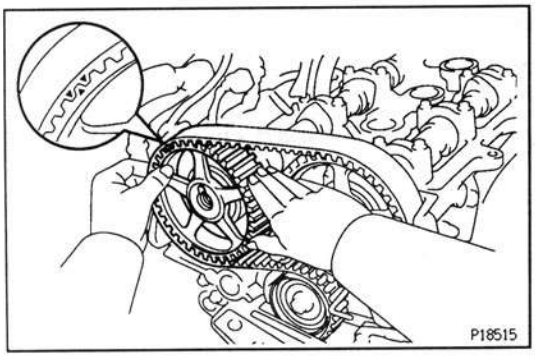
(a) Remove any oil or water on the exhaust camshaft timing pulley, and keep it clean.

(b) Turn the hexagon wrench head portion of the camshaft with a wrench, and turn the exhaust camshaft timing pulley clockwise. Align the matchmarks of the timing belt and exhaust camshaft timing pulley, and hang the timing belt on the exhaust camshaft timing pulley.



(c) Align the groove of the camshaft with the dot mark of the No.1 camshaft bearing cap.

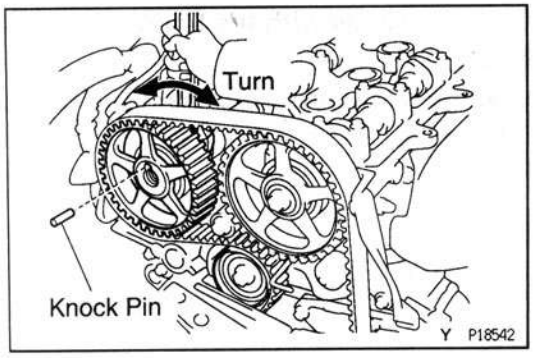
(d) Check that the timing belt has tension between the crankshaft timing pulley and exhaust camshaft timing pulley.



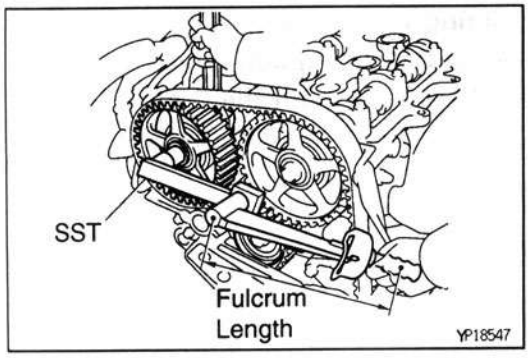
(e) Remove any oil or water on the intake camshaft timing pulley and No.1 idler pulley, and keep them clean.

(f) Align the matchmarks of the timing belt and intake camshaft timing pulley, and hang the timing belt on the intake camshaft timing pulley, facing mark "S" outward.

(g) Slide the intake camshaft timing pulley on the camshaft.



(h) Turn the hexagon wrench head portion of the camshaft with a wrench, and align the knock pin hole of the camshaft with the knock pin groove of the pulley and install the knock pin.



(i) Hold the hexagon wrench head portion of the camshaft with a wrench, and install the intake camshaft timing pulley bolt.

Torque:

59 N·m (600 kgf·cm, 43 ft·lbf)

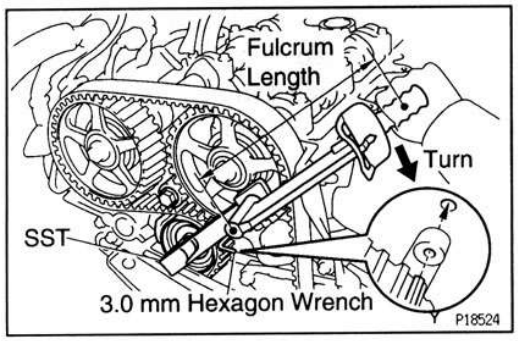
41 N·m (420 kgf·cm, 30 ft·lbf) for SST

HINT (On vehicle):

- Use SST.

SST 09249–63010

- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

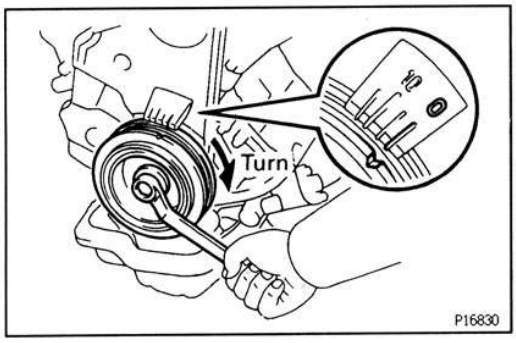


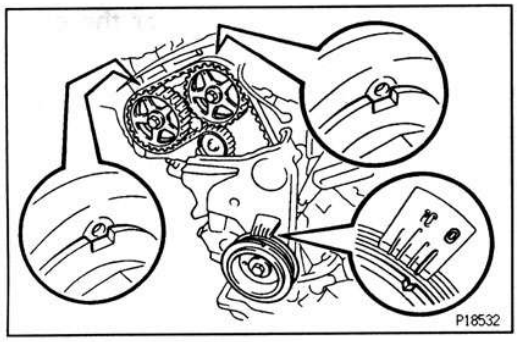
(j) Turn the No.1 idler pulley bolt to obtain the specified torque or less, remove the 3.0 mm hexagon wrench.
Torque:
69 N·m (700 kgf·cm, 51 ft·lbf)
48 N·m (490 kgf·cm, 35 ft·lbf) for SST
HINT (On vehicle):
- Use SST.

SST 09249–63010
- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

Q. Check valve timing

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

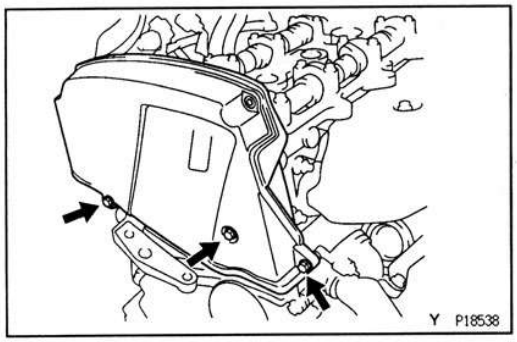




(b) Check that each pulley aligns with the timing marks as shown in the illustration.
If the timing marks do not align, disconnect the timing belt and reconnect it.

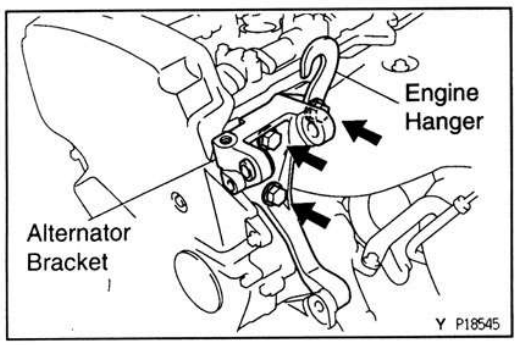
R. Reinstall No.2 timing belt cover

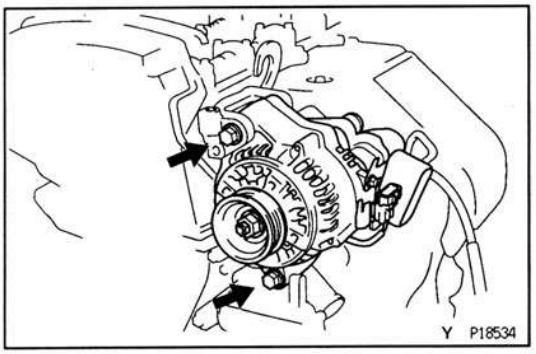
(a) Install the gasket to the timing belt cover.
(b) Install the timing belt cover with the 3 bolts.
HINT: Use the 20 mm (0.79 in.) long bolt.



S. Reinstall alternator bracket and RH front engine hanger

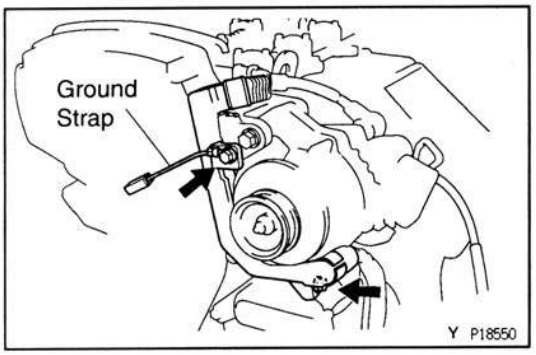
Install the alternator bracket and engine hanger with the 3 bolts.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)



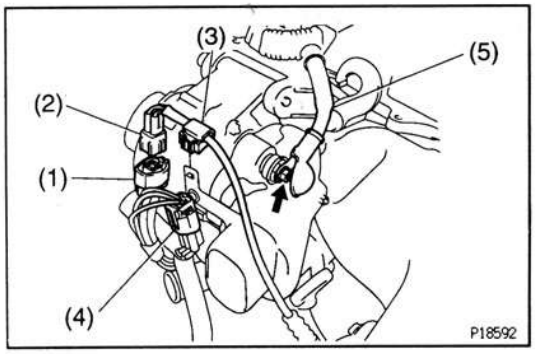


T. Reinstall alternator

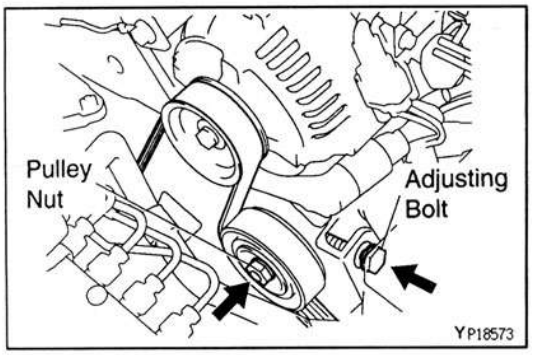
(a) Install the alternator with the 2 bolts.
Torque:
12 mm head 19 N·m (190 kgf·cm, 14 ft·lbf)
14 mm head 52 N·m (530 kgf·cm, 38 ft·lbf)



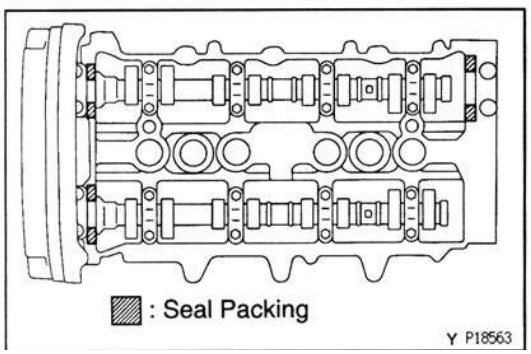
(b) Install the engine wire protector and ground strap with the 2 bolts.



(c) Connect the following wires and connectors:
(1) Oxygen sensor connector to bracket
(2) Oxygen sensor connector
(3) Oxygen sensor wire clamp to bracket
(4) Alternator connector
(5) Alternator wire



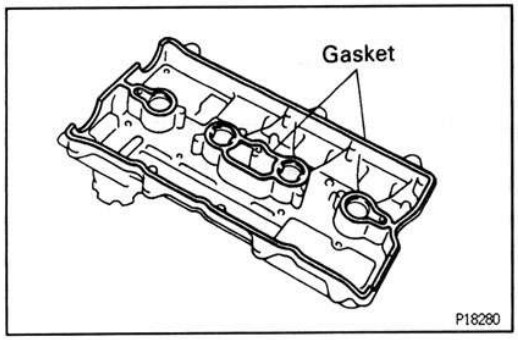
(d) Install the drive belt with the adjusting bolt.
(e) Tighten the pulley nut.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)



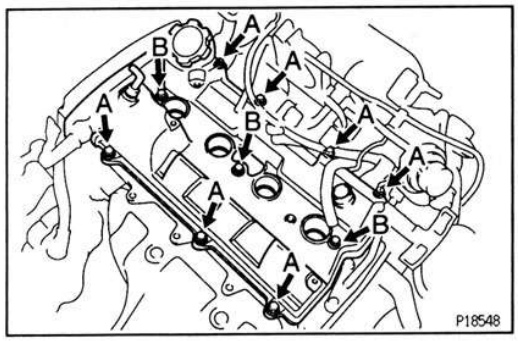
12. REINSTALL CYLINDER HEAD COVER

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

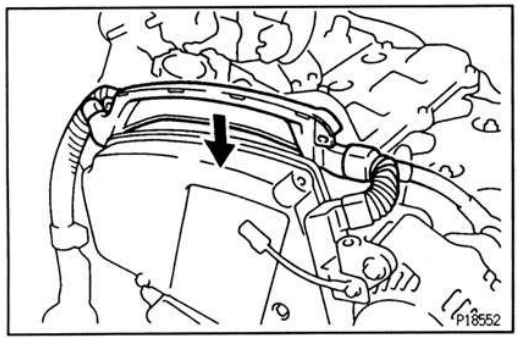
EG



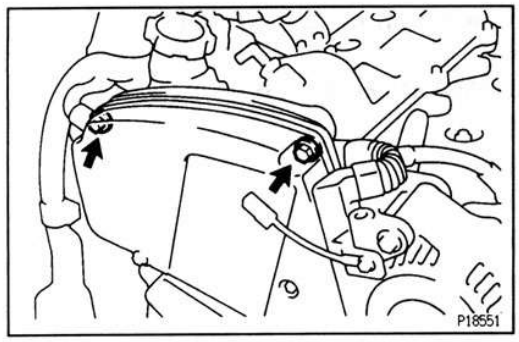
(b) Install the 2 gaskets to the head cover.



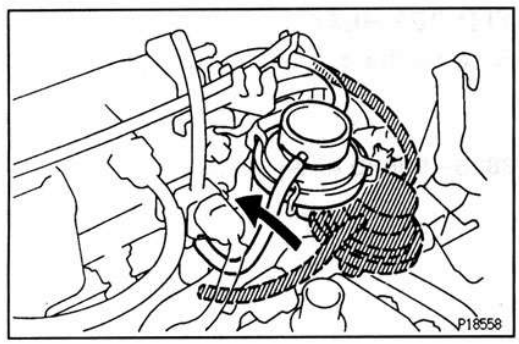
(c) Install the head cover with the 10 seal washers and screws. Uniformly tighten the screw in several passes.
Torque: 6.0 N·m (61 kgf·cm, 53 in.·lbf)
HINT: Each bolt length is indicated in the illustration.
Bolt length:
A: 25 mm (0.98 in.)
B: 50 mm (1.97 in.)



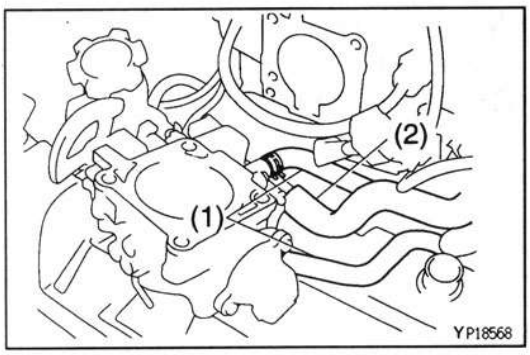
(d) Settle in the engine wire protector as shown in the illustration.



(e) Install the 2 bolts holding the No.2 timing belt cover to the No.4 timing belt cover.
HINT: Use the 25 mm (0.98 in.) long bolt.

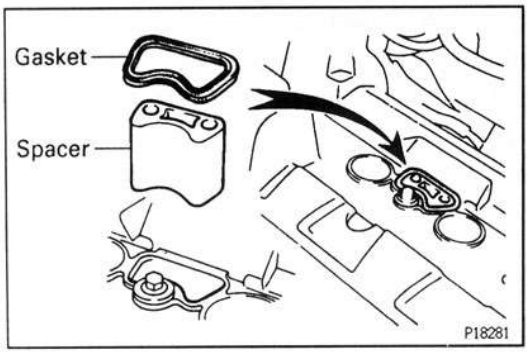


(f) Connect the EGR vacuum modulator to the bracket.
(g) Connect the vacuum hose to the VSV.

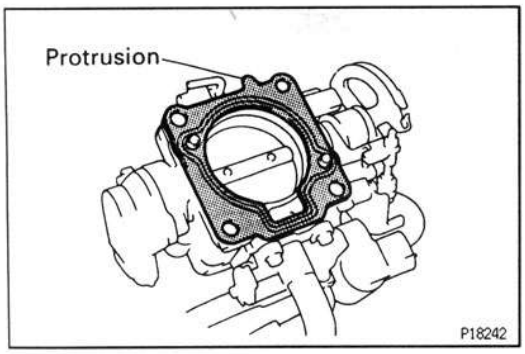


13. REINSTALL THROTTLE BODY

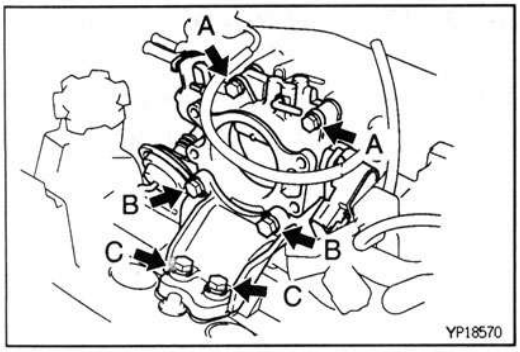
(a) Connect the following hoses to the throttle body.
(1) 2 ISC water bypass hoses from No.1 air tube
(2) Air hose from No.1 air tube



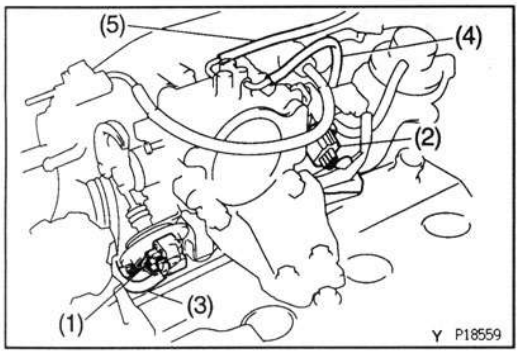
(b) Insert the spacer into the cylinder head cover, and install the gasket.



(c) Attach a new gasket to the throttle body, facing the protrusion upward.

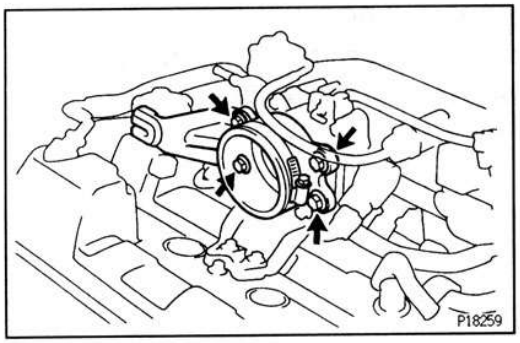


(d) Install the gasket, throttle body and air connector stay with the 6 bolts in several passes.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)
HINT: Different bolt lengths are used for locations A, B and C.
Bolt length:
A: 40 mm (1.57 in.)
B: 80 mm (3.15 in.)
C: 70 mm (2.76 in.)

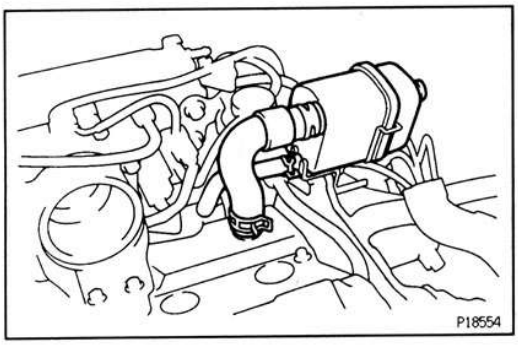


(e) Connect the following connectors and hoses:
(1) ISC valve connector
(2) Throttle position sensor connector
(3) Vacuum hose to throttle opener
(4) Vacuum hose from "P" port of throttle body
(5) Vacuum hose from "E" port of throttle body

EG



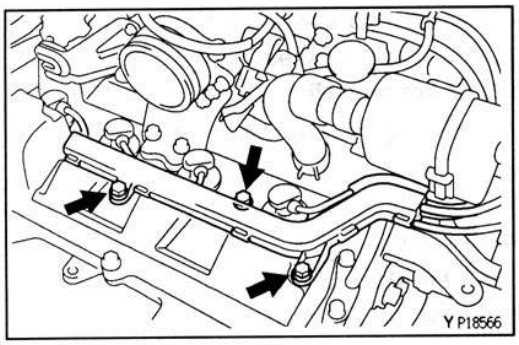
(f) Install the accelerator cable bracket and air intake connector with the 4 bolts.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)



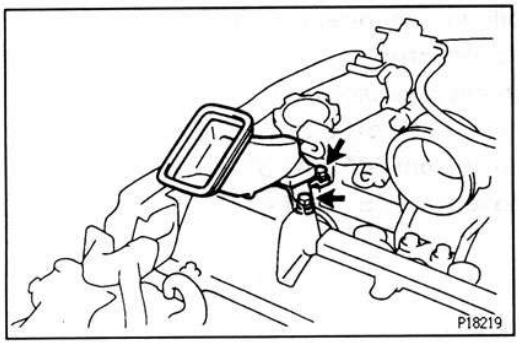
14. REINSTALL VENTILATION CASE
(a) Install the ventilation case to the bracket.
(b) Connect the No.3 water bypass hose (for PCV hose) to the ventilation case.
(c) Connect the No.2 PCV hose to the cylinder head cover.



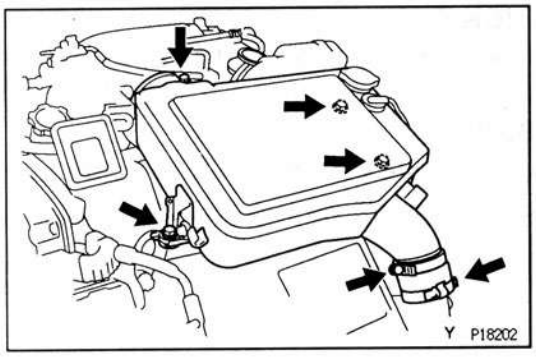
15. RECONNECT NO.1 PCV HOSE



16. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS
(a) Connect the 4 high–tension cords to the spark plugs.
(b) Install the high–tension cord clamp with the 3 bolts.



17. REINSTALL COOL AIR INLET
Install the cool air inlet with the 2 bolts.



18. REINSTALL INTERCOOLER

Connect the intercooler to the turbocharger and intake air connector, and install the intercooler with the 3 bolts.

19. REFILL INTERCOOLER WITH COOLANT
(See page EG–97)

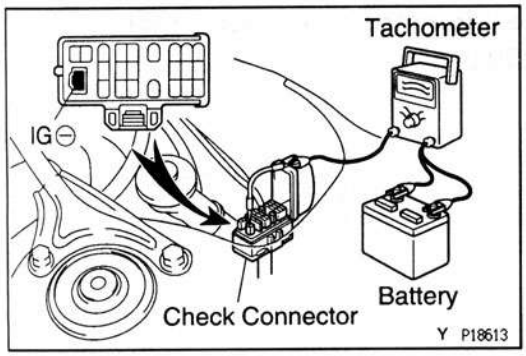
20. START ENGINE AND CHECK FOR LEAKS

IGNITION TIMING INSPECTION AND ADJUSTMENT

EG42Z–02

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

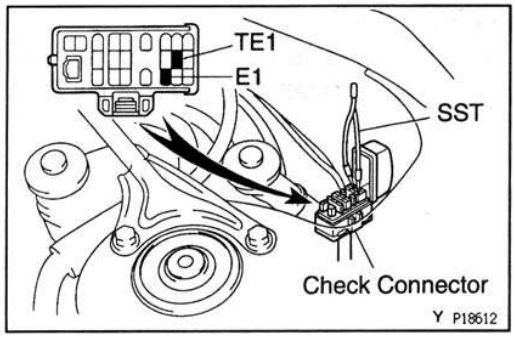


2. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

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

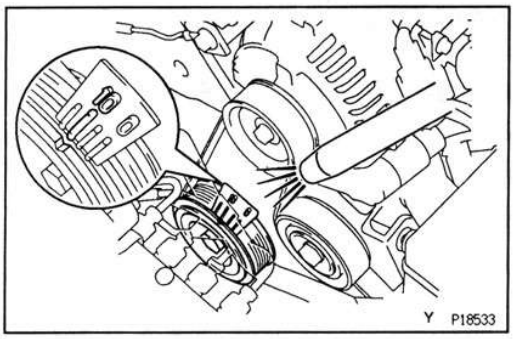
NOTICE:

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

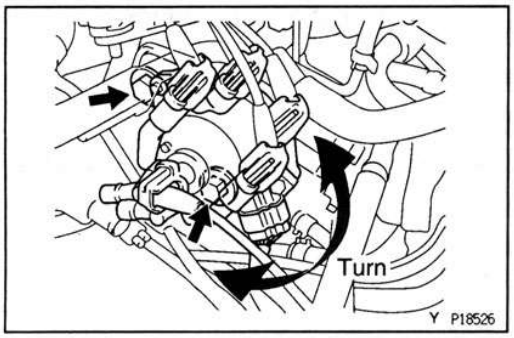


3. ADJUST IGNITION TIMING

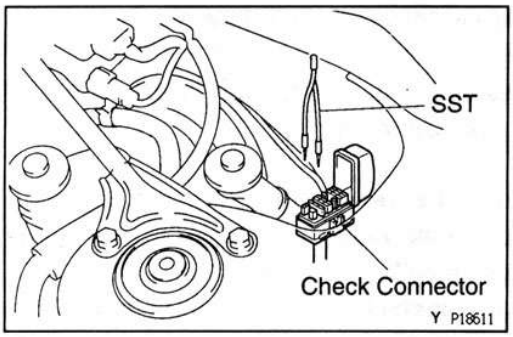
(a) Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843–18020
HINT: After engine rpm is kept at 1,000 – 1,300 rpm for 5 seconds, check that it returns to idle speed.



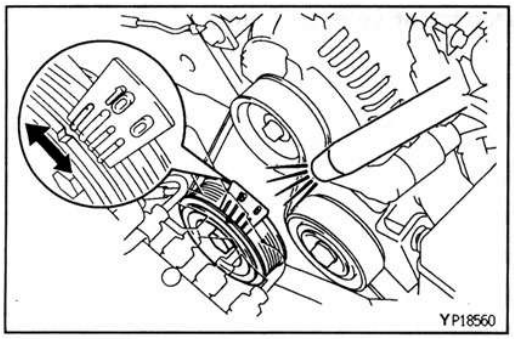
(b) Using a timing light, check the ignition timing.
Ignition timing:
10° BTDC @ idle
(Transmission in neutral position)



(c) Loosen the 2 bolts, and adjust by turning the distributor.
(d) Tighten the 2 bolts, and recheck the ignition timing.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)



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



4. CHECK IGNITION TIMING AGAIN

Ignition timing:
7 – 22° BTDC @ idle
(Transmission in neutral position)
HINT: The timing mark moves in a range between 7° and 22°.

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

EG463-01

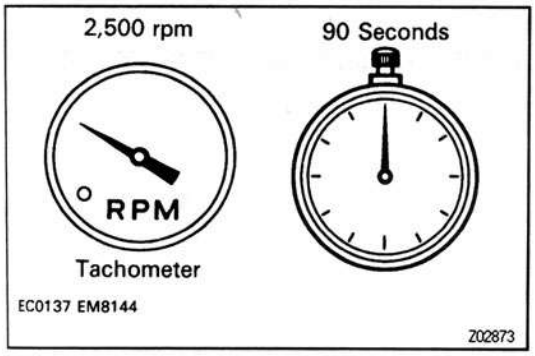
IDLE SPEED INSPECTION

1. INITIAL CONDITIONS

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

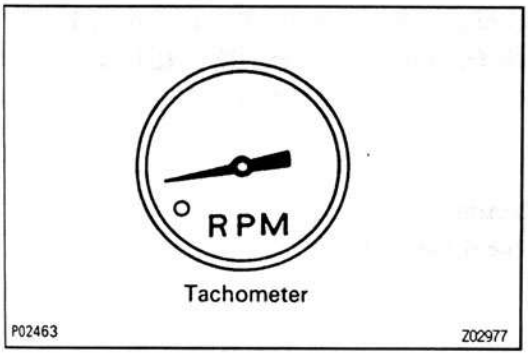
2. CONNECT TACHOMETER

(See step 2 on page EG–31)



3. INSPECT IDLE SPEED

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



(b) Check the idle speed.

Idle speed:

w/ Daytime running light system
750 ± 50 rpm

w/o Daytime running light system
700 ± 50 rpm

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

4. DISCONNECT TACHOMETER

IDLE CO/HC CHECK

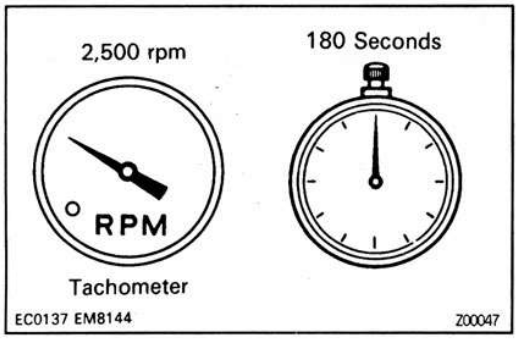
EG45U-01

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

EG

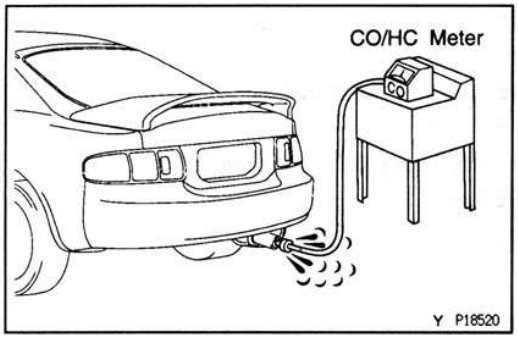
1. INITIAL CONDITIONS

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



2. START ENGINE

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



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

5. CHECK CO/HC CONCENTRATION AT IDLE

Idle CO concentration:

0 — 0.5 %

Idle HC concentration:

Applicable local regulation

Troubleshooting

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

(a) Check oxygen sensor operation.
(See Pub. No. RM396E on page EG–286)

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

HC	CO	Symptom	Causes
High	Normal	Rough idle	1. Faulty ignitions: • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed high-tension cords • Cracked distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve 4. Leaky intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: • PCV hose • EGR valve • Intake manifold • Throttle body • ISC valve • Brake booster line 2. Lean mixture causing misfire
High	High	Rough Idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty EFI systems: • Faulty pressure regulator • Clogged fuel return line • Defective water temp. sensor • Faulty ECU • Faulty injector • Faulty throttle position sensor • Faulty vacuum sensor

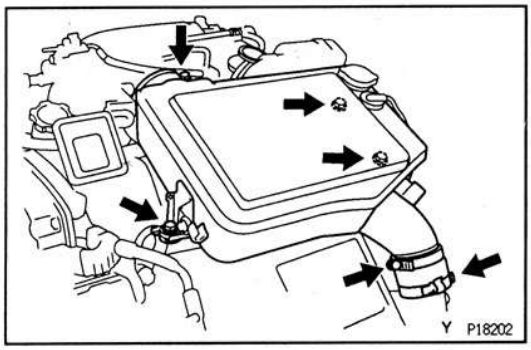
V05545

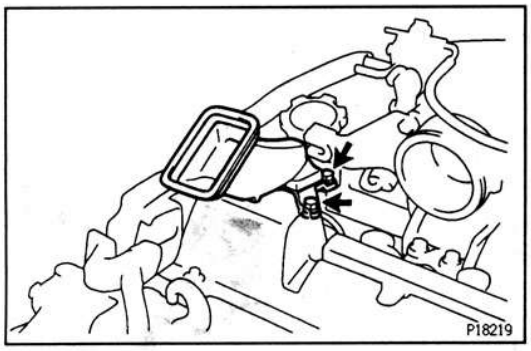
COMPRESSION CHECK

EG45T-01

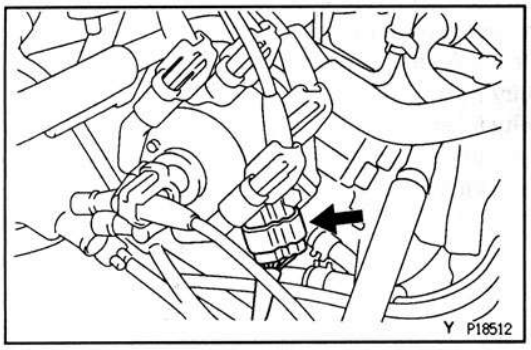
HINT: If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. **WARM UP AND STOP ENGINE**
Allow the engine to warm up to normal operating temperature.
2. **DRAIN INTERCOOLER COOLANT**
(See page EG—97)
3. **REMOVE INTERCOOLER**
(a) Remove the 3 bolts.
(b) Disconnect the intercooler from the turbocharger and intake air connector, and remove the intercooler and air hose.

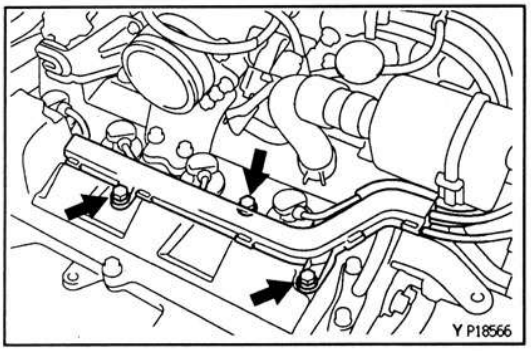




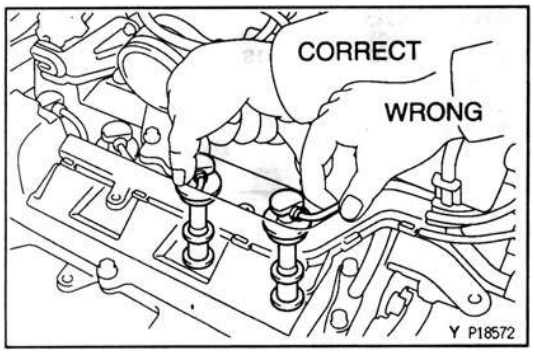
4. **REMOVE COOL AIR INLET**
Remove the 2 bolts and cool air inlet



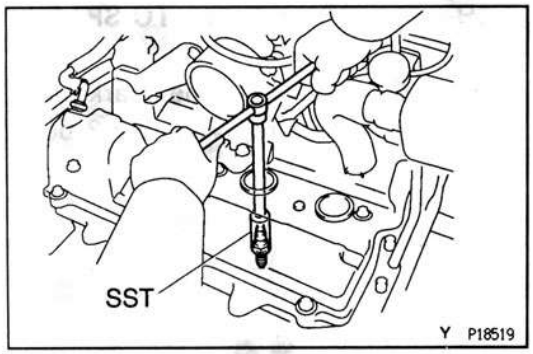
5. **DISCONNECT DISTRIBUTOR CONNECTOR**



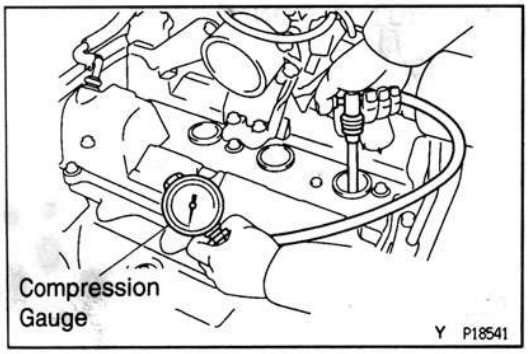
6. **DISCONNECT HIGH—TENSION CORDS FROM SPARK PLUGS**
(a) Remove the 3 bolts, and disconnect the high—tension cord clamp from the cylinder head cover.



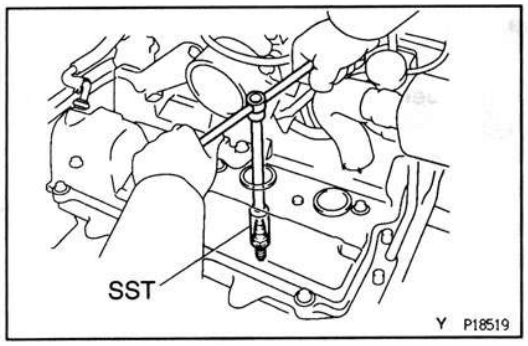
(b) Disconnect the high — tension cords at the rubber boot. Do not pull on the high—tension cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.



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

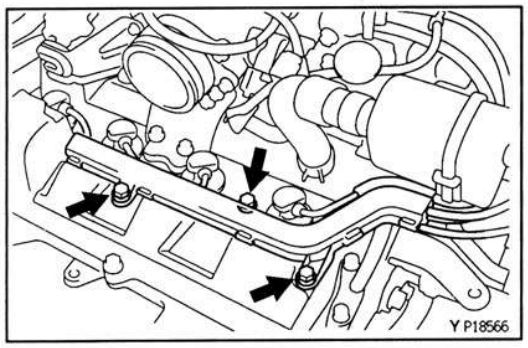


8. CHECK CYLINDER COMPRESSION PRESSURE
(a) Insert a compression gauge into the spark plug hole.
(b) Fully open the throttle.
(c) While cranking the engine, measure the compression pressure.
HINT: Always use a fully charged battery to obtain engine speed of 250 rpm or more.
(d) Repeat steps (a) through (c) for each cylinder.
NOTICE: This measurement must be done in as short a time as possible.
Compression pressure:
1,130 kPa (11.5 kgf/cm², 164 psi) or more
Minimum pressure:
880 kPa (9.0 kgf/cm², 128 psi)
Difference between each cylinder:
100 kPa (1.0 kgf/cm², 14 psi) or less
(e) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.
- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.



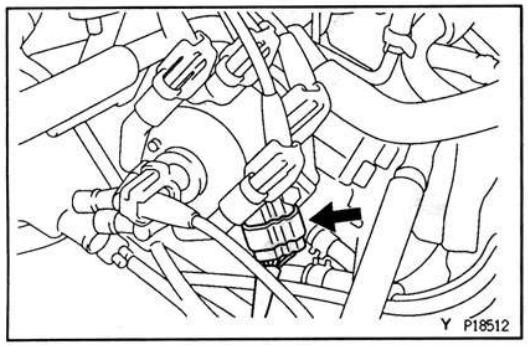
9. REINSTALL SPARK PLUGS

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

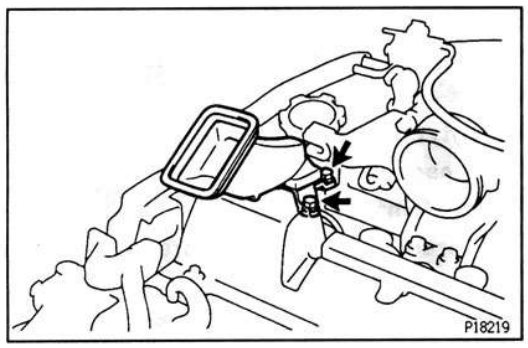


10. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS

(a) Connect the 4 high–tension cords to the spark plugs.
(b) Install the high–tension cord clamp with the 3 bolts.

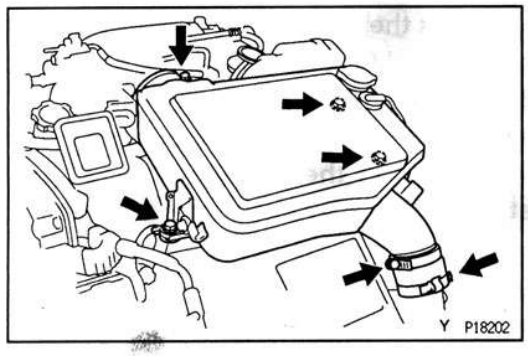


11. RECONNECT DISTRIBUTOR CONNECTOR



12. REINSTALL COOL AIR INLET

Install the cool air inlet with the 2 bolts.



13. REINSTALL INTERCOOLER

Connect the intercooler to the turbocharger and intake air connector, and install the intercooler with the 3 bolts.

14. FILL WITH INTERCOOLER COOLANT

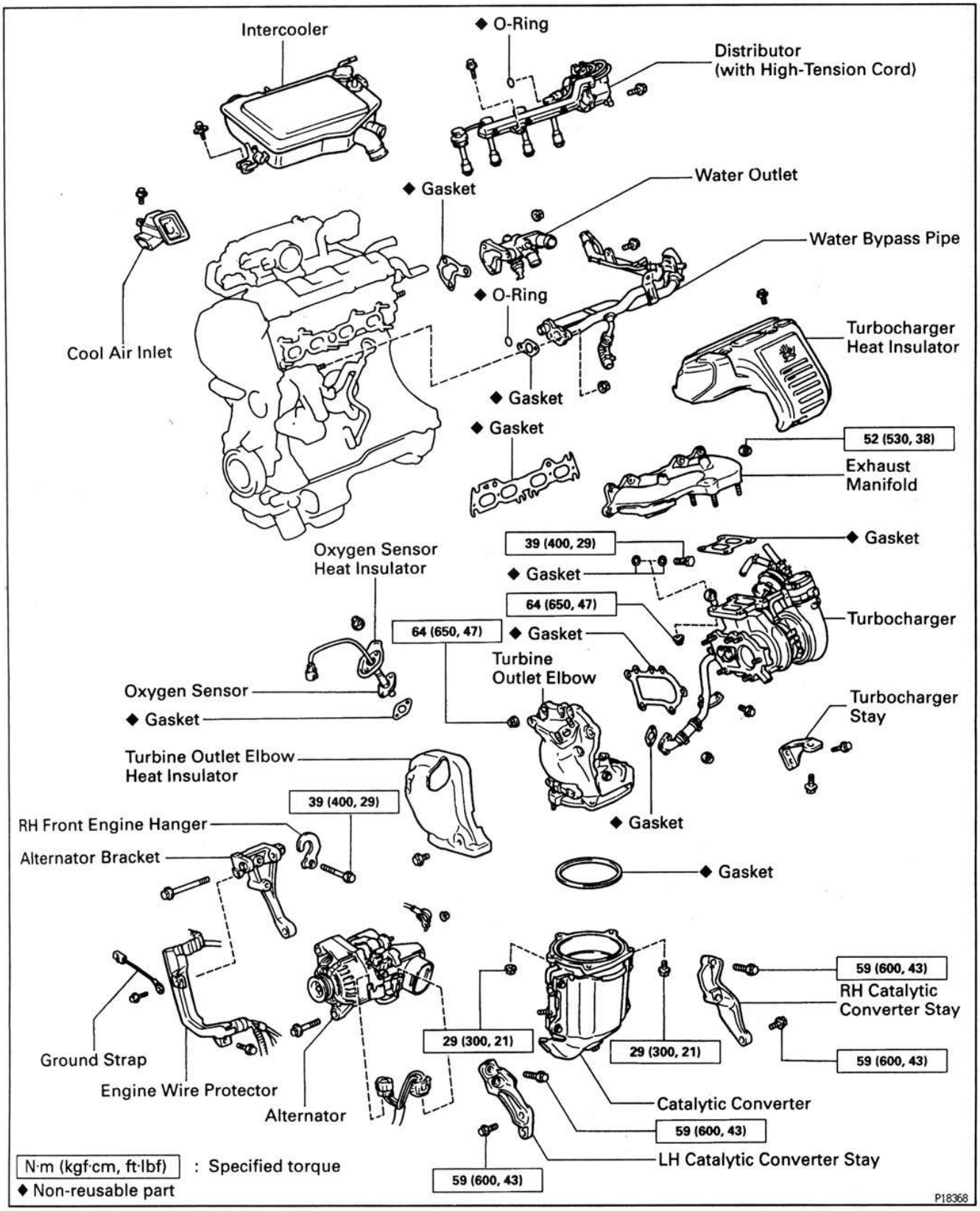
(See page EG–97)

15. START ENGINE AND CHECK FOR LEAKS

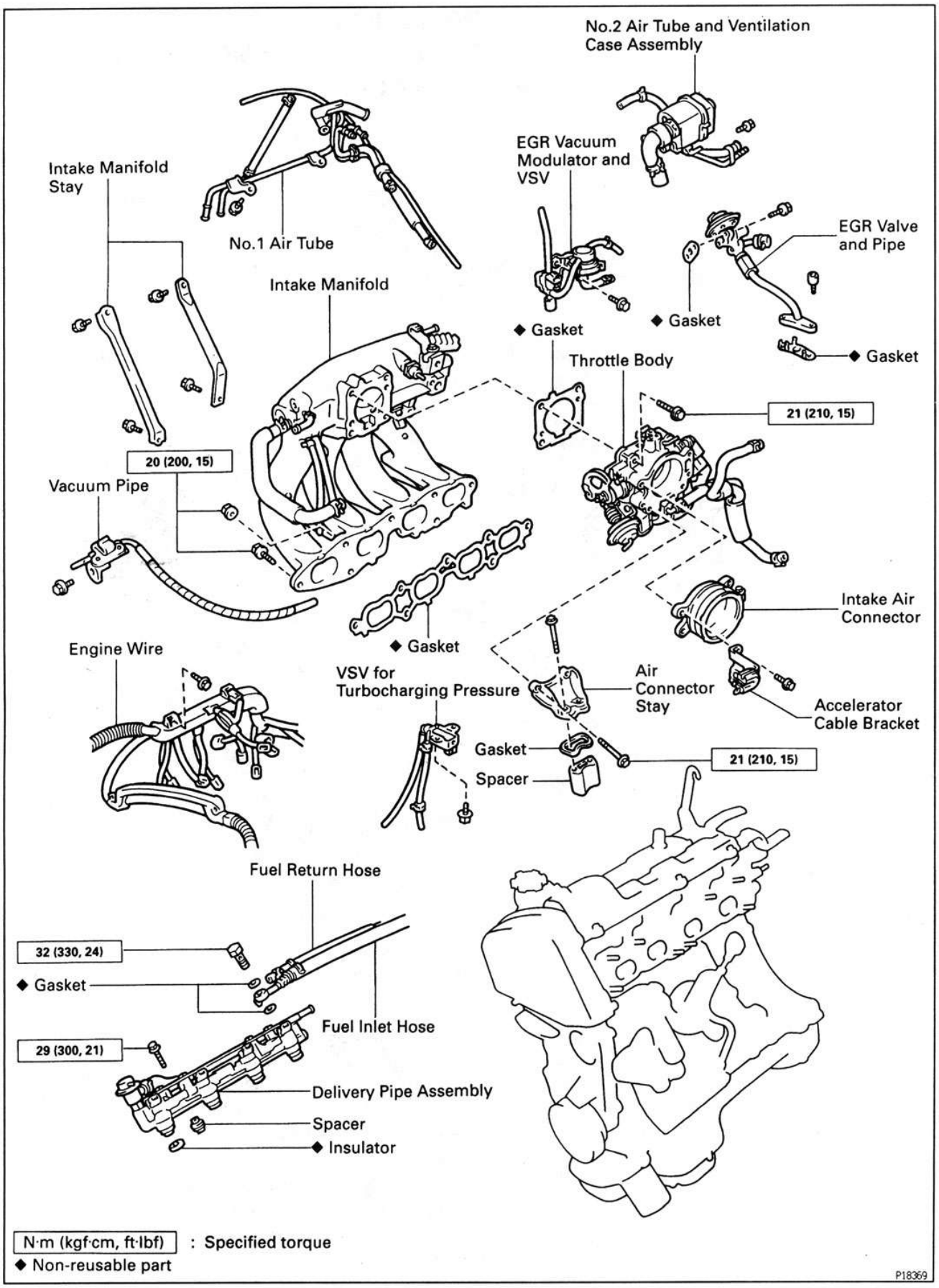
CYLINDER HEAD

COMPONENTS FOR REMOVAL AND INSTALLATION

EGOWC-03

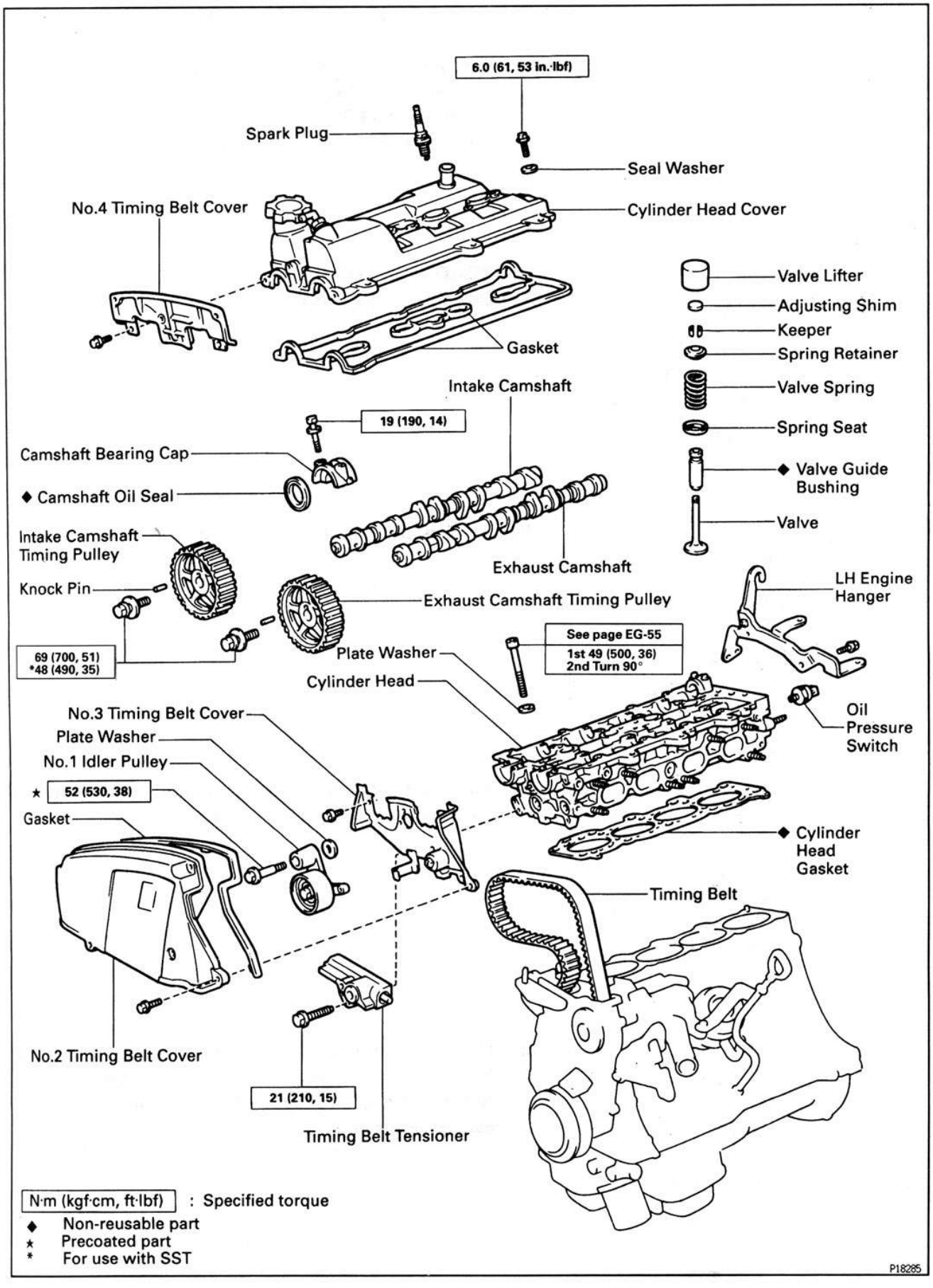


EG



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

P18369


6.0 (61, 53 in.·lbf)
Spark Plug
Seal Washer
No.4 Timing Belt Cover
Cylinder Head Cover
Gasket
Valve Lifter
Adjusting Shim
Keeper
Spring Retainer
Valve Spring
Spring Seat
◆ Valve Guide Bushing
Valve
Intake Camshaft
19 (190, 14)
Camshaft Bearing Cap
◆ Camshaft Oil Seal
Intake Camshaft Timing Pulley
Knock Pin
Exhaust Camshaft
Exhaust Camshaft Timing Pulley
69 (700, 51)
*48 (490, 35)
Plate Washer
See page EG-55
1st 49 (500, 36)
2nd Turn 90°
LH Engine Hanger
Cylinder Head
Oil Pressure Switch
No.3 Timing Belt Cover
Plate Washer
No.1 Idler Pulley
★ 52 (530, 38)
Gasket
◆ Cylinder Head Gasket
Timing Belt
No.2 Timing Belt Cover
21 (210, 15)
Timing Belt Tensioner
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
★ Precoated part
* For use with SST
P18285

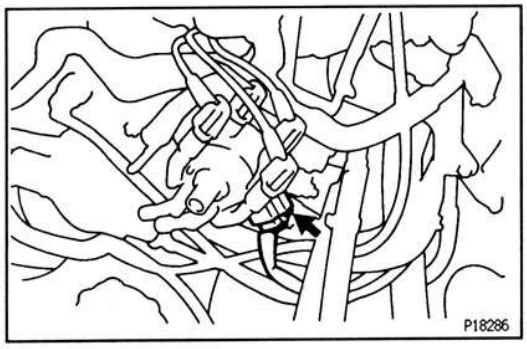
EG47V-01

CYLINDER HEAD REMOVAL

(See Components for Removal and Installation)

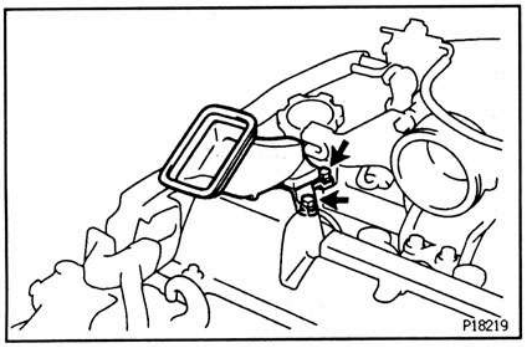
1. **DRAIN ENGINE COOLANT**
2. **REMOVE INTERCOOLER**
   (See steps 3 and 5 on page EG—88)

EG

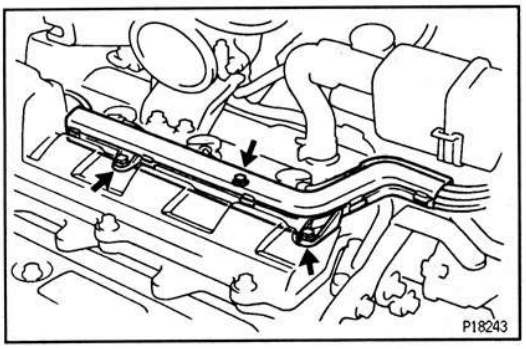


3. **REMOVE DISTRIBUTOR**

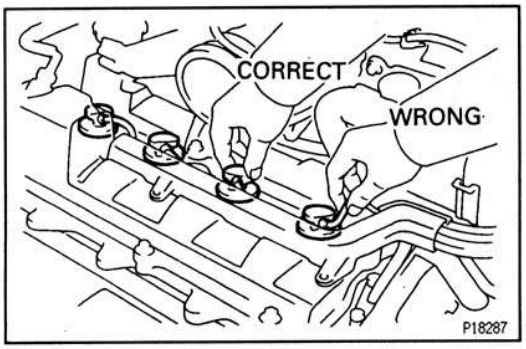
(a) Disconnect the distributor connector.



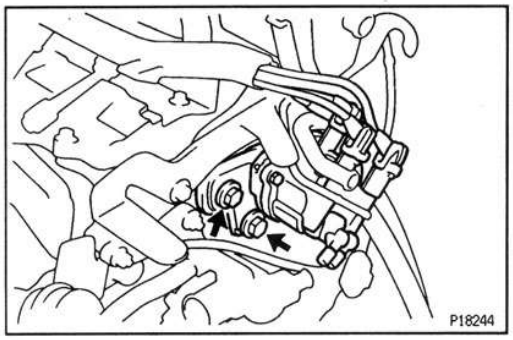
(b) Remove the 2 bolts and cool air inlet.



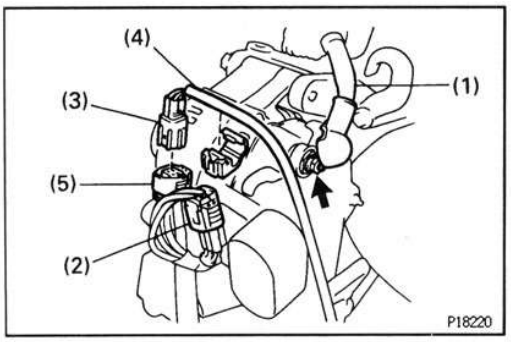
(c) Remove the 3 bolts, and disconnect the high—tension cord clamp from the cylinder head cover.



(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.

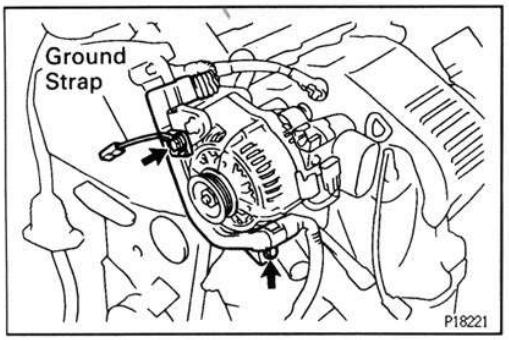


(e) Remove the 2 bolts, and pull out the distributor.
(f) Remove the O—ring from the distributor housing.

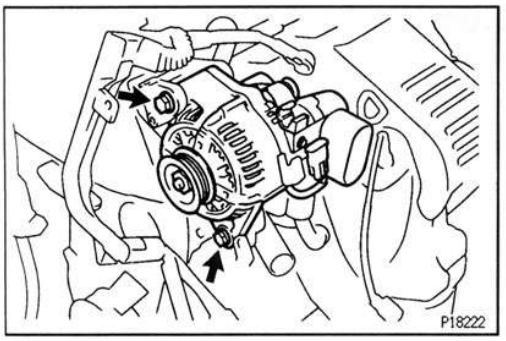


4. REMOVE ALTERNATOR

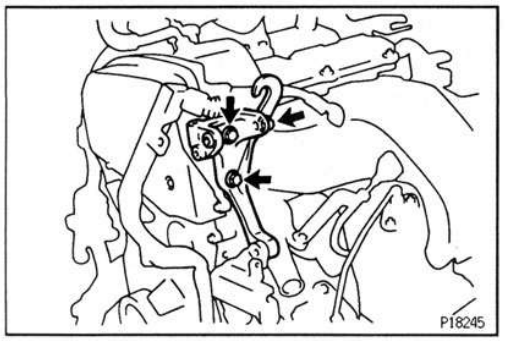
(a) Disconnect the following wires and connectors:
(1) Alternator wire
(2) Alternator connector
(3) Oxygen sensor connector
(4) Oxygen sensor wire from wire clamp
(5) Oxygen sensor connector from wire bracket



(b) Remove the 2 bolts and ground strap, and disconnect the engine wire protector from the brackets.



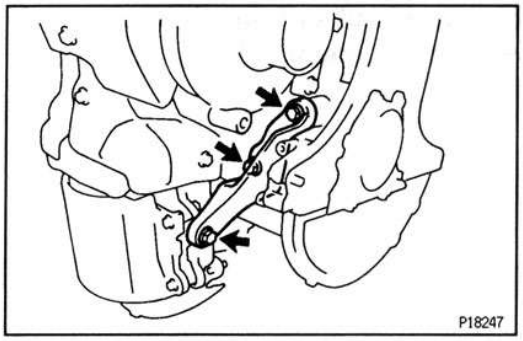
(c) Remove the 2 bolts and alternator.



5. REMOVE RH FRONT ENGINE HANGER AND ALTERNATOR BRACKET

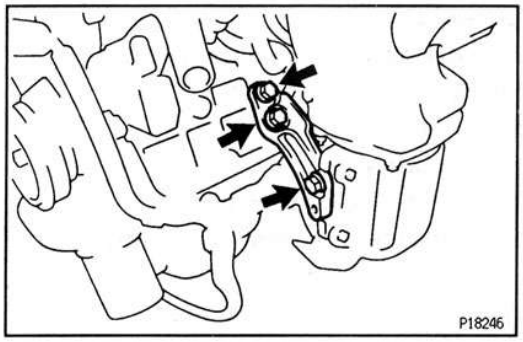
Remove the 3 bolts, engine hanger and alternator bracket.

EG

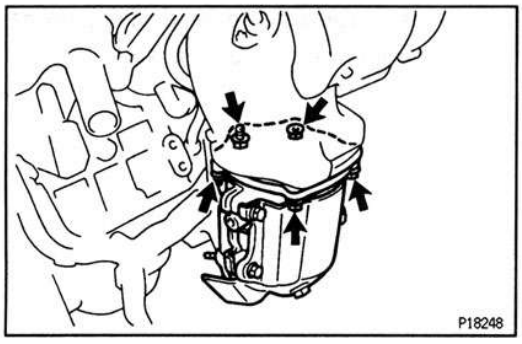


6. REMOVE LH AND RH CATALYTIC CONVERTER STAYS

(a) Remove the 3 bolts and LH converter stay.



(b) Remove the 3 bolts and RH converter stay.

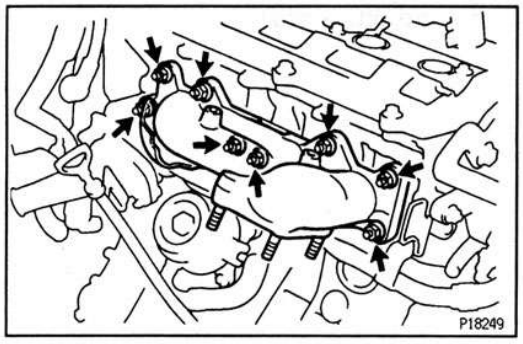


7. REMOVE CATALYTIC CONVERTER

Remove the 3 bolts, 2 nuts, catalytic converter and gasket.

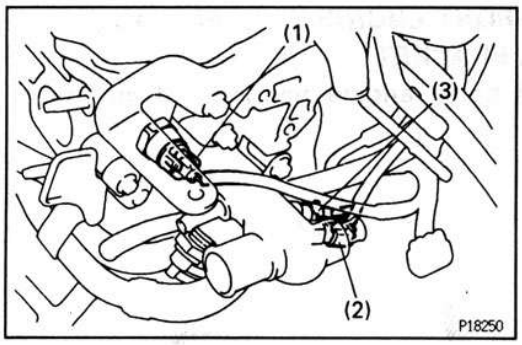
8. REMOVE TURBOCHARGER

(See steps 6 to 14 on pages EG–88 to 90)



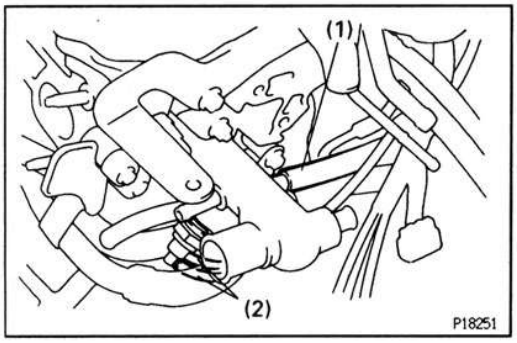
9. REMOVE EXHAUST MANIFOLD

Remove the 8 nuts, exhaust manifold and gasket.

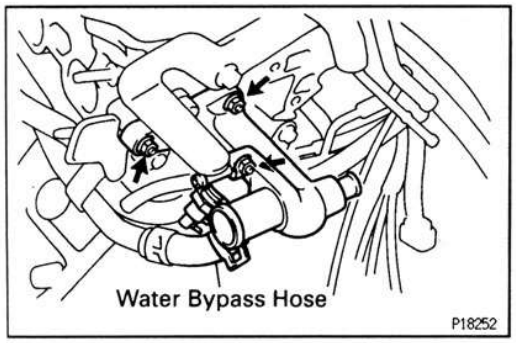


10. REMOVE WATER OUTLET

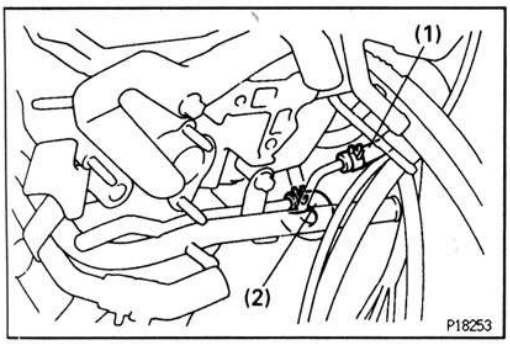
(a) Disconnect the following connectors:
- (1) Oil pressure switch connector
- (2) Water temperature sensor connector
- (3) Water temperature sender gauge connector



(b) Disconnect the following hoses from the water outlet:
(1) ISC water bypass hose
(2) 2 vacuum hoses

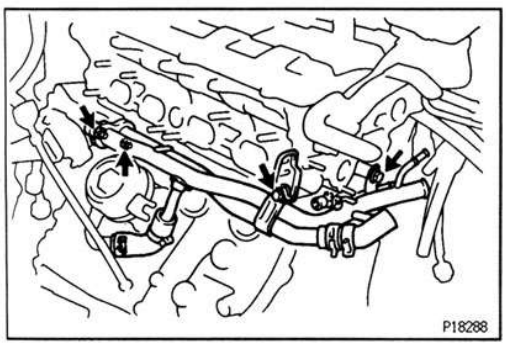


(c) Remove the 3 nuts.
(d) Disconnect the water bypass hose from the water outlet, and remove the water outlet and gasket.

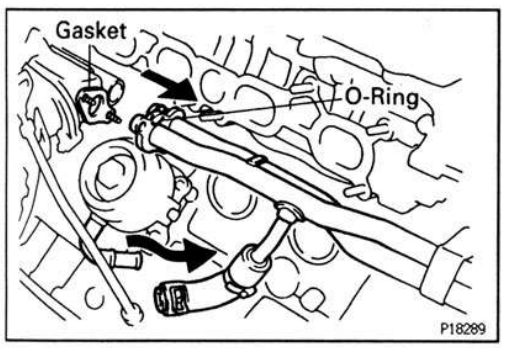


11. REMOVE WATER BYPASS PIPE

(a) Disconnect the following hoses from the water bypass pipe:
(1) ISC water bypass hose
(2) Air hose from turbocharging pressure VSV

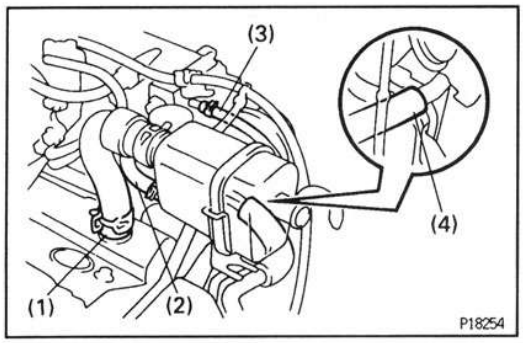


(b) Remove the 2 bolts and 2 nuts.



