

TOYOTA

5VZ-FE

ENGINE

REPAIR MANUAL

Apr., 1996

FOREWORD

This repair manual has been prepared to provide information covering general service repairs for the 5VZ-FE engine equipped in the TOYOTA LAND CRUISER/LAND CRUISER PRADO.

Applicable models: VZJ90, 95 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.
• 5VZ-FE Engine Emission Control Repair Manual	ERM120E

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.

TOYOTA MOTOR CORPORATION

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CHARGING

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INTRODUCTION

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HOW TO USE THIS MANUAL INDEX

IN00F-02

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

IN00G-03

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

IN00H-02

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

PREPARATION

IN00J-02

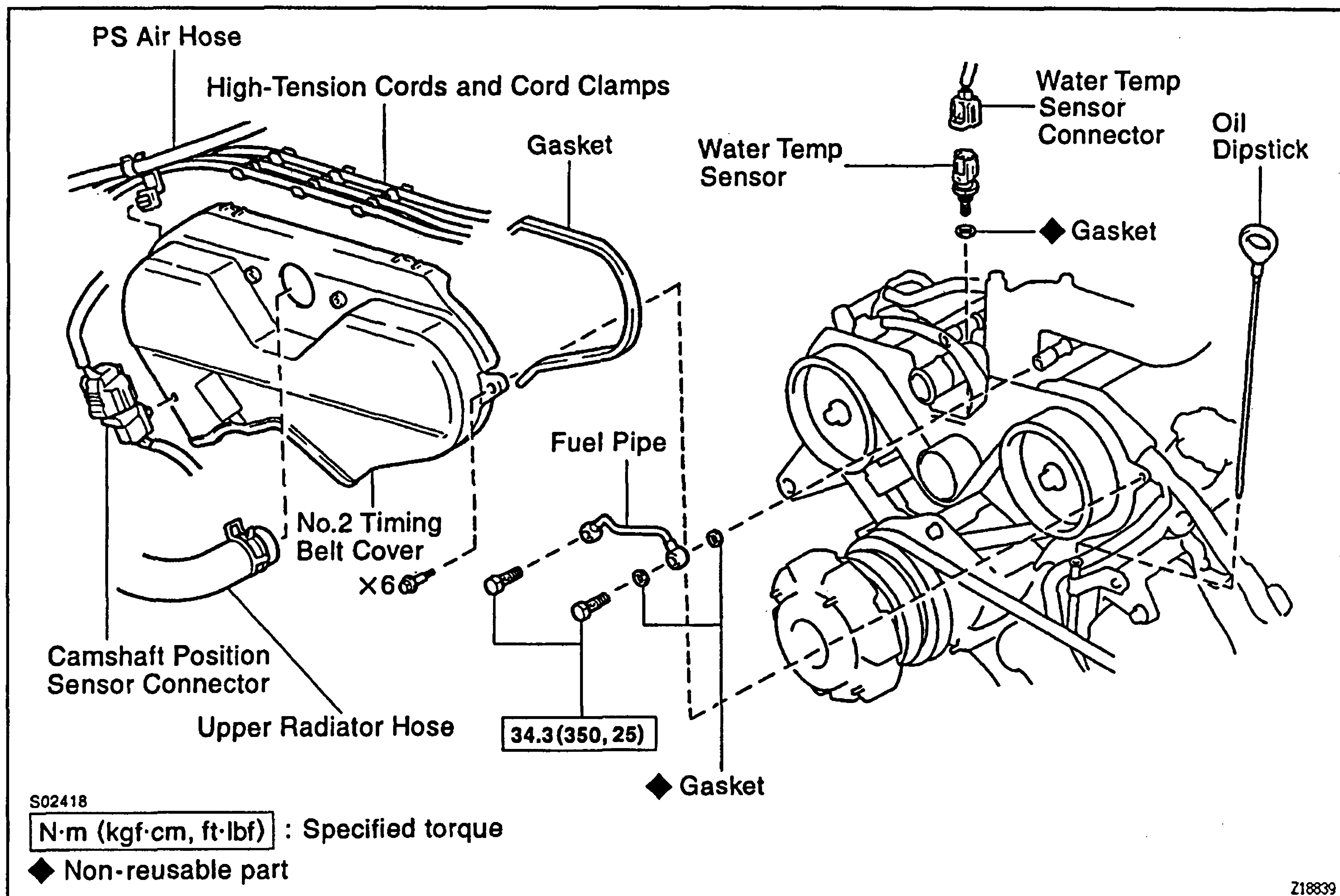
Preparation lists the SST (Special Service Tools), recommended tools, equipment, lubricant and SSM (Special Service Materials) which should be prepared before beginning the operation and explains the purpose of each one.

REPAIR PROCEDURES

IN00K-00

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

Example:

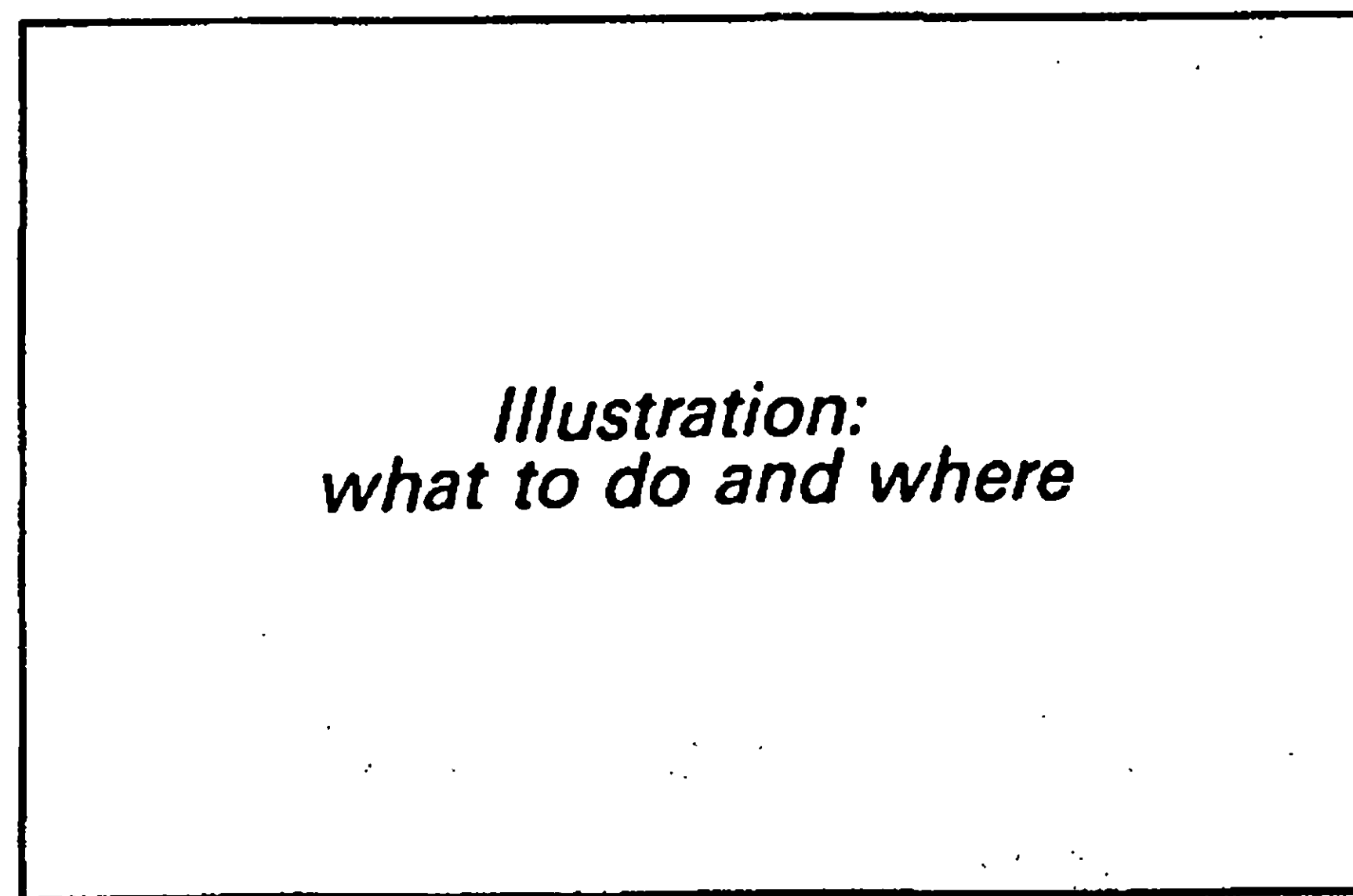


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The procedures are presented in a step—by—step format:

- 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:



Task heading: what to do

6. **INSTALL CRANKSHAFT PULLEY**

(a) Using SST, install the bolt.

SST 09213-54015 (90119-08126)

Set part No.

Component part No.

Detailed text: how to do task

(b) Install the bolt.

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

Specification

V00801

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

REFERENCES

IN00L-02

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

SPECIFICATIONS

IN00M-02

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:

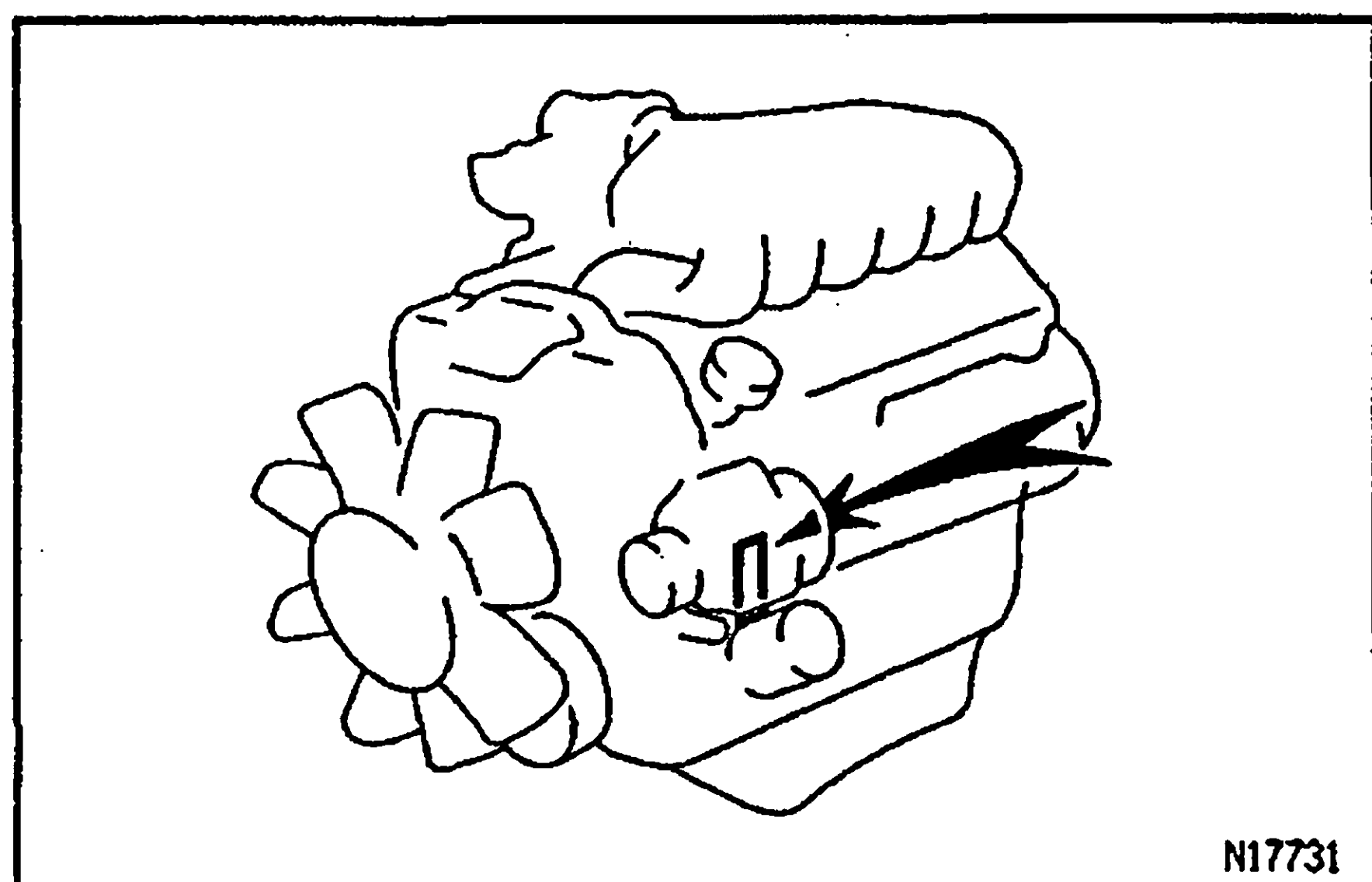
- **CAUTIONS** are presented in bold type, and indicate there is a possibility of injury to you or other people.
- **NOTICES** are also presented in bold type, and indicate the possibility of damage to the components being repaired.
- **HINTS** are separated from the text but do not appear in bold. They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

SI UNIT

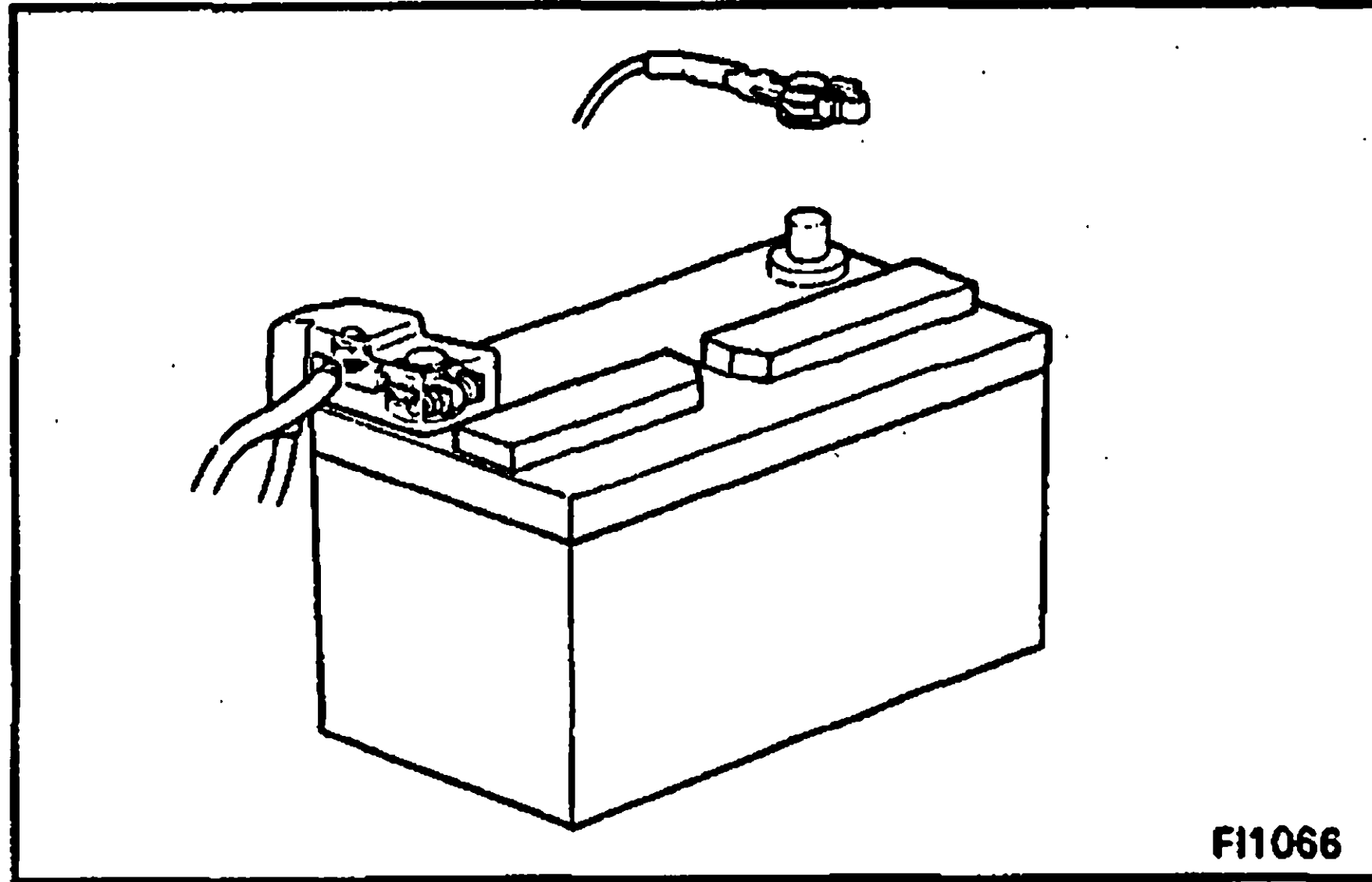
The UNIT given in this manual are primarily expressed with the SI UNIT (International System of Unit), and alternately expressed in the metric system and in the yard/pound system.

Example:

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

**IDENTIFICATION INFORMATION
ENGINE SERIAL NUMBER**

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

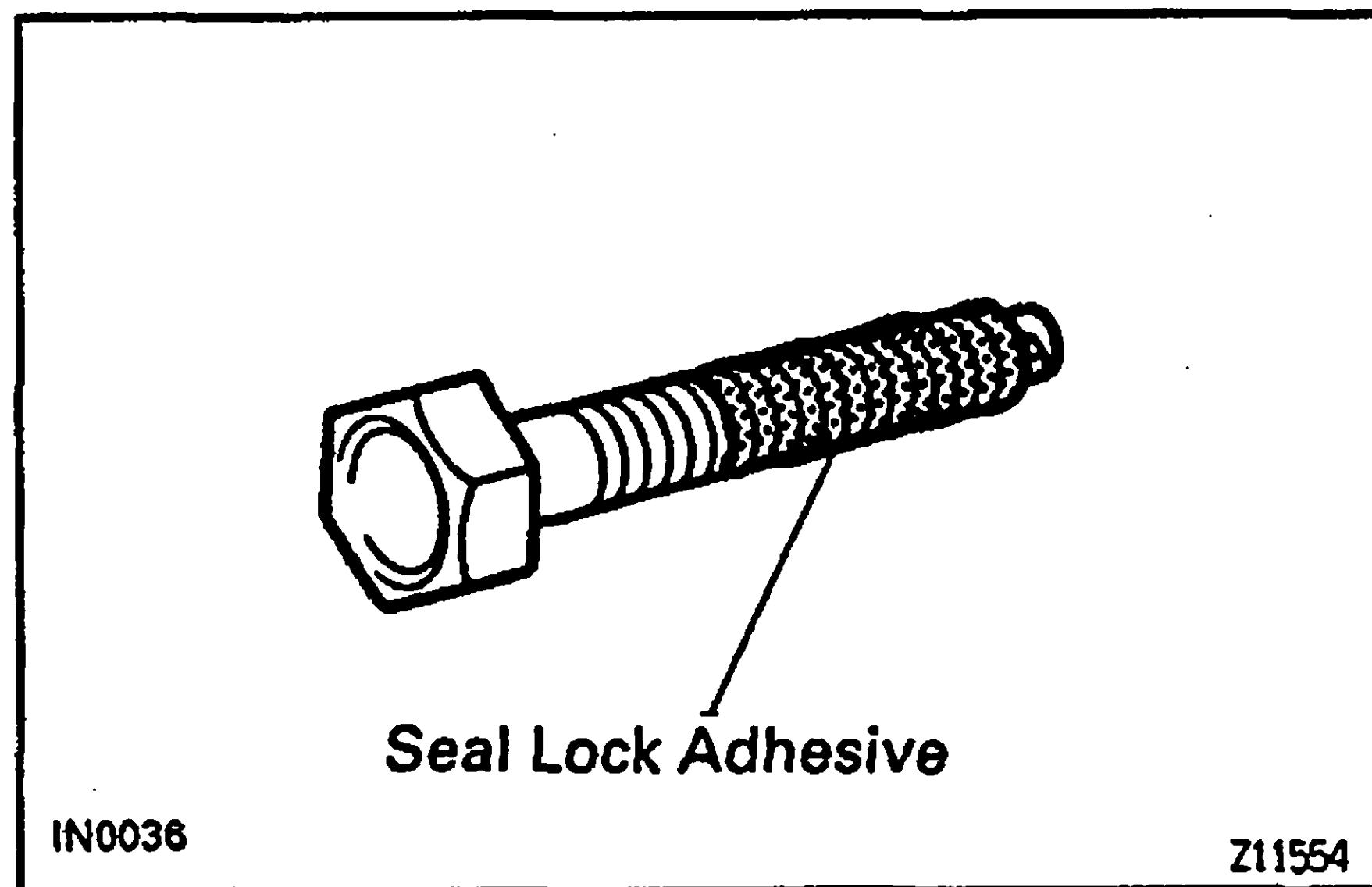


GENERAL REPAIR INSTRUCTIONS

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 negative (—) terminal cable from the battery which is grounded to the vehicle body.
 - (c) To prevent damage to the battery terminal, loosen the cable nut and raise the cable straight up without twisting or prying it.
 - (d) Clean the battery terminals and cable ends with a shop rag. Do not scrape them with a file or other abrasive objects.
 - (e) Install the cable ends to the battery terminals with the nut loose, and tighten the nut after installation. Do not use a hammer to tap the cable ends onto the terminals.
 - (f) Be sure the cover for the positive(+) terminal is properly in place.
4. Check hose and wiring connectors to make sure that they are secure and correct.
5. Non—reusable parts.
 - (a) Always replace cotter pins, gaskets, O—rings and oil seals etc. with new ones.
 - (b) Non—reusable parts are indicated in the component illustrations by the "◆" symbol.
6. Precoated parts.

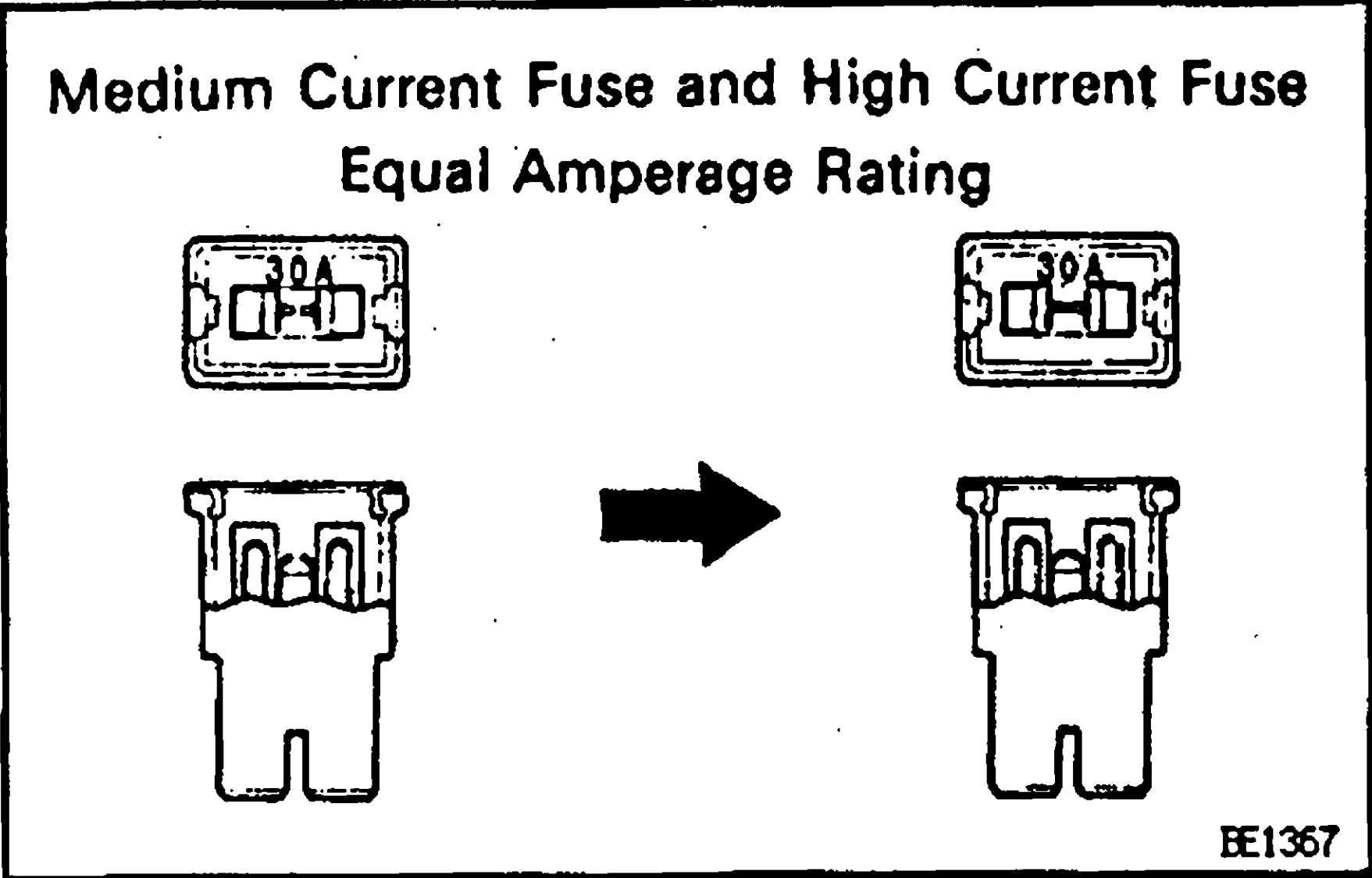
Precoated parts are bolts and nuts, etc. that are coated with a seal lock adhesive at the factory.

 - (a) If a precoated part is retightened, loosened or caused to move in any way, it must be recoated with the specified adhesive.
 - (b) When reusing precoated parts, clean off the old adhesive and dry with compressed air. Then apply the specified seal lock adhesive to the bolt, nut or threads.
 - (c) Precoated parts are indicated in the component illustrations by the "★" symbol.
7. When necessary, use a sealer on gaskets to prevent leaks.
8. Carefully observe all specifications for bolt tightening torques. Always use a torque wrench.



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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

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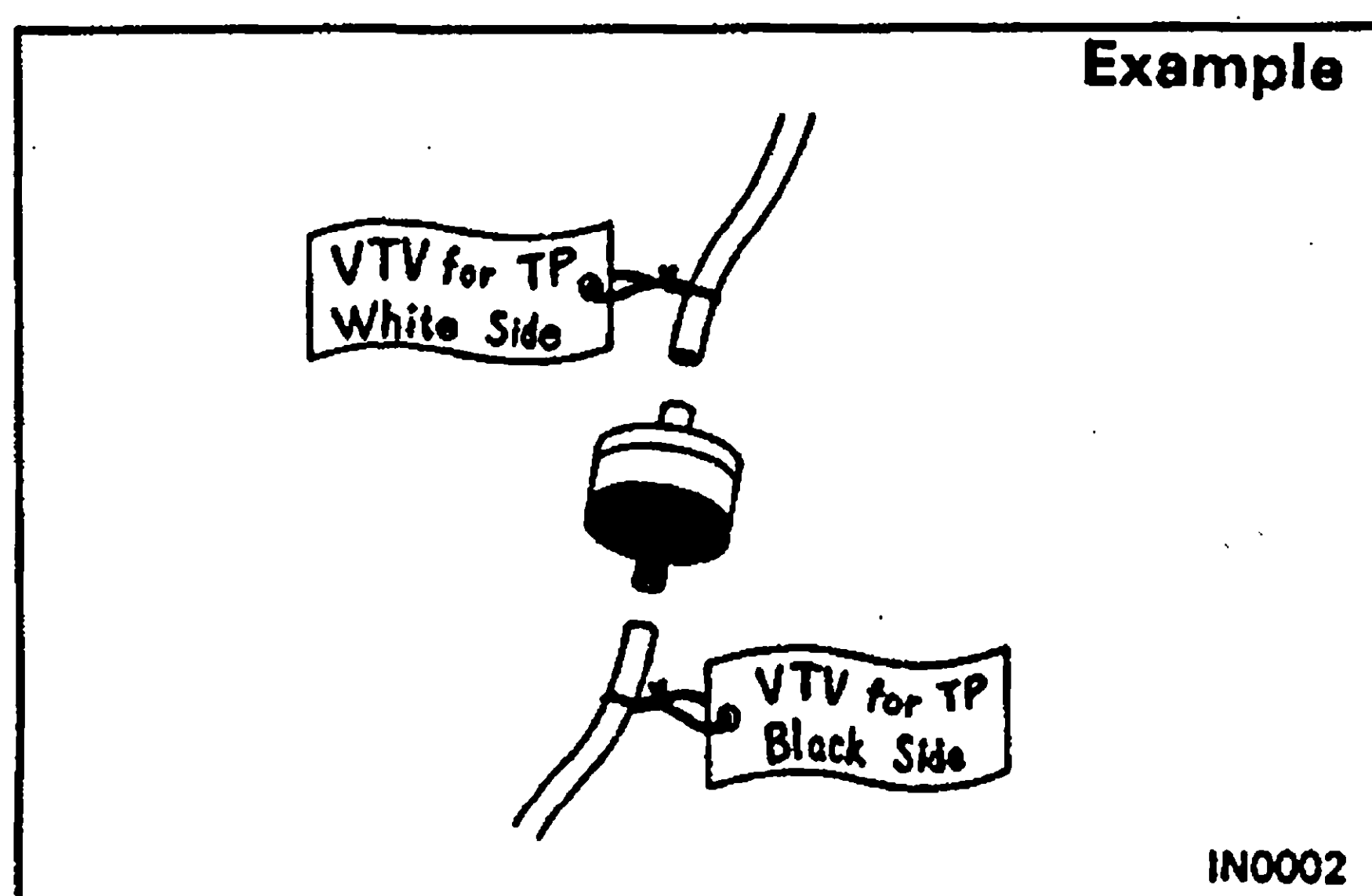
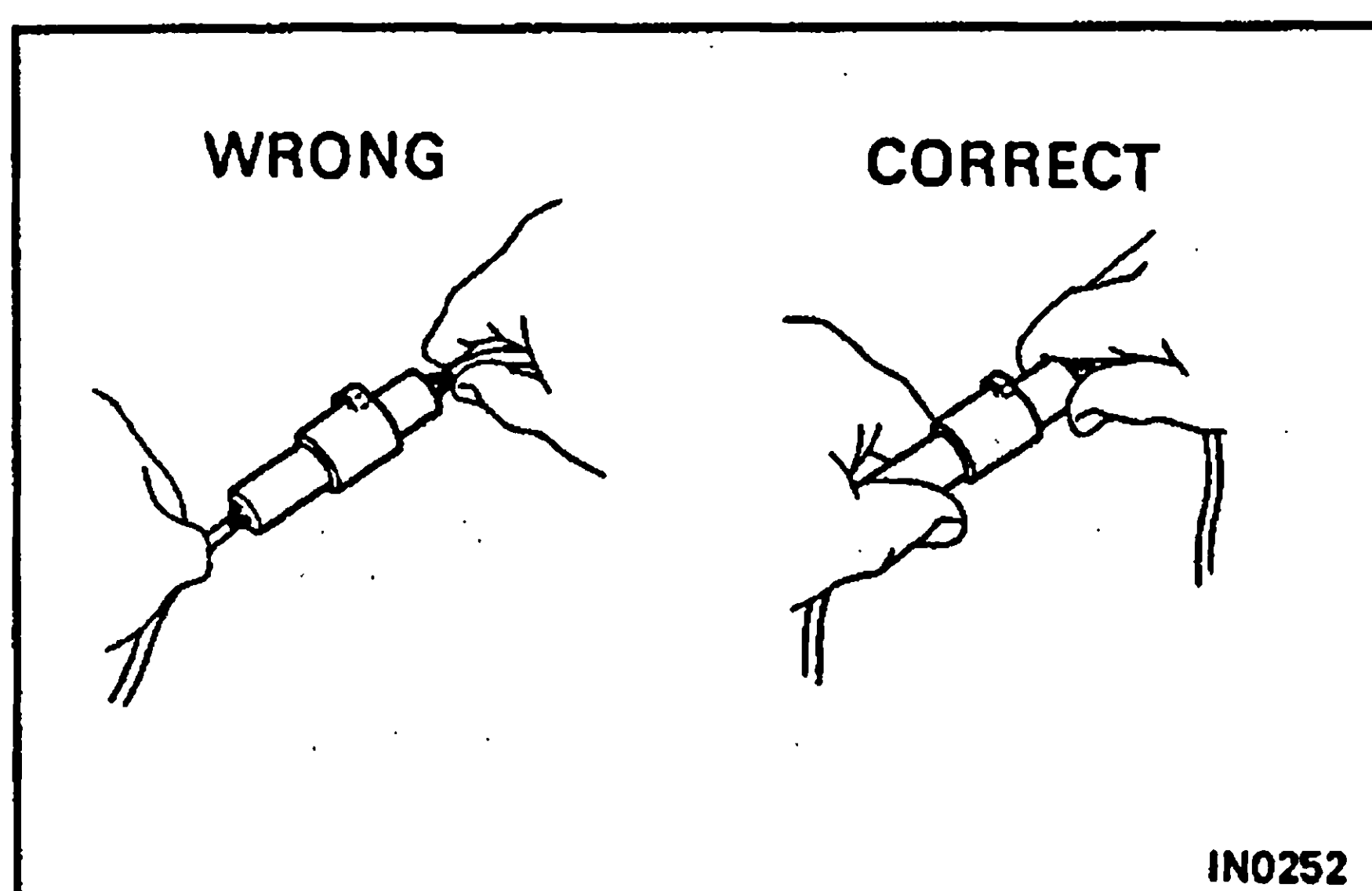
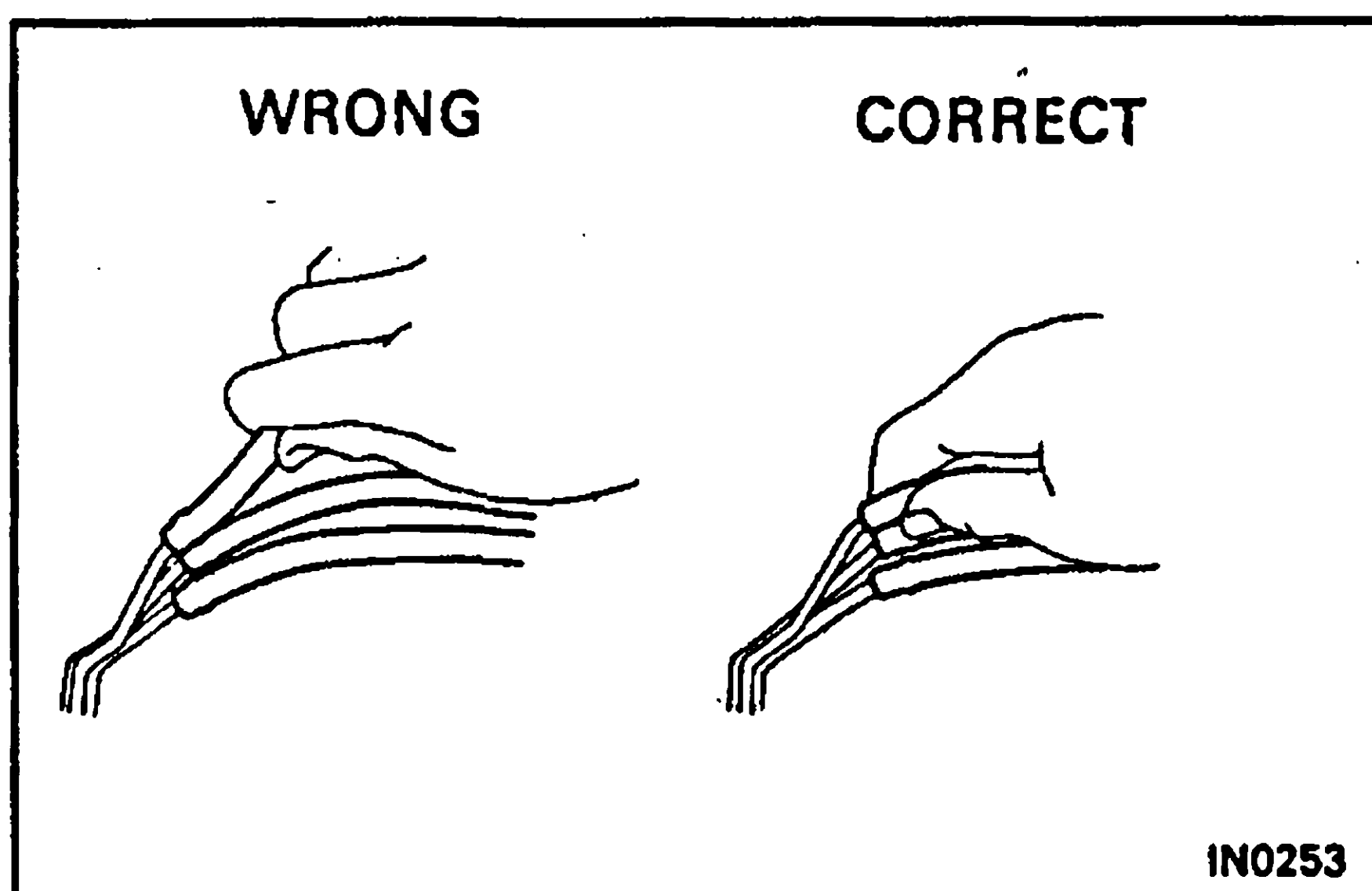
11. Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.

(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, igniter and air filter from water.
- (f) Never use an impact wrench to remove or install temperature switches or temperature sensors.
- (g) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.
- (h) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step-down adapter instead. Once the hose has been stretched, it may leak.
13. Tag hoses before disconnecting them:
- (a) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.
- (b) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.

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

PRECAUTION

FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER

IN00T-06

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

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1. **Use only unleaded gasoline.**
2. **Avoid prolonged idling.**
Avoid running the engine at idle speed for more than 20 minutes.
3. **Avoid spark jump test.**
 - (a) Perform spark jump test only when absolutely necessary. Perform this test as rapidly as possible.
 - (b) While testing, never race the engine.
4. **Avoid prolonged engine compression measurement.**
Engine compression tests must be done as rapidly as possible.
5. **Do not run engine when fuel tank is nearly empty.**
This may cause the engine to misfire and create an extra load on the converter.
6. **Avoid coasting with ignition turned off and prolonged braking.**
7. **Do not dispose of used catalyst along with parts contaminated with gasoline or oil.**

IF VEHICLE IS EQUIPPED WITH MOBILE COMMUNICATION SYSTEM

IN02R-08

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

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

ABBREVIATIONS USED IN THIS MANUAL

IN031-0M

A/C	Air conditioner
A/T	Automatic Transaxle
BTDC	Before Top Dead Center
CPU	Central Processing Unit
ECT	Electronic Controlled Transmission
ECU	Electronic Control Unit
EFI	Electronic Fuel Injection
EVAP	Evaporative Emission
FIPG	Formed in Place Gasket
H—Fuse	High Current Fuse
IG	Ignition
ISC	Idle Speed Control
LH	Light—Hand
M—Fuse	Medium Current Fuse
MP	Multipurpose
M/T	Manual Transaxle
O/S	Oversized
PCV	Positive Crankcase Ventilation
PS	Power steering
RH	Right—Hand
SST	Special Service Tools
STD	Standard
SW	Switch
TDC	Top Dead Center
TEMP.	Temperature
TWC	Three—Way Catalyst
U/S	Under size
VSV	Vacuum Switching Valve
w/	With
w/o	Without

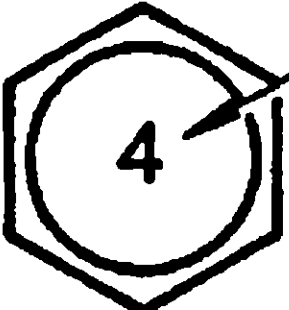
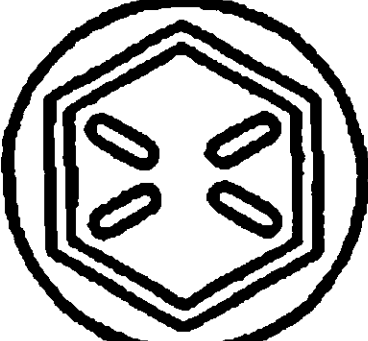
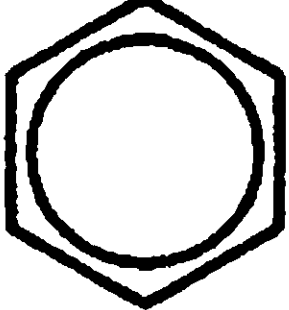
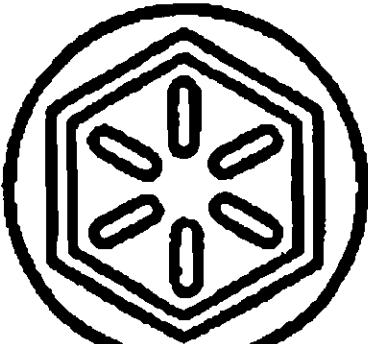
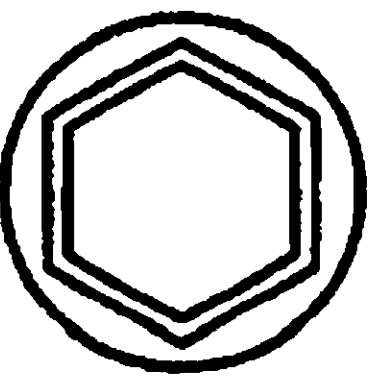
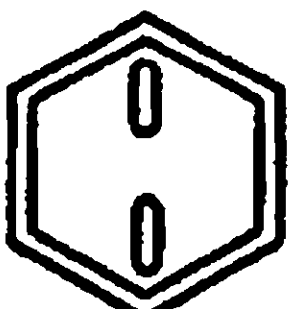
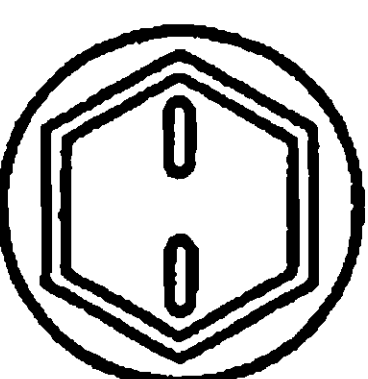
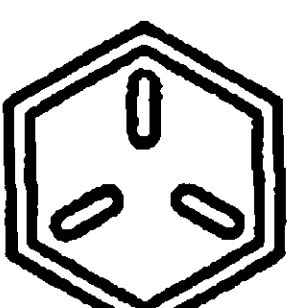
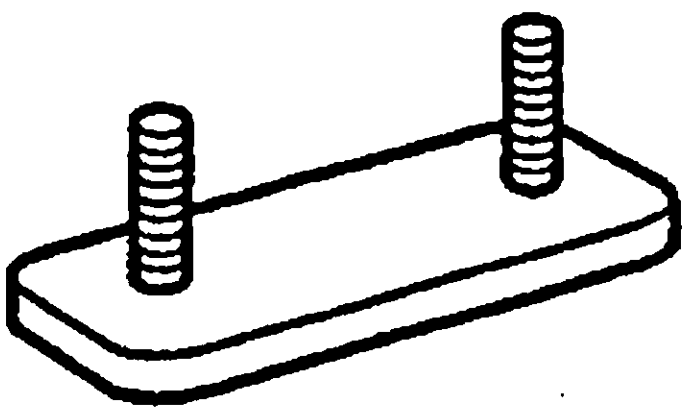
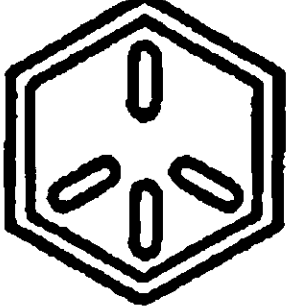
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STANDARD BOLT TORQUE SPECIFICATIONS

IN006-07

IN

HOW TO DETERMINE BOLT STRENGTH

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

SPECIFIED TORQUE FOR STANDARD BOLTS

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

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ENGINE

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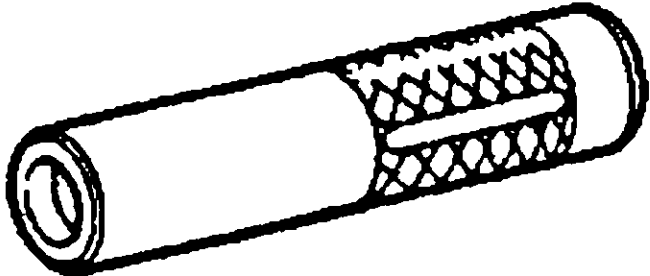
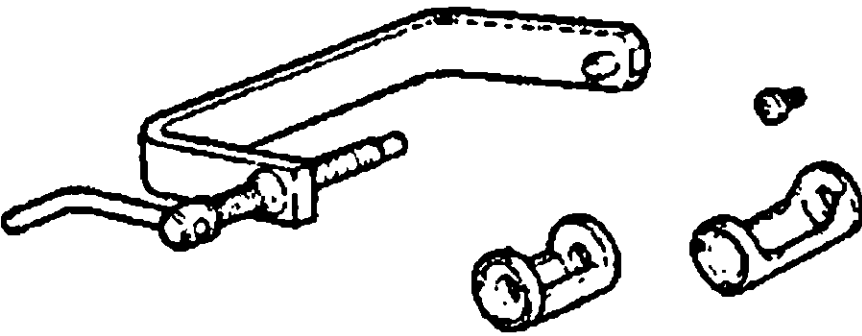
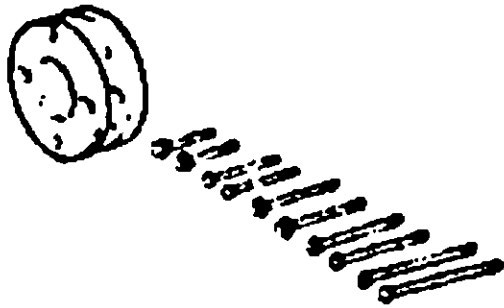
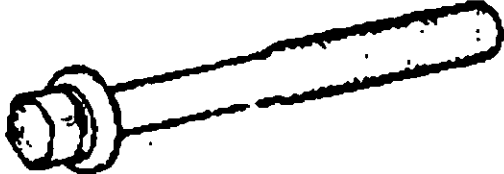
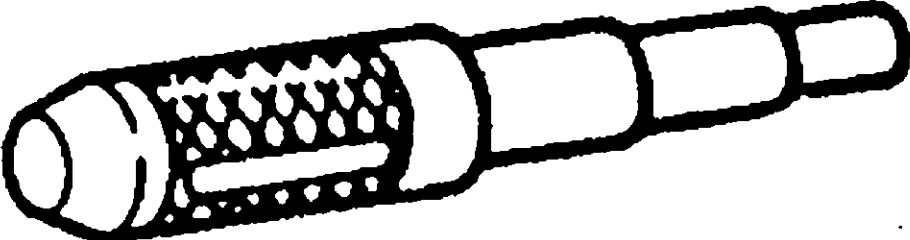
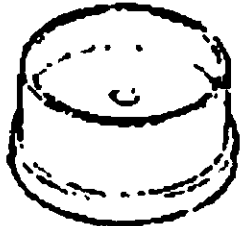
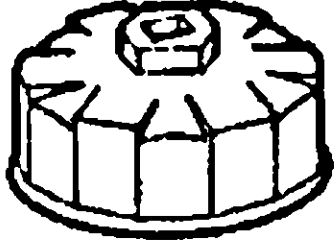
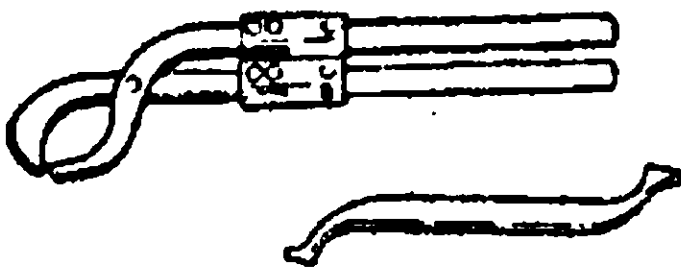
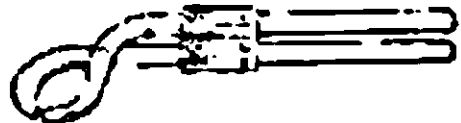
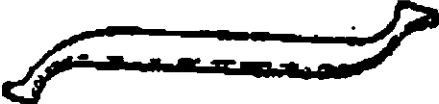
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ENGINE MECHANICAL

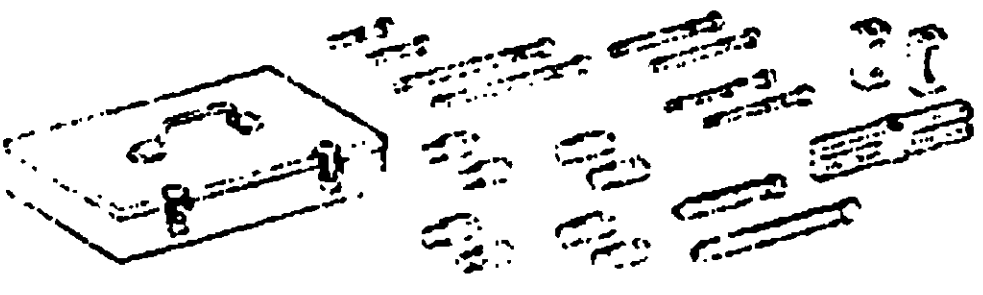
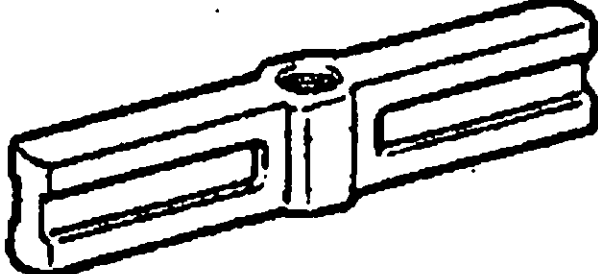
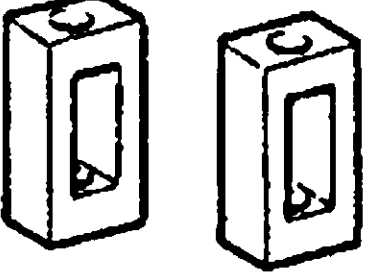
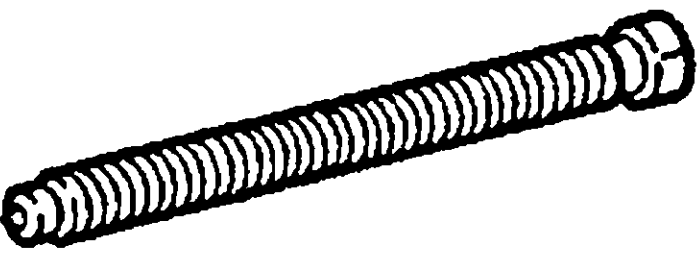
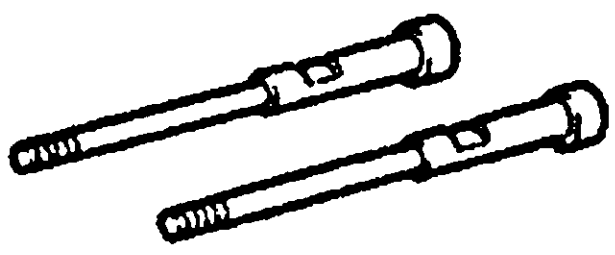
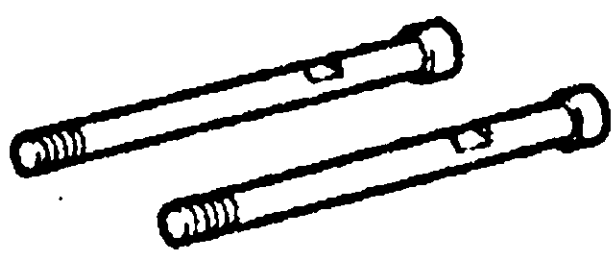
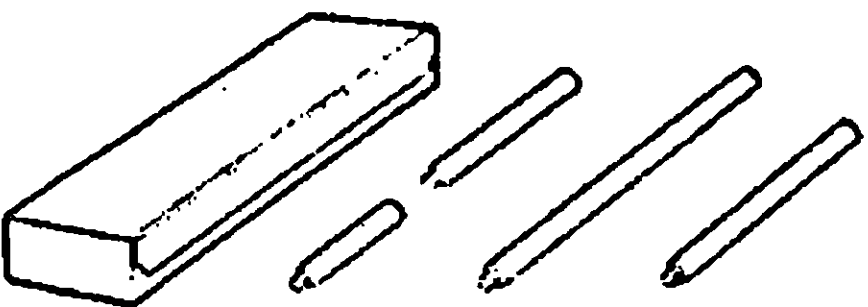
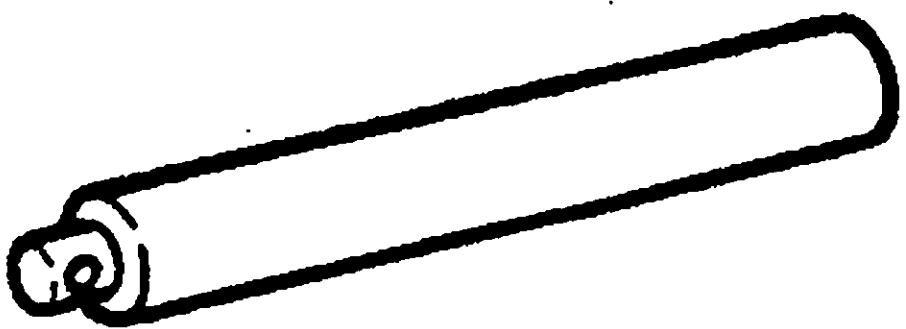
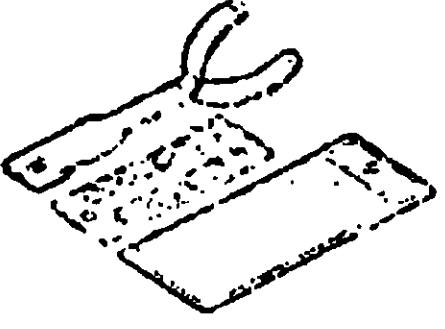
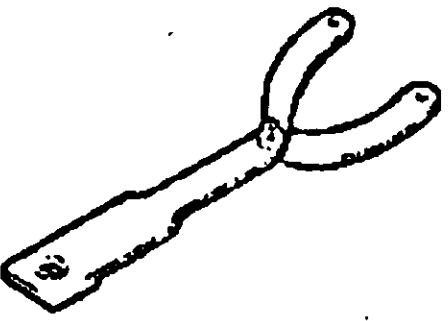
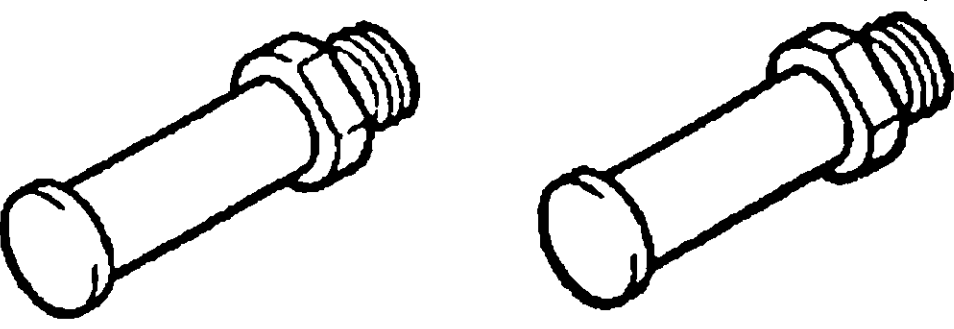
PREPARATION

SST (SPECIAL SERVICE TOOLS)

EG00EG-0K

	09201-10000	Valve Guide Bushing Remover & Replacer Set	
	(09201-01060)	Valve Guide Bushing Remover & Replacer 6	
	09201-41020	Valve Stem Oil Seal Replacer	
	09202-70020	Valve Spring Compressor	
	09213-54015	Crankshaft Pulley Holding Tool	
	(90119-08216)	Bolt	
	09222-30010	Connecting Rod Bushing Remover & Replacer	
	09223-15030	Oil Seal & Bearing Replacer	Crankshaft rear oil seal
	09228-07501	Oil Filter Wrench	
	09248-55040	Valve Clearance Adjust Tool Set	
	(09248-05410)	Valve Lifter Press	
	(09248-05420)	Valve Lifter Stopper	

ENGINE — ENGINE MECHANICAL

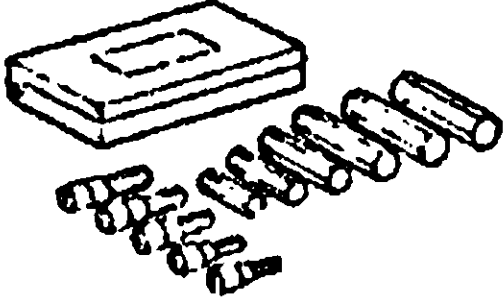
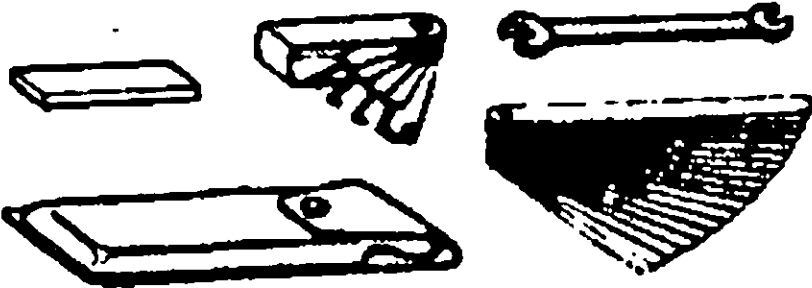
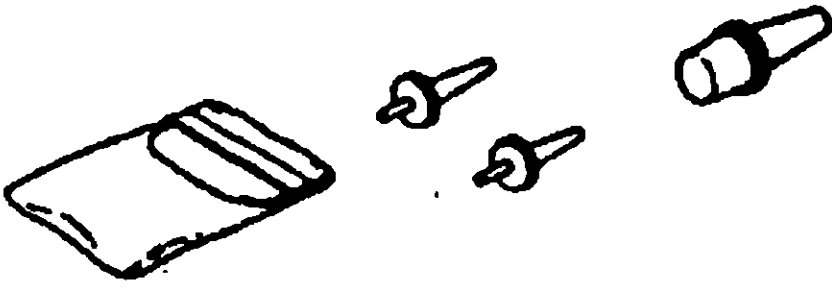
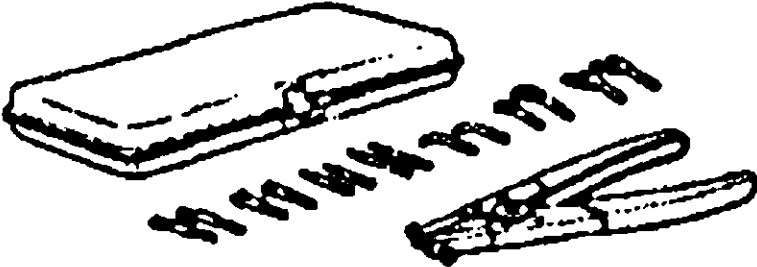
	09330-00021 Companion Flange Holding Tool	Crankshaft pulley
	09816-30010 Oil Pressure Switch Socket	Oil pressure switch
	09843-18020 Diagnosis Check Wire	
	09950-50010 Puller C Set	
	(09951-05010) Hanger 150	Crankshaft pulley Crankshaft timing pulley
	(09952-05010) Slide Arm	Crankshaft pulley Crankshaft timing pulley
	(09953-05020) Center Bolt 150	Crankshaft pulley Crankshaft timing pulley
	(09954-05010) Claw No.1	Crankshaft timing pulley
	(09954-05030) Claw No.3	Crankshaft pulley
	09950-70010 Handle Set	
	(09951-07150) Handle 150	Crankshaft rear oil seal Valve guide bushing
	09960-10010 Variable Pin Wrench Set	
	(09962-01000) Variable Pin Wrench Arm Assy	Camshaft timing pulley Camshaft sub-gear
	(09963-01000) Pin 10	Camshaft timing pulley

EG

	(09963-00600) Pin 6	Camshaft sub-gear
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RECOMMENDED TOOLS

EG0EH-0A

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

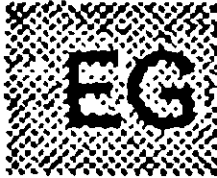
EQUIPMENT

EG0EJ-0A

Caliper gauge	
CO/HC meter	
Compression gauge	
Connecting rod aligner	
Cylinder gauge	
Dial indicator	
Dye penetrant	
Timing light	Ignition timing
Heater	
Magnetic finger	
Micrometer	
Piston ring compressor	
Piston ring expander	
Plastigage	
Precision straight edge	
Soft brush	
Spring tester	Valve spring
Steel square	Valve spring
Thermometer	
Torque wrench	
Valve seat cutter	
Vernier calipers	

SSM (SPECIAL SERVICE MATERIALS)

08826-00080	Seal Packing Black or equivalent (FIPG)	Camshaft bearing cap Cylinder head cover Rear oil seal retainer
08826-00100	Seal Packing 1282B, THREE BOND 1282B or equivalent (FIPG)	Water bypass pipe
08833-00070	Adhesive 1324, THREE BOND 1324 or equivalent	Flywheel bolt Drive plate bolt Spark plug tube
08833-00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure sender gauge



IDLE CO CHECK (w/ TWC)

EG780-01

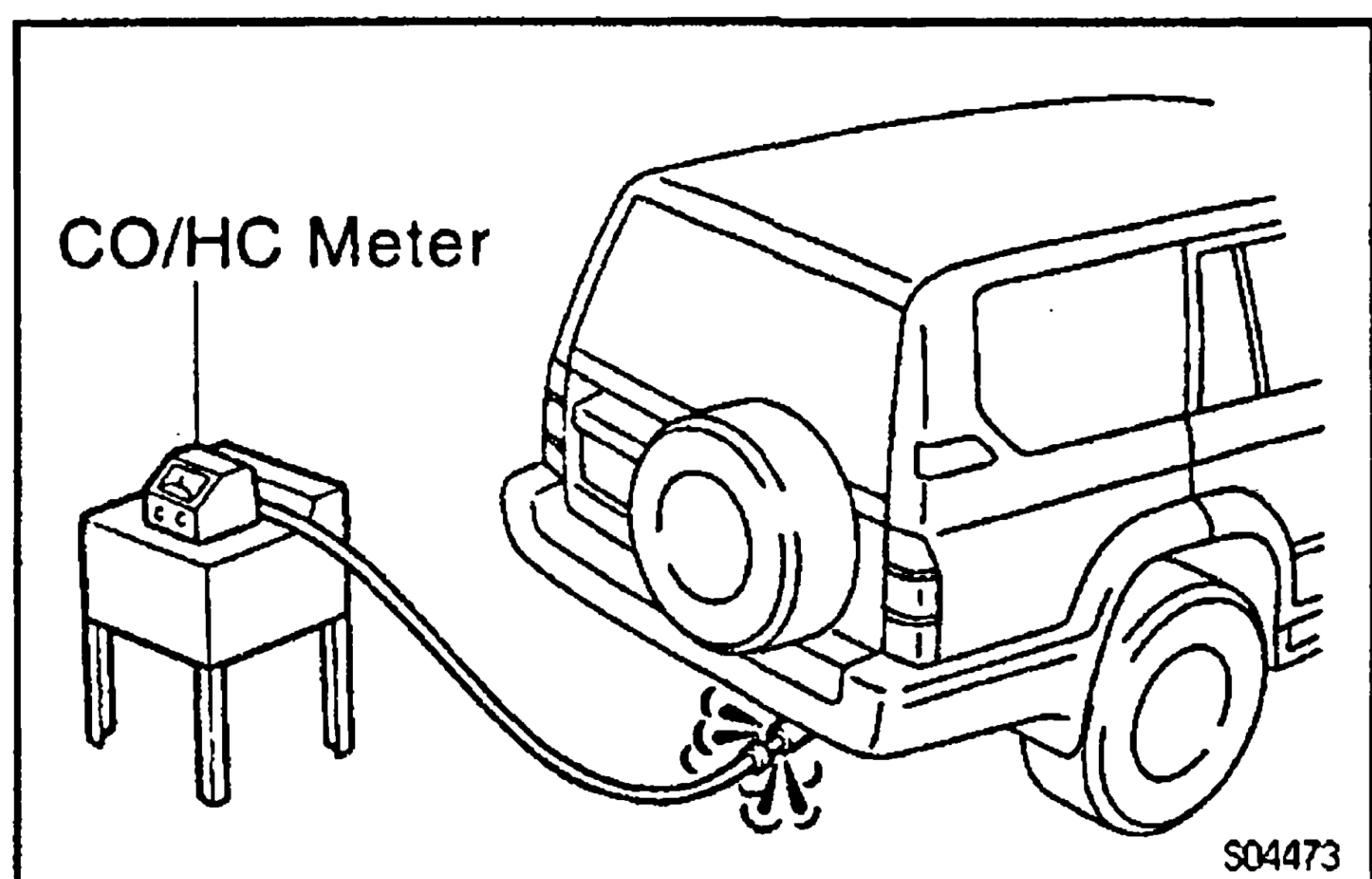
HINT: This check is used only to determine whether or not the idle CO/HC complies with regulations.

1. INITIAL CONDITIONS

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

2. START ENGINE

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



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

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

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

Troubleshooting

If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below. See the table below for possible causes, and then inspect and correct the applicable causes if necessary.

EG

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

IDLE CO CHECK AND ADJUST (w/o TWC)

EG78R-01

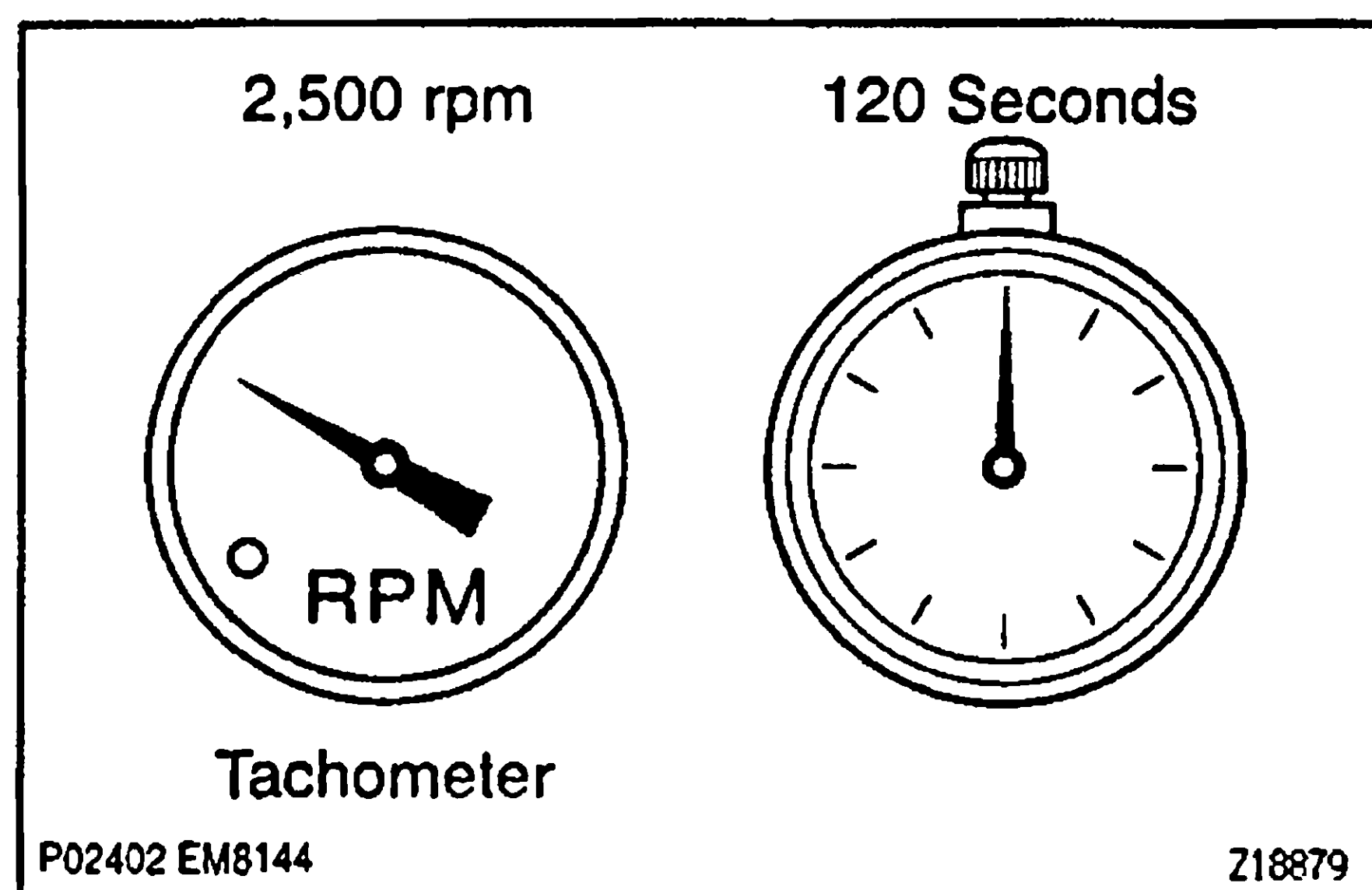
HINT: This check is used only to determine whether or not the idle CO/HC complies with regulations.

1. INITIAL CONDITIONS

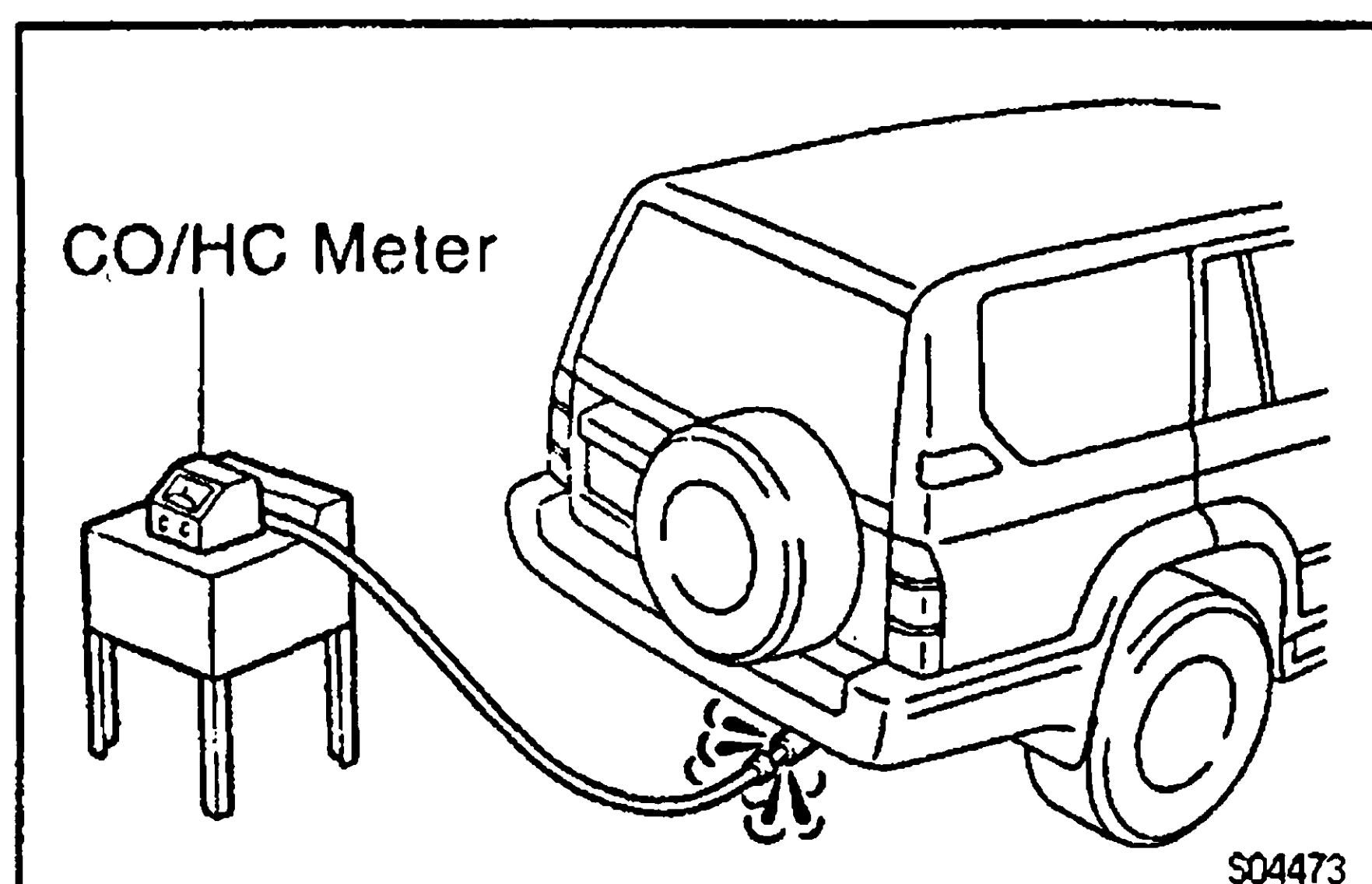
- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected
- (f) EFI system wiring connectors fully plugged
- (g) Ignition timing checked correctly
- (h) Transmission in neutral position
- (i) Tachometer and CO/HC 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 vehicle if they are in good condition. If a CO meter is not available, DO NOT ATTEMPT TO ADJUST IDLE MIXTURE.



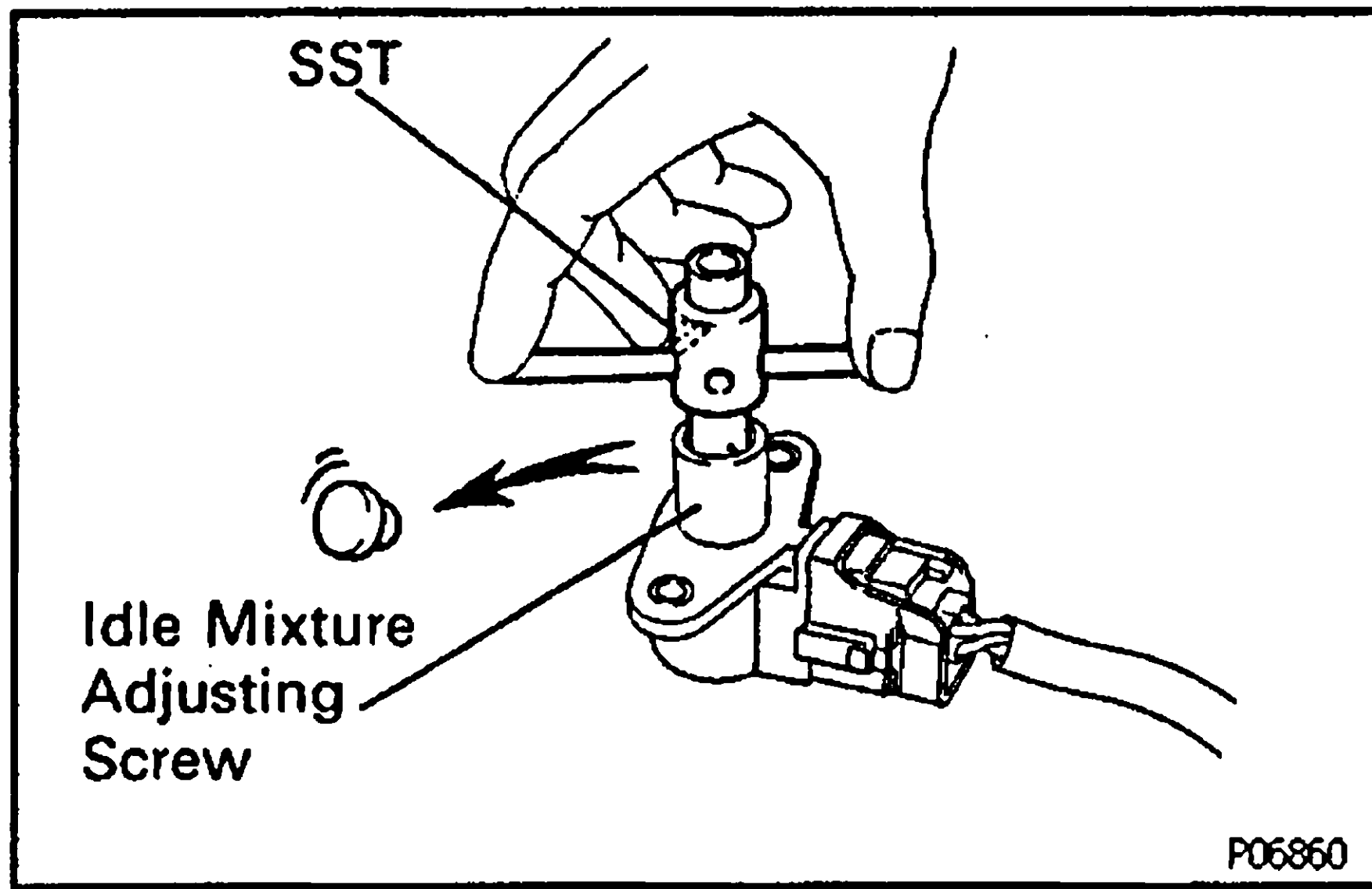
- (a) Race the engine at 2,500 rpm for approx. 120 seconds.



- (b) Insert a tester probe at least 40 cm (1.3 ft) into the tailpipe during idling.
- (c) Wait at least 1 minute before measuring to allow the concentration to stabilize. Complete the measuring within 3 minutes.

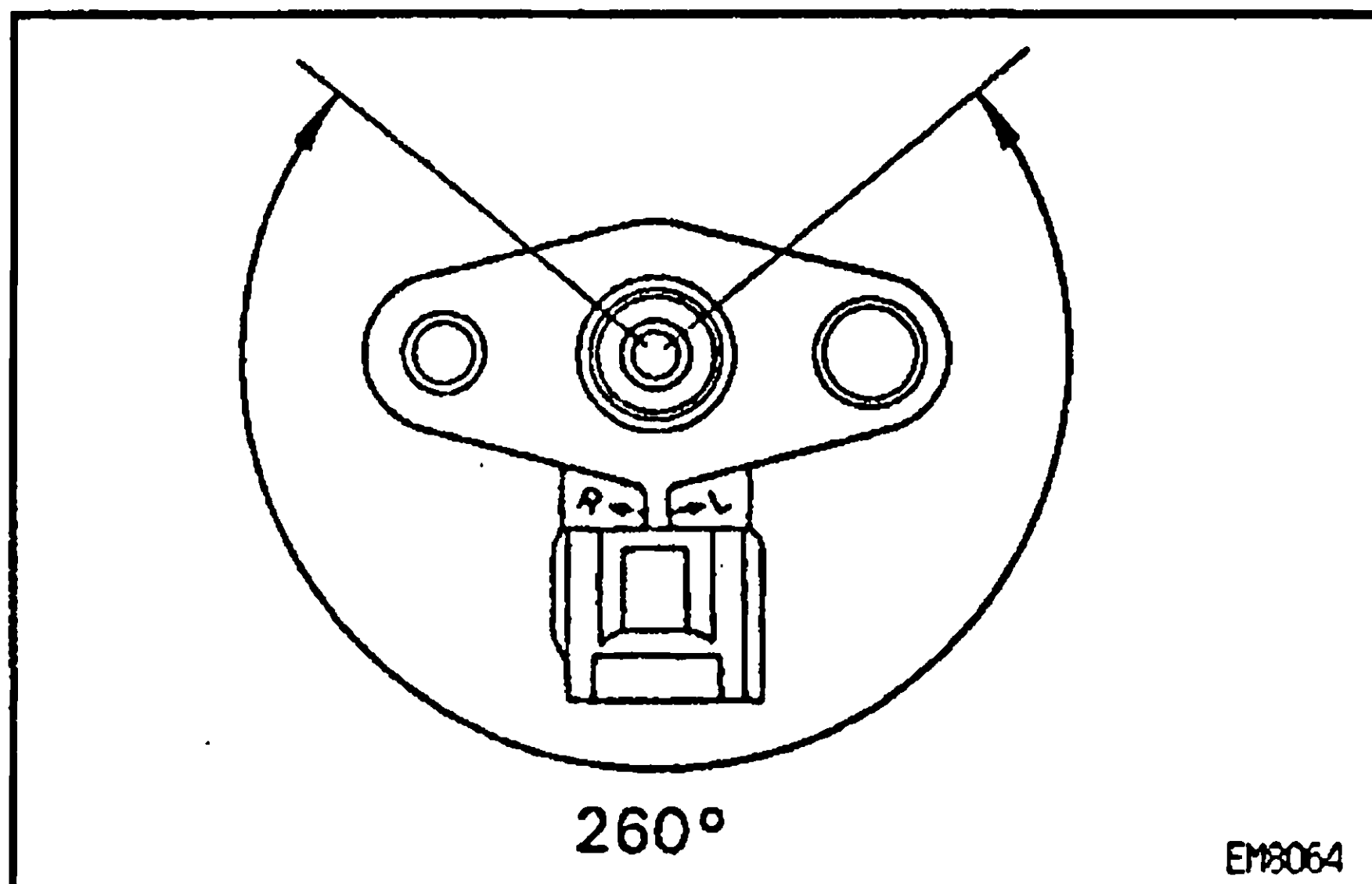
Idle CO concentration (w/ Cooling fan OFF):

1.5 ± 0.5 %



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

EG



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

LOCATION: In the engine compartment on the rear right side.

- If the CO concentration is within specification, this adjustment is complete.
- If the CO concentration cannot be corrected by idle mixture adjustment, see the table on the page 7 for other possible causes.

COMPRESSION CHECK

EG51P-04

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

1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

2. REMOVE IGNITION COILS AND HIGH — TENSION CORDS

(See ignition coils removal in Ignition System)

3. REMOVE SPARK PLUGS

Using a 16 mm plug wrench, remove the 6 spark plugs.

4. CHECK CYLINDER COMPRESSION PRESSURE

- Insert a compression gauge into the spark plug hole.
- Fully open the throttle.
- While cranking the engine, measure the compression pressure.

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

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

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

Compression pressure:

1,200 kPa (12.2 kgf/cm², 174 psi) or more

Minimum pressure:

1,000 kPa (10.2 kgf/cm², 145 psi)

Difference between each cylinder:

100 kPa (1.0 kgf/cm², 15 psi) or less

- If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.

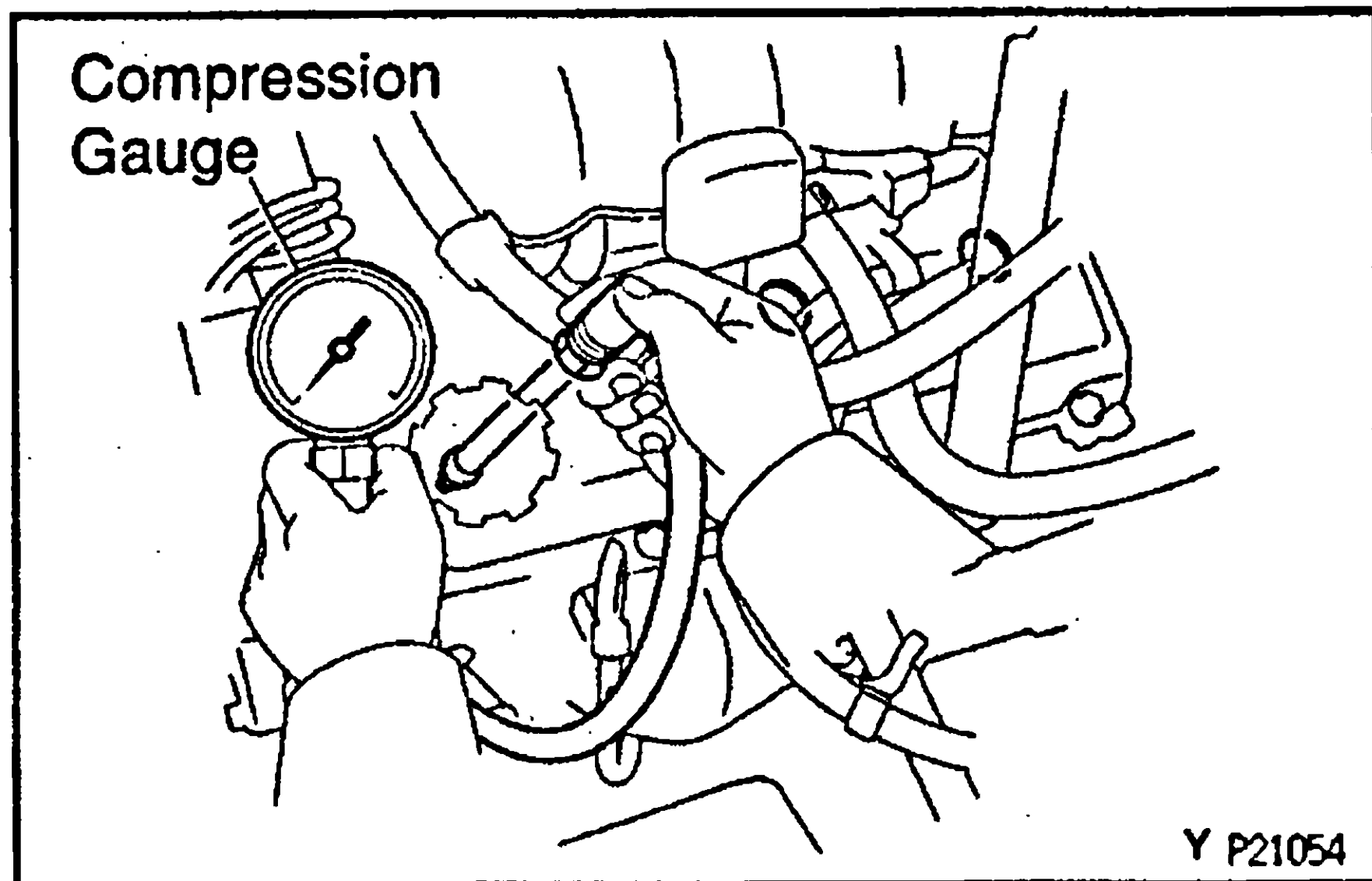
- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

5. REINSTALL SPARK PLUGS

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

6. INSTALL IGNITION COILS AND HIGH — TENSION CORDS

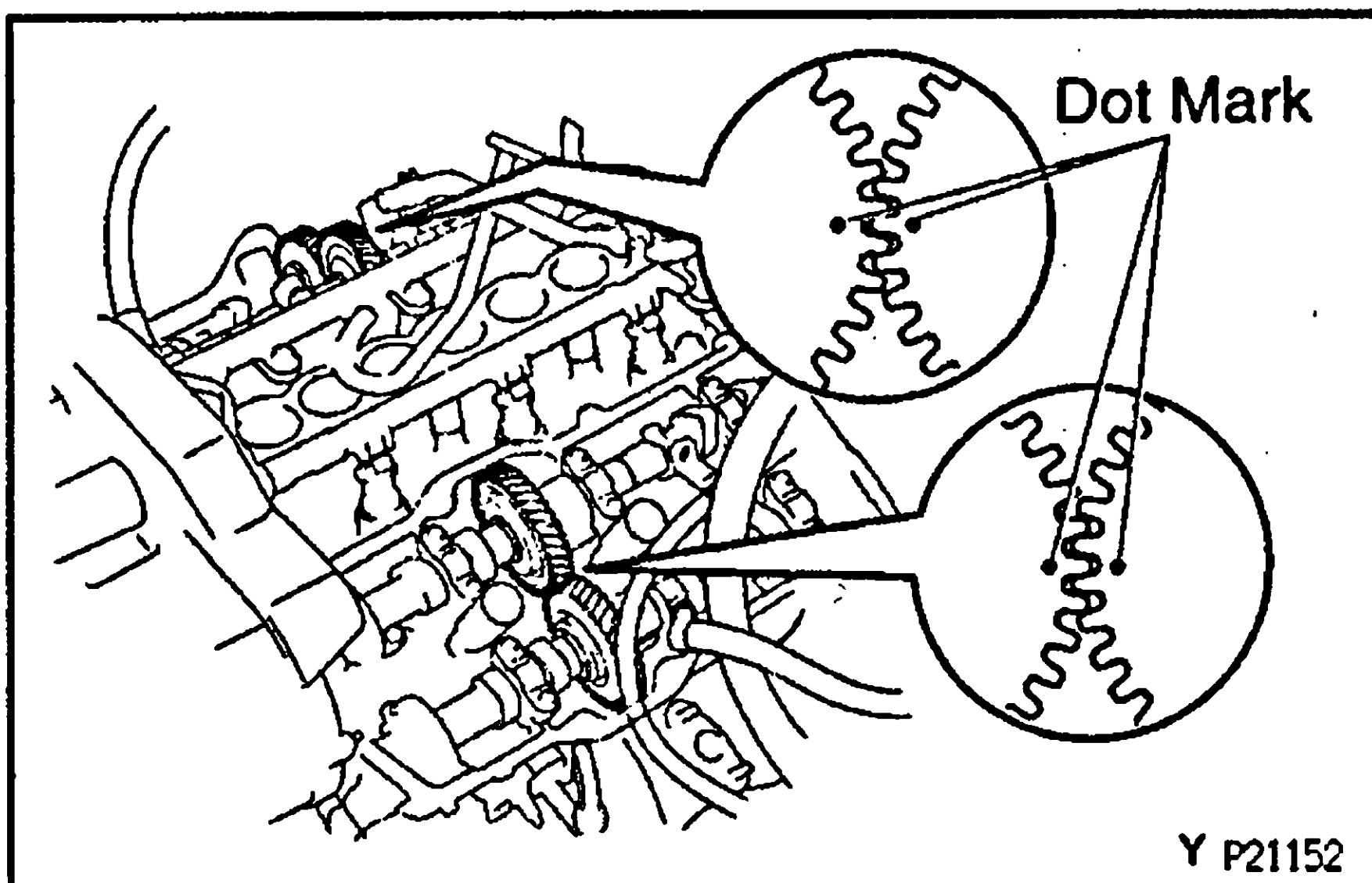
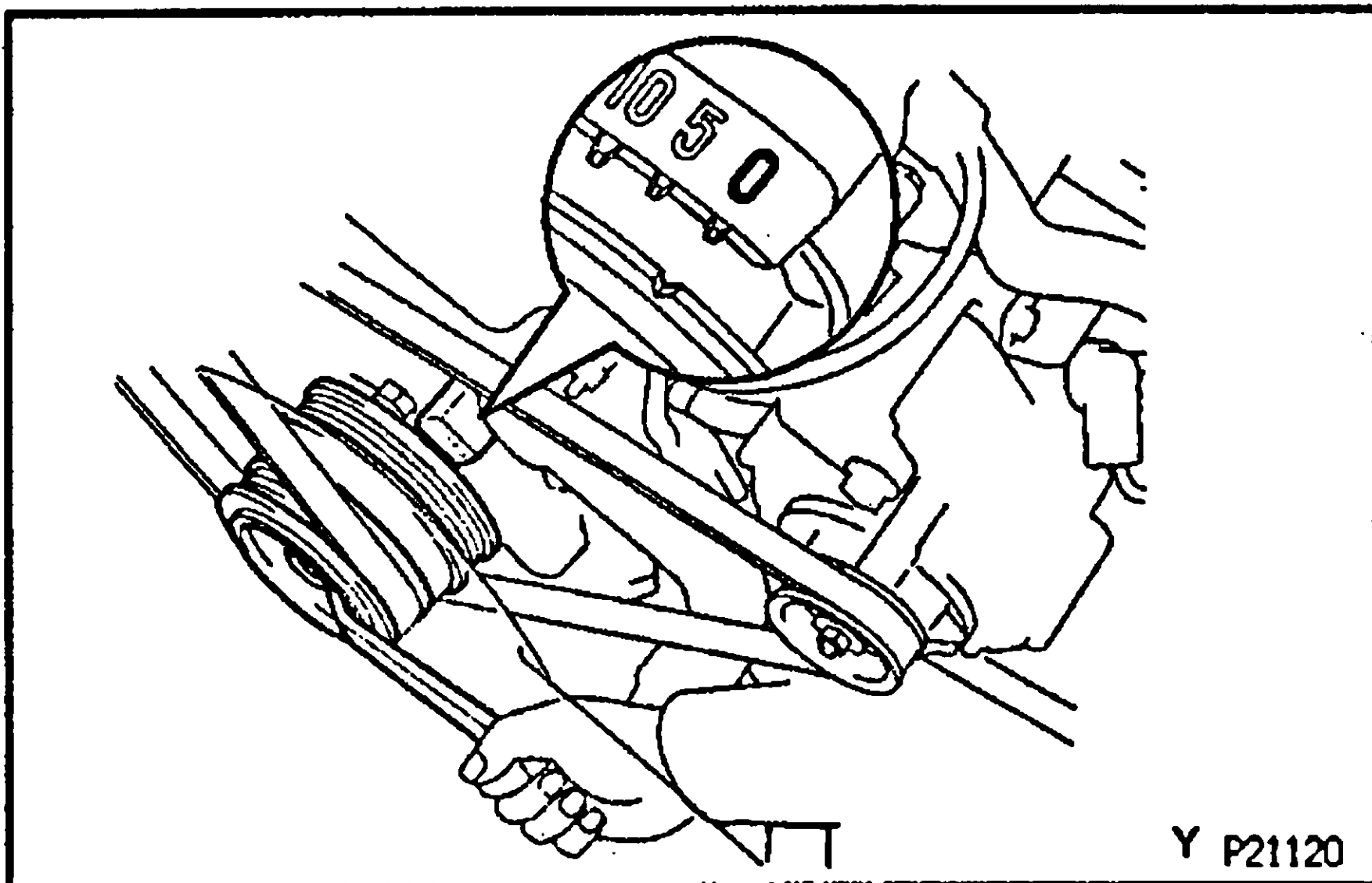
(See ignition coils installation in Ignition System)



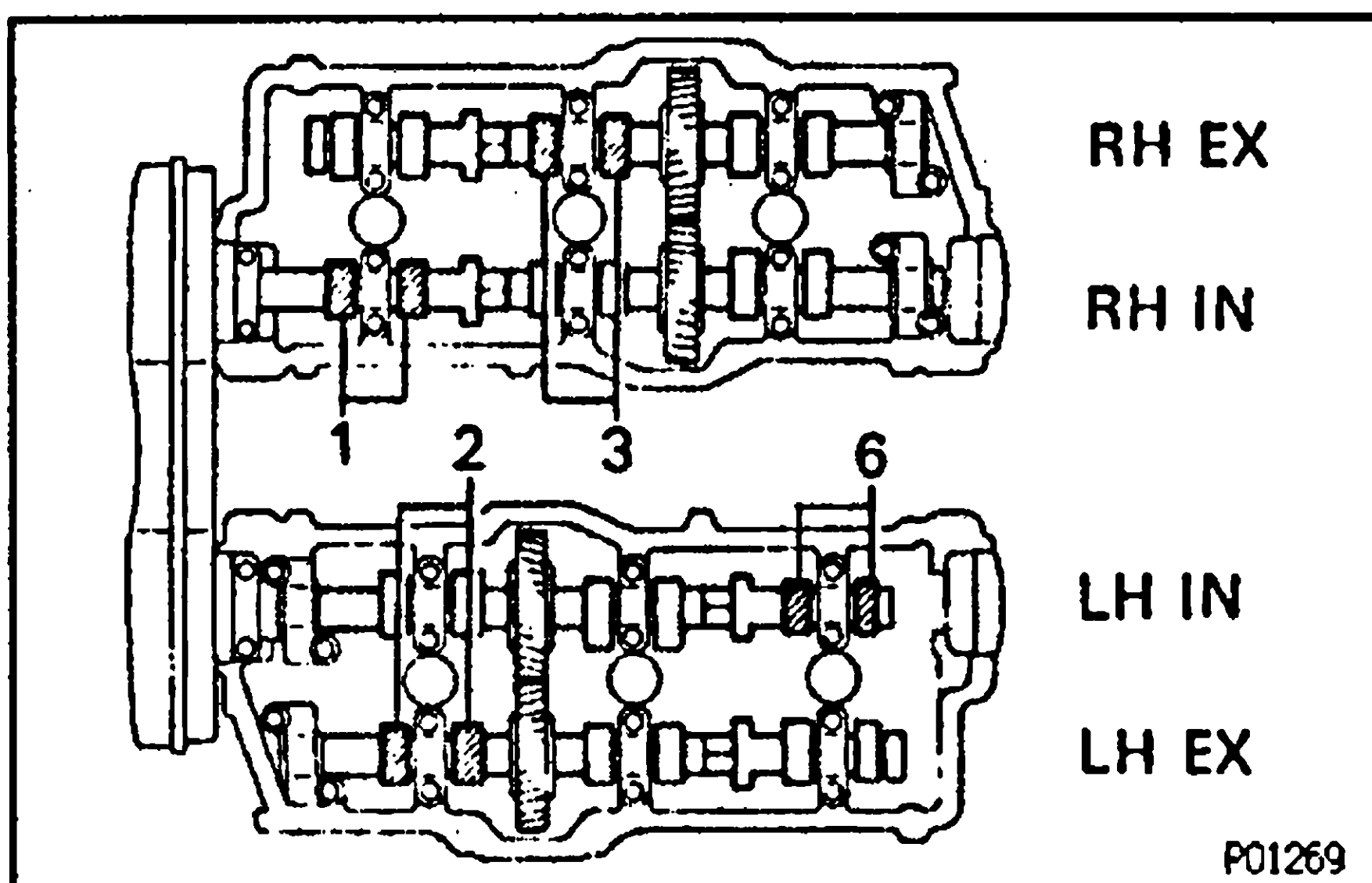
VALVE CLEARANCE INSPECTION AND ADJUSTMENT

HINT: Inspect and adjust the valve clearance when the engine is cold. EG510-04

1. **REMOVE CYLINDER HEAD COVERS**
(See cylinder heads removal)



2. **SET NO.1 CYLINDER TO TDC/COMPRESSION**
 - (a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the No.1 timing belt cover.
 - (b) Check that the timing marks (1 dot) of the camshaft drive and driven gears are in straight line on the cylinder heads surface as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) and align the marks.



3. INSPECT VALVE CLEARANCE

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

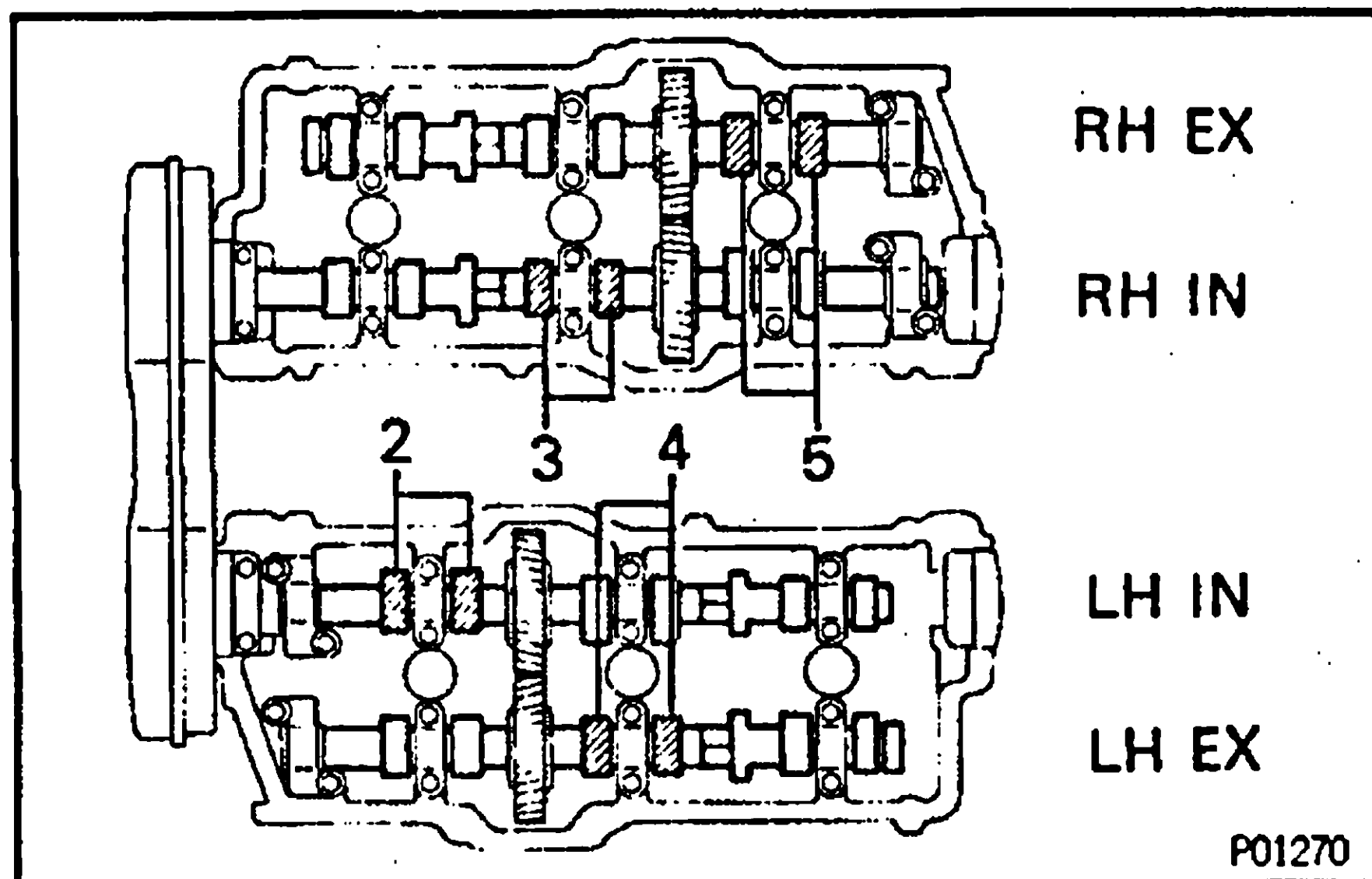
Valve clearance (Cold):

Intake

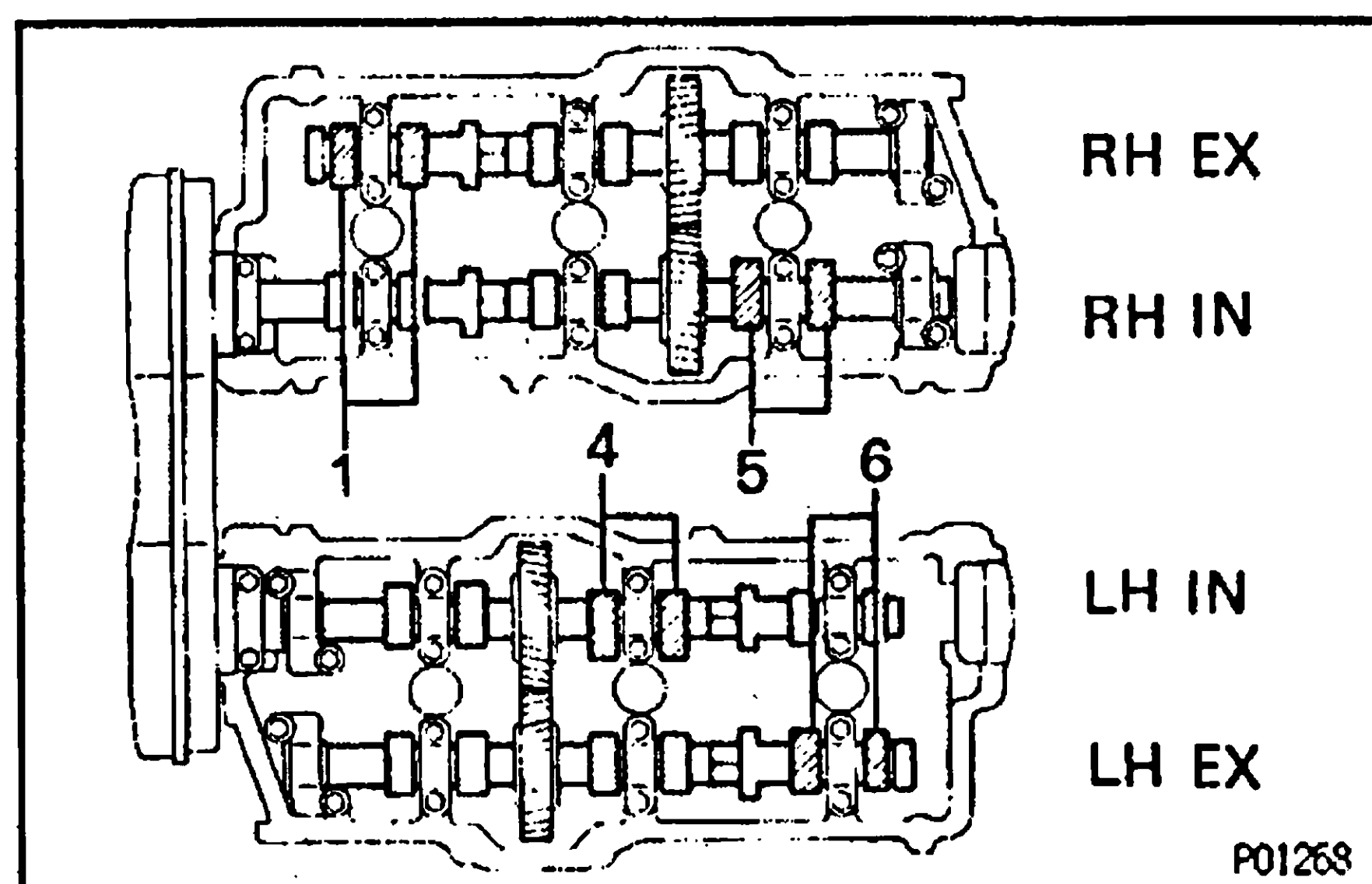
0.13 — 0.23 mm (0.006 — 0.009 in.)

Exhaust

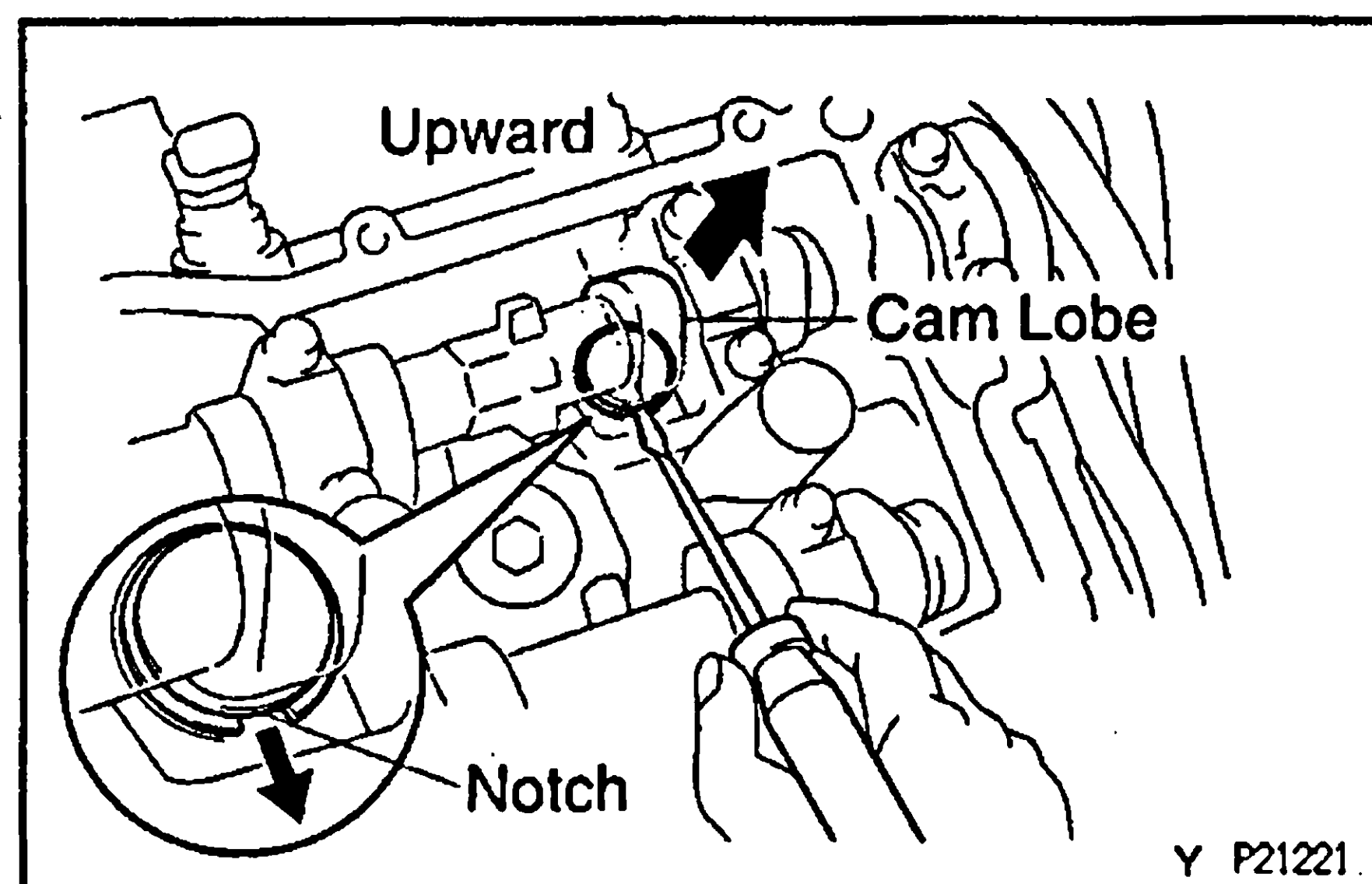
0.27 — 0.37 mm (0.011 — 0.014 in.)



- (b) Turn the crankshaft $2/3$ of a revolution (240°), and check only the valves indicated in the illustration. Measure the valve clearance.
(See procedure step (a))



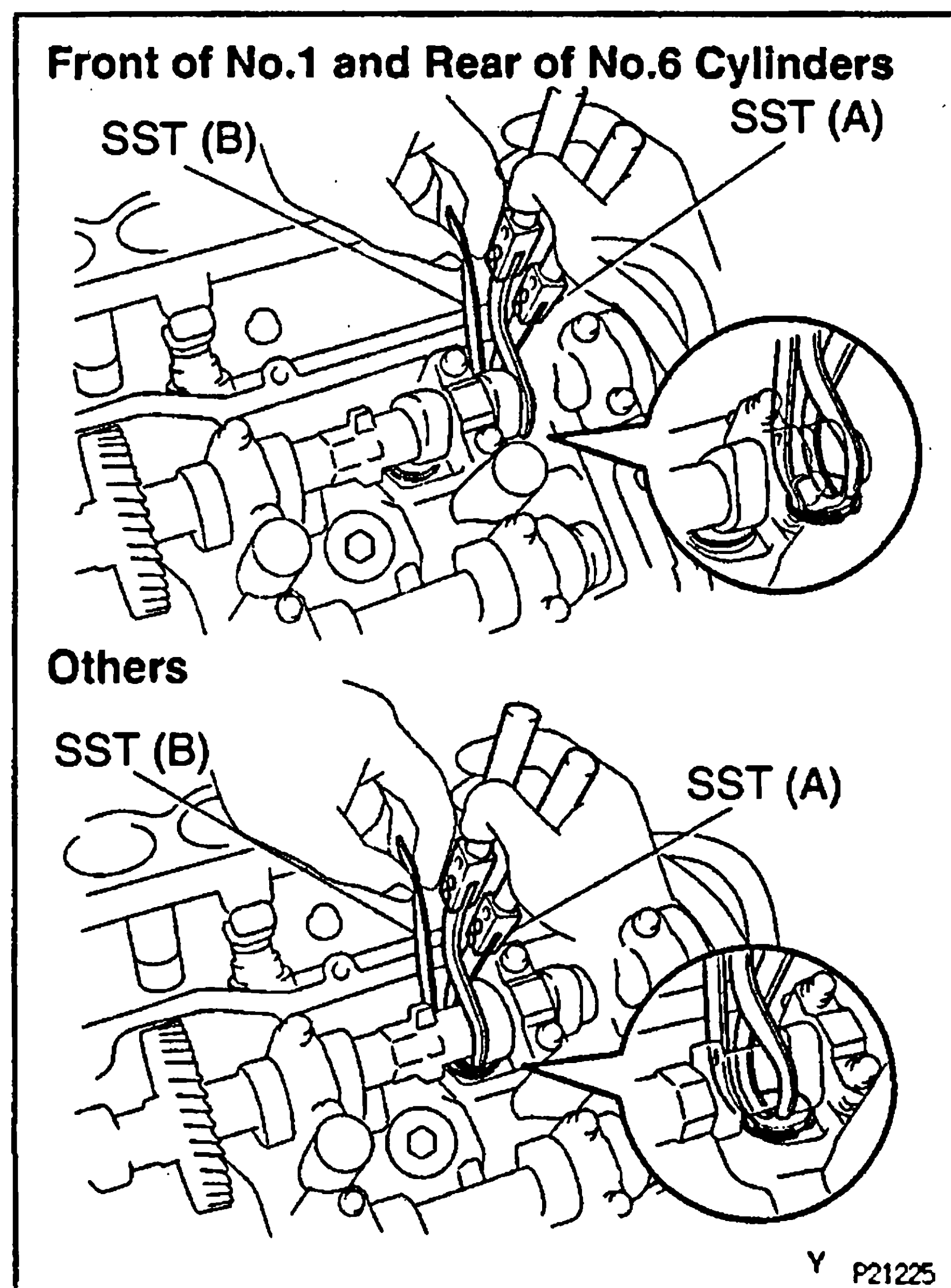
- (c) Turn the crankshaft a further $2/3$ of a revolution (240°), and check only the valves indicated in the illustration. Measure the valve clearance.
(See procedure step (a))



4. ADJUST VALVE CLEARANCE

- (a) Remove the adjusting shim.

- Turn the camshaft so that the cam lobe for the valve to be adjusted faces up.
- Turn the valve lifter with a screwdriver so that the notches are perpendicular to the camshaft.

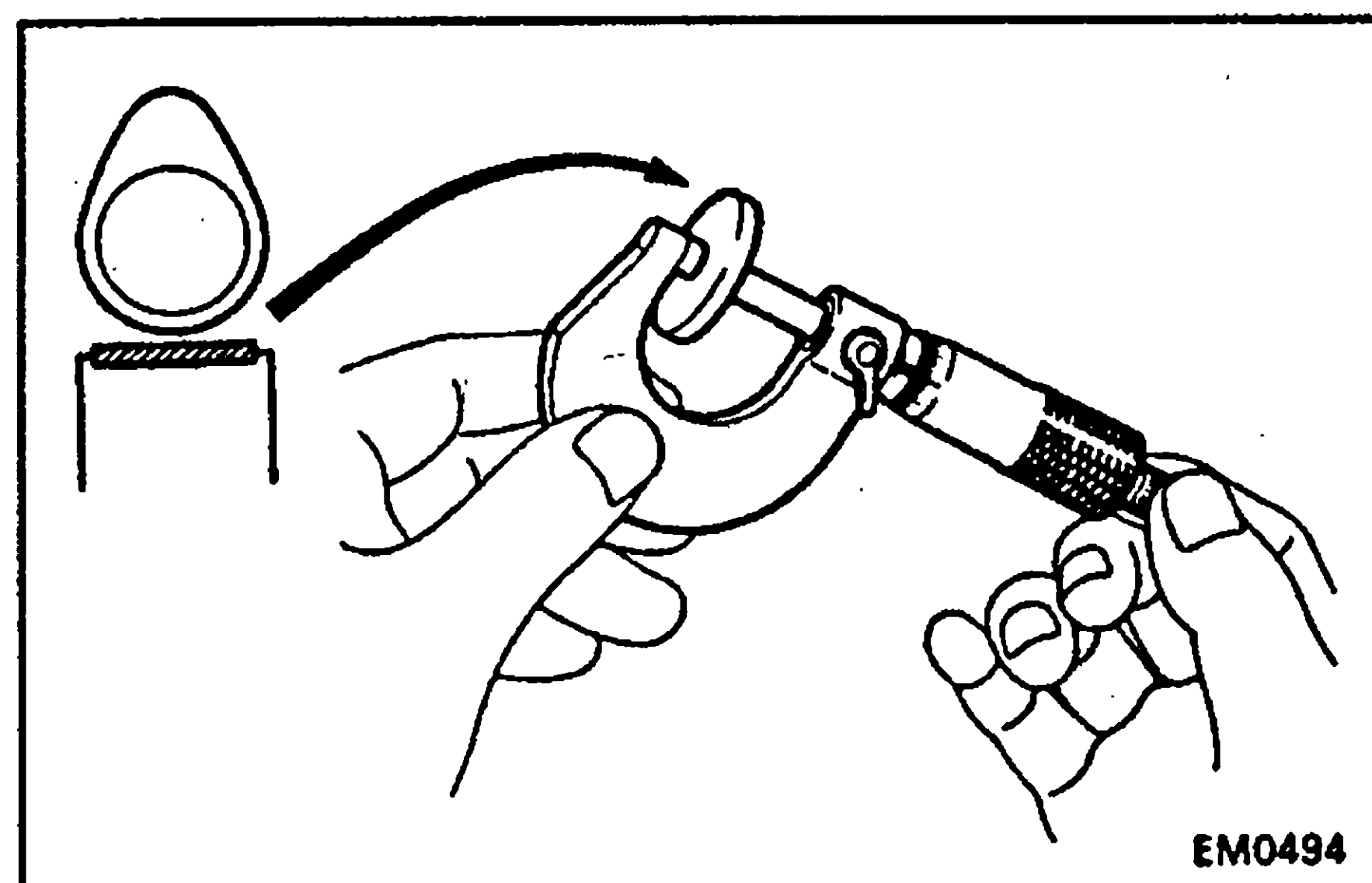
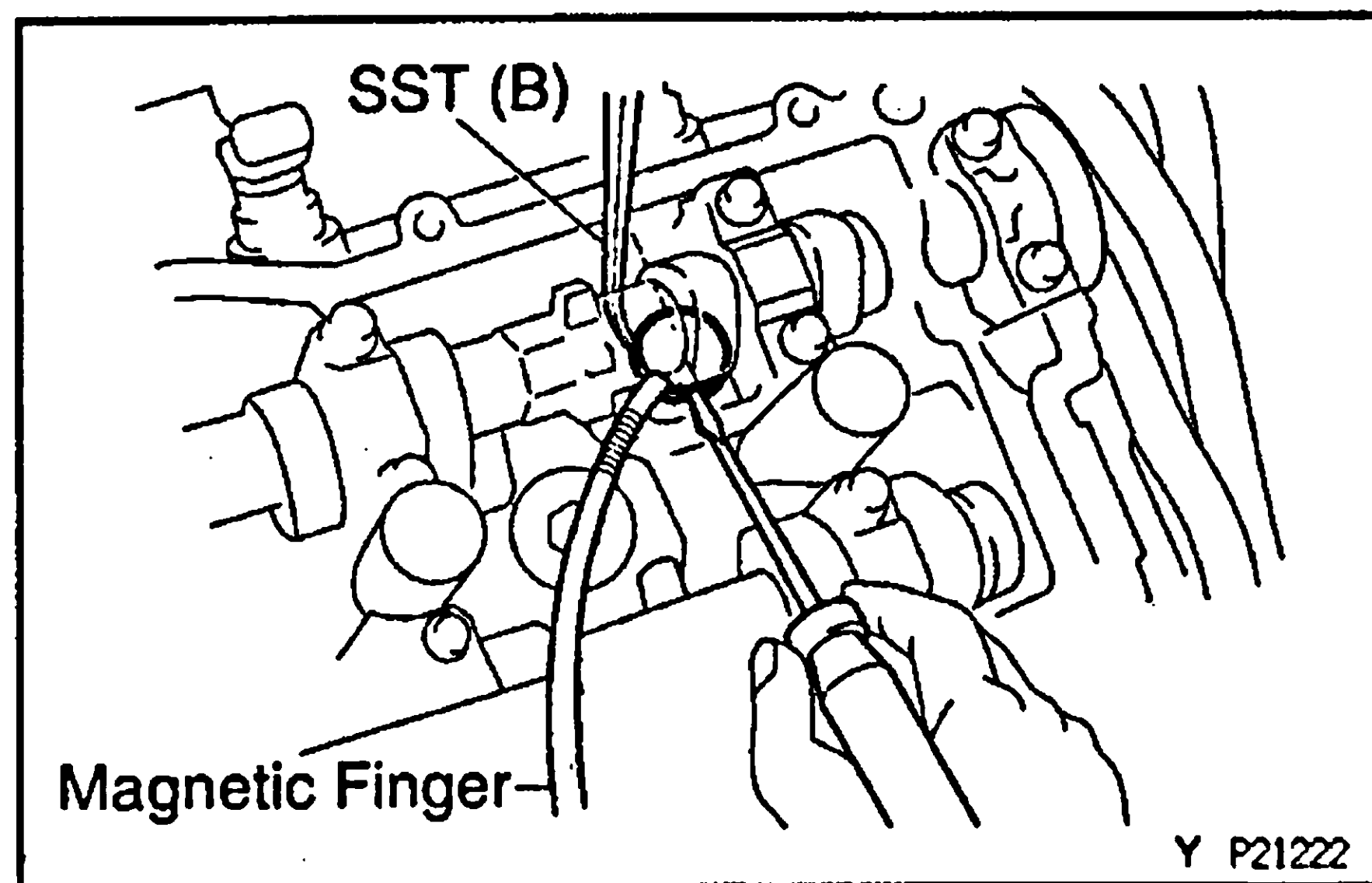


- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

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

HINT:

- Apply SST (B) at a slight angle on the side marked with "9" or "7", at the position shown in the illustration.
- When SST (B) is inserted too deeply, it will get pinched by the shim. To prevent it from being stuck, insert it gently from the intake side, at a slight angle.



- Using a small screwdriver and magnetic finger, remove the adjusting shim.

EG

- (b) Determine the replacement adjusting shim size according to these Formula or Charts:

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

T Thickness of used shim

A Measured valve clearance

N Thickness of new shim

Intake

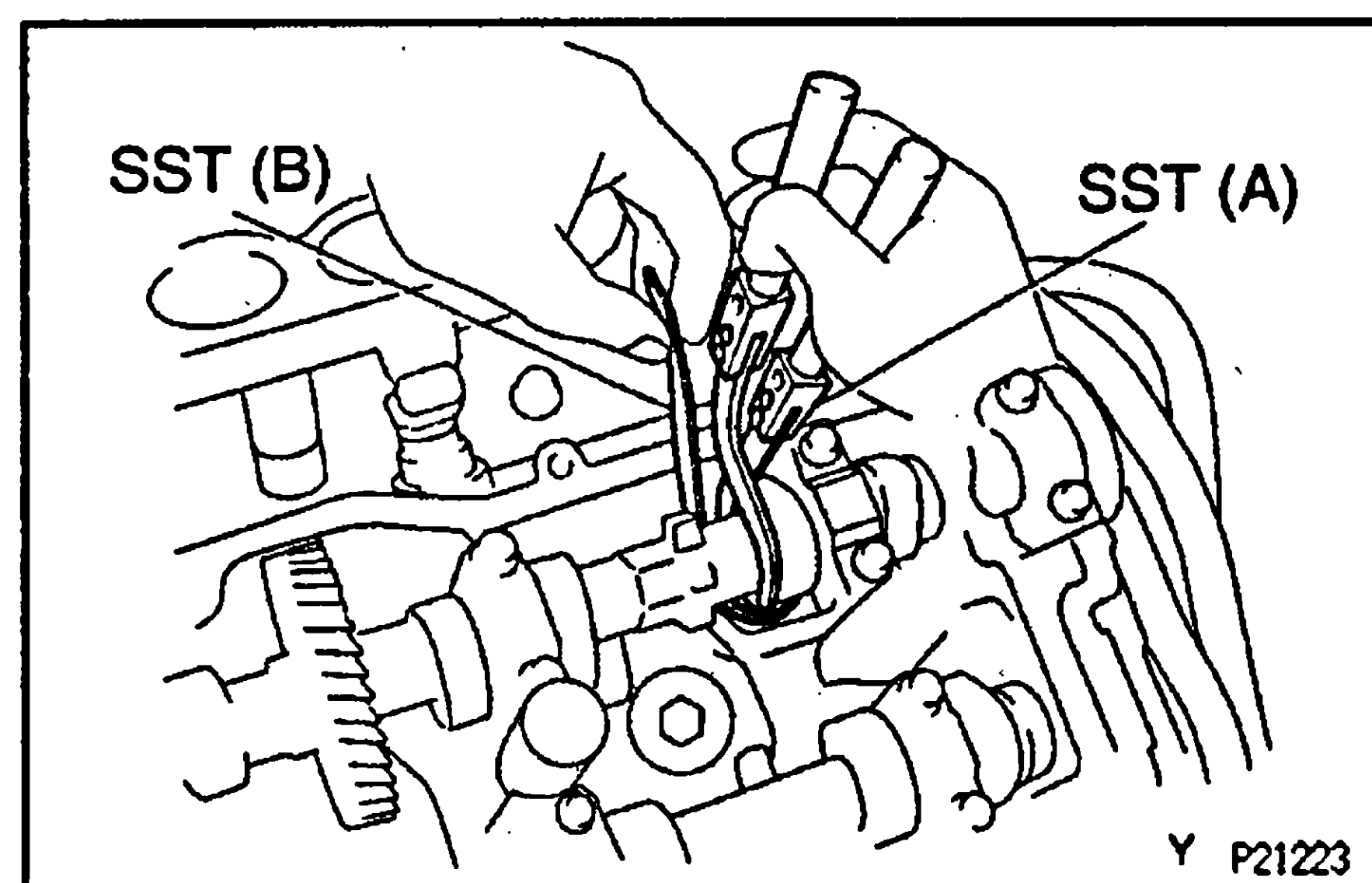
$$N = T + (A - 0.18 \text{ mm (0.007 in.)})$$

Exhaust

$$N = T + (A - 0.32 \text{ mm (0.013 in.)})$$

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

HINT: Shims are available in 17 sizes in increments of 0.050 mm (0.0020 in.), from 2.500 mm (0.0984 in.) to 3.300 mm (0.1299 in.).



- (c) Install a new adjusting shim.
- Place a new adjusting shim on the valve lifter, with imprinted numbers facing down.
 - Press down the valve lifter with SST (A), and remove SST (B).

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

- (d) Recheck the valve clearance.

5. REINSTALL CYLINDER HEAD COVERS (See cylinder heads installation)

Adjusting Shim Selection Chart (Intake)

[illegible]

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

Intake valve clearance (Cold):

0.13 – 0.23 mm (0.006 – 0.009 in.)

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a No. 12 shim.

Adjusting Shim Selection Chart (Exhaust)

Installed shim thickness mm (in.)		Measured clearance mm (in.)		New shim thickness mm (in.)	
0.000 - 0.020 (0.0000 - 0.0008)	2.500 (0.0984)	0.000 - 0.020 (0.0000 - 0.0008)	2.500 (0.0984)	1	2.500 (0.0984)
0.021 - 0.040 (0.0008 - 0.0016)	2.520 (0.0992)	0.021 - 0.040 (0.0008 - 0.0016)	2.520 (0.0992)	2	2.550 (0.1004)
0.041 - 0.060 (0.0016 - 0.0024)	2.540 (0.1000)	0.041 - 0.060 (0.0016 - 0.0024)	2.540 (0.1000)	3	2.600 (0.1024)
0.061 - 0.080 (0.0024 - 0.0031)	2.560 (0.1008)	0.061 - 0.080 (0.0024 - 0.0031)	2.560 (0.1008)	4	2.650 (0.1043)
0.081 - 0.100 (0.0032 - 0.0039)	2.580 (0.1016)	0.081 - 0.100 (0.0032 - 0.0039)	2.580 (0.1016)	5	2.700 (0.1063)
0.101 - 0.120 (0.0040 - 0.0047)	2.600 (0.1024)	0.101 - 0.120 (0.0040 - 0.0047)	2.600 (0.1024)	6	2.750 (0.1083)
0.121 - 0.140 (0.0048 - 0.0055)	2.620 (0.1031)	0.121 - 0.140 (0.0048 - 0.0055)	2.620 (0.1031)	7	2.800 (0.1102)
0.141 - 0.160 (0.0056 - 0.0063)	2.640 (0.1039)	0.141 - 0.160 (0.0056 - 0.0063)	2.640 (0.1039)	8	2.850 (0.1122)
0.161 - 0.180 (0.0063 - 0.0071)	2.660 (0.1047)	0.161 - 0.180 (0.0063 - 0.0071)	2.660 (0.1047)	9	2.900 (0.1142)
0.181 - 0.200 (0.0071 - 0.0079)	2.680 (0.1055)	0.181 - 0.200 (0.0071 - 0.0079)	2.680 (0.1055)		
0.201 - 0.220 (0.0079 - 0.0087)	2.700 (0.1063)	0.201 - 0.220 (0.0079 - 0.0087)	2.700 (0.1063)		
0.221 - 0.240 (0.0087 - 0.0094)	2.720 (0.1071)	0.221 - 0.240 (0.0087 - 0.0094)	2.720 (0.1071)		
0.241 - 0.260 (0.0095 - 0.0102)	2.740 (0.1079)	0.241 - 0.260 (0.0095 - 0.0102)	2.740 (0.1079)		
0.261 - 0.279 (0.0103 - 0.0106)	2.760 (0.1087)	0.261 - 0.279 (0.0103 - 0.0106)	2.760 (0.1087)		
0.280 - 0.370 (0.0106 - 0.0146)	2.780 (0.1094)	0.280 - 0.370 (0.0106 - 0.0146)	2.780 (0.1094)		
0.371 - 0.380 (0.0146 - 0.0150)	2.800 (0.1102)	0.371 - 0.380 (0.0146 - 0.0150)	2.800 (0.1102)		
0.381 - 0.400 (0.0150 - 0.0157)	2.820 (0.1110)	0.381 - 0.400 (0.0150 - 0.0157)	2.820 (0.1110)		
0.401 - 0.420 (0.0158 - 0.0165)	2.840 (0.1118)	0.401 - 0.420 (0.0158 - 0.0165)	2.840 (0.1118)		
0.421 - 0.440 (0.0166 - 0.0173)	2.860 (0.1126)	0.421 - 0.440 (0.0166 - 0.0173)	2.860 (0.1126)		
0.441 - 0.460 (0.0174 - 0.0181)	2.880 (0.1134)	0.441 - 0.460 (0.0174 - 0.0181)	2.880 (0.1134)		
0.461 - 0.480 (0.0181 - 0.0189)	2.900 (0.1142)	0.461 - 0.480 (0.0181 - 0.0189)	2.900 (0.1142)		
0.481 - 0.500 (0.0189 - 0.0197)	2.920 (0.1150)	0.481 - 0.500 (0.0189 - 0.0197)	2.920 (0.1150)		
0.501 - 0.520 (0.0197 - 0.0205)	2.940 (0.1158)	0.501 - 0.520 (0.0197 - 0.0205)	2.940 (0.1158)		
0.521 - 0.540 (0.0205 - 0.0213)	2.960 (0.1166)	0.521 - 0.540 (0.0205 - 0.0213)	2.960 (0.1166)		
0.541 - 0.560 (0.0213 - 0.0220)	2.980 (0.1174)	0.541 - 0.560 (0.0213 - 0.0220)	2.980 (0.1174)		
0.561 - 0.580 (0.0221 - 0.0228)	3.000 (0.1182)	0.561 - 0.580 (0.0221 - 0.0228)	3.000 (0.1182)		
0.581 - 0.600 (0.0229 - 0.0236)	3.020 (0.1190)	0.581 - 0.600 (0.0229 - 0.0236)	3.020 (0.1190)		
0.601 - 0.620 (0.0237 - 0.0244)	3.040 (0.1197)	0.601 - 0.620 (0.0237 - 0.0244)	3.040 (0.1197)		
0.621 - 0.640 (0.0244 - 0.0252)	3.060 (0.1205)	0.621 - 0.640 (0.0244 - 0.0252)	3.060 (0.1205)		
0.641 - 0.660 (0.0252 - 0.0260)	3.080 (0.1213)	0.641 - 0.660 (0.0252 - 0.0260)	3.080 (0.1213)		
0.661 - 0.680 (0.0260 - 0.0268)	3.100 (0.1220)	0.661 - 0.680 (0.0260 - 0.0268)	3.100 (0.1220)		
0.681 - 0.700 (0.0268 - 0.0276)	3.120 (0.1228)	0.681 - 0.700 (0.0268 - 0.0276)	3.120 (0.1228)		
0.701 - 0.720 (0.0276 - 0.0283)	3.140 (0.1236)	0.701 - 0.720 (0.0276 - 0.0283)	3.140 (0.1236)		
0.721 - 0.740 (0.0284 - 0.0291)	3.160 (0.1244)	0.721 - 0.740 (0.0284 - 0.0291)	3.160 (0.1244)		
0.741 - 0.760 (0.0292 - 0.0299)	3.180 (0.1252)	0.741 - 0.760 (0.0292 - 0.0299)	3.180 (0.1252)		
0.761 - 0.780 (0.0300 - 0.0307)	3.200 (0.1260)	0.761 - 0.780 (0.0300 - 0.0307)	3.200 (0.1260)		
0.781 - 0.800 (0.0307 - 0.0315)	3.220 (0.1268)	0.781 - 0.800 (0.0307 - 0.0315)	3.220 (0.1268)		
0.801 - 0.820 (0.0315 - 0.0323)	3.240 (0.1276)	0.801 - 0.820 (0.0315 - 0.0323)	3.240 (0.1276)		
0.821 - 0.840 (0.0323 - 0.0331)	3.260 (0.1283)	0.821 - 0.840 (0.0323 - 0.0331)	3.260 (0.1283)		
0.841 - 0.860 (0.0331 - 0.0339)	3.280 (0.1291)	0.841 - 0.860 (0.0331 - 0.0339)	3.280 (0.1291)		
0.861 - 0.880 (0.0339 - 0.0346)	3.300 (0.1299)	0.861 - 0.880 (0.0339 - 0.0346)	3.300 (0.1299)		
0.881 - 0.900 (0.0347 - 0.0354)	3.320 (0.1307)	0.881 - 0.900 (0.0347 - 0.0354)	3.320 (0.1307)		
0.901 - 0.920 (0.0355 - 0.0362)	3.340 (0.1315)	0.901 - 0.920 (0.0355 - 0.0362)	3.340 (0.1315)		
0.921 - 0.940 (0.0363 - 0.0370)	3.360 (0.1323)	0.921 - 0.940 (0.0363 - 0.0370)	3.360 (0.1323)		
0.941 - 0.960 (0.0370 - 0.0378)	3.380 (0.1331)	0.941 - 0.960 (0.0370 - 0.0378)	3.380 (0.1331)		
0.961 - 0.980 (0.0378 - 0.0386)	3.400 (0.1339)	0.961 - 0.980 (0.0378 - 0.0386)	3.400 (0.1339)		
0.981 - 1.000 (0.0386 - 0.0394)	3.420 (0.1347)	0.981 - 1.000 (0.0386 - 0.0394)	3.420 (0.1347)		
1.001 - 1.020 (0.0394 - 0.0402)	3.440 (0.1355)	1.001 - 1.020 (0.0394 - 0.0402)	3.440 (0.1355)		
1.021 - 1.040 (0.0402 - 0.0409)	3.460 (0.1363)	1.021 - 1.040 (0.0402 - 0.0409)	3.460 (0.1363)		
1.041 - 1.060 (0.0410 - 0.0417)	3.480 (0.1371)	1.041 - 1.060 (0.0410 - 0.0417)	3.480 (0.1371)		
1.061 - 1.080 (0.0418 - 0.0425)	3.500 (0.1379)	1.061 - 1.080 (0.0418 - 0.0425)	3.500 (0.1379)		
1.081 - 1.100 (0.0426 - 0.0433)	3.520 (0.1387)	1.081 - 1.100 (0.0426 - 0.0433)	3.520 (0.1387)		
1.101 - 1.120 (0.0433 - 0.0441)	3.540 (0.1395)	1.101 - 1.120 (0.0433 - 0.0441)	3.540 (0.1395)		
1.121 - 1.140 (0.0441 - 0.0449)	3.560 (0.1403)	1.121 - 1.140 (0.0441 - 0.0449)	3.560 (0.1403)		
1.141 - 1.160 (0.0449 - 0.0457)	3.580 (0.1411)	1.141 - 1.160 (0.0449 - 0.0457)	3.580 (0.1411)		
1.161 - 1.170 (0.0457 - 0.0461)	3.600 (0.1419)	1.161 - 1.170 (0.0457 - 0.0461)	3.600 (0.1419)		

New shim thickness mm (in.)

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

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

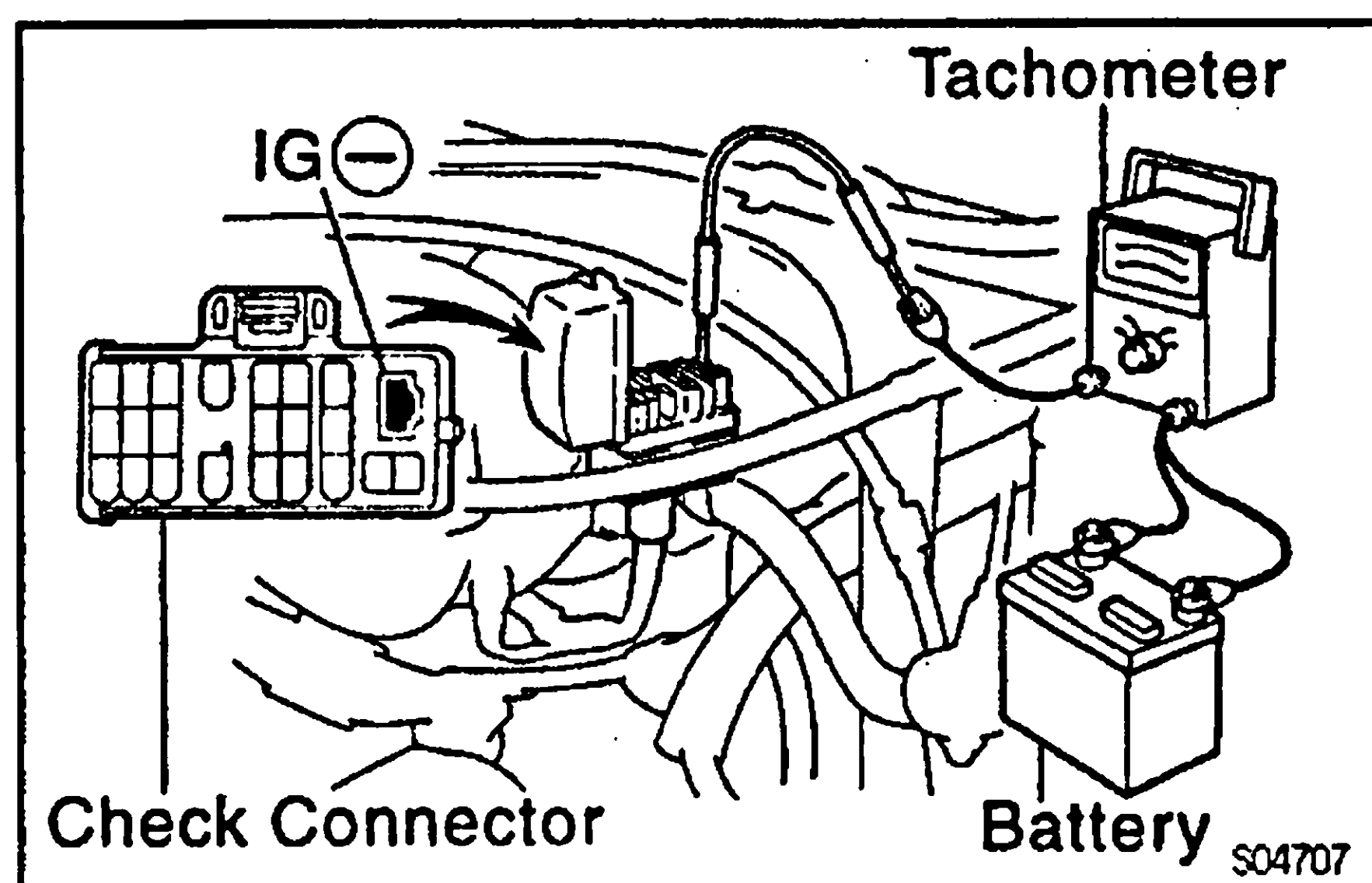
Exhaust valve clearance (Cold):
0.27 - 0.37 mm (0.011 - 0.014 in.)
EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a No. 10 shim.

IGNITION TIMING INSPECTION

E0680-03

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.



2. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

Connect the tester probe of a tachometer to terminal IG $\ominus$ 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.

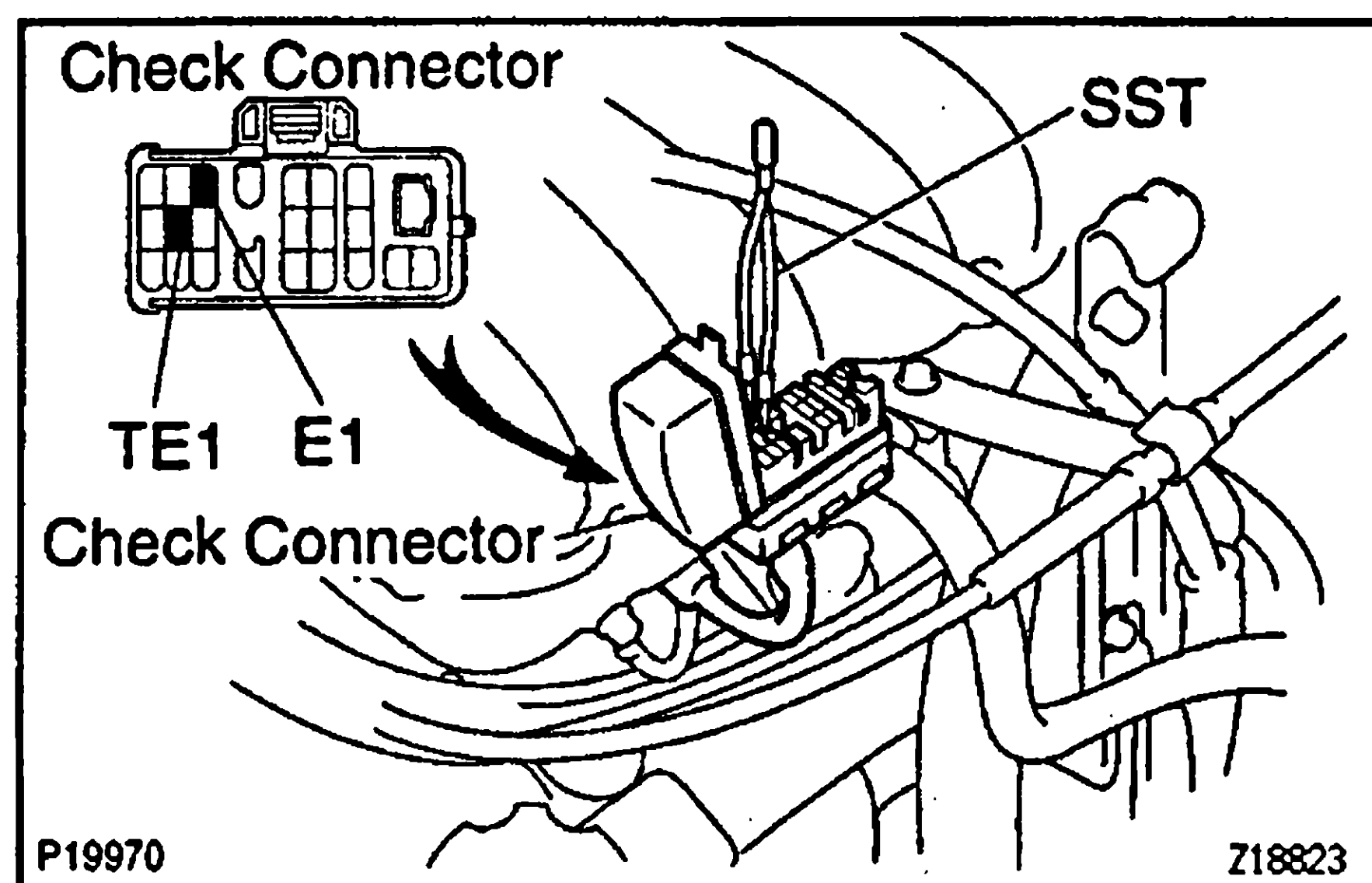
3. CHECK IDLE SPEED

- Race the engine speed at 1,000 rpm for approx. 5 seconds.
- Check the idle speed.

Idle speed:

700 $\pm$ 50 rpm

(Transmission in neutral position and A/C OFF)



4. INSPECT IGNITION TIMING

- Using SST, connect terminals TE1 and E1 of the check connector.

SST 09843-18020

- Using a timing light, check the ignition timing.

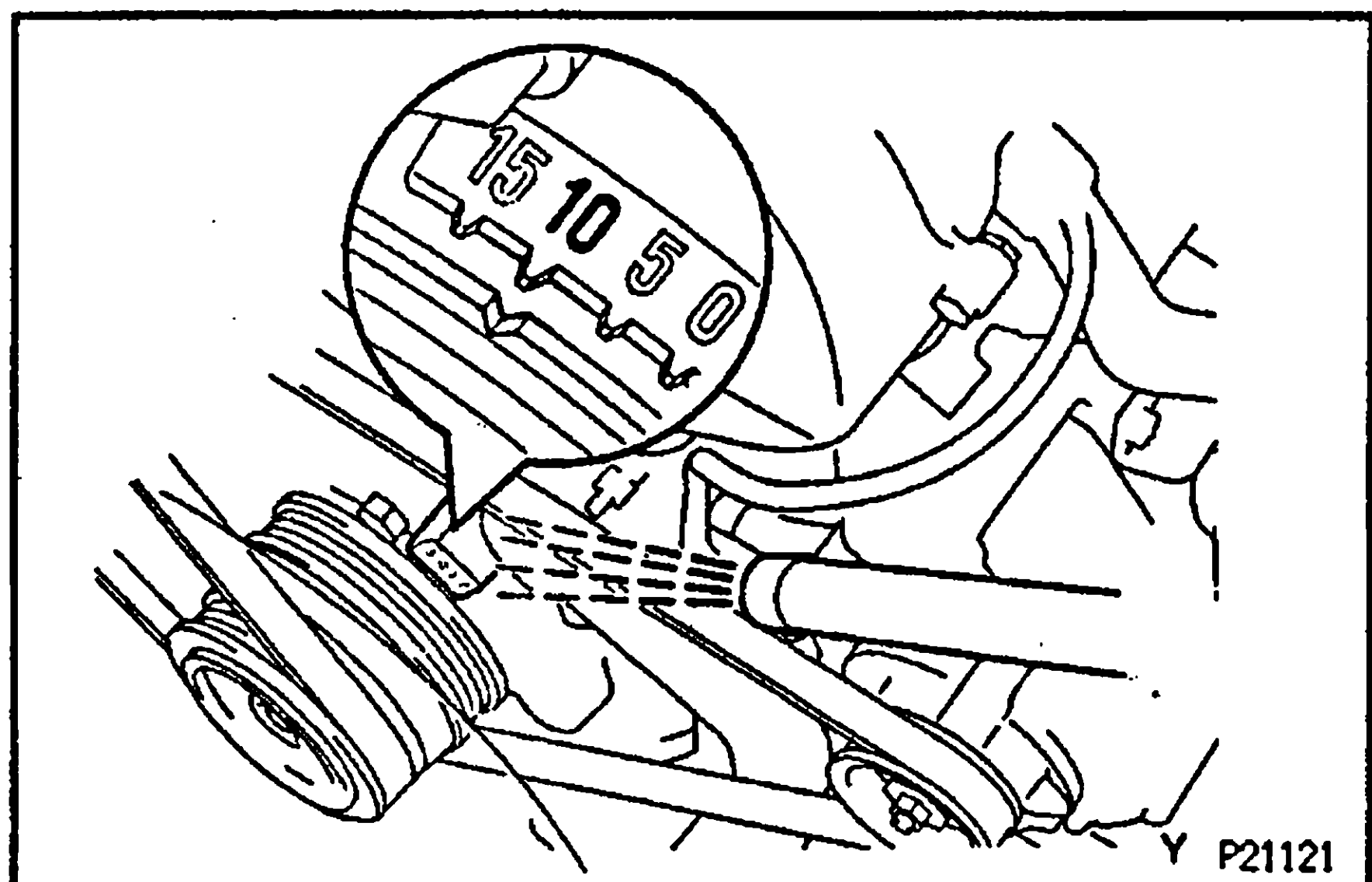
Ignition timing:

8 – 12° BTDC @ idle

(Transmission in neutral position)

- Remove the SST from the check connector.

SST 09843-18020



5. FURTHER CHECK IGNITION TIMING

Ignition timing:

10 — 24° BTDC @ idle**(Transmission in neutral position)**

HINT: The timing mark moves in a range between 10° and 24°.

6. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

EG

IDLE SPEED INSPECTION

EG788-01

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 checked correctly
- (h) Transmission in neutral position
- (i) A/C switch is OFF

2. CONNECT TACHOMETER**(See ignition timing inspection)****3. INSPECT IDLE SPEED**

- (a) Race the engine speed at 1,000 rpm for approx. 5 seconds.
- (b) Check the idle speed.

Idle speed:

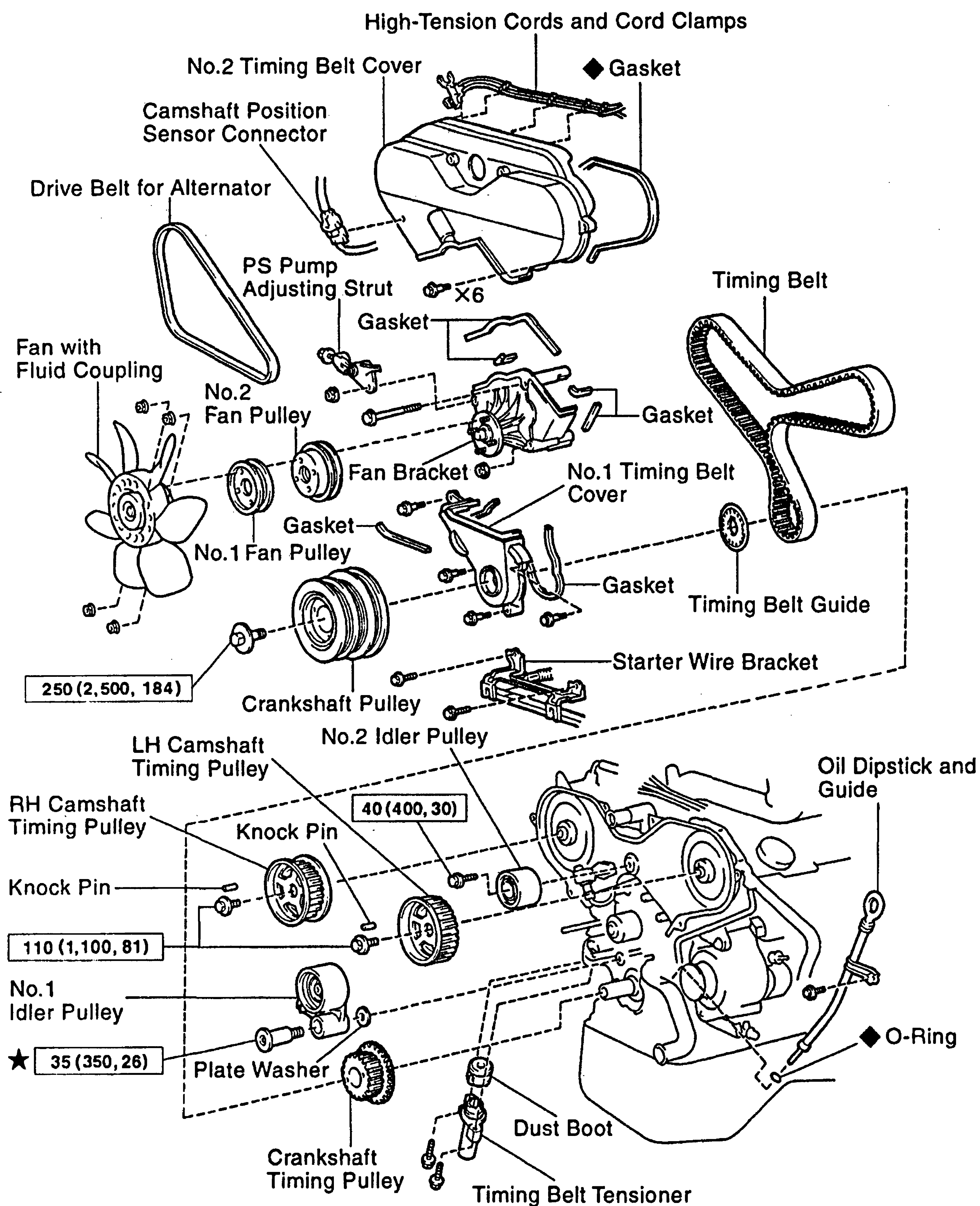
700 ± 50 rpm

If the idle speed is not as specified, check the ISC valve and air intake system.

4. DISCONNECT TACHOMETER

TIMING BELT COMPONENTS FOR REMOVAL AND INSTALLATION

EG6YV-03



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

◆ Non-reusable part

★ Precoated part

TIMING BELT REMOVAL

1. LOOSEN FAN WITH FLUID COUPLING AND FAN PULLEYS
2. REMOVE DRIVE BELT FOR ALTERNATOR
3. REMOVE FAN WITH FLUID COUPLING AND FAN PULLEYS

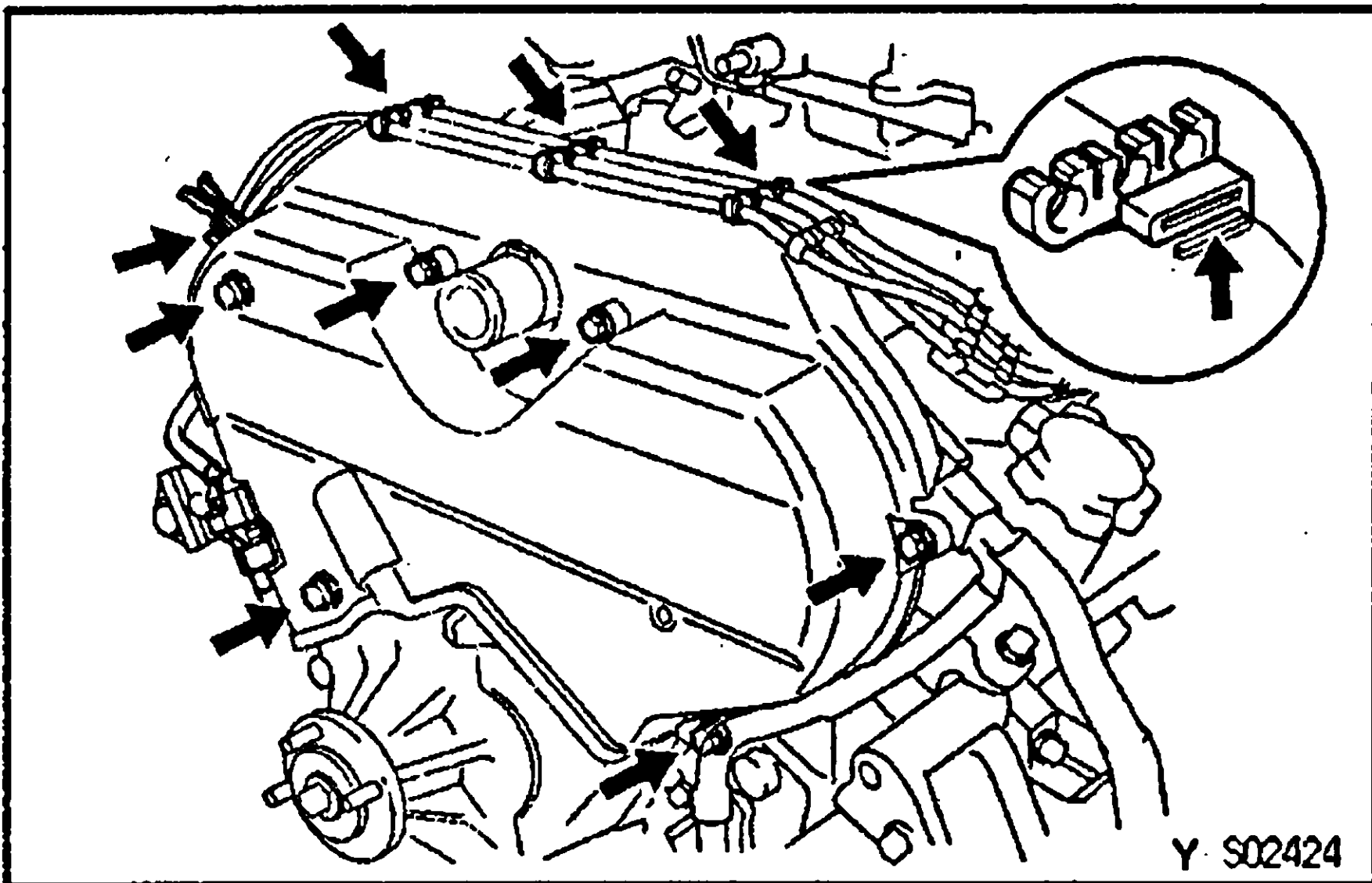
4. REMOVE OIL DIPSTICK AND GUIDE

Remove the bolt, oil dipstick, guide and O-ring.

EG

5. REMOVE NO.2 TIMING BELT COVER

- (a) Disconnect the 4 high-tension cord clamps from the No.2 timing belt cover.
- (b) Remove the 6 bolts and No.2 timing belt cover.
- (c) Disconnect the camshaft position sensor connector.



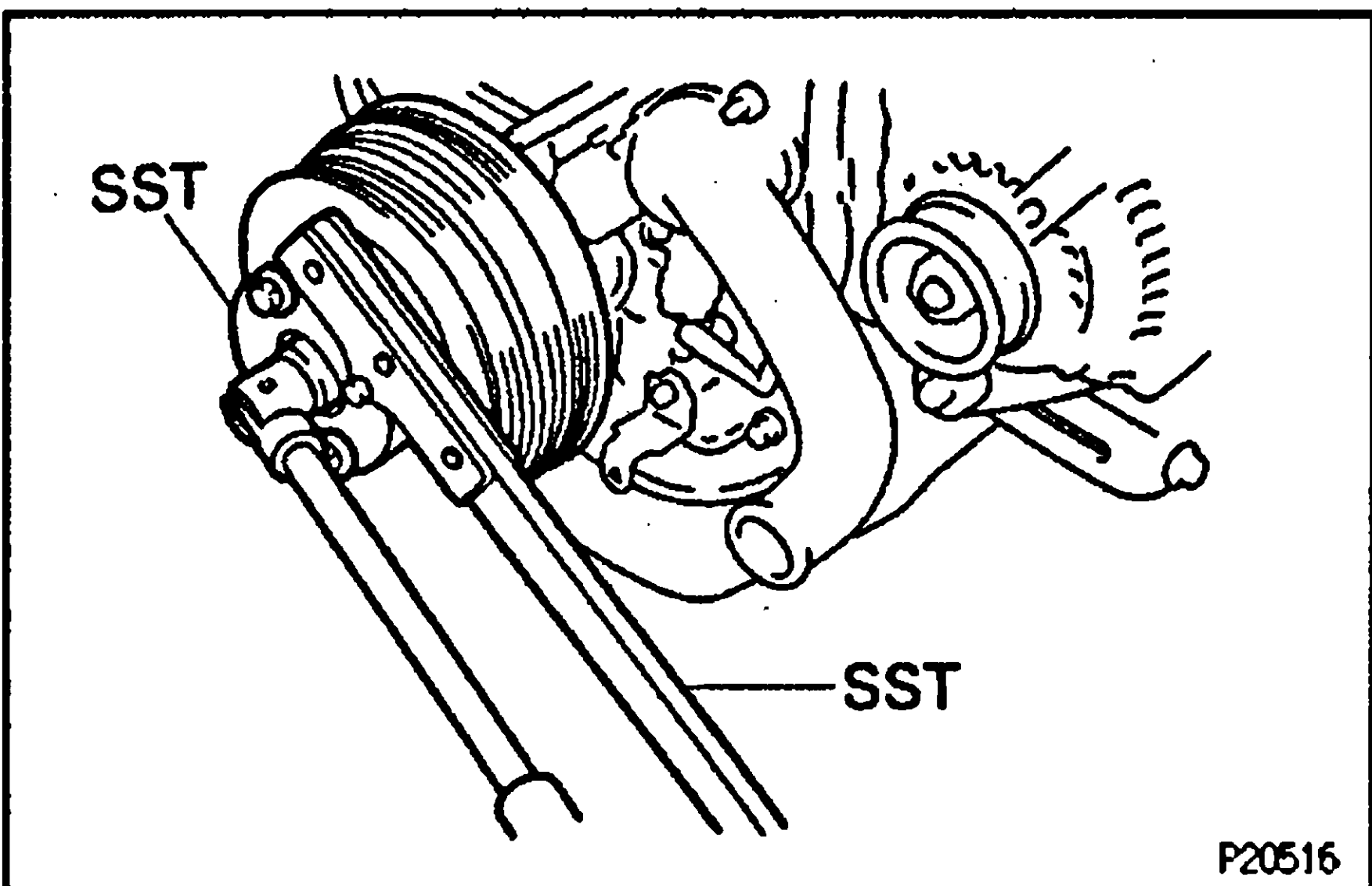
6. REMOVE FAN BRACKET

- (a) Remove the nut and PS pump adjusting strut.
- (b) Remove the bolt, nut, and fan bracket.



