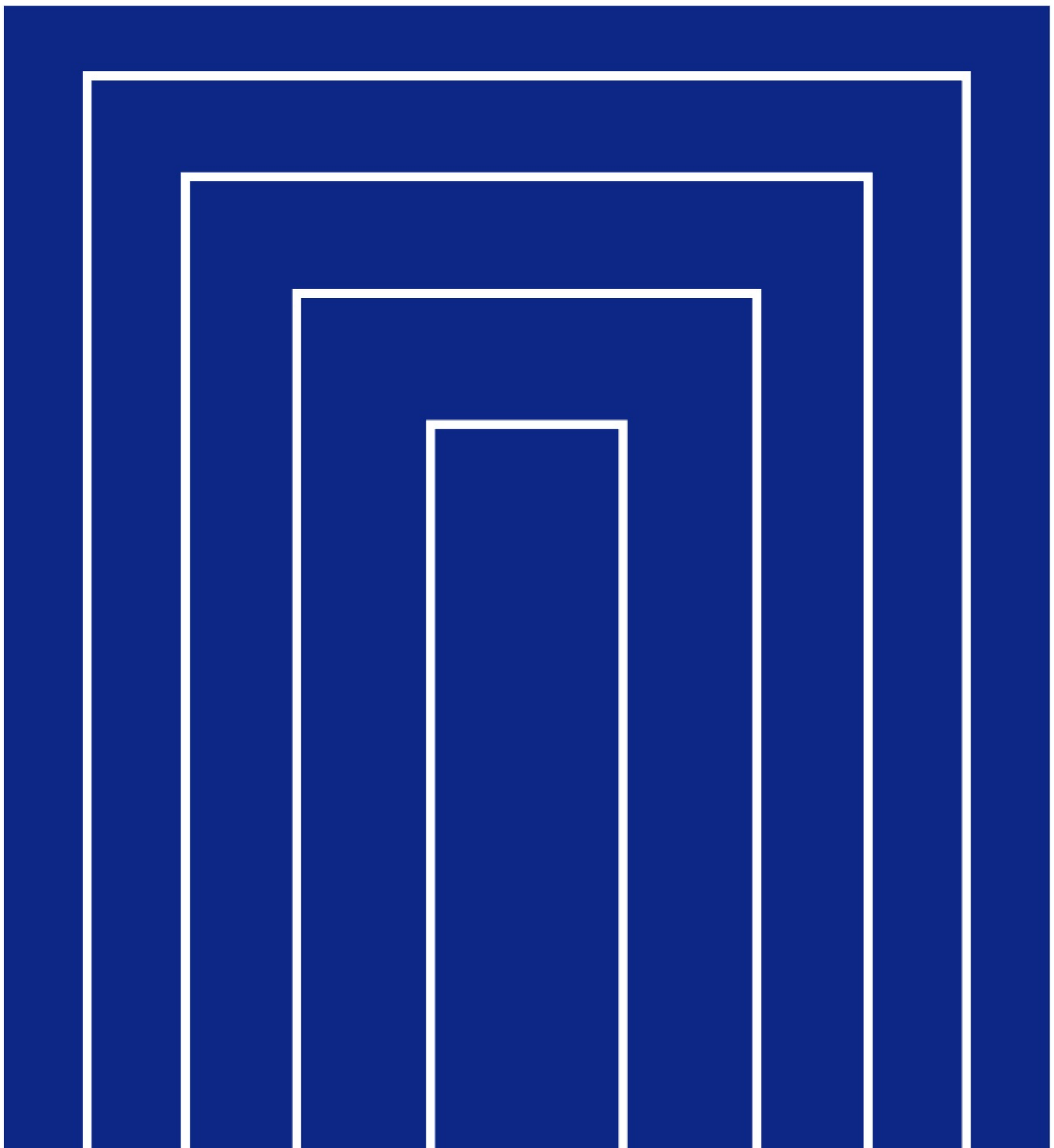
TOYOTA

3RZ-F, 3RZ-FE ENGINE

REPAIR MANUAL

Apr., 1996



Pub. No. RM521E

FOREWORD

This repair manual has been prepared to provide information covering general service repairs for the 3RZ-F, 3RZ-FE engine equipped in the TOYOTA LAND CRUISER.

Applicable models: RZJ90, RZJ95 series

Please note that the publications below have also been prepared as relevant service manuals for the components and system in this engine.

Manual Name	Pub. No.
• LAND CRUISER/LAND CRUISER PRADO	NCF131E

All information in this manual is based on the latest product information at the time of publication. However, specifications and procedures are subject to change without notice.

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STARTING ST
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INTRODUCTION

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HOW TO USE THIS MANUAL

IN002-1E

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.

IN

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.

TROUBLESHOOTING

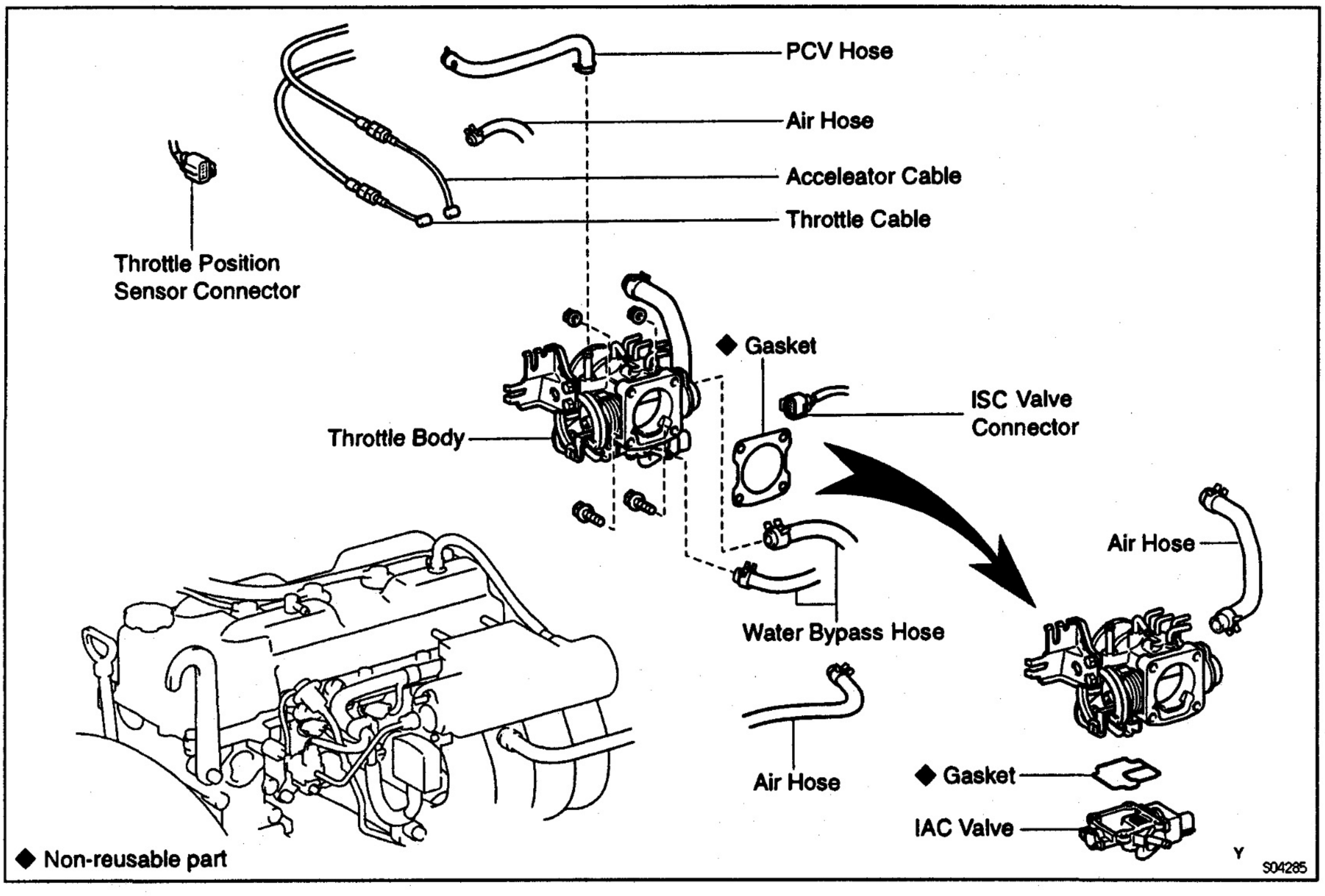
TROUBLESHOOTING tables are included for each system to help you diagnose the problem and find the cause.

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.

REPAIR PROCEDURES

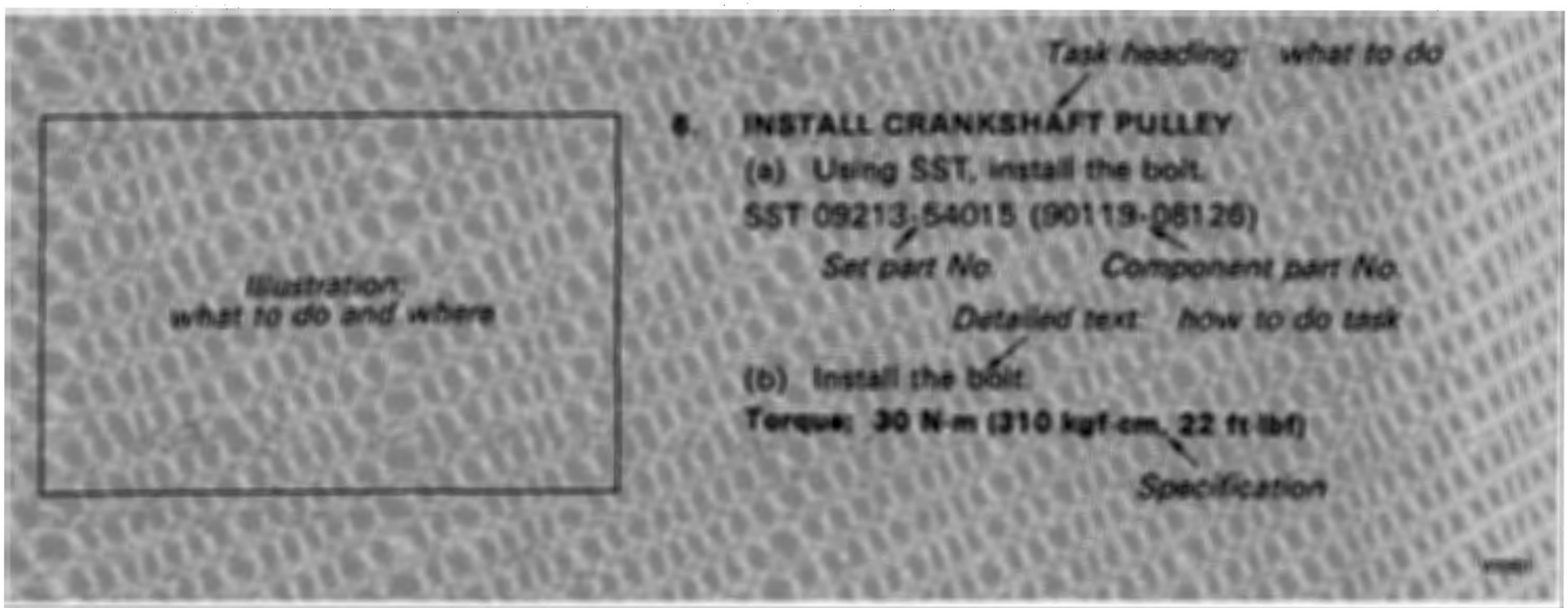
Most repair operations begin with an overview illustration. It identifies the components and shows how the parts fit together.
Example:



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.

Example:



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

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

SPECIFICATIONS

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.

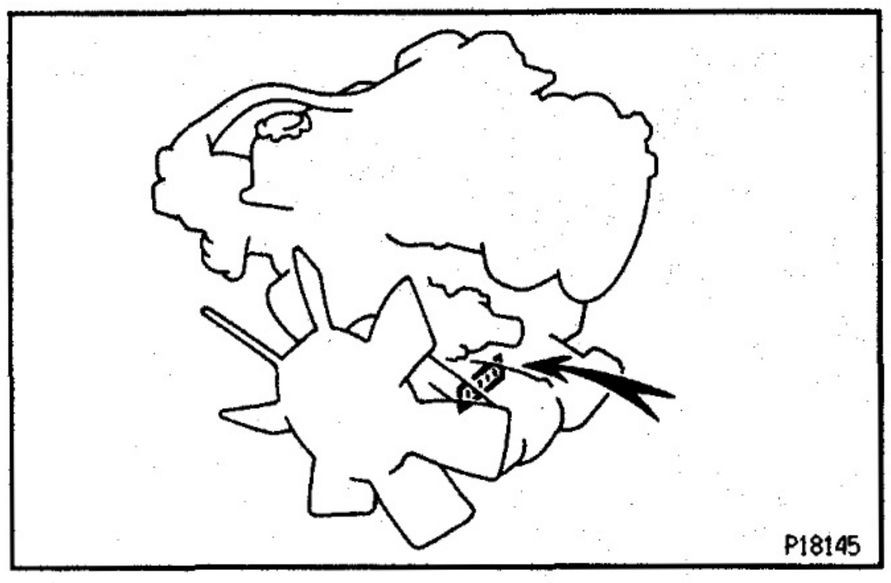
CAUTIONS, NOTICES, HINTS:

- 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

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)

IN



IDENTIFICATION INFORMATION

ENGINE SERIAL NUMBER

IN004-0C

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

GENERAL REPAIR INSTRUCTIONS

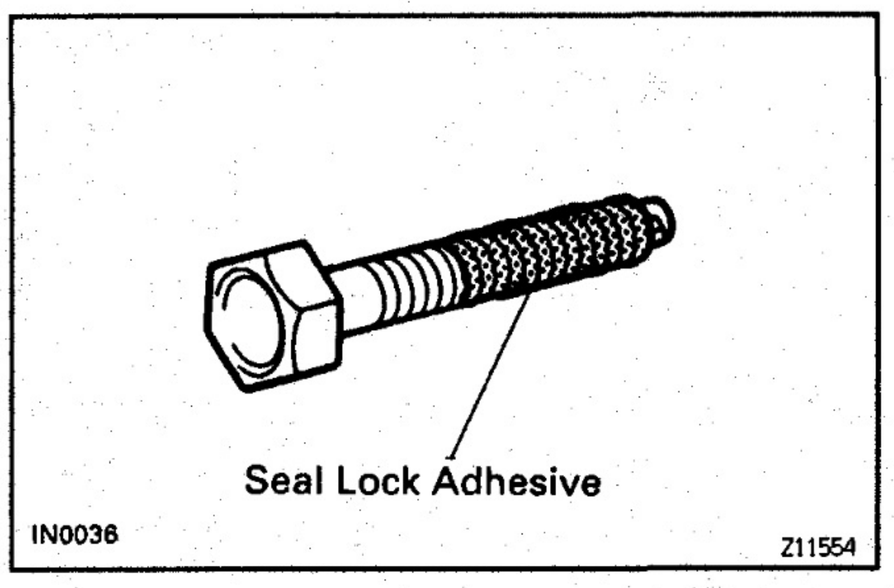
IN05M-03

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 cable from the negative (−) terminal which is grounded to the vehicle body.
(c) To prevent damage to the battery terminal post, loosen the terminal nut and raise the cable straight up without twisting or prying it.
(d) Clean the battery terminal posts and cable terminals with a shop rag. Do not scrape them with a file or other abrasive objects.
(e) Install the cable terminal to the battery post with the nut loose, and tighten the nut after installation. Do not use a hammer to tap the terminal onto the post.
(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.

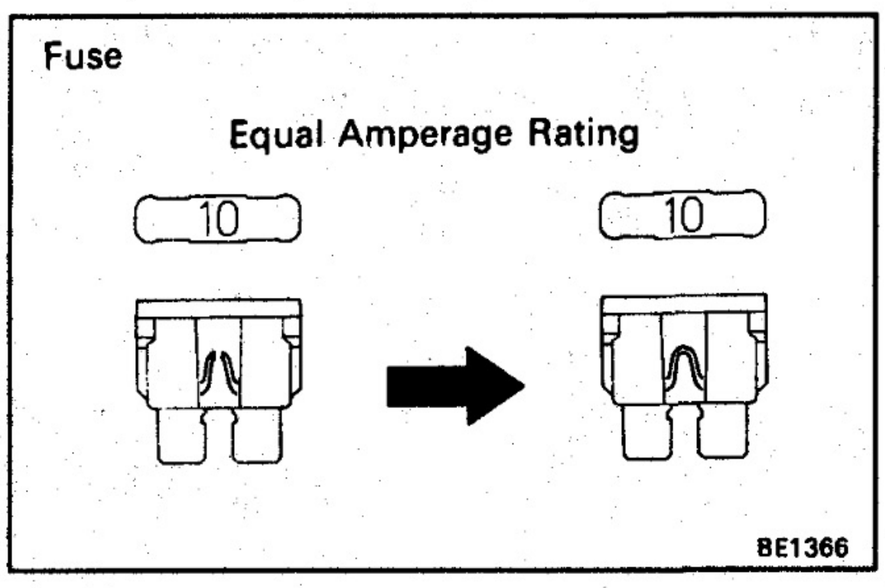
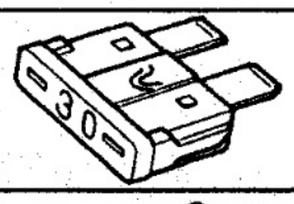
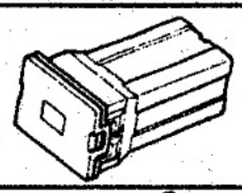
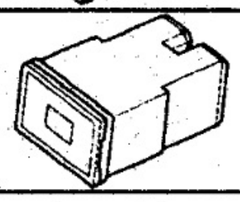
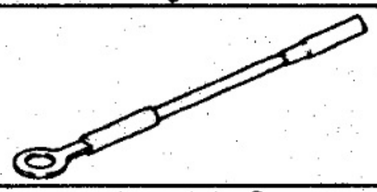
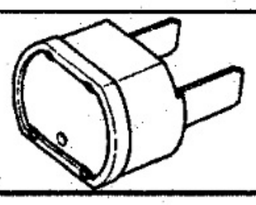
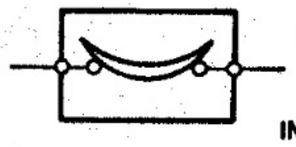
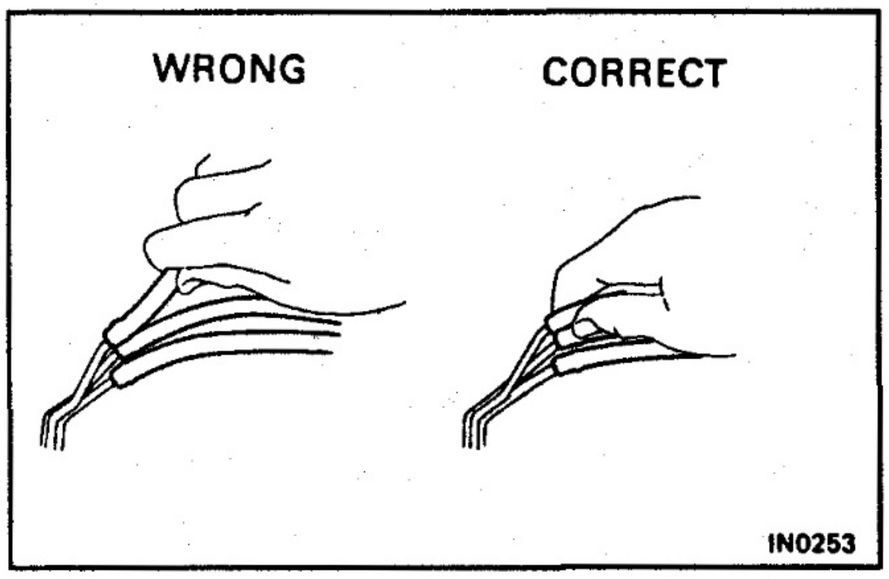
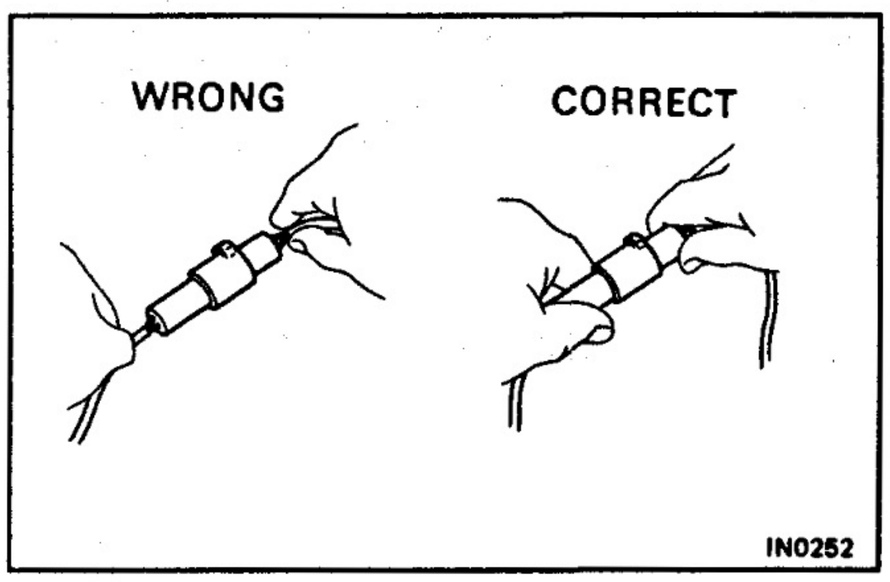


Illustration	Symbol	Part Name	Abbreviation
 BE5594	IN0365	FUSE	FUSE
 BE5595	IN0366	MEDIUM CURRENT FUSE	M-FUSE
 BE5596	IN0367	HIGH CURRENT FUSE	H-FUSE
 BE5597	IN0367	FUSIBLE LINK	FL
 BE5598	 IN0368	CIRCUIT BREAKER	CB

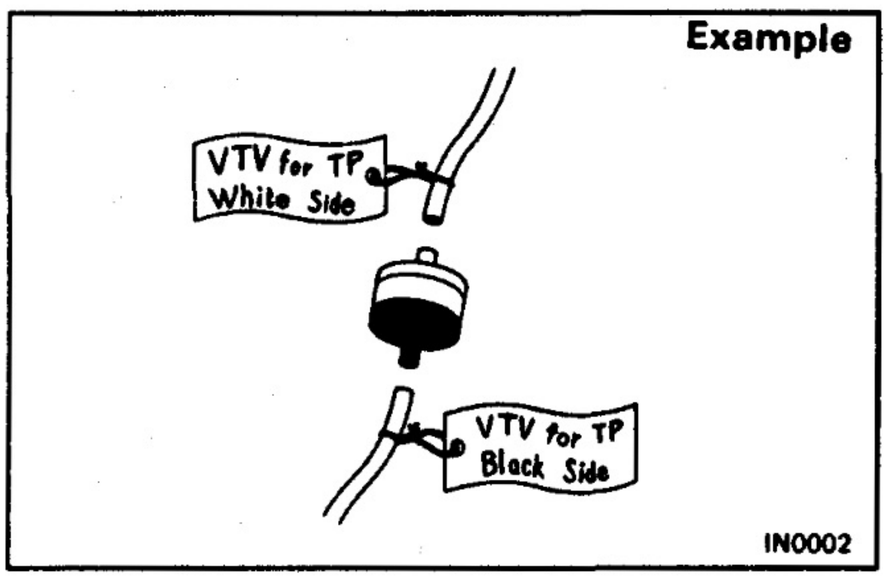
V00076

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 necessary. (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, air filter, and VCV 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

IF VEHICLE IS EQUIPPED WITH MOBILE COMMUNICATION SYSTEM

IN03R–00

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.

FOR USING OBD Ⅱ SCAN TOOL OR HAND–HELD TESTER

IN06Q–01

CAUTION: Observe these for safety reasons:

- Before using the OBD Ⅱ scan tool or hand–held tester, the OBD Ⅱ scan tool,s instruction book or hand–held tester,s operator manual should be read thoroughly.
- Be sure to rote all cableas securely when driving with the OBD Ⅱ scan tool or hand–held tester connected to the vihicle. (I.e. Keep cables away from feet, pedals, steering wheel and shift lever.)
- Two persons are required when test driving with the OBD Ⅱ scan tool or hand–held tester, one person to drive the vehicle and one person to operate the OBD Ⅱ scan tool or hand–held tester.

IN

ABBREVIATIONS USED IN THIS MANUAL

1IN031—0L

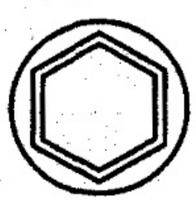
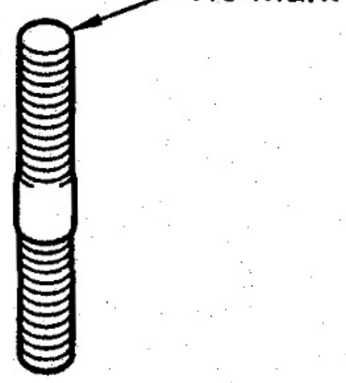
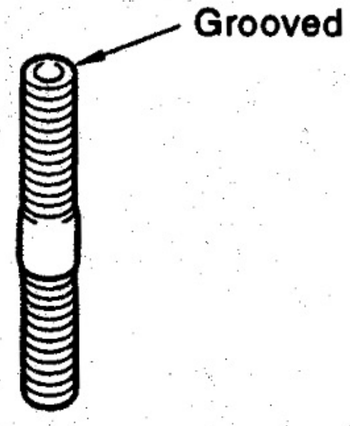
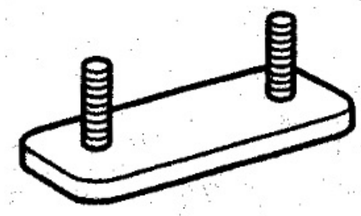
A/C	Air conditioner
AAP	Auxiliary Acceleration Pump
BTDC	Before Top Dead Center
BVSV	Bimetallic Vacuum Switching Valve
CB	Circuit Breaker
CO	Chock Breaker
DOHC	Double Over Head Cam
EX	Exhaust
FIPG	Formed in Place Gasket
FL	Fusible Link
H—Fuse	High Current Fuse
ECT	Electronic Controlled Transmission
ECU	Electronic Control Unit
EFI	Electronic Fuel Injection
IAT	Intake Air Temperature
MAF	Mass Air Flow Meter
PCV	Positive Crankcase Ventilation
IG	Ignition
IN	Intake
LH	Left—Hand
Max.	Maximum
M—Fuse	Medium Current Fuse
O/S	Oversize
OVCV	Outer Vent Control Valve
RH	Right—Hand
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch
TEMP.	Temperature
TDC	Top Dead Center
TP	Throttle Positioner
U/S	Undersize
VSV	Vacuum Switching Valve
w/	With
w/o	Without

STANDARD BOLT TORQUE SPECIFICATIONS

IM00V-06

IN

HOW TO DETERMINE BOLT STRENGTH

	Mark	Class		Mark	Class
Hexagon head bolt		4T 5T 6T 7T 8T 9T 10T 11T	Hexagon flange bolt w/ washer hexagon bolt	4 Protruding lines	9T
			Hexagon flange bolt w/ washer hexagon bolt	5 Protruding lines	10T
	No mark	4T	Hexagon flange bolt w/ washer hexagon bolt	6 Protruding lines	11T
Hexagon flange bolt w/ washer hexagon bolt	 No mark	4T	Stud bolt		4T
Hexagon head bolt	2 Protruding lines	5T			
Hexagon flange bolt w/ washer hexagon bolt	2 Protruding lines	6T			6T
Hexagon head bolt	3 Protruding lines	7T	Welded bolt		4T
Hexagon head bolt	4 Protruding lines	8T			

V06821

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

V00079

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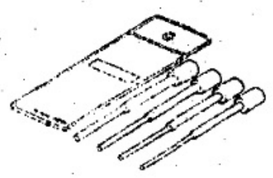
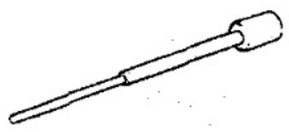
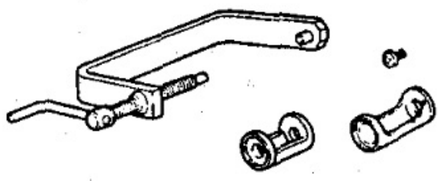
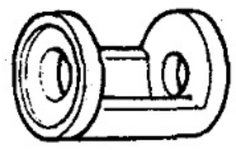
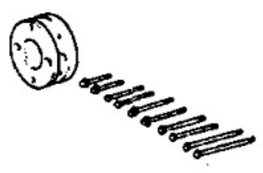
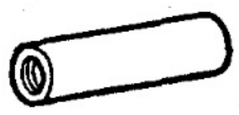
ENGINE MECHANICAL

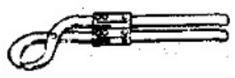
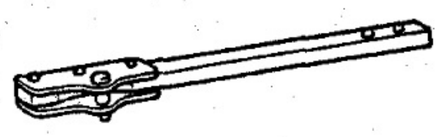
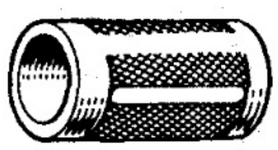
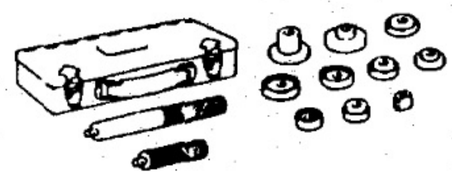
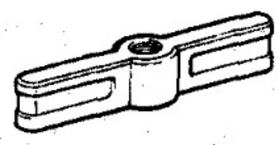
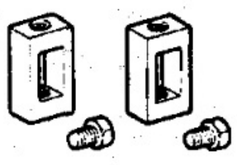
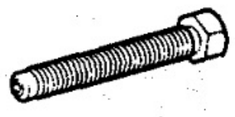
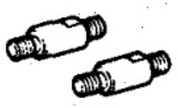
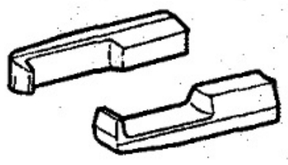
PREPARATION

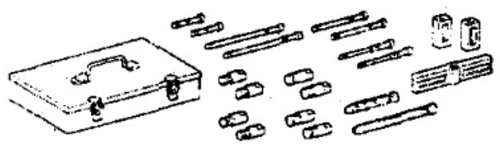
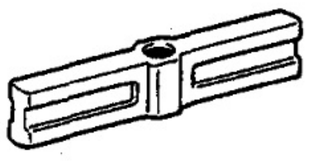
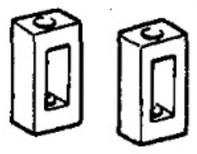
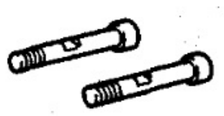
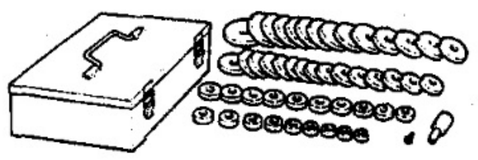
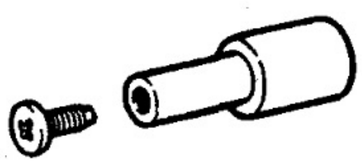
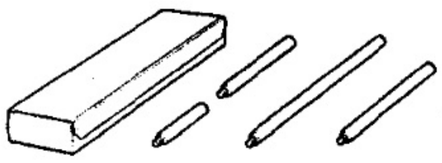
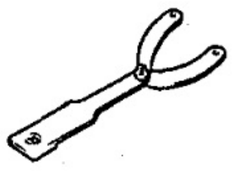
SST (SPECIAL SERVICE TOOLS)

EG0AY-28

EG

	09032-00100 Oil Pan Seal Cutter	
	09201-10000 Valve Guide Bushing Remover & Replacer Set	
	(09201-01060) Valve Guide Bushing Remover & Replacer 6	
	09202-70020 Valve Spring Compressor	
	(09202-00010) Attachment	
	09207-76010 Rocker Arm Bushing	
	09213-54015 Crankshaft Pulley Holding Tool	
	09223-15030 Oil Seal & Bearing Replacer	Crankshaft rear oil seal
	09236-00101 Water Pump Overhaul Tool Set	
	(09236-15010) Bearing Stay	Valve stem oil seal
	09243-00020 Idle Adjusting Screw Wrench	
	09248-55040 Valve Clearance Adjust Tool Set	

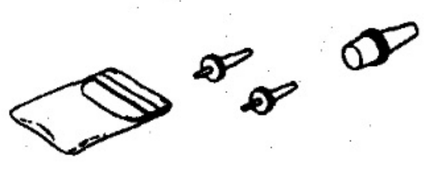
	(09248−05410) Valve Lifter Press	
	(09248−05420) Valve Lifter Stopper	
	09330−00021 Companion Flange Holding Tool	Crankshaft pulley
	09636−20010 Upper Ball Joint Dust Cover Replacer	Crankshaft timing gear
	09816−30010 Oil Pressure Switch Socket	Knock sensor Oil pressure switch
	09843−18020 Diagnosis Check Wire	
	09550−10012 Replacer Set "B"	
	(09252−10010) No. 1 Replacer Handle−	
	09950−40010 Puller B Set	Crankshaft timing gear
	(09951−04010) Hanger 150	
	(09952−04010) Slide Arm	
	(09953−04010) Center Bolt 100	
	(09954−04010) Arm 25	
	(09955−04060) Claw No.6	

	09950–50010 Puller C Set	Crankshaft pulley
	(09951–05010) Hanger 150	
	(09952–05010) Slide Arm	
	(09953–05010) Center Bolt 100	
	(09954–05020) Claw No.2	
	09950–60010 Replacer Set	Spark plug tube gasket
	(09951–00260) Replacer 26	
	(09951–00490) Replacer 49	
	(09952–06010) Adapter	
	09950–70010 Handle Set	
	(09951–07150) Handle 150	Valve guide bushing Spark plug tube gasket Crankshaft rear oil seal
	09960–10010 Variable Pin Wrench Set	
	(09962–01000) Variable Pin Wrench Arm Assy	
	(09963–00500) Pin 5	Exhaust camshaft sub–gear

EG

EG0AZ–1W

RECOMMENDED TOOLS

	09082–00040	TOYOTA Electrical Tester.	
	09200–00010	Engine Adjust Kit .	
	09258–00030	Hose Plug Set .	Plug for the vacuum hose, fuel hose etc.

EG

EG080–1Z

EQUIPMENT

Caliper gauge	
CO meter	
Compression gauge	
Connecting rod aligner	
Cylinder gauge	
Dial indicator	
Dye penetrant	
Engine tune–up tester	
Heater	
Magnetic finger	
Micrometer	
Piston ring compressor	
Piston ring expander	
Plastigage	
Precision straight edge	
Soft brush	
Spring tester	Valve spring
Steel square	Valve spring
Thermometer	
Torque wrench	
V–block	
Valve seat cutter	
Vernier calipers	

EG081–2Z

SSM (SPECIAL SERVICE MATERIALS)

08826–00080	Seal Packing Black or equivalent (FIPG)	Over space between cylinder head and timing chain cover Semi–circular plug Oil pan, Rear oil seal retaine
08833–00070	Adhesive 1324, THREE BOND 1324 or equivalent	Spark plug tube Drive plate bolt

08833–00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure switch

EG

IDLE CO CHECK AND ADJUST (3RZ–FE)

EG5HV–02

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

1. INITIAL CONDITIONS

(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All 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 meter calibrated by hand

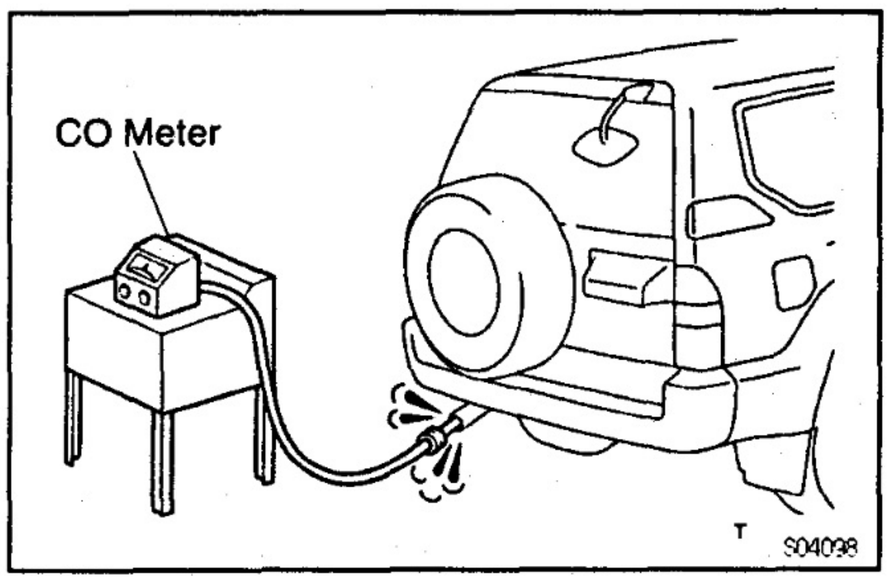
2. CHECK AND ADJUST CO CONCENTRATION AT IDLE

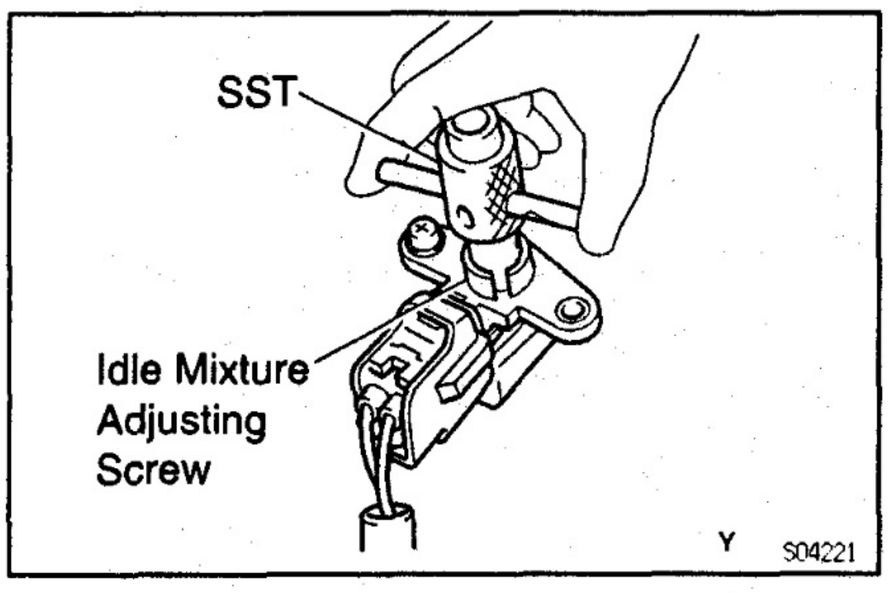
NOTICE: Always use a CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture screw in most vehicles if they are in good condition. If a CO meter is not available, DO NOT ATTEMPT TO ADJUST IDLE MIXTURE.

(a) Race the engine at 2,500 rpm for approx. 180 seconds.
(b) Insert a tester probe at least 40 cm (1.3 ft) into the tailpipe.
(c) Wait at least 1 minute before measuring to allow the concentration to stabilize. Complete the measuring within 3 minutes.

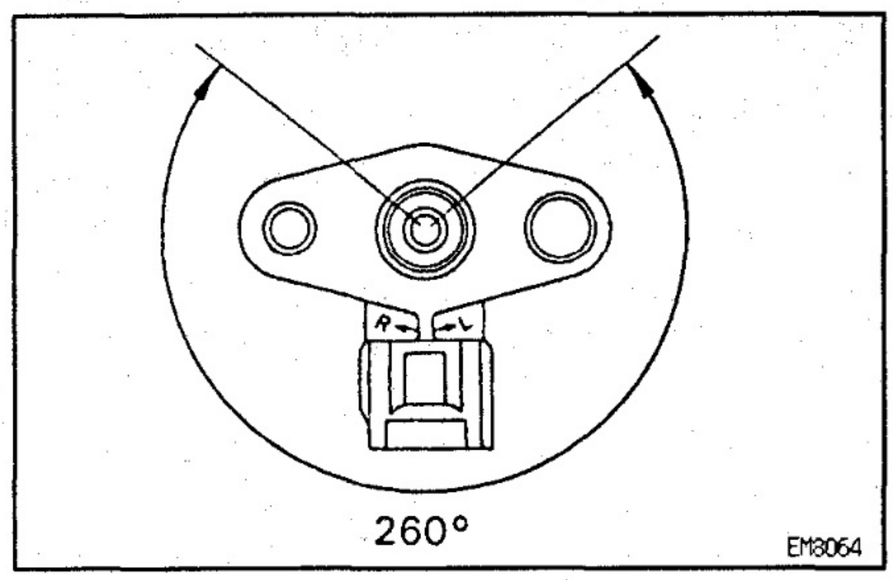
Idle CO concentration:

1.5 ± 0.5 %





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



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

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

Troubleshooting

CO	Phenomenon	Causes
High	Rough idle (Black smoke from exhaust)	1. Clogged air filter 2. Plugged PCV valve 3. Faulty EFI systems: • Faulty pressure regulator • Clogged fuel return line • Defective water temperature sensor • Faulty engine ECU • Faulty injectors • Faulty throttle position sensor • Faulty air flow meter

V06463

EG78E-01

A. METHOD WITH CO METER (3RZ–F)

1. VISUALLY INSPECT CARBURETOR

(a) Check for loose screws or a loose mounting to the manifold.

(b) Check for wear in the linkage, missing snap rings or excessive looseness in the throttle shaft. Correct any problems found.

2. INITIAL CONDITIONS

(a) Air cleaner installed

(b) Normal operating coolant temperature

(c) Choke fully open

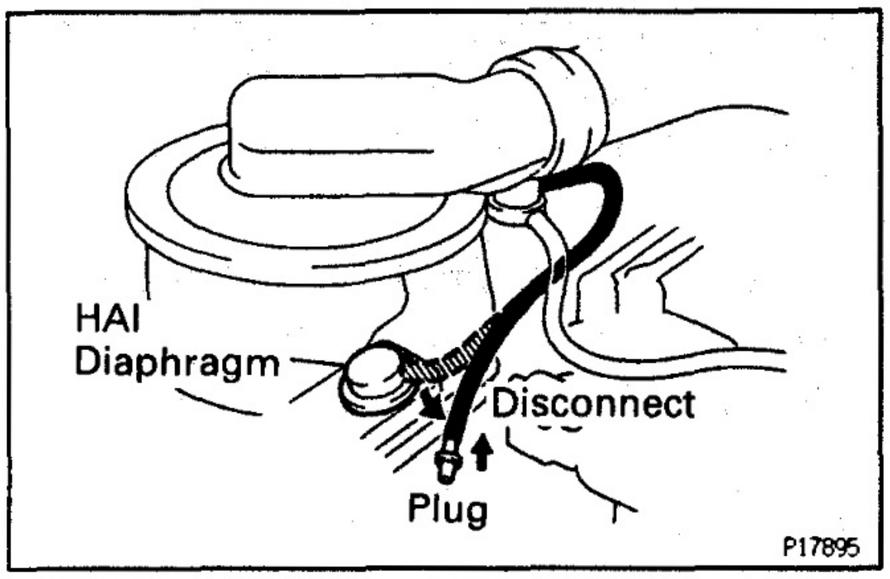
(d) All accessories switched off

(e) All vacuum lines connected

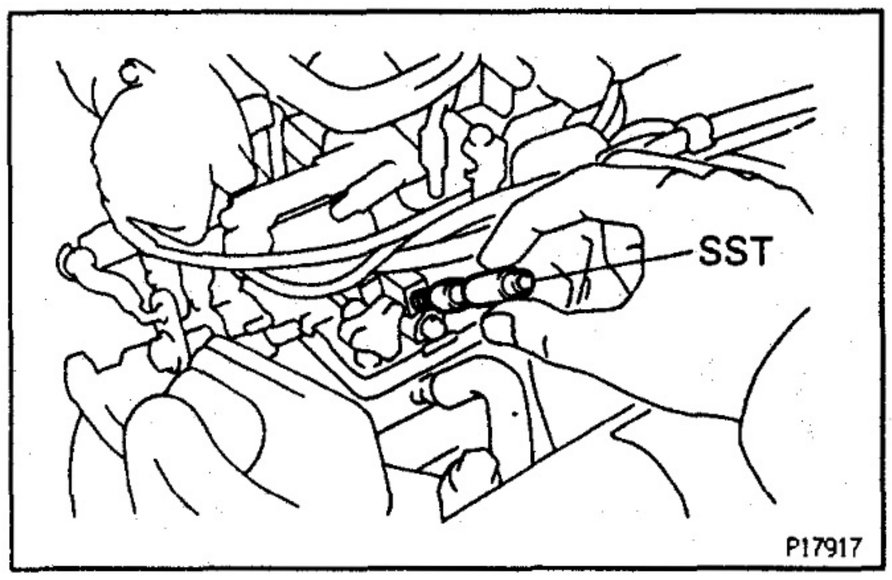
(f) Ignition timing set correctly

(g) Transmission in the neutral range

(h) CO meter operates normally

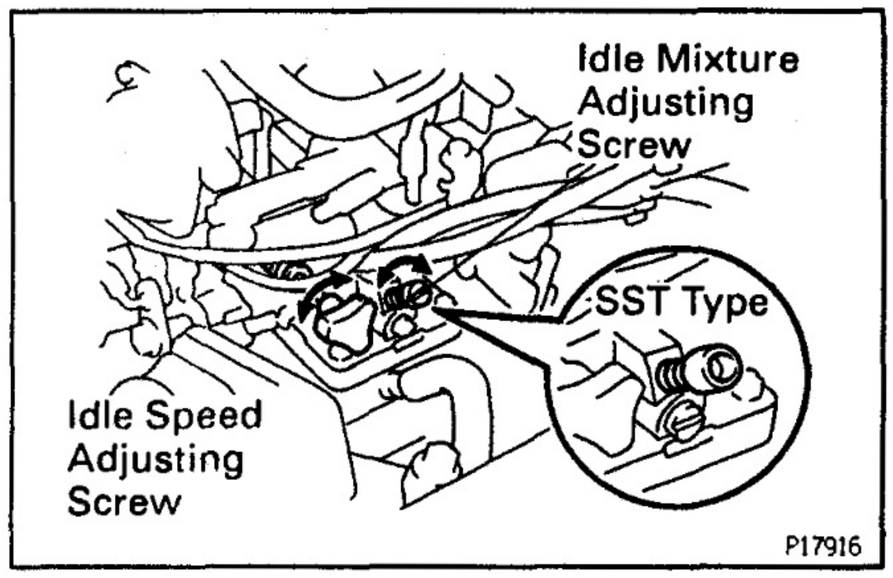


3. DISCONNECT HOT AIR INTAKE (HAI) VACUUM HOSE AND PLUG HOSE END



4. ADJUST IDLE SPEED AND IDLE MIXTURE

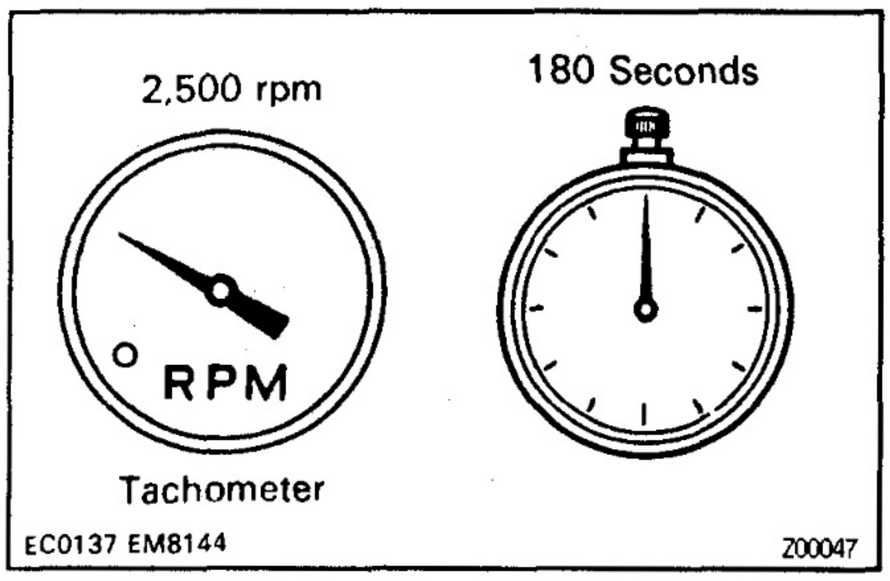
HINT: Use SST if necessary.
SST 09243—00020



(a) Start the engine.
(b) Using a CO meter to measure the CO concentration in the exhaust, turn the idle speed and idle mixture adjusting screws to obtain the specified concentration value at idle speed.

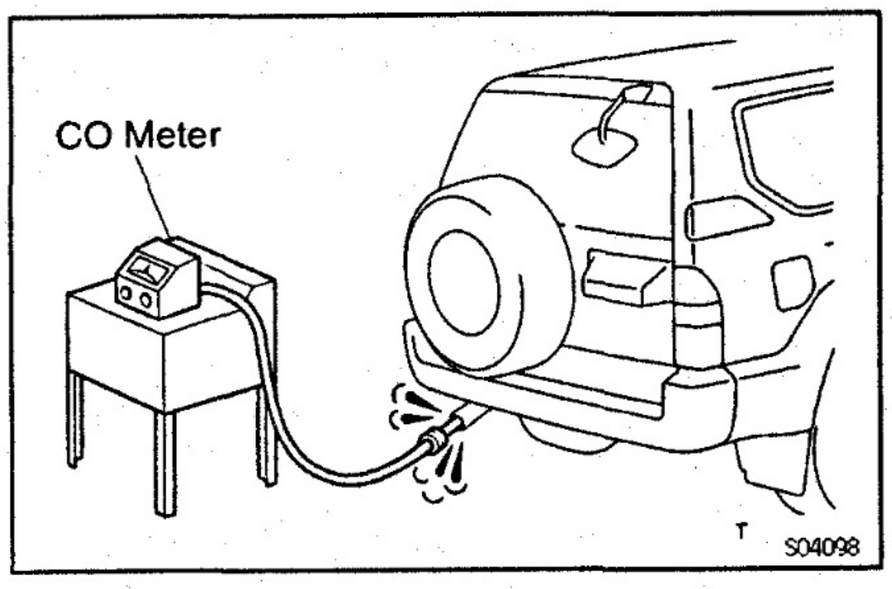
Idle speed:

800 rpm



4. INSPECT CO CONCENTRATION

(a) Check that the CO meter is properly calibrated.
(b) Race the engine 180 seconds at about 2,500 rpm before measuring concentration.
(c) Wait 1—3 minutes after racing the engine to allow the concentration to stabilize.



(d) Insert a testing probe at least 40 cm (1.3 ft) into the tailpipe, and measure the CO concentration within a short time.

Idle CO concentration:

1.5 ± 0.5 %

- If the CO concentration is within specification this adjustment is complete.
- If the CO concentration is not within specification, turn the idle mixture adjusting screw to obtain the specified concentration value.
- If the CO concentration cannot be corrected by adjusting the idle mixture, see table below for other possible causes.

(c) Reconnect the HAI vacuum hose.

TROUBLESHOOTING

CO	Problems	Causes
High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty carburetion: • Faulty choke action • Incorrect float setting • Leaking needle or seat • Leaking power valve

V08001

EG0V7-03

B. ALTERNATIVE METHOD (3RZ–F)

To be used only if CO meter is not available.

1. VISUALLY INSPECT CARBURETOR

(a) Check for loose screws or loose a mounting to the manifold.

(b) Check for wear in the linkage, missing snap rings or excessive looseness in the throttle shaft. Correct any problems found.

2. INITIAL CONDITIONS

(a) Air cleaner installed

(b) Normal operating coolant temperature

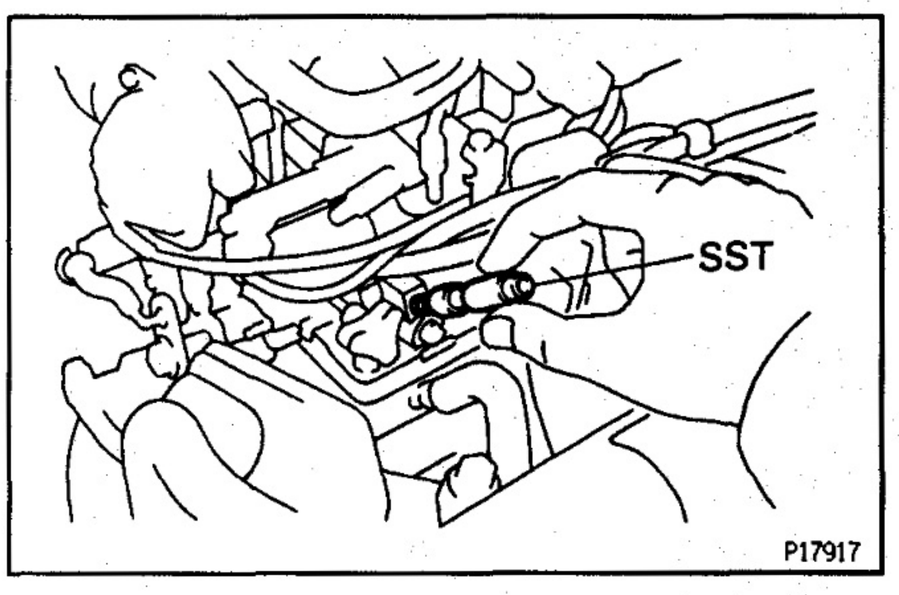
(c) Choke fully open

(d) All accessories switched off

(e) All vacuum lines connected

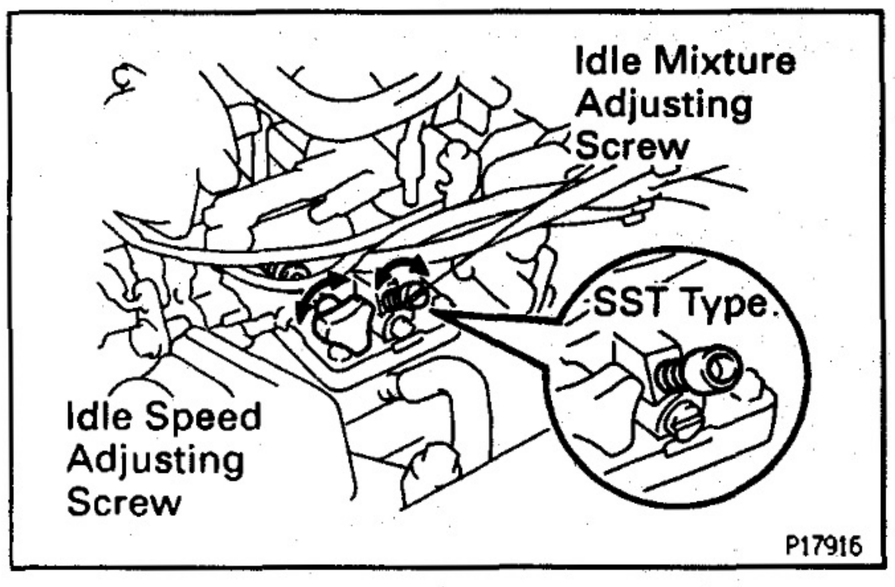
(f) Ignition timing set correctly

(g) Transmission in neutral range



3. ADJUST IDLE SPEED AND IDLE MIXTURE

HINT: Use SST if necessary.
SST 09243–00020

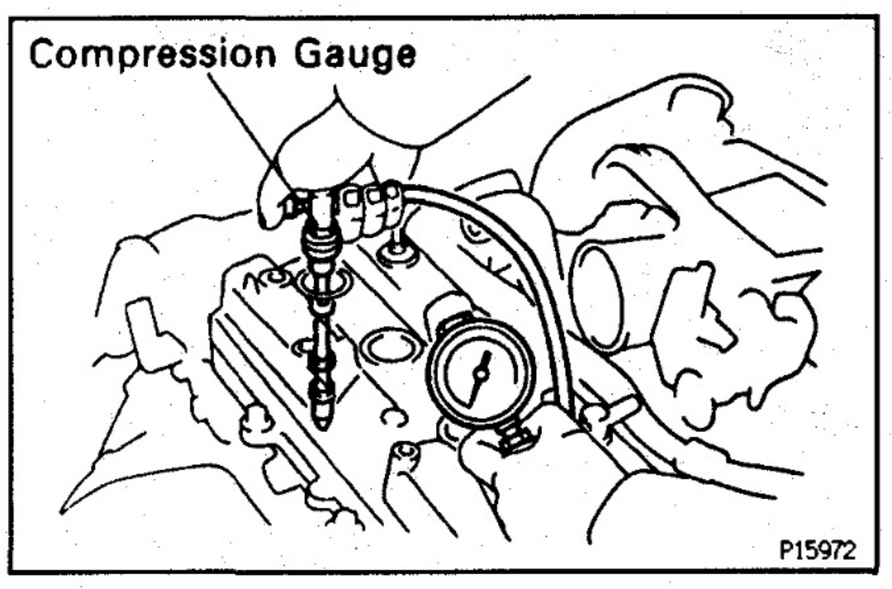


(a) Start the engine.
(b) Set to the maximum speed by turning the idle mixture adjusting screw.
(c) Set to the idle mixture speed by turning the idle speed adjusting screw.
Idle mixture speed:
850 rpm
(d) Before moving to the next step continue adjustments (b) and (c) until the maximum speed will not rise any further no matter how much the idle mixture adjusting screw is adjusted.
(e) Set to the idle speed by screwing in the idle mixture adjusting screw.
Idle speed:
750 – 850 rpm
This is Lean Drop Method for setting idle speed and mixture.

COMPRESSION CHECK

EG64C-02
HINT: If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. **WARM UP AND STOP ENGINE**
2. **3RZ–FE:**
REMOVE INTAKE AIR CONNECTOR
3. **REMOVE DISTRIBUTOR CONNECTORS**
4. **DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS**
NOTICE: Pulling on or bending the cords may damage the conductor inside.
5. **REMOVE SPARK PLUGS**



6. 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:

1,230 kPa (12.5 kgf/cm², 178 psi) or more

Minimum pressure:

880 kPa (9.0 kgf/cm², 127 psi)

Difference between each cylinder:

98 kPa (1.0 kgf/cm², 14 psi) or less

(e) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.

- If adding oil helps the compression, chances are that the piston rings and/or cylinder bore are worn or damage.
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

7. REINSTALL SPARK PLUGS

Torque: 19 N·m (200 kgf·cm, 14 ft·lbf)

8. REINSTALL HIGH—TENSION CORDS TO SPARK PLUGS

9. RECONNECT DISTRIBUTOR CONNECTOR

10. 3RZ—FE:
REINSTALL INTAKE AIR CONNECTOR

EG

VALVE CLEARANCE INSPECTION AND ADJUSTMENT

EG78F-01

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

1. **REMOVE INTAKE AIR CONNECTOR**
2. **REMOVE PCV HOSES**
3. **DISCONNECT HIGH—TENSION CORDS FROM SPARK PLUGS**

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

4. **3RZ—FE:**

DISCONNECT ENGINE WIRE

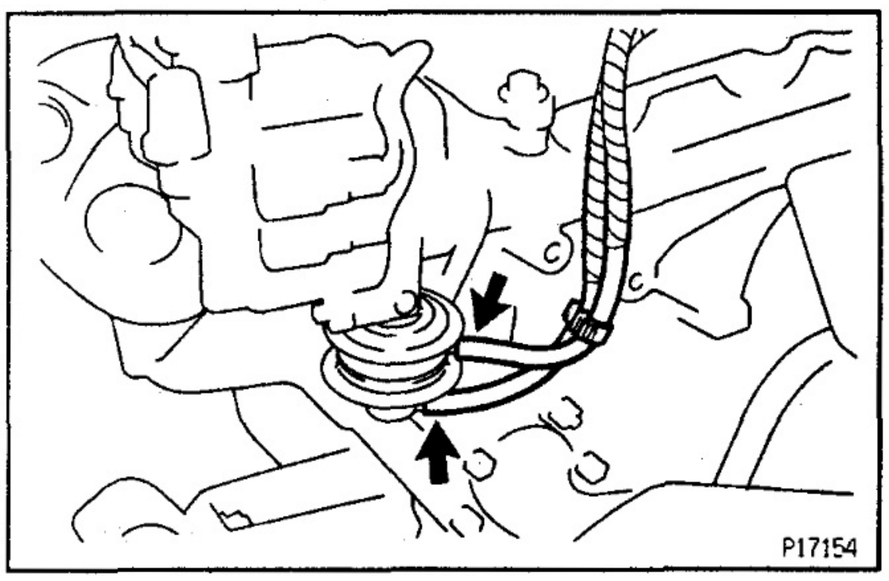
(a) Disconnect these connectors:
- w/ A/C:
  A/C compressor connector
- Oil pressure sensor connector
- Engine coolant temperature sender gauge connector
- Distributor connector

(b) Disconnect the 4 engine wire clamps and engine wire.

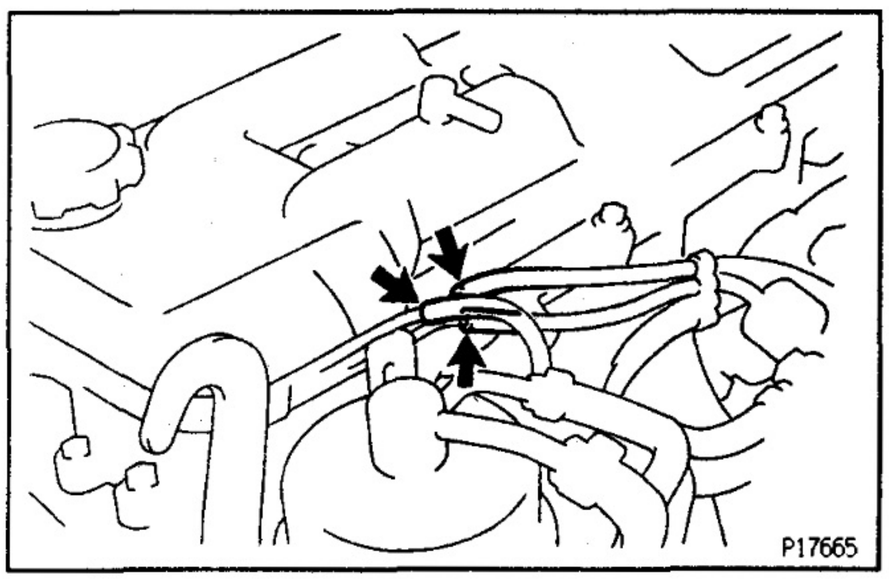
5. **3RZ—F:**

REMOVE NO.2 VACUUM PIPE

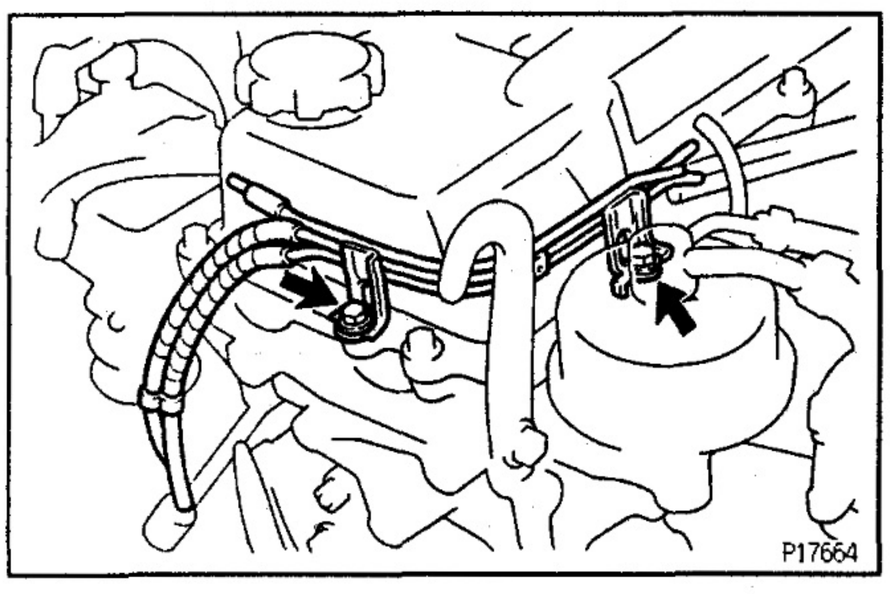
(a) Disconnect the 2 vacuum hoses.

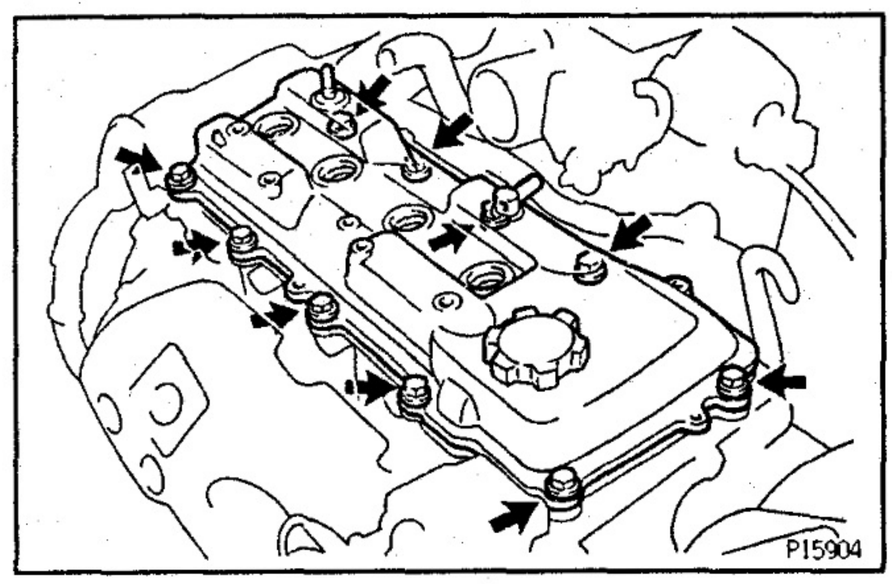


(b) Disconnect the 3 vacuum hoses.



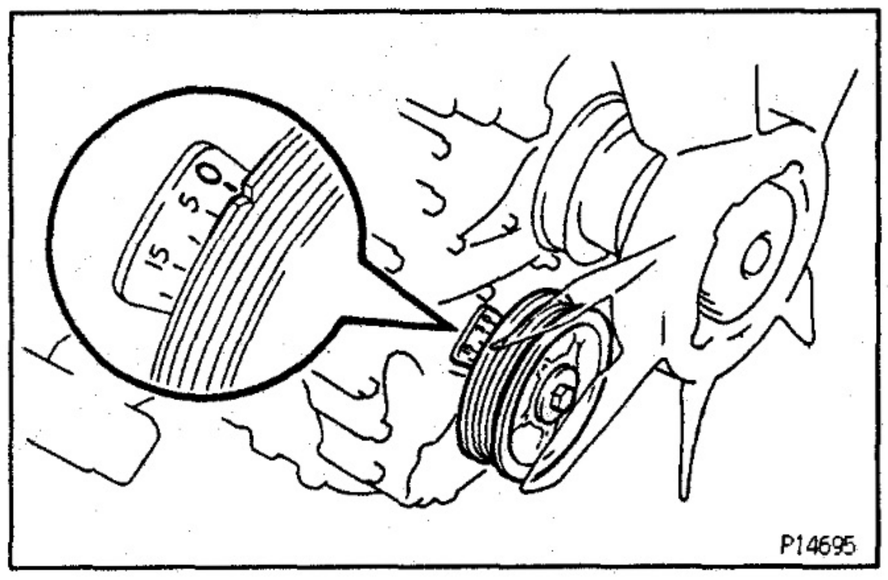
(c) Remove the 2 bolts and vacuum pipe.





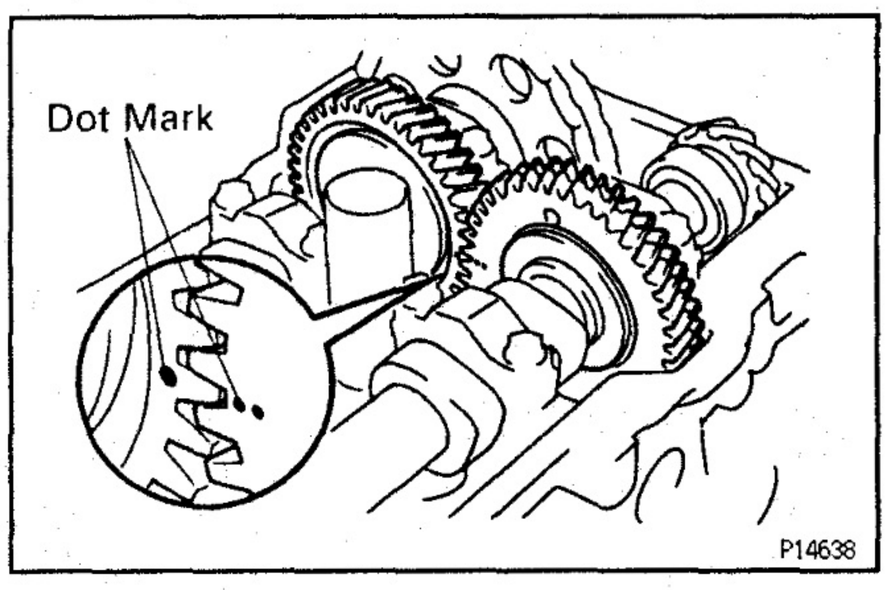
6. REMOVE CYLINDER HEAD COVER

Remove the 10 bolts, seal washers, cylinder head cover and gasket.

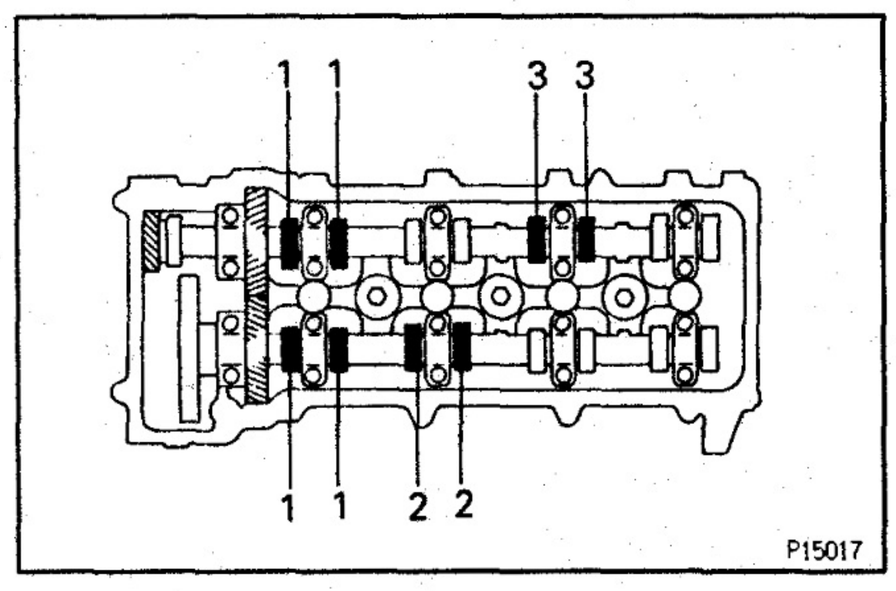


7. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley clockwise and align its groove with the "0" mark on the timing chain cover.



(b) Check that the timing marks (1 and 2 dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) and align the marks as above.



8. INSPECT VALVE CLEARANCE

(a) Check only the valves indicated.

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

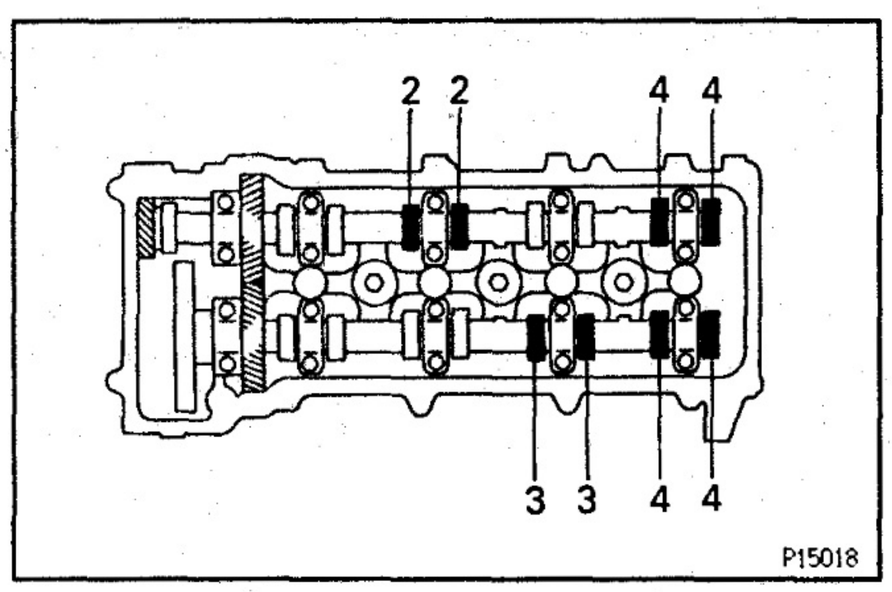
Valve clearance (Cold):

Intake

0.15 – 0.25 mm (0.006 – 0.010 in.)

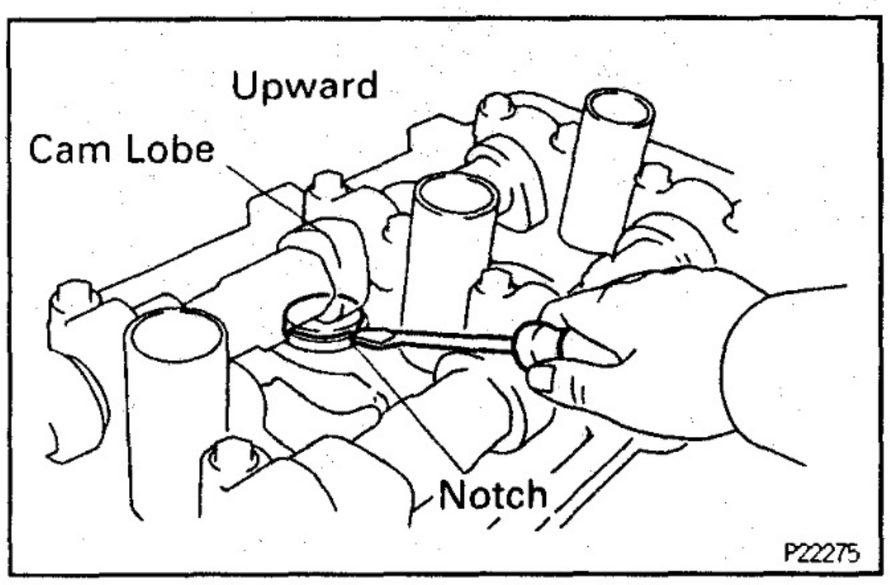
Exhaust

0.25 – 0.35 mm (0.010 – 0.014 in.)



(b) Turn the crankshaft pulley 1 revolution (360°) and align its groove with timing mark "0" of the timing chain cover.

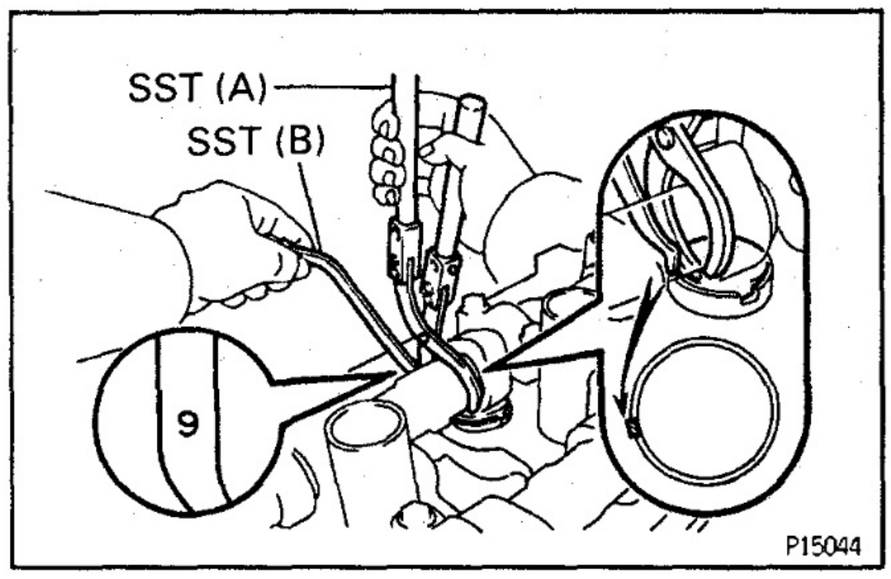
(c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure in step (a))



9. ADJUST VALVE CLEARANCE

(a) Remove the adjusting shim.

- Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward.
- Position the notch of the valve lifter toward the spark plug side.



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

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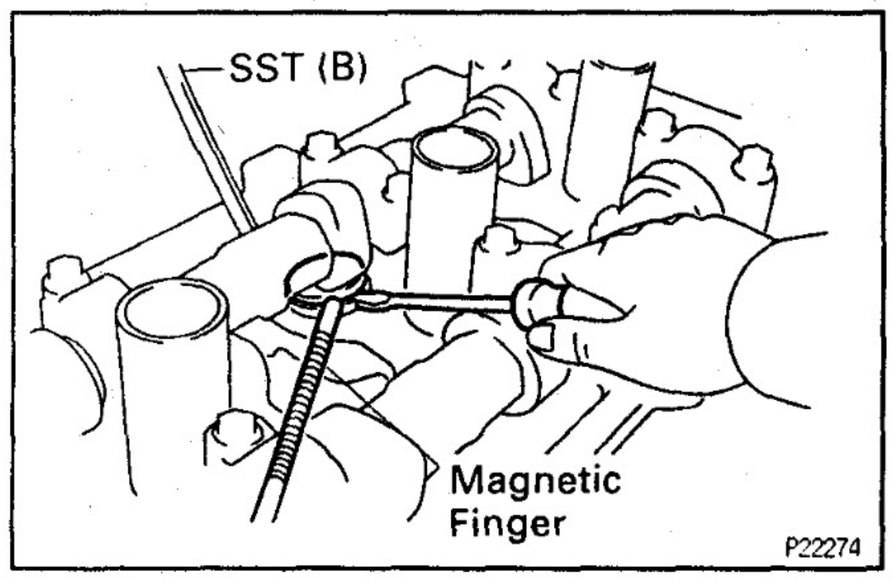
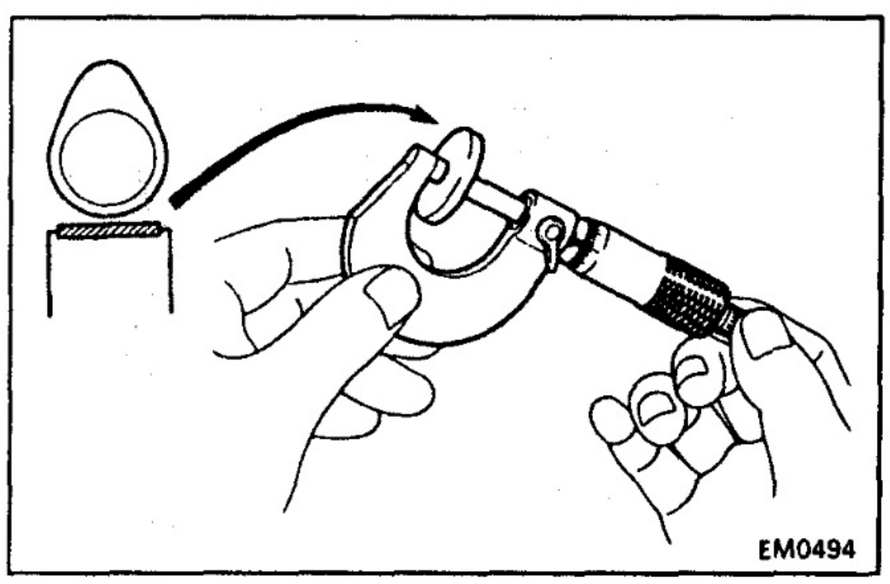
HINT:

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



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



(b) Determine the replacement adjusting shim size by these 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 – 0.30 mm (0.012 in.))

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

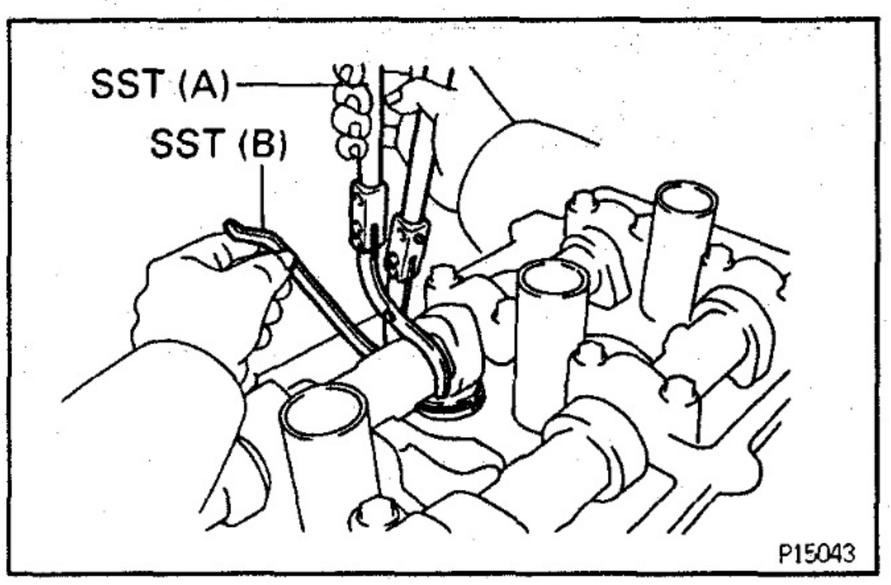
HINT: Shims are available in 17 sized in increments of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).

Adjusting Shim Selection Chart (Intake)

| Measured clearance mm (in.) \ Installed shim thickness mm (in.) | 2.500 (0.0984) | 2.520 (0.0992) | 2.540 (0.1000) | 2.550 (0.1004) | 2.560 (0.1008) | 2.580 (0.1016) | 2.600 (0.1024) | 2.620 (0.1031) | 2.640 (0.1039) | 2.650 (0.1043) | 2.660 (0.1047) | 2.680 (0.1055) | 2.700 (0.1063) | 2.710 (0.1067) | 2.720 (0.1071) | 2.730 (0.1075) | 2.740 (0.1079) | 2.750 (0.1083) | 2.760 (0.1087) | 2.770 (0.1091) | 2.780 (0.1094) | 2.790 (0.1098) | 2.800 (0.1102) | 2.810 (0.1106) | 2.820 (0.1110) | 2.830 (0.1114) | 2.840 (0.1118) | 2.850 (0.1122) | 2.860 (0.1126) | 2.870 (0.1130) | 2.880 (0.1134) | 2.890 (0.1138) | 2.900 (0.1142) | 2.910 (0.1146) | 2.920 (0.1150) | 2.930 (0.1154) | 2.940 (0.1157) | 2.950 (0.1161) | 2.960 (0.1166) | 2.970 (0.1169) | 2.980 (0.1173) | 2.990 (0.1177) | 3.000 (0.1181) | 3.010 (0.1185) | 3.020 (0.1189) | 3.030 (0.1193) | 3.040 (0.1197) | 3.050 (0.1201) | 3.060 (0.1205) | 3.070 (0.1209) | 3.080 (0.1213) | 3.090 (0.1217) | 3.100 (0.1220) | 3.120 (0.1228) | 3.140 (0.1236) | 3.150 (0.1240) | 3.160 (0.1244) | 3.180 (0.1252) | 3.200 (0.1260) | 3.220 (0.1268) | 3.240 (0.1276) | 3.250 (0.1280) | 3.260 (0.1283) | 3.280 (0.1291) | 3.300 (0.1299) |
|---|---|---

Adjusting Shim Selection Chart (Exhaust)

| Measured clearance mm (in.) \ Installed shim thickness mm (in.) | 2.500 (0.0984) | 2.520 (0.0992) | 2.540 (0.1000) | 2.550 (0.1004) | 2.560 (0.1008) | 2.580 (0.1016) | 2.600 (0.1024) | 2.620 (0.1031) | 2.640 (0.1039) | 2.650 (0.1043) | 2.660 (0.1047) | 2.680 (0.1055) | 2.700 (0.1063) | 2.710 (0.1067) | 2.720 (0.1071) | 2.730 (0.1075) | 2.740 (0.1079) | 2.750 (0.1083) | 2.760 (0.1087) | 2.770 (0.1091) | 2.780 (0.1094) | 2.790 (0.1098) | 2.800 (0.1102) | 2.810 (0.1106) | 2.820 (0.1110) | 2.830 (0.1114) | 2.840 (0.1118) | 2.850 (0.1122) | 2.860 (0.1126) | 2.870 (0.1130) | 2.880 (0.1134) | 2.890 (0.1138) | 2.900 (0.1142) | 2.910 (0.1146) | 2.920 (0.1150) | 2.930 (0.1154) | 2.940 (0.1157) | 2.950 (0.1161) | 2.960 (0.1166) | 2.970 (0.1169) | 2.980 (0.1173) | 2.990 (0.1177) | 3.000 (0.1181) | 3.010 (0.1185) | 3.020 (0.1189) | 3.030 (0.1193) | 3.040 (0.1197) | 3.050 (0.1201) | 3.060 (0.1205) | 3.070 (0.1209) | 3.080 (0.1213) | 3.090 (0.1217) | 3.100 (0.1220) | 3.120 (0.1228) | 3.140 (0.1236) | 3.150 (0.1240) | 3.160 (0.1244) | 3.180 (0.1252) | 3.200 (0.1260) | 3.220 (0.1268) | 3.240 (0.1276) | 3.250 (0.1280) | 3.260 (0.1283) | 3.280 (0.1291) | 3.300 (0.1299) |
|---|---|---

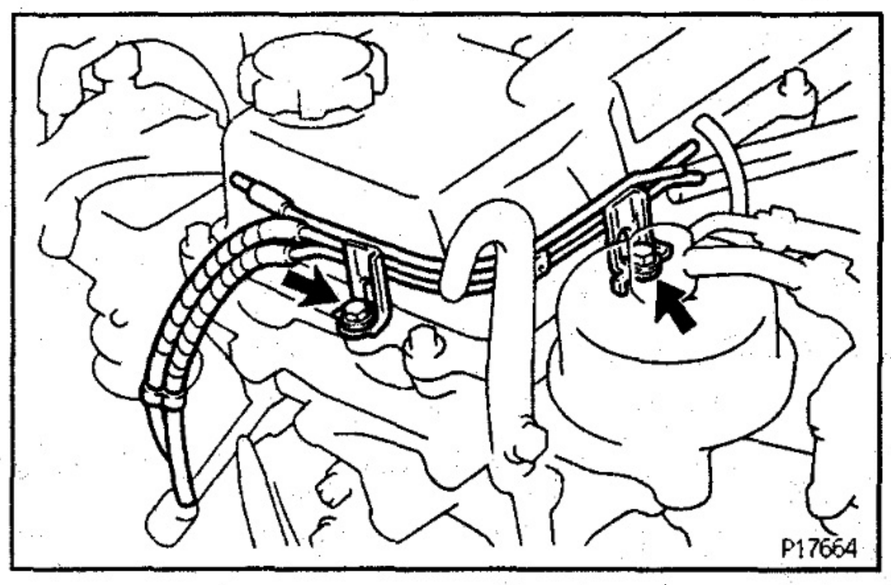


(c) Install a new adjusting shim.
- Place a new adjusting shim on the valve lifter.
- Using SST (A), press down the valve lifter and remove SST (B).

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

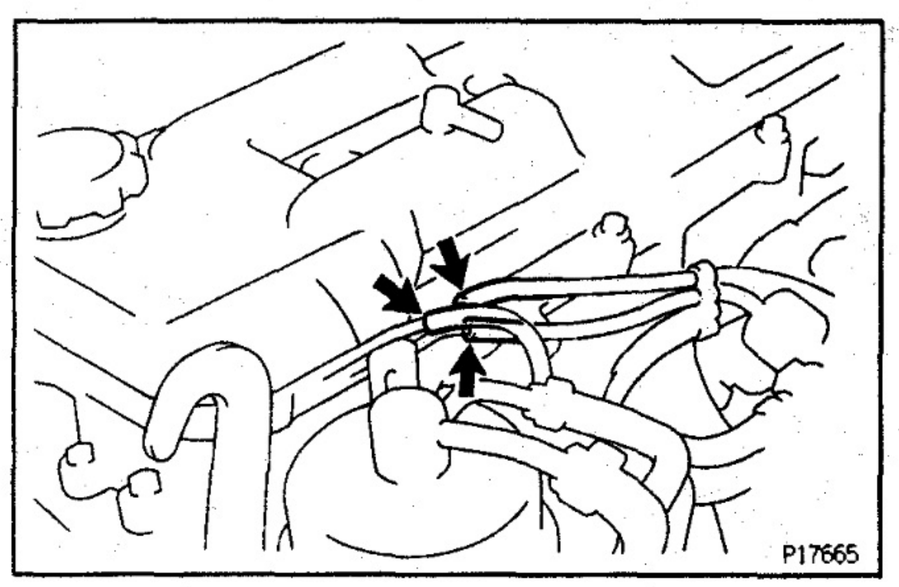
(d) Recheck the valve clearance.

10. REINSTALL CYLINDER HEAD COVER

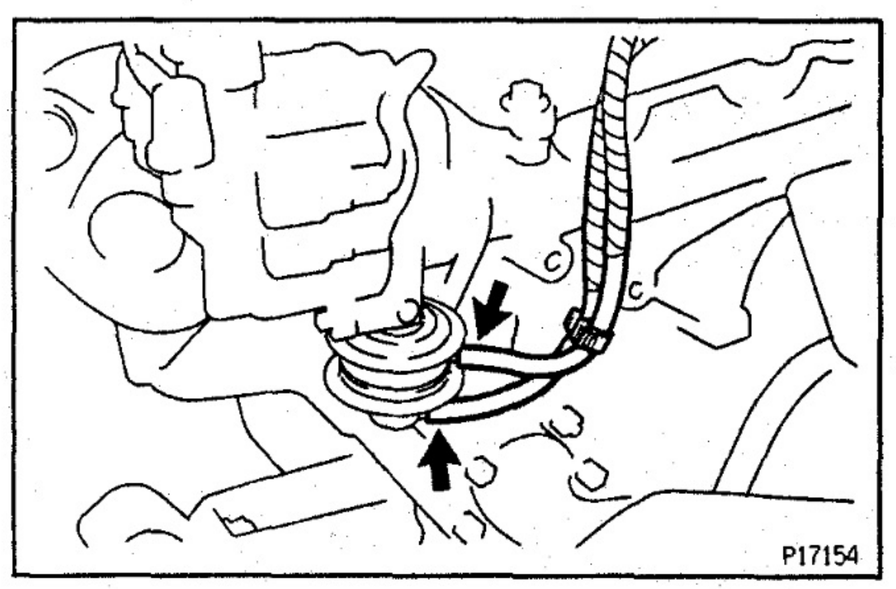


11. 3RZ–F:
INSTALL NO.2 VACUUM PIPE

(a) Install the vacuum pipe with the 2 bolts.
Torque: 8.5 N·m (85 kgf·cm, 74 in.·lbf)



(b) Connect the 3 vacuum hoses to the vacuum pipe.



(c) Connect the 2 vacuum hoses to the vacuum pipe.

12. 3RZ–FE:
RECONNECT ENGINE WIRE

13. REINSTALL HIGH–TENSION CORDS TO SPARK PLUGS

14. REINSTALL PCV HOSES

IGNITION TIMING INSPECTION

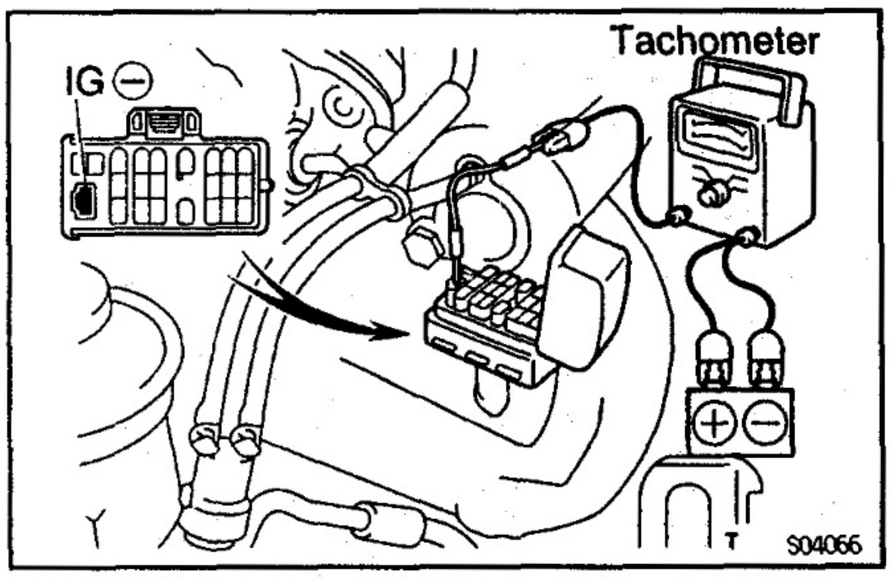
EG78G-01

IGNITION TIMING INSPECTION

(3RZ-FE)

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

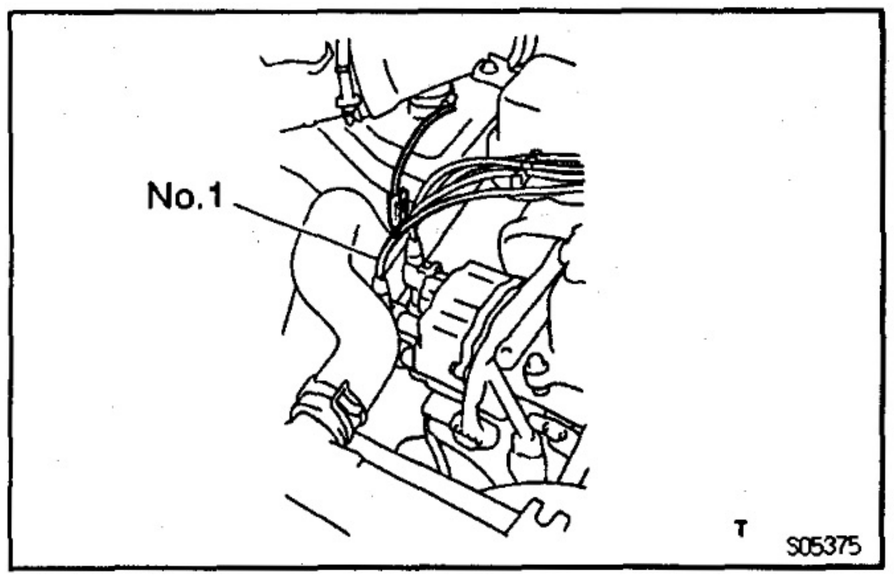


2. CONNECT TACHOMETER TO ENGINE

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. CONNECT TIMING LIGHT TO ENGINE

Connect the tester probe of a timing light to the high-tension cord for No.1 cylinder.

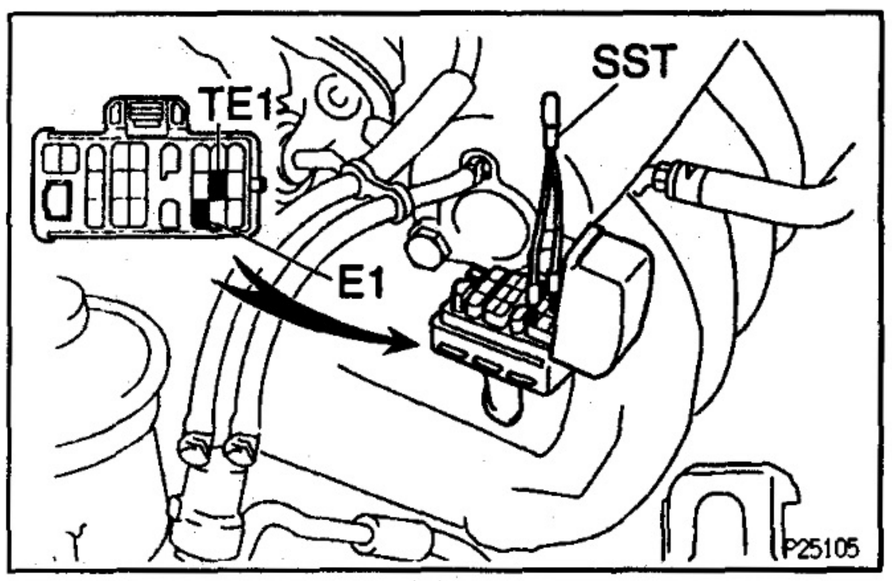
4. CHECK IDLE SPEED

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

(b) Check the idle speed.

Idle speed:

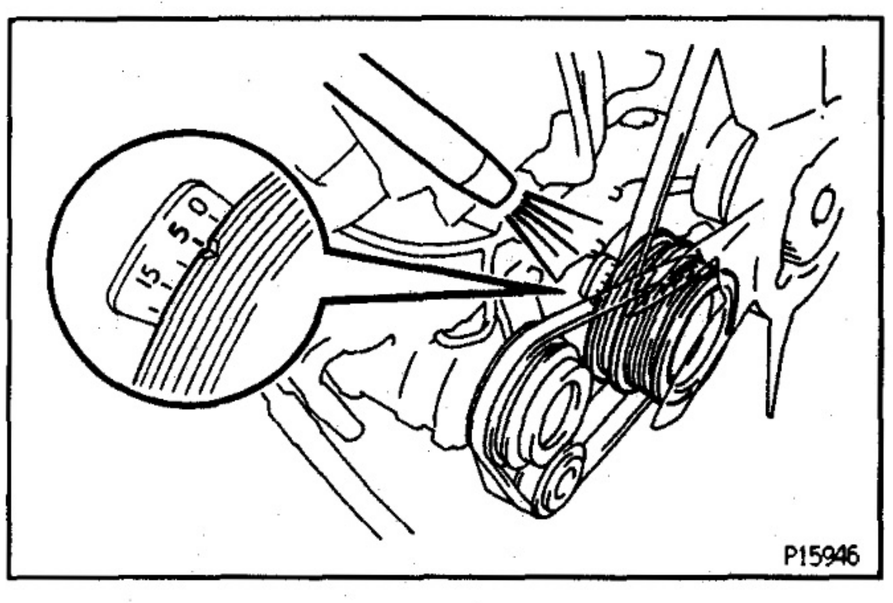
650 — 750 rpm



5. INSPECT IGNITION TIMING

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

SST 09843-18020



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

Ignition timing:

3 — 7° BTDC @ idle

(Transmission in neutral position)

(c) Remove the SST from the check connector.

SST 09843-18020

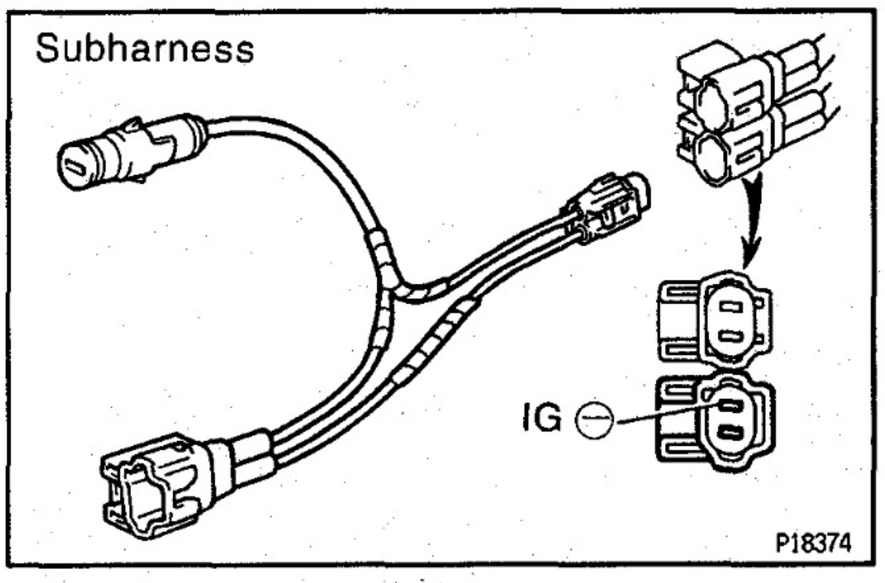
6. DISCONNECT TIMING LIGHT FROM ENGINE

7. DISCONNECT TACHOMETER FROM ENGINE

IGNITION TIMING INSPECTION AND ADJUSTMENT (3RZ−F)

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

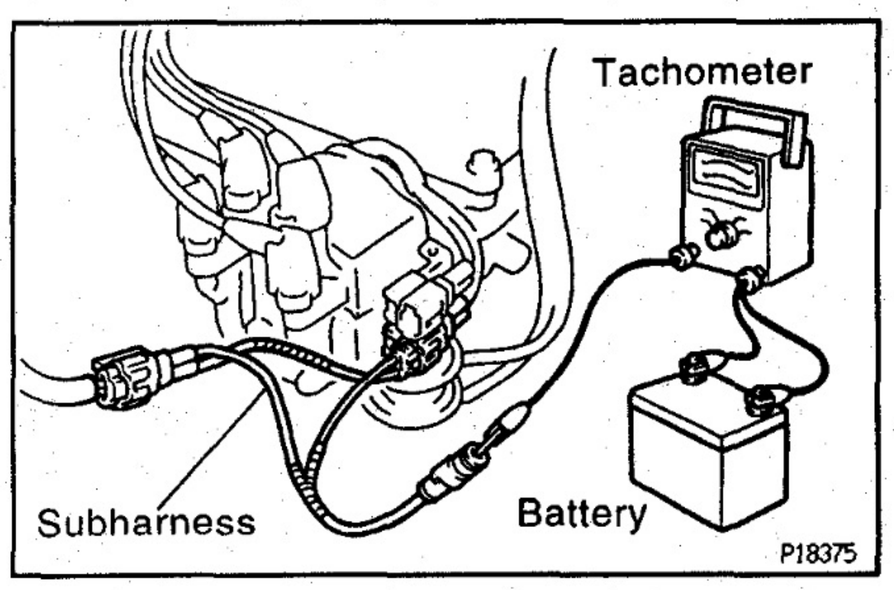


2. CONNECT TACHOMETER AND TIMING LIGHT

(a) Assemble the tachometer subharness using the following parts.

Subharness

Parts No.:
90980−11137,
82998−12440, 90980−11038, 82998−12430,
90980−10115, 82998−12020

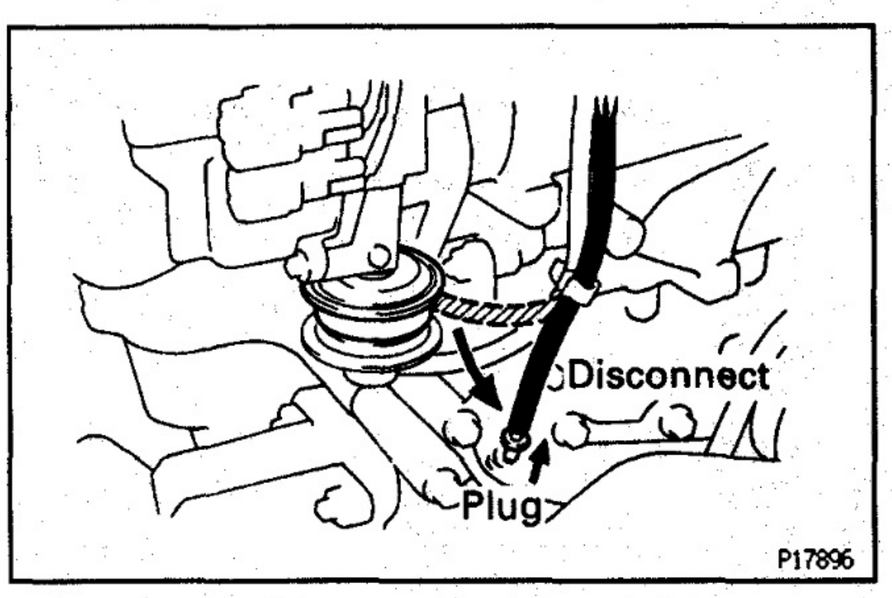


(b) Disconnect the distributor connector (for negative (−) terminal of ignition coil).
Then connect the subharness to the distributor.

(c) Connect the test probe of a tester to the subharness form the distributor.

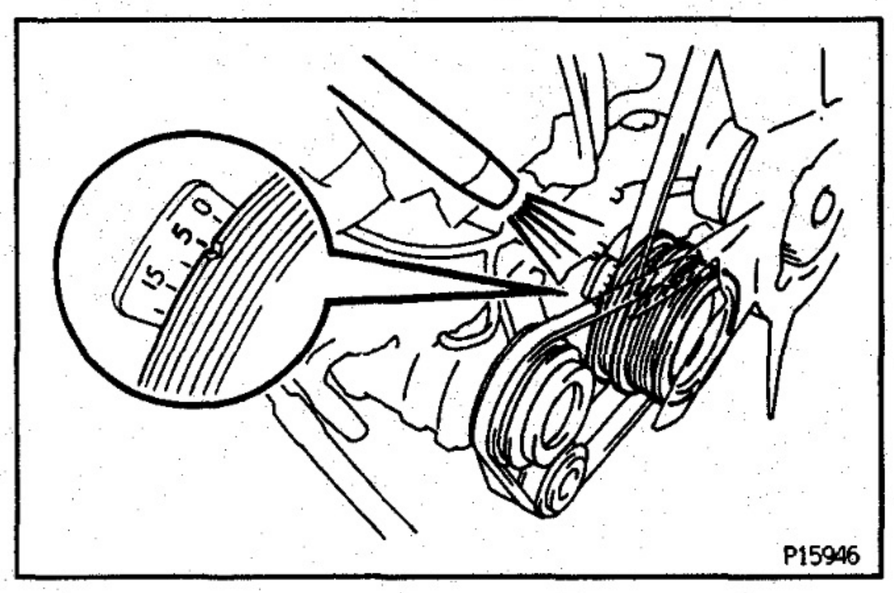
NOTICE:

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



3. INSPECT AND ADJUST IGNITION TIMING

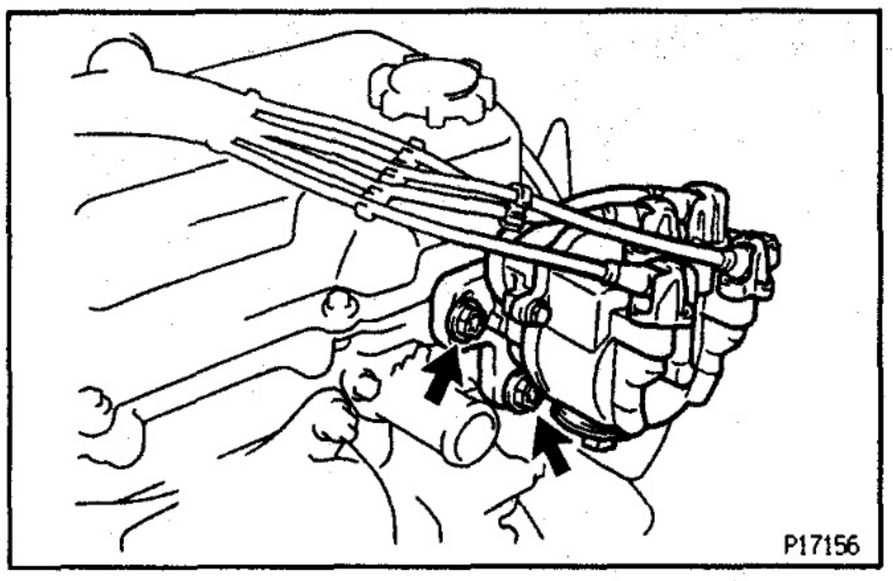
(a) Disconnect the vacuum hose from the sub vacuum advancer diaphragm and plug the hose.



(b) With the engine idling as specified, use a timing light to check the timing.

Ignition timing:

3 − 7° BTDC @ Max. 850 rpm



If necessary, loosen the distributor bolt and turn the distributor to align the marks. Recheck the timing after tightening the distributor bolt.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)

(c) Reconnect the vacuum hose to the distributor.

IDLE SPEED INSPECTION

EG78H-01

IDLE SPEED INSPECTION (3RZ—FE)

1. INITIAL CONDITIONS

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

2. CONNECT TACHOMETER TO ENGINE

3. INSPECT IDLE SPEED

(a) Race the engine speed at 2,500 rpm for approx. 90 seconds.
(b) Check the idle speed.
Idle speed:
650 — 750 rpm
If the idle speed is not as specified, check the ISC valve, intake air leakage and EFI system.

4. DISCONNECT TACHOMETER FROM ENGINE

IDLE SPEED INSPECTION AND ADJUSTMENT (3RZ—F)

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

2. CONNECT TACHOMETER

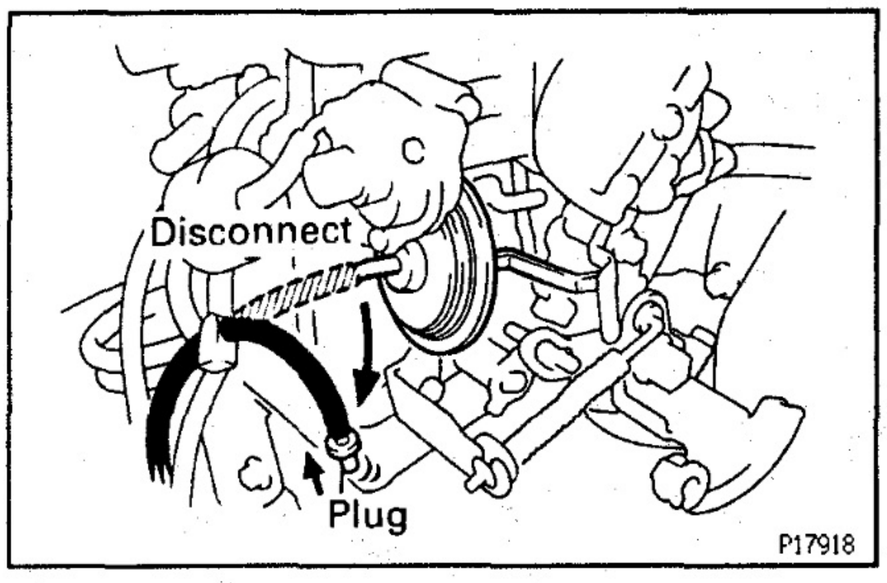
(See page EG—19)

3. INSPECT IDLE SPEED

Idle speed:
750 — 850 rpm
If not as specified, adjust according to the following procedure:

CAUTION:

- **Always use a CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture adjusting screw in most vehicles if they are in good condition.**
- **If a CO meter is not available and it is absolutely necessary to adjust with the idle mixture adjusting screw, use the alternative method (See page EG—8).**



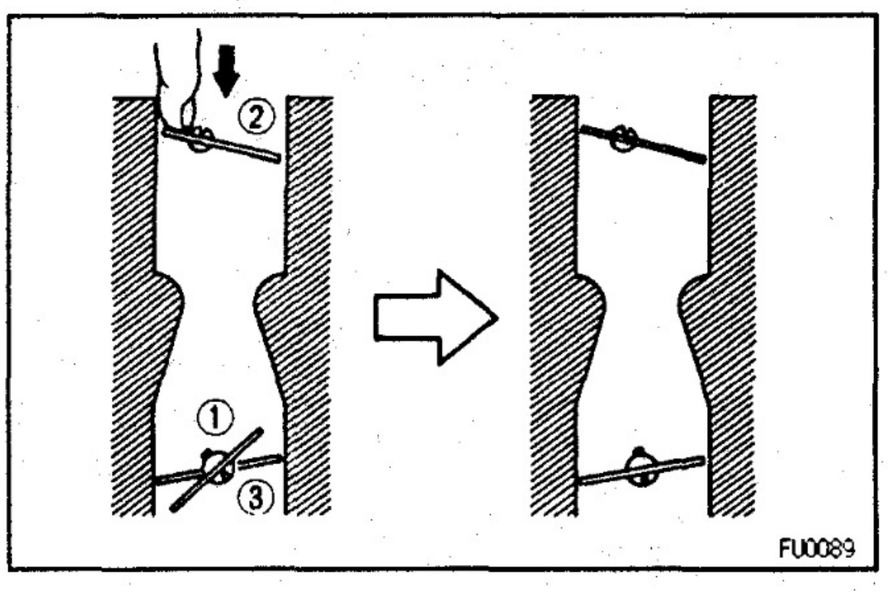
FAST IDLE SPEED INSPECTION AND ADJUSTMENT (3RZ—F)

1. WARM UP AND STOP ENGINE

2. CONNECT TACHOMETER TO ENGINE

3. CUT OPERATION OF CHOKE OPENER (CO) SYSTEM

Disconnect the vacuum hose from the CO, and plug the hose end. This shuts off the CO.

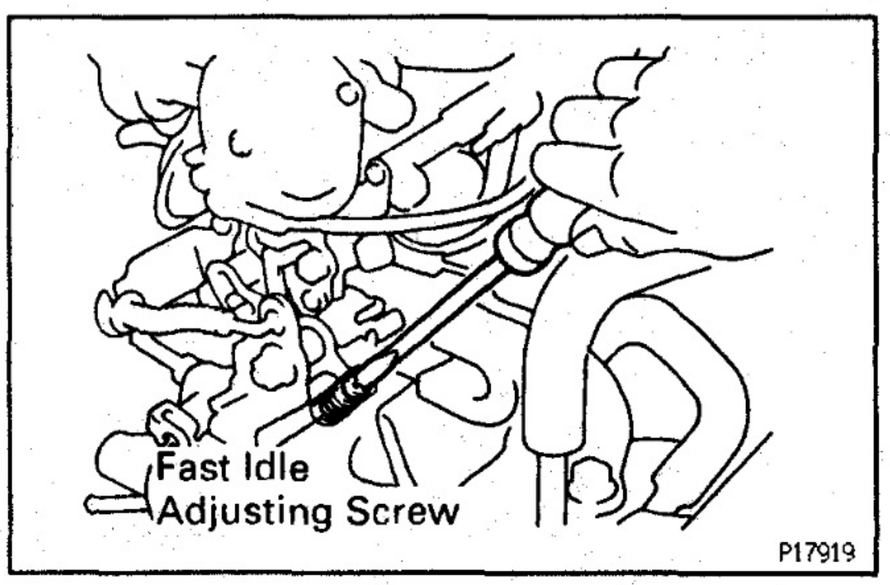


4. SET FAST IDLE CAM

(a) Set the fast idle cam. While holding the throttle slightly open, push the choke valve closed, and hold it closed as you release the throttle valve.

(b) Check that the fast idle cam is in the 1st step.

(c) Start the engine, but do not touch the accelerator pedal.



5. INSPECT AND ADJUST FAST IDLE SPEED

(a) Check the fast idle speed.

Fast idle speed:

2,400 — 2,800 rpm

If the fast idle speed is not as specified, adjust the fast idle speed by turning the fast idle adjusting screw.

Fast idle speed:

2,600 rpm

(b) Lightly race the engine and release the throttle and recheck the idle speed.

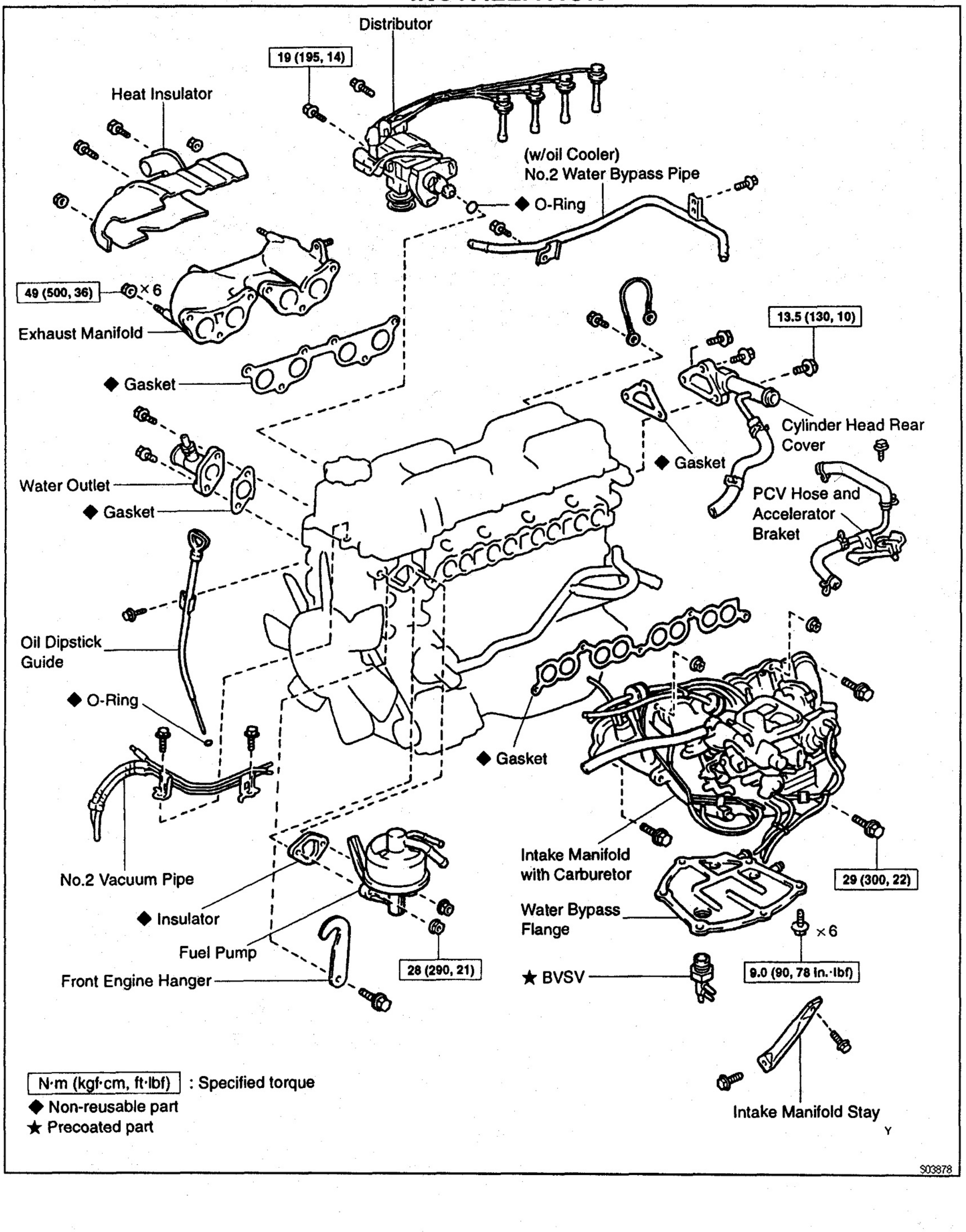
6. RECONNECT VACUUM HOSE TO CO

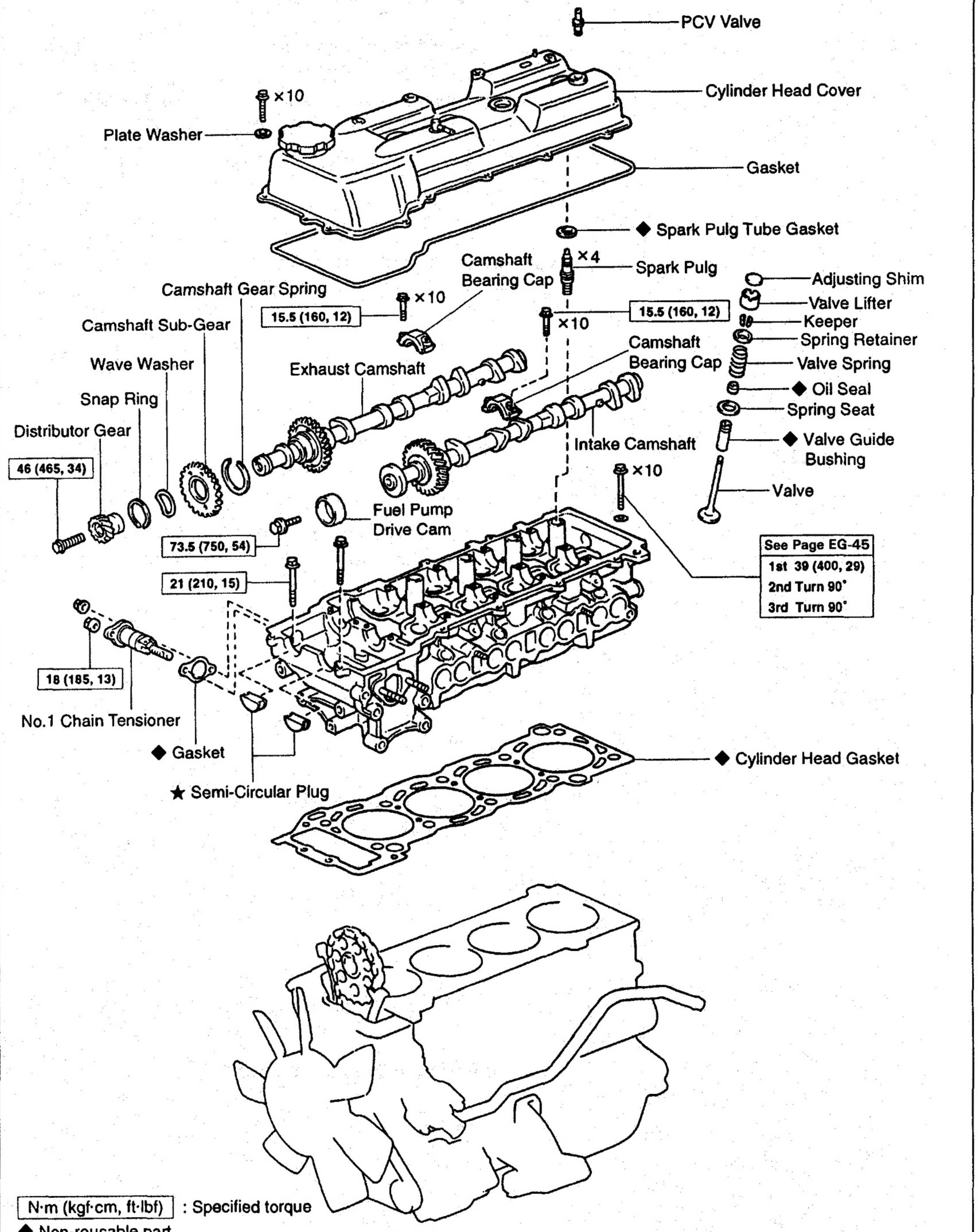
EG

CYLINDER HEAD (3RZ—F)

EG0BK—0F

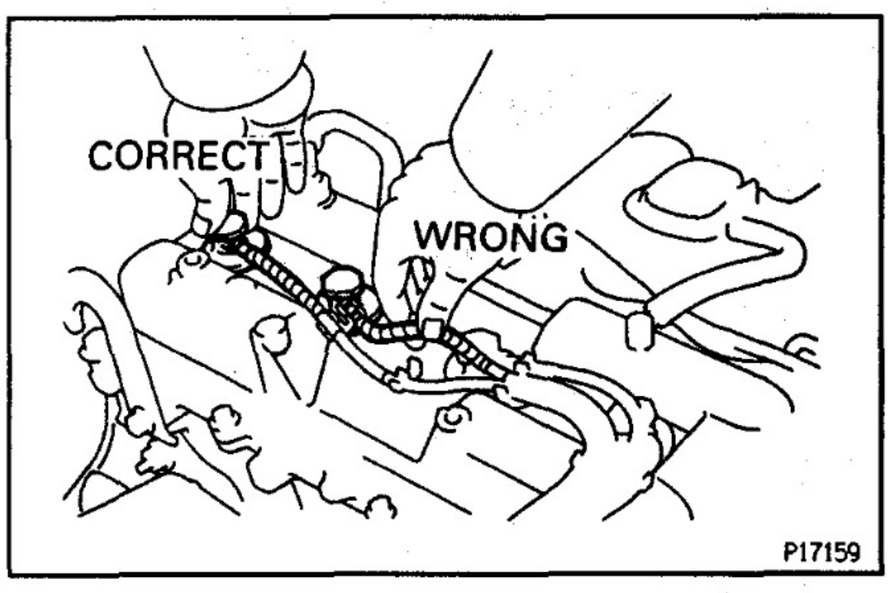
COMPONENTS FOR REMOVAL AND INSTALLATION



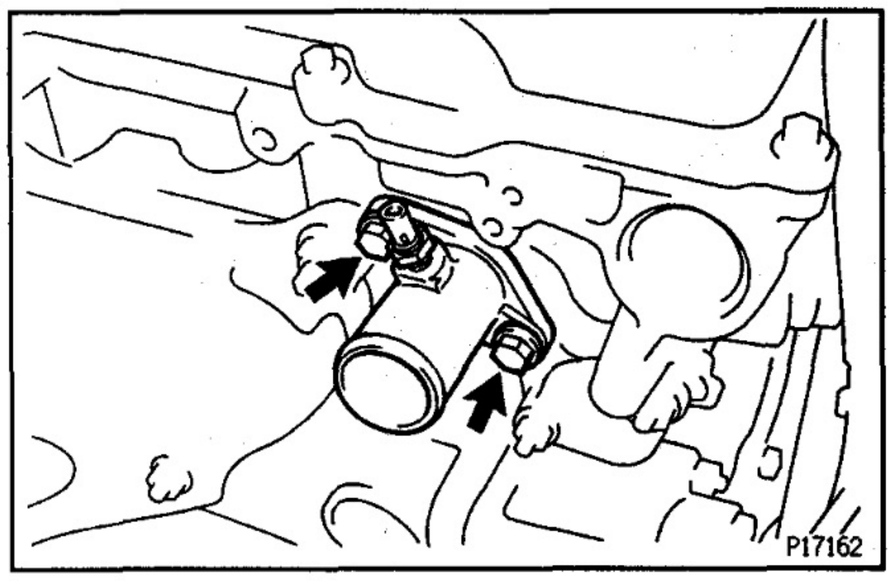

PCV Valve
Cylinder Head Cover
×10
Plate Washer
Gasket
◆ Spark Pulg Tube Gasket
Camshaft Bearing Cap
×4
Spark Pulg
Adjusting Shim
Valve Lifter
Keeper
Spring Retainer
Valve Spring
◆ Oil Seal
Spring Seat
◆ Valve Guide Bushing
Valve
Camshaft Gear Spring
15.5 (160, 12)
×10
Camshaft Sub-Gear
Wave Washer
Snap Ring
Distributor Gear
Exhaust Camshaft
Camshaft Bearing Cap
Intake Camshaft
46 (465, 34)
Fuel Pump Drive Cam
73.5 (750, 54)
21 (210, 15)
See Page EG-45
1st 39 (400, 29)
2nd Turn 90°
3rd Turn 90°
18 (185, 13)
No.1 Chain Tensioner
◆ Gasket
★ Semi-Circular Plug
◆ Cylinder Head Gasket
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
★ Precoated part
S03883

EG76J-01

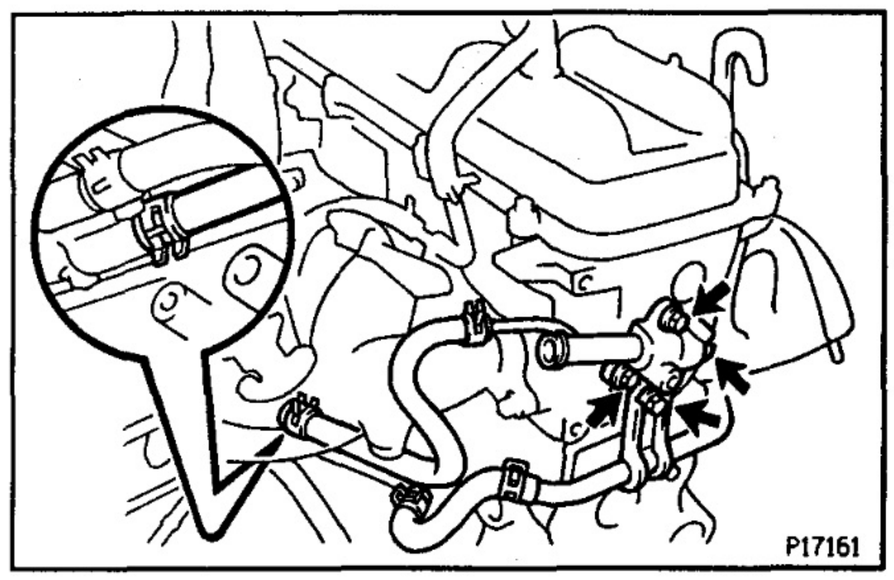
CYLINDER HEAD REMOVAL



1. **DRAIN ENGINE COOLANT**
2. **REMOVE DISTRIBUTOR**
   (See distributor removal in Ignition System)
3. **REMOVE OIL DIPSTICK GUIDE**



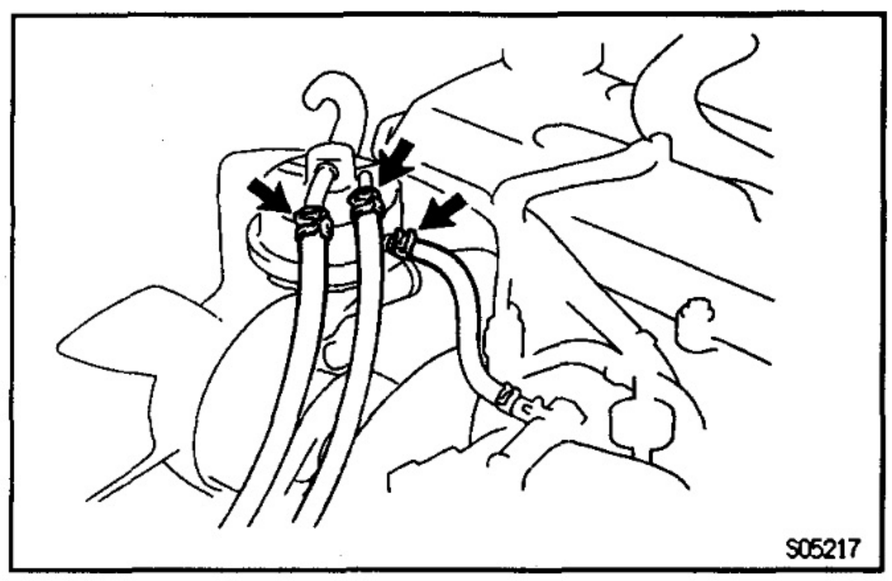
4. **REMOVE WATER OUTLET**
   Remove the 2 bolts, water outlet and gasket.



5. **REMOVE CYLINDER HEAD REAR COVER**

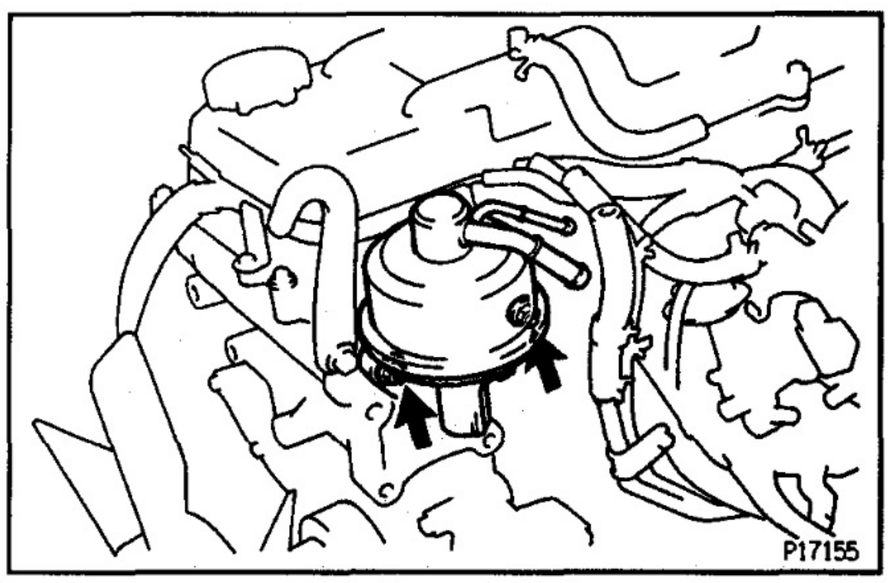
(a) Remove the 3 bolts and the rear cover and gasket.

(b) w/ Oil cooler:
Remove the No.2 water bypass mounting bolt.

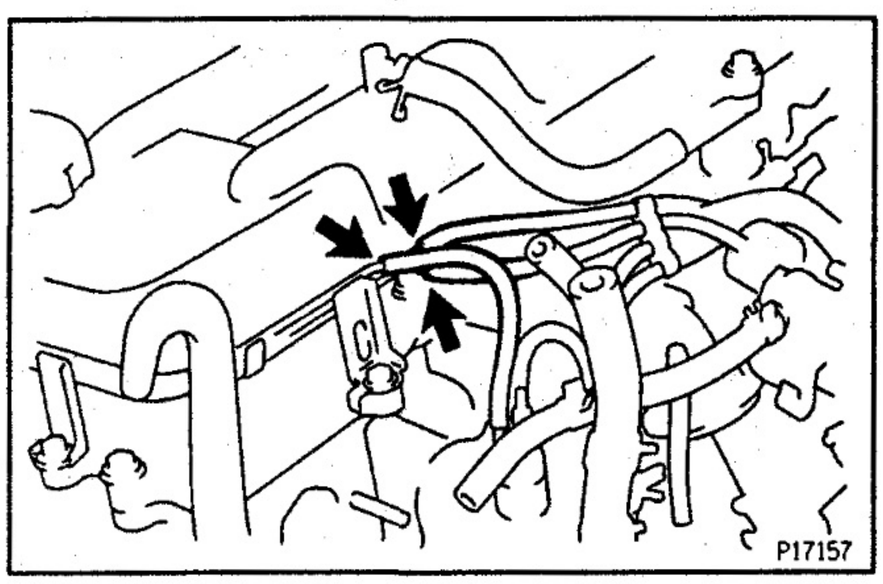


6. **REMOVE FUEL PUMP**

(a) Disconnect the 3 fuel hoses.

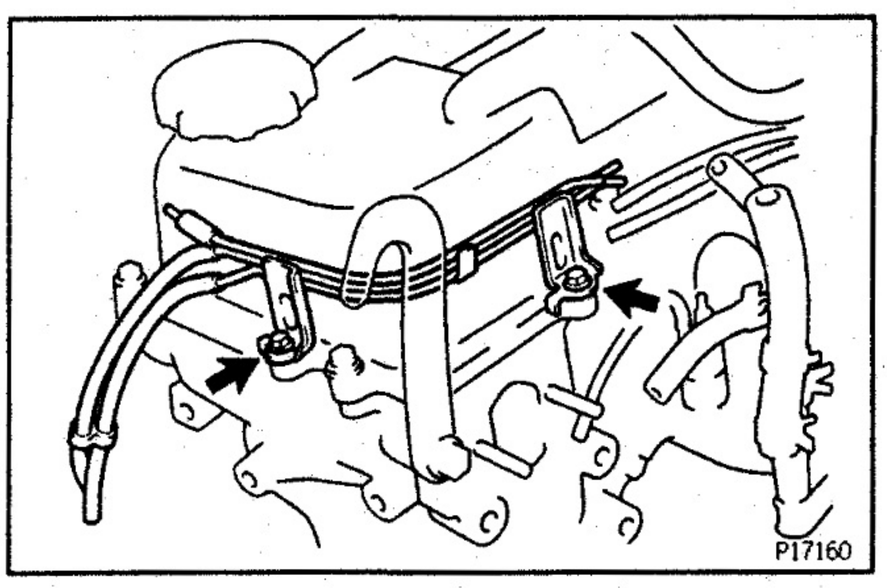


(b) Remove the 2 nuts, fuel pump and insulator.

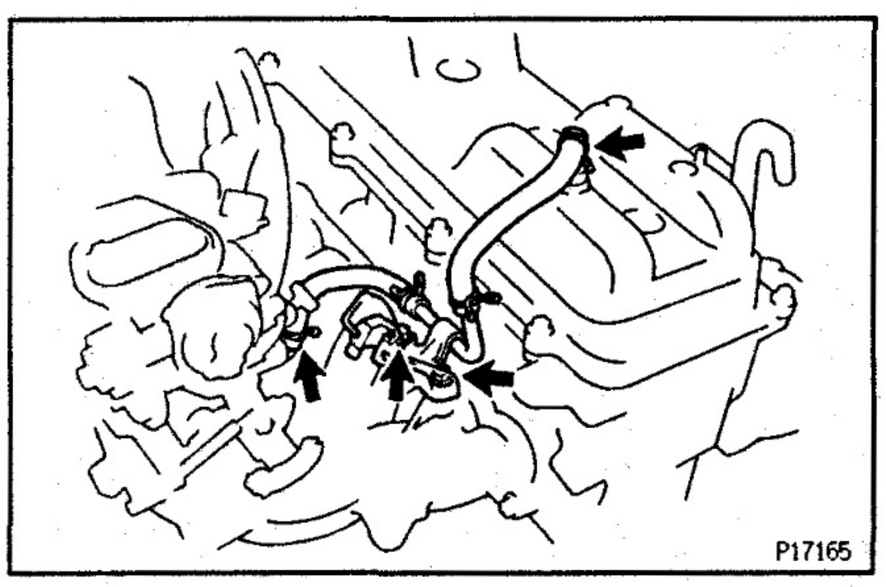


7. REMOVE NO.2 VACUUM PIPE

(a) Disconnect the 3 vacuum hoses.



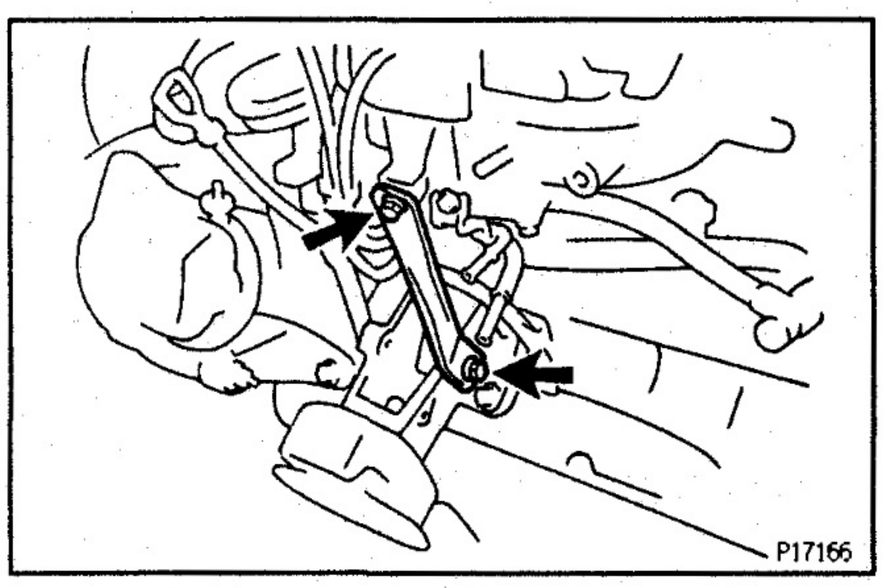
(b) Remove the 2 bolts and vacuum pipe.



8. REMOVE PCV HOSE AND ACCELERATOR CABLE BRACKET

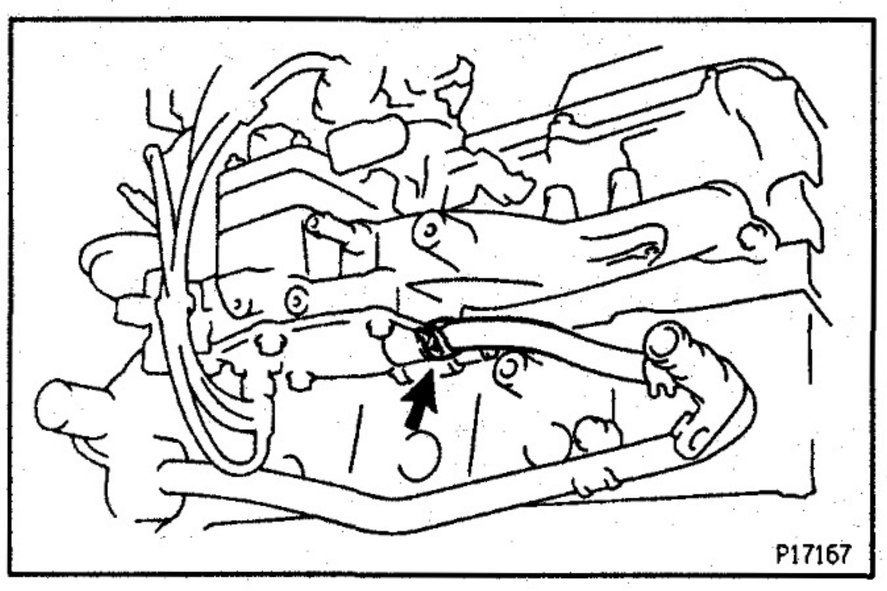
(a) Disconnect the 2 PCV hoses.

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



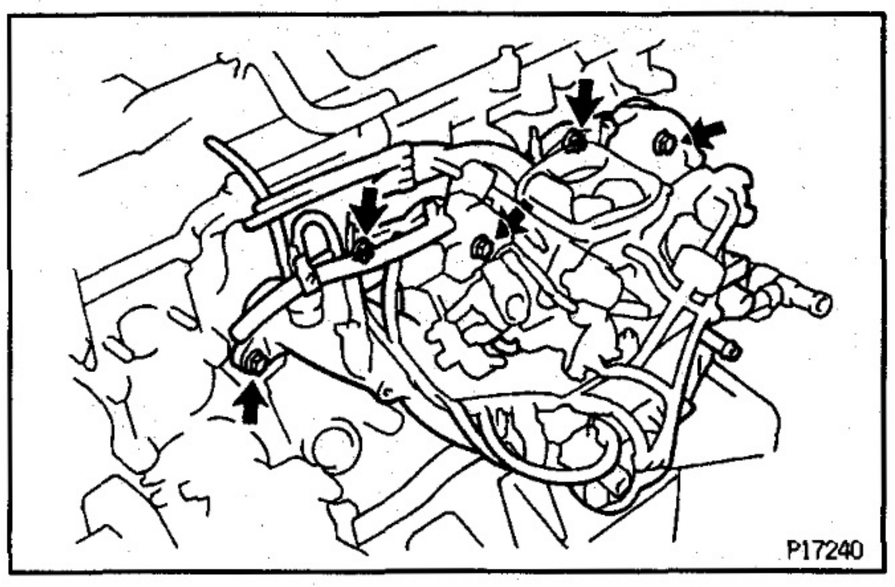
9. REMOVE INTAKE MANIFOLD STAY

Remove the 2 bolts and intake manifold stay.



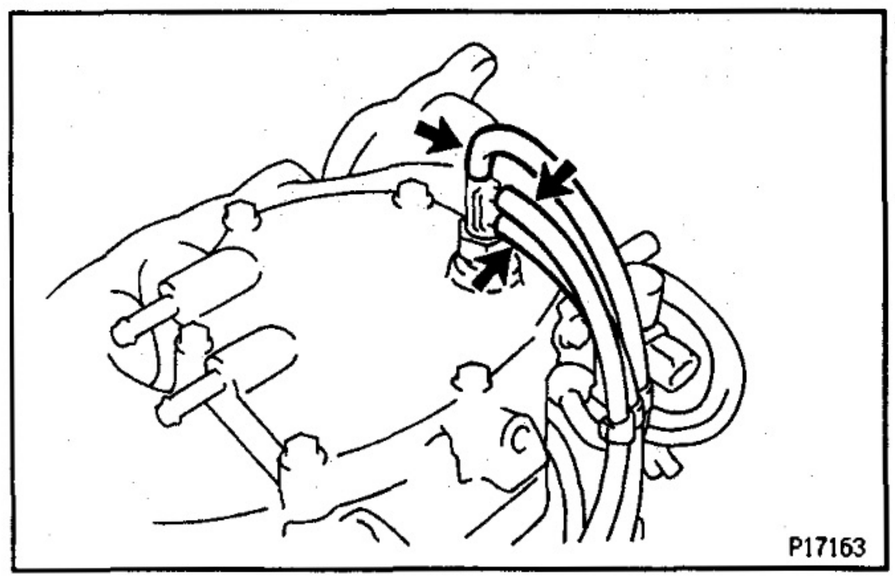
10. REMOVE INTAKE MANIFOLD WITH CARBURETOR

(a) Disconnect the water bypass hose from intake manifold.



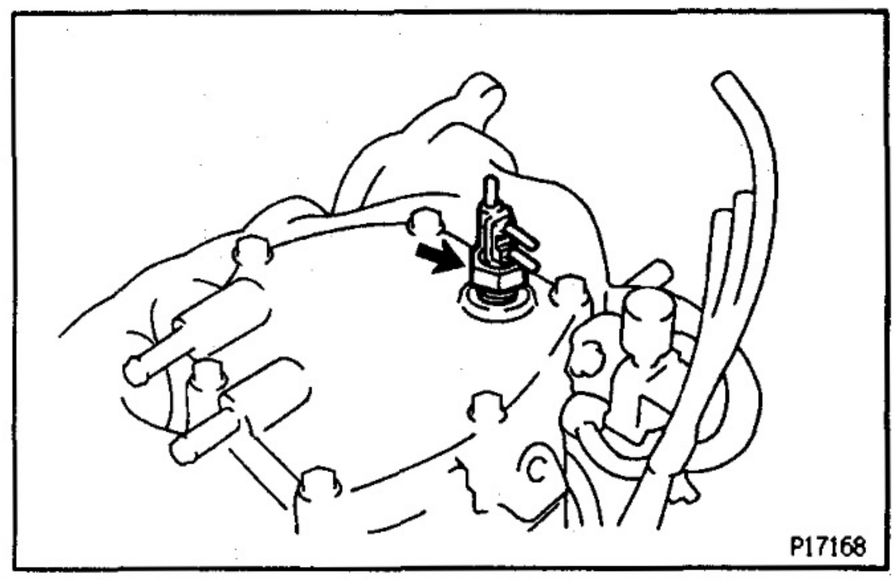
(b) Remove the 3 bolts, 2 nuts intake manifold and gasket.

EG

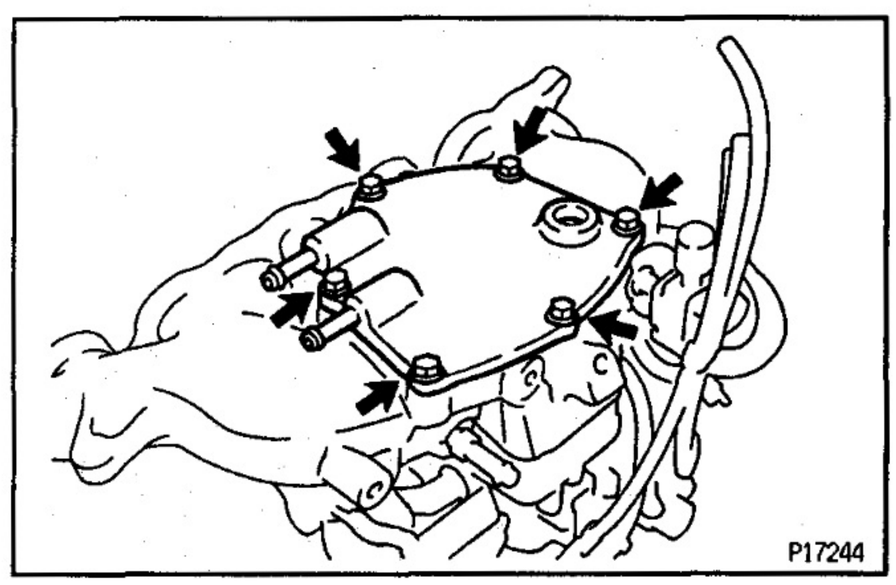


11. IF NECESSARY, REMOVE WATER BYPASS FLANGE

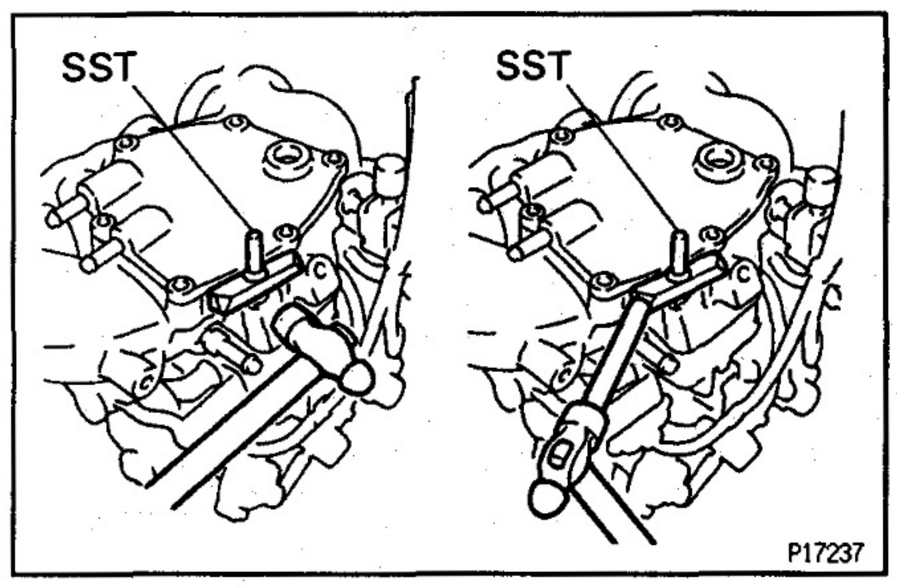
(a) Disconnect the 3 vacuum hoses from the BVSV.



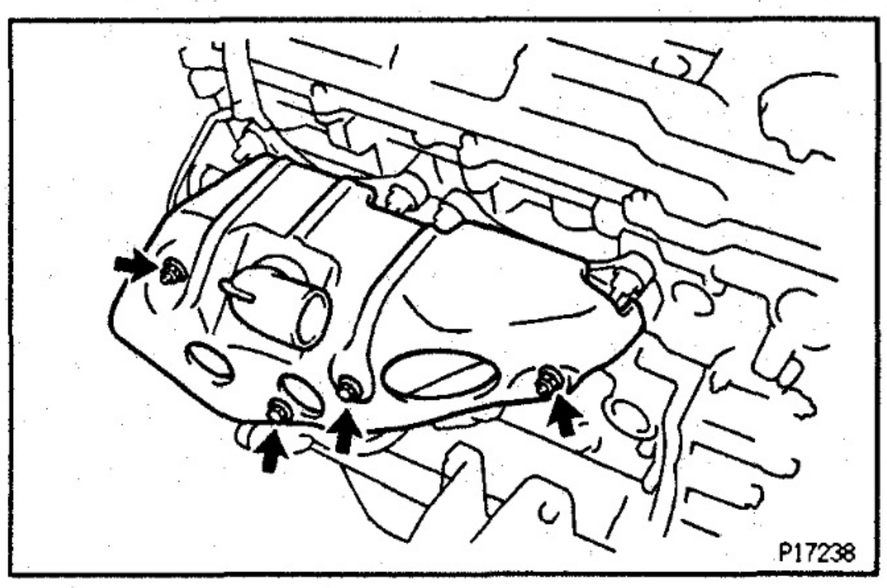
(b) Remove the BVSV.



(c) Remove the 6 bolts.

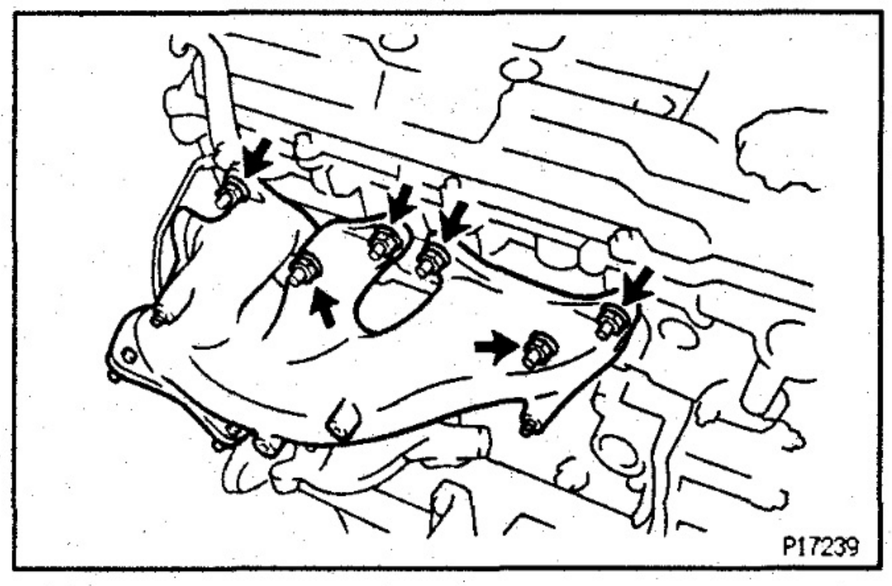


(d) Insert the blade of SST between the intake manifold and water bypass flange, and cut off applied sealer and remove the flange.
SST 09302—00100
NOTICE: Be careful not to damage the intake manifold and flange.



12. REMOVE EXHAUST MANIFOLD

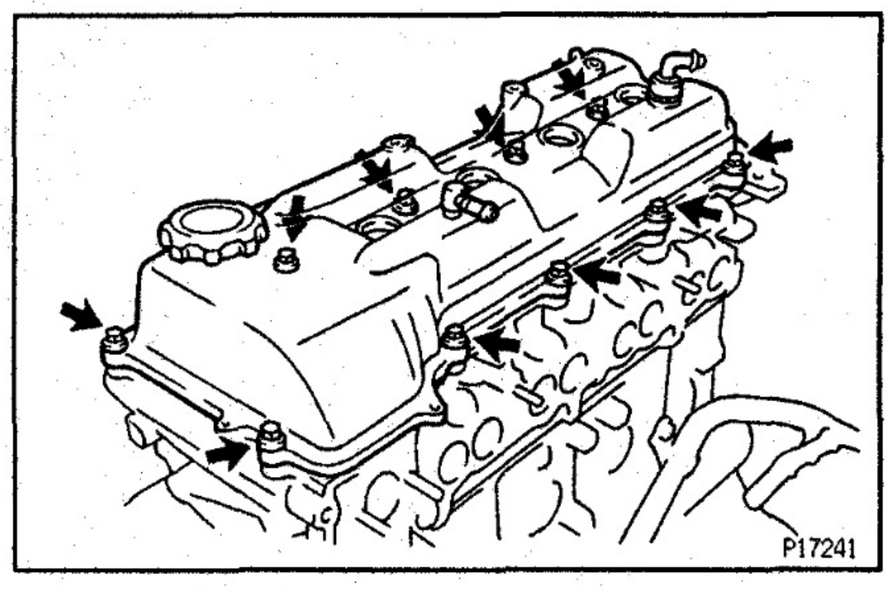
(a) Remove the 2 bolts, 2 nuts and heat insulator.



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

13. REMOVE FRONT ENGINE HANGER

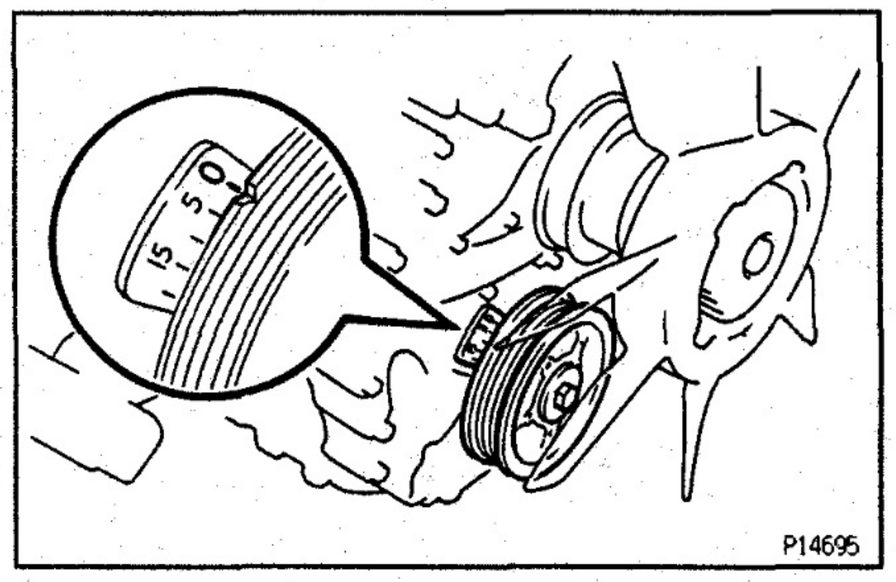
14. REMOVE GROUND STRAP



15. REMOVE CYLINDER HEAD COVER

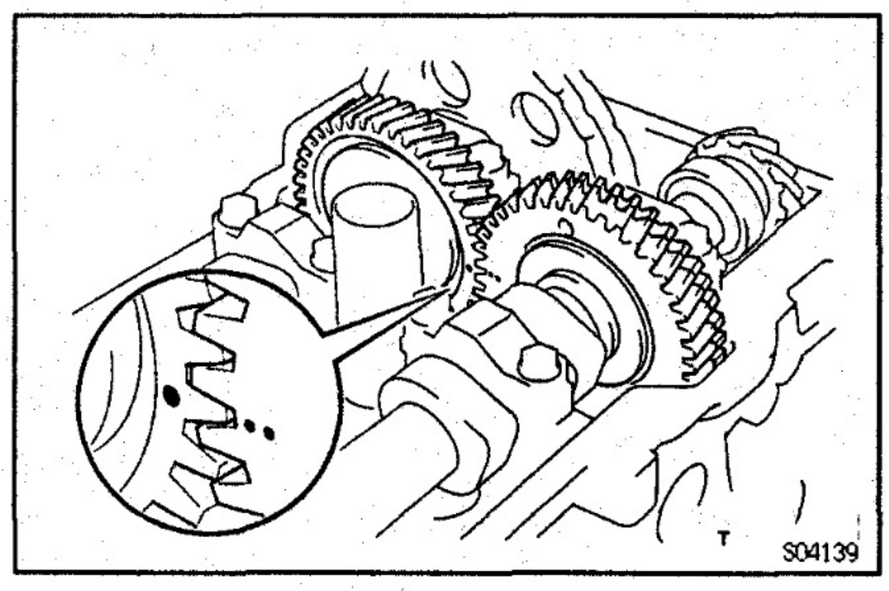
Remove the 10 bolts, cylinder head cover and gasket.

16. REMOVE SPARK PLUGS

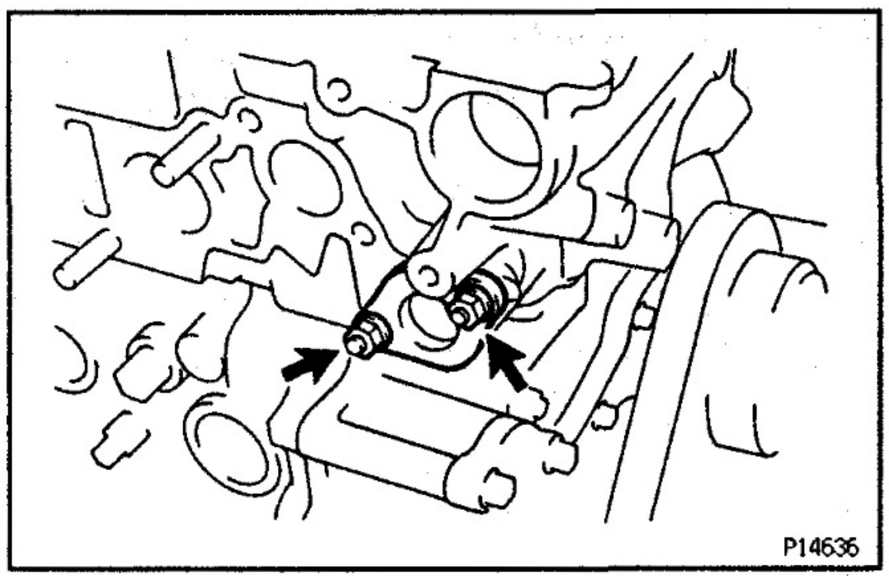


17. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley clockwise and align its groove with the "0" mark on the timing chain cover.

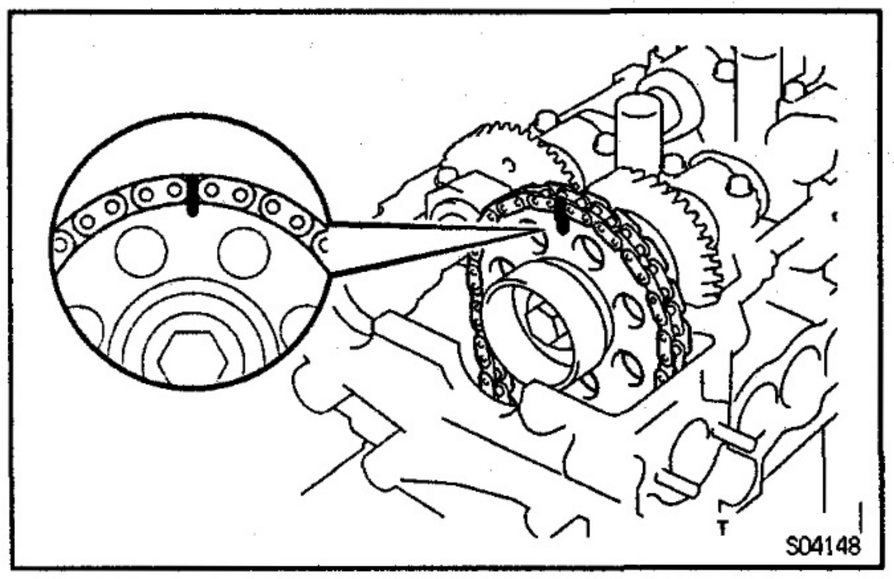


(b) Check that the timing marks (one and two dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) and align the marks as above.



18. REMOVE CHAIN TENSIONER

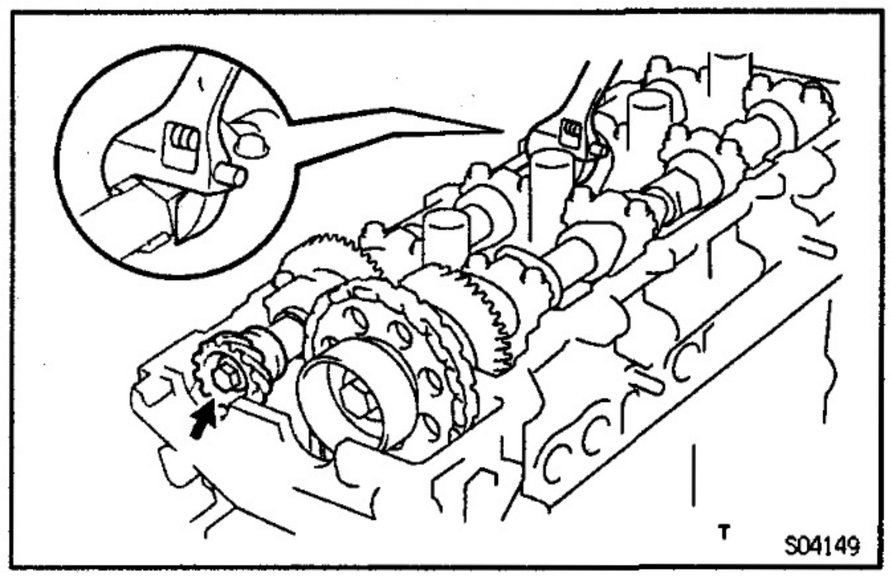
Remove the 2 nuts, chain tensioner and gasket.



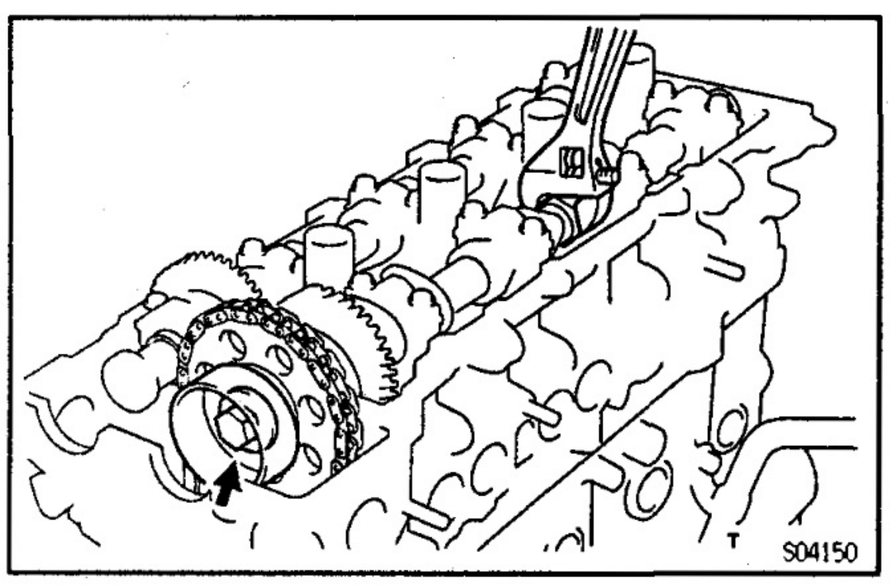
19. REMOVE CAMSHAFT TIMING GEAR

(a) Remove the 2 semi—circular plugs.

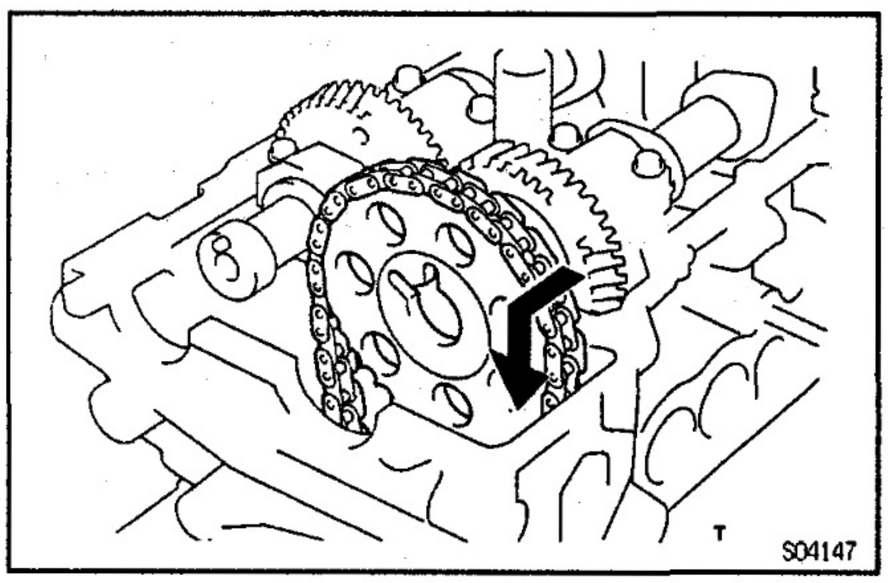
(b) Place the matchmarks on the camshaft timing gear and No.1 timing chain.



(c) Hold the exhaust camshaft with a wrench, remove the bolt and distributor gear.



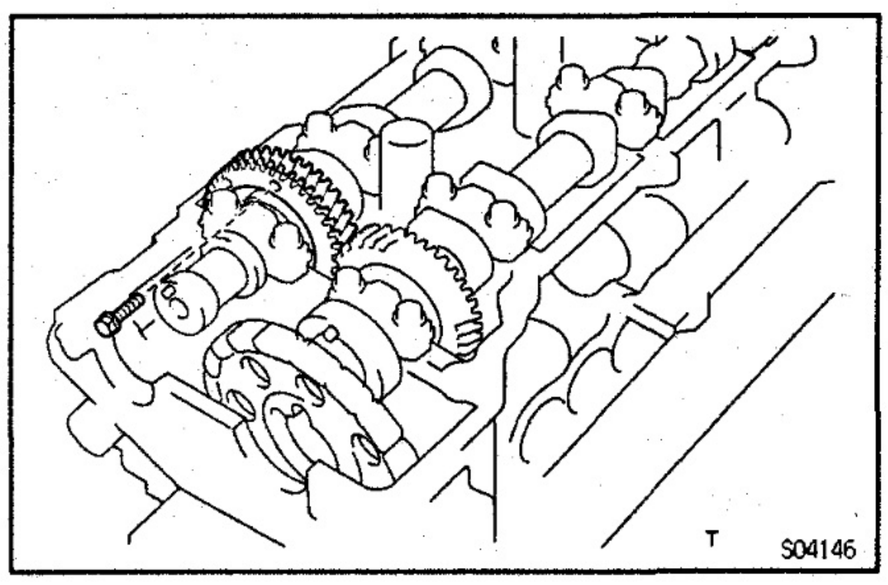
(d) Hold the intake camshaft with a wrench and remove the bolt and fuel pump drive cam.



(e) Remove the camshaft timing gear and chain from the intake camshaft and leave on the slipper and damper.

20. REMOVE CAMSHAFTS

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



A. Remove exhaust camshaft

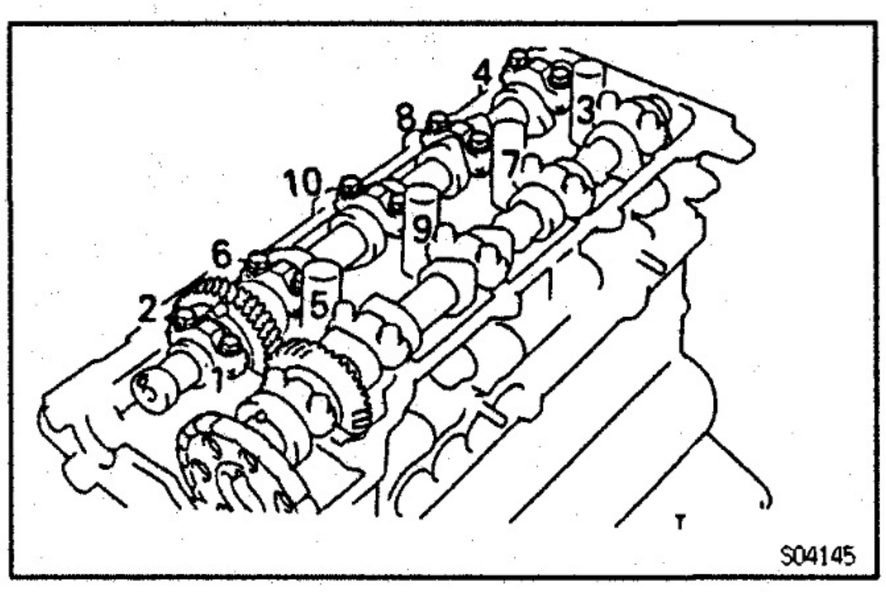
(a) Bring the service bolt hole of the driven sub–gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.

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

Recommended service bolt:

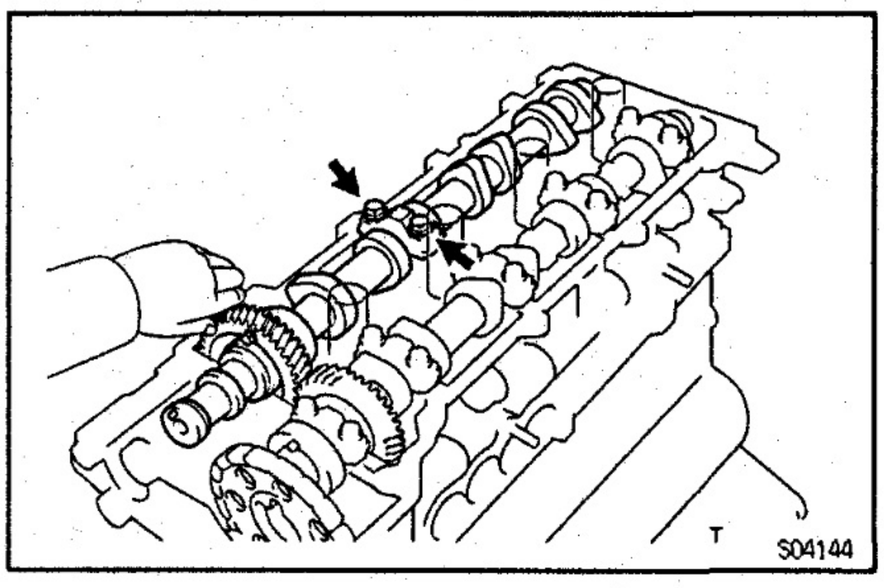
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

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



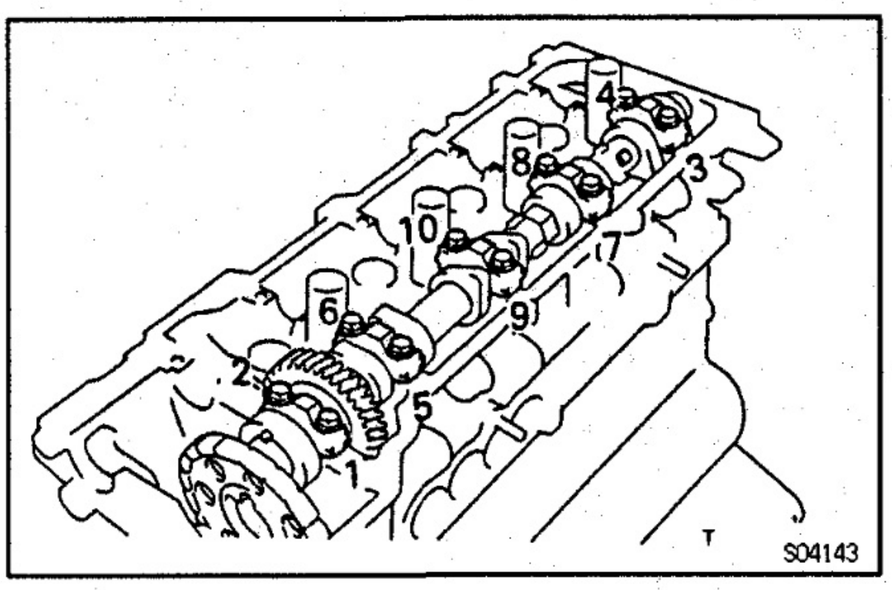
(c) Uniformly loosen and remove the 10 bearing cap bolts in several passes, in the sequence shown.

(d) Remove the 5 bearing caps and camshaft.



HINT: If the camshaft is not being lifted out straight and level, reinstall the No.3 bearing cap with the 2 bolts. Then alternately loosen and remove the bearing cap bolts with the camshaft gear pulled up.

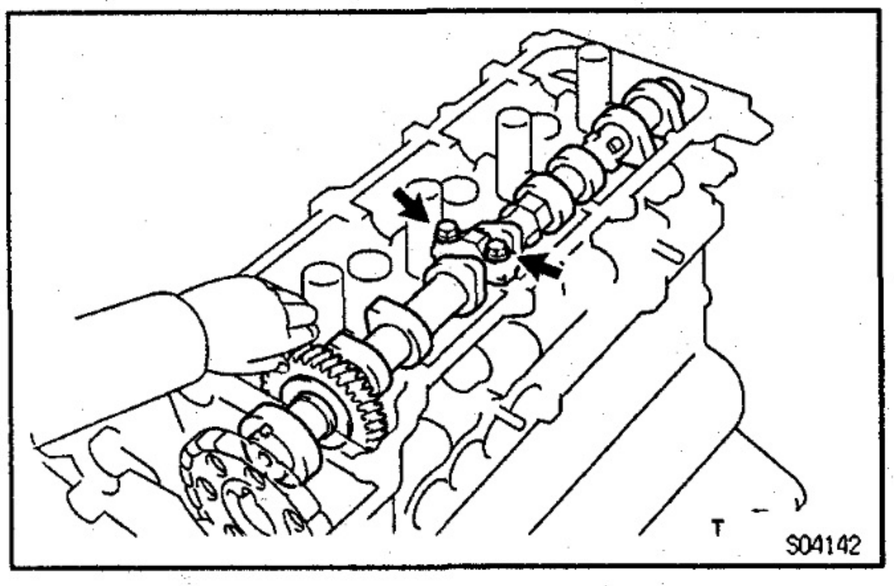
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.



B. Remove intake camshaft

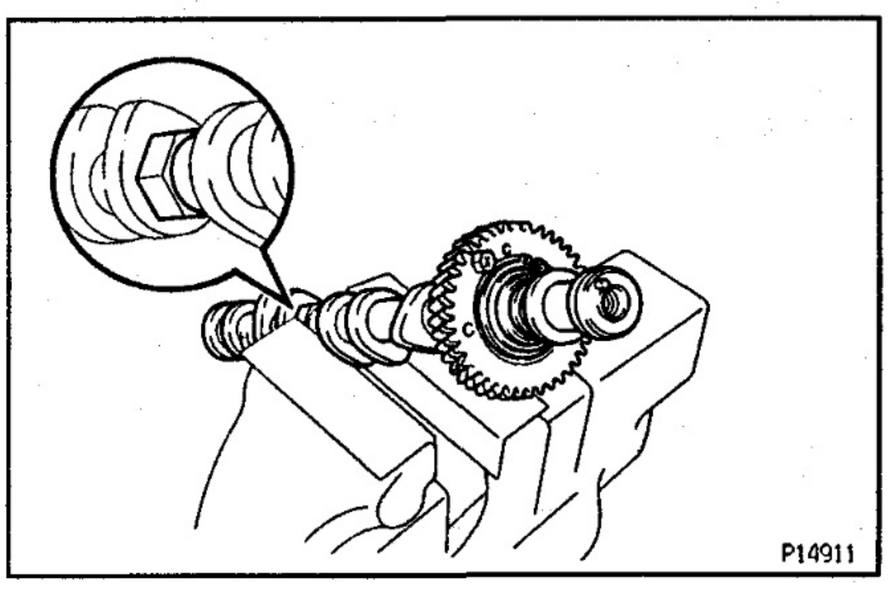
(a) Uniformly loosen and remove 10 bearing cap bolts in several passes, in the sequence shown.

(b) Remove the 5 bearing caps and camshaft.



HINT: If the camshaft is not being lifted out straight and level, reinstall the No.3 bearing cap with the 2 bolts. Then alternately loosen and remove the 2 bearing cap bolts with the camshaft gear pulled up.

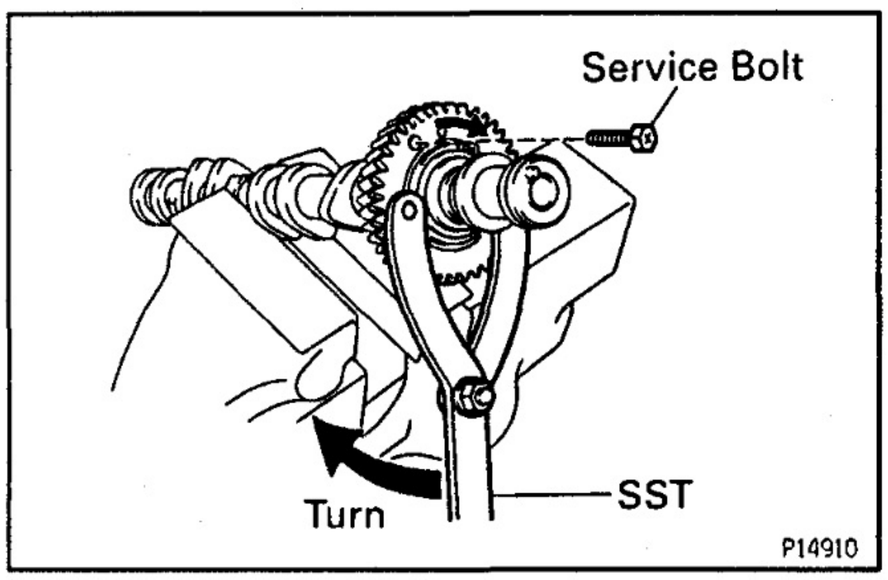
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.



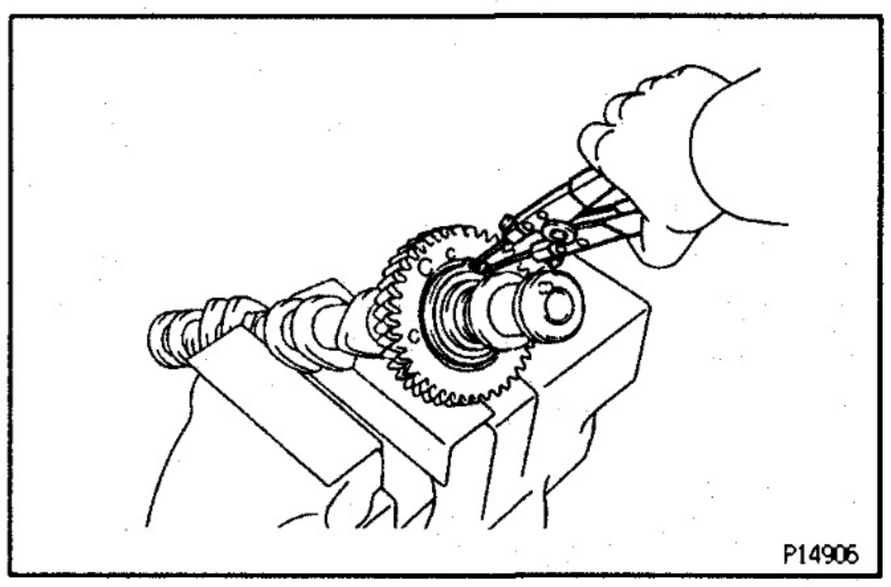
21. DISASSEMBLE EXHAUST CAMSHAFT

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

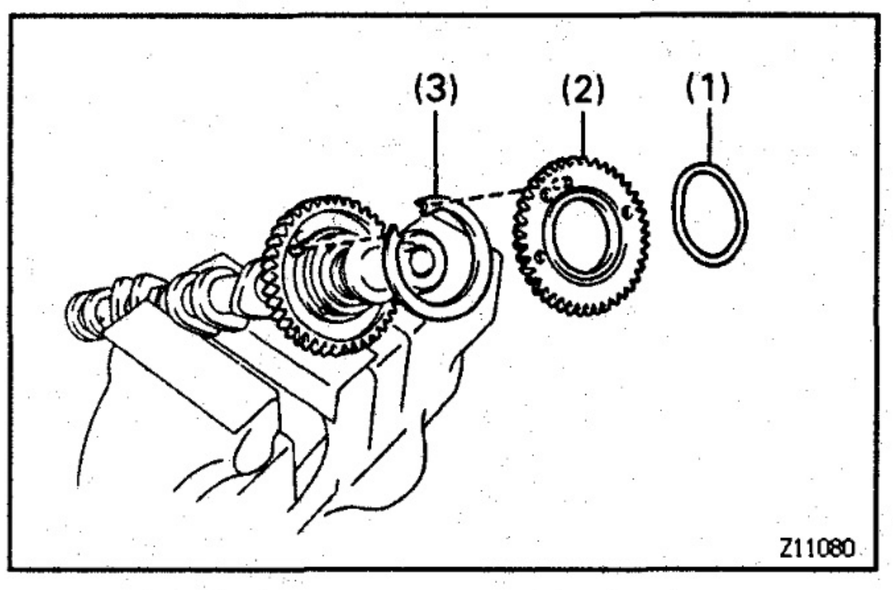
NOTICE: Be careful not to damage the camshaft.



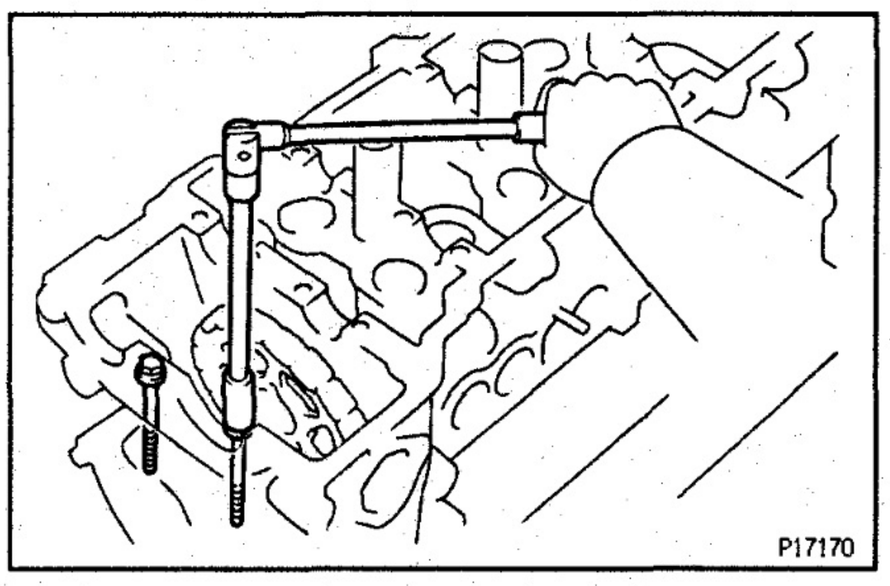
(b) Using SST, turn the sub—gear clockwise, and remove the service bolt.
SST 09960—10010 (09962—01000, 09963—00500)



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

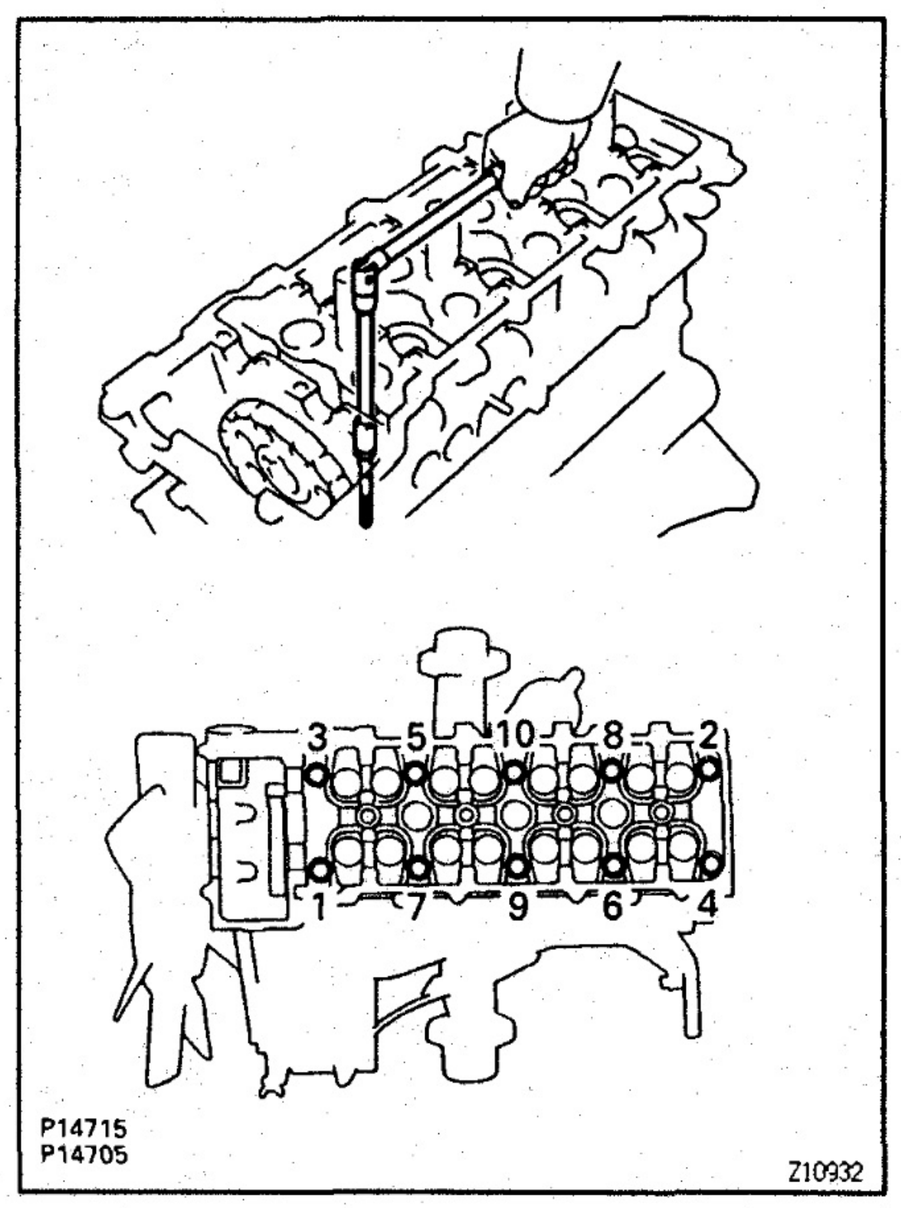


(d) Remove the following parts:
(1) Wave washer
(2) Camshaft sub–gear
(3) Camshaft gear spring

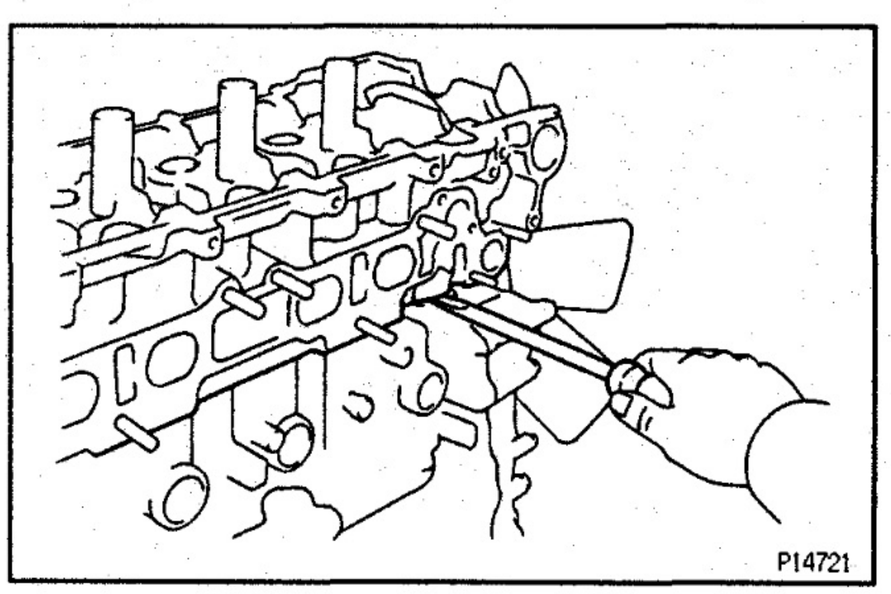


22. REMOVE CYLINDER HEAD

(a) Remove the 2 bolts in front of the head before the other head bolts are removed.

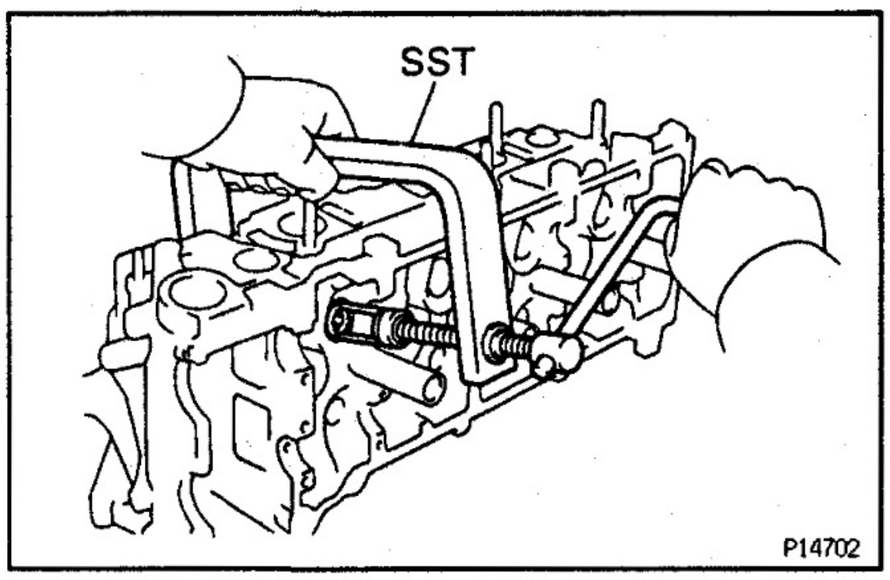


(b) Uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.
NOTICE: Cylinder head warpage or cracking could result from removing bolts in incorrect order.



(c) 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 difficult to lift off, pry between the cylinder head and cylinder block with a screwdriver.
NOTICE: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

EG



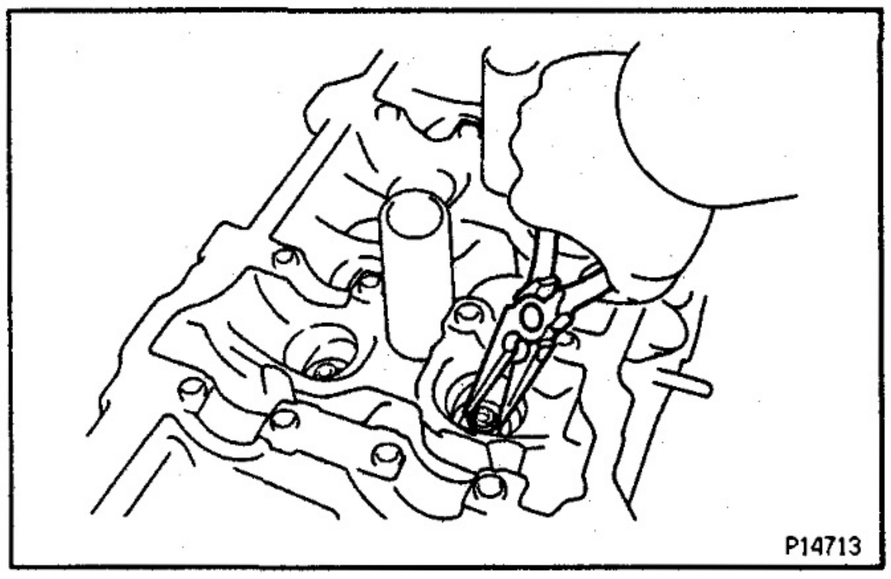
EG78K–01

CYLINDER HEAD DISASSEMBLY

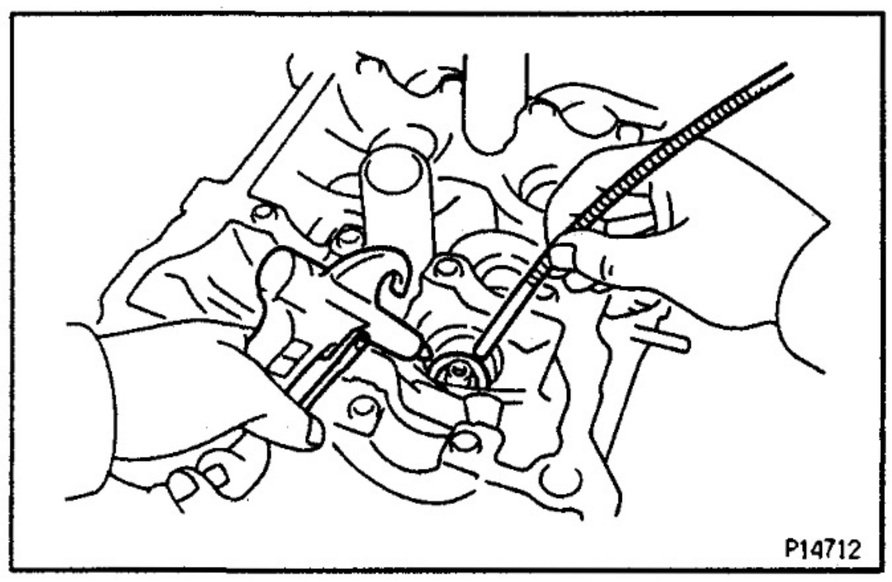
1. **REMOVE VALVE LIFTERS AND SHIMS**
   HINT: Arrange the valve lifters and shims in correct order.
2. **REMOVE VALVES**

(a) Using SST, compress the valve spring and remove the 2 keepers.
SST 09202–70020 (09202–00010)

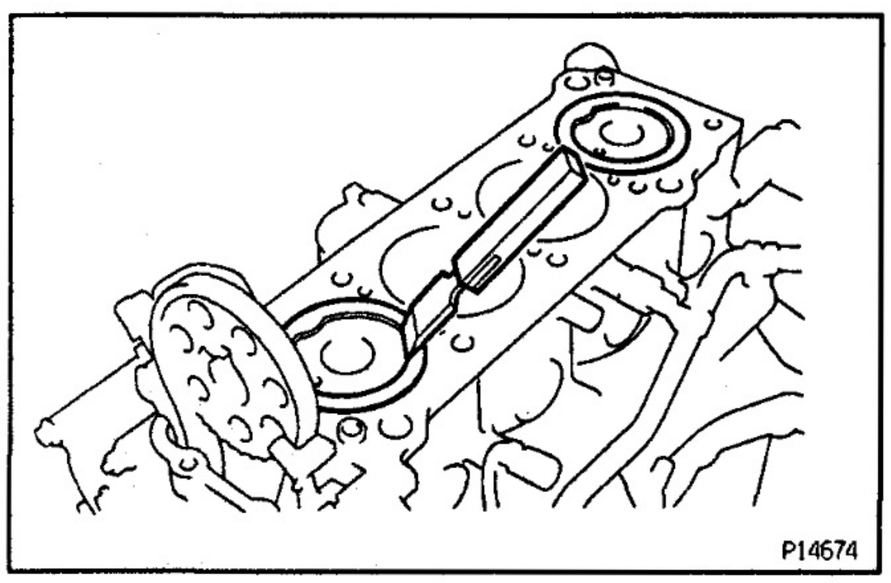
(b) Remove the spring retainer, valve spring and valve.



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



(d) Using compressed air and a magnetic finger, remove the spring seat by blowing air.
HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.

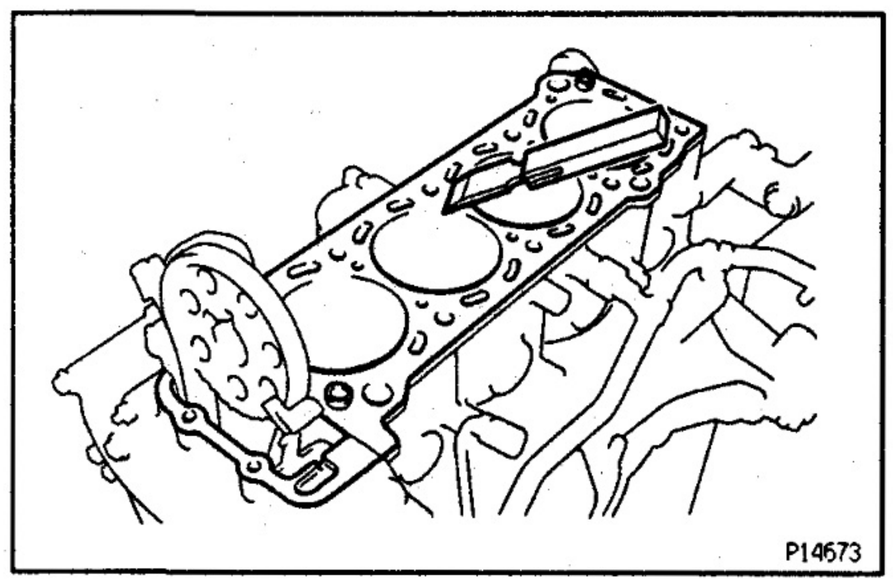


EG78L–01

CYLINDER HEAD COMPONENTS INSPECTION, CLEANING AND REPAIR

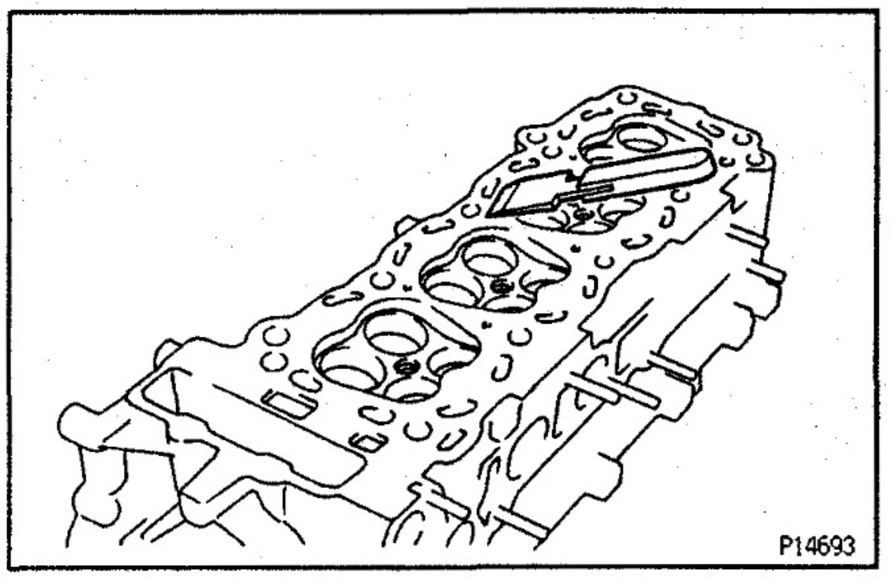
1. **CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK**

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



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

(c) Using compressed air, blow carbon and oil from the bolt holes.
CAUTION: Protect your eyes when using high–pressure.

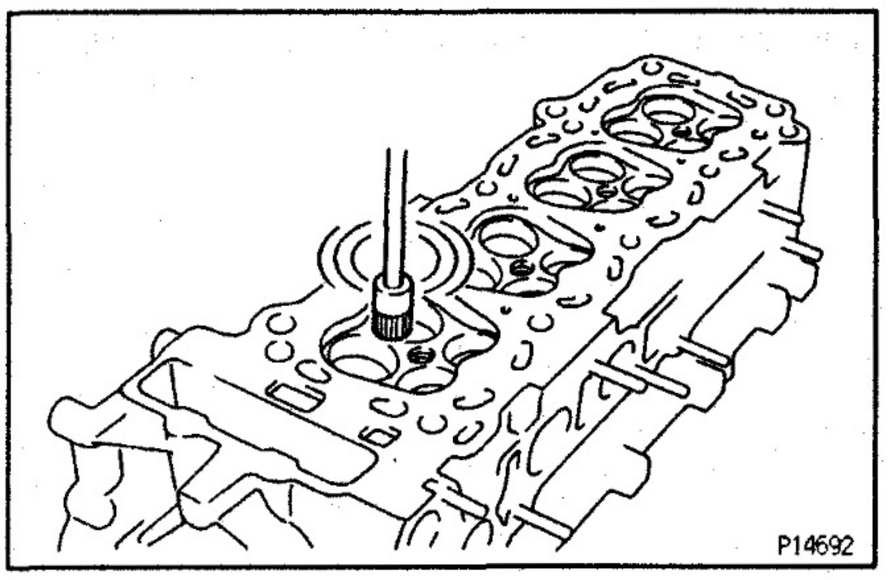


2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

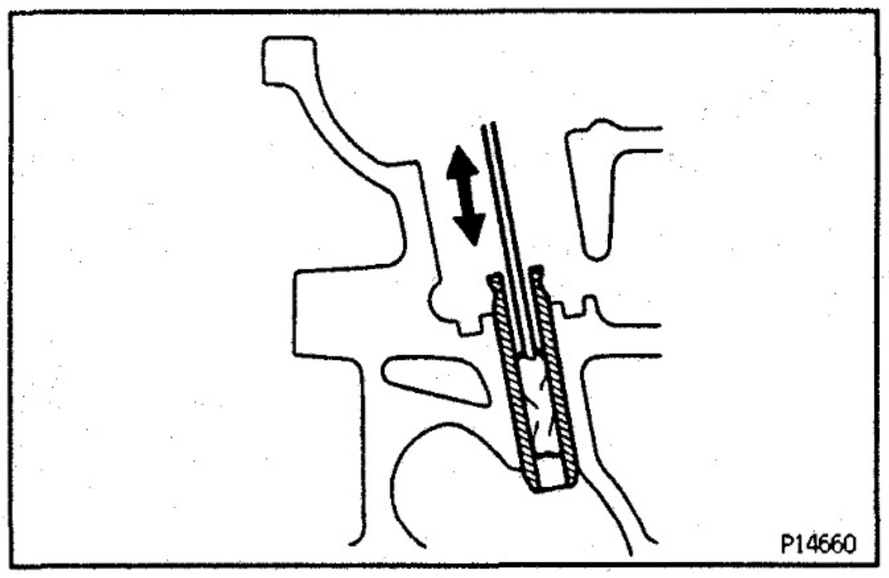
NOTICE: Be careful not to scratch the cylinder block contact surface.



B. Clean combustion chambers

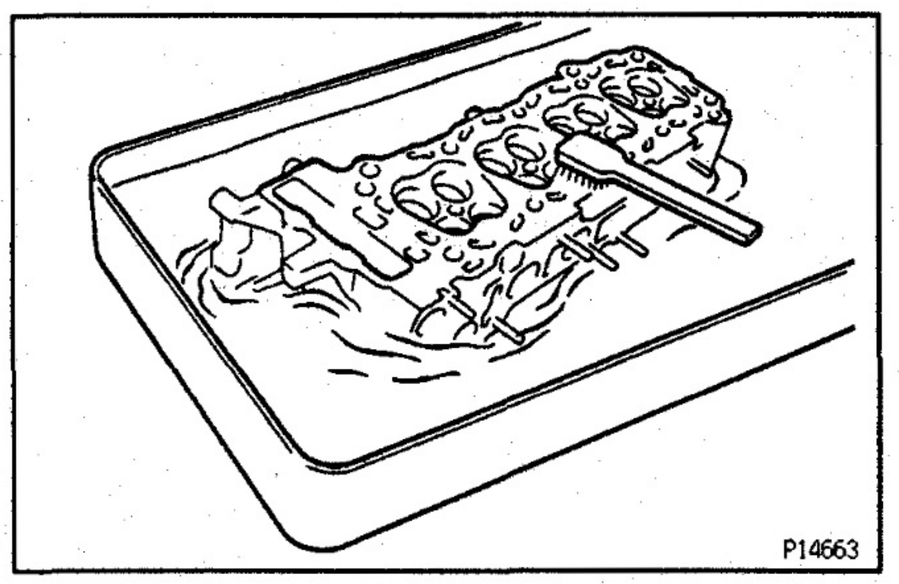
Using a wire brush, remove all the carbon from the combustion chambers.

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



C. Clean valve guide bushings

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



D. Clean cylinder head

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

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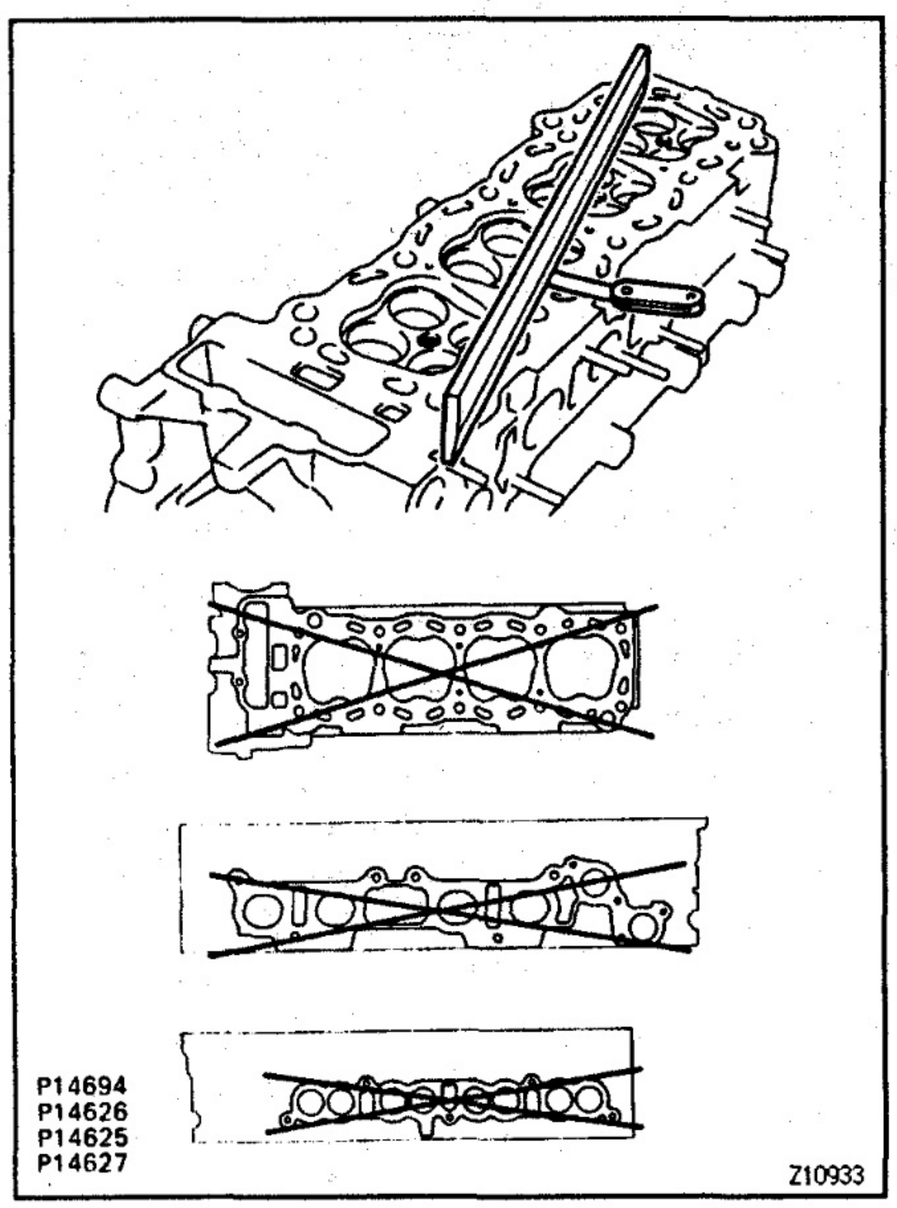
EG



3. INSPECT CYLINDER HEAD

A. Inspect for flatness

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

Maximum warpage:

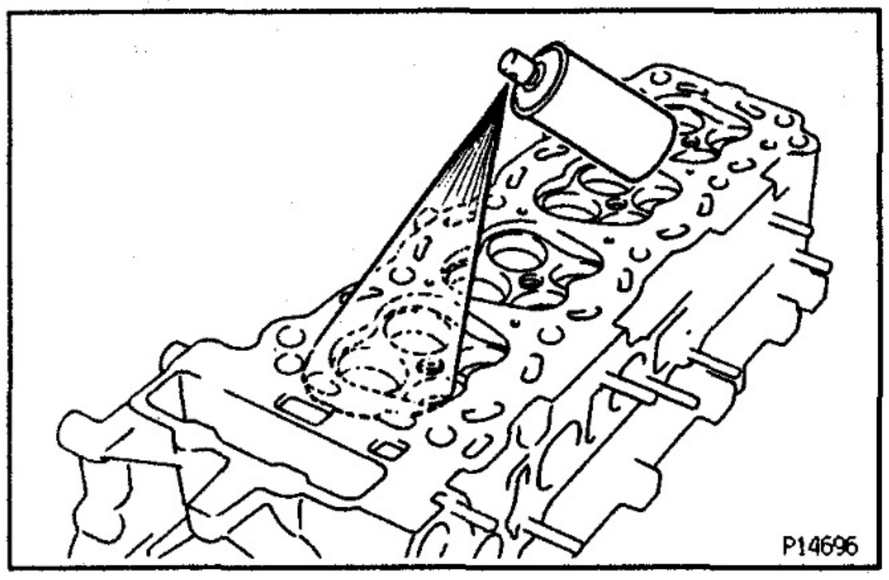
Cylinder block side

0.05 mm (0.0020 in.)

Manifold side

0.10 mm (0.0039 in.)

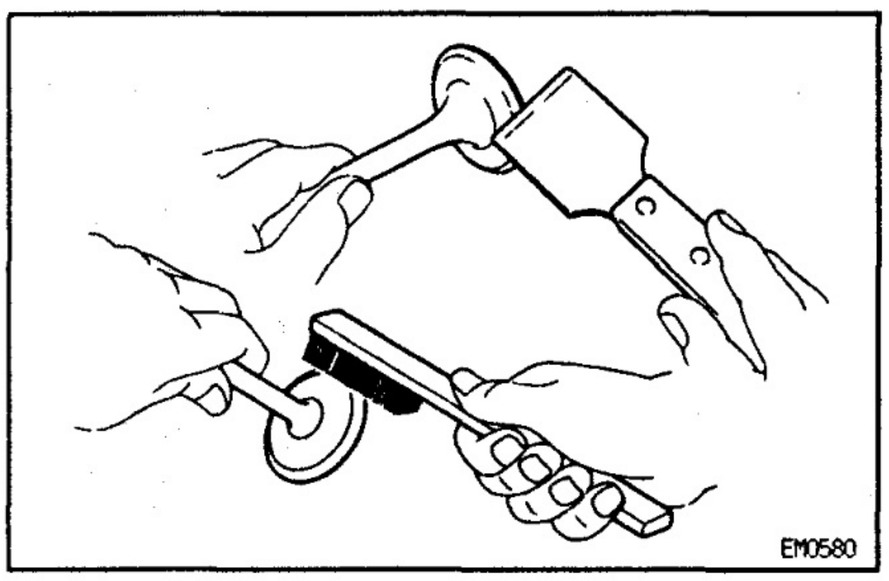
If warpage is greater than maximum, replace the cylinder head.



B. Inspect for cracks

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

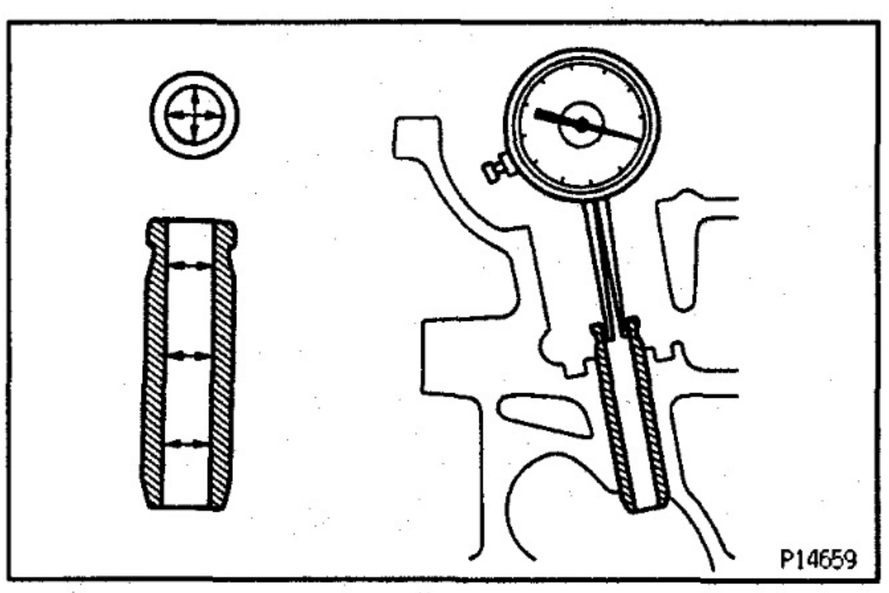
If cracked, replace the cylinder head.



4. CLEAN VALVES

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

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

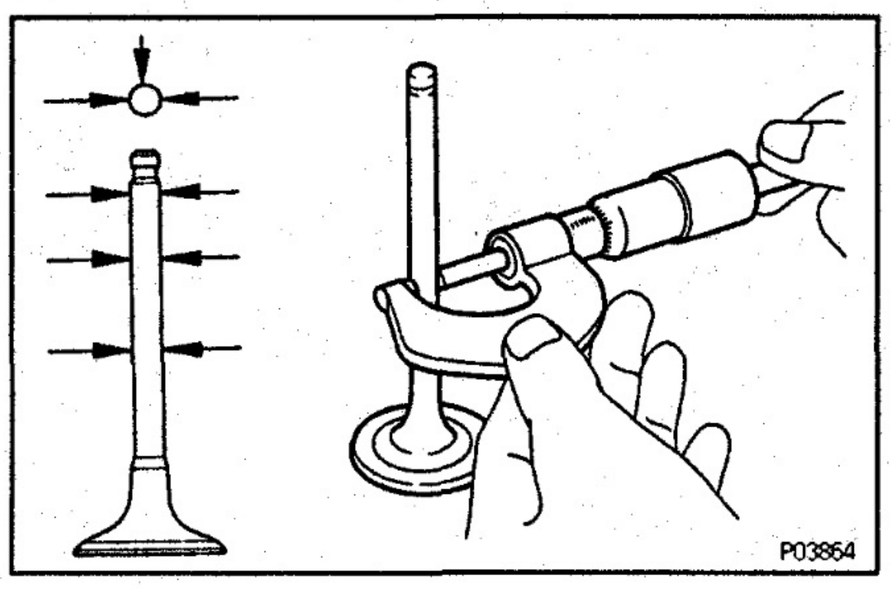


5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

6.010 — 6.030 mm (0.2366 — 0.2374 in.)



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

Valve stem diameter:

Intake

5.970 — 5.985 mm (0.2350 — 0.2356 in.)

Exhaust

5.965 — 5.980 mm (0.2348 — 0.2354 in.)

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

Standard oil clearance:

Intake

0.025 — 0.060 mm (0.0010 — 0.0024 in.)

Exhaust

0.030 — 0.065 mm (0.0012 — 0.0026 in.)

Maximum oil clearance:

Intake

0.08 mm (0.0031 in.)

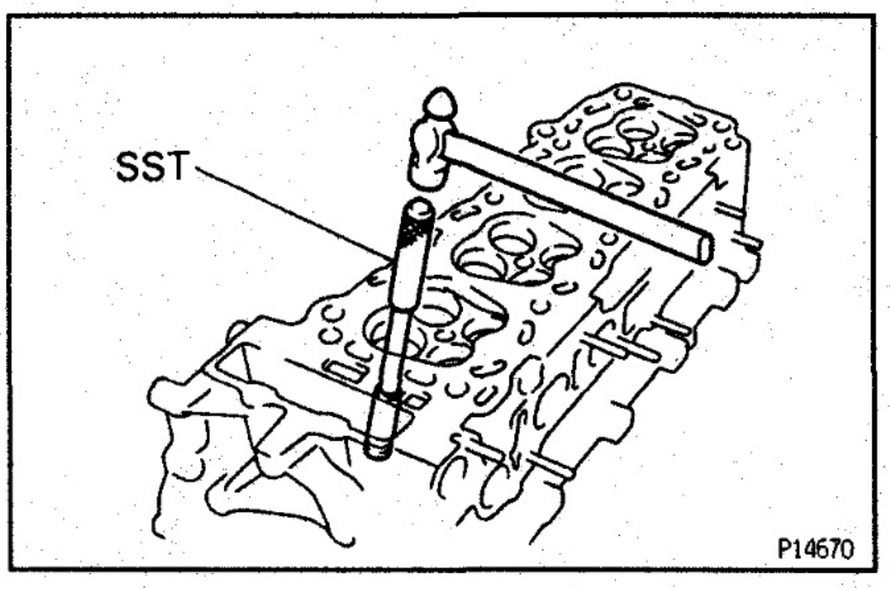
Exhaust

0.10 mm (0.0039 in.)

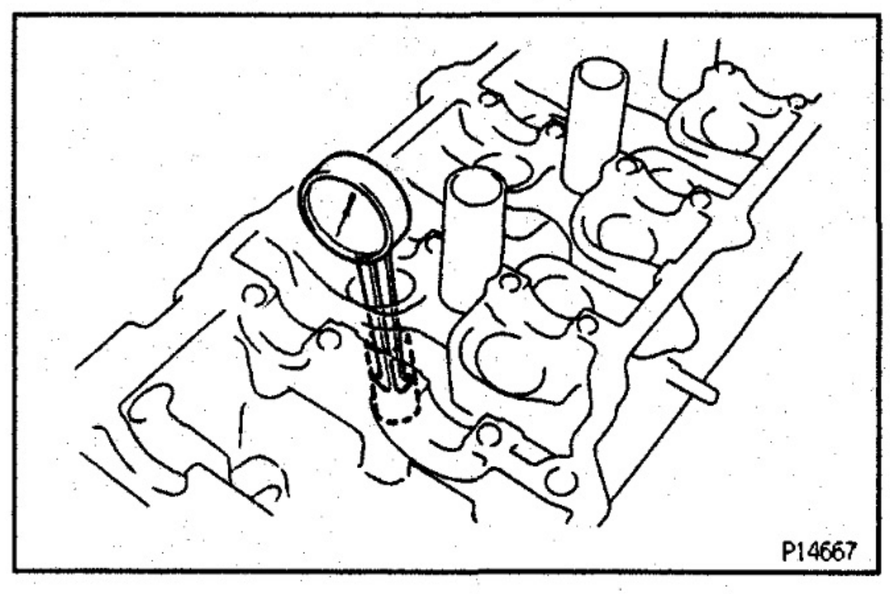
If the clearance is greater than maximum, replace the valve and guide bushing.

6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

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



(b) Using SST and a hammer, tap out the guide bushing.
SST 09201—10000 (09201—01060),
09550—10012 (09252—10010)



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

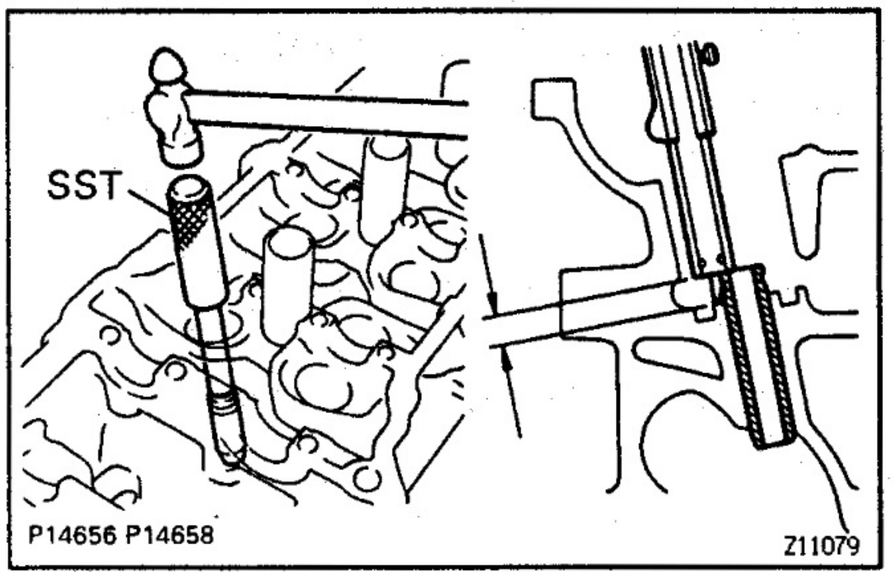
Both intake and exhaust

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

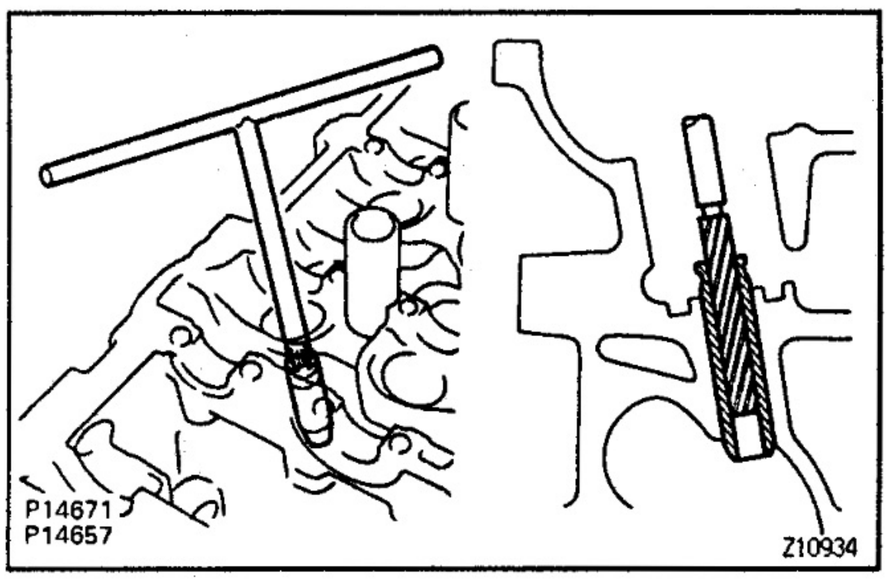
V04903

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

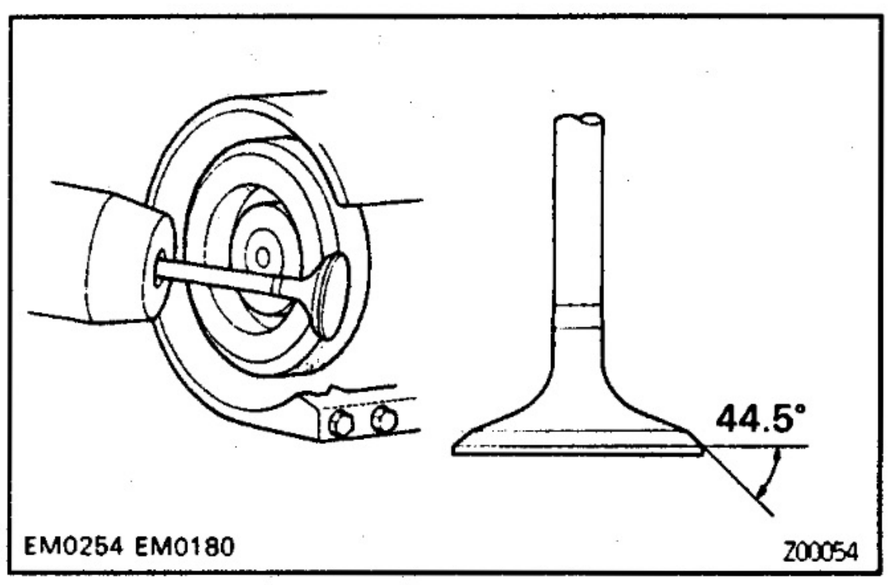
(e) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).



(f) Using SST and a hammer, tap in a new guide bushing to where there is 8.2 – 8.6 mm (0.323 – 0.339 in.) protruding from the cylinder head.
SST 09201–10000 (09201–01060),
09550–10012 (09252–10010)



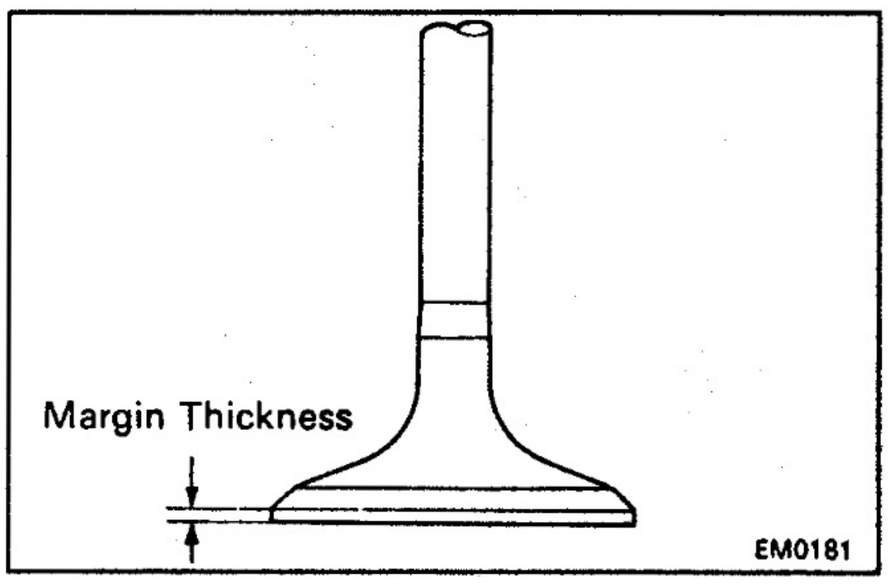
(g) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See step–5) between the guide bushing and valve stem.



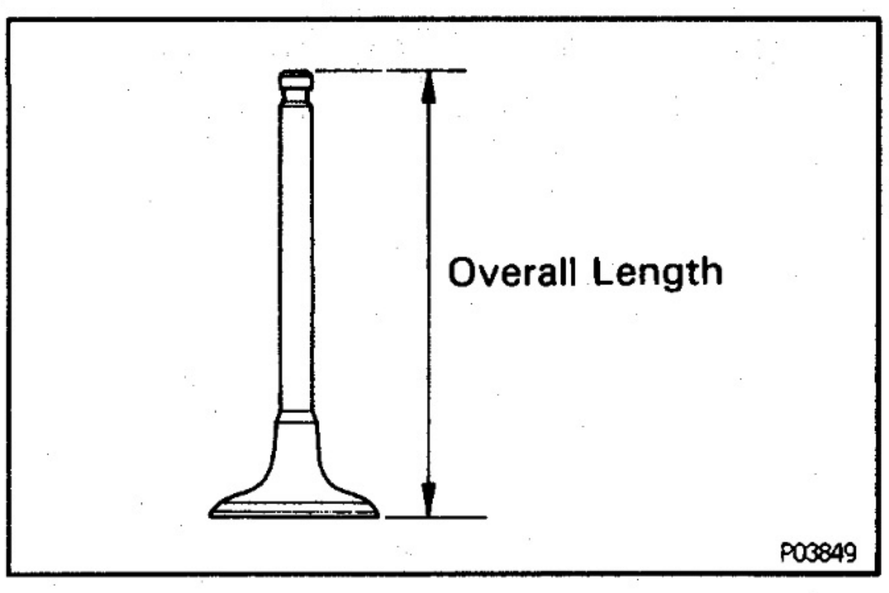
7. INSPECT AND GRIND VALVES

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

(b) Check that the valve is ground to the correct valve face angle.
Valve face angle:
44.5°



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



(d) Check the valve overall length.

Standard overall length:

Intake

103.45 mm (4.0728 in.)

Exhaust

103.60 mm (4.0787 in.)