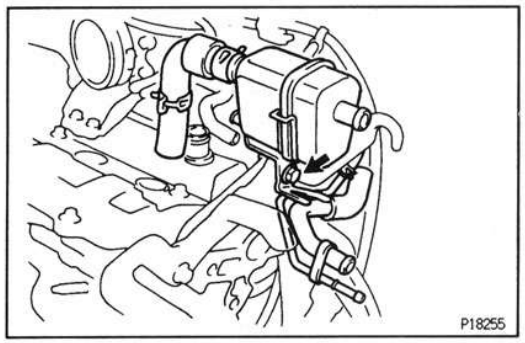
(c) Disconnect the water bypass pipe and hose from the water pump cover and oil cooler, and remove the water bypass pipe.
(d) Remove the gasket and O—ring.

EG

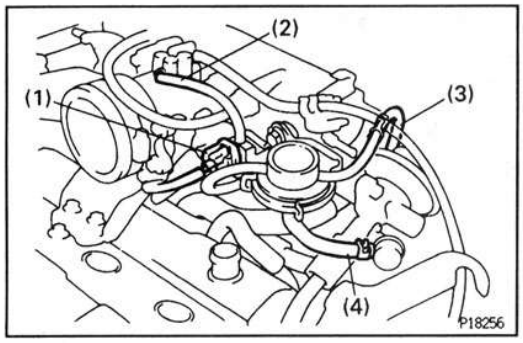


12. REMOVE NO.2 AIR TUBE AND VENTILATION CASE ASSEMBLY

(a) Disconnect the following hoses:
- (1) PCV hose from cylinder head cover
- (2) PCV hose from ventilation case
- (3) Vacuum hose from intake manifold
- (4) Air hose from No.1 air tube

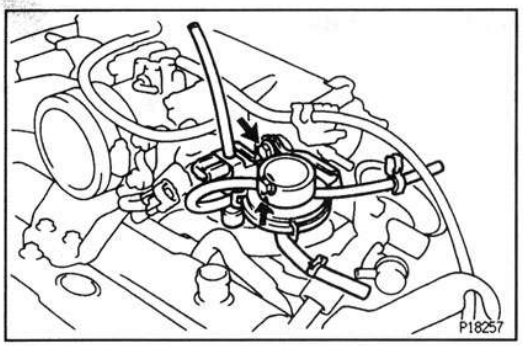


(b) Remove the bolt, No.2 air tube and ventilation case assembly.

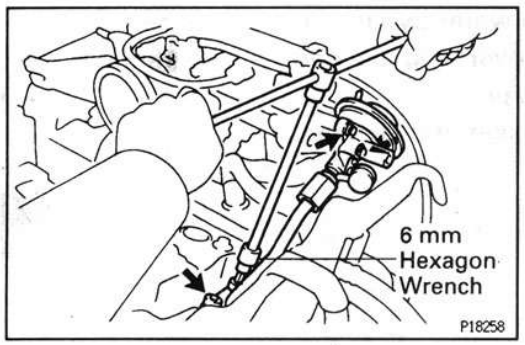


13. REMOVE EGR VACUUM MODULATOR AND VSV ASSEMBLY

(a) Disconnect the following connector and hoses:
- (1) VSV connector for EGR
- (2) Vacuum hose from throttle body
- (3) Vacuum hose from EGR valve
- (4) EGR hose from EGR valve

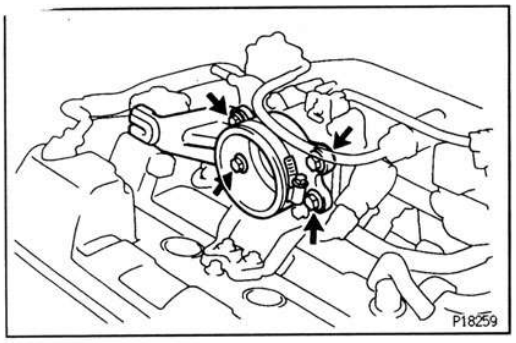


(b) Remove the 2 bolts, EGR vacuum modulator and VSV assembly.



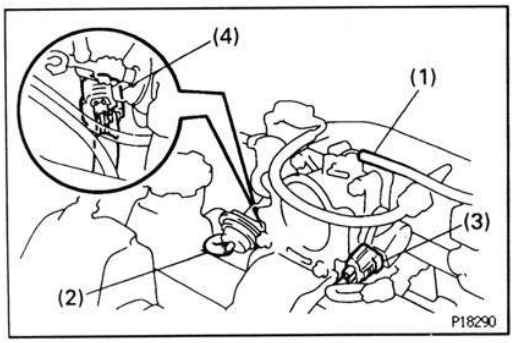
14. REMOVE EGR VALVE AND PIPE

Remove the 4 bolts, EGR valve and pipe assembly and 2 gaskets.

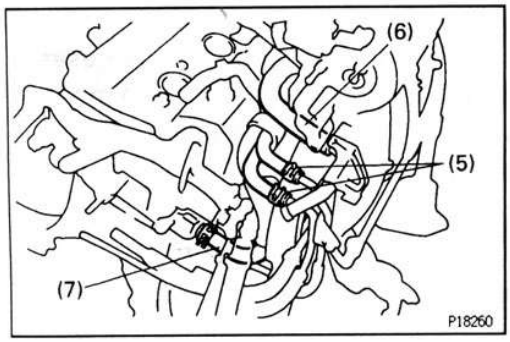


15. REMOVE THROTTLE BODY

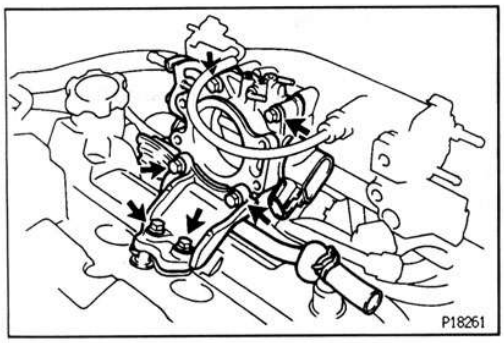
(a) Remove the 4 bolts, accelerator cable bracket and intake air connector.



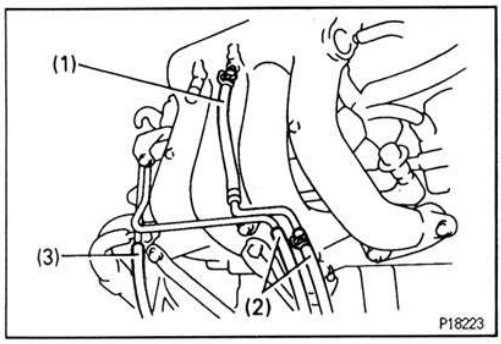
(b) Disconnect the following hoses and connectors:
(1) Vacuum hose from throttle body
(2) Vacuum hose from throttle opener
(3) Throttle position sensor connector
(4) ISC valve connector



(5) 2 ISC water bypass hoses from No.1 air tube
(6) Air hose from No.1 air tube
(7) PCV hose from cylinder head



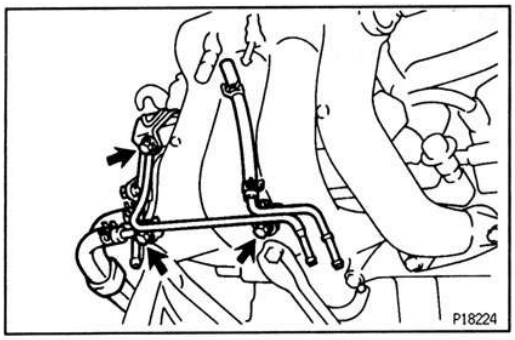
(c) Remove the 6 bolts, air connector stay, throttle body and hose assembly and gasket.
(d) Remove the gasket and spacer.



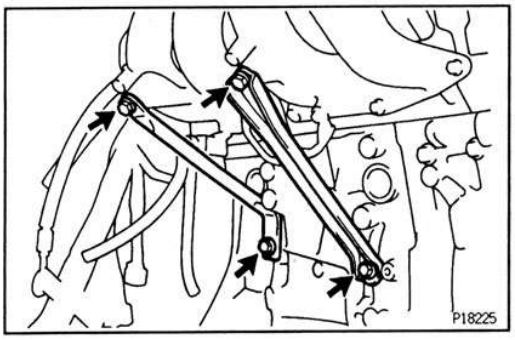
16. REMOVE NO.1 AIR TUBE

(a) Disconnect the following hoses:
(1) Air hose from intake manifold
(2) 2 PS air hoses from air tube
(3) Air hose from air tube

EG

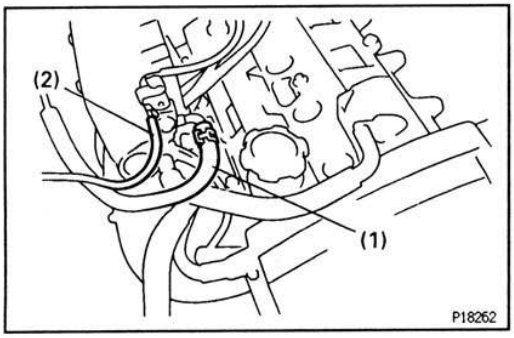


(b) Remove the 3 bolts and No.1 air tube.



17. REMOVE INTAKE MANIFOLD STAYS

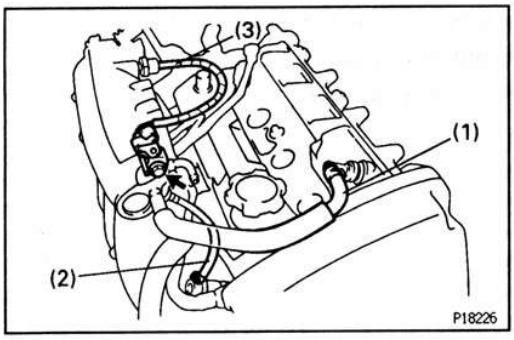
Remove the 2 bolts and manifold stay. Remove the 2 manifold stays.



18. DISCONNECT HOSES

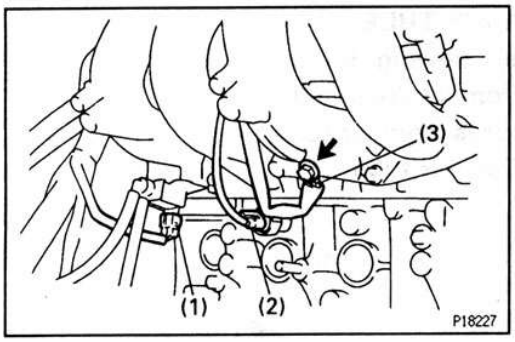
HINT (On vehicle): Disconnect the following hoses:

(1) Brake booster vacuum hose from intake manifold
(2) Vacuum hose from vacuum pipe



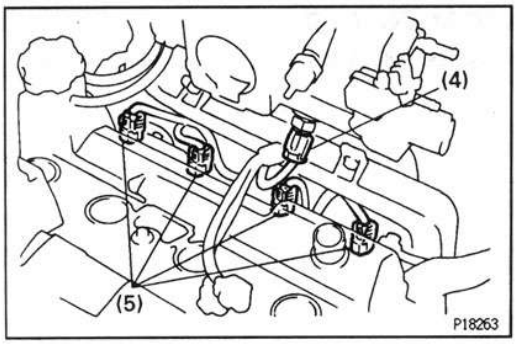
(a) Disconnect the following hoses:
(1) PCV hose from PCV valve
(2) Vacuum sensing hose from fuel pressure regulator
(3) Vacuum hose from gas filter

(b) Remove the bolt and vacuum pipe.

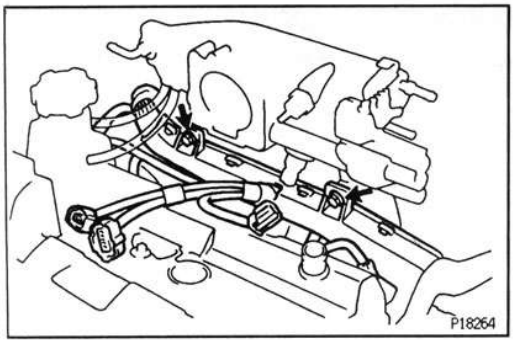


19. DISCONNECT ENGINE WIRE

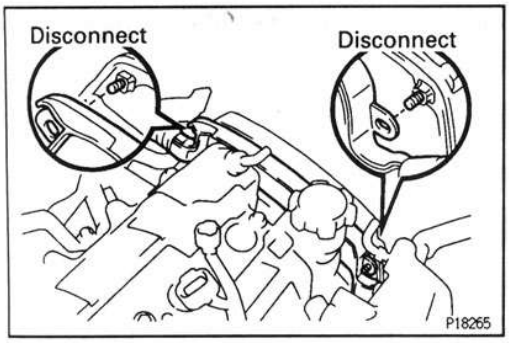
(a) Disconnect the following connectors and ground cable:
(1) VSV connector for turbocharging pressure
(2) Knock sensor connector
(3) Ground cable



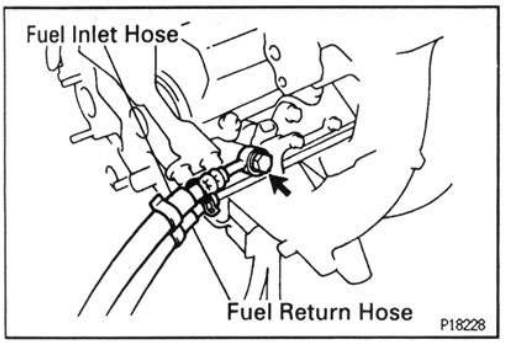
(4) Intake air temperature sensor connector
(5) 4 injector connectors



(b) Remove the 2 bolts, and disconnect the engine wire protector from the intake manifold.

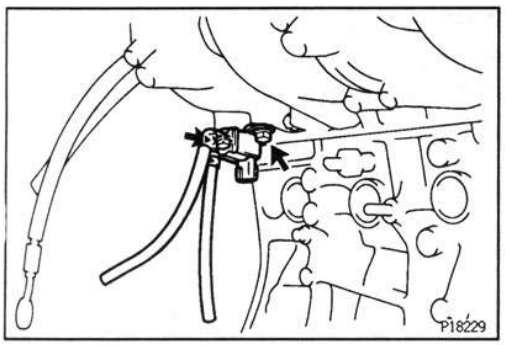


(c) Disconnect the engine wire protector from the 2 mounting bolts of the No.2 timing belt cover.

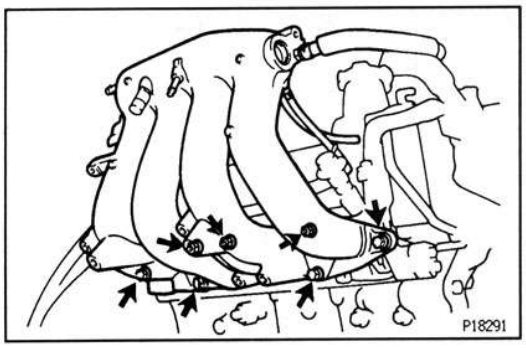


20. DISCONNECT FUEL INLET HOSE
Remove the union bolt and 2 gaskets, and disconnect the inlet hose from the delivery pipe.

21. DISCONNECT FUEL RETURN HOSE FROM RETURN PIPE

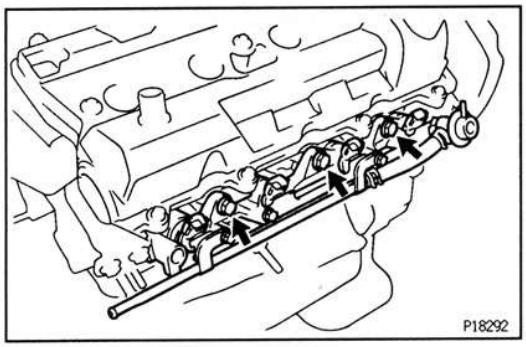


22. REMOVE VSV FOR TURBOCHARGING PRESSURE
Remove the 2 bolts and VSV.



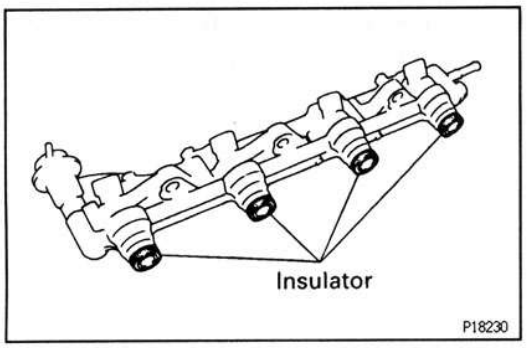
23. REMOVE INTAKE MANIFOLD

Remove the 4 bolts, 3 nuts, intake manifold and gasket.

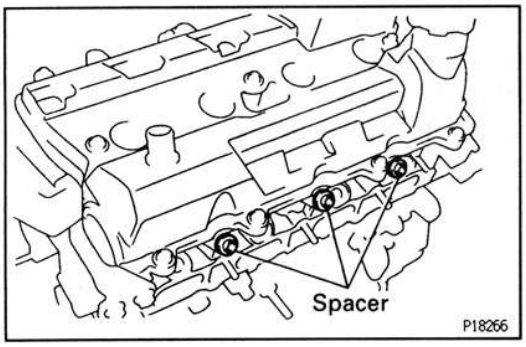


24. REMOVE DELIVERY PIPE ASSEMBLY

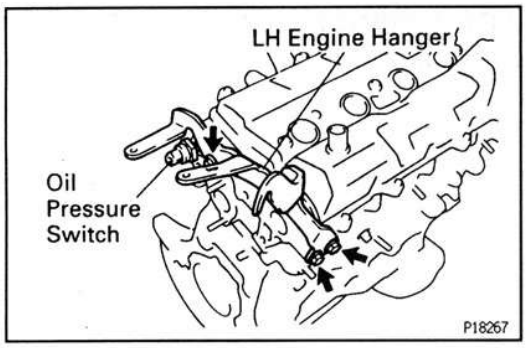
(a) Remove the 3 bolts and delivery pipe assembly.



(b) Remove the 4 insulators from the delivery pipe.



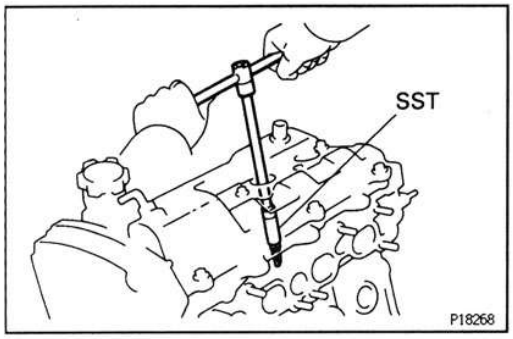
(c) Remove the 3 spacers from the cylinder head.



25. REMOVE LH ENGINE HANGER

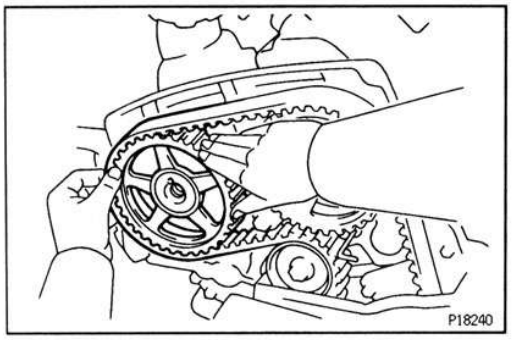
Remove the 3 bolts and engine hanger.

26. REMOVE OIL PRESSURE SWITCH



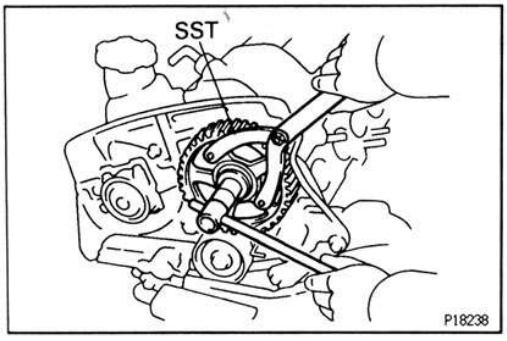
27. REMOVE SPARK PLUGS

Using SST, remove the 4 spark plugs.
SST 09155–16100



28. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEYS

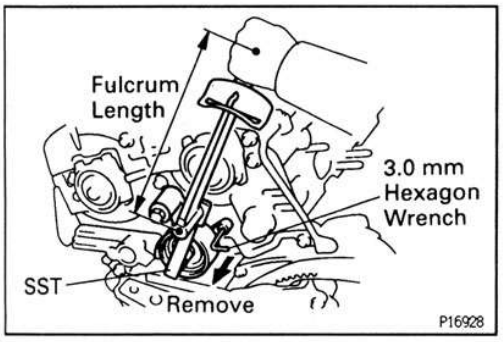
(See Pub.No.RM396E, steps 4 to 6 on pages EG–50 to 51)



29. REMOVE EXHAUST CAMSHAFT TIMING PULLEY

(a) Using SST, loosen the pulley bolt.
SST 09960–10010 (09962–01000, 09963–01000)

(b) Remove the bolt, timing pulley and knock pin.



30. REMOVE NO.1 IDLER PULLEY

(a) Turn the No.1 idler pulley bolt to obtain the specified torque or less, and remove the 3.0 mm hexagon wrench.

Torque:

69 N·m (700 kgf·cm, 51 ft·lbf)

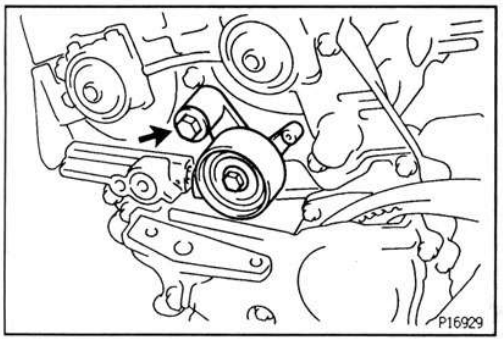
48 N·m (490 kgf·cm, 35 ft·lbf) for SST

HINT (On vehicle):

- Use SST.

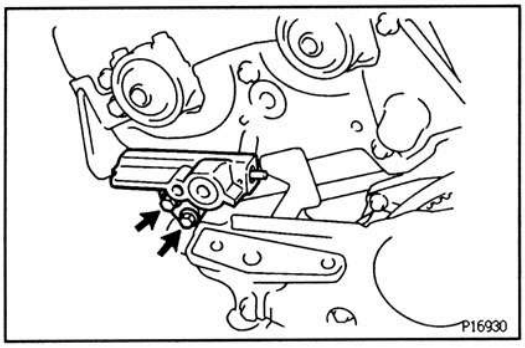
SST 09249–63010

- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

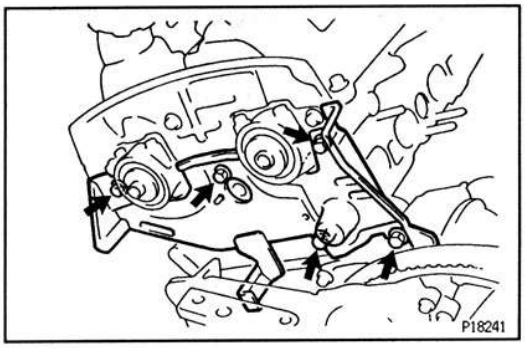


(b) Remove the pivot bolt, pulley and plate washer.

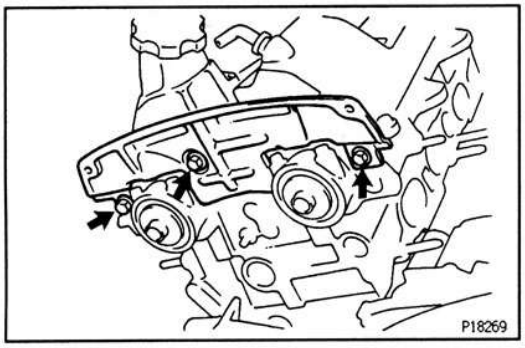
EG



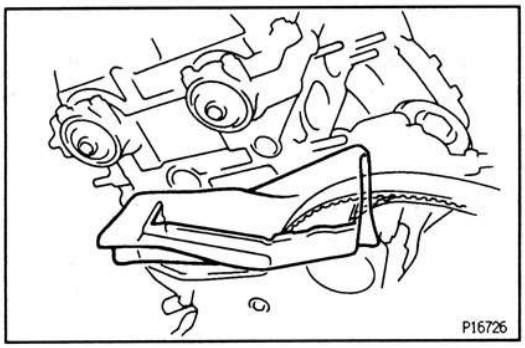
31. REMOVE TIMING BELT TENSIONER
Remove the 2 bolts and tensioner.



32. REMOVE NO.3 TIMING BELT COVER
Remove the 5 bolts and timing belt cover.

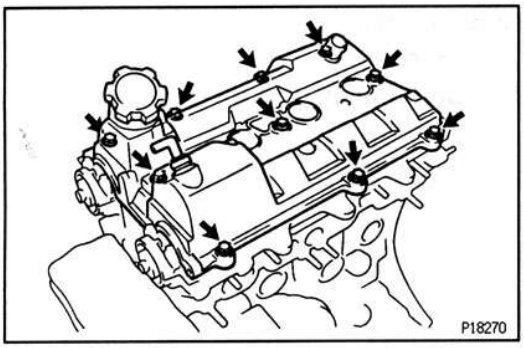


33. REMOVE NO.4 TIMING BELT COVER
Remove the 3 bolts and timing belt cover.

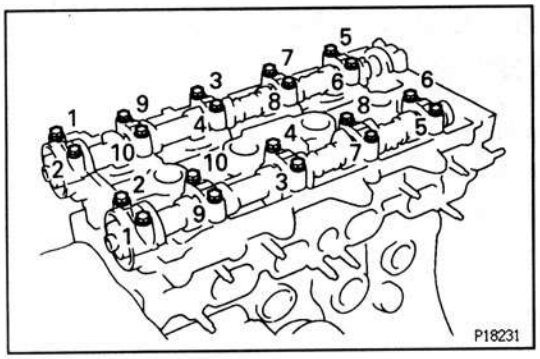


NOTICE:

- **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.**

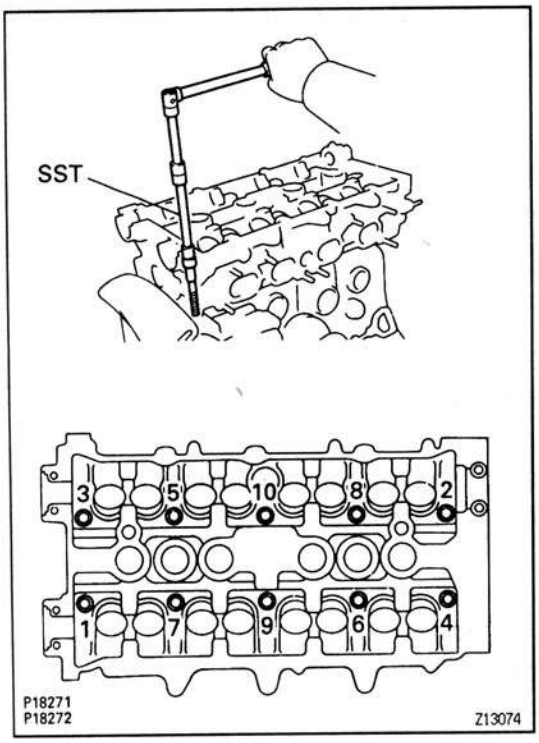


34. REMOVE CYLINDER HEAD COVER
Remove the 10 bolts, seal washers, cylinder head cover and 2 gaskets.



35. REMOVE CAMSHAFTS

Uniformly loosen and remove the 10 bearing cap bolts in several passes, in the sequence shown, and remove the 5 bearing caps, oil seal and camshaft. Remove the intake and exhaust camshafts.

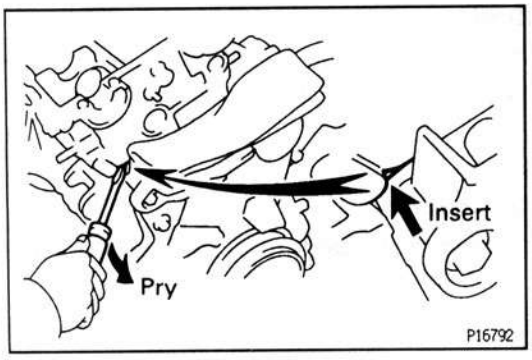


36. REMOVE CYLINDER HEAD

(a) Using SST, uniformly loosen and remove the 10 cylinder head bolts in several passes, in the sequence shown.

SST 09043—38100

HINT: Cylinder head warpage or cracking could result from removing in the incorrect order.

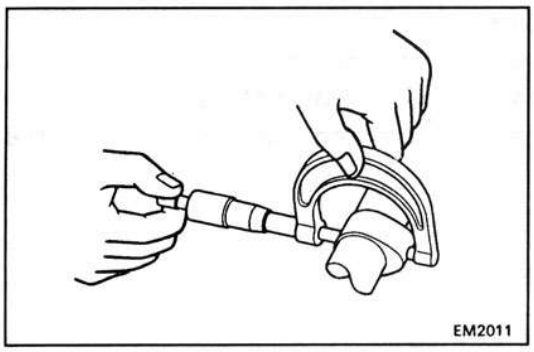


(b) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

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

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

EG47W-01


EM2011

CYLINDER HEAD COMPONENTS INSPECTION AND REPAIR

1. INSPECT CAMSHAFTS

Inspect cam lobes

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake

41.510 – 41.610 mm (1.6342 – 1.6382 in.)

Exhaust

41.100 – 41.200 mm (1.6181 – 1.6220 in.)

Minimum cam lobe height:

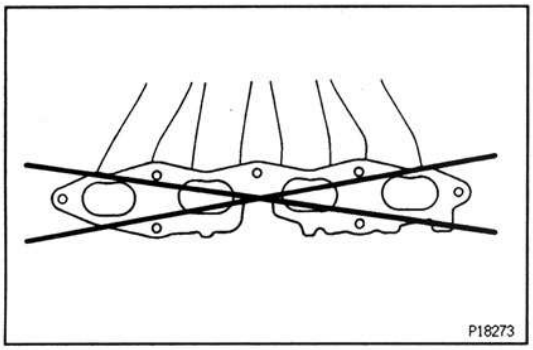
Intake

41.40 mm (1.6299 in.)

Exhaust

41.00 mm (1.6142 in.)

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


P18273

2. INSPECT MANIFOLDS

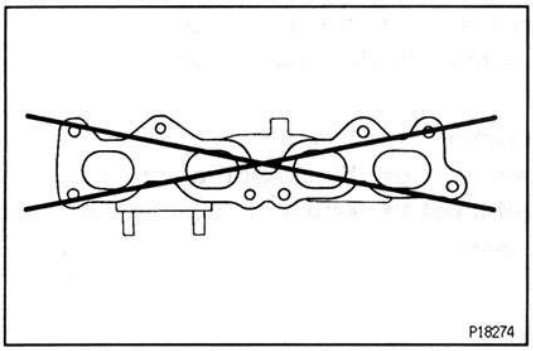
Intake Manifold:

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

Maximum warpage:

0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.


P18274

Exhaust Manifold:

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

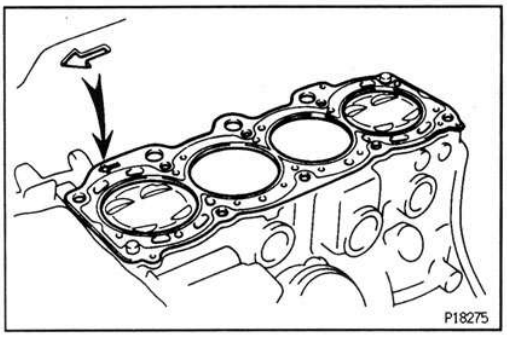
Maximum warpage:

1.00 mm (0.0394 in.)

If warpage is greater than maximum, replace the manifold.

EG47X-01

CYLINDER HEAD INSTALLATION



(See Components for Removal and Installation)

1. INSTALL CYLINDER HEAD

A. Place cylinder head on cylinder block

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

NOTICE: Be careful of the installation direction.

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

B. Install cylinder head bolts

HINT:

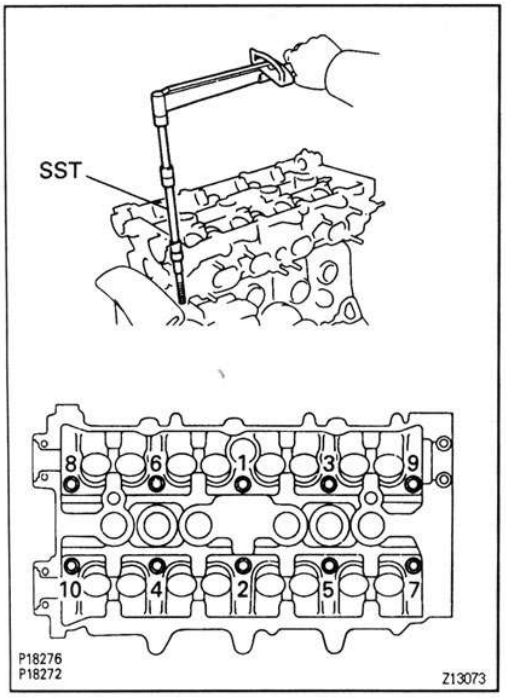
- The cylinder head bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any cylinder head bolt is broken or deformed, replace it.

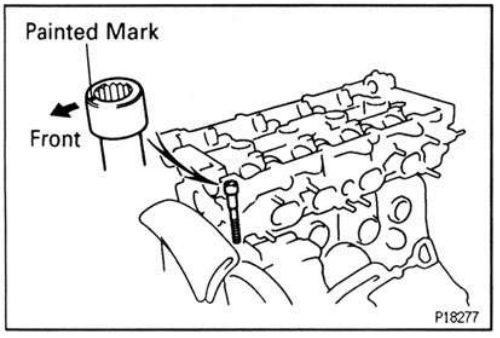
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

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

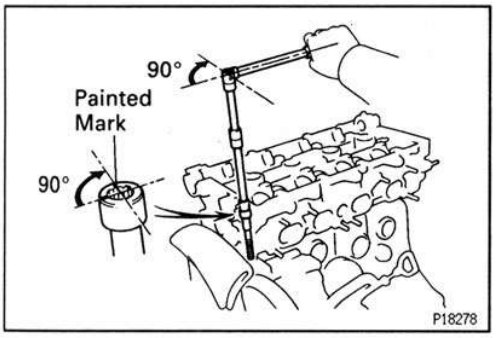
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

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





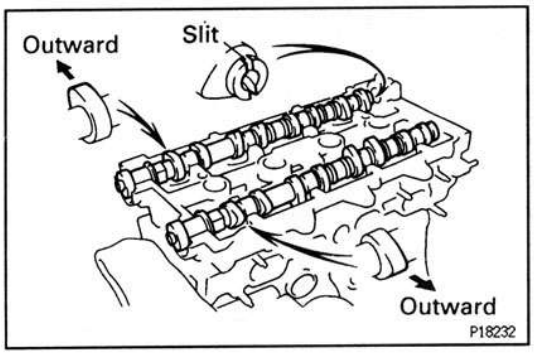
(c) Mark the front of the cylinder head bolt head with paint.



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

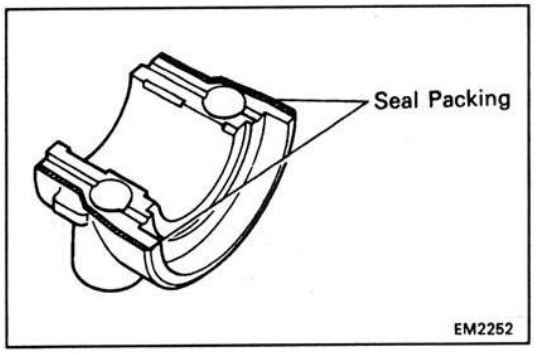
(e) Check that the painted mark is now at a 90° angle to the front.

EG

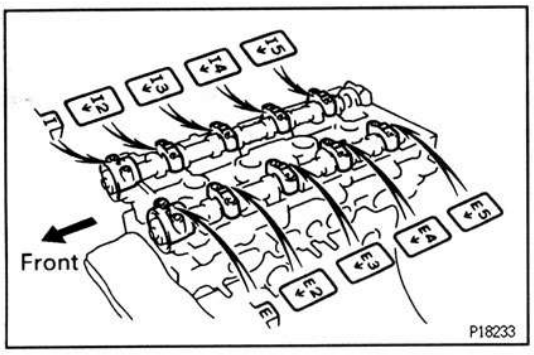


2. INSTALL CAMSHAFTS

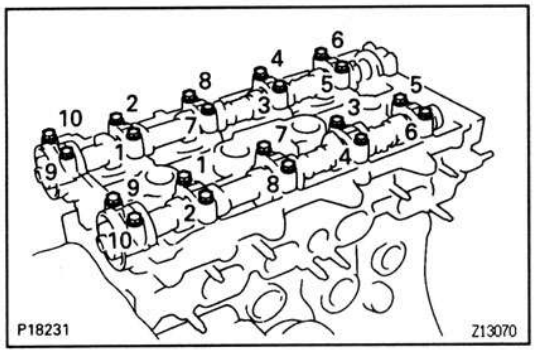
(a) Place the 2 camshafts on the cylinder head with the No.1 cam lobes facing outward as shown.
HINT: Intake camshaft have an slit; exhaust camshaft do not.



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



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



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

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

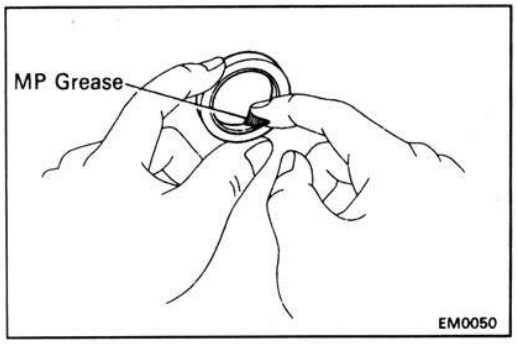
3. CHECK AND ADJUST VALVE CLEARANCE

(See page EG–11)

Turn the camshaft and position the cam lobe upward, and check and adjust the valve clearance.
Valve clearance (Cold):

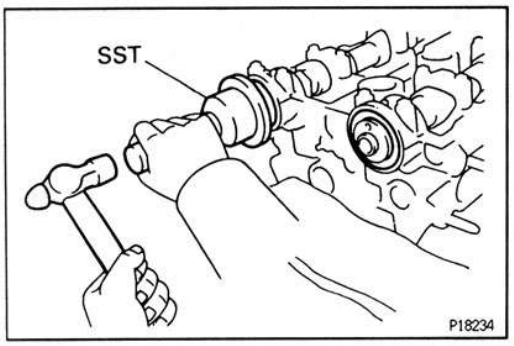
Intake
0.15 – 0.25 mm (0.006 – 0.010 in.)

Exhaust
0.28 – 0.38 mm (0.011 – 0.015 in.)

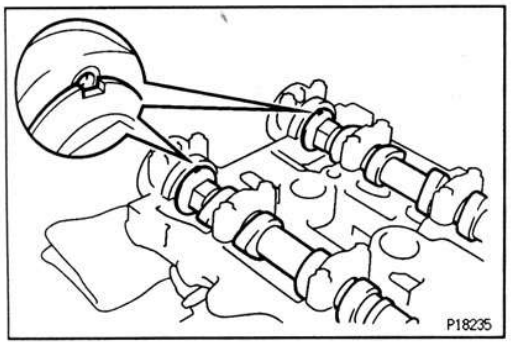


4. INSTALL CAMSHAFT OIL SEALS

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

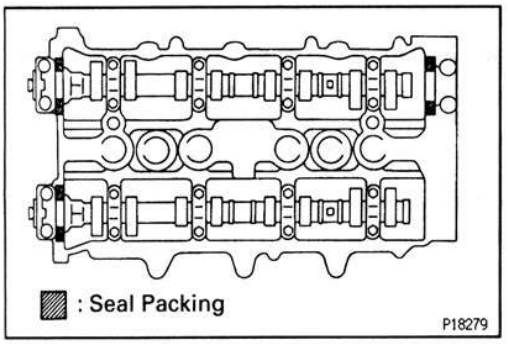


(b) Using SST, tap in the 2 camshaft oil seals.
SST 09223–46011

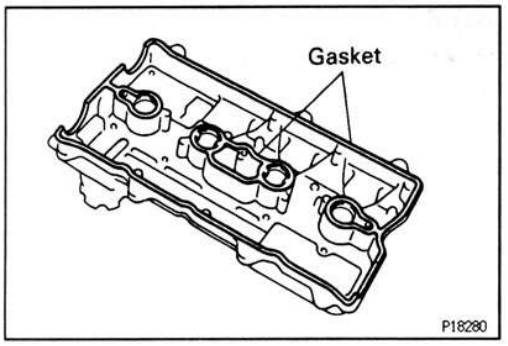


5. INSTALL CYLINDER HEAD COVER

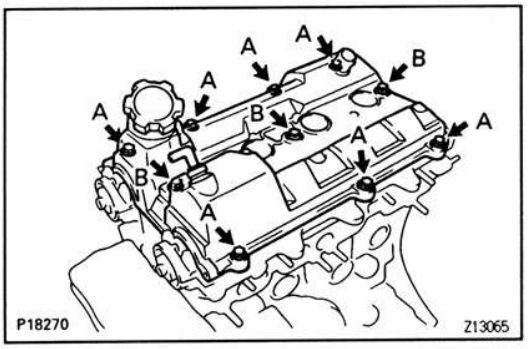
(a) Turn the hexagon head portion of the camshaft, align the groove of the camshaft with the dot mark of the No.1 camshaft bearing cap.



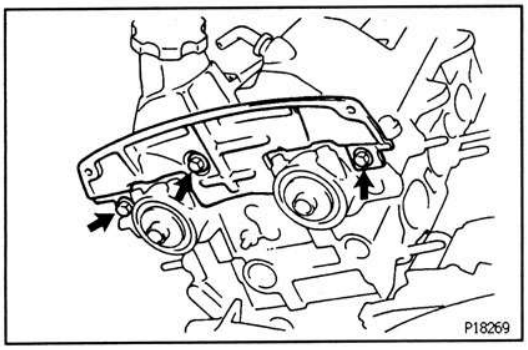
(b) Apply seal packing to the cylinder head as shown in the illustration.
Seal packing:
Part No. 08826–00080 or equivalent



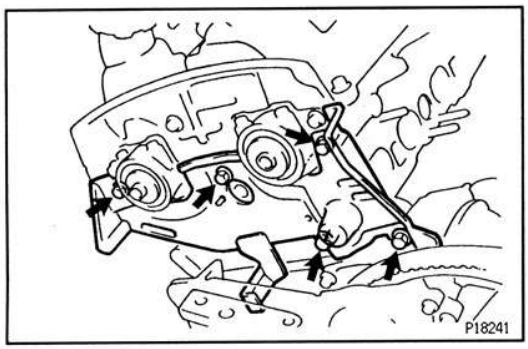
(c) Install the 2 gaskets to the head cover.



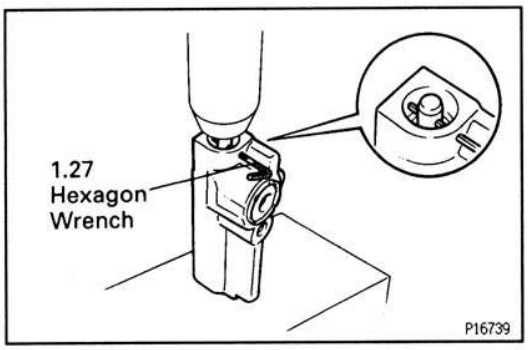
(d) Install the head cover with the 10 seal washers and bolts. Uniformly tighten the bolts in several passes.
Torque: 6.0 N·m (61 kgf·cm, 53 in.·lbf)
HINT: Each bolt length is indicated in the illustration.
Bolt length:
A: 25 mm (0.98 in.)
B: 50 mm (1.97 in.)



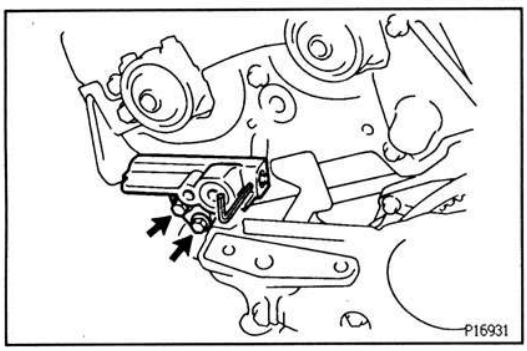
6. INSTALL NO.4 TIMING BELT COVER
Install the timing belt cover with the 3 bolts.
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)



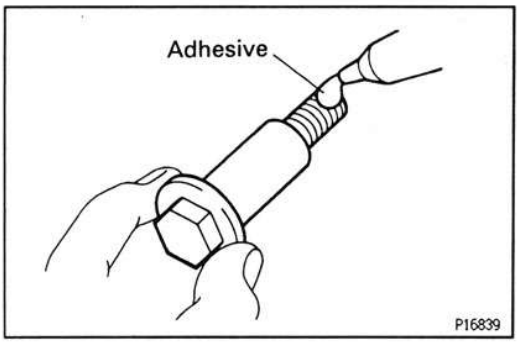
7. INSTALL NO.3 TIMING BELT COVER
Install the timing belt cover with the 5 bolts.
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)



8. SET TIMING BELT TENSIONER
(a) Using a press, slowly press in the push rod using 981 – 9,807 N (100 – 1,000 kgf, 220 – 2,205 lbf) of force.
(b) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
(c) Release the press.

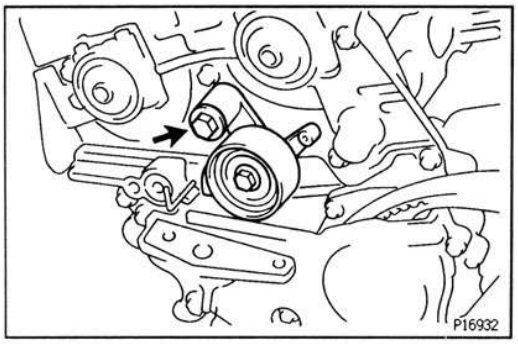


9. INSTALL TIMING BELT TENSIONER
Install the tensioner with the 2 bolts.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)



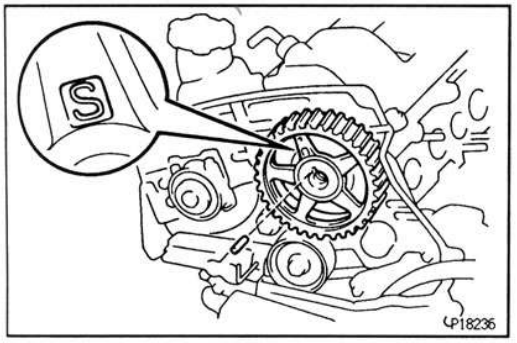
10. INSTALL NO.1 IDLER PULLEY

(a) Apply adhesive to 2 or 3 threads of the pivot bolt.
Adhesive:
Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent



(b) Install the plate washer and pulley with the pivot bolt.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

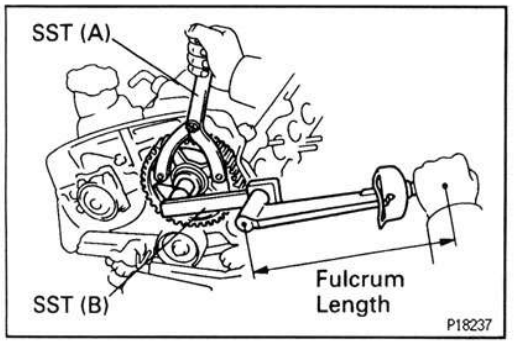
(c) Check that the idler pulley moves smoothly.



11. INSTALL EXHAUST CAMSHAFT TIMING PULLEY

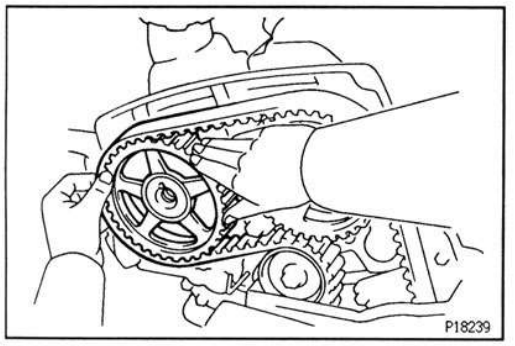
(a) Slide the timing pulley onto the camshaft, facing mark "S" outward.

(b) Align the pin holes of the camshaft and timing pulley, and insert the knock pin.

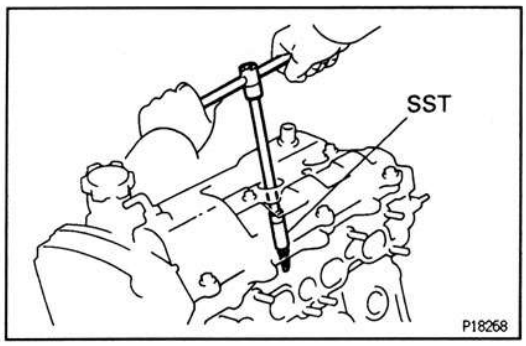


(c) Using SST (A), install the pulley bolt.
SST 09960–10010 (09962–01000, 09963–01000)
Torque:
69 N·m (700 kgf·cm, 51 ft·lbf)
48 N·m (490 kgf·cm, 35 ft·lbf) for SST
HINT (On vehicle):
- Use SST (B).

SST 09249–63010
- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).



12. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEYS
(See Pub.No.RM396E, steps 14 to 17 on pages EG–61 to 64)

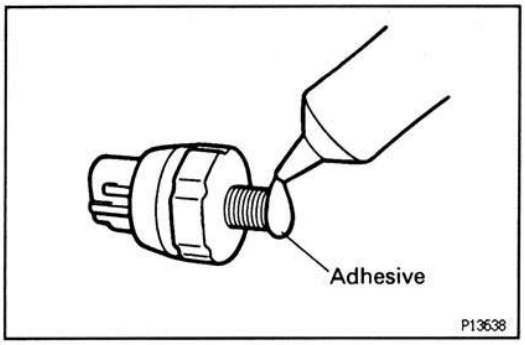


13. INSTALL SPARK PLUGS

Using SST, install the 4 spark plugs.

SST 09155–16100

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

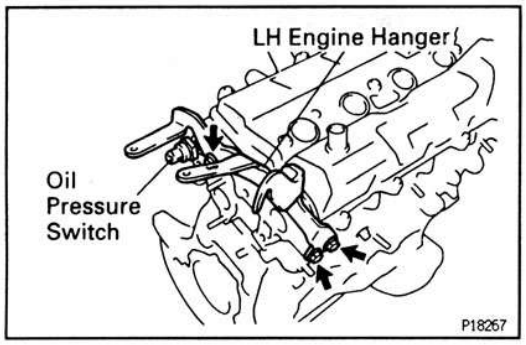


14. INSTALL OIL PRESSURE SWITCH

(a) Apply adhesive to 2 or 3 threads.

Adhesive:

Part No. 08833–00080, THREE BOND 1324 or equivalent



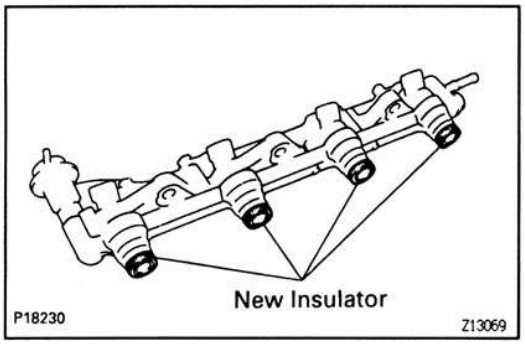
(b) Install the oil pressure switch.

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

15. INSTALL LH ENGINE HANGER

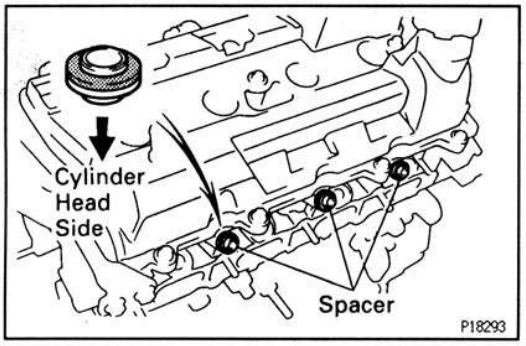
Install the LH engine hanger with the 3 bolts.

Torque: 44 N·m (450 kgf·cm, 32 ft·lbf)

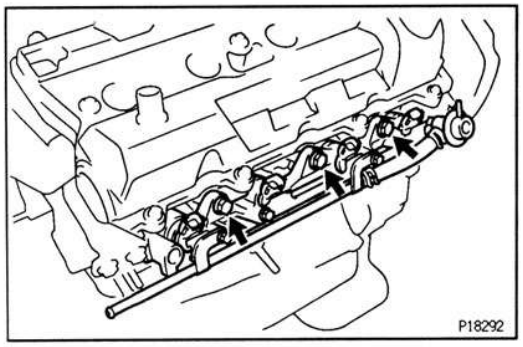


16. INSTALL DELIVERY PIPE ASSEMBLY

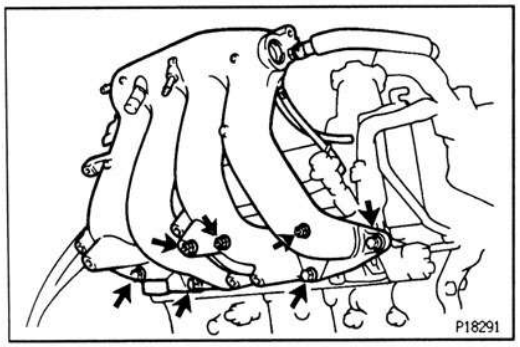
(a) Install 4 new insulators to the delivery pipe.



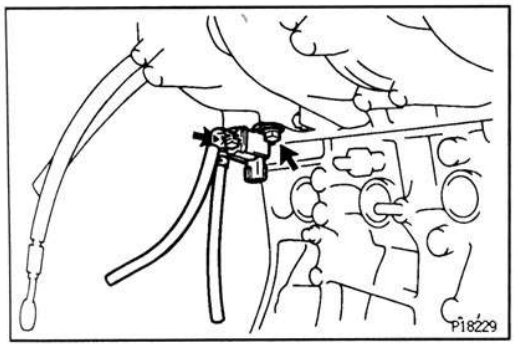
(b) Install the 3 spacers to the cylinder head as shown in the illustration.



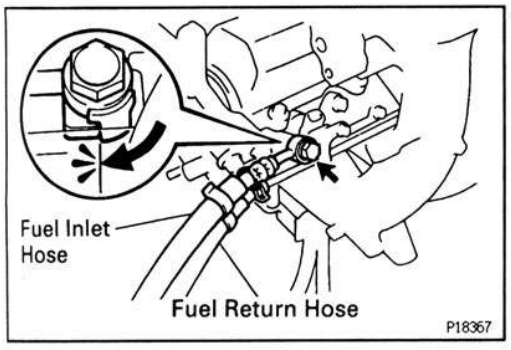
(c) Install the delivery pipe to the cylinder head with the 3 bolts.
Torque: 29 N·m (300 kgf·cm, 21 ft·lbf)



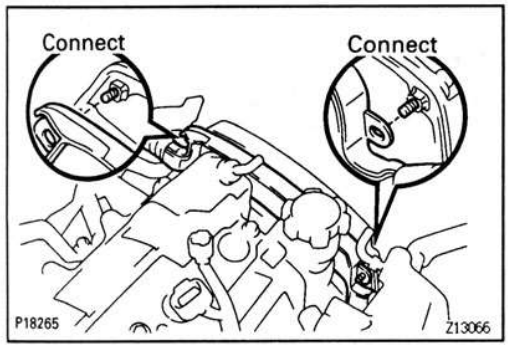
17. INSTALL INTAKE MANIFOLD
Install a new gasket and the intake manifold with the 4 bolts and 3 nuts. Uniformly tighten the bolts and nuts in several passes.
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)



18. INSTALL VSV FOR TURBOCHARGING PRESSURE
Install the VSV with the 2 bolts.

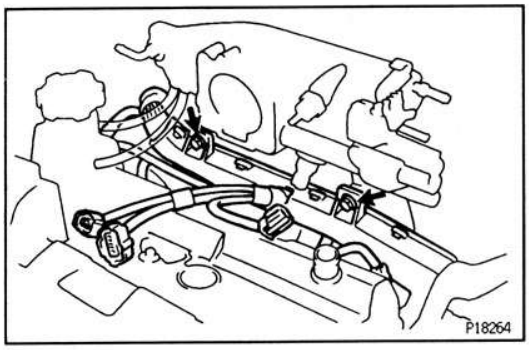


19. CONNECT FUEL RETURN HOSE TO RETURN PIPE
20. CONNECT FUEL INLET HOSE
Connect the fuel inlet hose to the delivery pipe with 2 new gaskets and the union bolt.
Torque: 32 N·m (330 kgf·cm, 24 ft·lbf)

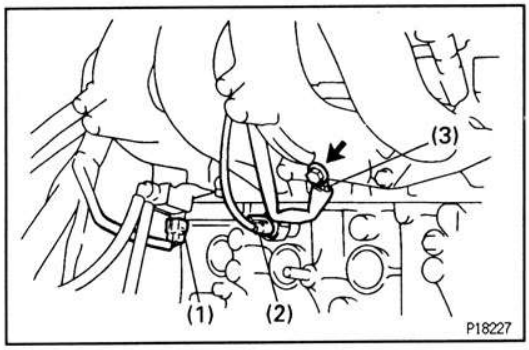


21. INSTALL ENGINE WIRE
(a) Install the engine wire protector to the 2 mounting bolts of the No.2 timing belt cover.

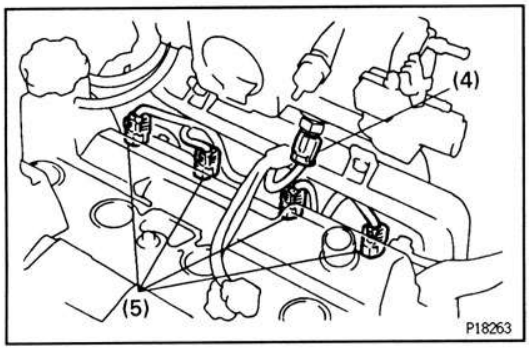
EG



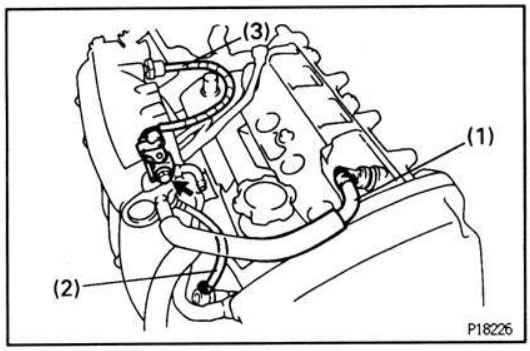
(b) Install the engine wire protector to the intake manifold with the 2 bolts.



(c) Connect the following connectors and ground cable:
(1) VSV connector for turbocharging pressure
(2) Knock sensor connector
(3) Ground cable

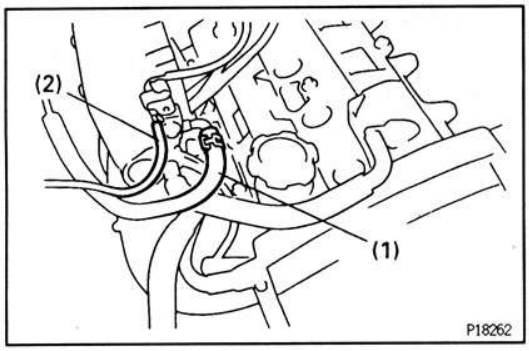


(4) Intake air temperature sensor connector
(5) 4 injector connectors
HINT: The No.1 and No.3 injector connectors are brown, and the No.2 and No.4 injector connectors are black.

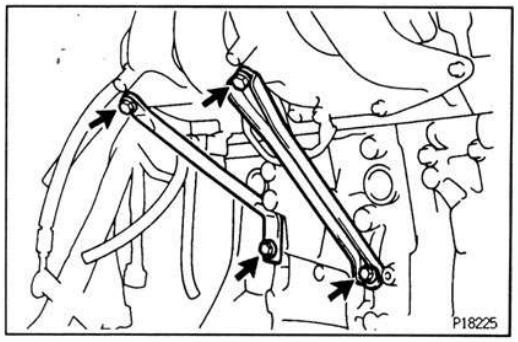


22. CONNECT HOSES

(a) Install the vacuum pipe with the bolt.
(b) Connect the following hoses:
(1) PCV hose to PCV valve
(2) Vacuum sensing hose to fuel pressure regulator
(3) Vacuum hose to gas filter



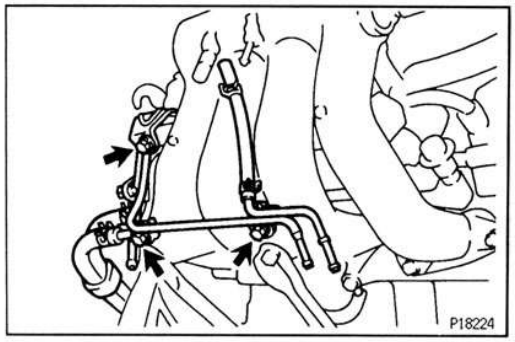
HINT (On vehicle): Connect the following hoses:
(1) Brake booster vacuum hose to intake manifold
(2) Vacuum hose to vacuum pipe



23. INSTALL INTAKE MANIFOLD STAYS

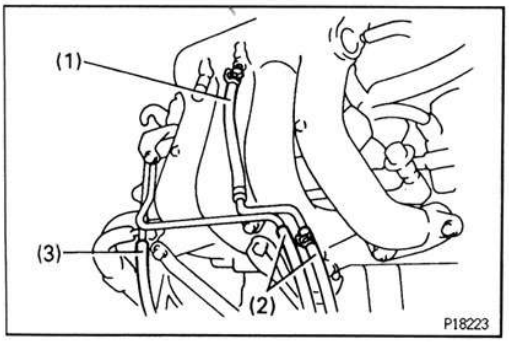
Install the manifold stay with the 2 bolts. Install the 2 manifold stays.

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

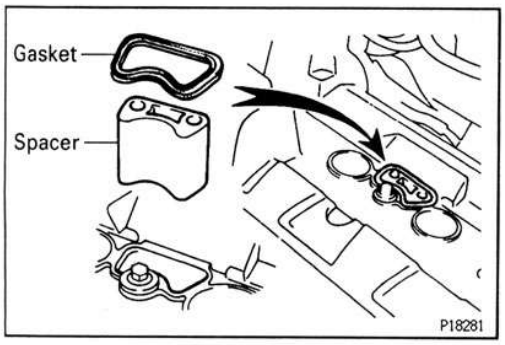


24. INSTALL NO.1 AIR TUBE

(a) Install the No.1 air tube with the 3 bolts.

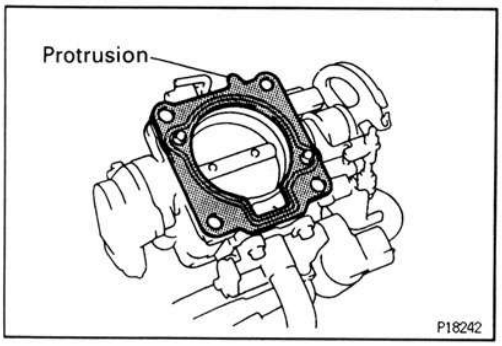


(b) Connect the following hoses:
- (1) Air hose to intake manifold
- (2) 2 PS air hoses to air tube
- (3) Air hose to air tube

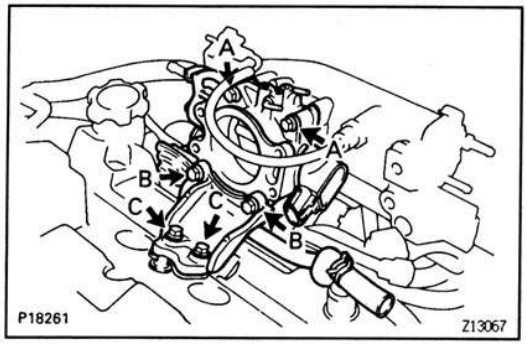


25. INSTALL THROTTLE BODY

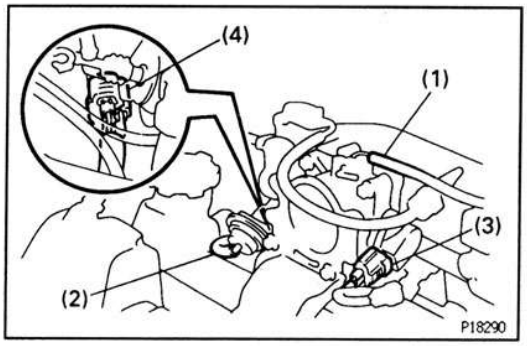
(a) Insert the spacer into the cylinder head cover, and install the gasket.



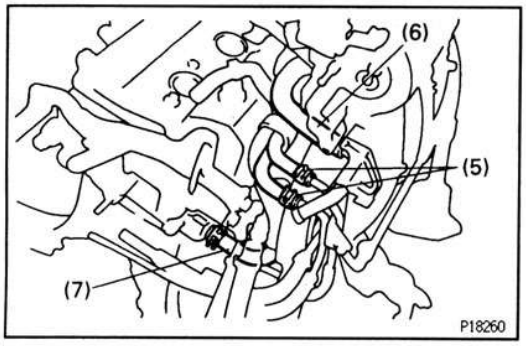
(b) Attach a new gasket to the throttle body, facing the protrusion upward.



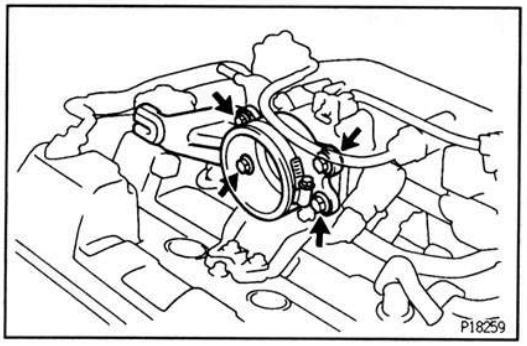
(c) Install the gasket, throttle body and hose assembly and air connector stay with the 6 bolts in several passes.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)
HINT: Different bolt lengths are used for locations A, B and C.
Bolt length:
A: 40 mm (1.57 in.)
B: 80 mm (3.15 in.)
C: 70 mm (2.76 in.)