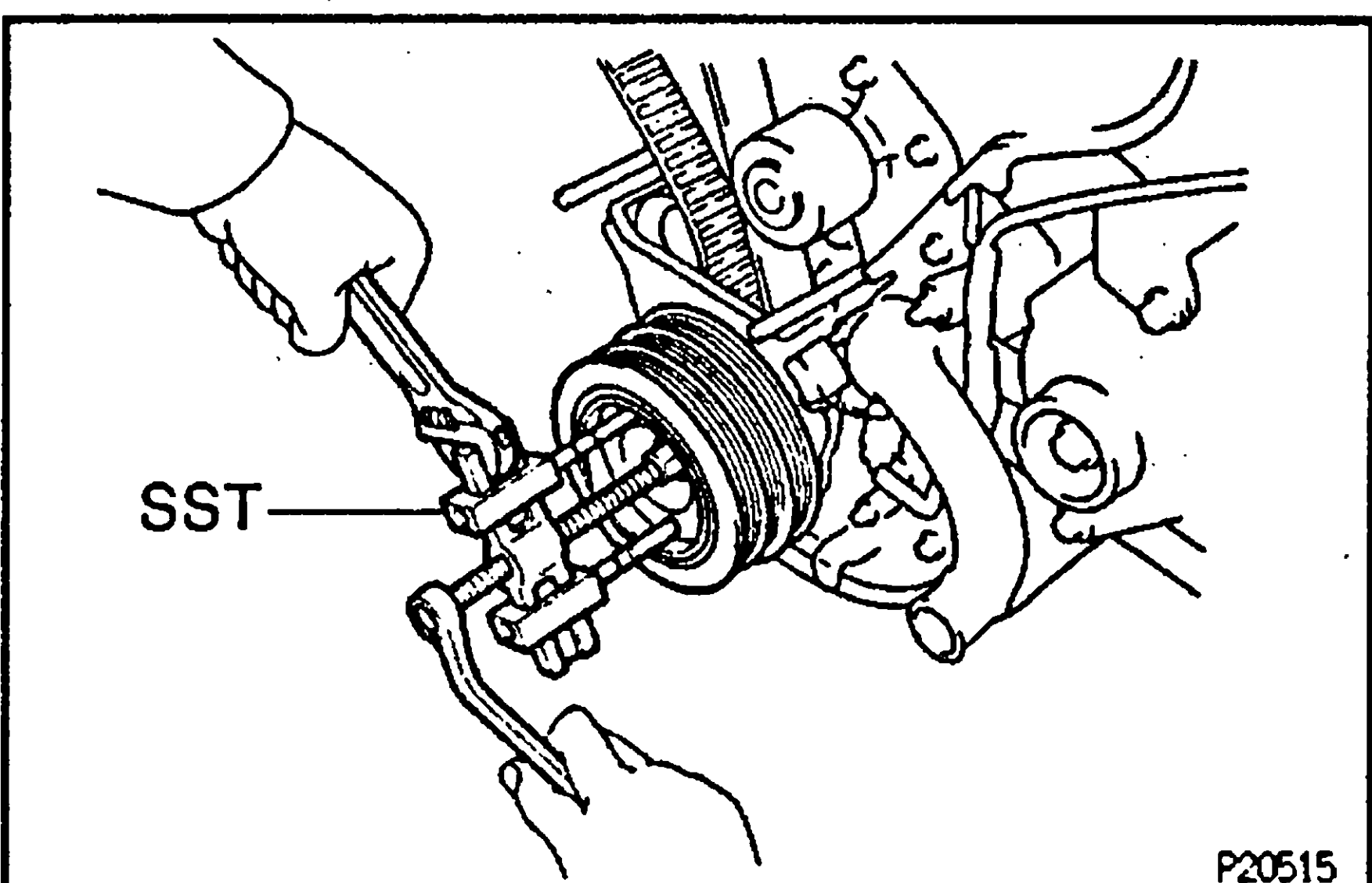
7. REMOVE CRANKSHAFT PULLEY

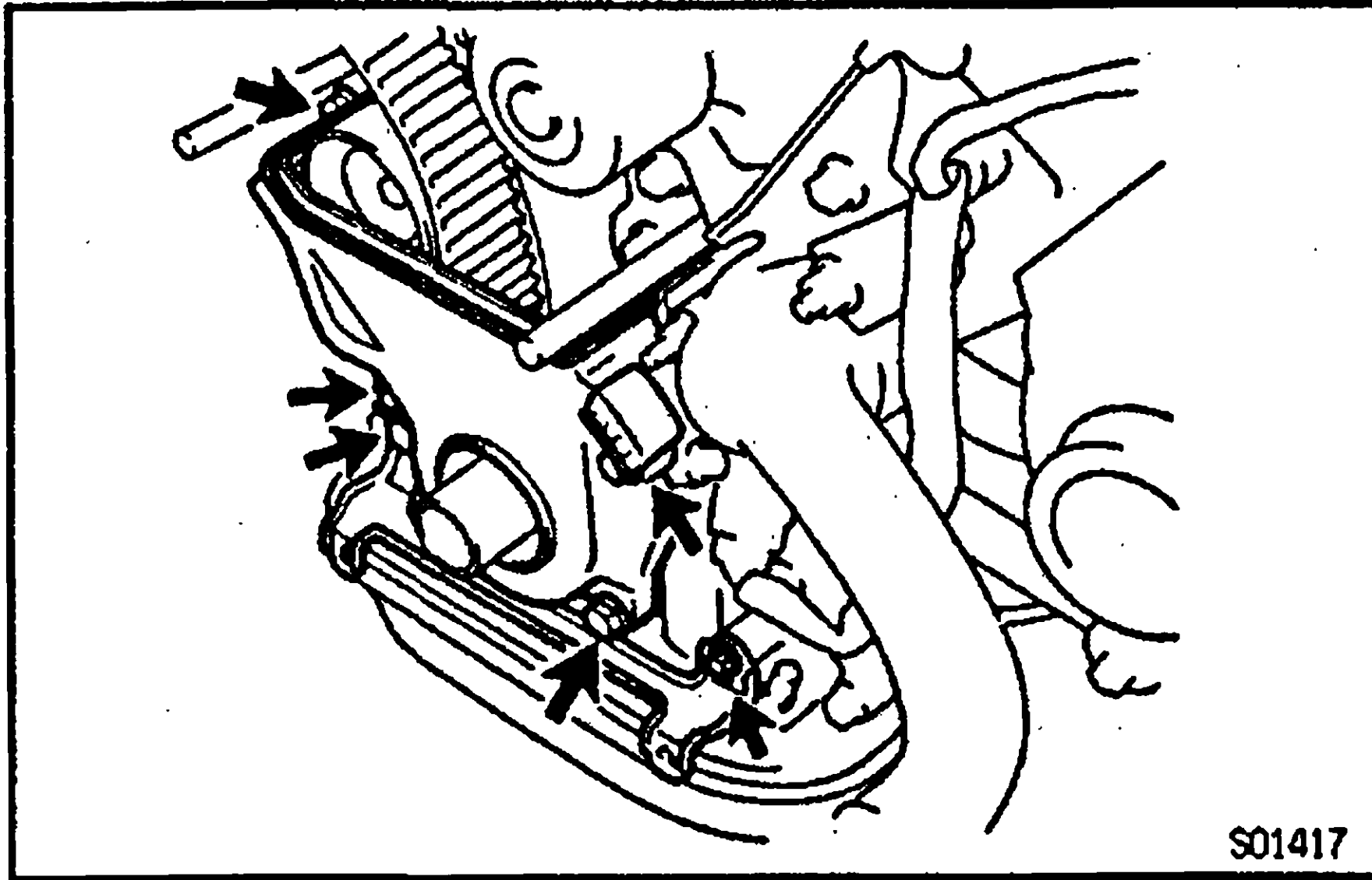
- (a) Using SST, loosen the pulley bolt.
SST 09213-54015 (90119-08216),
09330-00021
- (b) Remove the SST, pulley bolt and pulley.



HINT: If necessary, remove the pulley with SST and service bolt.

SST 09950-50010 (09551-05010, 09552-05010,
09553-05020, 09554-05030)

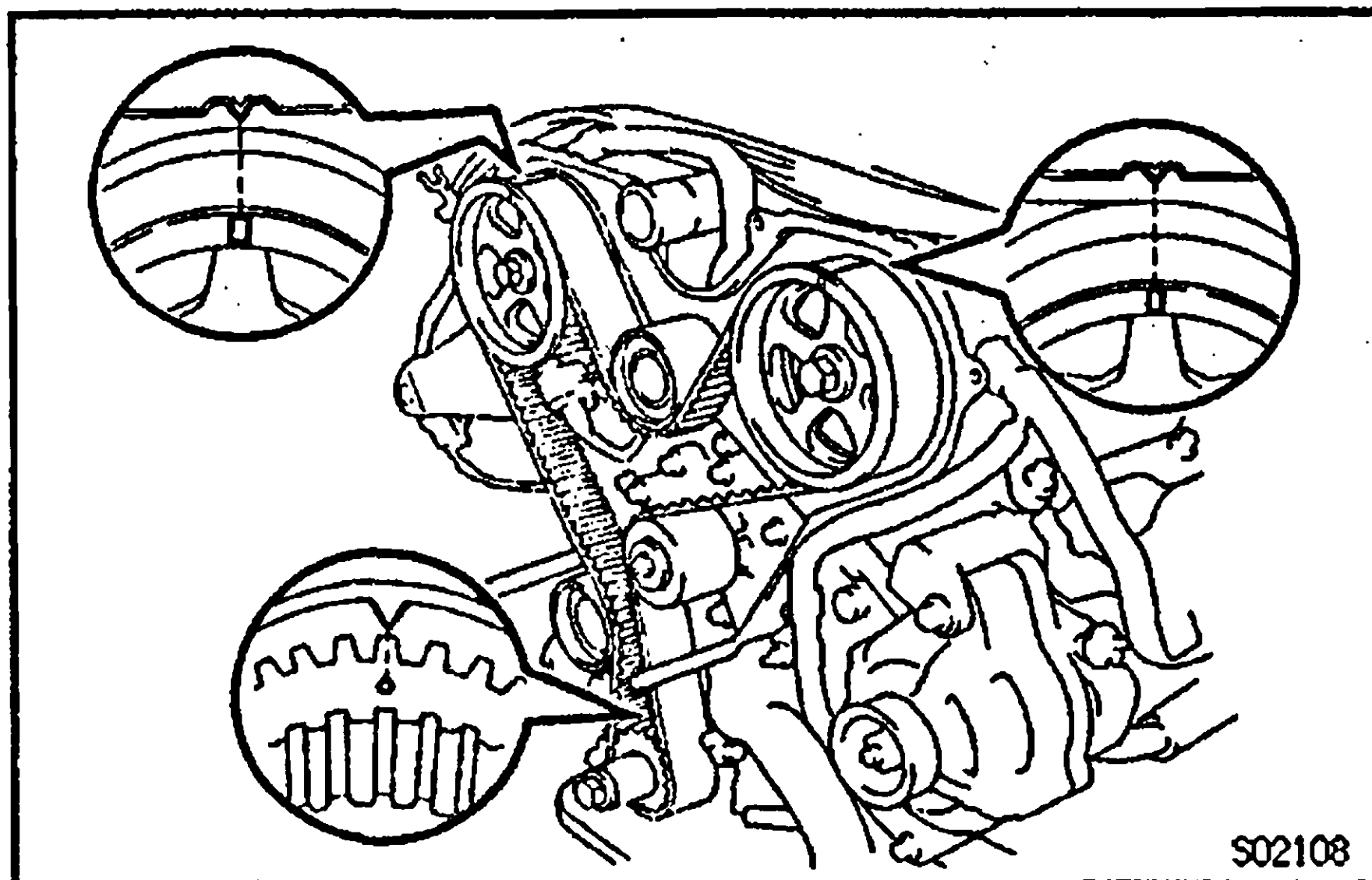




8. REMOVE STARTER WIRE BRACKET AND NO. 1 TIMING BELT COVER

- (a) Remove the 2 bolts and starter wire bracket.
- (b) Remove the 4 bolts timing belt cover.

9. REMOVE TIMING BELT GUIDE



10. SET NO.1 CYLINDER AT TDC/COMPRESSION

- (a) Temporarily install the crankshaft pulley bolt to the crankshaft.
- (b) Turn the crankshaft, and align the timing marks of the crankshaft timing pulley and oil pump body.
NOTICE: Always turn the crankshaft clockwise.

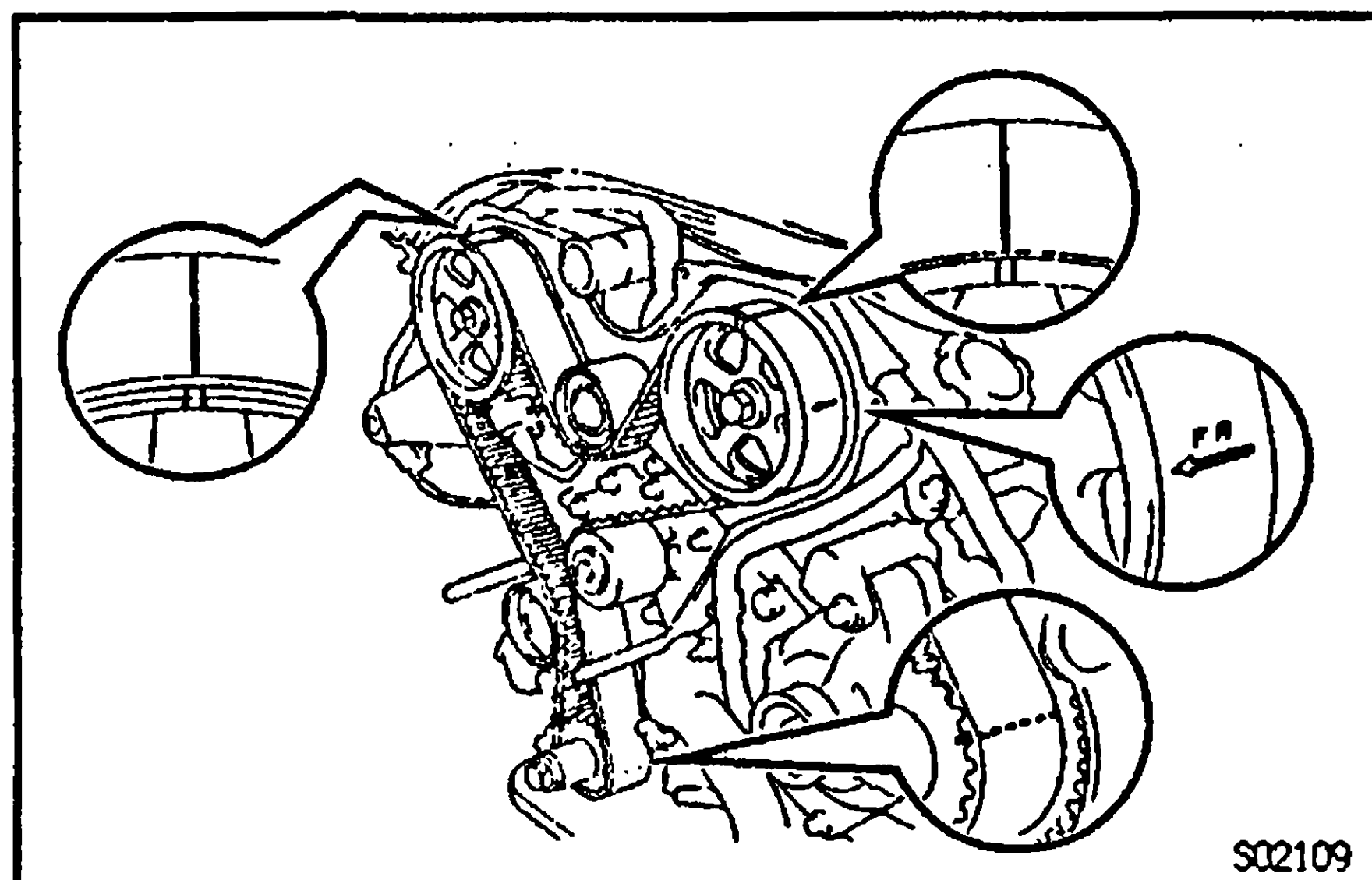
- (c) Check that the timing marks of the camshaft timing pulley and No.3 timing belt cover are aligned.
If not, turn the crankshaft pulley 1 revolution (360°).

- (d) Remove the crankshaft pulley bolt.

11. IF REUSING TIMING BELT, CHECK INSTALLATION MARKS ON TIMING BELT

Check that there are 3 installation marks and front mark on the timing belt.

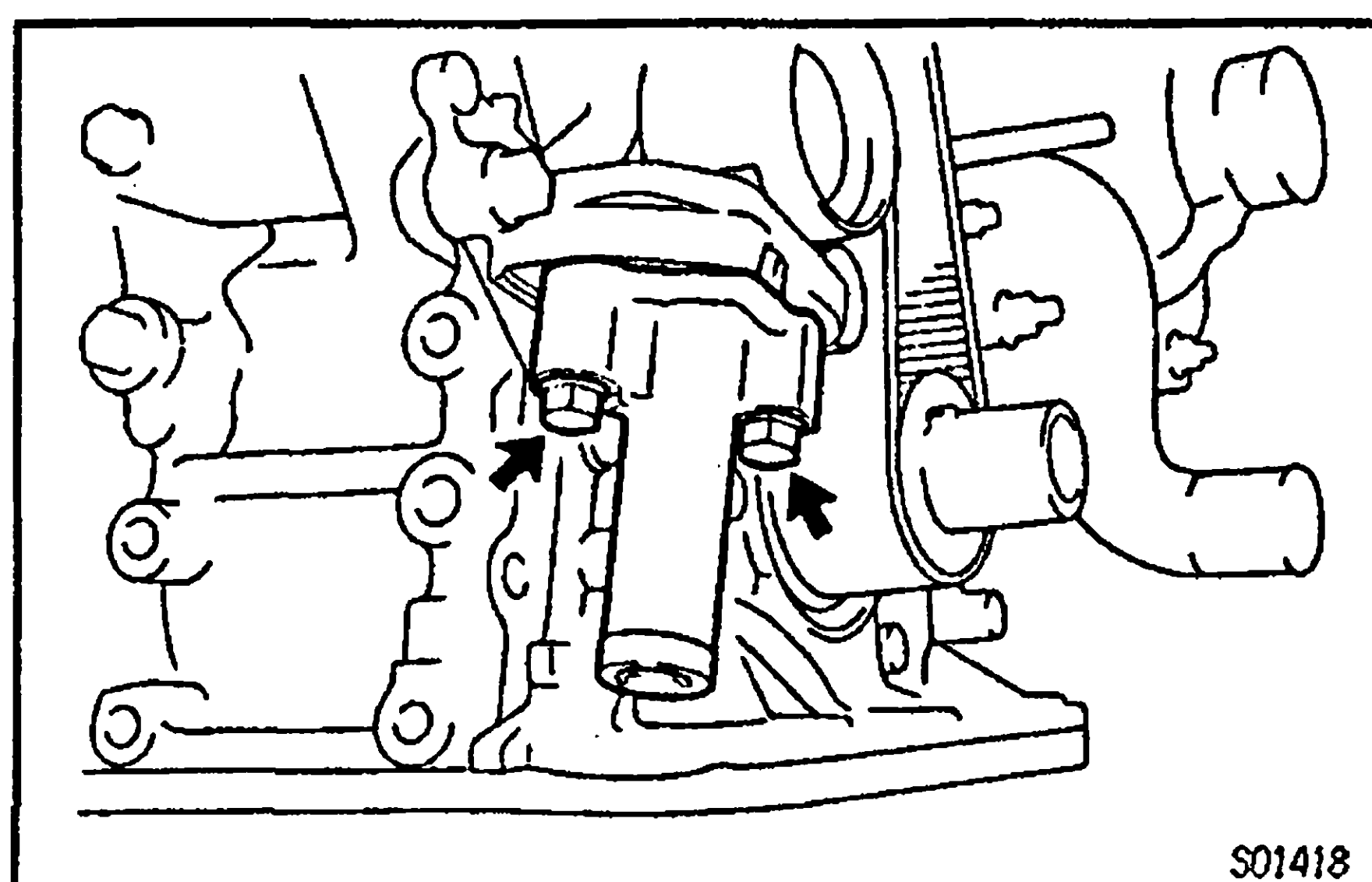
If the installation and front marks have disappeared, before removing the timing belt, place 3 new installation marks on the timing belt to match the timing marks of the timing pulleys, and place a new front mark on the timing belt.



12. REMOVE TIMING BELT TENSIONER

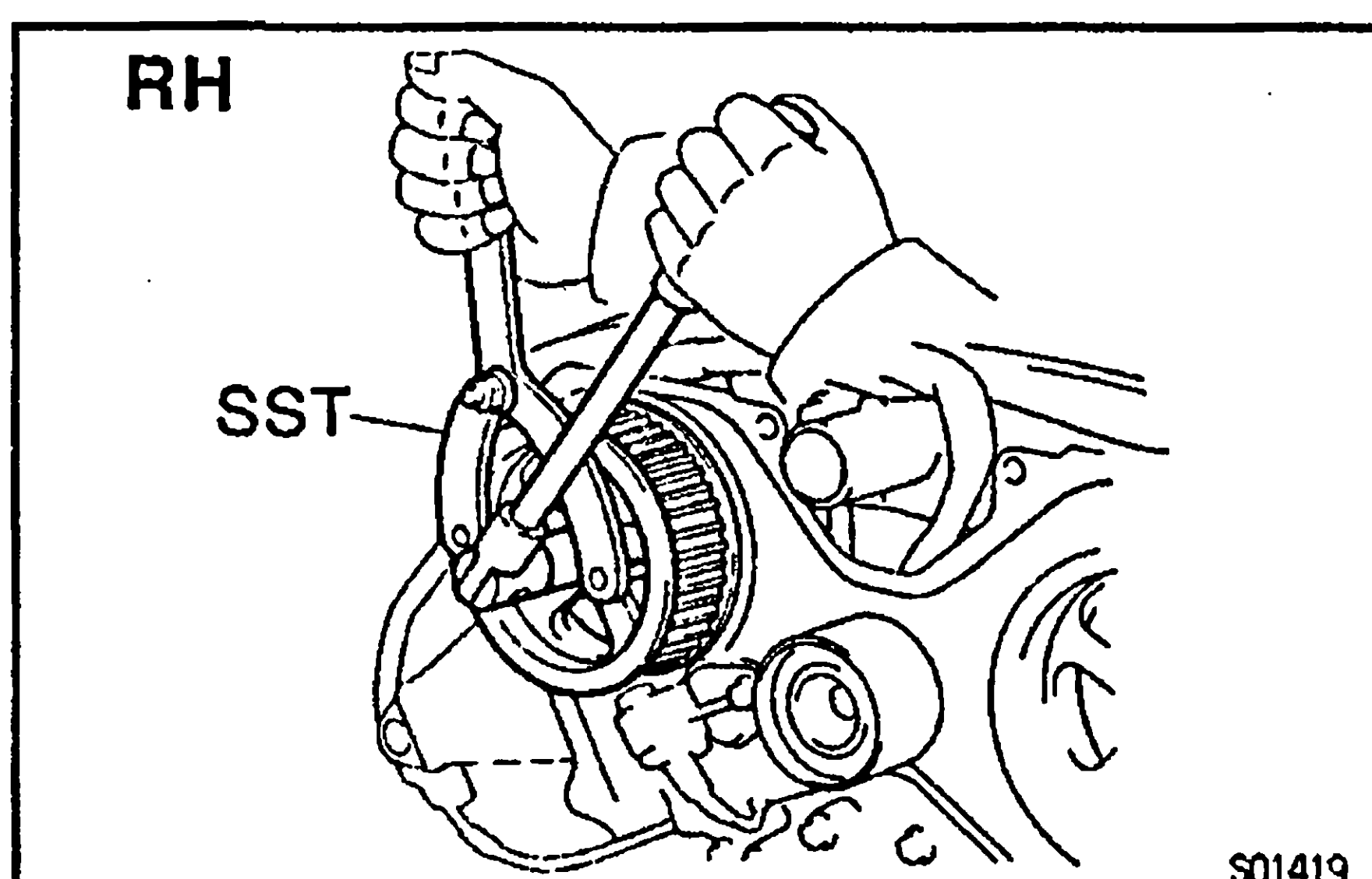
Alternately loosen the 2 bolts and remove them, then remove the belt tensioner and dust boot.

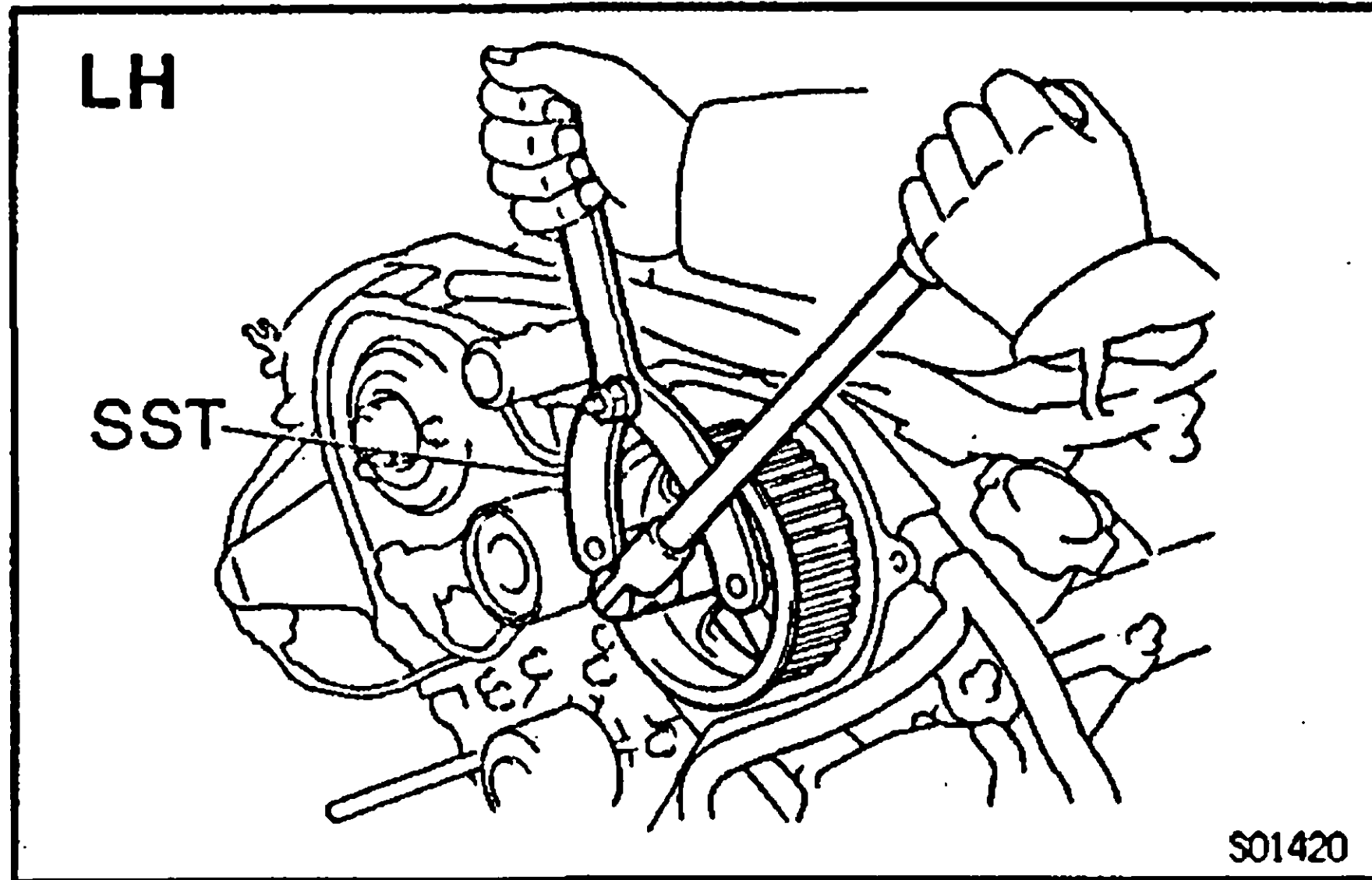
13. REMOVE TIMING BELT



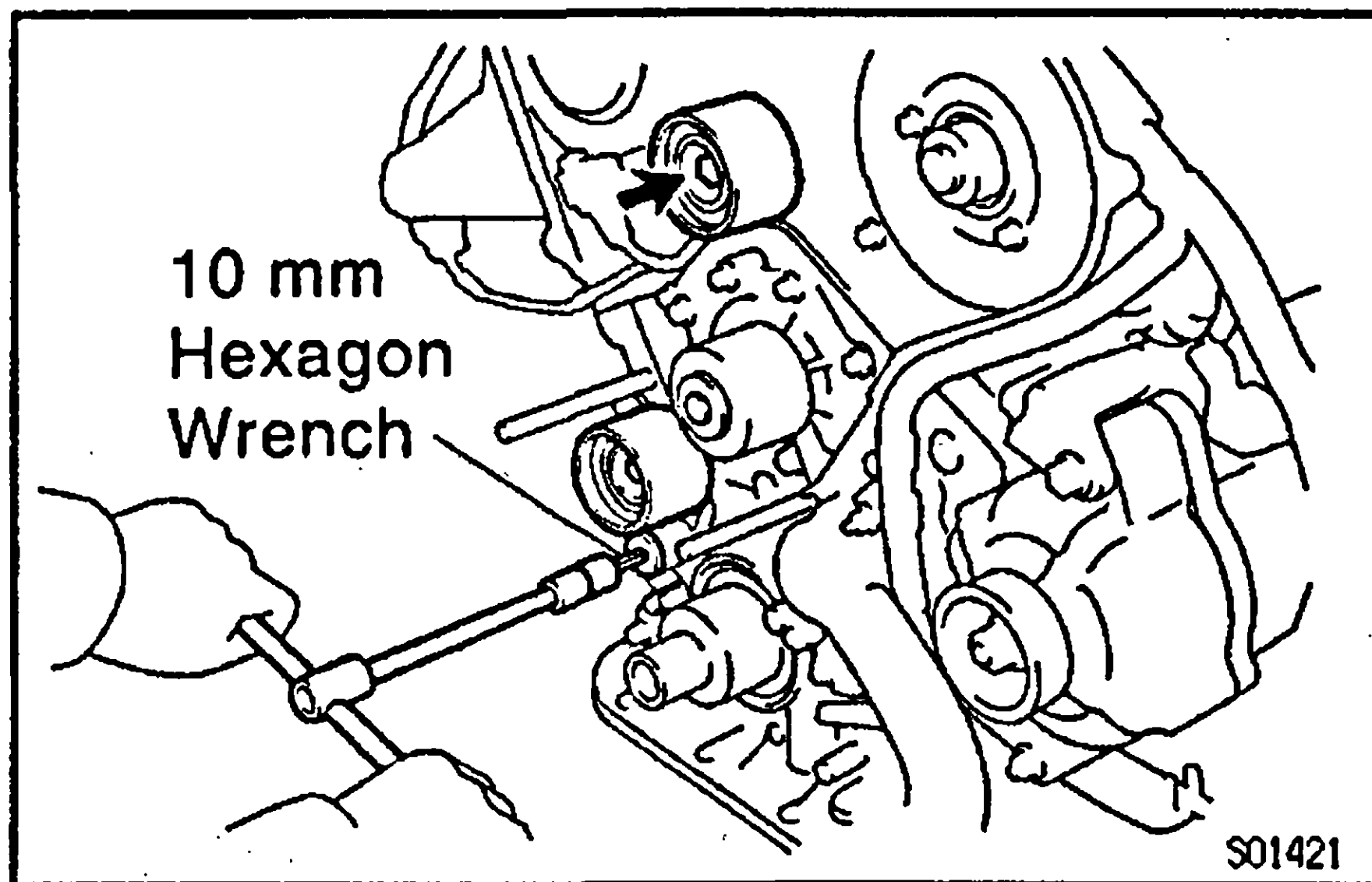
14. REMOVE RH CAMSHAFT TIMING PULLEY

- (a) Using SST, loosen the pulley bolt.
SST 09960-10010 (09962-01000, 09963-01000)
- (b) Remove the bolt, knock pin and camshaft timing pulley with timing belt.



**15. REMOVE LH CAMSHAFT TIMING PULLEY**

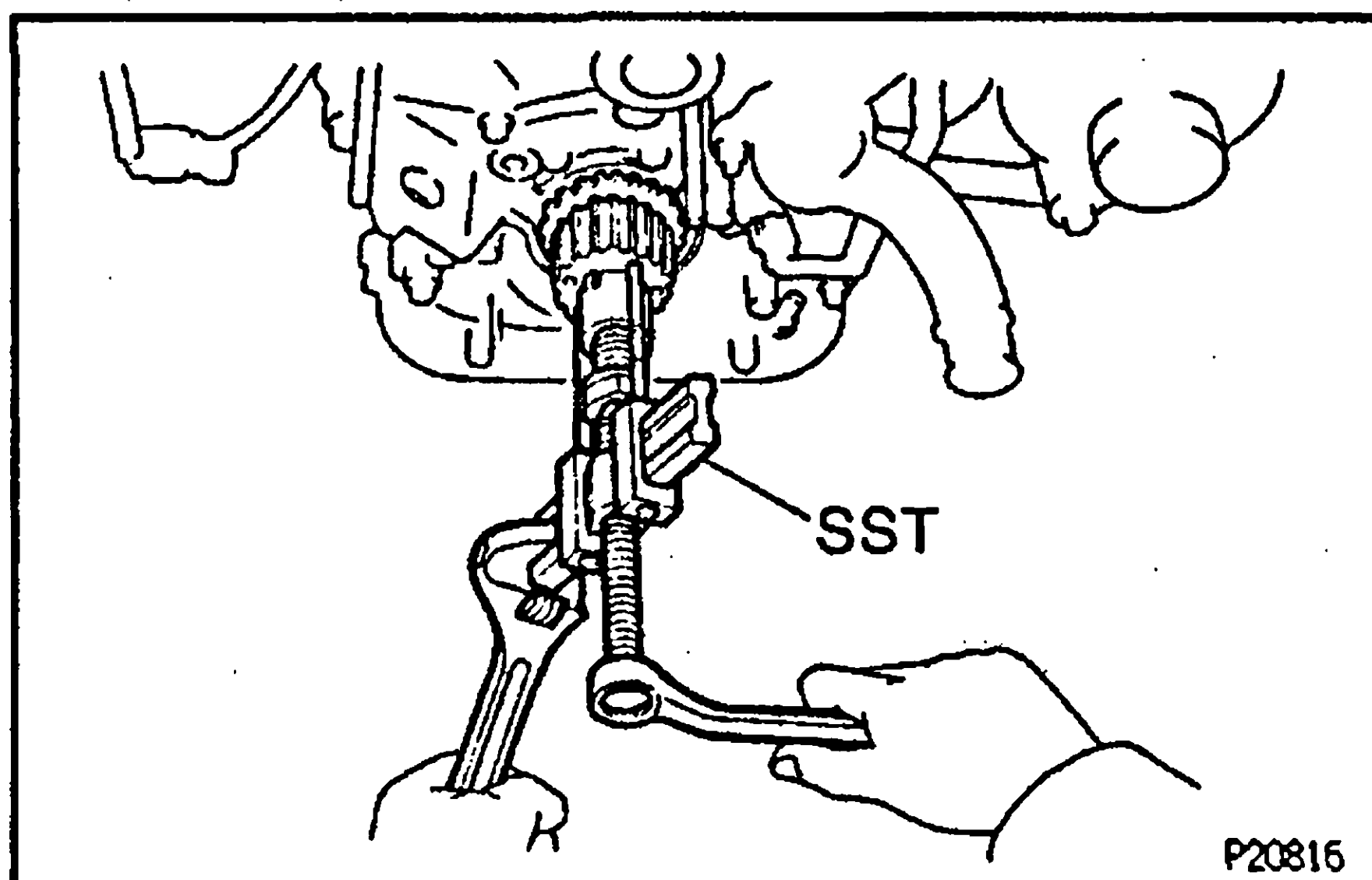
- (a) Using SST, loosen the pulley bolt.
SST 09960-10010 (09962-01000, 09963-01000)
- (b) Remove the bolt, knock pin and camshaft timing pulley.

**16. REMOVE NO.2 IDLER PULLEY**

Remove the bolt and No.2 idler pulley.

17. REMOVE NO.1 IDLER PULLEY

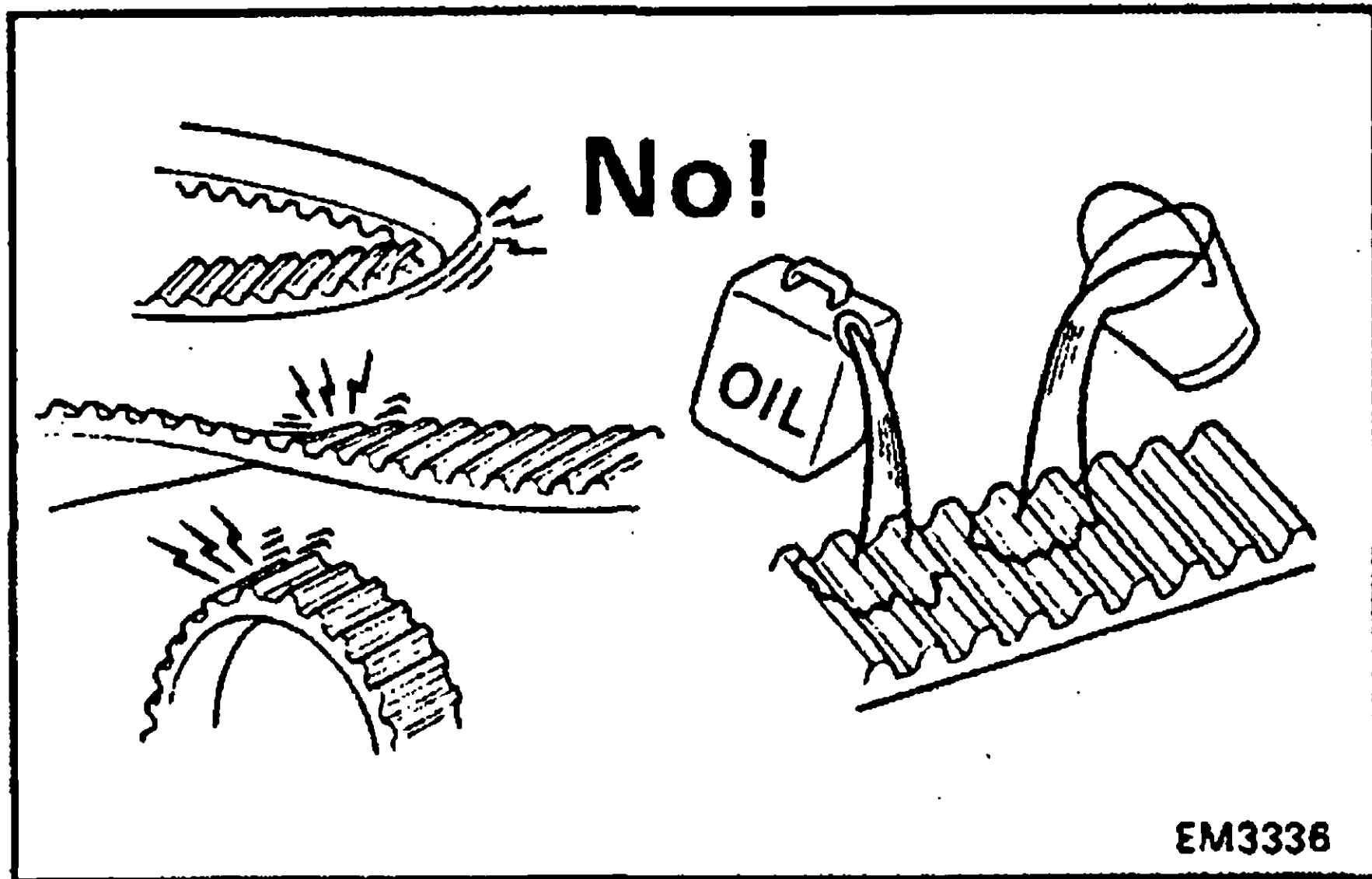
Using a 10 mm hexagon wrench, remove the pivot bolt, No.1 idler pulley and plate washer.

**18. REMOVE CRANKSHAFT TIMING PULLEY**

Remove crankshaft timing pulley.

HINT: If the pulley cannot be removed by hand, use SST and service bolt to remove the crankshaft timing pulley.

SST 09950-50010 (09951-05010, 09952-05010,
09953-05020, 09954-05010)



TIMING BELT INSPECTION

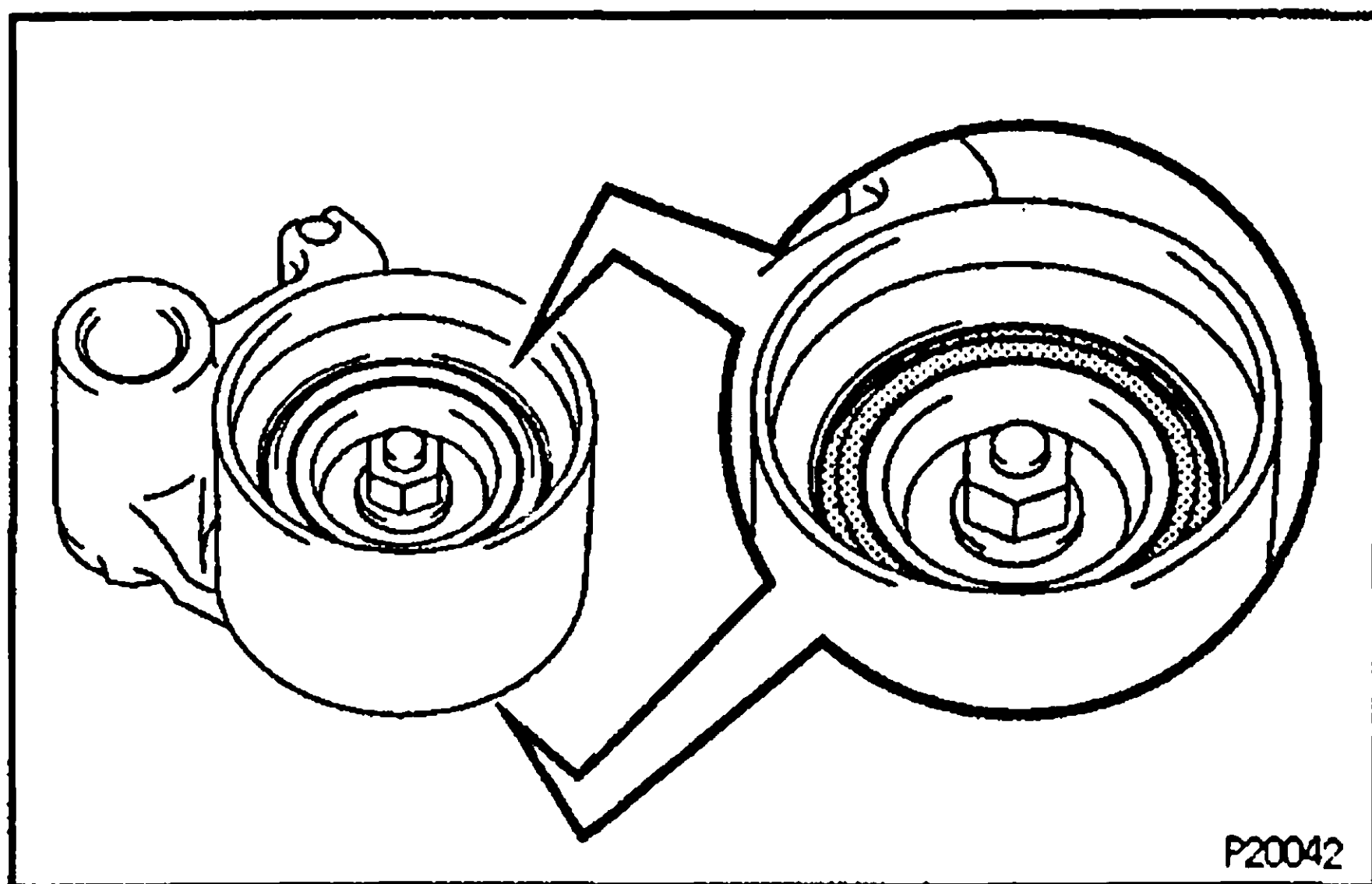
1. INSPECT TIMING BELT

NOTICE:

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

If there are any defects, as shown in the illustrations, check these points:

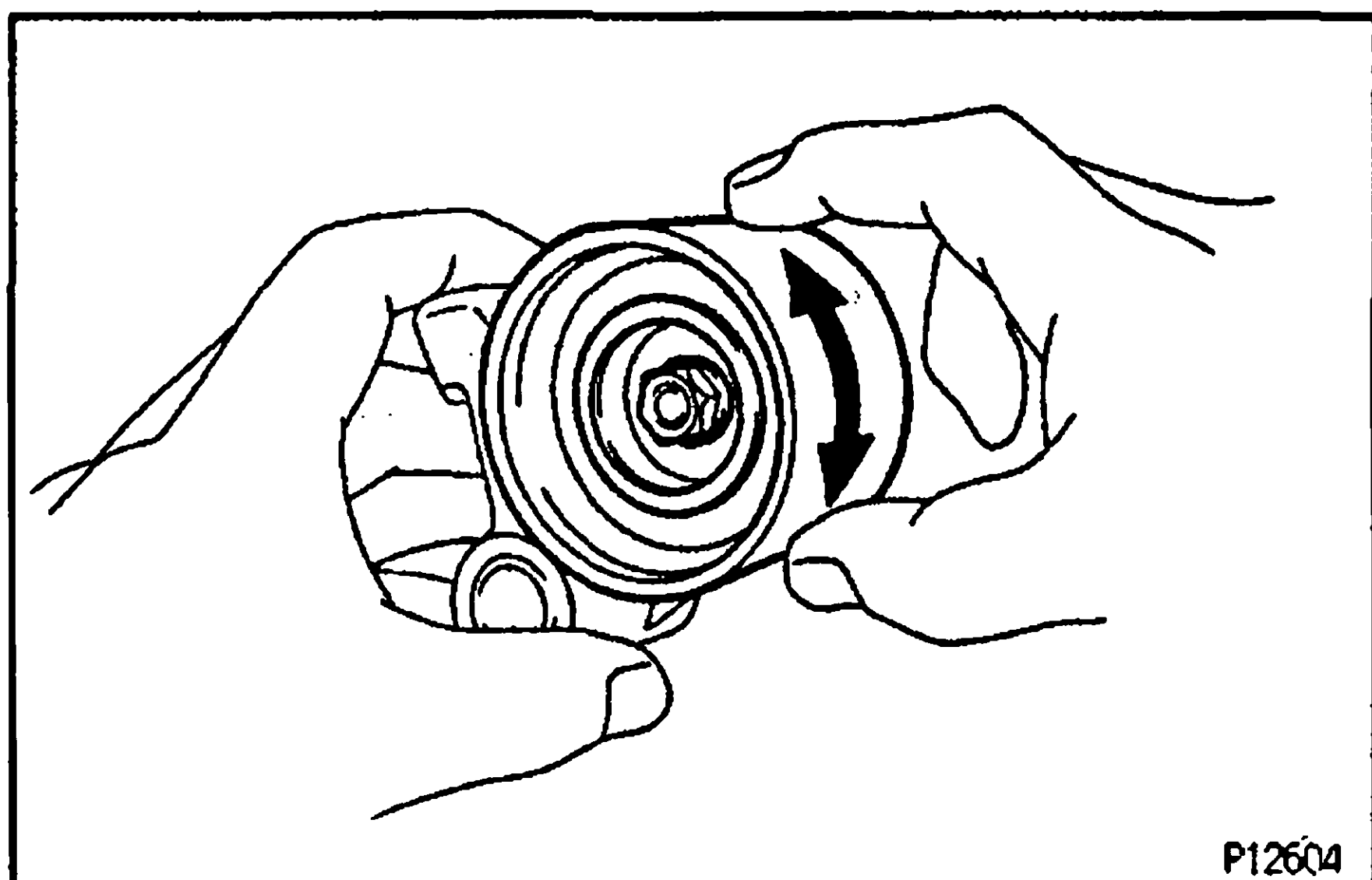
- Premature parting**
 - Check for proper installation.
 - Check the timing cover gasket for damage and proper installation.
 - If the belt teeth are cracked or damaged, check to see if either camshaft is locked.
 - If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.
 - If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.
 - If there is noticeable wear on the belt teeth, check the timing cover for damage, correct gasket installation, and for foreign material on the pulley teeth.
- If necessary, replace the timing belt.



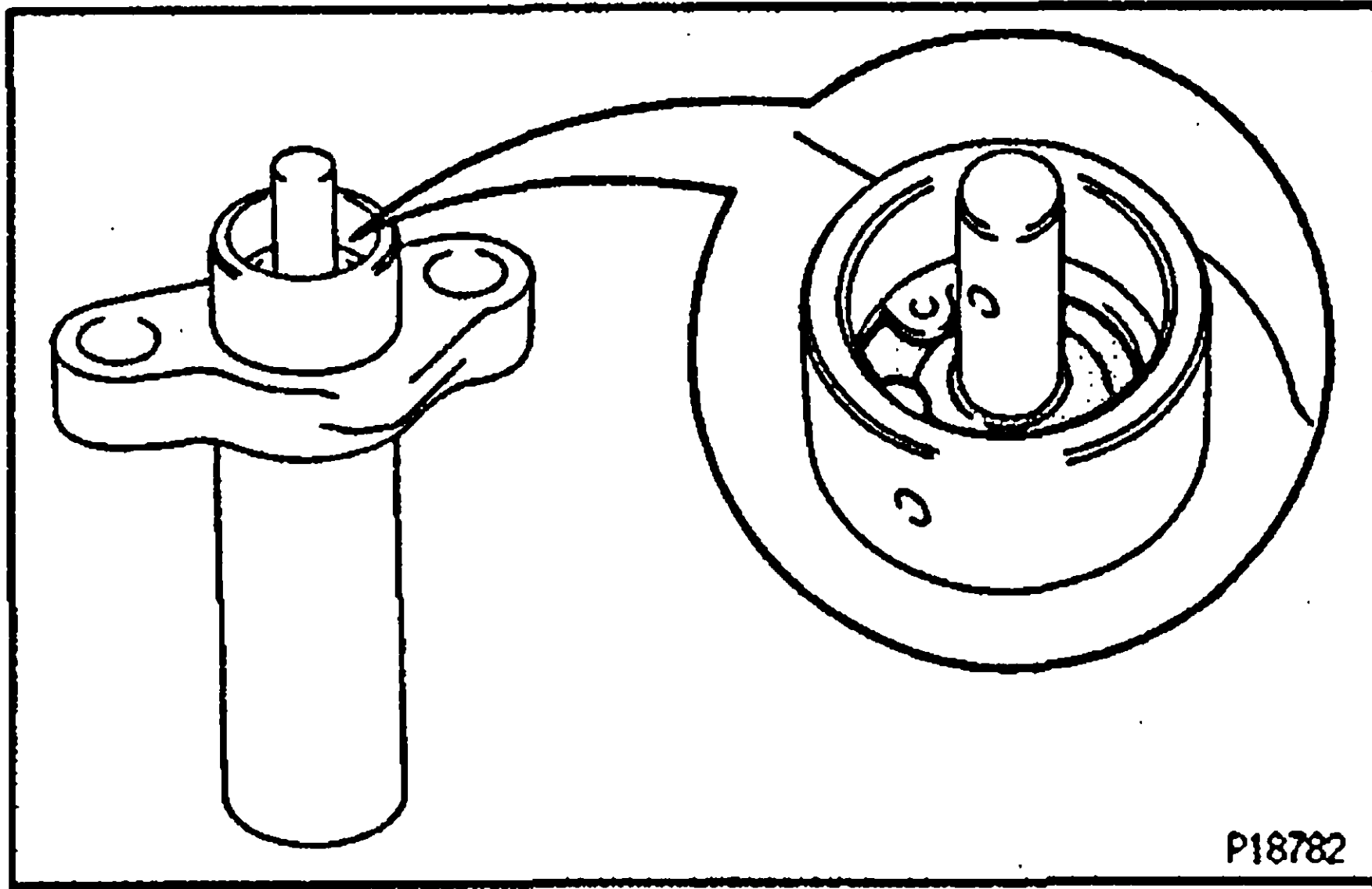
2. INSPECT IDLER PULLEYS

- Visually check the seal portion of the idler pulley for oil leakage.

If leakage is found, replace the idler pulley.



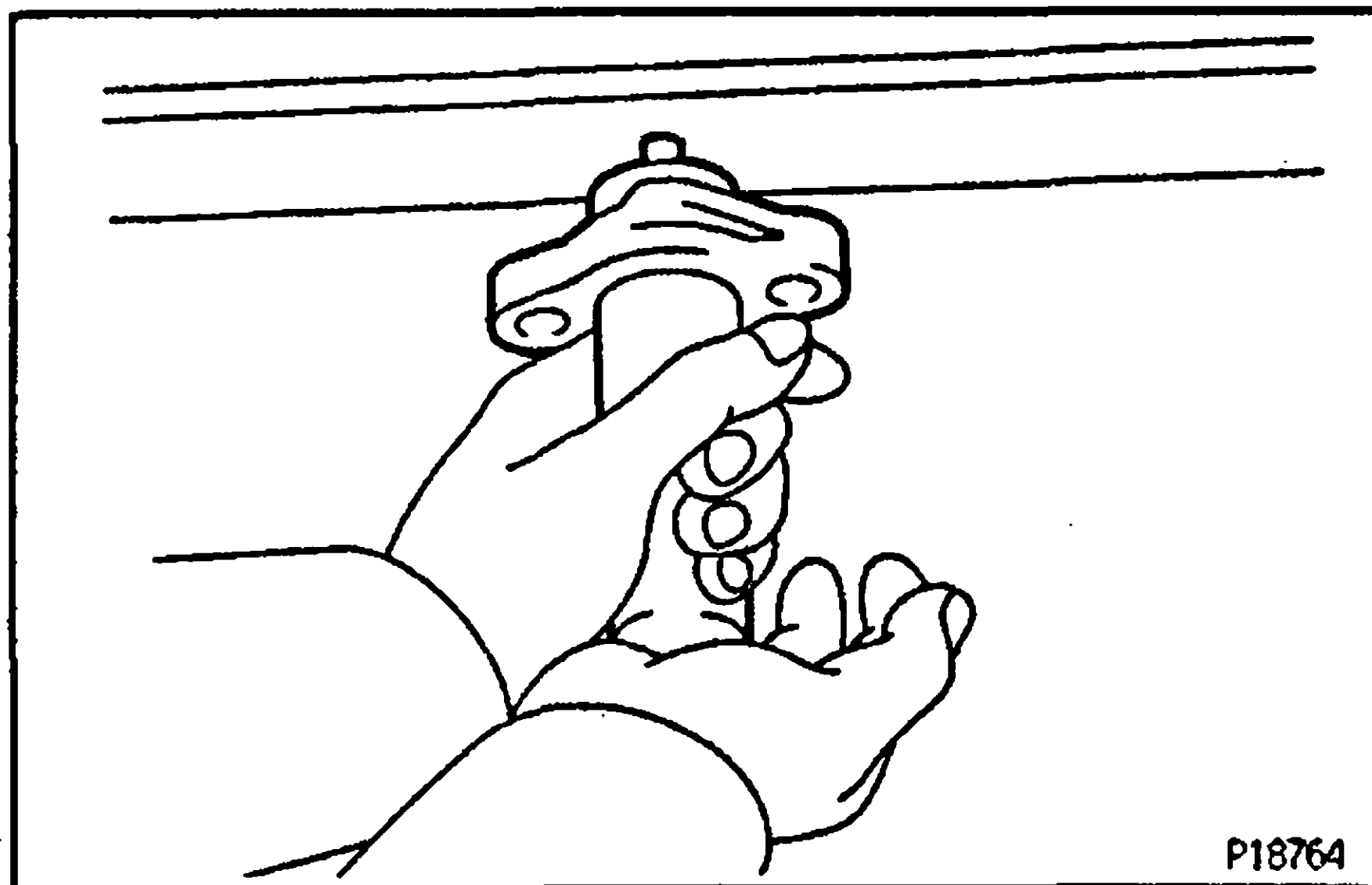
- Check that the idler pulley turns smoothly. If necessary, replace the idler pulley.



3. INSPECT TIMING BELT TENSIONER

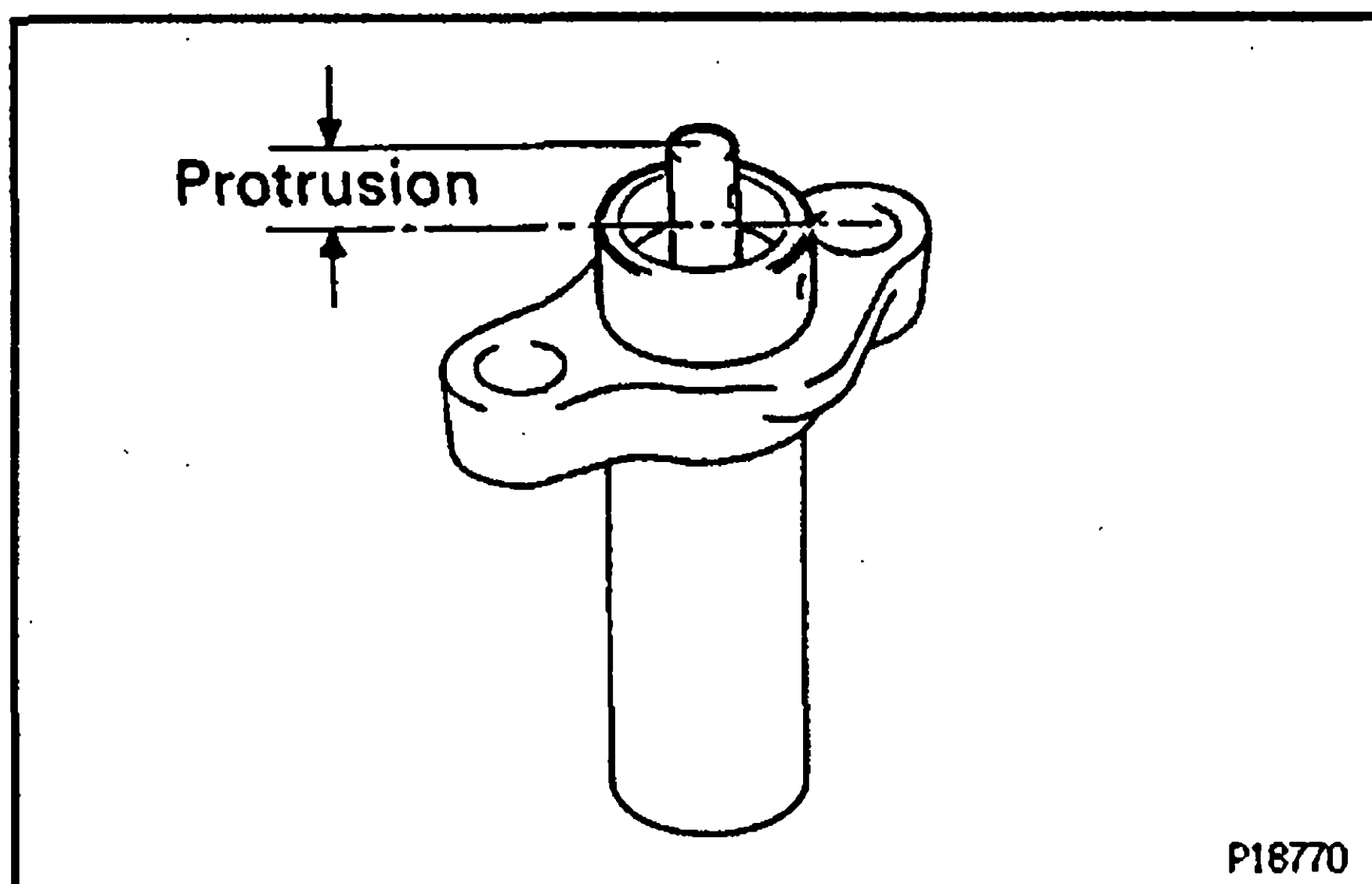
- (a) Visually check the seal portion of the tensioner for oil leakage.

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



- (b) Hold the tensioner with both hands and push the push rod strongly as shown to check that it doesn't move. If the push rod moves, replace the tensioner.

NOTICE: Never hold the tensioner push rod facing downward.

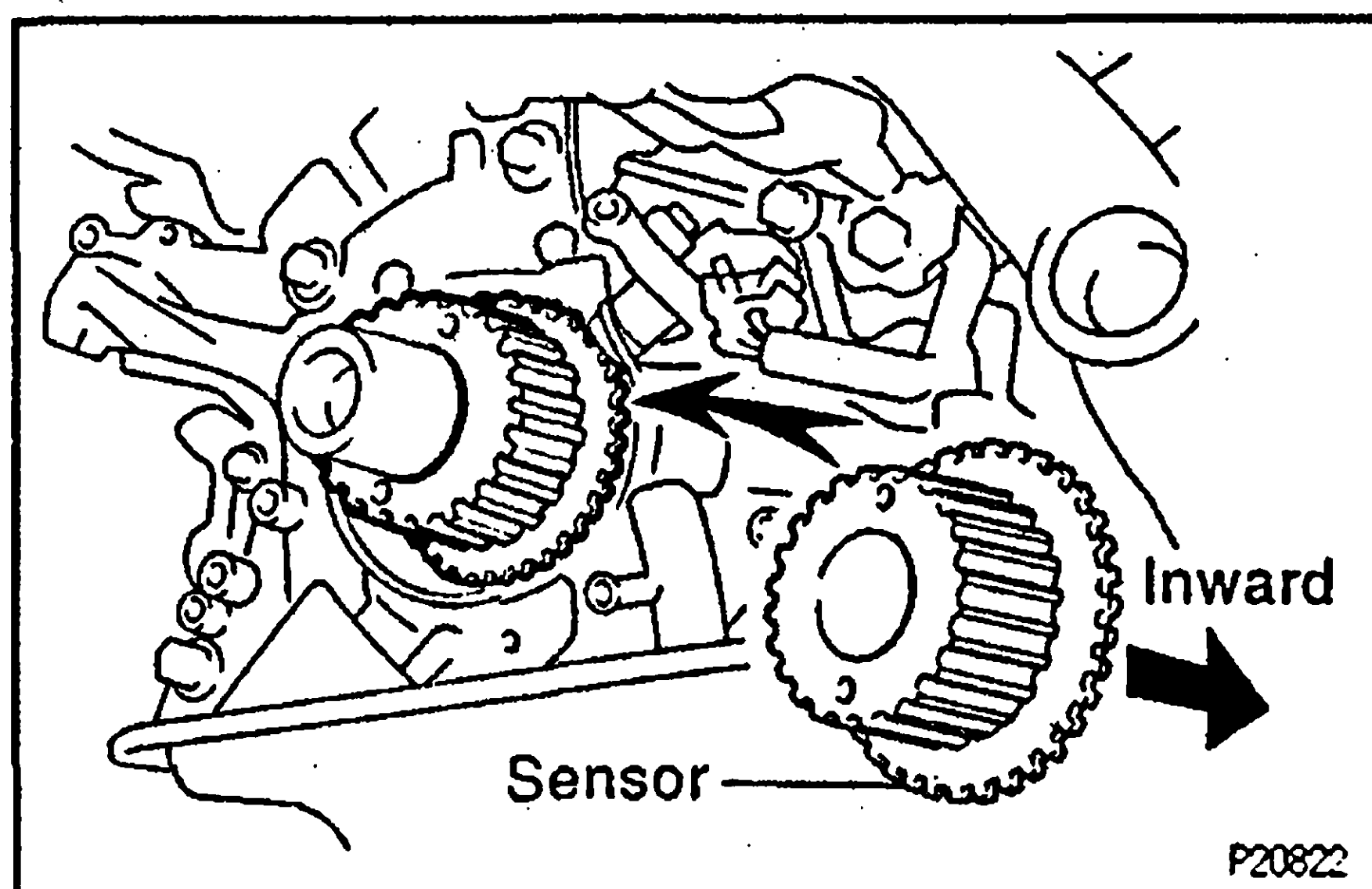


- (c) Measure the protrusion of the push rod from the housing end.

Protrusion:

10.0 – 10.8 mm (0.394 – 0.425 in.)

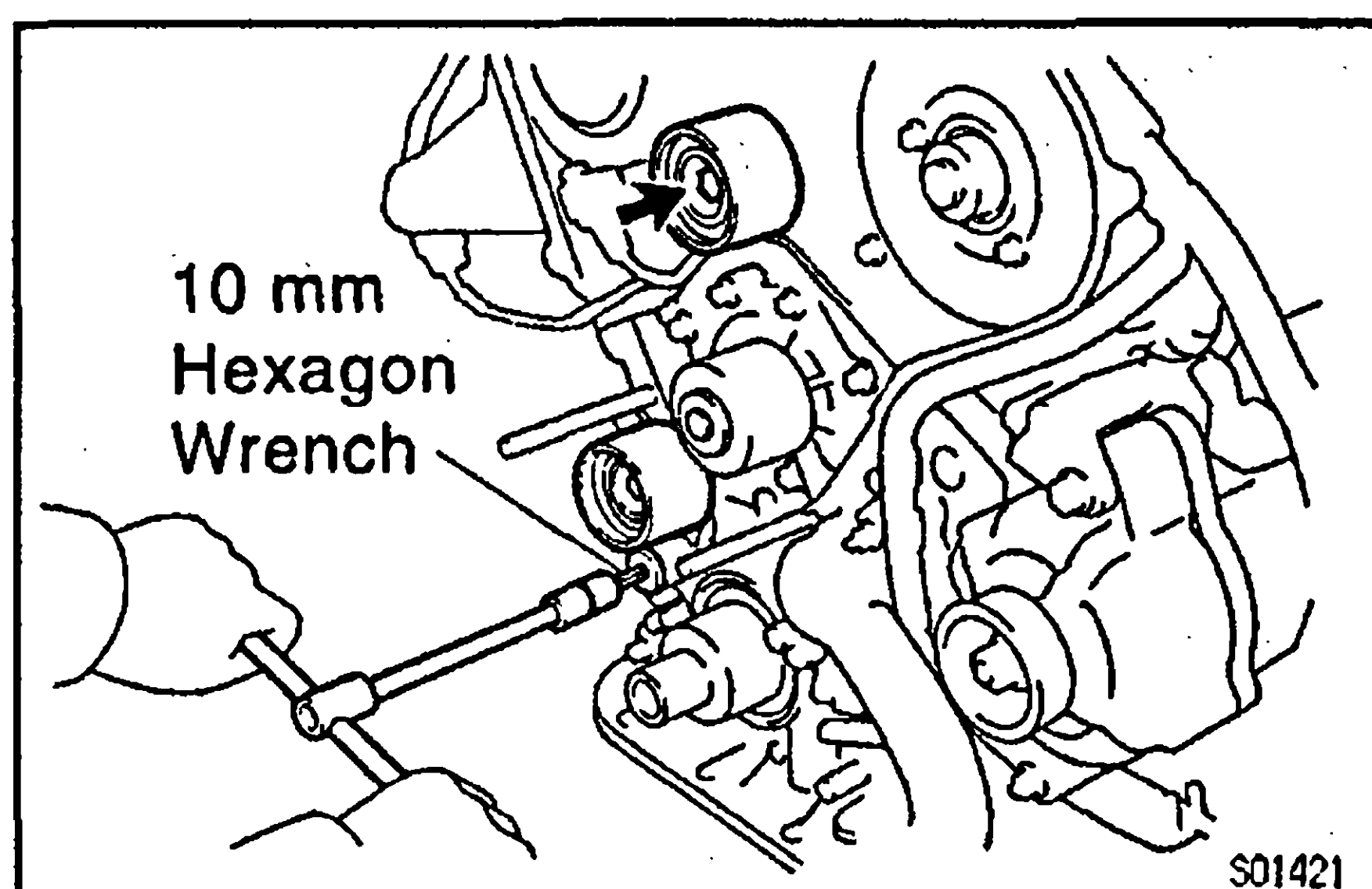
If the protrusion is not as specified, replace the tensioner.



TIMING BELT INSTALLATION

1. INSTALL CRANKSHAFT TIMING PULLEY

- (a) Align the pulley set key with the key groove of the timing pulley and slide on the timing pulley.
- (b) Slide on the timing pulley, facing the flange side inward.

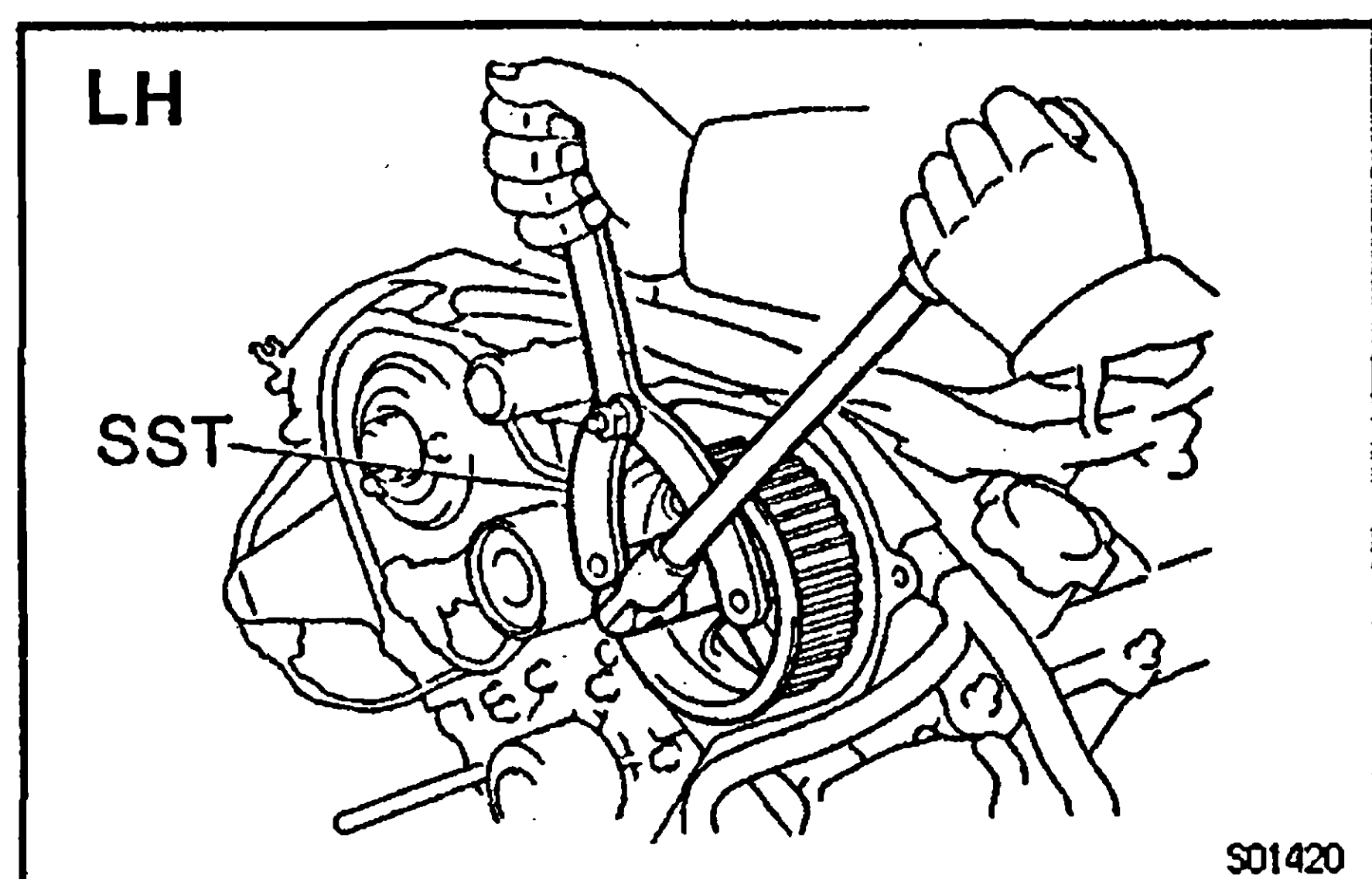


2. INSTALL NO.1 IDLER PULLEY

- (a) Using a 10 mm hexagon wrench, install the No.1 idler pulley with the plate washer and bolt.
- Torque: 35 N·m (350 kgf·cm, 26 ft·lbf)**
- (b) Check that the pulley bracket moves smoothly.

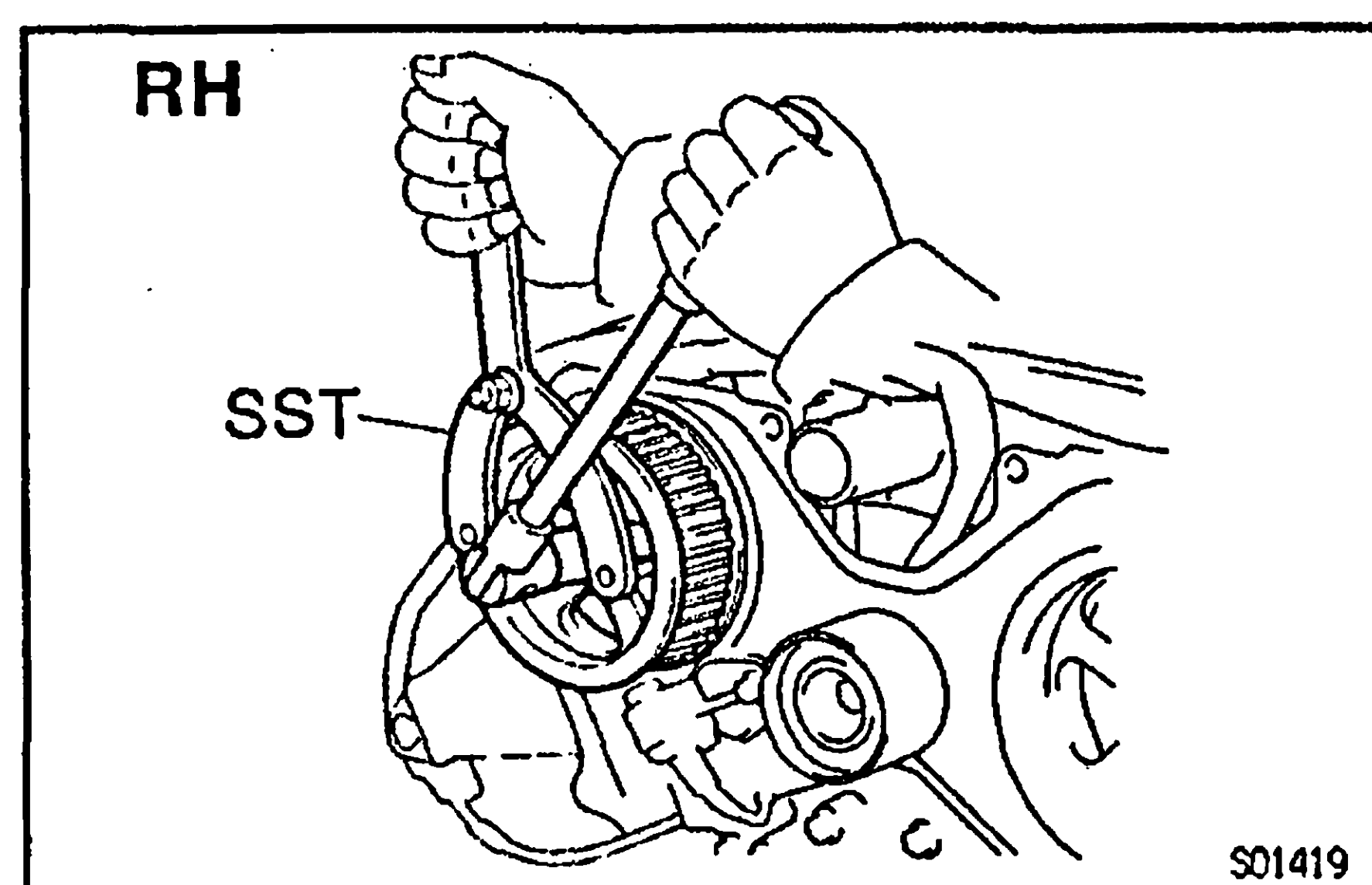
3. INSTALL NO.2 IDLER PULLEY

- (a) Install the No.2 idler pulley with the bolt.
- Torque: 40 N·m (400 kgf·cm, 30 ft·lbf)**
- (b) Check that the No.2 idler pulley moves smoothly.



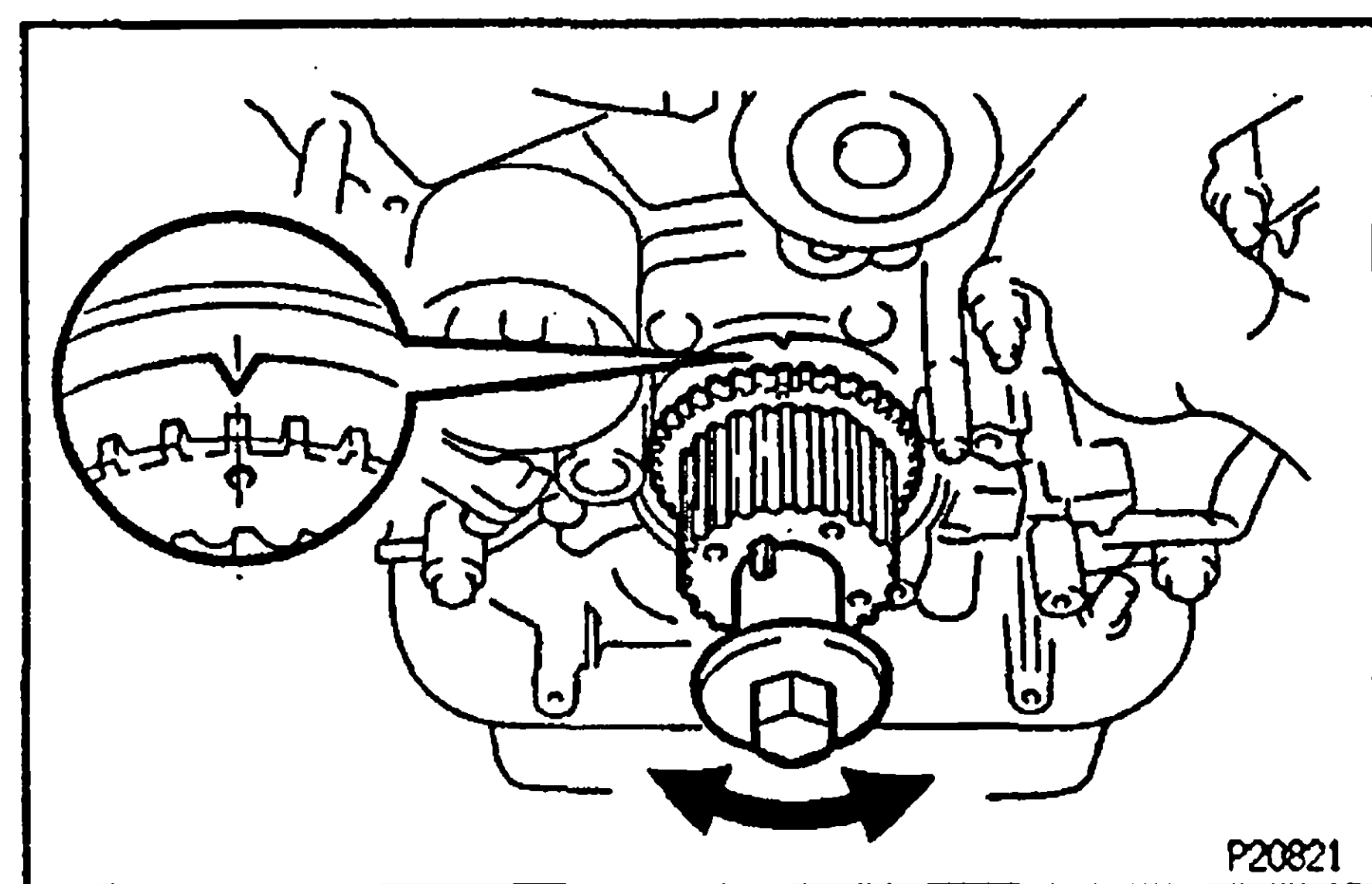
4. INSTALL LH CAMSHAFT TIMING PULLEY

- Face the flange side of the timing pulley outward.
- Align the knock pin on the camshaft with the knock pin groove of the timing pulley, and slide on the timing pulley.
- Using SST, install the pulley bolt.
SST 09960-10010 (09962-01000, 09963-01000)
Torque: 110 N·m (1,100 kgf·cm, 81 ft·lbf)



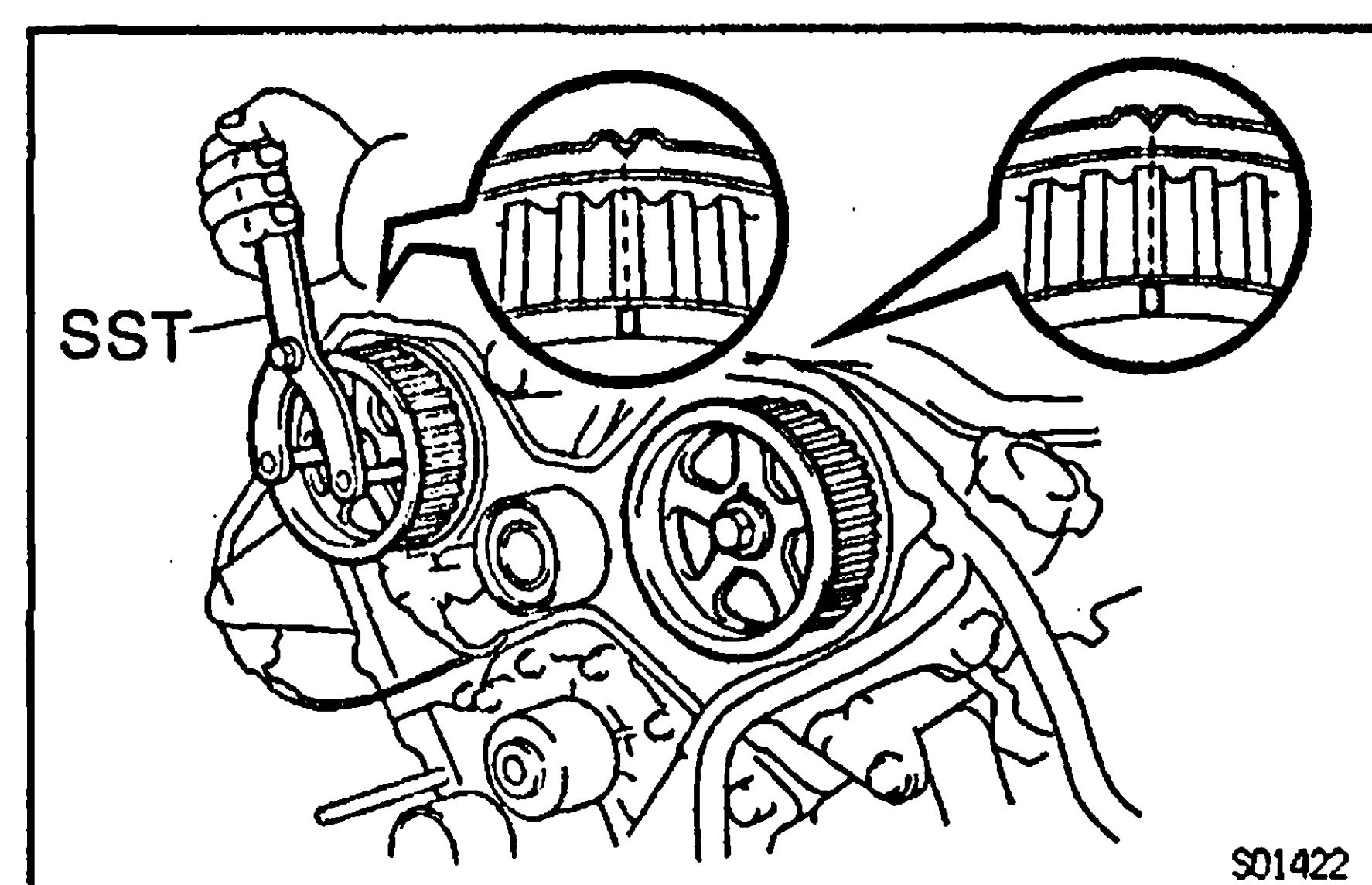
5. INSTALL RH CAMSHAFT TIMING PULLEY

- Face the flange side of the timing pulley outward.
- Align the knock pin on the camshaft with the knock pin groove of the timing pulley, and slide on the timing pulley.
- Using SST, install the pulley bolt.
SST 09960-10010 (09962-01000, 09963-01000)
Torque: 110 N·m (1,100 kgf·cm, 81 ft·lbf)

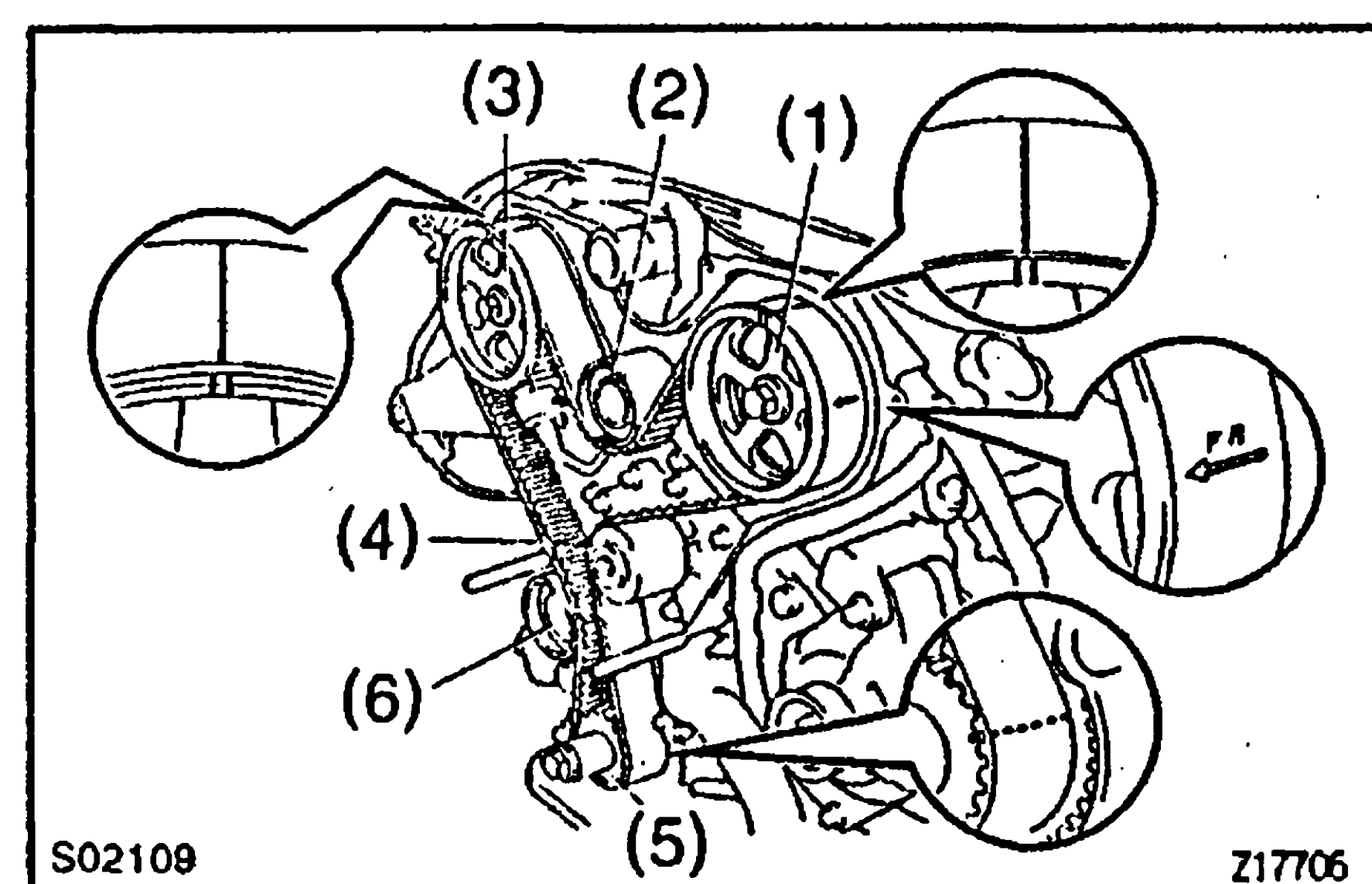


6. SET NO.1 CYLINDER TO TDC/COMPRESSION

- Crankshaft Timing Pulley Position:
 - Temporarily install the crankshaft pulley bolt to the crankshaft.
 - Turn the crankshaft, and align the timing marks of the crankshaft timing pulley and oil pump body.



- Camshaft Timing Pulley Positions:
Using SST, turn the camshaft pulley, align the timing marks of the timing pulley and No.3 timing belt cover.
SST 09960-10010 (09962-01000, 09963-01000)



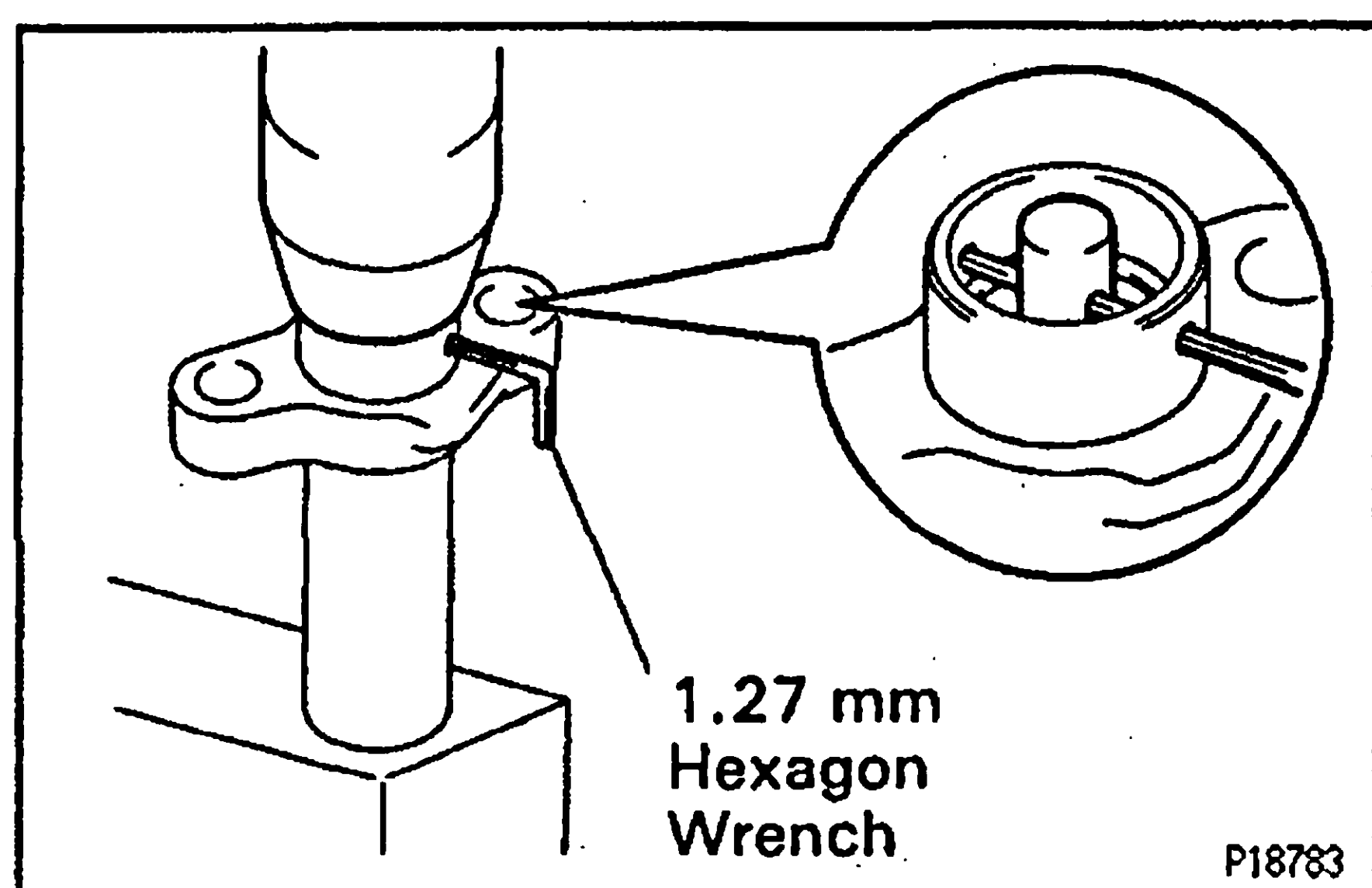
7. INSTALL TIMING BELT

NOTICE: The engine should be cold.

- Remove any oil or water on the pulleys, and keep them clean.
NOTICE: Only wipe the pulleys; do not use any cleansing agent.
- Face the front mark on the timing belt forward.
- Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.

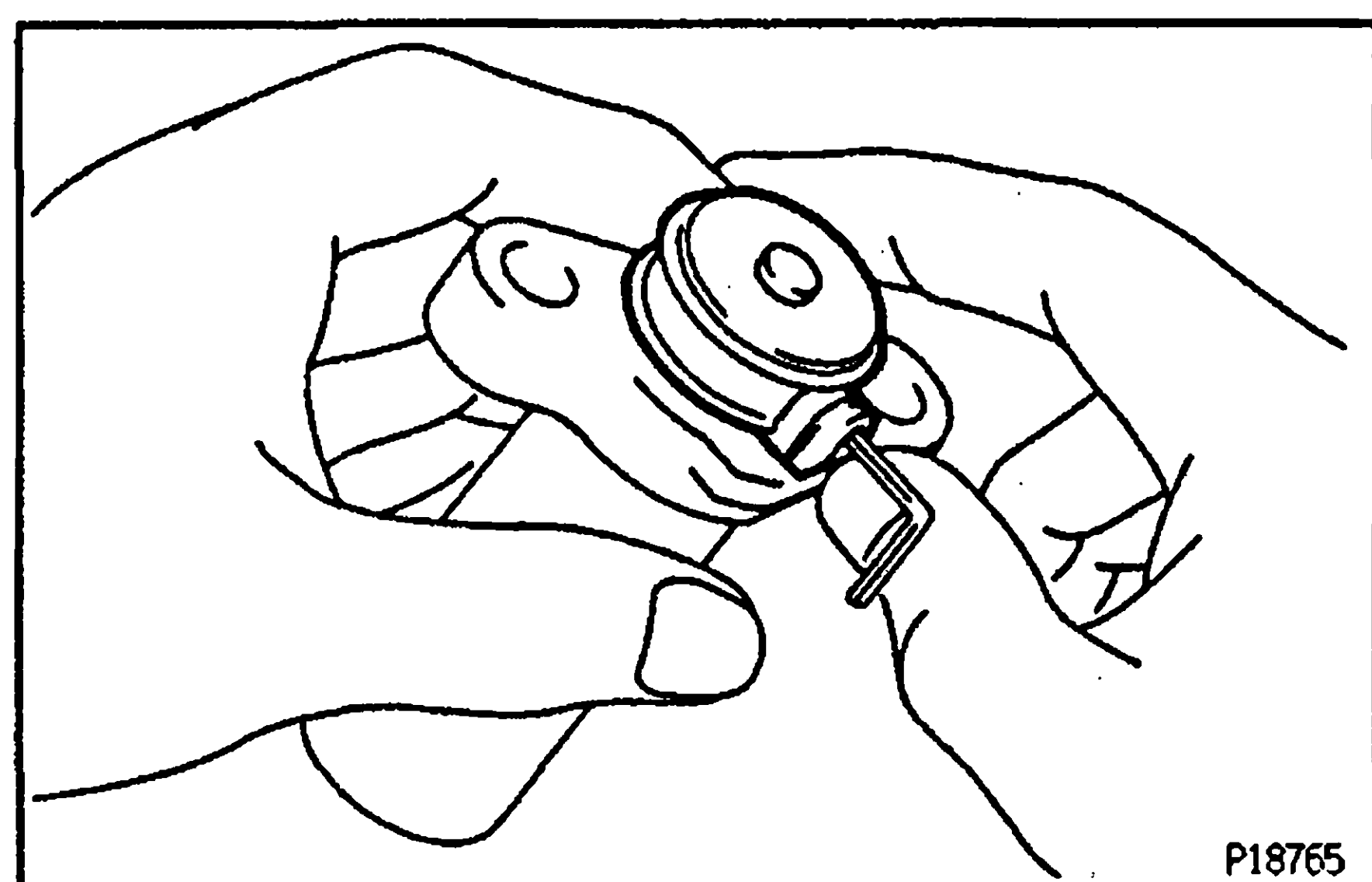
- (d) Align the installation marks on the timing belt with the timing marks of the camshaft timing pulleys.
- (e) Install the timing belt in this order:
 - (1) LH camshaft timing pulley
 - (2) No.2 idler pulley
 - (3) RH camshaft timing pulley
 - (4) Water pump pulley
 - (5) Crankshaft timing pulley
 - (6) No.1 idler pulley

EG

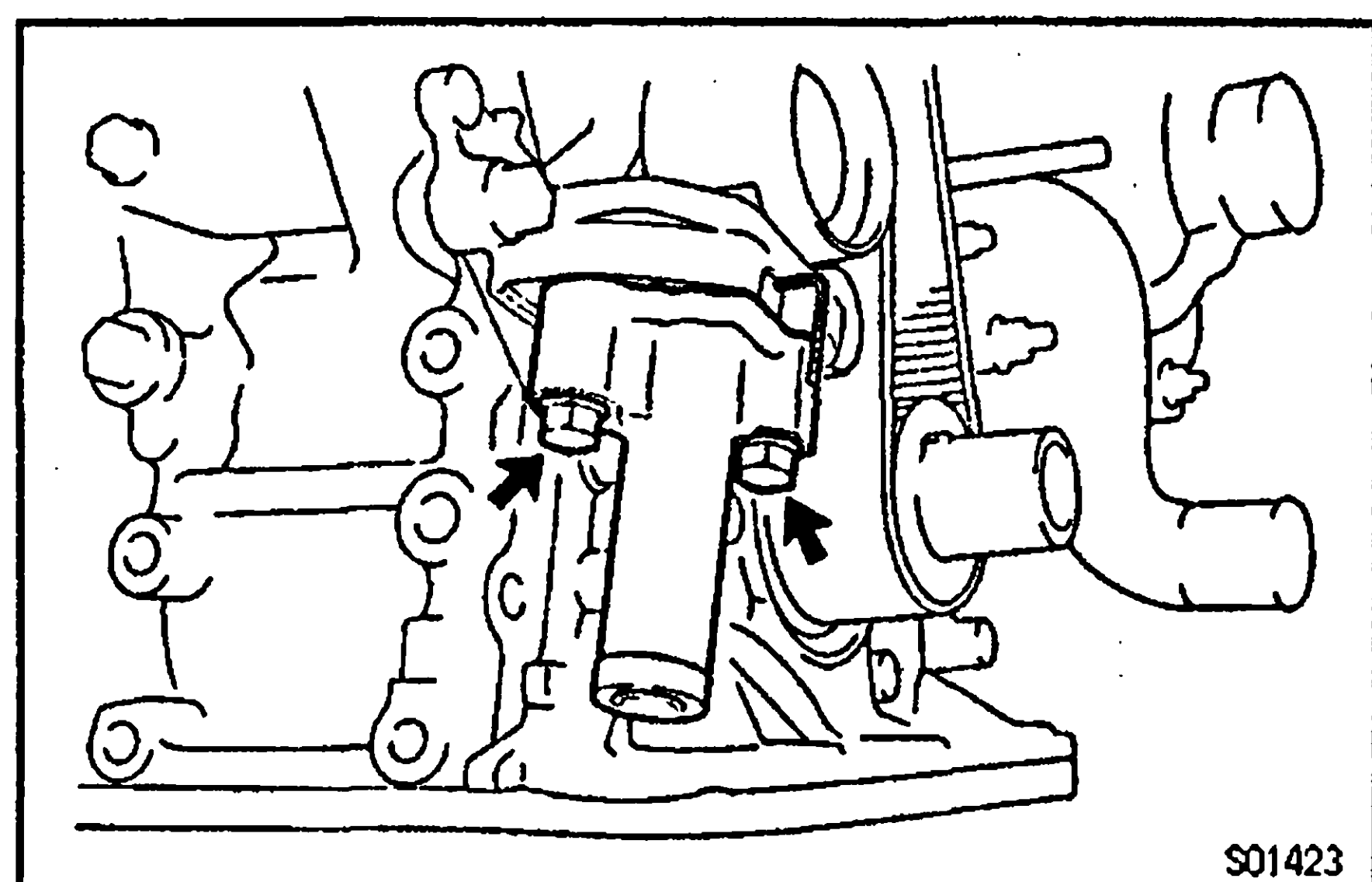


8. SET TIMING BELT TENSIONER

- (a) Using a press, slowly press in the push rod using 981 – 9,807 N (100 – 1,000 kgf, 200 – 2,205 lbf) of pressure.
- (b) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
- (c) Release the press.



- (d) Install the dust boot to the tensioner.

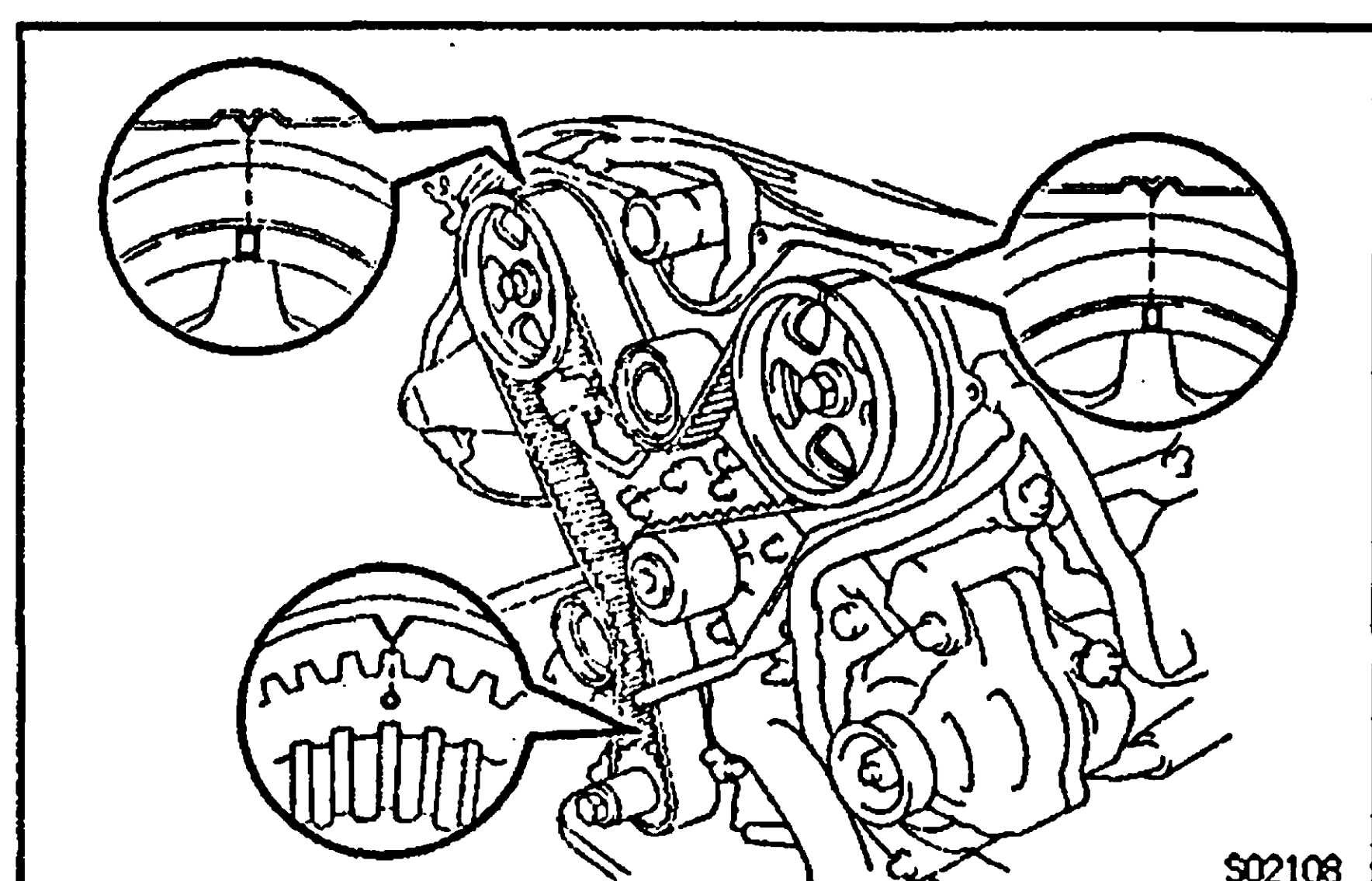


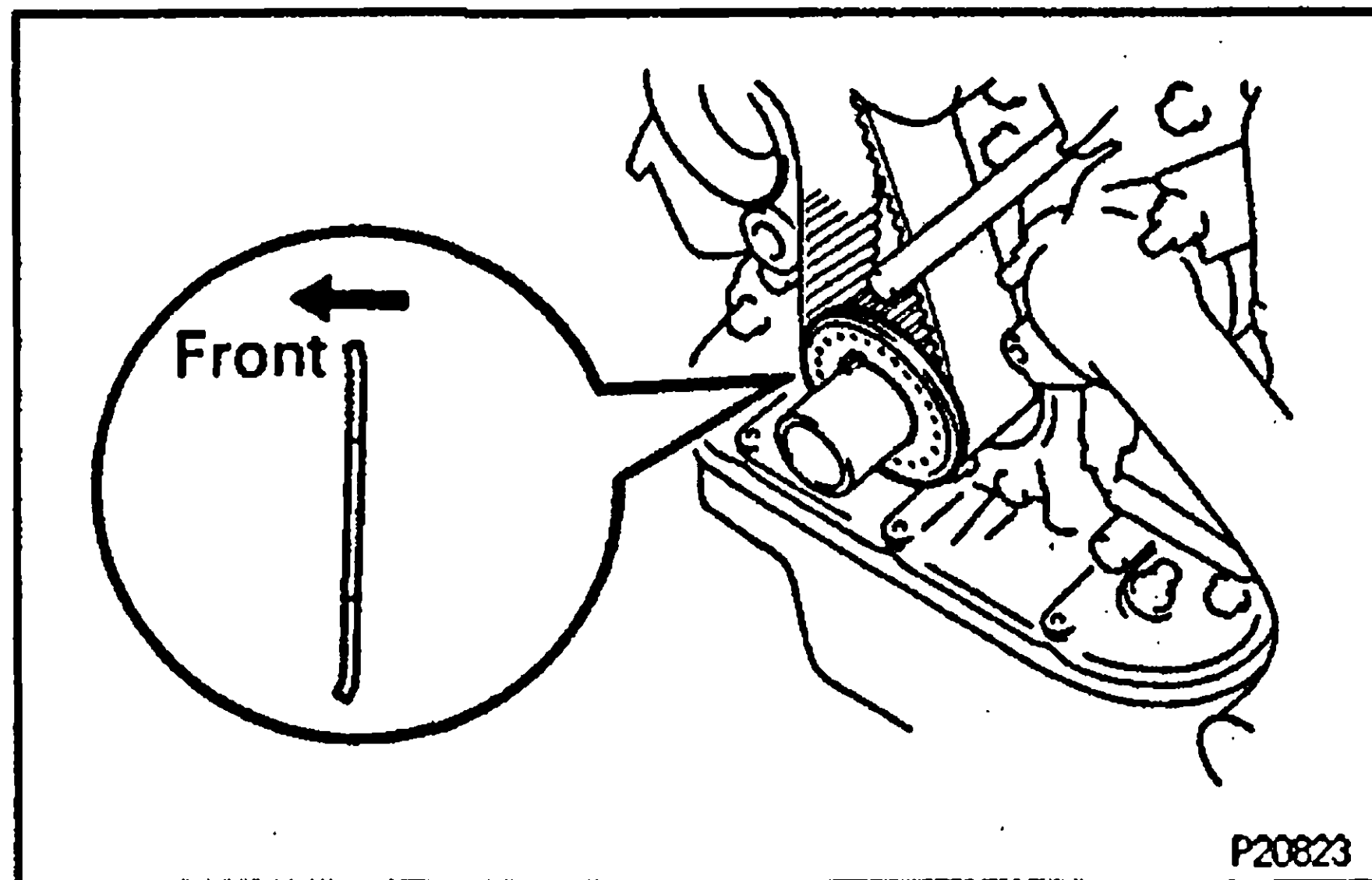
9. INSTALL TIMING BELT TENSIONER

- (a) Temporarily install the tensioner with the 2 bolts.
- (b) Alternately tighten the 2 bolts.
Torque: 27 N·m (280 kgf·cm, 20 ft·lbf)
- (c) Remove the 1.27 mm hexagon wrench from the tensioner.

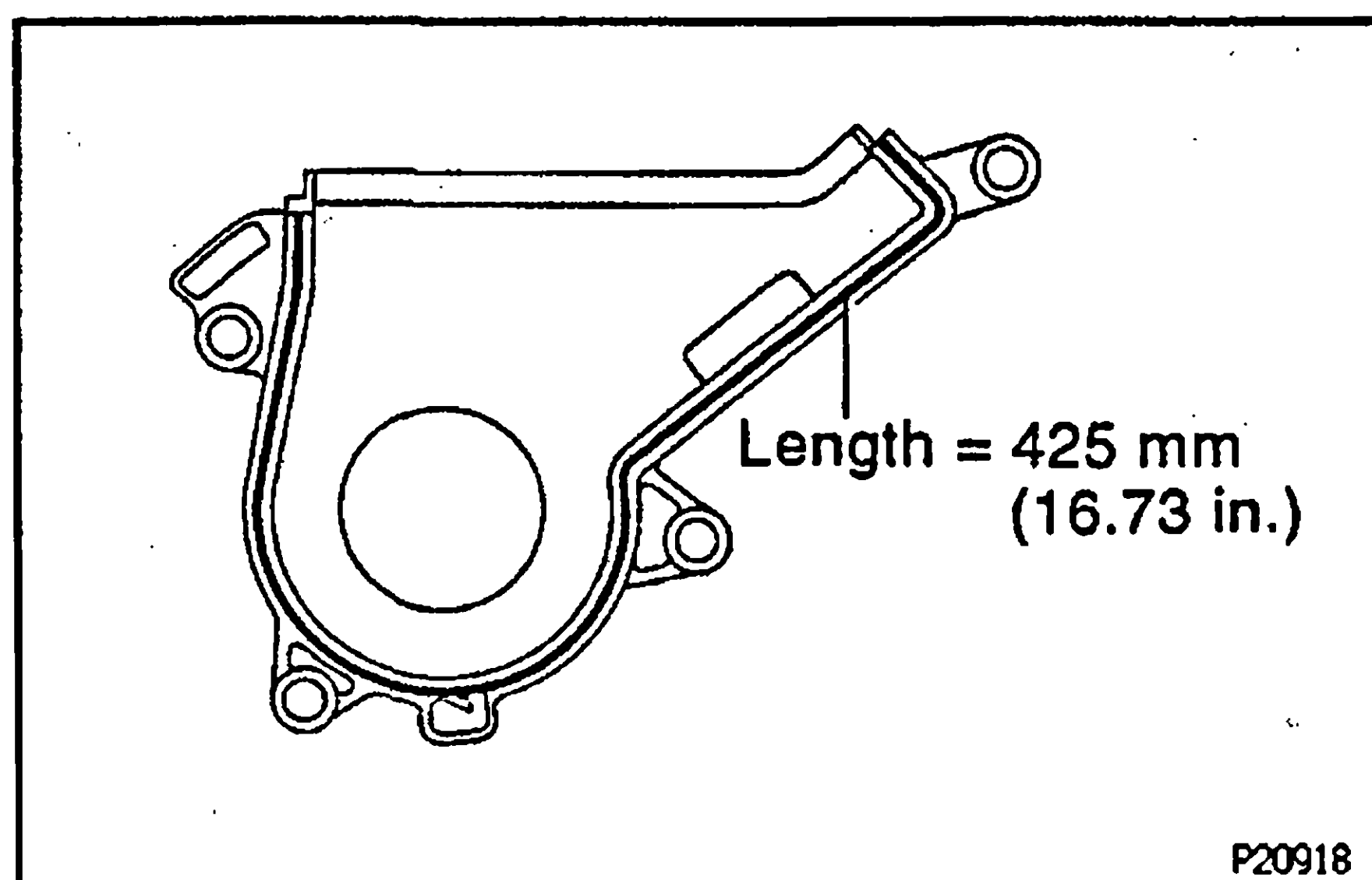
10. CHECK VALVE TIMING

- (a) Turn the crankshaft, and align the timing marks of the crankshaft timing pulley and oil pump body.
NOTICE: Always turn the crankshaft clockwise.
- (b) Check that the timing marks of the RH and LH timing pulleys with the timing marks of the No.3 timing belt cover as shown in the illustration.
If the marks do not align, remove the timing belt and reinstall it.
- (c) Remove the crankshaft pulley bolt.



**11. INSTALL TIMING BELT GUIDE**

Install the guide, facing the cup side outward.

**12. INSTALL NO.1 TIMING BELT COVER AND STARTER WIRE BRACKET**

- (a) Check that the timing belt cover gaskets have cracks or peeling, etc.

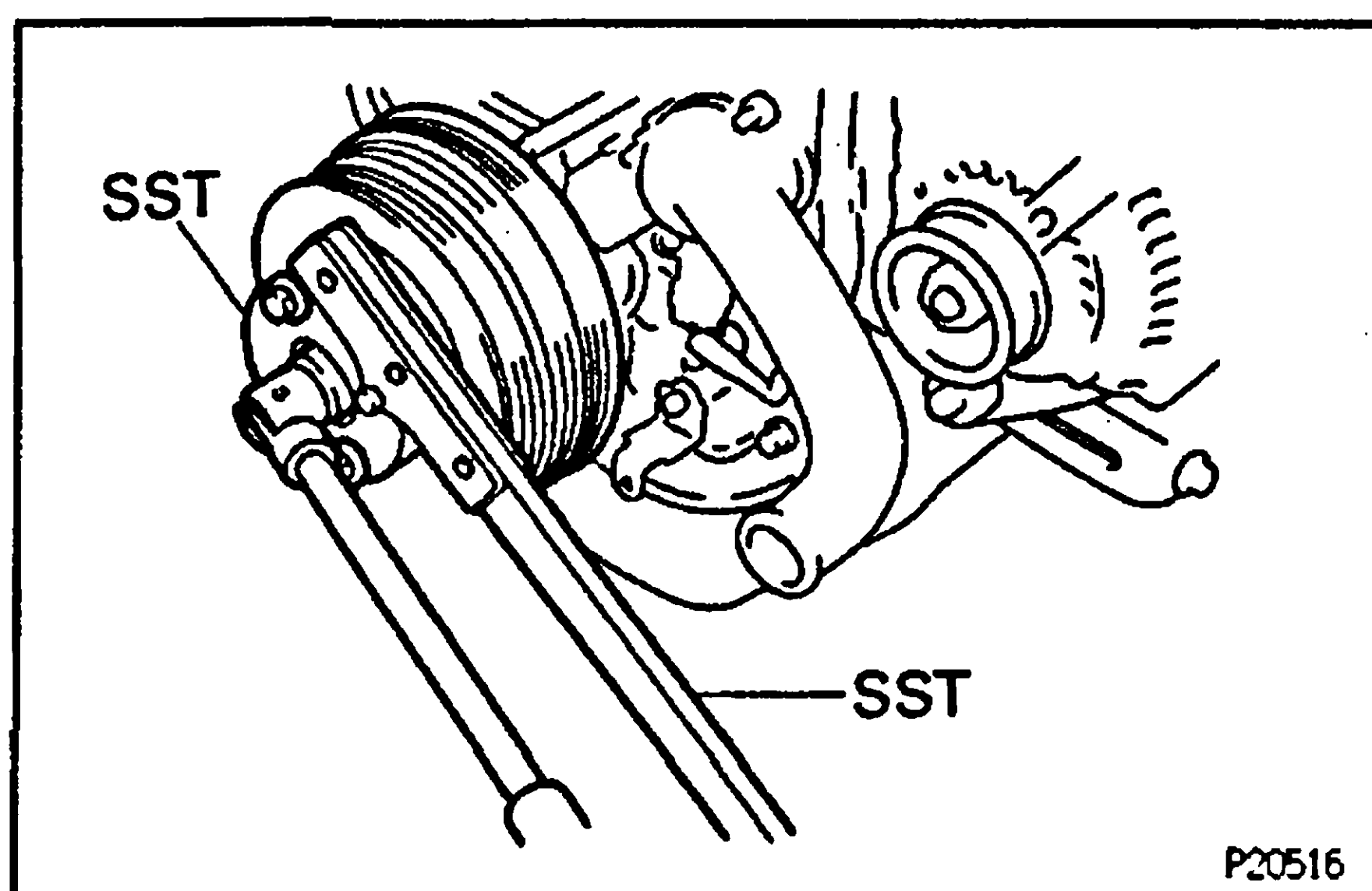
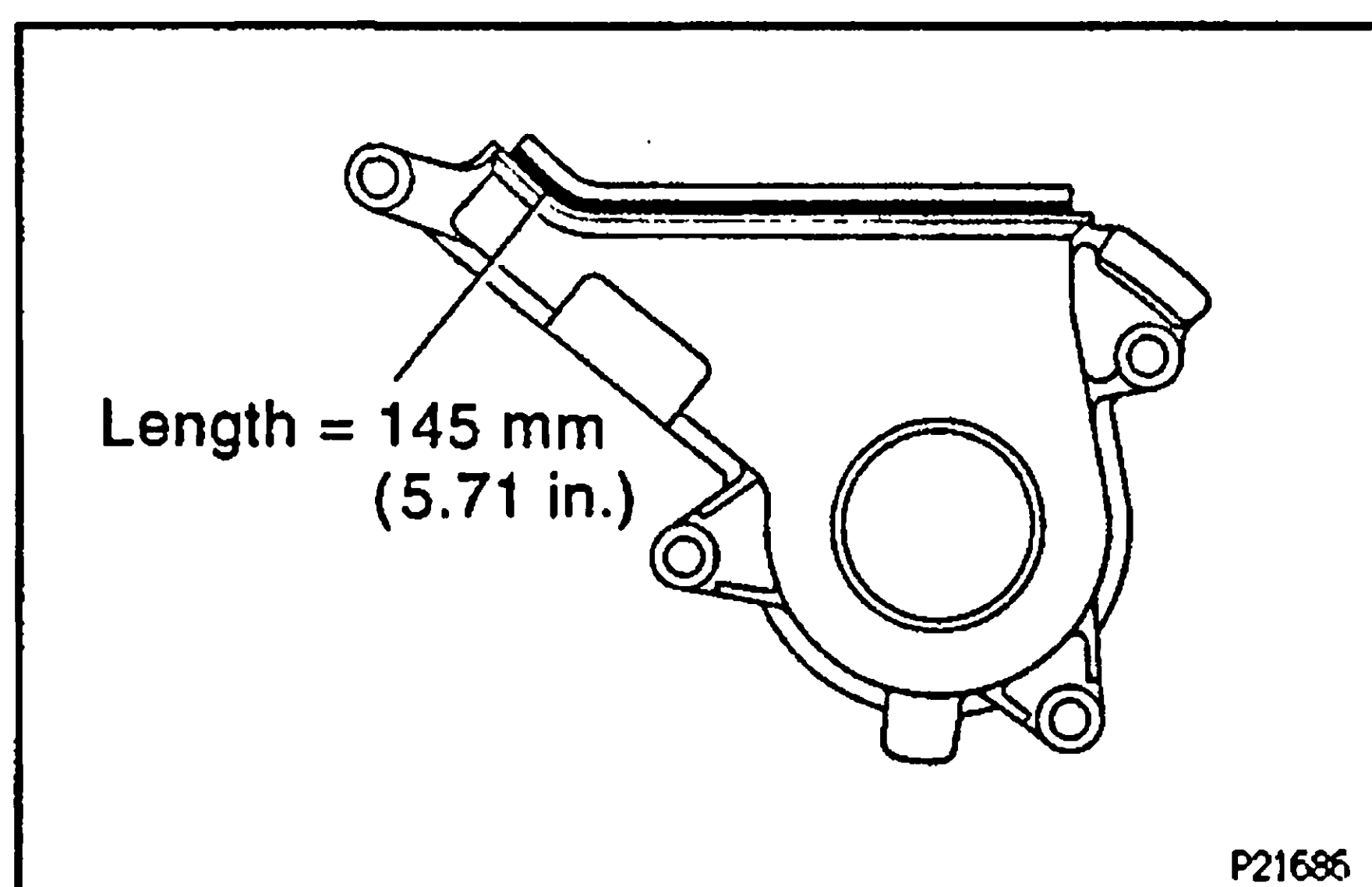
If the gasket does have cracks or peeling, etc., replace it using following steps.

- Using a screwdriver and gasket scraper, remove all the old gasket material.
- Thoroughly clean all components to remove all the loose material.
- Remove the backing paper from a new gasket and install the gasket evenly to the part of the belt cover shaded back in the illustration.

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

Torque: 9 N·m (90 kgf·cm, 80 in.-lbf)

- (c) Install the starter wire bracket with the 2 bolts.

**13. INSTALL CRANKSHAFT PULLEY**

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

- (b) Using SST, install and torque the bolt.

SST 09213-54015 (90119-08216),
09330-00021

Torque: 250 N·m (2,500 kgf·cm, 184 ft·lbf)

**14. INSTALL FAN BRACKET**

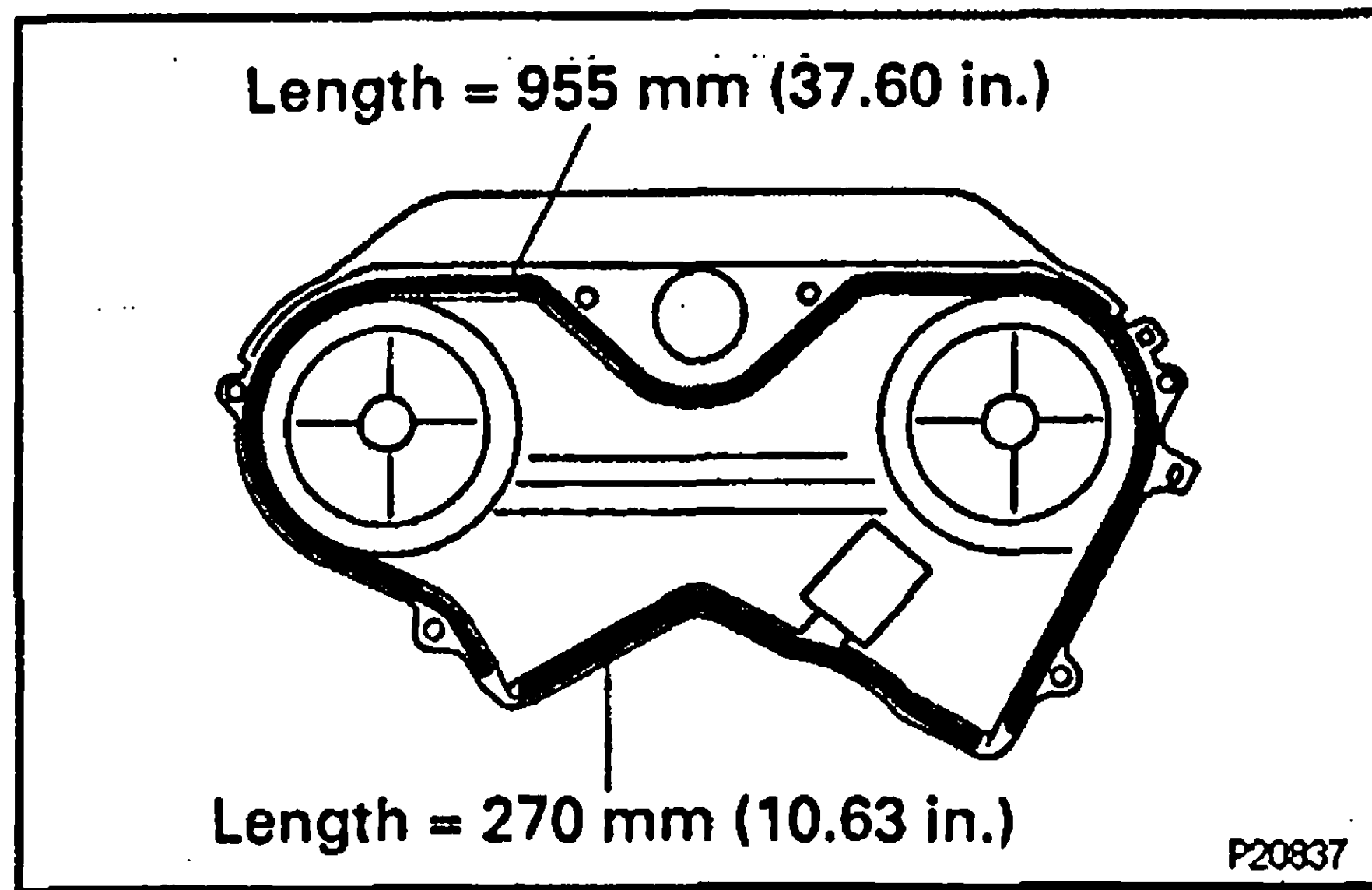
- (a) Install the fan bracket with the bolt and nut.

- (b) Install the PS pump adjusting strut with the nut.

15. INSTALL NO.2 TIMING BELT COVER

- (a) Check that the timing belt cover gasket has no cracks or peeling, etc.

If the gasket does have cracks or peeling, etc., replace it using following steps.



- Using a screwdriver and gasket scraper, remove all the old gasket material.
- Thoroughly clean all components to remove all the loose material.
- Remove the backing paper from a new gasket and install the gasket evenly to the part of the belt cover shaded black in the illustration.

(b) Install the belt cover with the 6 bolts.

Torque: 9 N·m (90 kgf·cm, 80 in.-lbf)

(c) Connect the 4 high-tension cord clamps and camshaft position sensor connector to the No.2 timing belt cover.

16. INSTALL OIL DIPSTICK AND GUIDE

(a) Install a new O-ring to the dipstick guide.

(a) Apply soapy water to the O-ring.

(c) Install the oil dipstick and guide to the cylinder block.

(d) Install the bolt to the generator bracket.

Torque: 8 N·m (80 kgf·cm, 71 in.-lbf)

17. TEMPORARILY INSTALL FAN WITH FLUID COUPLING AND FAN PULLEYS

18. INSTALL AND ADJUST DRIVE BELT FOR ALTERNATOR

(See on-vehicle inspection in Charging System)

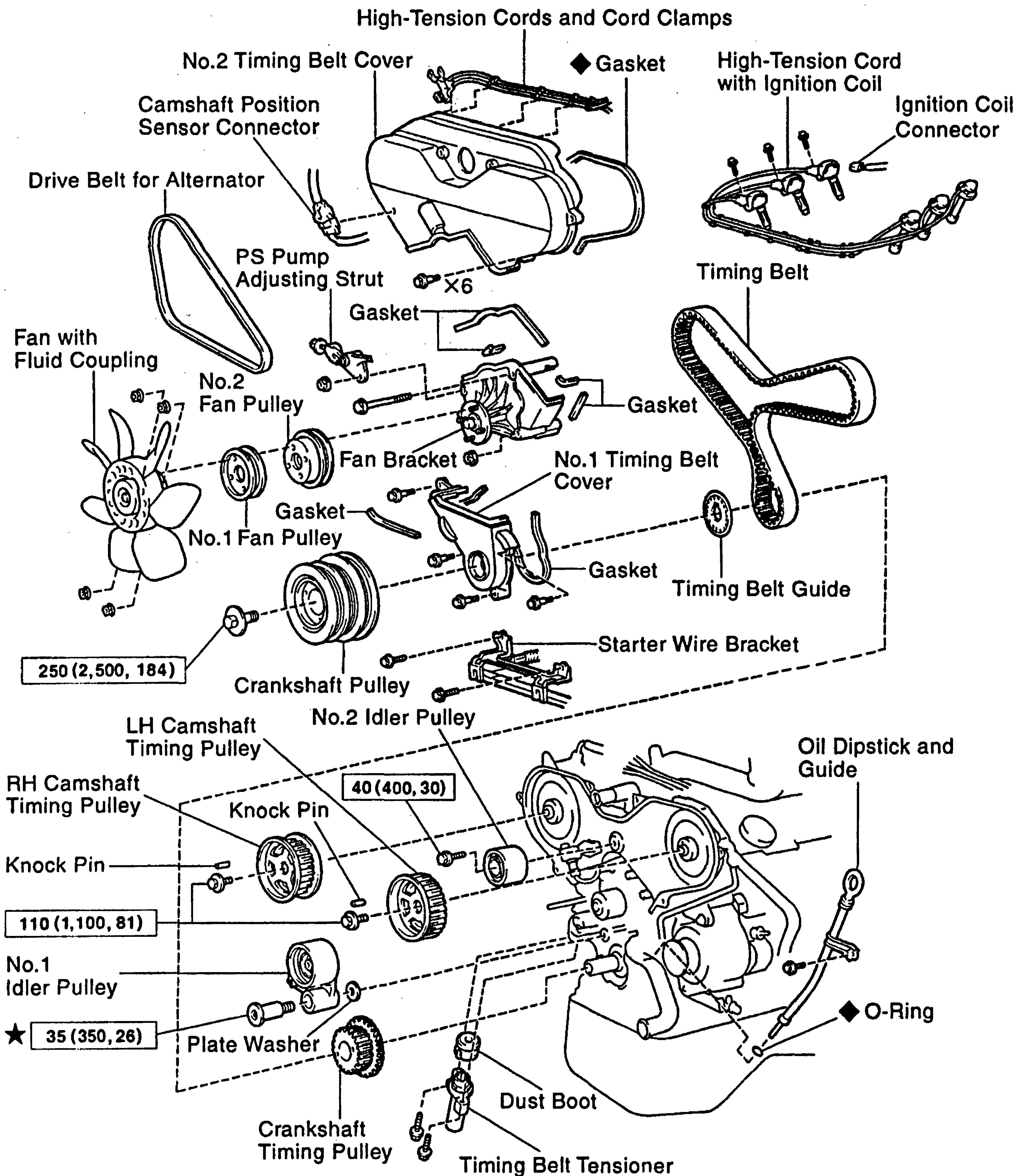
19. TIGHTEN FAN WITH FLUID COUPLING AND FAN PULLEYS

Torque: 5.4 N·m (54 kgf·cm, 48 in.-lbf)

CYLINDER HEAD COMPONENTS REMOVAL AND INSTALLATION

EQ79W-01

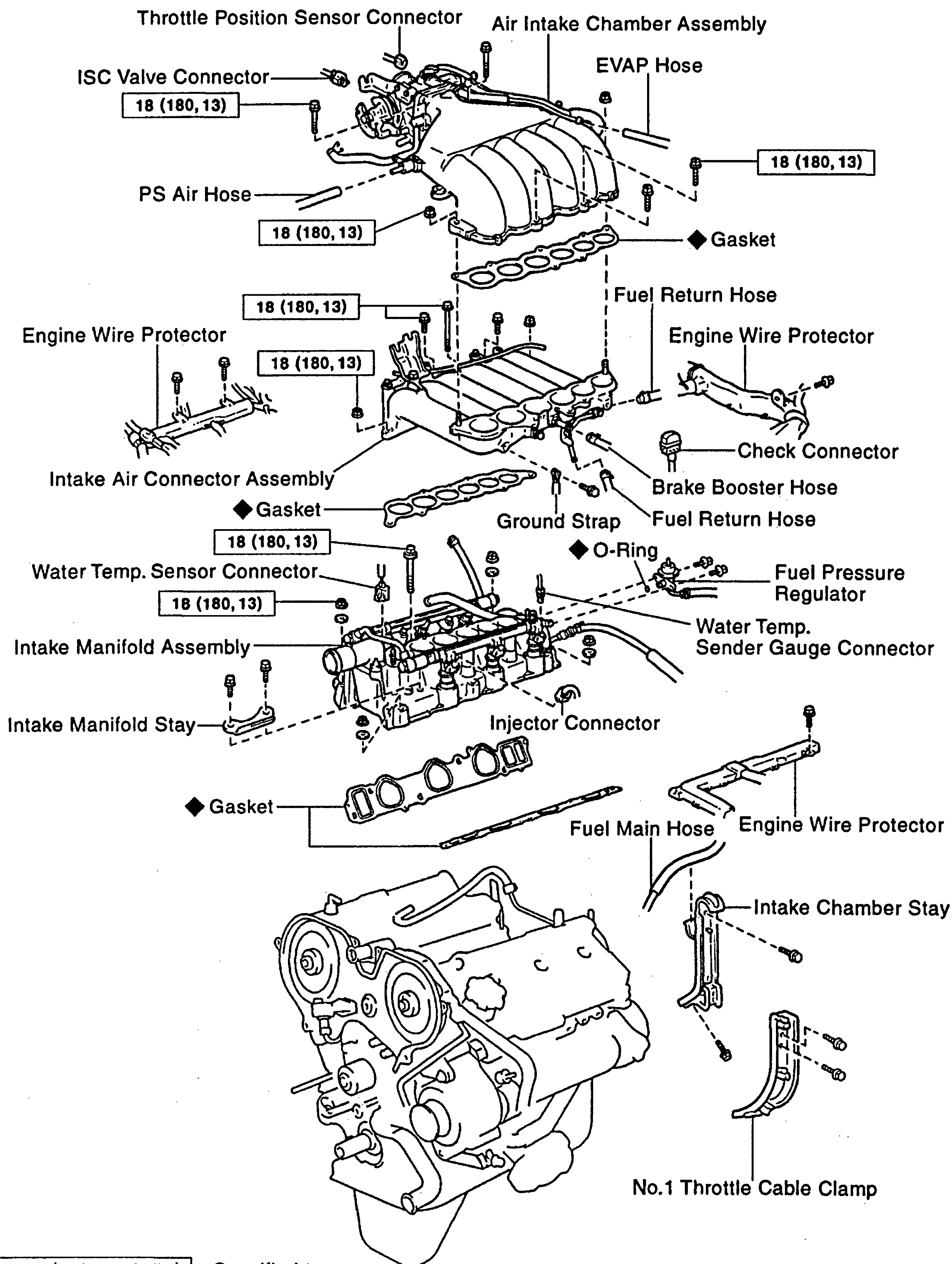
EG



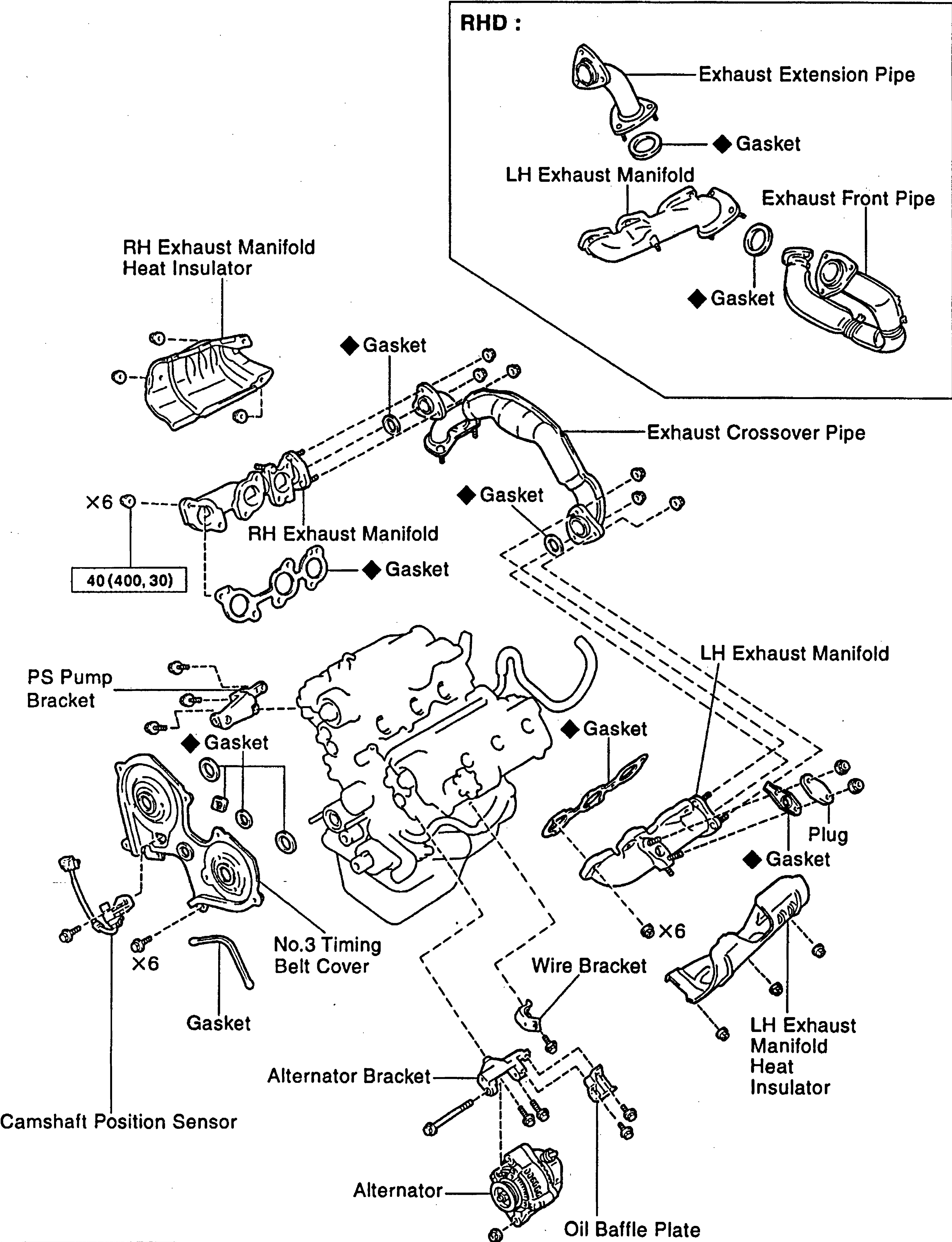
N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

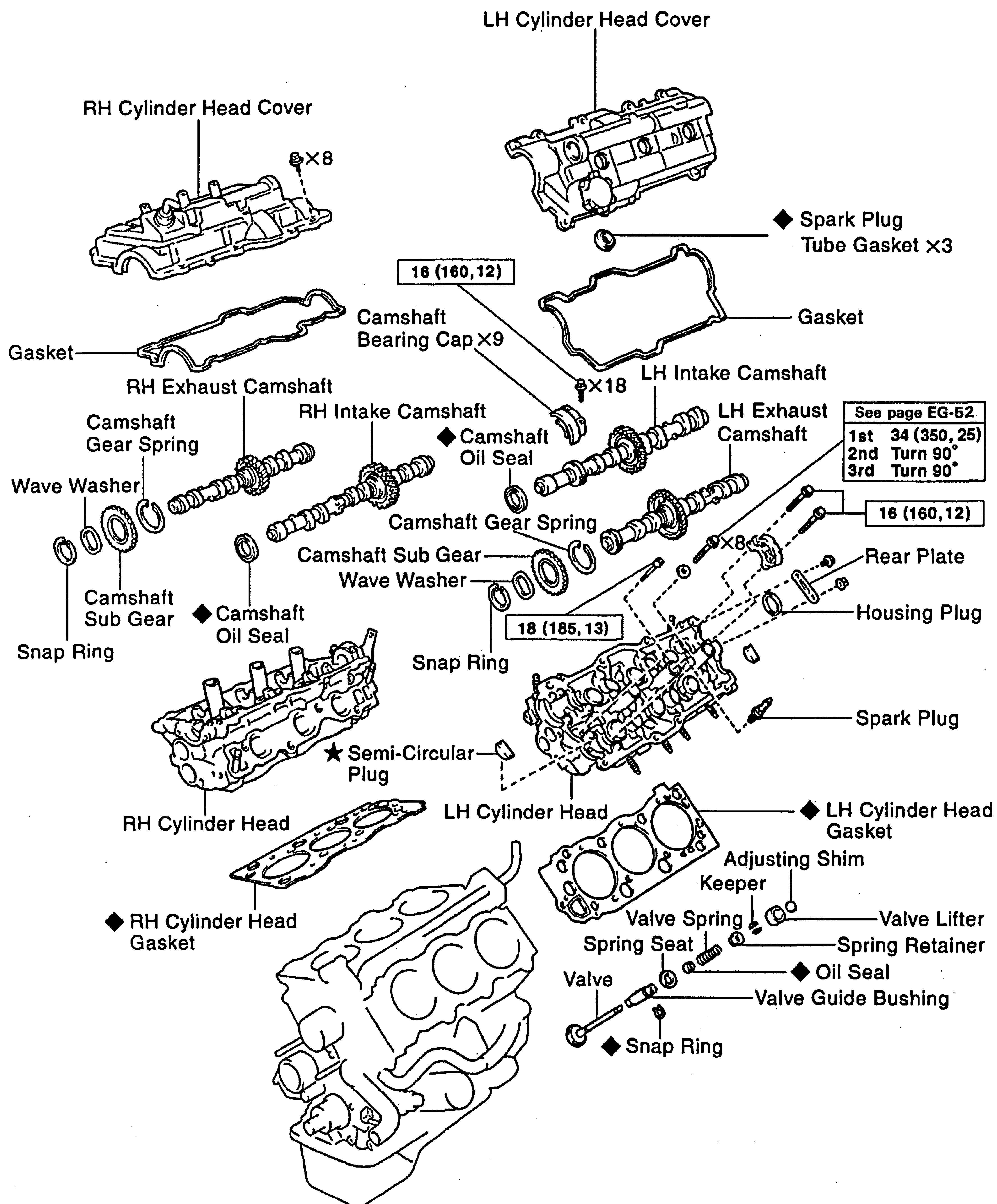
★ Precoated part



EG



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



S02363

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

◆ Non-reusable part

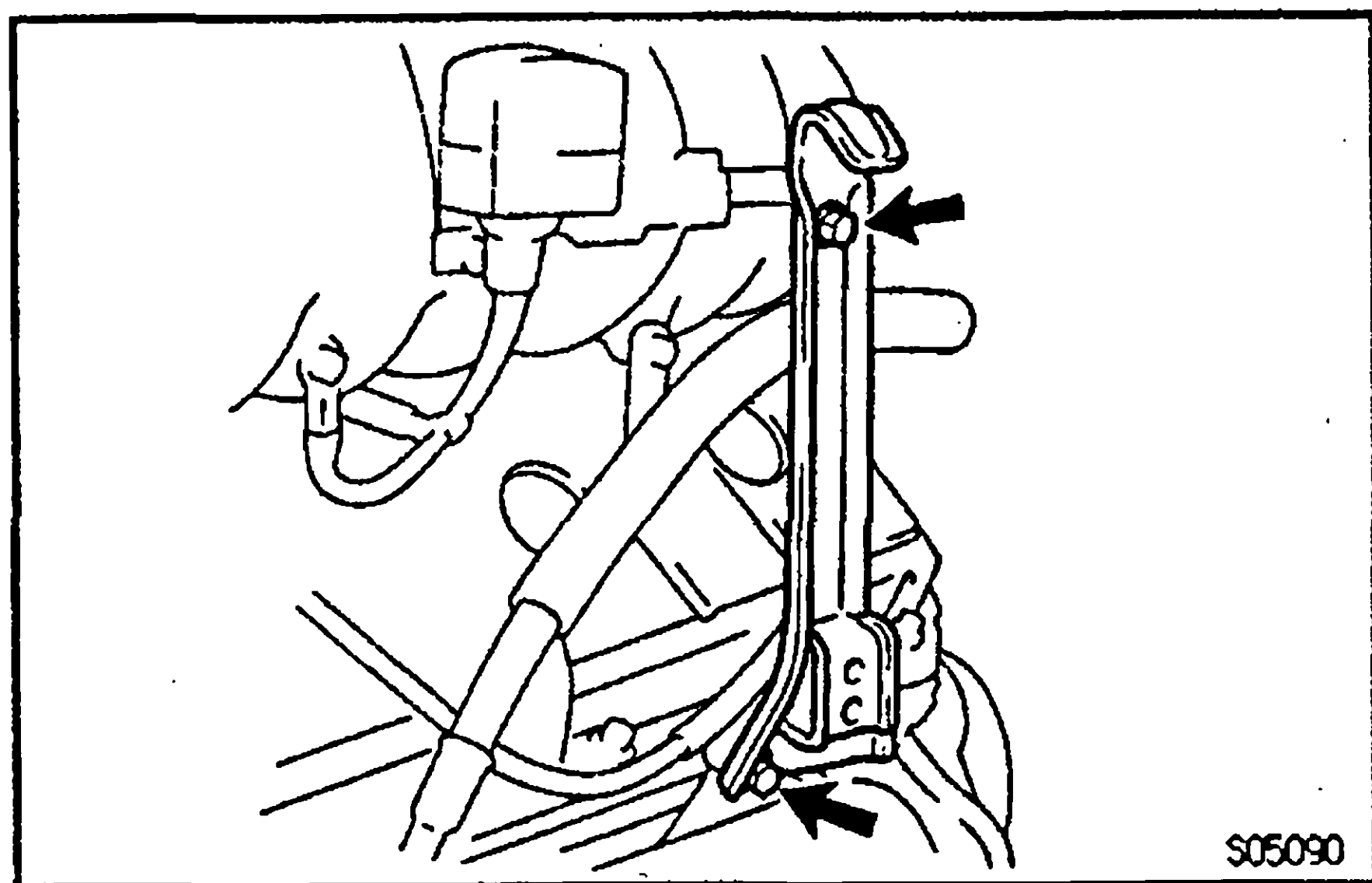
★ Precoated part

Z18852

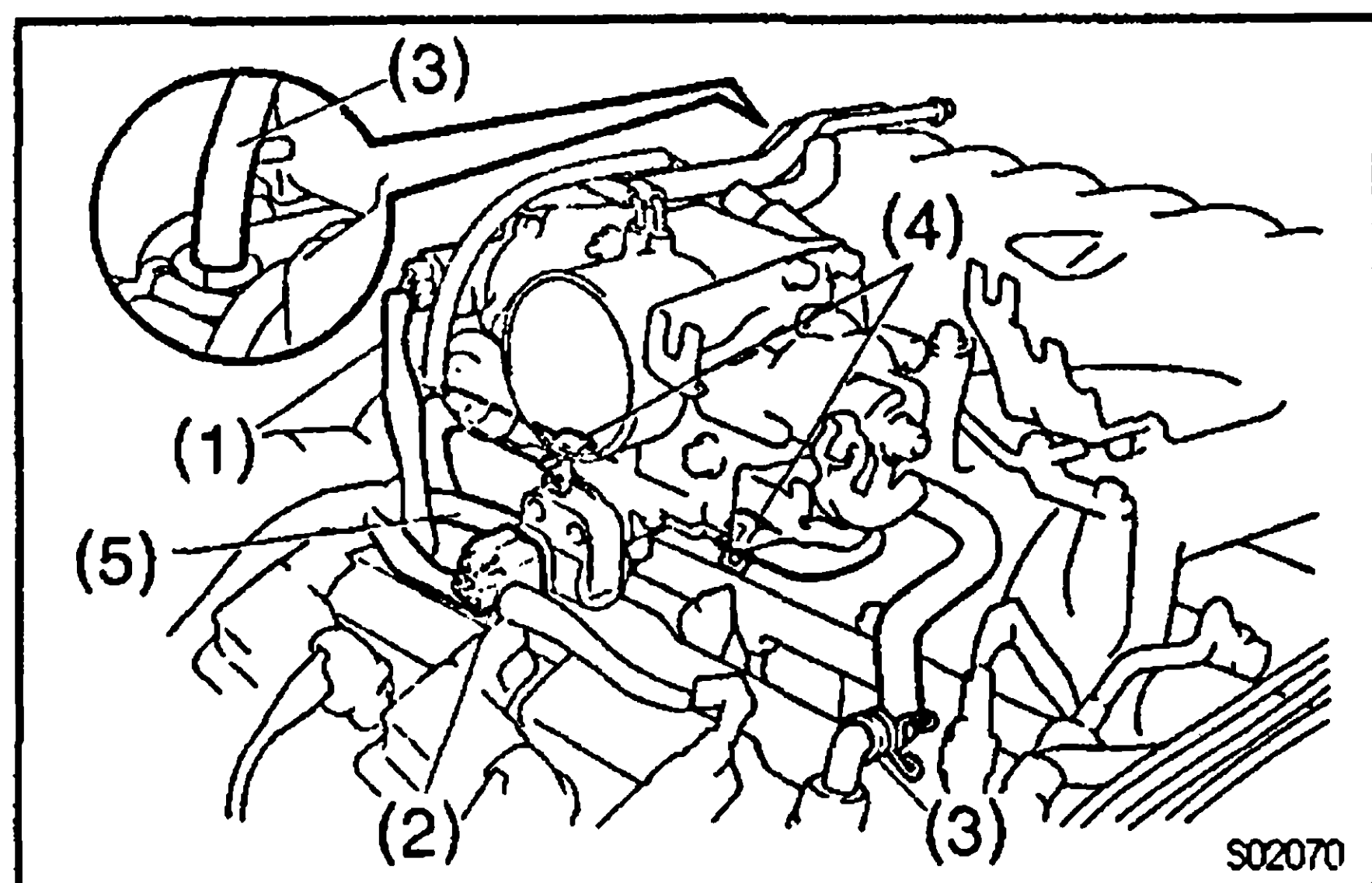
CYLINDER HEADS REMOVAL

1. DRAIN ENGINE COOLANT
2. REMOVE TIMING BELT
(See timing belt removal)
3. REMOVE HIGH-TENSION CORDS WITH IGNITION COILS AND SPARK PLUGS
(See ignition coils removal in Ignition System)

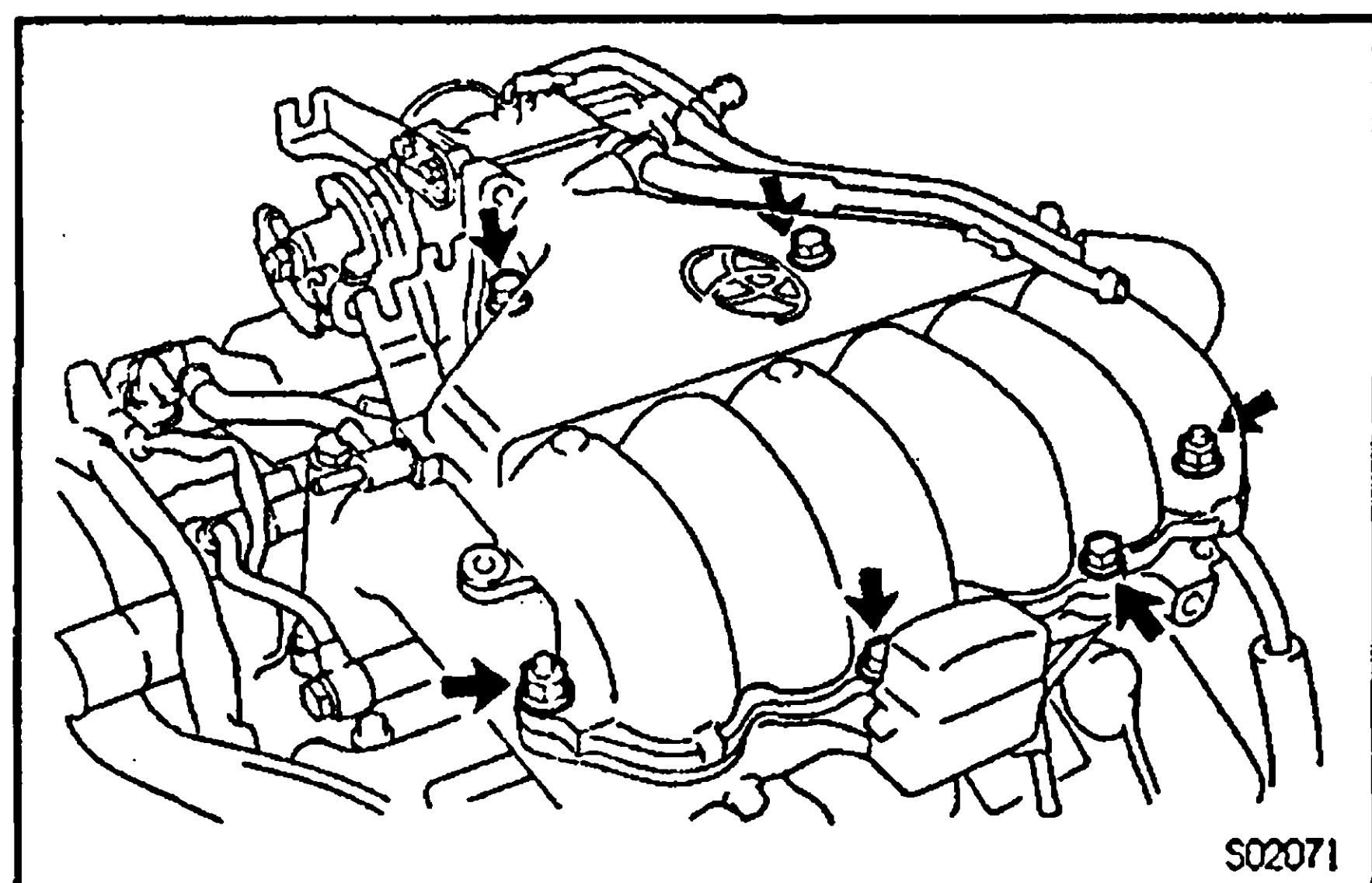
EG



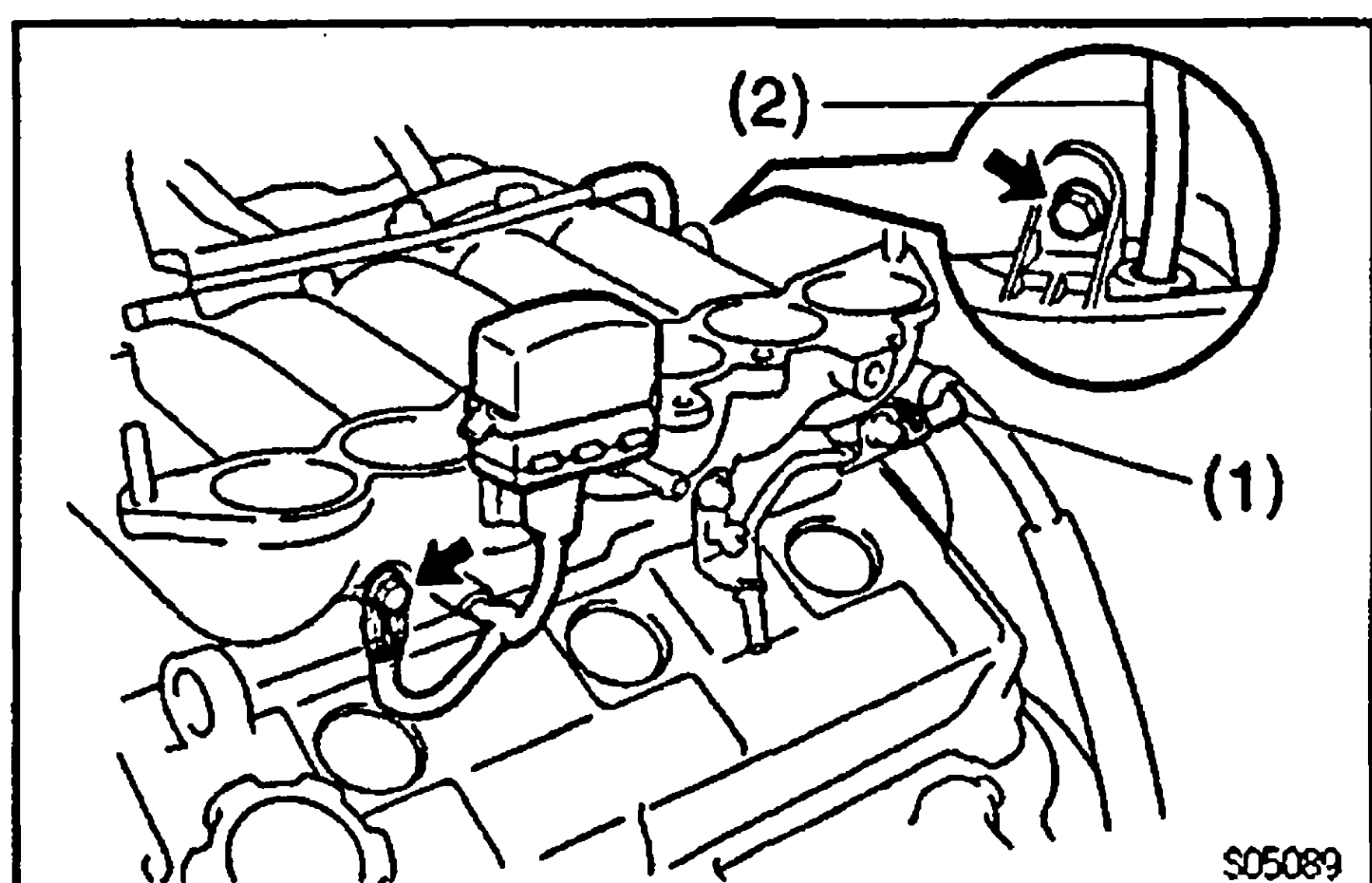
4. REMOVE INTAKE CHAMBER STAY
 - (a) Remove the 2 bolts and No.1 throttle cable clamp.
 - (b) Remove the 2 bolts and intake chamber stay.



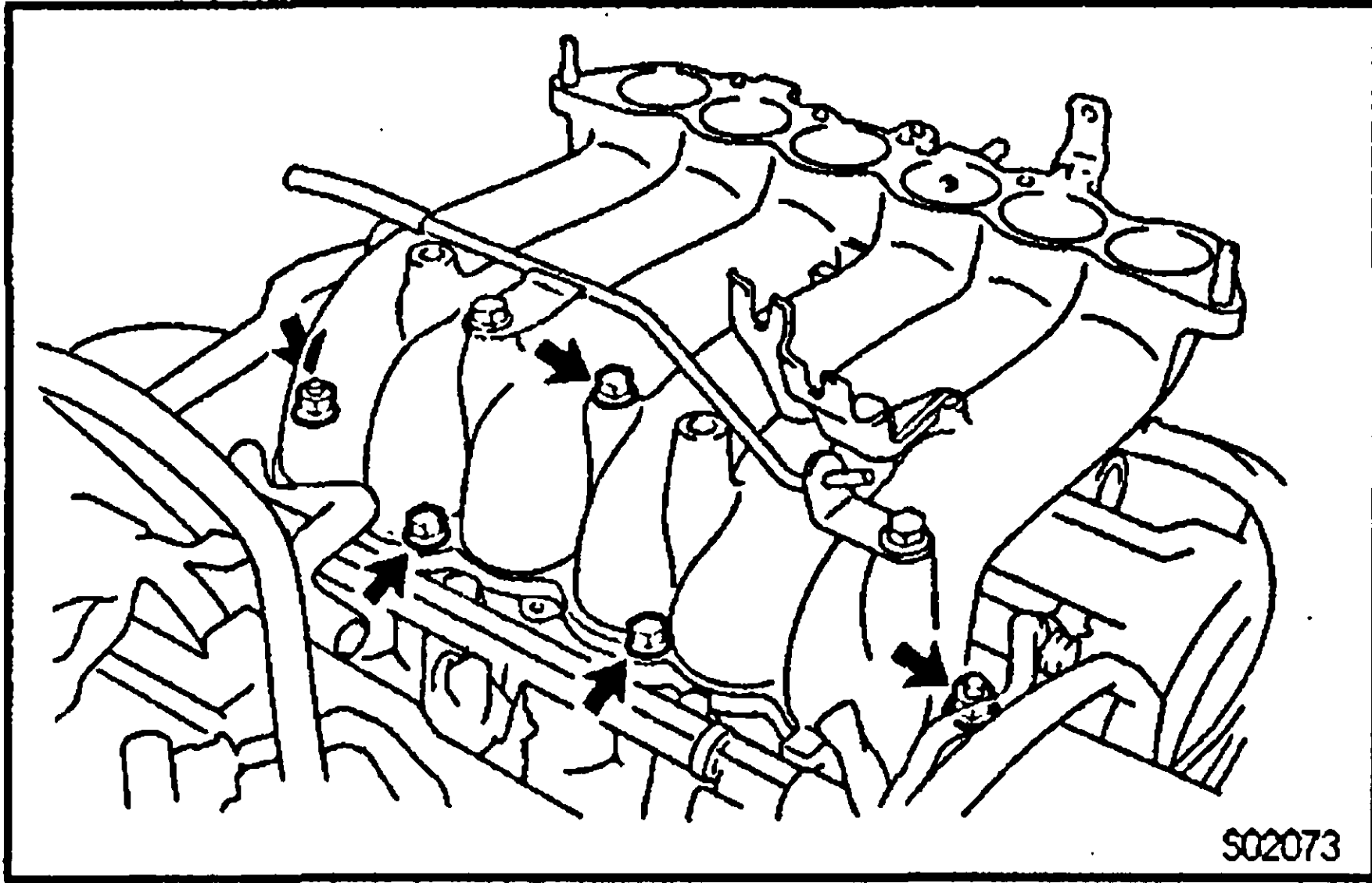
5. REMOVE AIR INTAKE CHAMBER ASSEMBLY
 - (a) Disconnect these connectors and these hoses:
 - (1) Throttle position sensor connector
 - (2) ISC valve connector
 - (3) 2 PCV hoses
 - (4) 2 water bypass hoses
 - (5) Air assist hose from throttle body



- (c) Remove the 4 bolts, 2 nuts, the air intake chamber assembly and gasket.

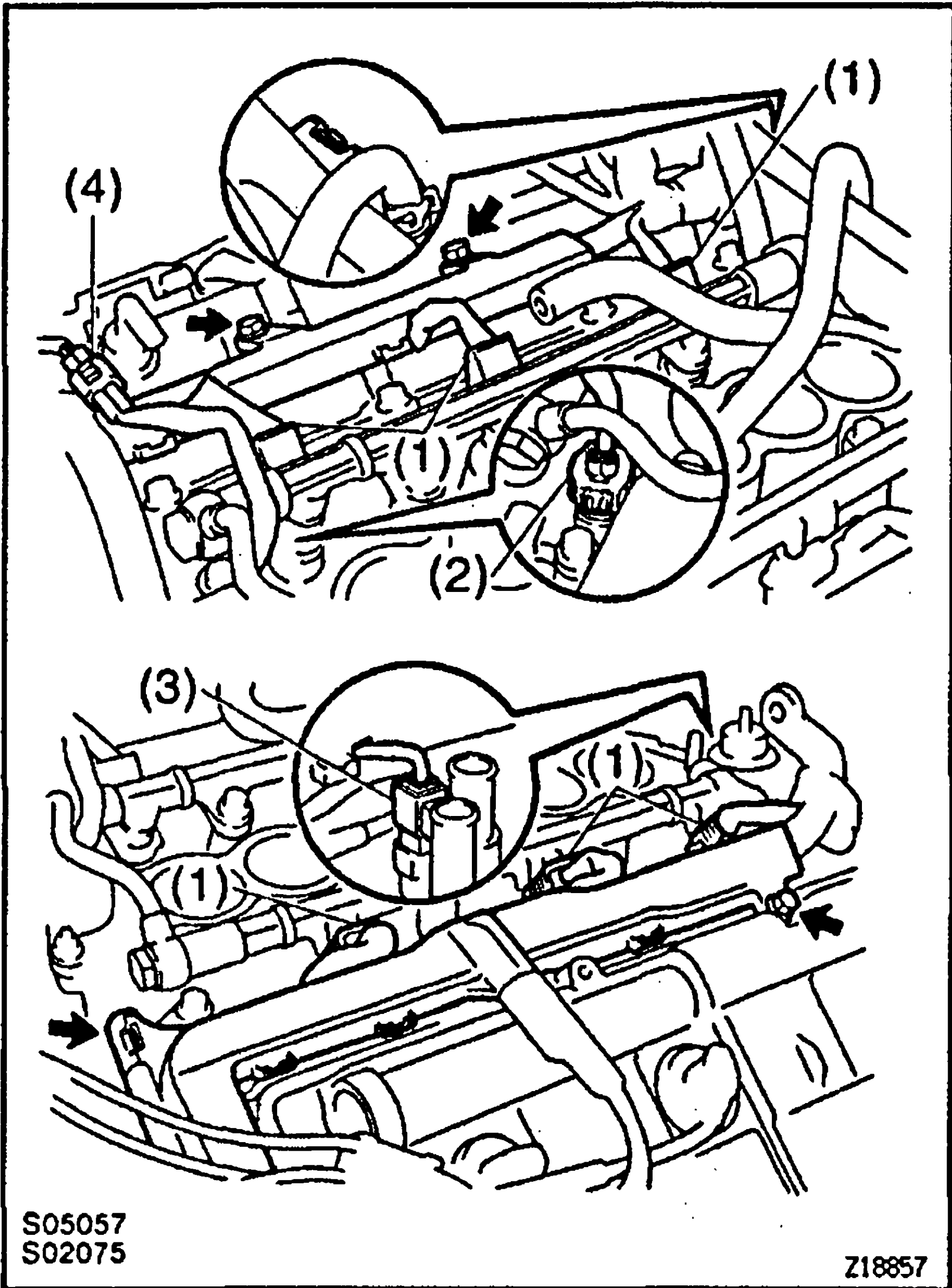


6. REMOVE INTAKE AIR CONNECTOR
 - (a) Remove the bolt and disconnect the engine wire.
 - (b) Disconnect these hoses:
 - (1) Fuel return hose
 - (2) Vacuum hose from the fuel pressure regulator
 - (c) Remove the bolt and disconnect the ground strap from the intake air connector.
 - (d) Disconnect the check connector from the bracket.