Minimum overall length:

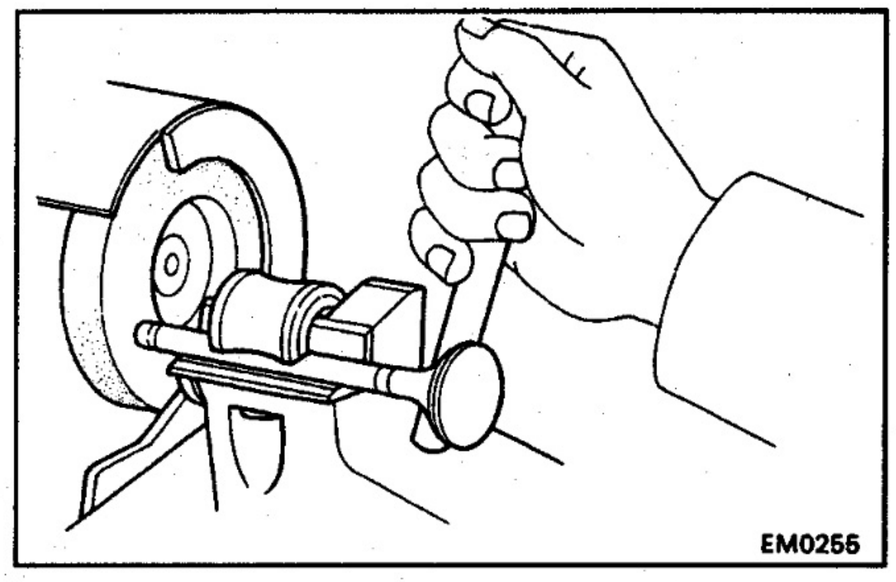
Intake

102.95 mm (4.0531 in.)

Exhaust

103.10 mm (4.0590 in.)

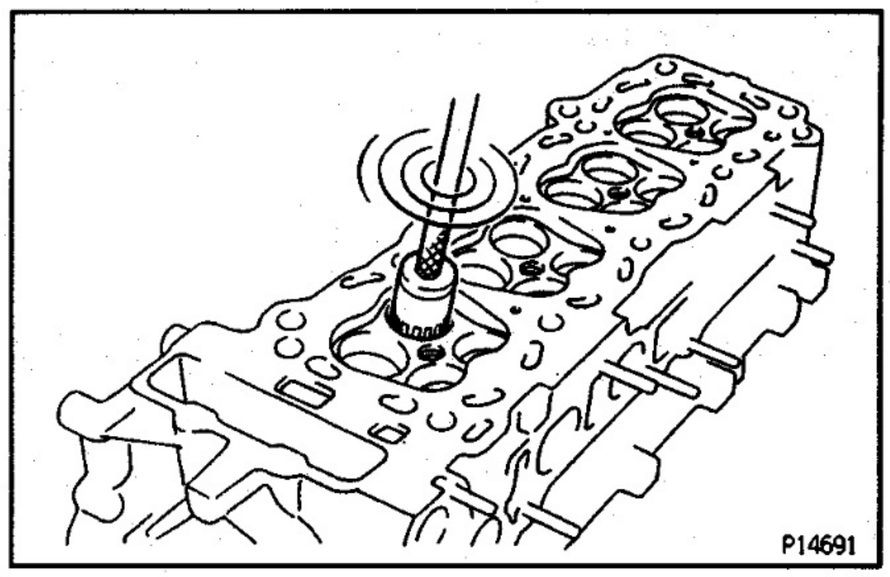
If the overall length is less than minimum, replace the valve.



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

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

NOTICE: Do not grind off more than minimum.



8. INSPECT AND CLEAN VALVE SEATS

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

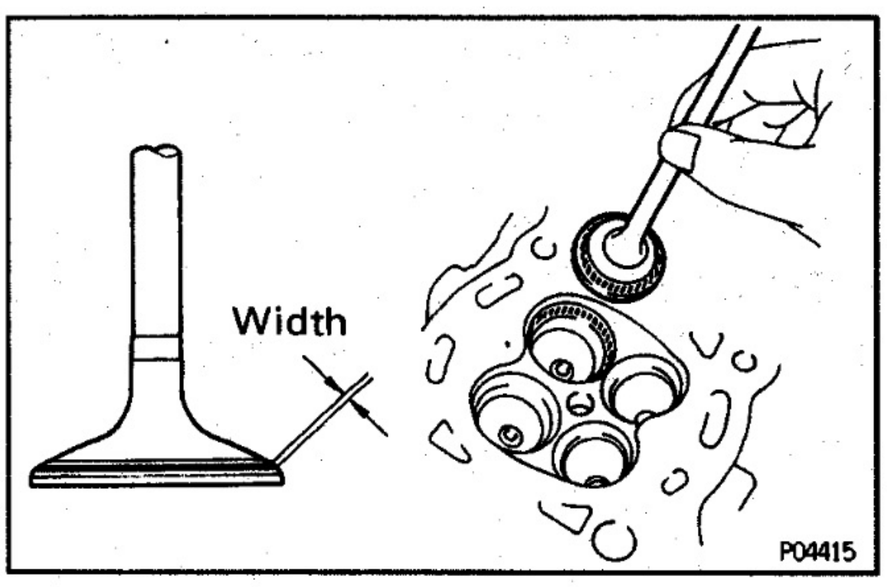
(b) Check the valve seating position.

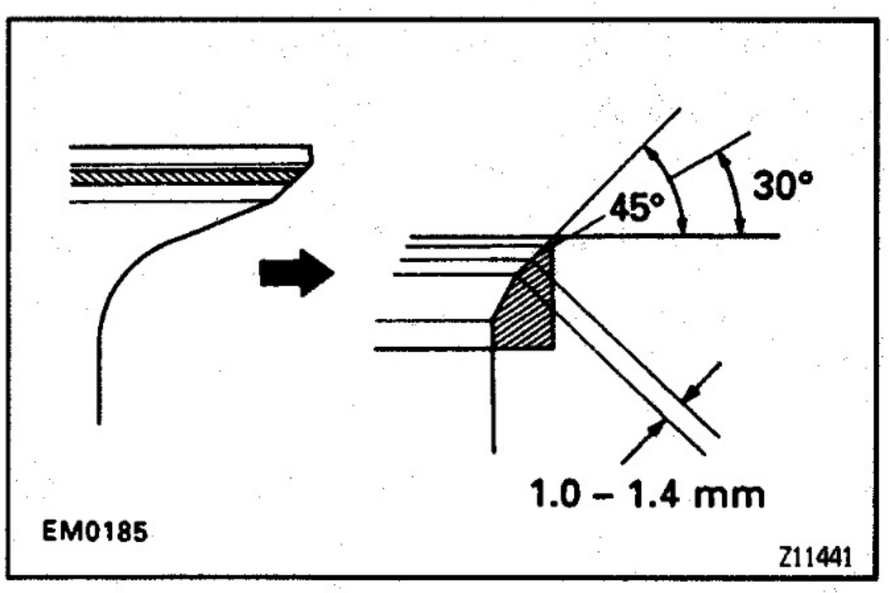
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.

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

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

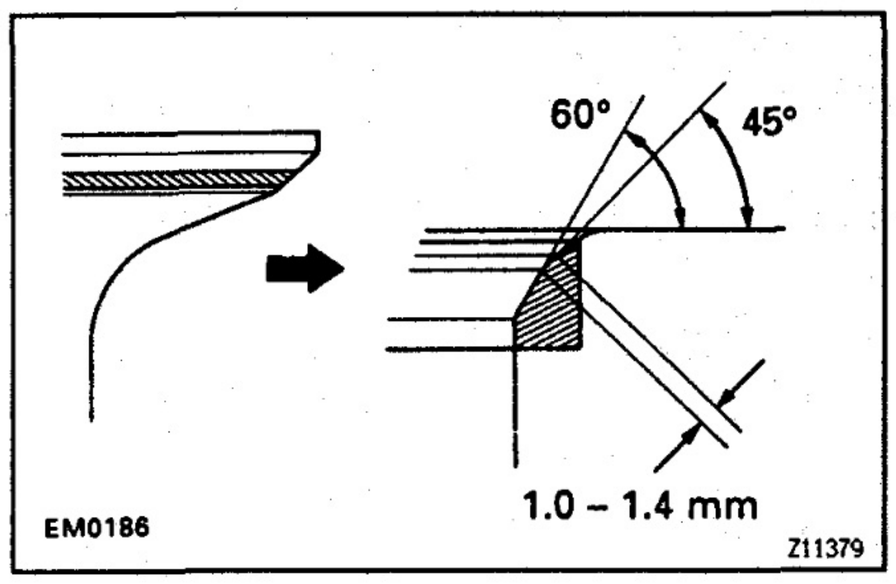
If not, correct the valve seats as follows:



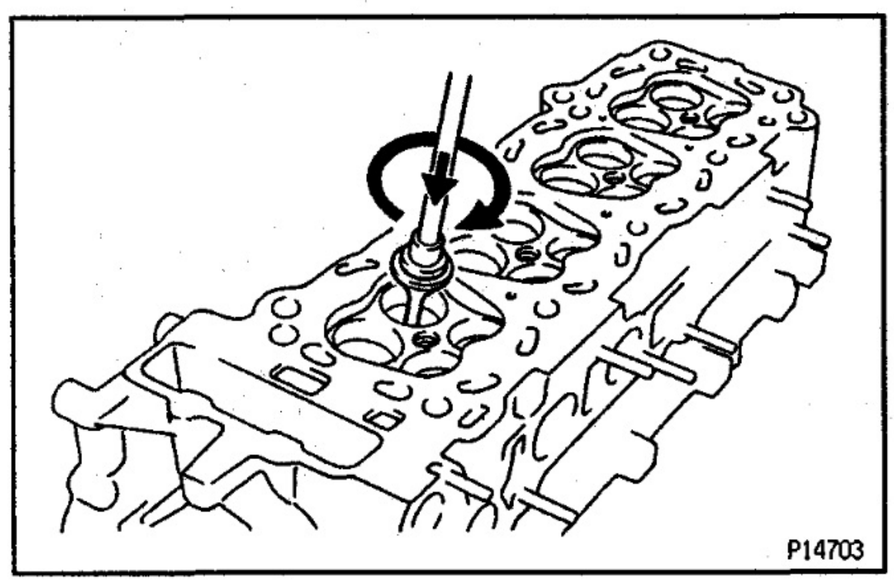


(1) Intake:

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

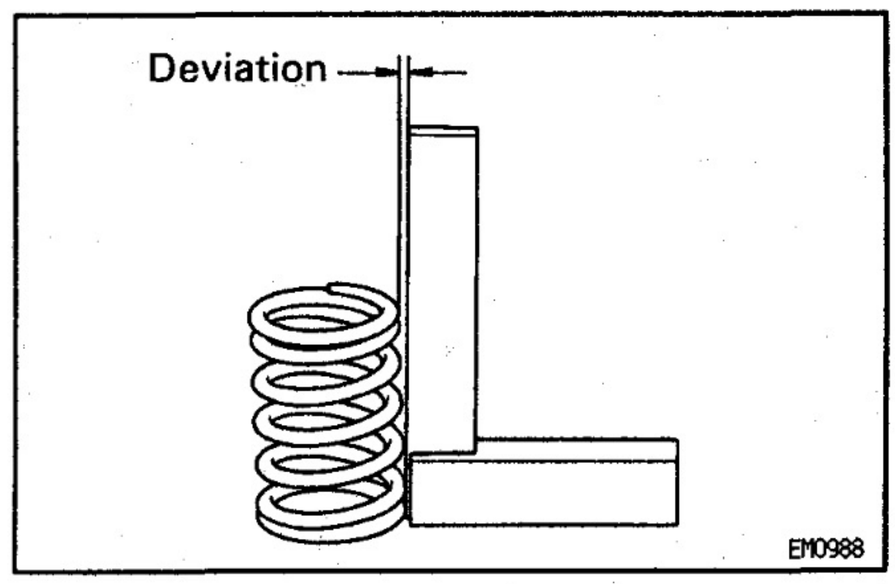


(2) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



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

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



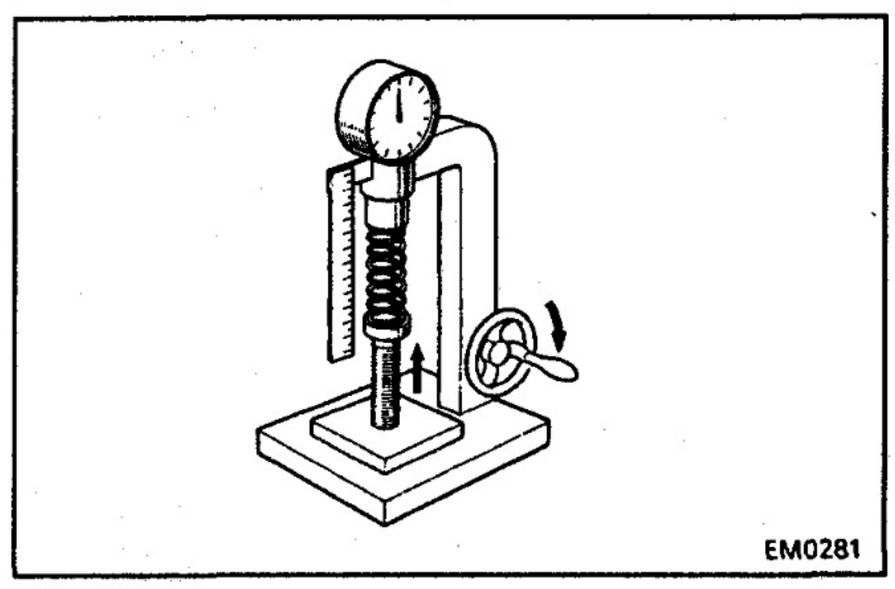
9. INSPECT VALVE SPRINGS

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

Maximum deviation:

2.0 mm (0.079 in.)

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



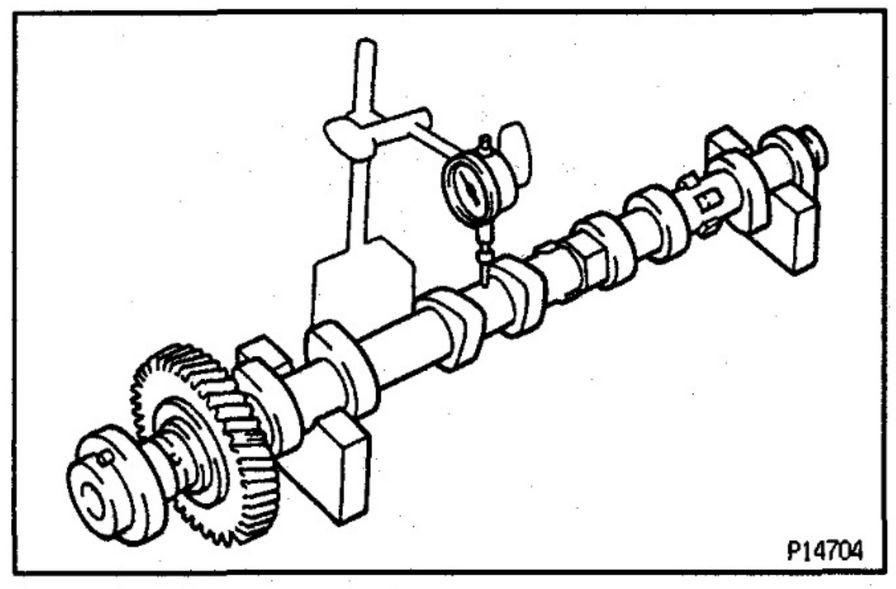
(b) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

At 35.7 mm (1.406 in.):

177 — 204 N (18.0 — 20.8 kgf, 45.9 — 39.7 lbf)

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



10. INSPECT CAMSHAFTS AND BEARINGS

A. Inspect camshaft for runout

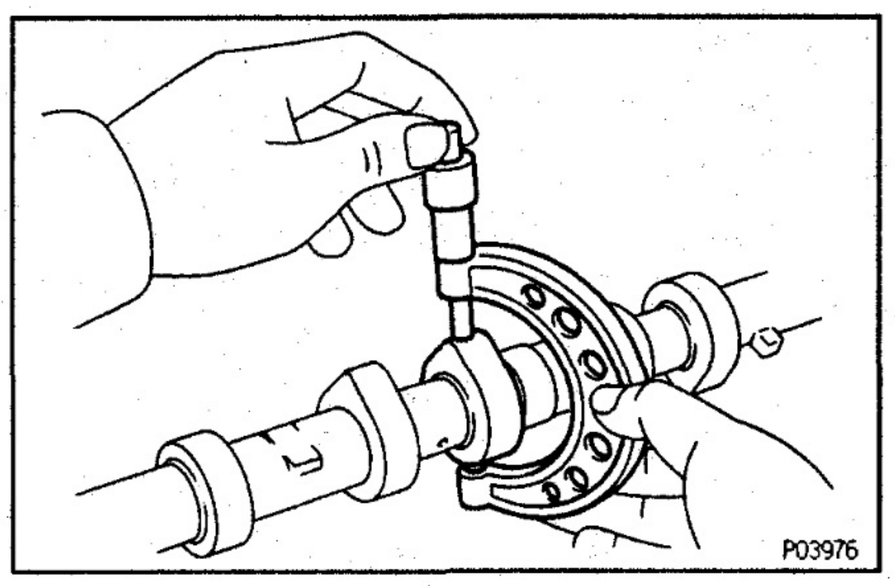
(a) Place the camshaft on V—blocks.

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

Maximum circle runout:

0.06 mm (0.0024 in.)

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



B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

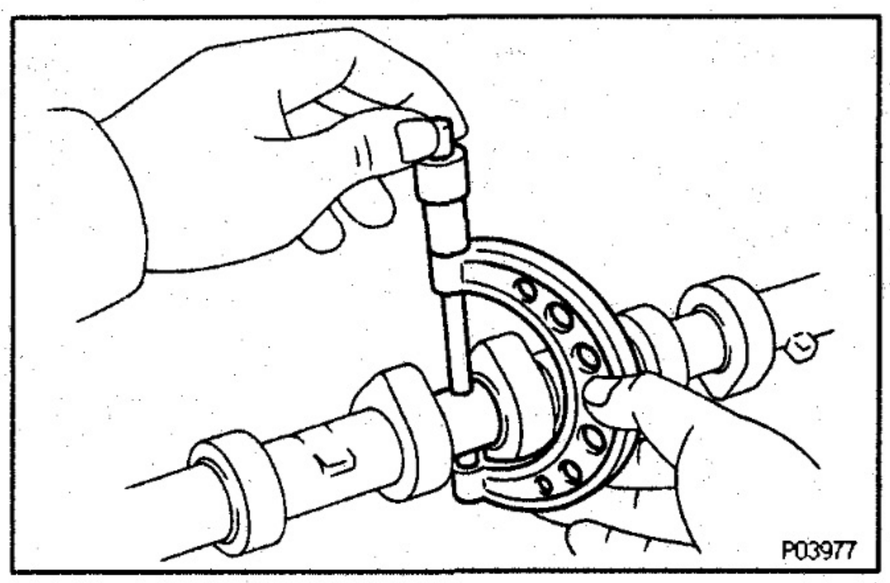
Intake

45.31 – 45.41 mm (1.7839 – 1.7878 in.)

Exhaust

45.06 – 45.16 mm (1.7740 – 1.7779 in.)

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



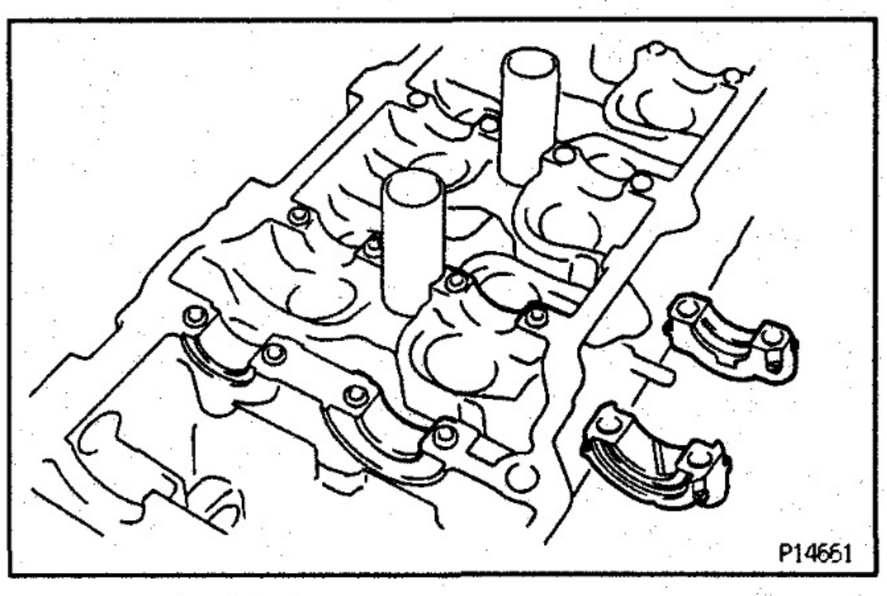
C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter:

26.959 – 26.975 mm (1.0614 – 1.0620 in.)

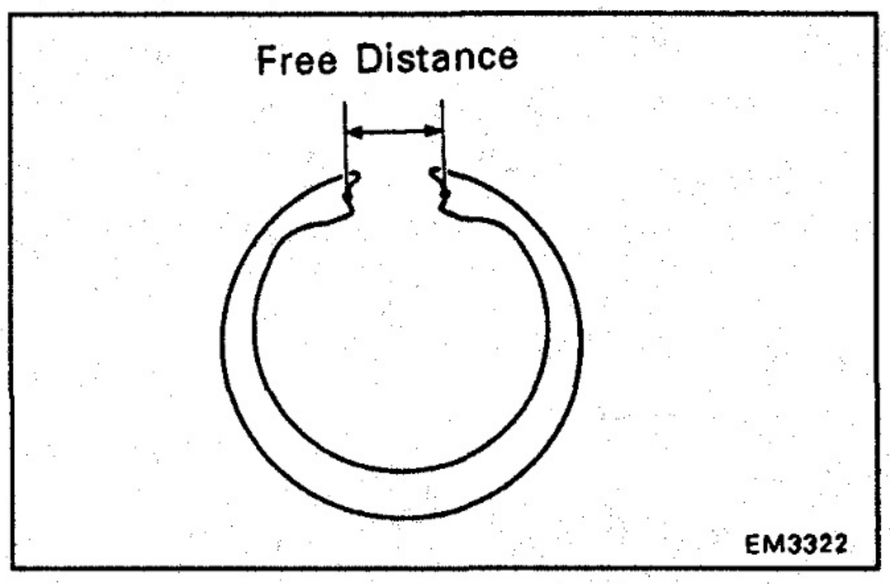
If the journal diameter is not as specified, check the oil clearance.



D. Inspect camshaft bearings

Check that bearings for flaking and scoring.

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



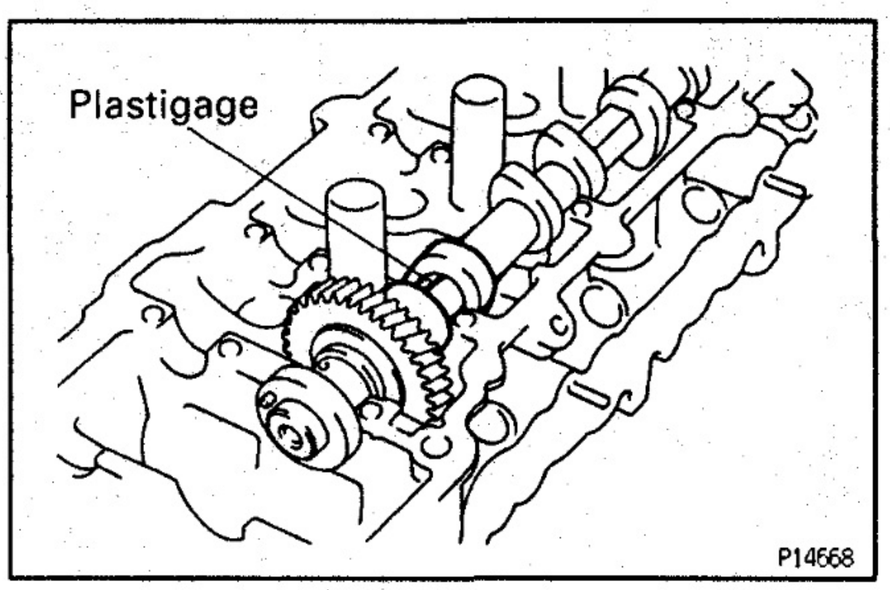
E. Inspect camshaft gear spring

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

Free distance:

22.5 – 22.9 mm (0.886 – 0.902 in.)

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

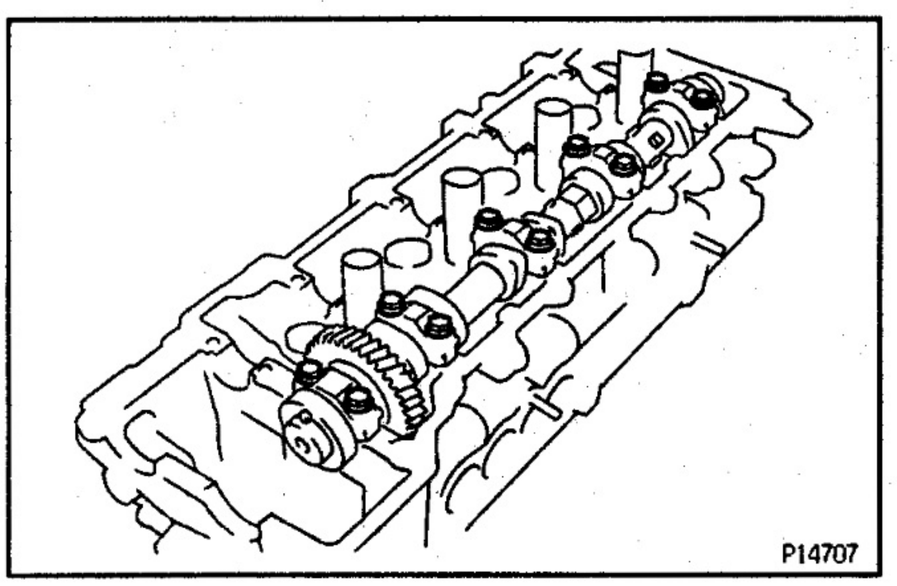


F. Inspect camshaft journal oil clearance

(a) Clean the bearing caps and camshaft journals.

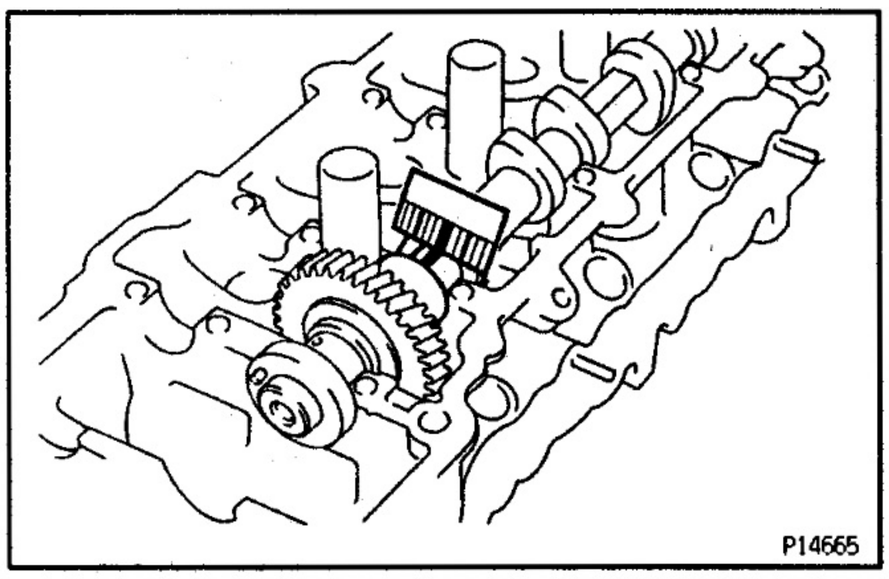
(b) Place the camshafts on the cylinder head.

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


P14707

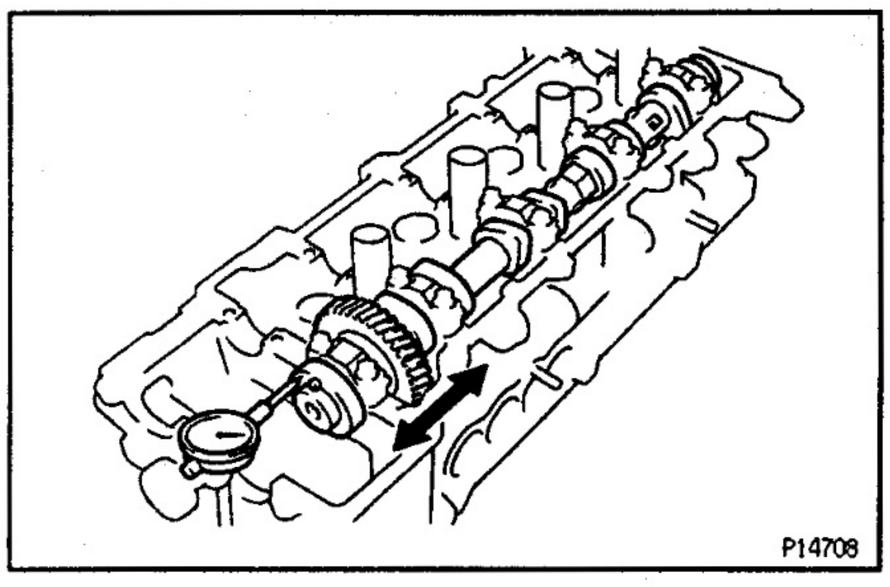
(d) Install the bearing caps.
(See step 3 in cylinder head installation)
Torque: 15.5 N·m (160 kgf·cm, 12 ft·lbf)
NOTICE: Do not turn the camshaft.

(e) Remove the bearing caps.


P14665

(f) Measure the Plastigage at its widest point.
Standard oil clearance:
0.025 — 0.062 mm (0.0010 — 0.0024 in.)
Maximum oil clearance:
0.08 mm (0.0031 in.)
If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

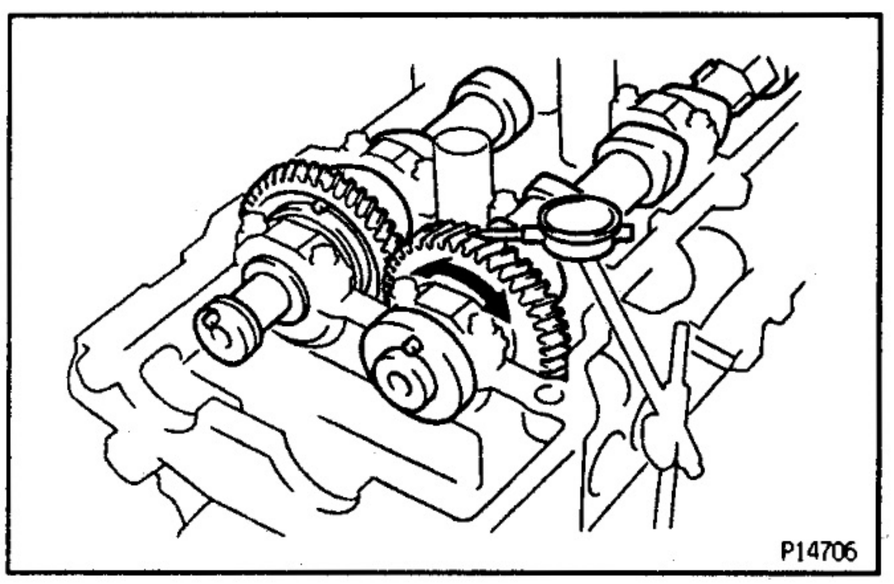
(g) Completely remove the Plastigage.


P14708

G. Inspect camshaft thrust clearance

(a) Install the camshaft.
(See step 3 in cylinder head installation)

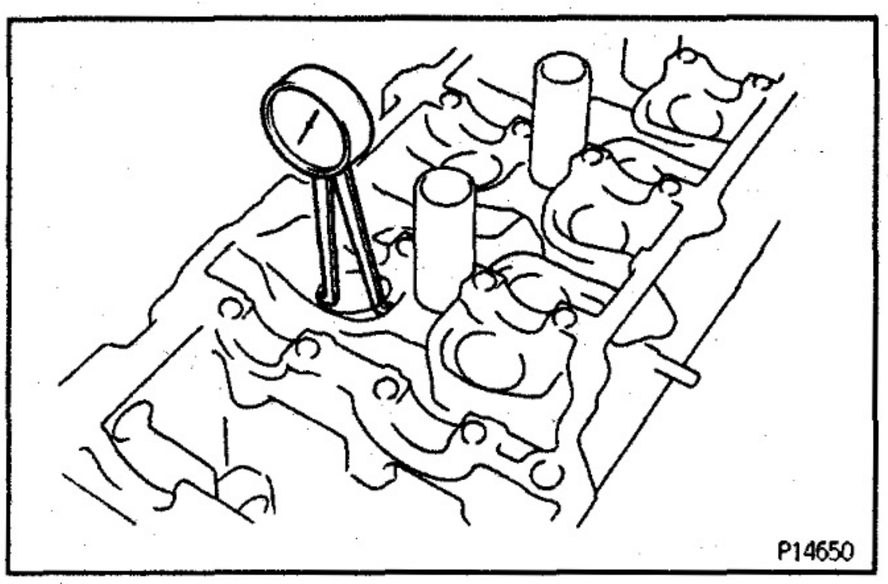
(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.
Standard thrust clearance:
0.040 — 0.095 mm (0.0016 — 0.0037 in.)
Maximum thrust clearance:
0.12 mm (0.0047 in.)
If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.


P14706

H. Inspect camshaft gear backlash

(a) Install the camshafts without installing the exhaust cam sub—gear.
(See step 5 in cylinder head installation)

(b) Using a dial indicator, measure the backlash.
Standard backlash:
0.020 — 0.200 mm (0.0008 — 0.0079 in.)
Maximum backlash:
0.30 mm (0.0188 in.)
If the backlash is greater than maximum, replace the camshafts.

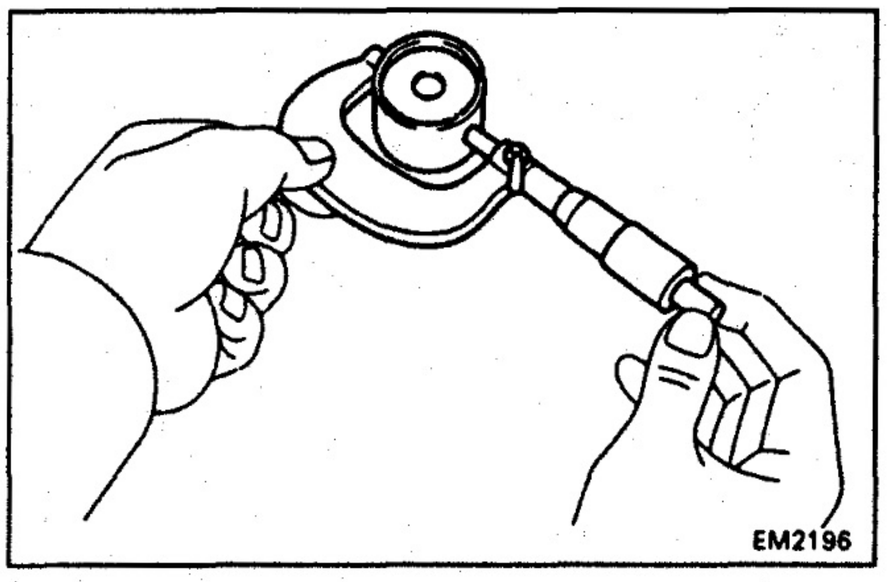


11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter:

31.000 – 31.016 mm (1.2205 – 1.2211 in.)



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

Lifter diameter:

30.966 – 30.976 mm (1.1578 – 1.2195 in.)

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

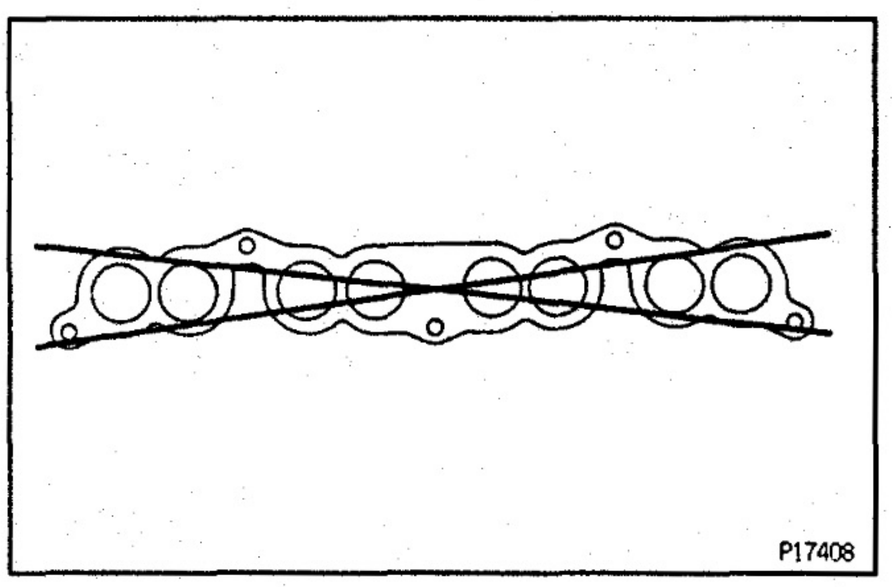
Standard oil clearance:

0.024 – 0.050 mm (0.0009 – 0.0020 in.)

Maximum oil clearance:

0.07 mm (0.0028 in.)

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



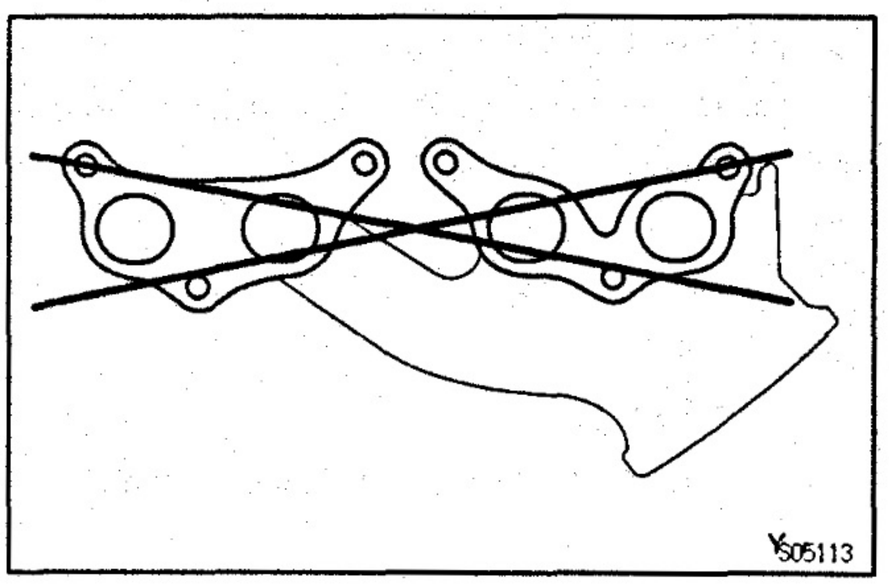
12. INSPECT INTAKE MANIFOLD

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

Maximum warpage:

0.20 mm (0.0078 in.)

If warpage is greater than maximum, replace the manifold.



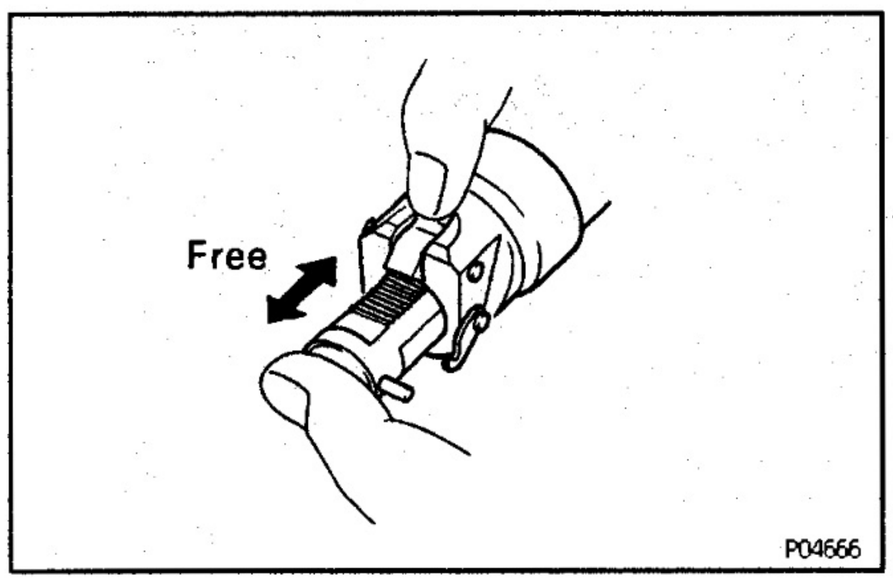
13. INSPECT EXHAUST MANIFOLD

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

Maximum warpage:

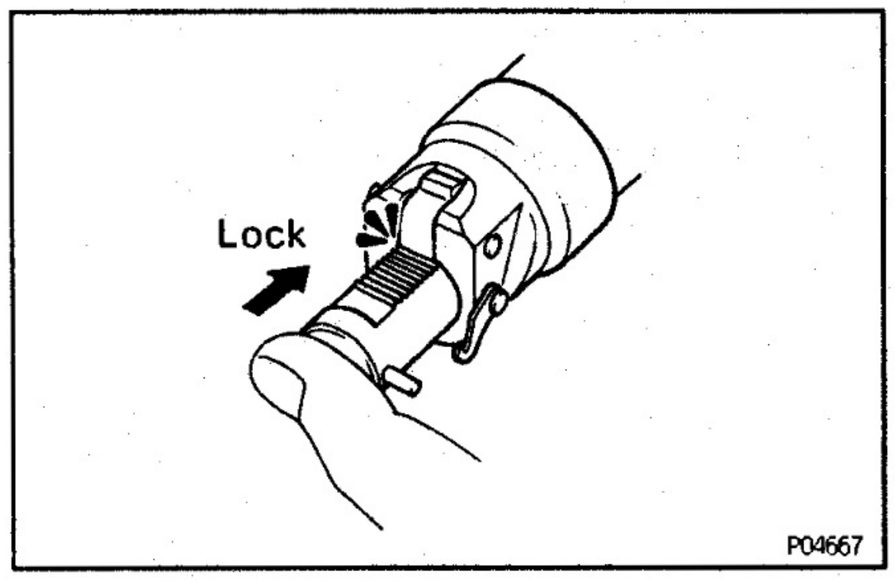
0.50 mm (0.0197 in.)

If warpage is greater than maximum, replace the manifold.

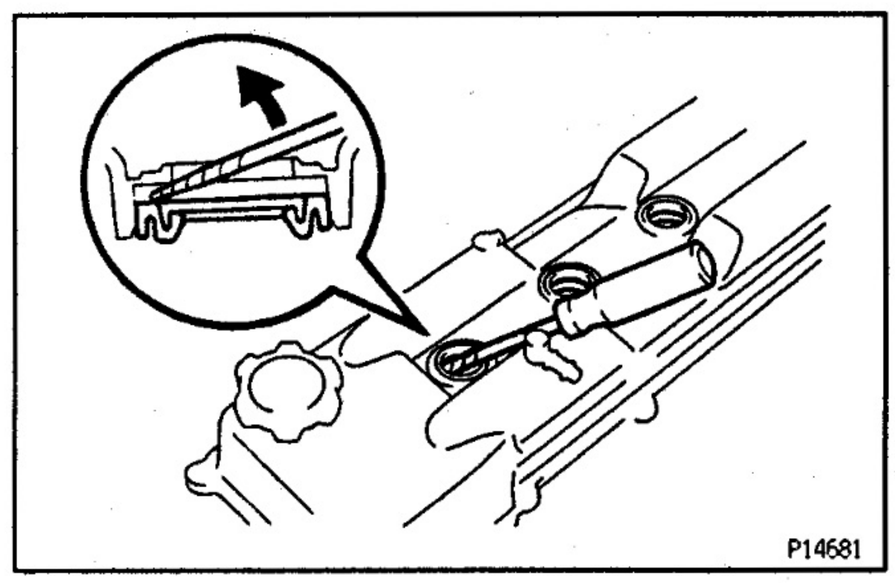


14. INSPECT CHAIN TENSIONER

(a) Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.

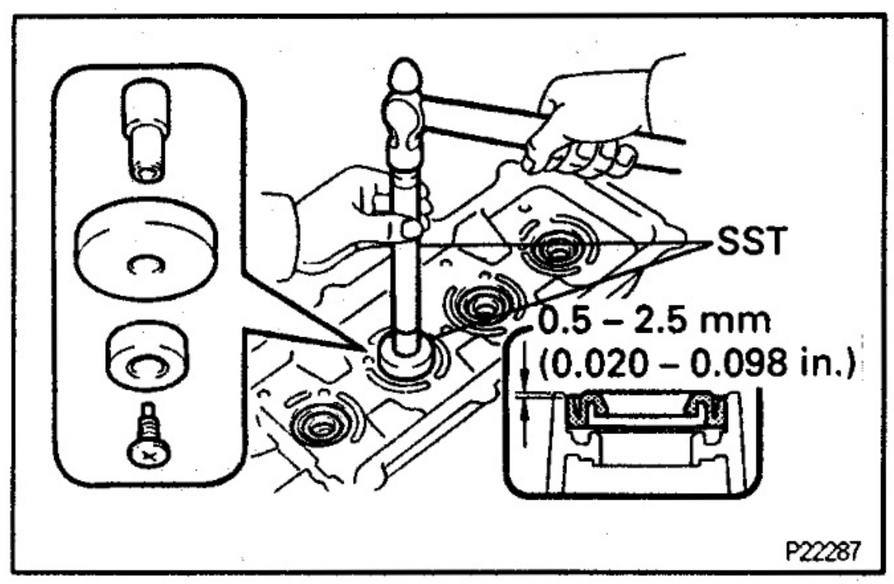


(b) Released the ratchet pawl and check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.



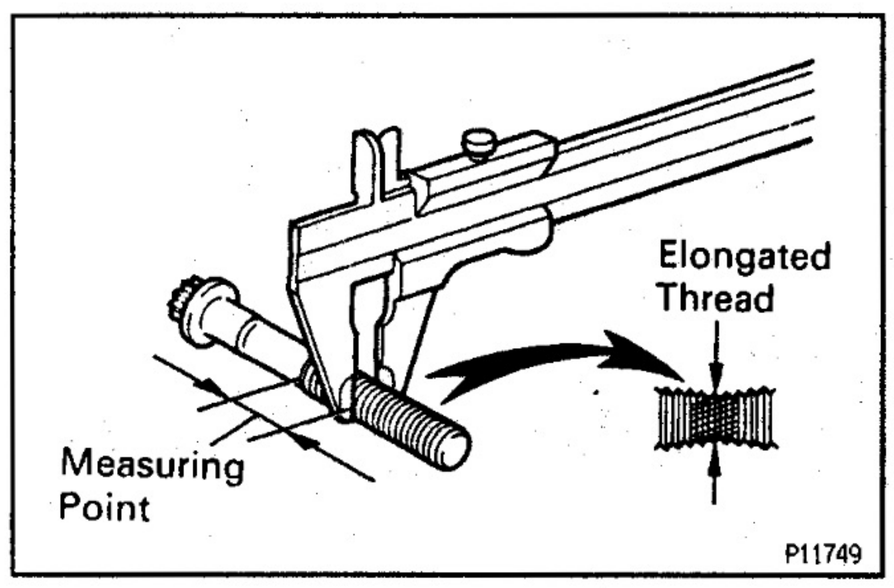
15. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKETS

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



(b) Using SST and a hammer, tap in a new tube gasket as shown in the illustration.
SST 09950–60010 (09951–00260, 09951–00490, 09952–06010), 09950–70010 (09951–07150)

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



16. INSPECT CYLINDER HEAD BOLTS

Using vernier calipers, measure the minimum diameter of the elongated thread at the measuring point.

Standard diameter:

10.76 – 10.97 mm (0.4236 – 0.4319 in.)

Minimum diameter:

10.40 mm (0.4094 in.)

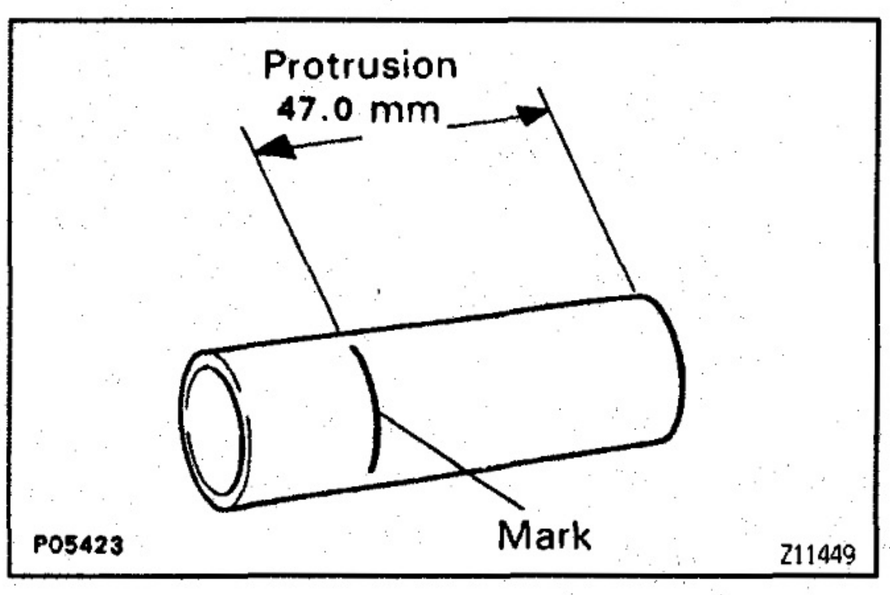
If the diameter is less than minimum, replace the bolt.

EG78M-01

CYLINDER HEAD ASSEMBLY

HINT:

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



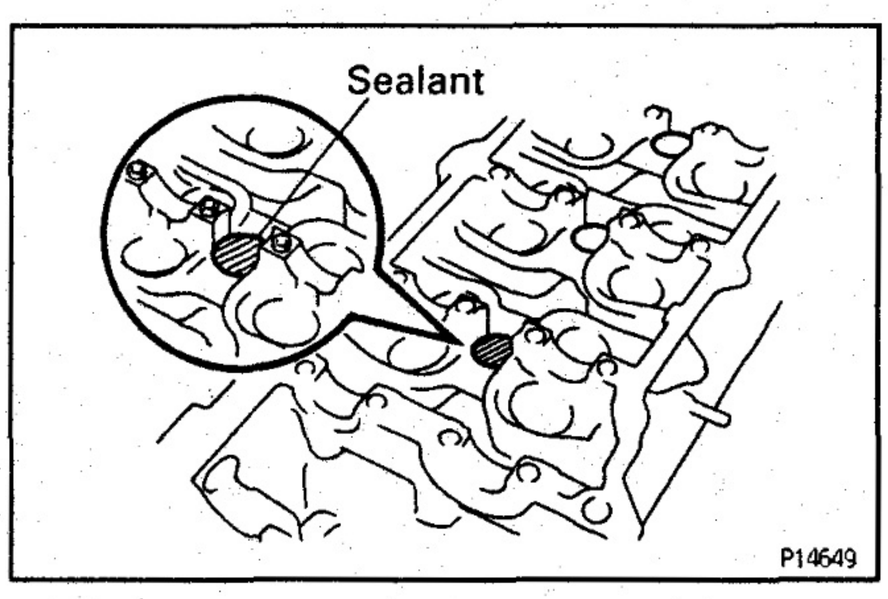
1. INSTALL SPARK PLUG TUBES

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

(a) Mark the standard position away from the edge, onto the spark plug tube.

Standard protrusion:

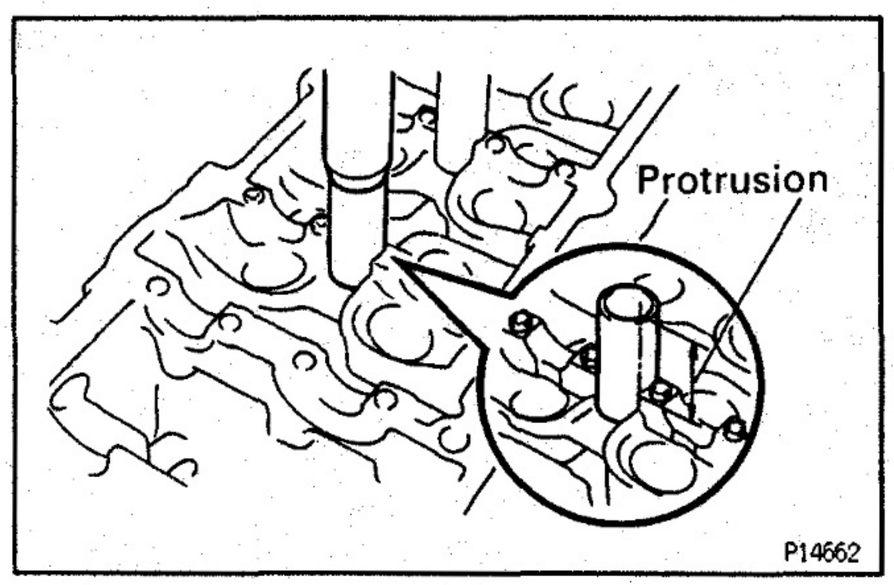
47.0 mm (1.850 in.)



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

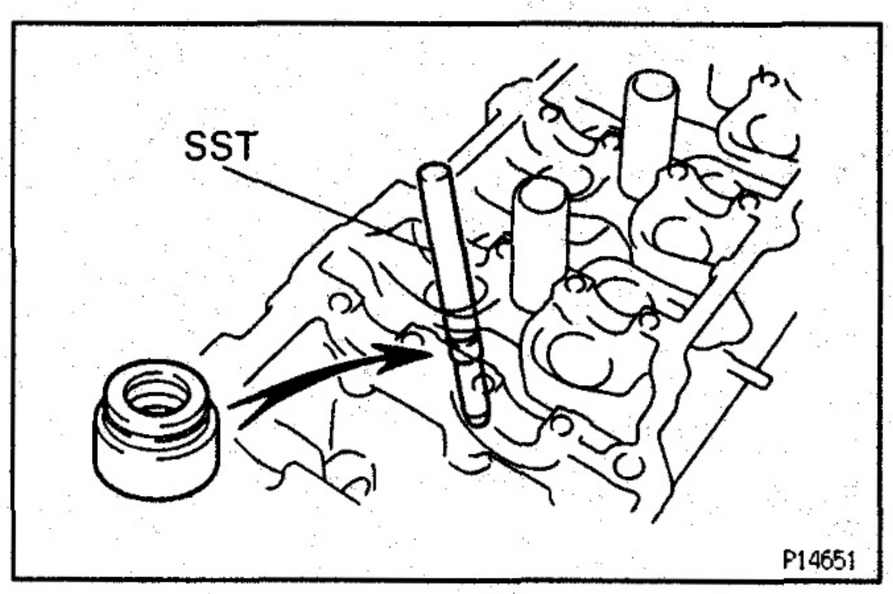
Sealant:

Part No. 08833 — 00070, Adhesive 1324, THREE BOND 1324 or equivalent



(c) Using a press, press in a new spark plug tube until there is 47.0 mm (1.850 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

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



2. INSTALL VALVES

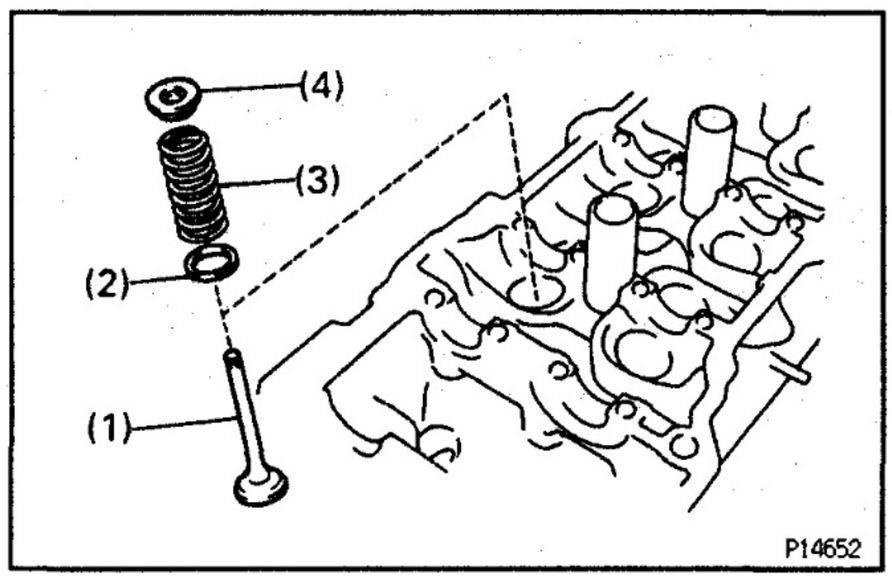
(a) Using SST, push in a new oil seal.

SST 09236—00101 (09236—15010)

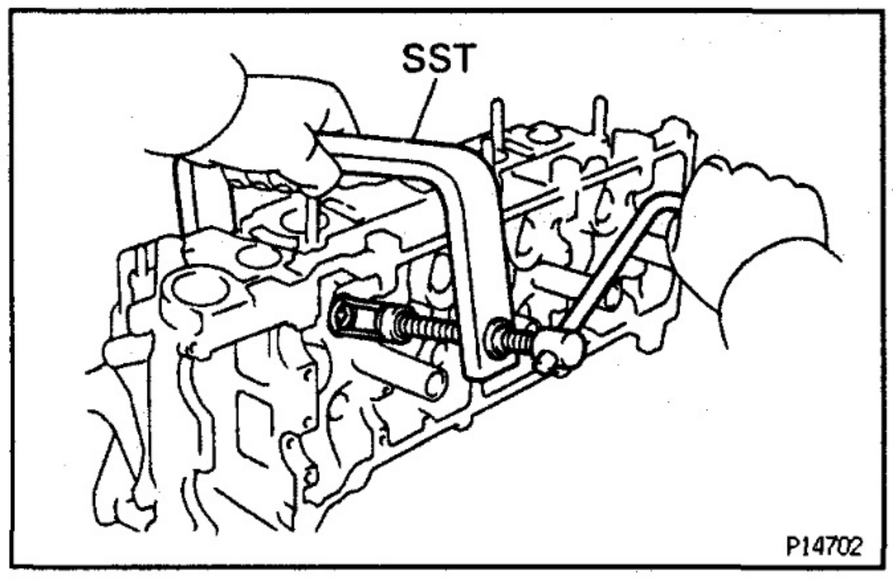
HINT: Different oil seals are used for the intake and exhaust.

Code mark (Intake side only):

"H"



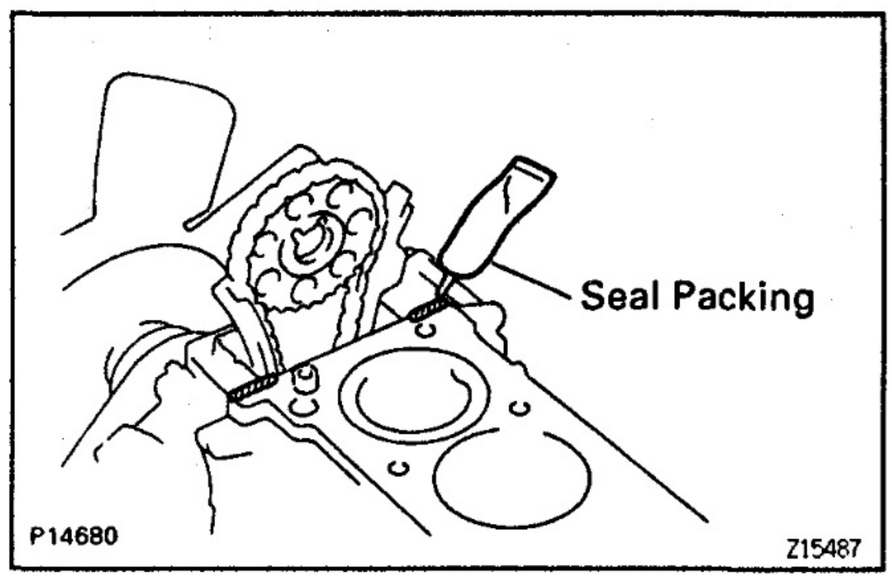
(b) Install the following parts:
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer



(c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202–70020 (09202–00010)
(d) Using a plastic–faced hammer, lightly tap the valve stem tip to on sure a proper fit.

3. INSTALL VALVE LIFTERS AND SHIMS

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



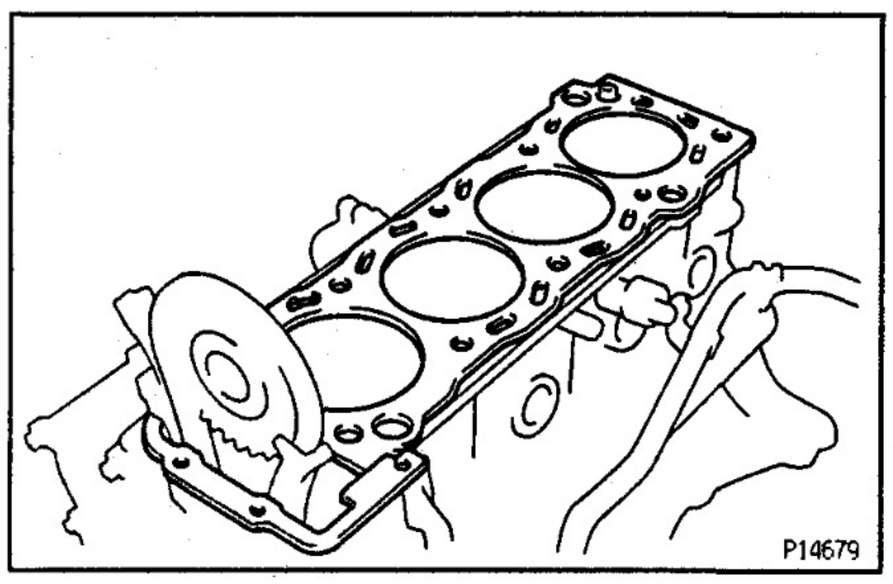
CYLINDER HEAD INSTALLATION

EG78N–02

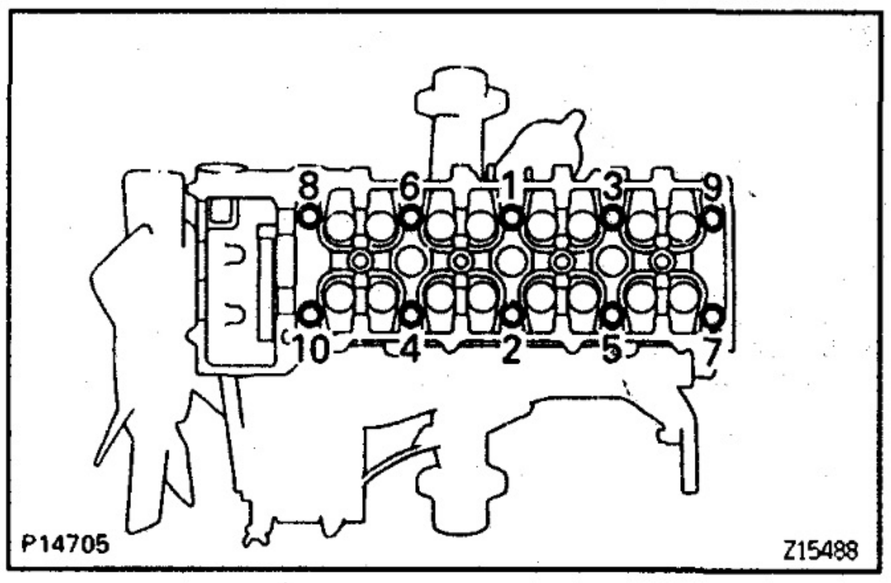
1. INSTALL CYLINDER HEAD

A. Place cylinder head on cylinder block

(a) Apply seal packing to the 2 locations as shown.
Seal packing:
Part No. 08826–00080 or equivalent
NOTICE: Do not apply too much seal packing.



(b) Place a new cylinder head gasket in position on the cylinder block.
NOTICE: Be careful of the installation direction.
(c) Place the cylinder head in position on the cylinder head gasket.

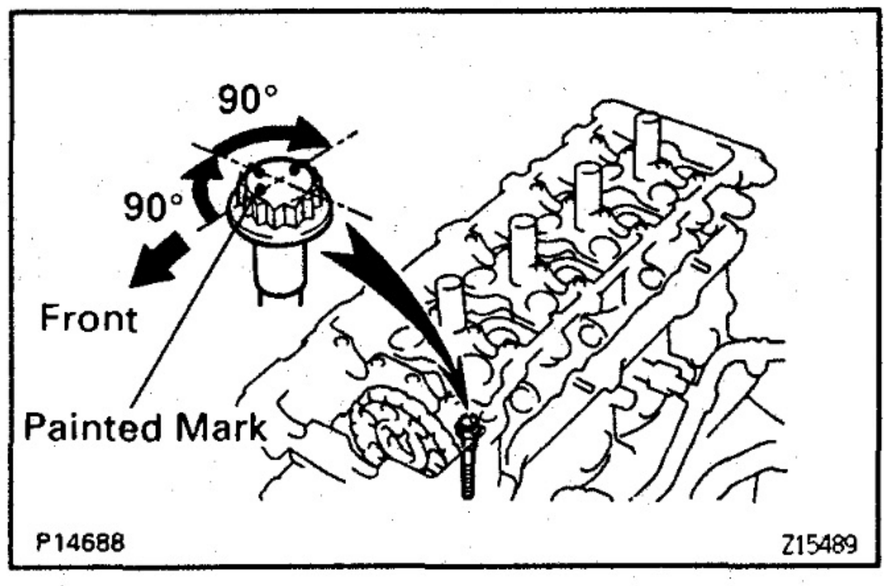


B. Install cylinder head bolts

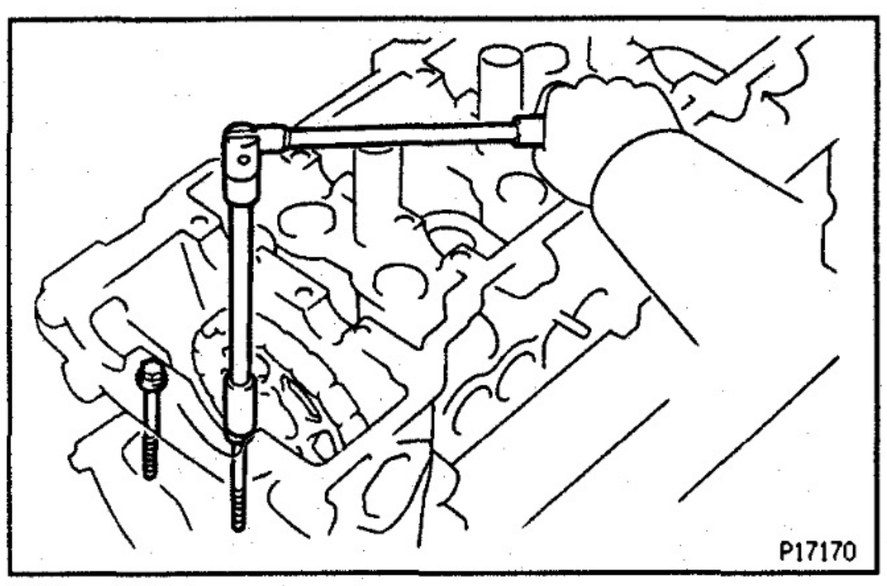
HINT:
- The cylinder head bolts are tightened in 3 progressive steps (steps (b) and (d)).
- If any cylinder head bolt is broken or deformed, replace it.

(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: 39 N·m (400 kgf·cm, 29 ft·lbf)
If any of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.



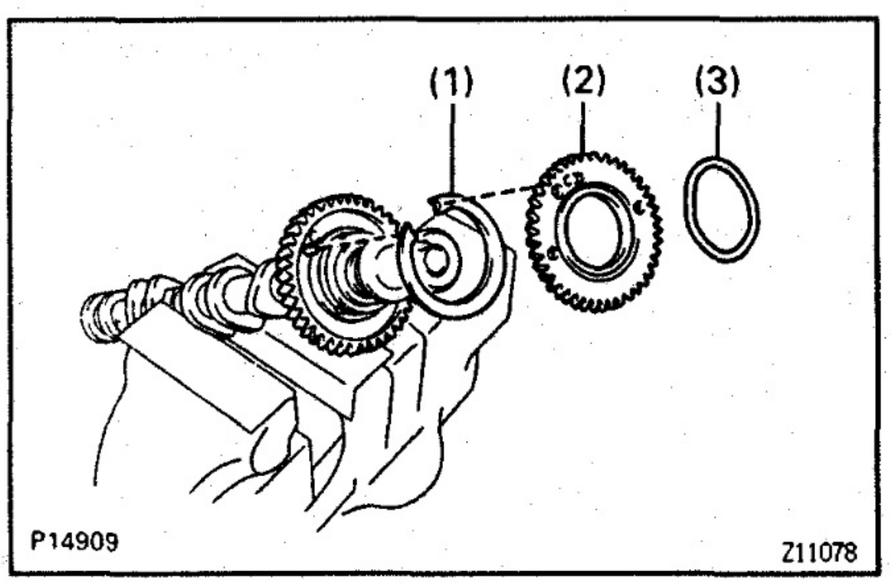
(c) Mark the front of the cylinder head bolt head with paint.
(d) Retighten the cylinder head bolts by 90° in the numerical order shown.
(e) Retighten the cylinder head bolts by an additional 90°.
(f) Check that the painted mark is now facing rearward.



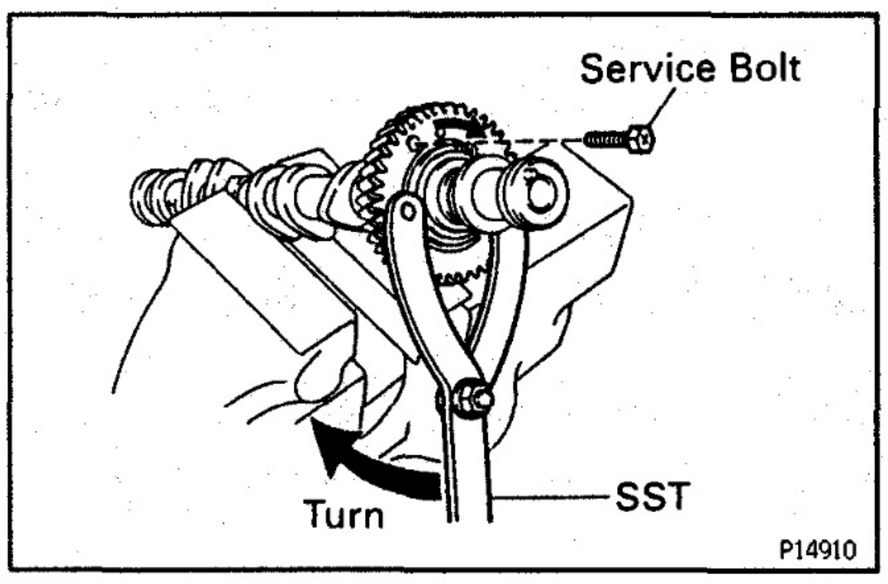
(g) Install and torque the 2 mounting bolts.
Torque: 21N·m (210 kgf·cm, 15 ft·lbf)

2. ASSEMBLE EXHAUST CAMSHAFT

(a) Mount the hexagon wrench head portion of the camshaft in a vise.
NOTICE: Be careful not to damage the camshaft.
(b) Install the following parts:
(1) Camshaft gear spring
(2) Camshaft sub–gear
(3) Wave washer
HINT: Align the pins on the gears with the spring ends.
(c) Using snap ring pliers, install the snap ring.



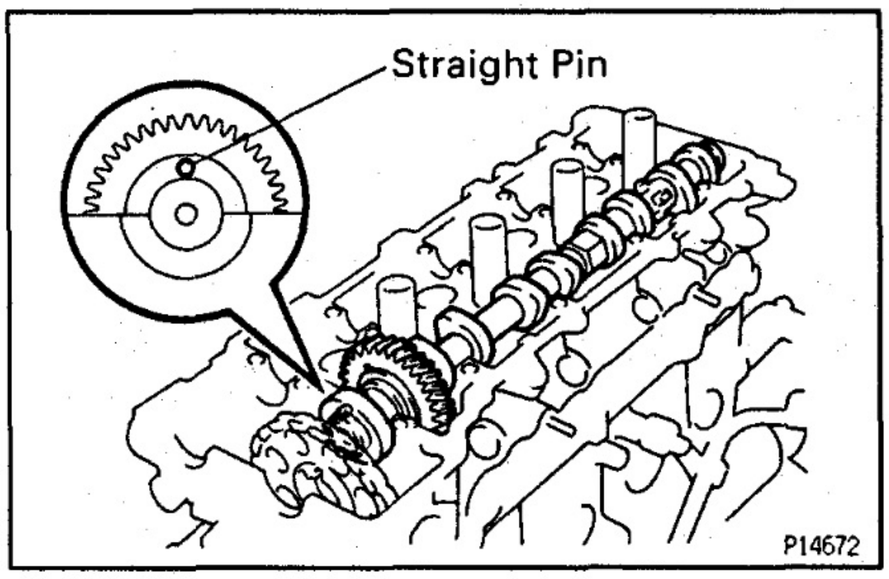
(d) Using SST, align the holes of the camshaft main gear and sub–gear by turning sub–gear clockwise, and install a service bolt.
SST 09960–10010 (09962–01000, 09963–00500)



EG

3. INSTALL CAMSHAFTS

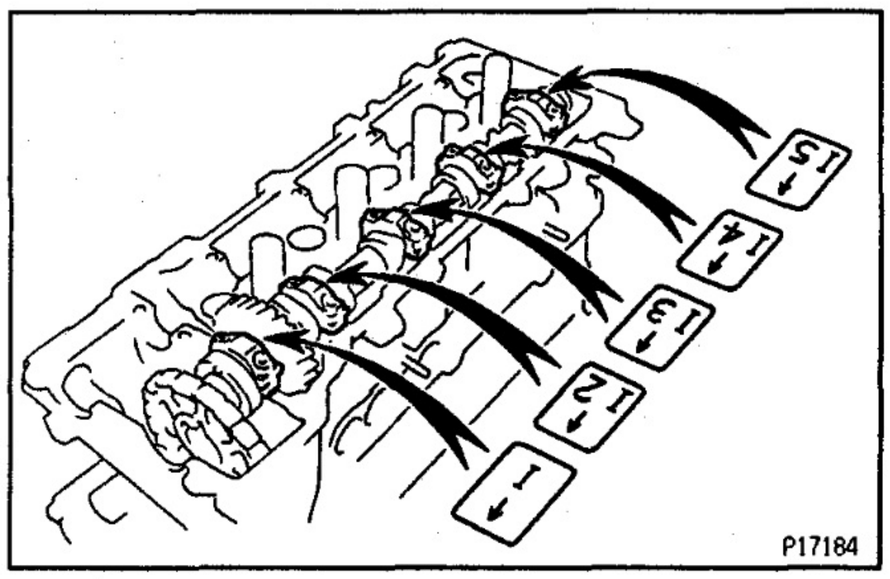
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the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



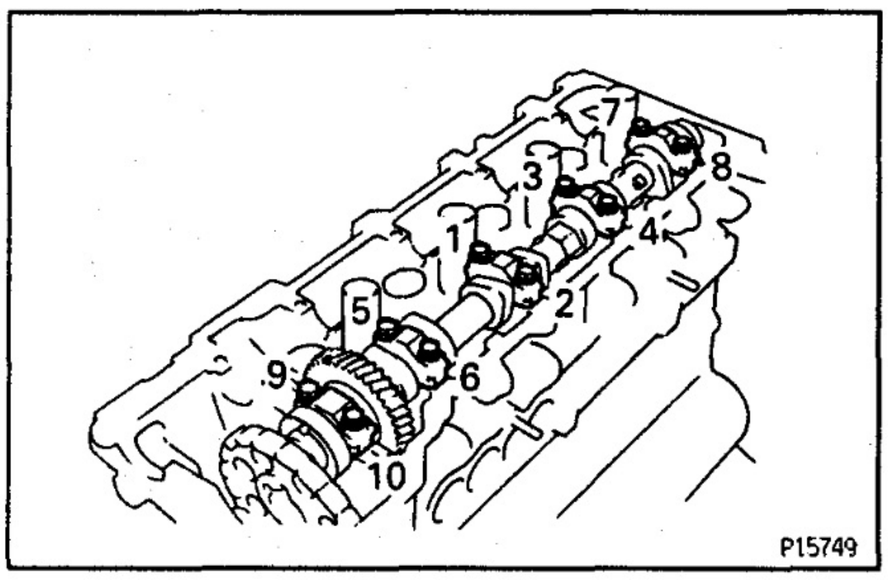
A. Install intake camshaft

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

(b) Place the intake camshaft with knock pin facing upward of camshaft angle on the cylinder head.



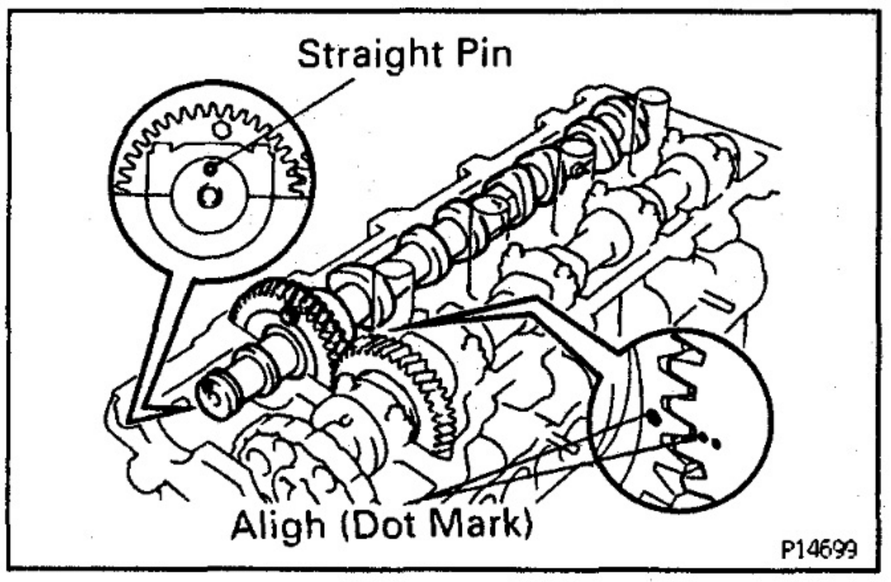
(c) Install the bearing caps in their proper locations.



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

(e) Install and uniformly tighten the 10 bearing cap bolts in the sequence shown.

Torque: 15.5 N·m (160 kgf·cm, 12 ft·lbf)



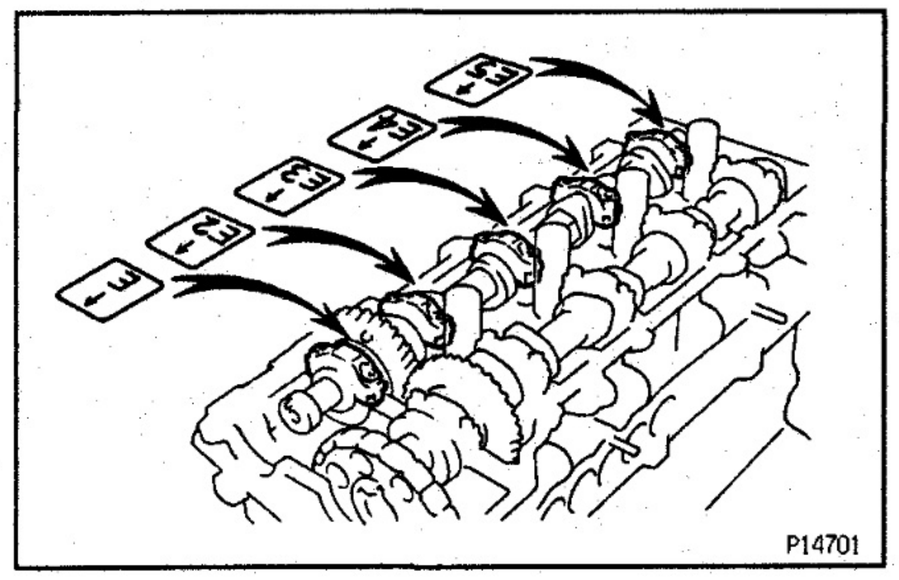
B. Install exhaust camshaft

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

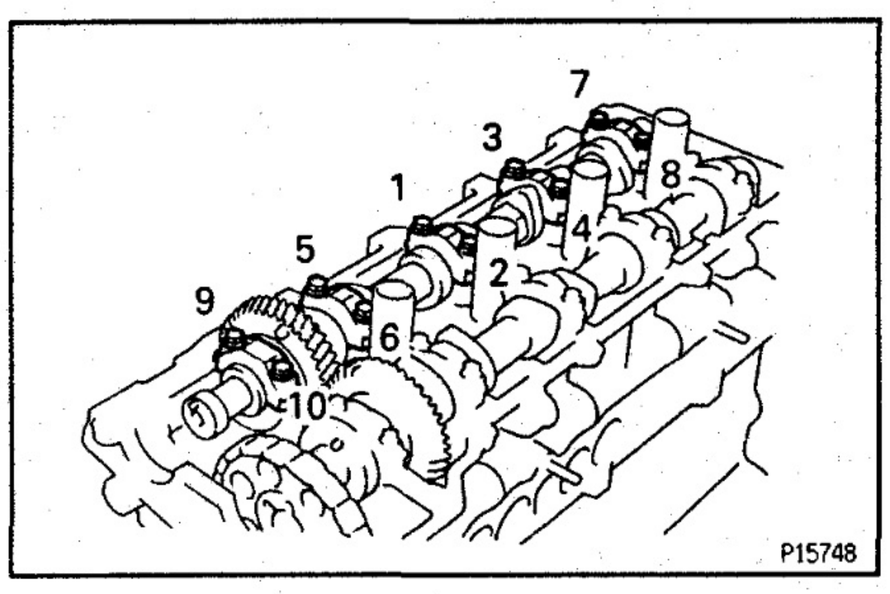
(b) Engage the exhaust camshaft gear to the intake camshaft gear by matching the timing marks (1 and 2 dots) on each gear.

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

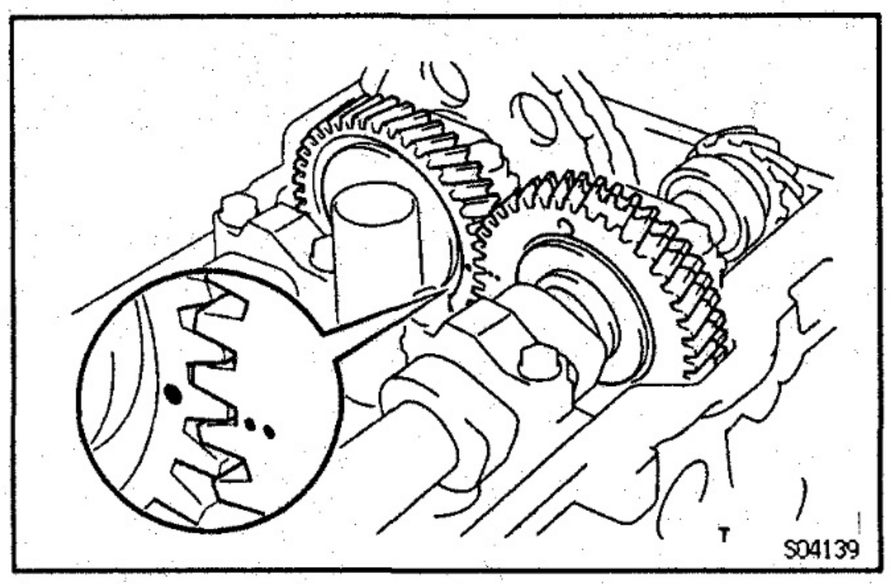
(c) Roll down the exhaust camshaft onto the bearing journals while engaging gears with each other.



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

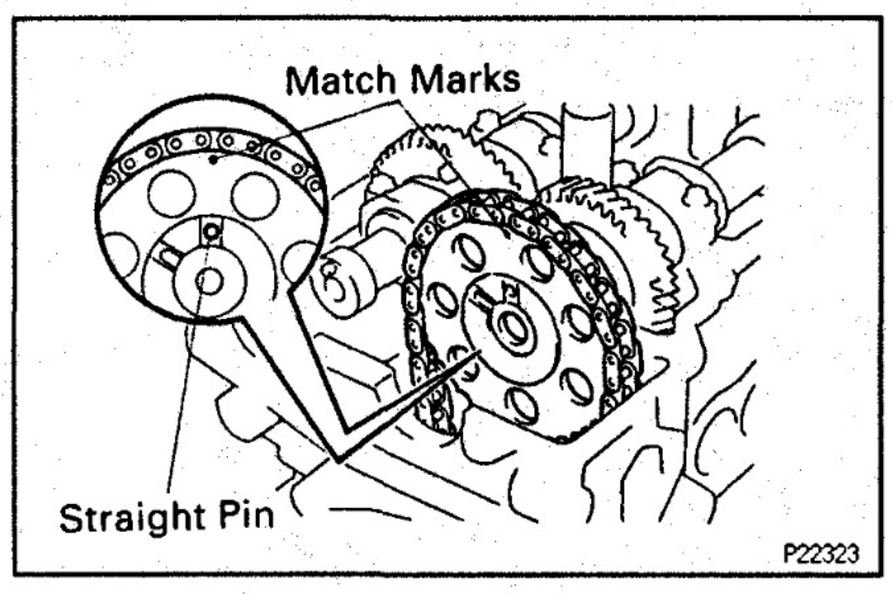


(e) Apply light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(f) Install and uniformly tighten the 10 bearing cap bolts in several passes in the sequence shown.
Torque: 15.5 N·m (160 kgf·cm, 12 ft·lbf)
(g) Remove the service bolt.
(h) Check that the intake and exhaust camshafts turn smoothly.



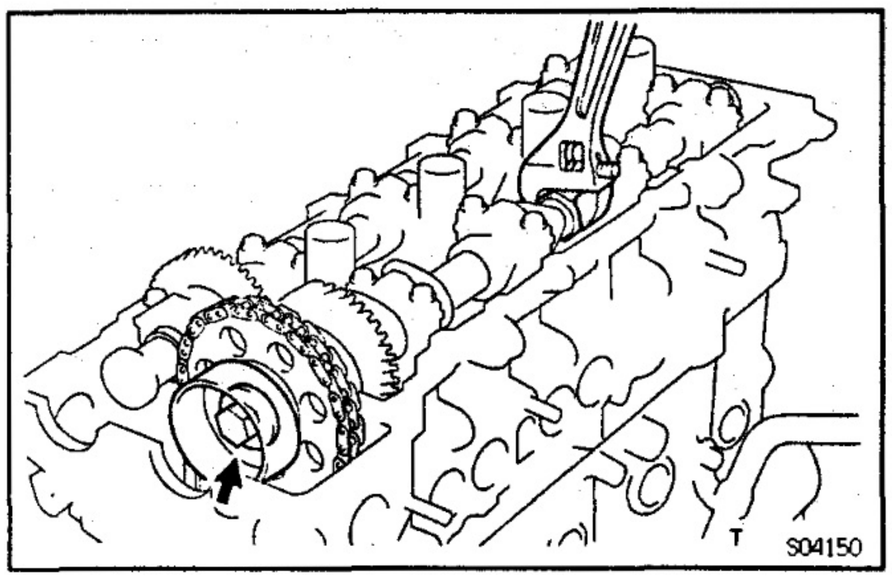
4. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley clockwise, and align its groove with the timing mark "0" of the timing chain cover.
(b) Turn the camshafts so that the timing marks with 1 and 2 dots will be in straight line on the cylinder head surface as shown in the illustration.

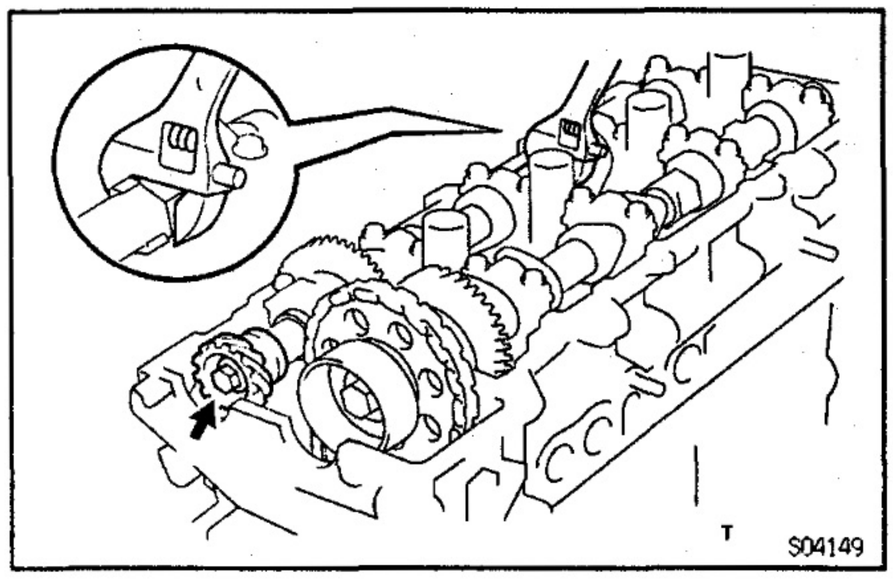


5. INSTALL CAMSHAFT TIMING GEAR

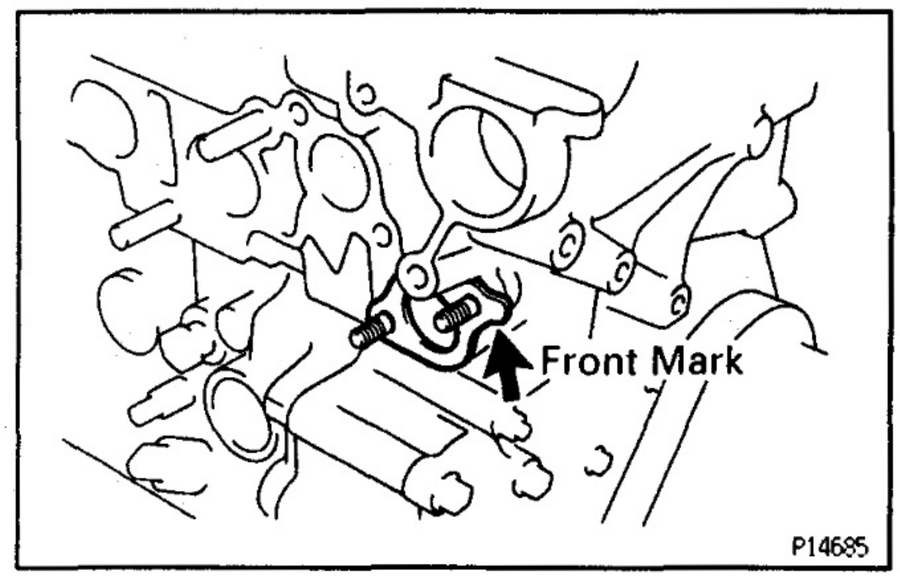
HINT: Check that the matchmarks on the camshaft timing gear and timing chain are aligned.
(a) Place the gear over the straight pin of the intake camshaft.
HINT: Install the fuel pump drive cam on white paint marking side at upward.



(b) Hold the intake camshaft with a wrench, install the fuel pump drive cam and torque the bolt.
Torque: 73.5 N·m (750 kgf·cm, 54 ft·lbf)

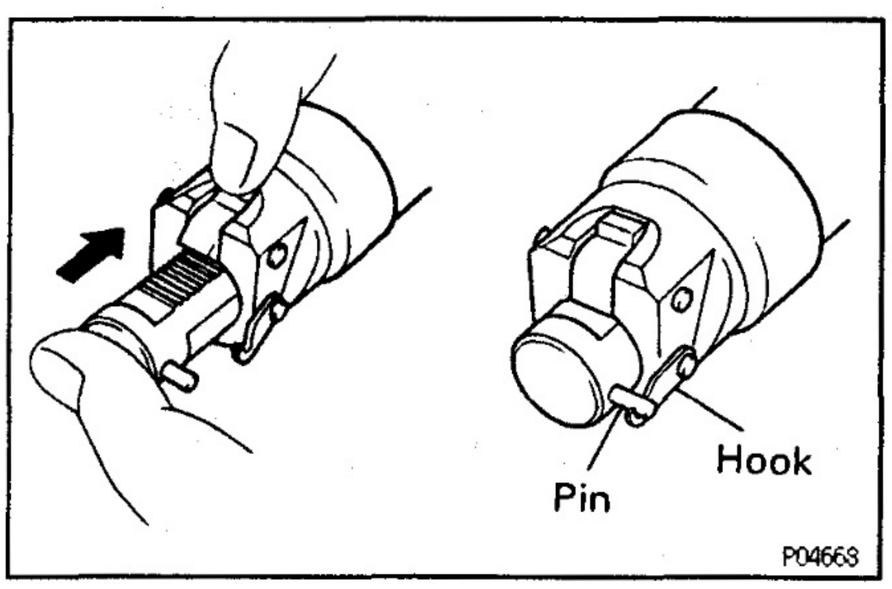


(c) Hold the exhaust camshaft with a wrench install the bolt and distributor gear.
Torque: 46 N·m (470 kgf·cm, 34 ft·lbf)



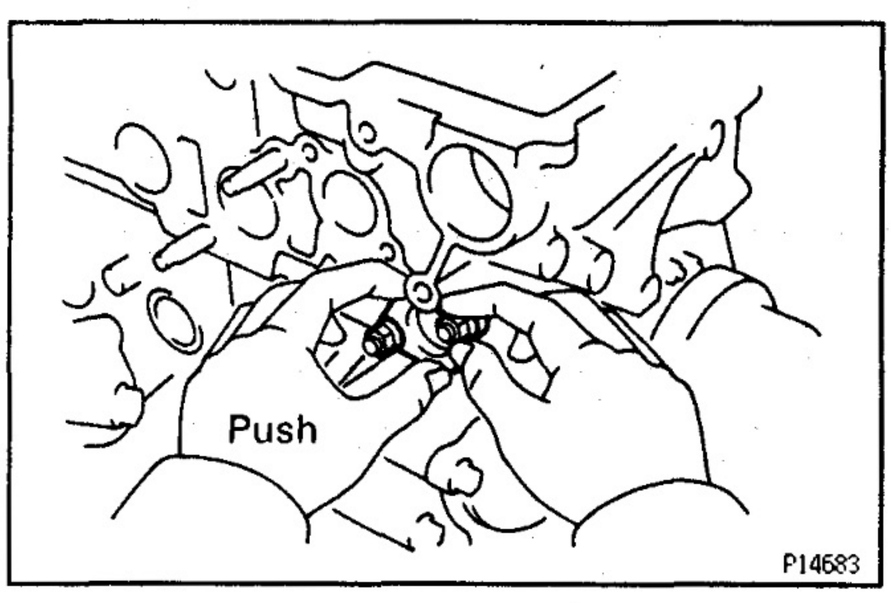
6. INSTALL CHAIN TENSIONER

(a) Place a new gasket so that the front mark is toward the front side.

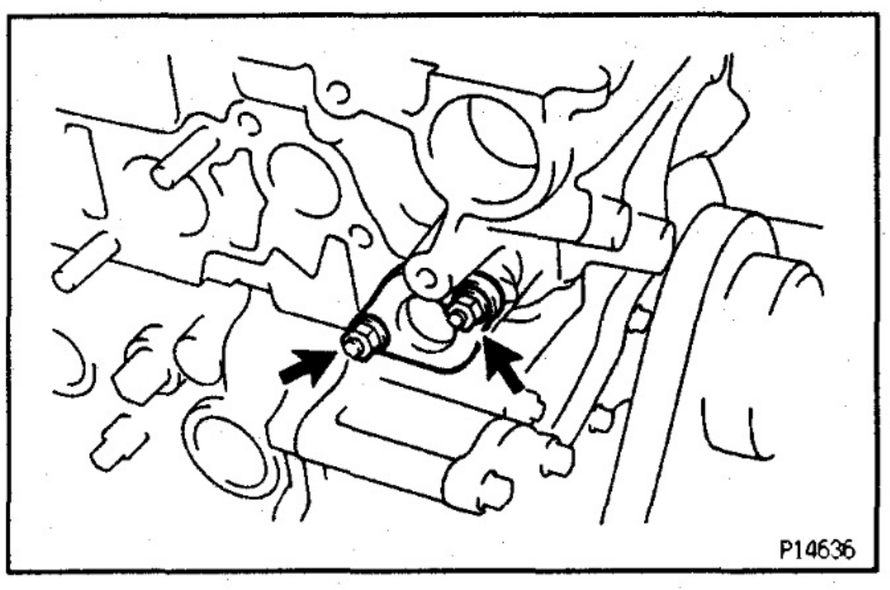


(b) Release the ratchet pawl, fully push in the plunger and apply the hook to the pin so that the plunger cannot spring out.

(c) Turn the crankshaft pulley clockwise to provide some slack for the chain on the tensioner side.
NOTICE: Do not turn the pulley counterclockwise.

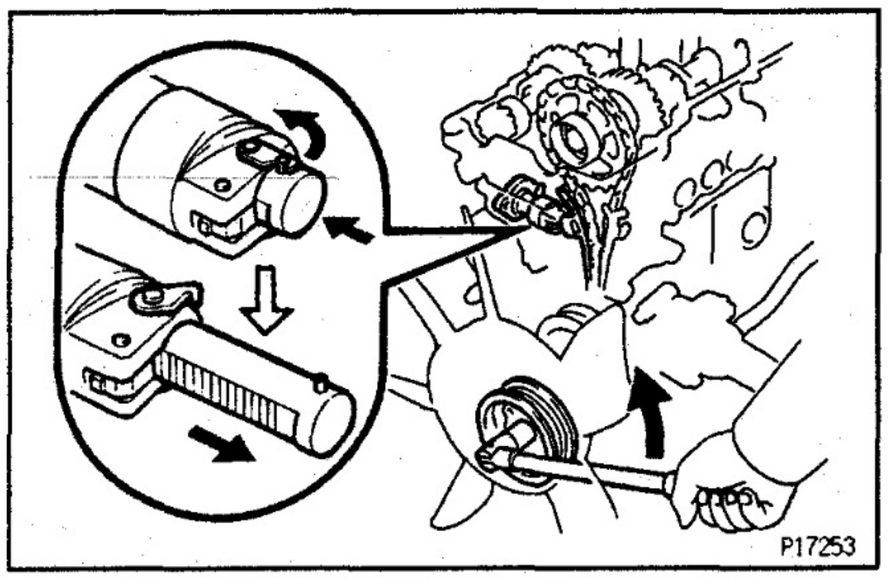


(d) Push the tensioner by hand until it touches the head installation surface, then install the 2 nuts.



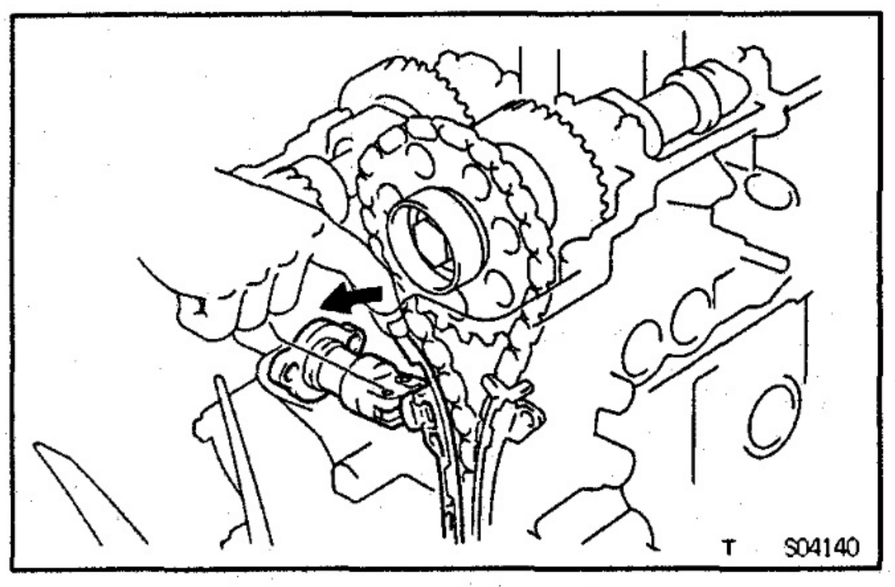
(e) Tighten the 2 nuts.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

(f) Check that the hook of the tensioner is not released.
NOTICE: If the plunger springs out during installation of the chain tensioner, repeat the operation in step (b) before installing the tensioner.

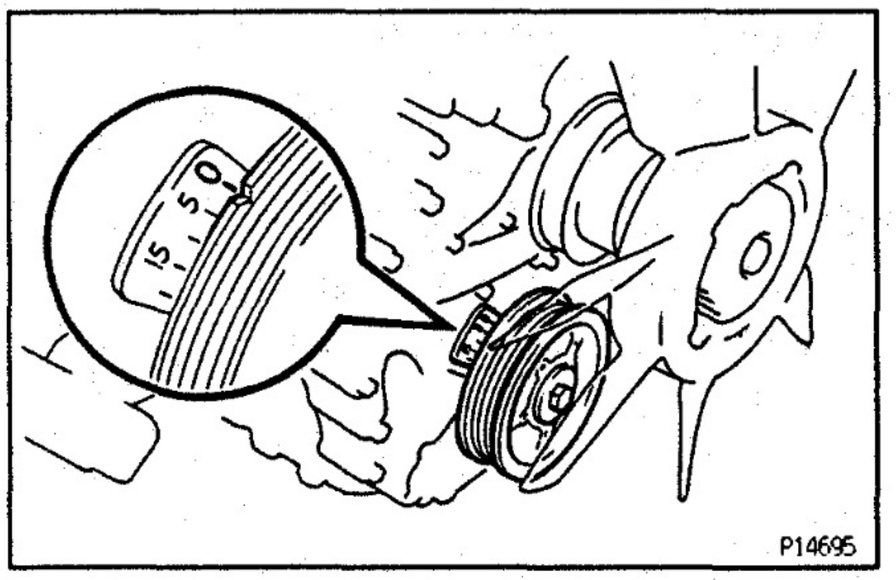


7. SET CHAIN TENSIONER

Turn the crankshaft to the left so that the hook of the chain tensioner is released from the pin of the plunger, causing the plunger to spring out and the slipper to be pushed into the chain.

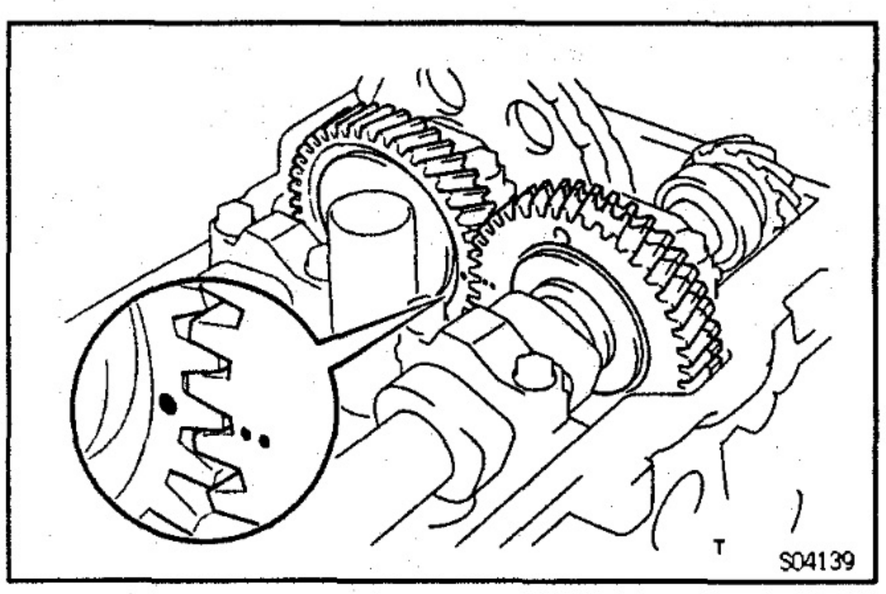


HINT: If the plunger does not spring out, press the slipper into the chain tensioner with a screwdriver or your finger so that the hook is released and the plunger springs out.



8. CHECK VALVE TIMING

(a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.
NOTICE: Always turn the crankshaft clockwise.



(b) Check that the timing marks (1 and 2 dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) and align the marks as above.

9. CHECK AND ADJUST VALVE CLEARANCE

(See step 8 and 9 in valve clearance inspection and adjustment)

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

Valve clearance (Cold):

Intake

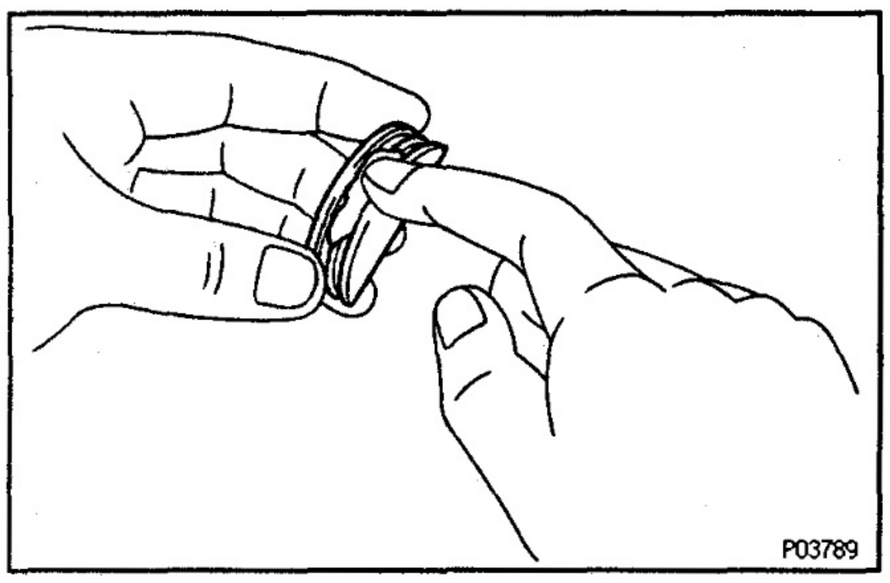
0.15 — 0.25 mm (0.006 — 0.010 in.)

Exhaust

0.25 — 0.35 mm (0.010 — 0.014 in.)

10. INSTALL SPARK PLUGS

(See Ignition System)



11. INSTALL SEMI—CIRCULAR PLUGS

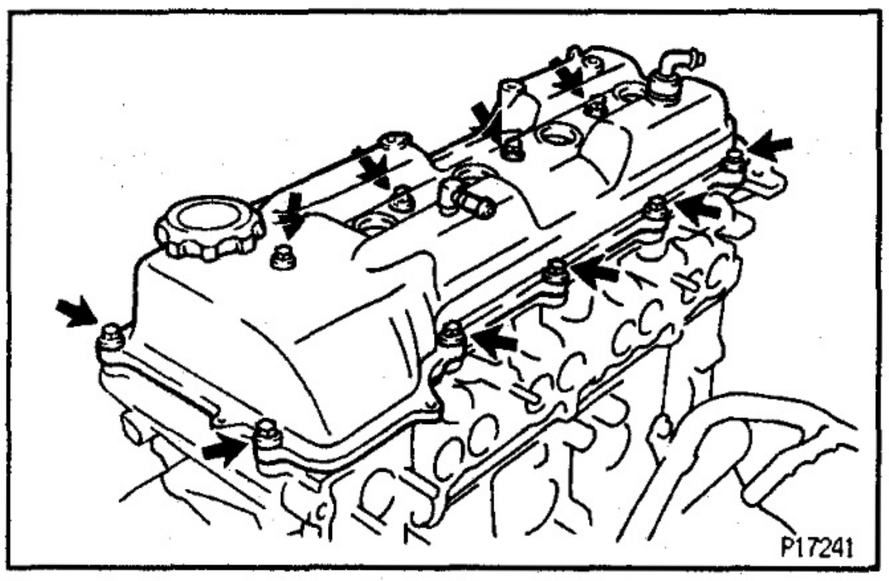
(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the cylinder head installation surface of the semi—circular plugs.

Seal packing:

Part No. 08826—00080 or equivalent

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



12. INSTALL CYLINDER HEAD COVER

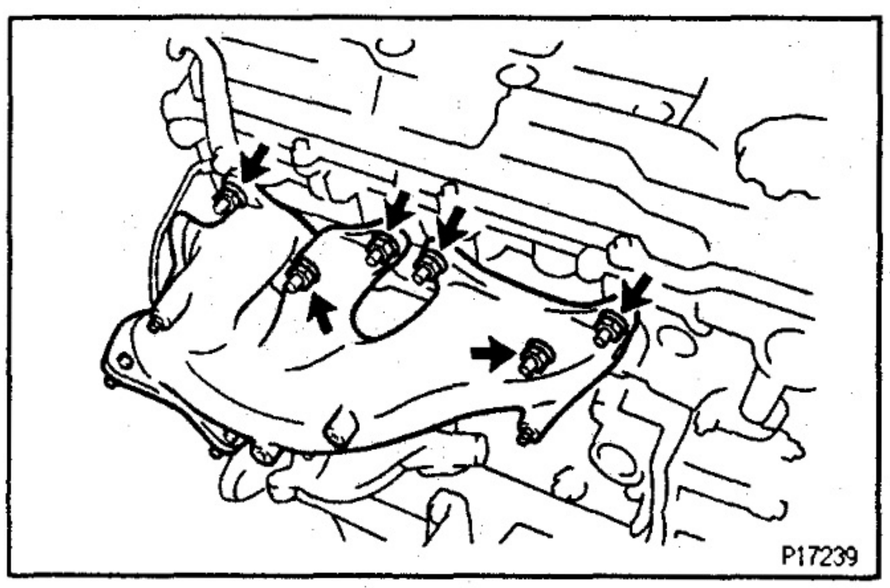
(a) Install the gasket to the cylinder head cover.

(b) Install the cylinder head cover with the 10 bolts.

13. INSTALL FRONT ENGINE HANGER

Install the front engine hanger with the bolt.

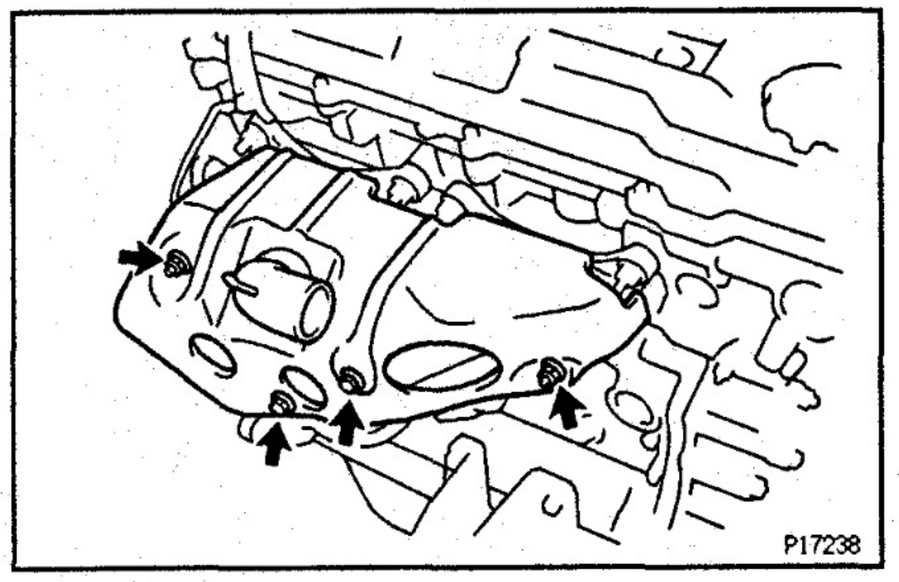
Torque: 42 N·m (420 kgf·cm, 30 ft·lbf)



14. INSTALL EXHAUST MANIFOLD

(a) Install a new gasket and exhaust manifold with the 6 nuts.

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

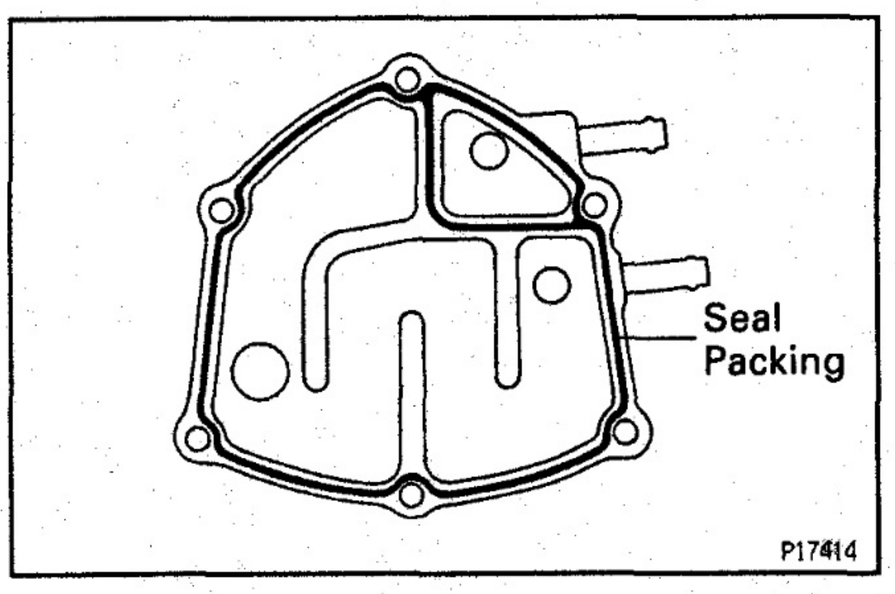


(b) Install the heat insulator with the 2 bolts and 2 nuts.
Torque: 5.5 N·m (55 kgf·cm, 48 in.·lbf)

15. INSTALL WATER BYPASS FLANGE

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

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

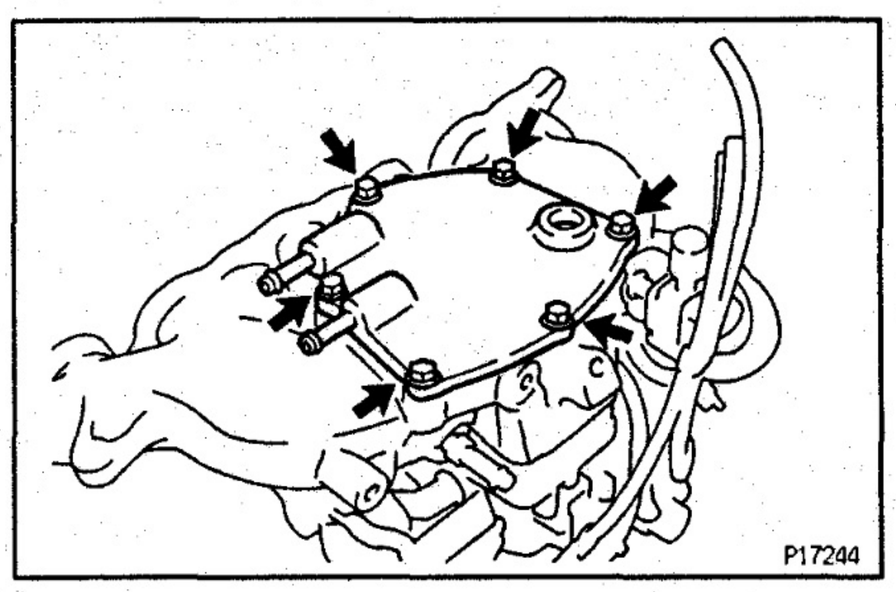


(b) Apply seal packing to the water bypass flange as shown in the illustration.
Seal packing:
Part No.08826—00080 or equivalent

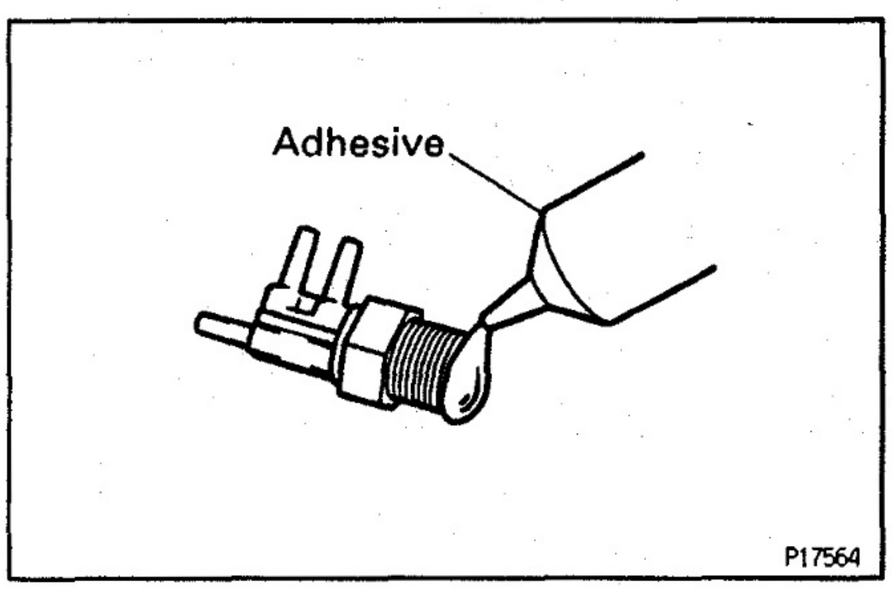
- Install a nozzle that has been cut to a 3 — 4 mm (0.12 — 0.16 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

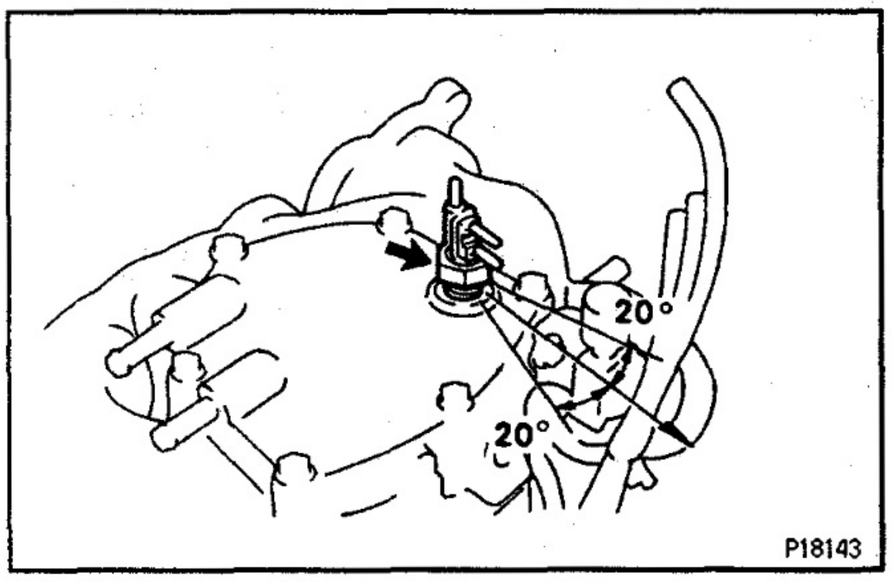
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



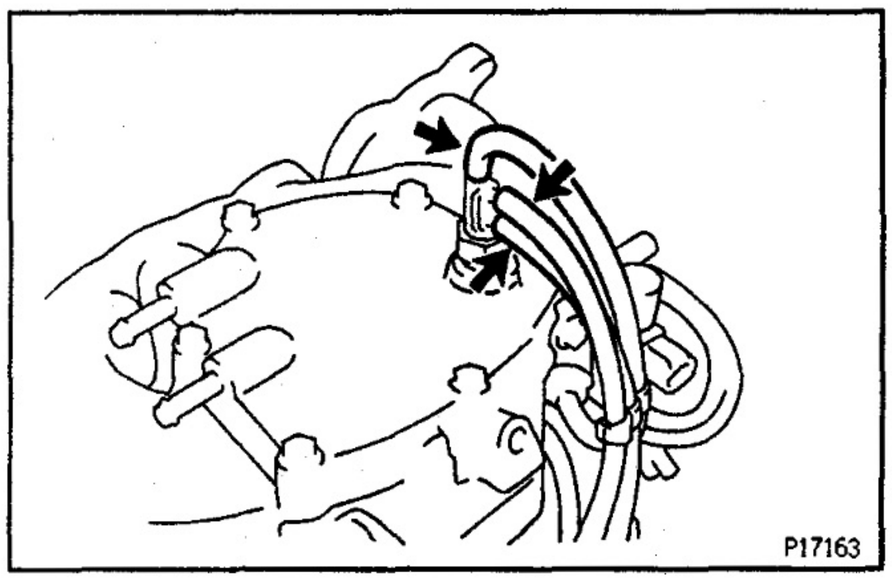
(c) Install the water bypass flange with the 6 bolts.
Torque: 9.0 N·m (90 kgf·cm, 78 in.·lbf)



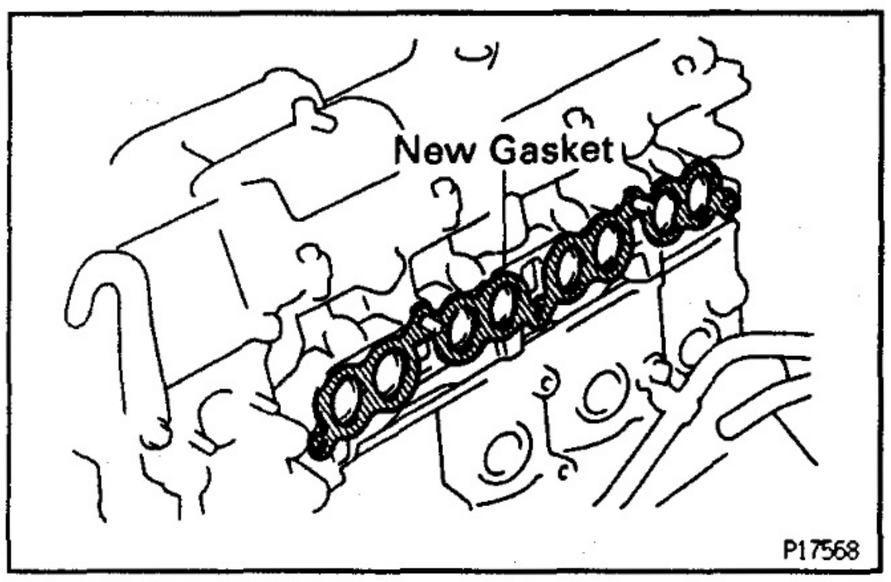
(d) Apply adhesive to 2 or 3 threads of the BVSV.
Adhesive:
Part No.08833—00080, THREE BOND 1344, LOCTITE 242 or equivalent



(e) Install the BVSV.
HINT: The BVSV may be set within 20° of either side of the prescribed position.

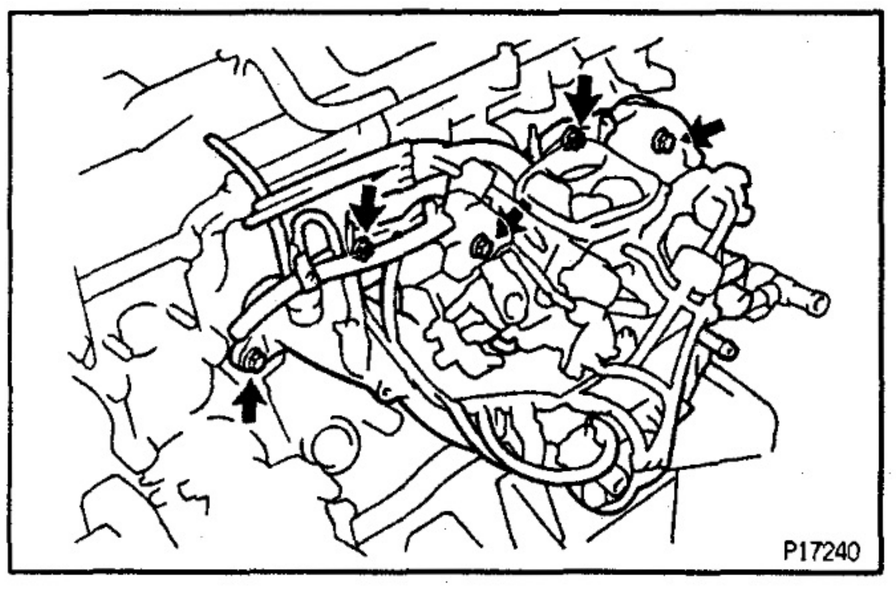


(f) Connect the 3 vacuum hoses to the BVSV.

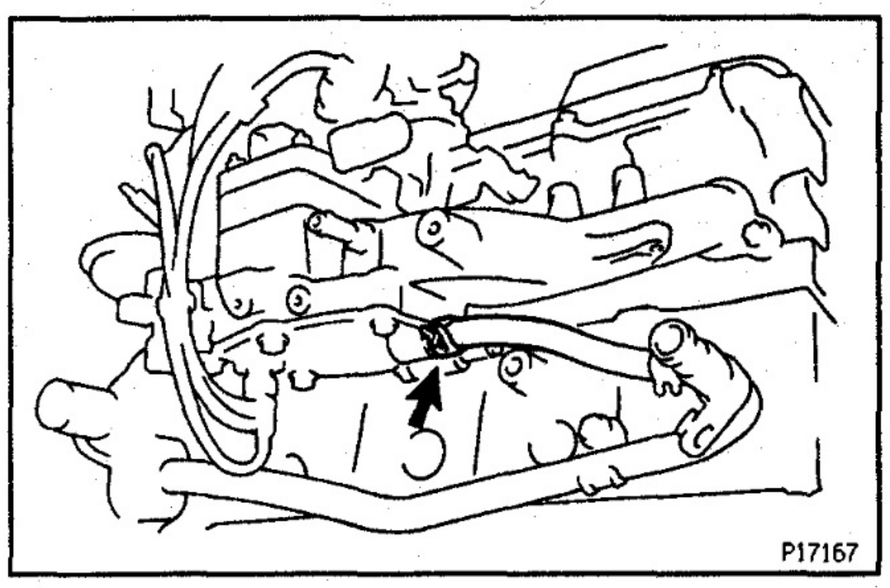


16. INSTALL INTAKE MANIFOLD WITH CARBURETOR

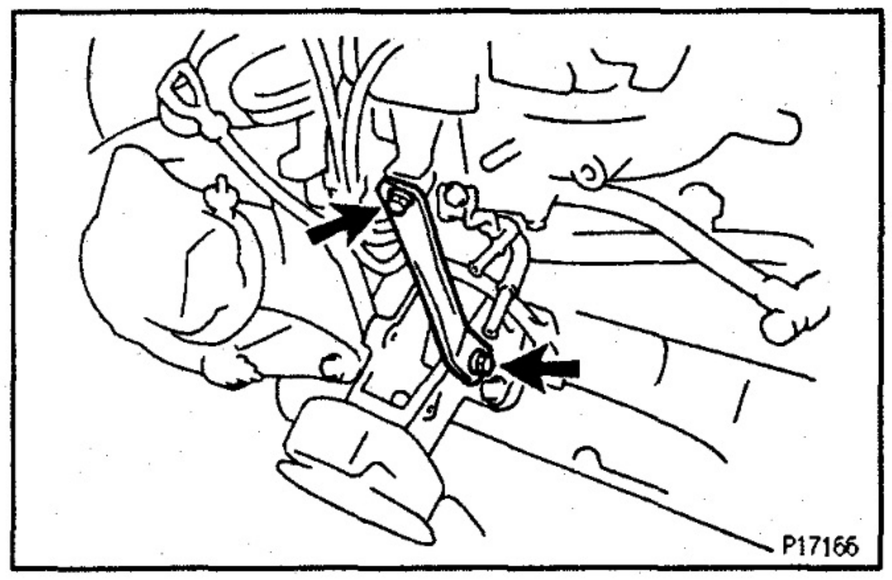
(a) Install a new gasket to the cylinder head.



(b) Install the intake manifold with the 3 bolts and 2 nuts.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)



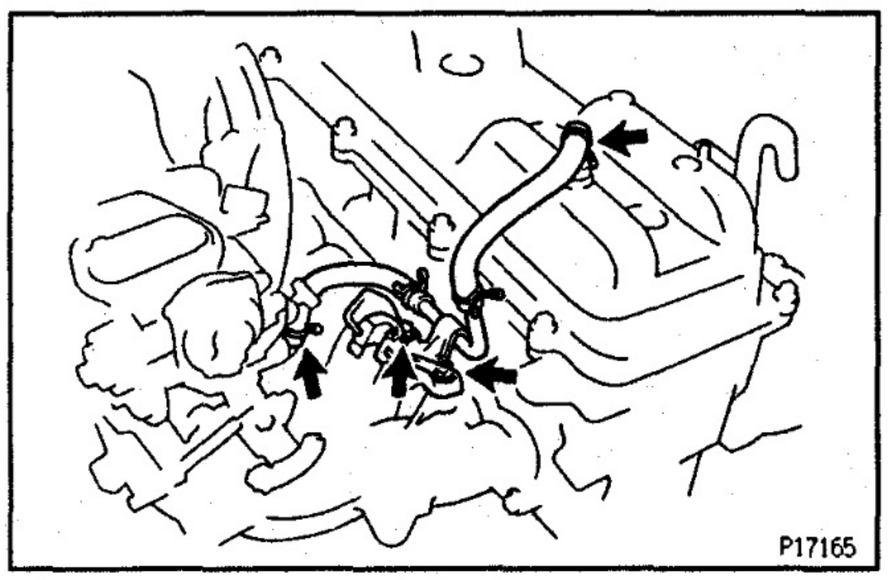
(b) Connect the water bypass hose to the intake manifold.



17. INSTALL INTAKE MANIFOLD STAY

Install the intake manifold stay with the 2 bolts.

Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

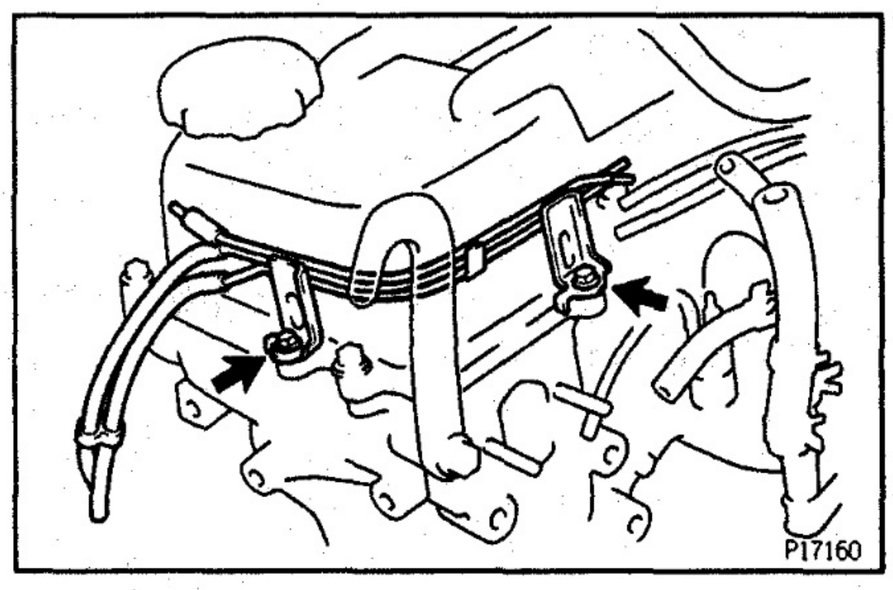


18. INSTALL PCV HOSE AND ACCELERATOR CABLE BRACKET

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

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

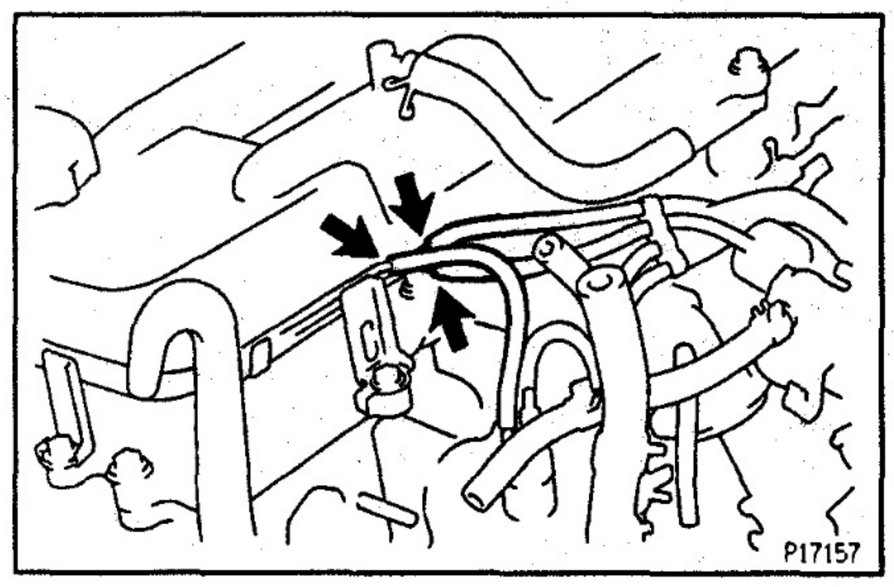
(b) Connect the 2 PCV hoses.



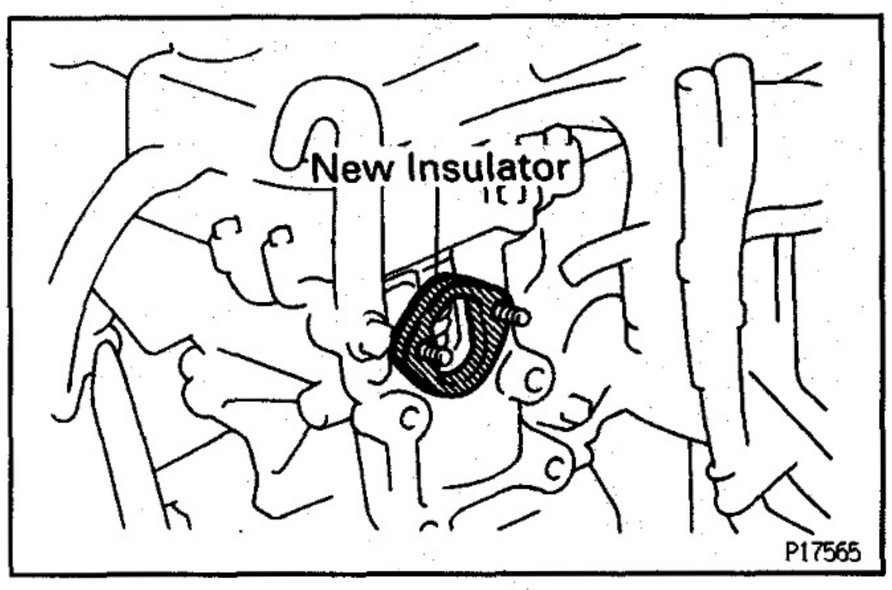
19. INSTALL NO.2 VACUUM PIPE

(a) Install the vacuum pipe with the 2 bolts.

Torque: 8.5 N·m (85 kgf·cm, 74 in.·lbf)

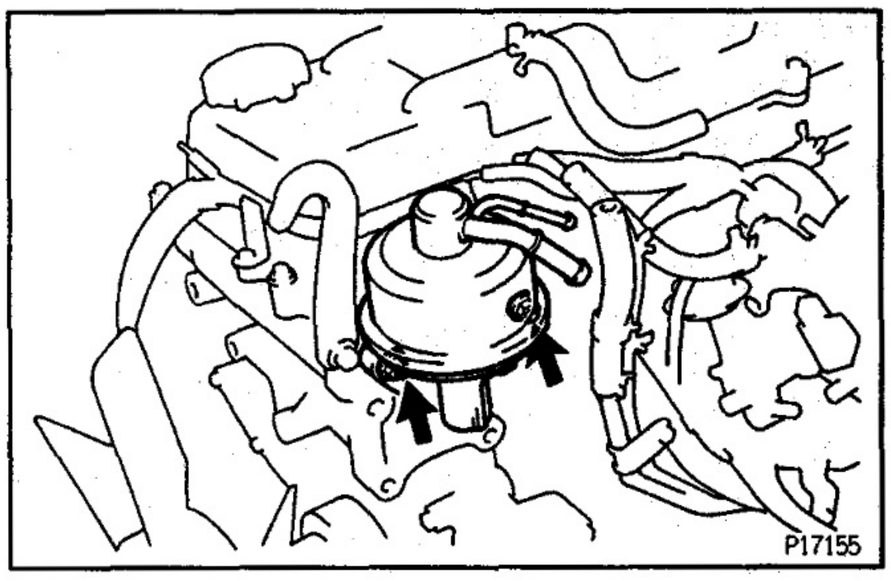


(b) Connect the 3 vacuum hoses to the vacuum pipe.

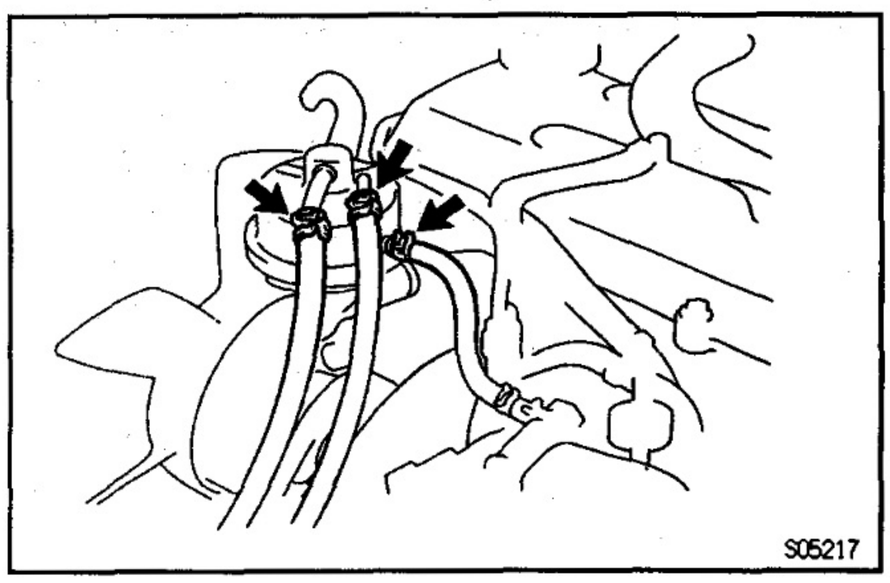


20. INSTALL FUEL PUMP

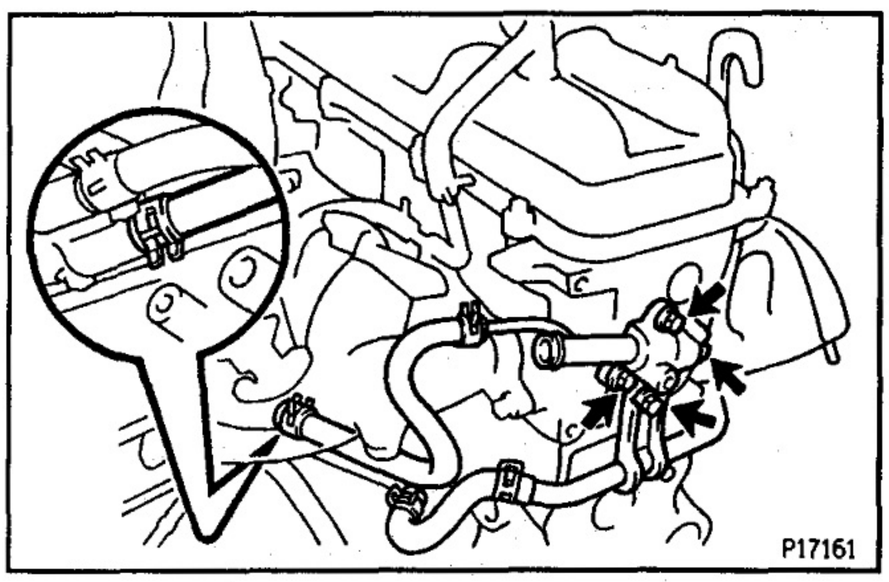
(a) Install a new insulator to the cylinder head.



(b) Install the fuel pump with the 2 nuts.
Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)



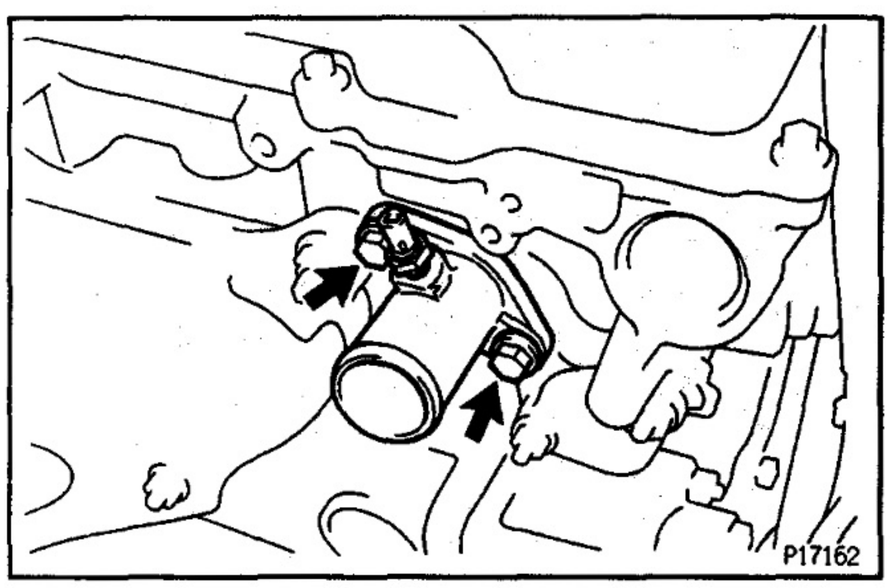
(c) Connect the 3 fuel hoses.



21. INSTALL CYLINDER HEAD REAR COVER

(a) Install a new gasket and rear cover with the 3 bolts.
Torque: 13.5 N·m (135 kgf·cm, 10 ft·lbf)

(b) w/ Oil cooler:
Install the No.2 water bypass pipe mounting bolt.
Torque: 19.5 N·m (200 kgf·cm, 14 ft·lbf)



22. INSTALL WATER OUTLET
Install a new gasket and water outlet with the 2 bolts.
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

23. INSTALL OIL DIPSTICK GUIDE

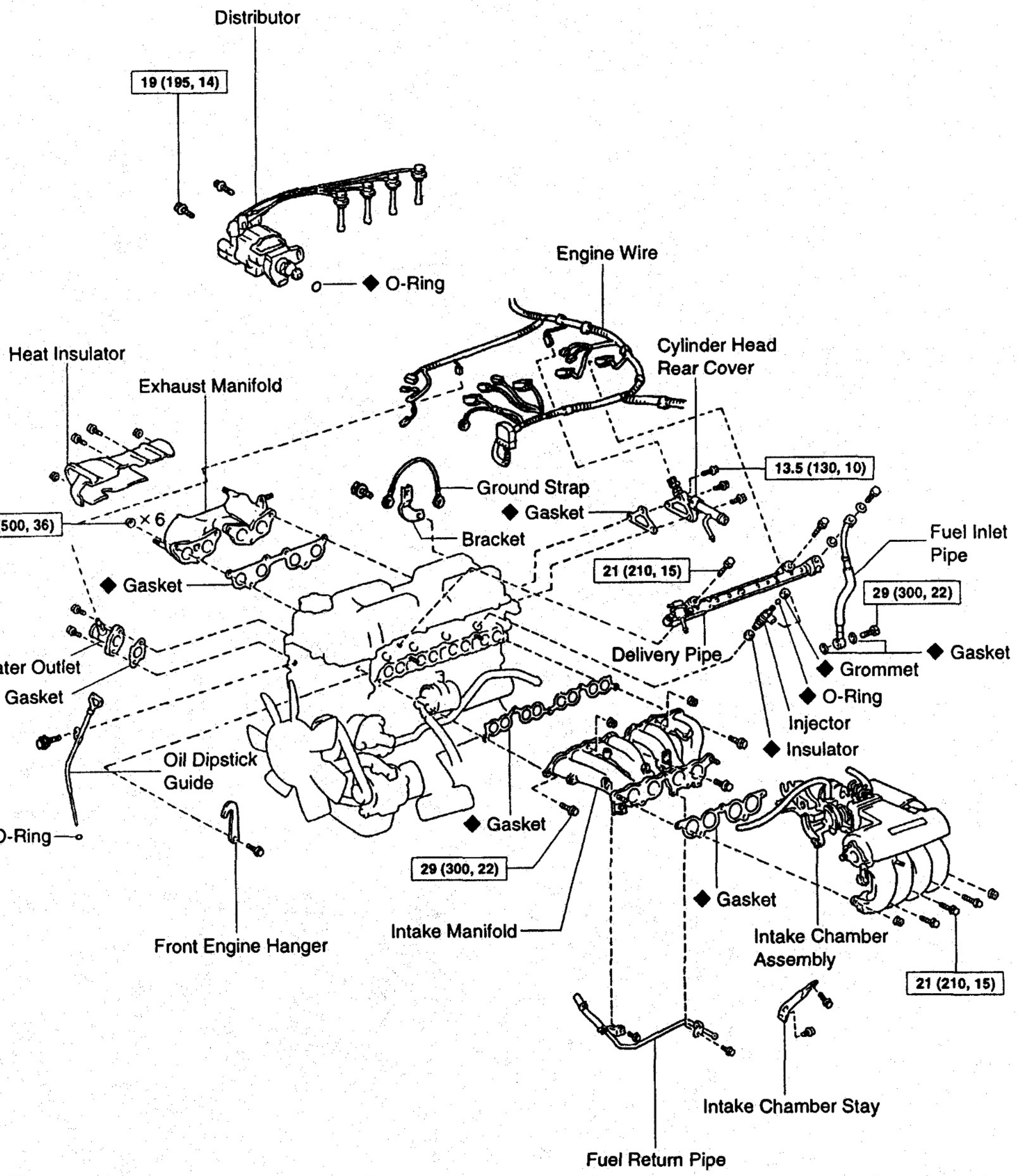
24. INSTALL DISTRIBUTOR
(See distributor installation in Ignition System)

25. FILL WITH ENGINE COOLANT

CYLINDER HEAD (3RZ–FE)

EG78P–01

COMPONENTS FOR REMOVAL AND INSTALLATION

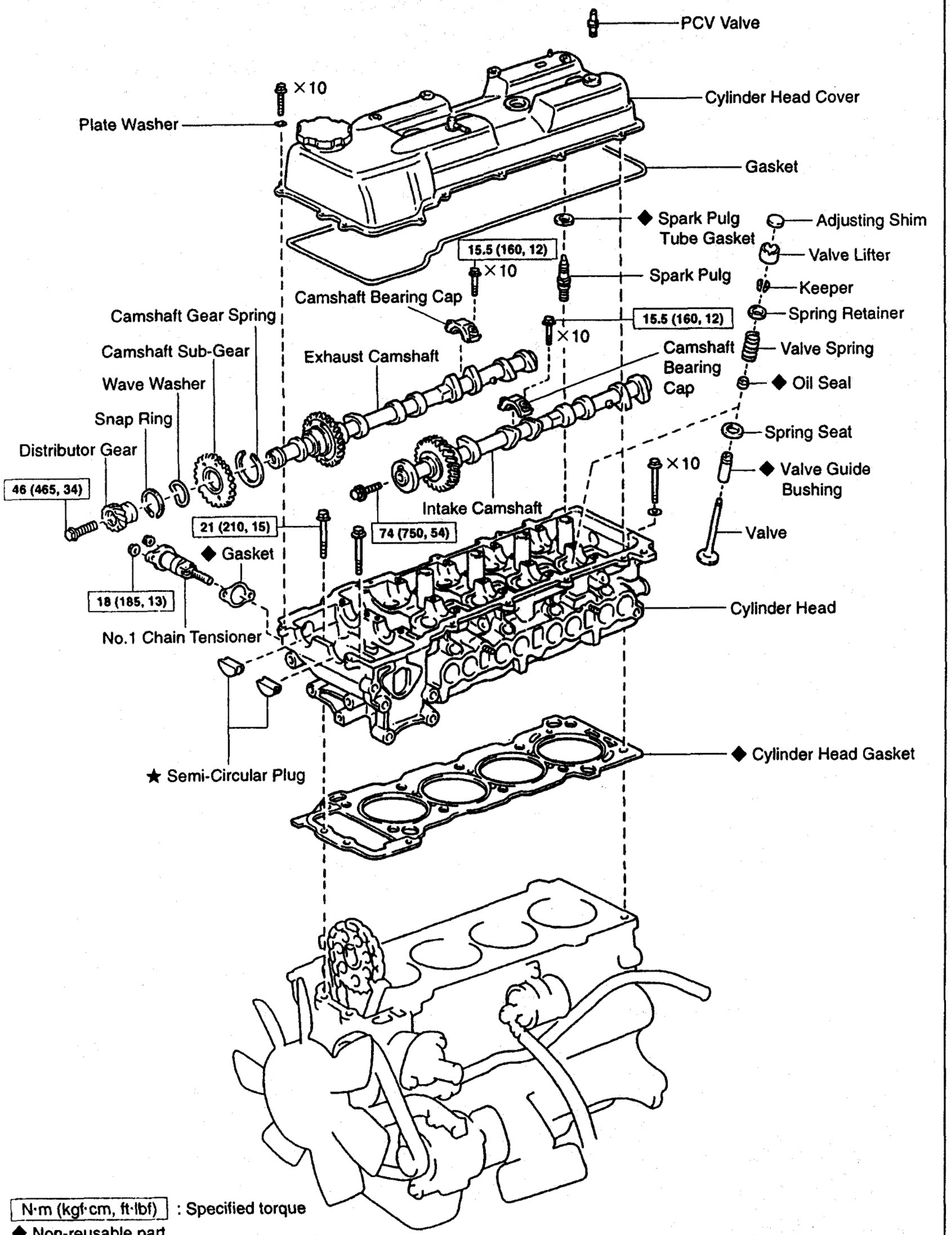


N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

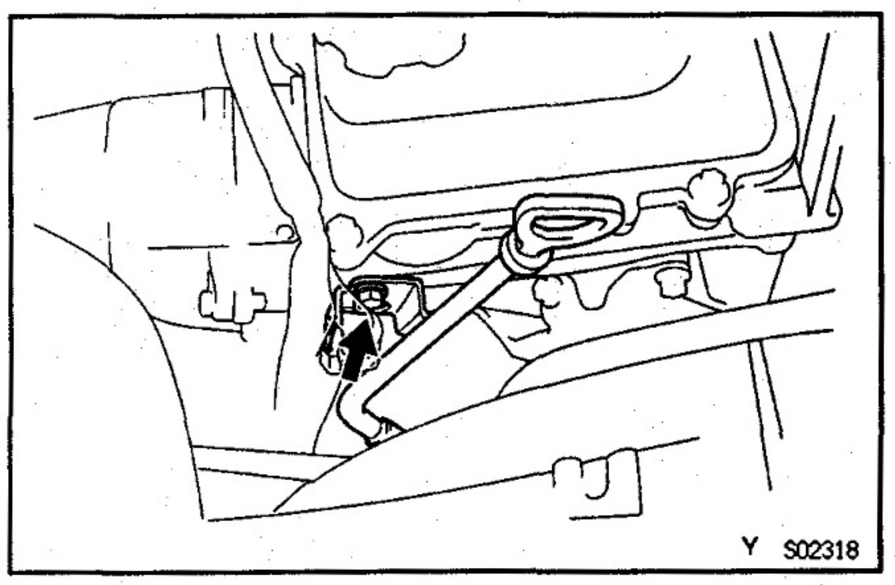
Y S03879

EG


PCV Valve
×10
Plate Washer
Cylinder Head Cover
Gasket
◆ Spark Pulg Tube Gasket
Adjusting Shim
Valve Lifter
15.5 (160, 12)
×10
Spark Pulg
Keeper
Camshaft Bearing Cap
Spring Retainer
15.5 (160, 12)
×10
Camshaft Gear Spring
Camshaft Sub-Gear
Exhaust Camshaft
Camshaft Bearing Cap
Valve Spring
Wave Washer
◆ Oil Seal
Snap Ring
Spring Seat
Distributor Gear
×10
◆ Valve Guide Bushing
46 (465, 34)
Intake Camshaft
21 (210, 15)
74 (750, 54)
Valve
◆ Gasket
18 (185, 13)
Cylinder Head
No.1 Chain Tensioner
◆ Cylinder Head Gasket
★ Semi-Circular Plug
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
★ Precoated part
Y
S03882

EG78Q–01

CYLINDER HEAD REMOVAL



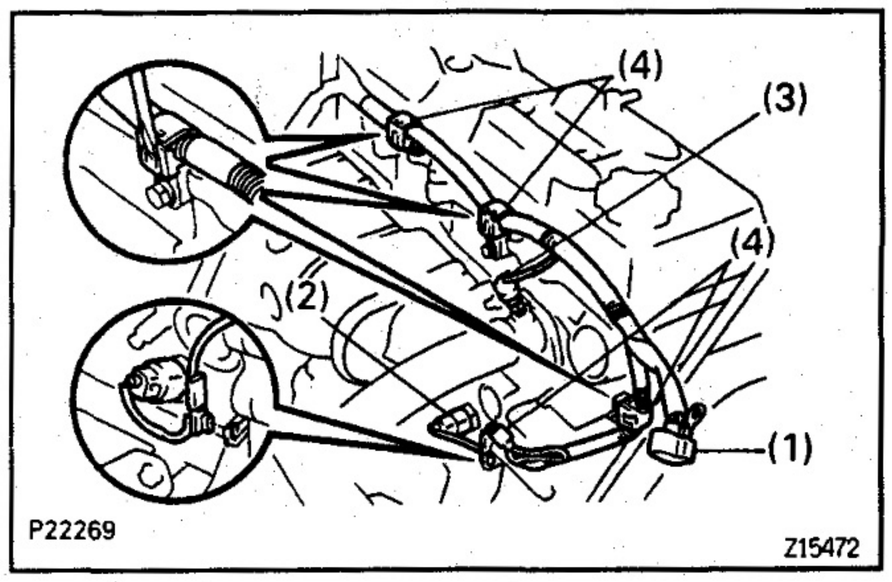
1. REMOVE OIL DIPSTICK GUIDE

(a) Remove the bolt, dipstick guide and engine wire bracket.

(b) Remove the O–ring from the dipstick guide.

2. REMOVE DISTRIBUTOR

(See distributor removal in Ignition System)



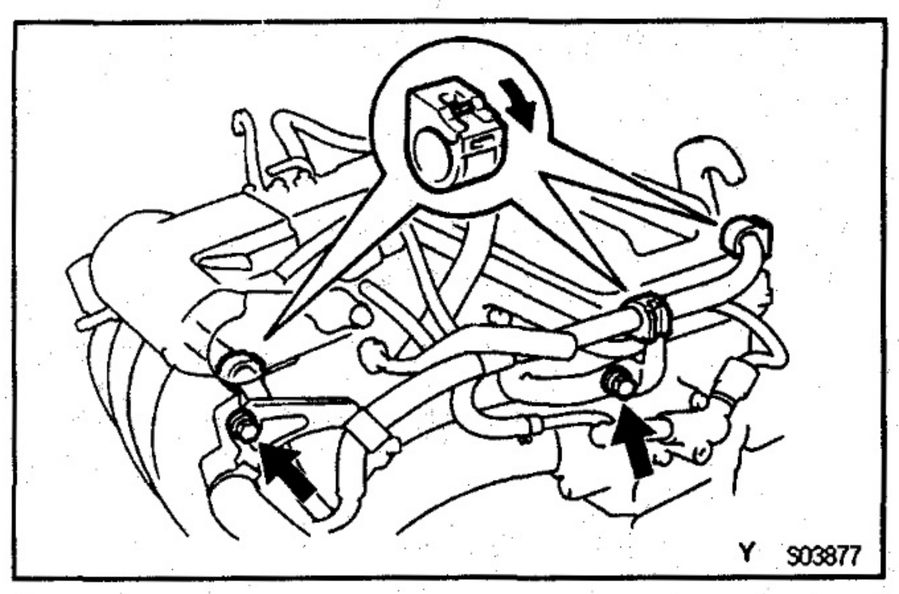
3. DISCONNECT ENGINE WIRE

(a) Disconnect these connectors and clamps:

(1) Oil pressure sensor connector and clamp

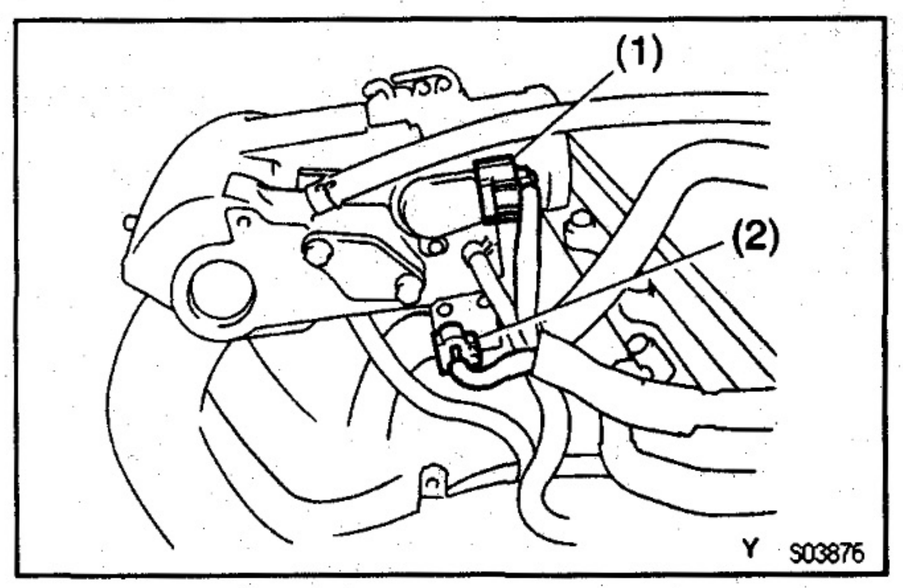
(2) Engine coolant temperature sender gauge connector

(3) 4 engine wire clamps and engine wire



(b) Disconnect the engine wire from the air intake chamber.

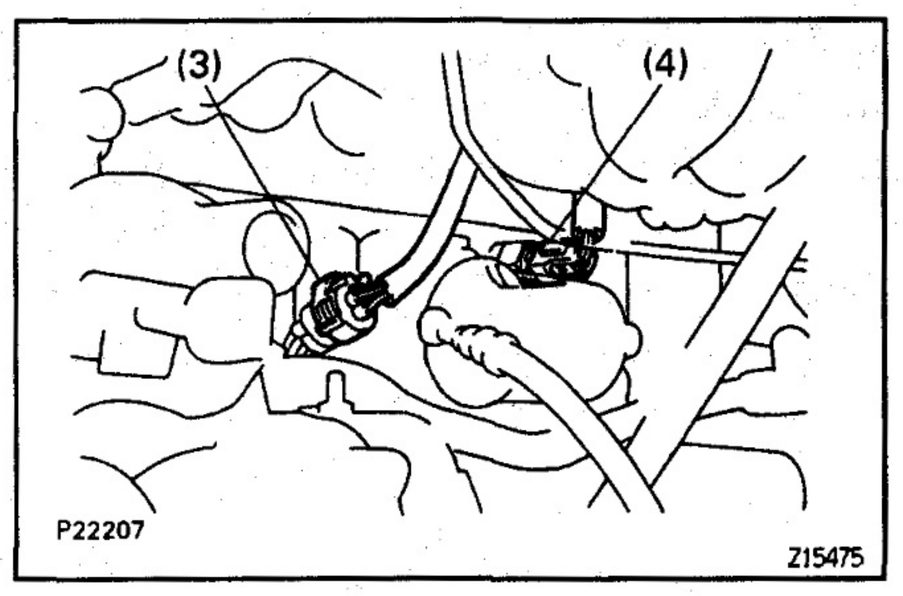
(c) Disconnect the 2 engine wire clamps and engine wire.



(e) Disconnect these connectors:

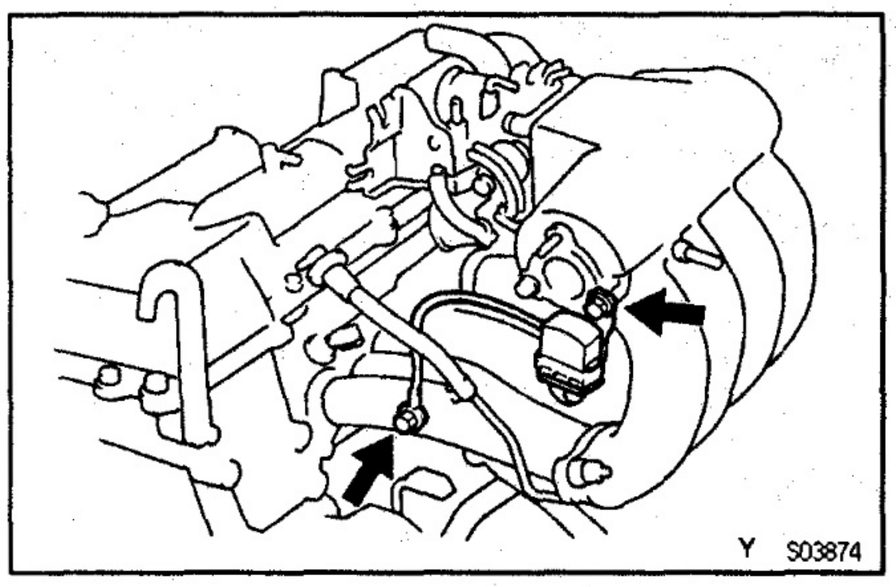
(1) Throttle position sensor connector

(2) ISC valve connector

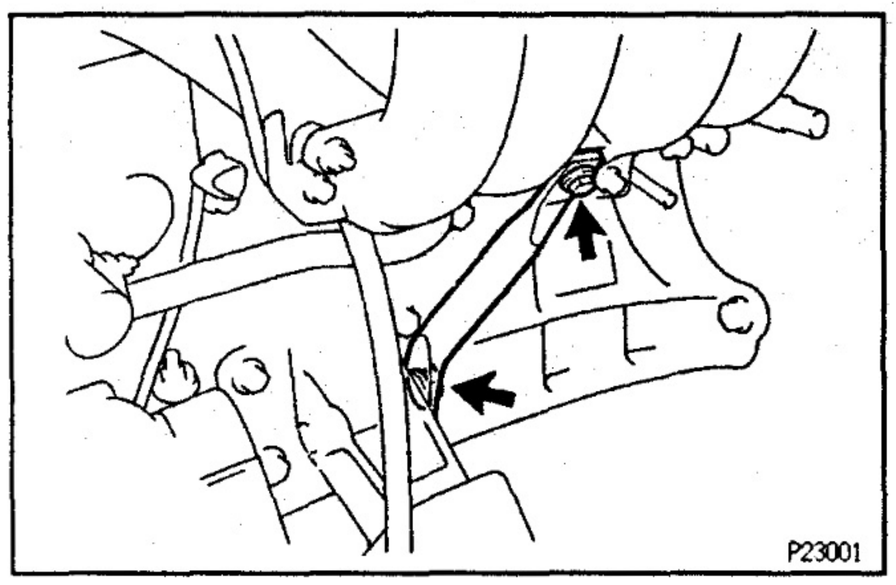


(3) Crankshaft position sensor connector

(4) Knock sensor connector

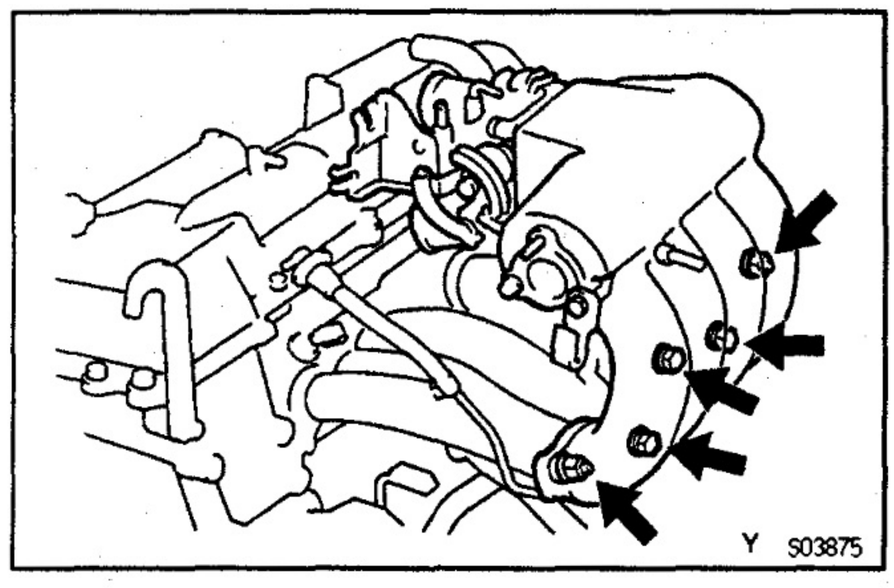


(f) Disconnect the check connecter from the bracket.
(g) Remove the wire ground.



4. REMOVE INTAKE CHAMBER STAY

Remove the 2 bolts and intake chamber stay.

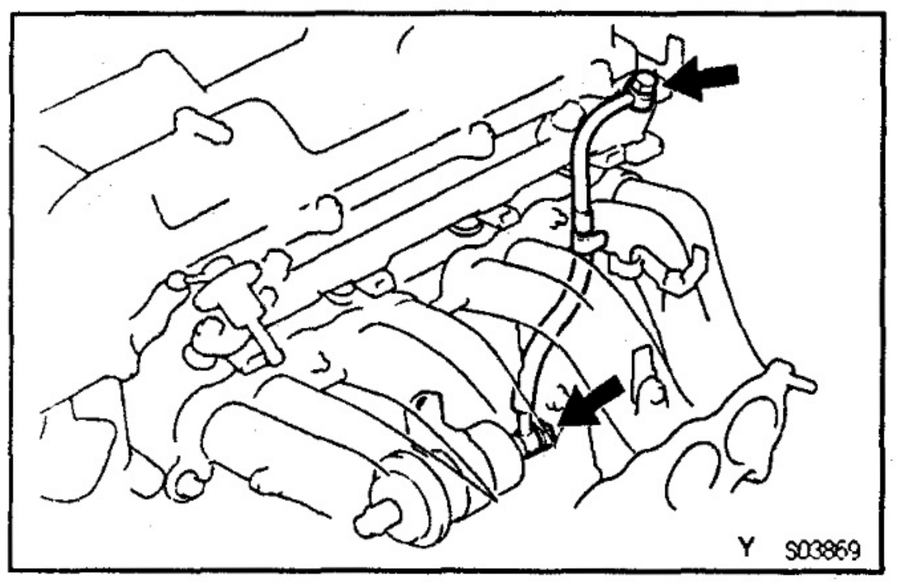


5. REMOVE AIR INTAKE CHAMBER ASSEMBLY

(a) Disconnect these hoses:
- PCV hose from throttle body
- Brake booster vacuum hose from union
- Water bypass hose from water bypass pipe
- Water bypass hose from cylinder head rear cover

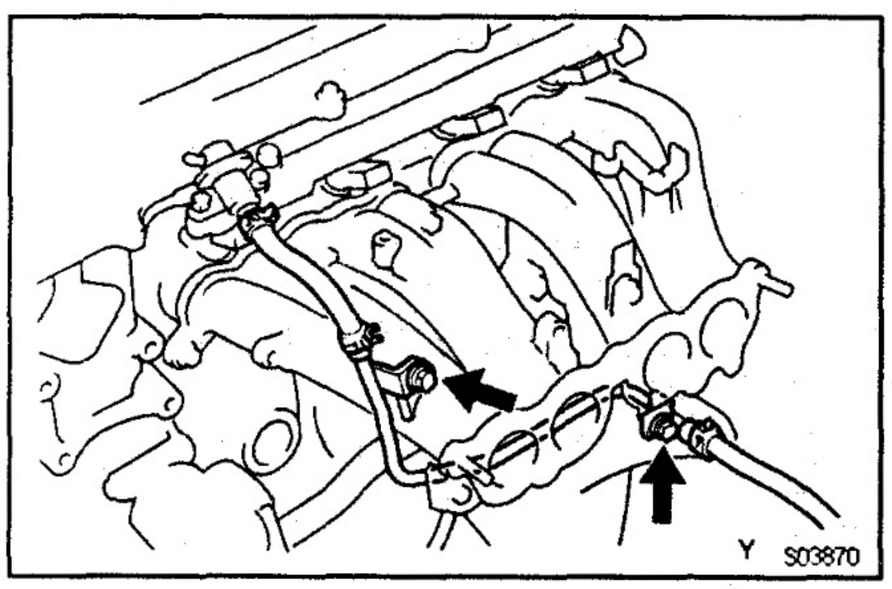
(b) Remove the 3 bolts, 2 nuts, air intake chamber assembly and gasket.

6. DISCONNECT INJECTOR CONNECTORS



7. REMOVE FUEL INLET PIPE

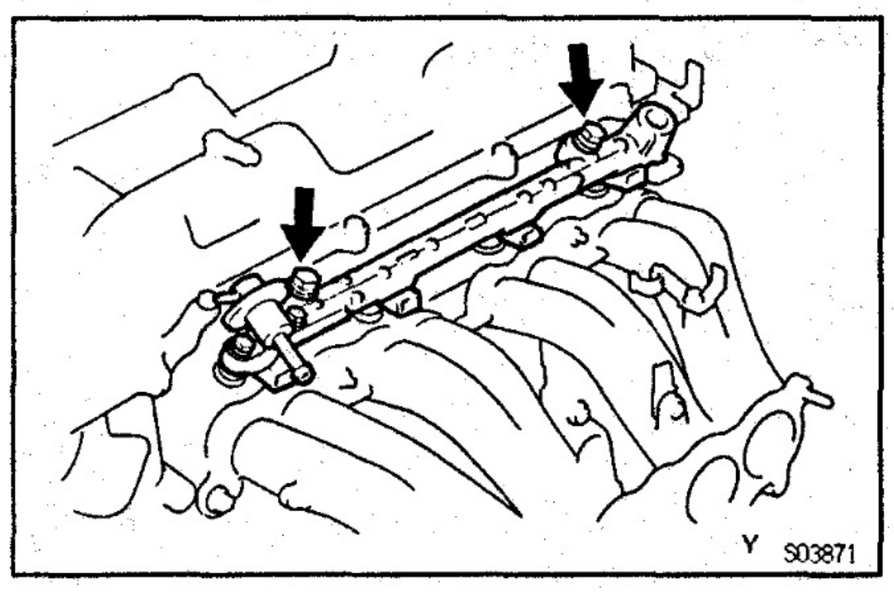
Remove the 2 union bolts, 4 gaskets and fuel inlet pipe.



8. REMOVE FUEL RETURN PIPE

(a) Disconnect these hoses:
- Fuel return hose from fuel pressure regulator
- Fuel return hose from fuel return pipe

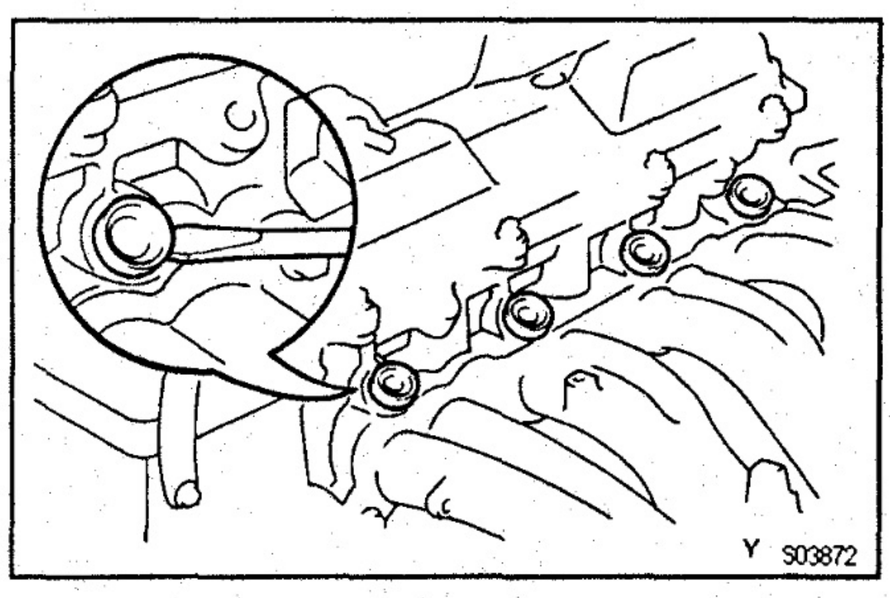
(b) Remove the 2 bolts and fuel return pipe.



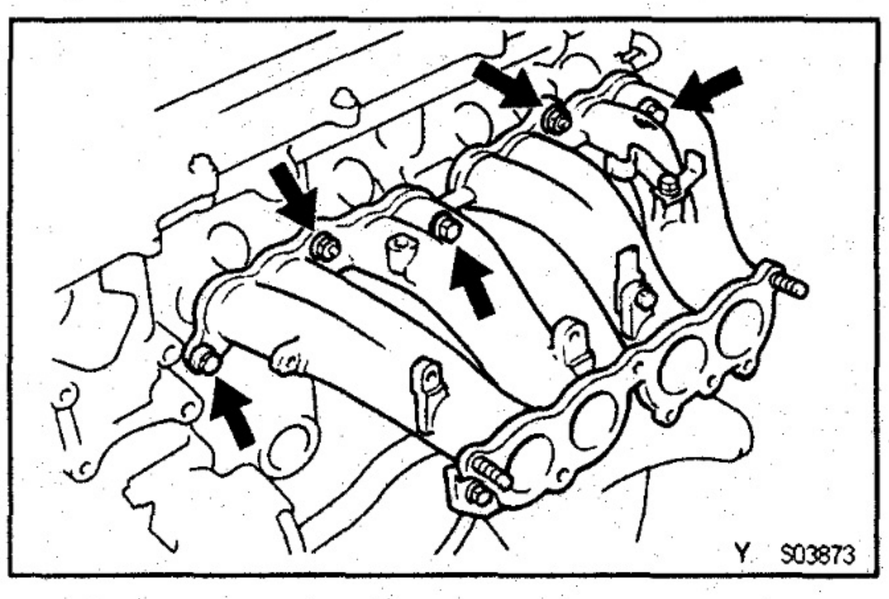
9. REMOVE DELIVERY PIPE AND INJECTORS

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

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

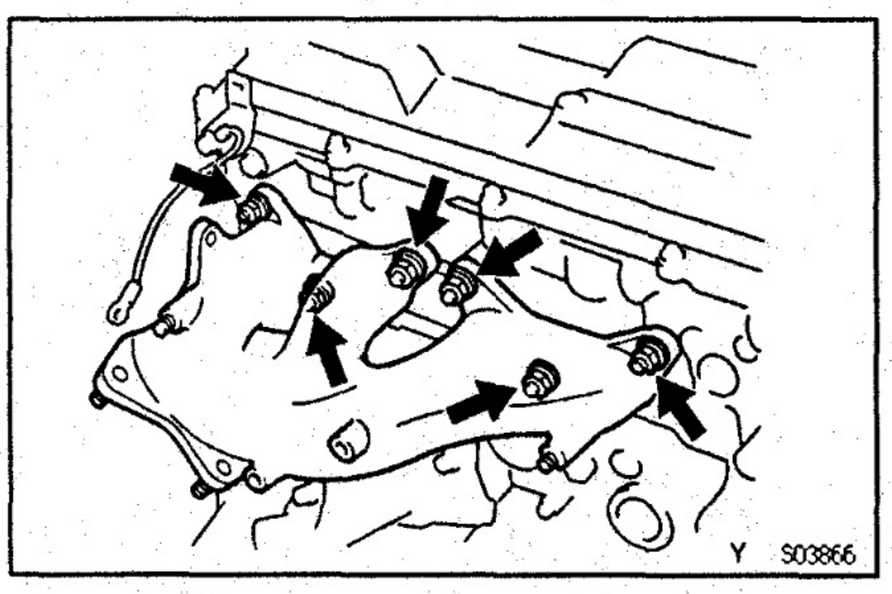


(b) Remove the 4 insulators from the 4 spacers.
(c) Pull out the 4 injectors from the delivery pipe.
(d) Remove the O–ring and grommet from each injector.
(e) Using a screwdriver, pry out the 4 spacers.



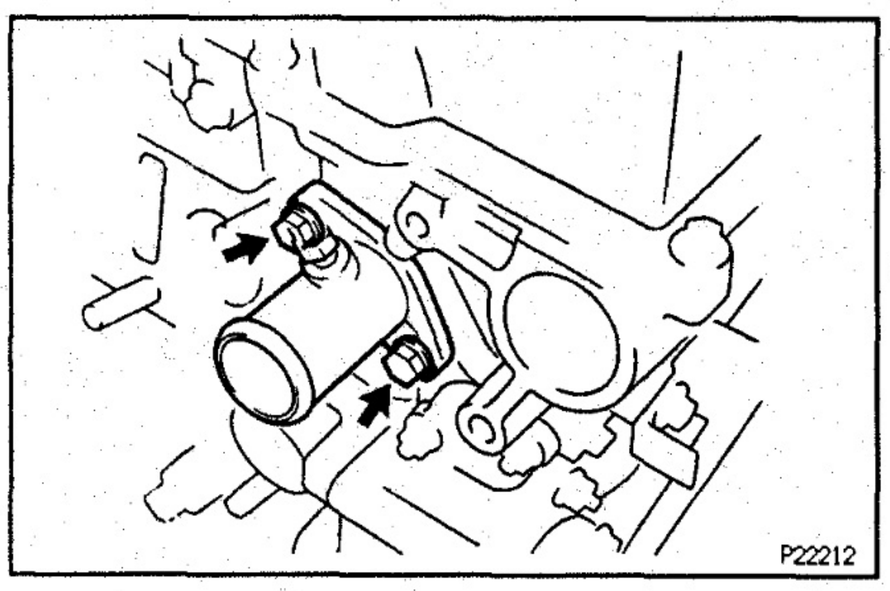
10. REMOVE INTAKE MANIFOLD

Remove the 3 bolts, 2 nuts, intake manifold and gasket.



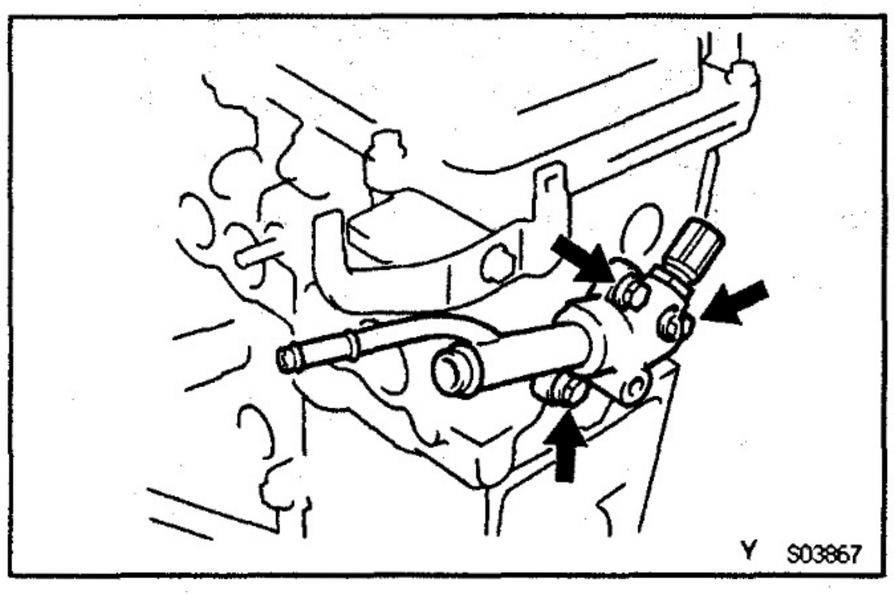
11. REMOVE EXHAUST MANIFOLD

(a) Remove the 2 bolts, 2 nuts and heat insulator.
(b) Remove the 6 nuts, exhaust manifold and gasket.

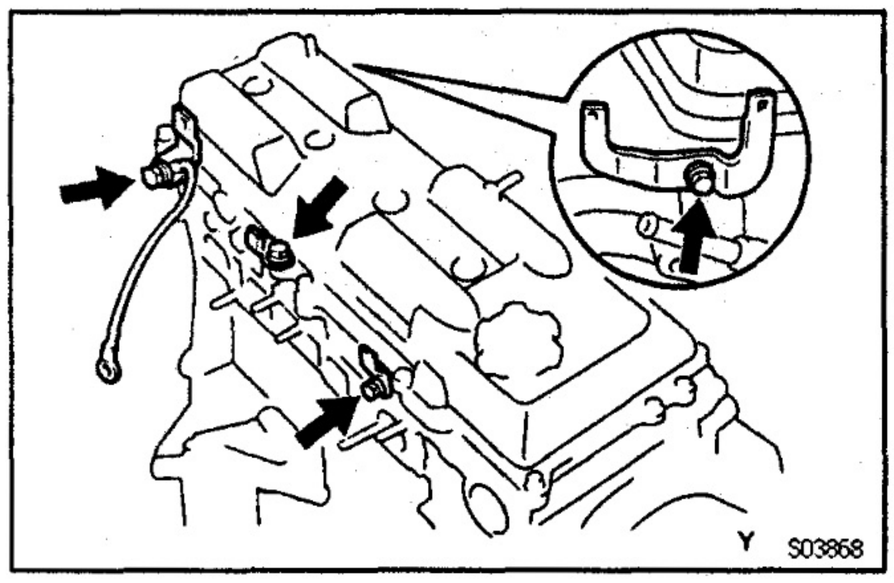


12. REMOVE WATER OUTLET

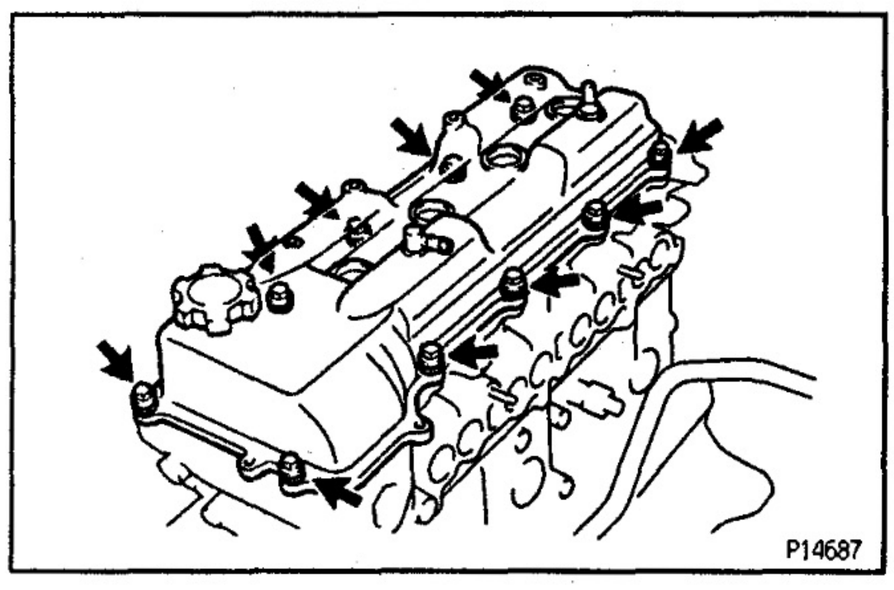
(a) Disconnect the upper radiator hose.
(b) Remove the 2 bolts, water outlet and gasket.



13. **REMOVE CYLINDER HEAD REAR COVER**
    Remove the 3 bolts, cylinder head rear cover and gasket.
14. **REMOVE SPARK PLUGS**
15. **REMOVE FRONT ENGINE HANGER**



16. **REMOVE ENGINE WIRE BRACKETS**
    Remove the 4 bolts, 4 wire brackets and ground strap.



17. **REMOVE CYLINDER HEAD COVER**
    Remove the 10 bolts, seal washers, cylinder head cover and gasket.
18. **SET NO.1 CYLINDER TO TDC/COMPRESSION**
    (See step 18 in cylinder head removal in 3RZ—F cylinder head)
19. **REMOVE CHAIN TENSIONER**
    (See step 19 in cylinder head removal in 3RZ—F cylinder head)
20. **REMOVE CAMSHAFT TIMING GEAR**
    (See step 20 in cylinder head removal in 3RZ—F cylinder head)
21. **REMOVE CAMSHAFTS**
    (See step 21 in cylinder head removal in 3RZ—F cylinder head)
22. **DISASSEMBLE EXHAUST CAMSHAFT**
    (See step 22 in cylinder head removal in 3RZ—F cylinder head)
23. **REMOVE CYLINDER HEAD**
    (See step 23 in cylinder head removal in 3RZ—F cylinder head)

CYLINDER HEAD DISASSEMBLY

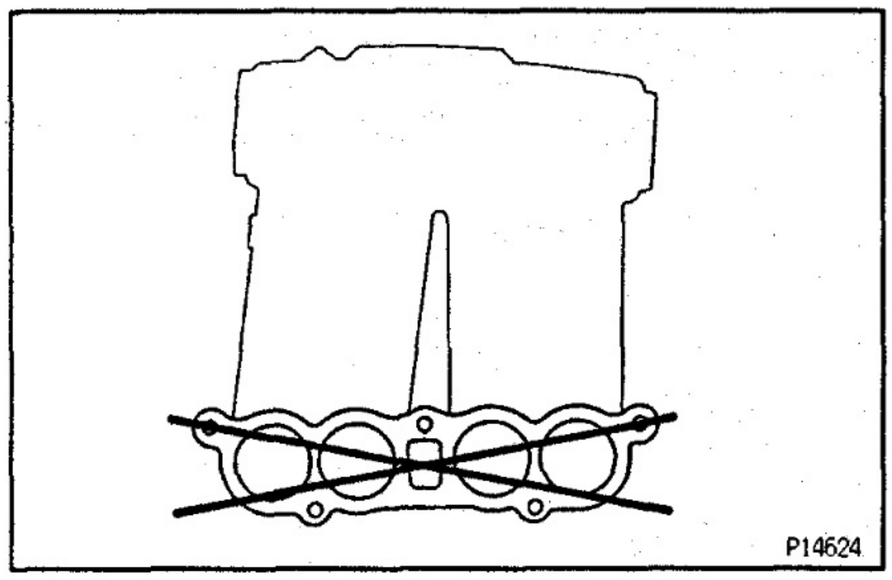
EG76R-01

(See cylinder head disassembly in 3RZ—F cylinder head)

EG788-01

CYLINDER HEAD COMPONENTS, INSPECTION, CLEANING AND REPAIR

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK
   (See step 1 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)
2. CLEAN CYLINDER HEAD
   (See step 2 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)
3. INSPECT CYLINDER HEAD
   (See step 3 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)
4. CLEAN VALVES
   (See step 4 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)
5. INSPECT VALVE STEMS AND GUIDE BUSHINGS
   (See step 5 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)
6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS
   (See step 6 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)
7. INSPECT AND GRIND VALVES
   (See step 7 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)
8. INSPECT AND CLEAN VALVE SEATS
   (See step 8 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)
9. INSPECT VALVE SPRINGS
   (See step 9 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)
10. INSPECT CAMSHAFTS AND BEARINGS
    (See step 10 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)
11. INSPECT VALVE LIFTERS AND LIFTER BORES
    (See step 11 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)



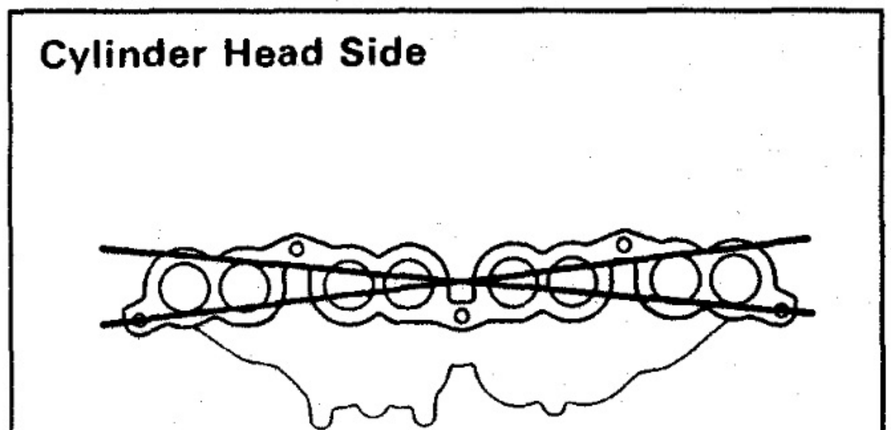
12. INSPECT AIR INTAKE CHAMBER

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

Maximum warpage:

0.20 mm (0.0078 in.)

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



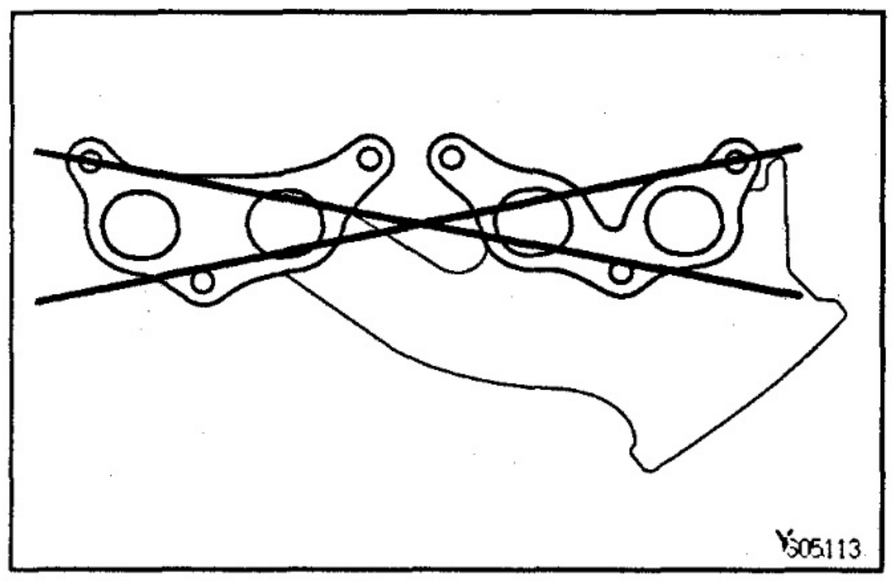
13. INSPECT INTAKE MANIFOLD

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

Maximum warpage:

0.20 mm (0.0078 in.)

If warpage is greater than maximum, replace the manifold.



14. INSPECT EXHAUST MANIFOLD

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

Maximum warpage:

0.50 mm (0.0197 in.)

If warpage is greater than maximum, replace the manifold.

15. INSPECT CHAIN TENSIONER

(See step 14 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)

16. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKETS

(See step 15 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)

17. INSPECT CYLINDER HEAD BOLTS

(See step 16 in cylinder head components, inspection, cleaning and repair in 3RZ—F cylinder head)

EG78T-01

CYLINDER HEAD ASSEMBLY

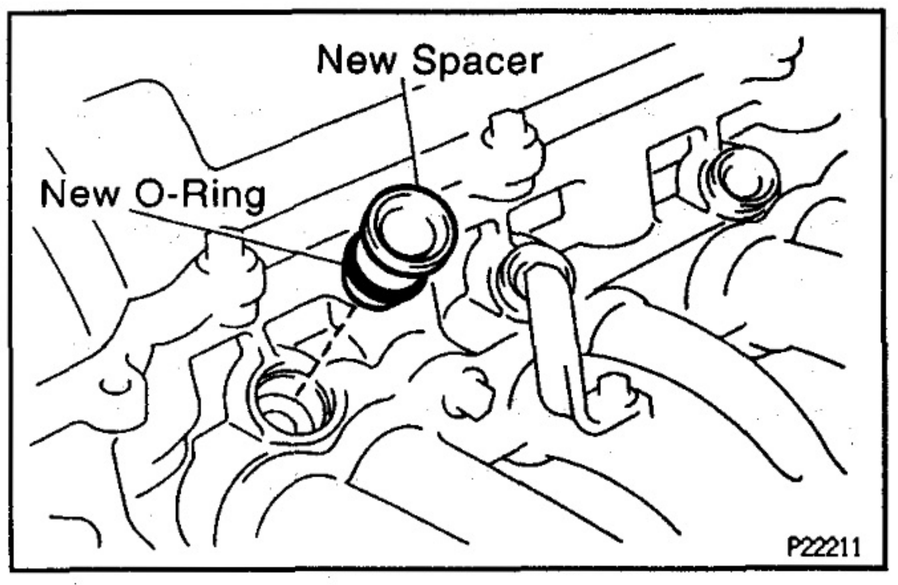
(See cylinder head assembly in 3RZ—F cylinder head)

EG78U-01

CYLINDER HEAD INSTALLATION

1. **INSTALL CYLINDER HEAD**
   (See step 1 in cylinder head installation in 3RZ—F cylinder head)
2. **ASSEMBLE EXHAUST CAMSHAFT**
   (See step 2 in cylinder head installation in 3RZ—F cylinder head)
3. **SET NO.1 CYLINDER TO TDC/COMPRESSION**
   (See step 4 in cylinder head installation in 3RZ—F cylinder head)
4. **INSTALL CAMSHAFT TIMING GEAR**
   (See step 5 in cylinder head installation in 3RZ—F cylinder head)
5. **INSTALL CHAIN TENSIONER**
   (See step 6 in cylinder head installation in 3RZ—F cylinder head)
6. **SET CHAIN TENSIONER**
   (See step 7 in cylinder head installation in 3RZ—F cylinder head)
7. **CHECK VALVE TIMING**
   (See step 8 in cylinder head installation in 3RZ—F cylinder head)
8. **CHECK AND ADJUST VALVE CLEARANCE**
   (See step 9 in cylinder head installation in 3RZ—F cylinder head)
9. **INSTALL SPARK PLUGS**
   (See step 10 in spark plugs inspection in on—vehicle inspection in Ignition System)
10. **INSTALL SEMI—CIRCULAR PLUGS**
    (See step 11 in cylinder head installation in 3RZ—F cylinder head)
11. **INSTALL CYLINDER HEAD COVER**
12. **INSTALL ENGINE WIRE BRACKETS**
13. **INSTALL FRONT ENGINE HANGER**
    Torque: 42 N·m (420 kgf·cm, 30 ft·lbf)
14. **INSTALL CYLINDER HEAD REAR COVER**
    Install a new gasket and the rear cover with the 3 bolts.
    Torque: 13.5 N·m (135 kgf·cm, 10 ft·lbf)

EG



15. INSTALL WATER OUTLET

(a) Install a new gasket and the water outlet with the 2 bolts.
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

(b) Connect the upper radiator hose.

16. INSTALL EXHAUST MANIFOLD

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

(b) Install the heat insulator with the 2 bolts and 2 nuts.
Torque: 5.5 N·m (55 kgf·cm, 48 in.·lbf)

17. INSTALL INTAKE MANIFOLD

Install a new gasket and the intake manifold with the 3 bolts and 2 nuts.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

18. INSTALL INJECTORS AND DELIVERY PIPE

(See steps 3 in injectors installation in EFI System)

HINT: When using a new cylinder head, spacers must be installed.

Apply a light coat of gasoline to a new O—ring and install it to a new spacer.

19. INSTALL FUEL RETURN PIPE

20. INSTALL FUEL INLET PIPE

Install the fuel inlet pipe and 4 new gaskets with 2 union bolts.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

21. CONNECT INJECTOR CONNECTORS

22. INSTALL AIR INTAKE CHAMBER ASSEMBLY

(a) Install a new gasket and the air intake chamber assembly with the 3 bolts and 2 nuts.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

(b) Connect these hoses:
- PCV hose from throttle body
- Brake booster vacuum hose to union
- Water bypass hose to water bypass pipe
- Water bypass hose to cylinder head rear cover

23. INSTALL INTAKE CHAMBER STAY
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)

24. CONNECT ENGINE WIRE

25. INSTALL DISTRIBUTOR

(See distributor installation in Ignition System)

26. INSTALL OIL DIPSTICK GUIDE
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)

27. FILL WITH ENGINE COOLANT

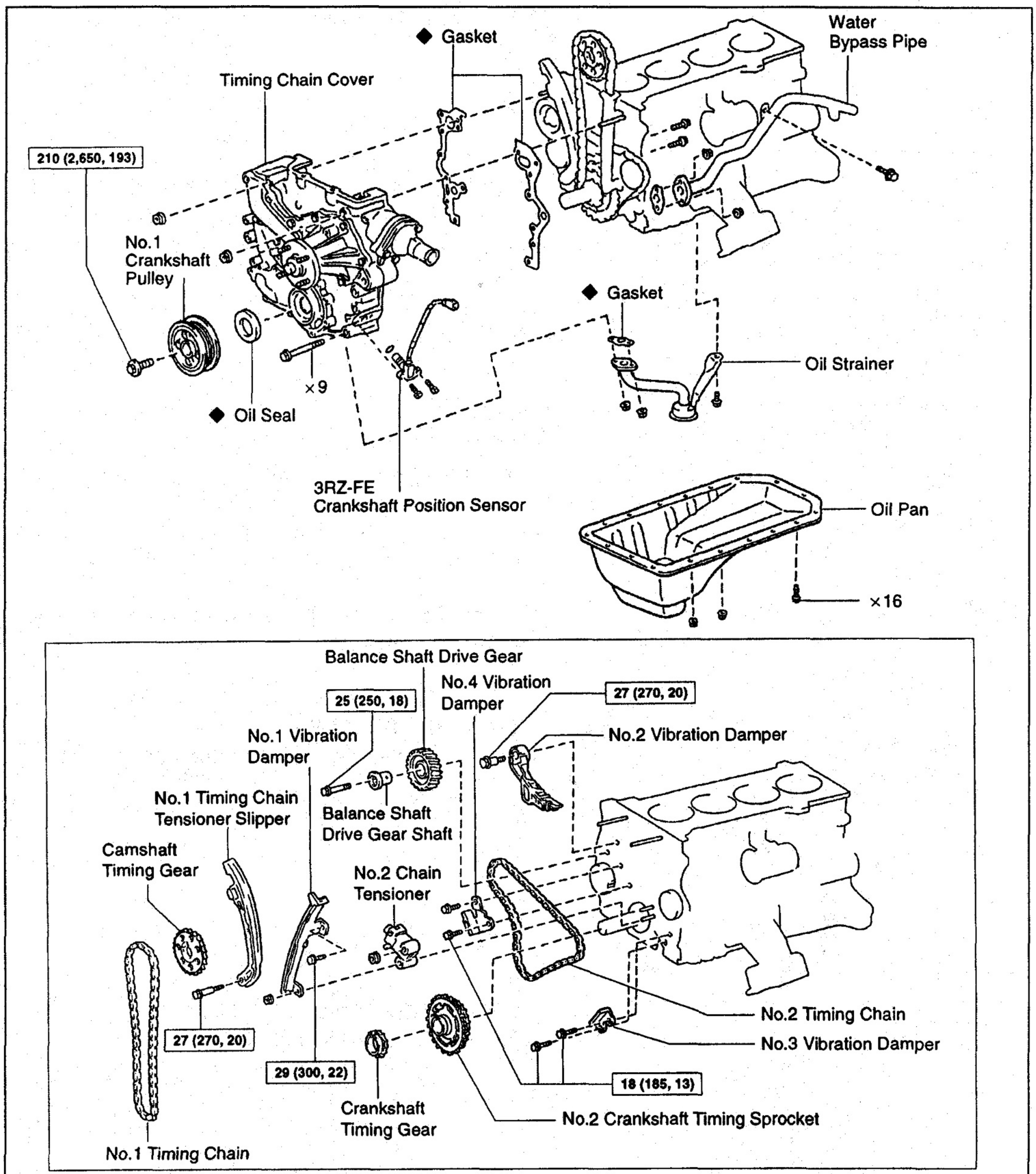
28. START ENGINE AND FOR LEAKS

29. RECHECK ENGINE COOLANT LEVEL

TIMING CHAIN

COMPONENTS FOR REMOVAL AND INSTALLATION

EG78V-01



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

◆ Non-reusable part

Y

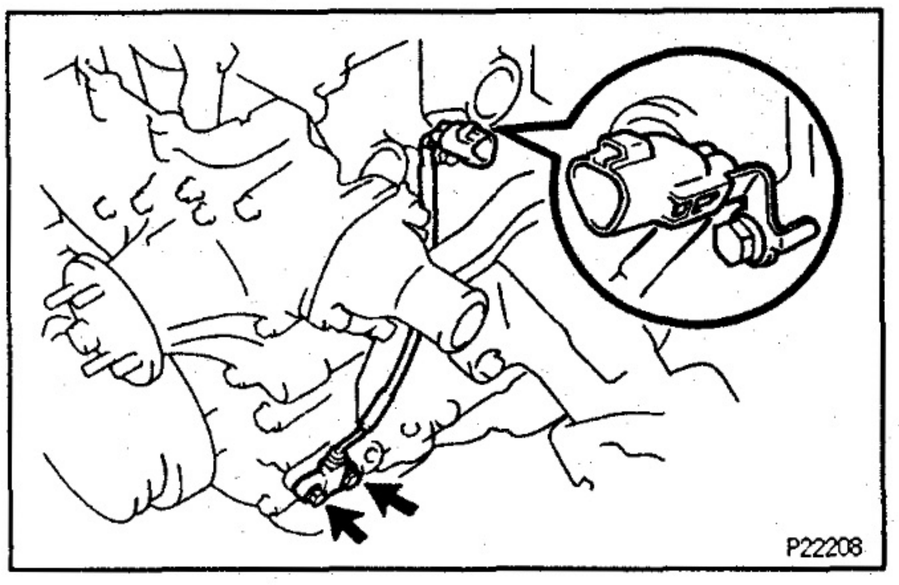
S03881

EG78W-01

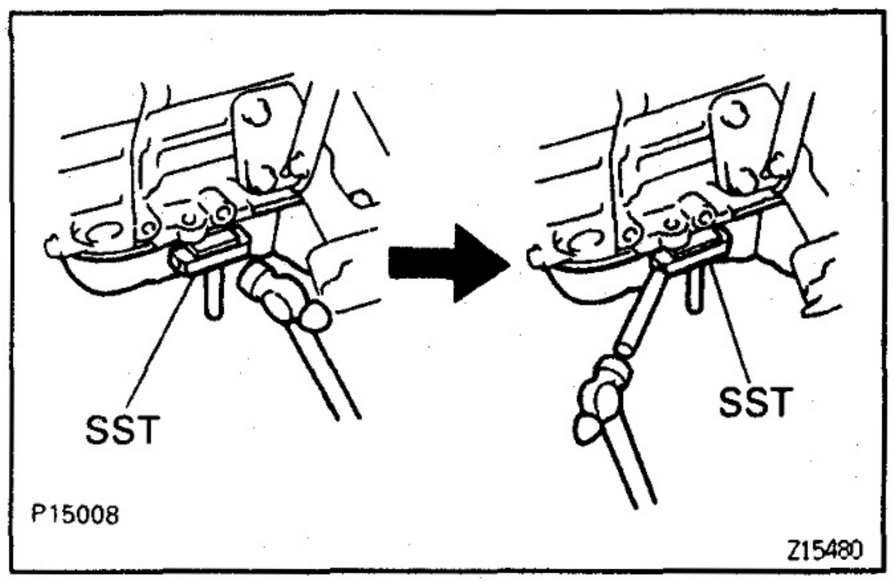
TIMING CHAIN REMOVAL

1. **DRAIN ENGINE OIL**
2. **DRAIN ENGINE COOLANT**
3. **REMOVE CYLINDER HEAD ASSEMBLY**
   (See cylinder head removal)

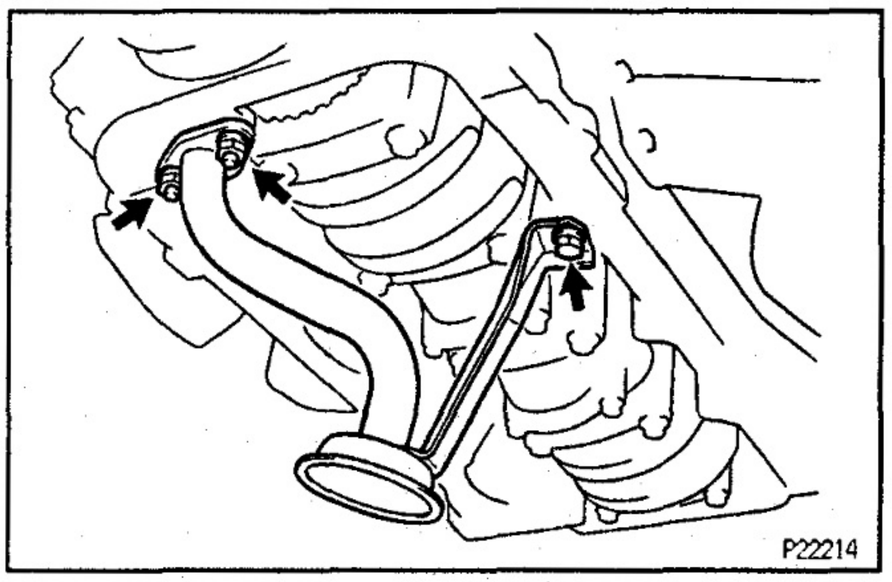
EG



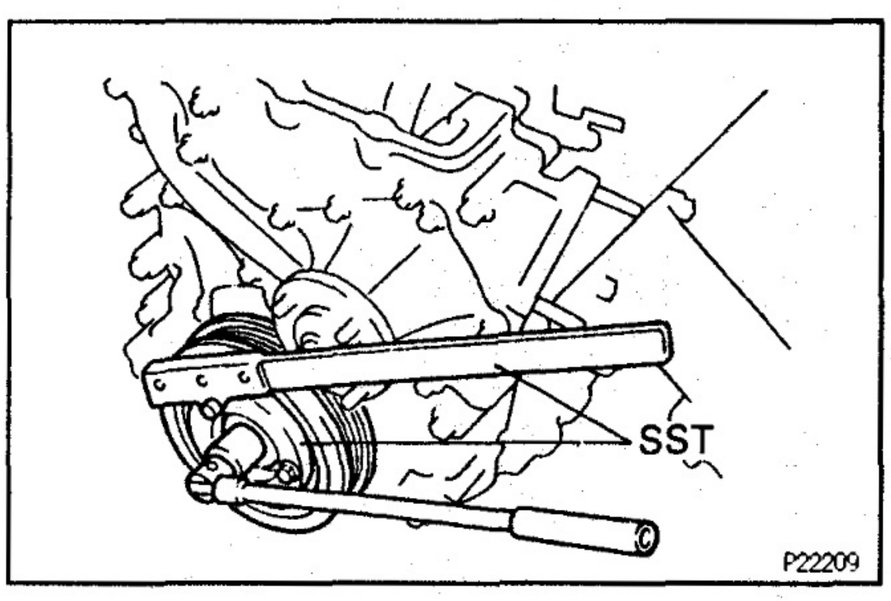
4. **3RZ–FE:**
   REMOVE CRANKSHAFT POSITION SENSOR
(a) Remove the 2 bolts and crankshaft position sensor.
(b) Remove the O – ring from the crankshaft position sensor.



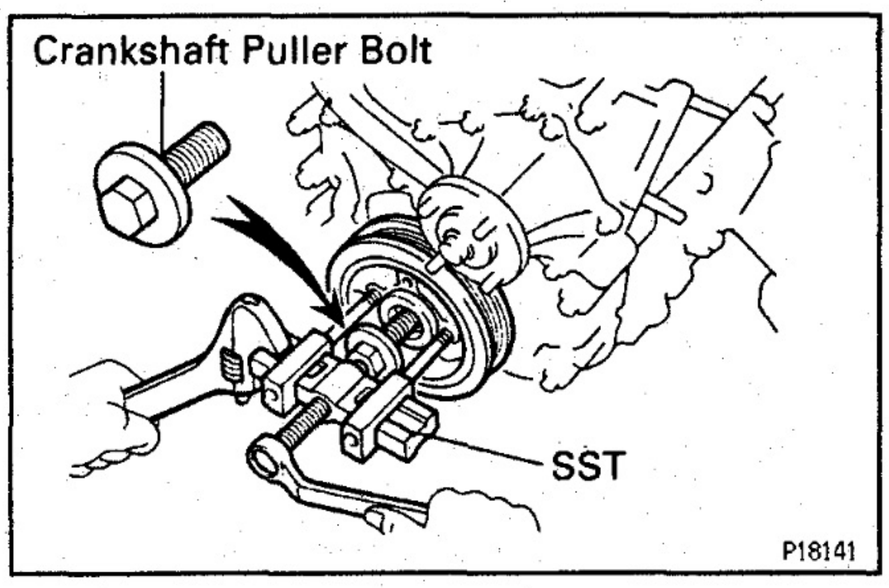
5. **REMOVE OIL PAN**
(a) Remove the 16 bolts and 2 nuts.
(b) Insert the blade of SST between the cylinder block and oil pan, cut off applied sealer and remove the oil pan.
SST 09032–00100
NOTICE: Be careful not to damage the oil pan flanges of the oil pan and cylinder block.



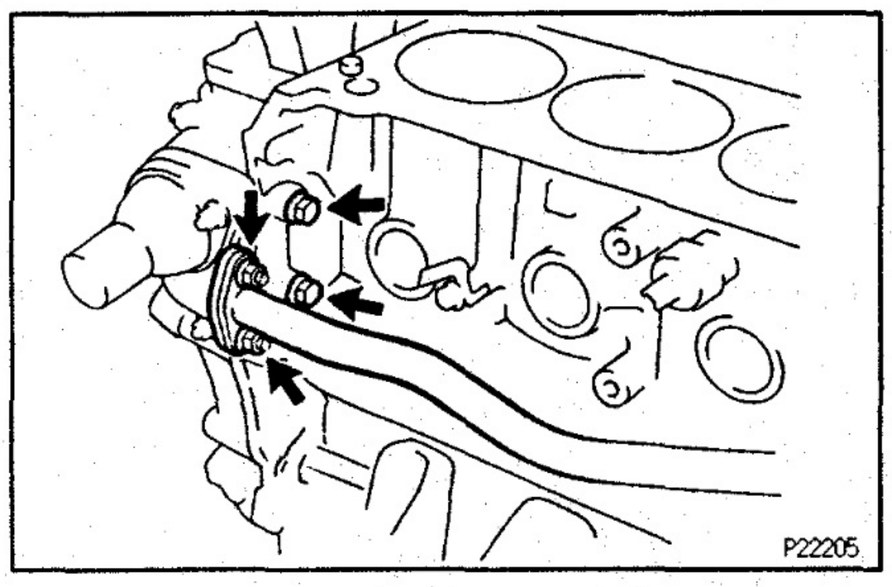
6. **REMOVE OIL STRAINER**
Remove the bolt, 2 nuts, oil strainer and gasket.



7. **REMOVE CRANKSHAFT PULLEY**
(a) Using SST, remove the pulley bolt.
SST 09213–54015, 09330–00021
(b) Remove the crankshaft pulley.

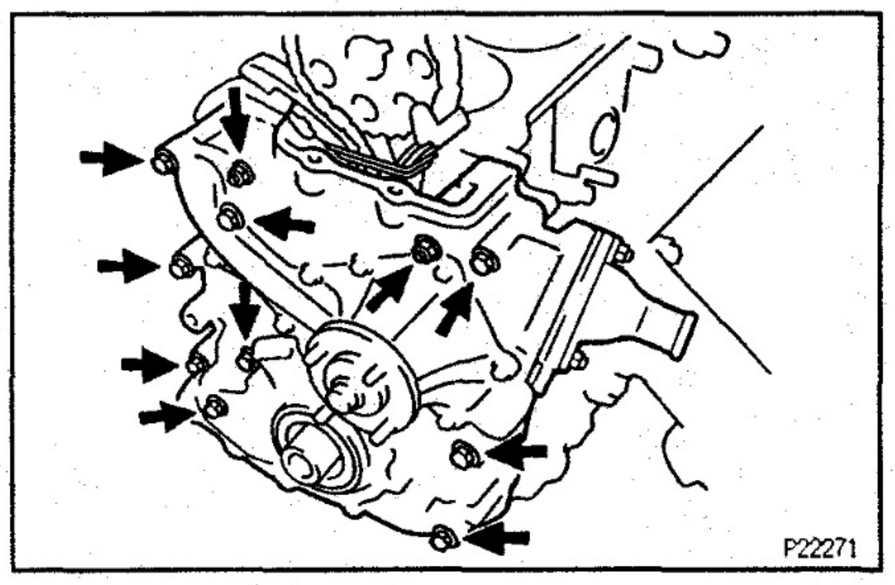


HINT: If necessary, remove the pulley with SST and crankshaft pulley bolt.
SST 09950—50010 (09951—05010, 09952—05010, 09953—05010, 09954—05020)

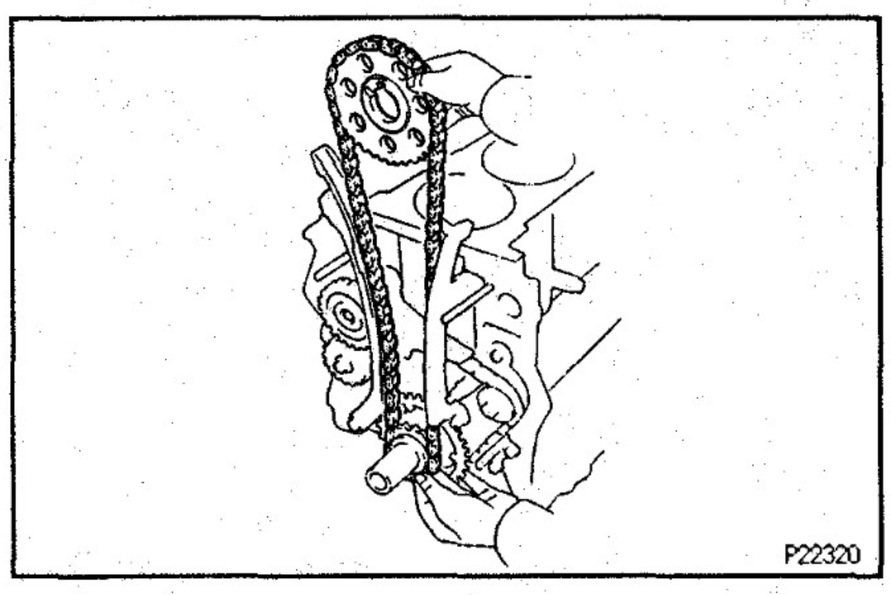


8. REMOVE TIMING CHAIN COVER

(a) Remove the 2 water bypass pipe nuts.
(b) Remove the 2 timing chain cover bolts.

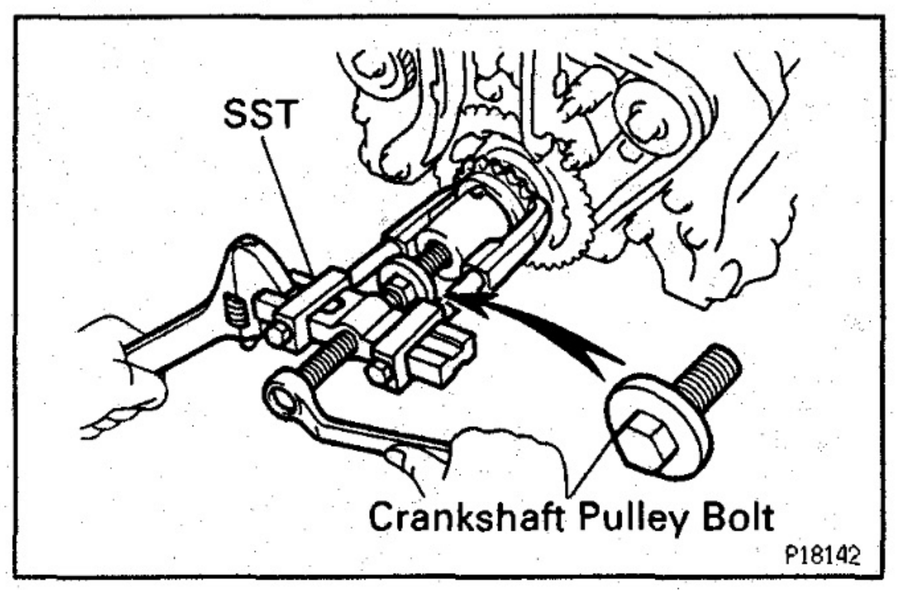


(c) Remove the 9 bolts and 2 nuts.
(d) Using a plastic faced hammer, loosen the chain cover and remove the timing chain cover and 3 gasket.



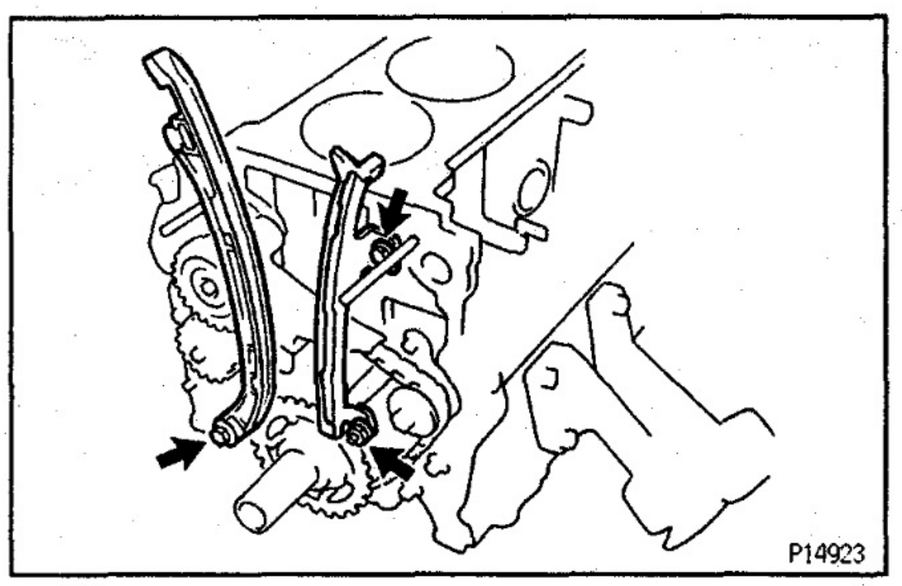
No.1 Timing Chain

9. REMOVE NO.1 TIMING CHAIN AND CAMSHAFT TIMING GEAR



10. REMOVE CRANKSHAFT TIMING GEAR

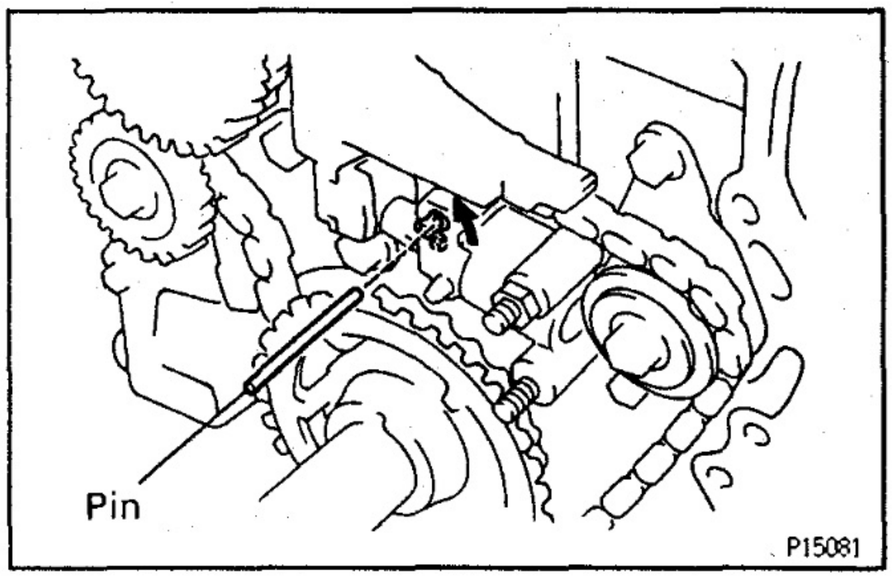
HINT: If necessary, remove the gear with SST and crankshaft pulley bolt.
SST 09950—40010 (09951—04010, 09952—04010, 09953—04010, 09954—04010, 09955—04060)



11. REMOVE NO.1 TIMING CHAIN TENSIONER SLIPPER AND NO.1 VIBRATION DAMPER

(a) Remove the bolt and slipper.

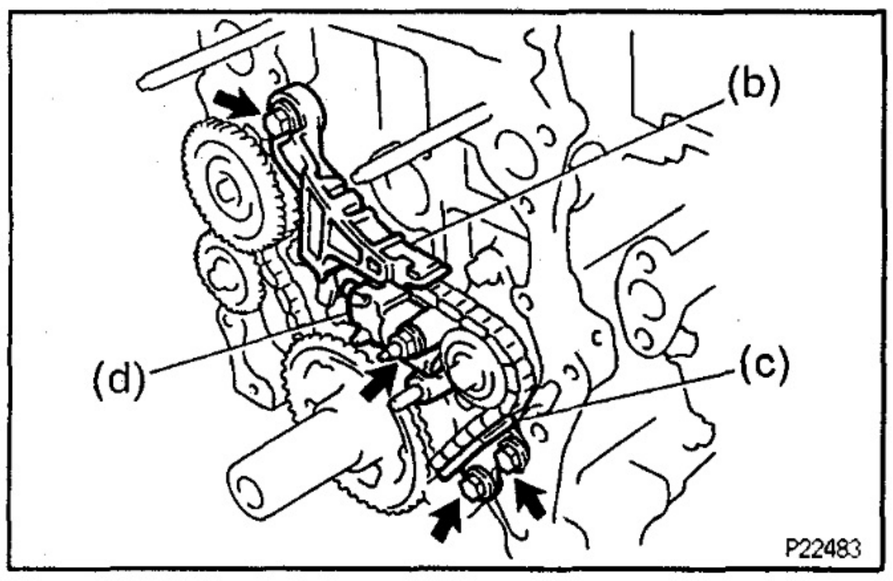
(b) Remove the bolt, nut and No.1 damper.



No.2 Timing Chain

12. REMOVE NO.2, NO.3 VIBRATION DAMPERS AND NO.2 CHAIN TENSIONER

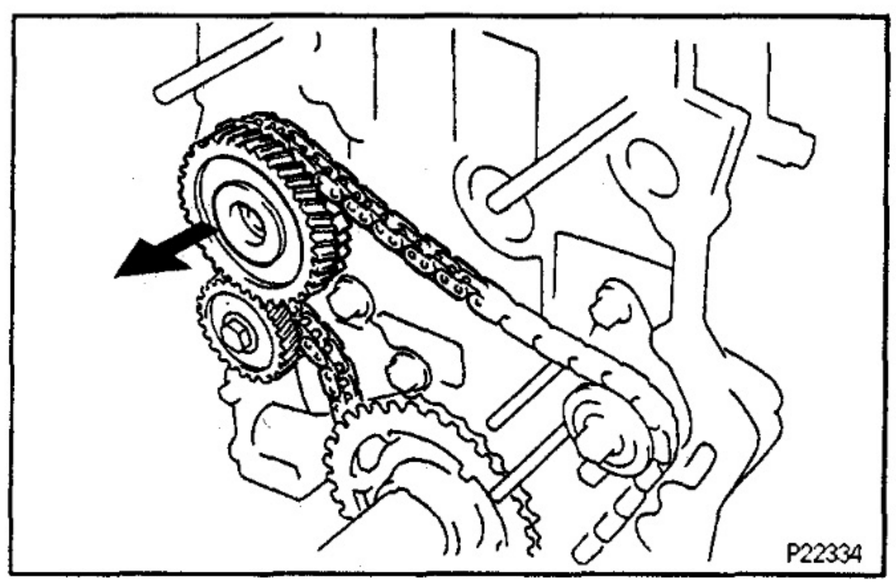
(a) Install a pin to the No.2 chain tensioner and lock the plunger.



(b) Remove the bolt and No.2 damper.

(c) Remove the 2 bolts and No.3 damper.

(d) Remove the nut and No.2 chain tensioner.

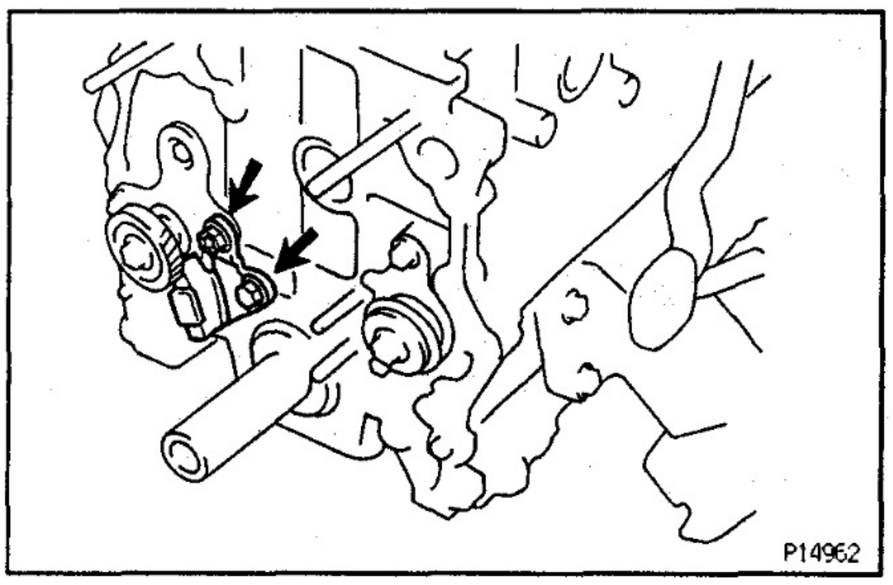


13. REMOVE BALANCE SHAFT DRIVE GEAR, SHAFT, NO. 2 TIMING CHAIN AND NO. 2 CRANKSHAFT TIMING SPROCKET

(a) Remove the bolt from the balance shaft drive gear.

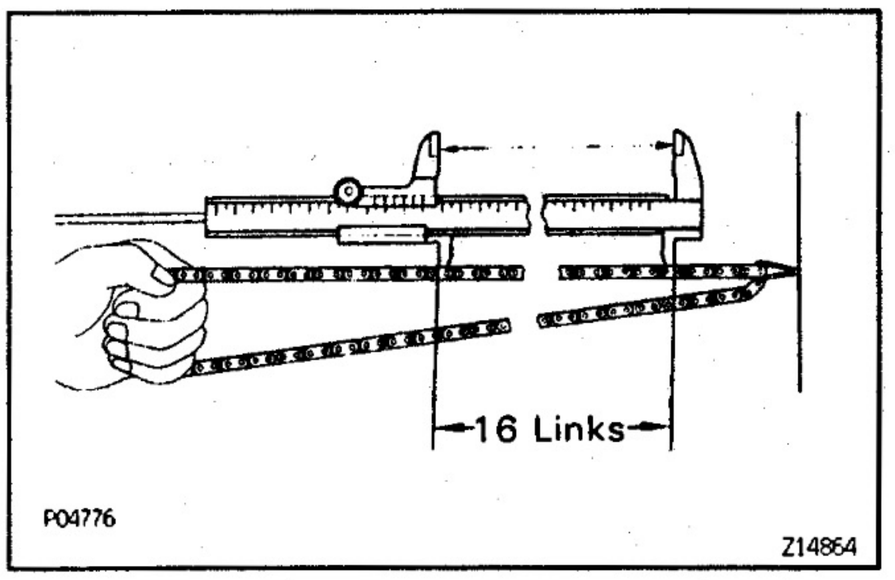
(b) Remove the balance shaft drive gear with the shaft.

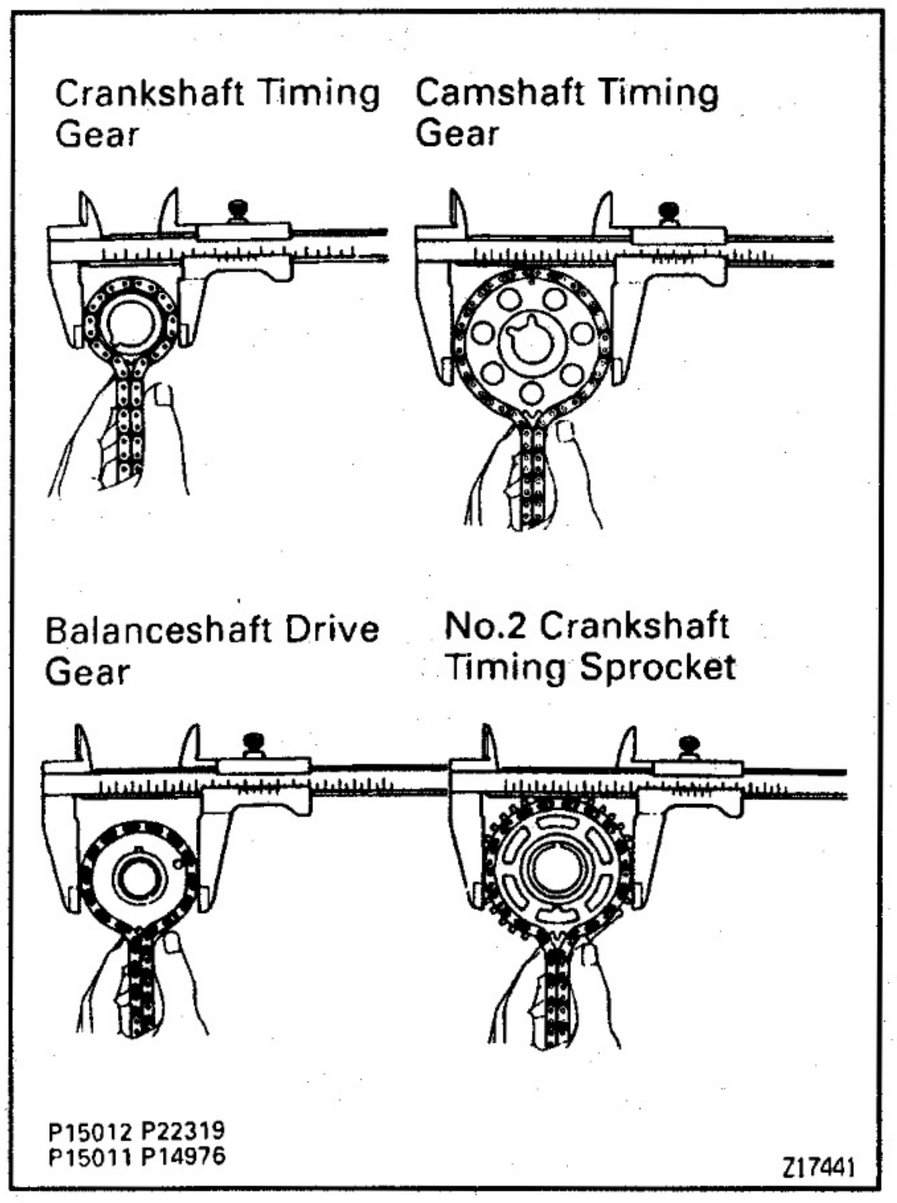
(c) Remove the No.2 timing chain with the No.2 crankshaft timing sprocket.