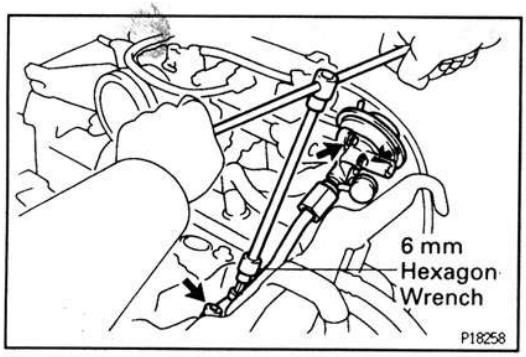
(d) Connect the following hoses and connectors:
(1) Vacuum hose (from lower port of BVSV) to throttle body
(2) Vacuum hose to throttle opener
(3) Throttle position sensor connector
(4) ISC valve connector



(5) 2 ISC water bypass hoses to No.1 air tube
(6) Air hose to No.1 air tube
(7) PCV hose to cylinder head



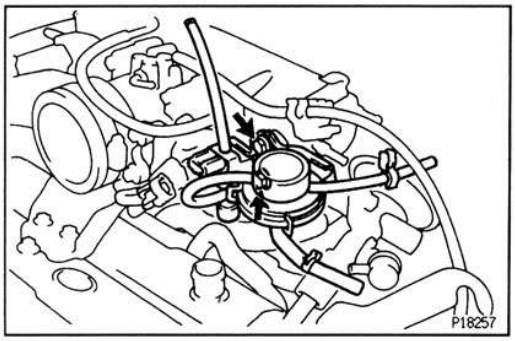
(e) Install the accelerator cable bracket and intake air connector with the 4 bolts.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)



26. INSTALL EGR VALVE AND PIPE

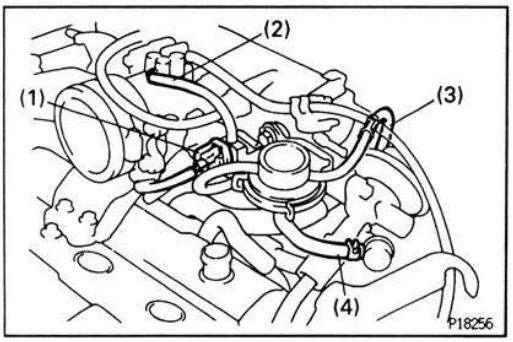
Install 2 new gaskets, the EGR valve and pipe assembly with the 4 bolts.
Torque:

Intake manifold	**19 N·m (190 kgf·cm, 14 ft·lbf)**
Cylinder head	**25 N·m (250 kgf·cm, 18 ft·lbf)**

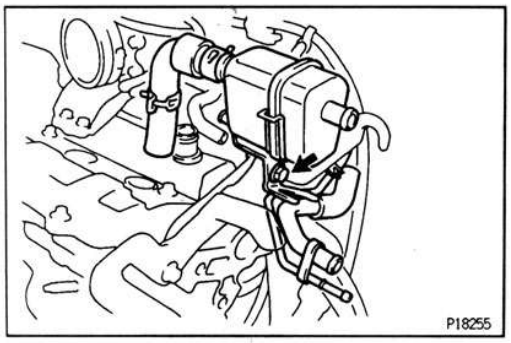


27. INSTALL EGR VACUUM MODULATOR AND VSV ASSEMBLY

(a) Install the EGR vacuum modulator and VSV assembly with the 2 bolts.

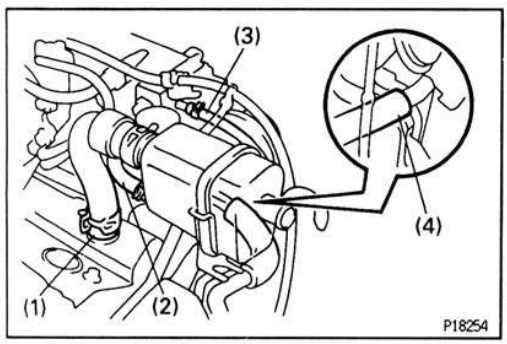


(b) Connect the following connector and hoses:
(1) VSV connector for EGR
(2) Vacuum hose to throttle body
(3) Vacuum hose to EGR valve
(4) EGR hose to EGR valve

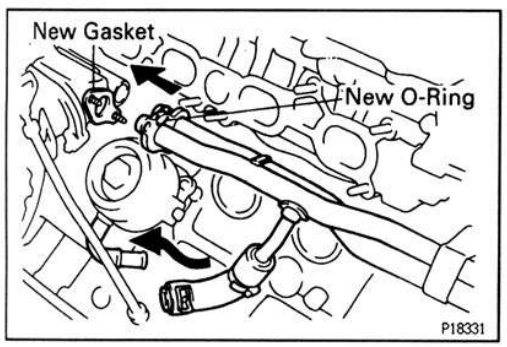


28. INSTALL NO.2 AIR TUBE AND VENTILATION CASE ASSEMBLY

(a) Install the No.2 air tube and ventilation case assembly with the bolt.



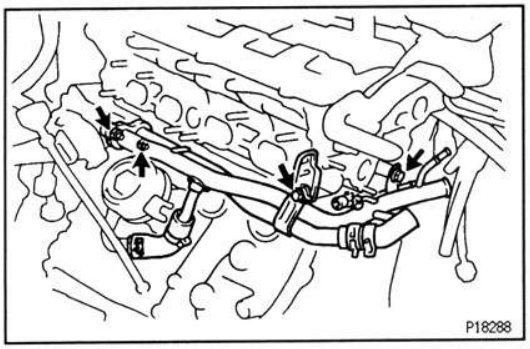
(b) Connect the following hoses:
(1) PCV hose to cylinder head cover
(2) PCV hose (from cylinder head) to ventilation case
(3) Vacuum hose (from No.2 air tube) to intake manifold
(4) Air hose to No.1 air tube



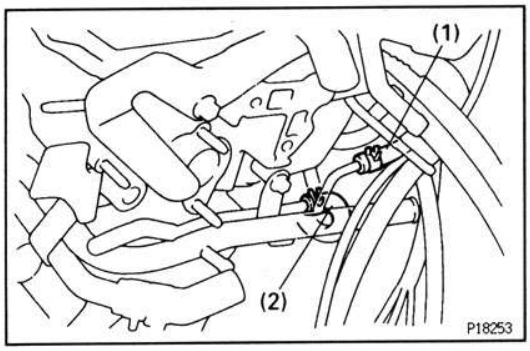
29. INSTALL WATER BYPASS PIPE

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

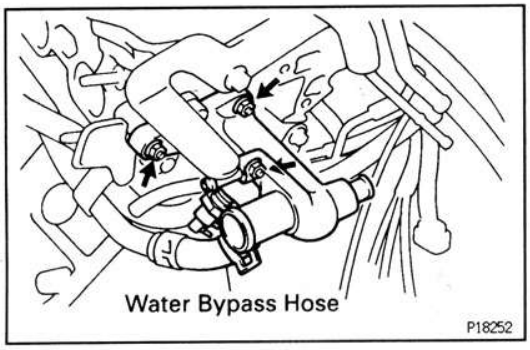
EG



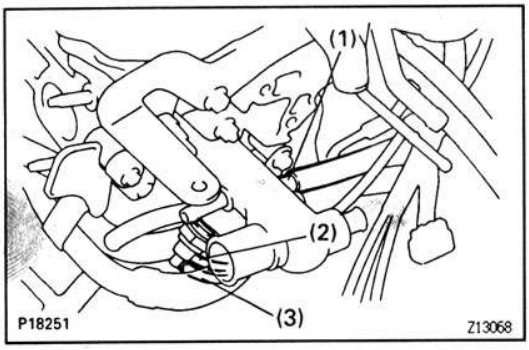
(e) Install the bypass pipe with the 2 nuts and 2 bolts.
Torque:
Nut: 10 N·m (100 kgf·cm, 7 ft·lbf)
Bolt: 24 N·m (240 kgf·cm, 18 ft·lbf)



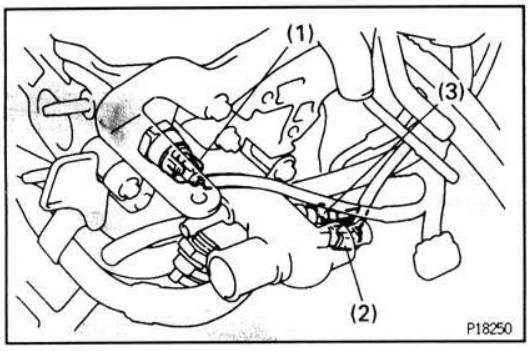
(f) Connect the following hoses to the water bypass pipe:
(1) ISC water bypass hose
(2) Air hose from turbocharging pressure VSV



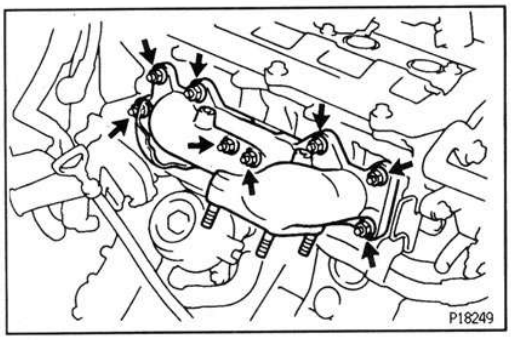
30. INSTALL WATER OUTLET
(a) Install a new gasket to the cylinder head.
(b) Connect the water bypass hose to the water outlet, and install the water outlet with the 3 nuts.
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)



(c) Connect the following hoses:
(1) ISC water bypass hose to water outlet
(2) Vacuum hose (from charcoal canister) to upper port of BVSV
(3) Vacuum hose (from port P of throttle body) to lower port of BVSV



(d) Connect the following connectors:
(1) Oil pressure switch connector
(2) Water temperature sensor connector
(3) Water temperature sender gauge connector



31. INSTALL EXHAUST MANIFOLD

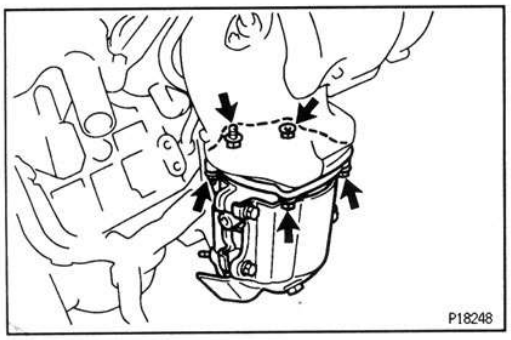
Install a new gasket and the exhaust manifold with the 8 nuts. Uniformly tighten the nuts in several passes.

Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

32. INSTALL TURBOCHARGER

(See steps 4 to 12 on pages EG–92 to 94)

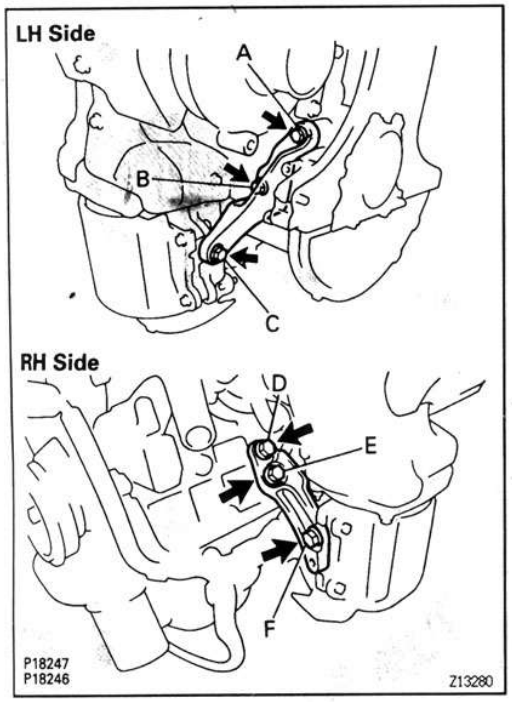
EG



33. INSTALL CATALYTIC CONVERTER

Install a new gasket and the catalytic converter with the 3 bolts and 2 nuts.

Torque: 29 N·m (300 kgf·cm, 21 ft·lbf)



34. INSTALL LH AND RH CATALYTIC CONVERTER STAYS

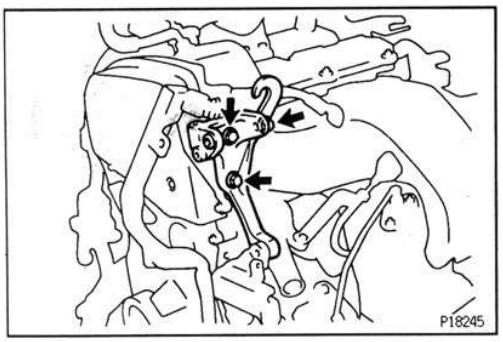
(a) Install bolts A and D to converter stays LH and RH, and tighten them by hand.

(b) Temporarily tighten bolts C and F so that the converter and stays fit securely together.

Torque: 10 N·m (100 kgf·cm, 7 ft·lbf)

(c) Torque the bolts in the order A, B, C, D, E, F.

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

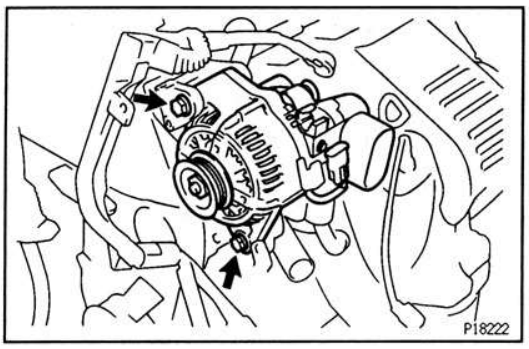


35. INSTALL ALTERNATOR BRACKET AND RH FRONT ENGINE HANGER

Install the alternator bracket and engine hanger with the 3 bolts.

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

EG

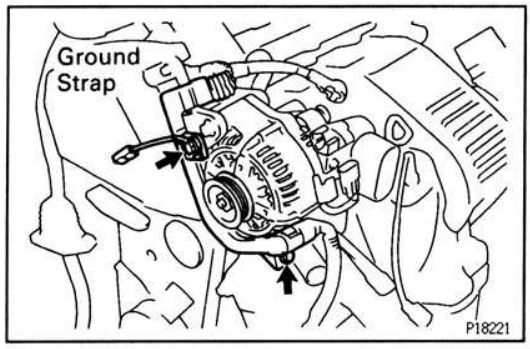


36. INSTALL ALTERNATOR

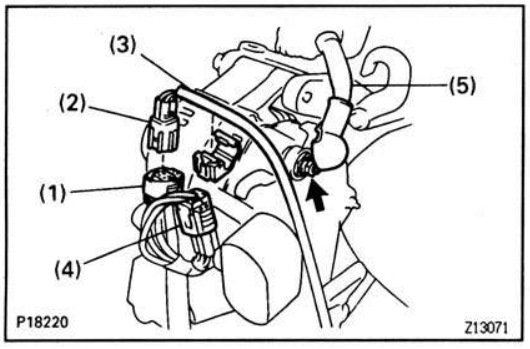
(a) Install the alternator with the 2 bolts.

Torque:

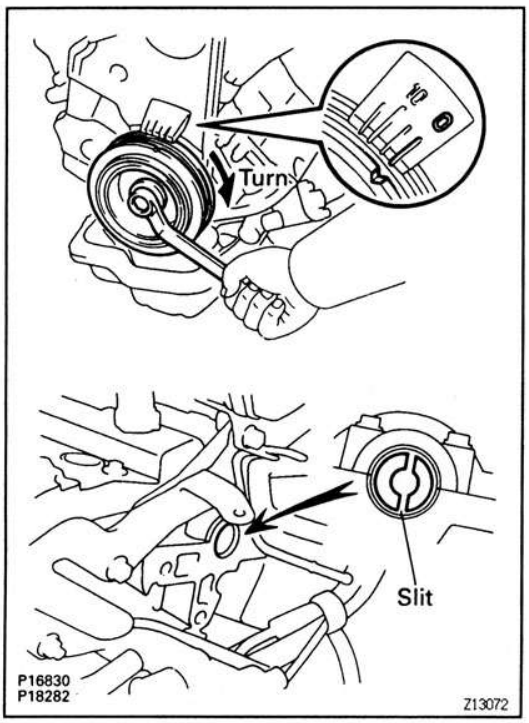
12 mm head 19 N·m (190 kgf·cm, 14 ft·lbf)
14 mm head 52 N·m (530 kgf·cm, 38 ft·lbf)



(b) Install the engine wire protector and ground strap with the 2 bolts.

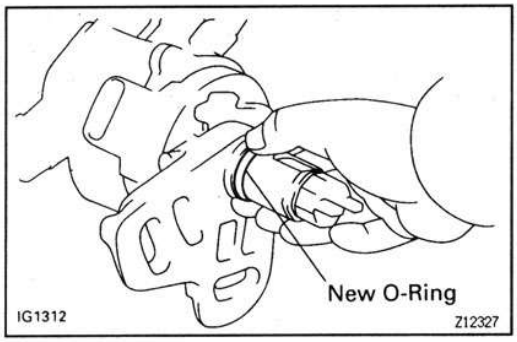


(c) Connect the following wires and connectors:
(1) Oxygen sensor connector to wire bracket
(2) Oxygen sensor connector
(3) Oxygen sensor wire to wire clamp
(4) Alternator connector
(5) Alternator wire



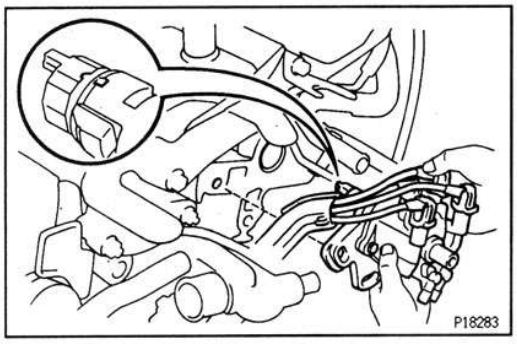
37. INSTALL DISTRIBUTOR

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

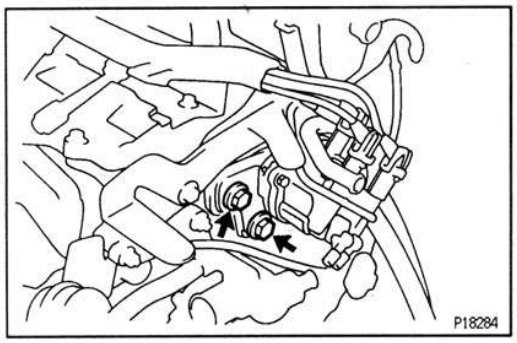


(b) Install a new O–ring to the distributor housing.
(c) Apply a light coat of engine oil on the O–ring.

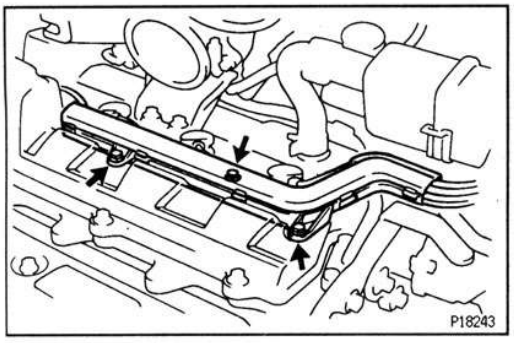
EG



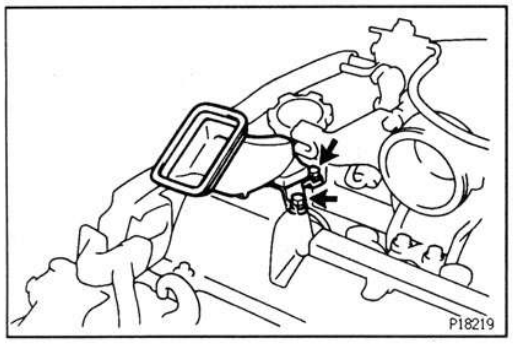
(d) Align the cutout portion of the coupling with the groove of the housing.
(e) Insert the distributor, aligning the center of the flange with that of the bolt hole on the cylinder head.



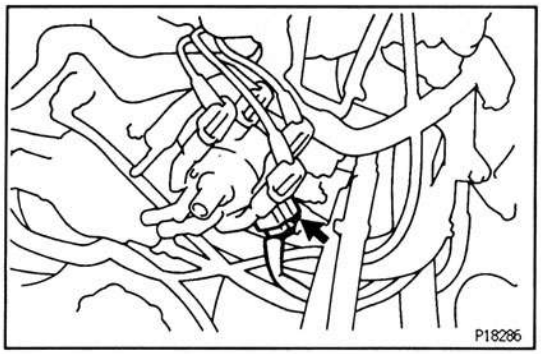
(f) Lightly tighten the 2 bolts.



(g) Connect the 4 high–tension cords to the spark plugs.
(h) Install the high–tension cord clamp with the 3 bolts.



(i) Install the cool air inlet with the 2 bolts.



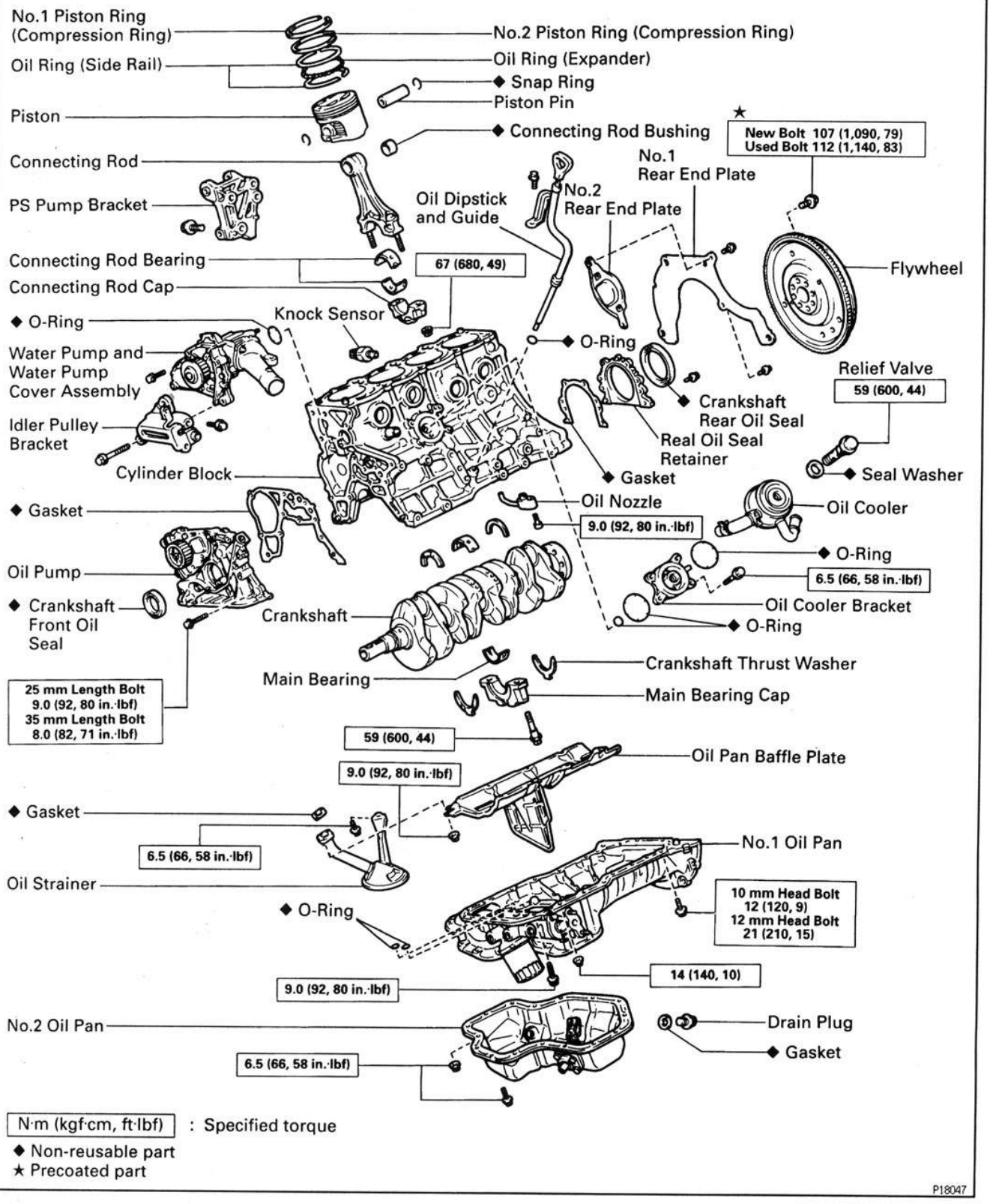
(j) Connect the distributor connector.

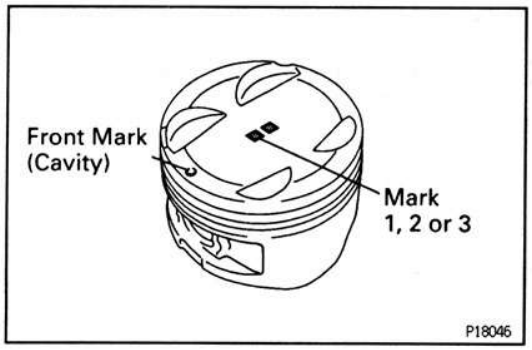
38. INSTALL INTERCOOLER
(See steps 13 and 15 on page EG–95)
39. FILL RADIATOR WITH ENGINE COOLANT
40. START ENGINE AND CHECK FOR LEAKS
41. PERFORM ENGINE ADJUSTMENT
(See pages EG–31 and 32)
42. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL

CYLINDER BLOCK

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EG088-0Y





EG

EG464-01

PISTON AND CONNECTING ROD INSPECTION

INSPECT PISTON

Inspect piston oil clearance

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

SERVICE SPECIFICATIONS

SERVICE DATA

EQ0CS-0W

Tune—up	Battery specific gravity	at 20°C (68°F)	1.25 — 1.27
	High—tension cord resistance	Limit	25 kΩ per cord
	Alternator drive belt deflection	w/ A/C New belt	10 — 11 mm (0.39 — 0.43 in.)
		Used belt	13 — 16 mm (0.51 — 0.63 in.)
		w/o A/C New belt	11 — 14 mm (0.43 — 0.55 in.)
		Used belt	12 — 18 mm (0.47 — 0.71 in.)
	Alternator drive belt tension (Reference)		
		w/ A/C New belt	686 — 785 N (70 — 80 kgf)
		Used belt	294 — 441 N (30 — 45 kgf)
		w/o A/C New belt	461 — 706 N (47 — 72 kgf)
		Used belt	353 — 610 N (36 — 62 kgf)
	Valve clearance (Cold)	Intake	0.15 — 0.25 mm (0.006 — 0.010 in.)
		Exhaust	0.28 — 0.38 mm (0.011 — 0.015 in.)
	Valve clearance adjusting shim (for repair part)		
		No.00	2.500 mm (0.0984 in.)
		No.53	2.550 mm (0.1004 in.)
		No.10	2.600 mm (0.1024 in.)
		No.15	2.650 mm (0.1043 in.)
		No.20	2.700 mm (0.1063 in.)
		No.25	2.750 mm (0.1083 in.)
		No.30	2.800 mm (0.1102 in.)
		No.35	2.850 mm (0.1122 in.)
		No.40	2.900 mm (0.1142 in.)
		No.45	2.950 mm (0.1161 in.)
		No.50	3.000 mm (0.1181 in.)
		No.55	3.050 mm (0.1201 in.)
		No.60	3.100 mm (0.1220 in.)
		No.65	3.150 mm (0.1240 in.)
		No.70	3.200 mm (0.1260 in.)
		No.75	3.250 mm (0.1280 in.)
		No.80	3.300 mm (0.1299 in.)
		No.85	3.350 mm (0.1319 in.)
		No.89	3.390 mm (0.1335 in.)
	Ignition timing		10° BTDC @ idle (w/ Terminals TE1 and E1 of check connector connected)
	Idle speed	w/ Daytime running light system	750 ± 50 rpm
		w/o Daytime running light system	700 ± 50 rpm
Idle CO	Concentration		0 — 0.5 %
Intake manifold vacuum	at idle speed		57 kPa (430 mmHg, 16.8 in.Hg)
Compression pressure	at 250 rpm	STD	1,130 kPa (11.5 kgf/cm², 164 psi) or more
		Limit	880 kPa (9.0 kgf/cm², 128 psi)
	Difference of pressure between each cylinder		100 kPa (1.0 kgfcm², 14 psi) or less
Timing belt tensioner	Protrusion		10.0 — 11.0 mm (0.394 — 0.433 in.)

EG

Cylinder head	Warpage		
	Cylinder block side	Limit	0.20 mm (0.0079 in.)
	Intake manifold side	Limit	0.20 mm (0.0079 in.)
	Exhaust manifold side	Limit	0.30 mm (0.0118 in.)
	Valve seat		
	Refacing angle		30°, 45°, 75°
	Contacting angle		45°
	Contacting width		1.0 — 1.4 mm (0.039 — 0.055 in.)
Valve guide bushing	Inside diameter		6.000 — 6.018 mm (0.2362 — 0.2369 in.)
	Outside diameter (for repair part)	STD	11.040 — 11.051 mm (0.4346 — 0.4351 in.)
		O/S 0.05	11.090 — 11.101 mm (0.4366 — 0.4370 in.)
Valve	Valve overall length	STD Intake	99.80 — 100.20 mm (3.9291 — 3.9449 in.)
		Exhaust	98.55 — 99.25 mm (3.8917 — 3.9075 in.)
		Limit Intake	99.30 mm (3.9094 in.)
		Exhaust	98.35 mm (3.8720 in.)
	Vale face angle		44.5°
	Stem diameter	Intake	5.960 — 5.975 mm (0.2346 — 0.2352 in.)
		Exhaust	5.955 — 5.970 mm (0.2344 — 0.2350 in.)
	Stem oil clearance	STD Intake	0.025 — 0.058 mm (0.0010 — 0.0023 in.)
		Exhaust	0.030 — 0.063 mm (0.0012 — 0.0025 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	Intake	43.18 mm (1.7000 in.)
		Exhaust	43.34 mm (1.7063 in.)
	Installed tension at 35.4 mm (1.394 in.)	Intake	163 — 190 N (16.6 — 19.4 kgf, 36.6 — 42.8 lbf)
		Exhaust	153 — 180 N (15.6 — 18.4 kgf, 34.4 — 40.6 lbf)
Valve lifter	Lifter diameter		30.975 — 30.985 mm (1.2195 — 1.2199 in.)
	Lifter bore diameter		31.000 — 31.021 mm (1.2205 — 1.2213 in.)
	Oil clearance	STD	0.015 — 0.046 mm (0.0006 — 0.0018 in.)
		Limit	0.07 mm (0.0028 in.)
Manifold	Warpage	Limit Intake	0.30 mm (0.0118 in.)
		Exhaust	1.00 mm (0.0394 in.)
Camshaft	Thrust clearance	STD	0.100 — 0.240 mm (0.0039 — 0.0094 in.)
		Limit	0.30 mm (0.0118 in.)
	Journal oil clearance	STD	0.0025 — 0.062 mm (0.0010 — 0.0024 in.)
		Limit	0.08 mm (0.0031 in.)
	Journal diameter		26.959 — 26.975 mm (1.0614 — 1.0620 in.)
	Circle runout	Limit	0.06 mm (0.0024 in.)
	Cam lobe height	STD Intake	41.510 — 41.610 mm (1.6342 — 1.6382 in.)
		Exhaust	41.100 — 41.200 mm (1.6181 — 1.6220 in.)
		Limit Intake	41.40 mm (1.6299 in.)
		Exhaust	41.00 mm (1.6142 in.)

Cylinder block	Cylinder head surface warpage		Limit	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD	Mark 1	86.000 — 86.010 mm (3.3858 — 3.3862 in.)
			Mark 2	86.010 — 86.020 mm (3.3862 — 3.3866 in.)
			Mark 3	86.020 — 86.030 mm (3.3866 — 3.3870 in.)
			Limit	86.23 mm (3.3949 in.)
Piston and piston ring	Piston diameter	STD	Mark 1	85.970 — 85.980 mm (3.3846 — 3.3850 in.)
			Mark 2	85.980 — 85.990 mm (3.3850 — 3.3854 in.)
			Mark 3	85.990 — 86.000 mm (3.3854 — 3.3858 in.)
	Piston oil clearance		STD	0.020 — 0.040 mm (0.0008 — 0.0016 in.)
			Limit	0.06 mm (0.0024 in.)
	Piston ring groove clearance		No.1	0.040 — 0.080 mm (0.0016 — 0.0031 in.)
			No.2	0.030 — 0.070 mm (0.0012 — 0.0028 in.)
	Piston ring end gap	STD	No.1	0.330 — 0.550 mm (0.0130 — 0.0217 in.)
			No.2	0.450 — 0.670 mm (0.0177 — 0.0264 in.)
			Oil	0.150 — 0.500 mm (0.0059 — 0.0197 in.)
		Limit	No.1	0.85 mm (0.0335 in.)
			No.2	0.97 mm (0.0382 in.)
			Oil	0.80 mm (0.0315 in.)
Connecting rod	Thrust clearance		STD	0.160 — 0.312 mm (0.0063 — 0.0123 in.)
			Limit	0.35 mm (0.0138 in.)
	Connecting rod bearing center wall thickness			
	(Reference)	STD	Mark 1	1.484 — 1.488 mm (0.0584 — 0.0586 in.)
			Mark 2	1.488 — 1.492 mm (0.0586 — 0.0587 in.)
			Mark 3	1.492 — 1.496 mm (0.0587 — 0.0589 in.)
	Connecting rod oil clearance	STD	STD	0.024 — 0.055 mm (0.0009 — 0.0022 in.)
			U/S 0.25	0.023 — 0.069 mm (0.0009 — 0.0027 in.)
			Limit	0.08 mm (0.0031 in.)
	Rod bend	Limit per 100 mm (3.94 in.)		0.05 mm (0.0020 in.)
	Rod twist	Limit per 100 mm (3.94 in.)		0.15 mm (0.0059 in.)
	Bushing inside diameter			22.005 — 22.017 mm (0.8663 — 0.8668 in.)
	Piston pin diameter			21.997 — 22.009 mm (0.8660 — 0.8665 in.)
	Piston pin oil clearance		STD	0.005 — 0.011 mm (0.0002 — 0.0004 in.)
			Limit	0.05 mm (0.0020 in.)

EG

EG

Crankshaft	Thrust clearance	STD	0.020 – 0.220 mm (0.0008 – 0.0087 in.)
		Limit	0.30 mm (0.0118 in.)
	Thrust washer thickness Main journal oil clearance		2.440 – 2.490 mm (0.0961 – 0.0980 in.)
		STD No.3 STD	0.028 – 0.047 mm (0.0011 – 0.0019 in.)
		No.3 U/S 0.25	0.027 – 0.067 mm (0.0011 – 0.0026 in.)
		Others STD	0.018 – 0.037 mm (0.0007 – 0.0015 in.)
		Others U/S 0.25	0.019 – 0.059 mm (0.0007 – 0.0023 in.)
		Limit	0.08 mm (0.0031 in.)
	Main journal diameter	STD	54.985 – 55.000 mm (2.1648 – 2.1654 in.)
		U/S 0.25	54.745 – 54.755 mm (2.1553 – 2.1557 in.)
	Main bearing center wall thickness (Reference)		
		STD No.3 Mark 1	1.992 – 1.995 mm (0.0784 – 0.0785 in.)
		Mark 2	1.995 – 1.998 mm (0.0785 – 0.0787 in.)
		Mark 3	1.998 – 2.001 mm (0.0787 – 0.0788 in.)
		Mark 4	2.001 – 2.004 mm (0.0788 – 0.0789 in.)
		Mark 5	2.004 – 2.007 mm (0.0789 – 0.0790 in.)
		Others Mark 1	1.997 – 2.000 mm (0.0786 – 0.0787 in.)
		Mark 2	2.000 – 2.003 mm (0.0787 – 0.0789 in.)
		Mark 3	2.003 – 2.006 mm (0.0789 – 0.0790 in.)
		Mark 4	2.006 – 2.009 mm (0.0790 – 0.0791 in.)
		Mark 5	2.009 – 2.012 mm (0.0791 – 0.0792 in.)
	Crank pin diameter	STD	47.985 – 48.000 mm (1.8892 – 1.8898 in.)
		U/S 0.25	47.745 – 47.755 mm (1.8797 – 1.8801 in.)
	Circle runout	Limit	0.06 mm (0.0024 in.)
	Main journal taper and out–of–round	Limit	0.02 mm (0.0008 in.)
	Crank pin taper and out–of–round	Limit	0.02 mm (0.0008 in.)

EGOC6–02

TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Distributor x Cylinder head		39	400	29
Spark plug x Cylinder head		18	180	13
Oil pump pulley x Oil pump drive shaft		35	360	26
No.2 idler pulley x Oil pump		44	450	32
Timing belt tensioner x Cylinder head		21	210	15
No.1 idler pulley x Cylinder head		52	530	38
Crankshaft pulley x Crankshaft		107	1,090	79
RH engine mounting bracket x Cylinder block		52	530	38
Camshaft timing pulley x Camshaft		69	700	51
	for SST	48	490	35
Alternator bracket x Cylinder head		39	400	29
Alternator x Alternator bracket	12 mm head	19	190	14
	14 mm head	52	530	38
Idler pulley for alternator drive belt x Idler pulley bracket		39	400	29
RH front engine hanger x Cylinder head		39	400	29
Cylinder head x Cylinder block	1st	49	500	36
	2nd	Turn 90°		
Camshaft bearing cap x Cylinder head		19	190	14
Cylinder head cover x Cylinder head		6.0	61	53 in.·lbf
No.4 timing belt cover x Cylinder head cover		8.0	82	71 in.·lbf

No.3 timing belt cover x Cylinder head	8.0	82	71 in.·lbf
Oil pressure switch x Cylinder head	15	150	11
LH engine hanger x Cylinder head	44	450	32
Delivery pipe x Cylinder head	29	300	21
Intake manifold x Cylinder head	20	200	15
Fuel inlet hose x Delivery pipe	32	330	24
Intake manifold stay x Intake manifold	39	400	29
Intake manifold stay x Cylinder block	39	400	29
Throttle body x Intake manifold	21	210	15
Air connector stay x Intake manifold	21	210	15
Air connector stay x Cylinder head	21	210	15
Intake air connector x Throttle body	21	210	15
EGR valve x Intake manifold	19	190	14
EGR pipe x Cylinder head	25	250	18
Water bypass pipe x Water pump cover	10	100	7
Water bypass pipe x Cylinder head	24	240	18
Water outlet x Cylinder head	20	200	15
Exhaust manifold x Cylinder head	52	530	38
Catalytic converter x Turbine outlet elbow	29	300	21
LH catalytic converter stay x Cylinder block	59	600	43
LH catalytic converter stay x Catalytic converter	59	600	43
RH catalytic converter stay x Cylinder block	59	600	43
RH catalytic converter stay x Catalytic converter	59	600	43
Oil nozzle x Cylinder block	9.0	92	80 in.·lbf
Main bearing cap x Cylinder block	59	600	44
Connecting rod cap x Connecting rod	67	680	49
Rear oil seal retainer x Cylinder block	9.0	92	80 in.·lbf
Knock sensor x Cylinder block	37	380	27
Oil cooler bracket x Cylinder block	6.5	66	58 in.·lbf
Oil cooler x Oil cooler bracket (Relief valve)	59	600	44
Water pump x Cylinder block	7.5	76	66 in.·lbf
Idler pulley bracket for alternator drive belt x Cylinder block			
Water pump side	23	230	17
Cylinder block side	19	190	14
PS pump bracket x Cylinder block	43	440	32
No.1 rear end plate x Cylinder block	9.3	95	82 in.·lbf
No.2 rear end plate x No.1 rear end plate	9.3	95	82 in.·lbf
Flywheel x Crankshaft — New bolt	107	1,090	79
Flywheel x Crankshaft — Used bolt	112	1,140	83

EG

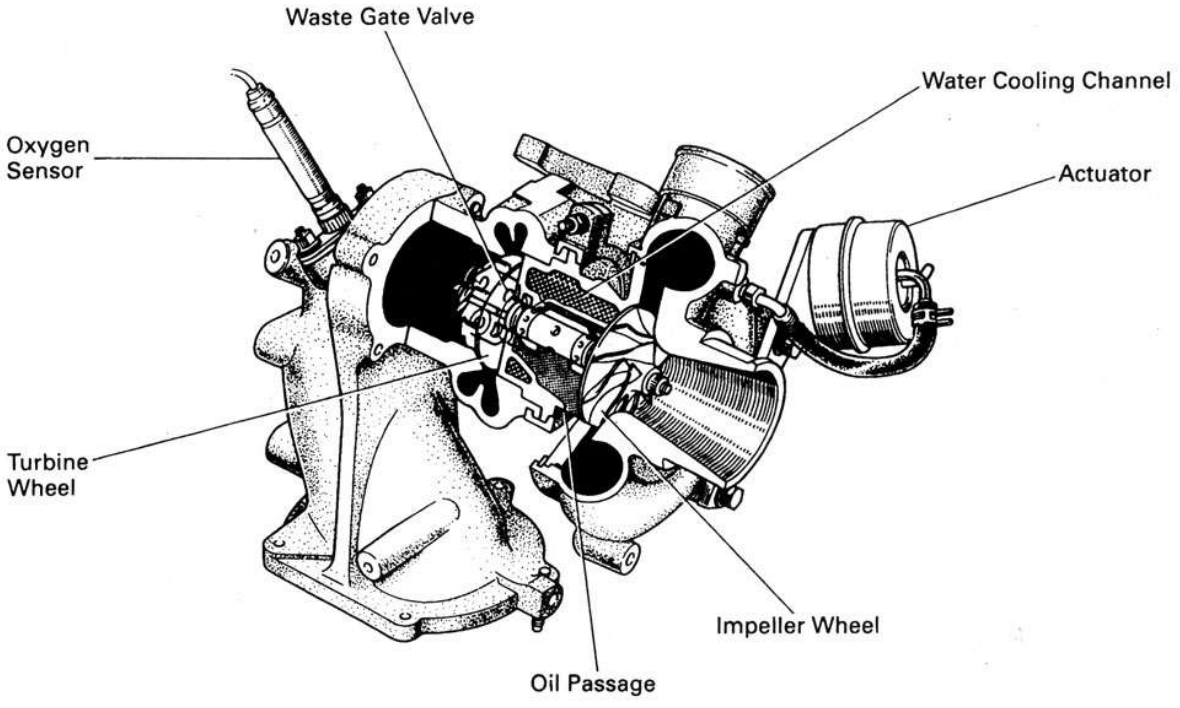
TURBOCHARGER SYSTEM

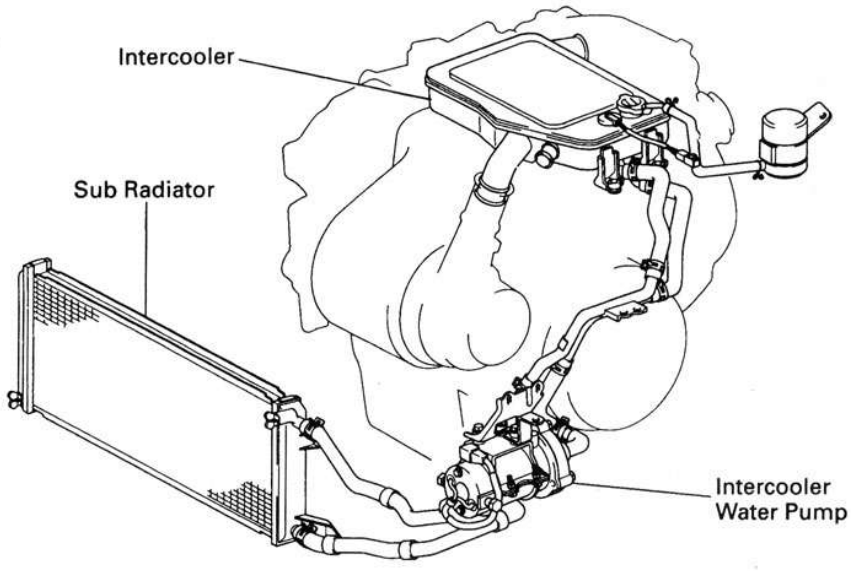
DESCRIPTION

EG44Y-02

The CELICA 3S—GTE engine uses a turbocharger to increase engine power (without increasing engine speed) by sending a greater amount of air—fuel mixture to the engine.

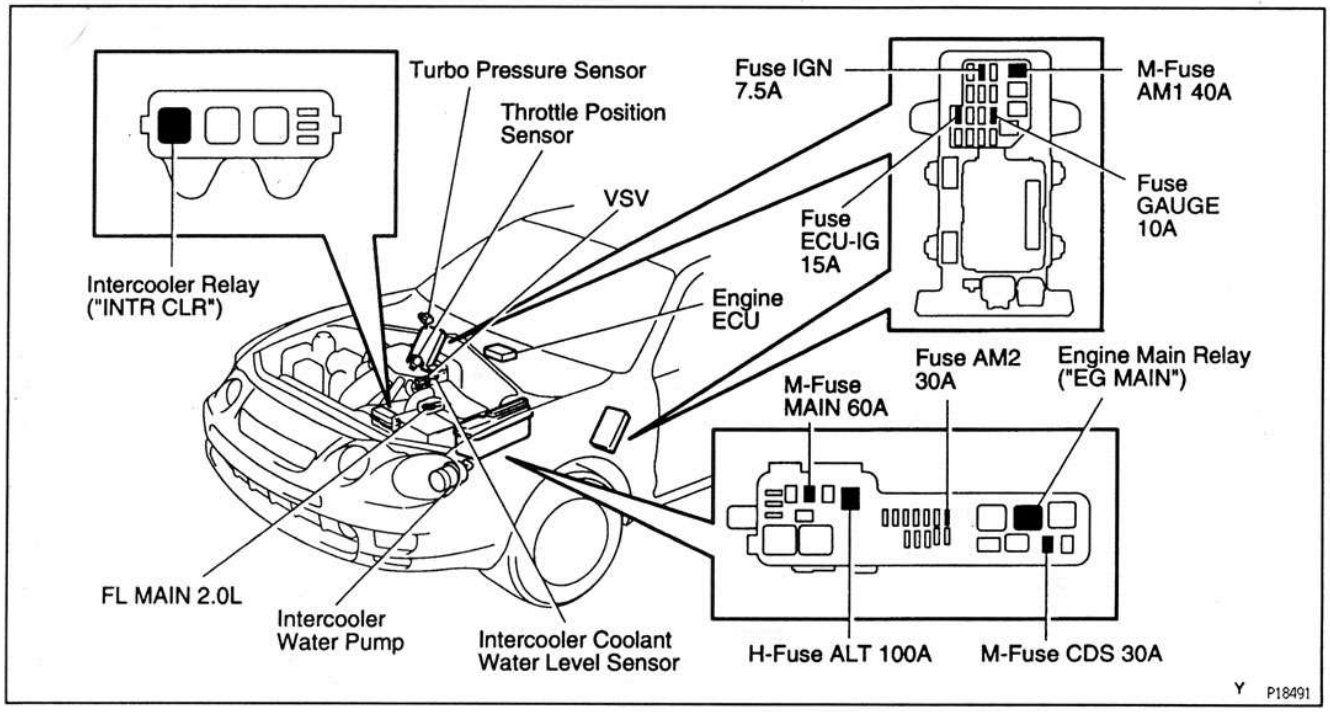
The engine is equipped with a water cooled intercooler with improved cooling capability. The intercooler, located above the engine, cools the turbocharged air by way the cooled water from the sub radiator located in the front of the vehicle.





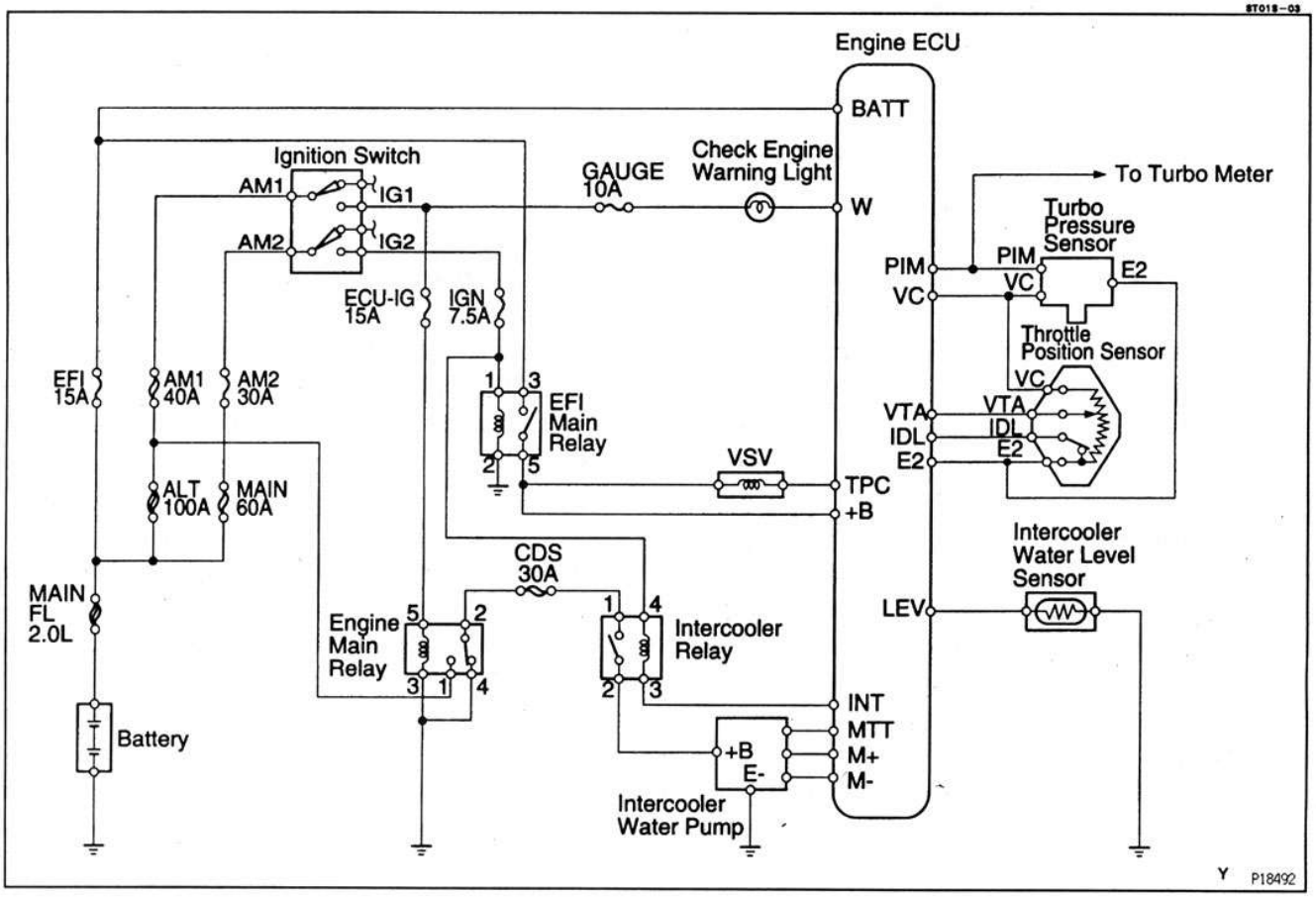
P18495
P18390

Z132

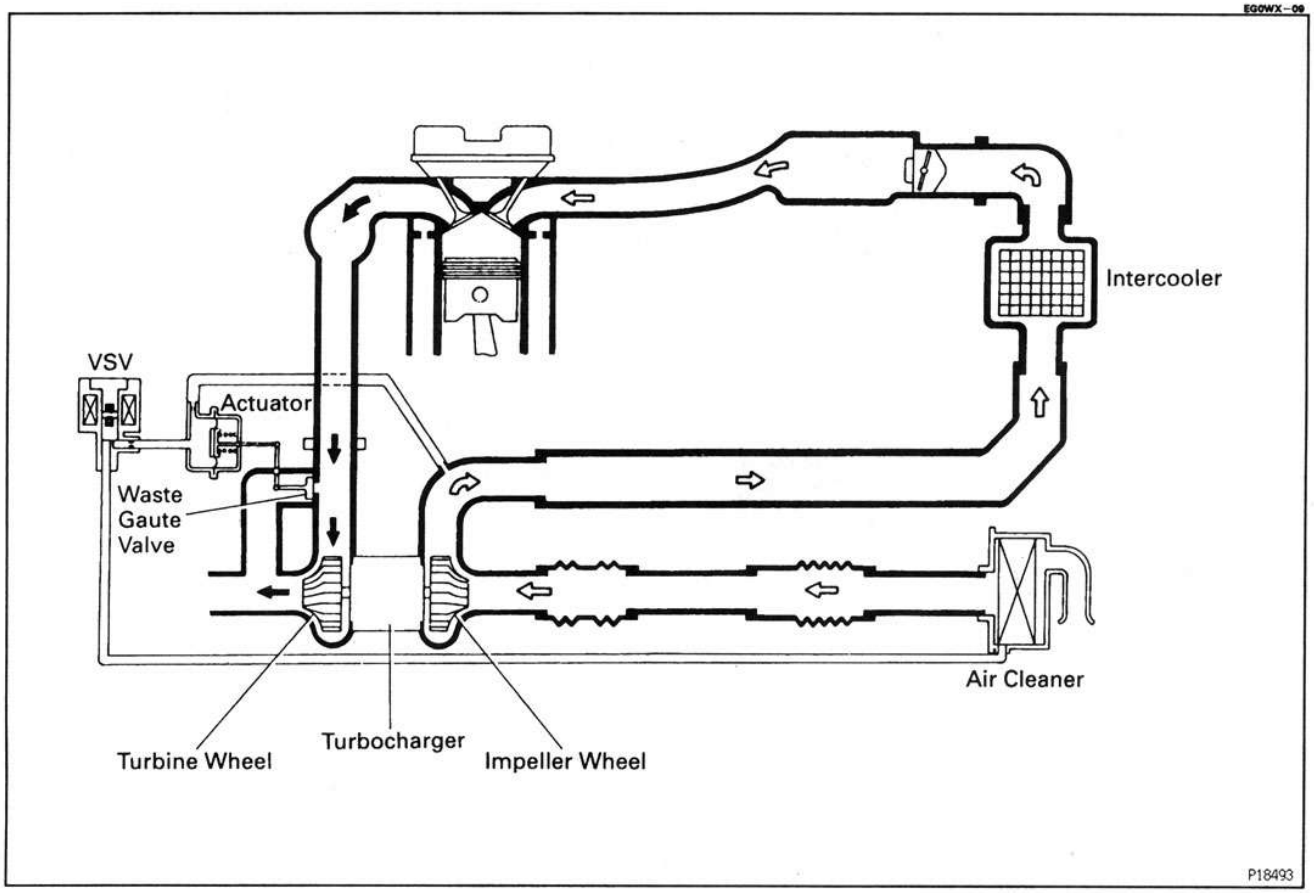


EG

SYSTEM CIRCUIT



OPERATION



Exhaust gas acts on the turbine wheel inside the turbine housing, causing it to rotate. The impeller, located on the turbine shaft, thus rotates and compresses the intake air which has passed through the air cleaner. This high pressure air then passes into the cylinders for combustion.

As the engine speed increases, the exhaust gas volume increases causing the turbine wheel speed to increase up to a maximum of approximately 120,000 rpm. The consequent increase in the impeller rpm increases the pressure of the intake air, which when accurately combined with an appropriate quantity of fuel, increases engine power.

Waste Gate Valve

Although turbocharging increases engine power, if the turbocharged air pressure becomes too high, knocking occurs which reduces engine power. If the intake air pressure exceeds a predetermined valve, the waste gate valve causes the exhaust gas to bypass the turbine. This reduces the speed of the turbine, thus reducing the intake air pressure.

Intercooler

The intercooler cools the turbocharged intake air, thereby increasing the air density. With a redustion in intake air temperature, the reduced combustion temperature suppresses the occurrence of knocking and allows full engine power to be realized.

PREPARATION

SST (SPECIAL SERVICE TOOLS)

IG00R-03

	09992–00241 Turbocharger Pressure Gauge	

RECOMMENDED TOOLS

ST00T-07

EG

	09082–00050 TOYOTA Electrical Tester Set	
	09258–00030 Hose Plug Set	

EQUIPMENT

IG00T-0A

Dial indicator	Impeller wheel
Radiator cap tester	Intercooler coolant filler cap
Torque wrench	

COOLANT

EG0B6-0C

Item	Capacity	Classification
Intercooler coolant	2.5 liters (2.6 US qts, 2.2 Imp. qts)	Ethylene–glycol base
Engine coolant	7.0 liters (7.4 US qts, 6.2 Imp. qts)	Ethylene–glycol base

LUBRICANT

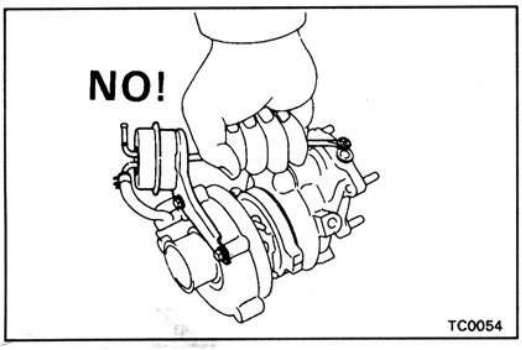
EG14X-0K

Item	Capacity	Classification
Engine oil		API grade SG, SH or ILSAC multigrade engine oil and recommended viscosity oil
Dry fill	5.2 liters (5.5 US qts, 4.6 Imp. qts)	
Drain and refill		
w/ Oil filter change	4.5 liters (4.8 US qts, 4.0 Imp. qts)	
w/o Oil filter change	4.0 liters (4.2 US qts, 3.5 Imp. qts)	

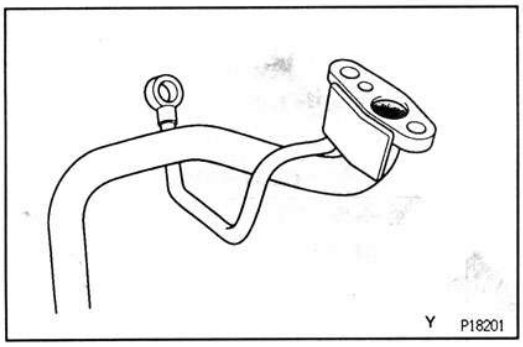
PRECAUTION

EGOWY-04

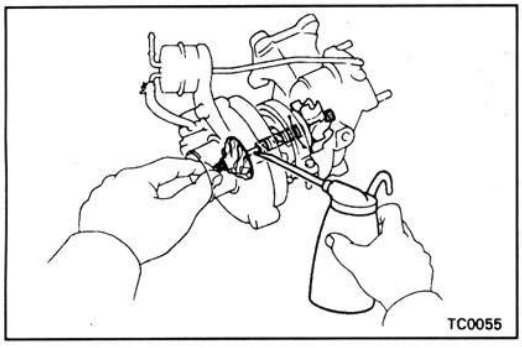
1. Do not stop the engine immediately after pulling a trailer or after high speed or uphill driving. Idle the engine for 20 – 120 seconds, depending on how hard the vehicle has been driven.
2. Avoid sudden acceleration or racing immediately after starting a cold engine.
3. Do not run the engine with air cleaner removed, as this may cause foreign material to enter and damage the impeller wheel operating at high speed.
4. If a turbocharger is found to be defective and must be replaced, check for the cause and repair or replace the following items as necessary:
   - Engine oil level and quality
   - Conditions under which the turbocharger was used
   - Oil lines leading to the turbocharger



5. Use caution when removing and reinstalling the turbocharger assembly. Do not drop it or bang it against anything or grasp it by easily–deformed parts, such as the actuator or rod, when moving it.
6. Before removing the turbocharger, plug the intake and exhaust ports and oil inlet to prevent entry of dirt or other foreign material.



7. If replacing the turbocharger, check for accumulation of sludge particles in the oil pipes, and if necessary, replace the oil pipes.
8. Completely remove the gasket adhered to the lubrication oil pipe flange and turbocharger oil flange.
9. When replacing bolt or nuts, use only anthorized replacement parts to prevent breakage or deformation.



10. If replacing the turbocharger, put 2 cm^3 (0.12 cu in.) of oil into the turbocharger oil inlet and turn the impeller wheel by hand to spread oil to the bearing.
11. If overhauling or replacing the engine, cut the fuel supply after reassembly and crank the engine for 30 seconds to distribute oil throughout the engine. Then allow the engine to idle for 60 seconds.

TROUBLESHOOTING

EG0WZ-06

HINT: Before troubleshooting the turbocharger, first check the engine itself. (Valve clearance, engine compression, ignition timing etc.)

INSUFFICIENT ACCELERATION, LACK OF POWER OR EXCESSIVE FUEL CONSUMPTION

Possible Cause	Check Procedure and Correction Method
1. TURBOCHARGING PRESSURE TOO LOW	Check turbocharging pressure. (See page EG-85) **Turbocharging pressure:** **82 – 115 kPa** **(0.84 – 1.17 kgf/cm², 11.9 – 16.7 psi)** If the pressure is below specification, begin diagnosis from item 2.
2. RESTRICTED INTAKE SYSTEM	Check intake air system, and repair or replace parts as necessary. (See page EG-85)
3. LEAK IN INTAKE AIR SYSTEM	Check intake air system, and repair or replace parts as necessary. (See page EG-85)
4. RESTRICTED EXHAUST SYSTEM	Check exhaust system, and repair or replace parts as necessary. (See page EG-85)
5. LEAK IN EXHAUST SYSTEM	Check exhaust system, and repair or replace parts as necessary. (See page EG-85)
6. ERRATIC TURBOCHARGER OPERATION	Check rotation of turbine shaft. If it does not turn or turns with a heavy drag, replace the turbocharger assembly. Check axial and radial play of turbine shaft. (See page EG-91) **Maximum axial play: 0.110 mm (0.0043 in.)** **Maximum radial play: 0.136 mm (0.0054 in.)** If the play is greater than maximum, replace the turbocharger assembly.

V05511

ABNORMAL NOISE

Possible Cause	Check Procedure and Correction Method
1. TURBOCHARGING HEAT INSULATOR RESONANCE	Check for loose, improperly installed or deformed insulator mounting bolts, and repair or replace as necessary.
2. EXHAUST PIPE LEAKING OR VIBRATING	Check for deformed exhaust pipe, loose mounting bolts or damaged gasket, and repair or replace as necessary.
3. ERRATIC TURBOCHARGER OPERATION	Refer to item 6 of INSUFFICIENT ACCELERATION, LACK OF POWER OR EXCESSIVE FUEL CONSUMPTION.

EXCESSIVE OIL CONSUMPTION OR WHITE EXHAUST

Possible Cause	Check Procedure and Correction Method
FAULTY TURBOCHARGER OIL SEAL	Check for oil leakage in exhaust system. • Remove the turbine elbow from the turbocharger and check for excessive carbon deposits on the turbine wheel. Excessive carbon deposits indicate a faulty turbocharger. Check for oil leakage in intake air system. • Check for axial and radial play of turbine shaft and replace the turbocharger if necessary. (See page EG-91) **Maximum axial play: 0.110 mm (0.0043 in.)** **Maximum radial play: 0.136 mm (0.0054 in.)** **NOTICE: Some oil mist in the blow-by from the PCV is normal.** **Do not mistake it for an oil leak from the turbocharger.**

V05512

TURBOCHARGER

ON–VEHICLE INSPECTION

EG4487–01

1. INSPECT INTAKE AIR SYSTEM

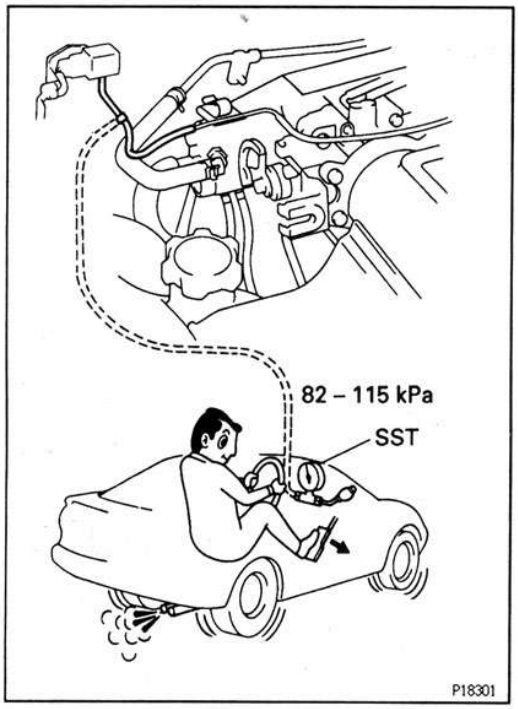
Check for leakage or clogging between the air cleaner housing and turbocharger inlet and between the turbocharger outlet and cylinder head.

- Clogged air cleaner .... Clean or replace element
- Hoses collapsed or deformed .... Repair or replace
- Leakage from connections .... Check each connection and repair
- Cracks in components .... Check and replace

2. INSPECT EXHAUST SYSTEM

Check for leakage or clogging between the cylinder head and turbocharger inlet and between the turbocharger outlet and exhaust pipe.

- Deformed components .... Repair or replace
- Foreign material in passages .... Remove
- Leakage from components .... Repair or replace
- Cracks in components .... Check and replace



3. INSPECT TURBOCHARGING PRESSURE

(a) Using a 3–way connector, connect SST (turbocharger pressure gauge) to the hose between the vacuum pipe and turbo pressure sensor.
SST 09992–00241

(b) While driving in 2nd gear with the engine running at 4,000 rpm or more with the throttle valve fully open, check the turbocharging pressure.

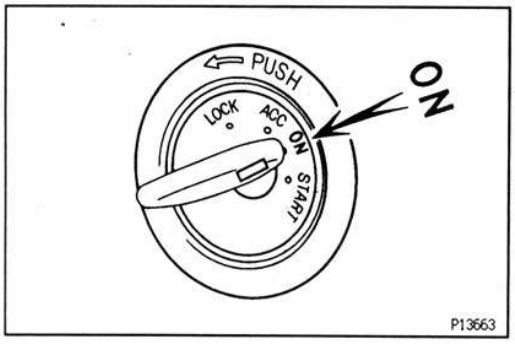
Standard pressure:

82 – 115 kPa

(0.84 – 1.17 kgf/cm², 11.9 – 16.7 psi)

If the pressure is less than that specified, check the intake air, VSV and exhaust systems for leakage. If there is no leakage, replace the turbocharger assembly and/or VSV.

If the pressure is above specification, check if the actuator hose is disconnected or cracked. If not, replace the turbocharger assembly.