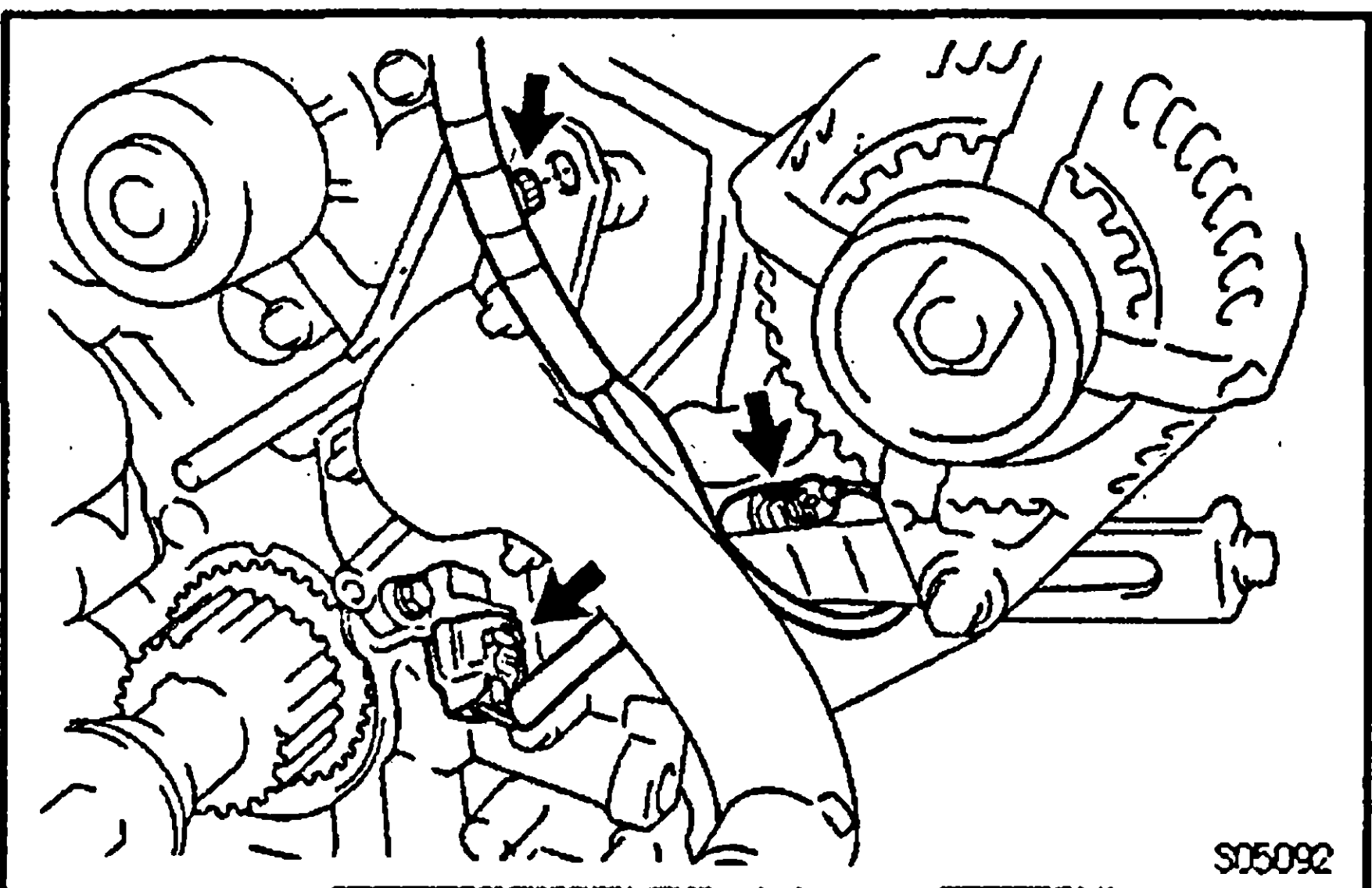
- (e) Remove the 3 bolts and 2 nuts, then intake air connector and gasket.

EG



7. DISCONNECT ENGINE WIRE PROTECTOR

- (a) Disconnect these connectors:
- (1) 6 injector connectors
 - (2) Water temperature sensor connector
 - (3) Water temperature sender gauge connector
 - (4) Knock sensor connector
- (b) Disconnect the 2 engine wire clamps.
- (c) Remove the 3 bolts, and disconnect the engine wire protector from the cylinder head.



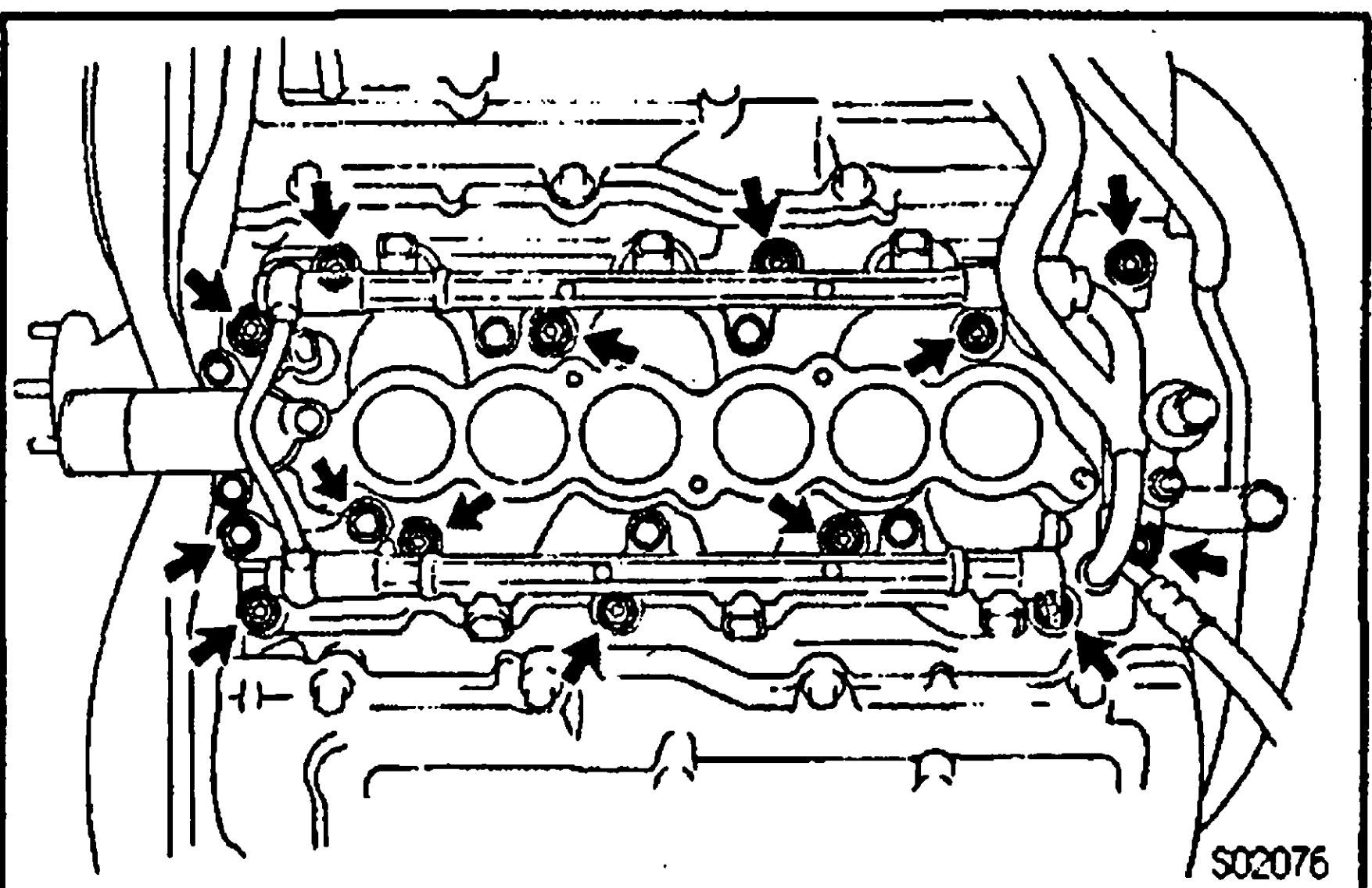
- (d) Disconnect the engine wire clamp from engine.

- (e) Disconnect these connectors:

- (1) Crankshaft position sensor connector
- (2) Oil pressure switch connector

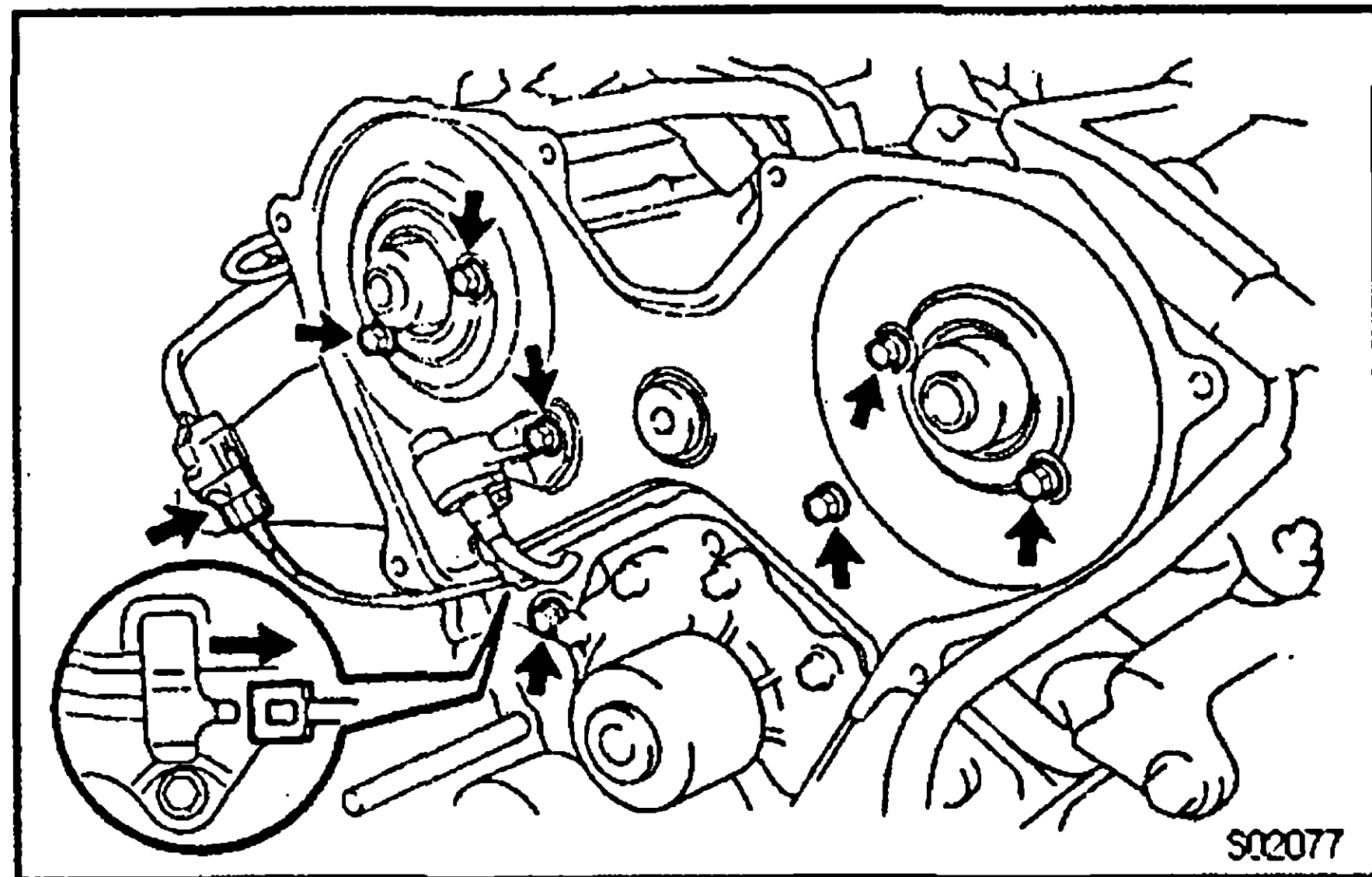
8. REMOVE FUEL PRESSURE REGULATOR

(See fuel pressure regulator removal in EFI System)



9. REMOVE INTAKE MANIFOLD ASSEMBLY

- (a) Remove the 2 bolts and intake manifold stay.
- (b) Remove the 8 bolts, 4 nuts, 4 plate washers, intake manifold, delivery pipes and injectors assembly and 2 gaskets.

**10. REMOVE CAMSHAFT POSITION SENSOR**

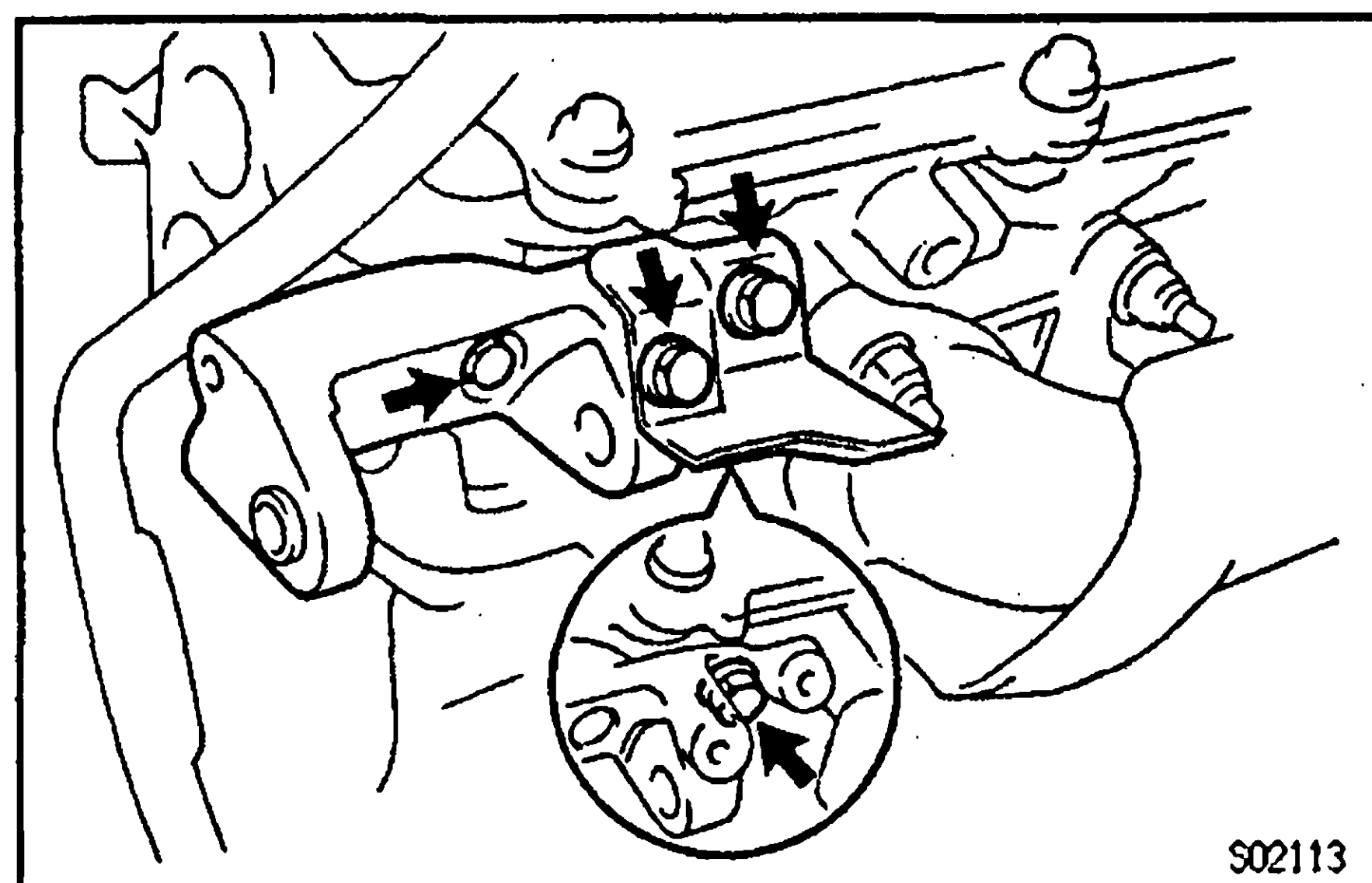
- (a) Disconnect the camshaft position sensor connector.
- (b) Disconnect the clamp from the No.3 timing belt cover.
- (c) Remove the bolt and camshaft position sensor.

11. REMOVE NO.3 TIMING BELT COVER

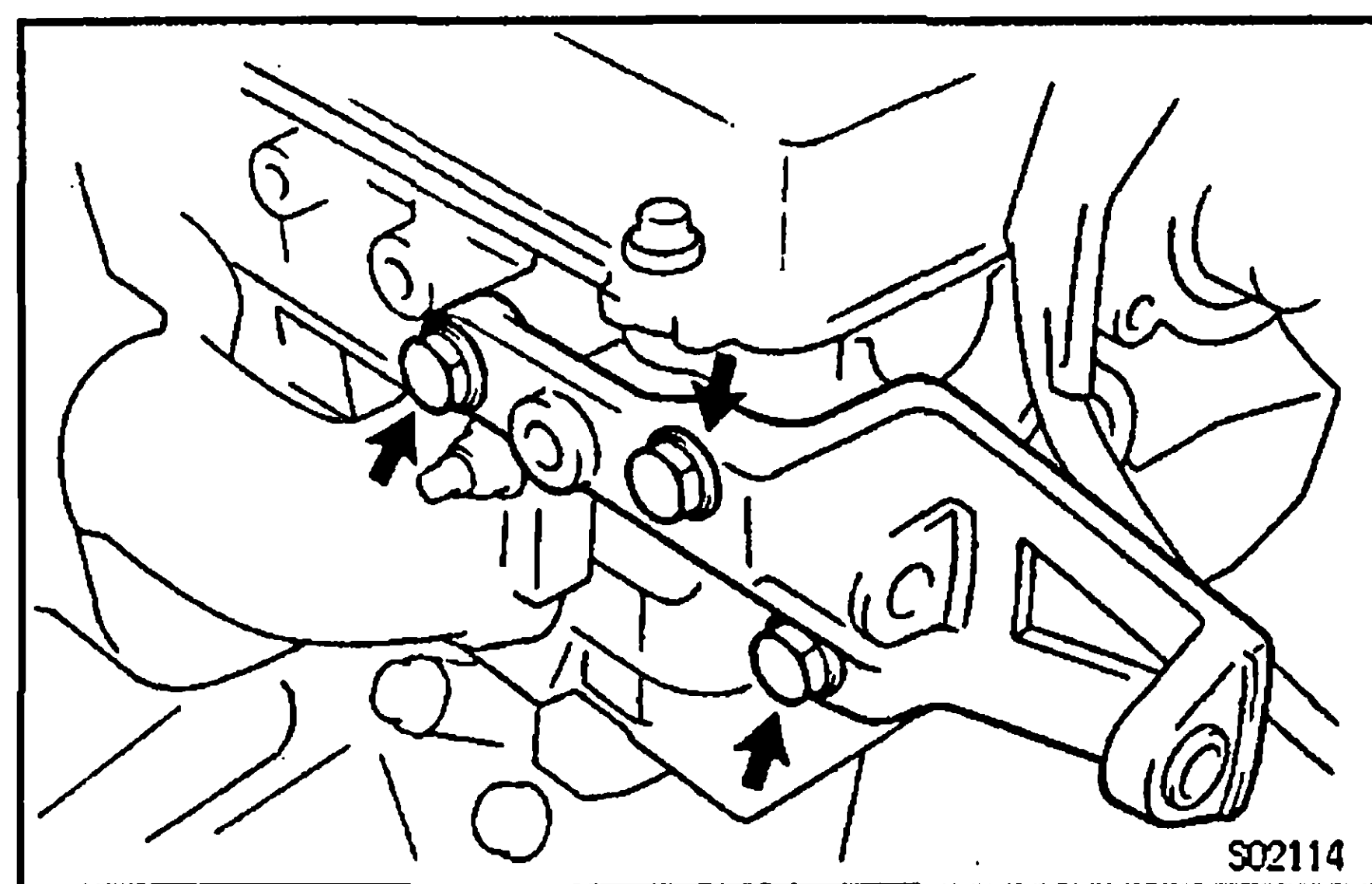
Remove the 6 bolts and timing belt cover.

12. REMOVE ALTERNATOR

(See alternator removal in Charging System)

**13. REMOVE ALTERNATOR BRACKET**

- (a) Remove the 2 bolts and oil baffle plate.
- (b) Remove the 2 bolts and alternator bracket.

**14. REMOVE PS PUMP BRACKET**

Remove the 3 bolts and PS pump bracket.

15. LHD:**REMOVE EXHAUST CROSSOVER PIPE**

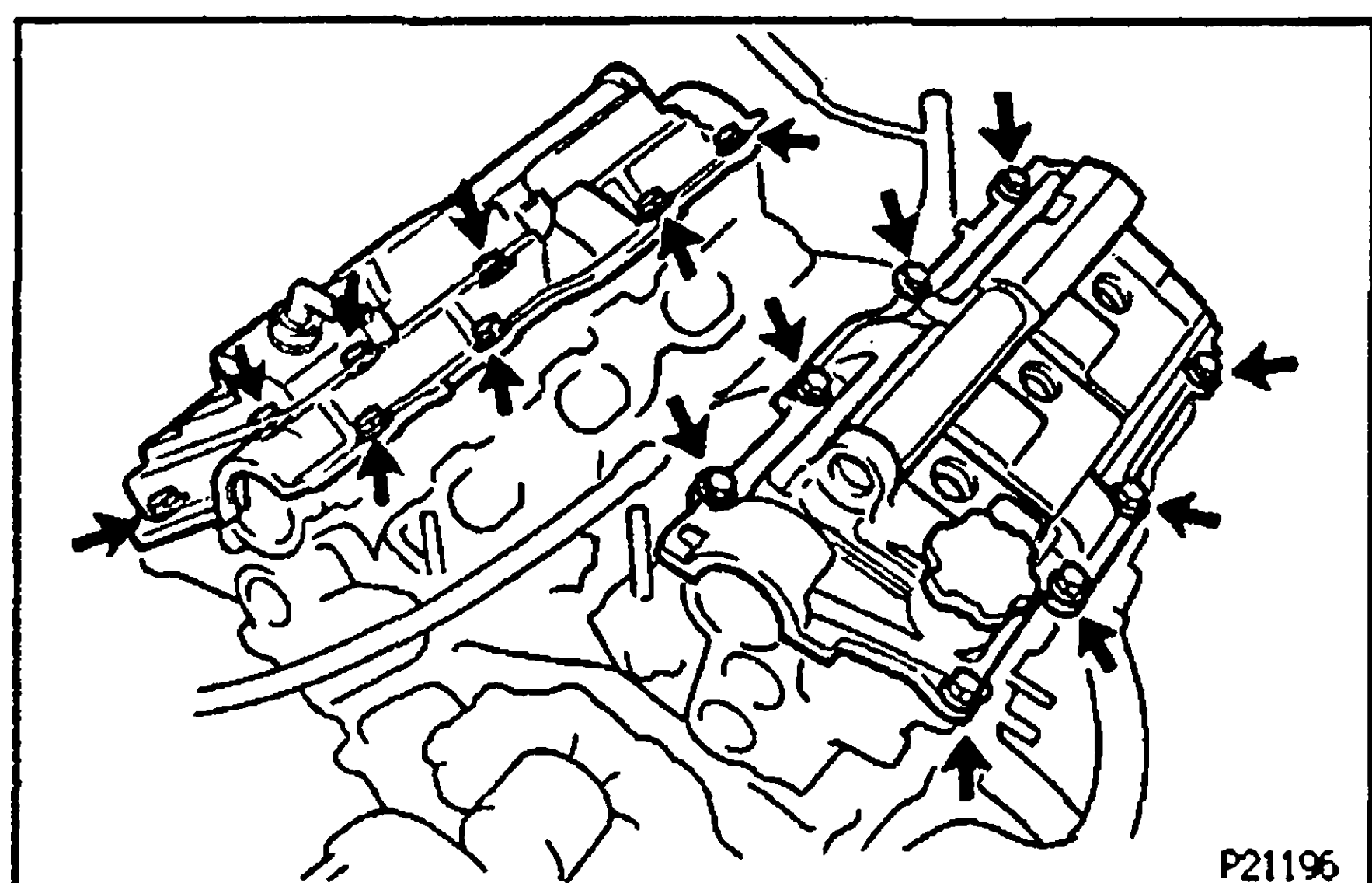
Remove the 6 nuts, crossover pipe and 2 gaskets.

RHD:**REMOVE EXHAUST EXTENSION PIPE AND EXHAUST FRONT PIPE NO.2**

- (a) Remove the 3 nuts, exhaust extension pipe and gasket.
- (b) Remove the 3 nuts, exhaust pipe No.2 and gasket.

16. REMOVE EXHAUST MANIFOLDS

- (a) Remove the 6 nuts and exhaust manifold heat insulators.
- (b) Remove the 12 nuts, exhaust manifolds and gaskets.

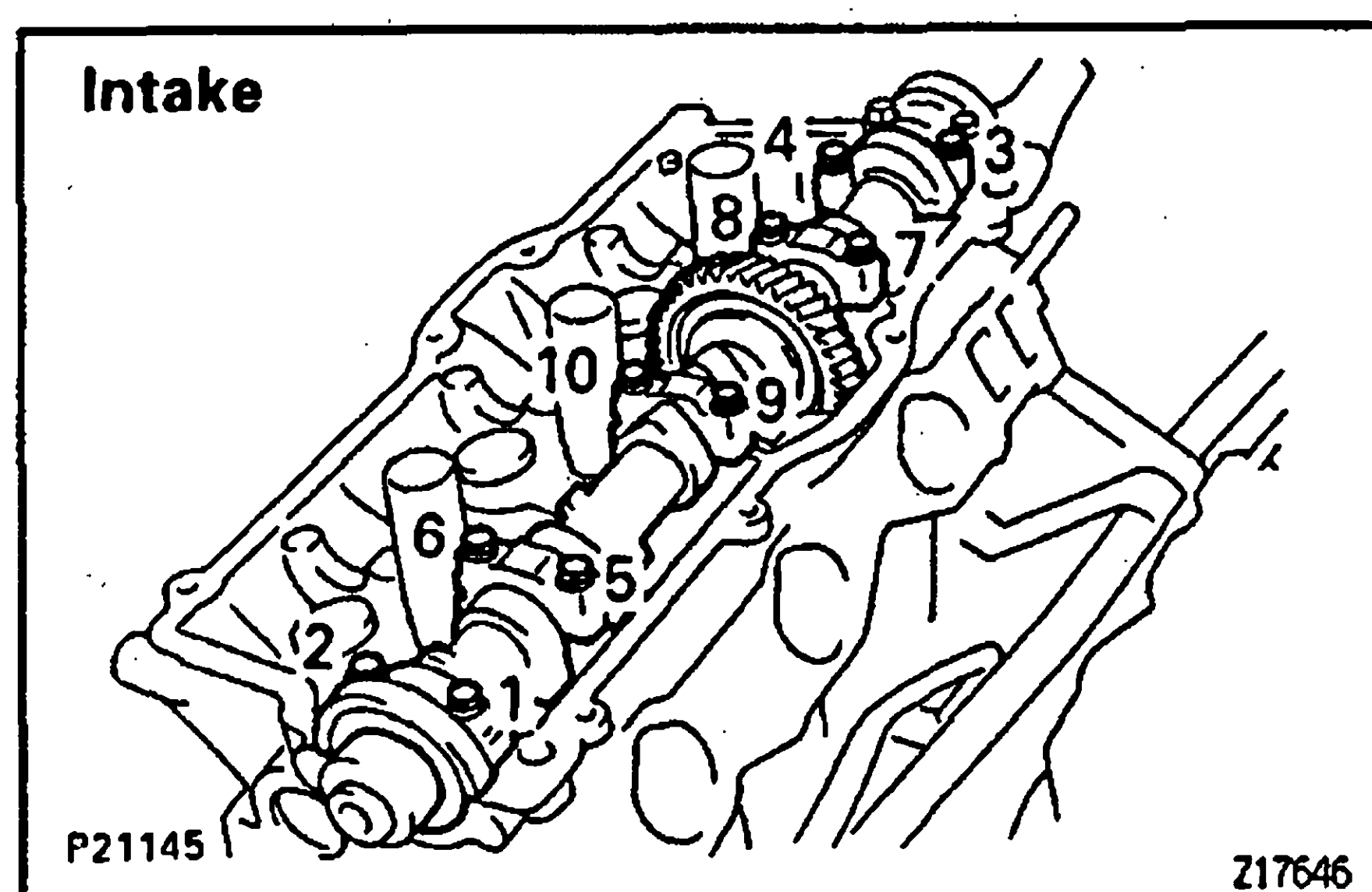
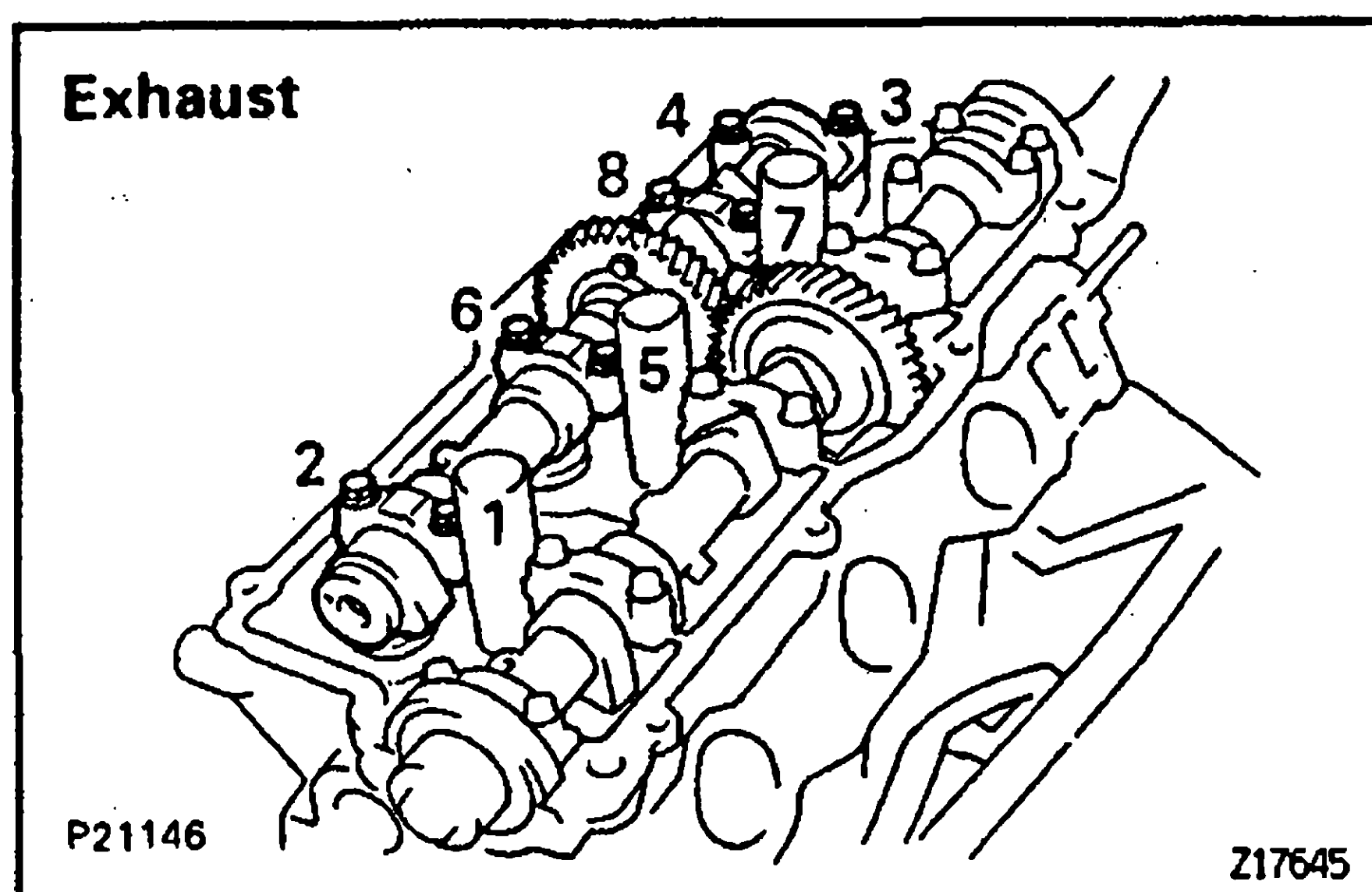
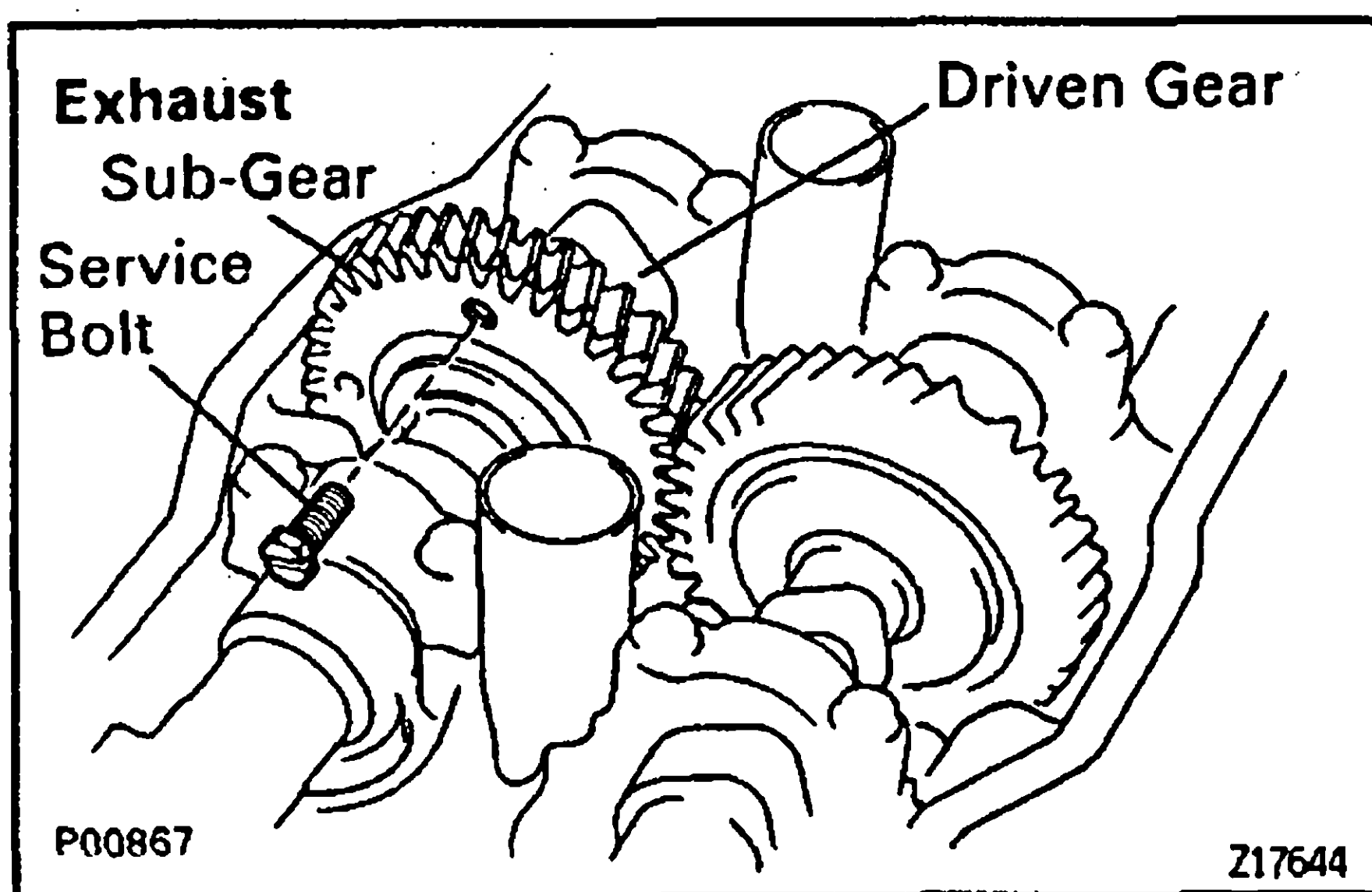
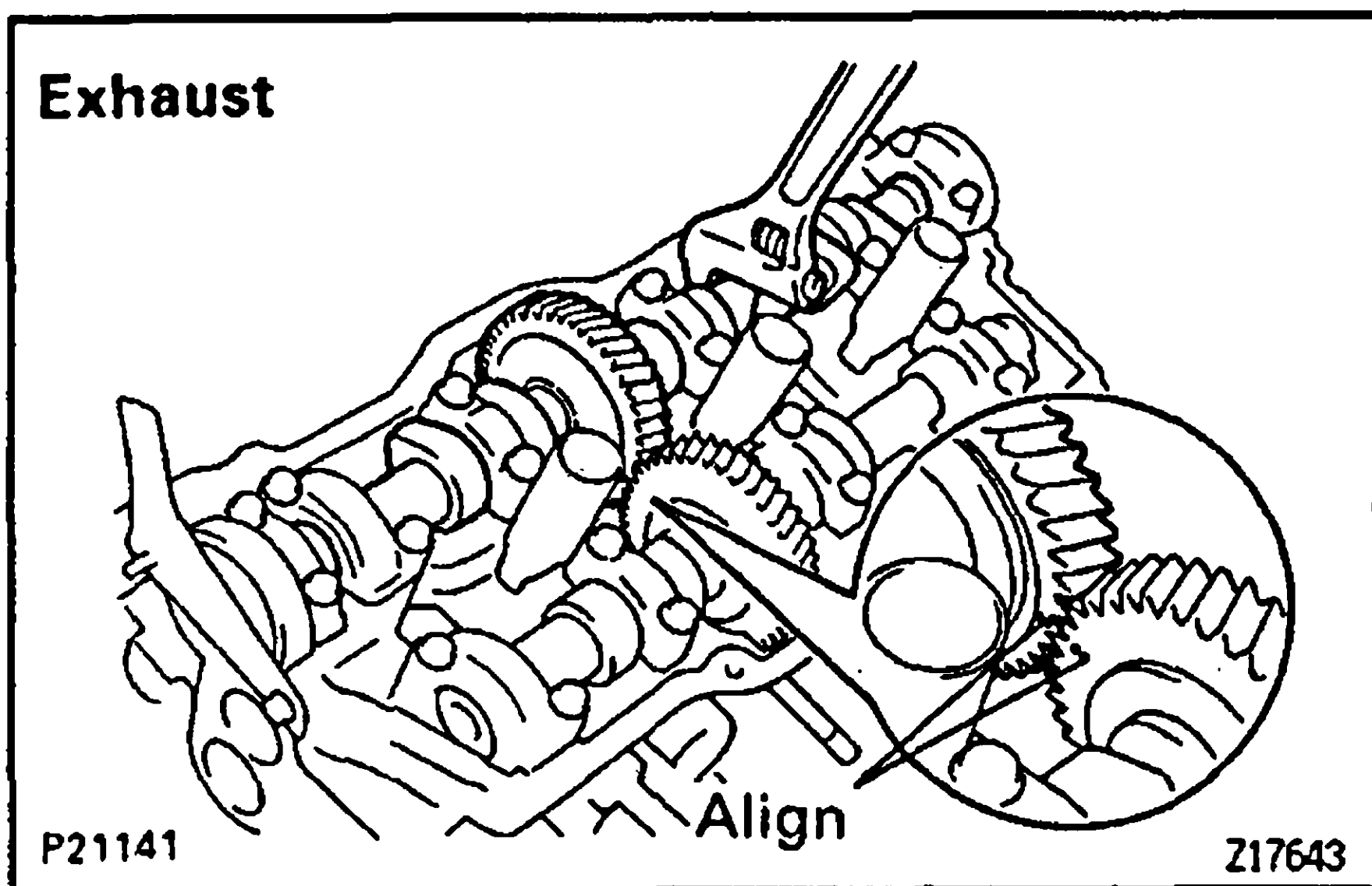
**17. REMOVE CYLINDER HEAD COVERS**

Remove the 8 bolts, seal washers, cylinder head cover and gasket. Remove the 2 cylinder head covers.

18. REMOVE CAMSHAFTS OF RH CYLINDER HEAD

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, these steps should be carried out.

EG

**A. Exhaust**

- (a) Boring 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) Align the timing marks (2 dot marks) of the camshaft drive and driven gears by turning the camshaft with a wrench.

- (c) 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

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

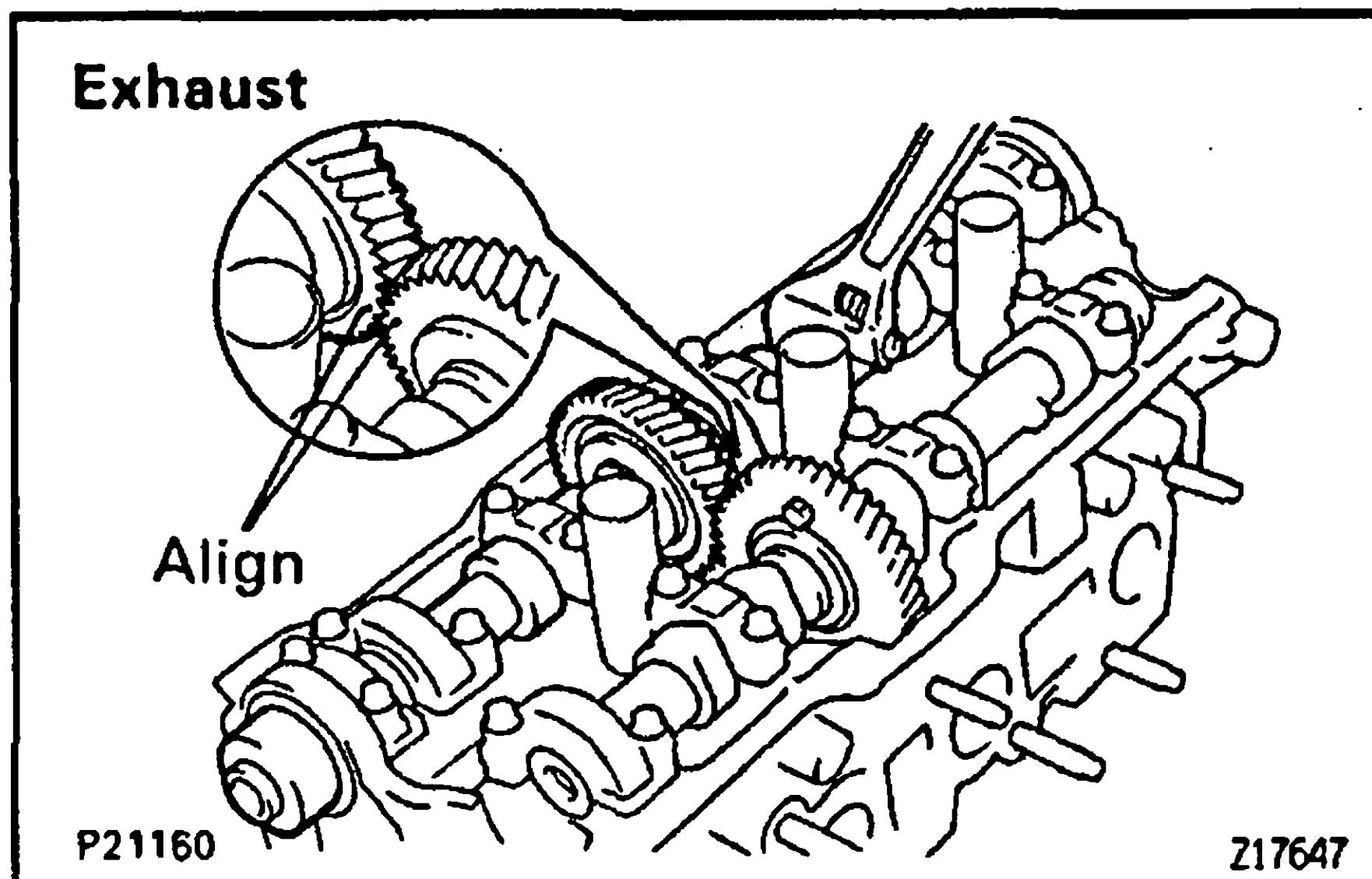
- (d) Uniformly loosen and remove the 8 bearing cap bolts, in several passes, in the sequence shown.
- (e) Remove the 4 bearing caps and exhaust camshaft.

B. Intake

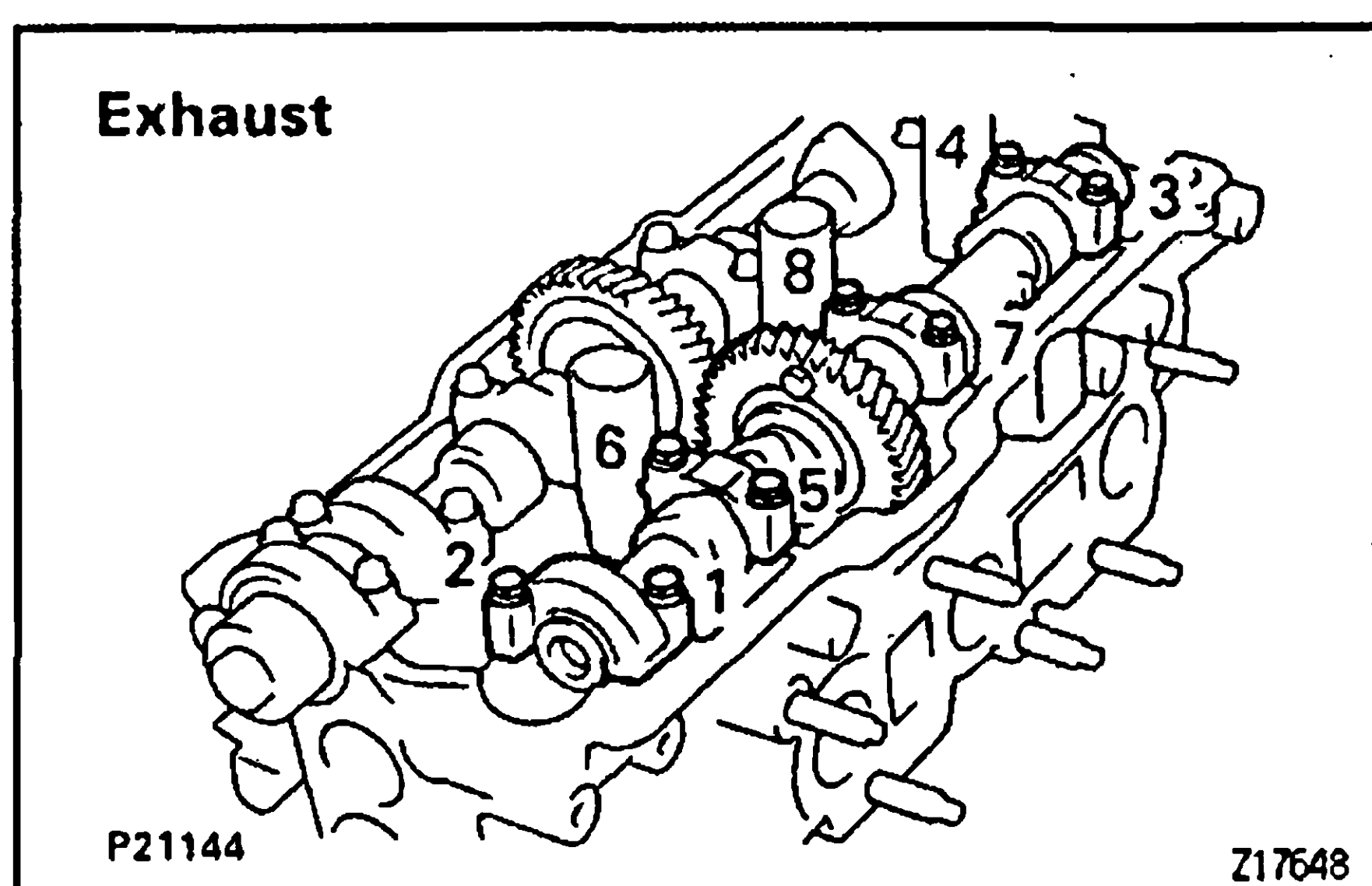
- (a) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.
- (b) Remove the 5 bearing caps, oil seal and intake camshaft.

19. REMOVE CAMSHAFTS OF LH CYLINDER HEAD

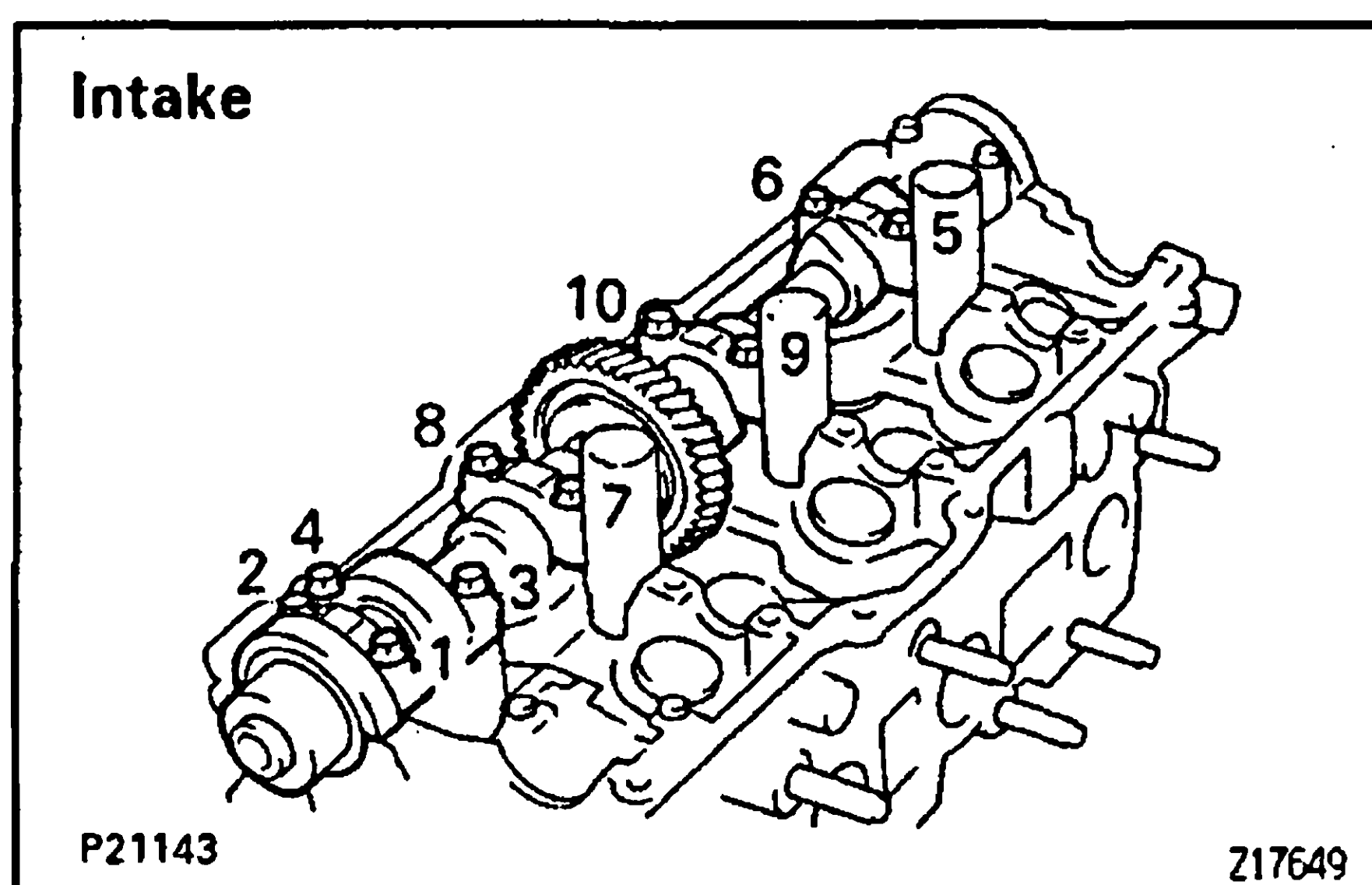
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, these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

**A. Exhaust**

- (a) Align the timing marks (1 dot mark) of the camshaft drive and driven gears by turning the camshaft with a wrench.
- (b) Secure the exhaust camshaft sub-gear to the main gear with a service bolt (See step (c) in step A in step 18).



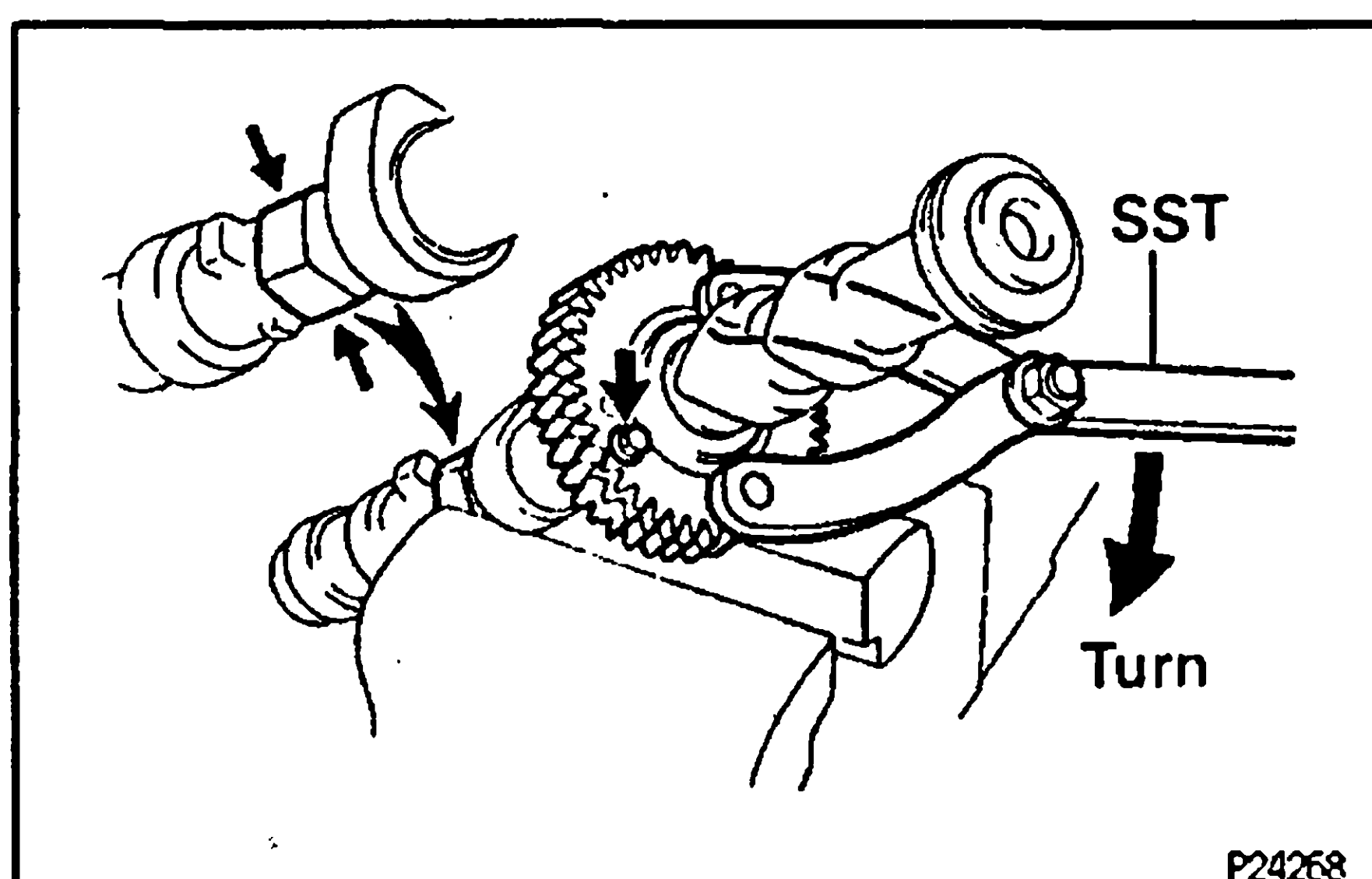
- (c) Uniformly loosen and remove the 8 bearing cap bolts, in several passes, in the sequence shown.
- (d) Remove the 4 bearing caps and exhaust camshaft.

**B. Intake**

- (a) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.
- (b) Remove the 5 bearing caps, oil seal and intake camshaft.

HINT:

- Arrange the camshafts in the correct order.
- Arrange the bearing caps in the correct order.

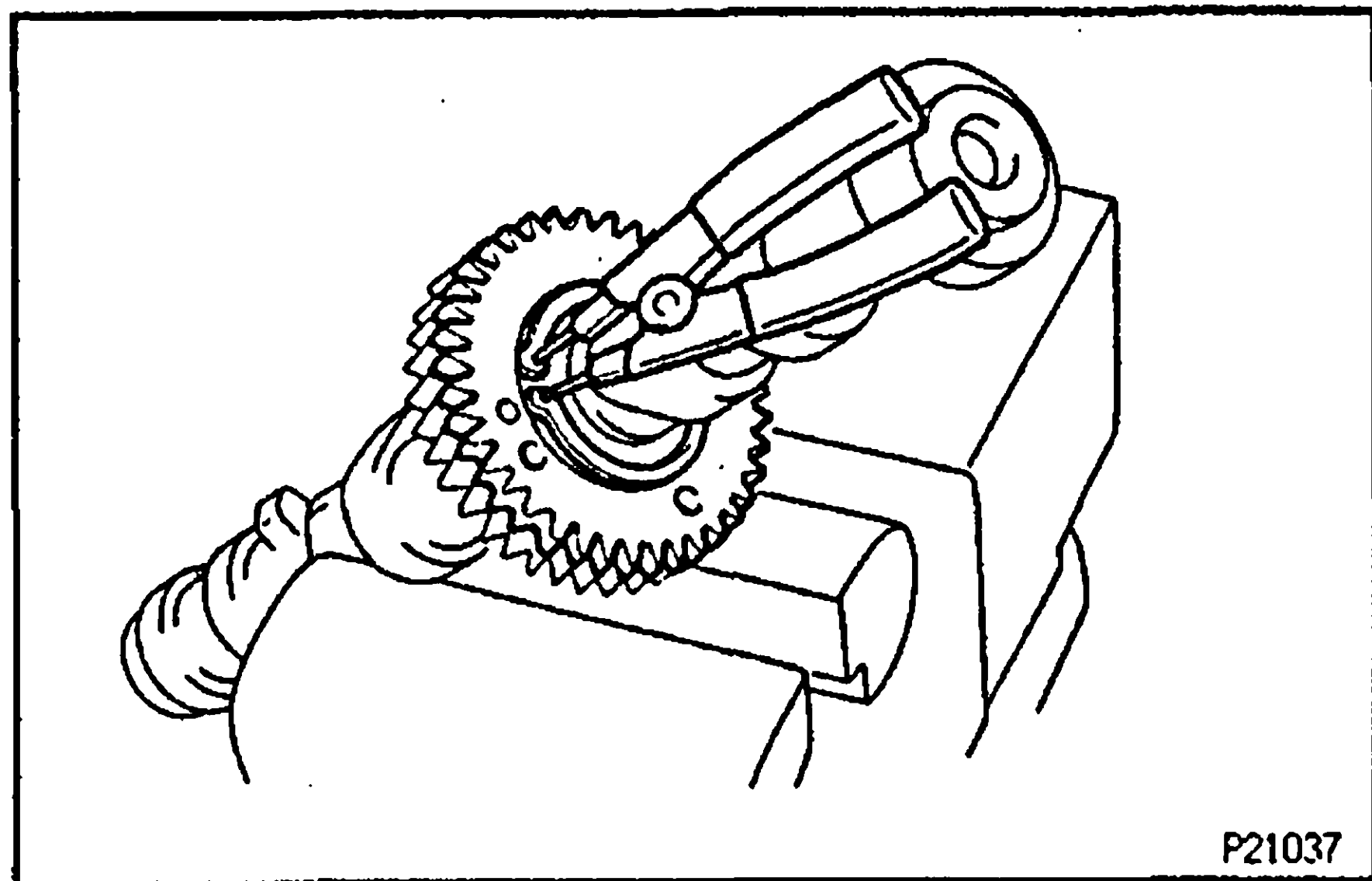
**20. DISASSEMBLE EXHAUST CAMSHAFTS**

- (a) Mount the hexagonal 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, 09963-00600)



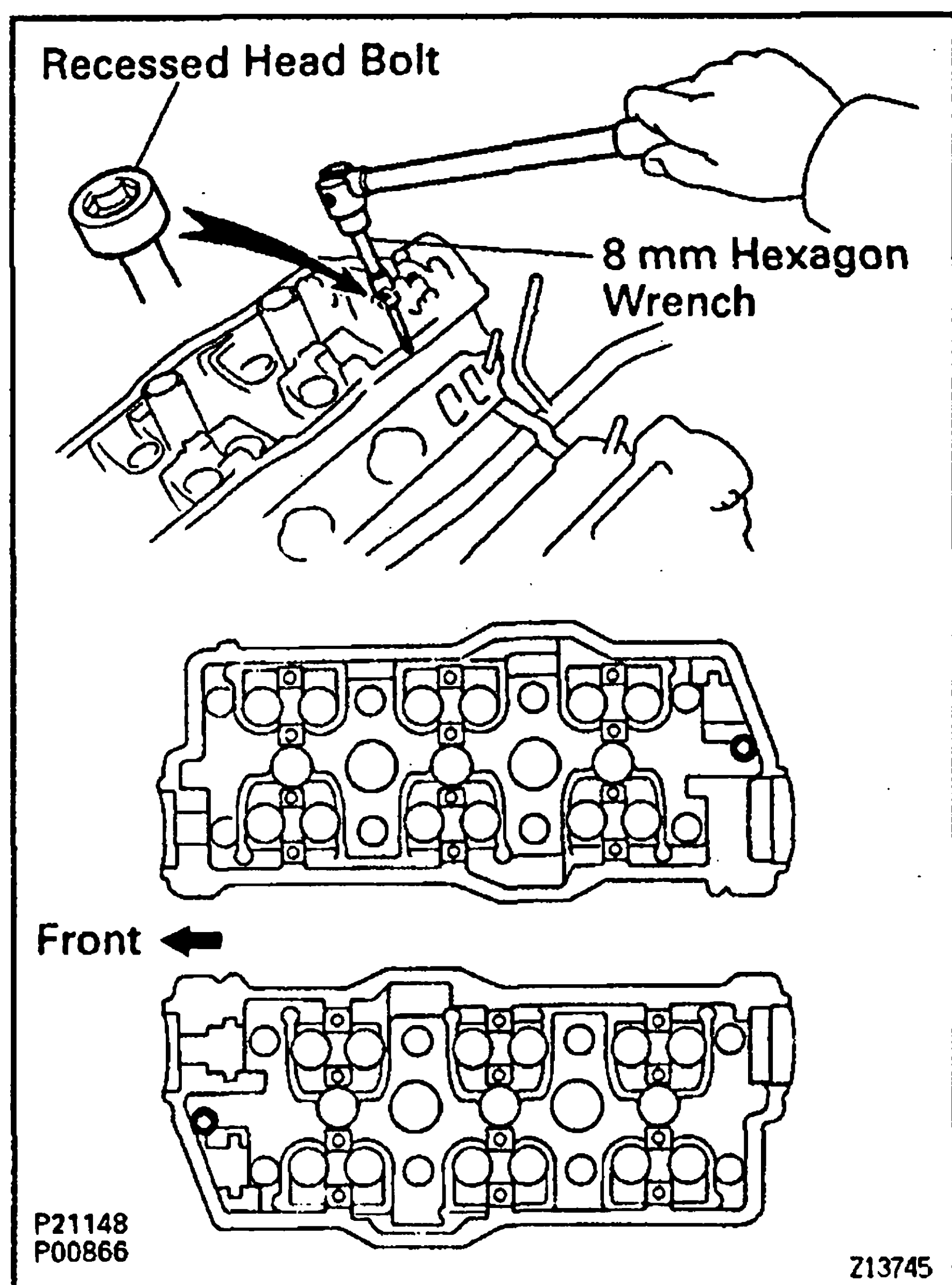
(c) Using snap ring pliers, remove the snap ring.

(d) Remove these parts:

- Wave washer
- Camshaft sub—gear
- Camshaft gear spring

HINT: Arrange the camshaft sub—gears and gear springs (RH and LH side).

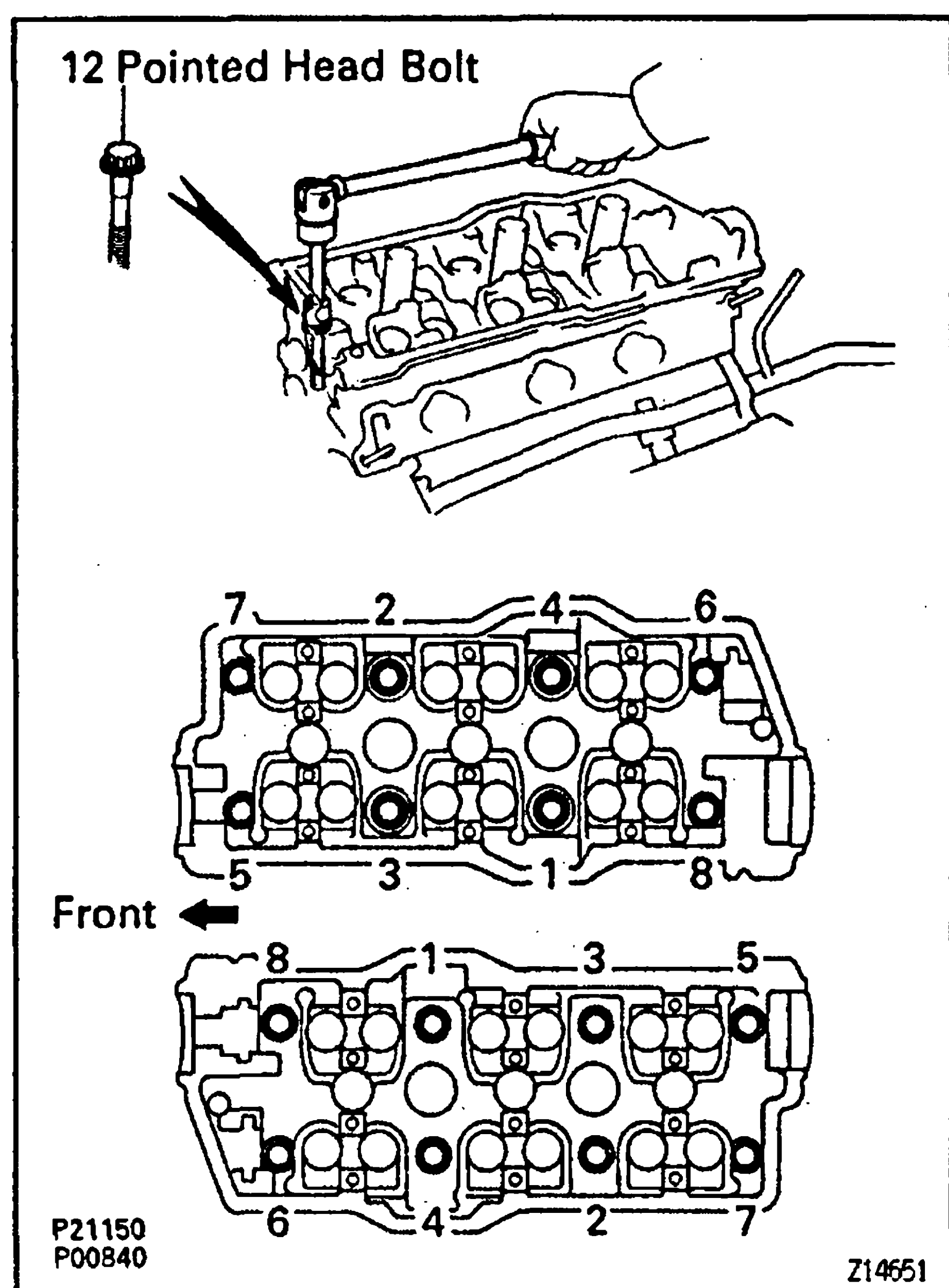
EG



21. REMOVE CYLINDER HEADS

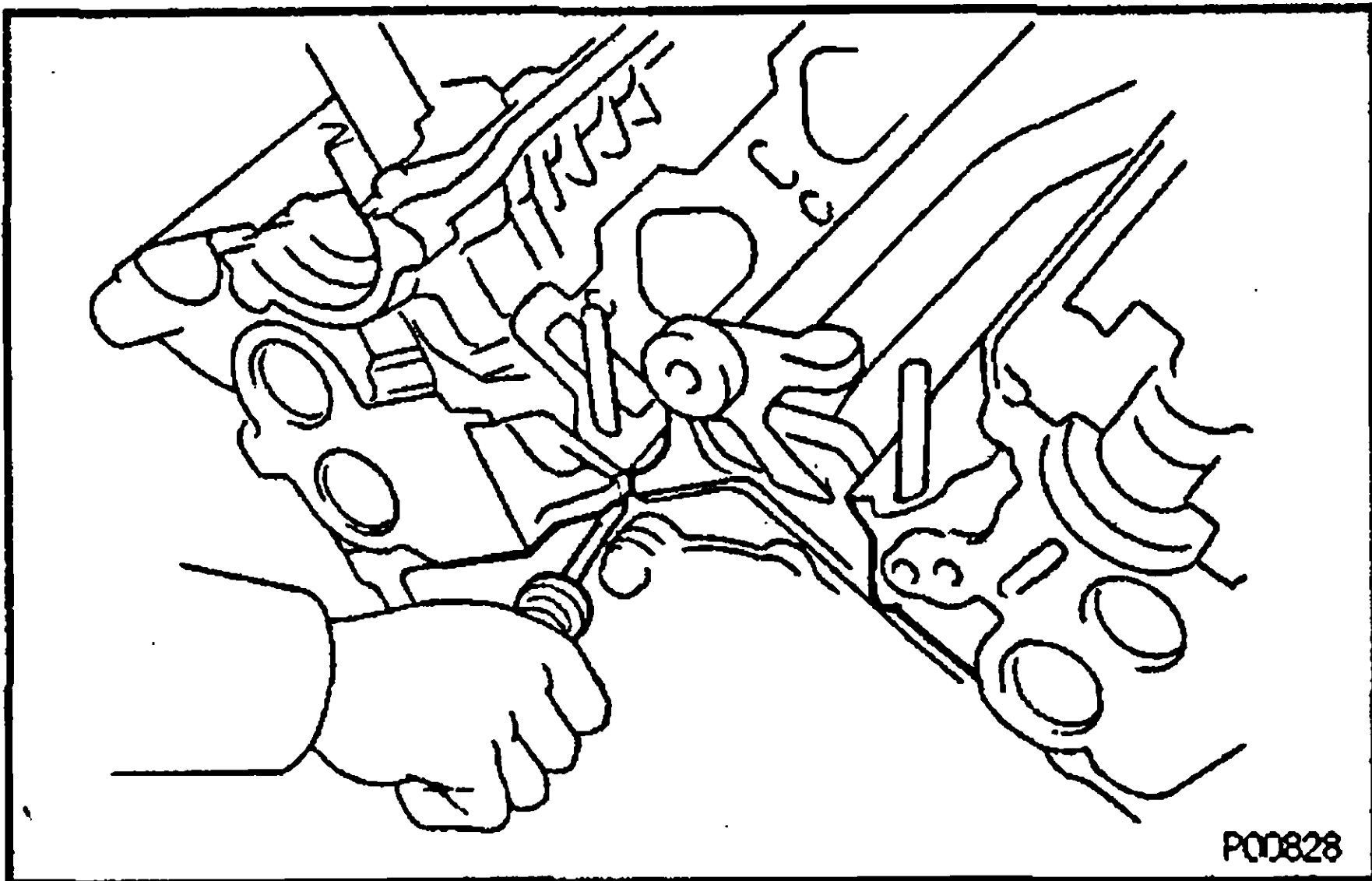
(a) Remove the bolt and disconnect the ground strap.

(b) Using an 8 mm hexagon wrench, remove the cylinder head (recessed head) bolt on each cylinder head, then repeat for the other side, as shown.



(c) Uniformly loosen and remove the 8 cylinder head (12 pointed head) bolts on each cylinder head, in several passes, in the sequence shown, then repeat for the other side, as shown. Remove the 16 cylinder head bolts and plate washers.

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



- (d) Lift the cylinder head from the dowels on the cylinder block and place the 2 cylinder heads 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.

- Arrange the cylinder heads in the correct order.

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

EG57D-03

CYLINDER HEADS DISASSEMBLY

1. REMOVE CAMSHAFT HOUSING PLUGS

- Remove the bolt, nut, cylinder head rear plate and ground strap.
- Remove the 2 bolts and camshaft bearing cap.
- Remove the housing plug.

2. REMOVE VALVE LIFTERS AND SHIMS

Pull out the valve lifter and shim by hand.

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

3. REMOVE VALVES

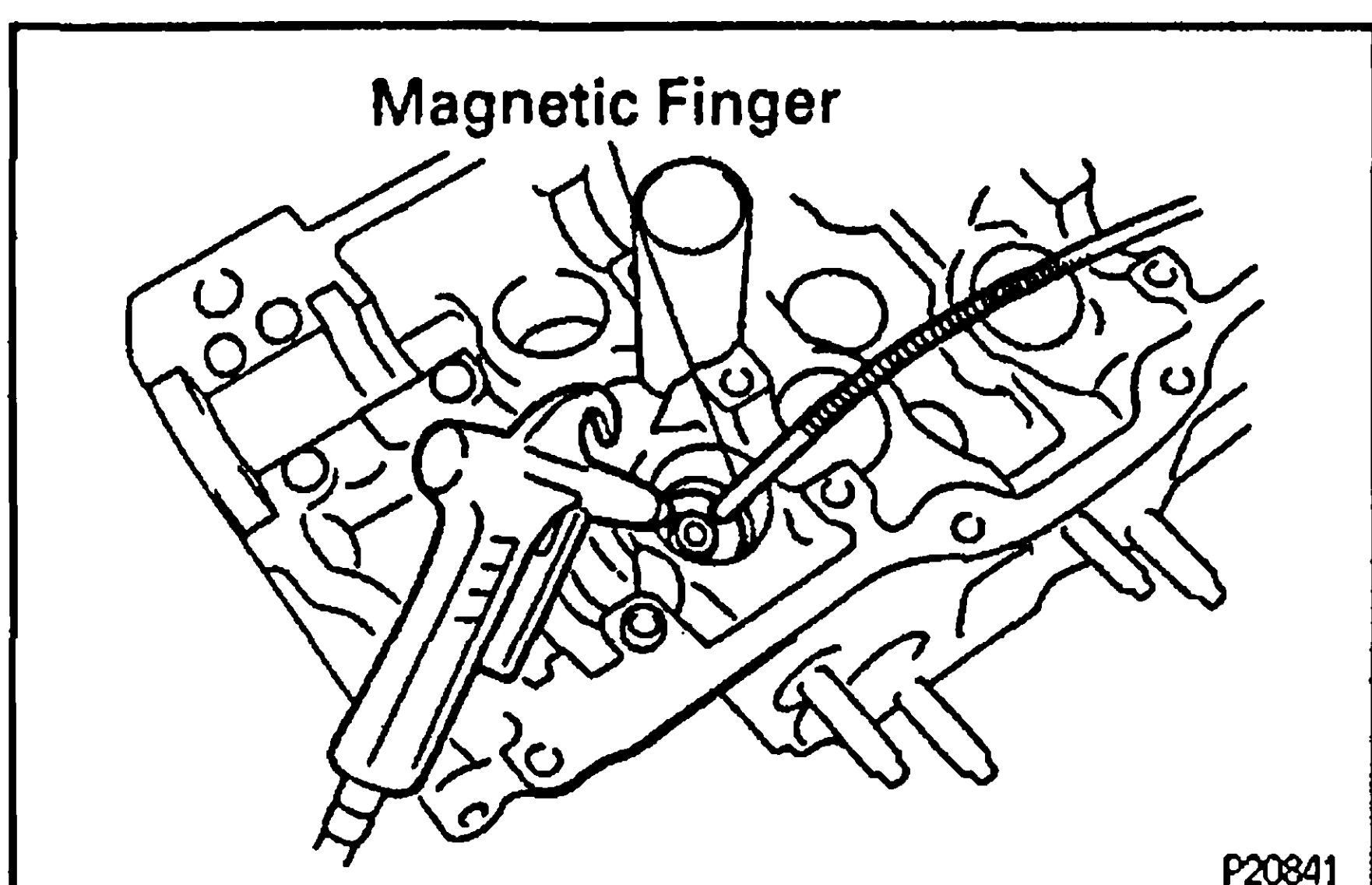
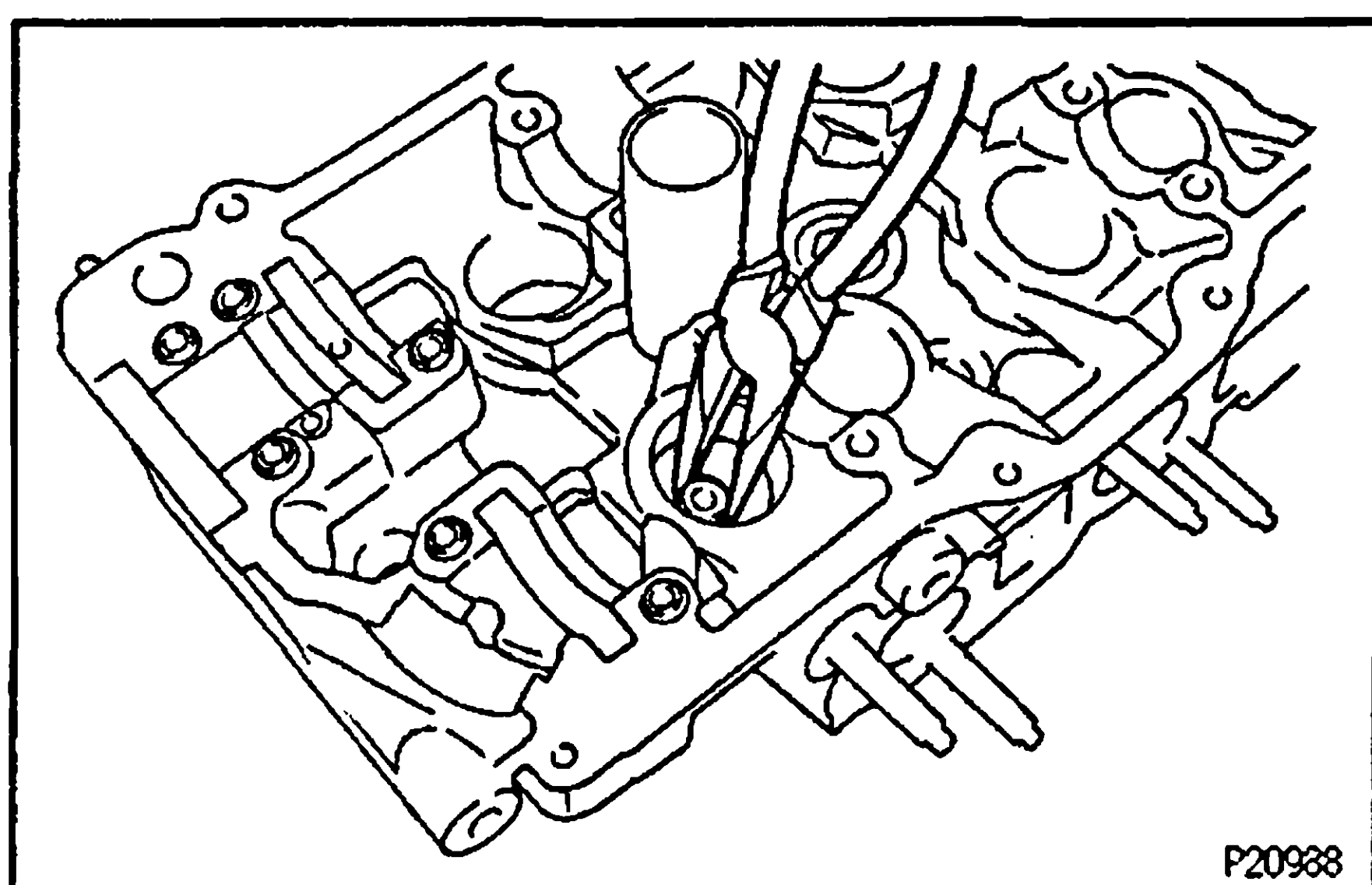
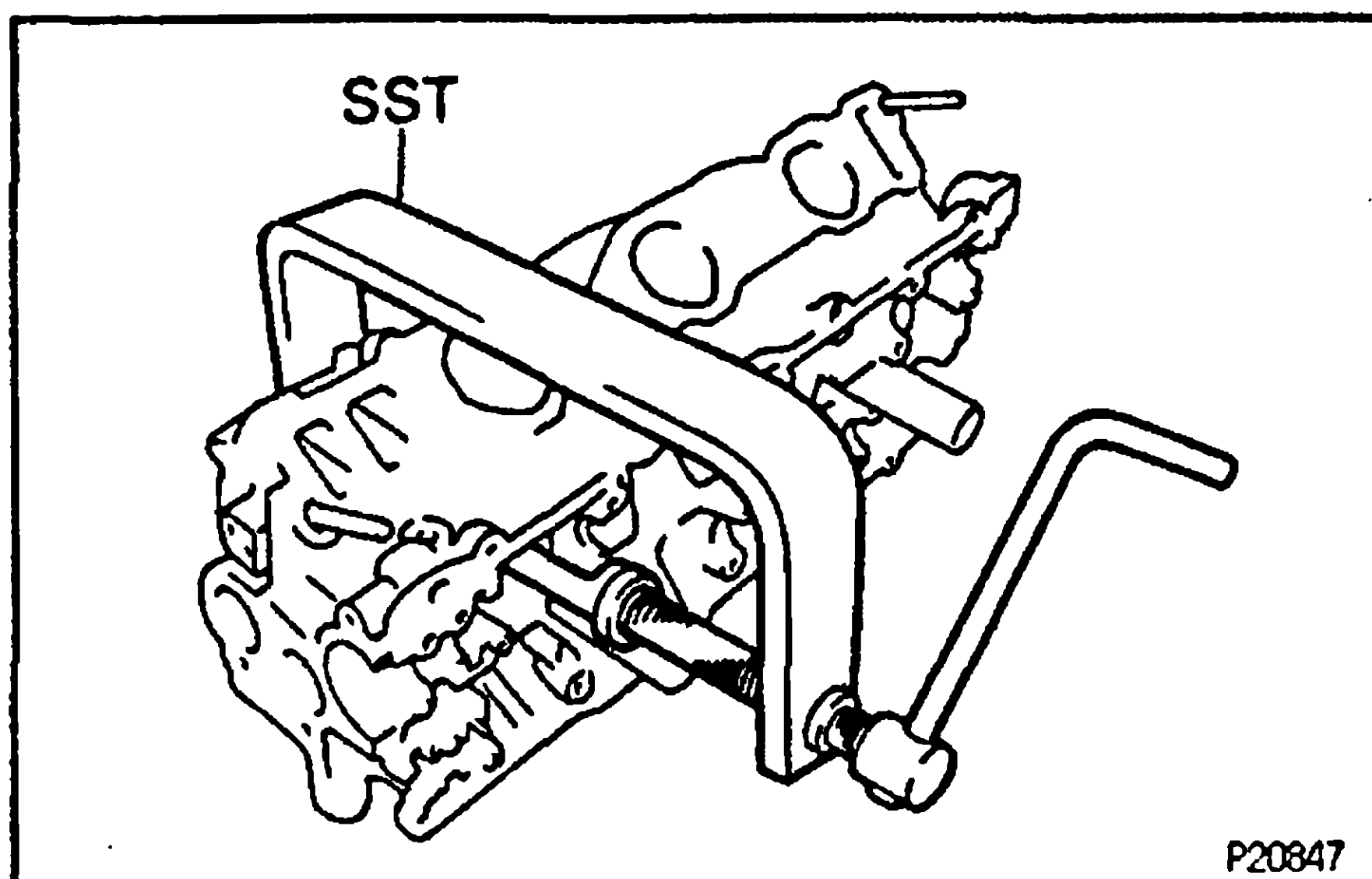
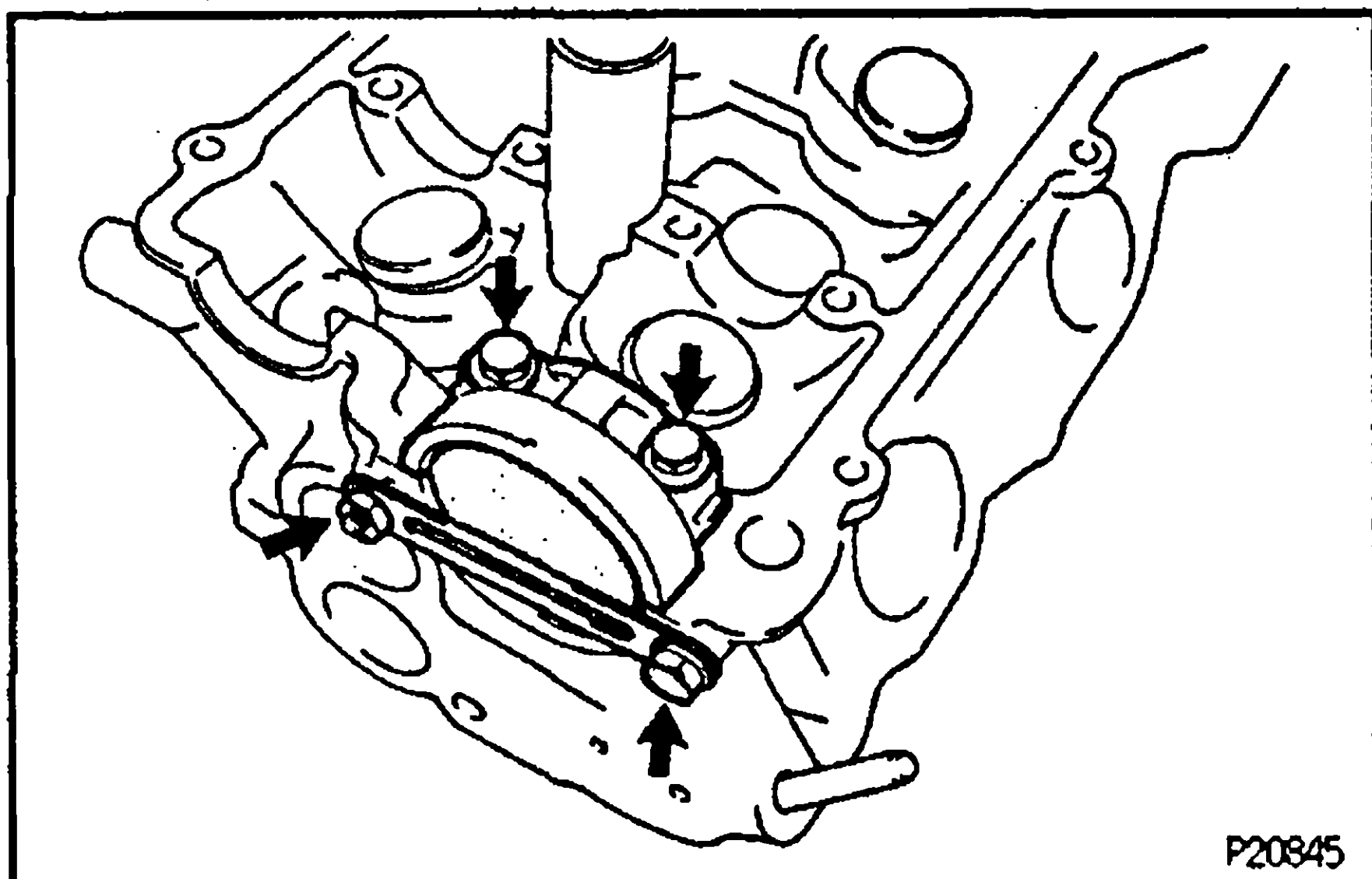
- Using SST, compress the valve spring and remove the 2 keepers.

SST 09202-70020

- Remove these parts:

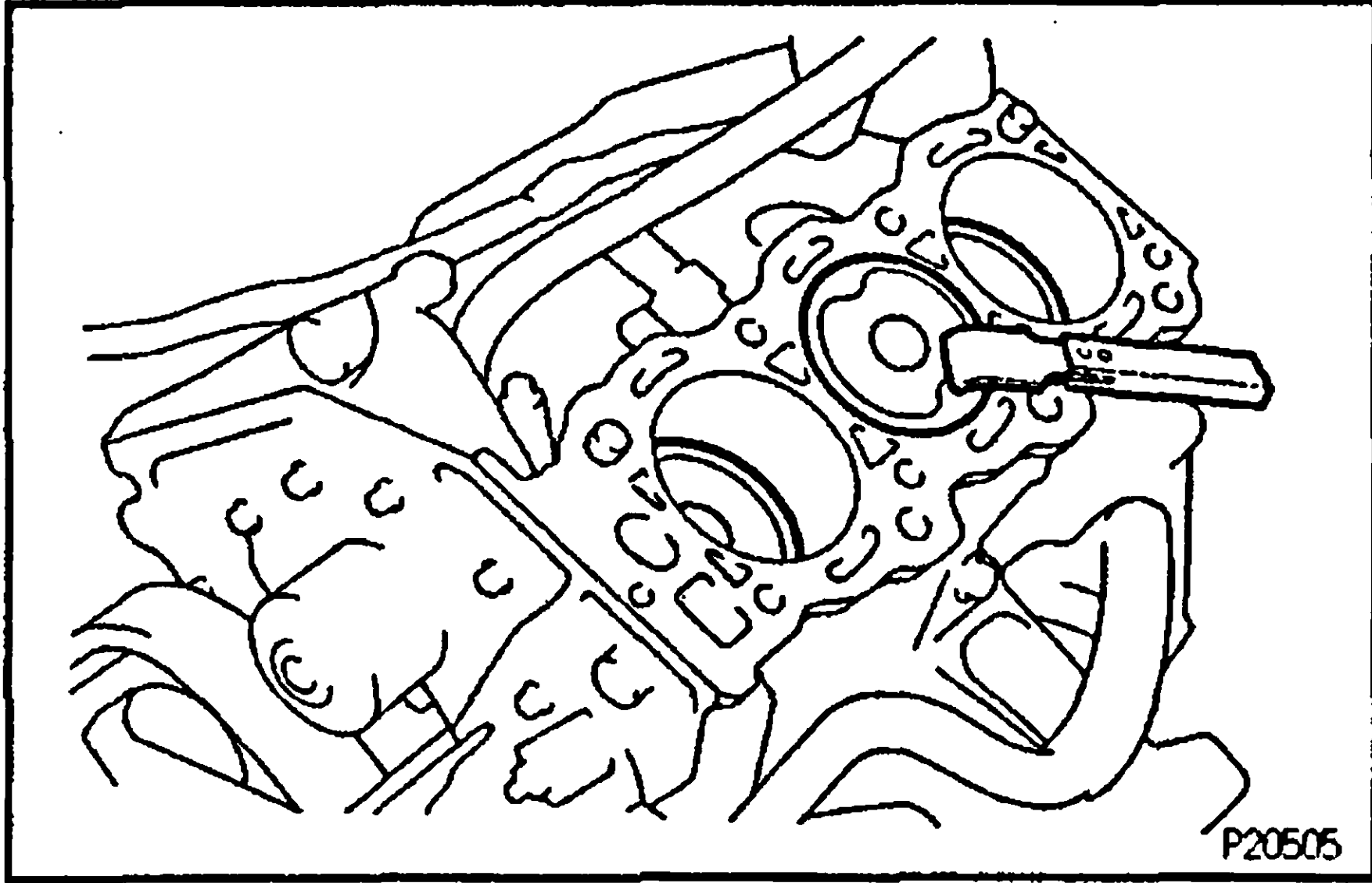
- Spring retainer
- Valve spring
- Valve

- Using needle-nose pliers, remove the oil seal.



- 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 the correct order.

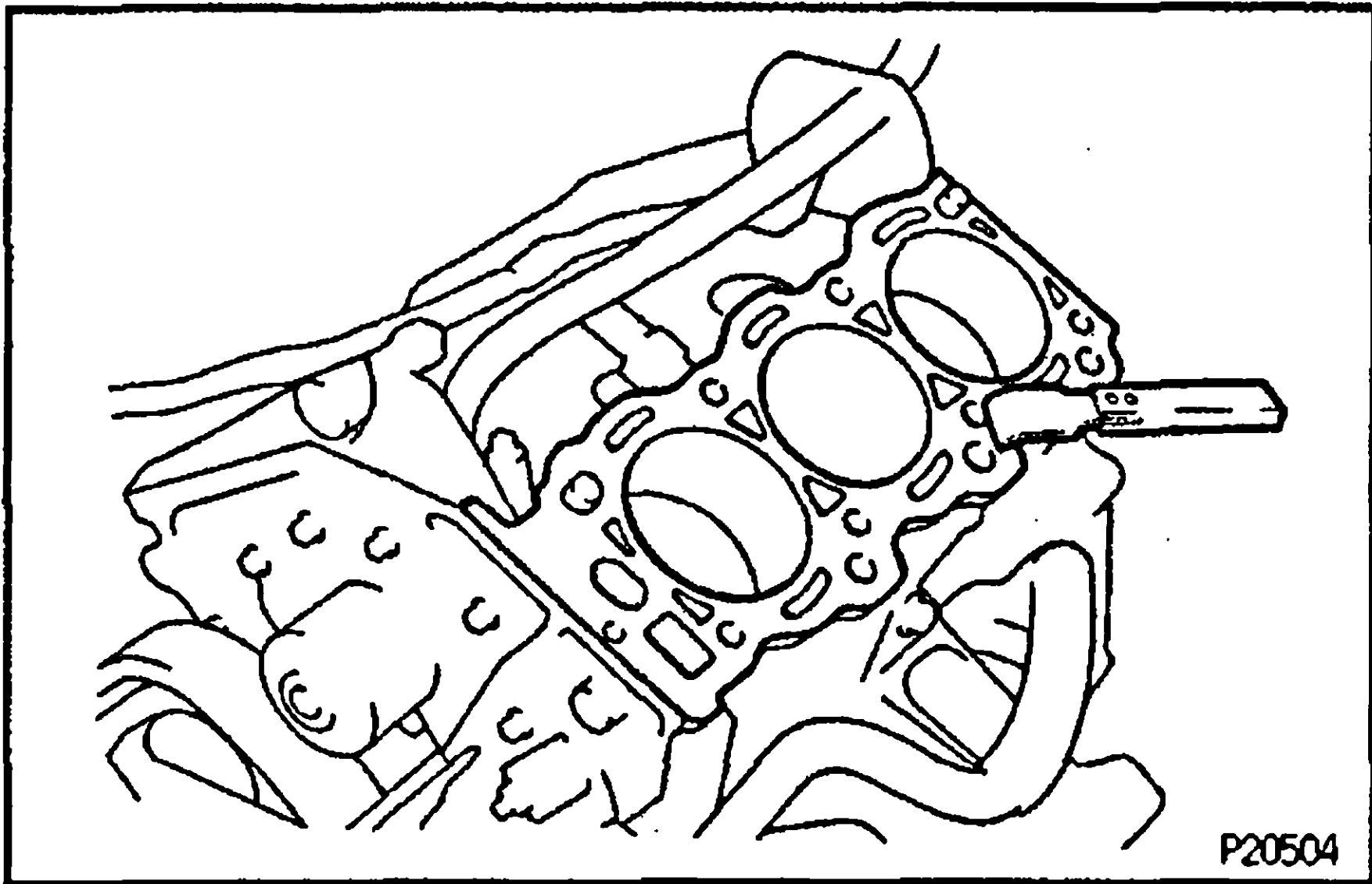


CYLINDER HEADS COMPONENTS INSPECTION AND REPAIR

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

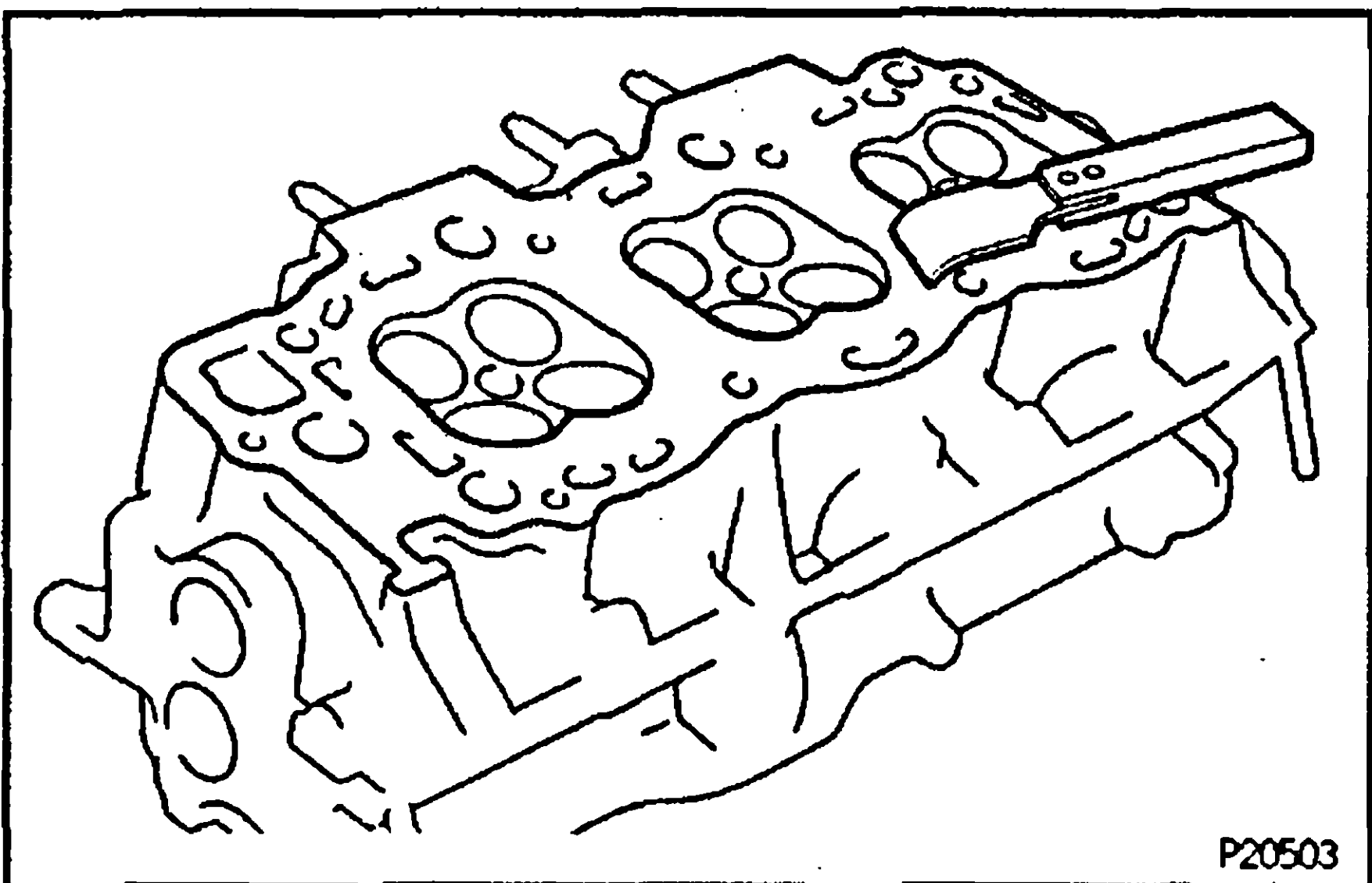
- (a) Turn the crankshaft and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surfaces.

EG



- (b) Using a gasket scraper, remove all the gasket material from the cylinder block surfaces.
(c) Using compressed air, blow carbon and oil from the bolt holes.

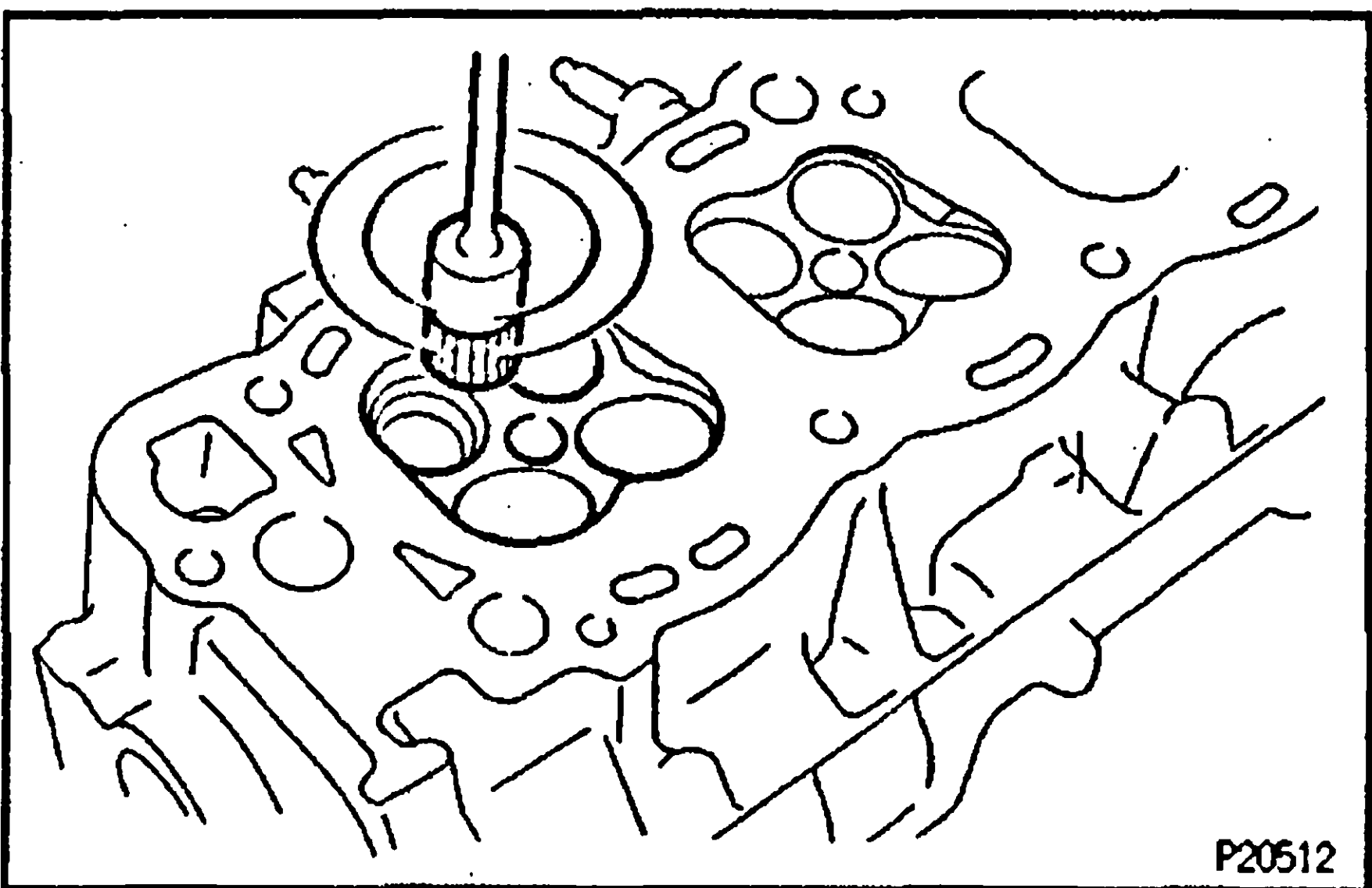
CAUTION: Protect your eyes when using high — compressed air.



2. REMOVE GASKET MATERIAL

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

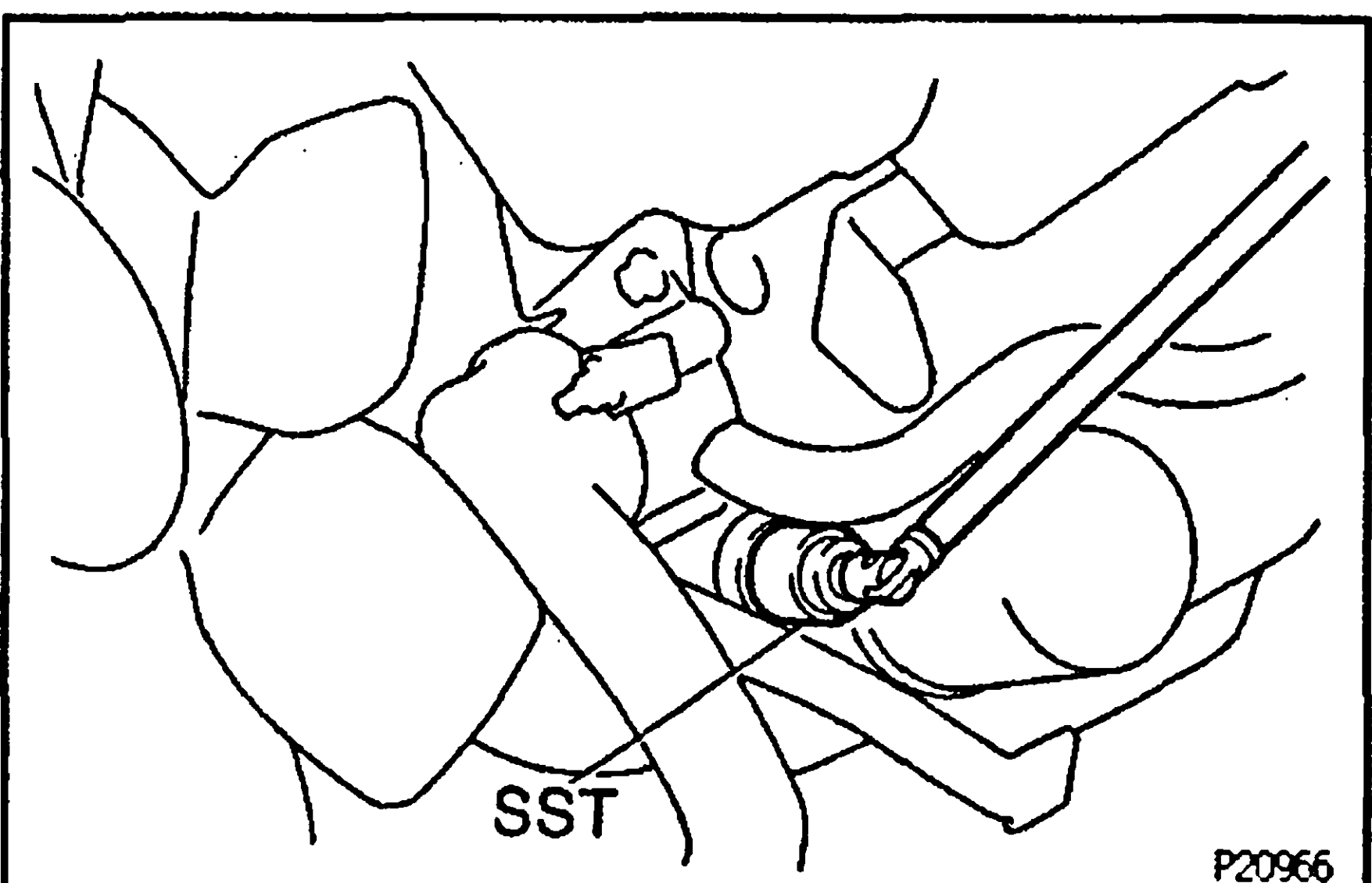
NOTICE: Be careful not to scratch the cylinder block contact surfaces.



3. CLEAN COMBUSTION CHAMBERS

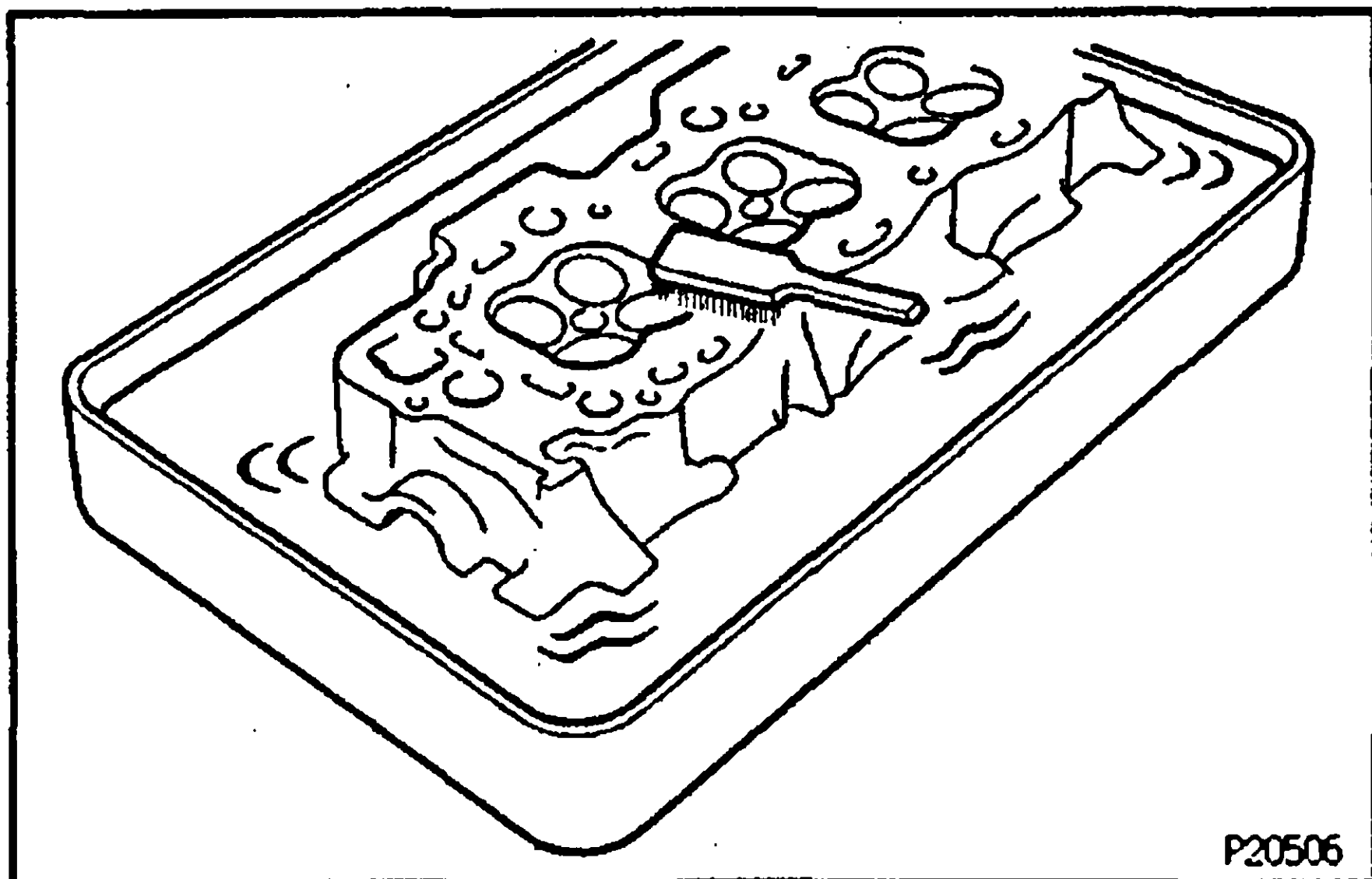
Using a wire brush, remove all the carbon from the combustion chambers.

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



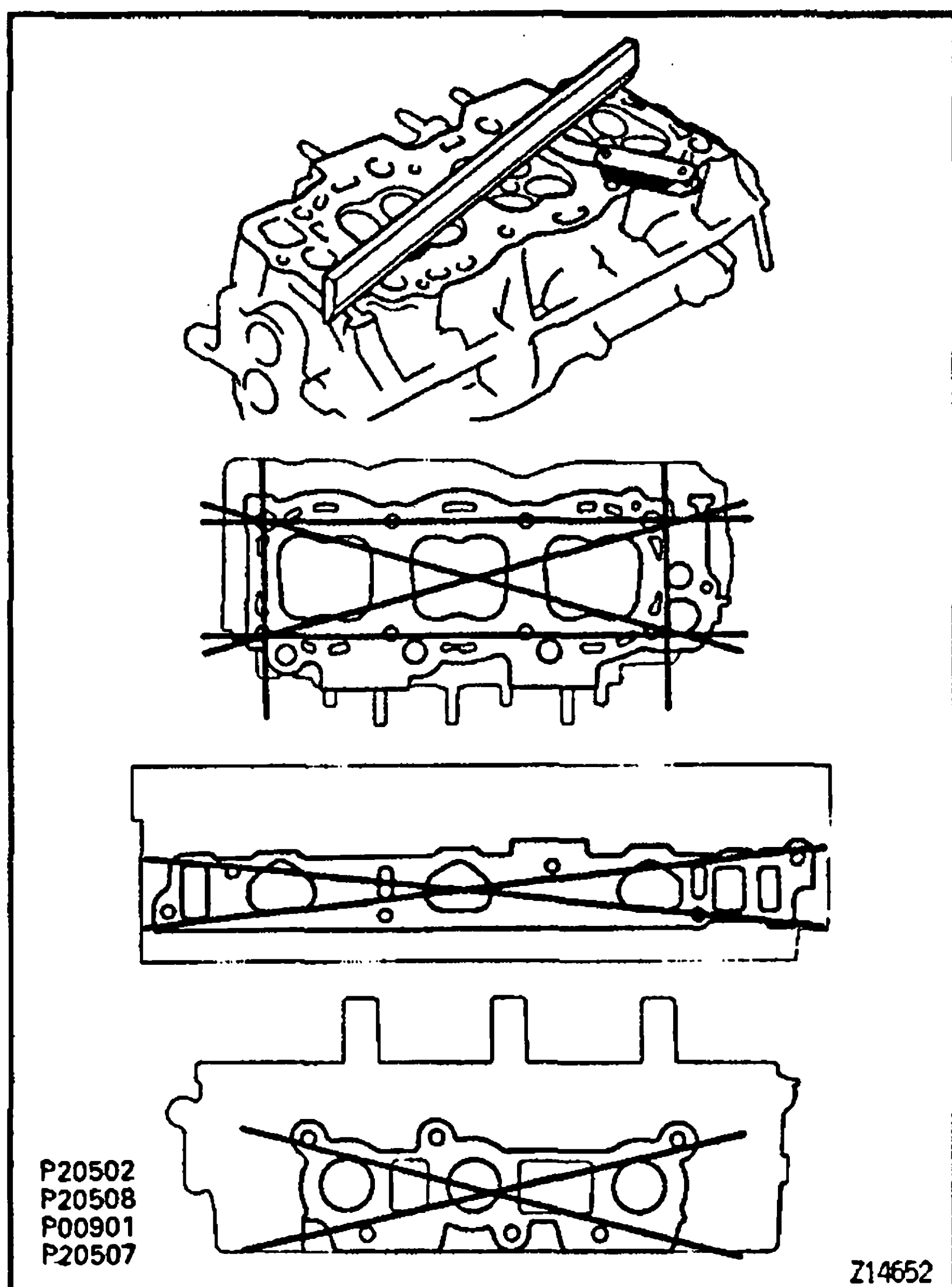
4. CLEAN VALVE GUIDE BUSHINGS

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



5. CLEAN CYLINDER HEADS

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



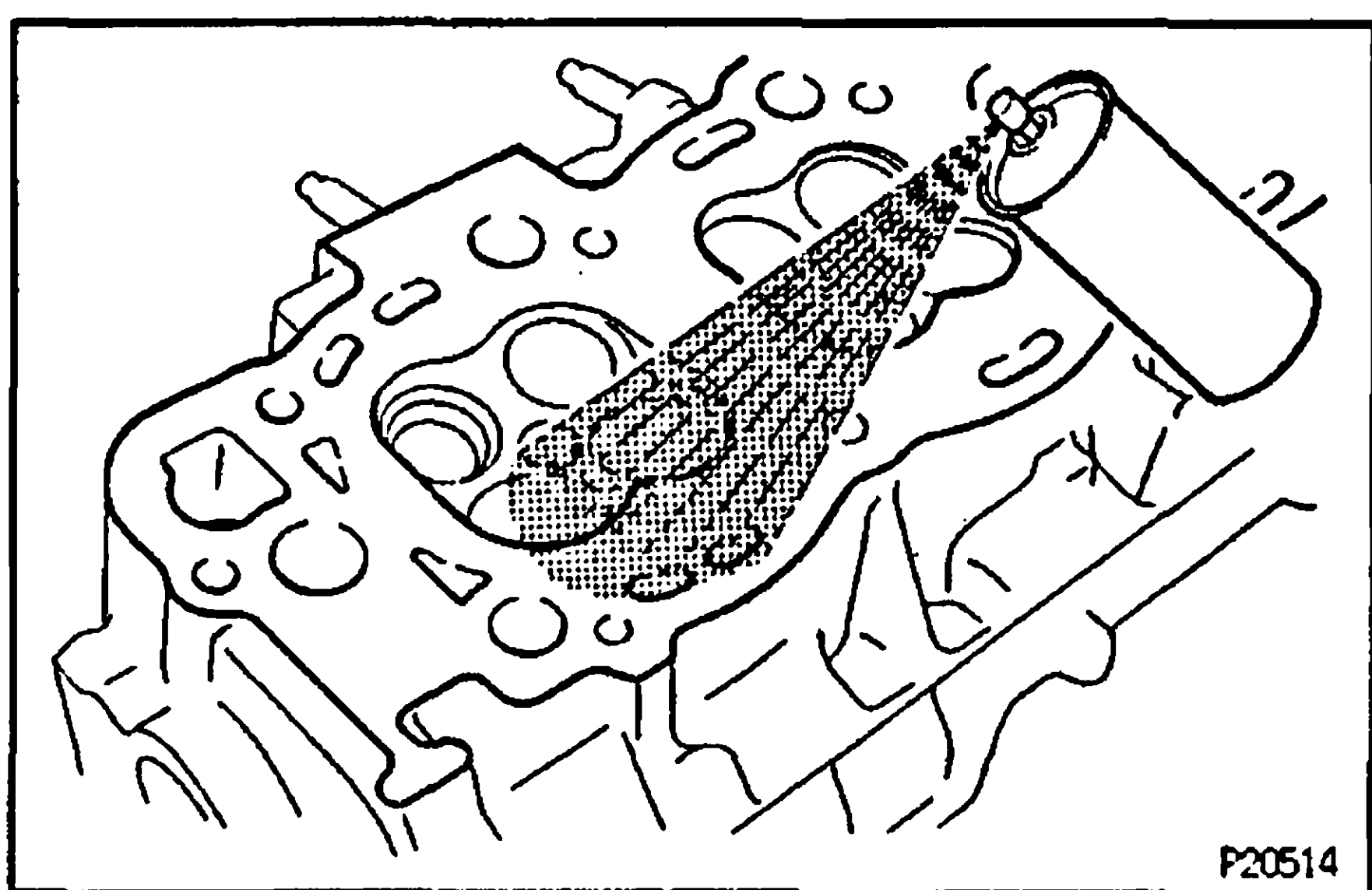
6. INSPECT FOR FLATNESS

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

Maximum warpage:

0.10 mm (0.0039 in.)

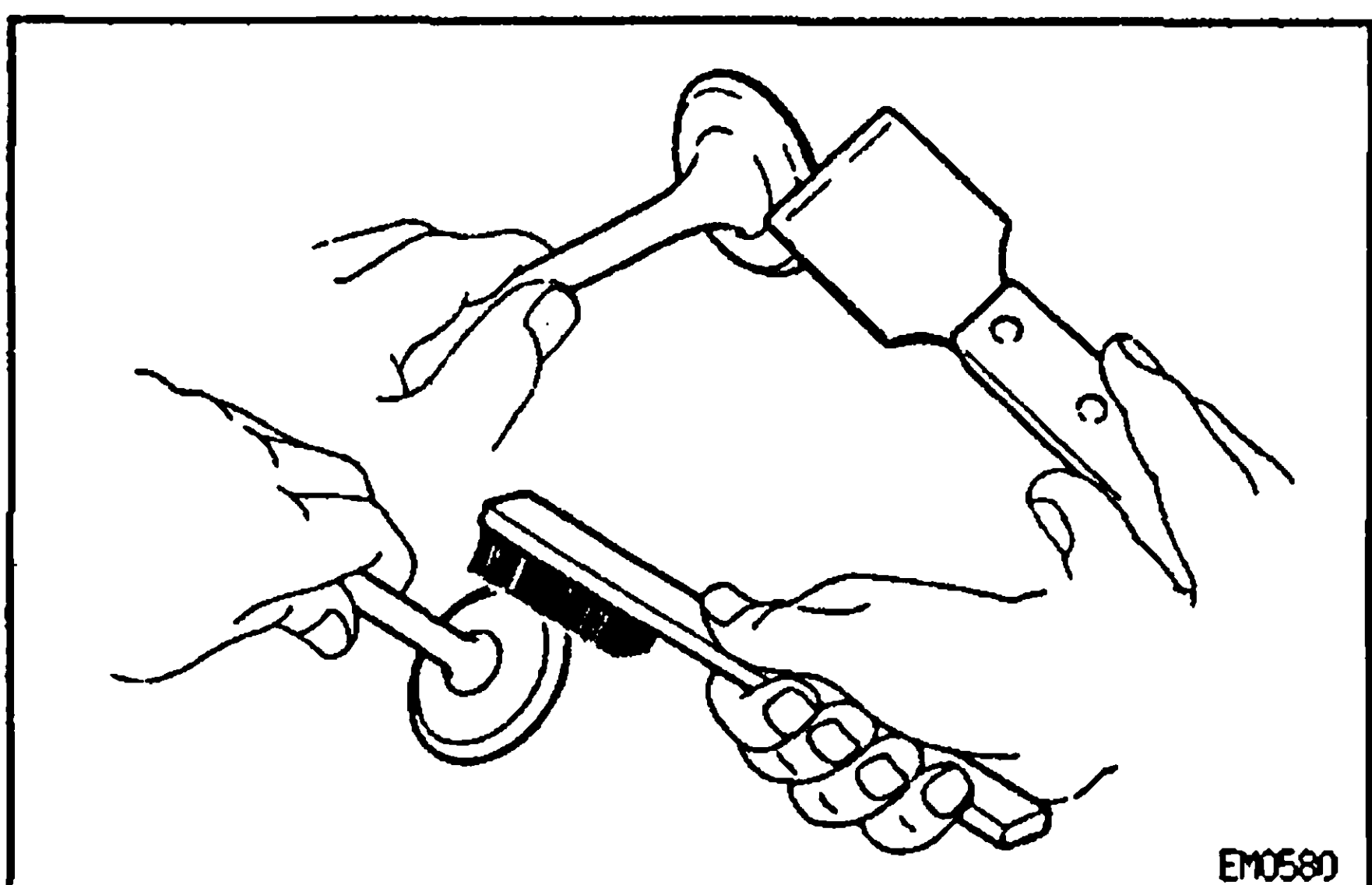
If warpage is greater than the maximum, replace the cylinder head.



7. INSPECT FOR CRACKS

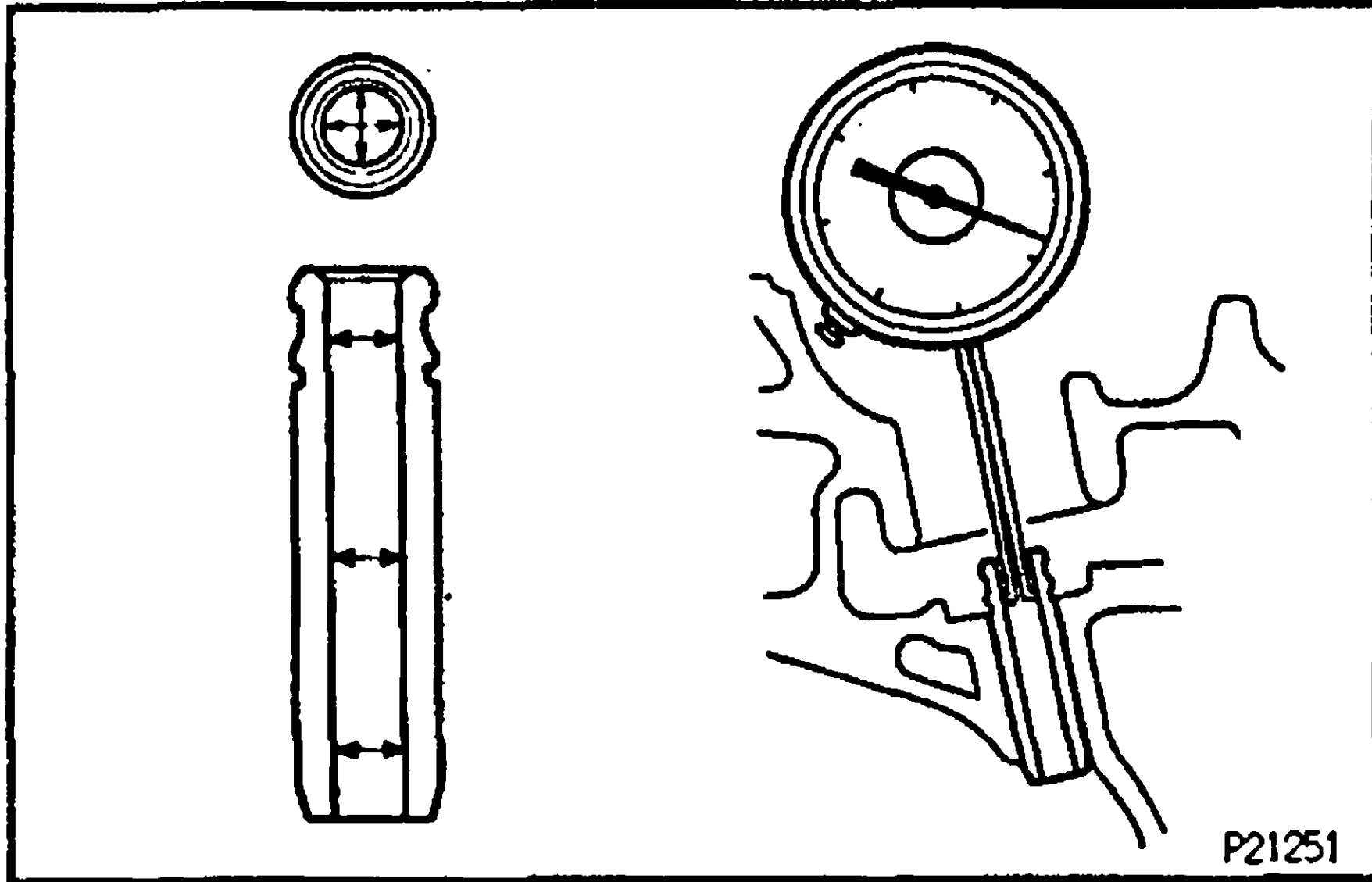
Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



8. CLEAN VALVES

- (a) Using a gasket scraper, chip off any carbon from the valve head.
- (b) Using a wire brush, thoroughly clean the valve.

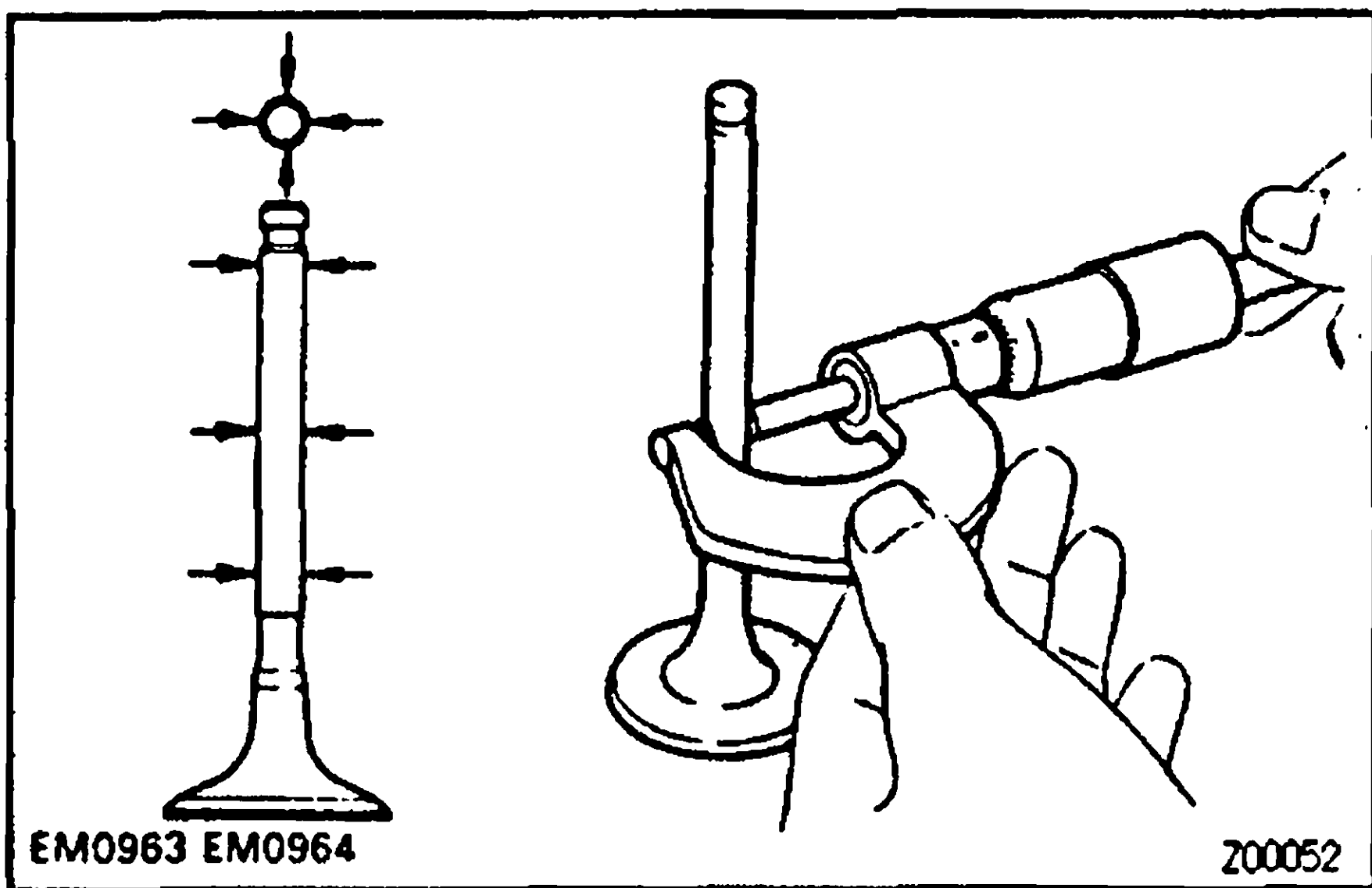


9. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

6.010 — 6.030 mm (0.2366 — 0.2374 in.)



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

Valve stem diameter:

Intake

5.970 — 5.985 mm (0.2350 — 0.2356 in.)

Exhaust

5.965 — 5.980 mm (0.2348 — 0.2354 in.)

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

Standard oil clearance:

Intake

0.025 — 0.060 mm (0.0010 — 0.0024 in.)

Exhaust

0.030 — 0.065 mm (0.0012 — 0.0026 in.)

maximum oil clearance:

Intake

0.08 mm (0.0031 in.)

Exhaust

0.10 mm (0.0039 in.)

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

10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

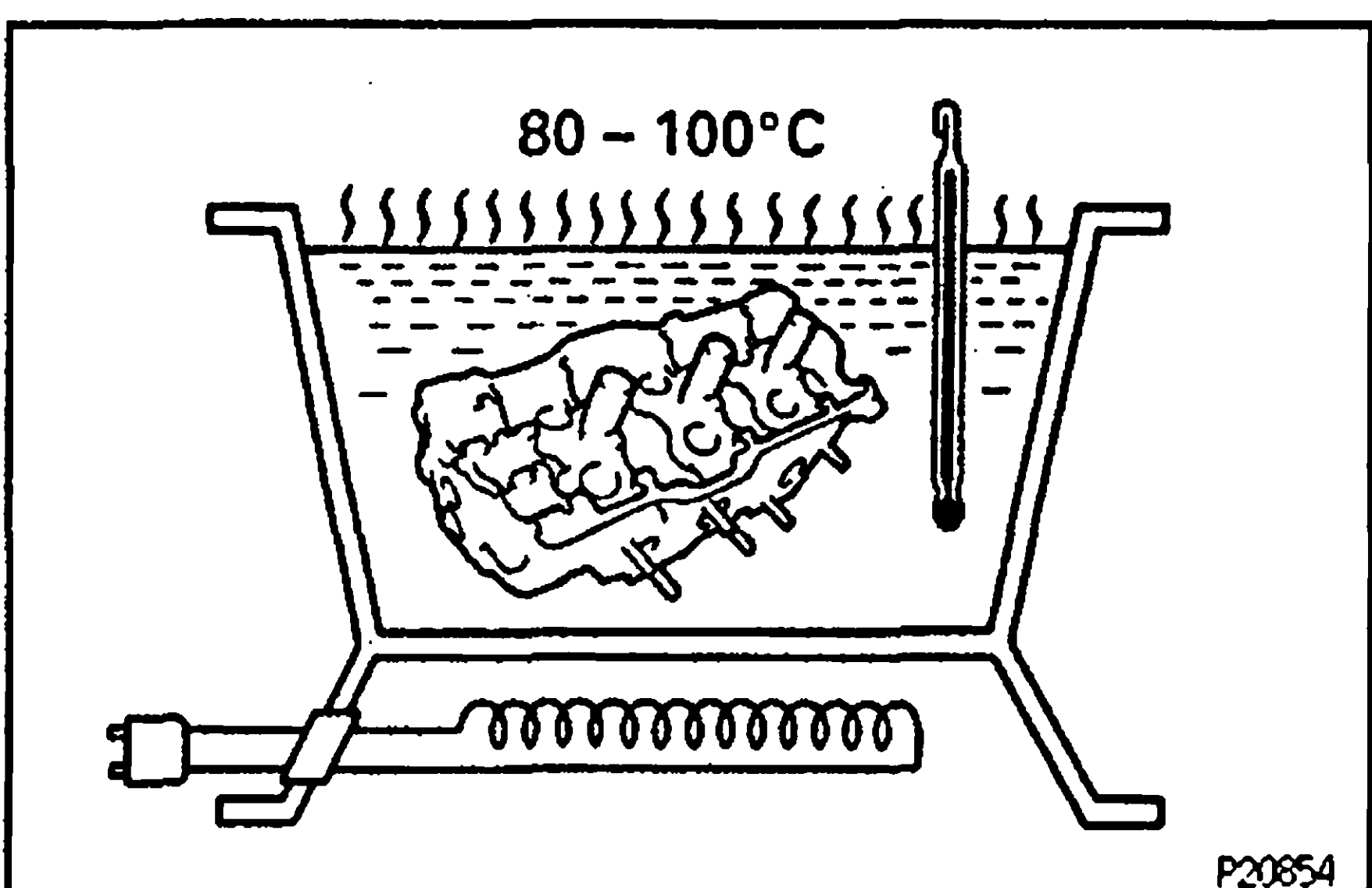
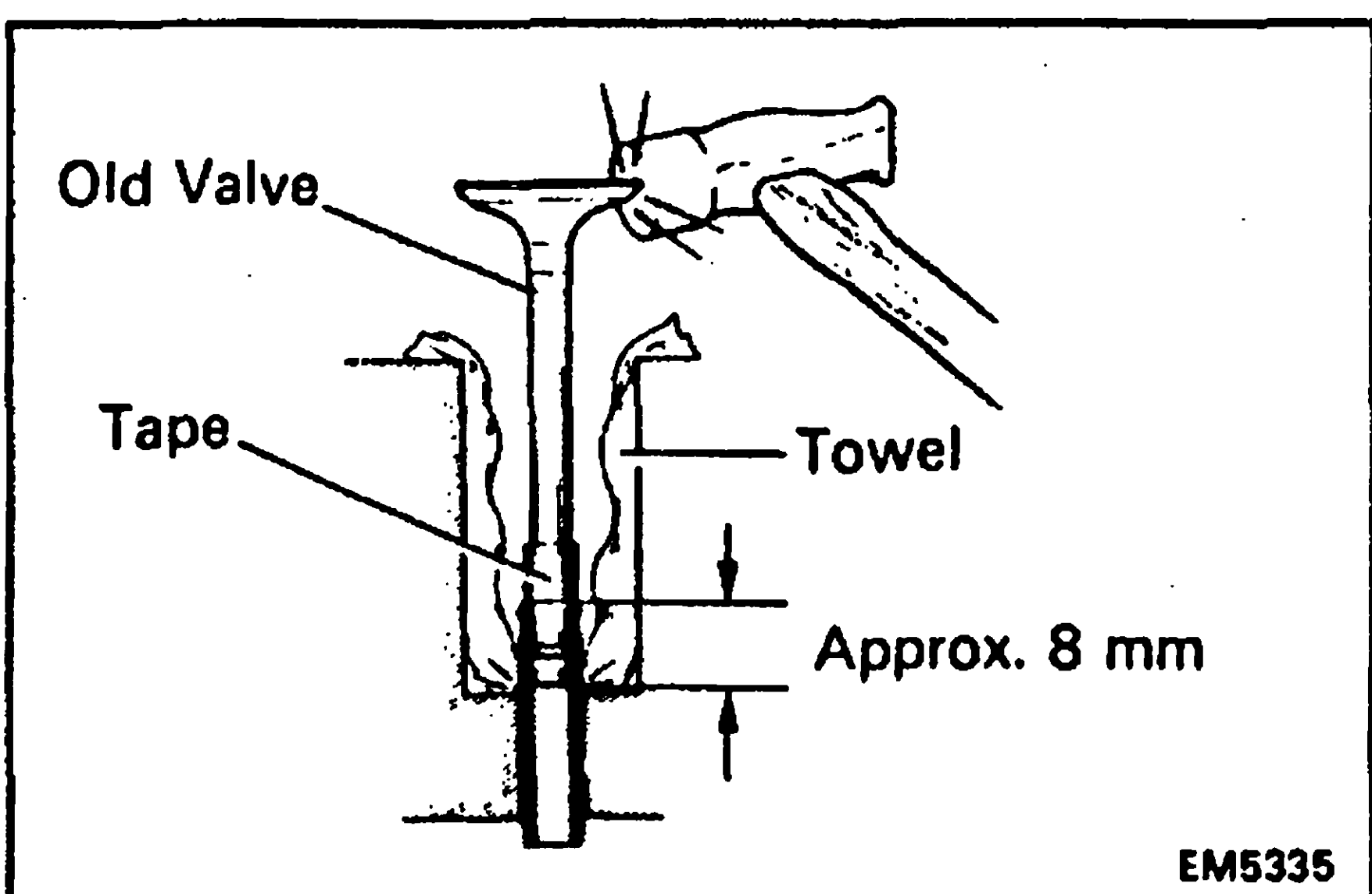
- (a) w/ Snap ring:

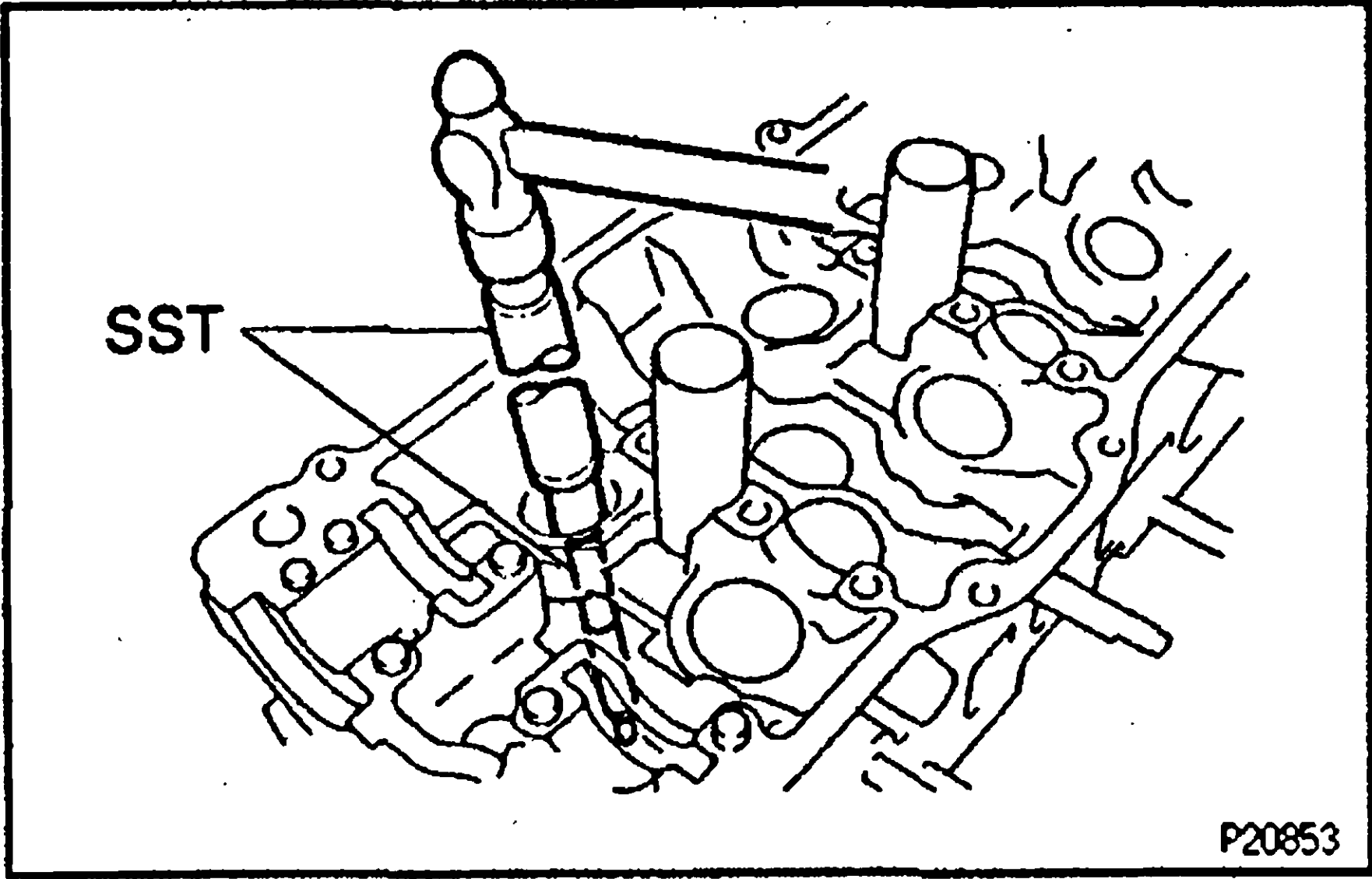
Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer. Remove the snap ring.

HINT: Wrap the tape approx. 8 mm (0.31 in.) from the valve stem end.

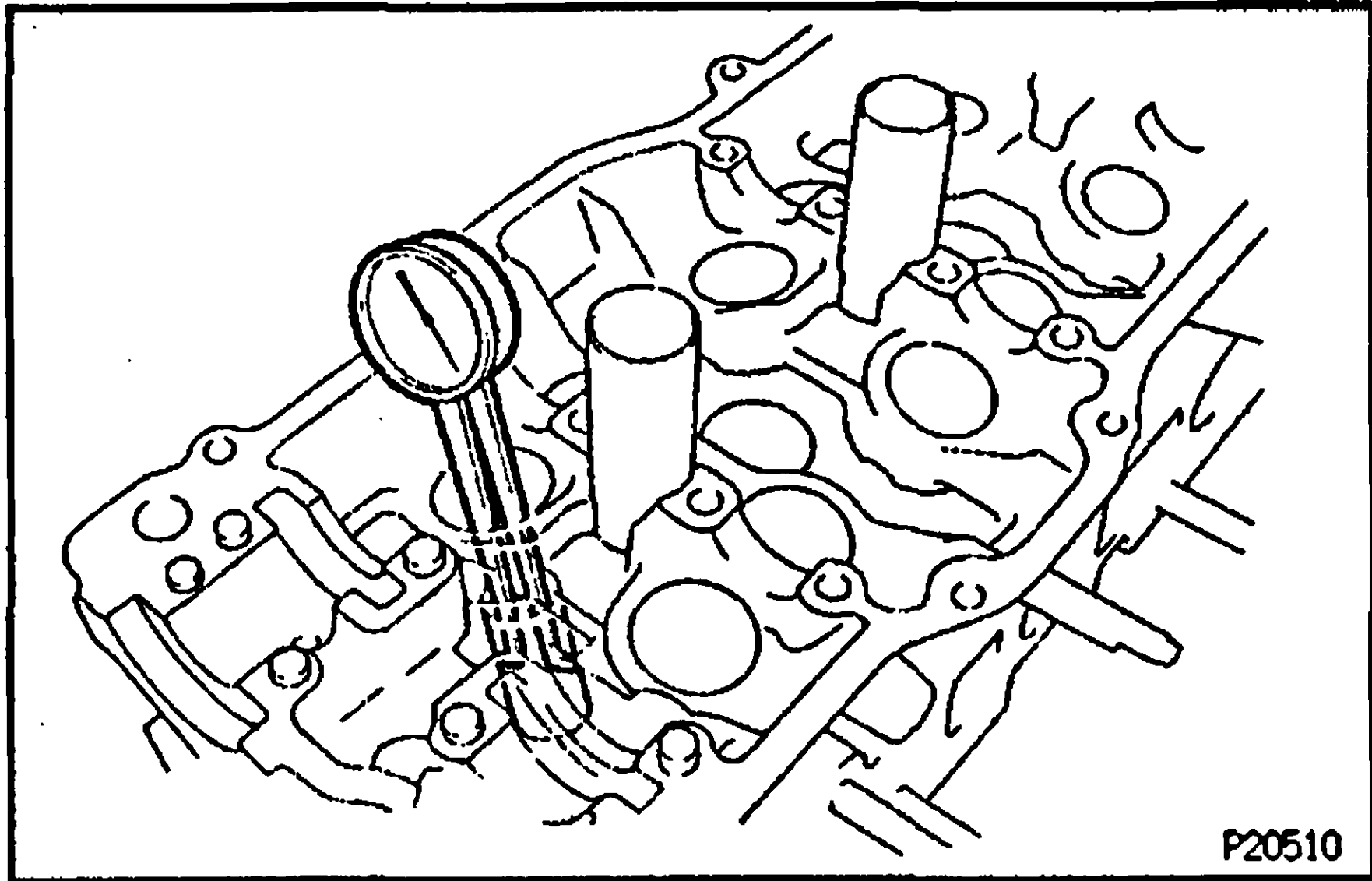
NOTICE: Be careful not to damage the valve lifter hole.

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





- (c) Using SST and a hammer, tap out the guide bushing.
SST 09201 – 10000 (09201 – 01060),
09950 – 70010 (09951 – 07150)



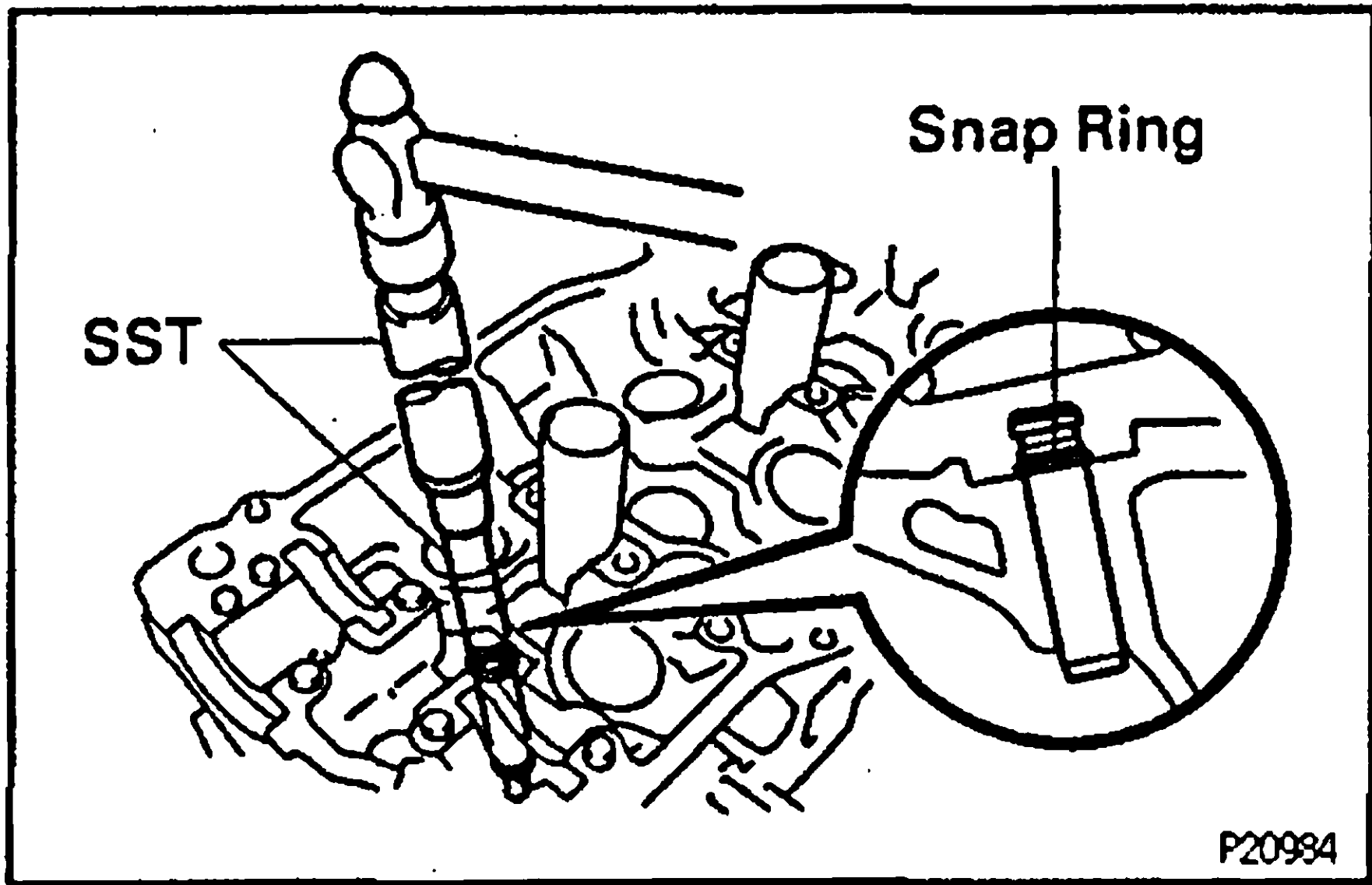
- (d) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Both intake and exhaust

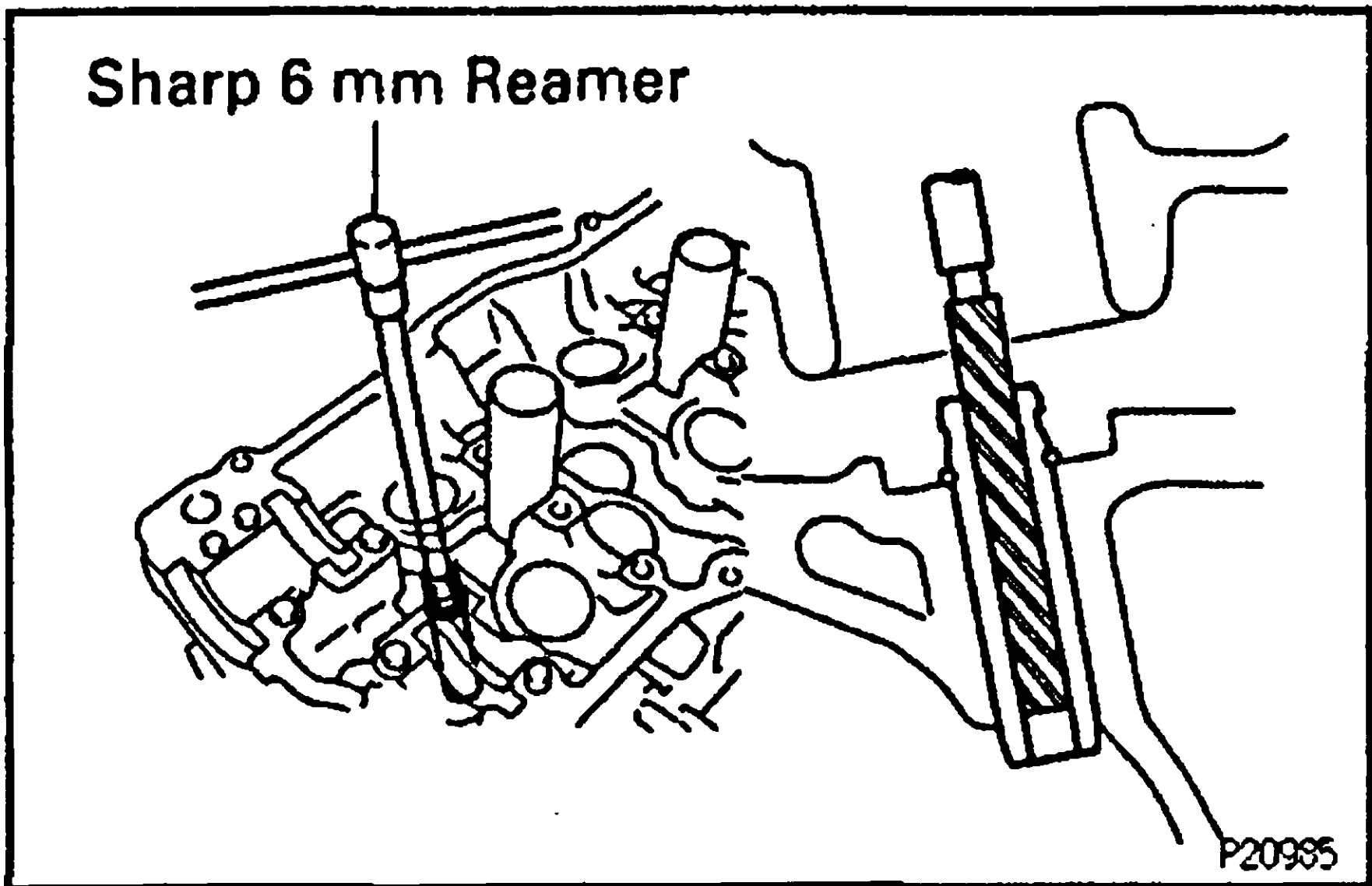
Bushing bore diameter mm (in.)	Bushing size
10.985 – 11.027 (0.4325 – 0.4341)	Use STD
11.050 – 11.077 (0.4350 – 0.4361)	Use O/S 0.05

- (e) 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 these 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.

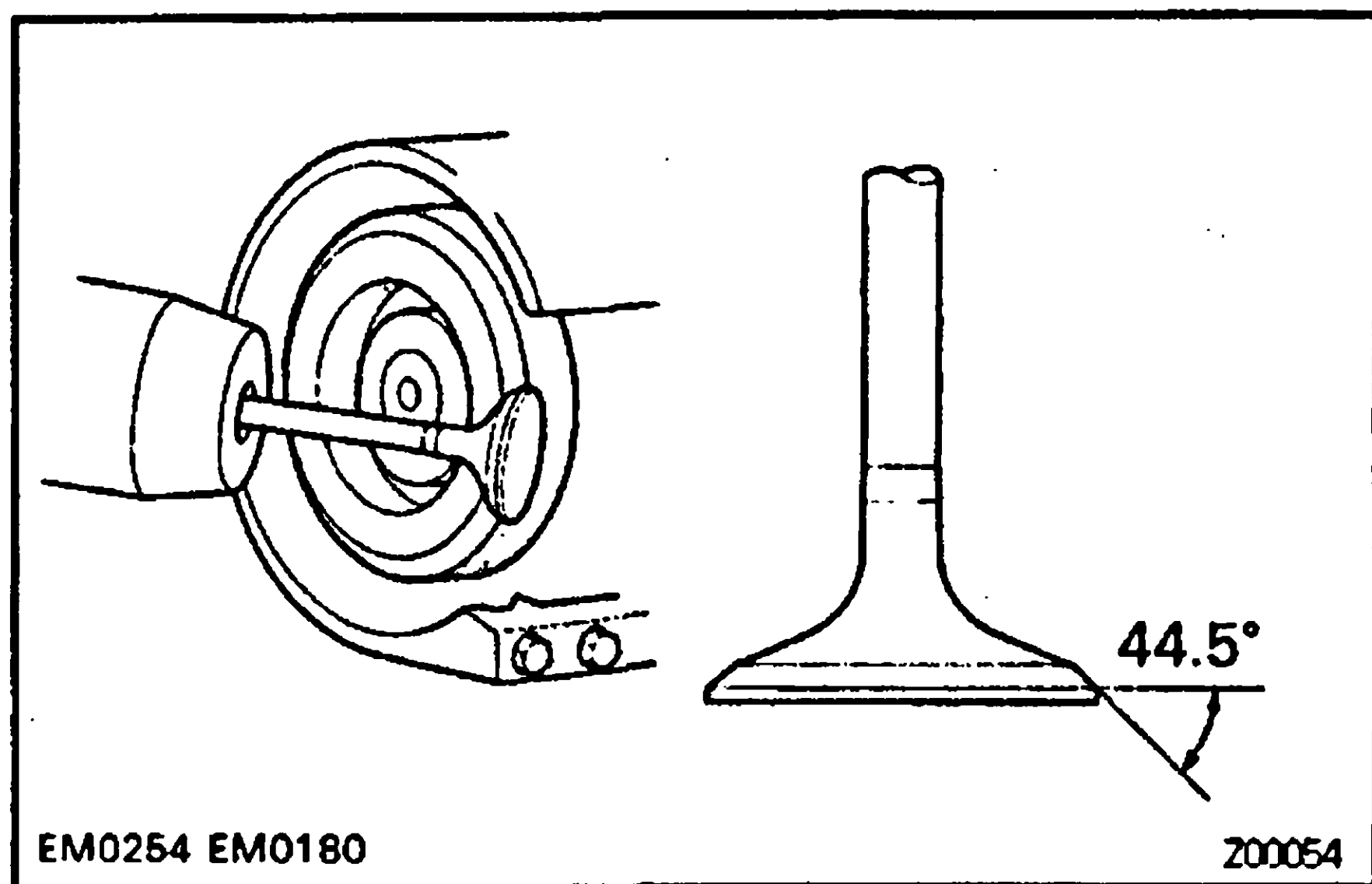
V06270



- (f) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).
(g) Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.
SST 09201 – 10000 (09201 – 01060),
09950 – 70010 (09951 – 07150)



- (h) 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.



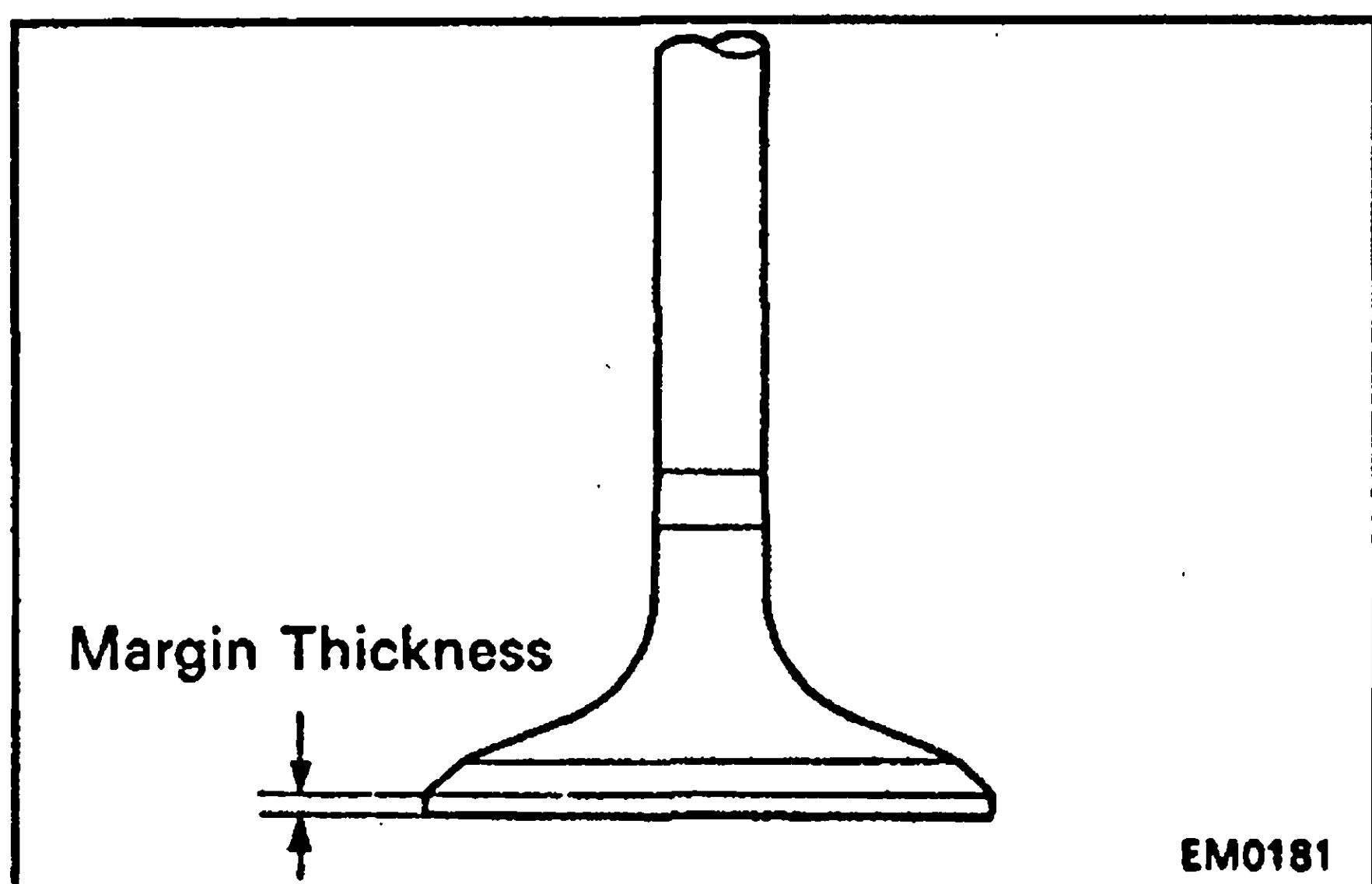
11. INSPECT AND GRIND VALVES

- Grind the valve enough to remove pits and carbon.
- Check that the valve is ground to the correct valve face angle.

Valve face angle:

44.5°

EG



- 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 the minimum, replace the valve.

- Check the valve overall length.

Standard overall length:

Intake

95.15 mm (3.7461 in.)

Exhaust

94.90 mm (3.7362 in.)

Minimum overall length:

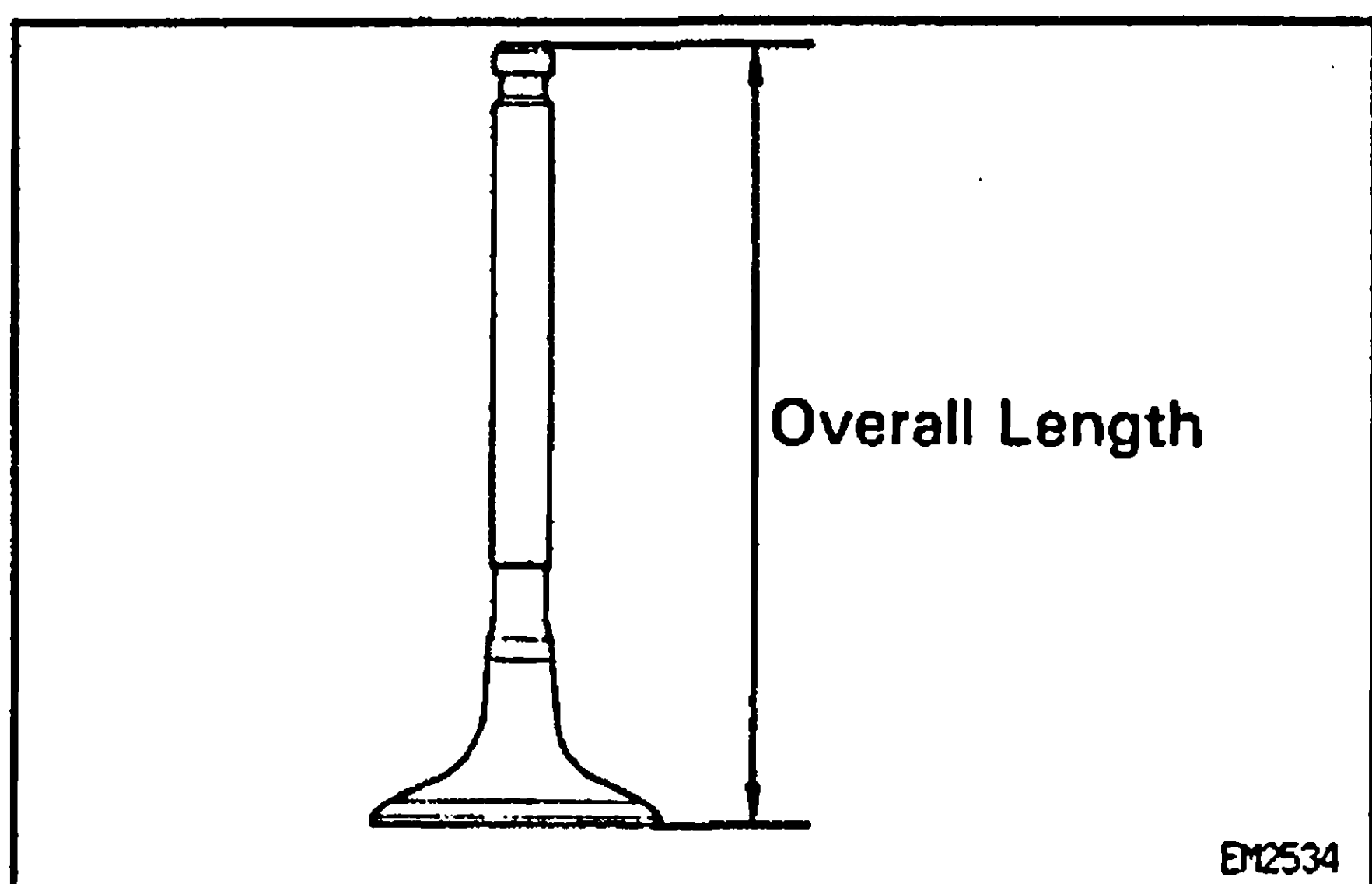
Intake

94.60 mm (3.7244 in.)