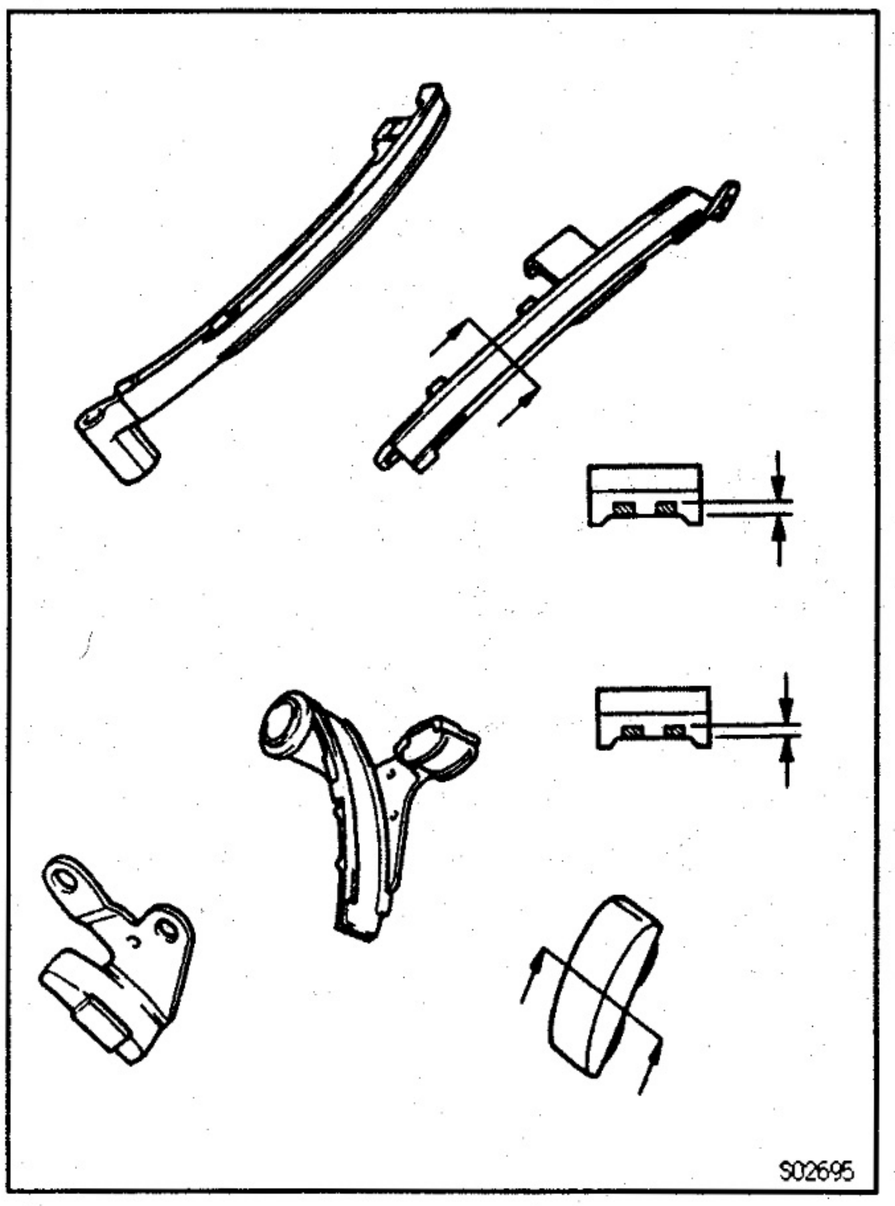


14. REMOVE NO.4 VIBRATION DAMPER

Remove the 2 bolts and No.4 damper.







5078X-01

TIMING CHAIN COMPONENTS INSPECTION

1. INSPECT TIMING CHAINS, TIMING GEARS AND TIMING SPROCKETS

(a) Measure the length of 16 links with the chain fully stretched.

Maximum chain elongation:

No.1 Timing chain

147.5 mm (5.807 in.)

No.2 Timing chain

123.6 mm (4.866 in.)

If the elongation is greater than maximum, replace the chain.

HINT: Make the same measurements pulling at 3 or more places selected at random.

(b) Wrap the chain around the timing gear and timing sprocket.

(c) Using vernier calipers, measure the timing gear and timing sprocket diameter with the chain.

NOTICE: Vernier calipers must contact the chain rollers for measuring.

Minimum gear diameter (w/ chain):

Camshaft

113.8 mm (4.480 in.)

Crankshaft

59.4 mm (2.339 in.)

Balance shaft

75.9 mm (2.988 in.)

Minimum sprocket diameter (w/ chain):

No.2 crankshaft

96.7 mm (3.807 in.)

If the diameter is less than minimum, replace the chain, gears and sprocket.

2. INSPECT CHAIN TENSIONER SLIPPER AND VIBRATION DAMPERS

Measure the chain tensioner slipper and vibration damper wears.

Maximum wear:

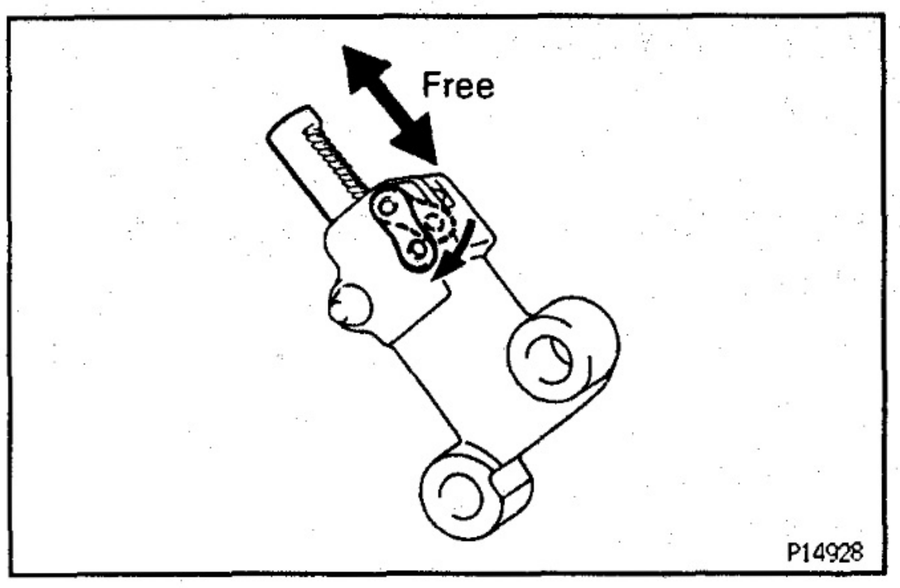
1.0 mm (0.039 in.)

If the wear is greater than maximum, replace the slipper and/or dampers.

3. INSPECT NO.1 CHAIN TENSIONER

(See step 14 in cylinder head components, inspection, cleaning and repair in cylinder head)

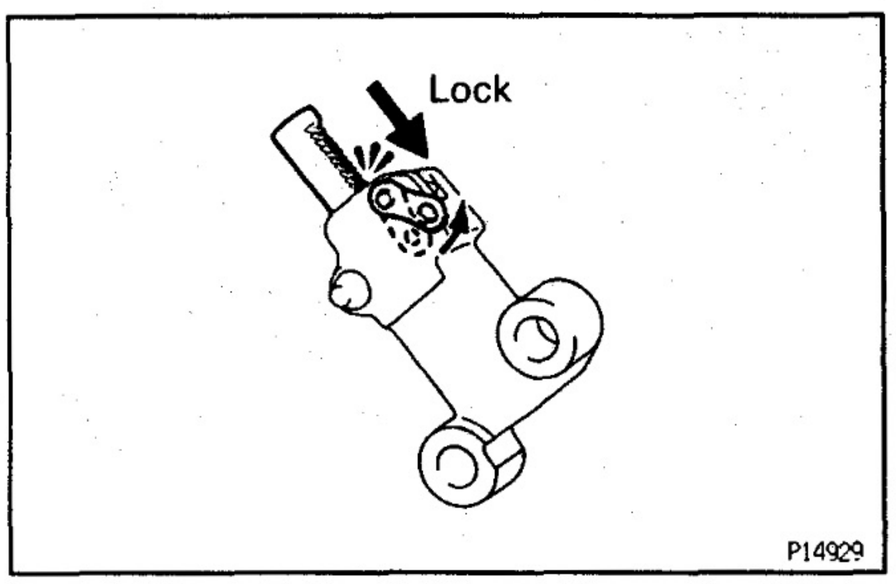
EG



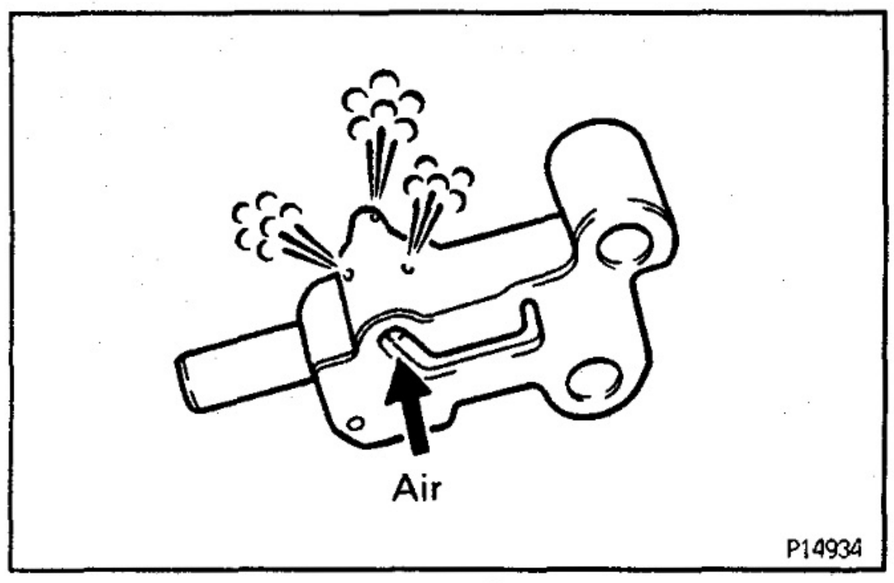
4. INSPECT NO.2 CHAIN TENSIONER

A. Inspect chain tensioner

(a) Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.

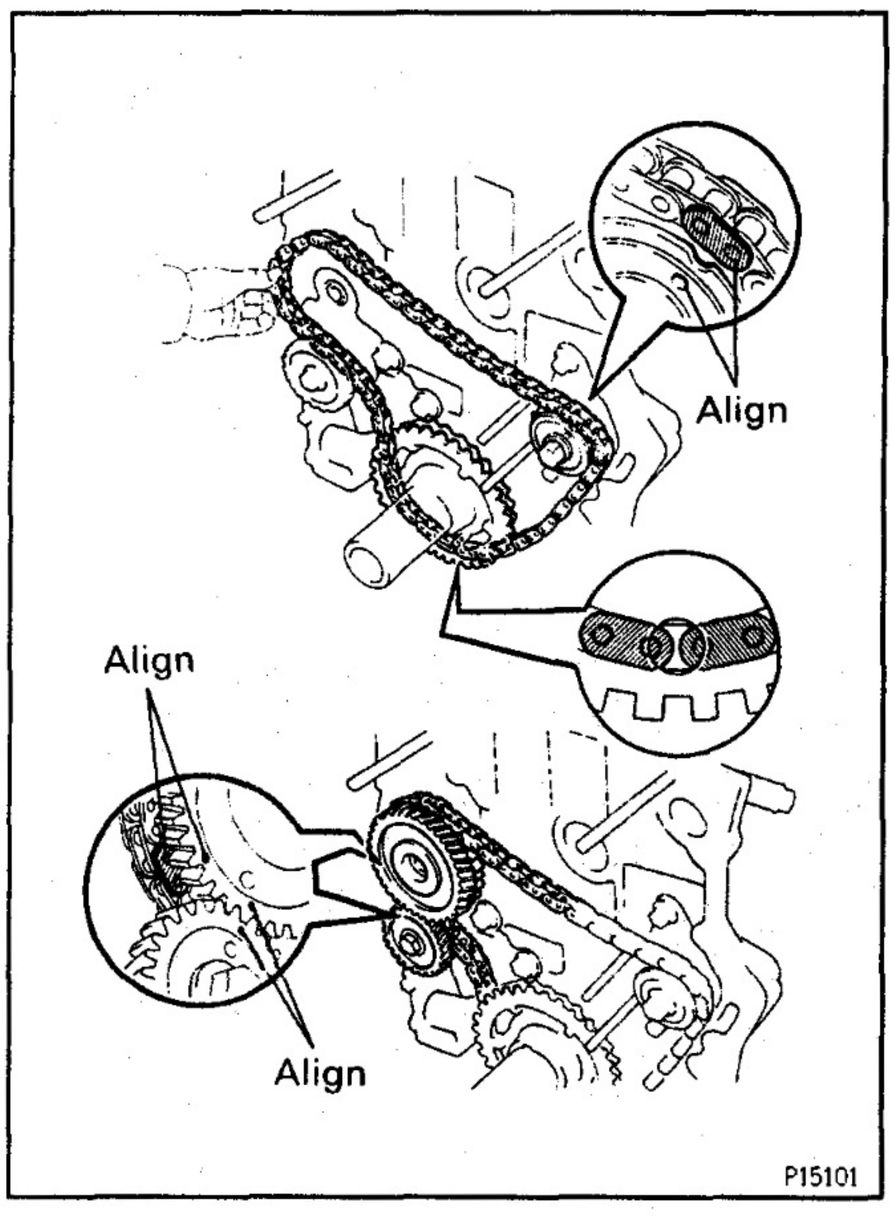


(b) Release the ratchet pawl and check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.



B. Inspect oil jet (No.2 chain tensioner).

Check the oil jet for damage or clogging.
If necessary, replace the oil jet (No.2 chain tensioner).



EG78Y–01

TIMING CHAIN INSTALLATION

No.2 Timing Chain

NOTICE: Check that No.1 cylinder is at TDC and that the weights of the No.1 and No.2 balance shafts are at the bottom side.

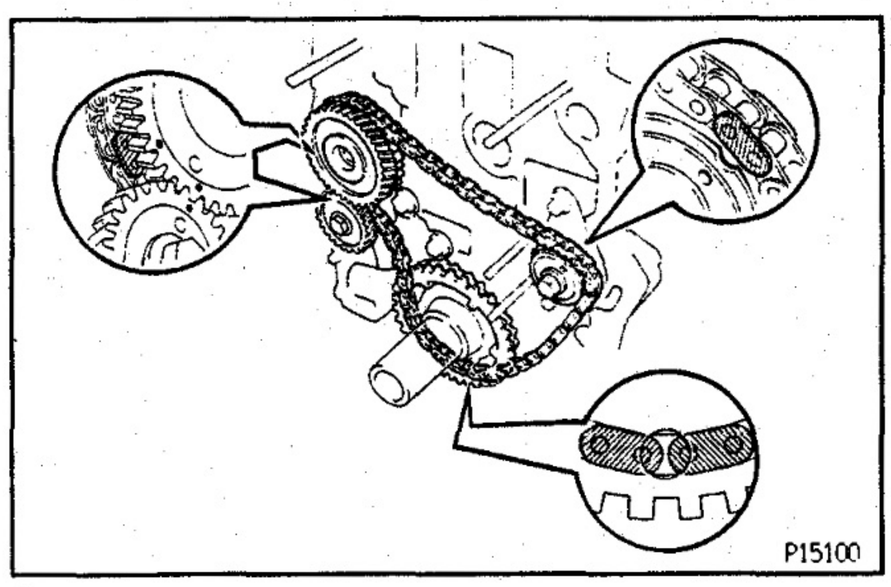
1. INSTALL NO.4 VIBRATION DAMPER

Install the No.4 damper with the 2 bolts.

2. INSTALL NO.2 TIMING CHAIN, NO.2 CRANKSHAFT TIMING SPROCKET, BALANCE SHAFT DRIVE GEAR AND SHAFT

(a) Install the No.2 timing chain by matching its mark links with the timing marks on the No.2 crankshaft timing sprocket and balance shaft timing sprocket.

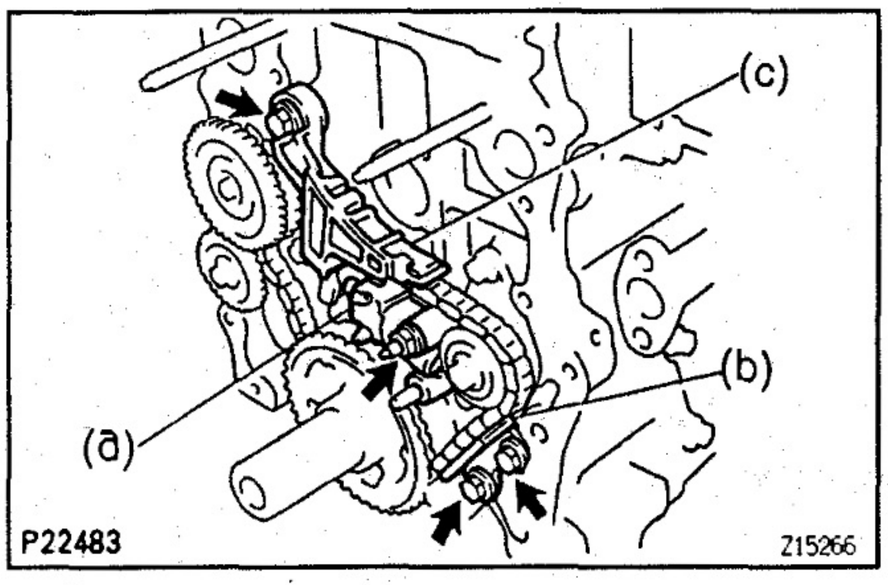
(b) Fit the other mark link of No.2 timing chain onto the sprocket behind the large timing mark of the balance shaft drive gear.



(c) Insert the balance shaft drive gear shaft through the balance shaft drive gear so that it fits into the thrust plate hole.
Then align the small timing mark of the balance shaft drive gear with the timing mark of the balance shaft timing gear.

(d) Install the bolt to the balance shaft drive gear and tighten it.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

(e) Check that each timing mark is matched with the corresponding mark link.



3. INSTALL NO.2, NO.3 VIBRATION DAMPERS AND NO.2 CHAIN TENSIONER

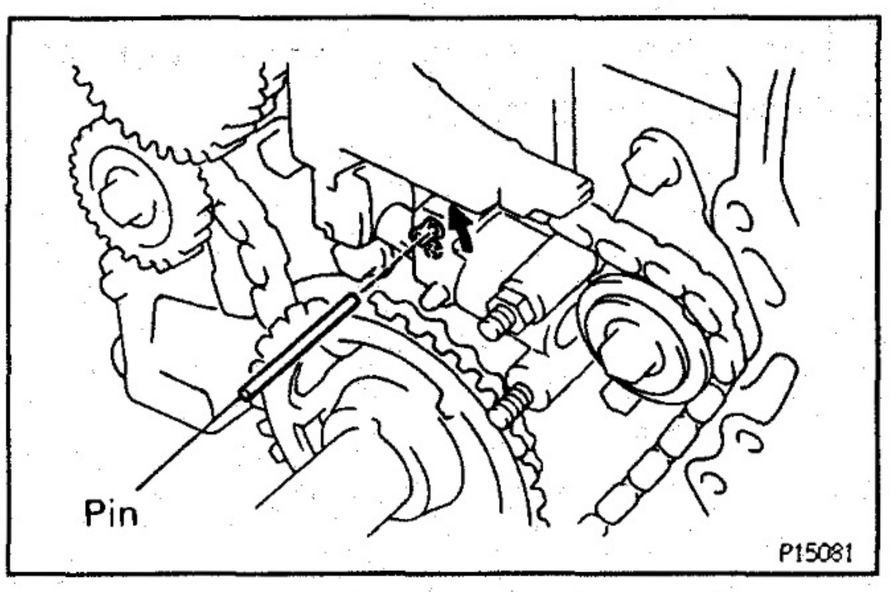
NOTICE: Assemble the chain tensioner with the pin installed, then remove the pin after assembly.
When doing this, avoid pushing the No.2 vibration damper against the chain.

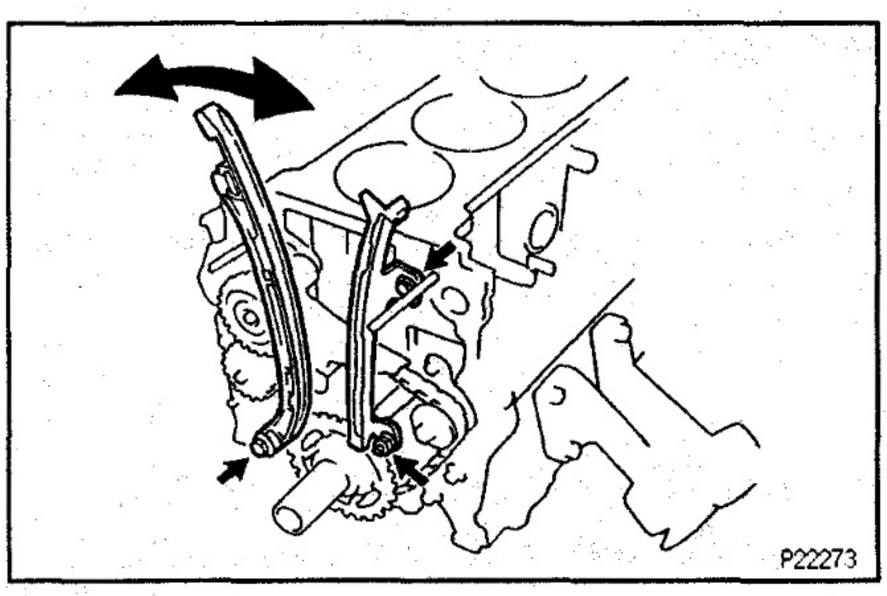
(a) Install the No.2 chain tensioner with the nut.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

(b) Install No.3 damper with the 2 bolts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

(c) Install No.2 damper with the bolt.
Torque: 27 N·m (270 kgf·cm, 20 ft·lbf)

(d) Remove a pin from the No.2 chain tensioner and free the plunger.





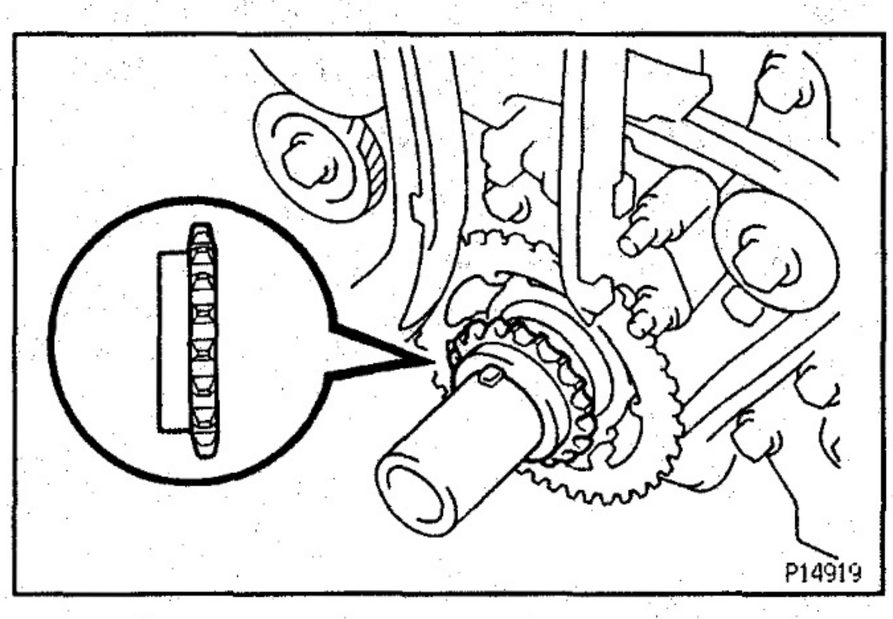
No.1 Timing Chain

4. INSTALL NO.1 TIMING CHAIN TENSIONER SLIPPER AND NO.1 VIBRATION DAMPER

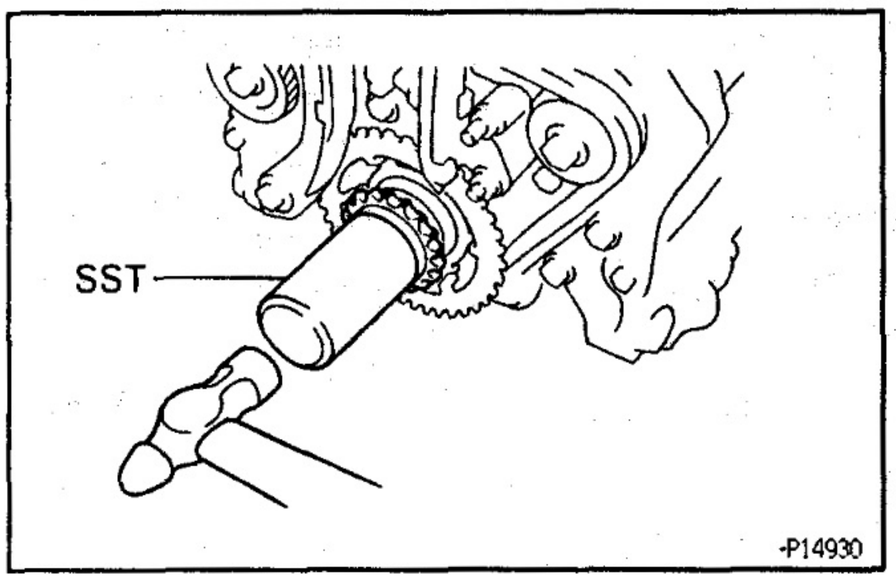
(a) Install the No.1 damper with the bolt and nut.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

(b) Install the slipper with the bolt.
Torque: 27 N·m (270 kgf·cm, 20 ft·lbf)

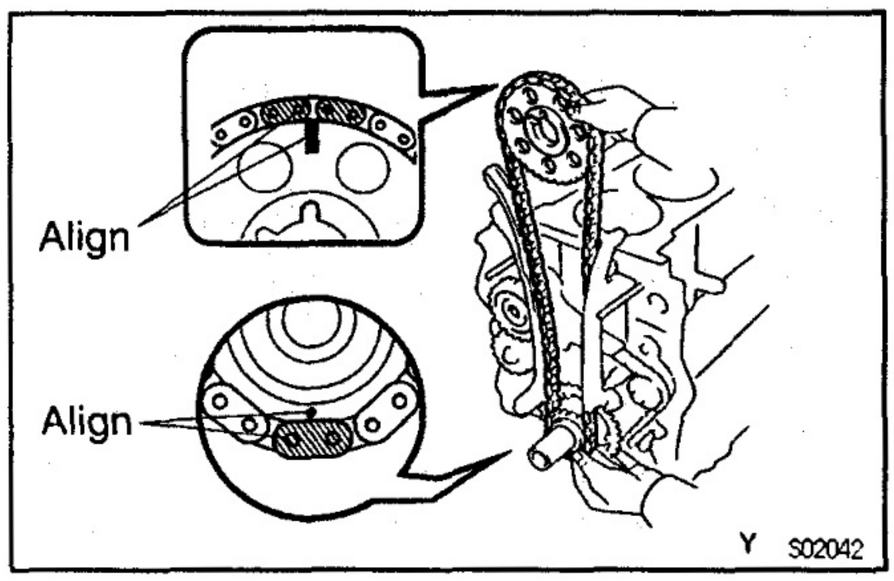
(c) Check that the slipper moves smoothly.



5. INSTALL CRANKSHAFT TIMING GEAR



HINT: If necessary, install the gear with SST.
SST 09636–20010

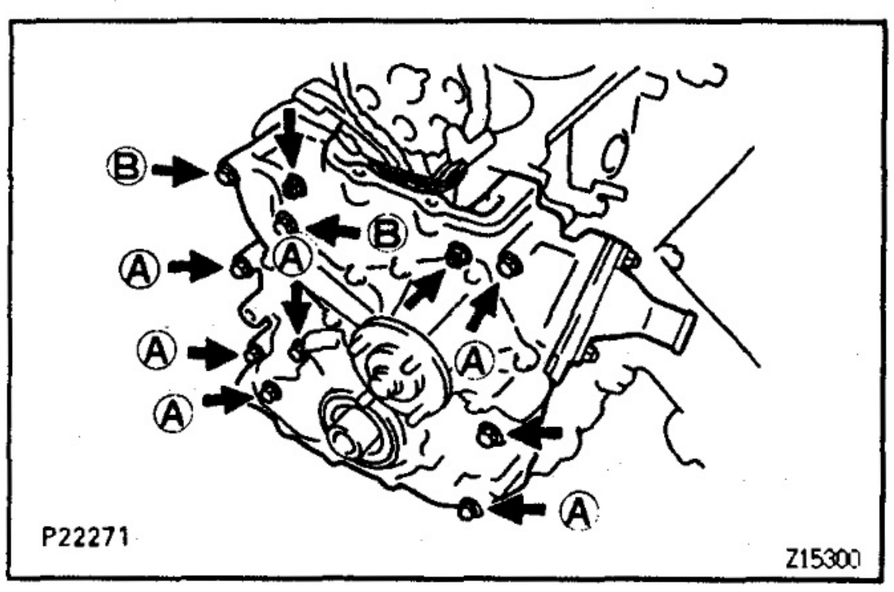


6. INSTALL NO.1 TIMING CHAIN AND CAMSHAFT TIMING GEAR

(a) Align the timing mark between the mark link of the No.1 timing chain, and install the No.1 timing chain to the timing gear.

(b) Align the timing mark of the crankshaft timing gear with the mark link of the No.1 timing chain and install the No.1 timing chain.

(c) Tie the No.1 timing chain with a cord as shown in the illustration, and make sure it doesn't come loose.



7. INSTALL TIMING CHAIN COVER

(a) Install 3 new gaskets to the cylinder block and water bypass pipe.

(b) Install the timing chain cover with the 9 bolts and 2 nuts.

Torque:

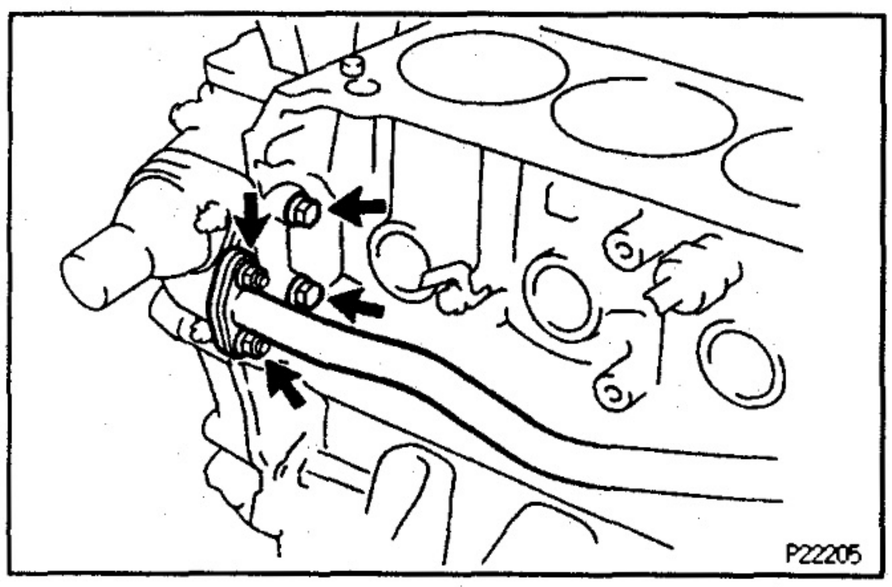
Bolt:

12 mm head Ⓐ: 20 N·m (200 kgf·cm, 14 ft·lbf)

12 mm head Ⓑ: 24.5 N·m (250 kgf·cm, 18 ft·lbf)

14 mm head: 44 N·m (440 kgf·cm, 32 ft·lbf)

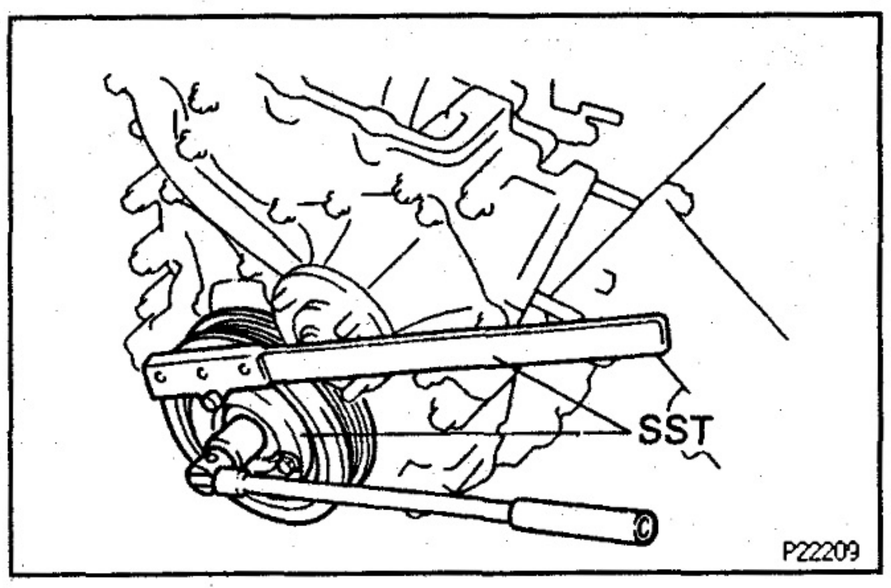
Nut : 20 N·m (200 kgf·cm, 14 ft·lbf)



(c) Install the 2 timing chain cover bolts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

(d) Install the 2 water bypass pipe nuts.
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

(e) Remove the cord from the chain.



8. INSTALL CRANKSHAFT PULLEY

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

(b) Using SST, install and torque the pulley bolt.
SST 09213–54015, 09330–00021
Torque: 260 N·m (2,650 kgf·cm, 193 ft·lbf)

9. INSTALL OIL STRAINER

Install a new gasket and the oil strainer with the bolt and 2 nuts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

10. INSTALL OIL PAN

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

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

NOTICE: Do not use a solvent which will affect the painted surfaces.

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

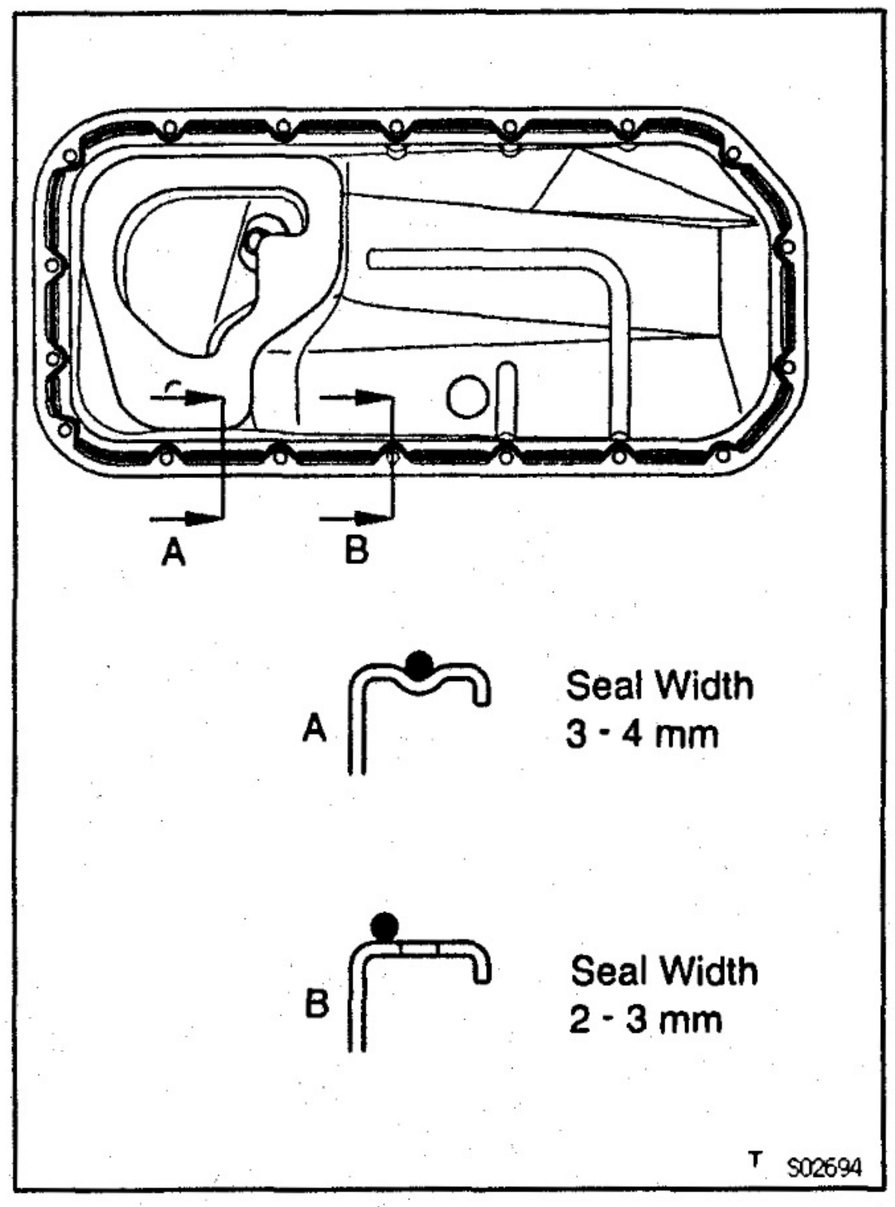
Seal packing:
Part No. 08826–00080 or equivalent

- Install a nozzle that has been cut to a 2 – 3 mm (0.08 – 0.12 in.)opening or 3 – 4 mm (0.012 – 0.016 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

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

(c) Install the oil pan with the 16 bolts and 2 nuts.
Torque: 12.5 N·m (130 kgf·cm, 9 ft·lbf)



11. 3RZ–FE:
INSTALL CRANKSHAFT POSITION SENSOR

Install a new O–ring.
Torque: 8.5 N·m (85 kgf·cm, 74 in.·lbf)

12. INSTALL CYLINDER HEAD ASSEMBLY

13. FILL WITH ENGINE OIL AND ENGINE COOLANT

14. START ENGINE AND CHECK FOR LEAKS

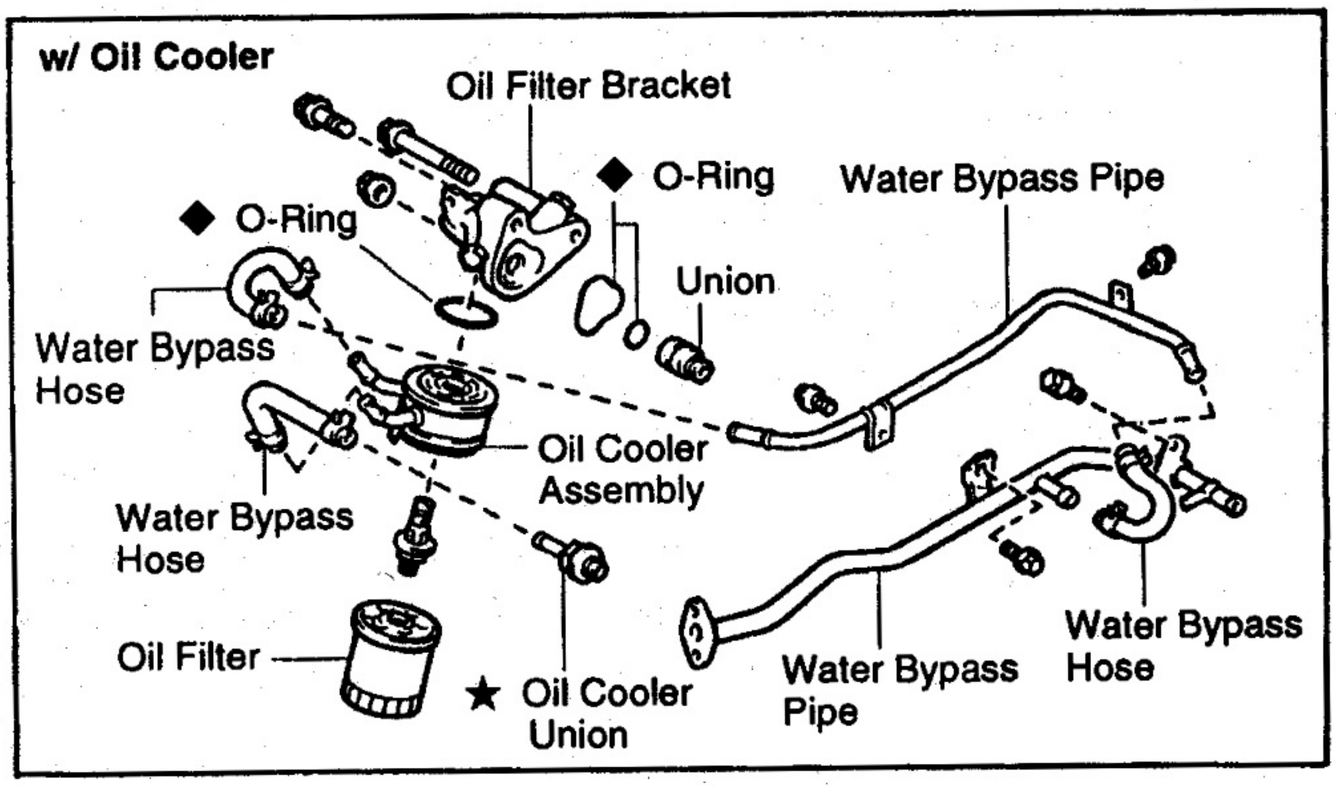
15. RECHECK ENGINE COOLANT AND ENGINE

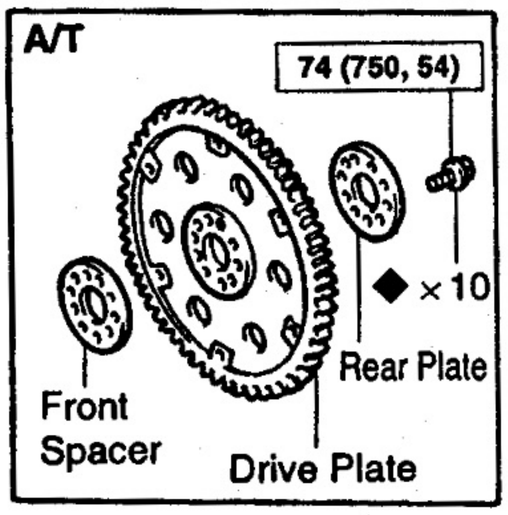
16. OIL LEVEL

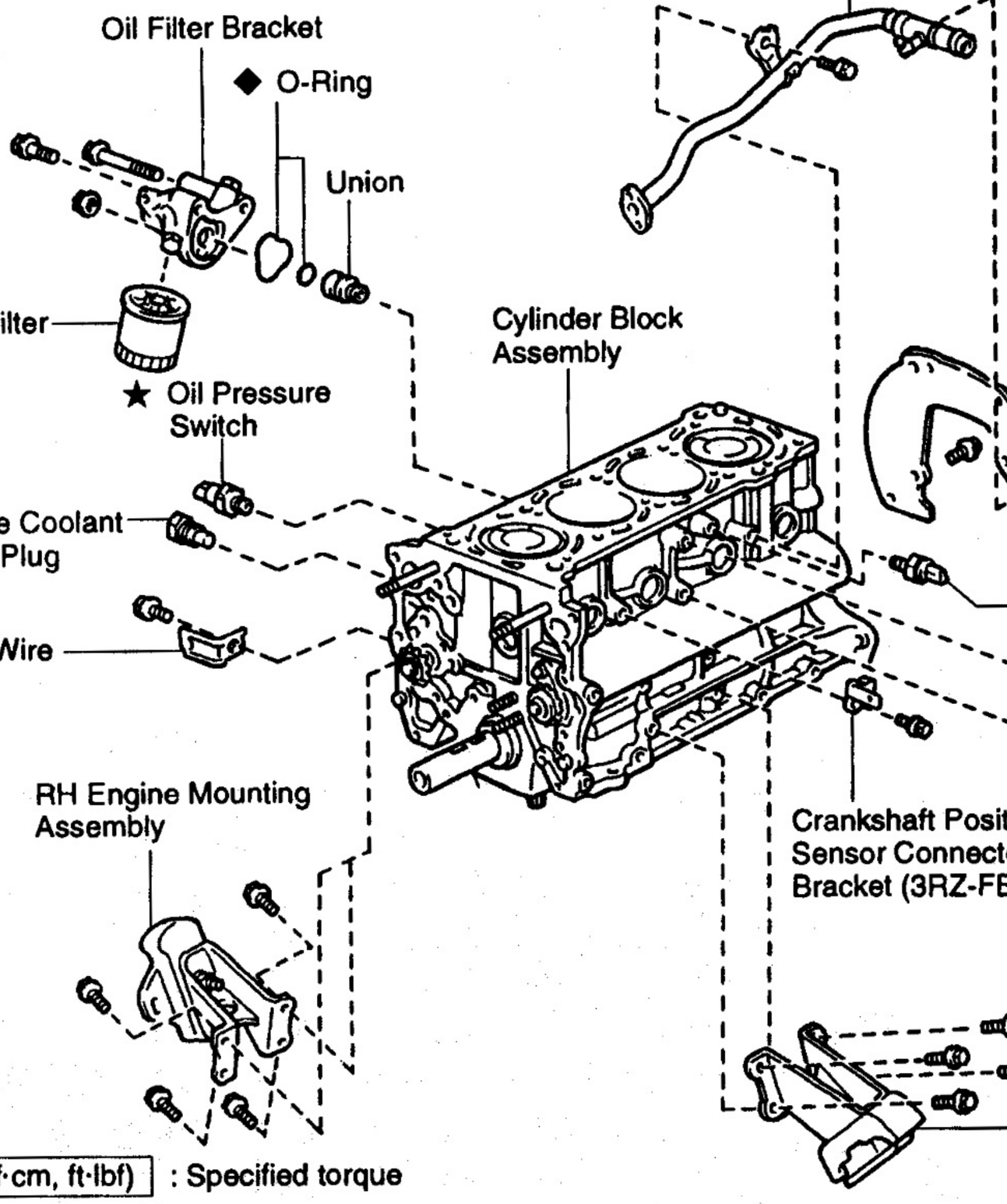
CYLINDER BLOCK

COMPONENTS FOR PREPARATION AND AFTER ASSEMBLY

EG1K5-08







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

◆ Non-reusable part

★ Precoated part

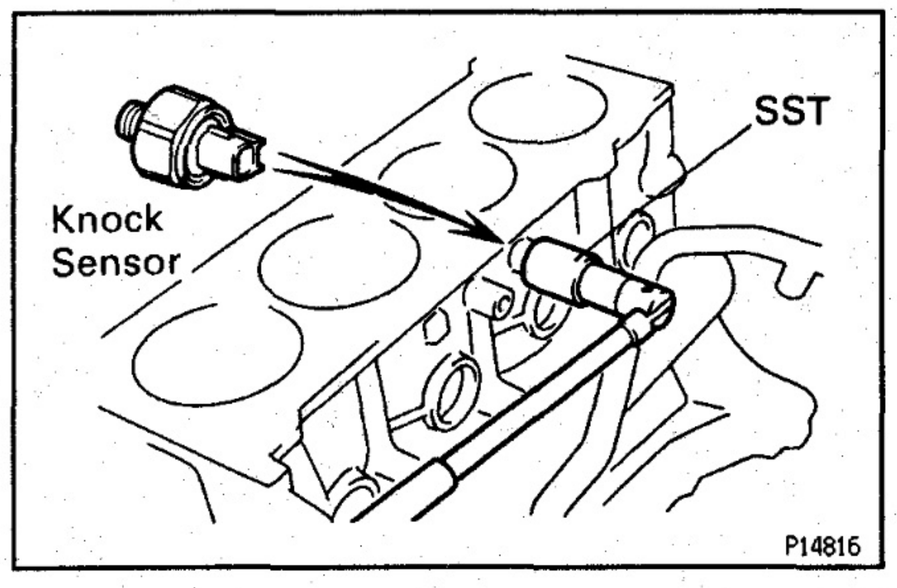
Y

S03880

EG5MT-03

PREPARATION FOR DISASSEMBLY

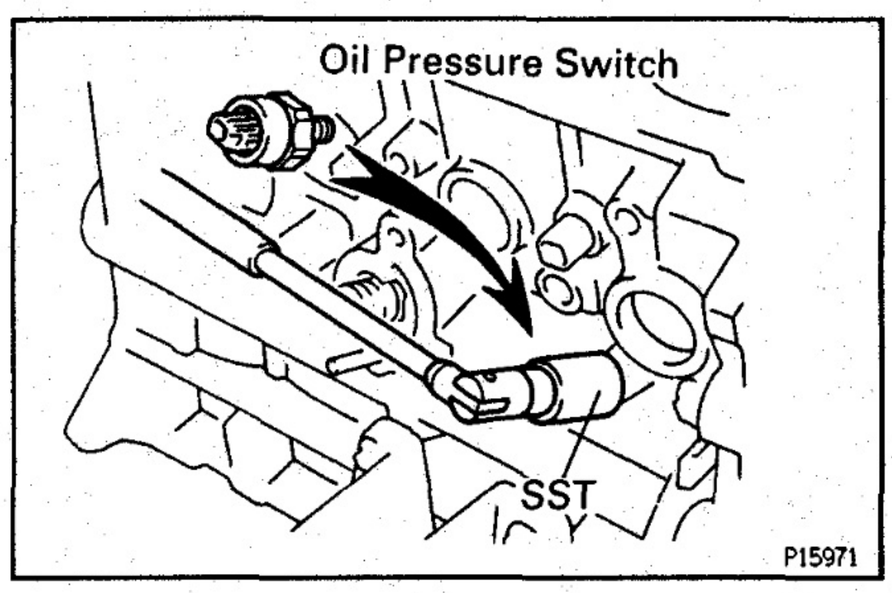
1. **M/T:**
   REMOVE FLYWHEEL
   Remove the 10 bolts and flywheel.
   A/T:
   REMOVE DRIVE PLATE
   Remove the 10 bolts, front spacer, drive plate and rear plate.
2. **REMOVE REAR END PLATE**
   Remove the 3 bolts and rear end plate.
3. **INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY**
4. **REMOVE CYLINDER HEAD**
   (See cylinder head removal)
5. **REMOVE TIMING CHAINS, GEARS AND SPROCKET**
   (See timing chain removal)
6. **3RZ–FE:**
   REMOVE FUEL FILTER



7. **3RZ–FE:**
   REMOVE KNOCK SENSOR
   Using SST, remove the knock sensor.
   SST 09816–30010
8. **REMOVE WATER BYPASS PIPE**
   Remove the bolt and water bypass pipe.
9. **REMOVE OIL FILTER**
   (See oil and filter replacement in Lubrication System)
10. **3RZ–F:**
    REMOVE OIL COOLER
    (See oil cooler removal in Lubrication System)
11. **REMOVE OIL FILTER BRACKET**

(a) Remove the 2 bolts, nut, oil filter bracket and O–ring.
(b) Using a 14 mm hexagon wrench, remove the union and O–ring.

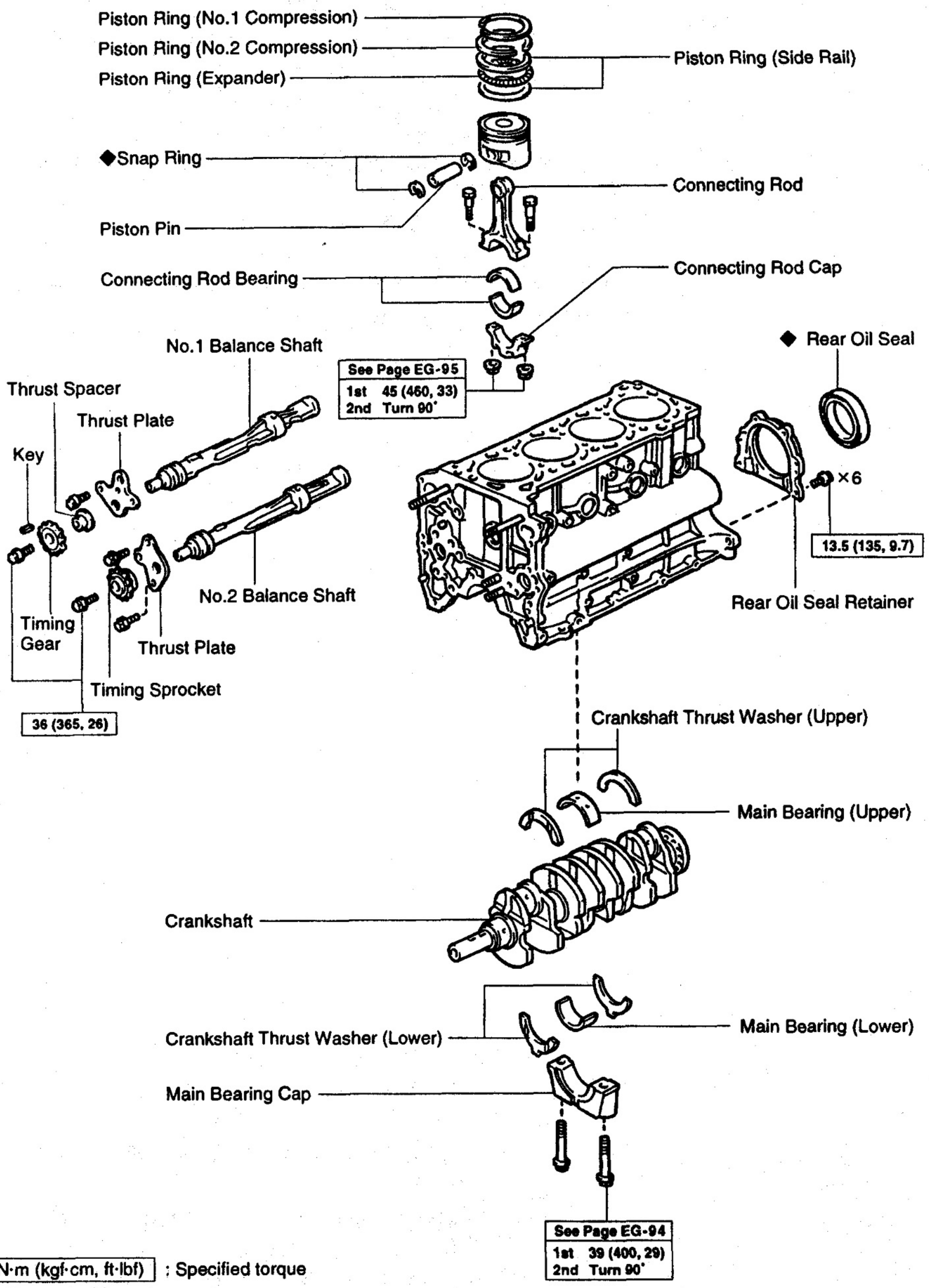
12. **REMOVE ENGINE COOLANT DRAIN PLUG**



13. **REMOVE OIL PRESSURE SWITCH**
    Using SST, remove the oil pressure switch.
    SST 09816–30010
14. **REMOVE RH AND LH ENGINE MOUNTING ASSEMBLIES**
    Remove the 4 bolts and mounting assembly.
15. **3RZ–FE:**
    REMOVE CRANKSHAFT POSITION SENSOR CONNECTOR BRACKET

EG5MU-03

COMPONENTS FOR CYLINDER BLOCK DISASSEMBLY AND ASSEMBLY



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

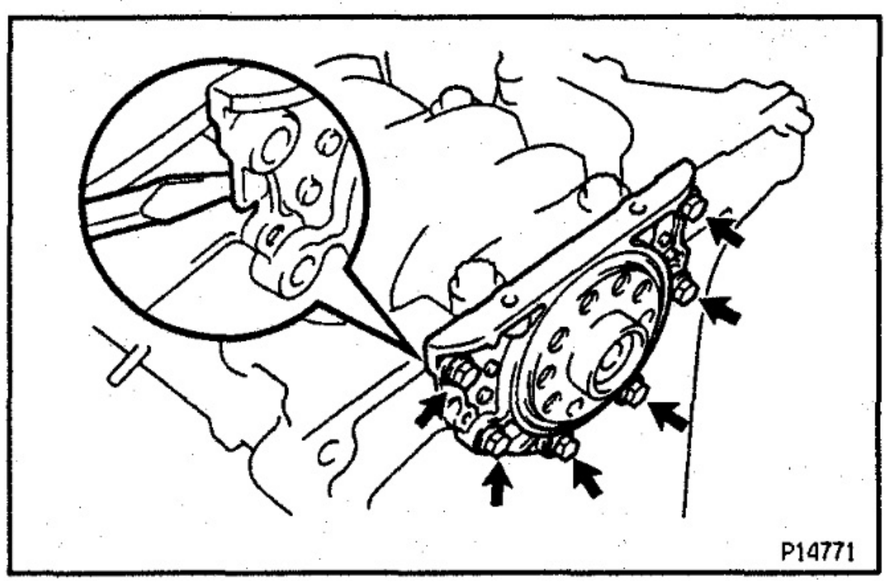
◆ Non-reusable part

Y

S03884

EGSMV–03

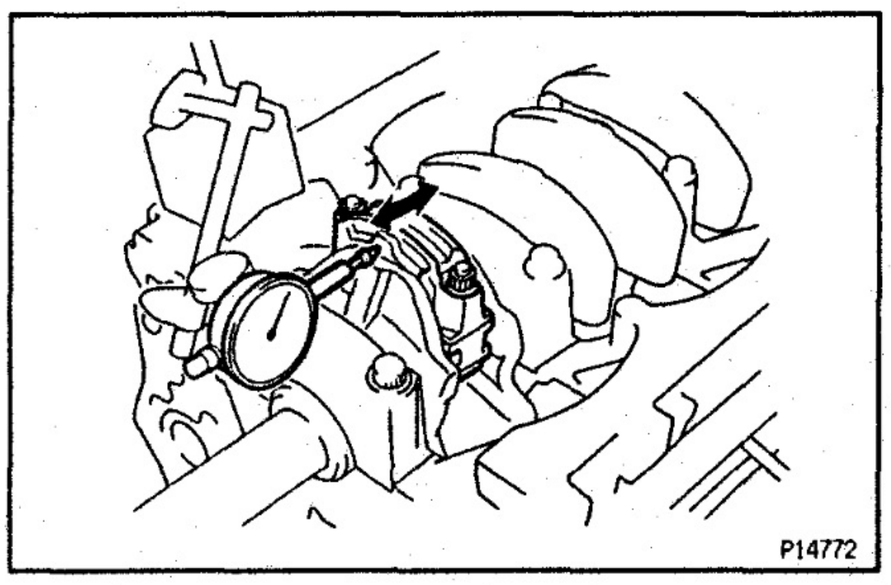
CYLINDER BLOCK DISASSEMBLY


P14771

1. REMOVE REAR OIL SEAL RETAINER

(a) Remove the 6 bolts.

(b) Using a screwdriver, remove the oil seal retainer by prying the portions between the oil seal retainer and cylinder block.


P14772

2. CHECK CONNECTING ROD THRUST CLEARANCE

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

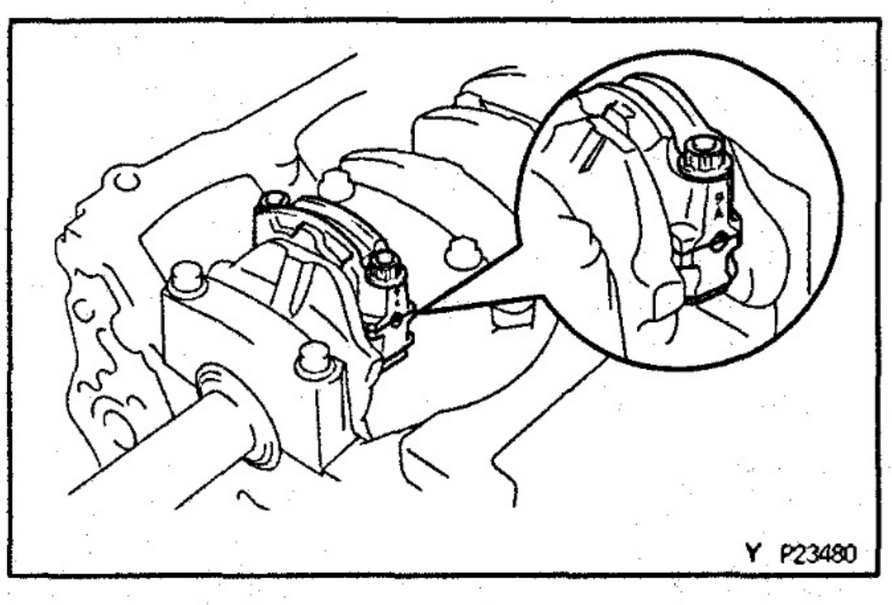
Standard thrust clearance:

0.160 — 0.312 mm (0.0063 — 0.0123 in.)

Maximum thrust clearance:

0.35 mm (0.0138 in.)

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

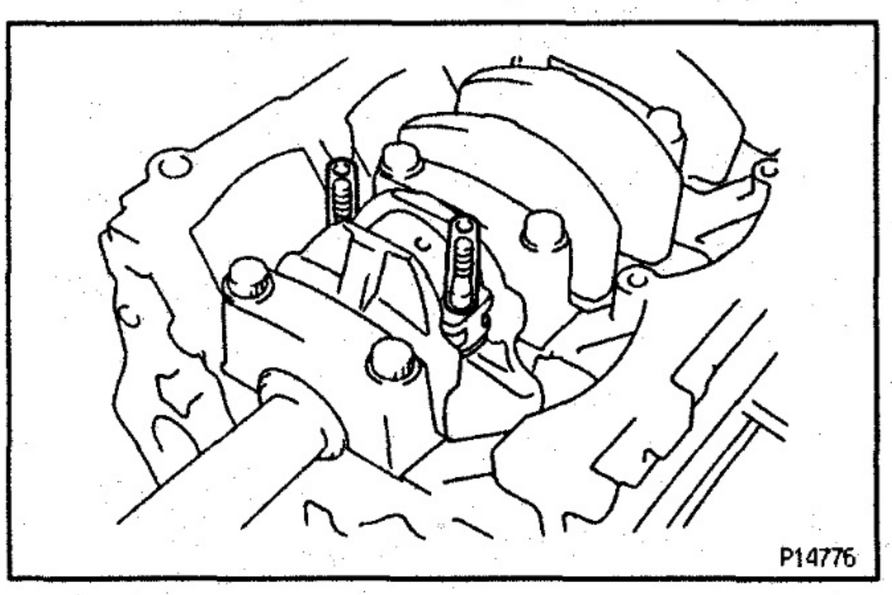

Y P23480

3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

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

(b) Remove the connecting rod cap nuts.

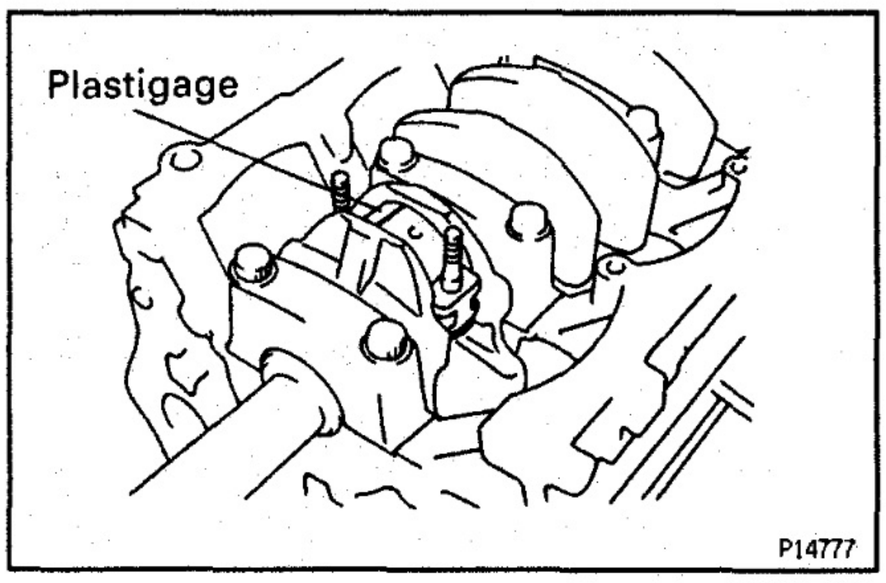
(c) Using a plastic—faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.
HINT: Keep the lower bearing inserted with the connecting rod cap.


P14776

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

(e) Clean the crank pin and bearing.

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



P14777

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

(h) Install the connecting rod cap with the 2 nuts.
(See step 9 in cylinder block assembly)

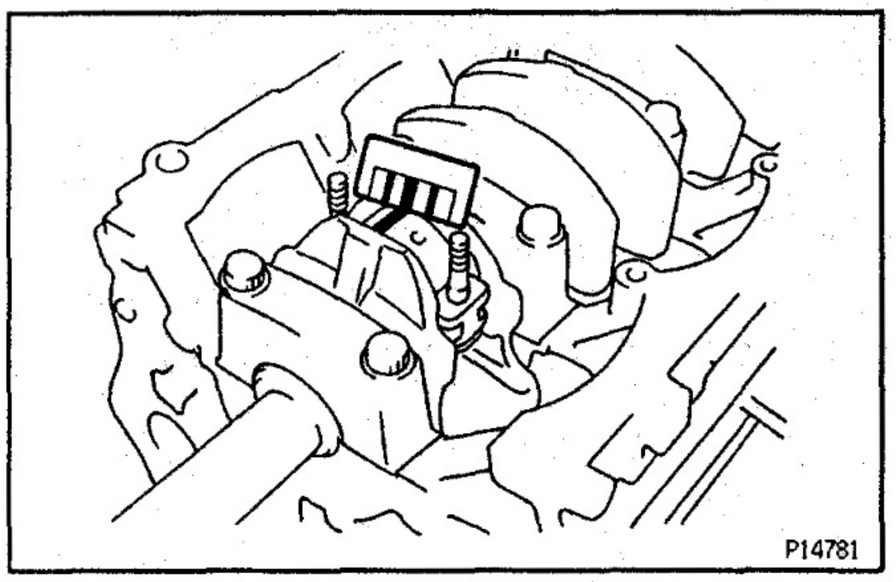
Torque:

1st 45 N·m (460 kgf·cm, 33 ft·lbf)

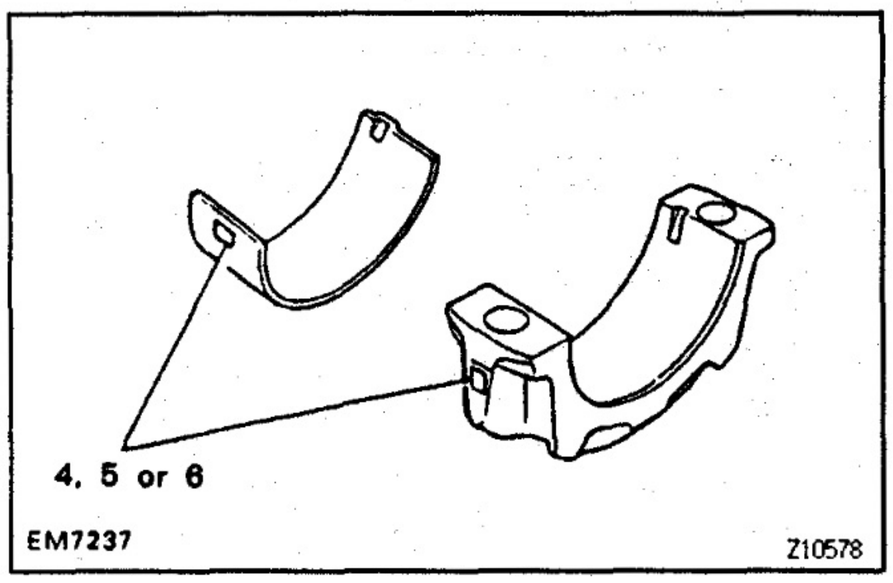
2nd Turn 90°

NOTICE: Do not turn the crankshaft.

(i) Remove the 2 nuts and connecting rod cap.
(See procedure (b) and (c) above)



EG



(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD

0.030 — 0.055 mm (0.0012 — 0.0022 in.)

U/S 0.25

0.031 — 0.071 mm (0.0012 — 0.0026 in.)

Maximum oil clearance:

0.10 mm (0.0039 in.)

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

HINT: If using a standard bearing, replace with one having the same number as marked on the bearing cap. There are 3 sizes of standard bearings, marked "4", "5" and "6" accordingly.

Reference:

Connecting rod big end inside diameter:

STD Mark "4"	56.000 — 56.006 mm (2.2047 — 2.2050 in.)
STD Mark "5"	56.006 — 56.012 mm (2.2050 — 2.2052 in.)
STD Mark "6"	56.012 — 56.018 mm (2.2052 — 2.2054 in.)
U/S 0.25	56.000 — 56.018 mm (2.2047 — 2.2054 in.)

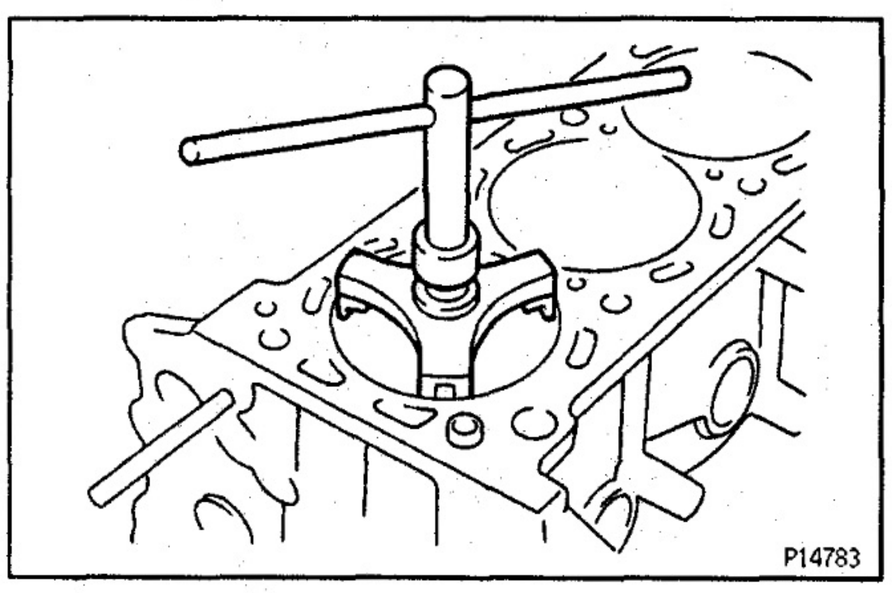
Crankshaft crank pin diameter:

STD	52.987 — 53.000 mm (2.0861 — 2.0866 in.)
U/S 0.25	52.745 — 52.755 mm (2.0766 — 2.0770 in.)

Standard sized bearing center wall thickness:

STD Mark "4"	1.482 — 1.485 mm (0.0583 — 0.0585 in.)
STD Mark "5"	1.485 — 1.488 mm (0.0585 — 0.0586 in.)
STD Mark "6"	1.488 — 1.491 mm (0.0586 — 0.0587 in.)
U/S 0.25	1.601 — 1.607 mm (0.0630 — 0.0633 in.)

(k) Completely remove the Plastigage.



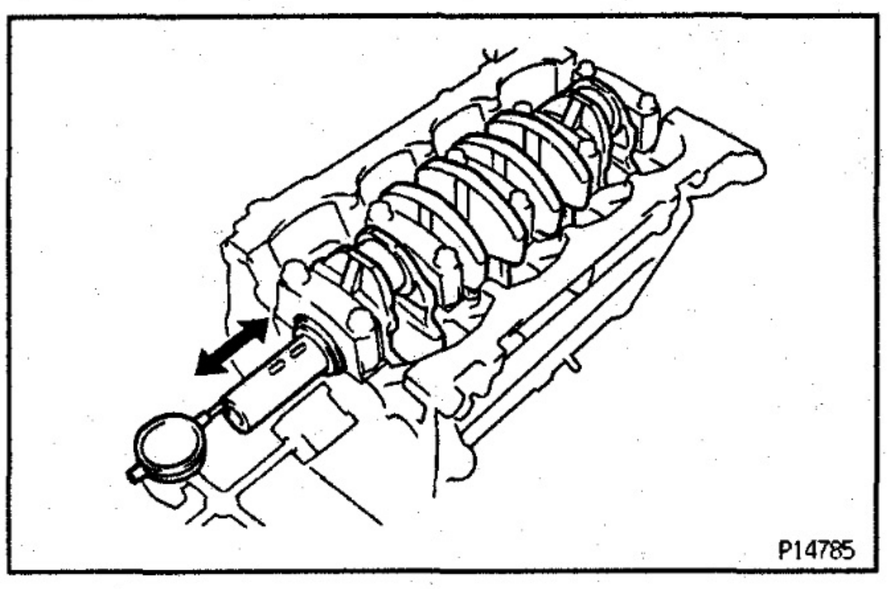
4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

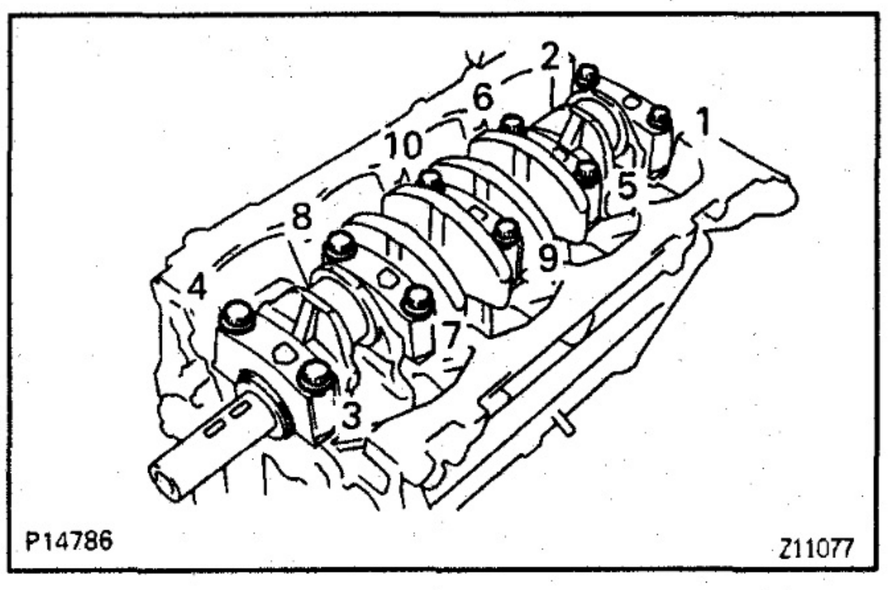
(a) Using a ridge reamer, remove the all carbon from the top of the cylinder.

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

HINT:

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


P14785



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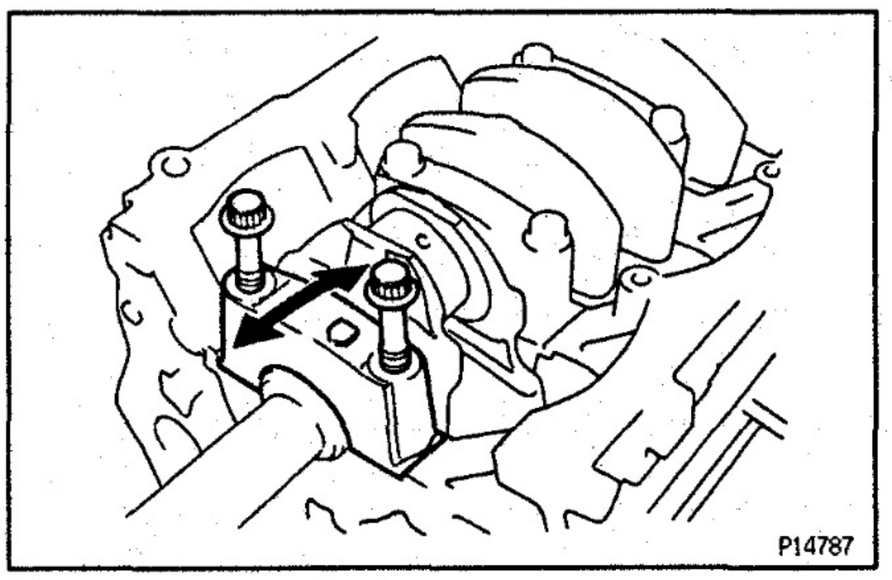
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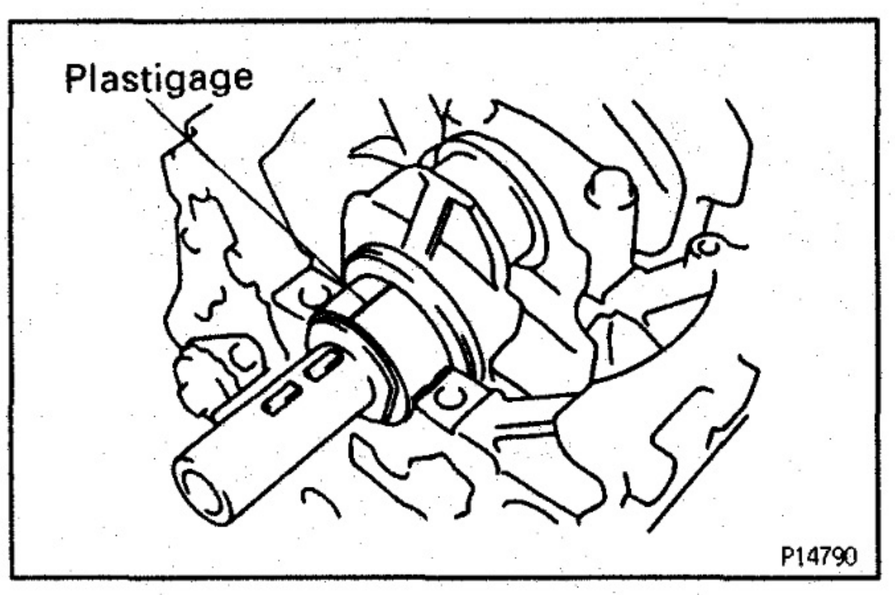

P14790

5. CHECK CRANKSHAFT THRUST CLEARANCE

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

Standard thrust clearance:

0.020 — 0.220 mm (0.0008 — 0.0087 in.)

Maximum thrust clearance:

0.30 mm (0.0118 in.)

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

Thrust washer thickness:

2.440 — 2.490 mm (0.0961 — 0.0980 in.)

6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

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

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

HINT:

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

(c) Lift out the crankshaft.

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

(d) Clean each main journal and bearing.

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

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

(f) Place the crankshaft on the cylinder block.

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

(h) Install the main bearing caps.

(See step 7 in cylinder block assembly)

Torque:

1st 39 N·m (400 kgf·cm, 29 ft·lbf)

2nd Turn 90°

NOTICE: Do not turn the crankshaft.

(i) Remove the main bearing caps.

(See procedure (a) and (b) above)

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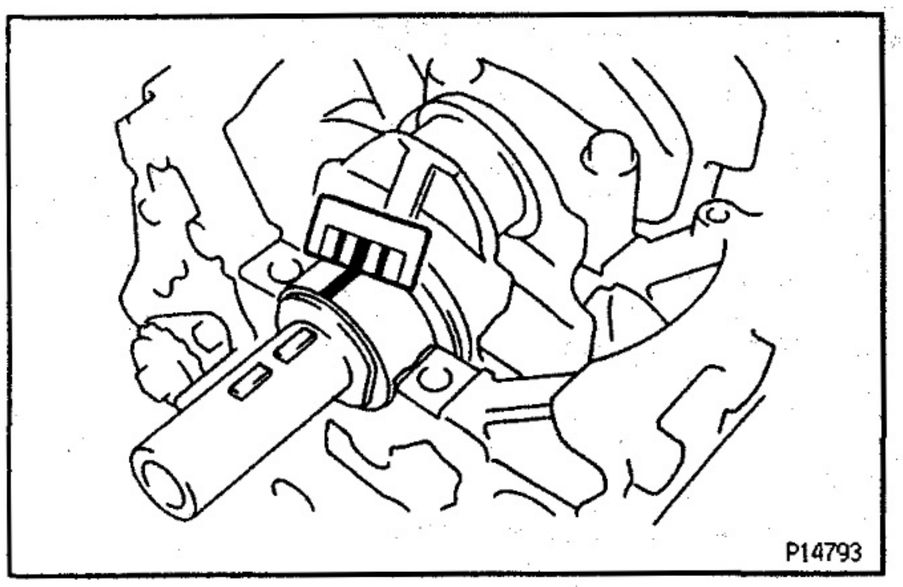
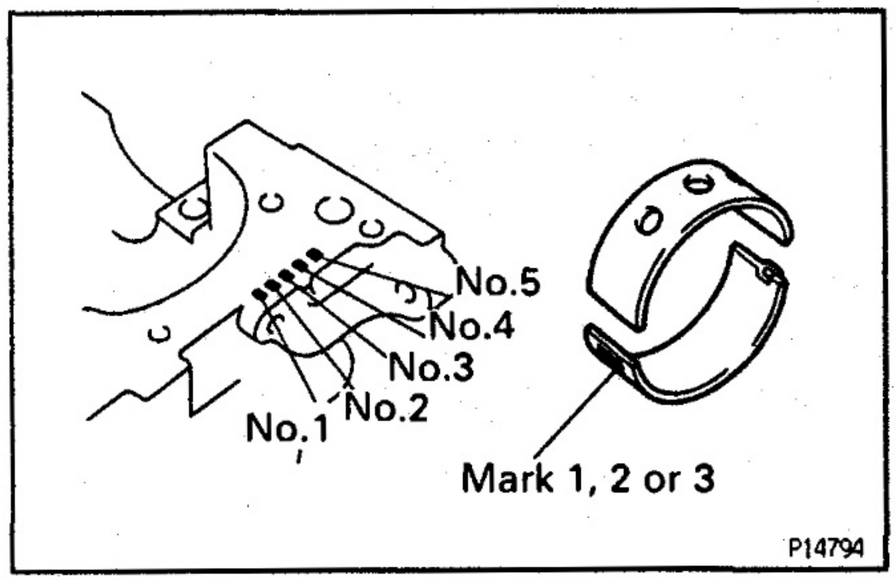




(j) Measure the Plastigage at its widest point.

Standard clearance:

STD

No.3

0.030 — 0.055 mm (0.0012 — 0.0022 in.)

Others

0.024 — 0.049 mm (0.0009 — 0.0019 in.)

U/S 0.25

No.3

0.030 — 0.070 mm (0.0012 — 0.0028 in.)

Others

0.025 — 0.065 mm (0.0010 — 0.0026 in.)

Maximum clearance:

0.10 mm (0.0039 in.)

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

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

Reference:

Cylinder block main journal bore diameter:

STD Mark "1"	64.004 — 64.010 mm (2.5198 — 2.5201 in.)
STD Mark "2"	64.011 — 64.016 mm (2.5201 — 2.5203 in.)
STD Mark "3"	64.017 — 64.022 mm (2.5203 — 2.5205 in.)
U/S 0.25	64.000 — 64.024 mm (2.5197 — 2.5206 in.)

Crankshaft Journal diameter:

STD No.3	59.981 — 59.994 mm (2.2615 — 2.3620 in.)
STD Others	59.987 — 60.000 mm (2.3617 — 2.3622 in.)
U/S 0.25 No.3	59.740 — 59.750 mm (2.3520 — 2.3524 in.)
U/S 0.25 Others	59.745 — 59.755 mm (2.3522 — 2.3526 in.)

Bearing center wall thickness:

STD Mark "1"	1.987 — 1.990 mm (0.0782 — 0.0783 in.)
STD Mark "2"	1.991 — 1.993 mm (0.0784 — 0.0785 in.)
STD Mark "3"	1.994 — 1.996 mm (0.0785 — 0.0786 in.)
U/S 0.25	2.106 — 2.112 mm (0.0829 — 0.0831 in.)

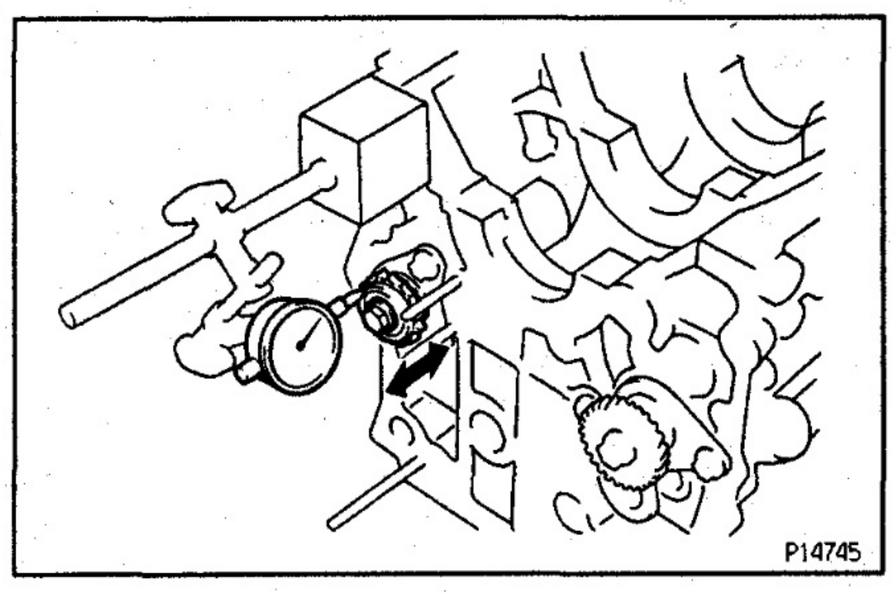
(k) Completely remove the Plastigage.

7. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

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

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



Balance Shaft

8. CHECK THRUST CLEARANCES OF NO.1 (RH) AND NO.2 (LH) BALANCE SHAFTS

Using a dial indicator, measure the thrust clearance while moving the balance shaft back and forth.

Standard thrust clearance:

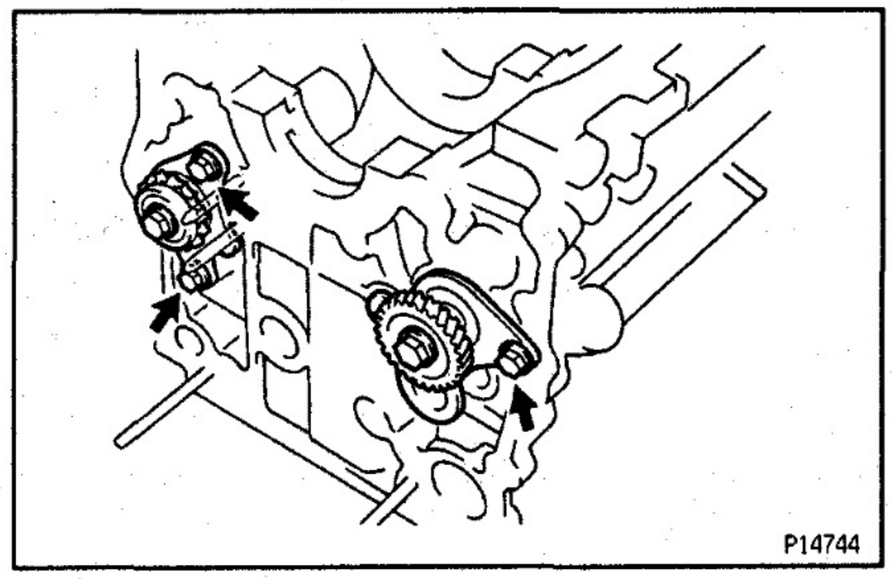
0.07 – 0.13 mm (0.0027 – 0.0051 in.)

Maximum thrust clearance:

0.20 mm (0.0079 in.)

If the thrust clearance is greater than maximum, replace the balance shaft thrust washer.

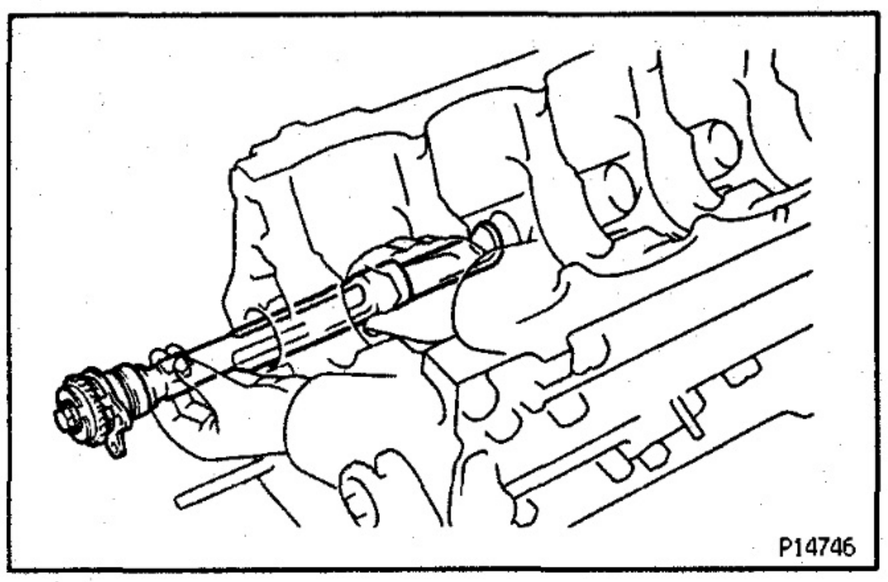
If necessary, replace the balance shaft.



9. REMOVE NO.1 (RH) AND NO.2 (LH) BALANCE SHAFTS

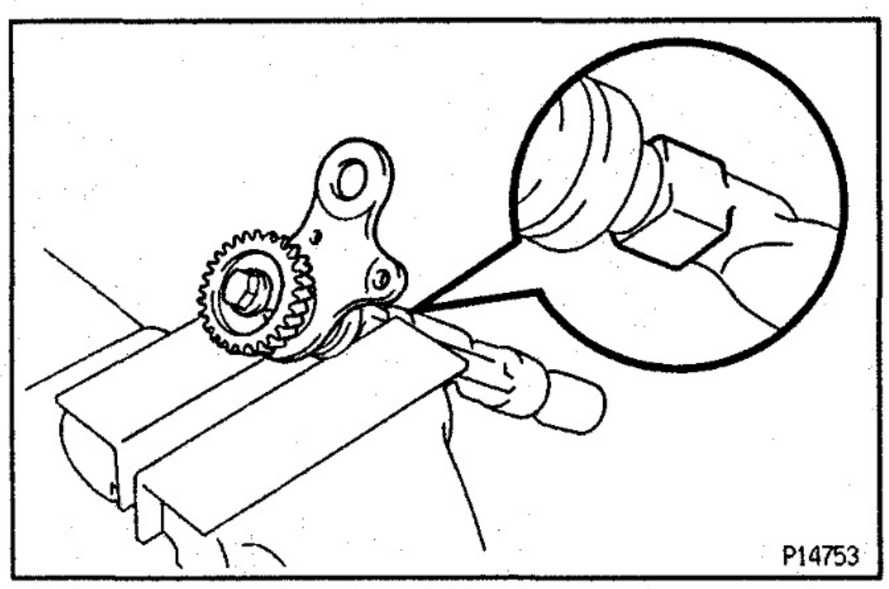
(a) Remove the 1 bolt from the No.1 balance shaft.

(b) Remove the 2 bolts from the No.2 balance shaft.



(c) Remove the balance shafts.

NOTICE: When removing the balance shaft make sure you support the balance shaft with both hands and avoid scratching the balance shaft bearing on the cylinder block side.



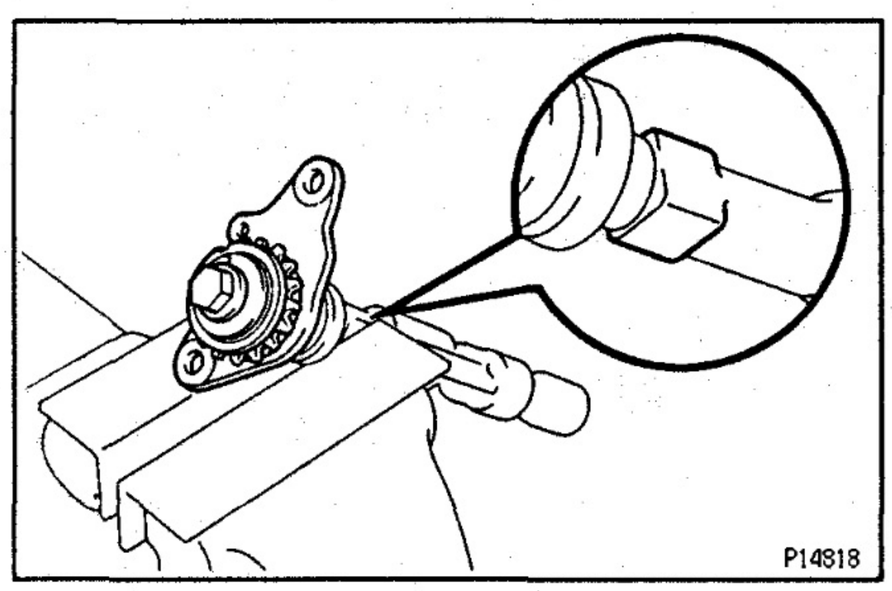
10. DISASSEMBLE NO.1 (RH) BALANCE SHAFT

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

NOTICE: Be careful not to damage the balance shaft.

(b) Remove these parts:

- Bolt
- No.1 balance shaft thrust plate
- Balance shaft thrust spacer
- Balance shaft timing gear
- Key



11. DISASSEMBLE NO.2 (LH) BALANCE SHAFT

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

NOTICE: Be careful not to damage the balance shaft.

(b) Remove these parts:

- Bolt
- No.2 balance shaft thrust prate
- Balance shaft timing sprocket

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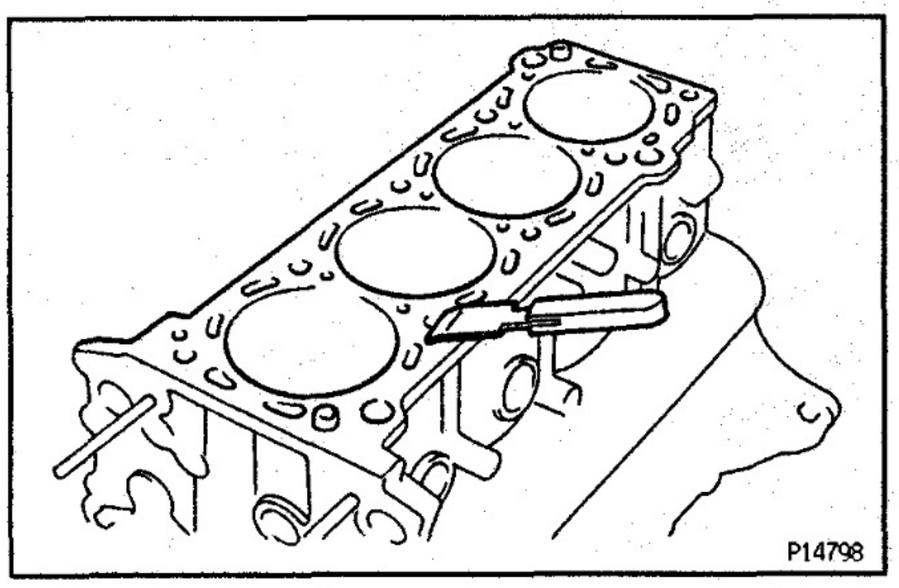
CYLINDER BLOCK INSPECTION



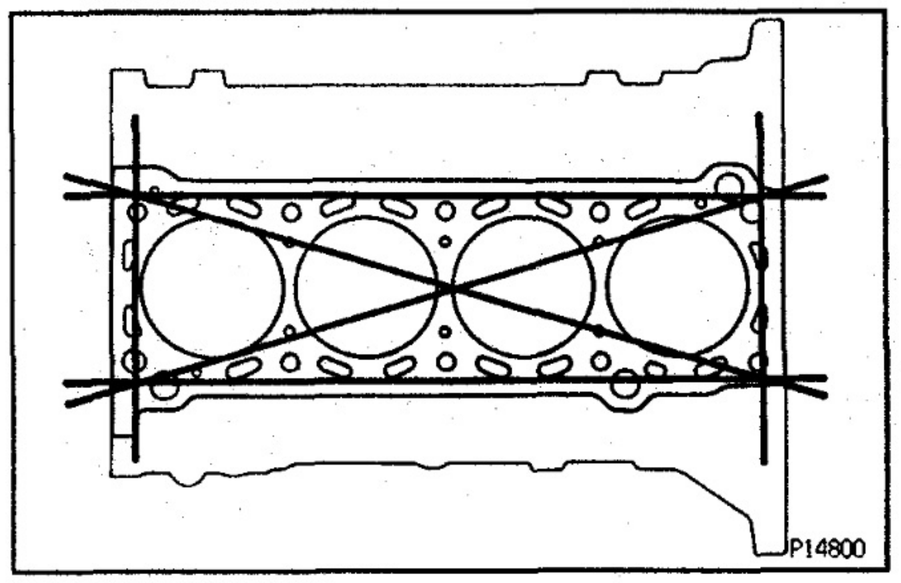
1. CLEAN CYLINDER BLOCK

A. Remove gasket material

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

B. Clean cylinder block

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



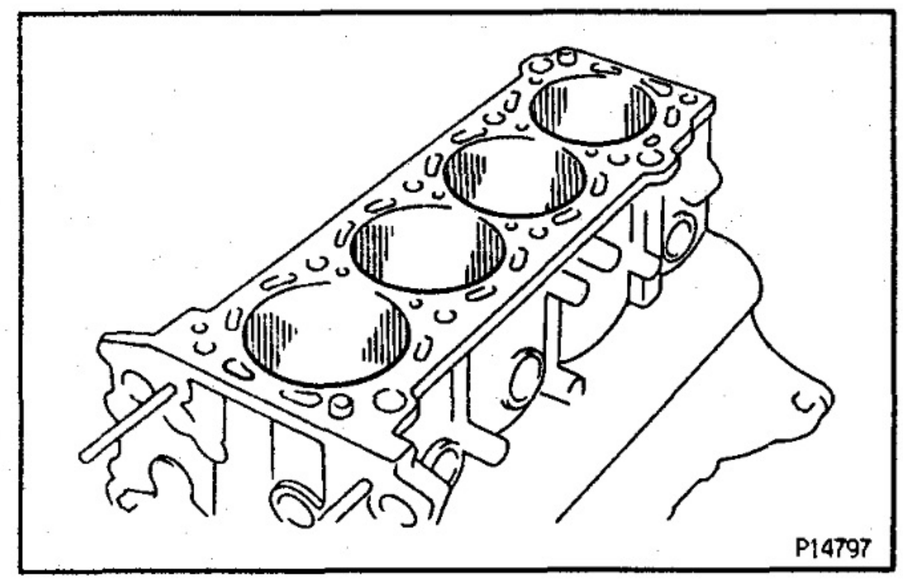
2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage:

0.05 mm (0.0020 in.)

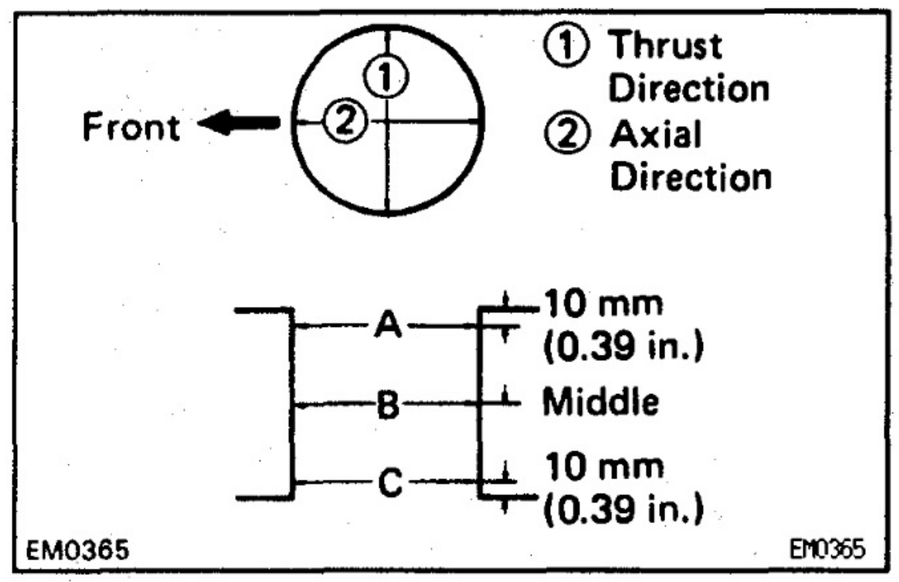
If warpage is greater than maximum, replace the cylinder block.



3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

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



4. INSPECT CYLINDER BORE DIAMETER

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

Standard diameter:

94.990 — 95.003 mm (3.7400 — 3.7403 in.)

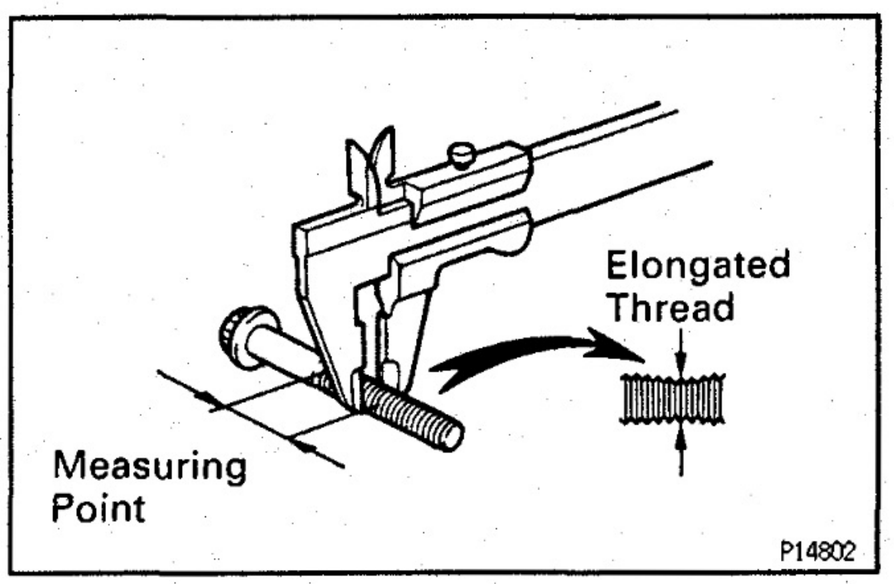
Maximum diameter:

95.06 mm (3.7425 in.)

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

5. REMOVE CYLINDER RIDGE

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



6. INSPECT MAIN BEARING CAP BOLTS

Using vernier calipers, measure the minimum diameter of the elongated thread at the measuring point.

Standard outside diameter:

10.76 — 10.97 mm (0.4236 — 0.4319 in.)

Minimum outside diameter:

10.40 mm (0.4094 in.)

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

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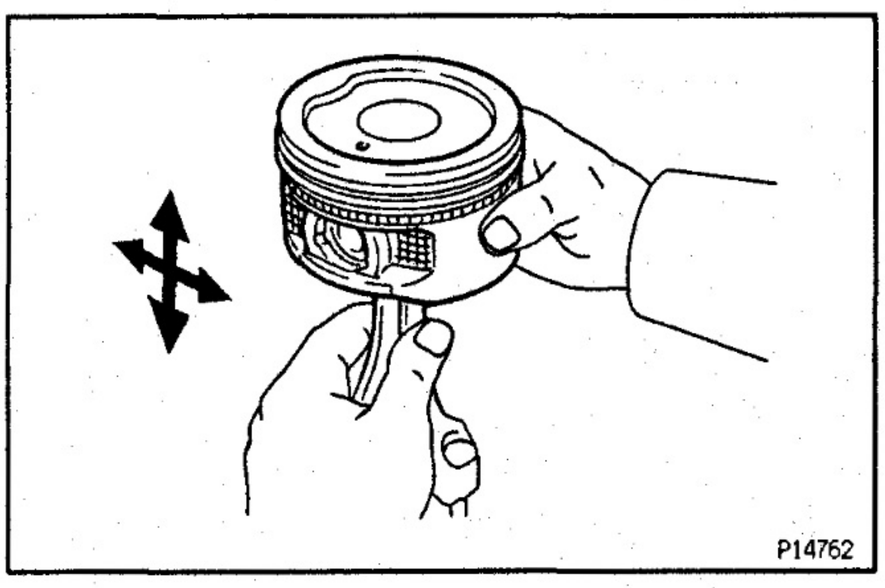
PISTON AND CONNECTING ROD ASSY DISASSEMBLY

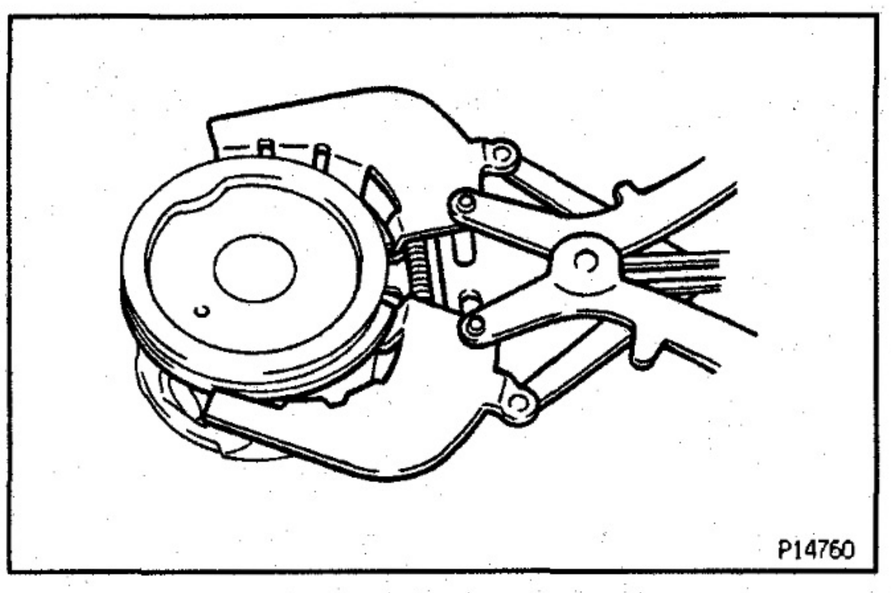
EGSMX-04



1. CHECK FIT BETWEEN PISTON AND PISTON PIN

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

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

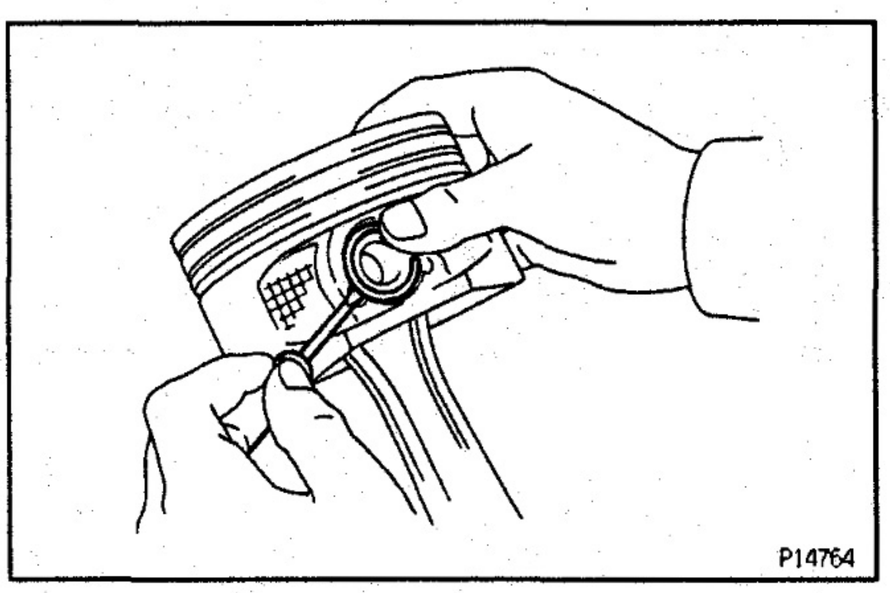


2. REMOVE PISTON RINGS

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

(b) Remove the 2 side rails and oil ring by hand.

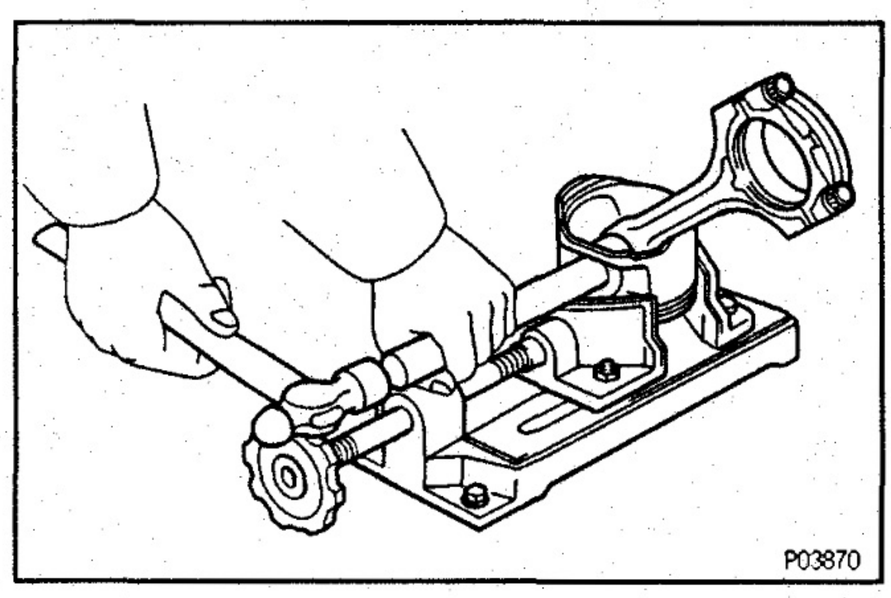
HINT: Arrange the rings in correct order only.



3. DISCONNECT CONNECTING ROD FROM PISTON

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

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

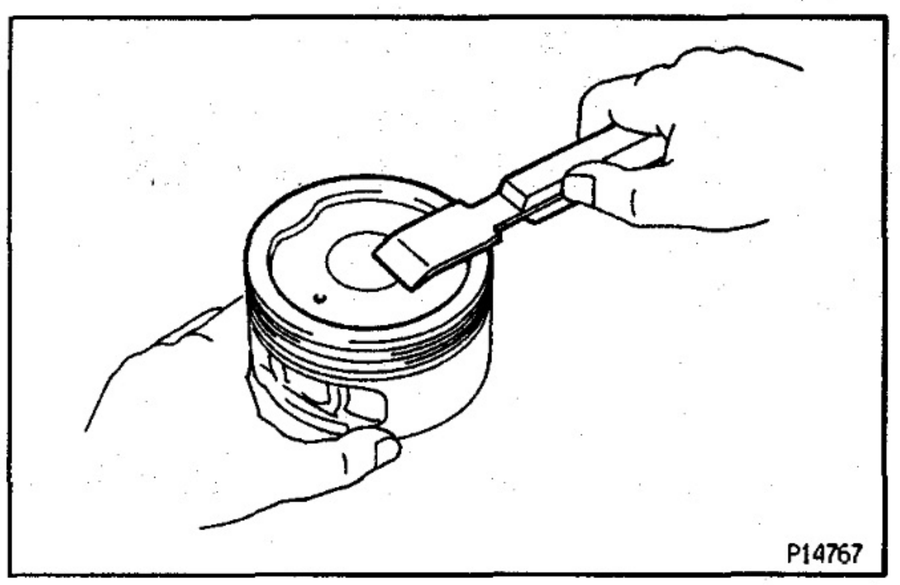


(c) Using plastic—faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

HINT:

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

EG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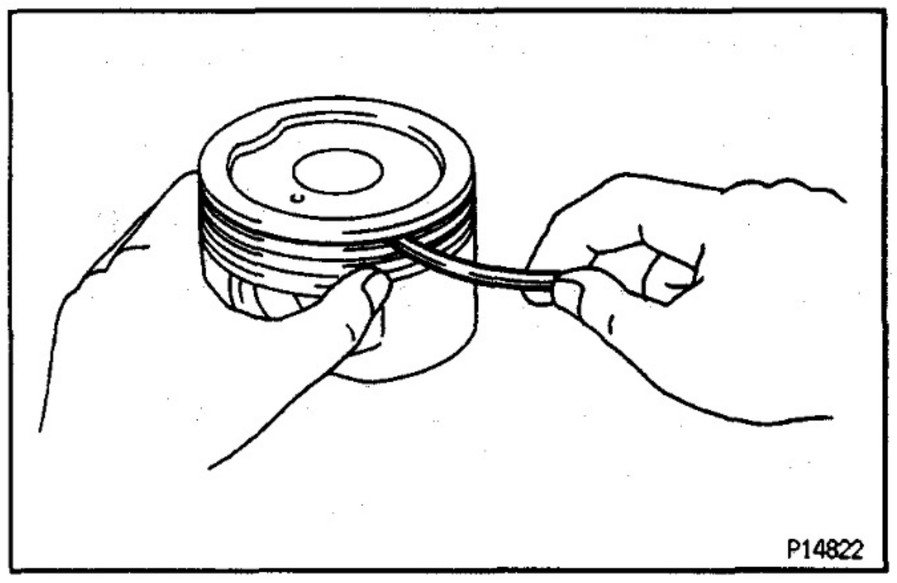
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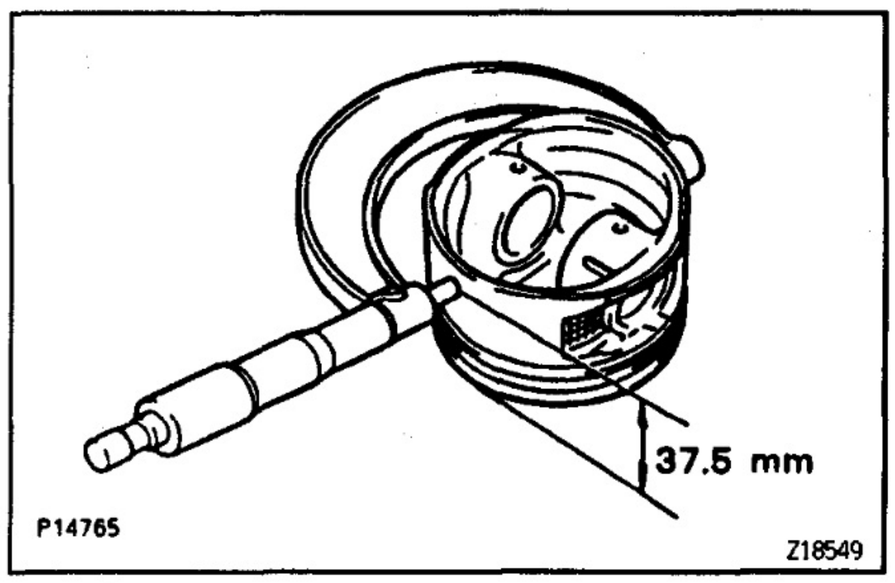

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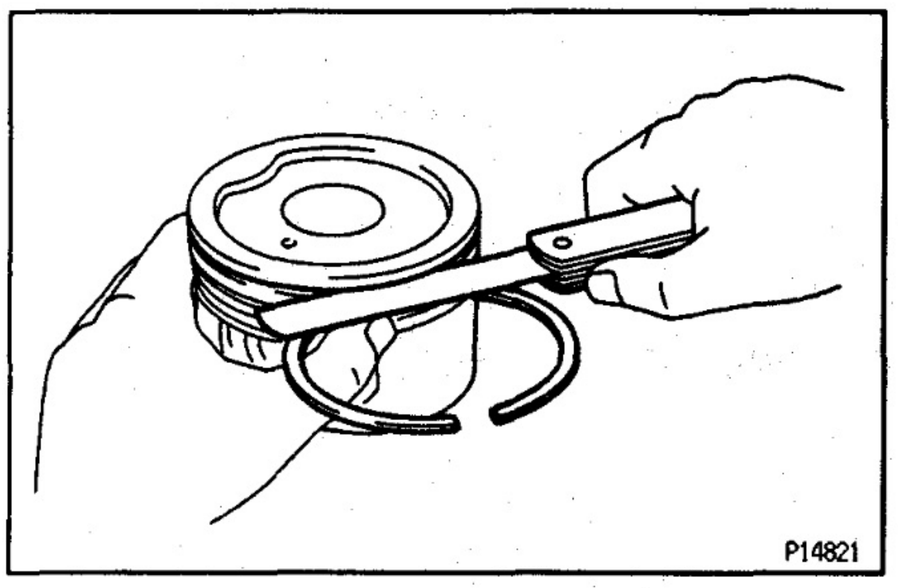

P14821

EG700-03

PISTON AND CONNECTING ROD INSPECTION

1. CLEAN PISTON

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

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

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

NOTICE: Do not use a wire brush.

2. INSPECT PISTON AND PISTON RING

A. Inspect piston oil clearance

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 37.5 mm (1.47 in.) for the piston head.

Piston diameter:

STD

94.933 — 94.943 mm (3.7375 — 3.7379 in.)

O/S 0.50

95.433 — 95.443 mm (3.7572 — 3.7576 in.)

(b) Measure the cylinder bore diameter in the thrust directions. (See step 4 in cylinder block inspection)

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

Standard oil clearance:

0.047 — 0.070 mm (0.0019 — 0.0028 in.)

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

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

B. Inspect piston ring groove clearance

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

Ring groove clearance:

3RZ—FE:

No.1 0.020 — 0.070 mm (0.0008 — 0.0028 in.)

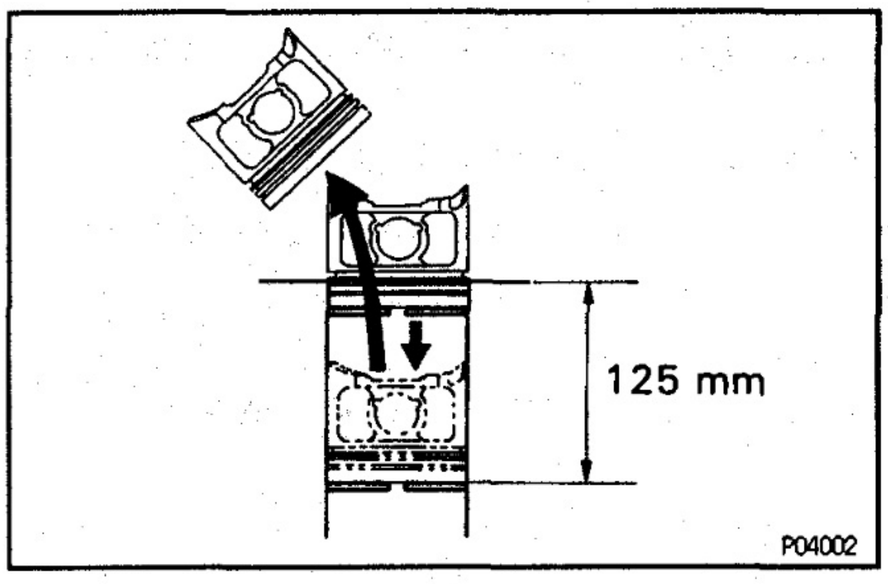
No.2 0.030 — 0.070 mm (0.0012 — 0.0028 in.)

3RZ—F:

No.1 0.030 — 0.080 mm (0.0012 — 0.0031 in.)

No.2 0.040 — 0.080 mm (0.0016 — 0.0031 in.)

If the clearance is not as specified, replace the piston.



C. Inspect piston ring end gap

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

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 125 mm (4.92 in.) from the top of the cylinder block.

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

Ring end gap:

3RZ–FE:

No.1 0.300 — 0.400 mm (0.0118 — 0.0157 in.)

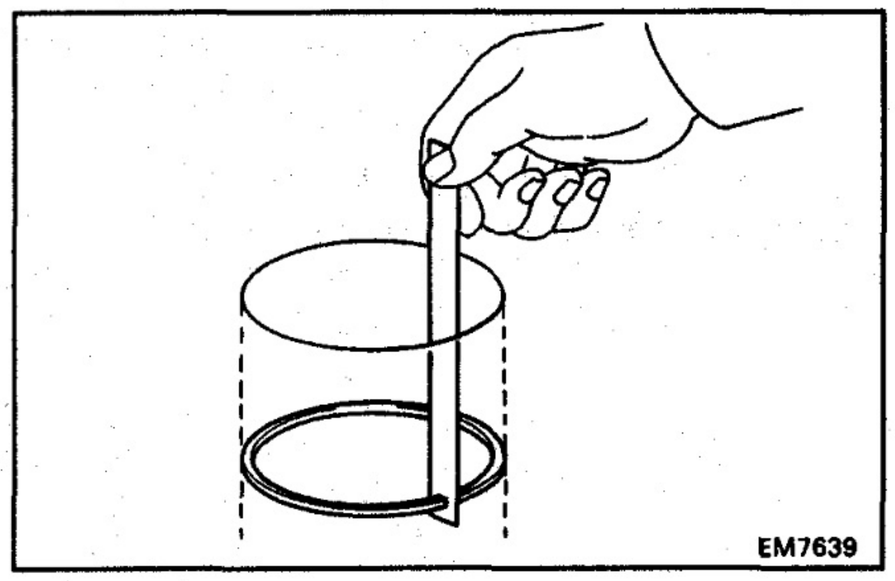
No.2 0.400 — 0.500 mm (0.0157 — 0.0197 in.)

3RZ–F:

No.1 0.300 — 0.430 mm (0.0118 — 0.0169 in.)

No.2 0.450 — 0.600 mm (0.0177 — 0.0236 in.)

If the end gap is not as specified, replace the piston ring. If the end gap is not as specified, even with a new piston ring, rebore all the 4 cylinders or replace the cylinder block.



D. Inspect piston pin fit

At 80 — 90°C (176 — 194°F), you should be able to push the piston pin into the piston pin hole with your thumb.

3. INSPECT CONNECTING ROD

A. Inspect connecting rod alignment

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

- Check for out–of–alignment.

Maximum out–of–alignment:

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

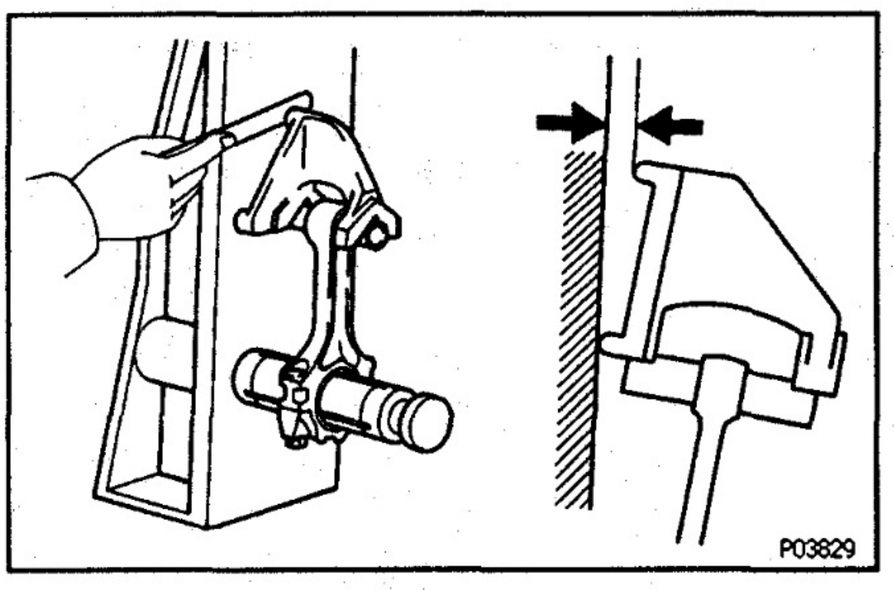
If out–of–alignment is greater than maximum, replace the connecting rod assembly.

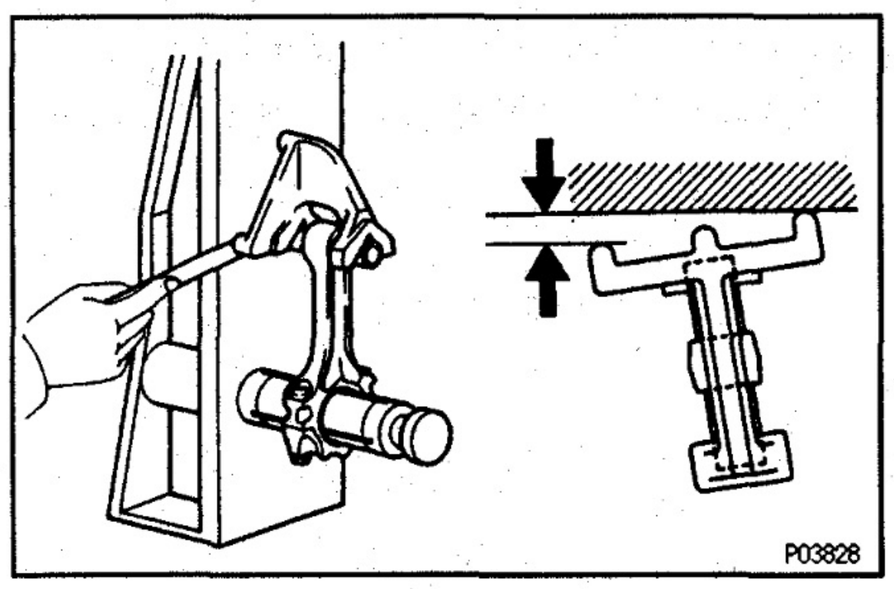
- Check for twist

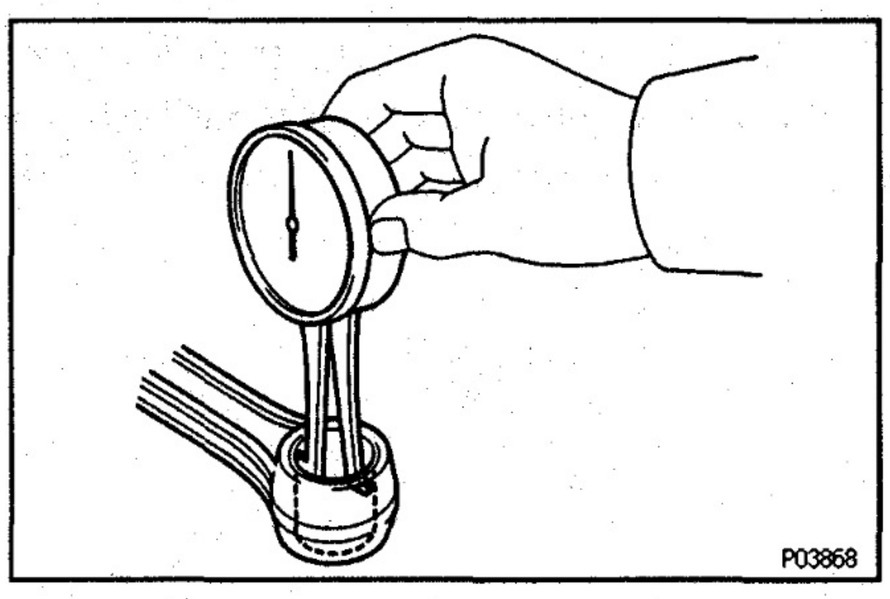
Maximum twist:

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

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





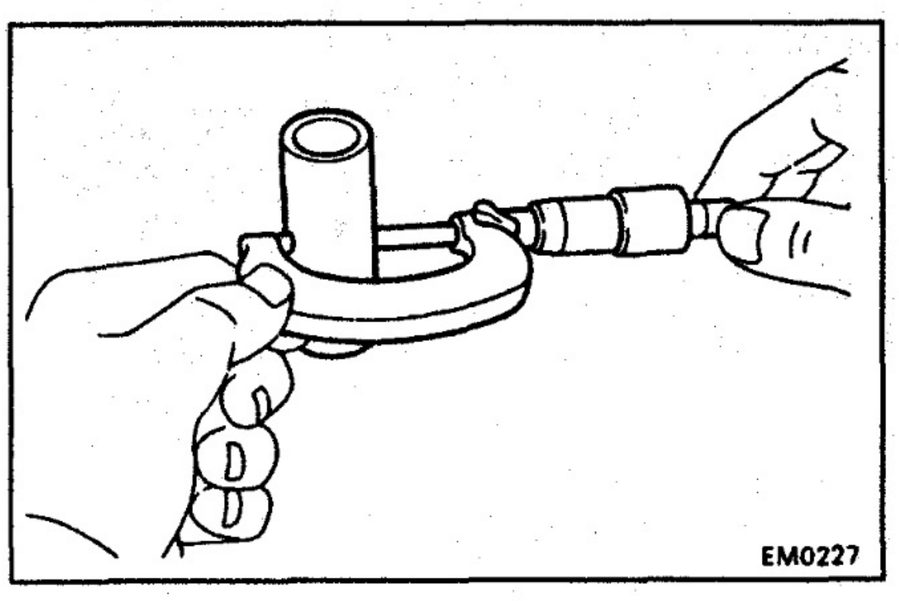


B. Inspect piston pin oil clearance

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

Bushing inside diameter:

24.008 — 24.017 mm (0.9452 — 0.9455 in.)

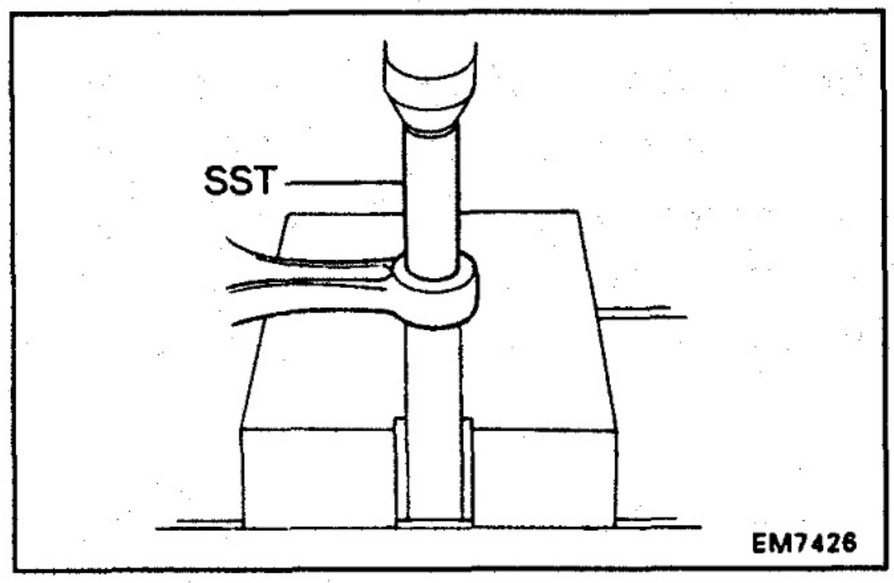


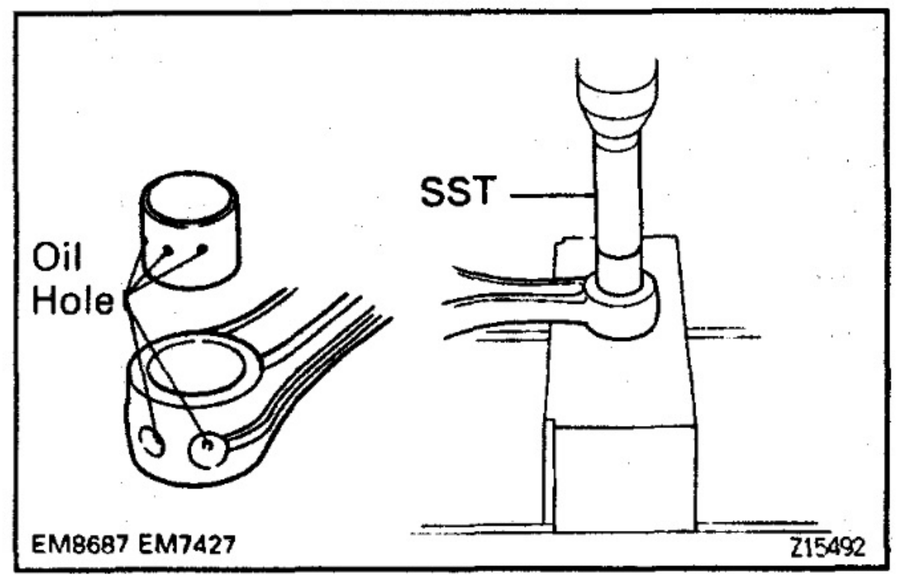
(b) Using a micrometer, measure the piston pin diameter.
Piston pin diameter:
24.000 — 24.009 mm (0.9449 — 0.9452 in.)

(c) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.
Standard oil clearance:
0.005 — 0.011 mm (0.0002 — 0.0004 in.)
Maximum oil clearance:
0.015 mm (0.0006 in.)
If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set.

C. If necessary, replace connecting rod bushing

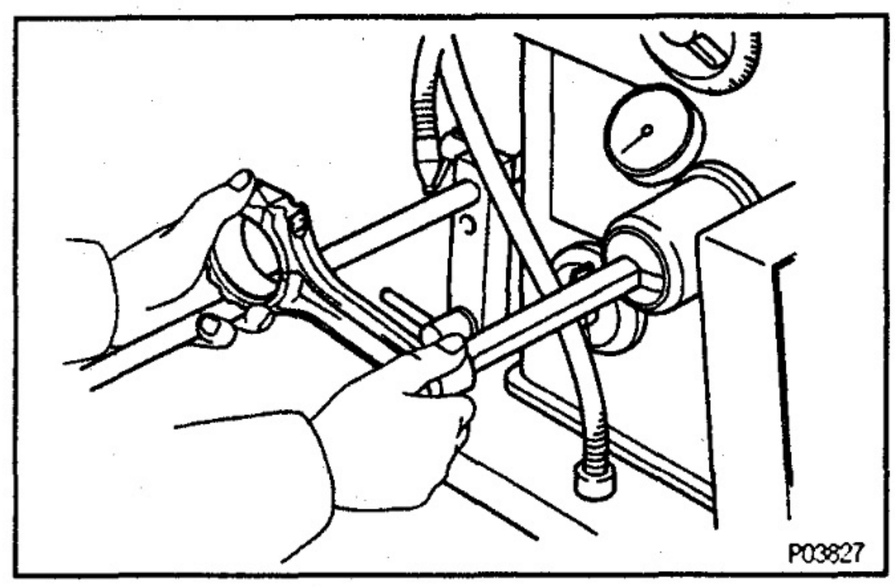
(a) Using SST and a press, press out the bushing.
SST 09207—76010



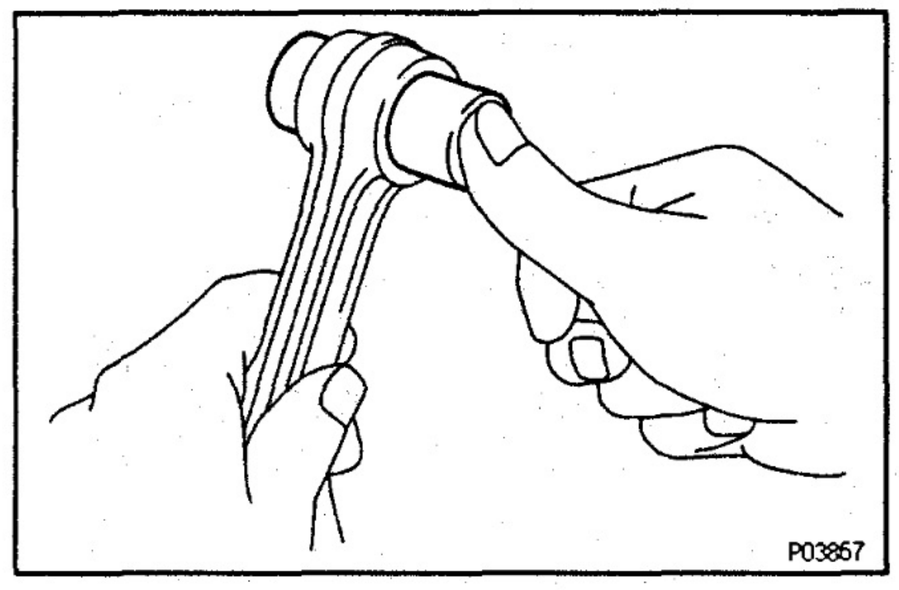


(b) Align the oil holes of a new bushing and the connecting rod.

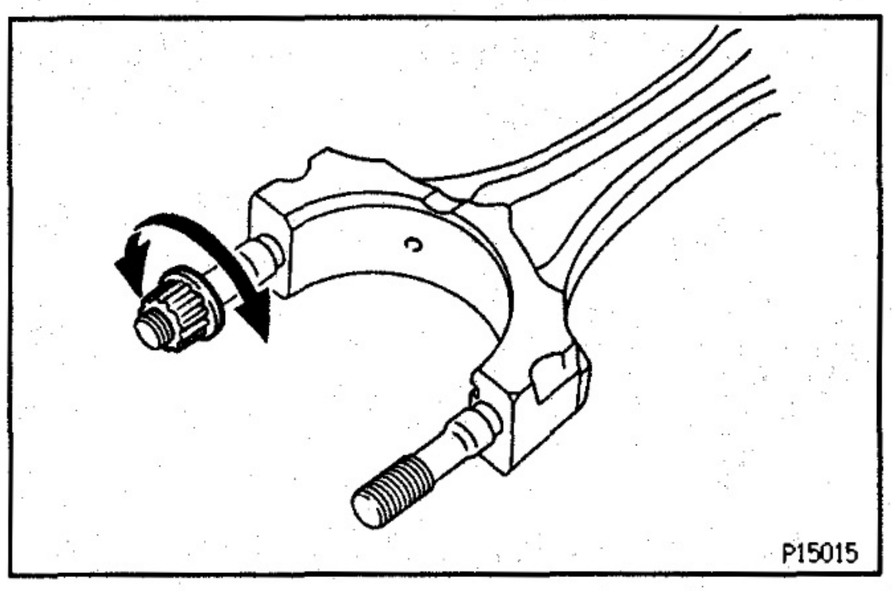
(c) Using SST and a press, press in the bushing.
SST 09207—76010



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



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



D. Inspect connecting rod bolts

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

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

Standard outside diameter:

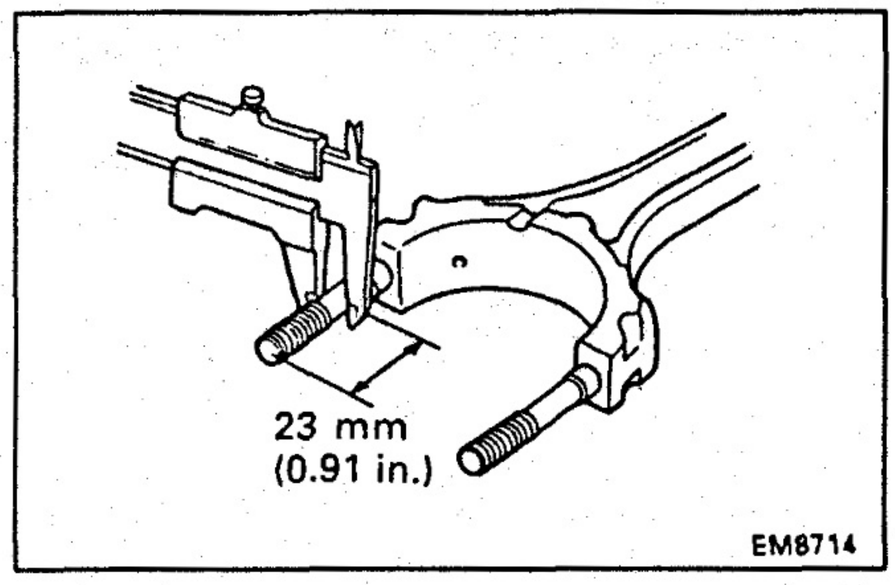
7.80 – 7.90 mm (0.3071 – 0.3110 in.)

Minimum outside diameter:

7.60 mm (0.2992 in.)

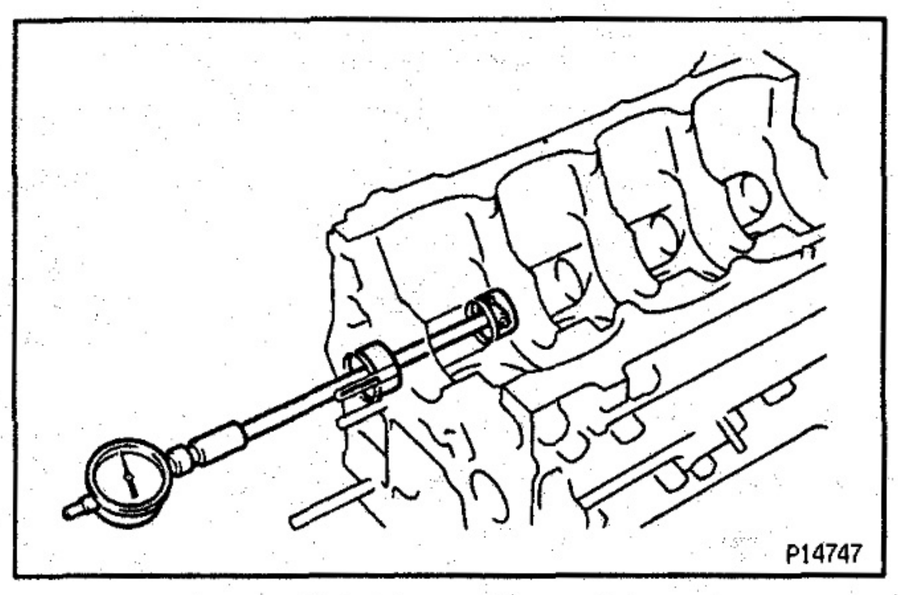
HINT: If the location of minimum diameter cannot be judged by visual inspection, measure the outer diameter at the location shown in the illustration.

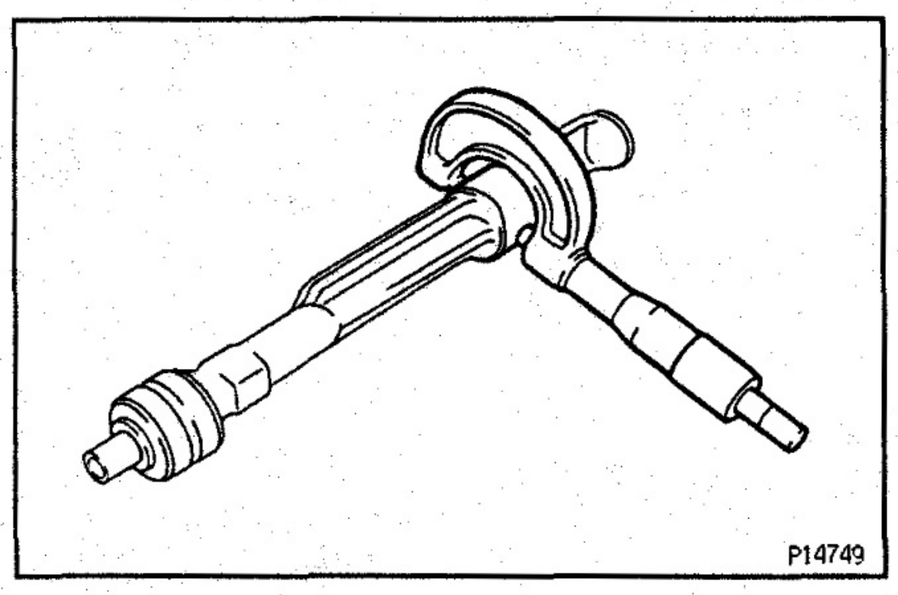
If the outside diameter is less than limit, replace the connecting rod bolt and nut as a set.



BALANCE SHAFT INSPECTION

EG35J–07





INSPECT NO.1 (RH) AND NO.2 (LH) BALANCE SHAFTS

(a) Using a cylinder gauge, measure the inside diameter of the balance shaft bearing.

Bearing inside diameter (from front side):

No.1 (RH)

38.025 – 38.045 mm (1.4970 – 1.4978 in.)

No.2 (LH)

37.525 – 37.545 mm (1.4774 – 1.4781 in.)

(b) Using a micrometer, measure the diameter of the balance shaft main journals.

Main journal diameter (from front side):

No.1 (RH)

37.969 – 37.985 mm (1.4948 – 1.4955 in.)

No.2 (LH)

37.449 – 37.465 mm (1.4744 – 1.4750 in.)

(c) Subtract the balance shaft main journal diameter measurement from the balance shaft bearing inside diameter measurement.

Standard oil clearance:

No.1 (RH)

0.040 – 0.076 mm (0.0016 – 0.0031 in.)

No.2 (LH)

0.060 – 0.096 mm (0.0024 – 0.0038 in.)

Maximum oil clearance: 0.15 mm (0.0059 in.)

If the clearance is greater than maximum, replace the cylinder block and balance shaft.

CYLINDER BORING

EG64M-03

EG

HINT:

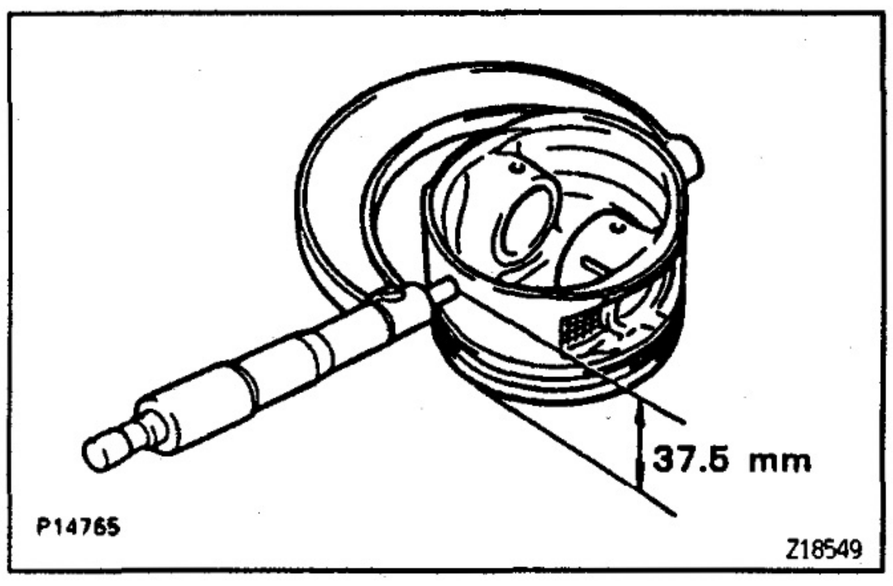
- Bore all the 4 cylinders for the oversized piston outside diameter.
- Replace all the piston rings with ones to match the oversized pistons.

1. SELECT OVERSIZED PISTONS

Oversized piston diameter:

O/S 0.50

95.433 — 95.443 mm (3.7572 — 3.7576 in.)



2. CALCULATE AMOUNT TO BORE CYLINDERS

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 37.5 mm (1.47 in.) for the piston head.

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

Size to be rebored = P + C — H

P = Piston diameter

C = Piston clearance

0.047 — 0.070 mm (0.0019 — 0.0028 in.)

H = Allowance for honing

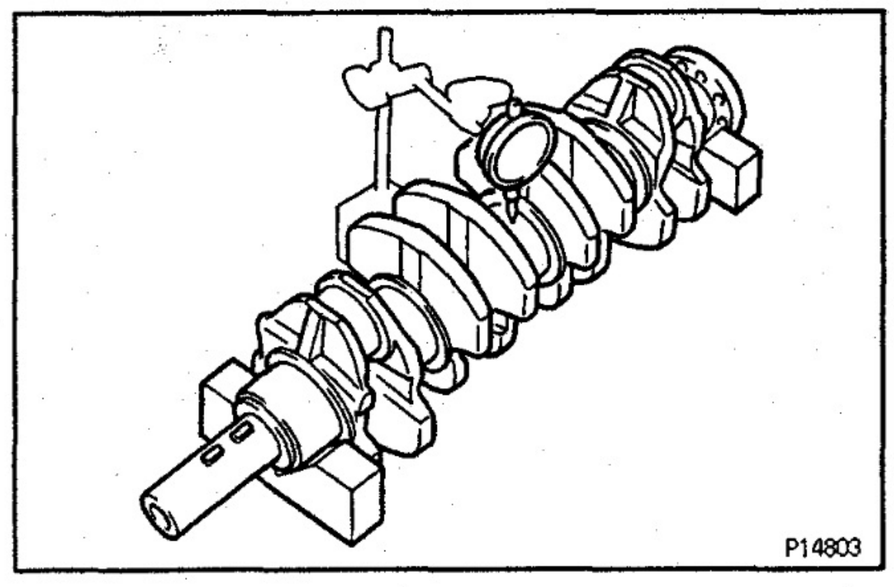
0.020 mm (0.0008 in.) or less

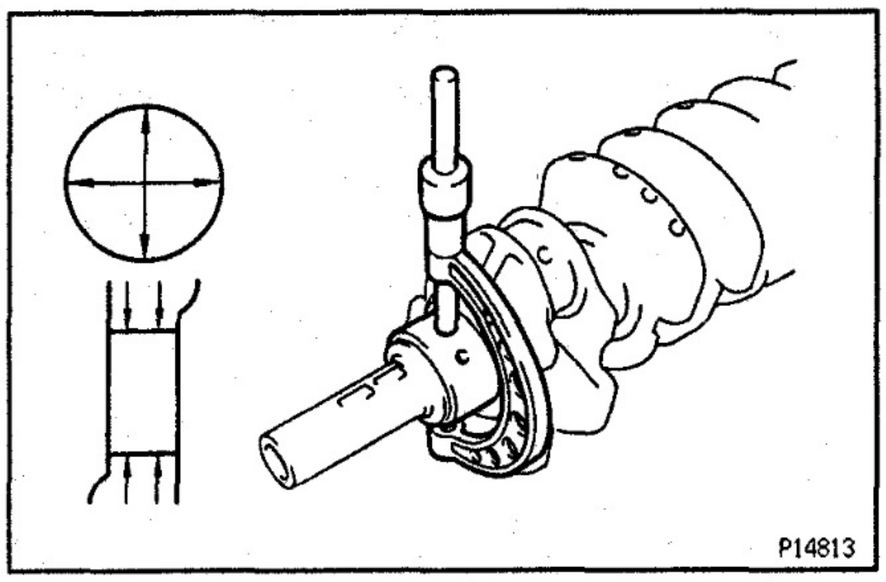
3. BORE AND HONE CYLINDER TO CALCULATED DIMENSIONS

Maximum honing:

0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.





CRANKSHAFT INSPECTION AND REPAIR EG0BY-20

1. INSPECT CRANKSHAFT FOR RUNOUT

(a) Place the crankshaft on V–blocks.

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

Maximum circle runout:

0.03 mm (0.0012 in.)

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

2. INSPECT MAIN JOURNALS AND CRANK PINS

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

Main journal diameter:

STD

No.3

59.981 – 59.994 mm (2.2615 – 2.3620 in.)

Others

59.987 – 60.000 mm (2.3617 – 2.3622 in.)

U/S 0.25

No.3

59.740 – 59.750 mm (2.3520 – 2.3524 in.)

Others

59.745 – 59.755 mm (2.3522 – 2.3526 in.)

Crank pin diameter:

STD

52.987 – 53.000 mm (2.0861 – 2.0866 in.)

U/S 0.25

52.745 – 52.755 mm (2.0766 – 2.0770 in.)

If the diameter is not as specified, check the oil clearance (See steps 3 and 6 in cylinder block disassembly). If necessary, grind or replace the crankshaft.

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

Maximum taper and out–of–round:

0.005 mm (0.0002 in.)

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

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

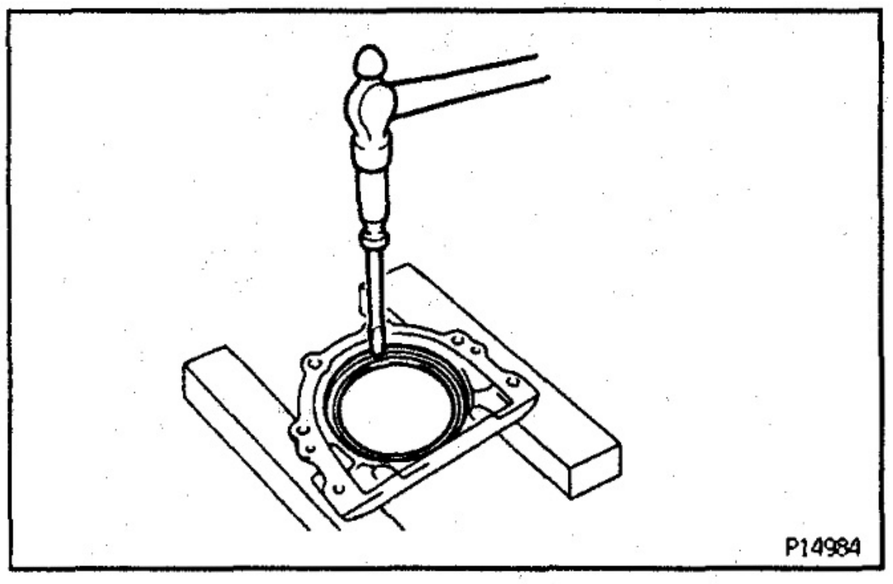
Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure in step 2).

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

CRANKSHAFT OIL SEALS REPLACEMENT EG5NQ-03

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

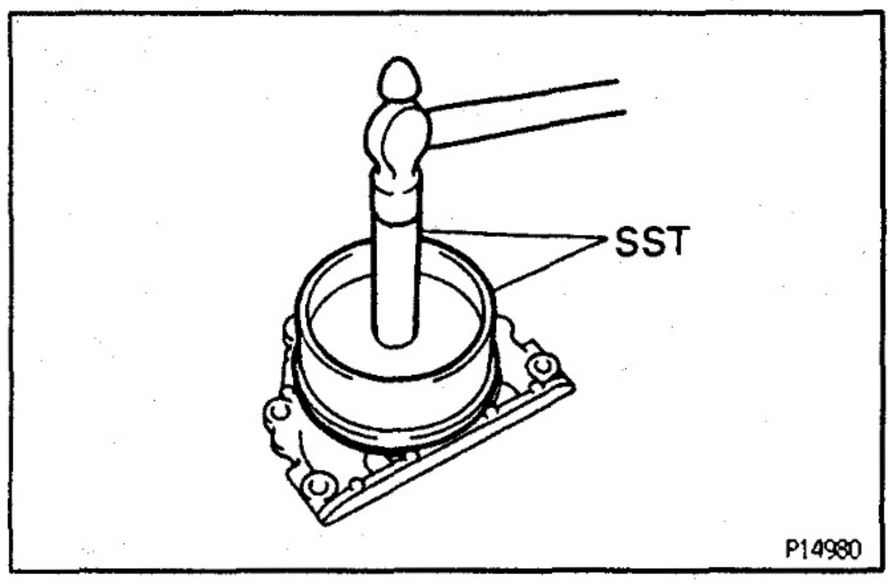
1. **REPLACE CRANKSHAFT FRONT OIL SEAL (See crankshaft front oil seal replacement in Lubrication System)**



2. **REPLACE CRANKSHAFT REAR OIL SEAL**

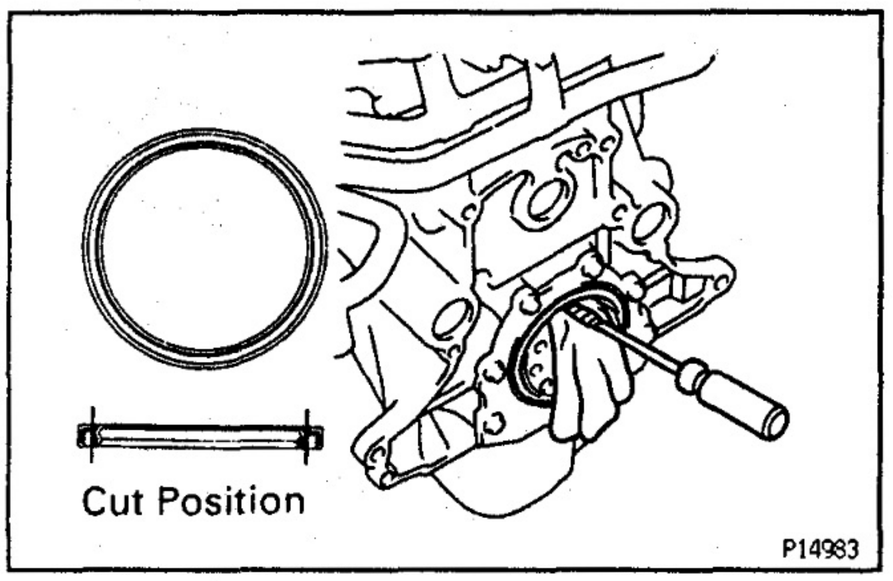
A. **If rear oil seal retainer is removed from cylinder block:**

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



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil seal retainer edge.
SST 09223—15030, 09950—70010 (09951—07150)

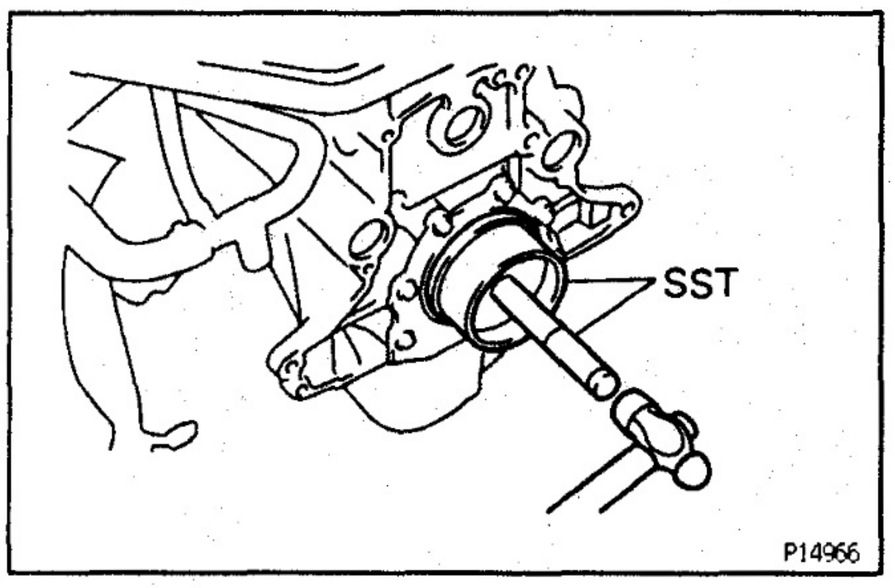
(c) Apply MP grease to the oil seal lip.



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

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

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

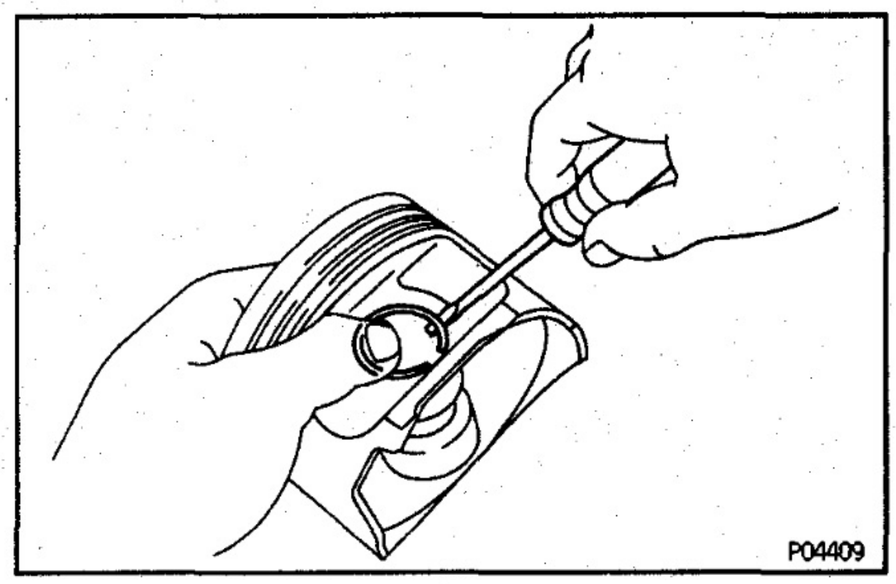


(c) Apply MP grease to a new oil seal lip.

(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223—15030, 09950—70010 (09951—07150)

EGSN1-06

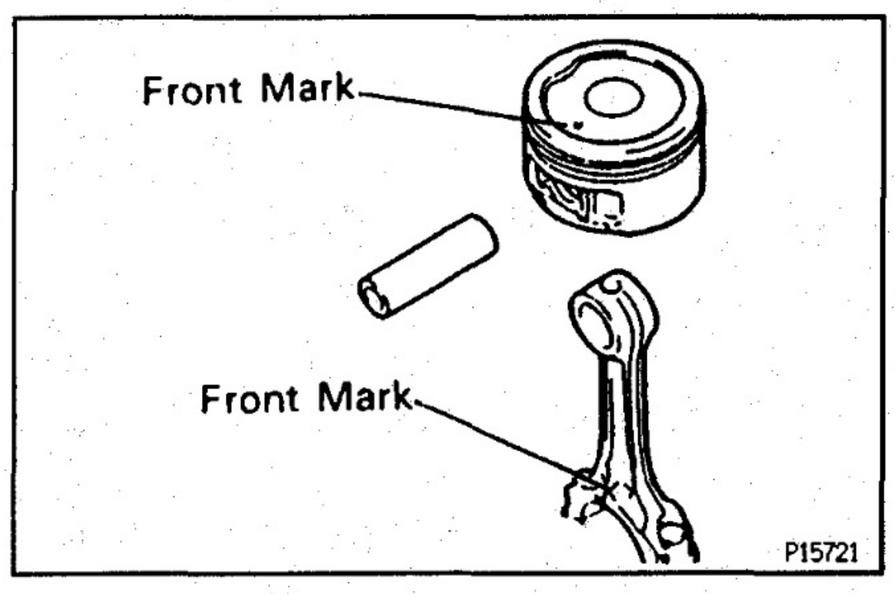
PISTON AND CONNECTING ROD ASSEMBLY



1. ASSEMBLE PISTON AND CONNECTING ROD

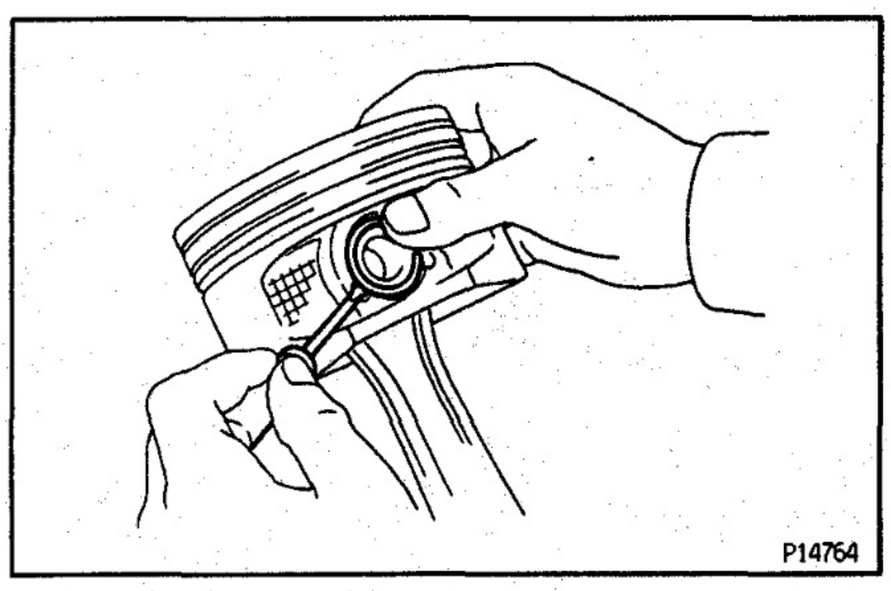
(a) Install a new snap ring on one side of the piston pin hole.

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

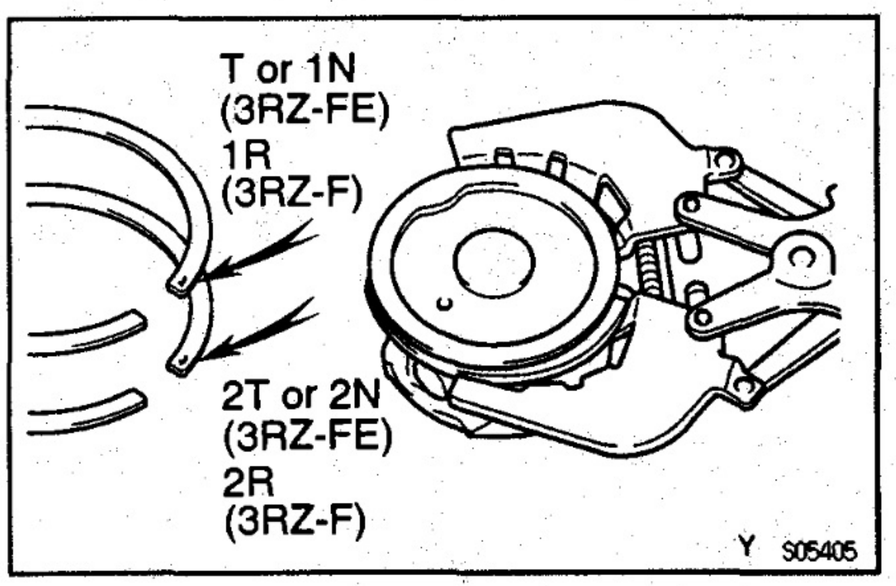


(c) Coat the piston pin with engine oil.

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



(e) Install a new snap ring on the other side of the piston pin hole.



2. INSTALL PISTON RINGS

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

(b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

Code mark:

3RZ–FE

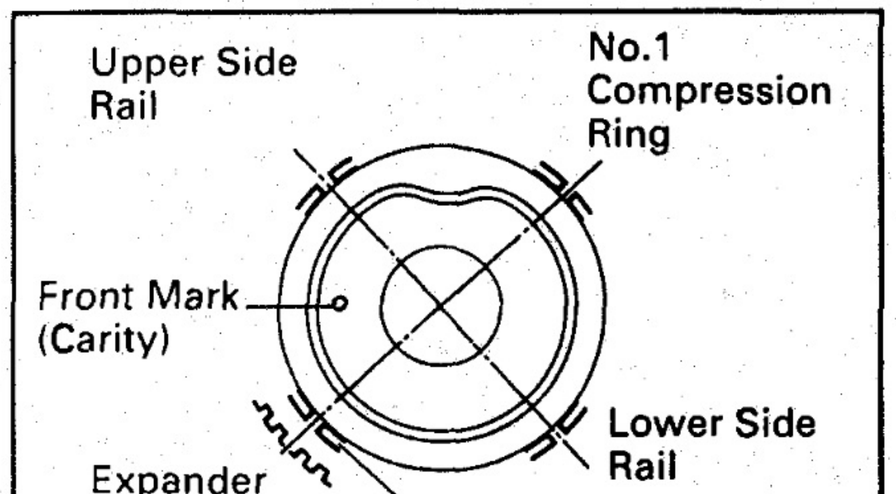
No.1: "T" or "1N"

No.2: "2T" or "2N"

3RZ–F

No.1: 1R

No.2: 2R



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

NOTICE: Do not align the ring ends.

3. INSTALL BEARINGS

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

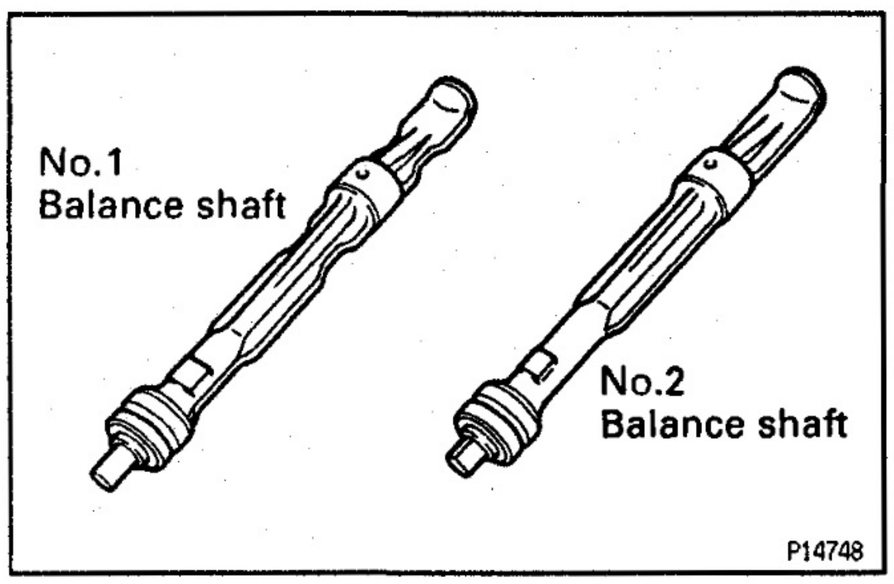
(b) Install the bearings in the connecting rod and connecting rod cap.

EG64N-02

CYLINDER BLOCK ASSEMBLY

HINT:

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



Balance Shaft

HINT:

- No.1 balance shaft: Has indentations
- No.3 balance shaft: Has no indentations

1. ASSEMBLY NO.1 (RH) BALANCE SHAFT

(a) Mount the hexagon wrench head portion of the No.1 balance shaft in a vise.

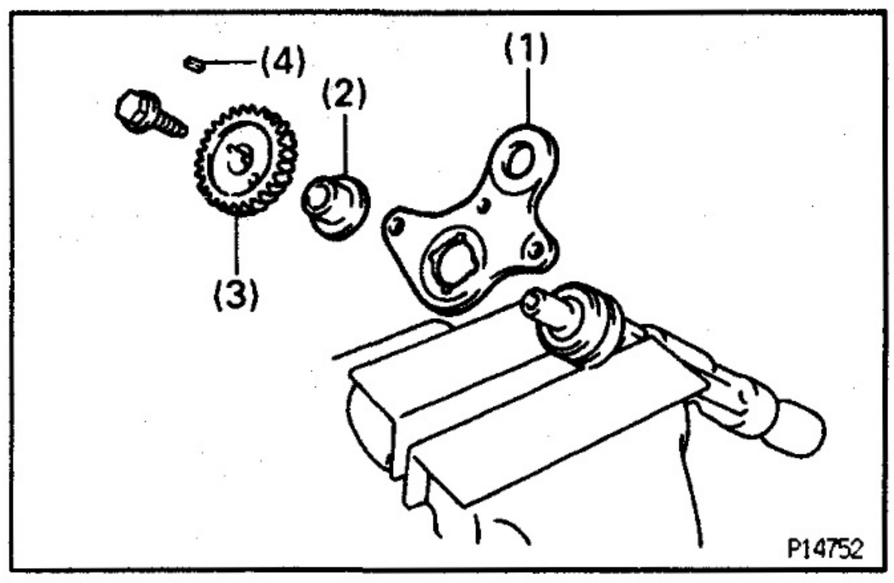
NOTICE: Be careful not to damage the balance shaft.

(b) Install these parts:

(1) No.1 balance shaft thrust plate
(2) Balance shaft thrust spacer
(3) Balance shaft timing gear
(4) Key

(c) Install and torque the bolt.

Torque: 36 N·m (365 kgf·cm, 26 ft·lbf)



2. ASSEMBLY NO.2 (LH) BALANCE SHAFT

(a) Mount the hexagon wrench head portion of the No.2 balance shaft in a vise.

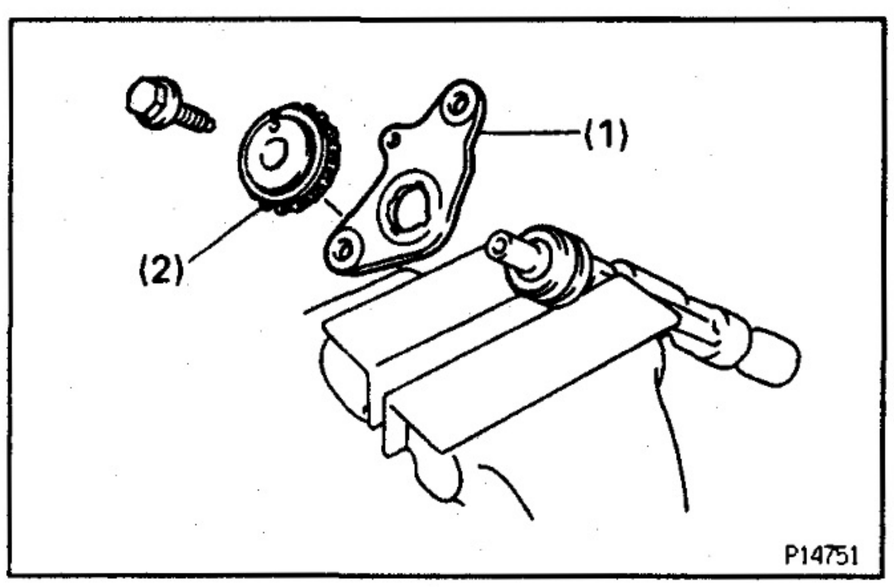
NOTICE: Be careful not to damage the balance shaft.

(b) Install these parts:

(1) No.2 balance shaft thrust plate
(2) Balance shaft timing sprocket

(c) Install and torque the bolt.

Torque: 36 N·m (365 kgf·cm, 26 ft·lbf)



3. INSTALL BALANCE SHAFTS

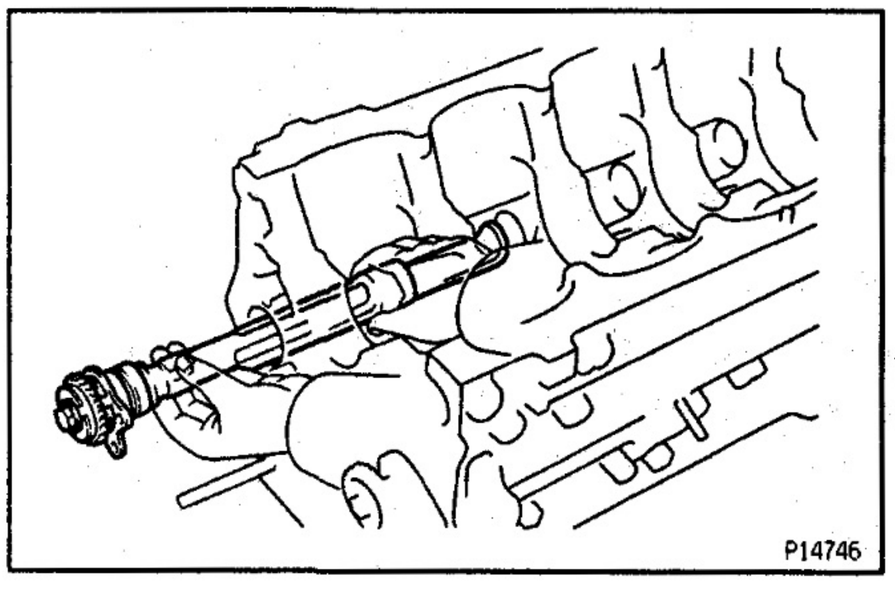
(a) Install balance shafts.

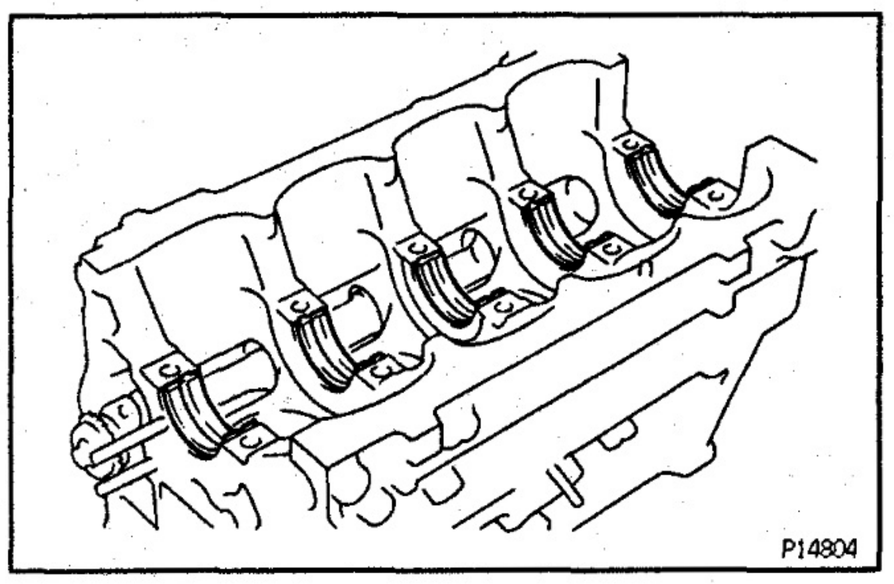
NOTICE: When installing the balance shaft make sure you support the balance shaft with both hands and avoid scratching the balance shaft bearing on the cylinder block side.

(b) Install the No.1 balance shaft with the bolt.

(c) Install the No.2 balance shaft with the 2 bolts.

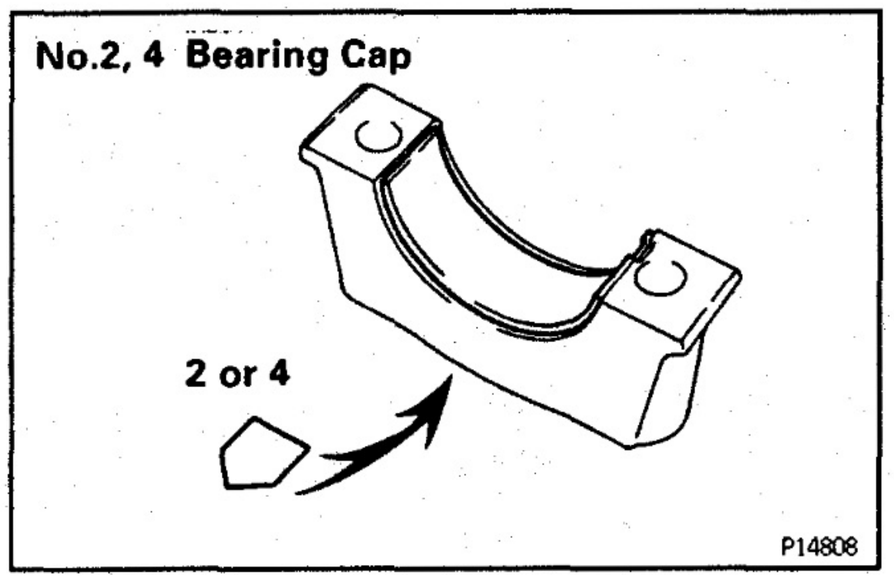
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)



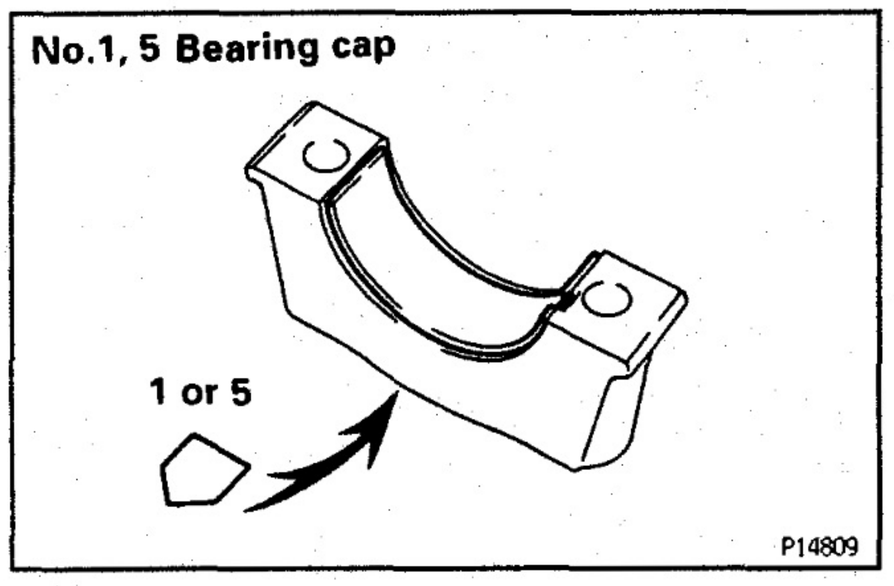


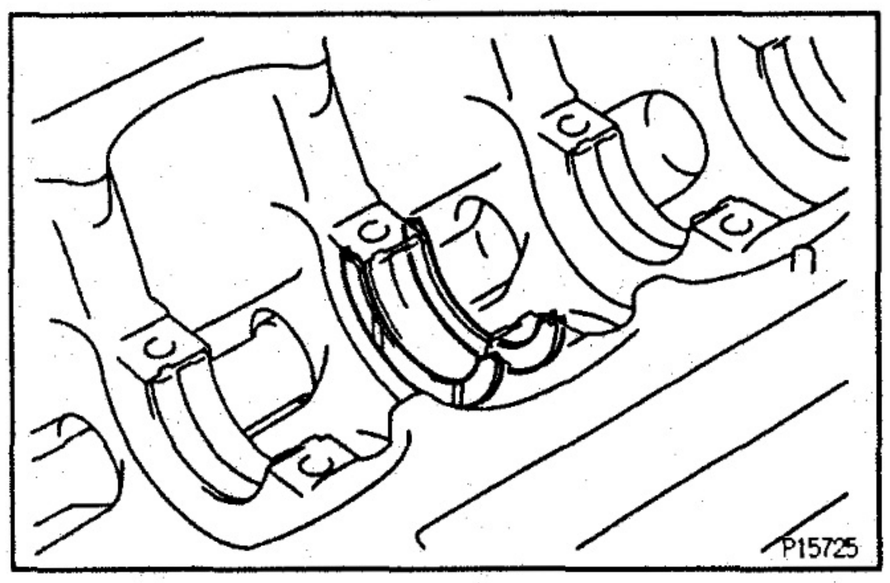
4. INSTALL MAIN BEARINGS

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



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

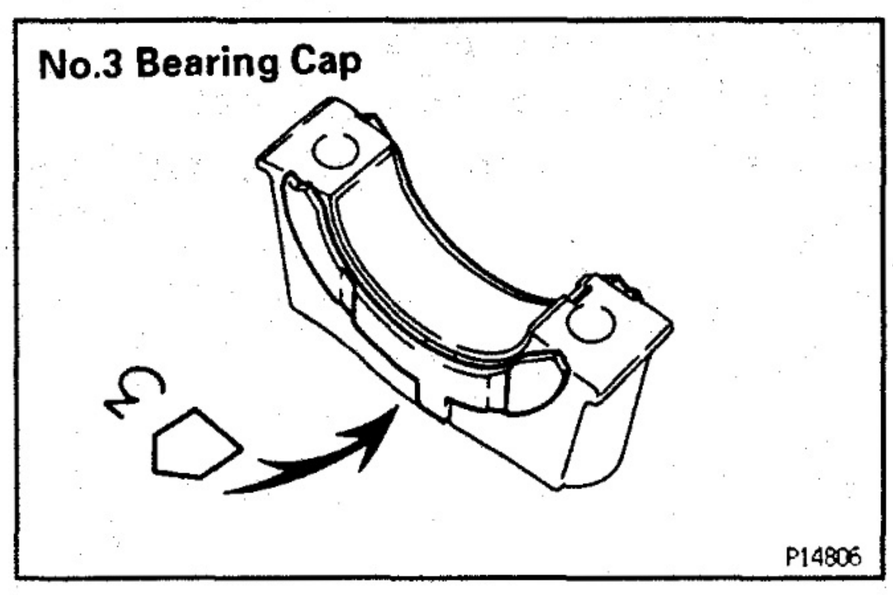




5. INSTALL UPPER THRUST WASHERS

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

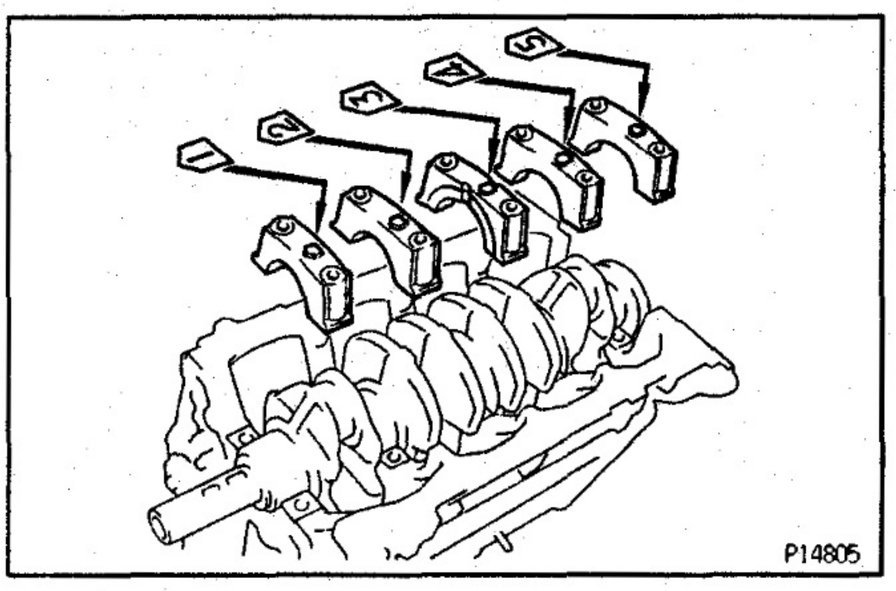
6. PLACE CRANKSHAFT ON CYLINDER BLOCK



7. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

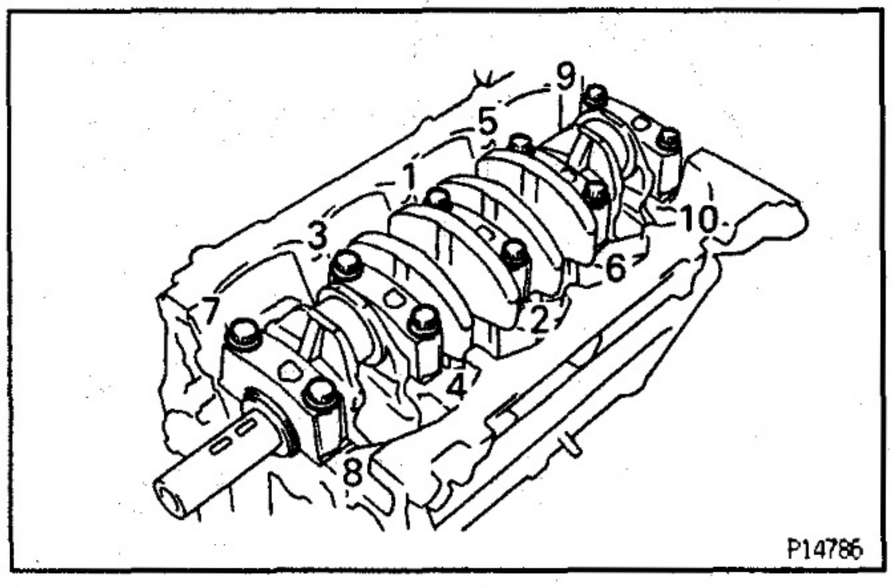
A. Place main bearing caps and lower thrust washers on cylinder block

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

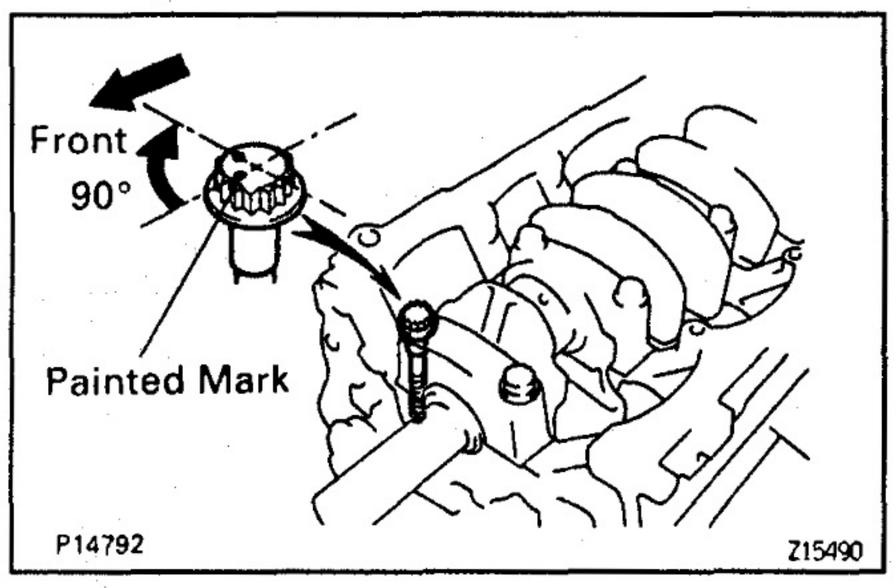


(b) Install the 5 main bearing caps in their proper locations.
HINT: Each bearing cap has a number and front mark.

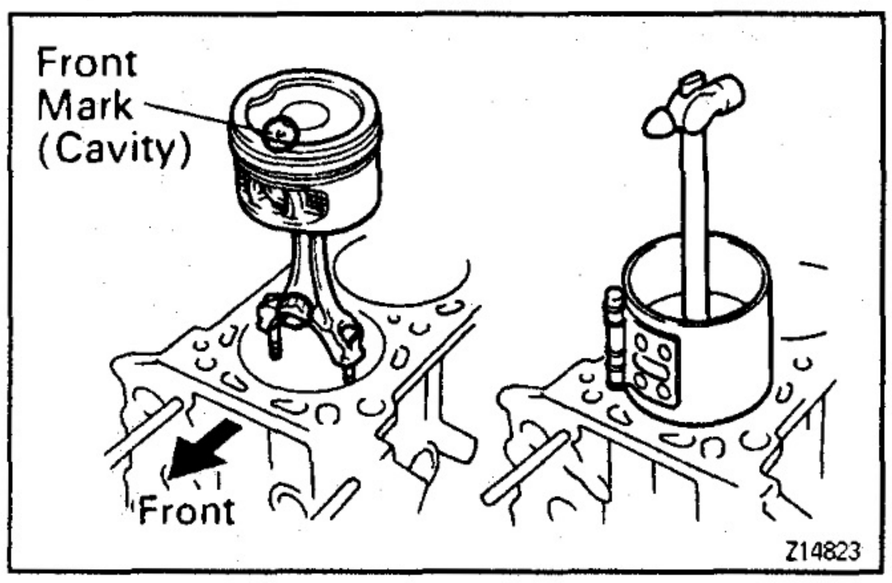
B. Install main bearing cap bolts
HINT:
- The main bearing cap bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any of the main bearing cap bolts is broken or deformed, replace it.



(a) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.
(b) Install and uniformly tighten the 10 bolts of the main bearing caps, in several passes, in the sequence shown.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)
If any one of the main bearing cap bolts does not meet the torque specification, replace the main bearing cap bolt.

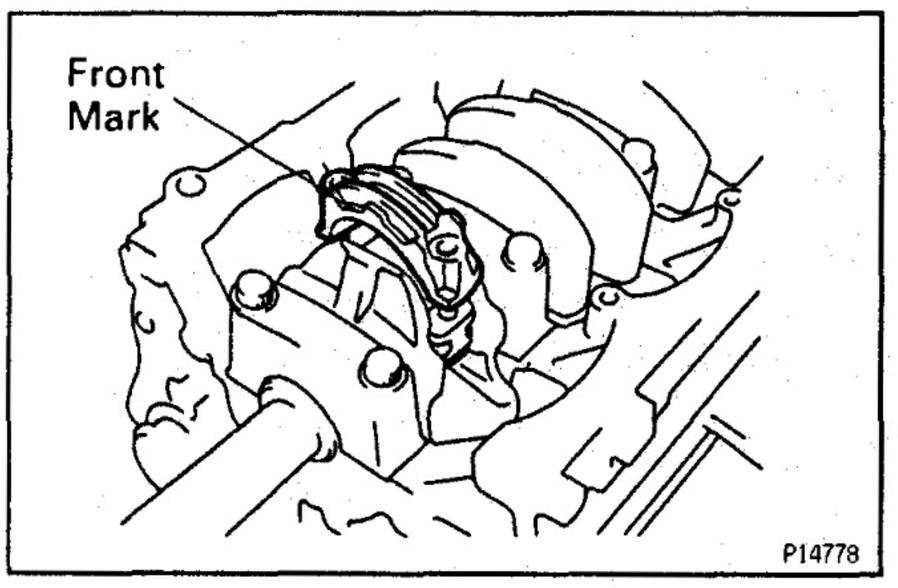


(c) Mark the front of the main bearing cap bolt with paint.
(d) Retighten the main bearing cap bolts by 90° in the numerical order shown above.
(e) Check that the painted mark is now at a 90° angle to the front.
(f) Check that the crankshaft turns smoothly.
(g) Check the crankshaft thrust clearance.
(See step 5 in cylinder block disassembly)



8. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

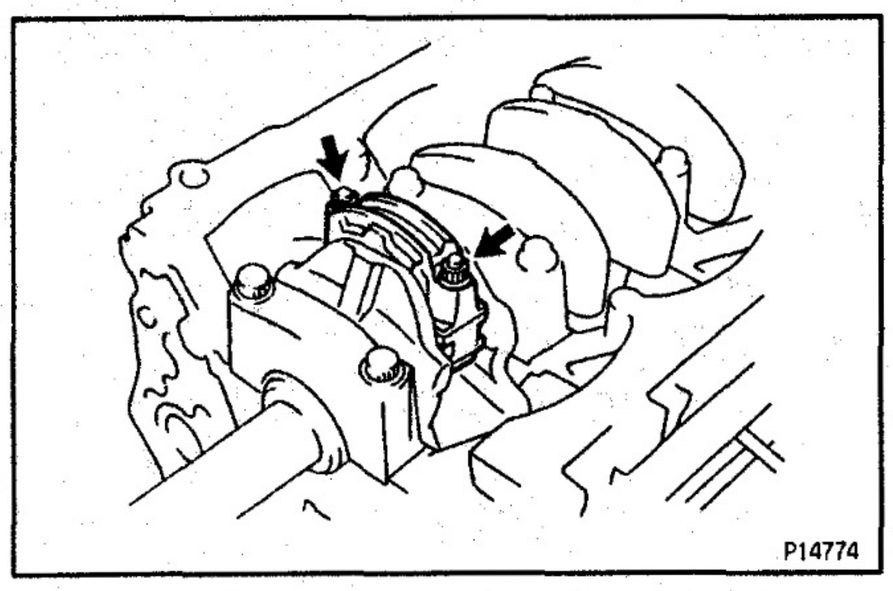
(a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.
(b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.

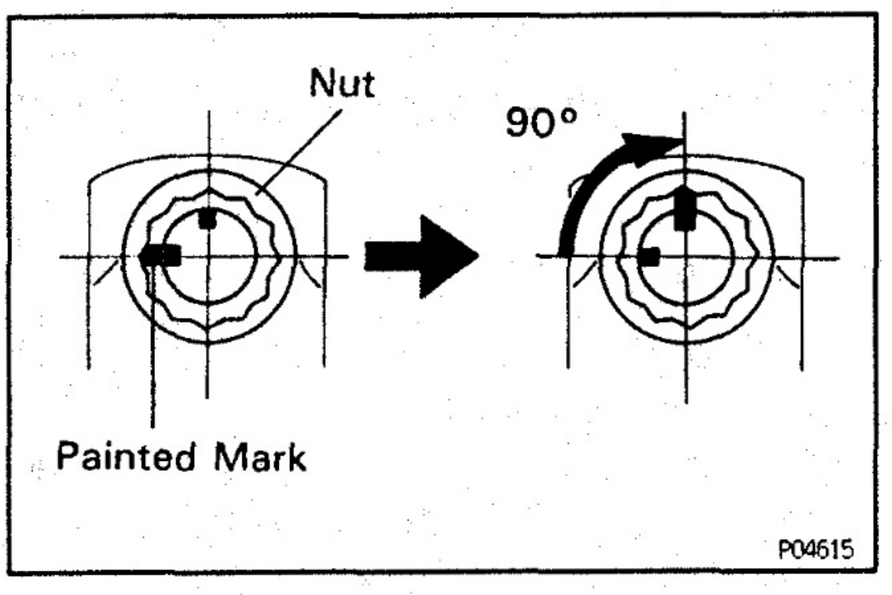


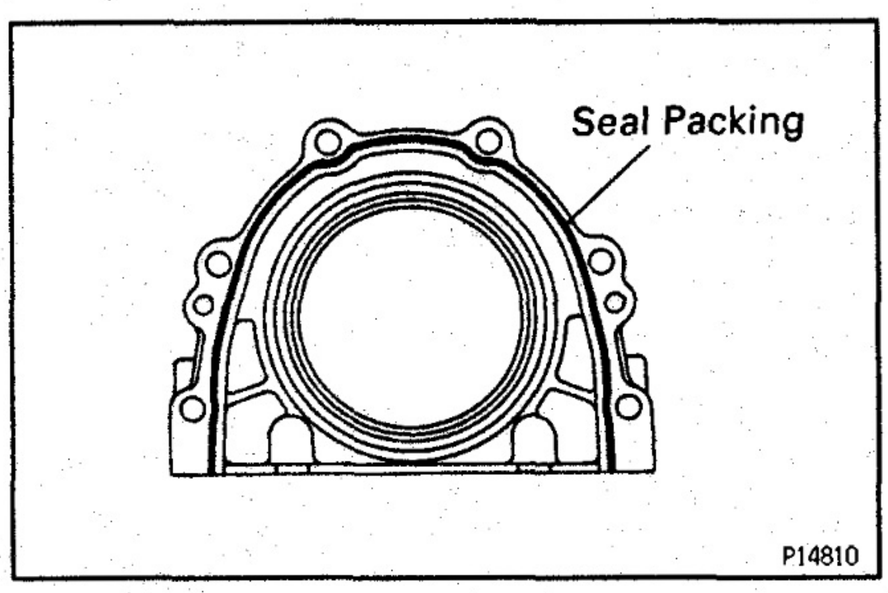
9. INSTALL CONNECTING ROD CAPS

A. Place connecting rod cap on connecting rod

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







B. Install connecting rod cap nuts

HINT:

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

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

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

Torque: 45 N·m (460 kgf·cm, 33 ft·lbf)

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

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

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

(e) Check that the painted mark on the nut is at a 90° angle in relation to the mark on the bolt.

(f) Check that the crankshaft turns smoothly.

(g) Check the connecting rod thrust clearance.
(See step 2 in cylinder block disassembly)

10. INSTALL REAR OIL SEAL RETAINER

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

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

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

Seal packing:

Part No. 08826—00080 or equivalent

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

HINT: Avoid applying an excessive amount to the surface.

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

(c) Install the retainer with the 6 bolts.

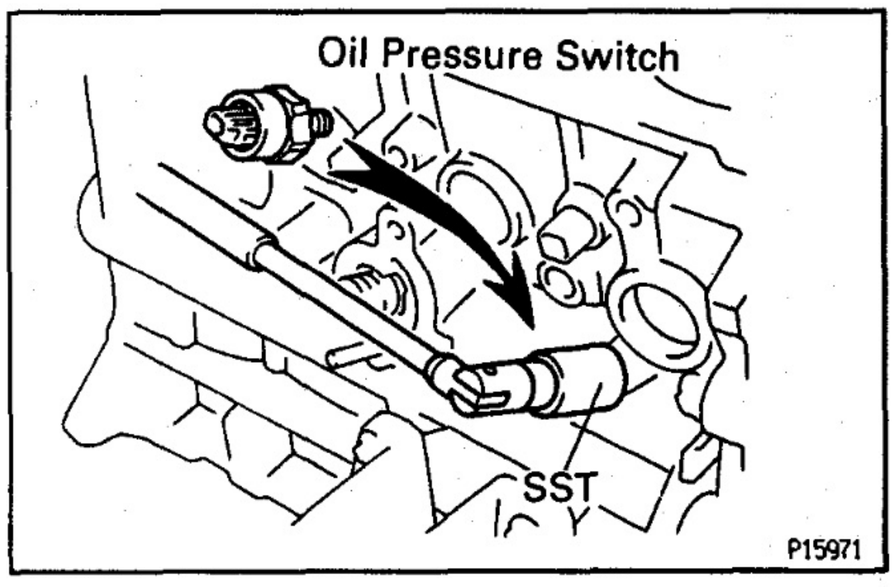
Torque: 13.5 N·m (135 kgf·cm, 9.7 ft·lbf)

EG

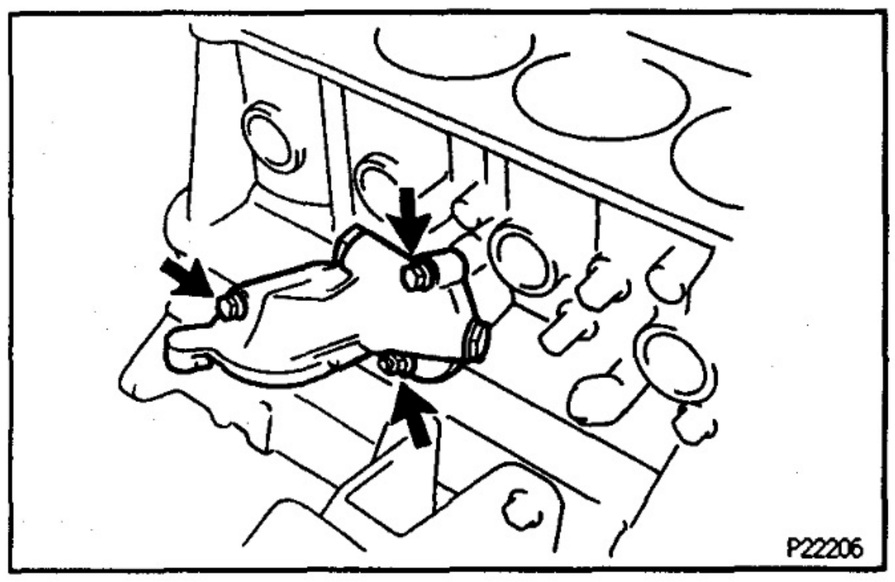
EG791-02

AFTER ASSEMBLY

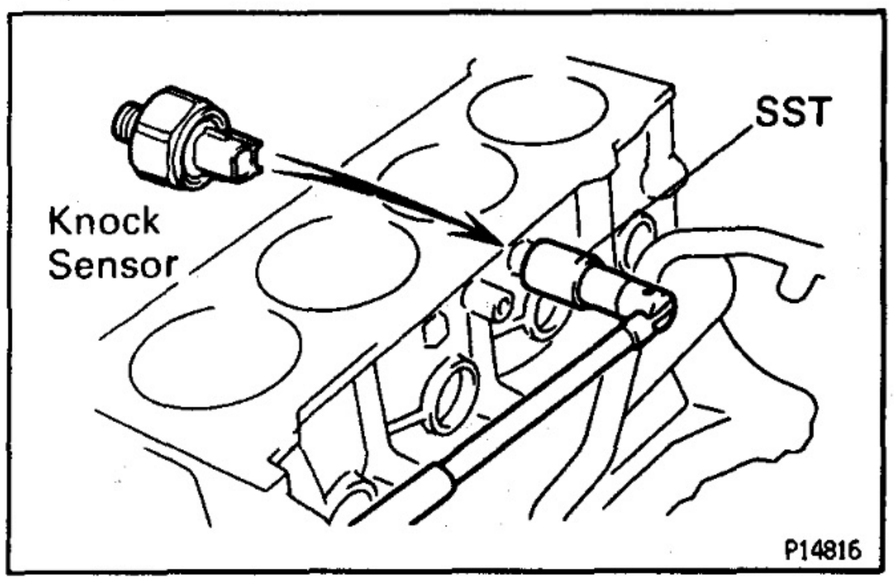
1. **3RZ—FE:**
   INSTALL CRANKSHAFT POSITION SENSOR CONNECTOR BRACKET
2. **INSTALL ENGINE WIRE BRACKET**
3. **INSTALL RH AND LH ENGINE MOUNTING ASSEMBLIES**
   Torque: 52 N·m (520 kgf·cm, 38 ft·lbf)



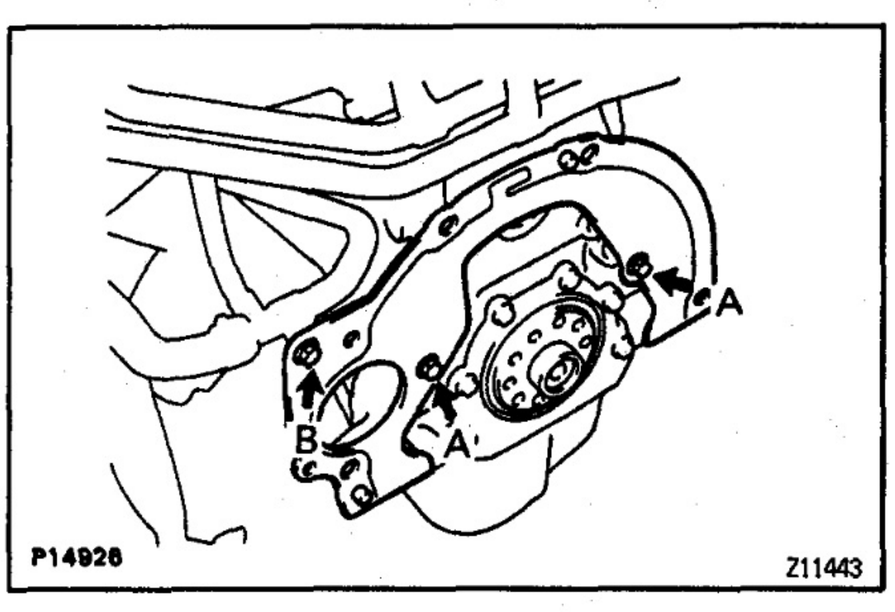
4. **INSTALL OIL PRESSURE SWITCH**
(a) Apply adhesive to 2 or 3 threads of the oil pressure switch.
Adhesive:
Part No. 08833—00080, THREE BOND 1344, LOCTITE 242 or equivalent
(b) Using SST, install the oil pressure switch.
SST 09816—30010
5. **INSTALL ENGINE COOLANT DRAIN COCK**
Torque: 24.5 N·m (250 kgf·cm, 18 ft·lbf)
6. **OIL FILTER BRACKET**
(a) Install a new O—ring to the union.
(b) Using a 14 mm hexagon wrench, install the union.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)
(c) Install a new O—ring and the oil filter bracket with the 2 bolts and nut.
Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)



7. **3RZ—F:**
INSTALL OIL COOLER
8. **INSTALL OIL FILTER**
(See oil and filter replacement in Lubrication System)
9. **INSTALL WATER BYPASS PIPE**
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)
10. **3RZ—FE:**
INSTALL KNOCK SENSOR
Using SST, install the knock sensor.
SST 09816—30010
Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)



11. **3RZ—FE:**
INSTALL FUEL FILTER
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)
12. **INSTALL TIMING CHAINS, GEARS AND SPROCKETS**
(See timing chain installation)
13. **INSTALL CYLINDER HEAD**
(See cylinder head installation)
14. **REMOVE ENGINE STAND**



15. INSTALL REAR END PLATE

Install the rear end plate with the 3 bolts.

Torque:

Bolt A: 18 N·m (185 kgf·cm, 13 ft·lbf)

Bolt B: 20 N·m (200 kgf·cm, 14 ft·lbf)

16. M/T:

INSTALL FLYWHEEL

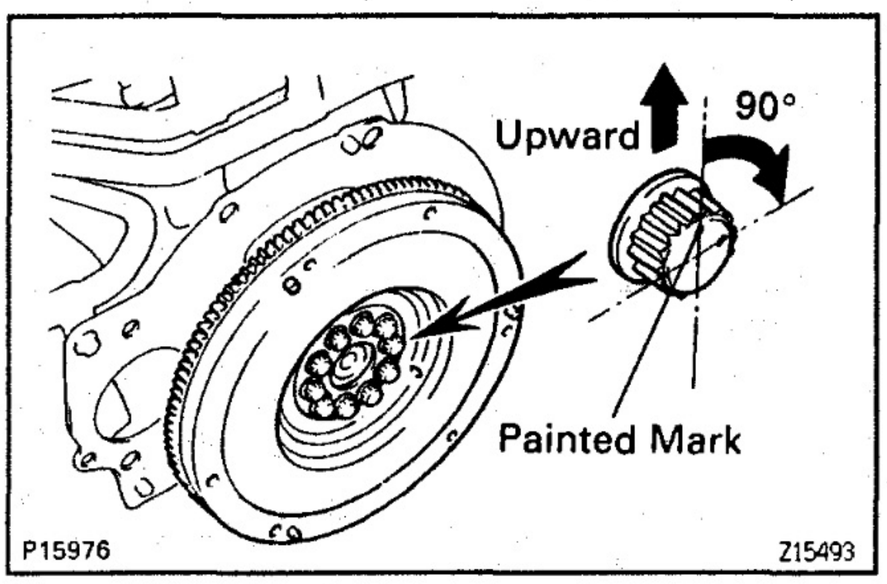
(a) Install and uniformly tighten 10 new bolts to the flywheel, in several passes, in the sequence shown.

Torque: 26.5 N·m (270 kgf·cm, 19 ft·lbf)

(b) Mark the top of the flywheel bolt with paint.

(c) Retighten the flywheel bolts by 90° in the numerical order shown above.

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



17. A/T:

INSTALL DRIVE PLATE

(a) Apply adhesive to 2 or 3 threads of the bolt end.

Adhesive:

Part No. 08833—00070, THREE BOND 1324

or equivalent

(b) Install the front spacer, drive plate and rear plate with the 10 bolts.

Torque: 74 N·m (750 kgf·cm, 54 ft·lbf)

SERVICE SPECIFICATIONS

SERVICE DATA

EG0VT-0V

Idle CO check and adjust	Idle CO concentration		1.5 ± 0.5 %
Compression pressure	at 250 rpm	STD 3RZ−FE	1,230 kPa (12.5 kgf/cm², 178 psi) or more
		3RZ−F	1,127 kPa (11.5 kgf/cm², 168 psi) or more
		Minimum	880 kPa (9.0 kgf/cm², 127 psi)
	Difference of pressure between each cylinder		98 kPa (1.0 kgf/cm², 14 psi) or less
Valve clearance		Intake	0.15 − 0.25 mm (0.006 − 0.010 in.)
		Exhaust	0.25 − 0.35 mm (0.010 − 0.014 in.)
Ignition timing	w/ Terminals TE1 and E1 connected of check connector	3RZ−FE	3 − 7° BTDC @ idle
Ignition timing		3RZ−F	3 − 7° BTDC @ Max.850rpm
Idle speed	Engine at normal operating temperature	3RZ−FE	650 − 750 rpm
		3RZ−F	750 − 850 rpm
	Fast idle speed	3RZ−F	2,600 rpm
Cylinder head	Warpage		
	Cylinder block side	Maximum	0.05 mm (0.0020 in.)
	Manifold side	Maximum	0.10 mm (0.0039 in.)
	Valve seat		
	Refacing angle	Intake	30°, 45°, 60°
		Exhaust	45°, 60°
	Contacting angle		45°
	Contacting width		1.0 − 1.4 mm (0.039 − 0.055 in.)
	Cylinder head bolt outside diameter	STD	10.76 − 10.97 mm (0.4236 − 0.4319 in.)
		Minimum	10.40 mm (0.4094 in.)
Valve guide bushing	Inside diameter		6.010 − 6.030 mm (0.2366 − 0.2374 in.)
	Outside diameter (for repair part)	STD	11.000 − 11.027 mm (0.4331 − 0.4341 in.)
		O/S 0.05	11.050 − 11.077 mm (0.4350 − 0.4361 in.)
	Protrusion height		8.2 − 8.6 mm (0.323 − 0.339 in.)
	Replacing temperature (Cylinder head side)		80 − 100°C (176 −212°F)
Valve	Valve overall length	STD Intake	103.45 mm (4.0728 in.)
		Exhaust	103.60 mm (4.0787 in.)
		Minimum Intake	102.95 mm (4.0531 in.)
		Exhaust	103.10 mm (4.0590 in.)
	Valve face angle		44.5°
	Stem diameter	Intake	5.970 − 5.985 mm (0.2350 − 0.2356 in.)
		Exhaust	5.965 − 5.980 mm (0.2348 − 0.2354 in.)
	Stem oil clearance	STD Intake	0.025 − 0.060 mm (0.0010 − 0.0024 in.)
		Exhaust	0.030 − 0.065 mm (0.0012 − 0.0026 in.)
		Maximum Intake	0.08 mm (0.0031 in.)
		Exhaust	0.10 mm (0.0039 in.)
	Margin thickness	STD	1.0 mm (0.039 in.)
		Minimum	0.5 mm (0.020 in.)
Valve spring	Deviation	Maximum	2.0 mm (0.079 in.)
	Installed tension	at 35.7 mm (1.406 in.)	177 − 204 N (18.0 − 20.8 kgf, 39.7 − 45.9 lbf)

Valve lifter	Lifter diameter		30.966 – 30.976 mm (1.1578 – 1.2195 in.)
	Lifter bore diameter		31.000 – 31.016 mm (1.2205 – 1.2211 in.)
	Oil clearance	STD	0.024 – 0.050 mm (0.0009 – 0.0020 in.)
		Maximum	0.07 mm (0.0028 in.)
Manifold	Warpage	Maximum Intake	0.20 mm (0.0078 in.)
		Exhaust	0.50 mm (0.0197 in.)
Air intake chamber	Warpage	Maximum	0.20 mm (0.0078 in.)
Camshaft	Thrust clearance	STD	0.040 – 0.095 mm (0.0016 – 0.0037 in.)
		Maximum	0.12 mm (0.0047 in.)
	Journal oil clearance	STD	0.025 – 0.062 mm (0.0010 – 0.0024 in.)
		Maximum	0.08 mm (0.0031 in.)
	Journal diameter		26.959 – 26.975 mm (1.0614 – 1.0620 in.)
	Circle runout	Maximum	0.06 mm (0.0024 in.)
	Cam lobe height	Intake	45.31 – 45.41 mm (1.7839 – 1.7878 in.)
		Exhaust	45.06 – 45.16 mm (1.7740 – 1.7779 in.)
	Camshaft gear backlash	STD	0.020 –0.200 mm (0.0008 – 0.0079 in.)
		Maximum	0.30 mm (0.0188 in.)
	Camshaft gear spring end free distance		22.5 – 22.9 mm (0.886– 0.902 in.)
Spark plug tube	Protrusion		47.0 mm (1.850 in.)
Chain and timing gear	Chain length at 16 links	Maximum (No.1)	147.5 mm (5.807 in.)
		(No.2)	123.6 mm (4.866 in.)
	Camshaft timing gear wear (w/ chain)	Minimum	113.8 mm (4.480 in.)
	Crankshaft timing gear wear (w/ chain)	Minimum	59.4 mm (2.339 in.)
	Balance shaft drive gear wear (w/ chain)	Minimum	75.9 mm (2.988 in.)
	No.2 crankshaft timing sprocket wear (w/ chain)	Minimum	96.7 mm (3.807 in.)
Chain tensioner slipper and vibration damper	Wear	Maximum	1.0 mm (0.039 in.)
Cylinder block	Cylinder head surface warpage	Maximum	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD	94.990 – 95.003 mm (3.7400 – 3.7403 in.)
		Maximum	95.06 mm (3.7425 in.)
	Main bearing bolt outside diameter	STD	10.76 – 10.97 mm (0.4236 – 0.4319 in.)
		Minimum	10.40 mm (0.4094 in.)
	Cylinder block main journal bore diameter		
		STD Mark 1	64.004 – 64.010 mm (2.5198 – 2.5201 in.)
		Mark 2	64.011 – 64.016 mm (2.5201 – 2.5203 in.)
		Mark 3	64.017 – 64.022 mm (2.5203 – 2.5205 in.)
		U/S 0.25	64.000 – 64.024 mm (2.5197 – 2.5206 in.)

Piston and piston ring	Piston diameter	STD	94.933 — 94.943 mm (3.7375 — 3.7379 in.)
		O/S 0.50	95.433 — 95.443 mm (3.7572 — 3.7576 in.)
	Piston oil clearance		0.047 — 0.070 mm (0.0019 — 0.0028 in.)
	Piston ring groove clearance	3RZ—FE No.1	0.020 — 0.070 mm (0.0008 — 0.0028 in.)
		No.2	0.030 — 0.070 mm (0.0012 — 0.0028 in.)
	Piston ring end gap	3RZ—FE No.1	0.300 — 0.400 mm (0.0118 — 0.0157 in.)
		No.2	0.400 — 0.500 mm (0.0157 — 0.0197 in.)
	Piston ring groove clearance	3RZ—F No.1	0.030 — 0.080 mm (0.0012 — 0.0031 in.)
		No.2	0.040 — 0.080 mm (0.0016 — 0.0031 in.)
	Piston ring end gap	3RZ—F No.1	0.300 — 0.430 mm (0.0118 — 0.0169 in.)
		No.2	0.450 — 0.600 mm (0.0177 — 0.0236 in.)
	Piston pin installing temperature		80 — 90°C (176 — 194°F)
Connecting rod	Thrust clearance	STD	0.160 — 0.312 mm (0.0063 — 0.0123 in.)
		Maximum	0.35 mm (0.0138 in.)
	Connecting rod bearing center wall thickness		
		STD Mark 4	1.482 — 1.485 mm (0.0583 — 0.0585 in.)
		Mark 5	1.485 — 1.488 mm (0.0585 — 0.0586 in.)
		Mark 6	1.488 — 1.491 mm (0.0586 — 0.0587 in.)
		U/S 0.25	1.601 — 1.607 mm (0.0630 — 0.0633 in.)
	Connecting rod big end inside diameter		
		STD Mark 4	56.000 — 56.006 mm (2.2047 — 2.2050 in.)
		Mark 5	56.006 — 56.012 mm (2.2050 — 2.2052 in.)
		Mark 6	56.012 — 56.018 mm (2.2052 — 2.2054 in.)
		U/S 0.25	56.000 — 56.018 mm (2.2047 — 2.2054 in.)
	Connecting rod oil clearance	STD	0.030 — 0.055 mm (0.0012 — 0.0022 in.)
		U/S 0.25	0.031 — 0.071 mm (0.0012 — 0.0026 in.)
		Maximum	0.10 mm (0.0039 in.)
	Rod out—of—alignment		
		Maximum per 100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Rod twist	Maximum per 100 mm (3.94 in.)	0.15 mm (0.0059 in.)
	Bushing inside diameter		24.008 — 24.017 mm (0.9452 — 0.9455 in.)
	Piston pin diameter		24.000 — 24.009 mm (0.9449 — 0.9452 in.)
	Piston pin oil clearance	STD	0.005 — 0.011 mm (0.0002 — 0.0004 in.)
		Maximum	0.015 mm (0.0006 in.)
	Connecting rod bolt outside diameter	STD	7.80 — 7.90 mm (0.3071 — 0.3110 in.)
		Minimum	7.60 mm (0.2992 in.)

Crankshaft	Thrust clearance	STD	0.020 – 0.0220 mm (0.0008 – 0.0087 in.)
		Maximum	0.30 mm (0.0118 in.)
	Thrust washer thickness		2.440 – 2.490 mm (0.0961 – 0.0980 in.)
	Main journal oil clearance	STD No.3	0.030 – 0.055 mm (0.0012 – 0.0022 in.)
		Others	0.024 – 0.049 mm (0.0009 – 0.0019 in.)
		U/S 0.25 No.3	0.030 – 0.070 mm (0.0012 – 0.0028 in.)
		Others	0.025 – 0.065 mm (0.0010 – 0.0026 in.)
		Maximum	0.10 mm (0.0039 in.)
	journal diameter	STD No.3	59.981 – 59.994 mm (2.2615 – 2.3620 in.)
		Others	59.987 – 60.000 mm (2.3617 – 2.3622 in.)
		U/S 0.25 No.3	59.740 – 59.750 mm (2.3520 – 2.3524 in.)
		Others	59.745 – 59.755 mm (2.3522 – 2.3526 in.)
	Main bearing center wall thickness		
		STD Mark 1	1.987 – 1.990 mm (0.0782 – 0.0783 in.)
		Mark 2	1.991 – 1.993 mm (0.0784 – 0.0785 in.)
		Mark 3	1.994 – 1.996 mm (0.0785 – 0.0786 in.)
		U/S 0.25	2.106 – 2.112 mm (0.0829 – 0.0831 in.)
	Crank pin diameter	STD	52.987 – 53.000 mm (2.0861 – 2.0866 in.)
		U/S 0.25	52.745 – 52.755 mm (2.0766 – 2.0770 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Main journal taper and out–of–round	Maximum	0.005 mm (0.0002 in.)
	Crank pin taper and out–of–round	Maximum	0.005 mm (0.0002 in.)
Balance shaft	Thrust clearance	STD	0.07 – 0.13 mm (0.0027 – 0.0051 in.)
		Maximum	0.20 mm (0.0079 in.)
	Bearing inside diameter	No.1	38.025 – 38.045 mm (1.4970 – 1.4978 in.)
		No.2	37.525 – 37.545 mm (1.4774 – 1.4781 in.)
	Journal diameter	No.1	37.969 – 37.985 mm (1.4948 – 1.4955 in.)
		No.2	37.449 – 37.465 mm (1.4744 – 1.4750 in.)
	Journal oil clearance	STD No.1	0.040 – 0.076 mm (0.0016 – 0.0031 in.)
		No.2	0.060 – 0.096 mm (0.0024 – 0.0038 in.)
		Maximum	0.15 mm (0.0059 in.)

EG0VU–01

TORQUE SPECIFICATIONS

Part tightened		N·m	kgf·cm	ft·lbf
Spark plug x Cylinder head		19	200	14
Cylinder head x Vacuum pipe		8.5	85	74 in.·lbf
Cylinder head x Cylinder block	1st	39	400	29
	2nd	Turn 90°	Turn 90°	Turn 90°
	3rd	Turn 90°	Turn 90°	Turn 90°
Cylinder head x Timing chain cover		21	210	15
Camshaft bearing cap x Cylinder head		15.5	160	12
Camshaft timing gear x Intake camshaft		73.5	750	54
Distributor gear x Exhaust camshaft		46	470	34
No.1 chain tensioner x Cylinder head		21	210	15
Front Engine hanger x Cylinder head		42	420	30
Intake manifold x Water bypass flange (3RZ–F)		9.0	90	78 in.·lbf
Intake manifold x Accelerator cable		21	210	15
Intake manifold x Vacuum pipe		8.5	85	74 in.·lbf
Cylinder head rear cover x Cylinder head		13.5	135	10

Water outlet x Cylinder head		20	200	14
Exhaust manifold x Cylinder head		49	500	36
Heat insulator x Exhaust manifold		5.5	55	48 in.·lbf
Intake manifold x Cylinder head		29	300	22
Fuel inlet pipe x Fuel filter (3RZ—FE)		29	300	22
Air intake chamber (3RZ—FE) x Intake manifold		21	210	15
Fuel inlet pipe x Delivery pipe (3RZ—FE)		29	300	22
Intake chamber stay x Air intake chamber (3RZ—FE)		20	200	15
Intake chamber stay x LH engine mounting bracket (3RZ—FE)		20	200	15
Intake manifold stay x Intake manifold, LH munting braket		20	200	15
Oil dipstick guide x Cylinder head		20	200	15
Intake air connector x Cylinder head		18	185	13
Balance shaft drive gear x Balance shaft		25	250	18
No.2 chain tensioner, No.3 vibration damper x Cylinder block		18	185	13
No.2 vibration damper x Cylinder block		27	270	20
No.1 vibration damper x Cylinder block		29	300	22
No.1 timing chain tensioner slipper x Cylinder block		27	270	20
Timing chain cover x Cylinder block	12 mm head bolt A	20	200	14
	bolt B	24.5	250	18
	14 mm head bolt	44	440	32
	Nut	20	200	14
Timing chain cover mounting bolt		18	185	13
Water bypass pipe mounting nut		20	200	14
Crankshaft pulley x Crankshaft		260	2,650	193
No.2 crankshaft pulley, No.3 crankshaft pulley x Crankshaft pulley		25	250	18
Oil strainer x Cylinder block		18	185	13
Oil pan x Cylinder block		12.5	130	9
Timing chain cover x Crankshaft position sensor		8.5	85	74 in.·lbf
Connecting rod cap x Connecting rod	1st	45	460	33
	2nd	Turn 90°	Turn 90°	Turn 90°
Main bearing cap x Cylinder block	1st	39	400	29
	2nd	Turn 90°	Turn 90°	Turn 90°
No.1 balance shaft, No.2 balance chaft x Timing gear		36	365	26
Balance shaft thrust plate x Cylinder block		18	185	13
Rear oil seal retainer x Cylinder block		13.5	135	9.7
Engine mounting bracket x Cylinder block		51	520	38
Engine coolant drain plug x Cylinder block		24.5	250	18
Oil filter bracket union x Cylinder block		25	250	18
Oil filter bracket x Cylinder block		28	290	21
Water bypass pipe x Cylinder block		20	200	14
Knock sensor (3RZ—FE) x Cylinder block		37	380	27
Fuel filter (3RZ—FE) x Cylinder block		20	200	14
Rear end plate x Cylinder block		18	185	13
Rear end plate x Water bypass pipe		20	200	14
Flywheel x Crankshaft	1st	26.5	270	19
	2nd	Turn 90°	Turn 90°	Turn 90°
Drive plate x Crankshaft		74	750	54
Fuel pump x Cylinder head (3RZ—F)		28	280	21
Accelerator braket x Cylinder head (3RZ—F)		21	210	15

FUEL SYSTEM

PRECAUTION

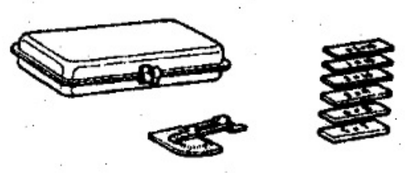
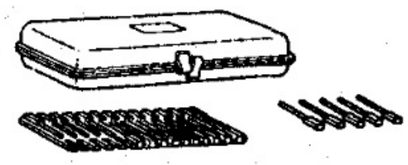
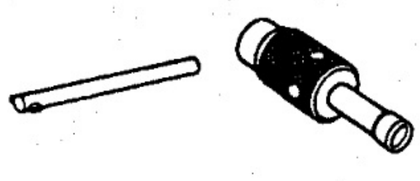
EG0UP–05

1. Disconnect the negative (−) terminal cable from battery.
2. When working on the fuel system, keep away from possible fire hazards and do not smoke.
3. Keep gasoline off rubber or leather parts.
4. Work on only one component group at a time to help avoid confusion between similar looking parts.
5. Keep work area clean to avoid contamination of the carburetor and components.
6. Be careful not to mix up or lose clips or springs.

PREPARATION

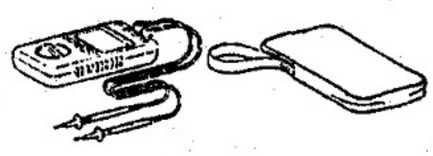
EG0UQ–05

SST (SPECIAL SERVICE TOOLS)

	09240–00014 Carburetor Adjusting Gauge Set	
	09240–00020 Wire Gauge Set	
	09243–00020 Idle Adjusting Screw Wrench	
	09922–00010 Wrench 5 x 12 mm	

EG0UR–04

RECOMMENDED TOOLS

	09082–00040 TOYOTA Electrical Tester.	
	09200–00010 Engine Adjust Kit .	
	09860–11011 Carburetor Driver Set.	

EG0US–04

EQUIPMENT

Torque wrench	

ON—VEHICLE INSPECTION

EG782-01

1. REMOVE INTAKE AIR CONNECTOR FROM CARBURETOR

2. INSPECT CARBURETOR AND LINKAGE

(a) Check that the various set screws, plugs and union bolts are tight and correctly installed.

(b) Check the linkage for excessive wear and missing snap rings.

(c) Check that the throttle valves open fully when the accelerator pedal is fully depressed.

COLD ENGINE

3. INSPECT AUTOMATIC CHOKE SYSTEM

(a) Disconnect the wiring connector.

(b) Using an ohmmeter, measure the resistance between the coil housing terminal (red wire) and body ground.