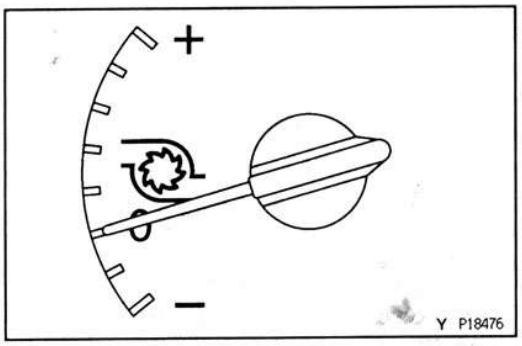


4. INSPECT TURBO METER OPERATION

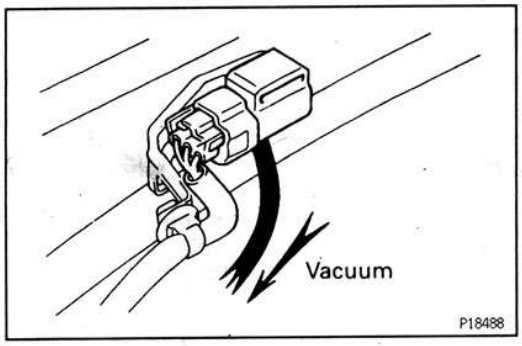
(a) Turn the ignition switch ON.

NOTICE: Do not start the engine.

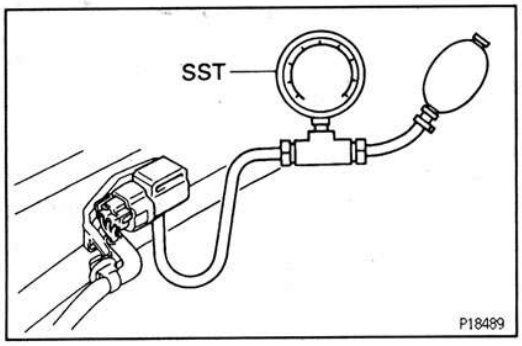
EG



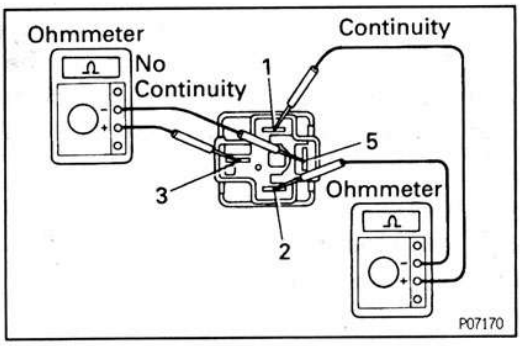
(b) Check that the turbo meter indication is zero.



(c) Check that the turbo meter indication is negative (–) when a vacuum is applied to the turbo pressure sensor.



(d) Check that the turbo meter indication is positive (+) when a pressure is applied to the turbo pressure sensor with SST (turbo pressure gauge).
SST 09992–00241

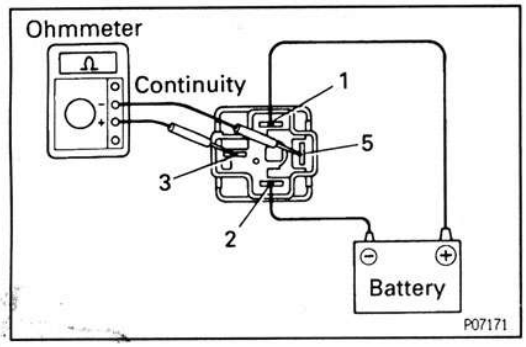


5. INSPECT EFI MAIN RELAY

A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

(b) Check that there is no continuity between terminals 3 and 5.
If continuity is not as specified, replace the relay.



B. Inspect relay operation

(a) Apply battery voltage across terminals 1 and 2.

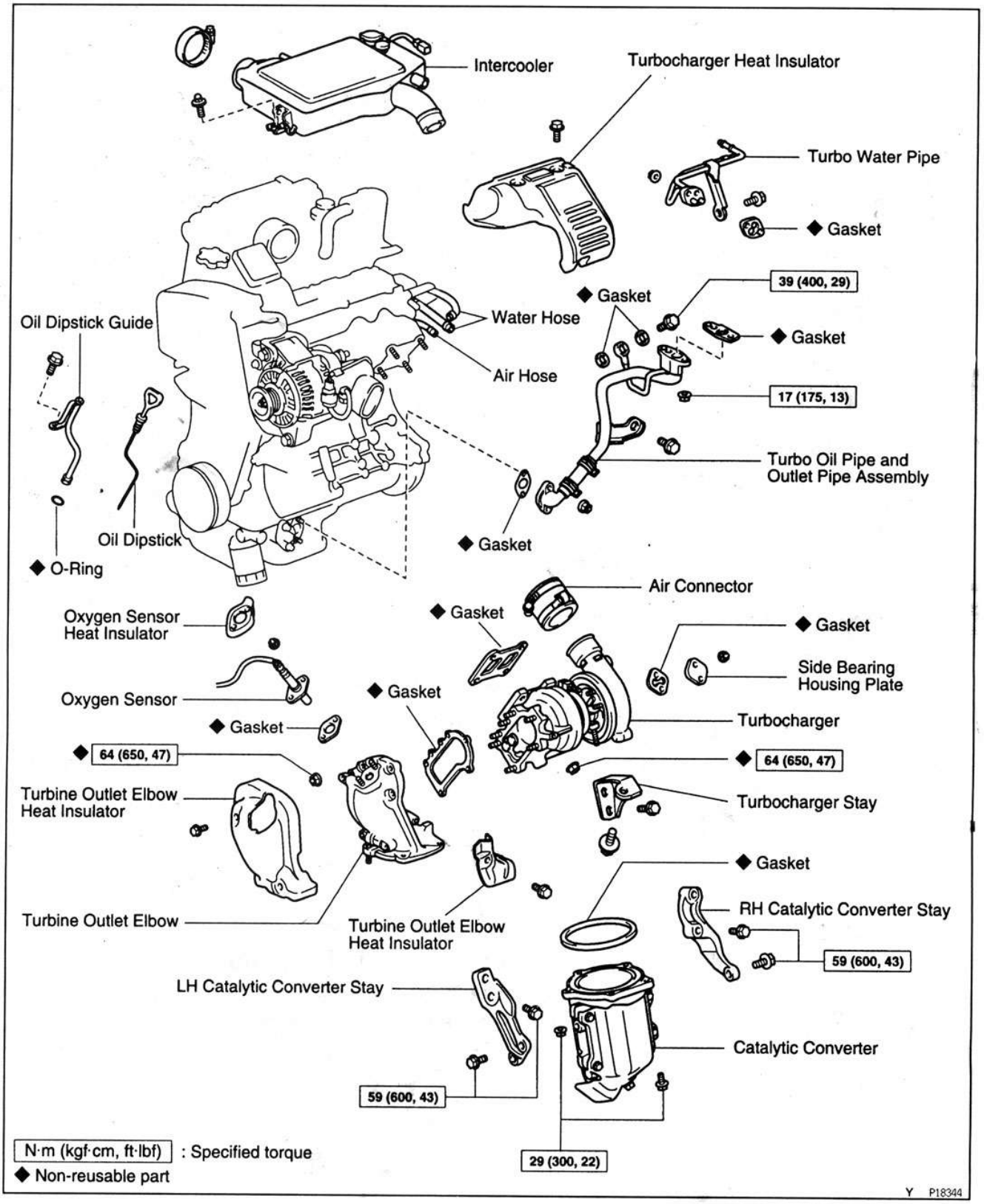
(b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.
If operation is not as specified, replace the relay.

6. INSPECT VSV FOR TURBOCHARGING PRESSURE
(See page EG–108)

7. INSPECT TURBO PRESSURE SENSOR
(See page EG–105)

EG2XJ-03

COMPONENTS FOR REMOVAL AND INSTALLATION



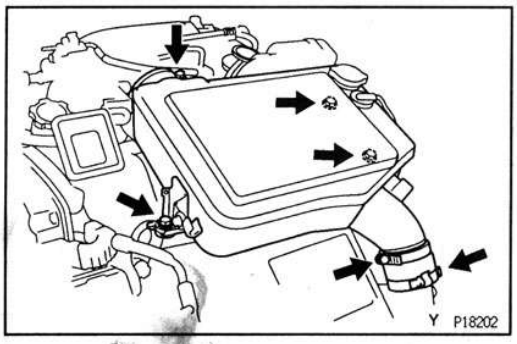
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EG468-02

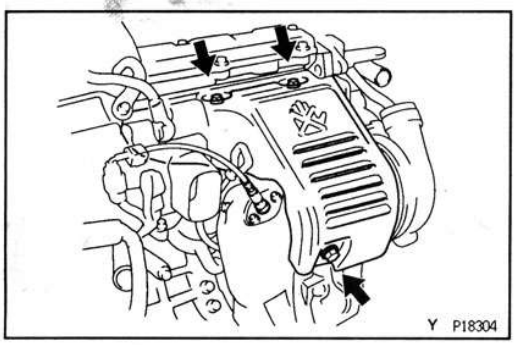
TURBOCHARGER REMOVAL

(See Components for Removal and Installation)

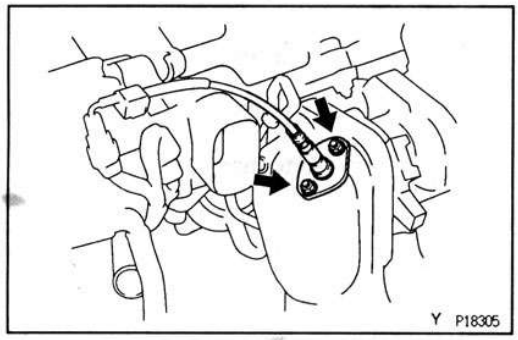
1. **DRAIN ENGINE OIL**
2. **DRAIN ENGINE COOLANT**
3. **DRAIN INTERCOOLER COOLANT**
   (See page EG–97)
4. **REMOVE CATALYTIC CONVERTER**
   (See steps 6 and 7 on page EG–44)



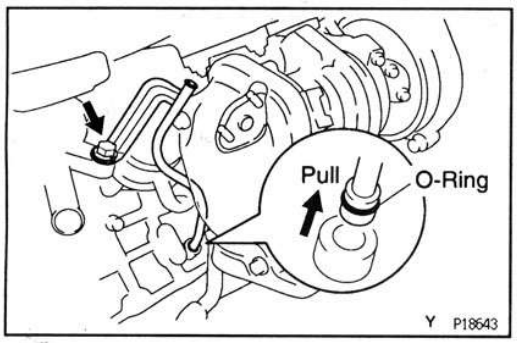
5. **REMOVE INTERCOOLER**
(a) Remove the 3 bolts.
(b) Disconnect the intercooler from the turbocharger and intake air connector, and remove the intercooler and air connector.



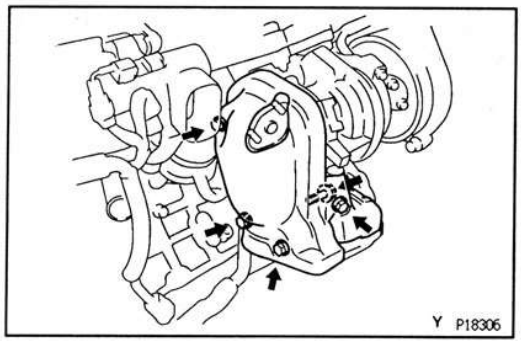
6. **REMOVE TURBOCHARGER HEAT INSULATOR**
Remove the 3 bolts and heat insulator.



7. **REMOVE OXYGEN SENSOR**
Remove the 2 nuts, heat insulator, oxygen sensor and gasket.



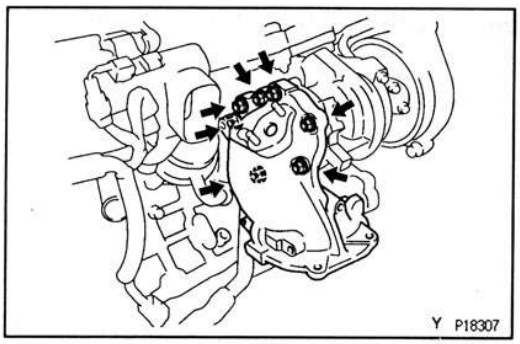
8. **REMOVE OIL DIPSTICK AND GUIDE**
(a) Pull out the oil dipstick.
(b) Remove the bolt and oil dipstick guide.
(c) Remove the O–ring from the oil dipstick guide.



9. REMOVE HEAT INSULATORS OF TURBINE OUTLET ELBOW

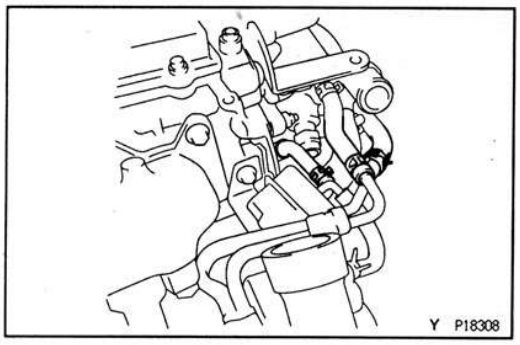
(a) Remove the 3 bolts and RH heat insulator.

(b) Remove the 2 bolts and LH heat insulator.



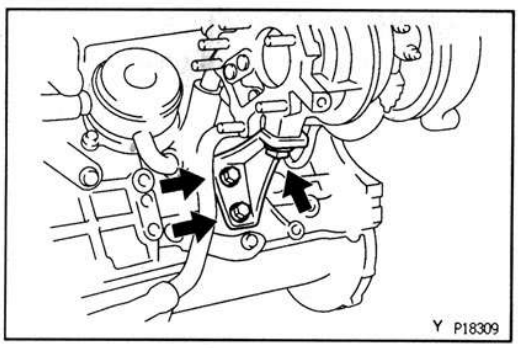
10. REMOVE TURBING OUTLET ELBOW

Remove the 7 nuts, outlet elbow and gasket.



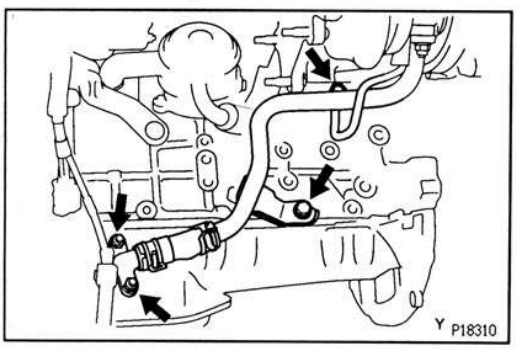
11. DISCONNECT WATER BYPASS HOSES FROM TURBO WATER PIPE

12. DISCONNECT AIR HOSE FROM ACTUATOR



13. REMOVE TURBOCHARGER STAY

Remove the 3 bolts and turbocharger stay.

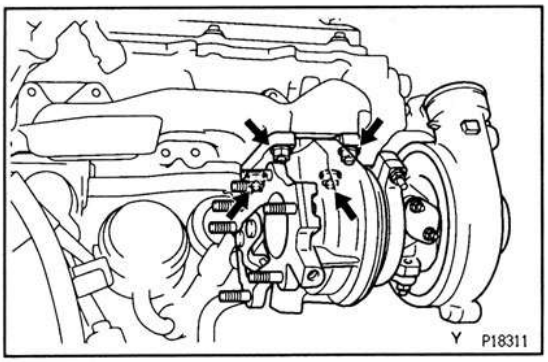


14. REMOVE TURBOCHARGER

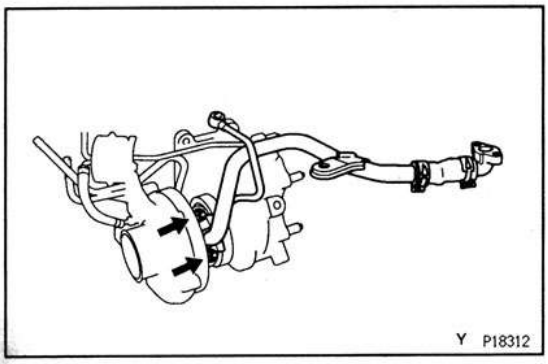
(a) Remove the 2 nuts holding the turbo oil outlet pipe to the No.1 oil pan. Remove the gasket.

(b) Remove the bolt and union bolt holding the turbo oil pipe to the cylinder block. Remove the 2 union bolt gaskets.

EG

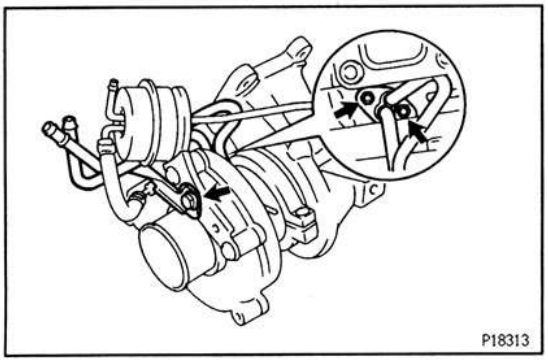


(c) Remove the 4 nuts, turbocharger and turbo oil pipe assembly, and gasket.



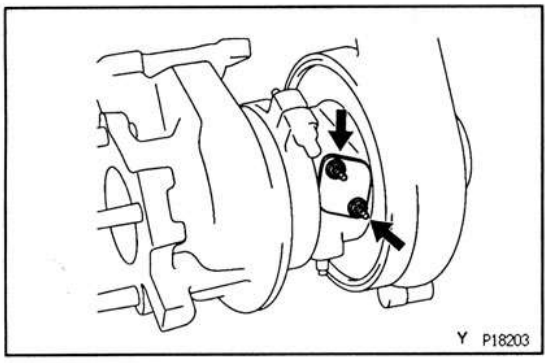
15. REMOVE TURBO OIL PIPE AND OUTLET PIPE ASSEMBLY

Remove the 2 nuts, oil pipe and gasket.



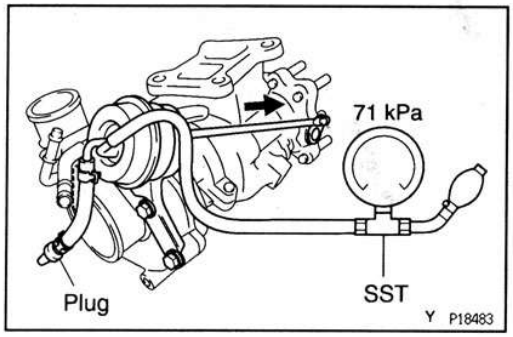
16. REMOVE TURBO WATER PIPE

Remove the 2 nuts, bolt, water pipe and gasket.



17. REMOVE SIDE BEARING HOUSING PLATE

Remove the 2 nuts, housing plate and gasket.



TURBOCHARGER INSPECTION

EG466-01

1. INSPECT ACTUATOR OPERATION

(a) Disconnect the actuator hose and plug it.

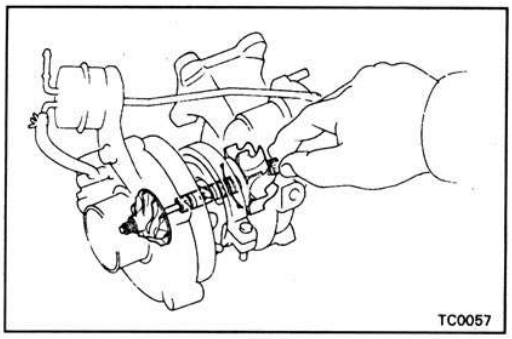
(b) Using SST (turbocharger pressure gauge) apply approx. 71 kPa (0.72 kgf/cm², 10.2 psi) of pressure to the actuator and check that the rod moves.

If the rod does not move, replace the turbocharger assembly.

SST 09992–00241

NOTICE: Never apply more than 88 kPa (0.90 kgf/cm², 12.8 psi) of pressure to the actuator.

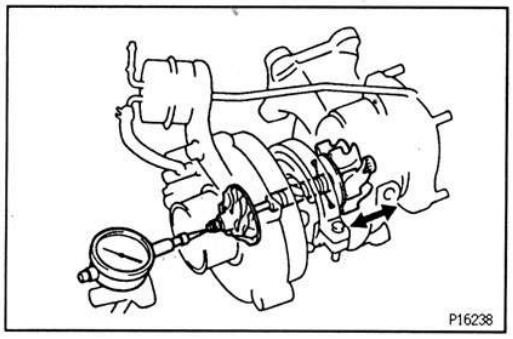
EG



2. INSPECT IMPELLER WHEEL ROTATION

Grasp the edge of the turbine wheel and turn it. Check that the impeller wheel turns smoothly.

If the impeller wheel does not turn or if it drags heavily, replace the turbocharger assembly.



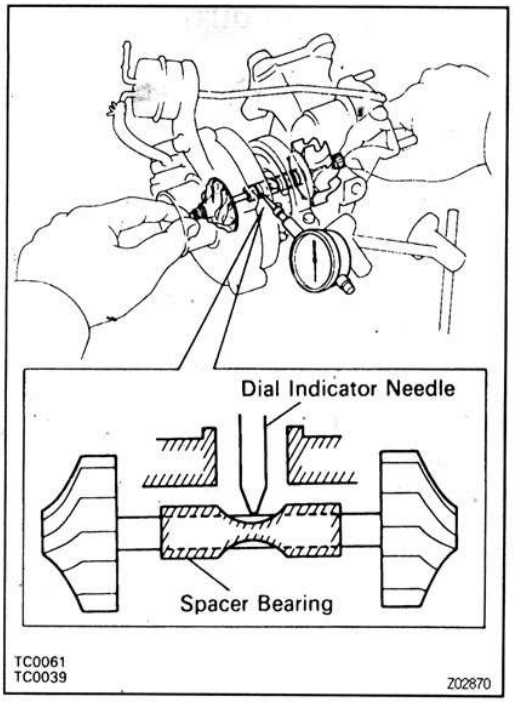
3. INSPECT AXIAL PLAY OF IMPELLER WHEEL

Insert a dial indicator into the intake side hold the turbine wheel edge by hand, and check the axial play.

Standard clearance:

0.110 mm (0.0043 in.) or less

If the axial play is not as specified, replace the turbocharger assembly.



4. INSPECT RADIAL PLAY OF IMPELLER WHEEL

(a) From oil outlet hole, insert a dial indicator through the hole in the spacer bearing and set it in the center of the impeller shaft.

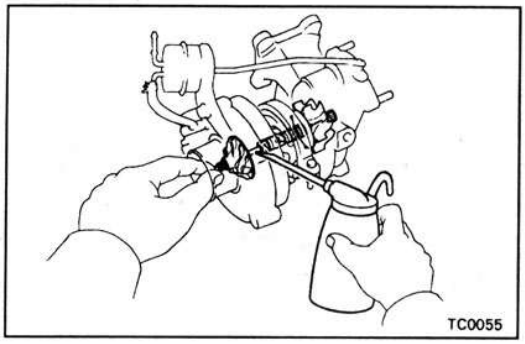
(b) Move the impeller shaft in a radial direction, measure the radial play of the impeller shaft.

Standard clearance:

0.136 mm (0.0054 in.) or less

If the radial play is not as specified, replace the turbocharger assembly.

EG

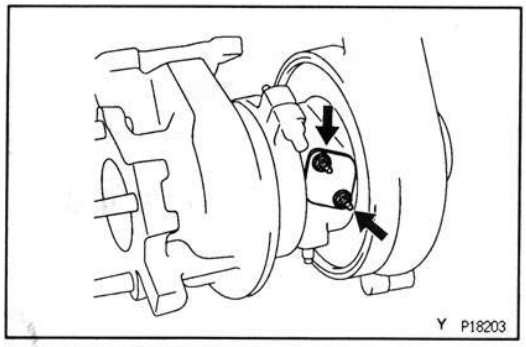


TURBOCHARGER INSTALLATION

EG46A-01

(See Components for Removal and Installation)

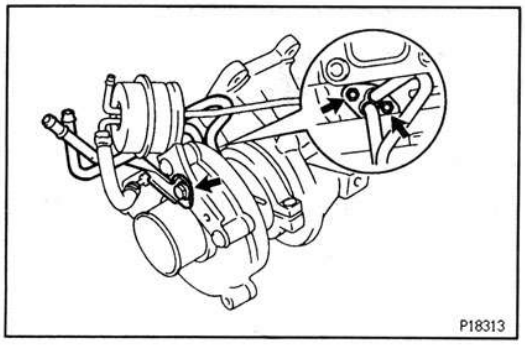
NOTICE: After replacing the turbocharger assembly, pour approx. 2 cm³ (0.12 cu in.) of fresh oil into the oil inlet and turn the impeller wheel by hand to spread oil on the bearing.



1. **INSTALL SIDE BEARING HOUSING PLATE**

Install a new gasket and the housing plate with the 2 nuts.

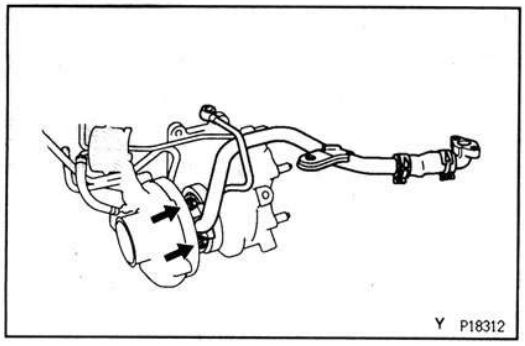
Torque: 11.5 N·m (120 kgf·cm, 9 ft·lbf)



2. **INSTALL TURBO WATER PIPE**

Install a new gasket and the water pipe with the 2 nuts and bolt.

Torque: 11.5 N·m (120 kgf·cm, 9 ft·lbf) for nut

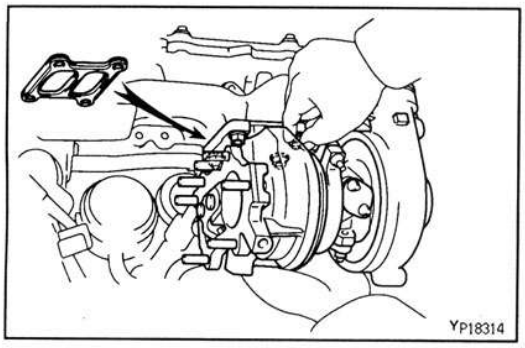


3. **INSTALL TURBO OIL PIPE AND OUTLET PIPE ASSEMBLY**

(a) Align the oil holes of the a new gasket and the turbocharger housing.

(b) Install the gasket and oil pipe with the 2 nuts.

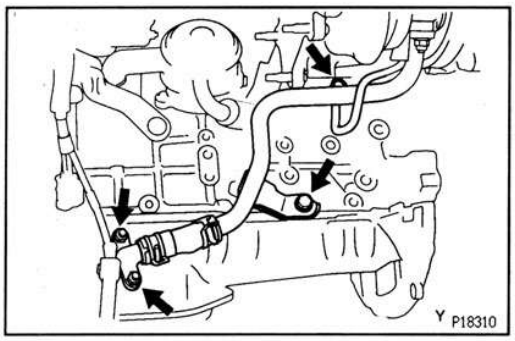
Torque: 17 N·m (175 kgf·cm, 13 ft·lbf)



4. **INSTALL TURBOCHARGER**

(a) Place a new gasket on the turbocharger.

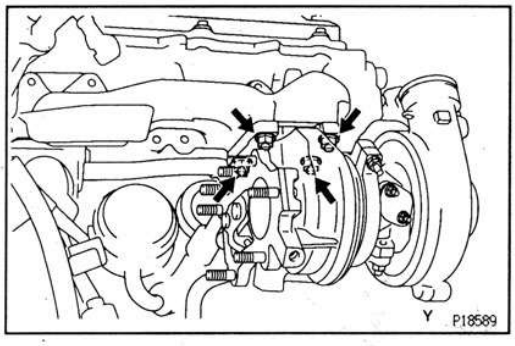
(b) Install the turbocharger and turbo oil pipe assembly with the 4 new nuts. Do not torque the nuts.



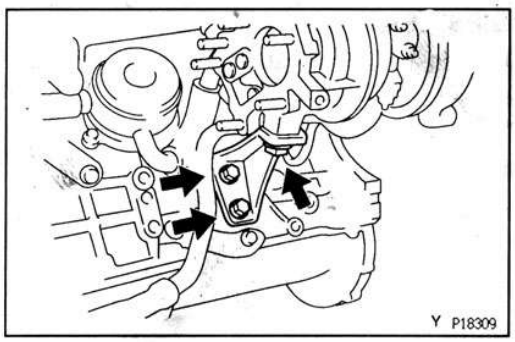
(c) Tighten the union bolt holding the oil pipe to the cylinder block.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

(d) Tighten the bolt holding the bracket of the oil pipe to the cylinder block.
Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)

(e) Install a new gasket and tighten the 2 nuts holding the turbo oil outlet pipe to the No.1 oil pan.
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)

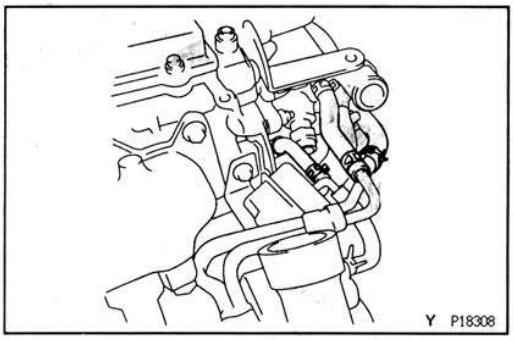


(f) Tighten the 4 nuts holding the turbocharger to the exhaust manifold.
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)



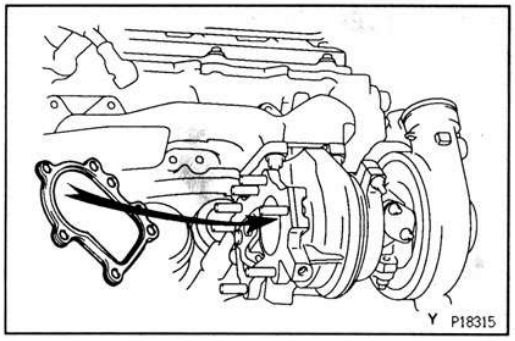
5. INSTALL TURBOCHARGER STAY

Install the turbocharger stay with the 3 bolts.
Torque:
Turbocharger side:
69 N·m (705 kgf·cm, 51 ft·lbf)
Cylinder block side:
58 N·m (590 kgf·cm, 43 ft·lbf)



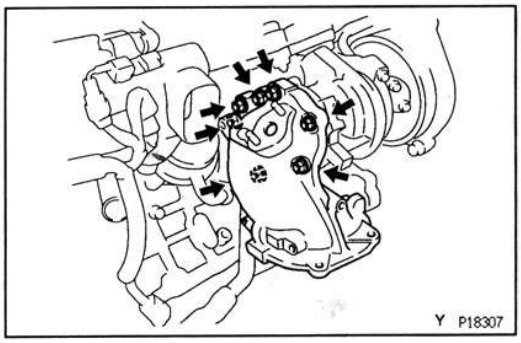
6. CONNECT WATER HOSES TO TURBO WATER PIPE

7. CONNECT AIR HOSE TO ACTUATOR

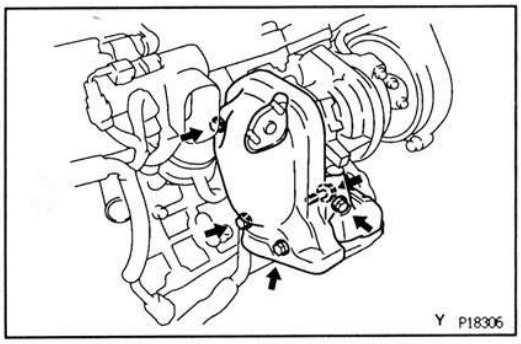


8. INSTALL TURBINE OUTLET ELBOW

(a) Place a new gasket on the turbocharger.

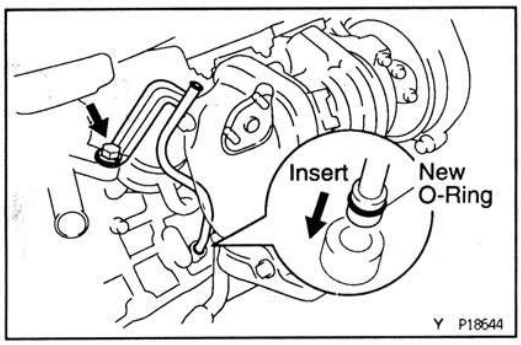


(b) Install the outlet elbow with the 7 new nuts.
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)



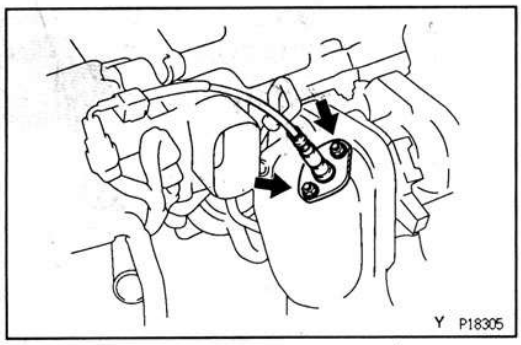
9. INSTALL HEAT INSULATORS OF TURBINE OUTLET ELBOW

(a) Install the RH heat insulator with the 3 bolts.
(b) Install the LH heat insulator with the 2 bolts.



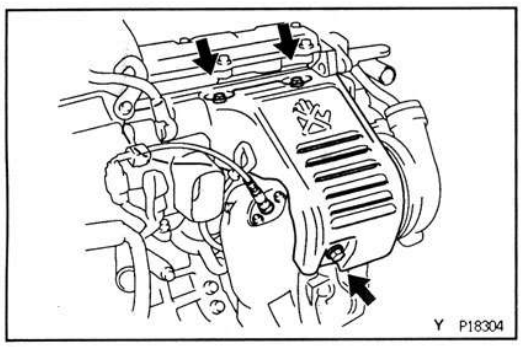
10. INSTALL OIL DIPSTICK AND GUIDE

(a) Install a new O–ring to the oil dipstick guide.
(b) Apply soapy water to the O–ring.
(c) Install the oil dipstick guide with the bolt.
(d) Insert the oil dipstick.



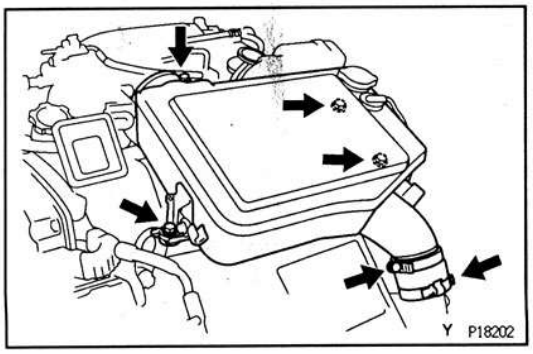
11. INSTALL OXYGEN SENSOR

Install a new gasket, the oxygen sensor and heat insulator with the 2 nuts.
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)



12. INSTALL TURBOCHARGER HEAT INSULATOR

Install the heat insulator with the 3 bolts.



13. INSTALL INTERCOOLER

Connect the intercooler to the turbocharger and intake air connector, and install the intercooler with the 3 bolts.

14. INSTALL CATALYTIC CONVERTER
(See steps 33 and 34 on page EG–67)

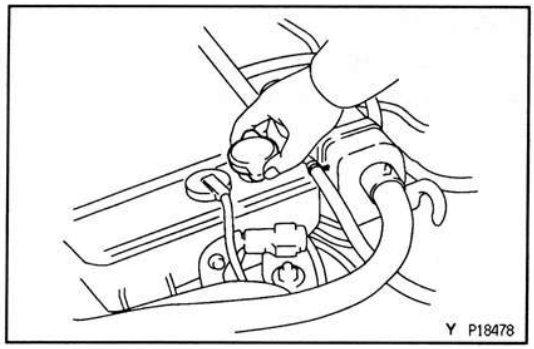
15. FILL WITH INTERCOOLER COOLANT
(See page EG–97)

16. FILL WITH ENGINE COOLANT

17. FILL WITH ENGINE OIL

18. START ENGINE AND CHECK FOR LEAKS

19. CHECK COOLANT AND OIL LEVELS



EG

INTERCOOLER

INTERCOOLER COOLANT CHECK

EG47Y-01

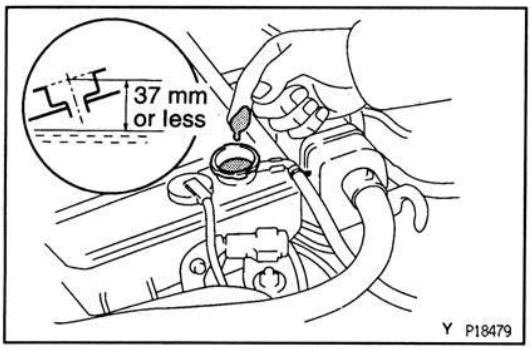
CHECK INTERCOOLER COOLANT QUALITY

(a) Remove the intercooler coolant filler cap.

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

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

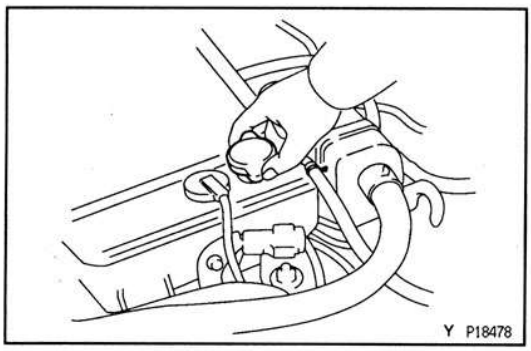
If excessively dirty, clean the coolant passages and replace the coolant.



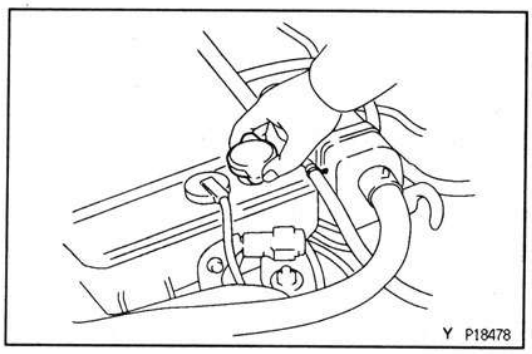
(c) Check that the level of intercooler coolant is full.

HINT: The coolant level should be within 37 mm (1.46 in.) from the top of the hole, as shown in the illustration.

If the coolant level is not sufficient, add coolant until the coolant level is close to the top of the filler hole.



(d) Reinstall the intercooler coolant filler cap.

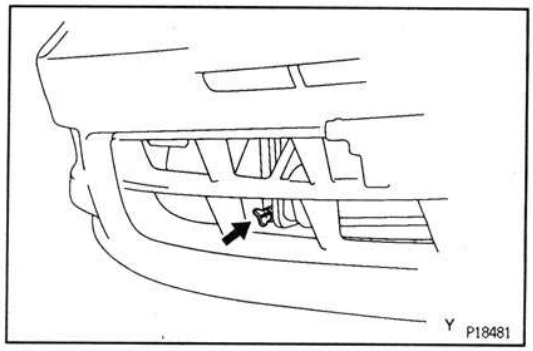


INTERCOOLER COOLANT REPLACEMENT EG46C-02

1. DRAIN INTERCOOLER COOLANT

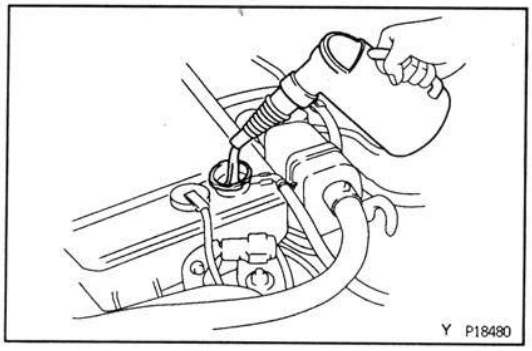
(a) Remove the intercooler coolant filler cap.

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



(b) Loosen the drain cock (for the sub radiator) and drain the coolant.

(c) Close the drain cock.



2. FILL WITH INTERCOOLER COOLANT

(a) Slowly fill coolant until it reaches the top of the intercooler refill inlet.

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

NOTICE:

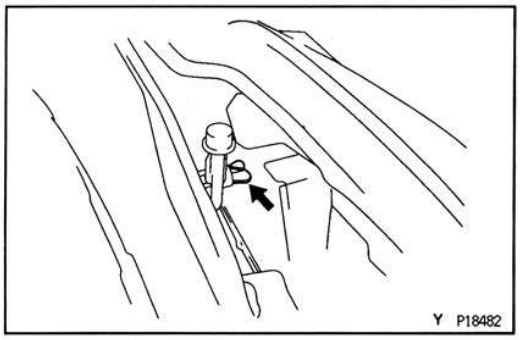
- **Do not use an alcohol type coolant.**
- **The coolant should be mixed with demineralized water or distilled water.**
- **Do not mix engine coolant with the intercooler coolant.**
- **Do not add coolant to the reservoir.**
- **Do not mix engine coolant with the intercooler coolant.**
- **Performance is reduced if the coolant level is not full, so make sure all air is bled from the cooling system.**

Capacity:

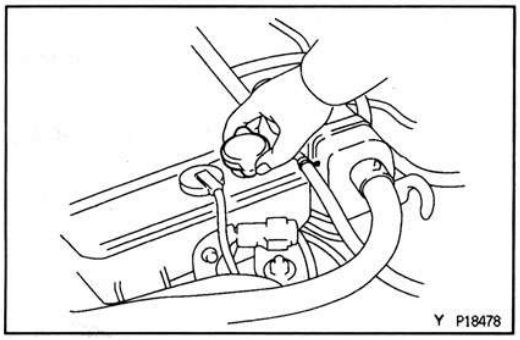
2.5 liters (2.6 US qts, 2.2 Imp. qts)

EG

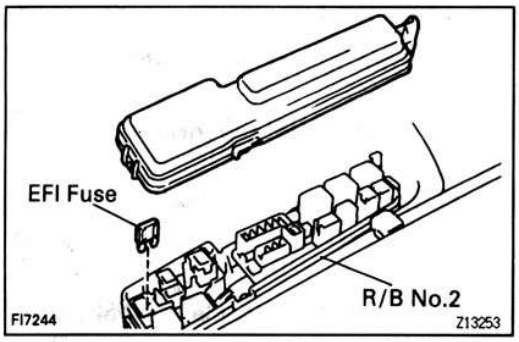
(b) Start the engine.
(c) Open the throttle valve (IDL contact OFF) to operate the water pump.
(d) Stop the pump and add coolant if the coolant level has dropped.
HINT: If the coolant level falls below 33 mm (1.30 in.) from the full level, the coolant level warning sensor comes on and the water pump stops.
(e) Repeat steps (c) and (d) above.



(f) When the coolant level stops dropping when the water pump is turned ON–OFF, open the bleeder cock at the top of the sub radiator and bleed the air out.
NOTICE: After air–bleeding is completed, make sure the cock is closed securely.
(g) Add coolant and repeat steps (c) to (f).



(h) When the coolant level stops dropping, install the filler cap on the refill inlet.



(i) Remove the EFI fuse (15 A) from the R/B No.2 for 10 seconds or more, then reinsert the fuse to erase the diagnostic code from the ECU.
HINT:
- Cancellation can also be done by removing the negative (–) terminal cable from the battery, but in this case, other memory systems (clock, etc.) will also be cancelled out.
- If the diagnostic code is not cancelled out, it will be retained by the ECU and appear along with a new code in the event of future trouble.
- If it is necessary to work on engine components requiring removal of the negative (–) terminal cable from the battery, a check must first be made to see if a diagnostic code has been recorded.

INTERCOOLER RADIATOR CLEANING

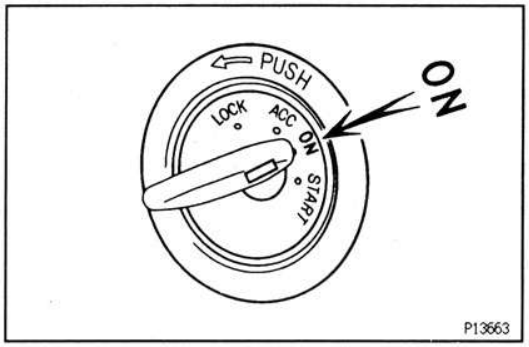
EG36W-02

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

NOTICE: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. If the cleaner nozzle pressure is 2,942 – 3,432 kPa (30 – 35 kgf/cm², 427 – 498 psi), keep a distance of at least 40 cm (15.75 in.) between the radiator core and cleaner nozzle.

ON–VEHICLE INSPECTION

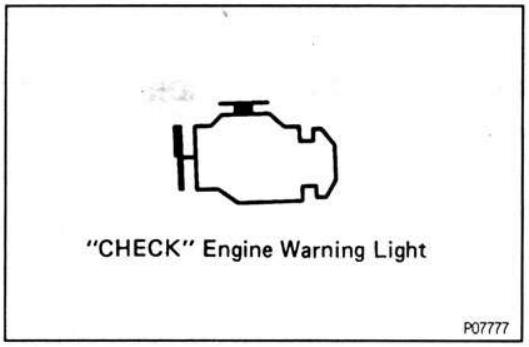
EG46D-01



1. CHECK ENGINE WARNING LIGHT OPERATION

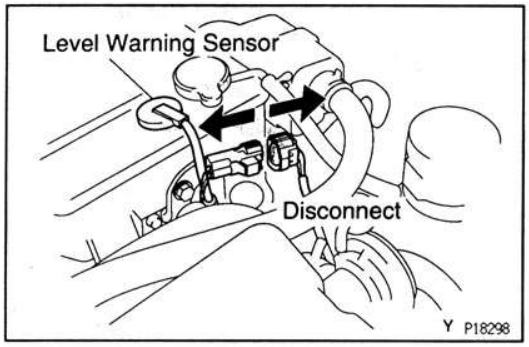
(a) Turn the ignition switch ON.

NOTICE: Do not start the engine.



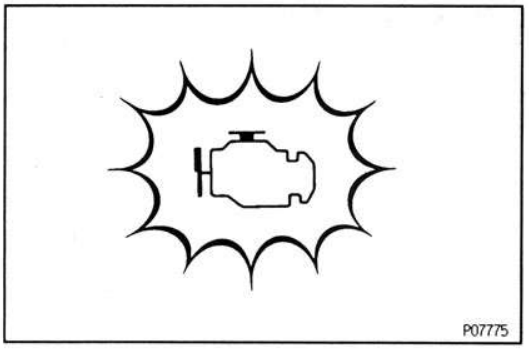
(b) Check that the warning light comes on.

(c) When the engine is started, check that the warning light goes out.

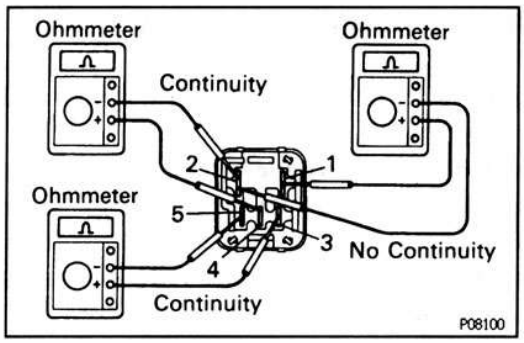


(d) Disconnect the intercooler coolant level warning sensor connector.

(e) Check that the warning light does not light up.



(f) Open the throttle valve, and check that the warning light comes on after approx. 20 seconds.



2. INSPECT ENGINE MAIN RELAY

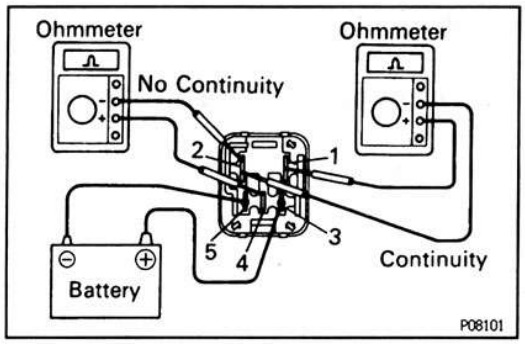
A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

(b) Check that there is continuity between terminals 2 and 4.

(c) Check that there is no continuity between terminals 1 and 2.

If continuity is not as specified, replace the relay.



B. Inspect relay operation

(a) Apply battery voltage across terminals 3 and 5.

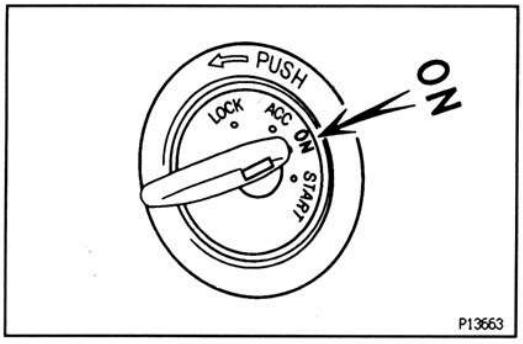
(b) Using an ohmmeter, check that there is no continuity between terminals 2 and 4.

(c) Check that there is continuity between terminals 1 and 2.

If operation is not as specified, replace the relay.

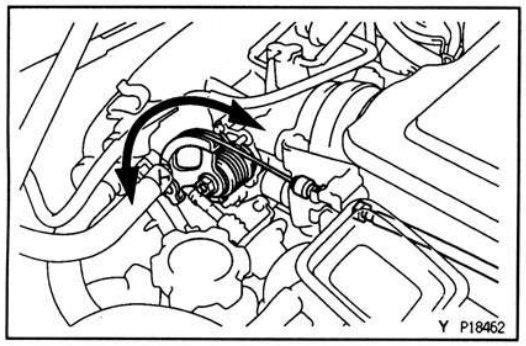
3. INSPECT INTERCOOLER RELAY
(See page EG–104)

4. INSPECT THROTTLE POSITION SENSOR
(See page EG–161)



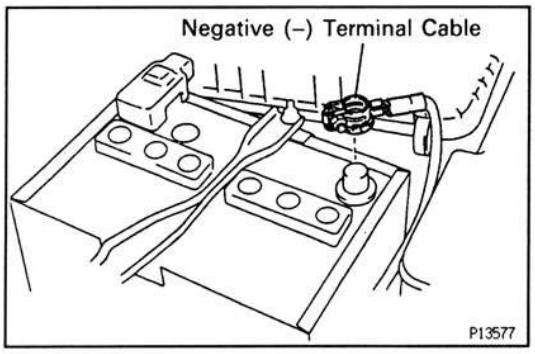
5. INTERCOOLER WATER PUMP OPERATION

(a) Turn the ignition switch ON and engine running.



(b) Open the throttle valve, and check that the water pump rotates.

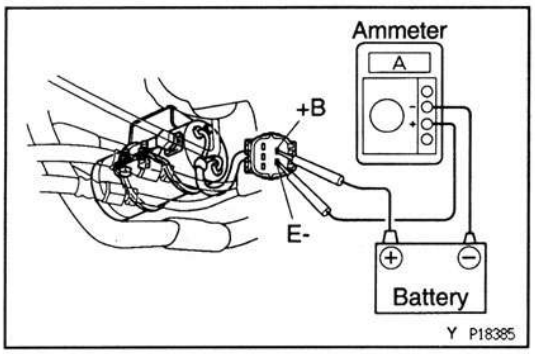
(c) When the throttle valve is closed, check that the water pump stops after approx. 30 seconds.



6. INSPECT INTERCOOLER WATER PUMP

(a) Disconnect the negative (–) terminal cable from the battery.

(b) Disconnect the intercooler water pump connector.



(c) Connect the battery and ammeter to terminals +B and E– of the water pump connector.

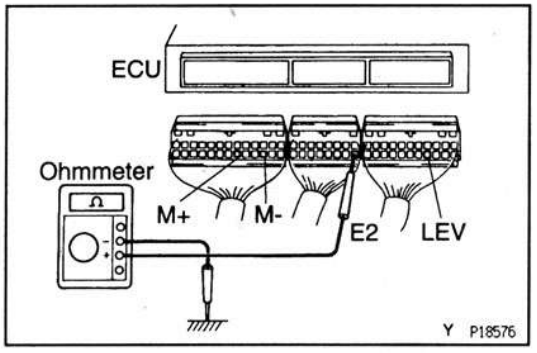
(d) Check that the water pump rotates smoothly, and check the reading on the ammeter.

Standard amperage:

5.6 A or less

NOTICE: Do not operate the pump for more than 30 seconds.

(e) Reconnect the intercooler water pump connector.



7. INSPECT ENGINE ECU FOR CIRCUIT

(a) Disconnect the connectors from ECU.

(b) Check the connectors on the wiring harness side as shown in the chart below.

Check for	Tester connection	Condition	Specified value
Continuity	E2 – Ground	–	Continuity
Voltage	M+ – Ground	Ignition SW ON	9 – 14 V
	M– – Ground		
Continuity	LEV – Ground	Level warning sensor ON (float up)	Continuity
		Level warning sensor OFF (float down)	No continuity

V05509

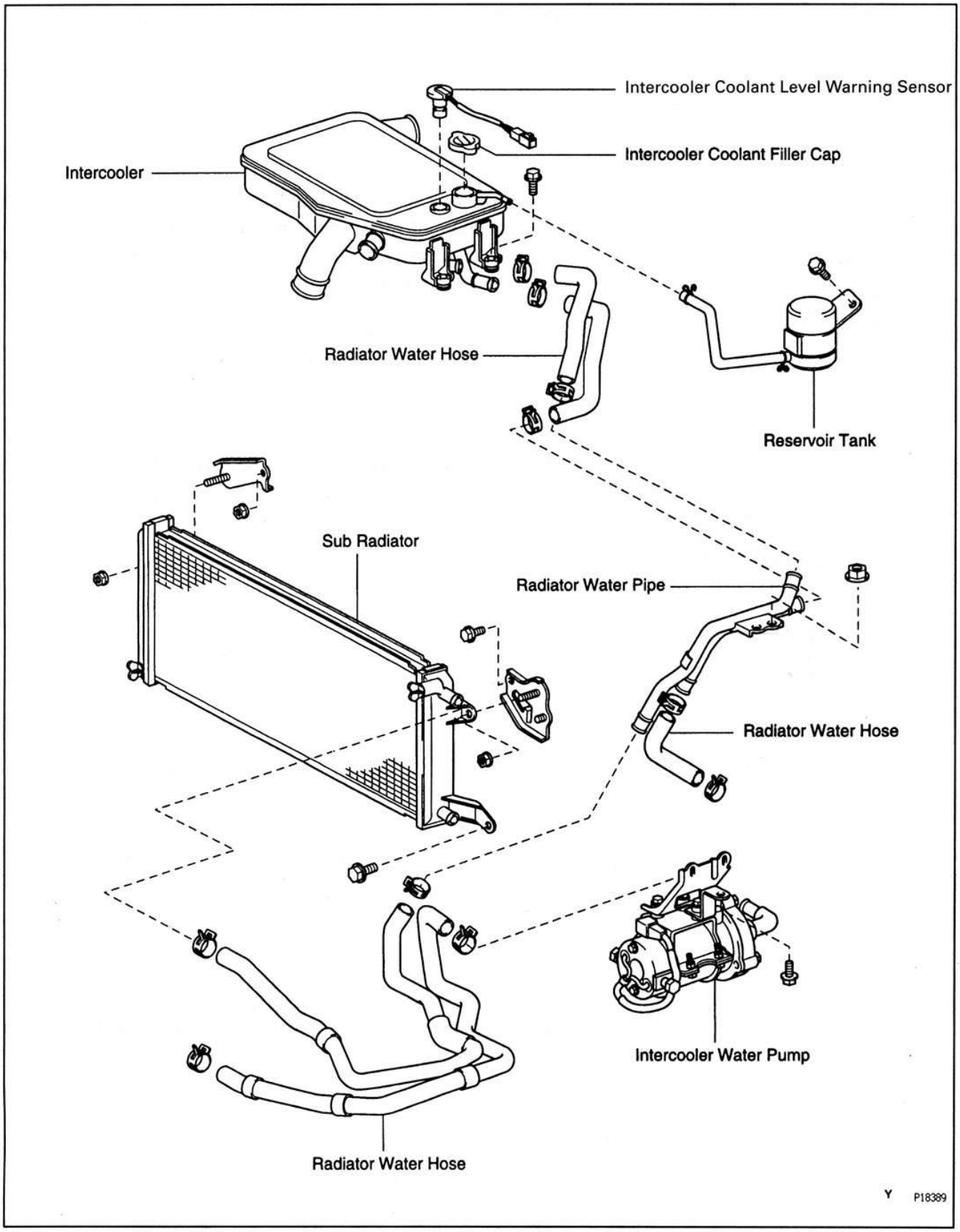
If circuit is as specified, replace the ECU.

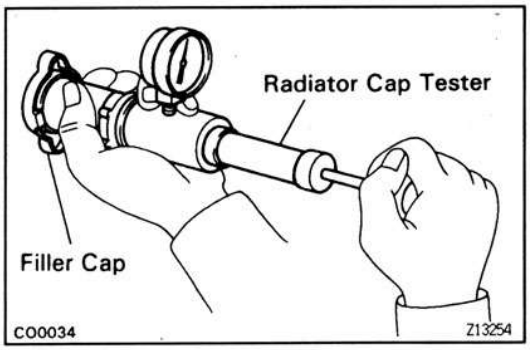
(c) Reconnect the negative (–) terminal cable to the battery.

EG

COMPONENTS

EG3MJ-04





INTERCOOLER COMPONENT INSPECTION EG448E-01

1. INSPECT INTERCOOLER COOLANT FILLER CAP

Using a radiator cap tester, pump the tester and measure the relief valve opening pressure.

Standard opening pressure:

74 – 103 kPa

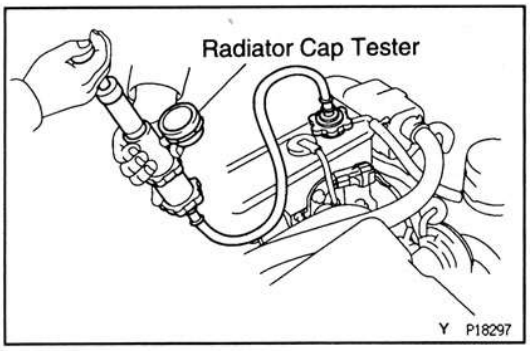
(0.75 – 1.05 kgf/cm², 10.7 – 14.9 psi)

Minimum opening pressure:

59 kPa (0.6 kgf/cm², 8.5 psi)

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

EG



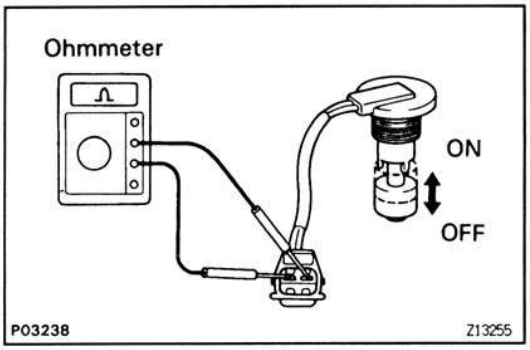
2. INSPECT INTERCOOLER COOLING SYSTEM FOR LEAKS

(a) Fill the cooling system with coolant and attach a radiator cap tester.

(b) Warm up the engine.

(c) Pump it to 118 kPa (1.2 kgf/cm², 17.1 psi), and check that the pressure does not drop.

If the pressure drops, check the hoses, radiator or water pump.



3. INSPECT INTERCOOLER COOLANT LEVEL WARNING SENSER

(a) Check that there is no continuity between terminals with the switch ON (float up).

(b) Check that there is continuity between terminals with the switch OFF (float down).

If operation is not as specified, replace the sensor.

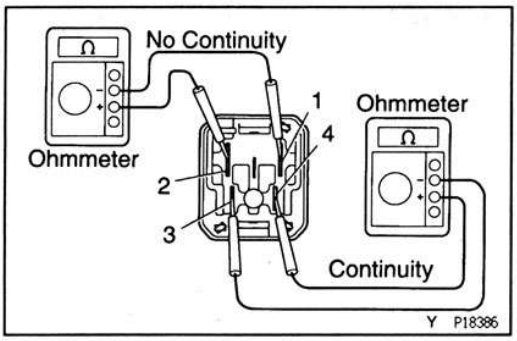
INTERCOOLER RELAY

EG3RP-02

INTERCOOLER RELAY INSPECTION

1. REMOVE INTERCOOLER RELAY

EG



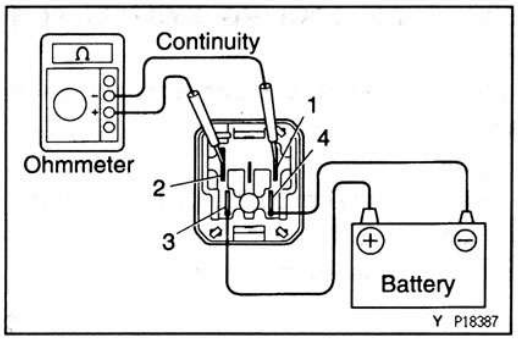
2. INSPECT INTERCOOLER RELAY

A. Inspect relay continuity

(a) Using an ohmmeter, check that there is no 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.



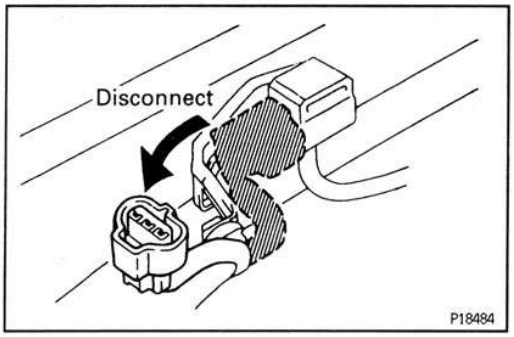
B. Inspect relay operation

(a) Apply battery voltage across terminals 3 and 4.

(b) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If operation is not as specified, replace the relay.

3. REINSTALL INTERCOOLER RELAY

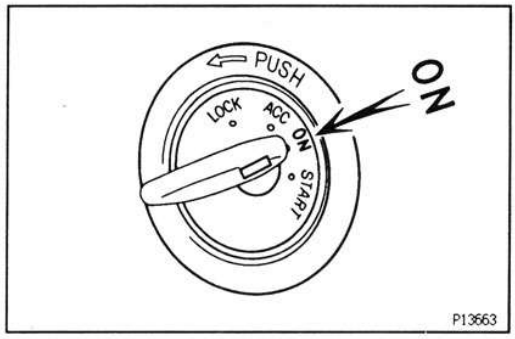


TURBO PRESSURE SENSOR

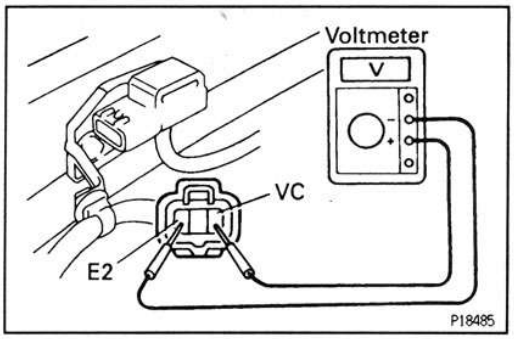
TURBO PRESSURE SENSOR INSPECTION EG44F-01

1. INSPECT POWER SOURCE VOLTAGE OF TURBO PRESSURE SENSOR

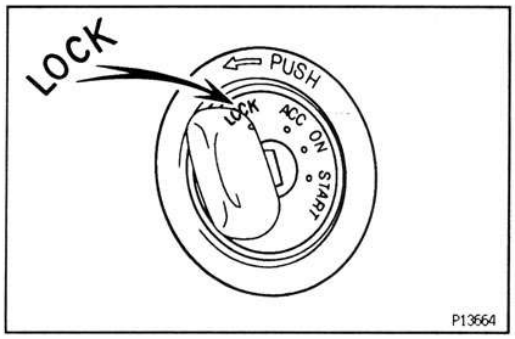
(a) Disconnect the turbo pressure sensor connector.



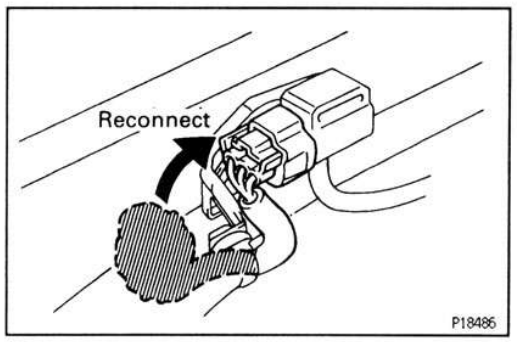
(b) Turn the ignition switch ON.



(c) Using a voltmeter, measure the voltage between connector terminals VC and E2 of the wiring harness side.
Voltage:
4.5 – 5.5 V

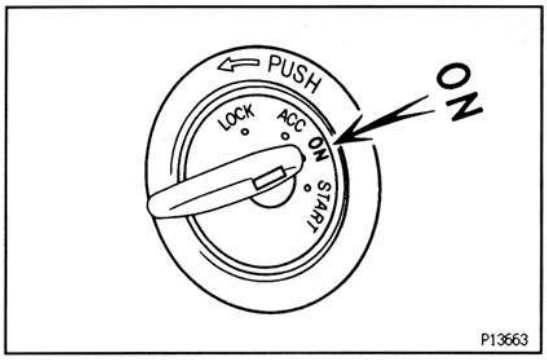


(d) Turn the ignition switch to LOCK.



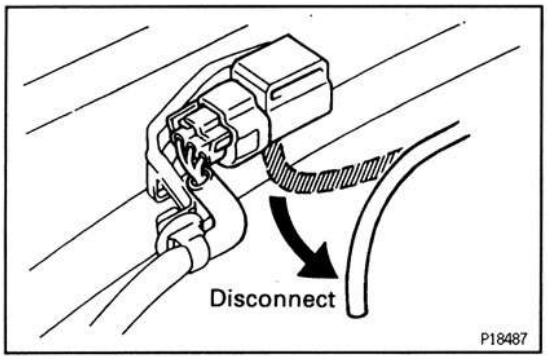
(e) Reconnect the turbo pressure sensor connector.

EG

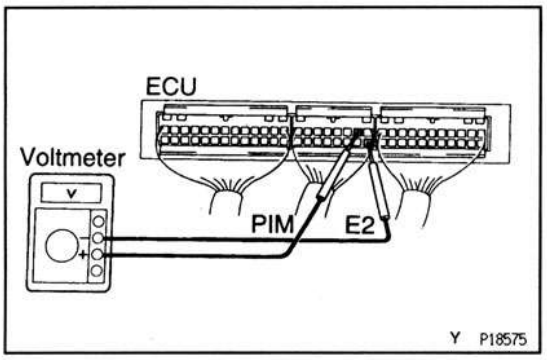


2. INSPECT SUPPLY POWER OF TURBO PRESSURE SENSOR

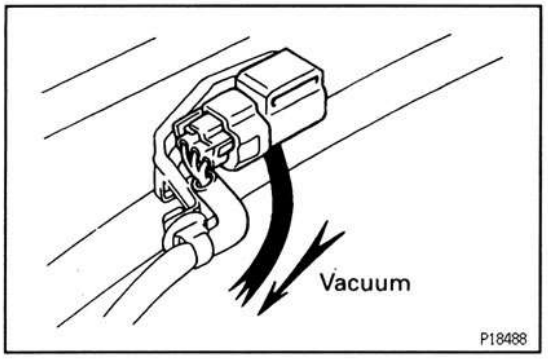
(a) Turn the ignition switch ON.



(b) Disconnect the vacuum hose from the turbo pressure sensor.