Exhaust

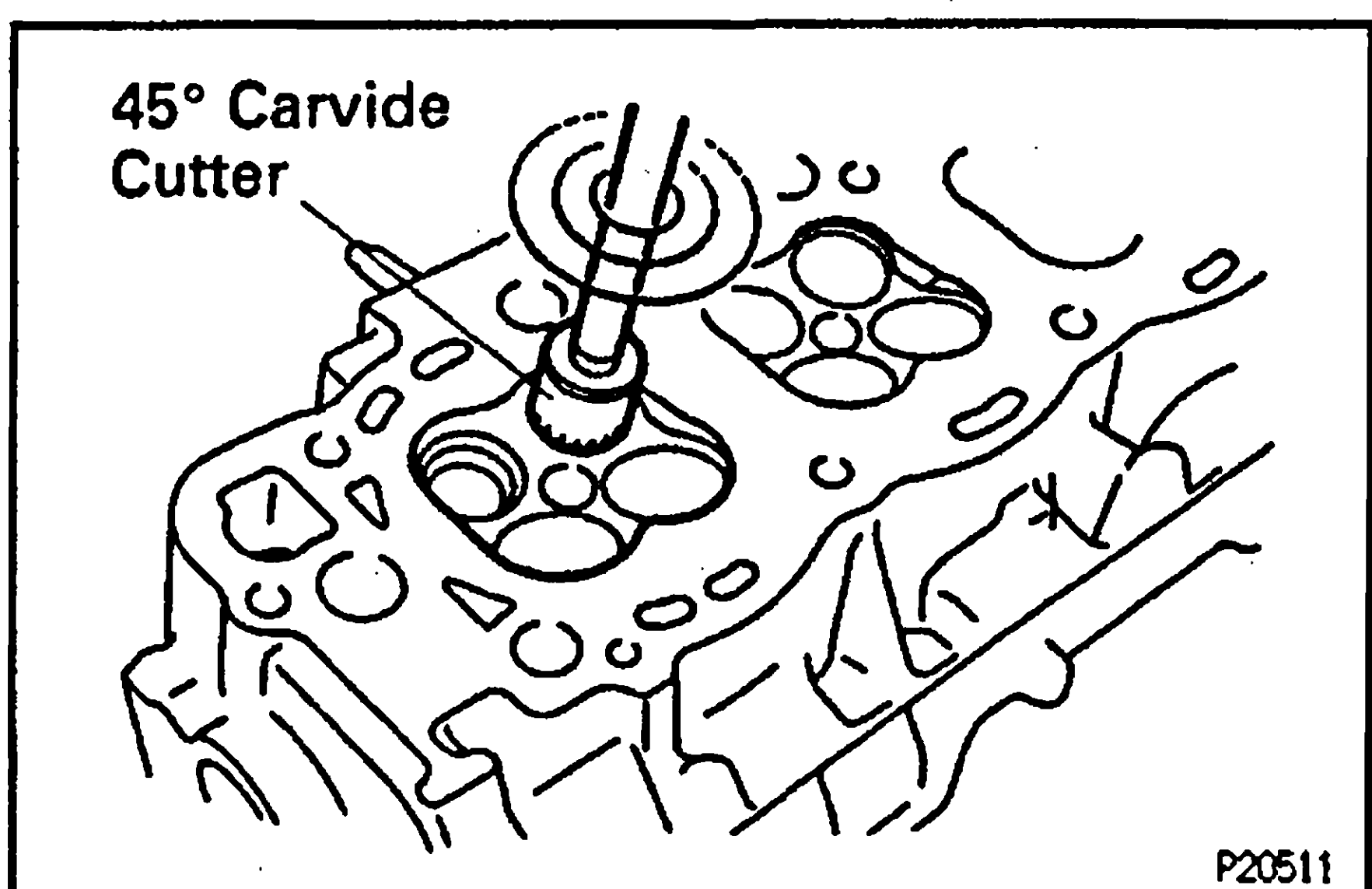
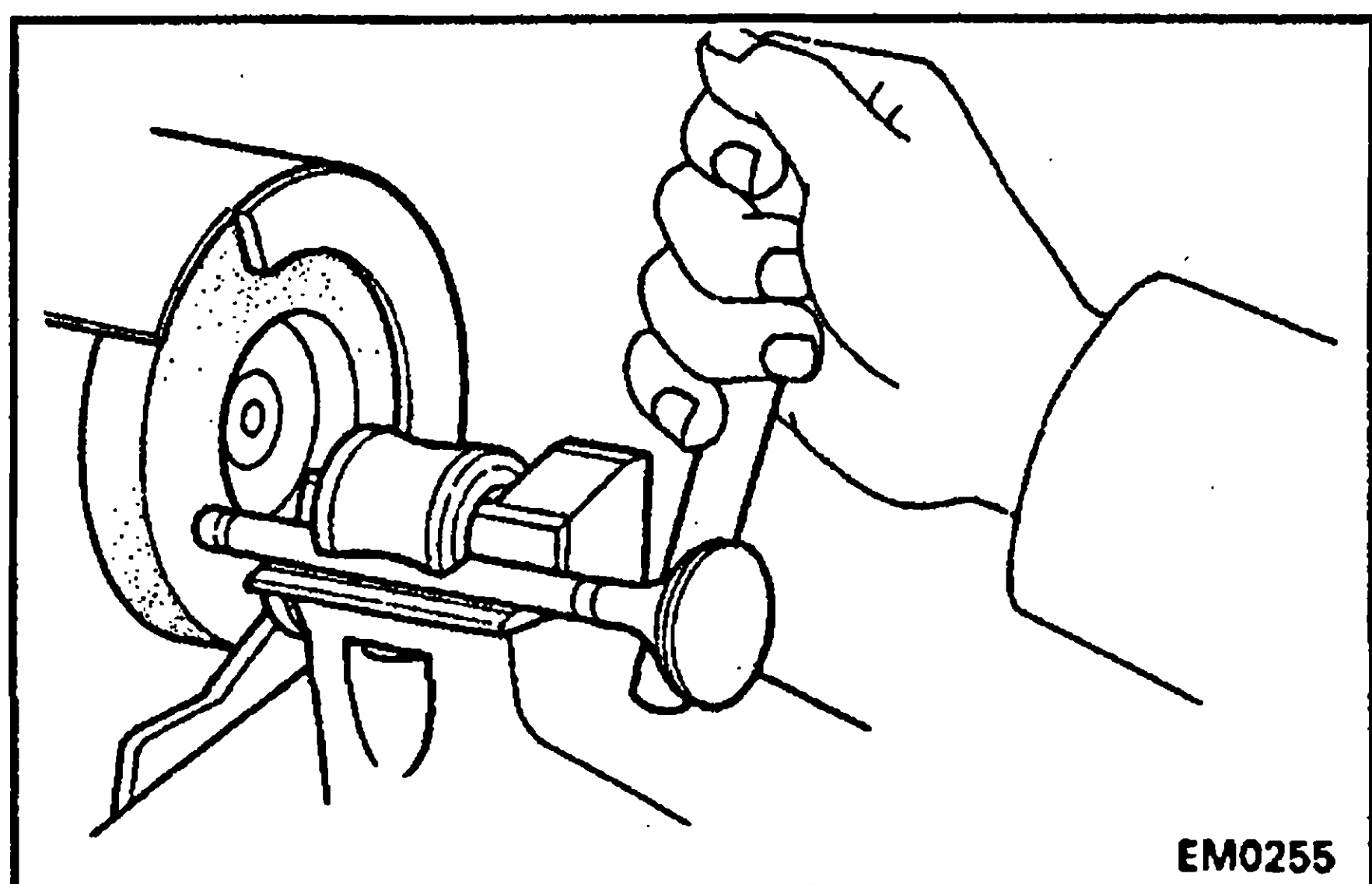
94.40 mm (3.7165 in.)

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



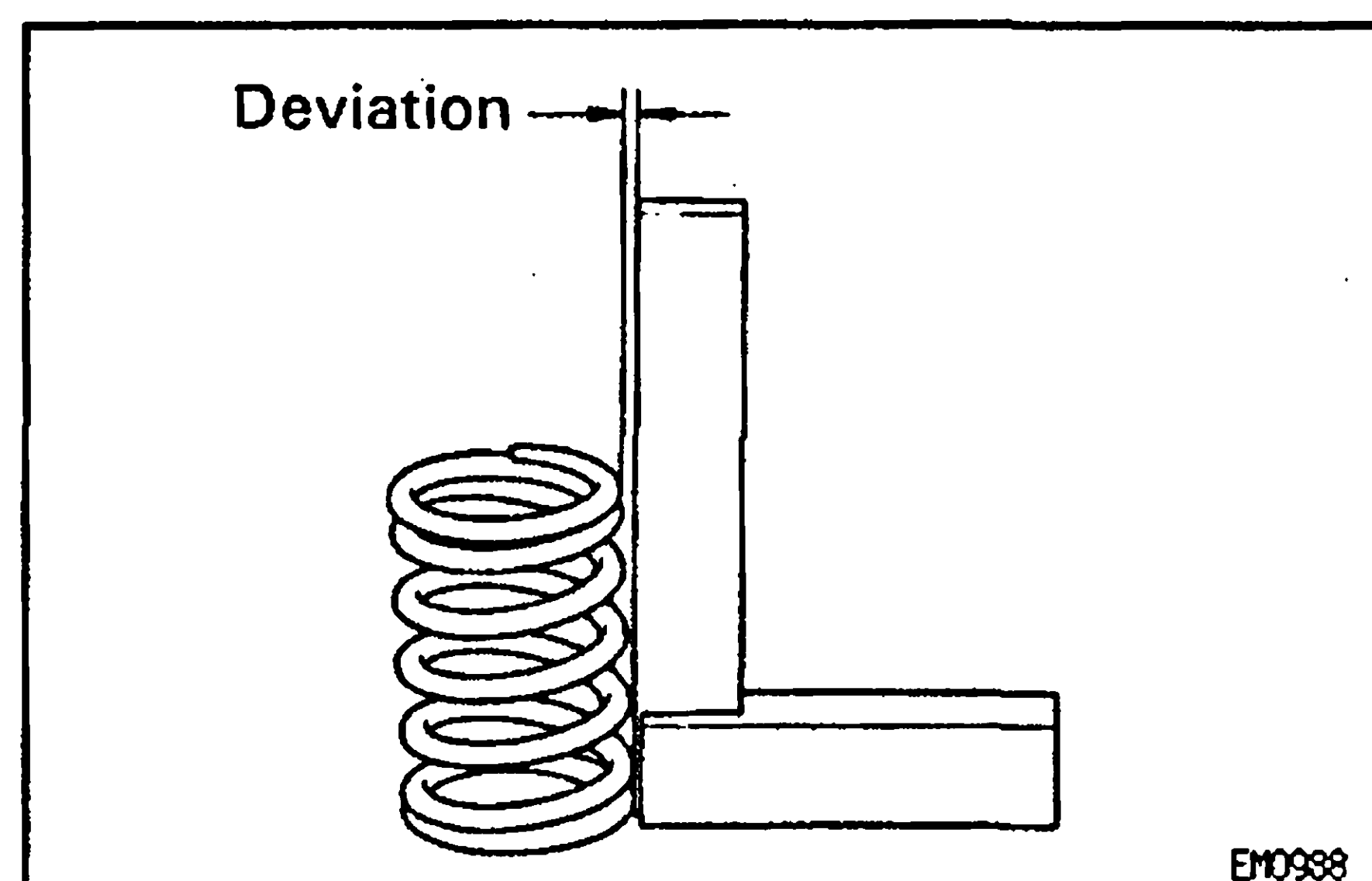
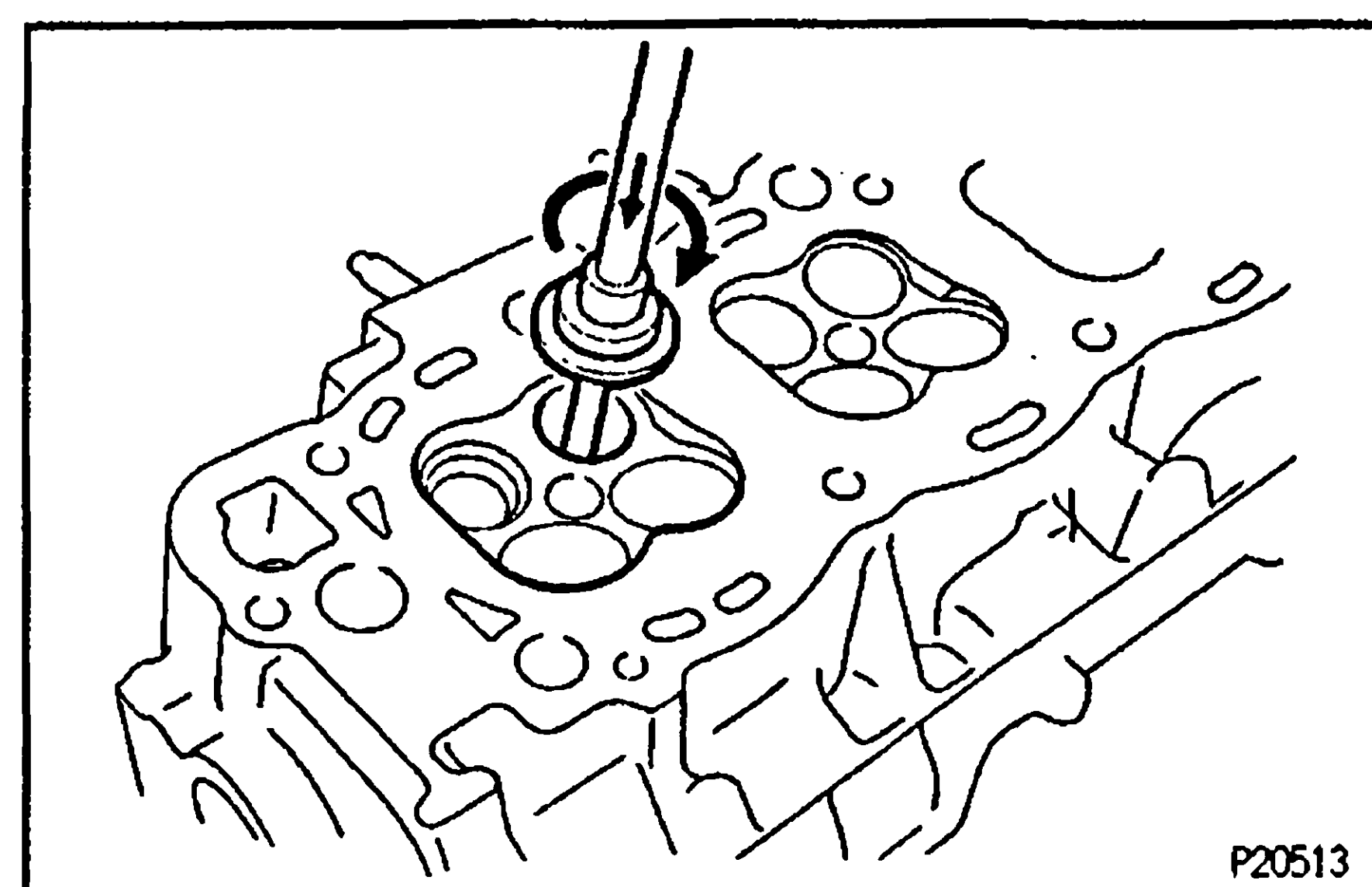
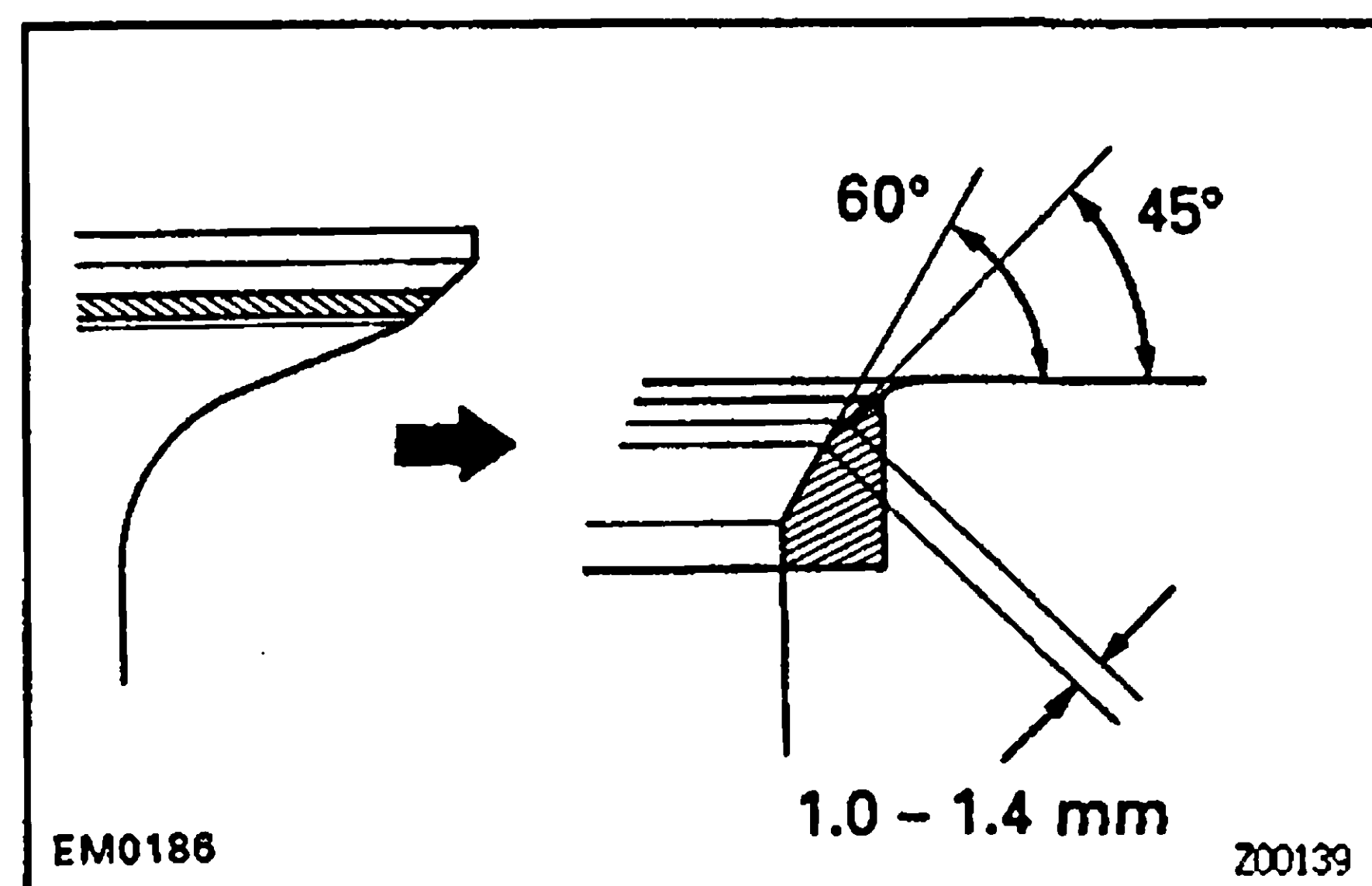
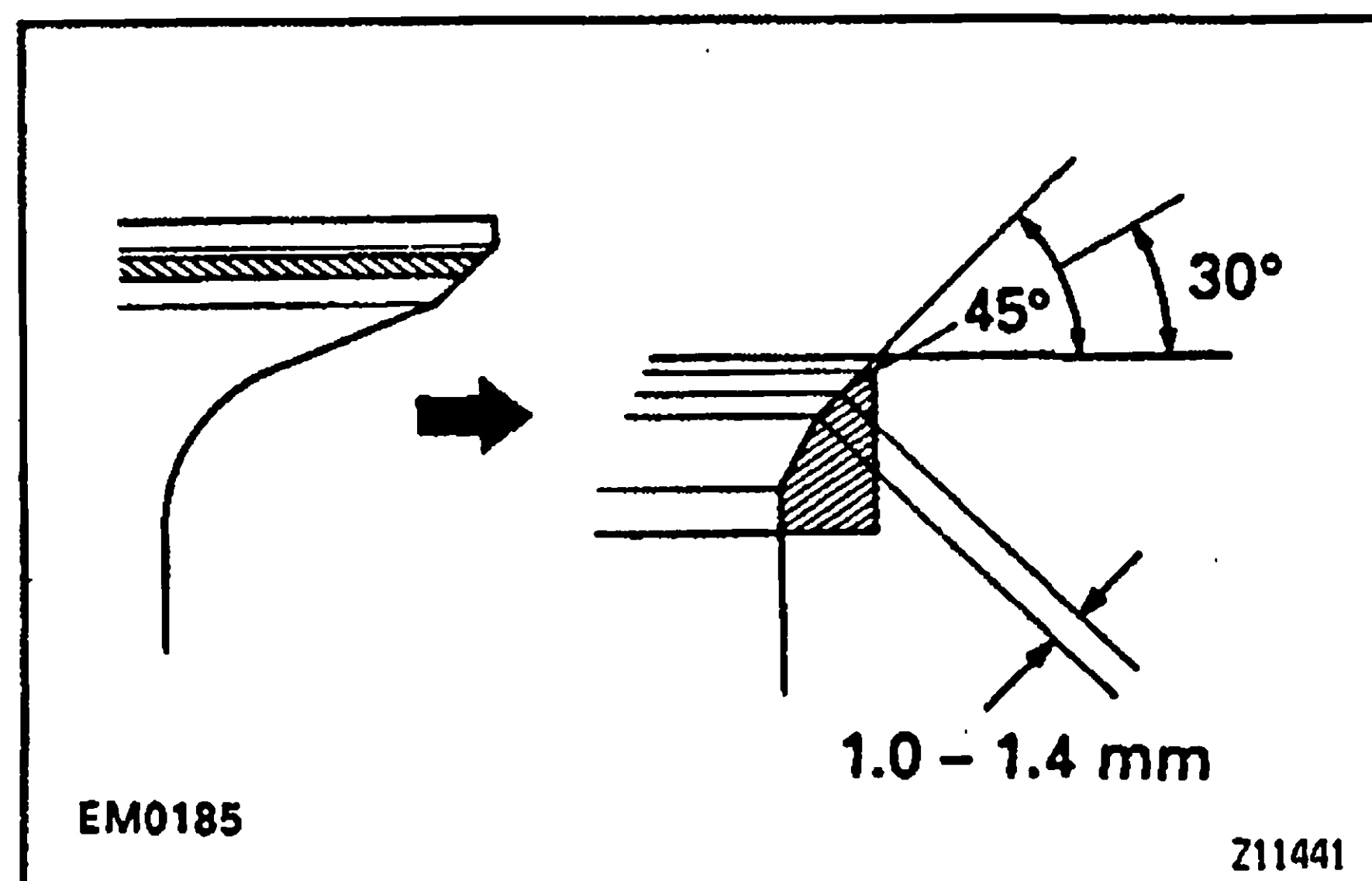
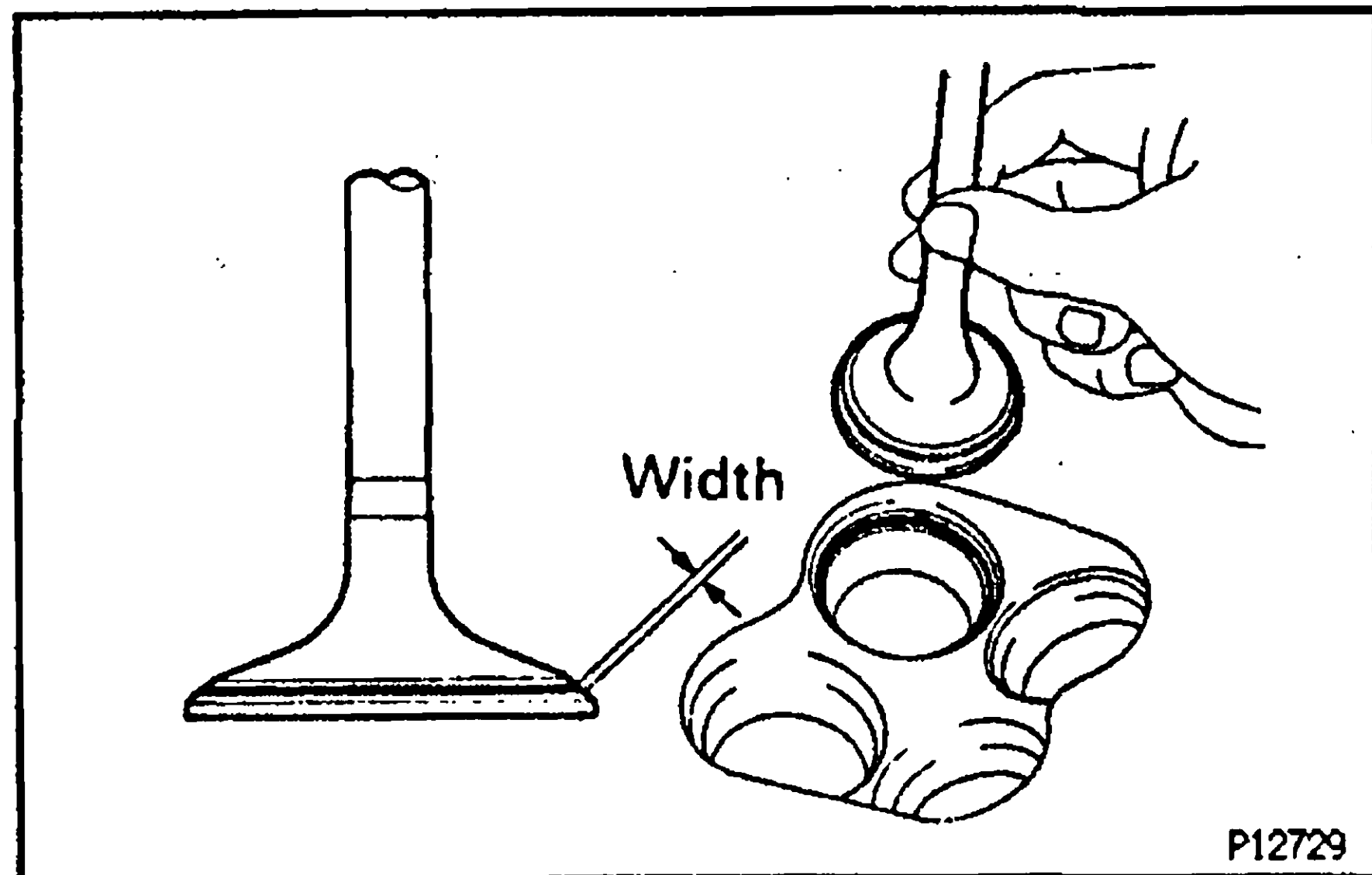
- Check the surface of the valve stem tip for wear. If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTICE: Do not grind off more than the minimum.



12. INSPECT AND CLEAN VALVE SEATS

- 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 thin coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate the 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 these width.

1.0 – 1.4 mm (0.039 – 0.055 in.)

If not, correct the valve seats as follows:

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

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

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

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

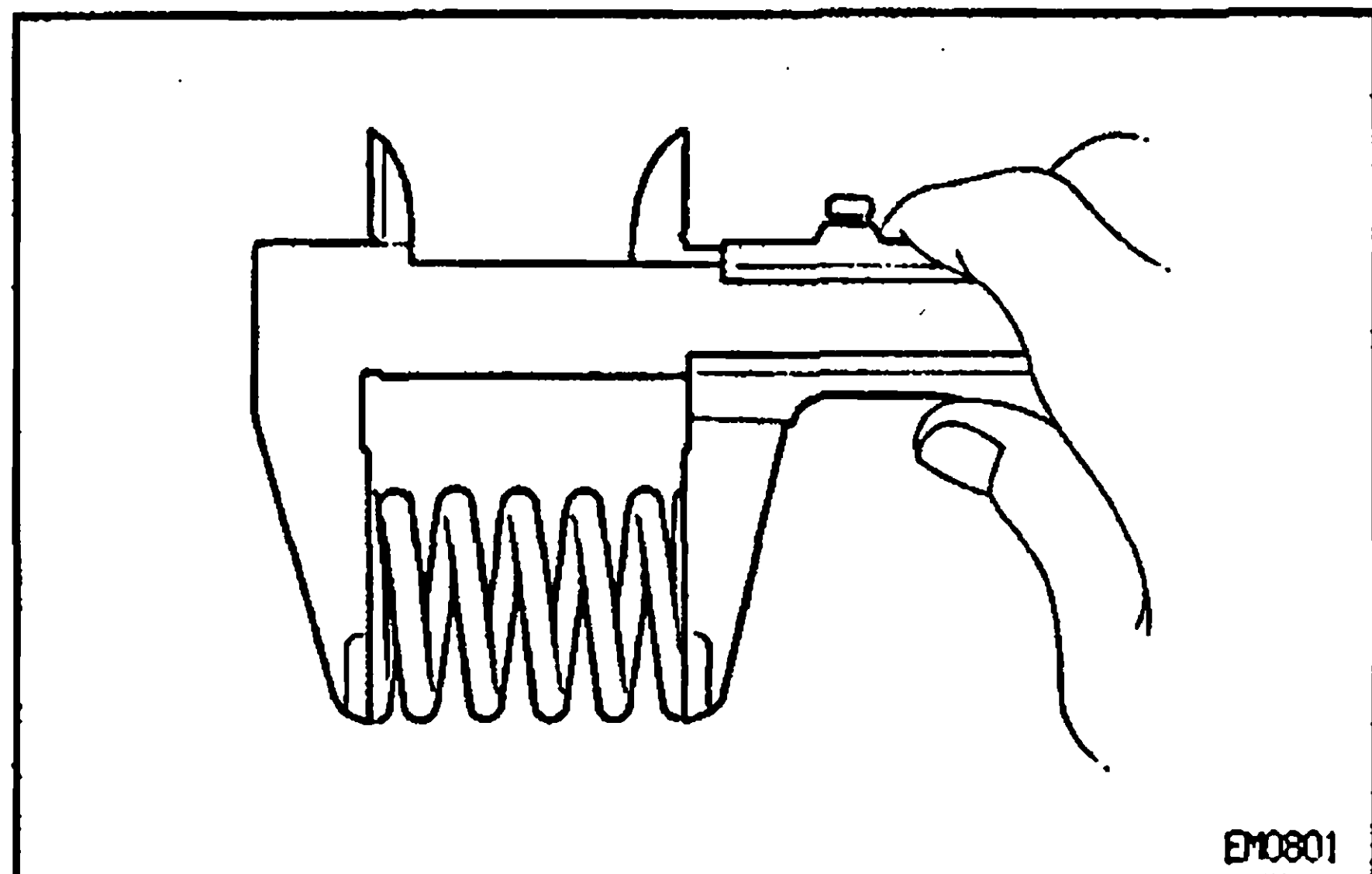
13. INSPECT VALVE SPRINGS

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

Maximum deviation:

2.0 mm (0.079 in.)

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

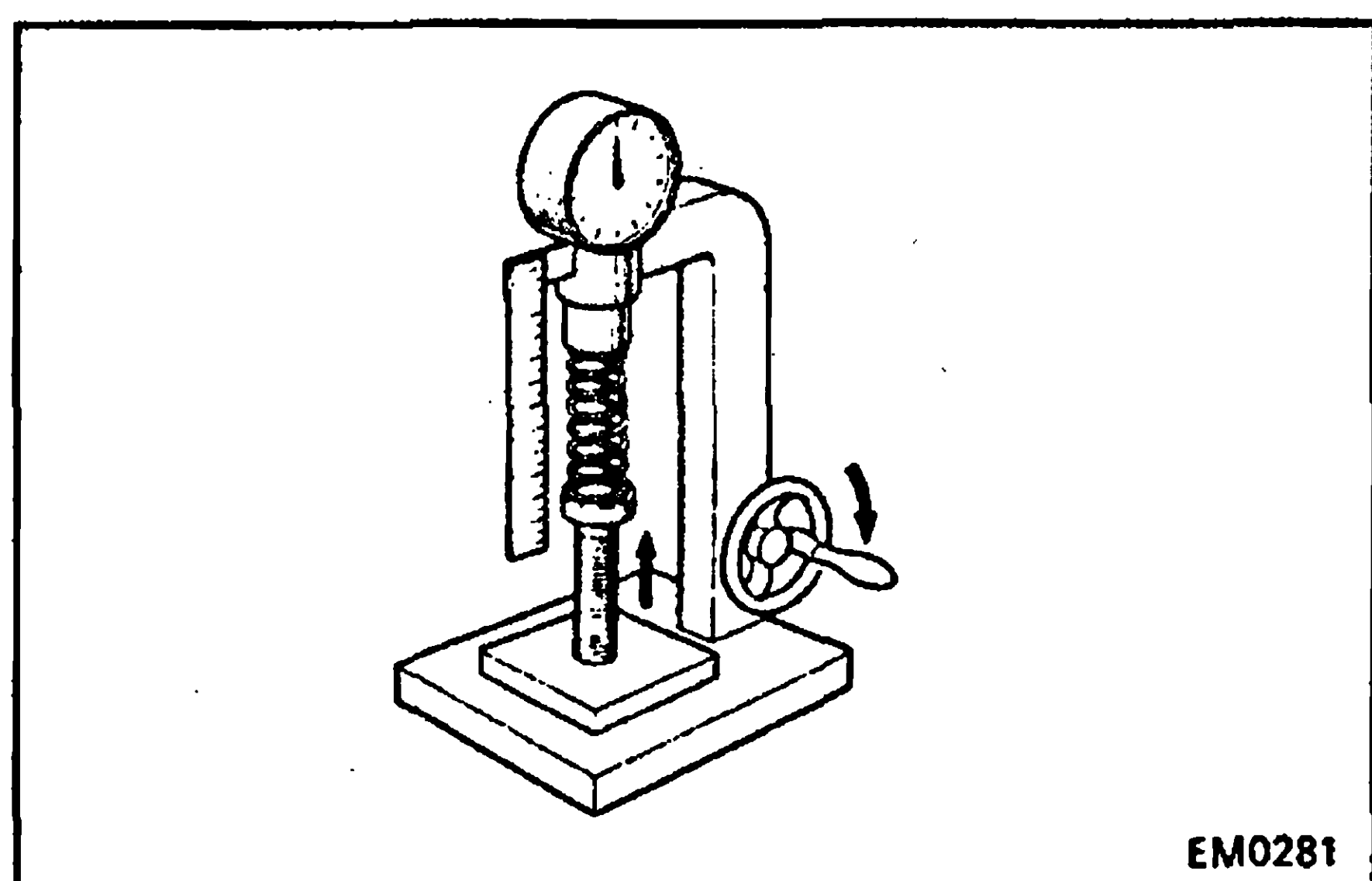


- (b) Using vernier calipers, measure the free length of the valve spring.

Free length:

44.78 mm (1.7630 in.)

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



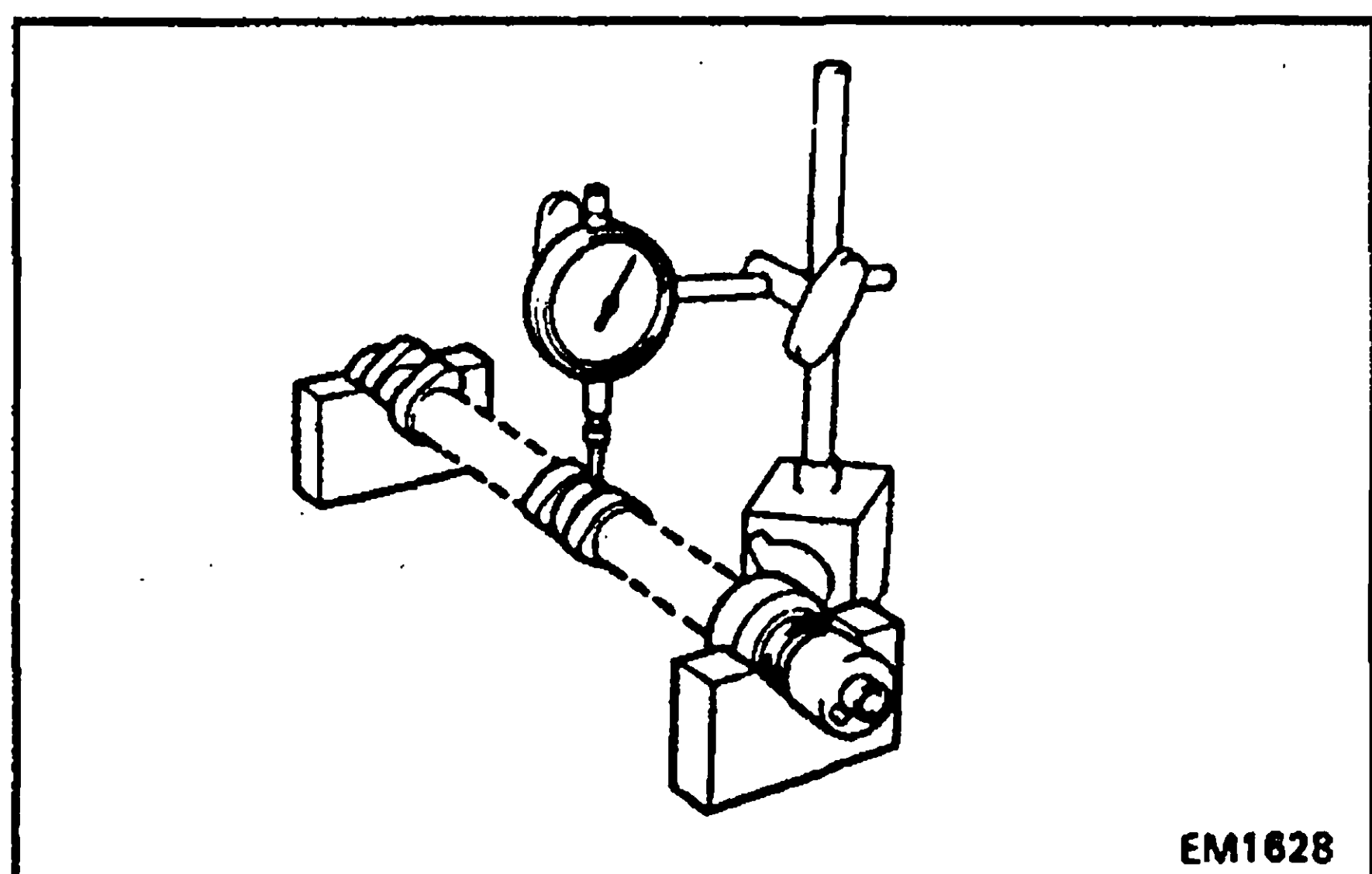
- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

At 33.3 mm (1.311 in.):

186 — 206 N (19.0 — 21.0 kgf, 41.9 — 46.3 lbf)

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



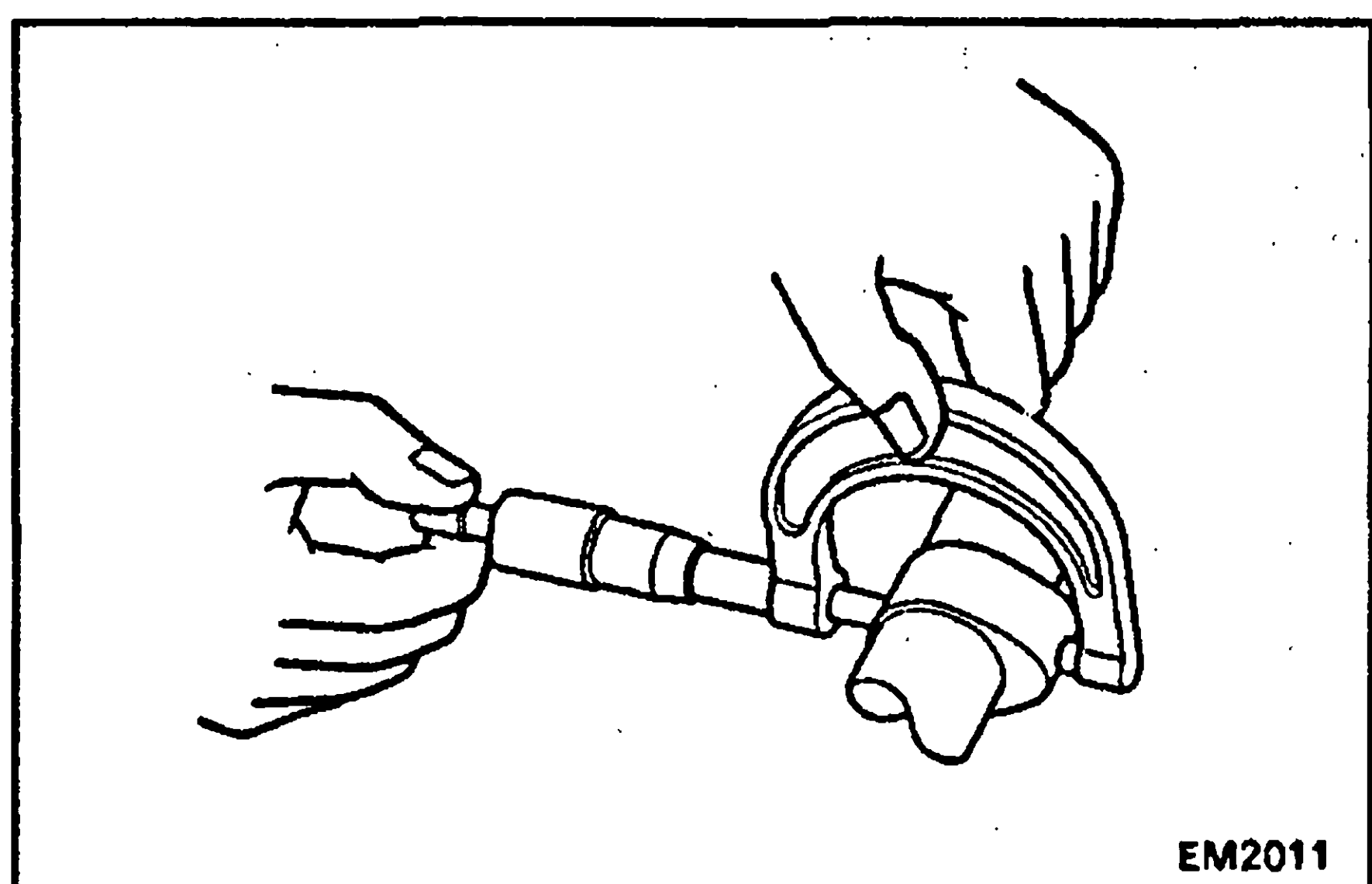
14. INSPECT CAMSHAFT FOR RUNOUT

- (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 the maximum, replace the camshaft.



15. INSPECT CAM LOBES

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake

42.31 — 42.41 mm (1.6657 — 1.6697 in.)

Exhaust

41.96 — 42.06 mm (1.6520 — 1.6559 in.)

Minimum cam lobe height:

Intake

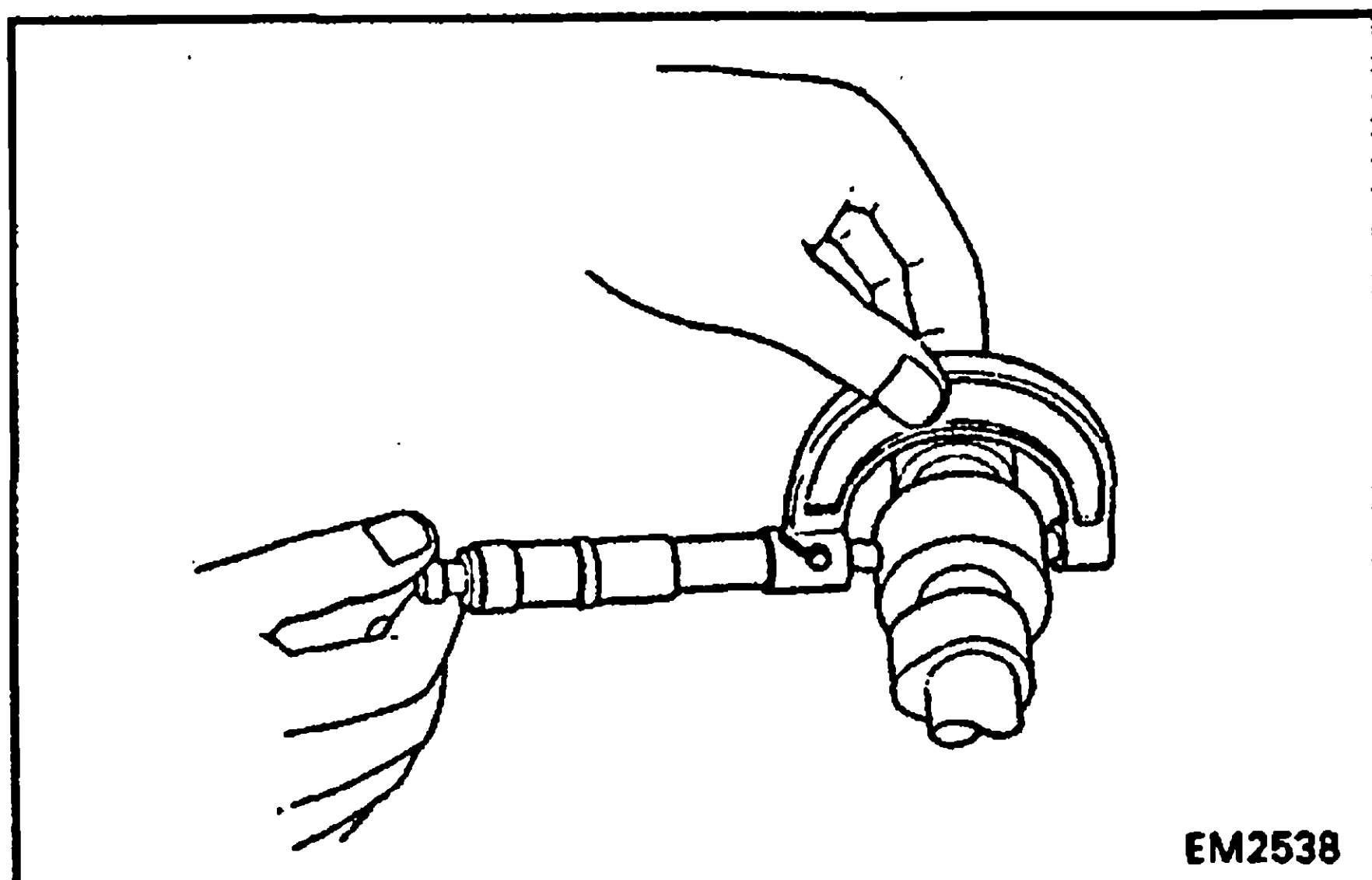
42.16 mm (1.6598 in.)

Exhaust

41.81 mm (1.6461 in.)

If the cam lobe height is greater than the maximum, replace the camshaft.

EG



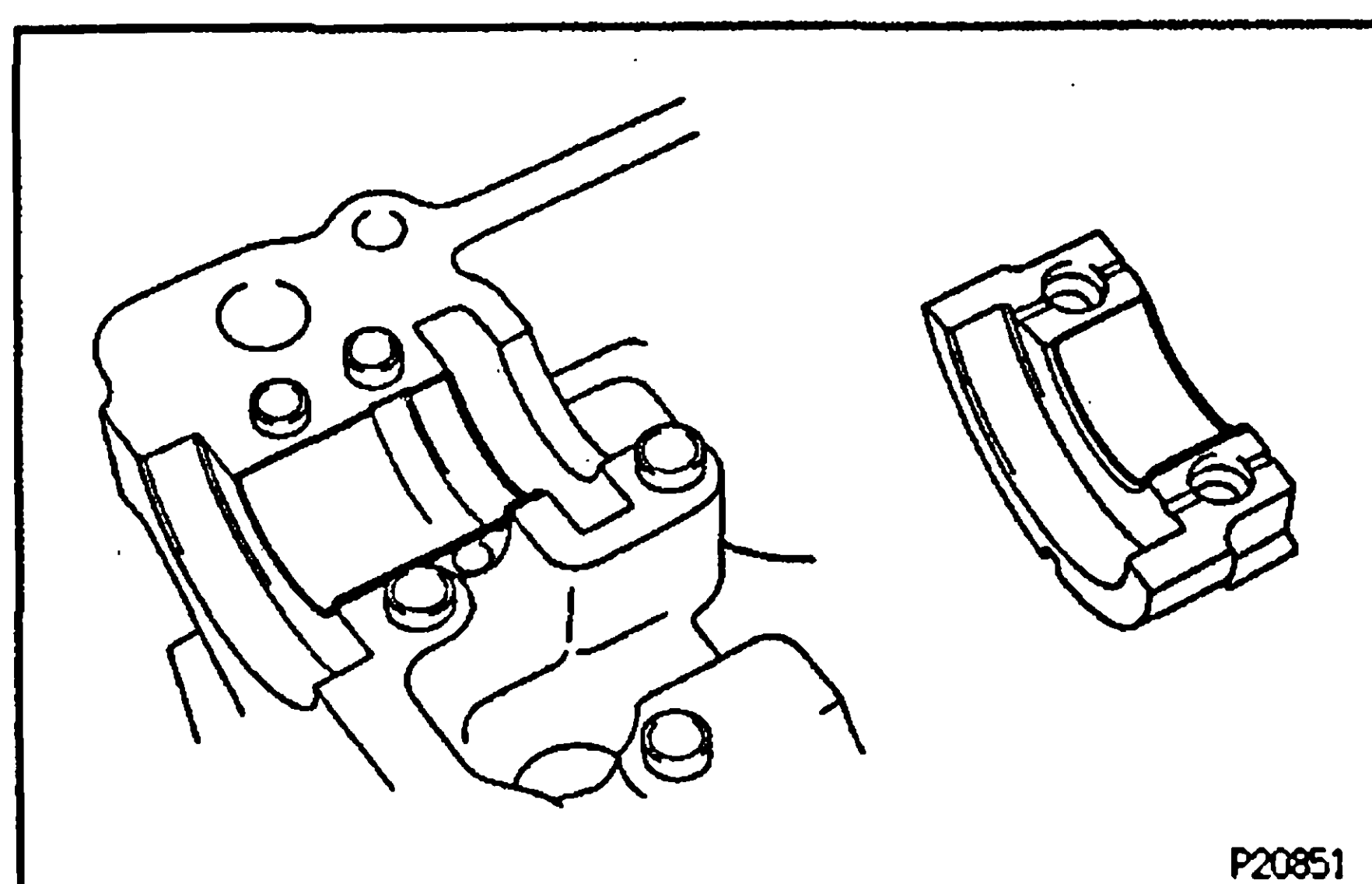
16. INSPECT CAMSHAFT JOURNALS

Using a micrometer, measure the journal diameter.

Journal diameter:

26.949 – 26.965 mm (1.0610 – 1.0616 in.)

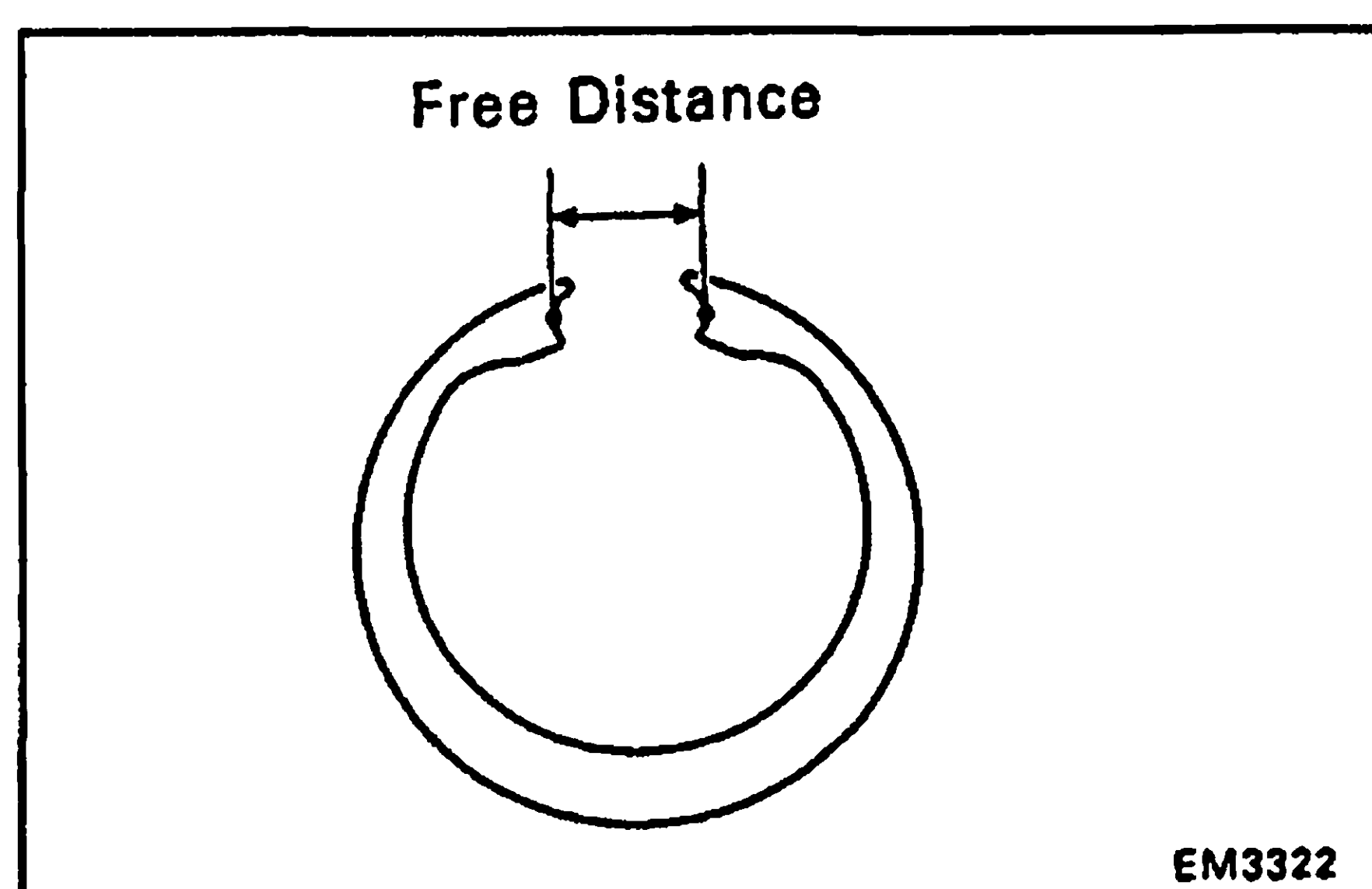
If the journal diameter is not as specified, check the oil clearance.



17. INSPECT CAMSHAFT BEARINGS

Check the bearings for flaking and scoring.

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



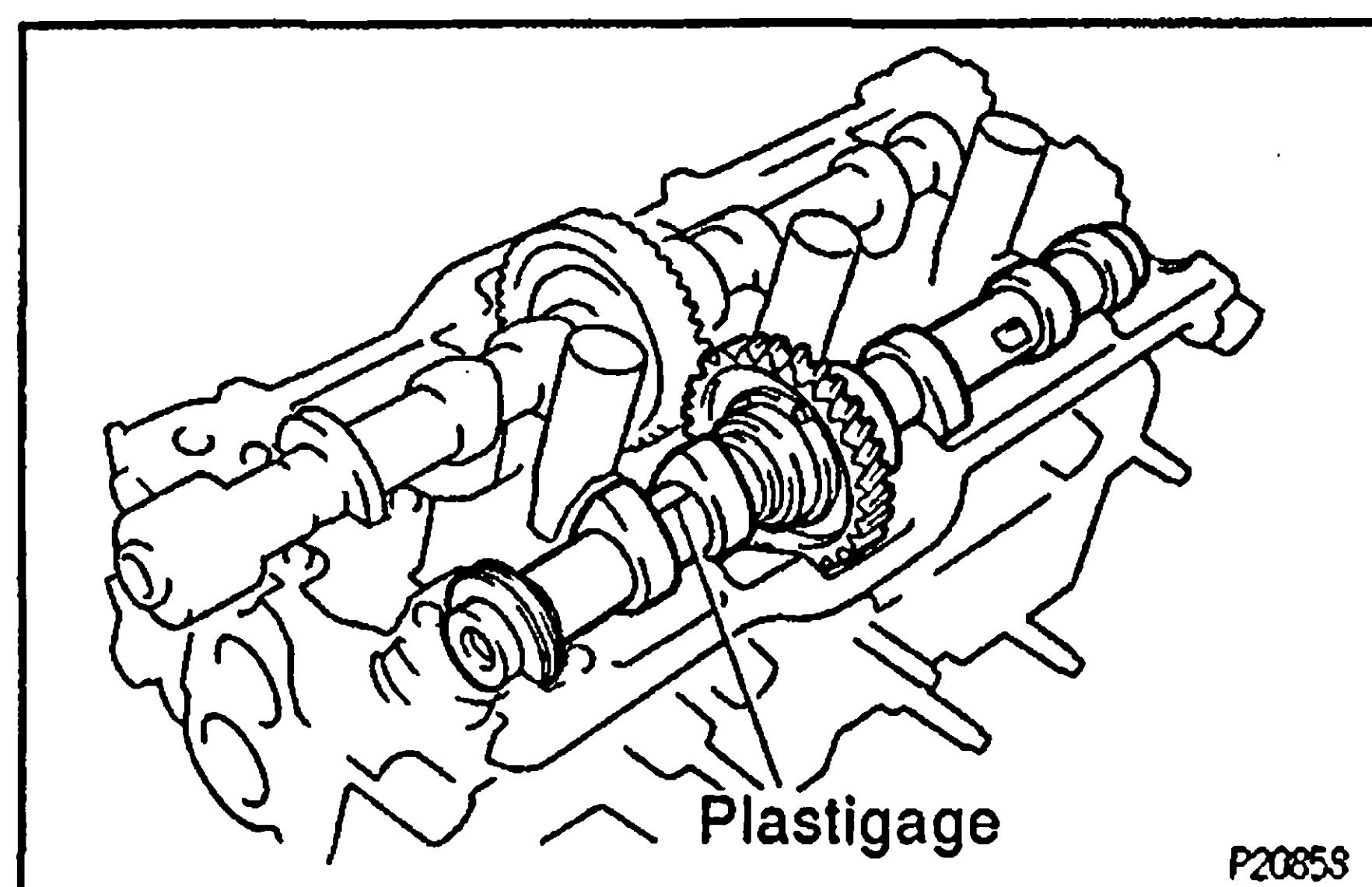
18. INSPECT CAMSHAFT GEAR SPRING

Using vernier calipers, measure the free distance between the spring end.

Free distance:

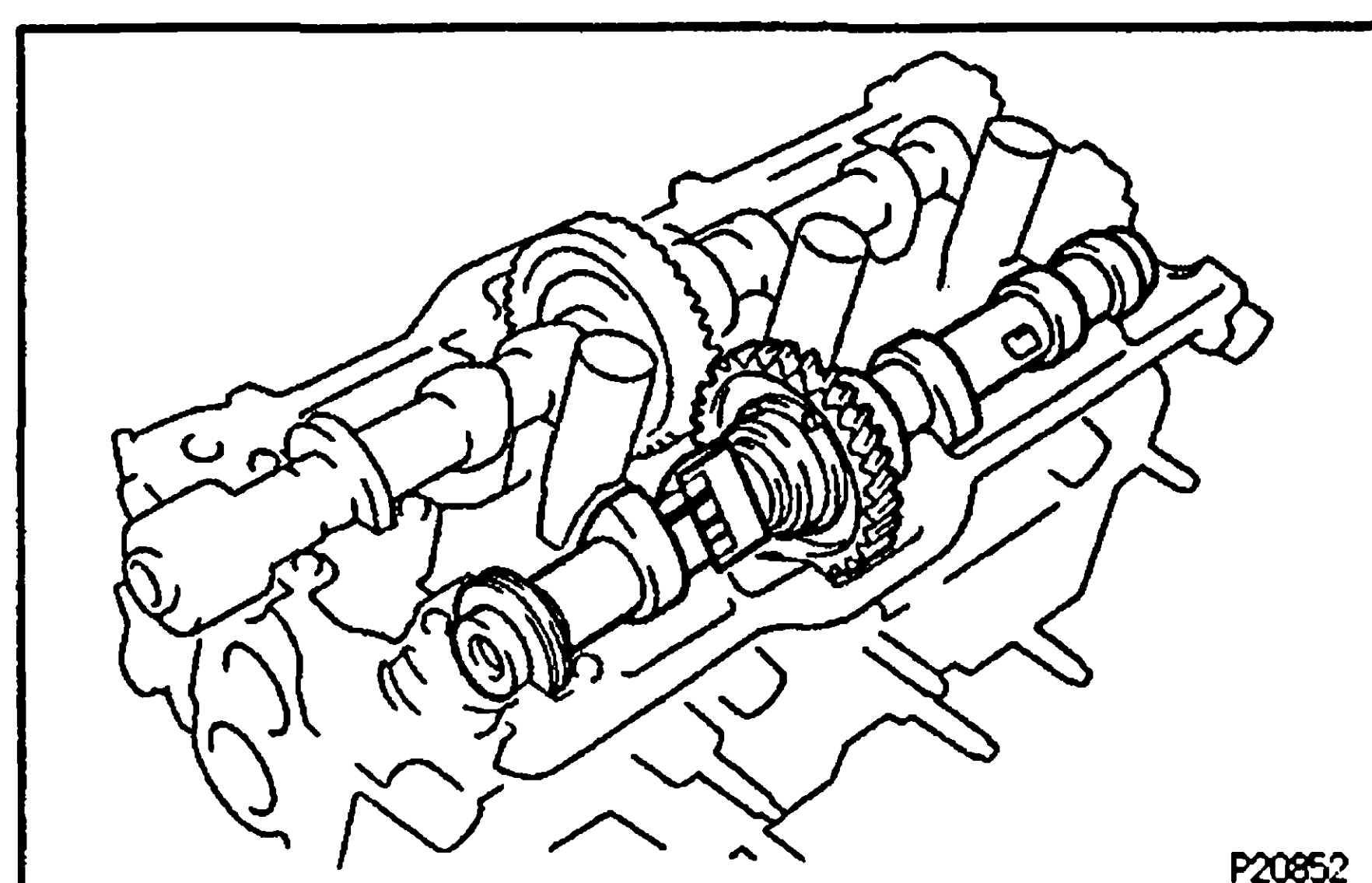
18.2 – 18.8 mm (0.712 – 0.740 in.)

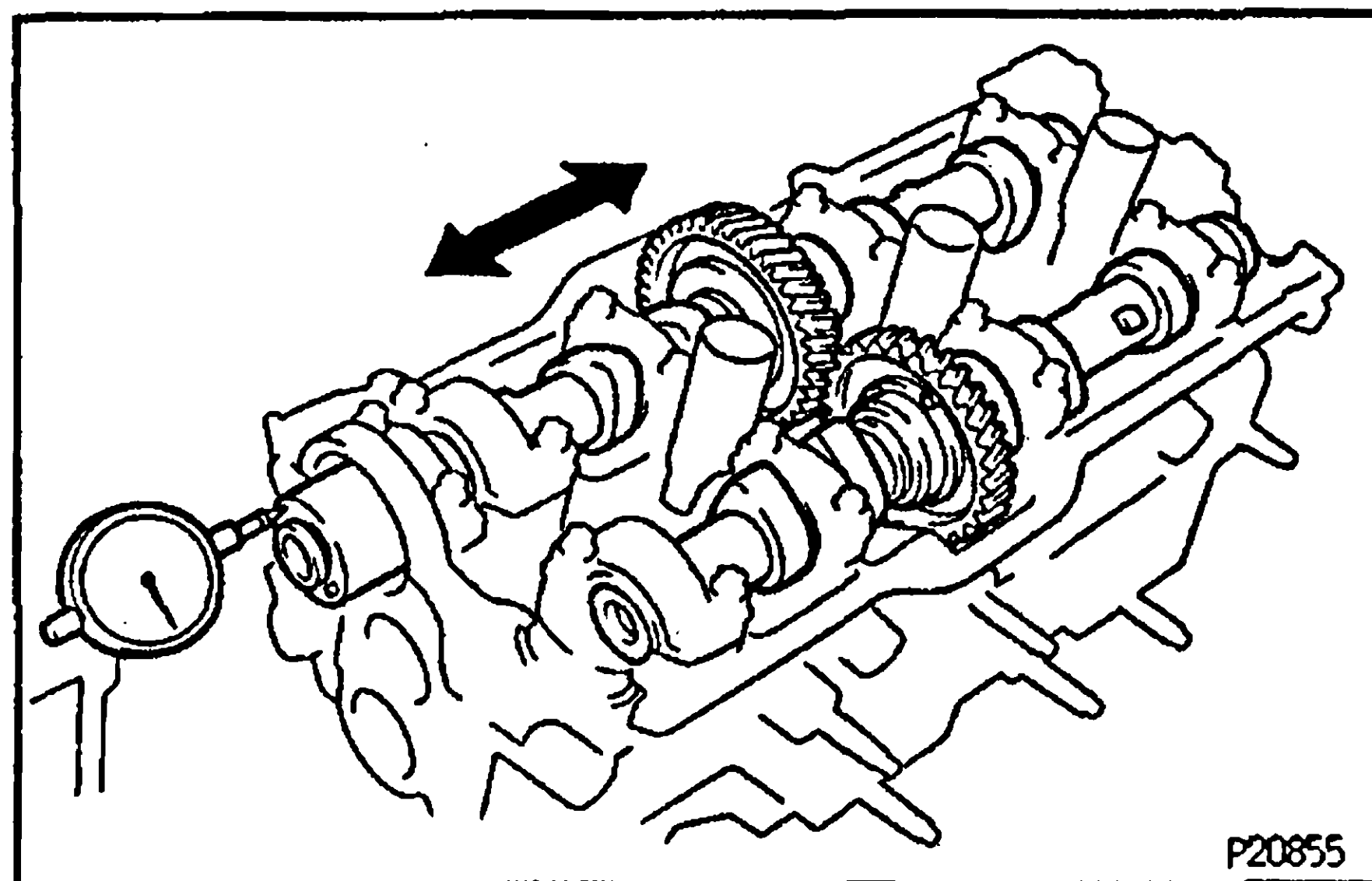
If the free distance is not as specified, replace the gear spring.



19. INSPECT CAMSHAFT JOURNAL OIL CLEARANCE

- Clean the bearing caps and camshaft journals.
- Place the camshafts on the cylinder head.
- Lay a strip of Plastigage across each of the camshaft journals.
- Install the bearing caps.
(See installation in cylinder head)
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)
NOTICE: Do not turn the camshaft.
- Remove the bearing caps.
- Measure the Plastigage at its widest point.
Standard oil clearance:
0.035 – 0.072 mm (0.0014 – 0.0028 in.)
Maximum oil clearance:
0.10 mm (0.0039 in.)
If the oil clearance is greater than the maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.
- Completely remove the Plastigage.





20. INSPECT CAMSHAFT THRUST CLEARANCE

- Install the camshafts.
(See installation in cylinder head)
- Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:

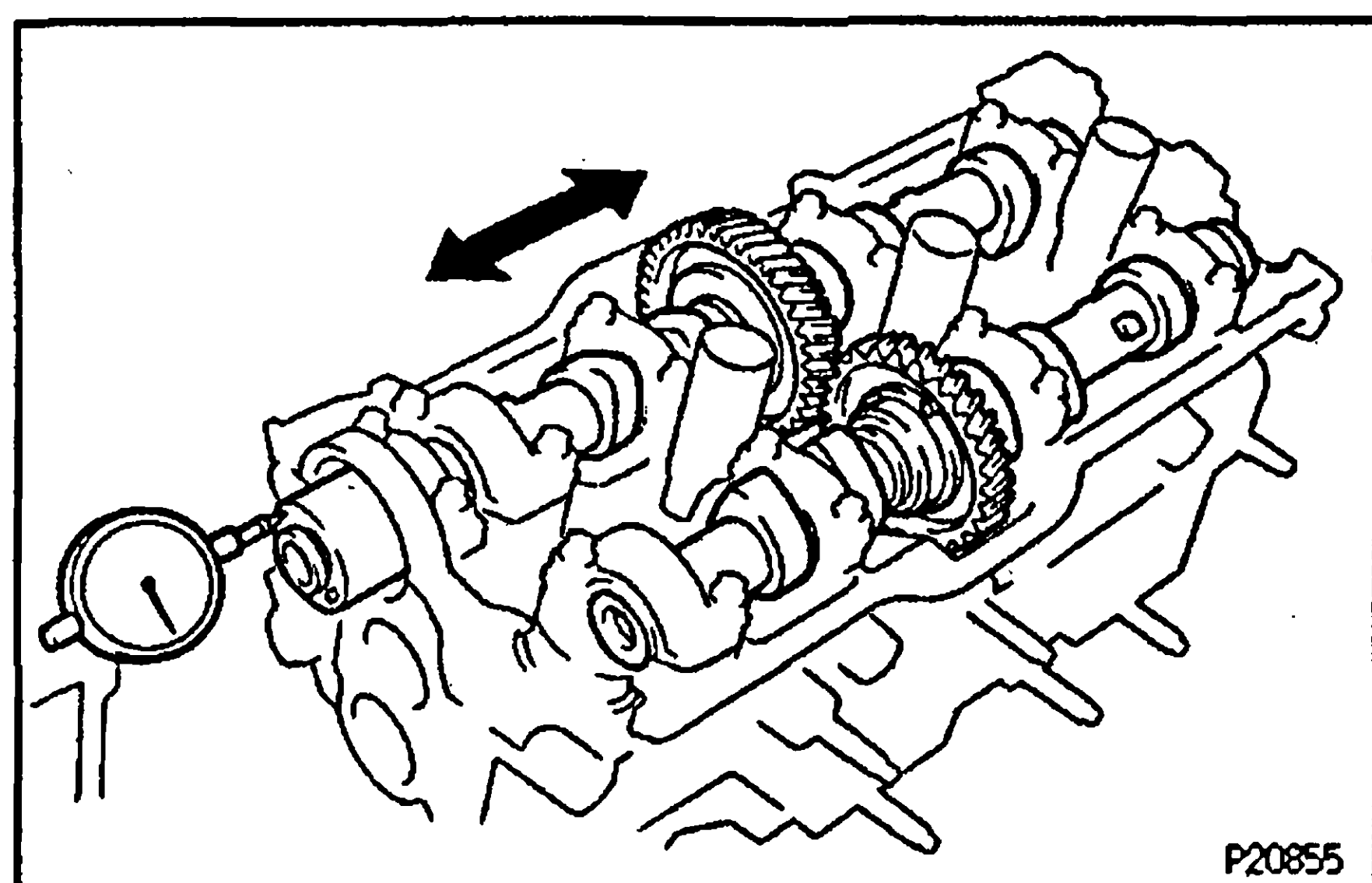
0.033 — 0.080 mm (0.0013 — 0.0031 in.)

Maximum thrust clearance:

0.12 mm (0.0047 in.)

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

EG



21. INSPECT CAMSHAFT GEAR BACKLASH

- Install the camshafts without installing the exhaust camshaft sub-gear.
(See installation in cylinder head)
- 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 the maximum, replace the camshafts.

22. INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter:

31.000 — 31.018 mm (1.2205 — 1.2212 in.)

- Using a micrometer, measure the lifter diameter.

Lifter diameter:

30.966 — 30.976 mm (1.2191 — 1.2195 in.)

- Subtract the lifter diameter measurement from the lifter bore diameter measurement.

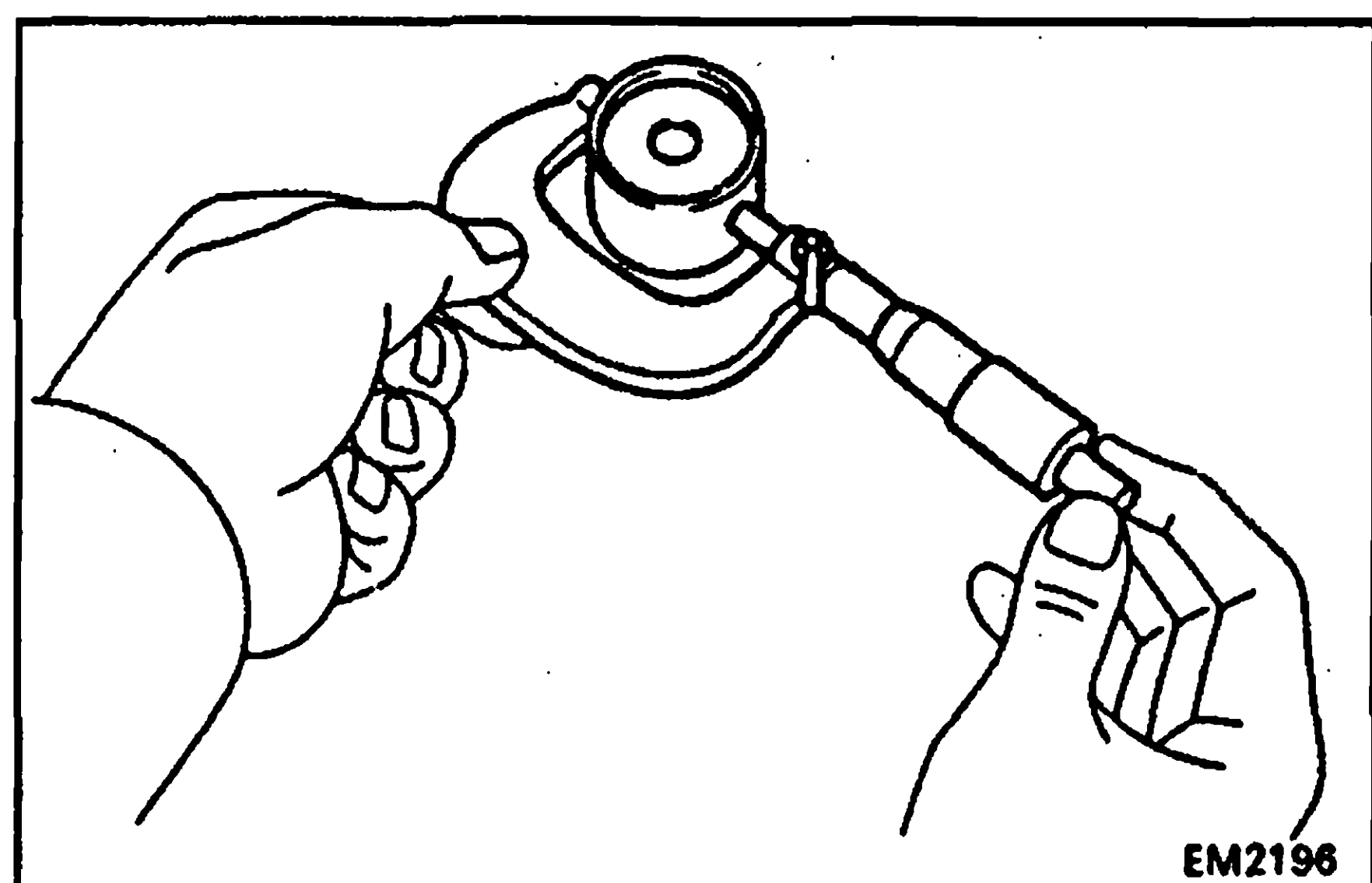
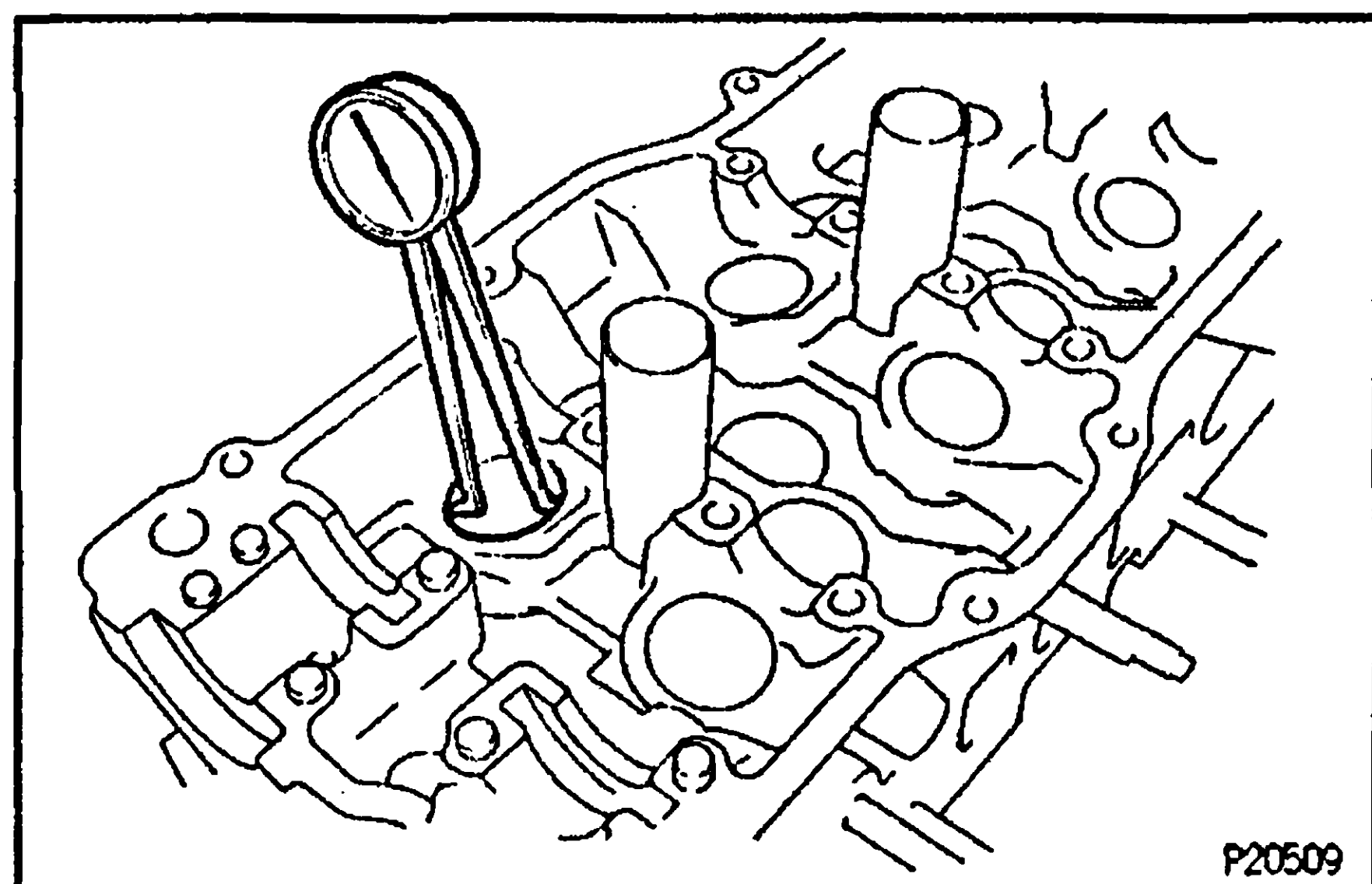
Standard oil clearance:

0.024 — 0.052 mm (0.0009 — 0.0020 in.)

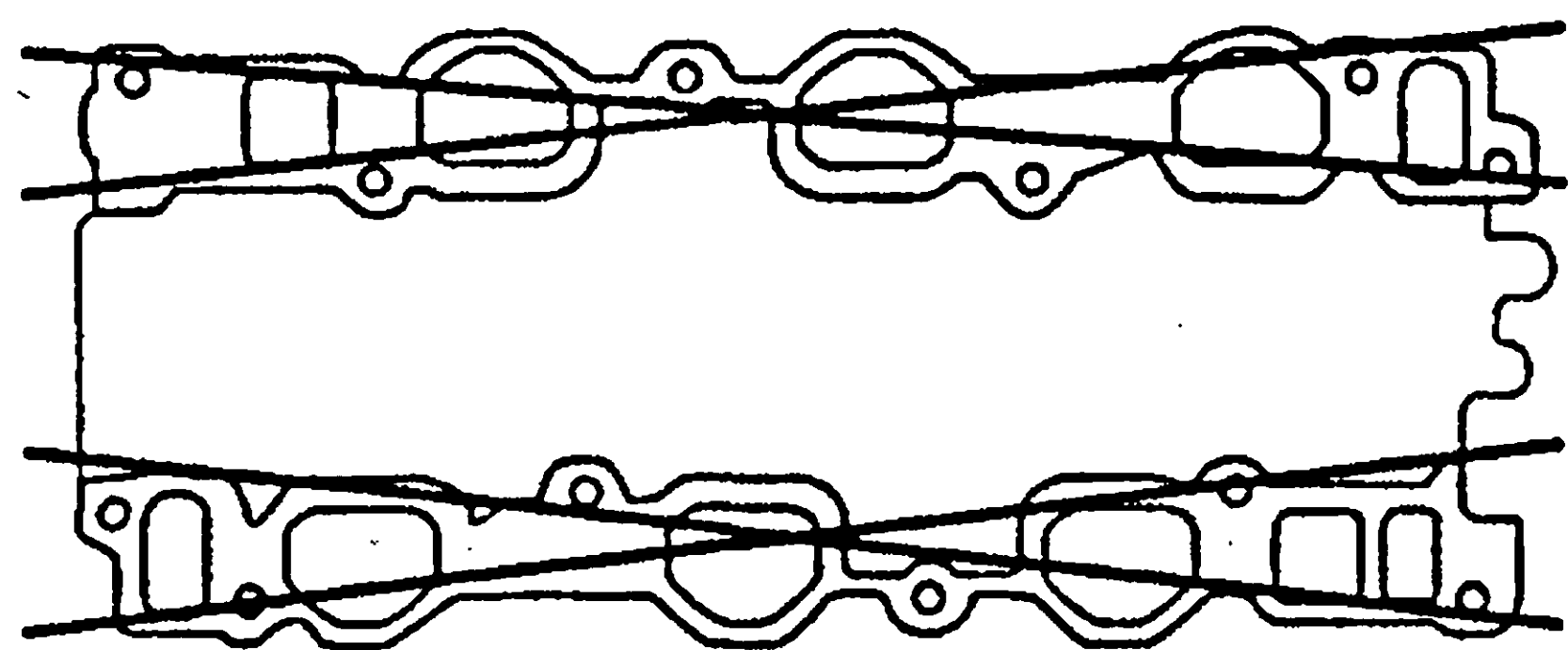
Maximum oil clearance:

0.08 mm (0.0031 in.)

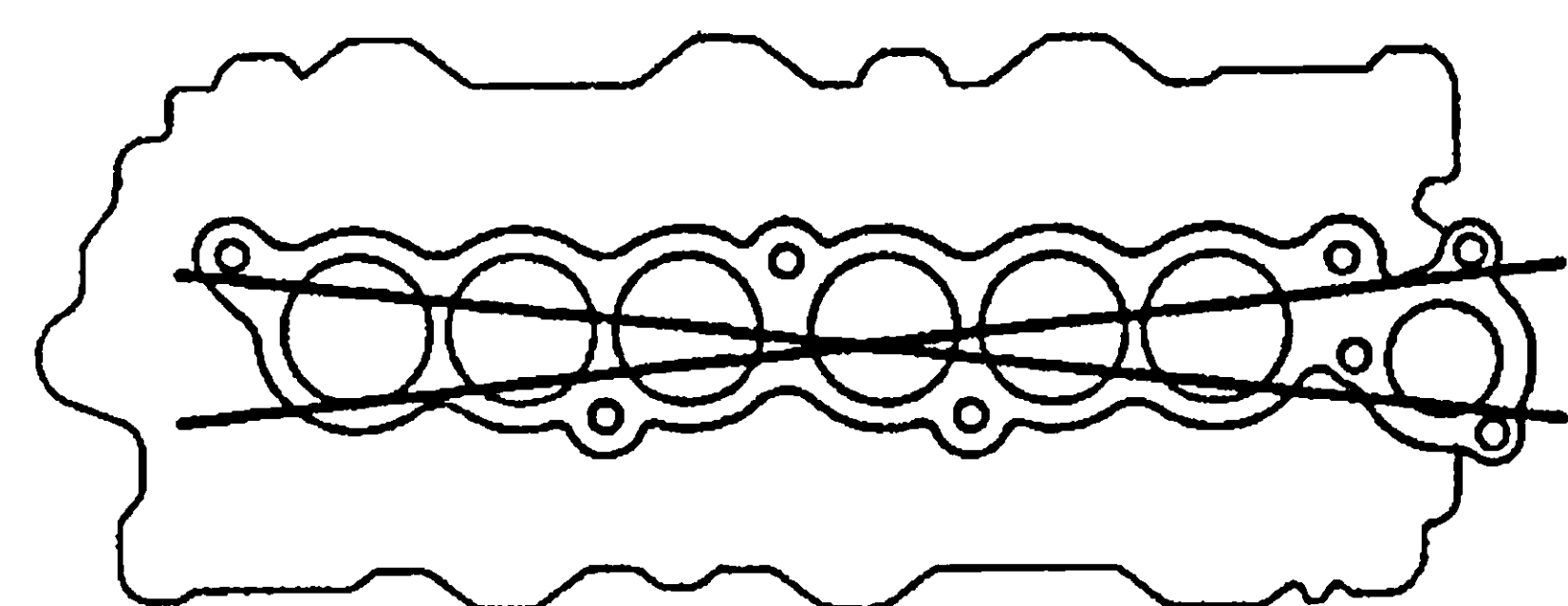
If the oil clearance is greater than the maximum, replace the lifter. If necessary, replace the cylinder head.



Cylinder Head Side

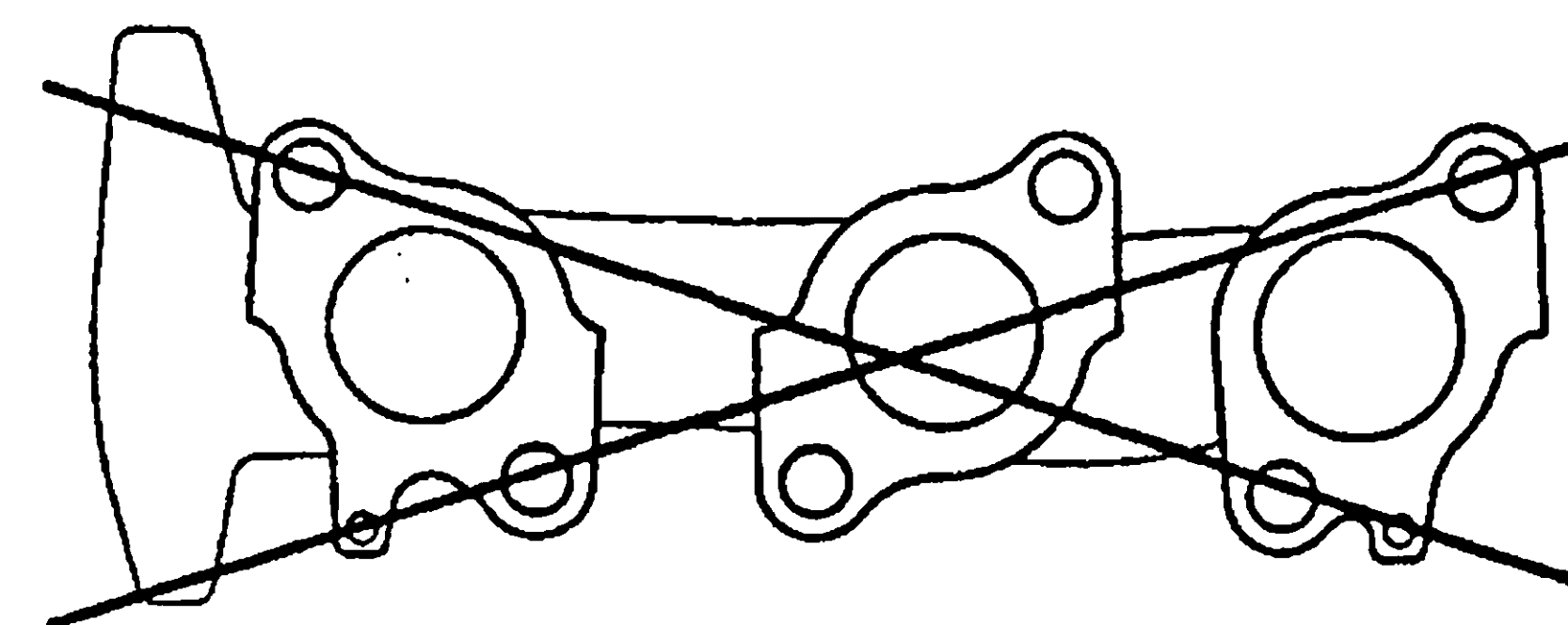


Intake Air Connector Side

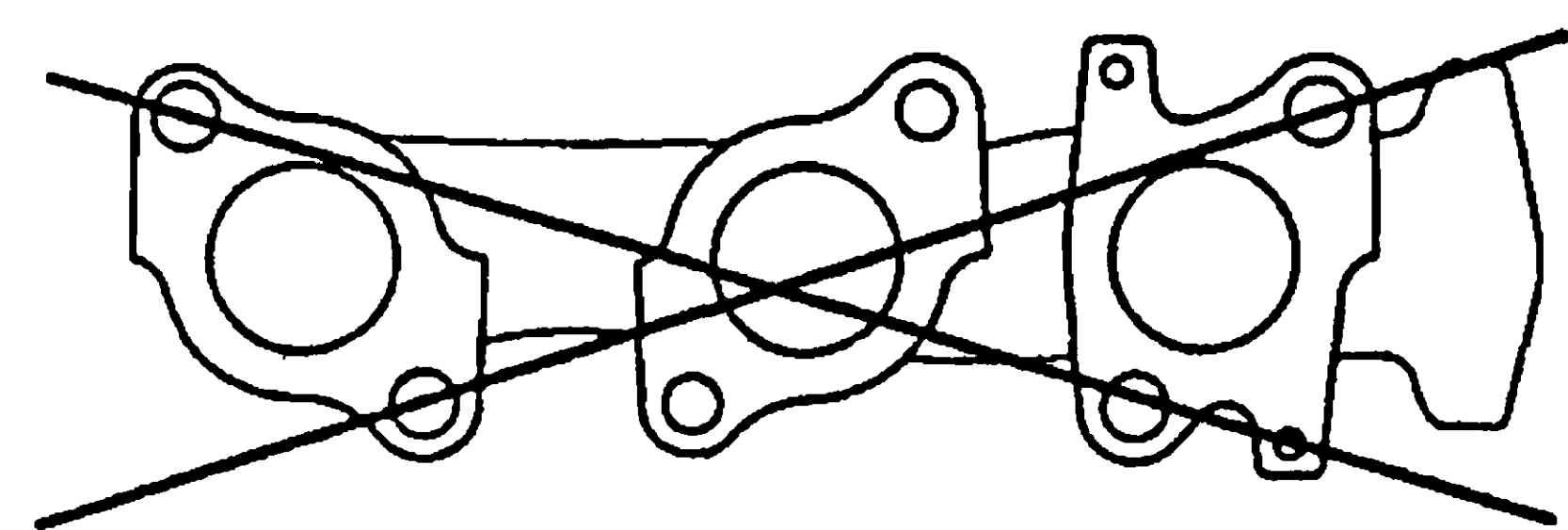
P21620
P21618

Z14655

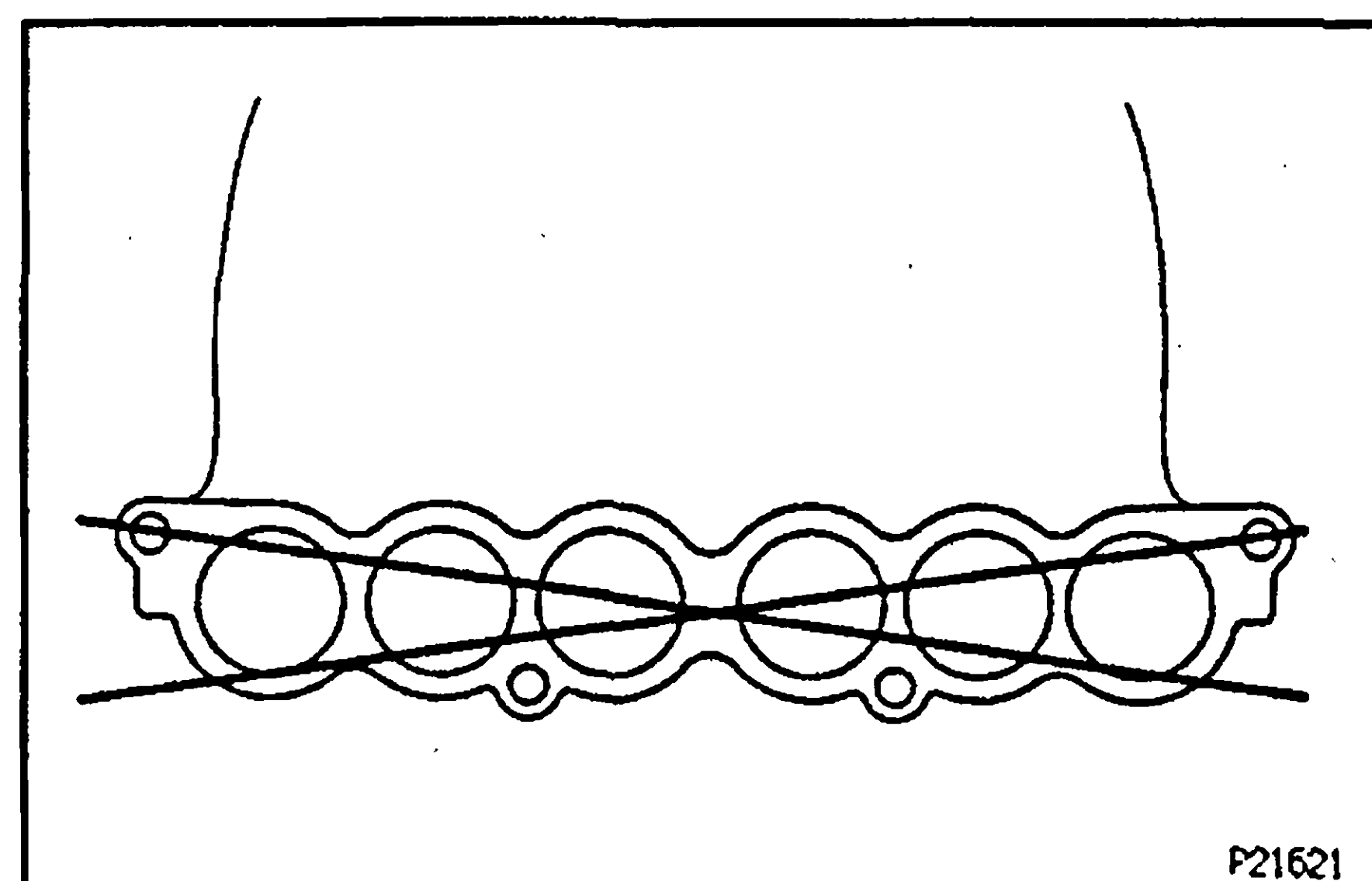
LH Side



RH Side

P21622
P21619

Z14656



P21621

23. INSPECT INTAKE MANIFOLD, EXHAUST MANIFOLDS, AIR INTAKE CHAMBER AND INTAKE AIR CONNECTOR

(a) Intake Manifold:

Using precision straight edge and thickness gauge, measure the surfaces contacting the cylinder head and intake air connector for warpage.

Maximum warpage:

0.10 mm (0.0039 in.)

If warpage is greater than the maximum, replace the intake manifold.

(b) Exhaust Manifolds:

Measure the surfaces contacting the cylinder head for warpage.

Maximum warpage:

1.00 mm (0.0394 in.)

If warpage is greater than the maximum, replace the exhaust manifold.

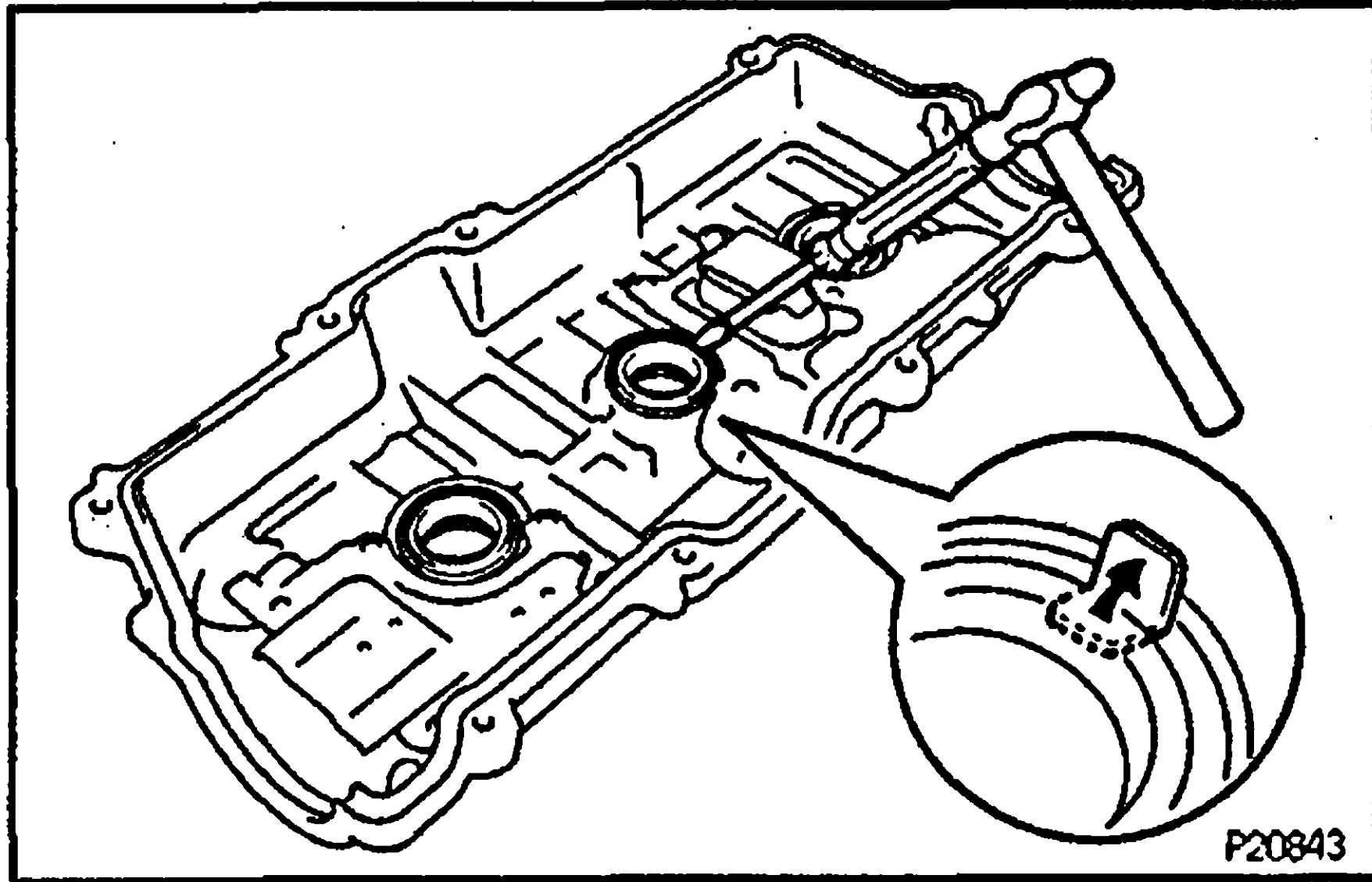
(c) Air intake chamber and intake air connector:

Measure the surfaces contacting the intake manifold and intake air connector for warpage.

Maximum warpage:

0.10 mm (0.0039 in.)

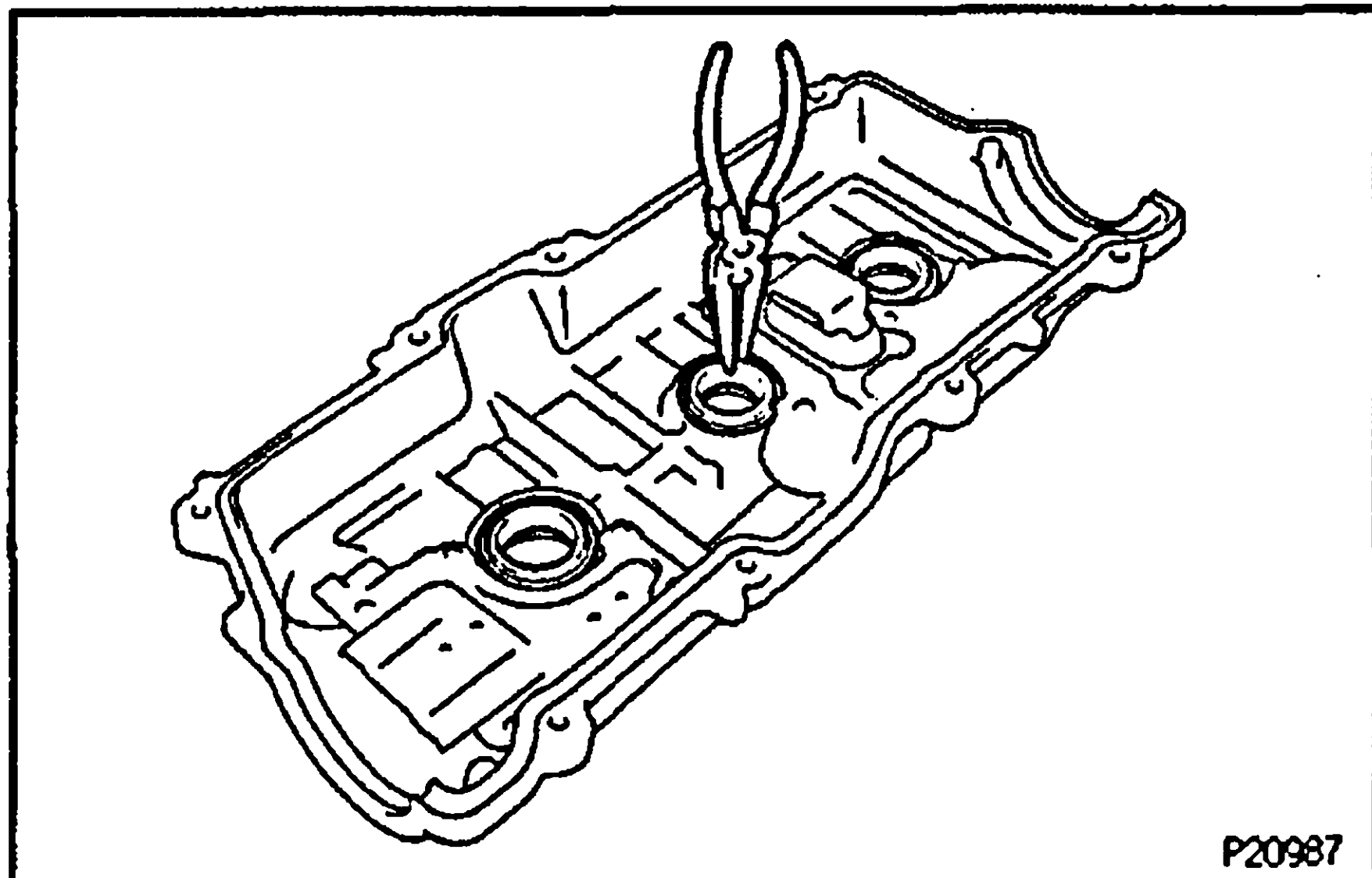
If warpage is greater than the maximum, replace the air intake chamber or intake air connector.



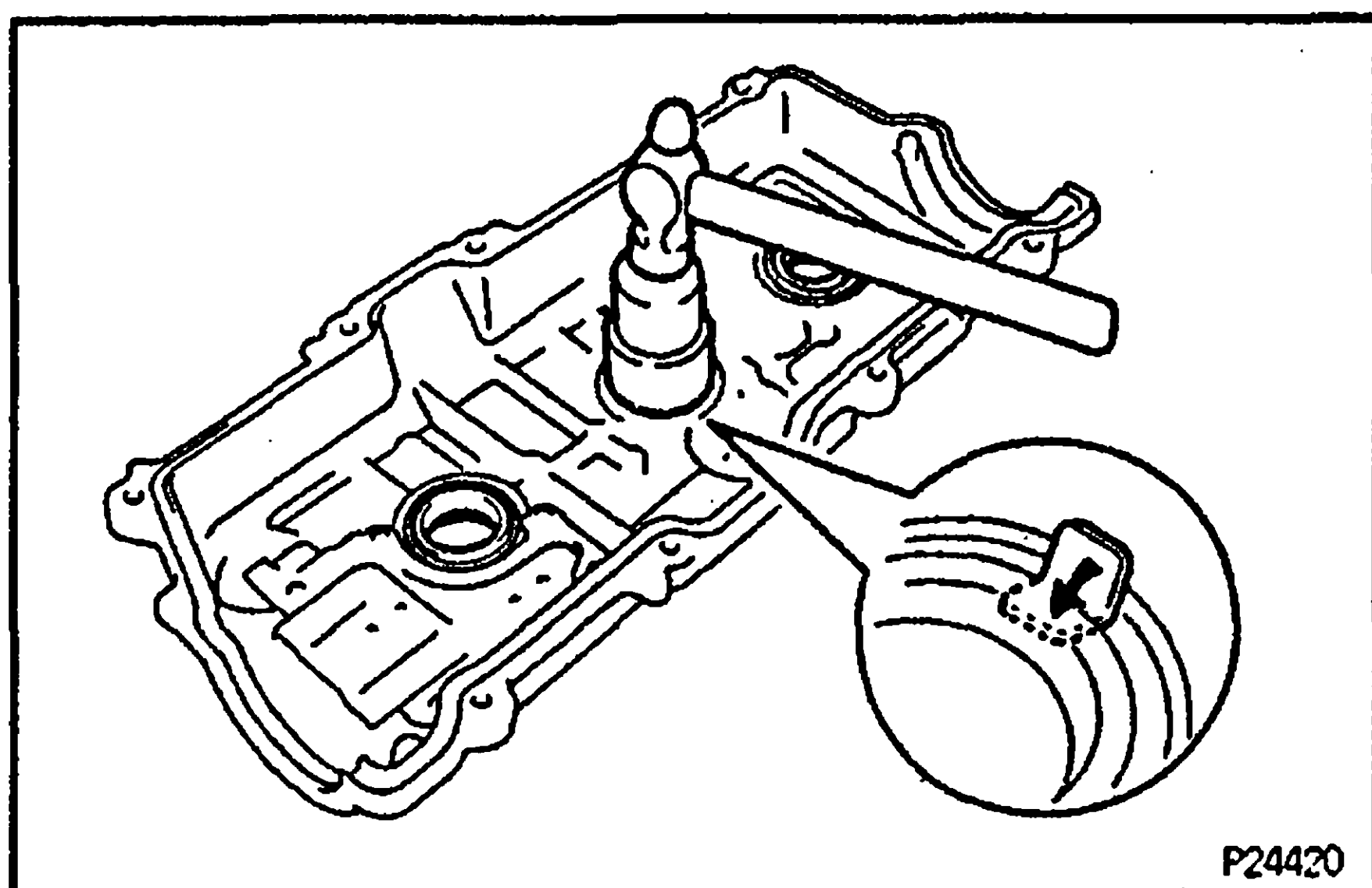
24. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKETS

- (a) Bend up the tab on the ventilation baffle plate which prevents the gasket from the slipping out.
- (b) Using a screwdriver and hammer, tap out the gasket. **NOTICE:** Do not scratch or damage the joint of the cylinder head cover.

EG



- (c) Using needle-nose pliers, pry out the gasket.



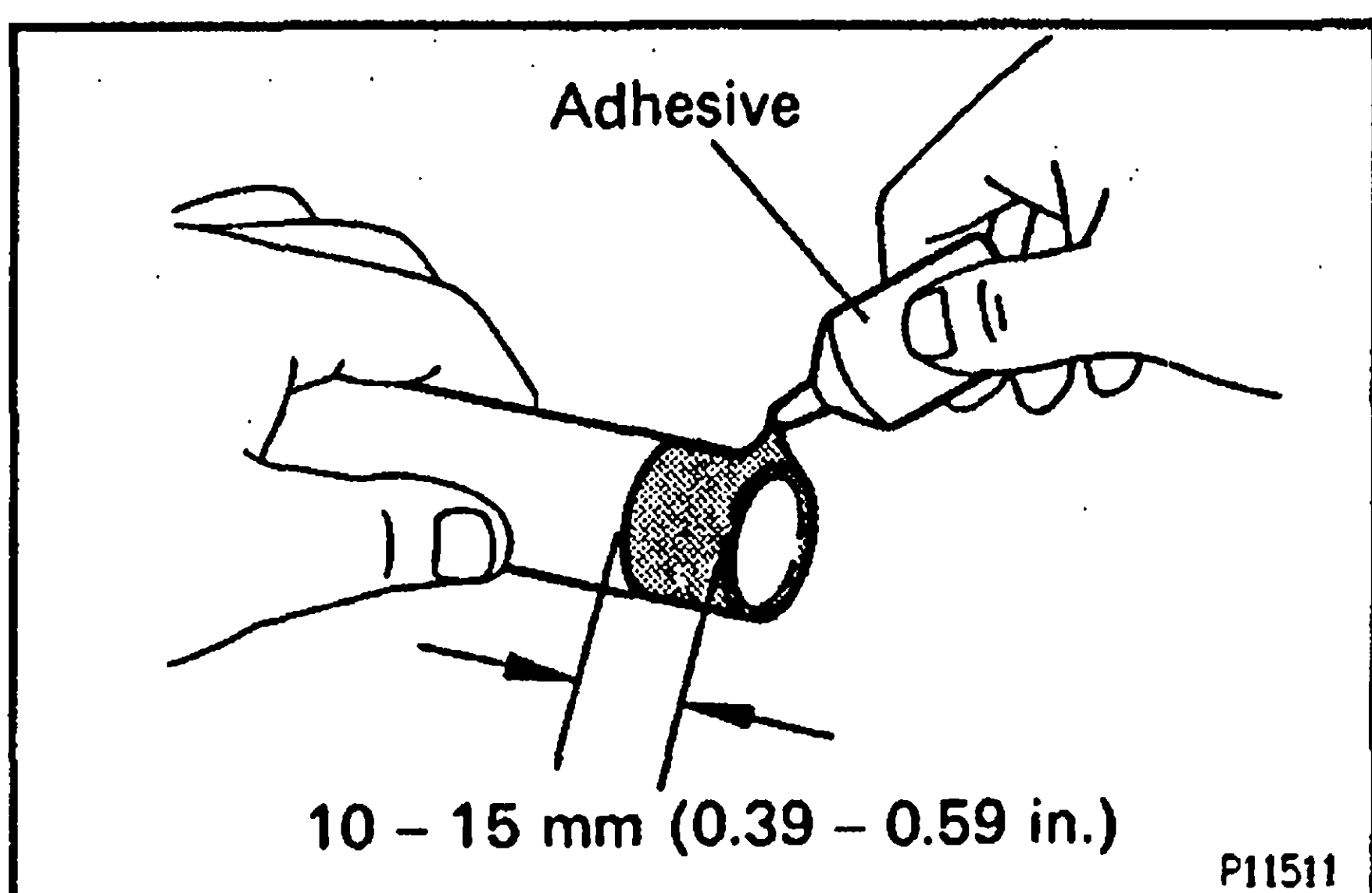
- (d) Using a 32 mm socket wrench and hammer, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.
- (e) Apply a light coat of MP grease to the gasket lip.
- (f) Return the ventilation plate tab to its original position.

CYLINDER HEADS ASSEMBLY

EG88C-06

HINT:

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



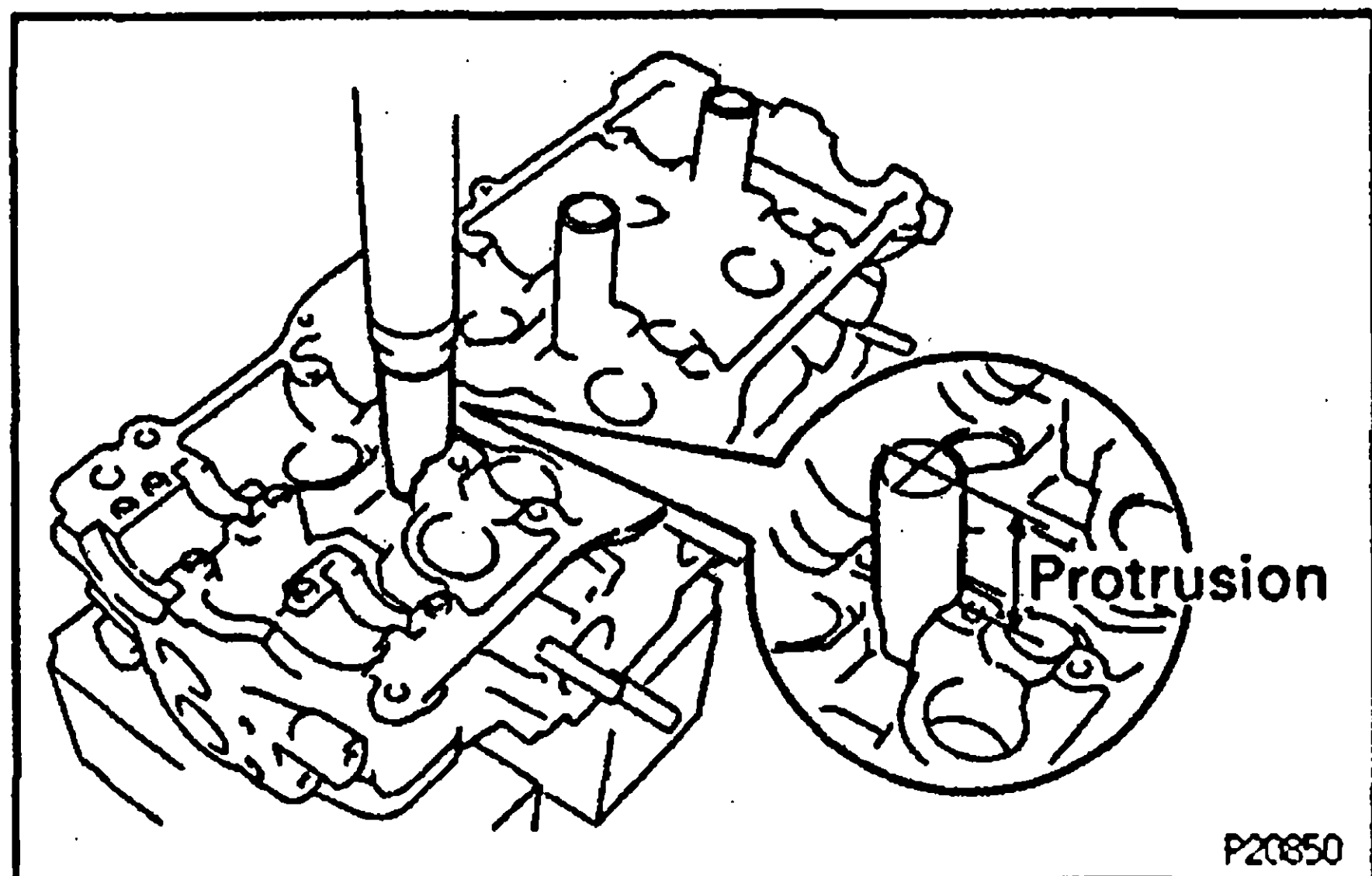
1. INSTALL SPARK PLUG TUBES

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

- (a) Apply adhesive to the end of the spark plug tube.

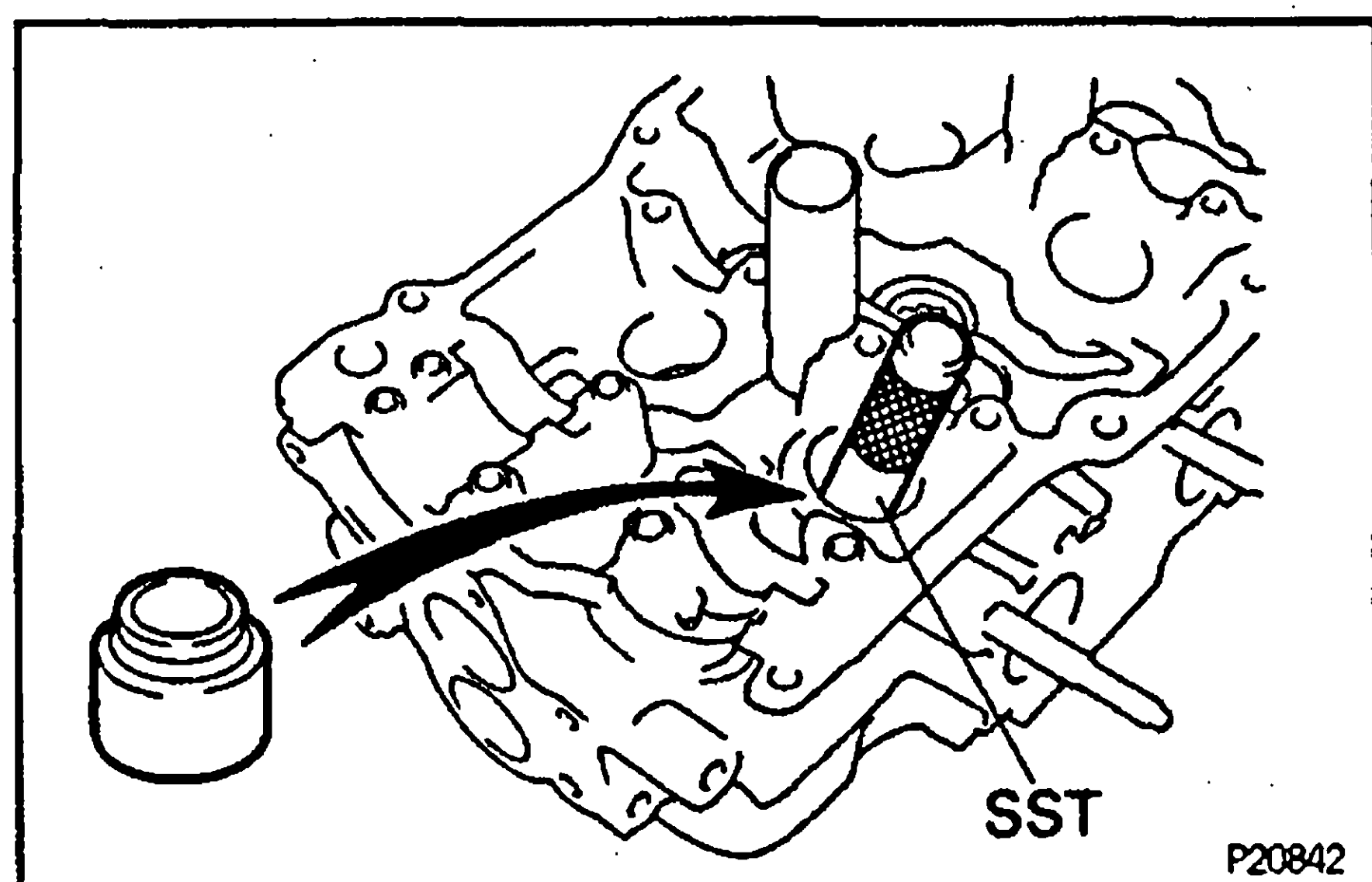
Adhesive:

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



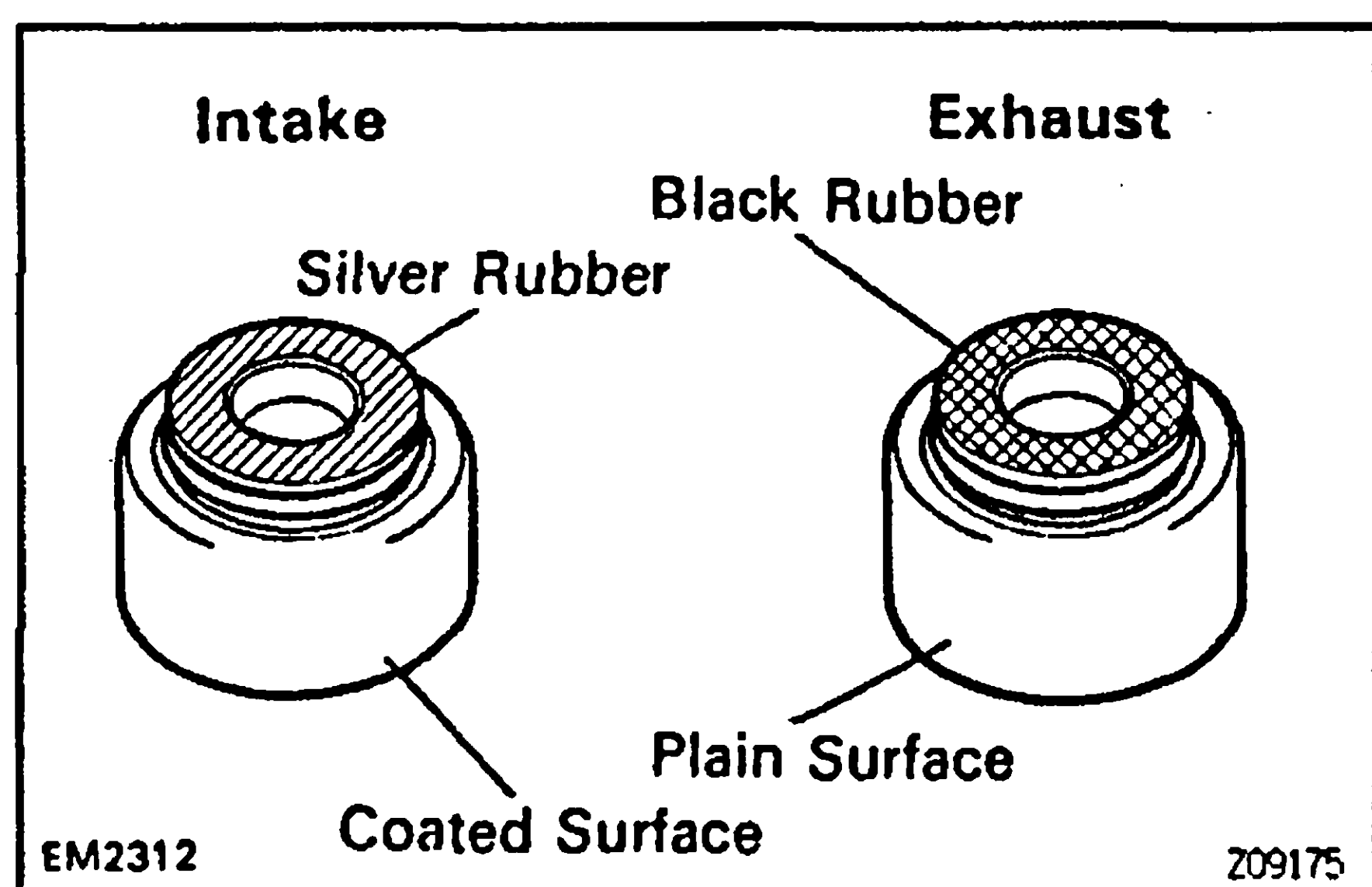
- (b) Using a press, press in a new spark plug tube until there is 49.0 — 49.4 mm (1.929 — 1.945 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

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

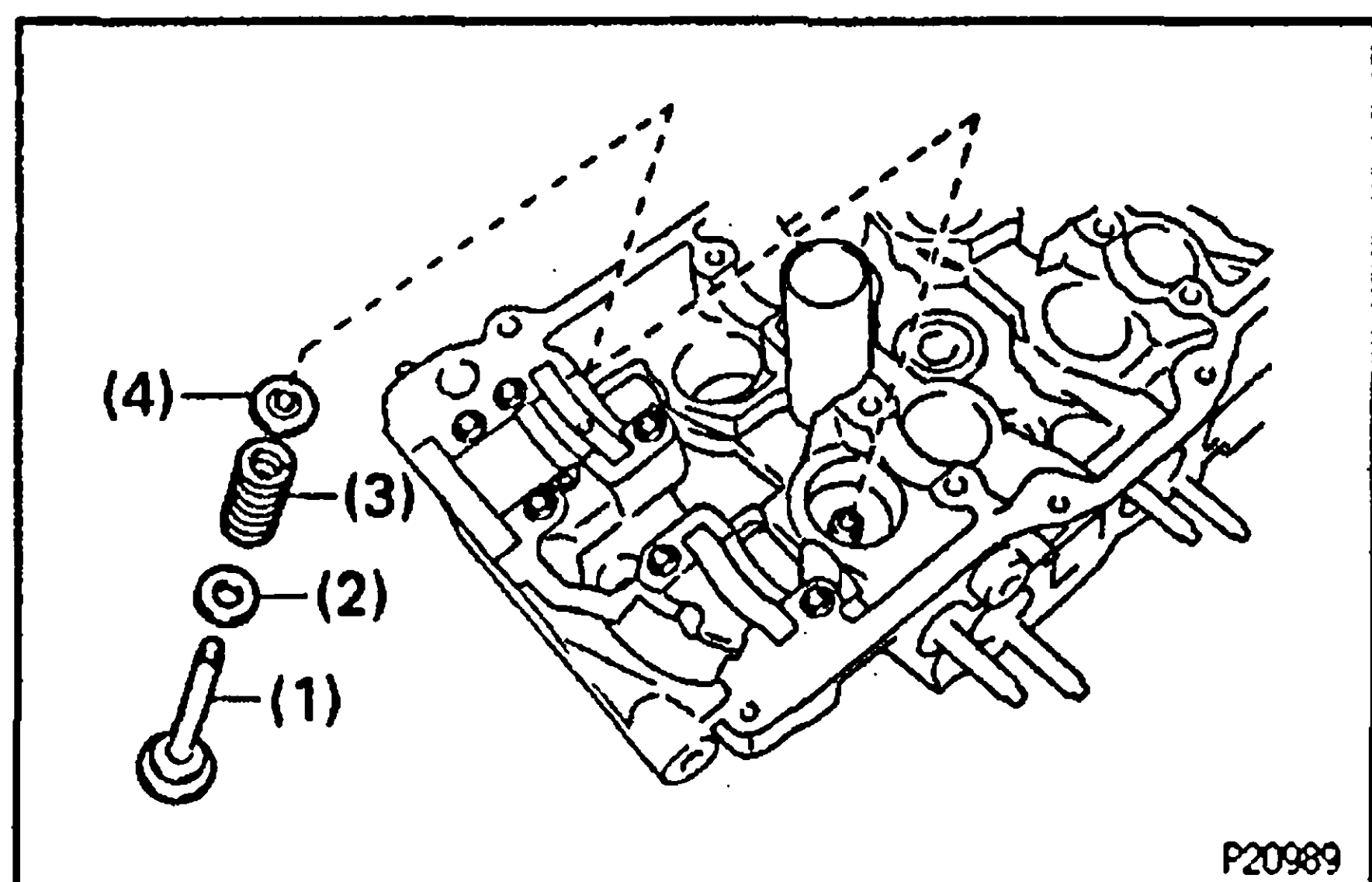


2. INSTALL VALVES

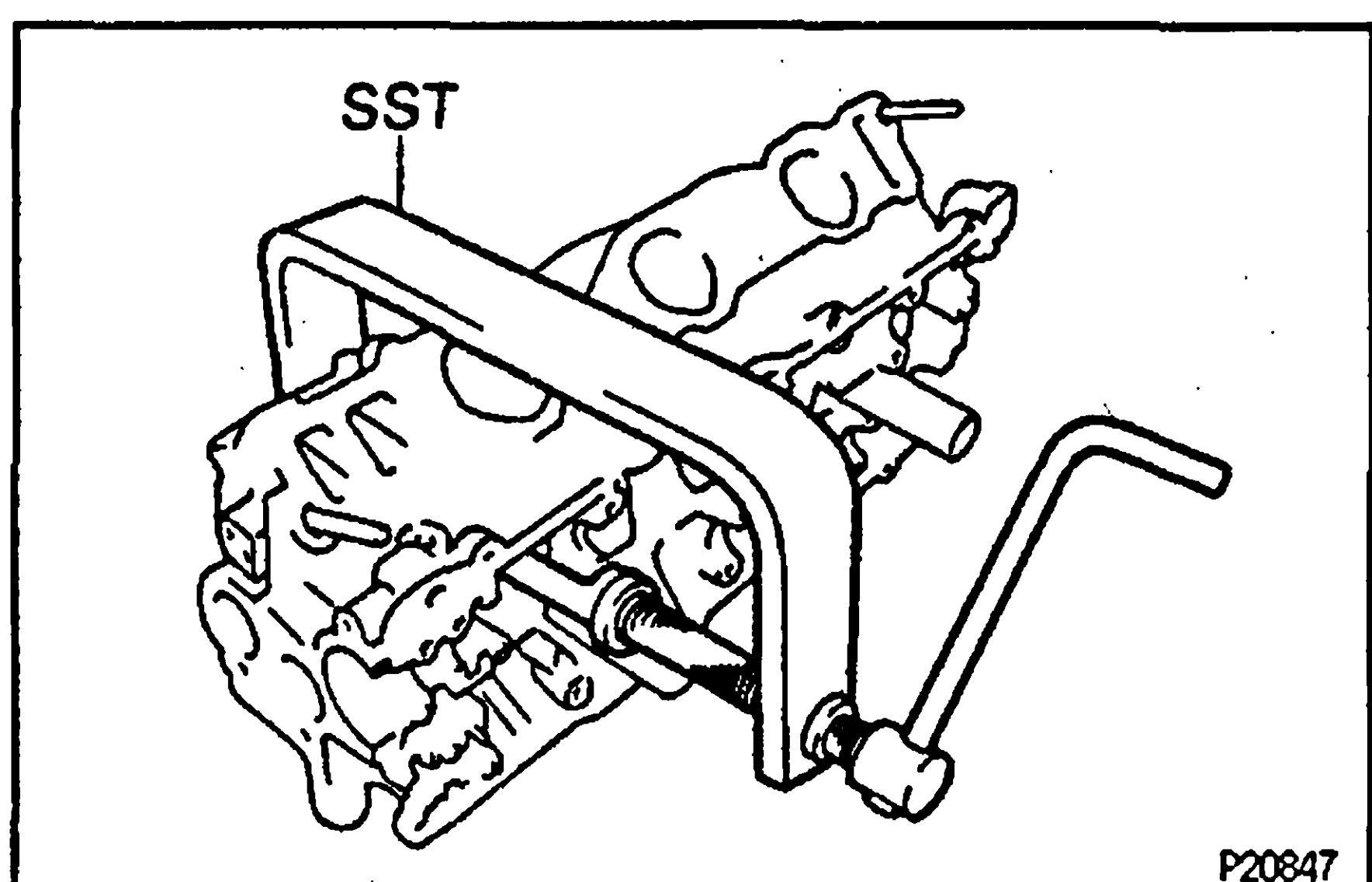
- (a) Using SST, push in a new oil seal.
SST 09201—41020



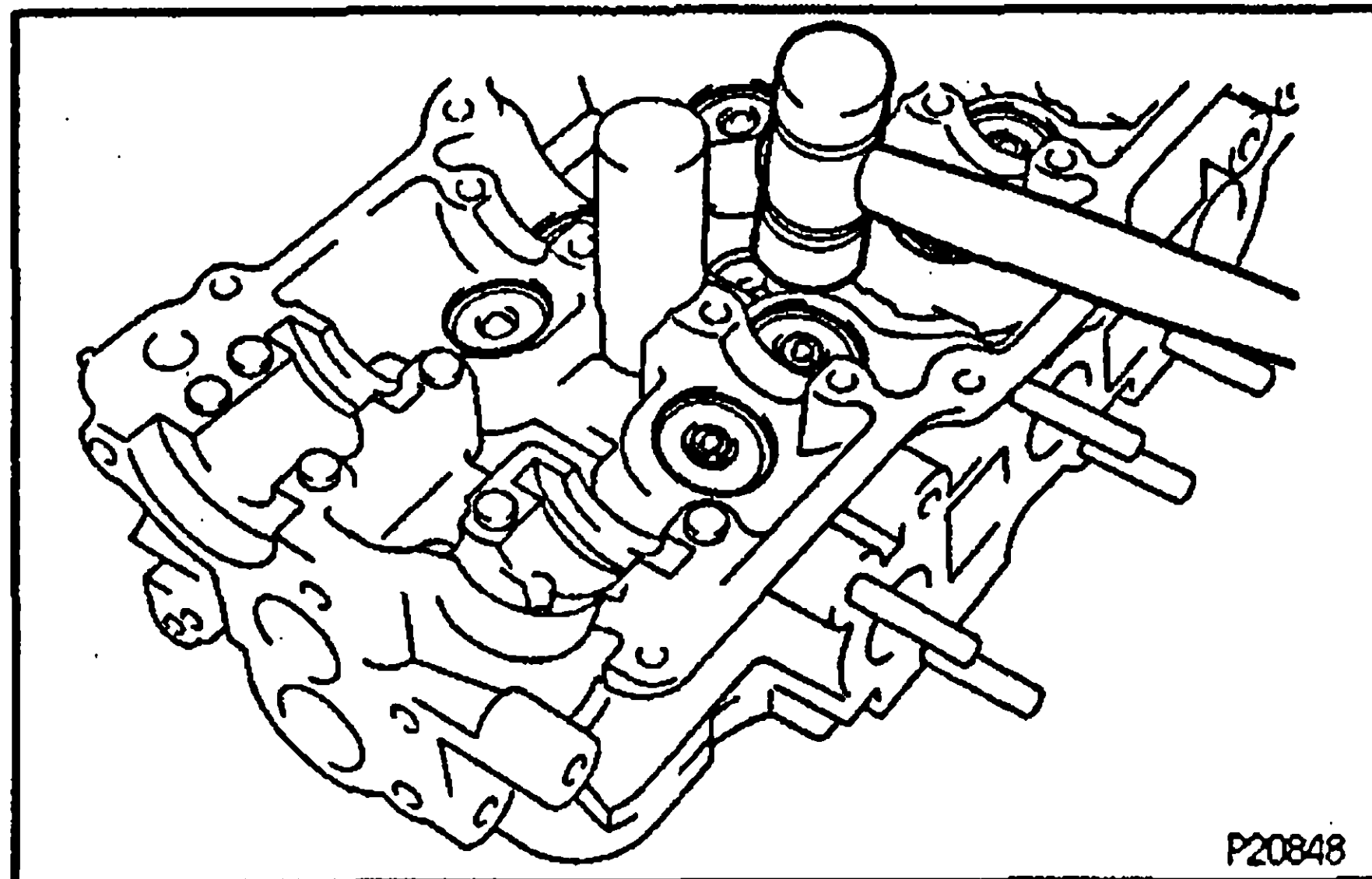
HINT: The intake valve oil seal is silver and the exhaust valve oil seal is black.



- (b) Install these 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

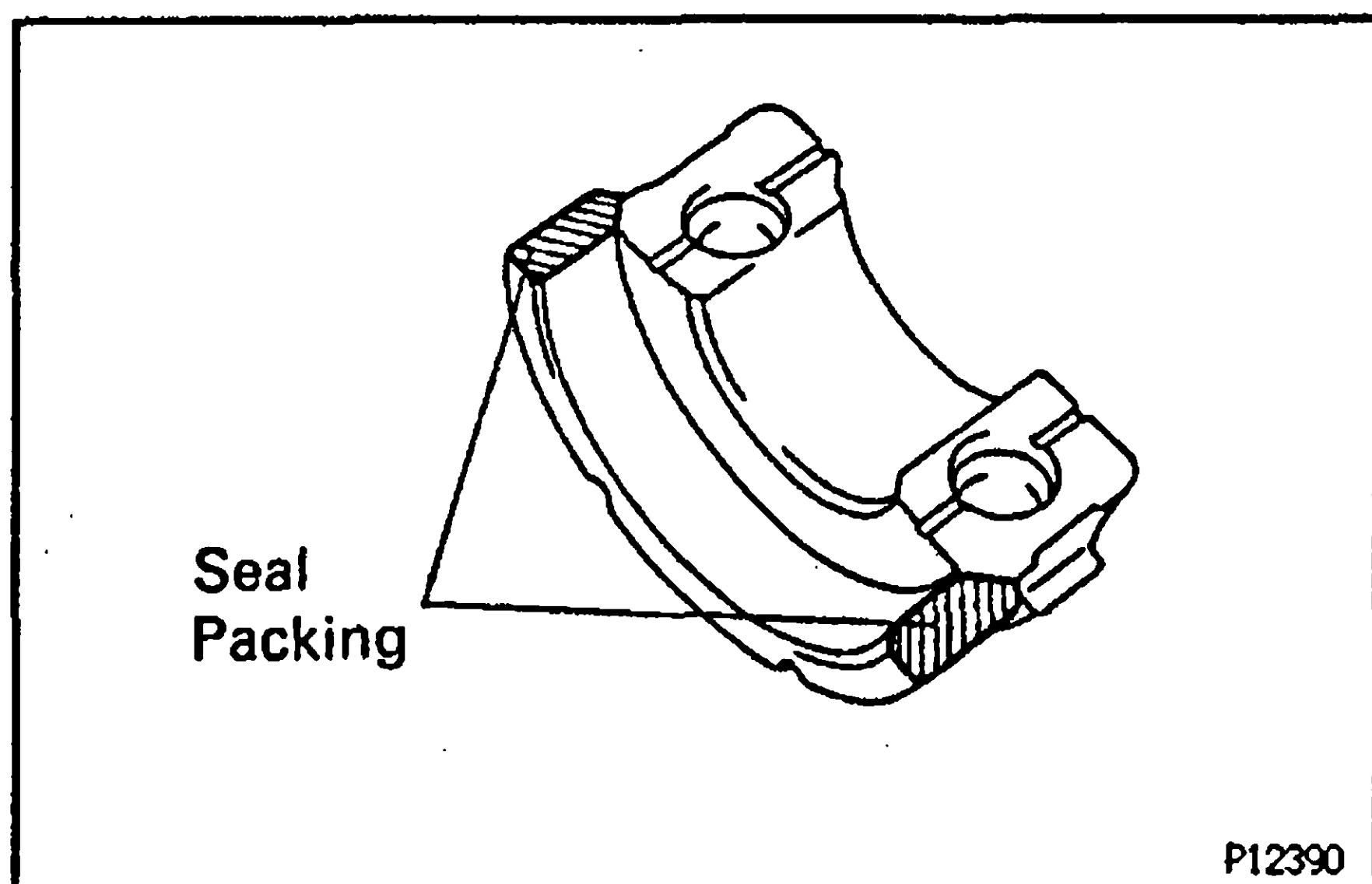


- (d) Using a plastic—faced hammer, lightly tap the valve stem tip to ensure a proper fit.

3. INSTALL VALVE LIFTERS AND SHIMS

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

EG

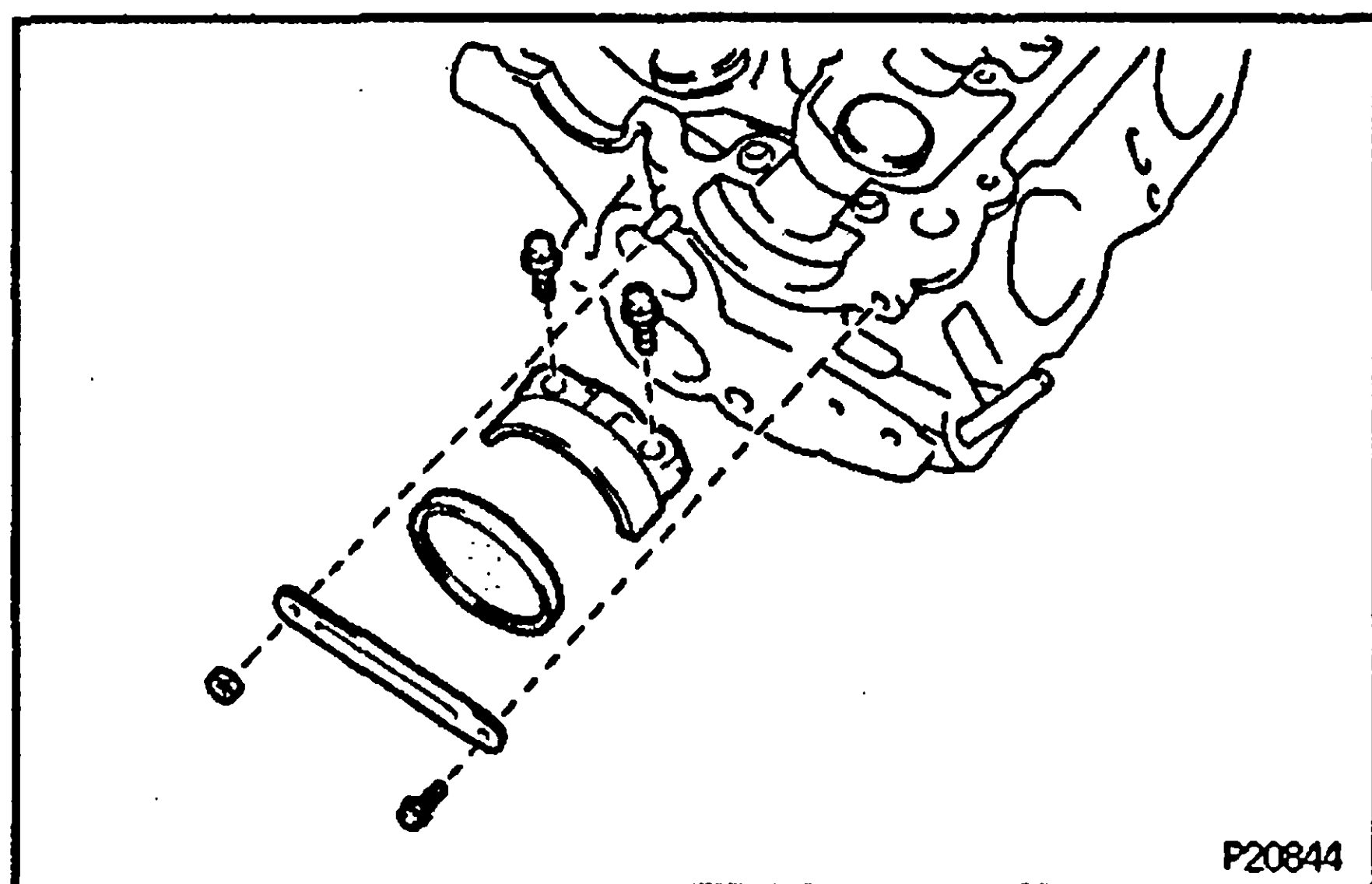


4. INSTALL CAMSHAFT HOUSING PLUGS

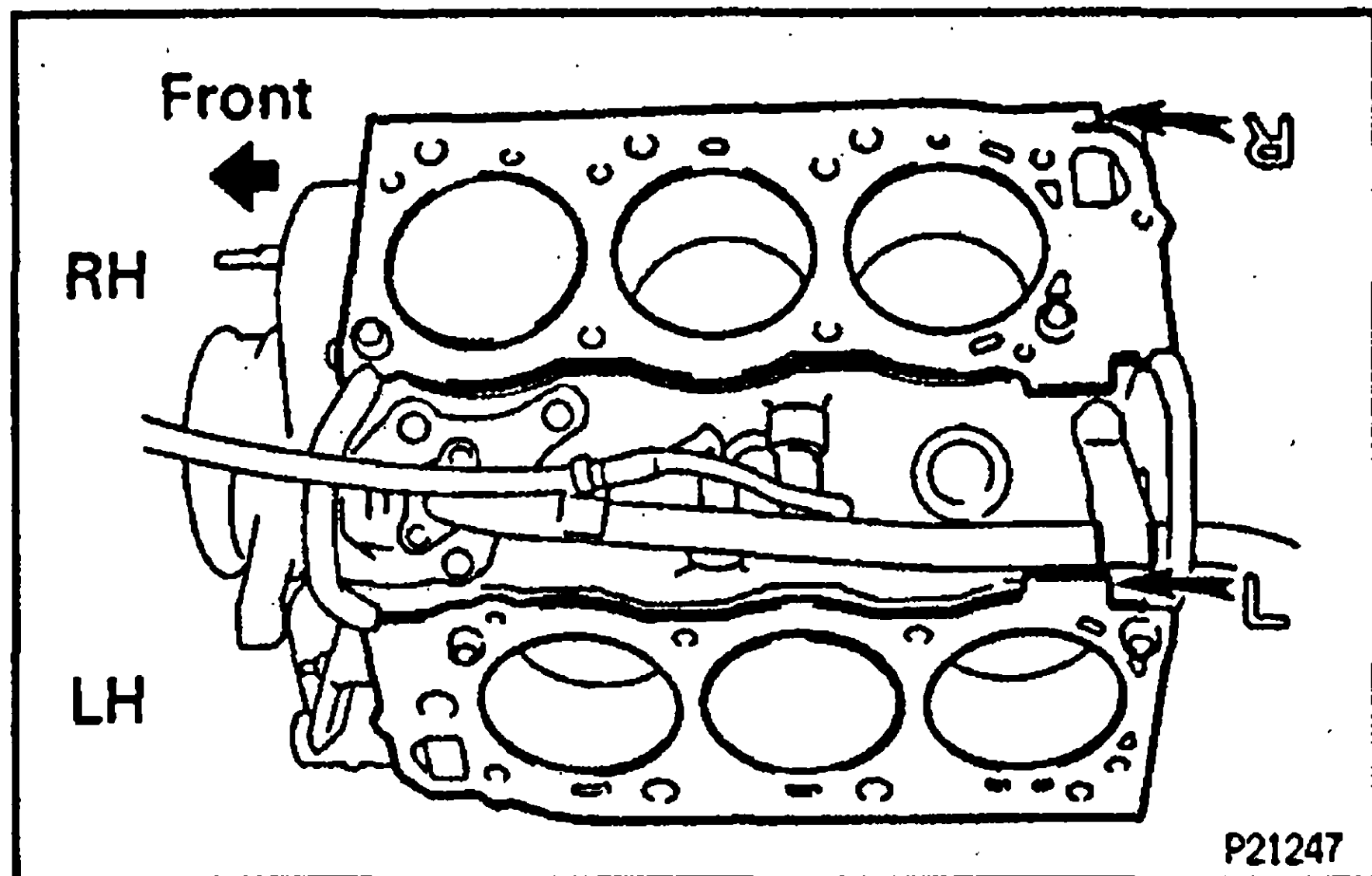
- (a) Remove any old packing (FIPG) material.
(b) Apply seal packing to the bearing cap as shown.

Seal packing:

Part No. 08826—00080 or equivalent



- (c) Place a new housing plug in position on the cylinder head, facing the cup side inward.
(d) Install the camshaft bearing cap with the 2 bolts.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)
(e) Install the rear plate, ground strap with the bolt and nut.
Torque: 8 N·m (80 kgf·cm, 71 in·lbf)



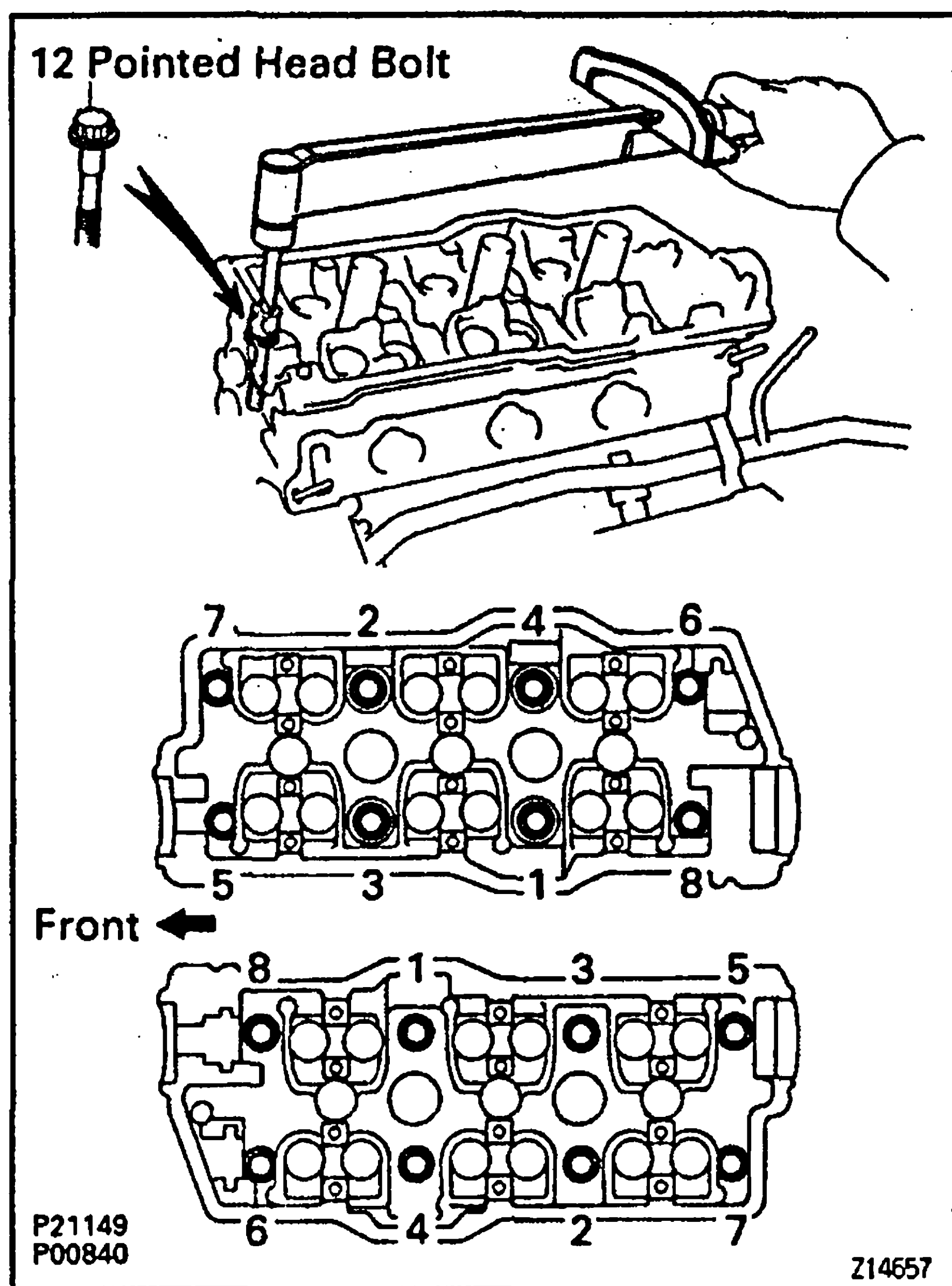
CYLINDER HEADS INSTALLATION

1. PLACE CYLINDER HEAD ON CYLINDER BLOCK

- (a) Place 2 new cylinder head gaskets in position on the cylinder block.

NOTICE: Be careful of the installation direction.

- (b) Place the 2 cylinder heads in position on the cylinder head gaskets.



2. INSTALL 12 POINTED HEAD CYLINDER HEAD BOLTS

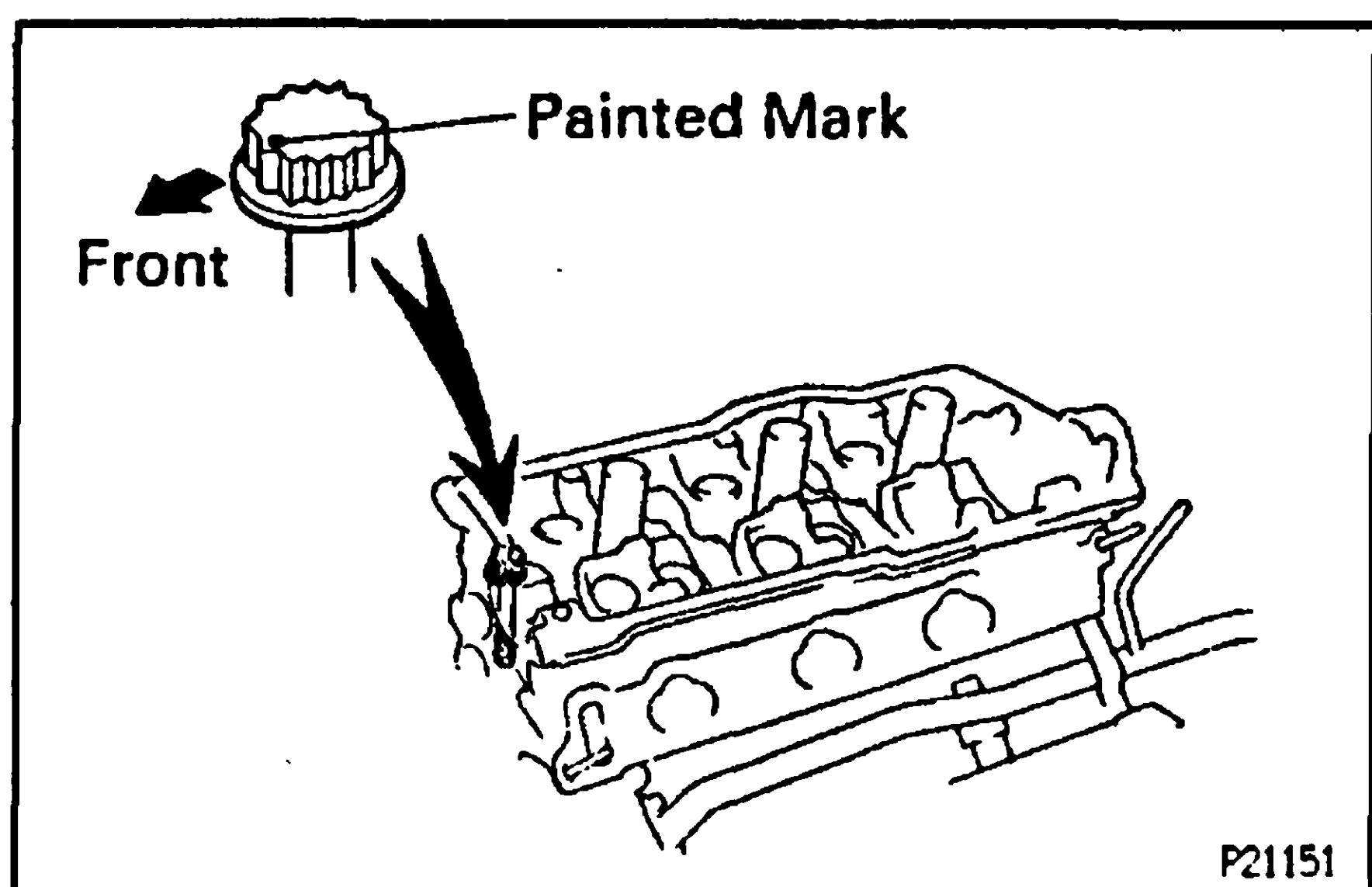
HINT:

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

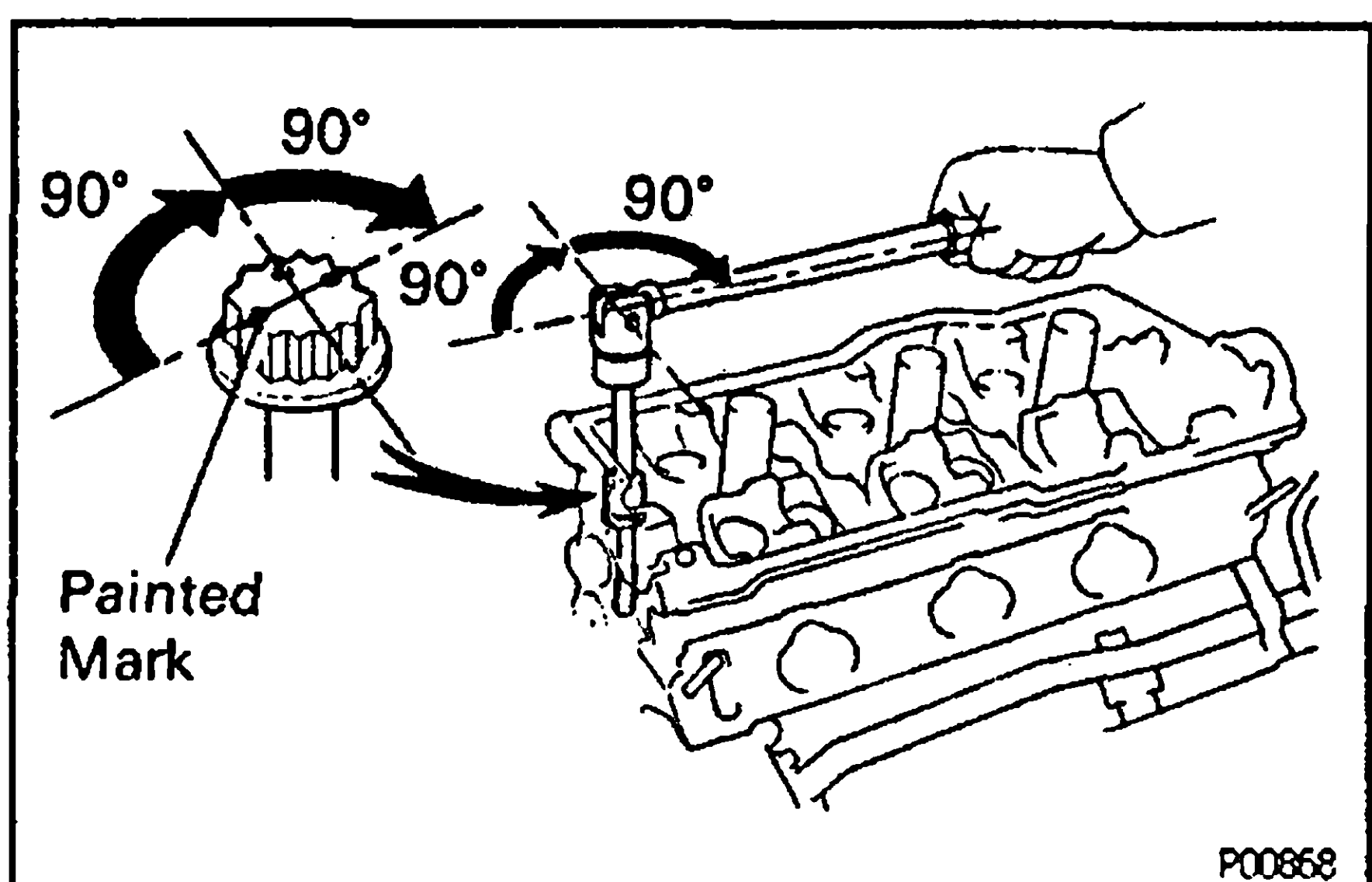
- (a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
- (b) Install and uniformly tighten the cylinder head bolts on each cylinder head, in several passes, in the sequence shown, then repeat for the other side, as shown.

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

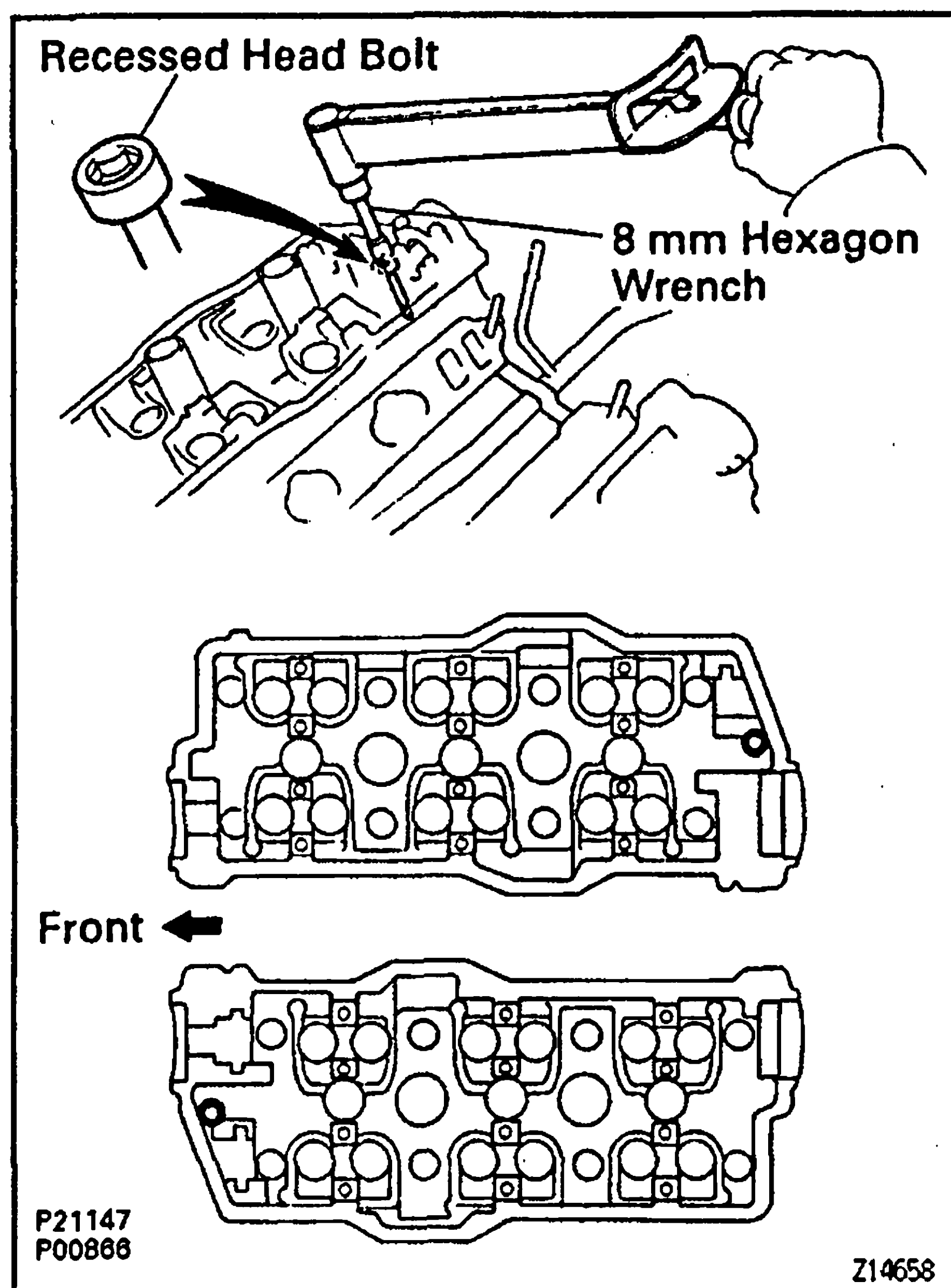
If any of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.



- (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.