Resistance:

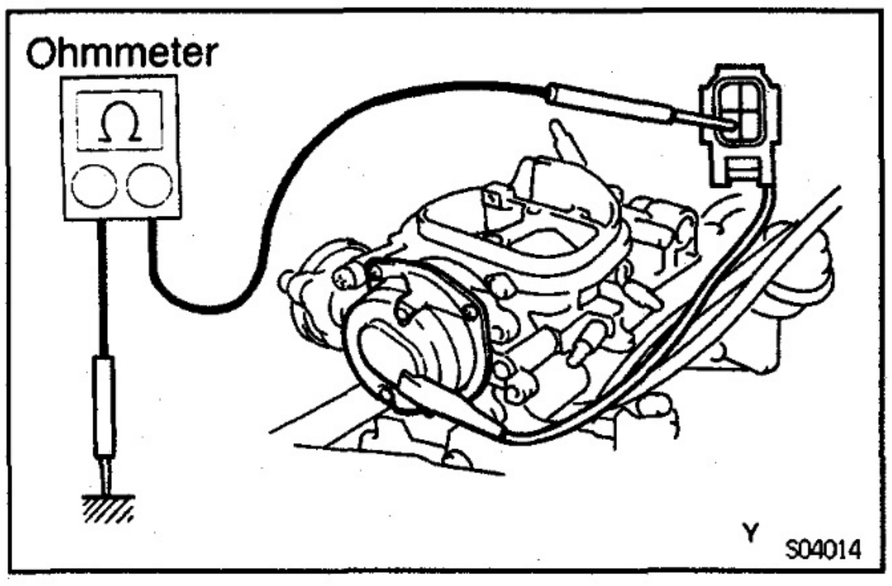
At 20°C (68°F): 17 — 19 Ω

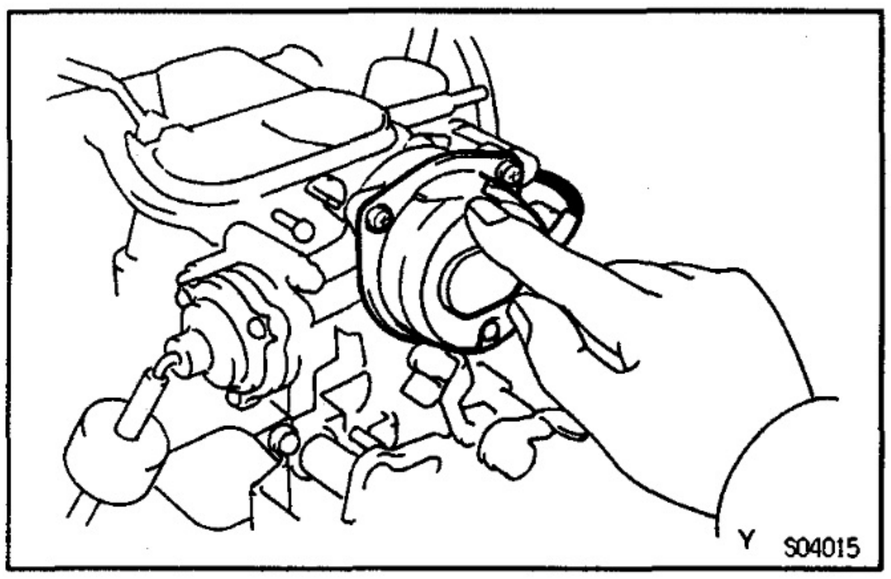
(c) Connect the wiring connector.

(d) Start the engine.

(e) Shortly after, check that the choke valve begins to open and the coil housing (choke heater) is heated.

(f) Stop the engine.





4. INSPECT CHOKE BREAKER (CB) SYSTEM

(a) Start the engine.

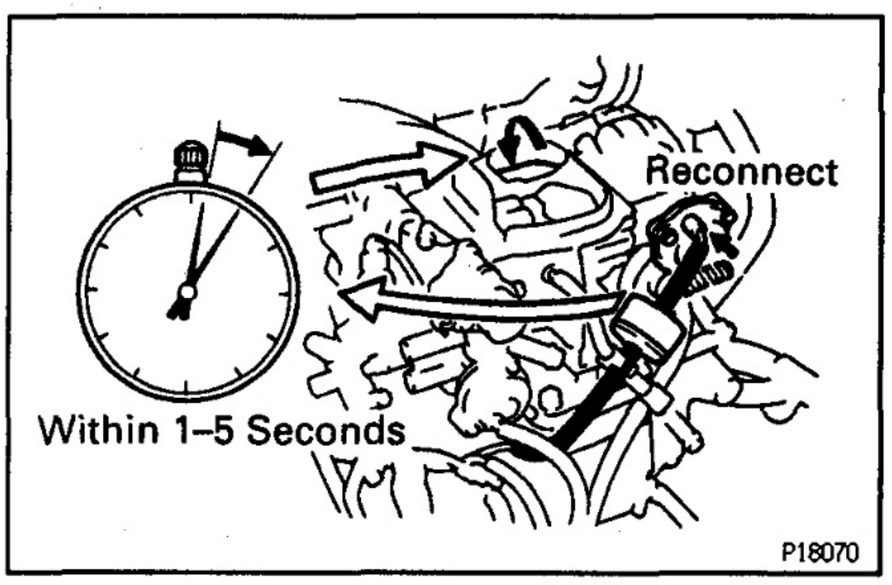
(b) Disconnect the vacuum hose from the CB and check that the choke valve moves.

(c) Reconnect the vacuum hose to the CB and check that the choke valve moves within the specified time after reconnecting the hose.

Time:

1 — 5 seconds

(d) Stop the engine.



5. INSPECT AUXILIARY ACCELERATION PUMP (AAP) SYSTEM

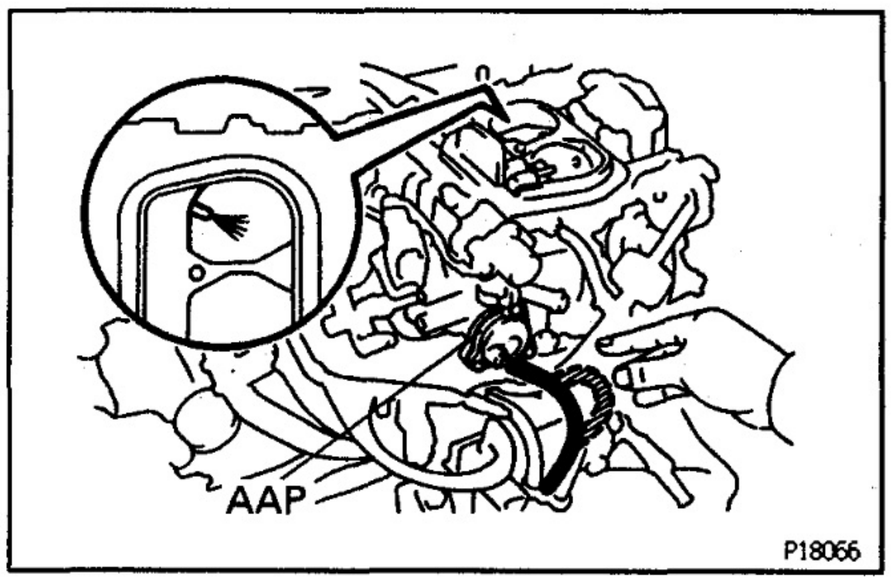
(a) Check that the coolant tempeature is below 55°C (131°F).

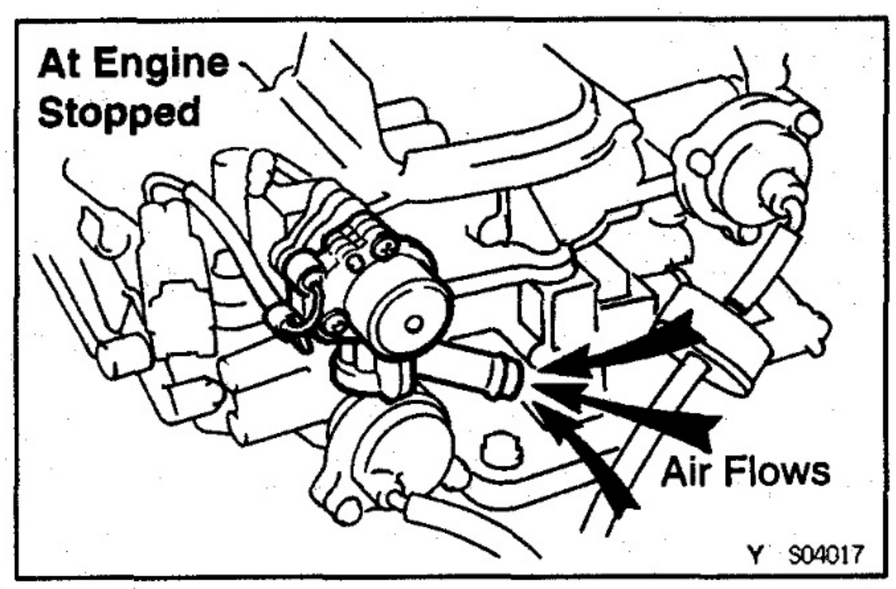
(b) Start the engine.

(c) Pinch the AAP hose, and stop the engine.

(d) Release the hose.

(e) Check that gasoline spurts out from the acceleration nozzle.

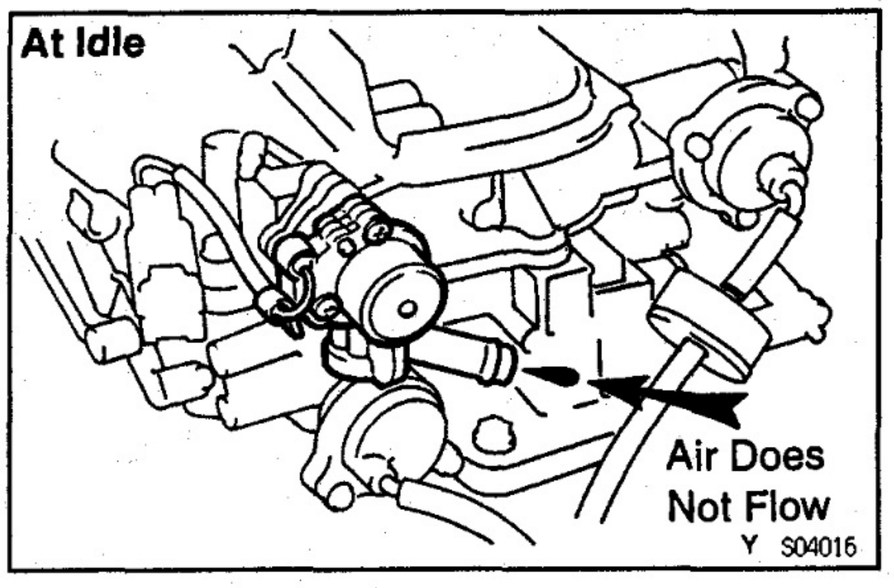




6. INSPECT OUTER VENT CONTROL VALVE (OVCV) OPERATION

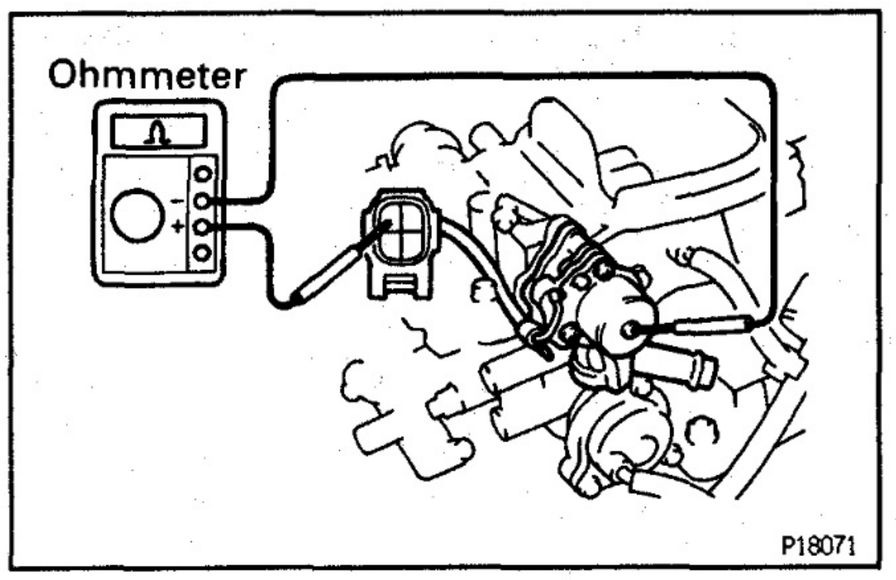
(a) Disconnect the outer vent hose from the carburetor.

(b) Blow air into the outer vent pipe and check that the OVCV is open.



(c) Start the engine.

(d) With the engine idling, blow air into the outer vent pipe and check that the OVCV is closed.



(e) Disconnect the carburetor connector.

(f) Using an ohmmeter, measure the resistance between the OVCV terminal of the carburetor connector and body ground.

Resistance:

Cold: 32 – 38 Ω

(g) Reconnect the outer vent hose.

HOT ENGINE

7. INSPECT CHOKE VALVE

Check that the choke valve opens fully.

8. INSPECT AUXILIARY ACCELERATIONS PUMP (AAP) SYSTEM

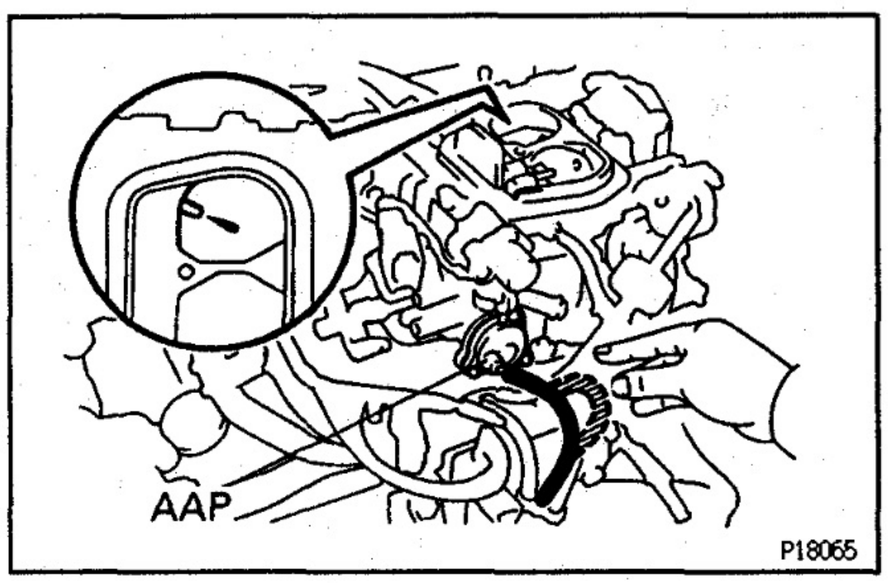
(a) Warm up the engine to normal operating temperature.

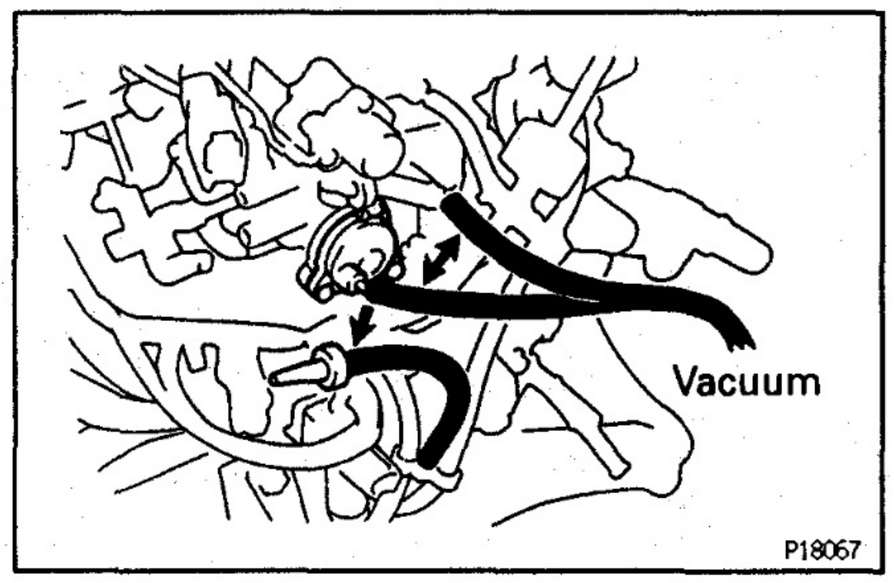
(b) Start the engine.

(c) Pinch the AAP hose, and stop the engine.

(d) Release the hose.

(e) Check that gasoline does not spurt out from the acceleration nozzle.





9. INSPECT AUXILIARY ACCELERATION PUMP (AAP) DIAPHRAGM

(a) Start the engine.

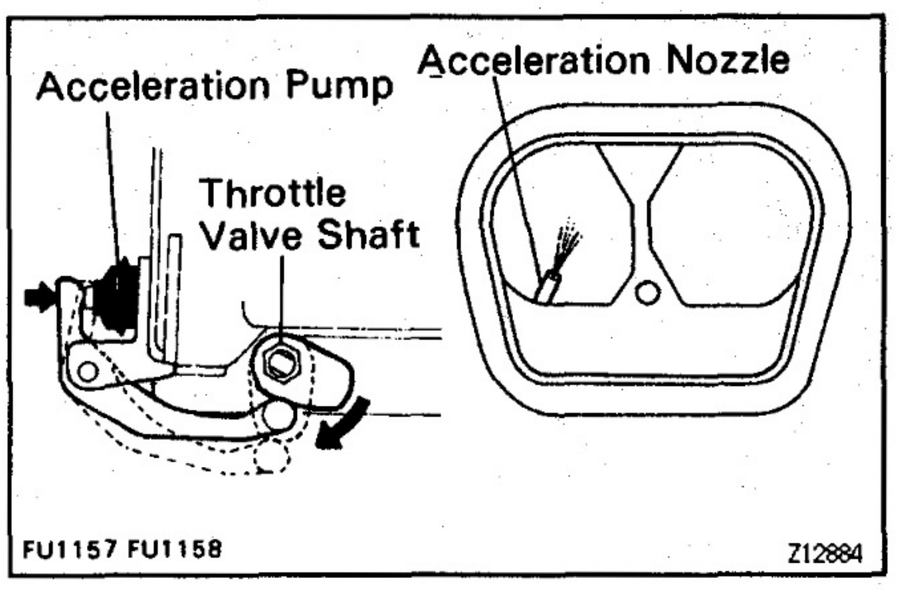
(b) Disconnect the hose from the AAP.

(c) Apply and release the vacuum directly to the AAP at idle.

(d) Check that the engine rpm changes by releasing vacuum.

(e) Reconnect the AAP hose.

If a problem is found, replace the AAP diaphragm.



EG

10. INSPECT ACCELERATION PUMP

Open the throttle valve, and check that gasoline spurts out from the acceleration nozzle.

11. INSTALL AIR INTAKE CONNECTOR

12. CHECK AND ADJUST IDLE SPEED AND IDLE MIXTURE

(See idle CO check and adjust in Engine Mechanical)

13. CHECK AND ADJUST FAST IDLE SPEED

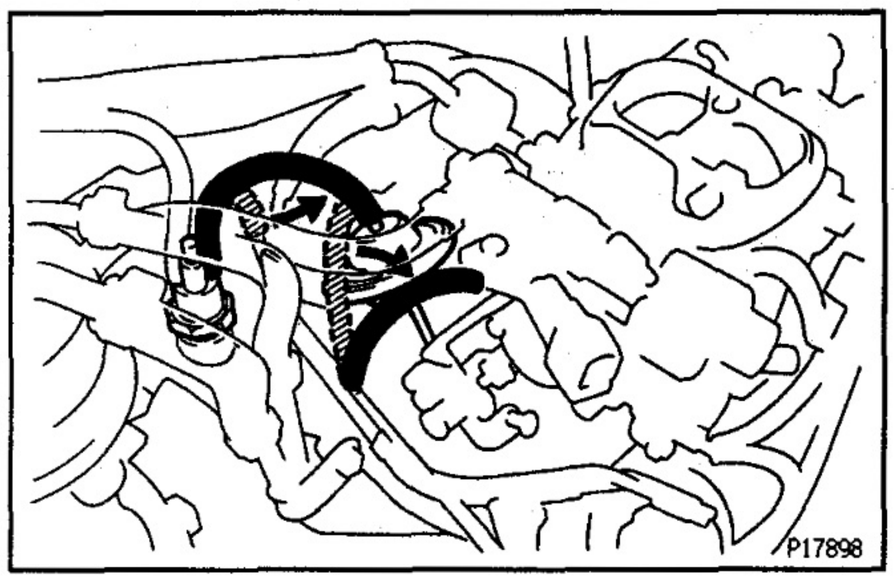
(See fast idle speed inspection and adjustment in Engine Mechanical)

14. CHECK AND ADJUST THROTTLE POSITIONER (TP) SETTING SPEED

(a) Warm up and stop engine.

(b) Connect tachometer to engine.

(c) Start the engine.



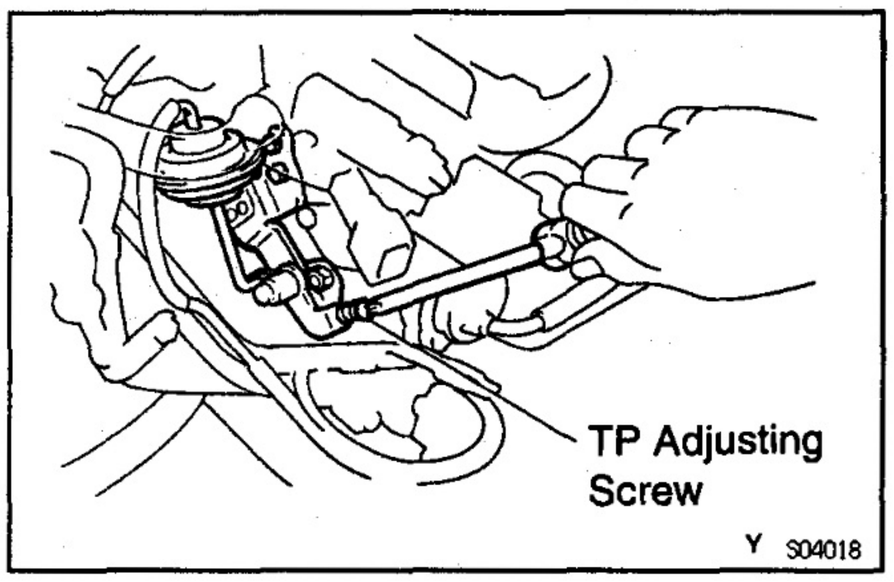
(d) Disconnect the vacuum hoses from the gas filter and TP.

(e) Connect the vacuum hose which you have disconnected from the gas filter onto the TP.

(f) Check the TP setting speed.

TP setting speed:

1,270 – 1,470 rpm



If the TP setting speed is not as specified, adjust the setting speed by turning the TP adjusting screw.

TP setting speed:

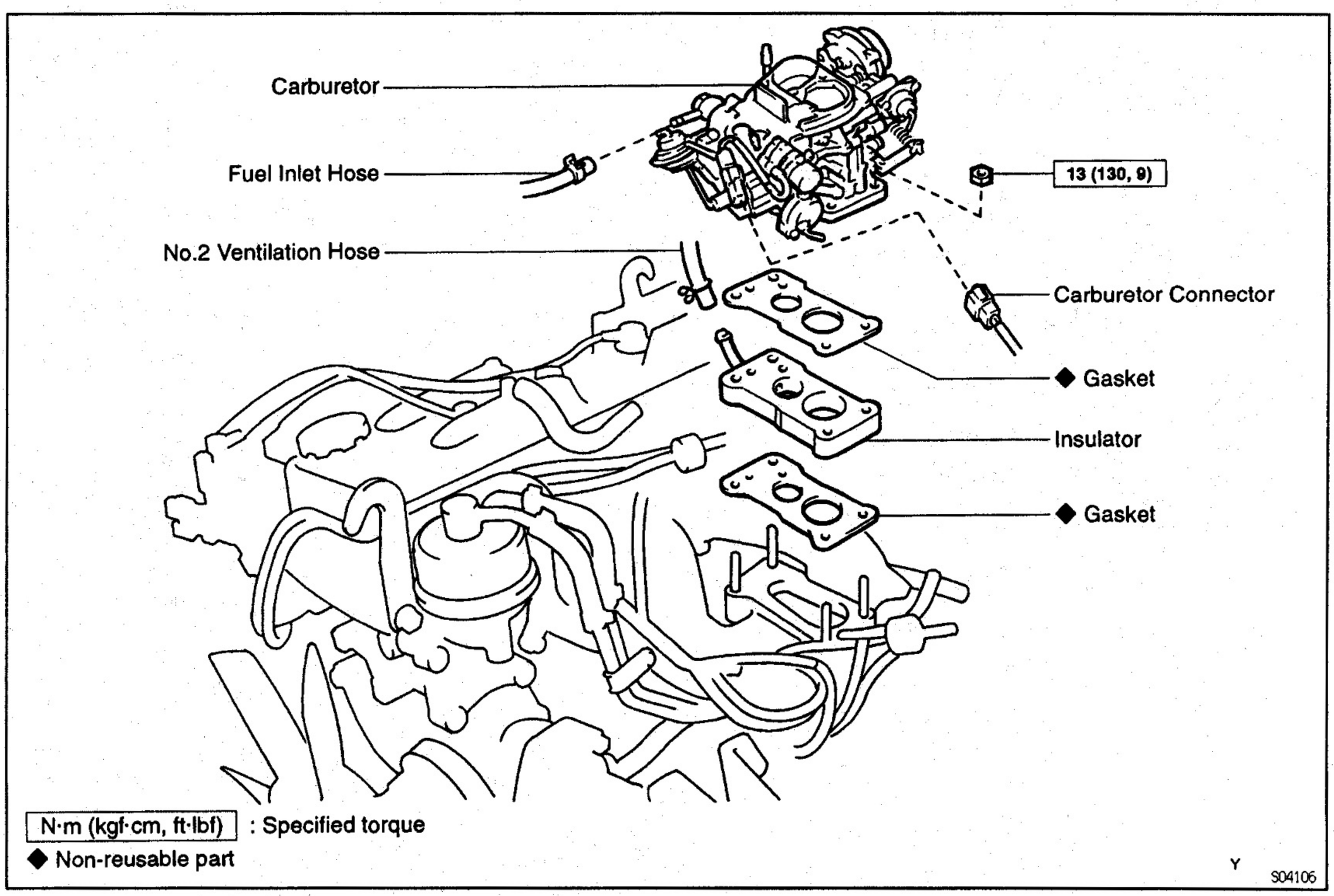
1,370 rpm

(g) Reconnect the vacuum hose and check the idle speed.

CARBURETOR

COMPONENTS FOR REMOVAL AND ASSEMBLY

EG40Z-02

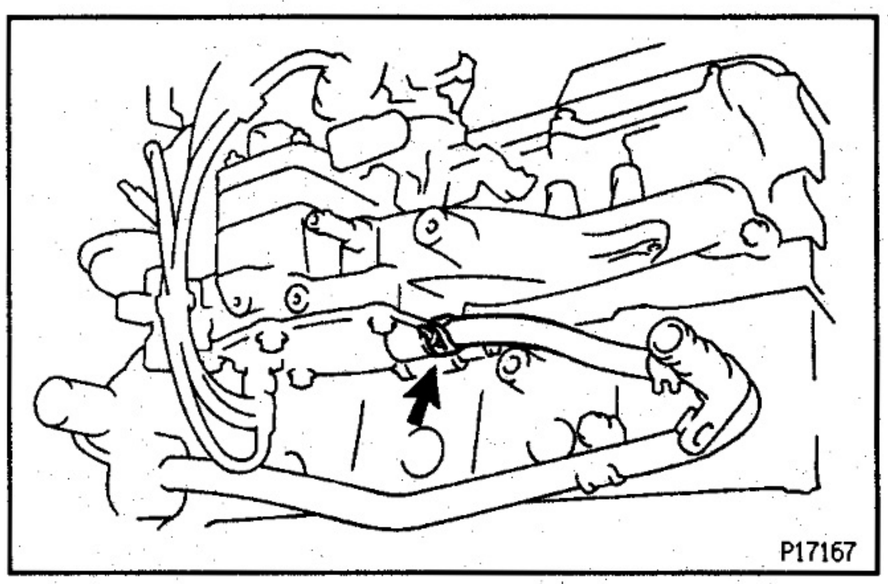


N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

Y

S04106



P17167

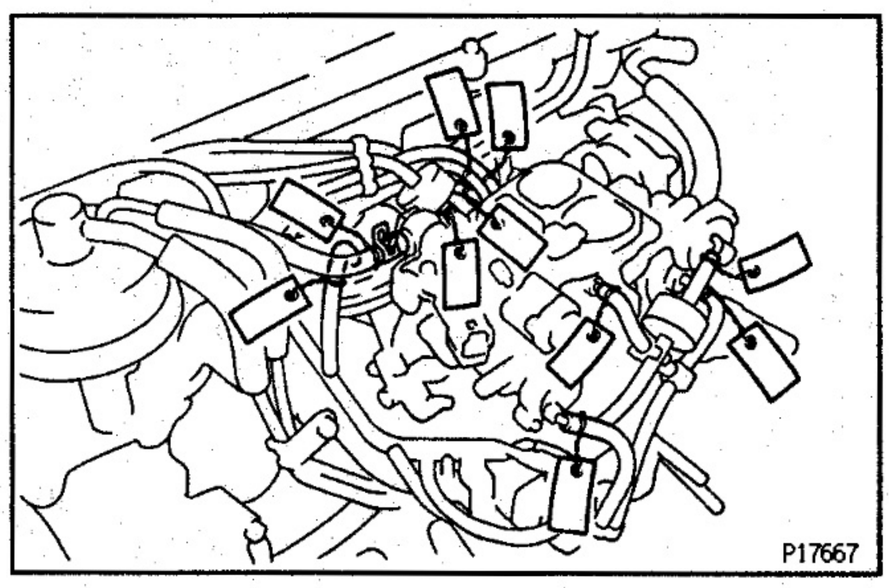
EG410-02

CARBURETOR REMOVAL

1. **DRAIN COOLANT**

   Disconnect the water bypass hose from the intake manifold and drain the coolant from the manifold.

2. **DISCONNECT CARBURETOR CONNECTOR**



P17667

3. **DISCONNECT FOLLOWING HOSES:**

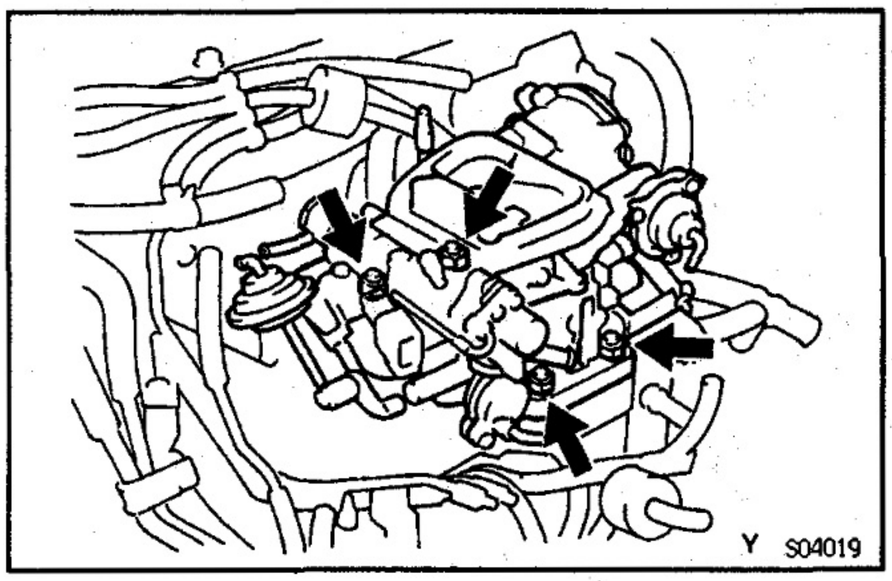
(a) Fuel inlet hose

(b) Outer vent control hose

(c) No.2 ventilation hose

(d) Emission control hoses

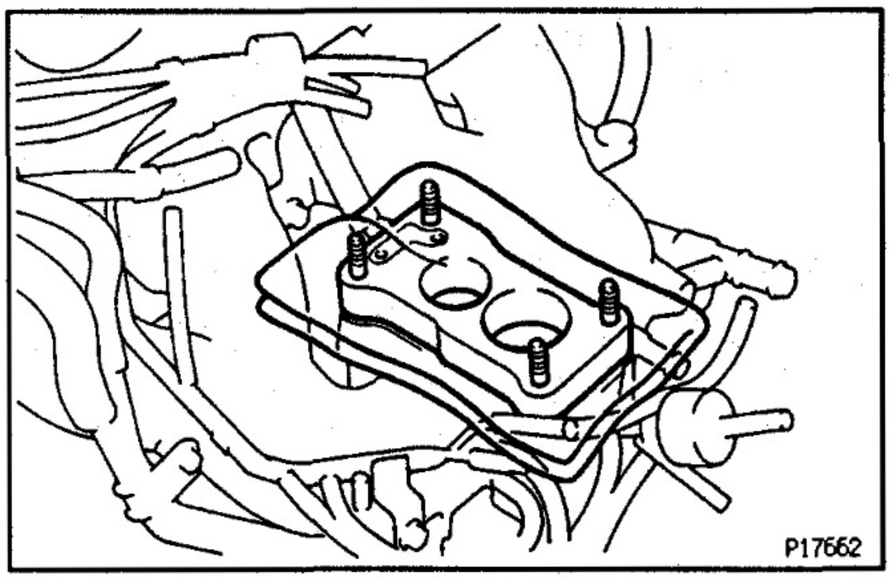
HINT: Before disconnecting the emission control hoses, use tags to identify how they should be reconnected.



4. REMOVE CARBURETOR

(a) Remove the 4 carburetor mounting nuts.

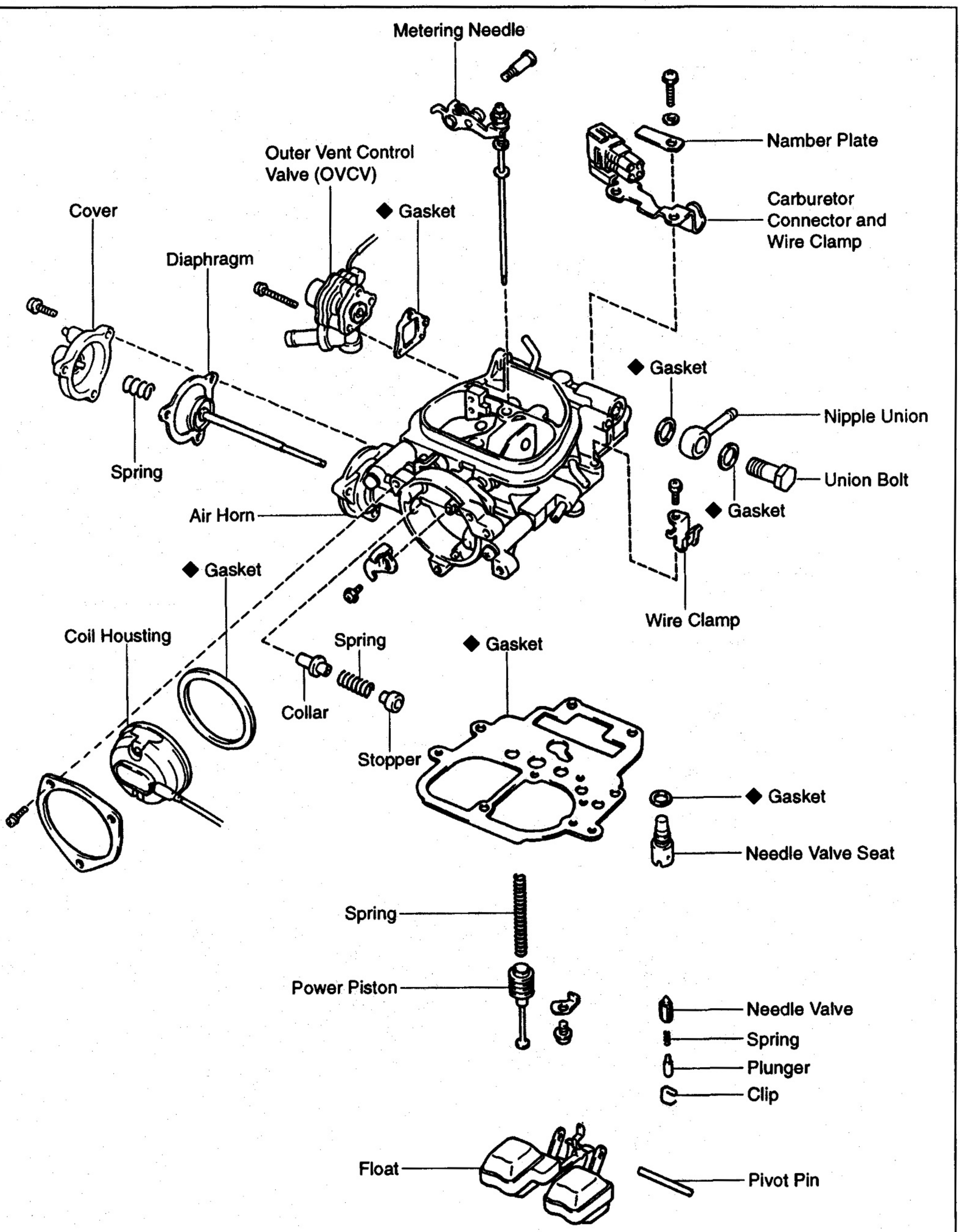
(b) Lift out the carburetor.



(c) Cover the inlet hole of the intake manifold with a cloth.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

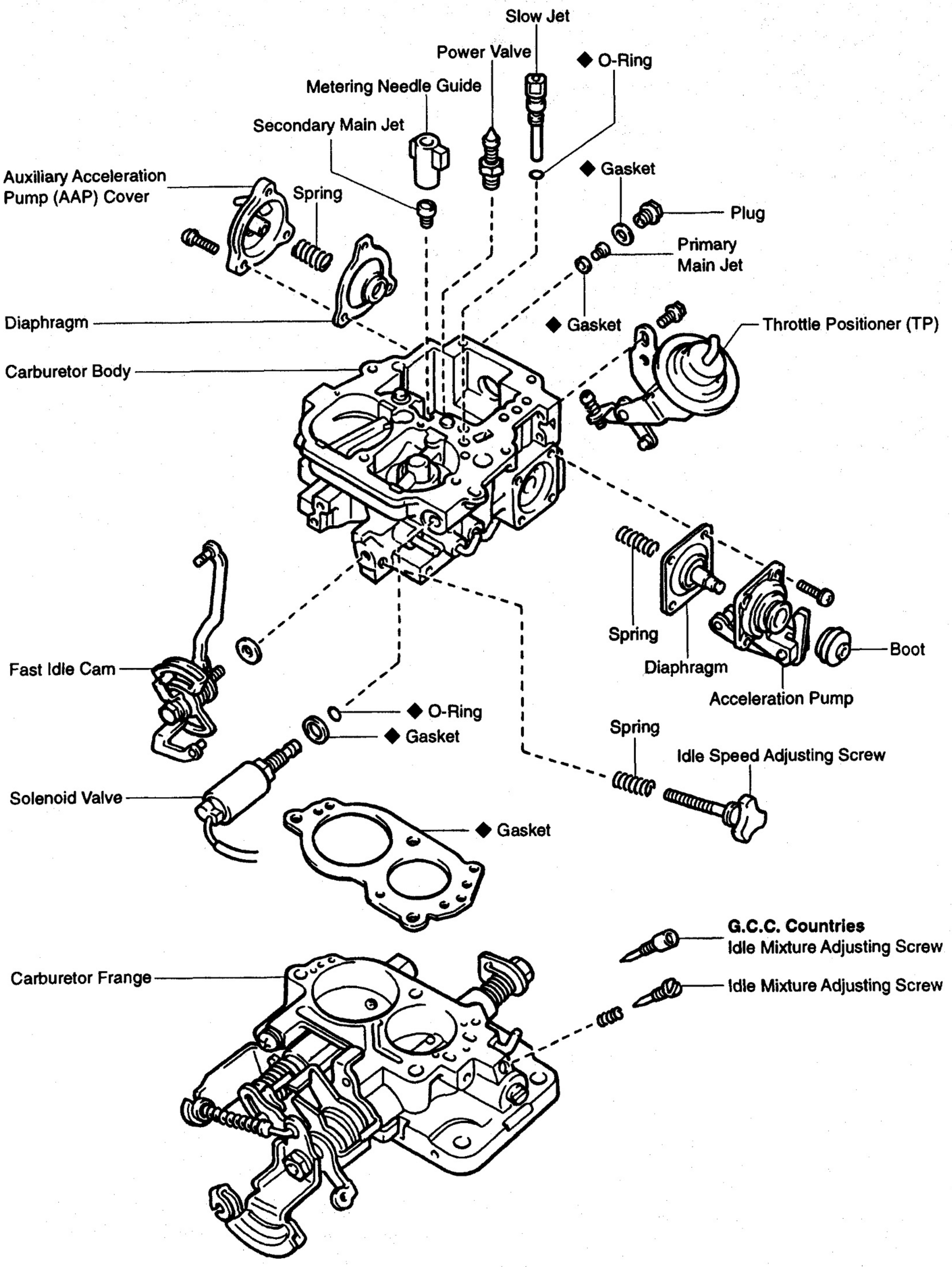
EG0UB-05



◆ Non-reusable part

Y S04104

EG



◆ Non-reusable part

Y S04105

EG783-01

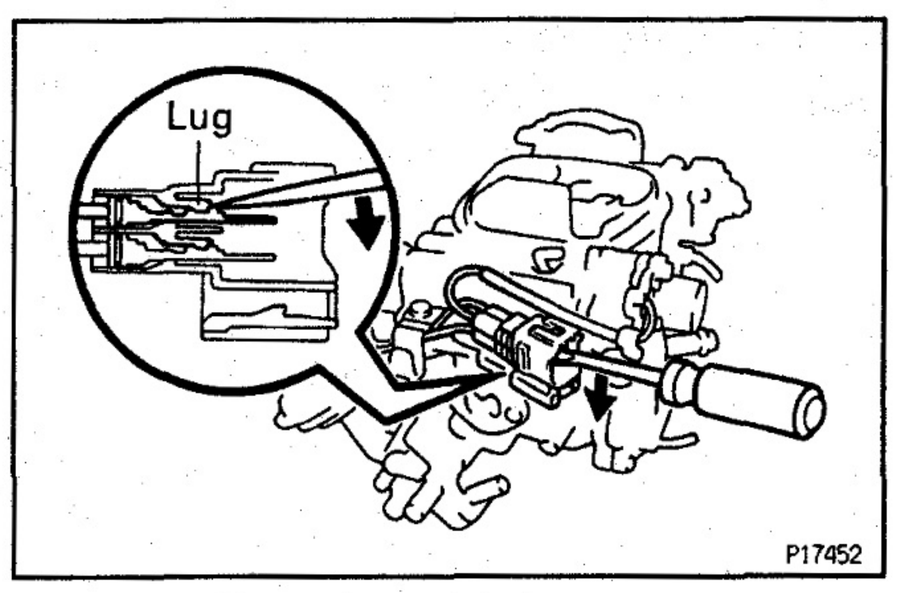
CARBURETOR DISASSEMBLY

HINT: The following instructions are organized so that you will work only on one component group at a time. This will help you avoid confusion between similar looking parts from different subassemblies being on your workbench at the same time.

(a) To facilitate reassembly, arrange parts in order.

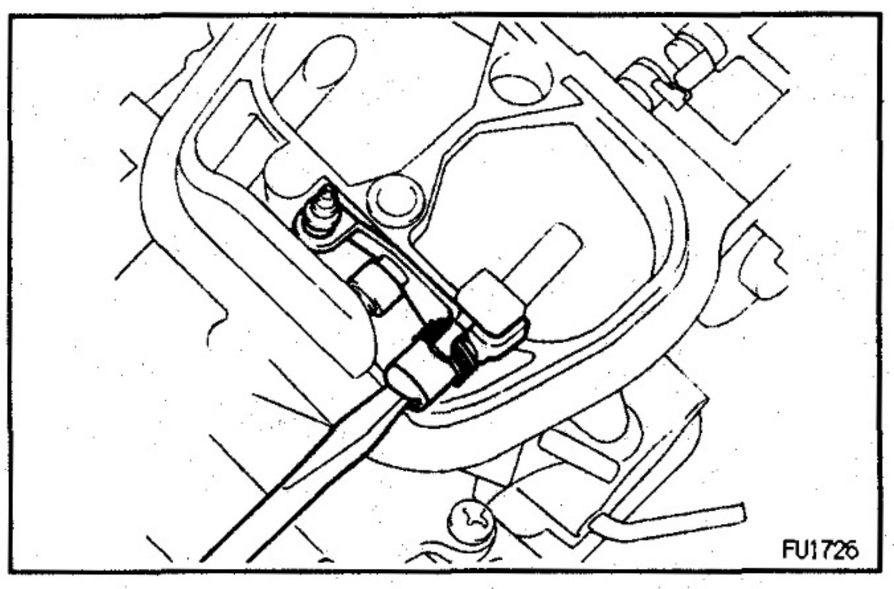
(b) Be careful not to mix up or lose balls, clips or springs.

Air Horn Disassembly



1. DISCONNECT WIRES FROM CARBURETOR CONNECTOR

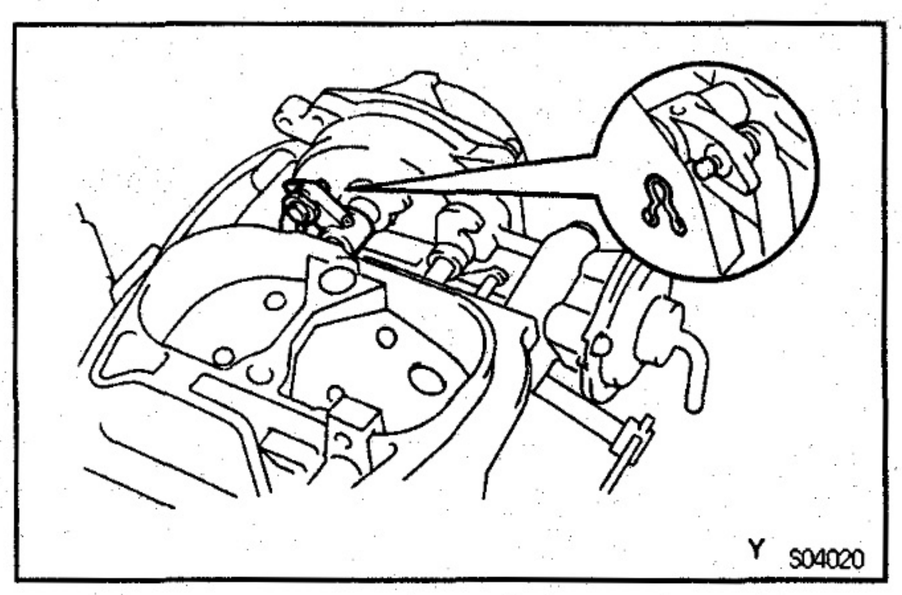
Pry up the locking lugs with a screwdriver and pull out the terminal.



2. REMOVE METERING NEEDLE

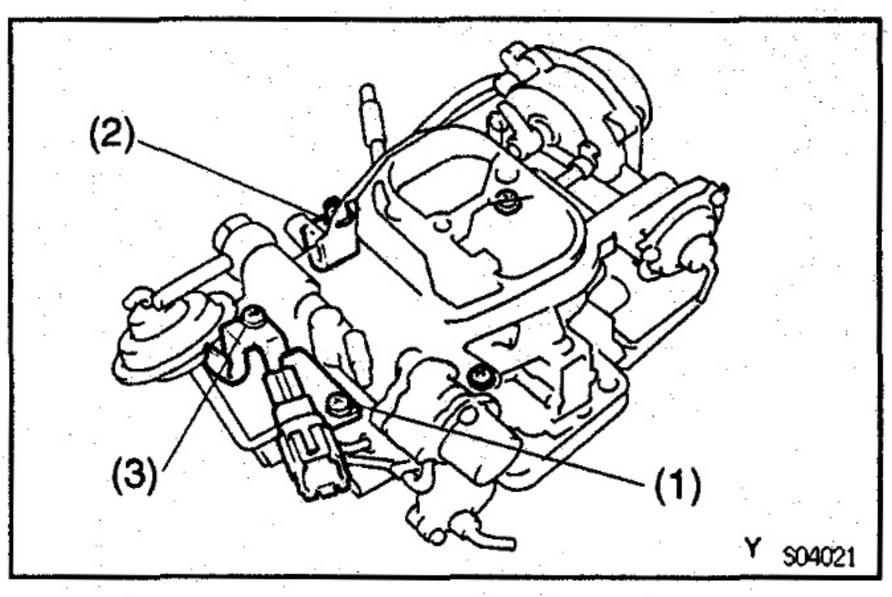
Loosen the screw and remove the metering needle.

3. REMOVE NIPPLE UNION



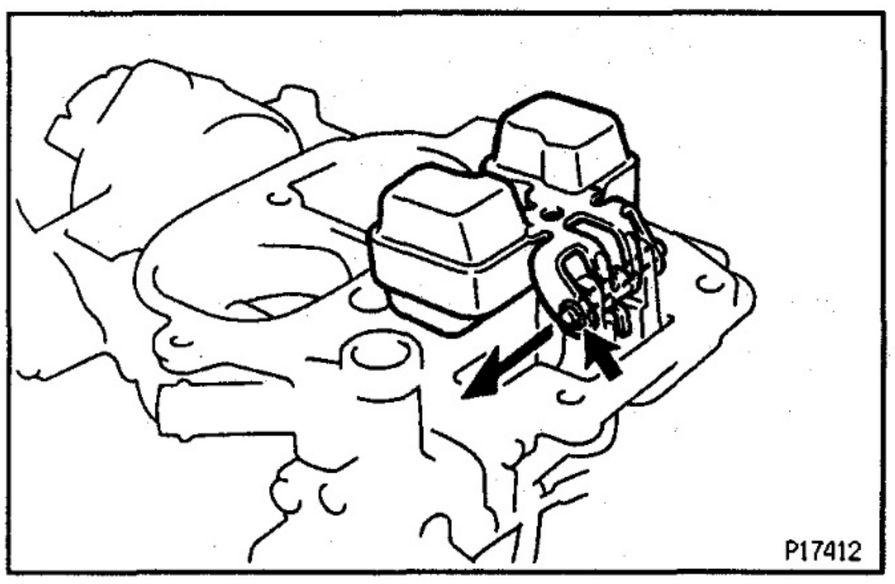
4. REMOVE AIR HORN ASSEMBLY

(a) Remove the snap ring and disconnect the fast idle link.



(b) Remove the 5 screws and following parts:
  (1) Number plate
  (2) Wire clamps
  (3) Vacuum hose clamp

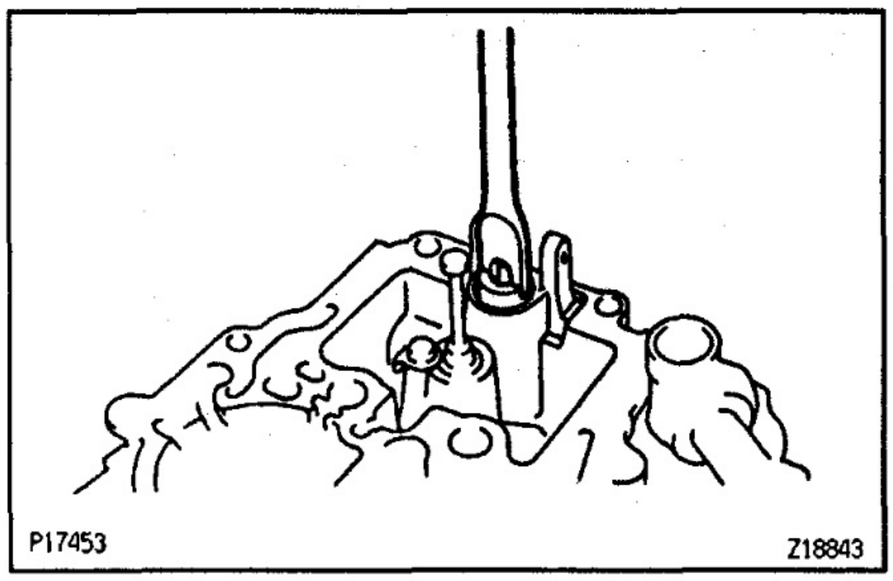
(c) Lift off the air horn assembly together with the air horn gasket.



5. REMOVE FLOAT AND NEEDLE VALVE

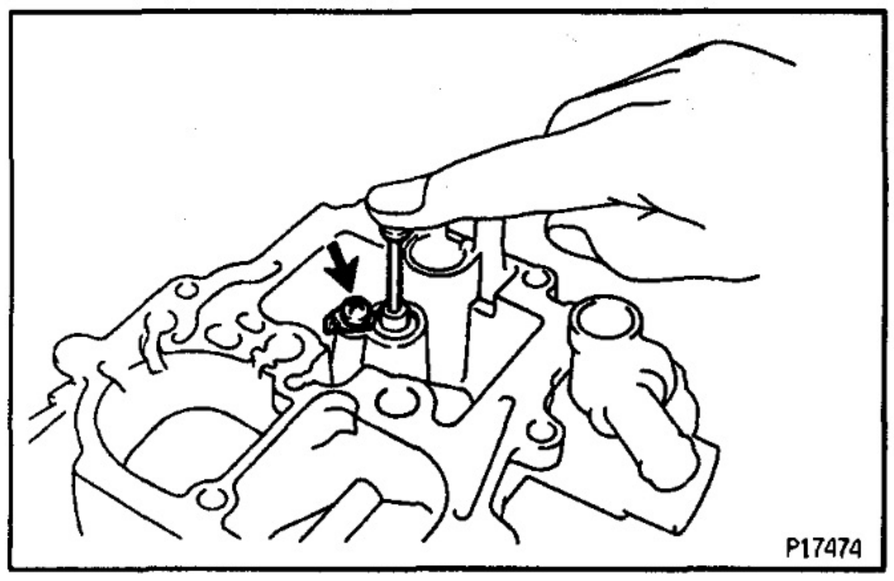
Remove the float pivot pin, float and needle valve subassembly.

6. REMOVE AIR HORN GASKET



7. REMOVE NEEDLE VALVE SEAT

Remove the needle valve seat and gasket.



8. REMOVE POWER PISTON

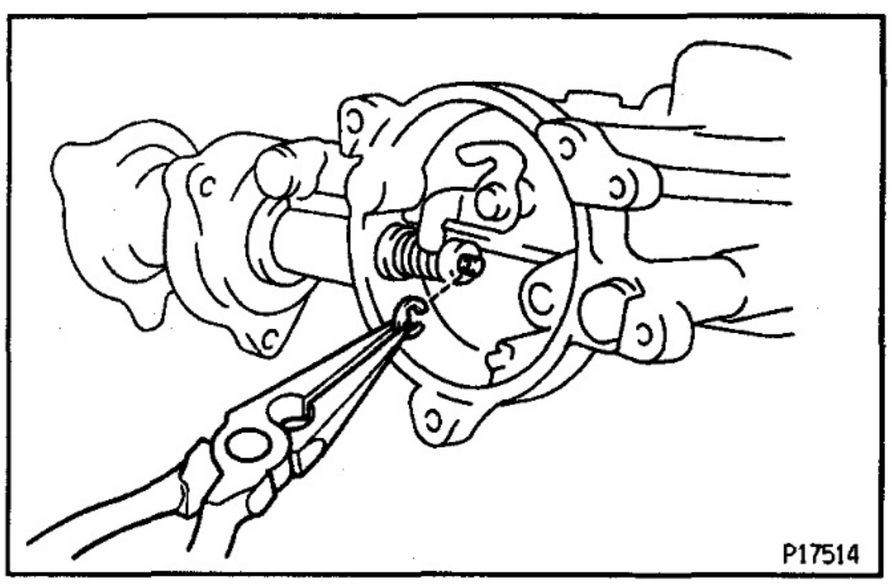
Remove the screw, retainer, power piston and spring.

9. REMOVE OUTER VENT CONTROL VALVE (OVCV)

Remove the 3 screws, wire clamp, OVCV and gasket.

10. REMOVE COIL HOUSING

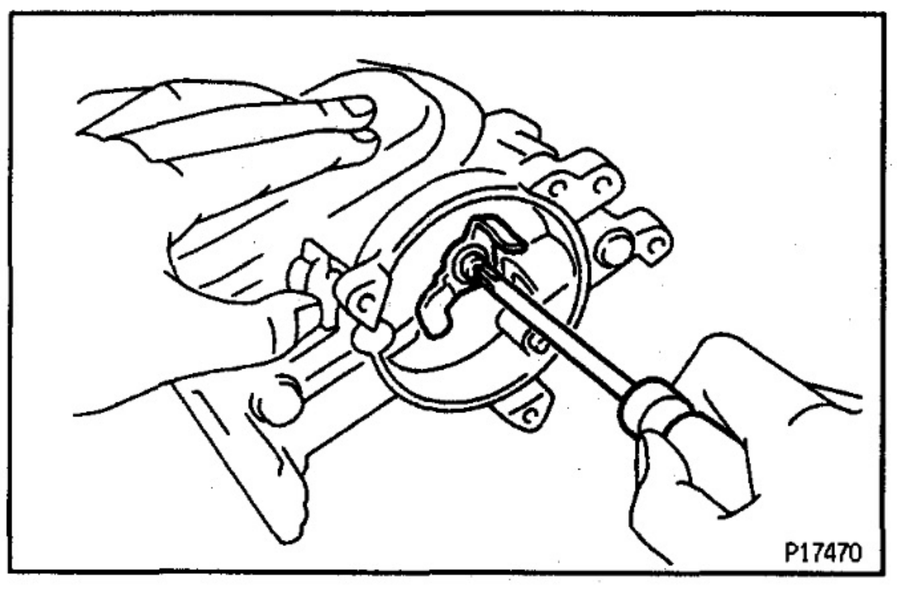
Remove the 3 screws, retainer, coil housing and gasket.



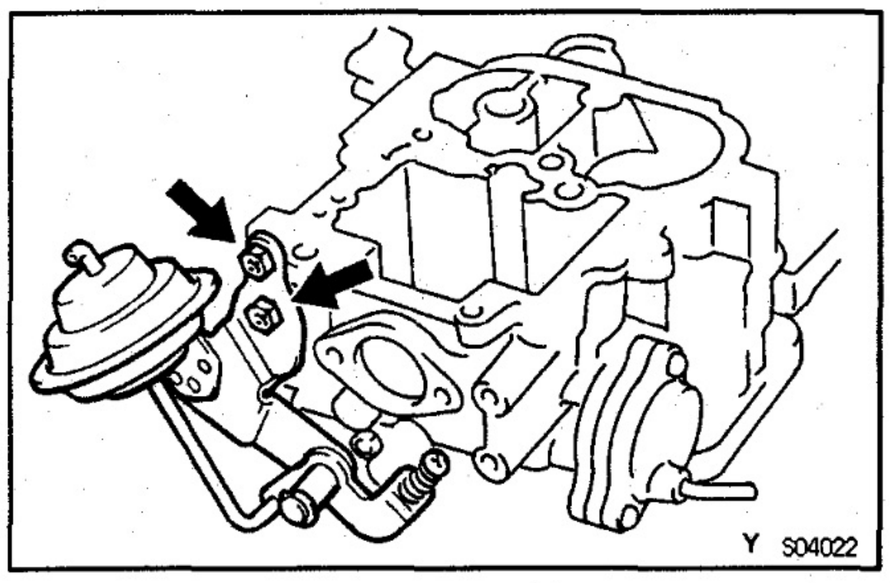
11. REMOVE CHOKE BREAKER (CB)

(a) Remove the 3 screws, cover and spring.

(b) Remove the E—ring, stopper, spring collar and diaphragm.

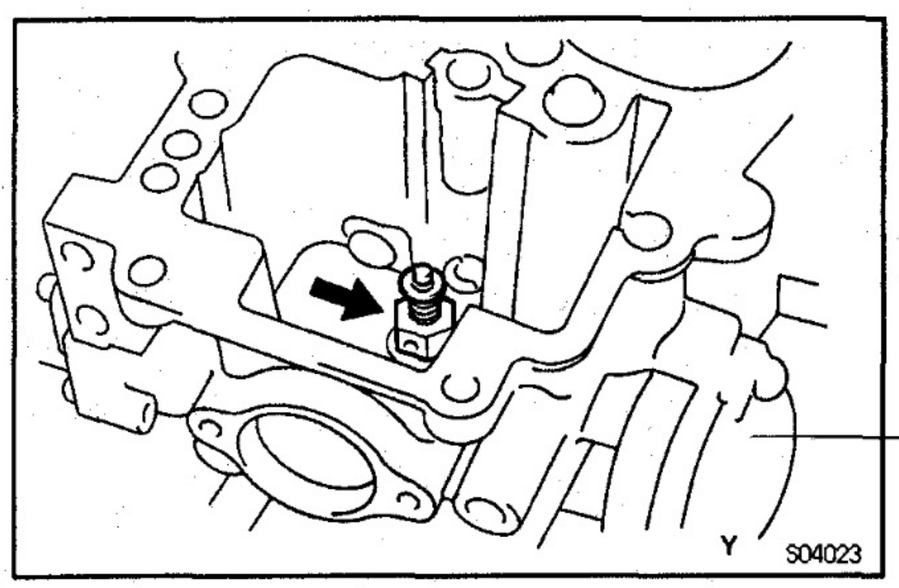


(c) Remove the screw and choke lever.

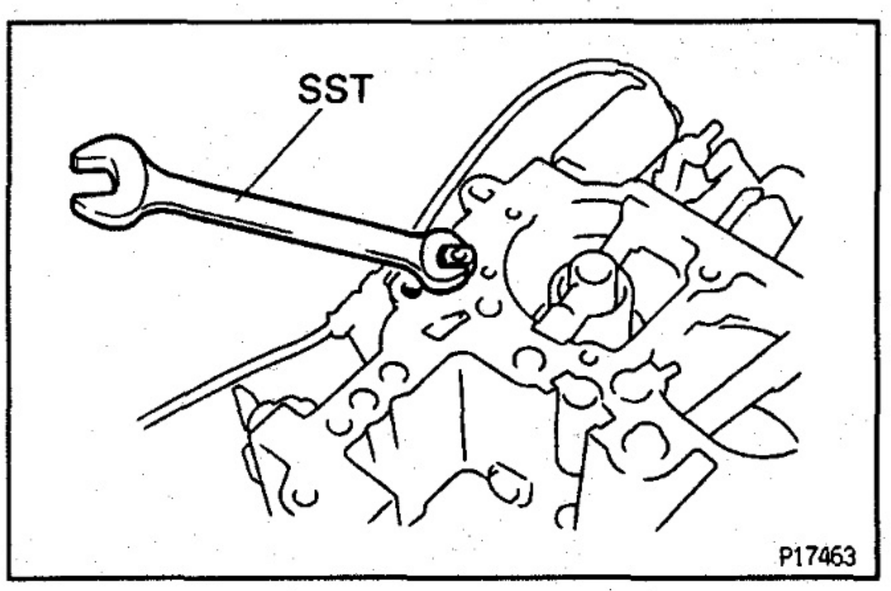


Carburetor Body Disassembly

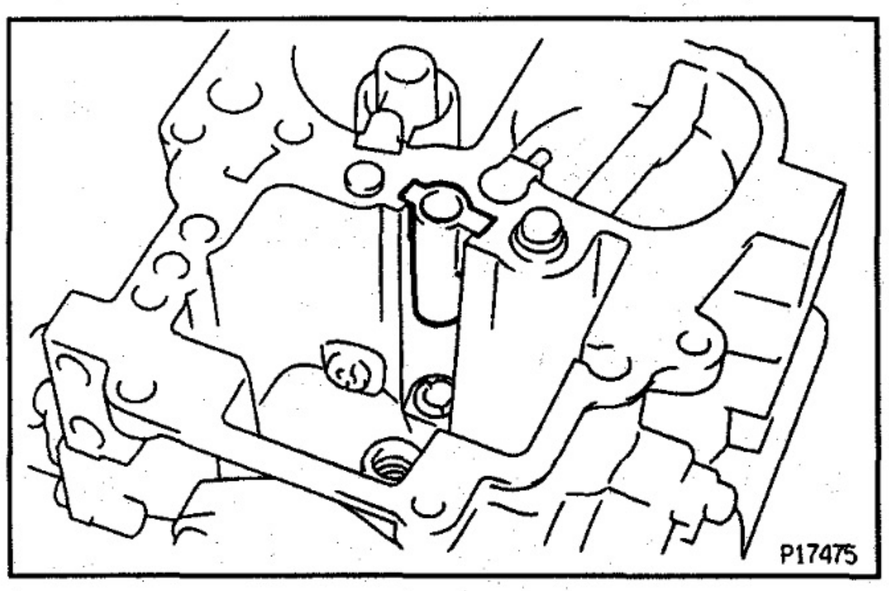
1. REMOVE THROTTLE POSITIONER (TP)
Remove the 2 screws and TP.



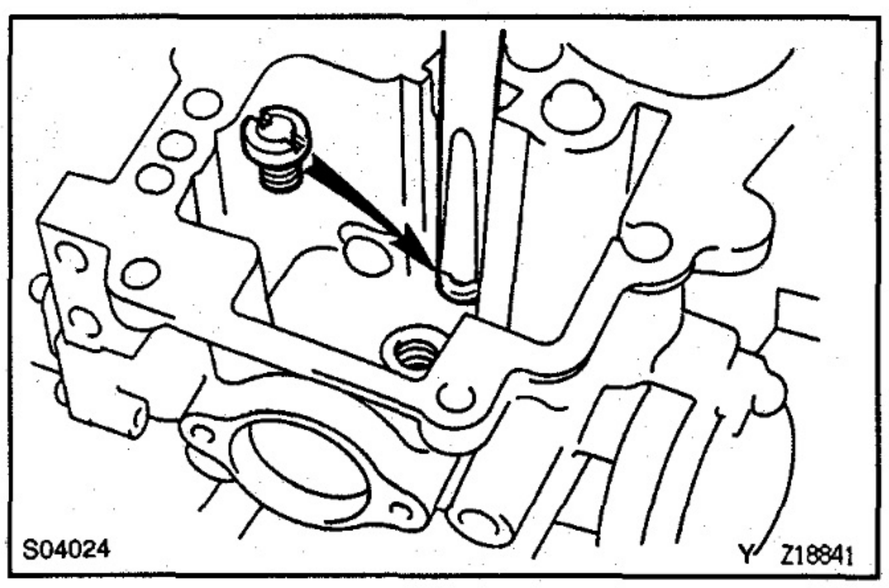
2. REMOVE POWER VALVE
Remove the power valve.



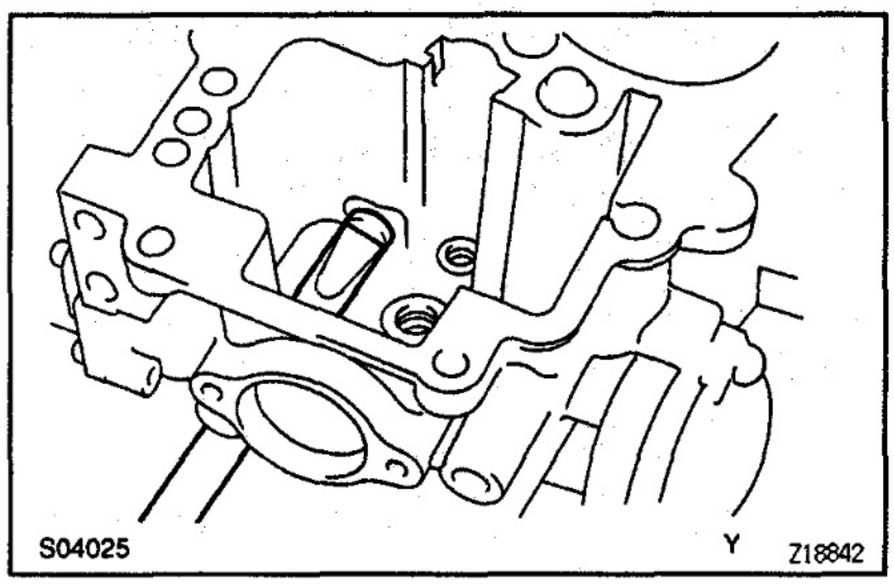
3. REMOVE SLOW JET
Using SST, remove the slow jet.
SST 09922–00010



4. REMOVE SECONDARY MAIN JET
(a) Remove the metering needle guide.



(b) Remove the secondary main jet.



5. REMOVE PRIMARY MAIN JET

(a) Remove the passage plug and gasket.

(b) Remove the primary main jet and gasket.

6. REMOVE ACCELERATION PUMP

Remove the 4 screws, pump housing, spring and diaphragm.

7. REMOVE AUXILIARY ACCELERATION PUMP (AAP)

Remove the 3 screws, pump housing, spring and diaphragm.

8. REMOVE FUEL CUT SOLENOID VALVE

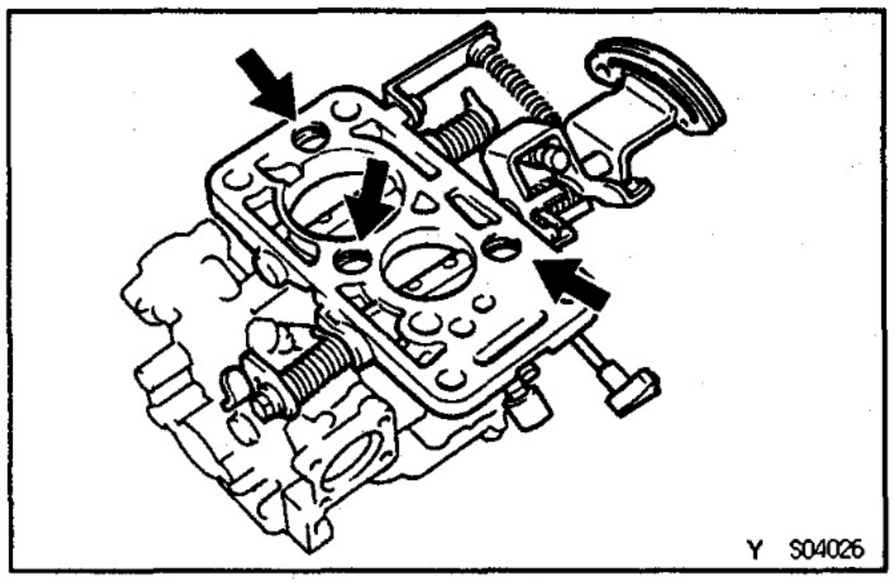
Remove the solenoid valve and gasket.

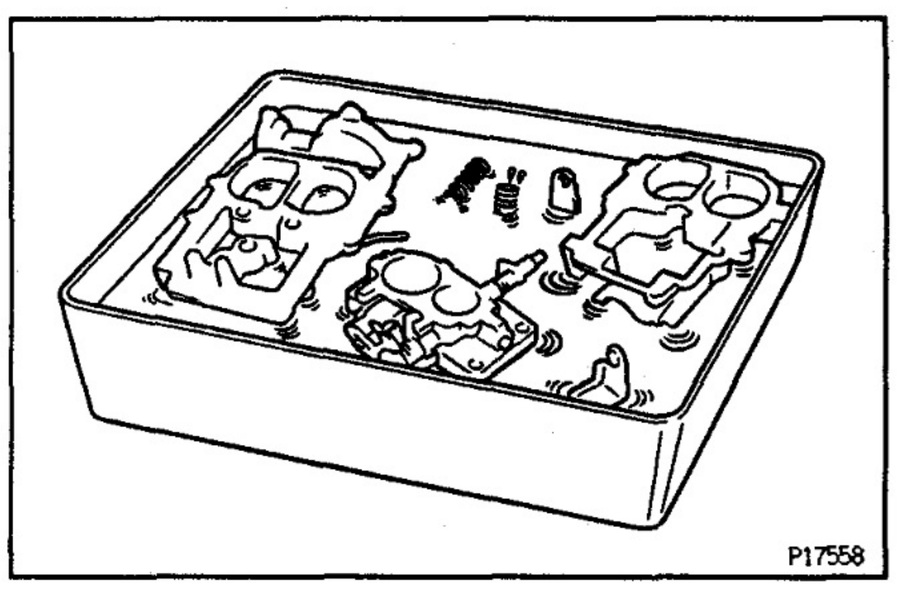
9. REMOVE FAST IDLE CAM

10. SEPARATE CARBURETOR BODY AND FLANGE

(a) Remove the 3 screws.

(b) Separate the body and flange.





GENERAL CLEANING PROCEDURE

EGOUF-05

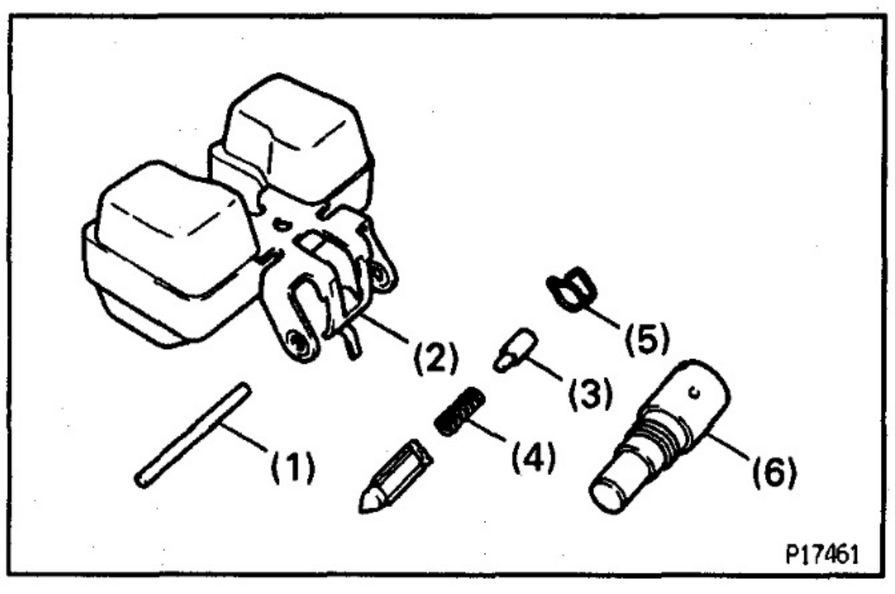
CLEAN DISASSEMBLED PARTS BEFORE INSPECTION

(a) With a soft brush wash clean the cast parts in carburetor cleaner.

(b) Clean off the carbon around the throttle valve.

(c) Wash the other parts thoroughly in carburetor cleaner.

(d) Blow all dirt and other foreign material from the jets, fuel passages and restrictions in the body.



INSPECTION OF CARBURETOR

EG7B4-01

1. INSPECT FLOAT AND NEEDLE VALVE

(a) Inspect the pivot pin (1) for scratches and excessive wear.

(b) Inspect the float (2) for broken lips and wear in the pivot pin holes.

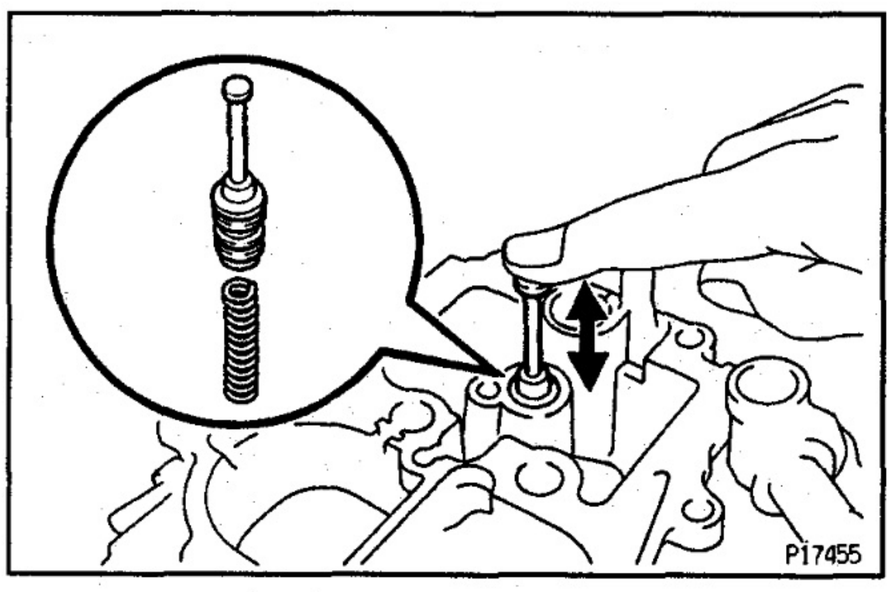
(c) Inspect the spring (3) for breaks and deformation.

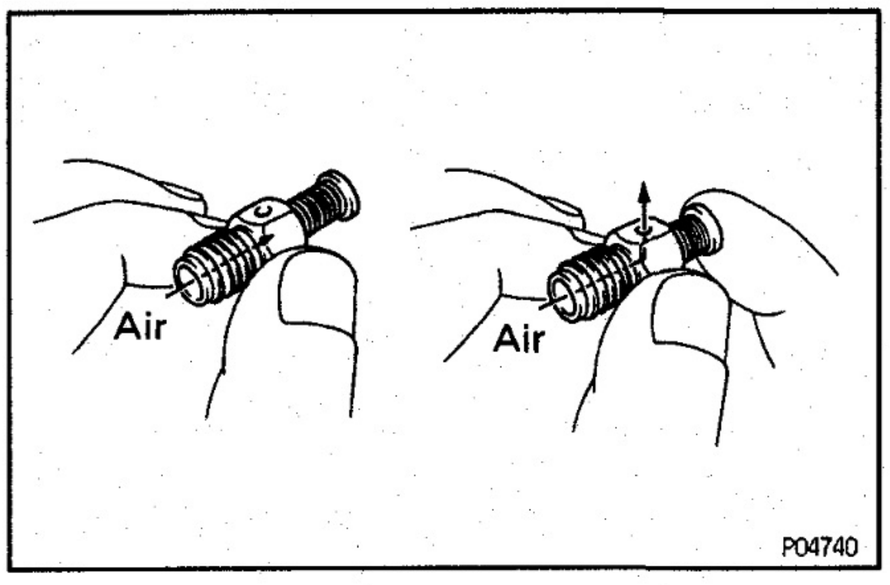
(d) Inspect the needle valve (4) and plunger (5) for wear or damage.

(e) Inspect the strainer (6) for rust and breaks.

2. INSPECT POWER PISTON

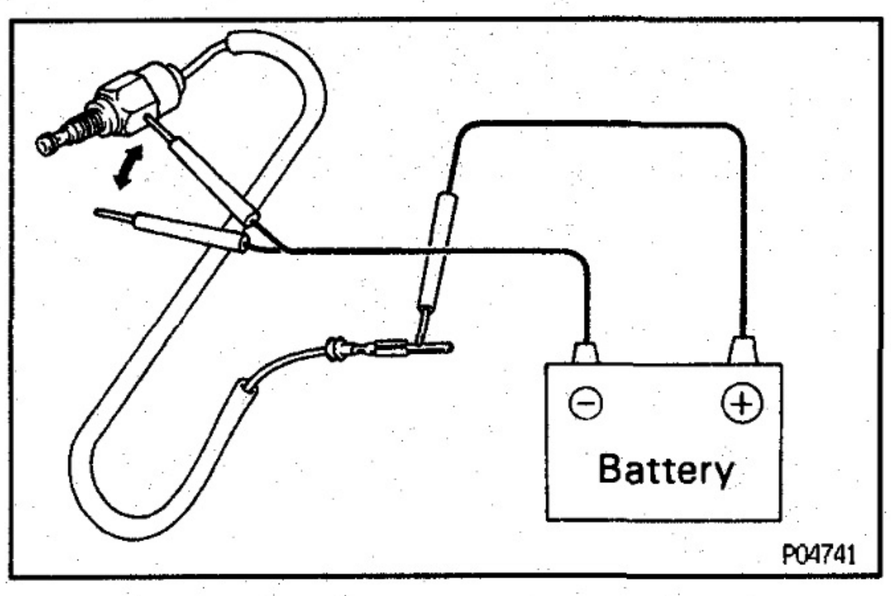
Check that the power piston moves smoothly.





3. INSPECT POWER VALVE

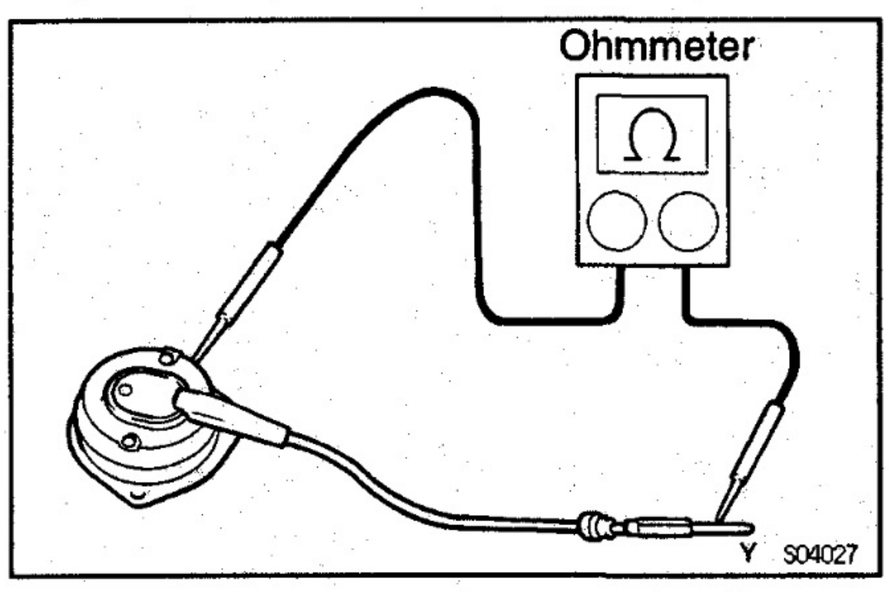
Check for faulty opening and closing action.



4. INSPECT FUEL CUT SOLENOID VALVE

(a) Connect the connector terminals to the battery terminals.

(b) You should feel a "click" from the solenoid valve when the battery power is connected and disconnected.
If the solenoid valve is not operating properly, replace it.



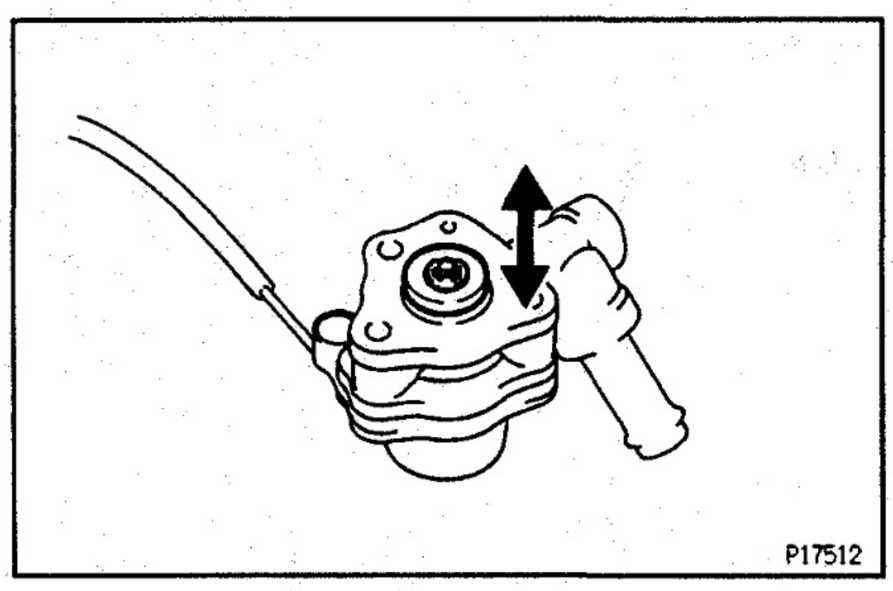
5. INSPECT CHOKE HEATER (COIL HOUSING)

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

At 20°C (68°F): 1.7 – 1.9 Ω

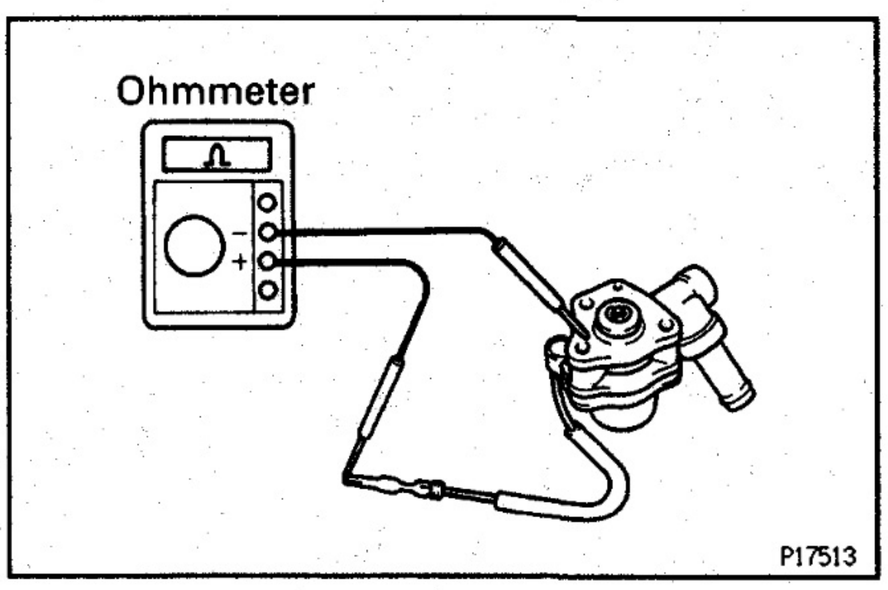
If a problem is found, replace the choke heater.



6. INSPECT OUTER VENT CONTROL VALVE (OVCV)

(a) Check the valve and seats for damage.

(b) Check the valve rod moves smoothly.

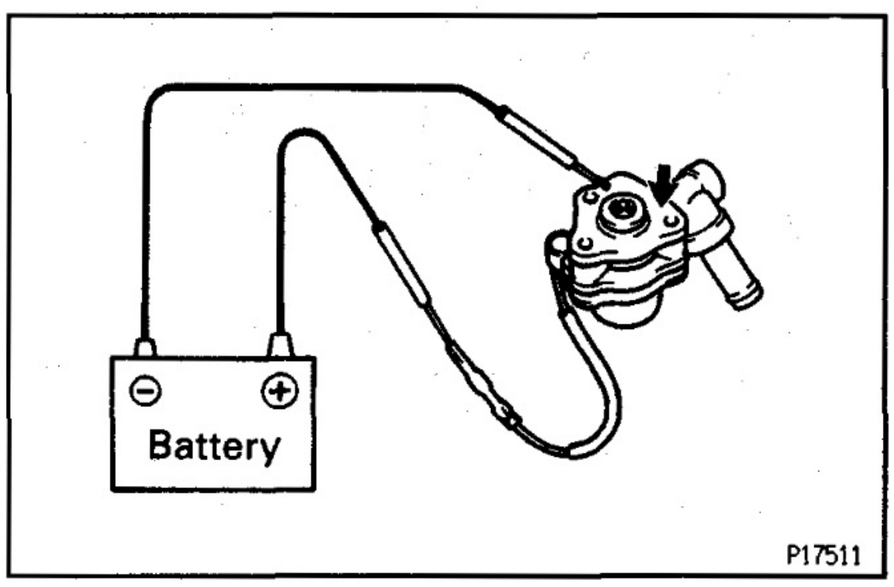


(c) Using an ohmmeter, measure the resistance between the wire terminal and body.

Resistance:

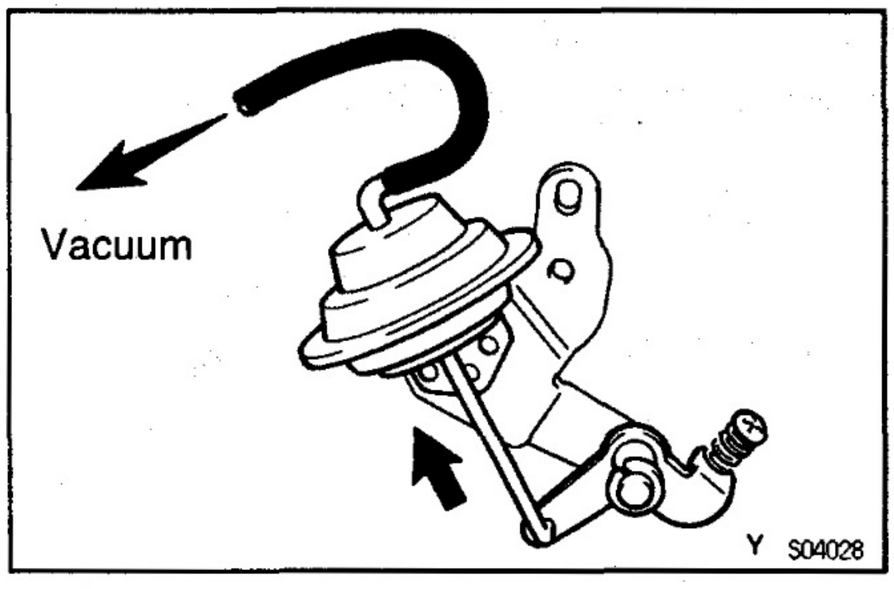
Cold: 32 – 38 Ω

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



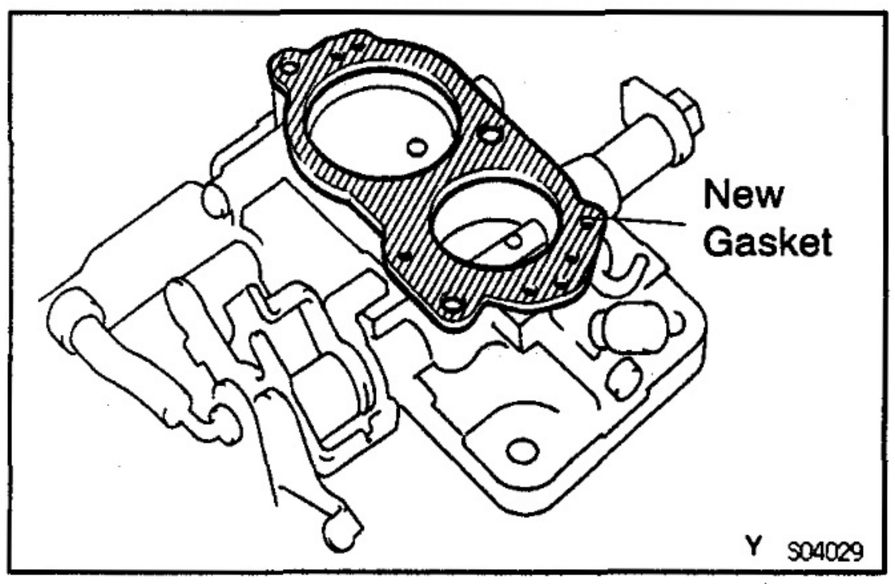
(d) Connect the OVCV body and wire terminal to the battery terminals and check that the valve retracts. If the OVCV is not operating properly, replace it.

EG



7. THROTTLE POSITIONER (TP) DIAPHRAGM

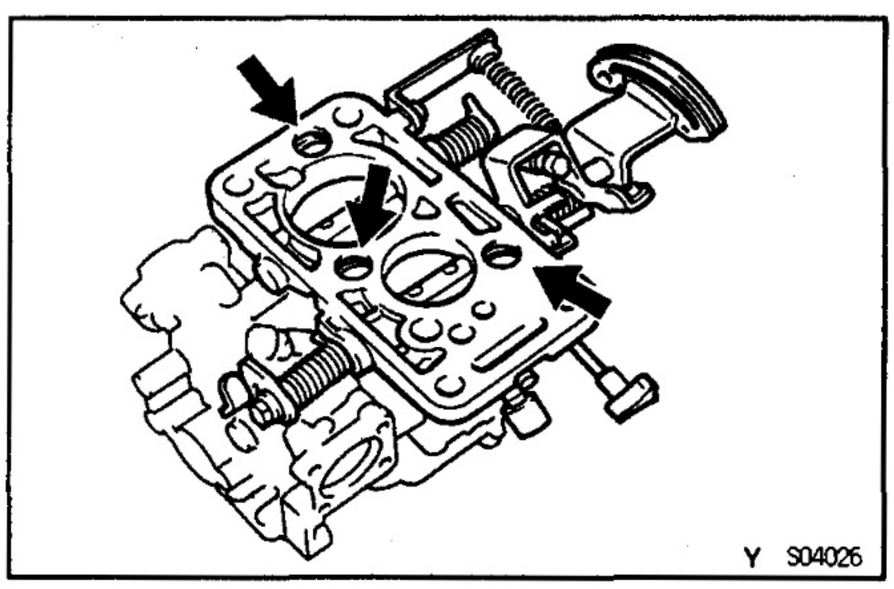
(a) Apply vacuum to the diaphragm.
(b) Check that the vacuum does not drop immediately.
(c) Check that the link moves when vacuum is applied.



EG785-01

CARBURETOR ASSEMBLY

HINT: Use new gaskets and O—rings throughout.

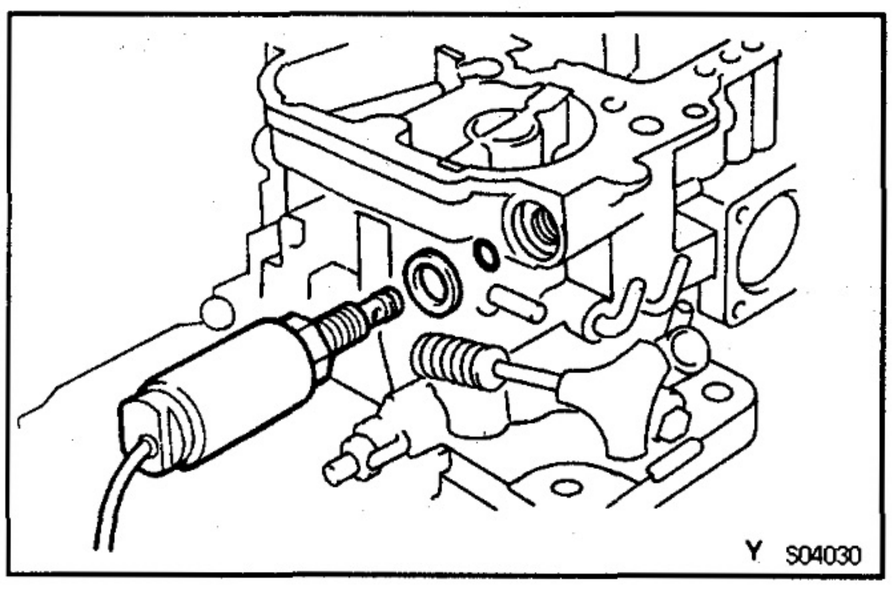


Carburetor Body Assembly

1. ASSEMBLE CARBURETOR BODY AND FLANGE

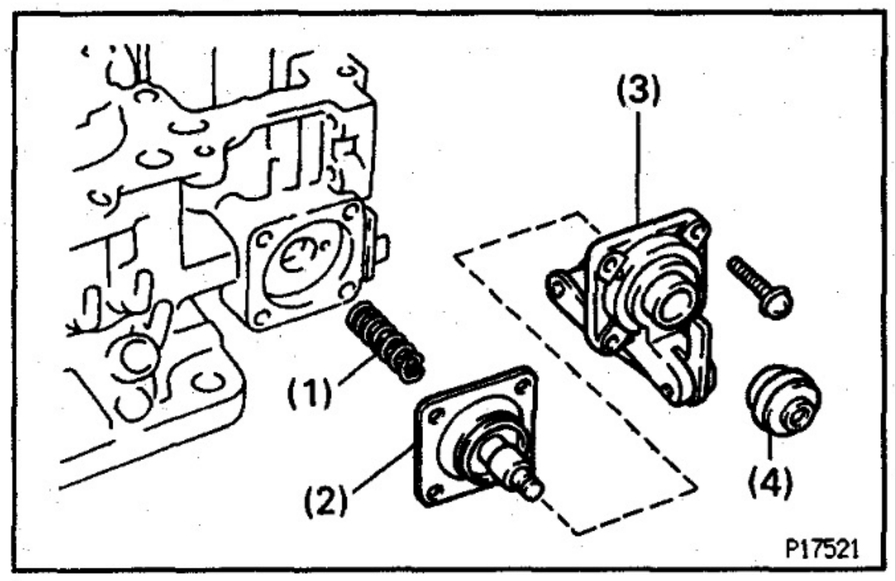
(a) Assemble the flange and body together with a new gasket.
(b) Install the passage screw together with the spring washer.

2. INSTALL FAST IDLE CAM



3. INSTALL FUEL CUT SOLENOID VALVE

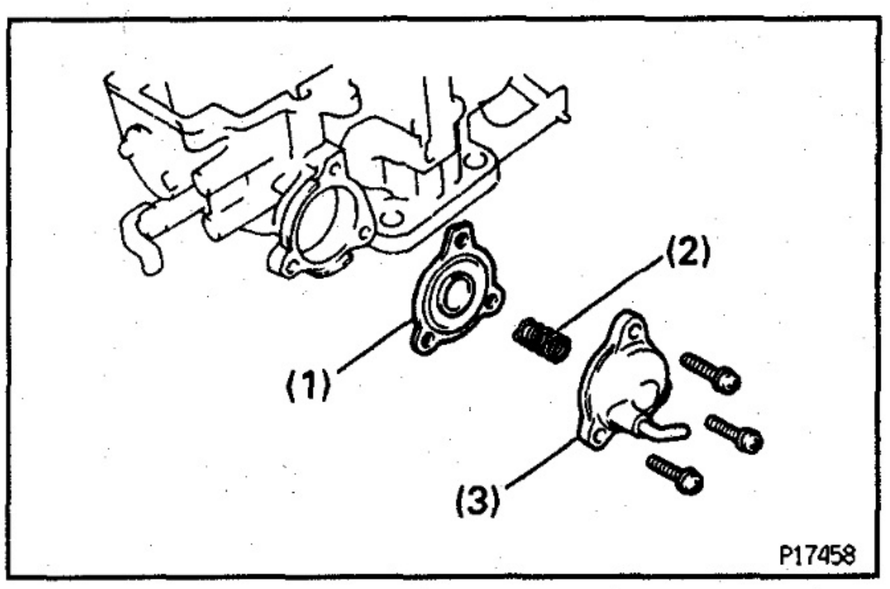
(a) Install a new O—ring to the solenoid valve.
(b) Install the solenoid valve together with a new gasket.



4. INSTALL ACCELERATION PUMP

Install the following parts with the 4 screws.

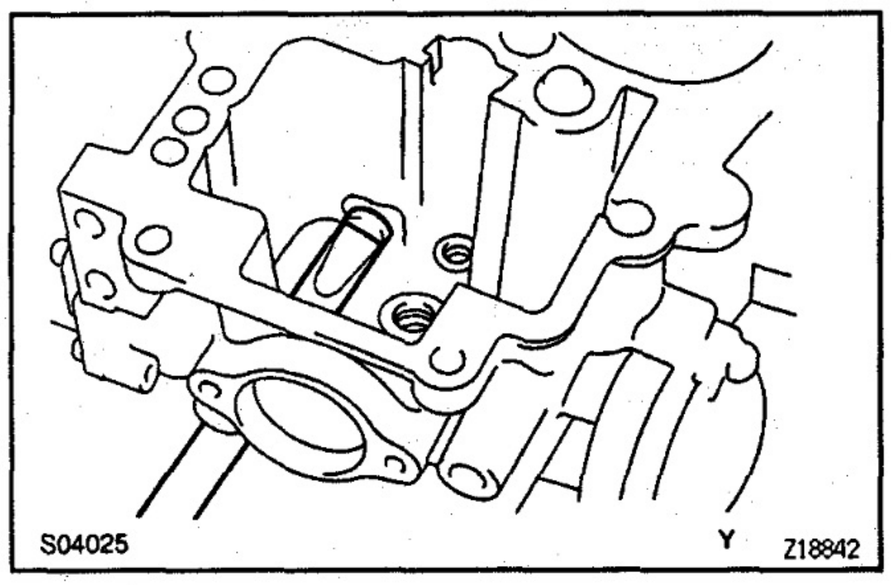
(1) Spring
(2) Diaphragm
(3) Cover
(4) Boot



5. INSTALL AUXILIARY ACCELERATION PUMP (AAP)

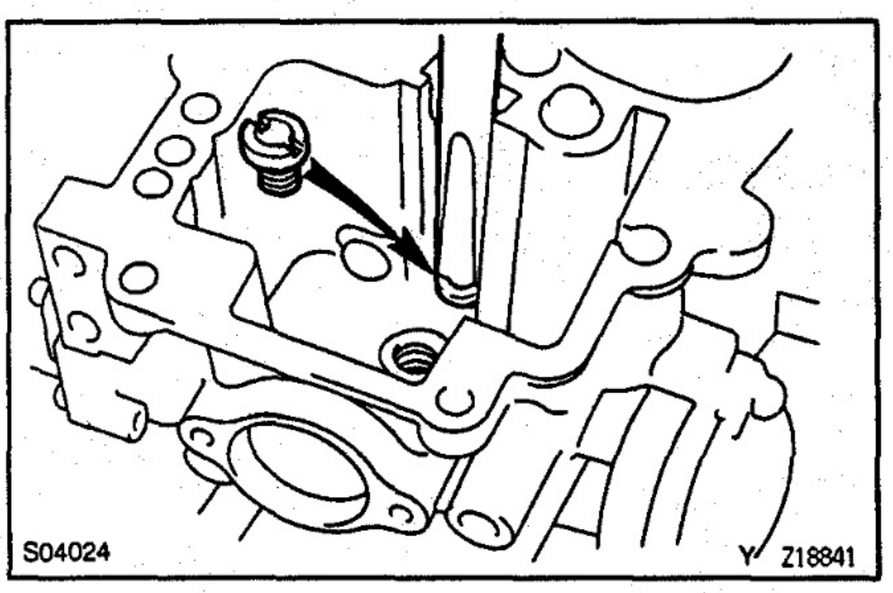
Install the following parts with the 3 screws.

(1) Diaphragm
(2) Spring
(3) Cover



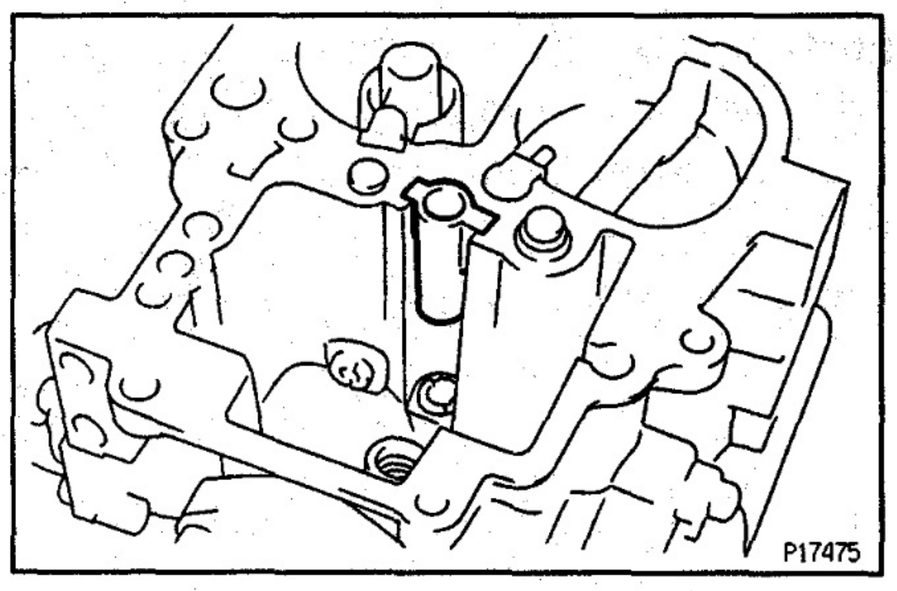
6. INSTALL PRIMARY MAIN JET

(a) Install the primary main jet with new gaskets.
(b) Install the primary passage plug with new gasket.

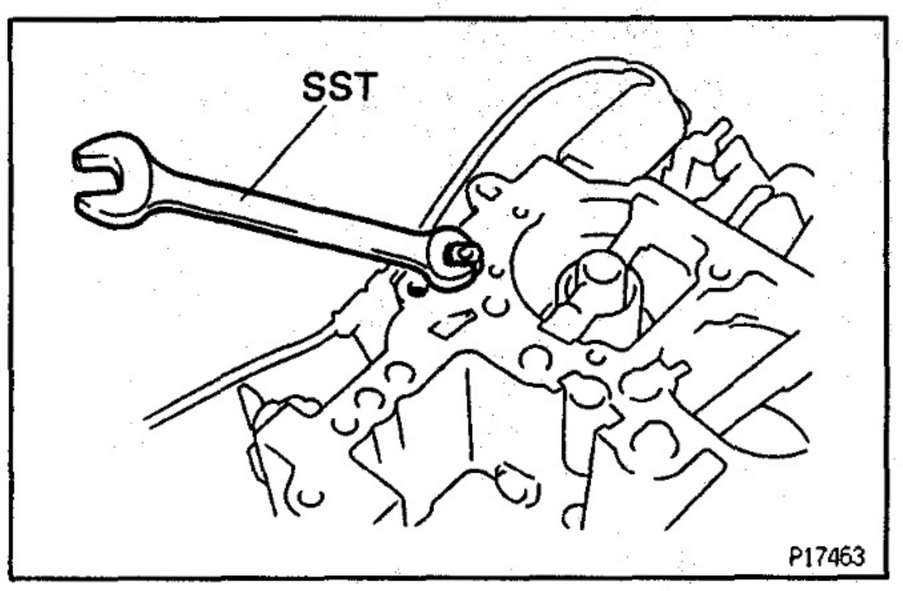


7. INSTALL SECONDARY MAIN JET

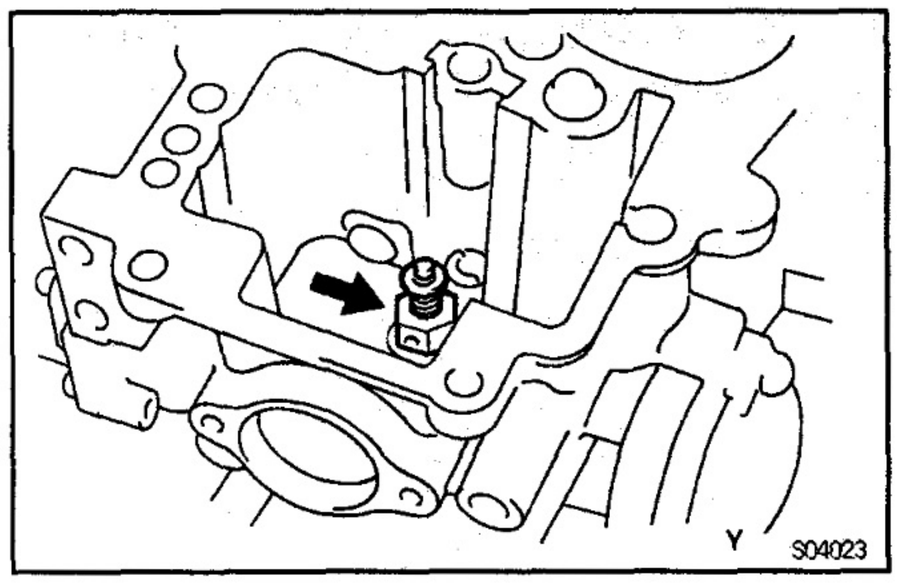
(a) Install the secondary main jet.



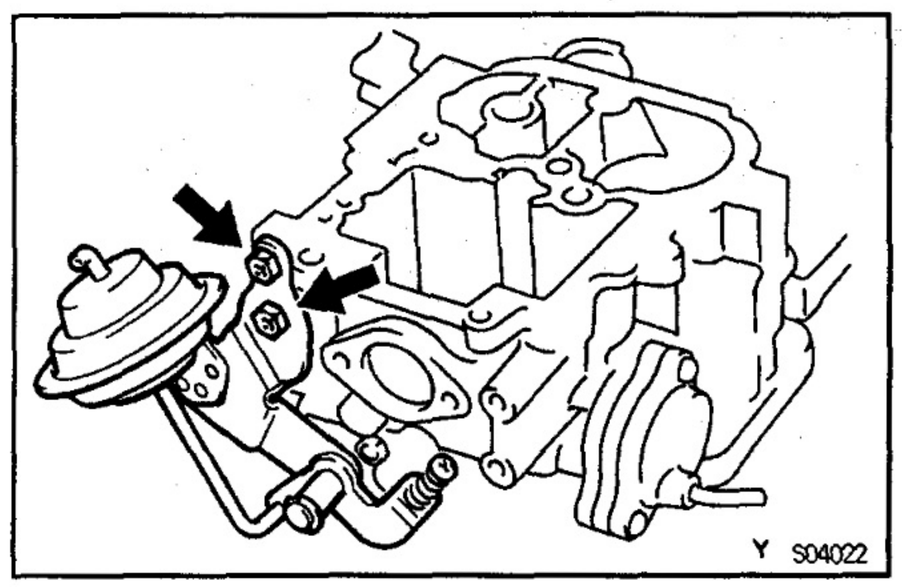
(b) Install the metering needle guide.



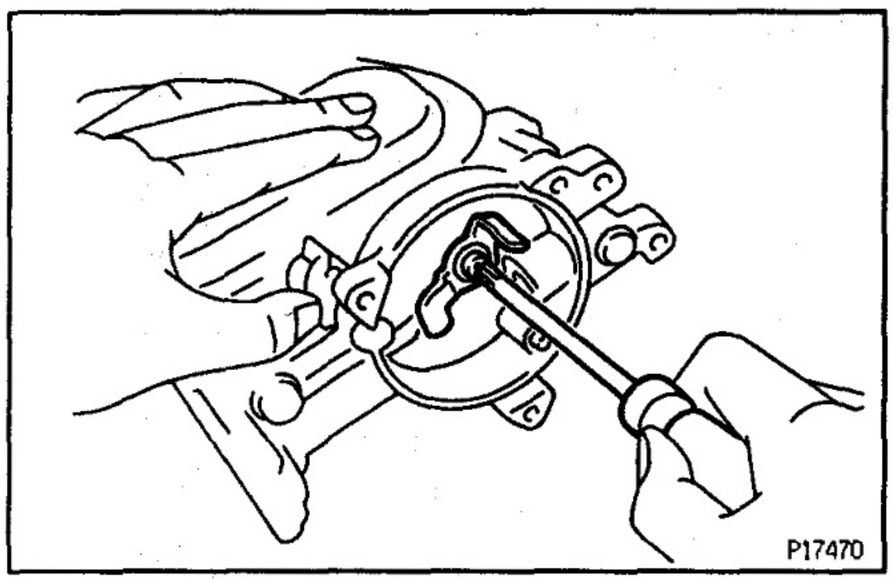
8. **INSTALL SLOW JET**
Using SST, install the slow jet.
SST 09922–00010



9. **INSTALL POWER VALVE**

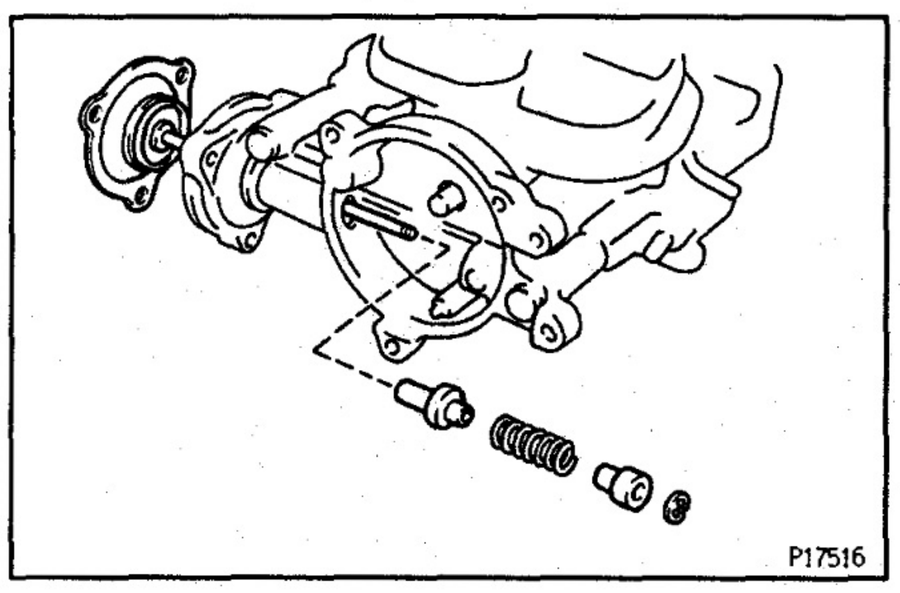


10. **INSTALL THROTTLE POSITIONER (TP)**
Install the TP with the 2 screws.

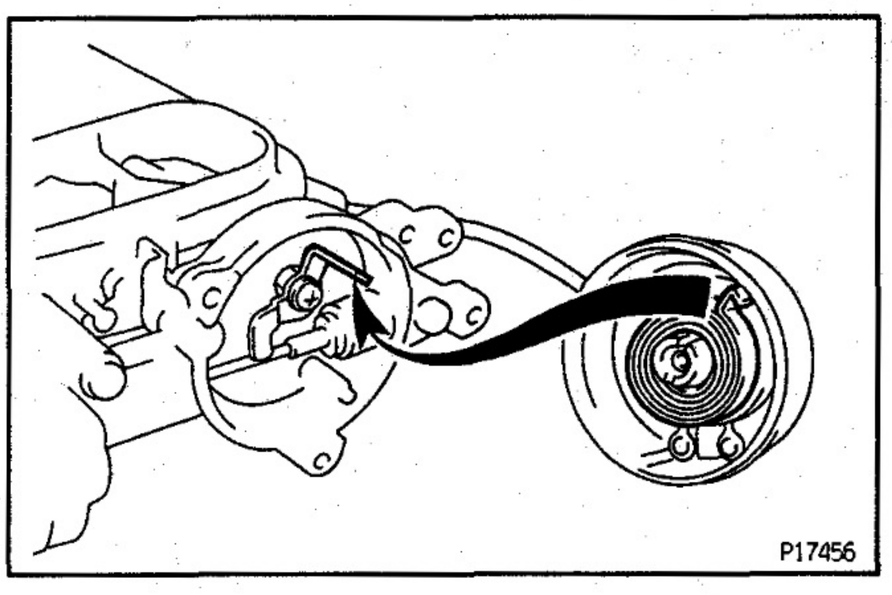


Air Horn Assembly

1. **INSTALL CHOKE BREAKER (CB)**
(a) Install the choke lever with the screw.



(b) Insert the diaphragm into the thermostat case, and install the collar, spring and stopper with the E–ring.
(c) Insert the shaft of the diaphragm into the hole of the thermostat case.
(d) Install the spring, cover and 3 screws.



2. INSTALL COIL HOUSING

(a) Install the gasket to the thermostat case.

(b) Align the bimetallic spring with the wire spring and in stall the coil housing, aligning the choke lever as shown in the illustration.

(c) Align the scale center line of the thermostat case with the coil housing line, and install the plate with the 3 screws.

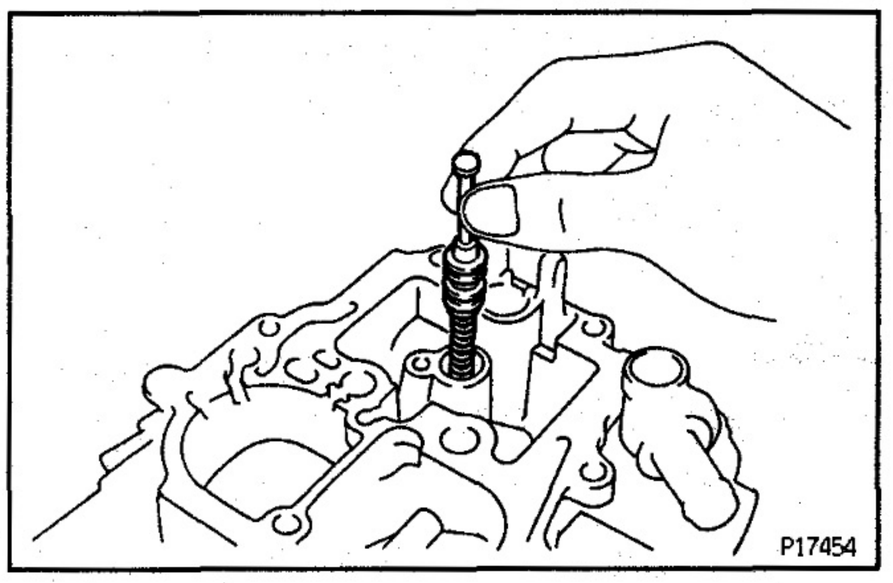
(d) Check the choke valve action.

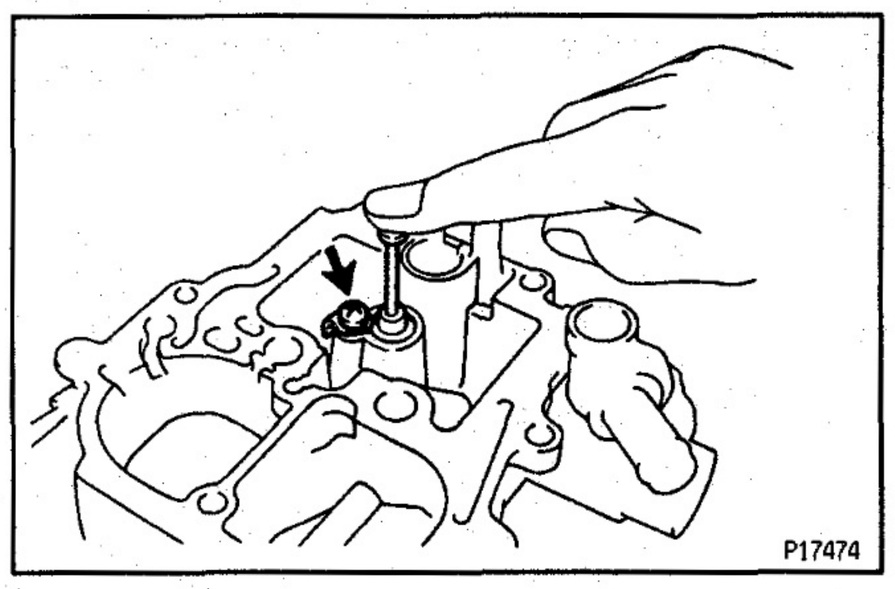
3. INSTALL OUTER VENT CONTROL VALVE (OVCV)

Install a new gasket, the wire clamp and OVCV with the 3 screws.

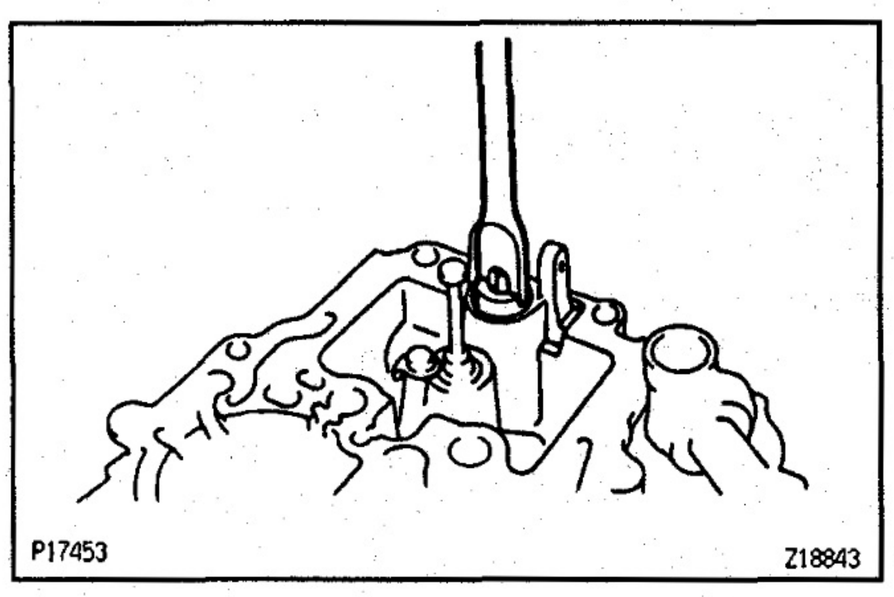
4. INSTALL POWER PISTON

(a) Install the spring and power piston.



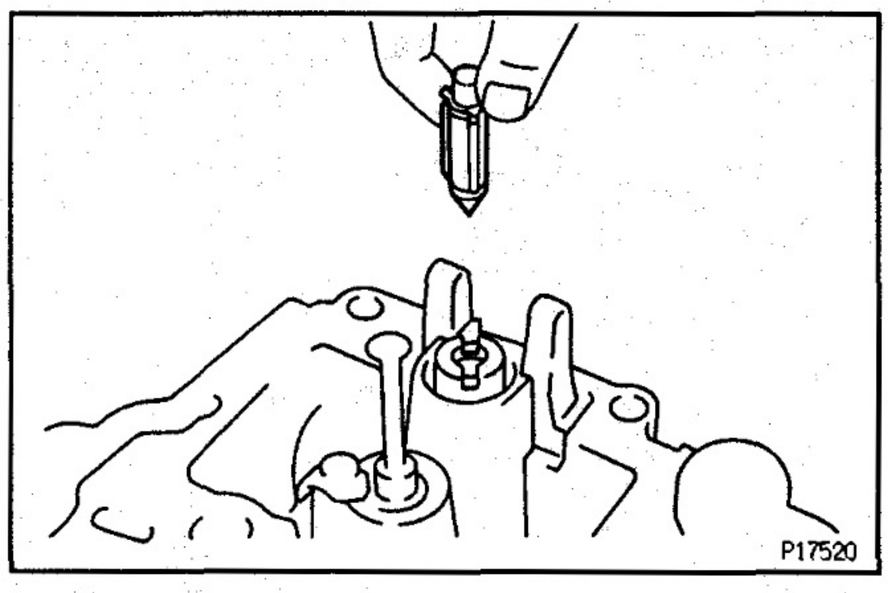


(b) Install the retainer and screw.



5. INSTALL NEEDLE VALVE SEAT

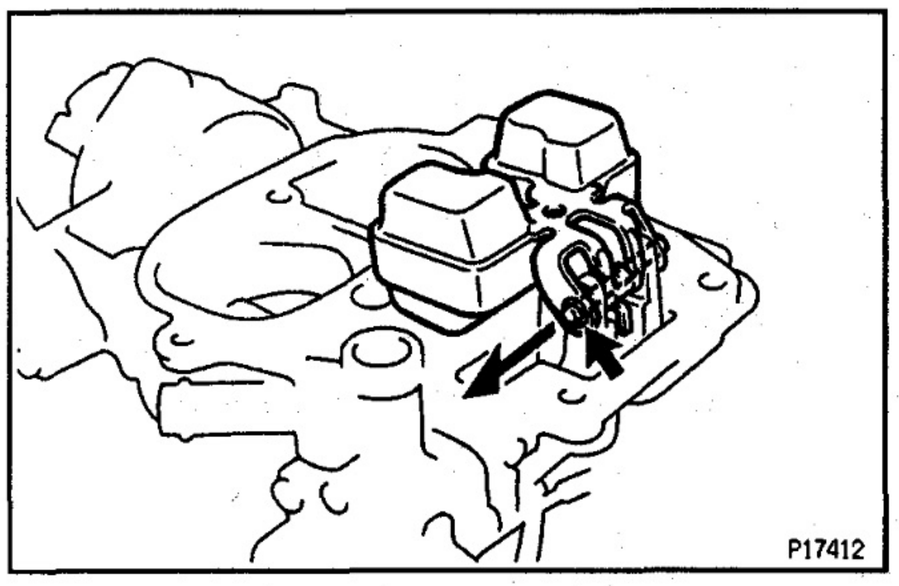
Install the valve seat together with a new gasket.



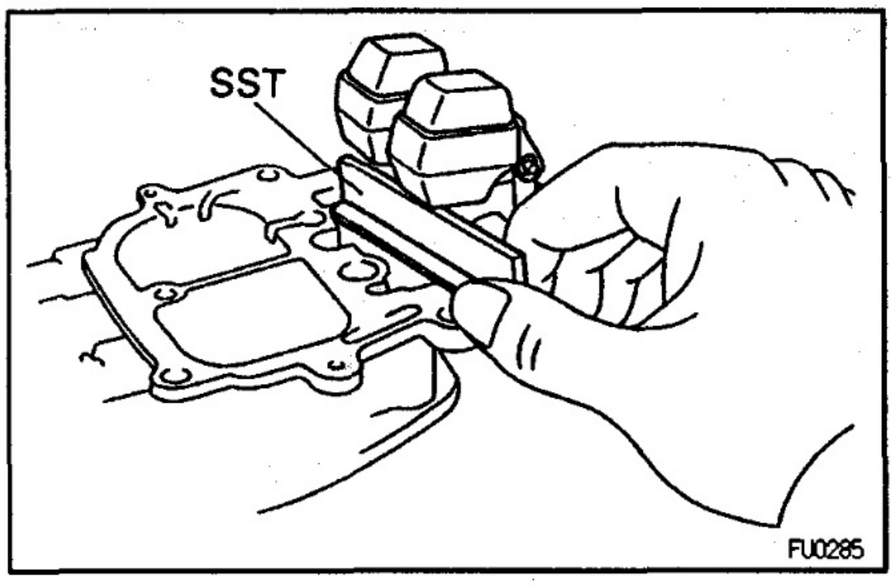
6. ADJUST FLOAT LEVEL

(a) Insert the needle valve, spring and plunger into the needle valve seat.

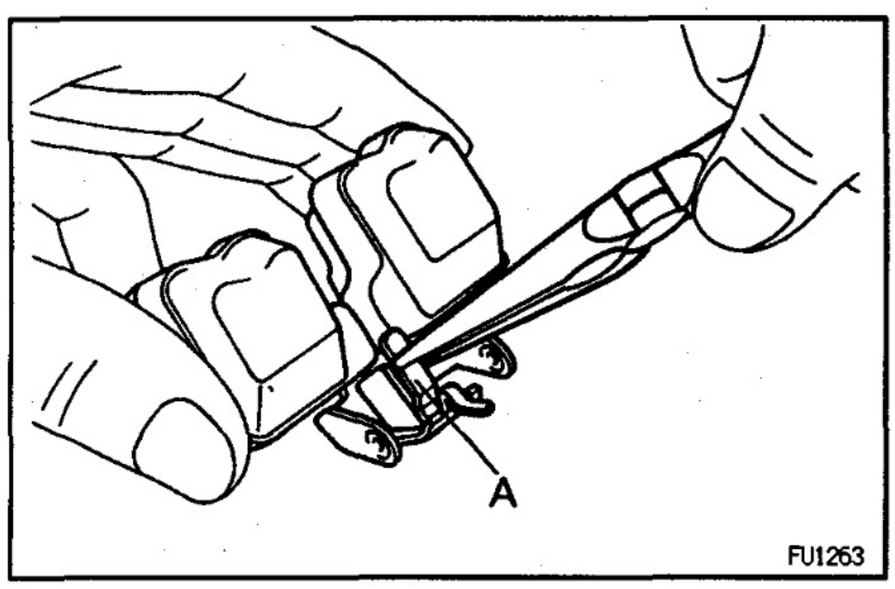
HINT: After adjusting the float level, install the clip onto the needle valve.



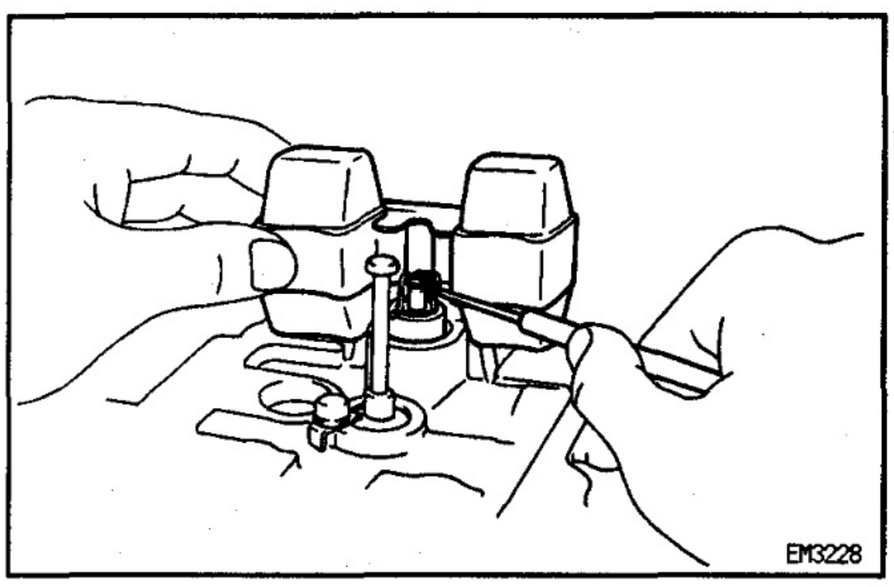
(b) Install the float with the pivot pin.



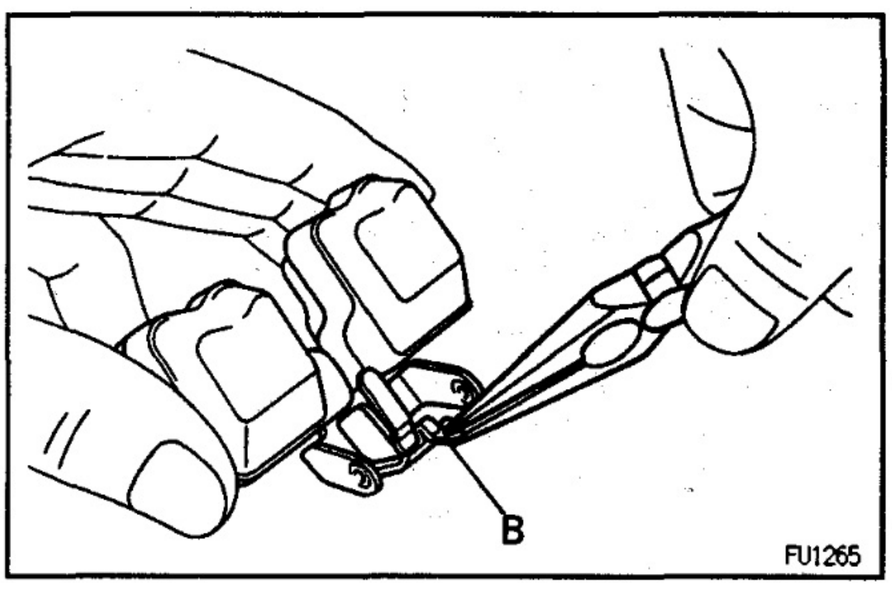
(c) Allow the float to hang down by its own weight.
Using SST, measure the clearance between the float tip and air horn.
SST 09240–00014
Float level (Raised position):
9.8 mm (0.386 in.)
HINT: This measurement should be made without a gasket on the air horn.



(d) Adjust by bending the portion of the float lip marked A.

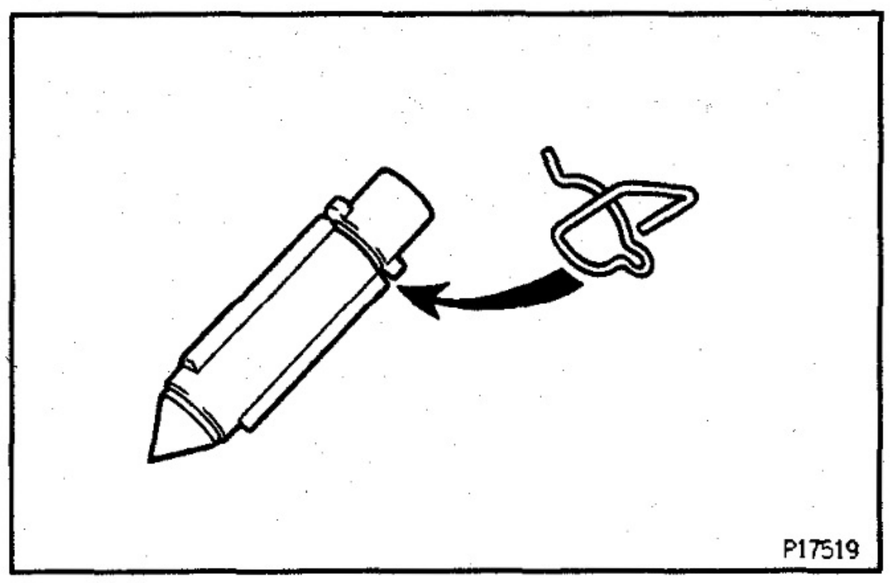


(e) Lift up the float.
Using SST, measure the clearance between the needle valve plunger and float lip.
SST 09240–00020
Float level (Lowered position):
0.9 – 1.1 mm (0.035 – 0.043 in.)



(f) Adjust by bending the position of the float lip marked B.

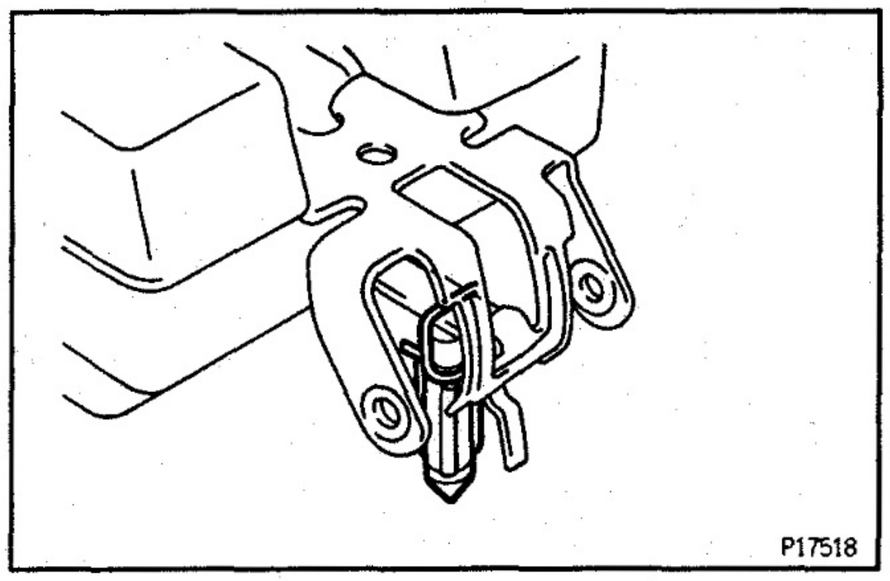
(g) After adjusting the float level, remove the float, plunger, spring and needle valve.



(h) Assemble the clip onto the needle valve.

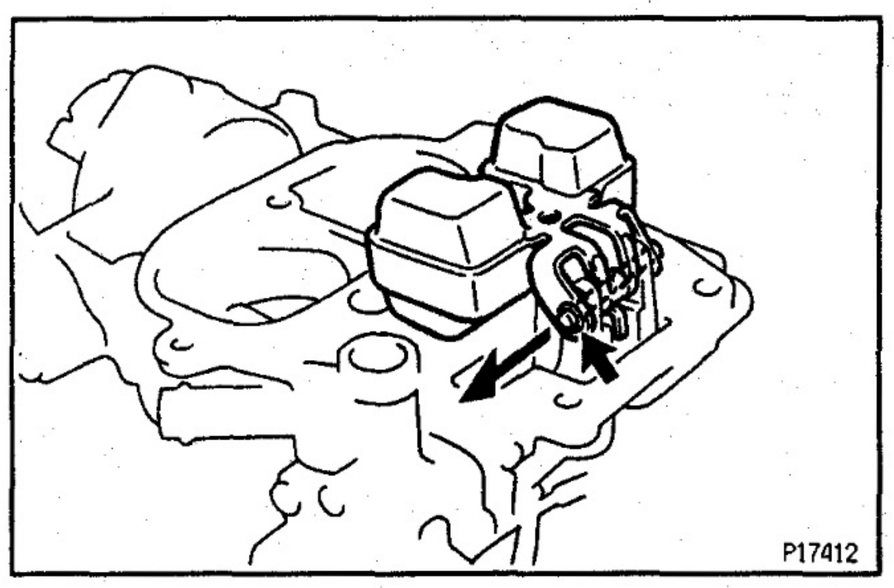
7. INSTALL NEW AIR HORN GASKET

Place the air horn gasket on the air horn.

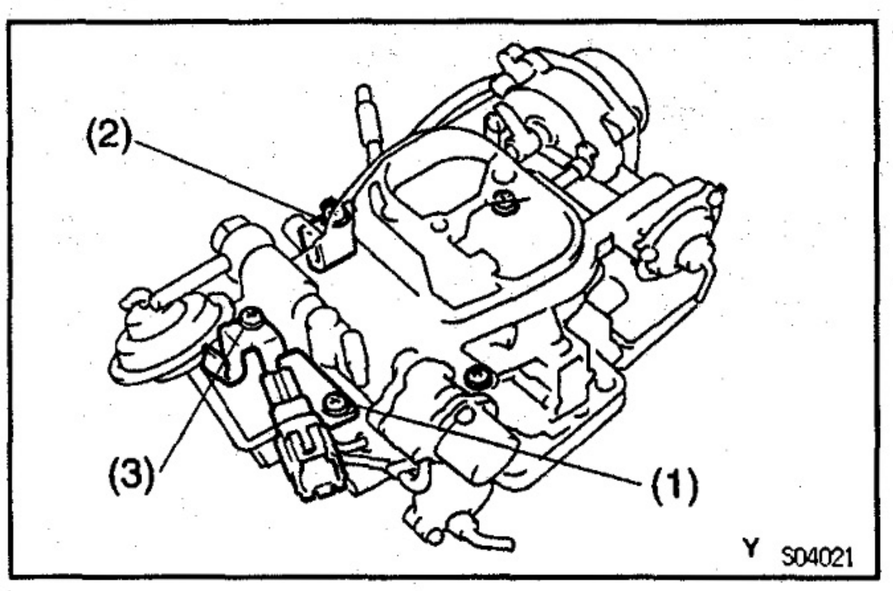


8. INSTALL NEEDLE VALVE AND FLOAT

(a) Hook the needle valve clip to the lip portion of the float.



(b) Install the float and secure it with the pivot pin.

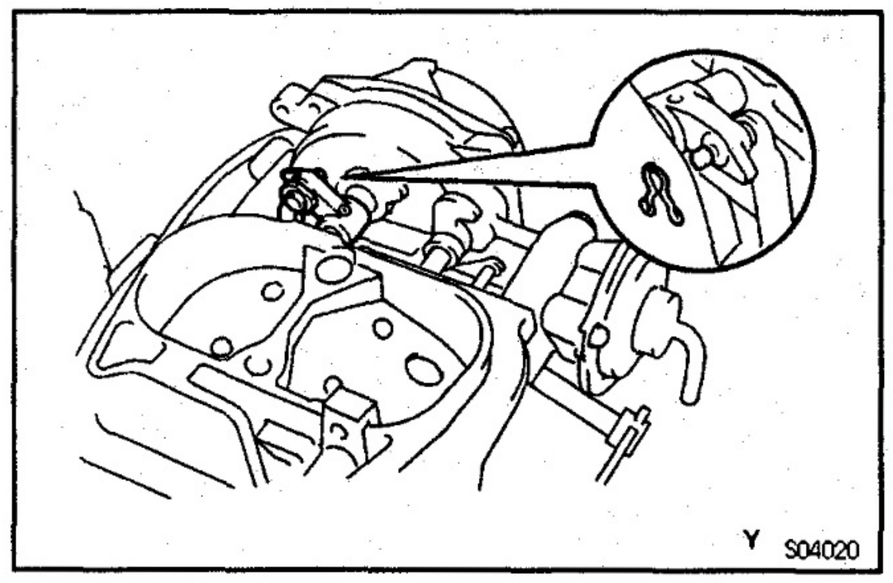


9. INSTALL AIR HORN ASSEMBLY

(a) Place the air horn in the carburetor body.

(b) Install the following parts with the 5 screws:

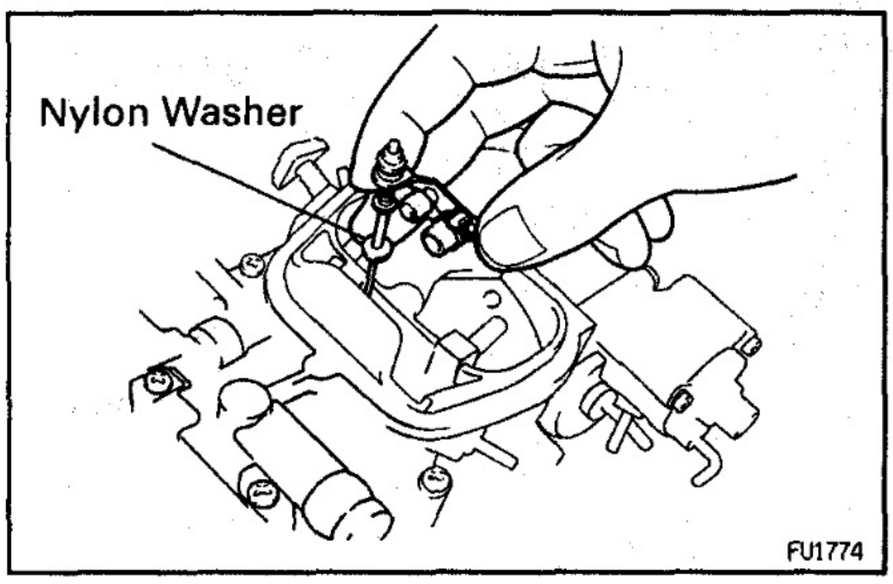
(1) Number plate
(2) Wire clamps
(3) Vacuum hose clamp



(c) Connect the fast idle link and install the snap ring.

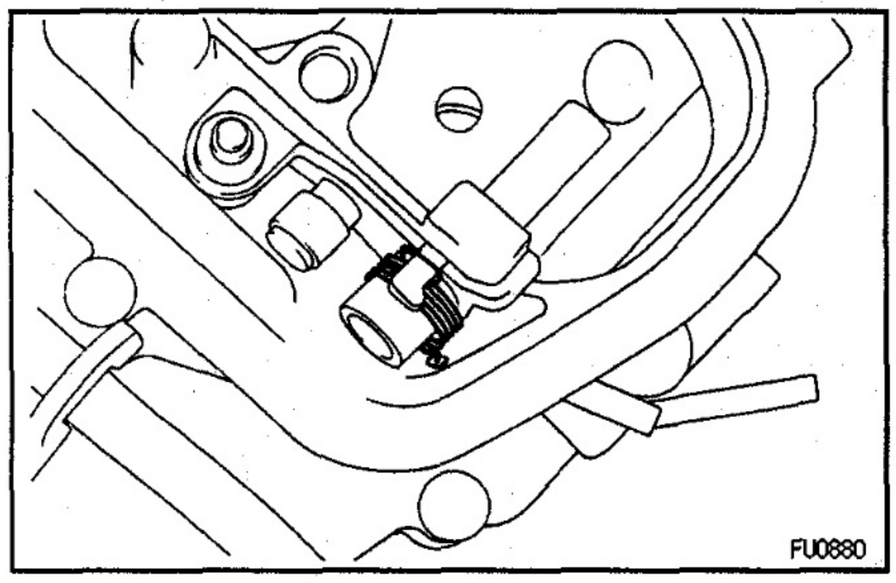
10. INSTALL NIPPLE UNION

Install a new gasket and nipple union

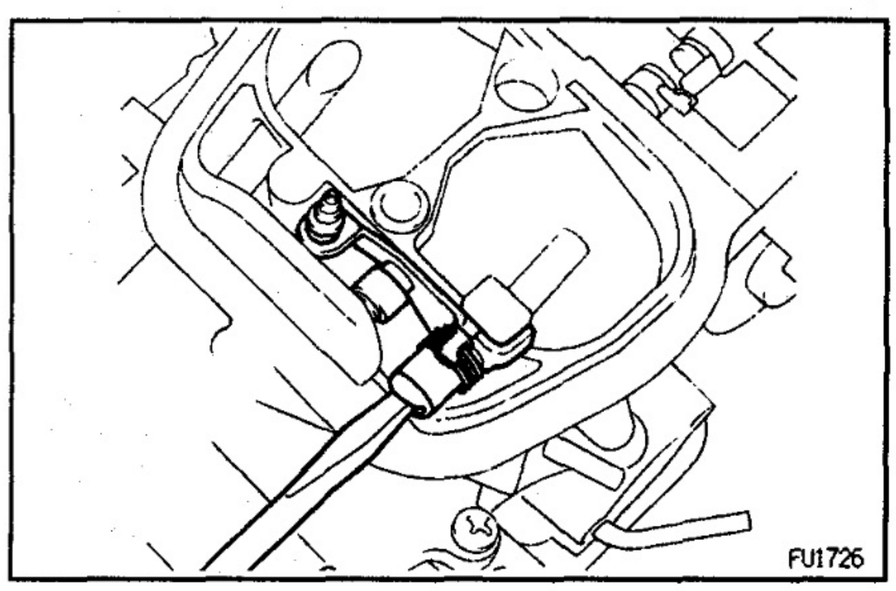


11. INSTALL METERING NEEDLE

(a) Insert the metering needle into the air horn with the nylon washer.

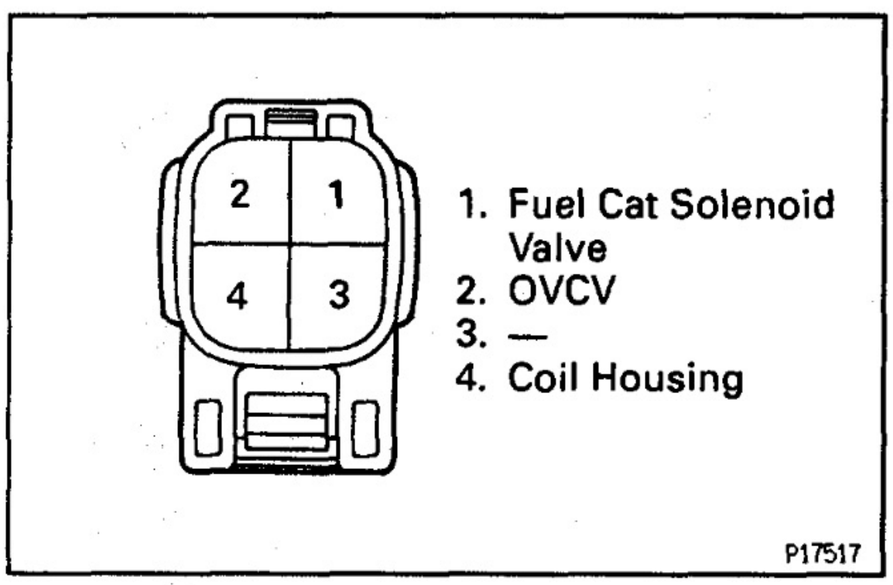


(b) Hook the spring end into the hole.



(c) Tighten the screw with the steel washer.

(d) Secure the link with the snap ring.



12. CONNECT WIRES TO CONNECTOR

(a) Push in the terminal until it is securely locked in the connecting lug.

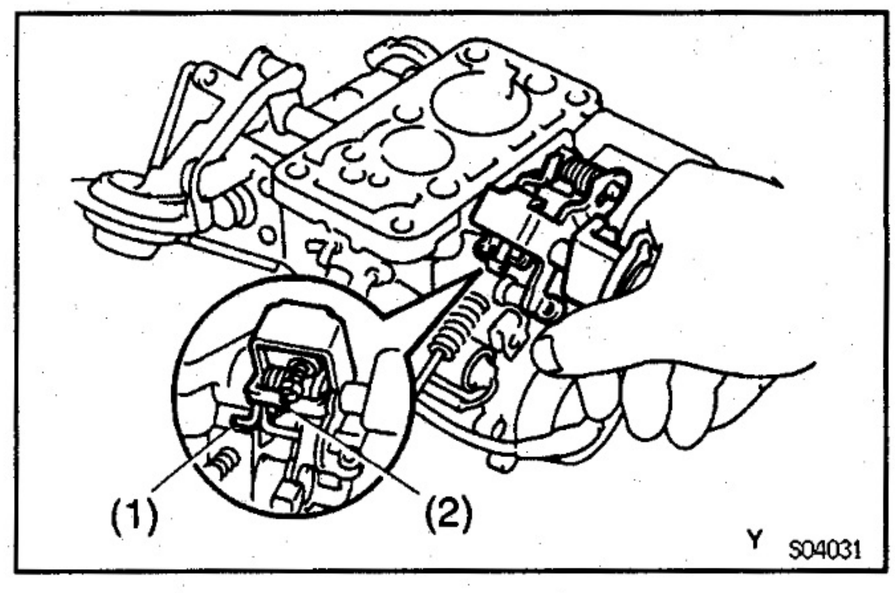
(b) Pull on the wire to check that it is securely locked.

13. CHECK EACH PART OPERATES SMOOTHLY

CARBURETOR ADJUSTMENT

EG7B9-02

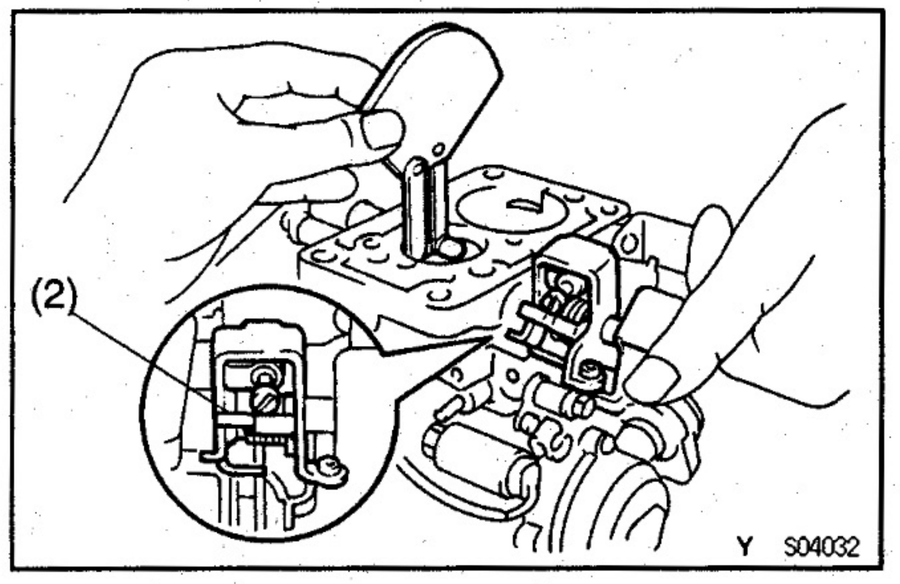
HINT: Use SST 09240–00014 and 09240–00020 to make adjustment.



1. CHECK AND ADJUST THROTTLE VALVE OPENING

(a) Check the full opening angle of the primary and secondary throttle valves.
Standard angle:
90° from horizontal

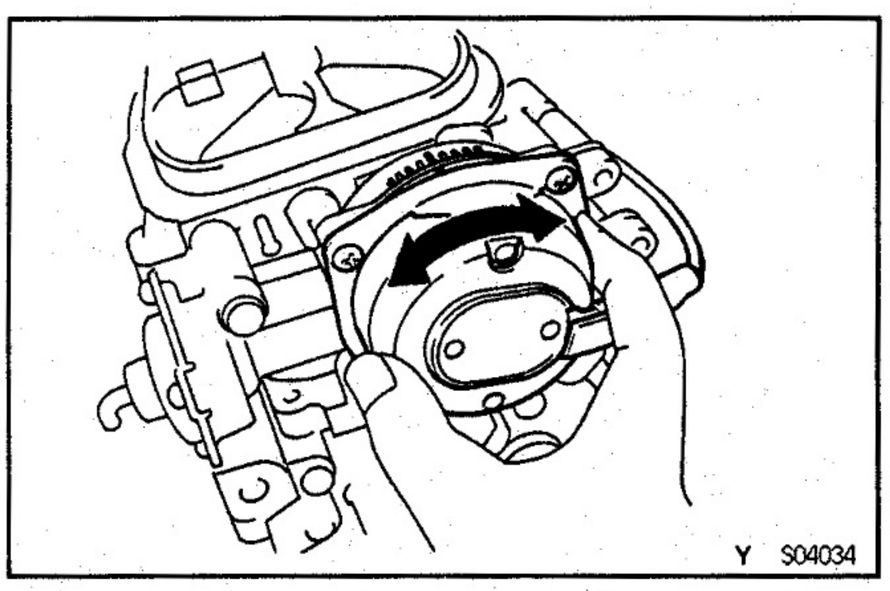
(b) Adjust by bending the respective first throttle arm levers for the primary (1) and secondary (2).



2. CHECK AND ADJUST SECONDARY TOUCH ANGLE

(a) Check the primary throttle valve opening angle at the same time the secondary throttle valve just starts to open.
Standard angle:
50° from horizontal

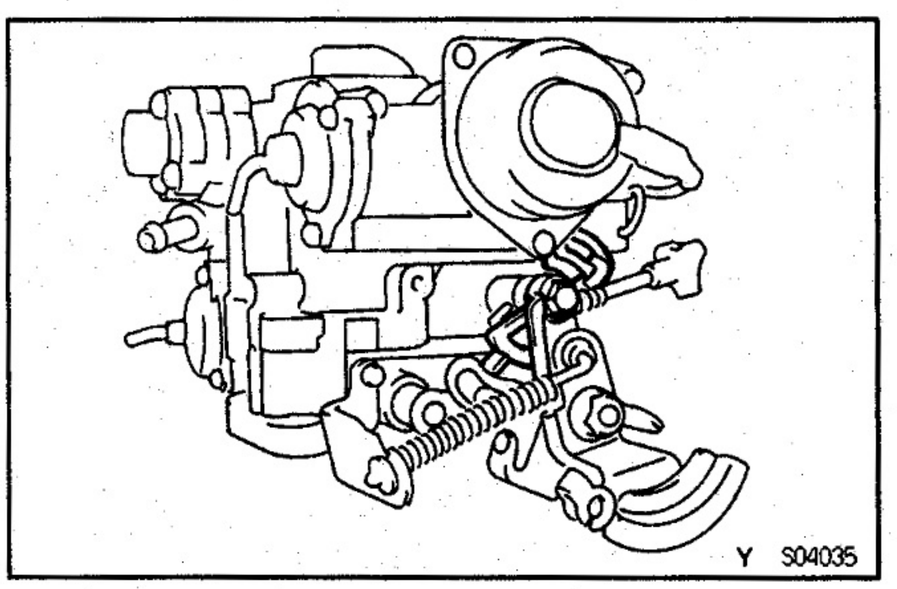
(b) If the angle is not within specification, adjust by bending the respective first throttle arm levers for (2).



3. SET AUTOMATIC CHOKE

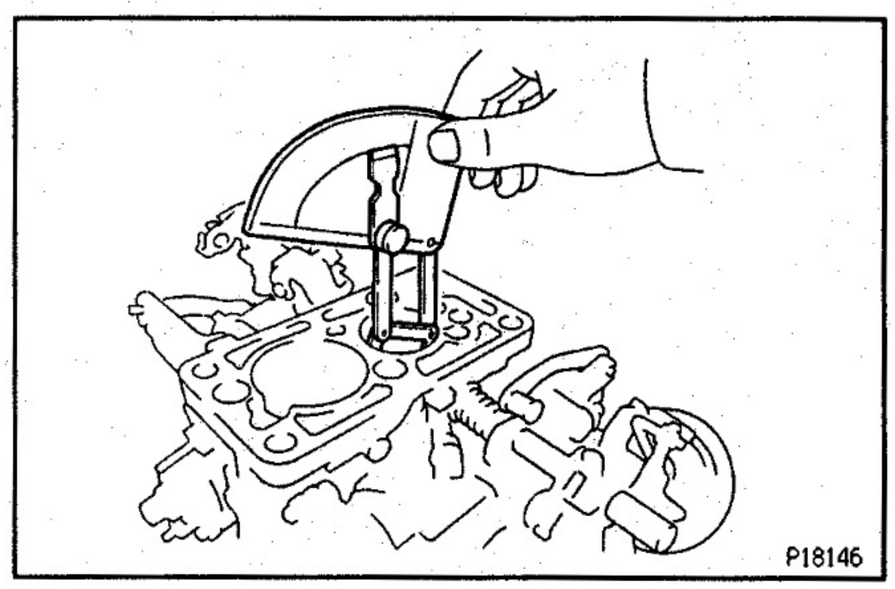
(a) Set the coil housing line so that it is aligned with the center line of the thermostat housing.
HINT: The choke valve becomes fully closed when the atmospheric temperature reaches 30°C (86°F).

(b) Depending on vehicle operating conditions, turn the coil housing and adjust the engine starting mixture.
If too rich ..... Turn clockwise
If too lean ..... Turn counterclockwise

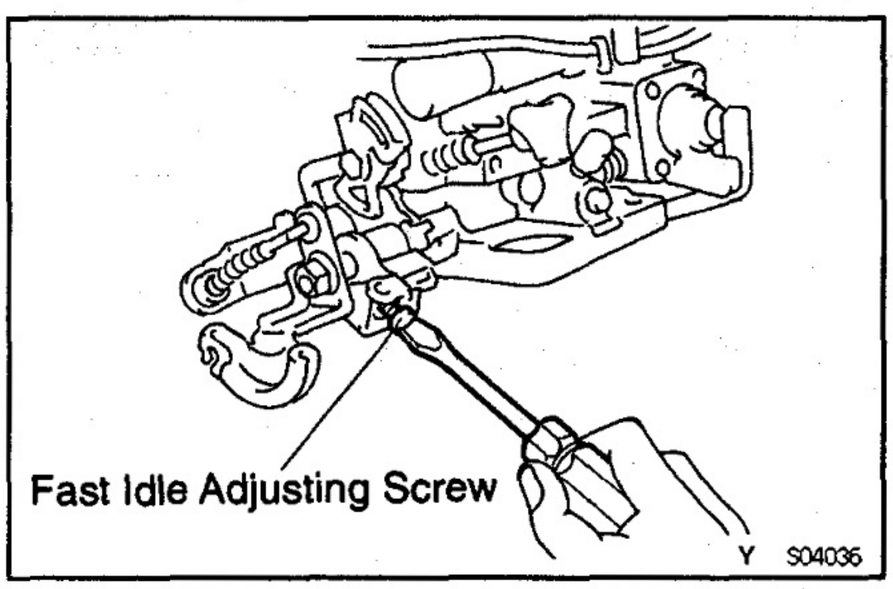


4. CHECK AND ADJUST FAST IDLE SETTING

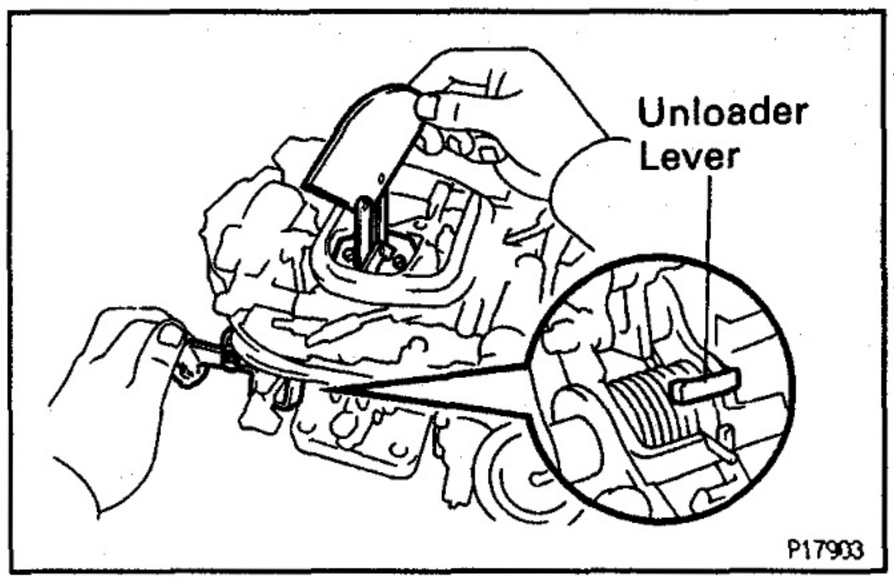
(a) Set the throttle shaft lever to the 1st step of the fast idle cam as shown.



(b) With the choke valve fully closed, check the primary throttle valve angle.
Standard angle:
16° from horizontal



(c) Adjust by turning the first idle adjust screw.



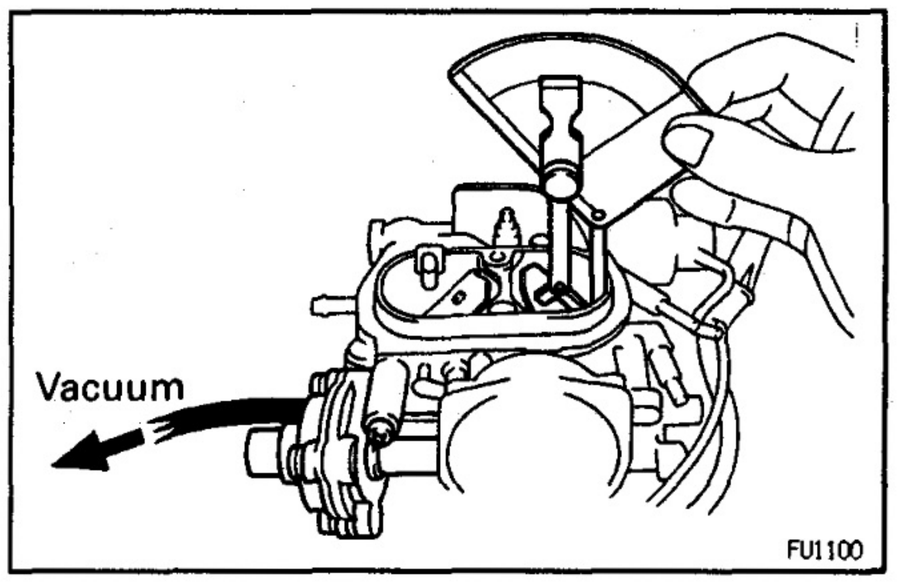
6. CHECK AND ADJUST UNLOADER

(a) With the primary throttle valve fully opened, check the choke valve angle.

Standard angle:

25° from horizontal

(b) Adjust by bending the primary throttle arm.



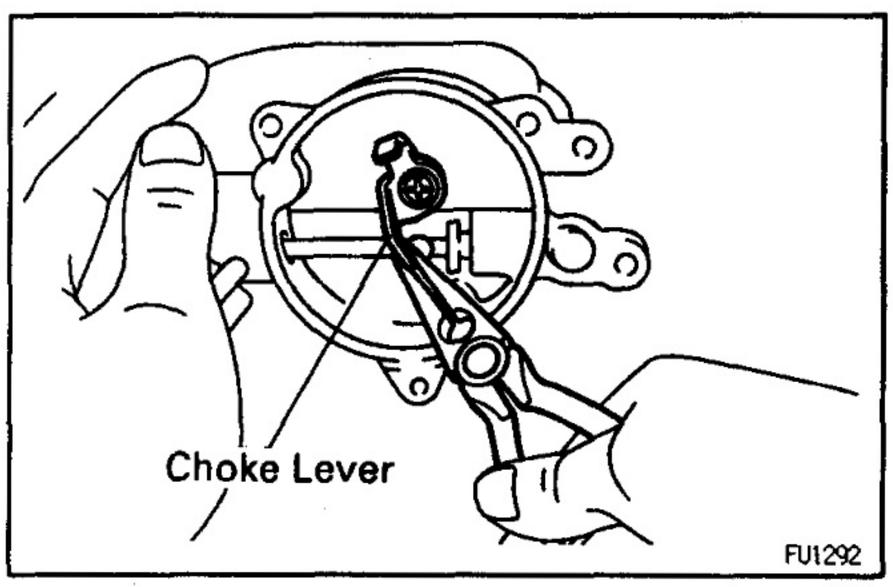
7. CHECK AND ADJUST CHOKE BREAKER (CB)

(a) Apply vacuum to the CB.

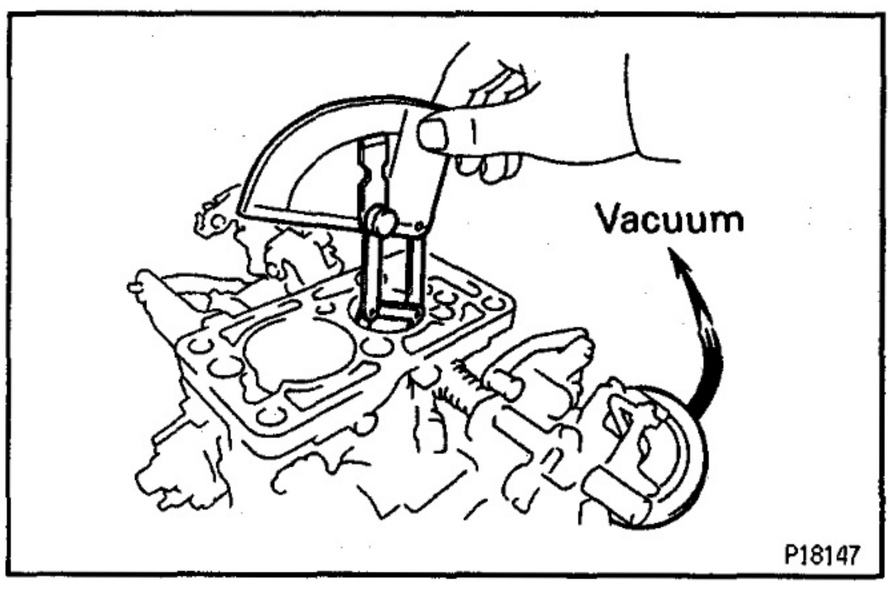
(b) Check the choke valve angle.

Standard angle:

22 – 33° from horizontal



(d) Remove the coil housing and adjust by bending the choke lever.



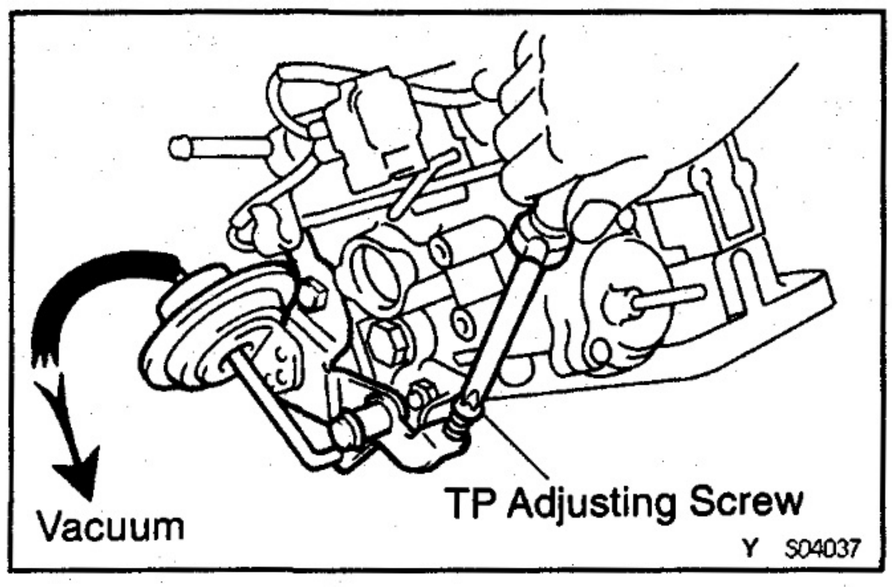
8. CHECK AND ADJUST THROTTLE POSITIONER (TP)

(a) Apply vacuum to throttle positioner (TP).

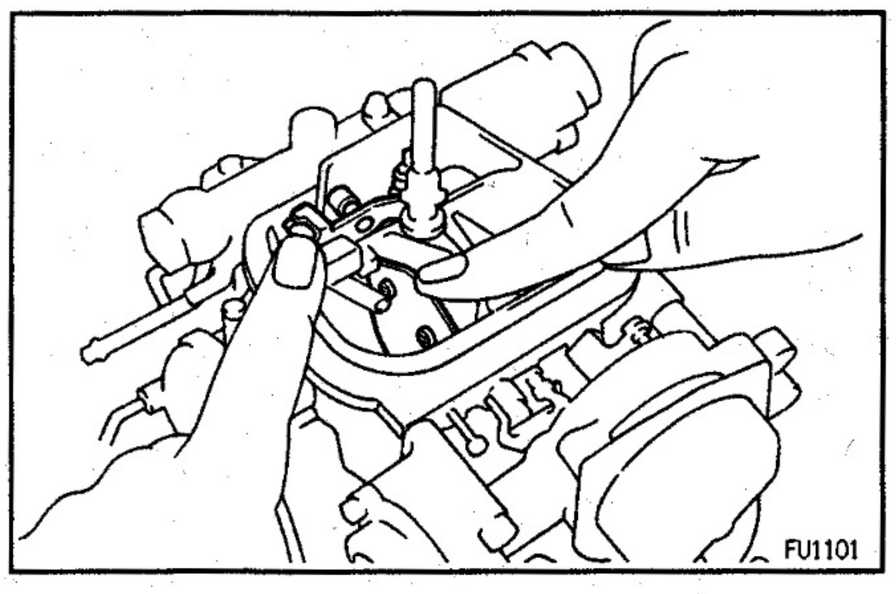
(b) Check the primary throttle valve angle.

Standard angle:

9.8° from horizontal



(c) Adjust by turning the TP adjusting screw.

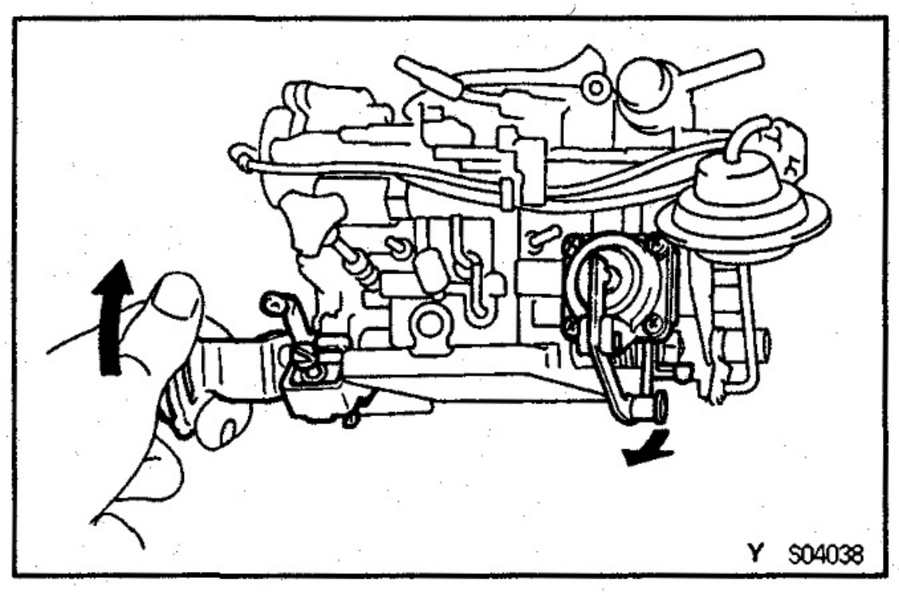


9. CHECK AIR VALVE AND METERING NEEDLE

(a) Check that the air valve and metering needle move smoothly together.

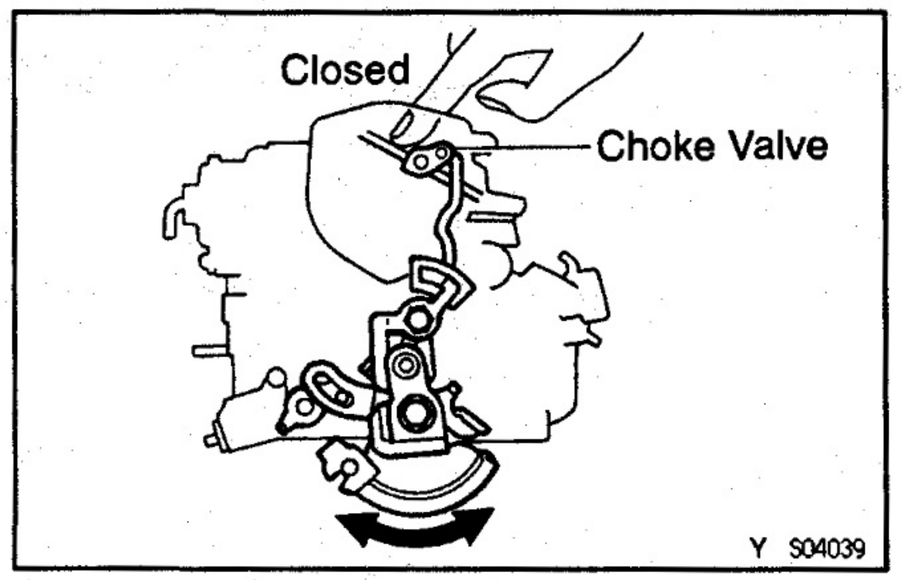
(b) While the primary throttle valve angle is at the idle position, check the air valve opening angle.

(c) While the primary throttle valve is full opened, check that here is clearance between the connecting rod and stopper.



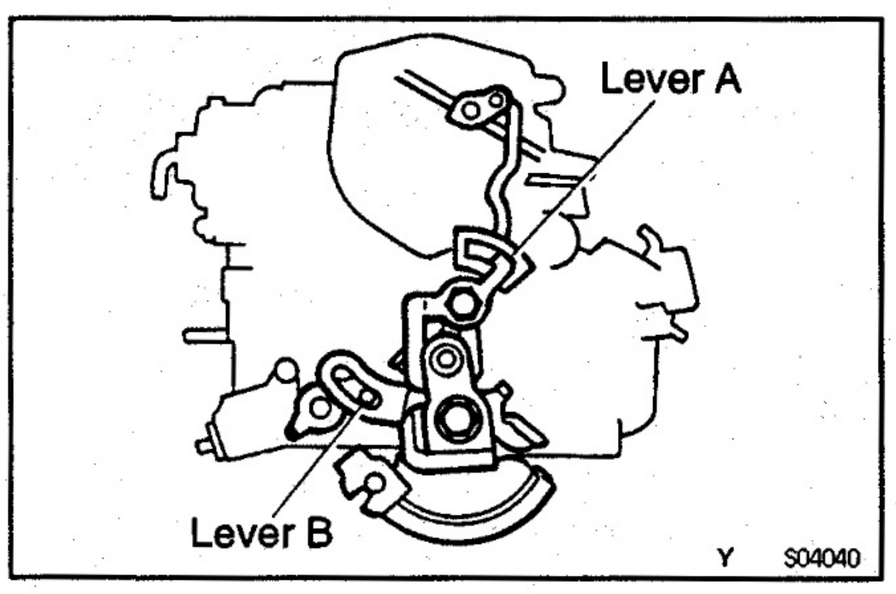
10. CHECK AND ADJUST ACCELERATION PUMP

Rotate the throttle shaft and check that the pump lever and diaphragm rod move smoothly.

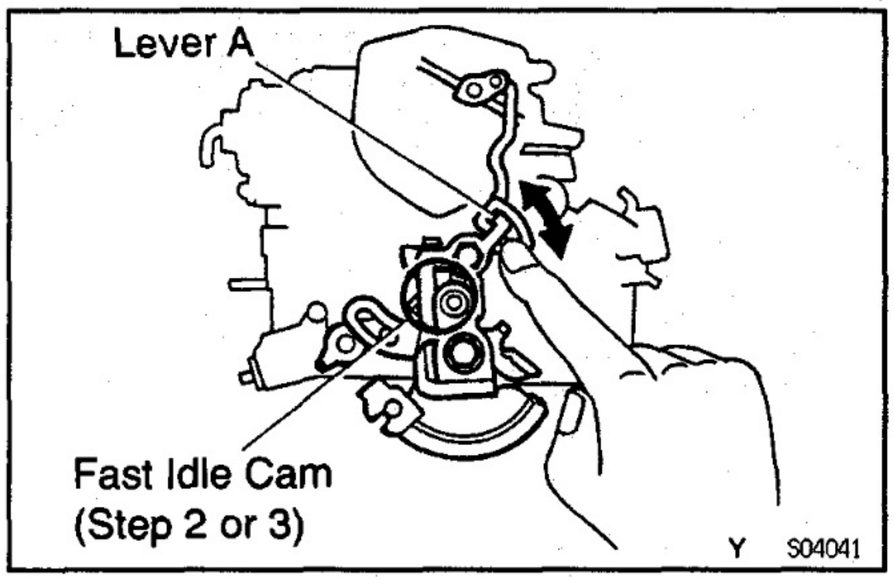


11. CHECK AND ADJUST SECONDARY THROTTLE VALVE LOCK SYSTEM

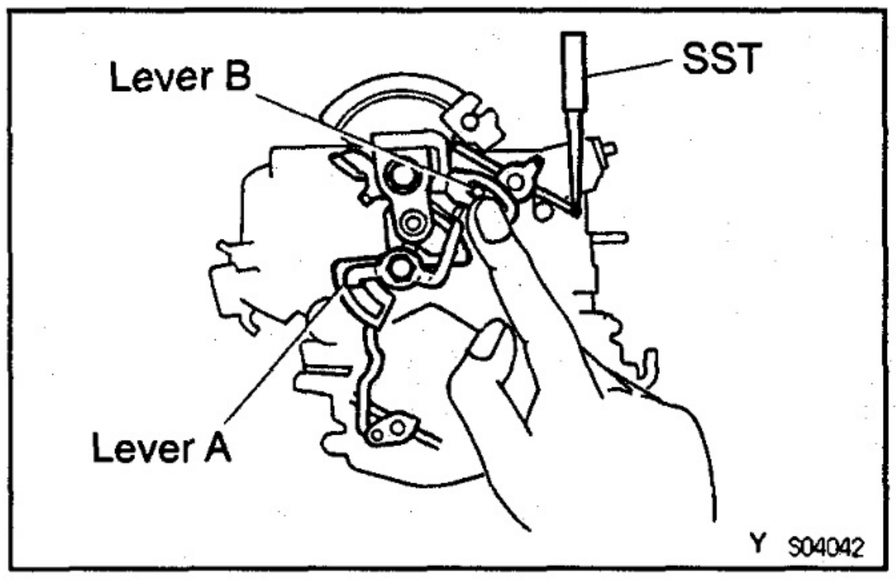
(a) While holding the throttle slightly open, push the choke valve closed, and hold it closed as you release the throttle valve.



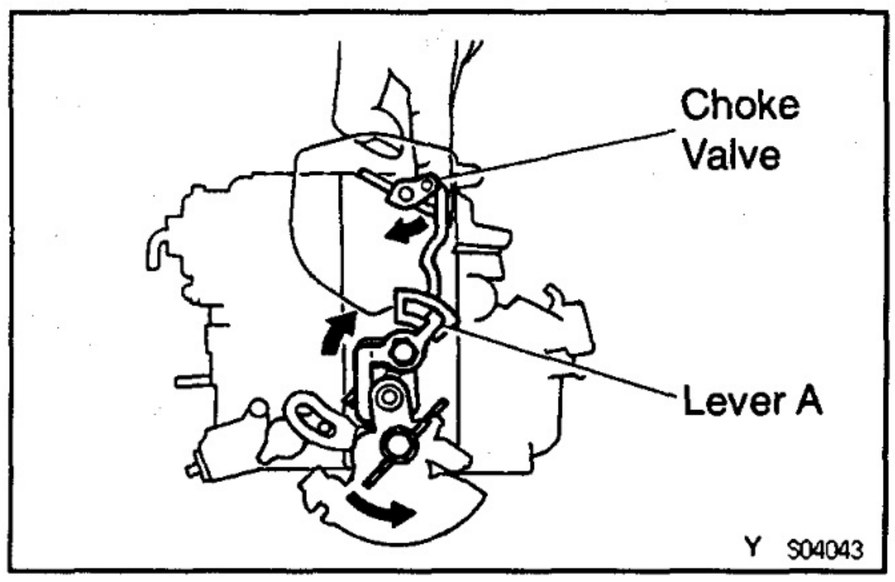
(b) In condition (a), check that lever A is holding lever B locked as shown.



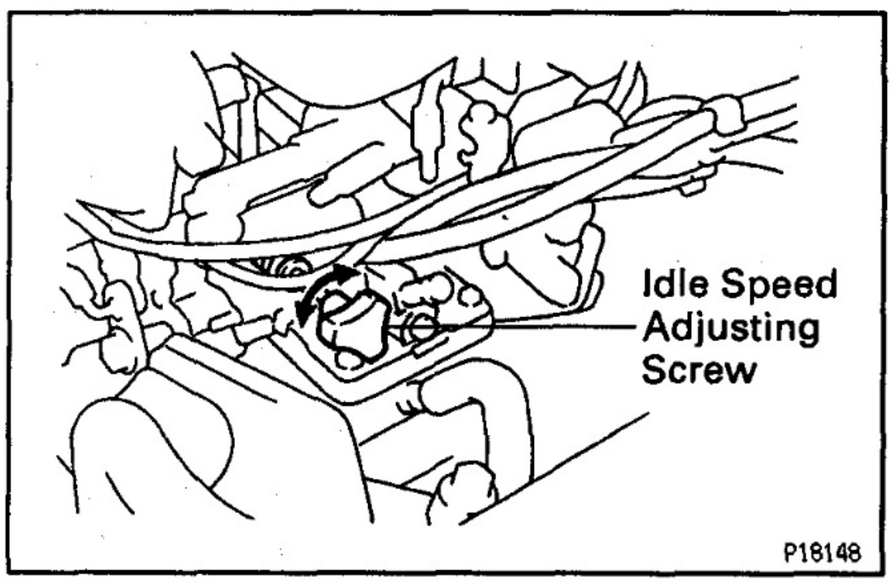
(c) Check that the lever A moves smoothly at step 2 or 3 of the fast idle cam.
Adjust by bending the top of lever A.



(d) In condition (a), rotate lever B to where it makes contact with lever A on this position, using SST, measure the clearance between the secondary valve bore. Adjust by bending the top of lever A.
SST 09240–00020
Standard clearance:
0 – 0.5 mm (0 – 0.020 in.)



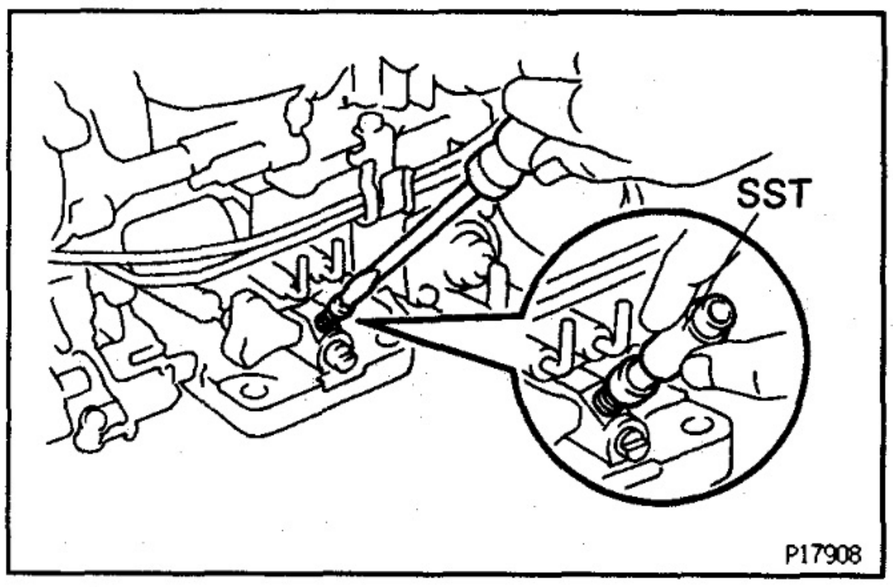
(e) With the choke valve opened (above 52°), check that lever A unlocks when the throttle valve is opened.



12. PRESET IDLE SPEED ADJUSTING SCREW

(a) Check the primary throttle valve angle.
Standard angle:
5.5° from horizontal

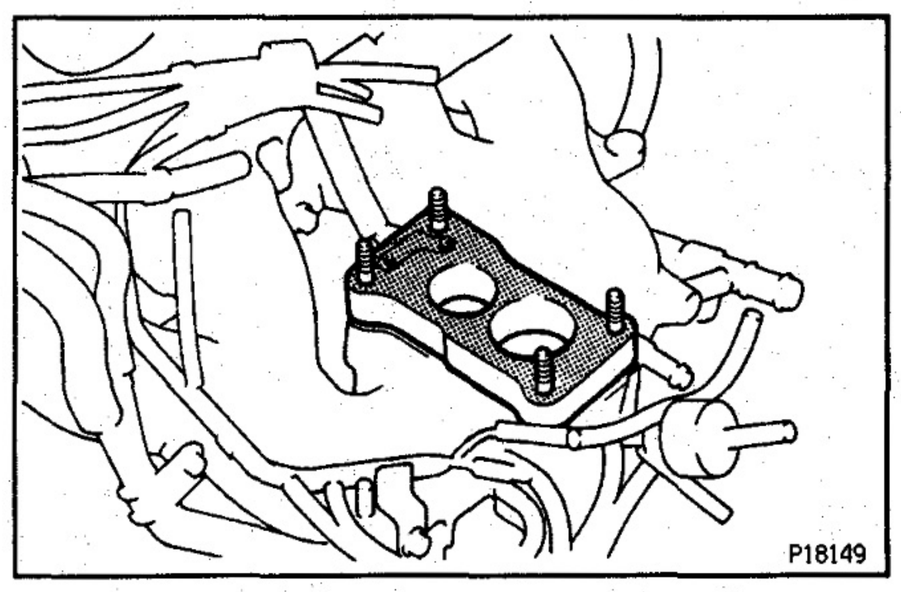
(b) Adjust turning the idle speed adjusting screw.

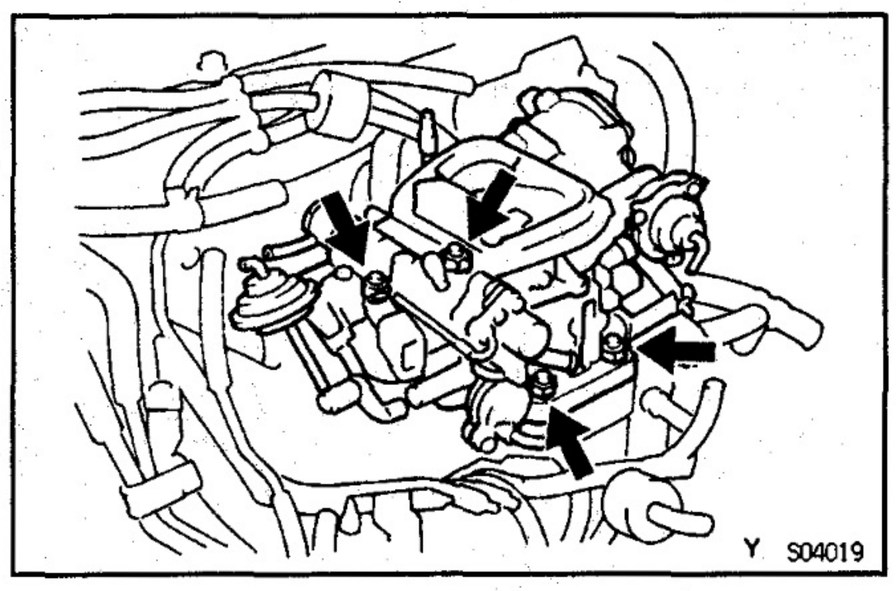


13. PRESET IDLE MIXTURE ADJUSTING SCREW

If the idle mixture adjusting screw has been removed, fully screw it in and then unscrew it the following amount.
Standard:
Return 2 and 1/4 turns from fully closed position
HINT: Use SST if necessary.
SST 09243–00020
NOTICE: Do not screw the screw tip in too tightly.

14. CHECK EACH PART OPERATES SMOOTHLY





CARBURETOR INSTALLATION

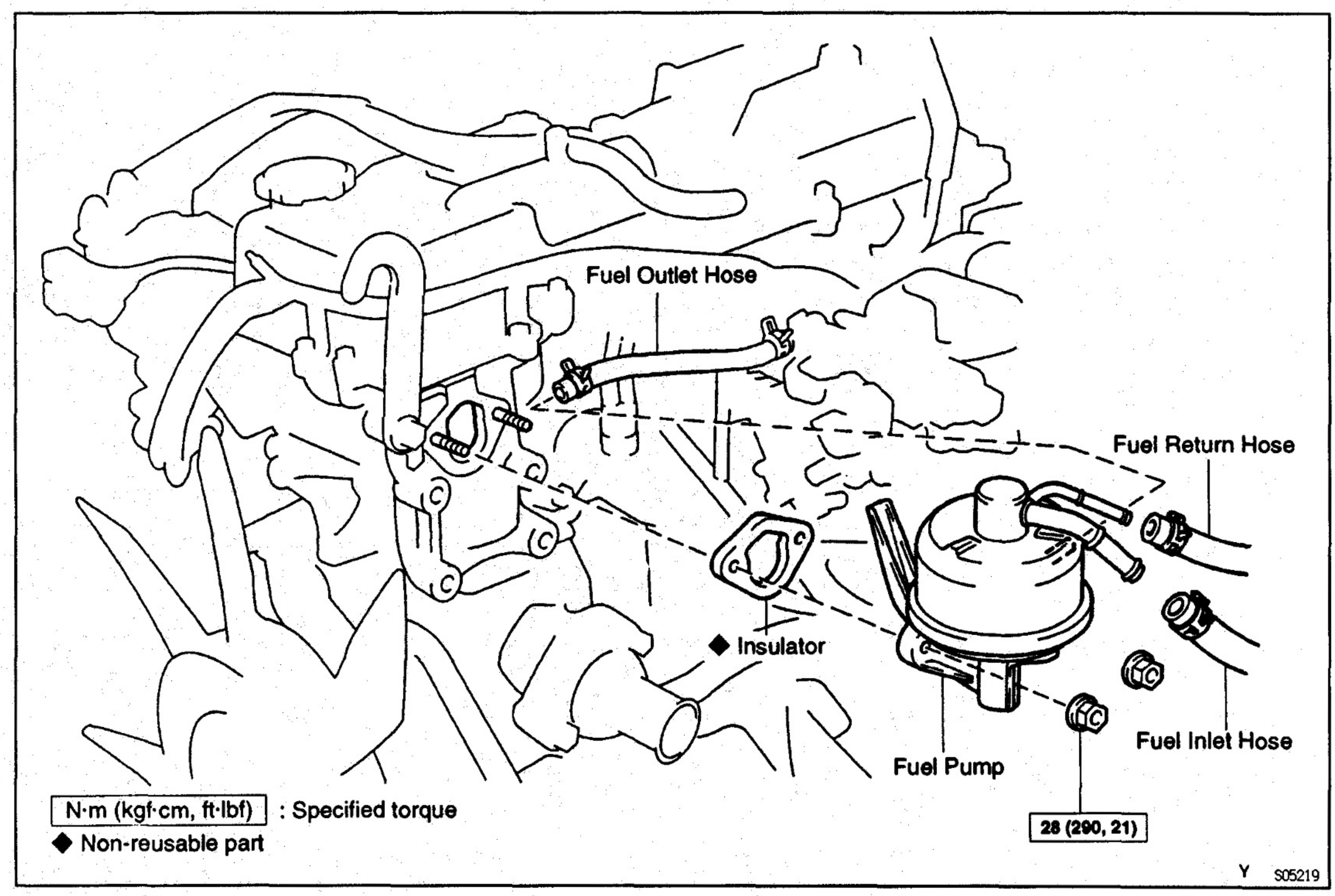
S078A-02

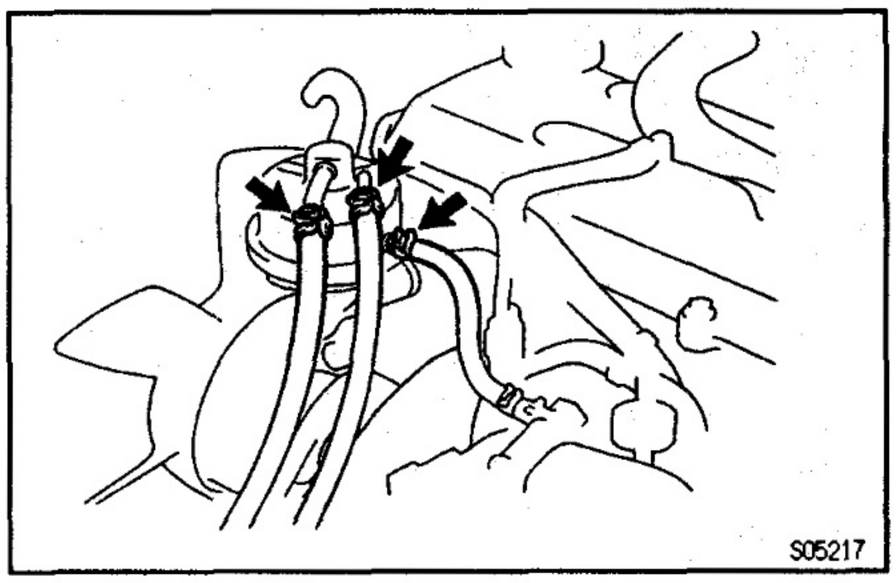
1. **INSTALL CARBURETOR**
(a) Place the insulator and new gaskets on the intake manifold.
(b) Place the carburetor on the insulator.
(c) Install the 4 carburetor mounting nuts.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)
2. **CONNECT THESE HOSES**
(a) Emission control hoses
(b) Fuel inlet hose
(c) Outer vent control hose
(d) No.2 ventilation hose
3. **CONNECT CARBURETOR CONNECTOR**
4. **FILL WITH COOLANT**
5. **ADJUST IDLE SPEED AND IDLE MIXTURE**
6. **ADJUST FAST IDLE SPEED**
7. **ADJUST THROTTLE POSITIONER (TP) SETTING SPEED**

FUEL PUMP

COMPONENTS FOR REMOVAL AND INSTALLATION

E0427-02

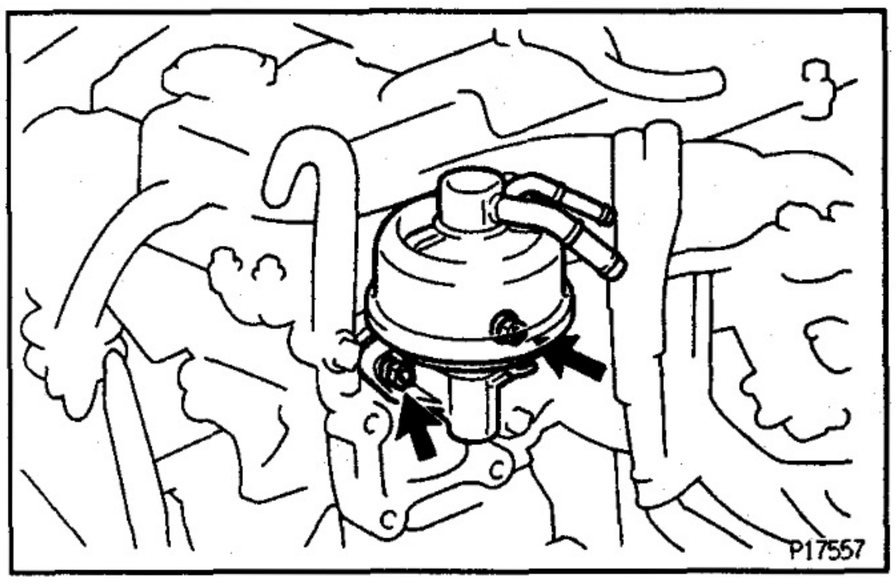




EG428-02

FUEL PUMP REMOVAL

1. DISCONNECT FUEL HOSES FROM FUEL PUMP



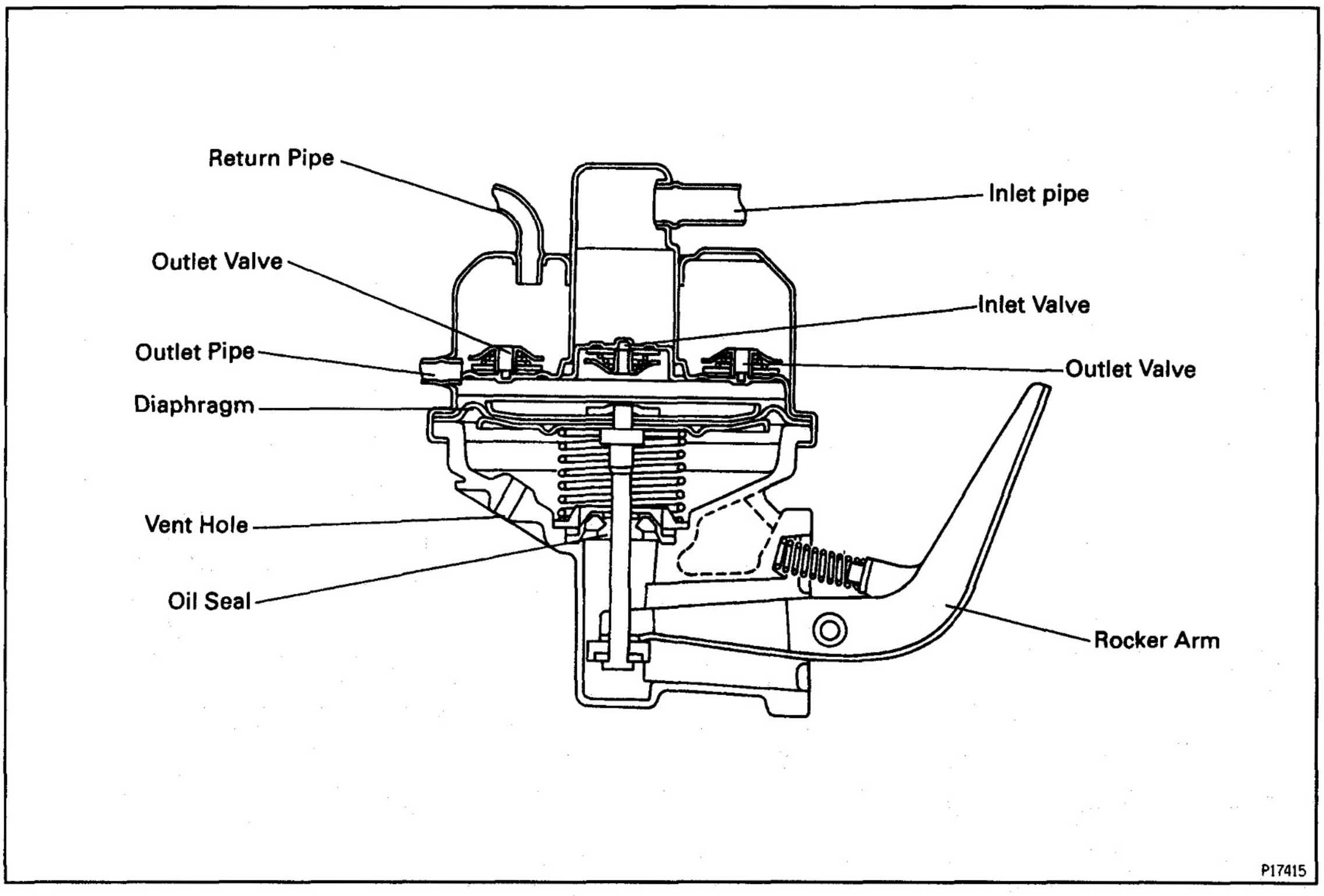
2. REMOVE FUEL PUMP

Remove the 2 nuts, fuel pump and insulator.

FUEL PUMP INSPECTION (Airtight Test)

EG0UV-03

CUTAWAY VIEW

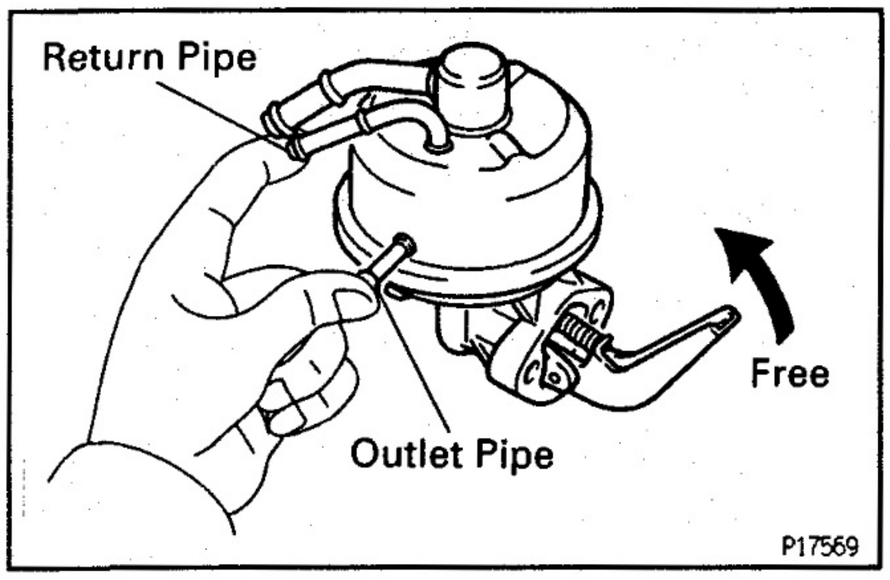


PRECHECKS

Before performing the following checks on the fuel pump:

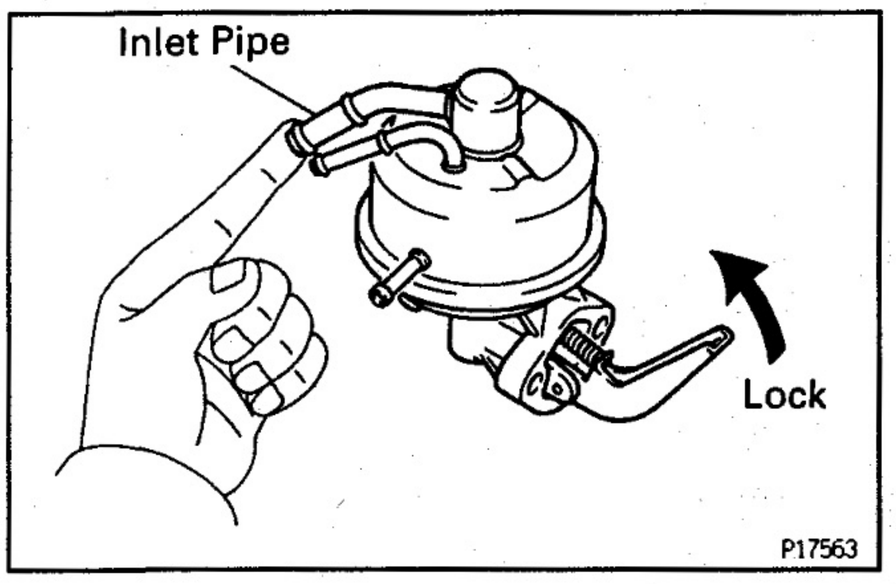
(a) Run some fuel through the pump to ensure that the check valves seal tightly (a dry check valve may not seal properly).

(b) Without blocking off any pipes, operate the rocker arm and check the amount of force necessary for operation and the amount of arm play. This same amount of force should be used in the checks.



1. CHECK INLET VALVE

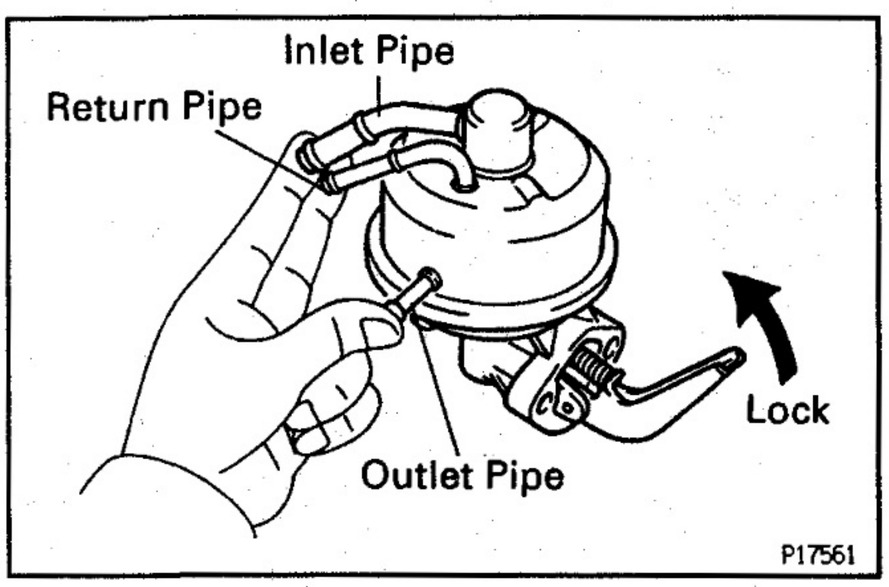
Block off the outlet and return pipes with your finger and check that there is an increase in rocker arm play and that the rocker arm moves freely (no reaction force).



2. CHECK OUTLET VALVE

Block off the inlet pipe with your finger and check that the rocker arm locks (does not operate with same amount of force used in the precheck above).

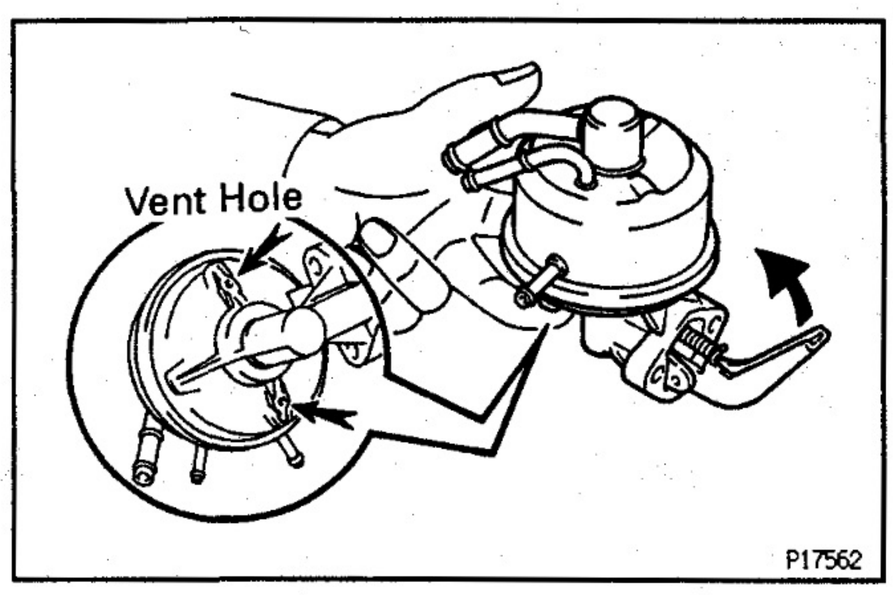
HINT: Never use more force than that used in the precheck. This applies to checks 3 and 4 also.



3. CHECK DIAPHRAGM

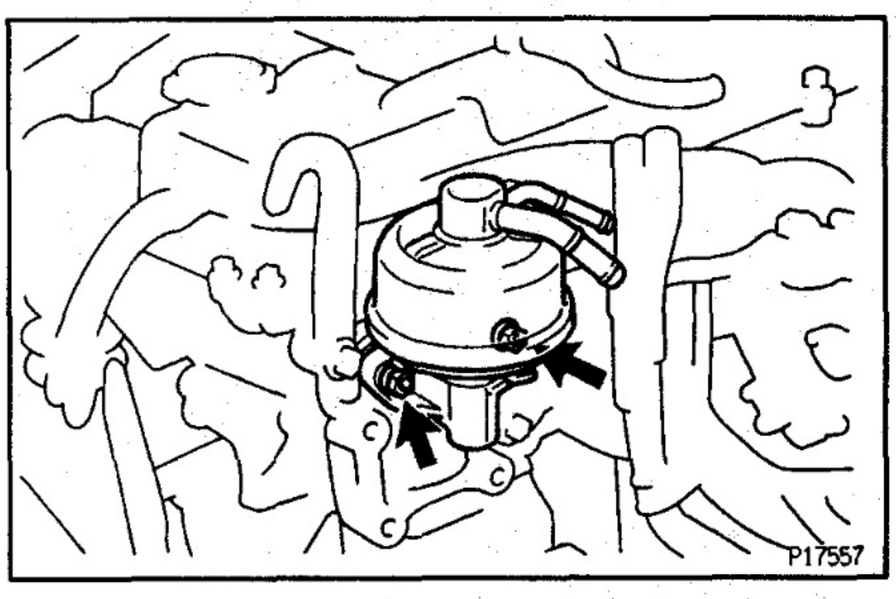
Block off the inlet, outlet and return pipes and check that the rocker arm locks.

HINT: If all three of these checks are not as specified, the caulking (sealing) of the body and upper casing is defective.



4. CHECK OIL SEAL

Block off the vent hole with your finger and check that the rocker arm locks.



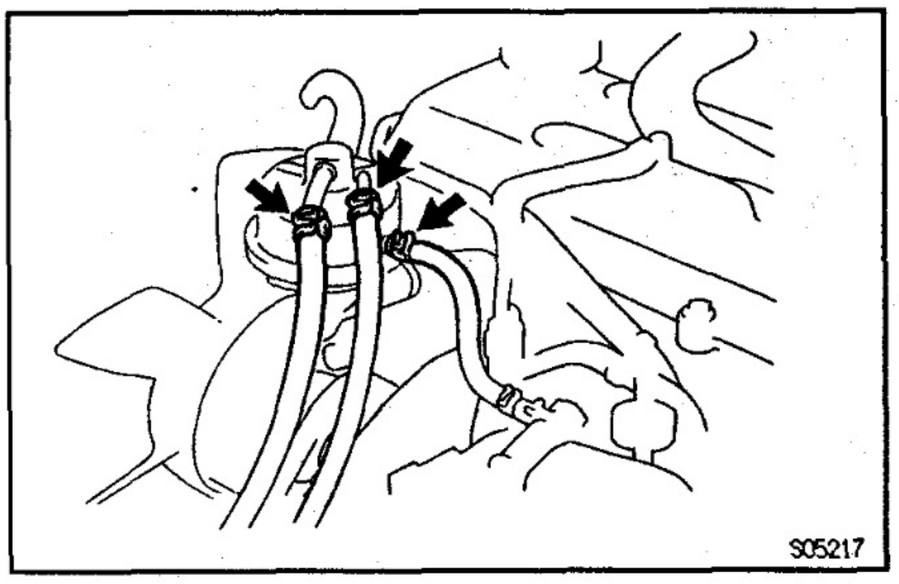
EG787-01

FUEL PUMP INSTALLATION

1. **INSTALL FUEL PUMP**

(a) Install a new insulator to the cylinder head.

(b) Install the fuel pump with the 2 nuts.
Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)



2. **CONNECT FUEL HOSES TO FUEL PUMP**
3. **START ENGINE AND CHECK FOR LEAKS**

SERVICE SPECIFICATIONS

SERVICE DATA

EGOUX-05

Carburetor	Float level (Raised position)	9.8 mm (0.386 in.)
	Float level (Lowered position)	0.9 – 1.1 mm (0.035–0.043 in.)
	Secondary throttle valve full open angle (Primary)	90° from horizontal
	Secondary throttle valve full open angle (Secondary)	90° from horizontal
	Secondary touch angle	50° from horizontal
	Fast idle angle (Pre–setting)	16° from horizontal
	Unloder angle	25° from horizontal
	Choke breaker angle	22 – 33° from horizontal
	Throttle positioner angle	9.8° from horizontal
	Idle speed angle (Pre–setting)	5.5° from horizontal
	Idle mixture adjusting screw (Pre–setting)	Screw out approx. 2 1/4 turns
	Choke heater resistance	1.7 – 1.9 Ω
	OVCV resistance	32 – 38 Ω

TORQUE SPECIFICATIONS

EGOUY-05

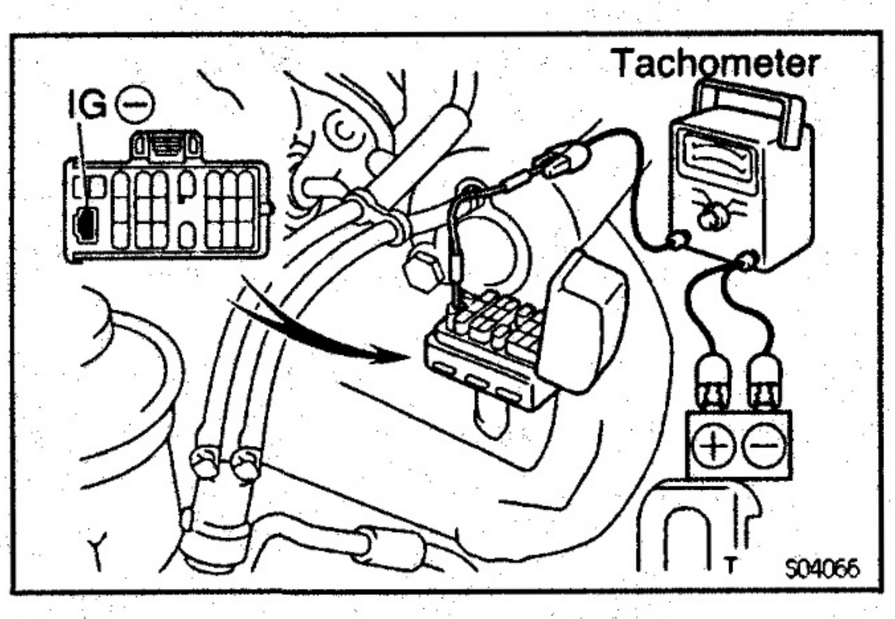
Part tightened	N·m	kgf·cm	ft·lbf
Carburetor x Intake manifold	13	130	9
Fuel pump x Cylinder head	28	290	21

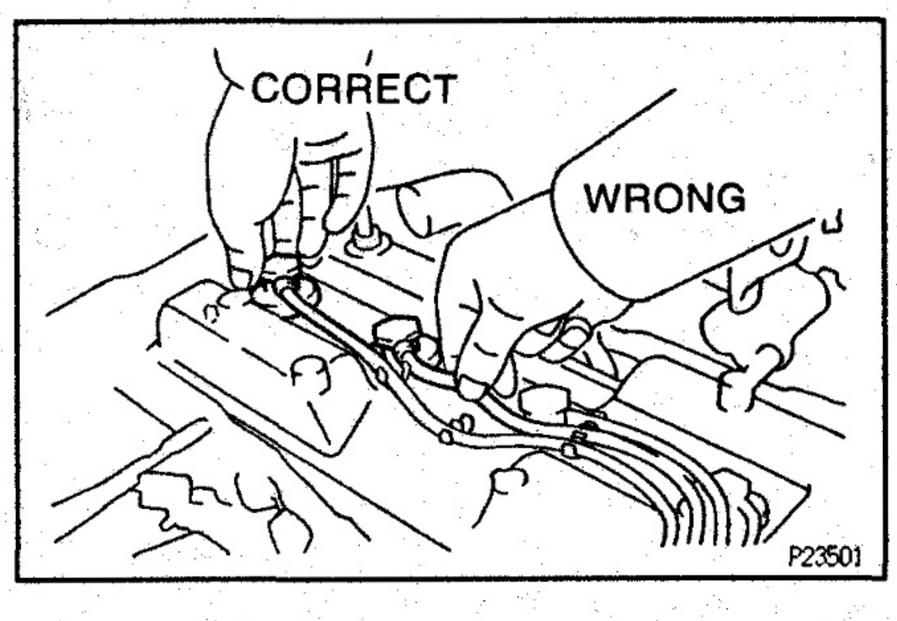
EFI SYSTEM

PRECAUTION

EG0CV-02

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





MAINTENANCE PRECAUTIONS

EG11U-0W

1. PRECAUTION WHEN CONNECTING GAUGE

(a) Use battery as the power source for the timing light, tachometer, etc.
(b) Connect the tester probe of a tachometer to the terminal IG⊖ of the check connector.

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

(a) Check proper connection of battery terminal cables, etc.
(b) Handle high−tension cords carefully.
(c) After repair work, check that the ignition coil terminals and all other ignition system lines are reconnected securely.
(d) When cleaning the engine compartment, be especially careful to protect the electrical system from water.

3. PRECAUTIONS WHEN HANDLING OXYGEN

(a) Do not allow oxygen sensor to drop or hit against an object.
(b) Do not allow the sensor to come into contact with water.

EG

AIR INDUCTION SYSTEM

EGOCM-01

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

ELECTRONIC CONTROL SYSTEM

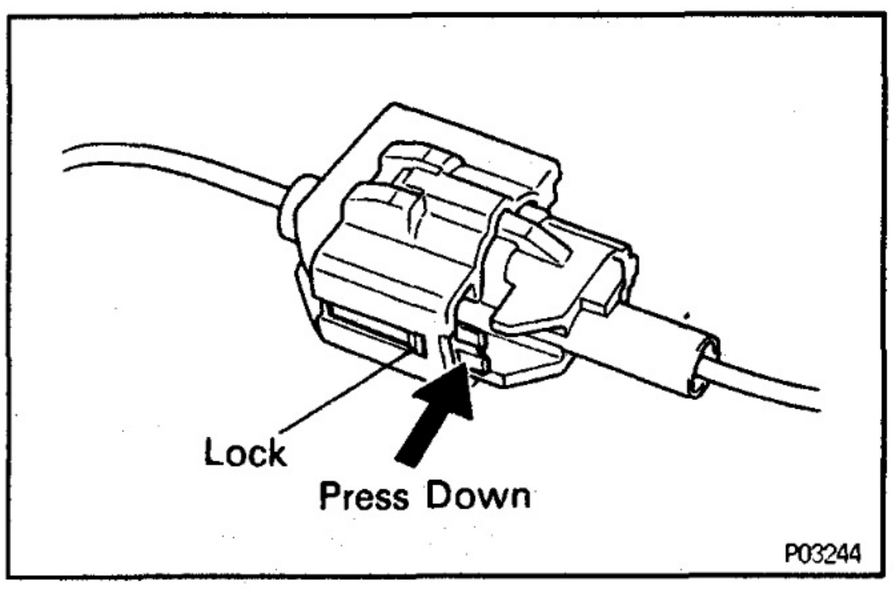
EGSEU-02

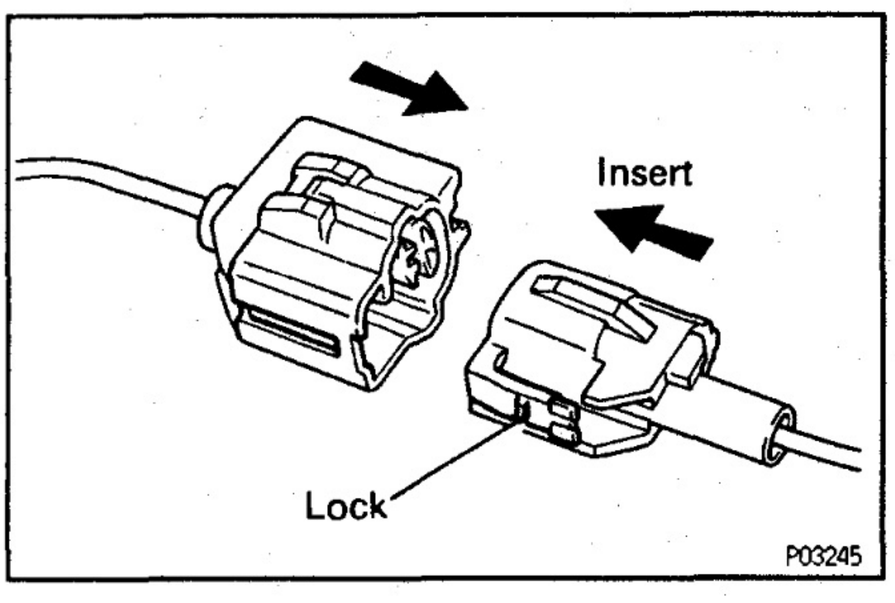
1. Before removing EFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch OFF or disconnecting the negative (−) terminal cable from the battery.
   HINT: Always check the diagnostic code before disconnecting the negative (−) terminal cable from the battery.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

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

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

9. When inspecting a connector with a volt/ohmmeter



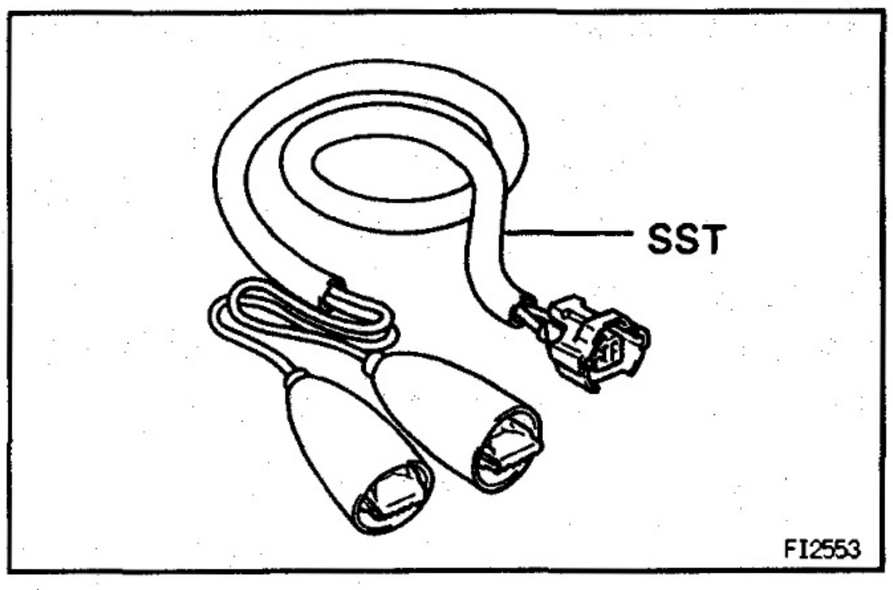


(a) Carefully take out the water−proofing rubber if it is a water−proof type connector.

(b) Insert the test probe into the connector from the wiring side when checking the continuity, amperage or voltage.

(c) Do not apply unnecessary force to the terminal.

(d) After checking, install the water−proofing rubber on the connector securely.

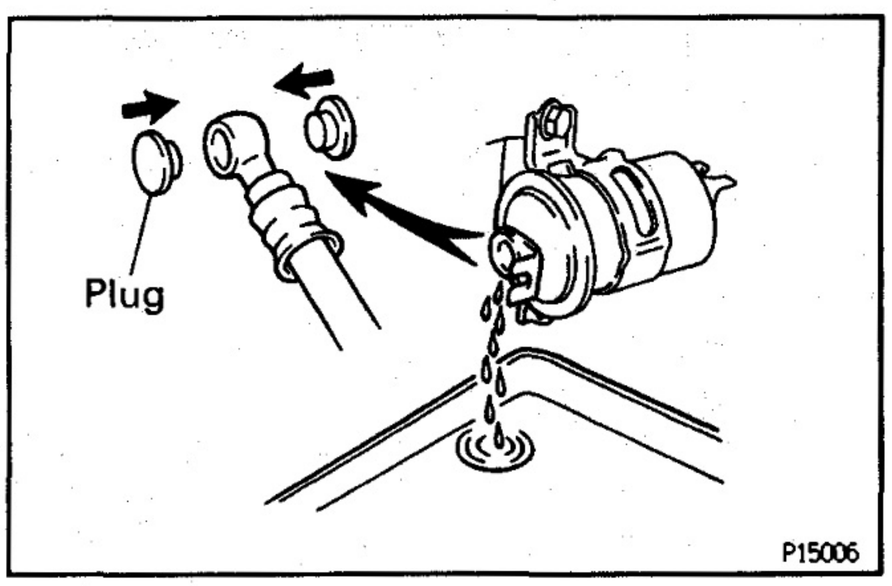


10. Use SST for inspection or test of the injector or its wiring connector.
SST 09842–30070

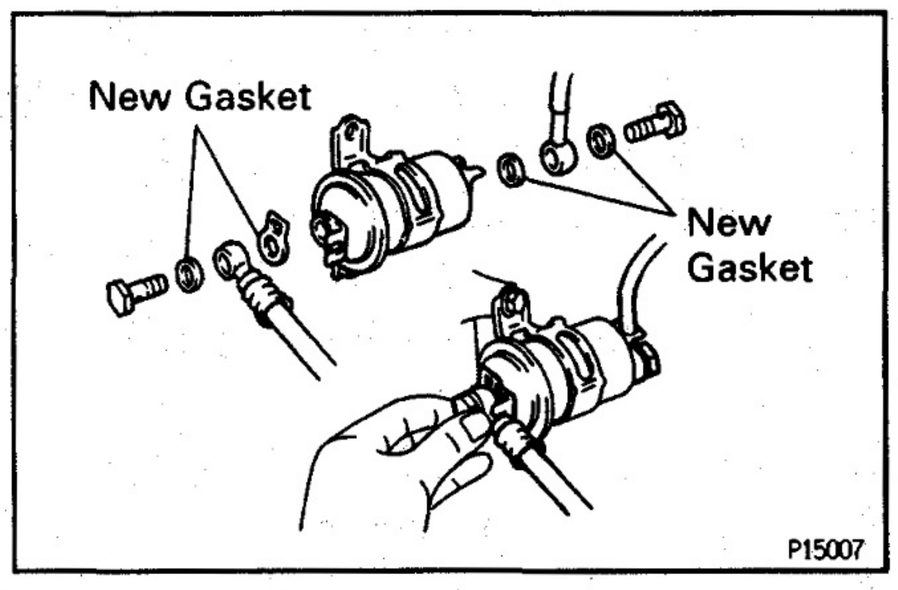
E0786-01

FUEL SYSTEM

1. When disconnecting the high pressure fuel line, a large amount of gasoline will spill out, so observe the following procedures:

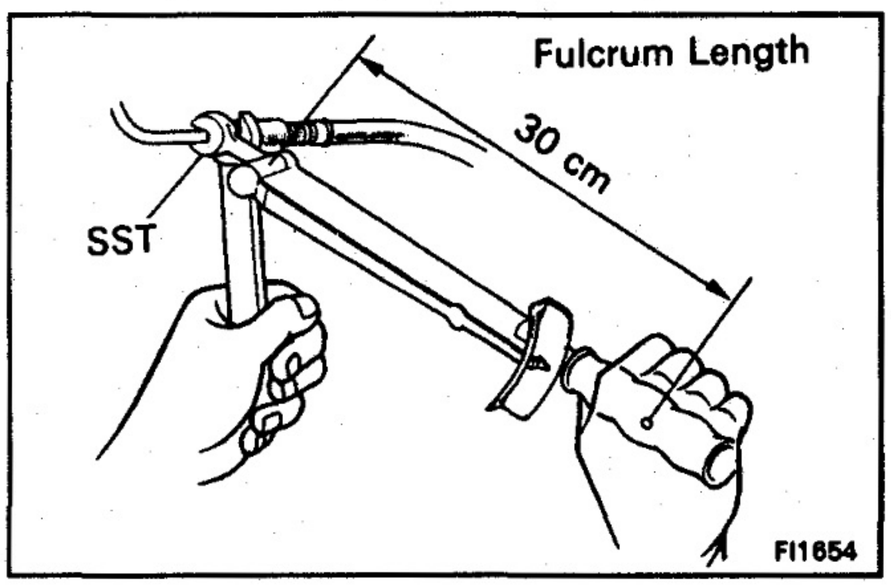


(a) Put a container under the connection.
(b) Slowly loosen the connection.
(c) Disconnect the connection.
(d) Plug the connection with a rubber plug.
(e) Reconnect the fuel pump connector.

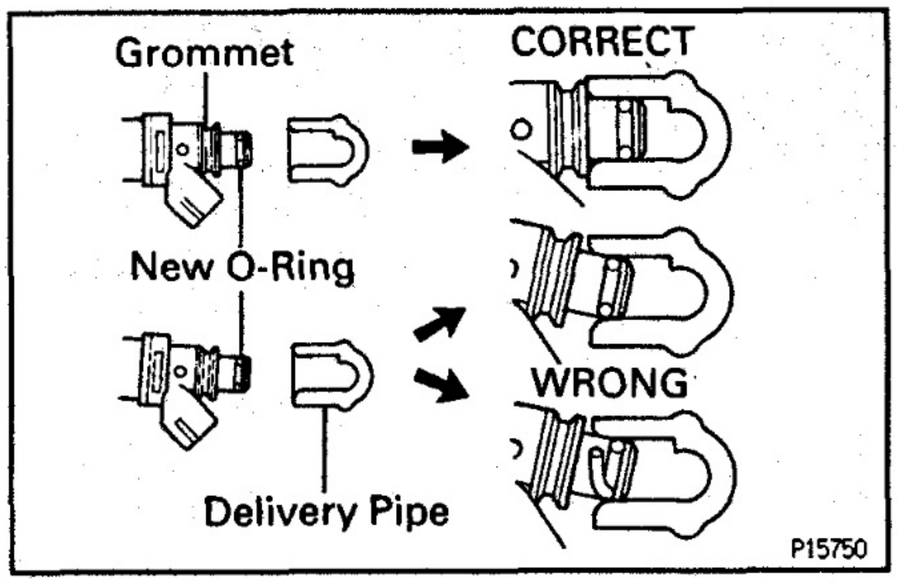


2. When connecting the flare nut or union bolt on the high pressure pipe union, observe the following procedures:

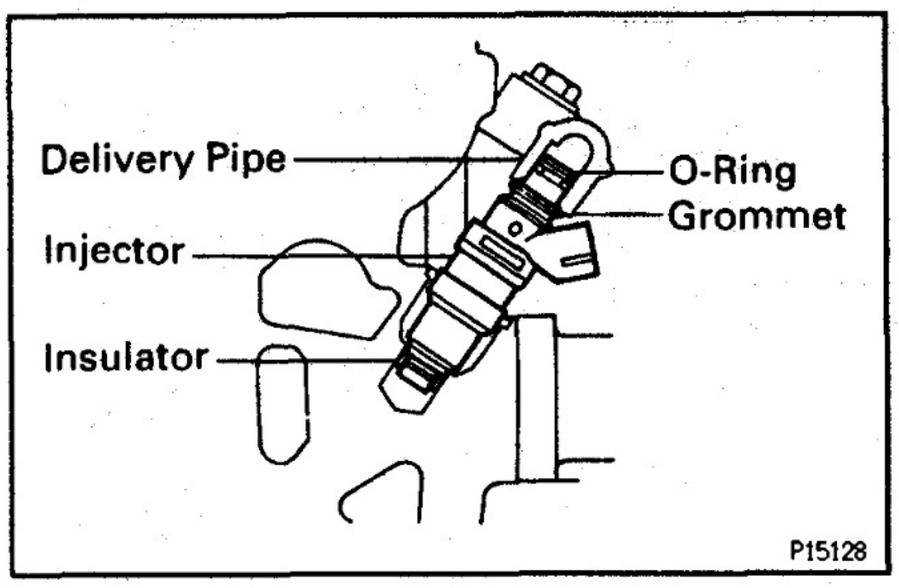
Union Bolt Type:
(a) Always use a new gasket.
(b) Tighten the union bolt by hand.
(c) Tighten the union bolt to the specified torque.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)



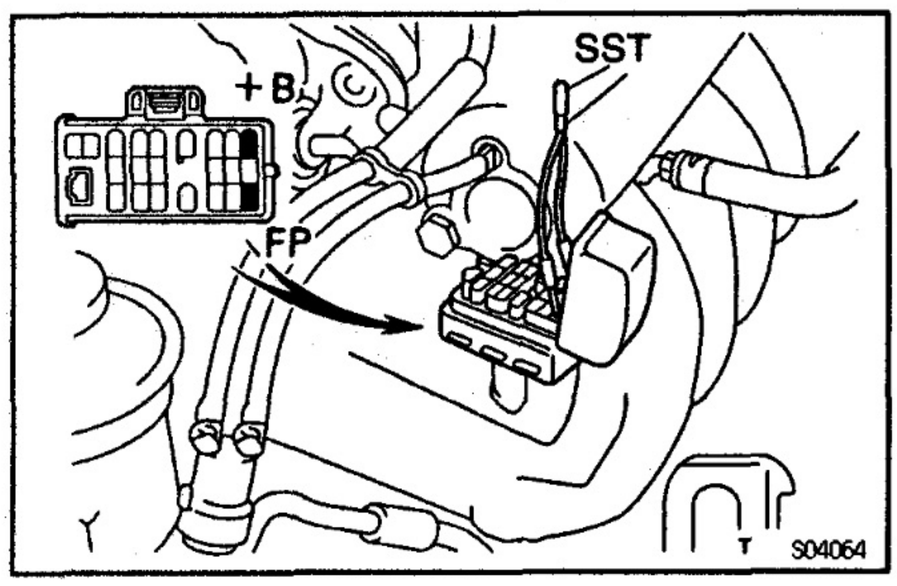
Flare Nut Type:
(a) Apply a light coat of engine oil to the flare and tighten the flare nut by hand.
(b) Using SST, tighten the flare nut to the specified torque.
SST 09631–22020
Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)
HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).