(c) Connect a voltmeter to terminals PIM and E2 of the ECU, and measure the output voltage under ambient atmospheric pressure.



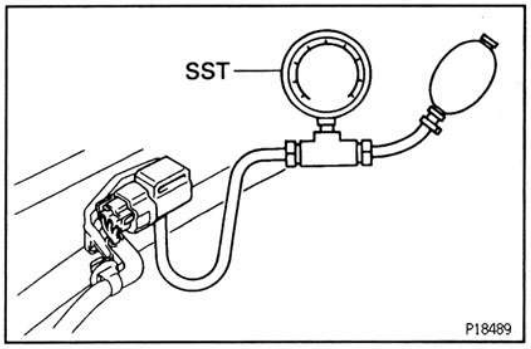
(d) Apply vacuum to the turbo pressure sensor in 13.3 kPa (100 mmHg, 3.94 in.Hg) segments to 66.7 kPa (500 mmHg, 19.69 in.Hg).

(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)	53.3 (400, 15.75)	66.7 (500, 19.69)
Voltage drop V	0.1 – 0.3	0.3 – 0.5	0.5 – 0.7	0.7 – 0.9	0.9 – 1.1

V05507



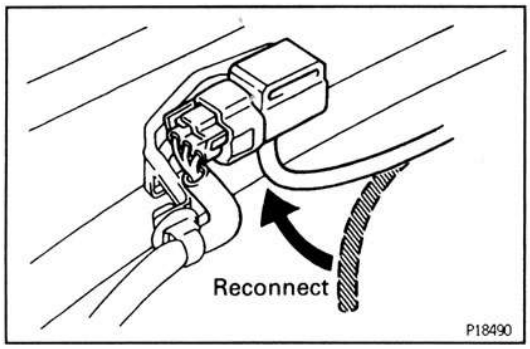
(f) Using SST (turbocharger pressure gauge), apply pressure to the turbo pressure sensor in 9.8 kPa (0.10 kgf/cm², 1.4 psi) segments to 49.0 kPa (0.50 kgf/cm², 7.1 psi).
SST 09992–00241

(g) Measure the voltage up from step (c) above for each segment.
Voltage up:

EG

Applied Pressure kPa (kgf/cm², psi)	9.8 (0.10, 1.4)	19.6 (0.20, 2.8)	29.4 (0.30, 4.3)	39.2 (0.40, 5.7)	49 (0.50, 7.1)
Voltage up V	0.05 – 0.20	0.20 – 0.35	0.35 – 0.50	0.50 – 0.65	0.65 – 0.80

V05508



(h) Reconnect the vacuum hose to the turbo pressure sensor.

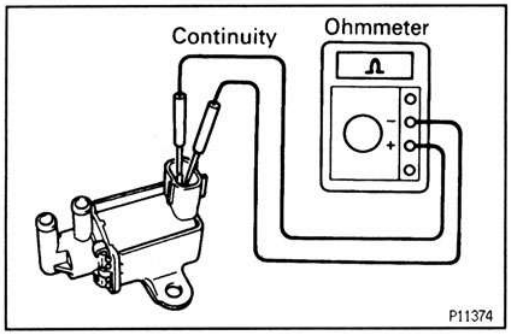
VSV
(For Turbocharging Pressure)

EG46G-01

VSV INSPECTION

1. **REMOVE VSV**

EG



2. **INSPECT VSV**

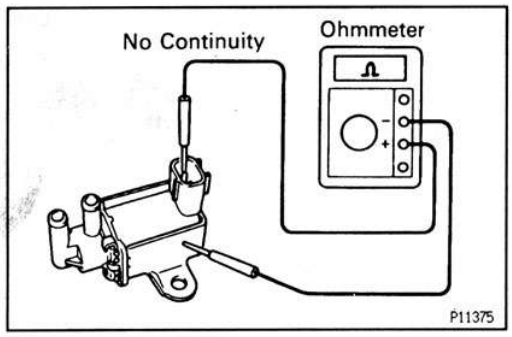
A. Inspect VSV for open circuit

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

Resistance:

22 – 26 Ω at 20°C (68°F)

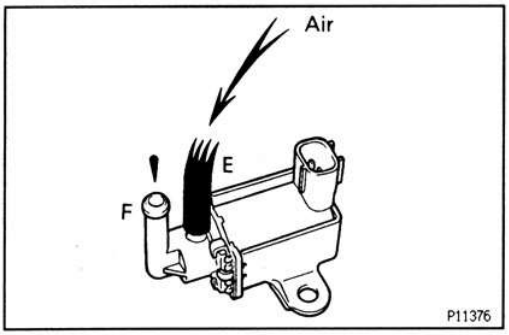
If there is no continuity, replace the VSV.



B. Inspect VSV for ground

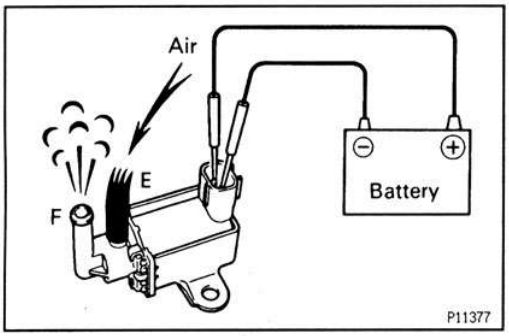
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.



C. Inspect VSV operation

(a) Check that air does not flow from port E to F.



(b) Apply battery voltage across the terminals.

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

If operation is not as specified, replace the VSV.

3. **REINSTALL VSV**

SERVICE SPECIFICATIONS

SERVICE DATA

EG0X8-08

Turbocharger	Turbocharging pressure		82 – 115 kPa (0.84 – 1.17 kgf/cm², 11.9 – 16.7 psi)
	Impeller wheel axial play		0.110 mm (0.0043 in.) or less
	Impeller wheel radial play		0.136 mm (0.0054 in.) or less
Intercooler coolant filler cap	Relief valve opening pressure	STD	74 – 103 kPa (0.75 – 1.05 kgf/cm², 10.7 – 14.9 psi)
		Limit	59 kPa (0.6 kgf/cm², 8.5 psi)
Intercooler water pump	Rotating amperage		5.6 A or less
VSV for turbo –charging pressure	Resistance	at 20°C (68°F)	22 – 26 Ω

EG

TORQUE SPECIFICATIONS

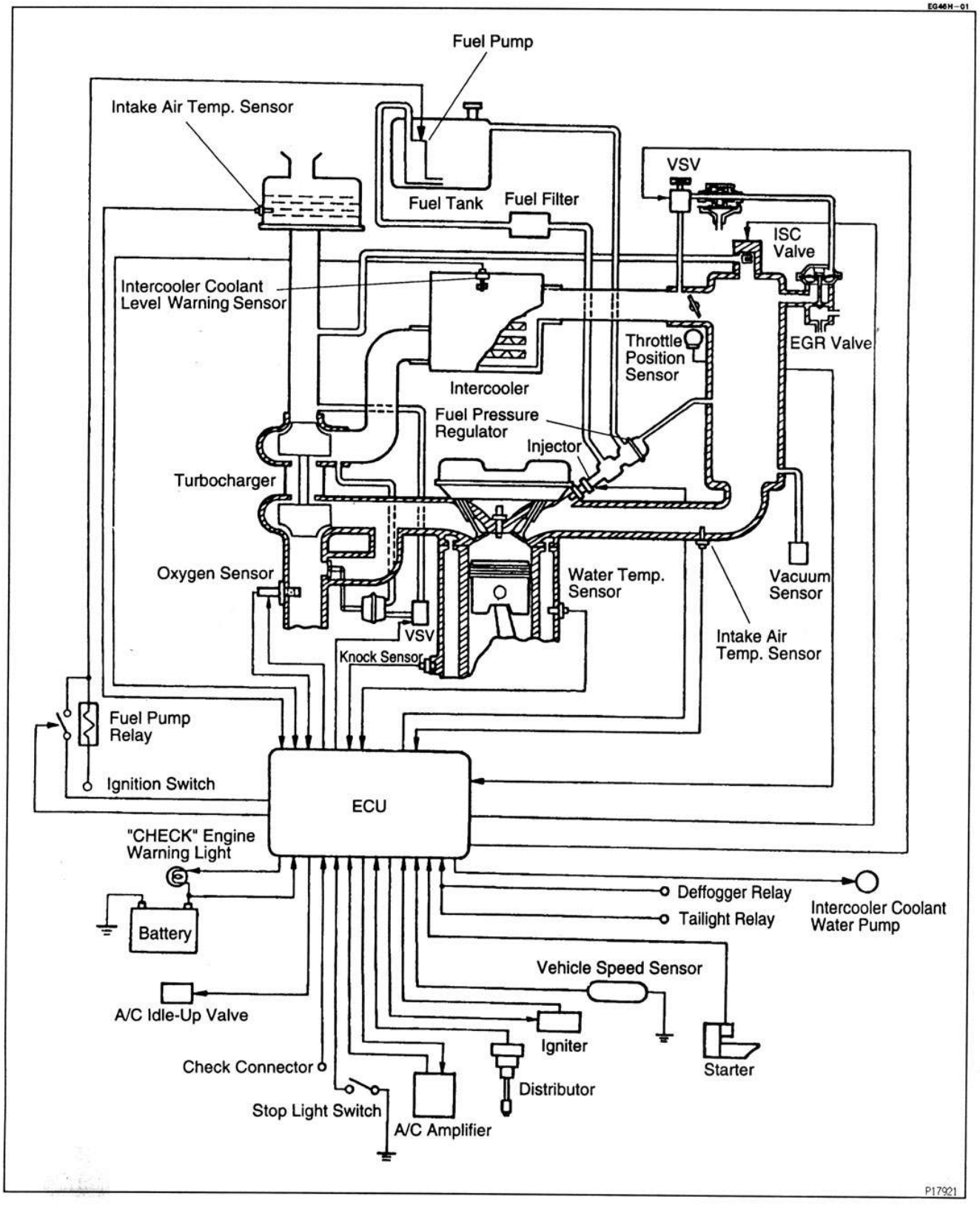
EG0X9-08

Part tightened		N·m	kgf·cm	ft·lbf
Side bearing housing plate x Turbocharger		11.5	120	9
Turbo water pipe x Turbocharger	Nut	11.5	120	9
Turbo oil pipe x Turbocharger		17	175	13
Turbocharger x Exhaust manifold		64	650	47
Turbo oil pipe x Cylinder block	Bolt	37	380	27
	Union bolt	39	400	29
Turbo oil outlet pipe x No.1 oil pan		20	200	15
Turbocharger stay x Turbocharger		69	705	51
Turbocharger stay x Cylinder block		58	590	43
Turbine outlet elbow x Turbocharger		64	650	47
Oxygen sensor x Turbine outlet elbow		20	200	15

EFI SYSTEM

DESCRIPTION

EG



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

FUEL SYSTEM

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

AIR INDUCTION SYSTEM

The air induction system provides sufficient air for engine operation.

ELECTRONIC CONTROL SYSTEM

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

The ECU controls the following functions:

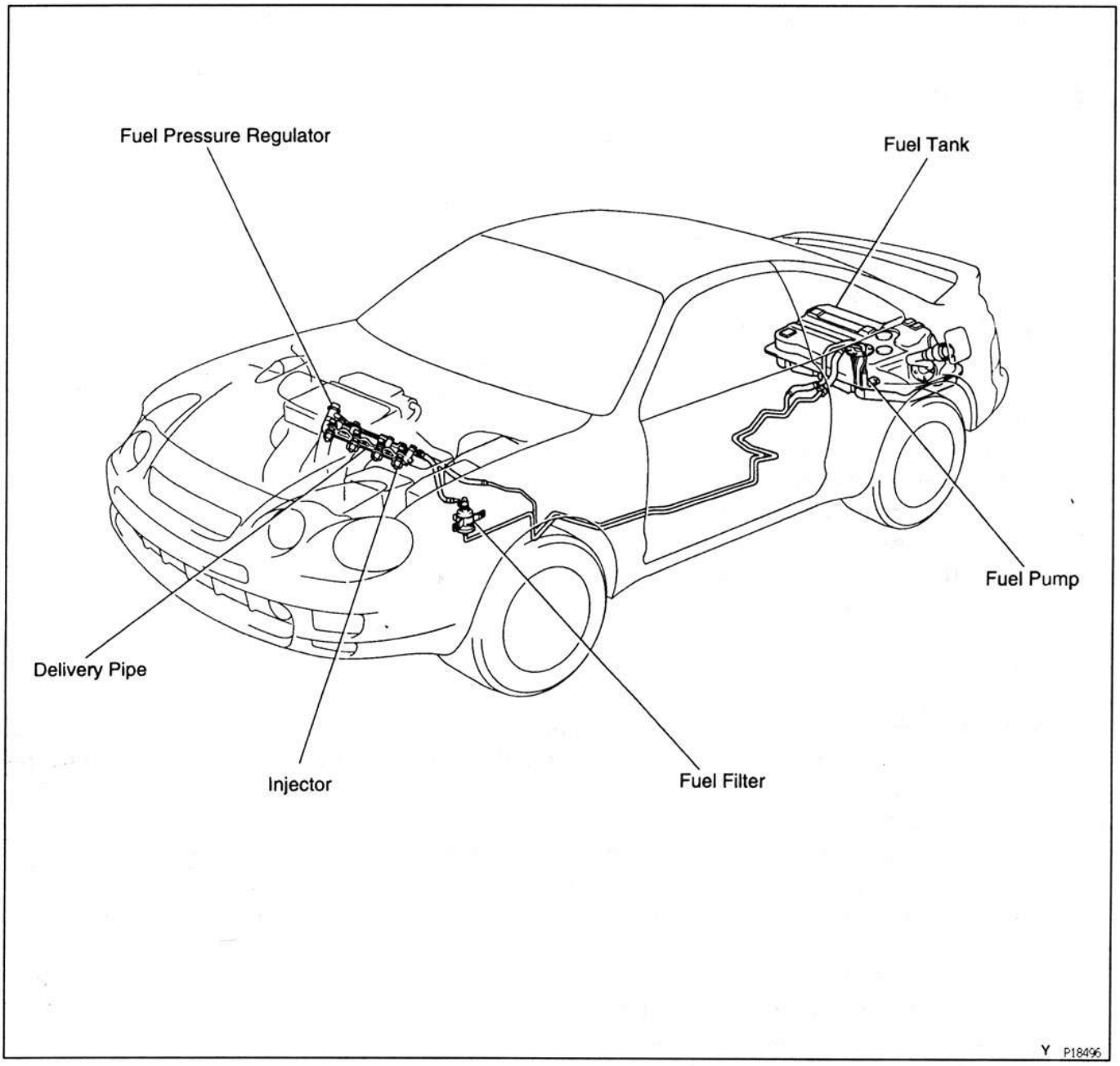
1. Electronic Fuel Injection (EFI)
   The ECU receives signals from various sensors indicating changing engine operating conditions such as:
   - Intake manifold pressure
   - Intake air temperature
   - Engine coolant temperature
   - Engine speed
   - Throttle valve opening angle
   - Exhaust oxygen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

   The signals are utilized by the ECU to determine the injection duration necessary for an optimum air–fuel ratio.
2. Electronic Spark Advance (ESA)
   The ECU is programmed with data for optimum ignition timing under all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, coolant temperature, etc.), the microcomputer (ECU) triggers the spark at precisely the right instant.
3. Idle Speed Control (ISC)
   The ECU is programmed with target idling speed values to respond to different engine conditions (coolant temperature, air conditioning ON/OFF, etc.). Sensors transmit signals to the ECU which control the flow of air through the throttle valve bypass and adjust idle speed to the target value.
4. Diagnosis
   The ECU detects any malfunctions and abnormalities in the sensor network and lights a check engine warning light in the combination meter. At the same time, trouble is identified and a diagnostic code is recorded by the ECU. The diagnostic code can be read by the number of blinks of the check engine warnig light when terminals TE1 and E1 of the check connector are connected. The diagnostic codes are referred to in a later page. (See page EG–118)
5. Self–Correction Function
   If any sensor malfunctions, an average value recorded in the back–up circuit is substituted to make driving possible. If danger is predicted, the engine is stopped and the check engine warning light will light up.
6. Fail–Safe Function
   In the event of the sensor malfunctioning, a back–up circuit will take over to provide minimal driveability, and the check engine warning light will illuminate.

OPERATION
FUEL SYSTEM

EG46J-01

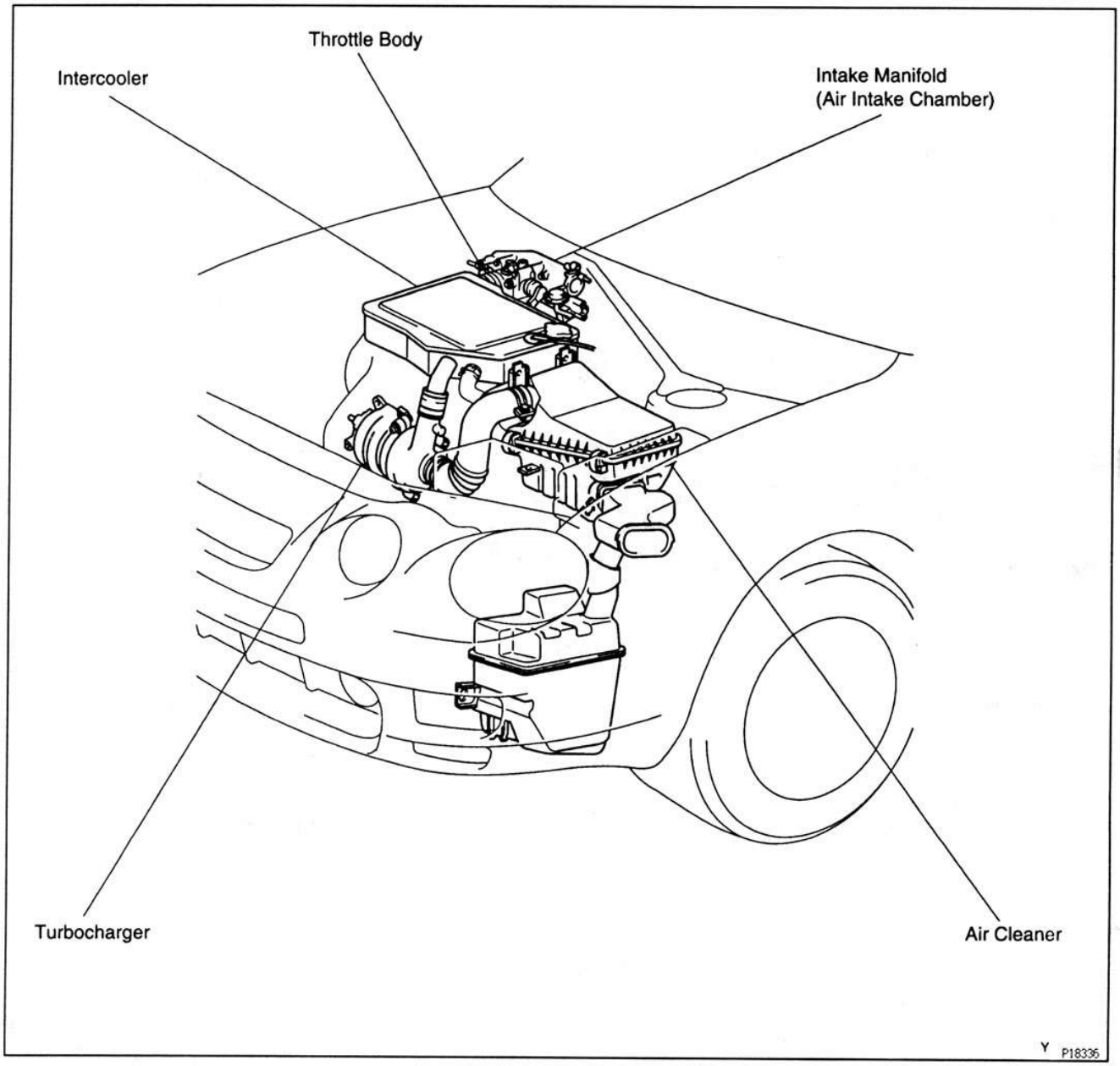
EG



Fuel pumped up by the fuel pump, flows through the fuel filter and is distributed to each injector at a set pressure maintained by the fuel pressure regulator.
The fuel pressure regulator adjusts the pressure of the fuel from the fuel line (high pressure side) to a pressure 250 kPa (2.55 kgf/cm², 36 psi) higher than the pressure inside the intake manifold, and excess fuel is returned to the fuel tank through the return pipe.
Fuel is injected into the intake manifold according to signals from the ECU.

EG46K–01

AIR INDUCTION SYSTEM



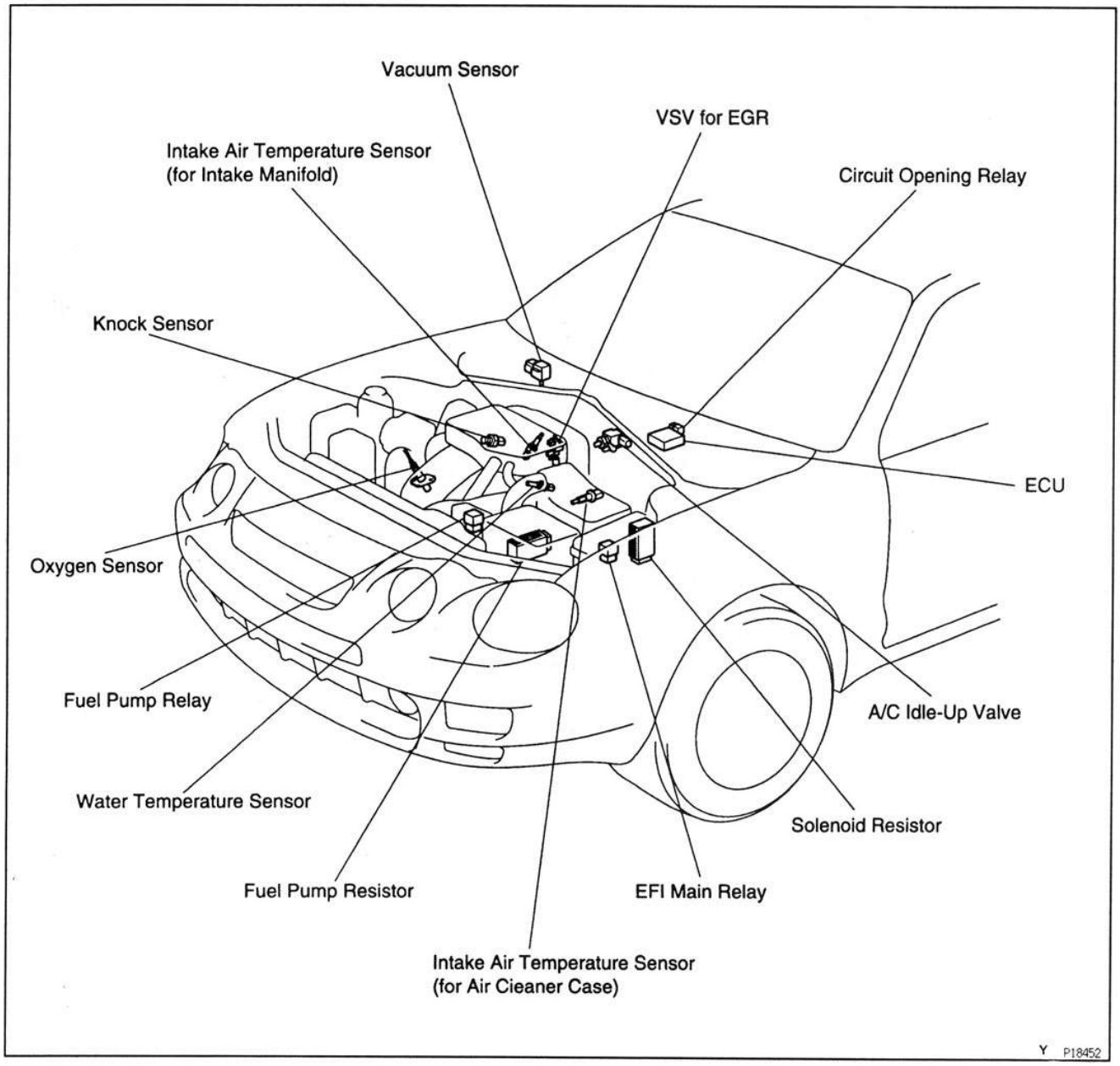
Air is filtered through the air cleaner and the amount flowing to the air intake chamber is determined according to the throttle valve opening in the throttle body and the engine speed. Intake air controlled by the throttle valve opening is distributed from the air intake chamber to the manifold of each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

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

ELECTRONIC CONTROL SYSTEM

EG46L–01

EG

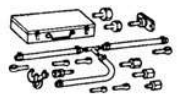
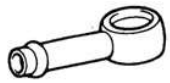
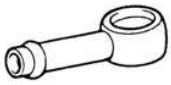


The control system consists of sensors which detect various engine conditions, and an ECU which determines the injection volume (timing) based on the signals from the sensors.
The various sensors detect the intake air pressure, engine speed, oxygen density in the exhaust gas, engine coolant temperature,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

PREPARATION

SST (SPECIAL SERVICE TOOLS)

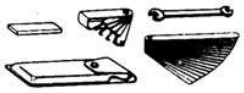
EG46M-01

	09268–41045	Injection Measuring Tool Set	
	(09268–41080)	No.6 Union	
	(90405–09015)	No.1 Union	
	09842–30060	Wire "E" EFI Inspection	Injector
	09843–18020	Diagnosis Check Wire	

EG

RECOMMENDED TOOLS

EG46N-01

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

EQUIPMEMT

EG46P-01

Carburetor cleaner	Throttle body
Graduated cylinder	Injector
Soft brush	Throttle body
Sound scope	Injector
Tachometer	
Thermometer	

Torque wrench	

EG480-01

SSM (SERVICE SPECIAL MATERIALS)

08826–00080	Seal Packing Black or equivalent (FIPG)	Cylinder head cover

DIAGNOSIS SYSTEM

DESCRIPTION

EG46R–01

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 light up.
By analyzing various signals as shown in the later table (See page EG–118) the ECU detects system malfunctions relating to the sensors or actuators.
The self–diagnosis system has 2 modes, a normal mode and a test mode.
If a malfunction is detected when in the normal mode, the ECU lights 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. 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 malfunction (except for code Nos. 42, 43 and 51). In this case, TE2 and E1 terminals on the check connector should be connected.
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.
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 technician can start the test mode by following the appropriate check terminal connection procedure.

DIAGNOSTIC CODES

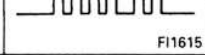
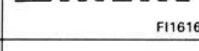
HINT:

- If a malfunction is detected during the diagnostic code check, refer to the circuit indicated in the table, and turn to the corresponding page.
- Your readings may vary from the parameters listed in the table, depending on the instruments used.

EG

Code No.	Number of blinks of Check Engine Warning Light	System	Check Engine*1 Warning Light		Diagnosis	Trouble Area	Memory*2	See Page
			Normal Mode	Test Mode				
-	 FI1401	Normal	-	-	No trouble code is recorded.	-	-	-
12	 FI1606	RPM Signal	ON	N.A.	• No G1, G2 or NE signal is input to the ECU for 2 secs. or more after STA turns ON. • Open in G – circuit	• Open or short in NE, G circuit • Distributor • Open or short in STA circuit • ECU	○	EG-133
13	 FI1607	RPM Signal	ON	ON	NE signal is not input to ECU for 0.05 sec. or more when engine speed is 1,000 rpm or more.	• Open or short in NE circuit • Distributor • ECU	○	-
14	 FI1608	Ignition Signal	ON	N.A.	IG signal from igniter is not input to ECU for 8 consecutive ignitions.	• Open or short in IGF or IGT circuit from igniter to ECU • Igniter • ECU	○	EG-134
16	 FI3600	Sub-CPU	ON	N.A.	Sub-CPU Malfunction	• ECU	X	-
21	 FI1609	Oxygen Sensor Signal	ON	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-137
				ON	At normal driving speed (below 100 km/h (60 mph) and engine speed is above 1,500 rpm), amplitude of oxygen sensor signal (OX1) is reduced to between 0.35 – 0.70 V continuously for 60 secs. or more. (2 trip detection logic)	• Open or short in oxygen sensor circuit • Oxygen sensor • Open or short in vacuum sensor circuit • Vacuum 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-132
24	 FI1611	Intake Air Temp. Sensor Signal (for air cleaner case)	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. sensor circuit • Intake air temp. sensor • ECU	○	EG-130
25	 FI2562	Air-Fuel Radio Lean Malfunction	ON	ON	Oxygen sensor output in less than 0.45 V for at least 90 secs. when oxygen sensor is warmed up (racing at 1,500 rpm). (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 • Water temp. sensor • ECU	○	EG-137
31	 FI1612	Vacuum Sensor Signal	ON	ON	Open or short detected continuously for 500 msec. or more in vacuum sensor sensor circuit. (PIM)	• Open or short in vacuum sensor circuit • Vacuum sensor • ECU	○	EG-128

DIAGNOSTIC CODES (Cont'd)

Code No.	Number of blinks of Check Engine Warning Light	System	Check Engine*1 Warning Light		Diagnosis	Trouble Area	Memory*2	See Page
			Normal Mode	Test Mode				
34	 BE3933	Turbocharging Pressure Signal	ON	N.A.	Abnormal over charge during high load driving.	• Open or short in vacuum sensor circuit • Vacuum sensor • Open or short in IG SW or EFI main relay circuit • ECU	○	-
41	 FI1614	Throttle Position Sensor Signal	ON	ON	Open or short detectd in throttle position sensor signal (VTA) for 0.5 sec. or more.	• Open or short in throttle position sensor circuit • Throttle position sensor • ECU	○	EG-126
42	 FI1615	Vehicle Speed Pulse Generator Signal	OFF	OFF	SPD signal is not input to the ECU for at least 8 seconds during high load driving with engine speed between 2,000 rpm and 5,000 rpm.	• Open or short in vehicle speed senor circuit • Vehicle speed sensor • ECU	○	-
43	 FI1616	Starter Signal	N.A.	OFF	Starter signal (STA) is not input to ECU until TE1 and E1 are connected.	• Open or short in starter signal circuit • Open or short in IG SW or EFI main relay circuit • ECU	X	EG-133
52	 FI1618	Knock Sensor Signal	ON	N.A.	With engine speed between 2,850 rpm and 7,300 rpm, signal from knock sensor is not input to ECU for 2 revolutions. (KNK)	• Open or short in knock sensor circuit • Knock sensor (looseness, etc.) • ECU	○	-
53	FI1619	Knock Control Signal	ON	N.A.	Engine speed is between 700 rpm and 7,300 rpm and ECU (for knock control) malfunction is detected.	• ECU	X	-
54	P03680	Intercooler System Malfunction	ON	N.A.	Intercooler water pump motor is locked or intercooler coolant level is low.	• Intercooler water pump • Intercooler relay • Intercooler water pump circuit • Intercooler coolant level sensor • Intercooler coolant level level sensor circuit	○	EG-96
51	 FI1617	Switch Condition Signal	N.A.	OFF	Displayed when A/C is ON or IDL contact OFF with the check terminals E1 and TE1 connected.	• A/C switch circuit • Throttle position sensor IDL circuit • Accelerator pedal, cable • ECU	X	EG-126

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.

EG

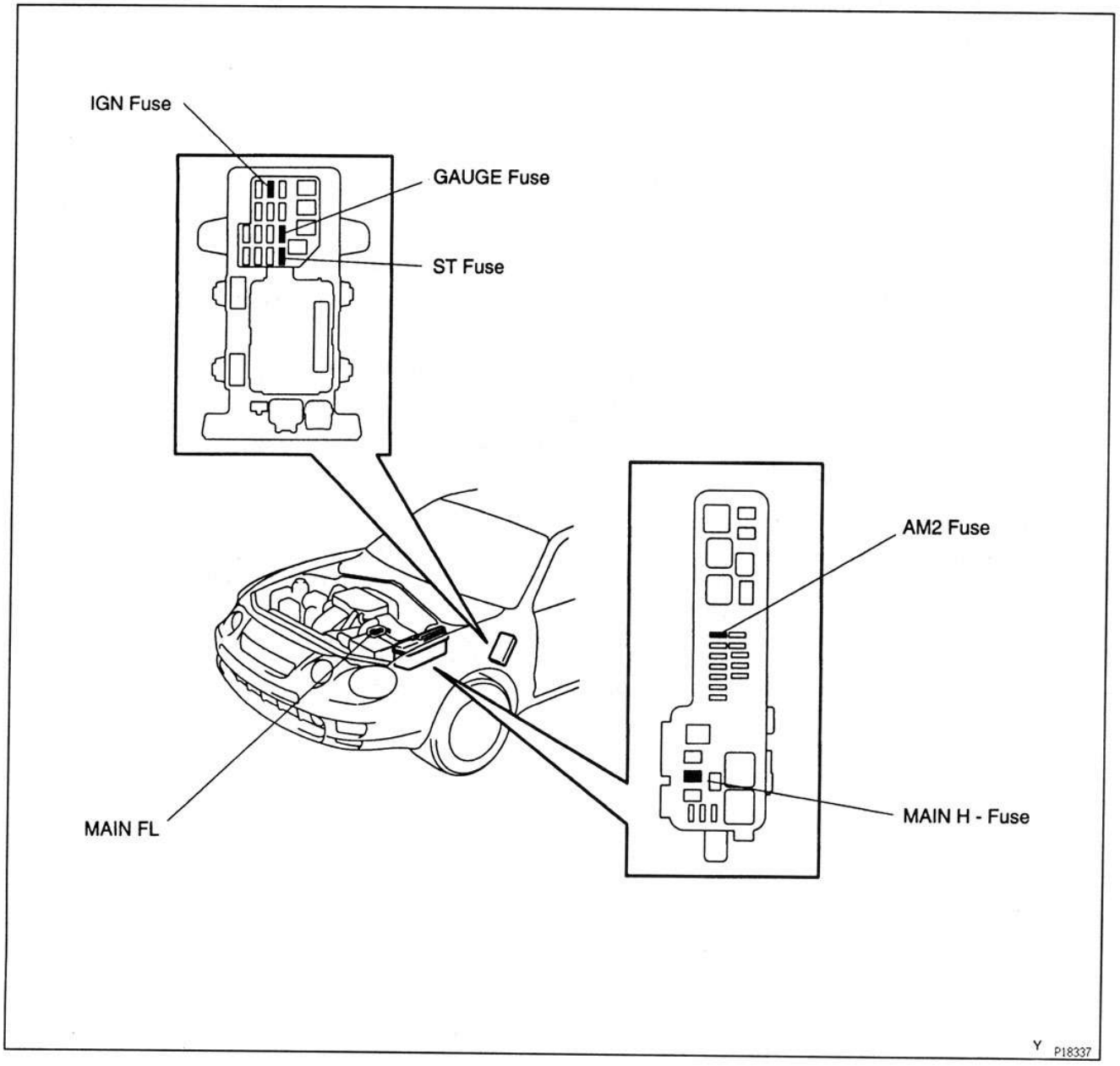
TROUBLESHOOTING w/ VOLT, OHMMETER

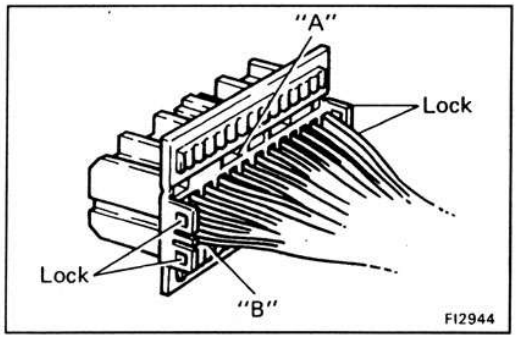
HINT: EG46T-01

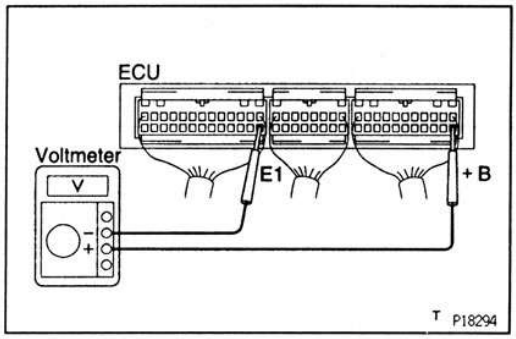
- The following troubleshooting procedures are designed for inspection of each separate system, and therefore the actual procedure may vary somewhat. However, troubleshooting should be performed while referring to the inspection methods described in this manual.
- Before beginning inspection, it is best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

FUSES AND FUSIBLE LINK LOCATION

EG46U-01







EFI SYSTEM CHECK PROCEDURE

EG46V-01

PREPARATION

(a) Disconnect the connectors from the ECU.

(b) Remove the locks as shown in the illustration so that the tester probe(s) can easily come in.
NOTICE: Pay attention to sections "A" and "B" in the illustration which can be easily broken.

(c) Reconnect the connectors to the ECU.
HINT:
- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11 V or more when the ignition switch is in the "ON" position.

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

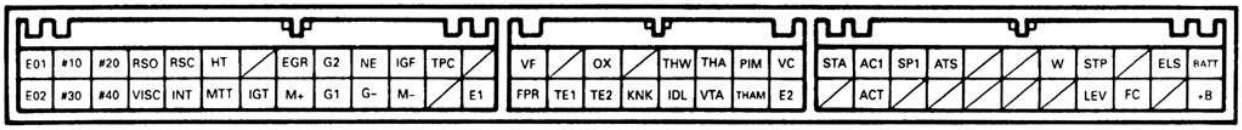
EG

EG

ECU Terminals

Symbol	Terminal name	Symbol	Terminal name	Symbol	Terminal name
E01	POWER GROUND	TPC	TURBOCHARGING PRESSURE VSV	AC1	A/C AMPLIFIER
E02	POWER GROUND		–	ACT	A/C AMPLIFIER
#10	INJECTOR		–	SP1	SPEED SENSOR
#30	INJECTOR	E1	ENGINE GROUND		–
#20	INJECTOR	VF	CHECK CONNECTOR	ATS	A/C AMPLIFIER
#40	INJECTOR	FPR	FUEL PUMP RELAY		–
RSO	ISC VALVE		–		–
VISC	A/C IDLE-UP VALVE	TE1	CHECK CONNECTOR		–
RSC	ISC VALVE	OX	CHECK CONNECTOR		–
INT	INTERCOOLER RELAY	TE2	CHECK CONNECTOR		–
HT	OXYGEN SENSOR HEATER		–	W	WARNING LIGHT
MTT	INTERCOOLER WATER PUMP	KNK	KNOCK SENSOR		–
	–	THW	WATER TEMP. SENSOR	STP	STOP LIGHT SWTICH
IGT	IGNITER	IDL	THROTTLE POSITION SENSOR	LEV	INTERCOOLER COOLANT LEVEL SENSOR
EGR	EGR VSV	THA	INTAKE AIR TEMP. SENSOR (FOR AIR CLEANER CASE)		–
M+	INTERCOOLER WATER PUMP	VTA	THROTTLE POSITION SENSOR	FC	CIRCUIT OPENING RELAY
G2	DISTRIBUTOR	PIM	TURBO PRESSURE SENSOR	ELS	TAILLIGHT RELAY, DEFOGGER RELAY
G1	DISTRIBUTOR	THAM	INTAKE AIR TEMP. SENSOR (FOR INTAKE MANIFOLD)		–
NE	DISTRIBUTOR	VC	SENSOR POWER SOURCE	BATT	BATTERY
G–	DISTRIBUTOR	E2	SENSOR GROUND	+B	EFI MAIN RELAY
IGF	IGNITER	STA	STARTER SWTICH		
M–	INTERCOOLER WATER PUMP		–		

ECU Terminals



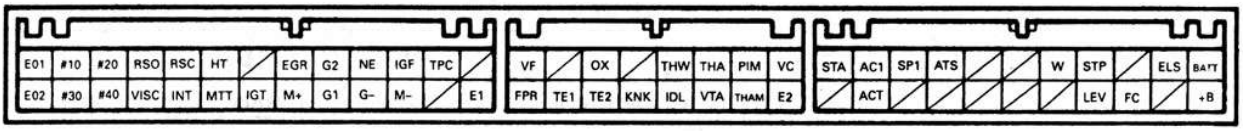
FI2796

V05459

ECU Wiring Connectors Voltage

No.	Terminals	Condition		STD voltage (V)	See page
1	+B – E1	IG SW ON		9 – 14	EG-124
2	BATT – E1	–		9 – 14	EG-125
3	IDL – E2	IG SW ON	Throttle valve open	9 – 14	EG-126
	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		2.2 – 2.8	EG-128
	VC – E2			4.5 – 5.5	
5	#10, #30 – E01 #20, #40 – E02			9 – 14	EG-129
6	THA – E2	IG SW ON	Intake air temp. 20°C (68°F)	0.5 – 3.4	EG-130
7	THAM – E2				EG-131
8	THW – E2		Coolant temp. 80°C (176°F)	0.2 – 1.0	EG-132
9	STA – E1	Cranking		6 or more	EG-133
10	IGT – E1	Cranking or idling		Pulse generation	EG-134
11	RSC, RSO – E1	IG SW ON	ECU connectors disconnected	9 – 14	EG-135
12	W – E1	No trouble (Check engine warning light off) and engine running		9 – 14	EG-136

ECU Terminals



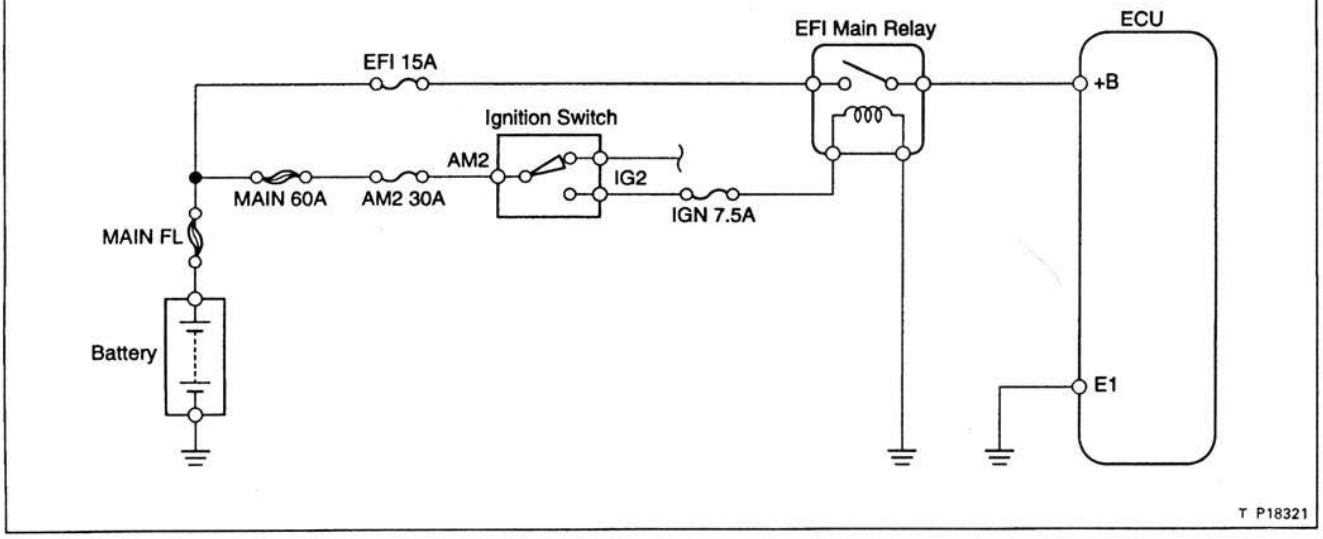
FI2796

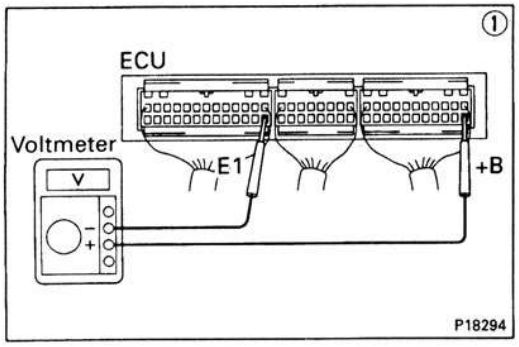
EG

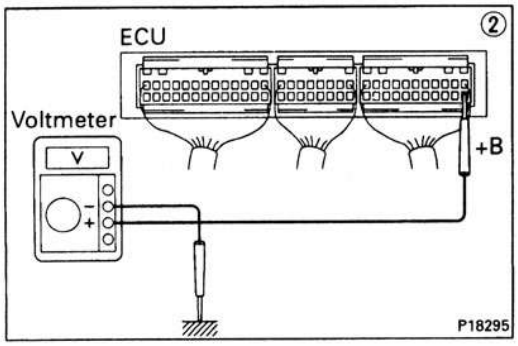
V05460

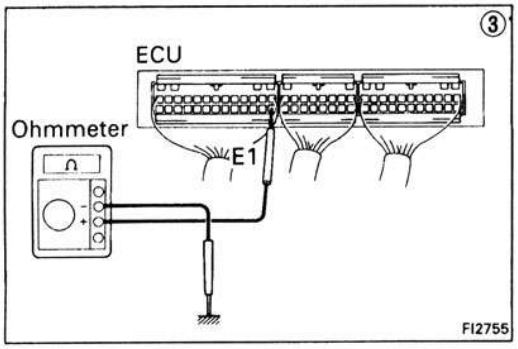
EG

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









① There is no voltage between ECU terminals +B and E1. **(IG SW ON)**

↓

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

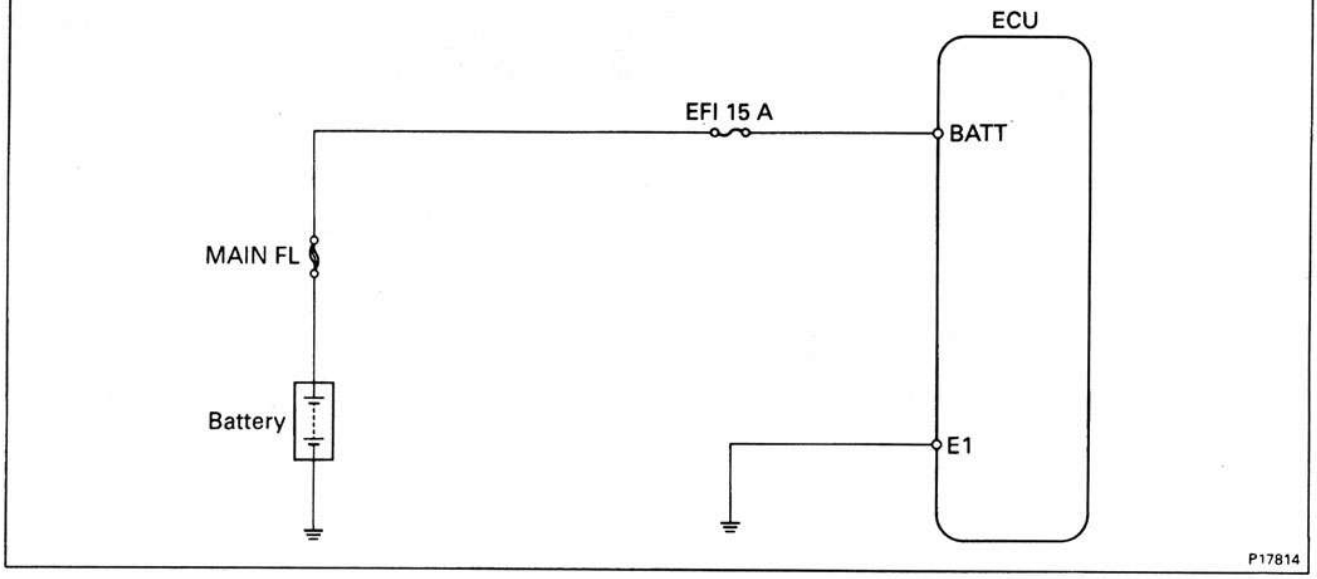
NO → ③ Check wiring between ECU terminal E1 and body ground.
- OK → Try another ECU.
- BAD → Repair or replace.

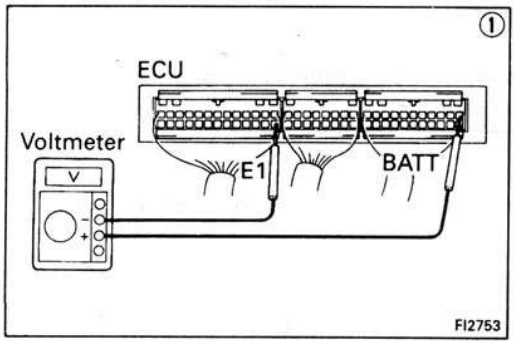
OK → Check fuses, fusible links and ignition switch.
- BAD → Repair or replace.

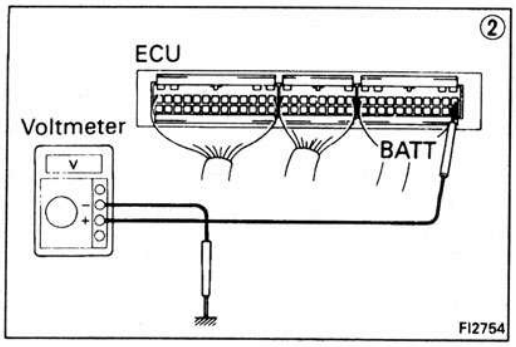
OK → Check EFI main relay.
- BAD → Replace.

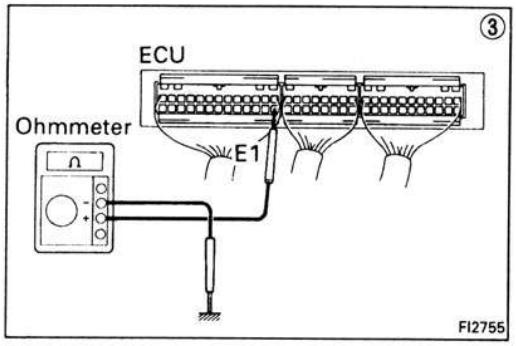
OK → Check wiring between EFI main relay and battery.
- BAD → Repair or replace.

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









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.

NO → Check fuse and fusible link.

BAD → Replace.

OK ↓

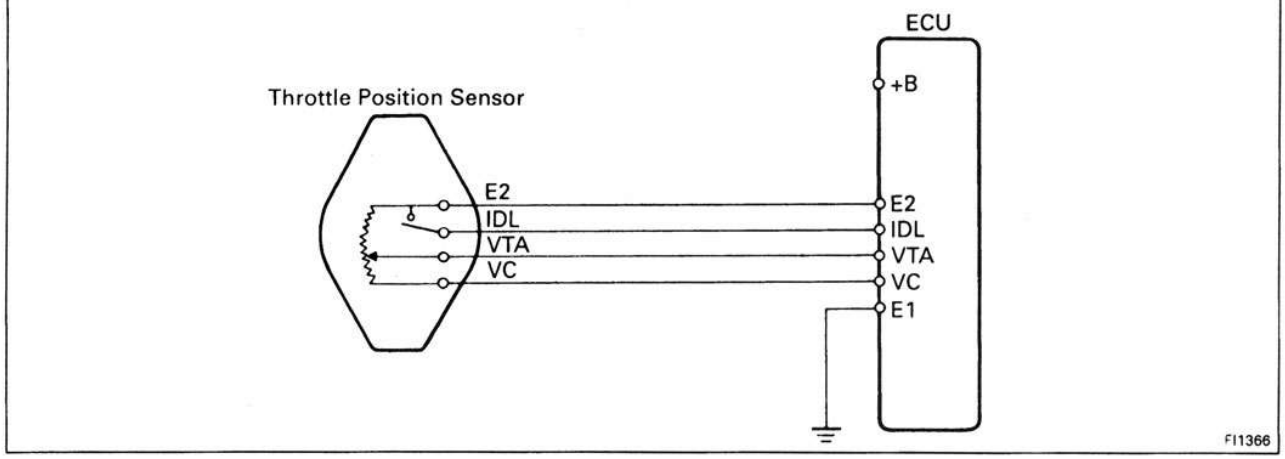
Check wiring between ECU terminal and battery.

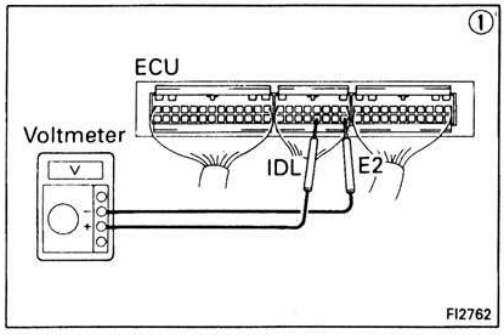
BAD → Repair or replace.

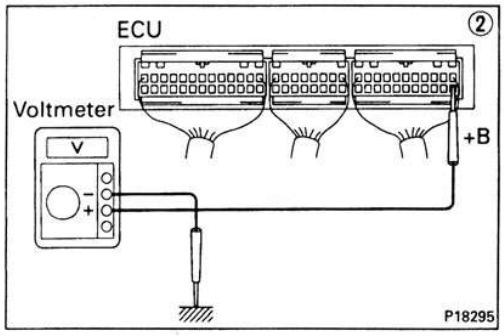
V05462

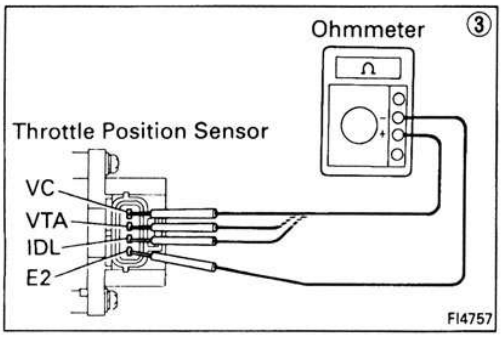
EG

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)**

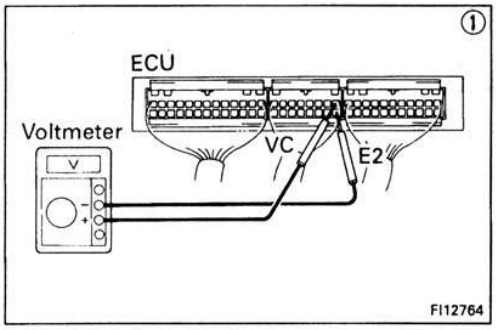
② Check that there is voltage between ECU terminal +B and body ground. **(IG SW ON)**

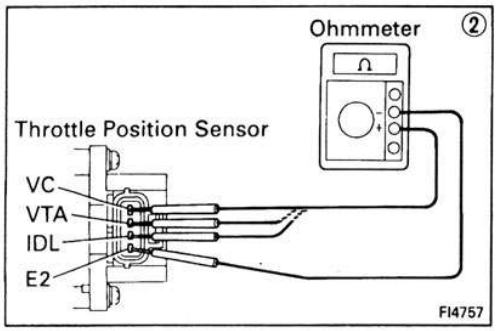
NO → Check wiring between ECU terminal E1 and body ground.
- OK → Try another ECU.
- BAD → Repair or replace.

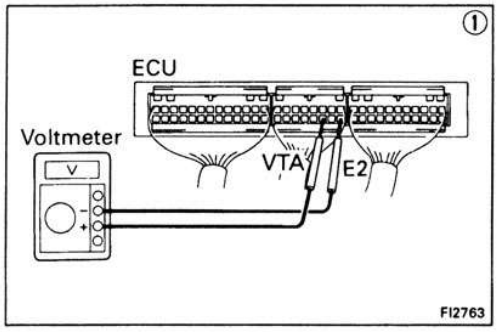
OK → Refer to +B – E1 troubleshooting section (No.1). (See page EG-124)
- BAD → Repair or replace.

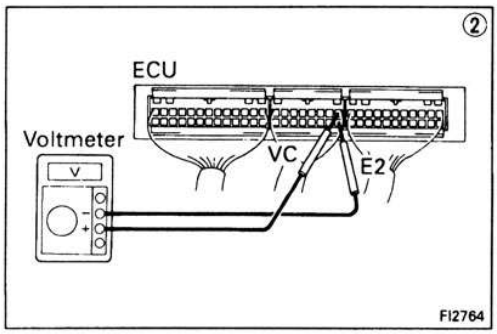
③ Check throttle position sensor. (See page EG-161)
- BAD → Repair or replace throttle position sensor.
- OK → Check wiring between ECU and throttle position sensor.
  - BAD → Repair or replace.
  - OK → Try another ECU.

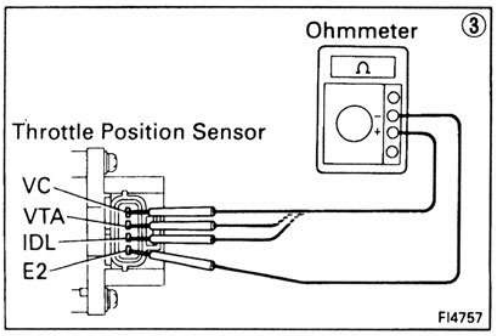
V05463











- **VC – E2**

① No voltage between ECU terminals VC and E2. **(IG SW ON)**

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

OK → ② Check throttle position sensor. (See page EG-161)

BAD → Repair or replace.

OK → Try another ECU.

NO → Refer to +B – E1 trouble **troubleshooting** section (No.1) (See page EG-124)

OK → Check wiring between ECU and throttle position sensor.

OK → Try another ECU.

BAD → Repair or replace.

- **VTA – E2**

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

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

NO → Refer to VC – E2 **troubleshooting** section.

OK → ③ Check throttle position sensor. (See page EG-161)

BAD → Repair or replace.

OK → Check wiring between ECU and throttle position sensor.

BAD → Repair or replace.

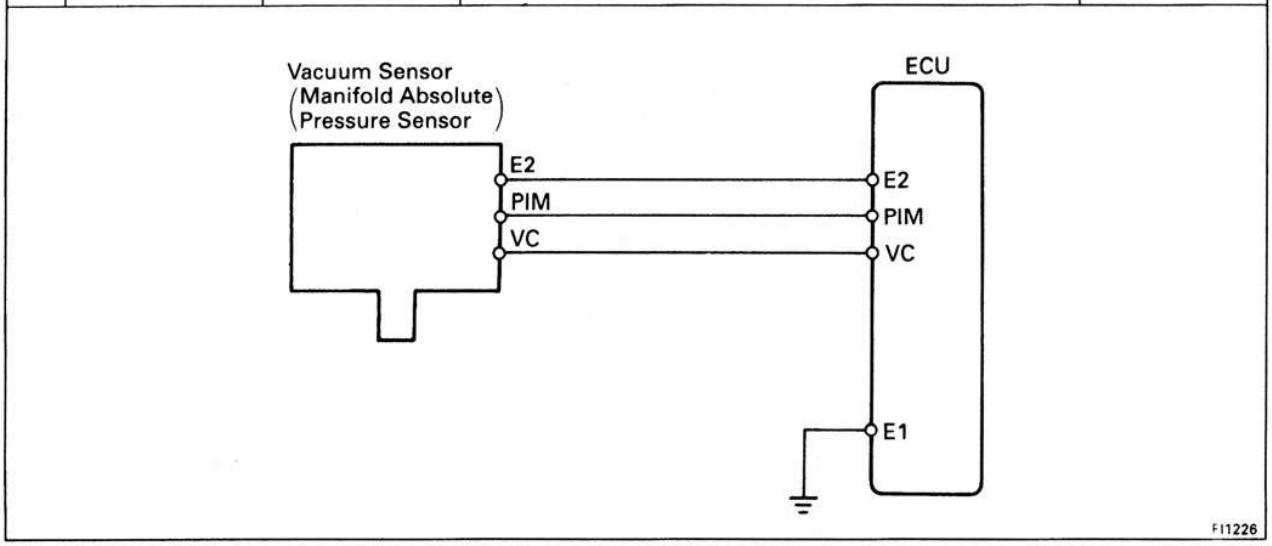
OK → Try another ECU.

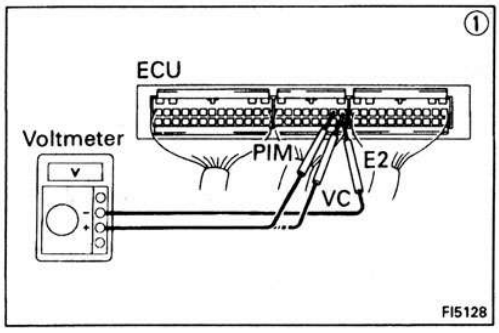
EG

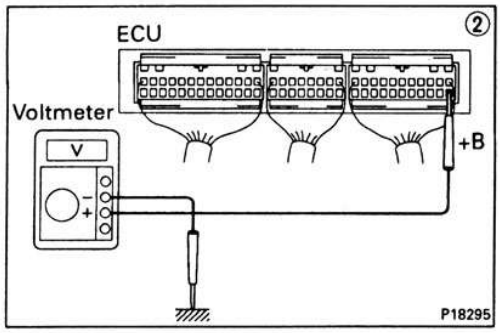
V05464

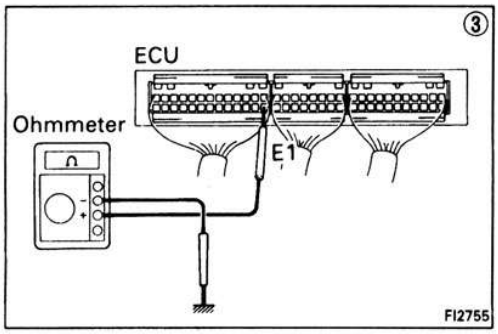
EG

No.	Terminals	Trouble	Condition	STD voltage
4	PIM – E2	No voltage	IG SW ON	2.2 – 2.8 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 and body ground. **(IG SW ON)**

OK → ↓

NO → Refer to +B – E1 troubleshooting section (No.1). (See page EG-124)

↓

③ Check wiring between ECU terminal E1 and body ground.

OK → ↓

BAD → Repair or replace.

Check vacuum sensor.

BAD → Replace vacuum sensor.

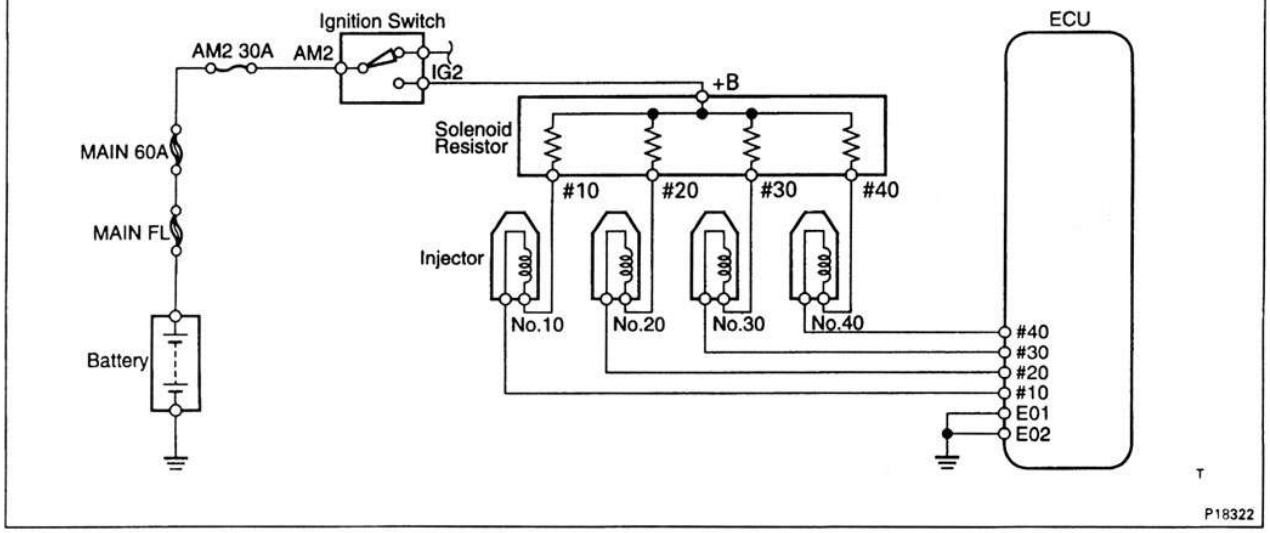
OK → Check wiring between ECU and vacuum sensor.

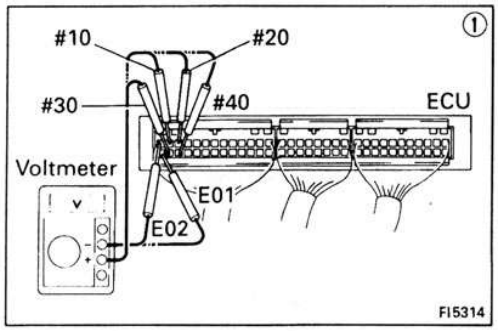
OK → Try another ECU.

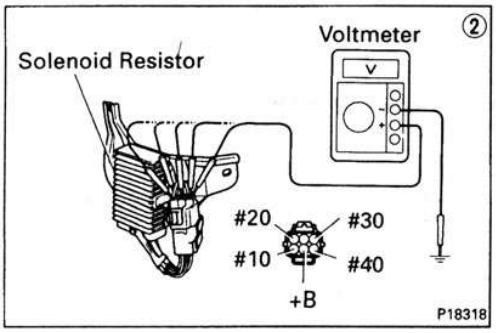
BAD → Repair or replace.

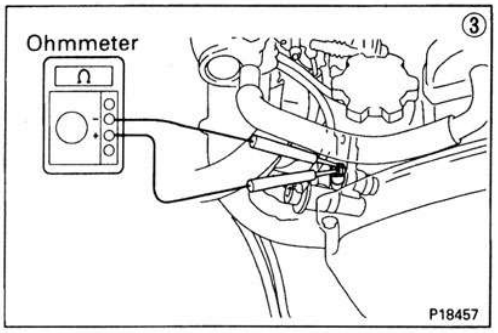
V05465

No.	Terminals	Trouble	Condition	STD voltage
5	#10, #30 – E01 #20, #40 – E02	No voltage	IG SW ON	9 – 14 V









① There is no voltage between ECU terminals #10, #20, #30 and/or #40 and E01 and/or E02. **(IG SW ON)**

↓

② Check that there is specified voltage between solenoid resistor terminal +B and body ground. **STD voltage: 9 – 14 V**

OK ↓ / NO → Check fusible links, wiring and ignition switch. → BAD → Repair or replace.

↓ OK

② Check that there is specified voltage between resistor terminals (#10, #20, #30 or #40) and body ground. **STD voltage: 9 – 14 V**

OK ↓ / NO → Replace resistor.

↓ OK

Check wiring between ECU and solenoid resistor. → BAD → Repair or replace.