3. INSTALL RECESSED HEAD CYLINDER HEAD BOLTS

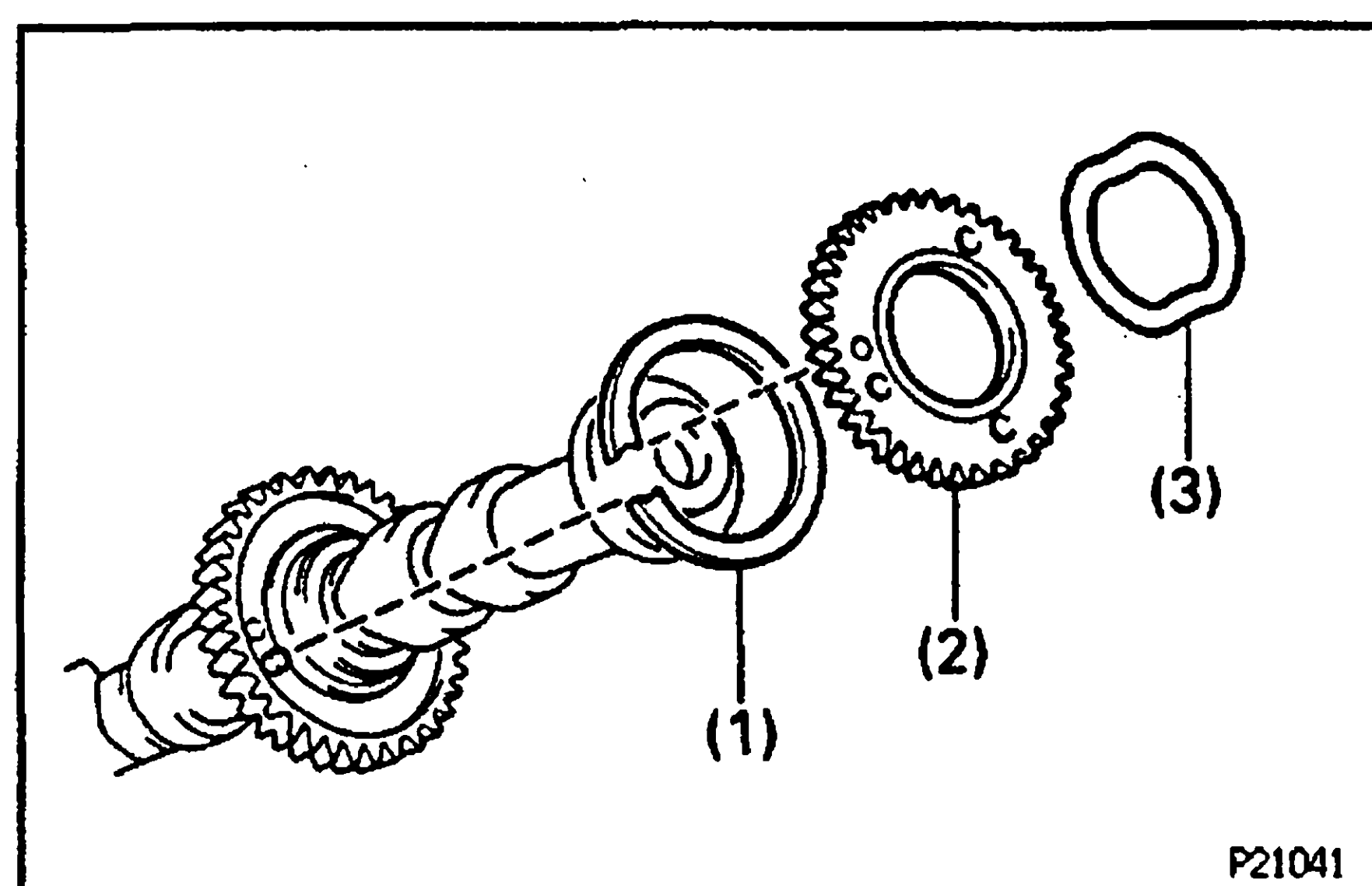
- Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
- Using an 8 mm hexagon wrench, install the cylinder head bolt on each cylinder head, then repeat for the other side, as shown.

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

4. CONNECT GROUND STRAP

Install the bolt and connect the ground strap.

EG



5. ASSEMBLE EXHAUST CAMSHAFTS

- Mount the hexagonal wrench head portion of the camshaft in a vise.

NOTICE: Be careful not to damage the camshaft.

- Install these parts:

(1) Camshaft gear spring

(2) Camshaft sub-gear

HINT: Attach the pins on the gears to the gear spring ends.

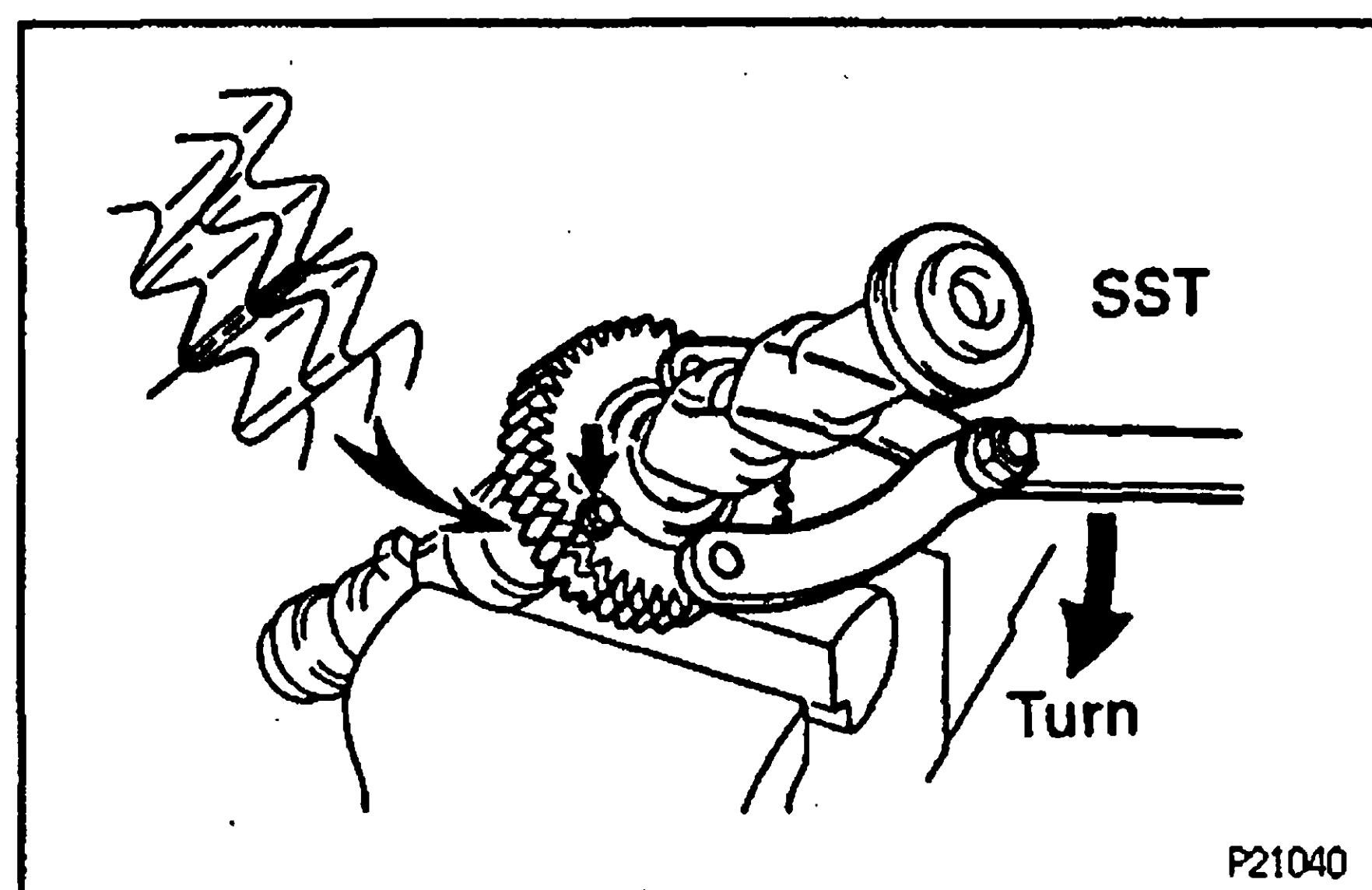
(3) Wave washer

- Using snap ring pliers, install the snap ring.

- Using SST, align the holes of the camshaft main gear and sub-gear by turning camshaft sub-gear clockwise, and temporarily install a service bolt.

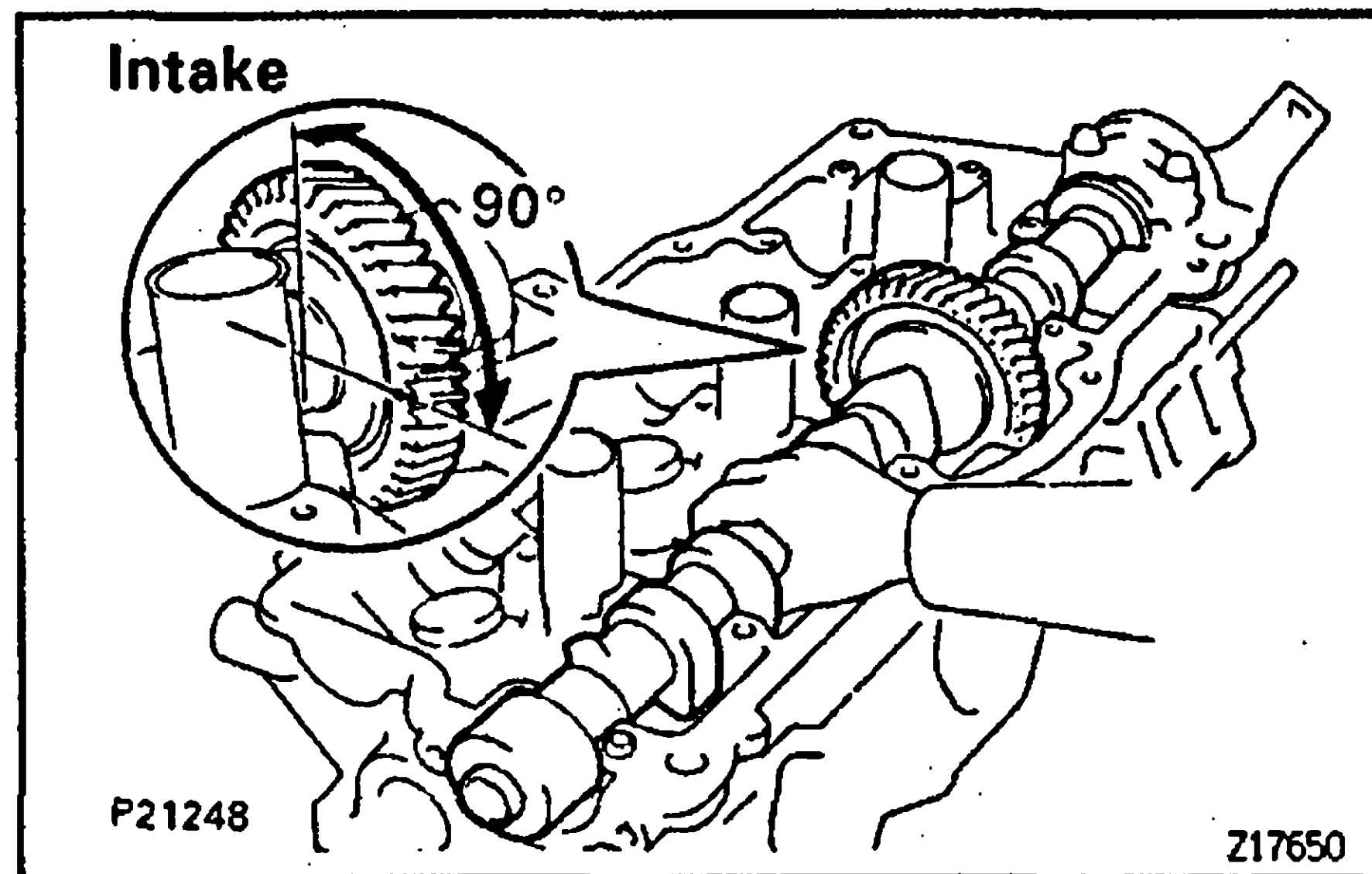
SST 09960-10010 (09962-01000, 09963-00600)

- Align the gear teeth of the main gear and sub-gear, and tighten the service bolt.

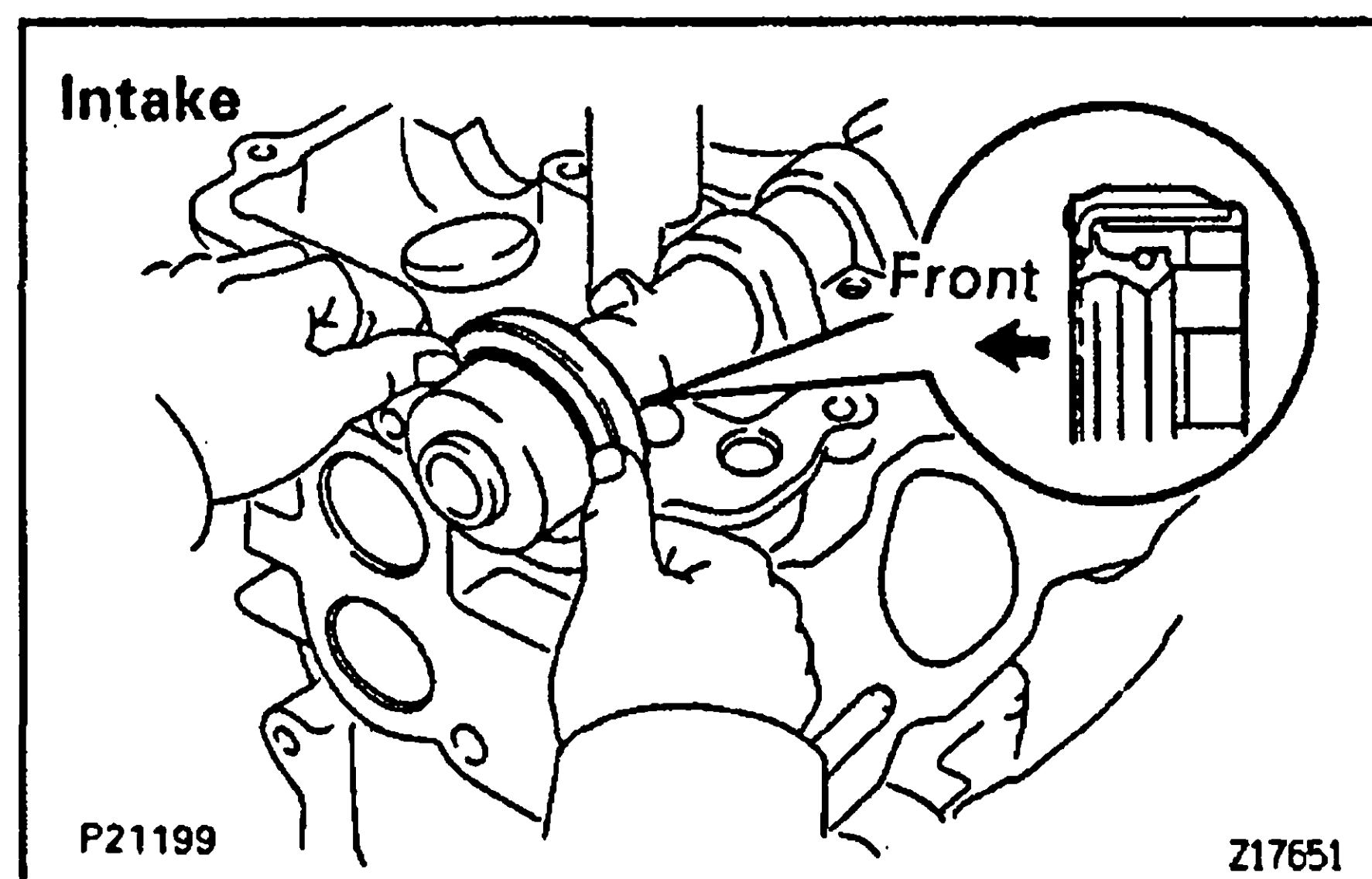


6. INSTALL CAMSHAFTS OF RH CYLINDER HEAD

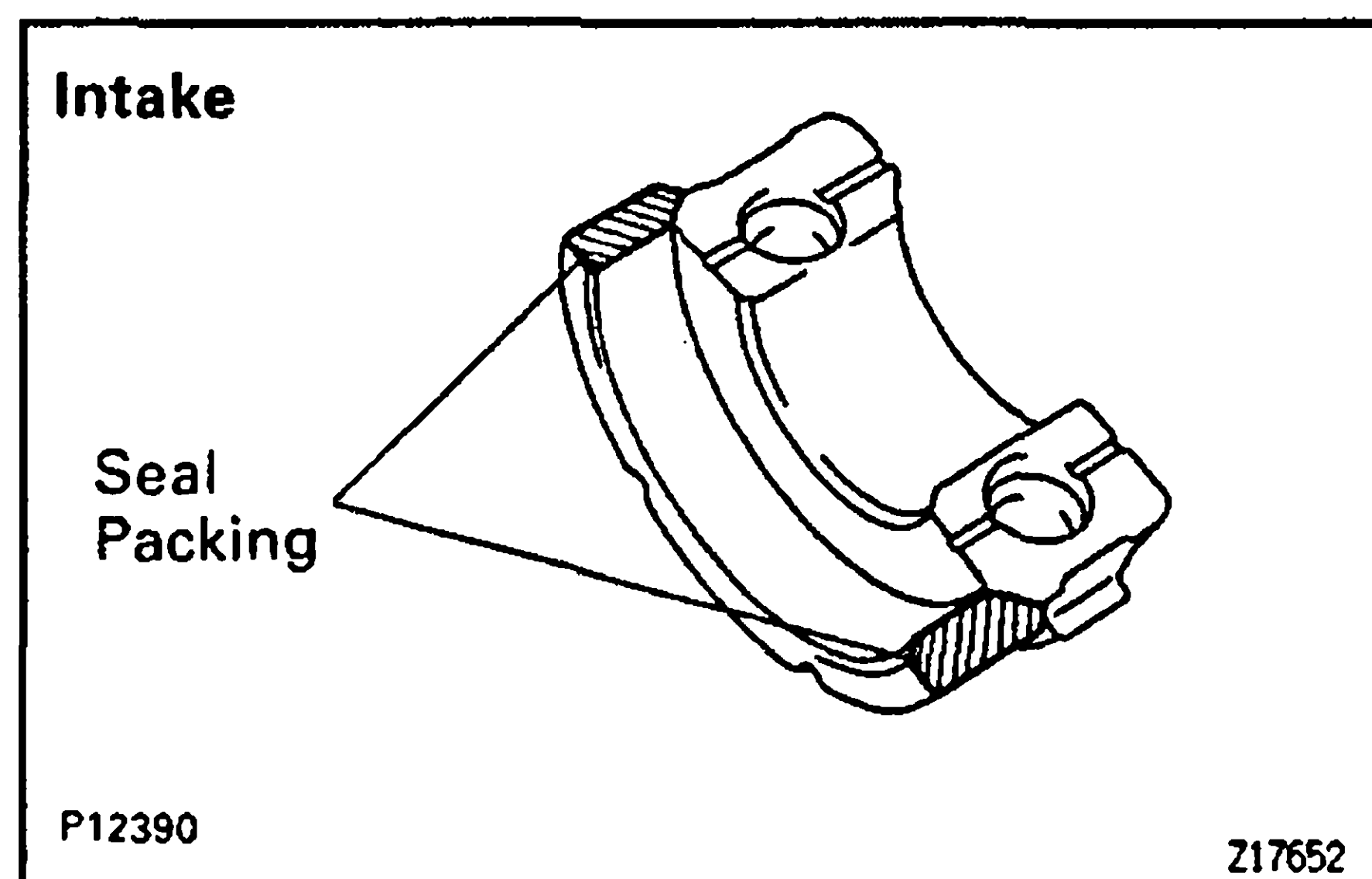
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, these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

**A. Intake**

- (a) Apply new engine oil to the thrust portion and journal of the camshaft.
- (b) Place the intake camshaft at 90° angle of timing mark (2 dot marks) on the cylinder head.



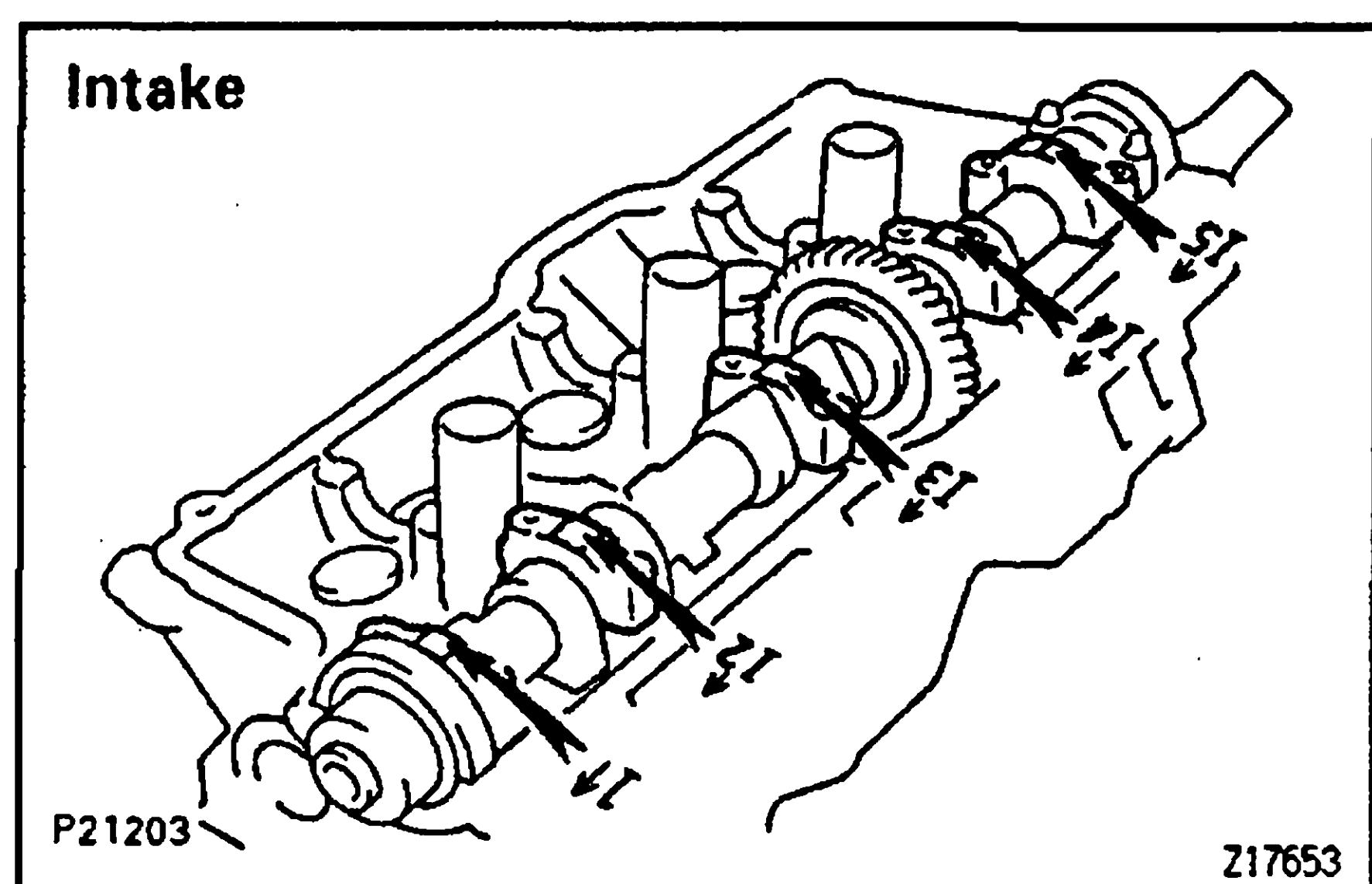
- (c) Apply MP grease to a new oil seal lip.
- (d) Install the oil seal to the camshaft.



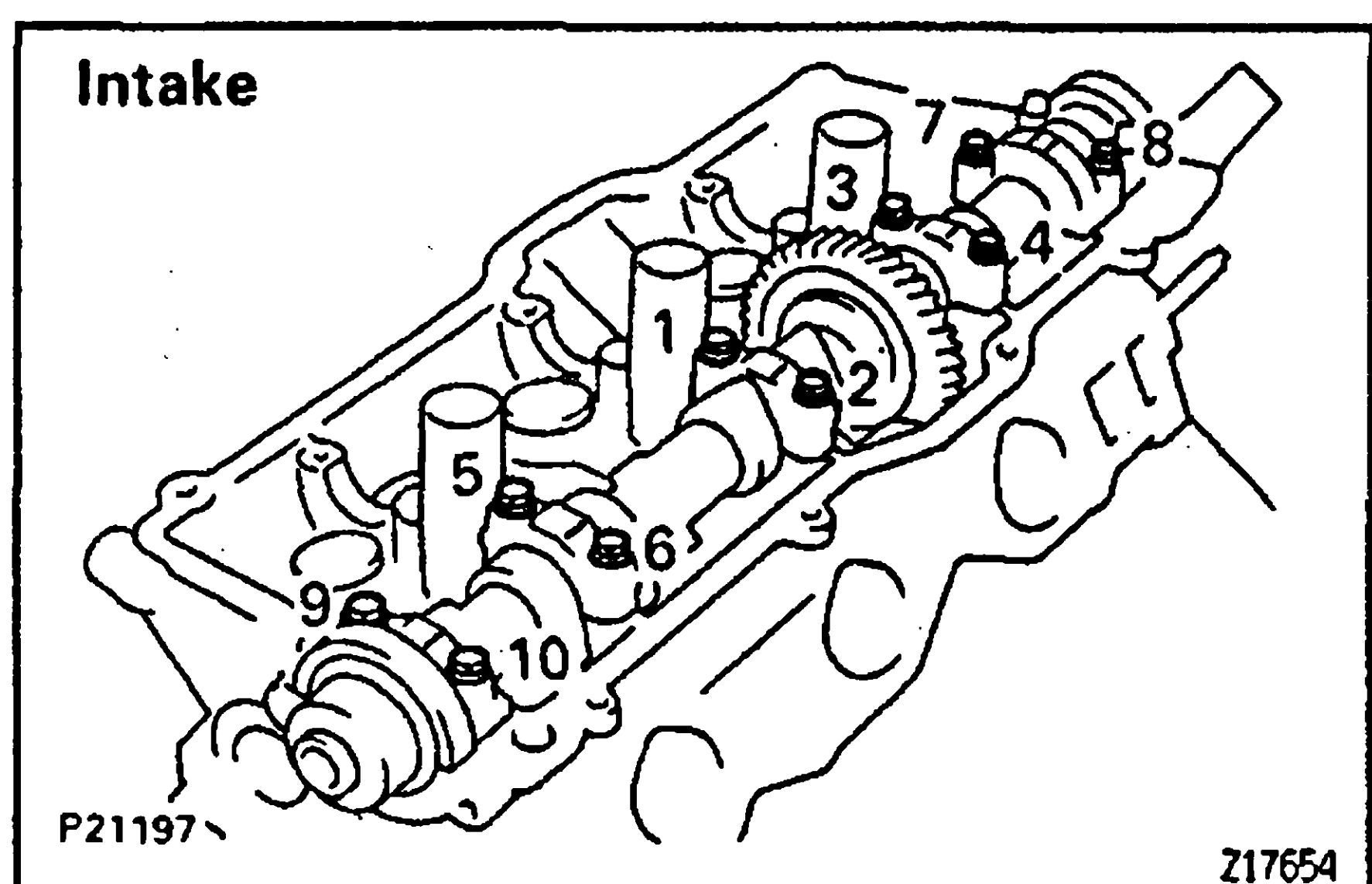
- (e) Remove any old packing (FIPG) material.
- (f) Apply seal packing to the No.1 bearing cap as shown.

Seal packing:

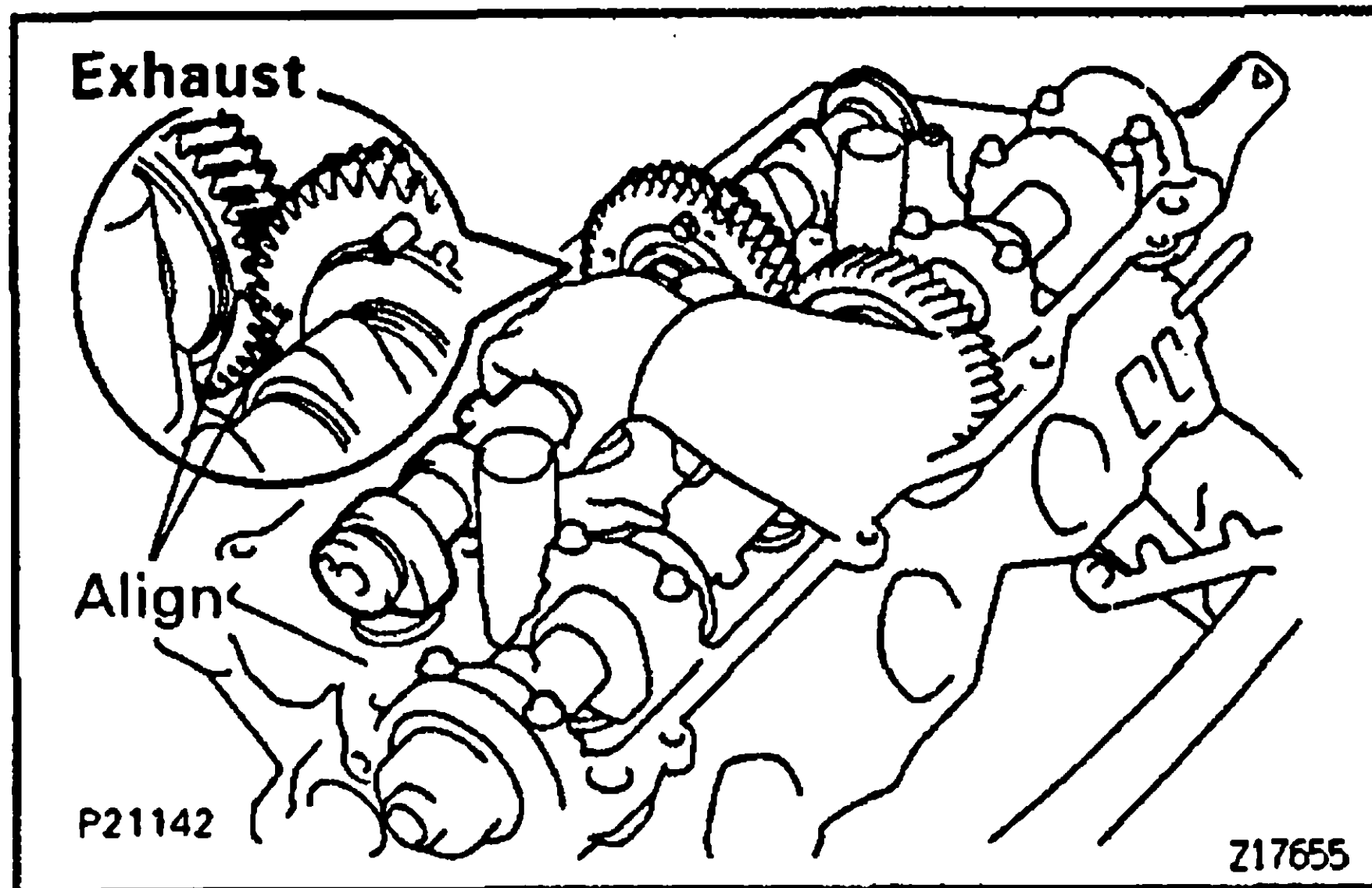
Part No. 08826-00080 or equivalent



- (g) Install the 5 bearing caps in their proper locations.

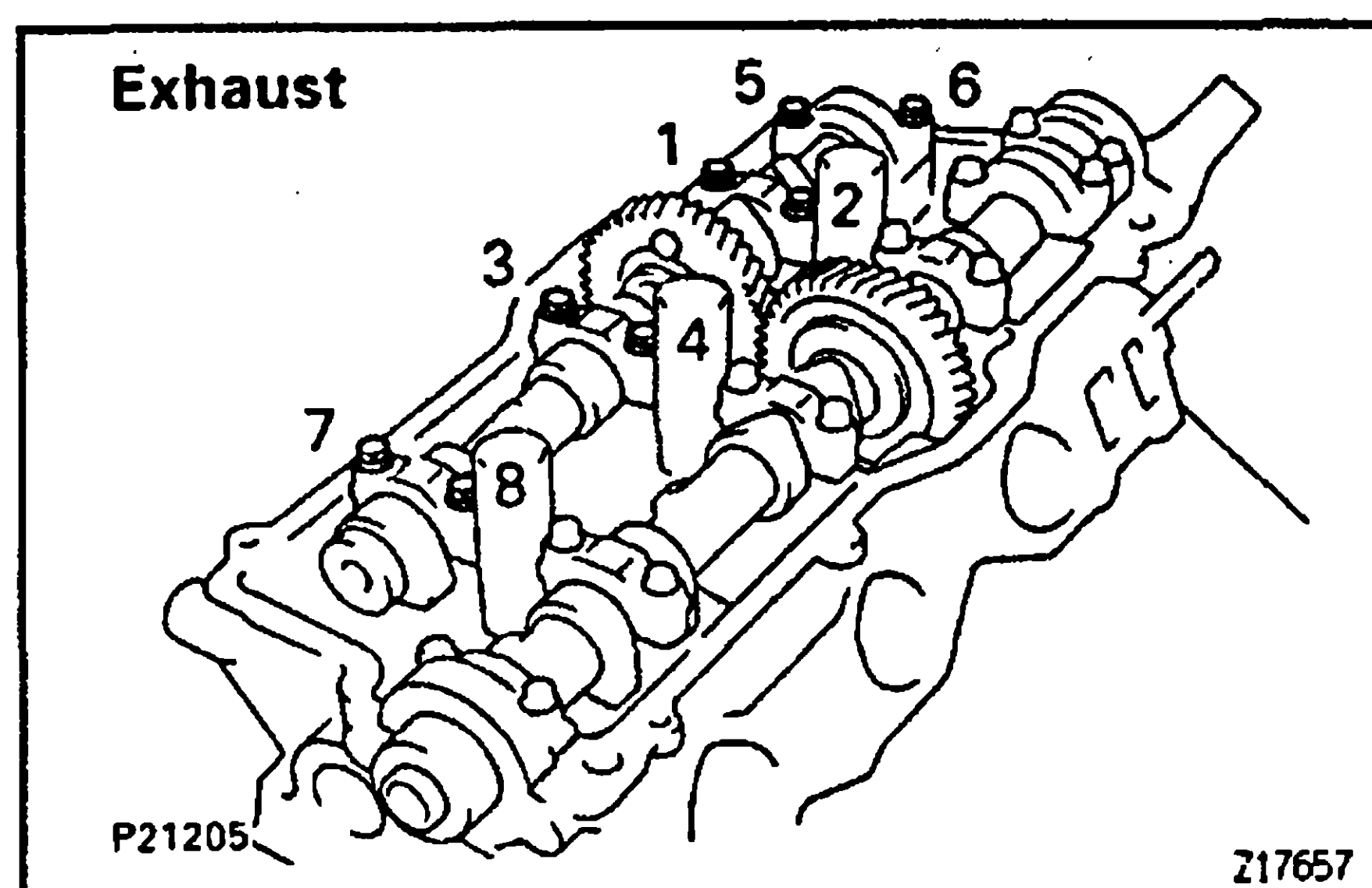
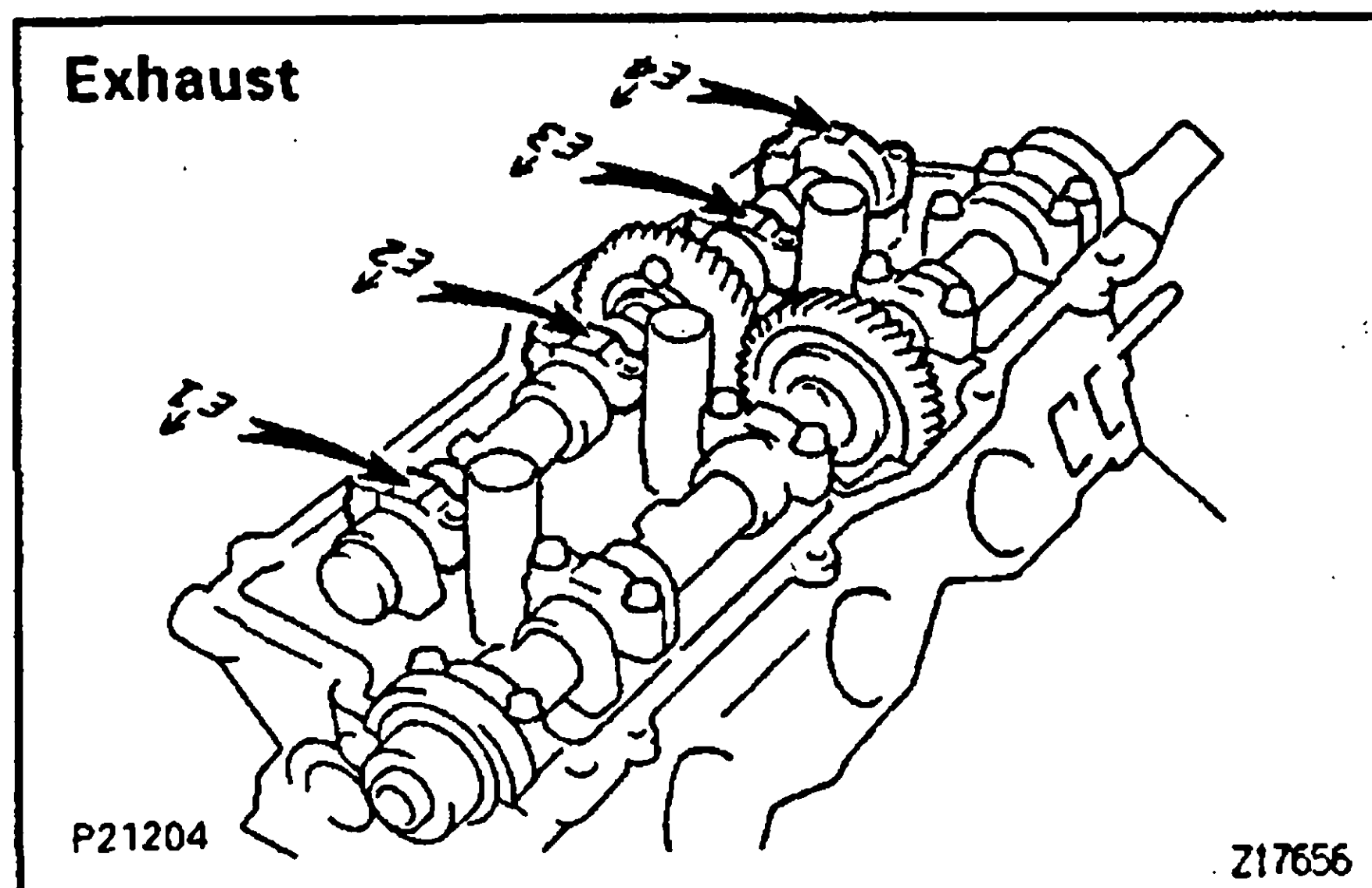


- (h) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
 - (i) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.
- Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)**

**B. Exhaust**

- (a) Apply new engine oil to the thrust portion and journal of the camshaft.
- (b) Align the timing marks (2 dot marks) of the camshaft drive and driven gears.
- (c) Place the exhaust camshaft on the cylinder head.

EG

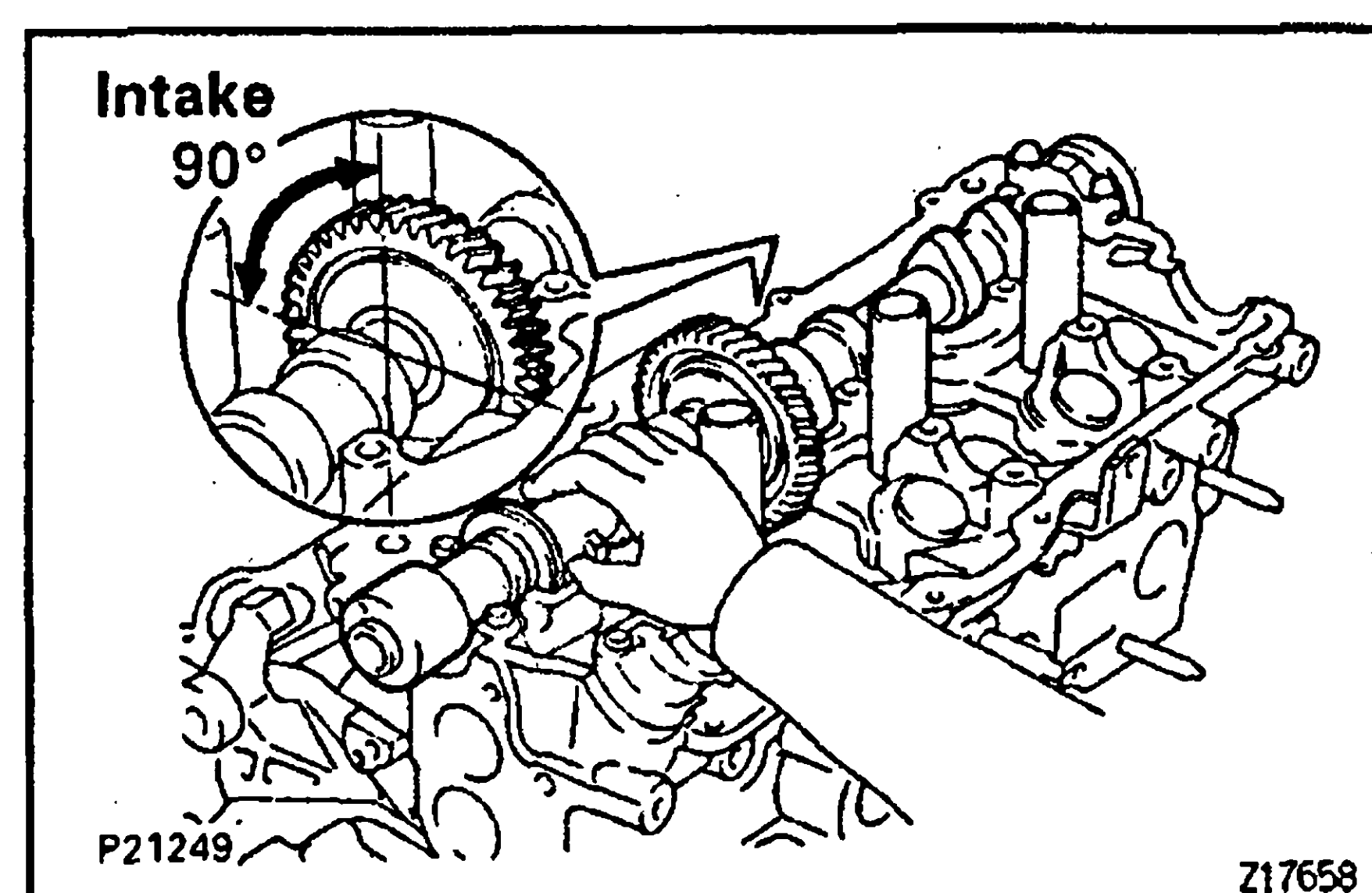


- (d) Install the 4 bearing caps in their proper locations.

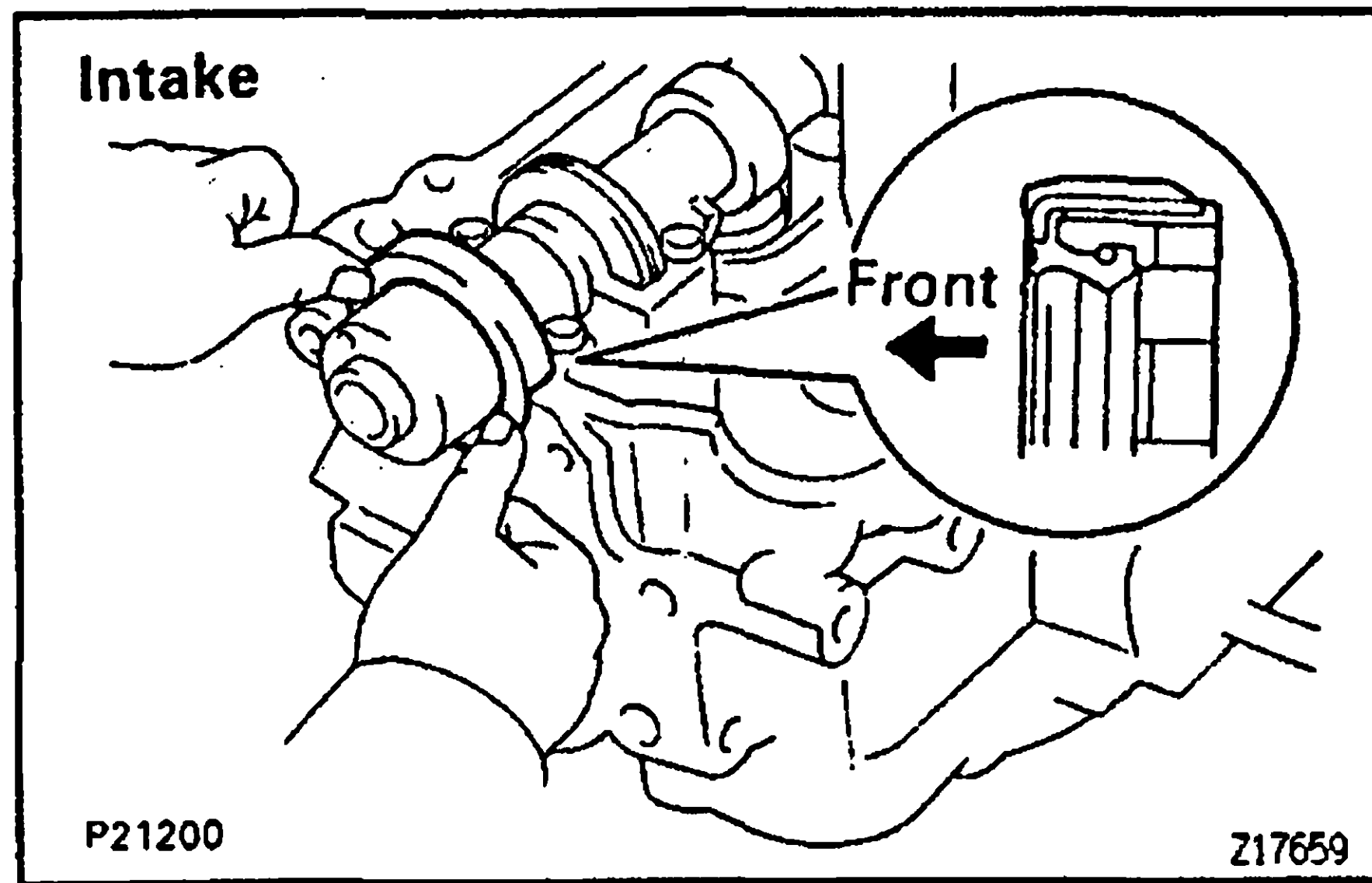
- (e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
- (f) Install and uniformly tighten the 8 bearing cap bolts, in several passes, in the sequence shown.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)
- (g) Remove the service bolt.
- (h) Align the timing marks (1 dot mark) of the camshaft drive and driven gears by turning the camshaft with a wrench.

7. INSTALL CAMSHAFTS OF LH CYLINDER HEAD

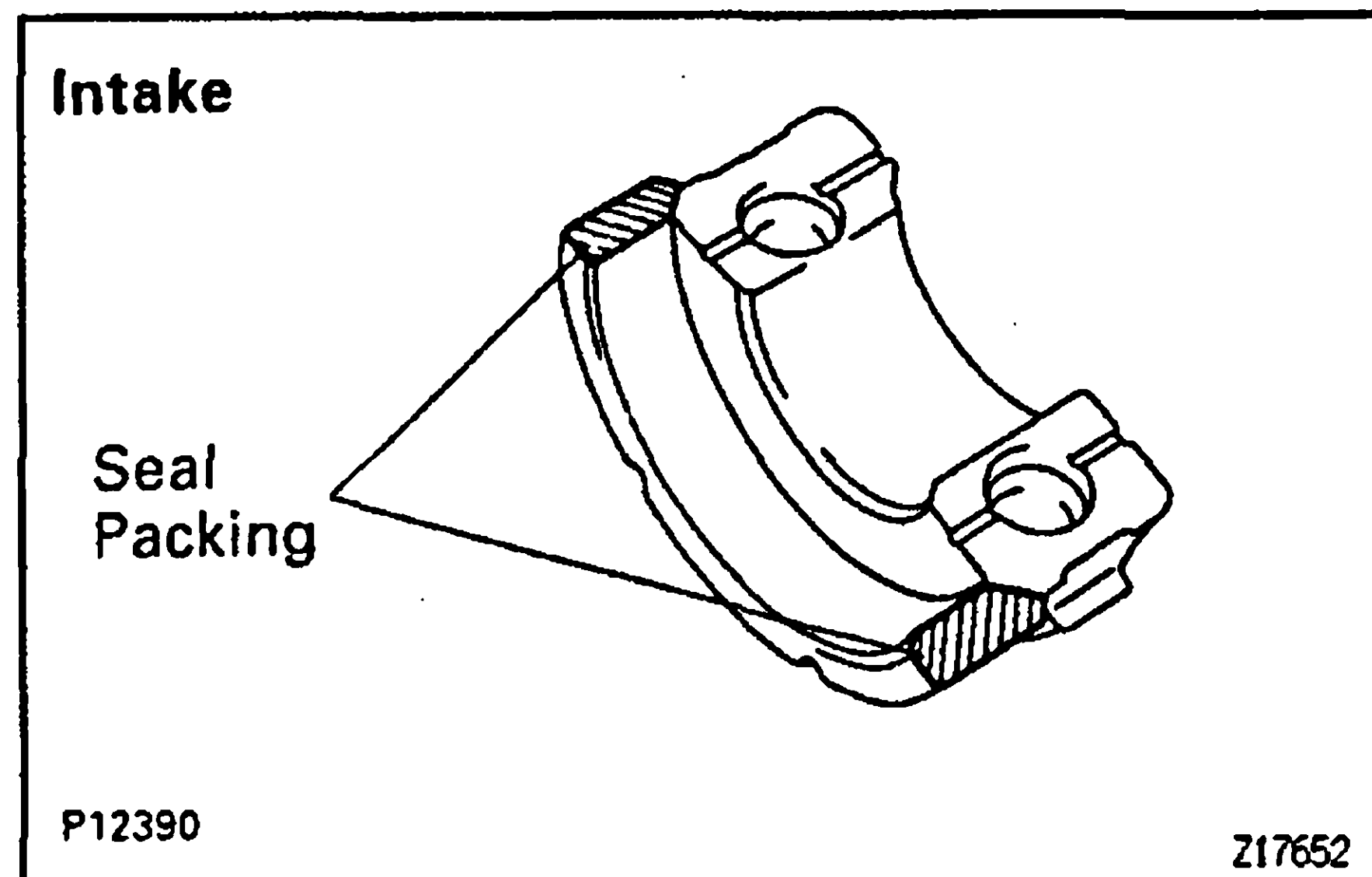
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, these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

**A. Intake**

- (a) Apply new engine oil to the thrust portion and journal of the camshaft.
- (b) Place the intake camshaft at 90° angle of timing mark (1 dot mark) on the cylinder head.

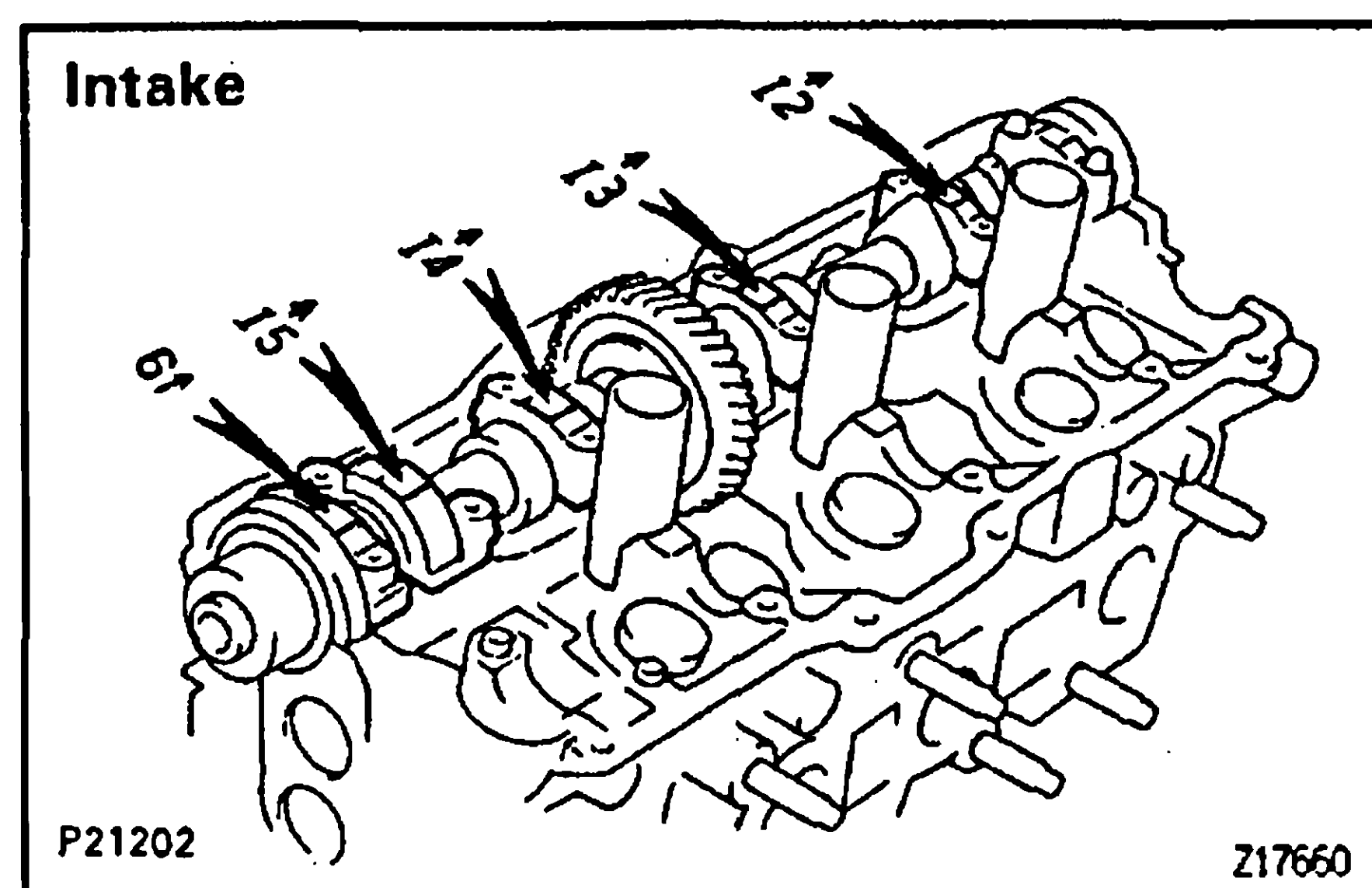


- (c) Apply MP grease to a new oil seal lip.
- (d) Install the oil seal to the camshaft.

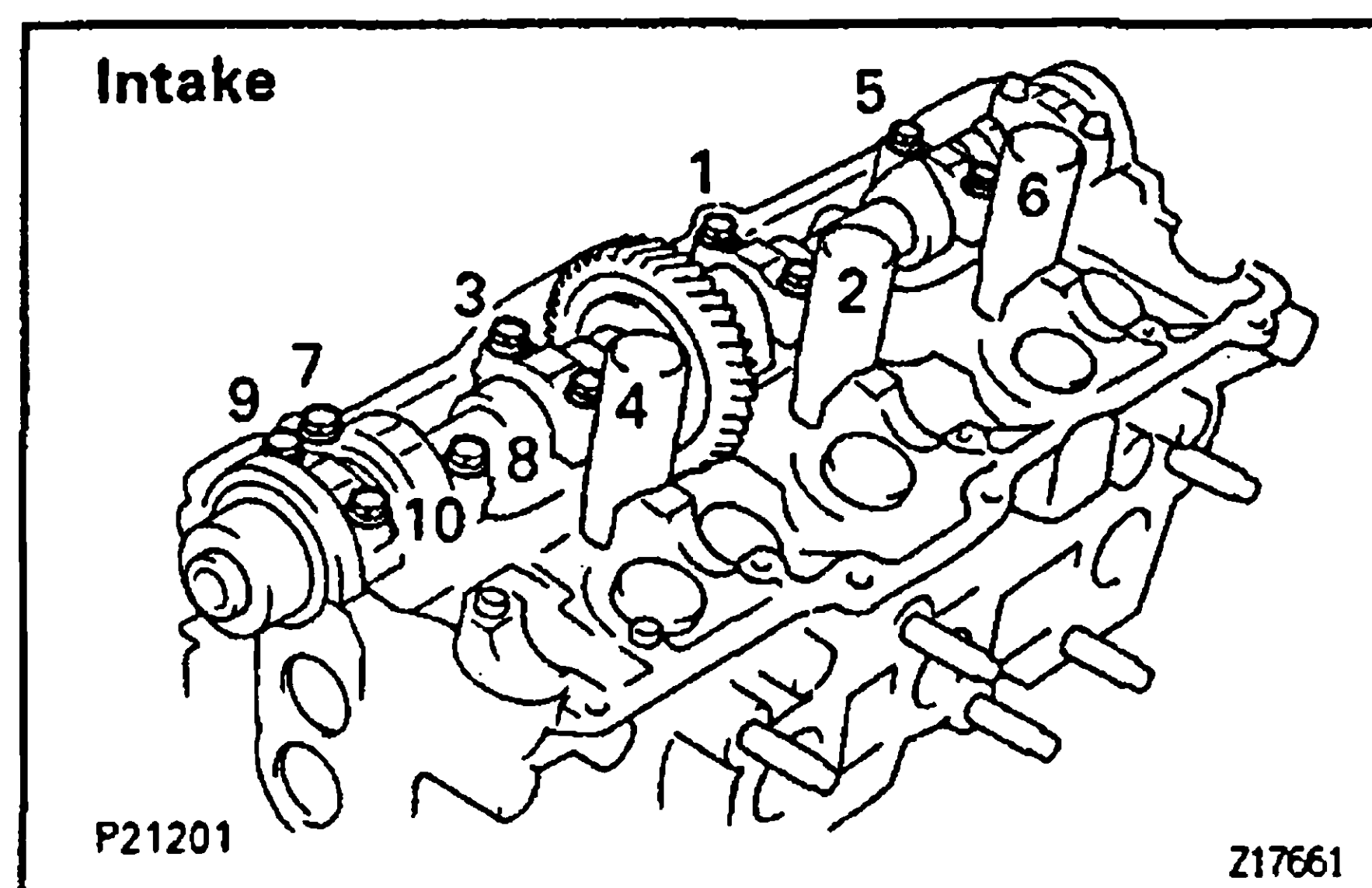


- (e) Remove any old packing (FIPG) material.
- (f) Apply seal packing to the No.1 bearing cap as shown.

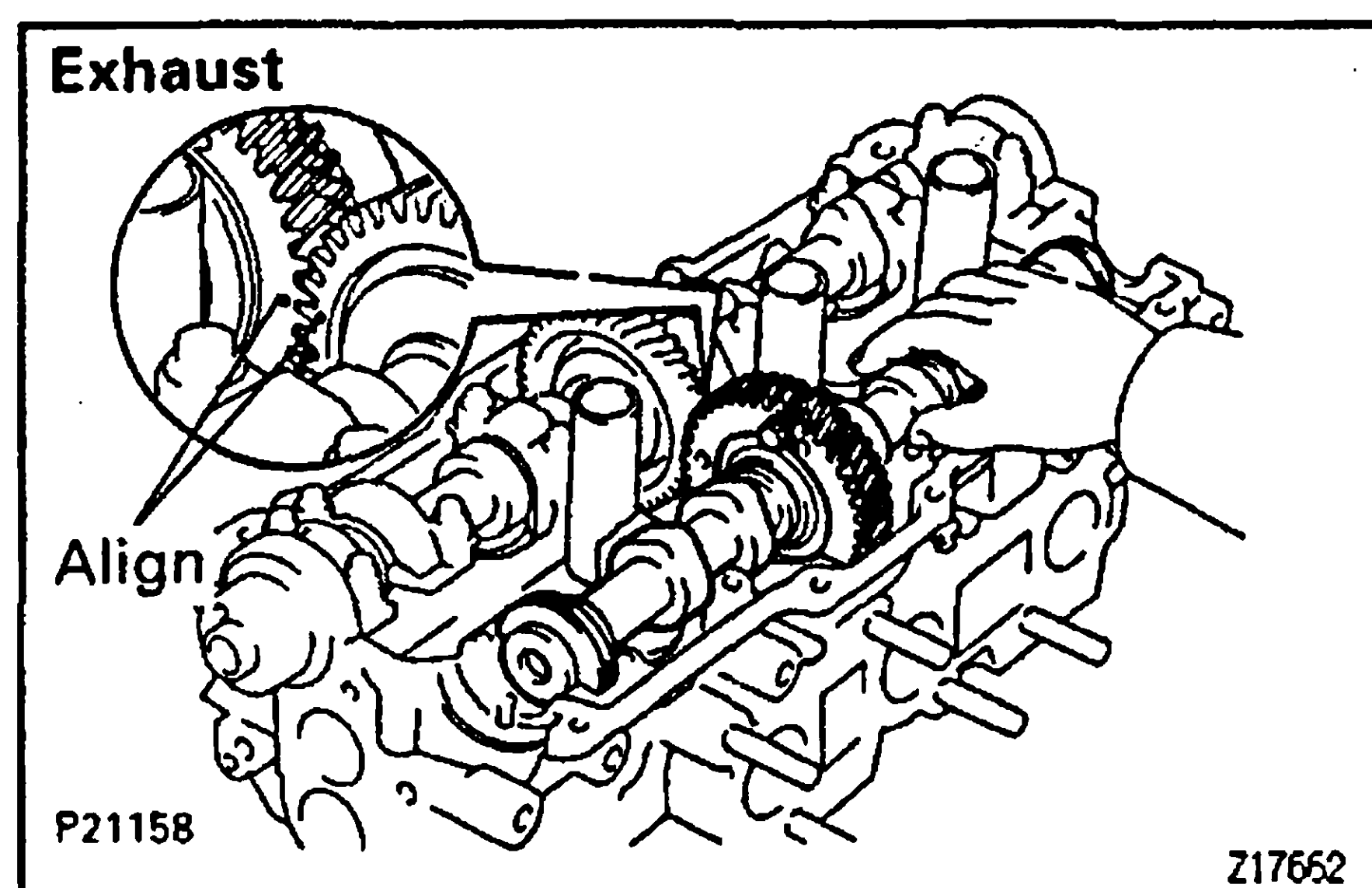
Seal packing:
Part No. 08826—00080 or equivalent



- (g) Install the 5 bearing caps in their proper locations.



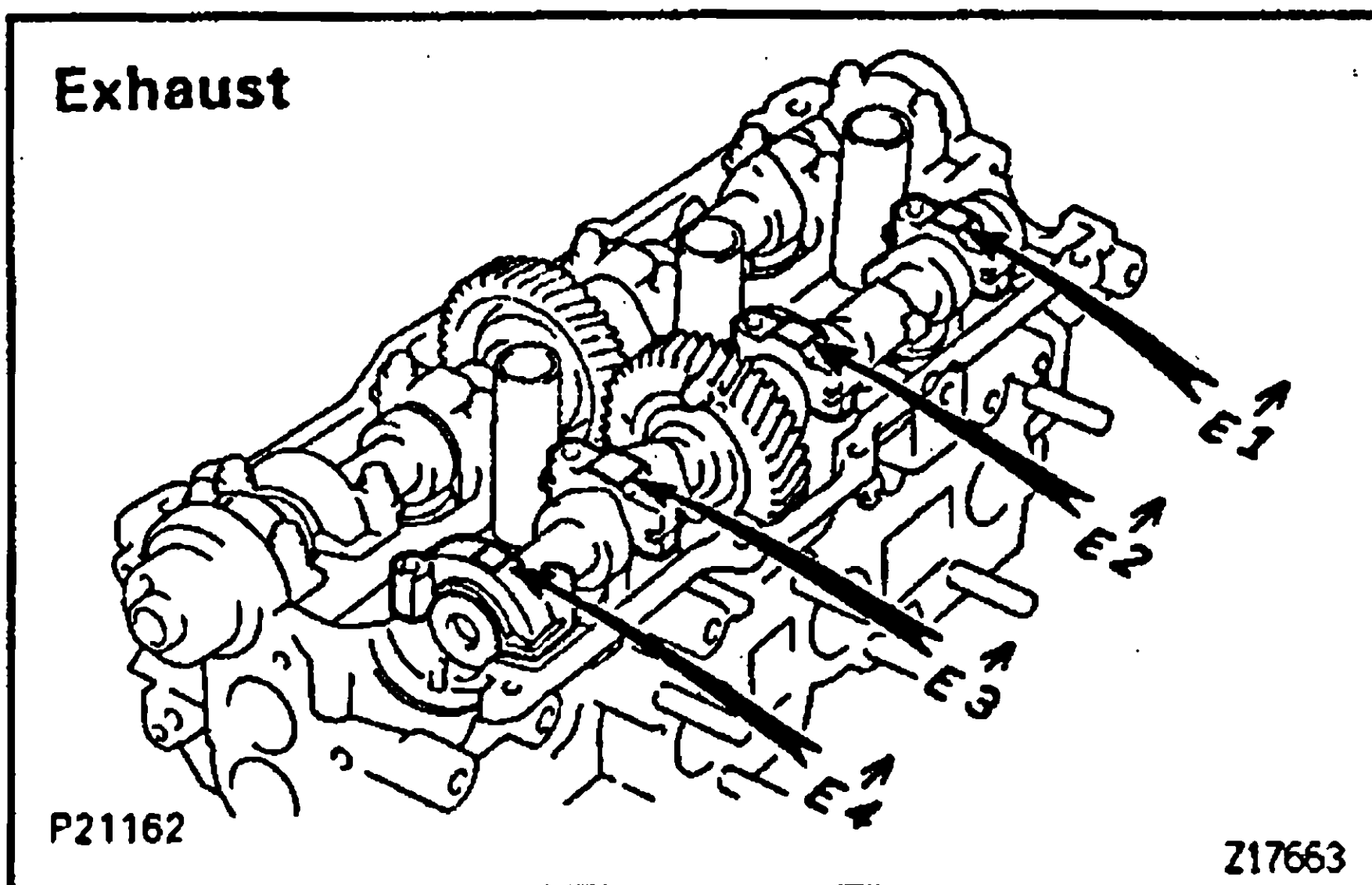
- (h) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
- (i) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)



B. Exhaust

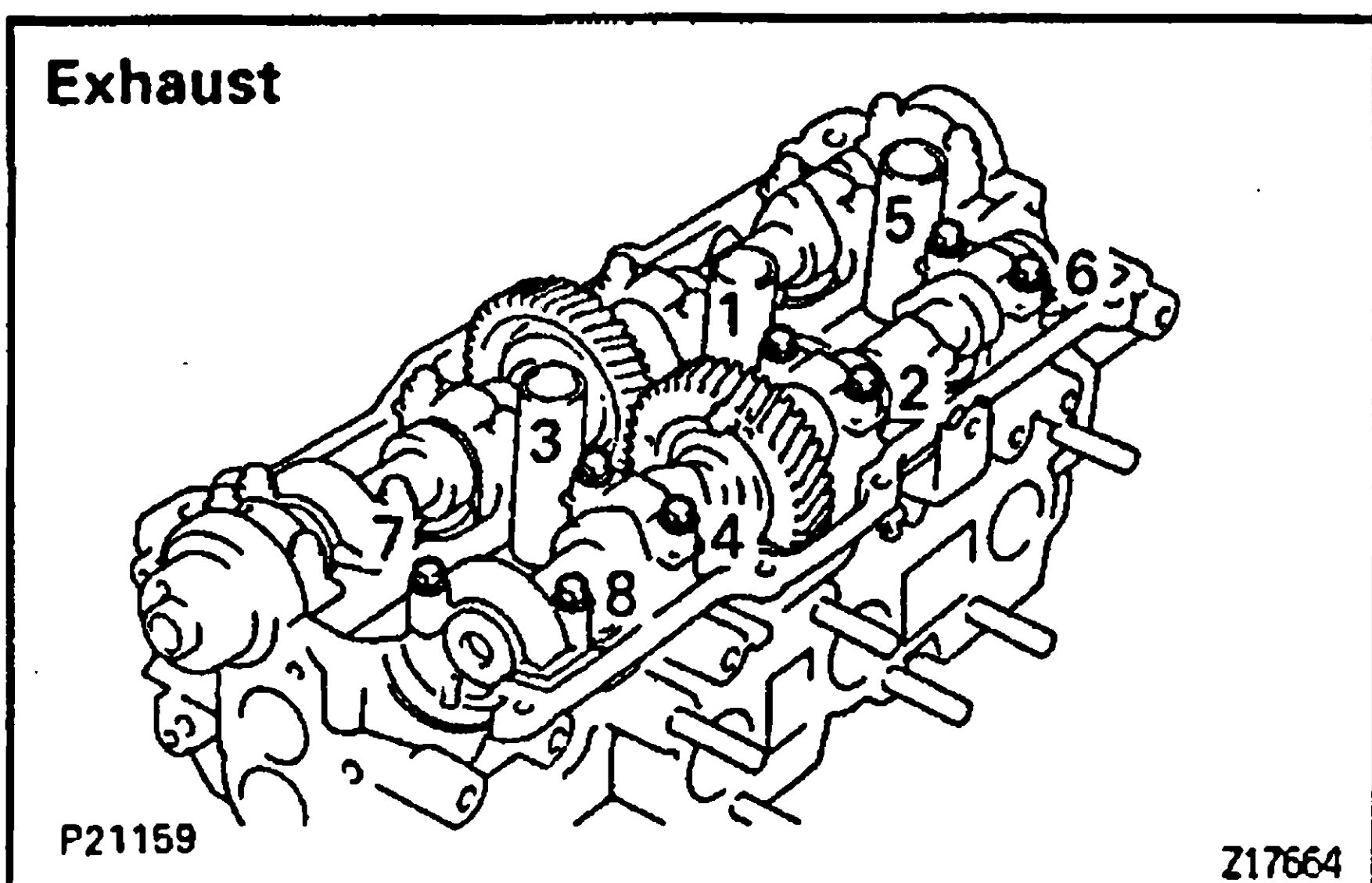
- (a) Apply new engine oil to the thrust portion and journal of the camshaft.
- (b) Align the timing marks (1 dot mark) of the camshaft drive and driven gears.
- (c) Place the exhaust camshaft on the cylinder head.

Exhaust



- (d) Install the 4 bearing caps in their proper locations.

Exhaust



- (e) Apply a light coat of engine oil on the threads and under the heads of bearing cap bolts.
- (f) Install and uniformly tighten the 8 bearing cap bolts, in several passes, in the sequence shown.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)
- (g) Remove the service bolt.
- 8. CHECK AND ADJUST VALVE CLEARANCE**
(See valve clearance)

9. INSTALL SEMI-CIRCULAR PLUGS

- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to the semi-circular plug grooves.

Seal packing:

Part No. 08826-00080 or equivalent

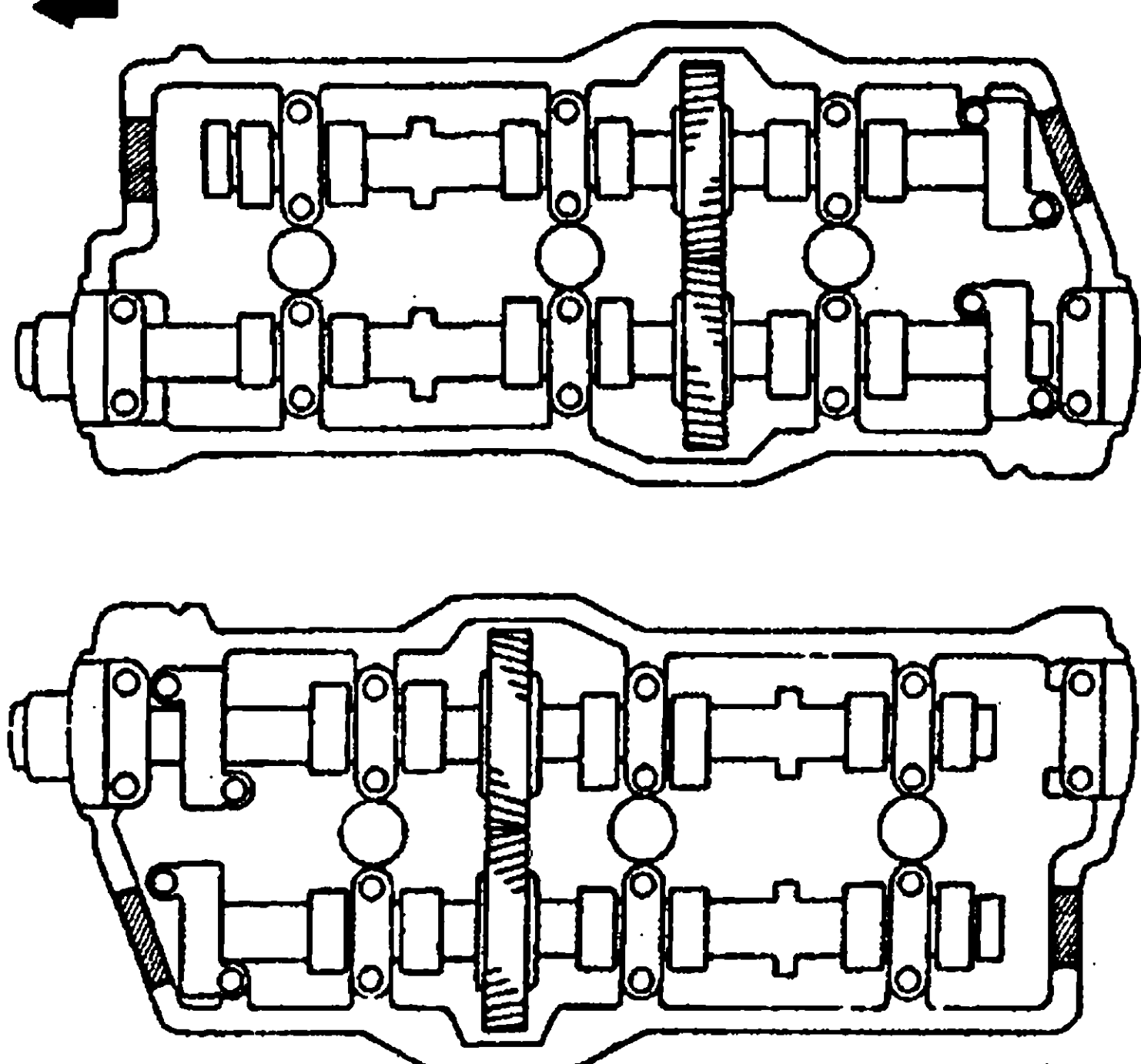
Seal Packing

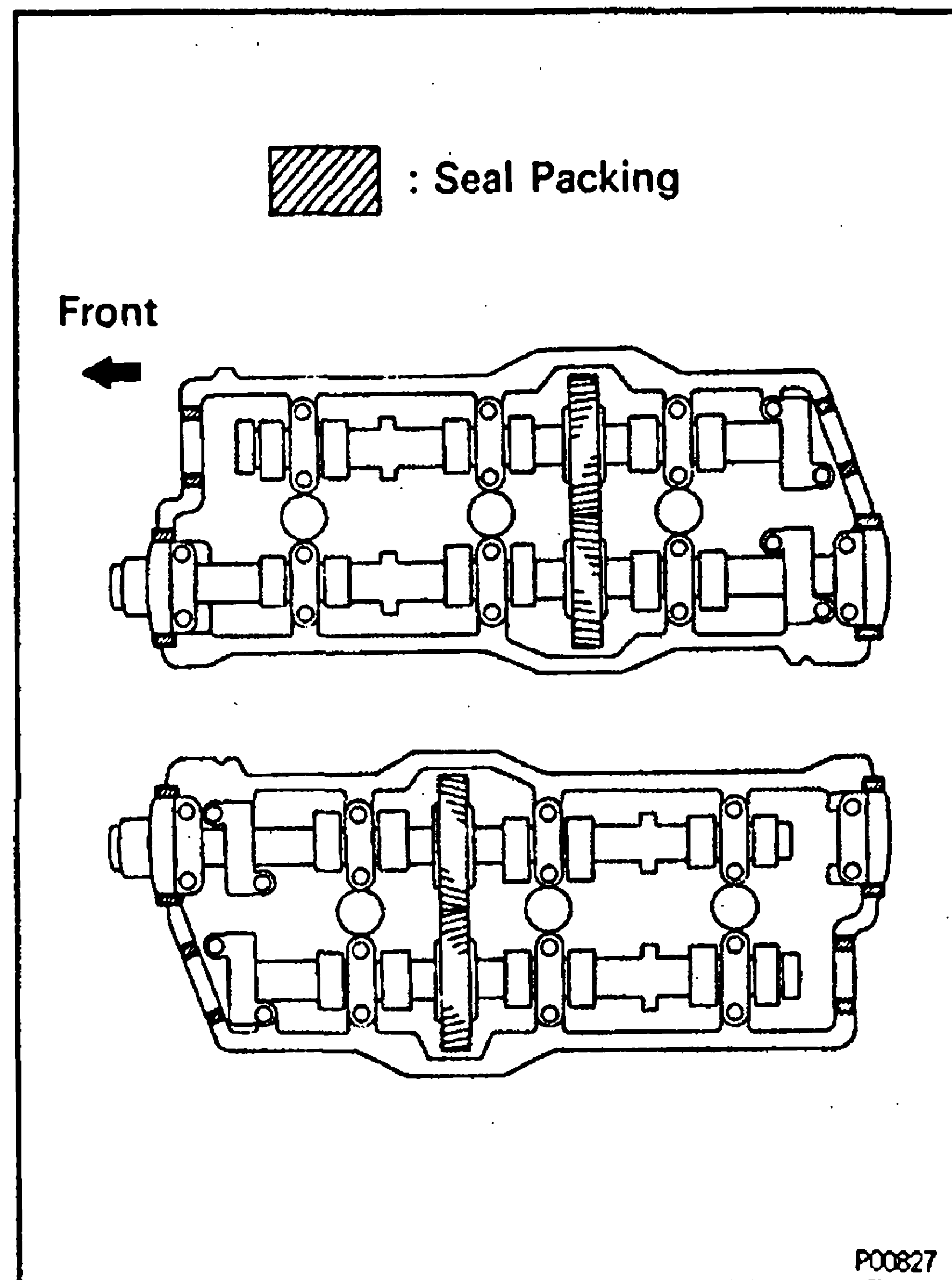
P13274

- (c) Install the 4 semi-circular plugs to the cylinder heads.

▨ : Semi-Circular Plug

Front





10. INSTALL CYLINDER HEAD COVERS

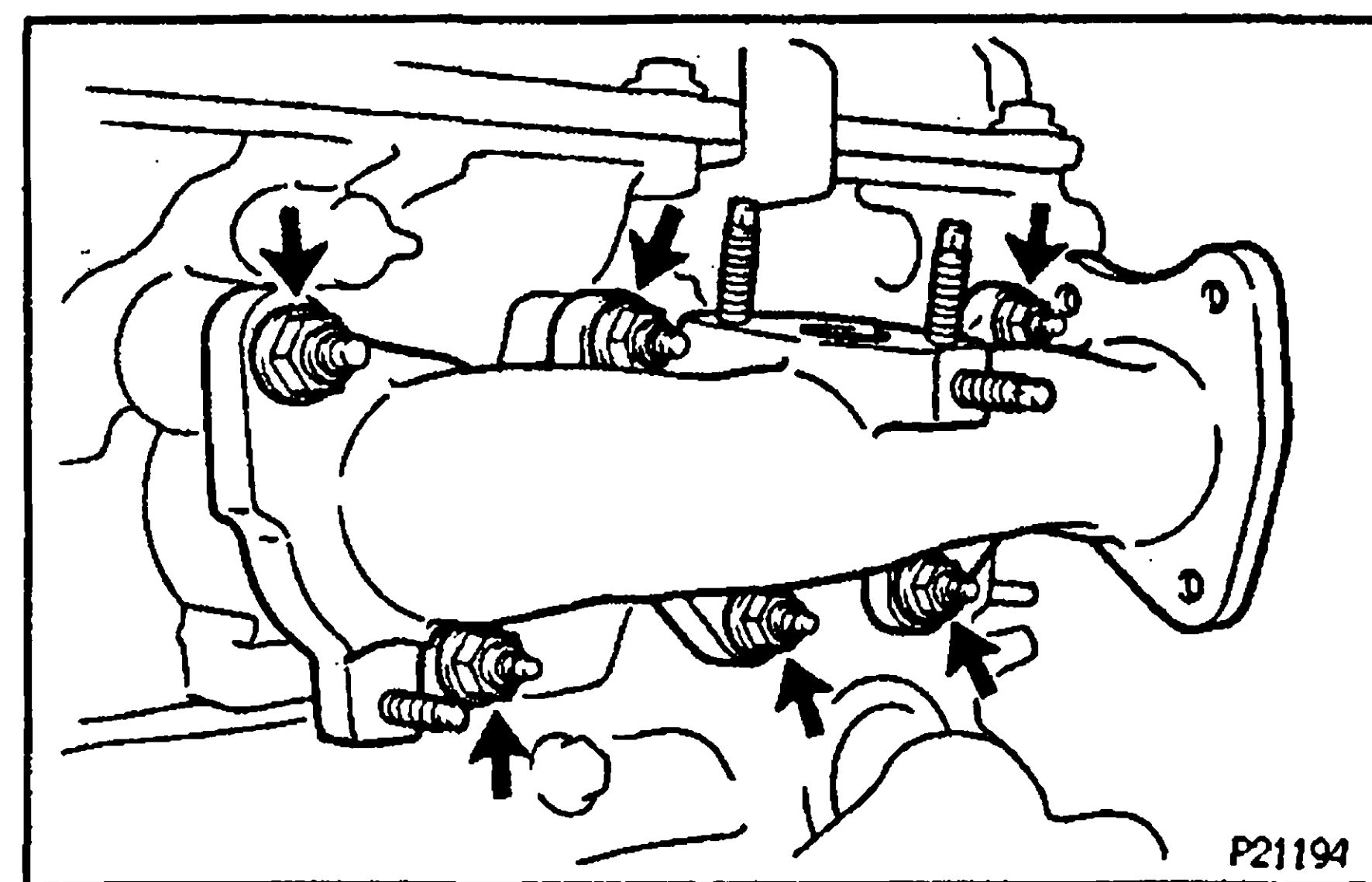
- (a) Apply seal packing to the cylinder heads as shown in the illustration.

Seal packing:

Part No. 08826—00080 or equivalent

- (b) Install the gasket to the cylinder head cover.
 (c) Install the cylinder head cover with the 8 bolts. Uniformly tighten the bolts in several passes. Install the 2 cylinder head covers.

Torque: 6 N·m (60 kgf·cm, 53 in·lbf)



11. INSTALL EXHAUST MANIFOLDS

- (a) Install 2 new gaskets and the exhaust manifolds with the 12 nuts.

Torque: 40 N·m (400 kgf·cm, 30 ft·lbf)

- (b) Install the exhaust manifold heat insulators with the 6 nuts.

Torque: 8 N·m (80 kgf·cm, 71 in·lbf)

12. LHD:

INSTALL EXHAUST CROSSOVER PIPE

Install 2 new gaskets and the crossover pipe with the 6 nuts.

Torque: 45 N·m (450 kgf·cm, 33 ft·lbf)

RHD:

INSTALL EXHAUST FRONT PIPE NO.2 AND EXHAUST EXTENSION PIPE

- (a) Install a new gasket and the exhaust pipe No.2 with the 3 nuts.

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

- (b) Install a new gasket and the exhaust extension pipe with the 3 nuts.

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

13. INSTALL PS PUMP BRACKET

Torque: 18.5 N·m (185 kgf·cm, 14 ft·lbf)

14. INSTALL ALTERNATOR BRACKET

Torque: 18.5 N·m (185 kgf·cm, 14 ft·lbf)

15. INSTALL ALTERNATOR

(See alternator installation in Charging System)

16. INSTALL NO.3 TIMING BELT COVER

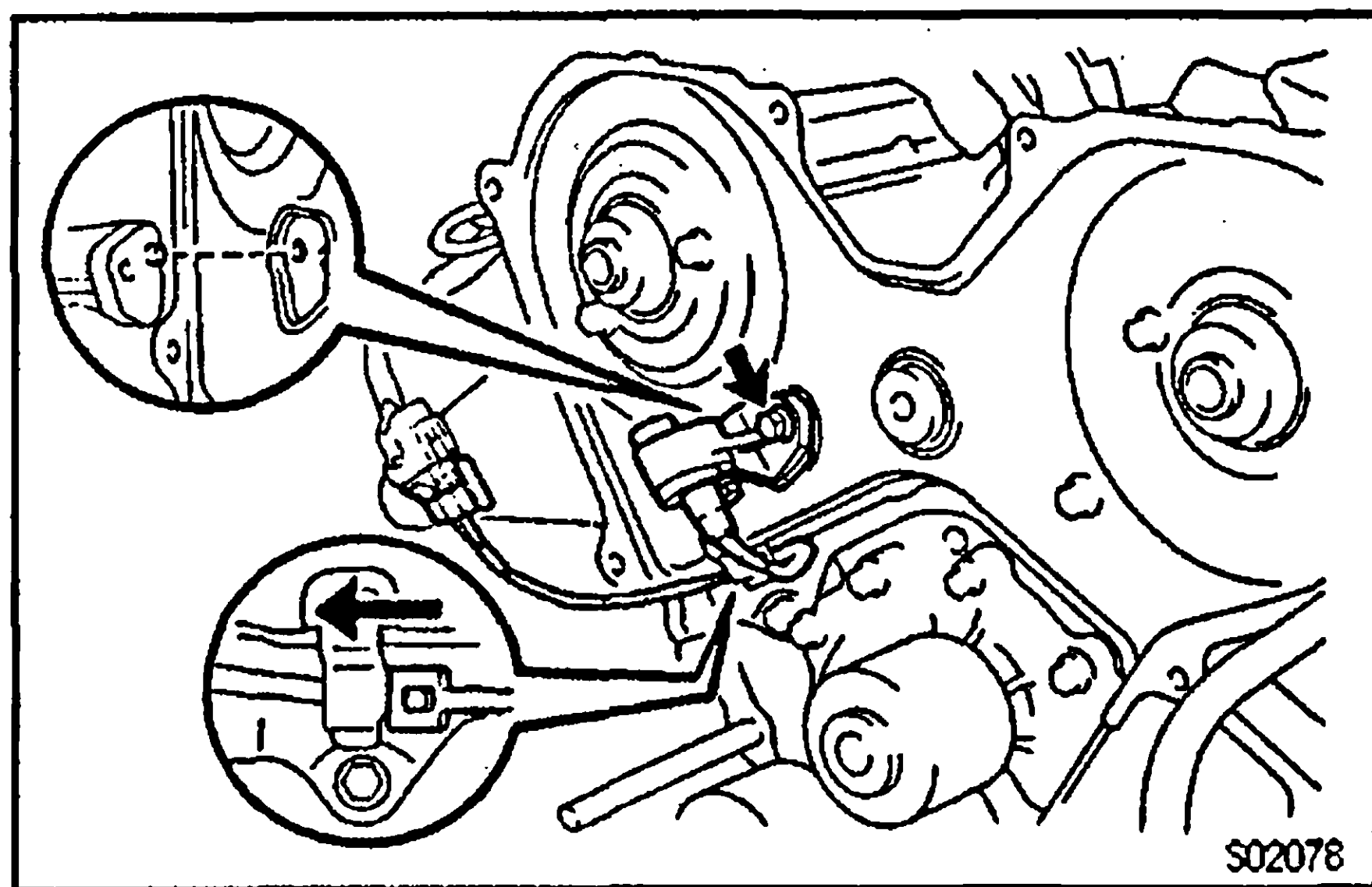
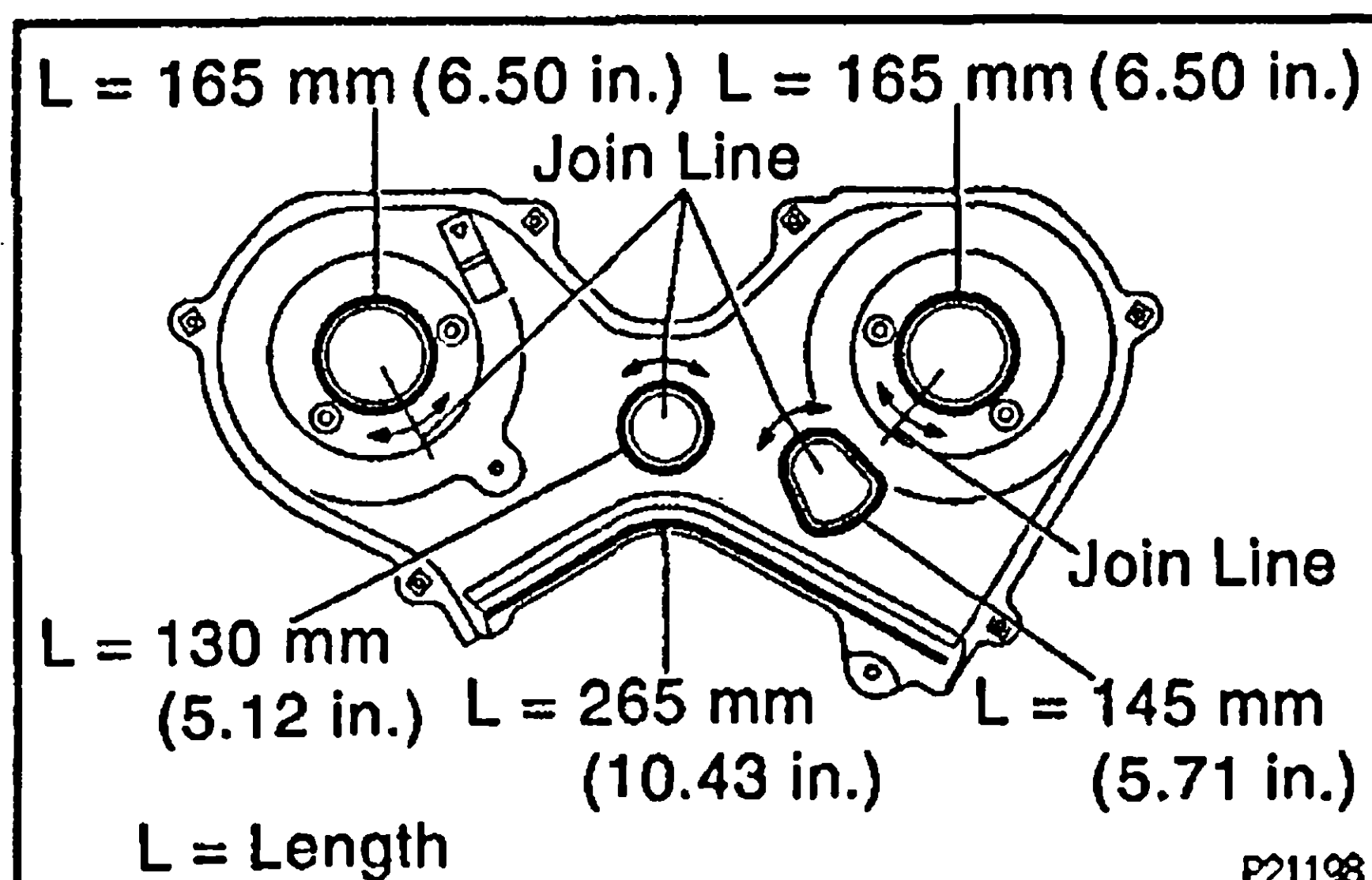
- (a) Check that the timing belt cover gaskets have no cracks or peeling, etc.

If the gaskets have cracks or peeling etc., replace them using these steps:

- Using a screwdriver and gasket scraper, remove all the old gasket material.
- Thoroughly clean all components to remove all the loose material.
- Remove the backing paper from a new gasket and install the gasket evenly to the part of the timing belt cover shaded black in the illustration.

- (b) Install the timing belt cover with the 6 bolts.

Torque: 9 N·m (90 kgf·cm, 80 in.-lbf)

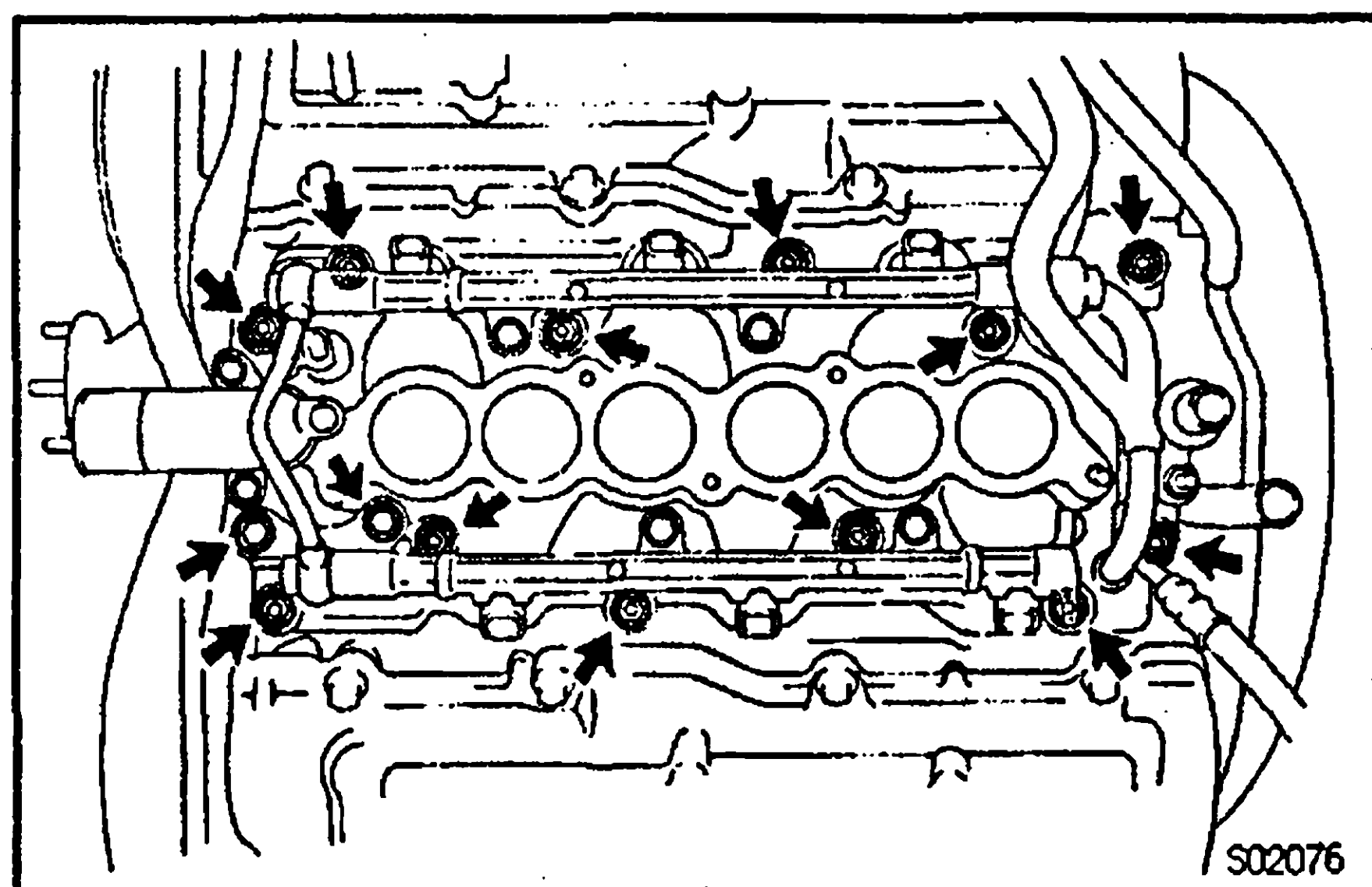
**17. INSTALL CAMSHAFT POSITION SENSOR**

- (a) Install the camshaft position sensor with the bolt.

Torque: 8 N·m (80 kgf·cm, 71 in.-lbf)

HINT: Match the protrusion of the sensor with the indentation of the RH cylinder head.

- (b) Connect the clamp to the No.3 timing belt cover.
(c) Connect the camshaft position sensor connector.

**18. INSTALL INTAKE MANIFOLD ASSEMBLY**

- (a) Install 2 new gaskets and the intake manifold, delivery pipe and injectors assembly with the 8 bolts, 4 plate washers and 4 nuts.

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

- (b) Install the intake manifold stay with the 2 bolts.

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

19. INSTALL FUEL PRESSURE REGULATOR

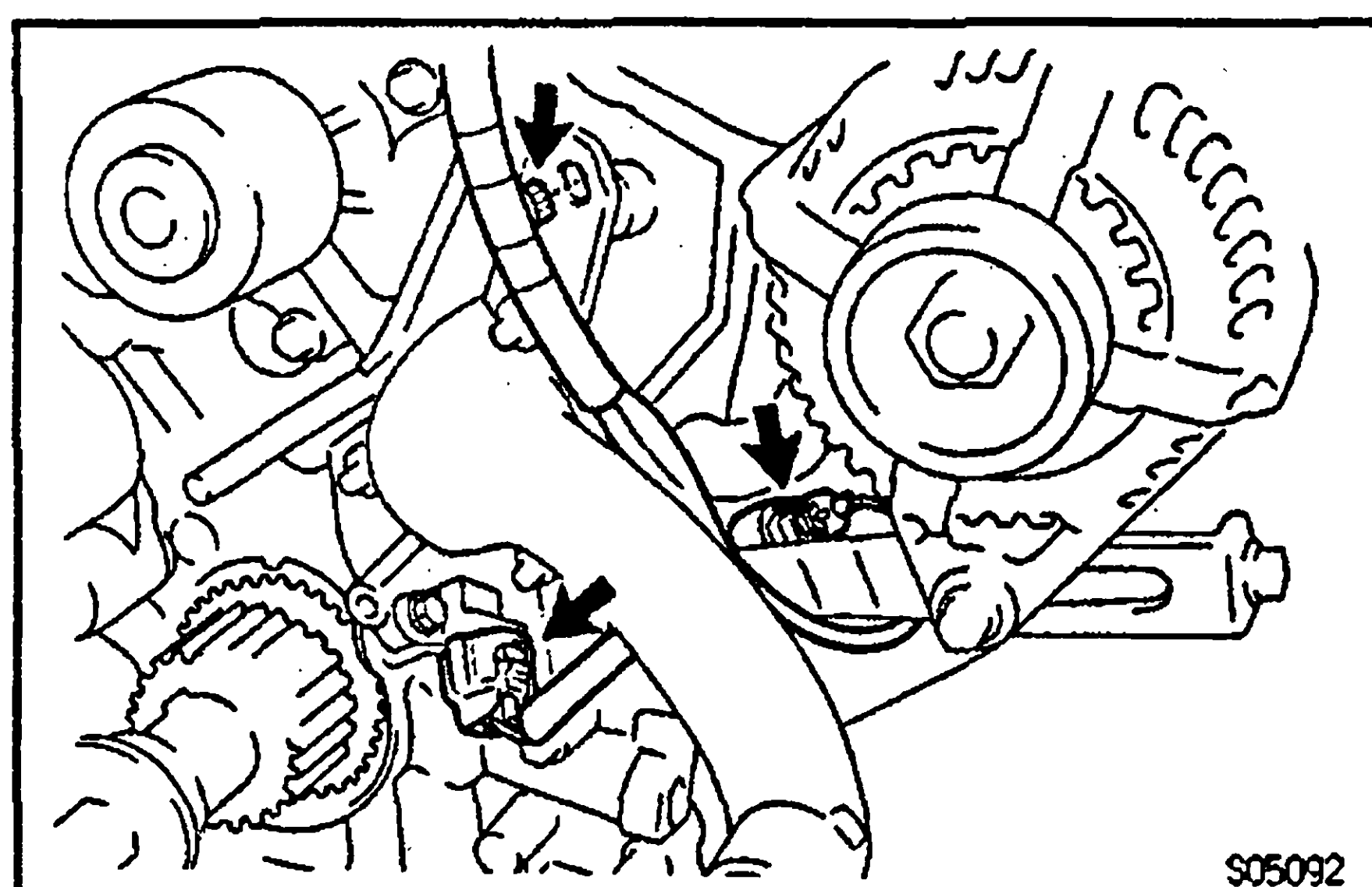
(See fuel pressure regulator installation in EFI System)

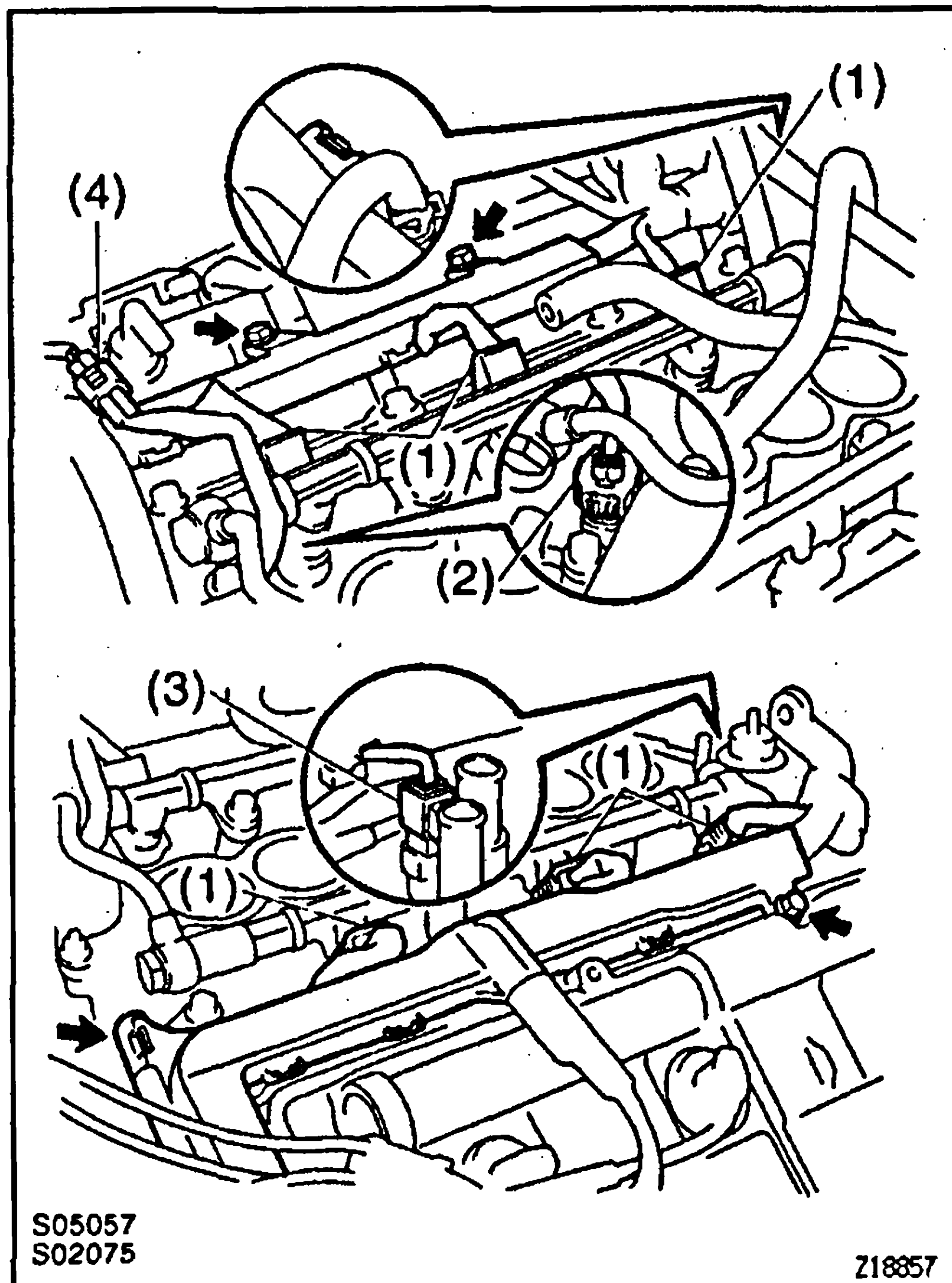
20. CONNECT ENGINE WIRE PROTECTOR

- (a) Connect these connectors:

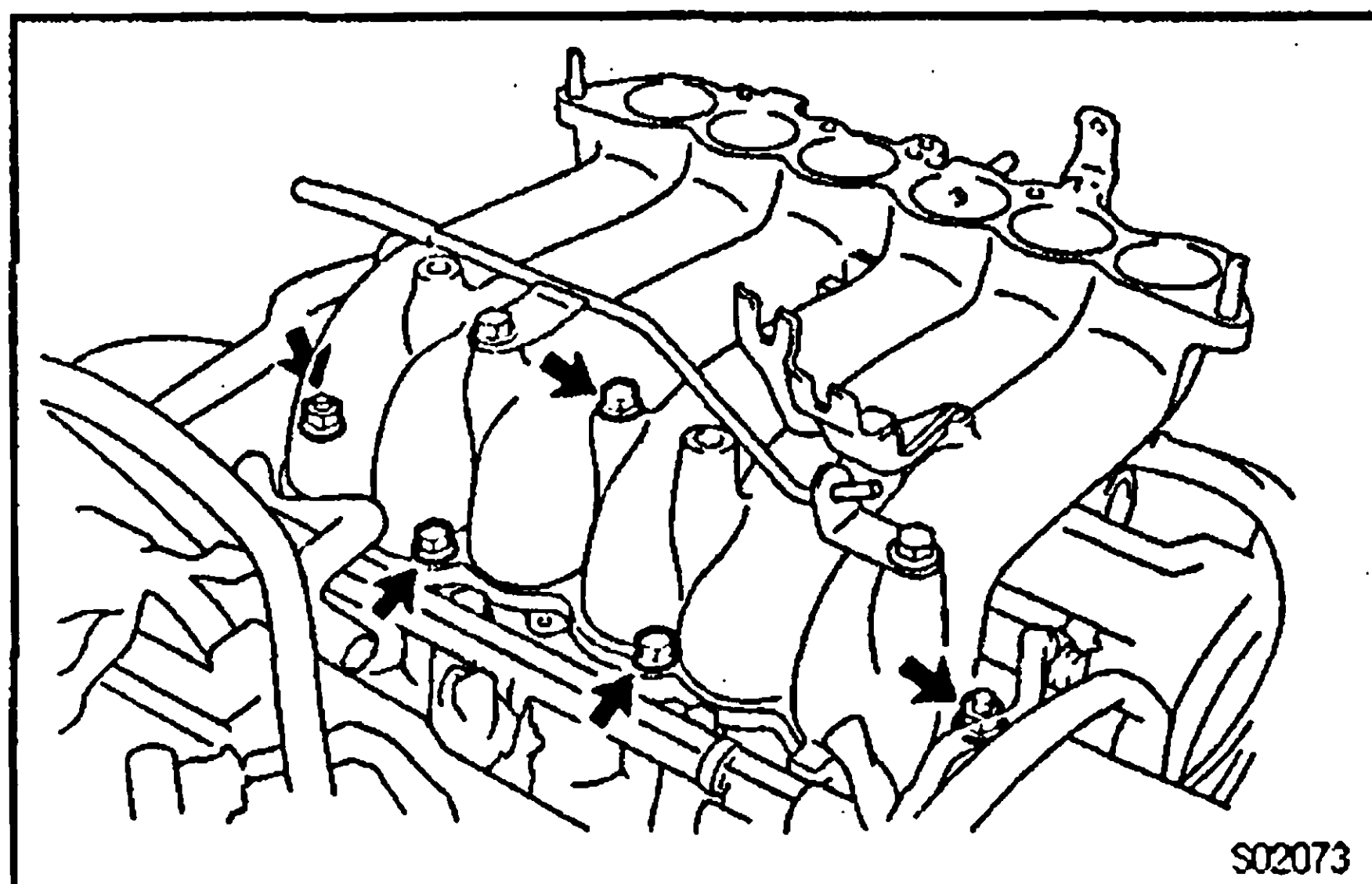
- (1) Crankshaft position sensor connector
- (2) Oil pressure switch connector

- (b) Connect the engine wire clamp.



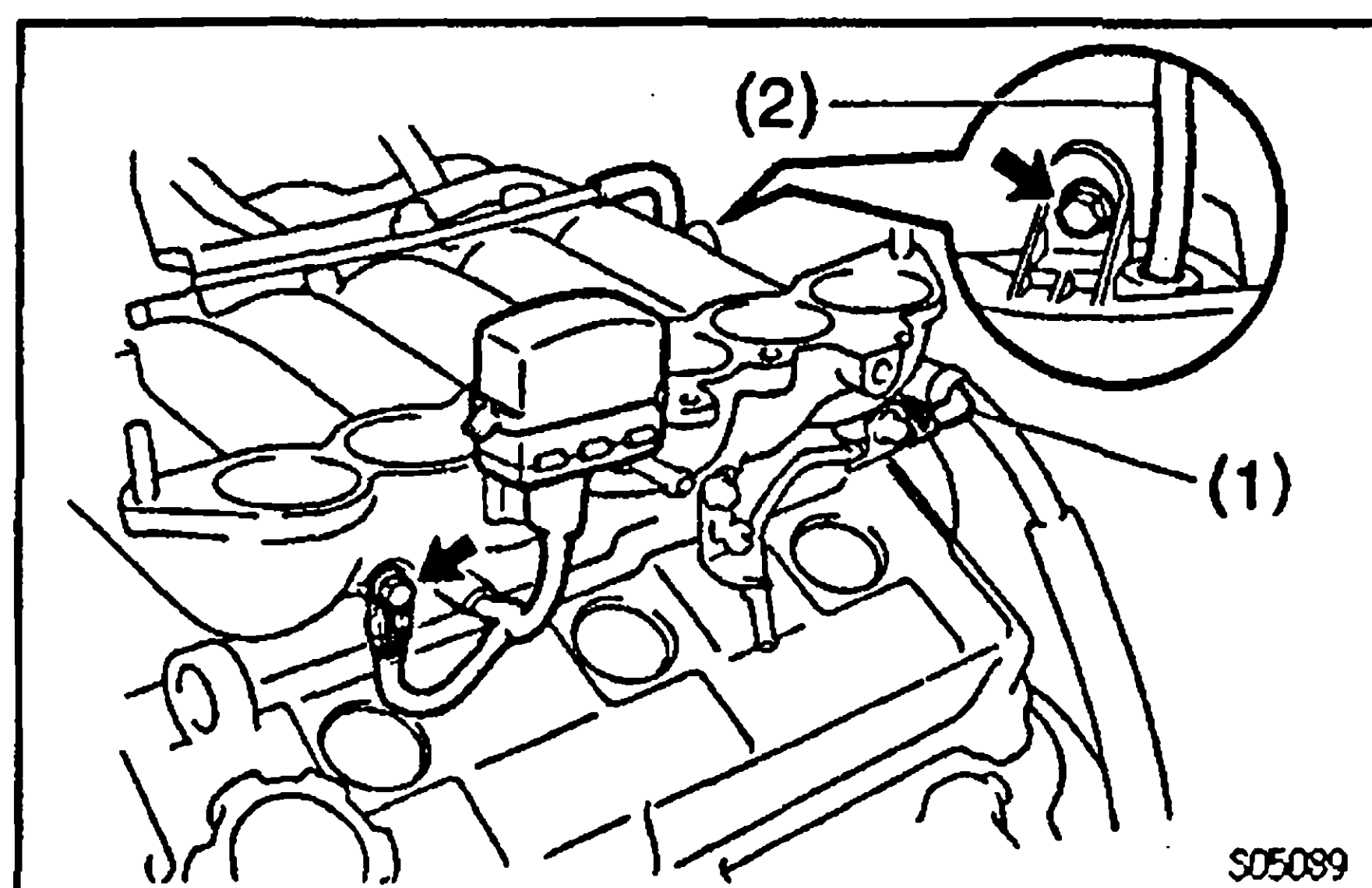


- (c) Install the engine wire with the 3 bolts.
- (d) Connect the 2 engine wire clamps.
- (e) Connect these connectors:
 - (1) 6 injector connectors
 - (2) Water temperature sensor connector
 - (3) Water temperature sender gauge connector
 - (4) Knock sensor connector

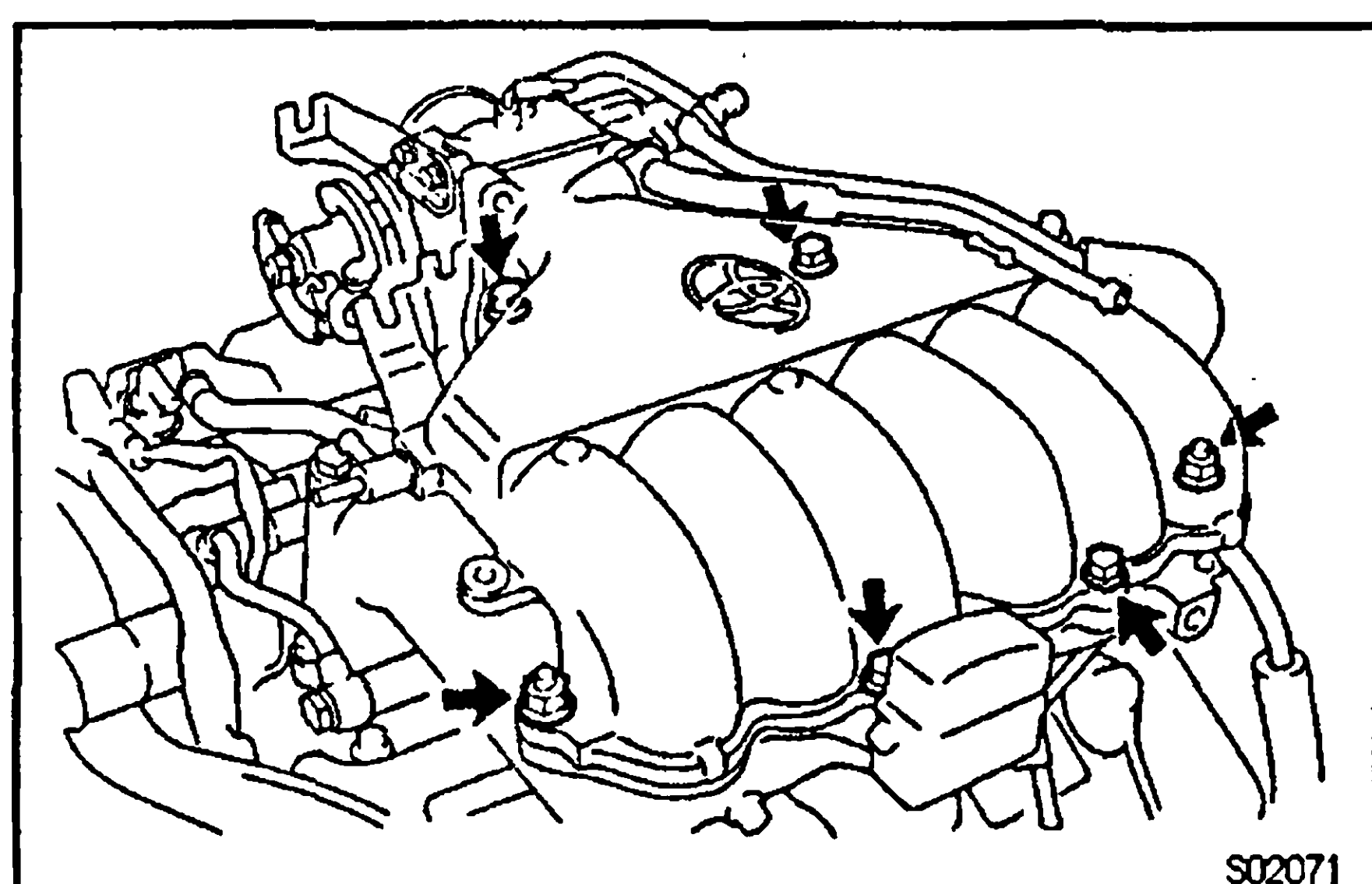


21. INSTALL INTAKE AIR CONNECTOR

- (a) Install a new gasket and the intake air connector with the 3 bolts and 2 nuts.
- Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)**

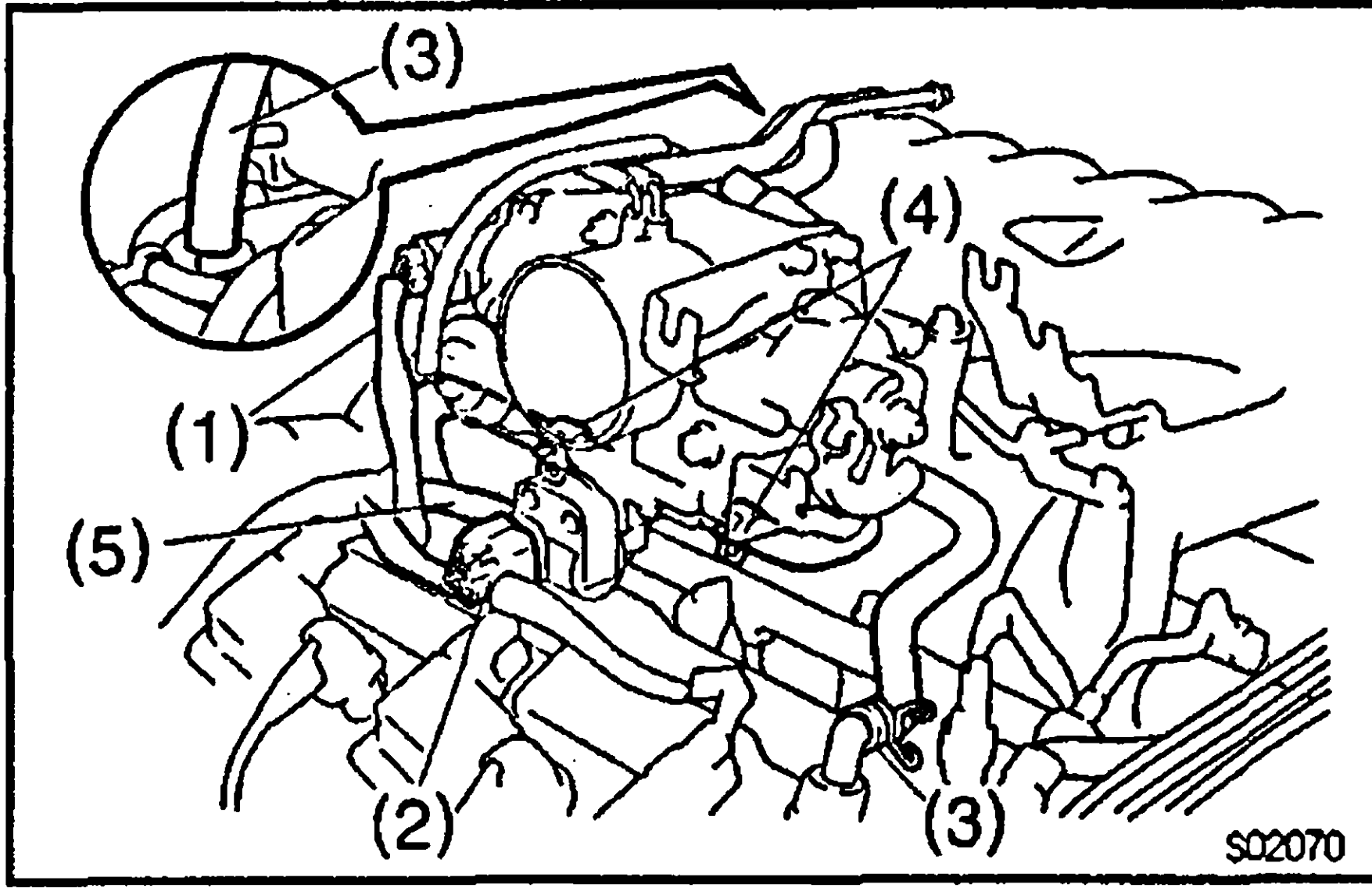


- (b) Connect the check connector to the bracket.
- (c) Install the ground strap to the intake air connector with the bolt.
- (d) Connect these hoses:
 - (1) Fuel return hose
 - (2) Vacuum hose to the fuel pressure regulator
- (e) Install the engine wire with the bolt.



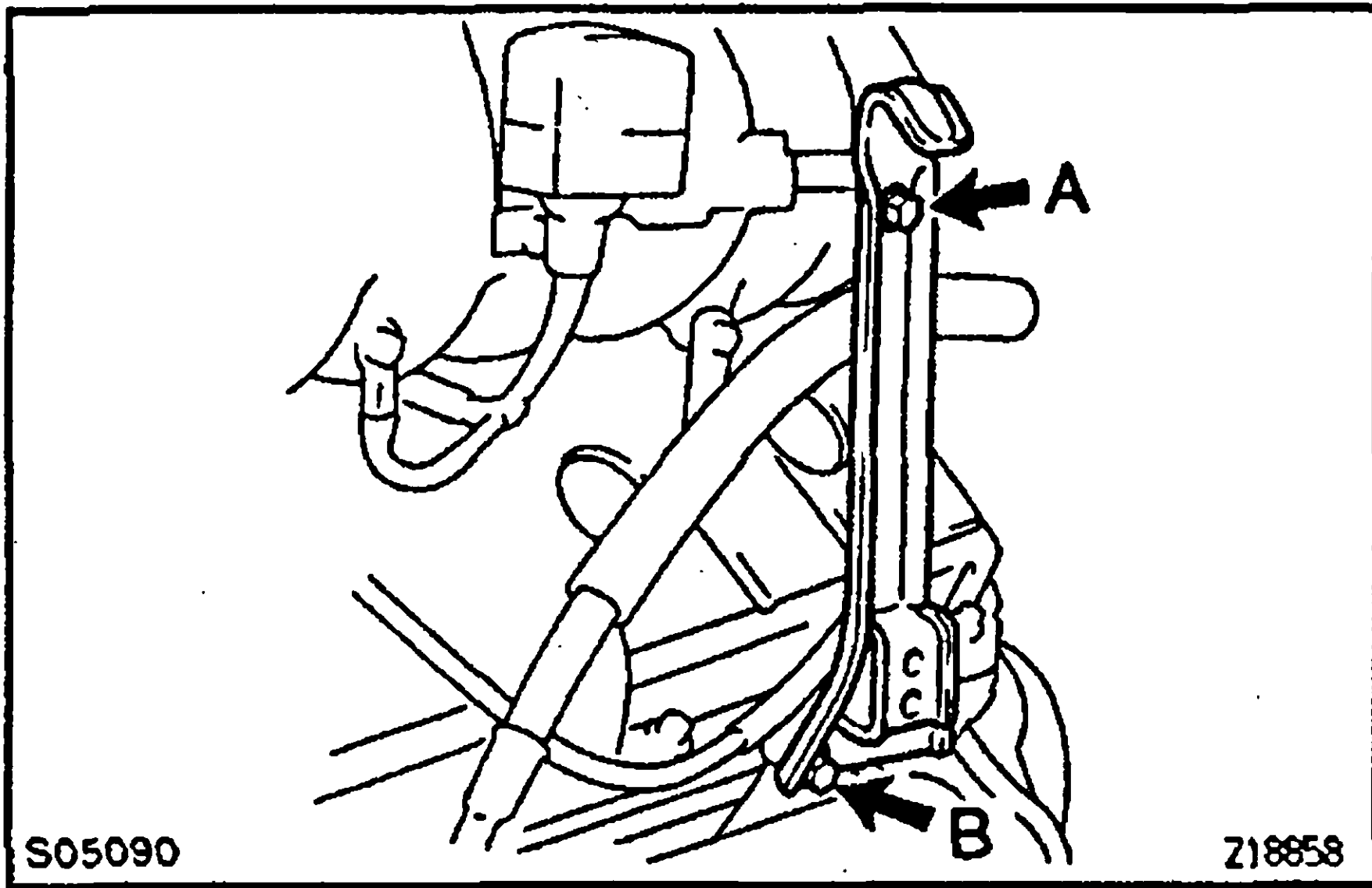
22. INSTALL AIR INTAKE CHAMBER ASSEMBLY

- (a) Install a new gasket and the air intake chamber assembly with the 4 bolts and 2 nuts.
- Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)**



- (b) Connect these hoses and these connectors:
- (1) Throttle position sensor connector
 - (2) ISC valve connector
 - (3) 2 PCV hoses
 - (4) 2 water bypass hoses
 - (5) Air assist hose to throttle body

EG



23. INSTALL AIR INTAKE CHAMBER STAY

- (a) Install the air intake chamber stay with the 2 bolts.

Torque:

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

B bolt: 40 N·m (400 kgf·cm, 30 ft·lbf)

- (b) Install the No.1 throttle cable clamp with the 2 bolts.

24. INSTALL SPARK PLUGS AND HIGH — TENSION CORDS WITH IGNITION COILS

(See ignition coils removal in Ignition System)

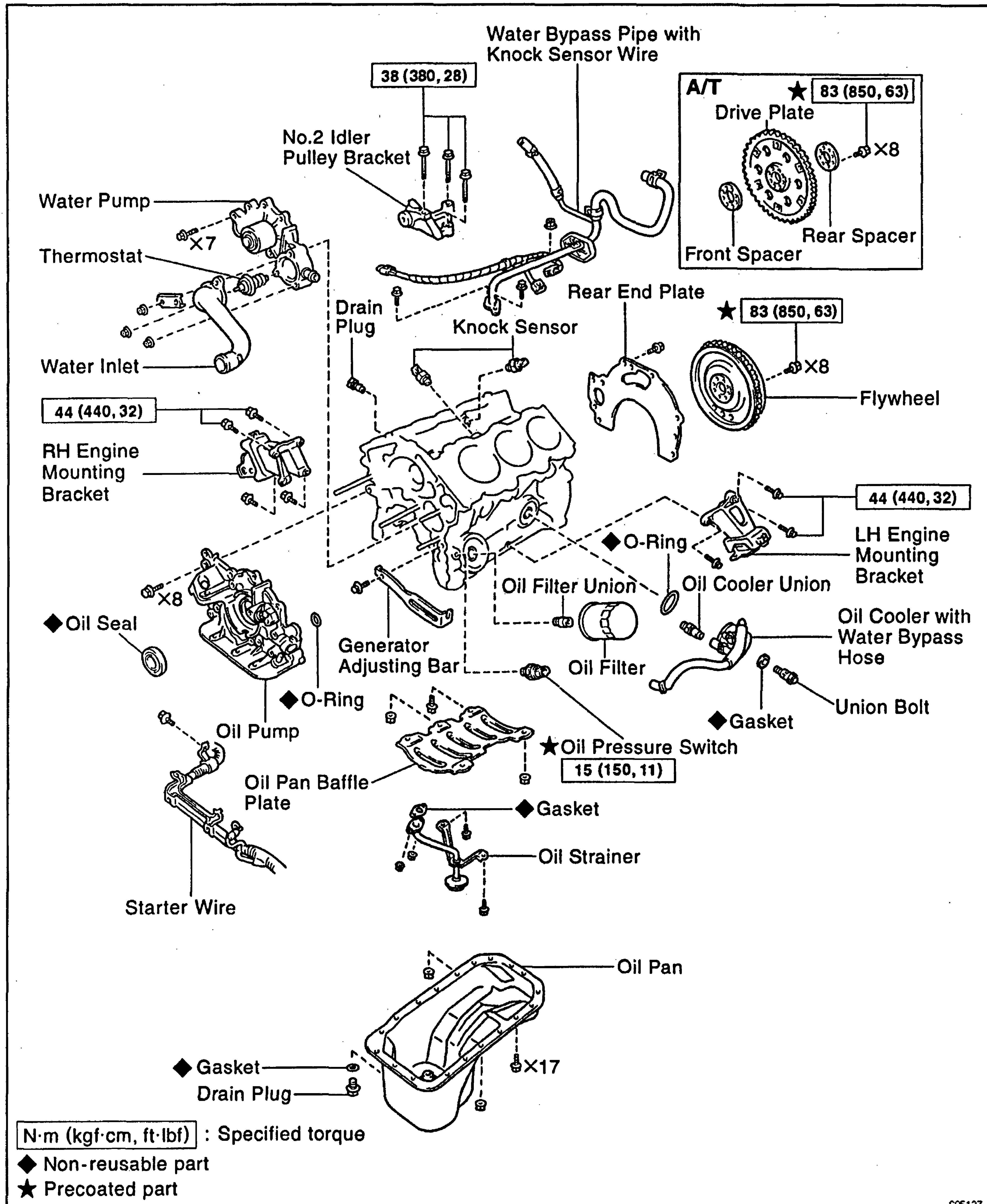
25. INSTALL TIMING BELT

(See timing belt installation)

26. FILL WITH ENGINE COOLANT

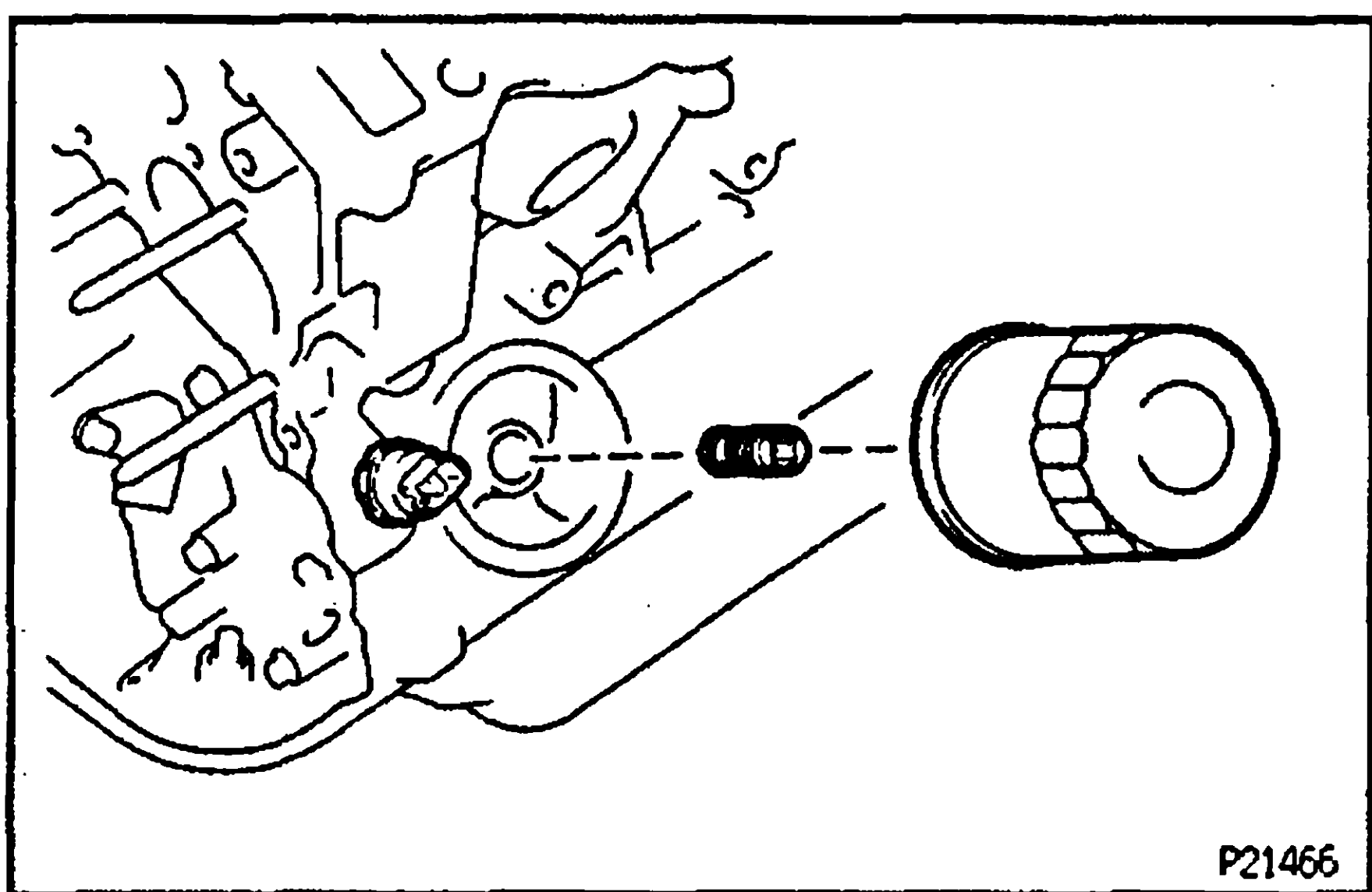
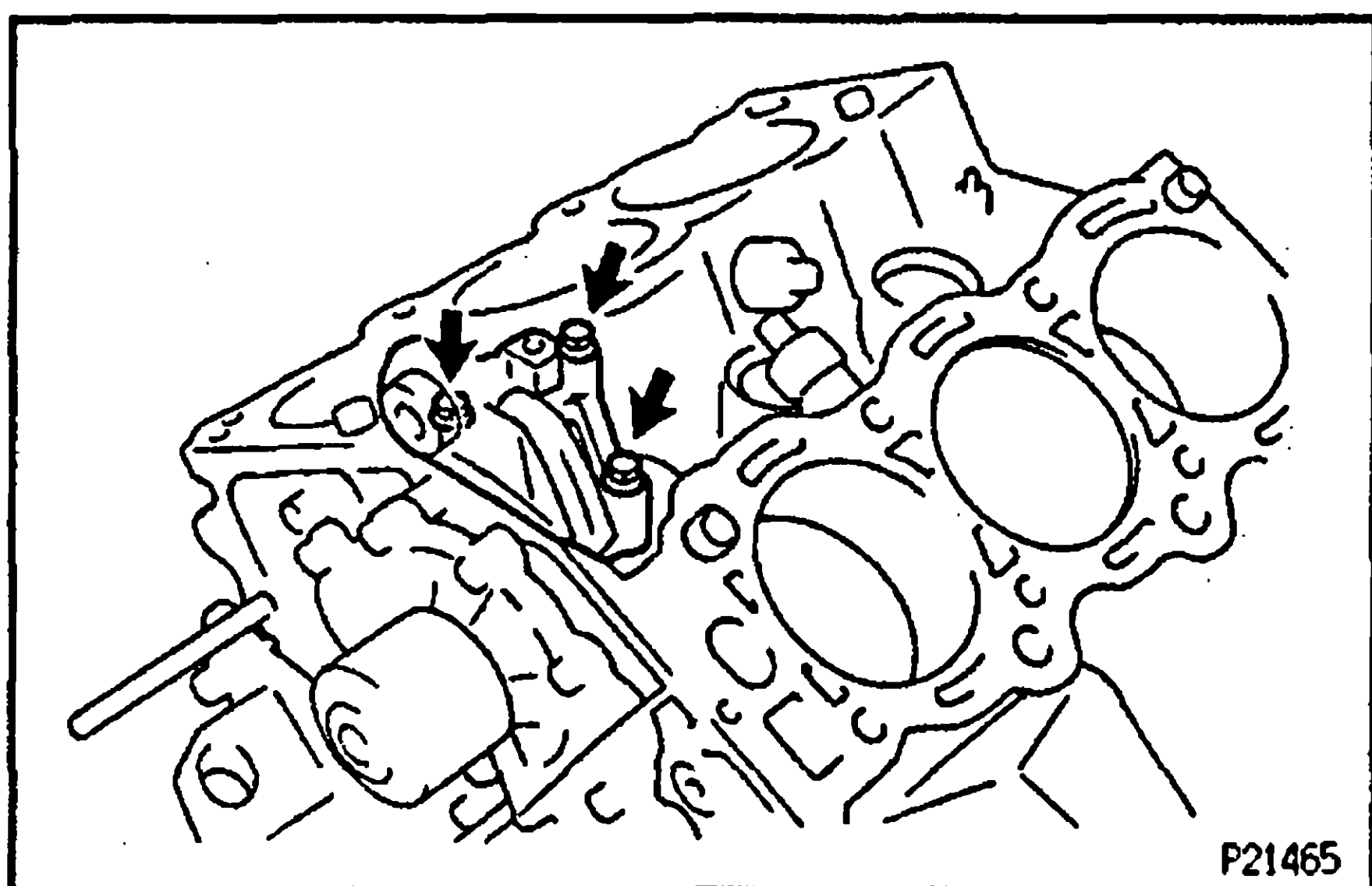
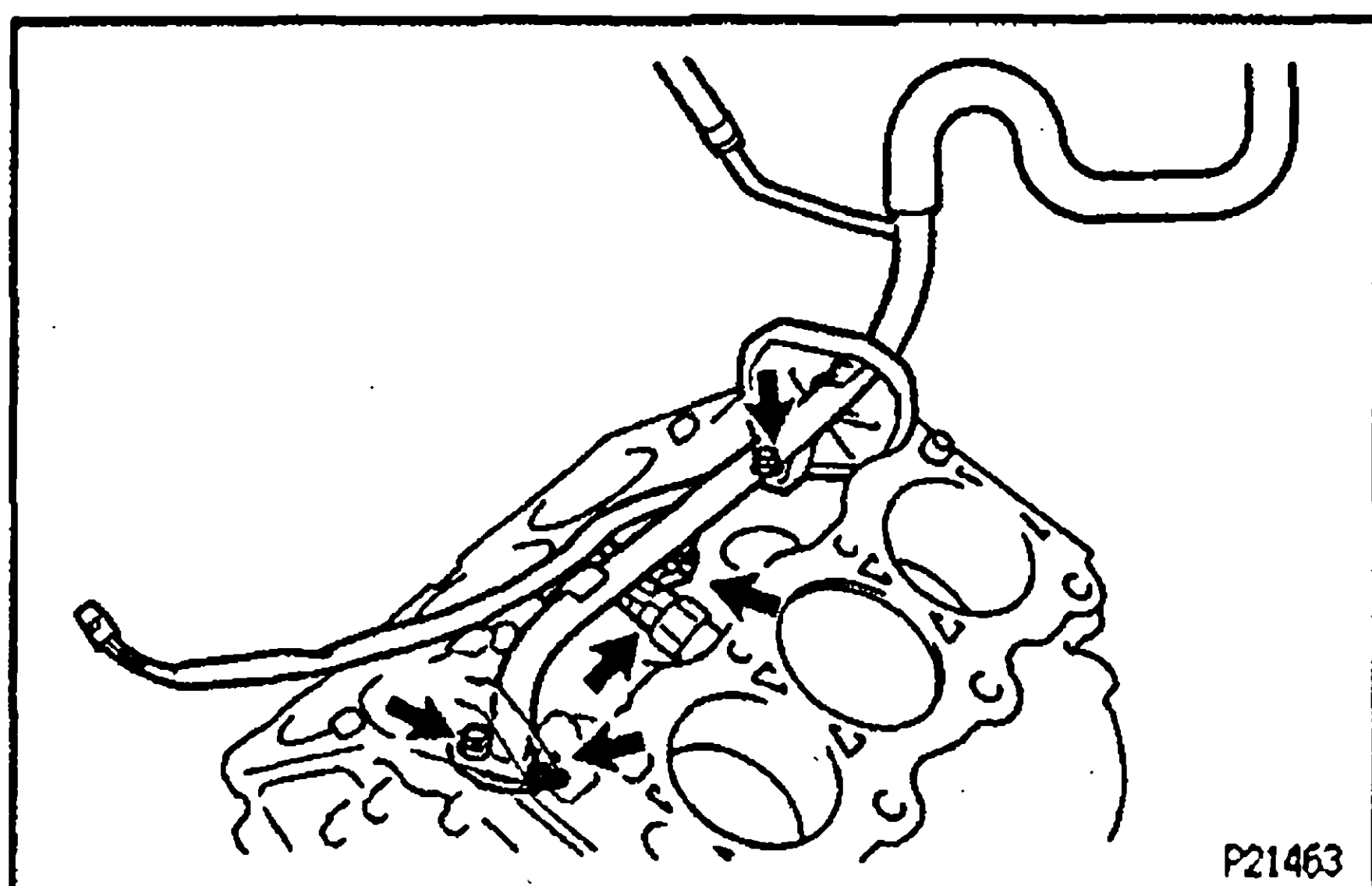
CYLINDER BLOCK COMPONENTS FOR PREPARATION AND AFTER ASSEMBLY

133A-0



PREPARATION FOR DISASSEMBLY

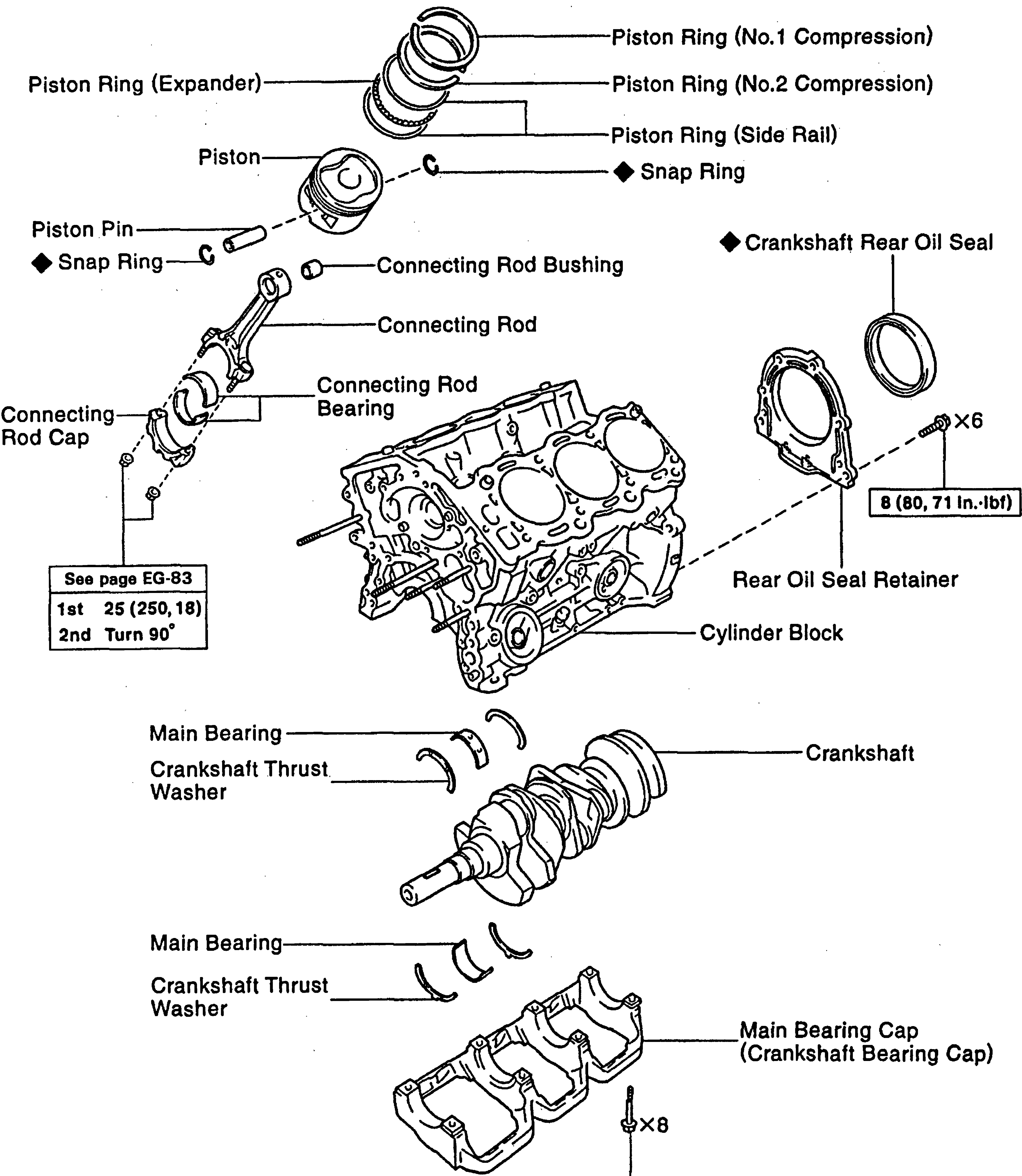
1. **M/T:**
REMOVE FLYWHEEL
2. **A/T:**
REMOVE DRIVE PLATE
3. **REMOVE REAR END PLATE**
4. **INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY**
5. **REMOVE TIMING BELT AND PULLEYS**
(See timing belt removal)
6. **REMOVE CYLINDER HEADS**
(See cylinder heads removal)
7. **REMOVE WATER BYPASS PIPE WITH KNOCK SENSOR WIRE**
 - (a) Disconnect the 2 knock sensor connectors.
 - (b) Remove the 2 bolts, nut and water bypass pipe.



8. **REMOVE NO.2 IDLER PULLEY BRACKET**
Remove the 3 bolts and idler pulley bracket.
9. **REMOVE KNOCK SENSORS**
(See knock sensor removal in EFI System)
10. **REMOVE WATER PUMP**
(See water pump removal in Cooling System)
11. **REMOVE GENERATOR ADJUSTING BAR**
12. **REMOVE OIL PRESSURE SWITCH**
Using SST, remove the oil pressure switch.
SST 09816-30010
13. **REMOVE OIL FILTER**
(See oil and filter replacement in Lubrication System)
14. **REMOVE OIL FILTER UNION**
Using 12 mm hexagon wrench, remove the union.
15. **REMOVE RH AND LH ENGINE MOUNTING BRACKET**
16. **REMOVE COOLANT DRAIN COCK**
17. **REMOVE OIL COOLER**
(See oil and filter replacement in Lubrication System)
18. **REMOVE OIL PUMP**
(See oil and filter replacement in Lubrication System)

COMPONENTS FOR CYLINDER BLOCK
DISASSEMBLY AND ASSEMBLY

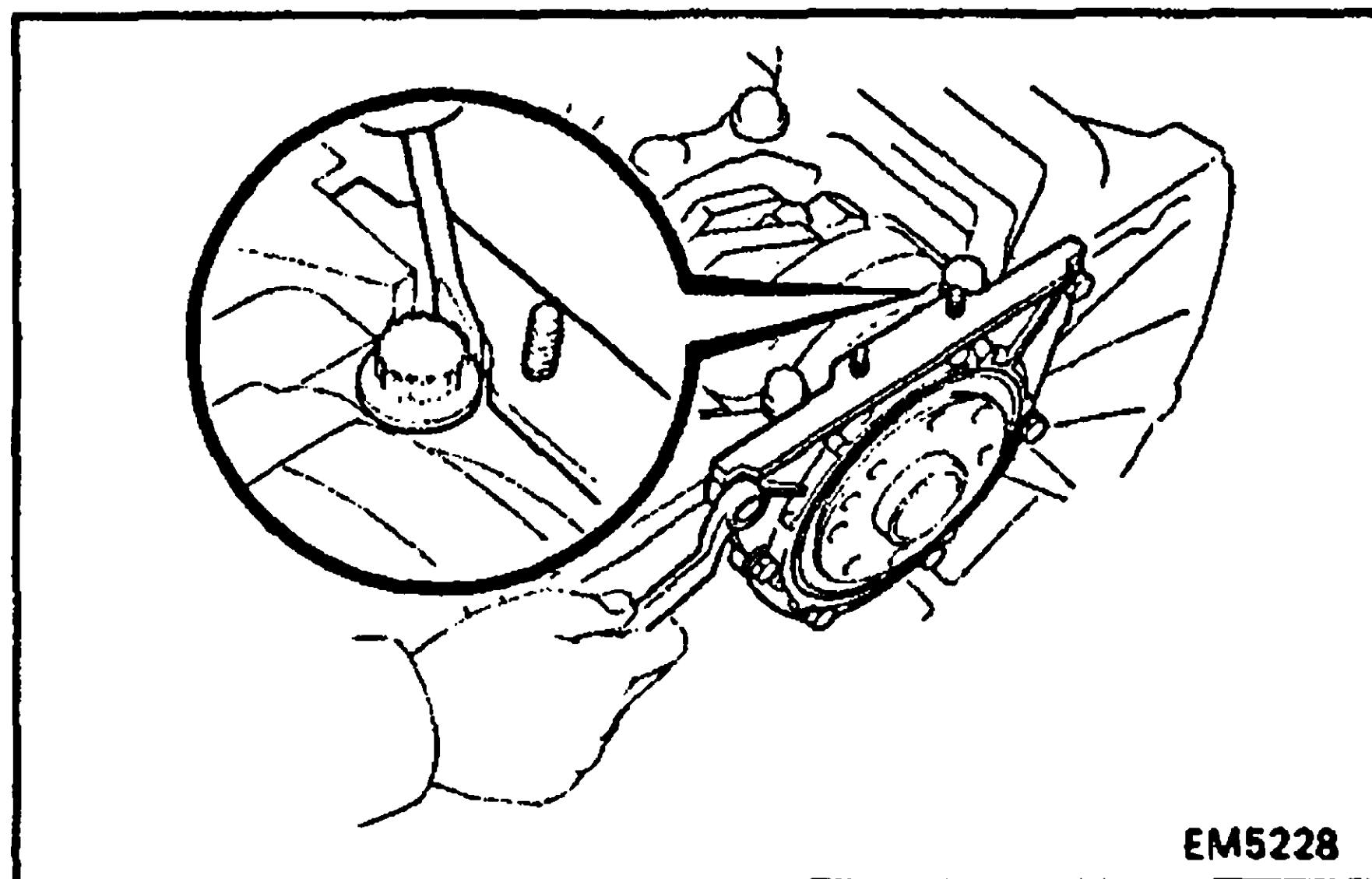
EG



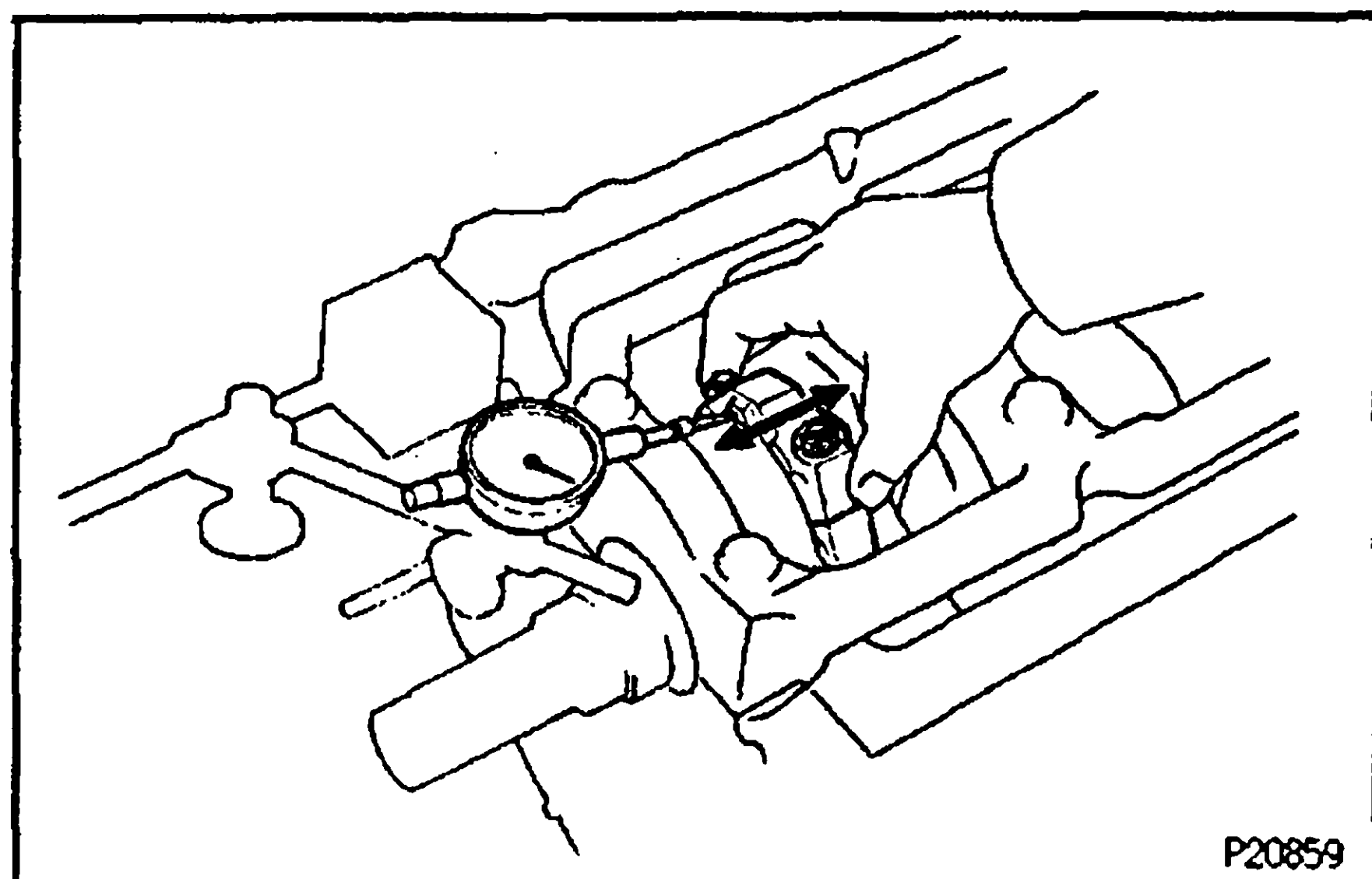
See page EG-83
1st 25 (250, 18)
2nd Turn 90°

See page EG-81
1st 61 (625, 45)
2nd Turn 90°

P21786
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part

CYLINDER BLOCK DISASSEMBLY**1. REMOVE REAR OIL SEAL RETAINER**

Remove the 6 bolts and retainer.

**2. CHECK CONNECTING ROD THRUST CLEARANCE**

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

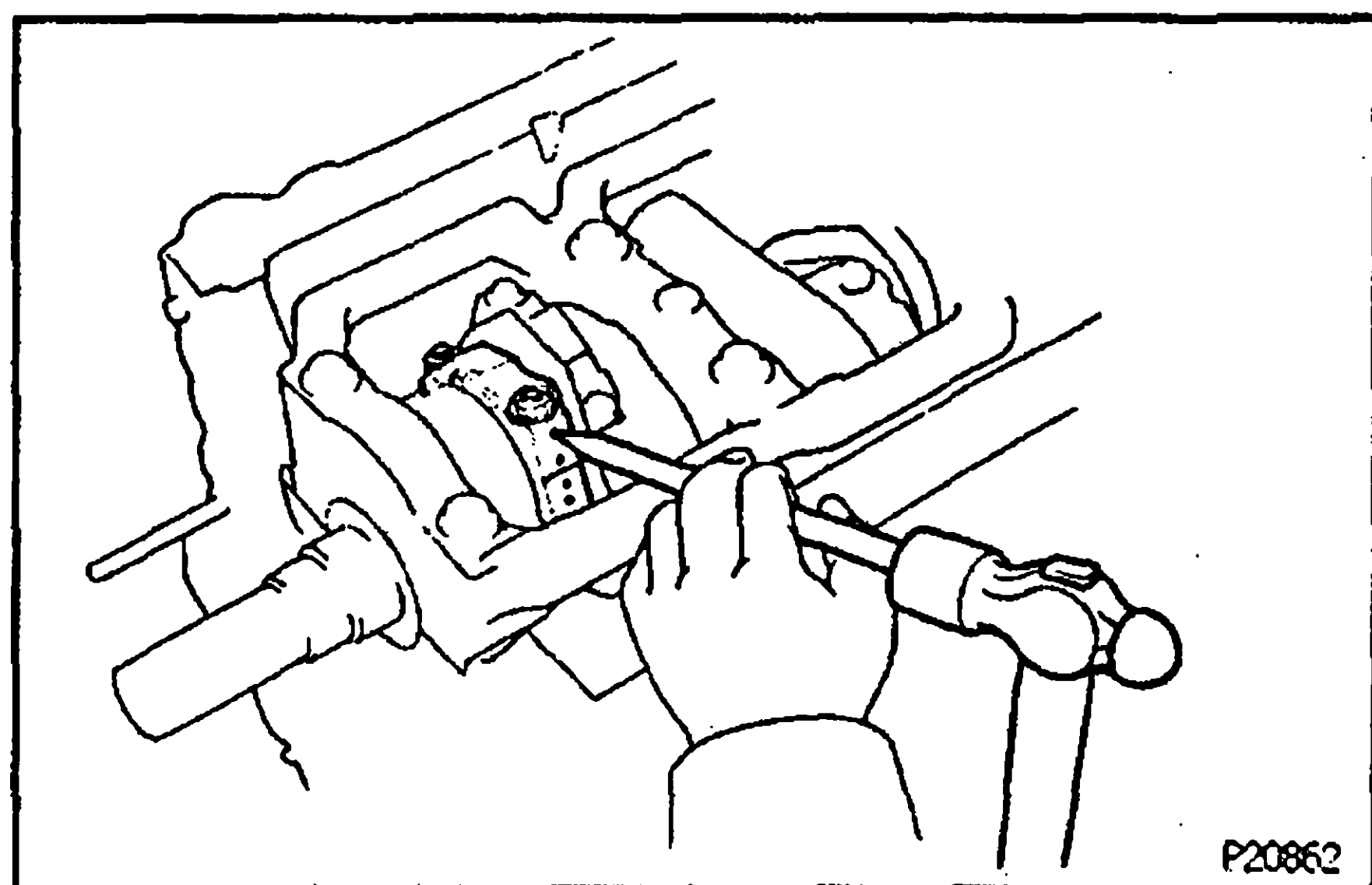
Standard thrust clearance:

0.150 — 0.330 mm (0.0059 — 0.0130 in.)

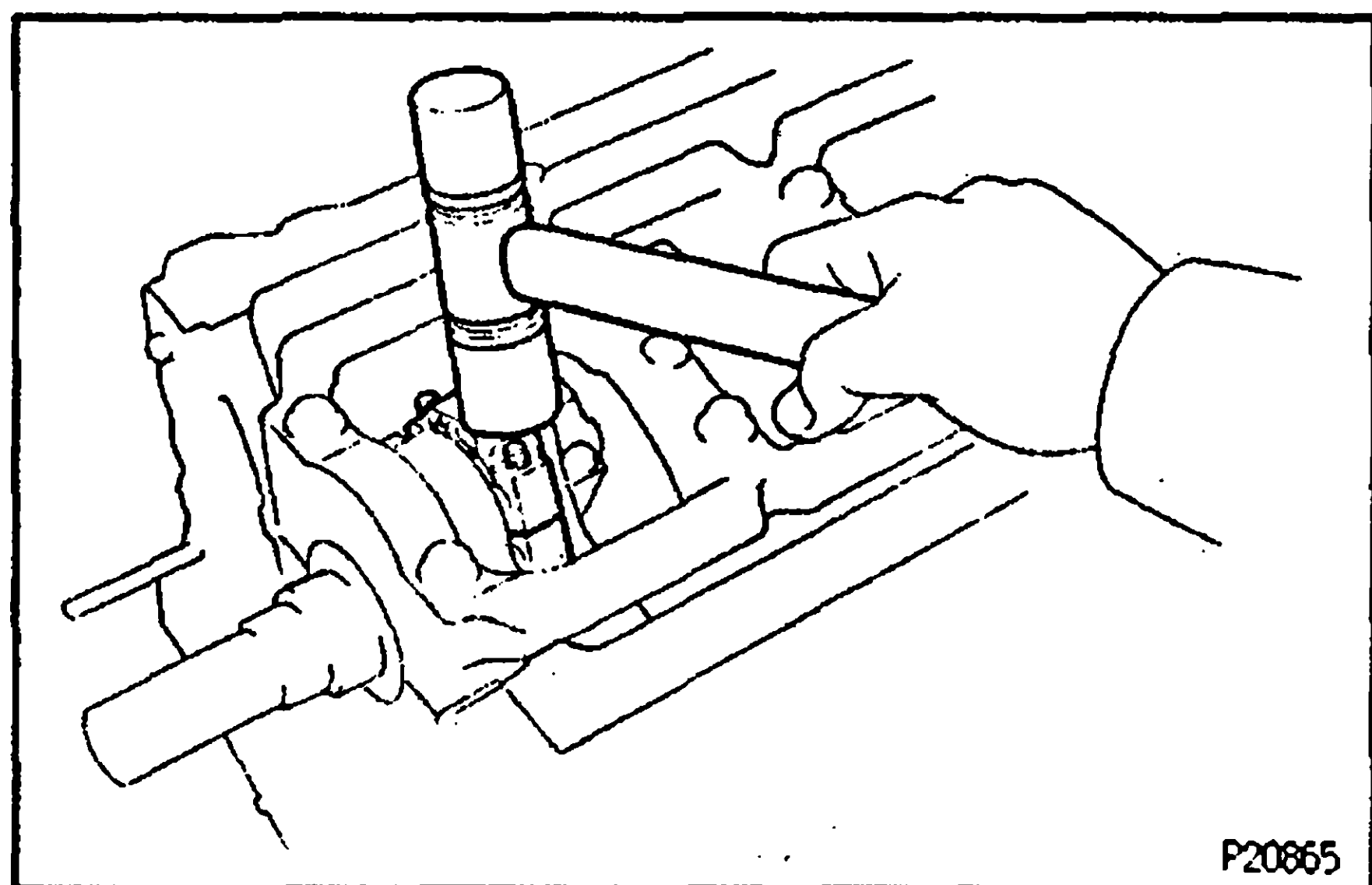
Maximum thrust clearance:

0.380 mm (0.0150 in.)