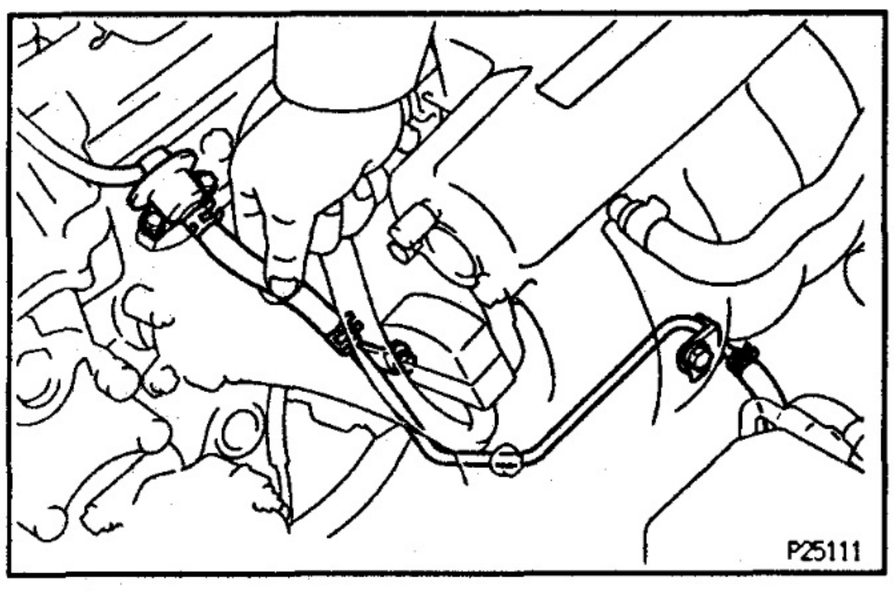
3. Observe the following precautions when removing and installing the injectors.
(a) Never reuse the O–ring and insulator.
(b) When placing a new O–ring on the injector, take care not to damage it in any way.
(c) Coat a new O–ring with spindle oil or gasoline before installing–never use engine, gear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



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



5. Check that there are no fuel leaks after performing maintenance anywhere on the fuel system.
(a) Using SST, connect terminals +B and FP of the check connector.
SST 09843–18020
(b) Turn the ignition switch ON.
NOTICE: Do not start the engine.

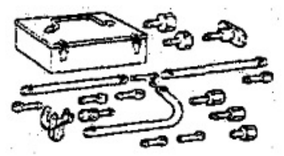
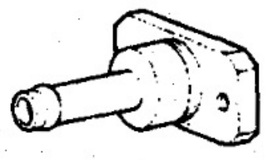
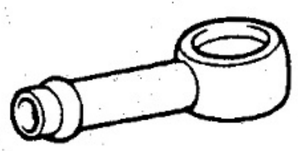
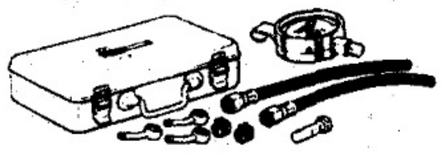
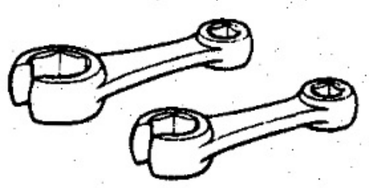


(c) Pinch the fuel return hose.
The pressure in the high pressure line will rise to approx. 392 kPa (4kgf/cm², 57 psi). In this state, check to see that there are no leaks from any part of the fuel system.
NOTICE: Always pinch the hose. Avoid bending as it may cause the hose to crack.
(d) Turn the ignition switch OFF.
(e) Remove the SST from the check connector.
SST 09843–18020

PREPARATION

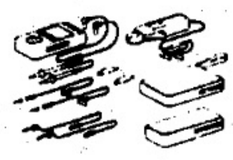
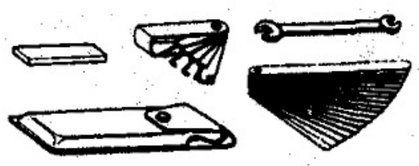
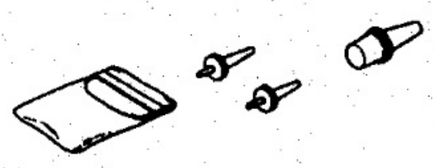
SST (SPECIAL SERVICE TOOLS)

EG0CF-2B

	09268–41046 Injection Measuring Tool Set	
	(09268–41091) NO.7 Union	
	(90405–09015) No.1 Union	
	09268–45012 EFI Fuel Pressure Gauge	
	09631–22020 Power Steering Hose Nut 14 x 17 mm Wrench Set	Fuel line flare nut
	09842–30070 Wiring "F" EFI Inspection	
	09843–18020 Diagnosis Check Wire	

EG0CG-1H

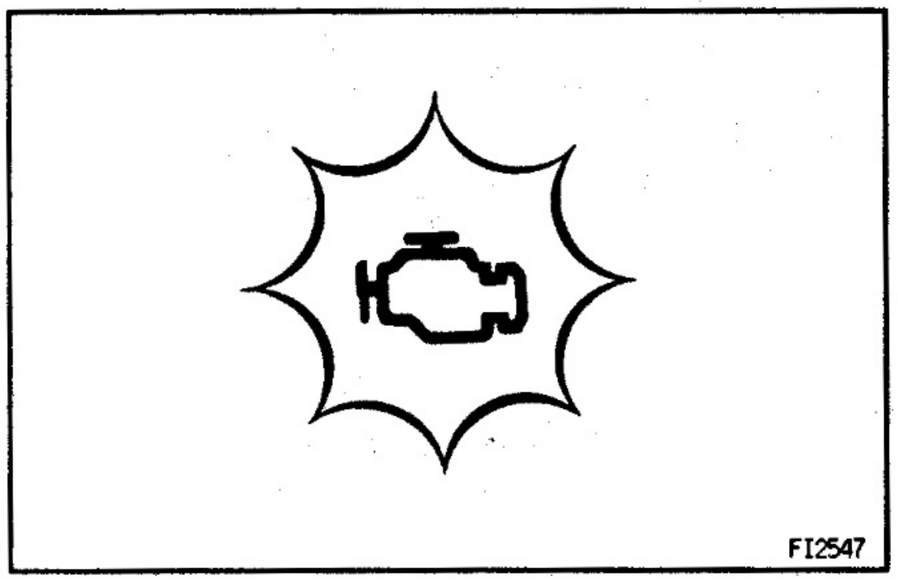
RECOMMENDED TOOLS

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

RECOMMENDED TOOLS

E00CH-1Y

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



DIAGNOSIS SYSTEM

CHECK ENGINE WARNING LIGHT CHECK

E05JE-06

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

DIAGNOSTIC TROUBLE CODES OUTPUT

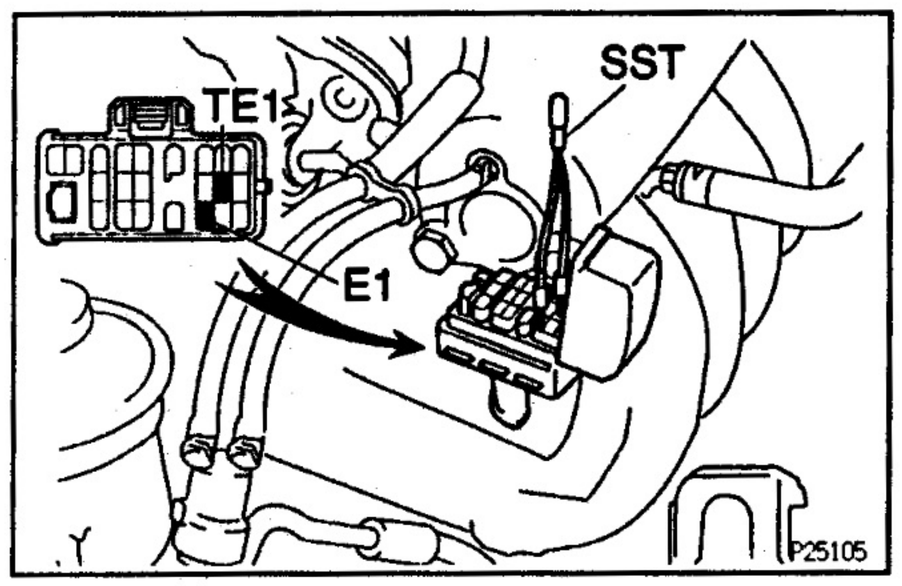
E0767-01

Normal mode:

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

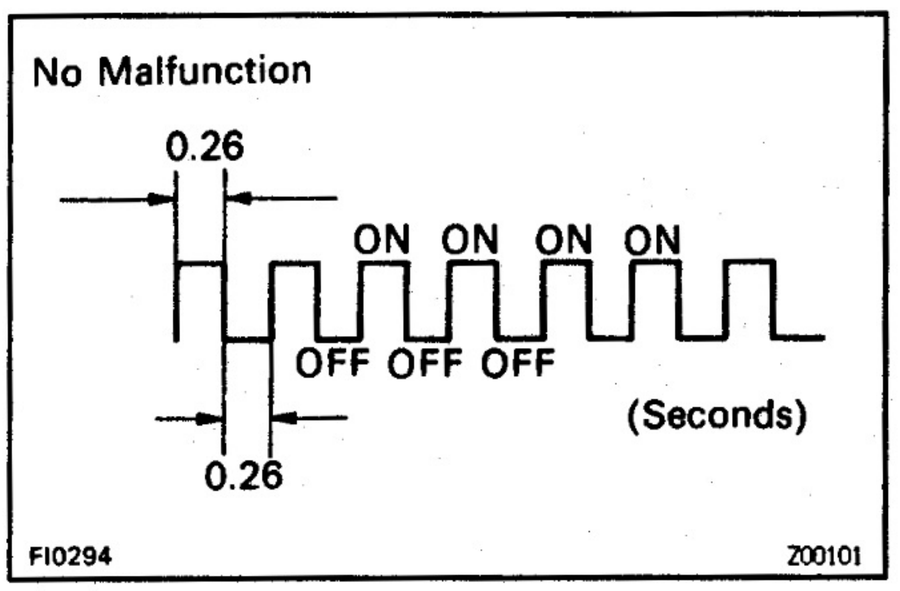
1. Initial conditions:

(a) Battery positive voltage 11 V or more
(b) Throttle valve fully closed
(c) Accessories switched OFF



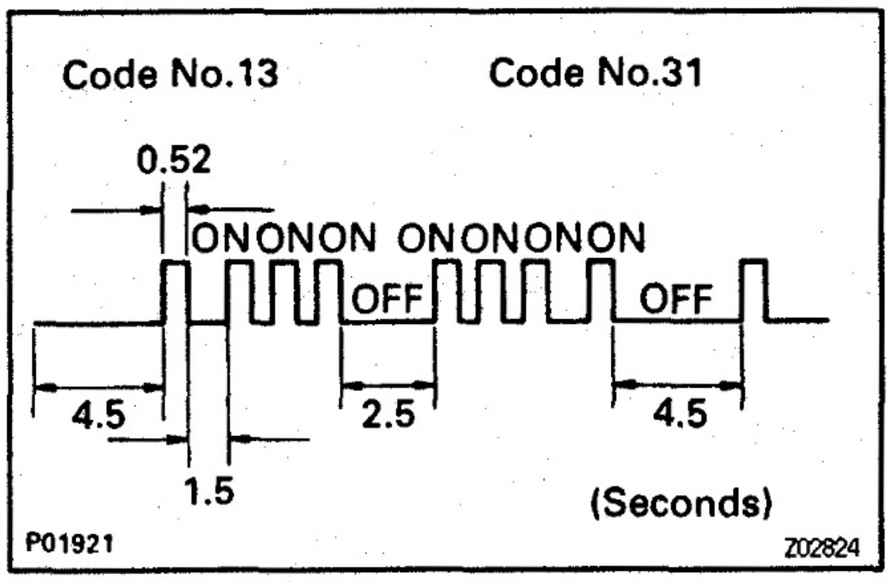
(d) Engine at normal operating temperature

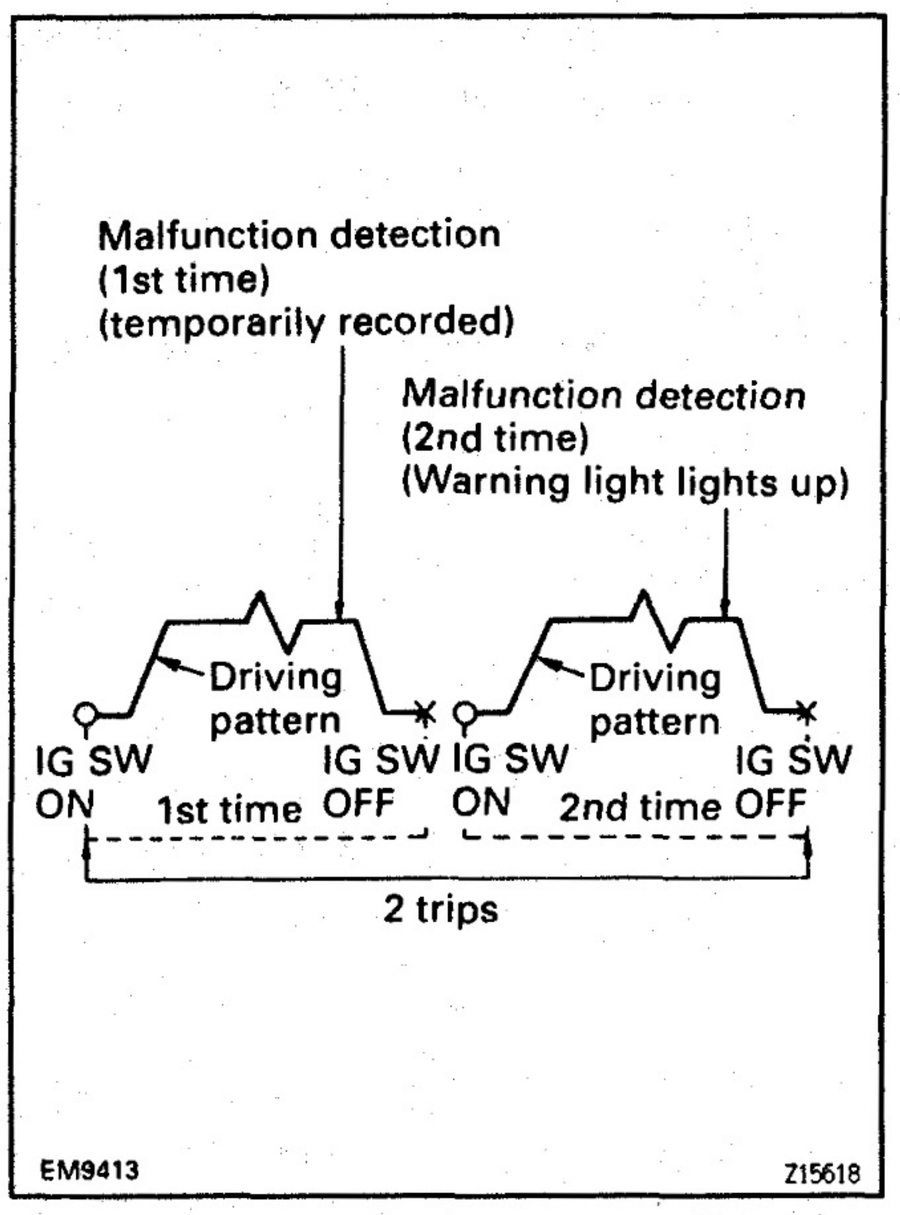
2. Turn the ignition switch ON.
   CAUTION: Do not start the engine.
3. Using SST, connect terminals TE1 and E1 of the check connector.
   SST 09843—18020
4. Read the diagnostic trouble code as indicated by the number of flashes of the check engine warning light.



Diagnostic Trouble Codes (DTC)

(a) Normal System Operation (no malfunction)
   - The light will alternately blink ON and OFF at 0.26 second intervals.





(b) Malfunction Code Indication

- In the event of a malfunction, the light will blink every 0.52 seconds. The 1st number of blinks will equal the 1st digit of a 2 digit diagnostic trouble code, and after a 1.5 second pause, the 2nd number of blinks will equal the second digit. If there are 2 or more codes, there will be a 2.5 second pause between each code.
- After all the codes have been output, there will be a 4.5 second pause and they will all be repeated as long the terminals TE1 and E1 of the check connector are connected.

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

(c) 2 trip detection logic:

Diagnostic trouble codes 21 and 25 use "2 trip detection logic". With this logic, when a malfunction is first detected, the malfunction is temporarily stored in the ECU memory. If the same case is detected again during the second drive test, this second detection causes the warning light to light up.

The 2 trip repeats the same mode a 2nd time. (However, the ignition switch must be turned OFF between the 1st time and 2nd time.) In the Test Mode, the check engine warning light lights up the 1st time a malfunction is detected.

5. After the diagnosis check, remove the SST from the check connector.
   SST 09843–18020

Test mode:

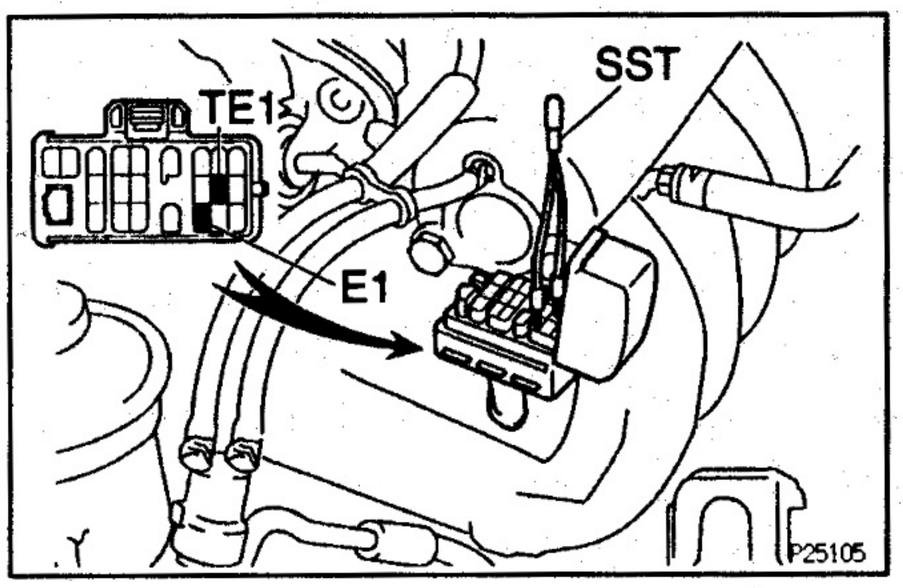
HINT:

- Compared to the normal mode, the test mode has an increased sensing ability to detect malfunctions.
- It can also detect malfunctions in the starter signal circuit, air conditioning signal.
- Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the test mode.

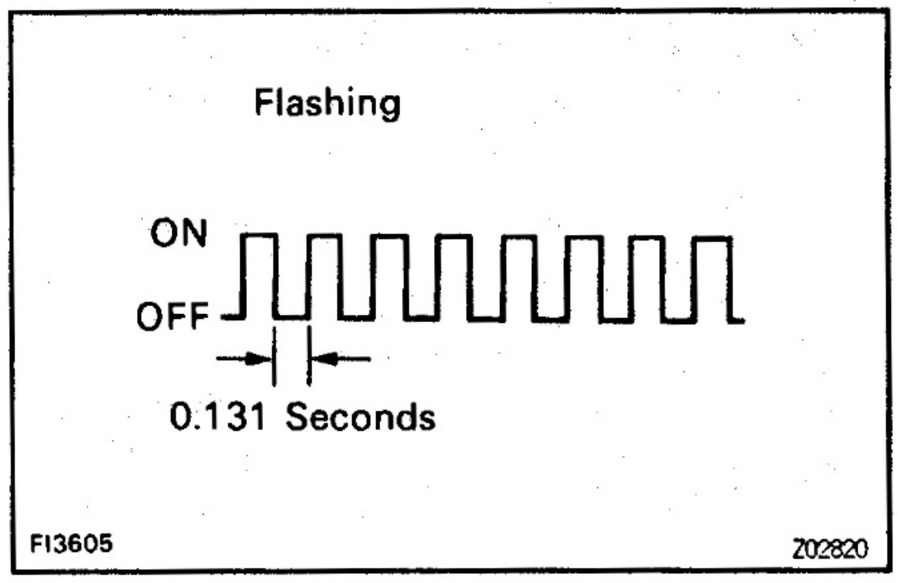
To obtain an output of diagnostic trouble codes, proceed as follows:

1. Initial conditions:

(a) Battery positive voltage 11 V or more
(b) Throttle valve fully closed
(c) Accessories switched OFF

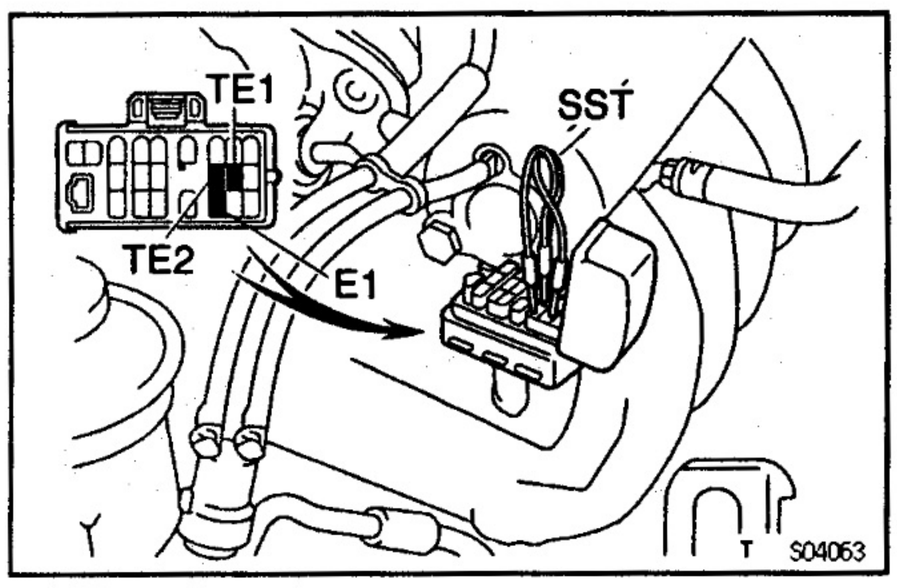


2. Turn the ignition switch OFF.
3. Using SST, connect terminals TE2 and E1 of the check connecter.
   SST 09843–18020
4. Turn the ignition switch ON to begin the diagnosis in the test mode.



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

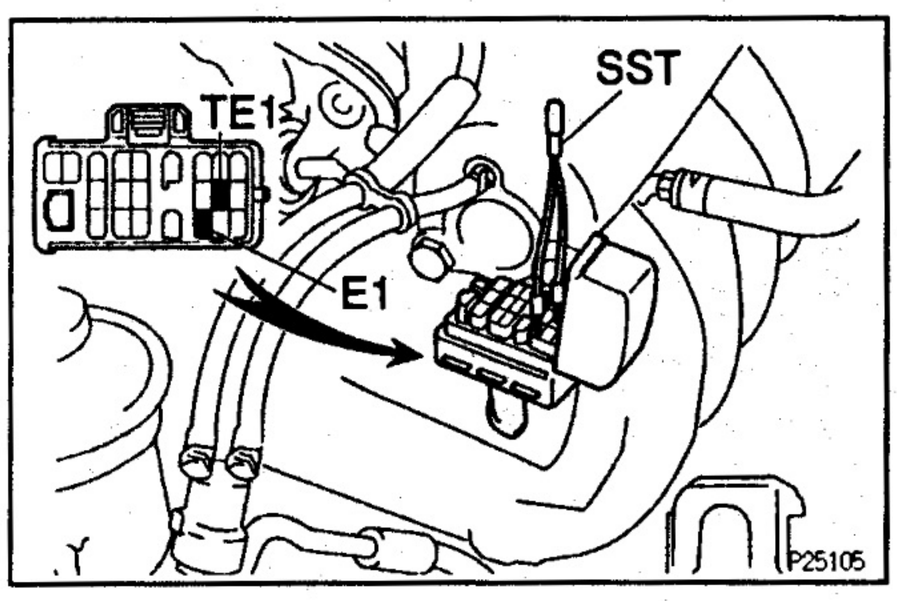
5. Start the engine, and drive the vehicle at a speed of 10 km/h (6 mph) or higher.
6. Simulate the conditions of the malfunction described by the customer.



7. Using SST, connect terminals TE1 and E1 of the check connecter.
   SST 09843–18020
8. Read the diagnostic trouble code as indicated by the number of flashes of the check engine warning light.
9. After the diagnosis check, remove the SST from the check connecter.
   SST 09843–18020

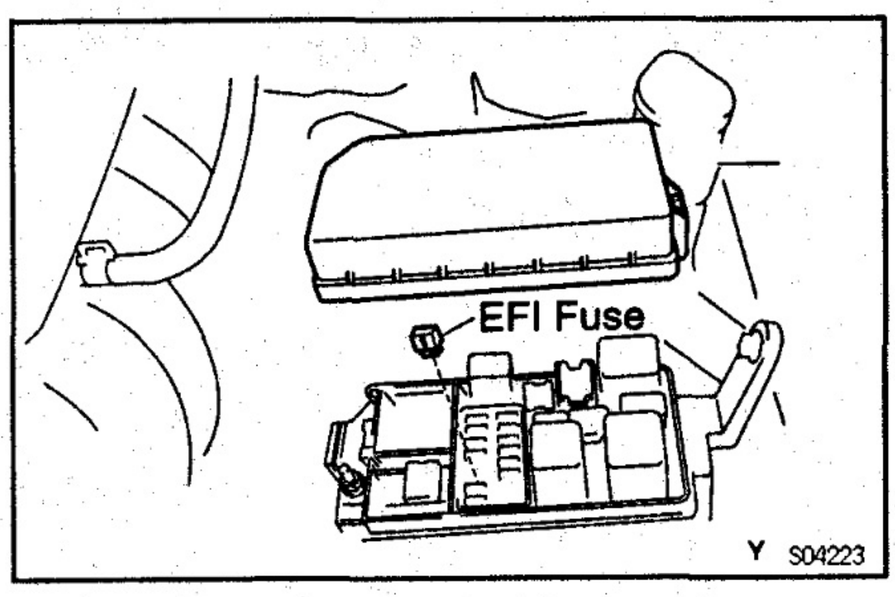
HINT:

- The test mode will not start if terminals TE2 and E1 are connected after the ignition switch is turned ON.
- The starter signal and vehicle speed signal will be diagnosed by the ECU as malfunctions, and code Nos. 42 and 43 will be output, if the operation in step 5 is not done.
- When the air conditioning is ON or when the accelerator pedal is depressed, code "51" (Switch Condition Signal) is output, but this is not abnormal.



DIAGNOSTIC TROUBLE CODE CHECK USING HAND–HELD TESTER

1. Hook up the hand–held tester to the check connecter.
2. Read the diagnostic trouble codes by following the prompts on the tester screen.
   Please refer to the hand – held tester operator's manual for further details.



B04ZT-0C

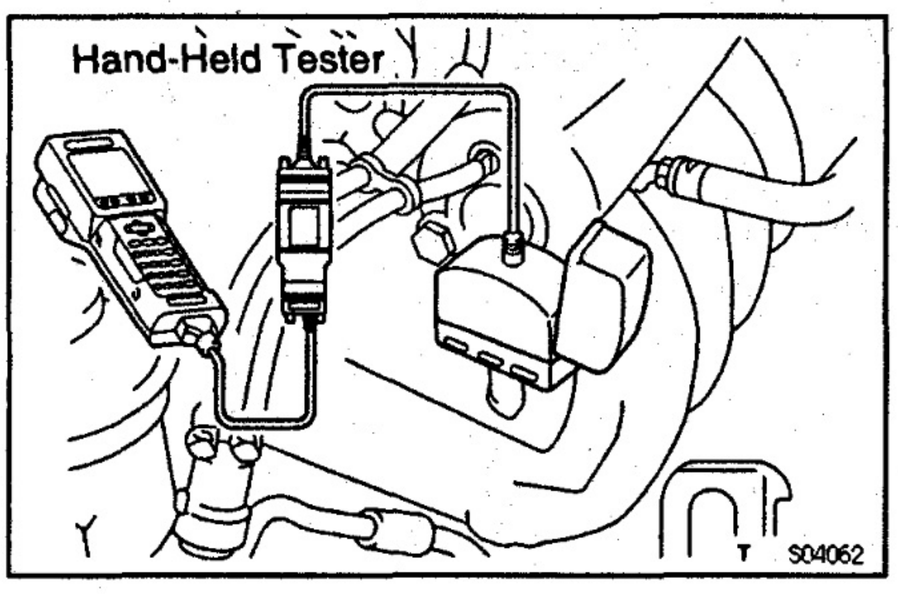
DIAGNOSTIC TROUBLE CODE CANCELLATION

1. After repair of the trouble area, the diagnostic trouble code retained in memory by the ECU must be cancelled out by removing the EFI fuse (15A) for 10 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch OFF.
   HINT:
   - Cancellation can also be done by removing the negative (−) terminal cable from the battery, but in this case, other memory systems (clock, etc.) will also cancelled out.
   - If the diagnostic trouble code is not cancelled out, it will be retained by the ECU and appear along with a new code in the event of future trouble.
   - If it is necessary to work on engine components requiring removal of the battery terminal, a check must first be made to see if a diagnostic trouble code has been recorded.
2. After cancellation, road test the vehicle to check that a normal code is now read on the check engine warning light.
   If the same diagnostic trouble code appears, it indicates that the trouble area has not been repaired thoroughly.

B0124-0G

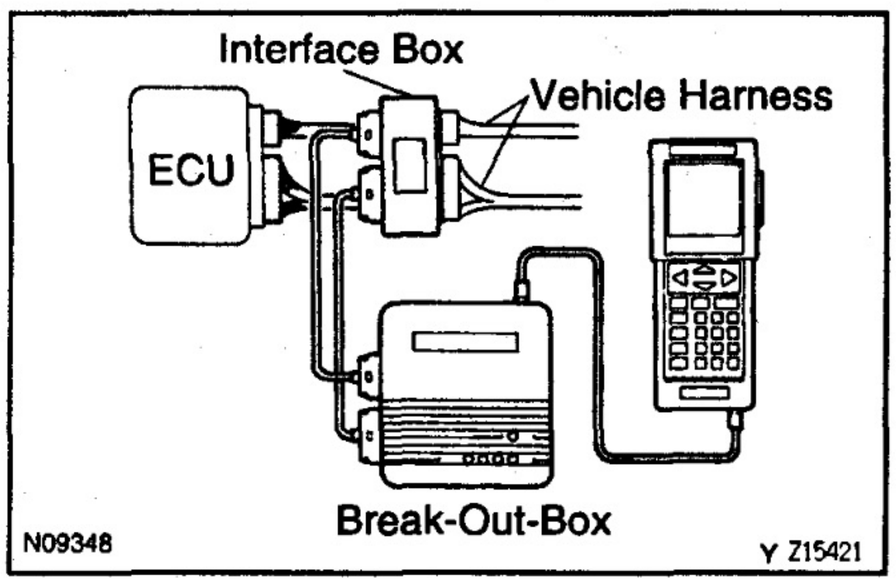
DIAGNOSIS INDICATION

1. When 2 or more codes are indicated, the lowest number (code) will appear first.
2. All detected diagnostic trouble codes, except code Nos. 43 and 51 under the test mode will be retained in memory by the ECU from the time of detection until cancelled out.
3. Once malfunction is cleared, the check engine warning light in the combination meter will go off but the diagnostic trouble code (s) remains stored in ECU memory.



ECU DATA MONITOR USING HAND–HELD TESTER

1. Hook up the hand–held tester to the check connecter.
2. Monitor the ECU data by following the prompts on the tester screen.
   HINT: Hand–held tester has a "Snapshot" function which records the monitored data.
   Please refer to the hand – held tester operator's manual for further details.



ECU TERMINAL VALUES MEASUREMENT USING BREAK–OUT–BOX AND HAND–HELD TESTER

1. Hook up the break–out–box and hand–held tester to the vehicle.
2. Read the ECU input/output values by following the prompts on the tester screen.
   HINT: Hand–held tester has a "Snapshot" function. This records the measured values and is effective in the diagnosis of intermittent problems.
   Please refer to the hand–held tester/break–out–box operator's manual for further details.

DIAGNOSTIC TROUBLE CODES

56701-03

HINT:

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

EG

DTC No.	Number of blinks of Check Engine Warning Light	System	Check Engine Warning Light *1		Diagnosis	Trouble Area	Memory *2	See Page
			Normal Mode	Test Mode				
—	FI1401	Normal	—	—	Output when no other code is recorded.	—	—	—
12	FI1606	RPM Signal	ON	N.A.	• No G or NE signal is not input to ECU for 2 sec. or more after cranking • Open in G - circuit	• Open or short in G, NE circuit • Distributor • ECU	○	EG-158
13	FI1607	RPM Signal	N.A.	ON	No NE signal to ECU for 0.1 sec. or more at 1,000 rpm or more.	• Open or short in NE circuit • Distributor • ECU	○	EG-158
14	FI1608	Ignition Signal	ON	N.A.	No IGF signal to ECU for 6 consecutive IGT signals during engine running.	• Open or short in IGF or IGT circuit from igniter to ECU • Igniter • ECU	○	EG-158
21	FI1609	Oxygen Sensor Circuit	ON	N.A.	Open or short in heater circuit of oxygen sensor for 0.5 sec. or moer. (HT)	• Open or short in heater circuit of oxygen sensor • Oxygen sensor heater • ECU	○	EG-161
				ON	At normal driving speed below 100 km/h (60 mph) and engine speed is above 1,500 rpm, amplitude of oxygen sensor signal (OX) is reduced to between 0.35 - 0.70 V continuosly for 60 sec. or more. *3 (2 trip detection logic)	• Open or short in oxygen sensor circuit • Oxygen sensor • ECU		
22	FI1610	Water Temp. Sensor Signal	ON	ON	Open or short in water temp. sensor circuit for 0.5 sec. or more. (THW)	• Open or short in water temp. sensor circuit • Water temp. sensor • ECU	○	EG-156
24	FI1611	Intake Air Temp. Sensor Signal	ON	ON	Open or short in intake air temp. sensor circuit for 0.5 sec. or more. (THA)	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor • ECU	○	EG-155
25	BE3932	Air-Fuel Ratio Lean Malfun - ction	ON	ON	Oxygen sensor output is less than 0.45 V for at least 90 secs. for others when oxygen sensor is warmed up (racing at 1,500 rpm) . *3 (2 trip detection logic)	• Engine ground bolt loose • Open in E1 circuit • Open in injector circuit • Fuel line pressure (injector blockage, etc.) • Open or short in oxygen sensor circuit • Oxygen sensor • Ignition system	○	EG-155
31	BE3933	Vacuum Sensor Signal	ON	ON	Open or short detected continuously for 3.0 sec. or more in vacuum sensor circuit. (PIM)	• Open or short in vacuum sensor circuit • Vacuum sensor • ECU	○	EG-152
33	BE3933	Idle Speed Control Valve	ON	ON	Idle speed control valve signal is not output more than 2,000 rpm pulse for 10 sec.	• Open or short in idle speed control valve circuit • ISC Valve • ECU	○	EG-159

V07995

Code No.	Number of blinks of Check Engine Warning Light	System	Check Engine Warning Light *1		Diagnosis	Trouble Area	Memory *2	See Page
			Normal Mode	Test Mode				
41	FI1614	Throttle Position Sensor Signal	ON	ON	Open or short in throttle position sensor circuit for 0.5 sec. or more.(VTA)	• Open or short in throttle position sensor circuit • Throttle position sensor • ECU	○	EG - 52
42	FI1614	Vehicle Speed Sensor Signal	ON	ON	M/T : No vehicle speed sensor signal to ECU for at least 8 sec. during heavy load driving with engine speed between 2,500 rpm and 5,000 rpm. M/T : SPD signal is not input to ECU for at leastg 8.0 sec. during hight load driving with 3,000 rpm≤NE	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECU	○	–
43	FI1616	Starter Signal	N.A.	ON	No starter signal to ECU when cranking with test mode. (STA)	• Open or short in starter signal circuit • Open or short in ignition switch or starter relay circuit • ECU	×	EG - 157
51	BE3935	Switch Condition Signal	N.A.	ON	Displayed when A/C is ON, IDL contact OFF or shift position in "R", "D", "2", or "1" range with the check terminals E1 and TE1 connected.	• A/C switch system • Throttle position sensor IDL circuit • Neutral start switch circuit • Accelerator pedal, cable • ECU	×	–
52	FI1618	Knock Sensor Signal	ON	N.A.	No knock sensor signal to ECU for crank revolutions with engine speed between 1,700 rpm and 5,200 rpm. (KNK1)	• Open or short in knock sensor circuit • Knock sensor (looseness) • ECU	○	EG - 194

T V07996

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 trouble code is recorded in the ECU memory when a malfunction occurs. "X" indicates that a diagnostic trouble code is not recorded in the ECU memory even if a malfunction occurs. Accordingly, output of diagnostic results in normal or test mode is performed with the ignition switch ON.

*3: "2 trip detection logic". (See step 4 (c) in trouble cords output (nomal mode))

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN

E0706-01

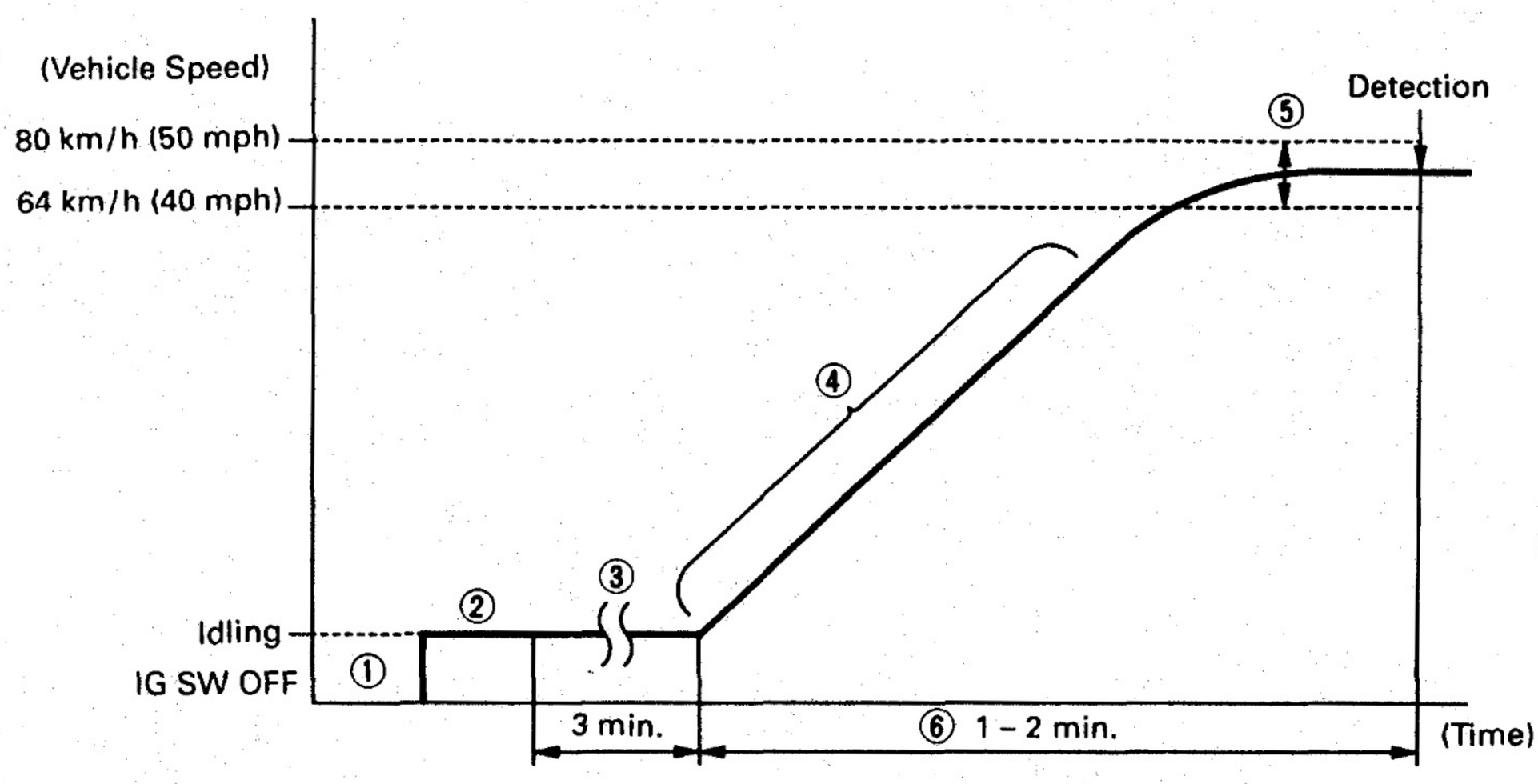
Purpose of the driving pattern

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

(b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

DTC No.21 Oxygen Sensor Circuit

Malfunction: Deterioration of Oxygen Sensor



① Disconnect the EFI fuse (15A) for 10 seconds or more with the ignition switch OFF.
Initiate test mode. (Connect terminals TE2 and E1 of the check connecter.with the ignition switch OFF.)

② Start the engine, and warm it up with all the accessories switched OFF.

③ Let the engine idle for 3 minutes.

④ Accelerate gradually within the range 1,300 – 1,700 rpm (centered around 1,500 rpm) with the A/C switch ON and 5th gear engaged. (Take care that the engine speed does not fall below 1,200 rpm when shifting. Gradually depress the accelerator pedal, and keep it steady so that engine braking does not occur.)

⑤ Maintain the vehicle speed at 64 – 80 km (40 – 50 mph).

⑥ Keep the vehicle running for 1 – 2 minutes after starting acceleration.
HINT: If a malfunction exists, the check engine warning light will light up after approx. 60 seconds from the start of acceleration.
NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

Purpose of the driving pattern

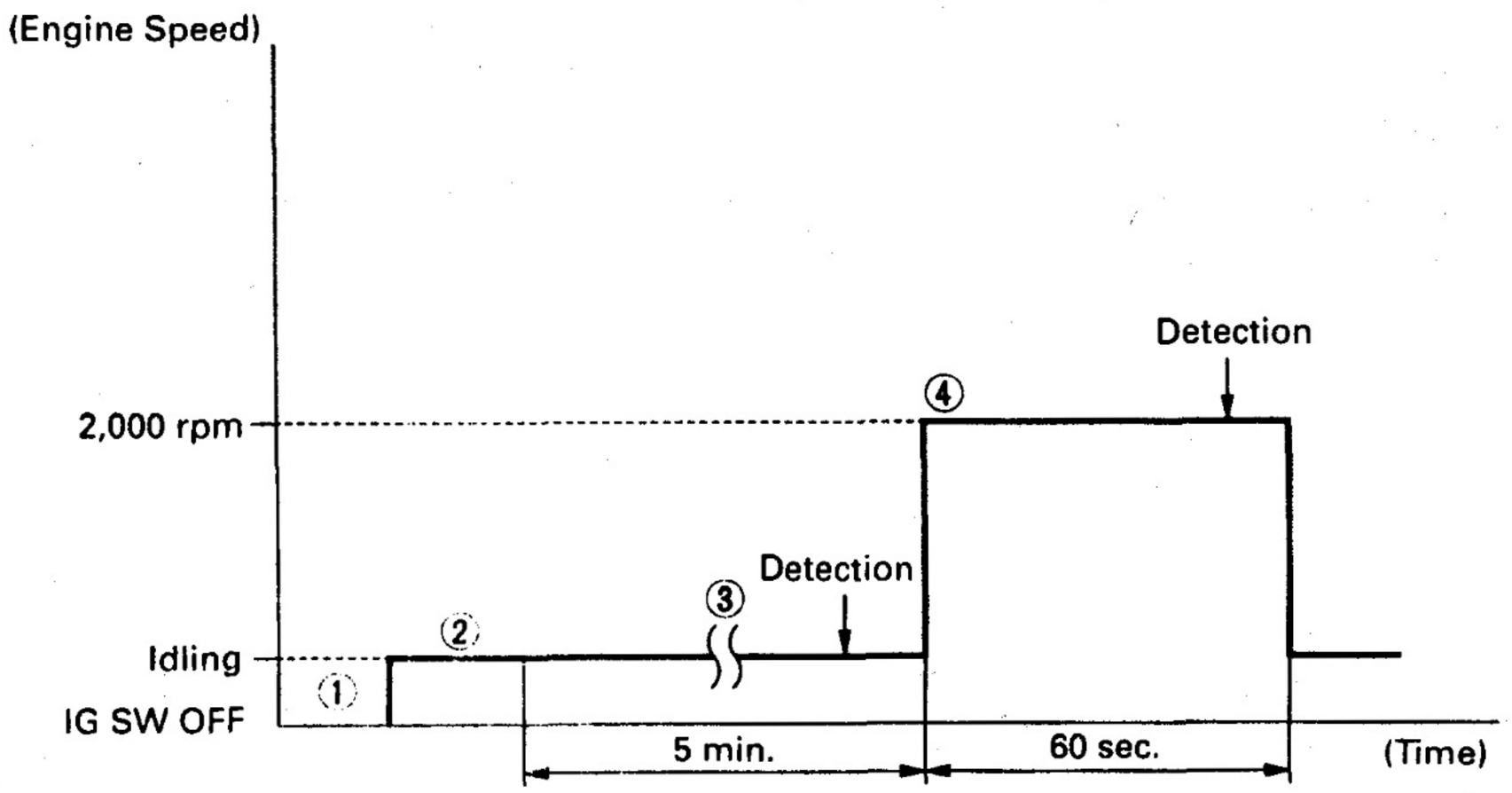
(a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.

(b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

EG

DTC No.25 Air–Fuel Ratio Lean Malfunction

Malfunction: Open or short in Injector Circuit, Injector Leak or Blockage



F16463 V07540

① Disconnect the EFI fuse (15A) for 10 seconds or more with the ignition switch OFF.
Initiate test mode. (Connect terminals TE2 and E1 of the check connector with the ignition switch OFF.)

② Start the engine, and warm it up with all the accessories switched OFF.

③ Let the engine idle for 3 minutes.
(After the engine is started, do not depress the accelerator pedal.)

④ If the malfunction is not detected during idling, race the engine without any load at approx. 2,000 rpm for 60 seconds.

HINT: If a malfunction exists, the check warning light will light up during the 5 minutes idling period or within 60 seconds of starting racing.

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

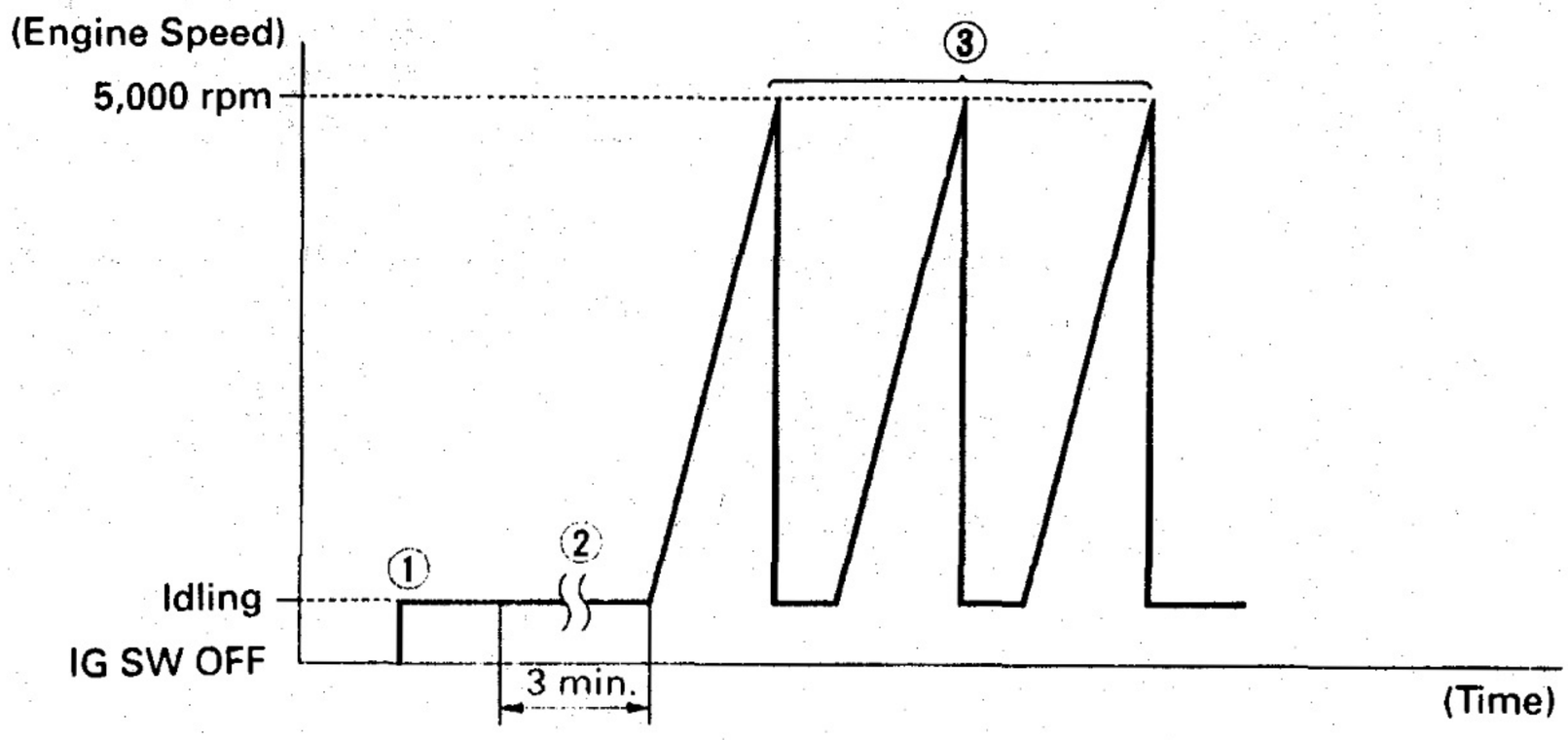
Purpose of the driving pattern

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

(b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

DTC Nos.52 Knock Sensor Circuit

Malfunction: Open or short in Knock Sensor



F16461 V07541

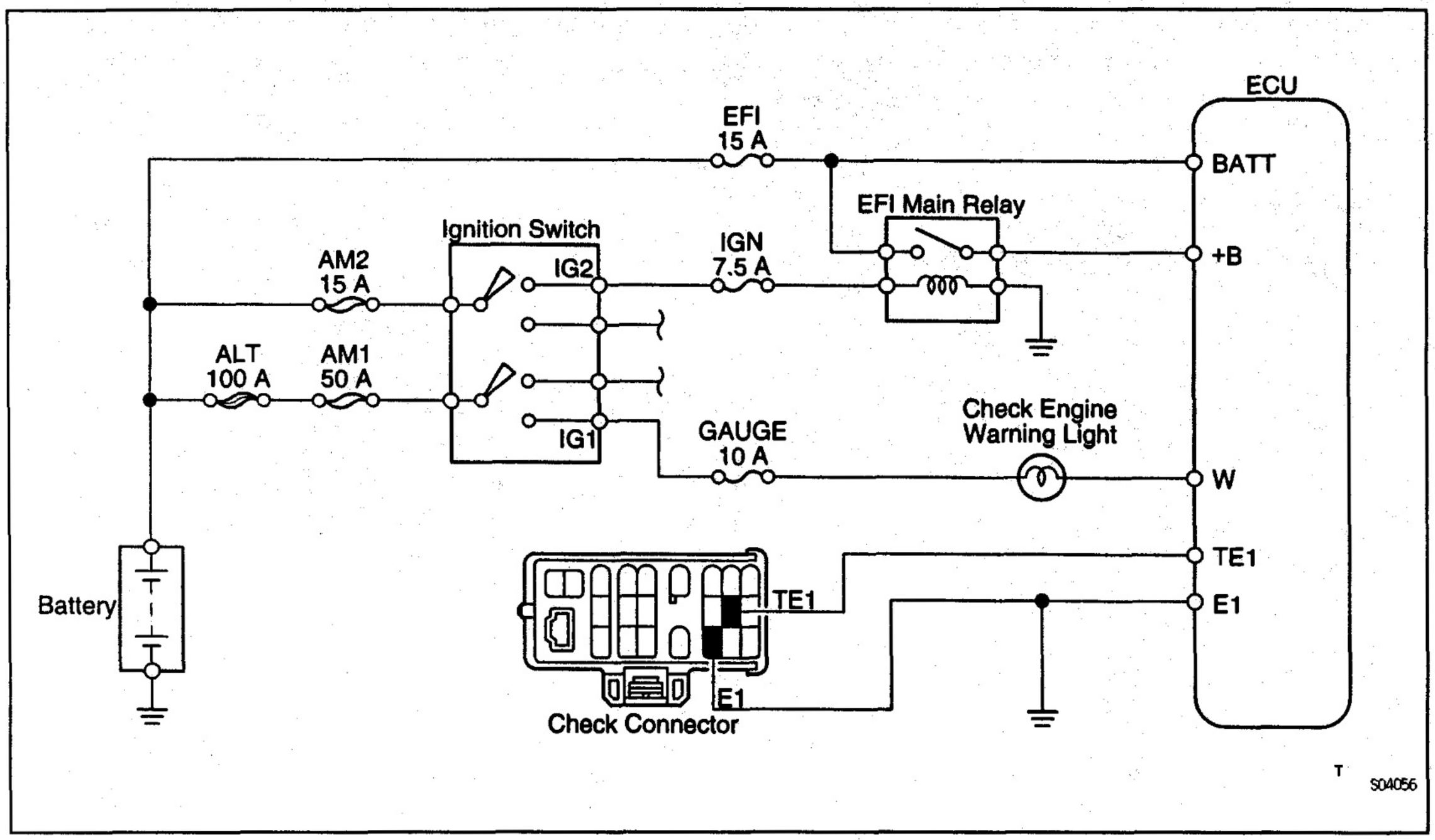
① Start the engine, and warm it up.

② Let the engine idle for 3 minutes.

③ With the A/C ON, quickly race the engine to 5,000 rpm 3 times.
(Replay depress the accelerator pedal and suddenly release it.)
HINT: If a malfunction exists, the check engine warning light will light up when the engine quickly raced.
NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

EG577-09

DIAGNOSIS CIRCUIT INSPECTION



1. Does check engine warning light come on when ignition switch is at ON?
   - YES → System normal.
   - NO → Does check engine warning light come on when engine ECU terminal W is grounded to the body?
     - YES → Check wiring between engine ECU terminal E1 and body ground.
       - OK → Try another engine ECU.
       - BAD → Repair or replace.
     - NO → Check bulb, fuse and wiring between engine ECU and ignition switch.
       - BAD → Repair or replace.

2. Does check engine warning light go off when the engine is started?
   - YES → System normal.
   - NO → Check wiring between engine ECU and check engine warning light.
     - BAD → Repair.
     - OK → Is there diagnostic code output when check connector terminals TE1 and E1 connected?
       - NO → Check wiring between engine ECU terminal TE1 and check connector terminal TE1, and engine ECU terminal E1 and check connector terminal E1.
         - OK → Try another engine ECU.
       - YES → Does check engine warning light go off after repair according to malfunction code?
         - NO → Further repair required.
         - YES → System OK → Cancel out diagnostic code.

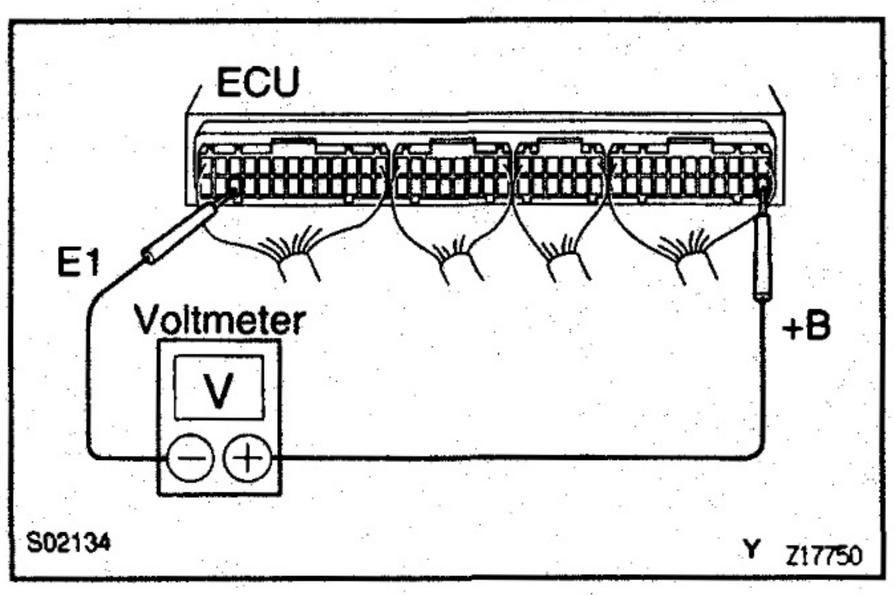
V06410

TROUBLESHOOTING w/ VOLT, OHMMETER

EG129-0E

HINT:

- The following troubleshooting procedures are designed for inspection of each separate system, and therefore the actual procedure may vary somewhat. However, troubleshooting should be performed while referring to the inspection methods described in this manual.
- Before beginning inspection, it is best to first make a simple check of the fuses, H—fuses 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.



EFI SYSTEM CHECK PROCEDURE

EG6M7-02

PREPARATION

Disconnect the ECU from the vehicle body.
(See engine ECU)

HINT:

- Do 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.

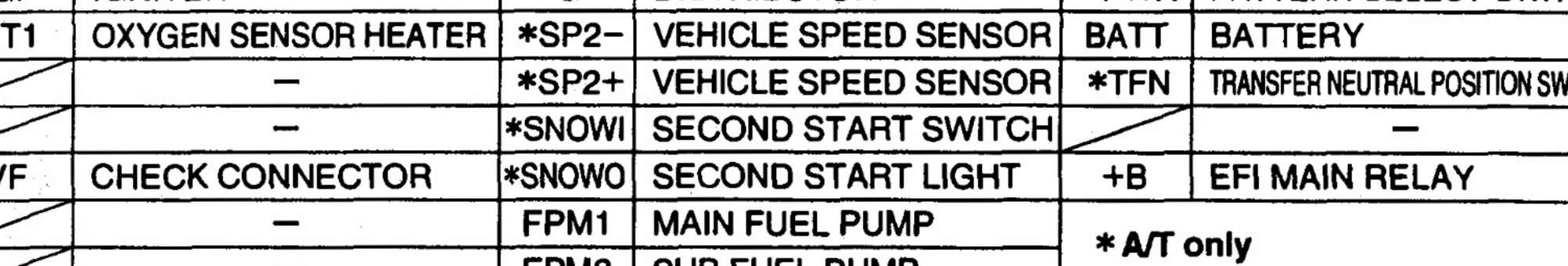
EG00Y-04

Engine (& ECT) ECU Terminals

Symbol	Connection	Symbol	Connection	Symbol	Connection
E01	POWER GROUND	ELS	TAILLIGHT RELAY. DEFOGGER RELAY	FPMS	FUEL TANK CHANGEOVER SWITCH
E02	POWER GROUND		—	FPMV	FUEL TANK SOLENOID RETURN VALVE
#10	INJECTOR	*TE1	CHECK CONNECTOR	STA	NEUTRAL START SWITCH
	—	TE2	CHECK CONNECTOR	NSW	IGNITION SWITCH
#20	INJECTOR	KNK	KNOCK SENSOR	4WD	4WD SWITCH
E1	COMPUTER GROUND		—	BK	STOP LIGHT SWITCH
*S1	ECT SOLENOID (NO.1)	OX1	OXYGEN SENSOR	FPR1	CIRCUIT OPENING RELAY
IGT	IGNITER	VAF	VARIABLE RESISTER	FPR2	FUEL TANK SOLENOID RETURN VALVE
*S2	ECT SOLENOID (NO.2)	THW	WATER TEMP. SENSOR	SP1	VEHICLE SPEED SENSOR
	—	THA	INTAKE AIR TEMP. SENSOR	FPLD	DOUBLE TANK INDICATOR
*SL	ECT SOLENOID (NO.3)	E3	SENSOR GROUND	AC1	A/C AMPLIFIER
*OIL	OIL TEMP. SENSOR	IDL	THROTTLE POSITION SENSOR	IMI	TRANSPONDER KEY COMPUTER
RSO	ISC VALVE	VG	AIR FLOW METER	ACT	A/C AMPLIFIER
L4	SHIFT POSITION SWITCH	VTA	THROTTLE POSITION SENSOR	IMO	TRANSPONDER KEY COMPUTER
RSC	ISC VALVE	VCC	VACUUM SENSOR	*OD2	O/D MAIN SWITCH
TT	CHECK CONNECTOR	E2	SENSOR GROUND	*2	NEUTRAL START SWITCH
EVP	VSV FOR EVAP	NE−	CRAKSHAFT POSITION SENSOR	W	WARNING LIGHT
	—	NE	CRAKSHAFT POSITION SENSOR	*L	NEUTRAL START SWITCH
	—	G−	DISTRIBUTOR	*OIL - W	OIL WARNING LIGHT
IGF	IGNITER	G	DISTRIBUTOR	*PWR	PATTERN SELECT SWITCH
HT1	OXYGEN SENSOR HEATER	*SP2−	VEHICLE SPEED SENSOR	BATT	BATTERY
	—	*SP2+	VEHICLE SPEED SENSOR	*TFN	TRANSFER NEUTRAL POSITION SWITCH
	—	*SNOWI	SECOND START SWITCH		—
VF	CHECK CONNECTOR	*SNOWO	SECOND START LIGHT	+B	EFI MAIN RELAY
	—	FPM1	MAIN FUEL PUMP		
	—	FPM2	SUB FUEL PUMP		

*** A/T only**

ECU Terminals



P01399

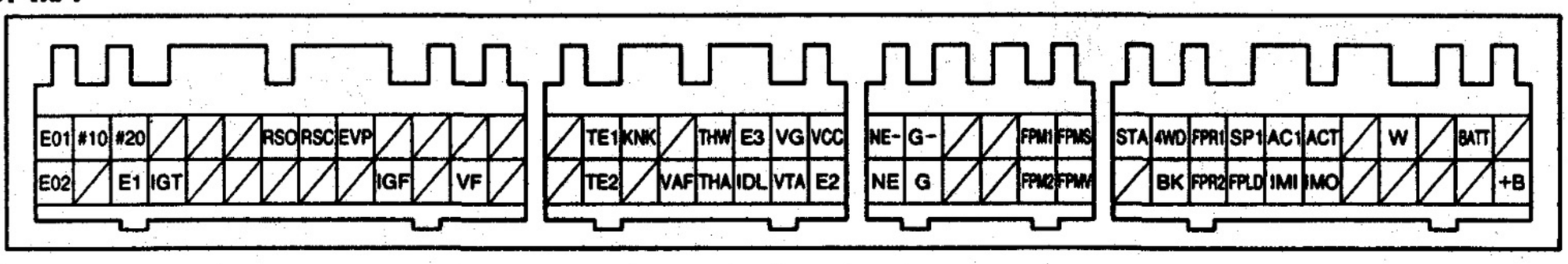
V08019

Engine (& ECT) ECU Wiring Connectors Voltage

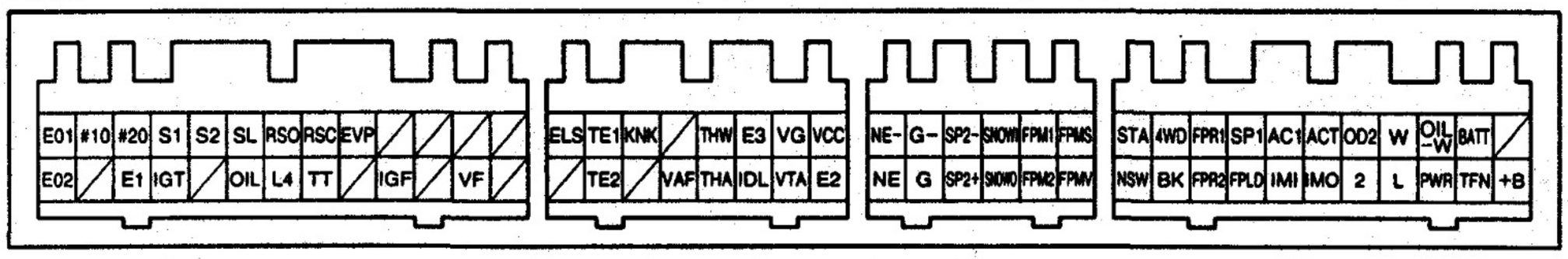
No.	Terminals	Condition		STD voltage (V)	See page
1	BATT - E1	No voltage		9 - 14	EG - 150
	+B - E1	No voltage	IG SW ON	9 - 14	EG - 150
2	VC - E2	IG SW ON	–	4.5 - 5.5	EG - 152
			Throttle valve fully Closed	0.3 - 0.8	
	VTA - E2		Throttle valve Open	3.2 - 4.9	
3	#10 - E01 #20 - E02	IG SW ON		9 - 14	EG - 154
4	THA - E2	IG SW ON	Intake air temp. 20°C (68°F)	0.5 - 3.4	EG - 155
5	THW - E2		Coolant temp. 80°C (176°F)	0.2 - 1.0	EG - 156
6	STA - E1	Cranking		6 or more	EG - 157
7	IGF - E1	IG SW ON	Igniter connector disconnected	4.5 - 5.5	EG - 158
	IGT - E1	Idling		Pulse generation	
8	RSC RSO - E1	IG SW ON	ECU Connector disconnected	9 - 14	EG - 159
9	W - E	No trouble (Check engine warning lightoff) and engine running		9 - 14	EG - 160

ECU Terminals

For M/T



For A/T

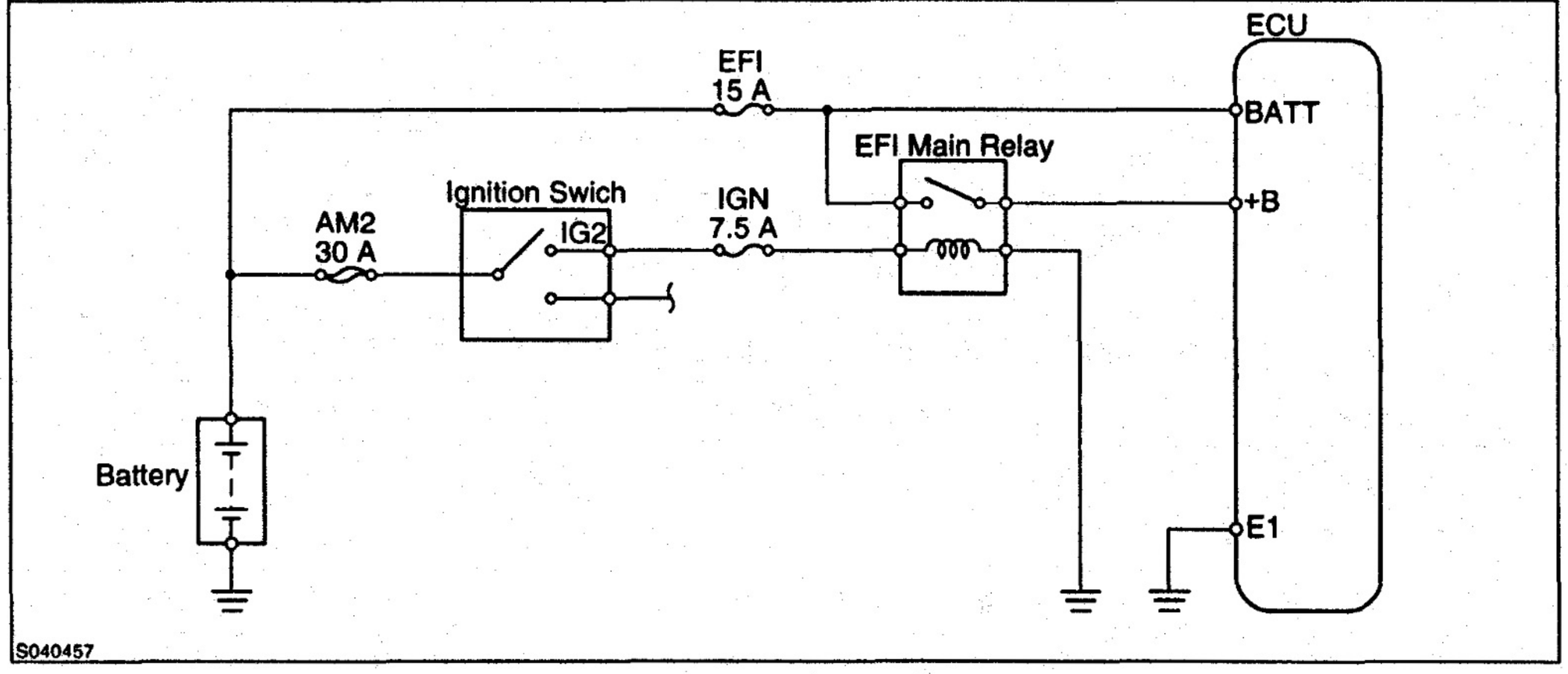


P01399
P01399

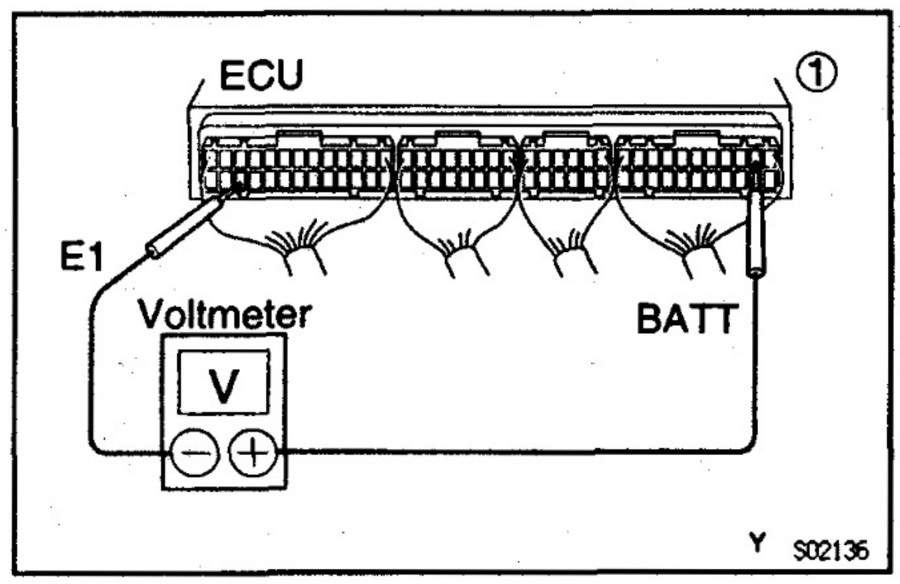
T V08020

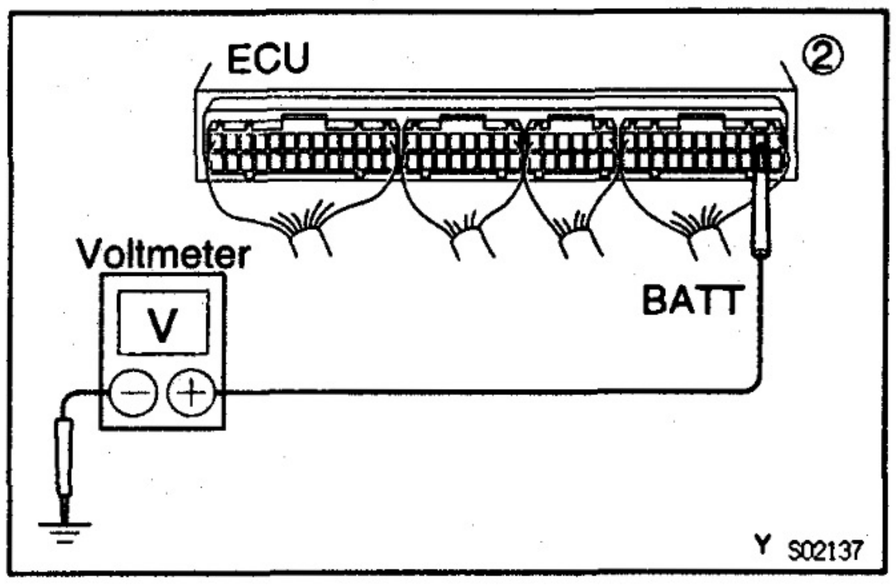
E0769-01

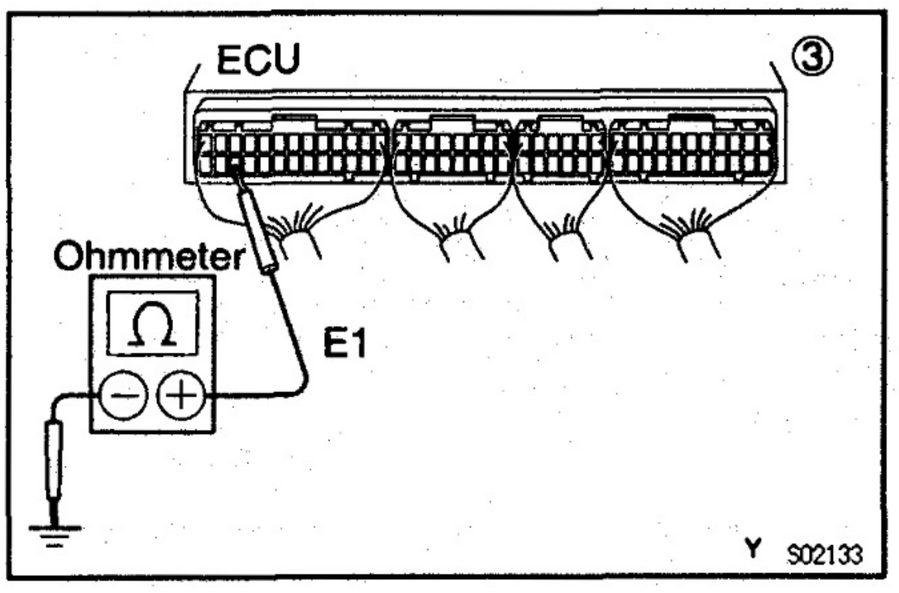
No.	Terminals	Trouble	Condition	STD Voltage
1	BATT - E1	No Voltage	—	9 - 14V
	+B - E1	No Voltage	IG SW ON	9 - 14V



T V07991







• BATT – E1

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

↓

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

NO → OK

↓

③ Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

↓

Check fuse.

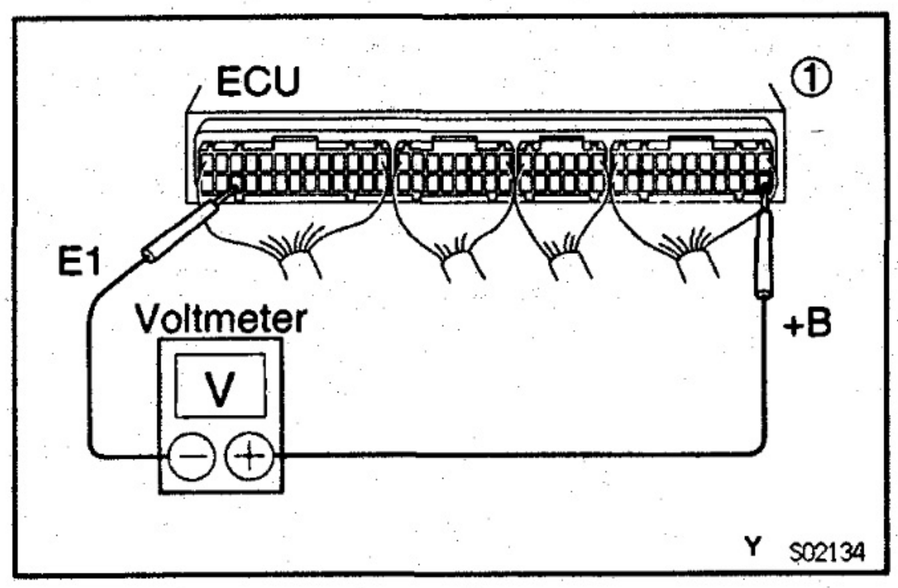
BAD → Replace.

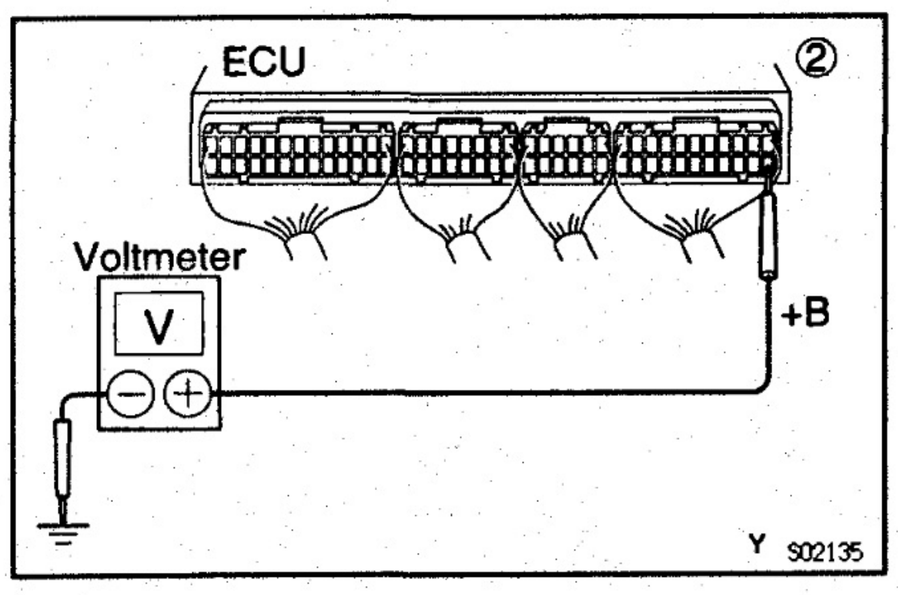
OK ↓

Check wiring between ECU terminal and battery.

BAD → Repair or replace.

V07488





• +B – E1

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

OK

Check wiring between ECU terminal E1 and body ground.

OK

Try another ECU.

BAD

Repair or replace.

Check fuses, fusible link and ignition switch.

BAD

Repair or replace.

OK

Check EFI main relay. (See page EG-189)

BAD

Replace.

OK

Check wiring between EFI main relay and battery.

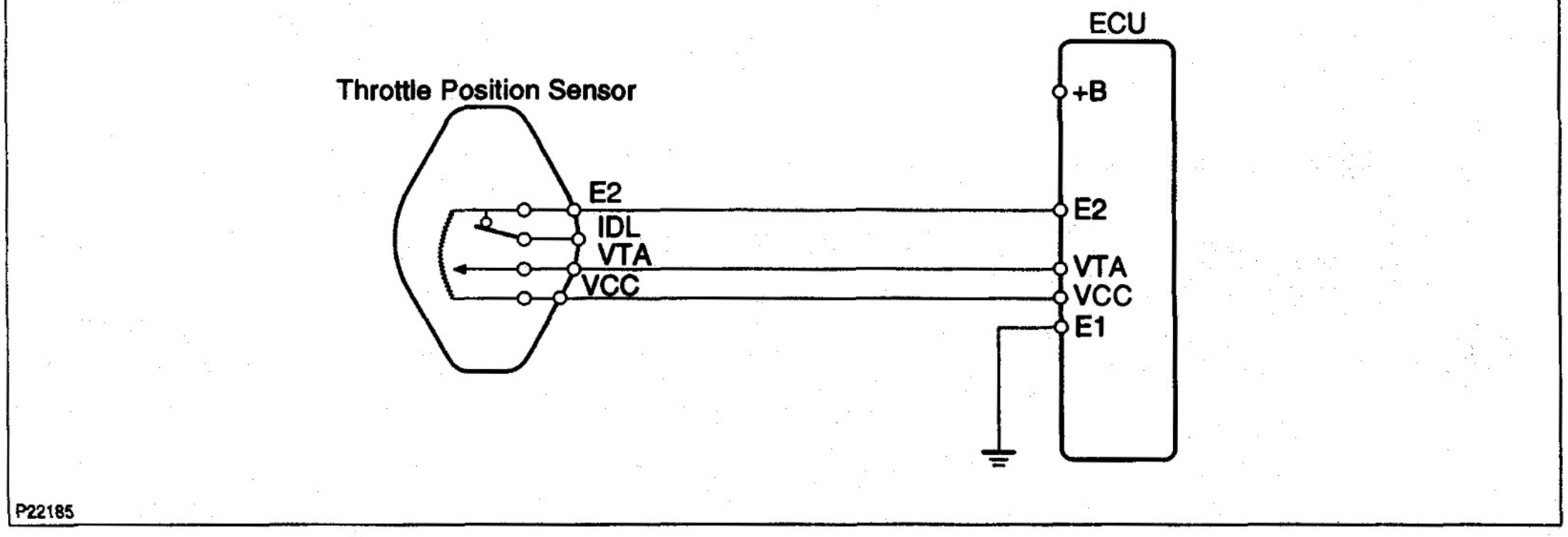
BAD

Repair or replace.

V08112

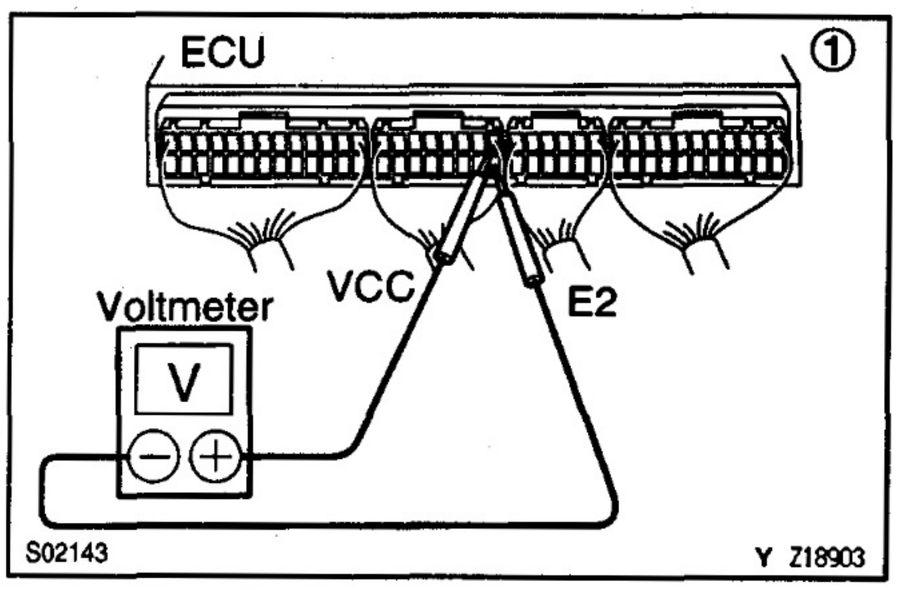
EG

No.	Terminals	Trouble	Condition		STD voltage
2	VCC - E2	No voltage	IG SW ON	—	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



P22185

Y V08211



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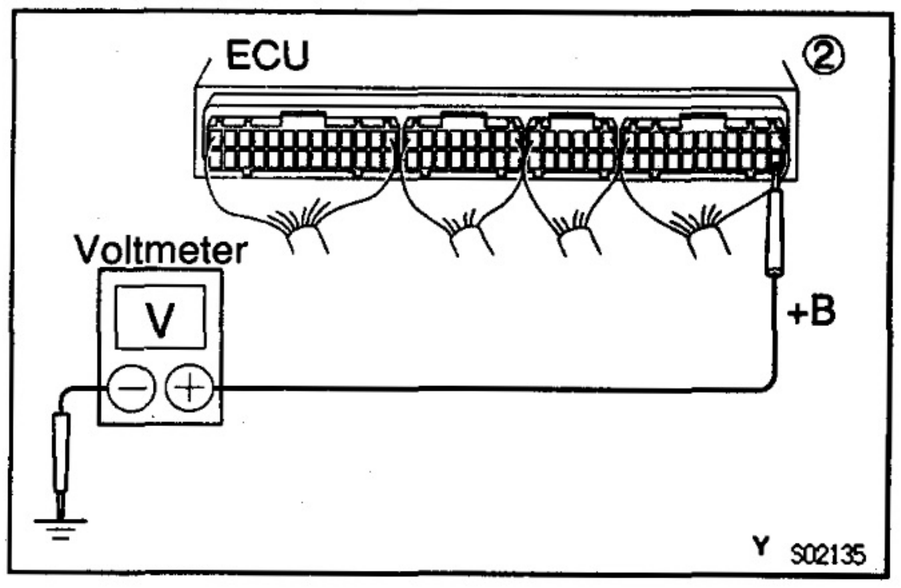
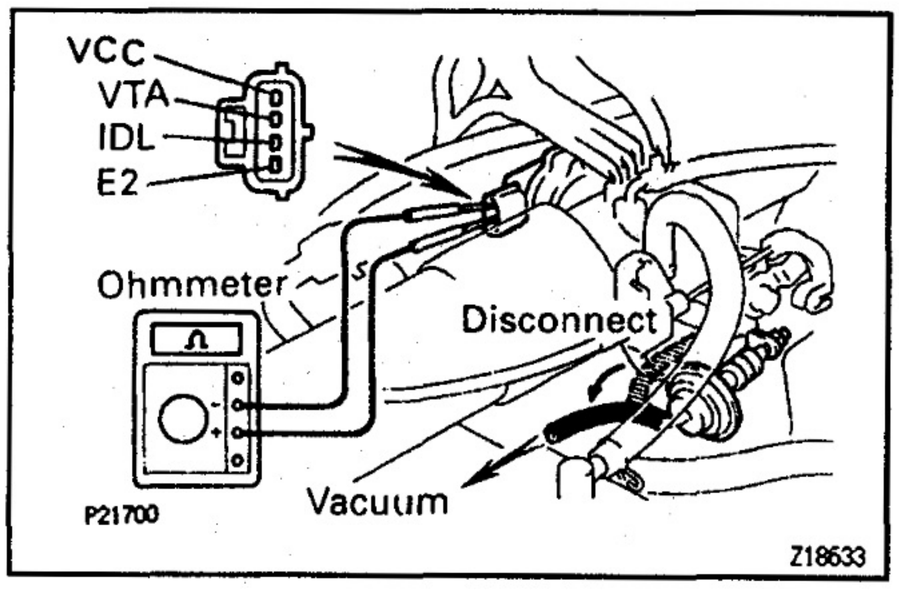


Y S02135



P21700 Z18633

• VCC – E2

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

↓

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

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

OK → Try another ECU.

BAD → Repair or replace.

↓

Refer to No.1 (See page EG-197)

BAD → Repair or replace.

↓ OK

↓

③ Check throttle position sensor.

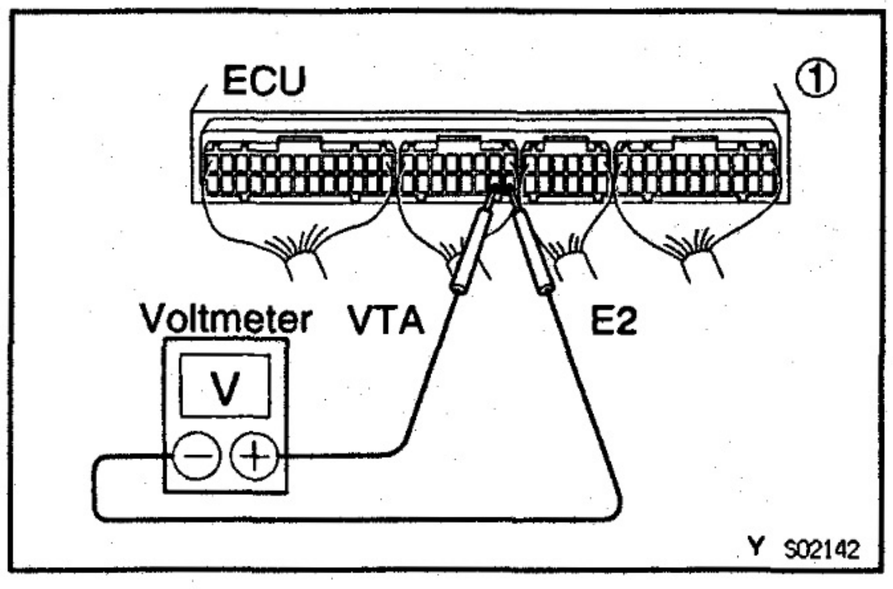
BAD → ↓ Repair or replace throttle position sensor.

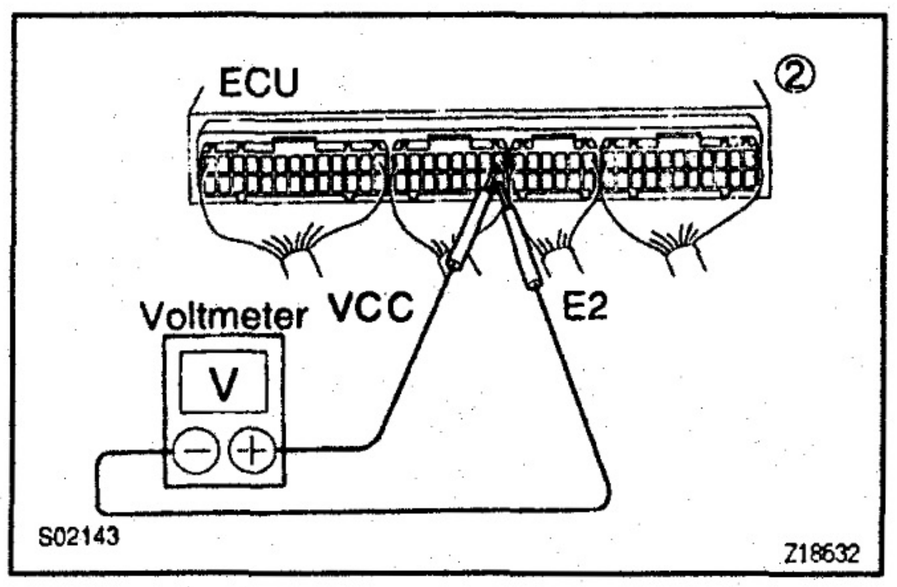
OK → Check wiring between ECU and throttle position sensor.

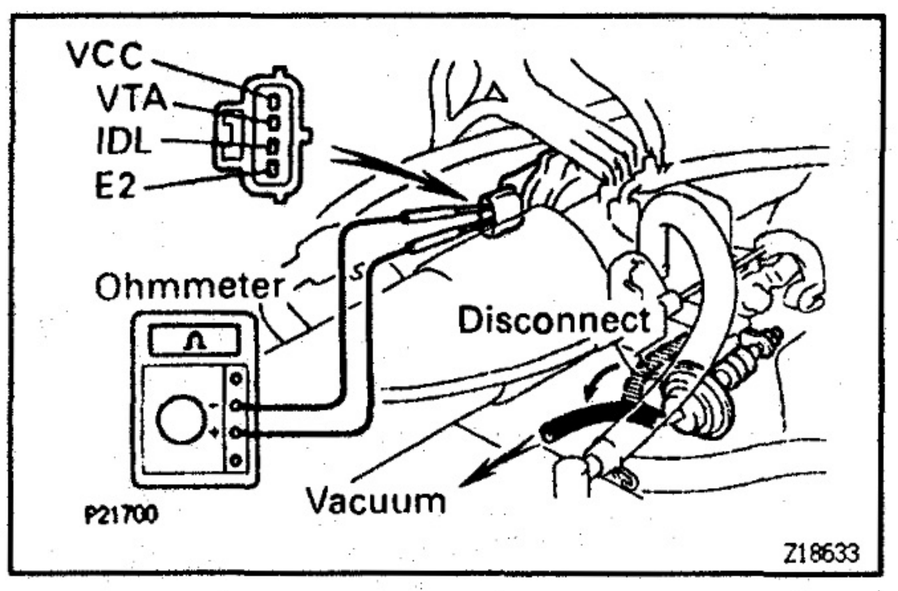
BAD → Repair or replace.

OK → ↓ Try another ECU.

Y V08098







• VTA – E2

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

↓

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

↓ NO

Refer to VCC - E2 trouble section.

↓ OK

OK →

③ Check throttle position sensor. → BAD → Repair or replace.

↓ OK

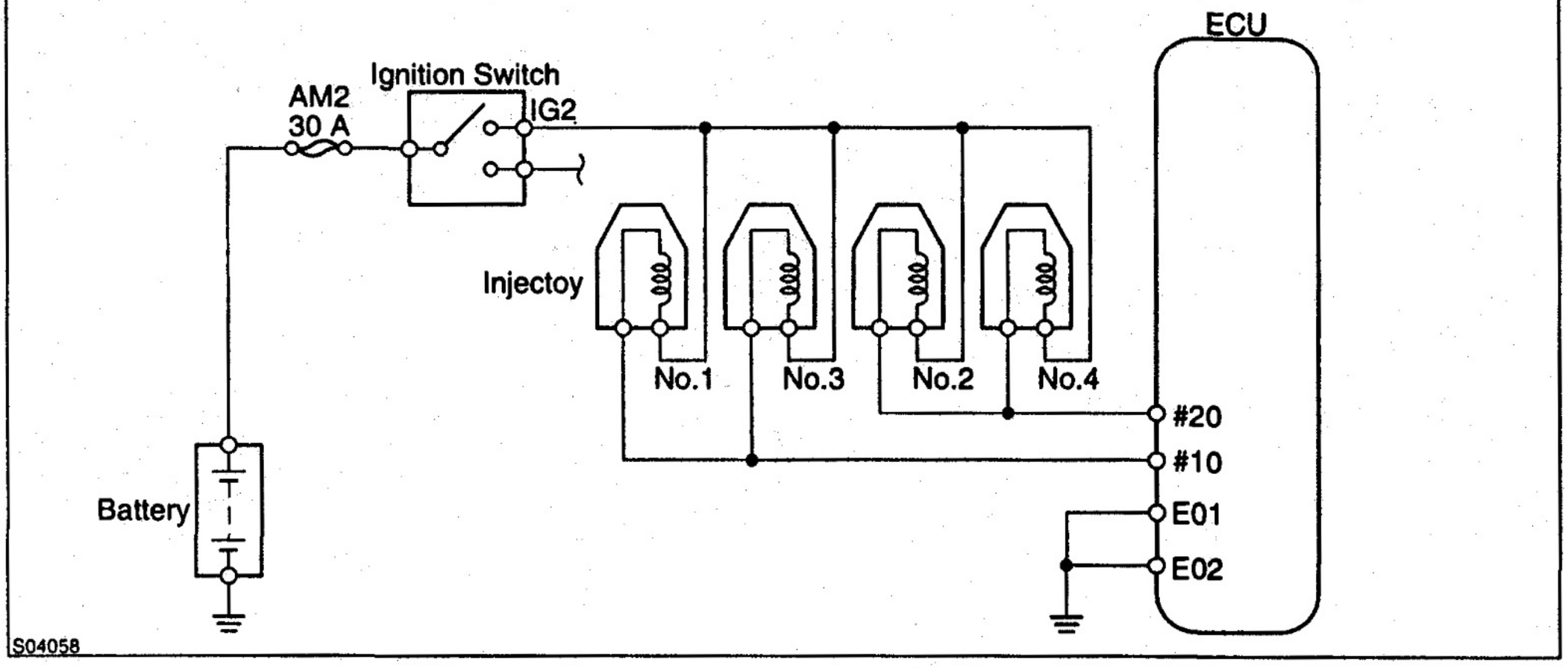
Check wiring between ECU and throttle position sensor. → BAD → Repair or replace.

↓ OK

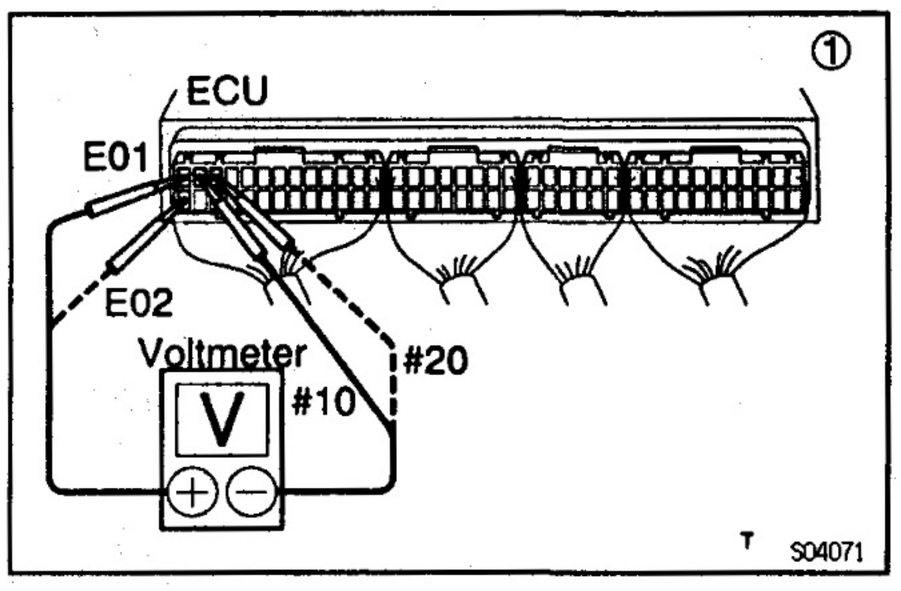
Try another ECU.

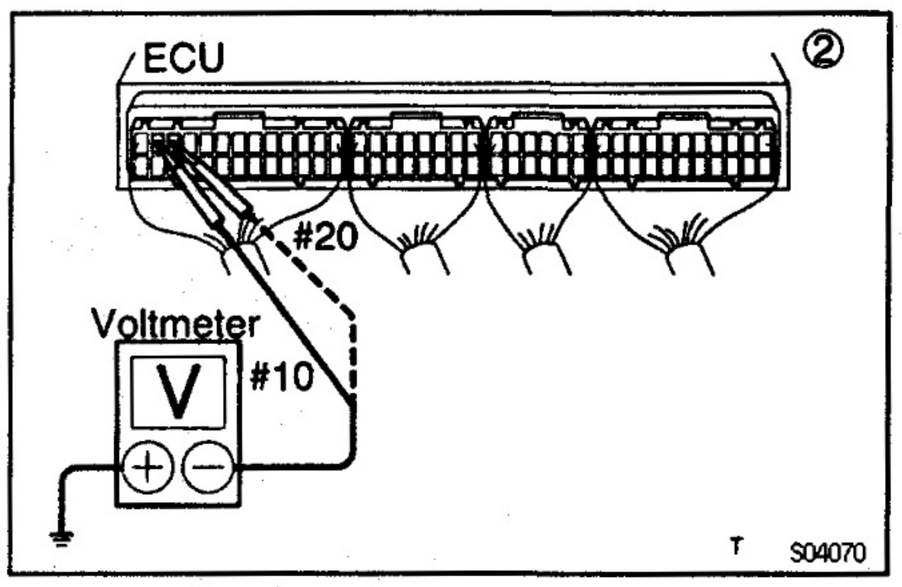
Y V08097

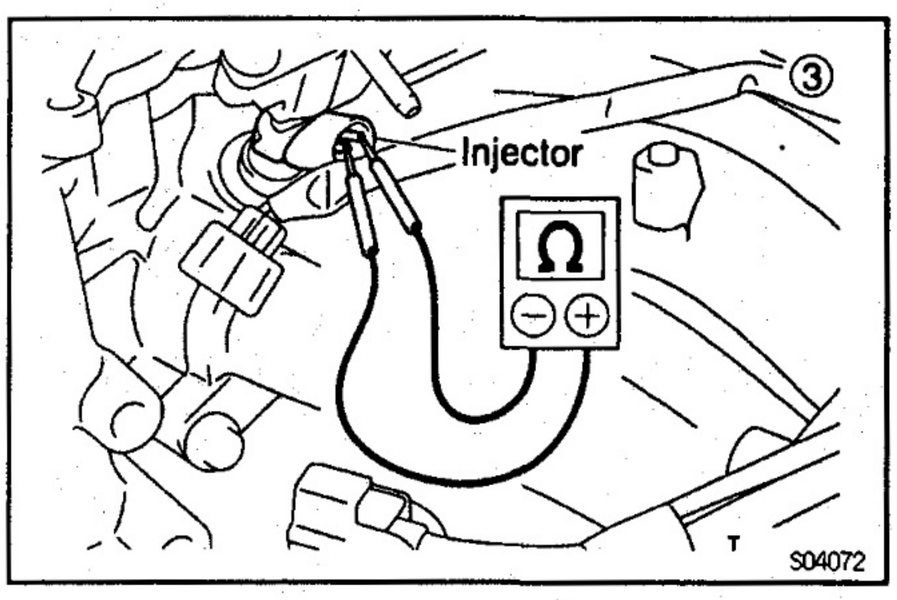
No.	Trouble	Condition	STD Voltage
3	#10 E01 – #20 E02	IG SW ON	9 - 14V



T V07992







- **#10, #20 – E01, E02**

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

↓

② Check that there is voltage between ECU terminal #10,#20 and body ground.

NO → Check wiring between ECU terminal E01 and / or E02 and body ground.
- OK → Try another ECU.
- BAD → Repair or replace.

OK → Check fuse and ignition switch.
- BAD → Repair or replace.

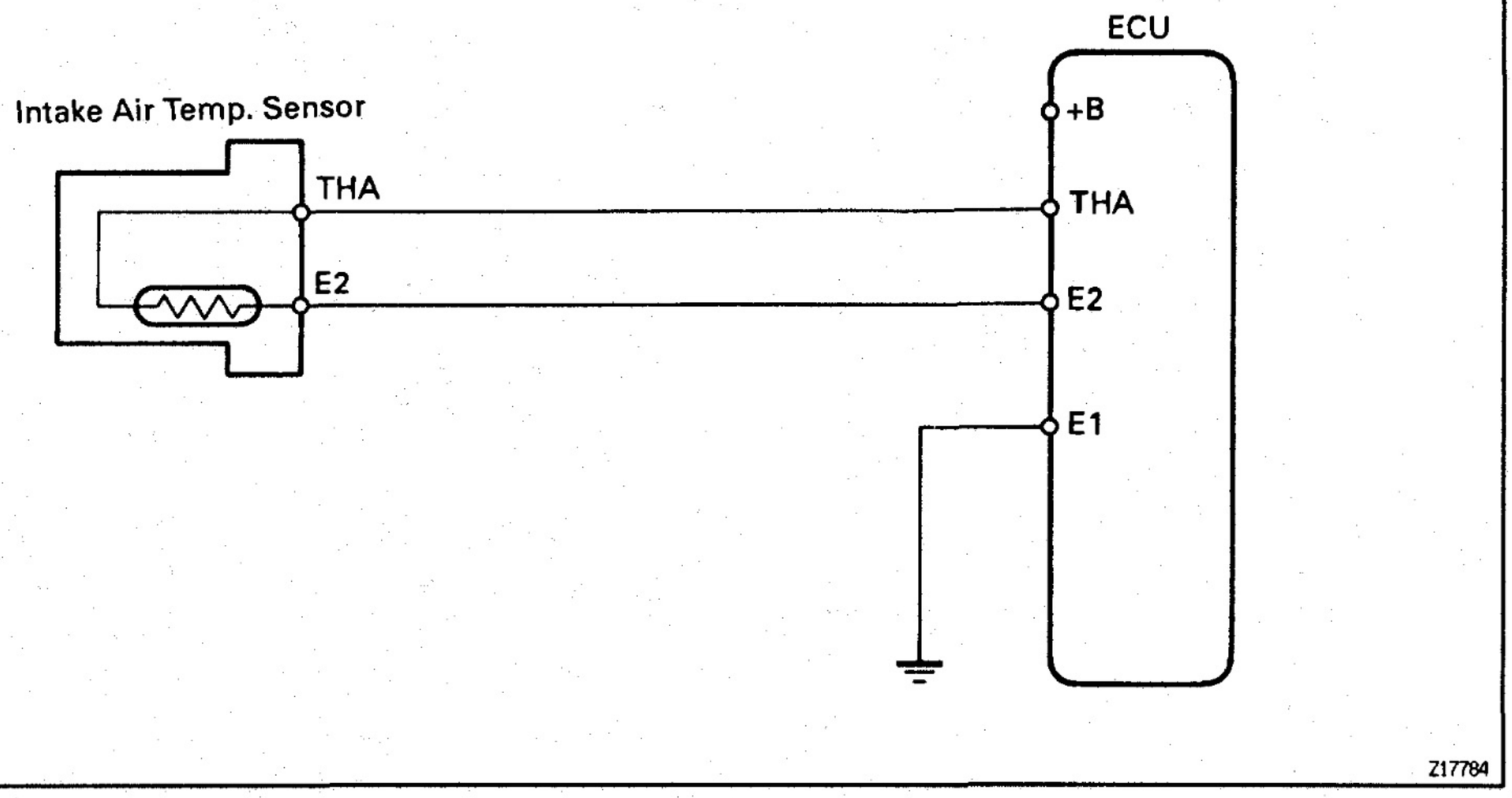
OK →

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

OK → Check wiring between ECU terminal #10,#20 and battery.
- BAD → Repair or replace.

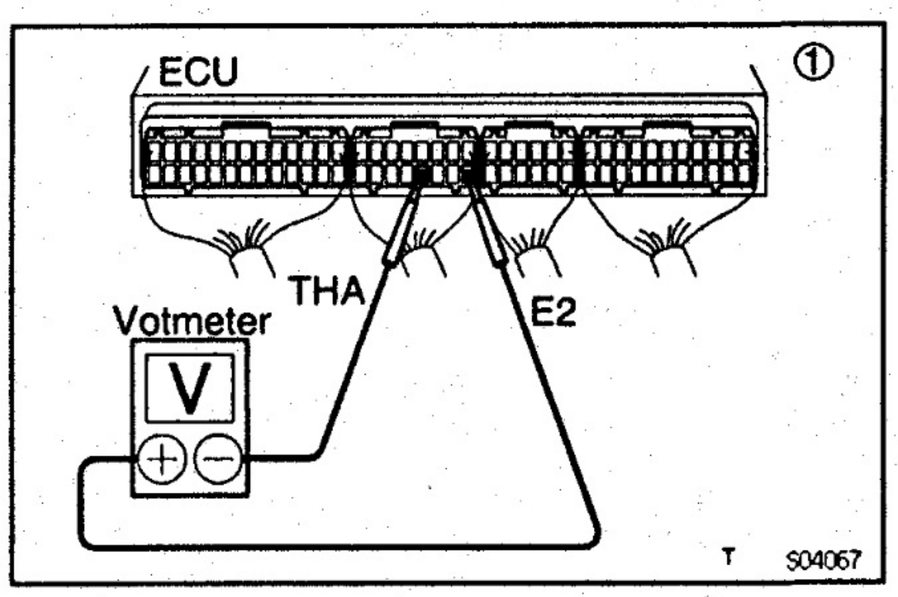
Y V08099

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

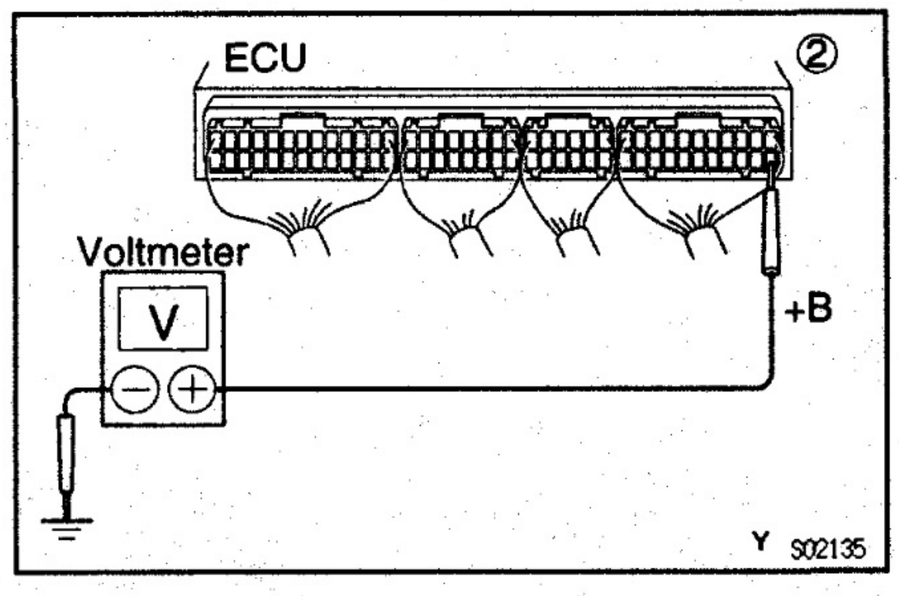


FI3572

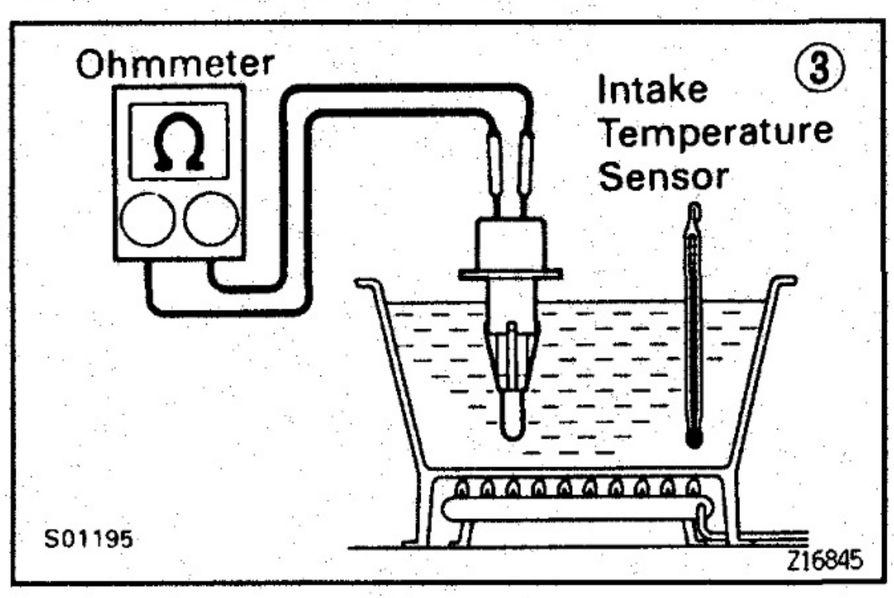
Z17784



T S04067



Y S02135



S01195

Z16845

• THA – E2

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 → Check wiring between ECU terminal E1 and body ground.

NO → Refer to No.1. (See page EG-198)

OK → ③ Check intake air temp. sensor.

BAD → Repair or replace.

③ Check intake air temp. sensor.

BAD → Replace intake air temp. sensor.

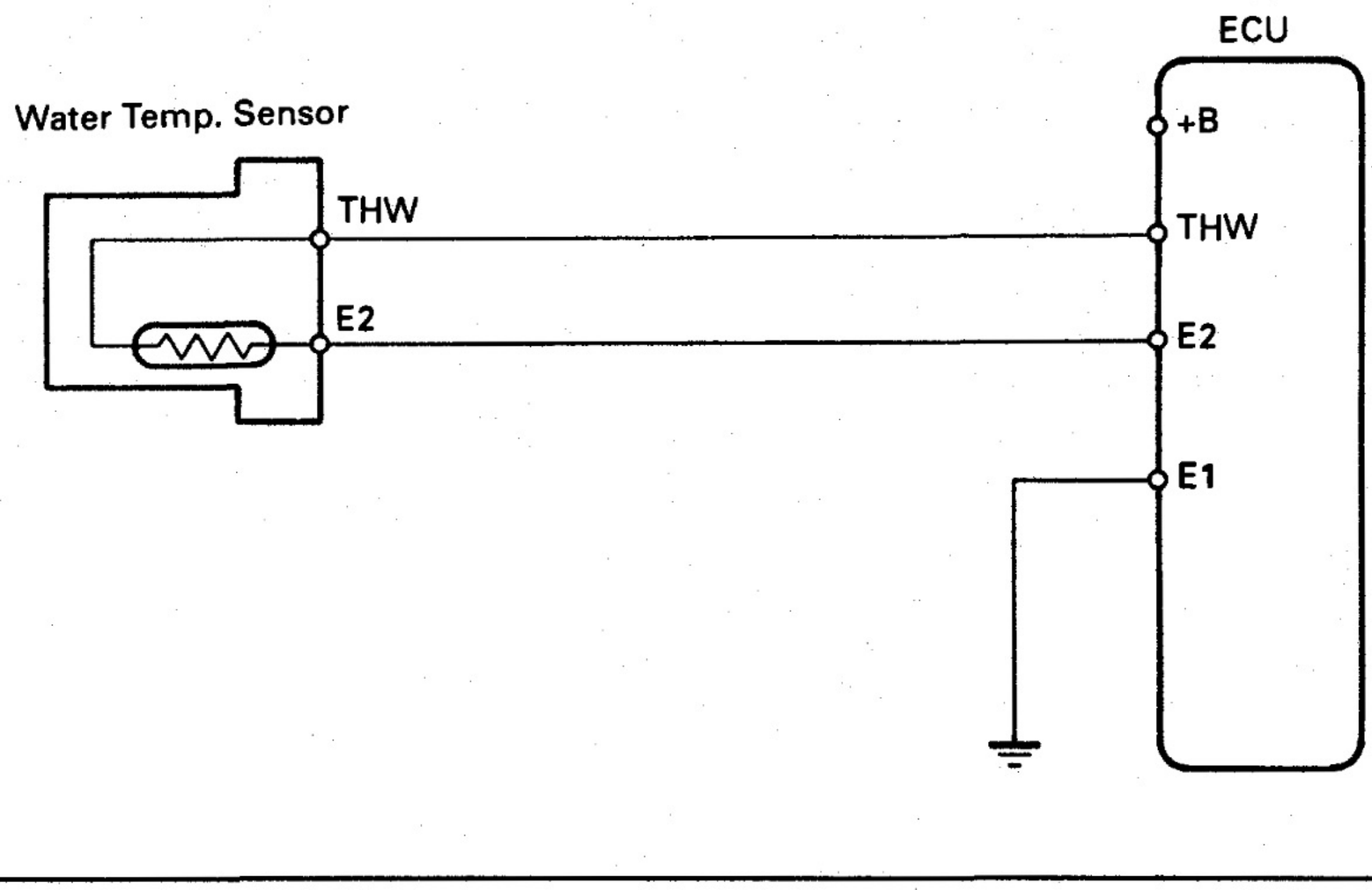
OK → Check wiring between ECU and intake air temp. sensor.

OK → Try another ECU.

BAD → Repair or replace.

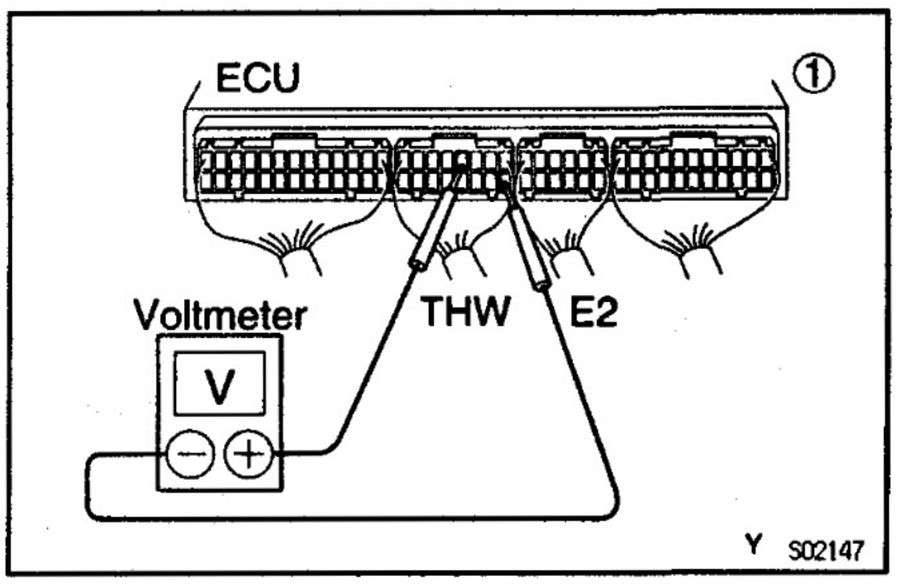
V07494

No.	Terminals	Trouble	Condition		STD voltage
5	THW – E2	No voltage	IG SW ON	Engine coolant temp. 80°C (176°F)	0.2 – 1.0 V

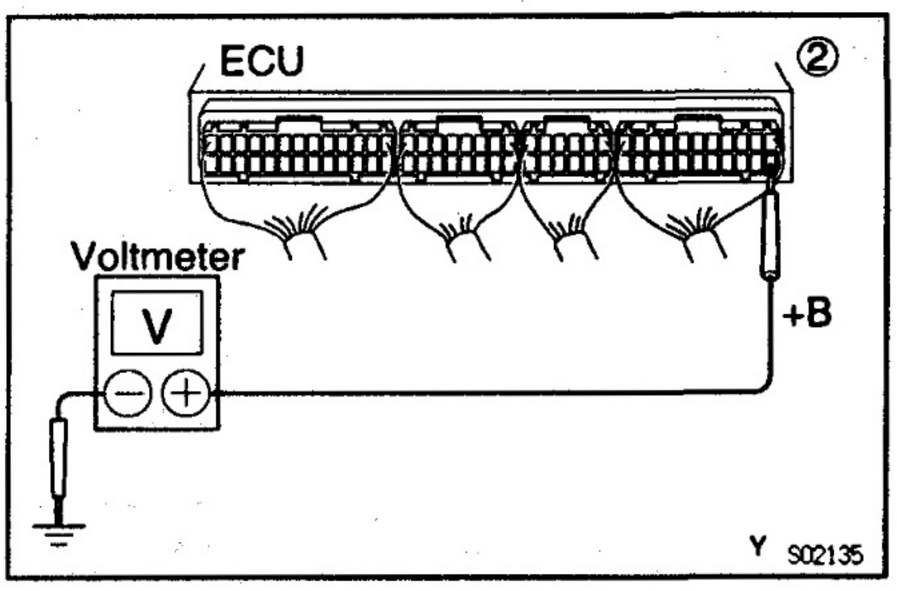


FI3572

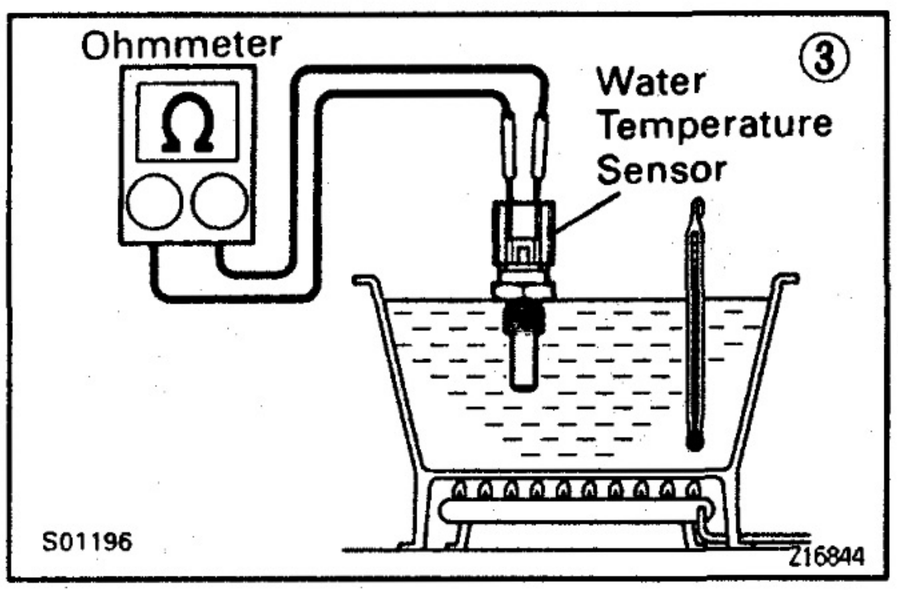
Z17785



Y S02147



Y S02135



S01196

Z16844

- **THW – E2**

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 No.1. (See page EG-198)

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.

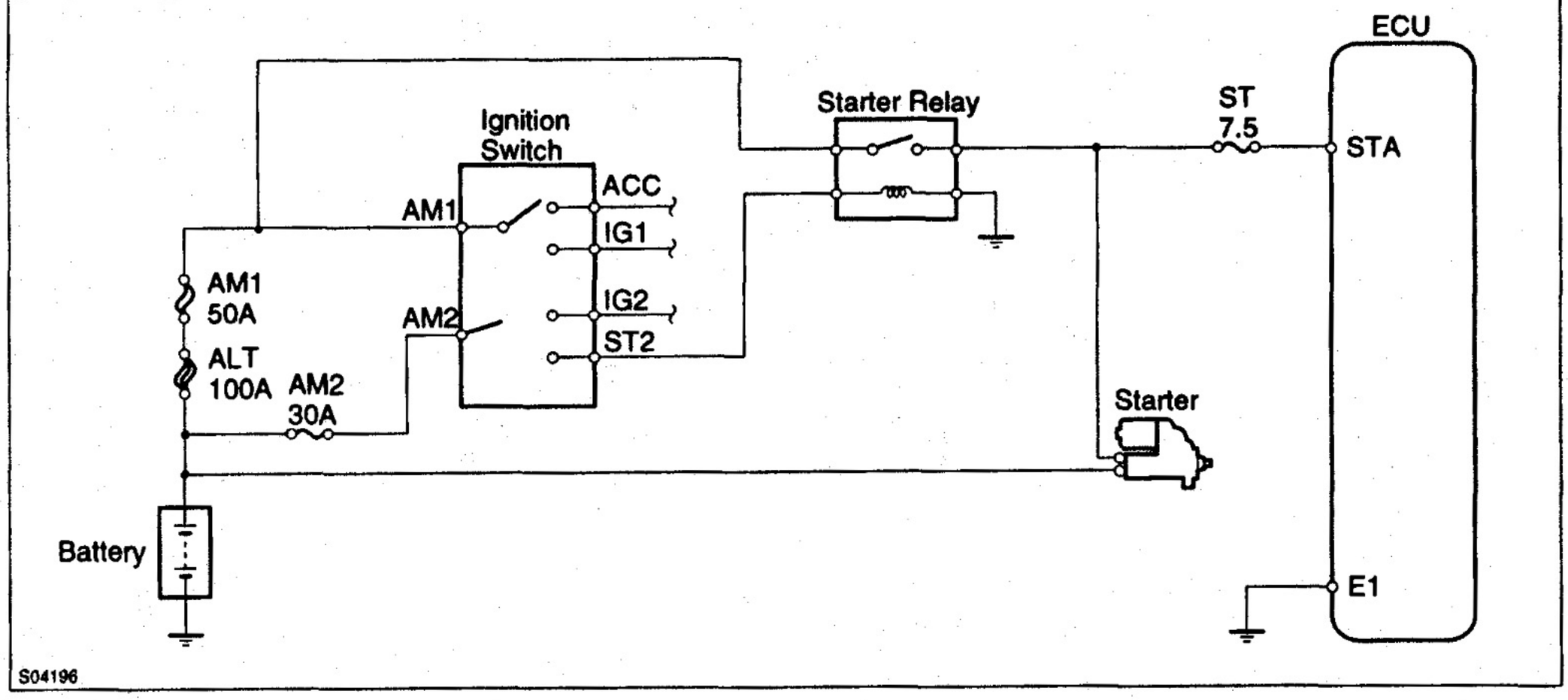
OK ↓

Try another ECU.

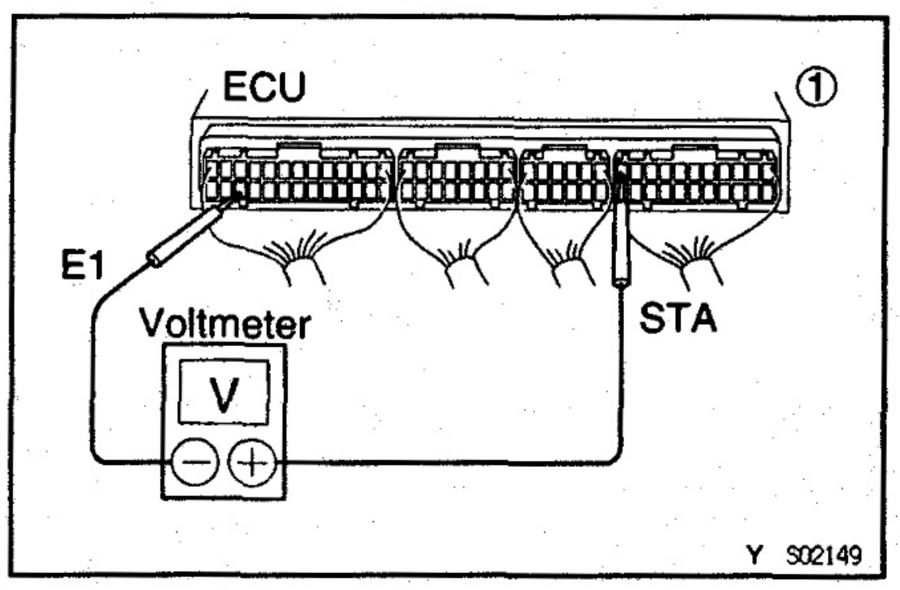
BAD → Repair or replace.

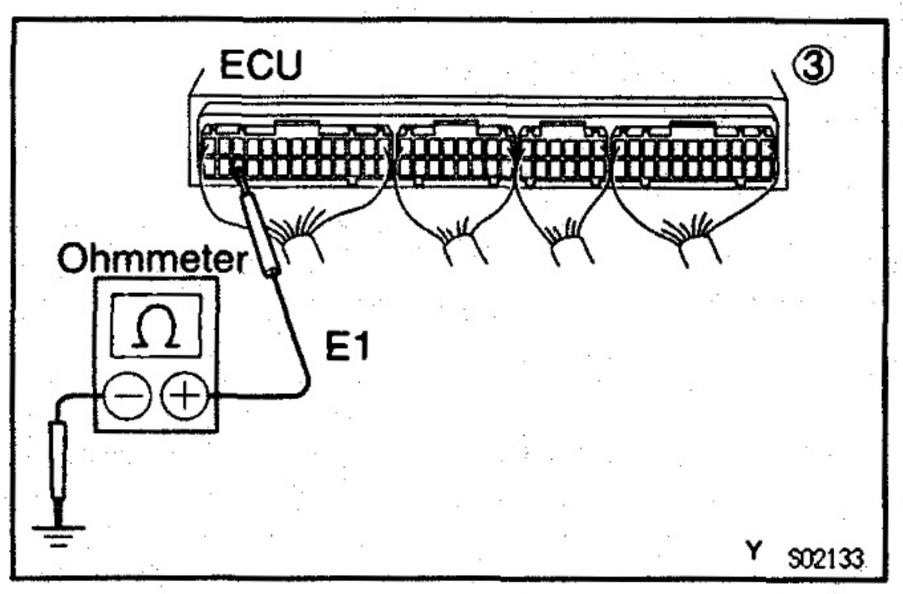
V07495

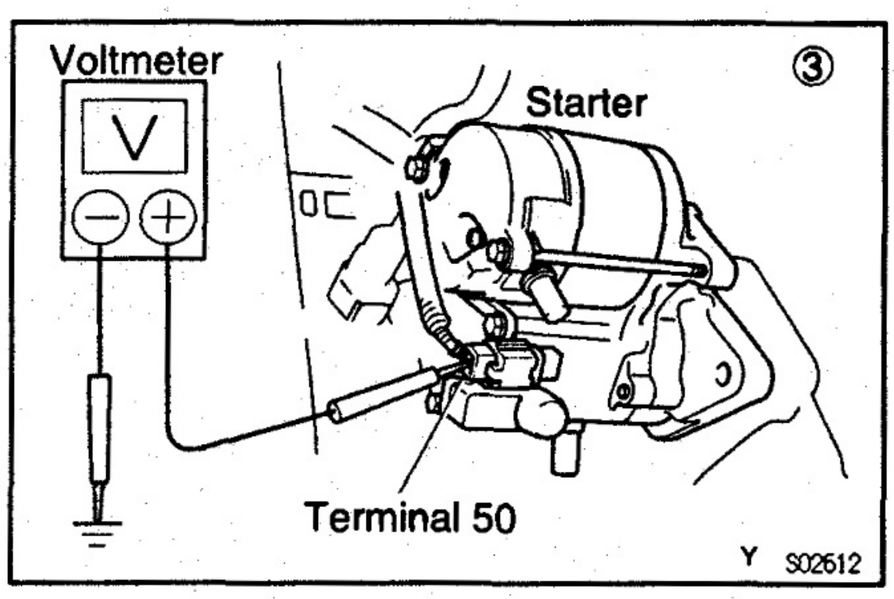
No.	Terminals	Trouble	Condition	STD voltage
6	STA-E2	No voltage	Cranking	6V or more



V08026







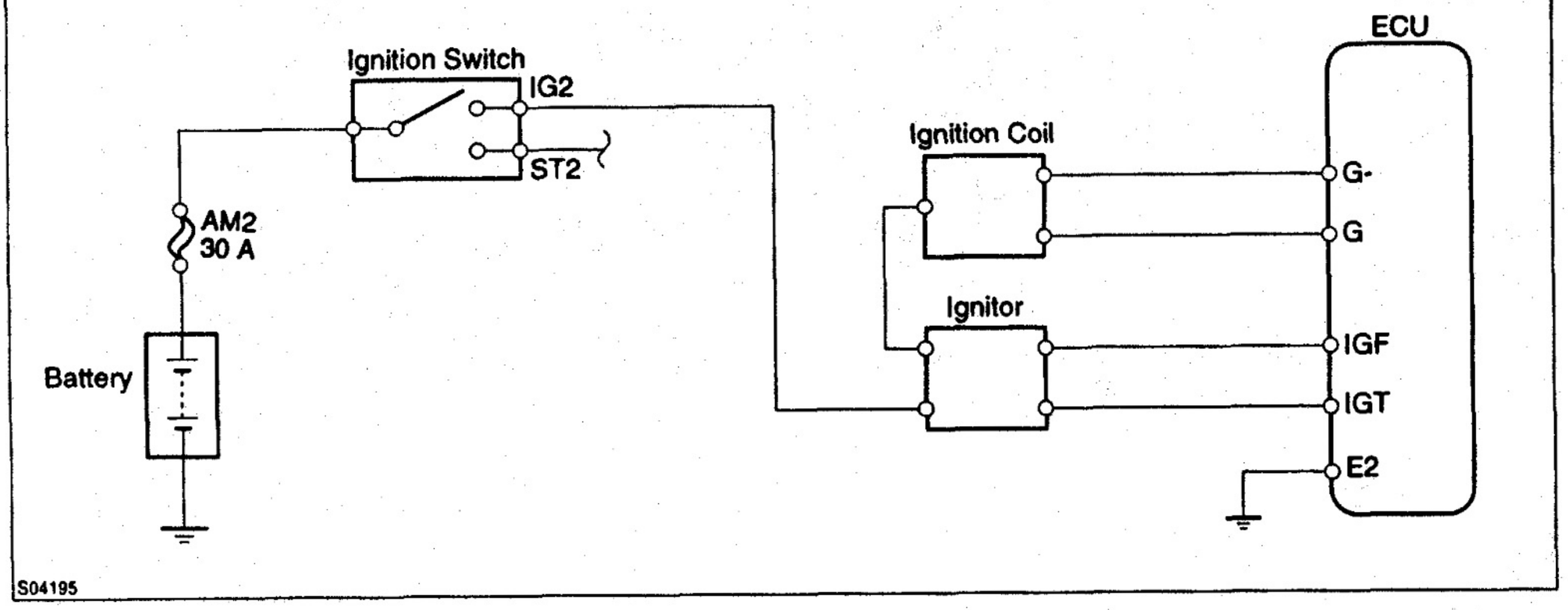
- **STA – E1**

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

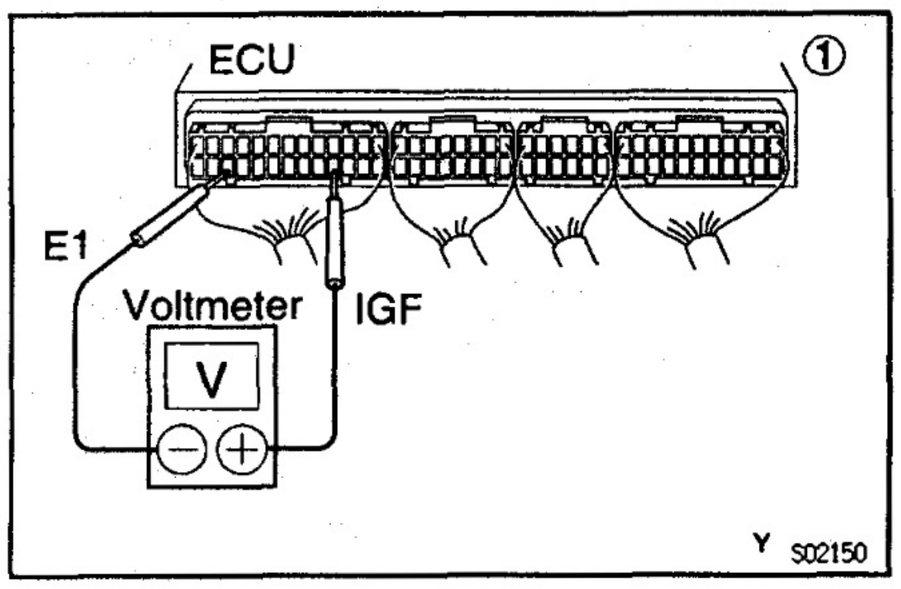
Check starter operation. — OK → Check wiring between ECU terminal STA and ignition switch terminal ST2.
- BAD → Check M-fuse, fuse, battery, wiring, ignition switch,and starter relay.
  - BAD → Repair or replace.
  - OK → ③ Check that there is voltage at starter terminal 50. **(IG SW START) STD voltage: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

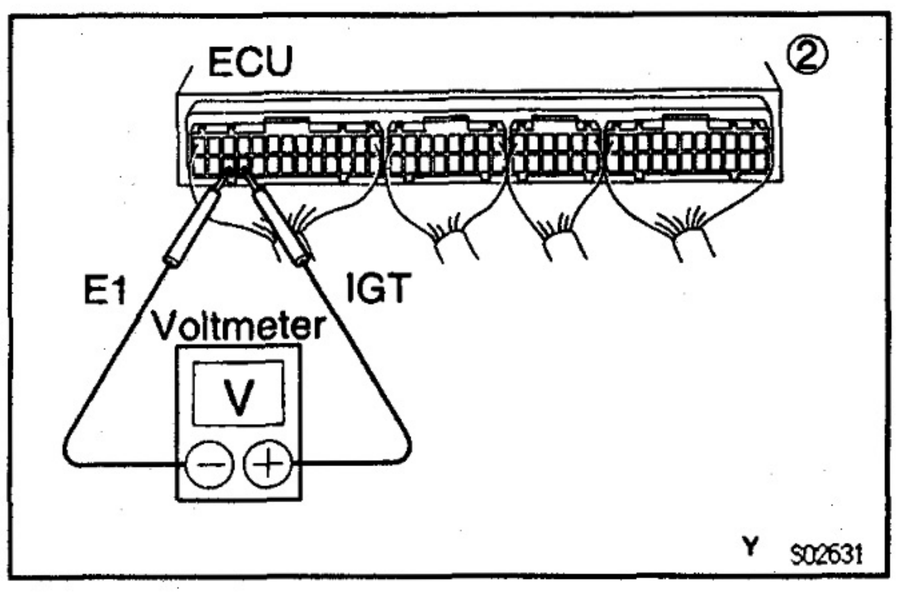
V08021

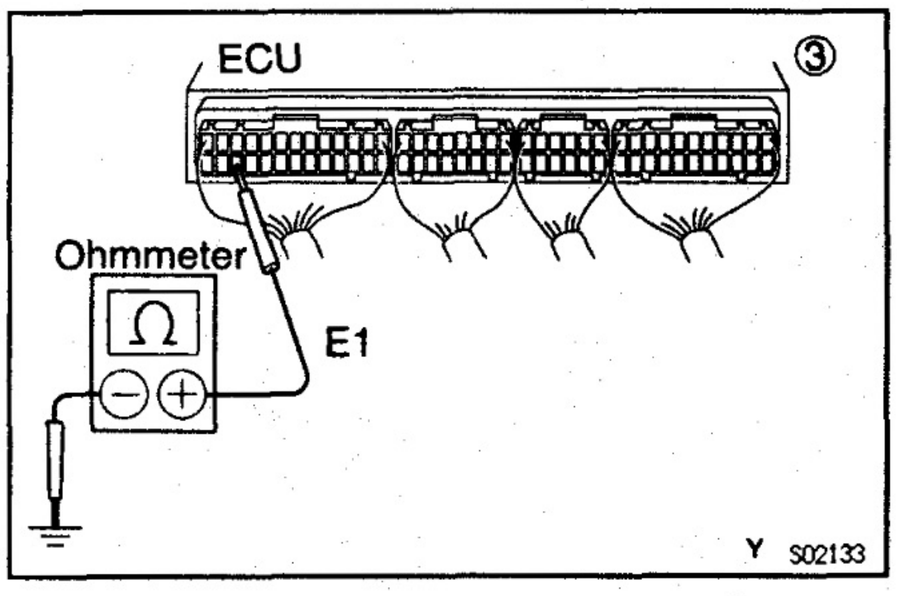
No.	Terminals	Trouble	Condition		STD voltage
7	IGF-E1	No voltage	IG SW ON	Igniter connector disconnected	4.5-5.5V
	IGT-E1	No voltage	Idling		Pulse generation



V08027







• IGF, IGT – E1

① There is no voltage between ECU terminals IGF and E1.
(Disconnect igniter connector, IG SW ON)

② Check that there is voltage between ECU terminals IGT and E1.
(Idling)

NO → Check fuse and ignition switch. BAD → Repair or replace.

OK → Check ignition coil. BAD → Repair or replace.

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

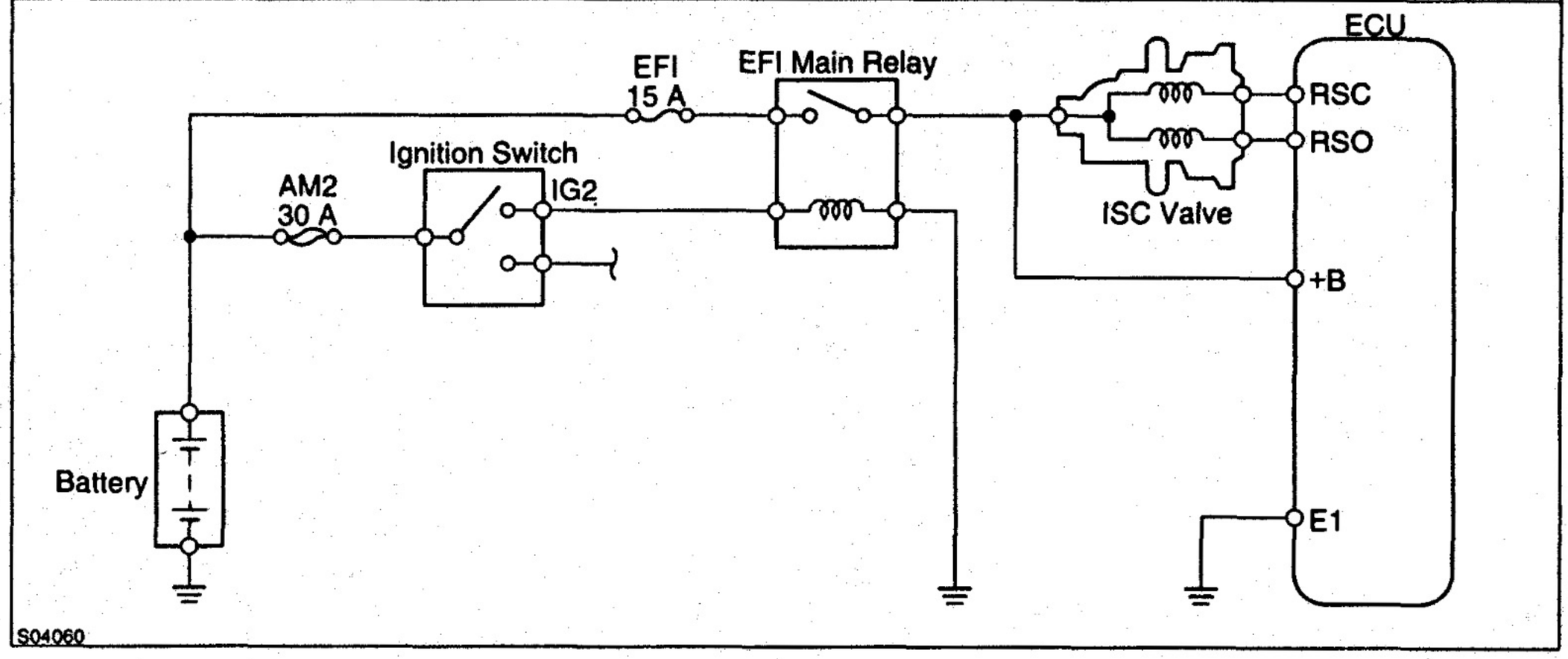
OK → Check igniter. BAD → Repair or replace.

OK (from ②) → ③ Check wiring between ECU terminal E1 and body ground. BAD → Repair or replace.

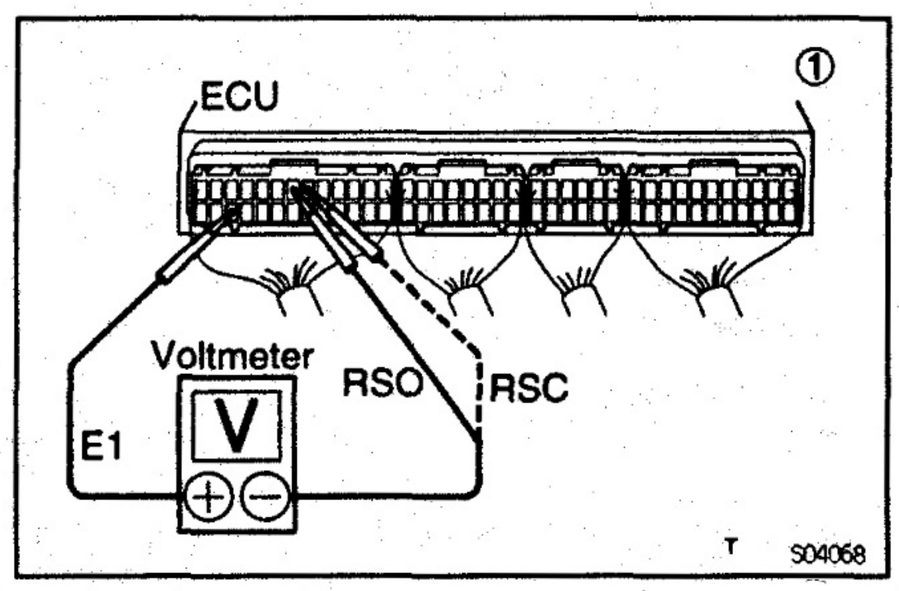
OK → Try another ECU.

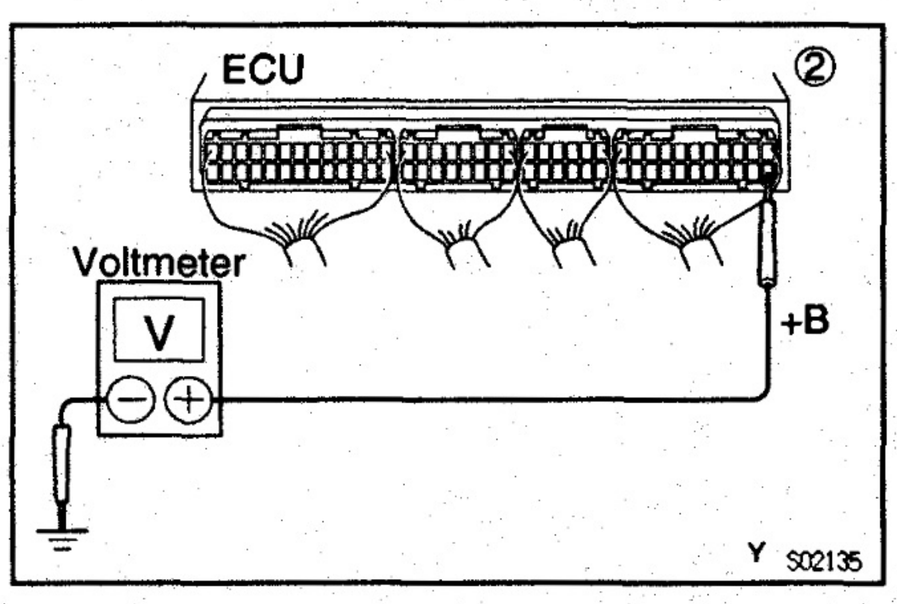
V07497

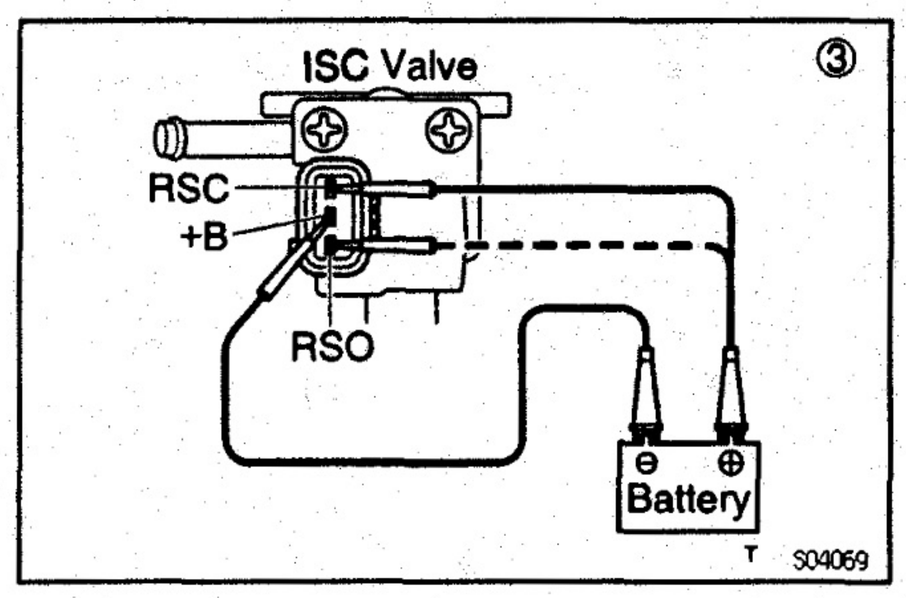
No.	Trouble	Condition		STD Voltage
8	RSC RSO – E1	IG SW ON	ECU Connector disconnected	9 – 14V



T V07993







- **RSC, RSO – E1**

① There is no voltage between ECU terminals RSC,RSO and E1. **(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.

OK → ③ Check ISC valve.

BAD → Replace ISC valve.

OK → Check wiring between ECU and EFI main relay.

OK → Try another ECU.

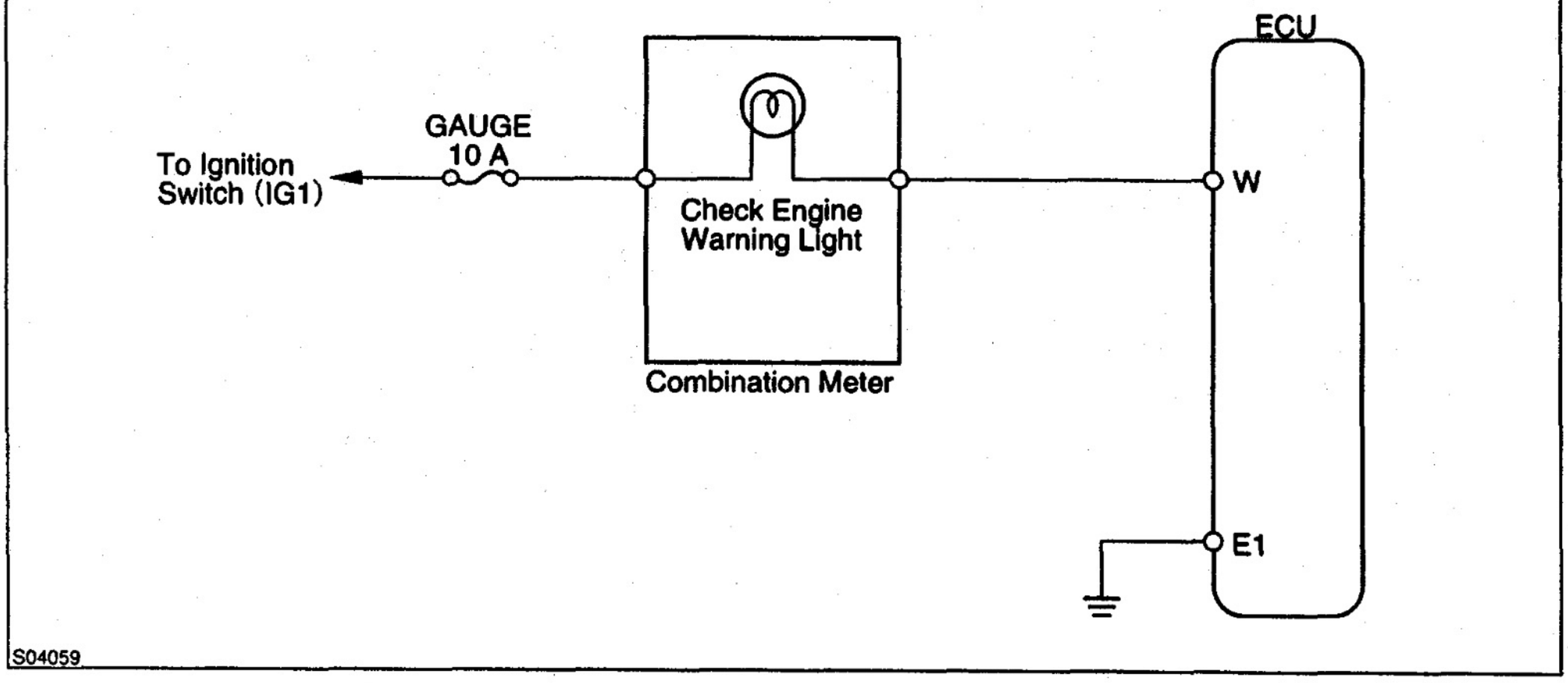
BAD → Repair or replace.

NO → Refer to No.1. (See page EG-198)

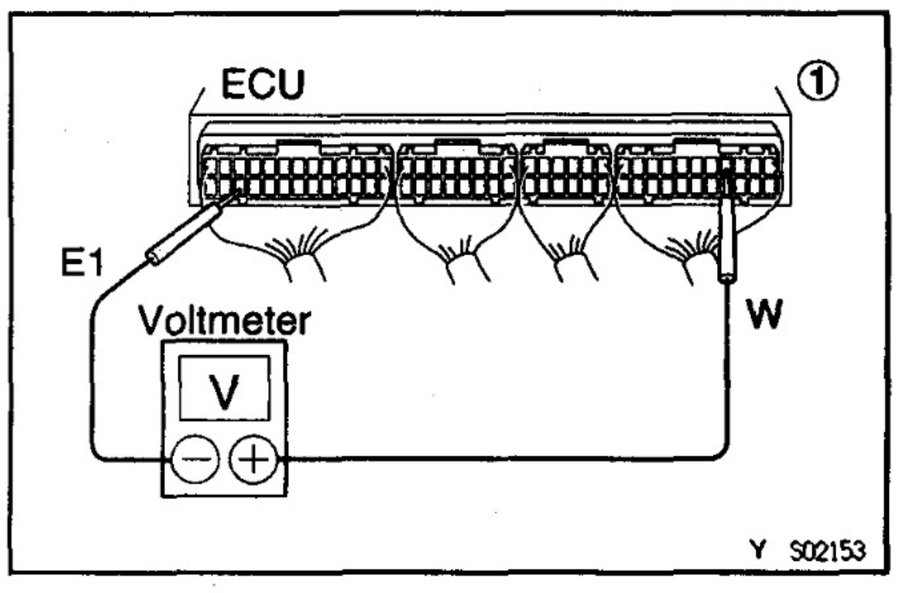
BAD → Repair or replace.

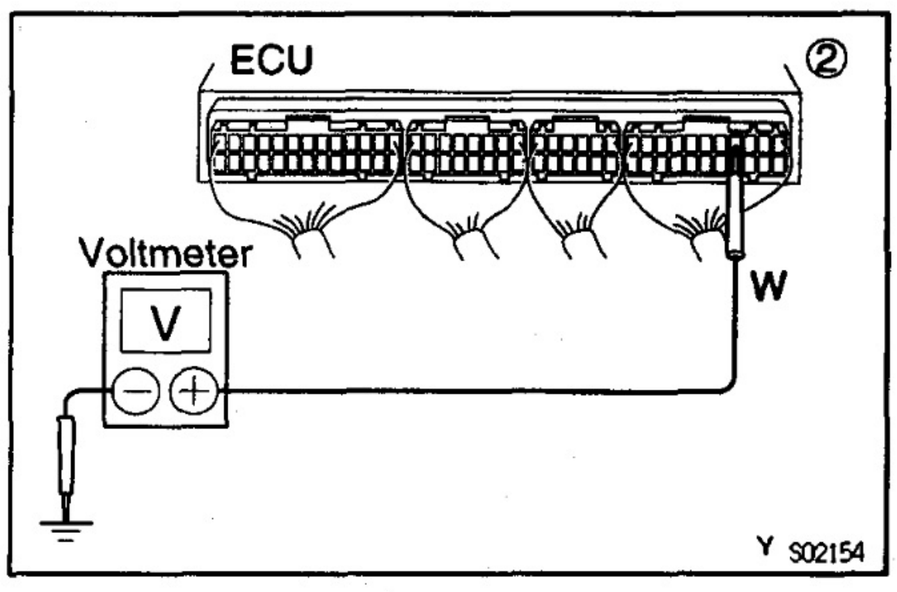
Y V08100

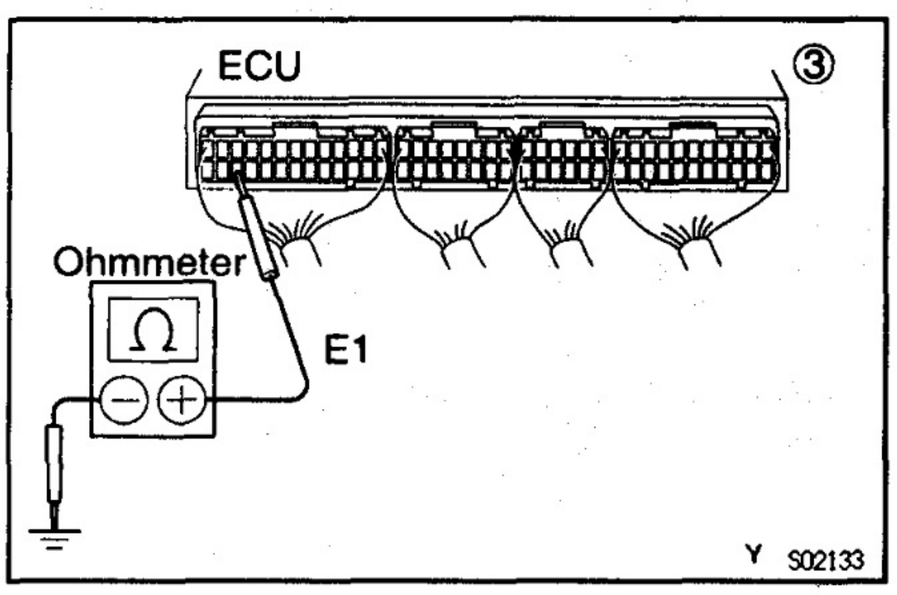
No.	Trouble	Condition	STD Voltage
9	W - E	No trouble (Check engine warning light off) and engine running	9 - 14 V



T V07994







- **W – E1**

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

↓

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

NO → OK

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

OK → Try another ECU.

BAD → Repair or replace.

Check GAUGE fuse (10 A) and check engine warning light.

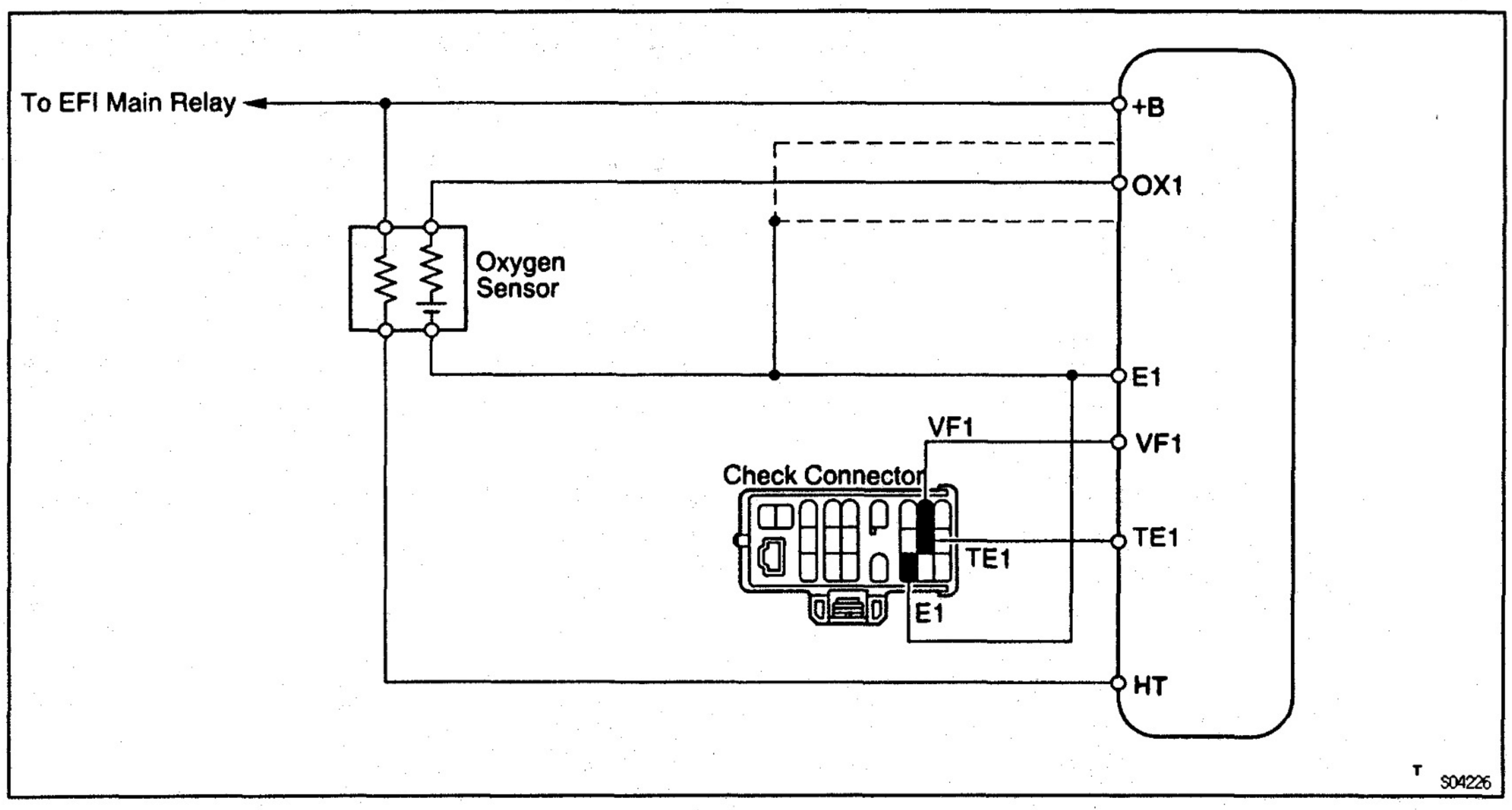
OK → Check wiring between ECU terminal W and fuse.

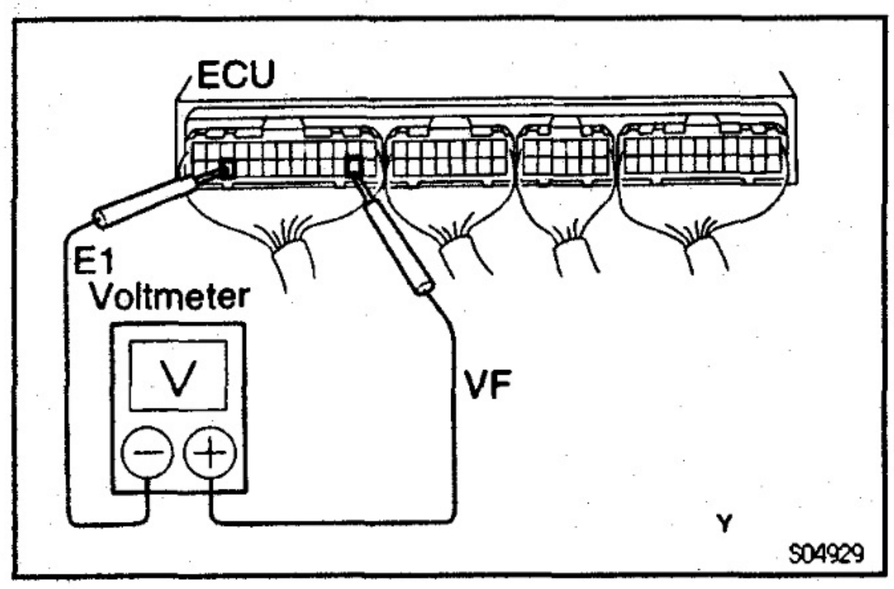
BAD → Repair or replace.

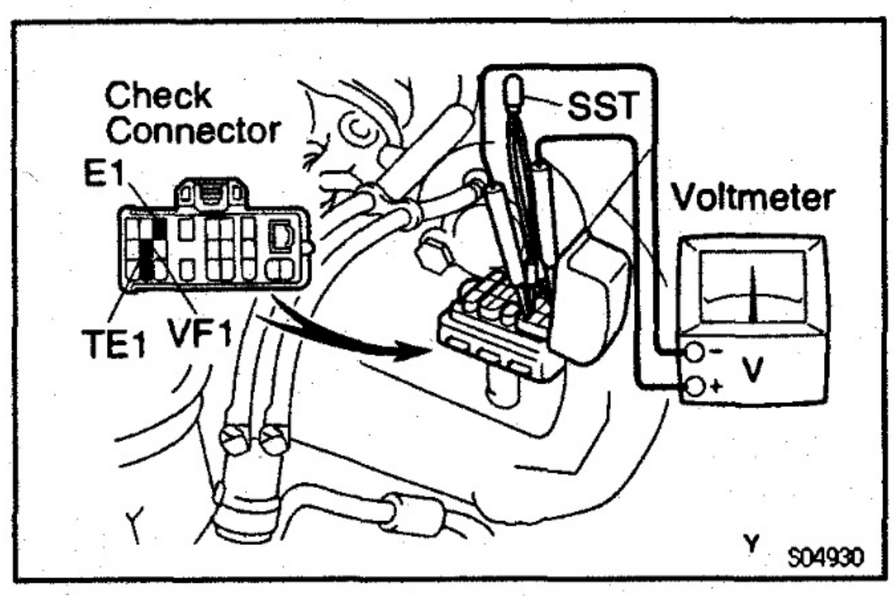
Fuse blows again → Check wiring between ECU terminal W and fuse.

BAD → Repair or replace.

Y V08217







• VF – E1

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 — ↓ BAD

Try another ECU. — BAD → Repair or replace.

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

↓ OK

Check for air leak from air intake system. — BAD → Repair air leak.

↓ OK

Check spark plugs. — BAD → Repair or replace.

↓ OK

Check ignition system. — BAD → Repair or replace.

↓ OK

Check fuel pressure. — BAD → Repair or replace.

↓ OK

Check injectors. — BAD → Repair or replace.

↓ OK

Check vacuum sensor. — BAD → Repair or replace.

↓ OK

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

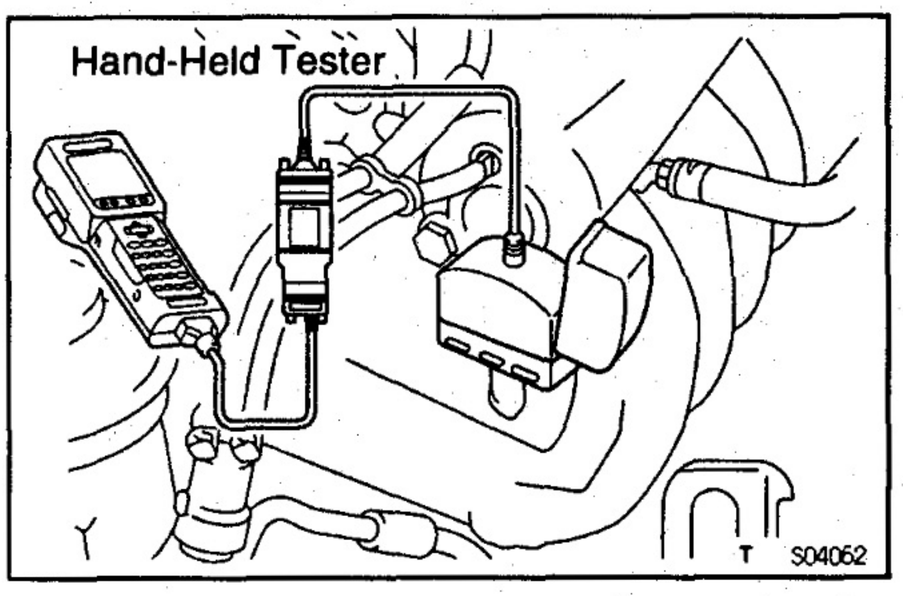
↓ BAD

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

↓ OK

Replace oxygen sensor.

V07117



EG

REFERENCE VALUE OF ENGINE ECU DATA

EG39Z-0P

HINT: Engine ECU data can be monitored by hand—held tester.

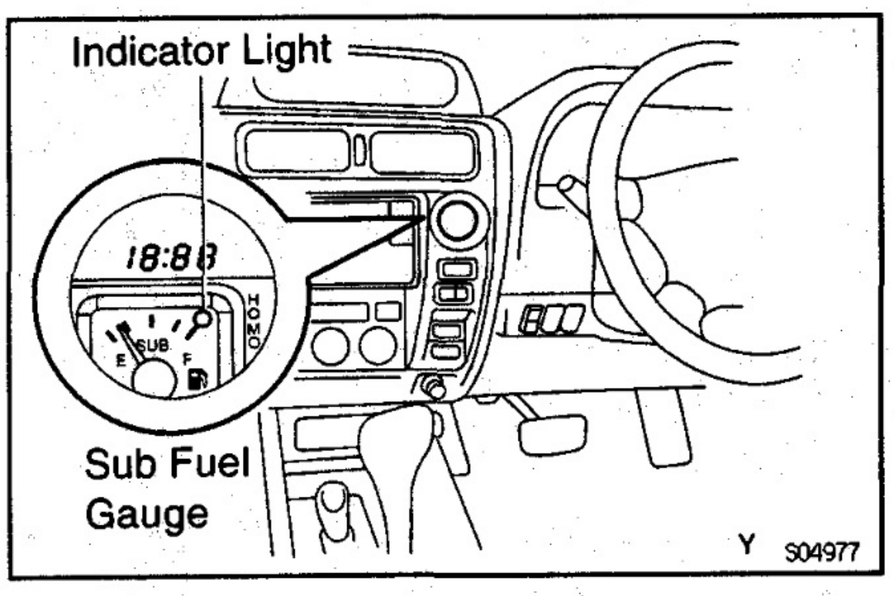
1. Hook up the hand—held tester to the check connecter.
2. Monitor engine ECU data by following the prompts on the tester screen. Please refer to the hand — held tester operator's manual for further details.

EG39B-07

REFERENCE VALUE FOR ENGINE ECU DATA (Engine at normal operating temp.

Item	Inspection condition	Reference value
INJECTOR	Engine cold to hot Engine idling at normal operating temp. *1	Gradually decreases Approx. 2.1 — 3.6 msecs
IGNITION	Increase engine speed	Gradually increases
ISC DUTY	Engine idling at normal operating temp. *1 A/C switch ON A/T shifting in "D" position	Approx 24.8 — 50 % Duty ratio incveases Duty ratio incveases
ENGINE SPD	RPM kept stable (Comparison with tachometer)	No great changes
AIR FLOW	Engine idling at normal operating temp. *1 Increase engine speed	3.8 — 5.5 g/sec. Gradually increases
COOLANT TEMP.	Engine at normal operating temp.	75 — 95°C (185 — 203°F) *2
THROTTLE	Closed throttle position Wide open throttle From closed throttle position to wide open throttle	Below 5° Above 70° Gradually increases
VEHICLE SPD	During driving (Comparison with speedometer)	No large differences
TARGET A/F	Engine idling at normal operating temp.	2.50±1.25 V *3
A/F FB LEFT	RPM stable at 2,500 rpm with normal operating temp.	ON
KNOCK FB	Depress throttle pedal suddenly during idling	ON
STA SIGNAL	During cranking	ON
IDL SIGNAL	Closed throttle position	ON
A/C SIGNAL	A/C switch ON	ON
NSW SIGNAL	When shifting from "P" or "N" position into a position other than "P" or "N".	GEAR
OxL	RPM stable at 2,500 rpm with normal operating temp.	RICH LEAN is repeated.

*1: All accessories and A/C are switch OFF.
*2: If the water temperature sensor circuit is open or shorted, the engine ECU assumes an engine coolant temp. value of 80°C (176°F).
*3: When feedback control is forbidden, 0 V is displayed.



DOUBLE TANK SYSTEM

INDICATOR LIGHT LIGHT CHECK

EG79A–03

1. The indicator light will come on when the ignition switch is at ON and the engine is not running.
2. When the engine is started, the indicator light should go in case the fuel tank changeover switch is off. If the light blinks on, the double tank system has detected a malfunction or abnormality in the system.

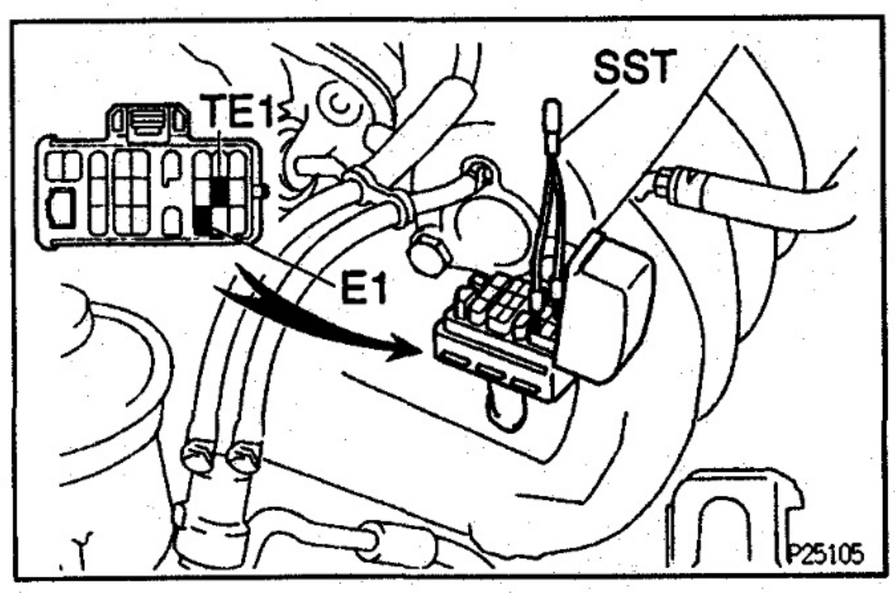
EG

DIAGNOSTIC TROUBLE CODES OUTPUT

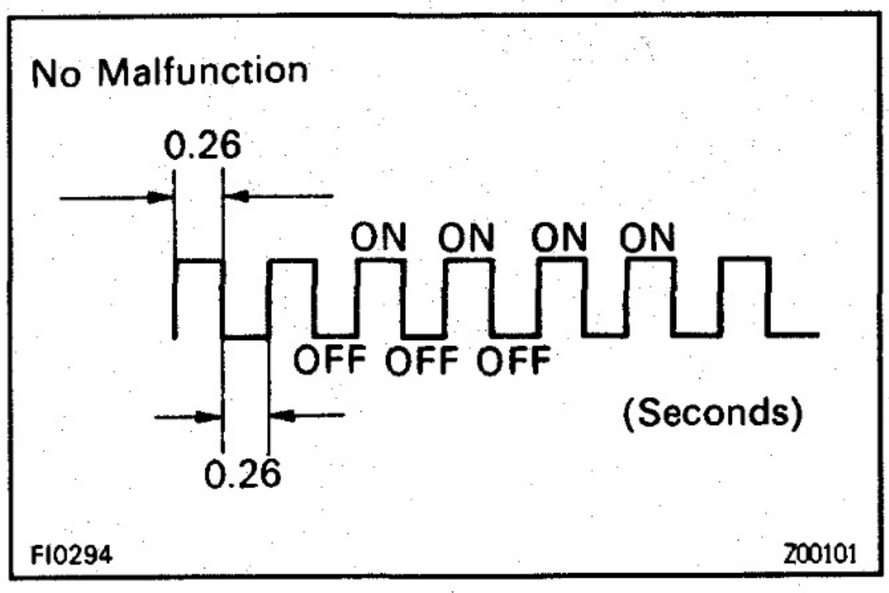
EG7DU–01

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

1. Initial conditions
(a) Battery voltage 11 V or more
(b) Accessories switched OFF
2. Turn the ignition switch ON.
CAUTION: Do not start the engine.

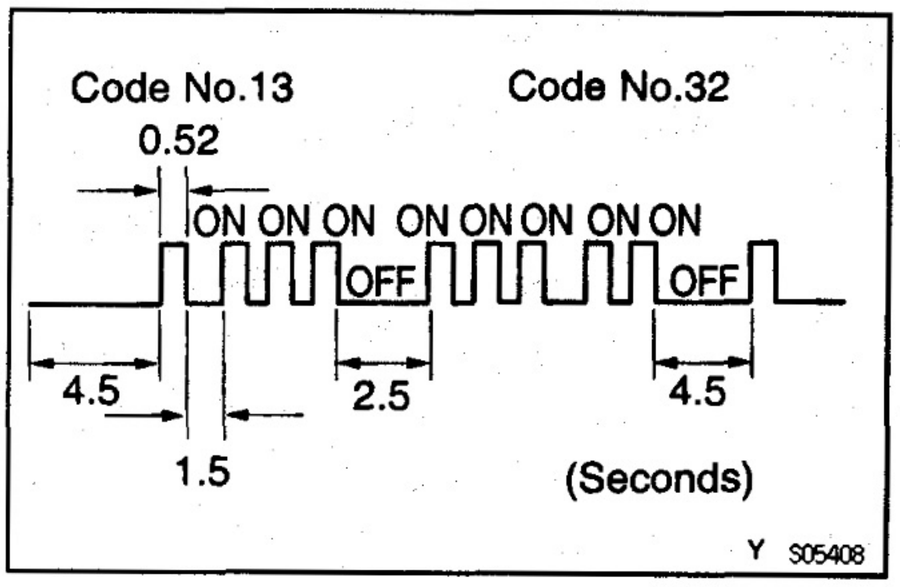


3. Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843–18020
4. Read the diagnostic trouble code as indicated by the number of flashes of the check engine warning light.



Diagnostic trouble Codes

(a) Normal System Operation (no malfunction)
- The light will alternately blink ON and OFF at 0.26 second intervals.



(b) Malfunction Code Indication

- In the event of a malfunction, the light will blink every 0.52 seconds. The 1st number of blinks will equal the 1st digit of a 2 digit diagnostic trouble code, and after a 1.5 second pause, the 2nd number of blinks will equal the second digit. If there are 2 or more codes, there will be a 2.5 second pause between each code.
- After all the codes have been output, there will be a 4.5 second pause and they will all be repeated as long the terminals TE1 and E1 of the check connector are connected.

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

EG

DIAGNOSTIC TROUBLE CODES

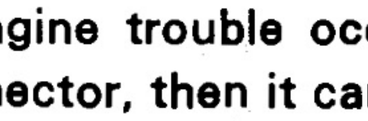
E079C-03

HINT:

- If a malfunction is detected during the diagnostic trouble code check, refer to the circuit indicated in the table, and turn to the corresponding page.
- Your readings may vary from the parameters listed in the table, depending on the instruments used.
- To memorize the following cords after the engine has started and abnormal condition (any failure) has occured when 6 seconds and more have been passed.

Code No.	Number of Blinks of Fuel Level Indicator Light	Diagnosis	Trouble Area
—	FI1401	Normal.	—
11	S04177	• When fuel tank changeover switch in "OFF". • Circuit opening relay in always "OFF" or fuel tank select relays contacts are not conducted or wire harness of main fuel pump is open.	• Circuit opening relay or fuel tank select relay or main fuel pump wire harnese system
13	FI1607	• When fuel tank changeover switch in "OFF". • Fuel tank select relay in always "ON".	• Fuel tank select relay

Y V08121

Code No.	Number of Blinks of Fuel Level Indicator Light	Diagnosis	Truble Area
23	S04178	• When fuel tank changeover switch in "OFF". • Sub fuel tank forcing driving relay in always "ON" or sub fuel pump wire harnese is short to power subly line.	• Sub fuel pump wire harnese system
32	S04179	• When fuel tank changeover switch in "ON". • Circuit opening relay in always "OFF" or fuel tank select relay contacts are not conducted or sub fuel pump wire harnese is open.	• Circuit opening relay or fuel tank select relay or sub fuel pump wire harnese system
33	BE3933	• When fuel tank changeover switch in "ON". • Wire harnese between changeover switch and fuel tank solenoid return valve is open.	• Fuel tank solenoid return valve wire harnese system
42	FI1615	• When fuel tank changeover switch in "ON". • Fuel tank select relay will not changeover.	• Fuel tank select relay • Fuel tank select relay wire hamese system
44	 S04180	• When fuel tank changeover switch in "ON". • Main fuel pump wire hamese is short to power subly line.	• Main fuel pump wire hamese system

Y V08122

EGQQV-06

TROUBLESHOOTING w/ VOLT, OHMMETER

HINT:

- Before beginning inspection, it is best to first make a simple check of the fuses, M—fuses, H—fuse 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.

EG70D-01

Engine (& ECT) ECU Terminals

(See EFI system check procedure in Troubleshooting w/volt,Ohmmeter.)

EQ79E-01

Engine (& ECT) ECU Terminals

(See engine (& ECT) ECU terminals in Troubleshooting w/volt, Ohmmeter.)

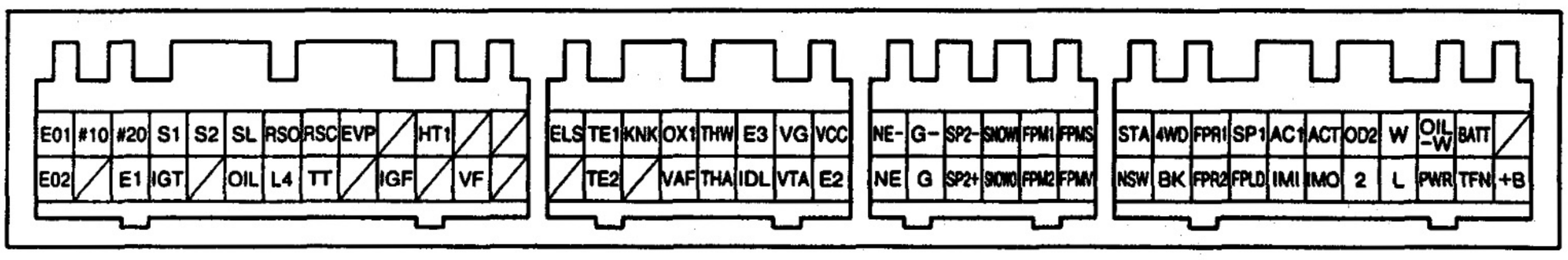
EQ57D-07

Engine (& ECT) ECU Wiring Connectors Voltage

EG

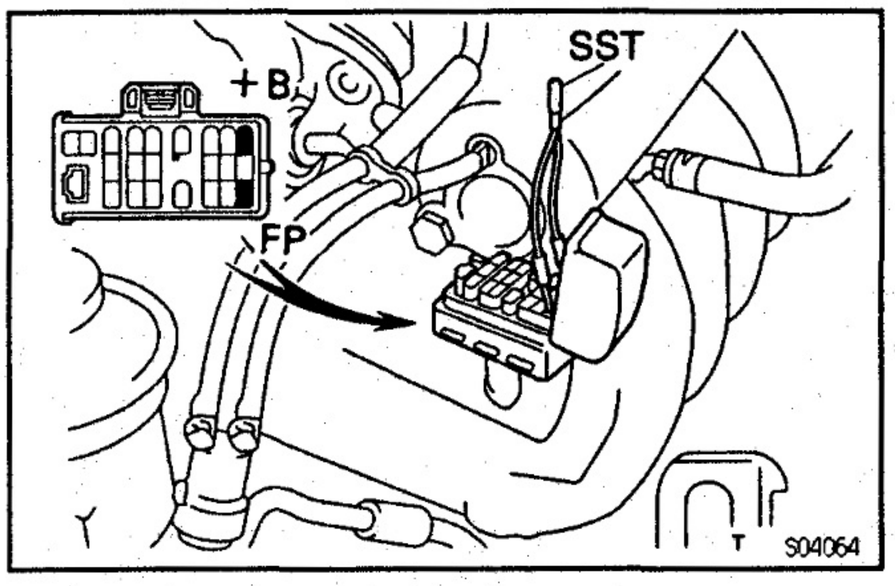
Terminals	Condition			STD voltage (V)
FPMV – E01	Fuel tank changeover switch		is ON	9 – 14
			is OFF	0 – 2
FPMS – E01	Idling			9 – 14
FPR2 – E01	Idling			9 – 14
FPM1 – E01	Idling	Fuel tank changeover switch	is ON	9 – 14
			is OFF	0 – 2
FPM2 – E01	Idling	Fuel tank changeover switch	is ON	9 – 14
			is OFF	0 – 2
FPR1 – E01	Idling			0 – 2
FPLD – E01	Idling	Fuel tank changeover switch	is ON	9 – 14
			is OFF	0 – 3

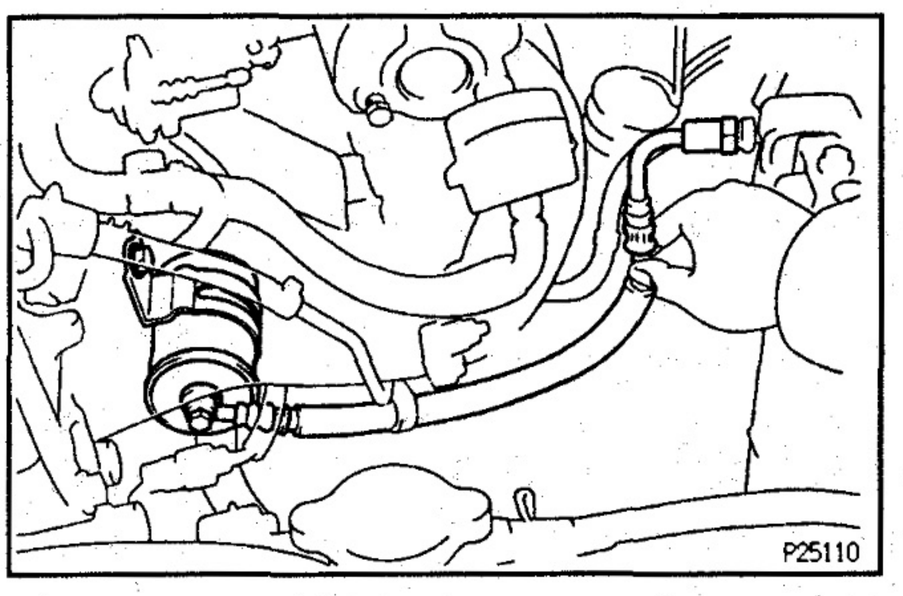
ECU Terminals

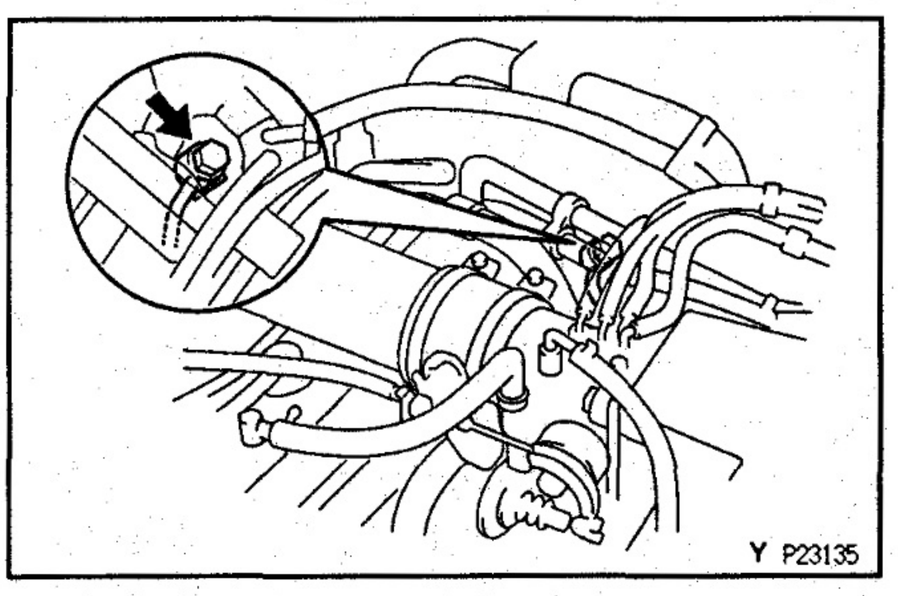


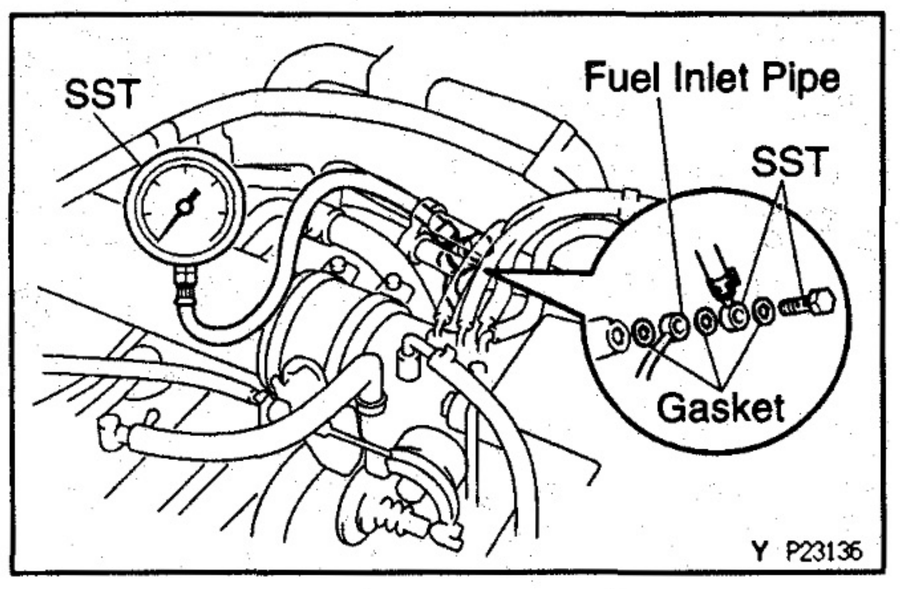
S01399

V08103









FUEL PUMP

ON–VEHICLE INSPECTION

B079F–02

1. CHECK FUEL PUMP OPERATION

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

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

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

(d) Turn the ignition switch OFF.

(e) Remove the SST.
SST 09843–18020

2. CHECK FUEL PRESSURE

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

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

(c) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the delivery pipe.
HINT:
- Put a suitable container or shop rag under the delivery pipe.
- Slowly loosen the union bolt.

(d) Install the fuel inlet hose and SST (pressure gauge) to the delivery pipe with the 2 gaskets and SST (union bolt).
SST 09268–45012
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

(e) Wipe off any splattered gasoline.

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

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

(h) Turn the ignition switch ON.

(i) Measure the fuel pressure.
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi)
If pressure is high, replace the fuel pressure regulator.

If pressure is low, check these parts:

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

(j) Remove the SST.
SST 09483–18020

(k) Start the engine.

(l) Disconnect the vacuum sensing hose from the fuel pressure regulator, and plug the hose end.

(m) Measure the fuel pressure at idle.
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi)

(n) Reconnect the vacuum sensing hose to the fuel pressure regulator.

(o) Measure the fuel pressure at idle.
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi)
If pressure is not as specified, check the vacuum sensing hose and fuel pressure regulator.

(p) Stop the engine.

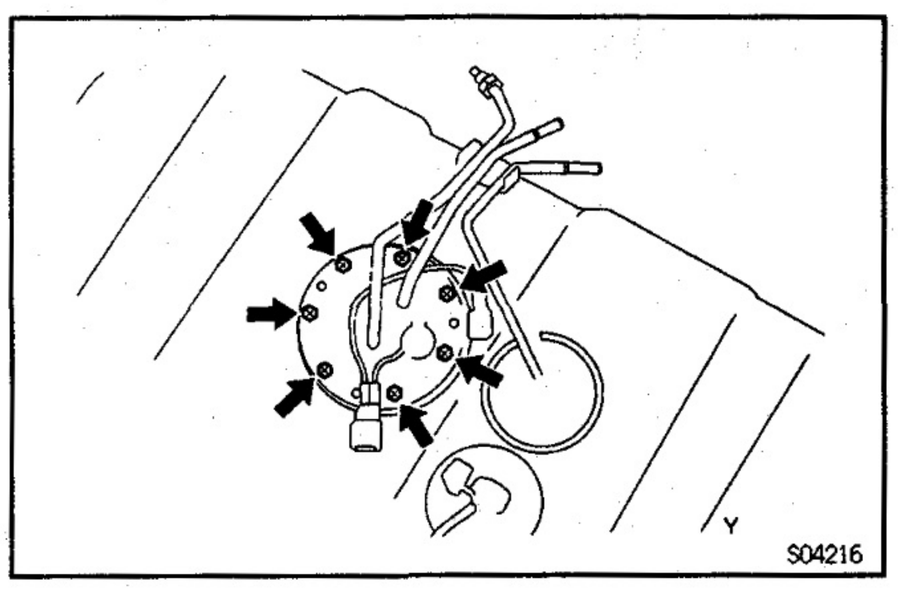
(q) Check that the fuel pressure remains as specified for 5 minutes after the engine is stopped.
Fuel pressure:
147 kPa (1.5 kgf/cm², 21 psi) or more
If pressure is not as specified, check the fuel pump, pressure regulator and/or injector.

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

(s) Reconnect the fuel inlet hose to the delivery pipe with 2 new gaskets and the union bolt.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

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

(u) Check for fuel leakage.



EG8AZ-06

MAIN FUEL PUMP REMOVAL

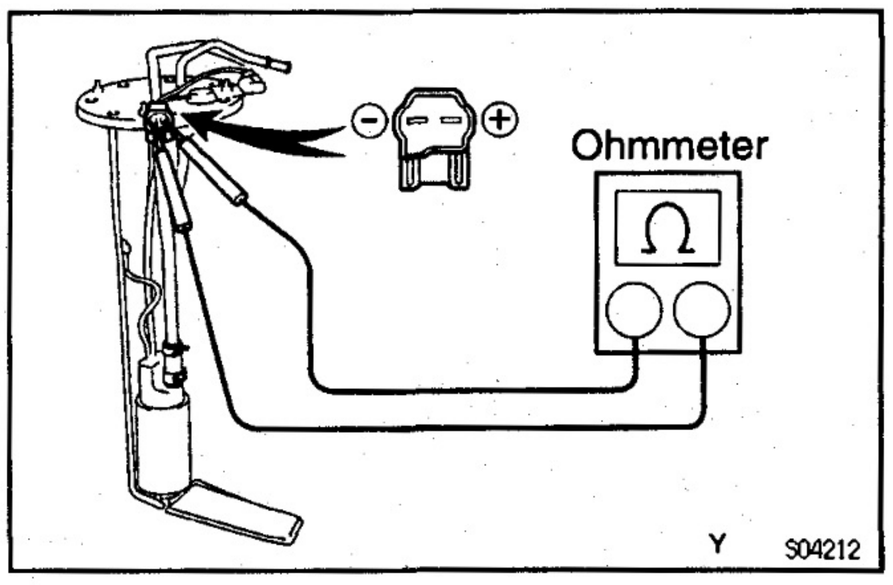
CAUTION: Do not smoke or work near an open flame when working on the fuel pump.

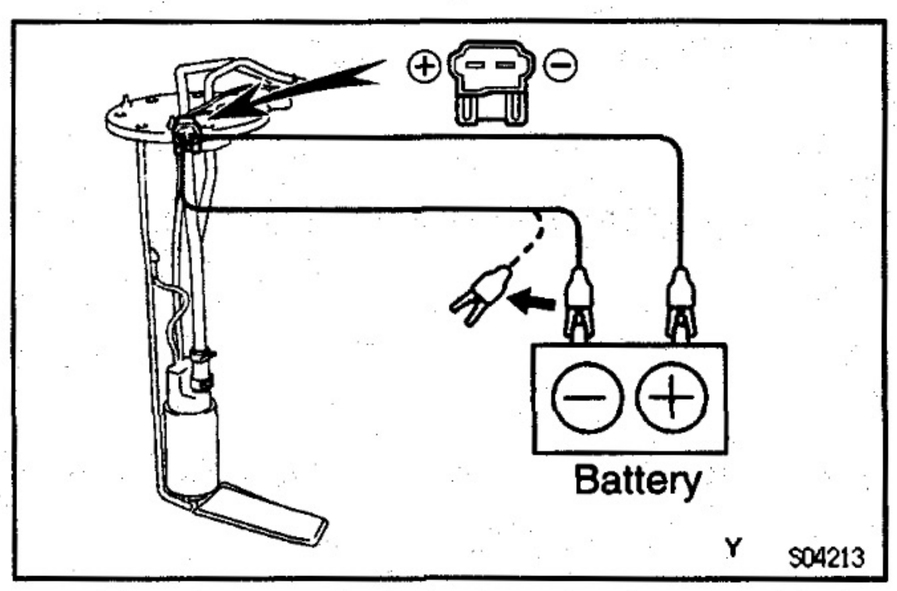
REMOVE FUEL PUMP BRACKET ASSEMBLY FROM FUEL TANK

(a) Remove the 7 bolts.
Torque: 3.5 N·m (35 kgf·cm, 31 in.·lbf)

(b) Pull out the pump bracket assembly.

(c) Remove the gasket from the pump bracket.
INSTALLATION HINT: Use a new gasket to the pump bracket.





SG78G-01

MAIN FUEL PUMP INSPECTION

1. **INSPECT MAIN FUEL PUMP RESISTANCE**
Using an ohmmeter, measure the resistance between the terminals + and −.
Resistance:
At 20°C (68°F): 0.2 – 3.0 Ω
If the resistance is not as specified, replace the main fuel pump and/or lead wire.

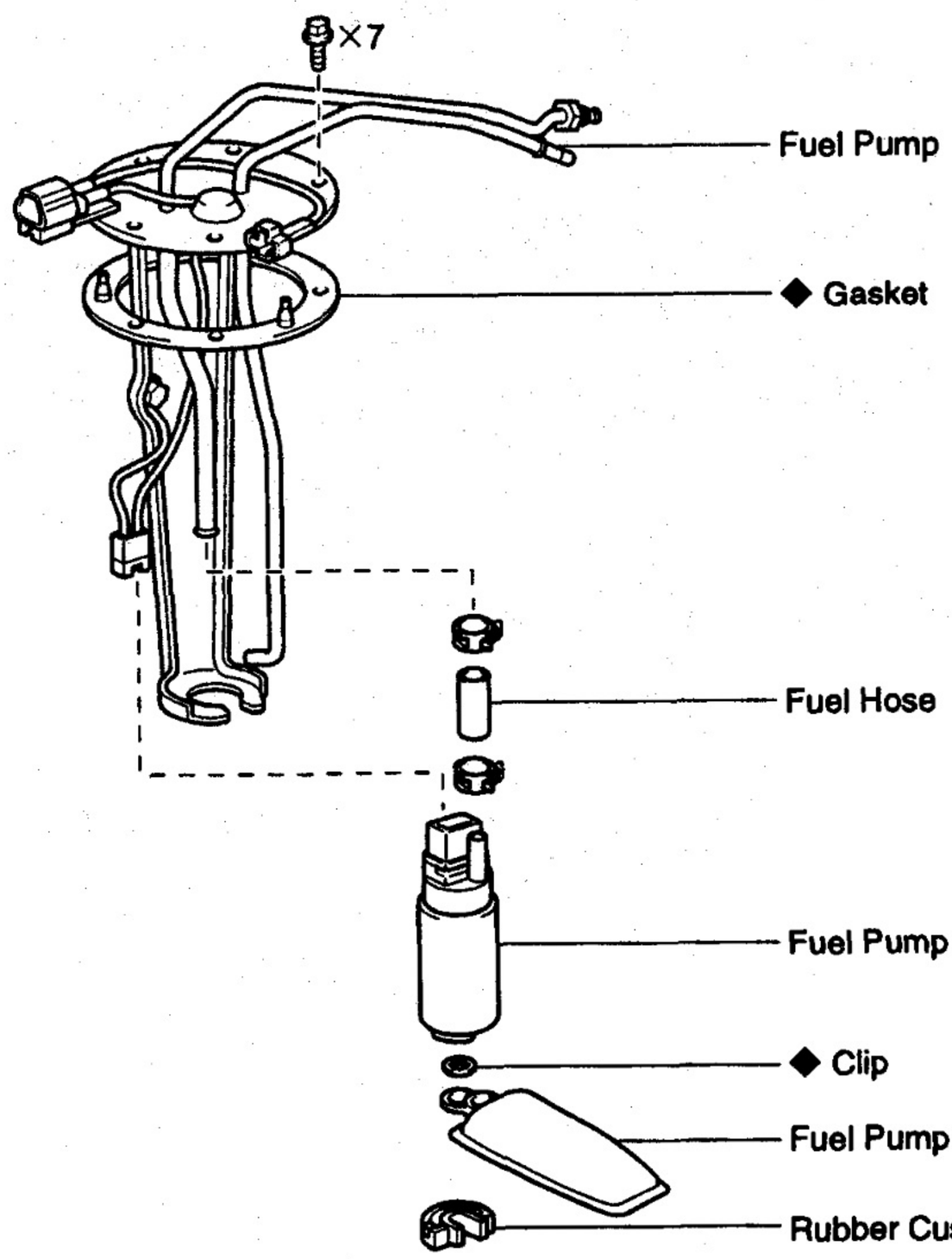
2. **INSPECT MAIN FUEL PUMP OPERATION**
Connect the positive (+) lead from the battery to terminal the connector, and the negative (−) lead to terminal. Check that the main fuel pump operates.
NOTICE:
- **These tests must be done quickly (within 10 seconds) to prevent the coil from burning out.**
- **Keep the main fuel pump as far away from the battery as possible.**
- **Always do the switching at the battery side.**

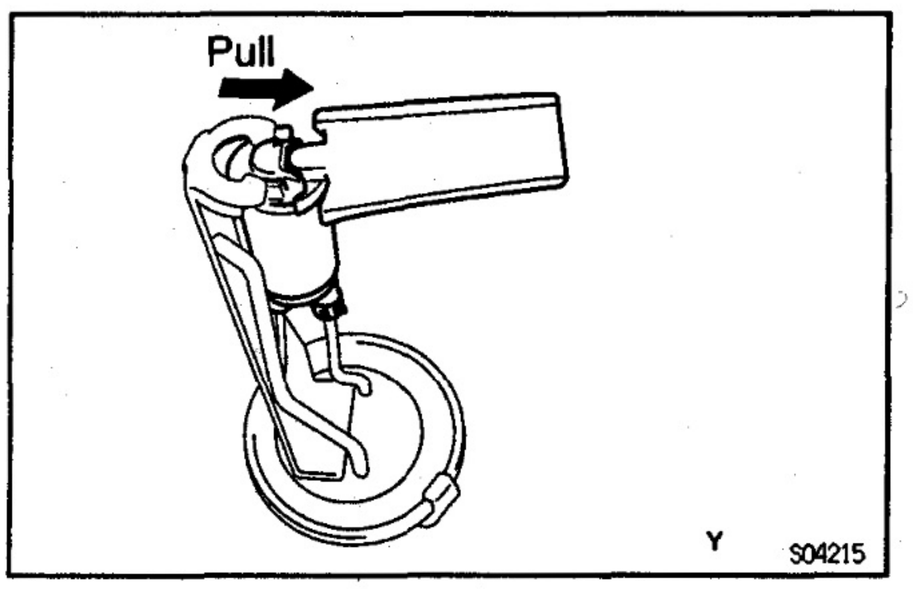
If operation is not as specified, replace the main fuel pump and/or lead wire.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

E0001-1J

EG





E0701-01

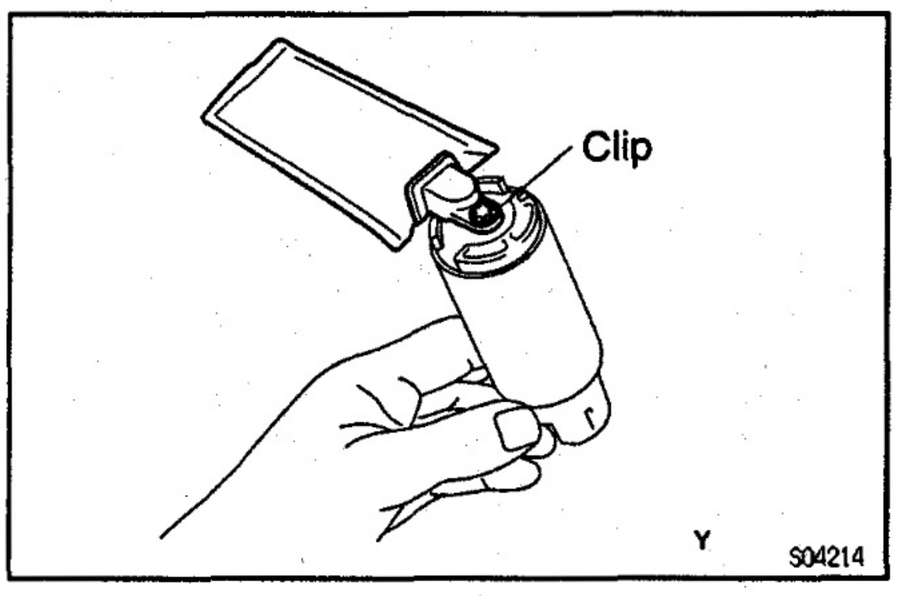
MAIN FUEL PUMP DISASSEMBLY

1. **REMOVE FUEL PUMP LEAD WIRE**
2. **REMOVE MAIN FUEL PUMP FROM FUEL PUMP BRACKET**

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

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

(c) Remove the rubber cushion from the main fuel pump.



4. **REMOVE FUEL PUMP FILTER FROM MAIN FUEL PUMP**

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

(b) Pull out the pump filter.

INSTALLATION HINT: Install the pump filter with a new clip.

EG64V-03

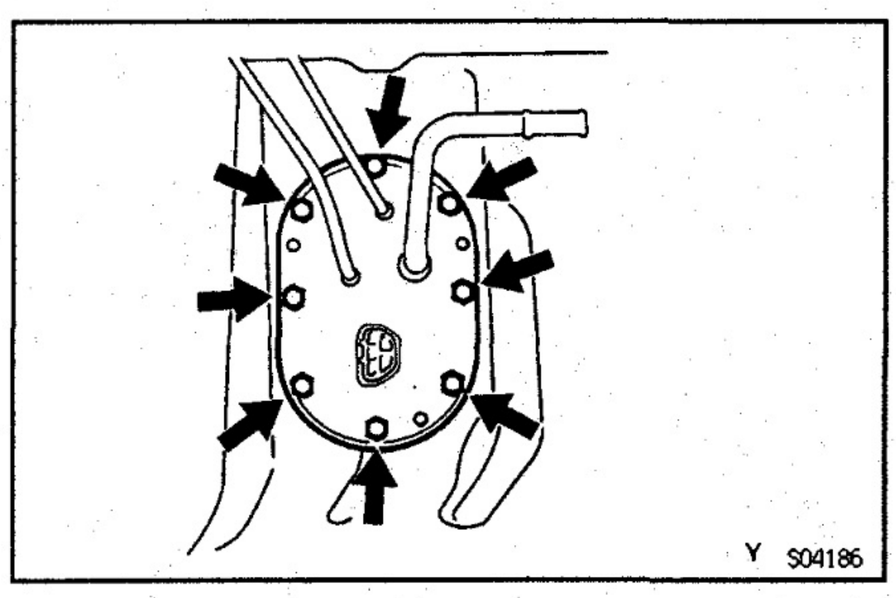
MAIN FUEL PUMP ASSEMBLY

Assembly is in the reverse order of disassembly.

EG64W-03

MAIN FUEL PUMP INSTALLATION

Installation is in the reverse order of removal.



EG79J-01

SUB FUEL PUMP REMOVAL

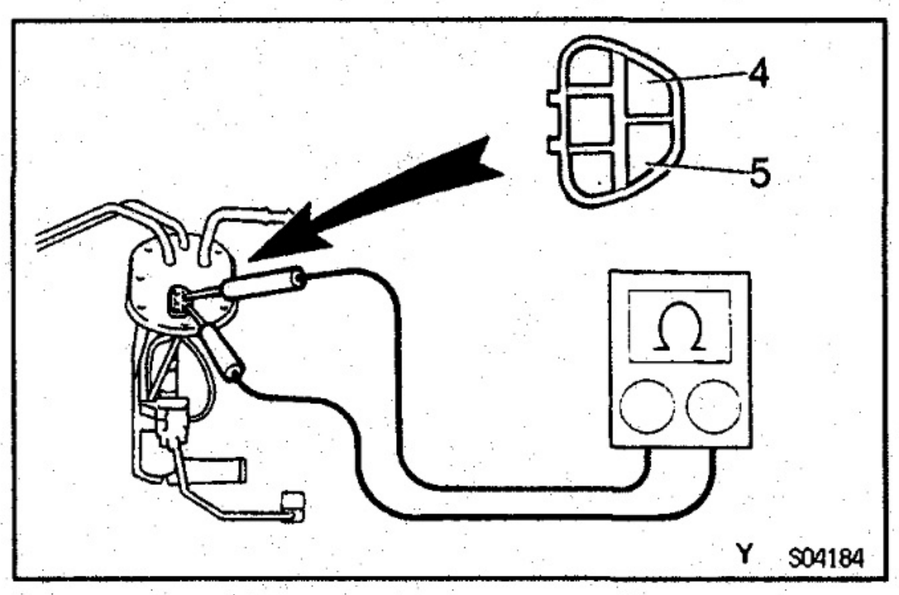
CAUTION: Do not smoke or work near an open flame when working on the sub fuel pump.

REMOVE FUEL PUMP BRACKET ASSEMBLY FROM FUEL TANK

(a) Remove the 8 bolts.
Torque: 3.5 N·m (35 kgf·cm, 31 in.·lbf)

(b) Pull out the pump bracket assembly.

(c) Remove the gasket from the pump bracket.
INSTALLATION HINT: Use a new gasket to the pump bracket.



EG79K-01

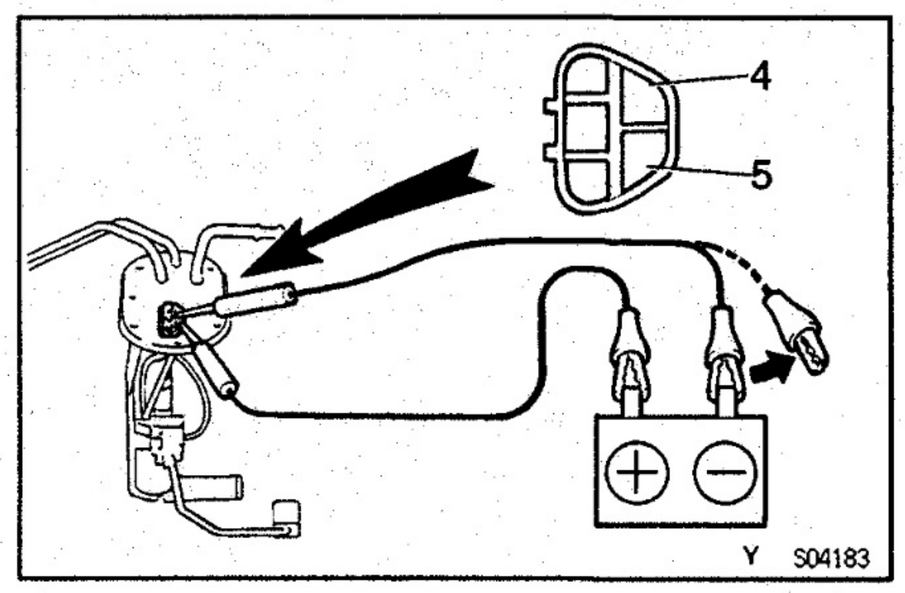
SUB FUEL PUMP INSPECTION

1. **INSPECT SUB FUEL PUMP RESISTANCE**
Using an ohmmeter, measure the resistance between the terminals 4 and 5.
Resistance: At 20°C (68°F): 0.2 — 3.0 Ω
If the resistance is not as specified, replace the sub fuel pump and/or lead wire.

2. **INSPECT SUB FUEL PUMP OPERATION**
Connect the positive (+) lead from the battery to terminal 4 of the connector, and the negative (—) lead to terminal 5. Check that the sub fuel pump operates.

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

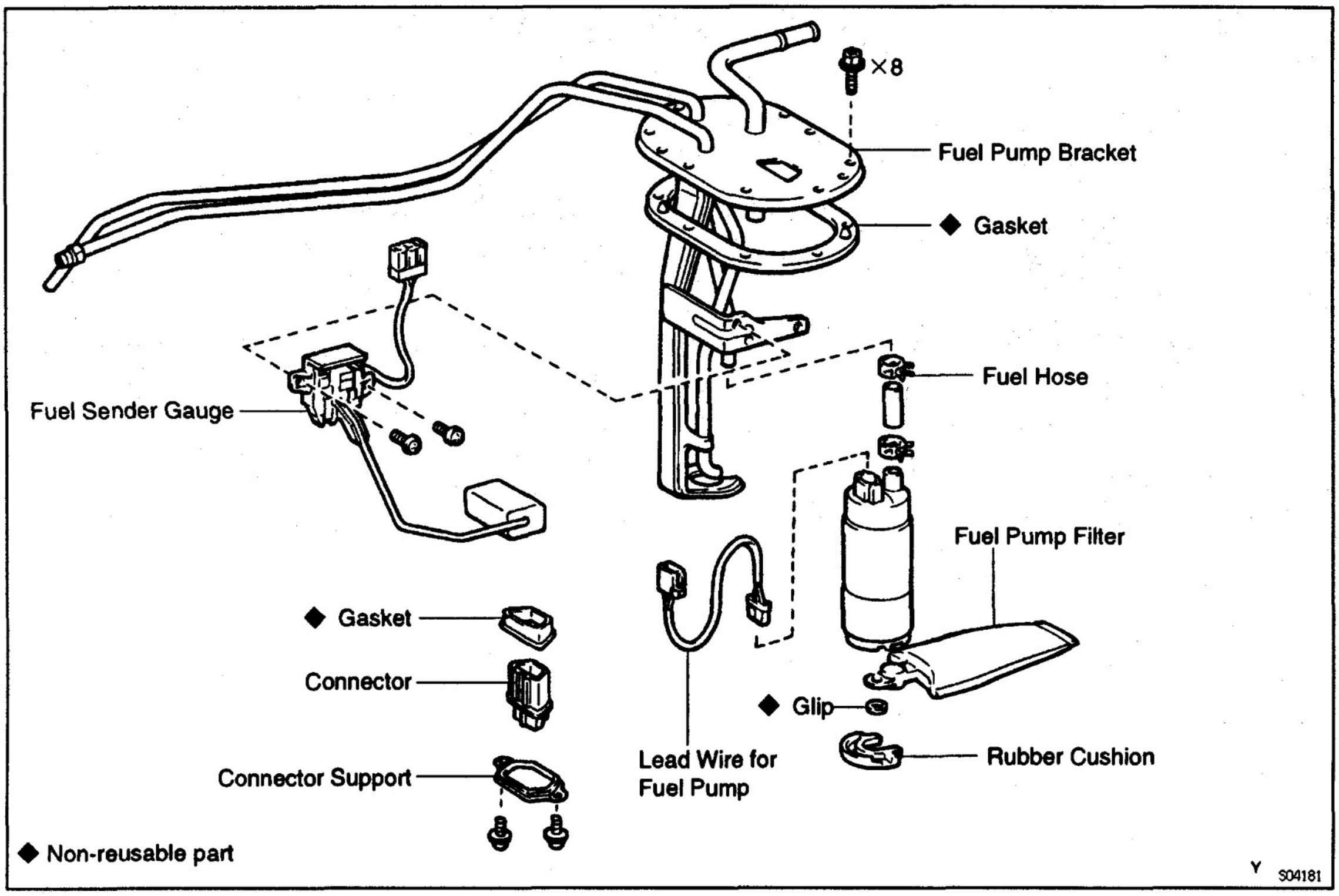
If operation is not as specified, replace the sub fuel pump and/or lead wire.

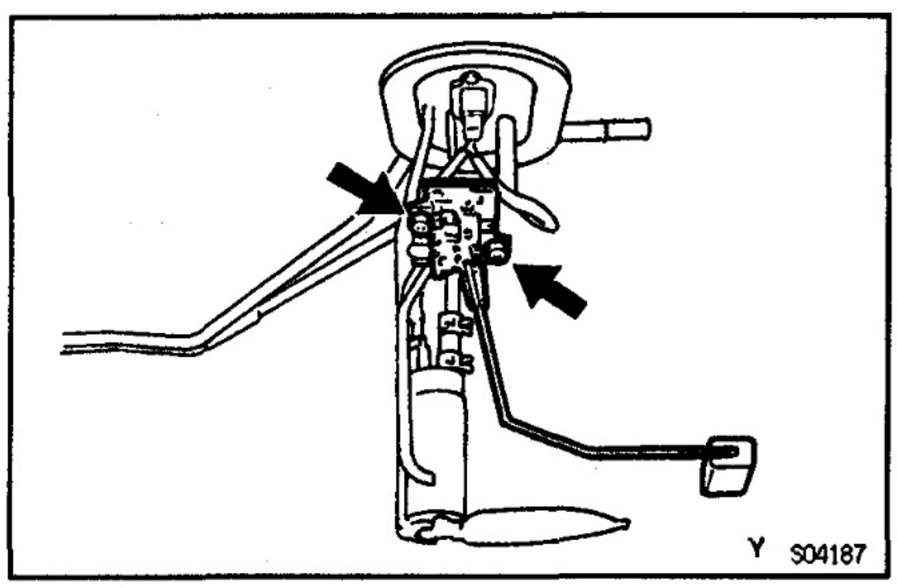


EG

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

E079L-01





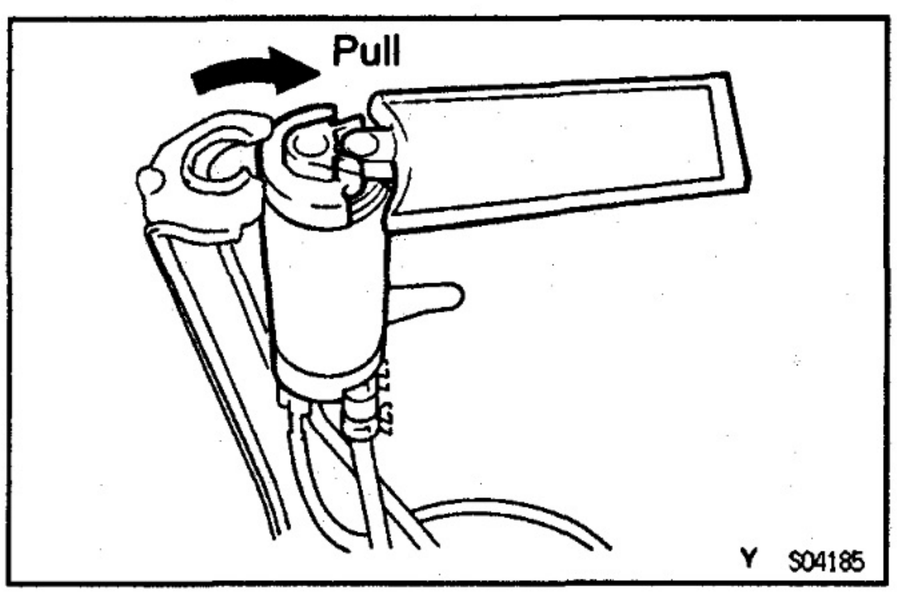
E079M-01

SUB FUEL PUMP DISASSEMBLY

1. **REMOVE FUEL PUMP LEAD WIRE**
2. **REMOVE FUEL SENDER GAUGE FROM FUEL PUMP BRACKET**

(a) Disconnect the fuel sender gauge connector.

(b) Remove the 2 screws and sender gauge.

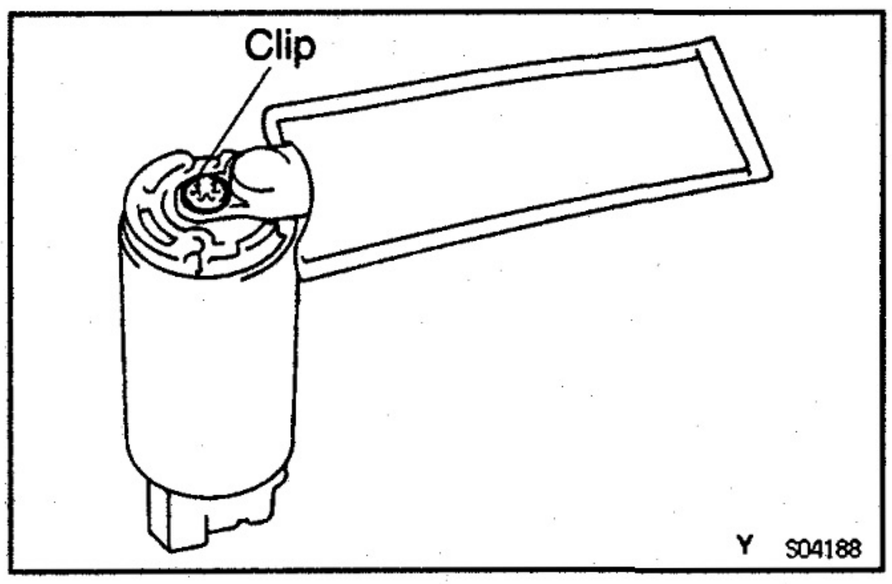


3. **REMOVE SUB FUEL PUMP FROM FUEL PUMP BRACKET**

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

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

(c) Remove the rubber cushion from the sub fuel pump.

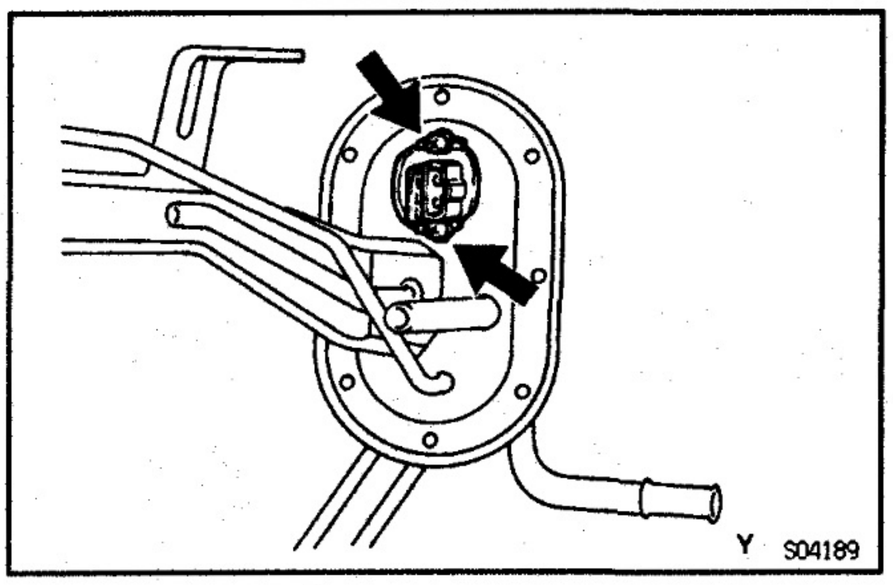


4. REMOVE FUEL PUMP FILTER FROM SUB FUEL PUMP

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

(b) Pull out the pump filter.

INSTALLATION HINT: Install the pump filter with a new clip.



5. REMOVE CONNECTOR

Remove the 2 screws, connector support, connector and gasket.

INSTALLATION HINT: Install the connector with a new gasket.

SUB FUEL PUMP ASSEMBLY

S070N–01

Assembly is in the reverse order of disassembly.

SUB FUEL PUMP INSTALLATION

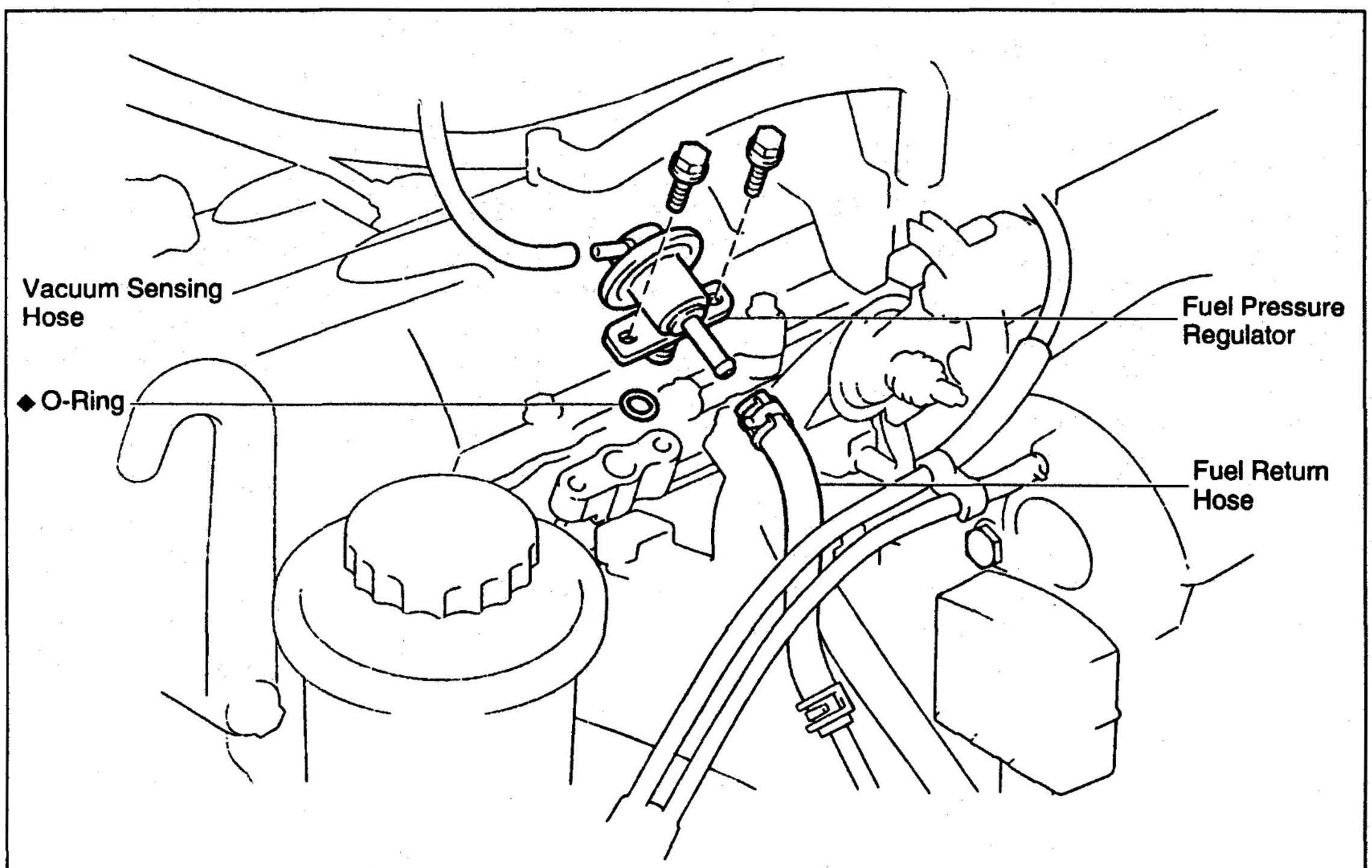
S070P–01

Installation is in the reverse order of removal.

FUEL PRESSURE REGULATOR COMPONENTS FOR REMOVAL AND INSTALLATION

B01AC-1M

EG

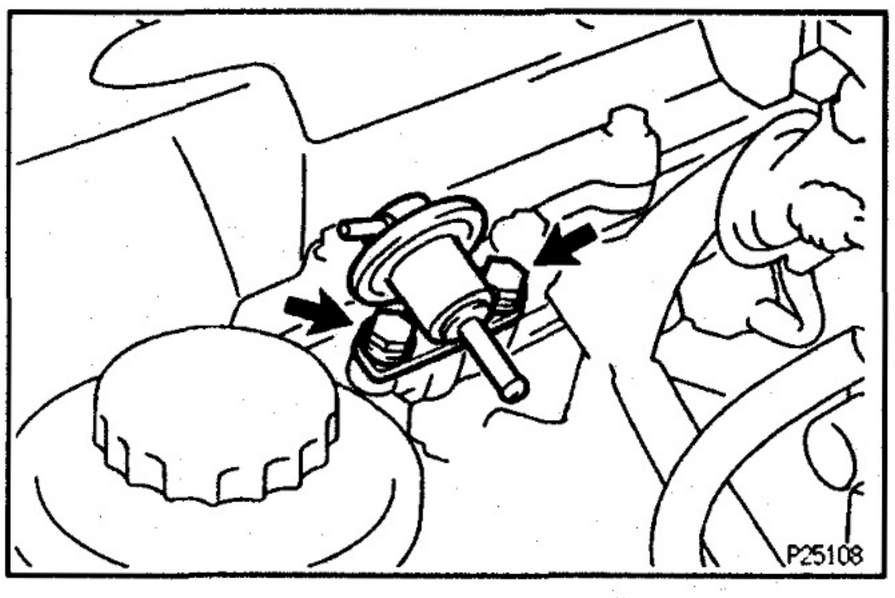


FUEL PRESSURE REGULATOR REMOVAL

EGBNK-04

1. **DISCONNECT VACUUM SENSING HOSE FROM FUEL PRESSURE REGULATOR**
2. **DISCONNECT FUEL RETURN HOSE FROM FUEL PRESSURE REGULATOR**

   HINT: Put a suitable container or shop towel under the pressure regulator.



3. **REMOVE FUEL PRESSURE REGULATOR**

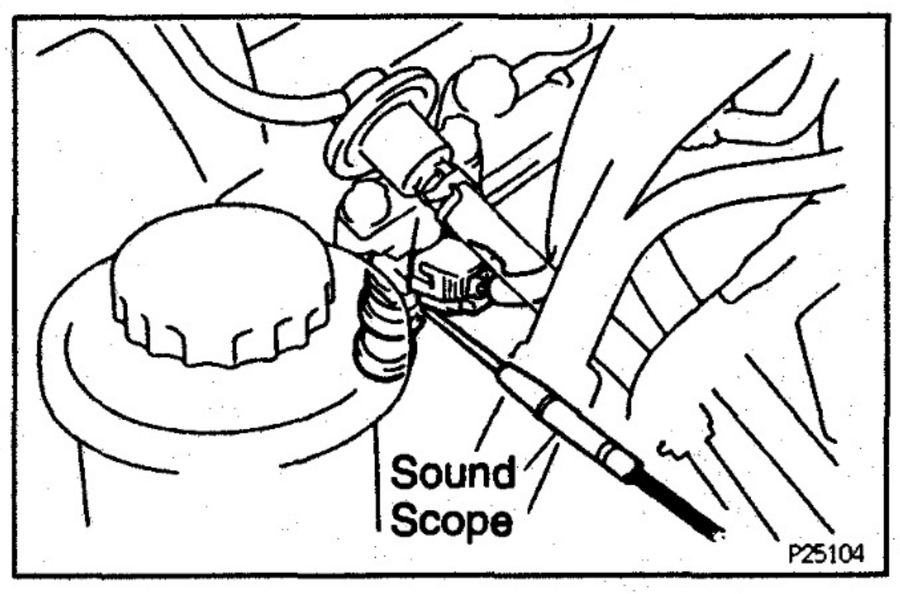
(a) Remove the 2 bolts and fuel pressure regulator.
Torque: 8.8 N·m (90 kgf·cm, 78 in.·lbf)

(b) Remove the O–ring.
INSTALLATION HINT: Use a new O–ring.