↓ OK

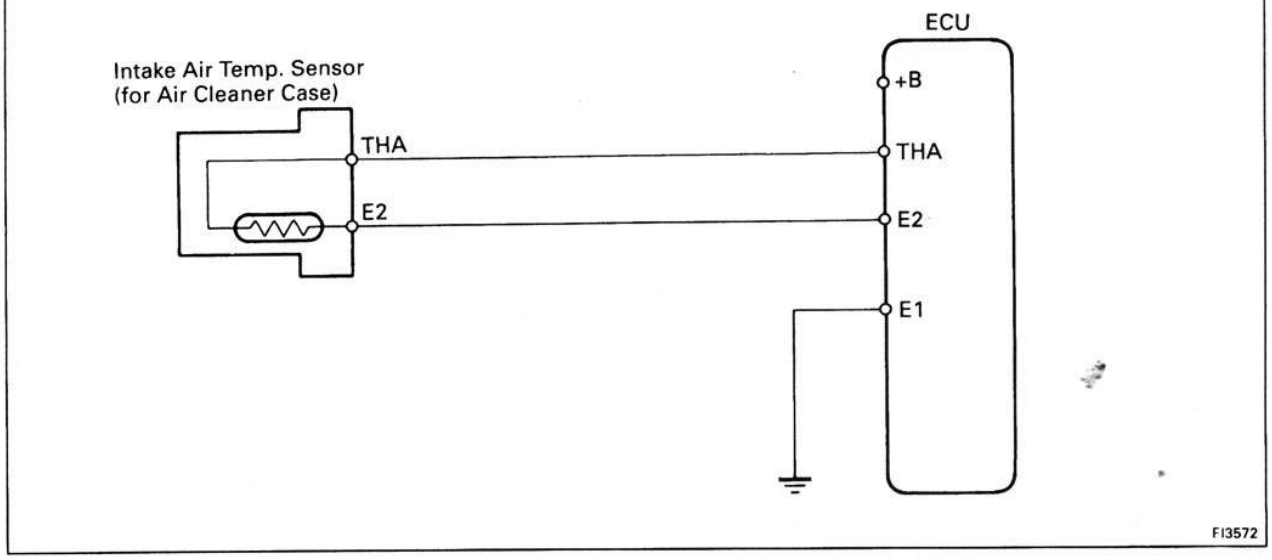
③ Check resistance of each injector. **STD resistance: 2 – 4 Ω** → BAD → Repair injector.

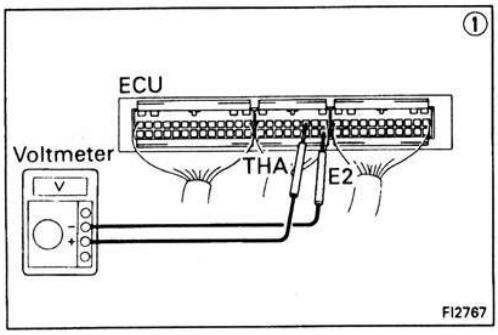
↓ OK

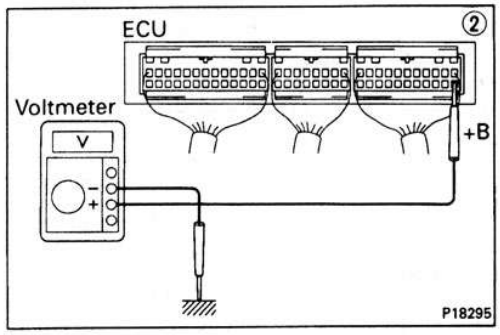
Try another ECU.

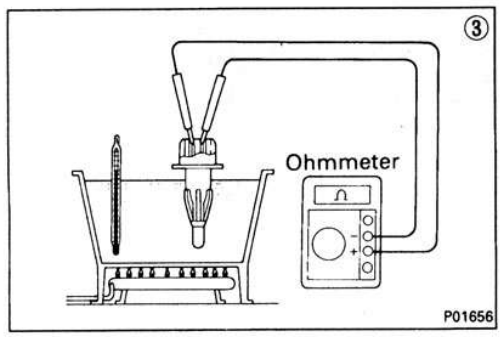
EG

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









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

↓

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

OK ↓ / NO → Refer to +B – E1 troubleshooting section (No.1). (See page EG-124)

↓

Check wiring between ECU terminal E1 and body ground.

OK ↓ / BAD → Repair or replace.

↓

③ Check intake air temp. sensor.

BAD → Repair intake air temp. sensor.

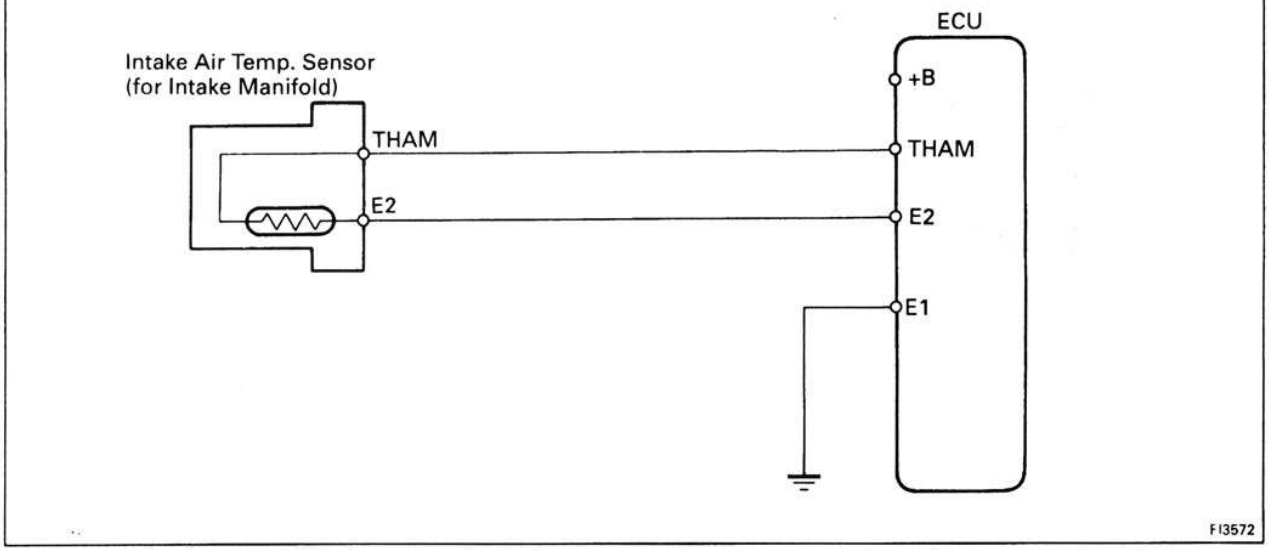
OK → Check wiring between ECU and intake air temp. sensor.

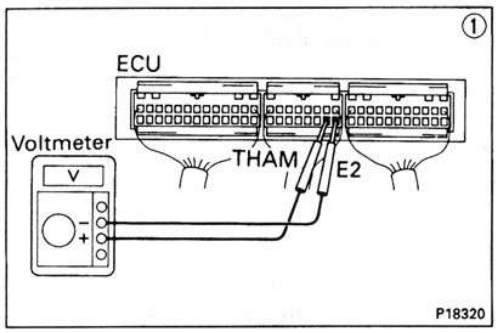
OK ↓ / BAD → Repair or replace.

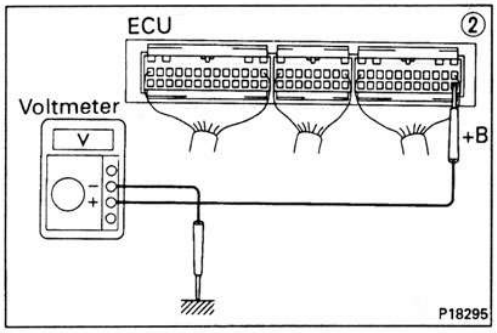
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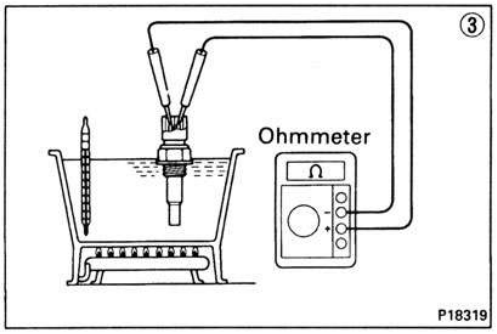
Try another ECU.

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









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

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

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

NO → Refer to +B – E1 troubleshooting section (No.1). (See page EG-124)

Check wiring between ECU terminal E1 and body ground.

OK → ③ Check intake air temp. sensor. (See page EG-168)

BAD → Repair or replace.

③ Check intake air temp. sensor. (See page EG-168)

BAD → Repair intake air temp. sensor.

OK → Check wiring between ECU and intake air temp. sensor.

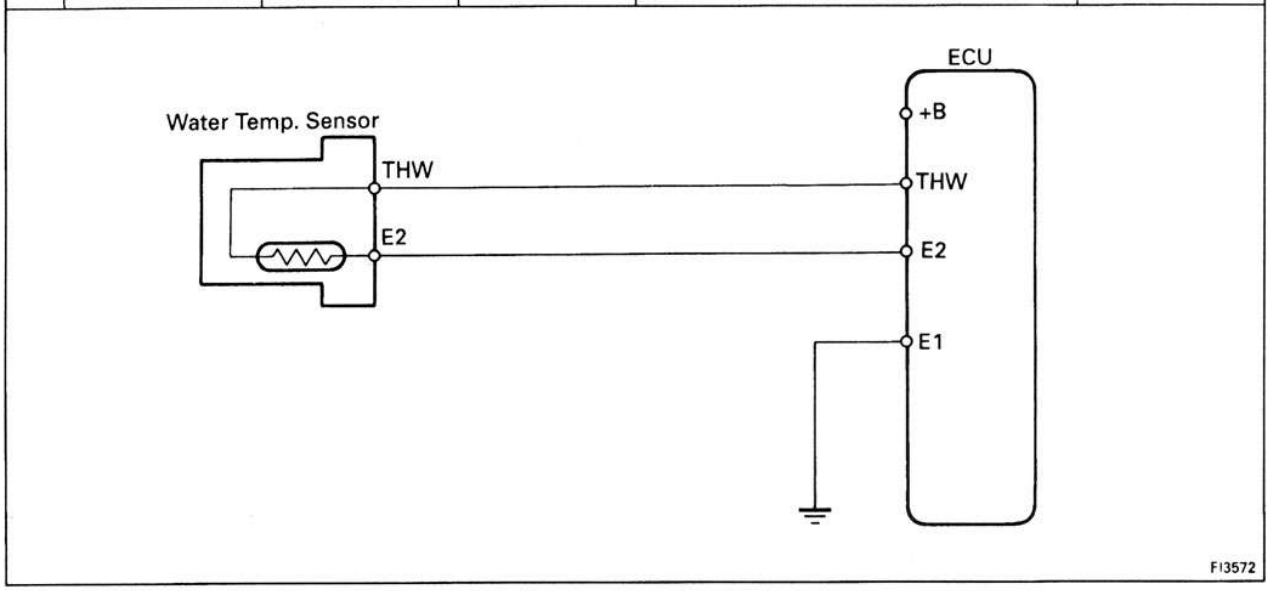
OK → Try another ECU.

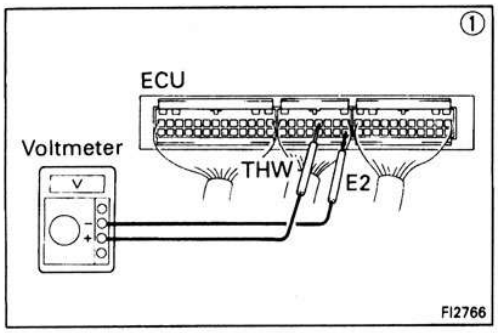
BAD → Repair or replace.

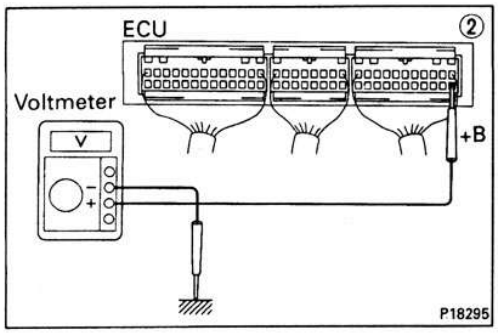
V05468

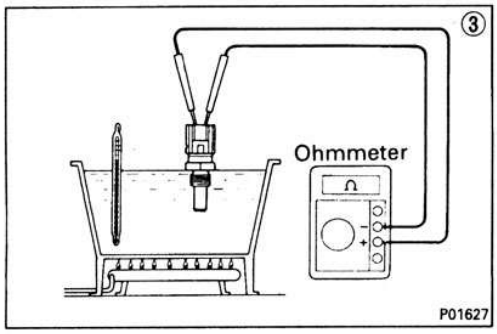
EG

No.	Terminals	Trouble	Condition		STD voltage
8	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 and body ground. **(IG SW ON)**

OK

NO → Refer to +B – E1 troubleshooting section (No.1). (See page EG-124)

Check wiring between ECU terminal E1 and body ground.

OK

BAD → Repair or replace.

③ Check water temp. sensor.

BAD → Replace water temp. sensor.

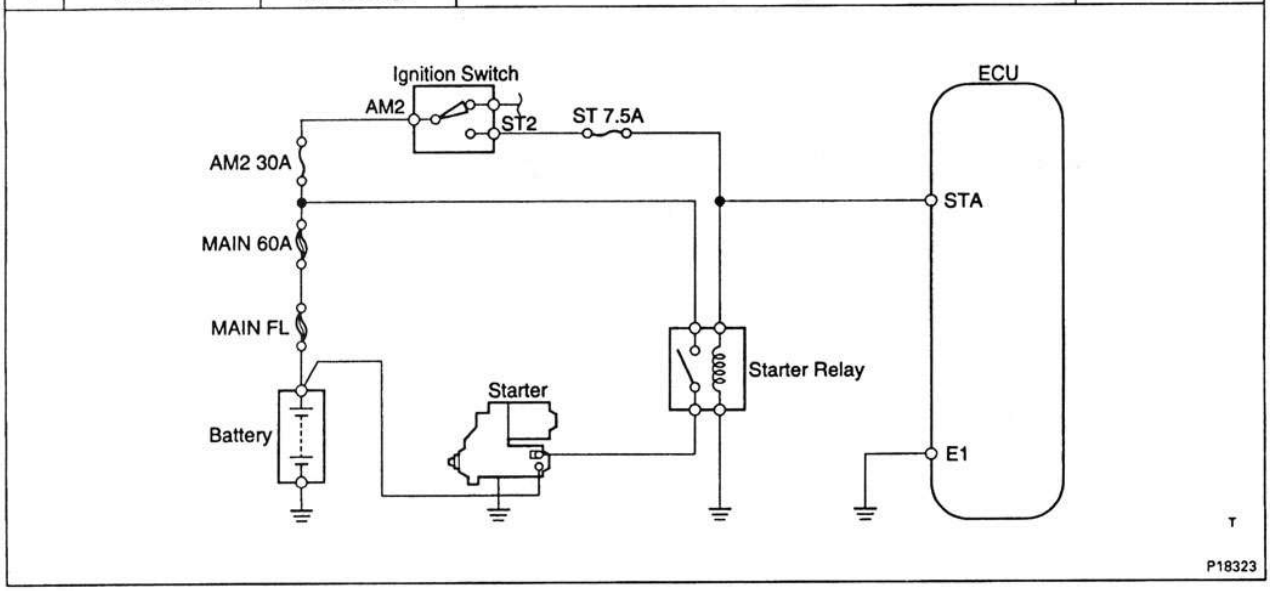
OK → Check wiring between ECU and water temp. sensor.

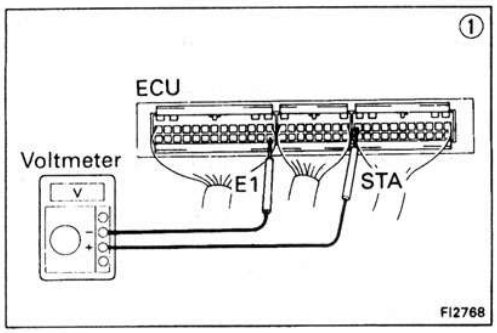
OK → Try another ECU.

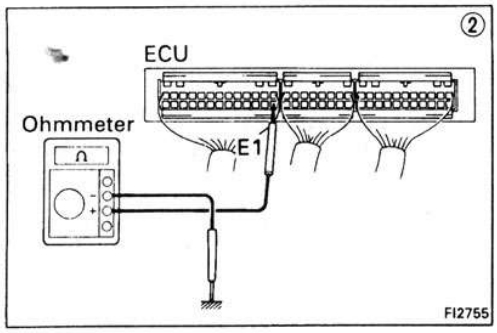
BAD → Repair or replace.

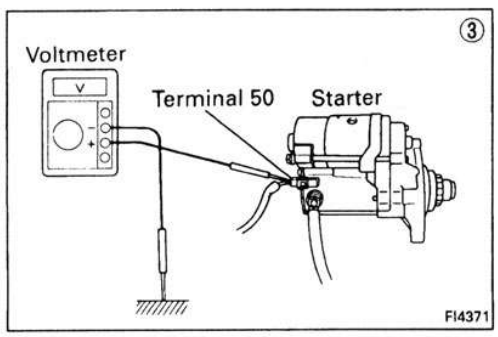
V05469

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







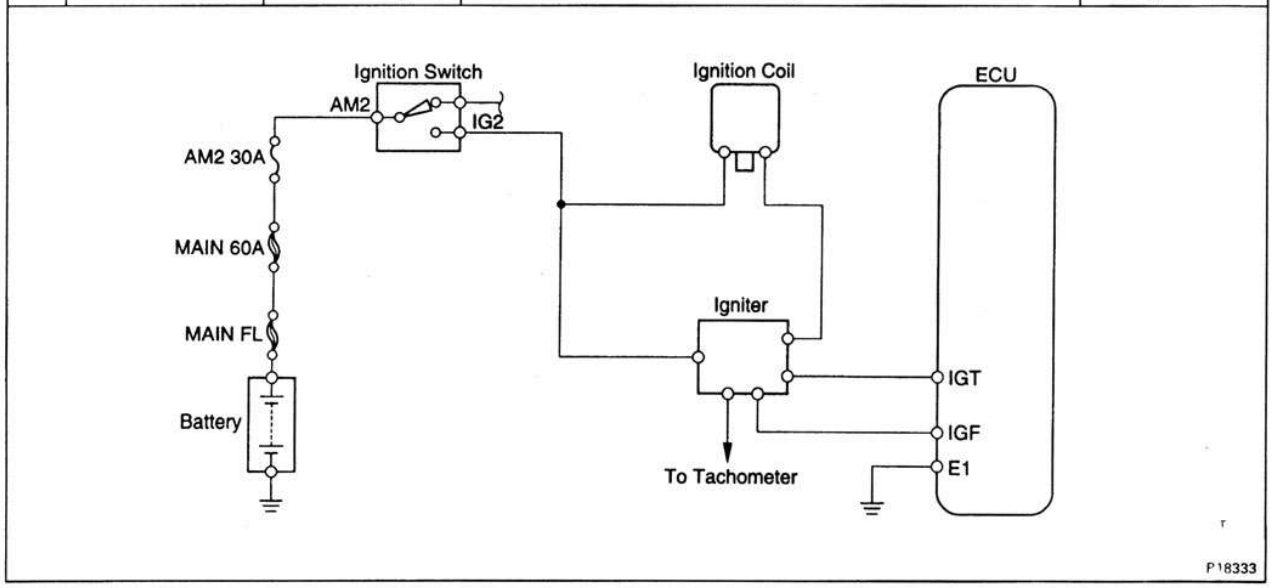


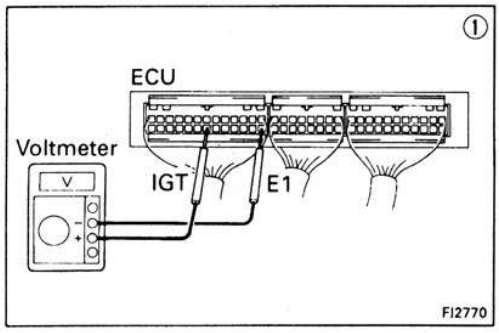
① There is no voltage between ECU terminals STA and E1. **(IG SW START)**

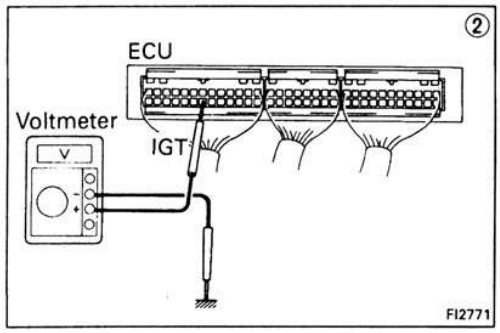
Check starter operation.
- OK → Check wiring between ECU terminal STA and ignition switch terminal ST2.
  - OK → ② Check wiring between ECU terminal E1 and body ground.
    - OK → Try another ECU.
    - BAD → Repair or replace.
  - BAD → Repair or replace.
- BAD → Check fusible links, battery, and ignition switch.
  - BAD → Repair or replace.
  - OK → ③ Check that there is voltage at terminal 50 of starter. **(IG SW START) STD voltage: 6 V or more**
    - OK → Check starter.
    - NO → Check wiring between 1). ST2 and starter relay, and 2). battery and starter terminal 50.

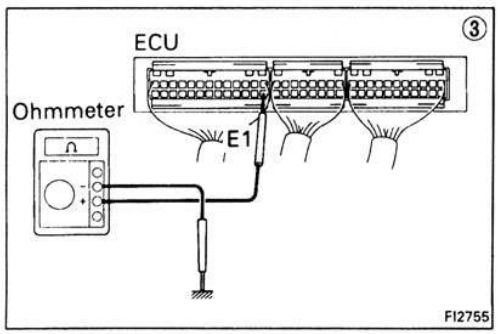
EG

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









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

↓

② Check that there is voltage between ECU terminal IGT and body ground. **(Idling)**

NO → ↓ OK

③ Check wiring between ECU terminal E1 and body ground. → BAD → Repair or replace.

↓ OK

Try another ECU.

↓

Check fusible links and ignition switch. → BAD → Repair or replace.

↓ OK

Check distributor. → BAD → Repair or replace.

↓ OK

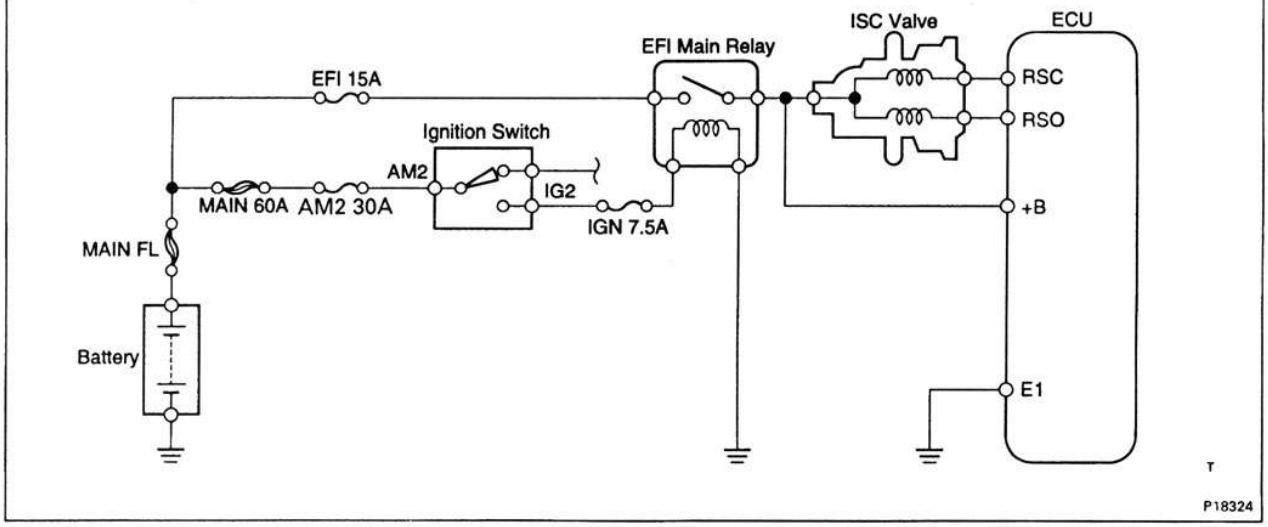
Check wiring between ECU and battery. → BAD → Repair or replace.

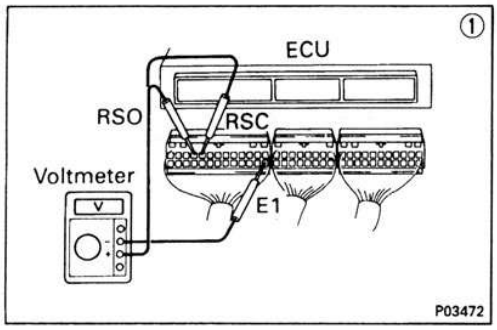
↓ OK

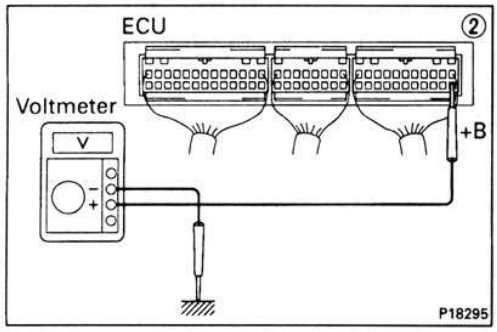
Check igniter. → BAD → Repair or replace.

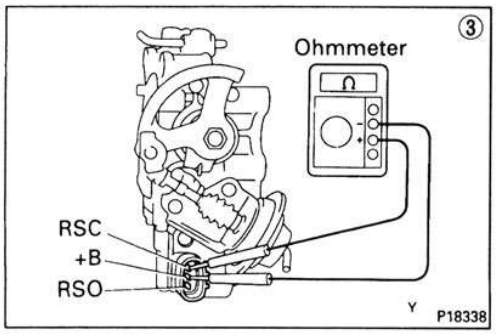
V05471

No.	Terminals	Trouble	Condition		STD voltage
11	RSC RSO – E1	No voltage	IG SW ON	ECU connectors disconnected	9 – 14 V









① There is no voltage between ECU terminals RSC or RSO and E1. **(IG SW ON)**

↓

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

OK ↓ / NO → Refer to +B – E1 troubleshooting section (No.1). (See page EG-124)

↓

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

BAD → Replace ISC valve.

OK ↓

Check wiring between ECU and ISC valve. BAD → Repair or replace.

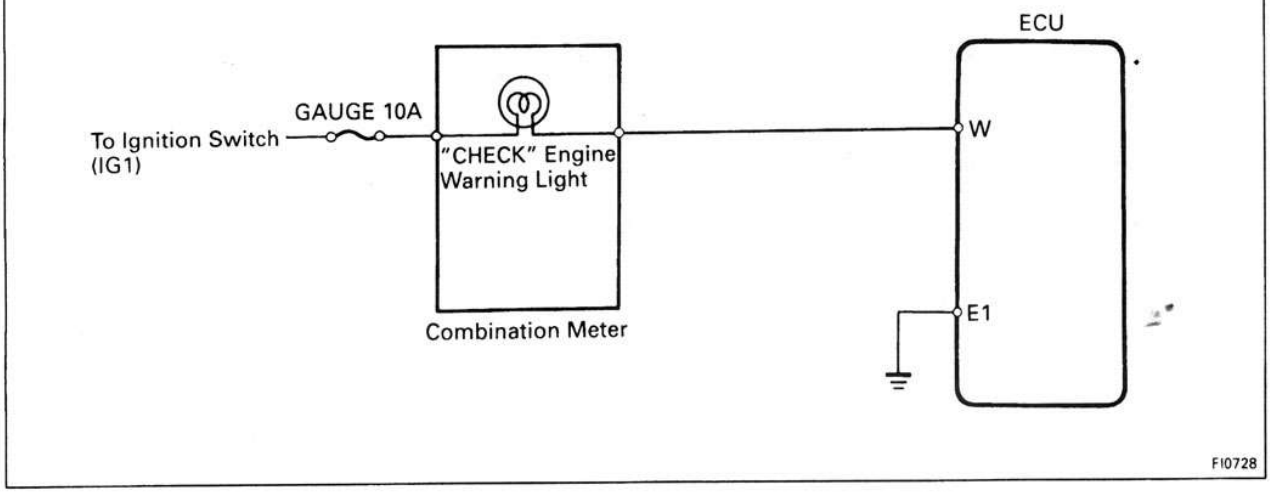
OK ↓

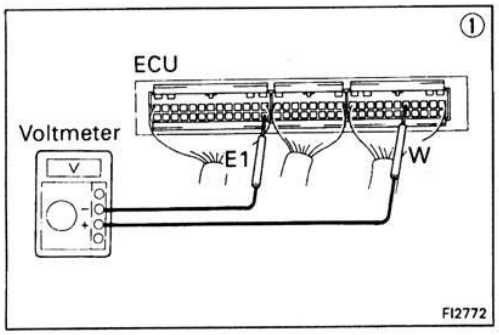
Try another ECU.

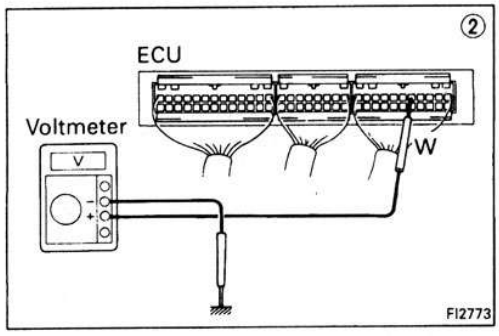
V05472

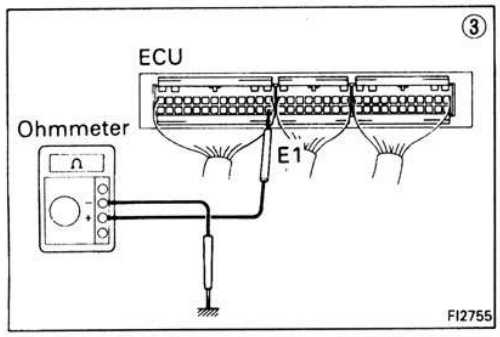
EG

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









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

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

NO → ③ Check wiring between ECU terminal E1 and body ground.

③ OK → Try another ECU.

③ BAD → Repair or replace.

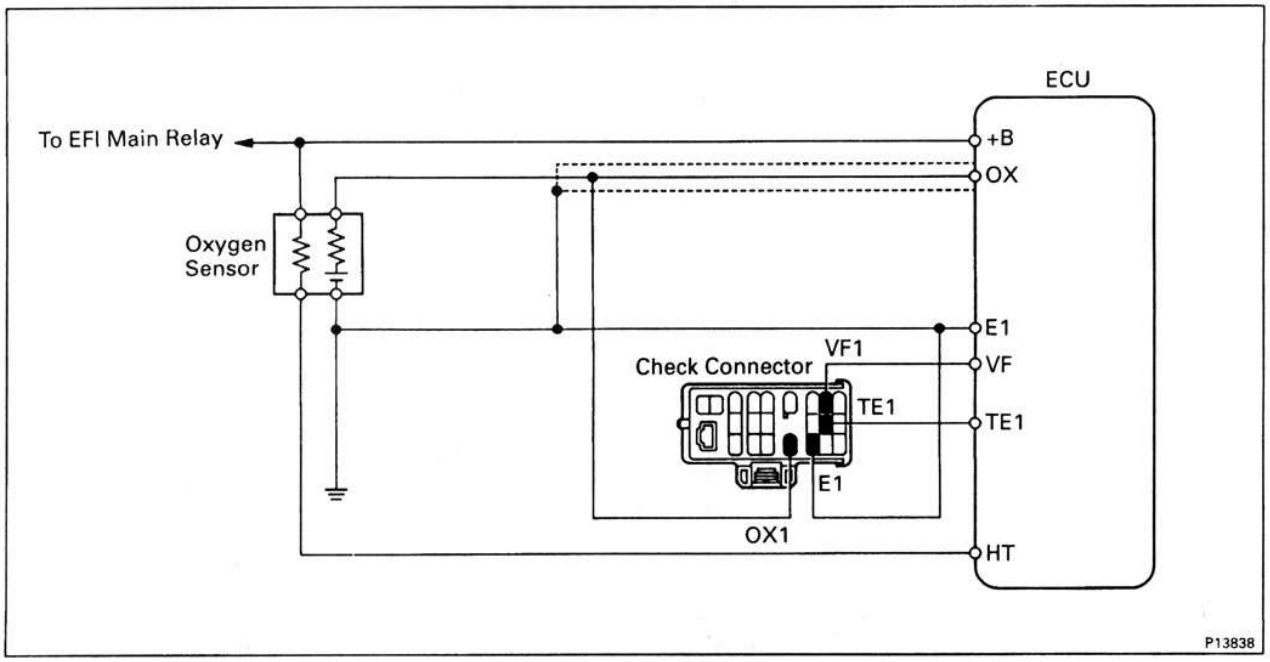
② OK → Check GAUGE fuse (10 A) and "CHECK" engine warning light.

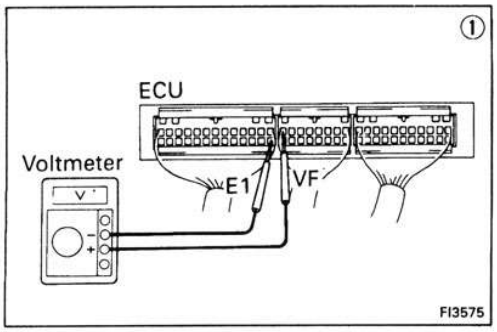
Check GAUGE fuse OK → Check wiring between ECU terminal W and fuse.

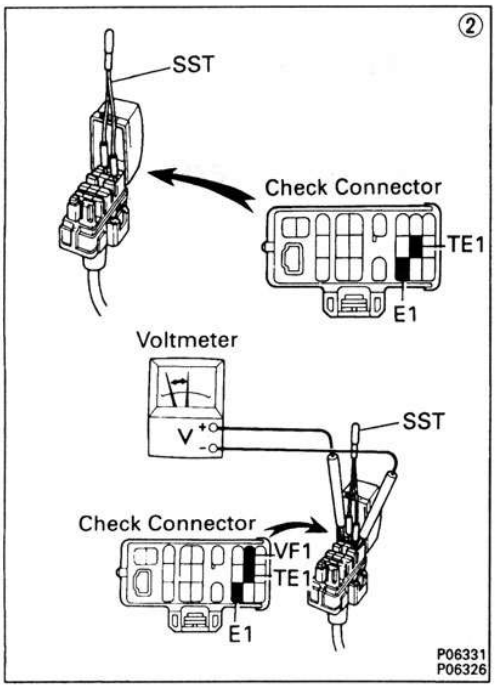
Check GAUGE fuse BAD → Repair or replace. → Fuse blows again → Check wiring between ECU terminal W and fuse.

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

V05473







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

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

NO → OK: Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU. BAD → Repair or replace.

BAD → Repair or replace.

Is air leaking into air induction system? BAD → Repair or replace.

OK

Check spark plugs. BAD → Repair or replace.

OK

Check distributor and ignition system. BAD → Repair or replace.

OK

Check fuel pressure. BAD → Repair or replace.

OK

Check injectors. (See page EG-148) BAD → Repair or replace.

OK

Check vacuum sensor. BAD → Repair or replace.

OK

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

BAD

Check wiring between oxygen sensor and ECU. BAD → Repair wiring.

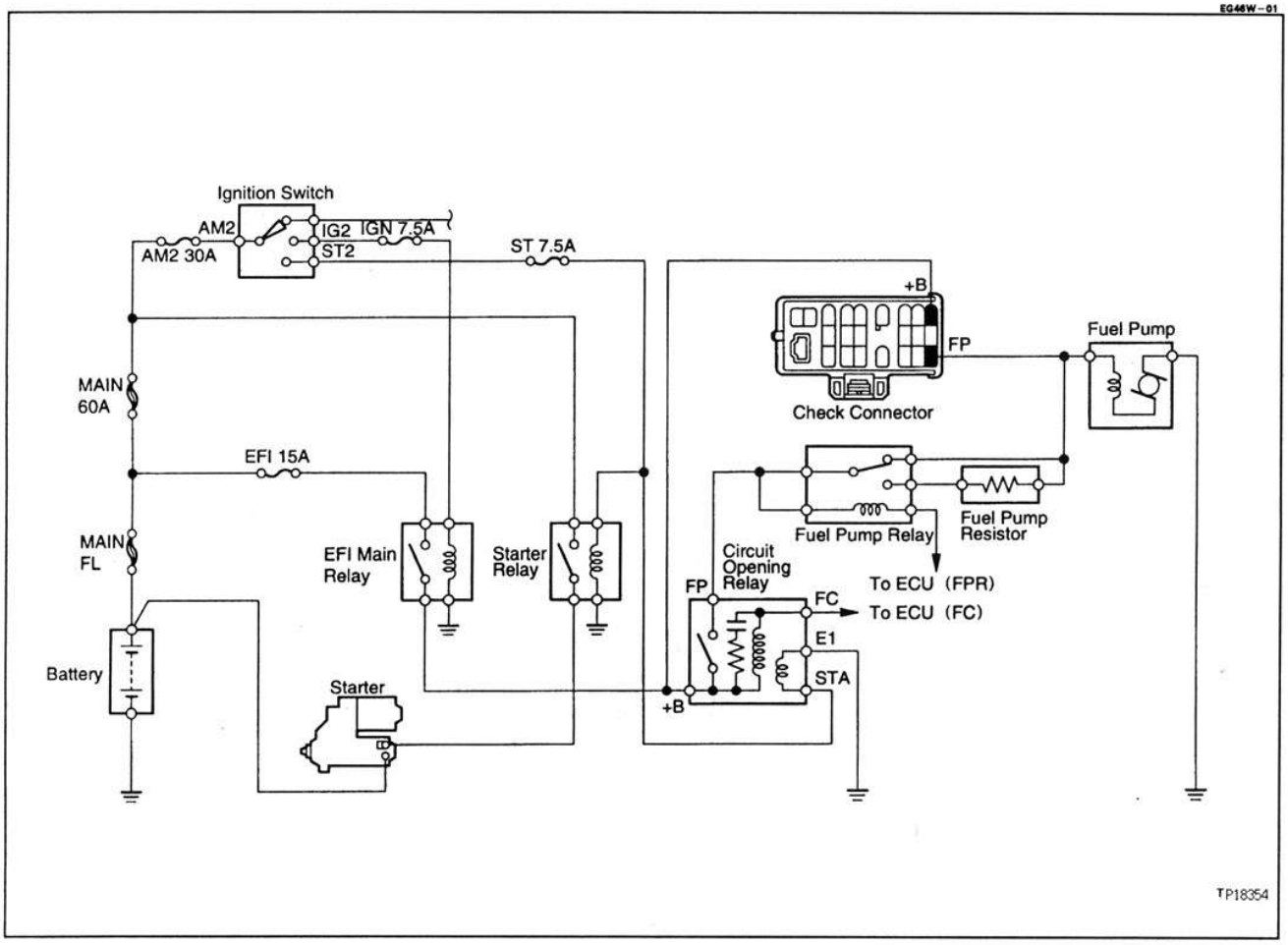
OK

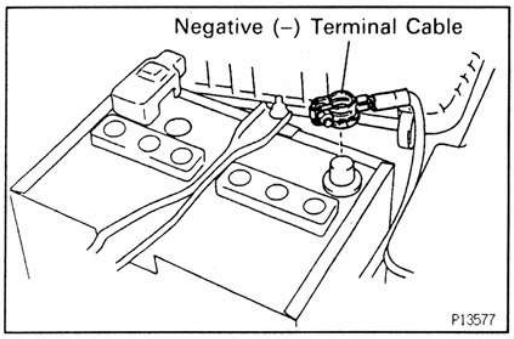
Replace oxygen sensor.

V05474

FUEL PUMP

EG46W-01



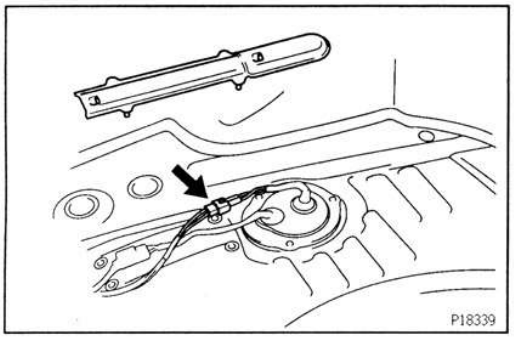


EG46X-01

ON–VEHICLE INSPECTION

FUEL PUMP INSPECTION

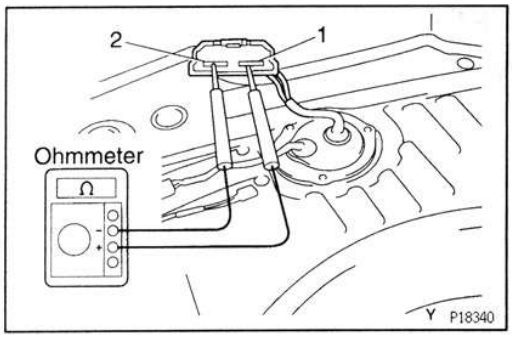
1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY



2. DISCONNECT FUEL PUMP CONNECTOR

(a) Remove the wire protector.

(b) Disconnect the fuel pump protector.



3. INSPECT FUEL PUMP

A. Inspect fuel pump resistance

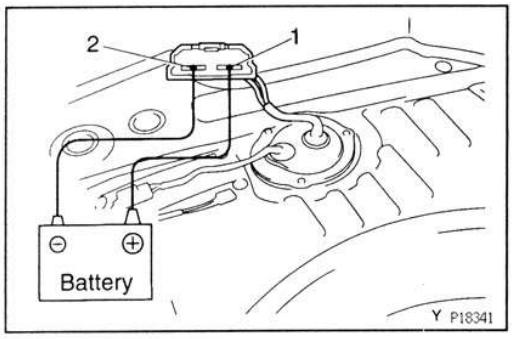
Using an ohmmeter, measure the resistance between the terminals 1 and 2.

Resistance:

0.2 – 3.0 Ω at 20°C (68°F)

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

EG



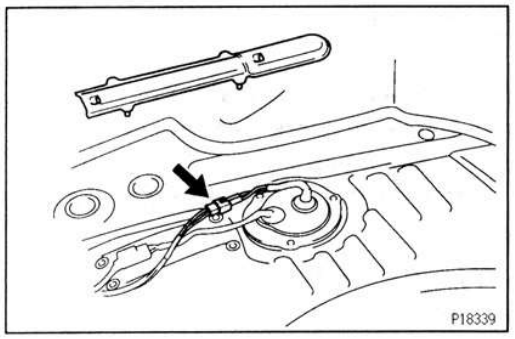
B. Inspect fuel pump operation

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.**



4. RECONNECT FUEL PUMP CONNECTOR

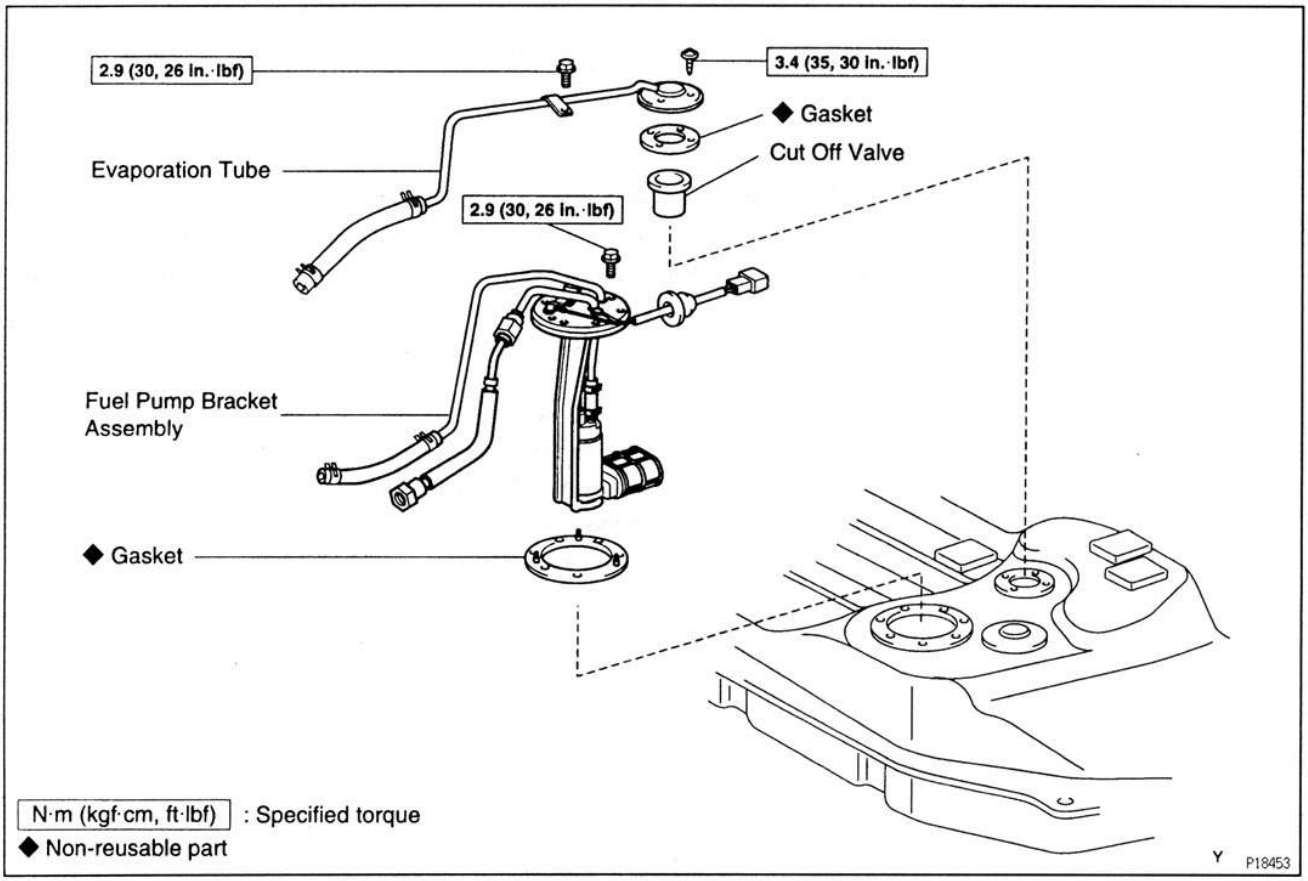
(a) Reconnect the fuel pump protector.

(b) Install the wire protector.

5. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

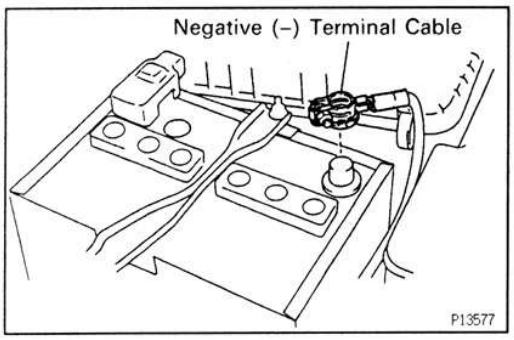
EG46Y-01

COMPONENTS FOR REMOVAL AND INSTALLATION



EG46Z-01

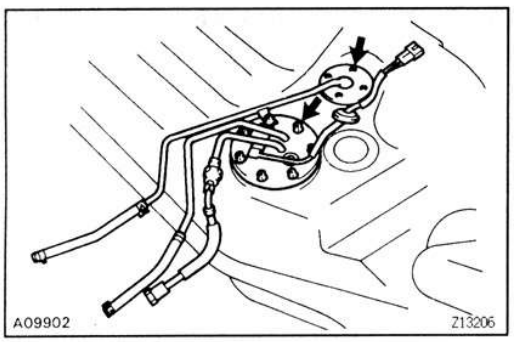
FUEL PUMP REMOVAL



(See Components for Removal and Installation)

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

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



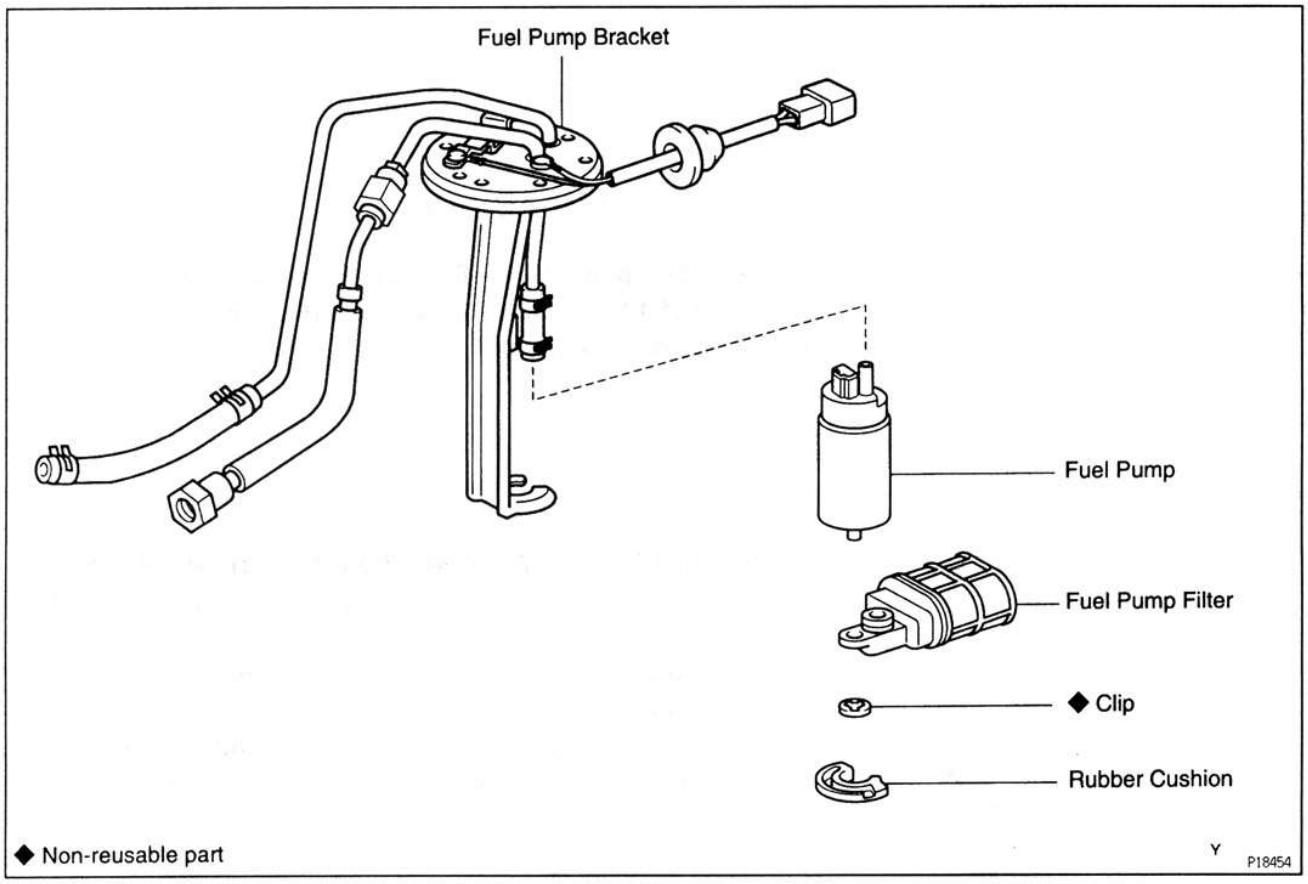
4. **REMOVE FUEL PUMP BRACKET FROM FUEL TANK**

(a) Remove the 4 screws and 7 bolts.

(b) Pull out the evaporation tube, fuel pump bracket and 2 gaskets.

EG470-01

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

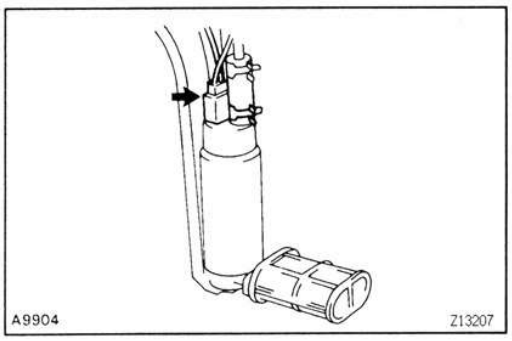


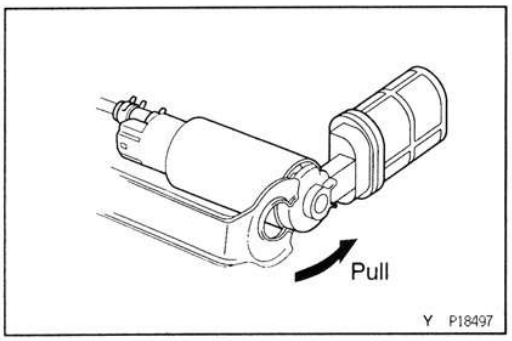
EG471-01

FUEL PUMP DISASSEMBLY

1. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET

(a) Disconnect the lead wire connector from the fuel pump.

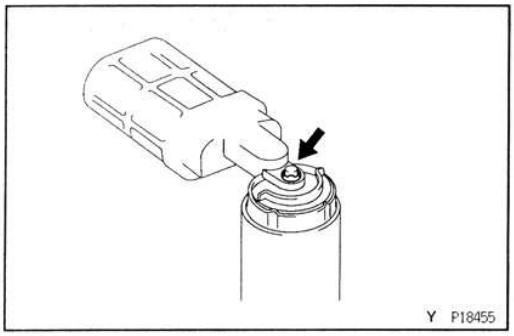




(b) Pull out the lower side of the fuel pump from the bracket.

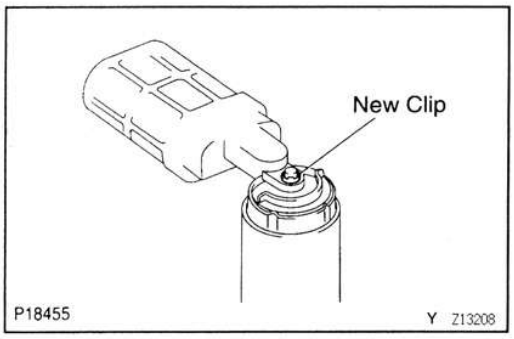
(c) Disconnect the fuel hose from the fuel pump, and remove the fuel pump.

(d) Remove the rubber cushion.



2. REMOVE FUEL PUMP FILTER FROM FUEL PUMP
Remove the clip and pull out the pump filter.

EG

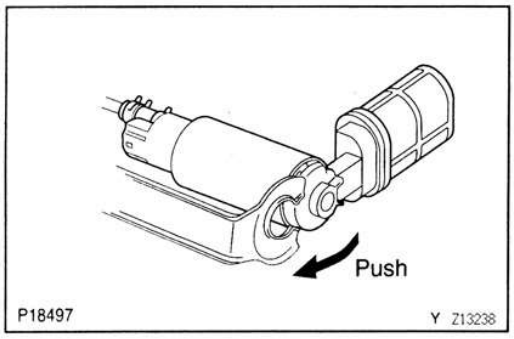


EG472-01

FUEL PUMP ASSEMBLY

(See Components for Disassembly and Assembly)

1. INSTALL FUEL PUMP FILTER TO FUEL PUMP
Install the pump filter with a new clip.

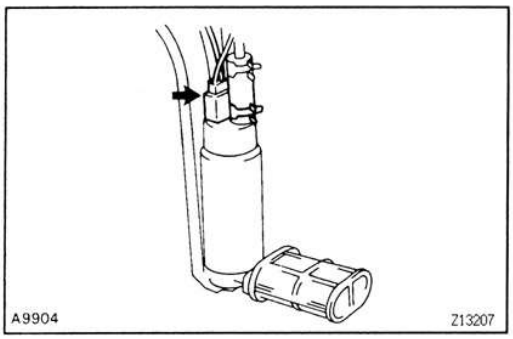


2. INSTALL FUEL PUMP TO FUEL PUMP BRACKET

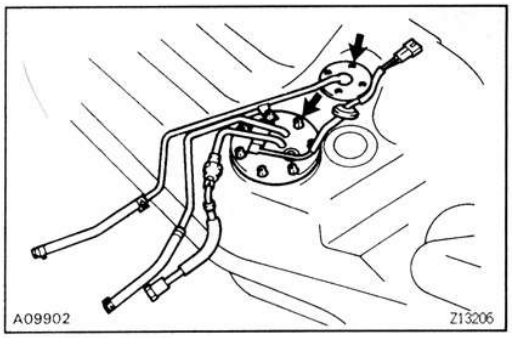
(a) Insert the outlet port of the fuel pump into the fuel hose.

(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.



(d) Connect the lead wire connector to the fuel pump.



EG473-01

FUEL PUMP INSTALLATION

(See Components for Removal and Installation)

1. INSTALL FUEL PUMP BRACKET

(a) Place the fuel pump bracket and evaporation tube with 2 new gaskets on the fuel tank.

(b) Install and torque the 7 bolts and 4 screws.

Torque:

Bracket: 2.9 N·m (30 kgf·cm, 26 in.·lbf)

Bent tube: 3.4 N·m (35 kgf·cm, 30 in.·lbf)

2. INSTALL FUEL TANK

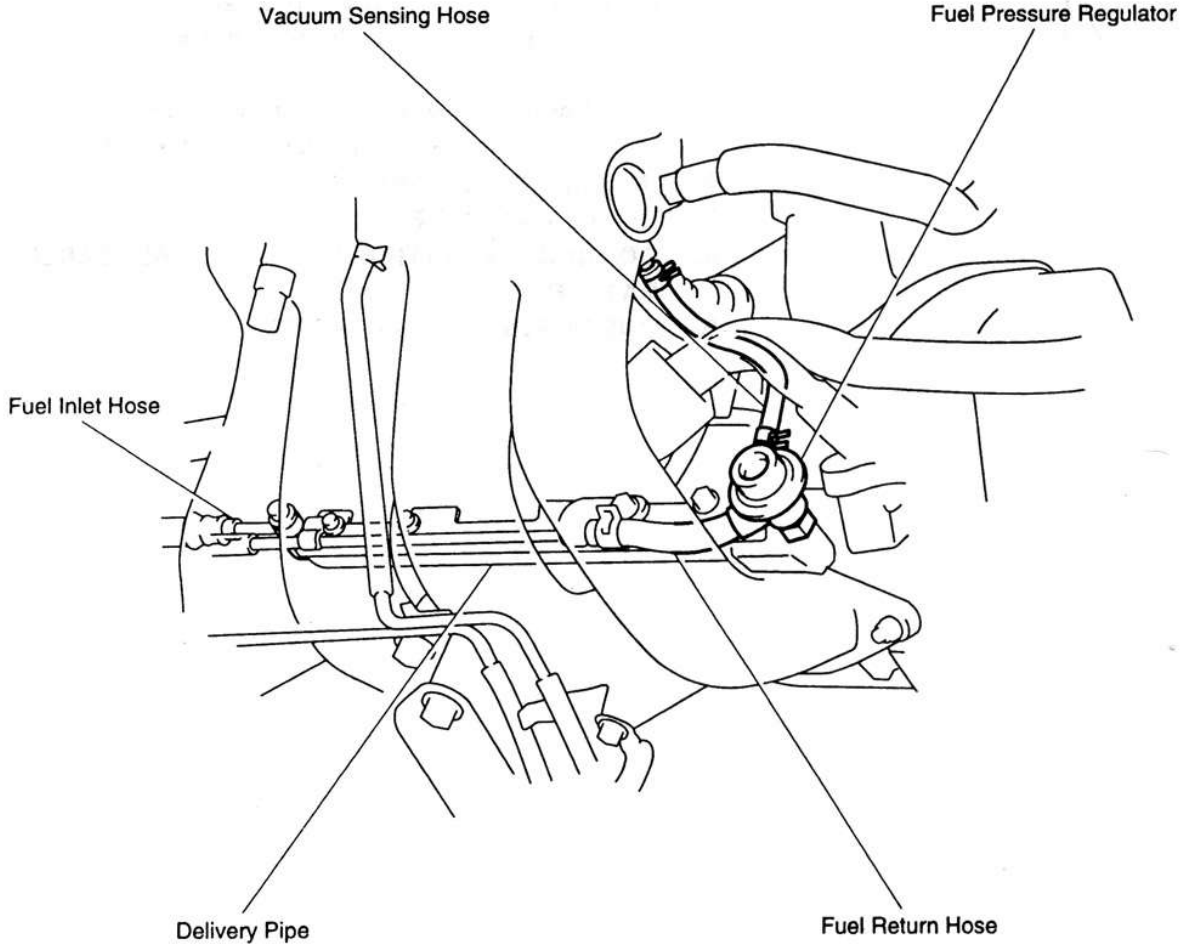
3. REFILL GASOLINE

4. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

5. CHECK FOR FUEL LEAKAGE

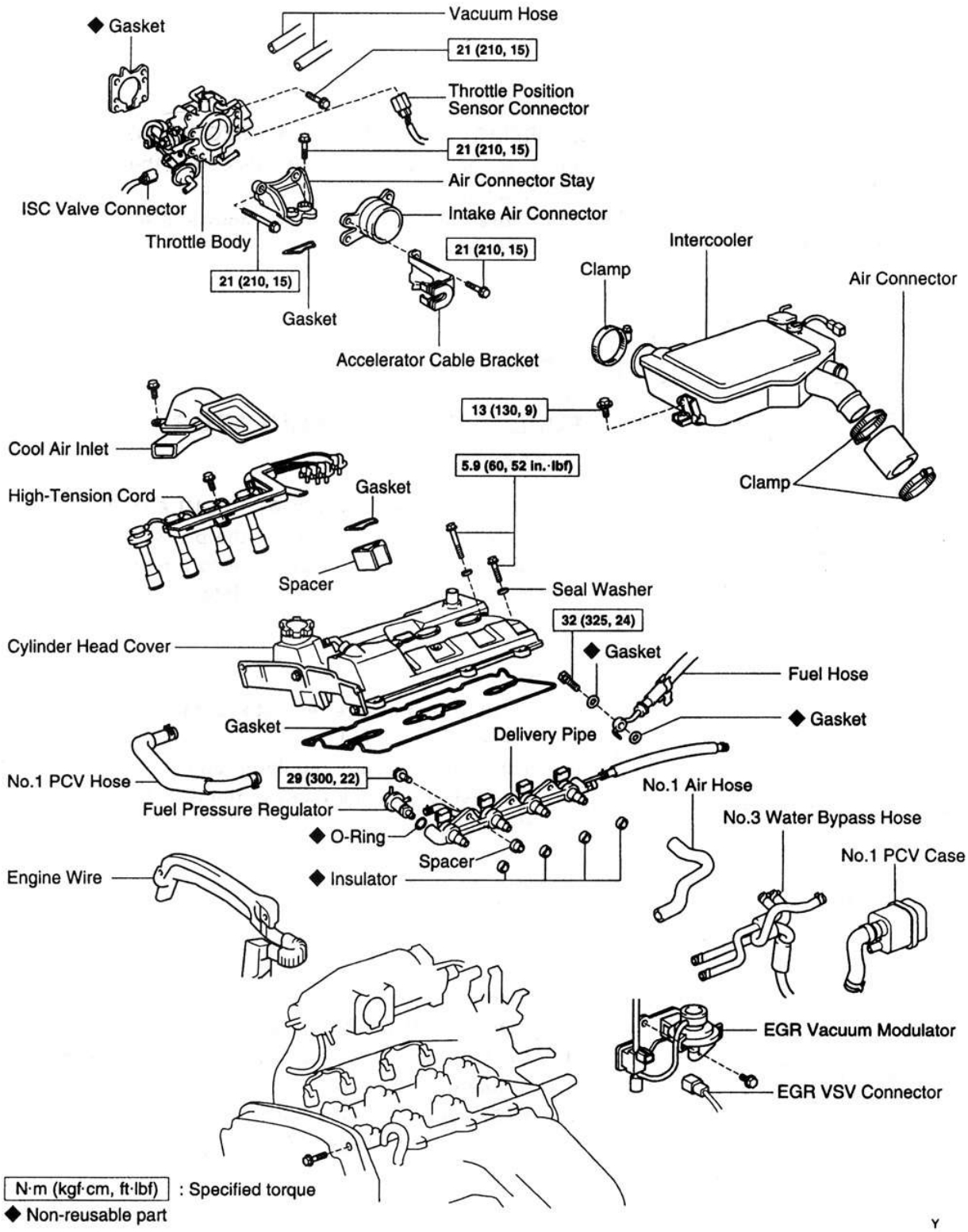
PRESSURE REGULATOR

EG474-01



EG475-01

COMPONENTS FOR REMOVAL AND INSTALLATION



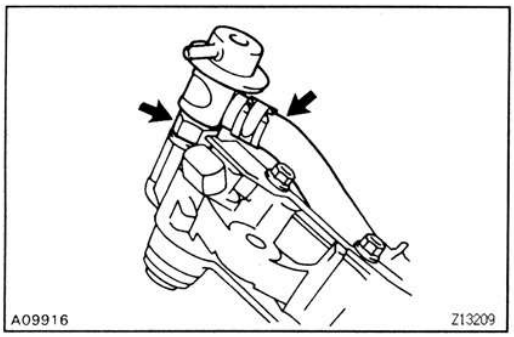
FUEL PRESSURE REGULATOR REMOVAL EG476-01

(See Components for Removal and Installation)

1. REMOVE DELIVERY PIPE

(See steps 1 to 11 pages EG–150 to EG–152)

EG

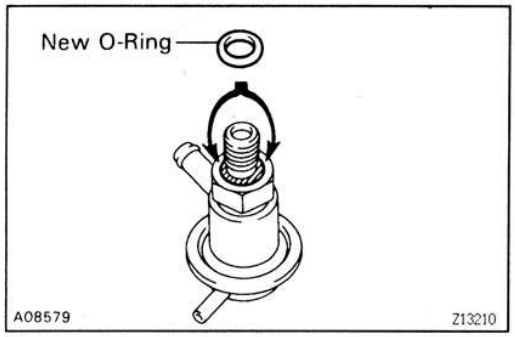


2. REMOVE FUEL PRESSURE REGULATOR

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

(b) Loosen the lock nut, and remove the fuel pressure regulator.