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

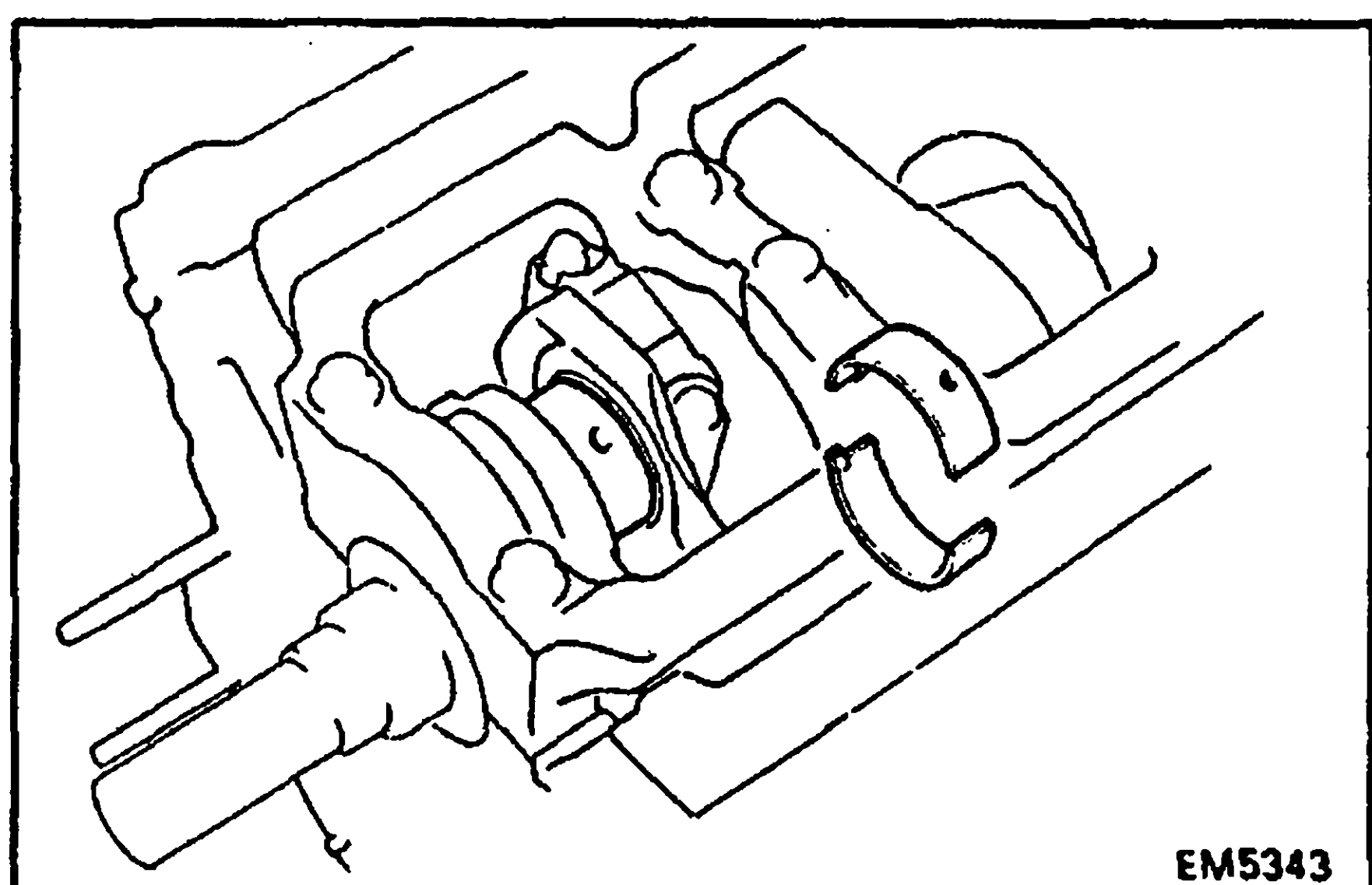
**3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE**

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

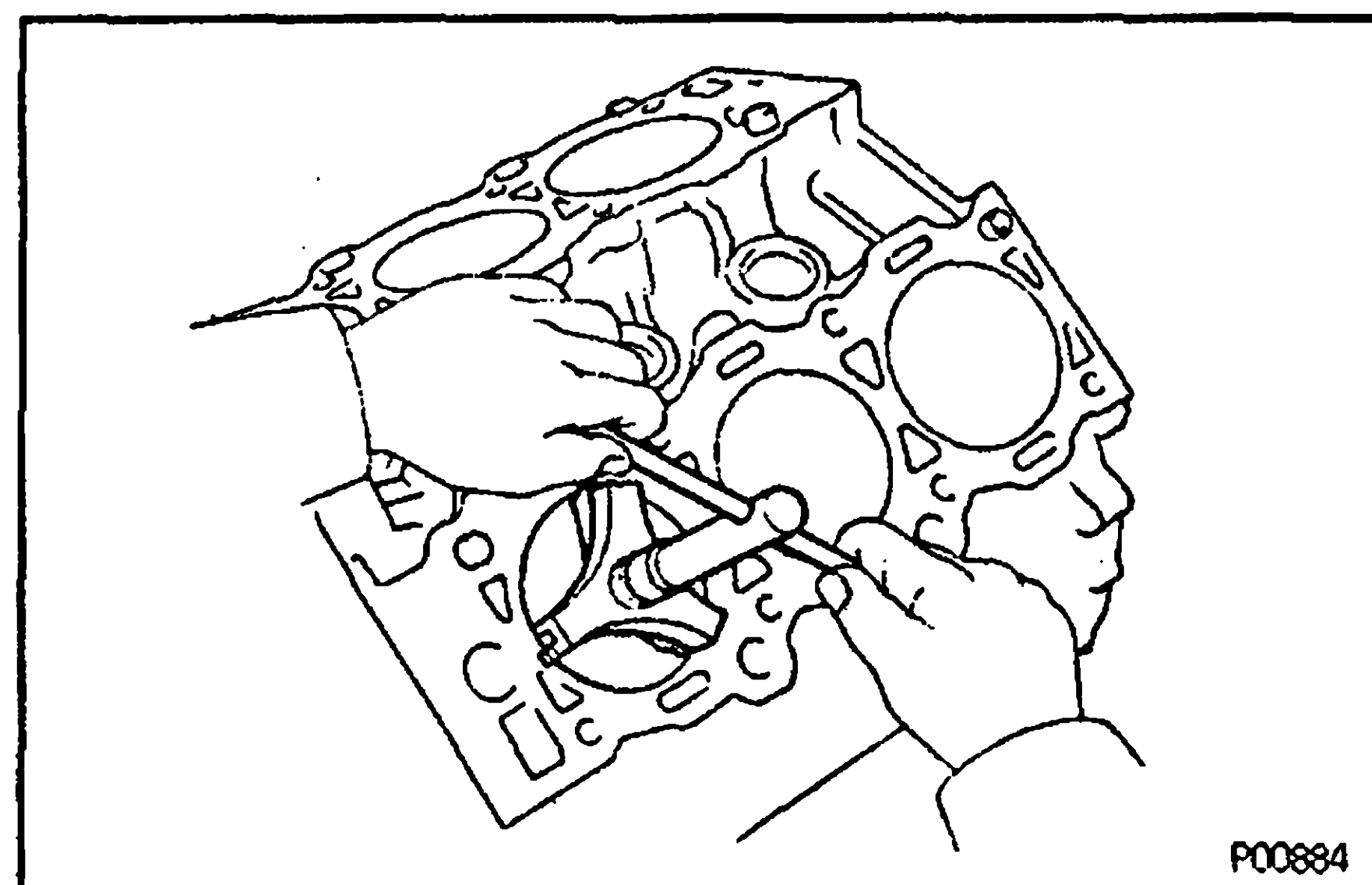
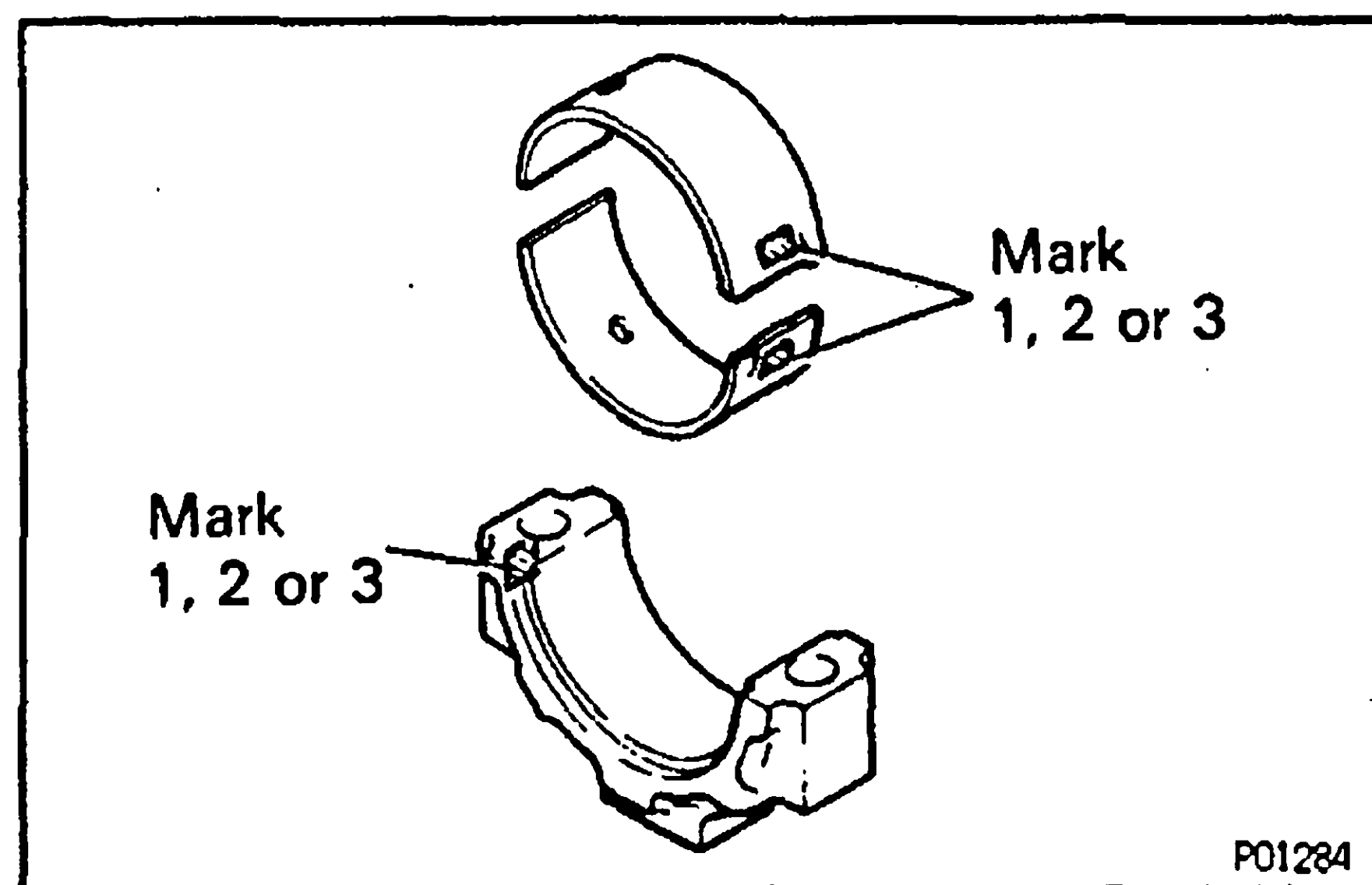
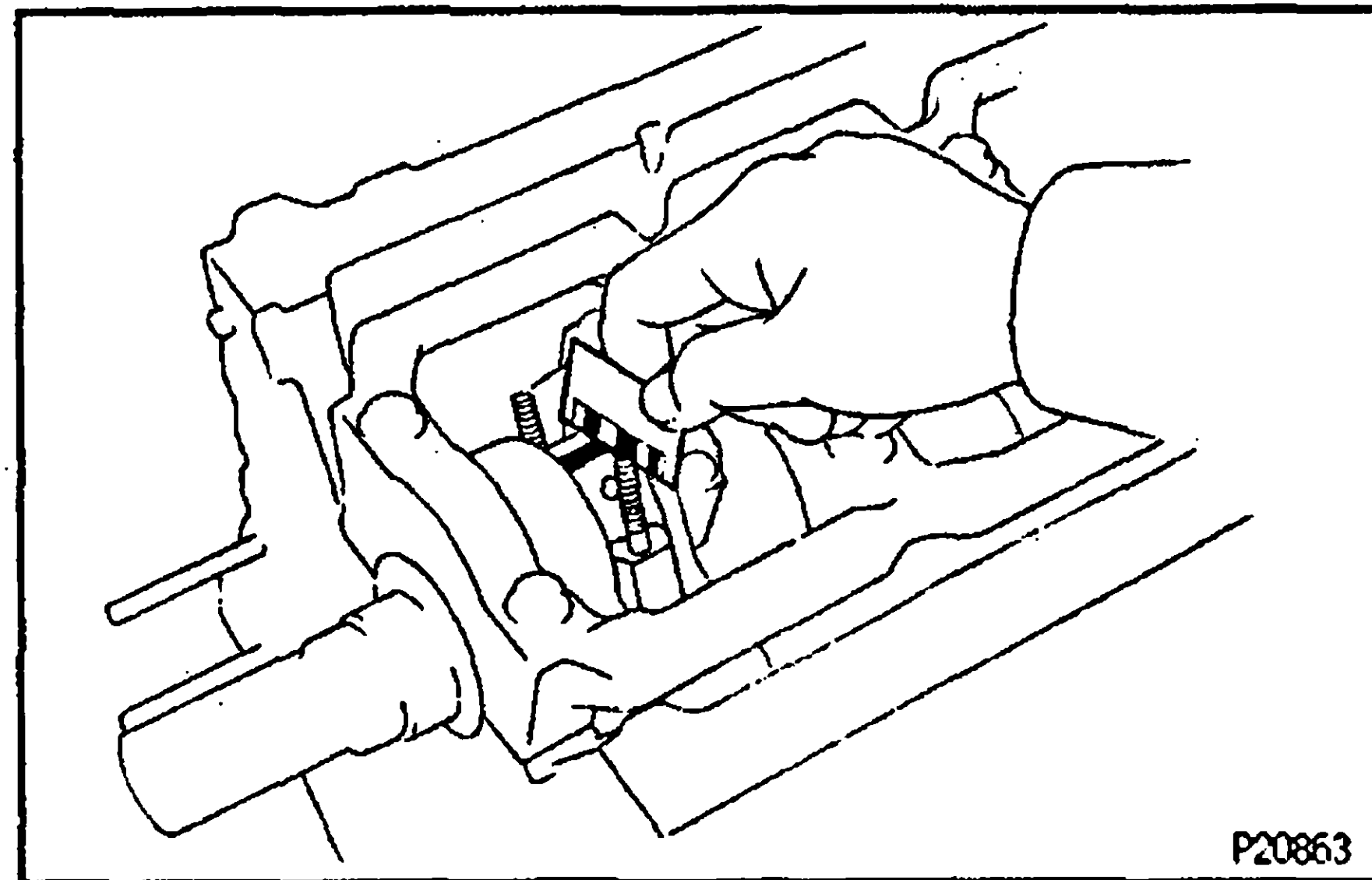
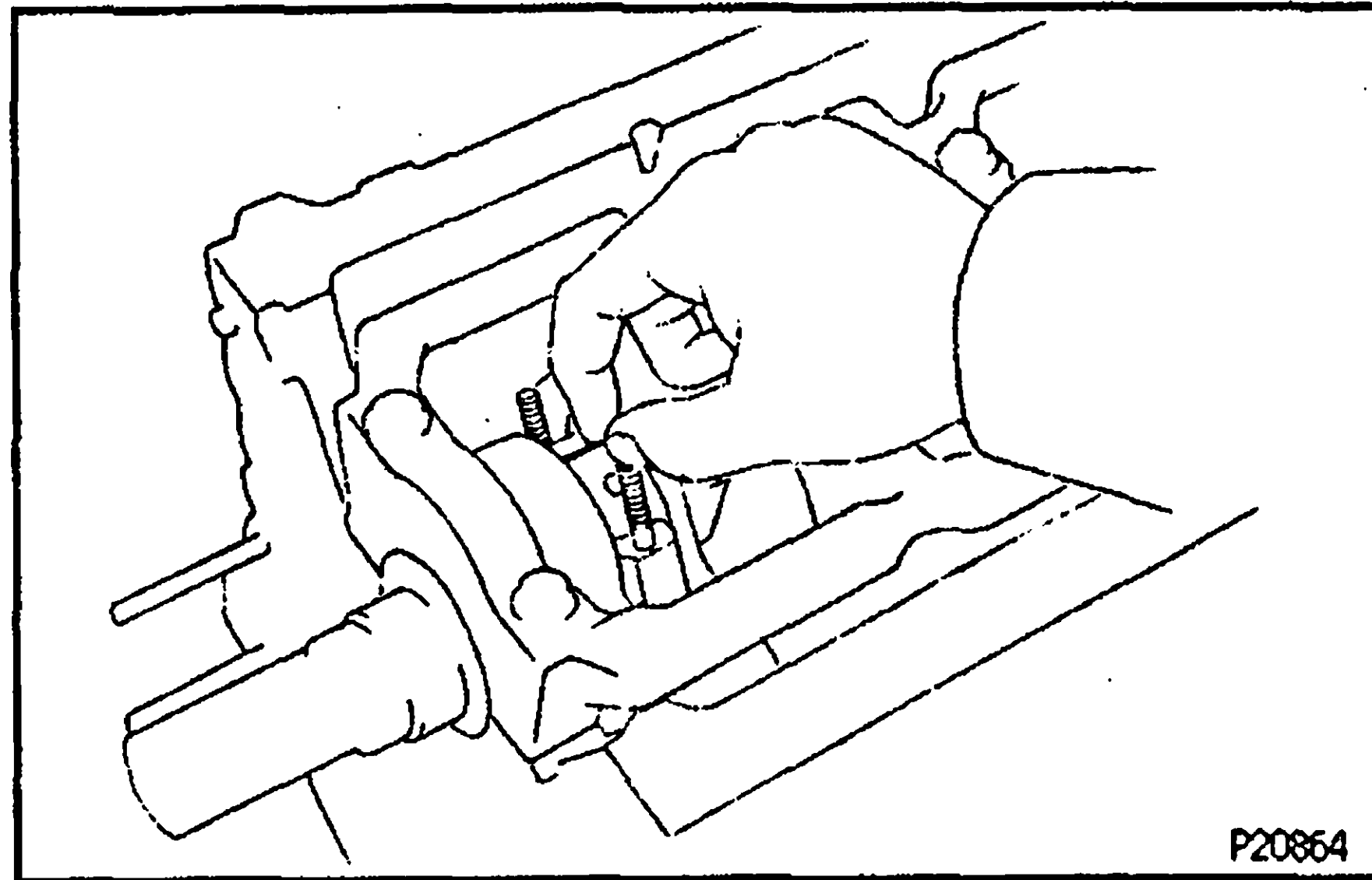


- (c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap. **HINT:** Keep the lower bearing inserted with the connecting rod cap.

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



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



- (g) Lay a strip of Plastigage across the crank pin.
 (h) Install the connecting rod cap with the 2 nuts.
 (See reassembly in cylinder block)

Torque:

1st 25 N·m (250 kgf·cm, 18 ft·lbf)

2nd Turn extra 90°

NOTICE: Do not turn the crankshaft.

- (i) Remove the 2 nuts and connecting rod cap.
 (See procedure (b) and (c) above)
 (j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD

0.024 — 0.053 mm (0.0009 — 0.0021 in.)

U/S 0.25

0.023 — 0.069 mm (0.0009 — 0.0027 in.)

Maximum oil clearance:

0.08 mm (0.0031 in.)

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

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

Reference

Standard bearing center wall thickness:

Mark "1"	1.484 — 1.488 mm (0.0584 — 0.0586 in.)
Mark "2"	1.488 — 1.492 mm (0.0586 — 0.0587 in.)
Mark "3"	1.492 — 1.496 mm (0.0587 — 0.0589 in.)

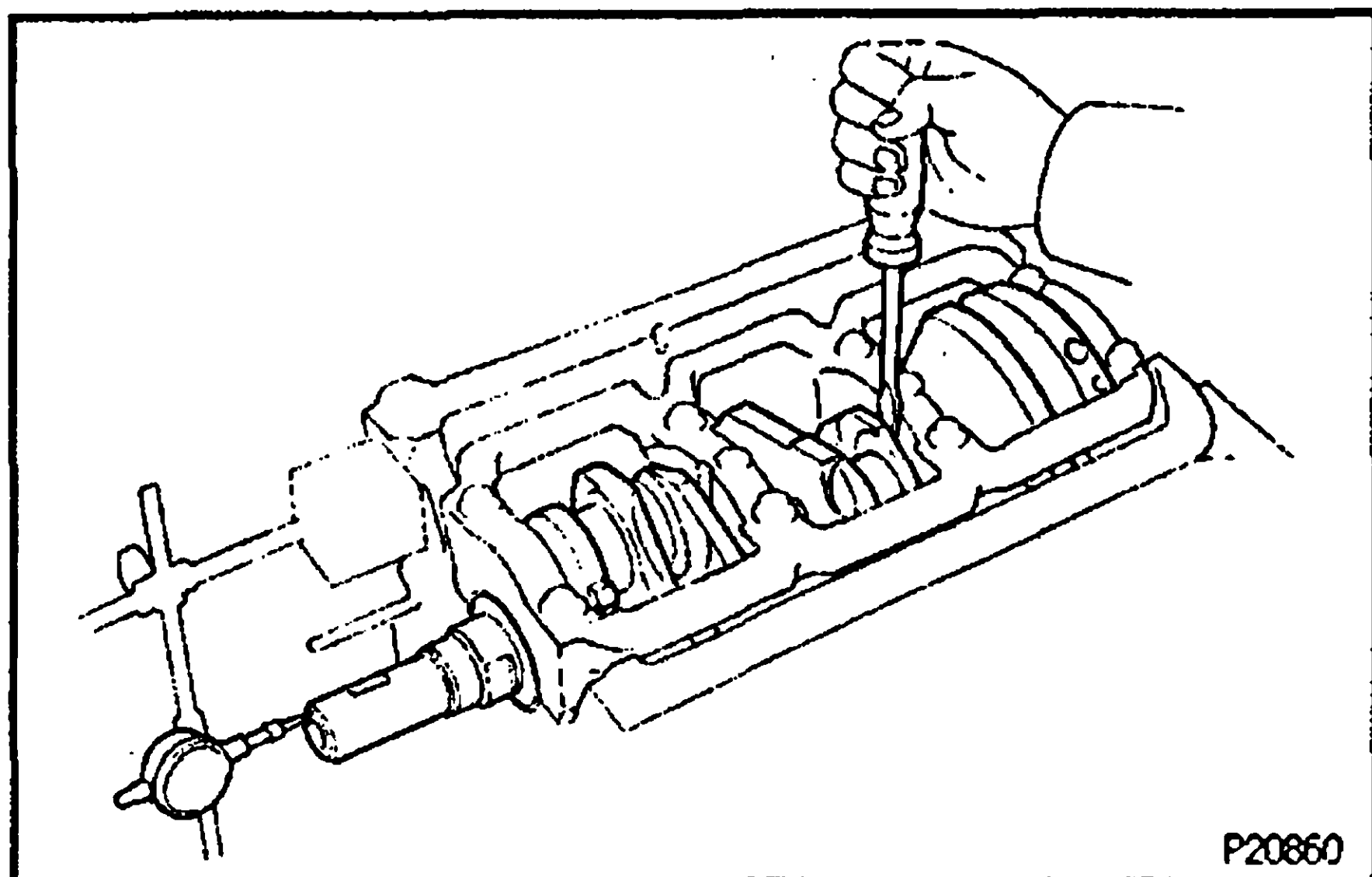
- (k) Completely remove the Plastigage.

4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

- (a) Using a ridge reamer, remove the all carbon from the top of the cylinder.
 (b) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.
 (c) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

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



5. CHECK CRANKSHAFT THRUST CLEARANCE

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

Standard thrust clearance:

0.020 — 0.220 mm (0.0008 — 0.0087 in.)

Maximum thrust clearance:

0.300 mm (0.0118 in.)

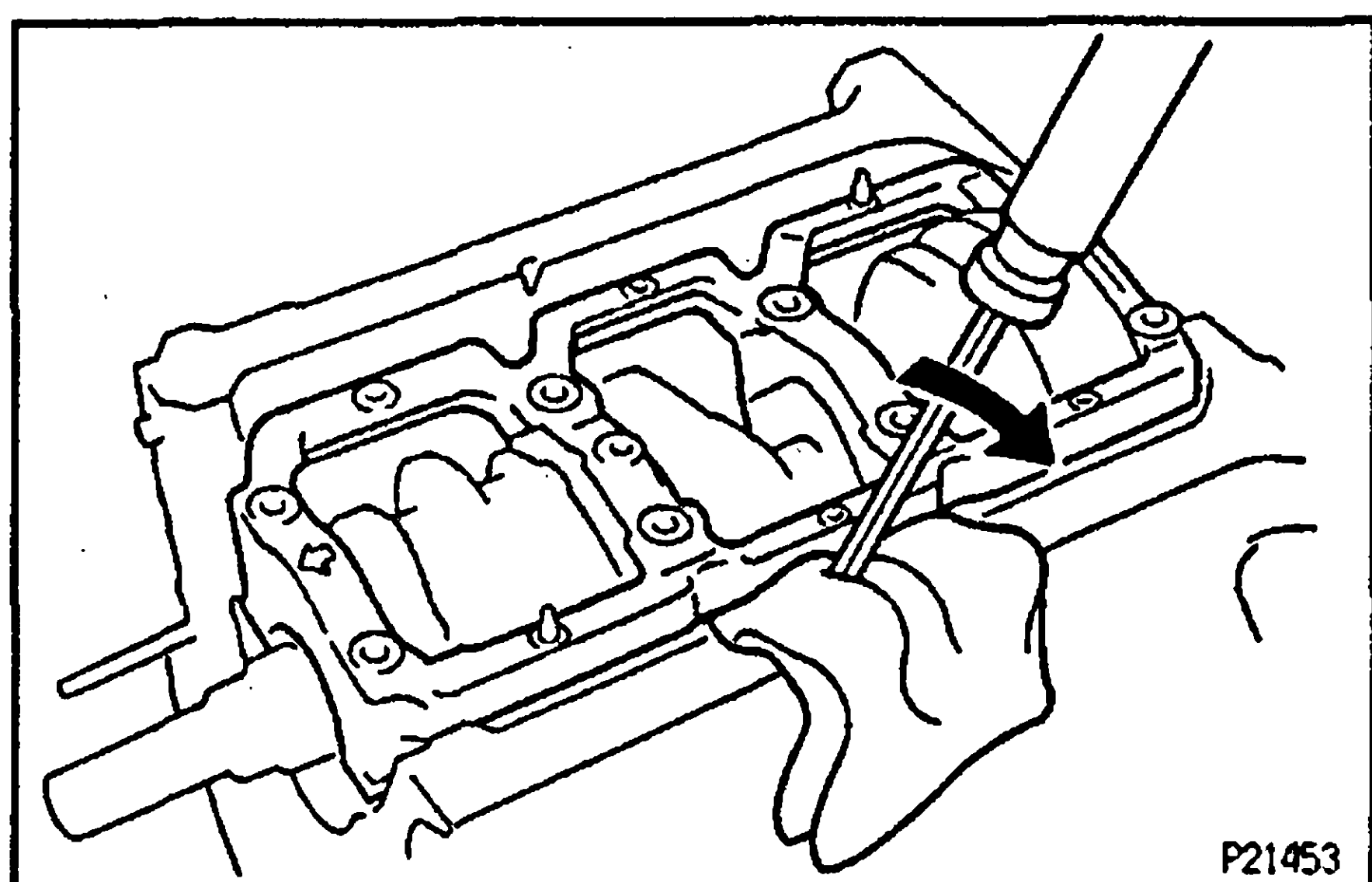
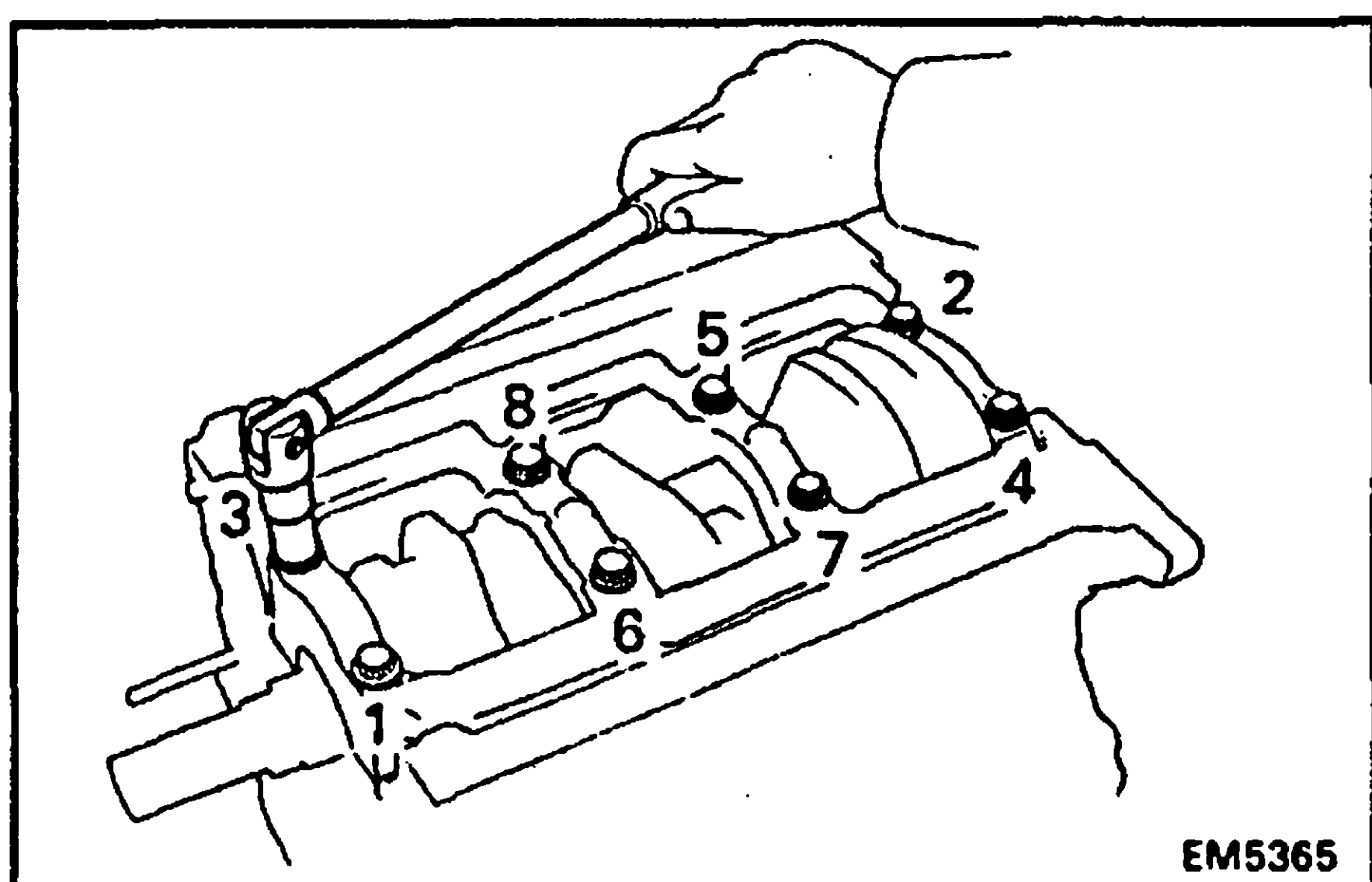
If the thrust clearance is greater than the maximum, replace the thrust washers as a set.

Thrust washer thickness:

2.440 — 2.490 mm (0.0961 — 0.0980 in.)

6. REMOVE MAIN BEARING CAP AND CHECK OIL CLEARANCE

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

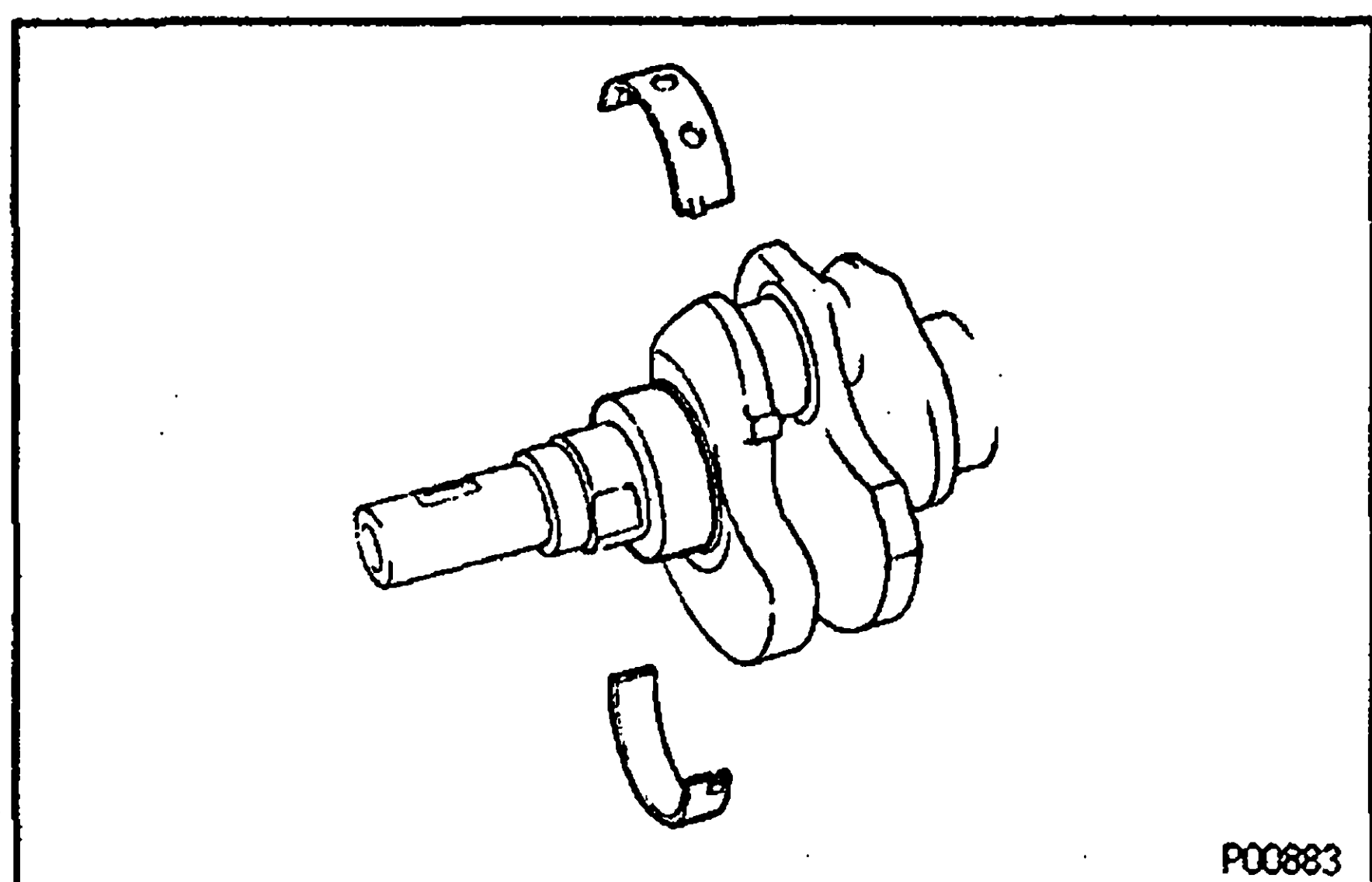


- (b) Using a screwdriver, pry out the main bearing cap and remove the main bearing cap, lower main bearings and lower thrust washers (No.2 journal position of main bearing cap only).

HINT: Keep the lower main bearings and lower thrust washers together with the main bearing cap.

- (c) Lift out the crankshaft.

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

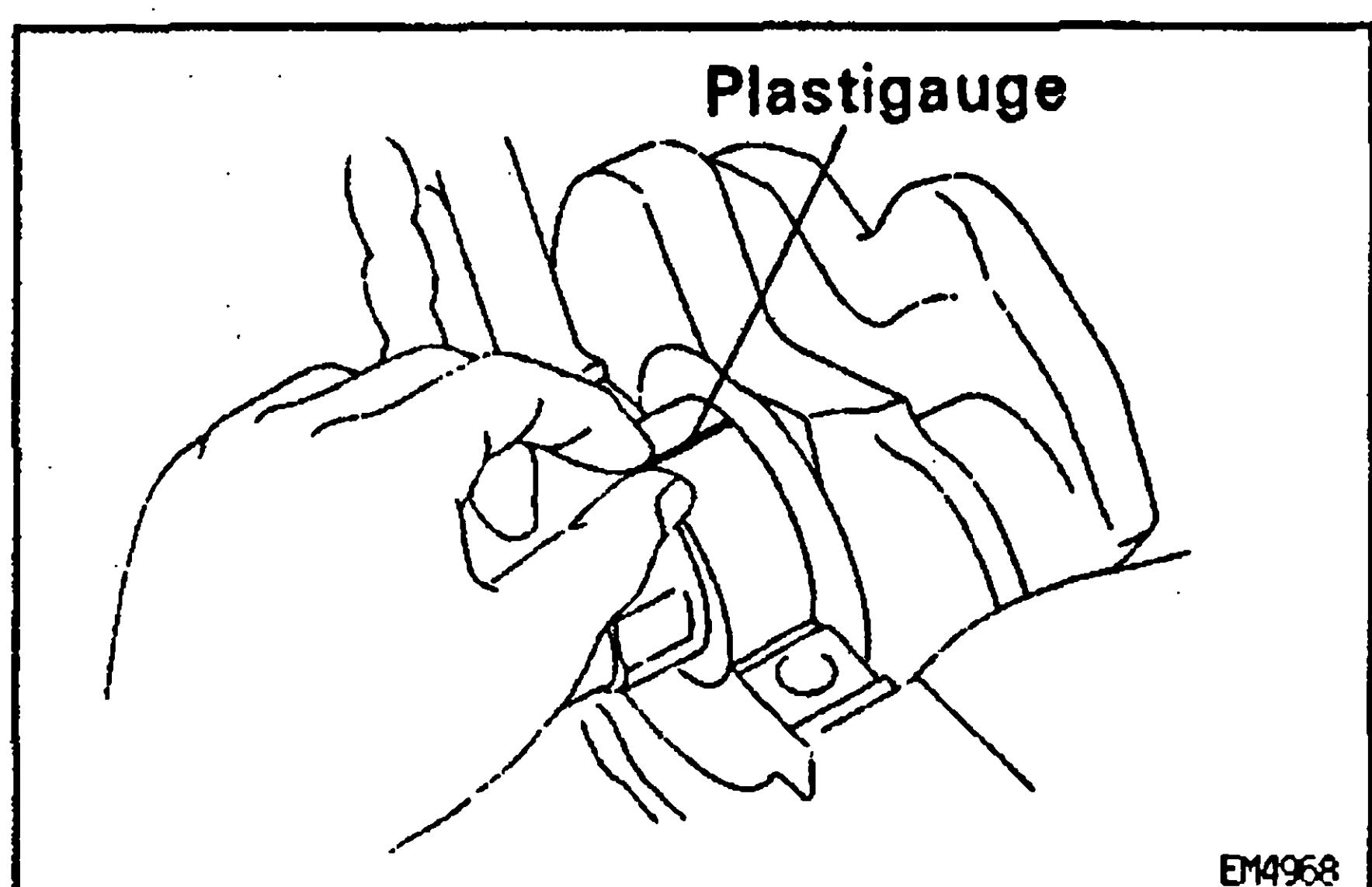


- (d) Clean each main journal and bearing.

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

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

- (f) Place the crankshaft on the cylinder block.



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

- (h) Install the main bearing cap with the 8 bolts. (See assembly in cylinder block)

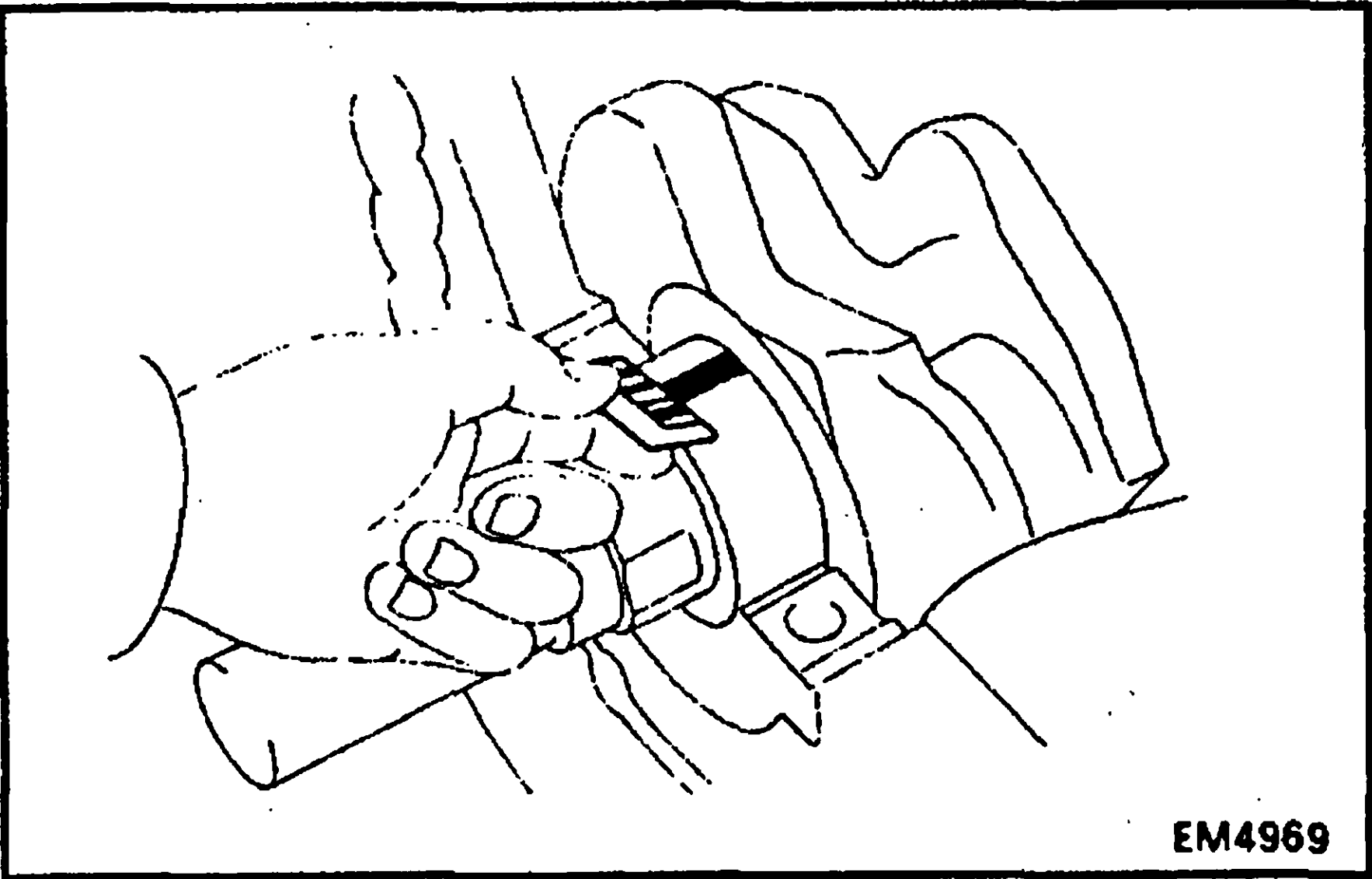
Torque:

1st 61 N·m (625 kgf·cm, 45 ft·lbf)

2nd Turn extra 90°

NOTICE: Do not turn the crankshaft.

- (i) Remove the 8 bolts and main bearing cap. (See procedure (a) and (b) above)



- (j) Measure the Plastigage at its widest point.
Standard clearance:

Item	STD mm (in.)	U/S 0.25 mm (in.)
No.1	0.020 – 0.038 (0.0008 – 0.0015)	0.019 – 0.059 (0.0007 – 0.0023)
Others	0.024 – 0.042 (0.0009 – 0.0017)	0.023 – 0.063 (0.0009 – 0.0025)

Maximum clearance:

0.08 mm (0.0031 in.)

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

No.1:

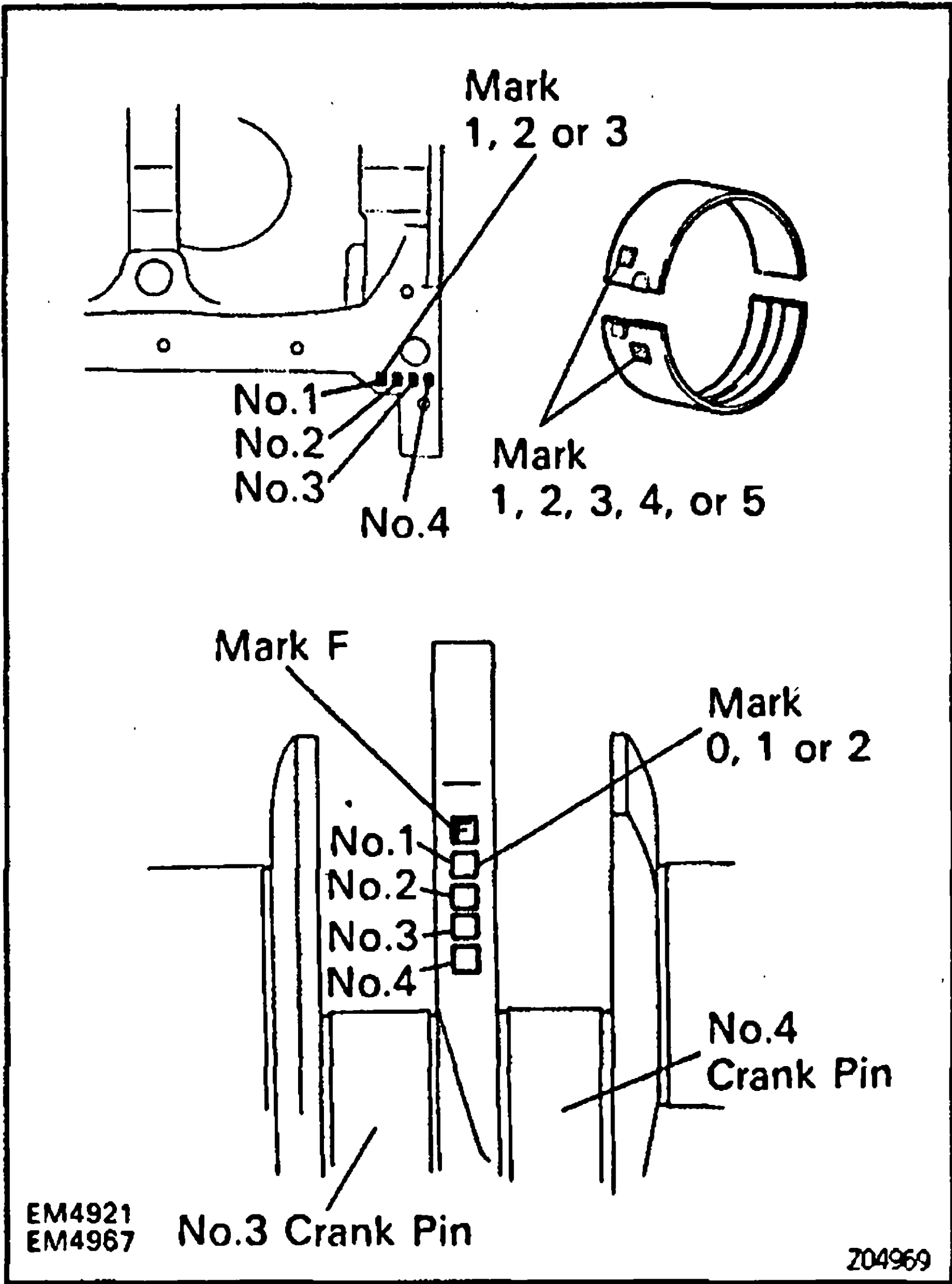
0.010 – 0.049 mm (0.0004 – 0.0020 in.)

Others:

0.014 – 0.053 mm (0.0006 – 0.0021 in.)

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

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



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

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

V00240

Reference:

Standard sized bearing center wall thickness:

No.1

Mark "1"	1.991 – 1.994 mm (0.0784 – 0.0785 in.)
Mark "2"	1.994 – 1.997 mm (0.0785 – 0.0786 in.)
Mark "3"	1.997 – 2.000 mm (0.0786 – 0.0787 in.)
Mark "4"	2.000 – 2.003 mm (0.0787 – 0.0789 in.)
Mark "5"	2.003 – 2.006 mm (0.0789 – 0.0790 in.)

Others

Mark "1"	1.989 — 1.992 mm (0.0783 — 0.0784 in.)
Mark "2"	1.992 — 1.995 mm (0.0784 — 0.0785 in.)
Mark "3"	1.995 — 1.998 mm (0.0785 — 0.0787 in.)
Mark "4"	1.998 — 2.001 mm (0.0787 — 0.0788 in.)
Mark "5"	2.001 — 2.004 mm (0.0788 — 0.0789 in.)

Cylinder block main journal bore diameter:

Mark "1"	68.010 — 68.016 mm (2.6776 — 2.6778 in.)
Mark "2"	68.016 — 68.022 mm (2.6778 — 2.6780 in.)
Mark "3"	68.022 — 68.028 mm (2.6780 — 2.6783 in.)

Crankshaft main journal diameter:

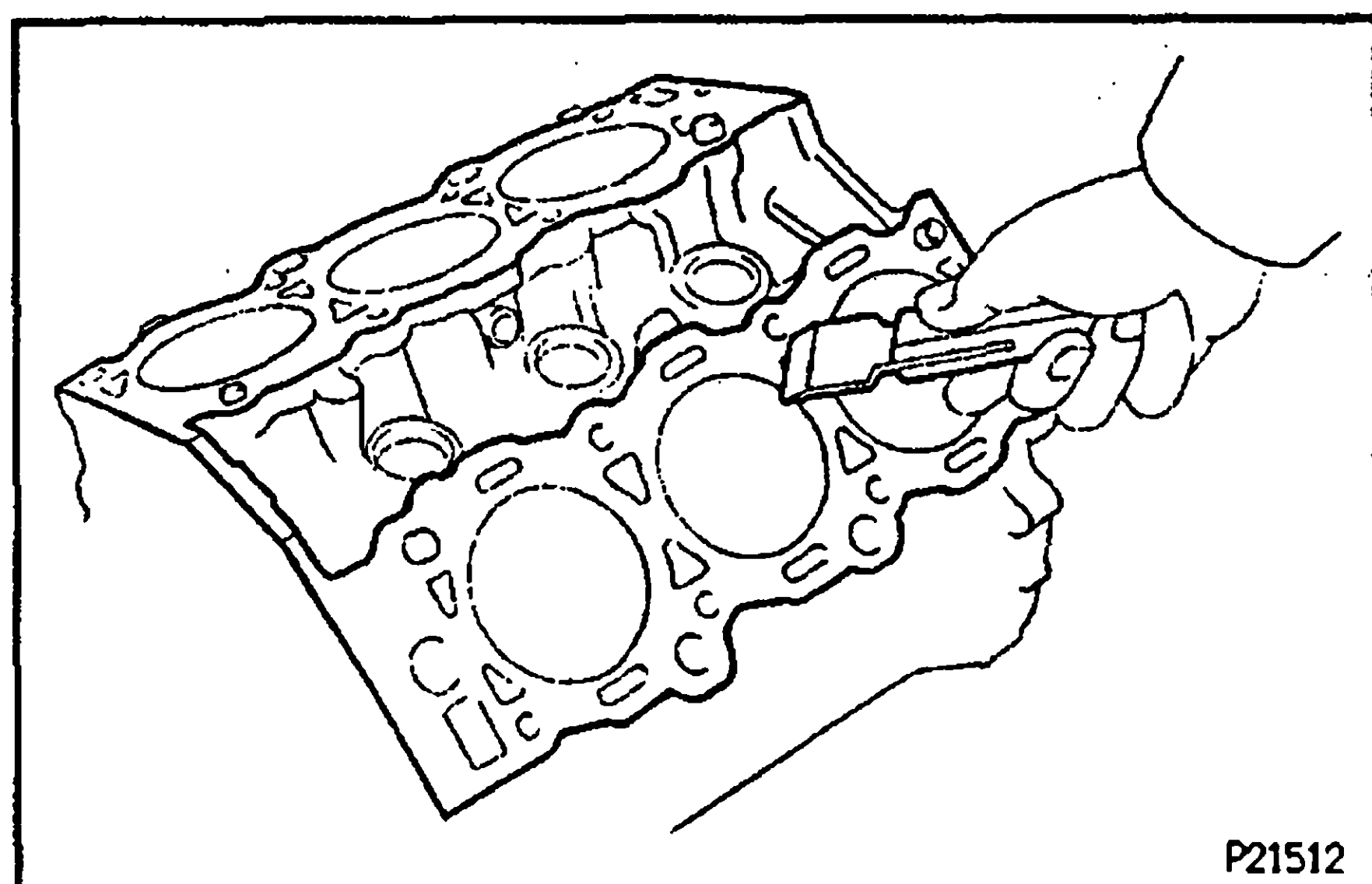
Mark "0"	63.996 — 64.000 mm (2.5195 — 2.5197 in.)
Mark "1"	63.990 — 63.996 mm (2.5193 — 2.5195 in.)
Mark "2"	63.985 — 63.990 mm (2.5191 — 2.5193 in.)

(k) Completely remove the Plastigage.

7. REMOVE CRANKSHAFT

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

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



P21512

CYLINDER BLOCK INSPECTION AND REPAIR

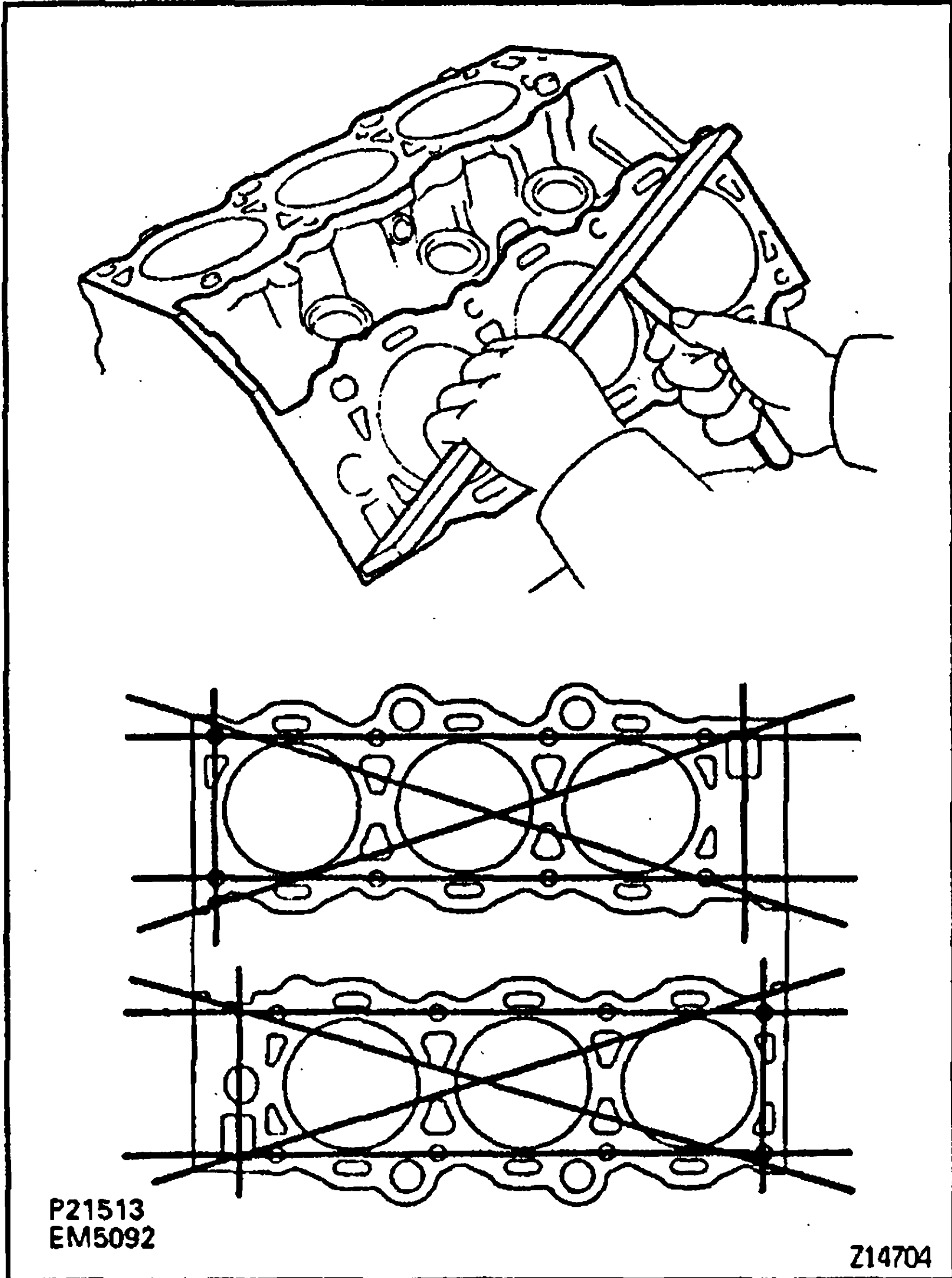
E07C2-01

1. REMOVE GASKET MATERIAL

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

2. CLEAN CYLINDER BLOCK

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



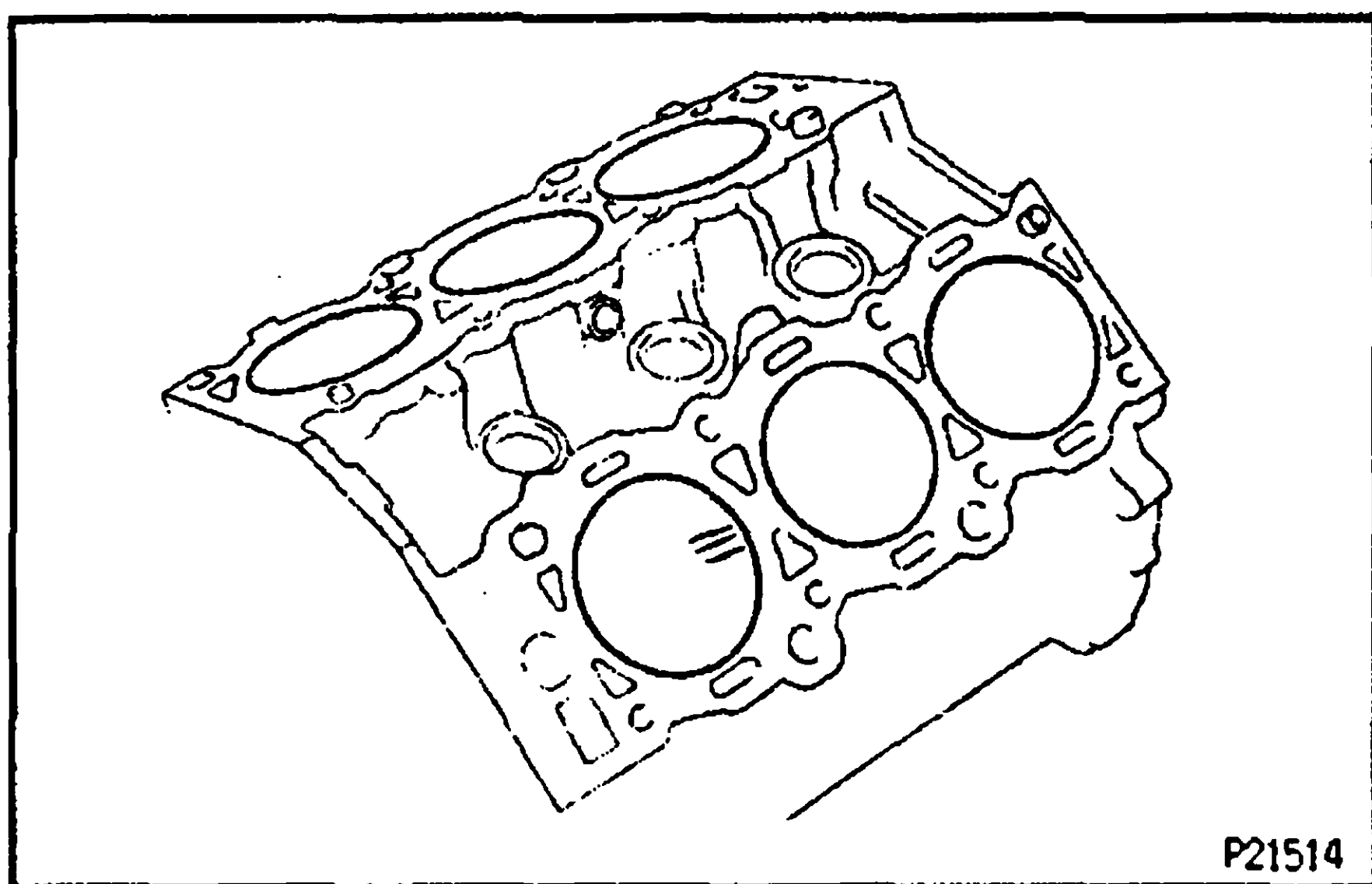
3. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage:

0.05 mm (0.0020 in.)

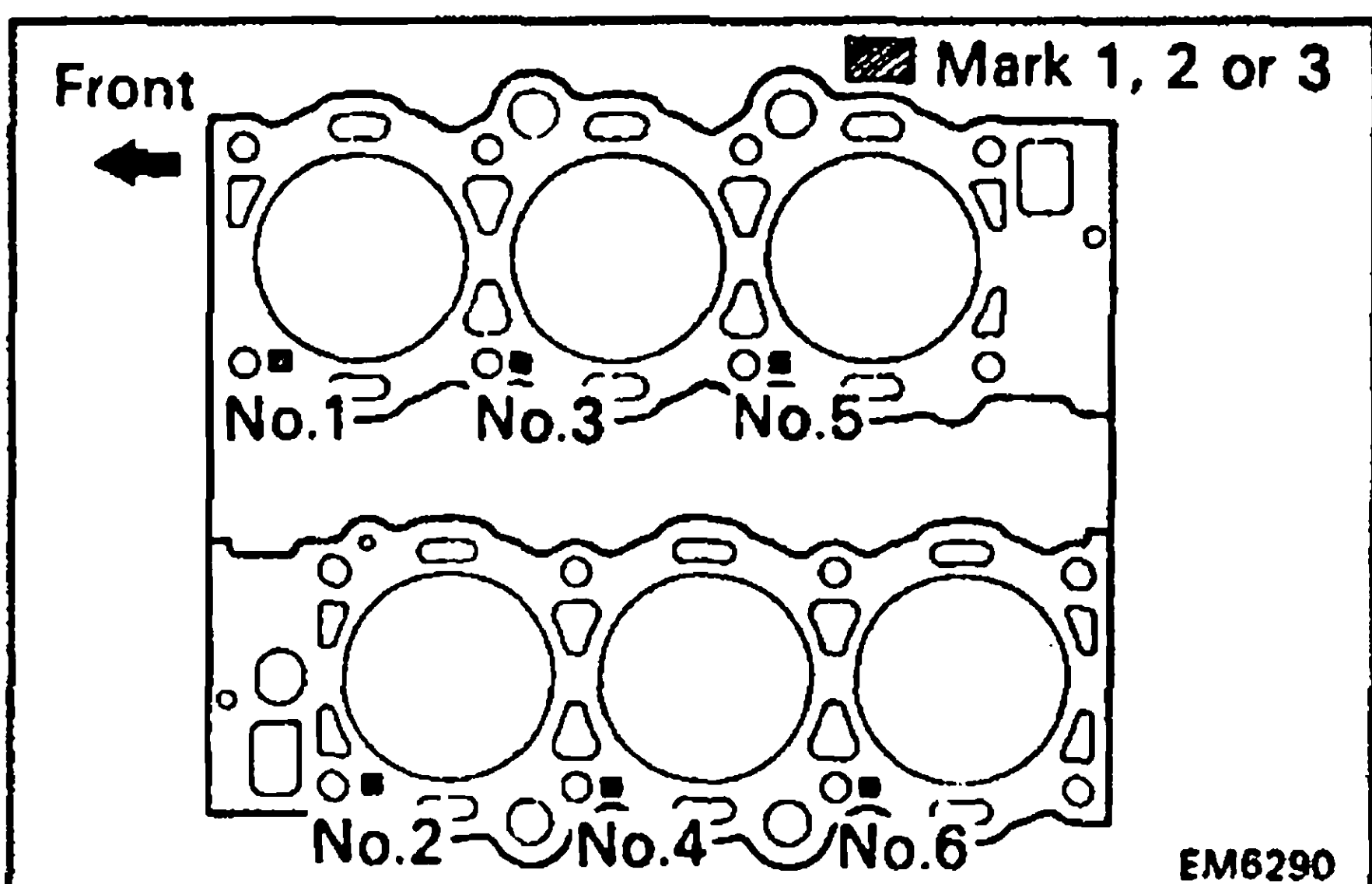
If warpage is greater than the maximum, replace the cylinder block.



4. INSPECT CYLINDER FOR VERTICAL SCRATCHES

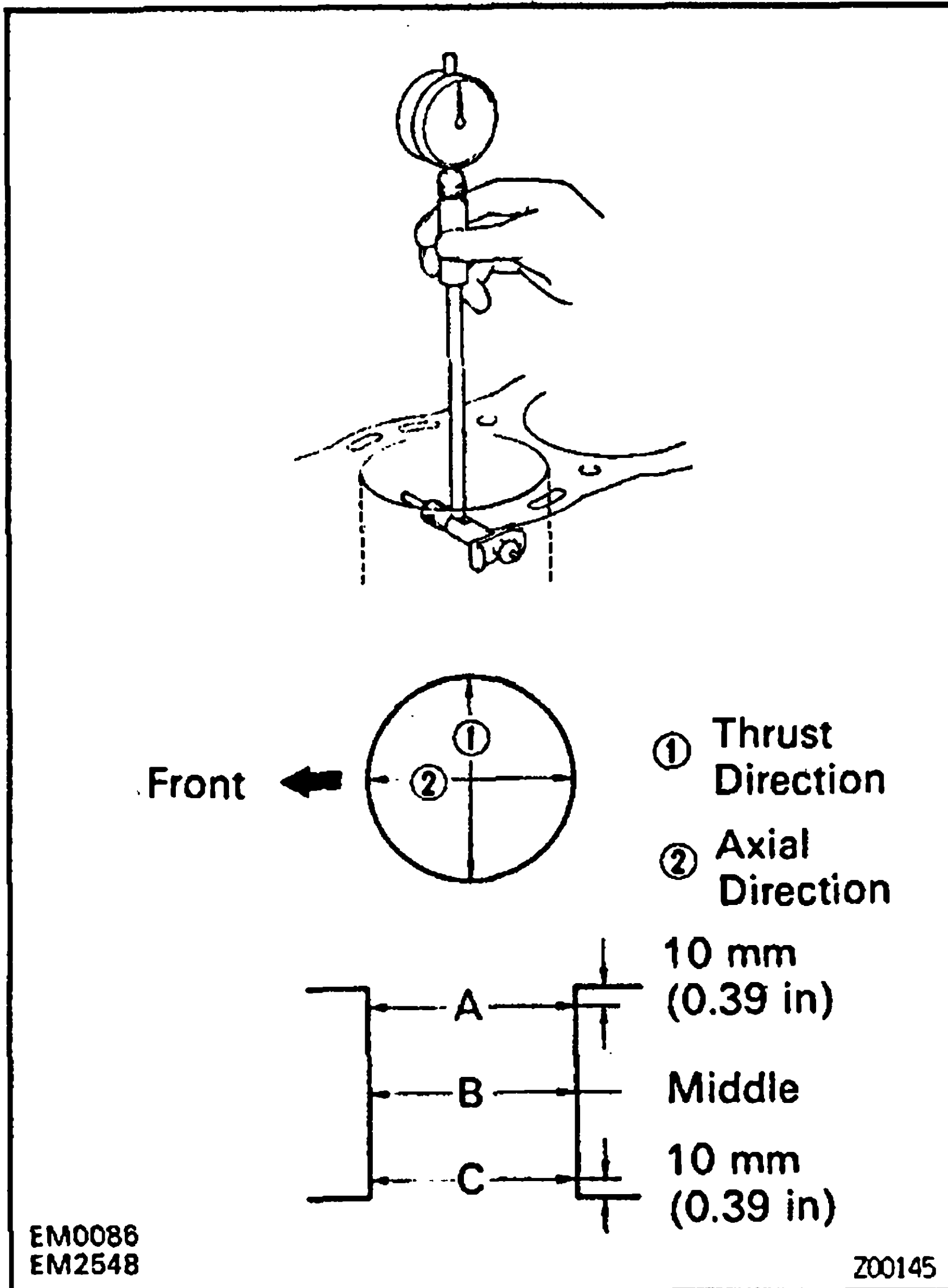
Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all the 6 cylinders. If necessary, replace the cylinder block.



5. INSPECT CYLINDER BORE DIAMETER

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



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

Standard diameter:

STD

Mark "1"	93.500 — 93.510 mm (3.6811 — 3.6815 in.)
Mark "2"	93.510 — 93.520 mm (3.6815 — 3.6819 in.)
Mark "3"	93.520 — 93.530 mm (3.6819 — 3.6823 in.)

Maximum diameter:

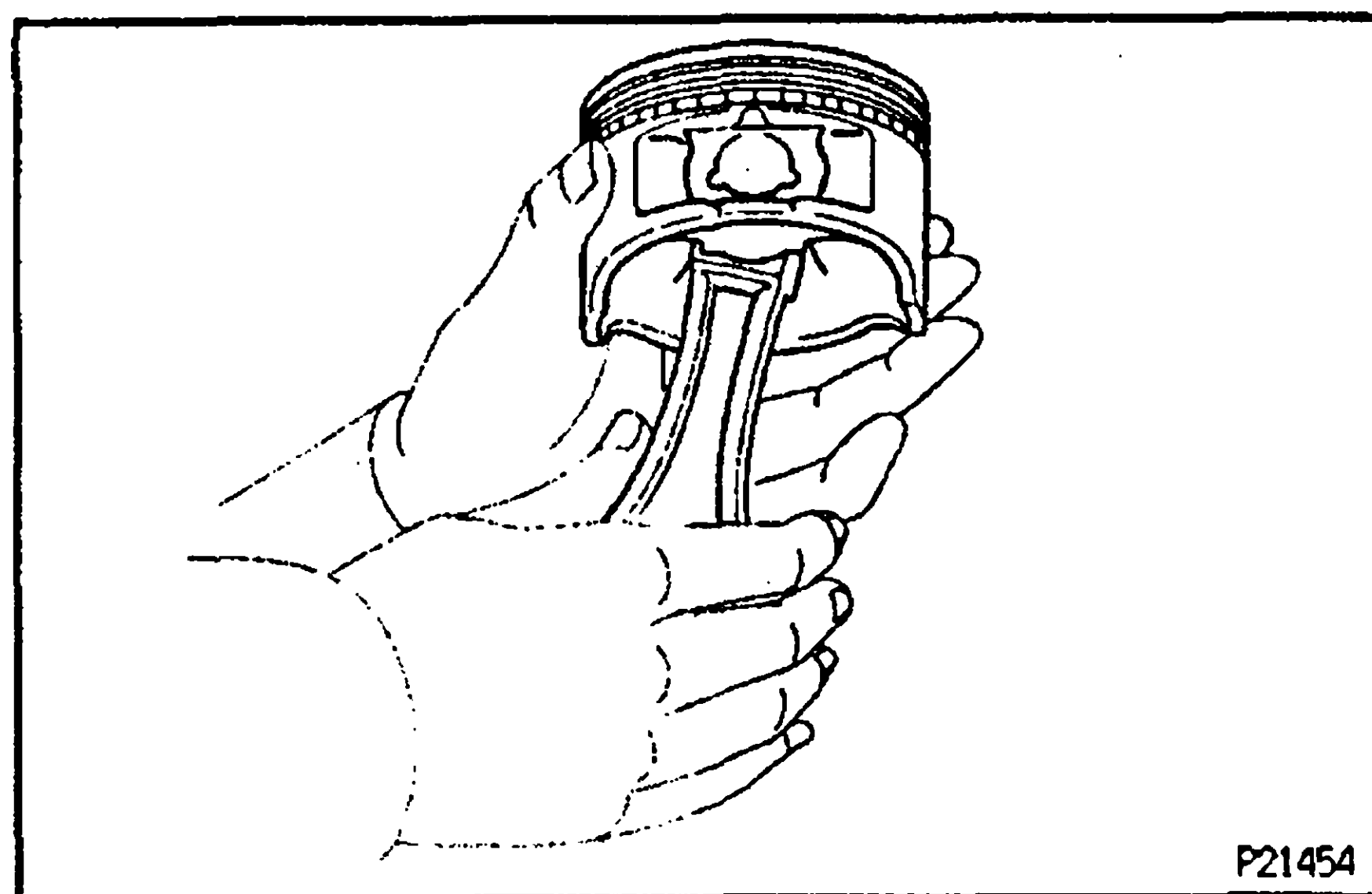
STD: 93.730 mm (3.6902 in.)

O/S 0.50: 94.230 mm (3.7098 in.)

If the diameter is greater than the maximum, rebore all the 6 cylinders. If necessary, replace the cylinder block.

6. REMOVE CYLINDER RIDGE

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



PISTON AND CONNECTION ROD DISASSEMBLY

1. CHECK FIT BETWEEN PISTON AND PISTON PIN

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

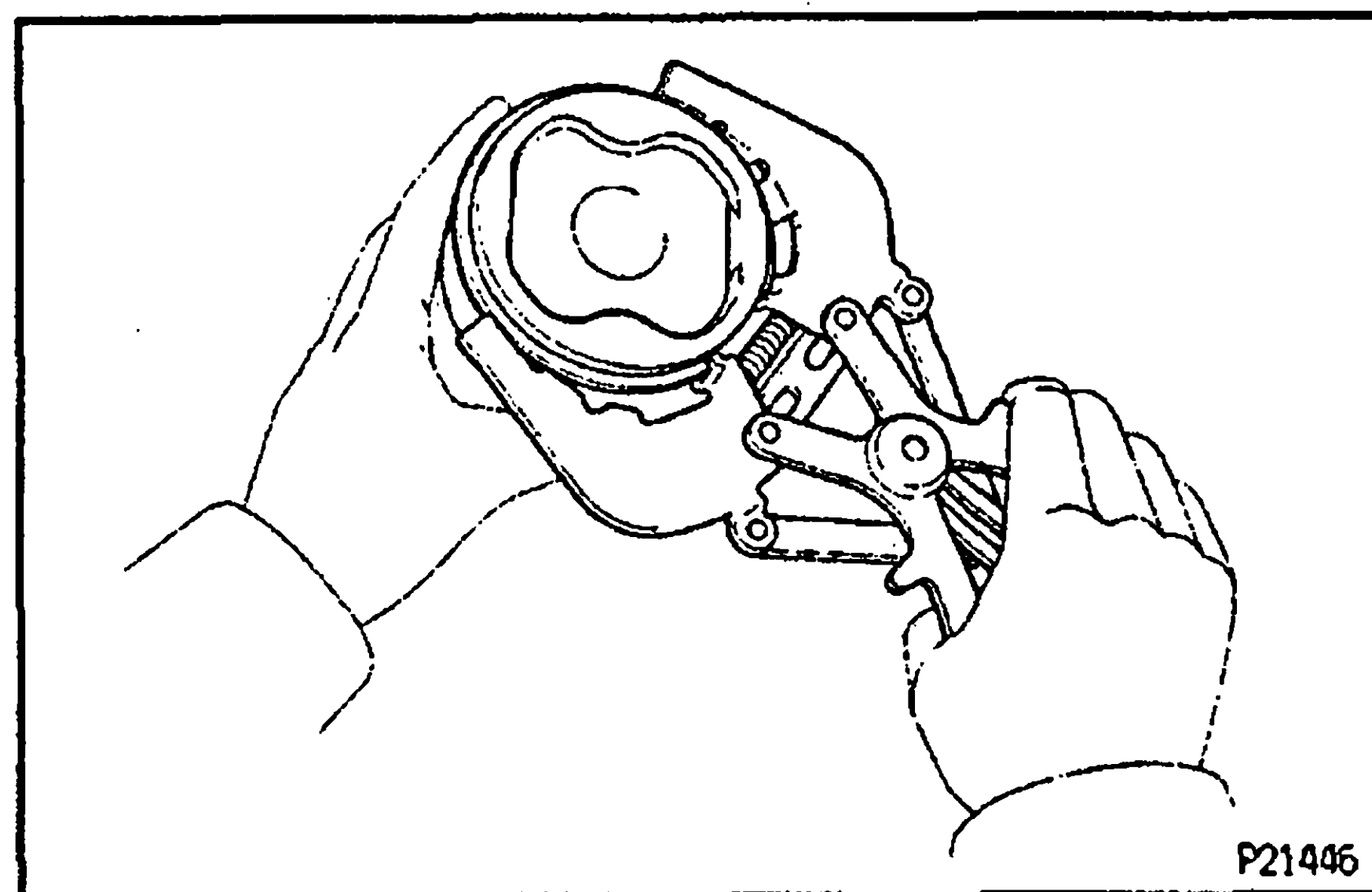
If any movement is felt, replace the piston and pin as a set.

2. REMOVE PISTON RINGS

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

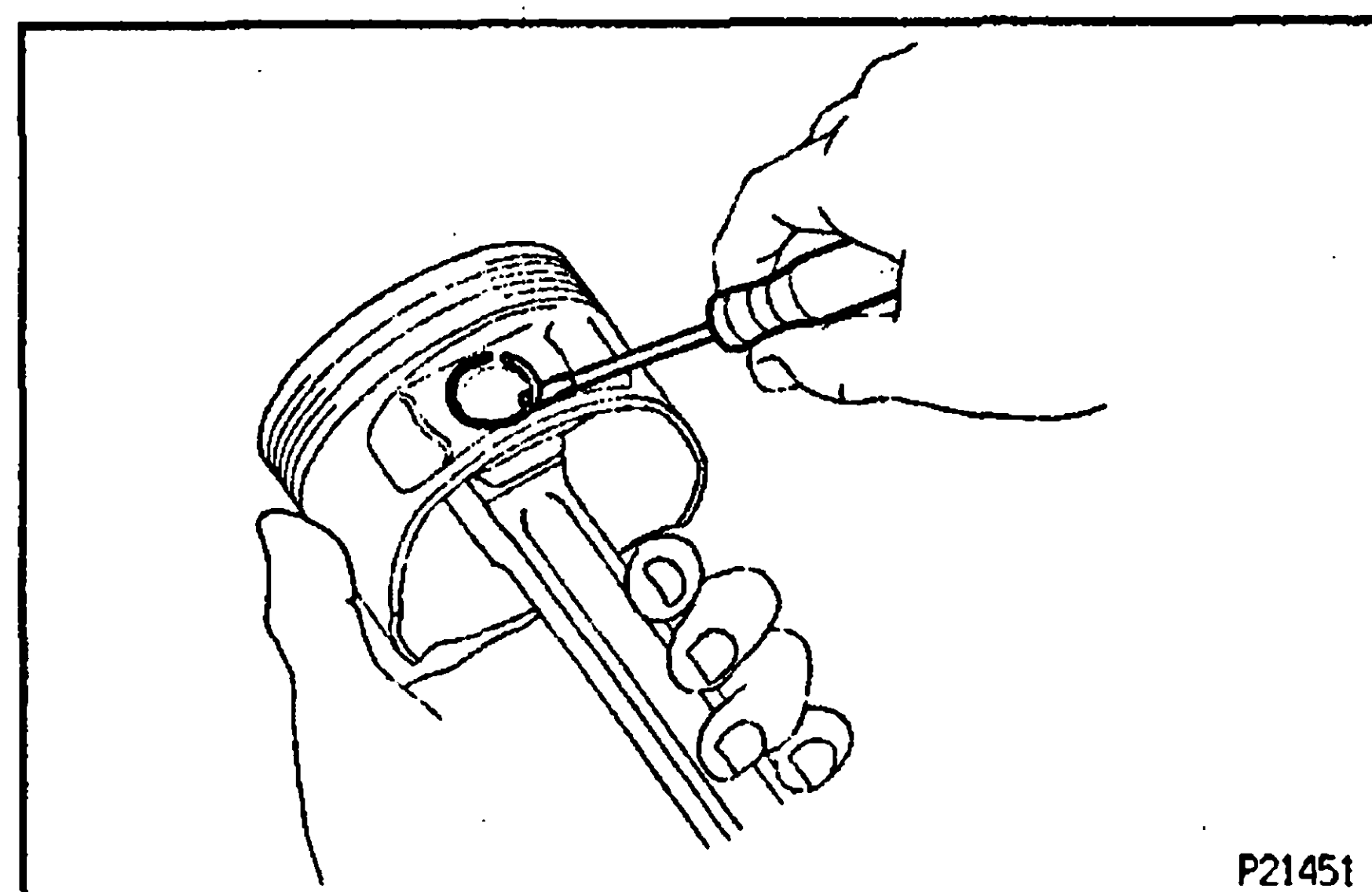
(b) Remove the 2 side rails and oil ring by hand.

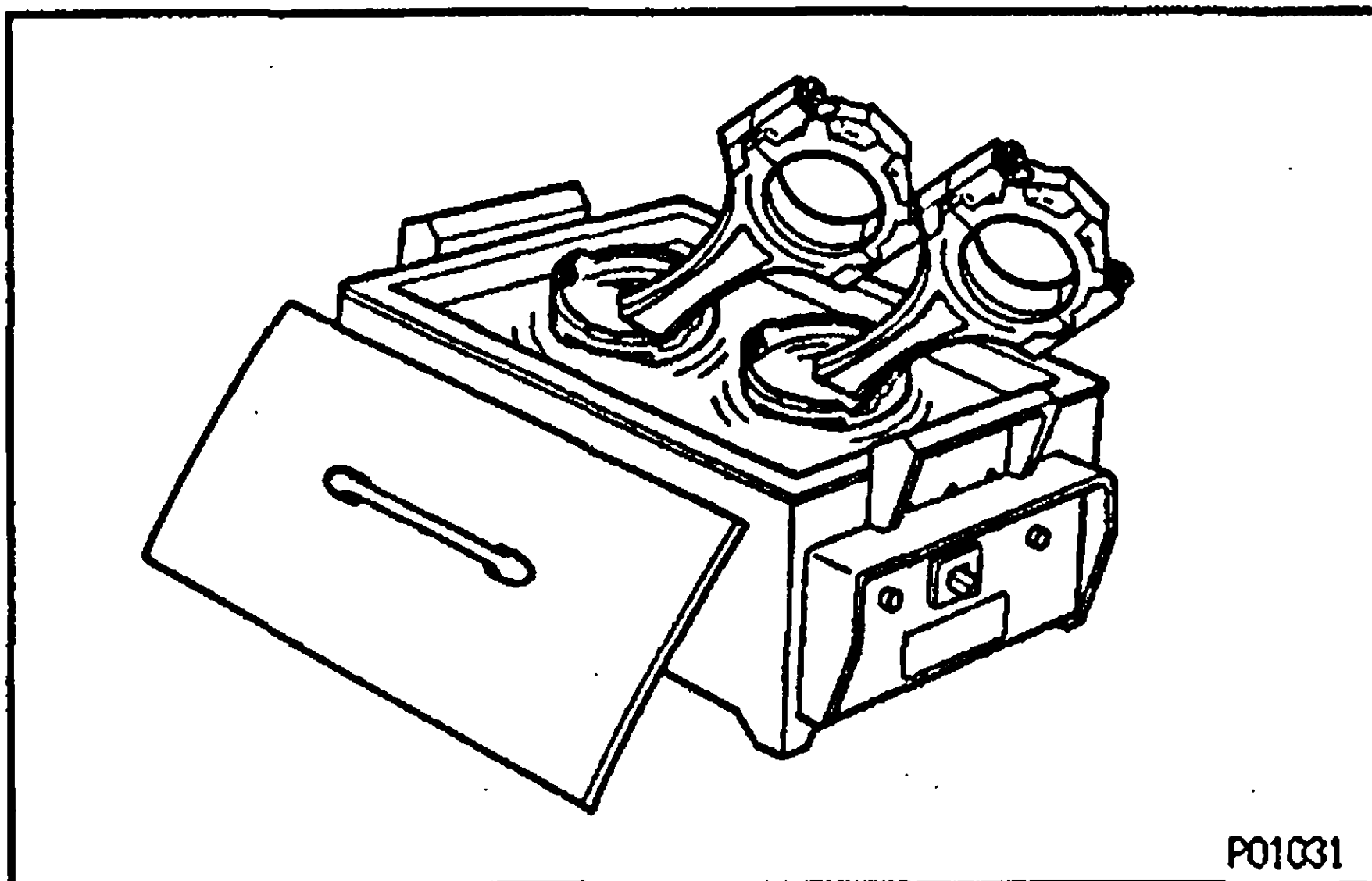
HINT: Arrange the piston rings in the correct order only.



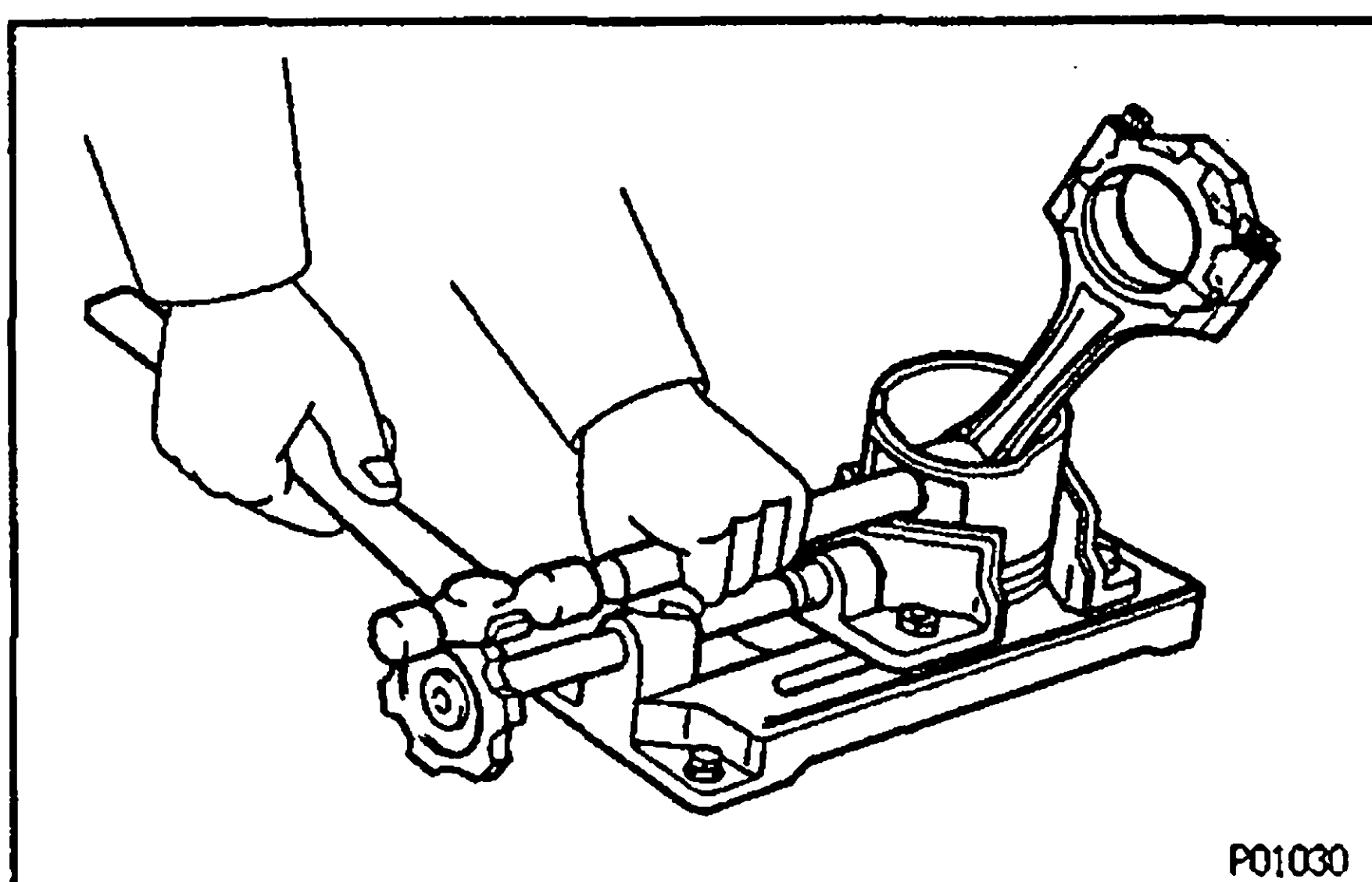
3. DISCONNECT CONNECTING ROD FROM PISTON

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





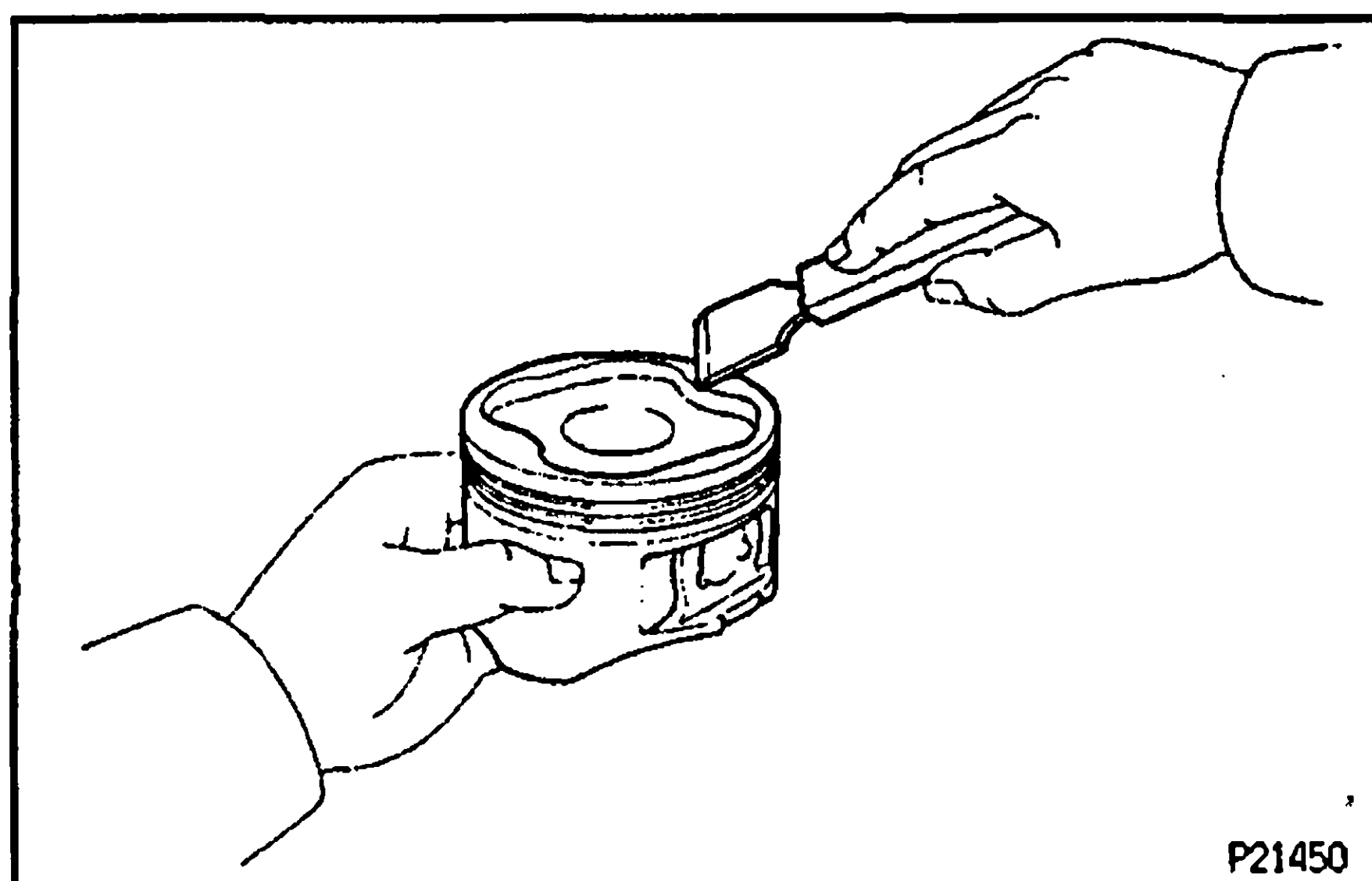
(b) Gradually heat the piston to about 60°C (140°F).



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

HINT:

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

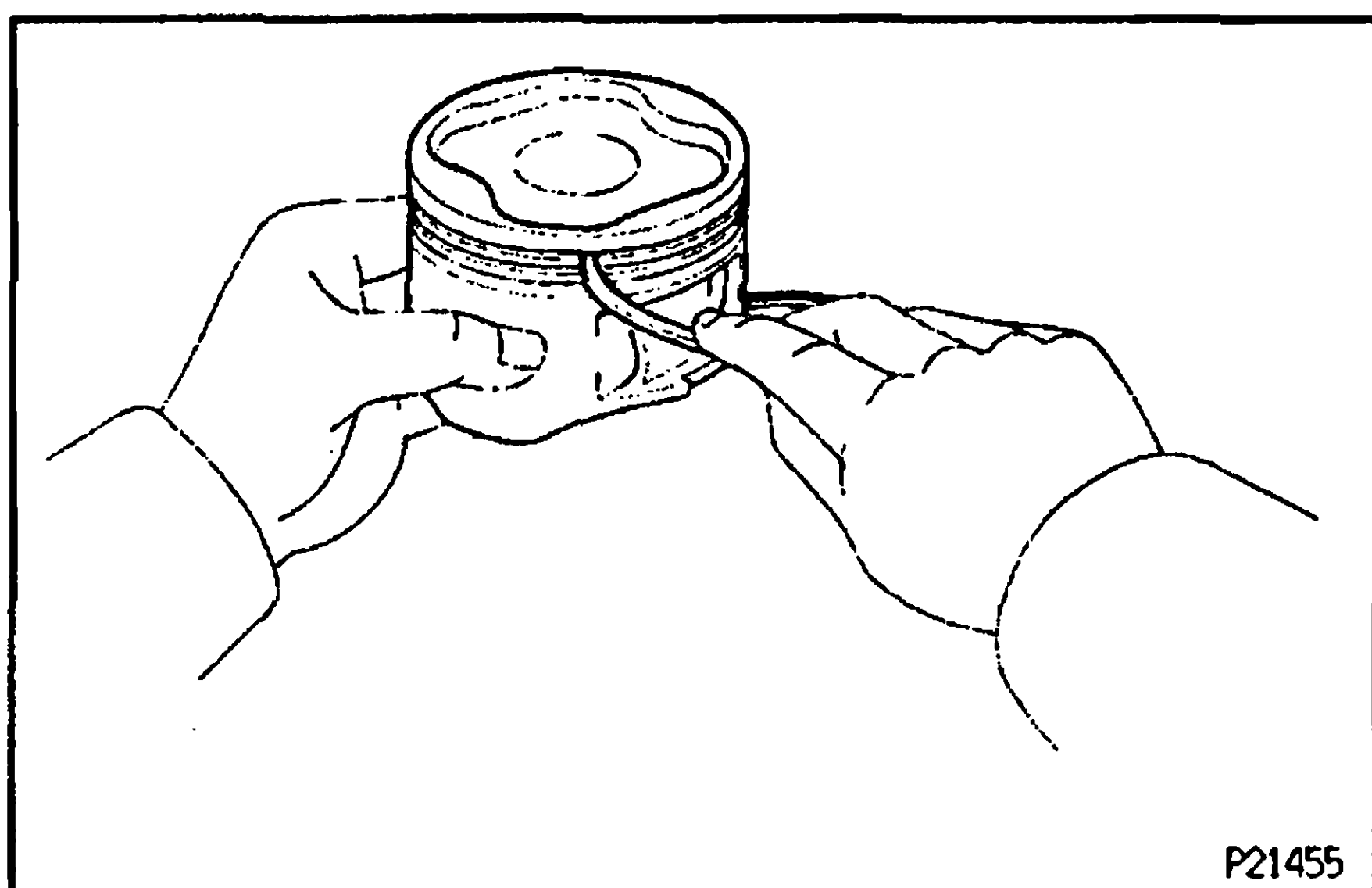


PISTON AND CONNECTION ROD INSPECTION

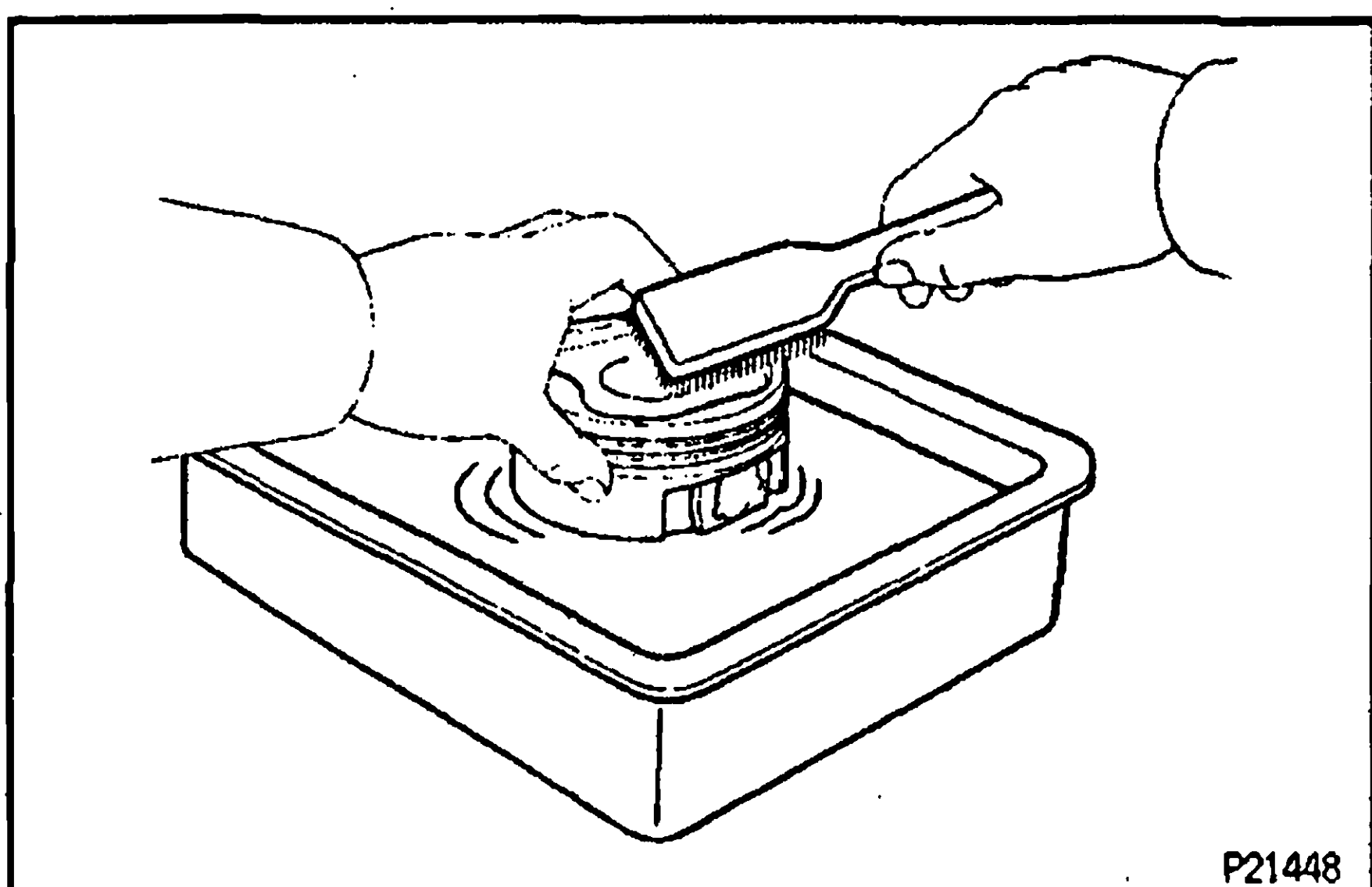
EQ7C9-01

1. CLEAN PISTON

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

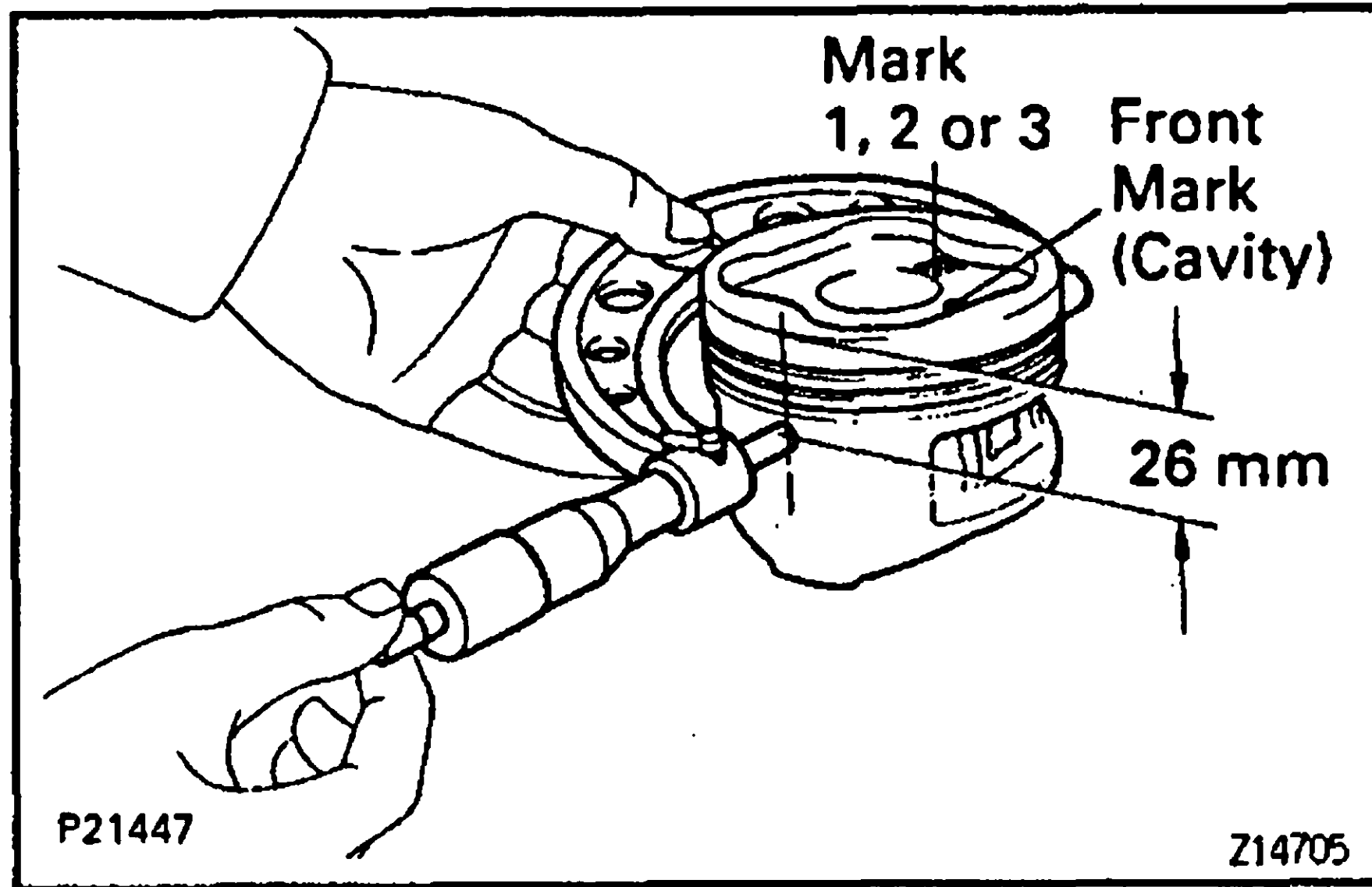


(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



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

NOTICE: Do not use a wire brush.



2. INSPECT PISTON OIL CLEARANCE

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

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

Piston diameter:

STD

Mark "1"	93.356 — 93.666 mm (3.6754 — 3.6758 in.)
Mark "2"	93.367 — 93.376 mm (3.6759 — 3.6762 in.)
Mark "3"	93.377 — 93.386 mm (3.6763 — 3.6766 in.)

O/S 0.50

93.856 — 93.886 mm (3.6951 — 3.6963 in.)

- (b) Measure the cylinder bore diameter in the thrust directions (See inspection in cylinder block).
- (c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:

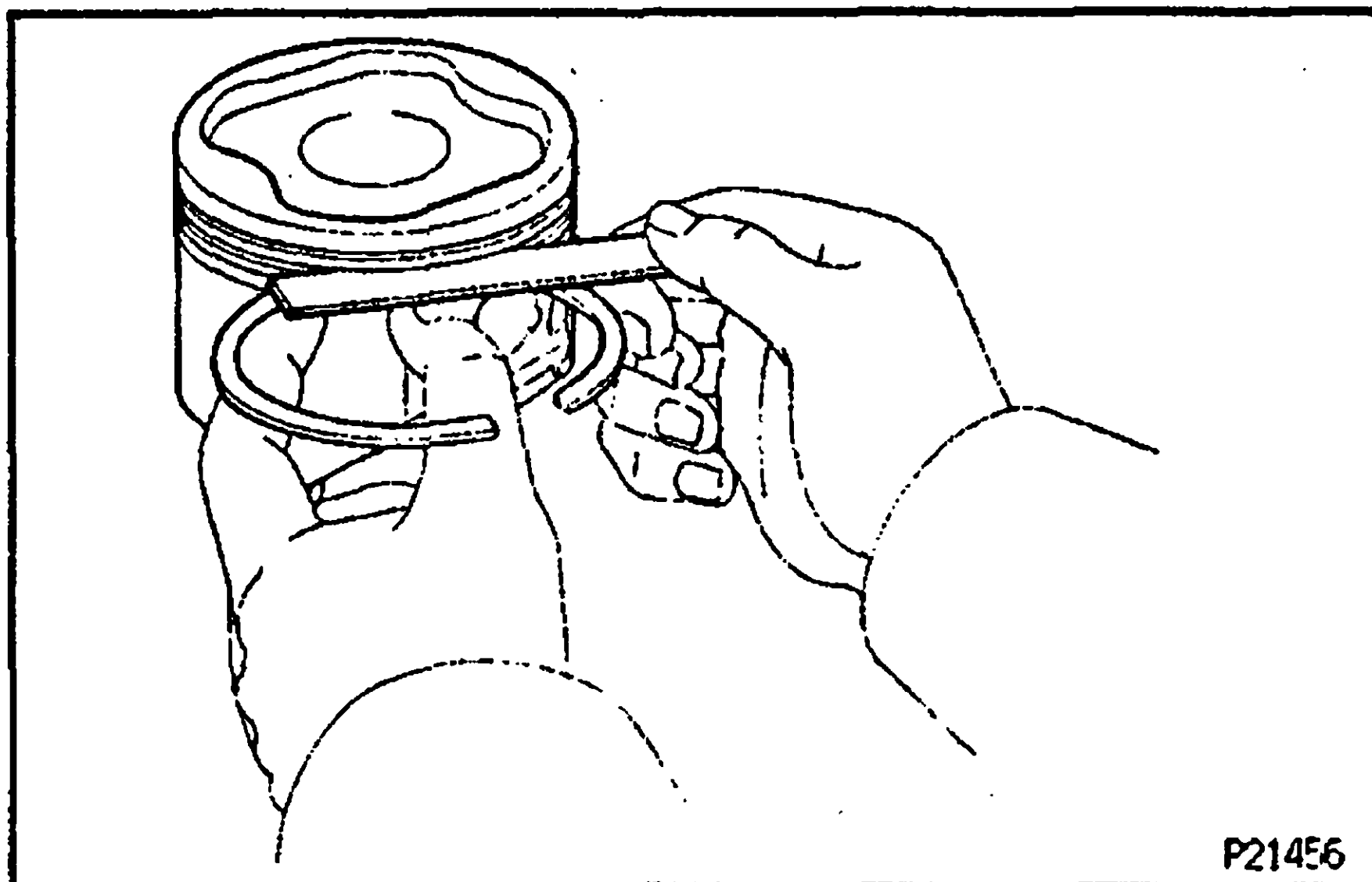
0.134 — 0.154 mm (0.0053 — 0.0060 in.)

Maximum oil clearance:

0.174 mm (0.0069 in.)

If the oil clearance is greater than the maximum, replace all the 6 pistons. If necessary, rebore all 6 cylinders or replace the cylinder block.

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



3. INSPECT PISTON RING GROOVE CLEARANCE

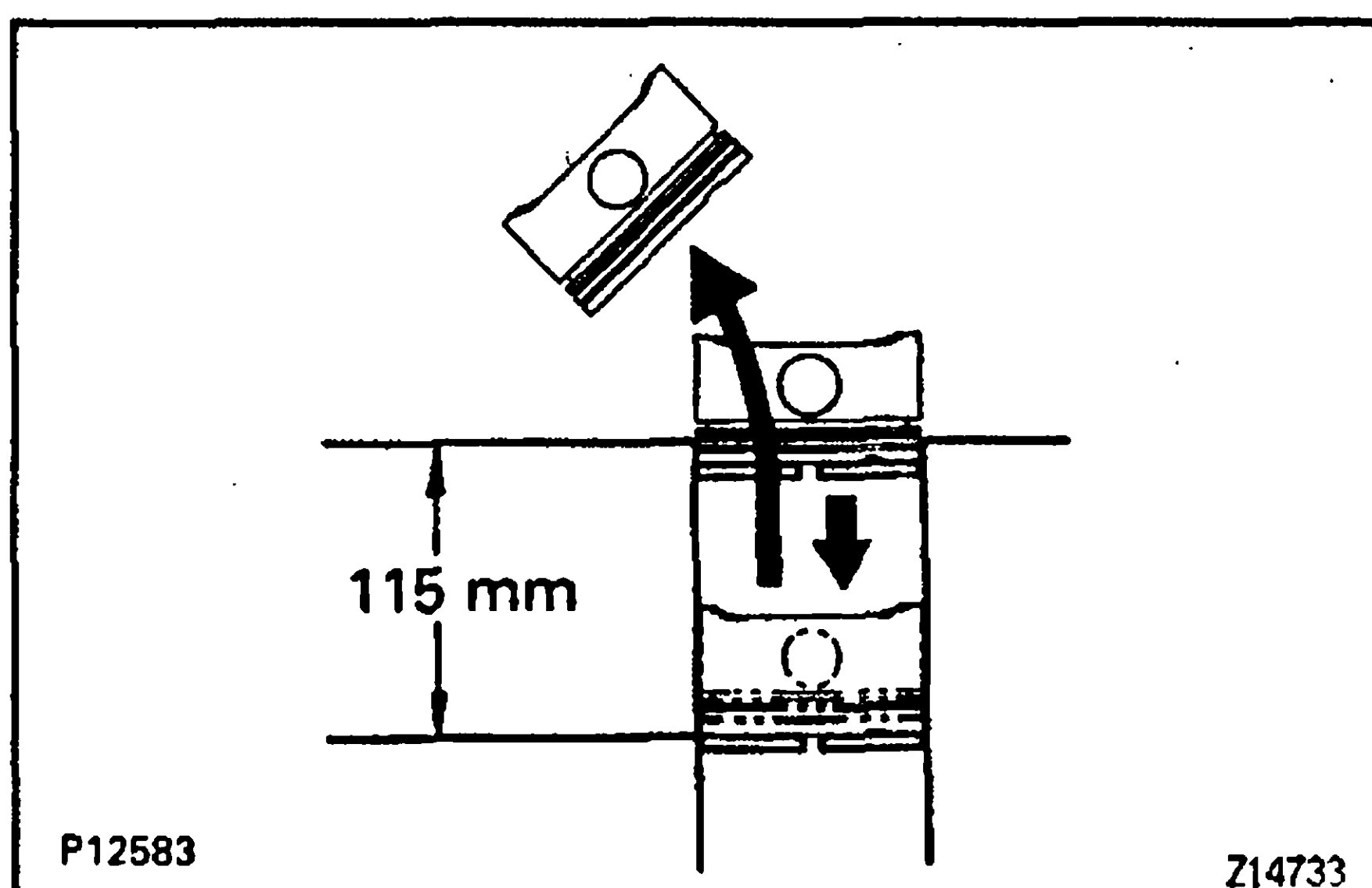
Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

Standard ring groove clearance:

No.1: 0.040 — 0.080 mm (0.0016 — 0.0031 in.)

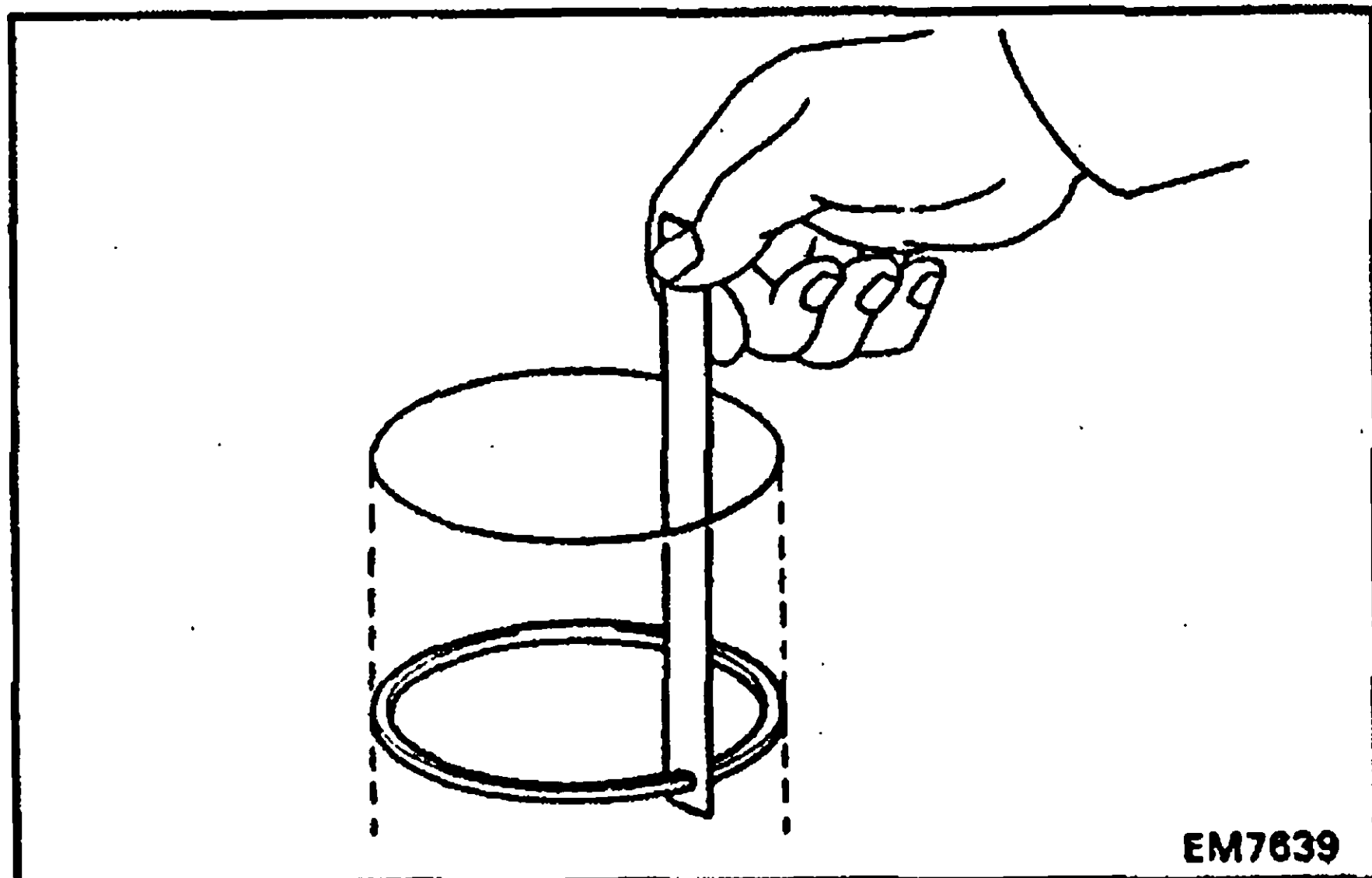
No.2: 0.030 — 0.070 mm (0.0012 — 0.0028 in.)

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



4. 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, 115 mm (4.53 in.) from the top of the cylinder block.



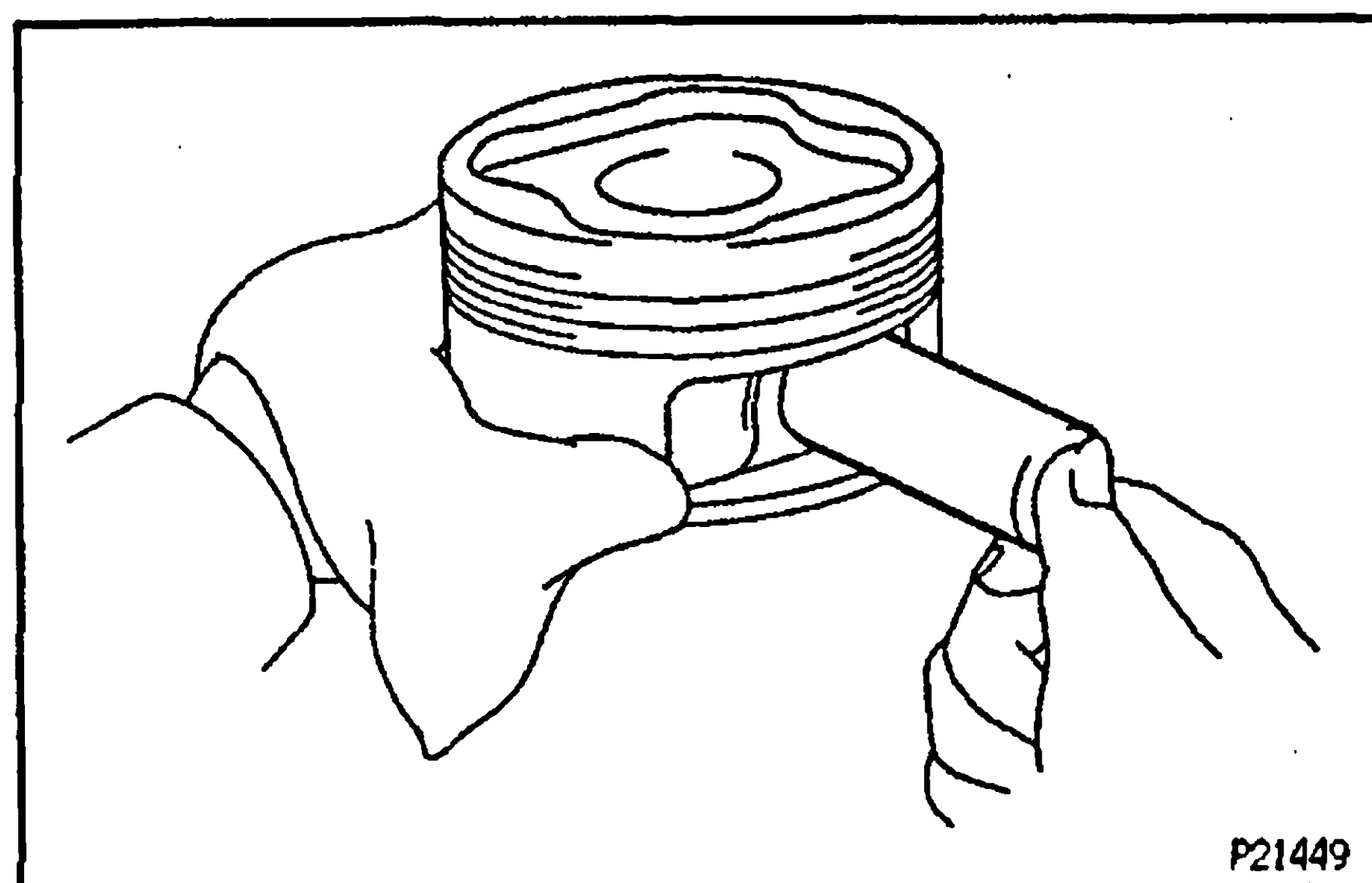
- (c) Using a feeler gauge, measure the ring end gap.
Ring end gap:

Piston ring	STD mm (in.)	Maximum mm (in.)
No.1	0.300 – 0.500 (0.0118 – 0.0197)	1.100 (0.0433)
No.2	0.400 – 0.800 (0.0157 – 0.0236)	1.200 (0.0472)
Oil (Side rail)	0.150 – 0.550 (0.0059 – 0.0217)	1.150 (0.0453)

If the end gap is greater than the maximum, replace the piston ring. If the end gap is greater than the maximum, even with a new piston ring, rebore all the 6 cylinders or replace the cylinder block.

5. INSPECT PISTON PIN FIT

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



6. INSPECT CONNECTING ROD ALIGNMENT

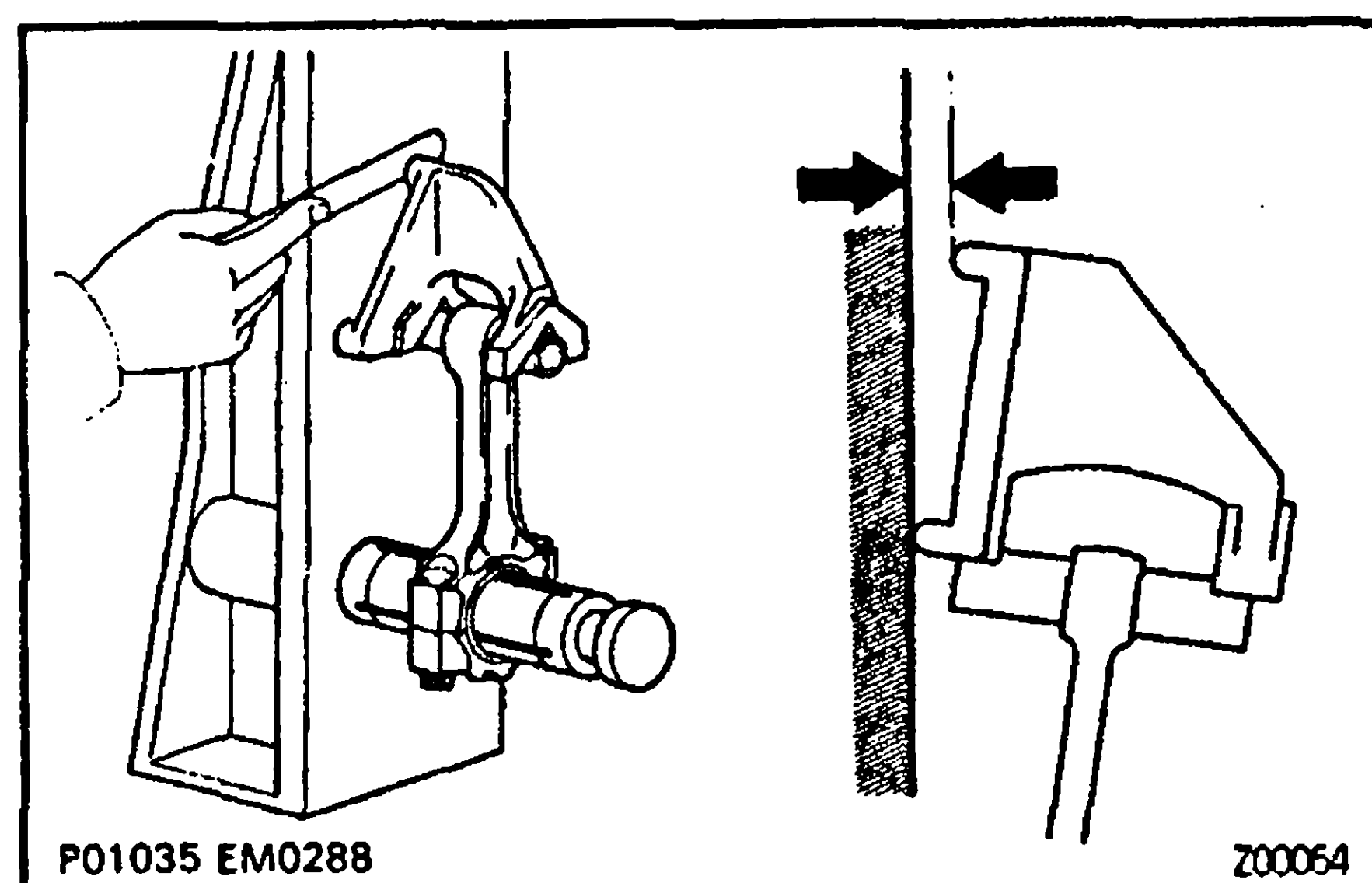
Using a rod aligner and feeler gauge, check the connecting rod alignment.

- Check for bend.

Maximum bend:

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

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

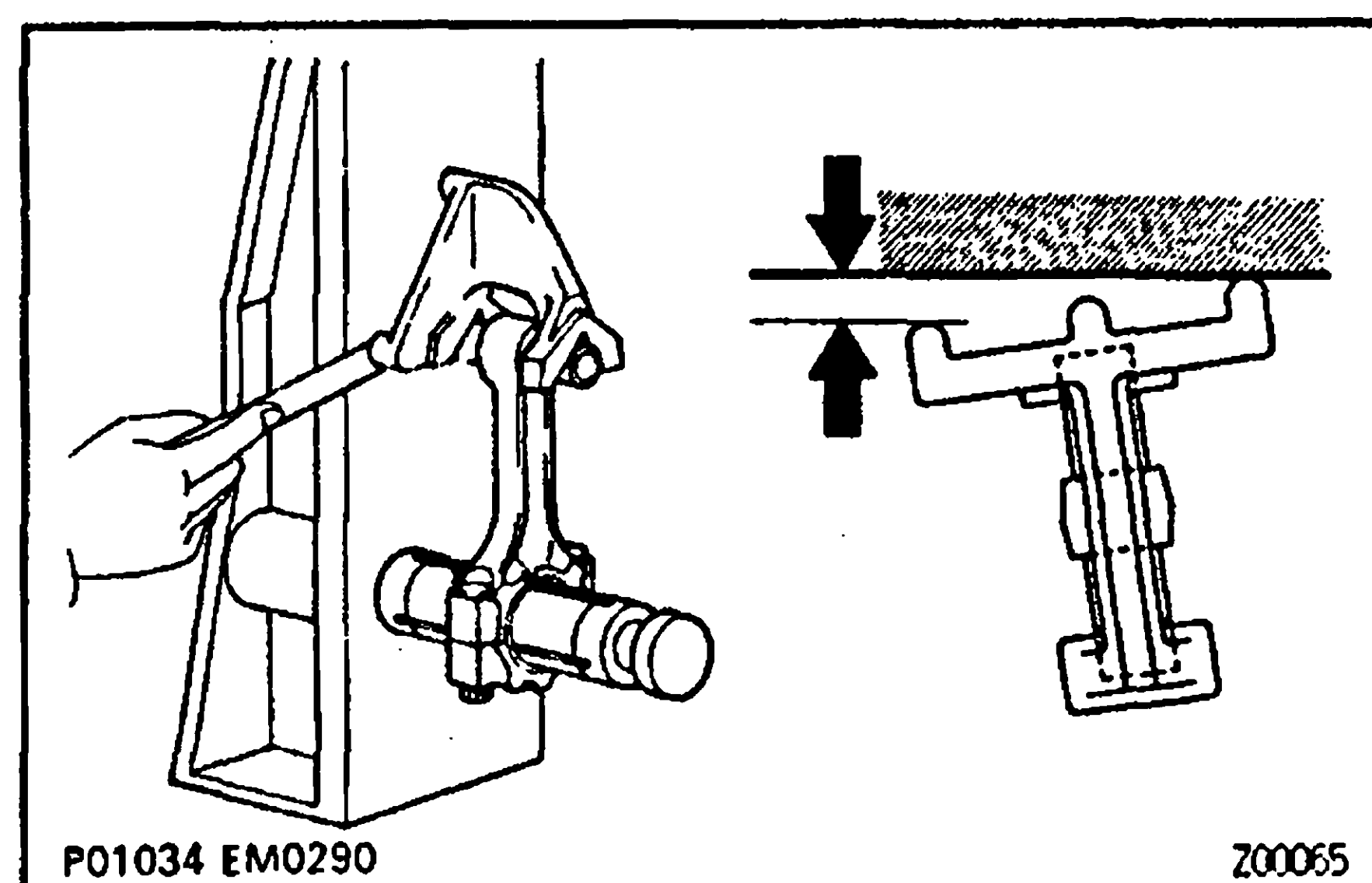


- Check for twist.

Maximum twist:

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

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

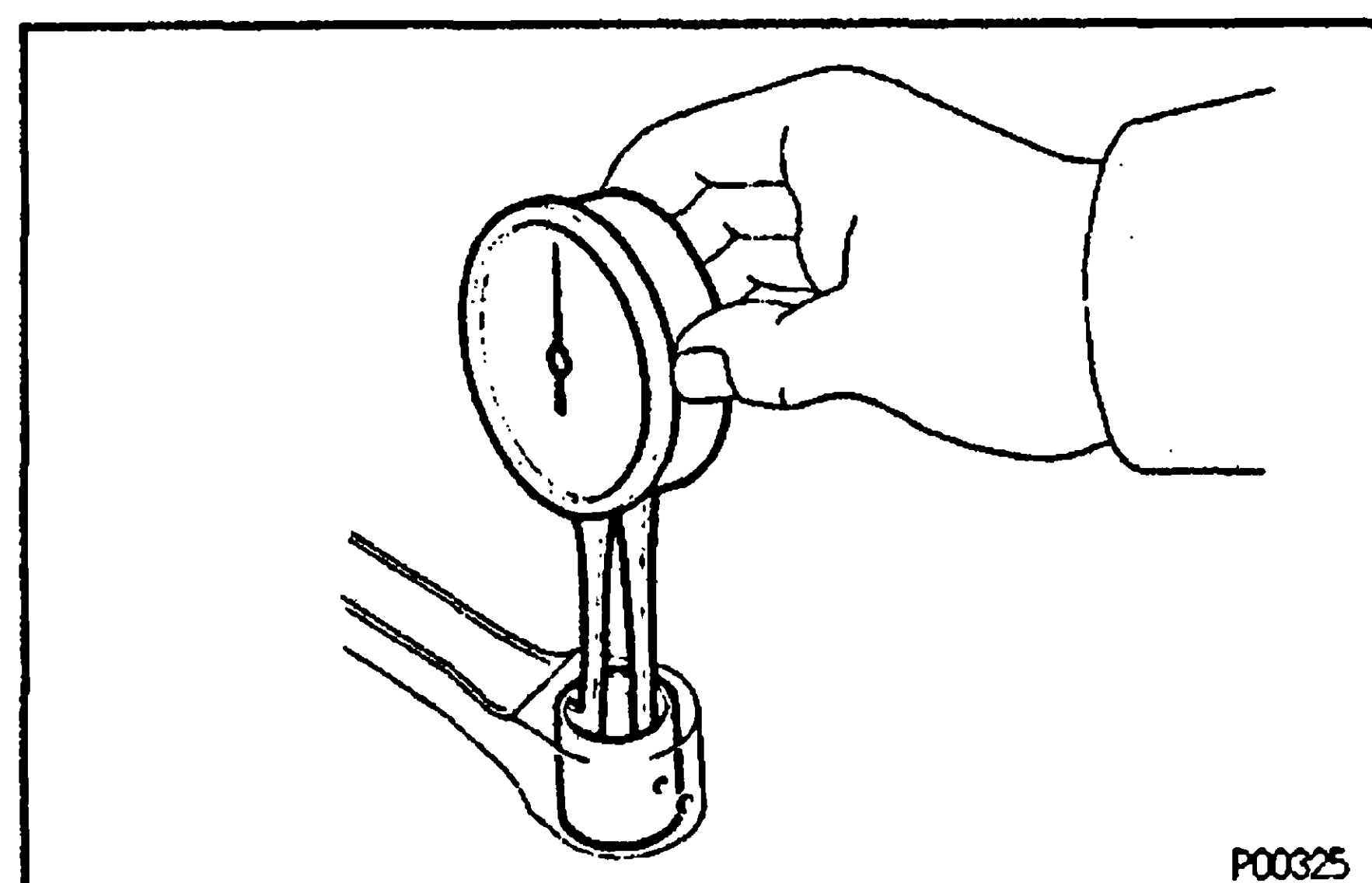


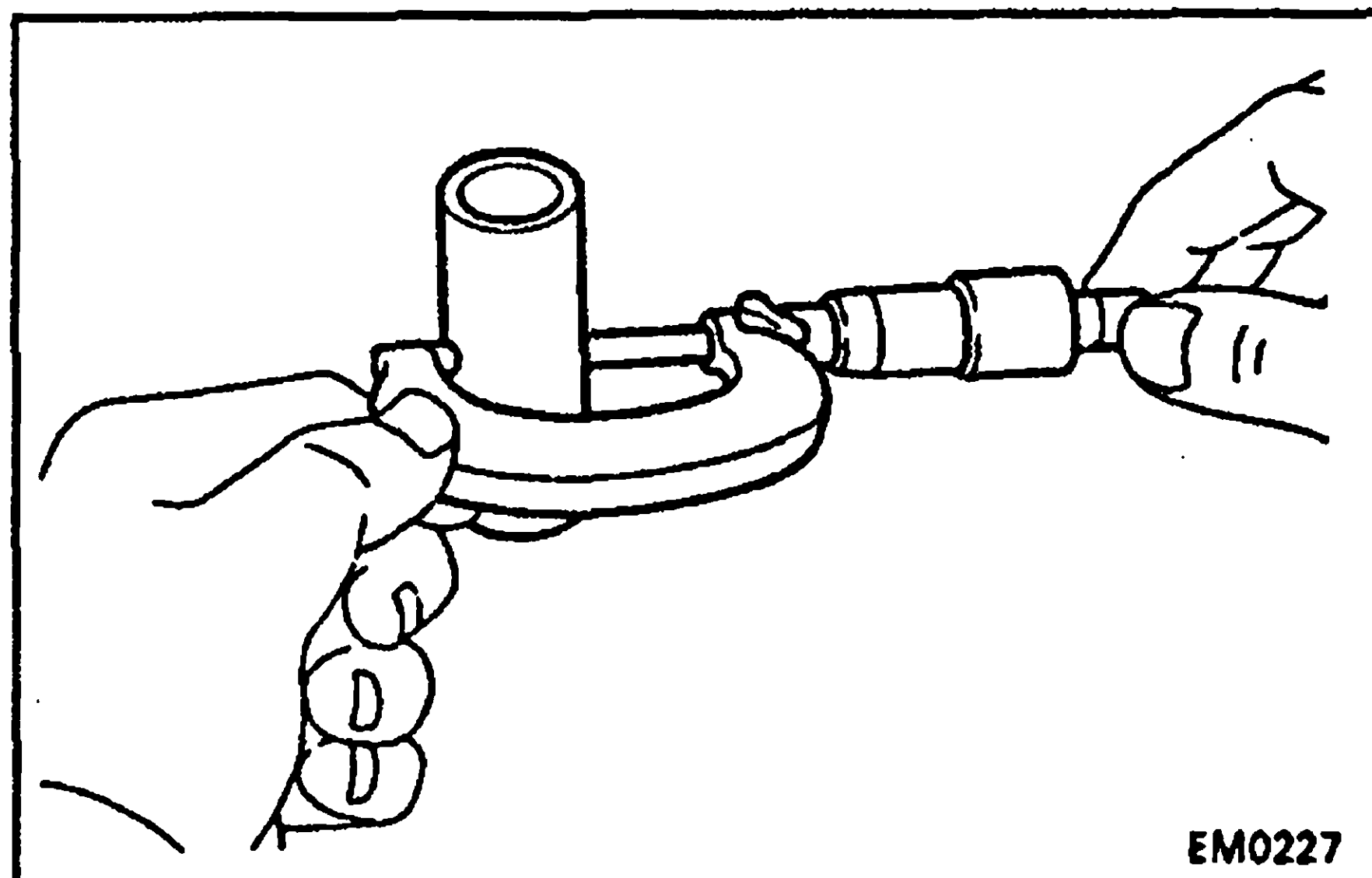
7. INSPECT PISTON PIN OIL CLEARANCE

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

Bushing inside diameter:

22.005 – 22.017 mm (0.8663 – 0.8668 in.)





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

Piston pin diameter:

21.997 — 22.009 mm (0.8660 — 0.8665 in.)

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

Standard oil clearance:

0.005 — 0.011 mm (0.0002 — 0.0004 in.)

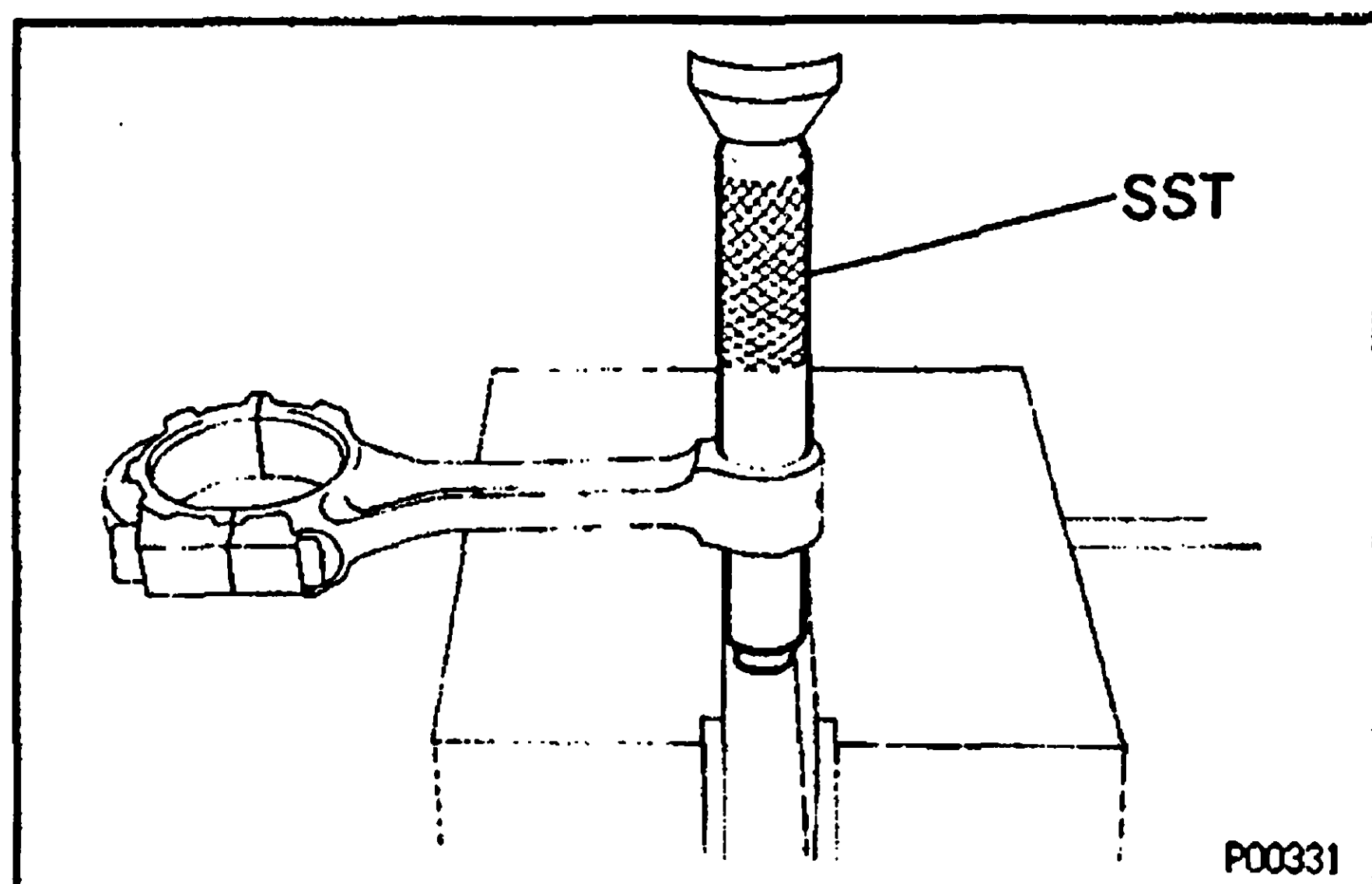
Maximum oil clearance:

0.05 mm (0.0020 in.)

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

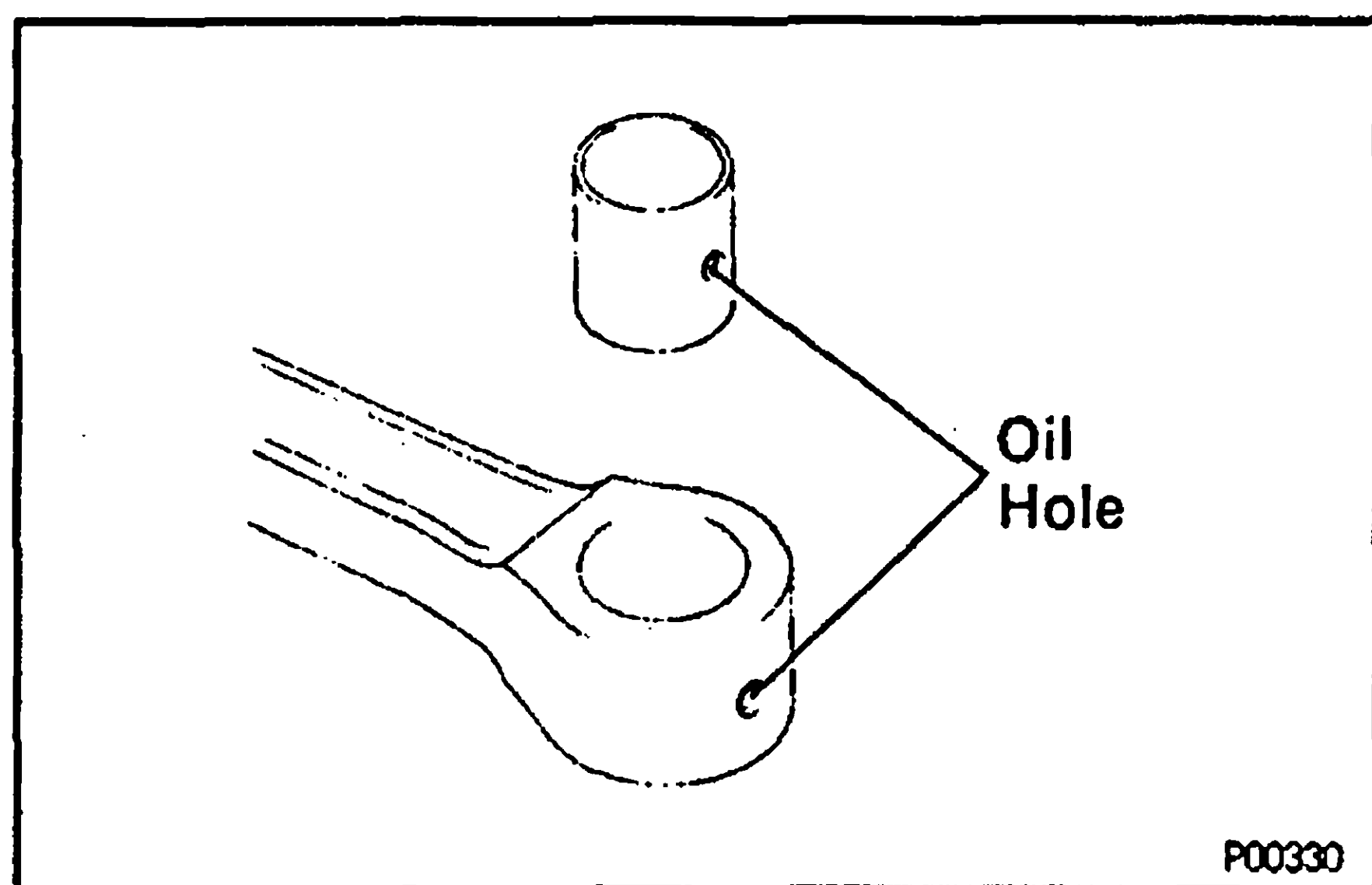
8. IF NECESSARY, REPLACE CONNECTING ROD BUSHING

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

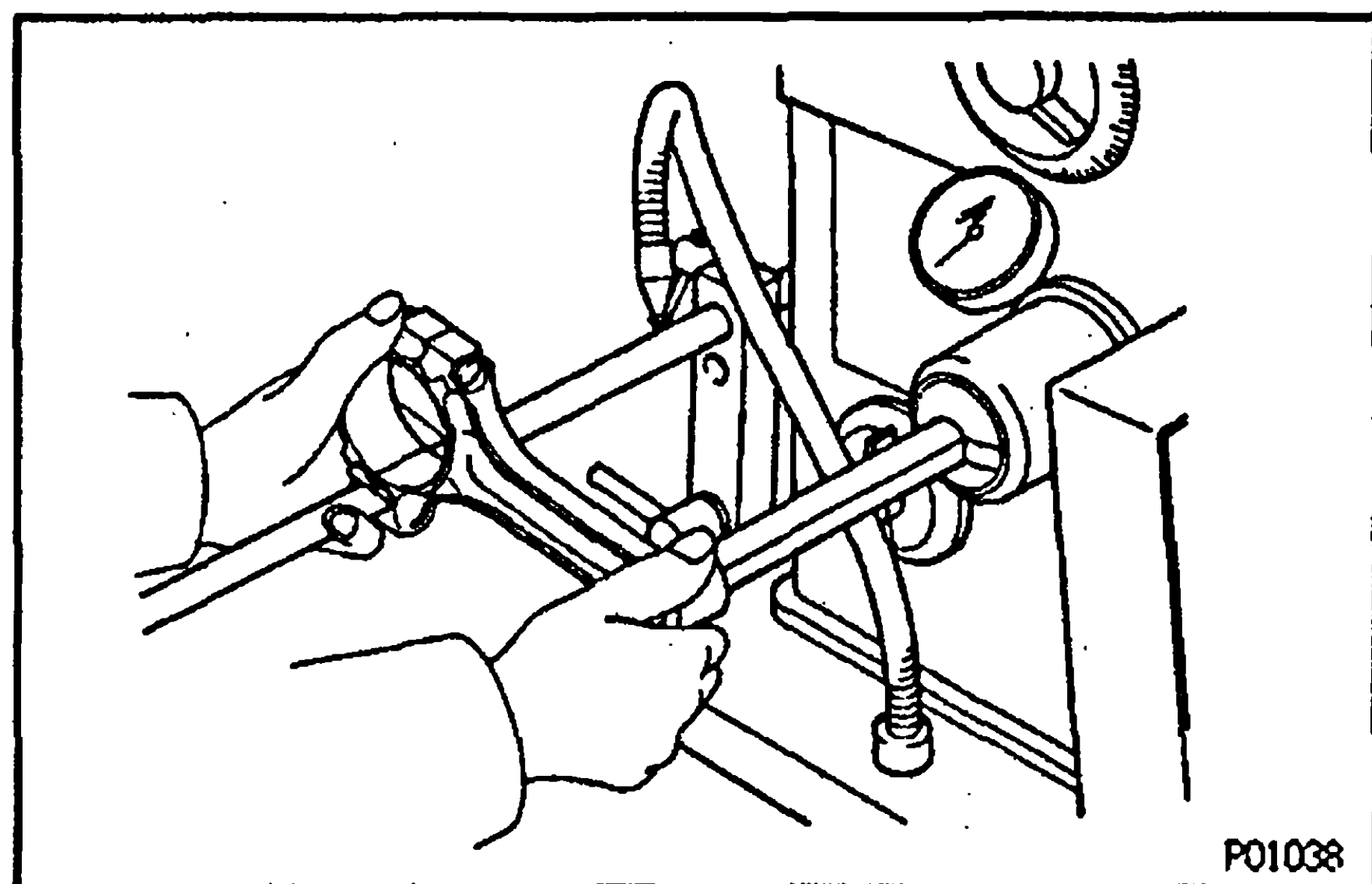


- (b) Align the oil holes of a new bushing and the connecting rod.

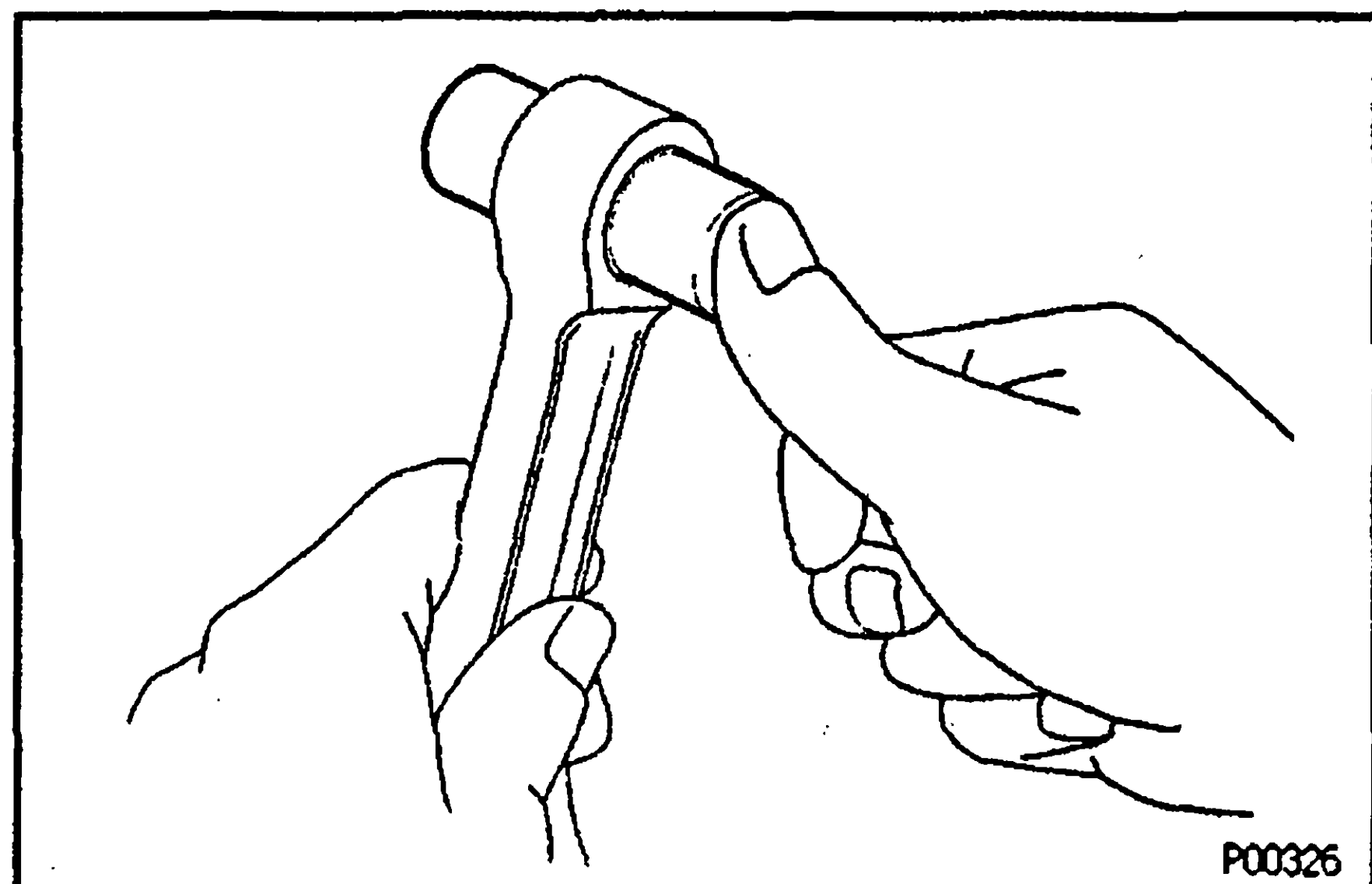
- (c) Using SST and a press, press in the bushing.
SST 09222-30010

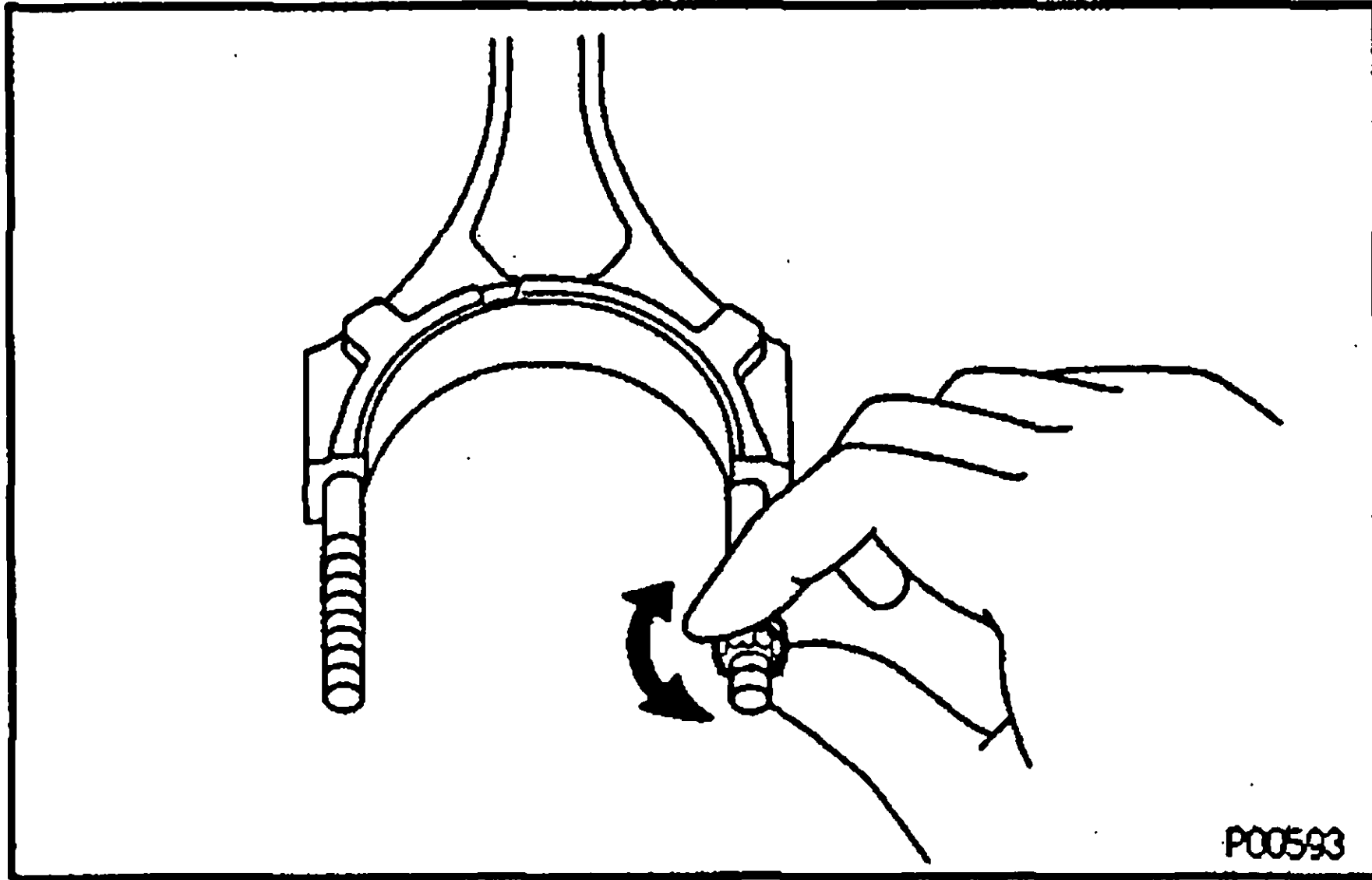


- (d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (see step 13 above) between the bushing and piston pin.



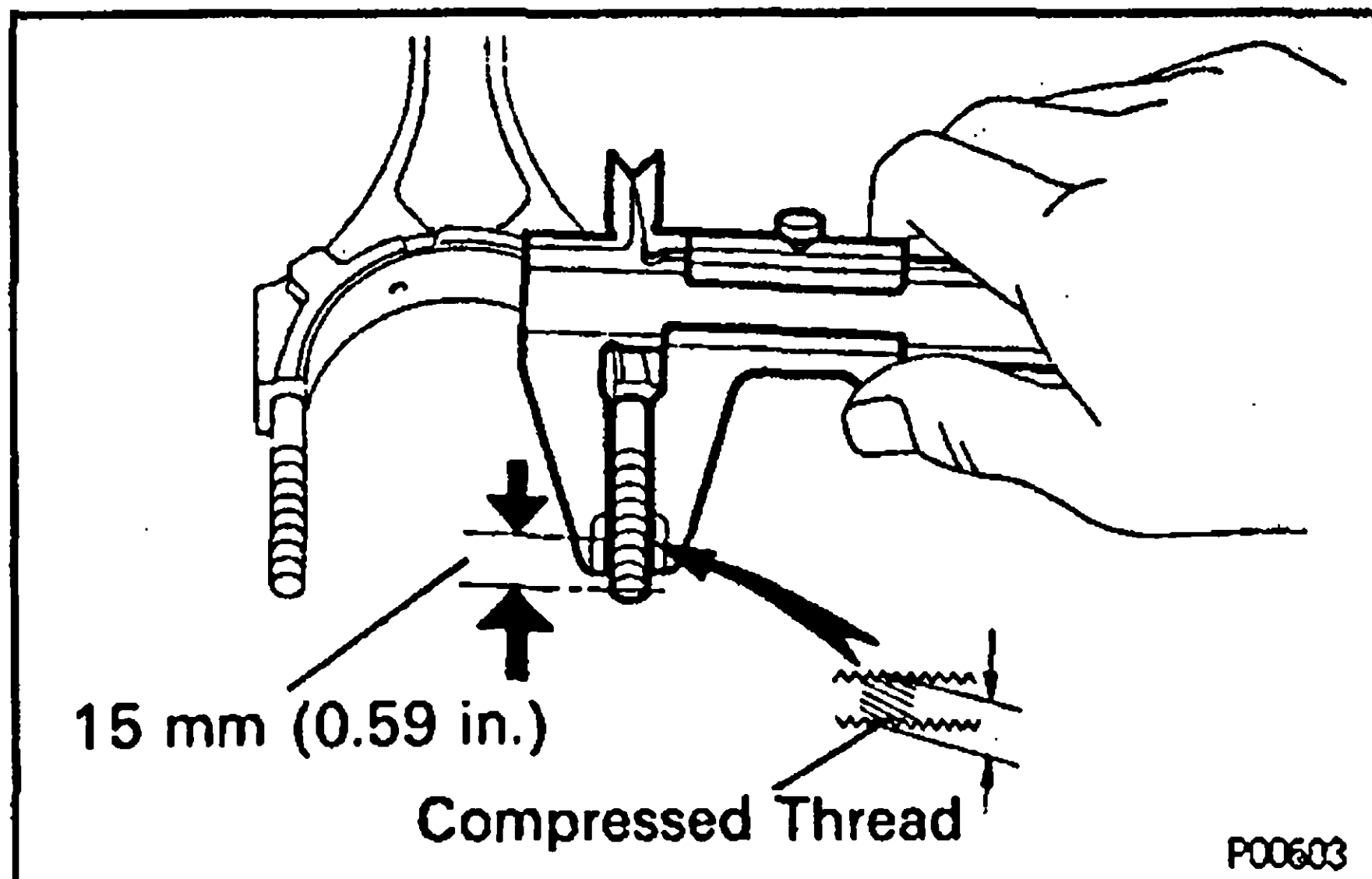
- (e) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.





9. INSPECT CONNECTING ROD BOLTS

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



- (b) If the cap nut cannot be turned easily, measure the outer diameter of the compressed thread with a vernier caliper.

Standard outer diameter:

7.860 — 8.000 mm (0.3094 — 0.3150 in.)

Minimum outer diameter:

7.600 mm (0.2992 in.)

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

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

10. CYLINDER BORING

HINT:

- Bore all the 6 cylinders for the oversized piston outside diameter.
- Replace all the piston rings with ones to match the oversized pistons.

A. Keep oversized pistons

Oversized piston diameter:

O/S 0.50

93.856 — 93.886 mm (3.6951 — 3.6963 in.)

B. Calculate amount to bore cylinders

- (a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 26 mm (1.02 in.) from the piston head.
- (b) Calculate the amount of each cylinder is to be rebored as follows:

Size to be rebored = P + C — H

P = Piston diameter

C = Piston oil clearance

0.134 — 0.154 mm (0.0053 — 0.0060 in.)

H = Allowance for honing

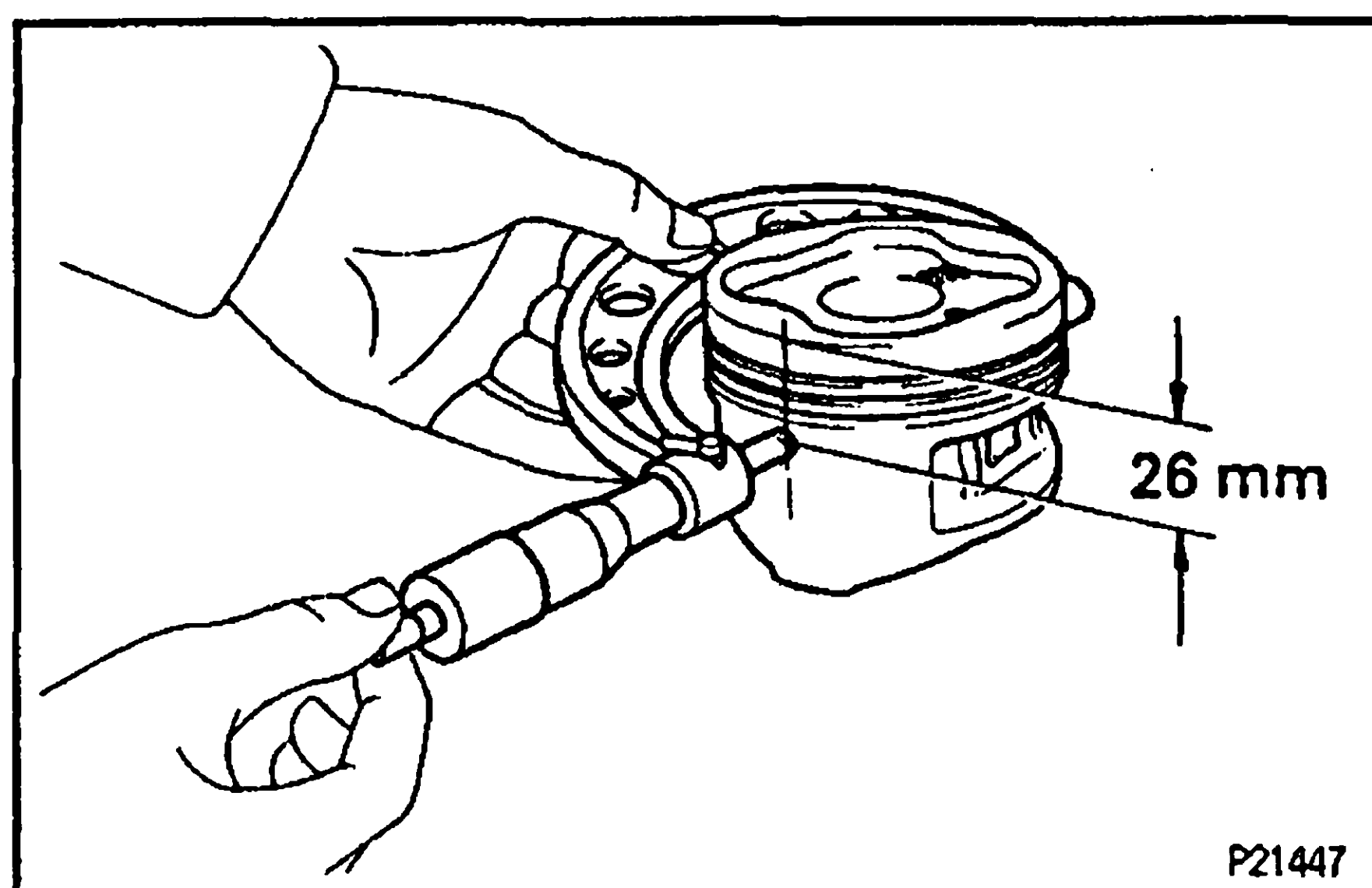
0.02 mm (0.0008 in.) or less

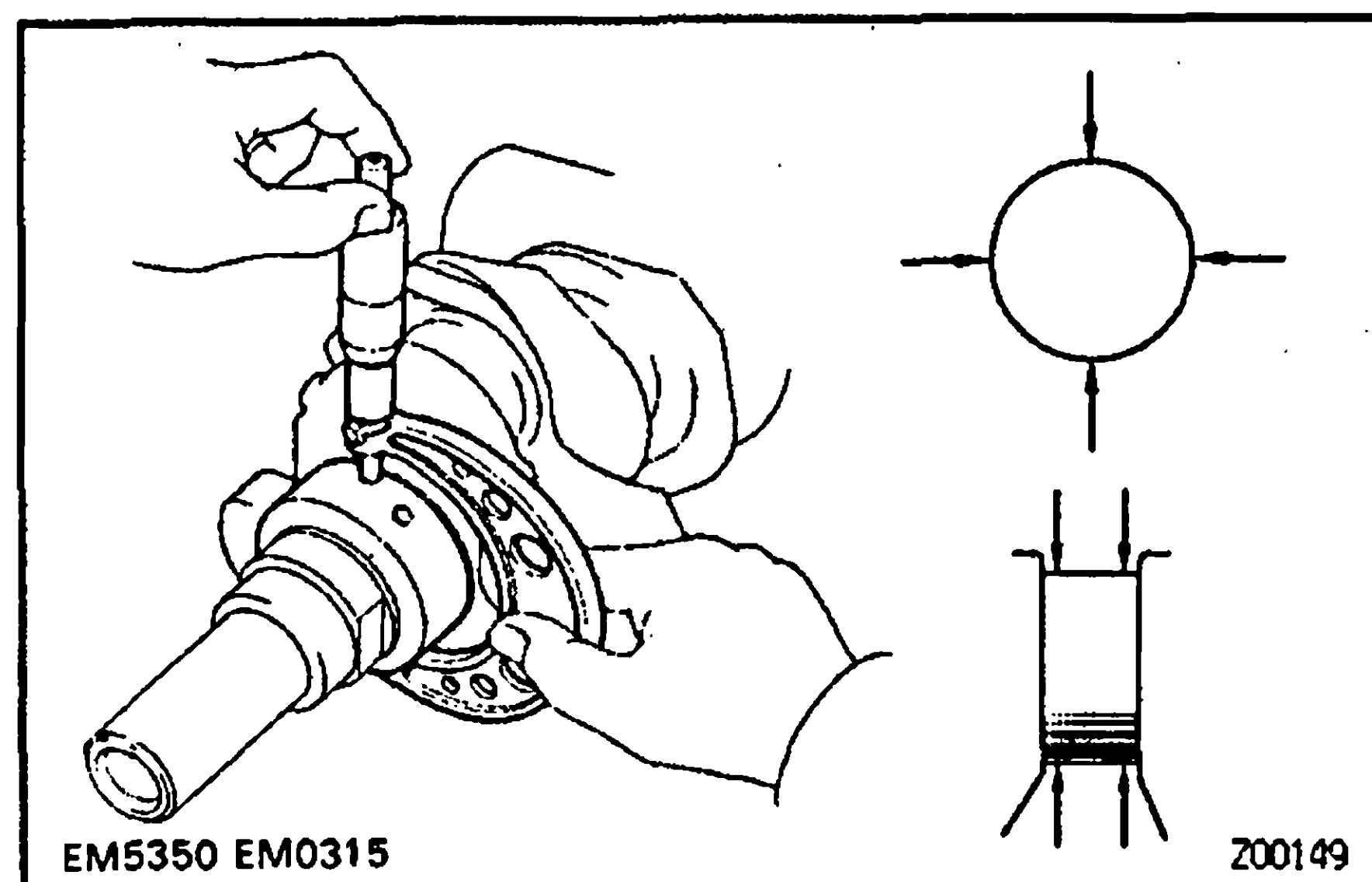
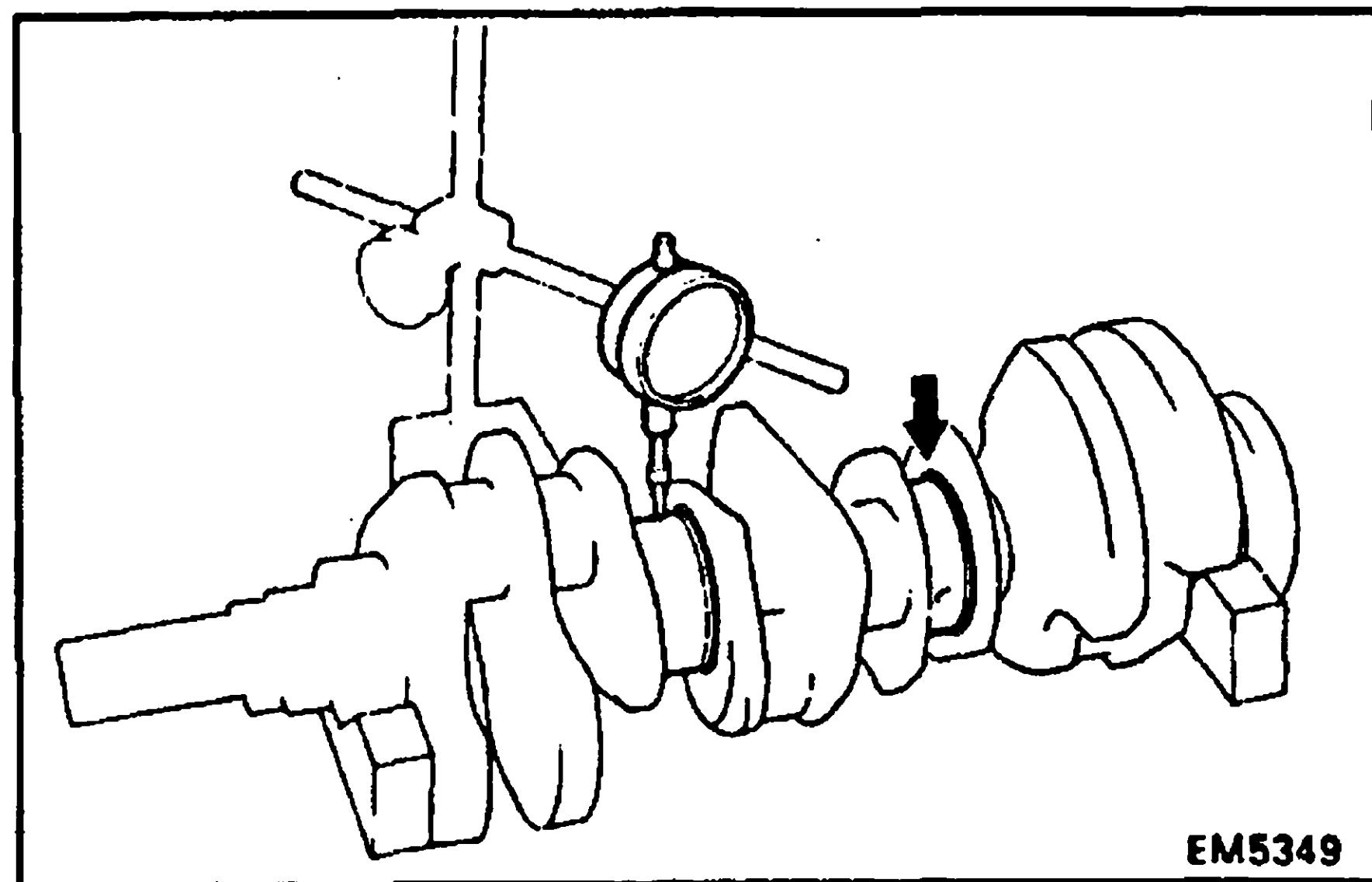
C. Bore and hone cylinder to calculated dimensions

Maximum honing:

0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.