EG060-03

FUEL PRESSURE REGULATOR INSTALLATION

Installation is in the reverse order of removal.



INJECTOR

ON–VEHICLE INSPECTION

EG6NL-03

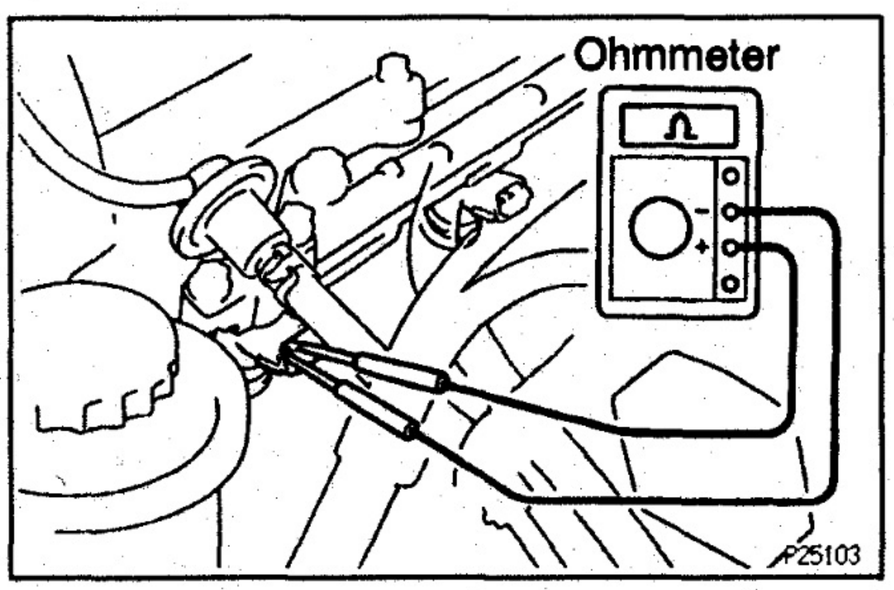
1. INSPECT INJECTOR OPERATION

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 speed.

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

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



2. INSPECT INJECTOR RESISTANCE

(a) Remove the throttle body.
(See throttle body removal)

(b) Disconnect the injector connectors.

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

Resistance:

At 20°C (68°F): 12 – 16 Ω

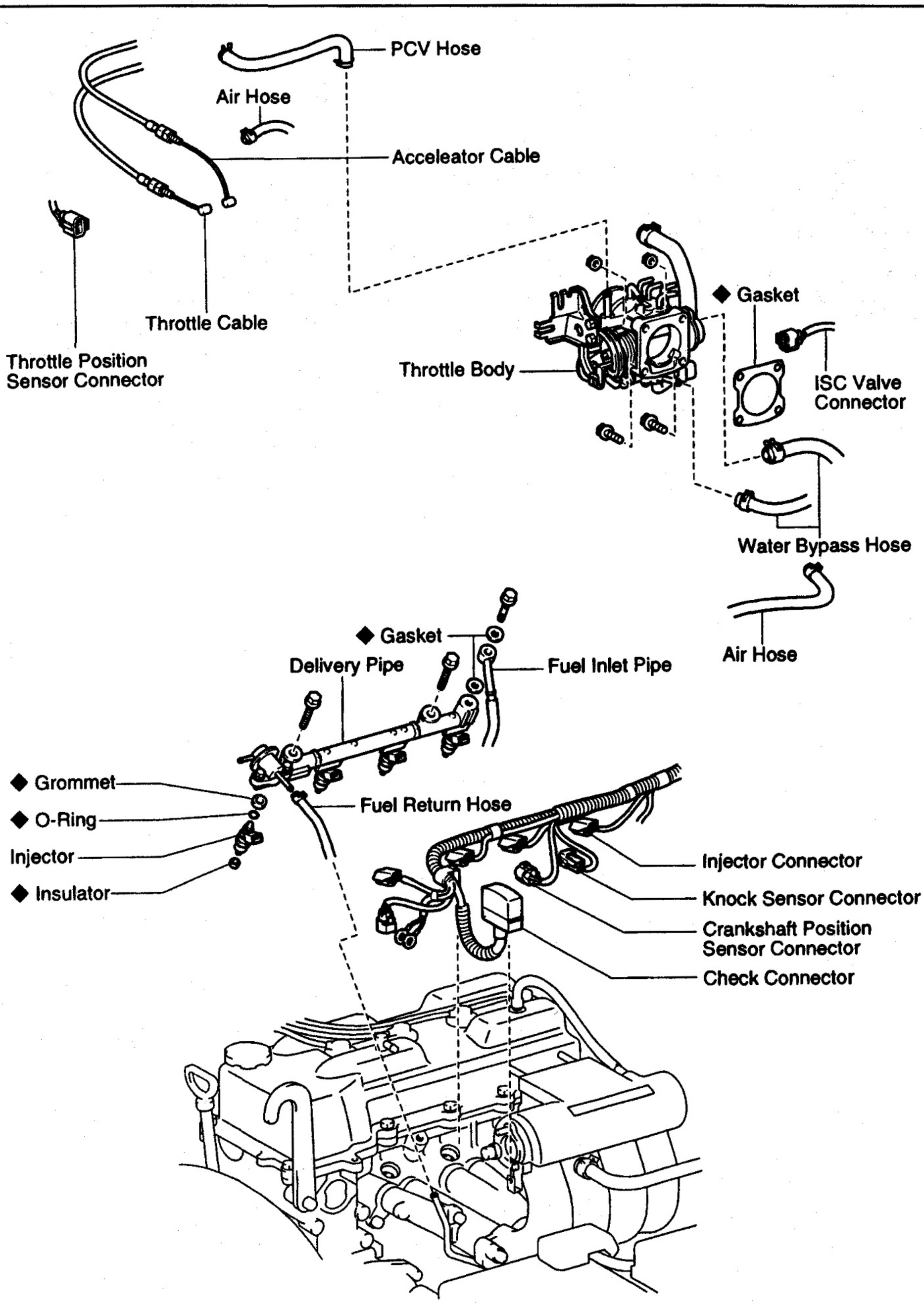
If the resistance is not as specified, replace the injector.

(d) Reconnect the injector connectors.

(e) Reinstall the throttle body.
(See throttle body installation)

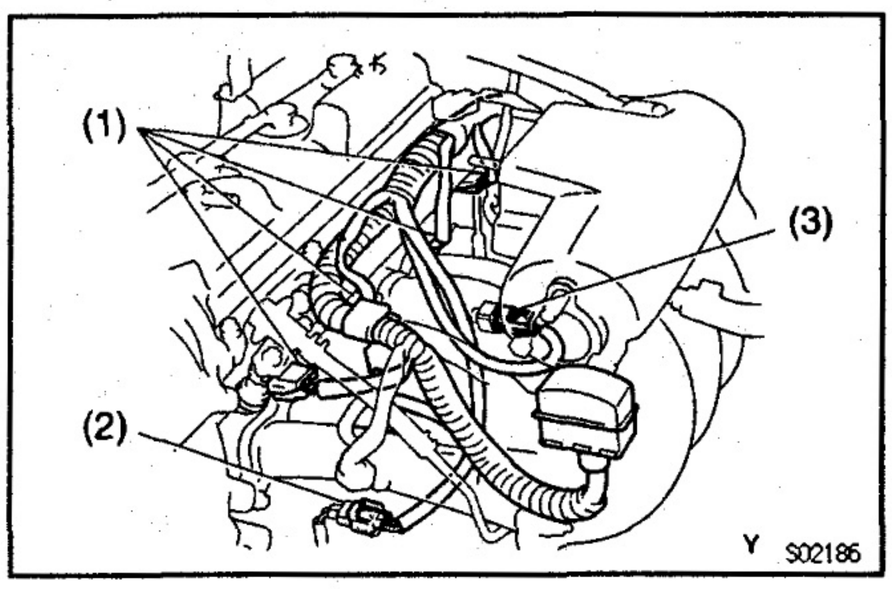
EG0190-15

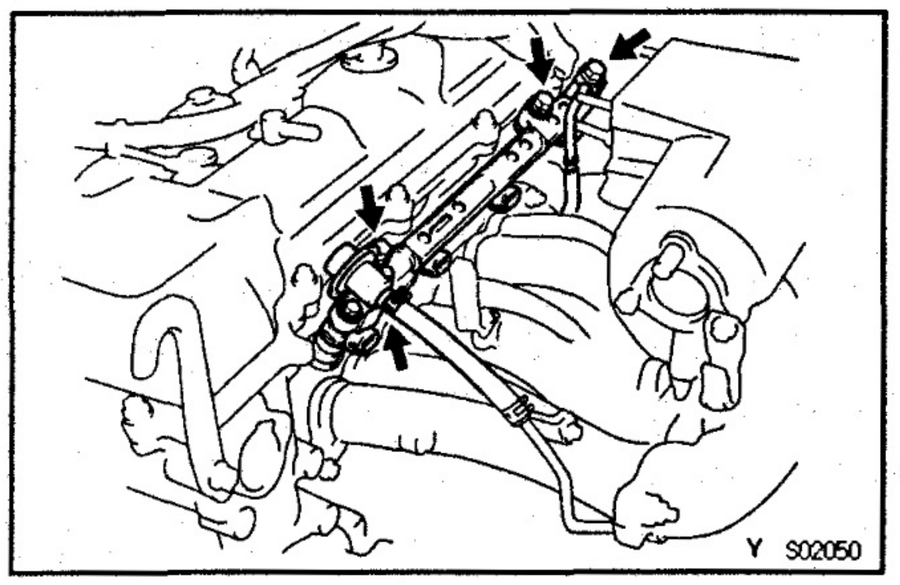
COMPONENTS FOR REMOVAL AND INSTALLATION



◆ Non-reusable part

S04389





INJECTORS REMOVAL

1. **REMOVE THROTTLE BODY**
   (See throttle body removal)
2. **DISCONNECT ENGINE WIRE**

(a) Disconnect these connectors:
   (1) 4 injector connectors
   (2) 3RZ–FE:Crankshaft position sensor connector
   (3) Knock sensor connector

(b) Disconnect the check connecter and wire clamp from the brackets.

3. **REMOVE DELIVERY PIPE AND INJECTORS**

(a) Disconnect the vacuum sensing hose from the fuel pressure regulator.

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

(c) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet pipe from the delivery pipe.
HINT:
- Put a suitable container or shop rag under the delivery pipe.
- Slowly loosen the union bolt.

(d) Remove the 2 bolts and delivery pipe together with the 4 injectors.
NOTICE: Be careful not to drop the injectors when removing the delivery pipe.

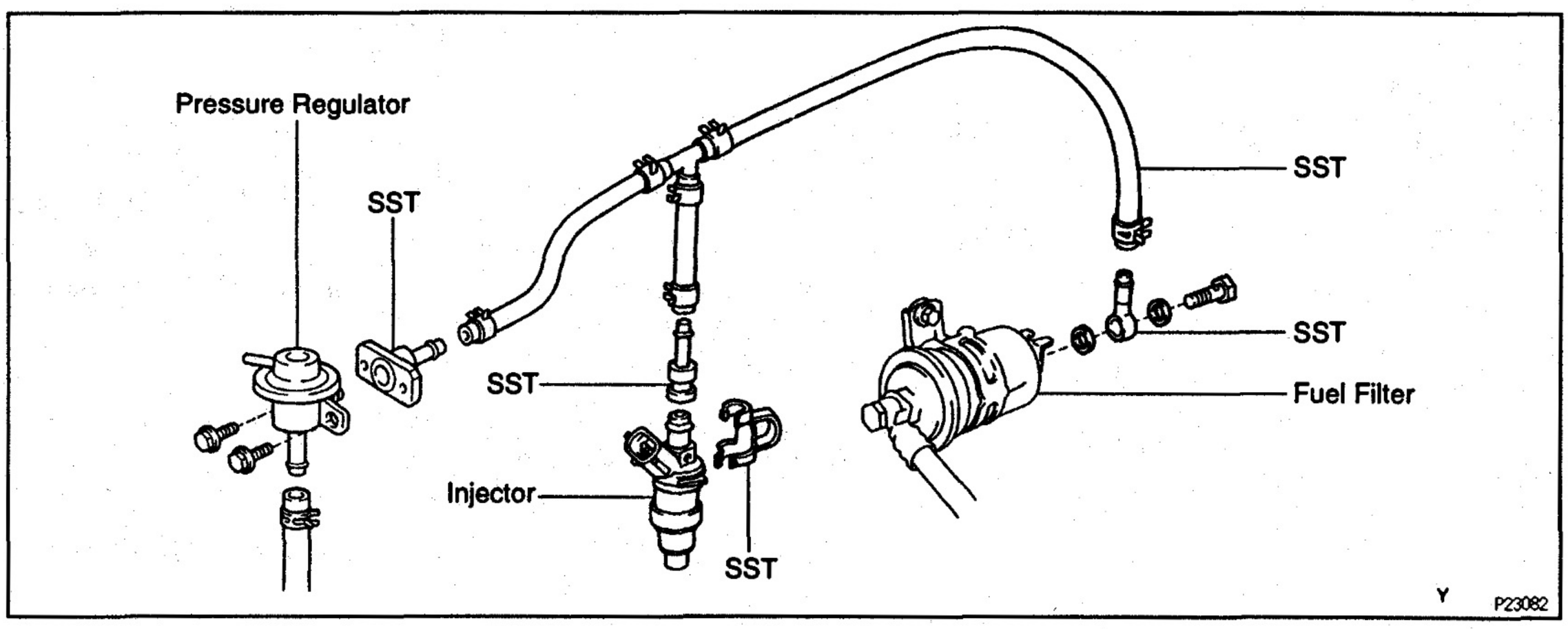
(e) Remove the 4 insulators from the 4 spacers.

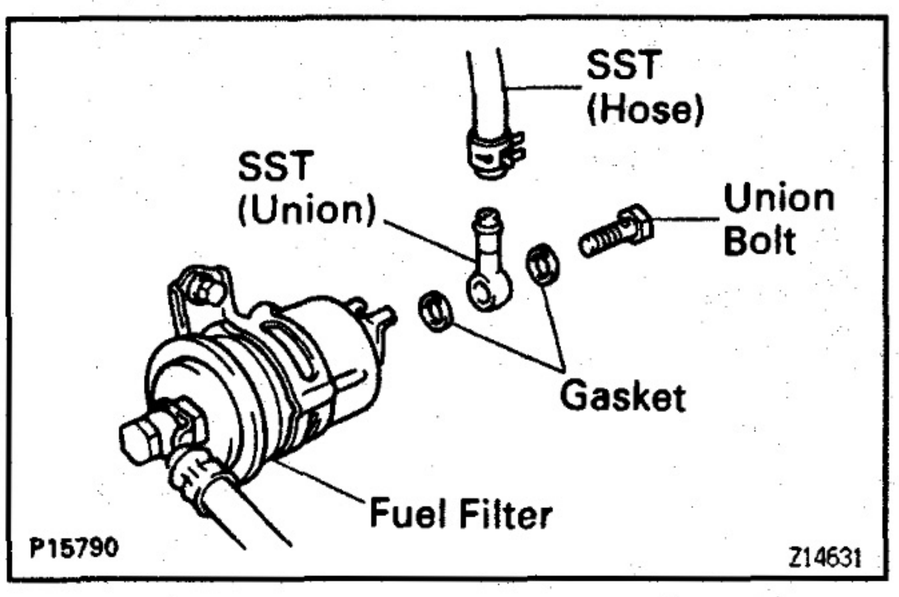
(f) Pull out the 4 injectors from the delivery pipe.

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

INJECTORS INSPECTION

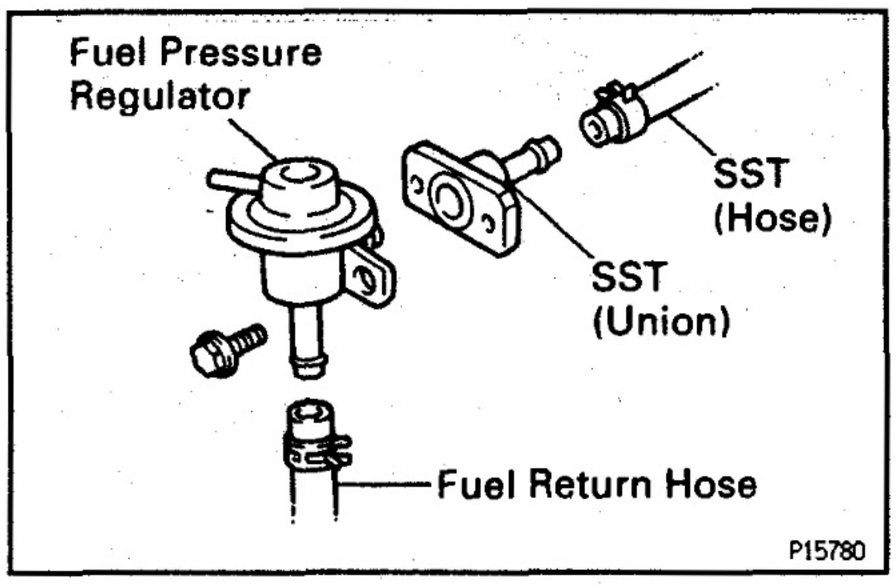
1. **INSPECT INJECTOR INJECTION**
CAUTION: Keep injector clean of sparks during the test.





(a) Remove the fuel inlet pipe from the fuel filter outlet.

(b) Connect SST (union and hose) to the fuel filter outlet with the 2 gaskets and union bolt.
SST 09268–41046 (90405–09015)
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

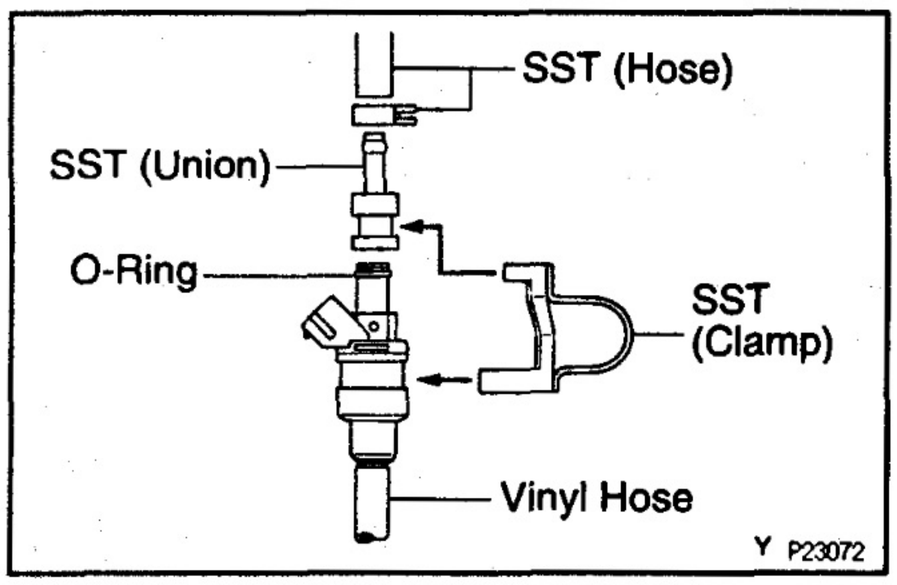


(c) Remove the fuel pressure regulator from the delivery pipe.

(d) Install the O–ring to the fuel inlet of pressure regulator.

(e) Connect SST (hose) to the fuel inlet of the pressure regulator with SST (union) and the 2 bolts.
SST 09268–41046 (09268–41091)

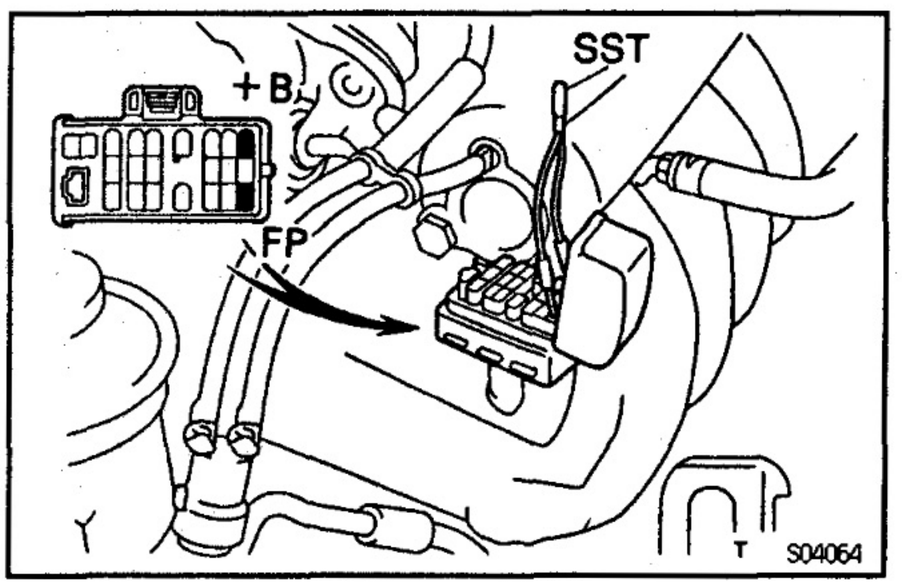
(f) Connect the fuel return hose to the fuel outlet of the pressure regulator.



(g) Install the O–ring to the injector.

(h) Connect SST (union and hose) to the injector, and hold the injector and union with SST (clamp).
SST 09268–41046

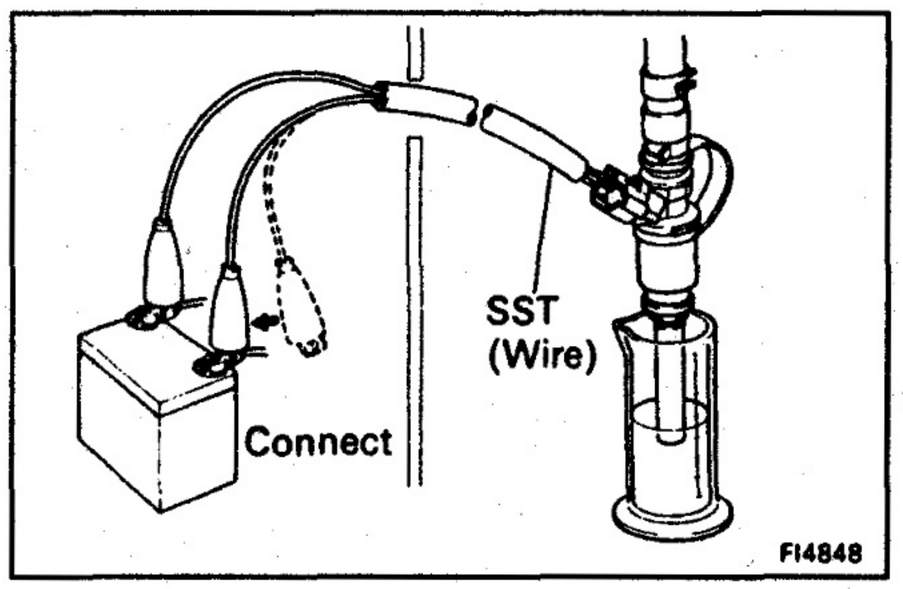
(i) Put the injector into a graduated cylinder.
HINT: Install a suitable vinyl hose onto the injector to prevent gasoline from splashing out.



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

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

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



(m) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.
SST 09842–30070

Volume:

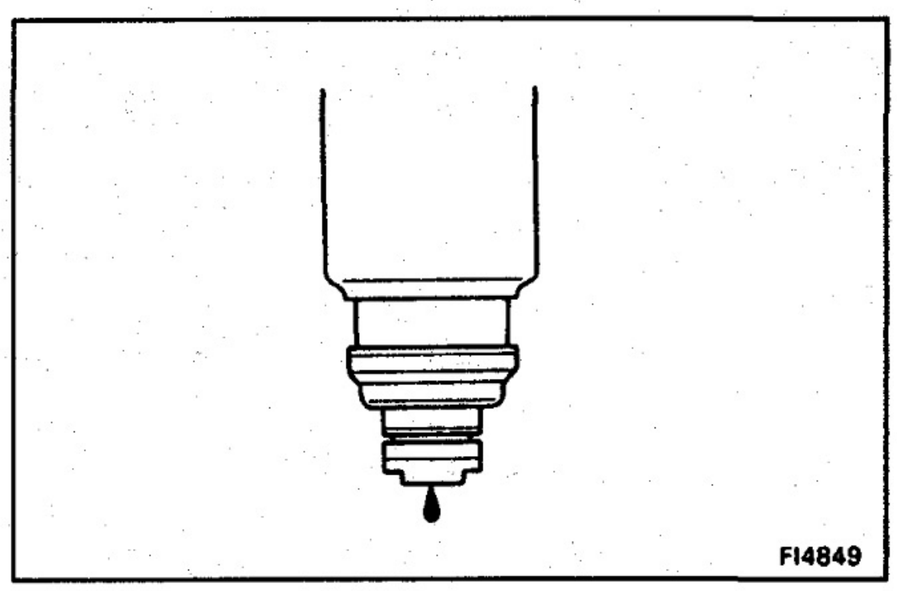
69 – 88 cm³ (4.2 – 5.4 cu in.) per 15 sec.

Difference between each injector:

5 cm³ (0.3 cu in.) or less

If the injection volume is not as specified, replace the injector.

EG



2. INSPECT LEAKAGE

(a) In the condition above, disconnect the test probes of SST (wire) from the battery and check the fuel leakage from the injector.
SST 09842–30070
Fuel drop:
1 drop or less per 3 minutes

(b) Turn the ignition switch OFF.

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

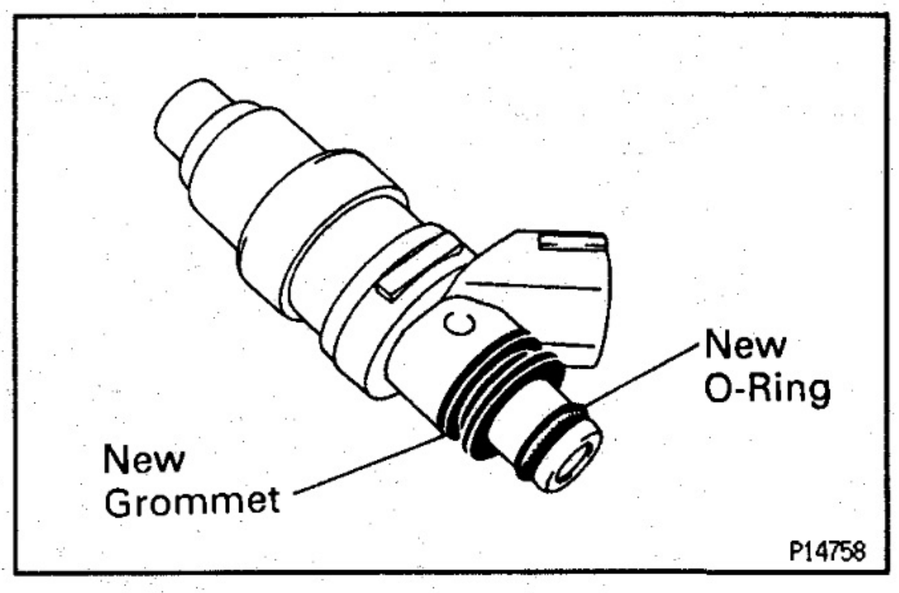
(d) Remove the SST.
SST 09268–41046, 09843–18020

(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)

EG

EG5B3–06

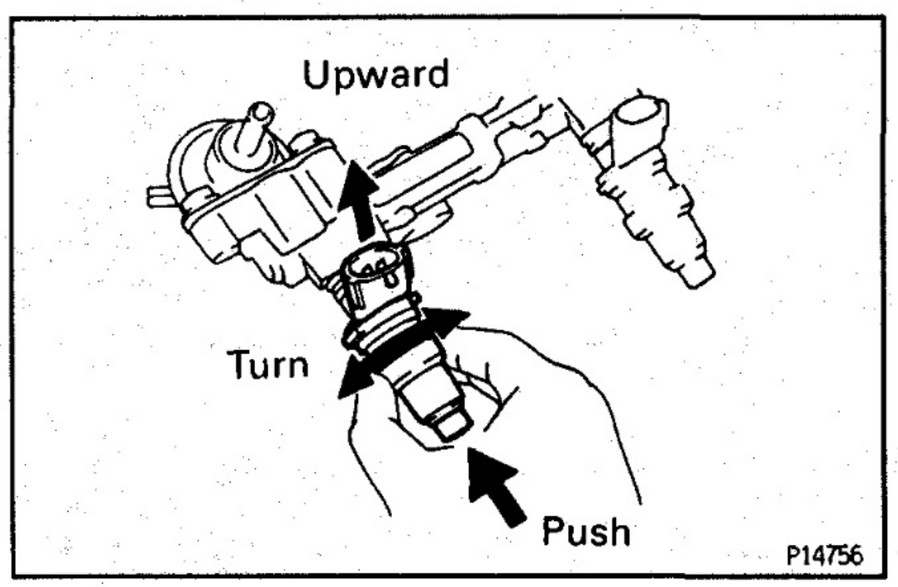
INJECTORS INSTALLATION



1. INSTALL INJECTORS TO DELIVERY PIPE

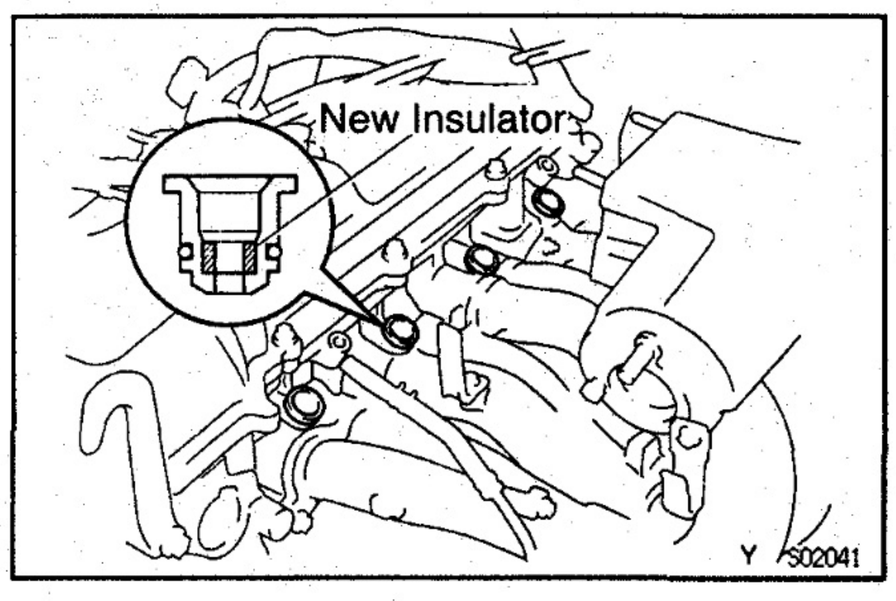
(a) Install a new grommet to the injector.

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



(c) While turning the injector left and right, install it to the delivery pipe. Install the 4 injectors.

(d) Position the injector connector upward.

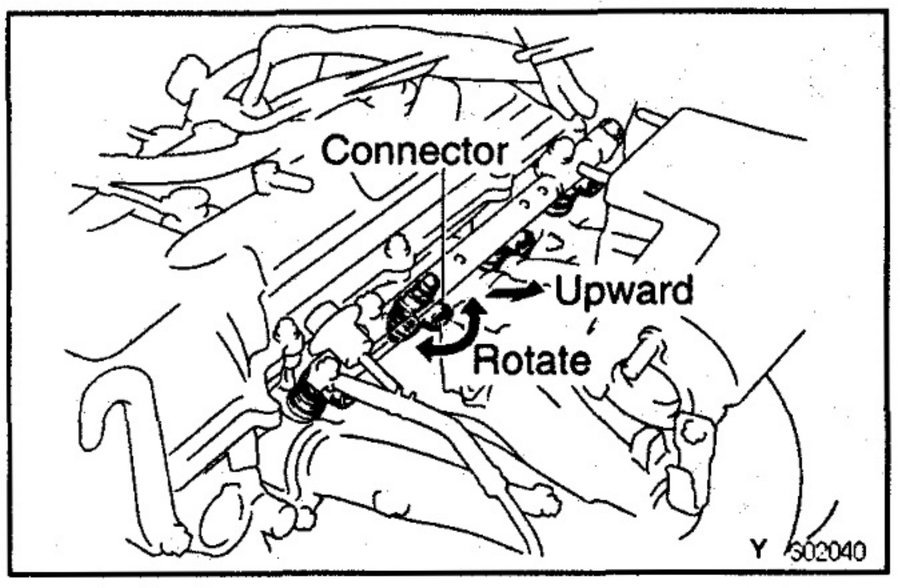


2. INSTALL INJECTORS AND DELIVERY PIPE

(a) Place the 4 new insulators and in position on the spacers.

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

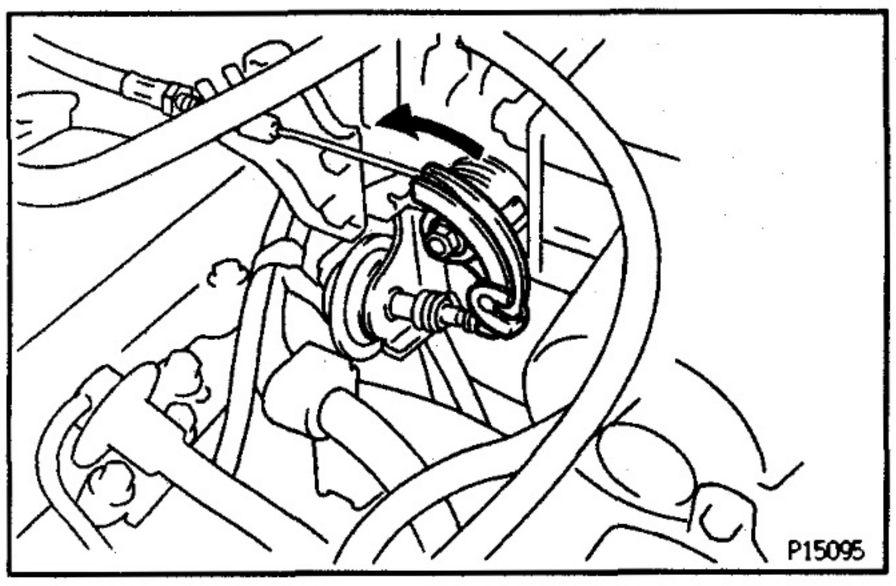
(c) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.



(d) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O–rings. Replace the O–rings.
(e) Position the injector connector upward.
(f) Tighten the 2 bolts holding the delivery pipe to the cylinder head.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)
(g) Connect the fuel inlet pipe to the delivery pipe with 2 new gaskets and the union bolt.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)
(h) Connect the fuel return hose to the fuel pressure regulator.
(i) Connect the vacuum sensing hose to the fuel pressure regulator.

3. CONNECT ENGINE WIRE

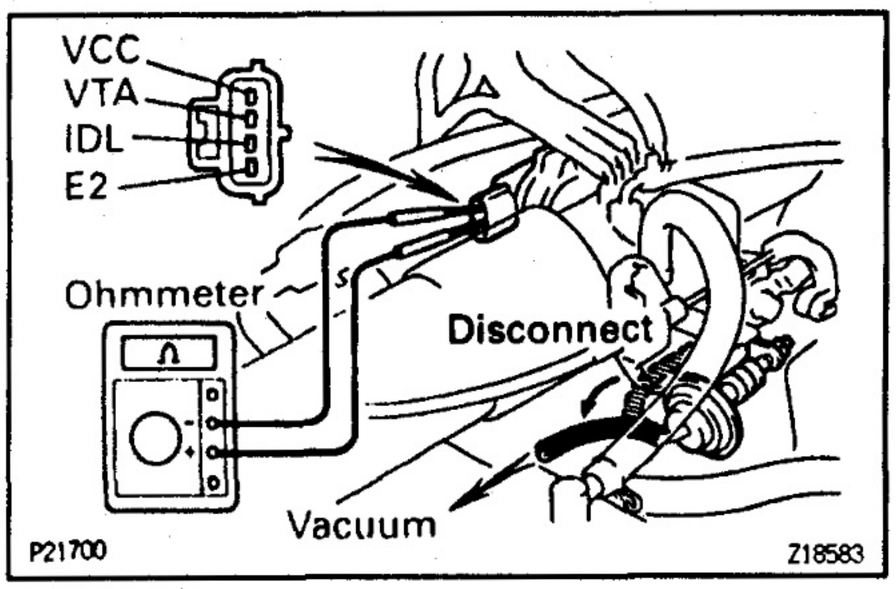
4. INSTALL THROTTLE BODY
(See throttle body installation)



THROTTLE BODY
ON–VEHICLE INSPECTION

BG7A1–01

1. INSPECT THROTTLE BODY
Check that the throttle linkage moves smoothly.



2. INSPECT THROTTLE POSITION SENSOR
(a) Disconnect the sensor connector.
(b) Apply vacuum to the throttle opener.
(c) Using an ohmmeter, measure the resistance between each terminal.

Throttle valve condition	Between terminals	Resistance
Fully closed	VTA – E2	0.2 – 5.7 kΩ
Fully closed	IDL – E2	2.3 kΩ or less
Open	IDL – E2	Infinity
Fully open	VTA – E2	2.0 – 10.2 kΩ
–	VCC – E2	2.5 – 5.9 kΩ

(d) Reconnect the sensor connector.

3. INSPECT THROTTLE OPENER

A. Warm up engine

Allow the engine to warm up to normal operating temperature.

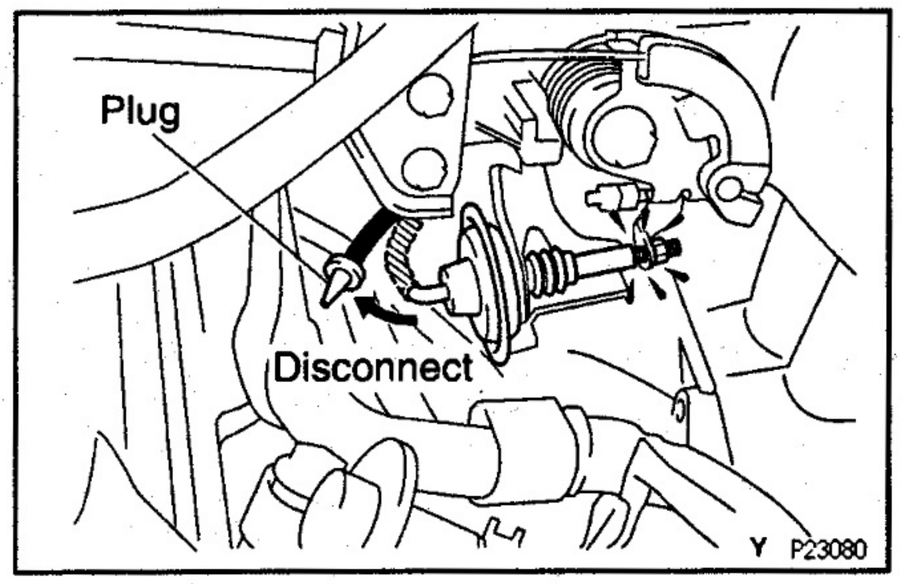
B. Check idle speed

(See steps 3 in idle speed inspection in Engine Mechanical)

Idle speed:

650 – 750 rpm

C. Check 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:

1,200 – 1,500 rpm

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

(c) Stop the engine.

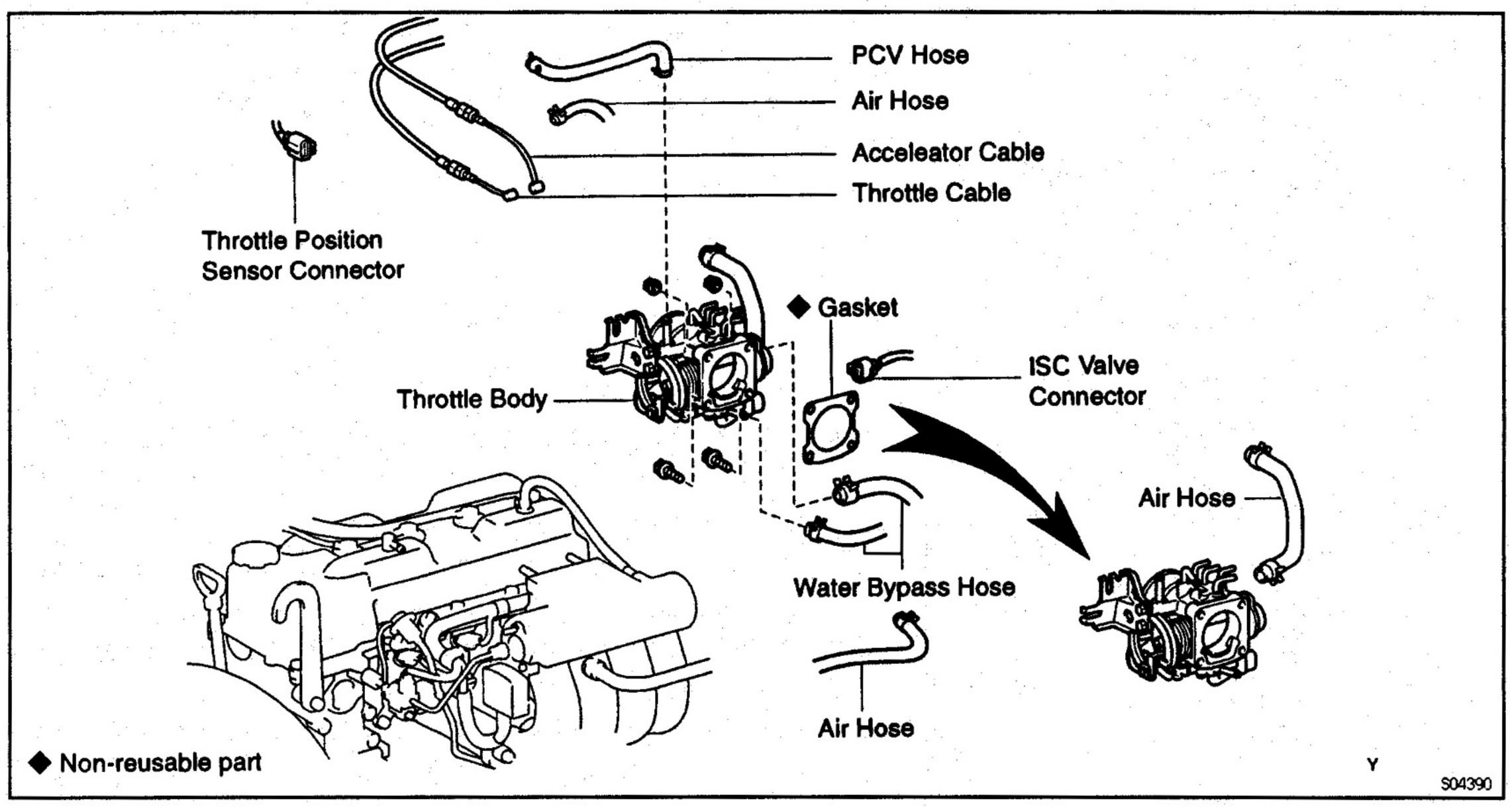
(d) Reconnect the vacuum hose to the throttle opener.

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

EG

E0130-21

COMPONENTS FOR REMOVAL AND INSTALLATION



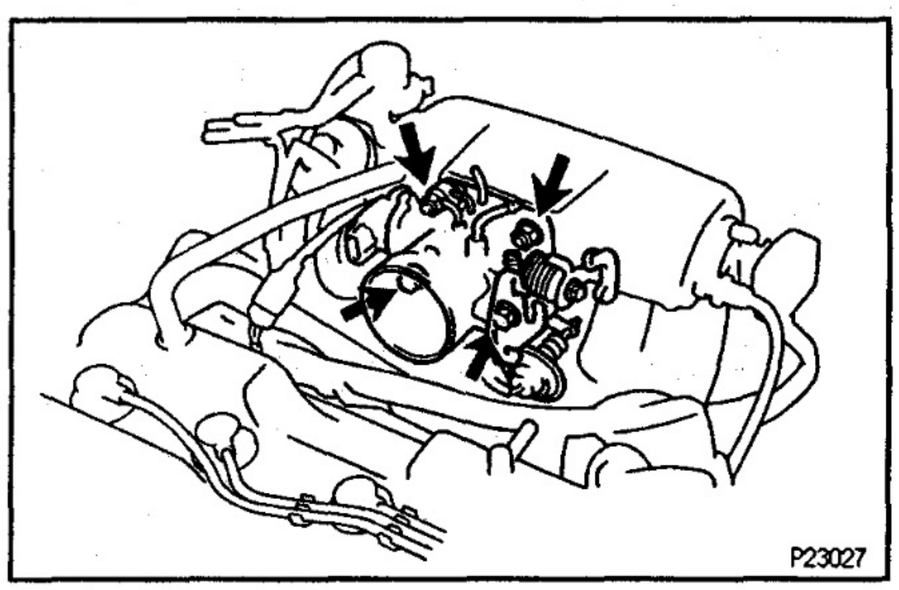
EG

THROTTLE BODY REMOVAL

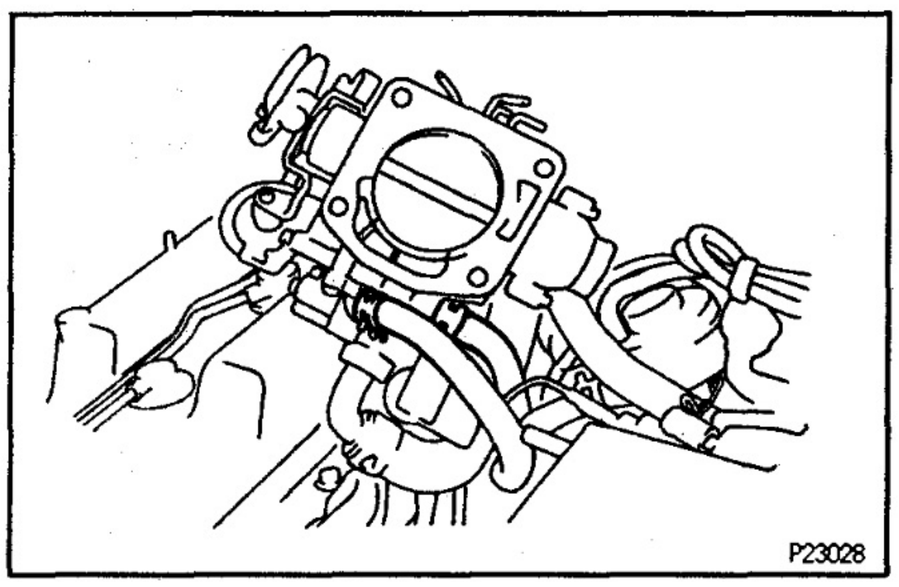
5B7A2-01

1. DRAIN ENGINE COOLANT
2. M/T:
   DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY
   A/T:
   DISCONNECT ACCELERATOR AND THROTTLE CABLES FROM THROTTLE BODY
3. REMOVE PCV HOSE
4. REMOVE THROTTLE BODY
   (a) Disconnect these hoses:
   - 3 vacuum hoses
   - w/ PS:
     Air hose for PS idle—up

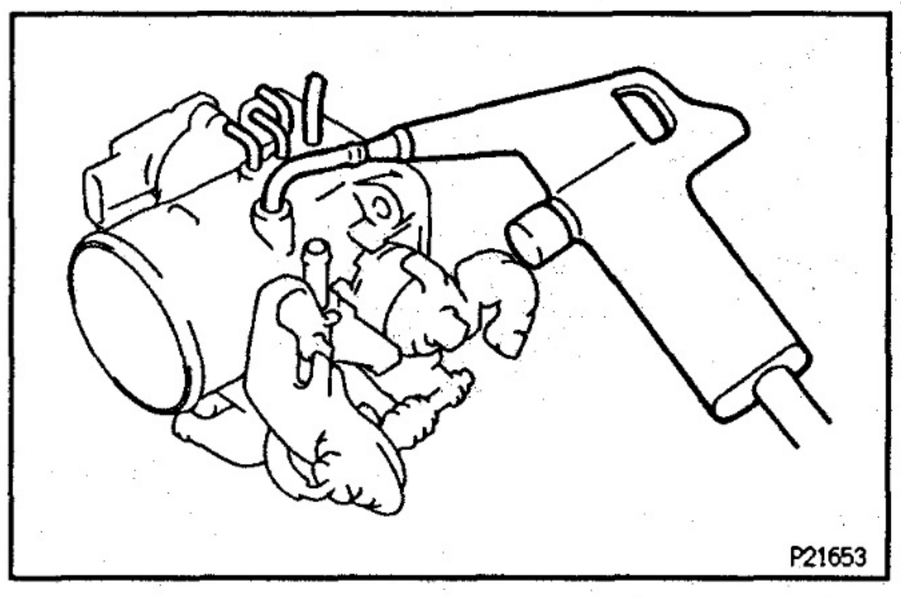
   (b) Disconnect the throttle position sensor connector.
   (c) Disconnect the ISC valve connector.



   (d) Remove the 2 bolts, 2 nuts, and disconnect the throttle body from the air intake chamber.
   Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)
   (e) Remove the throttle body gasket.
   INSTALLATION HINT: Use a new gasket.



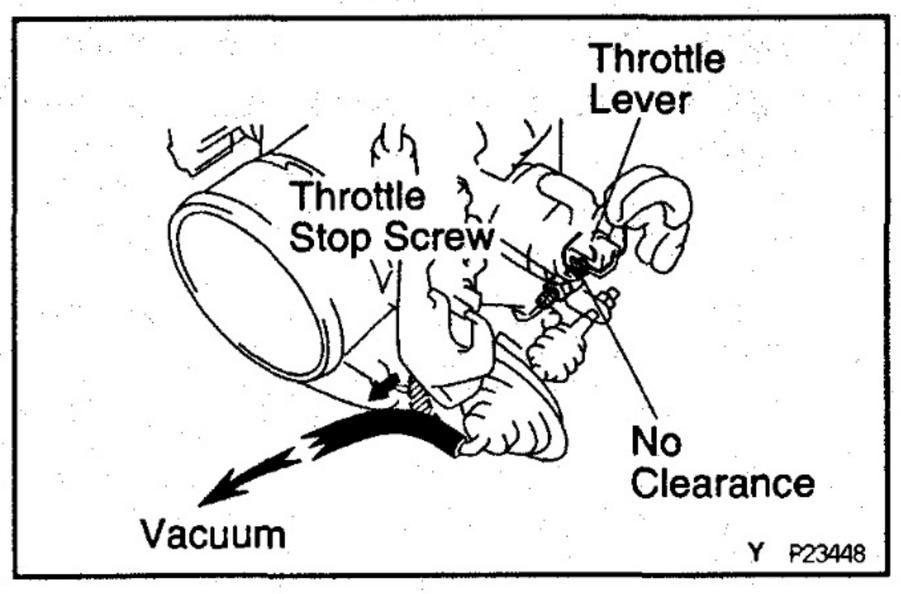
   (f) Disconnect the water bypass hoses from the throttle body, and remove the throttle body.
5. REMOVE AIR HOSE FROM ISC VALVE



THROTTLE BODY INSPECTION

B00DH-11

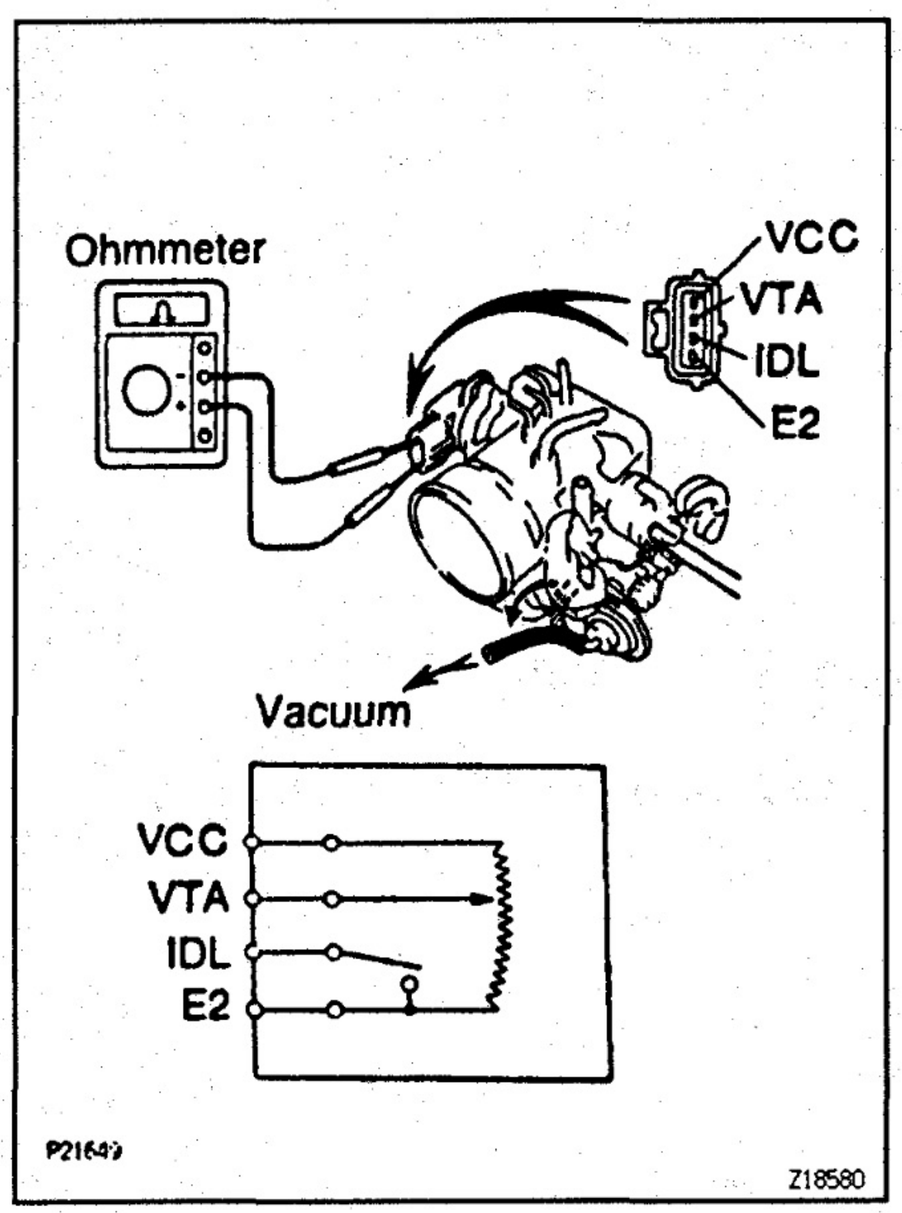
1. CLEAN THROTTLE BODY
(a) Using a soft brush and carburetor cleaner, clean the cast parts.
(b) Using compressed air, clean all the passages and apertures.
NOTICE: To prevent deterioration, do not clean the throttle position sensor and ISC valve.



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 closed throttle position.



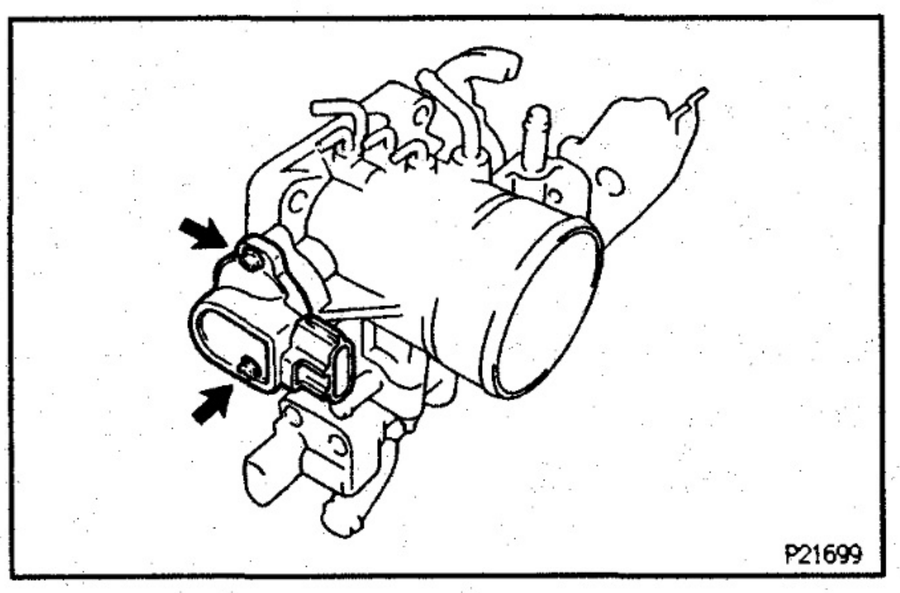
3. INSPECT THROTTLE POSITION SENSOR

(a) Apply vacuum to the throttle opener.

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

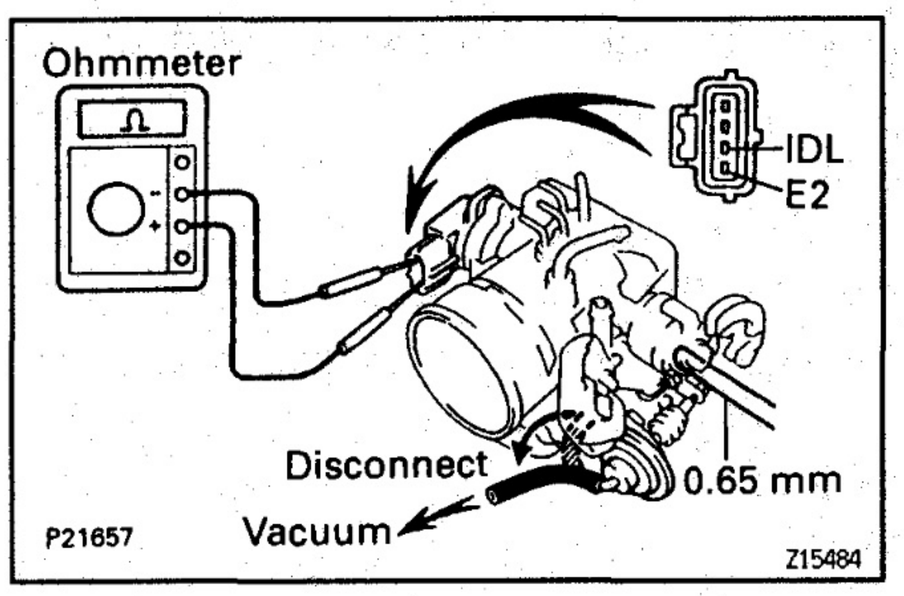
(c) Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA — E2	0.2 — 5.7 kΩ
0.57 mm (0.022 in.)	IDL — E2	2.3 kΩ or less
0.74 mm (0.029 in.)	IDL — E2	Infinity
Throttle valve fully open	VTA — E2	2.0 — 10.2 kΩ
—	VCC — E2	2.5 — 5.9 kΩ



4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

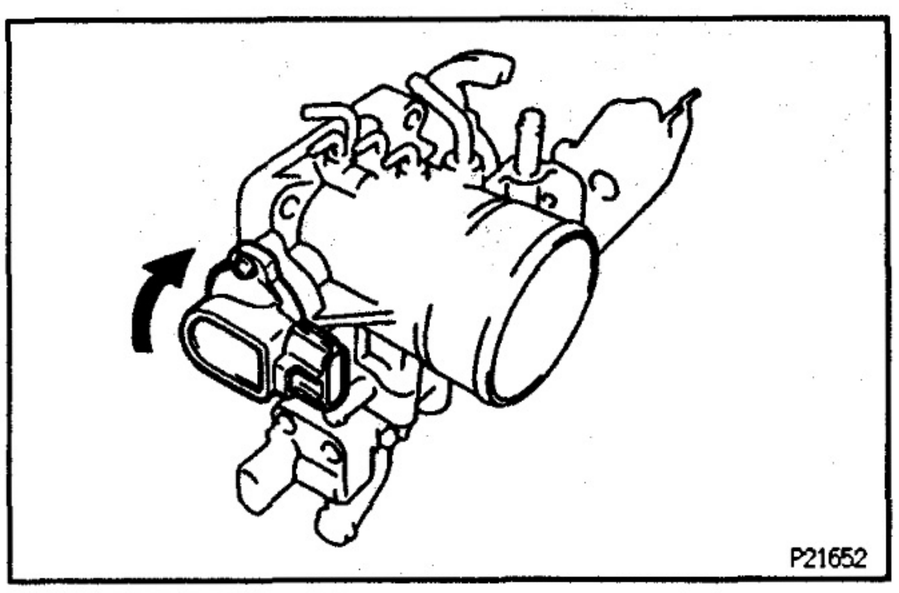
(a) Loosen the 2 set screws of the sensor.



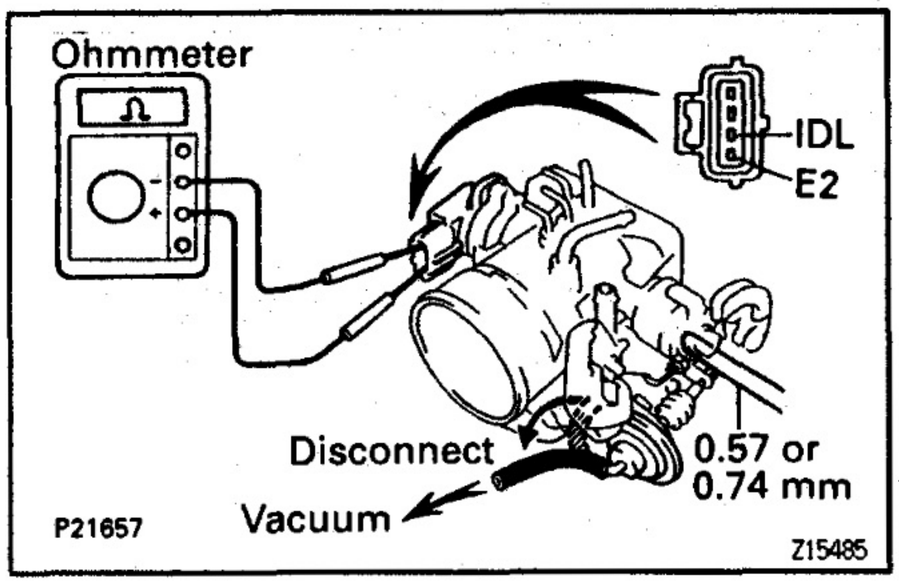
(b) Apply vacuum to the throttle opener.

(c) Insert a 0.65 mm (0.026 in.) thickness gauge between the throttle stop screw and stop lever.

(d) Connect the test 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)
0.57 mm (0.022 in.)	Continuity
0.74 mm (0.029 in.)	No continuity

THROTTLE BODY INSTALLATION

E0659-04

Installation is in the reverse order of removal.

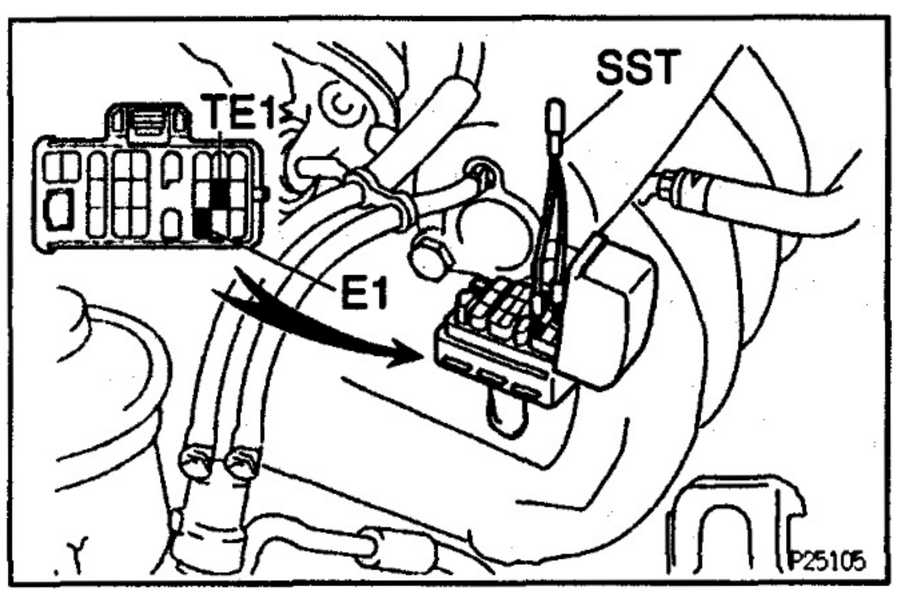
ISC VALVE

ON-VEHICLE INSPECTION

E0706-01

INSPECT ISC VALVE OPERATION

(a) Initial conditions:
- Engine at normal operating temperature
- Idle speed check correctly
- Transmission in neutral position



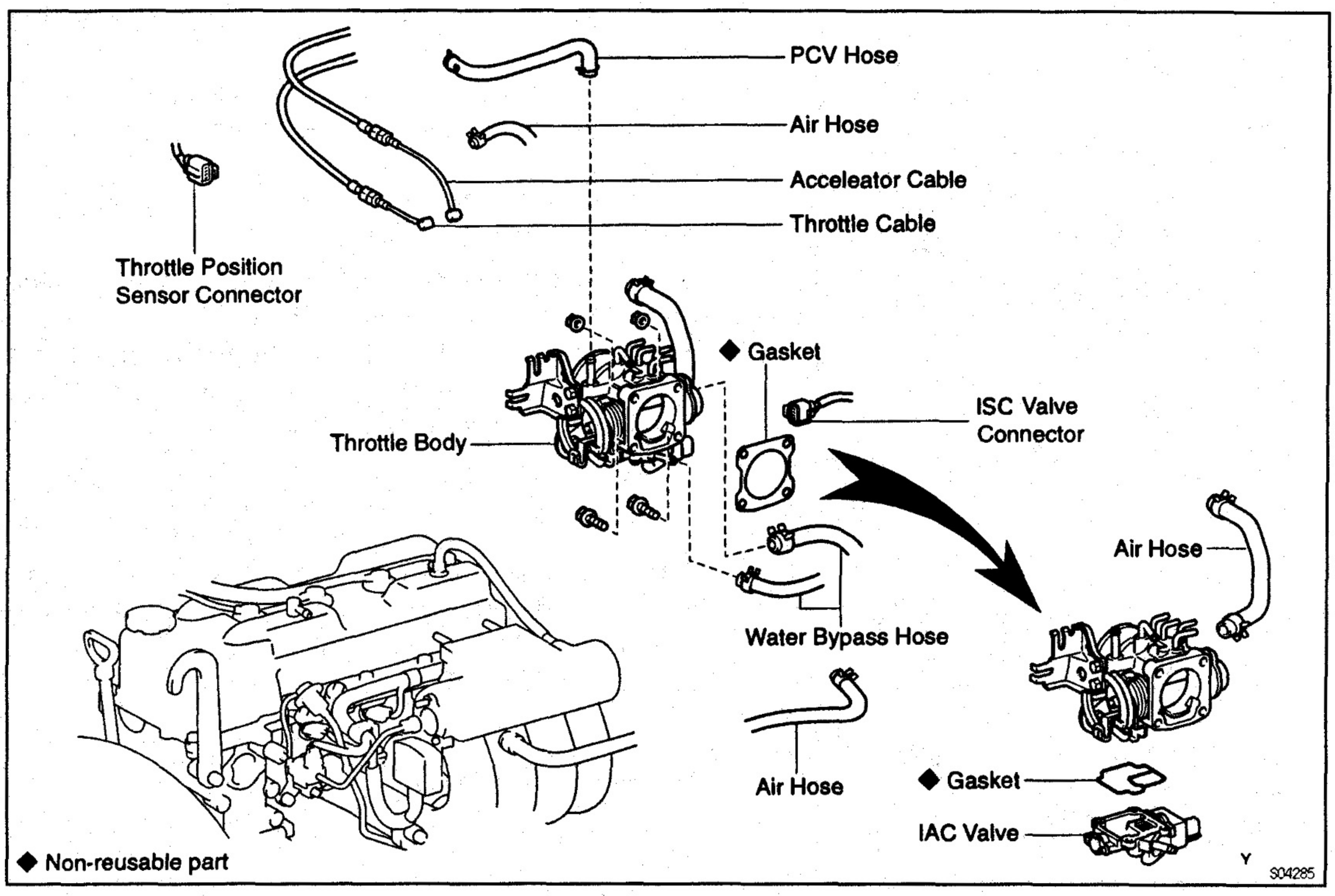
(b) Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843-18020

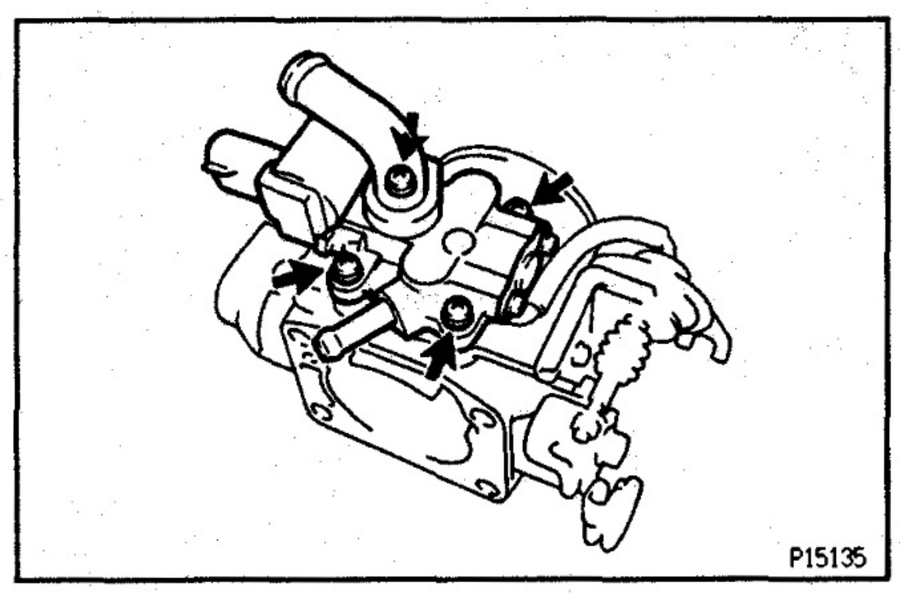
(c) After engine speed are kept at 1,000-1,500 rpm for 5 seconds, check that they return to idle speed.
If the engine speed operation is not as specified, check the ISC valve, wiring and ECU.

(d) Remove the SST.
SST 09843-18020

EG16H-08

COMPONENTS FOR REMOVAL AND INSTALLATION

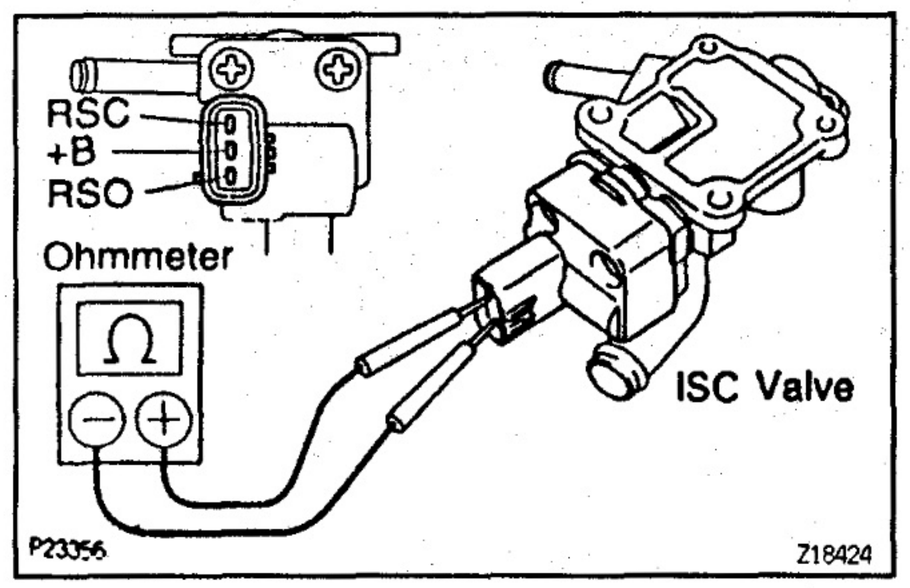




EG16J-08

ISC VALVE REMOVAL

1. **REMOVE THROTTLE BODY**
   (See throttle body removal)
2. **REMOVE ISC VALVE**
   Remove the 4 screws, ISC valve and gasket.



ISC VALVE INSPECTION

1. **INSPECT ISC VALVE RESISTANCE**

NOTICE: "Cold" and "Hot" in the following sentences express the temperature of the coils themselves. "Cold" is from −10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

Using an ohmmeter, measure the resistance between terminal +B and other terminals (RSC, RSO).

Resistance:

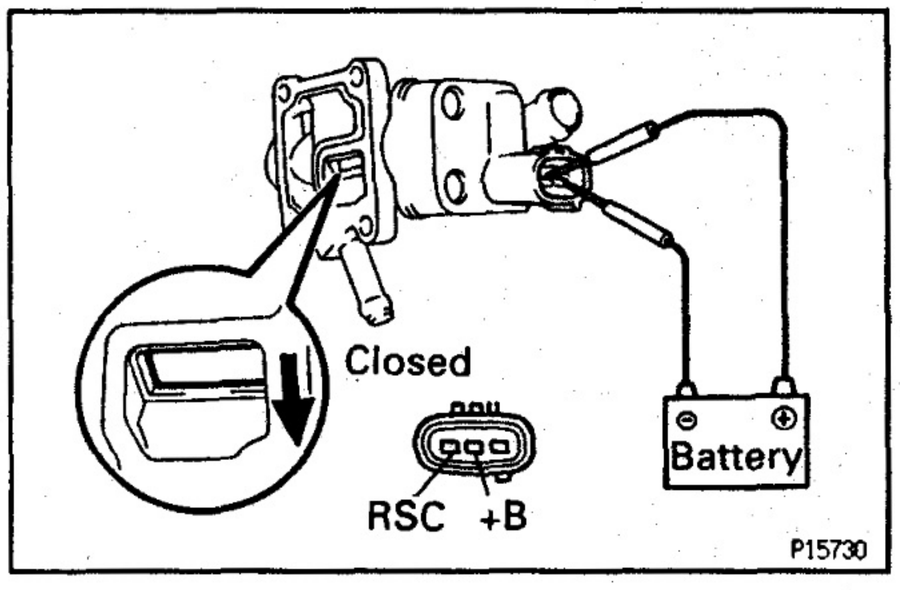
Cold: 17.0 – 24.5 Ω

Hot: 21.5 – 28.5 Ω

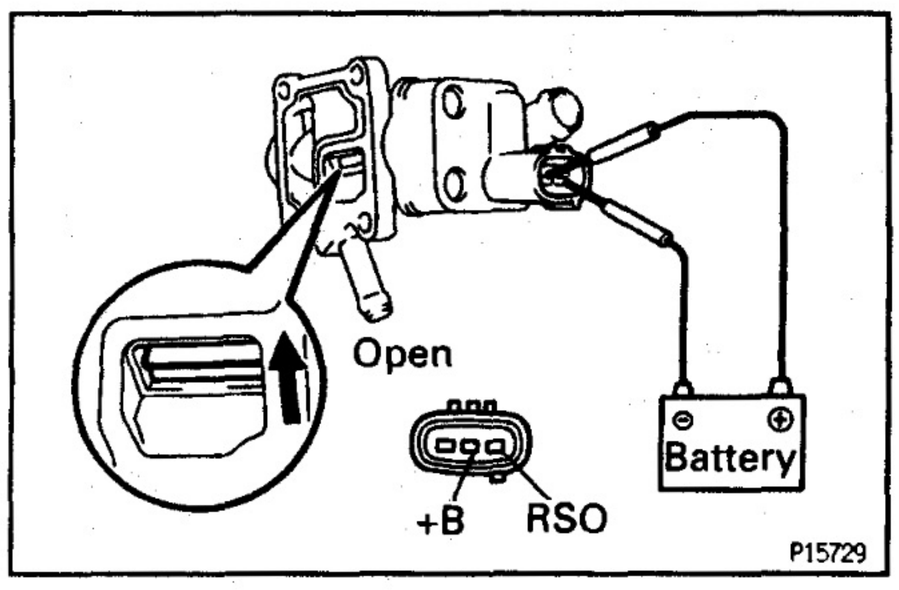
If resistance is not as specified, replace the ISC valve.

2. **INSPECT ISC VALVE OPERATION**

(a) Connect the positive (+) lead from the battery to terminal +B and negative (−) lead to terminal RSC, and check that the valve is closed.



(b) Connect the positive (+) lead from the battery to terminal + B and negative (−) lead to terminal RSO, and check that the valve is open.



ISC VALVE INSTALLATION

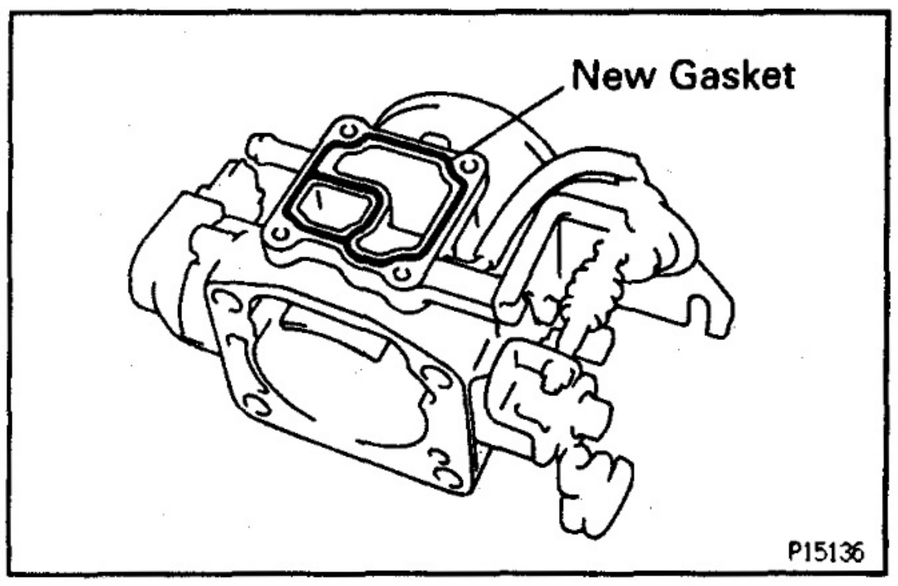
1. **INSTALL ISC VALVE**

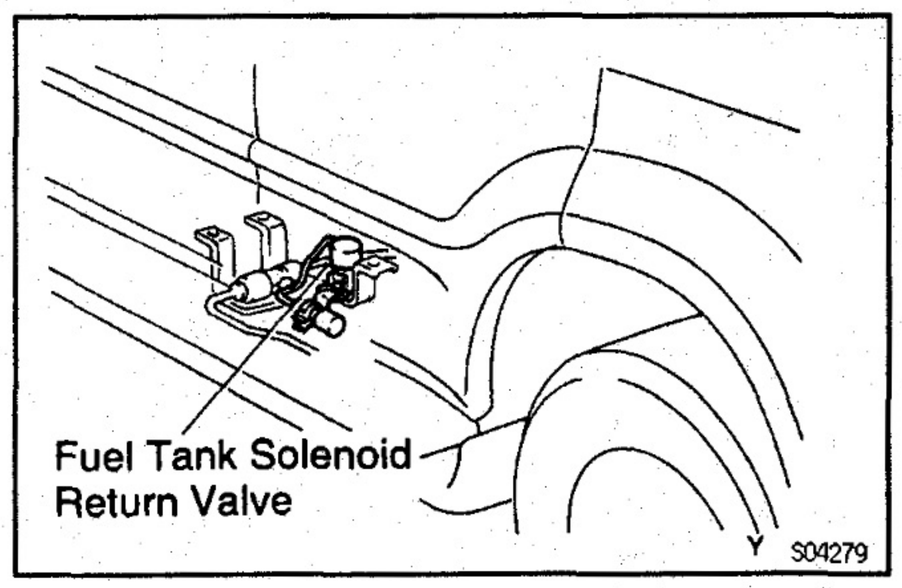
(a) Place a new gasket on the throttle body.

(b) Install the ISC valve with the 4 screws.

2. **INSTALL THROTTLE BODY**

(See throttle body installation)





FUEL TANK SOLENOID RETURN VALVE

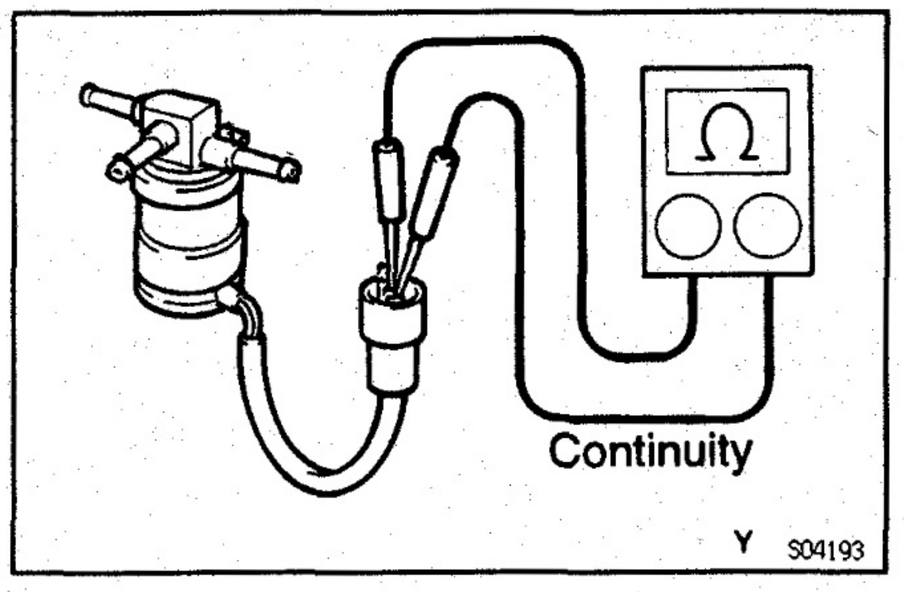
INSPECTION

EGRE–05

1. REMOVE VSV

(a) Disconnect the 2 fuel hoses from the fuel tank solenoid return valve.

(b) Remove the bolt and fuel tank solenoid return valve.



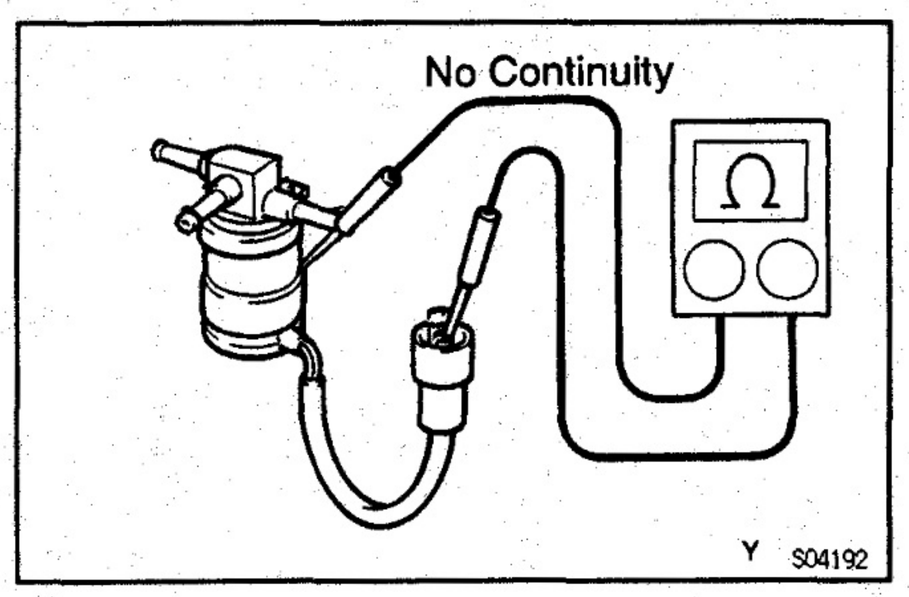
2. INSPECT FUEL TANK SOLENOID RETURN VALVE

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

Resistance:

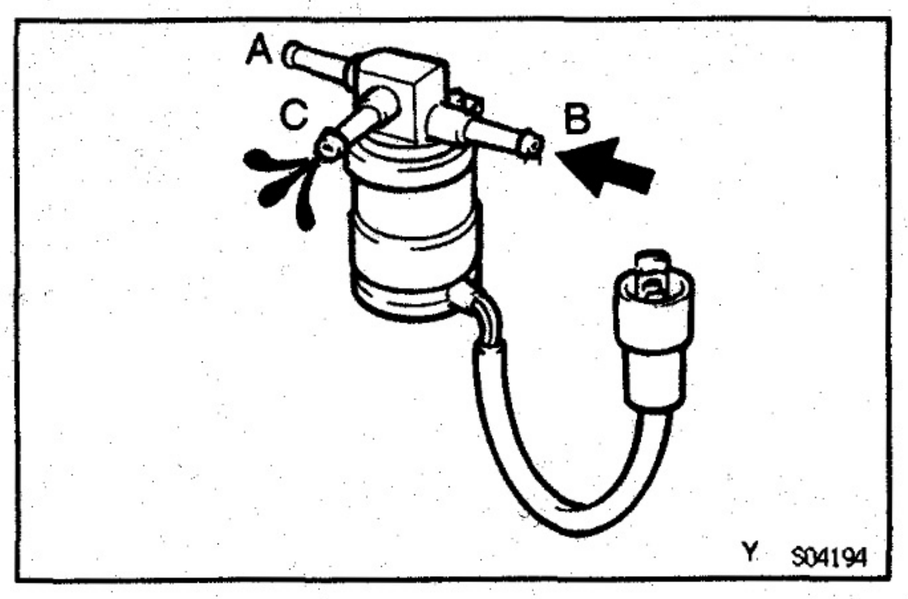
At 20°C (68°F): 33 – 39Ω

If there is no continuity, replace the fuel tank solenoid return valve.

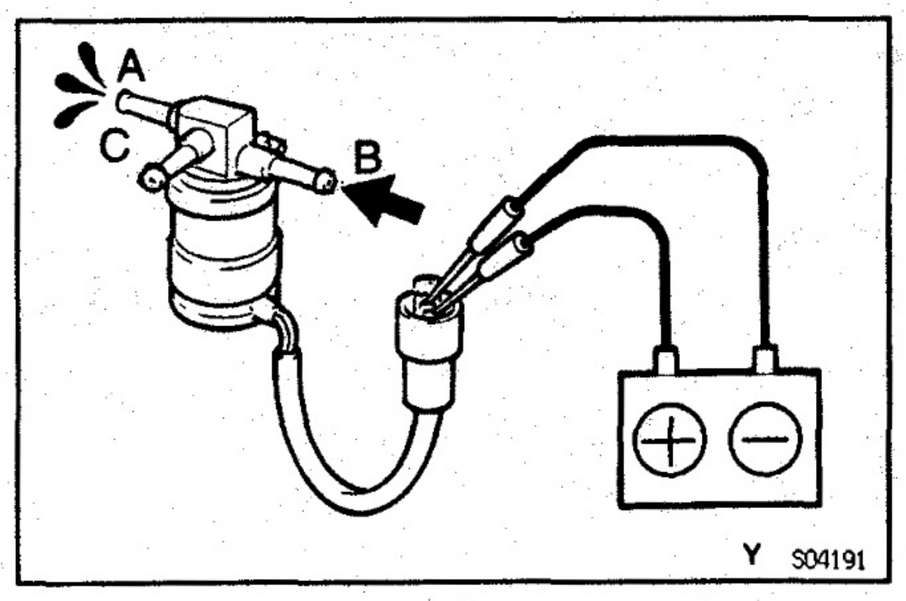


(b) Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the fuel tank solenoid return valve.



(c) Check that air flows from ports B to C.



(d) Apply battery positive voltage across the terminals.

(e) Check that air flows from ports B to A.

If operation is not as specified, replace the fuel tank solenoid return valve.

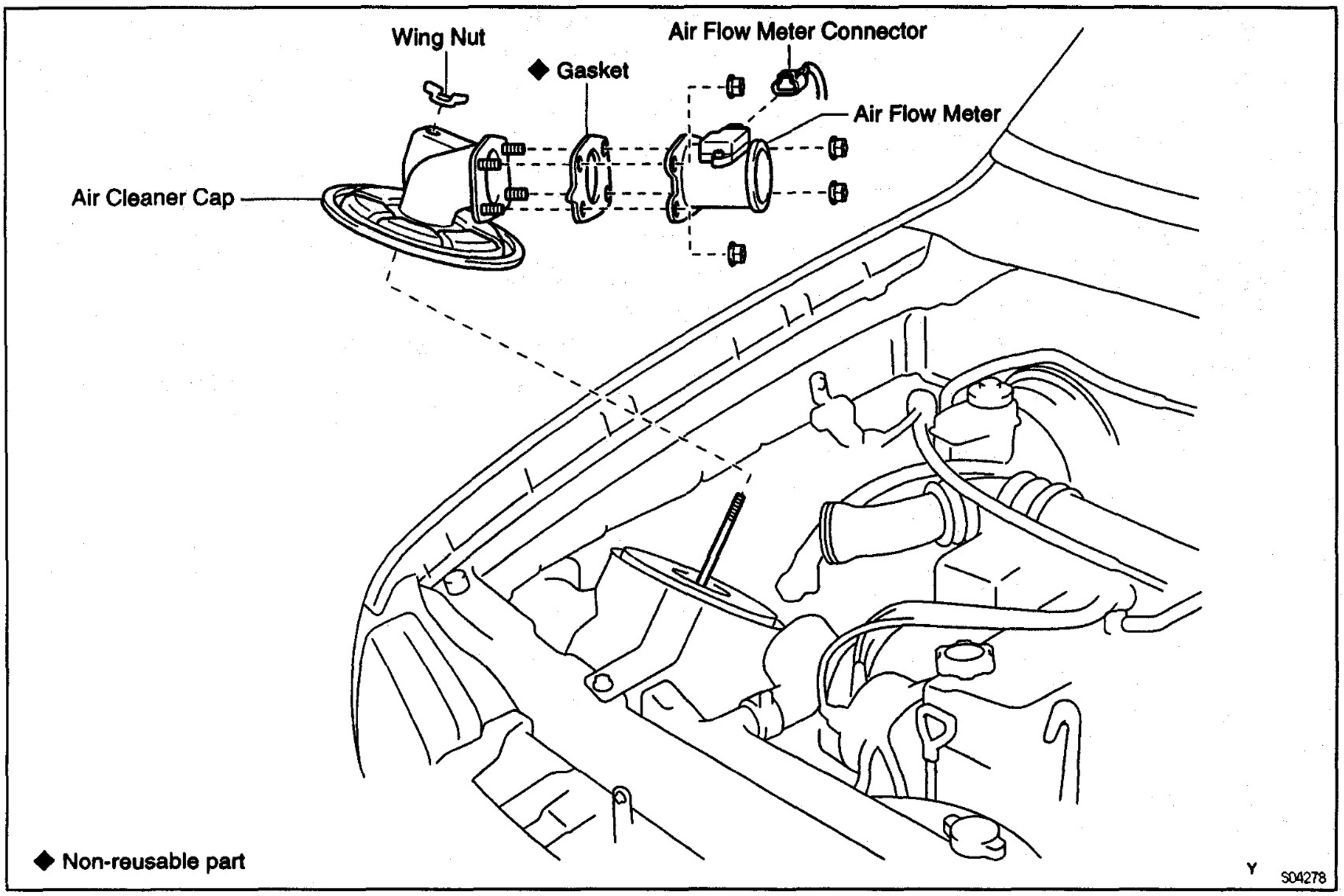
3. REINSTALL FUEL TANK SOLENOID RETURN VALVE

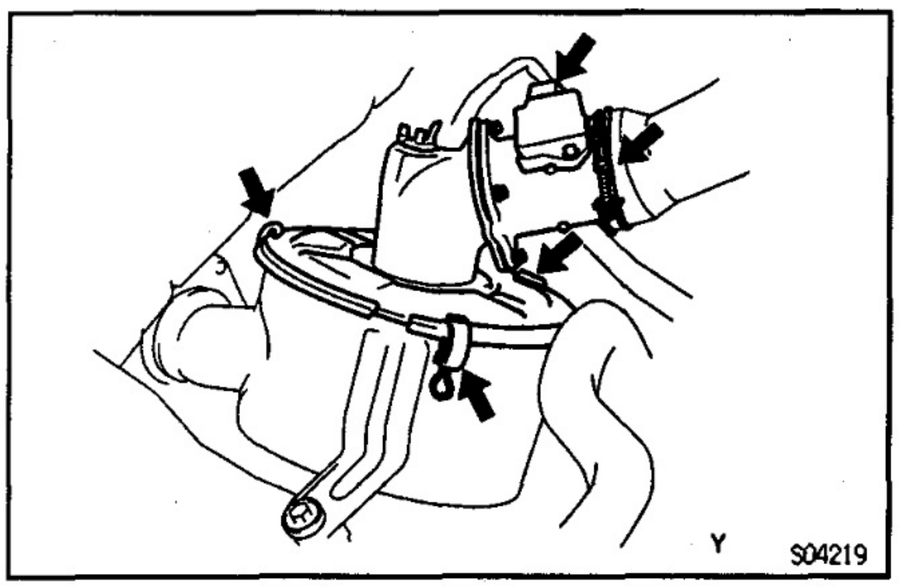
EG

AIR FLOW METER

EG0YJ-14

COMPONENTS FOR REMOVAL AND INSTALLATION





EG5S8-06

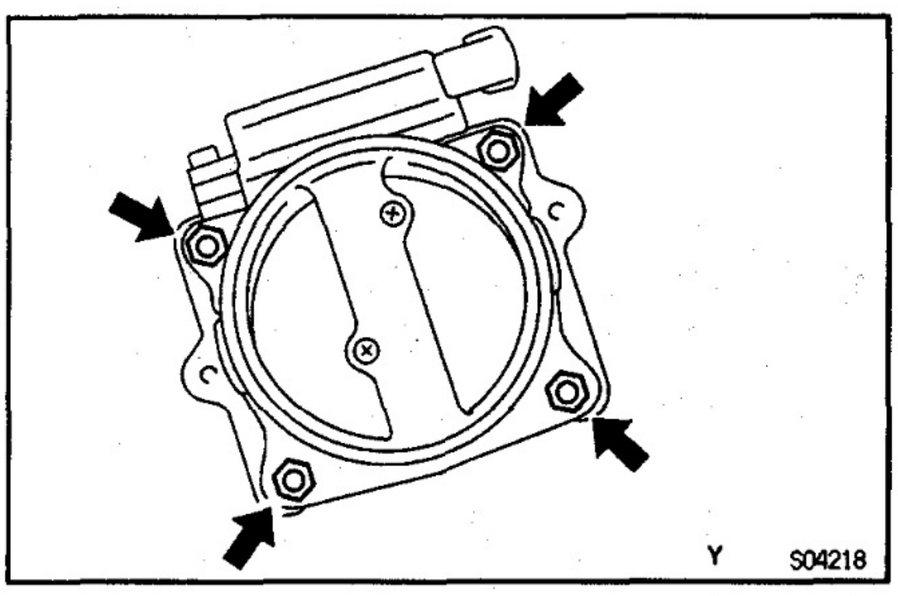
AIR FLOW METER REMOVAL

1. **REMOVE AIR CLEANER CAP WITH AIR FLOW METER**

(a) Disconnect the air flow meter connector and wire clamp.

(b) Disconnect the air hose from the air cleaner cap.

(c) Loosen the 3 clips, and remove the air cleaner cap together with the air flow meter.

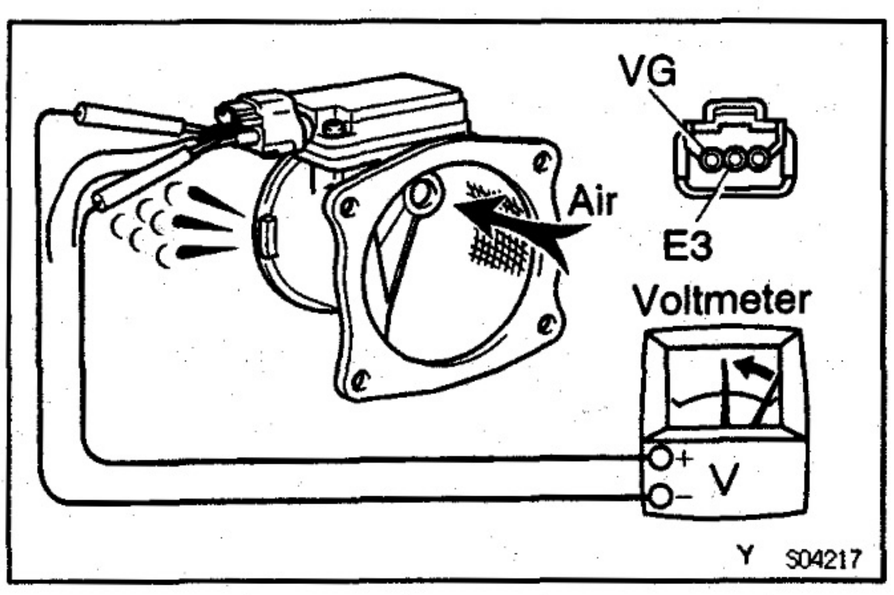


2. **REMOVE AIR FLOW METER FROM AIR CLEANER CAP**

Remove the 4 nuts, air flow meter and gasket.

Torque: 8.5 N·m (85 kgf·cm, 74 in.·lbf)

INSTALLATION HINT: Use a new gasket to the air flow meter.



AIR FLOW METER INSPECTION

20380-06

INSPECT AIR FLOW METER OPERATION

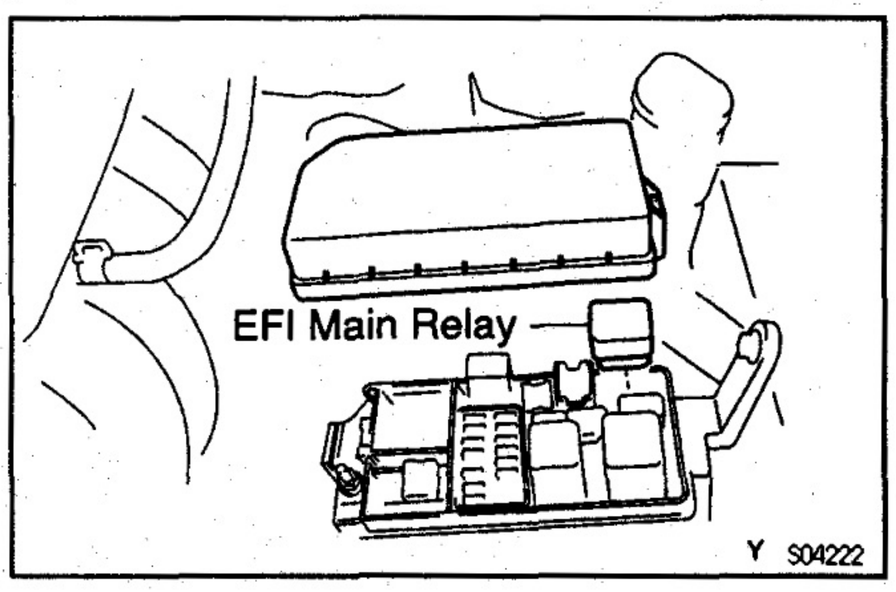
(a) Connect the negative (–) terminal cable to the battery.
(b) Turn the ignition switch ON.
(c) Connect the air flow meter connector.
(d) Using a voltmeter, connect the positive (+) tester probe to terminal VG, and negative (–) tester probe to terminal E3.
(e) Blow air into the air flow meter, and check that the voltage fluctuates.
If operation is not as specified, replace the air flow meter.
(f) Turn the ignition switch LOCK.
(g) Disconnect the negative (–) terminal cable from the battery.
(h) Disconnect the air flow meter connector.

EG

AIR FLOW METER INSTALLATION

EG795-02

Installation is in the reverse order of removal.



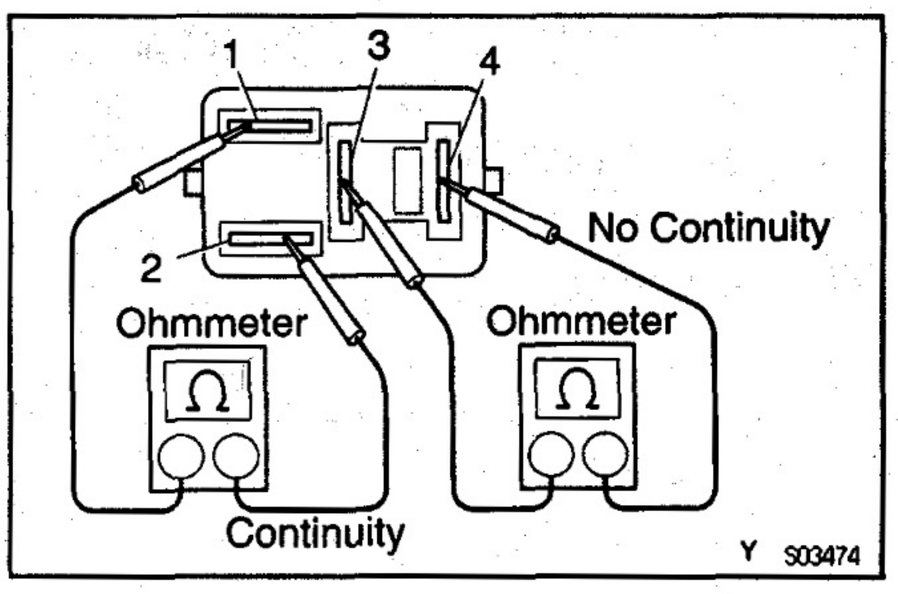
EFI MAIN RELAY

EFI MAIN RELAY (Marking:EFI)

EG664-04

INSPECTION

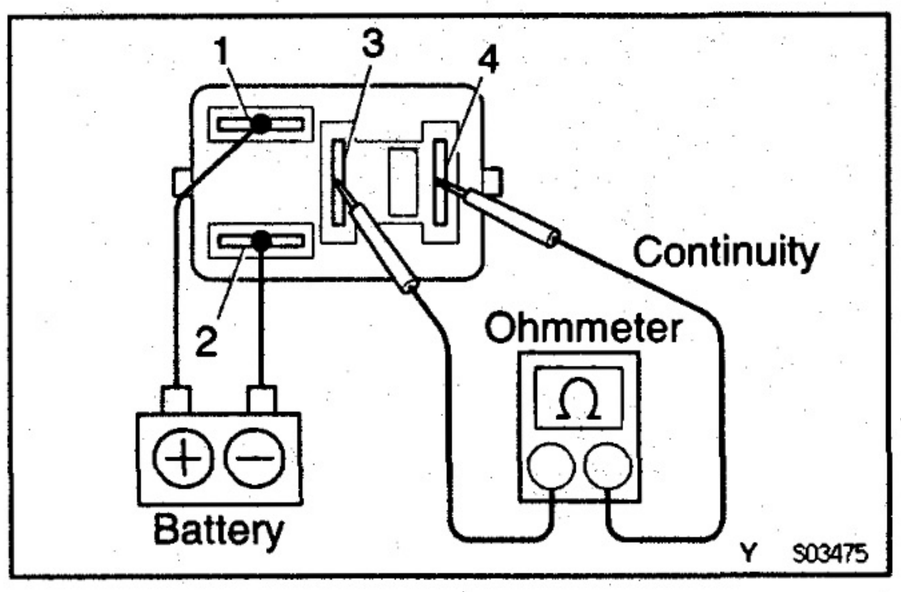
1. REMOVE EFI MAIN RELAY



2. INSPECT EFI MAIN RELAY

A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.
If there is no continuity, replace the relay.
(b) Check that there is no continuity between terminals 3 and 4.
If there is continuity, replace the relay.



B. Inspect relay operation

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

(b) Using an ohmmeter, check that there is continuity between terminals 3 and 4.
If operation is not as specified, replace the relay.

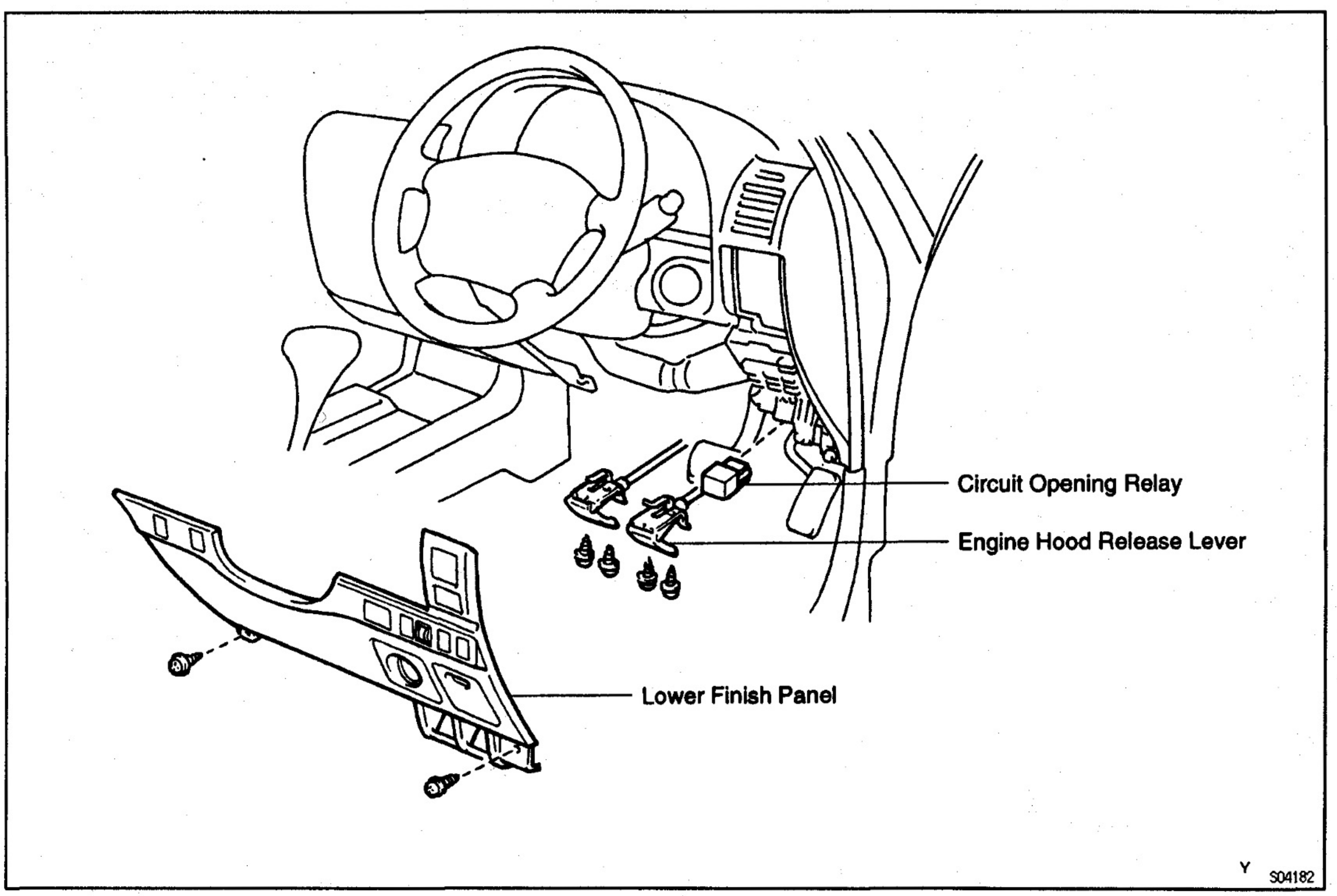
3. REINSTALL EFI MAIN RELAY

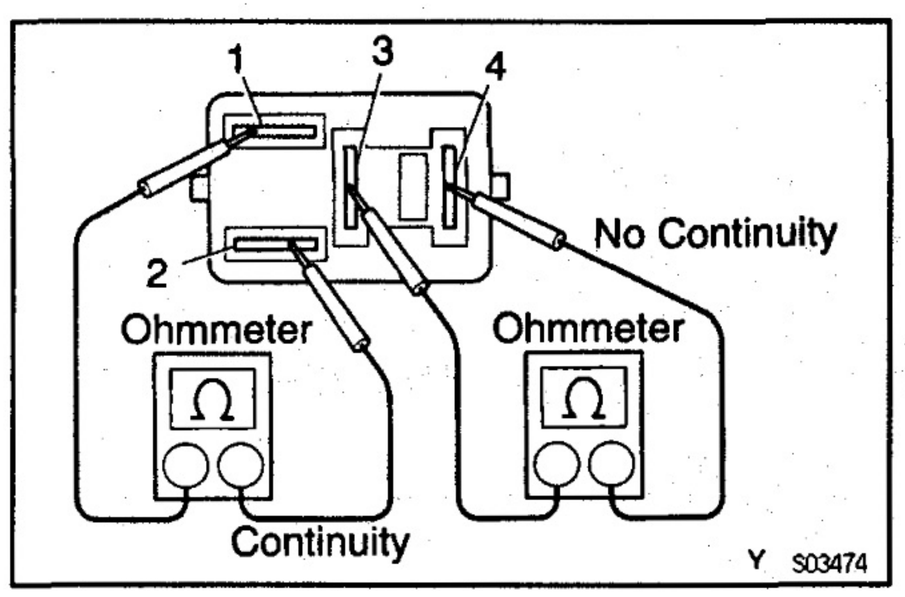
EG

CIRCUIT OPENING RELAY

COMPONENTS FOR REMOVAL AND INSTALLATION

E01T8-08





CIRCUIT OPENING RELAY INSPECTION

E07ST-01

1. REMOVE LOWER FINISH PANEL

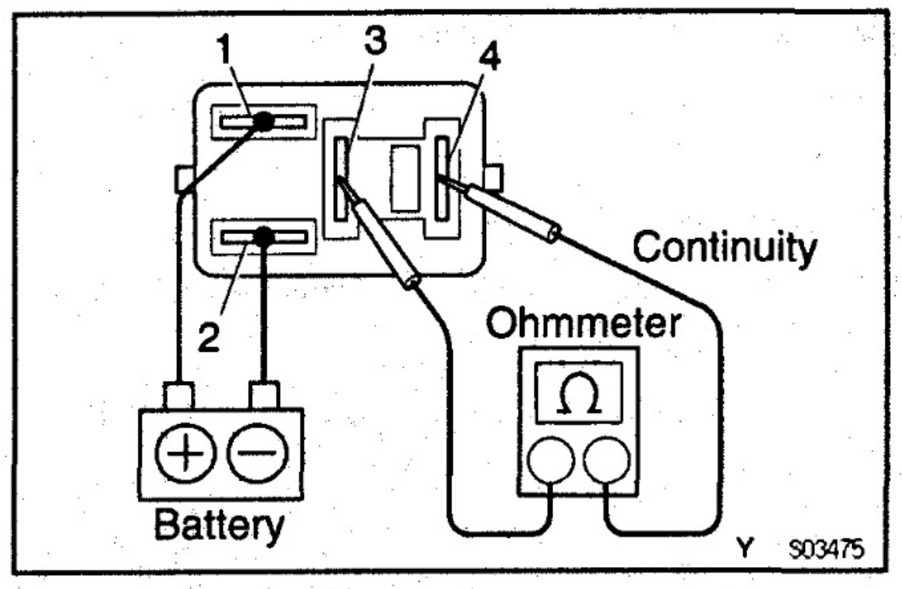
2. REMOVE CIRCUIT OPENING RELAY

3. INSPECT CIRCUIT OPENING RELAY

A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.
If there is no continuity, replace the relay.

(b) Check that there is no continuity between terminals 3 and 4.
If there is continuity, replace the relay.



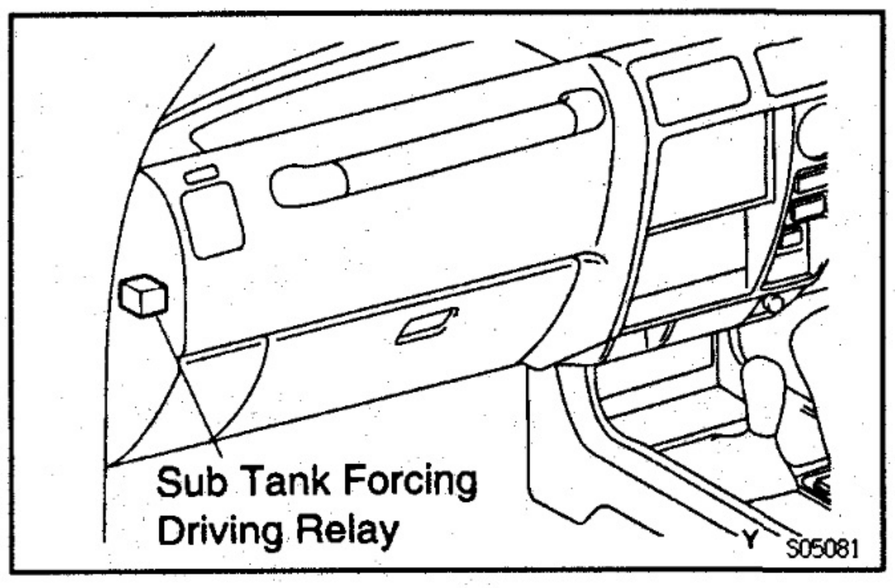
B. Inspect relay operation

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

(b) Using an ohmmeter, check that there is continuity between terminals 3 and 4.
If operation is not as specified, replace the relay.

4. REINSTALL CIRCUIT OPENING RELAY

5. REINSTALL LOWER FINISH PANEL

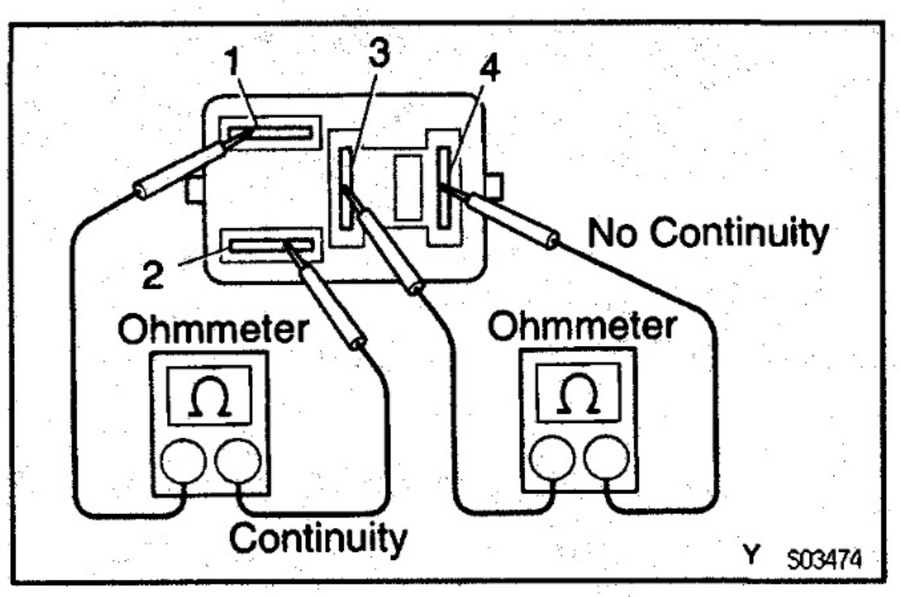


SUB TANK FORCING DRIVING RELAY

E0054-05

SUB TANK FORCING DRIVING RELAY INSPECTION

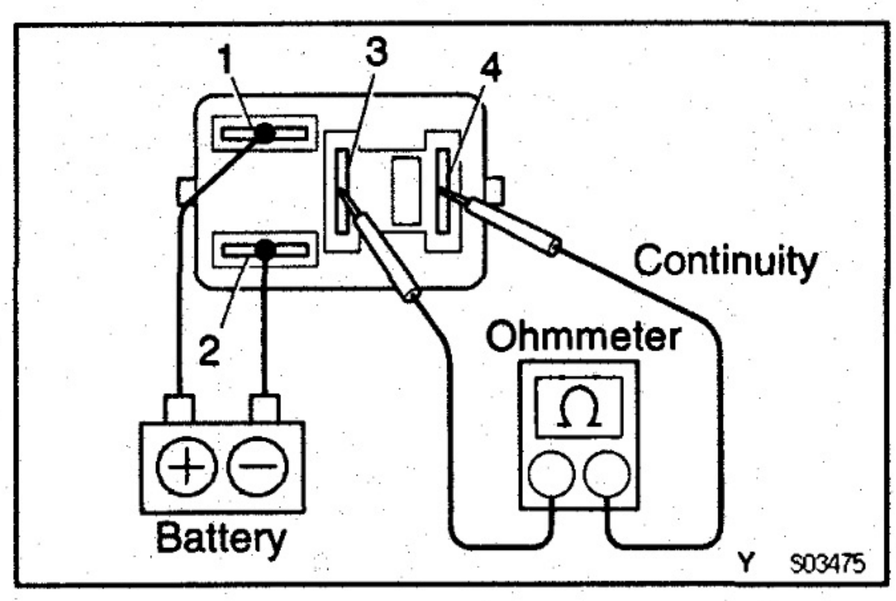
1. REMOVE SUB TANK FORCING DRIVING RELAY



2. INSPECT SUB TANK FORCING DRIVING RELAY

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.
If there is no continuity, replace the relay.

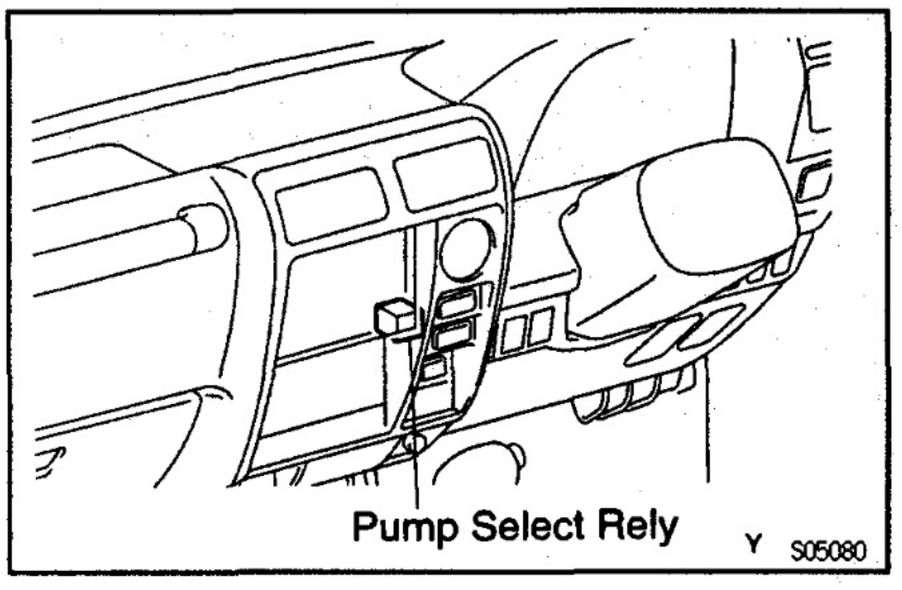
(b) Check that there is no continuity between terminals 3 and 4.
If there is continuity, replace the relay.



(c) Apply battery positive voltage across terminals 1 and 2.

(d) Using an ohmmeter, check that there is continuity between terminals 3 and 4.
If operation is not as specified, replace the relay.

3. REINSTALL SUB TANK FORCING DRIVING RELAY



PUMP SELECT RELAY

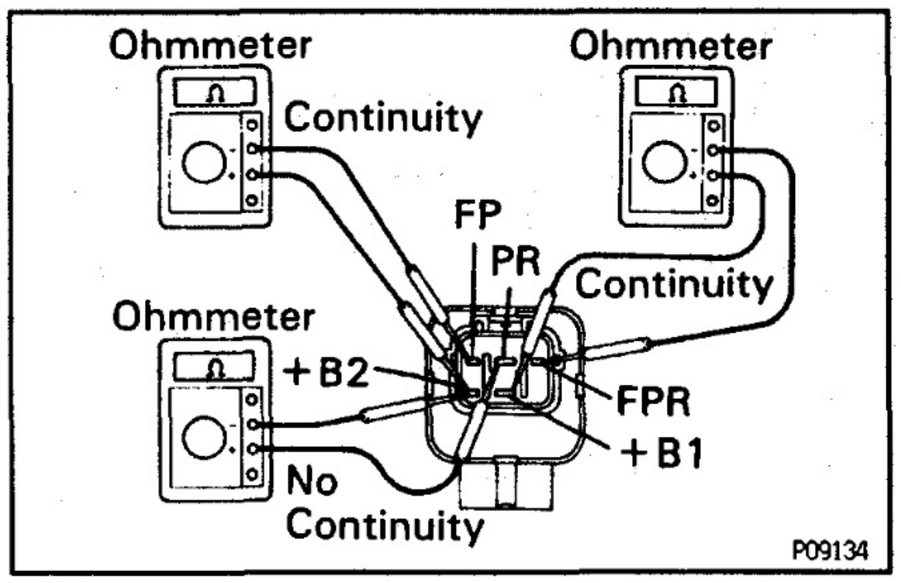
PUMP SELECT RELAY INSPECTION

E079U-01

1. REMOVE PUMP SELECTRELAY

(a) Disconnect pump select relay connecter

(b) Remove the bolt and pump select relay.



2. INSPECT PUMP SELECT RELAY

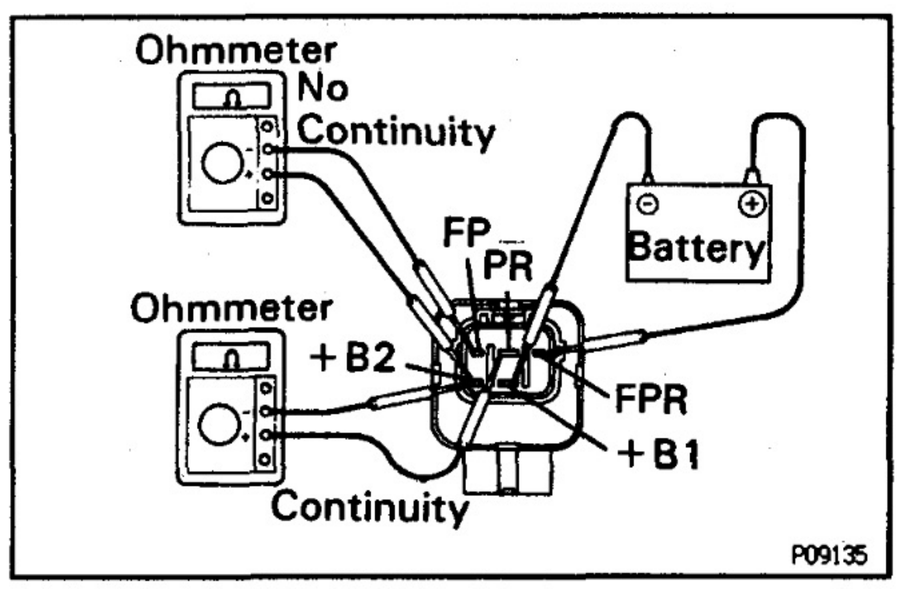
A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals +B1 and FPR.

(b) Check that there is continuity between terminals +B2 and FP.

(c) Check that there is no continuity between terminals +B2 and PR.

If continuity is not as specified, replace the relay.



B. Inspect relay operation

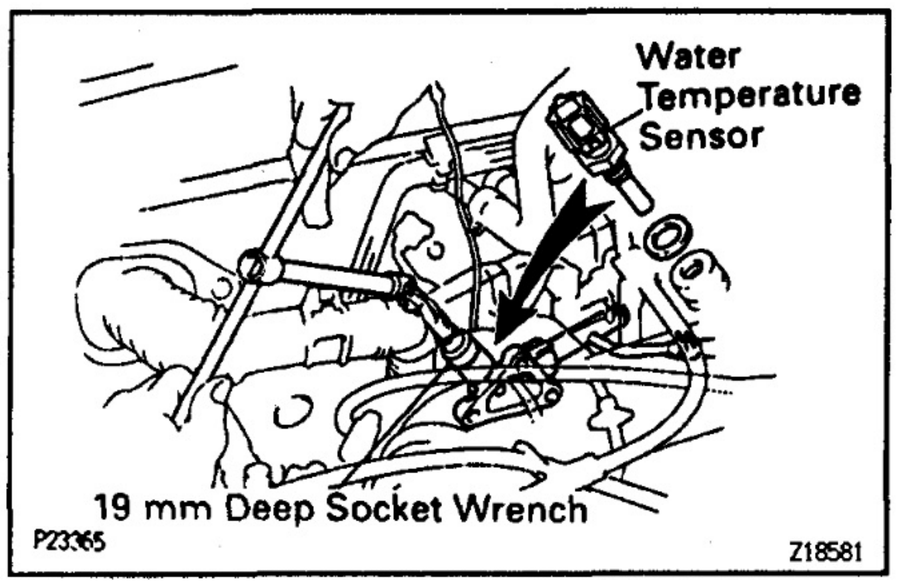
(a) Apply battery voltage across terminals +B1 and FPR.

(b) Using an ohmmeter, check that there is no continuity between the +B2 and FP.

(c) Check that there is continuity between terminals +B2 and PR.

If operation is not as specified, replace the relay.

3. REINSTALL PUMP SELECT RELAY



WATER TEMPERATURE SENSOR

WATER TEMPERATURE SENSOR INSPECTION

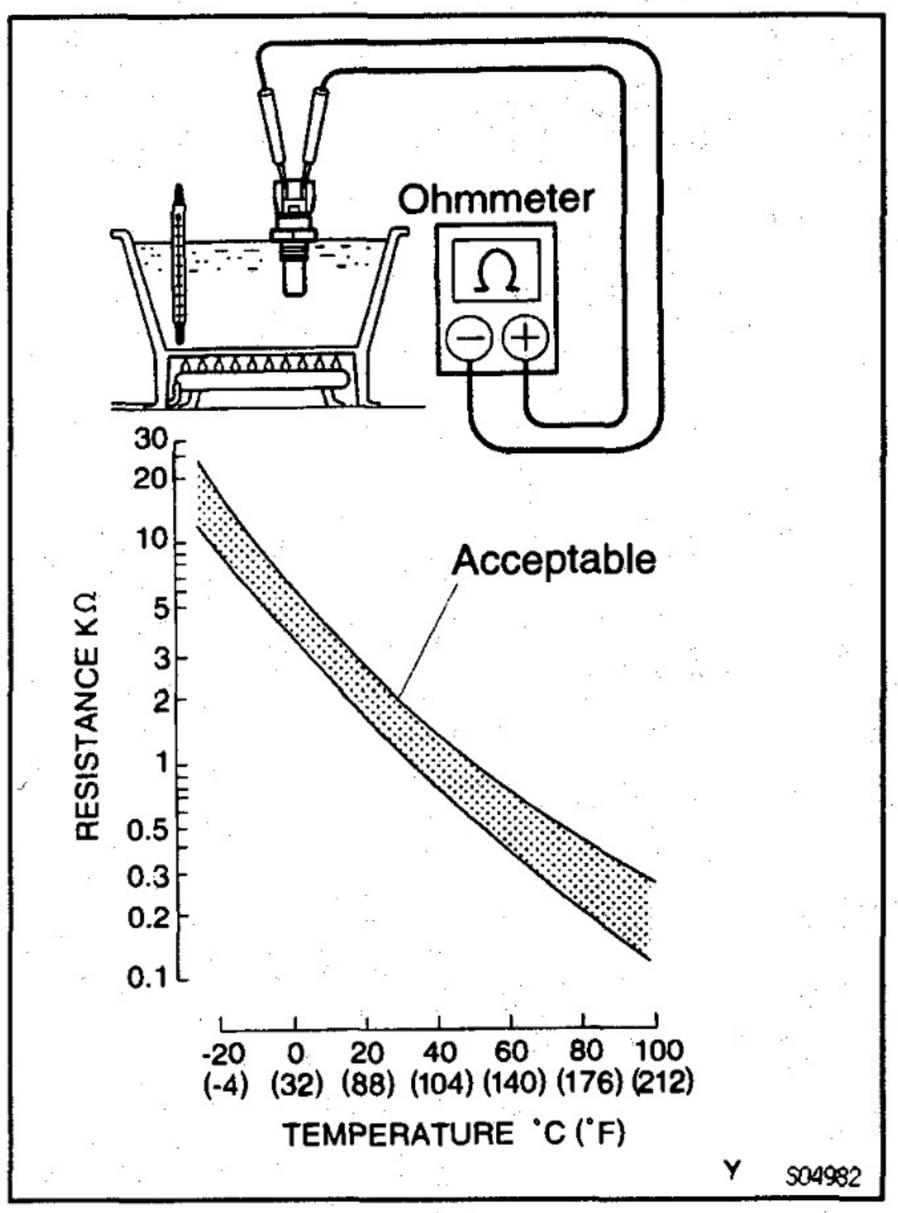
B079V-01

1. DRAIN ENGINE COOLANT

2. REMOVE WATER TEMPERATURE SENSOR

(a) Disconnect the water temperature sensor connector.

(b) Using a 19 mm deep socket wrench, remove the water temperature sensor and gasket.



3. INSPECT WATER TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

Refer to the chart graph

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

4. REINSTALL WATER TEMPERATURE SENSOR

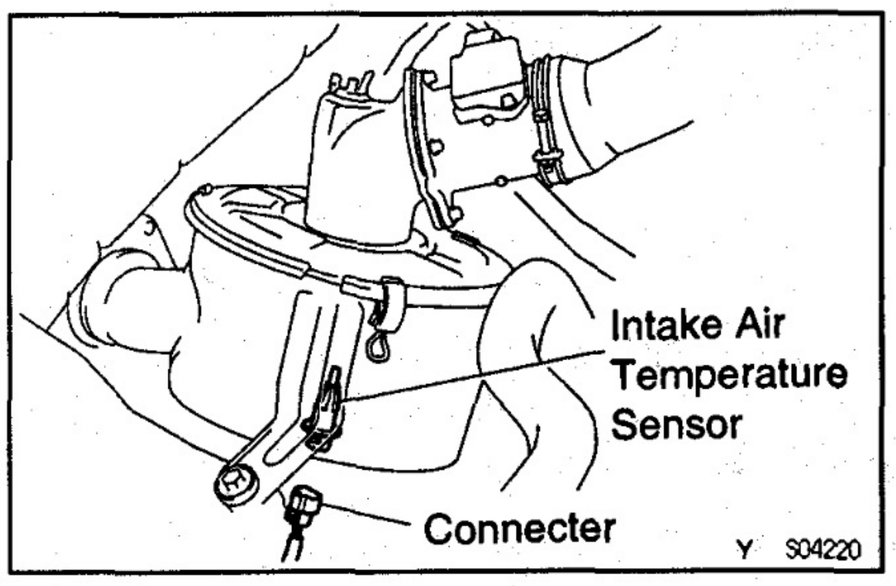
(a) Using a 19 mm deep socket wrench, install the water temperature sensor and gasket.

Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

(b) Connect the water temperature sensor connector.

(c) Install the engine wire protector to the 3 brackets.

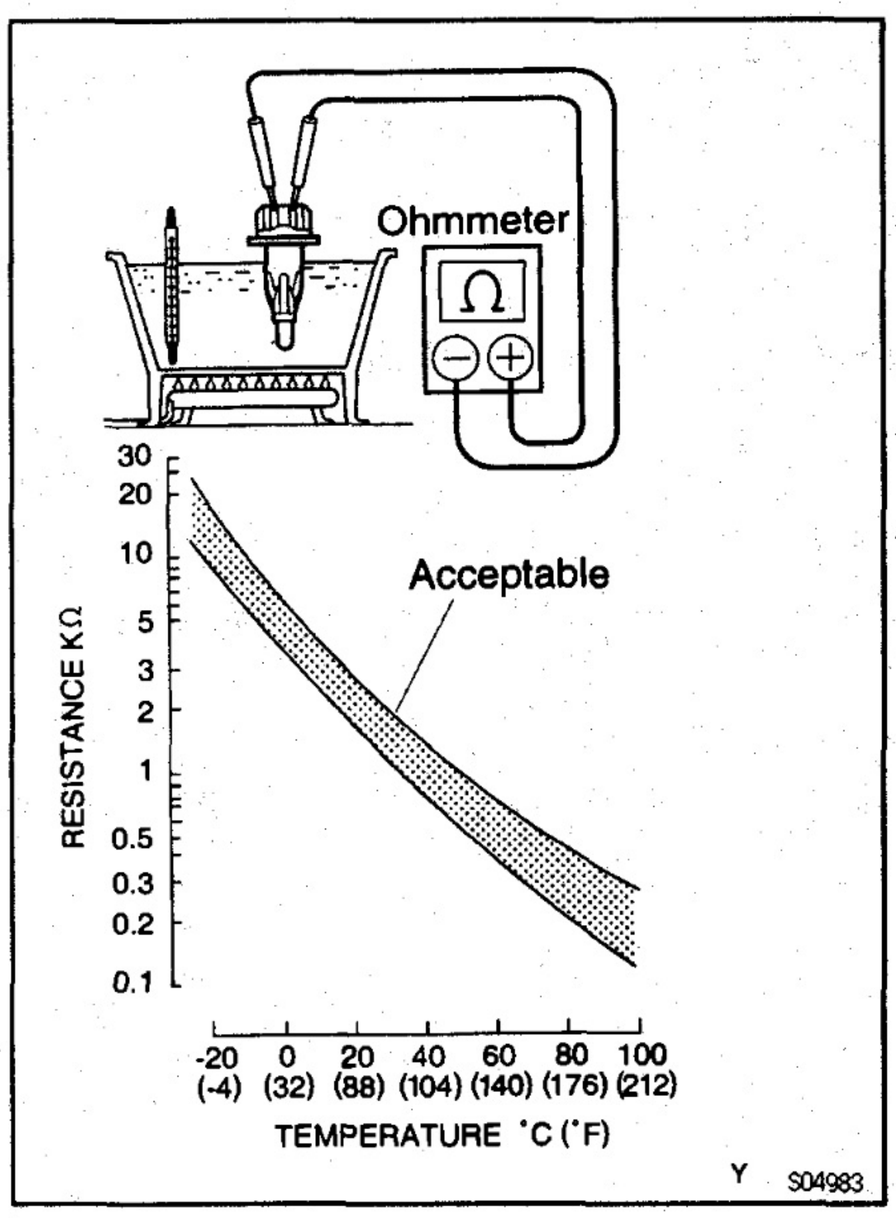
5. REFILL ENGINE COOLANT



INTAKE AIR TEMPERATURE SENSOR

INTAKE AIR TEMP. SENSOR INSPECTION EG1AN-08

1. REMOVE INTAKE AIR TEMP. SENCOR



2. INSPECT INTAKE AIR TEMP. SENSOR

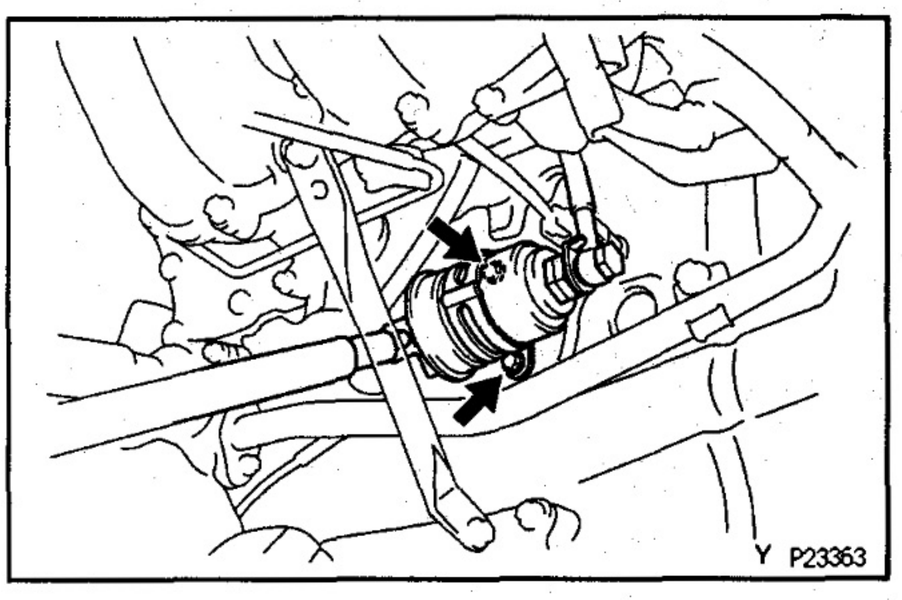
Using an ohmmeter, measure the resistance between the terminals.

Resistance:

Refer to the chart graph

If the resistance is not as specified, replace the intake air temp. sensor.

3. REINSTALL INTAKE AIR TEMP. SENSOR



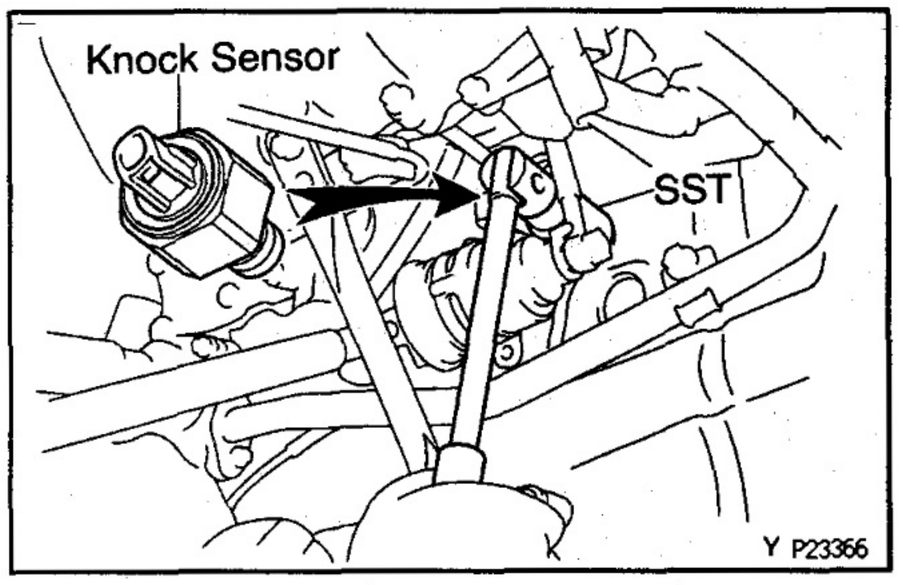
KNOCK SENSOR

KNOCK SENSOR INSPECTION

EQSNT-05

1. REMOVE STARTER

2. REMOVE FUEL FILTER SET BOLTS



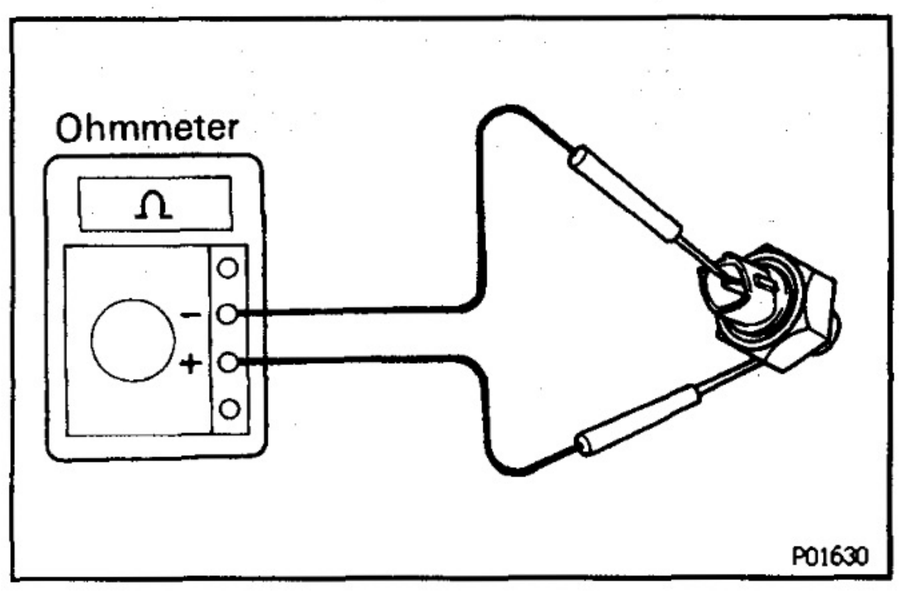
3. REMOVE KNOCK SENSOR

(a) Disconnect the knock sensor connector.

(b) Using SST, remove the knock sensor.
SST 09816—30010

4. INSPECT KNOCK SENSOR

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



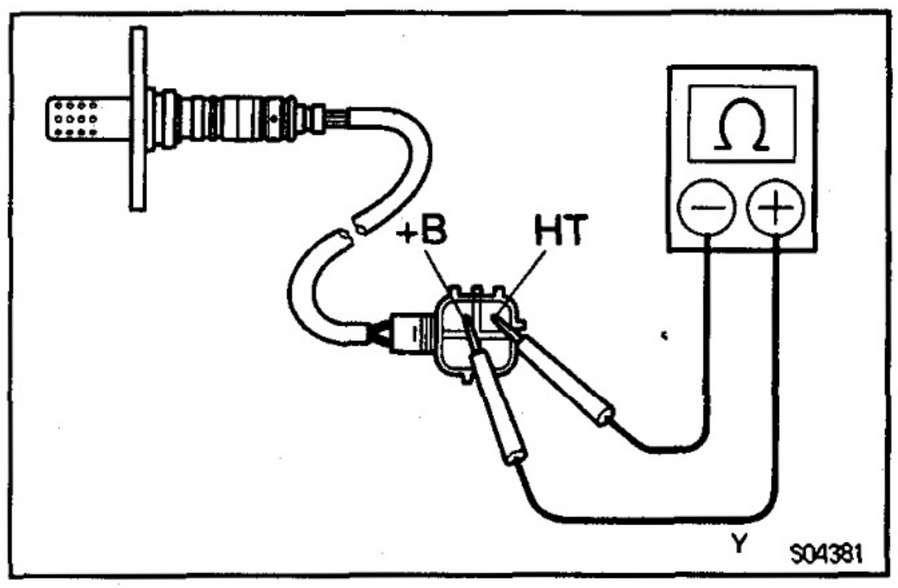
5. REINSTALL KNOCK SENSOR

(a) Using SST, install the knock sensor.
SST 09816—30010
Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)

(b) Connect the knock sensor connector.

6. REINSTALL FUEL FILTER SET BOLTS
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

7. REINSTALL STARTER
(See starter installation in Starting System)



OXYGEN SENSOR

OXYGEN SENSORS INSPECTION

EG7DV-01

1. INSPECT HEATER RESISTANCE OF OXYGEN SENSOR

Using an ohmmeter, measure the resistance between terminals +B and HT.

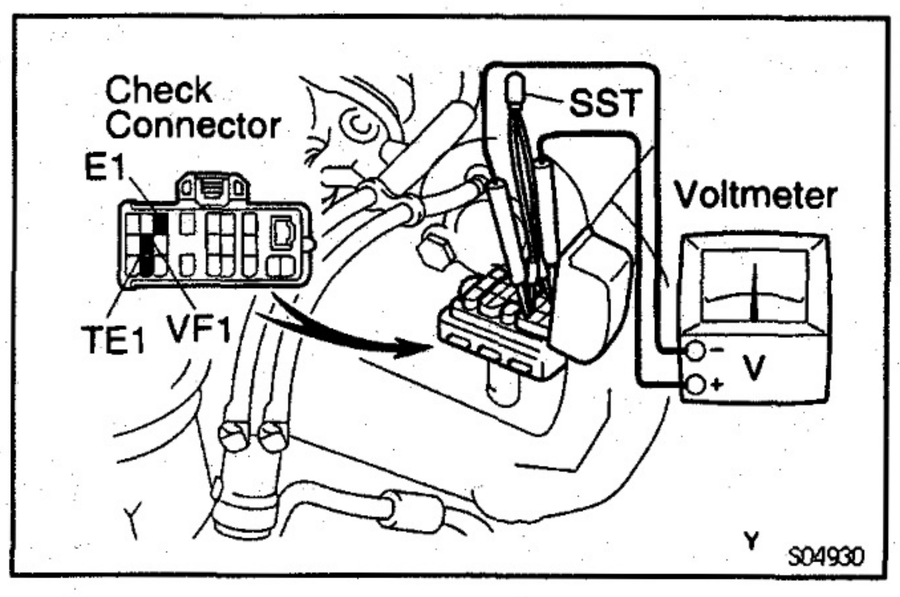
Resistance:

At 20°C (68°F) :11.7 —14.3 Ω

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

2. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.



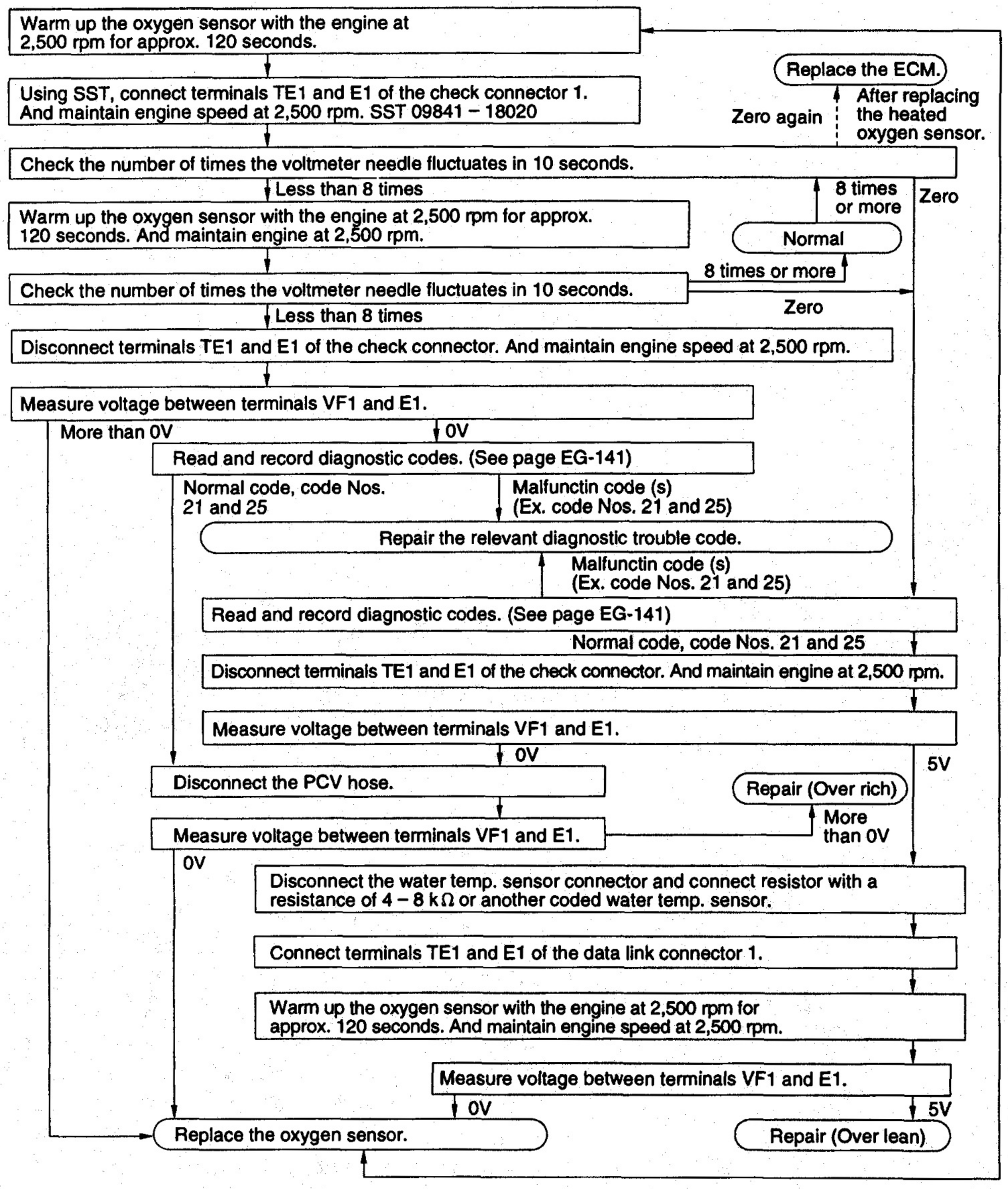
3. INSPECT FEEDBACK VOLTAGE

Connect the positive (+) tester probe of a voltmeter to terminal VF1 of the check connector, and negative (–) tester probe to terminal E1.Perform the test as follows described on the next page.

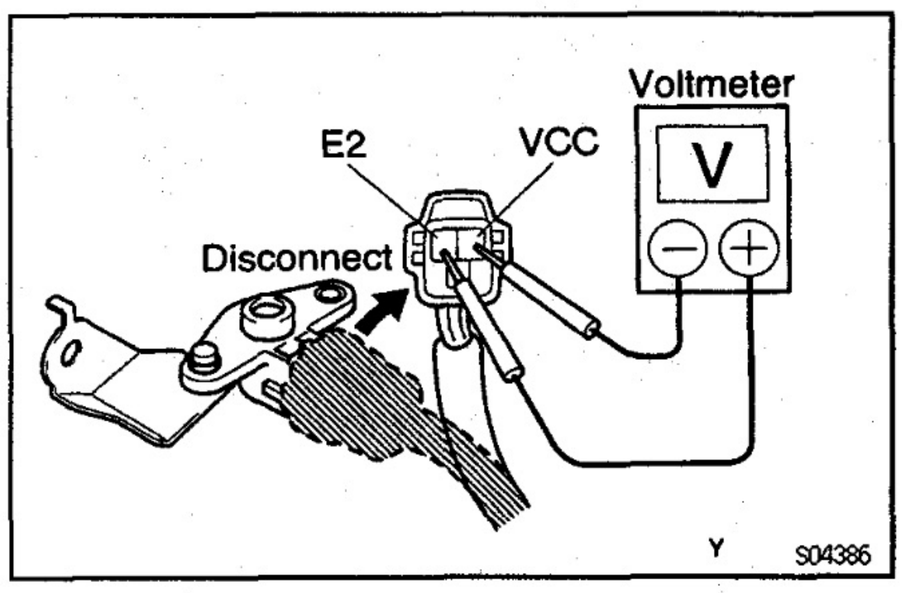
HINT: Use SST when connecting between terminals TE1 and E1 of the check connector.

SST 09843–18020

EG



V08218



VARIABLE RESISTOR

VARIABLE RESISTOR INSPECTION

E08RR-04

1. INSPECT POWER SOURCE VOLTAGE OF VARIABLE RESISTOR

(a) Disconnect the variable resistor connector.

(b) Turn the ignition switch ON.

(c) Using a voltmeter, measure the voltage between connector terminals VCC and E2 of the wiring harness side.

Voltage:

4.5 – 5.5 V

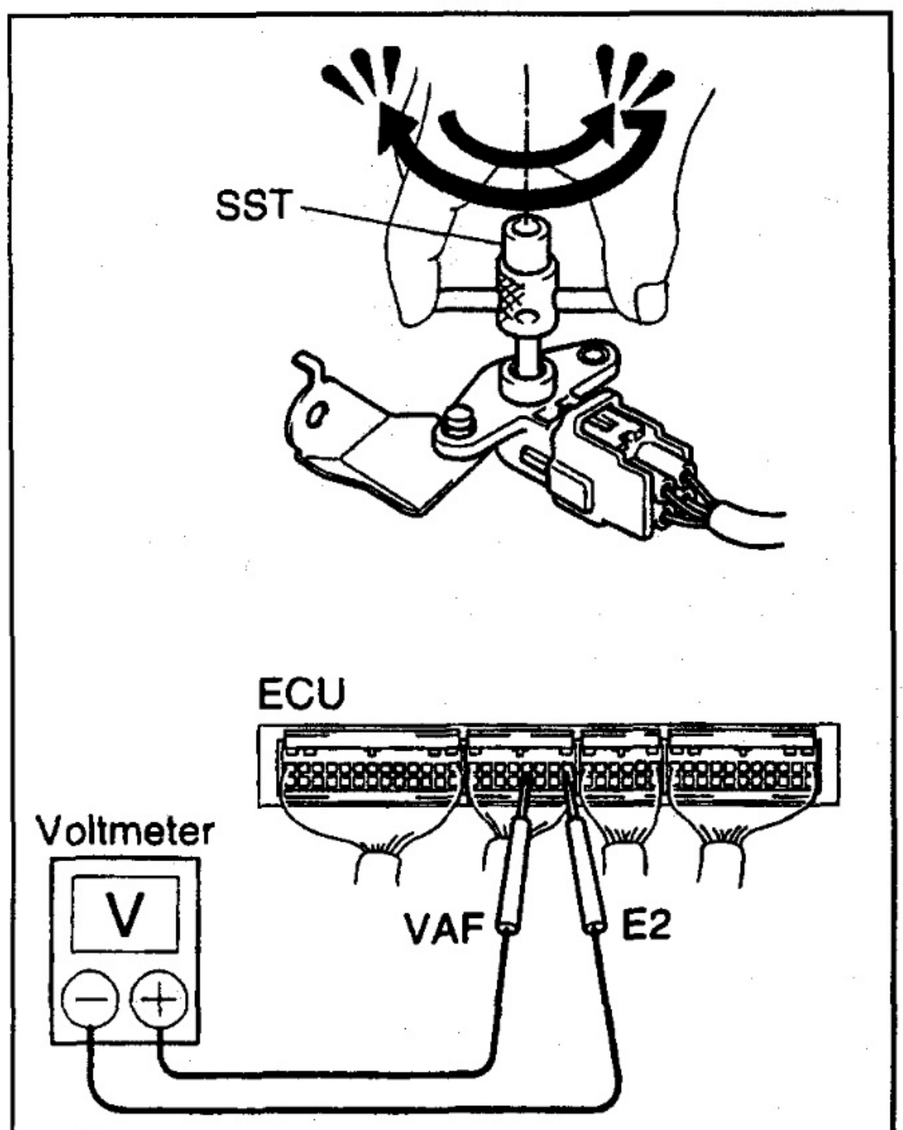
(d) Reconnect the variable resistor connector.

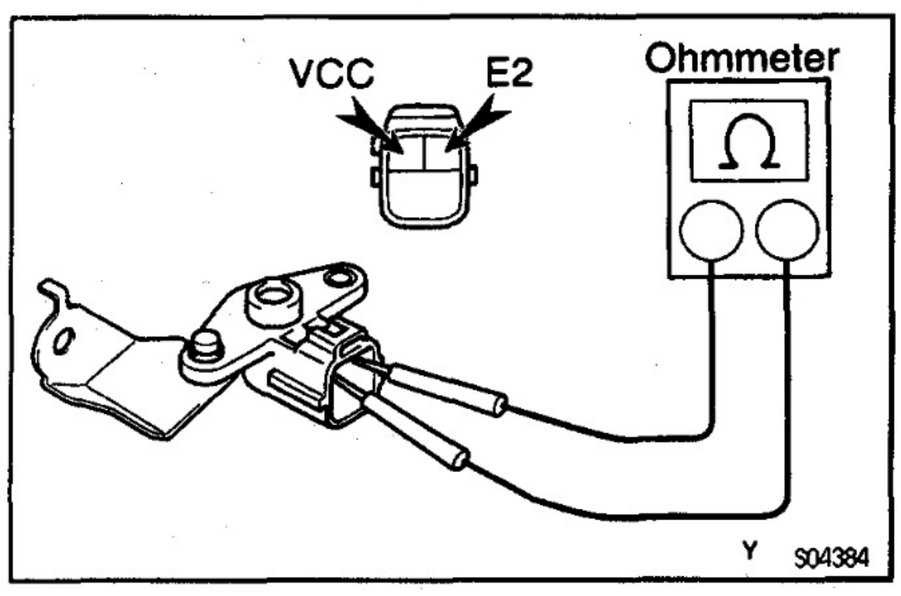
2. INSPECT POWER OUTPUT OF VARIABLE RESISTOR

(a) Turn the ignition switch ON.

(b) Connect a voltmeter to terminals VAF and E2 of the ECU, and measure the voltage while slowly turning the idle mixture adjusting screw first fully counter–clockwise, and then fully clockwise using SST.
SST 09243–00020

(c) Check that voltage changes smoothly from 0 V to approx. 5 V.
HINT: There is no sudden jump up to 5 V or down to 0 V.





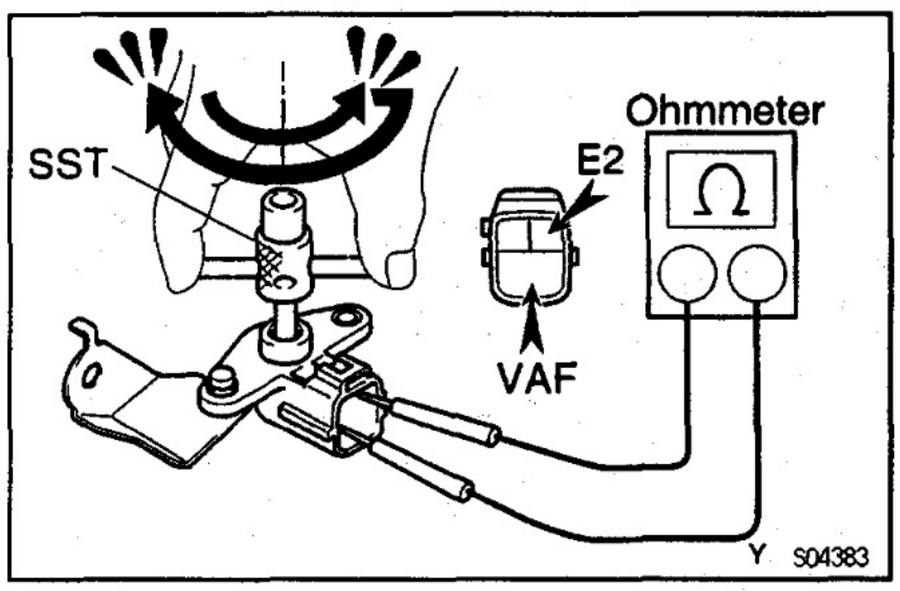
3. INSPECT RESISTANCE OF VARIABLE RESISTOR

(a) Disconnect the variable resistor connector.

(b) Using an ohmmeter, measure the resistance between terminals VCC and E2 of the variable resistor.

Resistance:

4 – 6 kΩ



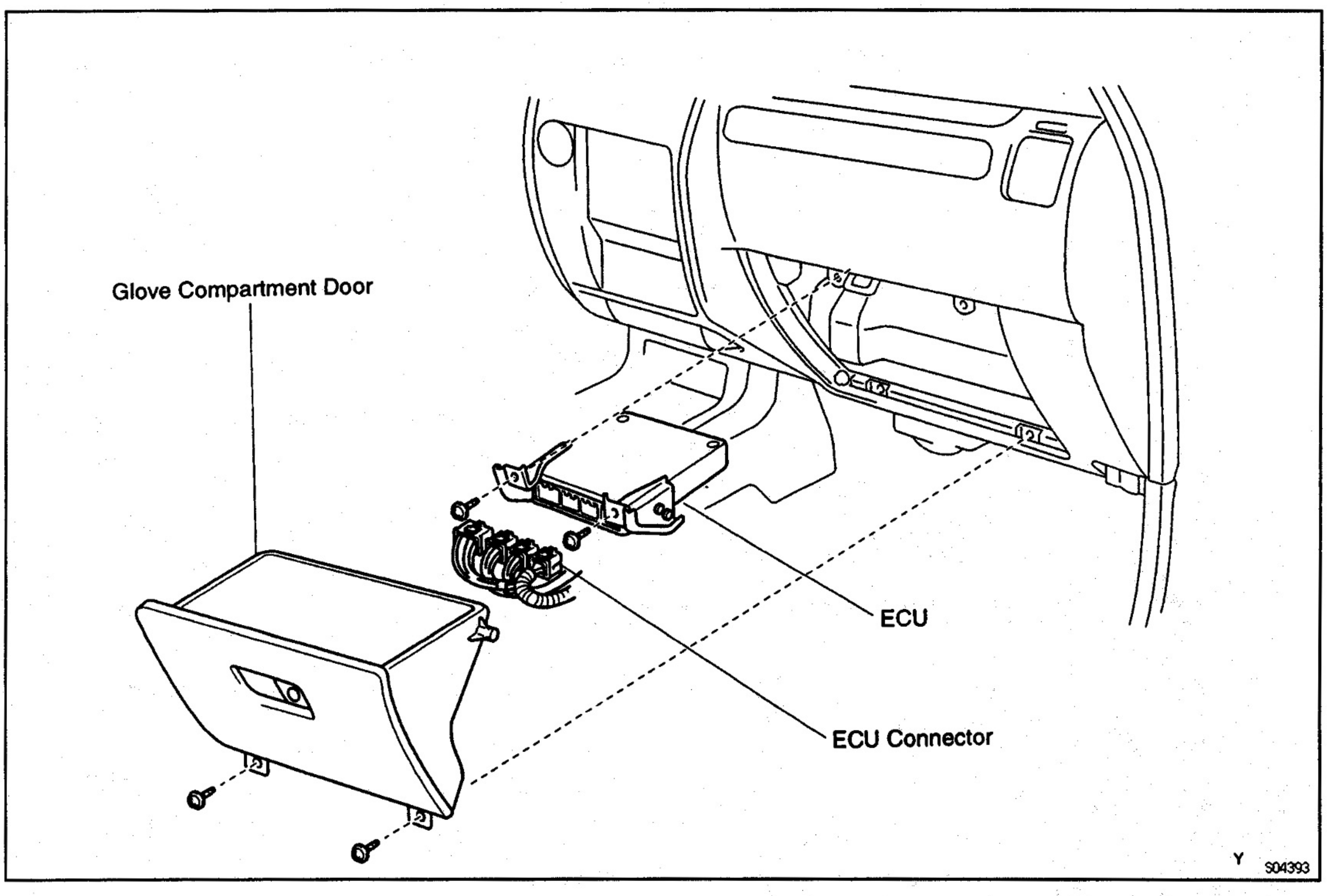
(c) Using SST, turn the idle mixture adjusting screw fully counterclockwise.
SST 09243–00020

(d) Connect the ohmmeter to terminals VAF and E2 of the variable resistor, and turn the idle mixture adjusting screw fully clockwise and check that the resistance value changes from approx. 5 kΩ to 0 Ω accordingly.

(e) Reconnect the variable resistor connector.

ECU
COMPONENTS FOR REMOVAL AND INSTALLATION

EGOE8-0M



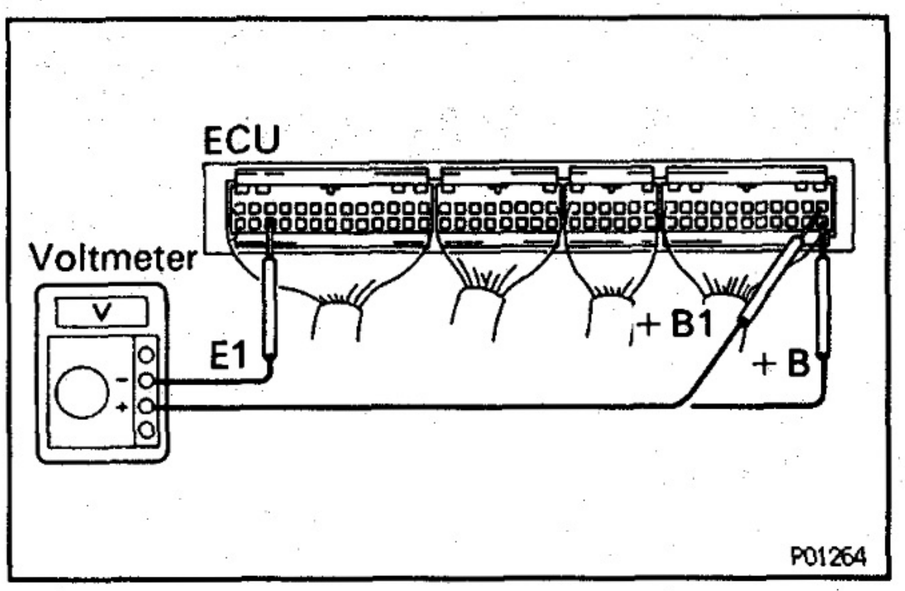
EG7DW-01

ENGINE (& ECT) ECU INSPECTION

HINT: The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the engine (& ECT) ECU.

1. **PREPARATION**

Disconnect the connectors from the engine (& ECT) ECU.



2. INSPECT VOLTAGE OF ENGINE (& ECT) ECU.

Check the voltage between each terminal of the wiring connectors.

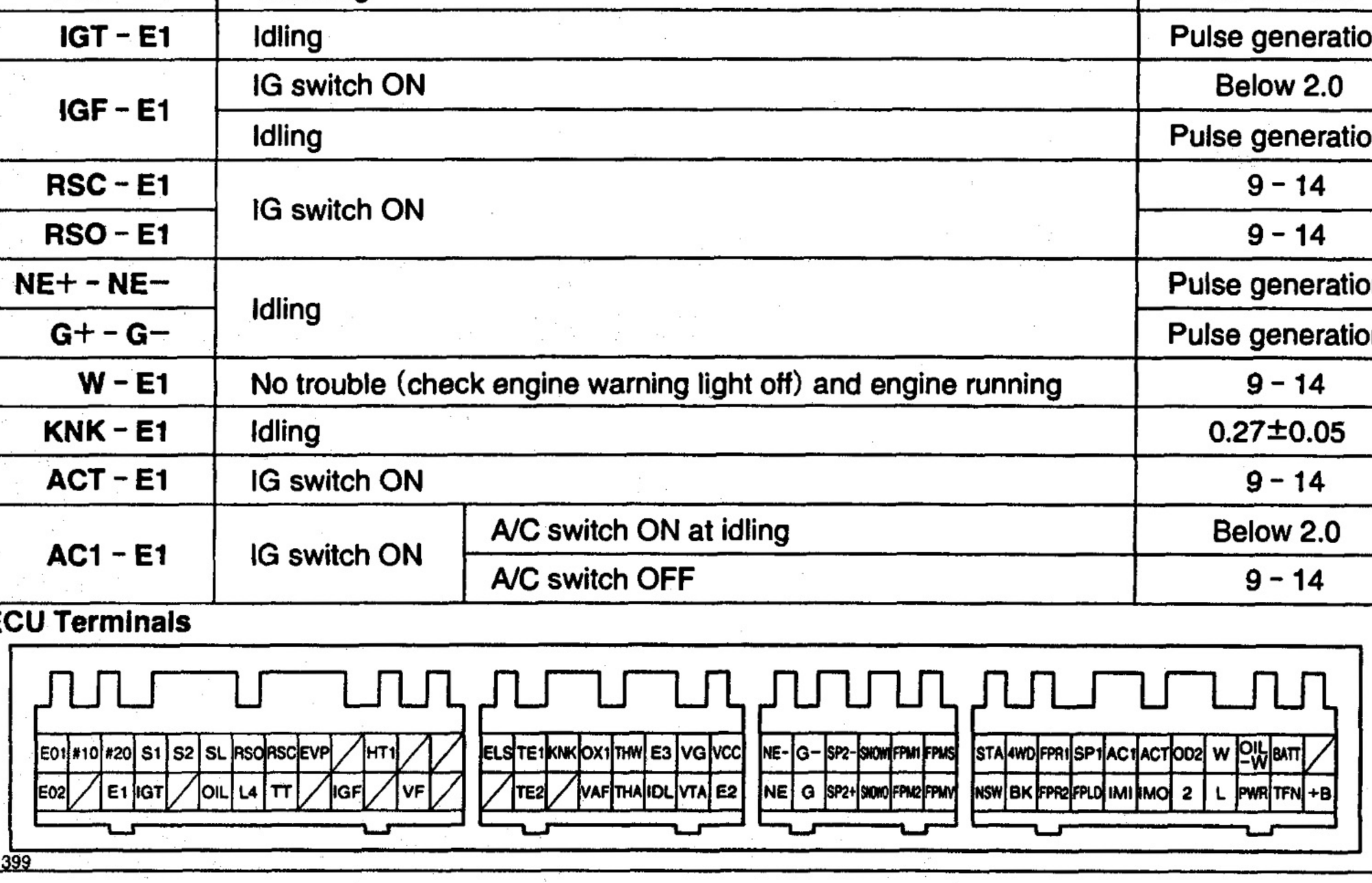
- Turn the ignition switch ON.
- Measure the voltage at each terminal.

HINT:

- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11 V or more when the ignition switch is ON.

Terminals	Condition		STD voltage (V)
+B – E1	IG switch ON		9 – 14
BATT – E1	–		9 – 14
IDL – E2	IG switch ON	Throttle valve fully closed	0 – 3.0
		Throttle valve fully open	9 – 14
VTA – E2		Throttle valve fully closed	0.3 – 0.8
		Throttle valve fully open	3.2 – 4.9
VCC – E2	IG switch ON		4.5 – 5.5
THA – E2	Intake air temp. 20°C (68°F)		0.5 – 3.4
THW – E2	Engine coolant temp. 80°C (176°F)		0.2 – 1.0
STA – E1	Cranking		6.0 or more
IGT – E1	Idling		Pulse generation
IGF – E1	IG switch ON		Below 2.0
	Idling		Pulse generation
RSC – E1	IG switch ON		9 – 14
RSO – E1			9 – 14
NE+ – NE–	Idling		Pulse generation
G+ – G–			Pulse generation
W – E1	No trouble (check engine warning light off) and engine running		9 – 14
KNK – E1	Idling		0.27±0.05
ACT – E1	IG switch ON		9 – 14
AC1 – E1	IG switch ON	A/C switch ON at idling	Below 2.0
		A/C switch OFF	9 – 14

ECU Terminals

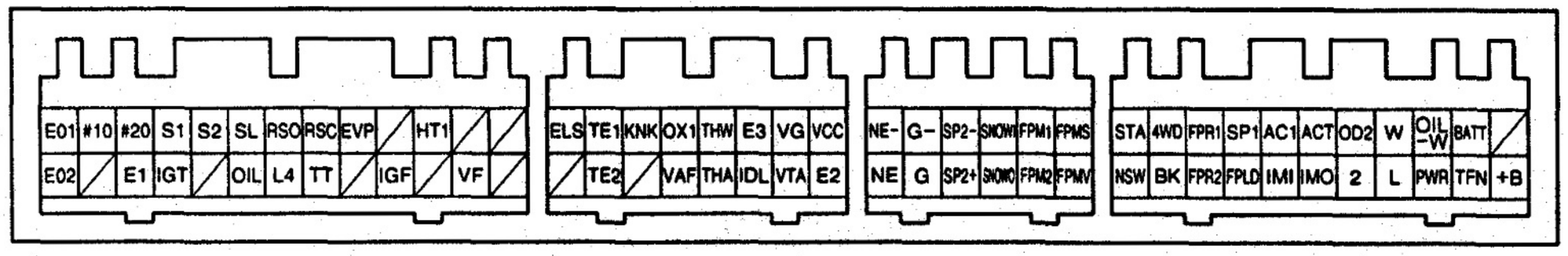


S01399

V08104

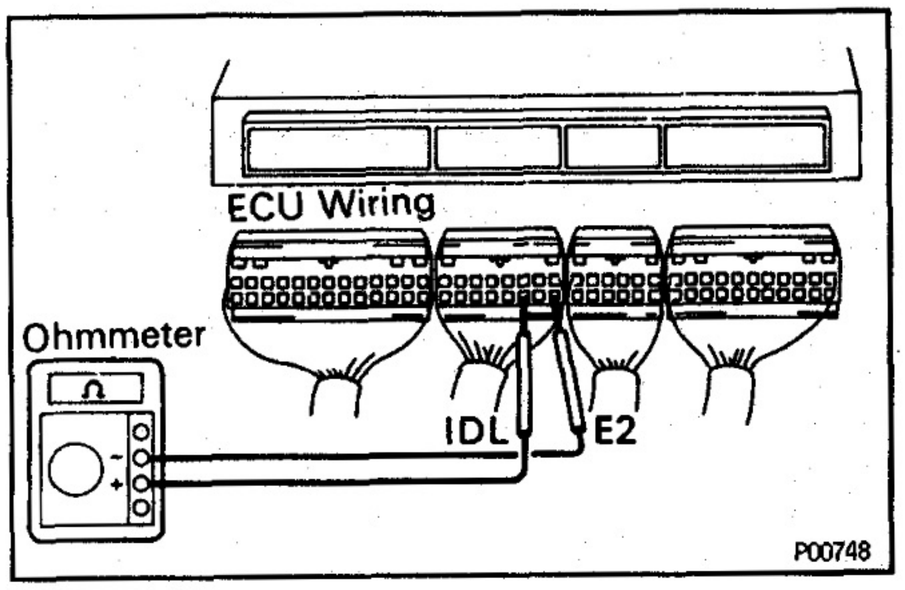
Terminals	Condition			STD voltage (V)
TE1 - E1	IG switch ON	Check connector TE1 - E1 not connected		9 - 14
		Check connector TE1 - E1 connected		3 or less
TE2 - E2		Check connector TE2 - E2 not connected		9 - 14
		Check connector TE2 - E2 connected		3 or less
TT - E1		Maintain speed at 2,500 rpm for 180 seconds after warning up them return to idling		1.8 - 3.2
VE - E1		Maintain speed at 2,500 rpm for 180 seconds after warning up them return to idling		1.8 - 3.2
OX1 - E1	Maintain engine speed at 2,500 rpm for 2 minutes after warning up			Pulse generation
	Idling			Belon 3.0
HT1 - E3	IG switch ON			9 - 14
VG - E3	Idling, A/C switch OFF			1.0 - 1.5
FPLD - E01	Idling	Fuel tank chengeover switch	is ON	9 - 14
			is OFF	0 - 3
IMI - E1	Several second after engine starting			Pulse generation
IMO - E1	Several second after engine starting			Pulse generation
EVP - E1	IG switch ON			9 - 14
NSW - E1	Neutral start switch P or N range			0 - 2
	EX. neutral start switch P or N range			6 - 14
FPMV - E01	Fuel tank changeover switch		is ON	9 - 14
			is OFF	0 - 2
FPMS - E01	Idling			9 - 14
FPR2 - E01				9 - 14
FPR1 - E01				0 - 2
FPM1 - E01	Idling	Fuel tank changeover switch	is ON	9 - 14
			is OFF	0 - 2
FPM2 - E01			is ON	9 - 14
			is OFF	0 - 2

ECU Terminals



S01399

V08102



3. INSPECT RESISTANCE OF ENGINE (& ECT) ECU

NOTICE:

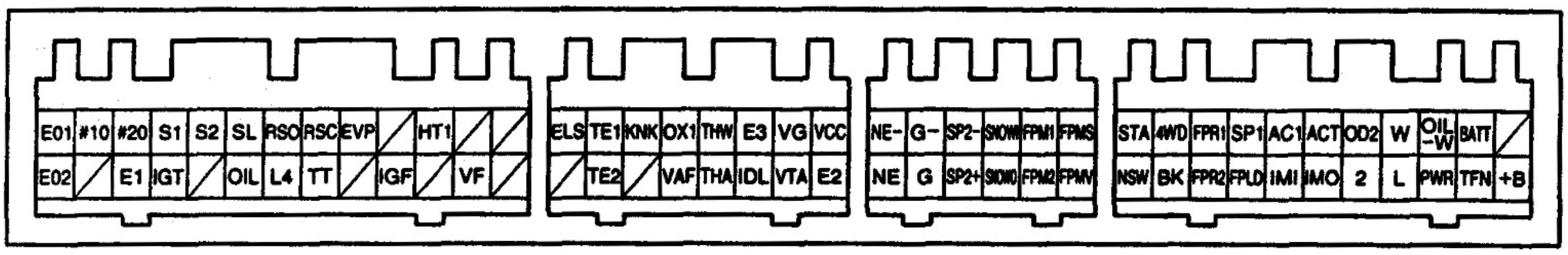
- **Do not touch the engine (& ECT) ECU terminals.**
- **The tester probe should be inserted in the wiring connector from the wiring side.**

Check the resistance between each of the terminals of the wiring connector.

- Disconnect the connectors from the engine (& ECT) ECU.
- Measure the resistance at each terminal.

Terminals	Condition	STD resistance (Ω)
VTA - E2	Throttle valve fully open	2,000 - 10,200
	Throttle valve fully closed	200 - 5,700
THA - E2	Intake air temp. 20°C (68°F)	2,000 - 3,000
THW - E2	Coolant temp. 80°C (176°F)	200 - 400
G - G–	Cold	125 - 190
NE+ - NE–	Cold [–10°C (14°F) to 50°C (122°F)]	370 - 550
	Hot [50°C (122°F) to 100°C (212°F)]	475 - 650
RSC, RSO - +B	Cold [–10°C (14°F) to 50°C (122°F)]	17.0 - 24.5
	Hot [50°C (122°F) to 100°C (212°F)]	21.5 - 28.5
#10, #20 - +B	–	13.2 - 14.2

ECU Terminals



S01399

T V08101

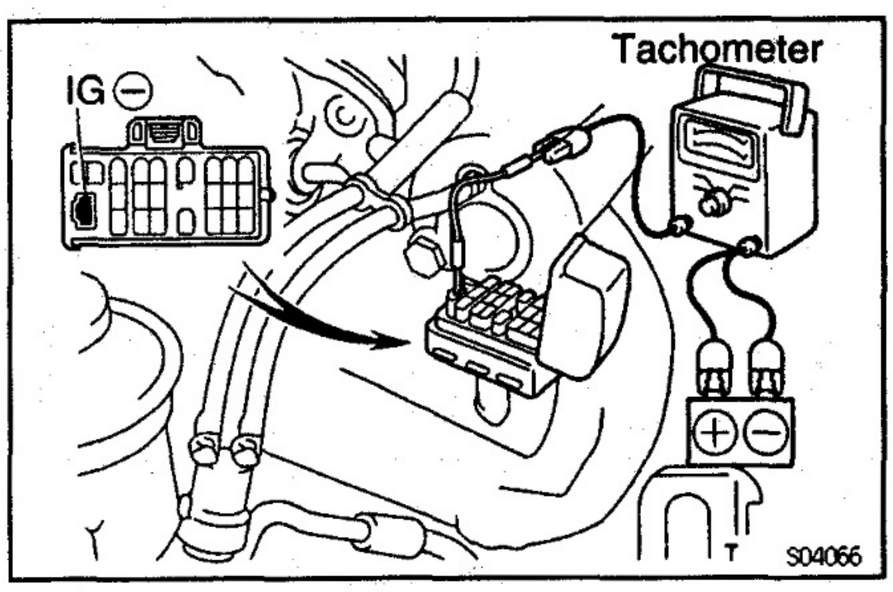
FUEL CUT RPM

5G79X-02

FUEL CUTOFF RPM INSPECTION

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

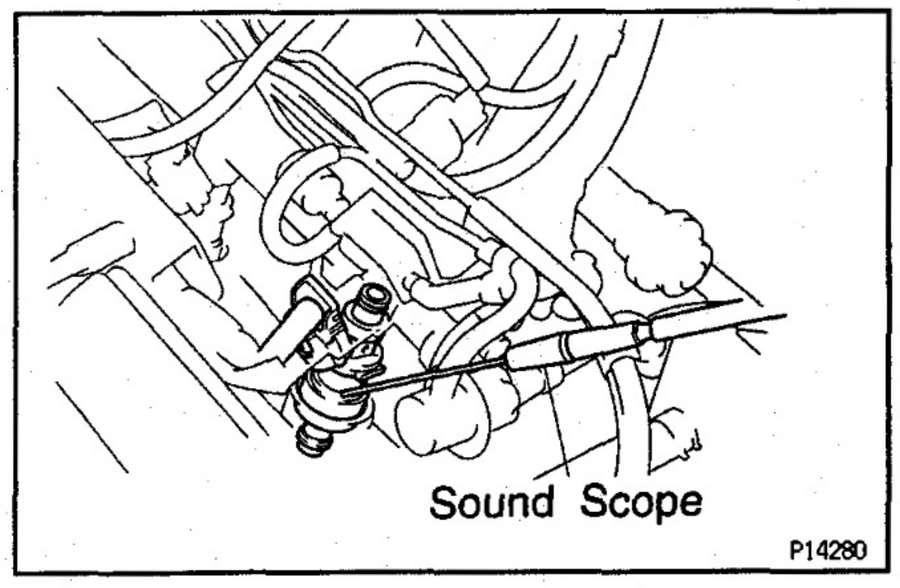


2. CONNECT TACHOMETER TO ENGINE

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

NOTICE:

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



3. INSPECT FUEL CUT OFF PRM

(a) Increase the engine speed to at least 3,500 rpm.

(b) Use a sound scope to check for injector operating noise.

(c) Check that when the throttle lever is released, injector operation noise stops momentarily and then resumes.

HINT: Measure with the A/C OFF.

Fuel return rpm:

M/T: 1,400 rpm A/T: 1,500 rpm

SERVICE SPECIFICATIONS

SERVICE DATA

EQ0ZA–16

Fuel pressure regulator	Fuel pressure	at no vacuum	265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi)
Main fuel pump	Resistance	at 20°C (68°F)	0.2 – 3.0 Ω
Sub fuel pump	Resistance	at 20°C (68°F)	0.2 – 3.0 Ω
Injector	Resistance	at 20°C (68°F)	12 – 16 Ω
	Injection volume		69 – 88 cm³ (4.2 – 5.4 cu in.) per 15 seconds
	Difference between each cylinder		5 cm³ (0.3 cu in.) or less
	Fuel leakage		1 drop or less per 3 minutes
Throttle body	Throttle valve fully closed angle		6°
	Throttle opener setting speed		1,200 – 1,500 rpm
Throttle position sensor	Clearance between stop screw and lever		
	0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
	0.57 mm (0.022 in.)	IDL – E2	2.3 kΩ or less
	0.74 mm (0.029 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 cold	17.0 – 24.5 Ω
		at hot	21.5 – 28.5 Ω
Fuel tank solenoid return valve		at 20°C (68°F)	33 – 39 Ω

Water temperature sensor and Intake air temperature sensor	Resistance	at −20°C (−4°F)	10 – 20 kΩ
		at 0°C (32°F)	4 – 7 kΩ
		at 20°C (68°F)	2 – 3 kΩ
		at 40°C (104°F)	0.9 – 1.3 kΩ
		at 60°C (140°F)	0.4 – 0.7 kΩ
		at 80°C (176°F)	0.2 – 0.4 kΩ
Oxygen sensor	Heater resistance	20°C (68°F)	11.7 – 14.3 Ω
Variable resistor		VCC – E2	4.5 – 5.5 V
	Resistance		4 – 6 kΩ
ECU	Condition	Terminal	Voltage
	IG switch ON	+B – E1	9 – 14 V
	–	BATT	9 – 14 V
	IG switch ON (Throttle valve fully closed)	IDL – E2	0 – 3.0 V
	IG switch ON (Throttle valve fully open)	IDL – E2	9 – 14 V
	IG switch ON (Throttle valve fully closed)	VTA – E2	0.3 – 0.8V
	IG switch ON (Throttle valve fully open)	VTA – E2	3.2 – 4.9 V
	IG switch ON	VCC – E2	4.5 – 5.5 V
	Intake air temp. 20°C (68°F)	THA – E2	0.5 – 3.4 V
	Engine coolant tempe. 20°C (68°F)	THW – E2	0.2 – 1.0 V
	Cranking	STA – E1	6.0 V or more
	Idring	IGF, IGT – E1	Pulse generation
	IG switch ON	IGF – E1	Below 2.0 V
	IG switch ON	RSO, RSC – E1	9 – 14 V
	Idring	NE+ – NE−, G+ – G−	Pulse generation
	No troudle (Check engine warning light off and engine ranning)	W – E1	9 – 14 V
	Idring	KNK – E1	0.27 ± 0.05
	IG swith ON	ACT – E1	9 – 14 V
	IG swith ON (A/C switch ON at idling)	AC1 – E1	Below 2.0
	IG swith ON (A/C switch OFF)	AC1 – E1	9 – 14 V
	IG swith ON (Chack connector TE1 – E1 not connected)	TE1 – E1	9 – 14 V
	IG swith ON (Chack connector TE1 – E1 connected)	TE1 – E1	3 V or less
	IG swith ON (Chack connector TE2 – E2 not connected)	TE2 – E2	9 – 14 V
	IG swith ON (Chack connector TE2 – E2 connected)	TE2 – E2	3 V or less
	IG switch ON (Maintain speed at 2,500 rpm for 180 sec. after warning up them return to idle)	TT, VF – E1	1.8 – 3.2
	Maintain engine speed at 2,500 rpm for 2 minutes after waning up	OX1 – E1	Pulse genaration

EG

ECU (Cont'd)	Idling	OX1 – E1	Below 3.0
	IG switch ON	HT1 – E1	9 – 14 V
	Idling, A/C switch OFF	VG – E3	
	Idling (Fuel tank changeover		1.0 – 1.5 V
	switch is ON	FPLD – E01	9 – 14 V
	Idling (Fuel tank changeover		
	switch is OFF	FPLD – E01	0 – 3 V
	Several secound afterengine starting	IMI, IMO – E1	Pulse generation
	IG switch ON	EVP – E1	9 – 14 V
	Neutral stert switch P or N range	NSW – E1	0 – 2 V
	Ex.neutral stert switch P or N range	NSW – E1	9 – 14 V
	Fuel tank changeover switch is ON	FPMV – E01	9 – 14 V
	Fuel tank changeover switch is OFF	FPMV – E01	0 – 2 V
	Idling	FPM2, FPMS – E01	9 – 14 V
	Idling	FPR1 – E01	0 – 2 V
	Idring (Fuel tank changeover		
	switch is ON)	FPM1, FPM2 – E01	9 – 14 V
	Idring (Fuel tank changeover		
	switch is OFF)	FPM1, FPM2 – E01	0 – 2 V
	Condition	Terminal	Resistance
	Throttle valve fully open	VTA – E2	2,000 – 10,200Ω
	Throttle valve fully closed	VTA – E2	200 – 5,700Ω
	Intake air temp. 20°C (68°F)	THA – E2	2.000 – 3,000Ω
	Coolant temp. 80°C (176°F)	THW – E2	200 – 400Ω
	Cold	G – G–	125 – 190Ω
	Cold (–10°C (14°F) to 50°C (122°F))	NE+ – NE–	370 – 550Ω
	Hot (50°C (122°F) to 100°C (212°F))	NE+ – NE–	475 – 650Ω
	Cold (–10°C (14°F) to 50°C (122°F))	RSC – +B	17.0 – 24.5Ω
	Hot (50°C (122°F) to 100°C (212°F))	RSO – +B	21.5 – 28.5Ω
	–	#10 – +B	13.2 – 14.2Ω
	–	#20 – +B	13.2 – 14.2Ω
Fuel cut RPM	Fuel return rpm	M/T	1,400 rpm
		A/T	1,500 rpm

EGGEE-20

TORQUE SPECIFICATIONS

Part tightened		N·m	kgf·cm	ft·lbf
Fuel line (Union bolt type)		29	300	22
Fuel line (Flare nut type)	w/ SST	30	310	22
Fuel pump bracket assembly x Fuel tank		3.5	35	31 in.·lbf
Fuel pressure regulator x Delivery pipe		8.8	90	78 in.·lbf
Fuel inlet pipe x Fuel filter		29	300	22
Delivery pipe x Cylinder head		21	210	15
Fuel inlet pipe x Delivery pipe		29	300	22
MAF meter x Air cleaner cap		8.5	85	74 in.·lbf
Water temperature sensor x Cylinder head		20	200	14
Knock sensor x Cylinder block		44	450	33
Fuel filter x Cylinder block		20	200	14

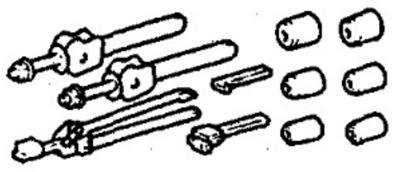
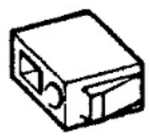
COOLING SYSTEM

PREPARATION

SST (SPECIAL SERVICE TOOLS)

EG0CF-26

EG

	09230-01010 Radiator Service Tool Set	
	09231-14010 Punch	Aluminum type radiator

EQUIPMENT

EG06U-0R

Heater	Thermostat
Radiator cap tester	
Thermometer	Thermostat
Torque wrench	

ENGINE COOLANT

EG06V-0P

Item	Capacity	Classification
M/T	9.5 liters (10.0 US qts, 8.4 Imp. qts)	Ethylene-glycol base
A/T	9.3 liters (9.8 US qts, 8.2 Imp. qts)	

COOLANT CHECK AND REPLACEMENT

EG0NZ-03

1. CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR

The coolant level should be between the "L" and "F" lines.

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

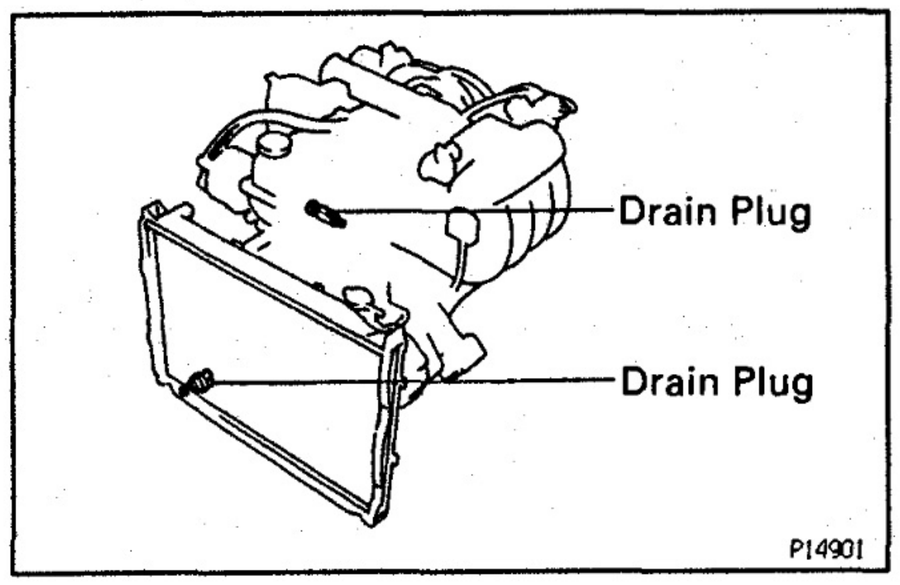
2. CHECK ENGINE COOLANT QUALITY

(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 scales around the radiator cap or radiator filler hole, and the coolant should be free from oil.

If excessively dirty, replace the coolant.



(c) Reinstall the radiator cap.

3. REPLACE ENGINE COOLANT

(a) Remove the radiator cap.

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

(b) Drain the coolant from the radiator and cylinder drain plugs. (Engine coolant drain plug at the right of cylinder block.)

(c) Close the drain plugs.

Torque (Engine coolant drain plug):

24.5 N·m (250 kgf·cm, 18 ft·lbf)

(d) Slowly fill the system with coolant.

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

NOTICE:

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

Capacity:

M/T

9.5 liters (10.0 US qts, 8.4 Imp. qts)

A/T

9.3 liters (9.8 US qts, 8.2 Imp. qts)

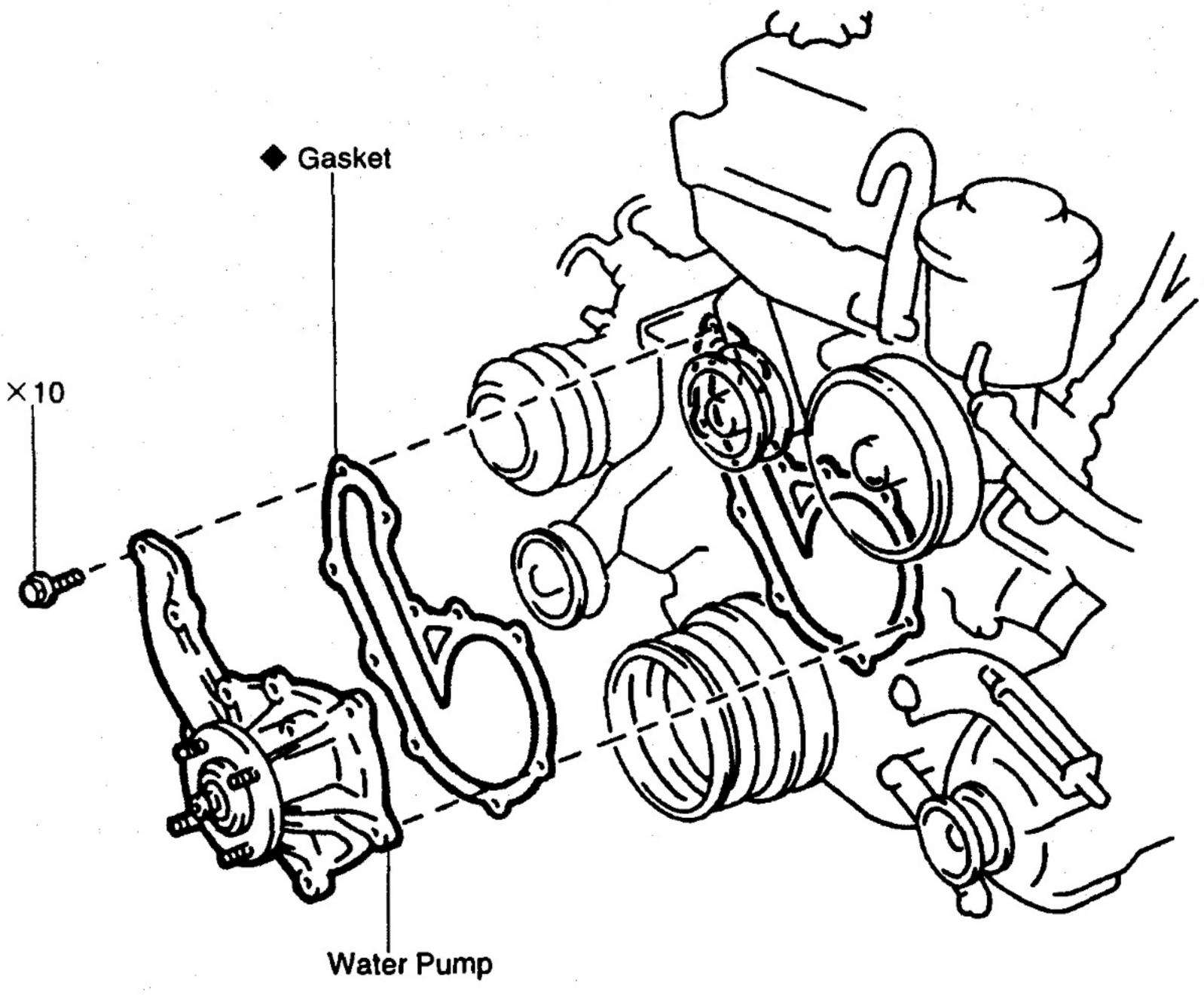
(e) Reinstall the radiator cap.

(f) Warm up the engine and check for leaks.

(g) Recheck the coolant level and refill as necessary.

WATER PUMP
COMPONENTS FOR REMOVAL AND INSTALLATION

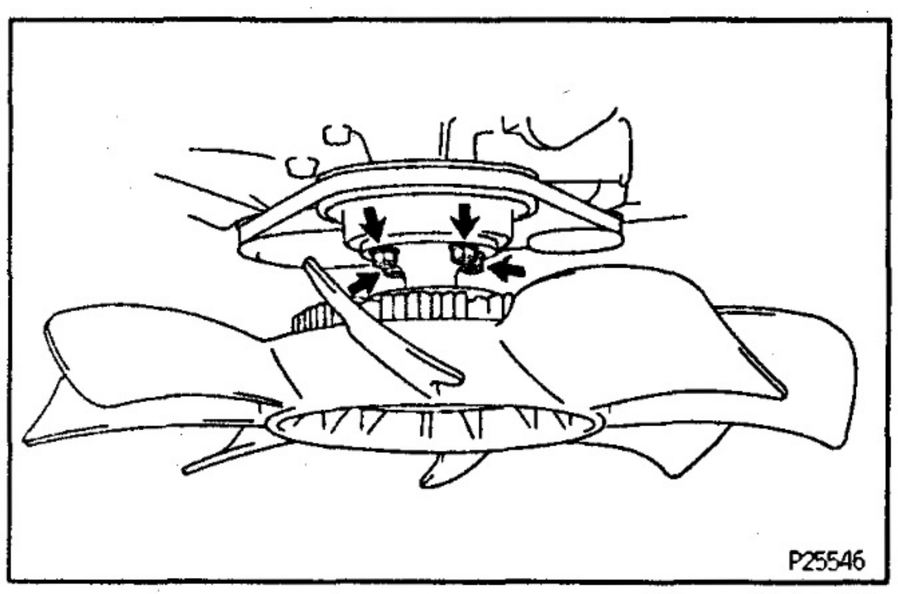
EG79Y-02



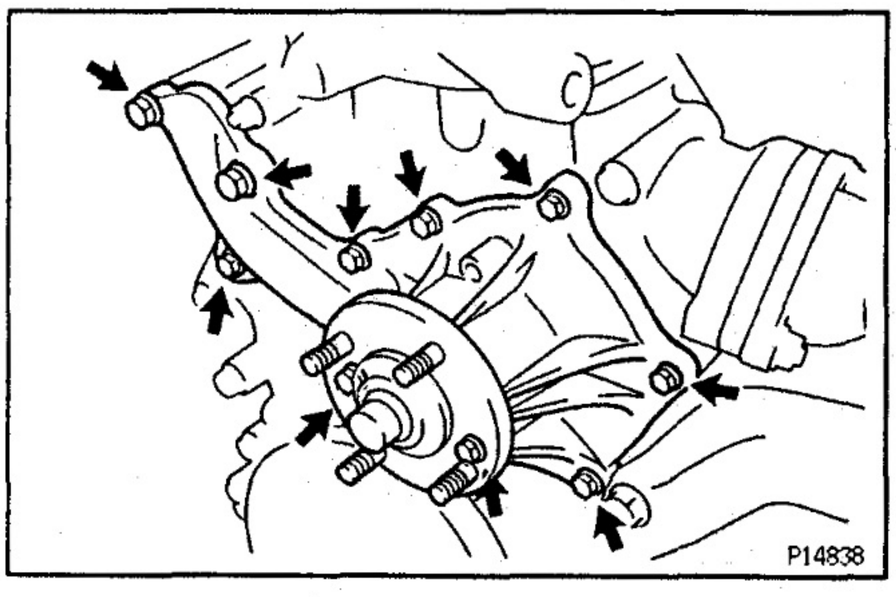
P22377

◆ Non-reusable part

Y Z18812



P25546



P14838

EG79Z-01

WATER PUMP REMOVAL

1. **DRAIN ENGINE COOLANT**
2. **REMOVE DRIVE BELT, FAN, FLUID COUPLING AND WATER PUMP PULLEY**

(a) Stretch the belt and loosen the fan pulley mounting nuts.

(b) Loosen the pivot and adjusting bolts of the alternator, and remove the drive belt.

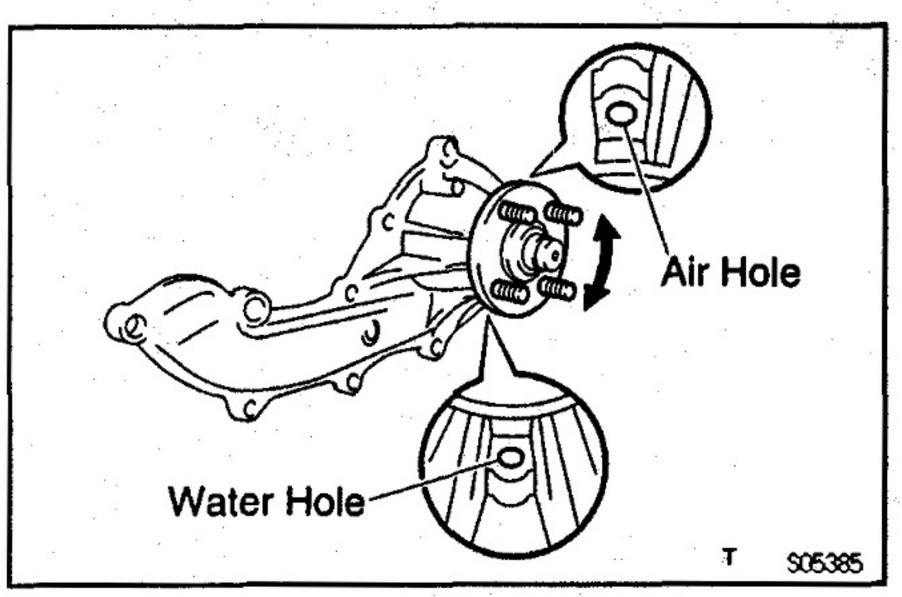
(c) Remove the 4 nuts fan with fluid coupling and pulley.
Torque: 21 N·m (210 kgf·cm, 16 ft·lbf)

(d) Remove the 4 nuts and fan from the fluid coupling.

3. **REMOVE WATER PUMP**

Remove the 10 bolts, water pump and gasket.
Torque:
14 mm head bolt : 24.5 N·m (250 kgf·cm, 18 ft·lbf)
12 mm head bolt : 8.9 N·m (90 kgf·cm, 78 in.·lbf)

INSTALLATION HINT: Use a new gasket.



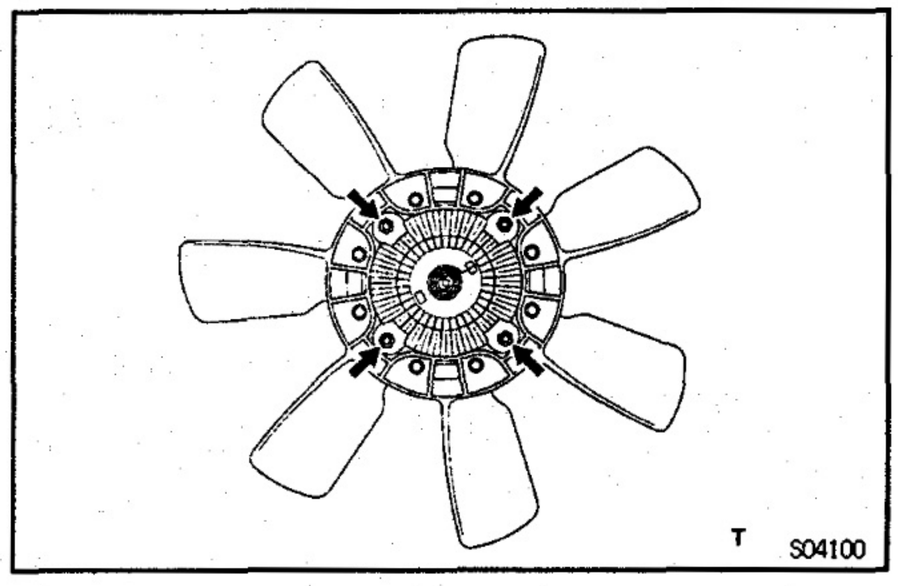
WATER PUMP COMPONENTS INSPECTION

EGONG-0D

1. INSPECT WATER PUMP

(a) Visually check the air hole and water hole for coolant leakage.
If leakage is found, replace the water pump.

(b) Turn the pulley, and check that the water pump bearing moves smoothly and quietly.
If necessary, replace the water pump.



2. INSPECT FLUID COUPLING

(a) Remove the 4 nuts and fan from the fluid coupling.

(b) Check the fluid coupling for damage and silicon oil leakage.
If necessary, replace the fluid coupling.

(c) Install the fan and fluid coupling with the 4 nuts.
Torque: 5.5 N·m (55 kgf·cm, 49 in.·lbf)

WATER PUMP INSTALLATION

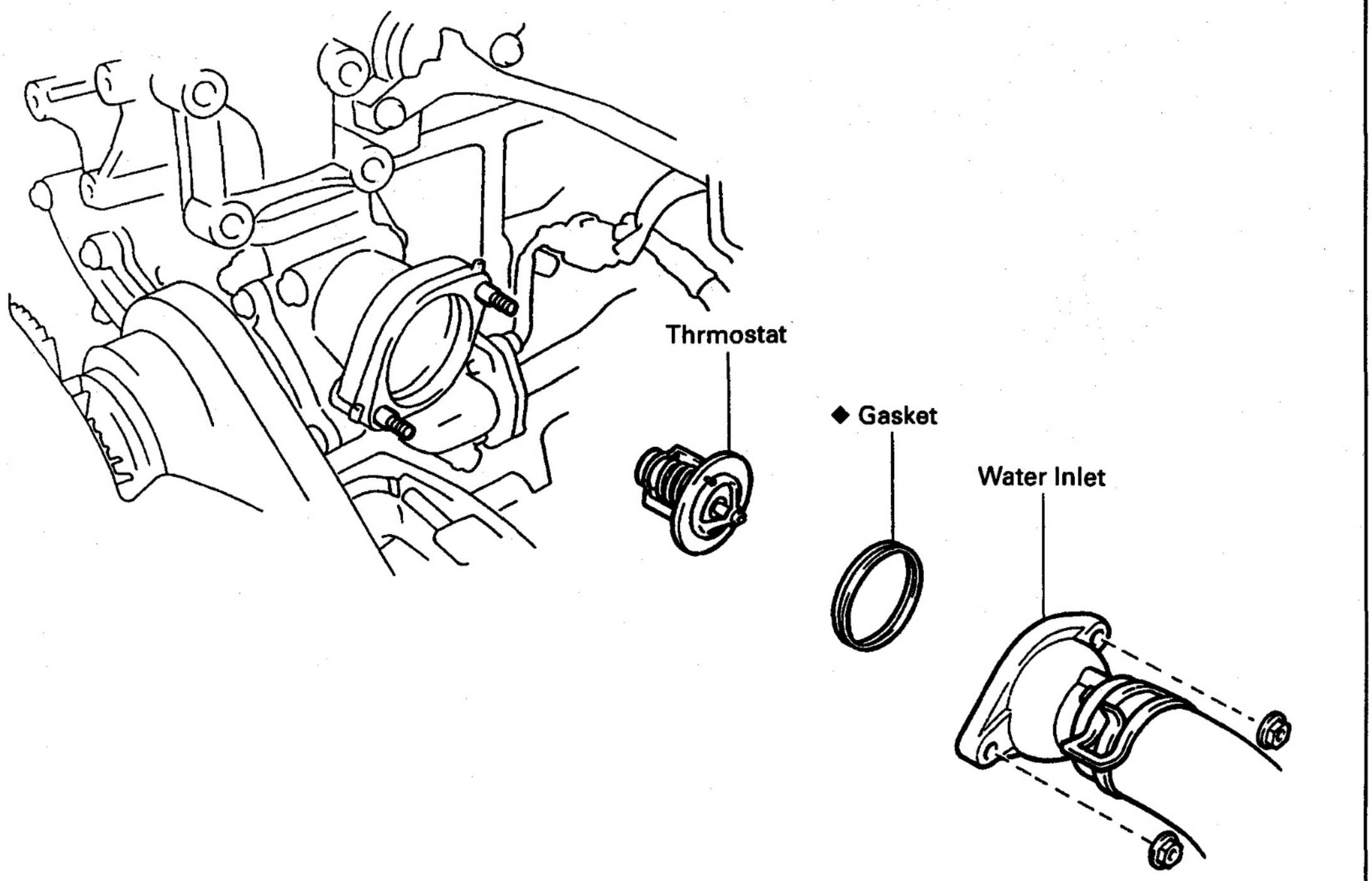
EGOGE-03

Installation is in the reverse order of removal.

THERMOSTAT

COMPONENTS FOR REMOVAL AND INSTALLATION

EG13D-1J



◆ Non-reusable part

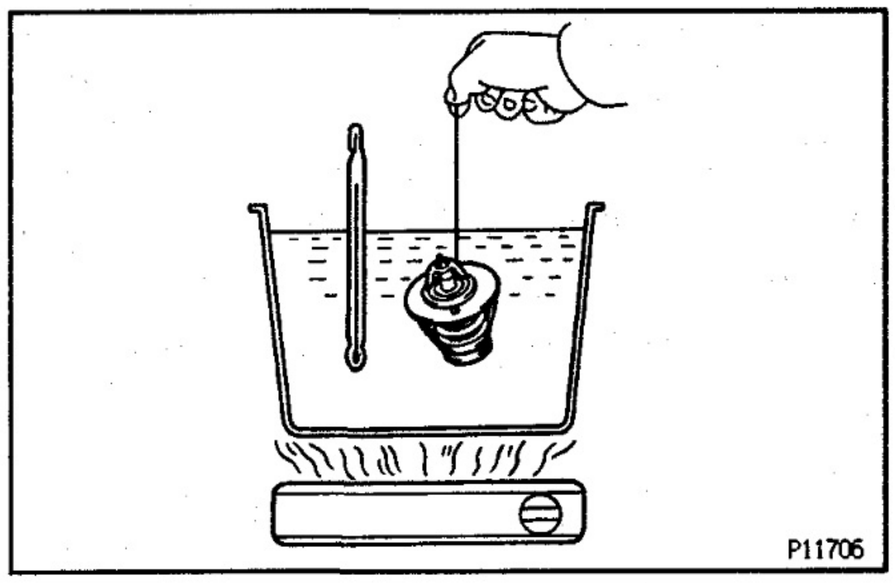
P23587

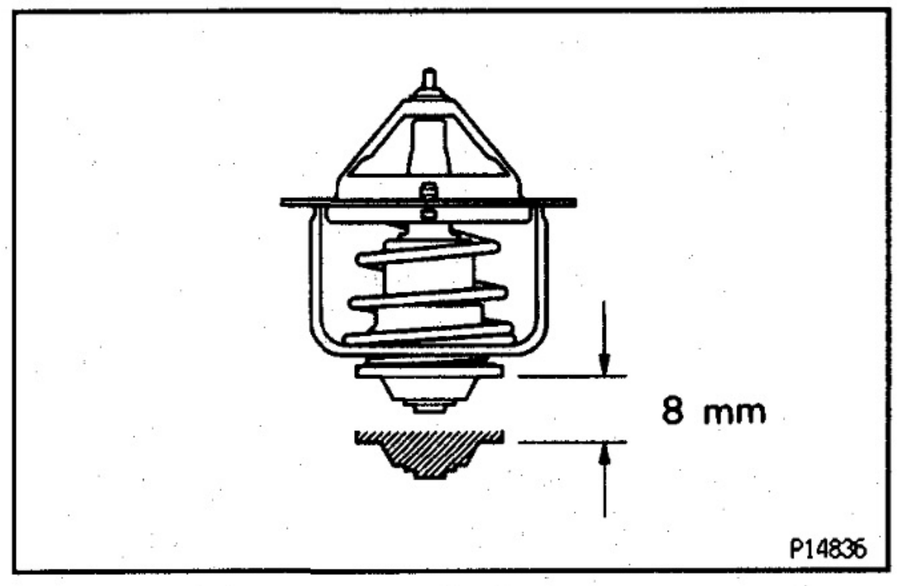
EG7D6-01

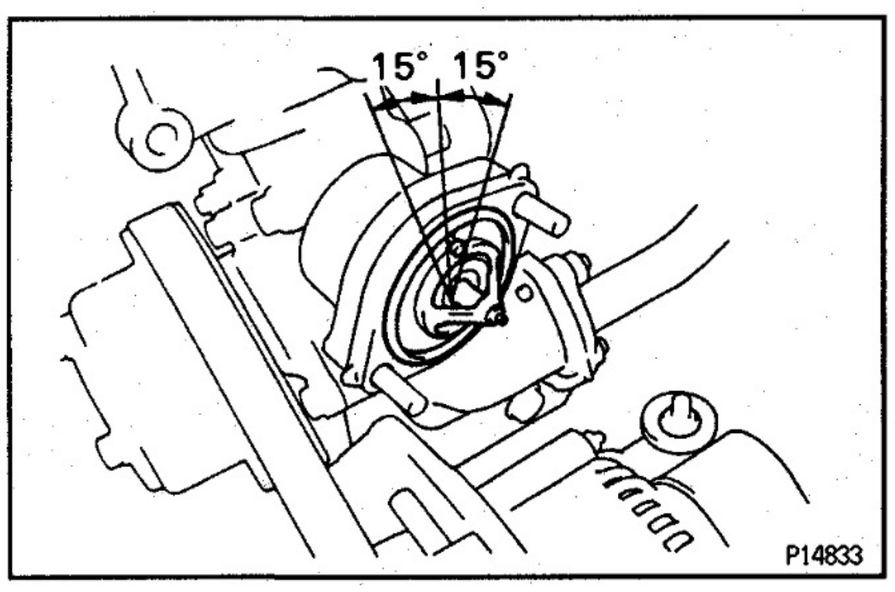
THERMOSTAT REMOVAL

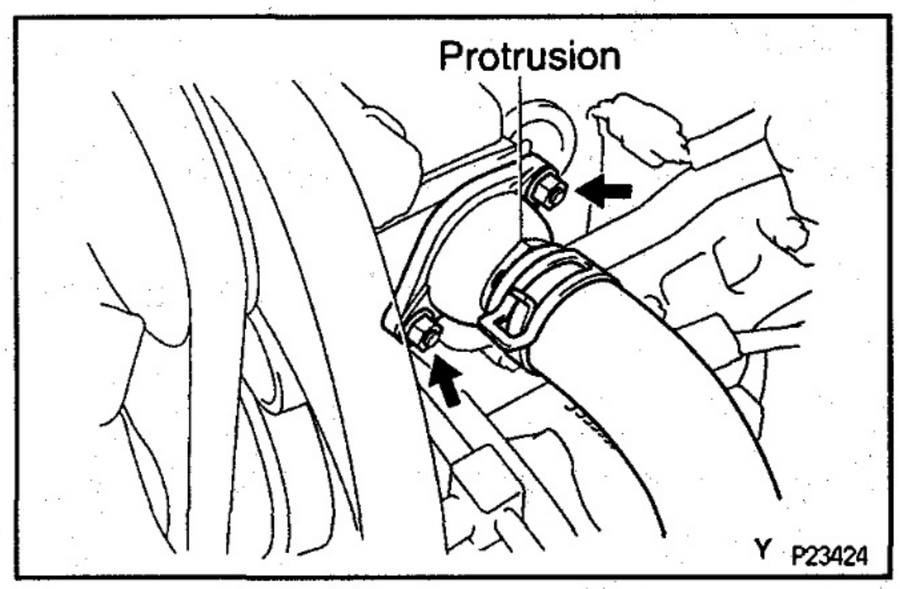
HINT: Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. **DRAIN ENGINE COOLANT**
2. **DISCONNECT WATER INLET WITH LOWER RADIATOR HOSE, AND REMOVE THERMOSTAT**
   (a) Remove the 2 nuts holding the water inlet to the inlet housing, and disconnect the water inlet from the inlet housing.
   (b) Remove the thermostat.
   (c) Remove the gasket from the thermostat.









EG5P2-04

THERMOSTAT INSPECTION

INSPECT THERMOSTAT

HINT: The thermostat is numbered with the valve opening temperature.

(a) Immerse the thermostat in water and gradually heat the water.

(b) Check the valve opening temperature.

Valve opening temperature:

80 — 84°C (176 — 183°F)

If the valve opening temperature is not as specified, replace the thermostat.

(c) Check the valve lift.

Valve lift:

At 95°C (203°F): 8 mm (0.31 in.) or more

If the valve lift is not as specified, replace the thermostat.

(d) Check that the valve is fully closed when the thermostat is at low temperatures (below 40°C (104°F)).

If not closed, replace the thermostat.

EG7D6-01

THERMOSTAT INSTALLATION

1. PLACE THERMOSTAT IN WATER INLET HOUSING

(a) Install a new gasket to the thermostat.

(b) Align the jiggle valve of the thermostat with the protrusion of the water inlet housing, and insert the thermostat in the water inlet housing.

HINT: The jiggle valve may be set within 15° of either side of the prescribed position.

2. CONNECT WATER INLET WITH LOWER RADIATOR HOSE

Install the water inlet with the 2 nuts.

HINT: Facing the top mark (protrusion) upward.

Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)

3. FILL WITH ENGINE COOLANT

4. START ENGINE AND CHECK FOR LEAKS

RADIATOR

RADIATOR CLEANING

EG074-0L

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

NOTICE: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. (i.e. Maintain a distance between the cleaner nozzle radiator core)

CO002-02

RADIATOR INSPECTION

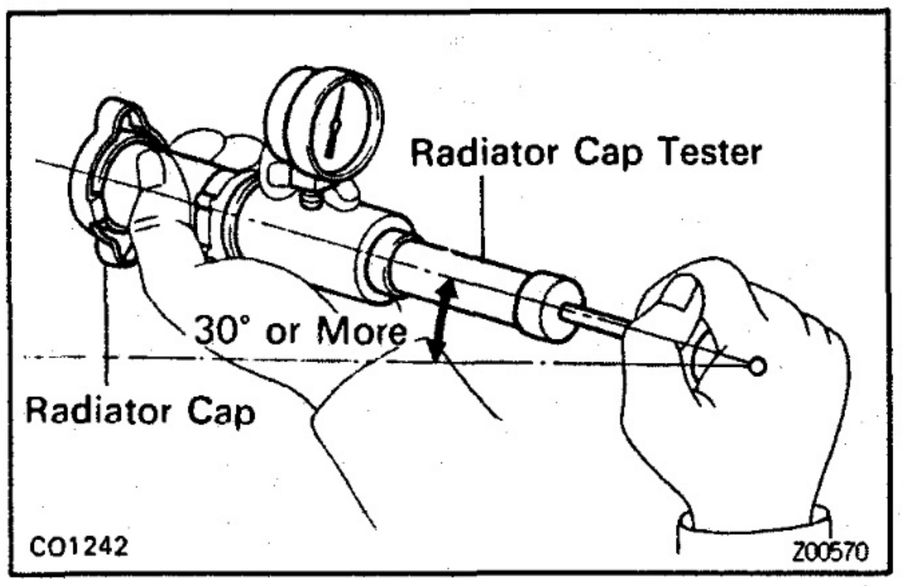
1. REMOVE RADIATOR CAP

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

2. INSPECT RADIATOR CAP

NOTICE:

- **If the radiator cap contaminations, always rinse it with water.**
- **When performing steps (a) and (b) below, keep the radiator pump tester at an angle of over 30° above the horizotal.**
- **Before using a radiator cap tester, wet the relief valve and pressure valve with engine coolant or water.**



(a) Using a radiator cap tester, slowly pump the tester and check that air is coming from vacuum valve.

Pump speed: 1 push/(3 seconds or more)

NOTICE: Push the pump at a constant speed.

If air is not coming from the vacuum valve, replace the radiator cap.

(b) Pump the tester and measure the relief valve opening pressure.

Pump speed: 1 push within 1 second

NOTICE: This pump speed is for the first pump only (in order to close the vacuum valve). After this, the pump speed can be reduced.

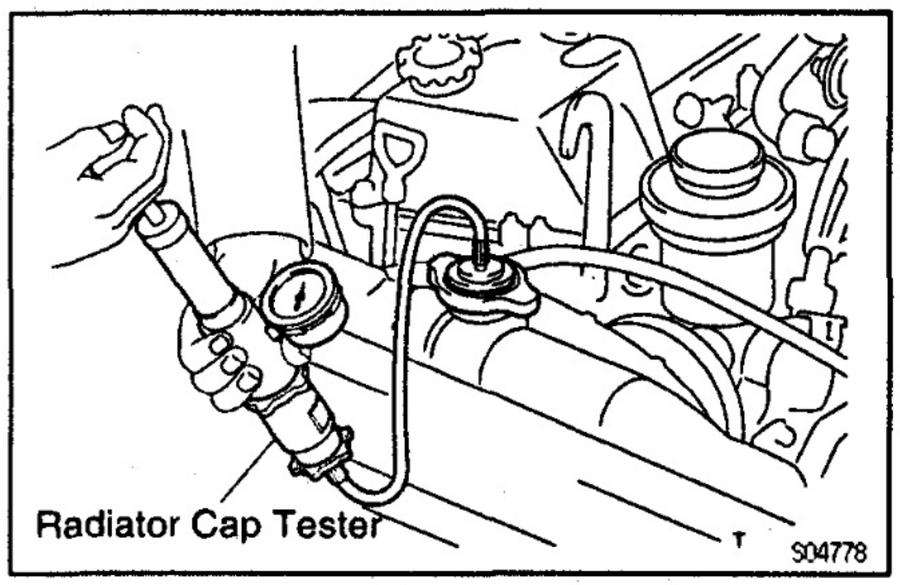
Standard opening pressure:

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)

HINT: Use the tester's maximum reading as the opening pressure.

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



3. INSPECT COOLING SYSTEM FOR LEAKS

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

(b) Warm up the engine.

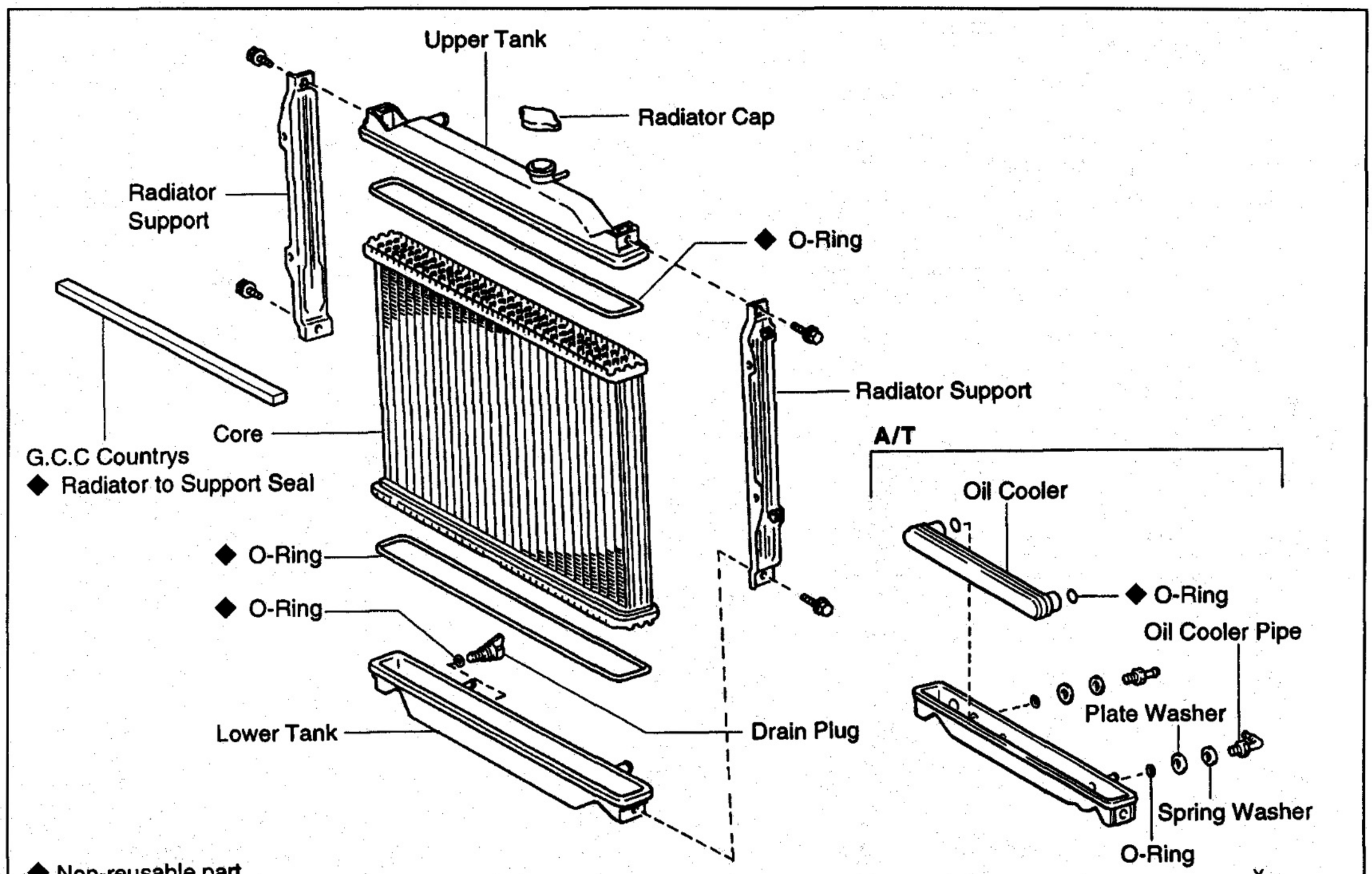
(c) Pump it to 118 kPa (1.2 kgf/cm², 17.1 psi), and check that the pressure does not drop.

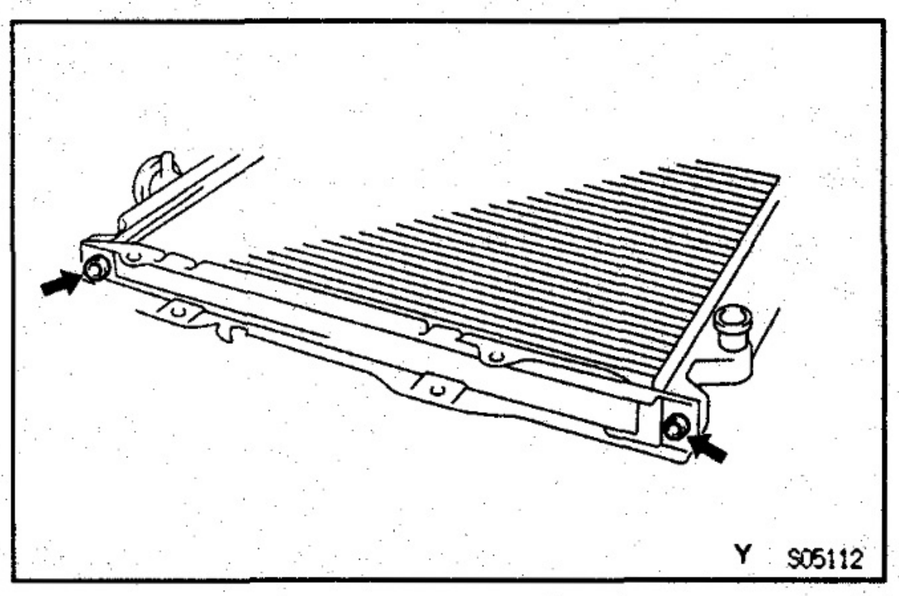
If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, cylinder block and head.

4. REINSTALL RADIATOR CAP

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

E07A0-02

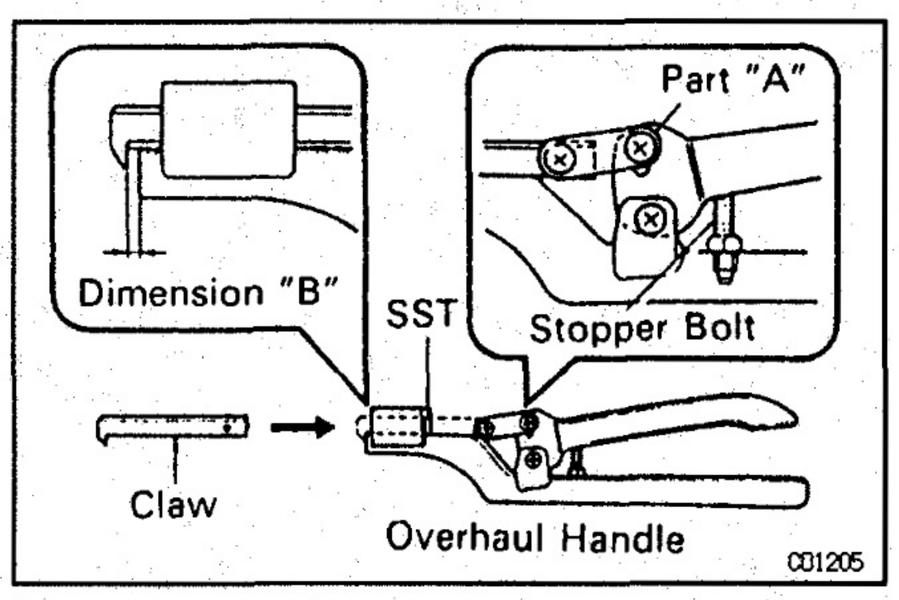




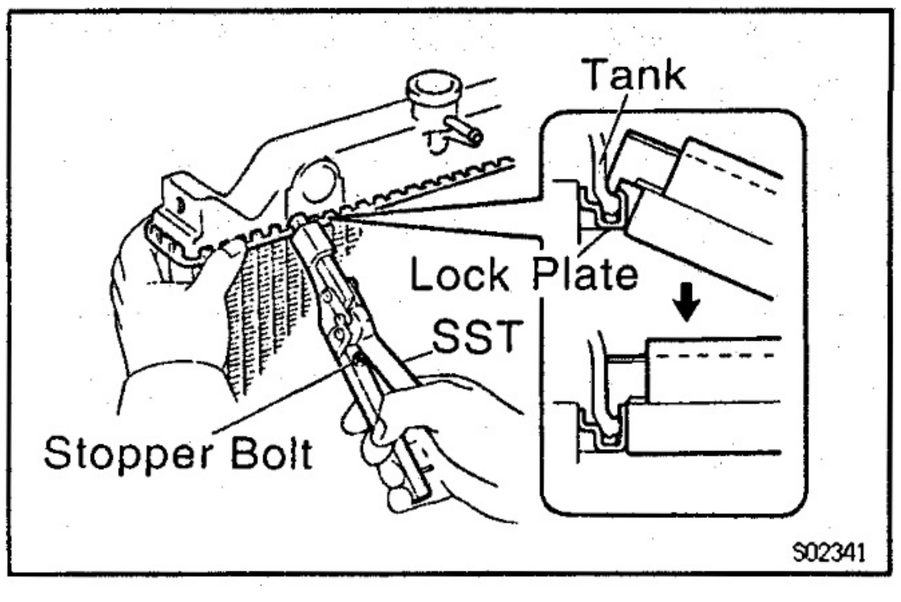
C0006-03

RADIATOR DISASSEMBLY

1. **G.C.C Countrys:**
   REMOVE RADIATOR TO SUPPORT SEAL
2. **REMOVE RADIATOR SUPPORTS**
   Remove the 4 screws and 2 radiator supports.
   Torque: 13 N·m (130 kgf·cm, 9.6 ft·lbf)
3. **REMOVE DRAIN PLUG**



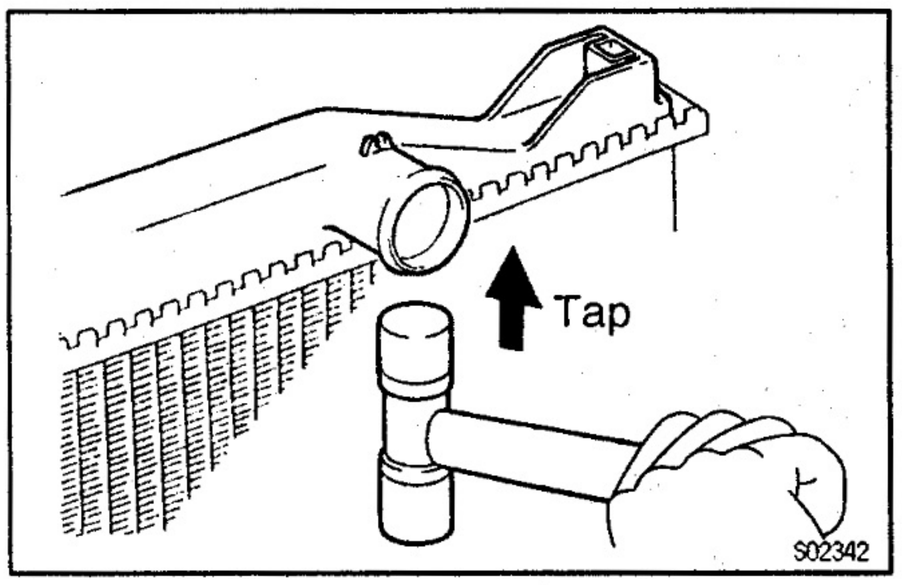
4. **ASSEMBLE SST**
   SST 09230−01010
   (a) Install the claw to the overhaul handle, inserting it in the hole in part "A" as shown in the diagram.
   (b) While gripping the handle, adjust the stopper bolt so that dimension "B" shown in the diagram is 0.2 — 0.3 mm (0.008 — 0.012 in.).
   NOTICE: If this adjustment is not done, the claw may be damaged.