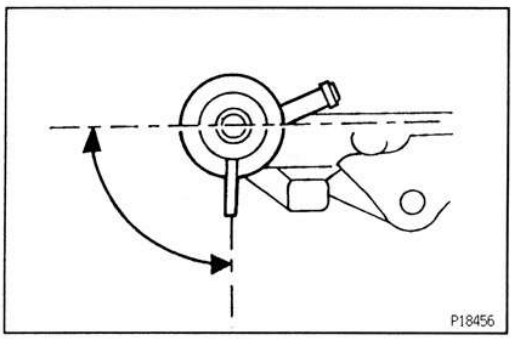
FUEL PRESSURE REGULATOR INSTALLATION EG3W7-02



1. INSTALL FUEL PRESSURE REGULATOR

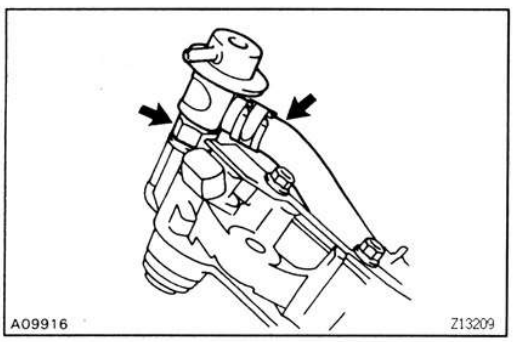
(a) Fully loosen the lock nut of the pressure regulator.

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



(c) Thrust the pressure regulator completely into the delivery pipe by hand.

(d) Turn the pressure regulator counterclockwise until the fuel return pipe faces in the direction indicated in the illustration.



(e) Tighten the lock nut
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

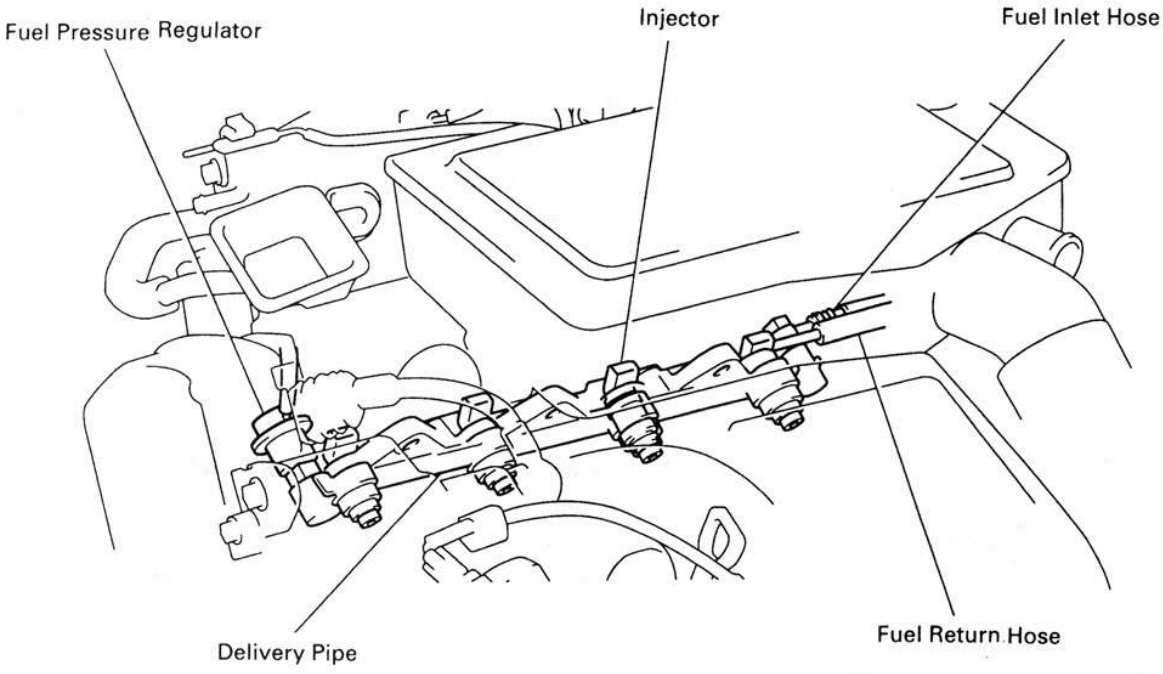
(f) Connect the fuel return hose to the fuel pressure regulator.

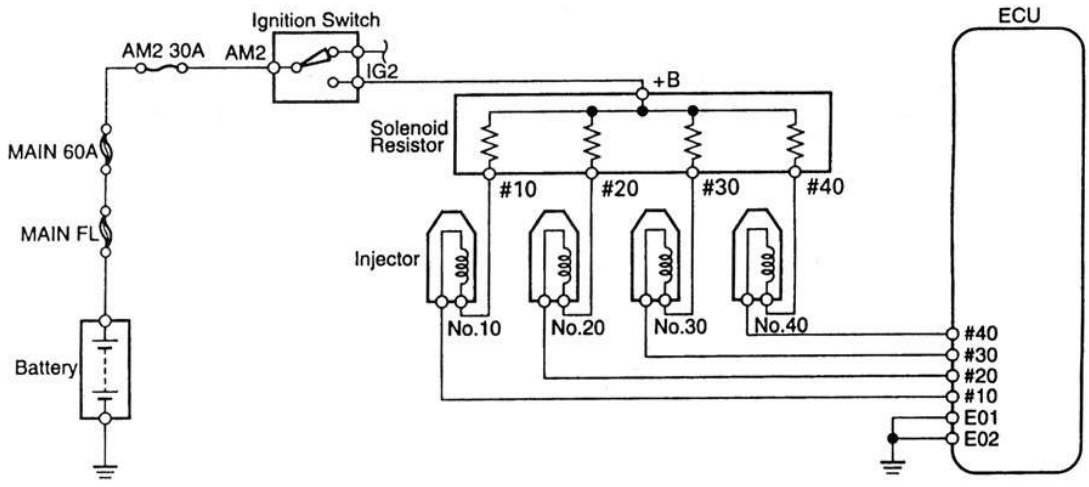
2. INSTALL DELIVERY PIPE

(See steps 1 to 12 pages EG–157 to EG–159)

INJECTOR

EG477–01



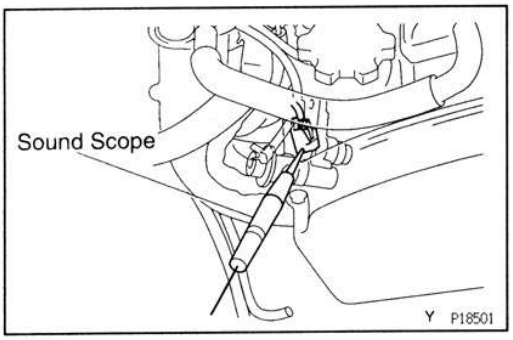


P18382
P18322

Z13203

EG478-01

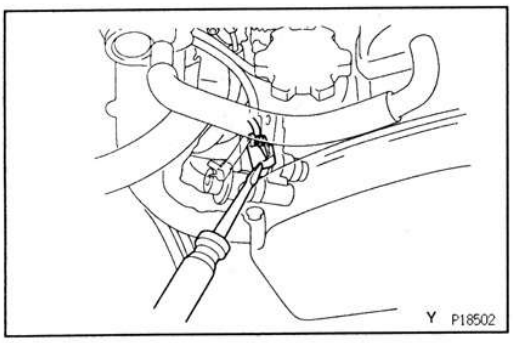
ON–VEHICLE INSPECTION



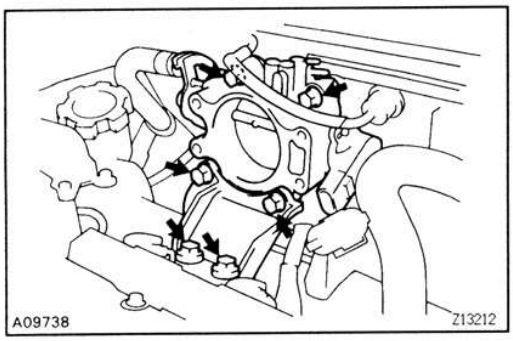
1. INSPECT INJECTOR OPERATION

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.



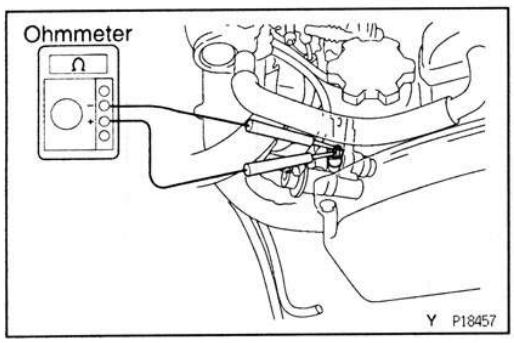
(b) If you have no sound scope, you can check the injector transmission operation with a screwdriver.
If no sound or unusual sound is heard, check the wiring connector, injector or injection signal from the ECU.



2. INSPECT INJECTOR RESISTANCE

(a) Remove the throttle body.
(See page EG–163)

(b) Disconnect the 4 injector connectors.



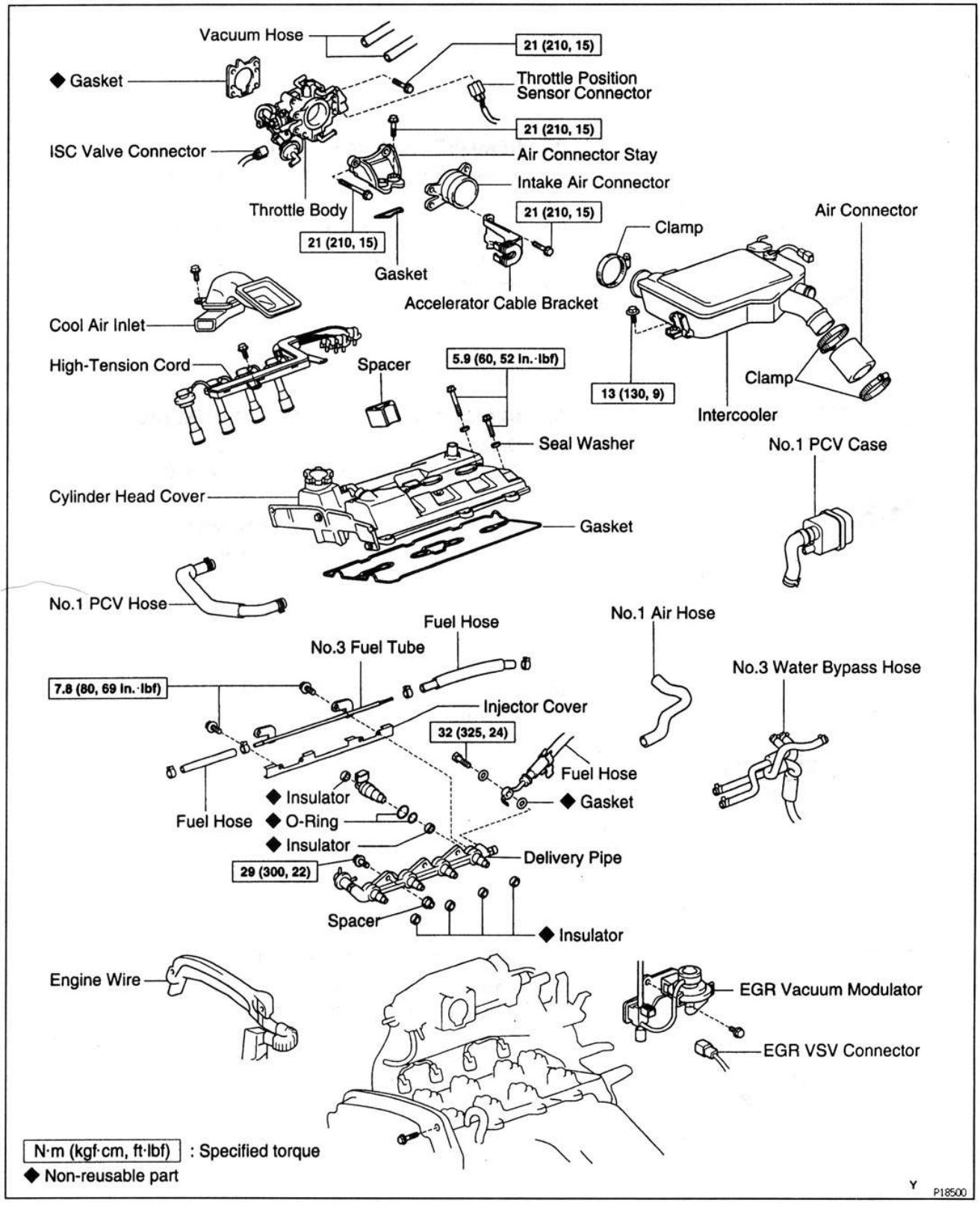
(c) Using an ohmmeter, measure the resistance between the terminals.
Resistance:
Approx. 2 – 4 Ω at 20°C (68°F)
If the resistance is not as specified, replace the injector.

(d) Reconnect the 4 injector connectors.

(e) Reinstall the throttle body.
(See page EG–166)

EG479-01

COMPONENTS FOR REMOVAL AND INSTALLATION

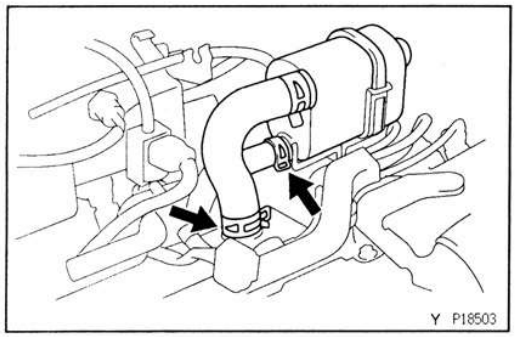


EG47A–01

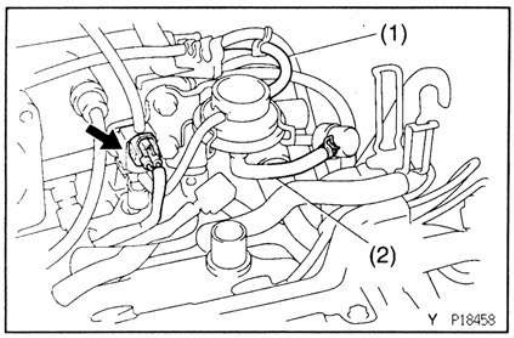
INJECTORS REMOVAL

1. **REMOVE THROTTLE BODY**
(See Page EG–163)

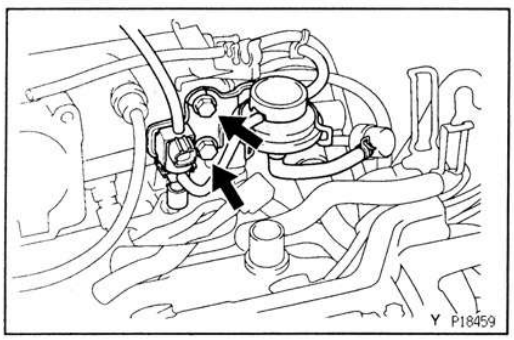
EG



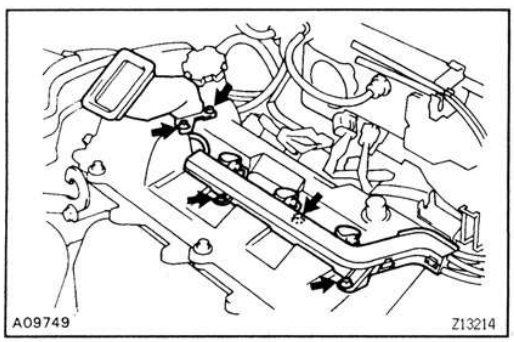
2. **REMOVE NO.1 PCV CASE**
(a) Disconnect the No.2 PCV hose from the cylinder head cover.
(b) Disconnect the No.3 water bypass hose from the No.1 PCV case.
(c) Remove the No.1 PCV case from the bracket.



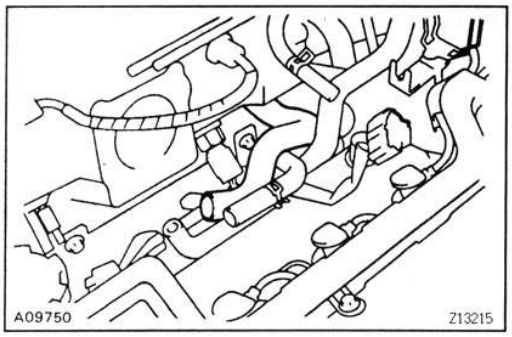
3. **REMOVE VSV AND EGR VACUUM MODULATOR**
(a) Disconnect the VSV connector.
(b) Remove the following hoses from the EGR vacuum modulator:
(1) Vacuum hose (from EGR valve)
(2) EGR hose (from EGR valve)



(c) Remove the 2 bolts, VSV and EGR vacuum modulator assembly.



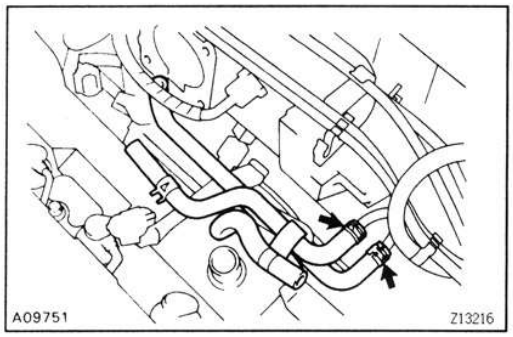
4. **REMOVE COOL AIR INLET**
Remove the 2 bolts and cool air inlet.
5. **REMOVE HIGH–TENSION CORDS**
Remove the 3 bolts, and pull out the high–tension cords from the cylinder head.



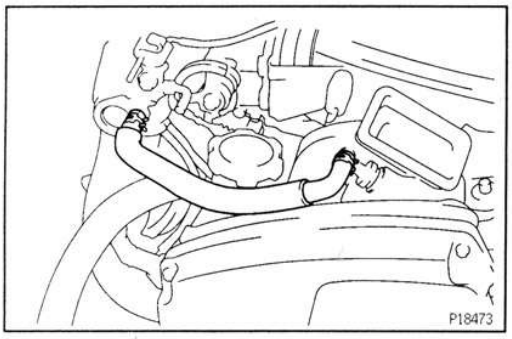
6. REMOVE NO.3 WATER BYPASS HOSE AND NO.1 AIR HOSE

Remove the following hoses:

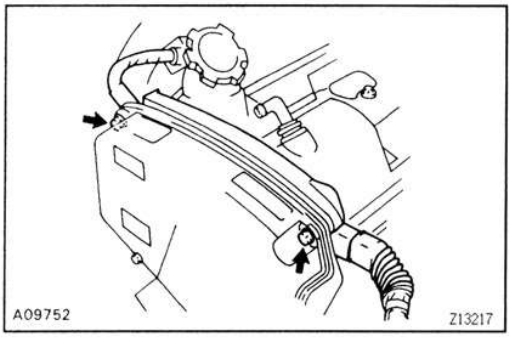
(1) No.1 air hose (from No.1 air tube)



(2) 2 water bypass hoses (from No.1 air tube)



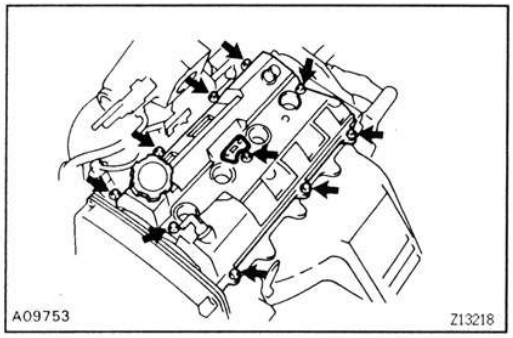
7. REMOVE NO.1 PCV HOSE



8. DISCONNECT ENGINE WIRE

Disconnect the 2 bolts, and disconnect the engine wire from the No.4 timing belt cover.

9. DISCONNECT VACUUM SENSING HOSE FROM PRESSURE REGULATOR

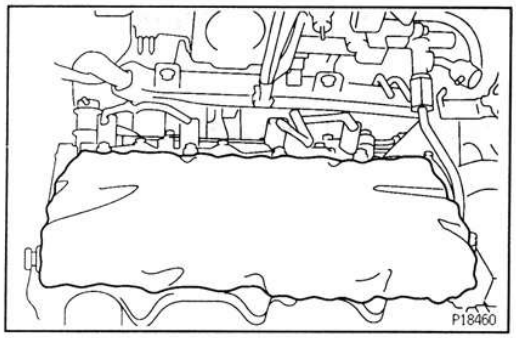


10. REMOVE CYLINDER HEAD COVER WITH NO. 4 TIMING BELT COVER

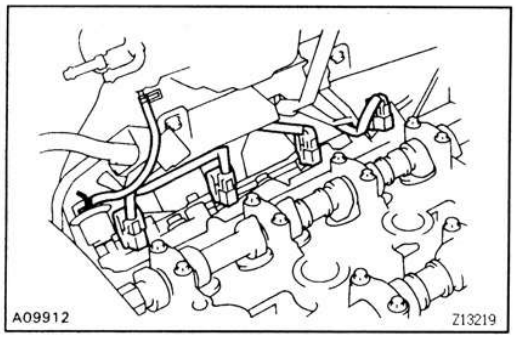
(a) Remove the gasket and spacer

(b) Remove the 10 bolts, cylinder head cover with No.4 timing belt cover, and gasket.

EG

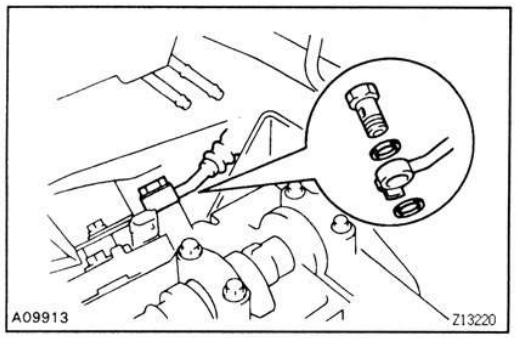


NOTICE: Cover the cylinder head with a clean shop rag to prevent damage to the cylinder head and camshafts.

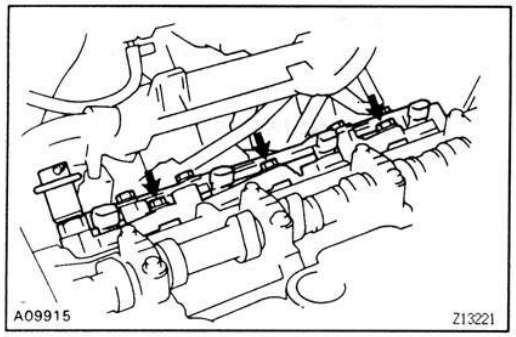


11. REMOVE DELIVERY PIPE ASSEMBLY

(a) Disconnect the 4 injector connectors.



(b) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the delivery pipe.



(c) Loosen the 3 bolts holding the delivery pipe to the cylinder head.

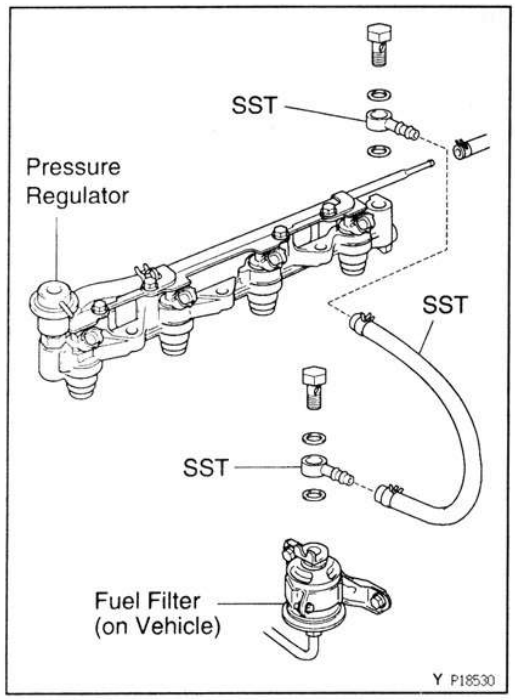
(d) Remove the delivery pipe and 3 spacers.

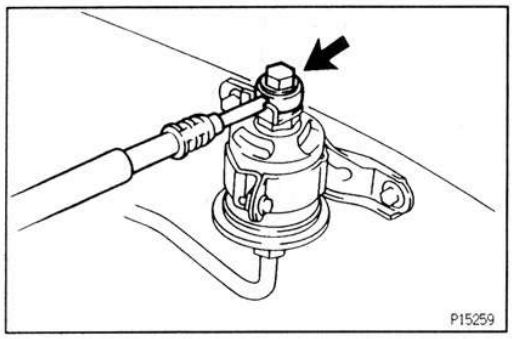
EG478–01

INJECTORS INSPECTION

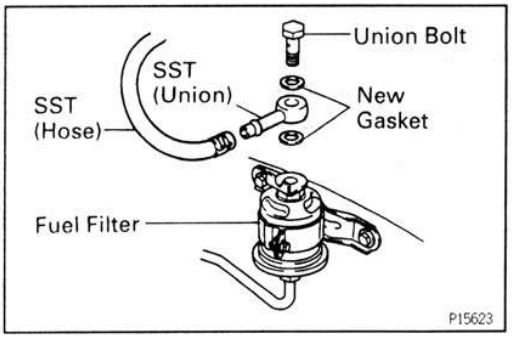
1. INSPECT INJECTOR INJECTION

CAUTION: Keep injector clean of sparks during the test.

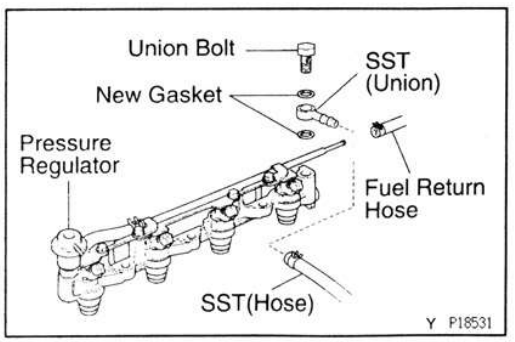




(a) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel filter outlet.
NOTICE: When removing or installing the union bolt fix the fuel filter in place using a spanner.

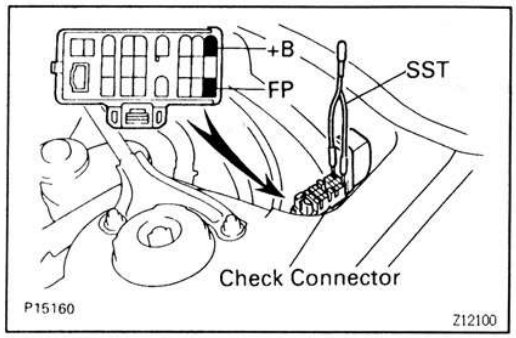


(b) Connect SST (union and hose) to the fuel filter outlet with 2 new gaskets and union bolt.
SST 09268–41045 (90405–09015)
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)



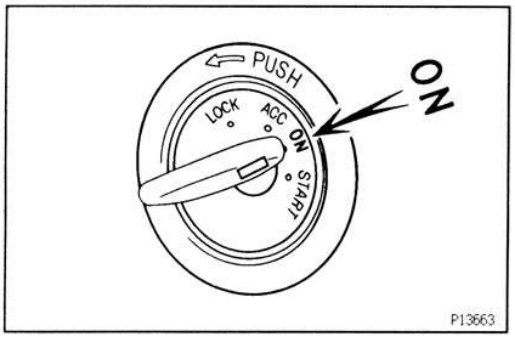
(c) Connect the fuel return hose to the fuel outlet of the No.3 fuel tube on the delivery pipe.
(d) Connect SST (union and hose) to the delivery pipe with 2 new gaskets and the union bolt.
SST 09268–41045 (09268–41080)
Torque: 32 N·m (325 kgf·cm, 24 ft·lbf)
(e) Put the injector into the graduated cylinder.

EG

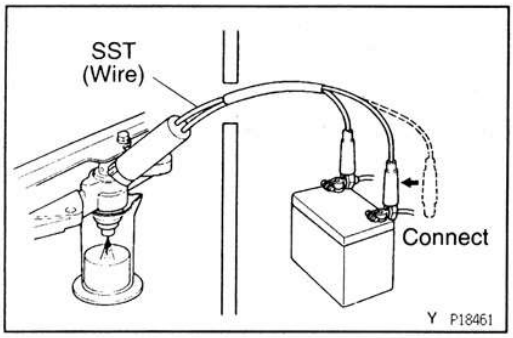


(f) Using SST, connect terminals +B and FP of the check connector.
SST 09843–18020

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

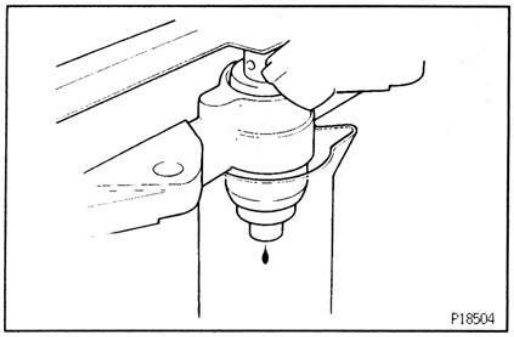


(h) Turn the ignition switch ON.
NOTICE: Do not start the engine.



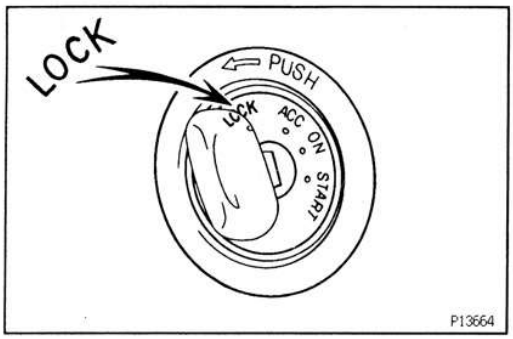
(i) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.
SST 09842–30060
Volume:
120 – 150 cm³ (7.3 – 9.2 cu in.) per 15 seconds

Difference between each injector:
5 cm³ (0.3 cu in.) or less
If the injection volume is not as specified, replace the injector.



2. INSPECT LEAKAGE

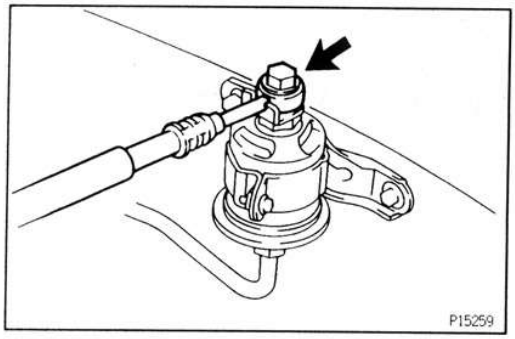
(a) In the condition above, disconnect the tester probes of SST (wire) from the battery and check for fuel leakage from the injector.
SST 09842–30060
Fuel drop:
One drop or less per minute



(b) Turn the ignition switch to LOCK.

(c) Disconnect the negative (–) terminal cable to the battery.

(d) Remove the SST.
SST 09268–41045, 09843–18020

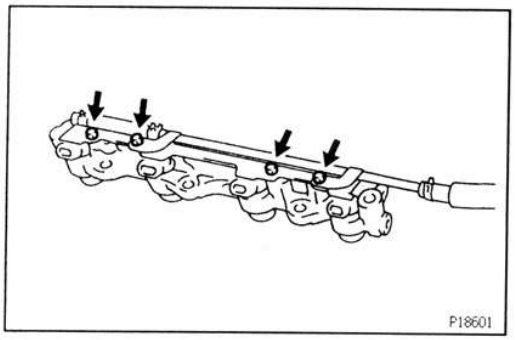


(e) Reinstall the fuel inlet hose to the fuel filter outlet with 2 new gaskets and the union bolt.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)
NOTICE: When removing or installing the union bolt fix the fuel filter in place using a spanner.

EG

INJECTORS REPLACEMENT

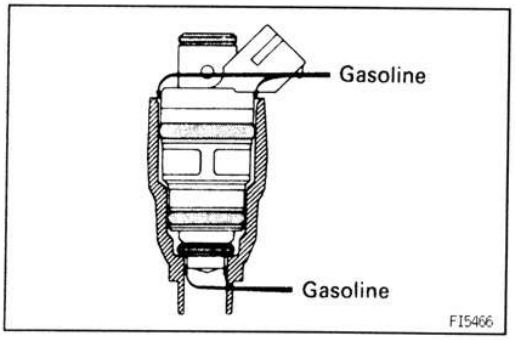
EG47C–01



(See Components for Removal and Installation)

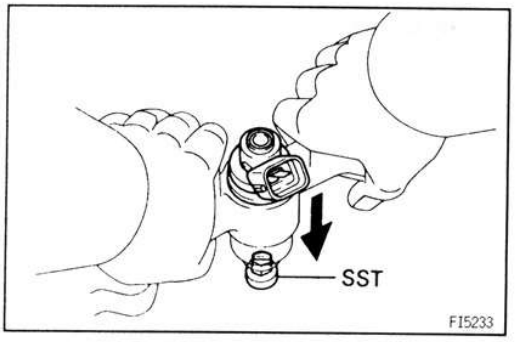
1. REMOVE INJECTOR COVER

(a) Disconnect the fuel hose from the fuel pressure regulator.
(b) Remove the 4 bolts, No.3 fuel tube and injector cover.
(c) Remove the 4 insulators from the injectors.

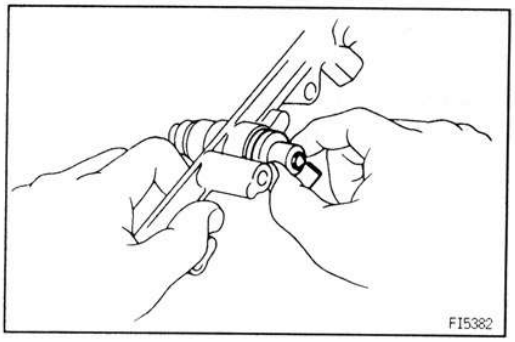


2. REMOVE INJECTORS

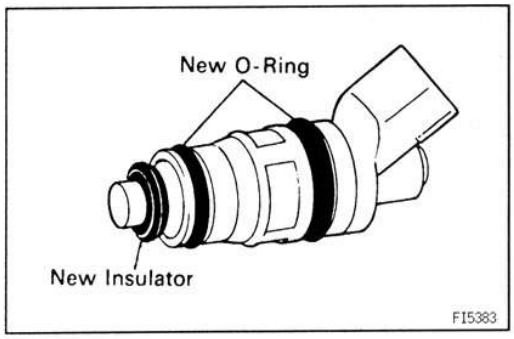
(a) Apply gasoline between the delivery pipe and injectors.



(b) Using SST, lift up the 4 injectors.
SST 09268–74010 (09268–04020)



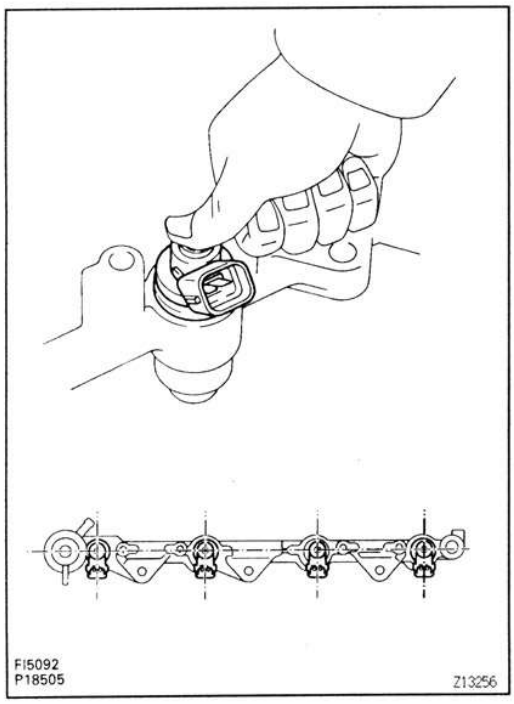
(c) Pull out the 4 injectors from the delivery pipe.
(d) Remove the insulator and 2 O–rings from each injector.



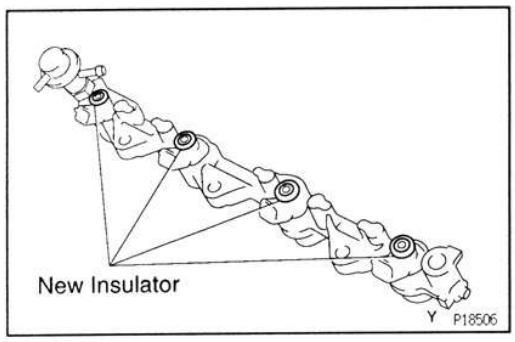
3. INSTALL INJECTORS

(a) Apply a light coat of gasoline to 2 new O–rings.

(b) Install the 2 O–rings and new insulator to each injector.

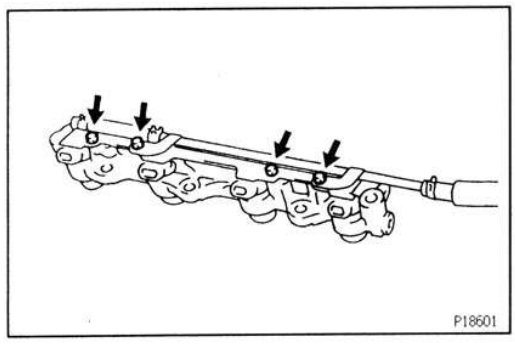


(c) Push in the 4 injectors so that the injector connectors are positioned as shown in the illustration.



4. INSTALL INJECTOR COVER

(a) Install a new insulator on each injector.



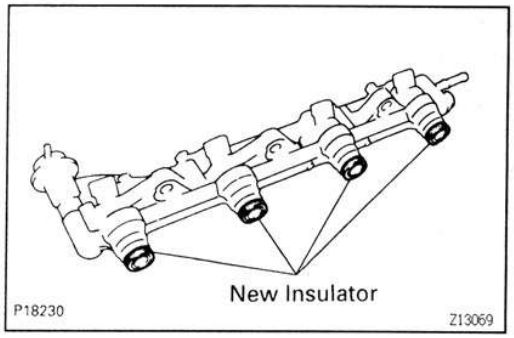
(b) Install the injector cover and No.3 fuel tube with the 4 bolts.

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

(c) Connect the fuel hose to the fuel pressure regulator.

EG47D-01

INJECTORS INSTALLATION

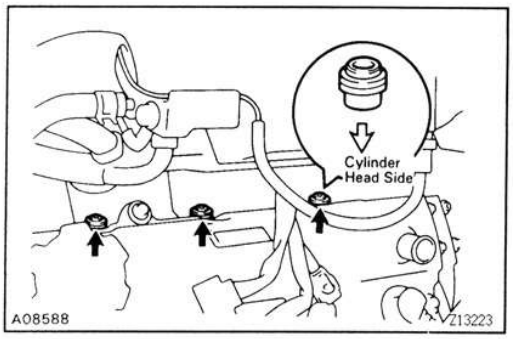


(See Components for Removal and Installation)

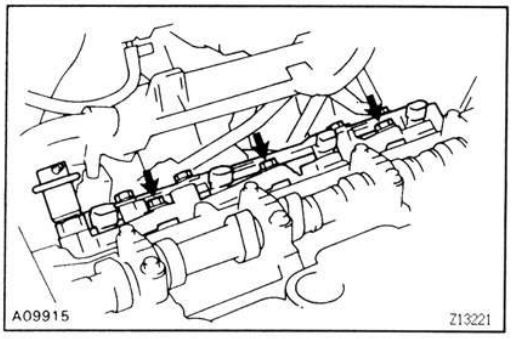
1. INSTALL DELIVERY PIPE ASSEMBLY

(a) Install 4 new insulators to the delivery pipe.

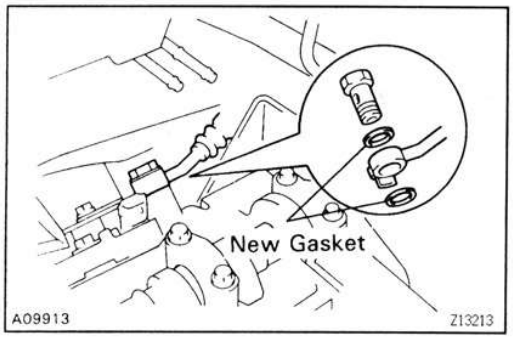
EG



(b) Install the 3 spacers to the cylinder head.
NOTICE: Install the spacers with the metal side toward the cylinder head.

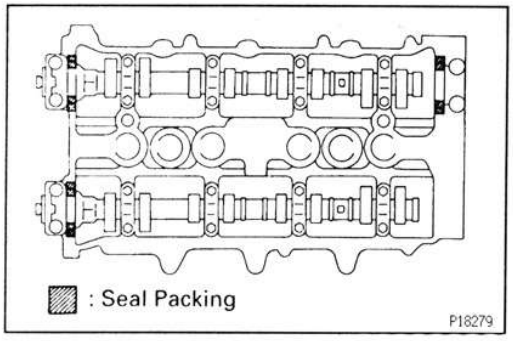


(c) Install the delivery pipe assembly with the 3 bolts.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)



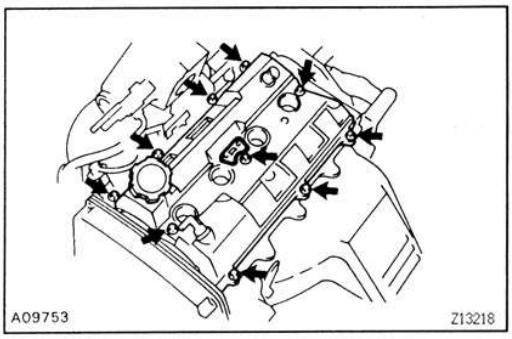
(d) Connect the fuel inlet hose to the delivery pipe with 2 new gaskets and union bolt.
Torque: 32 N·m (325 kgf·cm, 24 ft·lbf)

(e) Connect the 4 injector connectors.
HINT: No.1 and No.3 injector connectors are brown, No.2 and No.4 injector connectors are black.



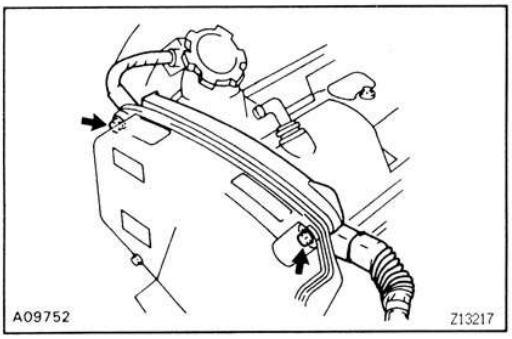
2. INSTALL CYLINDER HEAD COVER WITH NO. 4 TIMING BELT COVER

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

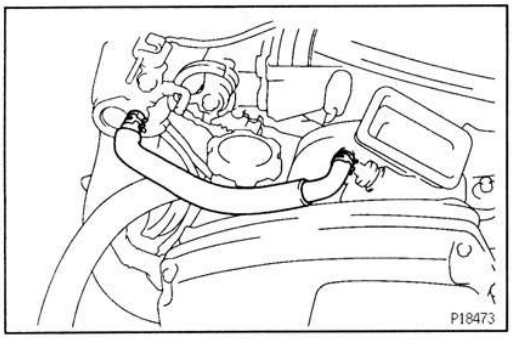


(b) Install the gasket to the cylinder head cover.
(c) Install the cylinder head cover with the No.4 timing belt cover, 10 seal washers and bolts. Uniformly tighten the bolts in several passes.
Torque: 16 N·m (60 kgf·cm, 12 ft·lbf)
(d) Install the spacer and gasket.

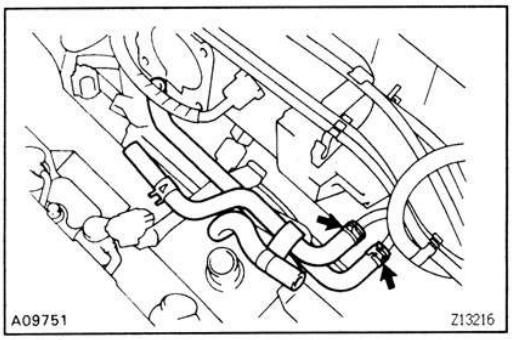
3. CONNECT VACUUM SENSING HOSE TO FUEL PRESSURE REGULATOR



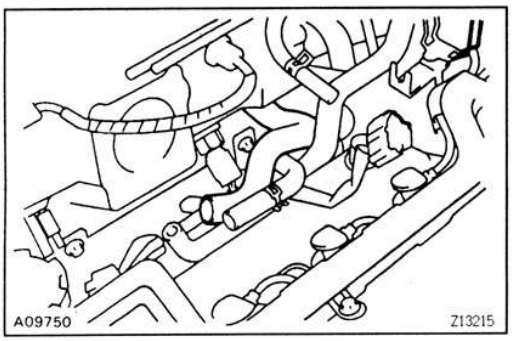
4. INSTALL ENGINE WIRE
Install the 2 bolts, and connect the engine wire to the No.4 timing belt cover.



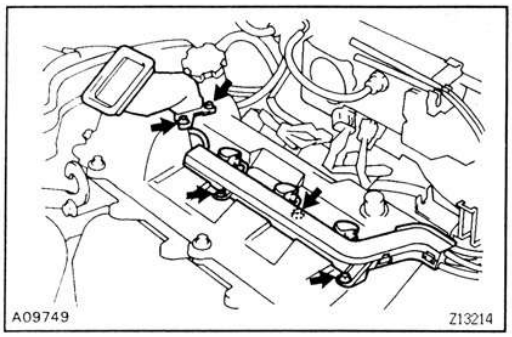
5. INSTALL NO.1 PCV HOSE



6. INSTALL NO.3 WATER BYPASS HOSE AND NO.1 AIR HOSE
Install the following hoses:
(1) 2 water bypass hoses (to No.1 air tube)



(2) No.1 air hose (to No.1 air tube)



7. INSTALL HIGH–TENSION CORDS

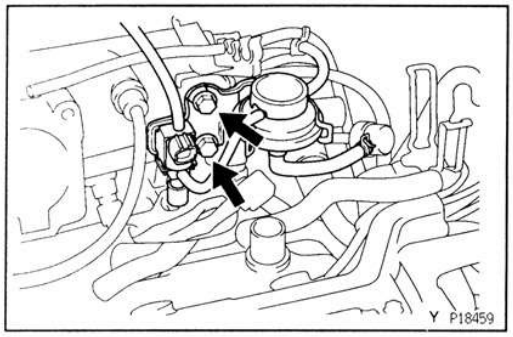
(a) Insert the high–tension cords to the cylinder head.

(b) Install the high–tension cords to the cylinder head cover with the 3 bolts.

8. INSTALL COOL AIR INLET

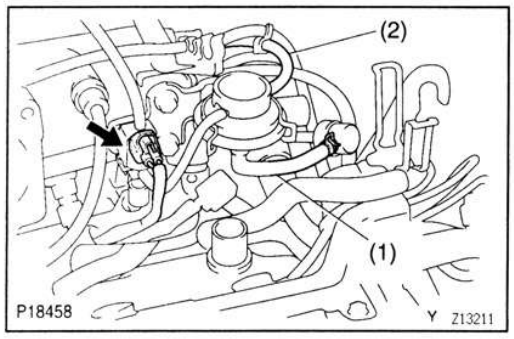
Install the cool air Inlet with the 2 bolts.

EG



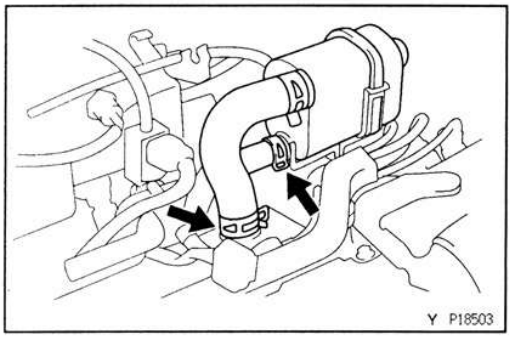
9. INSTALL VSV AND EGR VACUUM MODULATOR

(a) Install the VSV and vacuum modulator assembly with the 2 bolts.



(b) Install the following hoses to the vacuum modulator:
(1) EGR hose (from EGR valve)
(2) Vacuum hose (from EGR valve)

(c) Connect the VSV connector.



10. INSTALL NO.1 PCV CASE

(a) Install the PCV case to the backet.

(b) Connect the No.3 water bypass hose to the No.1 PCV case.

(c) Connect the No.2 PCV hose to the cylinder head cover.

11. INSTALL THROTTLE BODY

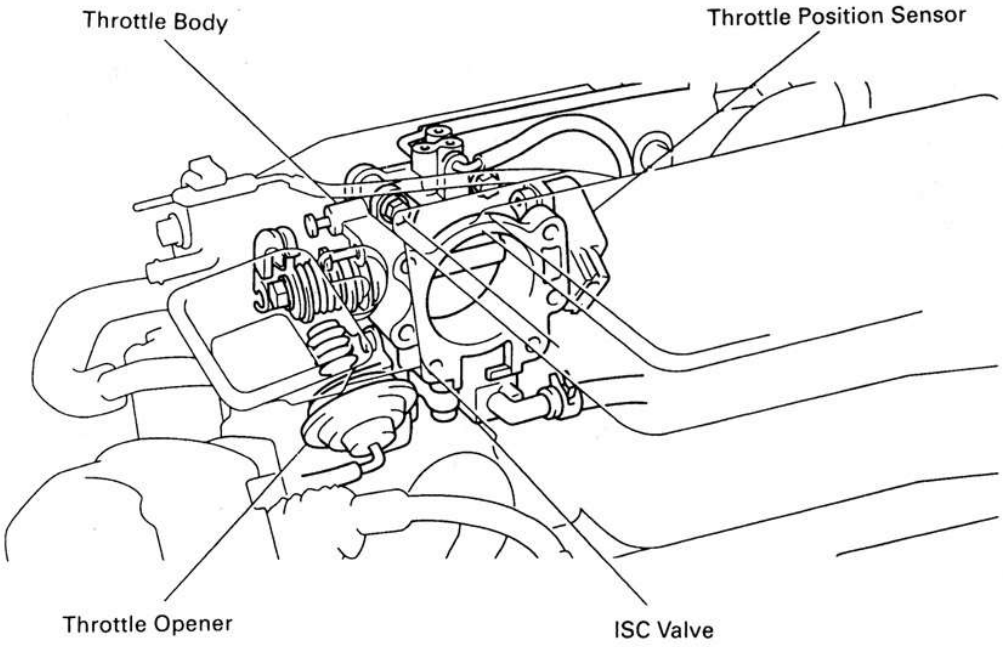
(See page EG–166)

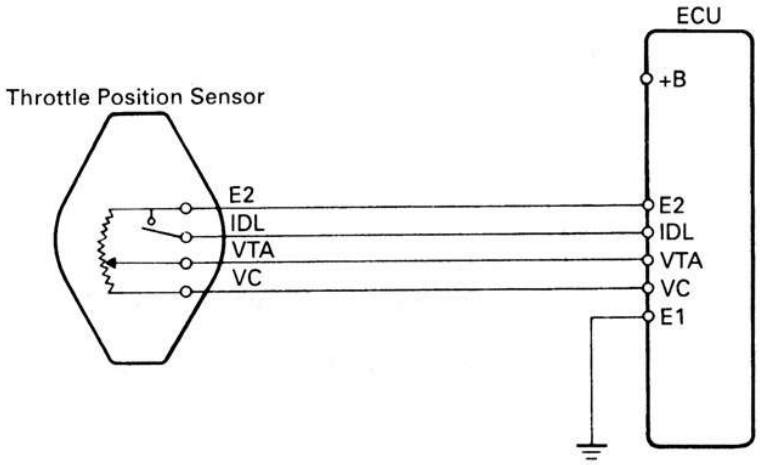
12. START ENGINE AND CHECK FOR FUEL LEAKS

THROTTLE BODY

EG47E-01

EG



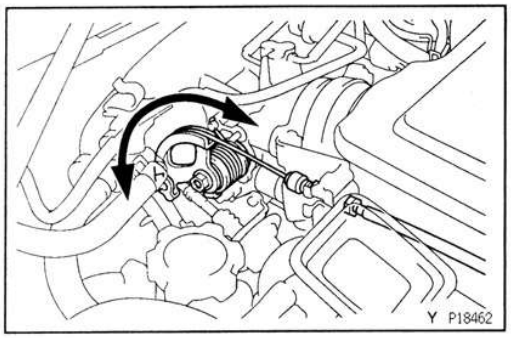


P18383
FI1366

Z13204

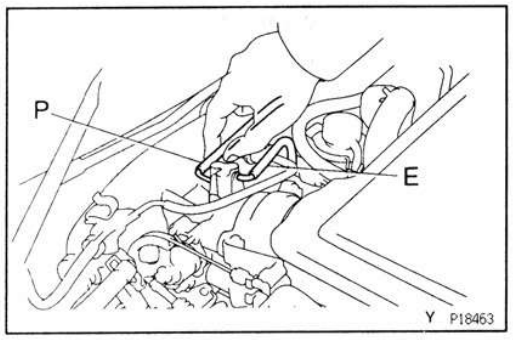
EG47F-01

ON–VEHICLE INPSECTION



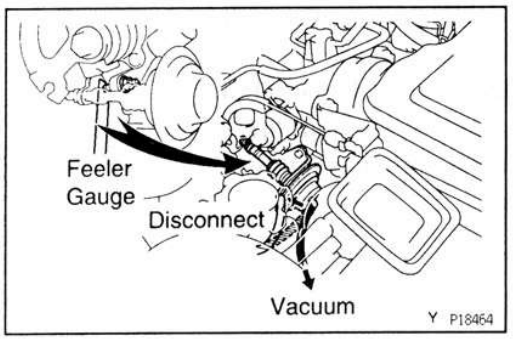
1. INSPECT THROTTLE BODY

(a) Check that the throttle linkage moves smoothly.



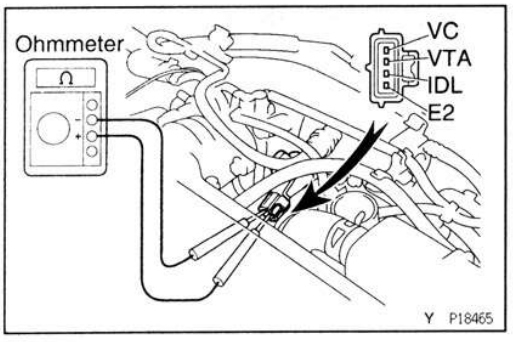
(b) Check the vacuum at each port.
- Start the engine.
- Check the vacuum with the vacuum hoses pick your finger.

Port name	At idle	Other than idle
P	No vacuum	Vacuum
E	No vacuum	Vacuum



2. INSPECT THROTTLE POSITION SENSOR

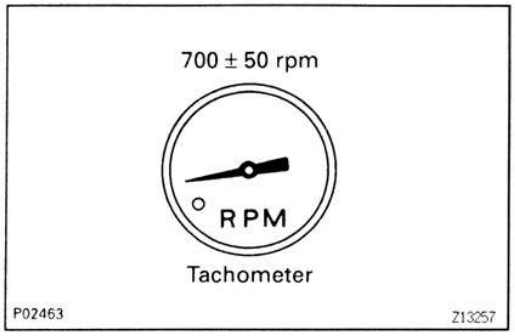
(a) Disconnect the throttle position sensor connector.
(b) Disconnect the vacuum hose from the throttle opener.
(c) Apply vacuum to the throttle opener.
(d) Insert a feeler gauge between the throttle stop screw and stop lever.



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

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
0.50 mm (0.020 in.)	IDL – E2	2.3 kΩ or less
0.90 mm (0.035 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ

(f) Reconnect the vacuum hose to the throttle opener.
(g) Reconnect the throttle position sensor connector.



EG

3. INSPECT THROTTLE OPENER

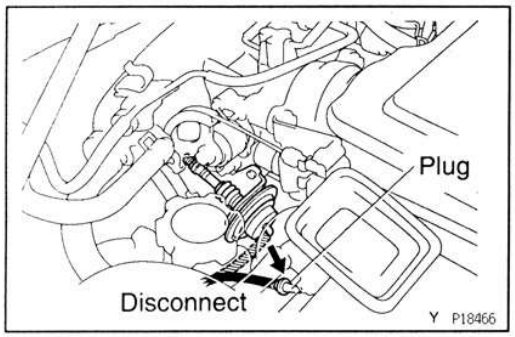
A. Warm up engine

Allow the engine to warm up to normal operating temperature.

B. Check idle speed

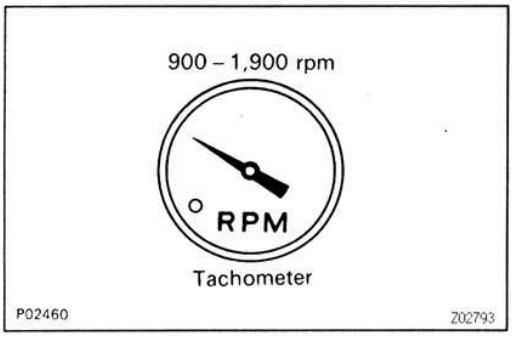
Idle speed:

700 ± 50 rpm



C. Check and adjust throttle opener setting speed

(a) Disconnect the vacuum hose from the throttle opener, and plug the hose end.



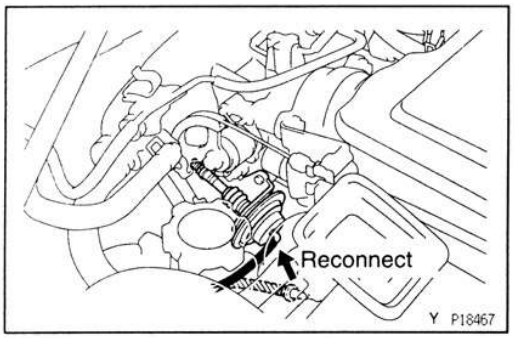
(b) Check the throttle opener setting speed.

Throttle opener setting speed:

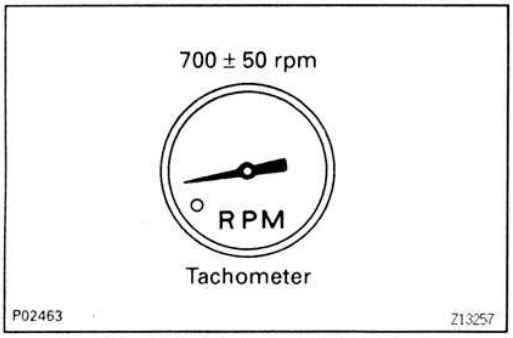
900 – 1,900 rpm (w/ Cooling fan OFF)

If the throttle opener setting is not as specified, replace the throttle body assembly.

(c) Stop the engine.



(d) Reconnect the vacuum hose to the throttle opener.



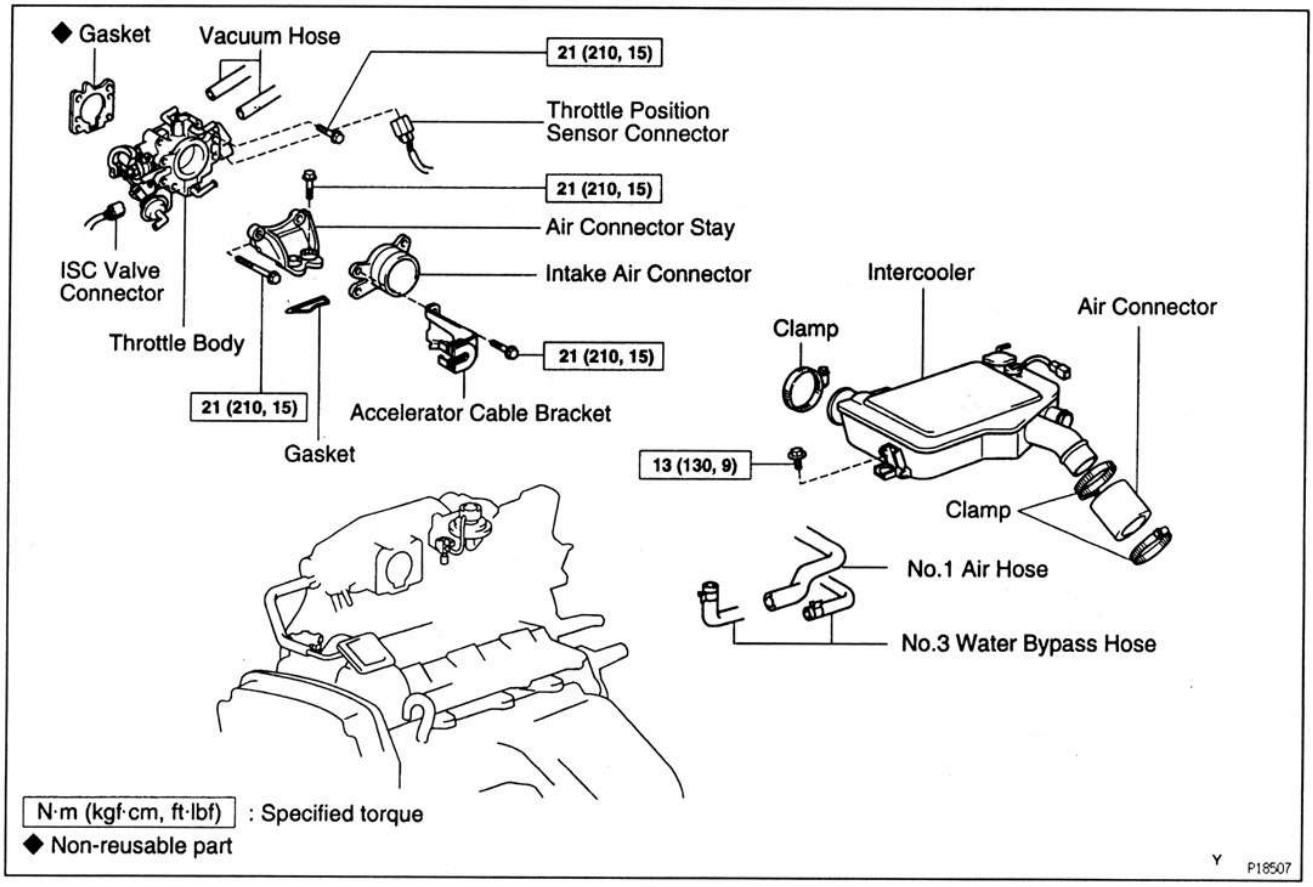
(e) Start the engine, and check that the idle rpm returns to the correct speed.

Idle speed:

700 ± 50 rpm

EG47G-01

COMPONENTS FOR REMOVAL AND INSTALLATION

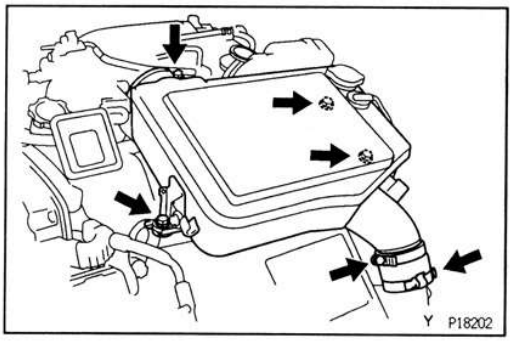


EG47H-01

THROTTLE BODY REMOVAL

(See Components for Removal Installation)

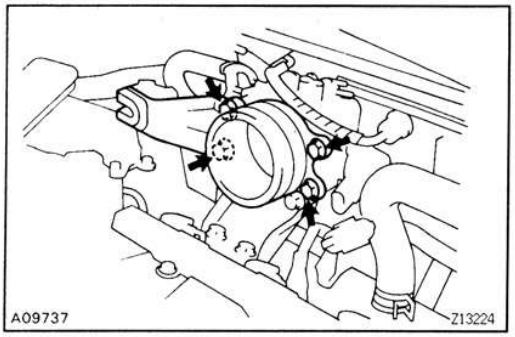
1. **DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**
2. **DRAIN ENGINE COOLANT**



3. **REMOVE INTERCOOLER**

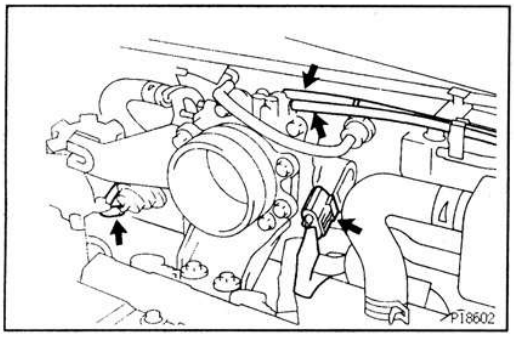
(a) Loosen the 3 clamps.

(b) Remove the 3 bolts and intercooler.



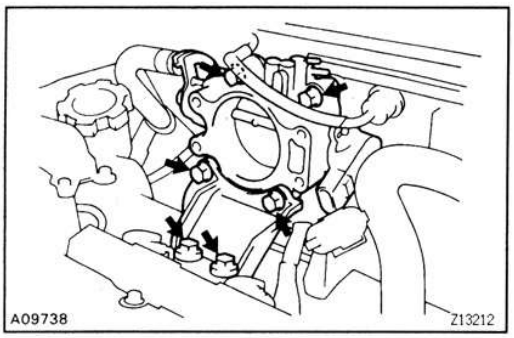
4. REMOVE INTAKE AIR CONNECTOR

Remove the 4 bolts, accelerator cable bracket and intake air connector.

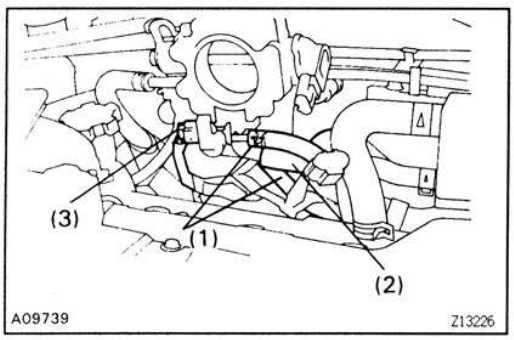


5. REMOVE THROTTLE BODY

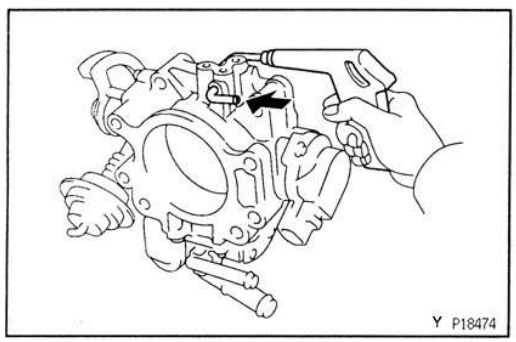
(a) Disconnect the throttle position sensor connector.
(b) Disconnect the following hoses:
  (1) Vacuum hose (from port "P" of throttle body)
  (2) Vacuum hose (from port "E" of throttle body)
  (3) Vacuum hose (from throttle opener)



(c) Remove the 6 bolts and air connector stay, and disconnect the throttle body from the intake manifold.
(d) Remove the throttle body gasket.
(e) Remove the No.3 cylinder head gasket.