CRANKSHAFT INSPECTION

1. INSPECT CRANKSHAFT FOR RUNOUT

- (a) Place the crankshaft on V—blocks.
- (b) Using a dial indicator, measure the circle runout at the No.2 and No.3 journals.

Maximum circle runout:

0.06 mm (0.0024 in.)

If the circle runout is greater than the 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.

Diameter:

Item	STD mm (in.)	U/S 0.25 mm (in.)
Main journal	63.985 – 64.000 (2.5191 – 2.5197)	63.745 – 63.755 (2.5098 – 2.5100)
Crank pin	54.987 – 55.000 (2.1648 – 2.1654)	54.745 – 54.755 (2.1553 – 2.1557)

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

(See disassembly in cylinder block)

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

Maximum taper and out—of—round:

0.02 mm (0.0008 in.)

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

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

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

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

CRANKSHAFT OIL SEALS 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, pry out the oil seal.
- (b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump body edge.
SST 09309-37010
- (c) Apply MP grease to the oil seal lip.

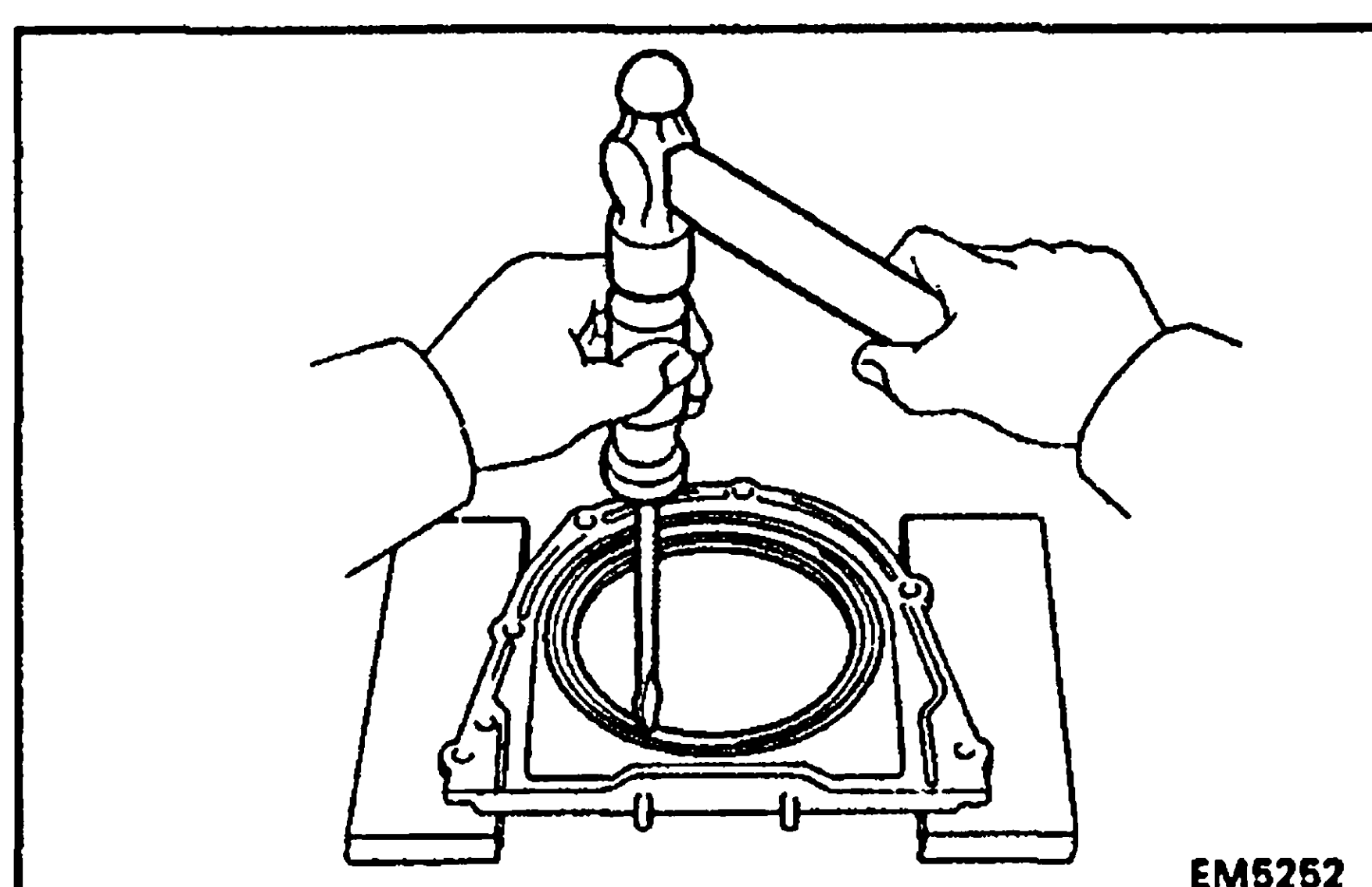
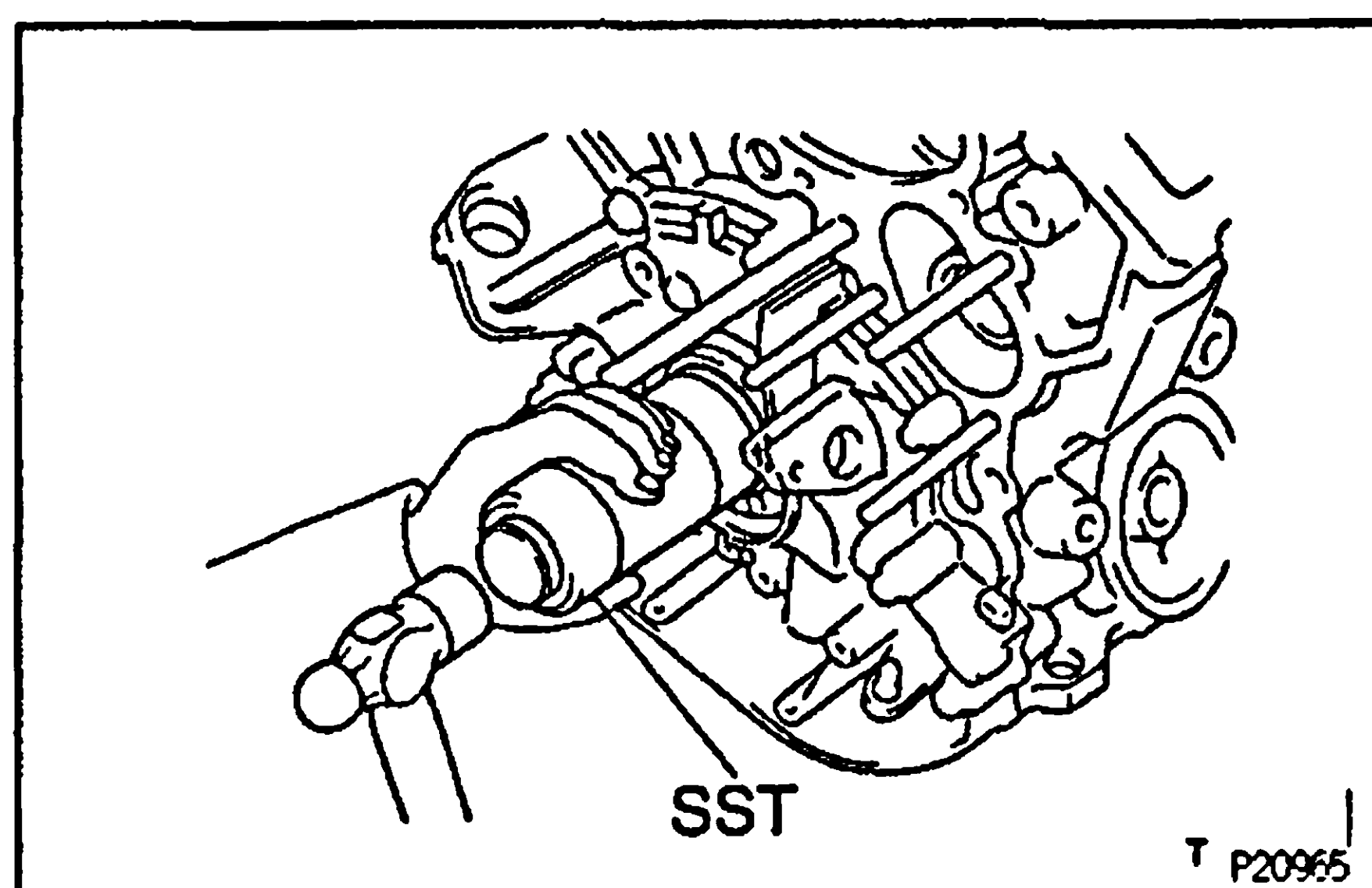
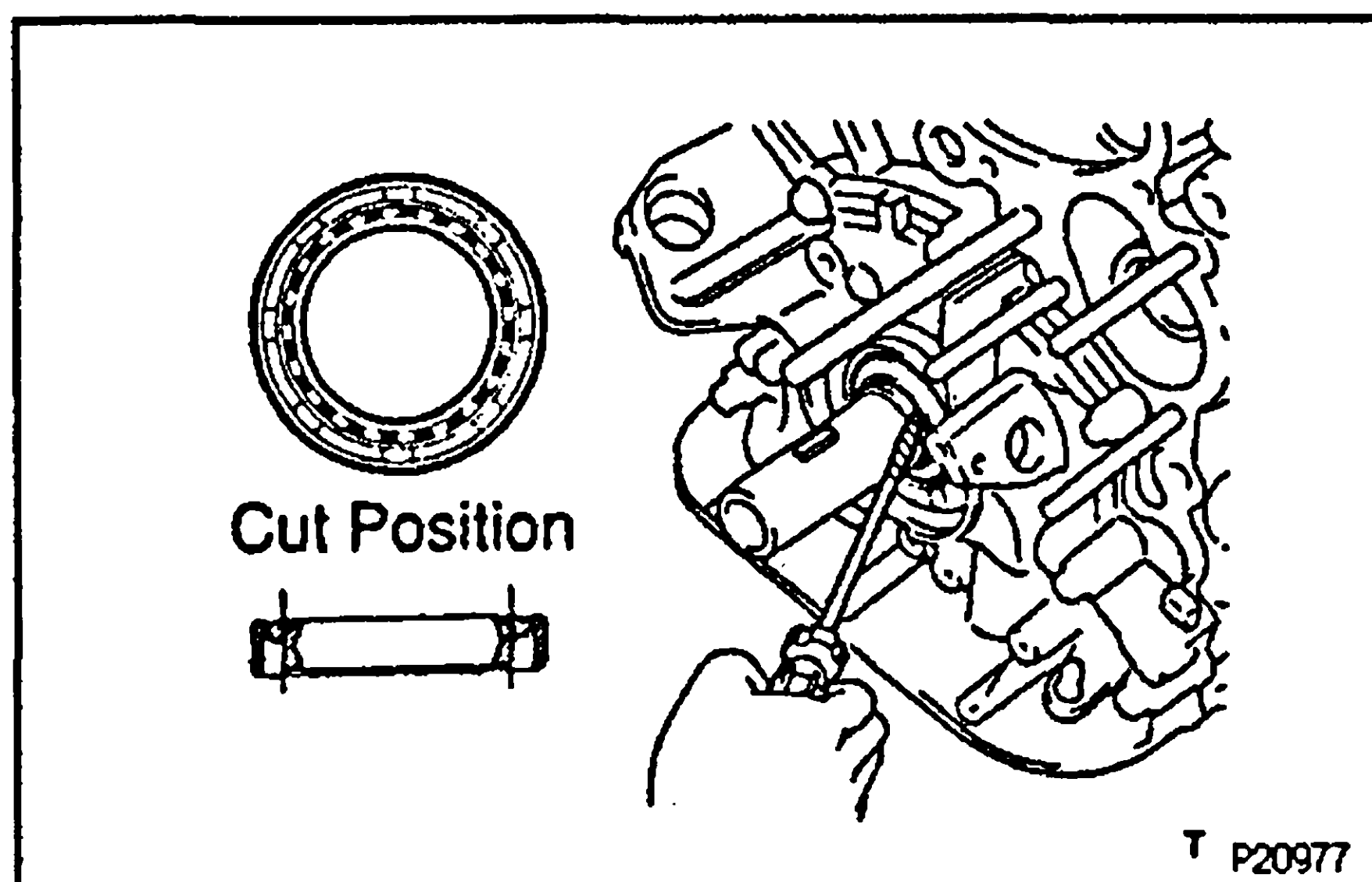
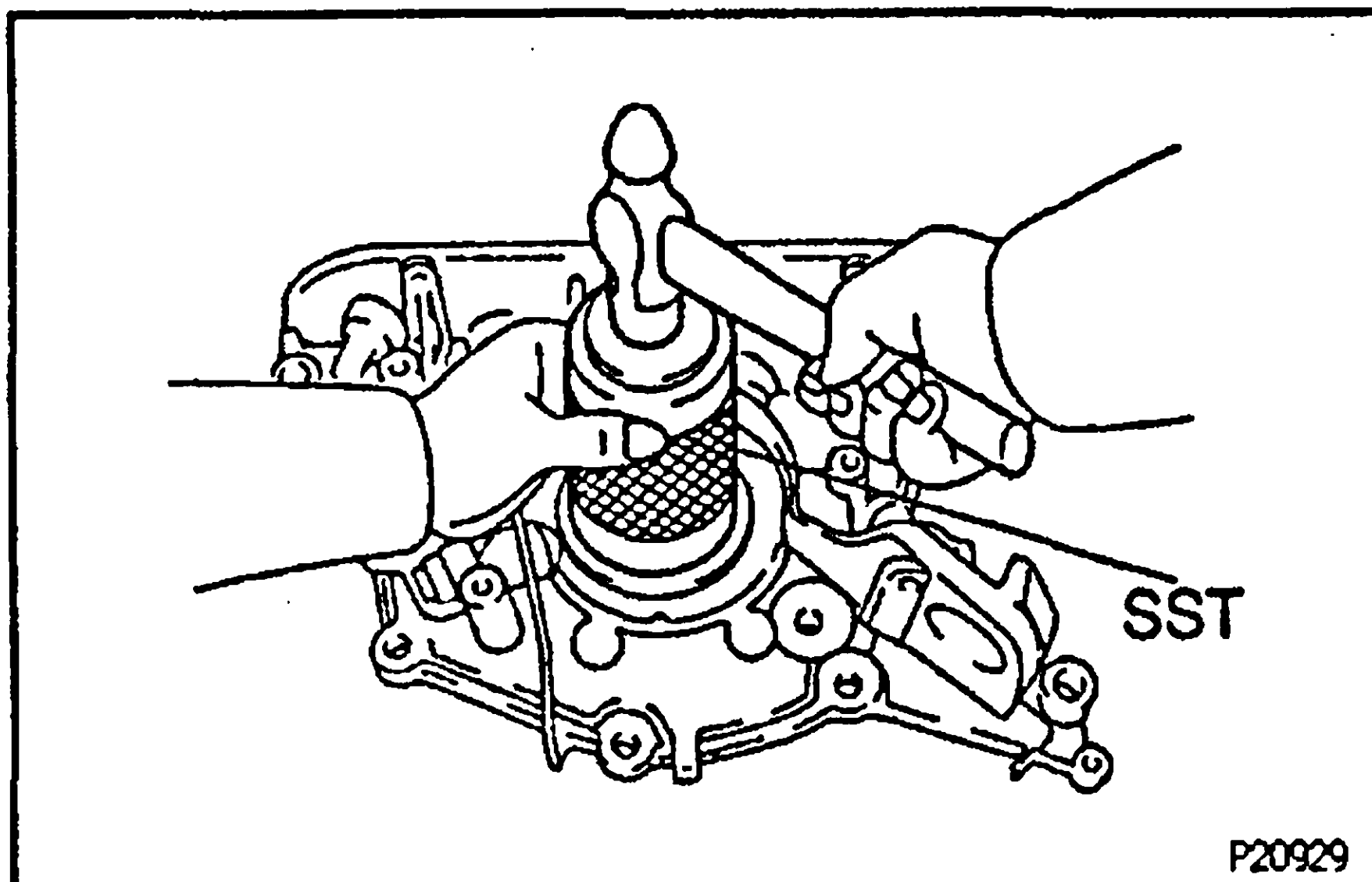
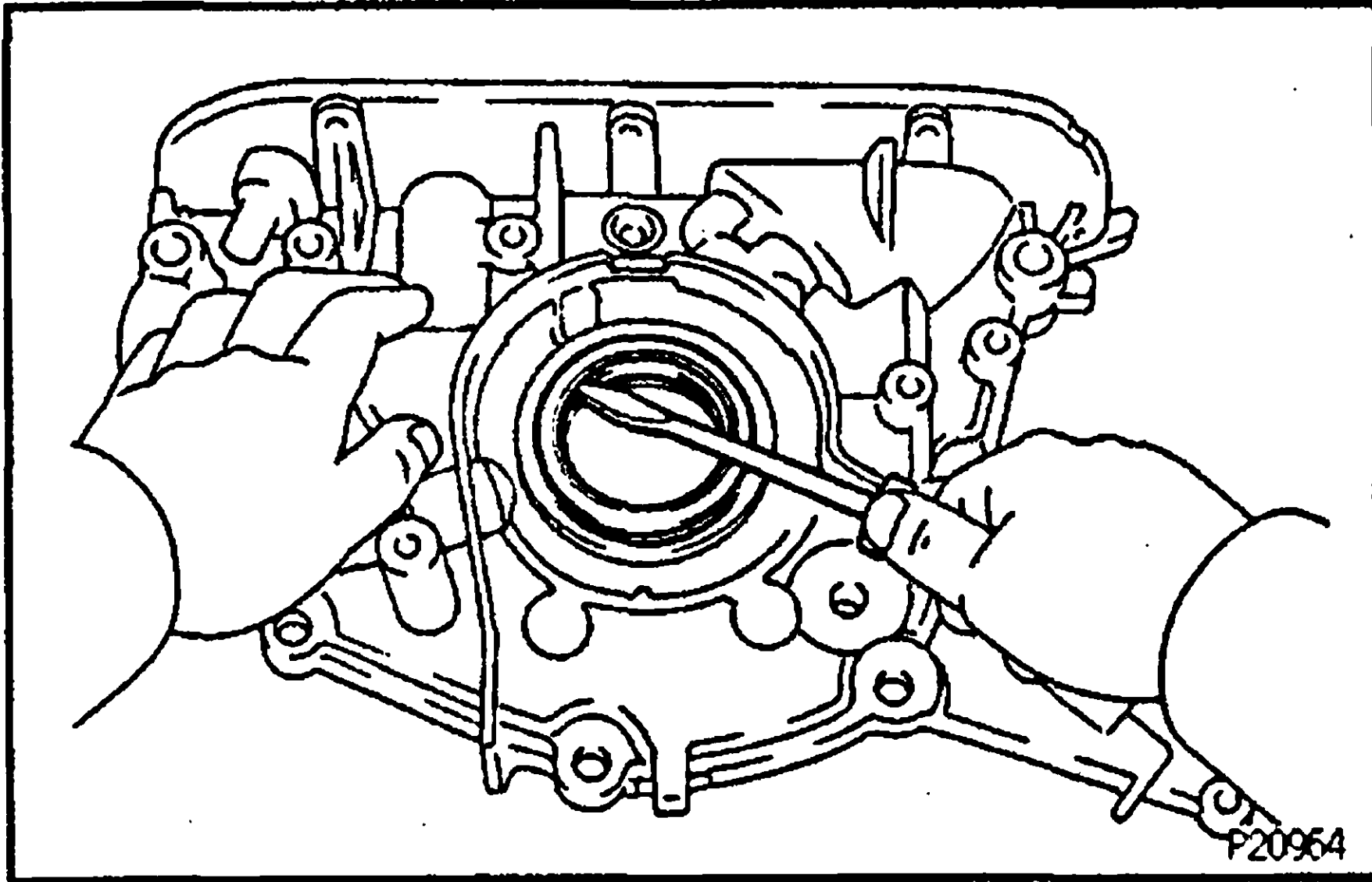
B. If oil pump is installed to the cylinder block:

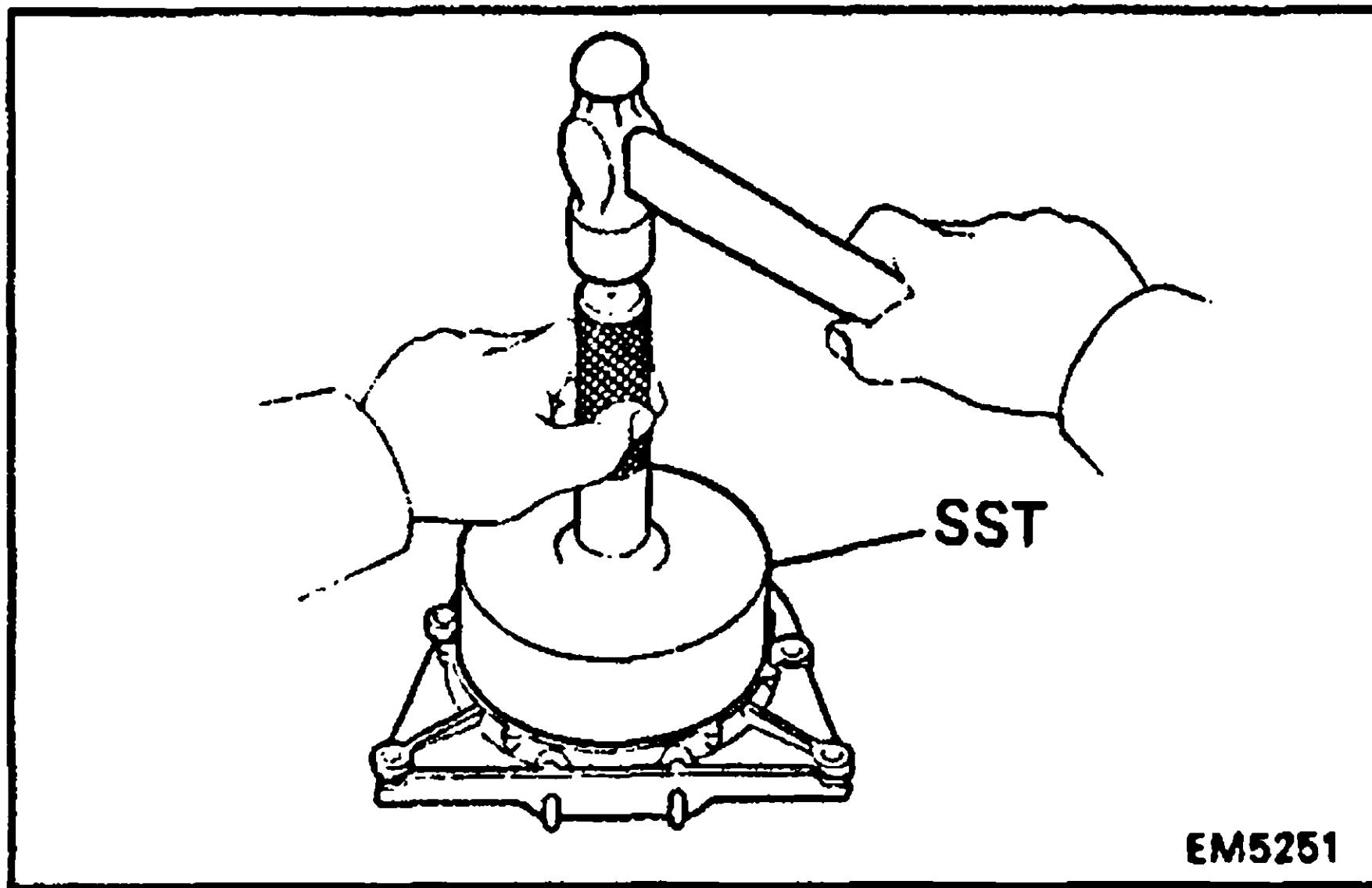
- (a) Using a knife, cut off the oil seal lip.
- (b) Using a screwdriver, pry out the oil seal.
NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.

- (c) Apply MP grease to a new oil seal lip.
- (d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump body edge.
SST 09306-37010

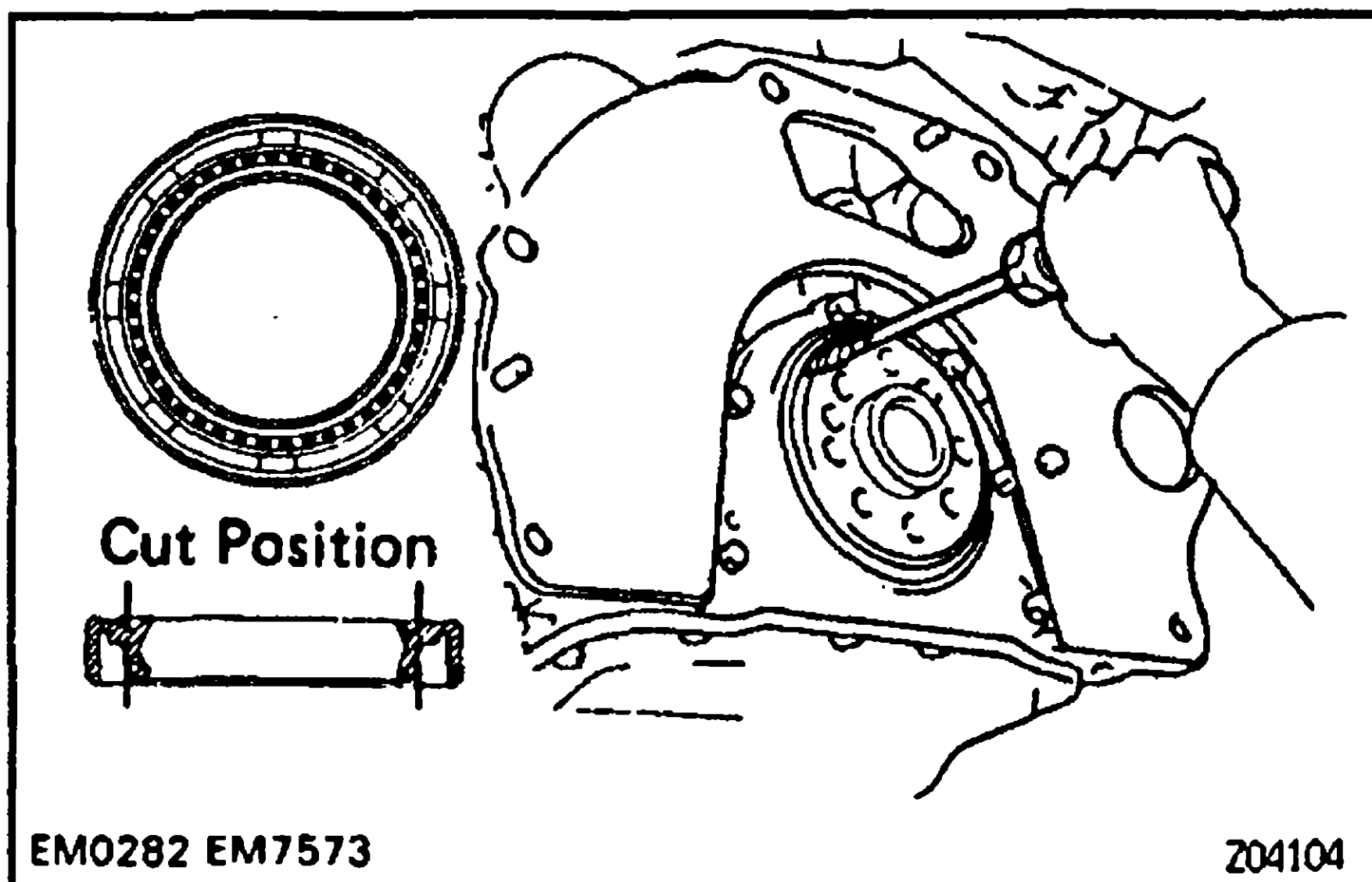
2. REPLACE CRANKSHAFT REAR OIL SEAL**A. If rear oil seal retainer is removed from cylinder block:**

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



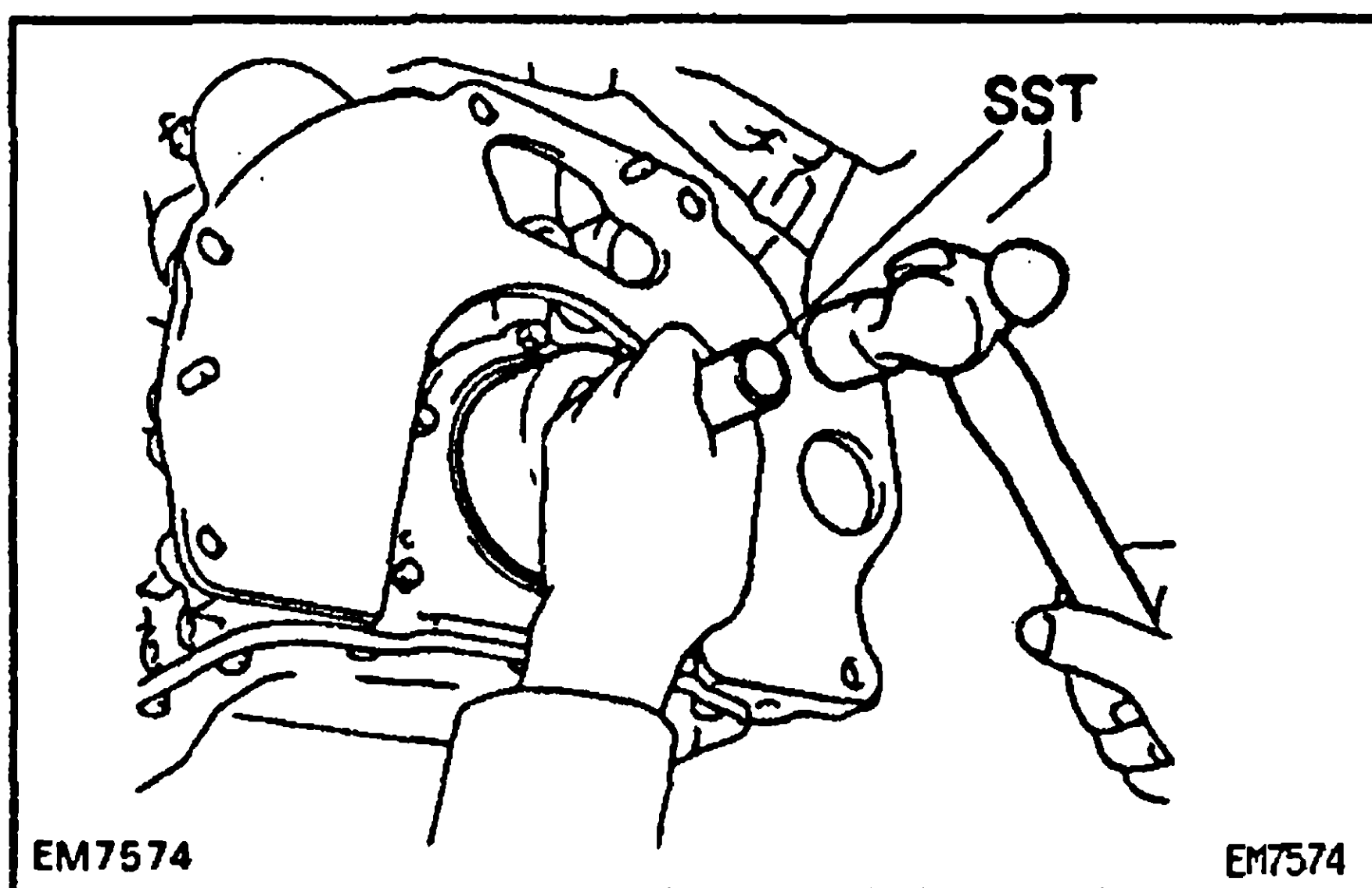


- (b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223-15030, 09950-70010 (09951-07150)
- (c) Apply MP grease to the oil seal lip.

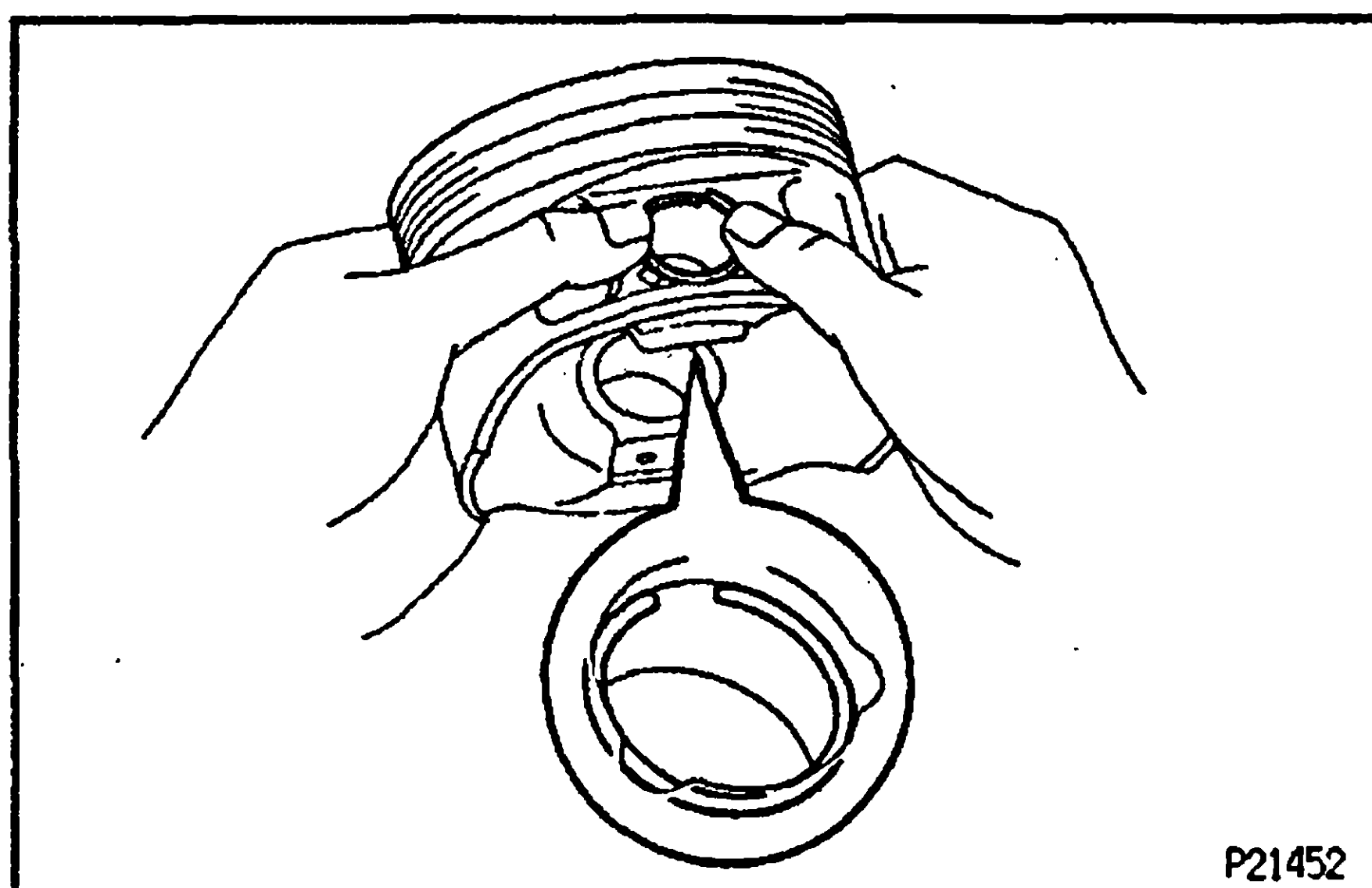


B. If rear oil seal retainer is installed to cylinder block:

- (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.



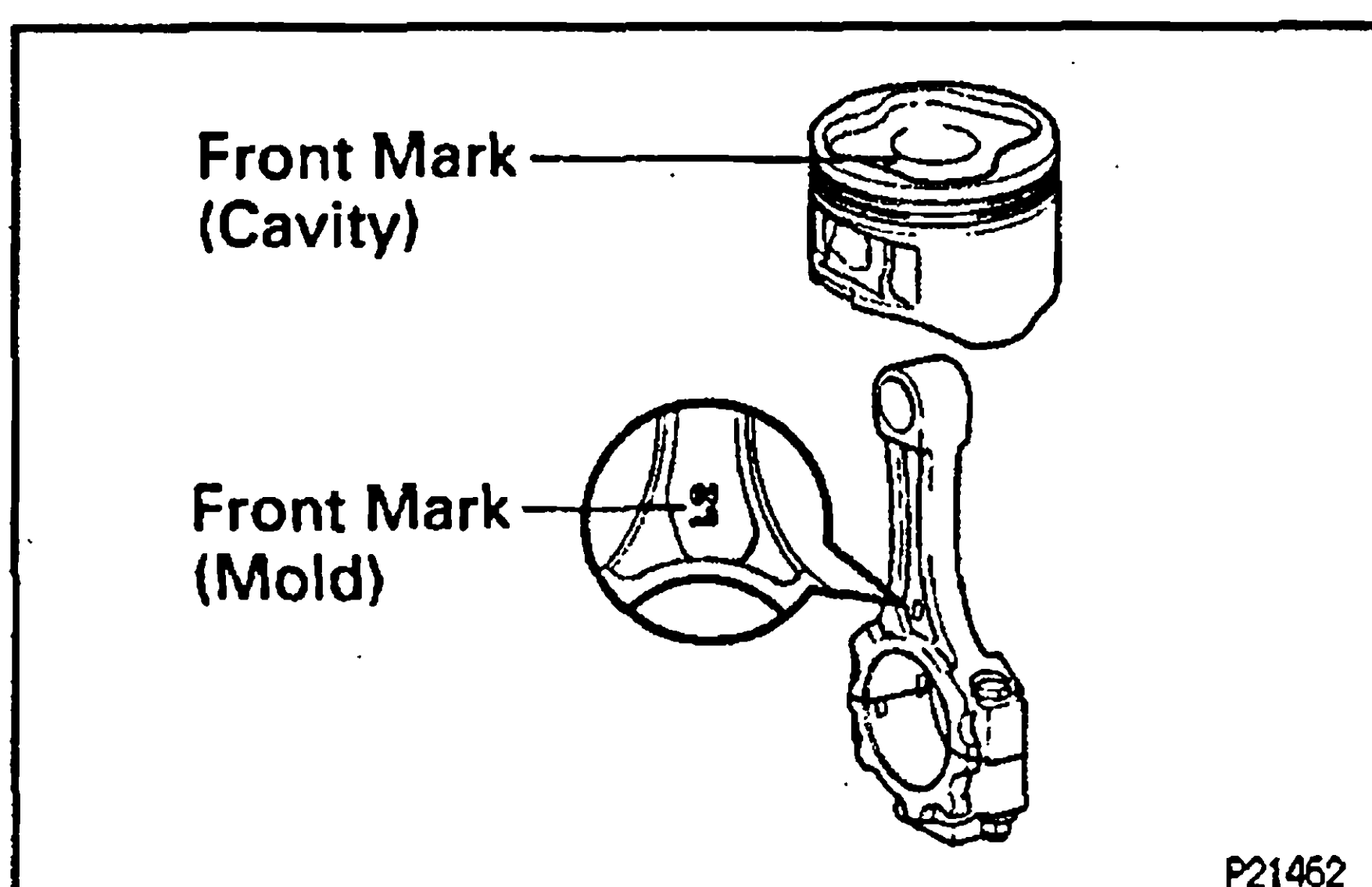
- (c) Apply MP grease to a new oil seal lip.
- (d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223-15030, 09950-70010 (09951-07150)



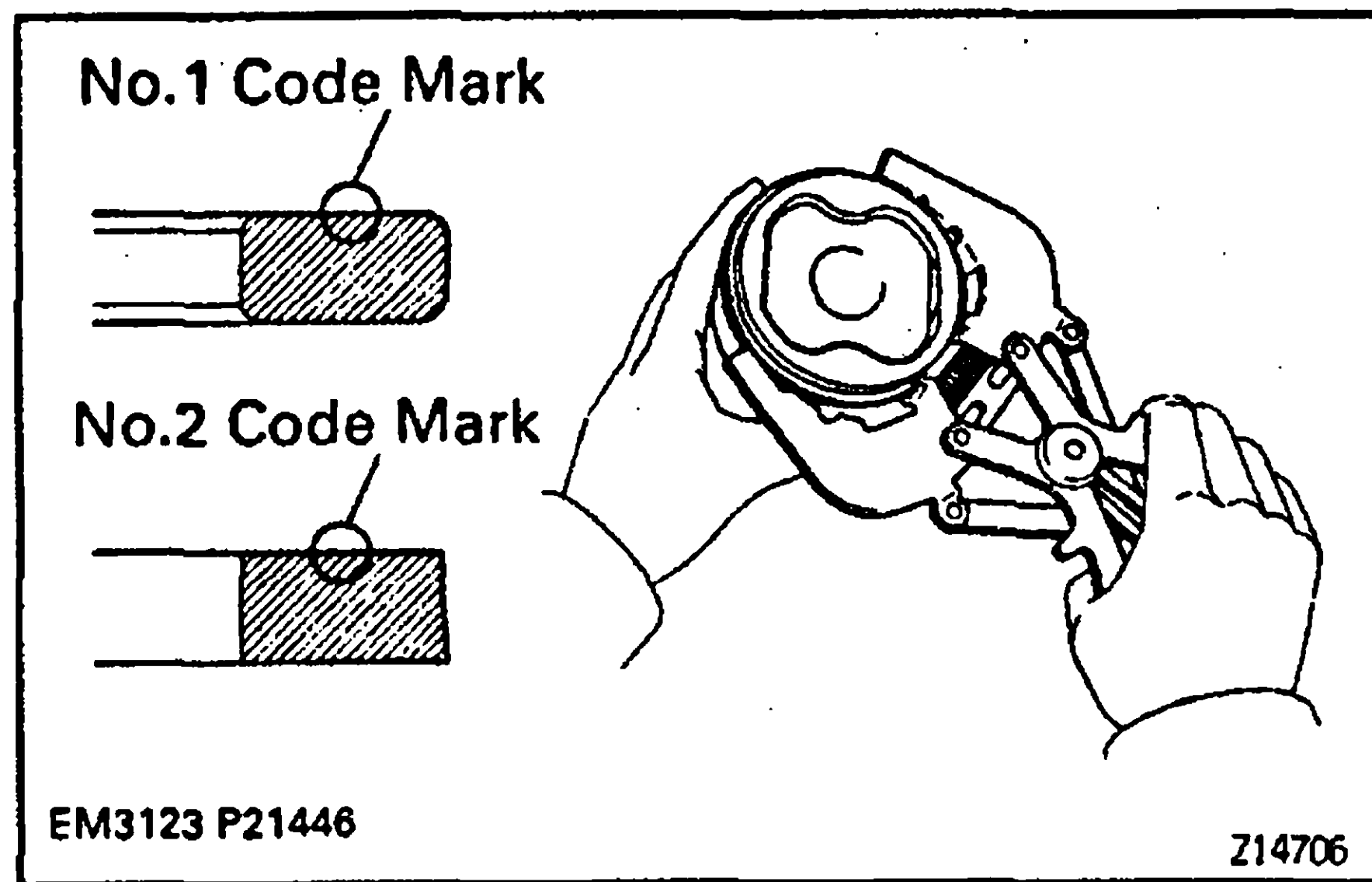
PISTON AND CONNECTION ROD ASSEMBLY

1. ASSEMBLE PISTON AND CONNECTING ROD

- (a) Using a small screwdriver, install a new snap ring at one end of the piston pin hole.
HINT: Be sure that end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.
- (b) Gradually heat the piston to about 60°C (140°F).



- (c) Coat the piston pin with engine oil.
- (d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.
- (e) Using a small screwdriver, install a new snap ring on the other end of the piston pin hole.
HINT: Be sure that end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.



2. INSTALL PISTON RINGS

- Install the oil ring expander and 2 side rails by hand.
- Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

Code mark:

No.1

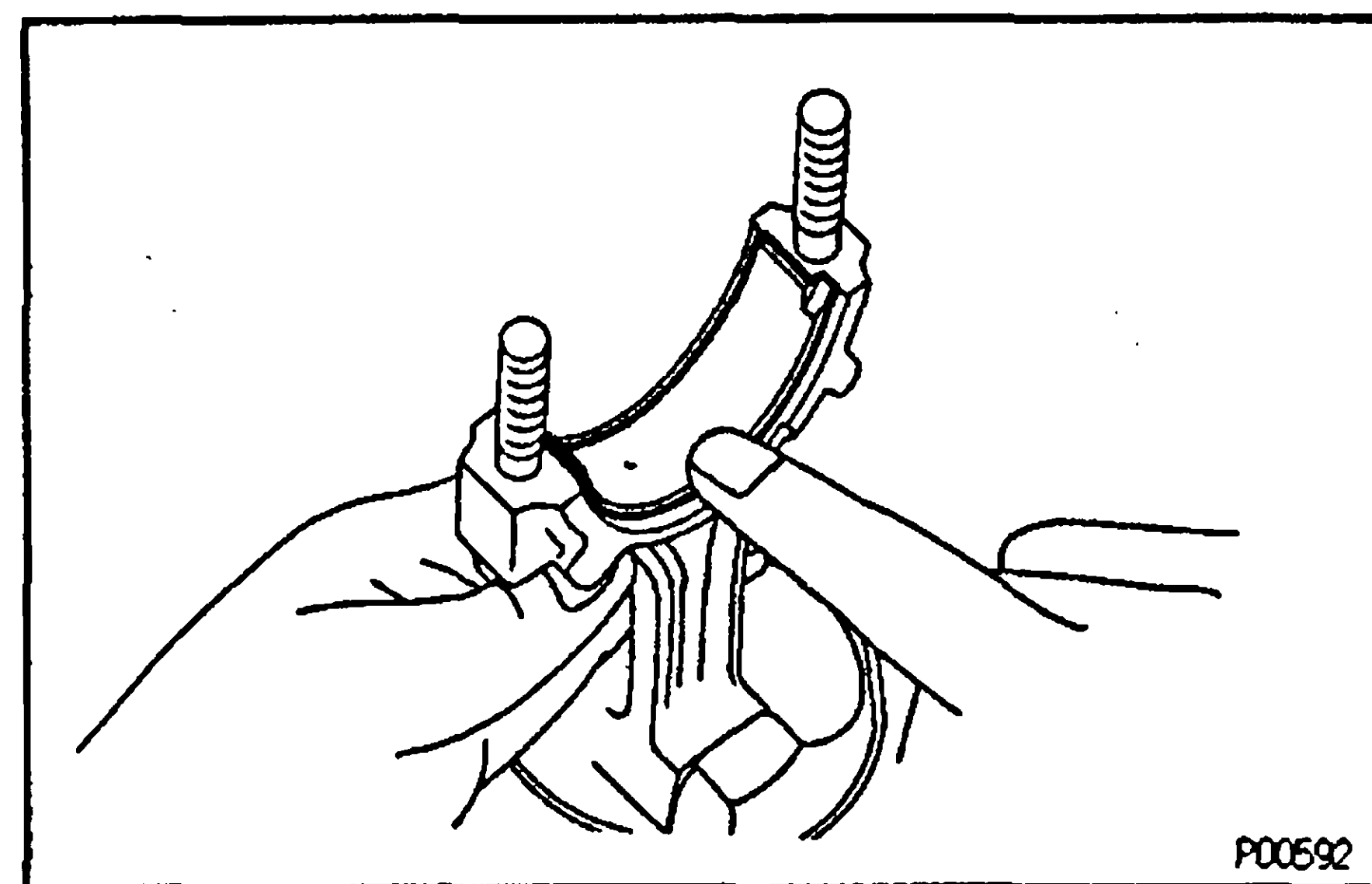
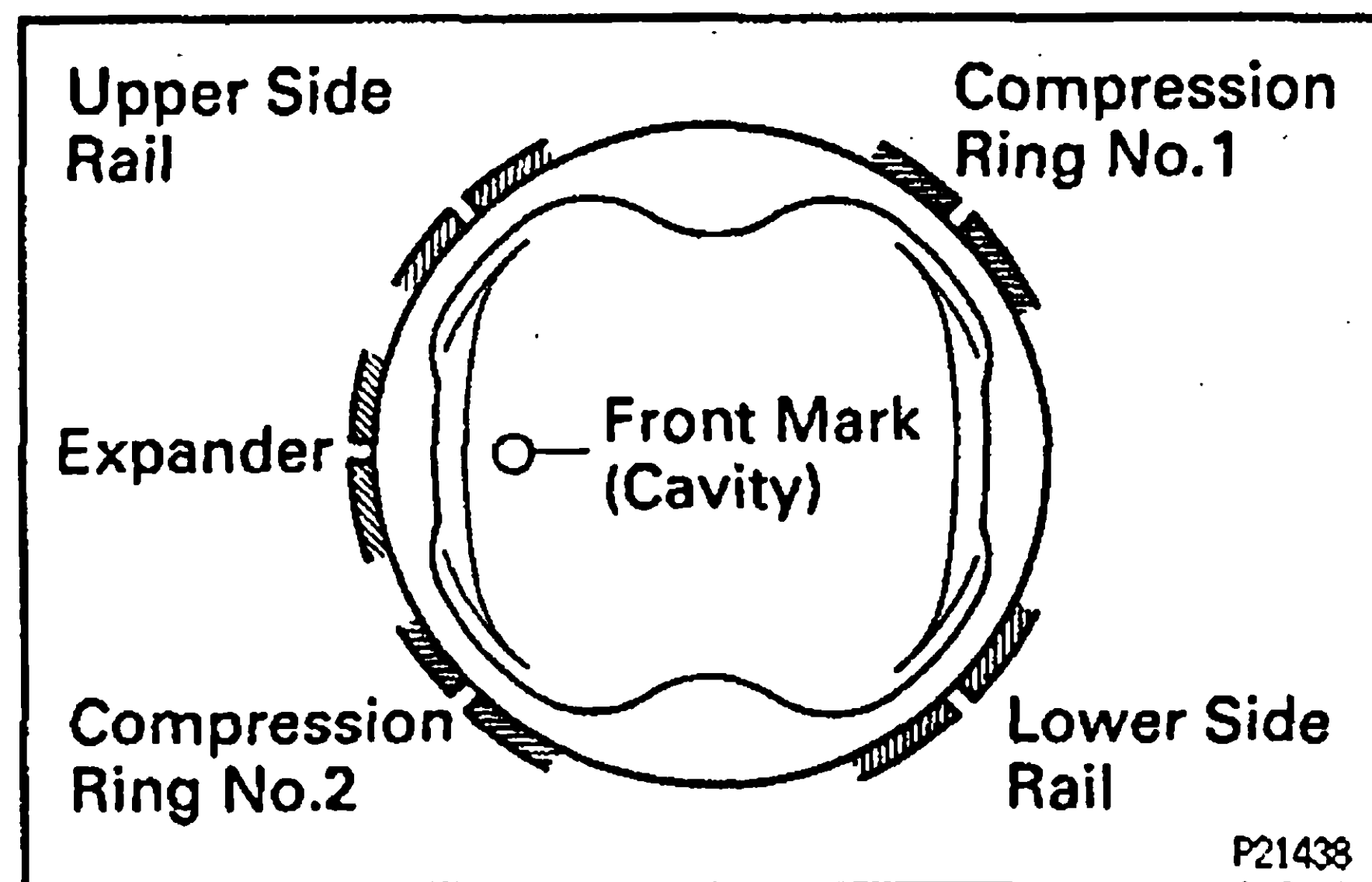
1R or T

No.2

2R or T

- Position the piston rings so that the ring ends are as shown.

NOTICE: Do not align the ring ends.



3. INSTALL BEARINGS

- Align the bearing claw with the groove of the connecting rod or connecting cap.
- Install the bearings in the connecting rod and connecting rod cap.

CYLINDER BLOCK ASSEMBLY

607C8-01

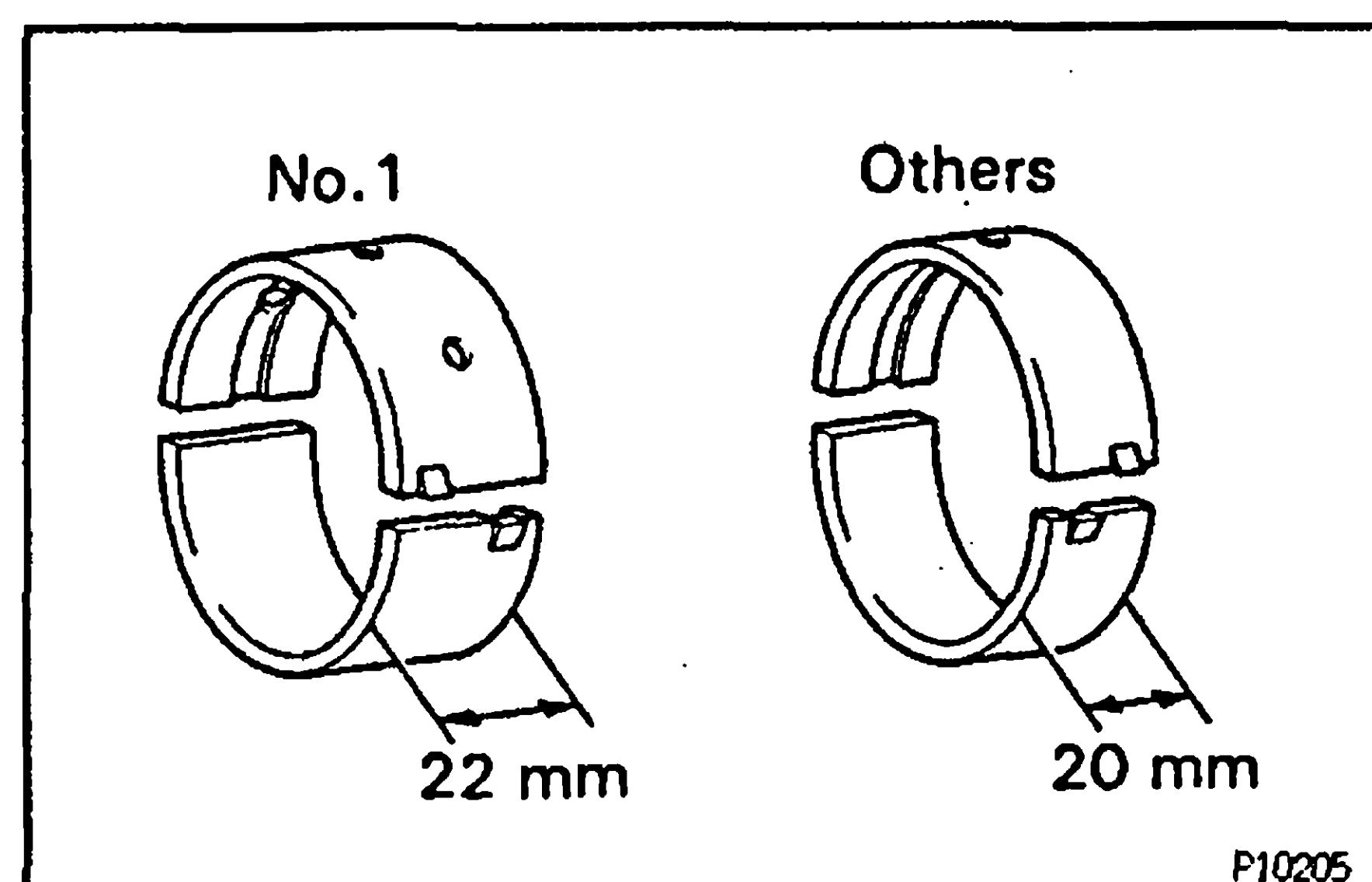
HINT:

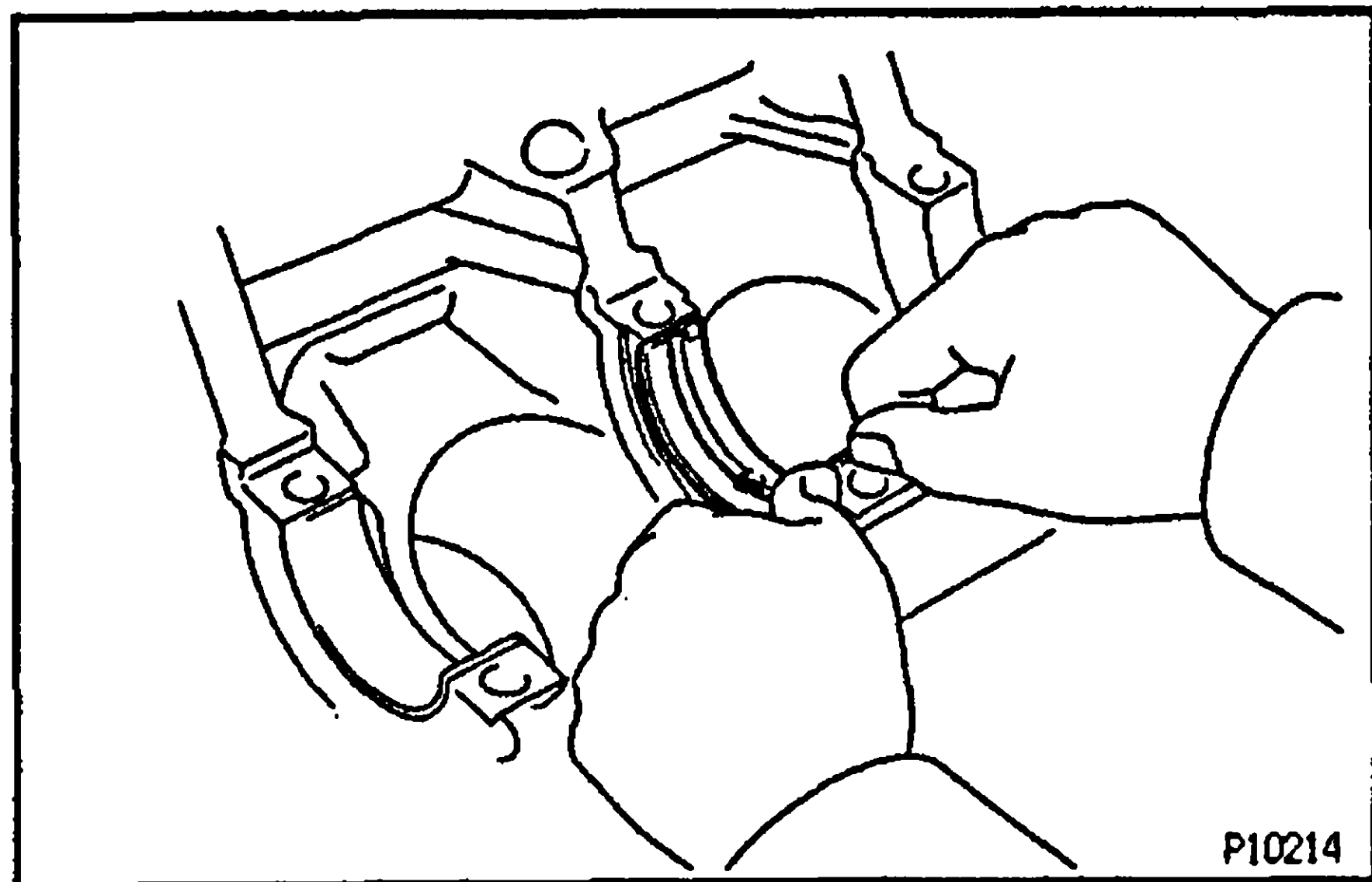
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

1. INSTALL MAIN BEARINGS

HINT:

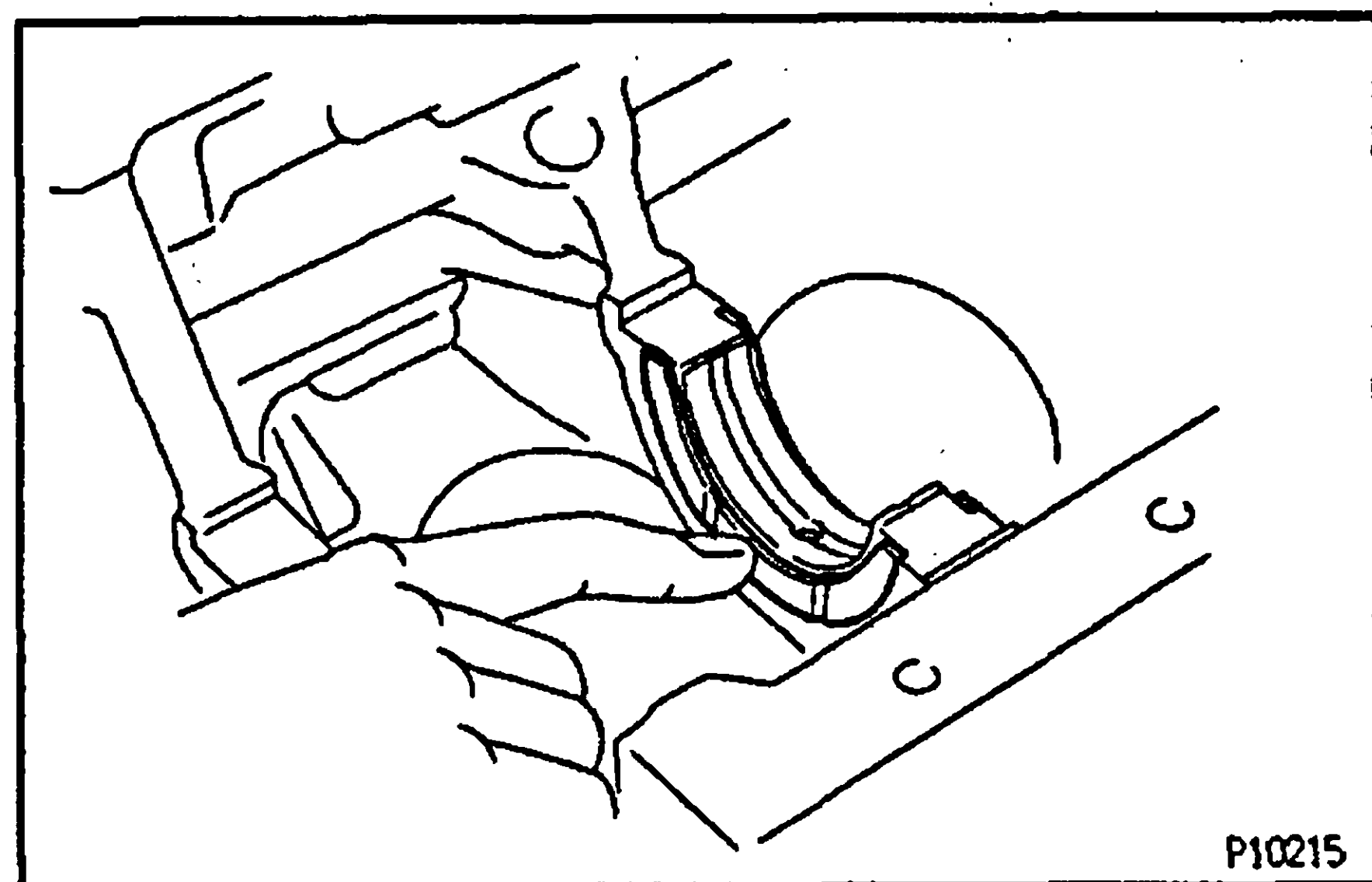
- Main bearings come in widths of 20 mm (0.79 in.) and 22 mm (0.87 in.). Install the 22 mm (0.87 in.) bearings in the No.1 cylinder block journal position with the main bearing caps. Install the 20 mm (0.79 in.) bearings in the other positions.
- Upper bearings have an oil holes; lower bearings do not.





- (a) Align the bearing claw with the claw groove of the main bearing cap or cylinder block.
- (b) Install the bearings in the cylinder block and main bearing cap.

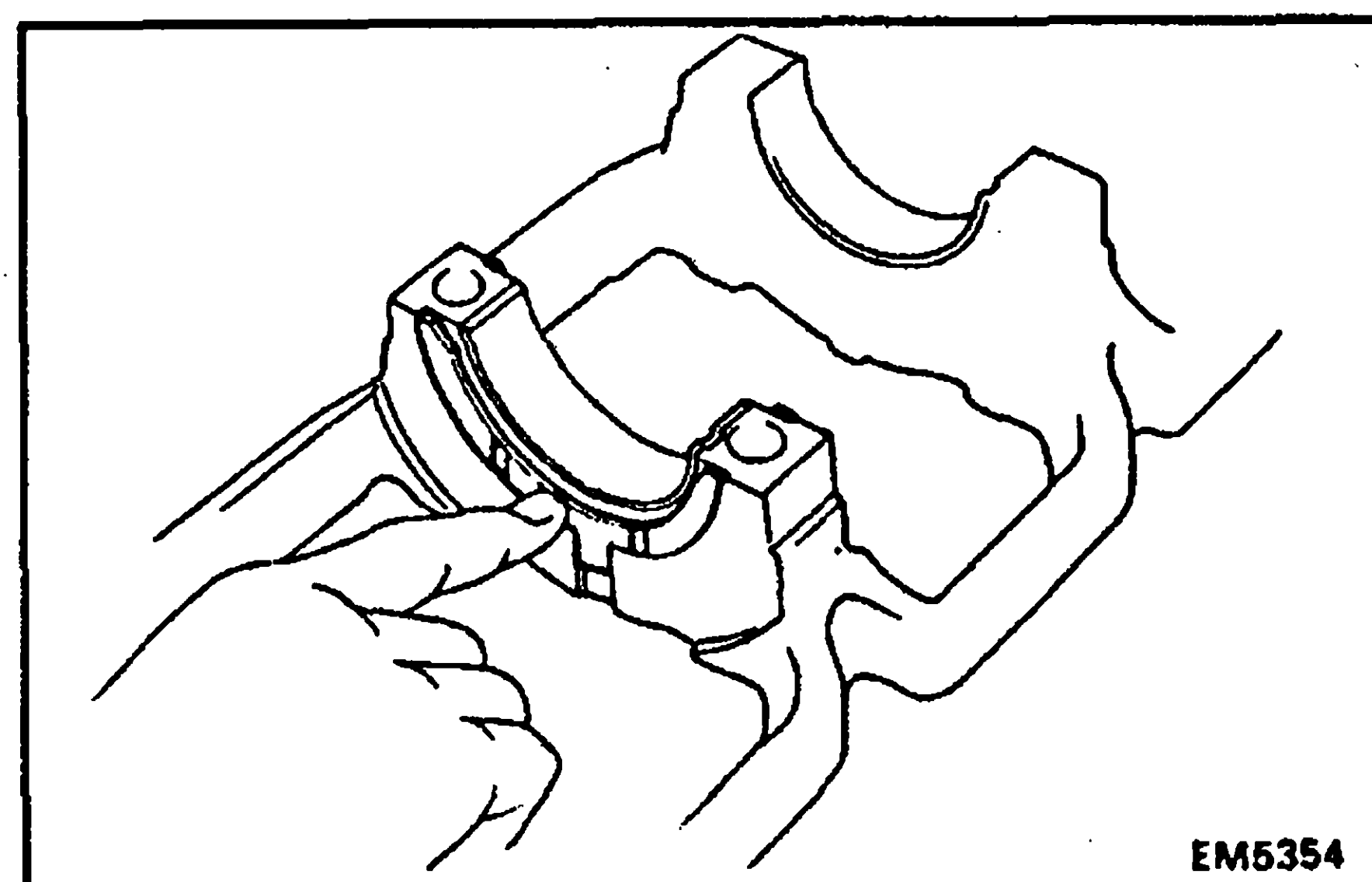
EG



2. INSTALL UPPER THRUST WASHERS

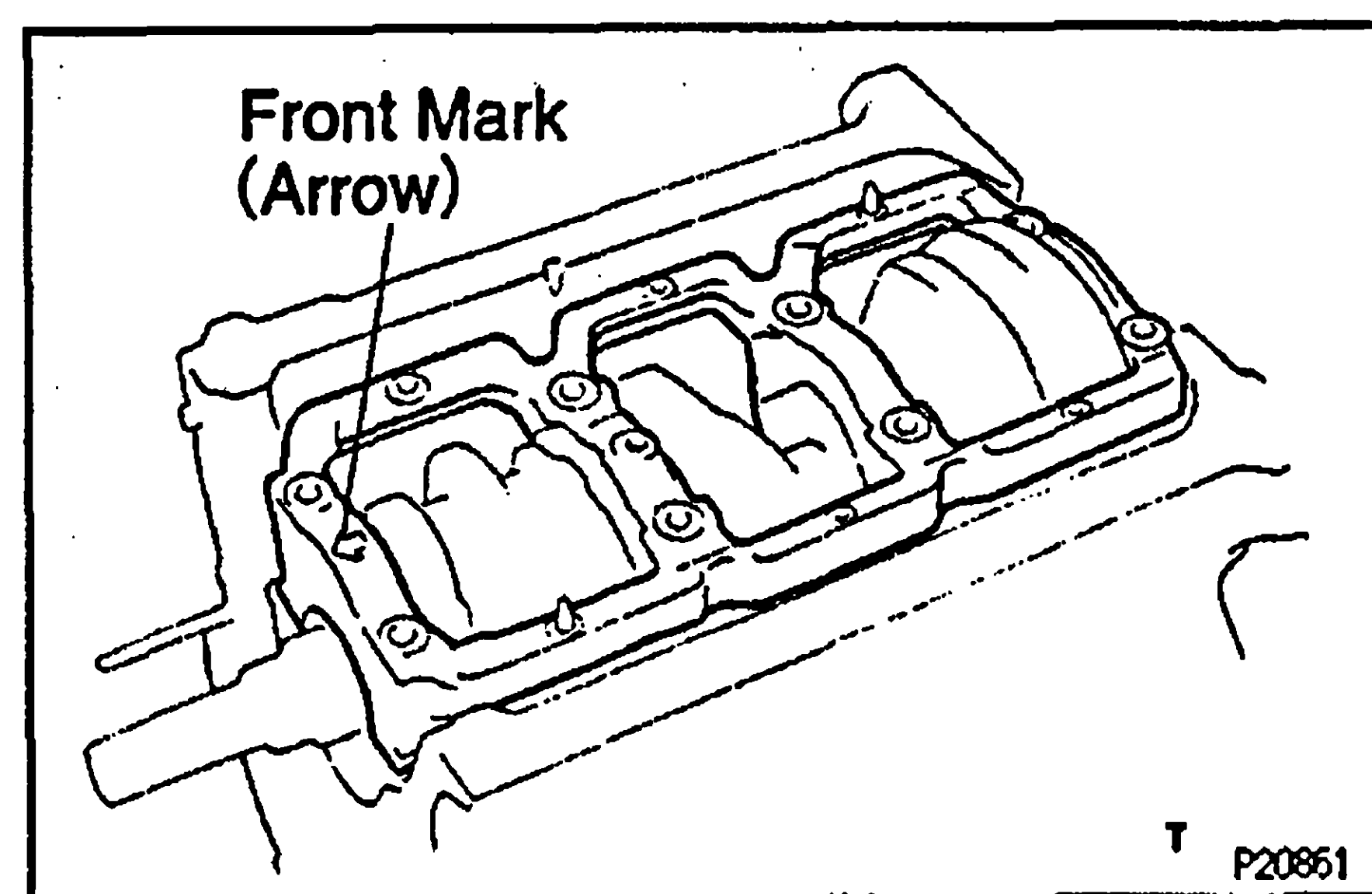
Install the thrust washers under the No.2 journal position of the cylinder block with the oil grooves facing outward.

3. PLACE CRANKSHAFT ON CYLINDER BLOCK



4. PLACE MAIN BEARING CAP AND LOWER THRUST WASHERS ON CYLINDER BLOCK

- (a) Install the thrust washers on the No.2 journal position of the bearing cap with the grooves facing outward.

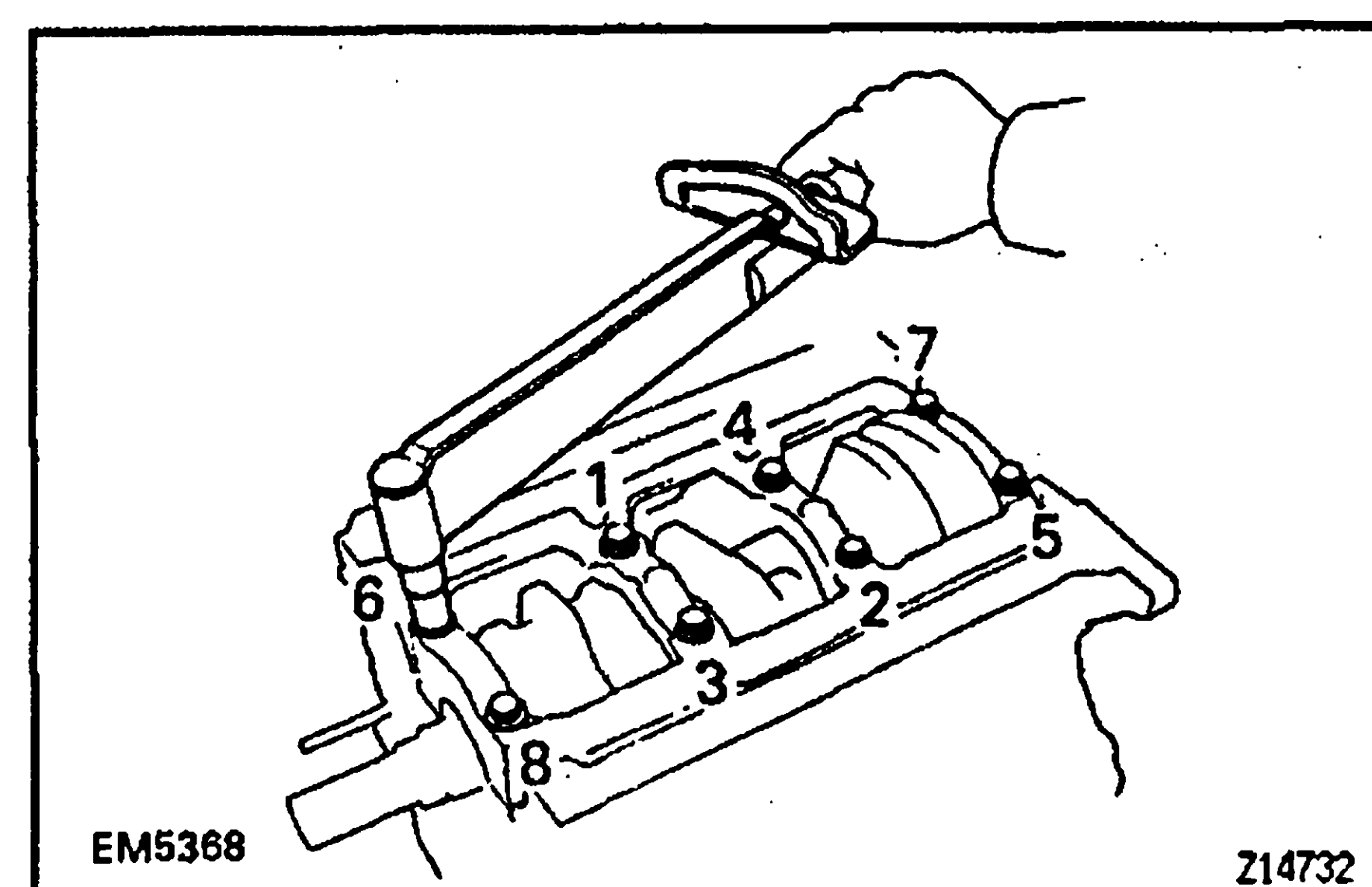


- (b) Install the main bearing cap with the front mark facing forward.

5. INSTALL MAIN BEARING CAP BOLTS

HINT:

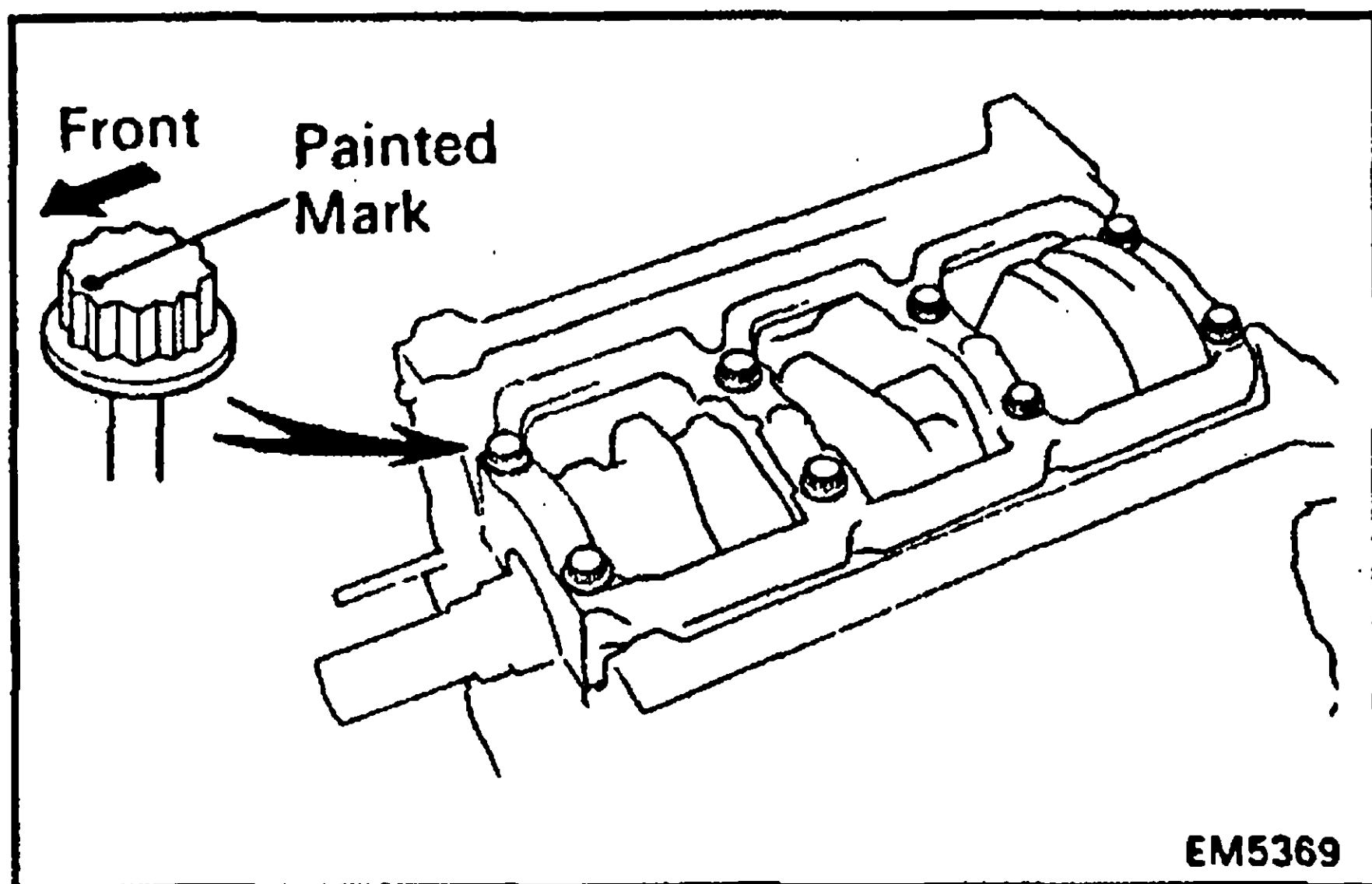
- The main bearing cap bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any main bearing cap bolt is broken or deformed, replace it.



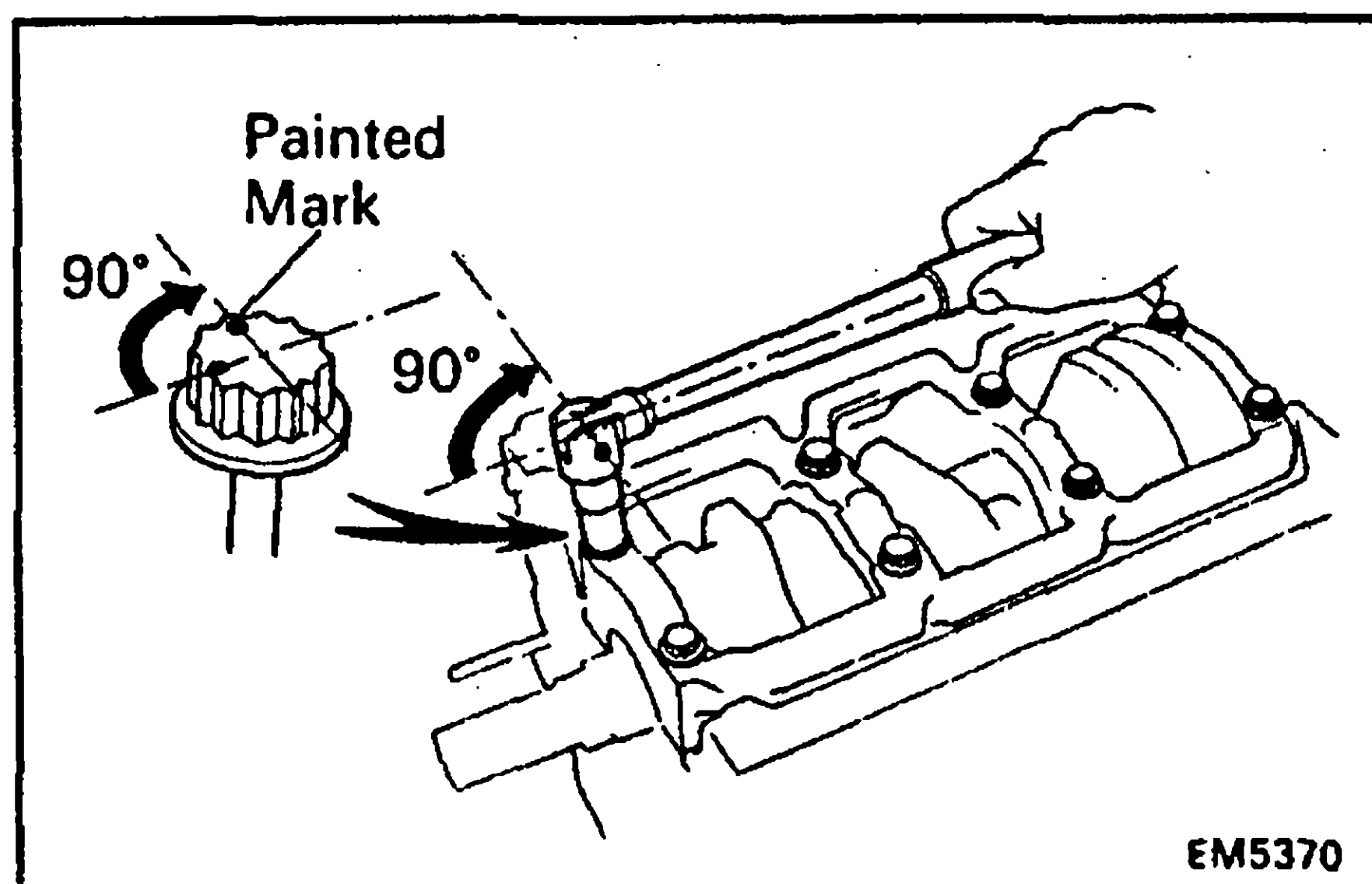
- (a) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.
- (b) Install and uniformly tighten the 8 main bearing cap bolts in several passes, in the sequence shown.

Torque: 61 N·m (625 kgf·cm, 45 ft·lbf)

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



(c) Mark the front of the main bearing cap bolt with paint.

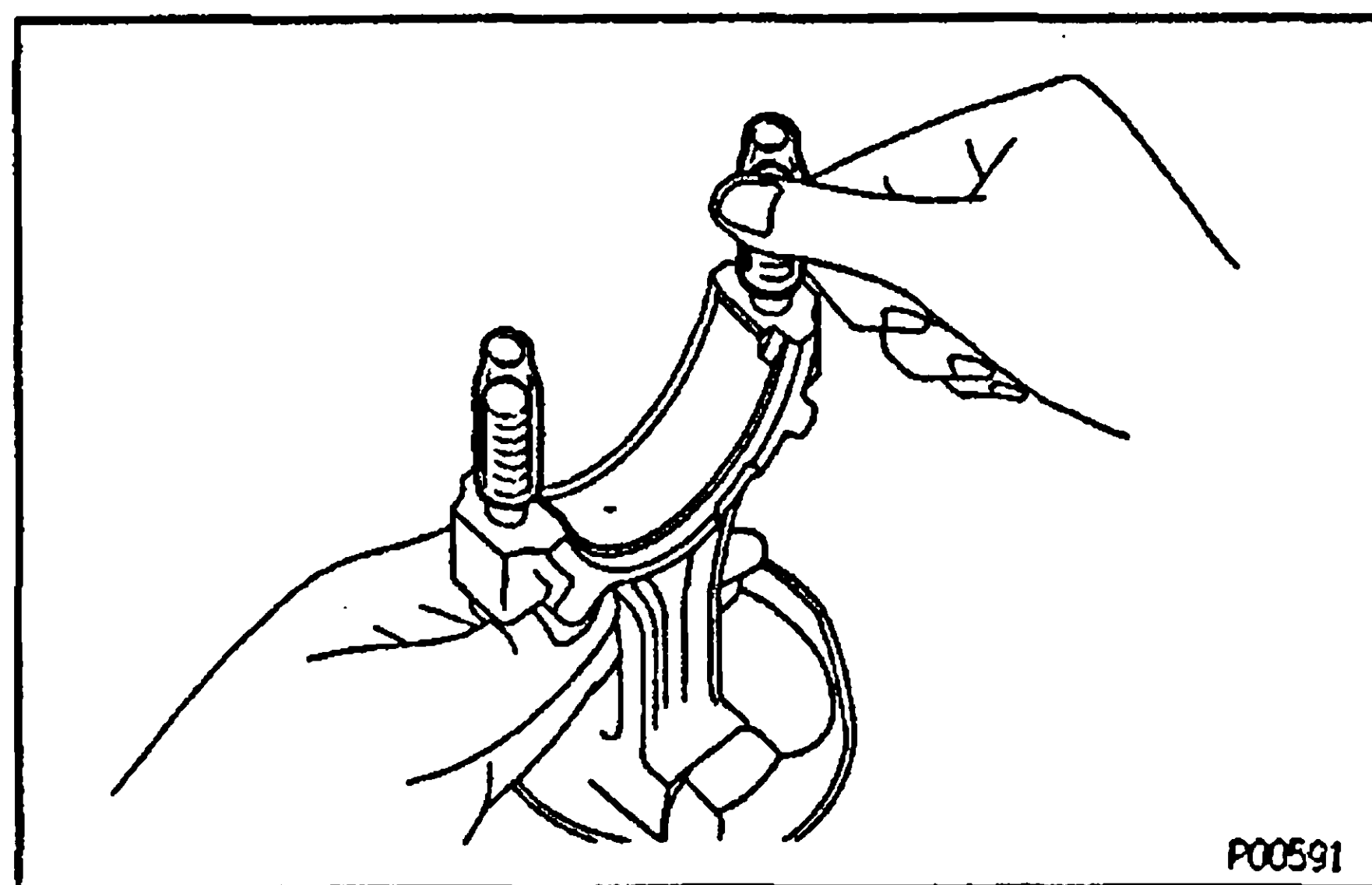


(d) Retighten the main bearing cap bolts by 90° in the numerical order as shown in the former page.

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

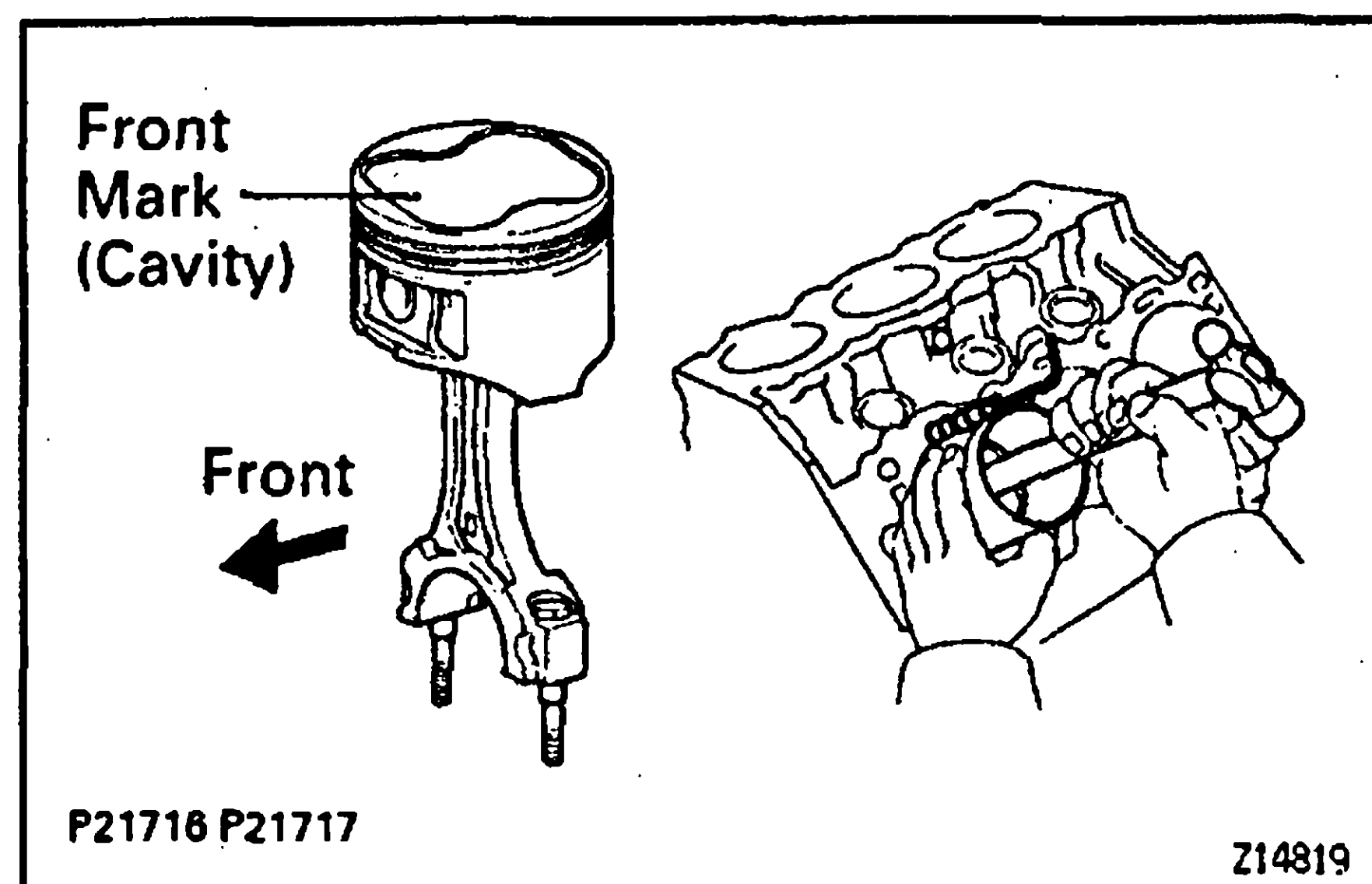
(f) Check that the crankshaft turns smoothly.

(g) Check crankshaft thrust clearance.
(See inspection in cylinder block)

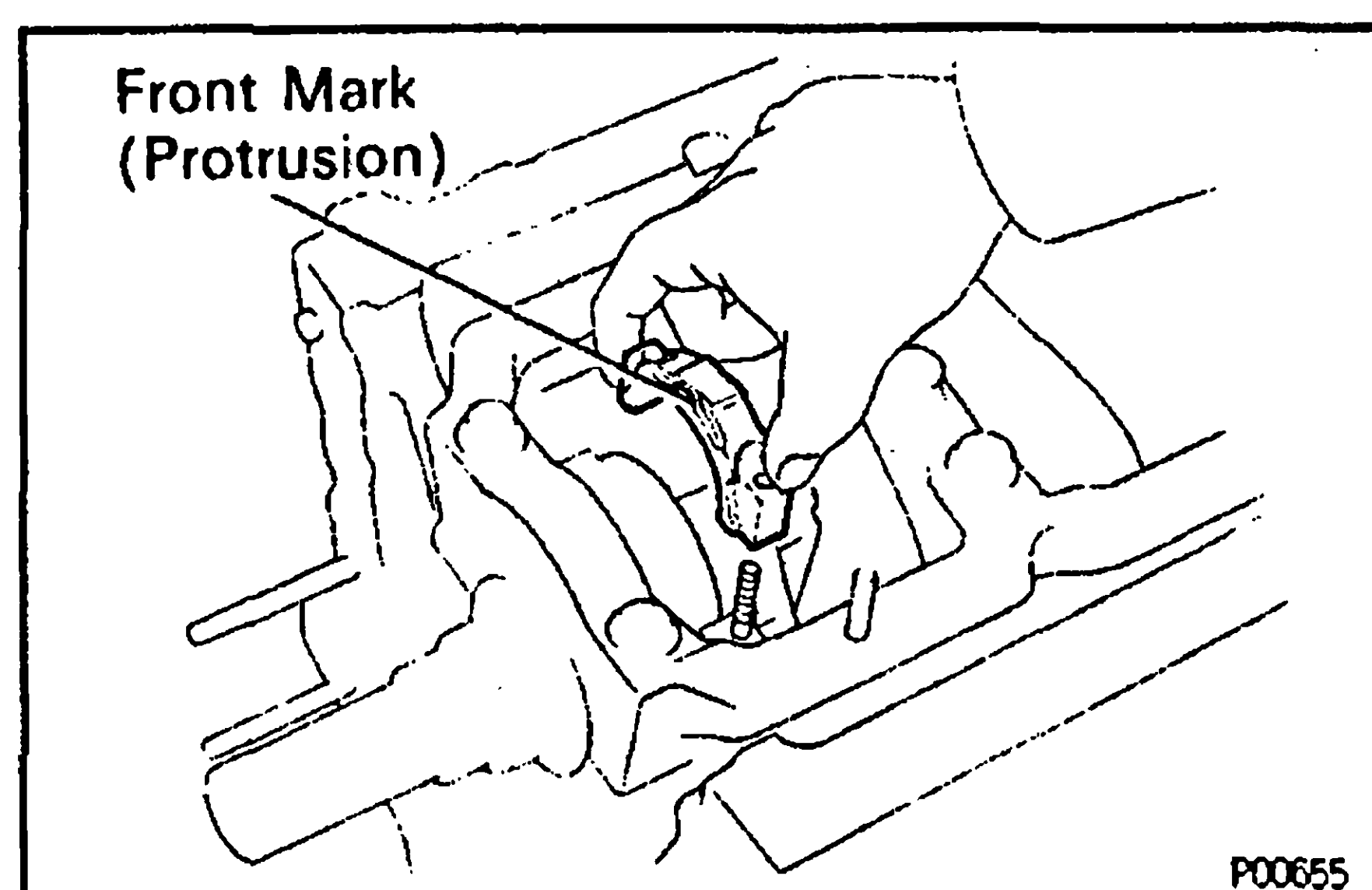


6. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

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



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



7. PLACE CONNECTING ROD CAP ON CONNECTING ROD

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

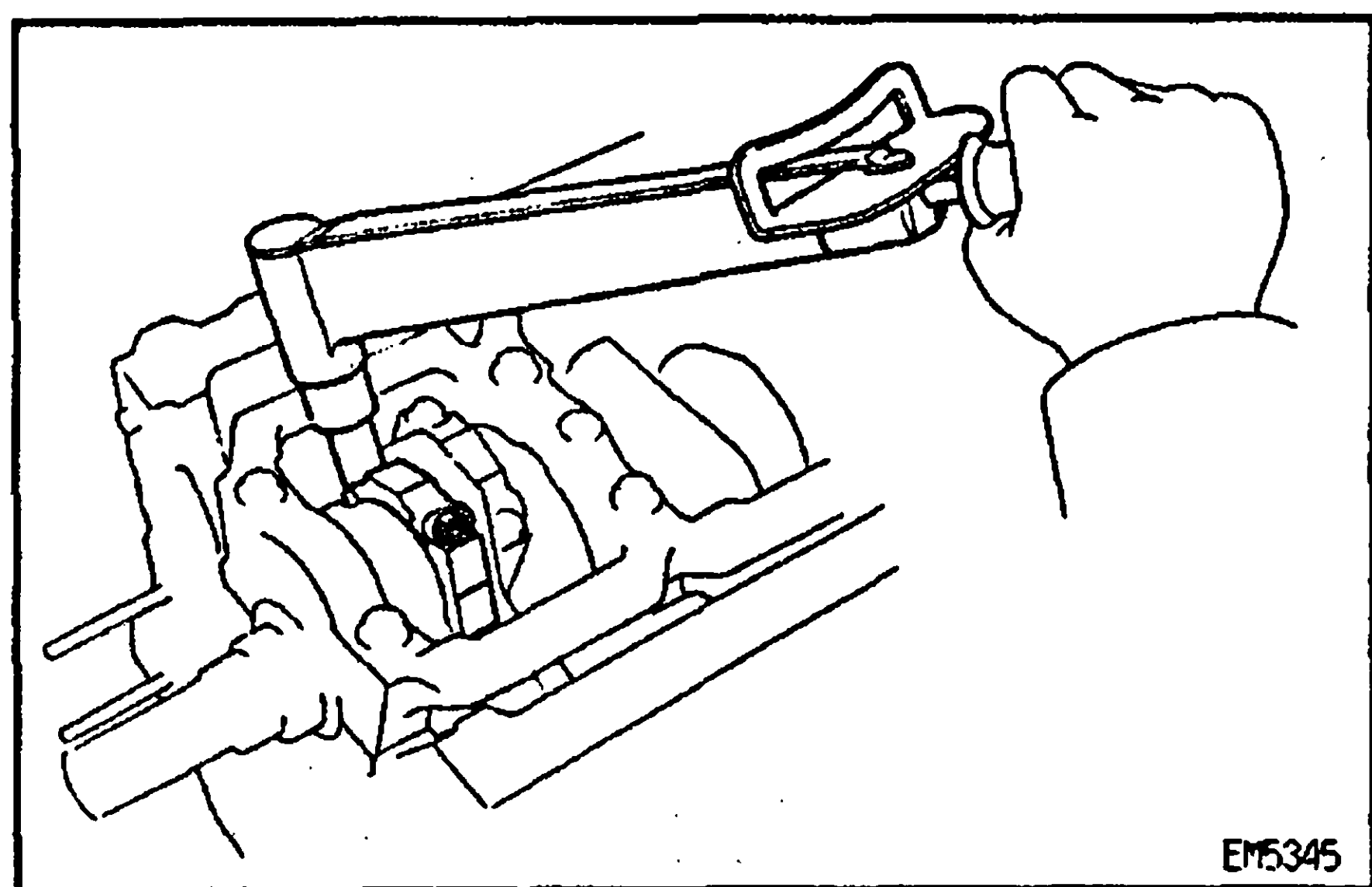
(b) Install the connecting rod cap with the front mark facing forward.

8. 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 of engine oil on the threads and under the nuts of the connecting rod cap.

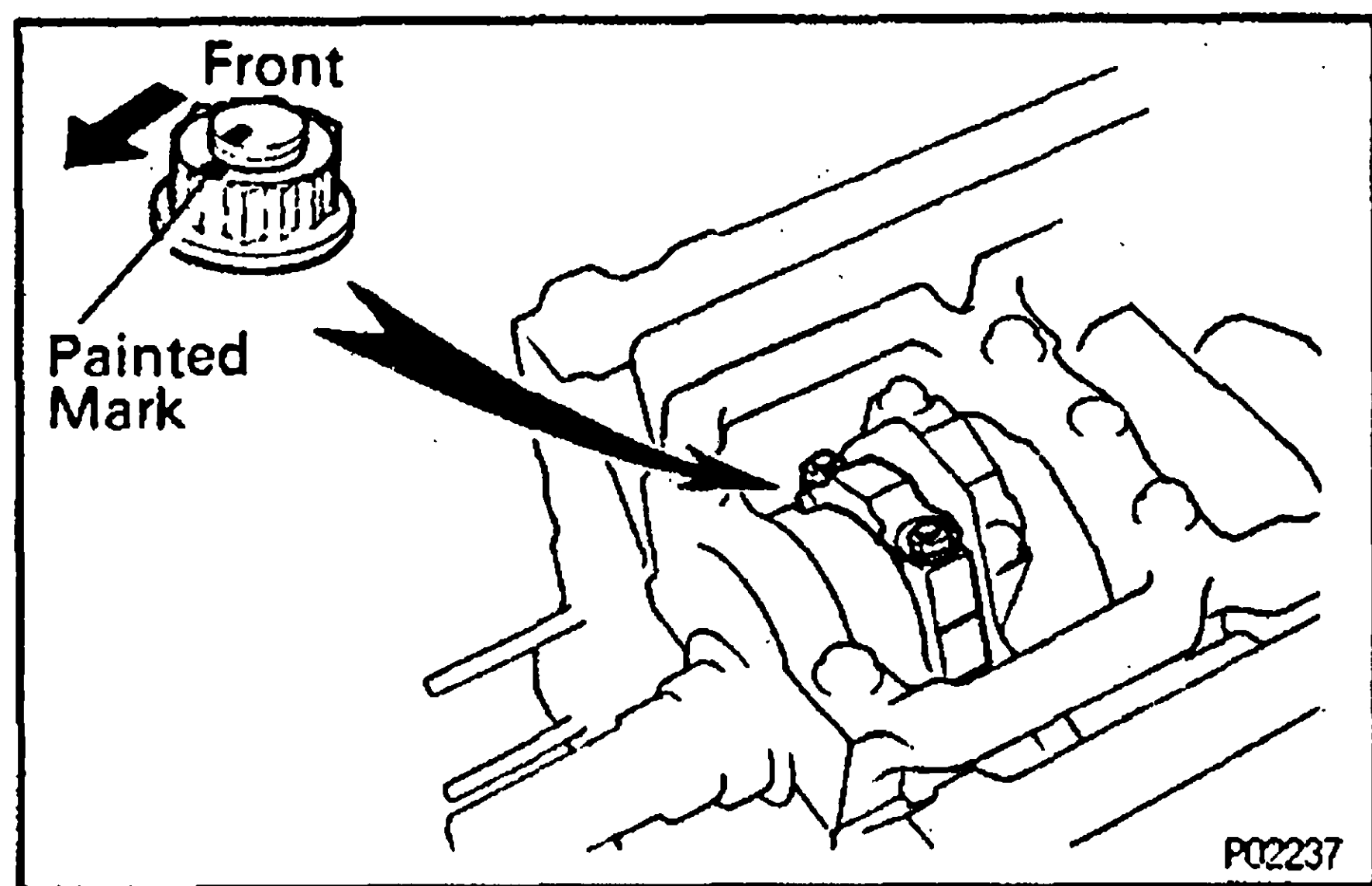
EG



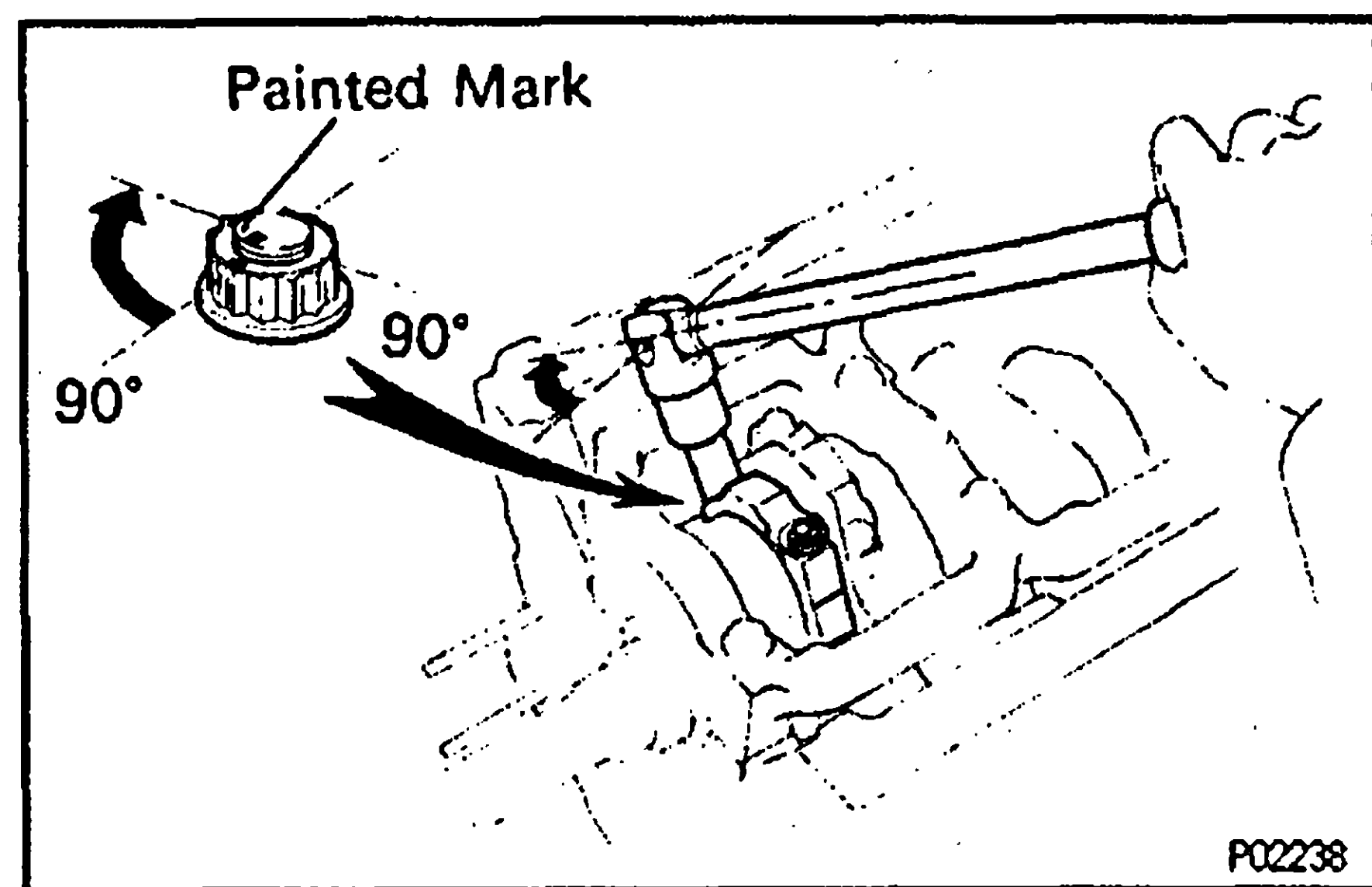
- (b) Install and alternately tighten the nuts of the connecting rod cap in several passes.

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

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



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



- (d) Retighten the connecting rod cap nuts 90° as shown.
- (e) Check that the painted mark is now at a 90° angle to the front.

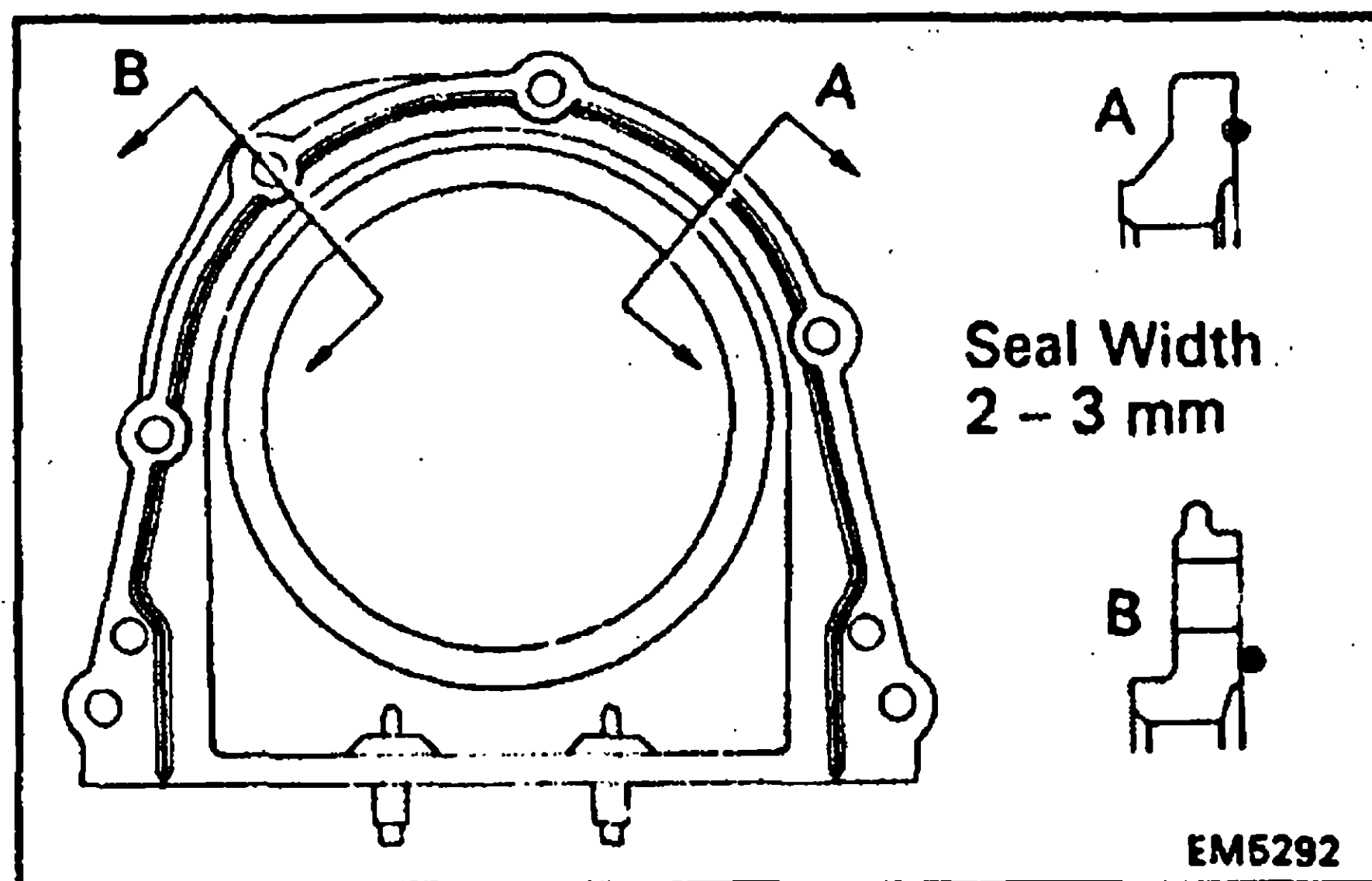
- (f) Check that the crankshaft turns smoothly.

9. CHECK CONNECTING ROD THRUST CLEARANCE
(See 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 oil seal retainer as shown in the illustration.

Seal packing:

Part No.08826—00080 or equivalent

- Install a nozzle that has been cut to a 2 — 3 mm (0.08 — 0.12 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

- (c) Install the oil seal retainer with the 6 bolts.

Torque: 8 N·m (80 kgf·cm, 71 in.-lbf)

AFTER ASSEMBLY

EG80P-05

1. INSTALL OIL PUMP

(See oil pump installation in Lubrication System)

2. INSTALL OIL COOLER

(See oil cooler installation in Lubrication System)

3. INSTALL COOLANT DRAIN COCK

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

4. INSTALL RH AND LH ENGINE MOUNTING BRACKET

Torque: 44 N·m (440 kgf·cm, 32 ft·lbf)

5. INSTALL OIL FILTER UNION

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

6. INSTALL OIL FILTER

(See oil and filter replacement in Lubrication System)

7. 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

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

8. INSTALL ALTERNATOR ADJUSTING BAR

Torque: 42 N·m (420 kgf·cm, 31 ft·lbf)

9. INSTALL WATER PUMP

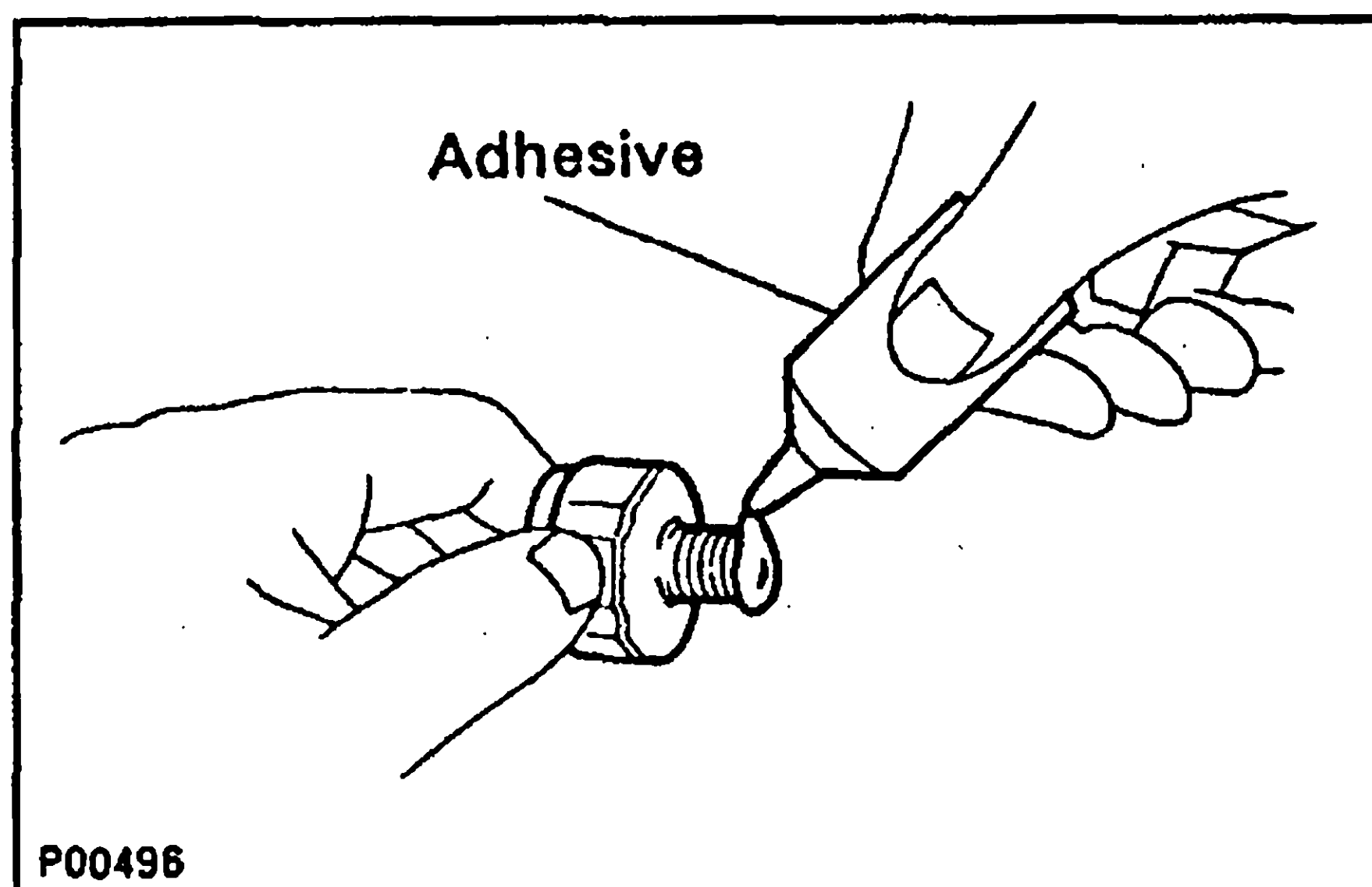
(See water pump installation in Cooling System)

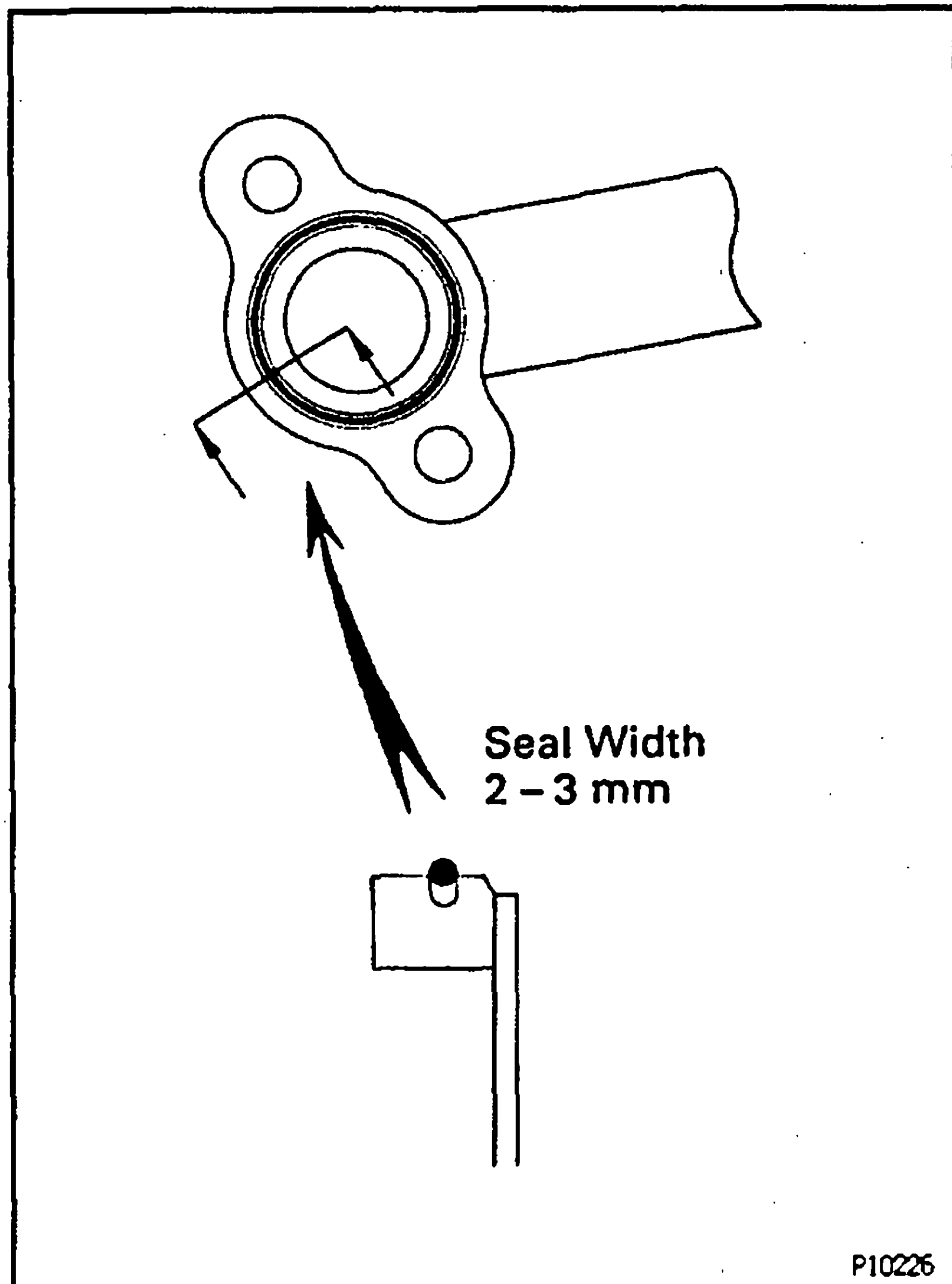
10. INSTALL KNOCK SENSORS

(See knock sensor installation in EFI System)

11. INSTALL NO.2 IDLER PULLEY BRACKET

Torque: 38 N·m (380 kgf·cm, 28 ft·lbf)





12. INSTALL WATER BYPASS PIPE WITH KNOCK SENSOR WIRE

- (a) Remove any old packing (FIPG) material and be careful not drop any oil on the contact surfaces of the bypass 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 loosen material.
- Using a non-residue solvent, clean both sealing surfaces.

- (b) Apply seal packing to the groove of the bypass pipe.
Seal packing:

Part No. 08826-00100 or equivalent

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

HINT: Avoid applying an excessive amount to the surface.

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

- (c) Install the bypass pipe with the 2 bolts and nut.
Torque: 8.5 N·m (85 kgf·cm, 75 in.-lbf)

- (d) Connect the 2 knock sensor connectors.

13. INSTALL CYLINDER HEADS

(See cylinder head installation)

14. INSTALL PULLEYS AND TIMING BELT

(See timing belt installation)

15. REMOVE ENGINE STAND

16. INSTALL REAR END PLATE

Torque: 7.5 N·m (75 kgf·cm, 66 in.-lbf)

17. A/T

INSTALL DRIVE PLATE

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

Adhesive:

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

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

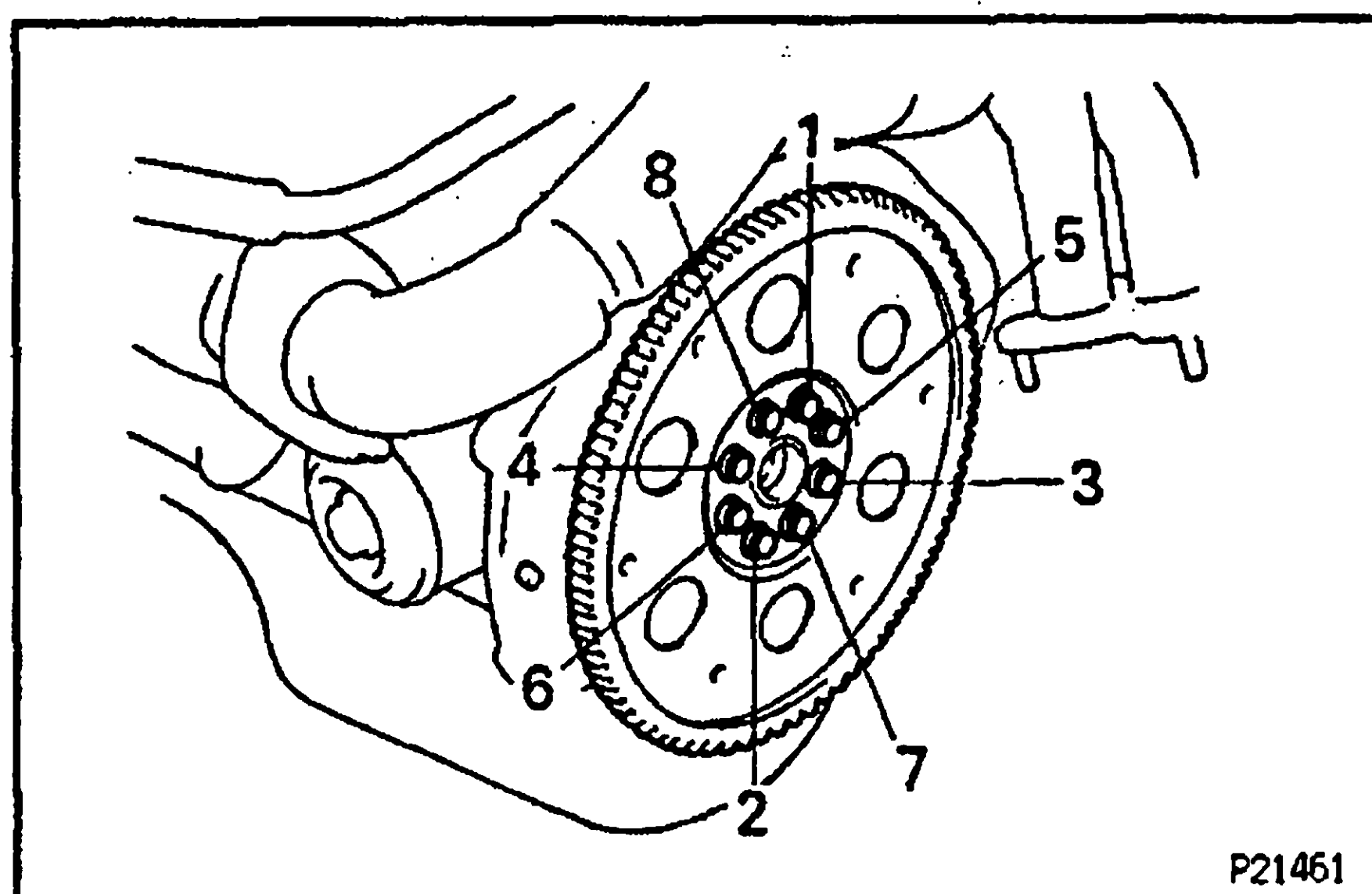
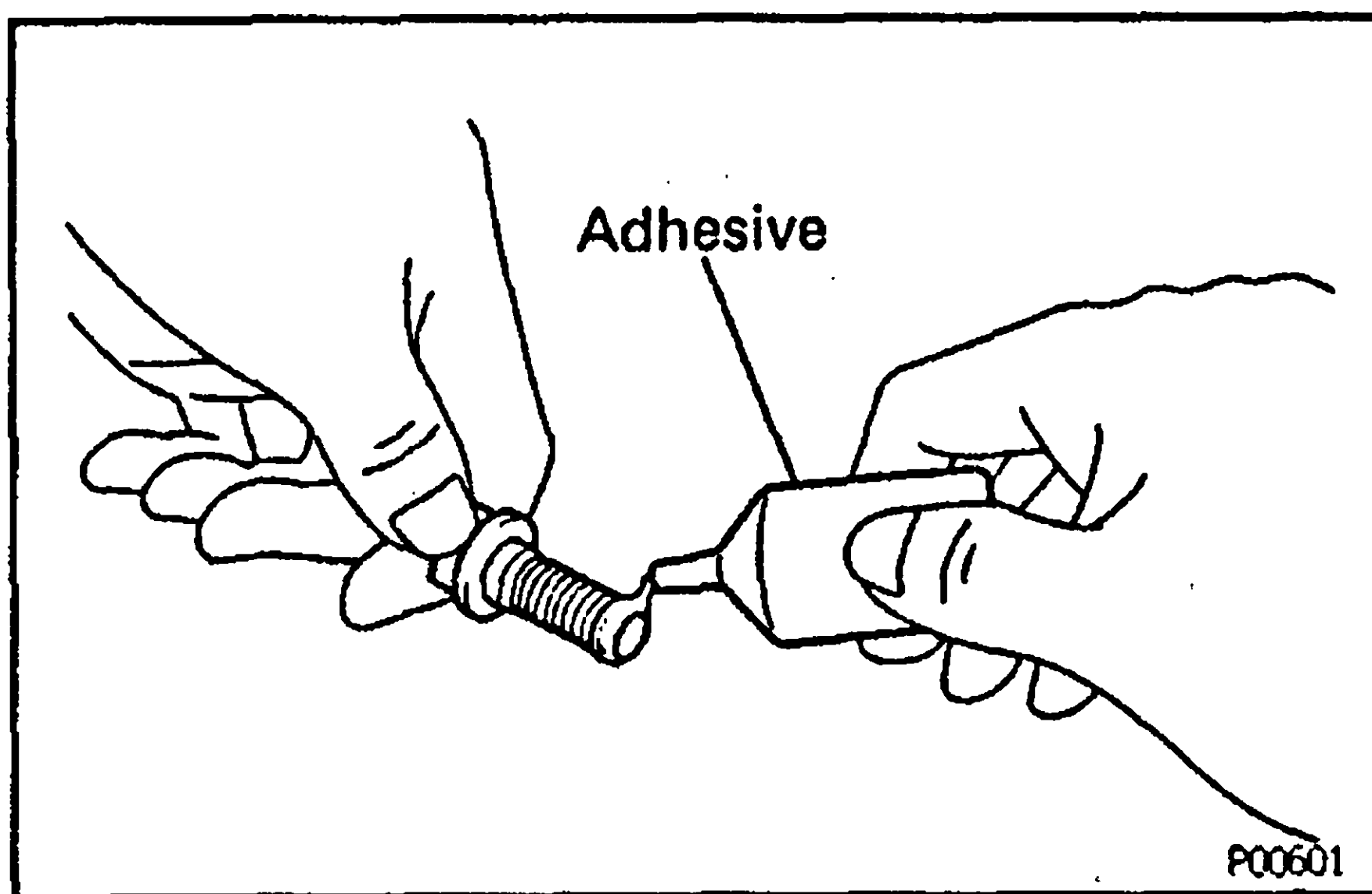
- (c) Install and uniformly tighten the 8 mount bolts in several passes, in the sequence shown.

Torque: 83 N·m (850 kgf·cm, 61 ft.-lbf)

18. M/T

INSTALL FLYWHEEL (See procedure step 17)

Torque: 85 N·m (850 kgf·cm, 63 ft.-lbf)



SERVICE SPECIFICATIONS

SERVICE DATA

EG0PW-11

Compression pressure	at 250 rpm STD Minimum Difference of pressure between each cylinder	1,200 kPa (12.2 kgf/cm ² , 174 psi) or more 1,000 kPa (10.2 kgf/cm ² , 145 psi) 100 kPa (1.0 kgf/cm ² , 15 psi) or less
Valve clearance	at cold Intake Exhaust Adjusting shim for repair part Mark 2.500 Mark 2.550 Mark 2.600 Mark 2.650 Mark 2.700 Mark 2.750 Mark 2.800 Mark 2.850 Mark 2.900 Mark 2.950 Mark 3.000 Mark 3.050 Mark 3.100 Mark 3.150 Mark 3.200 Mark 3.250 Mark 3.300	0.13 — 0.23 mm (0.006 — 0.009 in.) 0.27 — 0.37 mm (0.011 — 0.014 in.) 2.500 mm (0.0984 in.) 2.550 mm (0.1004 in.) 2.600 mm (0.1024 in.) 2.650 mm (0.1043 in.) 2.700 mm (0.1063 in.) 2.750 mm (0.1083 in.) 2.800 mm (0.1102 in.) 2.850 mm (0.1122 in.) 2.900 mm (0.1142 in.) 2.950 mm (0.1161 in.) 3.000 mm (0.1181 in.) 3.050 mm (0.1201 in.) 3.100 mm (0.1220 in.) 3.150 mm (0.1240 in.) 3.200 mm (0.1260 in.) 3.250 mm (0.1280 in.) 3.300 mm (0.1299 in.)
Ignition timing	w/ Terminals TE1 and E1 connected of check connector	8 — 12° BTDC @ idle
Idle speed	—	700 ± 50 rpm
Intake manifold vacuum	at idle speed	60 kPa (450 mmHg, 17.7 in.Hg) or more
Timing belt tensioner	Protrusion from housing side	10.0 — 10.8 mm (0.394 — 0.425 in.)
Cylinder head	Warpage Valve seat Refacing angle Contacting angle Contacting width Valve guide bushing bore diameter STD O/S 0.05	0.10 mm (0.039 in.) 30°, 45°, 60° 45° 1.0 — 1.4 mm (0.039 — 0.055 in.) 10.985 — 11.027 mm (0.4325 — 0.4341 in.) 11.050 — 11.077 mm (0.4350 — 0.4361 in.)
Valve guide bushing	Inside diameter Outside diameter for repair part STD O/S 0.05	6.010 — 6.030 mm (0.2366 — 0.2374 in.) 11.033 — 11.044 mm (0.4344 — 0.4348 in.) 11.083 — 11.094 mm (0.4363 — 0.4368 in.)

Valve	Valve overall length	STD Intake	95.15 mm (3.7461 in.)
		Exhaust	94.90 mm (3.7362 in.)
		Minimum Intake	94.60 mm (3.7244 in.)
		Exhaust	94.40 mm (3.7165 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.)
Valve spring	Deviation	STD	1.0 mm (0.039 in.)
		Minimum	0.5 mm (0.020 in.)
		Maximum	2.0 mm (0.079 in.)
Valve spring	Free length		44.78 mm (1.7630 in.)
	Installed tension	at 33.3 mm (1.311 in.)	186 — 206 N (19.0 — 21.0 kgf, 41.9 — 46.3 lbf)
Valve lifter	Lifter diameter		30.966 — 30.976 mm (1.2191 — 2.2195 in.)
	Lifter bore diameter		31.000 — 31.018 mm (1.2205 — 1.2212 in.)
	Oil clearance	STD	0.024 — 0.052 mm (0.0009 — 0.0020 in.)
		Maximum	0.08 mm (0.0031 in.)
Camshaft	Thrust clearance	STD	0.033 — 0.080 mm (0.0013 — 0.0031 in.)
		Maximum	0.12 mm (0.0047 in.)
	Journal oil clearance	STD	0.035 — 0.072 mm (0.0014 — 0.0028 in.)
		Maximum	0.10 mm (0.0039 in.)
	Journal diameter		26.949 — 26.965 mm (1.0610 — 1.0616 in.)
	Circle runout	Maximum	0.06 mm (0.0024 in.)
	Cam lobe height	STD Intake	42.31 — 42.41 mm (1.6657 — 1.6697 in.)
		Exhaust	41.96 — 42.06 mm (1.6520 — 1.6559 in.)
		Minimum Intake	42.16 mm (1.6598 in.)
		Exhaust	41.81 mm (1.6461 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		18.2 — 18.8 mm (0.712 — 0.740 in.)
Air intake chamber	Warpage	Maximum	0.10 mm (0.0039 in.)
Intake air connector	Warpage	Maximum	0.10 mm (0.0039 in.)
Intake manifold	Warpage	Maximum	0.10 mm (0.0039 in.)
Exhaust manifold	Warpage	Maximum	1.00 mm (0.0394 in.)
Cylinder block	Cylinder head surface warpage	Maximum	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD Mark 1	93.500 — 93.510 mm (3.6811 — 3.6815 in.)
		Mark 2	93.510 — 93.520 mm (3.6815 — 3.6819 in.)
		Mark 3	93.520 — 93.530 mm (3.6819 — 3.6823 in.)
		Maximum STD O/S 0.50	93.730 mm (3.6902 in.) 94.230 mm (3.7098 in.)

Piston and piston ring	Piston diameter	STD	Mark 1	93.356 — 93.366 mm (3.6754 — 3.6758 in.)
			Mark 2	93.367 — 93.376 mm (3.6759 — 3.6762 in.)
			Mark 3	93.377 — 93.386 mm (3.6763 — 3.6766 in.)
			O/S 0.50	93.856 — 93.886 mm (3.6951 — 3.6963 in.)
	Piston oil clearance	STD		0.134 — 0.154 mm (0.0053 — 0.0060 in.)
		Maximum		0.174 mm (0.0069 in.)
	Piston ring groove clearance		No.1	0.040 — 0.080 mm (0.0016 — 0.0031 in.)
			No.2	0.030 — 0.070 mm (0.0012 — 0.0028 in.)
	Piston ring end gap	STD	No.1	0.300 — 0.500 mm (0.0118 — 0.0197 in.)
			No.2	0.400 — 0.600 mm (0.0157 — 0.0236 in.)
			Oil	0.150 — 0.550 mm (0.0059 — 0.0217 in.)
		Maximum	No.1	1.100 mm (0.0433 in.)
			No.2	1.200 mm (0.0472 in.)
			Oil	1.150 mm (0.0453 in.)
Connecting rod	Thrust clearance	STD		0.150 — 0.330 mm (0.0059 — 0.0130 in.)
		Maximum		0.380 mm (0.0150 in.)
	Connecting rod bearing center wall thickness			
	Reference		Mark 1	1.484 — 1.488 mm (0.0584 — 0.0586 in.)
			Mark 2	1.488 — 1.492 mm (0.0586 — 0.0587 in.)
			Mark 3	1.492 — 1.496 mm (0.0587 — 0.0589 in.)
	Connecting rod oil clearance	STD		0.024 — 0.053 mm (0.0009 — 0.0021 in.)
		O/S 0.25		0.023 — 0.069 mm (0.0009 — 0.0027 in.)
		Maximum		0.08 mm (0.0031 in.)
	Rod bend	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.)
	Bushings inside diameter			22.005 — 22.017 mm (0.8663 — 0.8668 in.)
	Piston pin diameter			21.997 — 22.009 mm (0.8660 — 0.8665 in.)
	Bushings oil clearance	STD		0.005 — 0.011 mm (0.0002 — 0.0004 in.)
		Maximum		0.05 mm (0.0020 in.)
	Connecting rod bolt outer diameter	STD		7.860 — 8.000 mm (0.3094 — 0.3150 in.)
		Minimum		7.600 mm (0.2992 in.)

Crankshaft	Thrust clearance	STD	0.020 — 0.220 mm (0.0008 — 0.0087 in.)
		Maximum	0.300 mm (0.0118 in.)
	Thrust washer thickness		2.440 — 2.490 mm (0.0961 — 0.0980 in.)
	Main journal oil clearance	No.1 STD	0.020 — 0.038 mm (0.0008 — 0.0015 in.)
		U/S 0.25	0.019 — 0.059 mm (0.0007 — 0.0023 in.)
		Others STD	0.024 — 0.042 mm (0.0009 — 0.0017 in.)
		U/S 0.25	0.023 — 0.063 mm (0.0009 — 0.0025 in.)
		Maximum	0.08 mm (0.0031 in.)
	Main journal diameter	STD	63.985 — 64.000 mm (2.5191 — 2.5197 in.)
		U/S 0.25	63.745 — 63.755 mm (2.5096 — 2.5100 in.)
	Main bearing center wall thickness	Reference	No.1 Mark 1 1.991 — 1.994 mm (0.0784 — 0.0785 in.)
		Others	Mark 2 1.994 — 1.997 mm (0.0785 — 0.0786 in.)
		Others	Mark 3 1.997 — 2.000 mm (0.0786 — 0.0787 in.)
	Crank pin diameter	STD	54.987 — 55.000 mm (2.1648 — 2.1654 in.)
		U/S 0.25	54.745 — 54.755 mm (2.1553 — 2.1557 in.)
	Circle runout	Maximum	0.06 mm (0.0024 in.)
	Main journal taper and out-of-round	Maximum	0.02 mm (0.0008 in.)
	Crank pin taper and out-of-round	Maximum	0.02 mm (0.0008 in.)

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
No.1 idler pulley x Oil pump	35	350	26
No.2 idler pulley x No.2 idler pulley bracket	40	400	30
No.1 timing belt cover x Oil pump	9	90	80 in·lbf
Crankshaft pulley x Crankshaft	250	2,500	184
Camshaft timing pulley x Camshaft	110	1,100	81
Timing belt tensioner x Oil pump	27	280	20
No.2 timing belt cover x No.3 timing belt cover	9	90	80 in·lbf
Oil dipstick guide x Alternator bracket	8	80	71 in·lbf
Fluid coupling x Fan bracket	5.4	54	48 in·lbf
Camshaft bearing cap x Cylinder head	16	160	12
Rear plate x Cylinder head	8	80	71 in·lbf
Cylinder head x Cylinder block	12 pointed head 1st	34	350
	2nd	Turn 90°	Turn 90°
	3rd	Turn 90°	Turn 90°
	Recessed head	18	185
Cylinder head cover x Cylinder head	6	60	53 in·lbf
Exhaust manifold x Cylinder head	40	400	30
Exhaust manifold heat insulator x Exhaust manifold	8	80	71 in·lbf
Exhaust crossover pipe x Exhaust manifold	45	450	33
Alternator bracket x LH cylinder head	18.5	185	14
PS pump bracket x RH cylinder head	18.5	185	14
Intake manifold, Intake manifold stay x Cylinder head	18	180	13
No.3 timing belt cover x Cylinder head	9	90	80 in·lbf
Camshaft position sensor x RH cylinder head	8	80	71 in·lbf
Intake air connector x Intake manifold	18	180	13
Air intake chamber x Intake air connector	18	180	13
Air intake chamber stay x LH cylinder head	40	400	30
Air intake chamber stay x Air intake chamber	18	180	13
Engine hanger No.2 x RH cylinder head	40	400	30
Frame crossmember x Engine rear mounting bracket	58	590	43
Engine rear mounting bracket x Engine rear mounting insulator	18	183	13
Engine front mounting insulator x Frame	38	387	28
Connecting rod cap x Connecting rod	1st	25	250
	2nd	Turn 90°	Turn 90°
Main bearing cap x Cylinder block	1st	61	625
	2nd	Turn 90°	Turn 90°
Rear oil seal retainer x Cylinder block	8	80	71 in·lbf
Engine coolant drain cock x Cylinder block	39	400	29
Engine mounting bracket x Cylinder block	44	440	32
Oil filter union x Cylinder block	25	250	18
Oil pressure switch x Cylinder block	15	150	11
Alternator adjusting bar x Cylinder block	42	420	31
No.2 idler pulley bracket x Cylinder block	38	380	28
Water bypass pipe x Cylinder block	8.5	85	75 in·lbf
Rear end plate x Cylinder block	7.5	75	66 in·lbf
Drive plate x Crankshaft	83	850	61
Flywheel x Crankshaft	85	850	63

EG

EFI SYSTEM

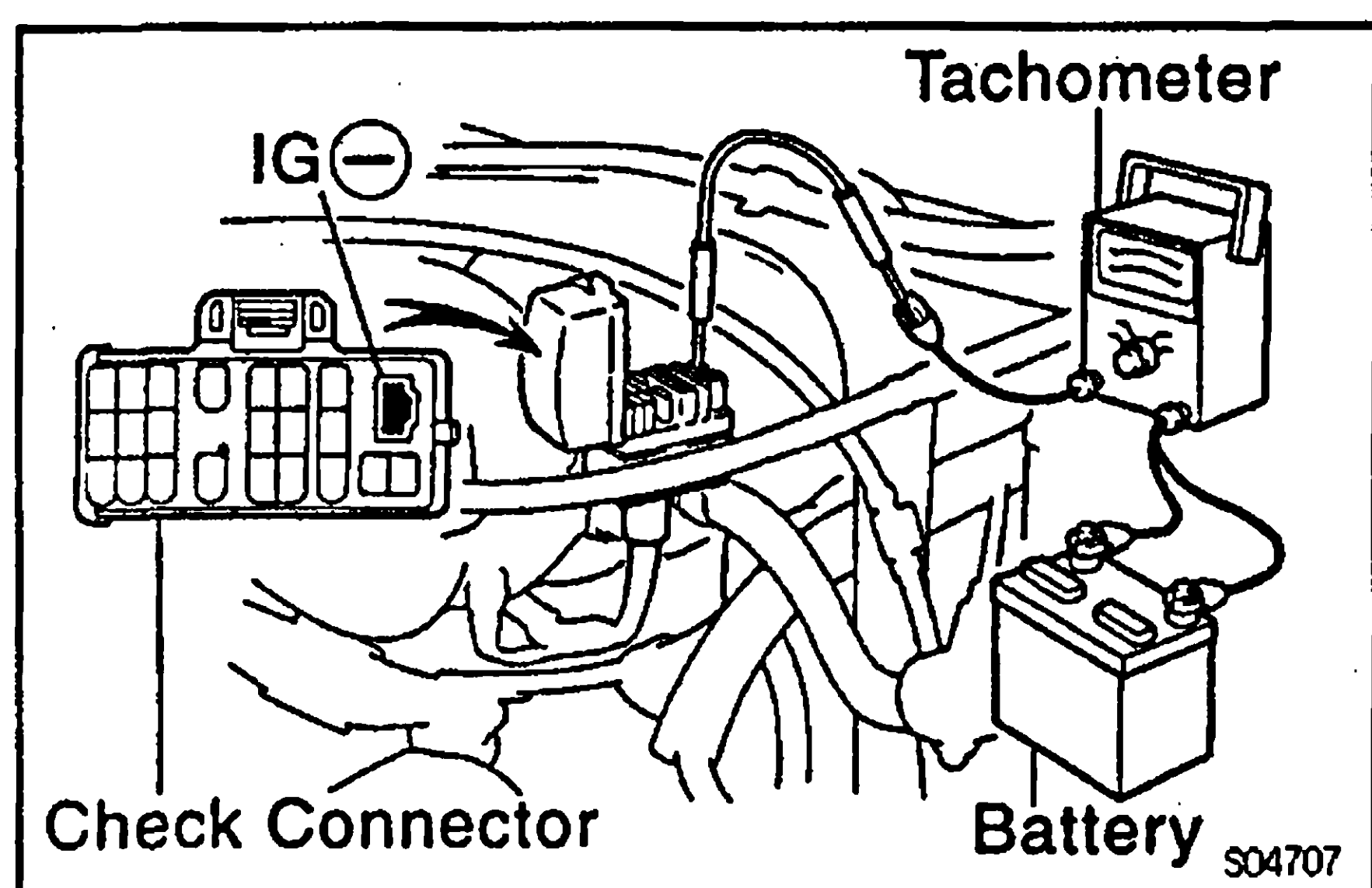
PRECAUTION

1. Before working on the fuel system, disconnect the negative (—) terminal cable from the battery. S040V-03

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

EG7CQ-01

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.

AIR INDUCTION SYSTEM

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

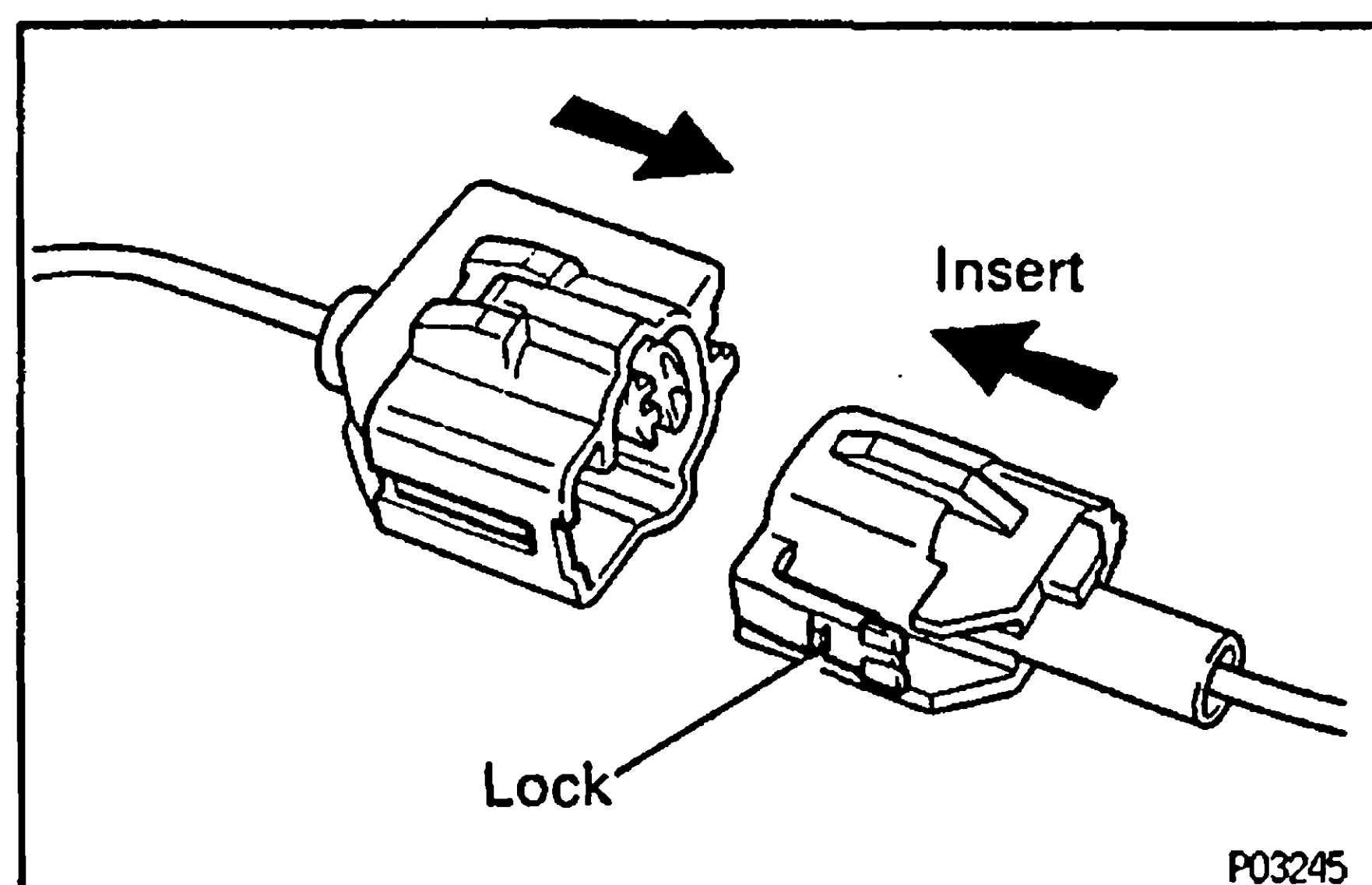
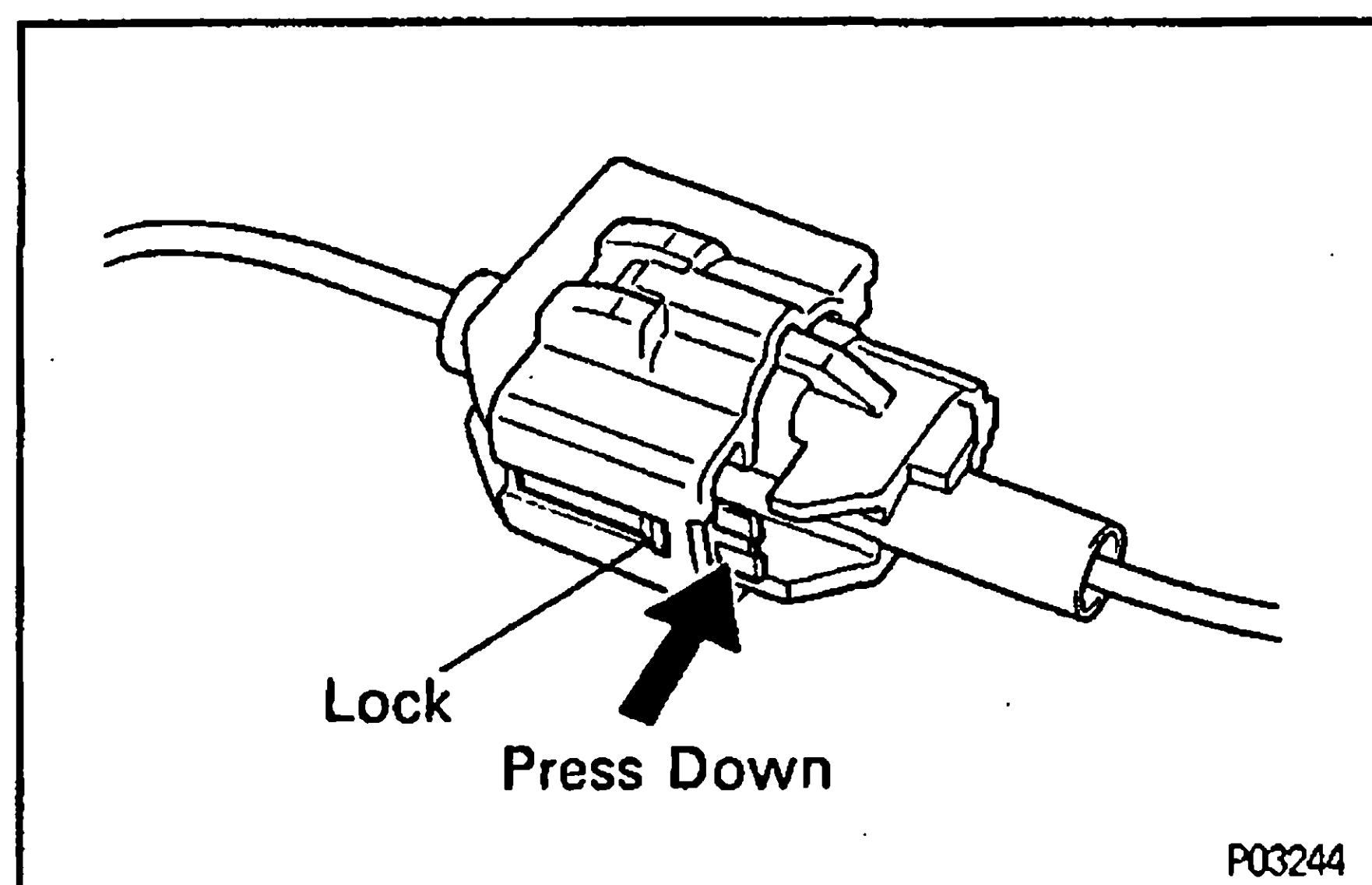
ELECTRONIC CONTROL SYSTEM

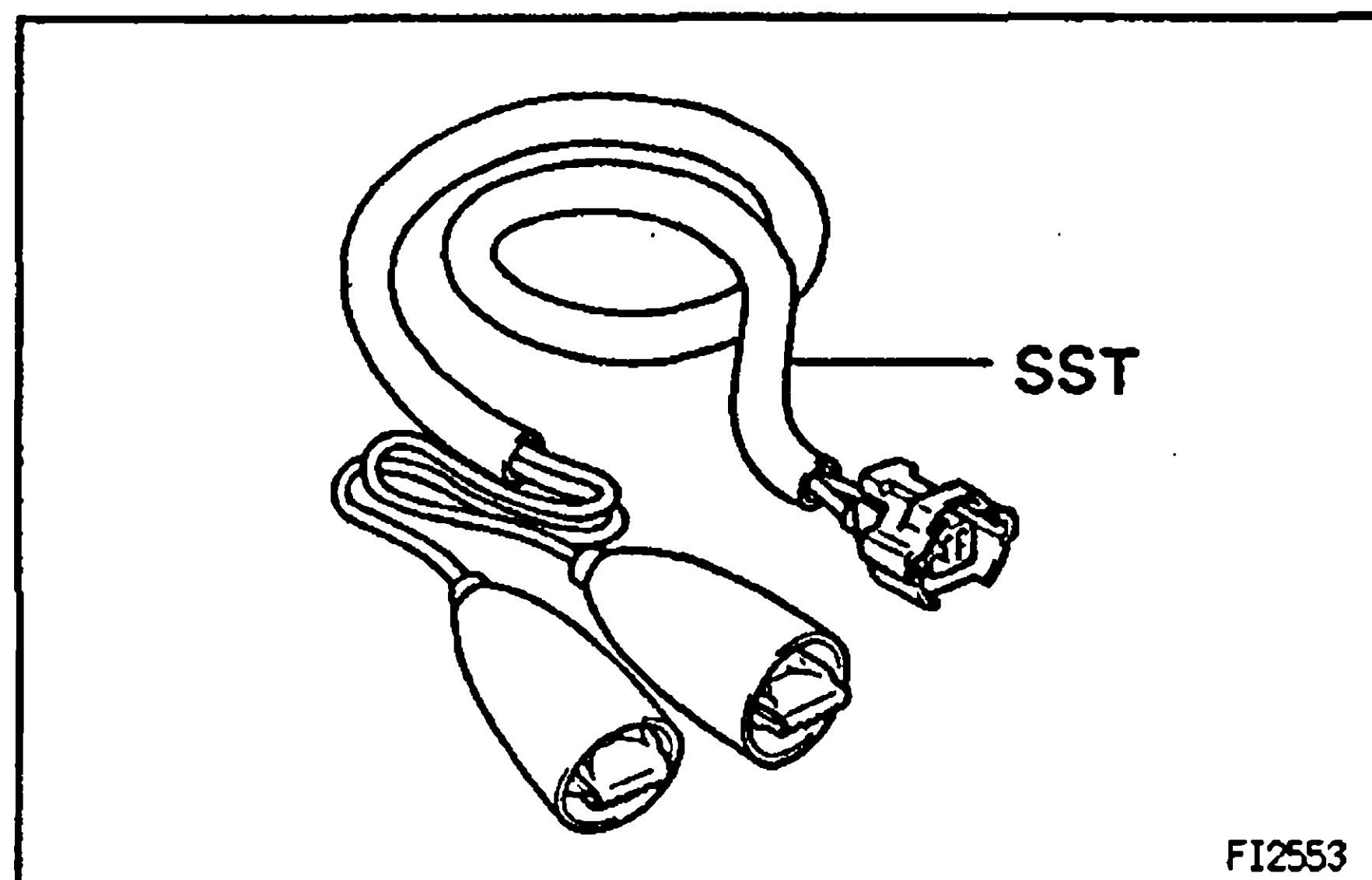
EGECU-0E

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.