5. UNCAULK LOCK PLATES

Using SST to release the caulking, squeeze the handle until stopped by the stopper bolt.

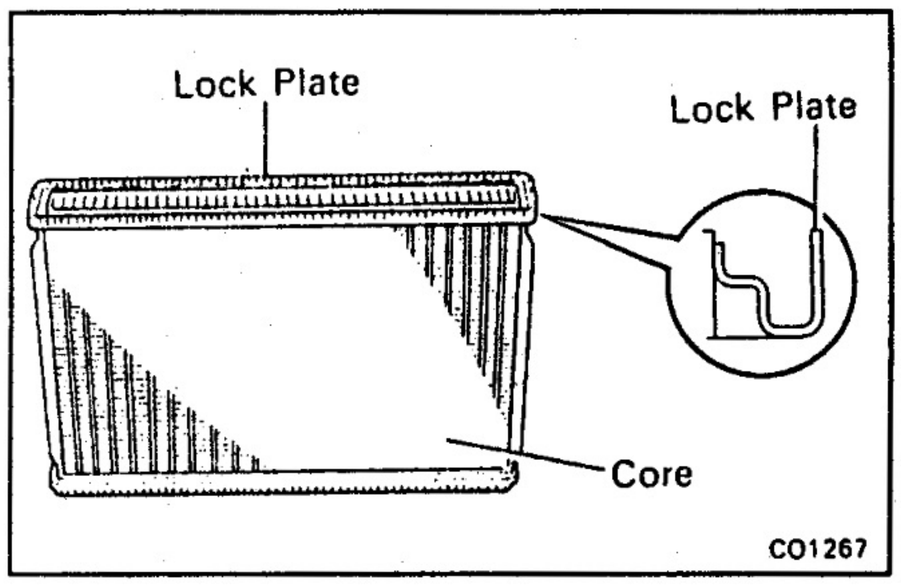
SST 09230−01010

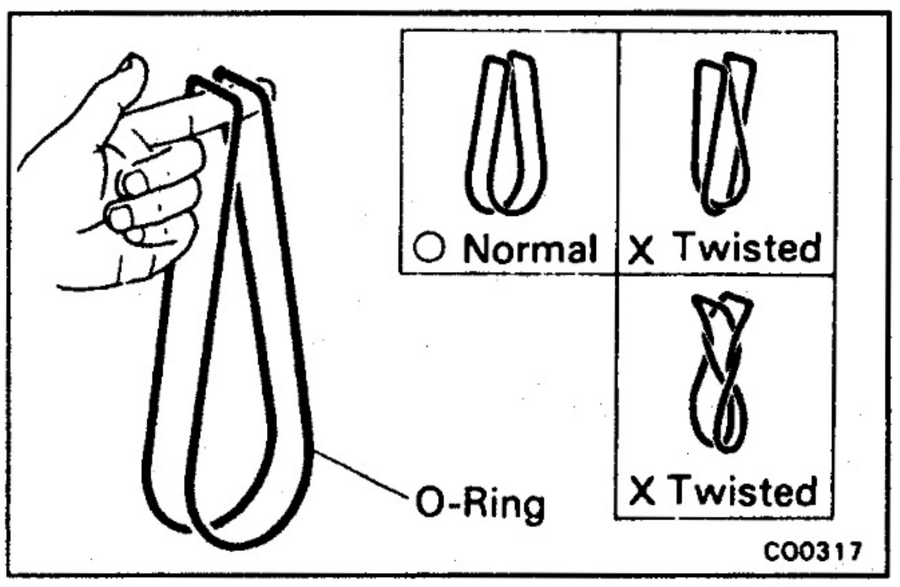


6. REMOVE TANKS AND O−RINGS

(a) Lightly tap the radiator port (inlet or outlet) with a soft −faced hammer, and remove the tank.

(b) Remove the O−ring.





RADIATOR REASSEMBLY

C0006−03

1. INSPECT LOCK PLATE

Inspect the lock plate for damage.

HINT:

- If the sides of the lock plate groove are deformed, reassembly of the tank will be impossible.
- Therefore, first correct any deformation with pliers or similar object. Water leakage will result if the bottom of the lock plate groove is damaged or dented. Therefore, repair or replace if necessary.

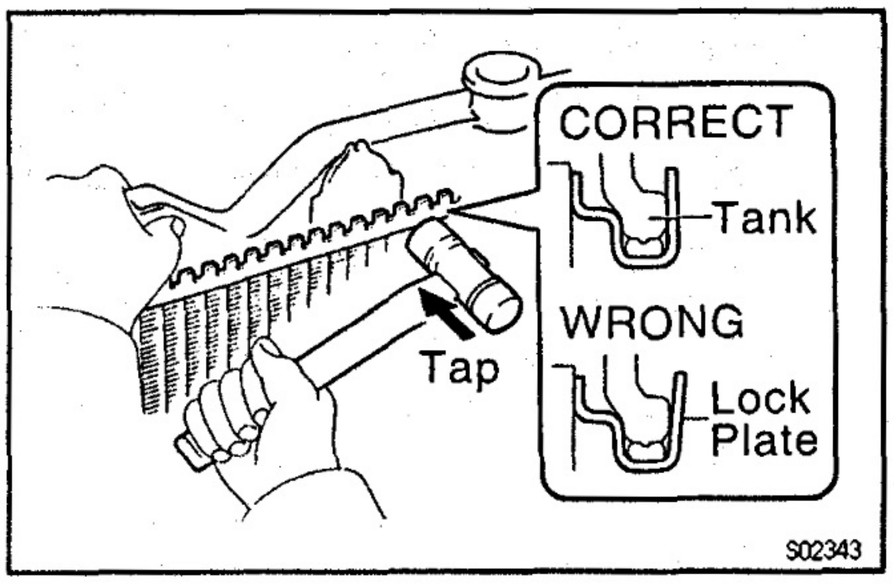
NOTICE: The radiator can only be recaulked 2 times. After the 2nd time, the radiator core must be replaced.

2. INSTALL NEW O−RINGS AND TANKS

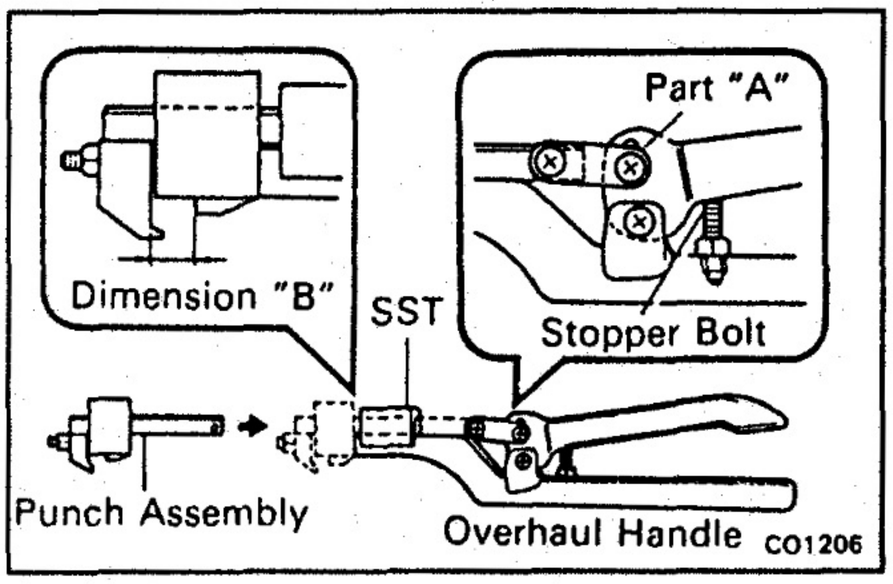
(a) After checking that there are no foreign objects in the lock plate groove, install the new O−ring without twisting it.

HINT: When cleaning the lock plate groove, lightly rub it with sand paper without scratching it.

(b) Install the tank without damaging the O−ring.



(c) Tap the lock plate with a soft–faced hammer so that there is no gap between it and the tank.



3. ASSEMBLE SST

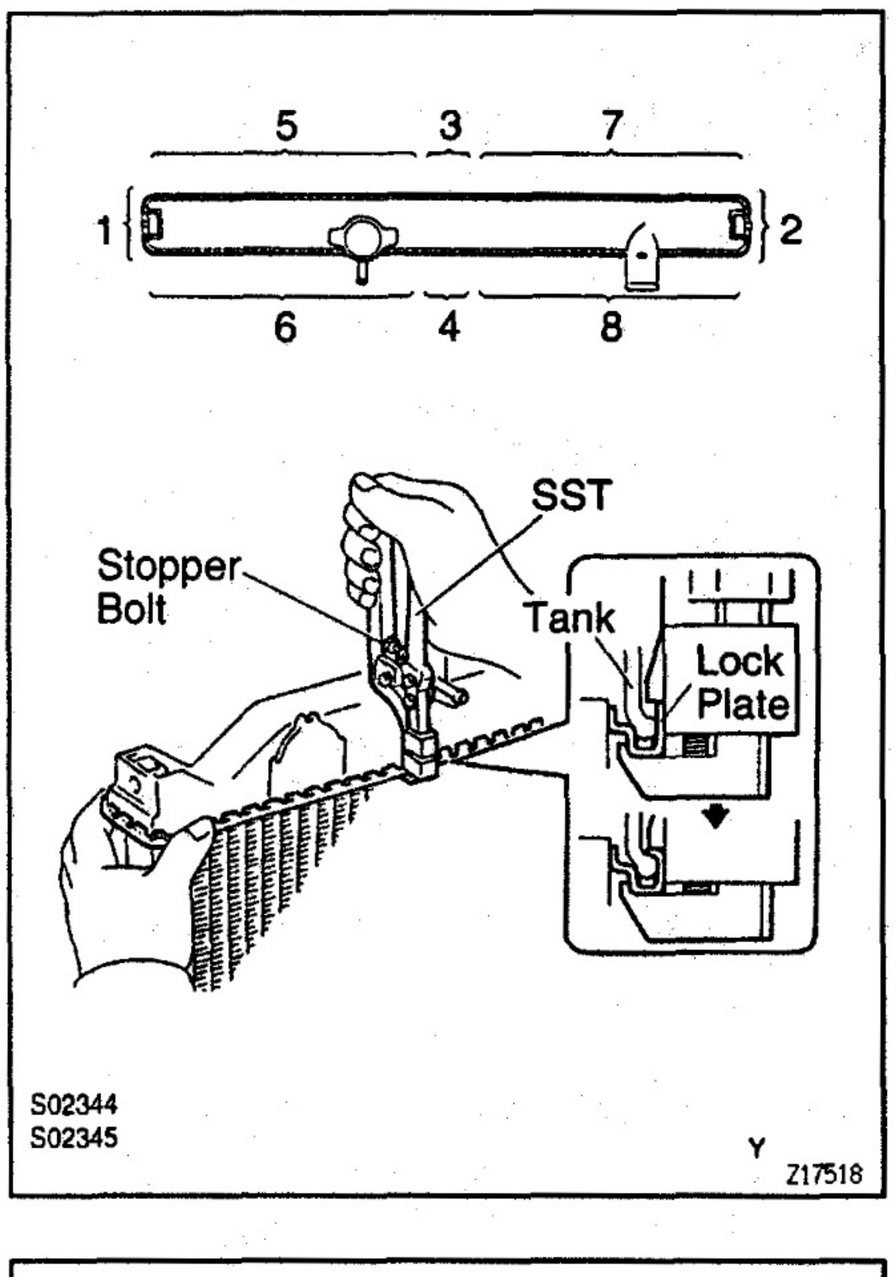
SST 09230–01010, 09231–14010

(a) Install the punch assembly to the overhaul handle, inserting it in the hole in part "A" as shown in the illustration.

(b) While gripping the handle, adjust the stopper bolt so that dimension "B" shown in the diagram.

Dimension "B":

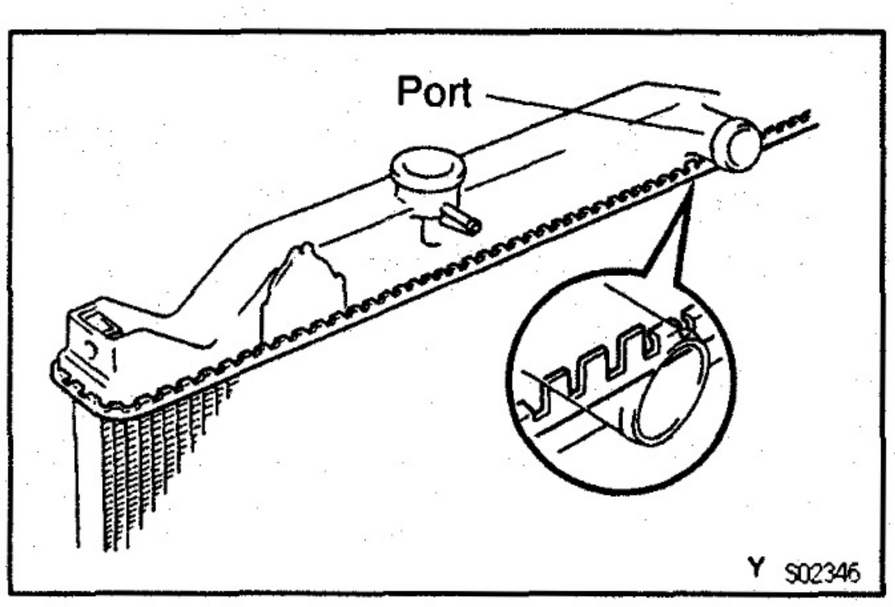
8.4 mm (0.34 in.)



4. CAULK LOCK PLATE

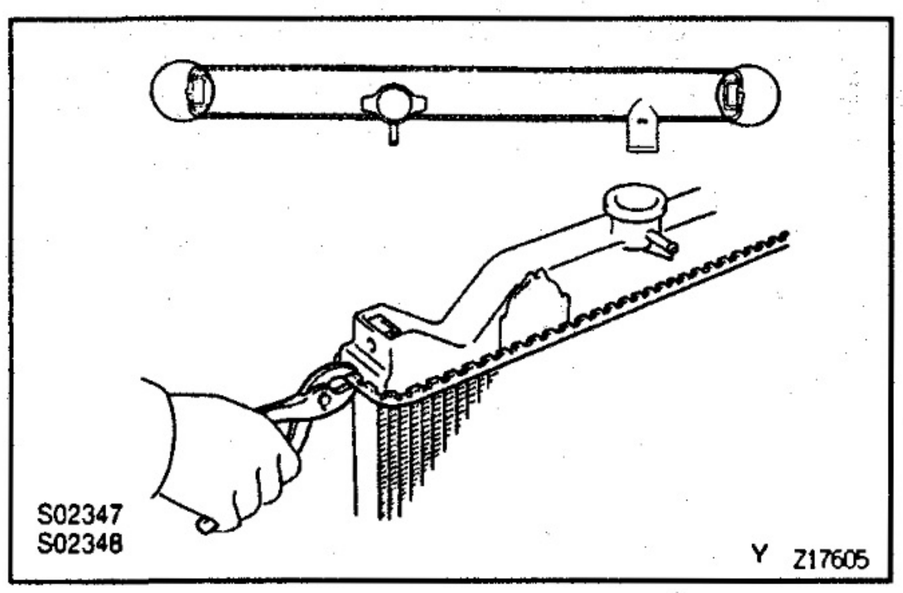
(a) Lightly press SST against the lock plate in the order shown in the illustration. After repeating this a few times, fully caulk the lock plate by squeezing the handle until stopped by the stopper bolt.

SST 09230–01010

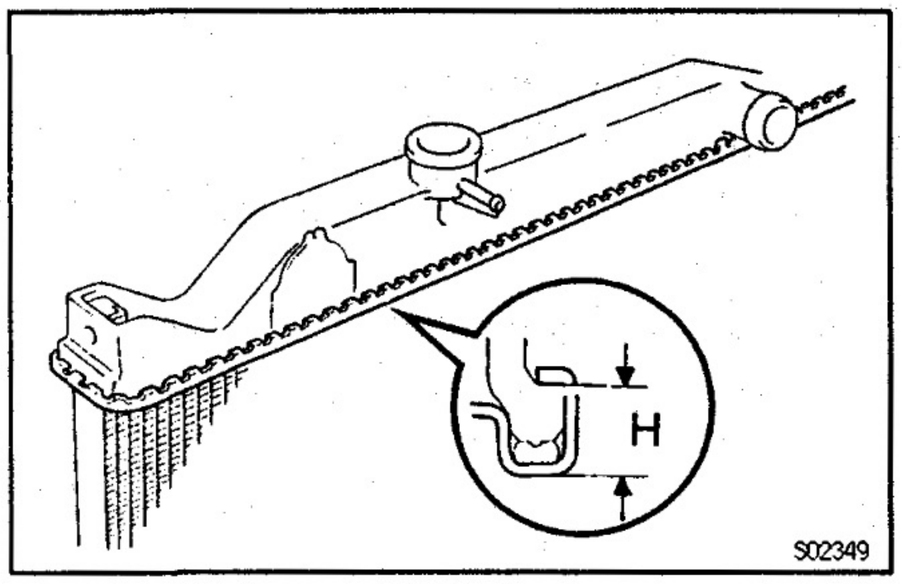


HINT:

- Do not stake the areas protruding around the ports.



- **The points shown in the rib sides near here cannot be staked with SST. Use pliers or similar object and be careful not to damage the core plates.**



(b) Check the lock plate height (H) after completing the caulking.

Plate height (H):

7.4 – 7.8 mm (0.2959 – 0.3119 in.)

If not within the specified height, adjust the stopper bolt of the handle again and caulk again.

5. PAINT LOCK PLATES

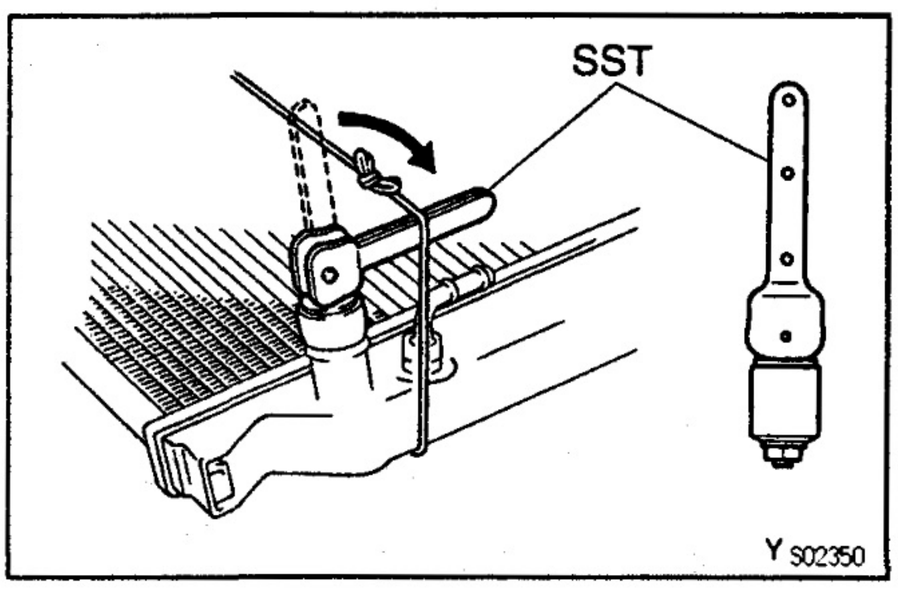
6. INSTALL DRAIN PLUG TO RADIATOR

(a) Install a new O–ring to the drain plug.

(b) Apply soapy water to the O–ring.

(c) Install the drain plug.

7. Reassembly steps 1 and 2 is in the reverse order of disassembly.



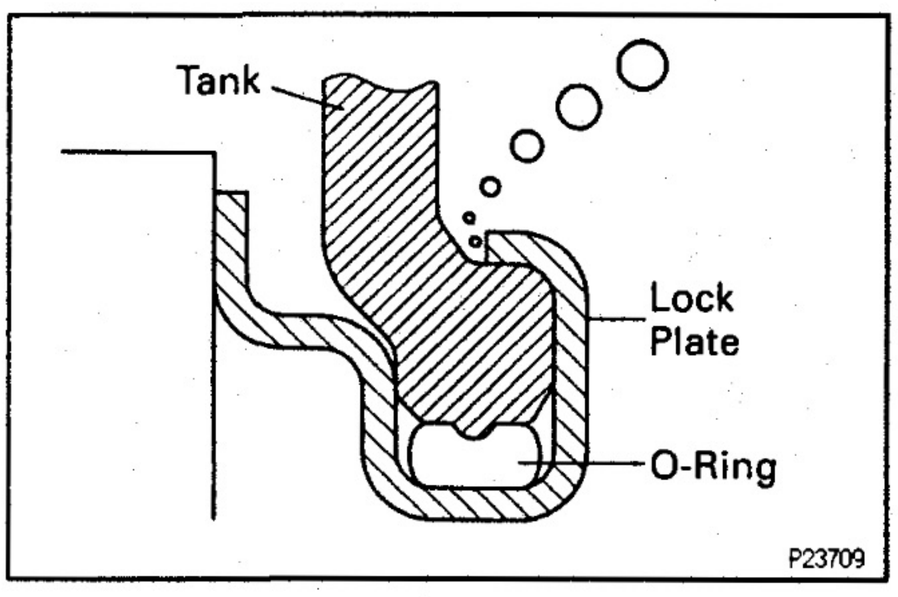
8. CHECK FOR WATER LEAKS

(a) Using SST, plug the inlet and outlet pipes of the radiator.
SST 09230–01010

(b) Using a radiator cap tester, apply pressure to the radiator.

Test pressure:

147 kPa (1.5 kgf/cm², 21 psi)



(c) Check for water leaks.
HINT: On radiators with resin tanks, there is a clearance between the core plate and tank plate where a minute amount of air will remain, giving the appearance of an air leak when the radiator is submerged in water. Therefore, before performing the water leak test, first swirl the radiator around in the water until all air bubbles disappear.

SERVICE SPECIFICATIONS

SERVICE DATA

EG07L–26

Thermostat	Valve opening temperature		80 – 84°C (176 – 183°F)
	Valve lift at 95°C (203°F)		8 mm (0.31 in.) or more
Radiator cap	Relief valve opening pressure	STD	74 – 103 kPa (0.75 – 1.05 kgf/cm², 10.7 – 14.9 psi)
Radiator	Lock plate hight		7.4 – 7.8 mm (0.2959 – 0.3119 in.)

EG

TORQUE SPECIFICATIONS

EG07M–25

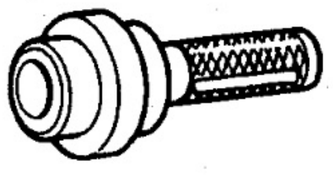
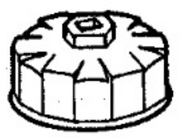
Part tightened		N·m	kgf·cm	ft·lbf
Cylinder block x Drain plug		24.5	250	18
Water pump pulley x Water pump		21	210	16
Water pump x Cylinder block	14 mm head bolt	24.5	250	18
	12 mm head bolt	8.9	90	78 in.·lbf
Fan x Fluid coupling		5.5	55	49 in.·lbf
Water inlet x Water inlet housing		20	200	15
Radiator support x Radiator		13	130	9.6 in.·lbf

LUBRICATION SYSTEM

PREPARATION

SST (SPECIAL SERVICE TOOLS)

EG07P–0X

	09223–50010 Crankshaft Front oil Seal Replacer	
	09228–07501 Oil Filter Wrench	
	09816–30010 Oil Pressure Switch Socket	

EG07Q–0P

RECOMMENDED TOOLS

	09200–00010 Engine Adjust Kit .	

EG07R–0T

EQUIPMENT

Oil pressure gauge	
Precision straight edge	Oil pump
Torque wrench	

EG1CU–0J

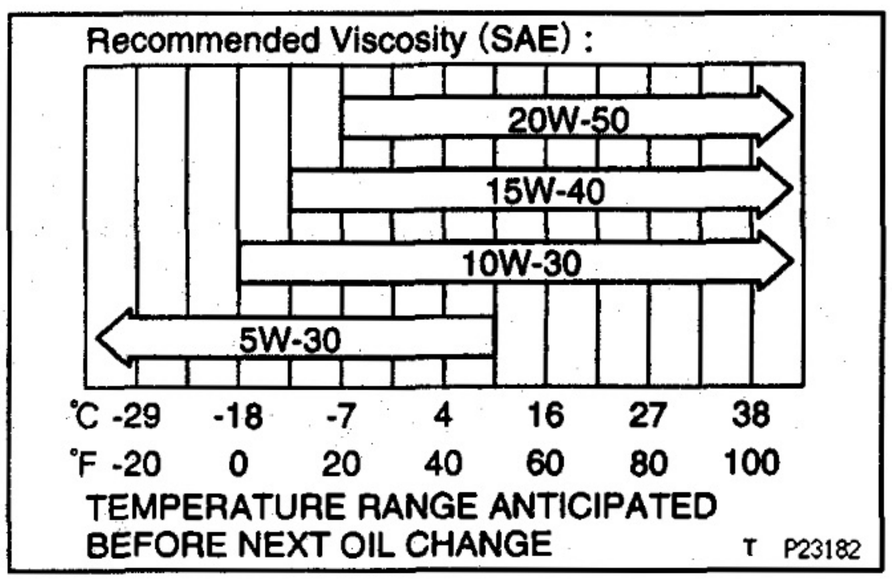
LUBRICANT

Item	Capacity	Classification
Engine oil		API grade SG, SH or ILSAC multigrade engine oil and recommended viscosity oil.
Dry fill	5.8 liters (6.1 US qts, 5.1 Imp. qts)	
Drain and refill		
w/ Oil filter change	5.4 liters (5.7 US qts, 4.8 Imp. qts)	
w/o Oil filter change	4.7 liters (5.0 US qts, 4.1 Imp. qts)	

SSM (SPECIAL SERVICE MATERIALS)

EG07T–0K

	08833–00080 Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure switch



OIL PRESSURE CHECK

EG702-01

1. CHECK ENGINE OIL QUALITY

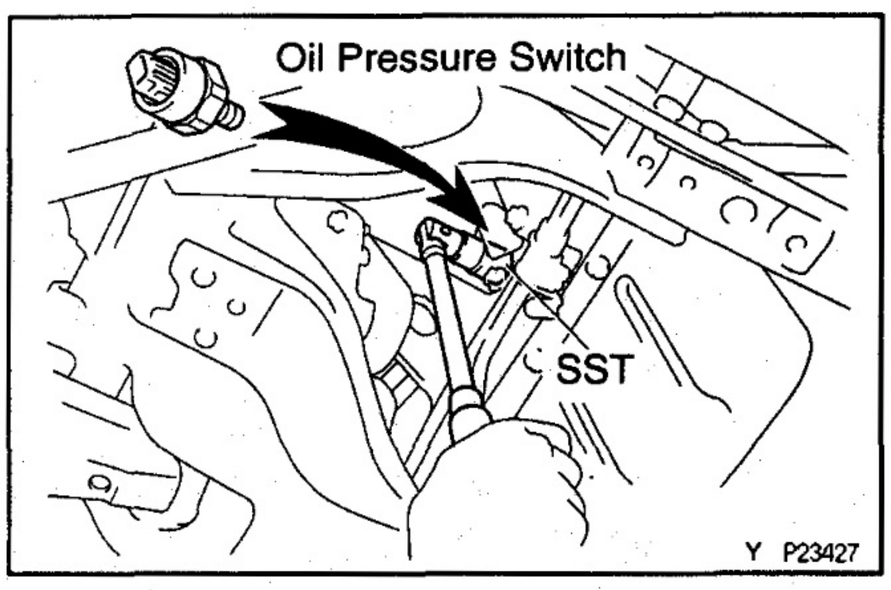
Check the oil for deterioration, entry of water, discoloring or thinning.
If the quality is visibly poor, replace the oil.
Oil grade:

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

2. CHECK ENGINE OIL LEVEL

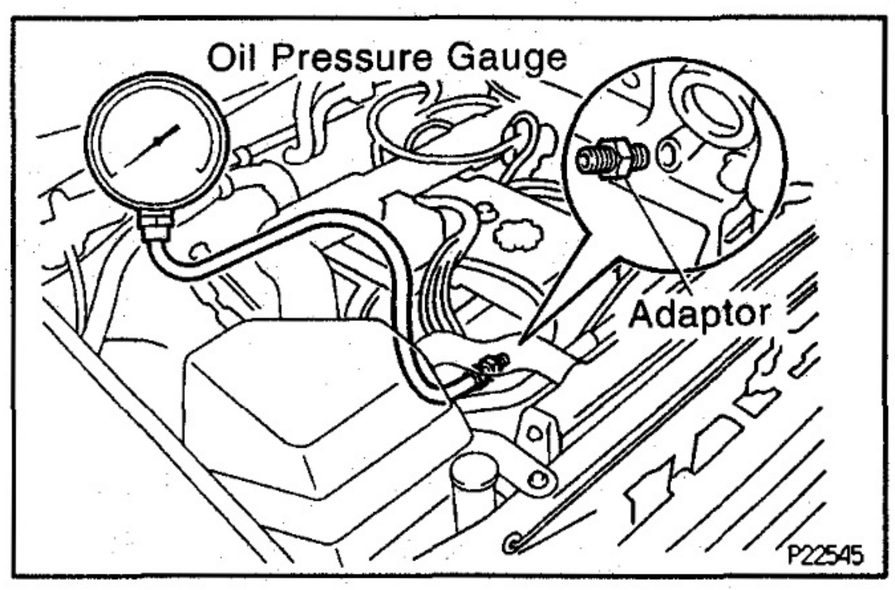
The oil level should be between the "L" and "F" marks on the dipstick.
If low, check for leakage and add oil up to "F" mark.

3. REMOVE ENGINE UNDER COVER



4. REMOVE OIL PRESSURE SWITCH

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



5. INSTALL OIL PRESSURE GAUGE

Install an oil pressure gauge to an adaptor.

6. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

7. INSPECT OIL PRESSURE

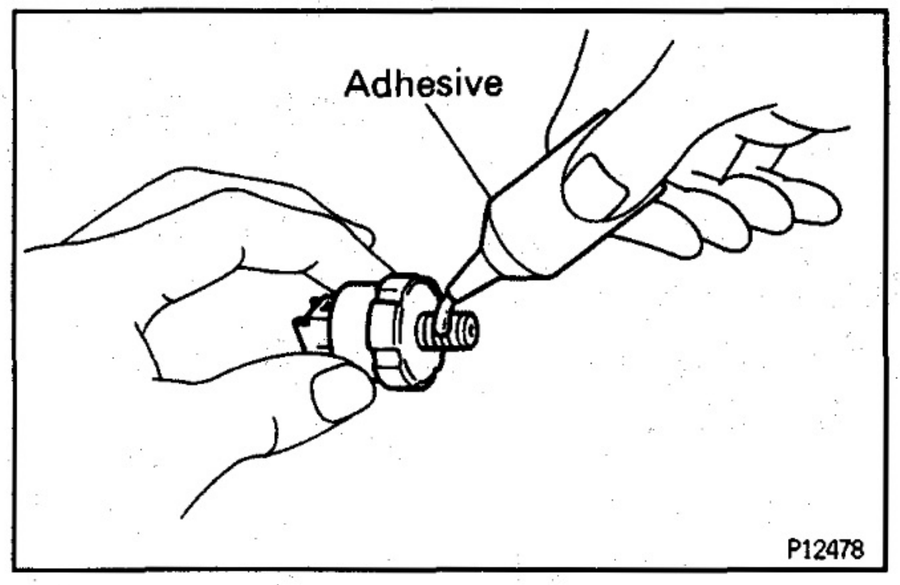
Oil pressure:

At idle

29 kPa (0.3 kgf/cm², 4.3 psi) or more

At 3,000 rpm

245 – 490 kPa (2.5 – 5.0 kgf/cm², 36 – 71 psi)



8. REMOVE OIL PRESSURE GAUGE

9. REINSTALL OIL PRESSURE SWITCH

(a) Apply adhesive to 2 or 3 threads of the oil pressure switch.
Adhesive:

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

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

10. REINSTALL ENGINE UNDER COVER

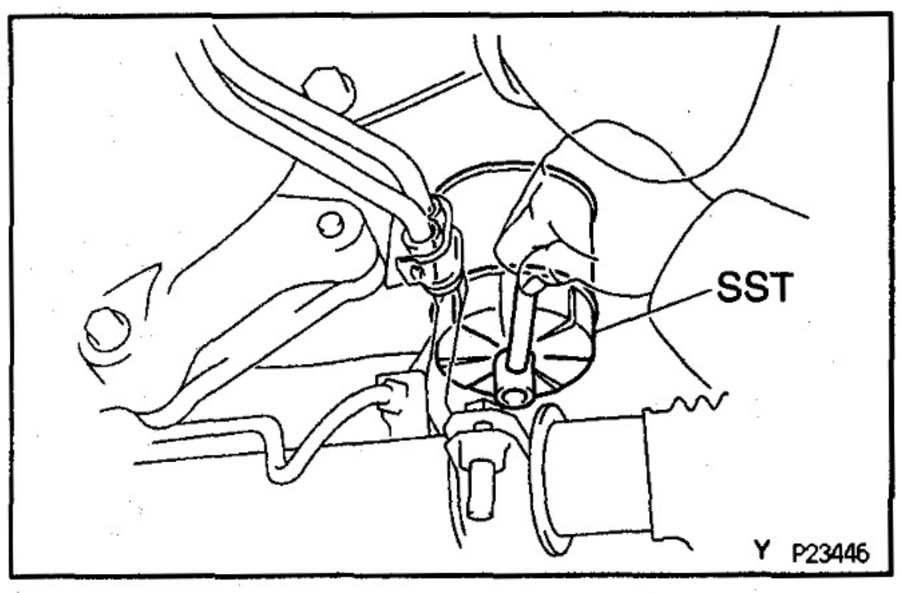
11. START ENGINE AND CHECK FOR LEAKS

OIL AND FILTER REPLACEMENT

5G7A3–02

CAUTION:

- **Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.**
- **Care should be taken, therefore, when changing engine, oil to minimize the frequency and length of time your skin is exposed to used engine oil. Protective clothing and gloves that cannot be penetrated by oil should be worn. The skin should be thoroughly washed with soap and water, or use water–less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.**
- **In order to preserve the environment, used oil and used oil filters must be disposed of only at designated disposal sites.**



1. DRAIN ENGINE OIL

(a) Remove the oil filler cap.

(b) Remove the oil drain plug, and drain the oil into a container.

2. REPLACE OIL FILTER

(a) Using SST, remove the oil filter.
SST 09228–07501

(b) Check and clean the oil filter installation surface.

(c) Apply clean engine oil to the gasket of a new oil filter.

(d) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.

(e) Using SST, tighten it an additional 3/4 turn.
SST 09228–07501

3. REFILL WITH ENGINE OIL

(a) Clean and install the oil drain plug with a new gasket.
Torque: 37 N·m (375 kgf·cm, 27 ft·lbf)

(b) Fill with fresh engine oil.
Oil capacity
Dry fill
5.8 liters (6.1 US qts, 5.1 Imp. qts)
Drain and refill
w/ Oil filter change
5.4 liters (5.7 US qts, 4.8 Imp. qts)
w/o Oil filter change
4.7 liters (5.0 US qts, 4.1 Imp. qts)

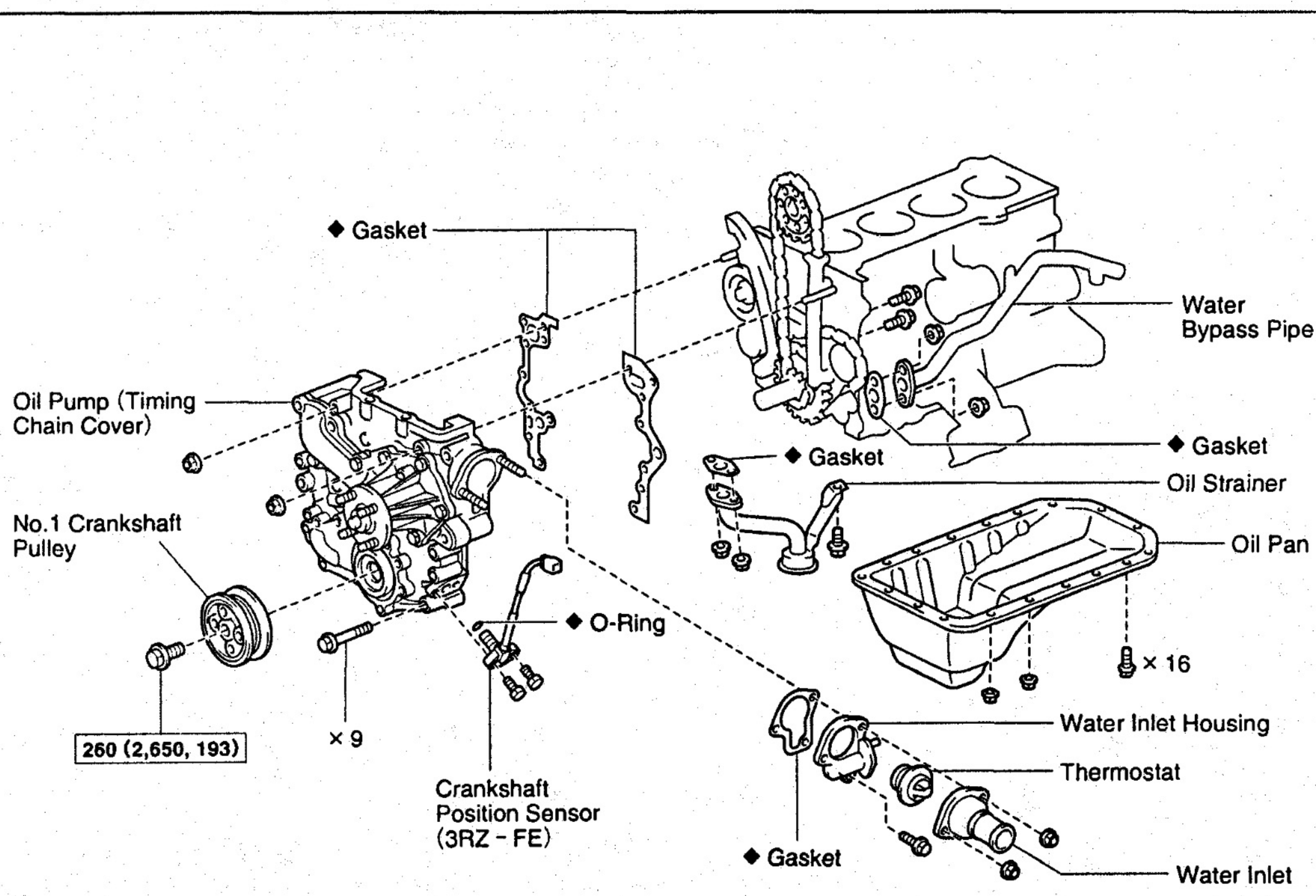
(c) Reinstall the oil filler cap.

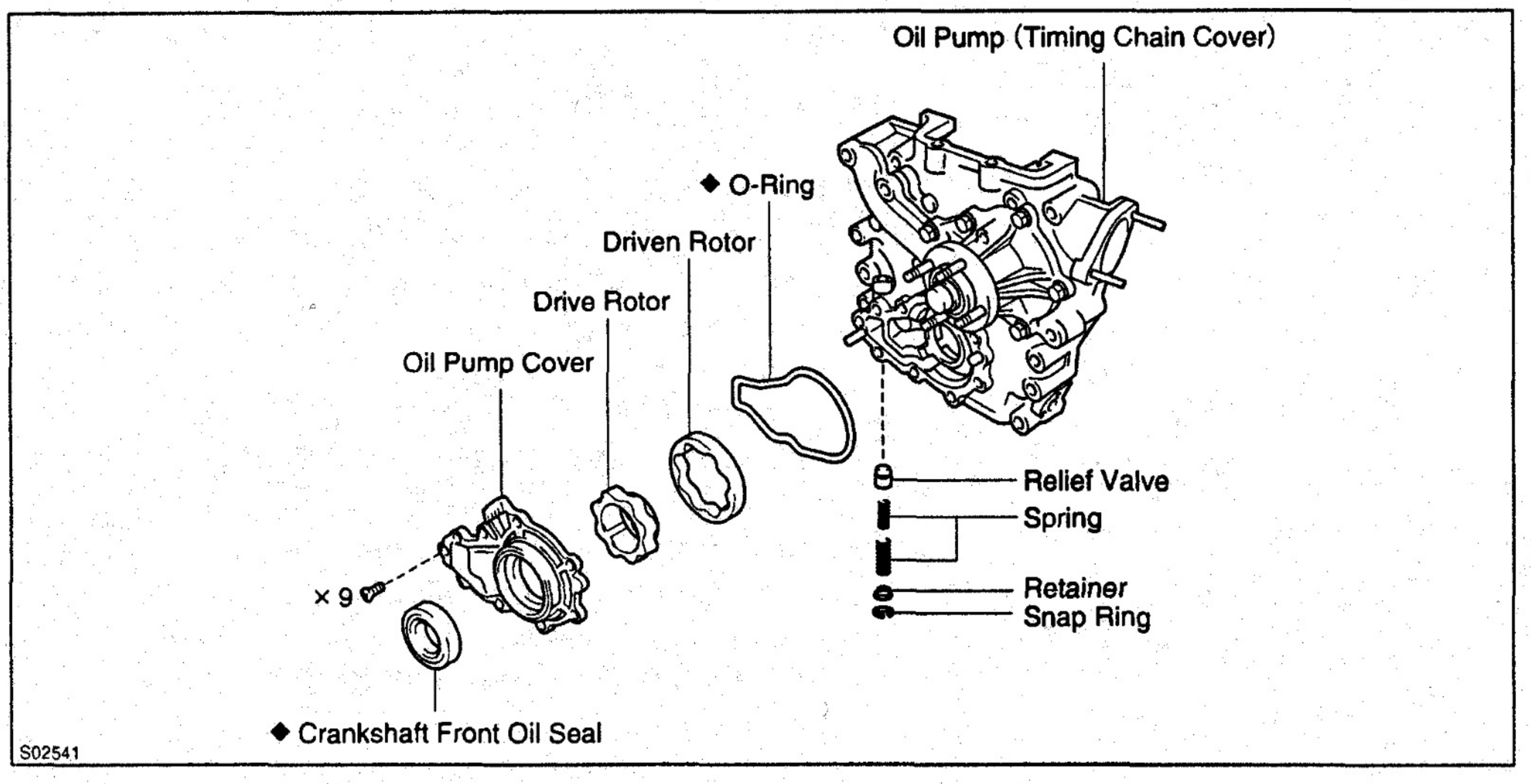
4. START ENGINE AND CHECK FOR LEAKS

5. RECHECK ENGINE OIL LEVEL

OIL PUMP
COMPONENTS

EG794-01





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

◆ Non-reusable part

T

S03885

EG

EGSCU–05

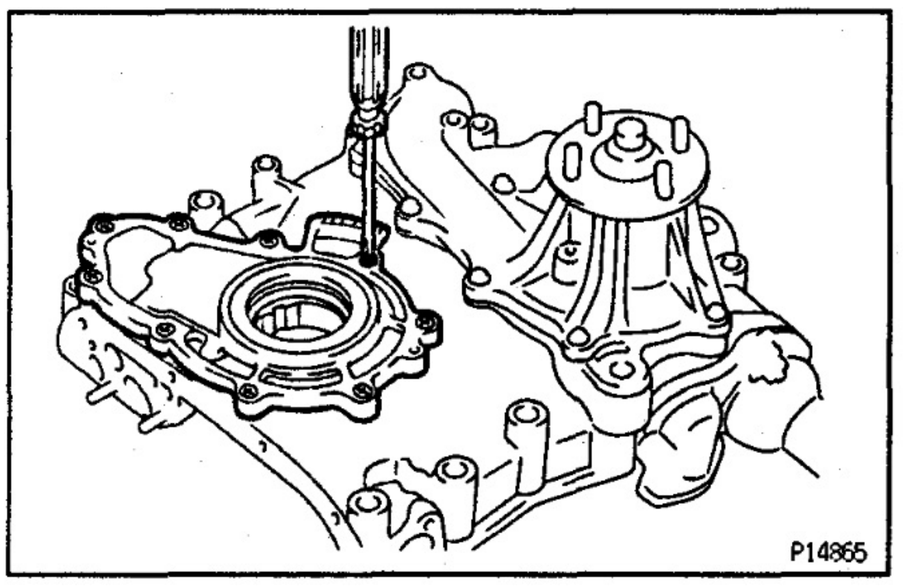
OIL PUMP REMOVAL

1. **REMOVE CYLINDER HEAD ASSEMBLY**
   (See cylinder head removal in Engine Mechanical)
2. **REMOVE OIL PAN**
3. **REMOVE WATER INLET AND WATER INLET HOUSING**

(a) Remove the 2 nut, water inlet and thermostat.

(b) Remove the bolt and water inlet housing and gasket.

4. **REMOVE TIMING CHAIN COVER**
   (See timing chain removal in Engine Mechanical)



P14865

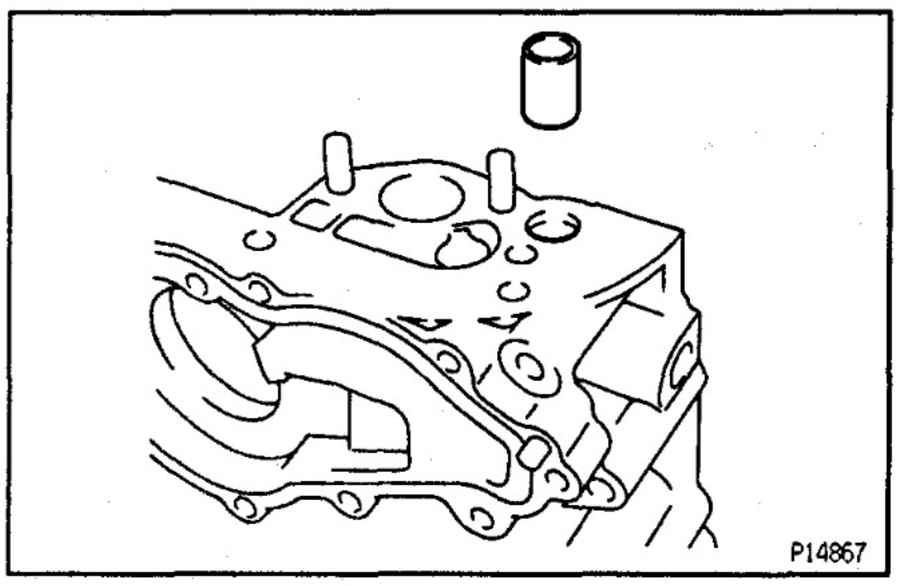
EGSP7–04

OIL PUMP DISASSEMBLY

1. **REMOVE DRIVE AND DRIVEN ROTORS**
   Remove the 9 screws, pump cover, drive rotor, driven rotor and O–ring.
2. **REMOVE RELIEF VALVE**

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

(b) Remove the retainer, spring(s) and relief valve.



P14867

EGSP8–00

OIL PUMP INSPECTION

1. **INSPECT RELIEF VALVE**
   Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.
   If it does not, replace the relief valve. If necessary, replace the oil pump assembly.

2. **INSPECT DRIVE AND DRIVEN ROTORS**

A. Inspect rotor body clearance

Using a thickness gauge, measure the clearance between the driven rotor and body.

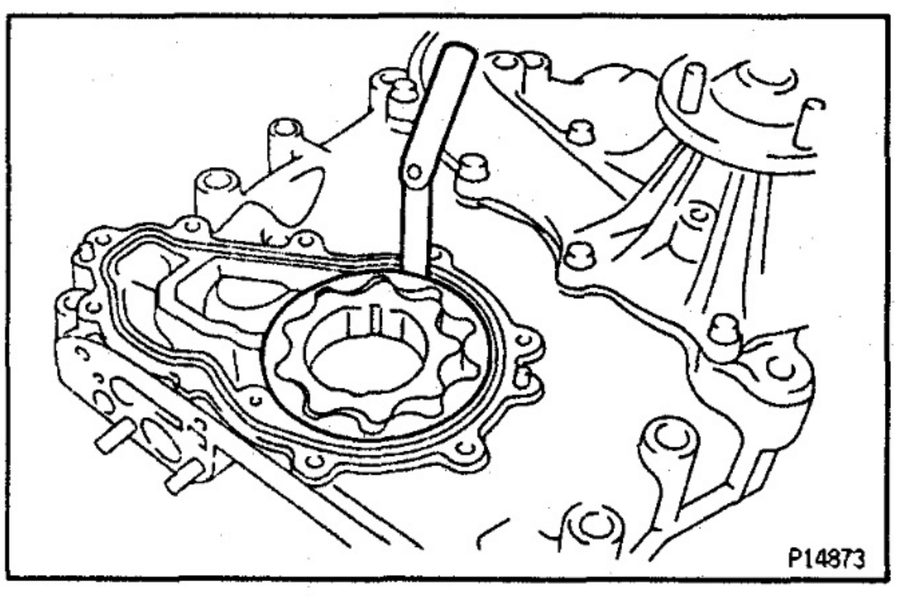
Standard body clearance:

0.100 – 0.175 mm (0.0039 – 0.0069 in.)

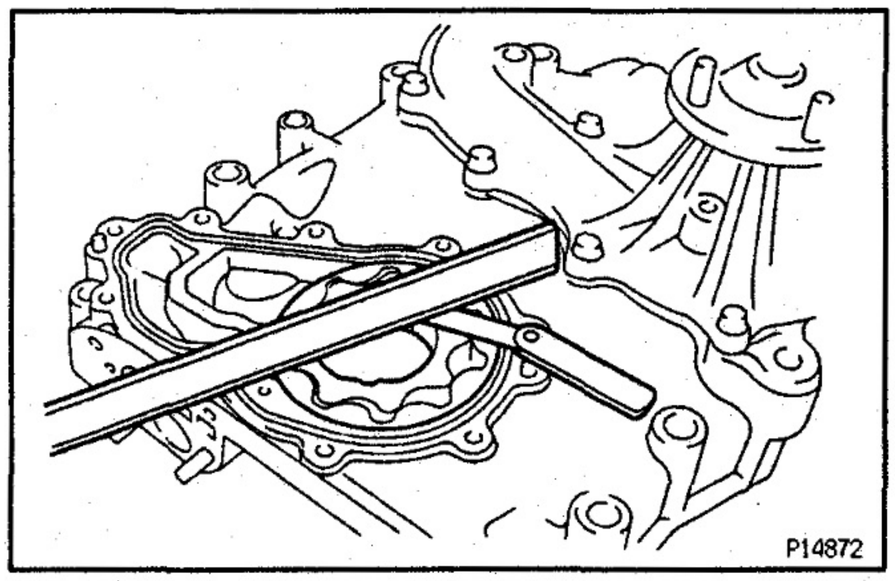
Maximum body clearance:

0.30 mm (0.0118 in.)

If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.



P14873



B. Inspect rotor side clearance

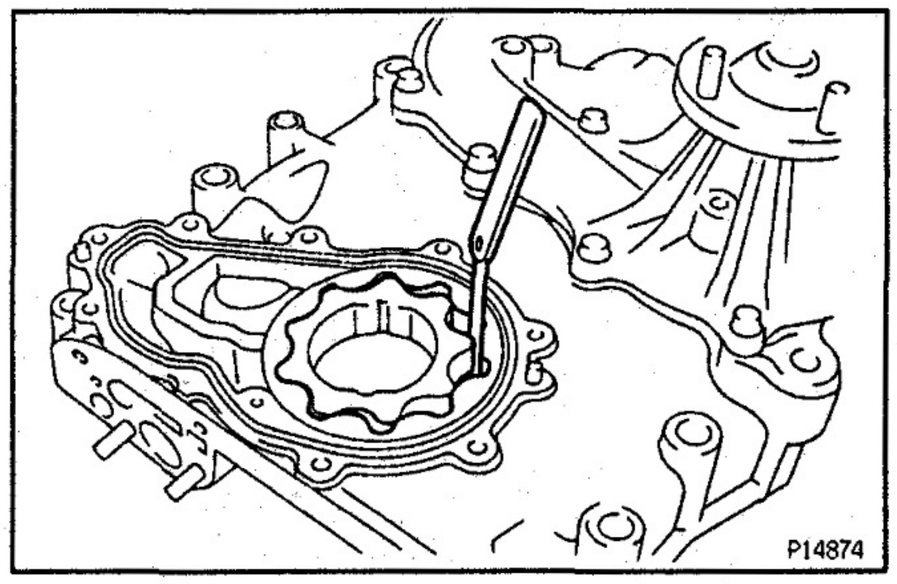
Using a thickness gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.

Standard side clearance:

0.030 — 0.090 mm (0.0012 — 0.0035 in.)

Maximum side clearance: 0.15 mm (0.0059 in.)

If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.



C. Inspect rotor tip clearance

Using a thickness gauge, measure the clearance between the drive and driven rotor tips.

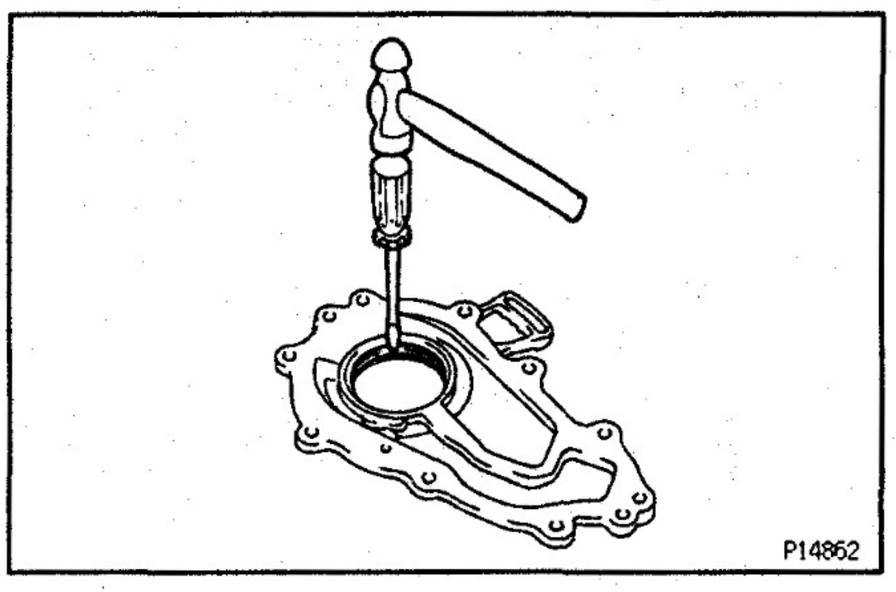
Standard tip clearance:

0.110 — 0.240 mm (0.0043 — 0.0094 in.)

Maximum tip clearance:

0.25 mm (0.0098 in.)

If the tip clearance is greater than maximum, replace the rotors as a set.



EG5P8-04

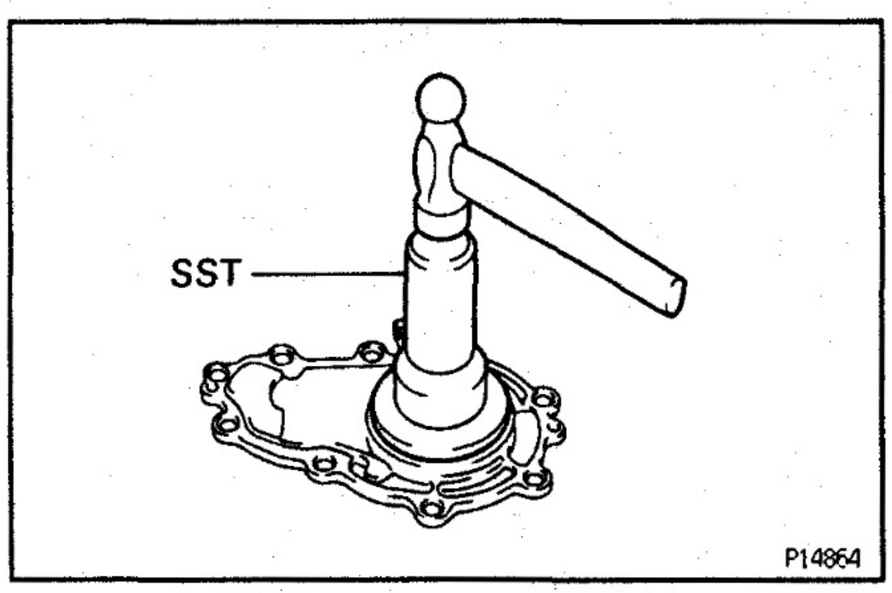
CRANKSHAFT FRONT OIL SEAL REPLACEMENT

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

1. REPLACE CRANKSHAFT FRONT OIL SEAL

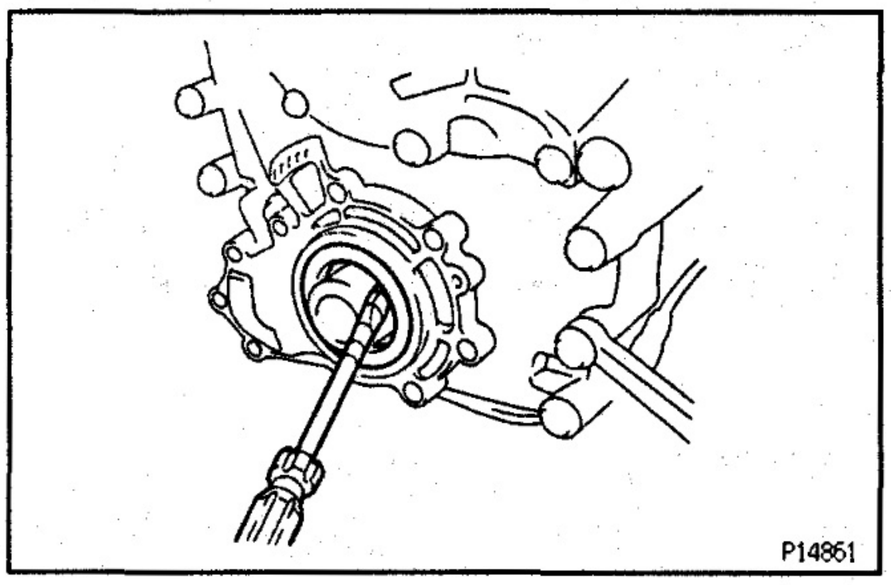
A. If oil pump is removed from cylinder block:

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



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump case edge.
SST 09223—50010

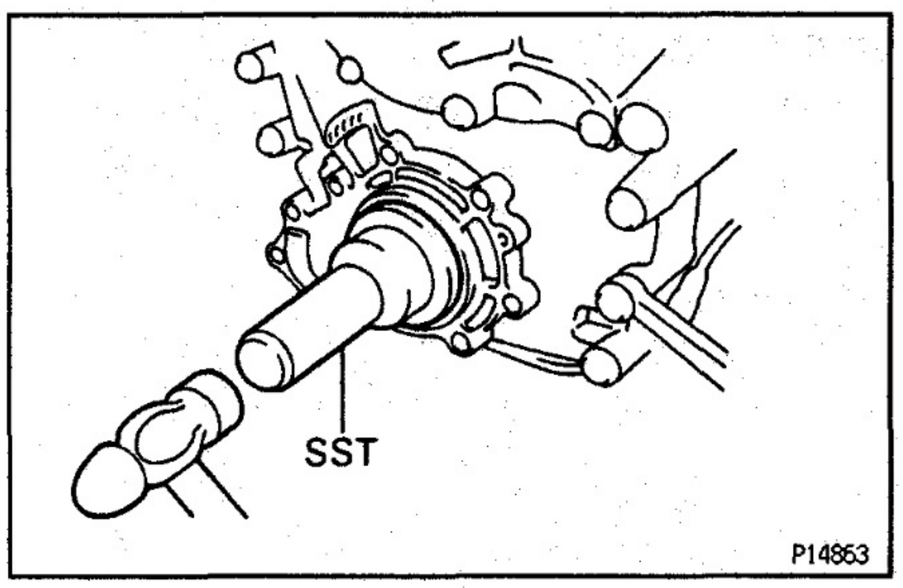
(c) Apply MP grease to the oil seal lip.



B. If oil pump is installed to cylinder block:

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

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

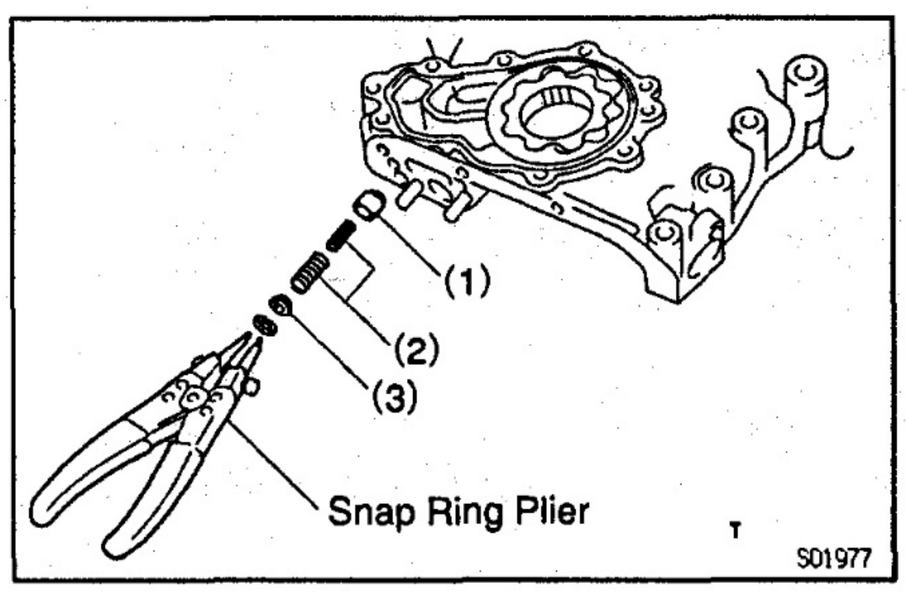


(b) Apply MP grease to a new oil seal lip.
(c) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.
SST 09223–50010

EG

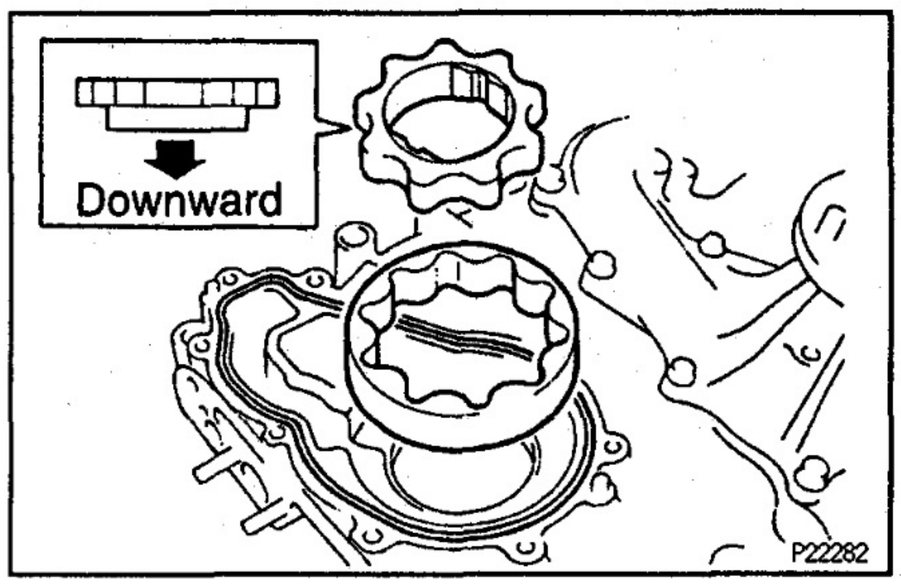
EG5CW–05

OIL PUMP ASSEMBLY



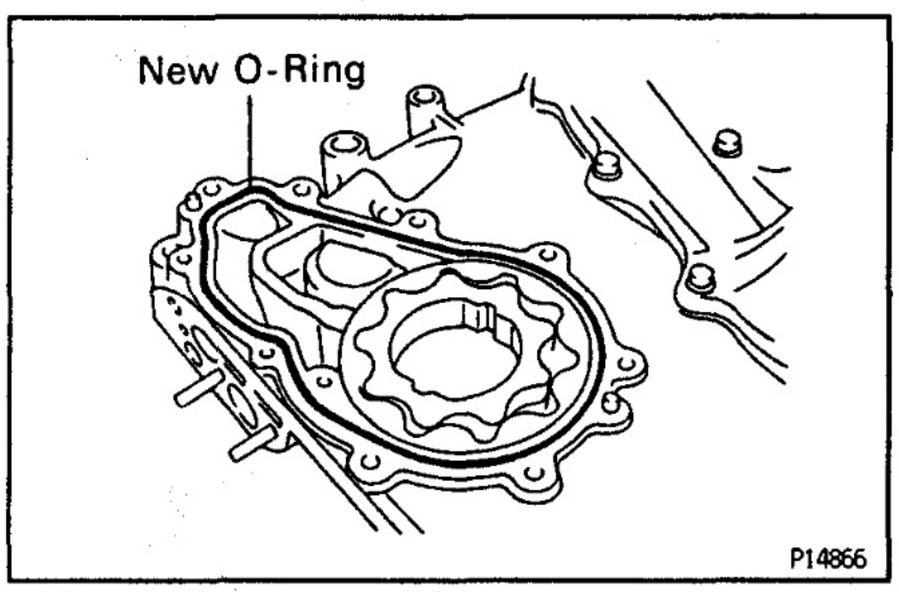
1. INSTALL RELIEF VALVE

(a) Install these parts:
(1) Relief valve
(2) Spring(s)
(3) Retainer
(b) Using snap ring pliers, install the snap ring.



2. INSTALL DRIVE AND DRIVEN ROTORS

(a) Place the drive and driven rotors into the pump body.



(b) Place a new O–ring to the pump body.
(c) Install the pump cover with the 9 screws.

EG5CX–05

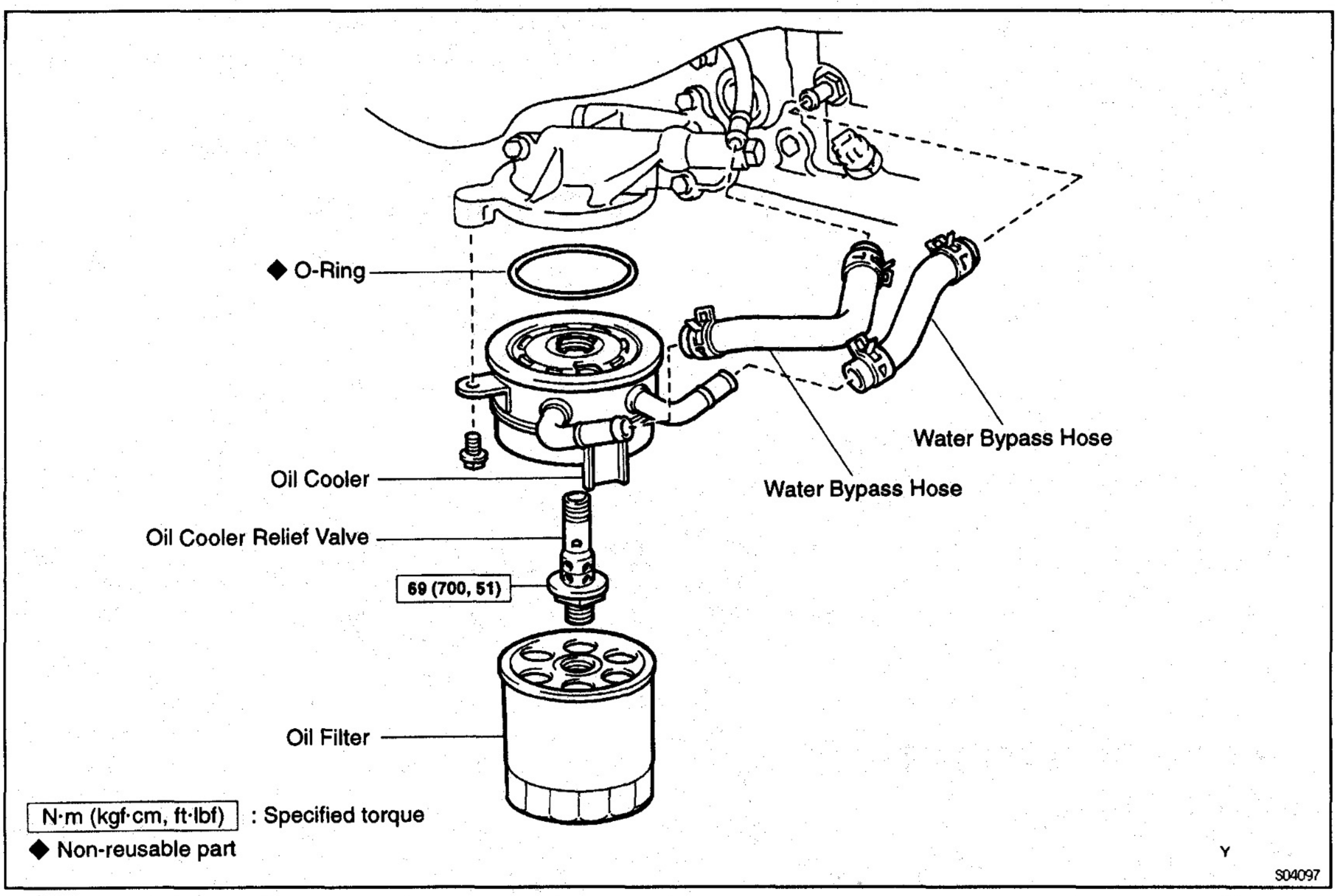
OIL PUMP INSTALLATION

1. INSTALL TIMING CHAIN COVER
(See timing chain installation in Engine Mechanical)
2. INSTALL WATER INLET AND WATER INLET HOUSING
3. INSTALL OIL PAN
4. INSTALL CYLINDER HEAD ASSEMBLY
(See cylinder head installation in Engine Mechanical)

OIL COOLER

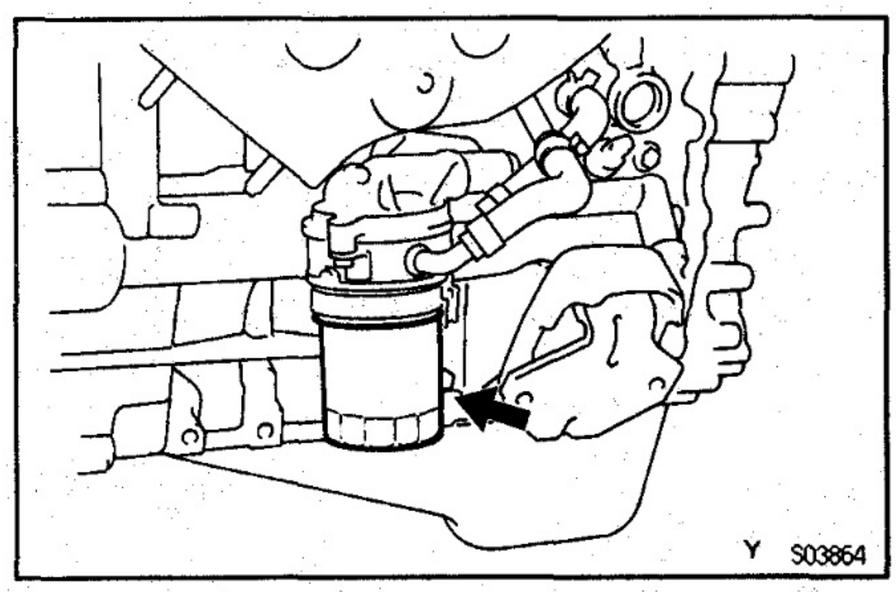
COMPONENTS FOR REMOVAL AND INSTALLATION

EG20M–09

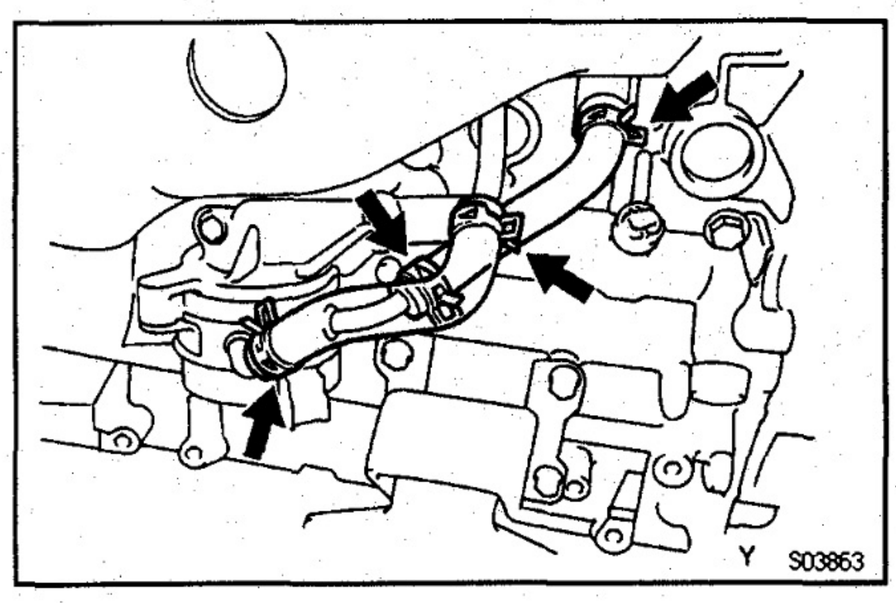


EG795–01

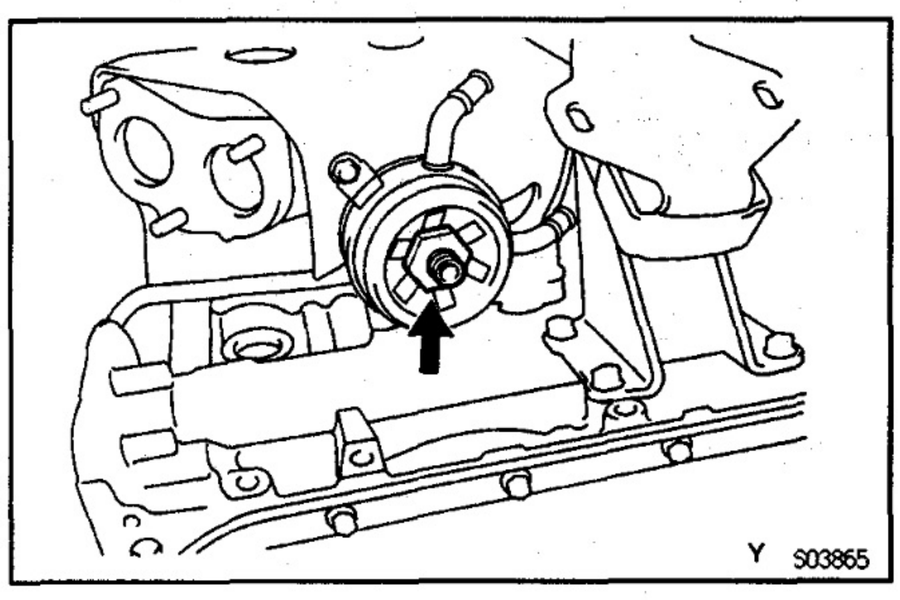
OIL COOLER REMOVAL



1. **DRAIN ENGINE COOLANT**
2. **REMOVE OIL FILTER**
   SST 09228–07501



3. **DISCONNECT OIL COOLER HOSES**
   Disconnect the oil cooler hoses.



4. REMOVE OIL COOLER

Remove the oil cooler relief valve, oil cooler and O–ring.

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

INSTALLATION HINT:

- Replace the O–ring with a new part.
- Use a new gasket to the oil cooler relief valve.

EG

OIL COOLER INSPECTION

EG1CZ–06

INSPECT OIL COOLER

Check the oil cooler for damage or clogging.

If necessary, replace the oil cooler.

OIL COOLER INSTALLATION

EG67E–03

Installation is in the reverse order of removal.

SERVICE SPECIFICATIONS

SERVICE DATA

EG09H–08

Oil pressure	Normal operating temperature	at idle speed	29 kPa (0.3 kgf/cm², 4.3 psi) or more
		at 3,000 rpm	245 – 490 kPa (2.5 – 5.0 kgf/cm², 36 – 71 psi)
Oil pump	Body clearance	STD	0.100 – 0.175 mm (0.0039 – 0.0069 in.)
		Maximum	0.30 mm (0.0118 in.)
	Tip clearance	STD	0.110 – 0.240 mm (0.0043 – 0.0094 in.)
		Maximum	0.25 mm (0.0098 in.)
	Side clearance	STD	0.030 – 0.090 mm (0.0012 – 0.0035 in.)
		Maximum	0.15 mm (0.0059 in.)

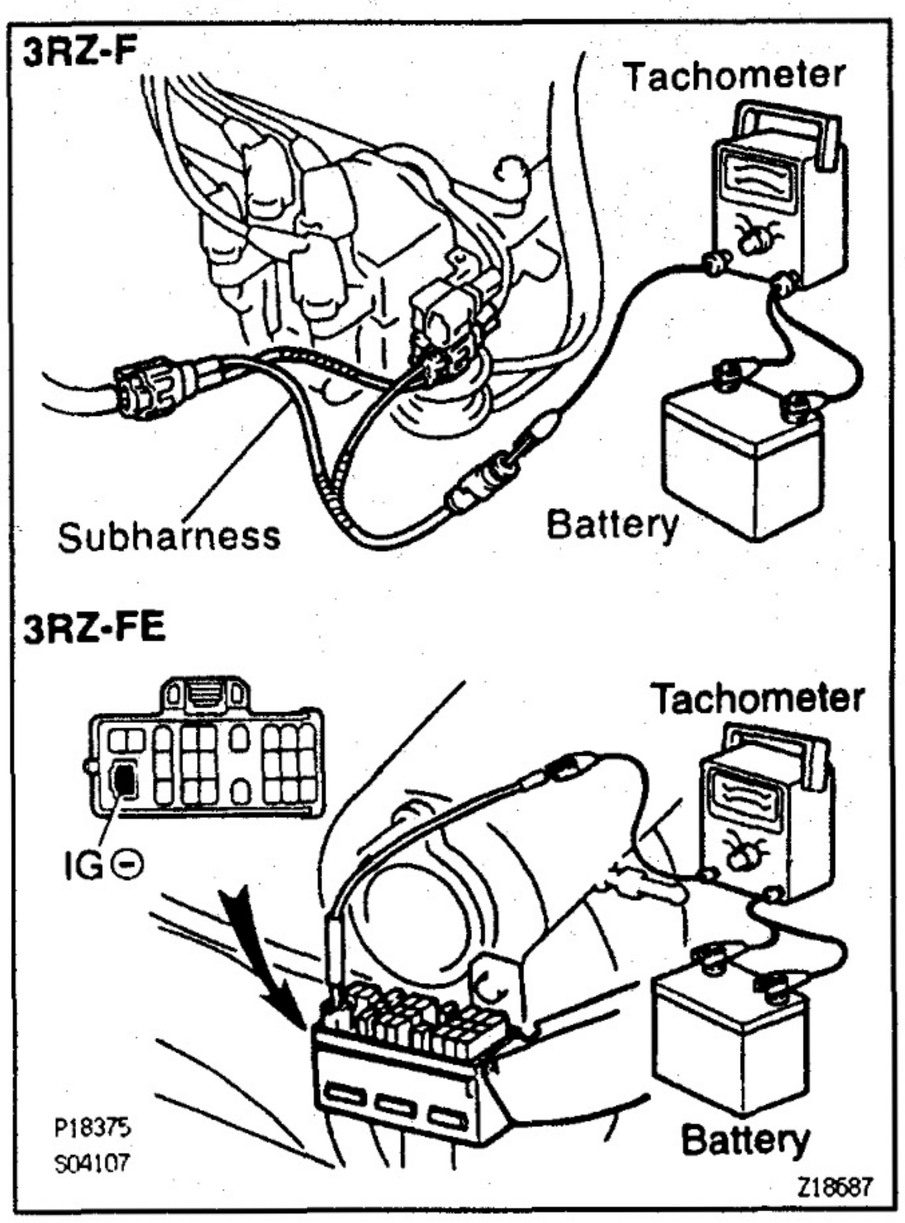
TORQUE SPECIFICATIONS

EG0NY–0K

Part tightened	N·m	kgf·cm	ft·lbf
Oil pan x Drain plug	37	375	27
Cylinder block x Relief valve	59	600	43

IGNITION

PRECAUTION ..... IG– 2
PREPARATION ..... IG– 2
ON–VEHICLE INSPECTION ..... IG– 3
DISTRIBUTOR
(3RZ–F) ..... IG– 8
DISTRIBUTOR
(3RZ–FE) ..... IG– 19
CRANKSHAFT POSITION SENSOR
(3RZ–FE) ..... IG– 23
SERVICE SPECIFICATIONS ..... IG– 24



PRECAUTION

IG003-01

1. Do not leave the ignition switch on for more than 10 minutes if the engine does not start.
2. 3RZ—F:
   With a tachometer connected to the system, disconnect the distributor connector (for negative (—) terminal of ignition coil). Then connect the subharness to the distributor. Connect the test probe of a tester to the subharness form the distributor.
   3RZ—FE:
   With a tachometer connected to the system, connect the tester probe of the tachometer to terminal IG⊖ of the check connector.
3. As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before use.
4. NEVER allow the tachometer terminals to touch ground as it could result in damage to the igniter and/or ignition coil.
5. Do not disconnect the battery while the engine is running.
6. Check that the igniter is properly grounded to the body.

PREPARATION

RECOMMENDED TOOLS

IG00S—0L

	09082—00040	TOYOTA Electrical Tester.	
	09200—00010	Engine Adjust Kit .	

EQUIPMENT

IG00T—1S

Spark plug cleaner	

SSM (SPECIAL SERVICE MATERIALS)

IG00U—0D

08826—00080	Seal Packing Black or equivalent (FIPG)	Ignition coil
08833—00070	Adhesive 1324, THREE BOND 1324 or equivalent	Signal generator (3RZ—F)

ON–VEHICLE INSPECTION

SPARK TEST

IGOG6–06

CHECK THAT SPARK OCCURS

(a) Disconnect the high–tension cords from the spark plugs.
(b) Remove the spark plugs.
(c) Install the spark plugs to each high–tension cord.
(d) Ground the spark plug.
(e) Check if spark occurs while engine is being cranked.
HINT: (3RZ–FE) To prevent gasoline from being injected from injectors during this test, crank the engine for no more than 1 – 2 seconds at a time.
If the spark does not occur, perform the test as follows:

SPARK TEST
↓ NO
CHECK CONNECTION OF IGNITION COIL IGNITER AND DISTRIBUTOR CONNECTOR → BAD → Connect securely.
↓ OK
CHECK RESISTANCE OF HIGH-TENSION CORD (See page IG-4)
Maximum resistance: 25 kΩ par cord → BAD → Replace the cord (s).
↓ OK
CHECK POWER SUPPLY TO IGNITION COIL AND IGNITER
1. Turn ignition switch to ON.
2. Check that there is battery voltage at ignition coil positive (+) terminal.
→ BAD → Check wiring between ignition switch to ignition coil and igniter
↓ OK
CHECK RESISTANCE OF IGNITION COIL
(See page IG-6)

Resistance:	Cold	Hot
Primary	0.36 - 0.55Ω	0.45 - 0.65Ω
Secondary	9.0 - 15.4 kΩ	11.4 - 18.1 kΩ

→ BAD → Replace the ignition coil.
↓ OK
CHECK RESISTANCE OF SIGNAL GENERATOR (PICKUP COIL)
(See page IG-6)

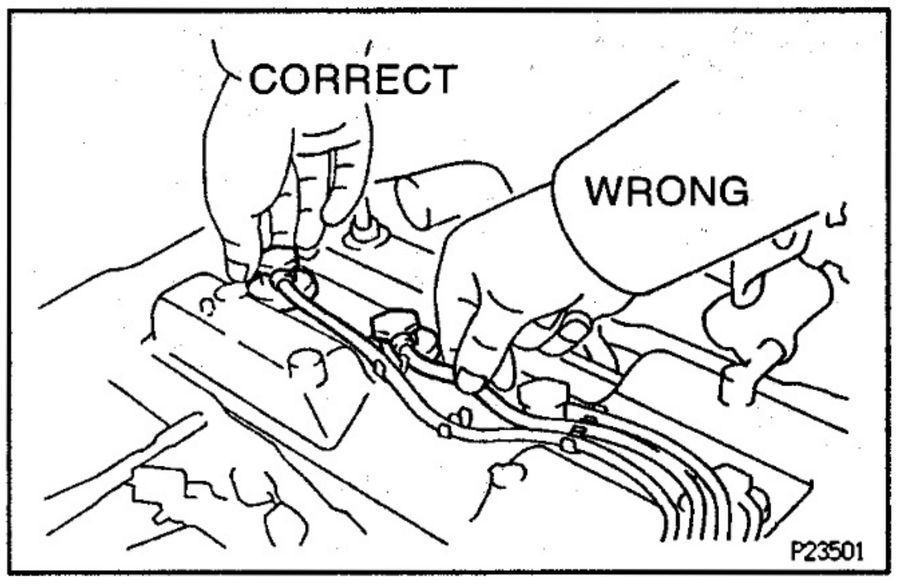
Resistance:	Cold	Hot
G ⊕ and GE ⊖	185 - 275Ω	240 - 325Ω

→ BAD → Replace the signal generator (pickup coil) (3RZ-F) or distributor housing assembly (3RZ-FE) .
↓ OK
(3RZ-FE) CHECK RESISTANCE OF CRANKSHAFT POSITION SENSOR
(See page IG-7)

Resistance:	Cold	Hot
NE ⊕ and NE ⊖	1630 - 2740Ω	2065 - 3225Ω

→ BAD → Replace the crankshaft position sensor.
↓ OK
CHECK AIR GAP OF DISTRIBUTOR
(See page IG-6)
Air gap: 0.2 - 0.4 mm (0.008 - 0.016 in.)
→ BAD → Replace the signal generator (pickup coil) (3RZ-F) or distributor housing assembly (3RZ-FE) .
↓ OK
(3RZ-FE) CHECK IGT SIGNAL FROM ECU
(See page EG-158)
→ BAD → Check wiring between ECU,distributor and igniter,and then try another ECU.
↓
TRY ANOTHER IGNITER

Y
V07969



HIGH–TENSION CORDS INSPECTION

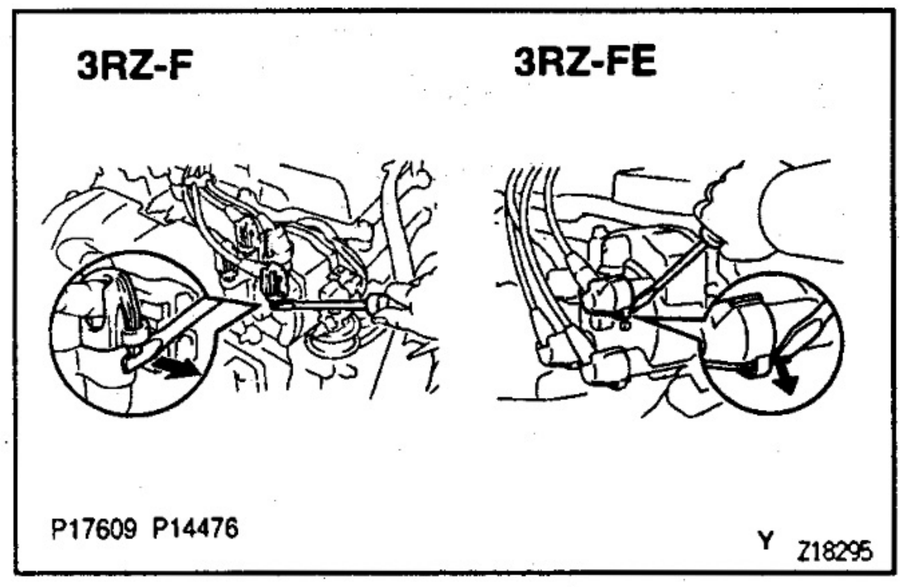
IG004-01

1. DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS

Disconnect the high – tension cords at the rubber boot.

DO NOT pull on the cords.

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



2. DISCONNECT HIGH–TENSION CORDS FROM DISTRIBUTOR CAP

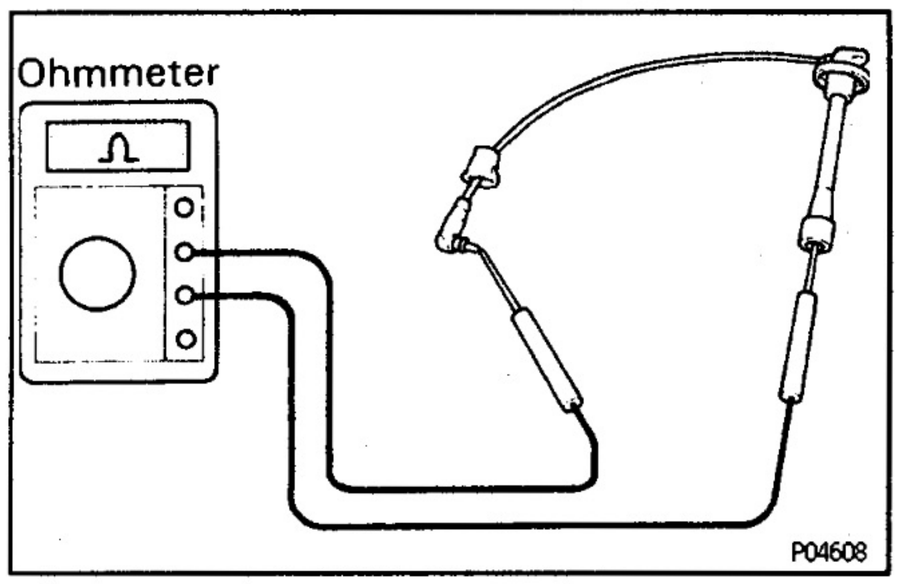
(a) Using a screwdriver, lift up the lock claw and disconnect the holder from the distributor cap.

(b) Disconnect the high–tension cord at the grommet.

DO NOT pull on the cord.

NOTICE:

- **Pulling on or bending the cords may damage the conductor inside.**
- **Do not wipe any of the oil from the grommet after the high–tension cord is disconnected.**



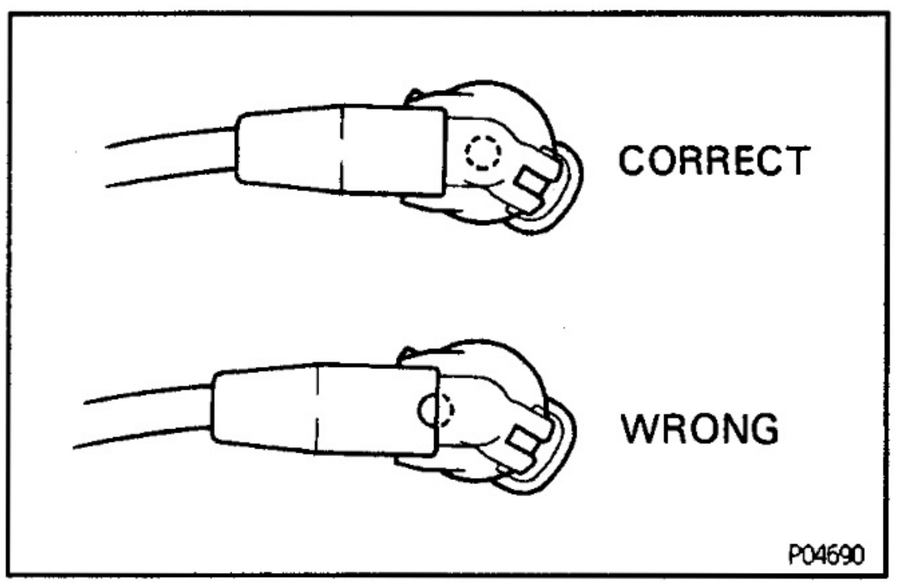
3. INSPECT HIGH–TENSION CORD RESISTANCE

Using an ohmmeter, measure the resistance.

Maximum resistance:

25 kΩ per cord

If the resistance is greater than the maximum, check the terminals. If necessary, replace the high–tension cord.

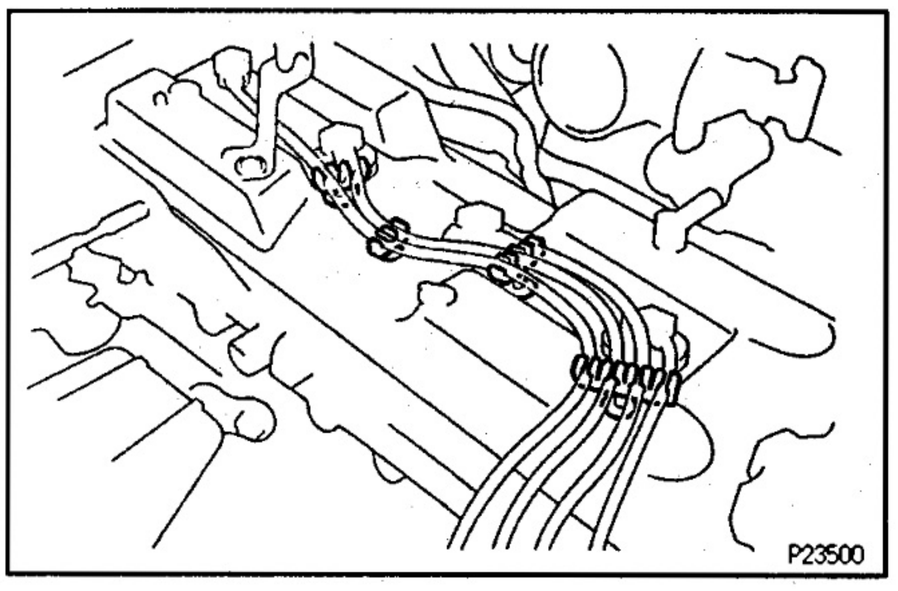


4. RECONNECT HIGH–TENSION CORDS TO DISTRIBUTOR CAP

(a) Connect the high–tension cords to the distributor cap.

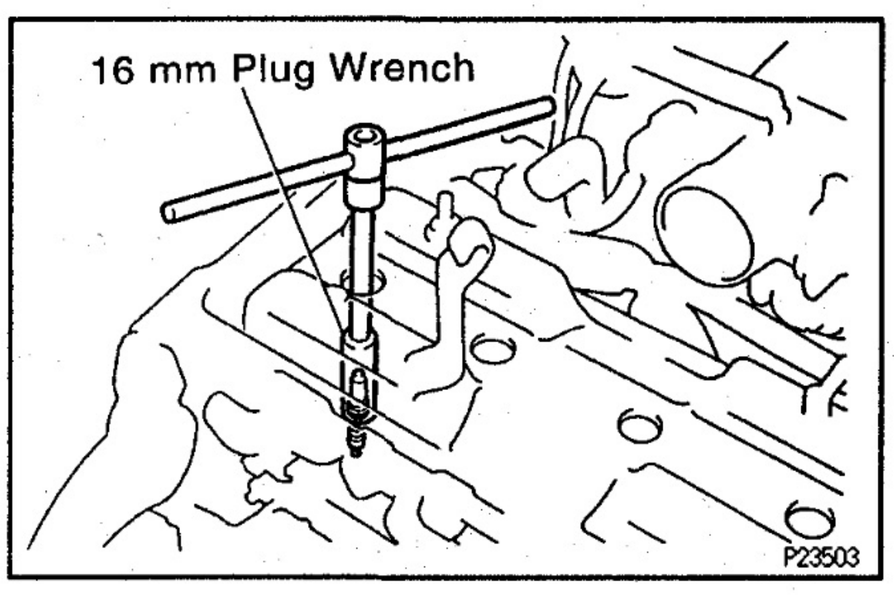
NOTICE: Check that the holder is correctly installed to the grommet and distributor cap as shown in the illustration.

(b) Check that the lock claw of the holder is engaged by lightly pulling the holder.



5. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS

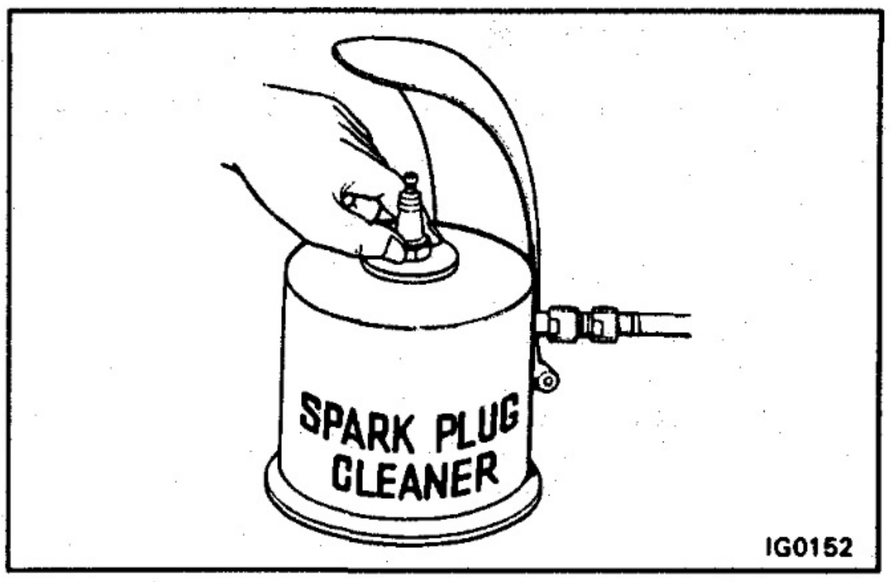
Secure the high–tension cords with the clamps as shown in the illustration.

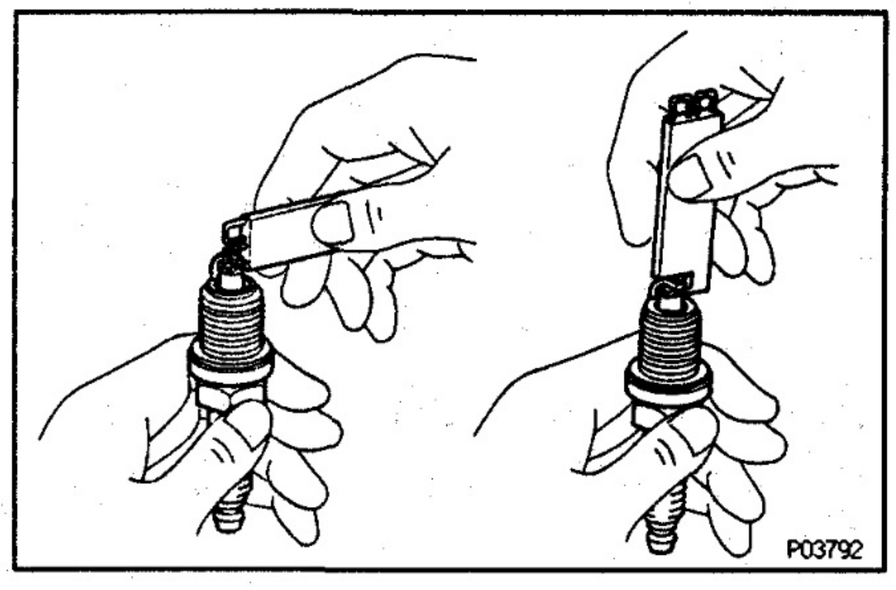


IGOJ2—03

SPARK PLUGS INSPECTION

1. **DISCONNECT HIGH—TENSION CORDS FROM SPARK PLUGS**
   (See steps 1 in high—tension cords inspection)
2. **REMOVE SPARK PLUGS**
   Using a 16 mm plug wrench, remove the spark plug.





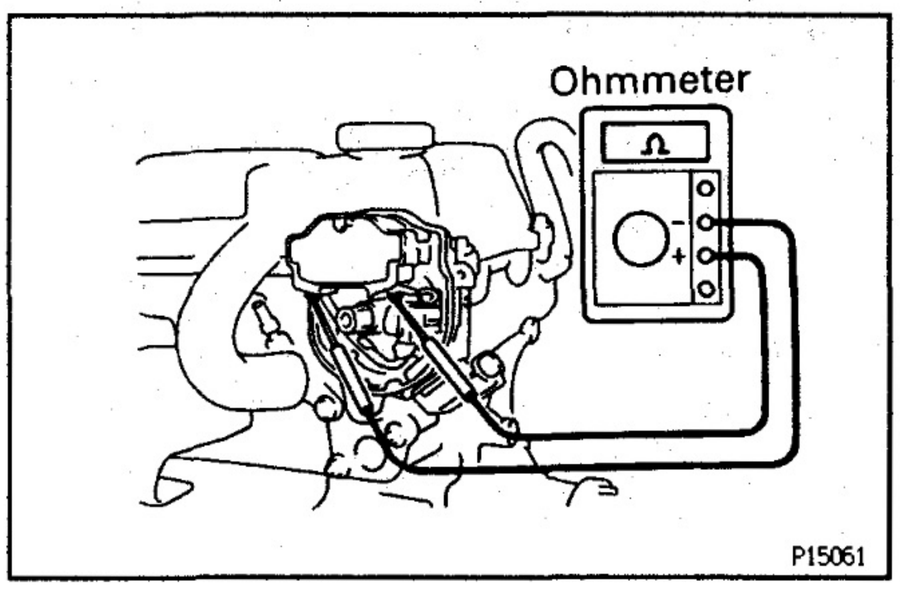
3. **CLEAN SPARK PLUGS**
   Using a spark plug cleaner or wire brush, clean the spark plug.
4. **VISUALLY INSPECT SPARK PLUGS**
   Check the spark plug for electrode wear, threads damage and insulator damage.
   If abnormal, replace the plugs.
   Recommended spark plugs:
   ND: K16R—U
   NGK: BKR5EYA
5. **ADJUST ELECTRODE GAP**
   Carefully bend the outer electrode to obtain the correct electrode gap.
   Correct electrode gap:
   0.8 mm (0.031 in.)
6. **INSTALL SPARK PLUGS**
   Using a 16 mm plug wrench, install the spark plug.
   Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)
7. **RECONNECT HIGH—TENSION CORDS TO SPARK PLUGS**
   (See steps 5 in high—tension cords inspection)

IGOQ5—01

DISTRIBUTOR INSPECTION

NOTICE: "Cold" and "Hot" in the following sentences express the temperature of the coils themselves. "Cold" is from —10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

1. **DISCONNECT DISTRIBUTOR CONNECTOR**
2. **REMOVE DISTRIBUTOR CAP AND ROTOR**
3. **REMOVE IGNITION COIL DUST COVER**



Ignition Coil

4. INSPECT PRIMARY COIL RESISTANCE

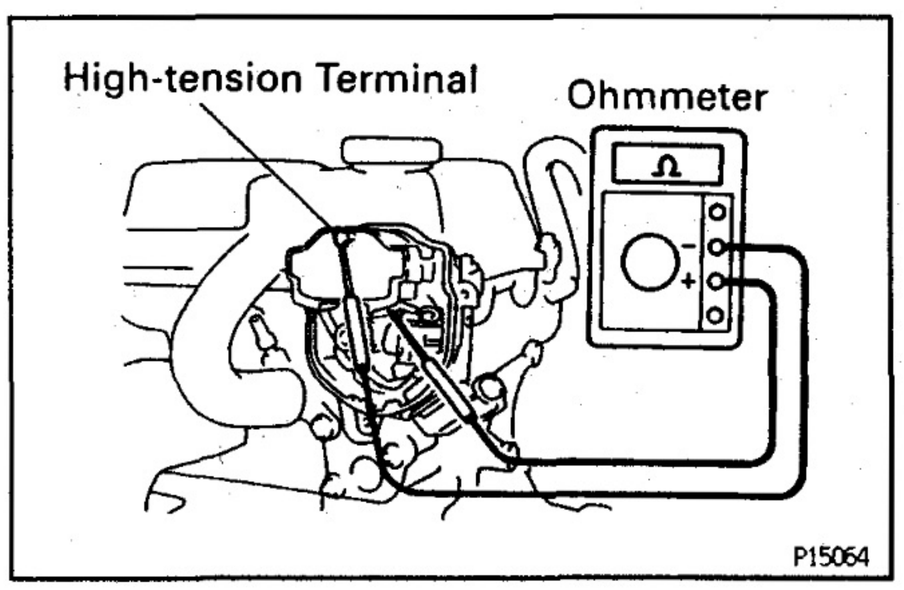
Using an ohmmeter, measure the resistance between the positive (+) and negative (−) terminals.

Primary coil resistance:

Cold: 0.36 − 0.55 Ω

Hot: 0.45 − 0.65 Ω

If the resistance is not as specified, replace the ignition coil.



5. INSPECT SECONDARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between positive (+) and high−tension terminals.

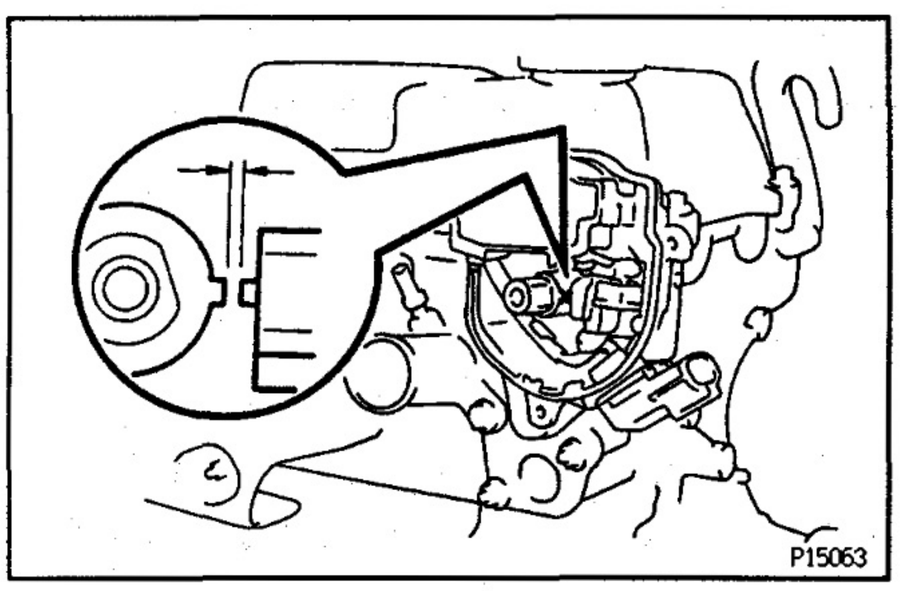
Secondary coil resistance:

Cold: 9.0 − 15.4 kΩ

Hot: 11.4 − 18.1 kΩ

If the resistance is not as specified, replace the ignition coil.

Distributor



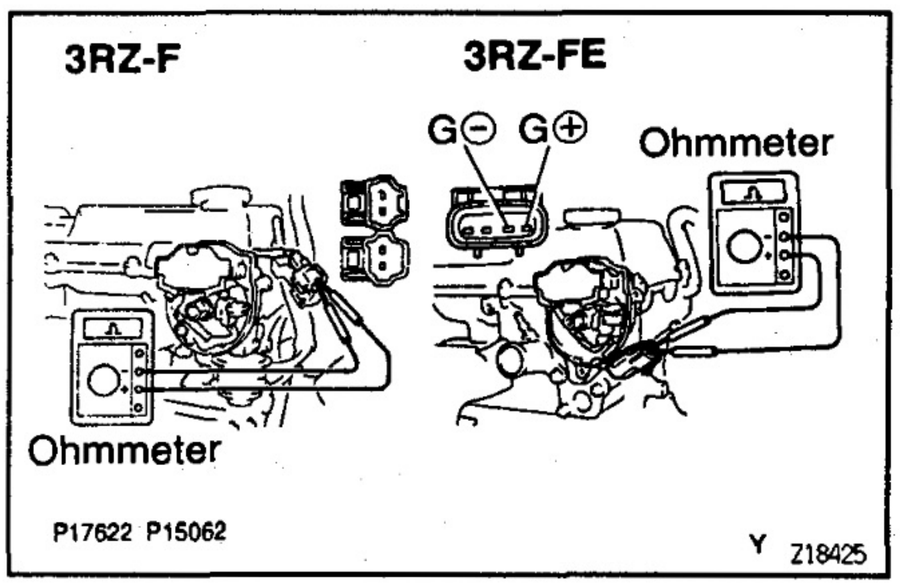
6. INSPECT AIR GAP

Using a feeler gauge, measure the air gap between the signal rotor and pickup coil projection.

Air gap:

0.2 − 0.4 mm (0.008 − 0.016 in.)

If the air gap is not as specified, replace the distributor housing assembly.



7. INSPECT SIGNAL GENERATOR (PICKUP COIL) RESISTANCE

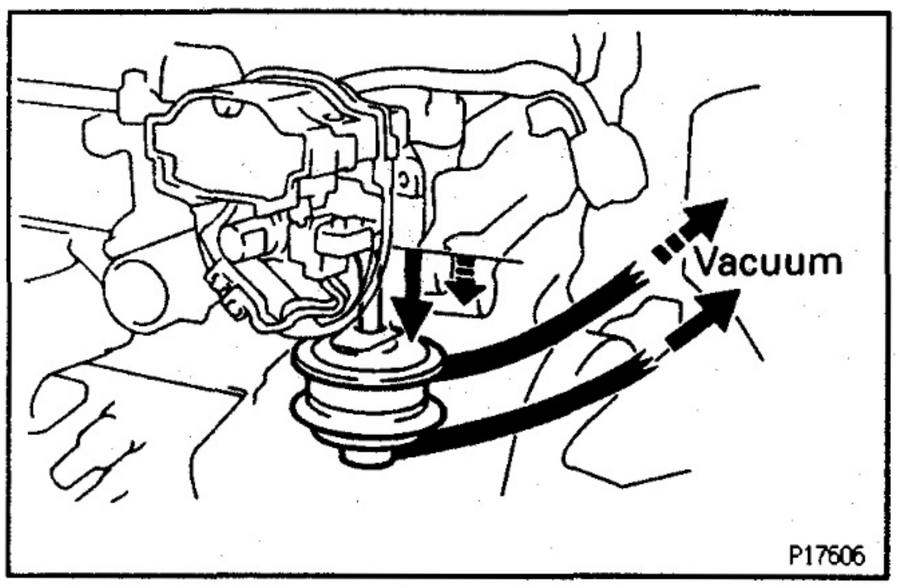
Using an ohmmeter, measure the resistance between the terminals as shown in the illustration.

Pickup coil resistance:

Cold: 185 − 275 Ω

Hot: 240 − 325 Ω

If the resistance is not as specified, replace the signal generator (pickup coil) (3RZ−F) or distributor housing assembly (3RZ−FE).



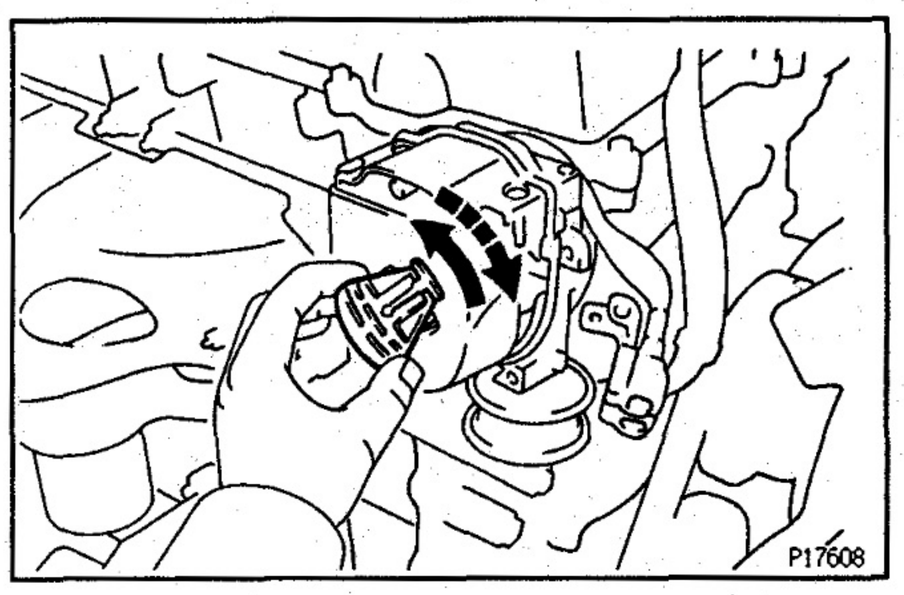
8. 3RZ−F:

INSPECT VACUUM ADVANCE

(a) Disconnect the vacuum hoses and connect a vacuum pump to the vacuum advancers.

(b) Apply vacuum and check that the vacuum advancer moves .

If the vacuum advancer does not work, repair or replace if necessary.



9. 3RZ–F:
INSPECT GOVERNOR ADVANCE

(a) Turn the rotor shaft counterclockwise, release it and check that the rotor returns quickly clockwise.

(b) Check that the rotor is not excessively loose.

10. REINSTALL IGNITION COIL DUST COVER

11. REINSTALL ROTOR AND DISTRIBUTOR CAP

12. RECONNECT DISTRIBUTOR CONNECTOR

IG

IG0G9–04

CRANKSHAFT POSITION SENSOR

INSPECTION (3RZ–FE)

NOTICE: "Cold" and "Hot" in the following sentences express the temperature of the sensors themselves. "Cold" is from –10°C (14°F) to 50 °C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

1. REMOVE CRANKSHAFT POSITION SENSOR
(See crankshaft position sensor removal in crankshaft position sensor)

2. INSPECT CRANKSHAFT POSITION SENSOR RESISTANCE

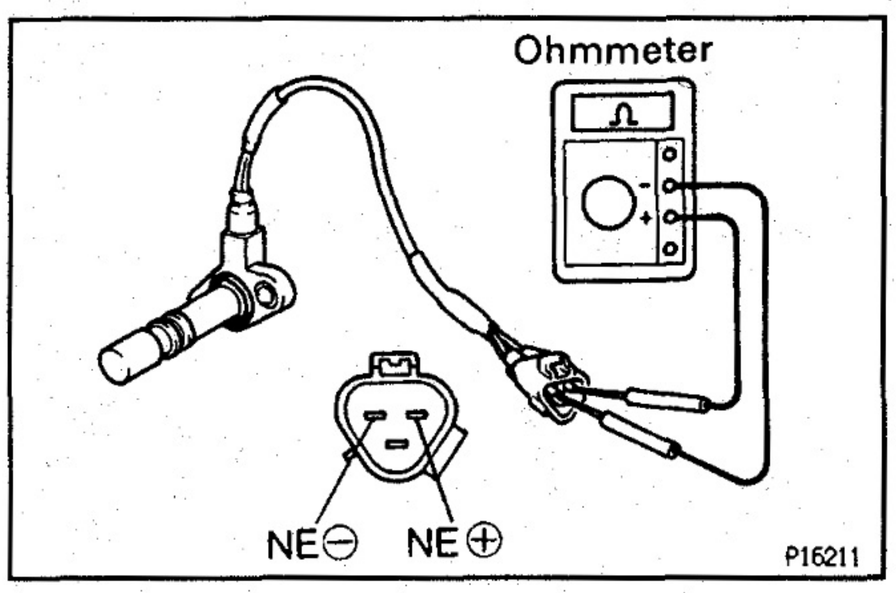
Using an ohmmeter, measure the resistance between the terminals.

Resistance (NE ⊕ and NE ⊖):

Cold: 1,630 – 2,740 Ω

Hot: 2,065 – 3,225 Ω

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



3. REINSTALL CRANKSHAFT POSITION SENSOR

IG00Z–0J

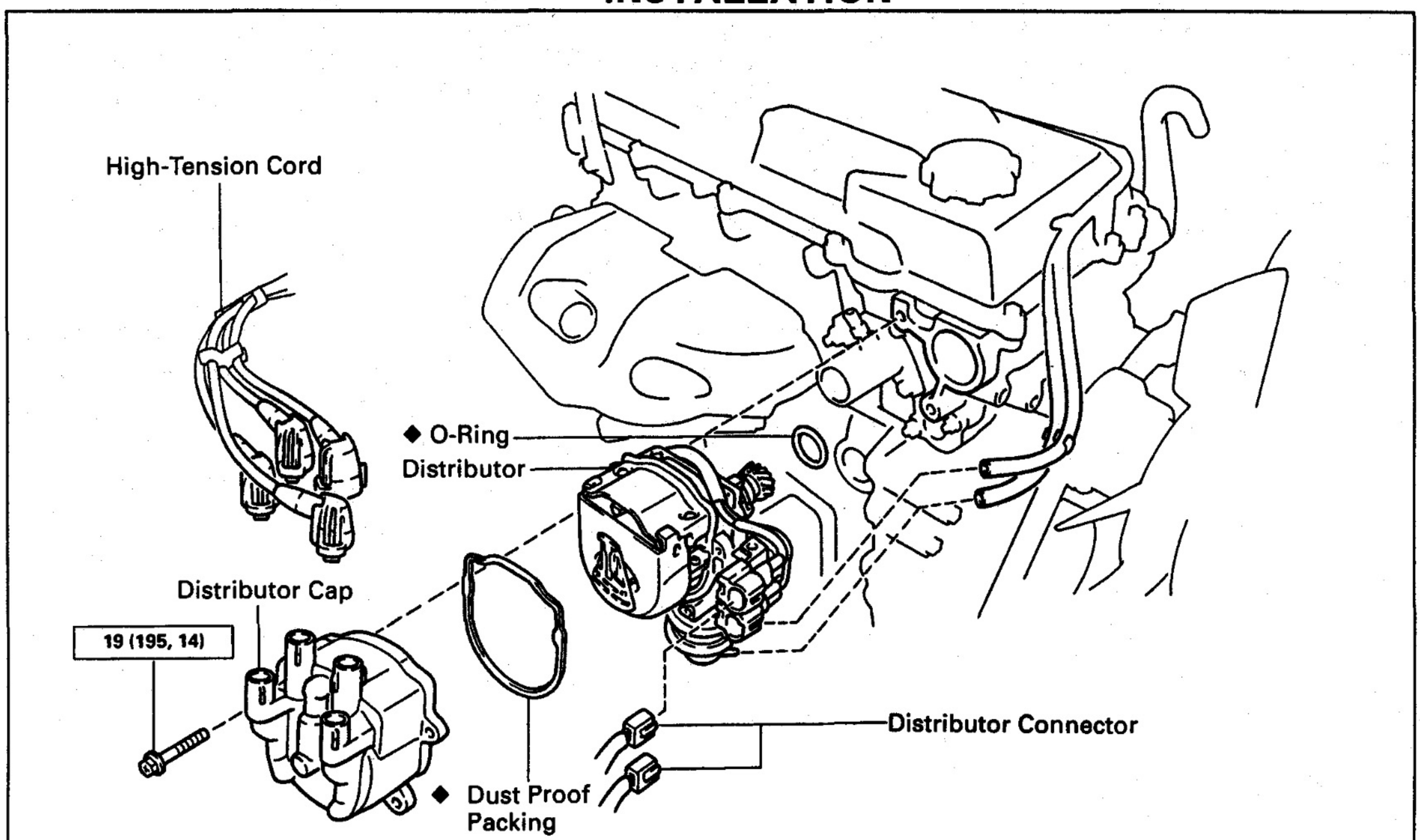
IGNITER INSPECTION

(See procedure Spark Test in on–vehicle inspection)

DISTRIBUTOR (3RZ–F)

IG039–0C

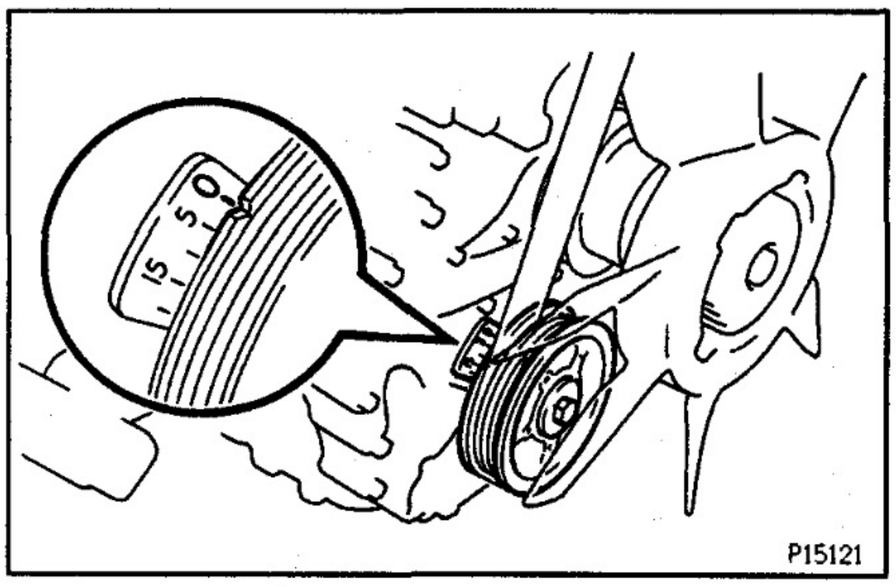
COMPONENTS FOR REMOVAL AND INSTALLATION



IG008–01

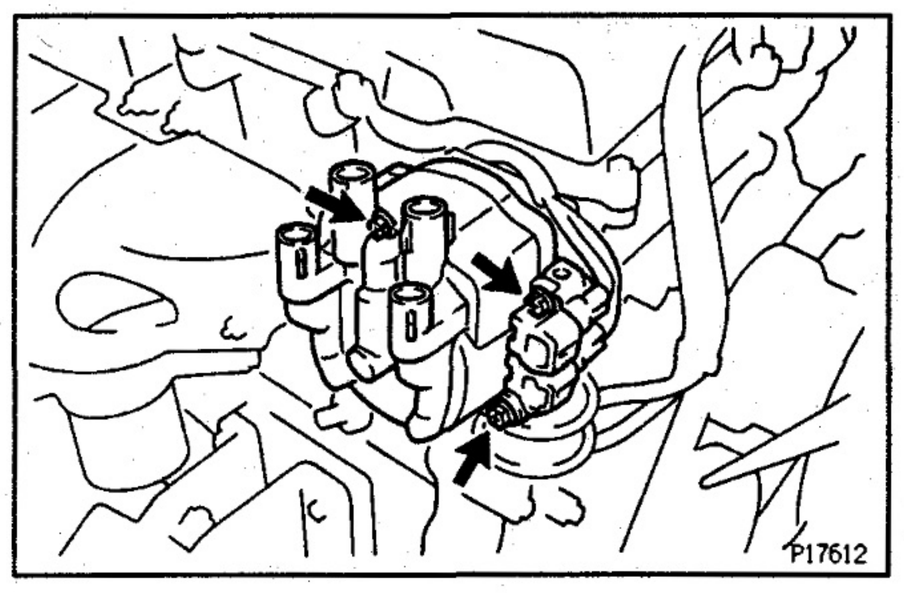
DISTRIBUTOR REMOVAL

1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY
2. DISCONNECT DISTRIBUTOR CONNECTORS
3. DISCONNECT HIGH–TENSION CORDS FROM DISTRIBUTOR CAP
   (See step 2 in high–tension cords inspection)

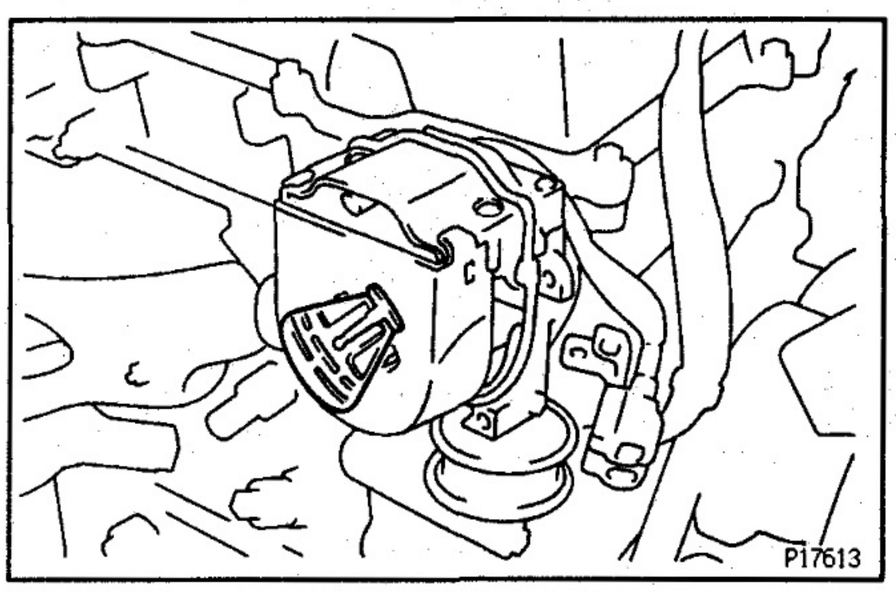


4. SET NO.1 CYLINDER TO TDC/COMPESSION

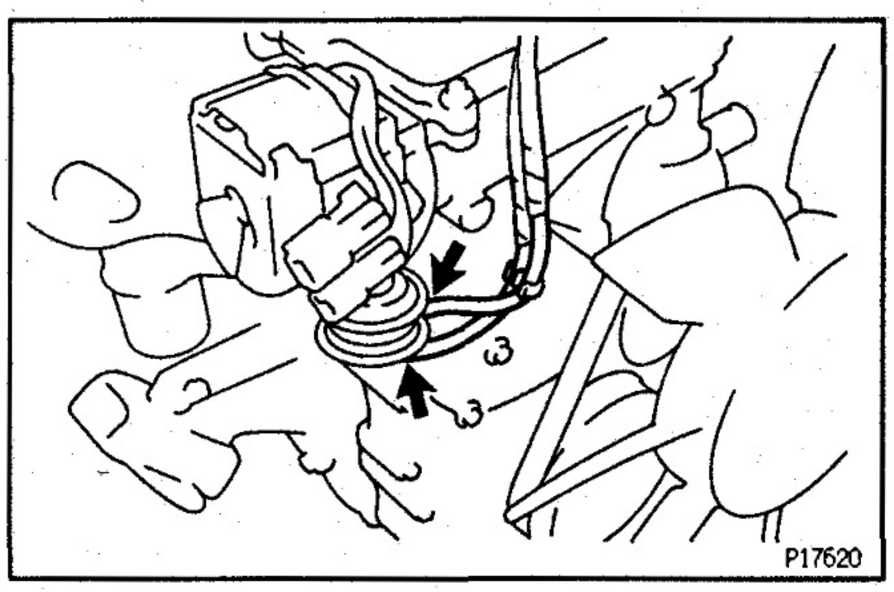
(a) Turn the crankshaft pulley clockwise until the timing mark is aligned with "0" mark on the oil pump cover.



(b) Remove the 3 bolts and distributor cap.

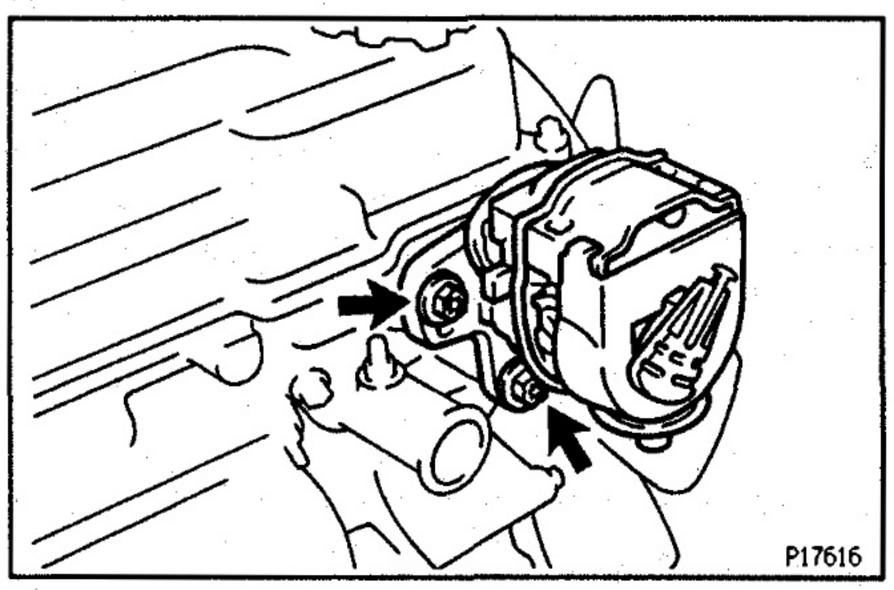


(c) Check that the distributor rotor direction is as shown. If not, turn the crankshaft pulley one complete revolution.



5. REMOVE DISTRIBUTOR

(a) Disconnect the 2 vacuum hoses.

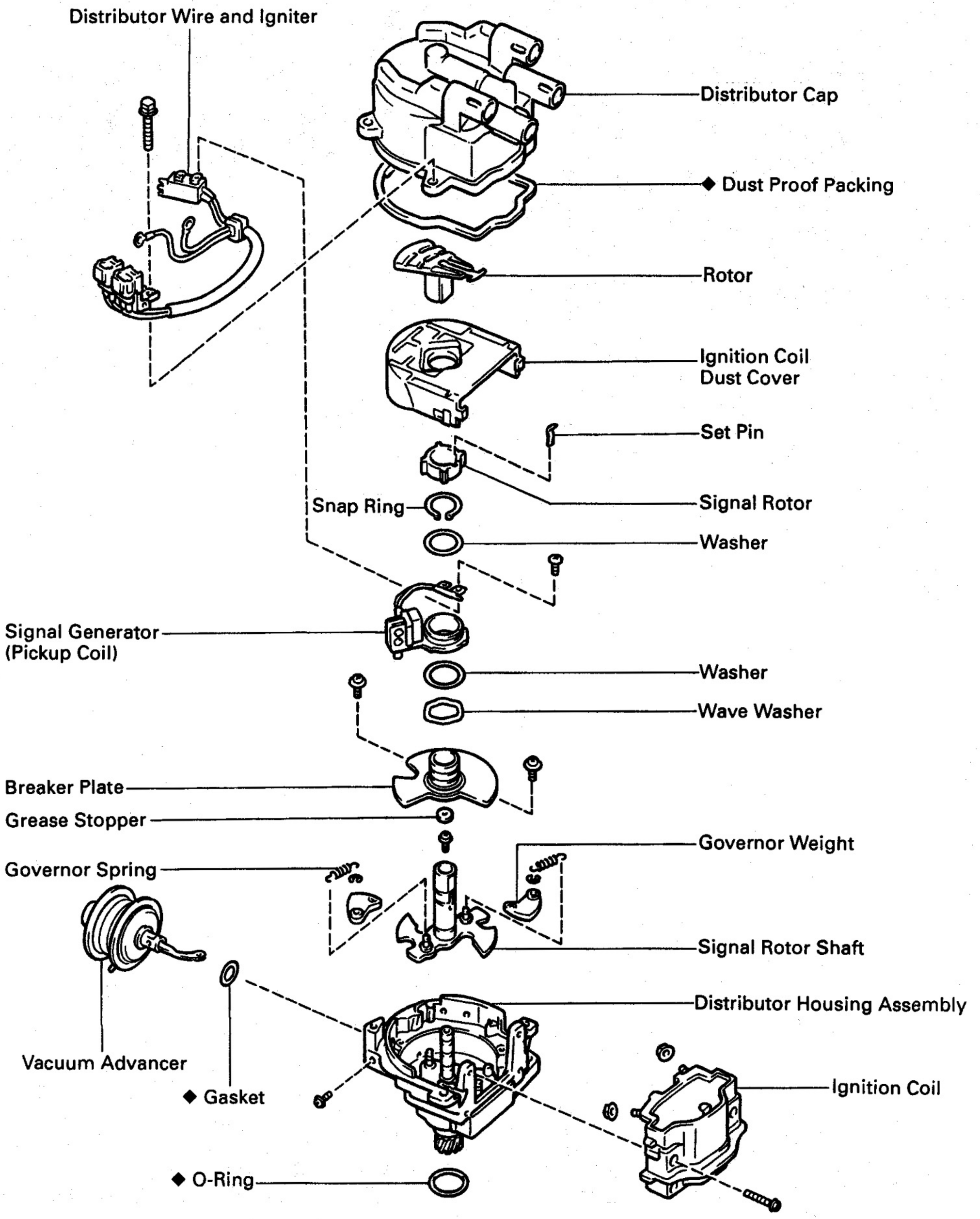


(a) Remove the 2 mounting bolts, and pull out the distributor.

(b) Remove the O–ring from the distributor housing.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

IG039–OD

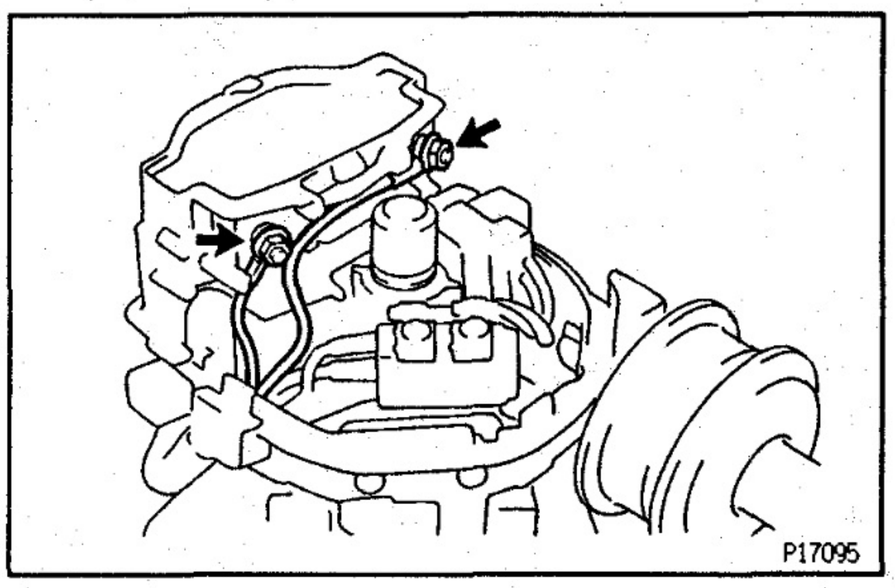


◆ Non-reusable part

P17202

IG0Q7–01

DISTRIBUTOR DISASSEMBLY



1. REMOVE ROTOR

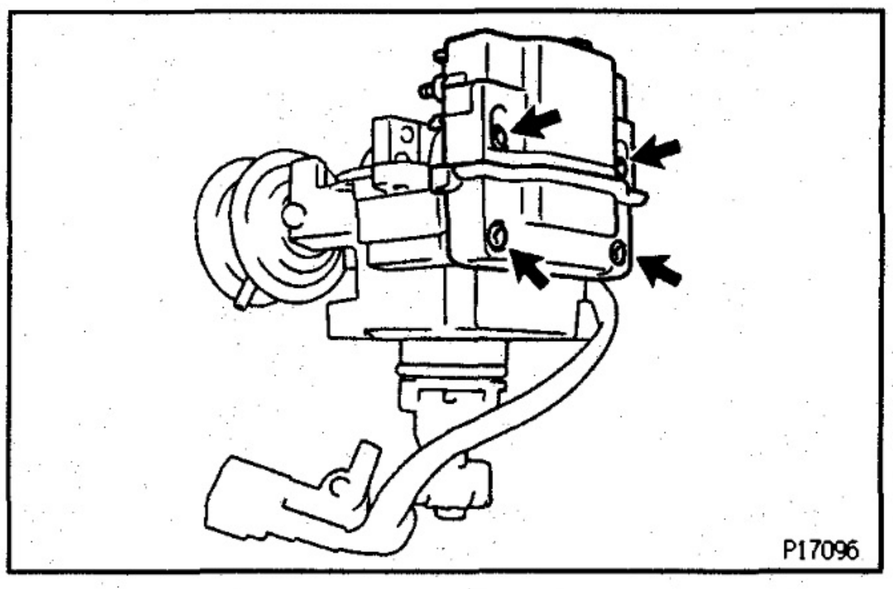
2. REMOVE IGNITION COIL DUST COVER

(a) Remove the dust cover.

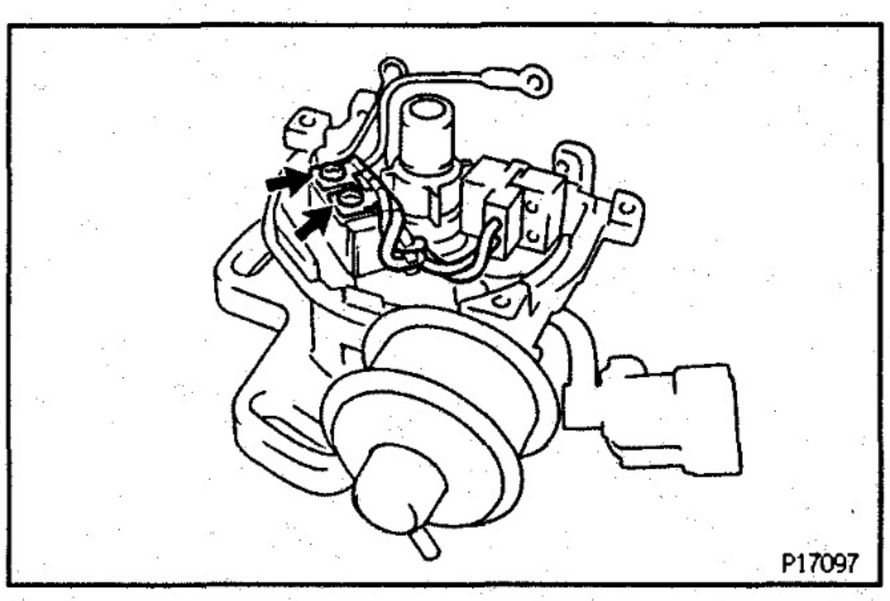
(b) Remove the dust proof packing.

3. REMOVE IGNITION COIL

(a) Remove the 2 nuts, and disconnect the 2 wires from the ignition coil terminals.

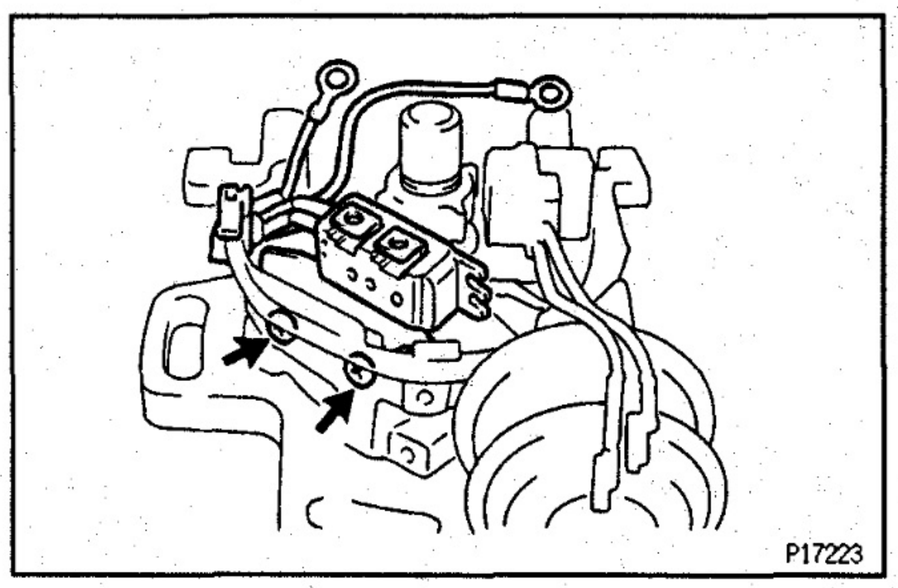


(b) Remove the 4 screws and ignition coil.

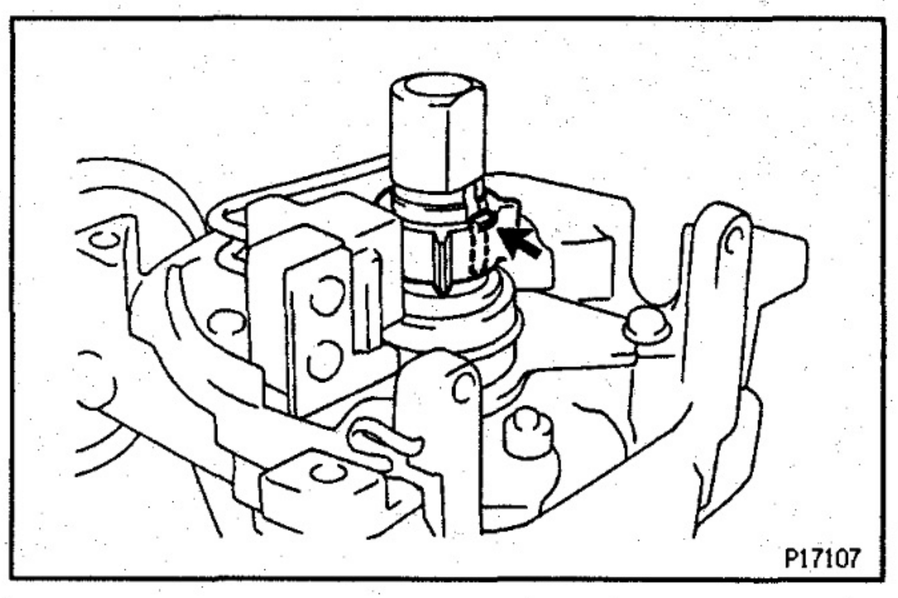


4. REMOVE IGNITER

(a) Remove the 2 screws, and disconnect the 2 pickup coil wire from the igniter.



(b) Remove the 2 screws and igniter.

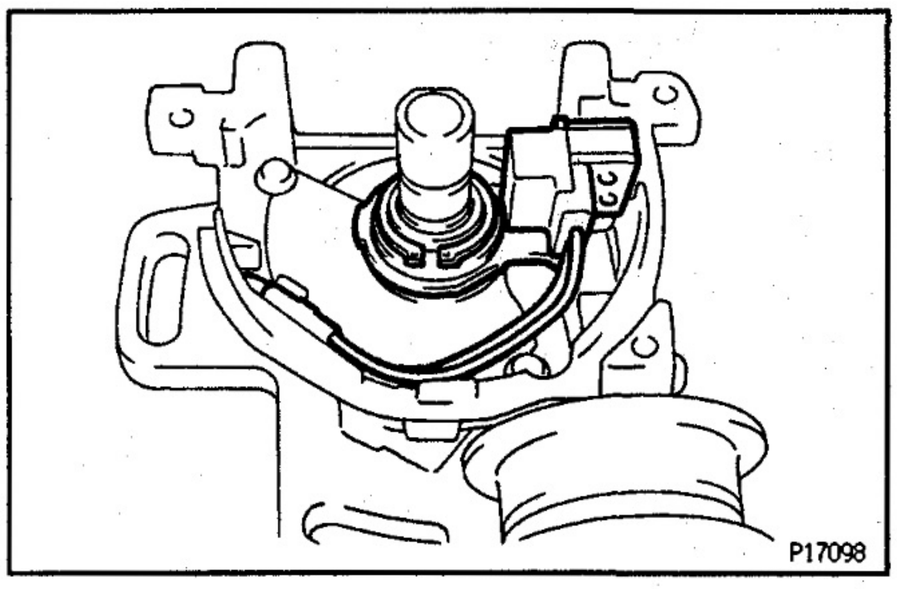


5. REMOVE SIGNAL ROTOR

(a) Using a small screwdriver, pry out the rotor set spring.

(b) Pull out the signal rotor.

IG

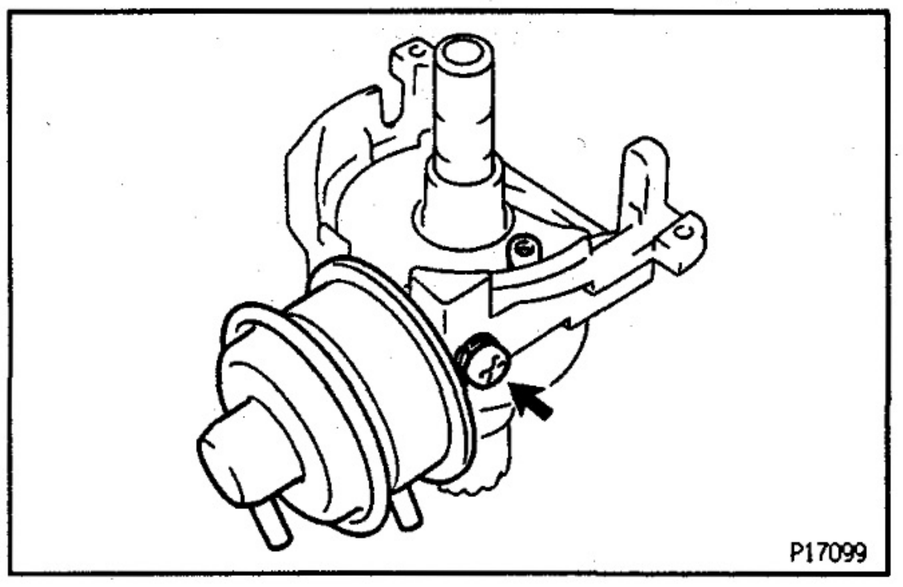


6. REMOVE SIGNAL GENERATOR (PICKUP COIL)

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

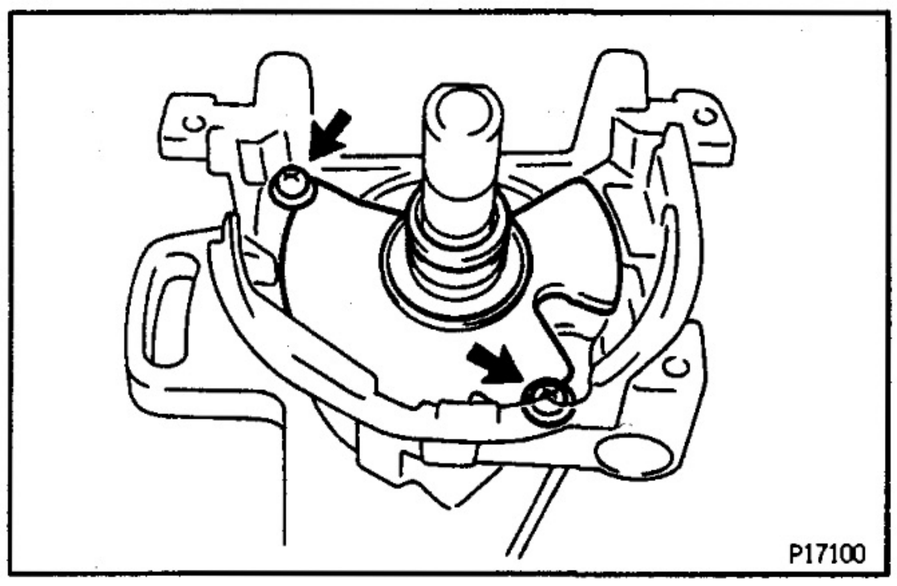
(b) Pull out the signal generator (pickup coil) and washer.

(c) Remove the washer and wave washer.



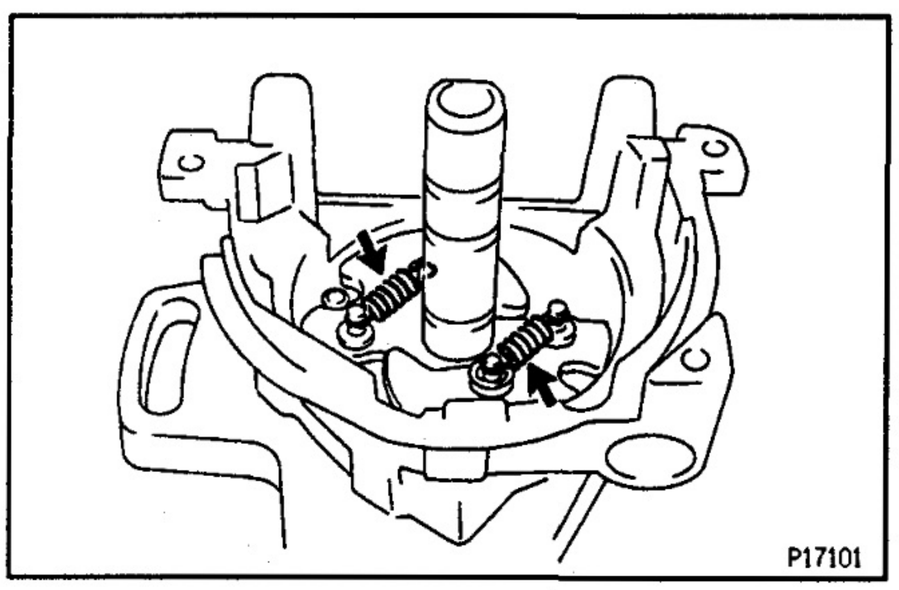
7. REMOVE VACUUM ADVANCER

Remove the screw and vacuum advancer.



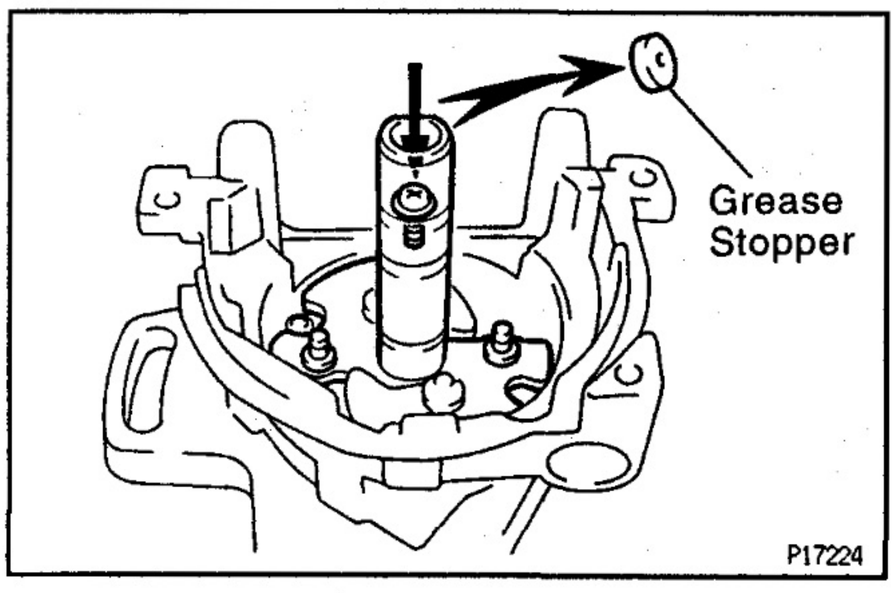
8. REMOVE BREAKER PLATE

Remove the 2 screws and breaker plate.



9. REMOVE GOVERNOR SPRINGS

Using needle—nose pliers, remove the 2 springs.

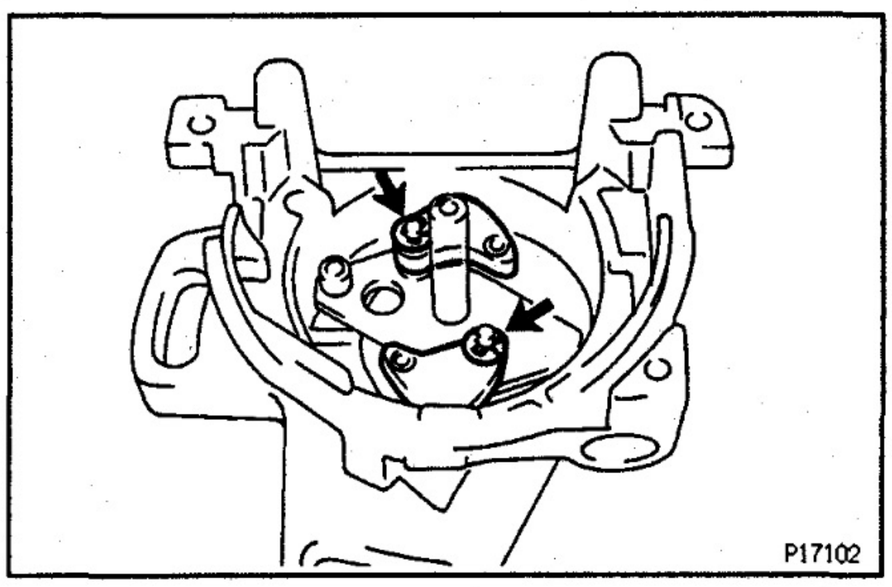


10. REMOVE SIGNAL ROTOR SHAFT

(a) Pry out the grease stopper.

(b) Remove the screw at the top of the governor shaft.

(c) Pull out the signal rotor shaft.

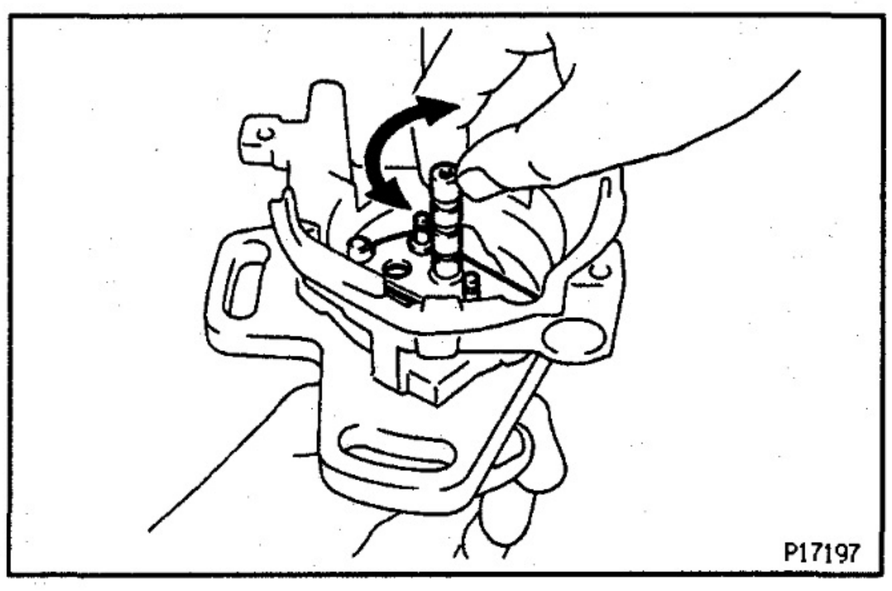


11. REMOVE GOVERNOR WEIGHTS

Using a small screwdriver, remove the E–rings and pull out the 2 weights.

IG0C1–02

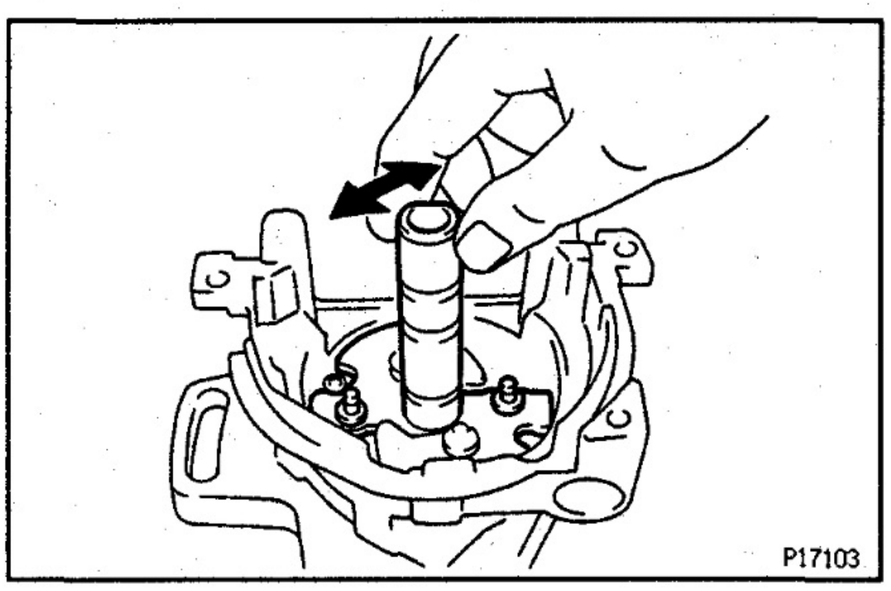
DISTRIBUTOR INSPECTION



1. INSPECT GOVERNOR SHAFT

Turn the governor shaft and check that it is not rough or worn.

If it feels rough or worn, replace the distributor housing.



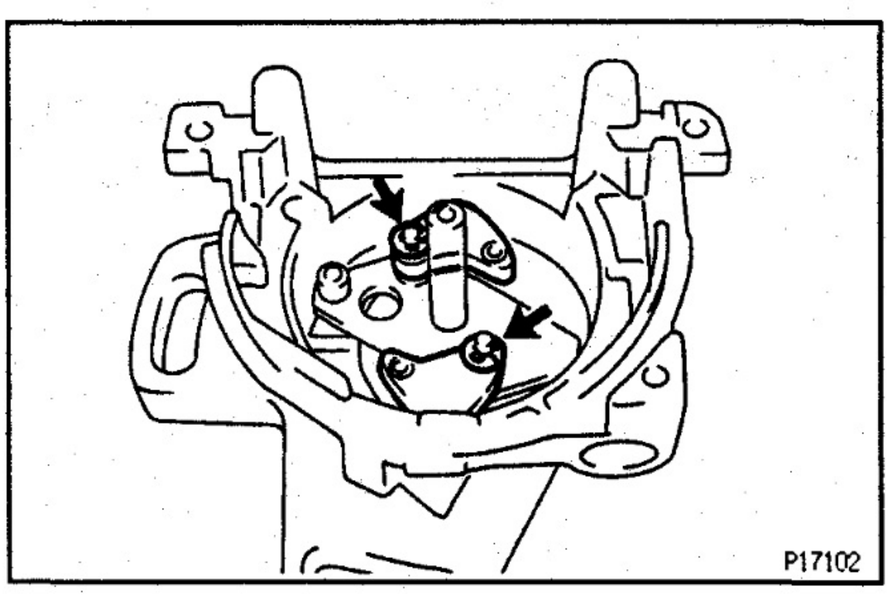
2. INSPECT SIGNAL ROTOR SHAFT

Temporarily install the signal rotor to the governor shaft and check that they fit together correctly.

If necessary, replace the signal rotor shaft or distributor housing.

IG0Q8–02

DISTRIBUTOR ASSEMBLY



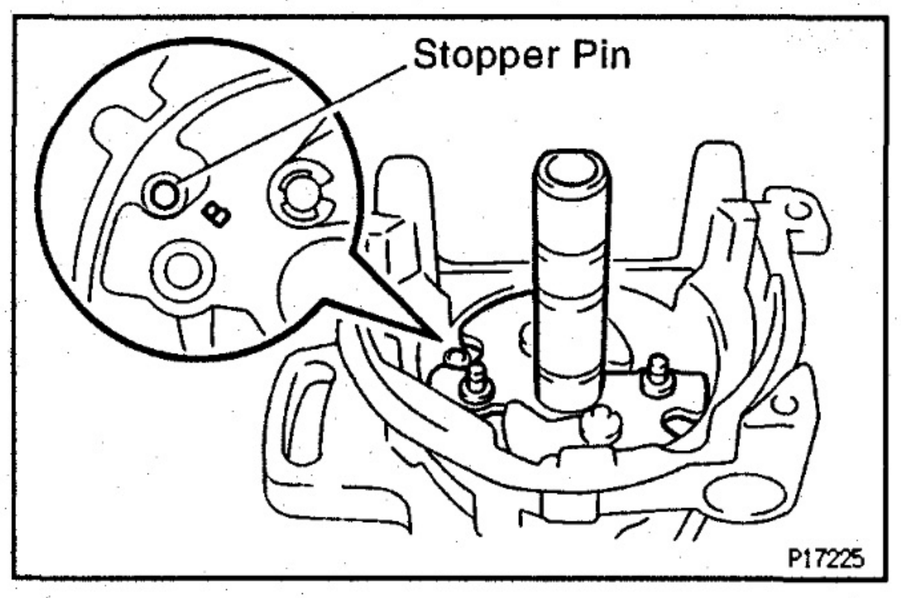
1. INSTALL GOVERNOR WEIGHTS

(a) Lightly coat the pivot pin of the governor shaft with high–temperature grease.

(b) Slide the weights over the small shafts.

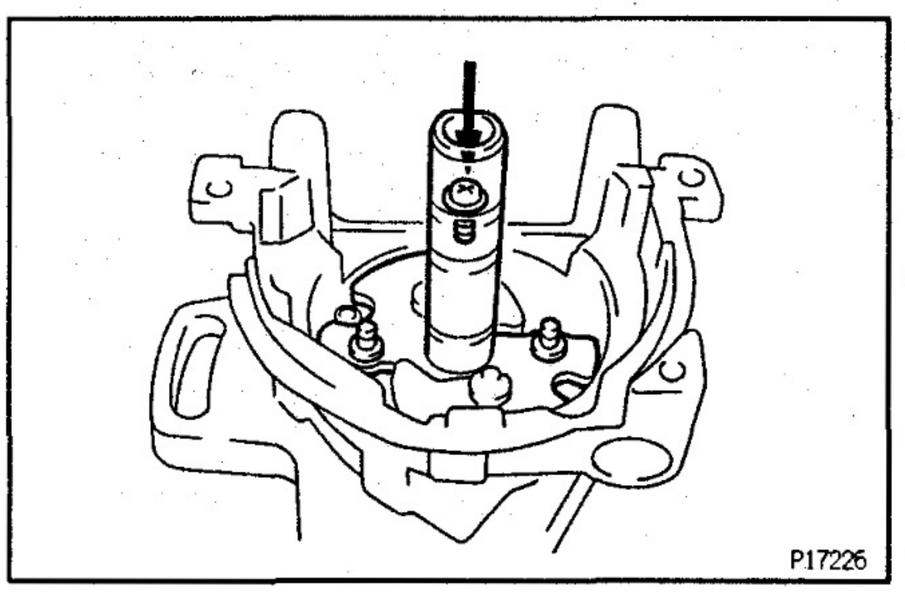
(c) Using needle–nose pliers, install the E–rings.

2. LIGHTLY COAT GOVERNOR SHAFT WITH HIGH–TEMPERATURE GREASE

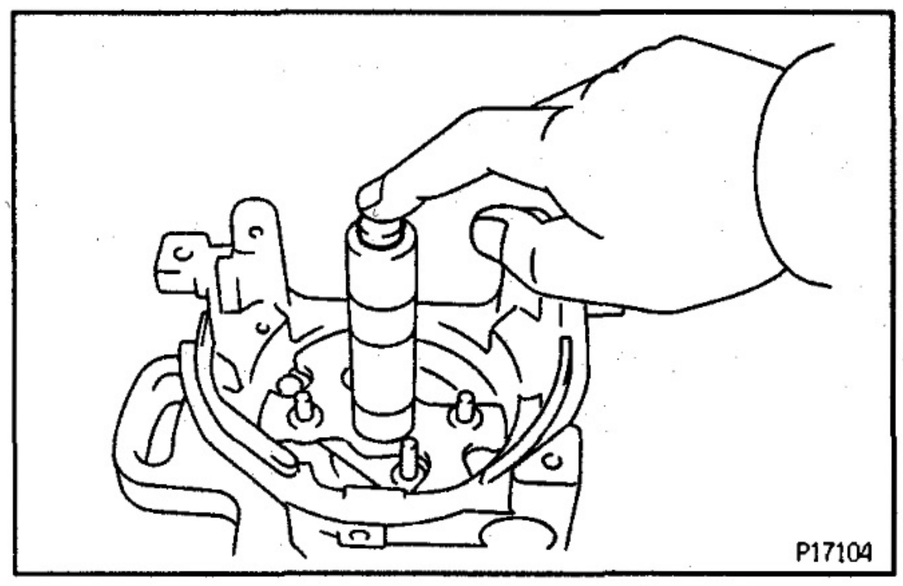


3. INSTALL SIGNAL ROTOR SHAFT

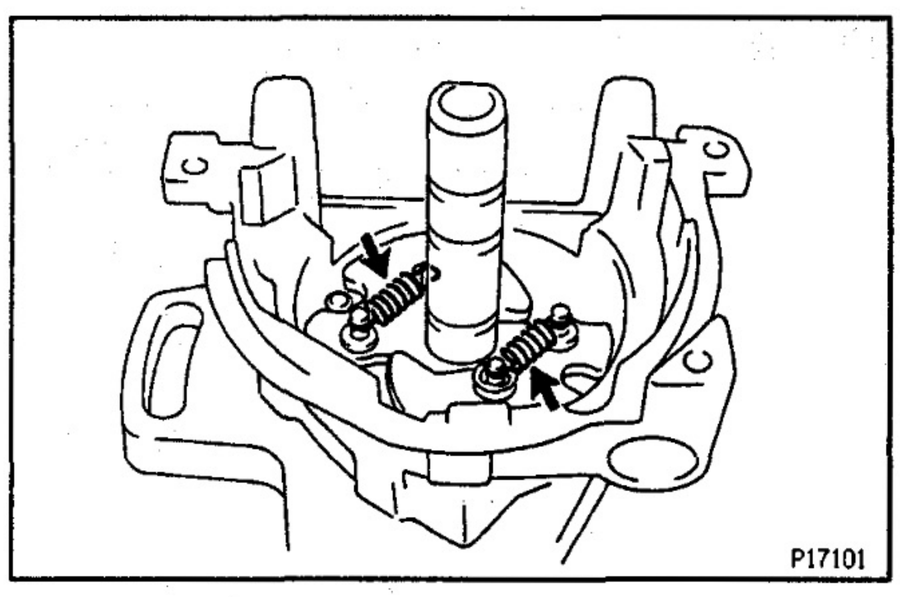
(a) Install the signal rotor shaft on the governor shaft as shown in the illustration.



(b) Install the screw.
(c) Pack high–temperature grease into the shaft.

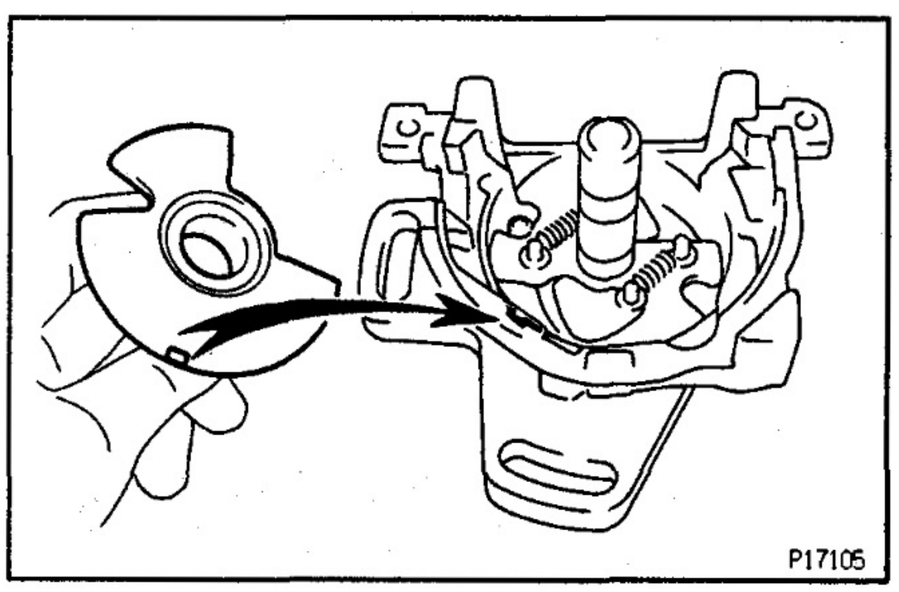


(d) Push on the grease stopper with your finger.



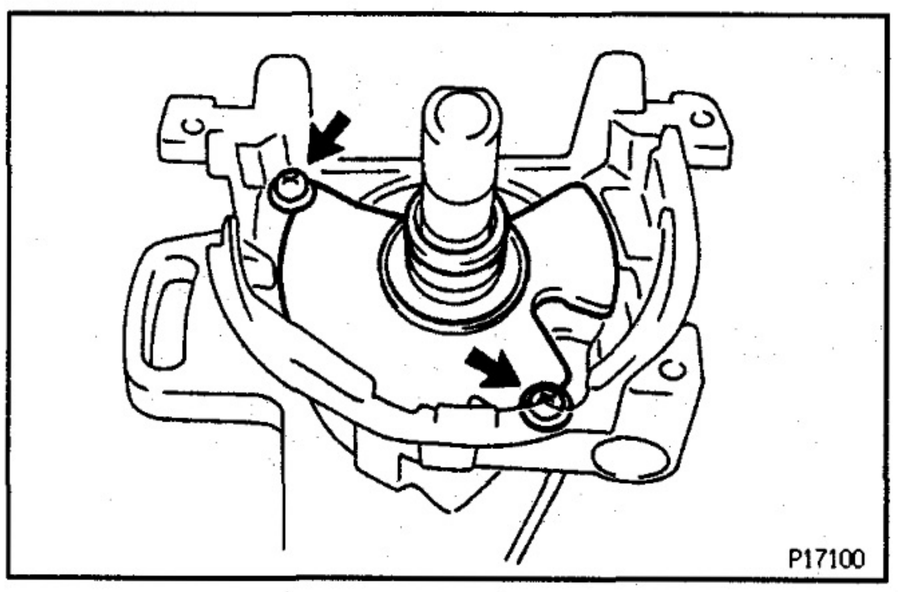
4. INSTALL GOVERNOR SPRINGS

Using needle–nose pliers, install the 2 springs.

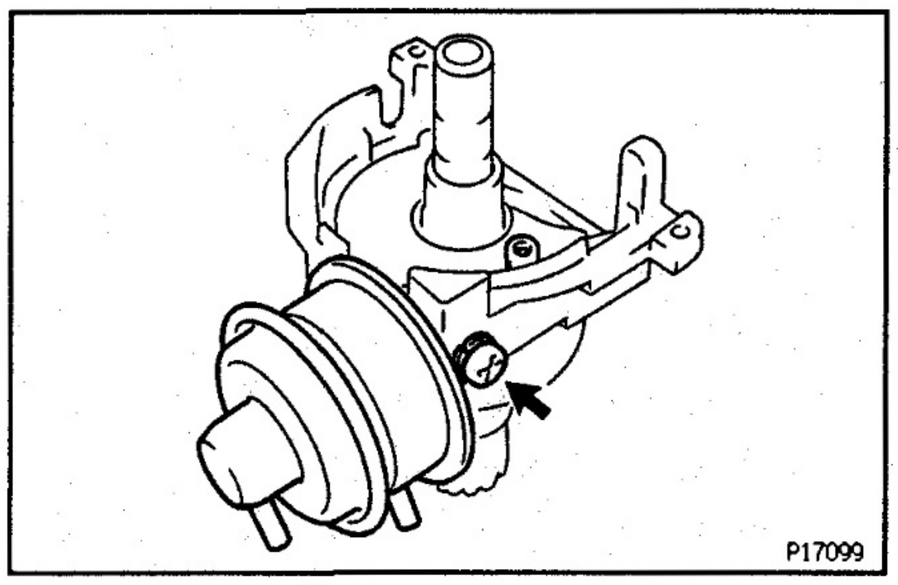


5. INSTALL BREAKER PLATE

(a) Align the cutout parts of the breaker plate and housing, and install the breaker plate.



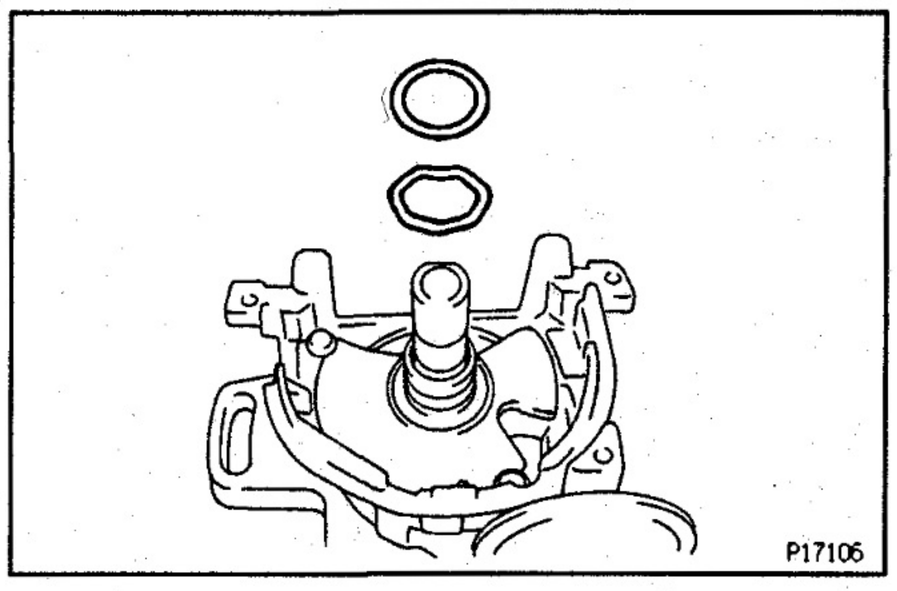
(b) Install the 2 screws.



6. INSTALL VACUUM ADVANCER

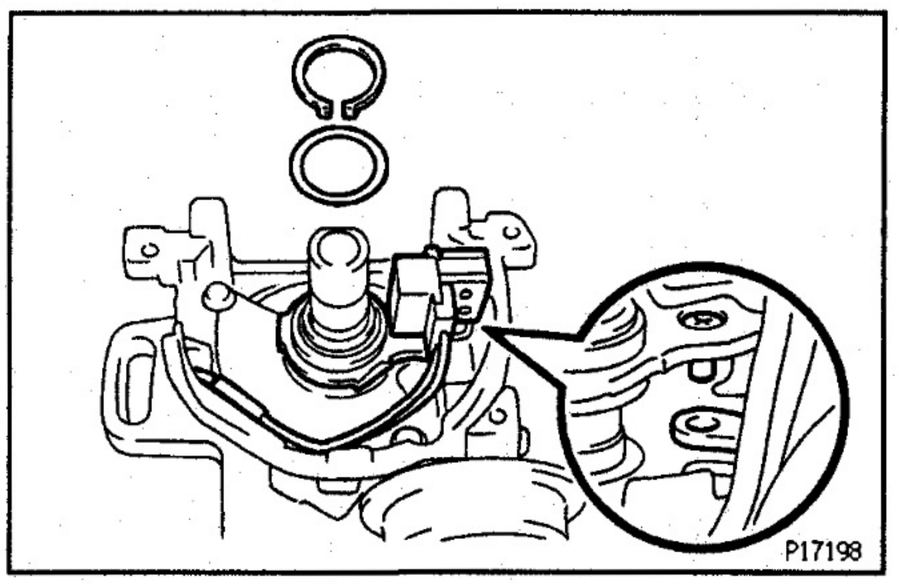
(a) Install a new gasket to the advancer.

(b) Install the vacuum advancer with the screw.



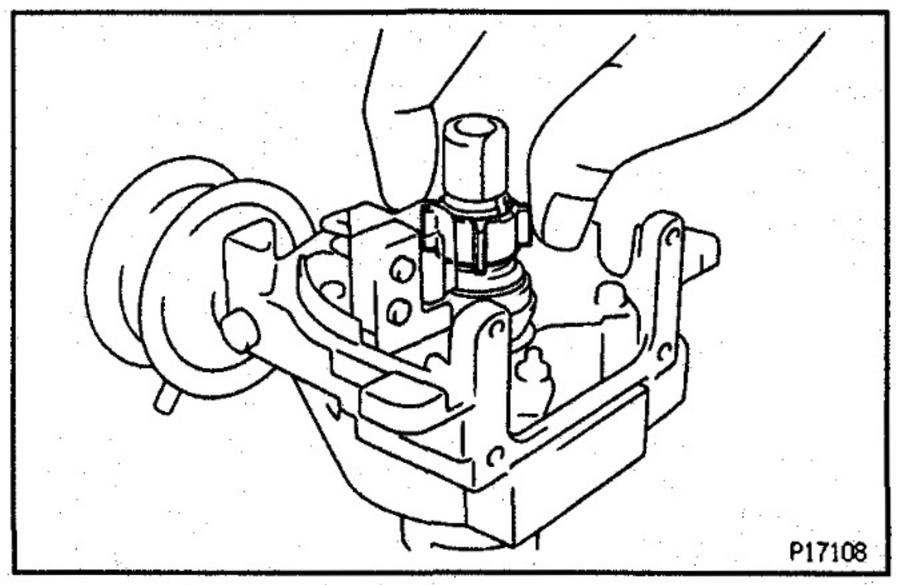
7. INSTALL SIGNAL GENERATOR (PICKUP COIL)

(a) Install the wave washer and washer.



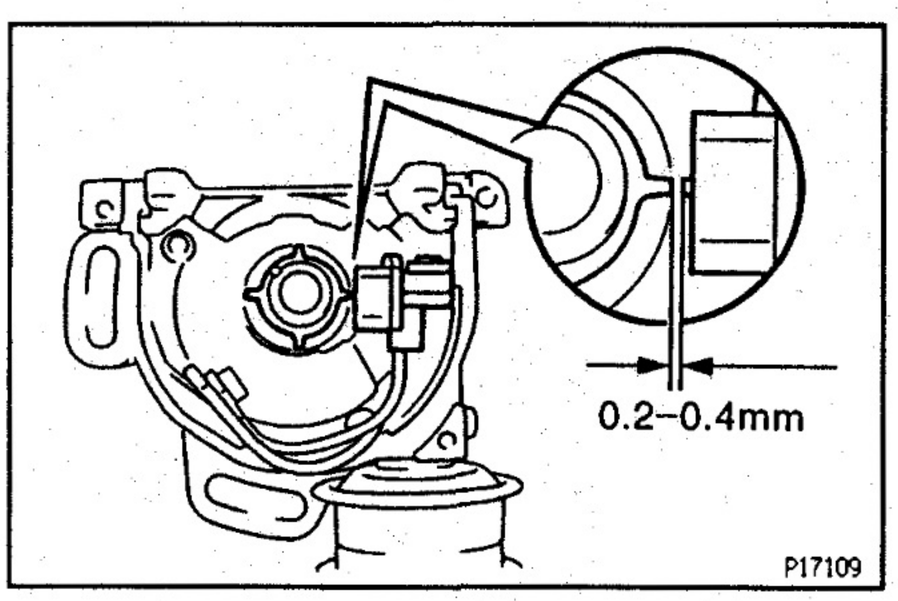
(b) Connect the advancer link to the signal generator pin and install the signal generator.

(c) Using needle—nose pliers, install the washer and snap ring.



8. INSTALL SIGNAL ROTOR

Push on the rotor with a new spring.



9. INSPECT AIR GAP

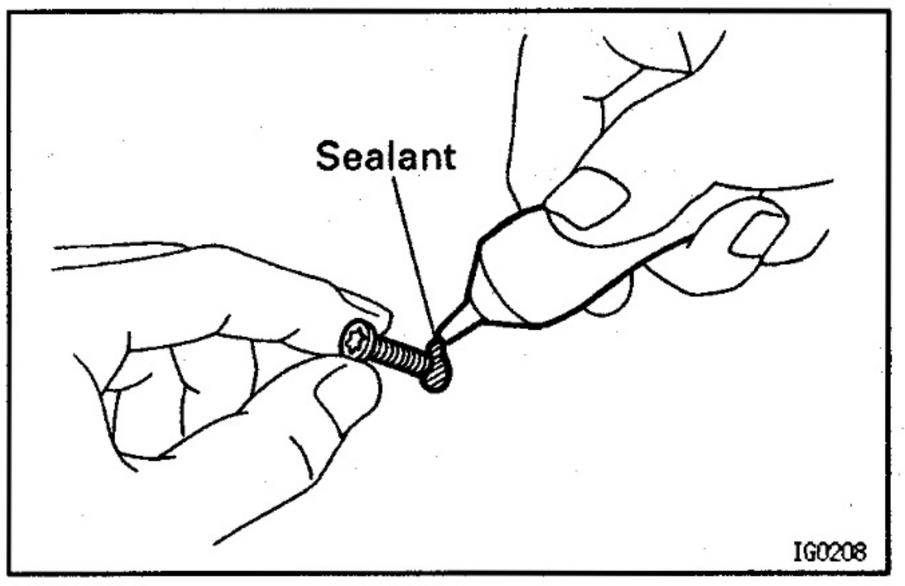
Using a thickness gauge, check the gap between the signal rotor and signal generator (pickup coil).

Air gap:

0.2 — 0.4 mm (0.008 — 0.016 in.)

If not within specification, replace the breaker plate with the signal generator(pickup coil).

IG



10. IF NECESSARY, REPLACE SIGNAL GENERATOR (PICKUP COIL)

(a) Remove the signal rotor.
(See step 5 on page IG–11)

(b) Remove the signal generator (pickup coil)
(See step 6 on page IG–12)

(c) Clean a new pickup set screws and pickup screw holes of any oil and foreign particles.

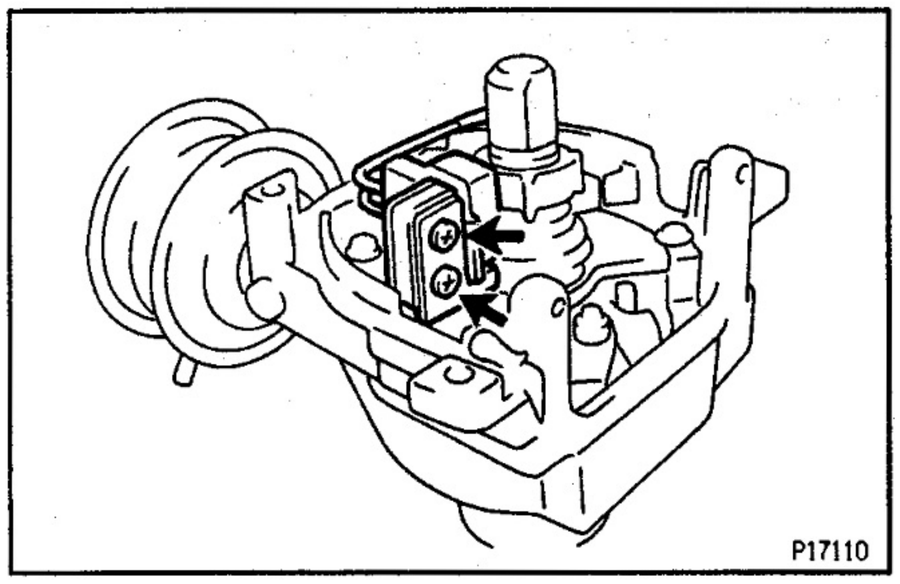
(d) Apply sealant to 3 or 5 mm (0.12 or 0.20 in.) of the screw end.

Sealant:

Part No. 08833–00070, adhesive 1324,
THREE BOND 1324 or Sealant:

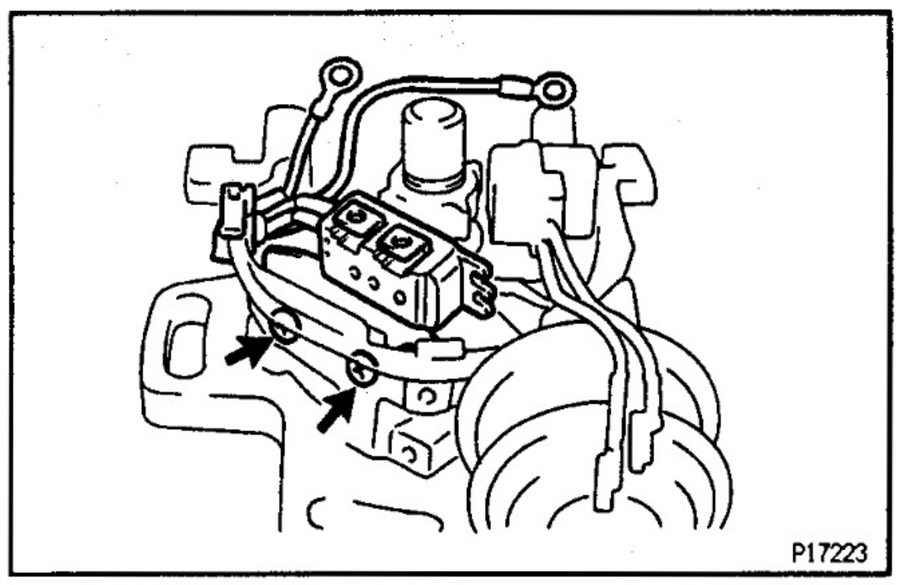
(e) Using a torx driver, install the set screws and adjust the air gap.

HINT: After installing, do not run the engine for at least 30 min., or at high speed for at least 120 min.

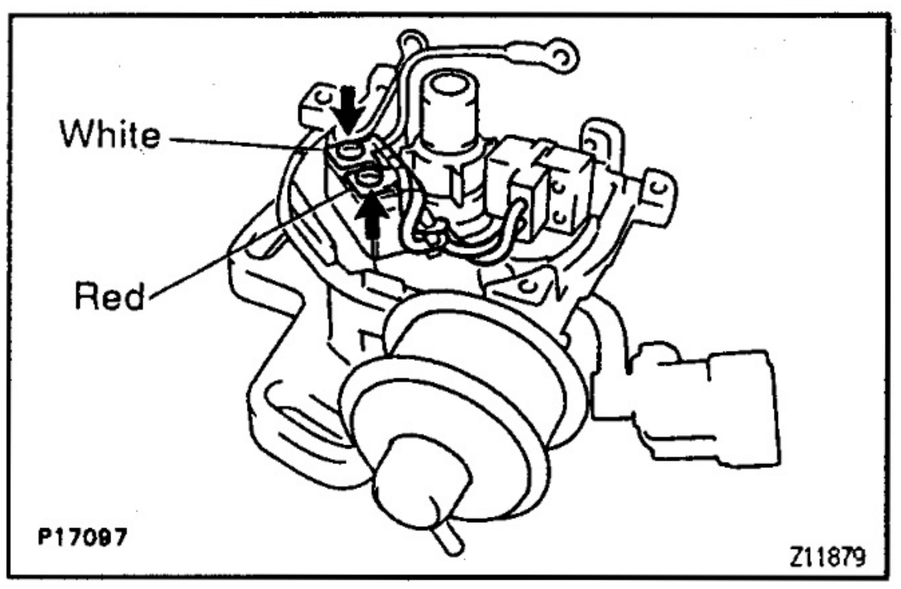


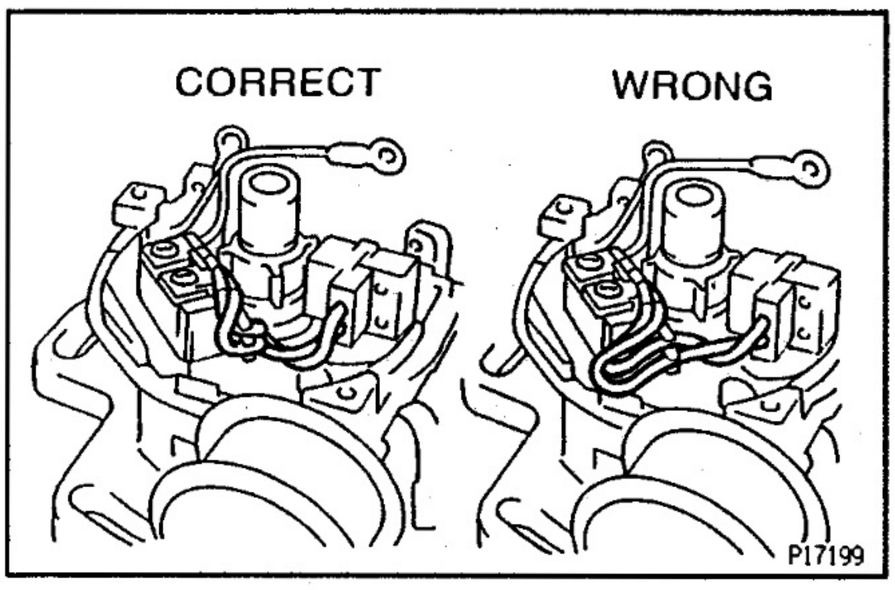
11. INSTALL IGNITER

(a) Install the igniter with the 2 screws.



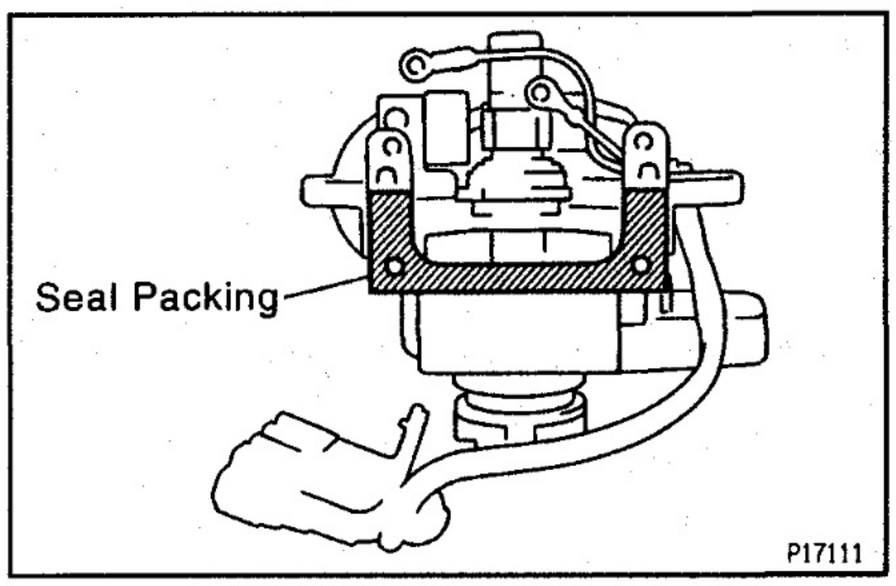
(b) **Connect the 2 wires to the igniter with the 2 screws as shown in the illustration.**





(c) Secure the pickup coil wires in the clips, allowing sufficient slack.

NOTICE: Be sure that the wires do not contact with signal rotor or distributor.



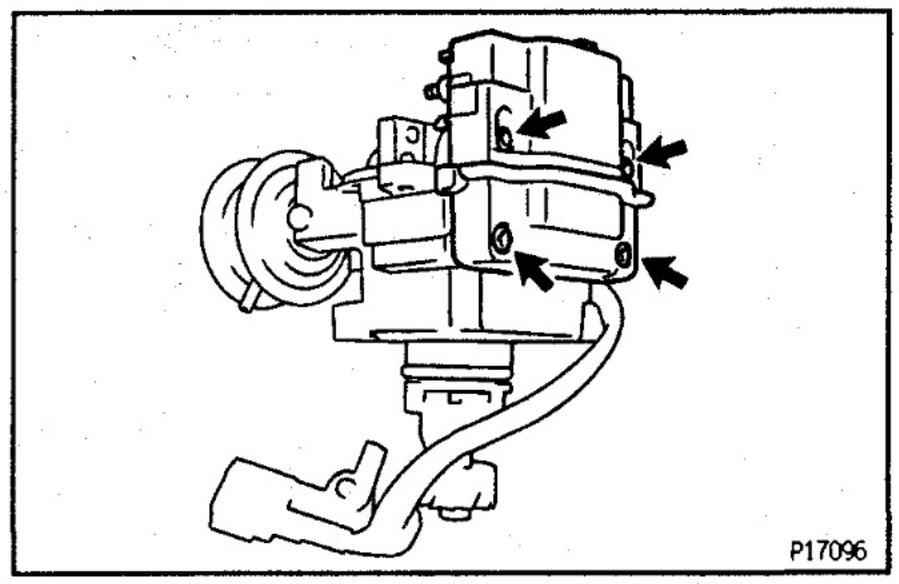
12. INSTALL IGNITION COIL

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

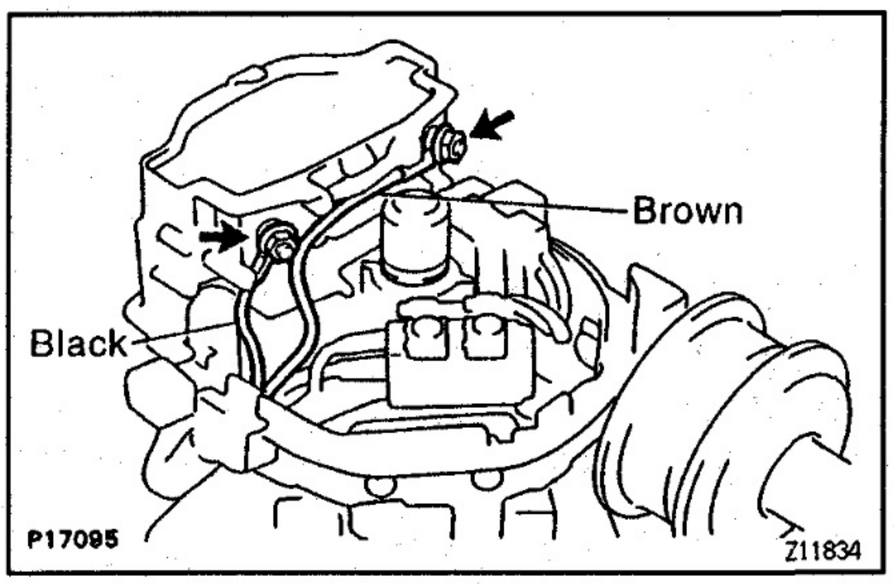
(b) Apply seal packing to the ignition coil installing surface of the housing as shown in the illustration.

Seal packing:

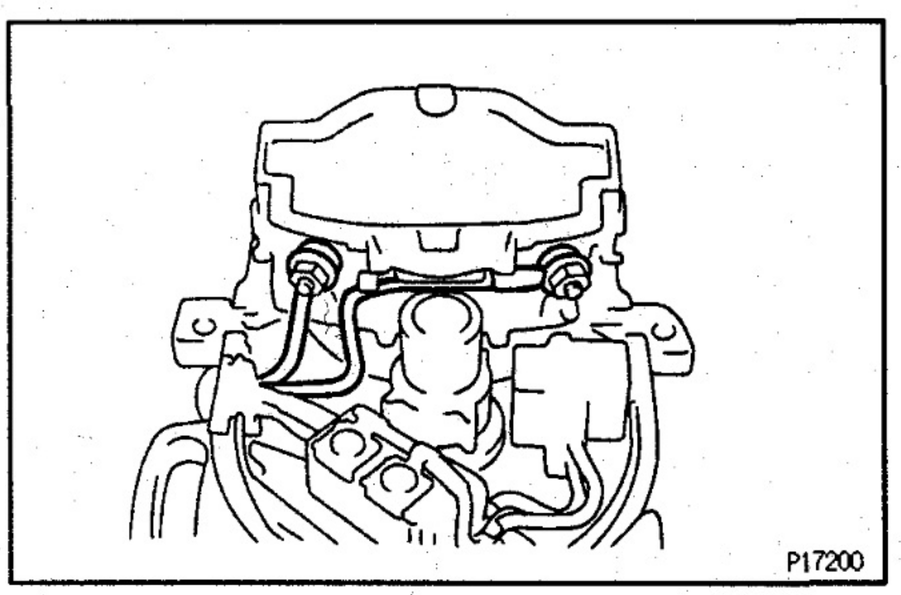
Part No. 08826–00080 or equivalent



(c) Install the ignition coil with the 4 screws.

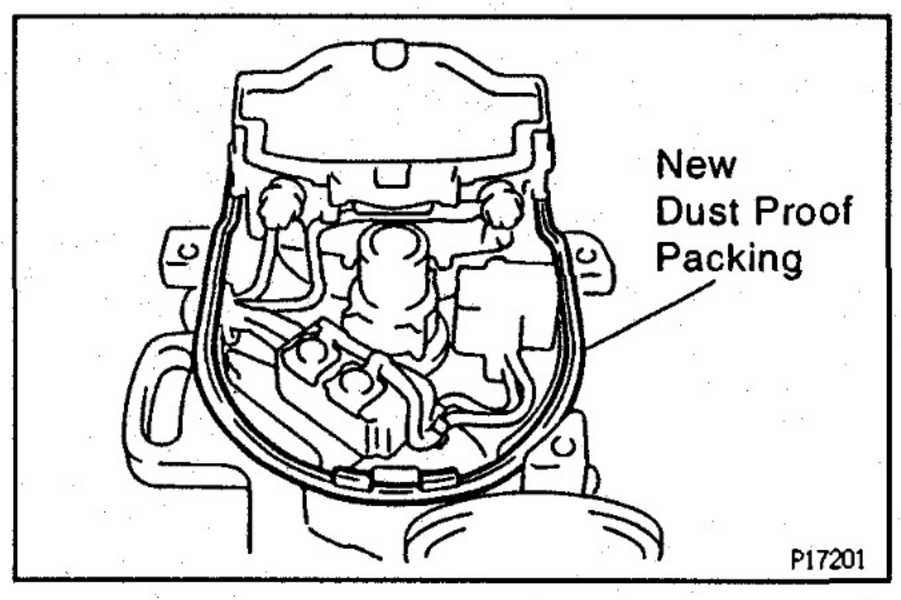


(d) Connect the 2 wires to the ignition coil terminals with the 2 nuts as shown in the illustration.



NOTICE:

- **When connecting the wires to the ignition coil, insert the wire properly into the groove found on the side of the ignition coil.**
- **Be sure the wires do not contact with signal rotor or distributor housing.**

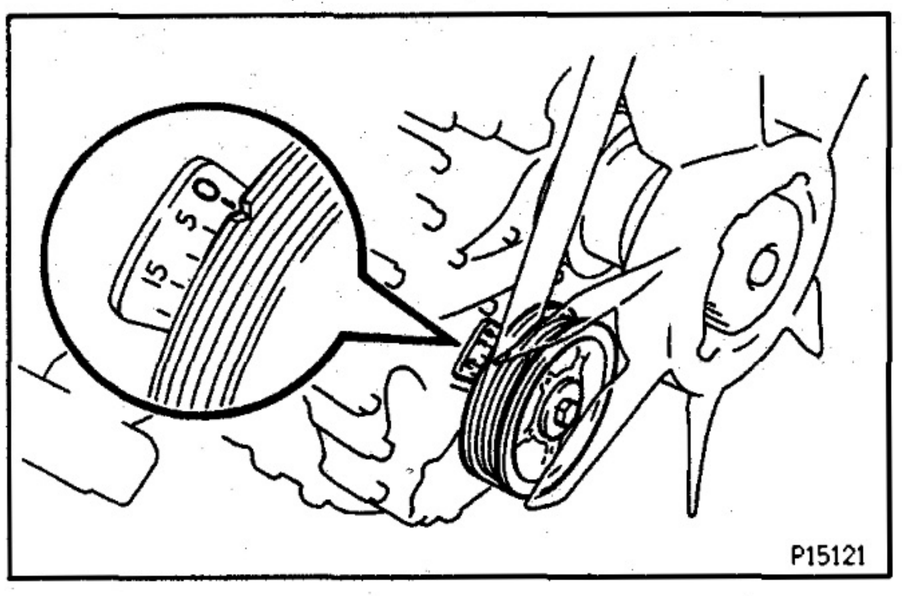


13. INSTALL IGNITION COIL DUST COVER

(a) Install a new dust proof packing to the distributor housing.

(b) Install the dust cover.

14. INSTALL ROTOR



IG0029–01

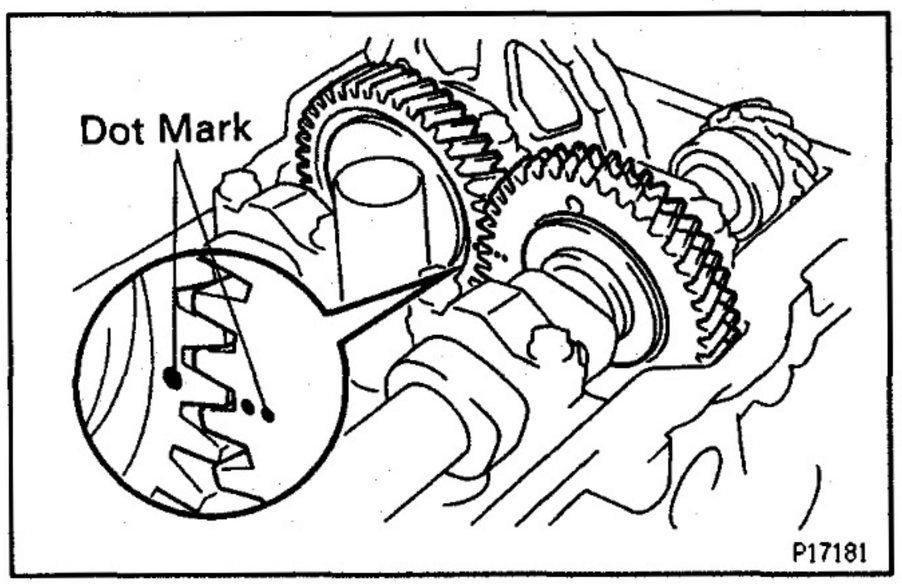
DISTRIBUTOR INSTALLATION

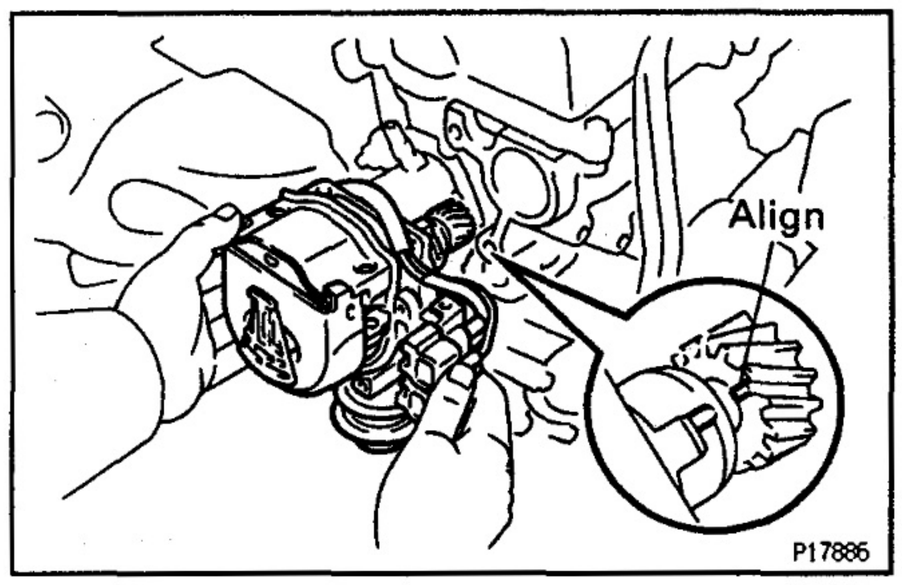
1. CHECK NO.1 CYLINDER TO TDC/COMPRESSION

If necessary, remove the cylinder head cover, and check the following conditions:

- Turn the crankshaft pulley clockwise and align its groove with the timing mark "0" of the oil pump cover.
- Verify that the timing marks with 1 and 2 dots are in a straight line on the cylinder head surface as shown in the illustration.

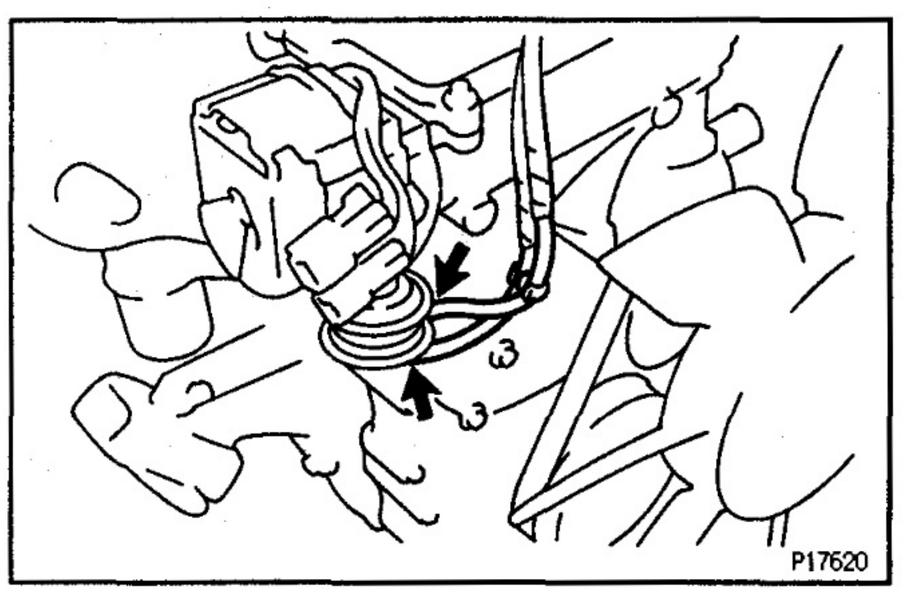
If not, turn the crankshaft 1 revolution (360°) and align the mark as above.





2. INSTALL DISTRIBUTOR

(a) Install a new O–ring to the distributor.
HINT: Always use a new O–ring when installing the distributor.
(b) Align the protrusion of the distributor housing with the groove on the driven gear.
(c) Apply a light coat of engine oil on the O–ring.
(d) Install the distributor with 2 bolts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



(e) Connect the 2 vacuum hoses.

3. INSTALL DISTRIBUTOR CAP

Install the distributor cap with the 3 bolts.

4. RECONNECT HIGH–TENSION CORDS TO DISTRIBUTOR CAP

5. CONNECT DISTRIBUTOR CONNECTORS

6. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

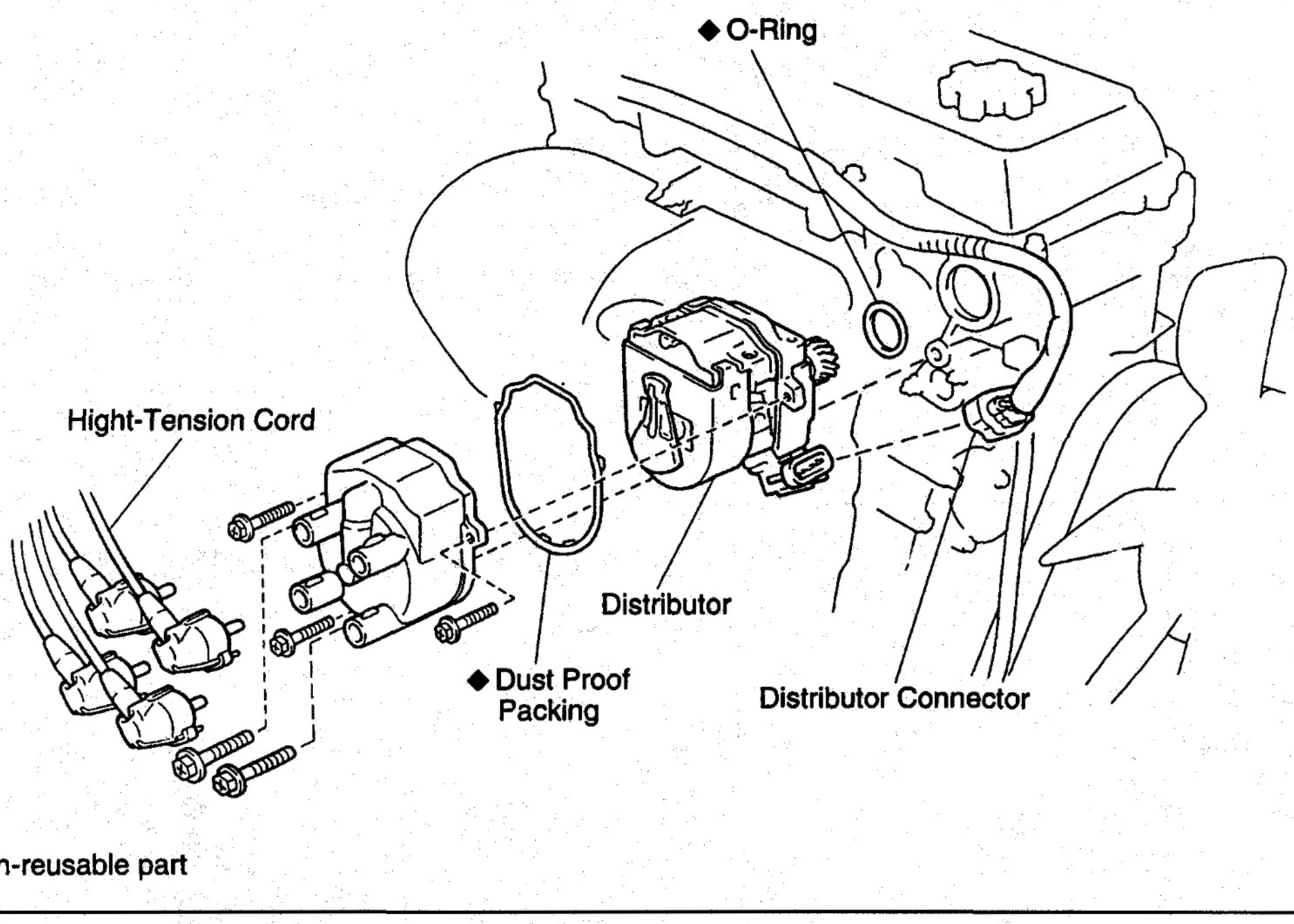
7. ADJUST IGNITION TIMING

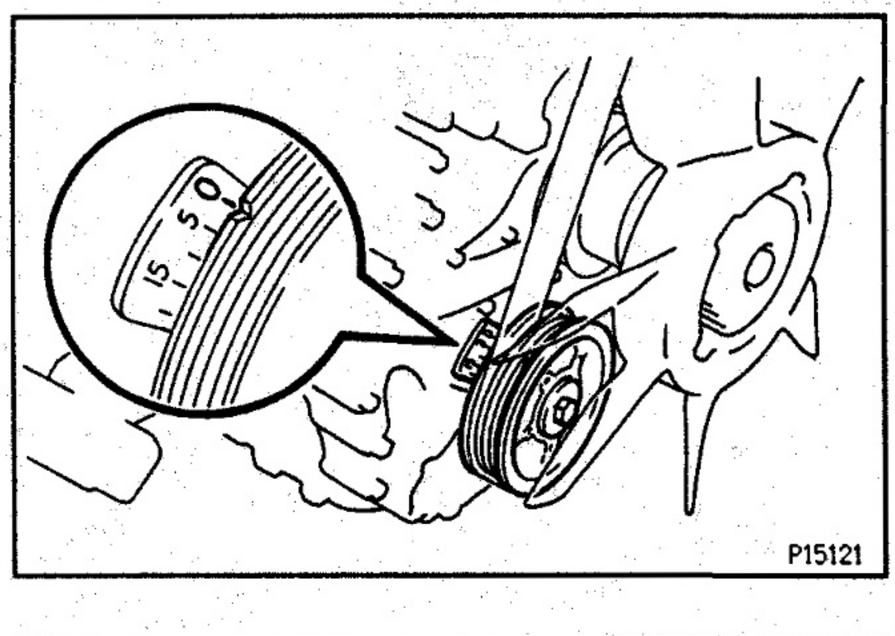
(See ignition timing inspection in Engine Mechanical)

DISTRIBUTOR (3RZ–FE)

IG039–0E

COMPONENTS FOR REMOVAL AND INSTALLATION



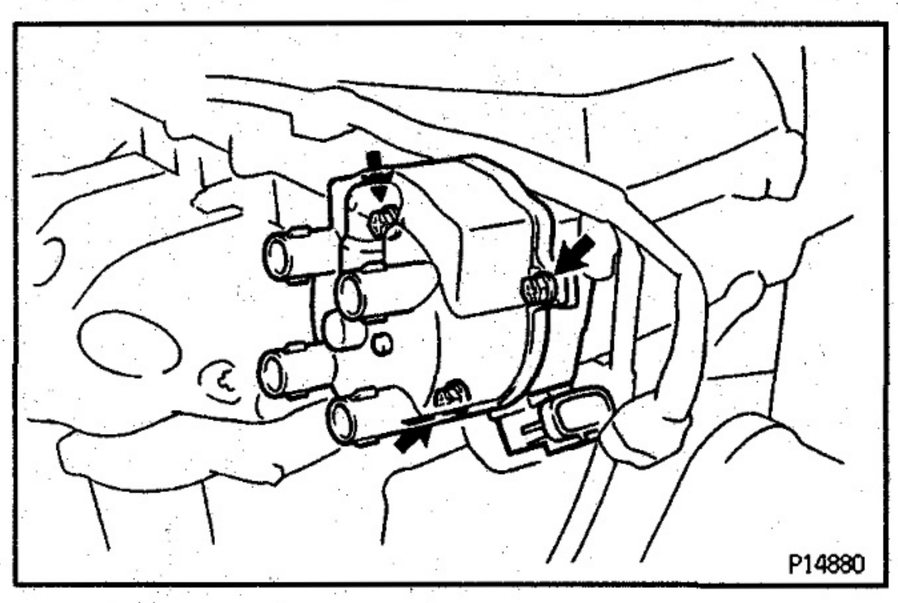


IGOGA–05

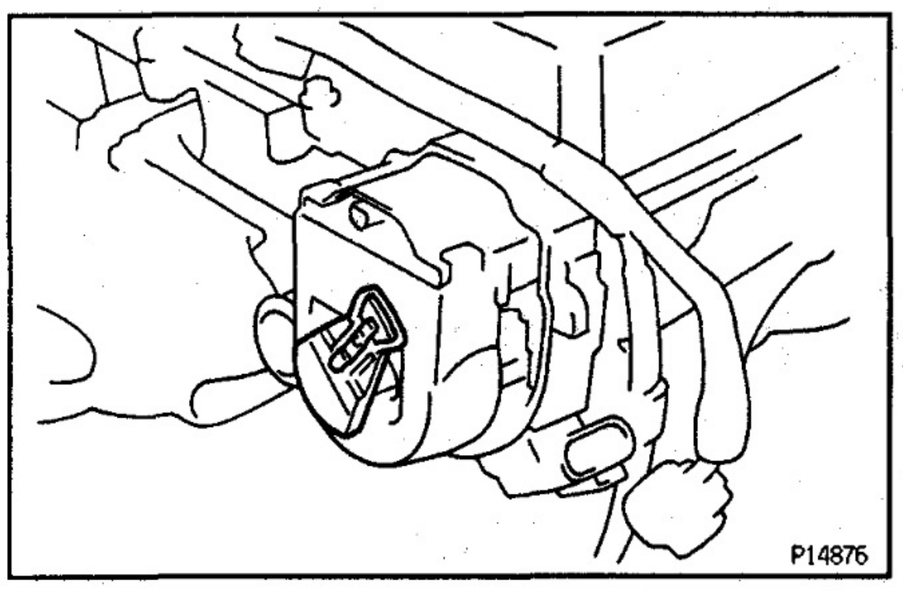
DISTRIBUTOR REMOVAL

1. **DISCONNECT DISTRIBUTOR CONNECTOR**
2. **DISCONNECT HIGH–TENSION CORDS FROM DISTRIBUTOR CAP**
   (See step 2 in high–tension cords inspection)
3. **SET NO.1 CYLINDER TO TDC/COMPRESSION**

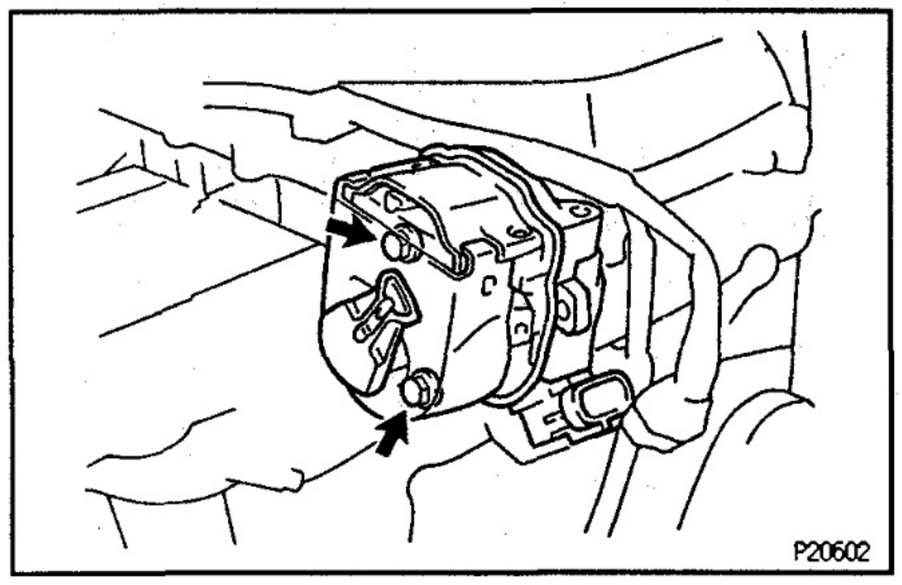
(a) Turn the crankshaft pulley clockwise until the timing mark is aligned with "0" mark on the oil pump cover.



(b) **Remove the 3 bolts and distributor cap.**



(c) Check that the distributor rotor direction is as shown. If not, turn the crankshaft pulley one complete revolution.



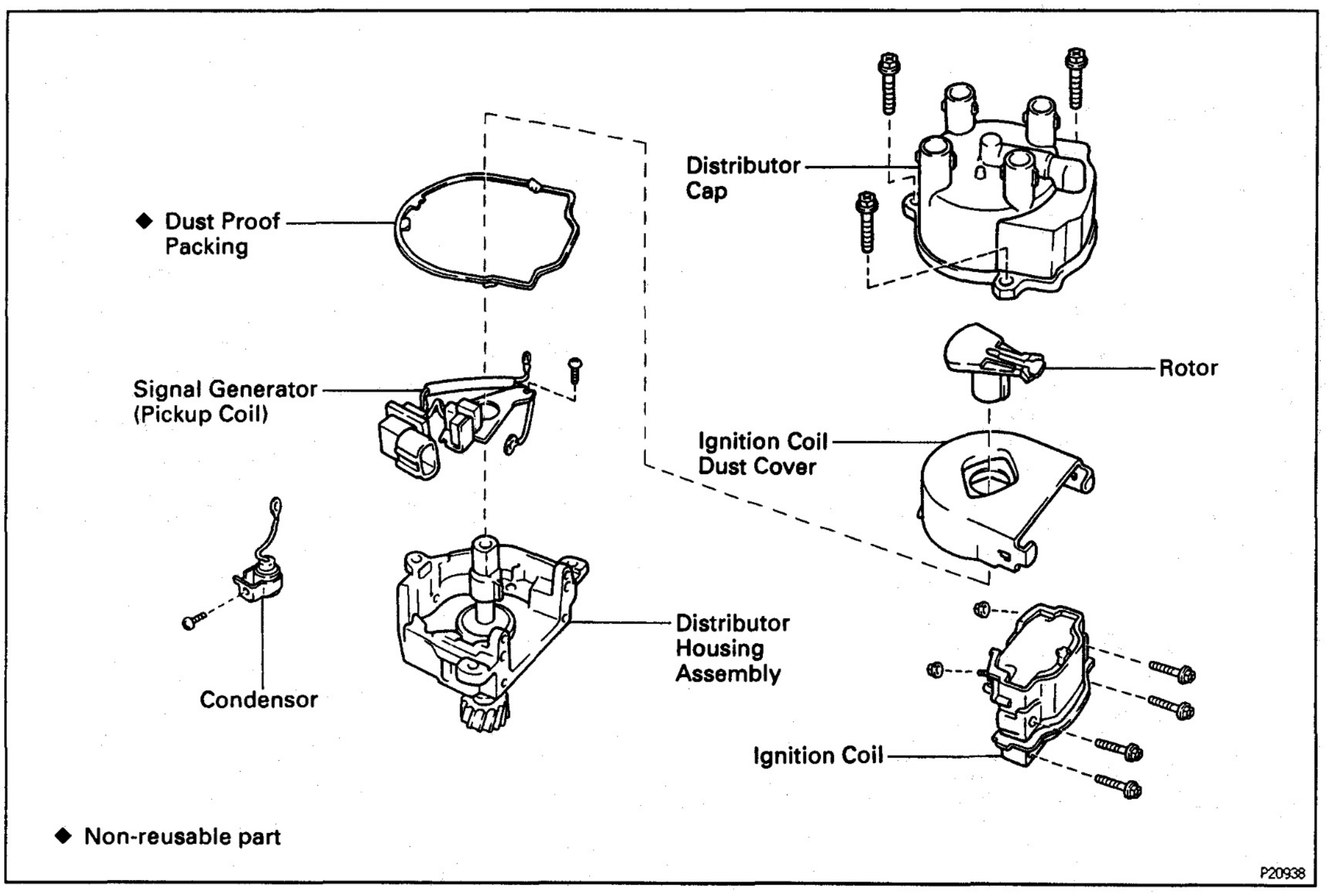
4. REMOVE DISTRIBUTOR

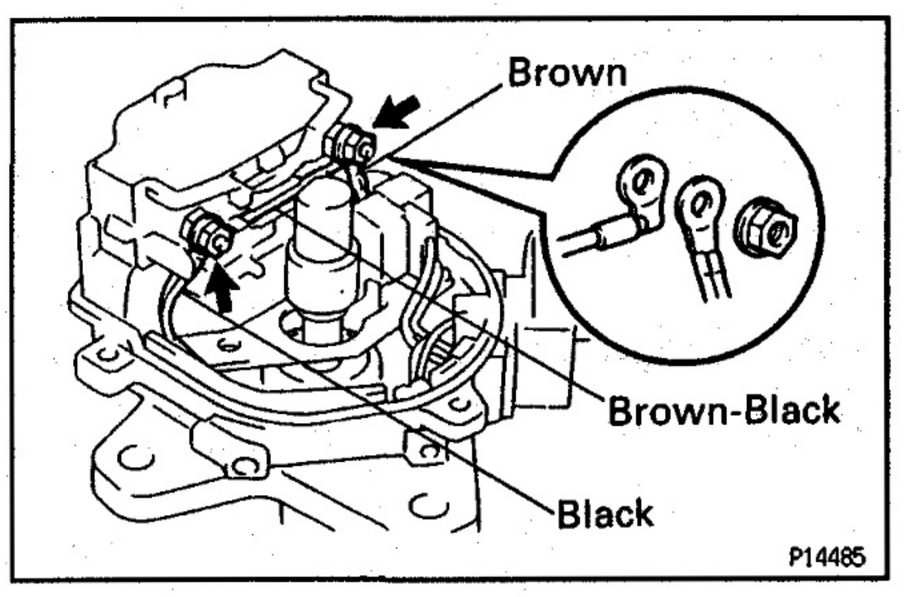
(a) Remove the 2 mounting bolts, and pull out the distributor.

(b) Remove the O–ring from the distributor housing.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

IG044–07





IG00A–01

DISTRIBUTOR DISASSEMBLY

1. **REMOVE ROTOR**
2. **REMOVE IGNITION COIL DUST COVER**

(a) Remove the dust cover.

(b) Remove the dust proof packing.

3. **REMOVE IGNITION COIL**

(a) Remove the 2 nuts, and disconnect the 3 wires from the ignition coil terminals.

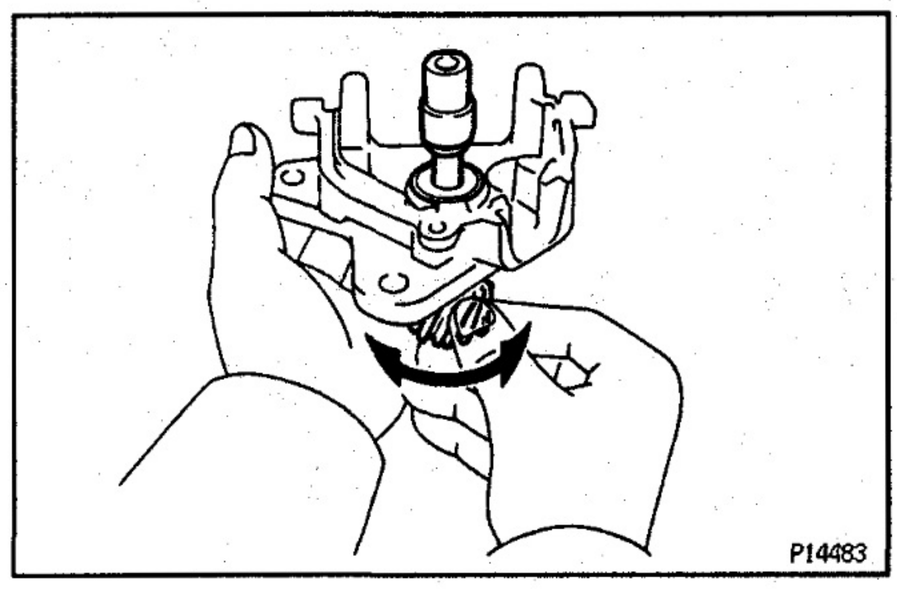
(b) Remove the 4 screws and ignition coil.

4. **REMOVE SIGNAL GENERATOR (PICKUP COIL)**

Remove the 2 screws and signal generator (pickup coil) from the distributor housing.

5. **REMOVE CONDENSER**

Remove the screw and condenser.

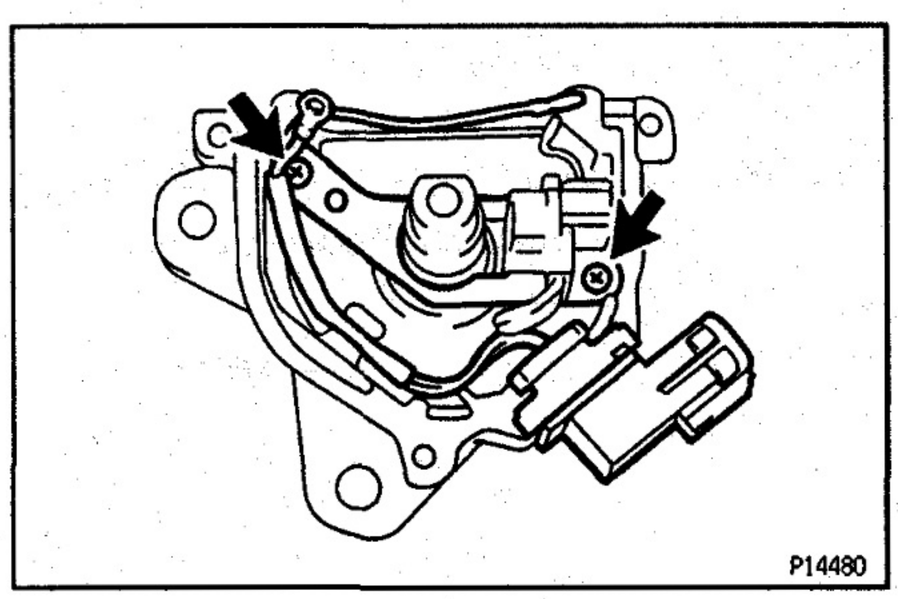


IG013–02

DISTRIBUTOR INSPECTION

INSPECT SHAFT

Turn the shaft and check that it is not rough or worn. If it feels rough or worn, replace the distributor housing assembly.



IG00B–01

DISTRIBUTOR ASSEMBLY

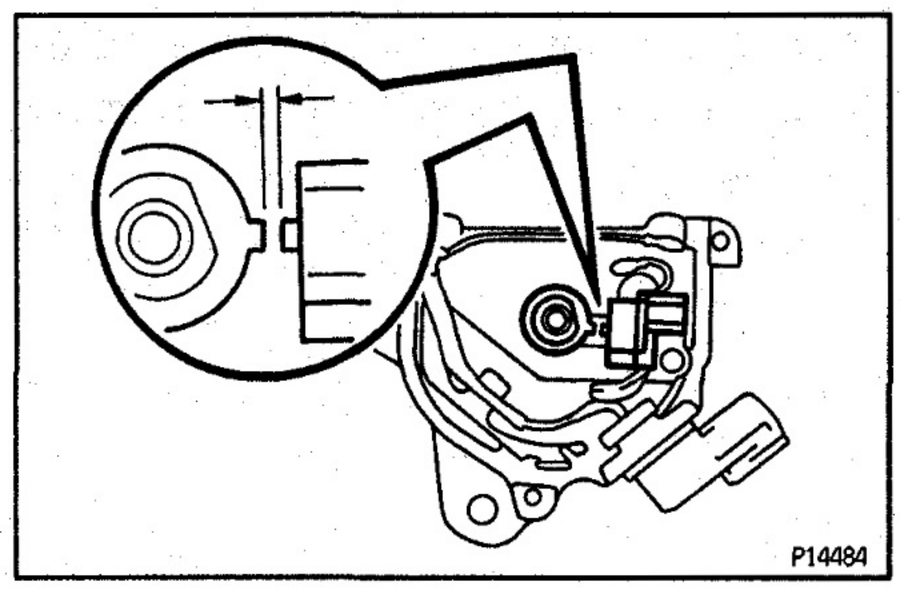
1. **INSTALL CONDENSER**

Install the condenser with the screw.