(f) Disconnect the following hoses and connector from the throttle body, and remove the throttle body:
  (1) No.3 water bypass hose
  (2) No.1 air hose
  (3) ISC valve connector



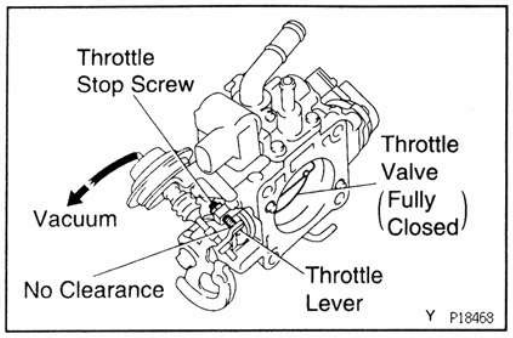
THROTTLE BODY INSPECTION

EG47J-01

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.

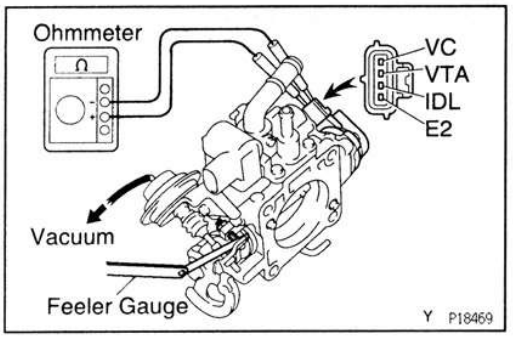


2. INSPECT THROTTLE VALVE

(a) Apply vacuum to the throttle opener.

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

EG



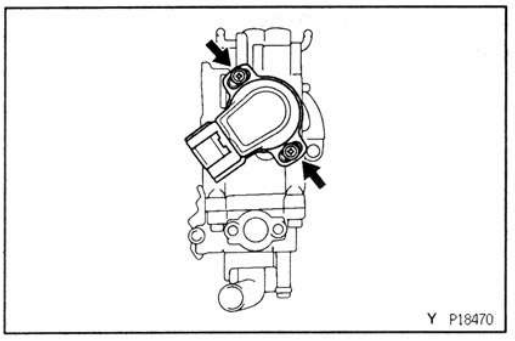
3. INSPECT THROTTLE POSITION SENSOR

(a) Apply vacuum to the throttle opener.

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

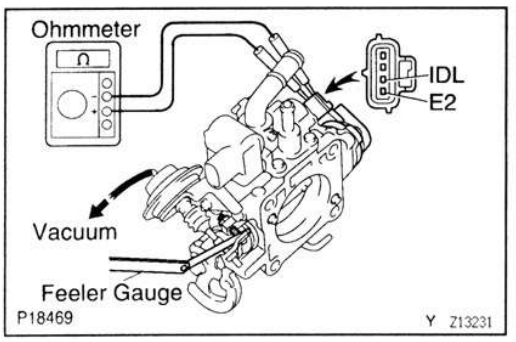
(c) Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
0.50 mm (0.020 in.)	IDL – E2	2.3 kΩ or less
0.90 mm (0.035 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ



4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

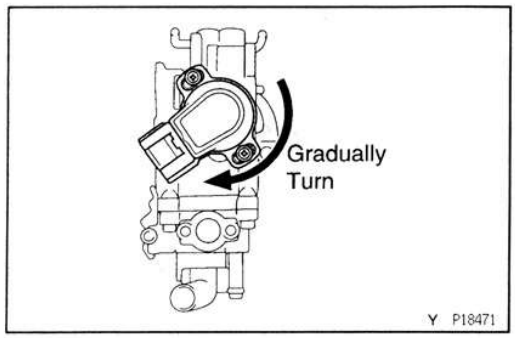
(a) Loosen the 2 set screws of the sensor.



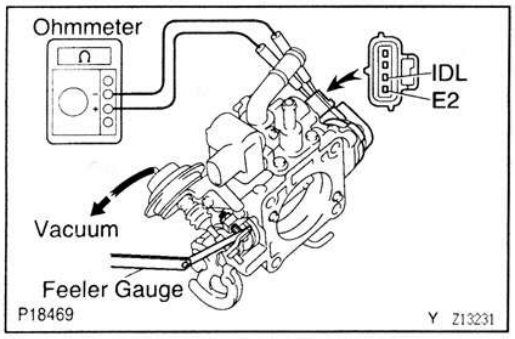
(b) Apply vacuum to the throttle opener.

(c) Insert a 0.70 mm (0.028 in.) feeler gauge between the throttle stop screw and stop lever.

(d) Connect the tester probe of an ohmmeter to the terminals IDL and E2 of the sensor.

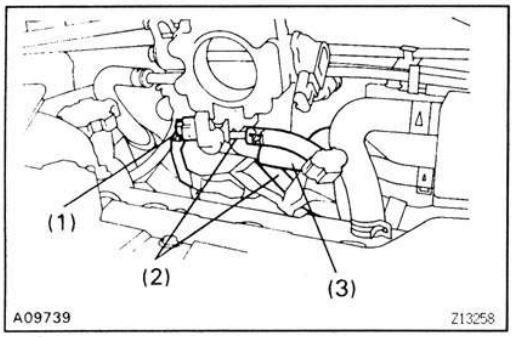


(e) Gradually turn the sensor clockwise until the ohmmeter deflects, and secure it with the 2 set screws.



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

Clearance between lever and stop screw	Continuity (IDL – E2)
0.50 mm (0.020 in.)	Continuity
0.90 mm (0.035 in.)	No continuity



THROTTLE BODY INSTALLATION

EG47K-01

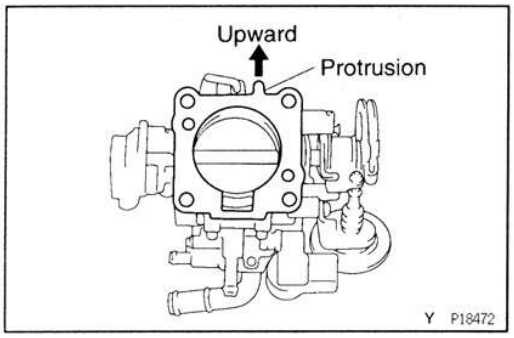
(See Components for Removal and Installation)

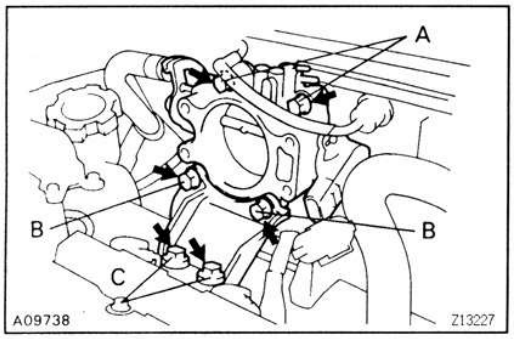
1. INSTALL THROTTLE BODY

(a) Connect the following connector and hoses to the throttle body:
- (1) ISC valve connector
- (2) No.3 water bypass hose
- (3) No.1 air hose

(b) Install the No.3 cylinder head gasket to the spacer.

(c) Install a new gasket on the throttle body, facing the protrusion upward.



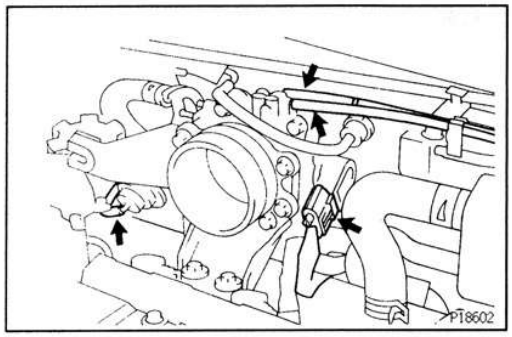


(d) Install the throttle body and air connector stay with the 6 bolts.

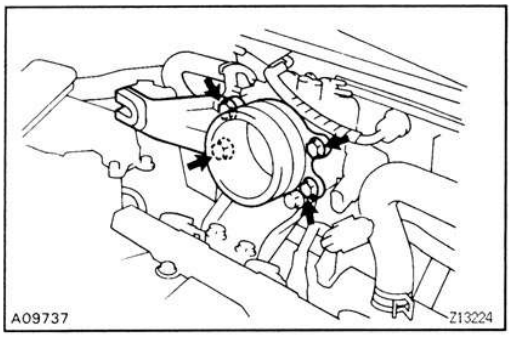
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

Different bolt lengths A, B and C.

Bolt length:
- A: 45 mm (1.77 in.)
- B: 70 mm (2.76 in.)
- C: 80 mm (3.15 in.)



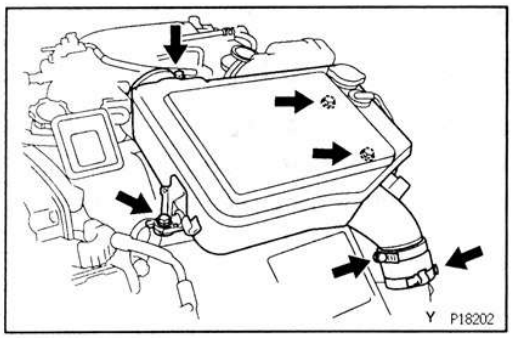
(e) Connect the following hoses:
(1) Vacuum hose (to port "P" of throttle body)
(2) Vacuum hose (to port "E" of throttle body)
(3) Vacuum hose (to throttle opener)
(f) Connect the throttle position sensor connector



2. INSTALL INTAKE AIR CONNECTOR

Install the intake air connector and accelerator cable bracket with the 4 bolts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)



3. INSTALL INTERCOOLER

(a) Install the intercooler with the 3 bolts.
(b) Connect the air connector to the intercooler, and tighten the 3 clamps.

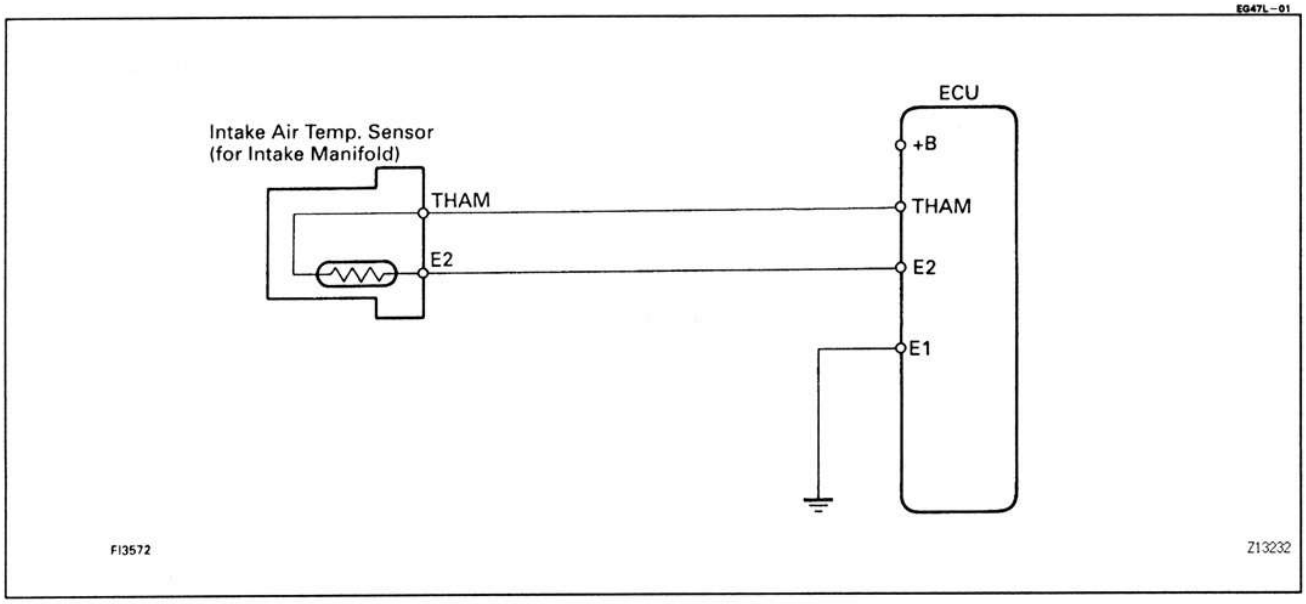
4. CONNECT NEGATIVE (–) TERMINAL CABLE T(BATTERY

5. REFILL WITH ENGINE COOLANT

6. START ENGINE AND CHECK FOR ENGINE COOLANT

INTAKE AIR TEMPERATURE SENSOR

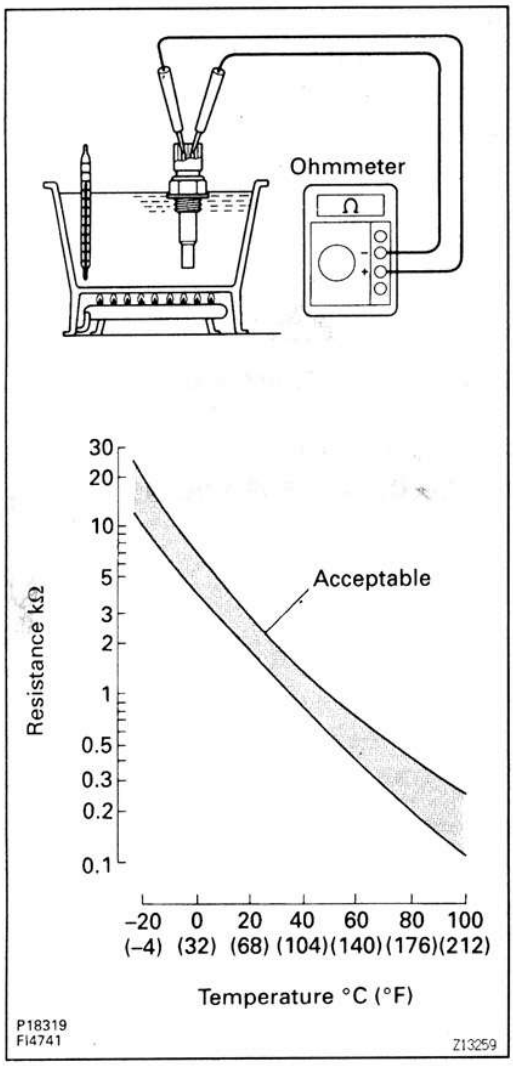
EG47L–01



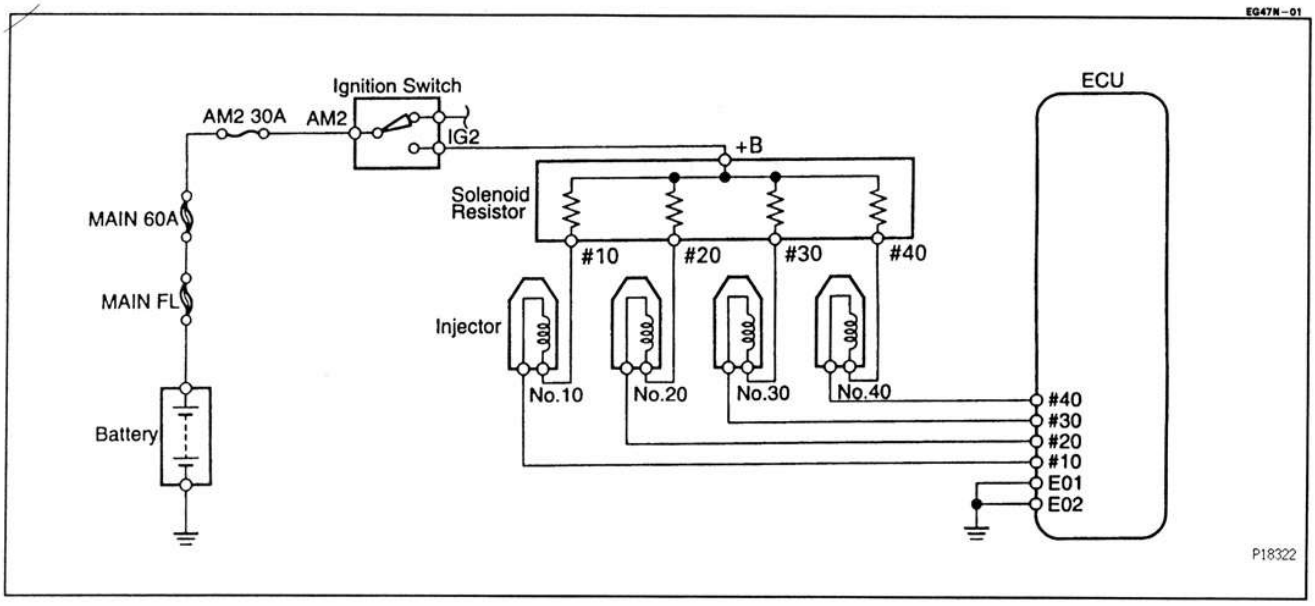
EG47M–01

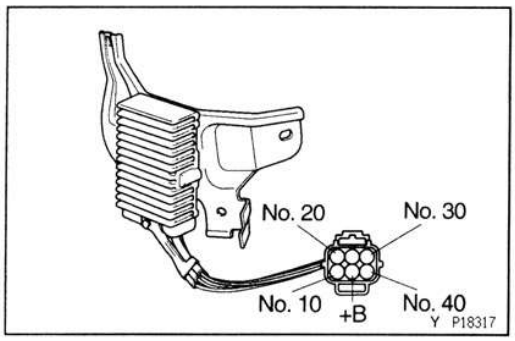
INTAKE AIR TEMPERATURE SENSOR INSPECTION (for INTAKE MANIFOLD)

1. **REMOVE INTAKE AIR TEMPERATURE SENSOR**
2. **INSPECT INTAKE AIR TEMPERATURE SENSOR**
   Using an ohmmeter, measure the resistance between the terminals.
   Resistance:
   Refer to the graph
   If the resistance is not as specified, replace the intake air temperature sensor.
3. **REINSTALL INTAKE AIR TEMPERATURE SENSOR**



SOLENOID RESISTOR



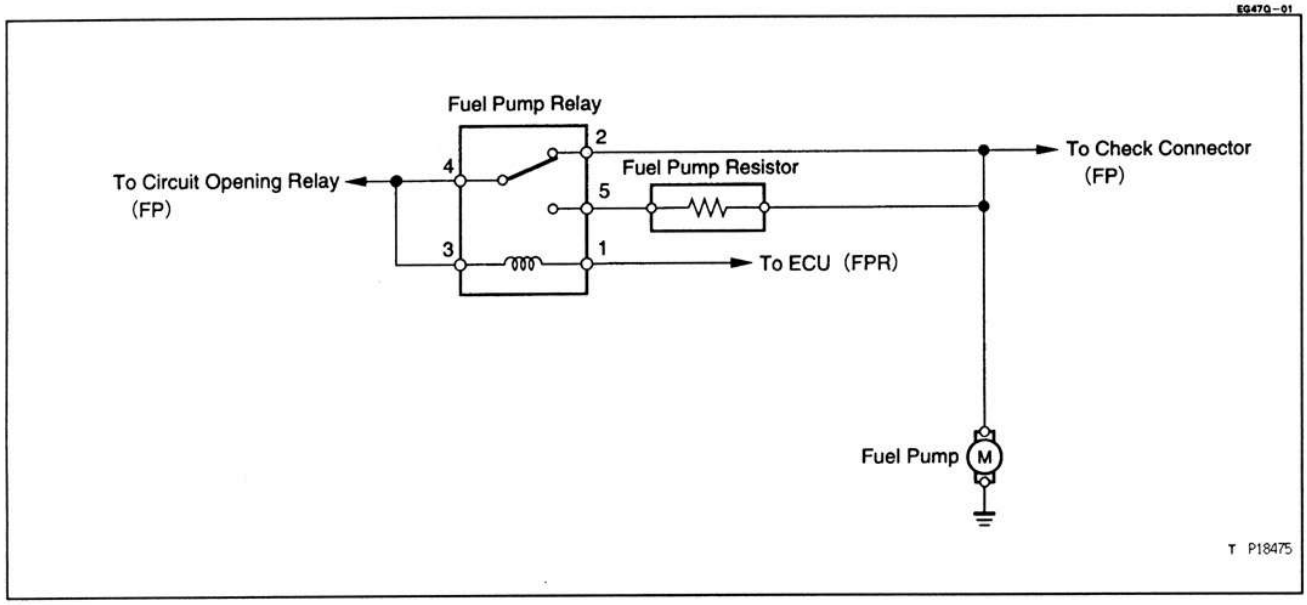


SOLENOID RESISTOR INSPECTION

EG47P-01

1. **DISCONNECT SOLENOID RESISTOR CONNECTOR**
2. **INSPECT SOLENOID RESISTOR**
   Using an ohmmeter, measure the resistance between terminals +B and other terminals.
   Resistance:
   4 – 6 Ω at 20°C (68°F)
   If the resistance is not as specified, replace the resistor.
3. **RECONNECT SOLENOID RESISTOR CONNECTOR**

FUEL PUMP RELAY AND RESISTOR

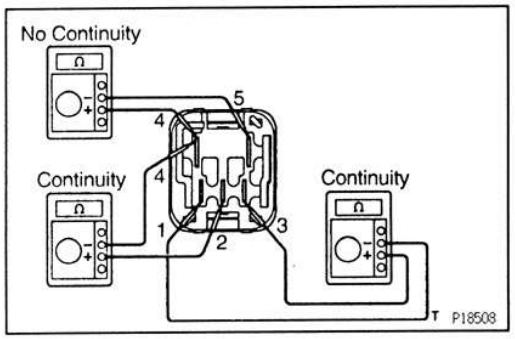


EG

EG47R-01

FUEL PUMP RELAY INSPECTION

1. **REMOVE FUEL PUMP RELAY**



2. **INSPECT FUEL PUMP RELAY**

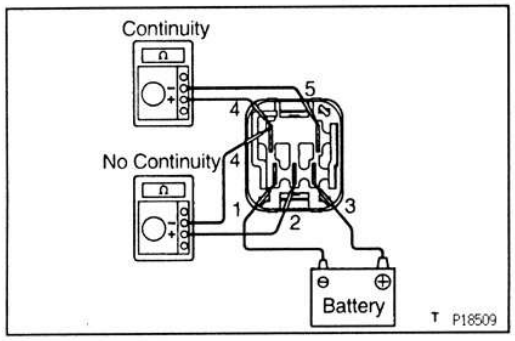
A. Inspect relay continuity

(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

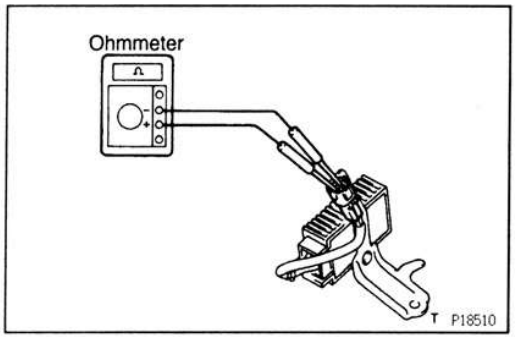
(a) Apply battery voltage across terminals 1 and 3.

(b) Using an ohmmeter, check that there is no continuity between the 2 and 4.

(c) Check that there is continuity between terminals 4 and 5.

If operation is not as specified, replace the relay.

3. **REINSTALL FUEL PUMP RELAY**



FUEL PUMP RESISTOR INSPECTION

EG478-01

1. **DISCONNECT FUEL PUMP RESISTOR CONNECTOR**
2. **INSPECT FUEL PUMP RESISTOR**
   Using an ohmmeter, measure the resistance between the terminal.
   Resistance:
   Approx. 0.73 Ω at 20°C (68°F)
   If the resistance is not as specified, replace the resistor.
3. **RECONNECT FUEL PUMP RESISTOR CONNECTOR**

SERVICE SPECIFICATIONS

SERVICE DATA

EG47T-01

Fuel pressure regulator	Fuel pressure	at no vacuum	231 – 270 kPa (2.35 – 2.75 kgf/cm², 33 – 39 psi)
Fuel pump	Resistance	at 20°C (68°F)	0.2 – 3.0 Ω
Injector	Resistance	at 20°C (68°F)	2 – 4 Ω
	Injection volume		120 – 150 cm³ (7.3 – 9.2 cu in.) per 15 sec.
	Difference between each cylinder		5 cm³ (0.3 cu in.) or less
	Fuel leakage		One drop or less per minute
Throttle body	Throttle body fully closed angle		6°
	Throttle opener setting speed		900 – 1,900 rpm (w/ Cooling fan OFF)
Throttle position sensor	Clearance between stop screw and lever		
	0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
	0.50 mm (0.020 in.)	IDL – E2	2.3 kΩ or less
	0.90 mm (0.035 in.)	IDL – E2	Infinity
	Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
	–	VC – E2	2.5 – 5.9 kΩ
ISC valve	Resistance (+B – RSC or RSO)	at 20°C (68°F)	19.3 – 22.3 Ω
VSV for EGR	Resistance		33 – 39 Ω
A/C idle-up valve	Resistance	at 20°C (68°F)	30 – 34 Ω
Water Temp. sensor	Resistance	at −20°C (−4°F)	10 – 20 kΩ
		at 0°C (32°F)	4 – 7 kΩ
		at 20°C (68°F)	2 – 3 kΩ
		at 40°C (104°F)	0.9 – 1.3 kΩ
		at 60°C (140°F)	0.4 – 0.7 kΩ
		at 80°C (176°F)	0.2 – 0.4 kΩ
Intake Air Temp. sensor (for Air Cleaner case)	Resistance	at −20°C (−4°F)	10 – 20 kΩ
		at 0°C (32°F)	4 – 7 kΩ
		at 20°C (68°F)	2 – 3 kΩ
		at 40°C (104°F)	0.9 – 1.3 kΩ
		at 60°C (140°F)	0.4 – 0.7 kΩ
		at 80°C (176°F)	0.2 – 0.4 kΩ
Intake Air Temp. sensor (for Intake Manifold)	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
Solenoid resistor	Resistance	at 20°C (68°F)	4 – 6 Ω
Fuel pump Resistor	Resistance	at 20°C (68°F)	Approx. 7.3 Ω
Oxygen sensor	Heater coil resistance		5.1 – 6.3 Ω
Fuel cut rpm	Fuel return rpm		1,700 rpm

SERVICE DATA (Cont'd)

ECU	Voltage		
	+B — 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	2.2 — 2.8 V
	VC — E2	IG SW ON	4.5 — 5.5 V
	#10, #20, #30 or #40 — E01	IG SW ON	9 — 14 V
	#10, #20, #30 or #40 — E02	IG SW ON	9 — 14 V
	THA — E2	IG SW ON (Intake air temp. 20°C (68°F))	0.5 — 3.4 V
	THAM — E2	IG SW ON (Intake air temp. 20°C (68°F))	0.5 — 3.4 V
	THW — E2	IG SW ON (Coolant temp. 80°C (176°F))	0.2 — 1.0 V
	STA — E1	Cranking	6 V or more
	IGT — E1	Idling	Pulse generation
	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
	TE1 — E1	IG SW ON (Check connector terminals TE1 — E1 not connected)	9 — 14 V
		IG SW ON (Check connector terminals TE1 — E1 connected)	0 — 3 V
	Resistance		
	IDL — E2	at throttle valve open	Infinity
		at throttle valve fully closed	2,300 Ω or less
	VTA — E2	at throttle valve fully open	2,000 — 10,200 Ω
		at throttle valve fully closed	200 — 5,700 Ω
	VC — E2		2,500 — 5,900 Ω
	THA — E2	at intake air temp. 20°C (68°F)	2,000 — 3,000 Ω
	THW — E2	at coolant temp. 80°C (176°F)	200 — 400 Ω
	G1 or G2 — G—	at cold (—10°C (14°F) to 50°C (122°F))	125 — 200 Ω
		at hot (50°C (122°F) to 100°C (212°F))	160 — 235 Ω
	NE+ — G—	at cold (—10°C (14°F) to 50°C (122°F))	155 — 250 Ω
		at hot (50°C (122°F) to 100°C (212°F))	190 — 290 Ω
	+B — RSC or RSO		19.3 — 22.3 Ω

EG

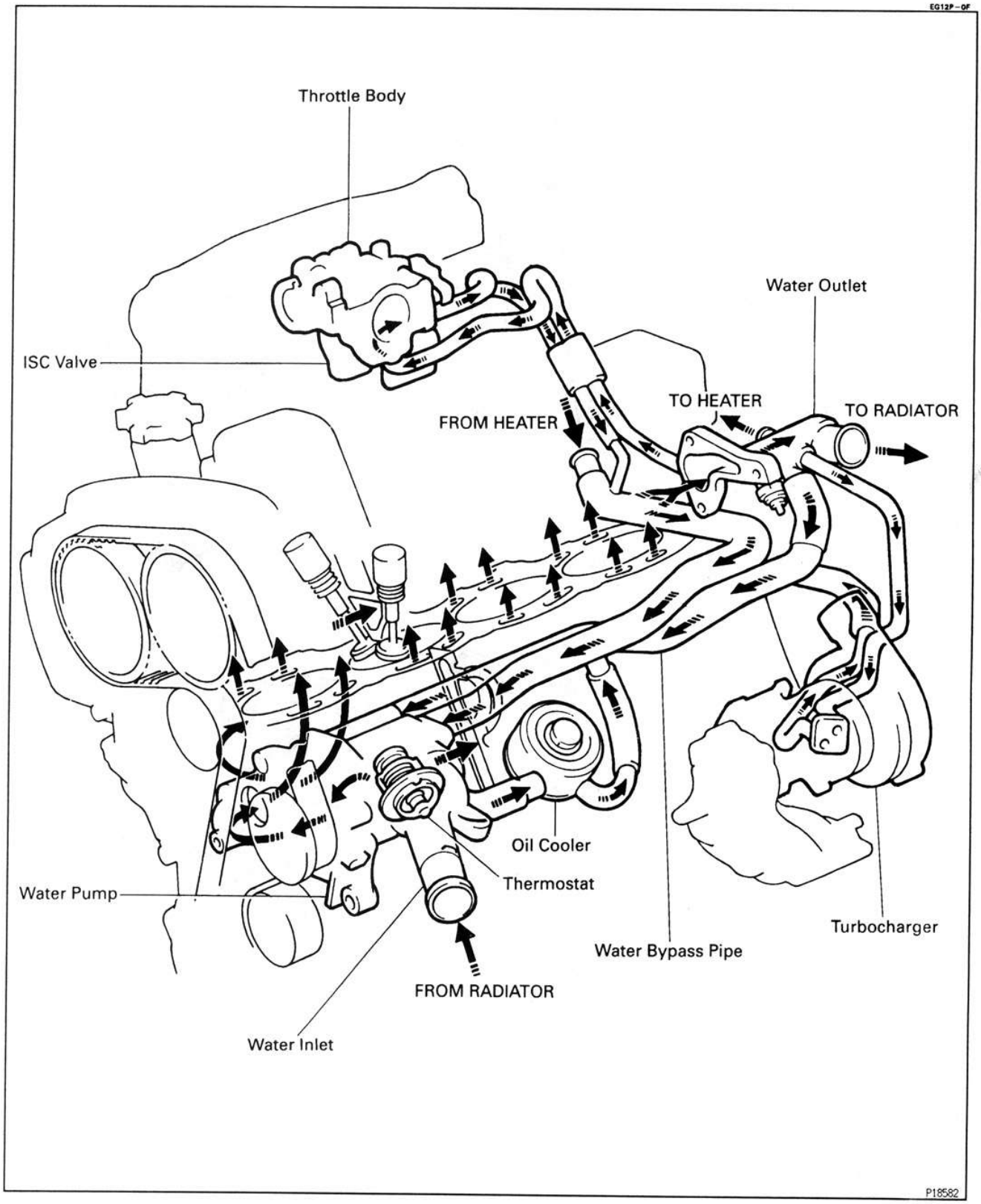
TORQUE SPECIFICATIONS

EG47U-01

Part tightened		N·m	kgf·cm	ft·lbf
Fuel line				
Union bolt type		29	300	22
Flare nut type	Fuel pump side	38	385	28
	Others	30	310	22
Fuel pump x Fuel tank		2.9	30	26 in.·lbf
Fuel pressure regulator x Delivery pipe		29	300	22
Fuel return pipe x Fuel pressure regulator		29	300	22
Delivery pipe x Cylinder head		29	300	22
Fuel inlet hose x Delivery pipe		32	325	24
Cylinder head cover x Cylinder head		16	60	12
Throttle body x Intake manifold		21	210	15
Air connector stay x Cylinder head		21	210	15
Air connector x Throttle body		21	210	15
Knock sensor x Cylinder block		44	450	33
Oxygen sensor x Exhaust manifold		20	200	14

COOLING SYSTEM

OPERATION



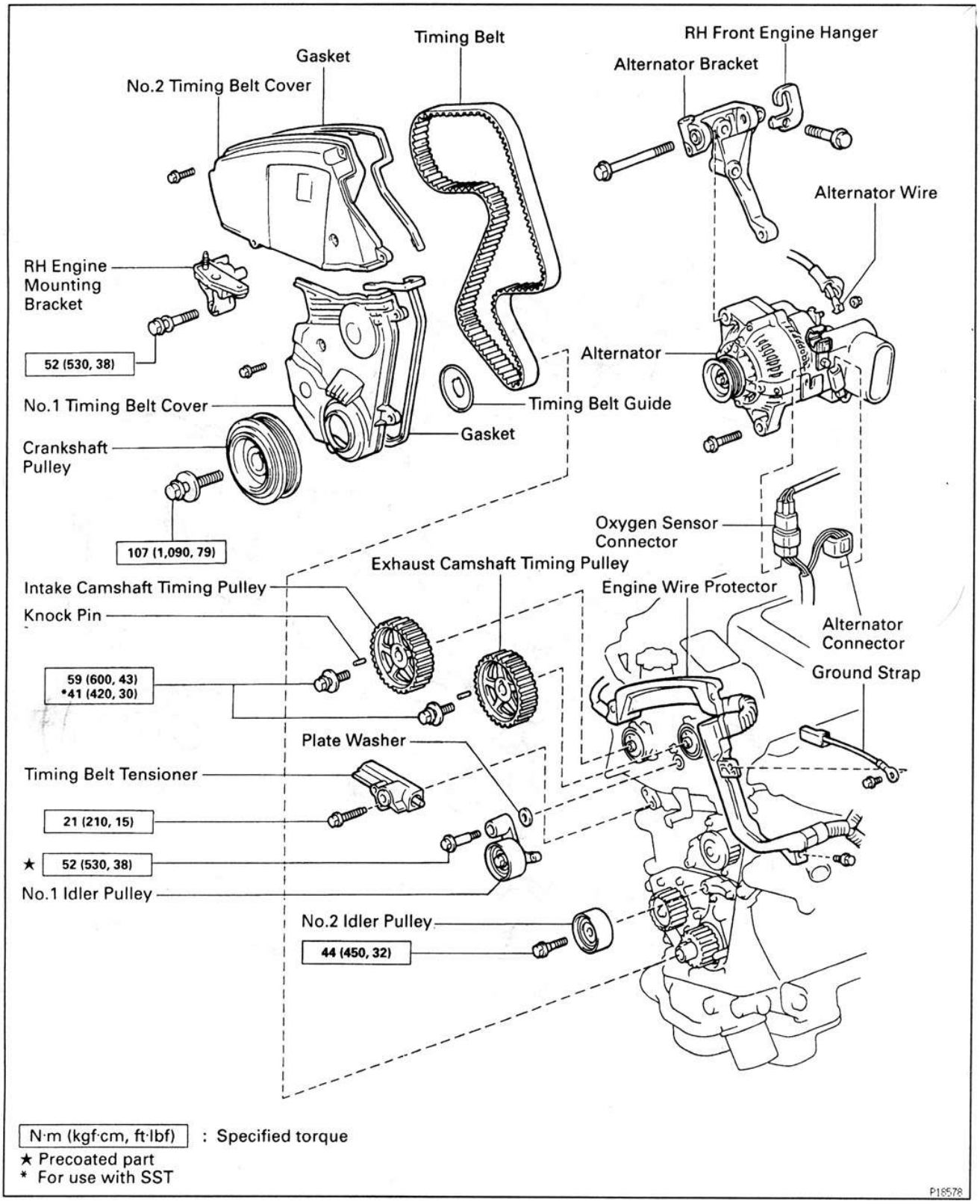
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WATER PUMP

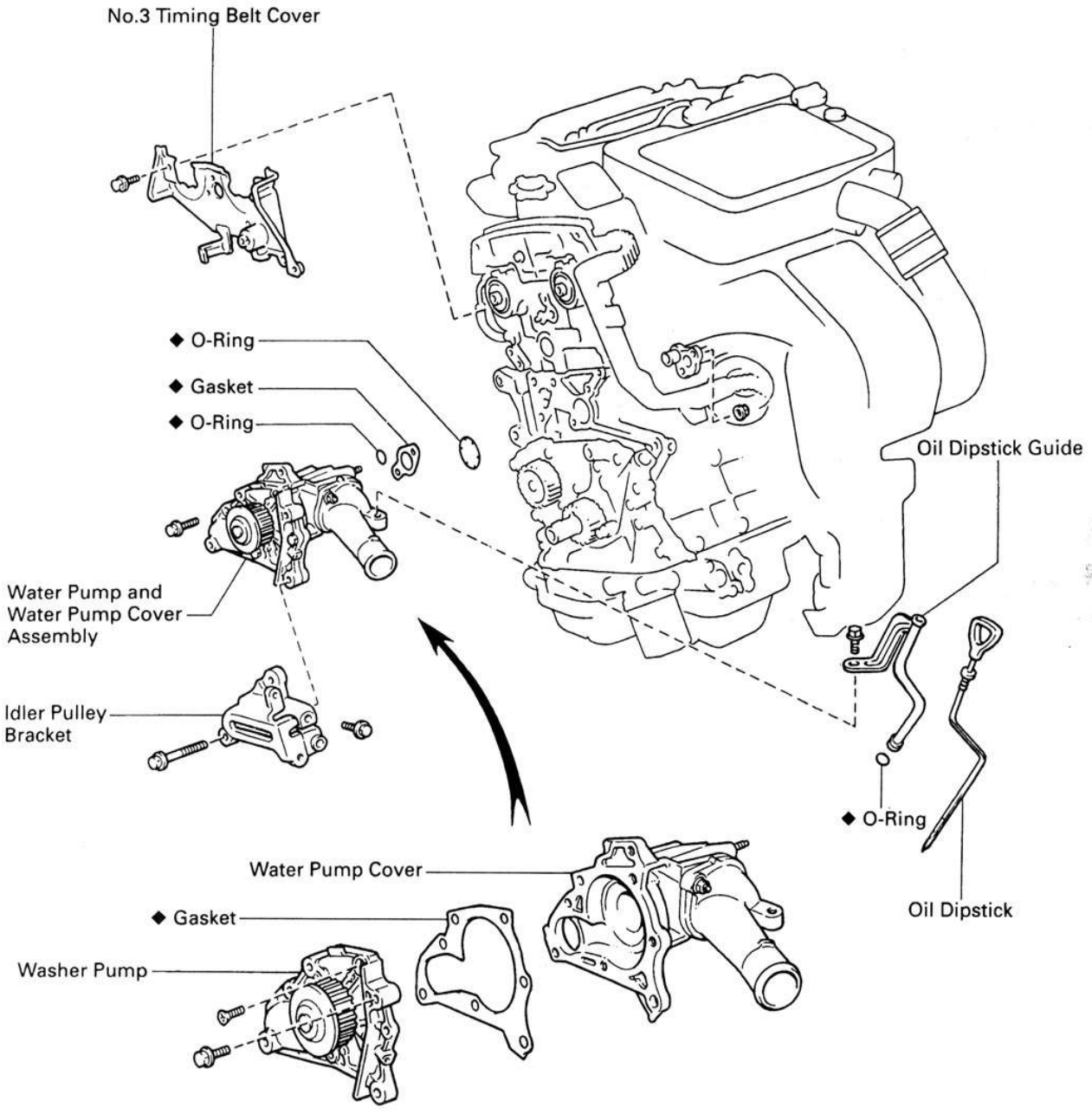
EG138-08

COMPONENTS FOR REMOVAL AND INSTALLATION



N·m (kgf·cm, ft·lbf) : Specified torque
★ Precoated part
* For use with SST

P18578


No.3 Timing Belt Cover
◆ O-Ring
◆ Gasket
◆ O-Ring
Water Pump and
Water Pump Cover
Assembly
Idler Pulley
Bracket
Oil Dipstick Guide
◆ O-Ring
Oil Dipstick
Water Pump Cover
◆ Gasket
Washer Pump
◆ Non-reusable part
P18579

SERVICE SPECIFICATIONS

SERVICE DATA

EG07L–08

Thermostat	Valve opening temperature		80 – 84°C (176 – 183°F)
	Valve lift	at 95°C (203°F)	10 mm (0.39 in.) or more
Radiator cap	Relief valve opening pressure	STD	74 – 103 kPa (0.75 – 1.05 kgf/cm², 10.7 – 14.9 psi)
		Limit	59 kPa (0.6 kgf/cm², 8.5 psi)
Electric cooling fan	Rotating amperage		5.7 – 7.7 A

EG

EG07M–0W

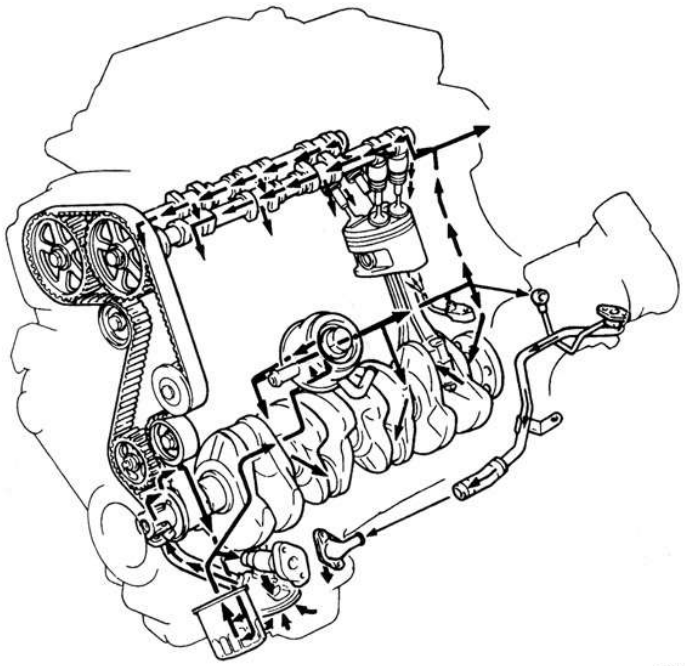
TORQUE SPECIFICATIONS

Part tightened		N·m	kgf·cm	ft·lbf
Cylinder block x Drain plug		25	250	18
Water pump x Water pump cover		8.8	90	78 in.·lbf
Water pump x Cylinder block		7.5	76	66 in.·lbf
Water bypass pipe x Water pump cover		10	100	7
Idler pulley bracket for alternator drive belt	Water pump side	23	230	17
x Cylinder block	Cylinder block side	19	190	14
No.3 timing belt cover x Cylinder head		8.0	82	71 in.·lbf
No.2 idler pulley x Cylinder block		44	450	32
Timing belt tensioner x Cylinder head		21	210	15
No.1 idler pulley x Cylinder head		52	530	38
Camshaft timing pulley x Camshaft		59	600	43
	for SST	41	420	30
Water inlet x Water pump cover		9.0	92	80 in.·lbf

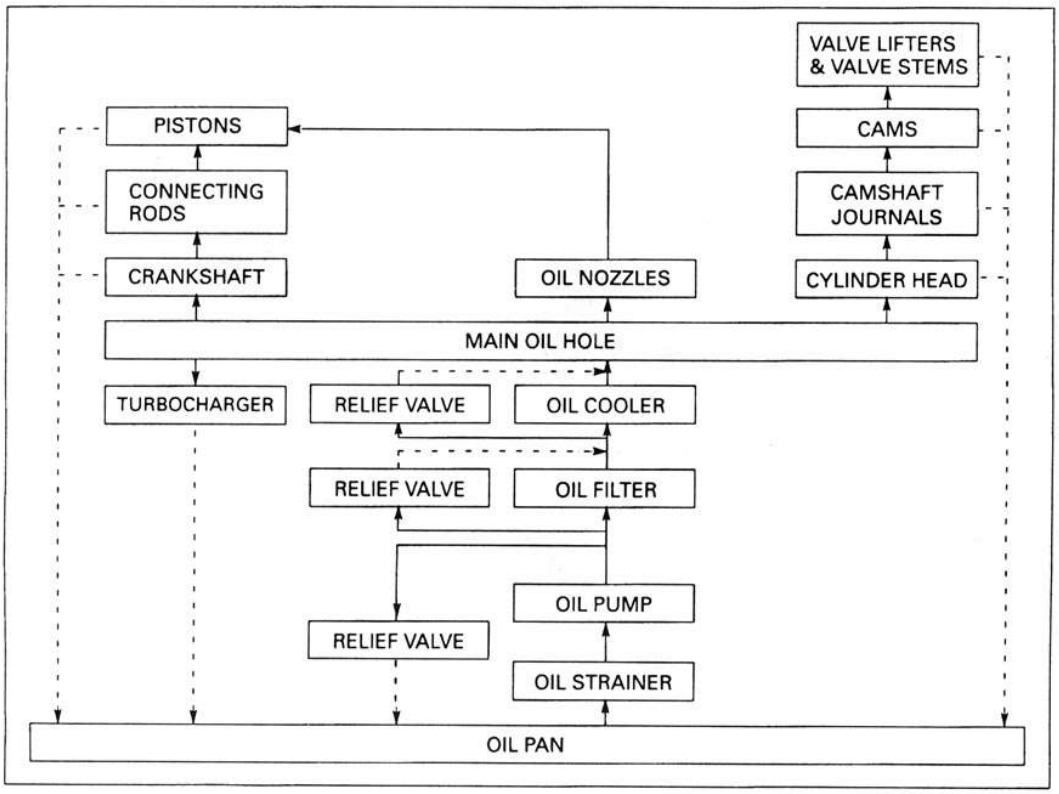
LUBRICATION SYSTEM

OPERATION

EG14S-0K



P18583



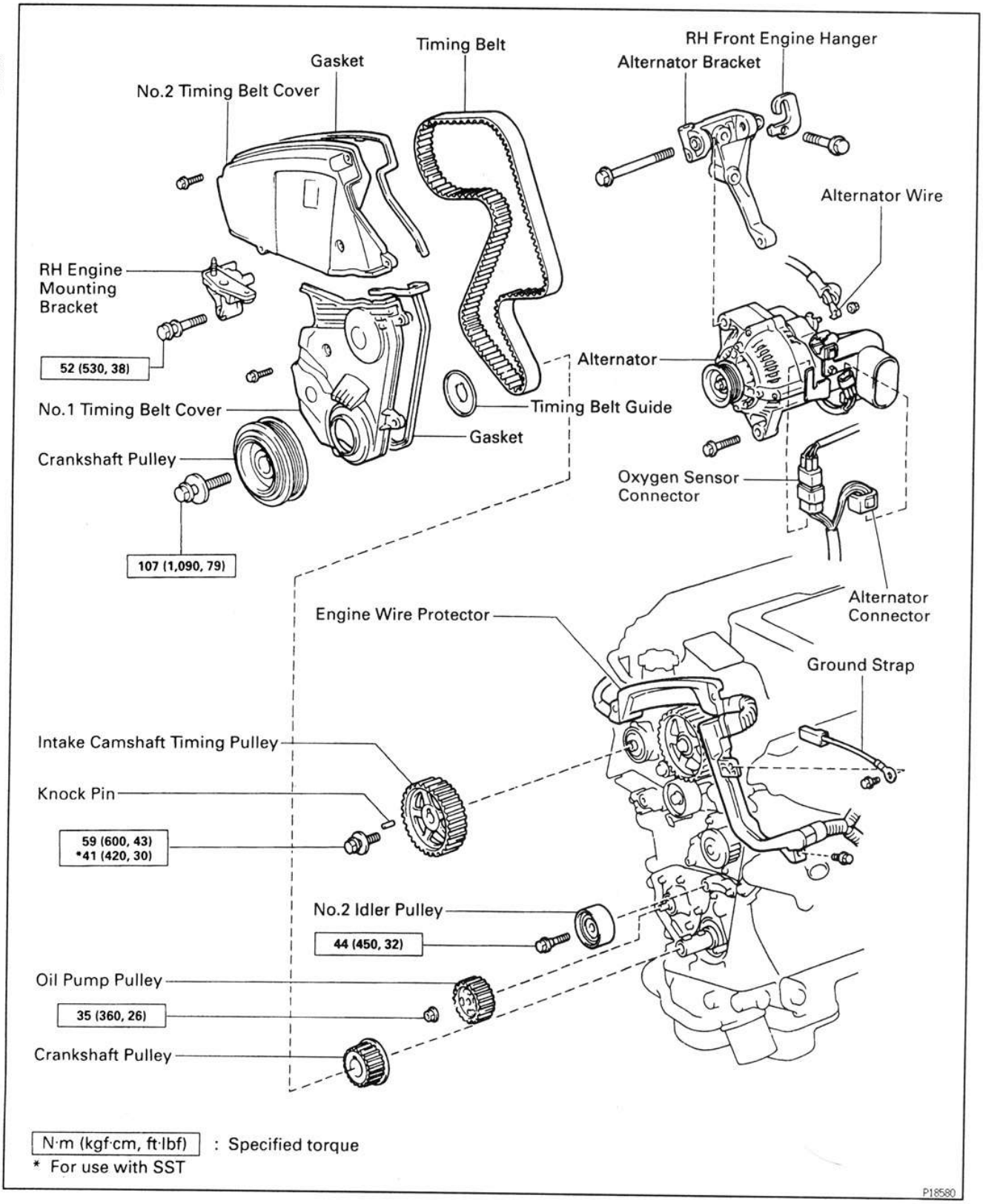
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OIL PUMP

COMPONENTS FOR REMOVAL AND INSTALLATION

EG152-08

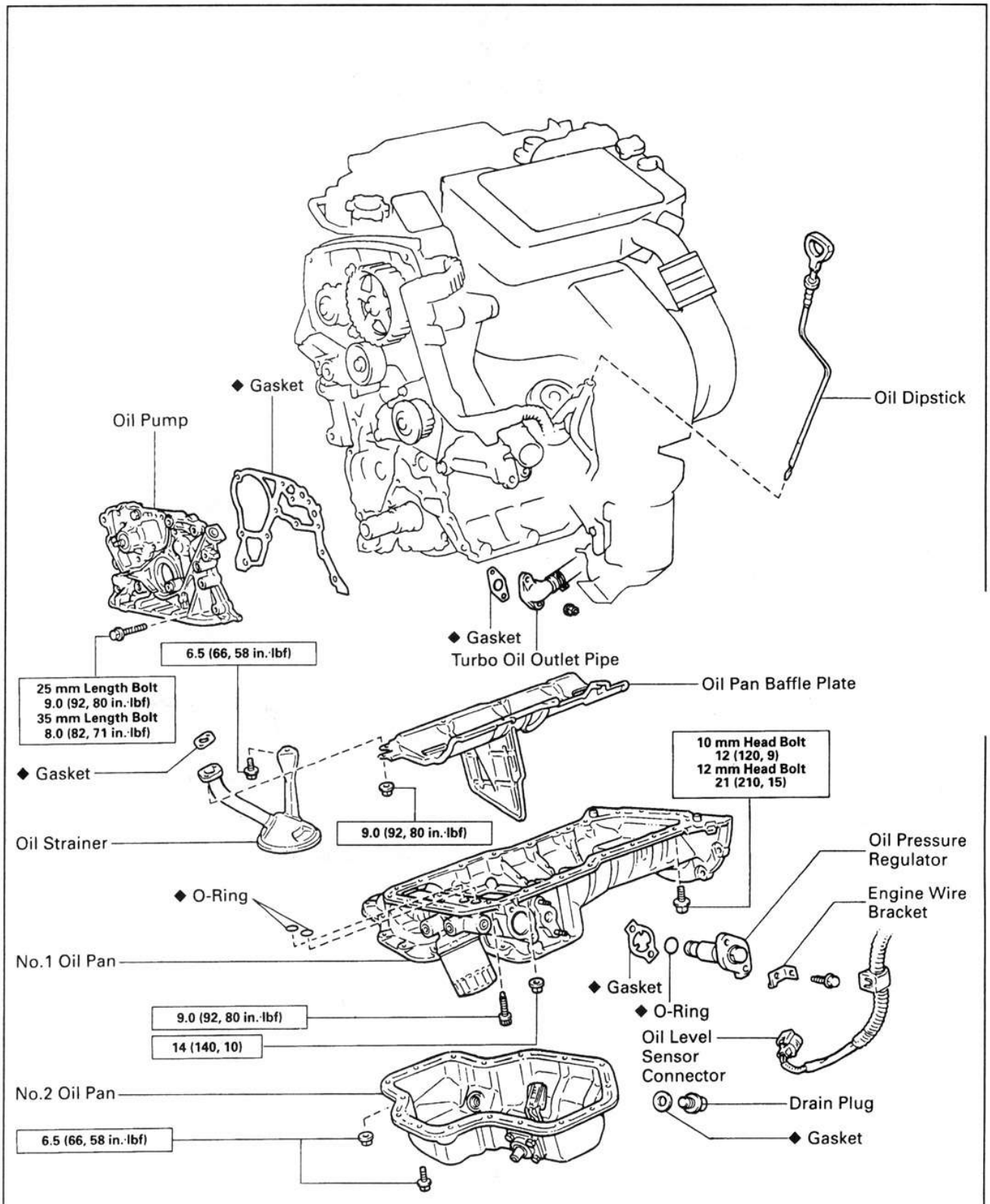


N·m (kgf·cm, ft·lbf) : Specified torque

* For use with SST

P18580

EG



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

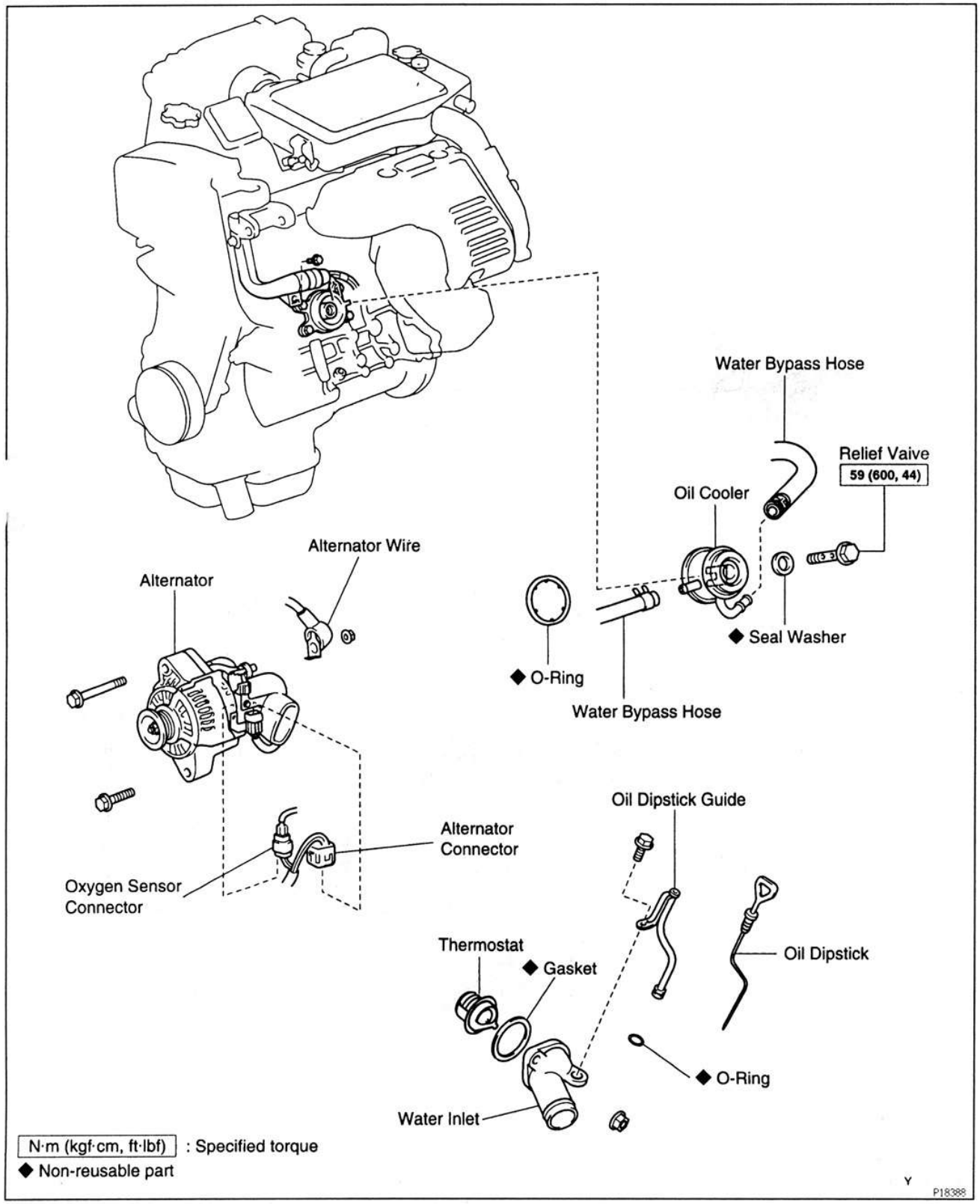
P18581

OIL COOLER

COMPONENTS FOR REMOVAL AND INSTALLATION

EG3Q8-05

EG



SERVICE SPECIFICATIONS

SERVICE DATA

EG15A–0B

Oil pressure		at idle speed	29 kPa (0.3 kgf/cm², 43 psi) or more
		at 5,000 rpm	245 – 490 kPa (2.5 – 5.0 kgf/cm², 36 – 71 psi)
Oil pump	Body clearance	STD	0.10 – 0.16 mm (0.0039 – 0.0063 in.)
		Limit	0.20 mm (0.0079 in.)
	Tip clearance	STD	0.04 – 0.16 mm (0.0016 – 0.0063 in.)
		Limit	0.20 mm (0.0079 in.)

EG

TORQUE SPECIFICATIONS

EG15C–0H

Part tightened	N·m	kgf·cm	ft·lbf
Oil pan x Drain plug	37	380	27
Oil pump body cover x Oil pump body	8.8	90	78 in.·lbf
Oil pump x Cylinder block 25 mm long bolt	9.0	92	80 in.·lbf
35 mm long bolt	8.0	82	71 in.·lbf
Oil strainer x Oil pump	9.0	92	80 in.·lbf
Oil strainer x Cylinder block	6.5	66	58 in.·lbf
Oil pan baffle plate x Cylinder block	6.5	66	58 in.·lbf
No.1 oil pan x Oil pump	9.0	92	80 in.·lbf
No.1 oil pan x Rear oil seal retainer	9.0	92	80 in.·lbf
No.1 oil pan x Cylinder block			
20 mm (0.79 in.) long bolt for 10 mm head	12	120	9
25 mm (0.98 in.) long bolt for 12 mm head	21	210	15
Nut	14	140	10
No.1 oil pan x No.2 oil pan	6.5	66	58 in.·lbf
Turbo oil outlet pipe x No.1 oil pan	20	200	15
Oil pressure regulator x No.1 oil pan	18	180	13
Oil pump pulley x Oil pump drive shaft	35	360	26
No.2 idler pulley x Cylinder block	44	450	32
Oil cooler x Oil cooler bracket (Relief valve)	59	600	44
Oil nozzle x Cylinder block	9.0	92	80 in.·lbf

STARTING SYSTEM

SERVICE SPECIFICATIONS ..... ST– 2

REFER TO 3S-GE ENGINE REPAIR MANUAL (Pub. No. RM396E)

NOTE: The above pages contain only the points which differ from the above listed manual.

SERVICE SPECIFICATIONS

SERVICE DATA

ST015–0K

Starter	Rated voltage and output power		12 V 1.2 kW
	No–load characteristics	Current	90 A or less at 11. 5 V
		rpm	3,000 rpm or more
	Brush length	STD	15.0 mm (0.591 in.)
		Limit	8.0 mm (0.315 in.)
	Spring installed load		10 – 16 N (1.0 – 1.6 kgf, 2.2 – 3.6 lbf)
	Commutator		
	Diameter	STD	30 mm (1.18 in.)
		Limit	29 mm (1.14 in.)
	Undercut depth	STD	0.6 mm (0.024 in.)
		Limit	0.2 mm (0.008 in.)
	Circle runout	Limit	0.05 mm (0.0020 in.)

ST016–0J

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
End cover x Brush holder	1.5	15	13 in.·lbf
Starter housing x Magnetic switch	5.9	60	52 in.·lbf
End cover x Starter housing	5.9	60	52 in.·lbf
Lead wire of field frame x Magnetic switch	7.9	81	70 in.·lbf

CHARGING SYSTEM

ALTERNATOR ..... CH– 2
SERVICE SPECIFICATIONS ..... CH– 3

REFER TO 3S-GE ENGINE REPAIR MANUAL (Pub. No. RM396E)

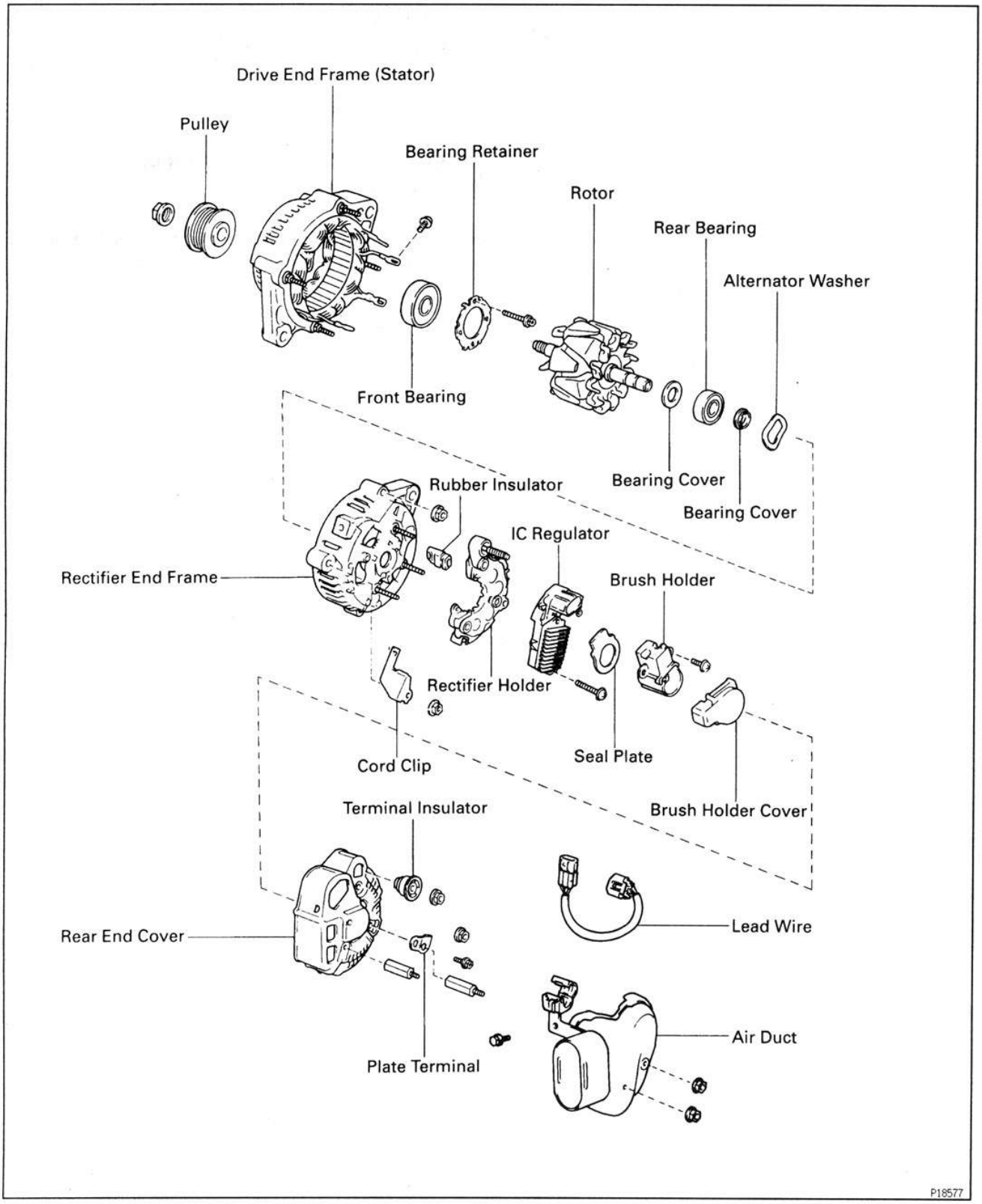
CH

NOTE: The above pages contain only the points which differ from the above listed manual.

ALTERNATOR

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

CH010-08



SERVICE SPECIFICATIONS

SERVICE DATA

CH01A-0G

Battery	Specific gravity	at 20°C (68°F)	1.25 – 1.27
Drive belt	Deflection	w/ A/C New belt	10 – 11 mm (0.39 – 0.43 in.)
		Used belt	13 – 16 mm (0.51 – 0.63 in.)
		w/o A/C New belt	11 – 14 mm (0.43 – 0.55 in.)
		Used belt	12 – 18 mm (0.47 – 0.71 in.)
	Tension	w/ A/C New belt	686 – 785 N (70 – 80 kgf)
		Used belt	294 – 441 N (30 – 45 kgf)
		w/o A/C New belt	461 – 706 N (47 – 72 kgf)
		Used belt	353 – 610 N (36 – 62 kgf)
Alternator	Rated output		12 V 80 A
	Rotor coil resistance		2.8 – 3.0 Ω
	Slip ring diameter	STD	14.2 – 14.4 mm (0.559 – 0.567 in.)
		Limit	12.8 mm (0.504 in.)
	Brush exposed length	STD	10.5 mm (0.413 in.)
		Limit	1.5 mm (0.059 in.)
IC regulator	Regulating voltage	at 25°C (77°F)	13.9 – 15.1 V
		at 115°C (239°F)	13.5 – 14.3 V

CH

TORQUE SPECIFICATIONS

CH01C-0L

Part tightened		N·m	kgf·cm	ft·lbf
Bearing retainer x Drive end frame		2.6	27	23 in.·lbf
Rectifier end frame x Drive end frame		4.5	46	40 in.·lbf
Cord clip x Rectifier end frame		5.4	55	47 in.·lbf
Alternator pulley x Rotor		110	1,125	81
Rectifier holder x Coil lead on rectifier end frame		2.9	30	26 in.·lbf
Rear end cover x Rectifier holder		4.4	45	39 in.·lbf
Plate terminal x Rectifier holder	Nut	4.4	45	39 in.·lbf
	Bolt	3.8	39	34 in.·lbf
Terminal insulator x Rectifier holder		4.1	42	36 in.·lbf
Air duct x Rear end cover		4.4	45	39 in.·lbf
Air duct x Rectifier end frame		3.4	35	30 in.·lbf

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QUALITY SERVICE

OVERSEAS SERVICE DIVISION
TOYOTA MOTOR CORPORATION

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