2. **INSTALL SIGNAL GENERATOR (PICKUP COIL)**

(a) Install the signal generator (pickup coil) to the distributor housing.

(b) Align the rotor tooth with the pickup coil, and temporarily install the 2 screws.

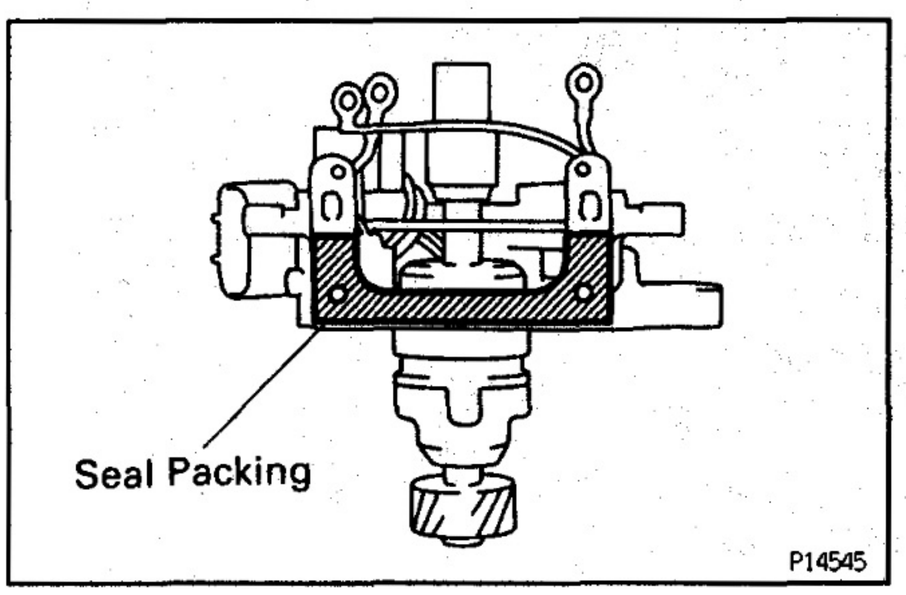


(c) Using a thickness gauge, set the air gap and tighten the 2 screws.

Air gap:

0.2 – 0.4 mm (0.008 – 0.016 in.)

NOTICE: Be sure that the wires do not contact with the signal rotor.



3. INSTALL IGNITION COIL

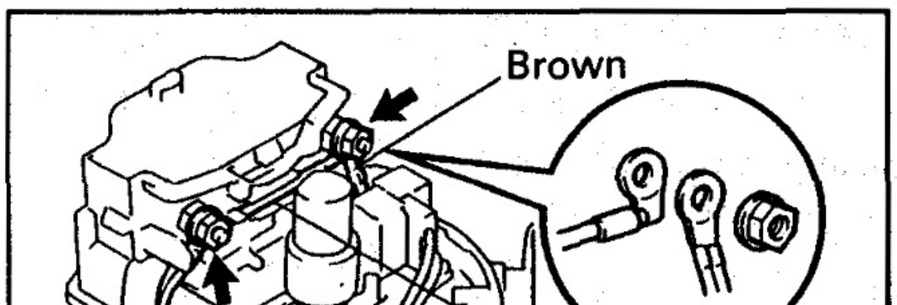
(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the ignition coil installing surface of the housing as shown in the illustration.

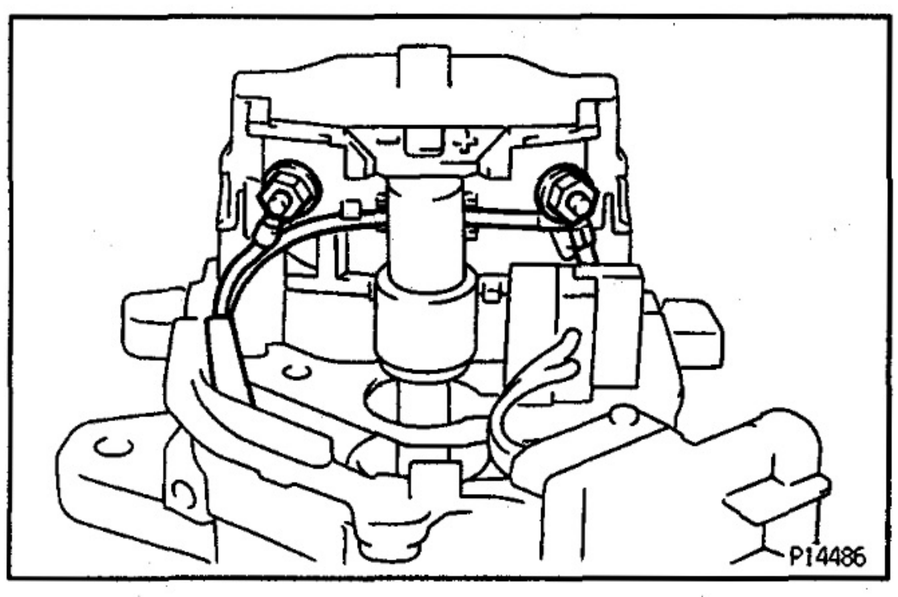
Seal packing:

Part No. 08826–00080 or equivalent

(c) Install the ignition coil with the 4 screws.



(d) Connect the 3 wires to the ignition coil terminals with the 2 nuts as shown in the illustration.



NOTICE:

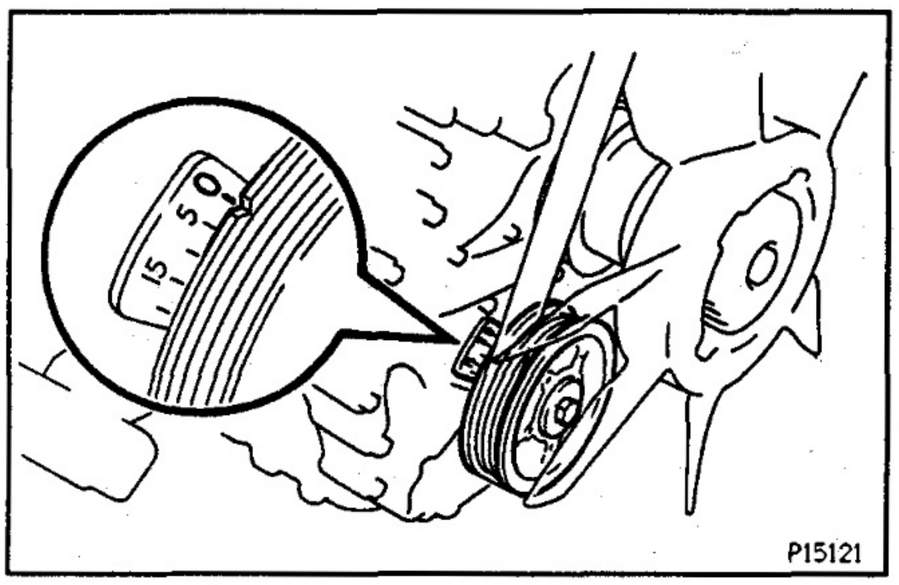
- **When connecting the wires to the ignition coil, insert the wire properly into the groove on the side of the ignition coil.**
- **Be sure the wires do not contact with signal rotor or distributor housing.**

4. INSTALL IGNITION COIL DUST COVER

(a) Install a new dust proof packing to the distributor housing.

(b) Install the dust cover.

5. INSTALL ROTOR



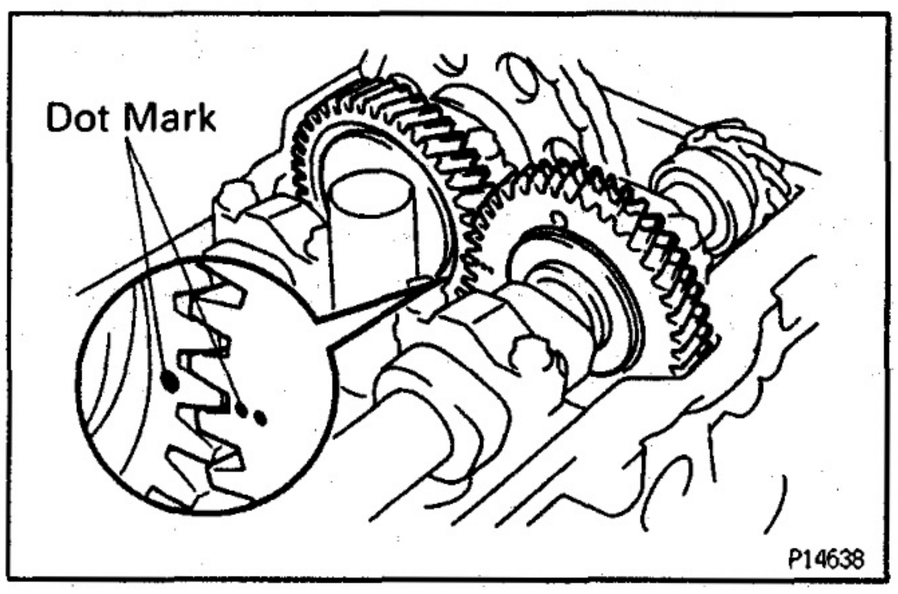
DISTRIBUTOR INSTALLATION

IG0J6–03

1. CHECK NO.1 CYLINDER TO TDC/COMPRESSION

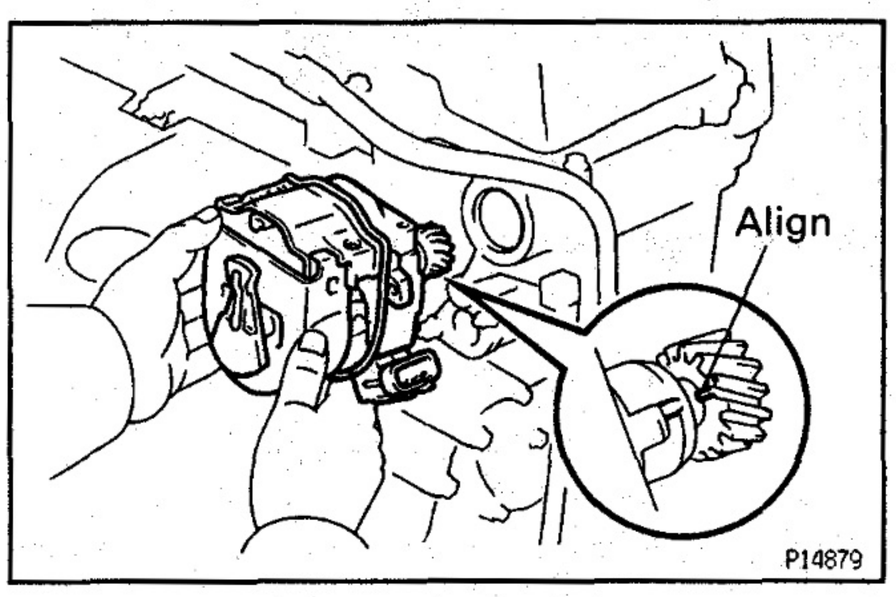
If necessary, remove the cylinder head cover, and check the following conditions:

- Turn the crankshaft pulley clockwise and align its groove with the timing mark "0" of the oil pump cover.



- Verify that the timing marks with 1 and 2 dots are in straight line on the cylinder head surface as shown in the illustration.

If not, turn the crankshaft 1 revolution (360°) and align the mark as above.



2. INSTALL DISTRIBUTOR

(a) Install a new O–ring to the distributor.
HINT: Always use a new O–ring when installing the distributor.

(b) Align the protrusion of the distributor housing with the groove on the driven gear.

(c) Apply a light coat of engine oil on the O–ring.

(d) Install the distributor with 2 bolts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)

3. INSTALL DISTRIBUTOR CAP

4. RECONNECT HIGH–TENSION CORDS TO DISTRIBUTOR CAP

5. CONNECT DISTRIBUTOR CONNECTOR

6. CHECK IGNITION TIMING
(See ignition timing inspection in Engine Mechanical)

IG

CRANKSHAFT POSITION SENSOR (3RZ–FE)

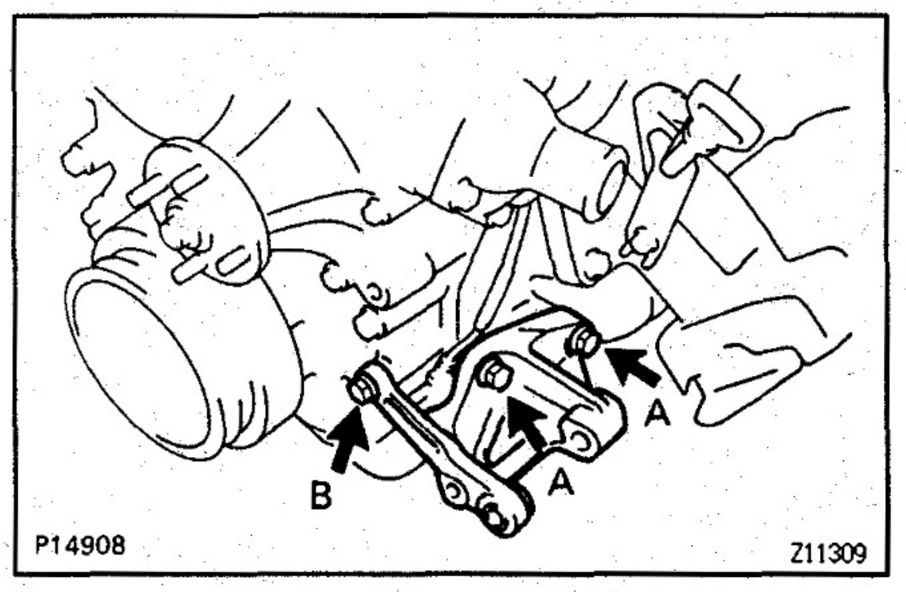
CRANKSHAFT POSITION SENSOR

IG0GD–06

REMOVAL

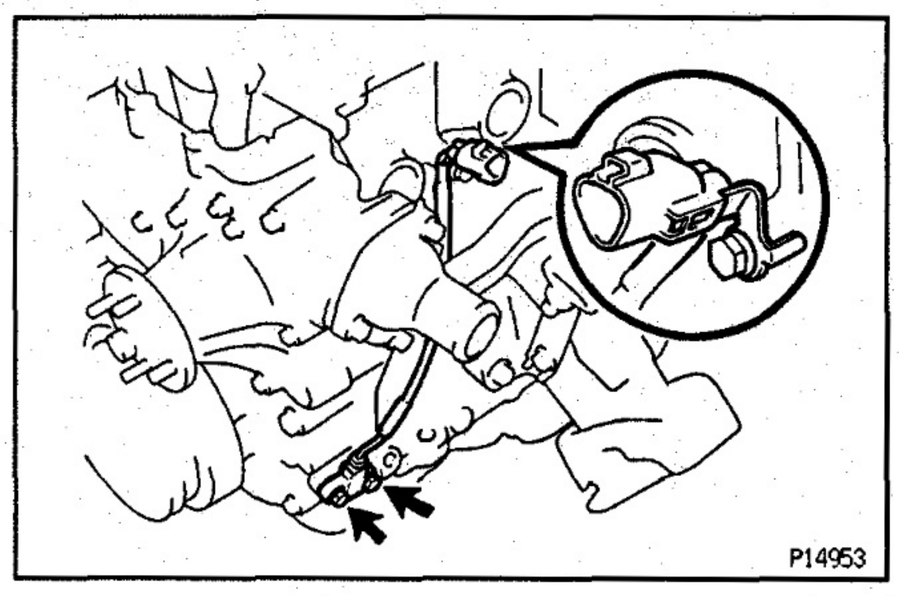
1. REMOVE ENGINE UNDER COVER

2. REMOVE ALTERNATOR
(See alternator removal in Charging)



3. REMOVE ALTERNATOR BRACKET
Remove the 3 bolts and bracket.
Torque:
Bolt A: 74.5 N·m (760 kgf·cm, 55 ft·lbf)
Bolt B: 18 N·m (180 kgf·cm, 13 ft·lbf)

4. DISCONNECT CRANKSHAFT POSITION SENSOR CONNECTOR



5. REMOVE CRANKSHAFT POSITION SENSOR

(a) Remove the 2 bolts and crankshaft position sensor.
Torque: 8.5 N·m (85 kgf·cm, 74 in.·lbf)

(b) Remove the O–ring.
INSTALLATION HINT:
- Always use a new O–ring when installing the crankshaft position sensor.
- Apply a light coat of engine oil on the O–ring.

IG0J7–0C

CRANKSHAFT POSITION SENSOR INSTALLATION

Installation is in the reverse order of removal.

SERVICE SPECIFICATIONS

IG05M–0B

SERVICE DATA

IG

Firing order	–		1 – 3 – 4 – 2
High–tension cord	Resistance	Maximum	25 kΩ per cord
Spark plug	Recommended spark plug	ND	K16R–U
	Recommended spark plug	NGK	BKR5EYA
	Correct electrode gap		0.8 mm (0.031 in.)
Ignition coil	Primary coil resistance	Cold	0.36 – 0.55 Ω
		Hot	0.45 – 0.65 Ω
	Secondary coil resistance	Cold	9.0 – 15.4 kΩ
		Hot	11.4 – 18.1 kΩ
Distributor	Air gap		0.2 – 0.4 mm (0.008 – 0.0016 in.)
	Signal generator (pickup coil) resistance	cold	185 – 275 Ω
		hot	240 – 325 Ω
(3RZ–FE) Crankshaft position sensor	Resistance at cold	NE⊕ – NE⊖	1,630 – 2,740 Ω
	at hot	NE⊕ – NE⊖	2,065 – 3,225 Ω

IG017–0M

TORQUE SPECIFICATIONS

Part tightened		N·m	kgf·cm	ft·lbf
Spark plug x Cylinder head		20	200	14
Distributor x Cylinder head		19	195	14
Crankshaft position sensor x Timing chain cover	(3RZ–FE)	8.5	85	74 in.·lbf
Generator bracket x Cylinder block	(3RZ–FE)	74.5	760	55
Generator bracket x Timing chain cover	(3RZ–FE)	18	180	13

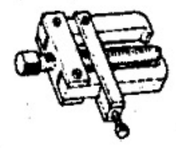
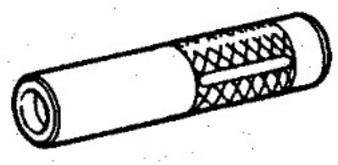
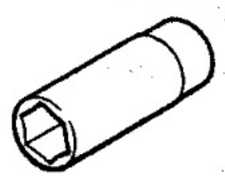
STARTING

PREPARATION ..... ST– 2
STARTER ..... ST– 3
STARTER RELAY ..... ST– 13
SERVICE SPECIFICATIONS ..... ST– 14

PREPARATION

SST (SPECIAL SERVICE TOOLS)

ST00S-1A

	09286-46011	Injection Pump Spline Shaft Puller	Armature bearing
	09201-41020	Valve Stem Oil Seal Replacer	Armature rear bearing
	09285-76010	Injection Pump Camshaft Bearing Cone Replacer	Armature rear bearing
	09810-38140	Starter Magnet Switch Nut Wrench 14	Terminal nut

ST

RECOMMENDED TOOLS

ST00T-11

	09082-00040	TOYOTA Electrical Tester.	

EQUIPMENT

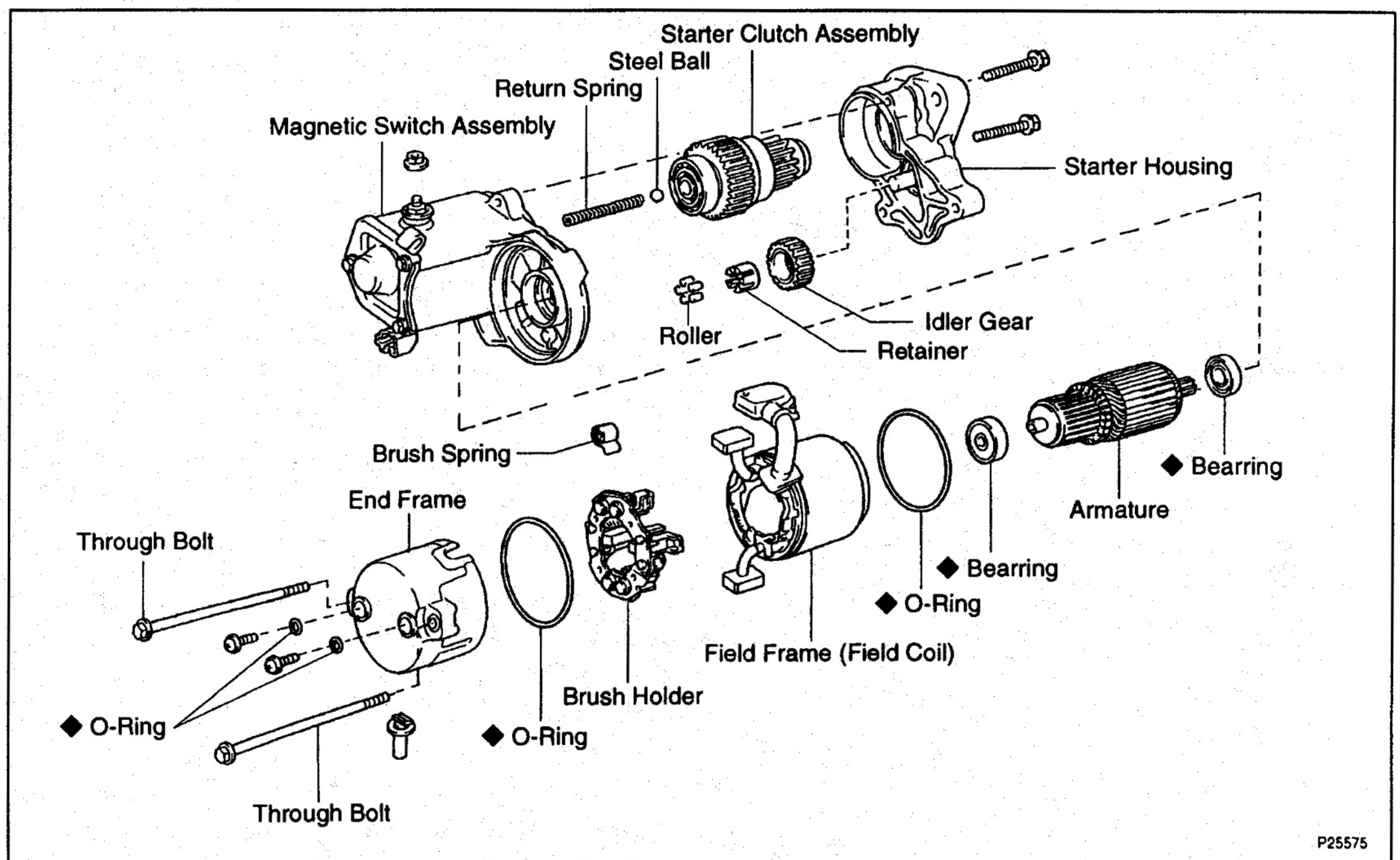
ST00U-0T

Dial indicator	Commutator
Magnetic finger	
Pull scale	Brush spring
Sandpaper	Commutator
Torque wrench	
V-block	
Vernier calipers	Commutator, Brush

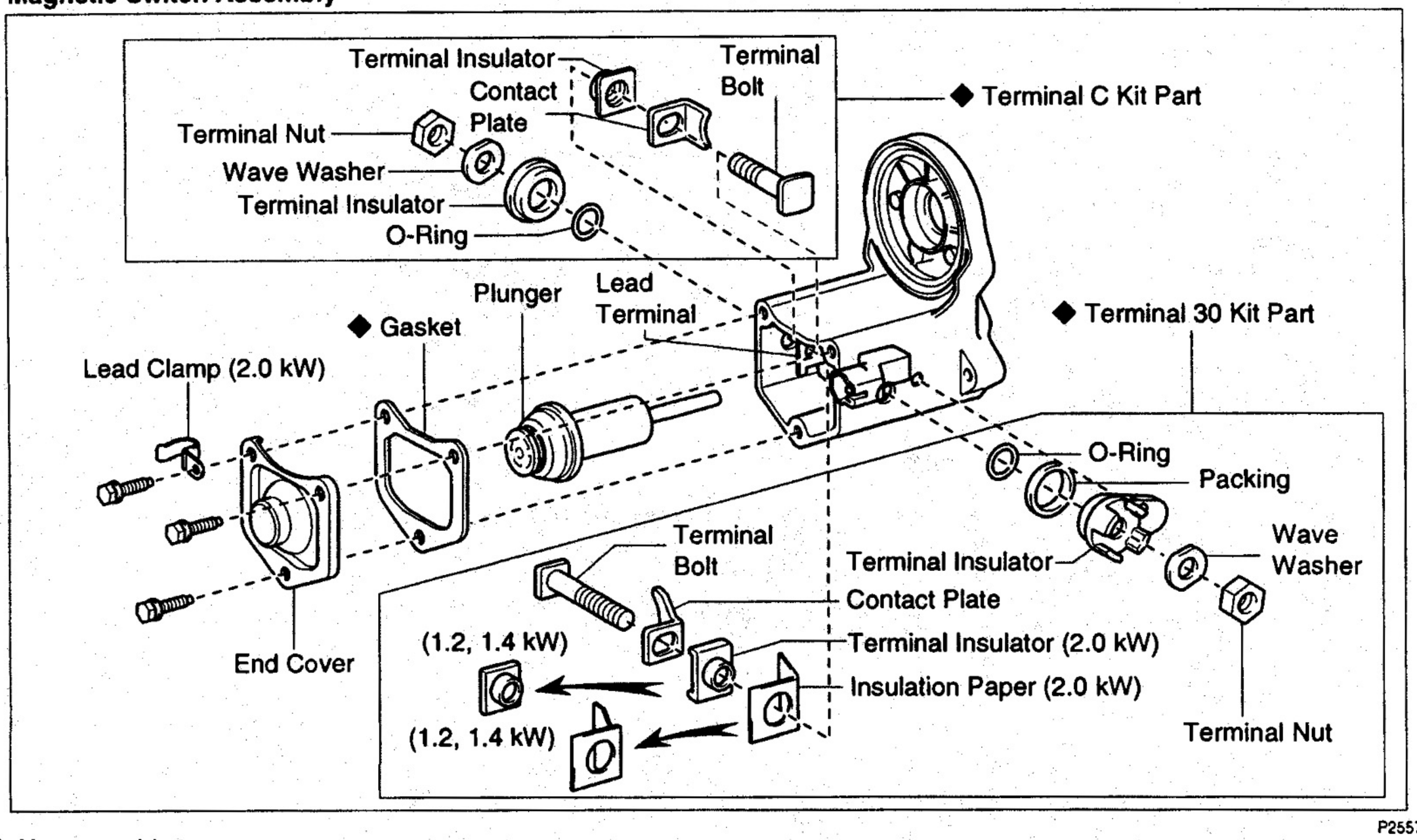
STARTER

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

ST0DA-02



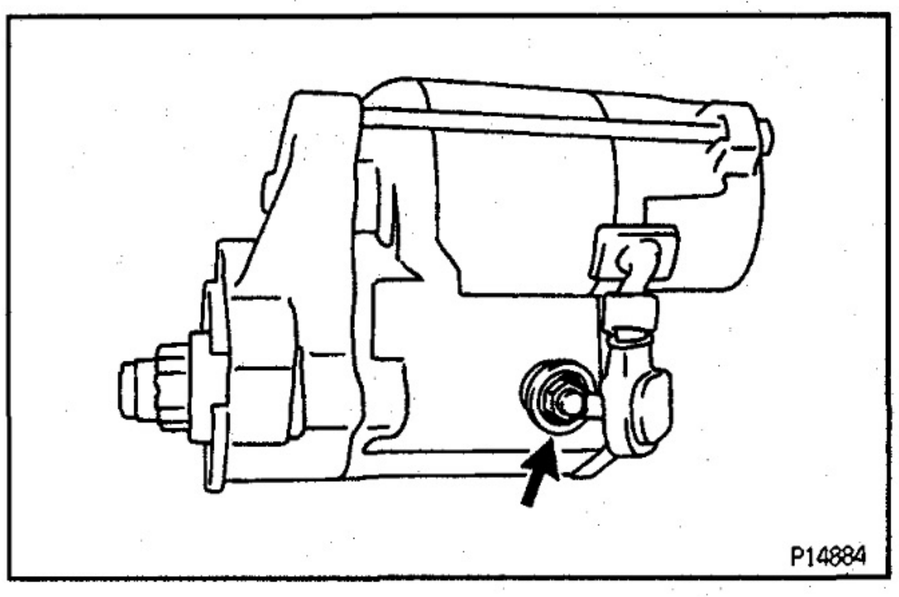
Magnetic Switch Assembly



◆ Non-reusable part

Y Z18509

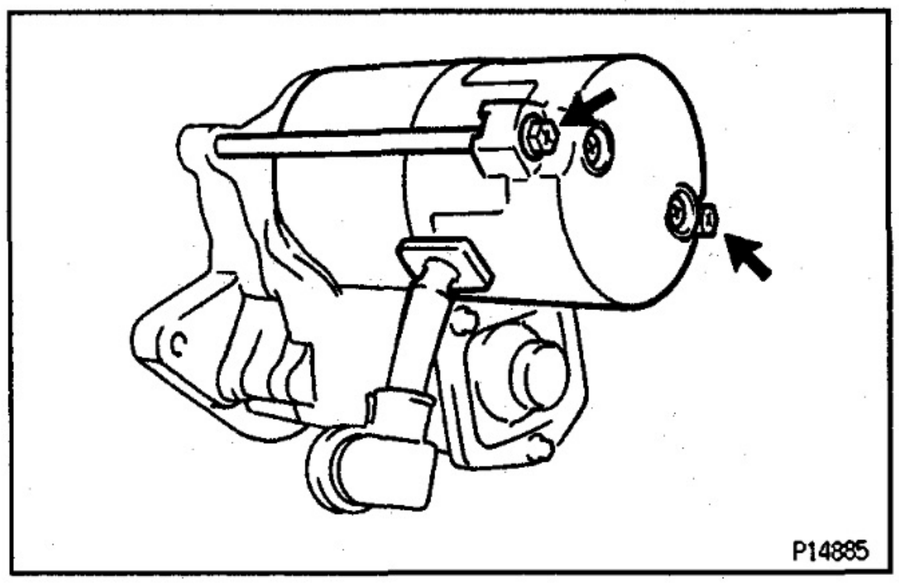
ST097-06



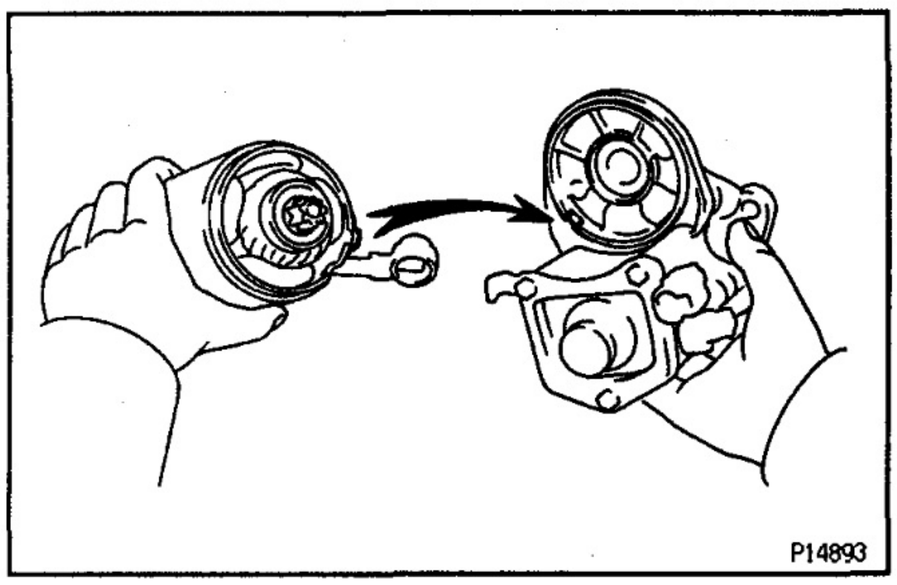
STARTER DISASSEMBLY

1. REMOVE FIELD FRAME AND ARMATURE

(a) Remove the nut and disconnect the lead wire from the magnetic switch terminal.
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)

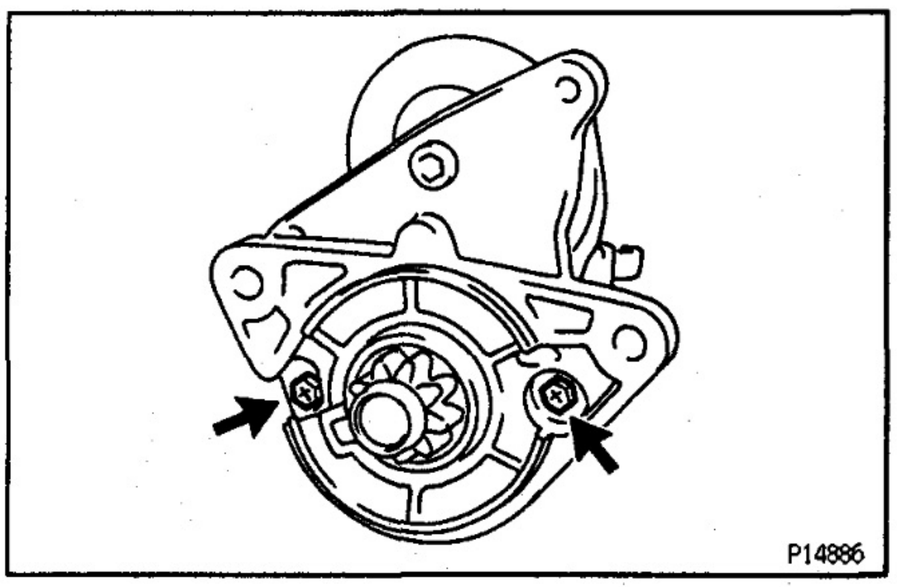


(b) Remove the 2 through bolts.
Torque:
1.2 kW type: 5.9 N·m (60 kgf·cm, 52 in.·lbf)
1.4 kW type: 5.9 N·m (60 kgf·cm, 52 in.·lbf)
2.0 kW type: 9.3 N·m (93 kgf·cm, 82 in.·lbf)



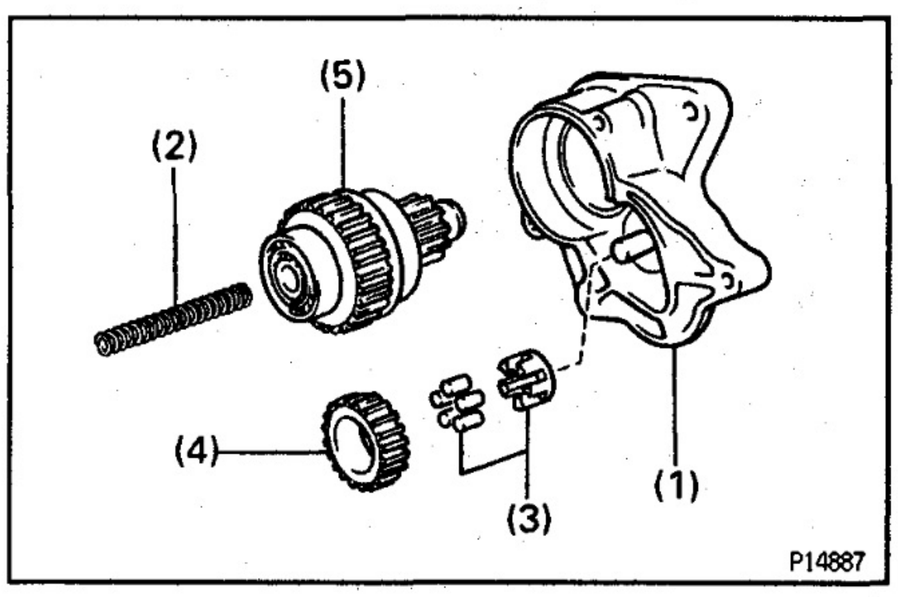
(c) Pull out the field frame with the armature from the magnetic switch assembly.

(d) Remove the O—ring.
ASSEMBLY HINT:
- Use a new O—ring.
- Align the protrusion of the field frame with the cutout of the magnetic switch.

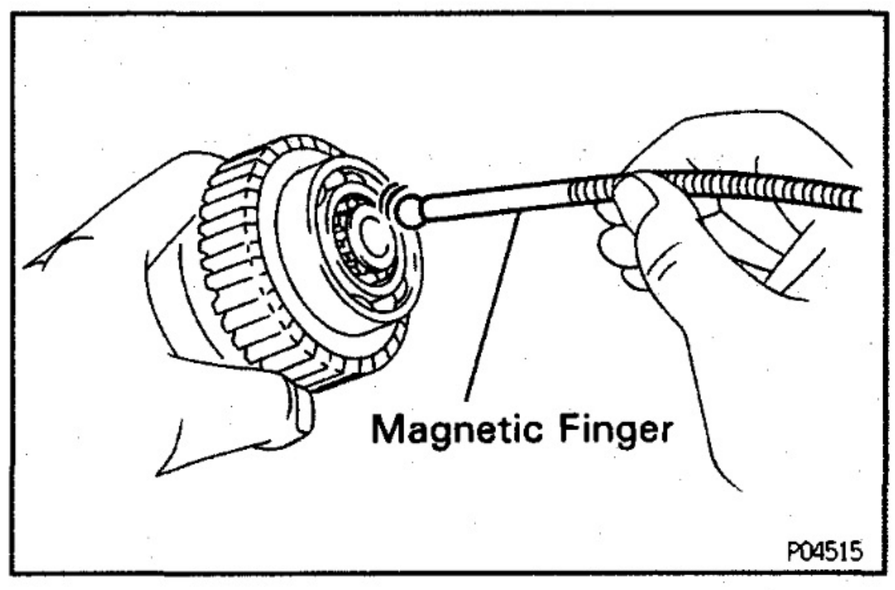


2. REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEAR

(a) Remove the 2 screws.
Torque:
1.2 kW type: 5.9 N·m (60 kgf·cm, 52 in.·lbf)
1.4 kW type: 5.9 N·m (60 kgf·cm, 52 in.·lbf)
2.0 kW type: 9.3 N·m (93 kgf·cm, 82 in.·lbf)

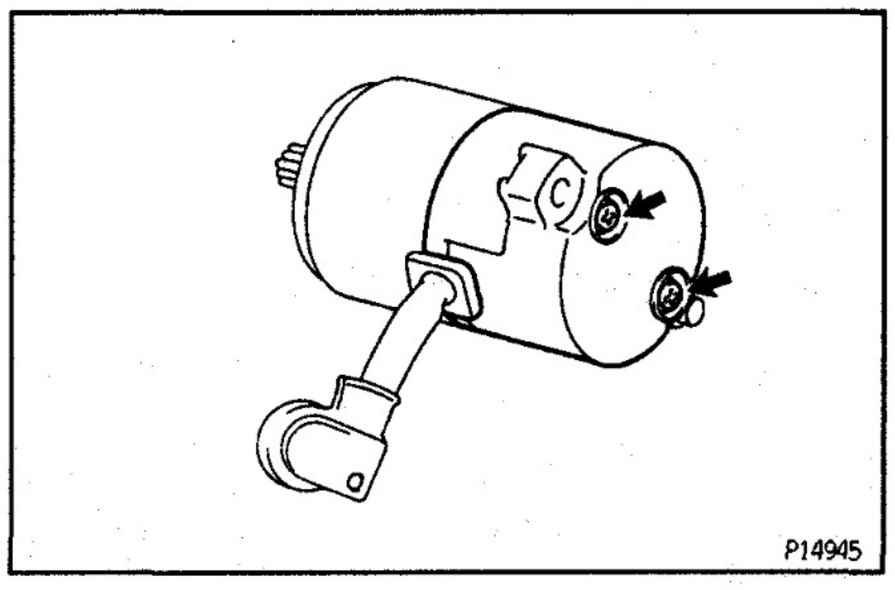


(b) Remove these parts from the magnetic switch assembly:
(1) Starter housing
(2) Return spring
(3) Bearing
(4) Idler gear
(5) Clutch assembly



3. REMOVE STEEL BALL

Using a magnetic finger, remove the steel ball from the clutch shaft hole.



4. REMOVE BRUSH HOLDER

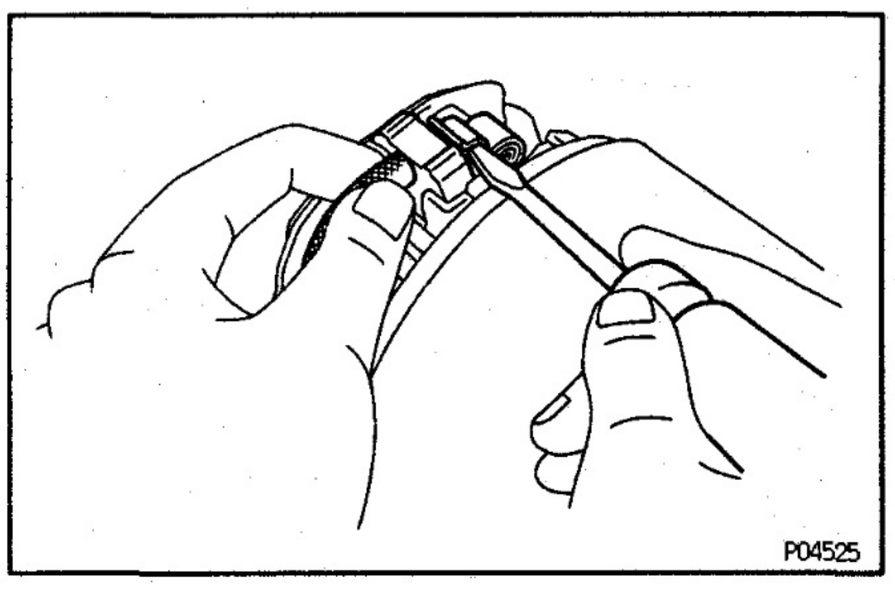
(a) Remove the 2 screws and end cover from the field frame.

Torque:

1.2 kW type: 1.5 N·m (15 kgf·cm, 13 in.·lbf)
1.4 kW type: 1.5 N·m (15 kgf·cm, 13 in.·lbf)
2.0 kW type: 3.8 N·m (39 kgf·cm, 34 in.·lbf)

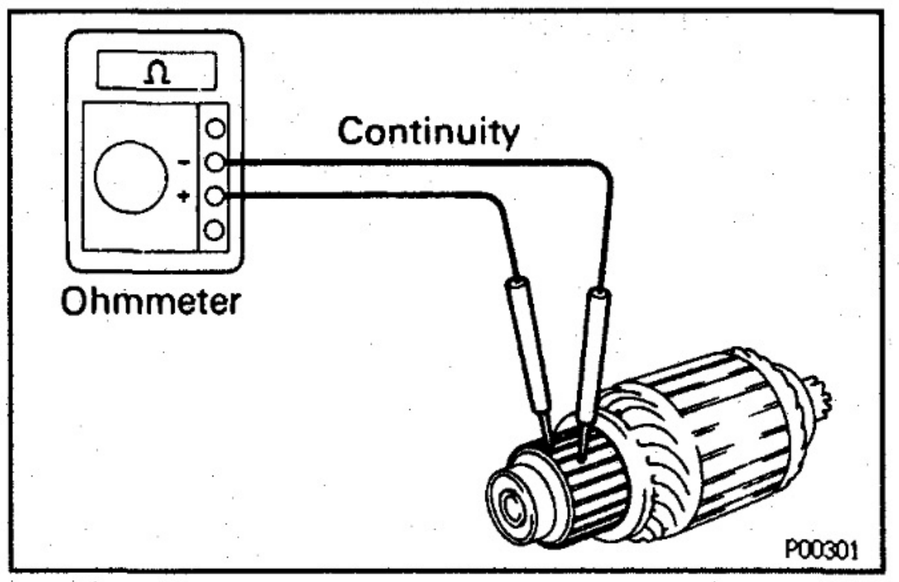
(b) Remove the O–ring from the field frame.

ASSEMBLY HINT: Use a new O–ring.



(c) Using a screwdriver, hold the spring back and disconnect the brush from the brush holder. Disconnect the 4 brushes and remove the brush holder.

5. REMOVE ARMATURE FROM FIELD FRAME



STARTER INSPECTION AND REPAIR

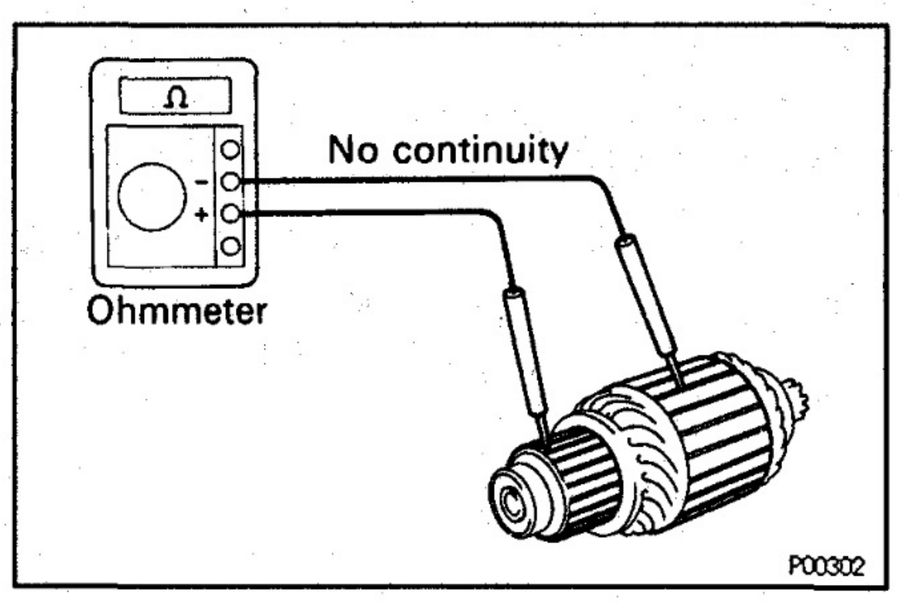
ST0DW–02

Armature Coil

1. INSPECT COMMUTATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the segments of the commutator.

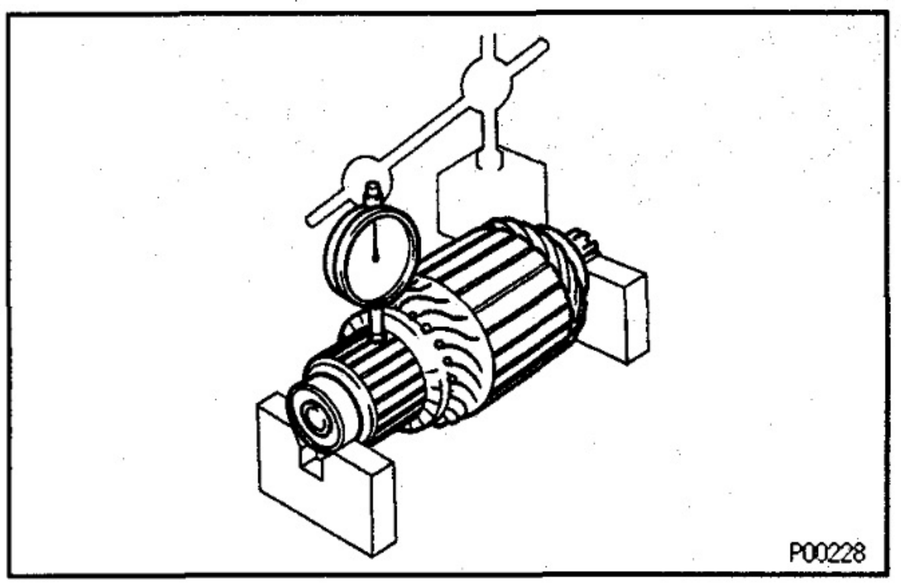
If there is no continuity between any segment, replace the armature.



2. INSPECT COMMUTATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.



Commutator

1. **INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES**

   If the surface is dirty or burnt, correct it with sandpaper (No. 400) or on a lathe.

2. **INSPECT COMMUTATOR CIRCLE RUNOUT**

(a) Place the commutator on V–blocks.

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

Maximum circle runout:

0.05 mm (0.0020 in.)

If the circle runout is greater than the maximum, correct it on a lathe.

3. **INSPECT COMMUTATOR DIAMETER**

Using vernier calipers, measure the commutator diameter.

Standard diameter:

1.2 kW type: 30 mm (1.18 in.)

1.4 kW type: 30 mm (1.18 in.)

2.0 kW type: 35 mm (1.378 in.)

Minimum diameter:

1.2 kW type: 29 mm (1.14 in.)

1.4 kW type: 29 mm (1.14 in.)

2.0 kW type: 34 mm (1.339 in.)

If the diameter is less than the minimum, replace the armature.

4. **INSPECT UNDERCUT DEPTH**

Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

Standard undercut depth:

1.2 kW type: 0.6 mm (0.024 in.)

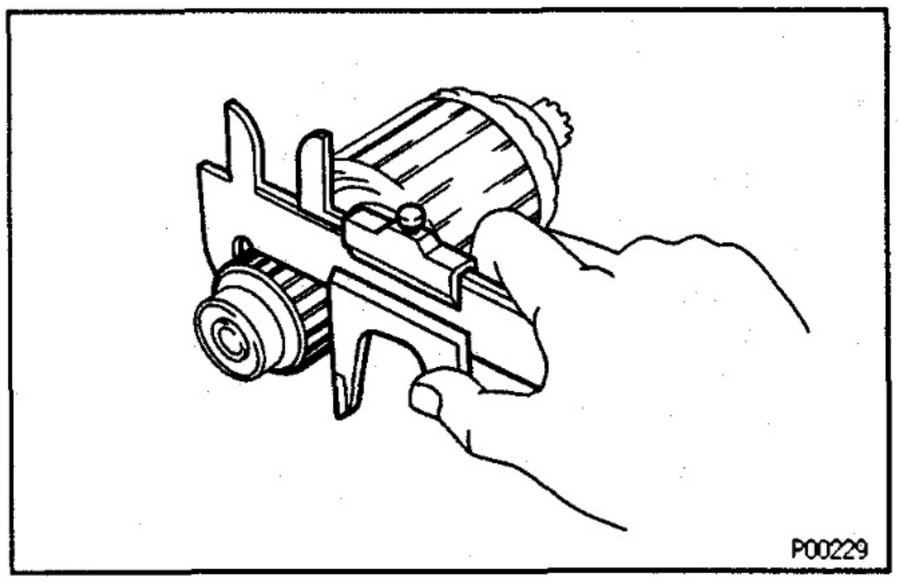
1.4 kW type: 0.6 mm (0.024 in.)

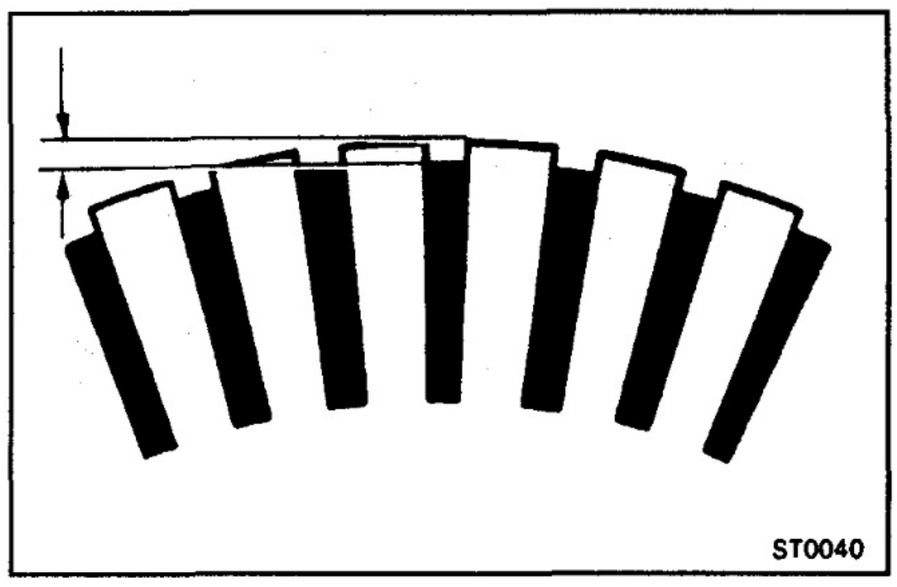
2.0 kW type: 0.7 mm (0.028 in.)

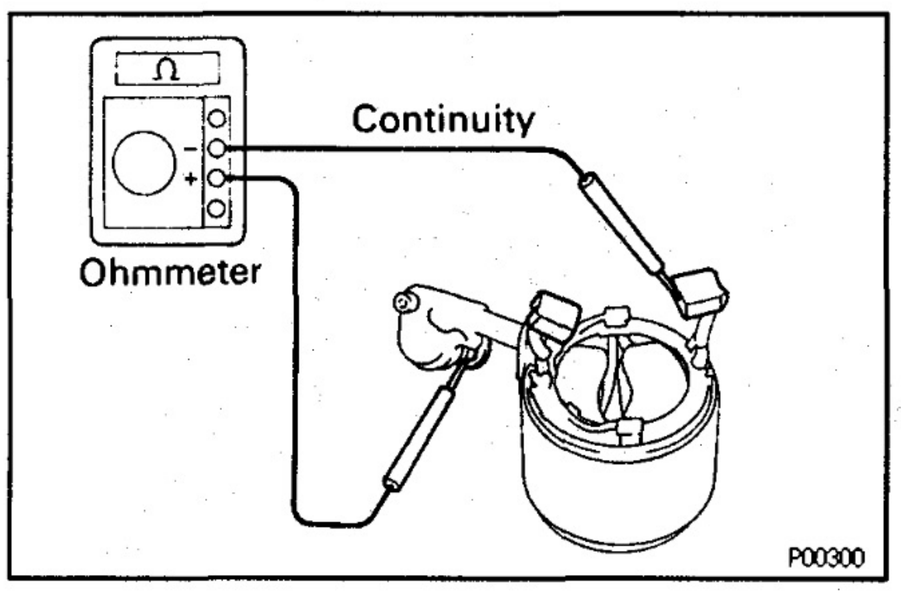
Minimum undercut depth:

0.2 mm (0.008 in.)

If the undercut depth is less than the minimum, correct it with a hacksaw blade.





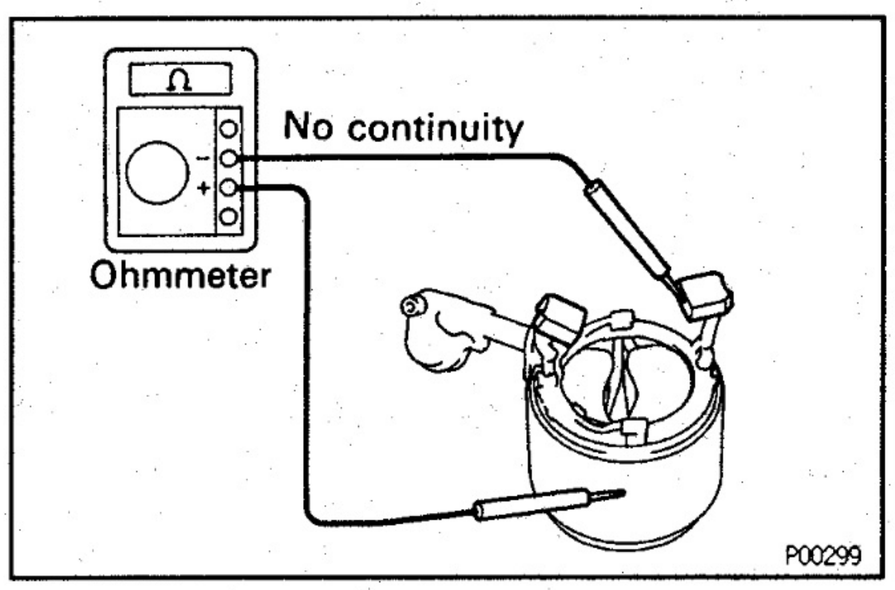


Field Frame (Field Coil)

1. **INSPECT FIELD COIL FOR OPEN CIRCUIT**

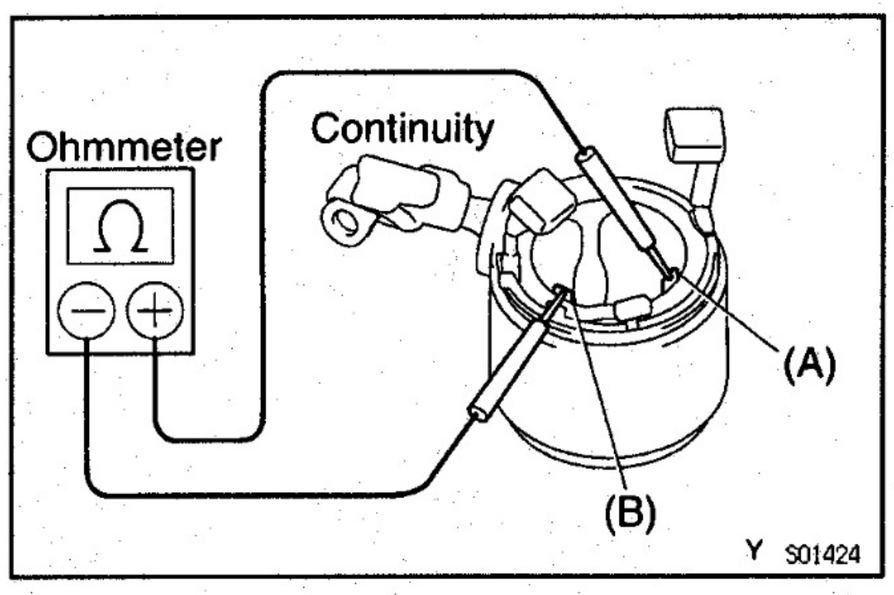
Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

If there is no continuity, replace the field frame.



2. INSPECT FIELD COIL FOR GROUND

Using an ohmmeter, check that there is no continuity between the field coil end and field frame.
If there is continuity, repair or replace the field frame.



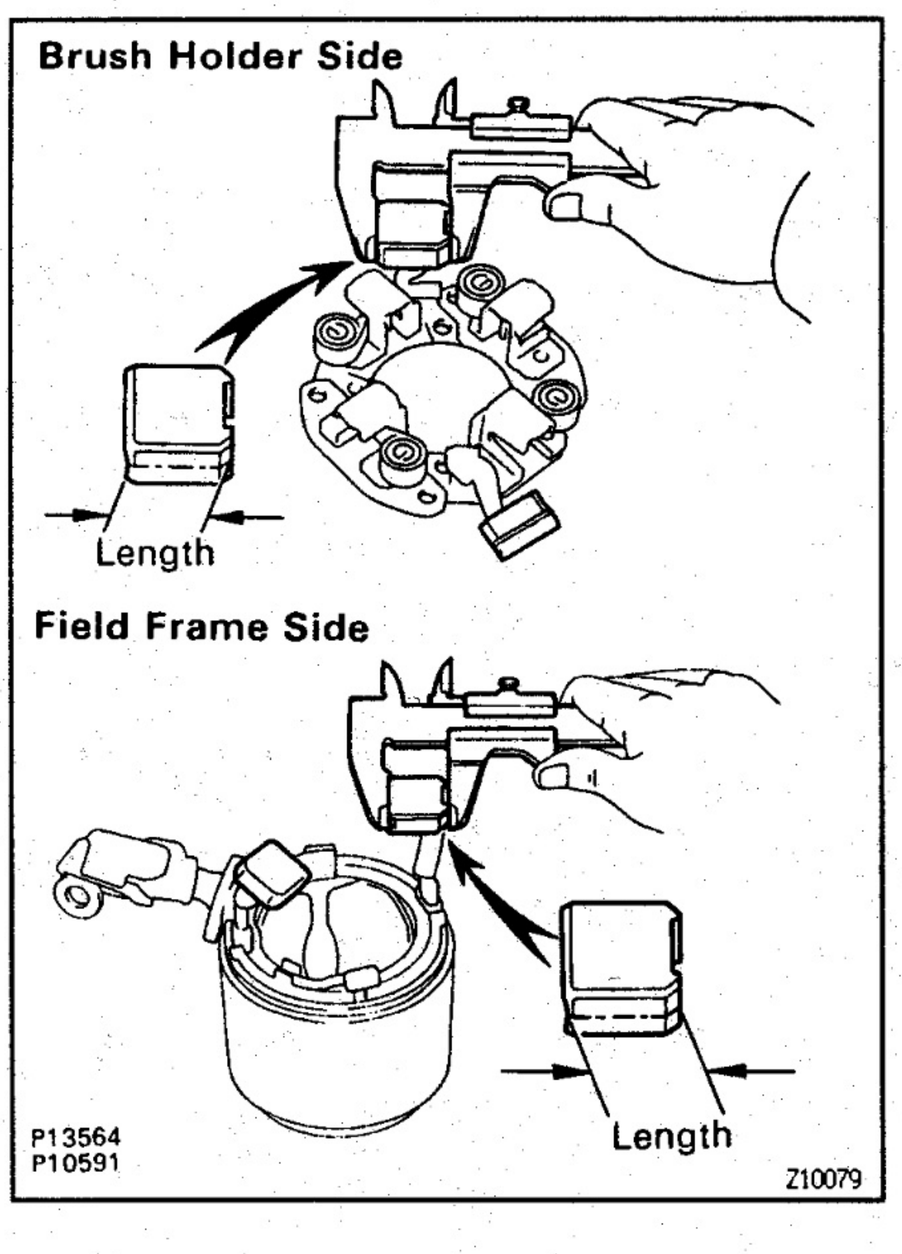
3. 2.0 kW type:

INSPECT SHUNT COIL FOR RESISTANCE

Using an ohmmeter, check that the resistance between the shunt terminal (A) and shunt terminal (B).

Standard Resistance:

At 20°C: 1.5 — 1.9 Ω



Brushes

INSPECT BRUSH LENGTH

Using vernier calipers, measure the brush length.

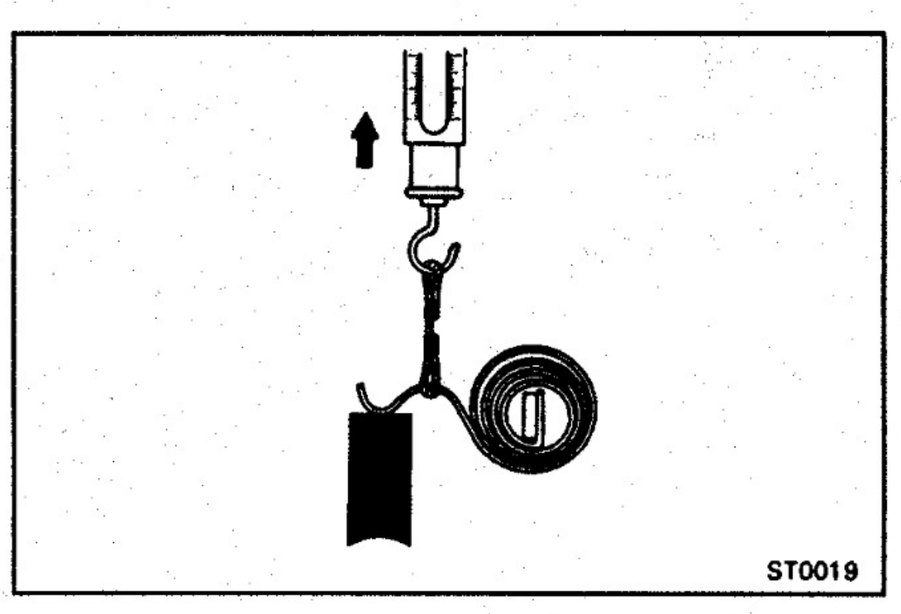
Standard length:

1.2 kW type: 15.5 mm (0.610 in.)
1.4 kW type: 15.5 mm (0.610 in.)
2.0 kW type: 15.0 mm (0.596 in.)

Minimum length:

1.2 kW type: 10.0 mm (0.394 in.)
1.4 kW type: 10.0 mm (0.394 in.)
2.0 kW type: 9.0 mm (0.355 in.)

If the length is less than the minimum, replace the brush holder and field frame.



Brush Springs

INSPECT BRUSH SPRING LOAD

Take the pull scale reading the instant the brush spring separates from the brush.

Spring installed load:

1.2 kW type:

13.7 – 19.6 N (1.40 – 2.00 kgf, 3.1 – 4.4 lbf)

1.4 kW type:

17.6 – 23.5 N (1.80 – 2.40 kgf, 4.0 – 5.3 lbf)

2.0 kW type:

21.5 – 27.5 N (2.20 – 2.80 kgf, 4.9 – 6.2 lbf)

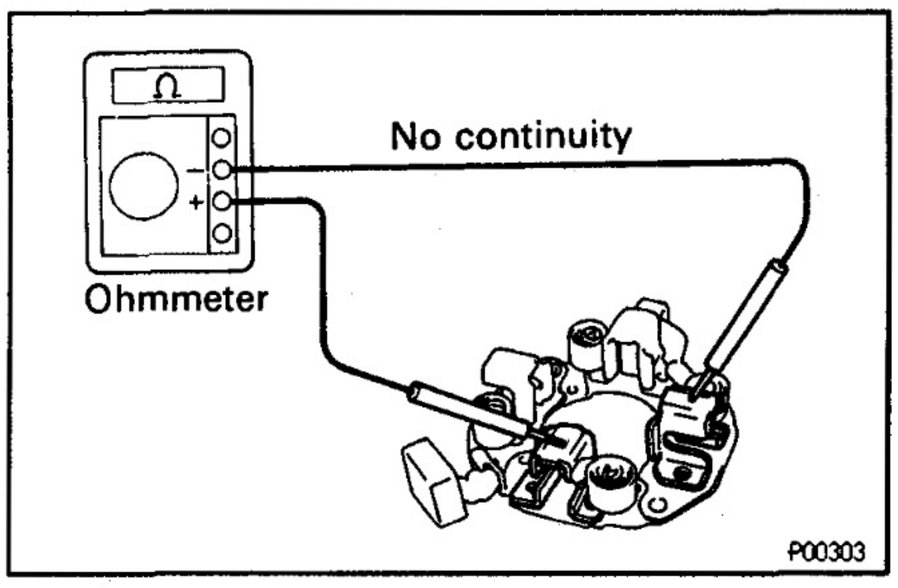
Minimum spring installed load:

1.2 kW type: 9.8 N (1.0 kgf, 2.2 lbf)

1.4 kW type: 11.8 N (1.2 kgf, 2.6 lbf)

2.0 kW type: 12.7 N (1.30 kgf, 2.7 lbf)

If the installed load is not within specification, replace the brush springs.



Brush Holder

INSPECT BRUSH HOLDER INSULATION

Using an ohmmeter, check that there is no continuity between the positive (+) and negative (–) brush holders.

If there is continuity, repair or replace the brush holder.

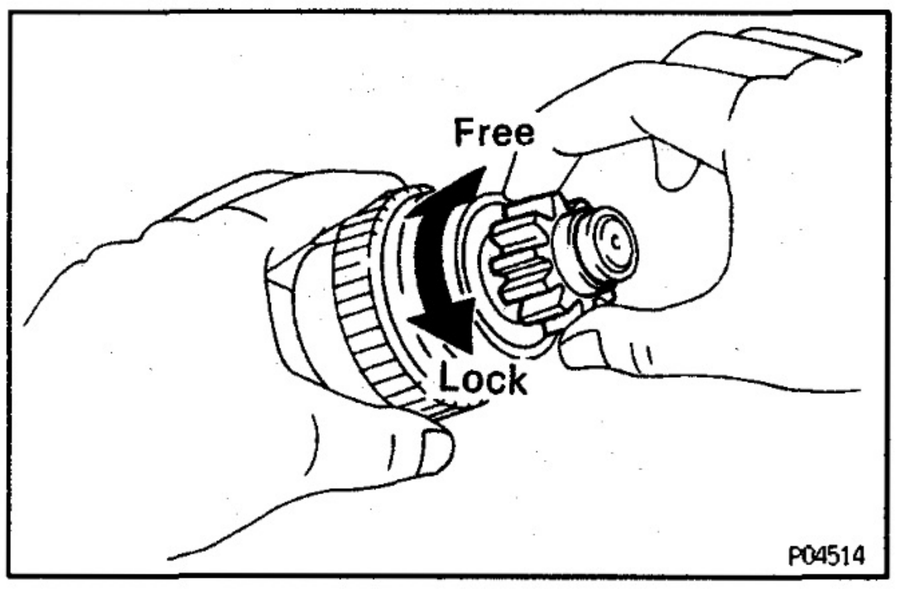
Clutch and Gears

1. INSPECT GEAR TEETH

Check the gear teeth on the pinion gear, idle gear and clutch assembly for wear or damage.

If damaged, replace the gear or clutch assembly.

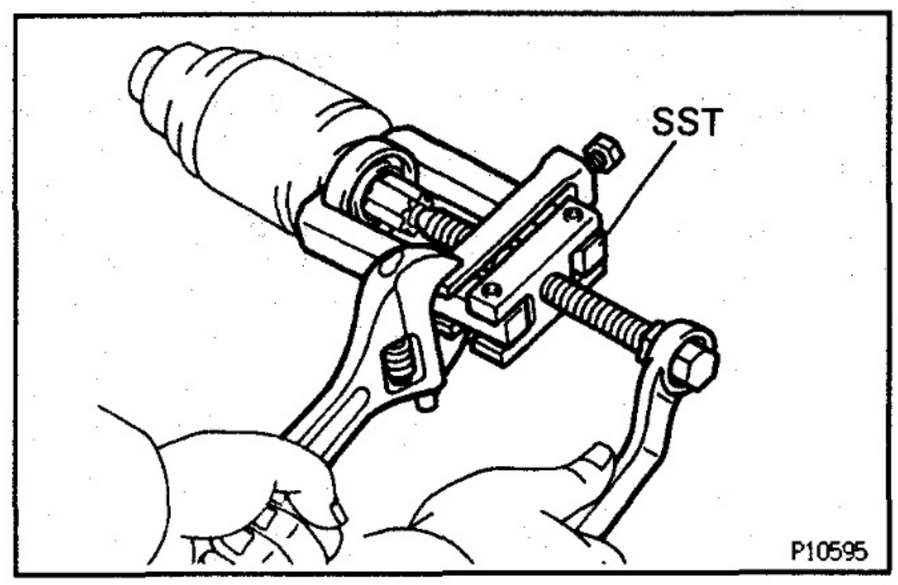
If damaged, also check the fly wheel ring gear for wear or damage.



2. INSPECT CLUTCH PINION GEAR

Hold the starter clutch and rotate the pinion gear clockwise, and check that it turns freely. Try to rotate the pinion gear counterclockwise and check that it locks.

If necessary, replace the clutch assembly.



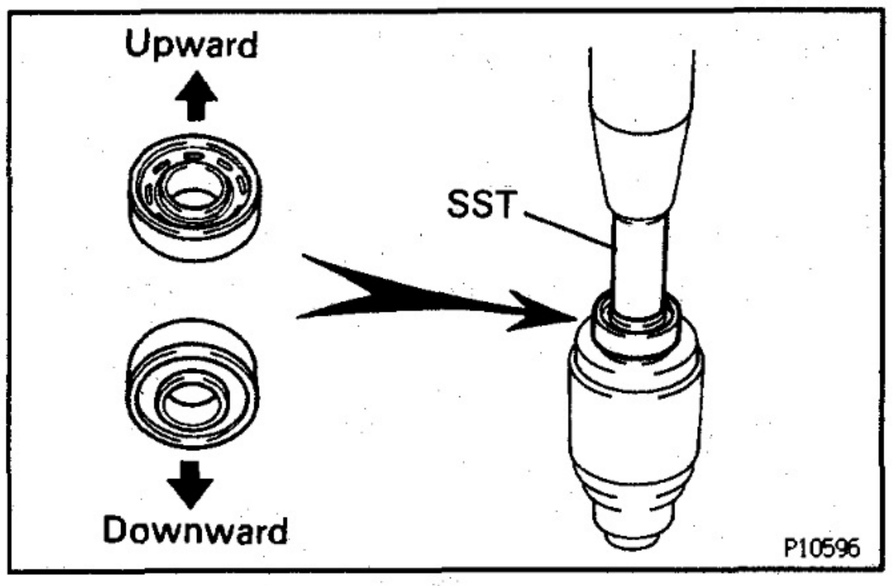
Bearings

3. INSPECT FRONT BEARING

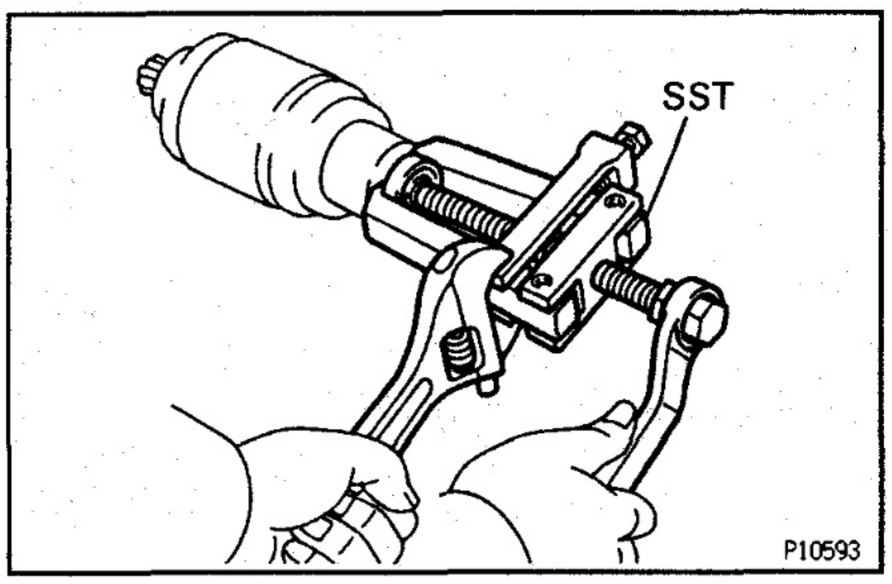
Turn the bearing by hand while applying inward force.
If resistance is felt or the bearing sticks, replace the bearing.

4. IF NECESSARY, REPLACE FRONT BEARING

(a) Using SST, remove the bearing.
SST 09286–46011



(b) Using a press, press in a new front bearing.
NOTICE: Be careful of the bearing installation direction.
SST 09201–41020

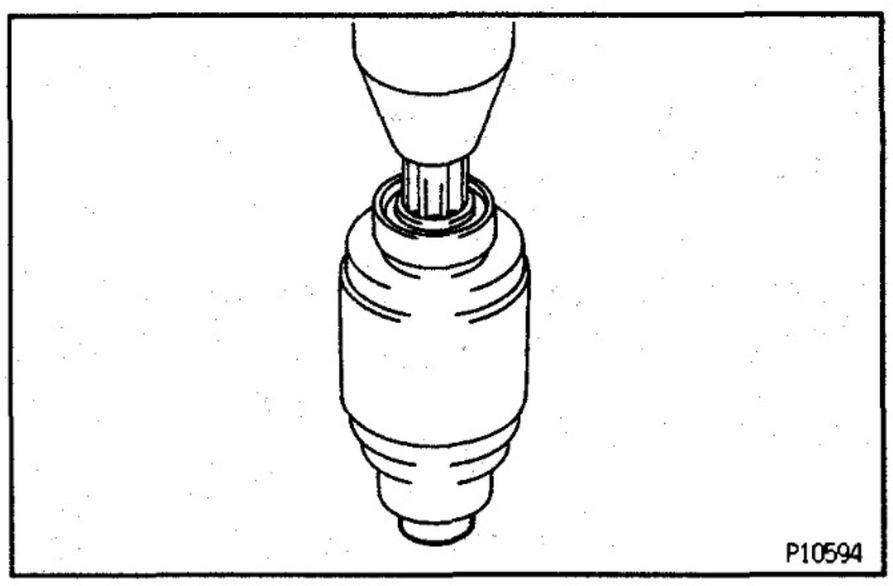


1. INSPECT REAR BEARING

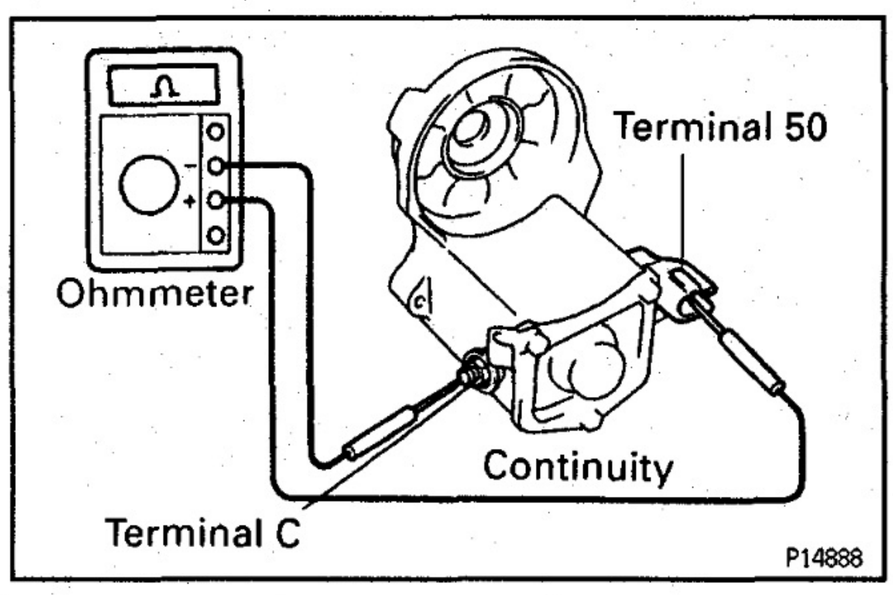
Turn the bearing by hand while applying inward force.
If resistance is felt or the bearing sticks, replace the bearing.

2. IF NECESSARY, REPLACE REAR BEARING

(a) Using SST, remove the bearing.
SST 09286–46011



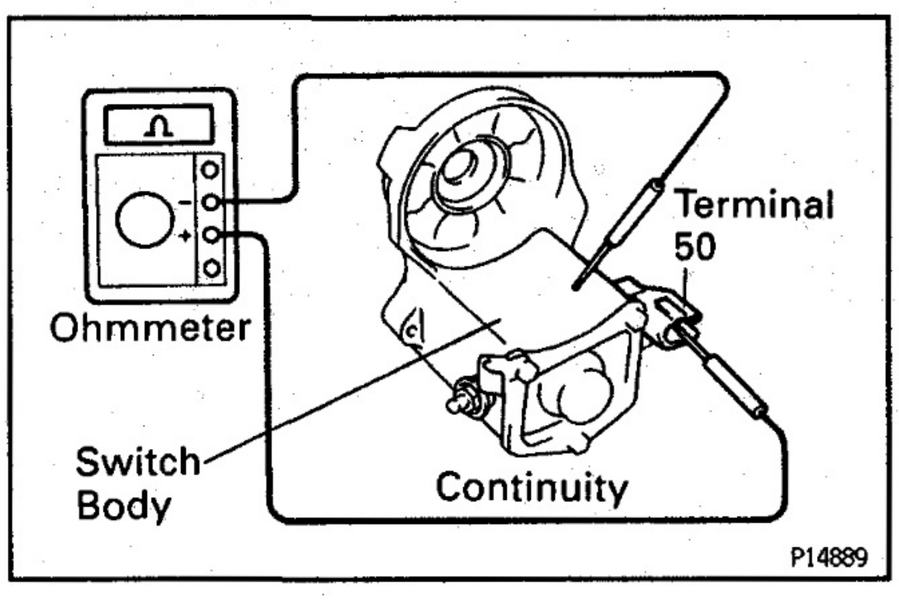
(b) Using a press, press in a new rear bearing.



Magnetic Switch

1. DO PULL–IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminals 50 and C.
If there is no continuity, check and replace the magnetic switch.

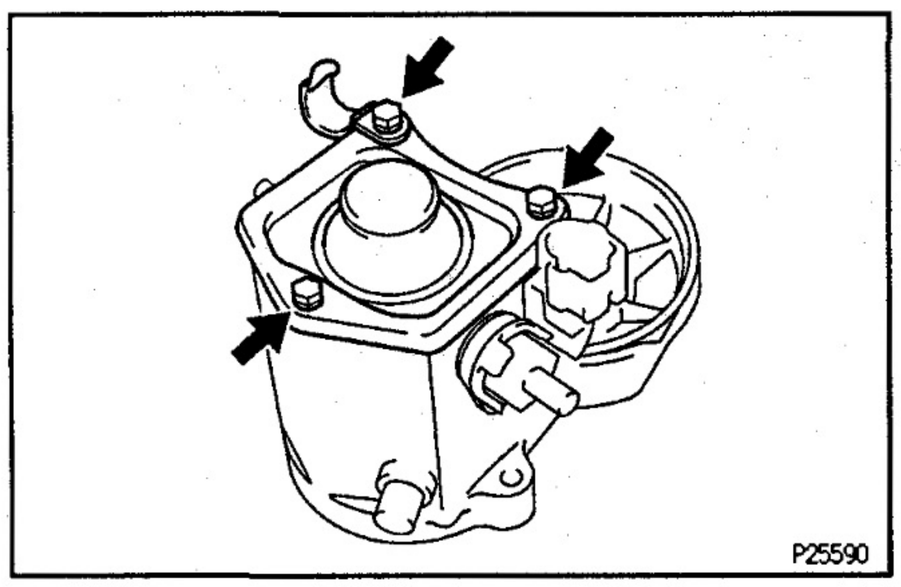


2. DO HOLD—IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

If there is no continuity, replace the magnetic switch.

ST

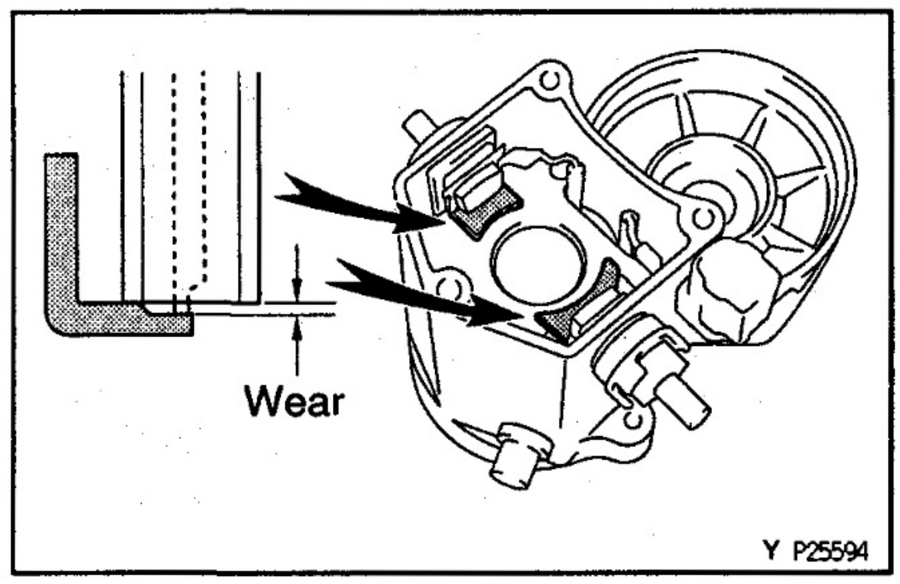


ST0068-03

MAGNETIC SWITCH TERMINAL KIT PARTS REPLACEMENT

1. REMOVE MAGNETIC SWITCH END COVER

Remove the 3 bolts, lead clamp(2.0 kW type), end cover, gasket and plunger.



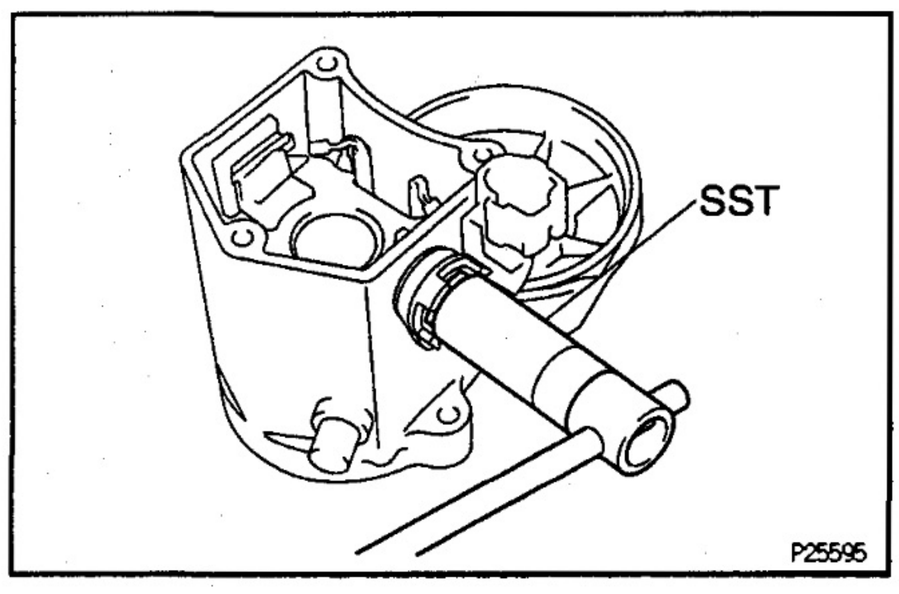
2. INSPECT CONTACT PLATE FOR WEAR

Using vernier calipers, measure the contact plate for depth of wear.

Maximum wear:

0.9 mm (0.035 in.)

If the depth of wear is greater than the maximum, replace the contact plate.

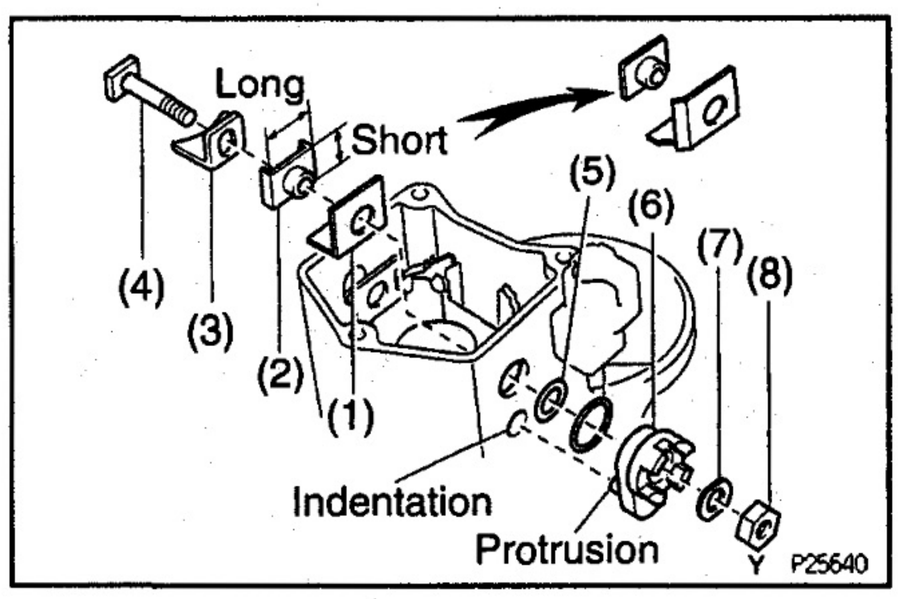


3. REMOVE TERMINAL KIT PARTS

(a) Using SST, loosen the terminal nuts.
SST 09810—38140

(b) Terminal C:
Remove the terminal nut, wave washer, terminal insulator (outside), O—ring, terminal bolt, contact plate and terminal insulator (inside).

(c) Terminal 30:
Remove the terminal nut, wave washer, terminal insulator (outside), packing, O—ring, terminal bolt, contact plate, terminal insulator (inside) and insulation paper.



4. REINSTALL TERMINAL KIT PARTS

(a) Install these new parts:
Terminal 30:
(1) Insulation paper
(2) Terminal insulator (inside)

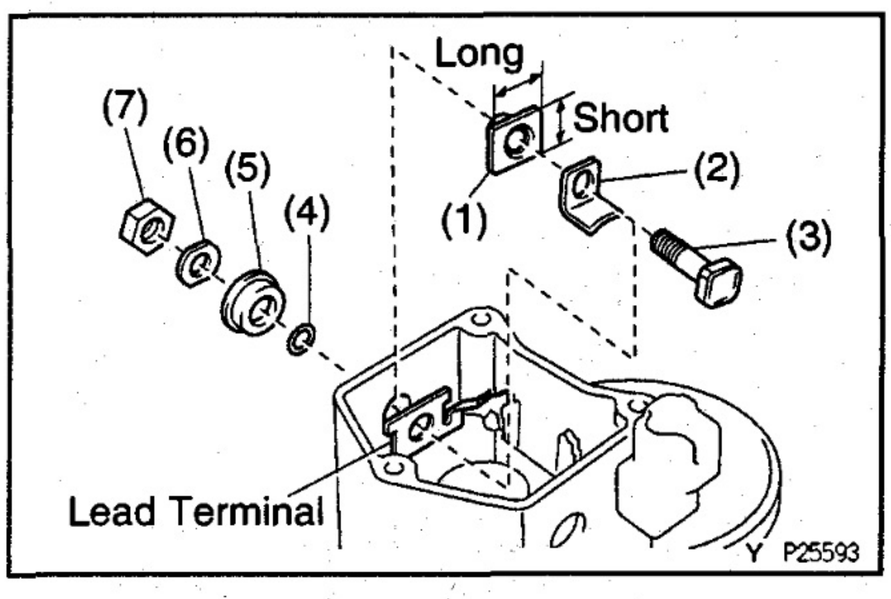
NOTICE: Be careful to install the terminal insulator in the correct direction.

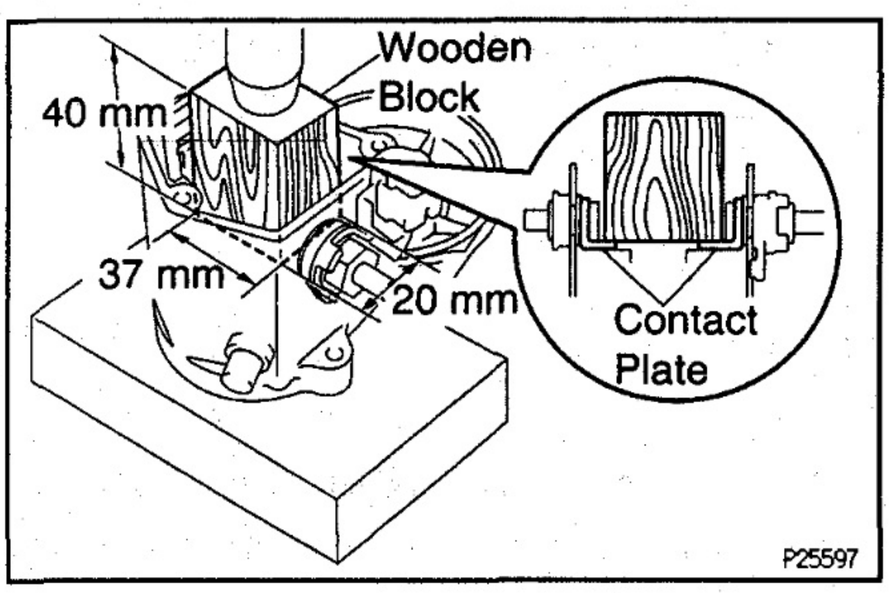
(3) Contact plate

(4) Terminal bolt
(5) O–ring
(6) Packing and terminal insulator (outside)
Install the packing to the terminal insulator, and install them.

HINT: Match the protrusion of the insulator with the indentation of the housing.

(7) Wave washer
(8) Terminal nut





Terminal C:

(1) Terminal insulator (inside)

NOTICE: Be careful to install the terminal insulator in the correct direction.

(2) Contact plate
(3) Terminal bolt
(4) O–ring
(5) Terminal insulator (outside)
(6) Wave washer
(7) Terminal nut

(b) Temporarily tighten the terminal nuts.

5. TIGHTEN TERMINAL NUT

(a) Put a wooden block on the contact plate and press it down with a hand press.

Dimensions of wooden block:

20 x 37 x 40 mm (0.79 x 1.46 x 1.57 in.)

Press force:

981 N (100 kgf, 221 lbf)

NOTICE:

- **Check the diameter of the hand press ram. Then calculate the gauge pressure of the press when 981 N (100 kgf, 221 lbf) of force is applied.**

Gauge pressure:

$$(\text{kgf/cm}^2) = \frac{100\ \text{kgf}}{\left(\frac{\text{Ram diameter (cm)}}{2}\right)^2 \times 3.14\ (\pi)}$$

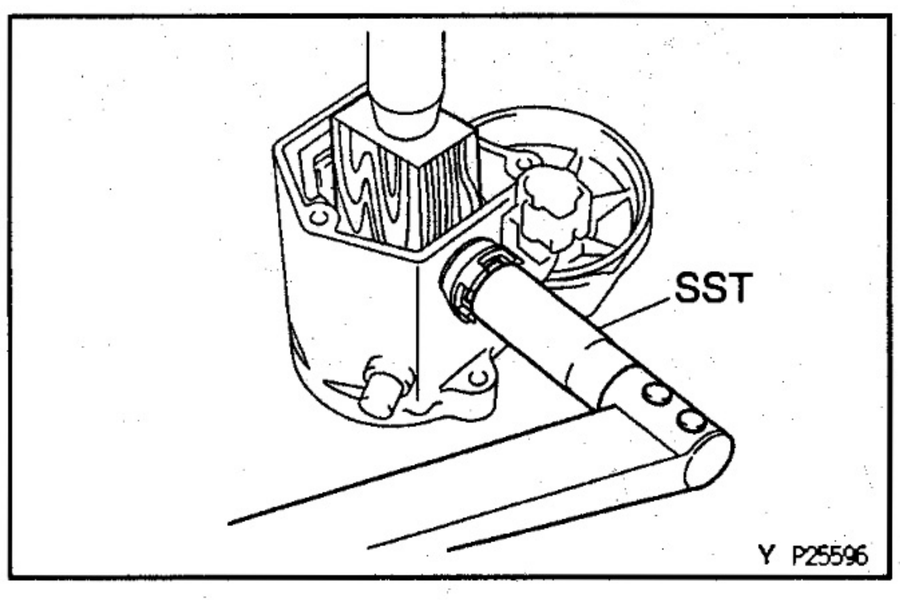
$$(\text{psi}) = \frac{221\ \text{lbf}}{\left(\frac{\text{Ram diameter (in.)}}{2}\right)^2 \times 3.14\ (\pi)}$$

$(\text{kPa}) = (\text{kgf/cm}^2) \times 98.1$

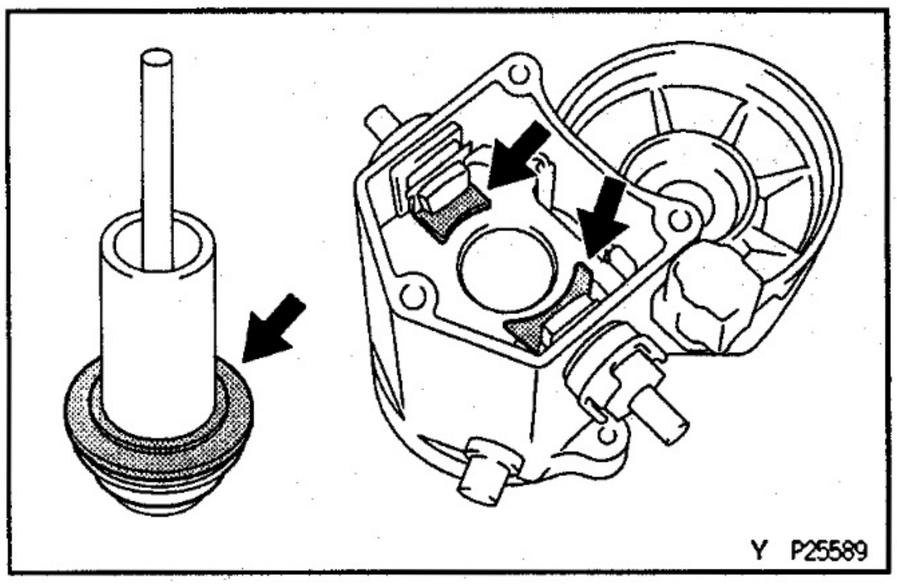
$(\text{kPa}) = (\text{psi}) \times 6.9$

V06796

- **If the contact plate is not pressed down with the specified pressure, the contact plate may tilt due to coil deformation or the tightening of the nut.**



(b) Using SST, tighten the nuts to the specified torque.
SST 09810–38140
Torque: 17 N·m (170 kgf·cm, 12 ft·lbf)
NOTICE: If the nut is over tightened, it may cause cracks on the inside of the insulator.



6. CLEAN CONTACT SURFACES OF CONTACT PLATE AND PLUNGER
Clean the contact surfaces of the remaining contact plate and plunger with a dry shop rag.

7. REINSTALL MAGNETIC SWITCH END COVER
Install the plunger, new gasket, end cover and lead clamp(2.0 kW type) with the 3 bolts.
Torque:
1.2 kW type: 2.5 N·m (26 kgf·cm, 23 in.·lbf)
1.4 kW type: 2.5 N·m (26 kgf·cm, 23 in.·lbf)
2.0 kW type: 3.6 N·m (37 kgf·cm, 32 in.·lbf)

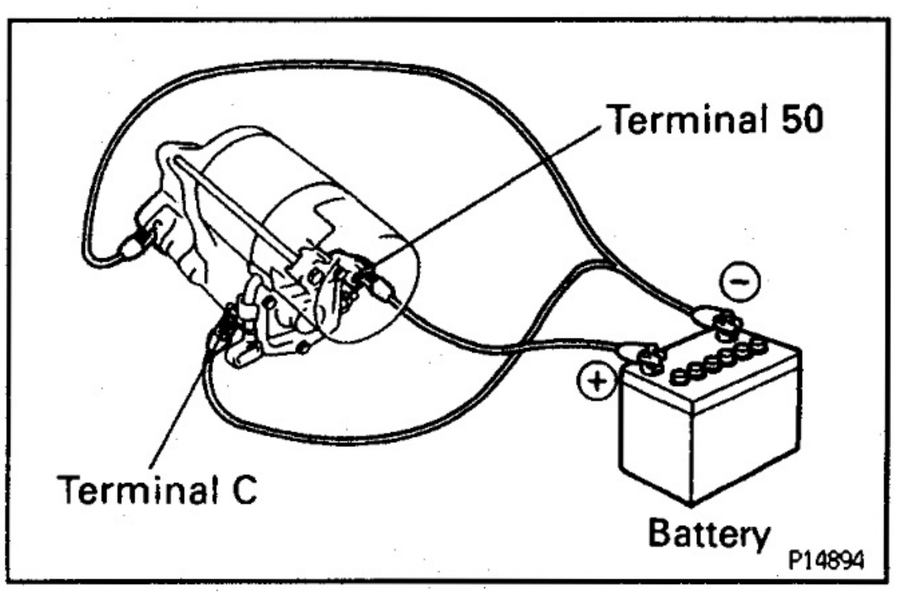
STARTER ASSEMBLY

ST0AA–03

Assembly is in the reverse order of disassembly.
HINT: Use high–temperature grease to lubricate the bearings and gears when assembling the starter.

STARTER PERFORMANCE TEST

ST010–1F

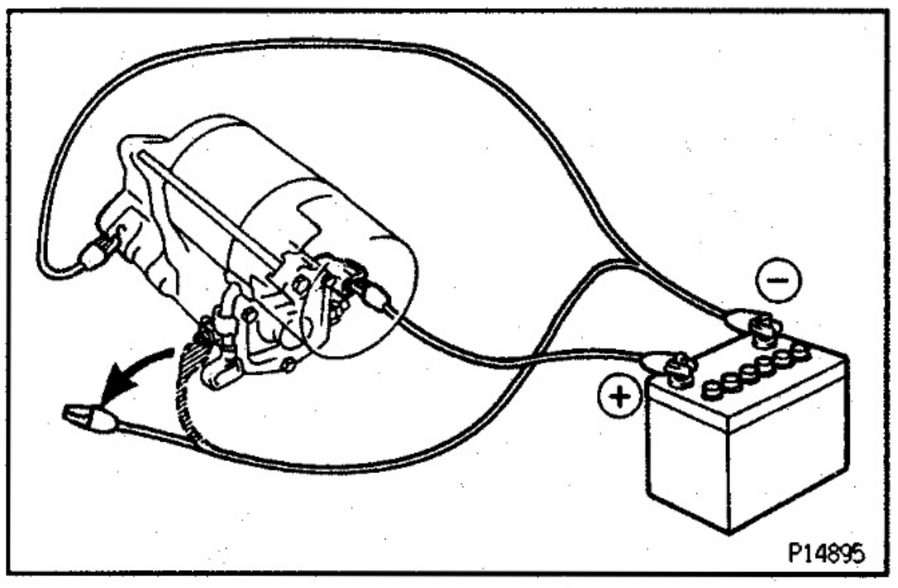


NOTICE: These tests must be done within 3 to 5 seconds to avoid burning out the coil.

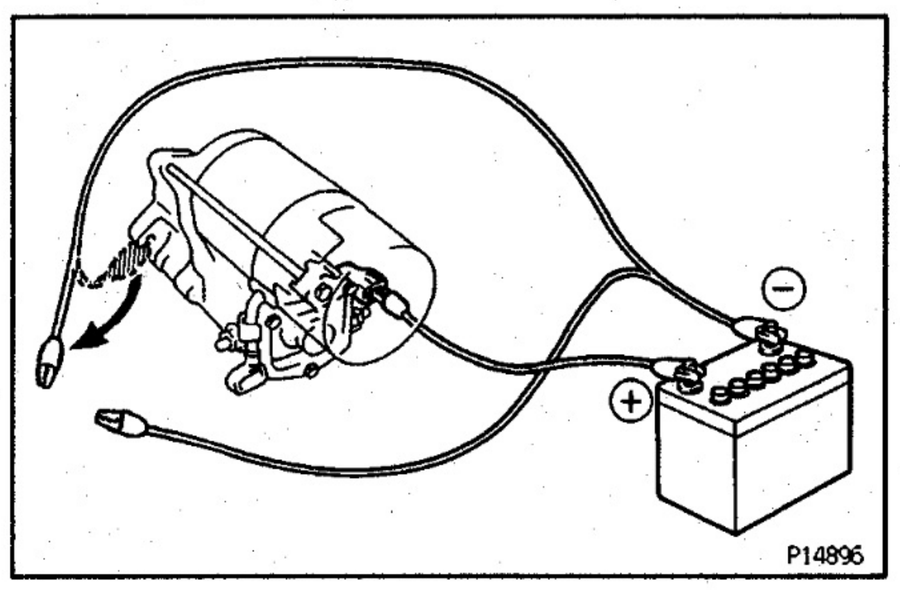
1. DO PULL–IN TEST

(a) Disconnect the field coil lead wire from terminal C.

(b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.



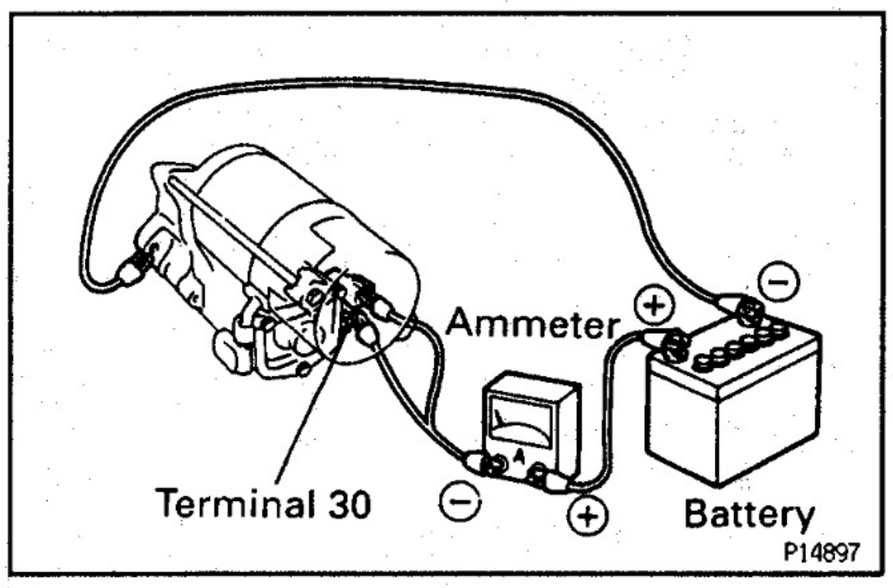
2. DO HOLD–IN TEST
With battery connected as above with the clutch pinion gear out, disconnect the negative (–) lead from terminal C. Check that the pinion gear remains out.



3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (–) lead from the switch body.

Check that the clutch pinion gear returns inward.



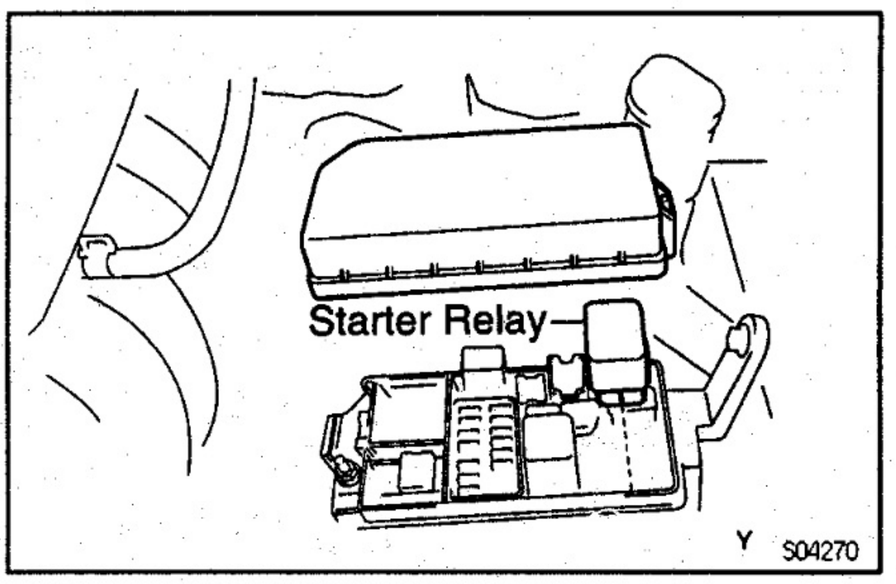
4. DO NO–LOAD PERFORMANCE TEST

(a) Connect the battery and ammeter to the starter as shown.

(b) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the ammeter shows the specified current.

Specified current:

At 11.5 V: 90 A or less

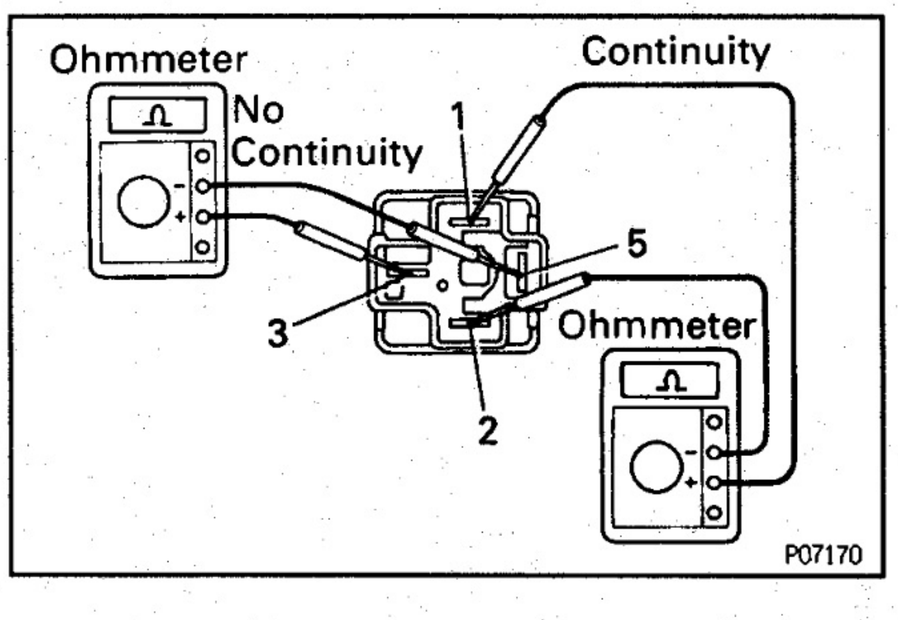


STARTER RELAY

STARTER RELAY INSPECTION (Marking:"ST")

ST0FJ–01

1. REMOVE STARTER RELAY



2. INSPECT STARTER RELAY

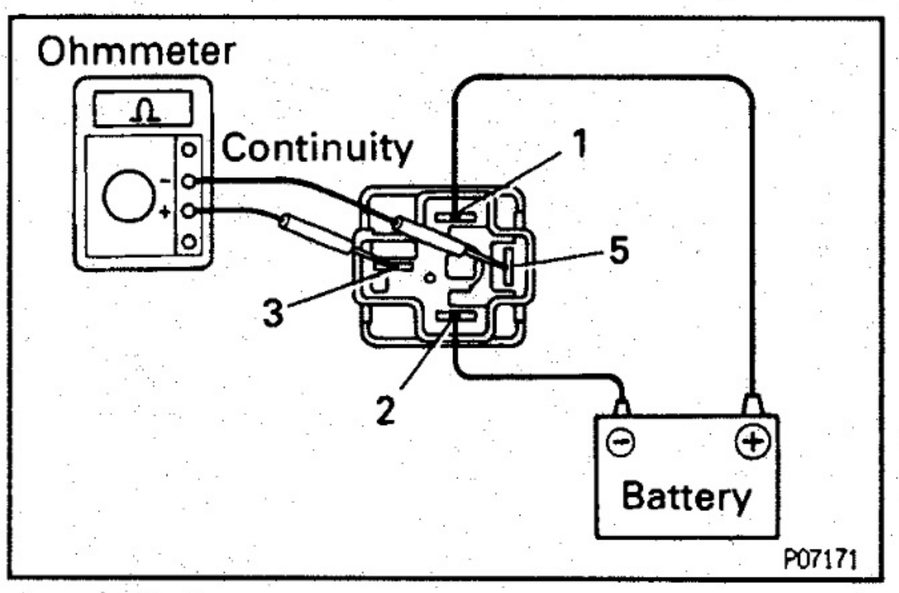
A. Inspect relay continuity

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

If there is no continuity, replace the relay.

(b) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.



B. Inspect relay operation

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

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

If operation is not as specified, replace the relay.

3. REINSTALL STARTER RELAY

SERVICE SPECIFICATIONS

SERVICE DATA

ST015-1Q

Starter (1.2 kW, 1.4 kW type)	Rated voltage and output power			12 V 1.2 kW, 1.4 kW
	No-load characteristics		Current	90 A or less at 11. 5 V
			rpm	3,000 rpm or more
	Brush length		STD	15.5 mm (0.610 in.)
			Minimum	10.0 mm (0.394 in.)
	Spring installed load	STD	1.2 kW type	13.7 — 19.6 N (1.4 — 2.0 kgf, 3.1 — 4.4 lbf)
			1.4 kW type	17.6 — 23.5 N (1.8 — 2.4 kgf, 4.0 — 5.3 lbf)
		Minimum	1.2 kW type	9.8 N (1.0 kgf, 2.2 lbf)
			1.4 kW type	11.8 N (1.2 kgf, 2.6 lbf)
	Commutator			
	Diameter		STD	30 mm (1.18 in.)
			Minimum	29 mm (1.14 in.)
	Undercut depth		STD	0.6 mm (0.024 in.)
			Minimum	0.2 mm (0.008 in.)
	Circle runout		Maximum	0.05 mm (0.0020 in.)
	Magnetic switch			
	Contact plate for wear		Maximum	0.9 mm (0.035 in.)
Starter (2.0 kW type)	Rated voltage and output power			12 V 2.0 kW
	No-load characteristics		Current	100 A or less at 11.5 V
			rpm	2000 rpm or more
	Brush length		STD	15.0 mm (0.591 in.)
			Minimum	9.0 mm (0.354 in.)
	Spring installed load		STD	21.5 — 27.5 N (2.20 — 2.80 kgf, 4.9 — 6.2 lbf)
			Minimum	12.7 N (1.30 kgf, 2.7 lbf)
	Commutator			
	Diameter		STD	35.0 mm (1.378 in.)
			Minimum	34.0 mm (1.339 in.)
	Undercut depth		STD	0.7 mm (0.028 in.)
			Minimum	0.2 mm (0.008 in.)
	Circle runout		Maximum	0.05 mm (0.0020 in.)
	Magnetic switch			
	Contact plate for wear		Maximum	0.9 mm (0.035 in.)

ST016-1Q

TORQUE SPECIFICATIONS

Part tightened		N·m	kgf·cm	ft·lbf
Field frame x Armature	1.2 kW, 1.4 kW type	5.9	60	52 in.·lbf
	2.0 kW type	9.3	93	82 in.·lbf
Starter housing x Clutch assembly	1.2 kW, 1.4 kW type	5.9	60	52 in.·lbf
	2.0 kW type	9.3	93	82 in.·lbf
End cover x Field frame	1.2 kW, 1.4 kW type	1.5	15	13 in.·lbf
	2.0 kW type	3.8	38	34 in.·lbf
Lead wire x Terminal C		5.9	60	52 in.·lbf
Terminal nut x Terminal 30 of starter, Terminal C of starter		17	170	12
Magnetic switch end cover x Magnetic switch	1.2 kW, 1.4 kW type	2.5	26	23 in.·lbf
	2.0 kW type	3.6	37	32 in.·lbf

CHARGING

PRECAUTION ..... CH— 2
PREPARATION ..... CH— 2
ON—VEHICLE INSPECTION ..... CH— 3
ALTERNATOR ..... CH— 7
SERVICE SPECIFICATIONS ..... CH— 17

PRECAUTION

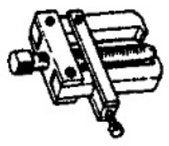
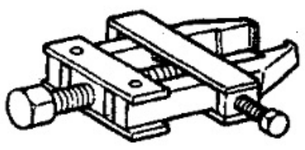
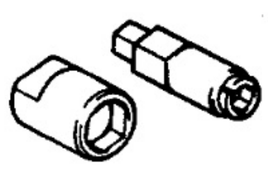
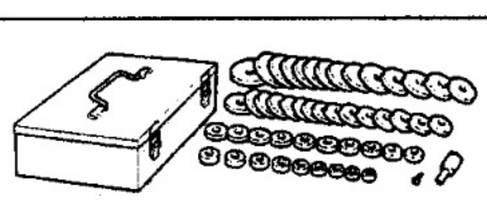
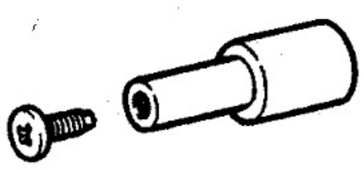
CH00K–0X

1. Check that the battery cables are connected to the correct terminals.
2. Disconnect the battery cables when the battery is given a quick charge.
3. Do not perform tests with a high voltage insulation resistance tester.
4. Never disconnect the battery while the engine is running.

PREPARATION

CH00Q–17

SST (SPECIAL SERVICE TOOLS)

	09285–76010	Injection Pump Camshaft Bearing Cone Replacer	Rotor rear bearing cover
	09286–46011	Injection Pump Spline Shaft Puller	Rectifier end frame
	09820–00021	Alternator Rear Bearing Puller	
	09820–00030	Alternator Rear Bearing Replacer	Rotor rear bearing
	09820–63010	Alternator Pulley Set Nut Wrench Set	
	09950–60010	Replacer Set	Rotor front bearing
	(09951–00260)	Replacer 26	
	(09951–00500)	Replacer 50	
	(09952–06010)	Adapter	

RECOMMENDED TOOLS

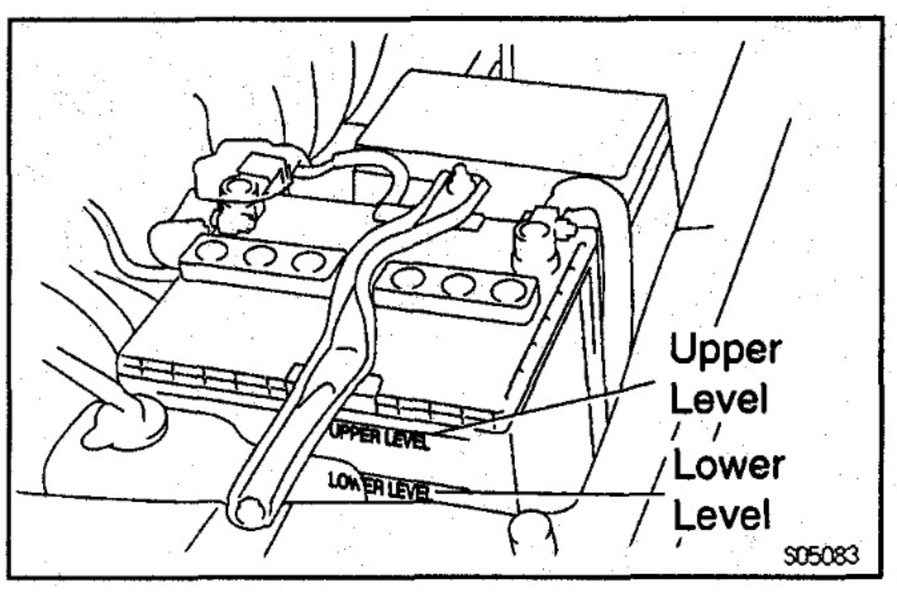
CH00S–15

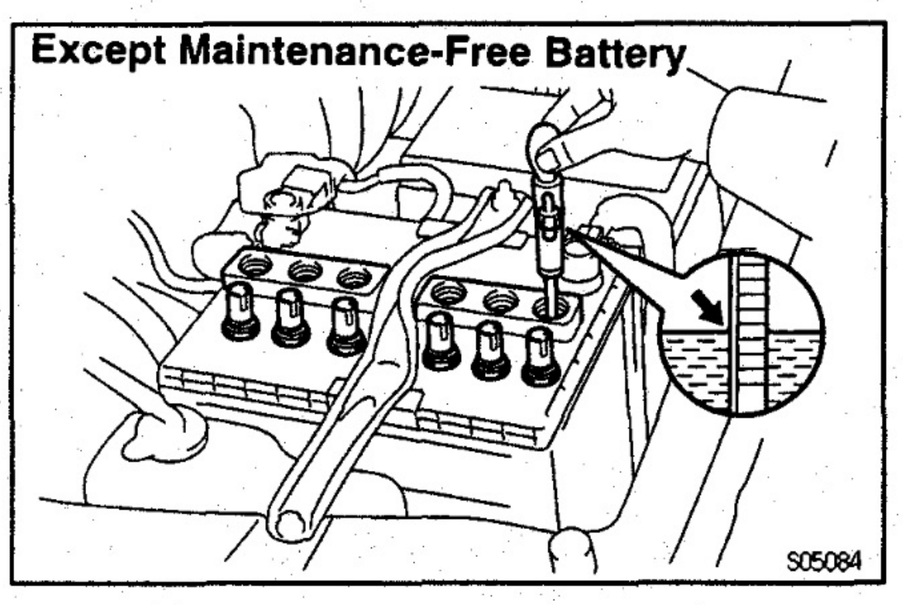
	09082–00040 TOYOTA Electrical Tester.	

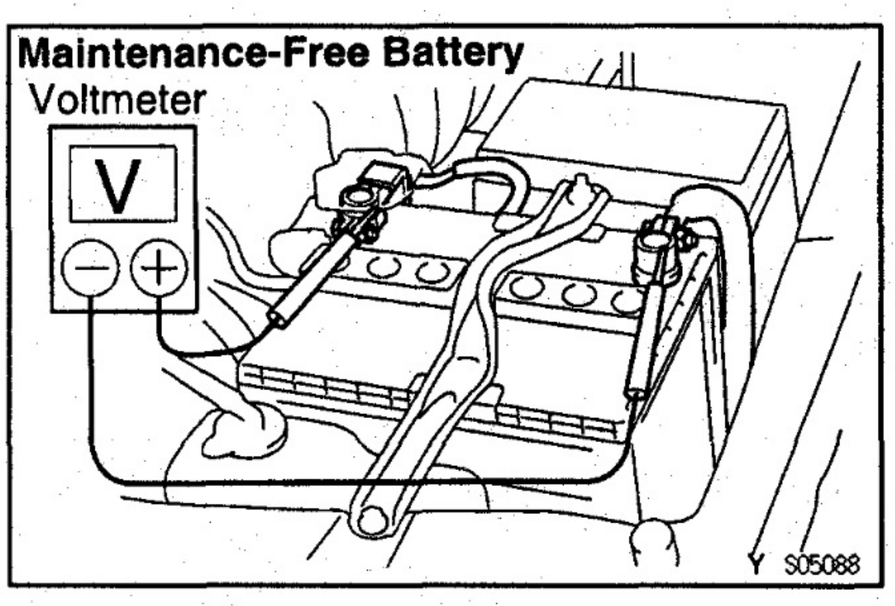
CH00U-1C

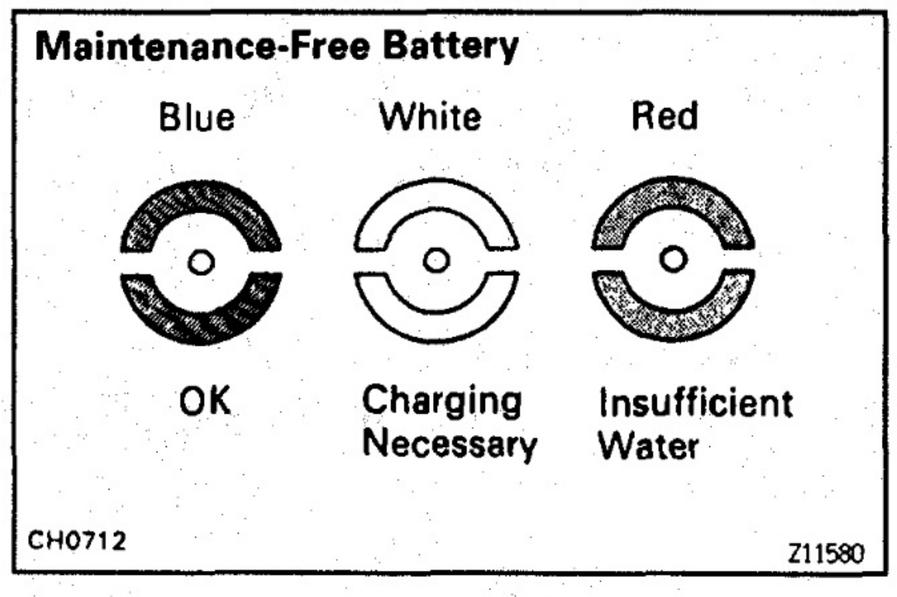
EQUIPMENT

Ammeter(A)	
Battery specific gravity gauge	
Belt tension gauge	
Torque wrench	
Vernier calipers	Rotor (Slip ring), Brush









ON—VEHICLE INSPECTION

CH0E5-01

CH

1. CHECK BATTERY ELECTROLYTE LEVEL

Check the electrolyte quantity of each cell.

Maintenance—Free Battery:

If under the lower level, replace the battery (or add distilled water if possible). Check the charging system.

Except Maintenance—Free Battery:

If under the lower level, add distilled water.

2. Except Maintenance—Free Battery:
CHECK BATTERY SPECIFIC GRAVITY

Check the specific gravity of each cell.

Standard specific gravity:

At 20°C (68°F): 1.25 — 1.29

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

3. Maintenance—Free Battery:
CHECK BATTERY VOLTAGE

(a) After having driven the vehicle and in the case that 20 minutes have not passed after having stopped the engine, turn the ignition switch ON and turn on the electrical system (headlight, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.

(b) Turn the ignition switch OFF and turn off the electrical systems.

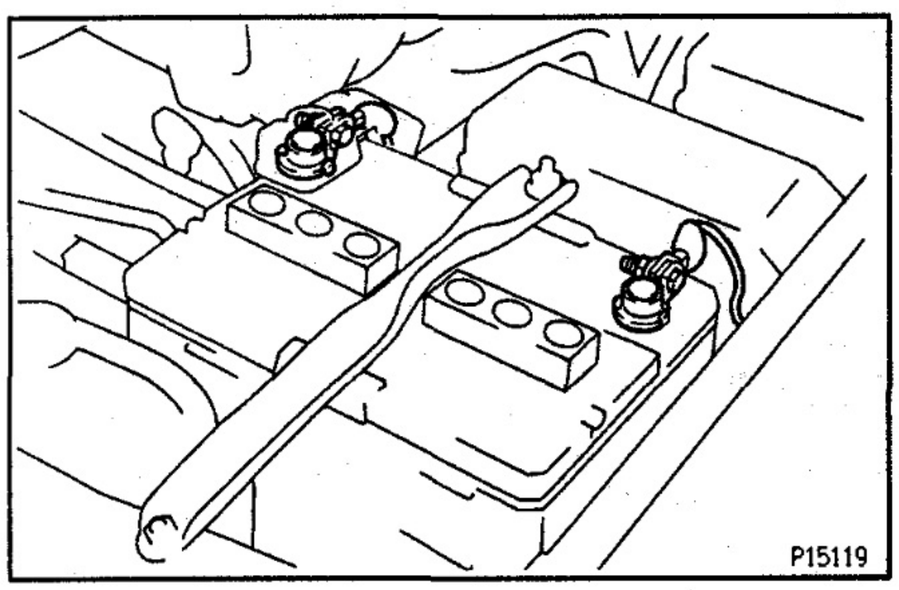
(c) Measure the battery voltage between the negative (—) and positive (+) terminals of the battery.

Standard voltage:

At 20°C (68°F): 12.5 — 12.9 V

If the voltage is less than specification, charge the battery.

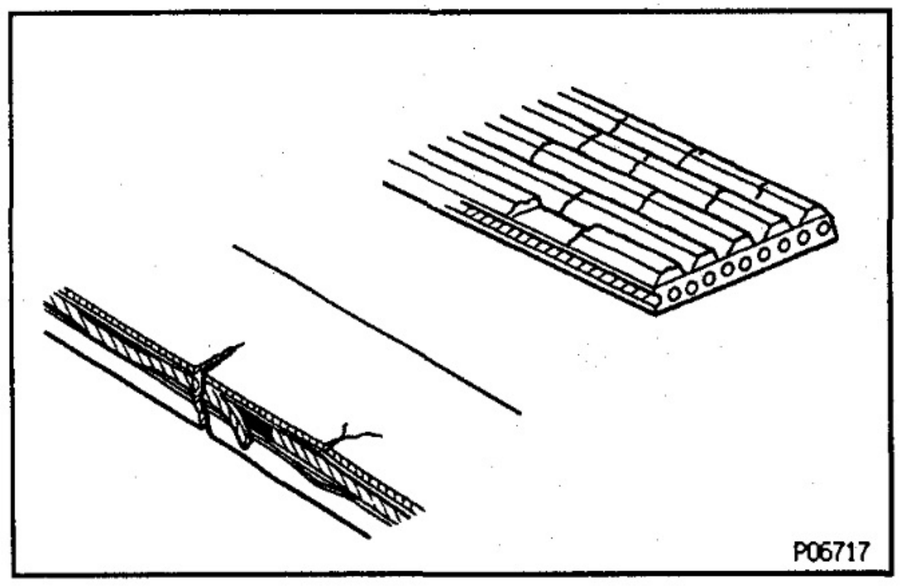
HINT: Check the indicator as shown in illustration.



4. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

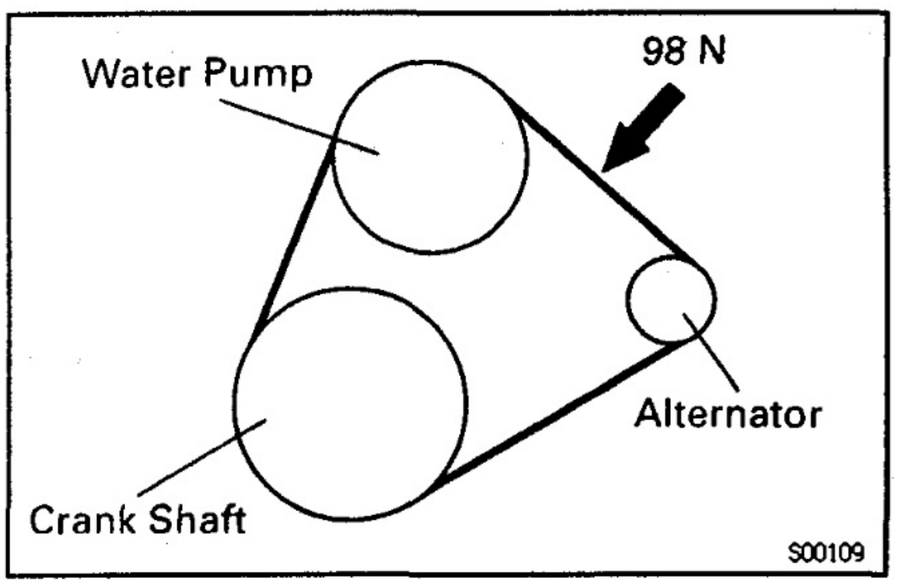
(a) Check that the battery terminals are not loose or corroded.
If the terminals are corroded, clean the terminals.

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



5. INSPECT DRIVE BELT

(a) Visually check the 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 belt are considered acceptable. If the 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:

New belt

5 – 7 mm (0.20 – 0.28 in.)

Used belt

7 – 8 mm (0.28 – 0.31 in.)

If necessary, adjust the drive belt deflection.

Reference

Using tension gauge, check the drive belt tension.

Drive belt tension:

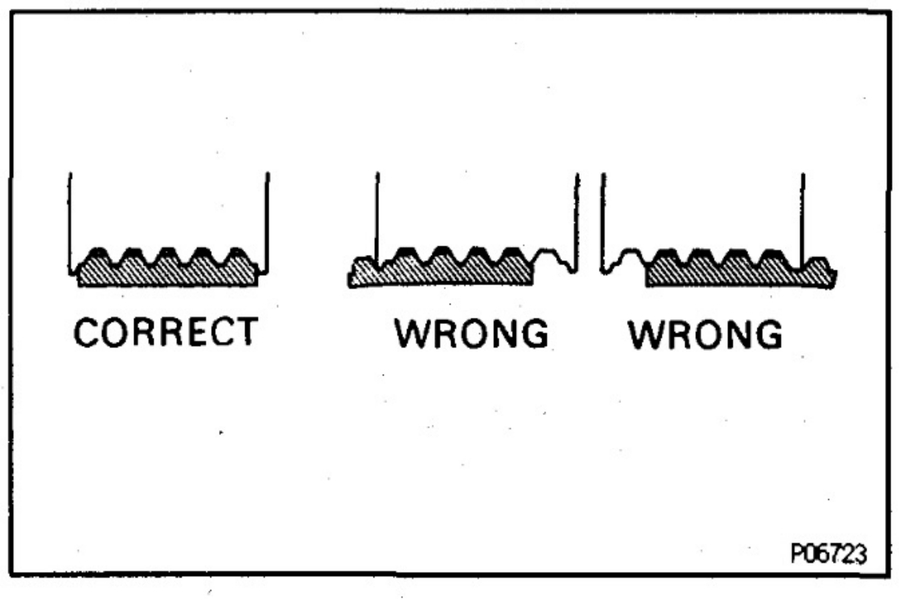
New belt

685 – 785 N (70 – 80 kgf)

Used belt

295 – 440 N (30 – 45 kgf)

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



HINT:

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

- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.

6. VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES

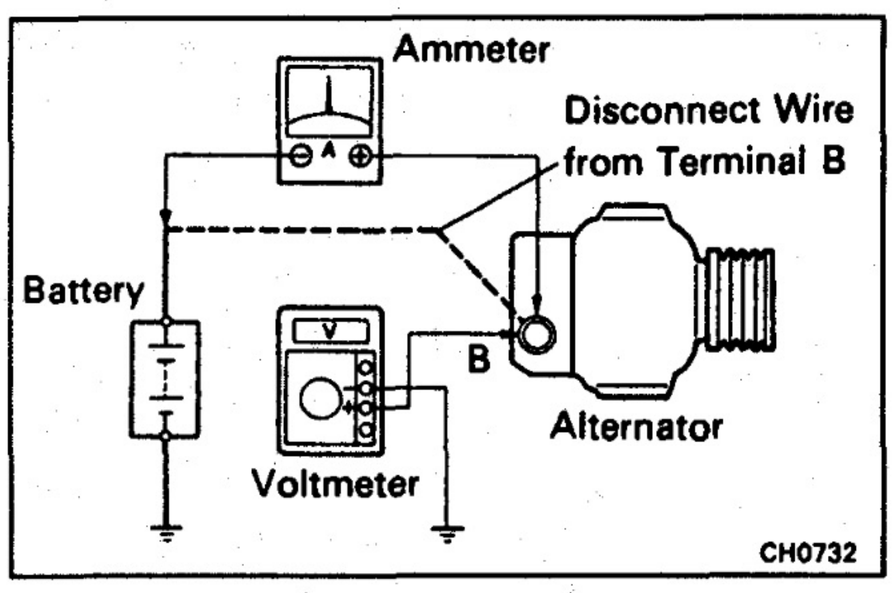
(a) Check that the wiring is in good condition.

(b) Check that there is no abnormal noise from the alternator while the engine is running.

7. INSPECT DISCHARGE WARNING LIGHT CIRCUIT

(a) Turn the ignition switch "ON". Check that the discharge warning light comes on.

(b) Start the engine. Check that the light goes off.
If the light does not operate as specified, troubleshoot the discharge warning light circuit.



8. INSPECT CHARGING CIRCUIT WITHOUT LOAD

HINT: If a battery/alternator tester is available, connect the tester to the charging circuit as per manufacturer's instructions.

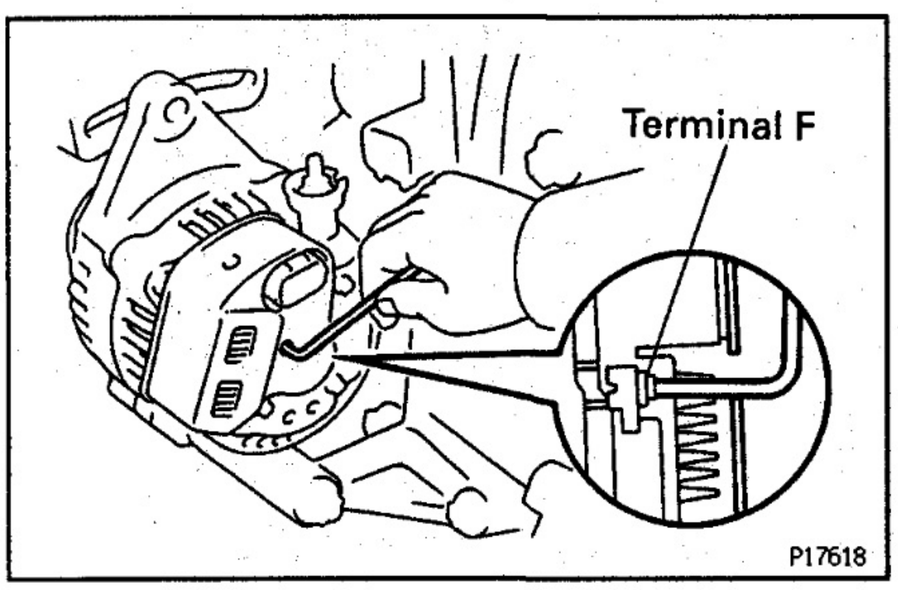
(a) If a tester is not available, connect a voltmeter and ammeter to the charging circuit as follows:

- Disconnect the wire from terminal B of the alternator and connect it to the negative (−) lead of the ammeter.
- Connect the positive (+) lead of the ammeter to terminal B of the alternator.
- Connect the positive (+) lead of the voltmeter to terminal B of the alternator.
- Ground the negative (−) lead of the voltmeter.

(b) Check the charging circuit as follows:
With the engine running from idle to 2,000 rpm, check the reading on the ammeter and voltmeter.

Standard amperage:
10 A or less

Standard voltage:
13.2 — 14.8 V



If the voltmeter reading is more than standard voltage, replace the IC regulator.
If the voltmeter reading is less than the standard voltage, check the IC regulator and alternator as follows:

- With terminal F grounded, start the engine and check the voltmeter reading of terminal B.
- If the voltmeter reading is more than standard voltage, replace the IC regulator.
- If the voltmeter reading is less than standard voltage, check the alternator.

9. INSPECT CHARGING CIRCUIT WITH LOAD

(a) With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater blower switch at "HI".

(b) Check the reading on the ammeter.

Standard amperage:

30 A or more

If the ammeter reading is less than standard amperage, repair the alternator.
HINT: If the battery is fully charged, the indication will sometimes be less than standard amperage.

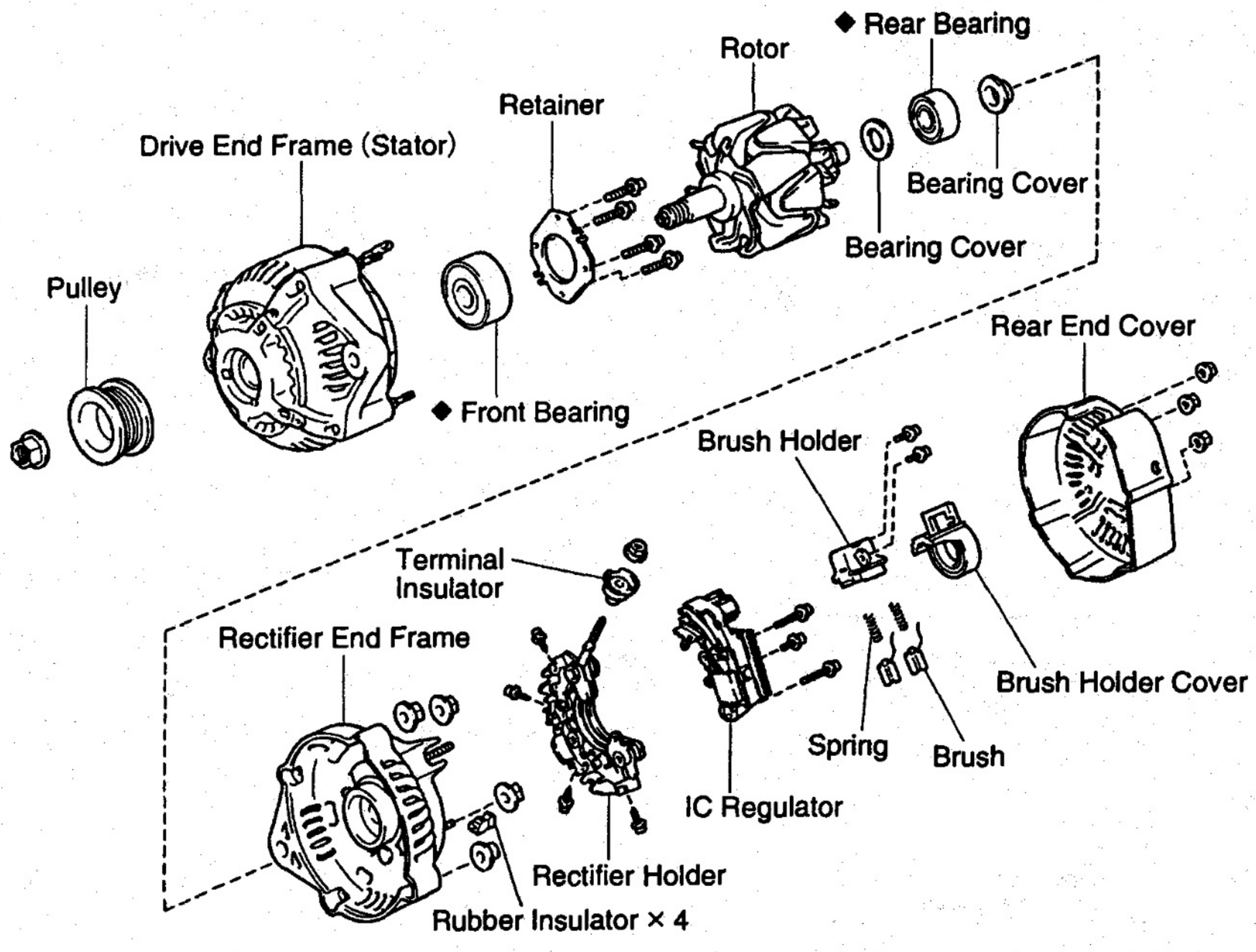
CH

ALTERNATOR

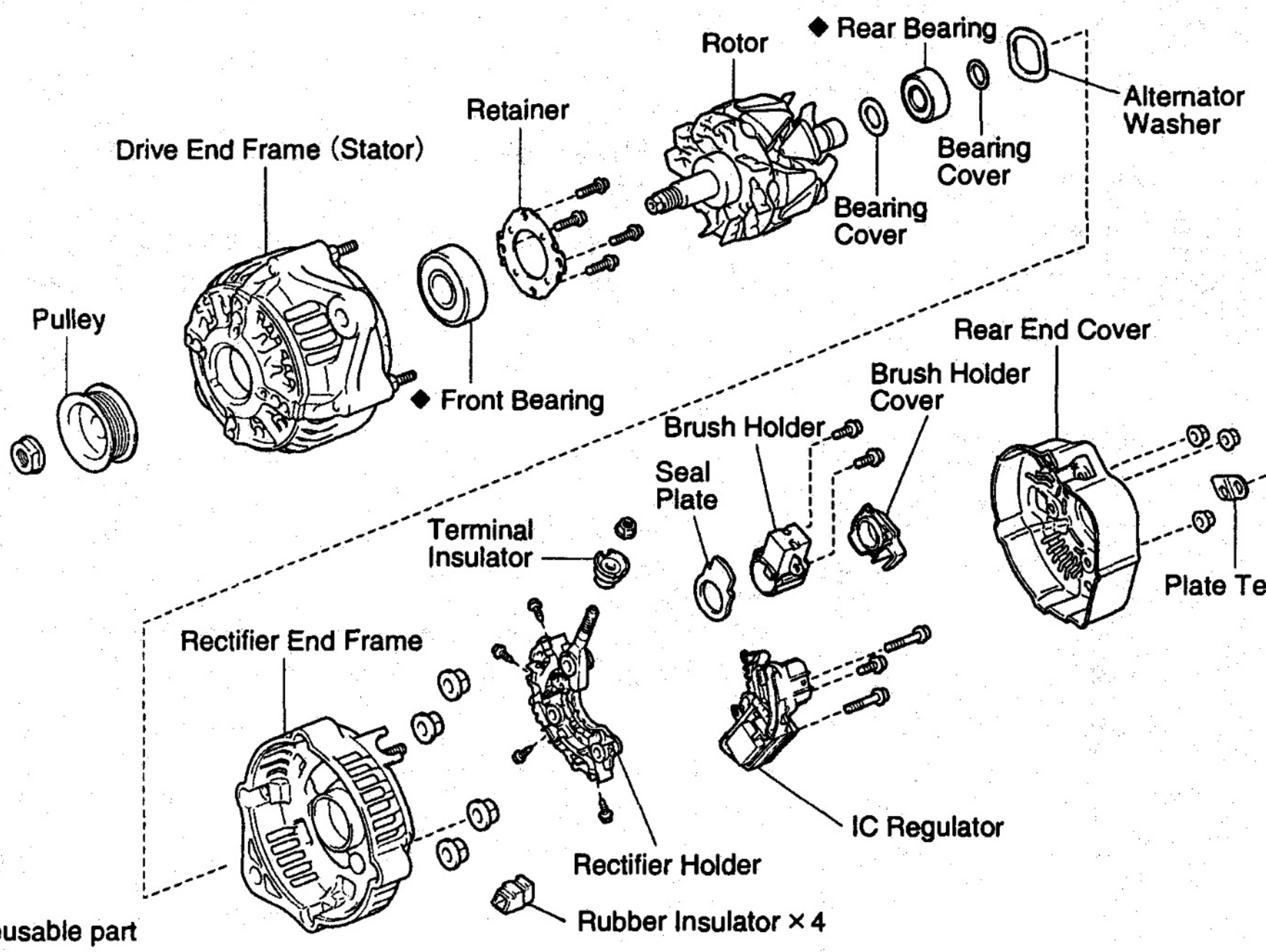
COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

CH011-1E

M/T



A/T



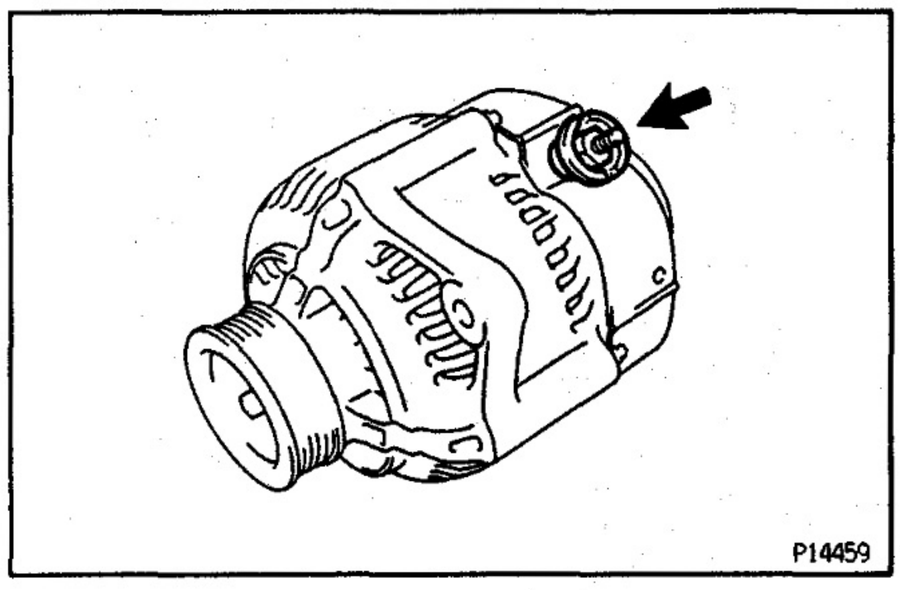
S02542
S04000

◆ Non-reusable part

Z18643

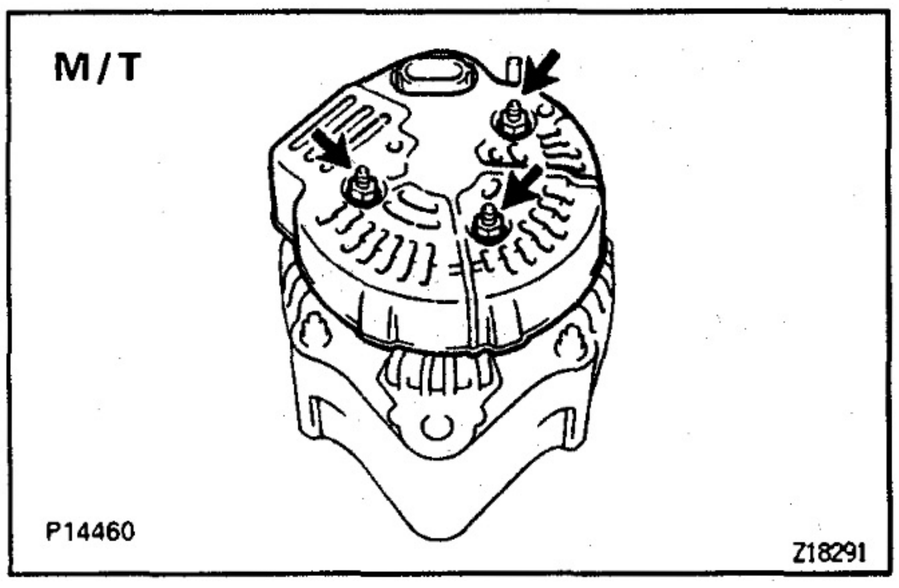
CH0E8-01

ALTERNATOR DISASSEMBLY

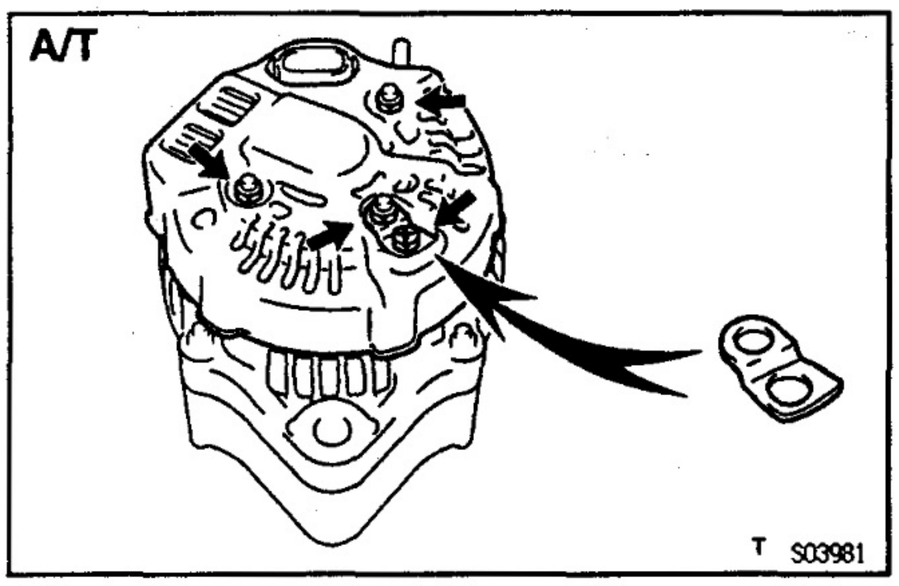


1. REMOVE REAR END COVER

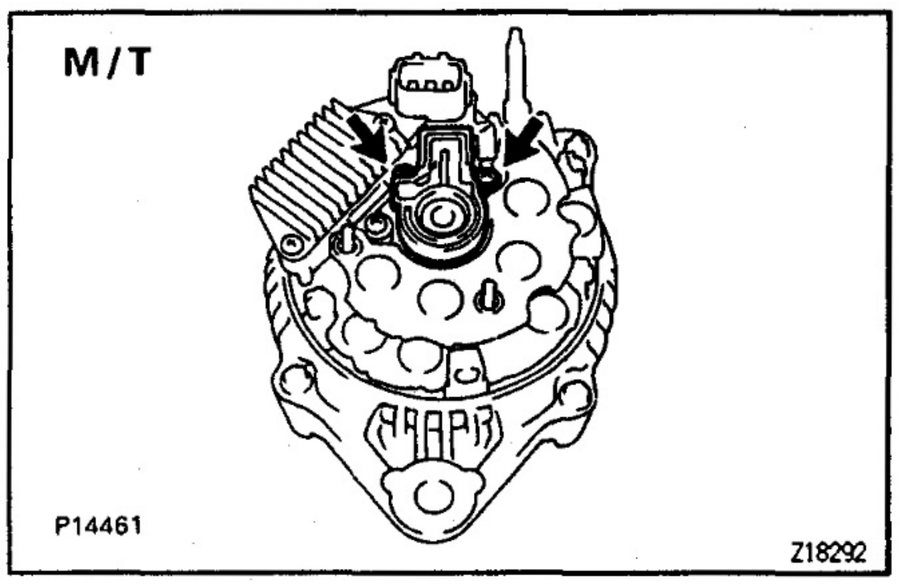
(a) Remove the nut and terminal insulator.



(b) M/T:
Remove the 3 nuts, and end cover.



(c) A/T:
Remove the bolt, 3 nuts, plate terminal and end cover.

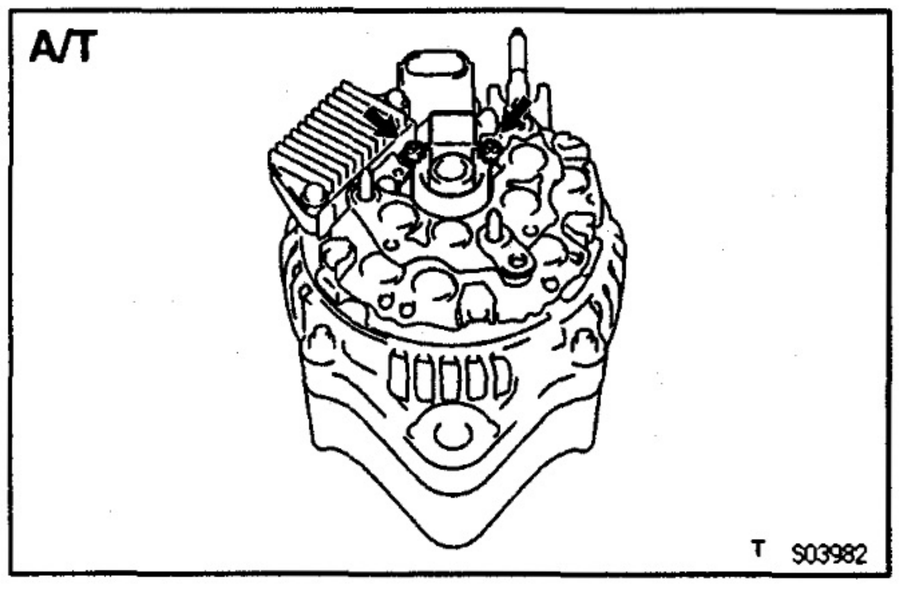


2. REMOVE BRUSH HOLDER

A. M/T:

(a) Remove the 2 screws and brush holder.

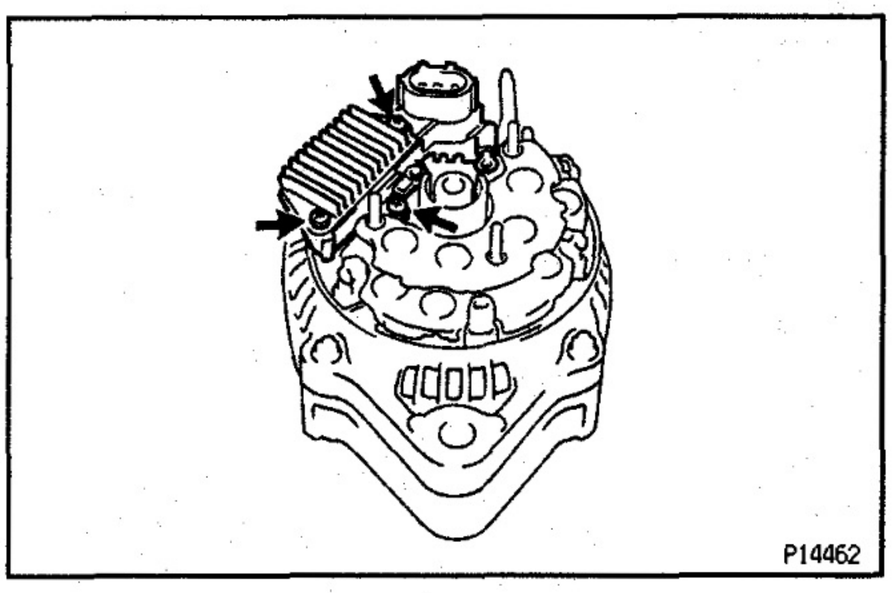
(b) Remove the brush holder cover from the brush holder.



B. A/T:

(a) Remove the brush holder cover from the brush holder.

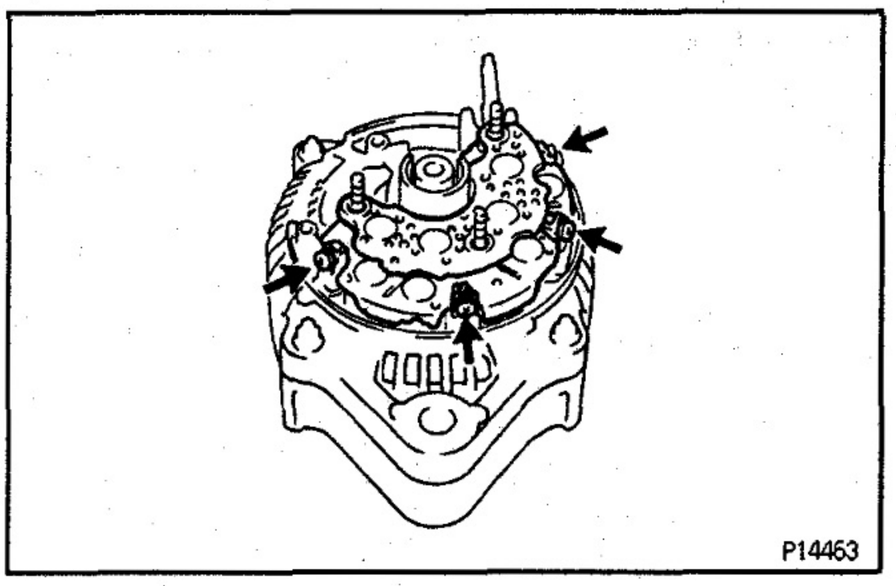
(b) Remove the 2 screws and brush holder.



3. REMOVE IC REGULATOR

(a) Remove the 3 screws and IC regulator.

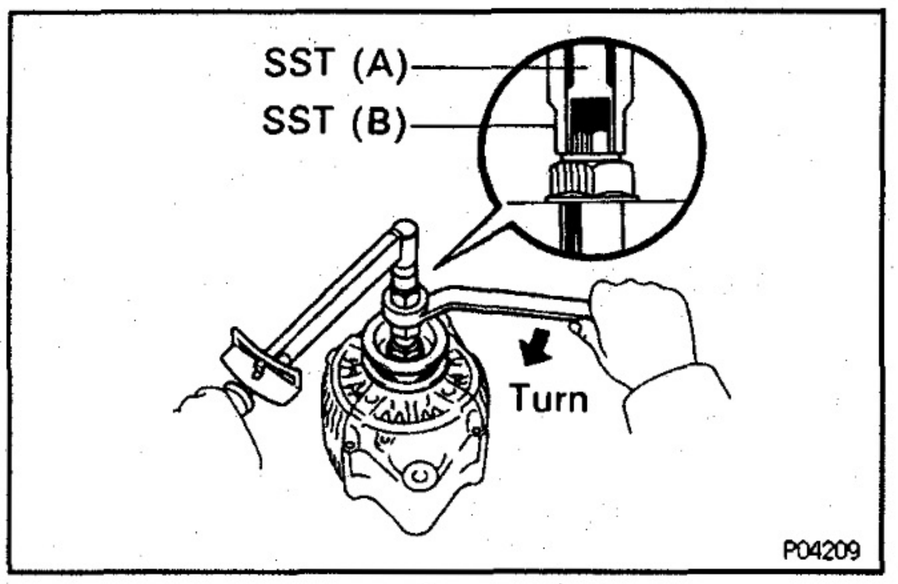
(b) A/T:
Remove the seal plate from the rectifier end frame.



4. REMOVE RECTIFIER HOLDER

(a) Remove the 4 screws and rectifier holder.

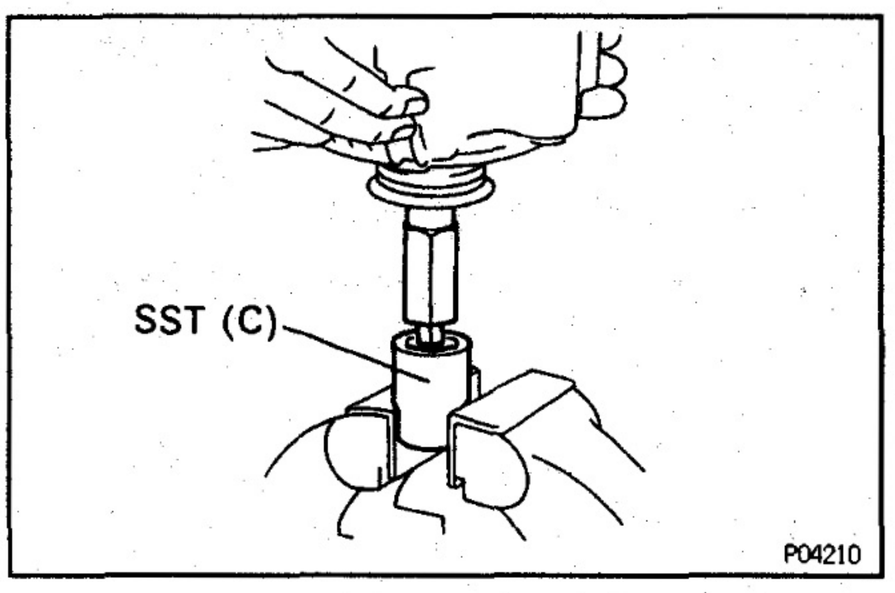
(b) Remove the 4 rubber insulators.



5. REMOVE PULLEY

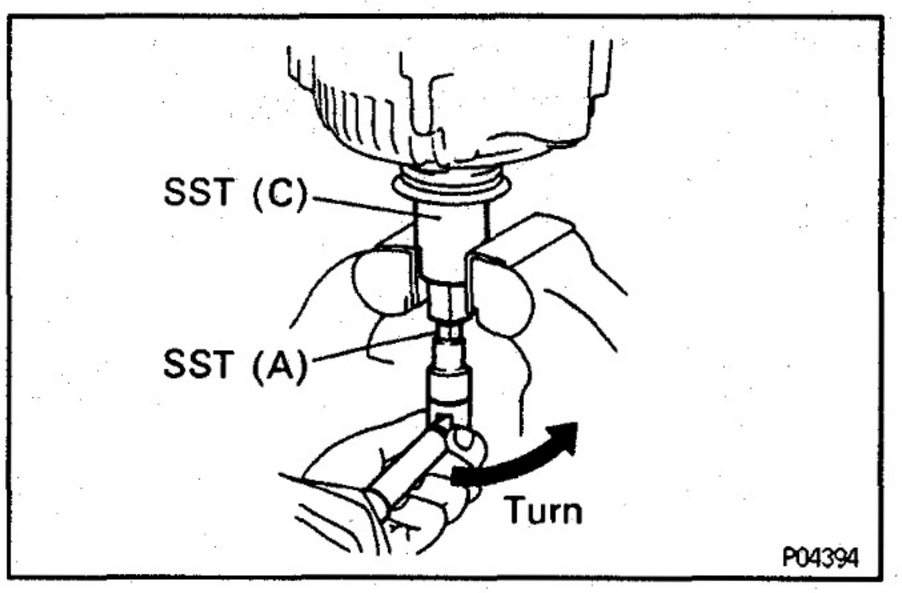
(a) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.
SST 09820–63010
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

(b) Check that SST (A) is secured to the rotor shaft.



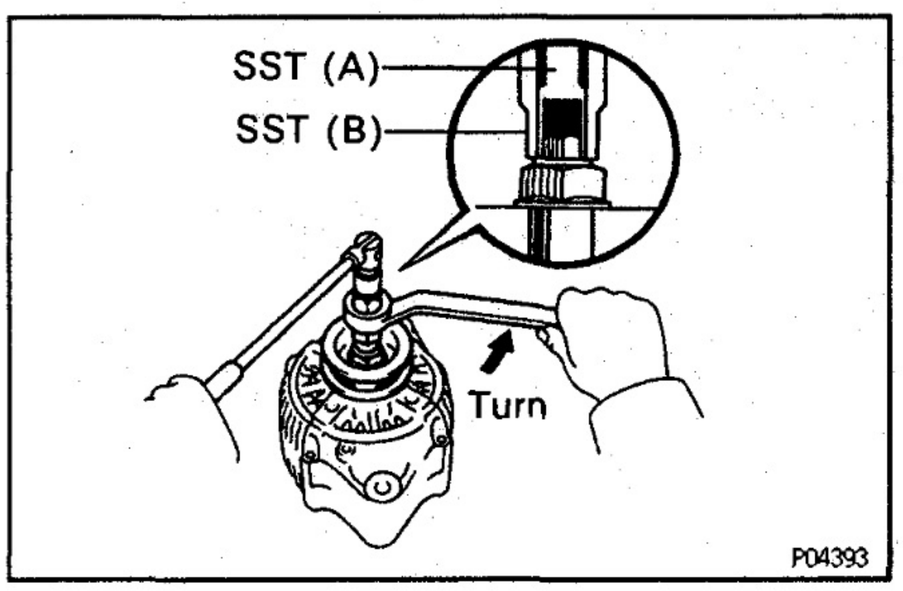
(c) Mount SST (C) in a vise.

(d) Install the generator to SST (C).

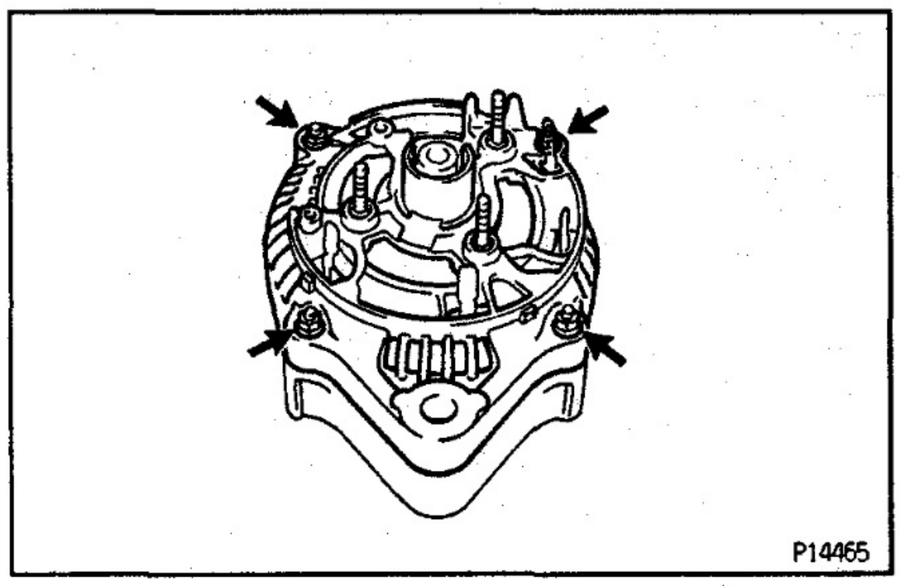


(e) To loosen the pulley nut, turn SST (A) in the direction shown in the illustration.
NOTICE: To prevent damage to the rotor shaft, do not loosen the pulley nut more than one–half of a turn.

(f) Remove the generator from SST (C).

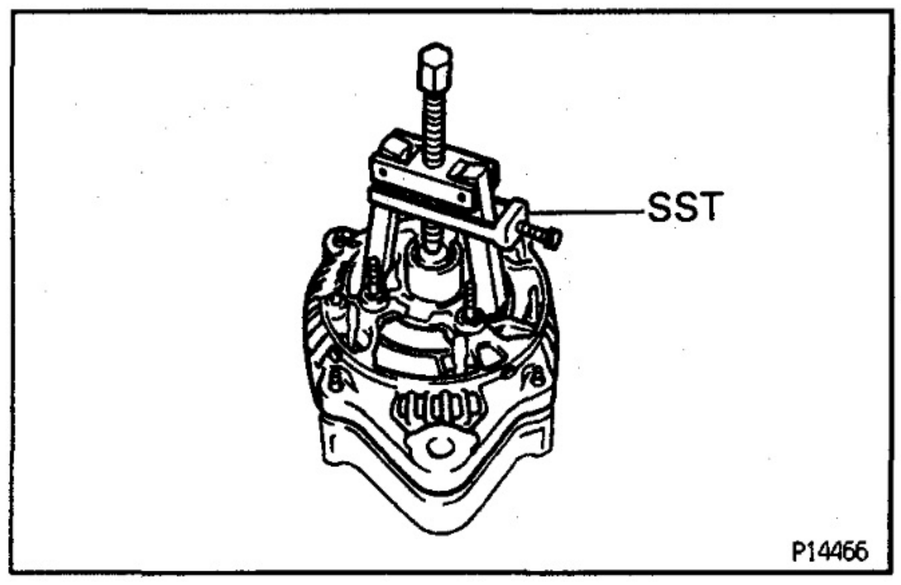


(g) Turn SST (B) and remove SST (A and B).
(h) Remove the pulley nut and pulley.



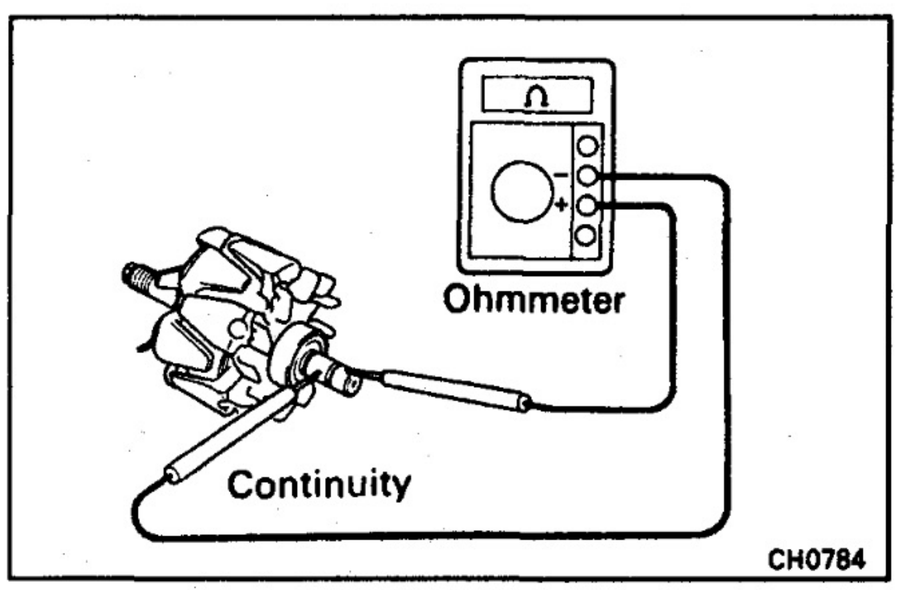
6. REMOVE RECTIFIER END FRAME

(a) Remove the 4 nuts.



(b) Using SST, remove the rectifier end frame.
SST 09286–46011
(c) A/T:
Remove the alternator washer from the rotor.

7. REMOVE ROTOR FROM DRIVE END FRAME



ALTERNATOR INSPECTION AND REPAIR CH0AK–03

Rotor

1. INSPECT ROTOR FOR OPEN CIRCUIT

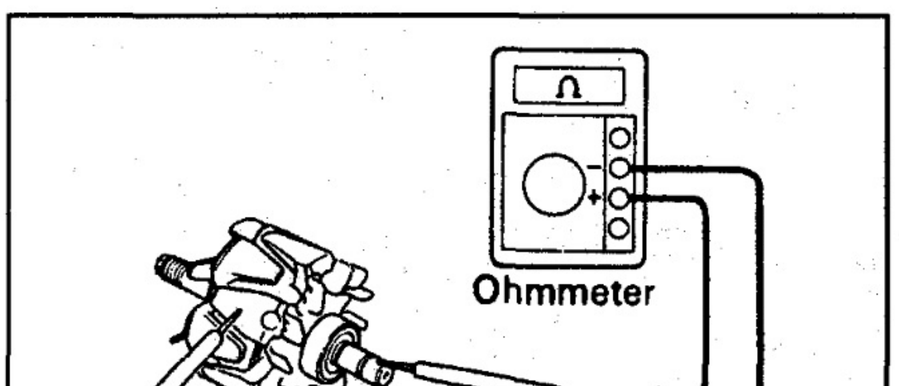
Using an ohmmeter, check that there is continuity between the slip rings.

Standard resistance (Cold):

M/T: 2.1 – 2.5 Ω

A/T: 2.7 – 3.1 Ω

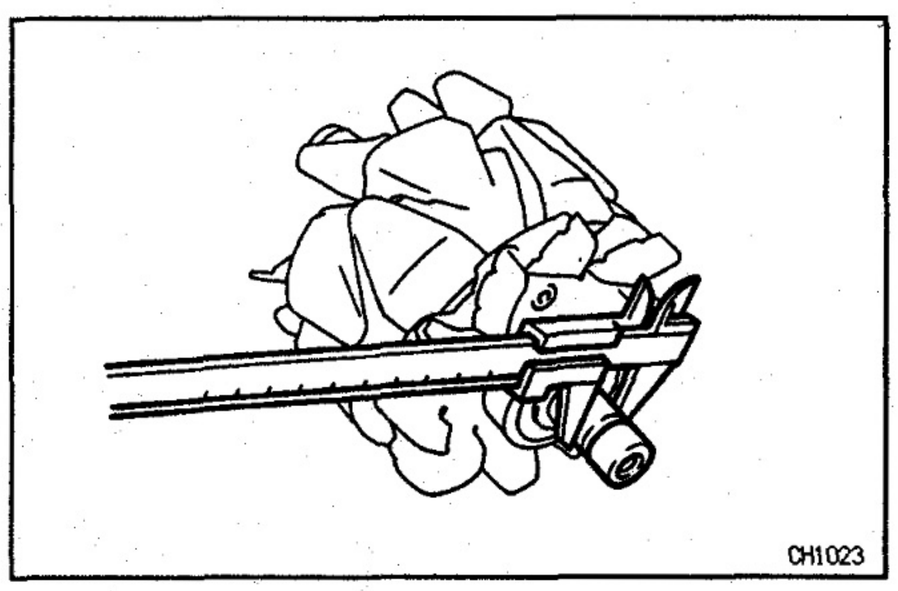
If there is no continuity, replace the rotor.



2. INSPECT ROTOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the slip ring and rotor.

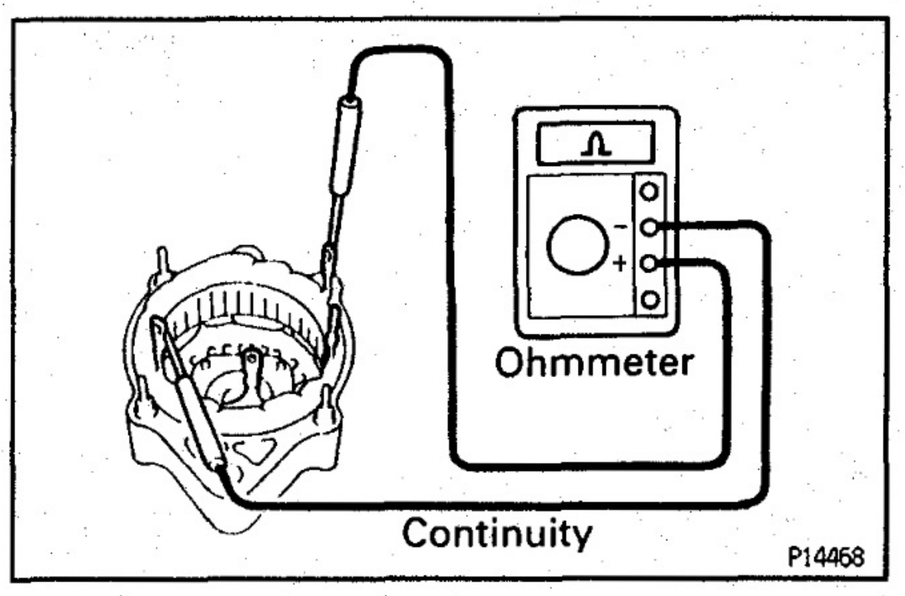
If there is continuity, replace the rotor.



3. INSPECT SLIP RINGS

(a) Check that the slip rings are not rough or scored.
If rough or scored, replace the rotor.

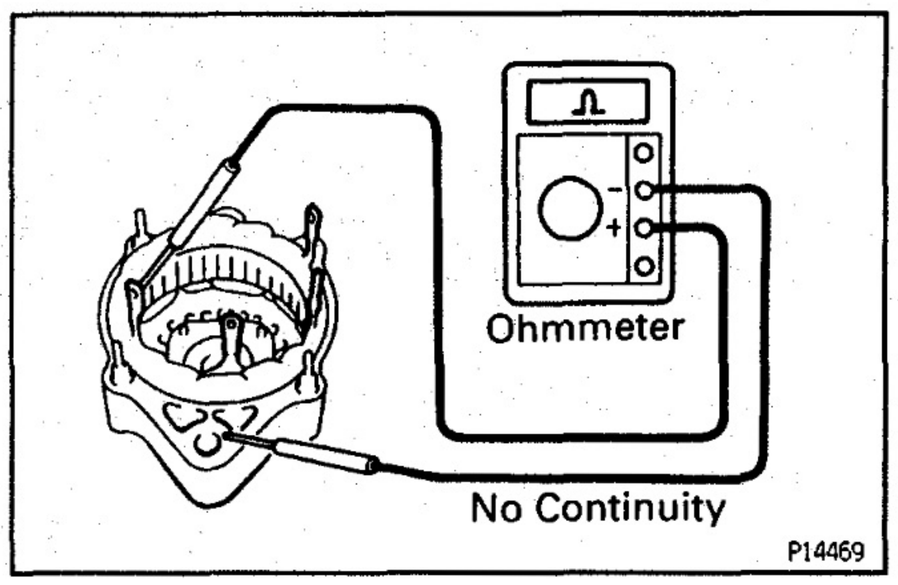
(b) Using a vernier caliper, measure the slip ring diameter.
Standard diameter:
14.2 – 14.4 mm (0.559 – 0.567 in.)
Minimum diameter:
12.8 mm (0.504 in.)
If the diameter is less than the minimum, replace the rotor.



Stator (Drive End Frame)

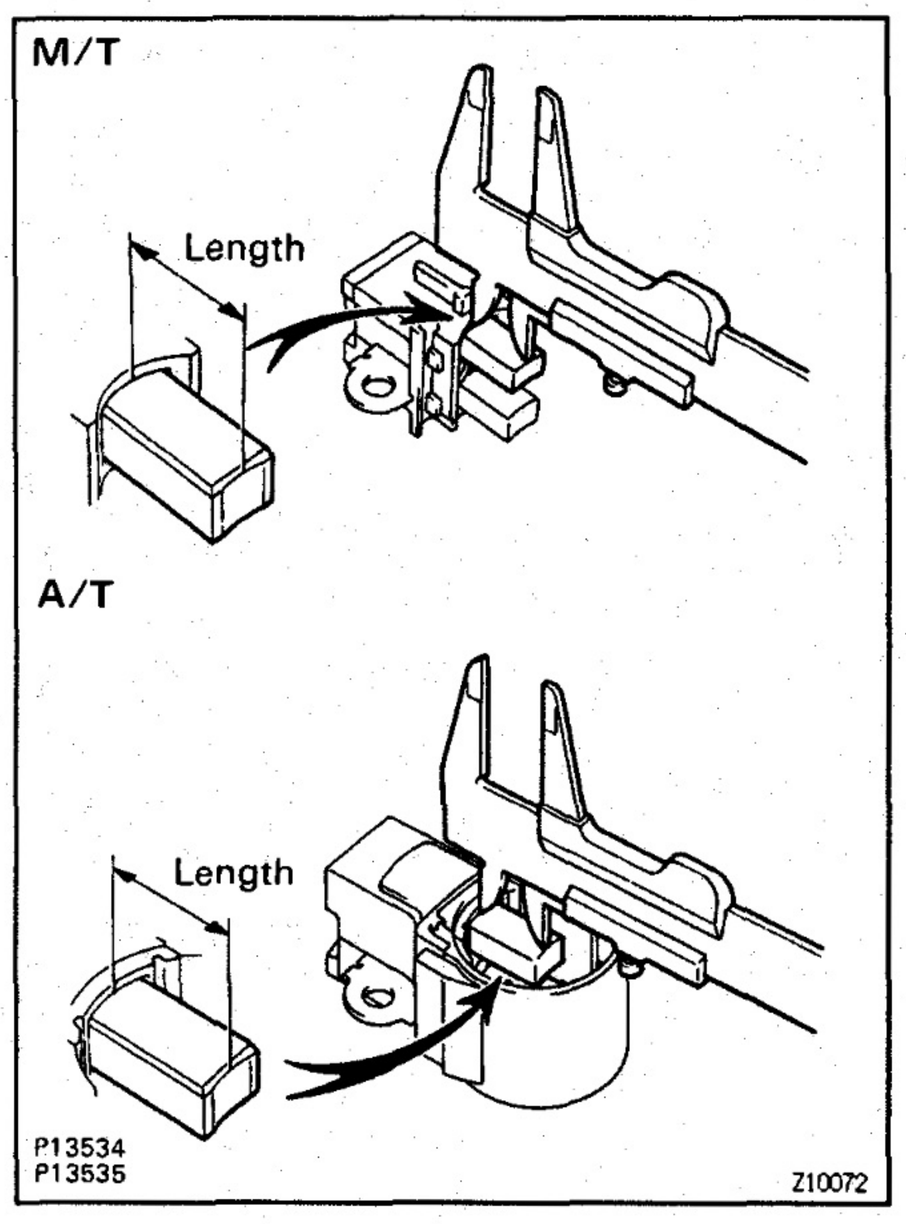
1. INSPECT STATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the coil leads.
If there is no continuity, replace the drive end frame assembly.



2. INSPECT STATOR FOR GROUND

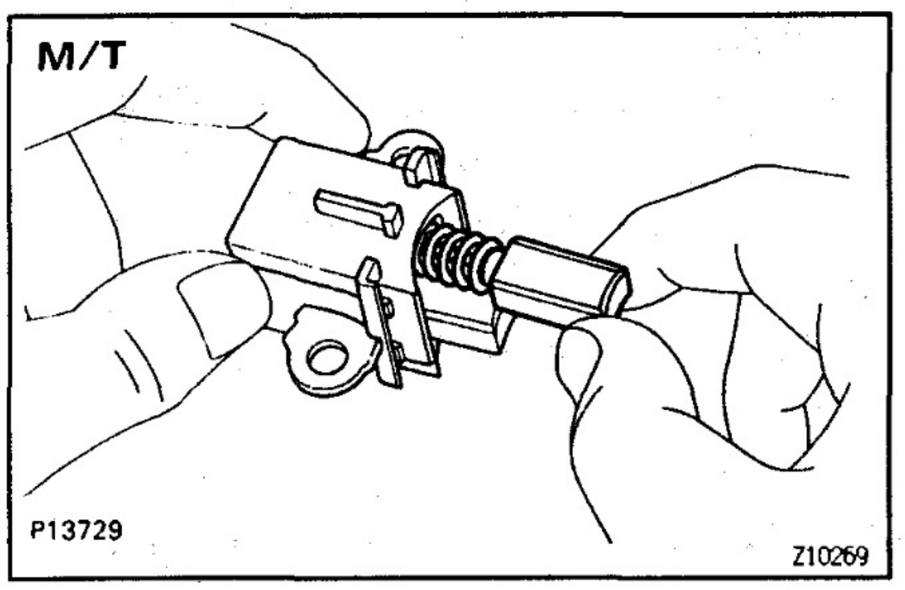
Using an ohmmeter, check that there is no continuity between the coil lead and drive end frame.
If there is continuity, replace the drive end frame assembly.



Brushes

1. INSPECT EXPOSED BRUSH LENGTH

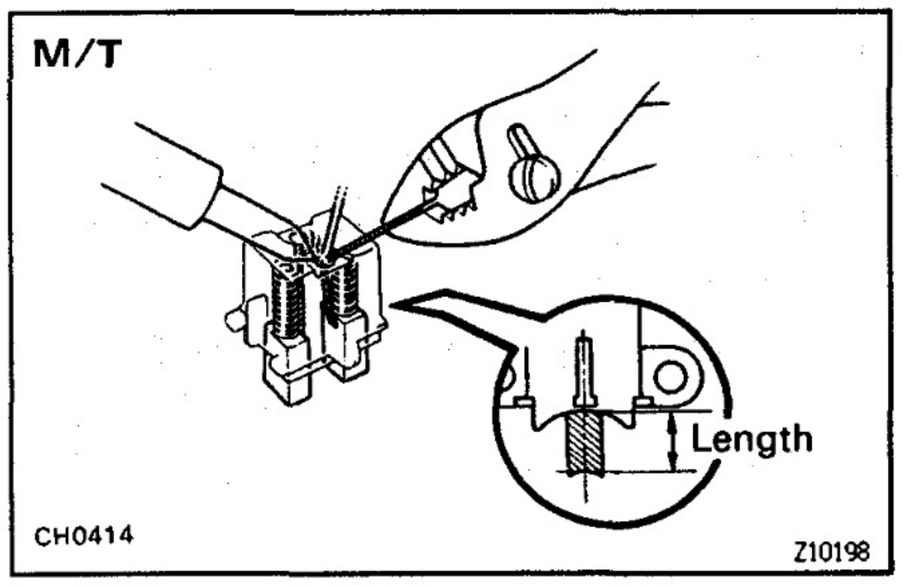
Using vernier calipers, measure the exposed brush length.
Standard exposed length:
10.5 mm (0.413 in.)
Minimum exposed length:
1.5 mm (0.059 in.)
If the exposed length is less than minimum, replace the brushes (M/T) or brush holder assembly (A/T).



2. M/T:
IF NECESSARY, REPLACE BRUSHES

(a) Unsolder and remove the brush and spring.

(b) Run the wire of a new brush through the hole in the brush holder, and insert the spring and brush into the brush holder.



(c) Solder the brush wire to the brush holder at specified exposed length.

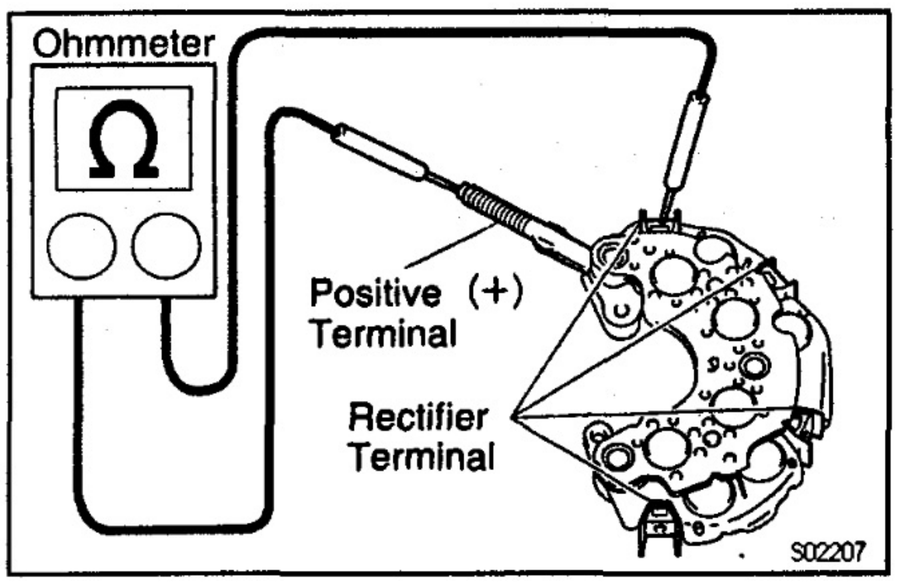
Exposed length:

10.5 mm (0.413 in.)

(d) Check that the brush moves smoothly in the brush holder.

(e) Cut off the excess wire.

(f) Apply insulation paint to the soldered area.



Rectifiers (Rectifier Holder)

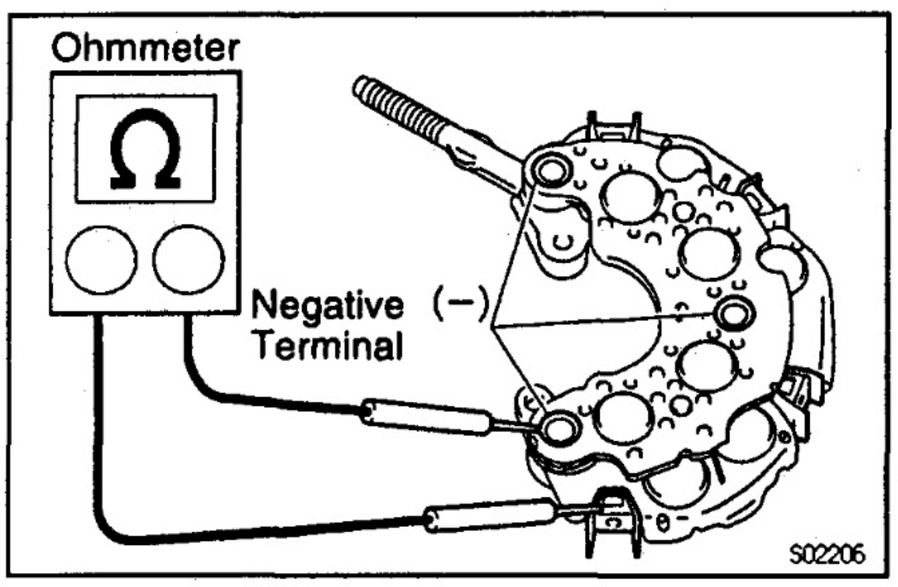
1. INSPECT POSITIVE RECTIFIER

(a) Using an ohmmeter, connect one tester probe to the positive (+) terminal and the other to each rectifier terminal.

(b) Reverse the polarity of the tester probes and repeat step (a).

(c) Check that one shows continuity and the other shows no continuity.

If continuity is not as specified, replace the rectifier holder.



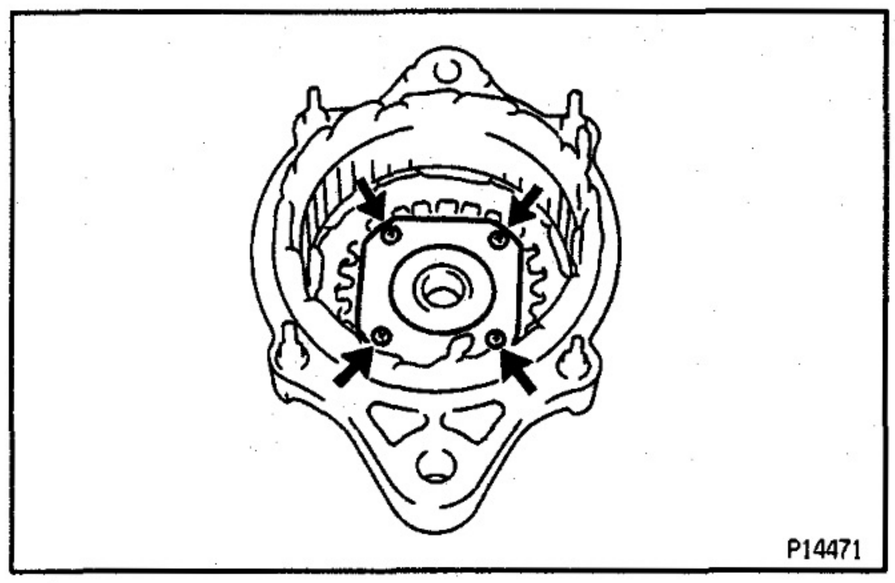
2. INSPECT NEGATIVE RECTIFIER

(a) Using an ohmmeter, connect one tester probe to each negative (–) terminal and the other to each rectifier terminal.

(b) Reverse the polarity of the tester probes and repeat step (a).

(c) Check that one shows continuity and the other shows no continuity.

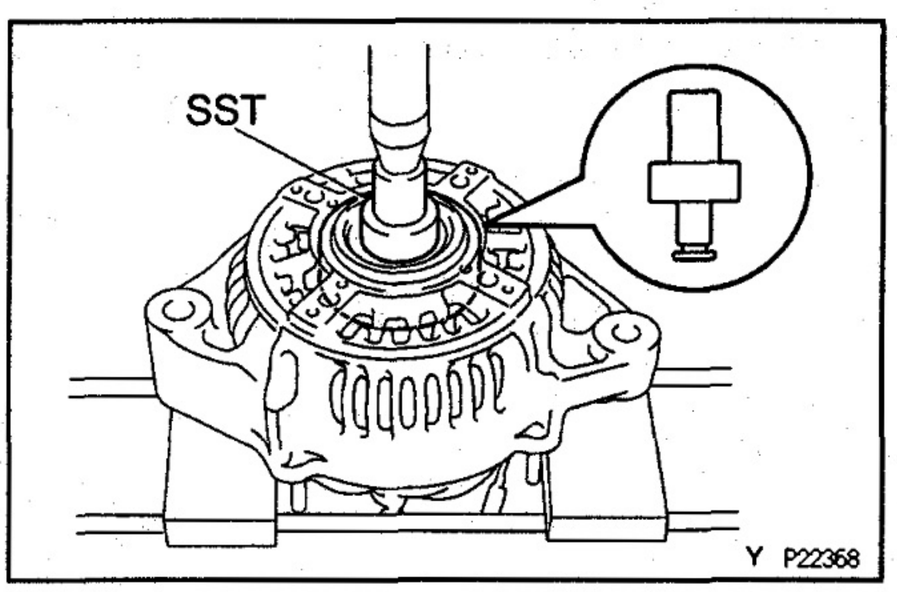
If continuity is not as specified, replace the rectifier holder.



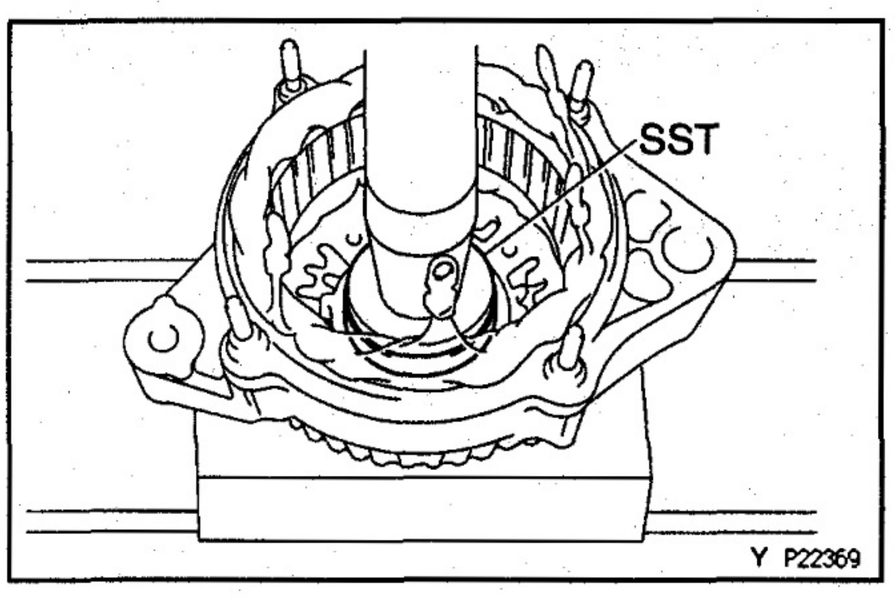
Bearings

1. **INSPECT FRONT BEARING**
   Check that the bearing is not rough or worn.
2. **IF NECESSARY, REPLACE FRONT BEARING**

(a) Remove the 4 screws, bearing retainer and bearing.

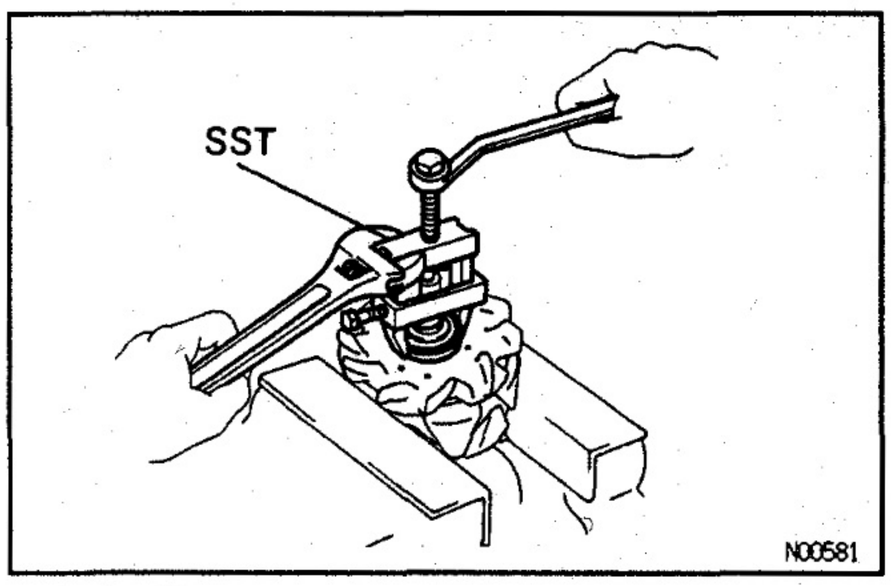


(b) Using SST and press, press out the bearing.
SST 09950–60010 (09951–00260, 09952–06010)



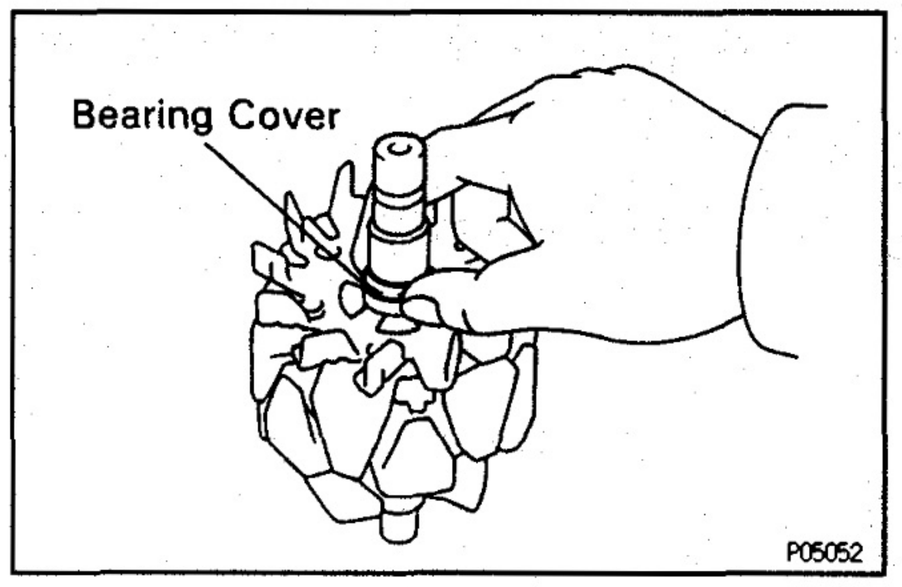
(c) Using SST and a press, press in a new bearing.
SST 09950–60010 (09951–00500)

(d) Install the bearing retainer with the 4 screws.
Torque:
M/T: 2.6 N·m (27 kgf·cm, 23 in.·lbf)
A/T: 2.95 N·m (30 kgf·cm, 27 in.·lbf)

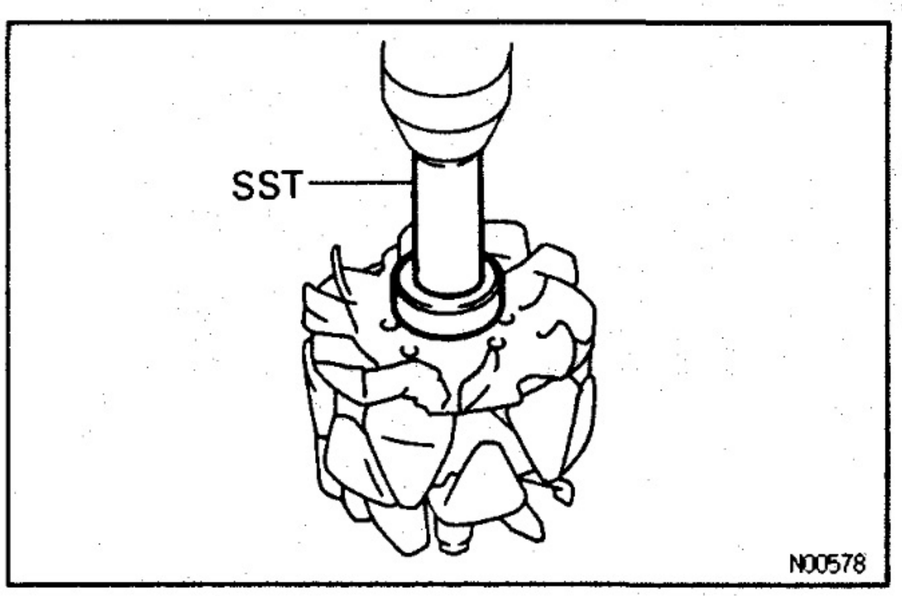


3. **INSPECT REAR BEARING**
   Check that the bearing is not rough or worn.
4. **IF NECESSARY, REPLACE REAR BEARING**

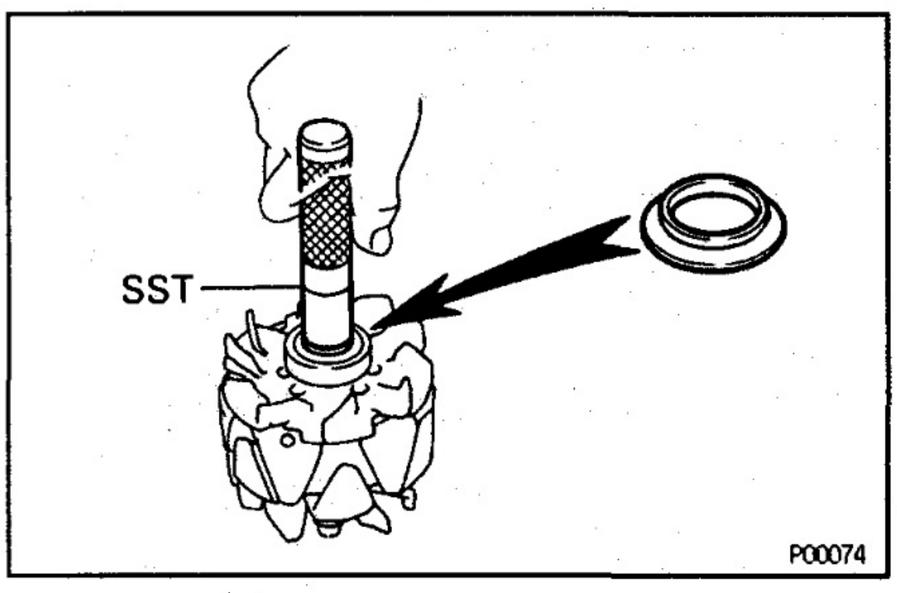
(a) Using SST, remove the bearing covers and bearing.
SST 09820–00021
NOTICE: Be careful not to damage the fan.



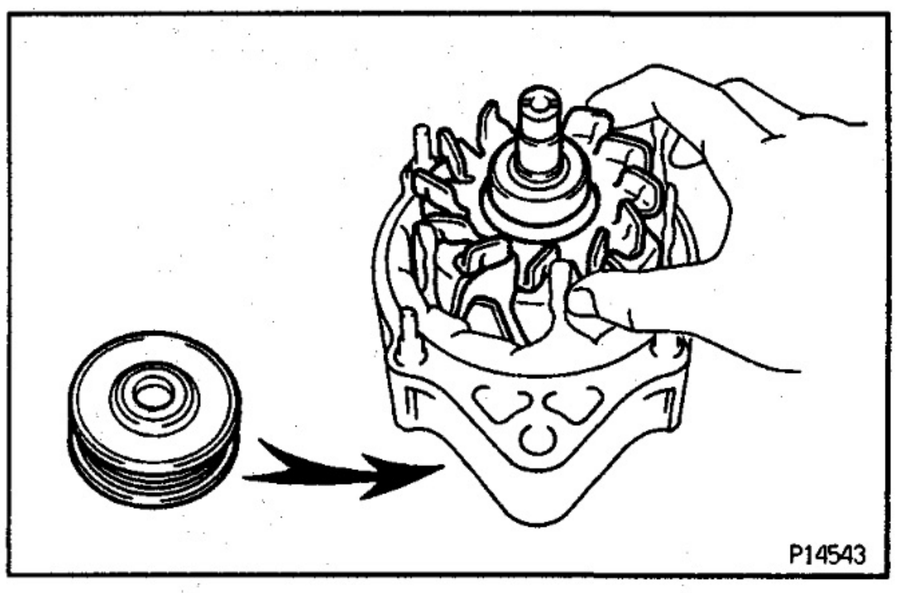
(b) Place the bearing cover on the rotor.



(c) Using SST and a press, press in a new bearing.
SST 09820–00030



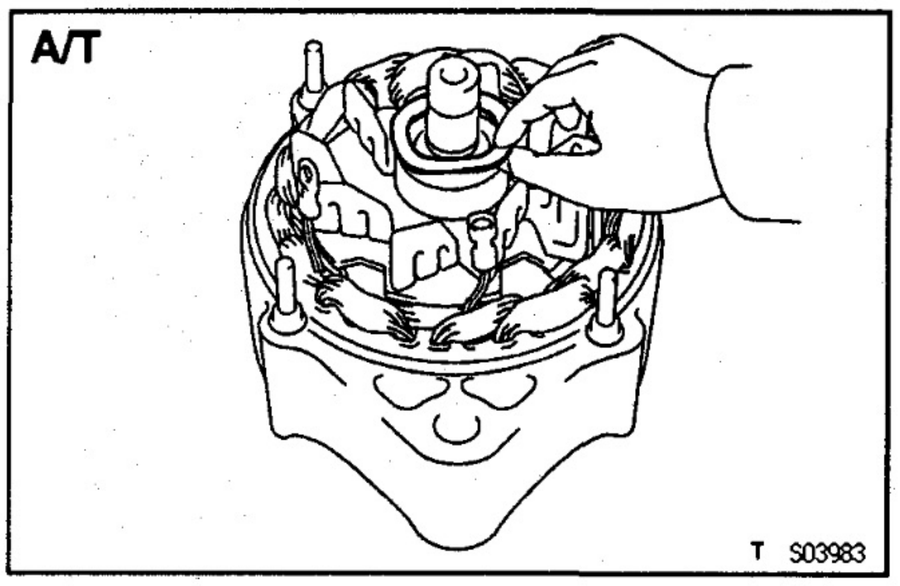
(d) Using SST, push in the bearing cover.
SST 09285–76010



CH0E7–01

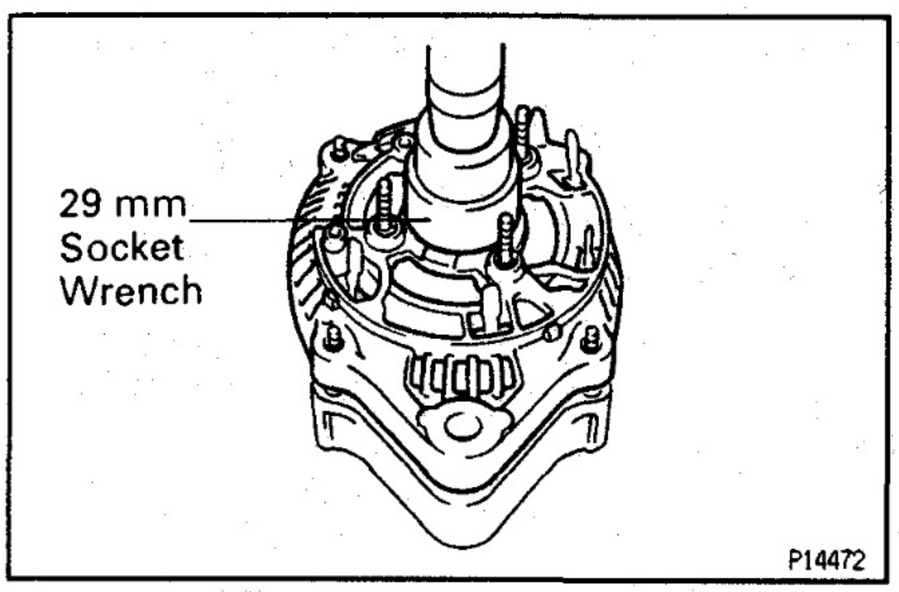
ALTERNATOR ASSEMBLY

1. PLACE DRIVE END FRAME ON PULLEY
2. INSTALL ROTOR TO DRIVE END FRAME



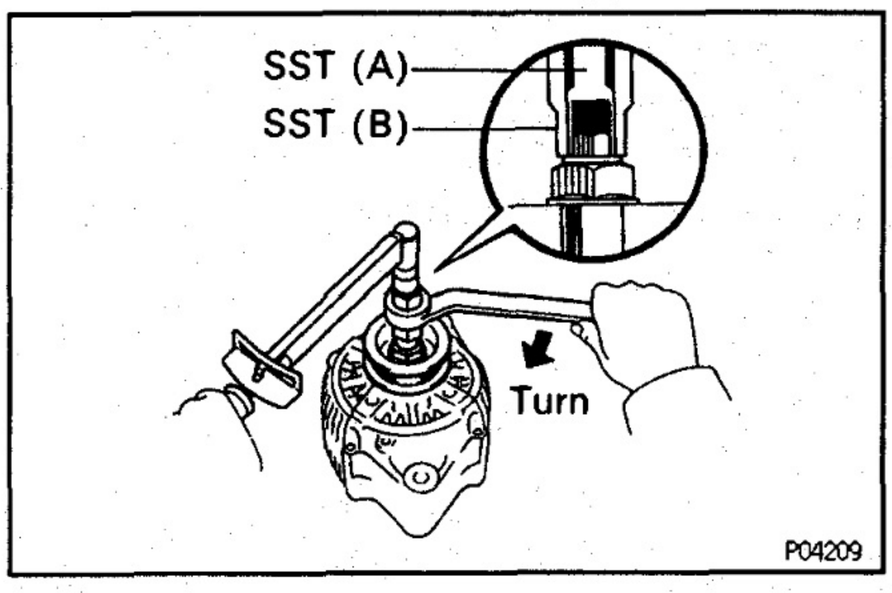
3. INSTALL RECTIFIER END FRAME

(a) A/T:
Place the alternator washer on the rotor.



(b) Using a 29 mm socket wrench and press, slowly press in the rectifier end frame.

(c) Install the 4 nuts.
Torque: 4.5 N·m (46 kgf·cm, 40 in.·lbf)

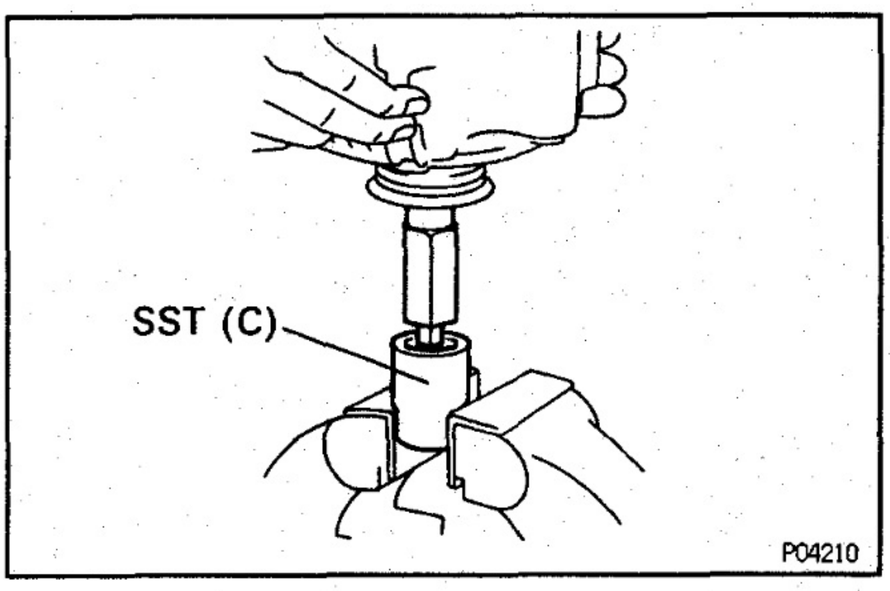


4. INSTALL PULLEY

(a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.

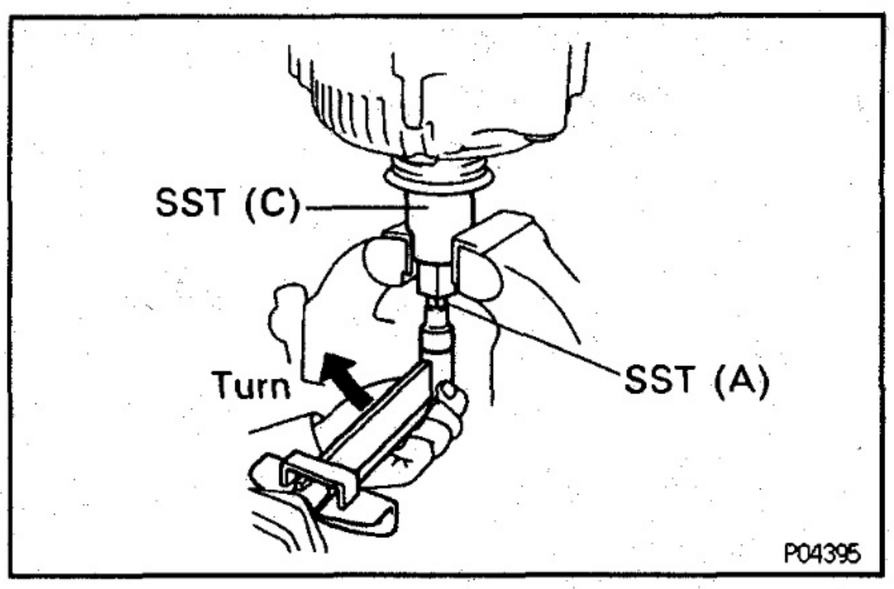
(b) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.
SST 09820–63010
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

(c) Check that SST (A) is secured to the pulley shaft.



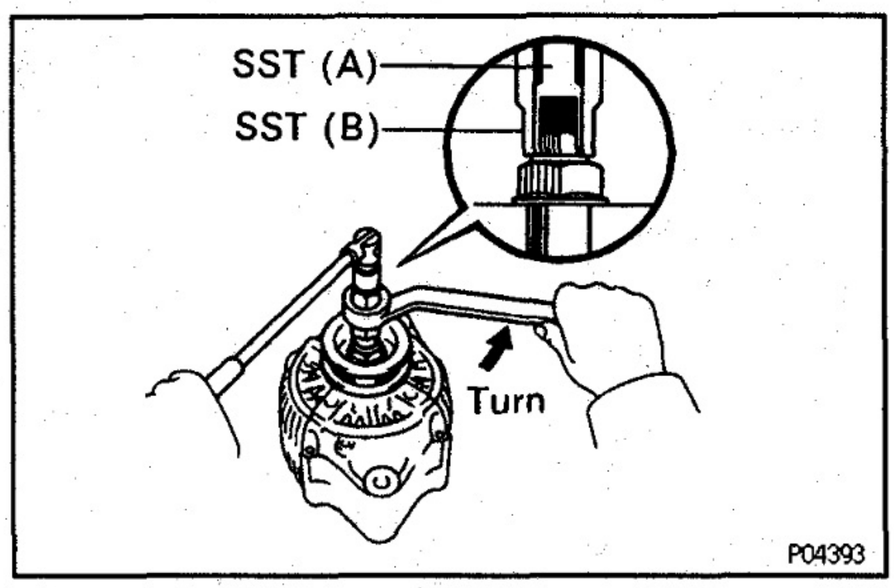
(d) Mount SST (C) in a vise.

(e) Install the alternator to SST (C).

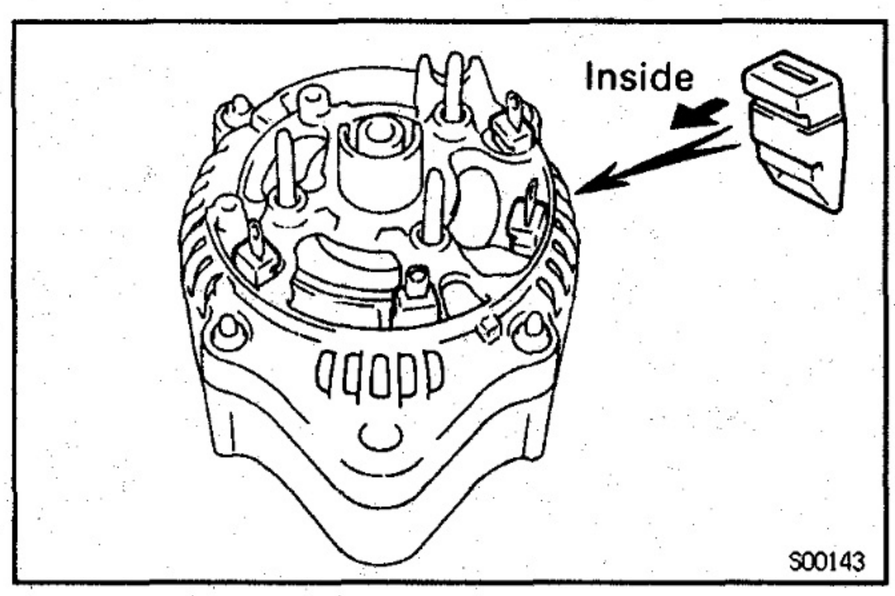


(f) To torque the pulley nut, turn SST (A) in the direction shown in the illustration.
Torque: 110.5 N·m (1,125 kgf·cm, 81 ft·lbf)

(g) Remove the alternator from SST (C).

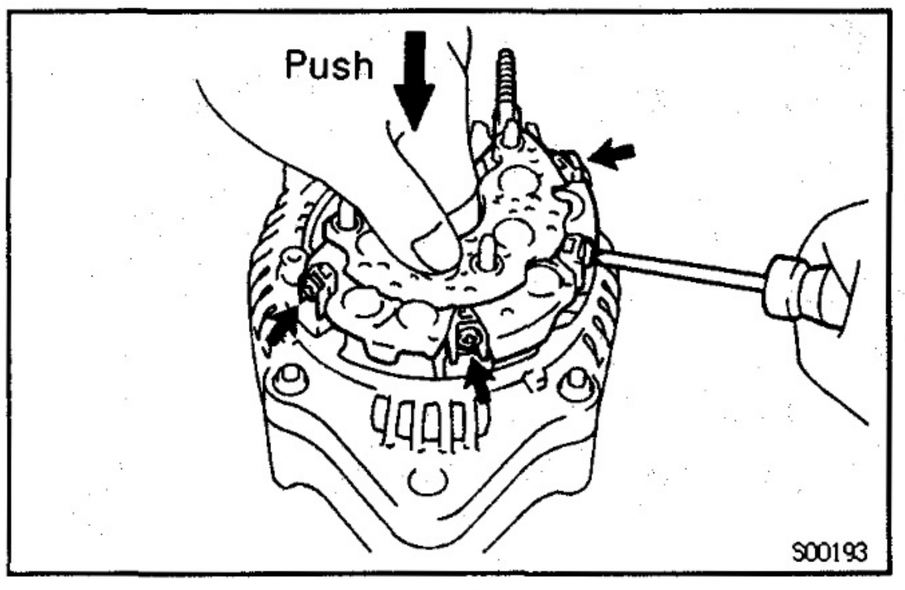


(h) Turn SST (B), and remove SST (A and B).

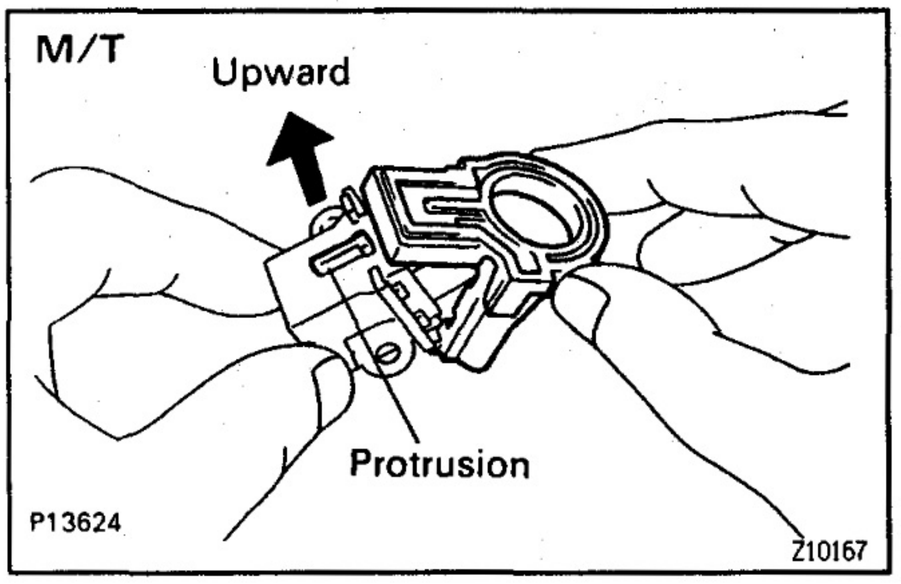


5. INSTALL RECTIFIER HOLDER

(a) Install the 4 rubber insulators on the lead wires.
NOTICE: Be careful of the rubber insulators installation direction.



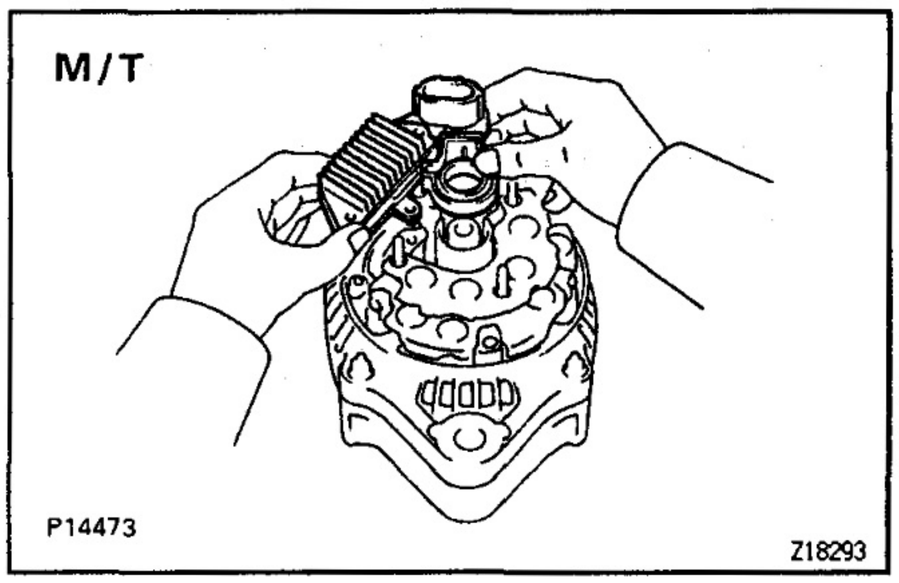
(b) Install the rectifier holder with the 4 screws.
Torque:
M/T: 2.0 N·m (20 kgf·cm, 17 in.·lbf)
A/T: 2.9 N·m (30 kgf·cm, 25 in.·lbf)



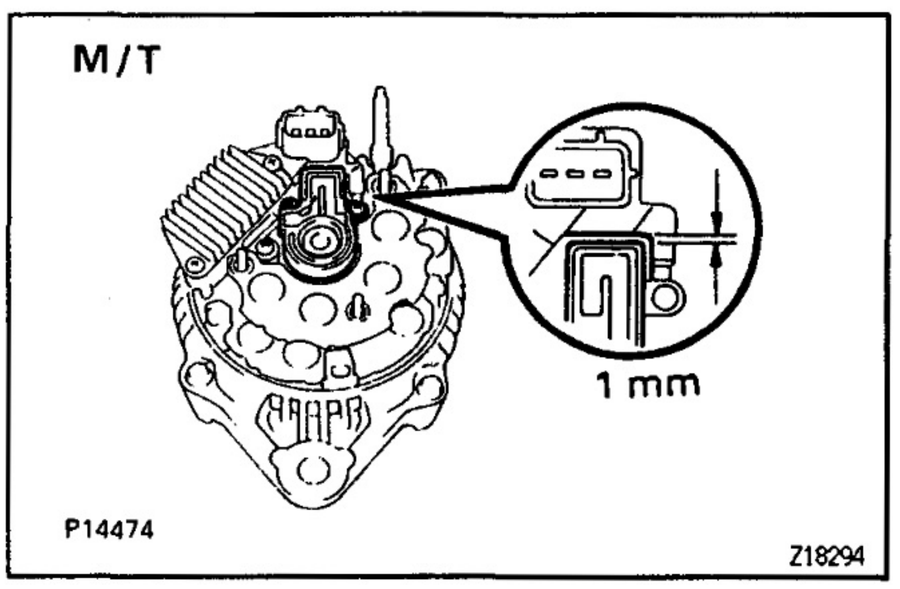
6. INSTALL IC REGULATOR AND BRUSH HOLDER

A. M/T:

(a) Install the brush holder cover to the brush holder.
NOTICE: Be careful of the holder installation direction.

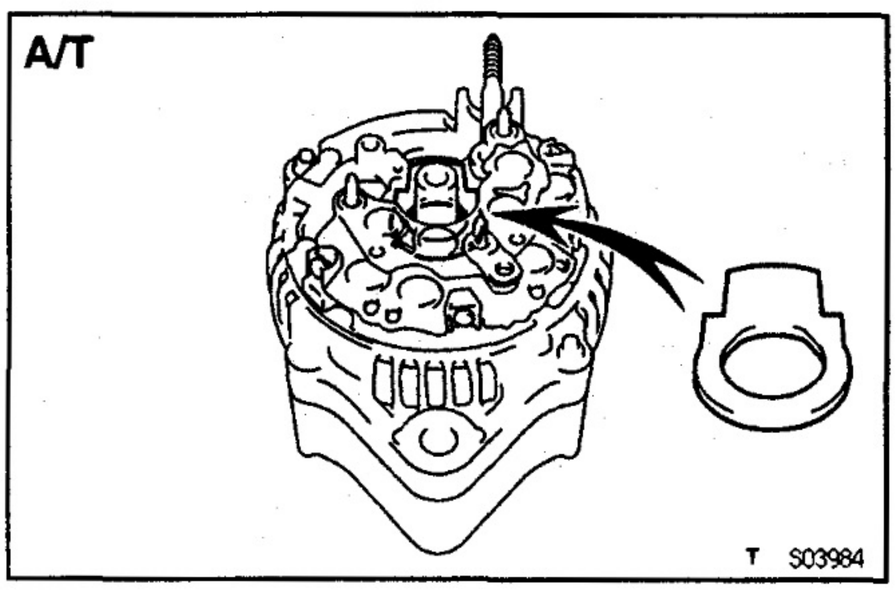


(b) Place the IC regulator together with the brush holder horizontally on the rectifier end frame.



(c) Install the 5 screws until there is a clearance of approx. 1 mm (0.04 in.) between the brush holder and connector.
Torque: 2.0 N·m (20kgf·cm, 17 in.·lbf)

(d) Fit the brush holder cover.

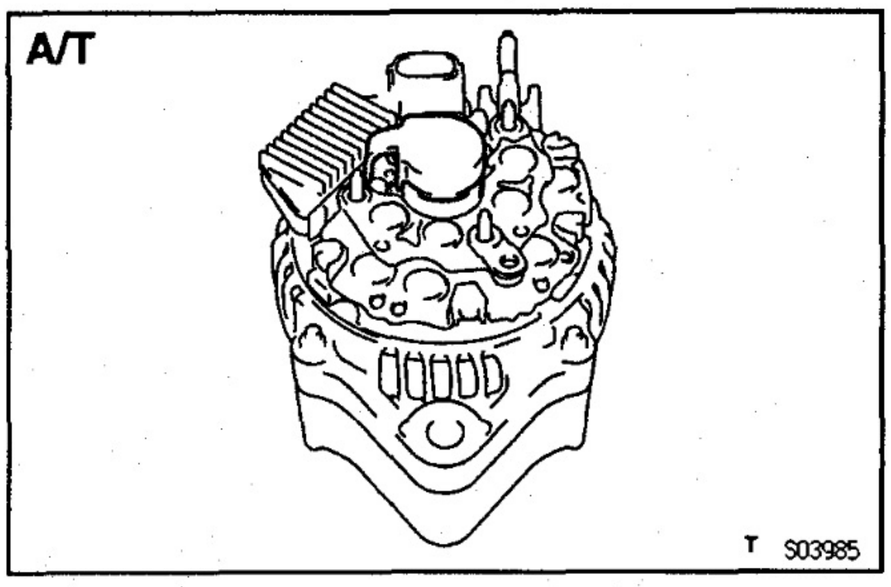


B. A/T:

(a) Place the seal plate on the rectifier end frame.

(b) Place the IC regulator and brush holder on the rectifier end frame.
NOTICE: Be careful of the holder installation direction.

(c) Install the 5 screws.
Torque: 2.0 N·m (20 kgf·cm, 17 in.·lbf)



(d) Place the brush holder cover on the brush holder.

7. INSTALL REAR END COVER

(a) M/T:
Install the end cover with the 3 nuts.
Torque: 4.4 N·m (45 kgf·cm, 39 in.·lbf)

(b) A/T:
Install the end cover and plate terminal with the bolt and 3 nuts.
Torque:
nut: 4.4 N·m (45 kgf·cm, 39 in.·lbf)
bolt: 3.8 N·m (39 kgf·cm, 34 in.·lbf)

(c) Install the terminal insulator with the nut.
Torque: 4.1 N·m (42 kgf·cm, 36 in.·lbf)

8. CHECK THAT ROTOR ROTATES SMOOTHLY

SERVICE SPECIFICATIONS

SERVICE DATA

CH01A–14

Battery	Specific gravity	at 20°C (68°F)	1.25 – 1.29
Drive belt	Deflection	New belt	5 – 7 mm (0.20 – 0.28 in.)
		Used belt	7 – 8 mm (0.28 – 0.31 in.)
	Tension	New belt	685 – 785 N (70 – 80 kgf)
		Used belt	295 – 440 N (30 – 45 kgf)
Alternator	Rated output	M/T	12 V 70 A
		A/T	12 V 80 A
	Rotor coil resistance	M/T	2.1 – 2.5 Ω
		A/T	2.7 – 3.1 Ω
	Slip ring diameter	STD	14.2 – 14.4 mm (0.559 – 0.567 in.)
		Minimum	12.8 mm (0.504 in.)
	Brush exposed length	STD	10.5 mm (0.413 in.)
		Minimum	1.5 mm (0.059 in.)
IC regulator	Regulating voltage		13.2 – 14.8 V

TORQUE SPECIFICATIONS

CH01C–15

Part tightened		N·m	kgf·cm	ft·lbf
Bearing retainer x Drive end frame	M/T	2.6	27	23 in.·lbf
	A/T	2.95	30	27 in.·lbf
Rectifier end frame x Drive end frame		4.5	46	40 in.·lbf
Alternator pulley x Rotor		110.5	1,125	81
Rectifier end frame x Brush holder, IC regulator		2.0	20	17 in.·lbf
Rectifier holder x Coil lead on rectifier end frame	M/T	2.0	20	17 in.·lbf
	A/T	2.9	30	25 in.·lbf
Rear end cover x Rectifier holder		4.4	45	39 in.·lbf
Plate terminal x Rectifier holder (A/T only)	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