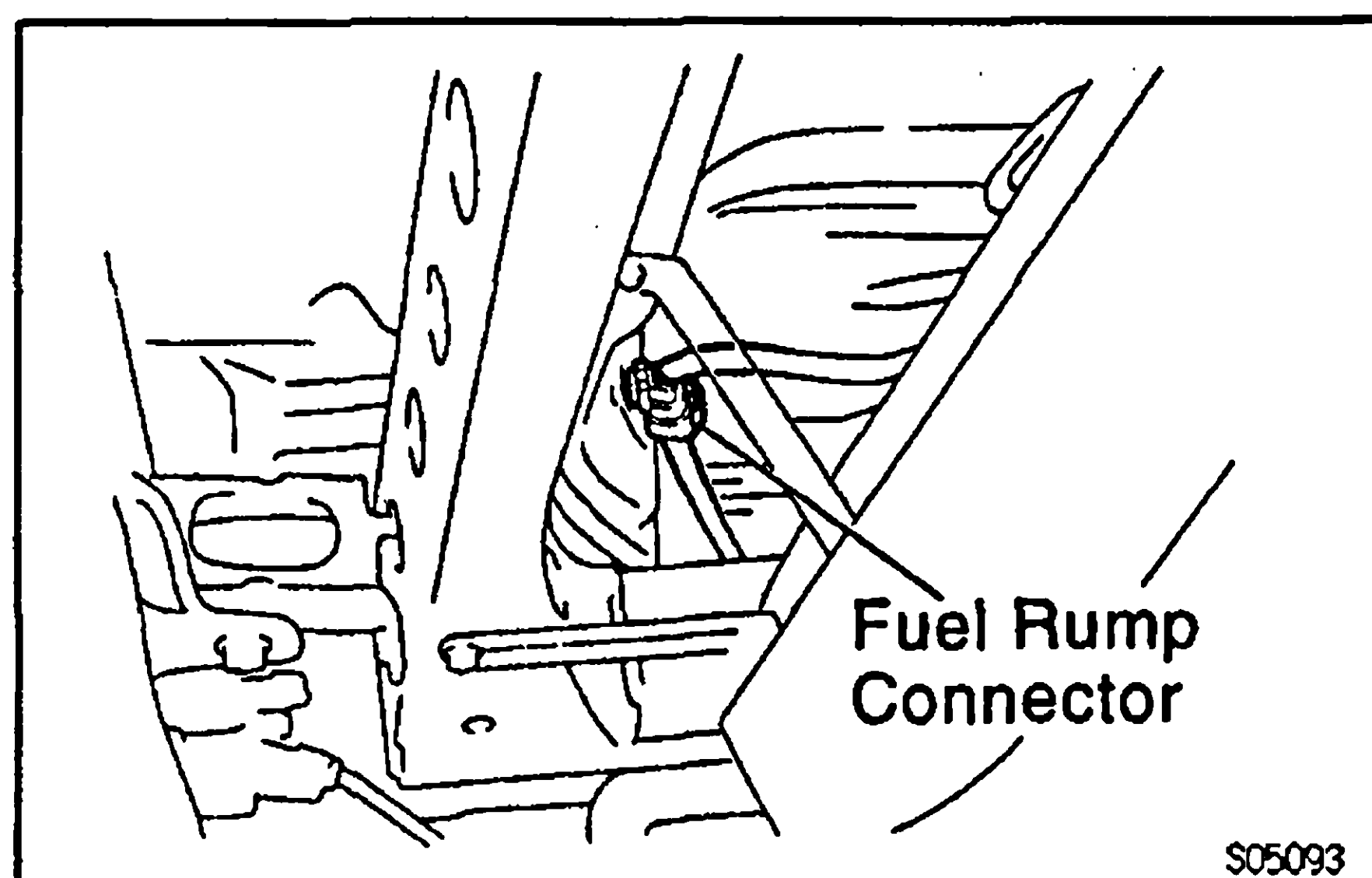


10. Use SST for inspection or test of the injector or its wiring connector.
SST 09842-30070

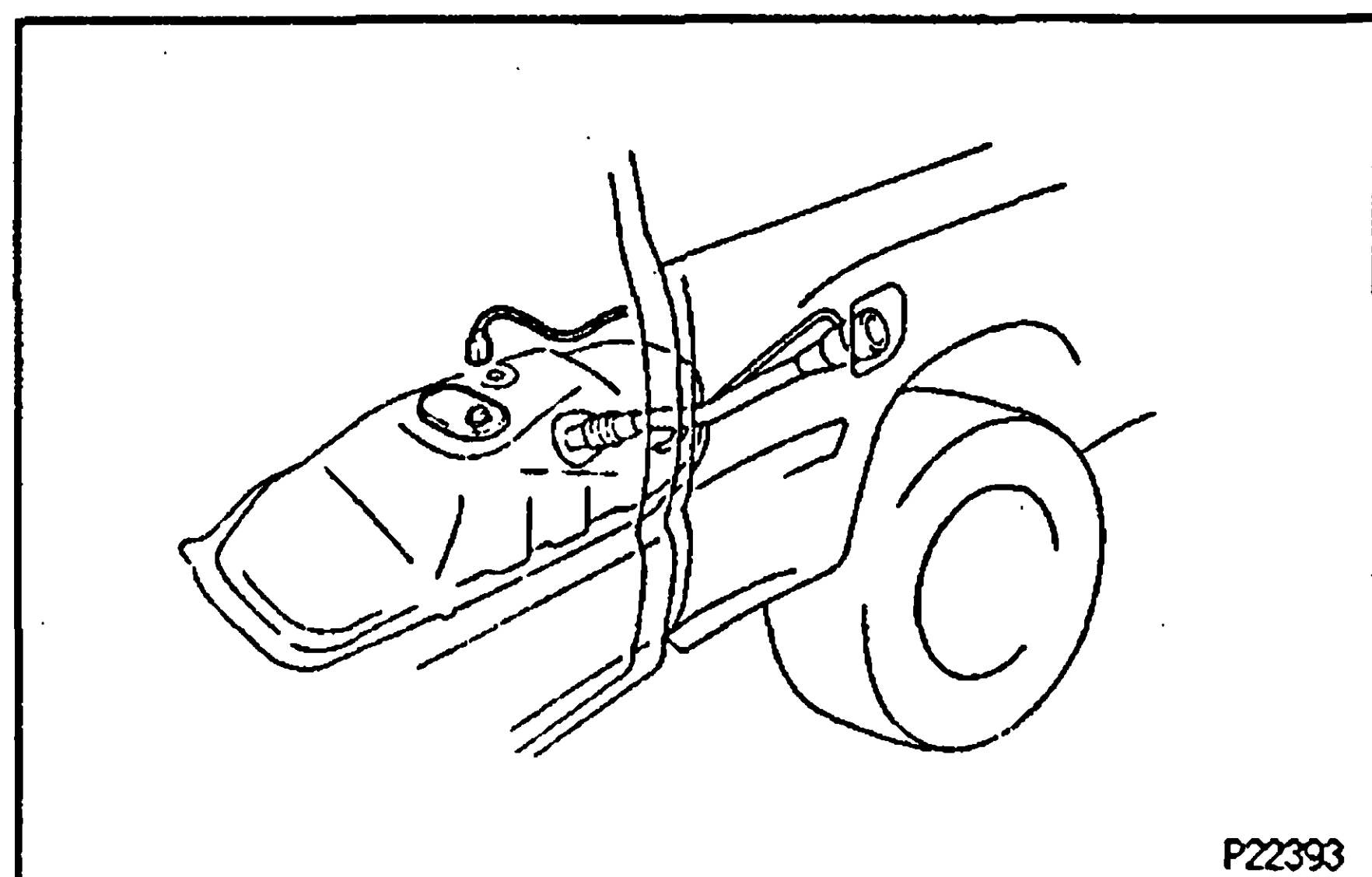
EG

EG93W-02

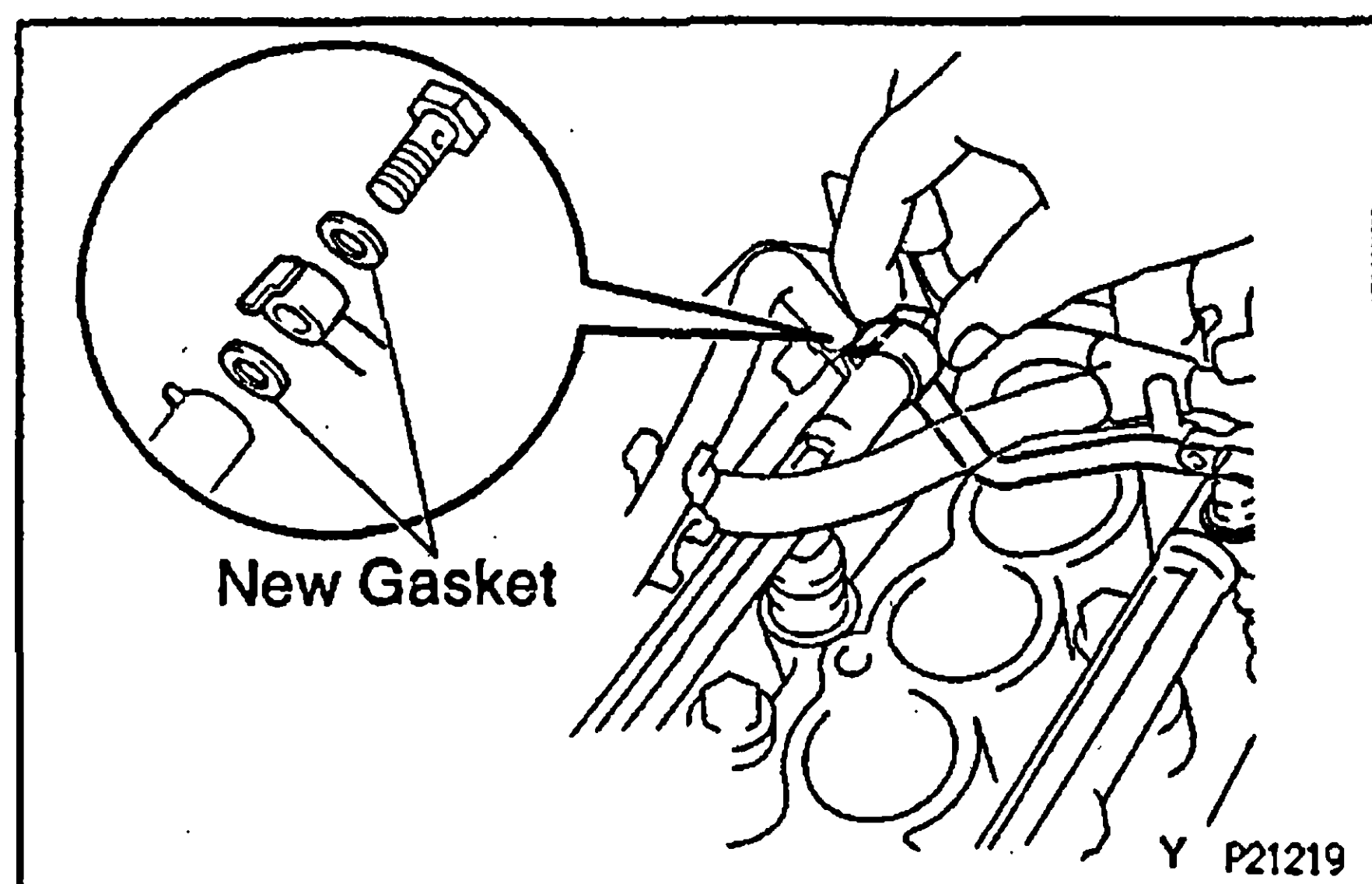
FUEL SYSTEM



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



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



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

Union Bolt Type:

- (a) Always use a new gasket.
 - (b) Tighten the union bolt by hand.
 - (c) Tighten the union bolt to the specified torque.
Torque: 34.3 N·m (350 kgf·cm, 25 ft·lbf)

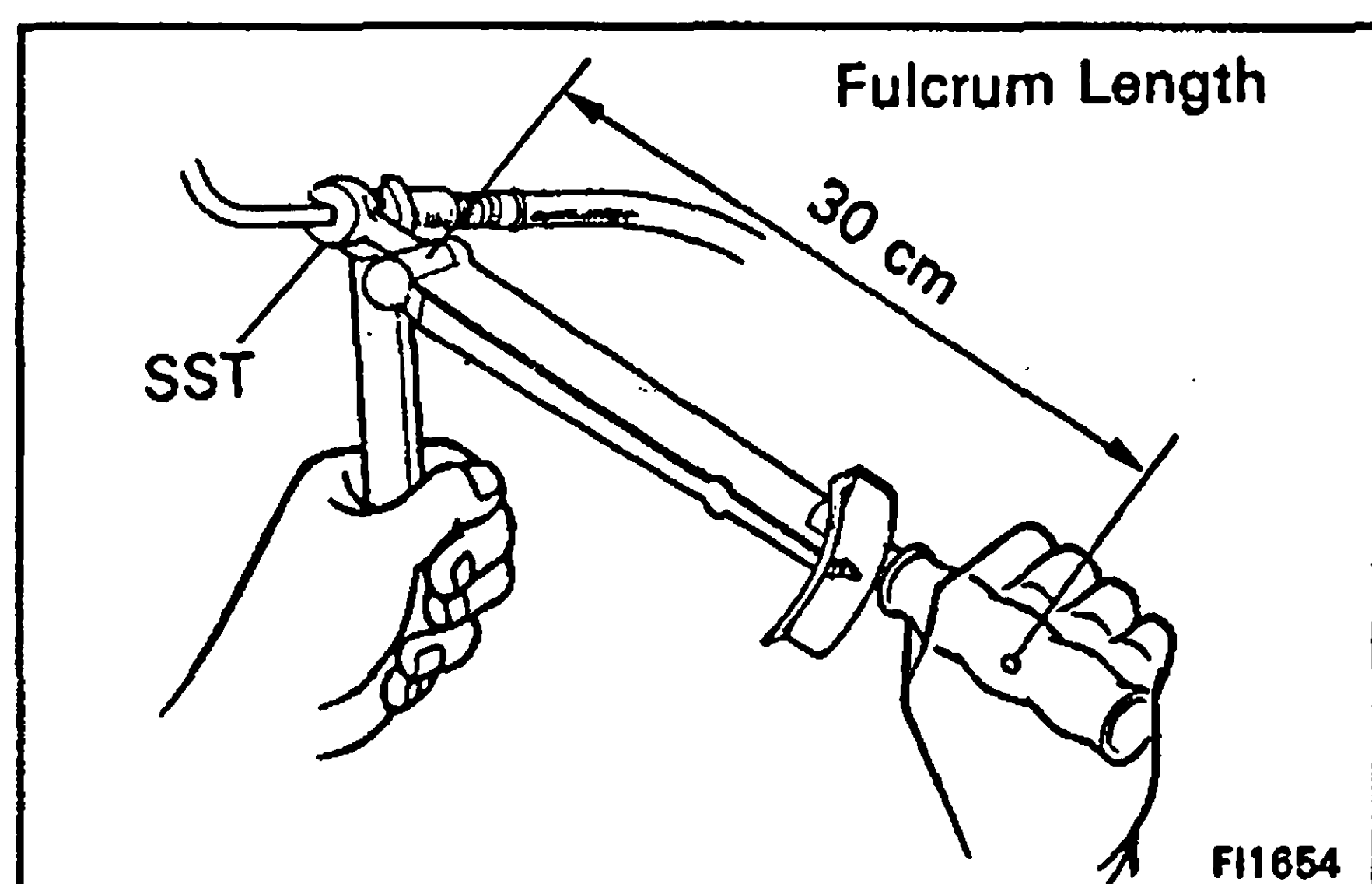
Flare Nut Type:

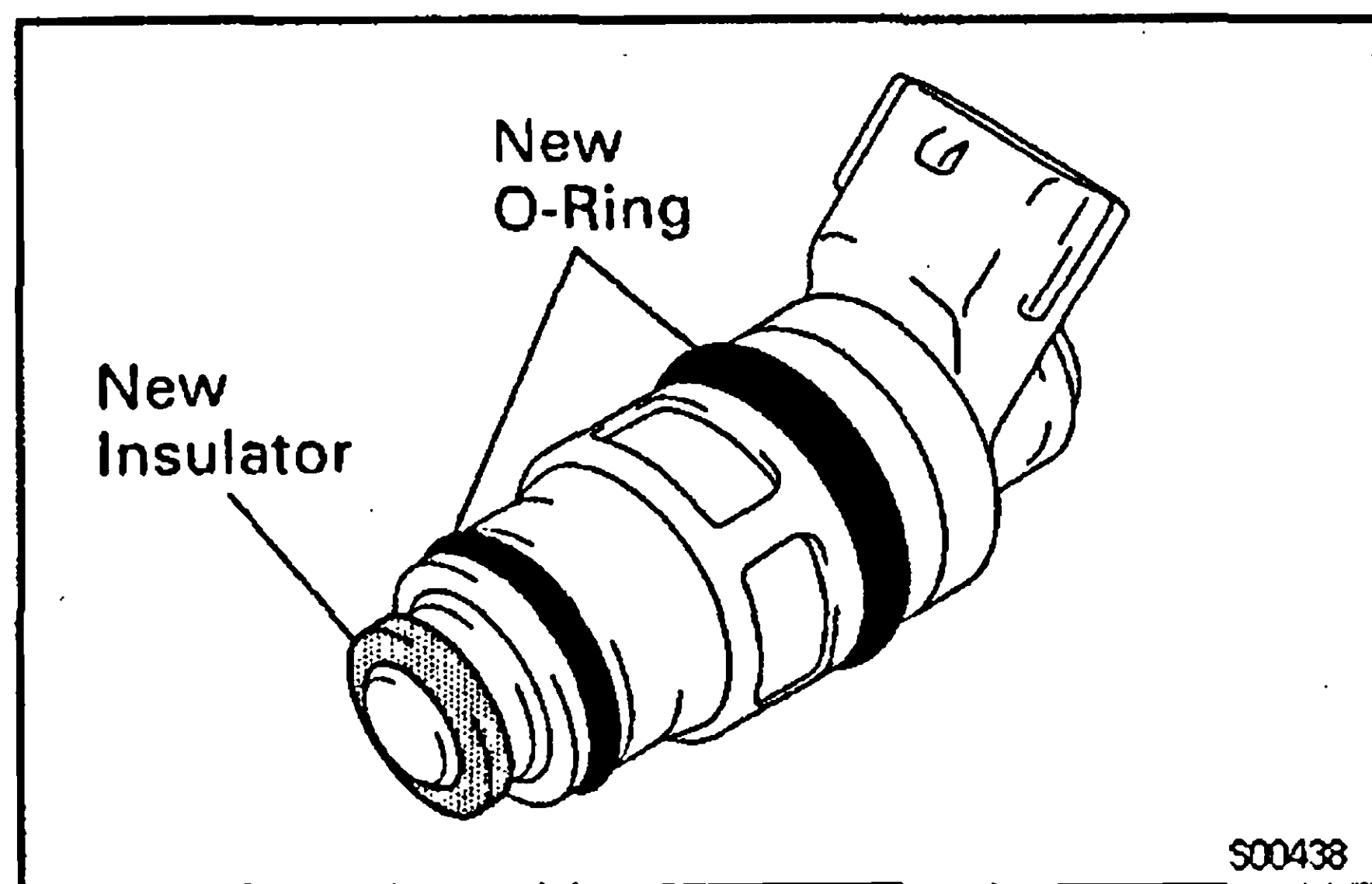
- (a) Apply a light coat of engine oil to the flare and tighten the flare nut by hand.
 - (b) Using SST, tighten the flare nut to the specified torque.

SST 09631-22020

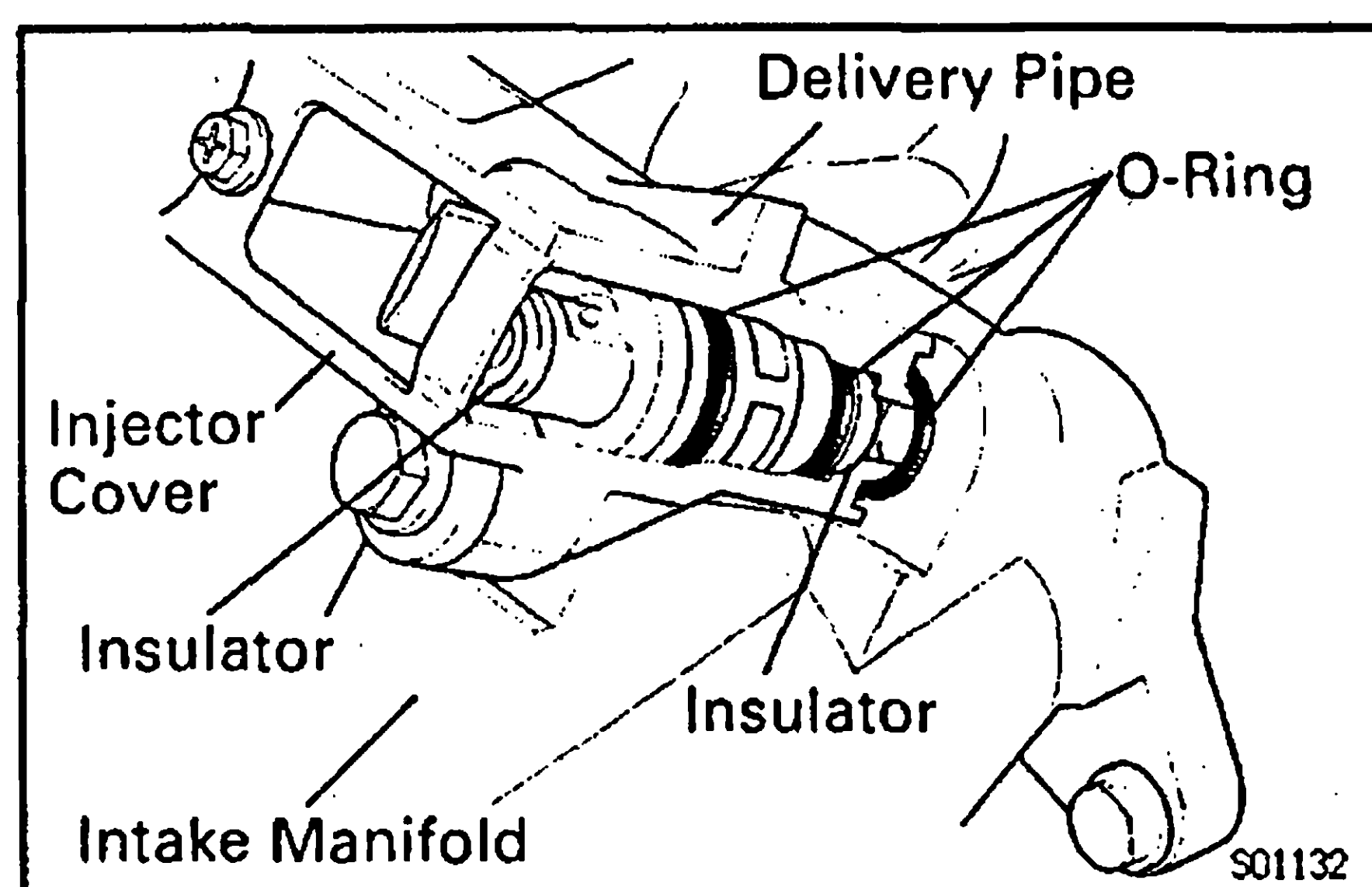
Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)

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

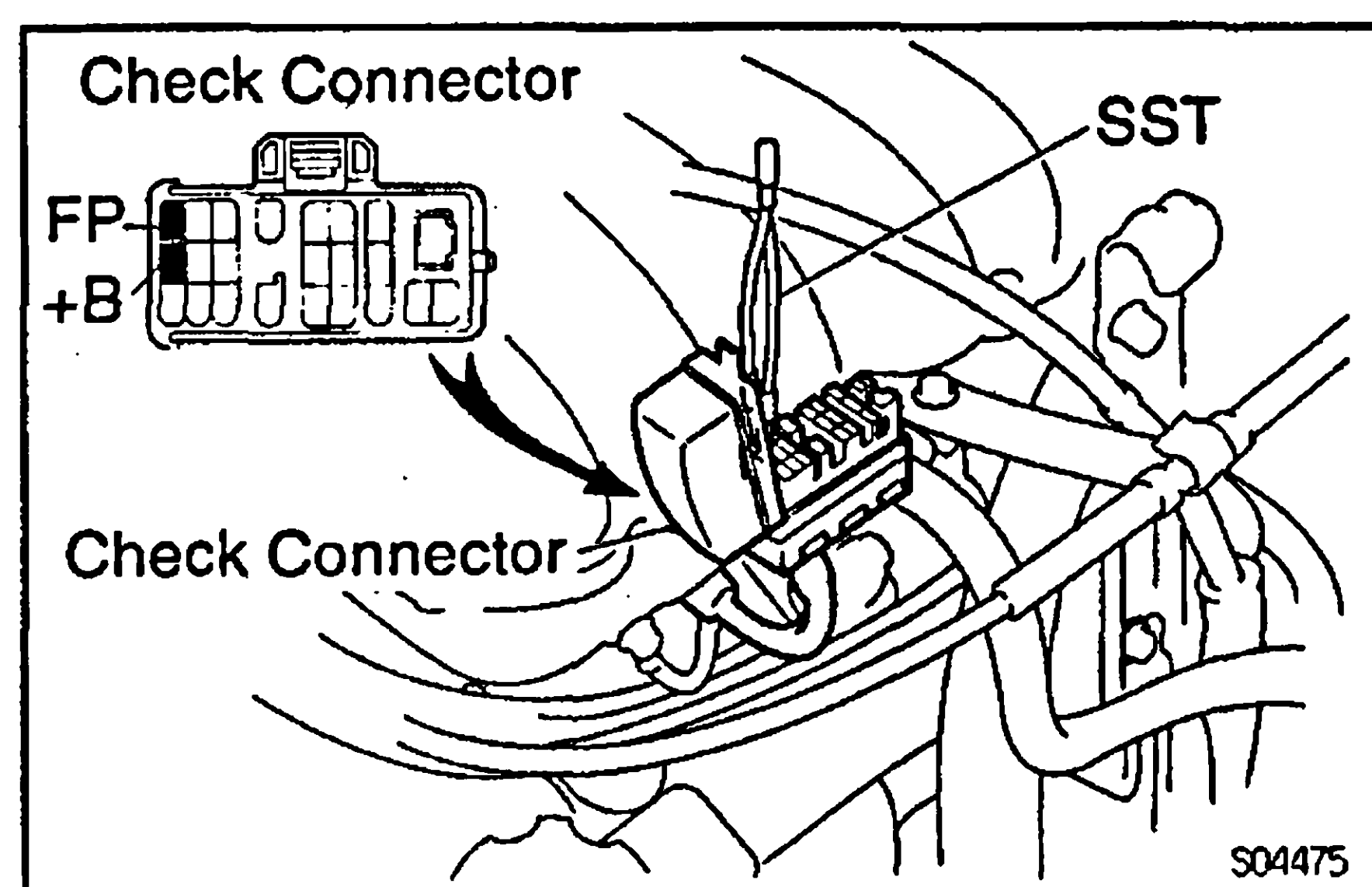




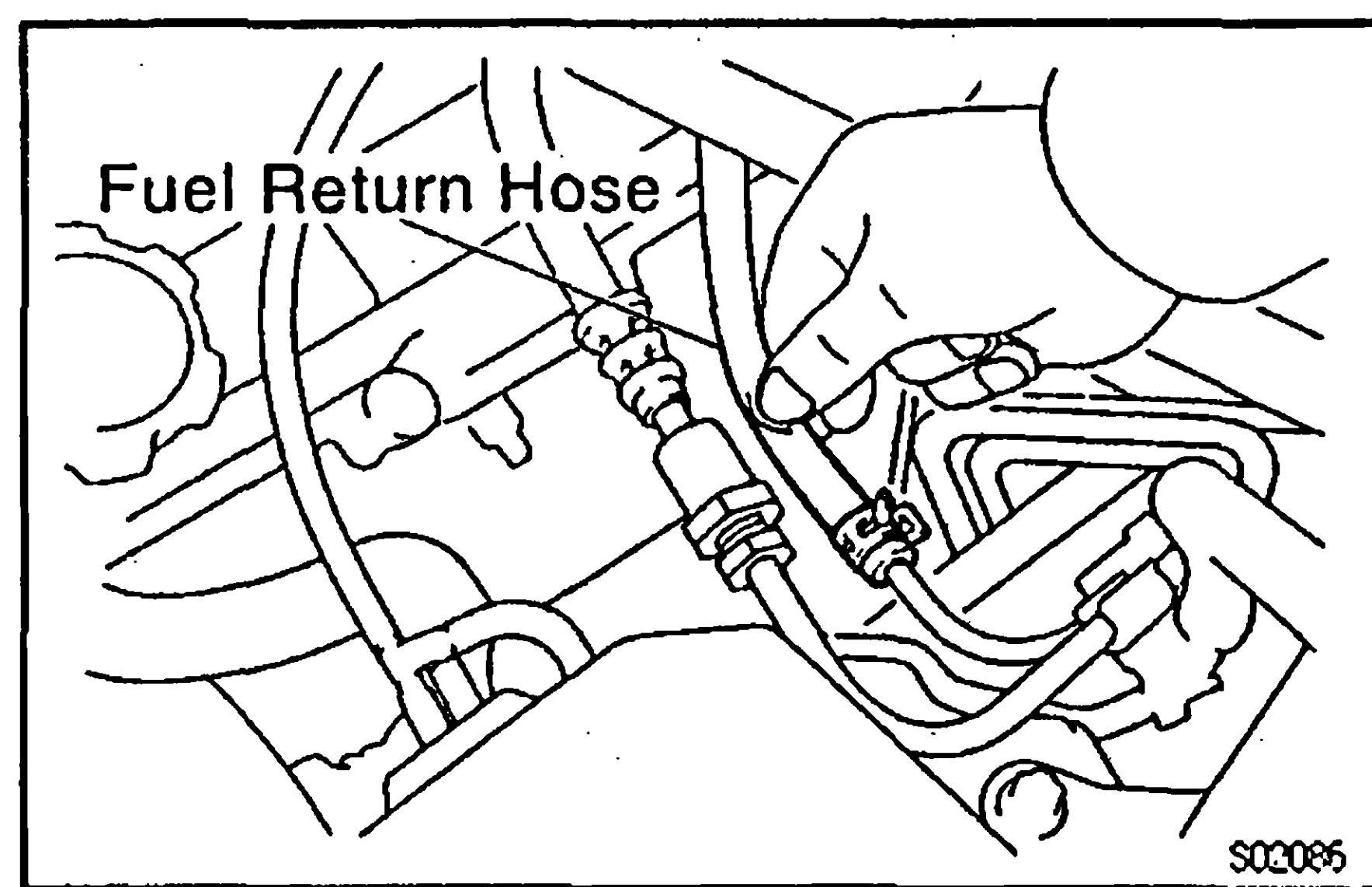
3. Observe the following precautions when removing and installing the injectors.
 - (a) Never reuse the O-ring and insulator.
 - (b) When placing a new O-ring on the injector, take care not to damage it in any way.
 - (c) Coat a new O-ring with spindle oil or gasoline before installing—never use engine,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

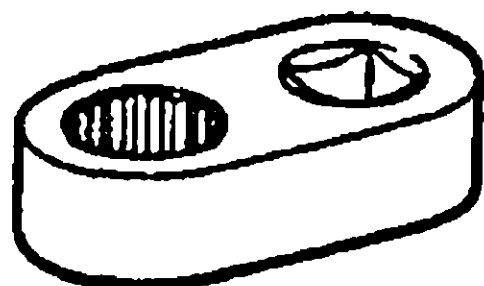
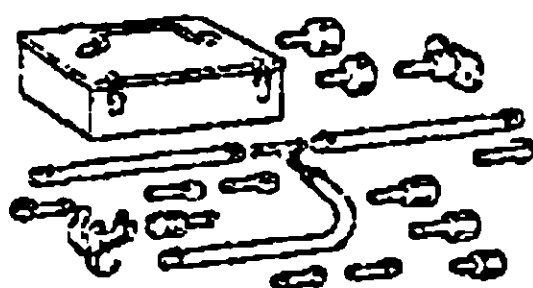
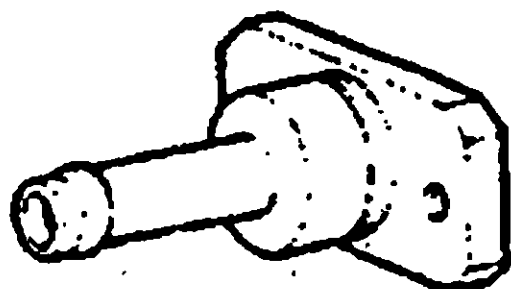
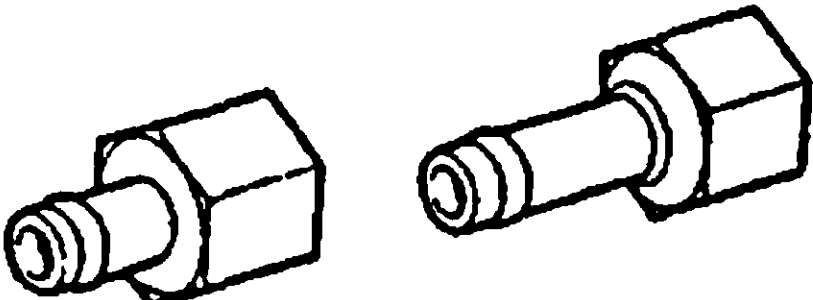
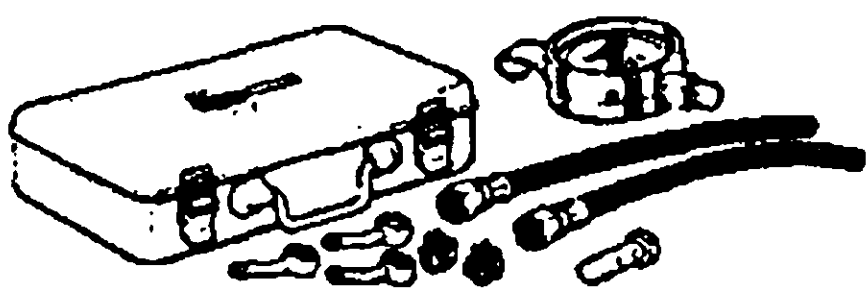
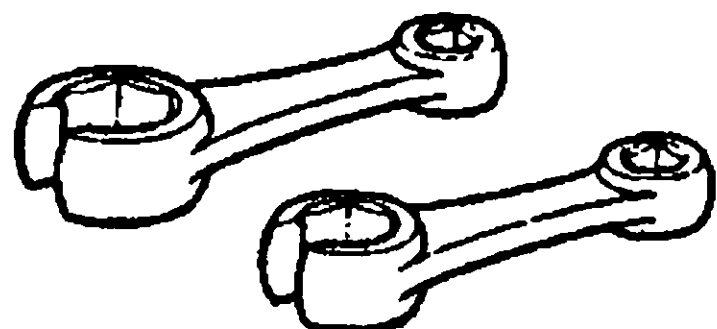
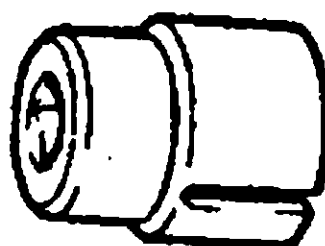


- (c) Pinch the fuel return hose.
The pressure in the high pressure line will rise to approx. 392 kPa (4kgf/cm², 57 psi). In this state, check to see that there are no leaks from any part of the fuel system.
NOTICE: Always pinch the hose. Avoid bending as it may cause the hose to crack.
 - (d) Turn the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

PREPARATION

SST (SPECIAL SERVICE TOOLS)

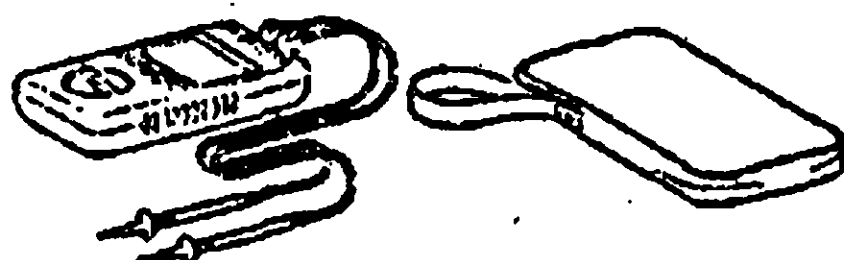
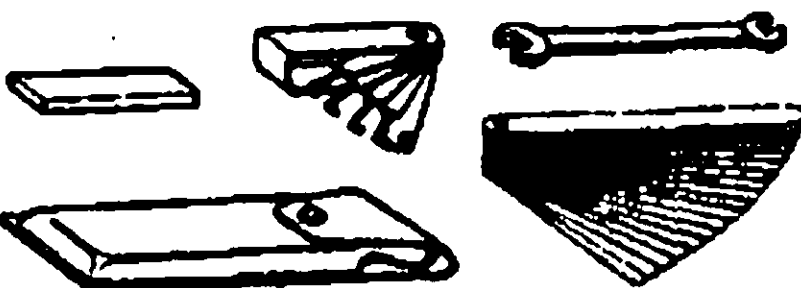
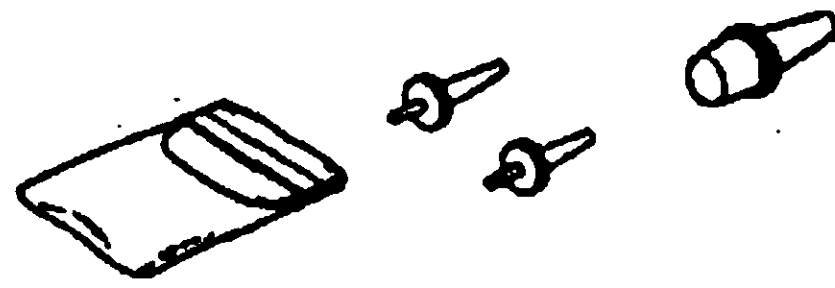
EQ0CF-29

	09205-76030 Cylinder Head Setting Bolt Tightening Adaptor	Water temp. sensor
	09268-41046 Injection Measuring Tool Set	
	(09268-41091) NO.7 Union	
	(09268-52011) Injection Measuring Attachment	
	09268-45012 EFI Fuel Pressure Gauge	
	09631-22020 Power Steering Hose Nut 14 x 17 mm Wrench Set	Fuel line flare nut
	09817-16011 Back-up Light Switch Tool	Knock sensor
	09842-30070 Wiring "F" EFI Inspection	
	09843-18020 Diagnosis Check Wire	

EG

RECOMMENDED TOOLS

EQ0CG-1L

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

EQUIPMENT

B00CH-21

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

EG

ENGINE COOLANT

B07CH-01

Item	Capacity	Classification
w/o Rear Heater	8.0 liters (8.5 US qts, 7.0 Imp. qts)	Ethylene—glycol base
w/ Rear Heater	9.0 liters (9.5 US qts, 7.9 Imp. qts)	

DIAGNOSIS SYSTEM DESCRIPTION

EG49L-0A

The ECU contains a built-in self-diagnosis system by which troubles with the engine signal network are detected and the check engine warning light on the combination meter lights up. By analyzing various signals as shown in the later table (See diagnostic codes) the ECU detects system malfunctions relating to the sensors or actuators.

The self-diagnosis system has 2 modes, a normal mode and a test mode.

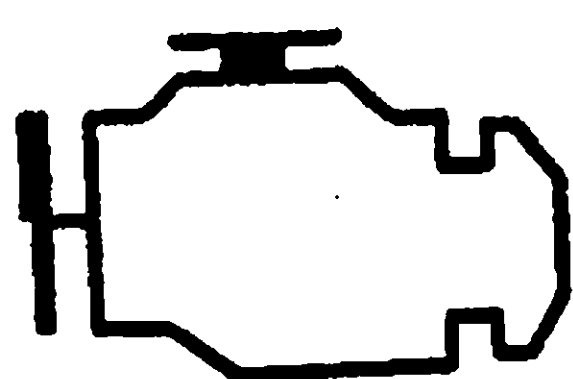
If a malfunction is detected when in the normal mode, the ECU lights up the check engine warning light to inform the driver of the occurrence of a malfunction. (For some codes the light does not come on.) The light goes OFF automatically when the malfunction has been repaired. But the diagnostic code(s) remains stored in the ECU memory. The ECU stores the code(s) until it is cleared by removing the EFI fuse with the ignition switch OFF.

The diagnostic code can be read by the number of blinks of the check engine warning light when TE1 and E1 terminals on the check connector are connected. When 2 or more codes are indicated, the lowest number (code) will appear first.

If a malfunction is detected when in the test mode, the ECU lights up the check engine warning light to inform the technician of the occurrence of a malfunction (except for codes No. 42, 43 and 51). In this case, TE2 and E1 terminals on the check connector should be connected as shown later. (See diagnostic codes output (test mode))

In the test mode, even if the malfunction is corrected, the malfunction code is stored in the ECU memory even when the ignition switch is OFF (except codes No. 42, 43 and 51). This also applies in the normal mode. The diagnostic mode (normal or test) and the output of the check engine warning light can be selected by connecting the TE1, TE2 and E1 terminals on the check connector, as shown later. (See diagnostic codes output)

A test mode function has been added to the functions of the self-diagnosis system of the normal mode for the purpose of detecting malfunctions such as poor contact, which are difficult to detect in the normal mode. This function fills up the self-diagnosis system. The test mode can be implemented by the technician following the appropriate procedures of check terminal connection and operation described later. (See diagnostic codes output (test mode))



"CHECK" Engine Warning Light

P07777

CHECK ENGINE WARNING LIGHT CHECK

EG5JE-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.

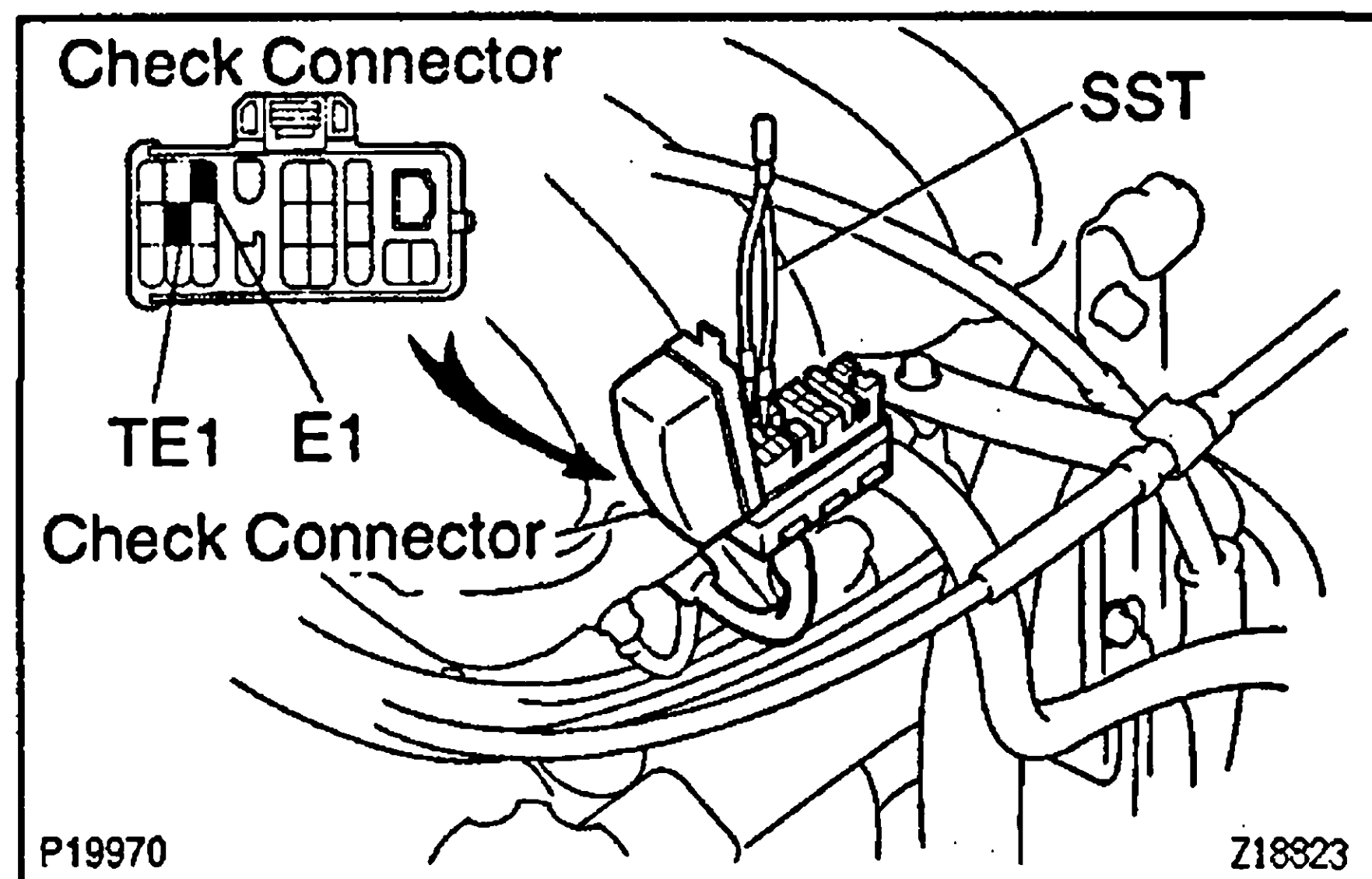
DIAGNOSTIC CODES OUTPUT

EG575-06

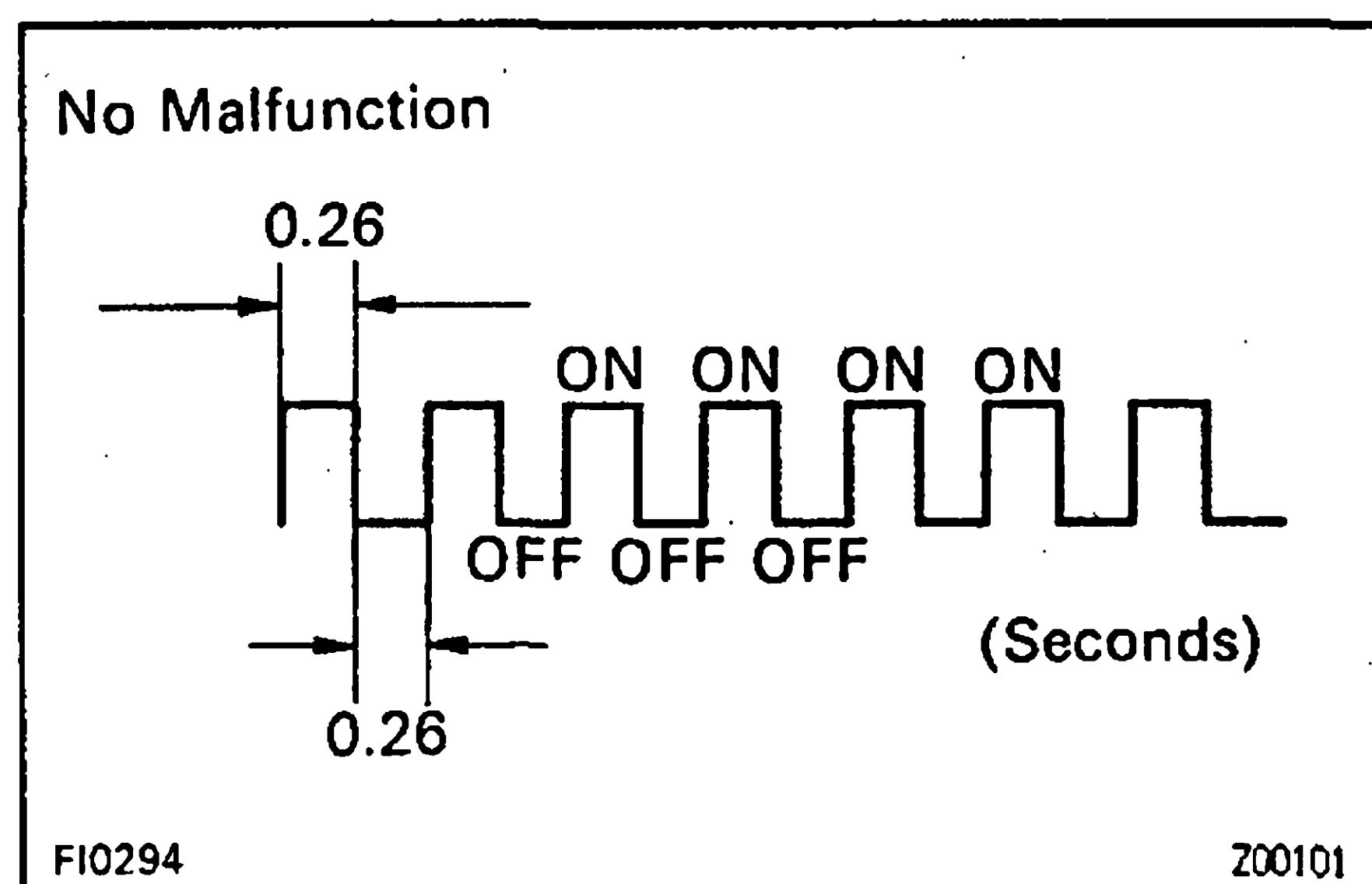
Normal mode:

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

1. Initial conditions
 - (a) Battery voltage 11 V or more
 - (b) Throttle valve fully closed
 - (c) Accessories switched OFF



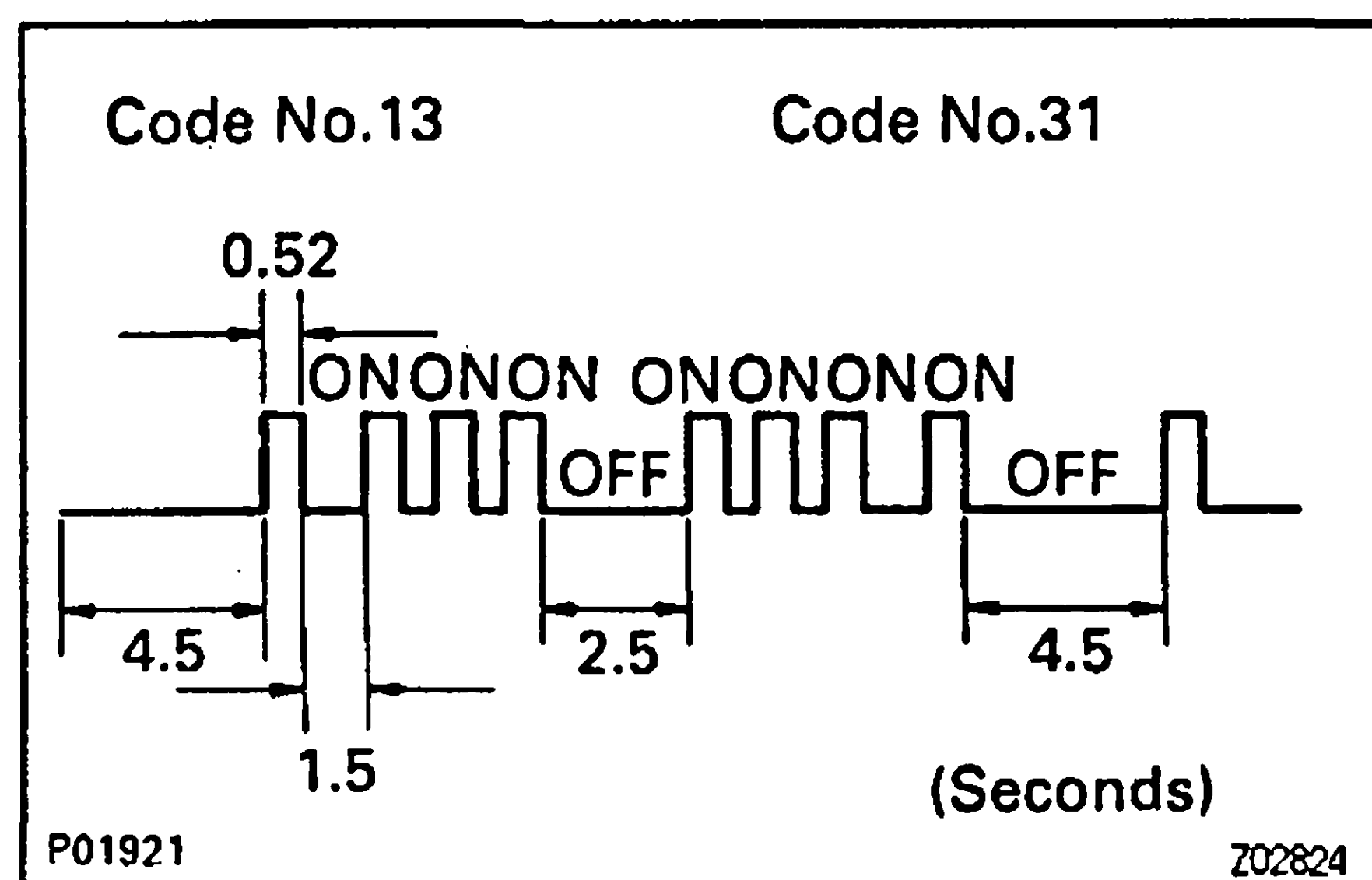
- (d) Engine at normal operating temperature
2. Turn the ignition switch ON.
CAUTION: Do not start the engine.
3. Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843—18020
4. Read the diagnostic code as indicated by the number of flashes of the check engine warning light.



Diagnostic 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 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.

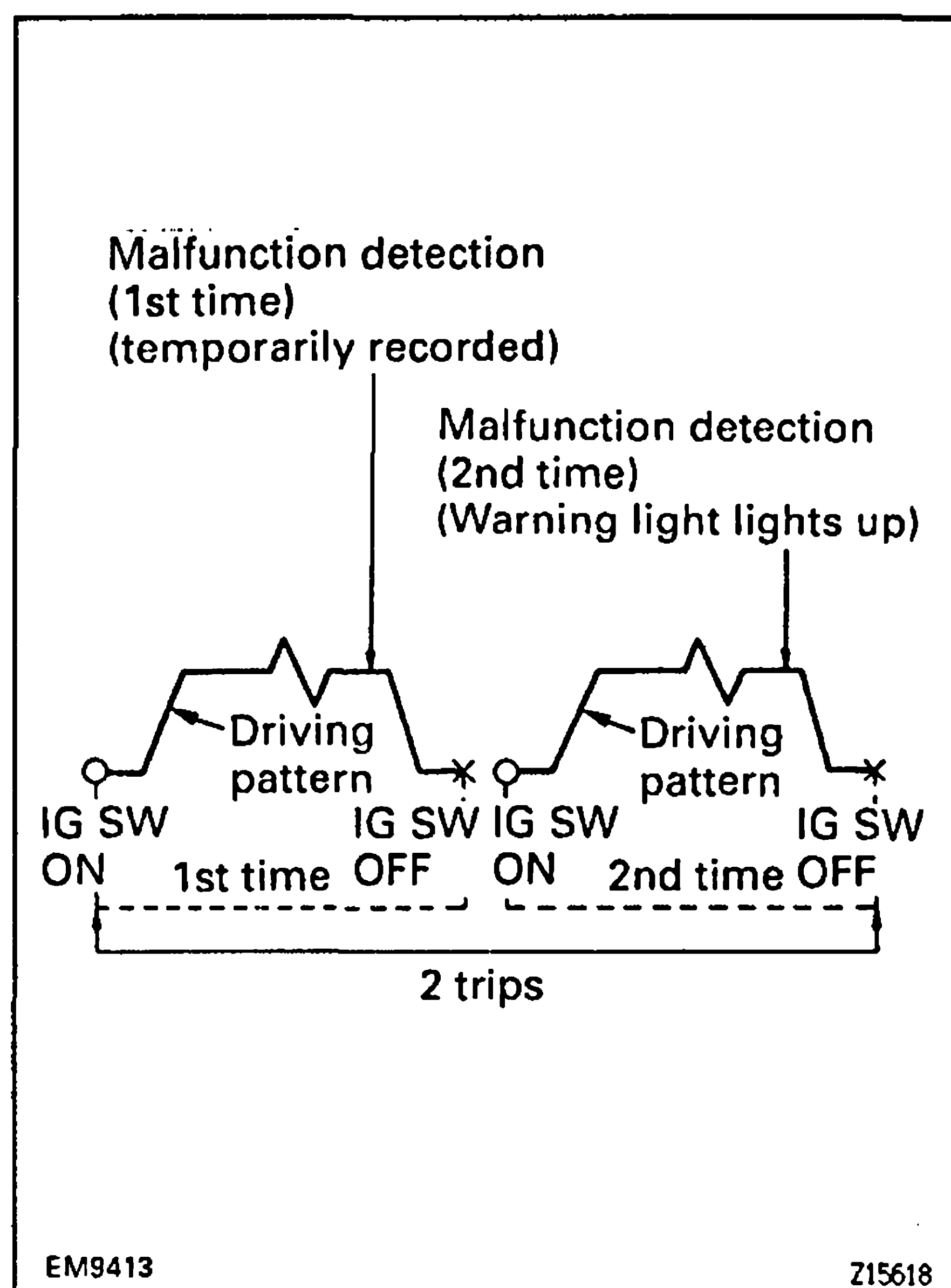
HINT: In the event of a number of trouble codes, indication will begin from the smaller value and continue to the larger.

(c) 2 trip detection logic:

Diagnostic code 21 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

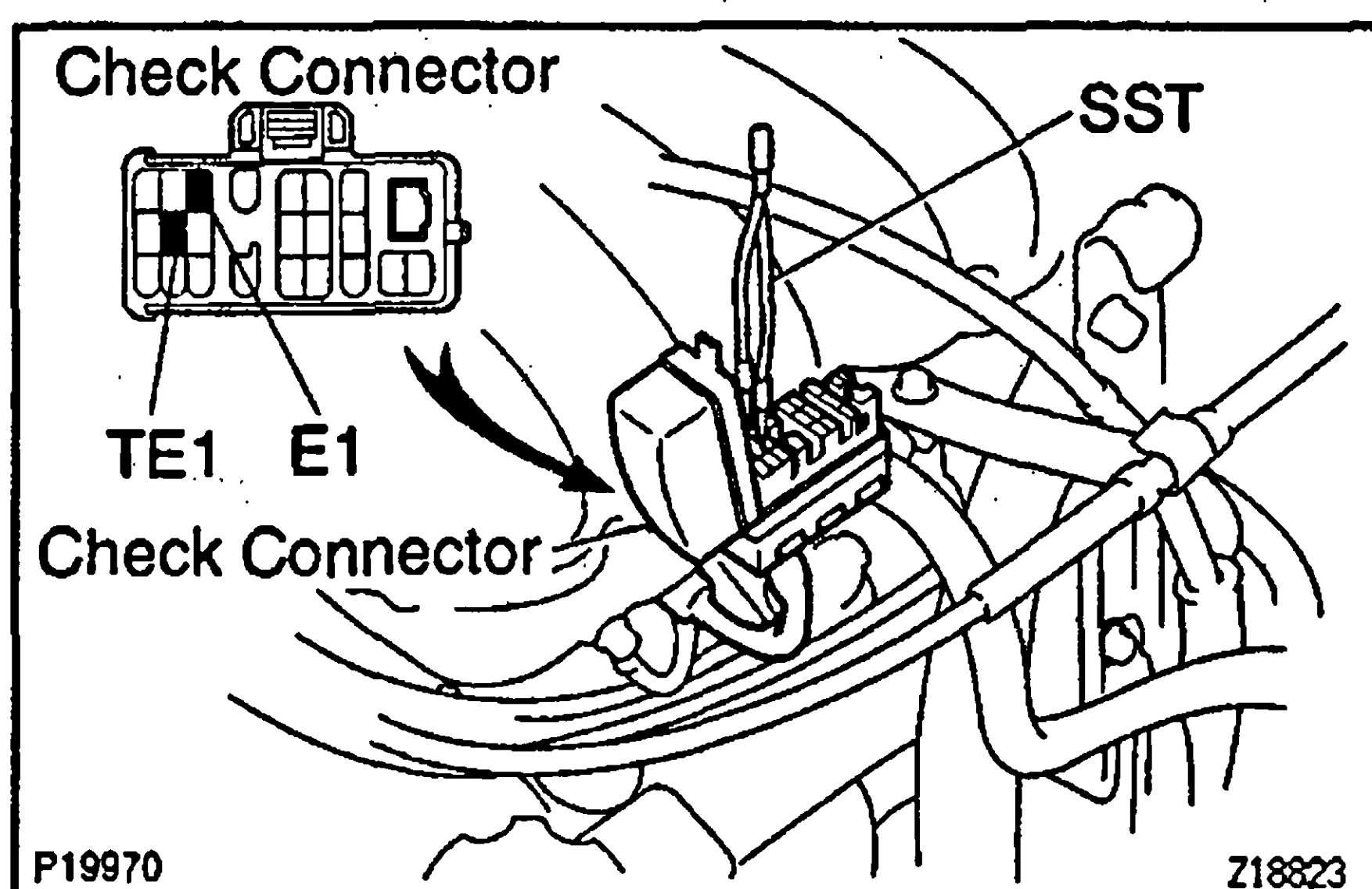
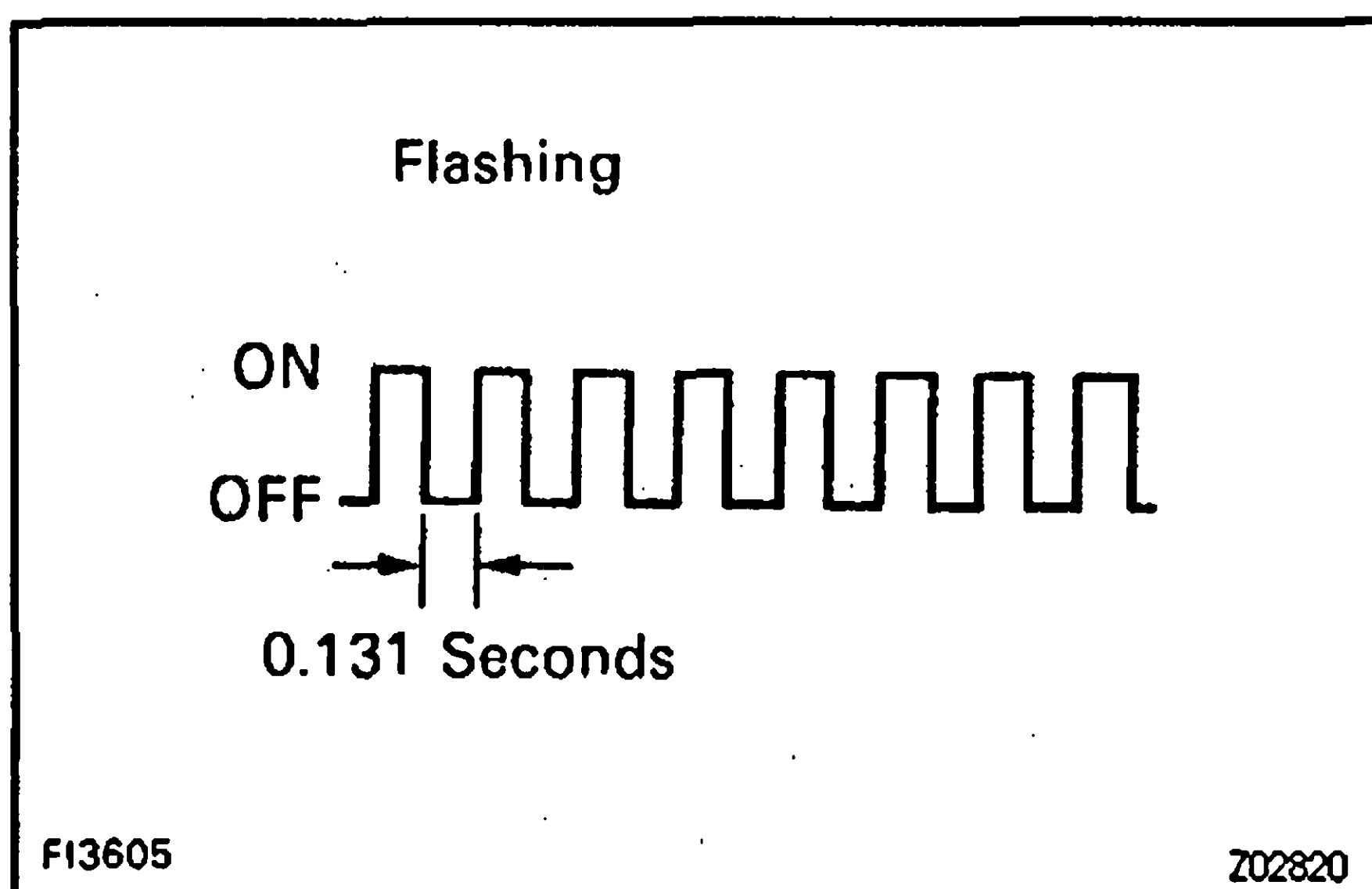
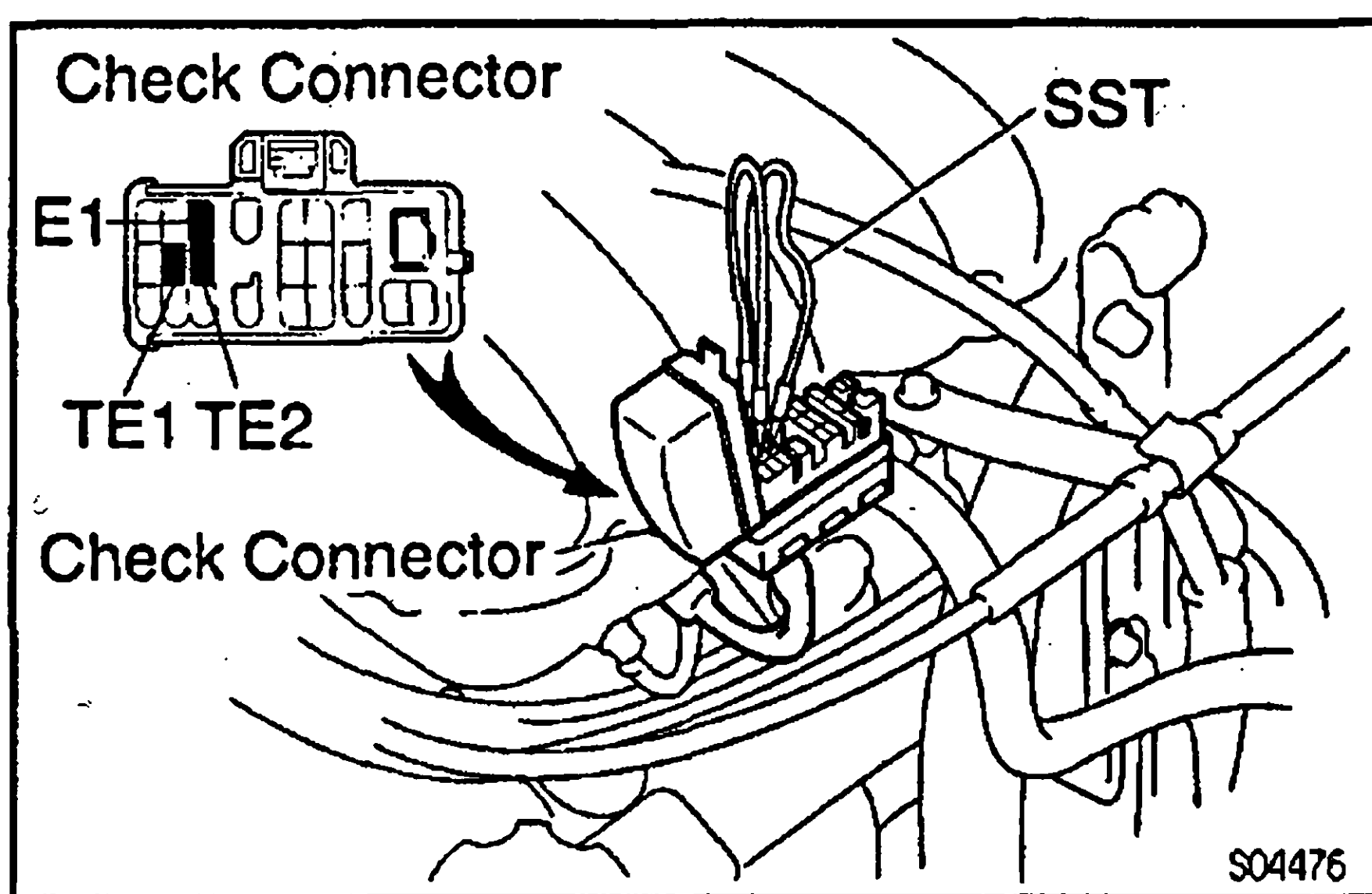


Test mode:**HINT:**

- 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 and 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 codes, proceed as follows:

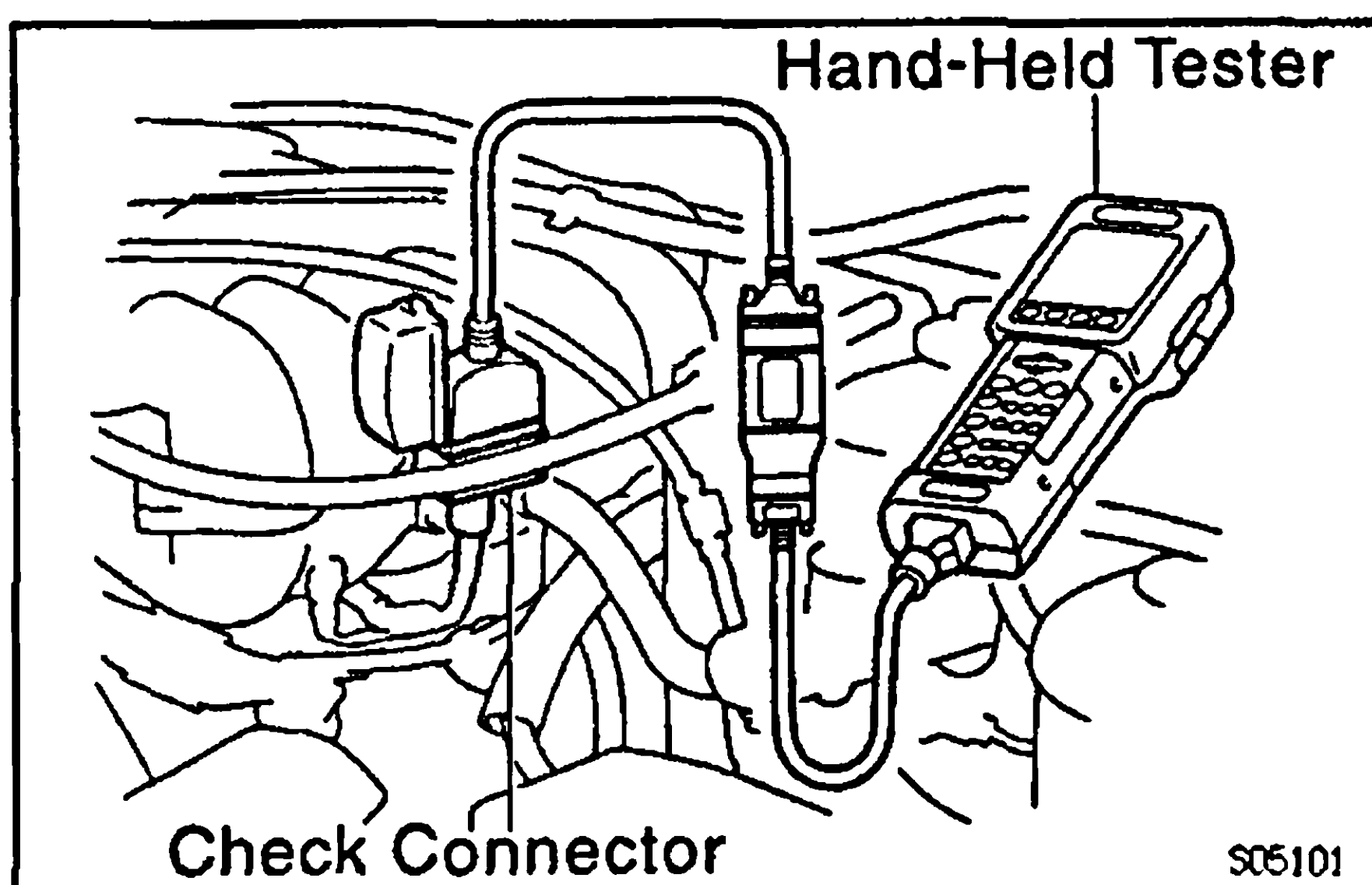
1. Initial conditions
 - (a) Battery voltage 11 V or more
 - (b) Throttle valve fully closed
 - (c) Accessories switched OFF
2. Turn the ignition switch OFF.
3. First, using SST, connect terminals TE2 and E1 of the check connector.
SST 09843-18020
4. Turn the ignition switch ON to begin the diagnosis 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 connector.
SST 09843-18020
 8. Read the diagnostic 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 connector.
SST 09843-18020

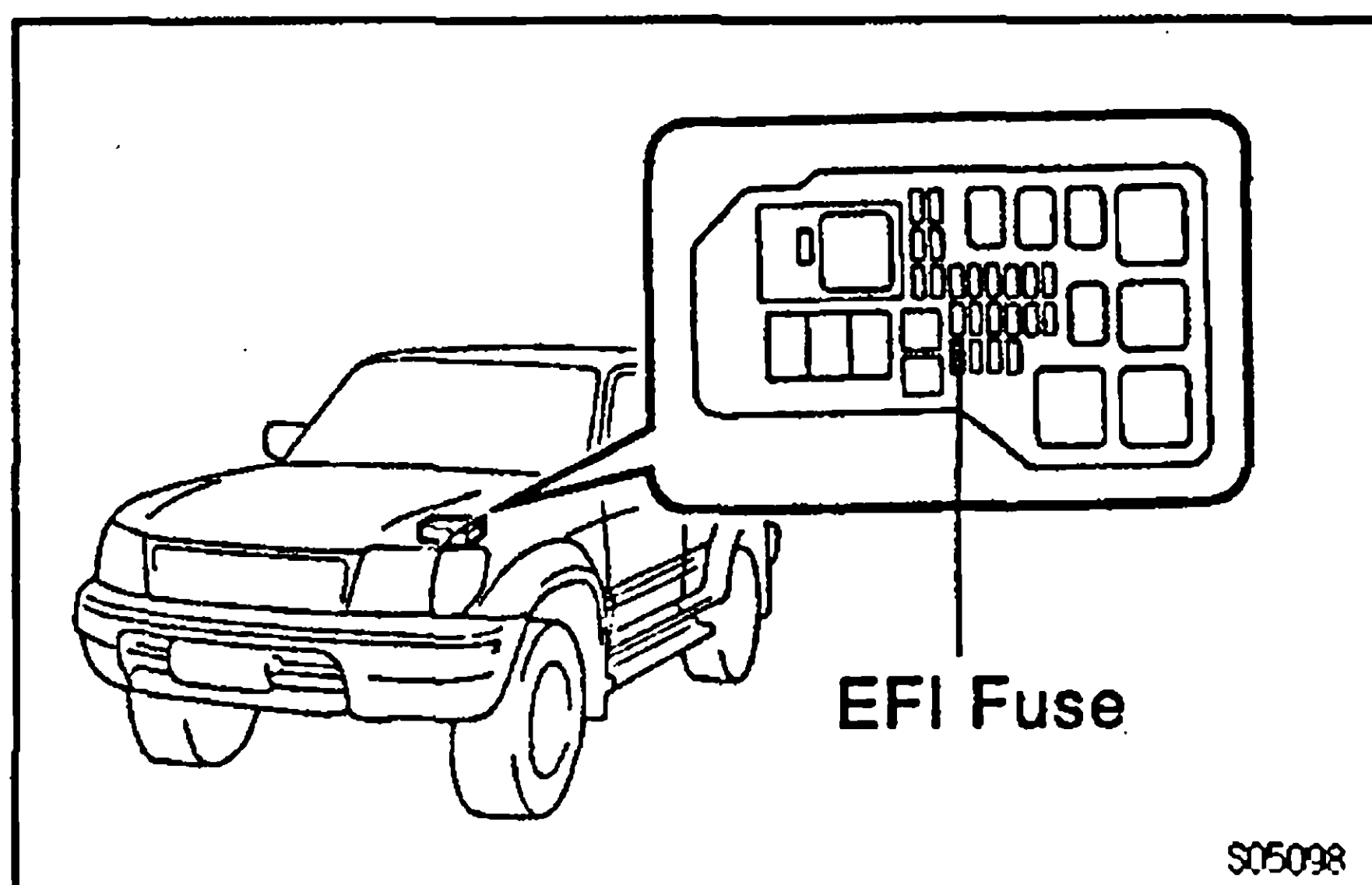
HINT:

- The test mode will not start if terminals TE2 and E1 are connected after the ignition switch is turned ON.
- The starter signal and vehicle speed signal will be diagnosed by the ECU as malfunctions, and codes No. 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 CODE CHECK USING HAND-HELD TESTER E030V-00

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



DIAGNOSTIC CODE CANCELLATION E042T-00

1. After repair of the trouble area, the diagnostic code retained in memory by the ECU must be canceled out by removing the EFI fuse (15A) for 10 seconds or more, depending on ambient temperature (the lower the temperature it is, 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 canceled out.
- If the diagnostic code is not canceled out, it will be retained by the ECU and appear along with a new code in the event of future trouble.

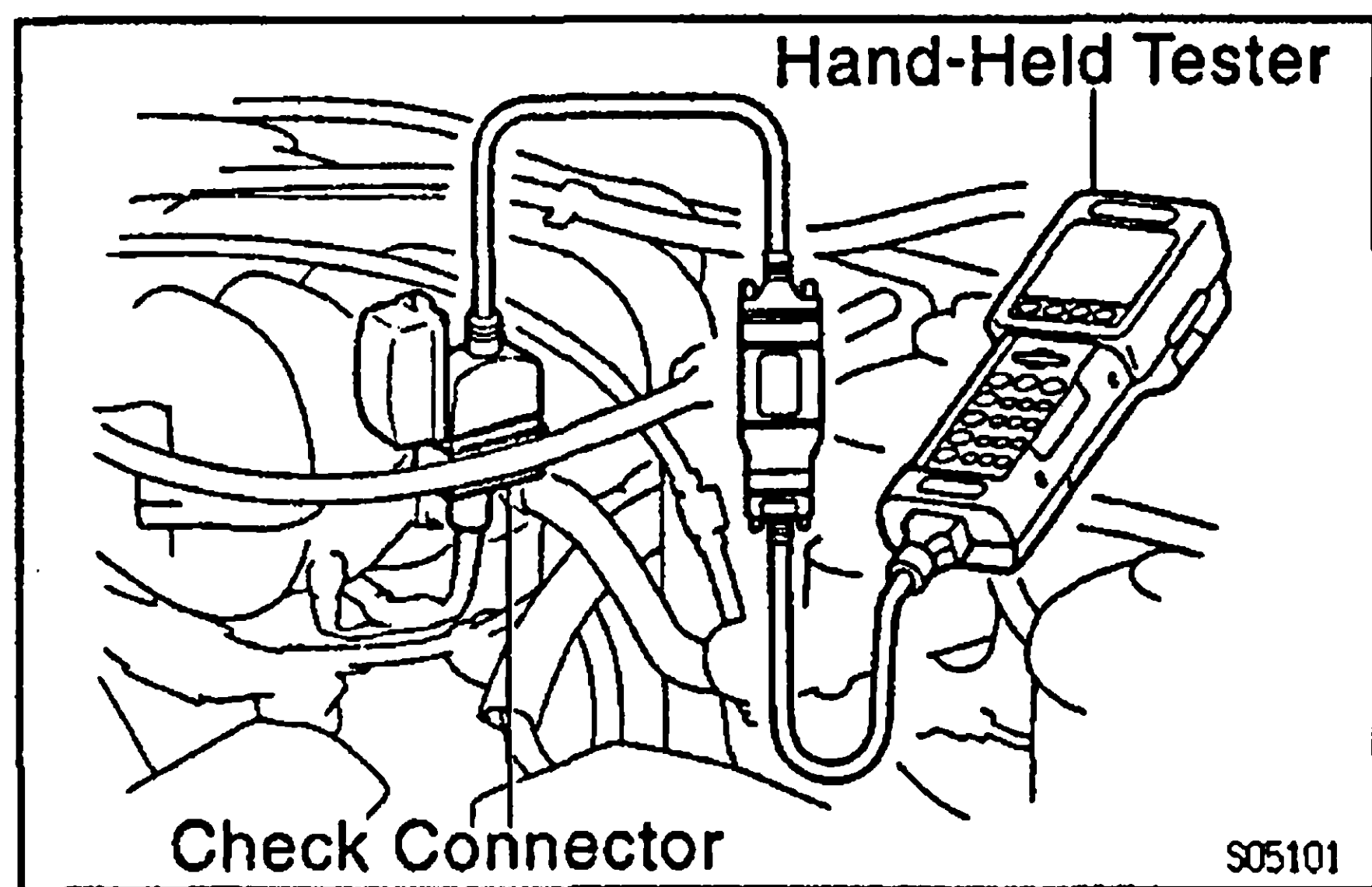
- If it is necessary to work on engine components requiring removal of the battery terminal, a check must first be made to see if a diagnostic code has been recorded.
2. After cancellation, do the road test to check that a normal code is now read on the check engine warning light.
- If the same diagnostic code appears, it indicates that the trouble area has not been repaired thoroughly.

EG

EG124-0H

DIAGNOSIS INDICATION

1. When 2 or more codes are indicated, the lowest number (code) will appear first.
2. All detected diagnostic codes, except codes No. 42, 43 and 51 under the test mode will be retained in memory by the ECU from the time of detection until canceled out.
3. Once malfunction is cleared, the check engine warning light in the combination meter will go off but the diagnostic code(s) remains stored in ECU memory.



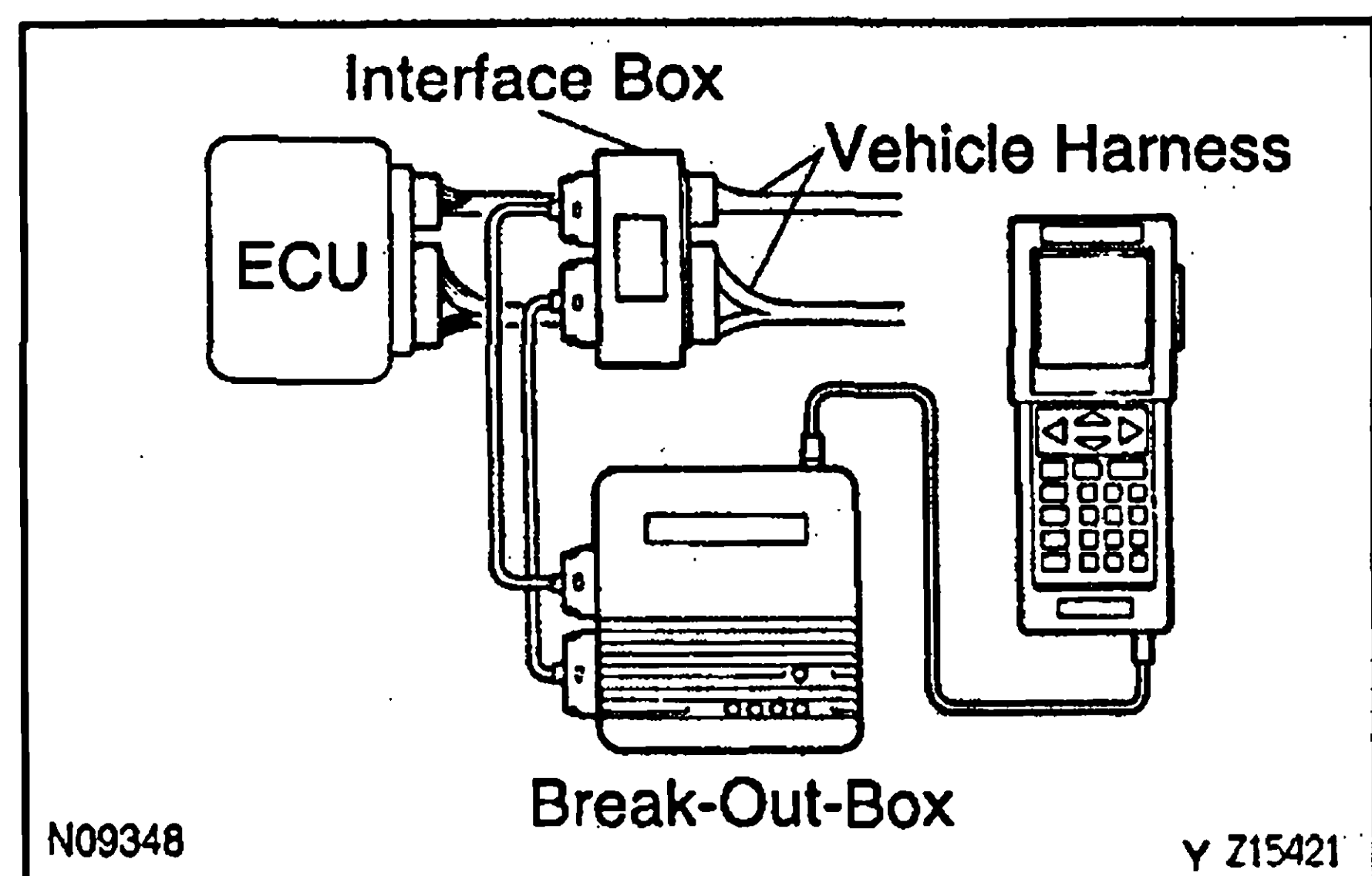
ECU DATA MONITOR USING HAND—HELD TESTER

EG20X-0L

1. Hook up the hand—held tester to the check connector.
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^{EG36Y-00} 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.

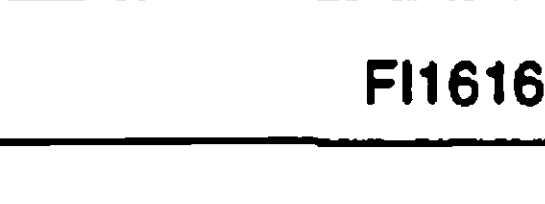
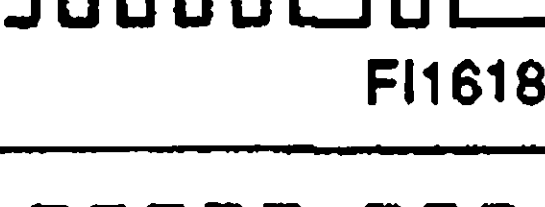
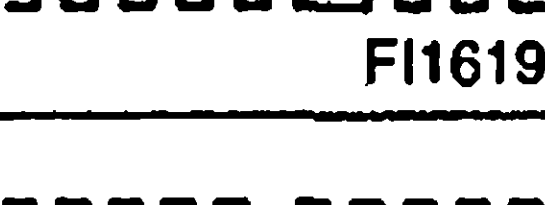
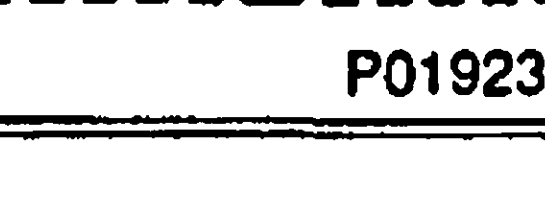
DIAGNOSTIC CODES

HINT:

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

DTC No.	Number of blinks of Check Engine Warning Light	System	Check Engine*1 Warning Light		Diagnosis	Trouble Area	Memory*2	See page
			Normal Mode	Test Mode				
—	 F11401	Normal	—	—	Output when no other code is recorded.	—	—	—
12	 F11606	RPM Signal	ON	N.A.	• No G or NE signal is not input to ECU for 2 secs. or more after cranking. • No G signal is not input to ECU for 5 secs. and engine revolution is more than 600 rpm	• Open or short in crankshaft position sensor or camshaft position sensor circuit. • Crankshaft position sensor • Camshaft position sensor • Starter • ECU	○	—
13	 F11607	RPM Signal	ON	N.A.	No NE signal to ECU for 1.0 sec. or more at 1,500 rpm or more.	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • ECU	○	—
14	 F11608	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-122
16	 F13600	A/T Control Signal	ON	N.A.	Fault in communications between the engine CPU and A/T CPU in the ECU.	• ECU	×	—
21	 F11609	Oxygen Sensor Signal	ON	ON	Open or short in heater circuit of oxygen sensor for 1.0 sec. or more. (HT)	• Open or short in heater circuit of oxygen sensor • Oxygen sensor • ECU	○	—
					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 below 0.3V continuously for 60 sec. or more. *3 (2 trip detection logic)	• Open or short in oxygen sensor circuit • Oxygen sensor • Open or short in vacuum sensor circuit • Vacuum sensor • ECU	○	—
22	 F11610	Water temp. Sensor Signal	ON	ON	Open or short in water temp. sensor circuit for 1.0 sec. or more. (THW)	• Open or short in water temp. sensor circuit • Water temp. sensor • ECU	○	EG-120
24	 F11611	Intake Air Temp. Sensor Signal	ON	ON	Open or short in intake air temp. sensor circuit for 1.0 sec. or more. (THA)	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor • ECU	○	EG-119
25	 F11612	Air-Fuel Ratio Lean Malfunction	ON	ON	Oxygen sensor output in less than 0.45V for at least 90 sec. when oxygen sensor is warmed up (racing at 1,500 rpm or more). *3 (2 trip detection logic)	• Open in injector circuit • Fuel line pressure (injector leak, blockage) • Ignition system (spark plug, igniter) • Vacuum sensor (air intake) • Open or short in oxygen sensor circuit • Oxygen sensor • ECU	○	—

DIAGNOSTIC CODES (Cont'd)

DTC No.	Number of blinks of Check Engine Warning Light	System	Check Engine* Warning Light		Diagnosis	Trouble Area	Memory*2	See page
			Normal Mode	Test Mode				
31	 FI1612	Air Flow Meter Signal	ON	OFF	At engine speed is below 3,000 rpm open or short detected continuously for 5.0 sec. or more in air flow meter circuit.	• Open or short in air flow meter circuit • Air flow meter • ECU	○	EG-143
33	 BE3933	Idle Speed Control Valve	ON	ON	At idling, open or short detected continuously for 10 sec. or more in idle speed control valve circuit	• Open or short in idle speed control valve circuit • ISC valve • ECU	○	EG-150
41	 FI1614	Throttle Position Sensor Signal	ON	ON	Condition a) or b) continues: a) VTA < 0.1V, and closed throttle position switch is OFF. b) VTA > 4.9V	• Open or short in throttle position sensor circuit • Throttle position sensor • ECU	○	EG-116
42	 FI1615	Vehicle Speed Sensor Signal	ON	ON	SPD signal is not input to ECU for at least 8 seconds when vehicle is running with below condition. • Engine speed 1,800-3,500 rpm • Coolant temp. More than 80°	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECU	○	—
43	 FI1616	Starter Signal	N.A.	ON	No starter signal to ECU.	• Open or short in starter signal circuit • Open or short in ignition switch or starter relay circuit • ECU	×	—
52	 FI1618	Knock Sensor 2 (Left bank) Signal	ON	ON	No knock sensor 2 signal to ECU for crank revolutions with engine speed 2,000 rpm and 5,600 rpm.	• Open or short in knock sensor circuit • Knock sensor (looseness) • ECU	○	—
53	 FI1619	Knock Control Signal	ON	N.A.	Engine control computer malfunction (for knock control).	• ECU	×	EG-162
55	 P01923	Knock Sensor 1 (Right bank) Signal	ON	ON	No knock sensor 1 signal to ECU with engine speed 1,800 rpm and 5,600 rpm	• Open or short in knock sensor circuit • Knock sensor (looseness) • ECU	○	—
51	 FI1617	Switch Condition Signal	N.A.	ON	Display when A/C is ON or NSW is OFF and STA is OFF with the check terminals E1 and TE1 connected at Test mode.	• A/C switch system • Throttle position sensor IDL circuit • Accelerator pedal, cable • ECU	×	—

V08163

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.
- *2: "○" in the memory column indicates that a diagnostic code is recorded in the ECU memory when a malfunction occurs. "X" indicates that a diagnostic code is not recorded in the ECU memory even if a malfunction occurs. Accordingly, output of diagnostic results is performed with the ignition switch ON.
- *3: "2 trip detection logic". (See step 4 (c) in trouble codes output (normal mode))

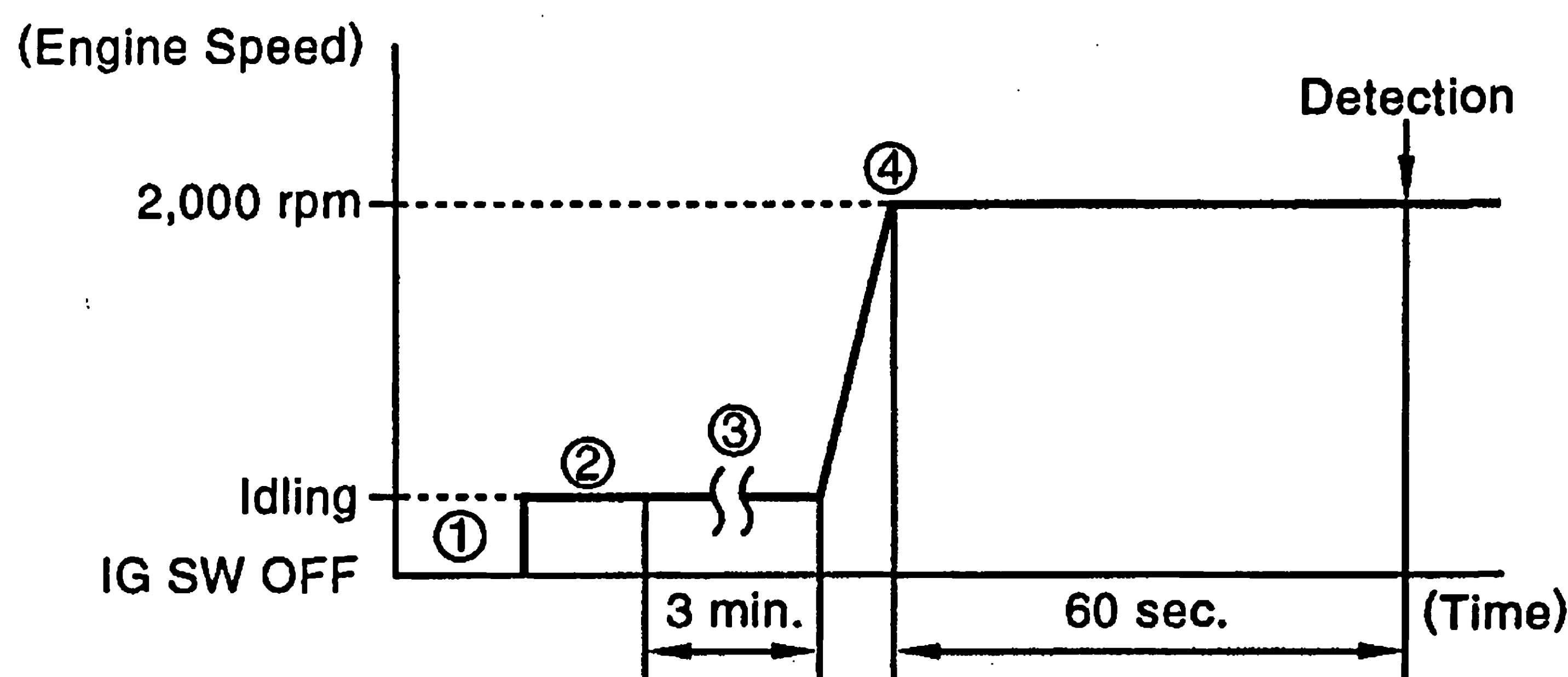
DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN

Purpose of the driving pattern

- (a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.
- (b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

DTC No.21 Oxygen Sensor Circuit

Malfunction: Deterioration of Oxygen Sensor



V08159

- 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.
- ④ Maintain the vehicle speed at 50 — 65 km (31 — 40 mph).
- ⑤ 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)

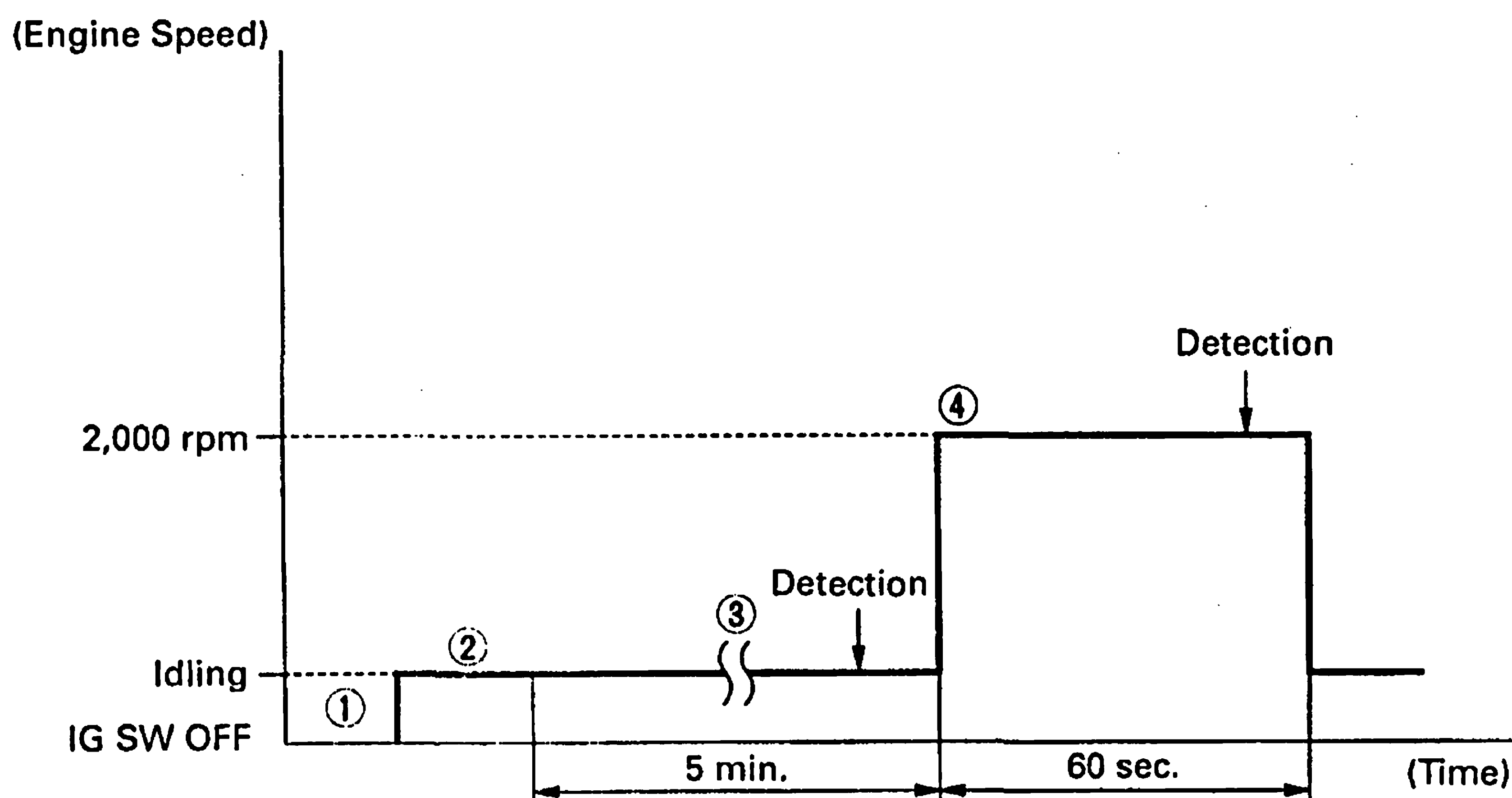
Purpose of the driving pattern

- (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 Oxygen Sensor



F16483

V07540

HINT: Before this test, check the feedback voltage for the 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 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.
- ④ Accelerate rapidly to 4,000 rpm 3 times.
- ⑤ Maintain 2,000 rpm for 90 seconds.

HINT: If any malfunction is detected, the check engine warning light will light up during step ⑤.

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)

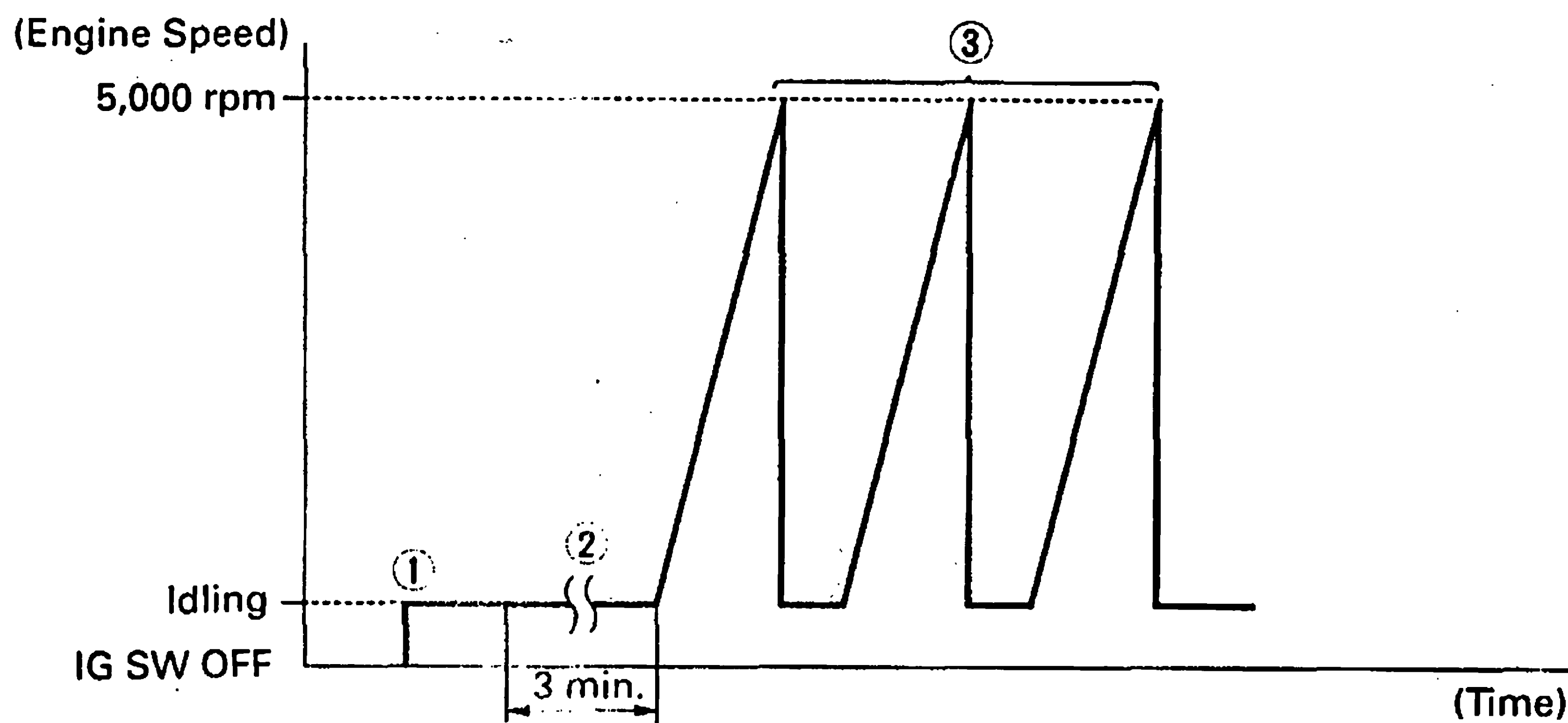
Purpose of the driving pattern

- (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 No.25 Air—Fuel Ratio Lean Malfunction

EG

Malfunction: Open or short in Injector Circuit, Injector Leak or Blockage



F16461

V07541

- 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)

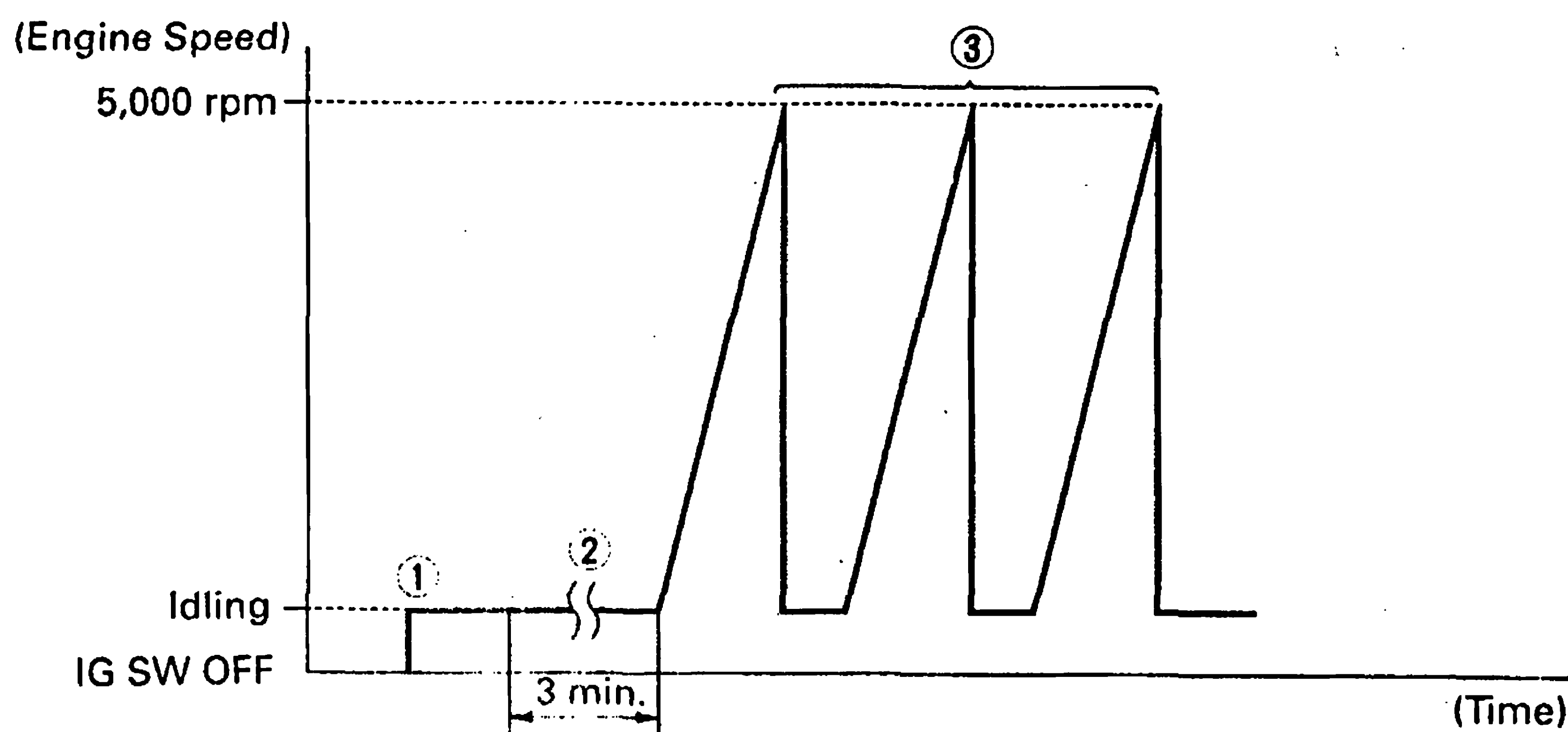
Purpose of the driving pattern

- (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.

EG

DTC Nos.52, 53, 55 Knock Sensor Circuit

Malfunction: Open or short in Knock Sensor



F16461

V07541

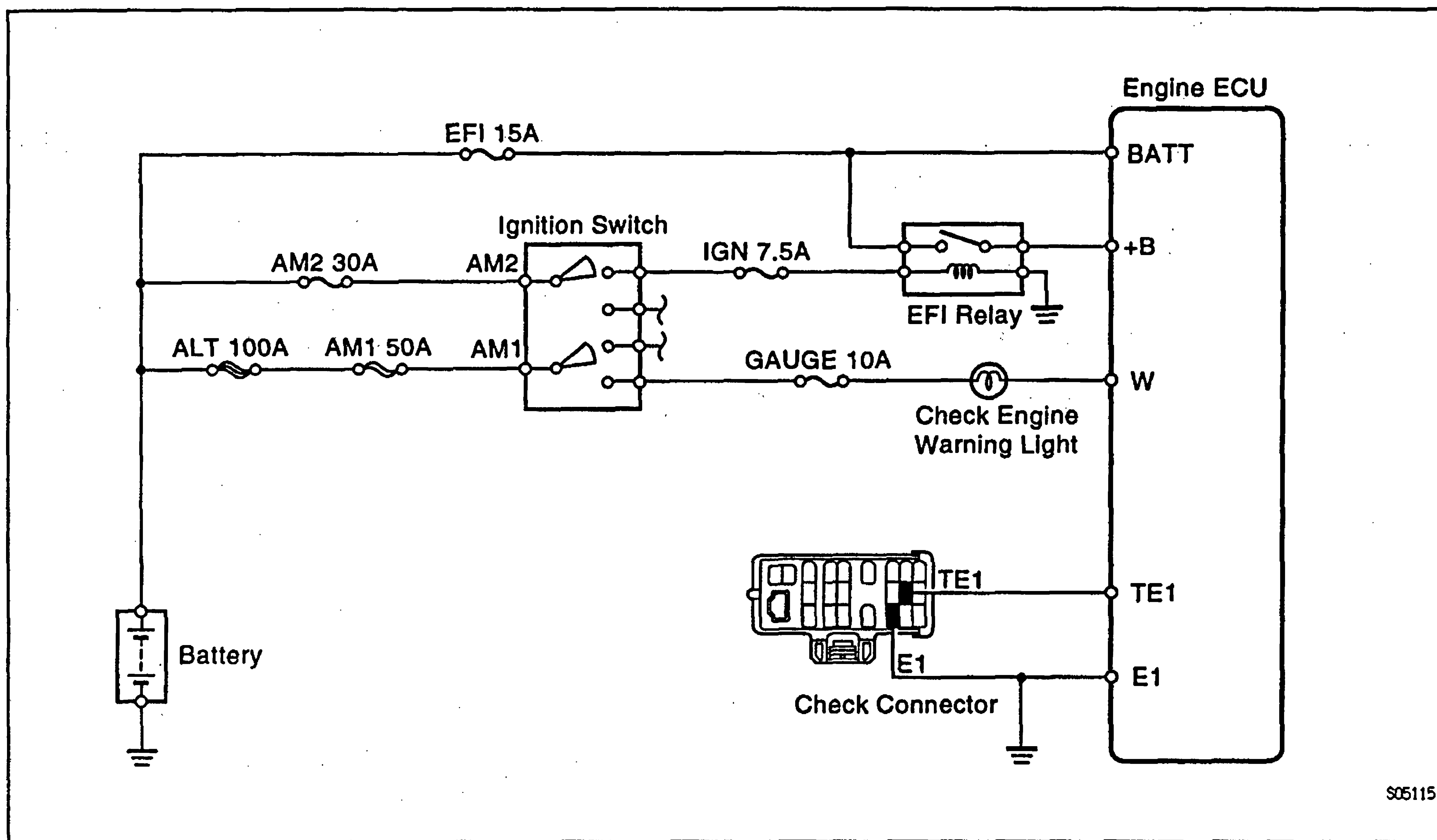
- ① Start the engine, and warm it up.
- ② Let the engine idle for 3 minutes.
- ③ With the A/C ON, quickly race the engine to 5,000 rpm 3 times.

(Replay depress the accelerator pedal and suddenly release it.)

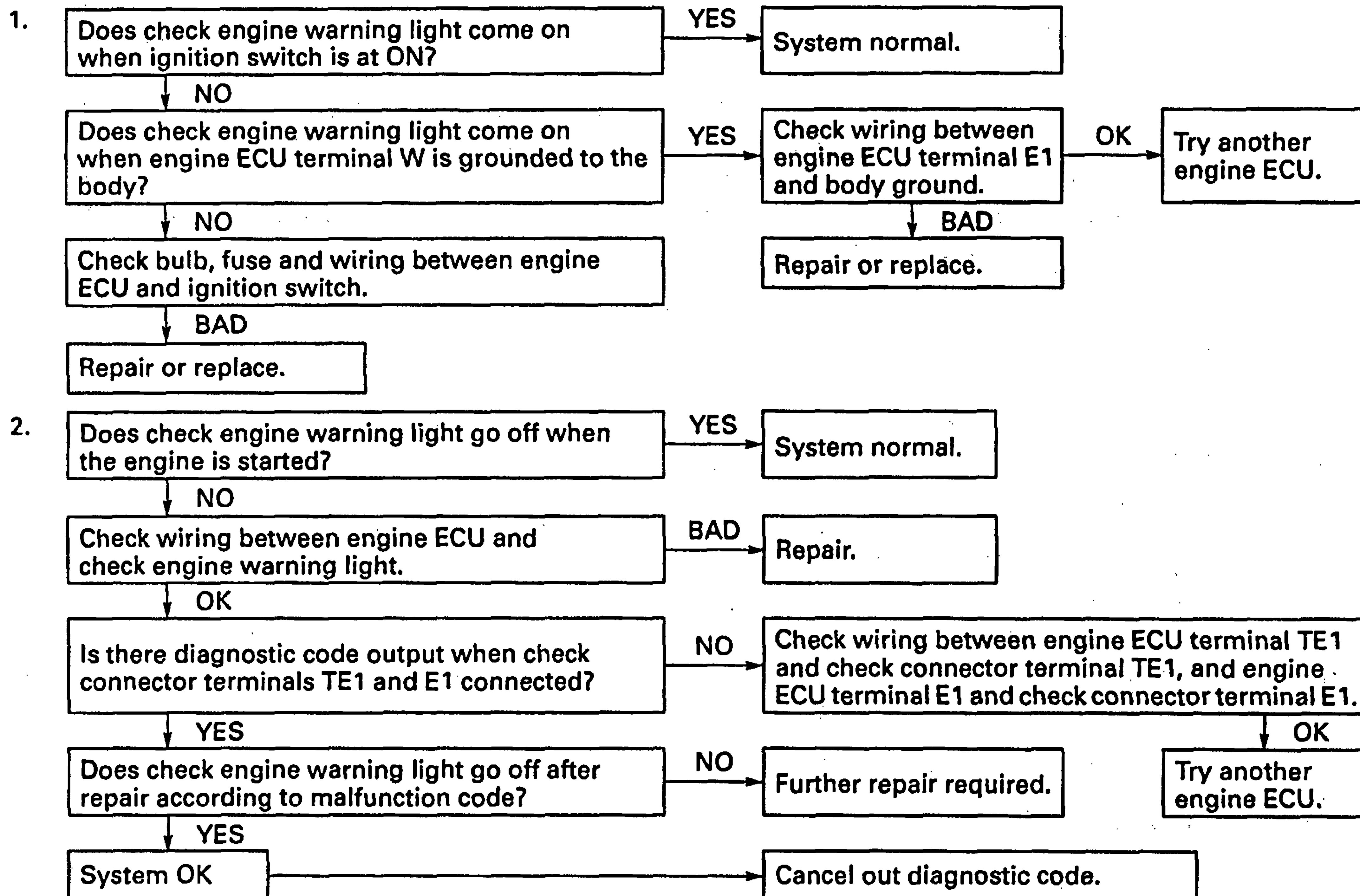
HINT: If a malfunction exists, the check engine warning light will light up when the engine quickly raced.

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

DIAGNOSIS CIRCUIT INSPECTION



S05115



TROUBLESHOOTING w/ VOLT, OHMMETER

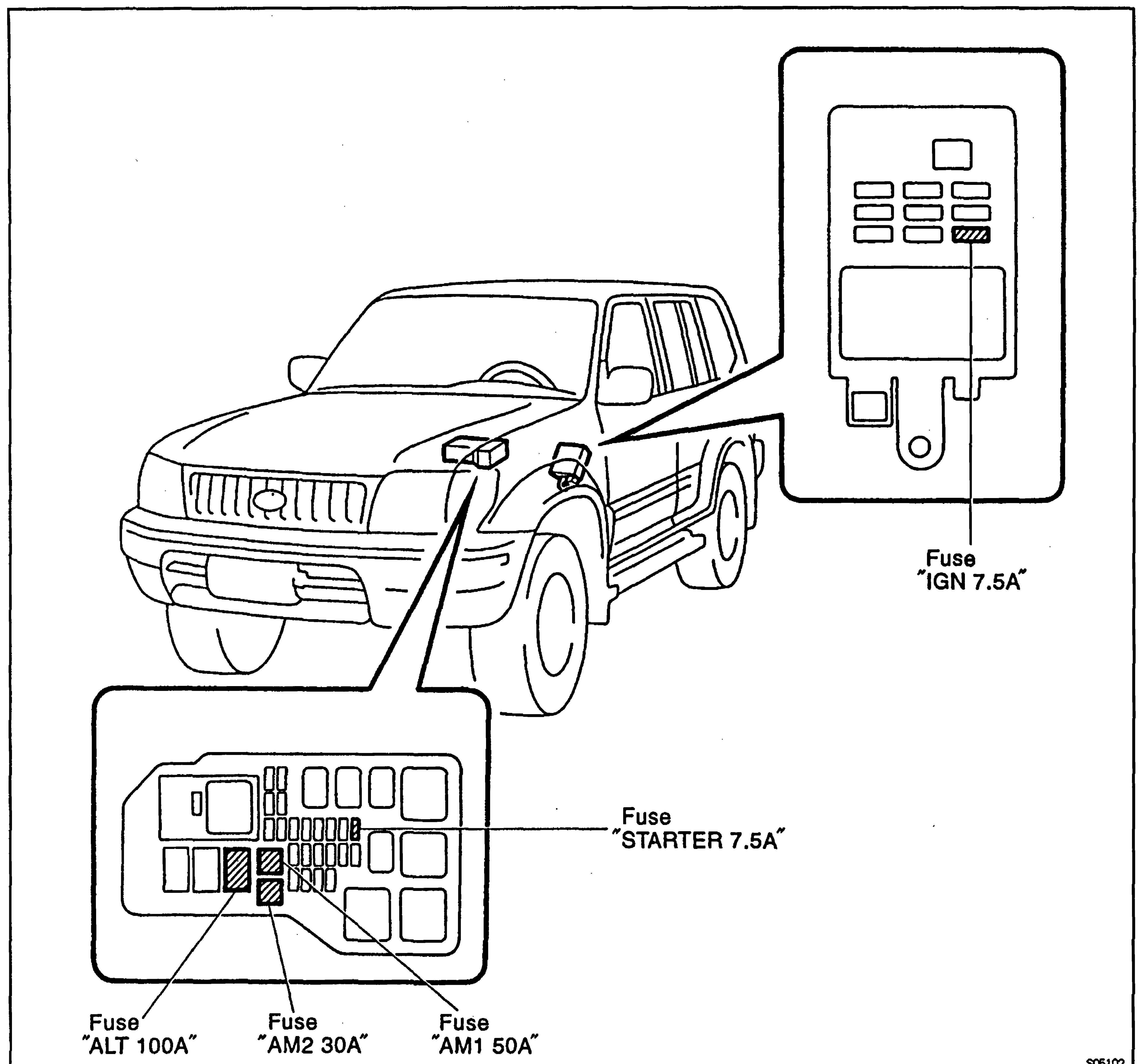
EG129-0F

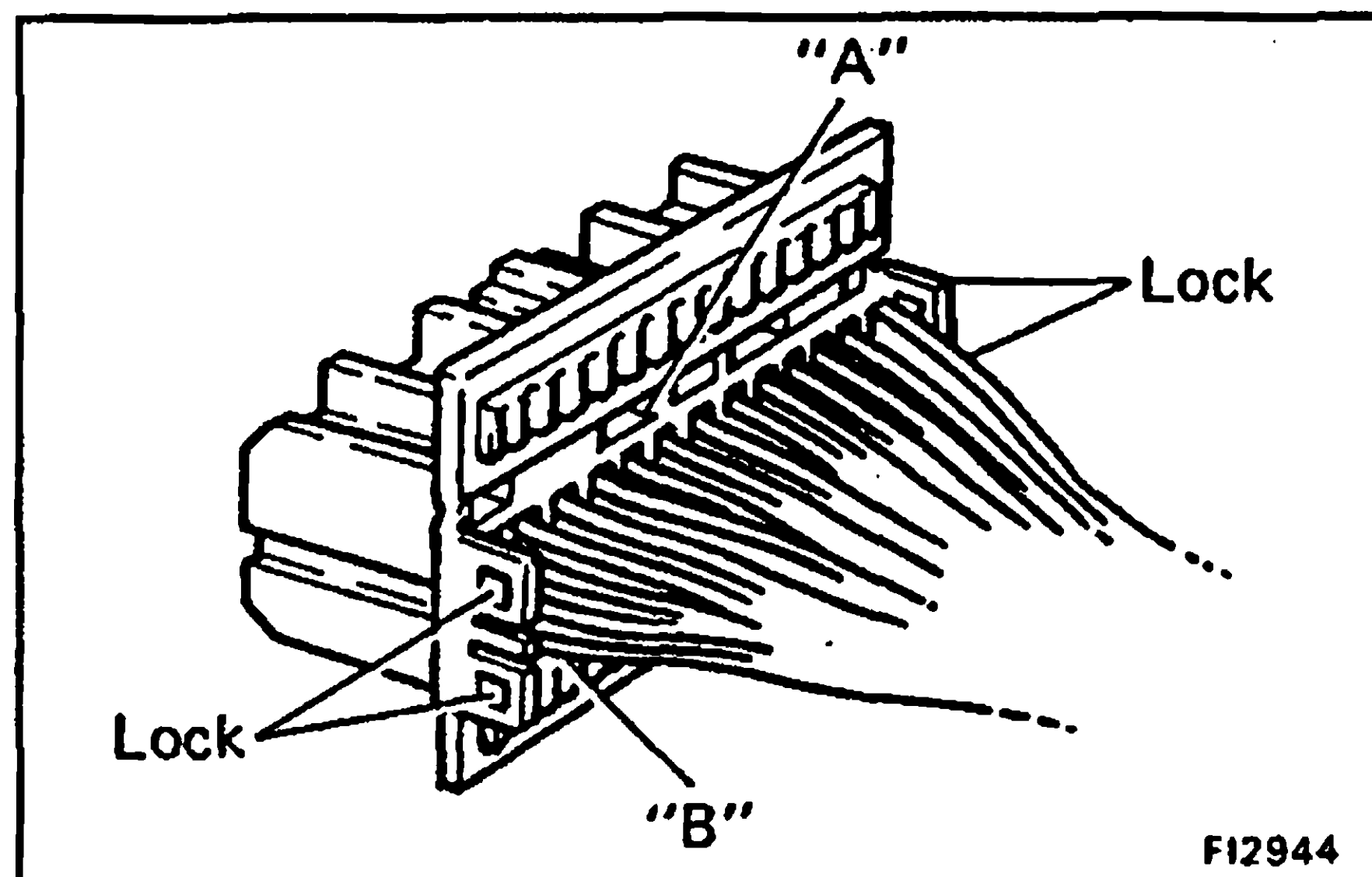
HINT:

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

FUSES, H—FUSES AND FUSIBLE LINK LOCATION

EG129-0F





EFI SYSTEM CHECK PROCEDURE

PREPARATION

- (a) Disconnect the connectors from the ECU.
- (b) Remove the locks as shown in the illustration so that the tester probe(s) can easily come in.

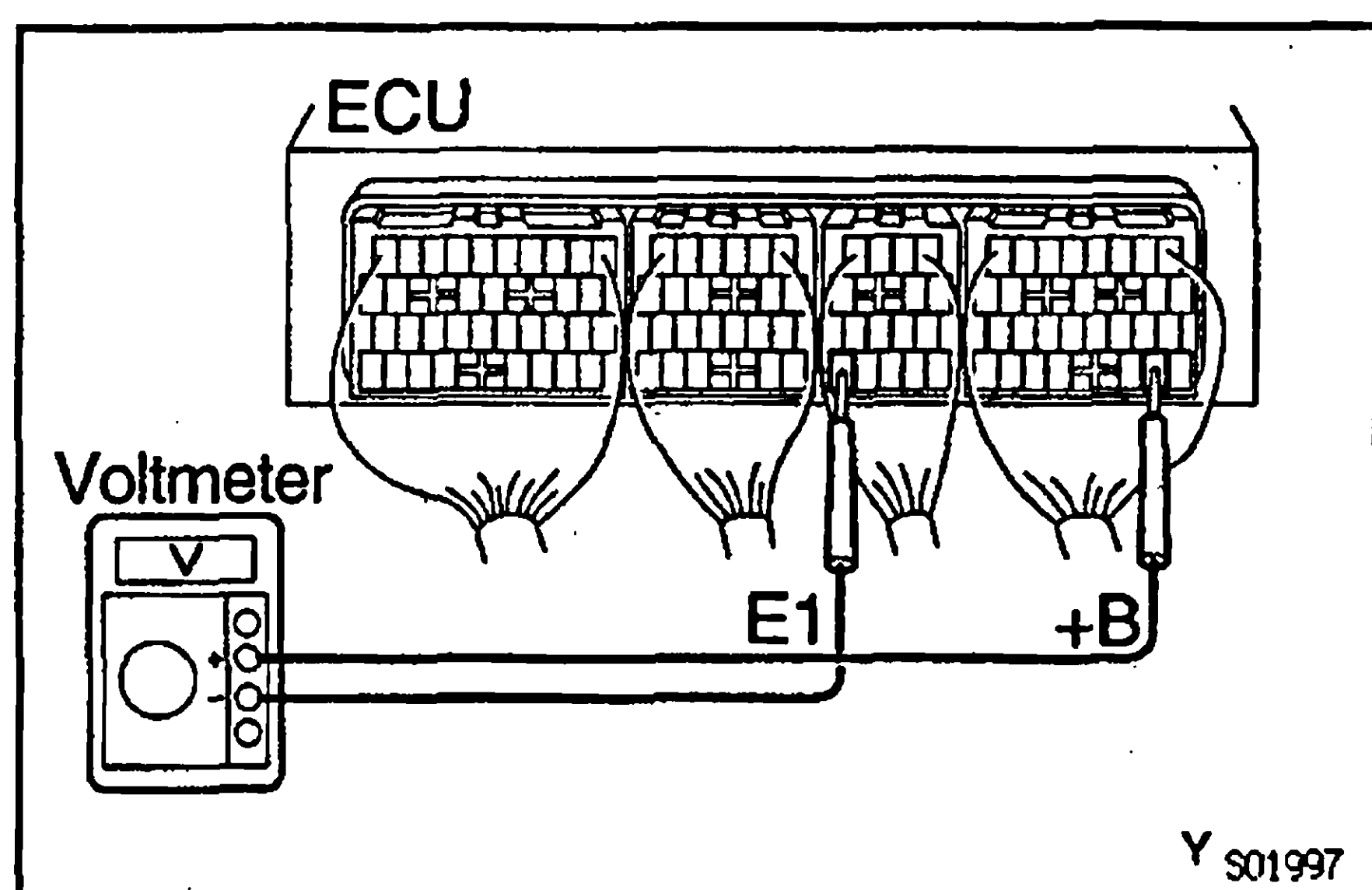
NOTICE: Pay attention to sections "A" and "B" in the illustration which can be easily broken.

- (c) Reconnect the connectors to the ECU.

HINT:

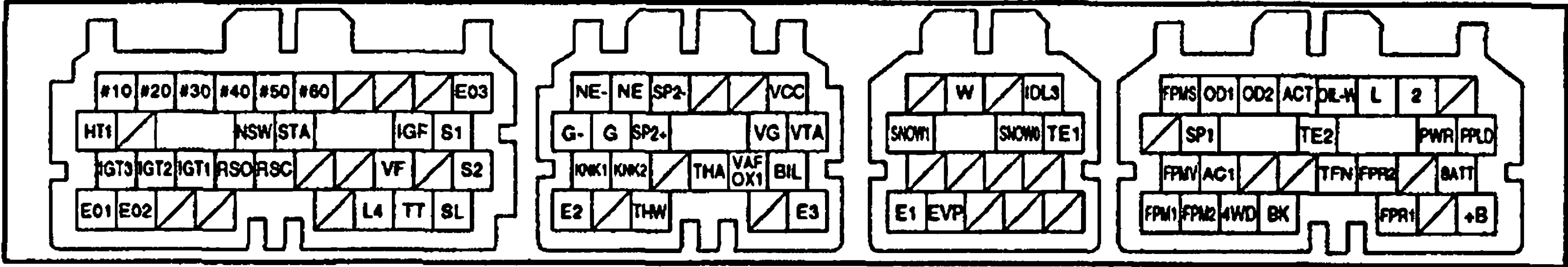
- Do all voltage measurements with the connectors connected.
- Make sure that the battery voltage is 11 V or more when the ignition switch is in the "ON" position.

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



Engine (and ECT) ECU Terminals

Symbol	Terminal Name	Symbol	Terminal Name	Symbol	Terminal Name
#10	INJECTOR	SL	ECT LOCK - UP SLENOID		—
#20	INJECTOR	NE⊖	CRANK POSITION SENSOR	E1	ENGINE GROUND
#30	INJECTOR	NE	CRANK POSITION SENSOR	EVP	EVAPORATOR CONTROL VSV
#40	INJECTOR	SP2⊖	VEHICLE SPEED SENSOR		—
#50	INJECTOR		—		—
#60	INJECTOR		—		—
	—	VCC	SENSORS	FPMS	TANK CHANGE SWITCH
	—	G⊖	CRANKSHAFT POSITION SENSOR	OD1	CRUISE CONTROL ECU
	—	G	CRANKSHAFT POSITION SENSOR	OD2	OD CUT SWITCH
E03	POWER GROUND	SP2⊕	VEHICLE SPEED SENSOR	ACT	AIR CONDITIONER ECU
HT1	OXYGEN SENSOR HEATER	VG	AIR FLOW METER	OIL-W	OIL WARNING LIGHT
	—	VTA	THROTTLE POSITION SENSOR	L	SHIFT POSITION SWITCH
NSW	NEUTRAL START SWITCH	KNK1	KNOCK SENSOR (RIGHT TBANK)	2	SHIFT POSITION SWITCH
STA	STARTER RELAY	KNK2	KNOCK SENSOR (LEFT BANK)		—
IGF	IGNITER		—		—
S1	ECT No.1 SOLENOID	THA	INTAKE AIR TEMP. SENSOR	SP1	VEHICLE SPPEED SENSOR
IGT3	IGNITER	VAF, OX1	VARIABLE RESISTER, OXGEN SENSOR	TE2	TDCL
IGT2	IGNITER	OIL	OIL TEMP. SENSOR	PWR	POWER SELECT SWITCH
IGT1	IGNITER	E2	SENSORS GROUND	FRLD	DOUBLE TANK INDICATOR
RSO	ROTARY SOLENOID		—	FPMV	RET
RSC	ROTARY SOLENOID	THW	WATER TEMP. SENSOR	AC1	AIR CONDITIONER
	—		—	IMO	TRANSPONDER KEY COMPUTER
	—	E3	SENSORS GROUND	IMI	TRANSPONDER KEY COMPUTER
VF1	CHECK CONNECTOR		—	TFN	TRANSFER NEUTRAL SWITCH
	—	W	WARNING LIGHT	FPR2	SUB FUEL PUMP RELAY
S2	ECT No.2 SOLENOID		—		—
E01	POWER GROUND	IDLO		BATT	BATTERY
E02	POWER GROUND	SNOW1	SECOND START MODE SWITCH	FPM1	MAIN FUEL PUMP
	—	SNOW0	SECOND START MODE INDICATOR	FPR2	SUB FUEL PUMP
	—	TE1	CHECK CONNECTOR	4WD	4WD SWITCH
			—	BK	STOP LAMP SWITCH
L4	L4 SEITCH		—	FPR1	CIRCUIT OPENING RELAY
TT	TDCL		—		—
Engine (and ECT) ECU Terminals				+B	BATTERY

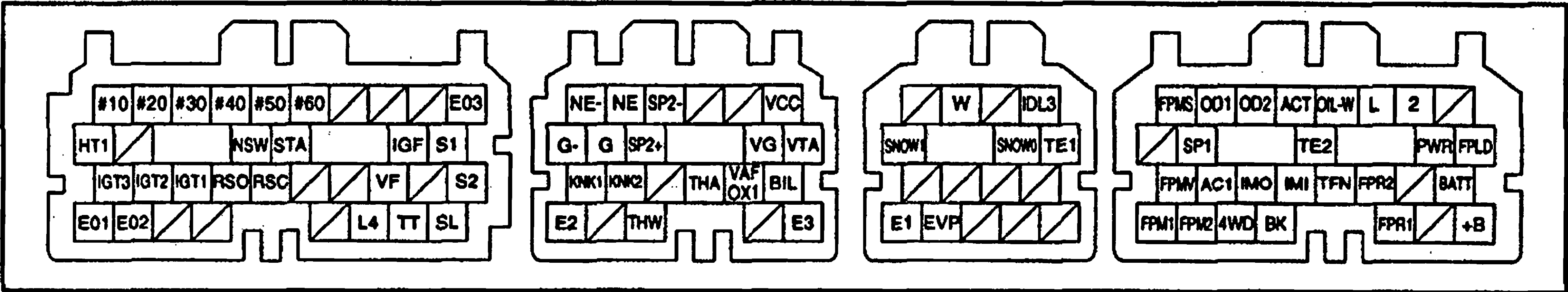


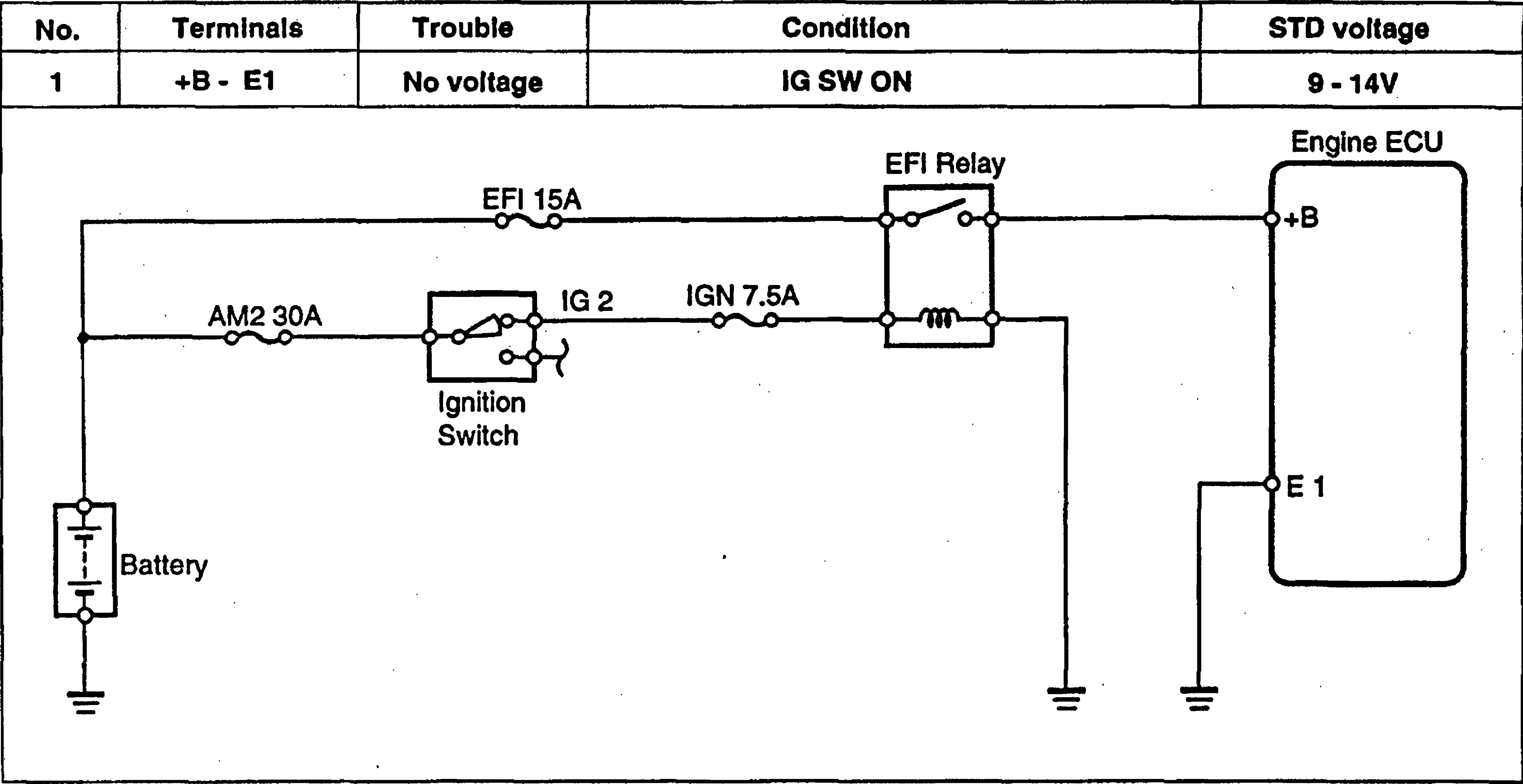
Y

Engine ECU Wiring Connectors Voltage

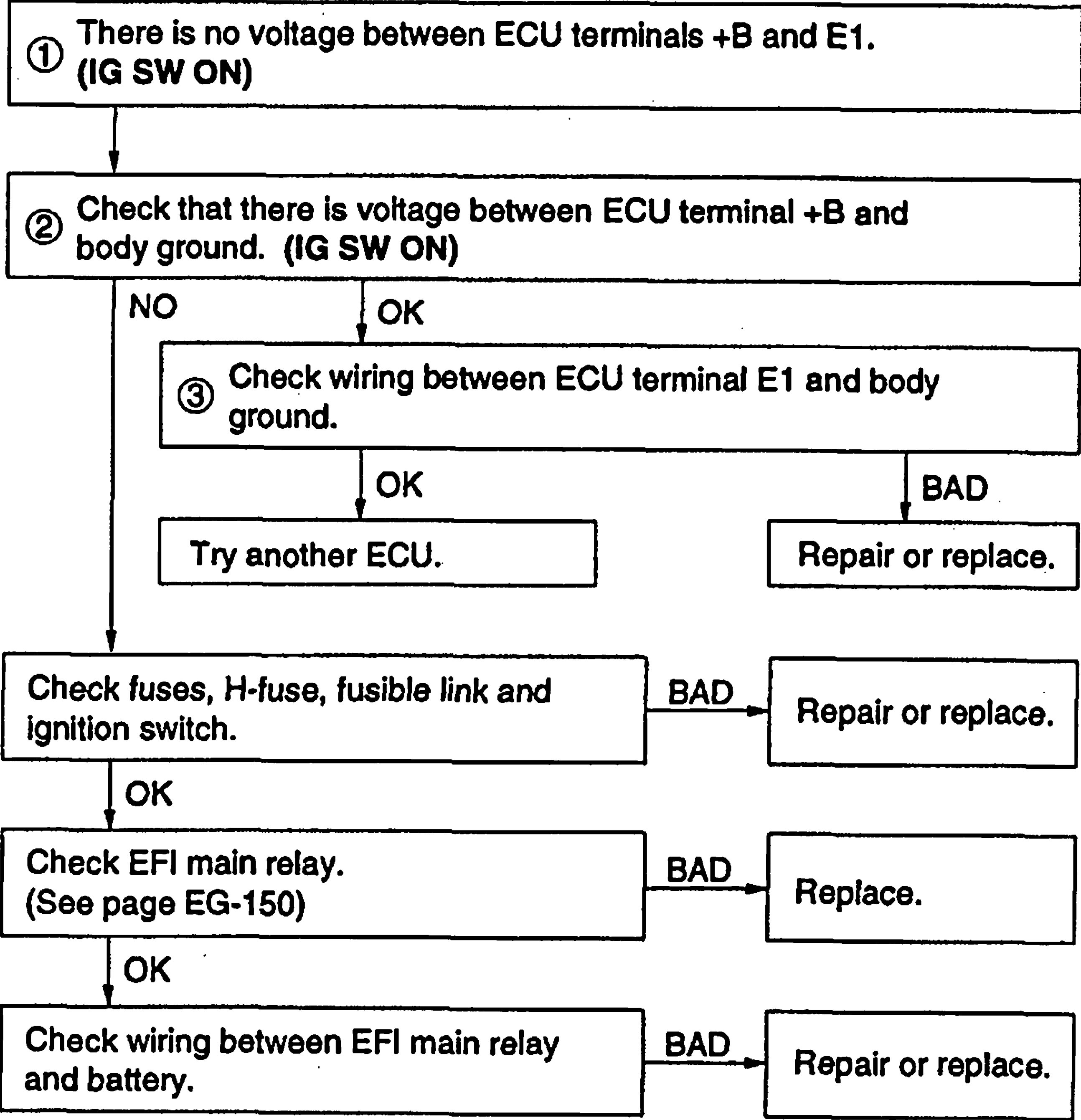
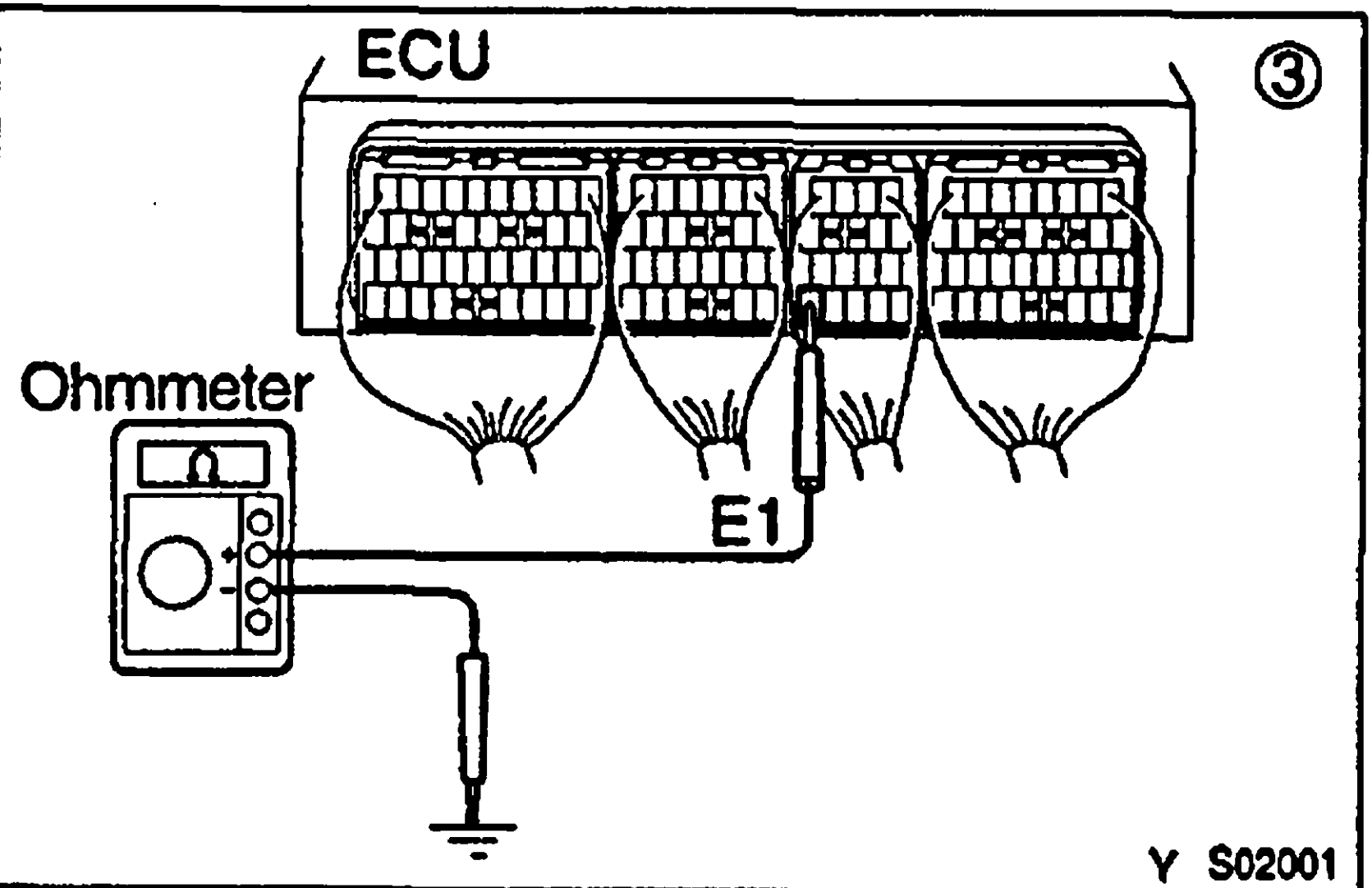
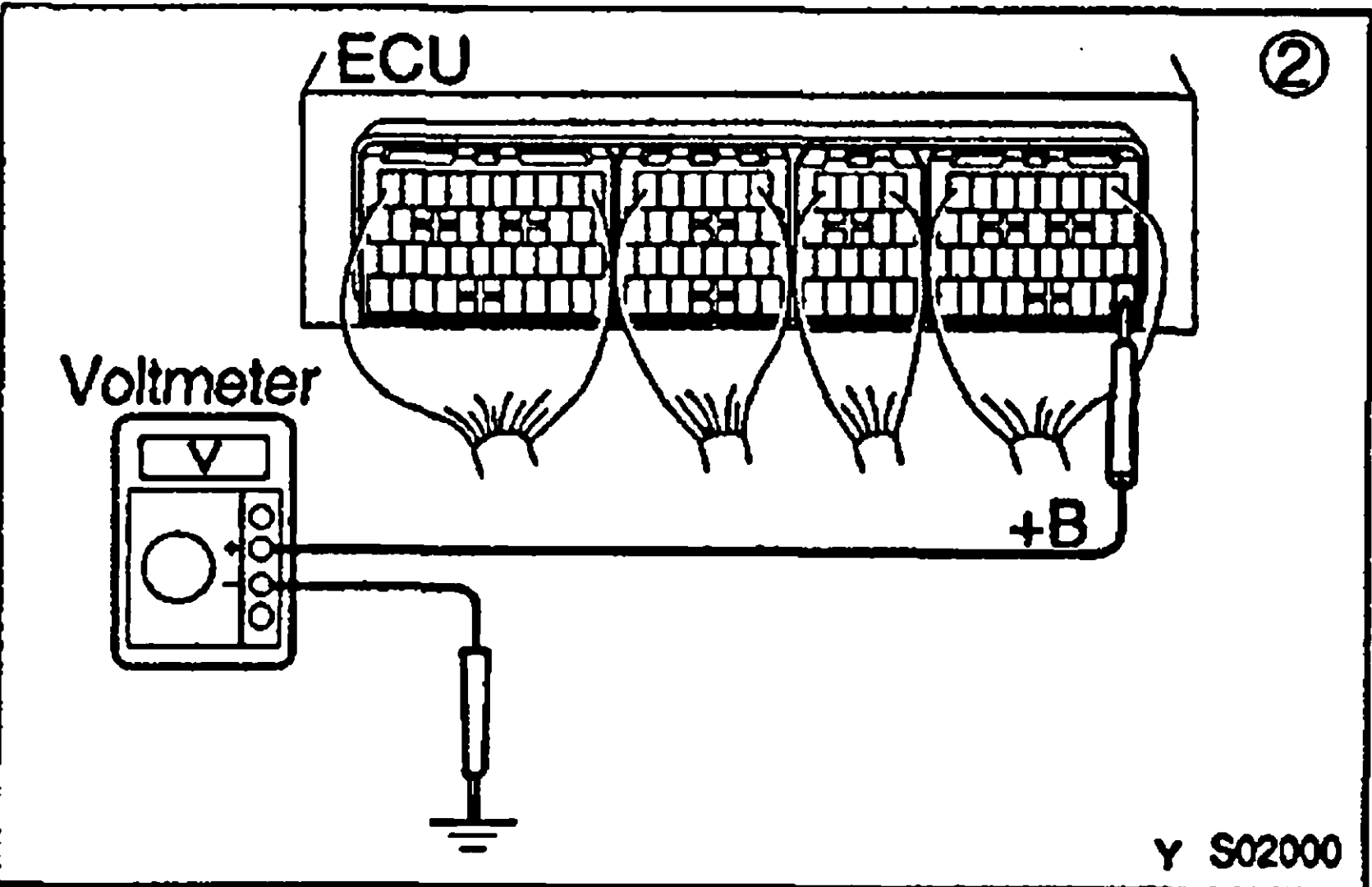
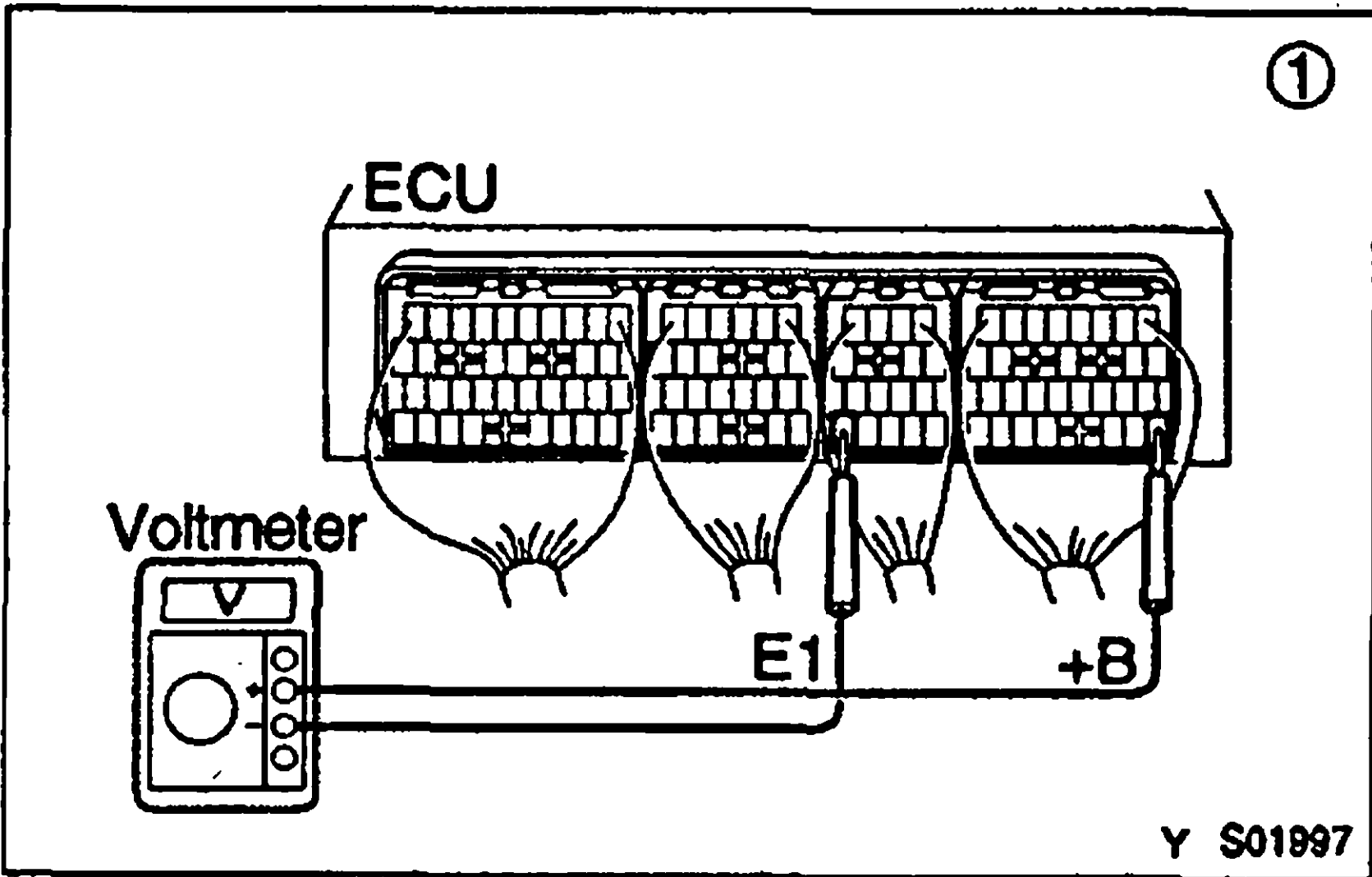
No.	Terminals	Condition		STD voltage (V)	See page
1	+B - E1	IG SW ON		9 - 14	EG-114
2	BATT - E1	—		9 - 14	EG-115
3	VCC - E2 VTA - E2	IG SW ON	—	4.5 - 5.5	EG-116
			Throttle valve fully closed	0.3 - 0.8	
			Throttle valve fully open	2.7 - 5.2	
4	#10 #20 #30 - E01 #40 - E02 #50 #60	IG SW ON		9 - 14	EG-118
5	THA - E2	IG SW ON	Intake air temperature 20°C (68°F)	0.5 - 3.4	EG-119
6	THW - E2	IG SW ON	Coolant temperature 80°C (176°F)	0.2 - 1.0	EG-120
7	STA - E1	Cranking		6 or more	EG-121
8	IGT1 IGT2 - E1 IGT3	Idling		Pulse generation	EG-122
9	RSC - E1 RSO	IG SW ON	Engine ECU connectors disconnected	9 - 14	EG-123
10	W - E1	No trouble (Check engine warning light off) and engine running		9 - 14	EG-124

Engine (and ECT) ECU Terminals

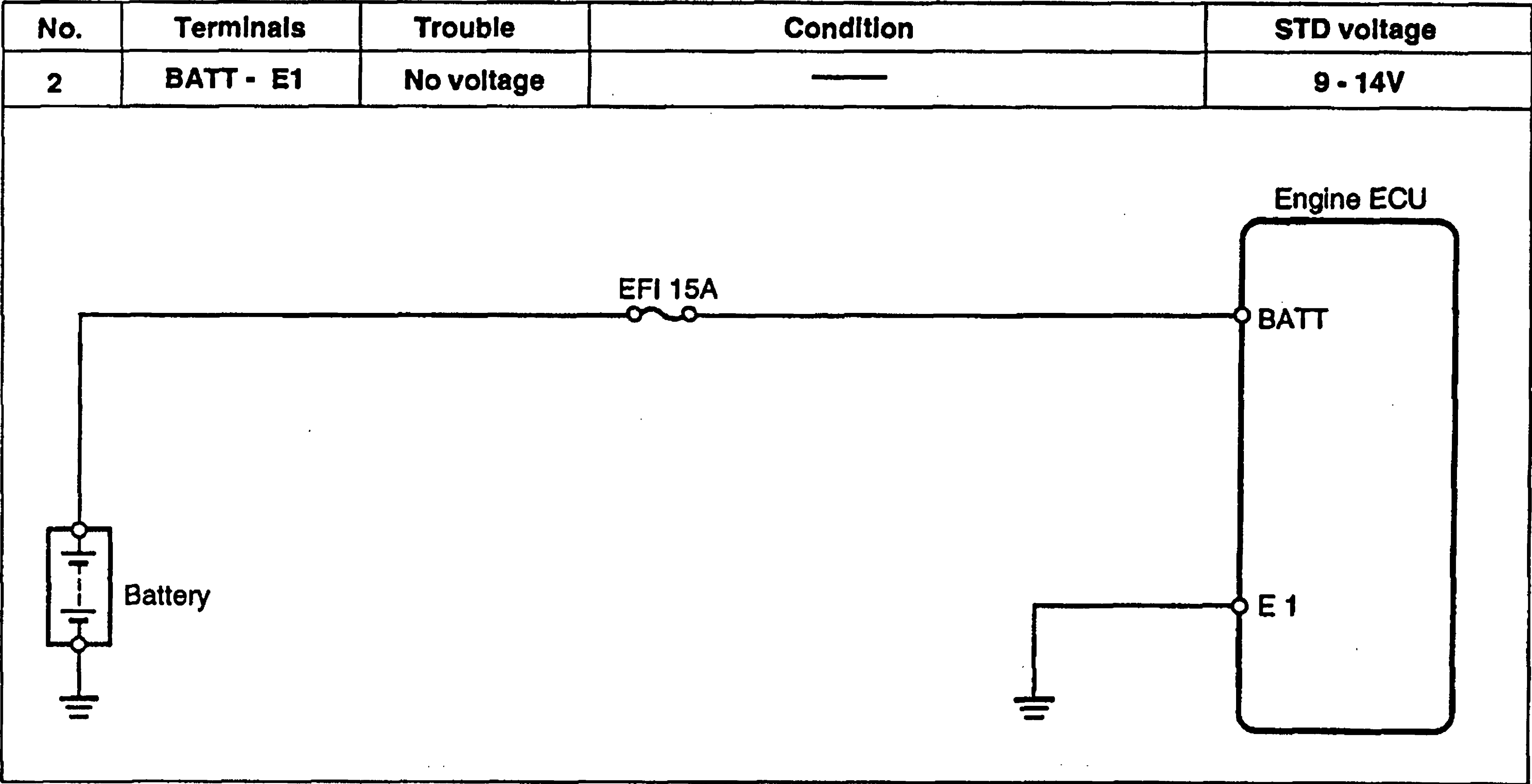




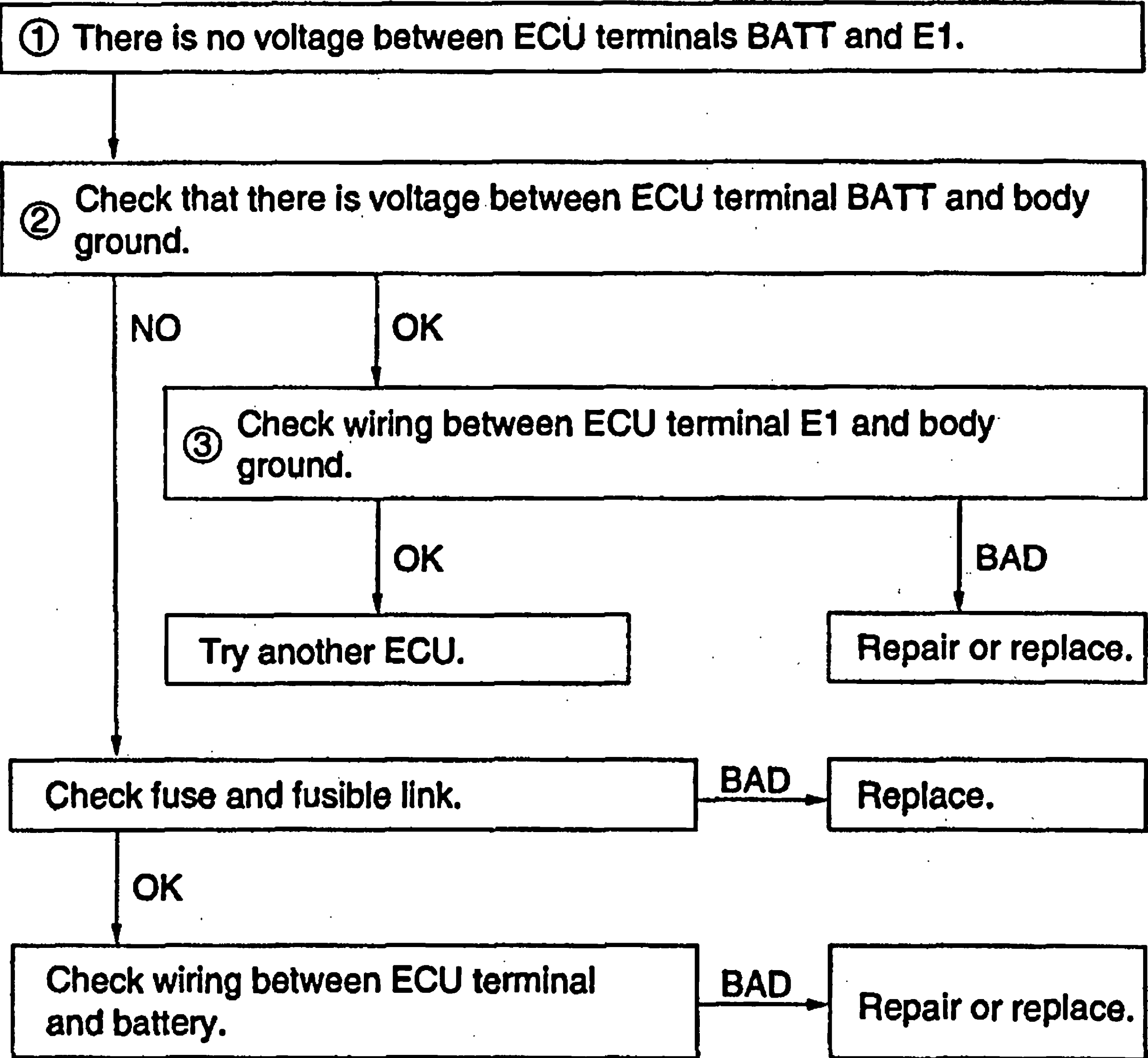
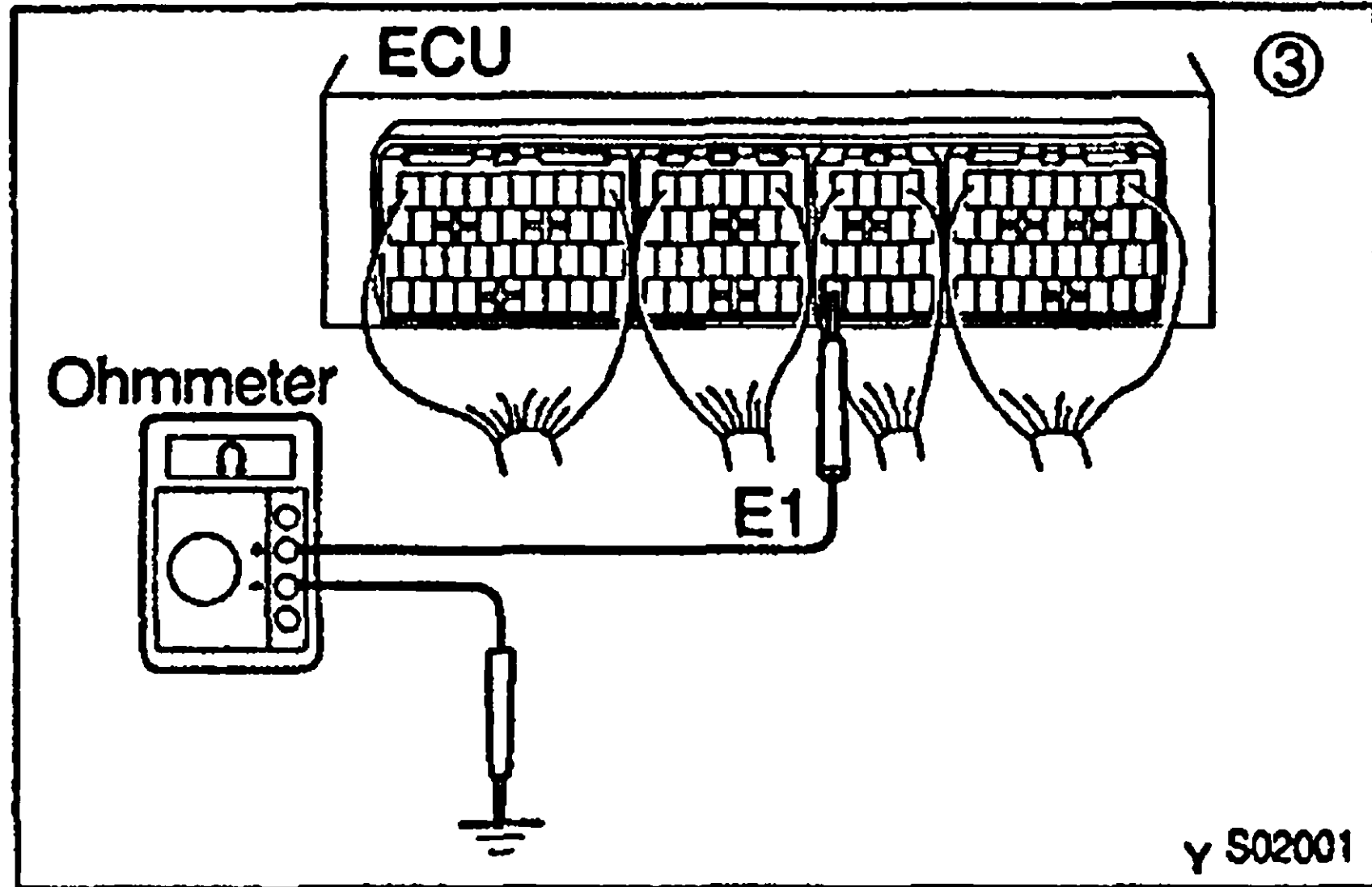
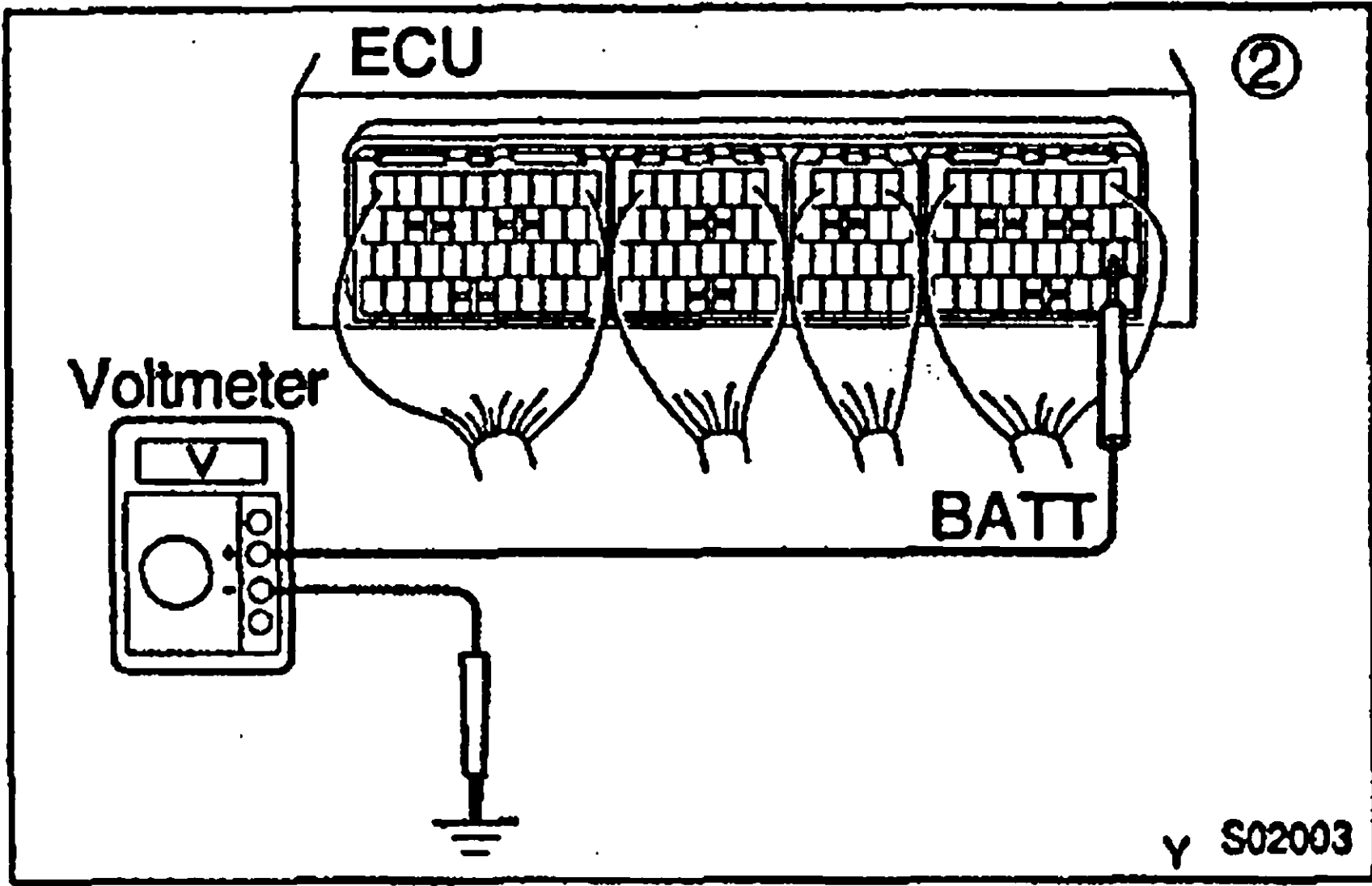
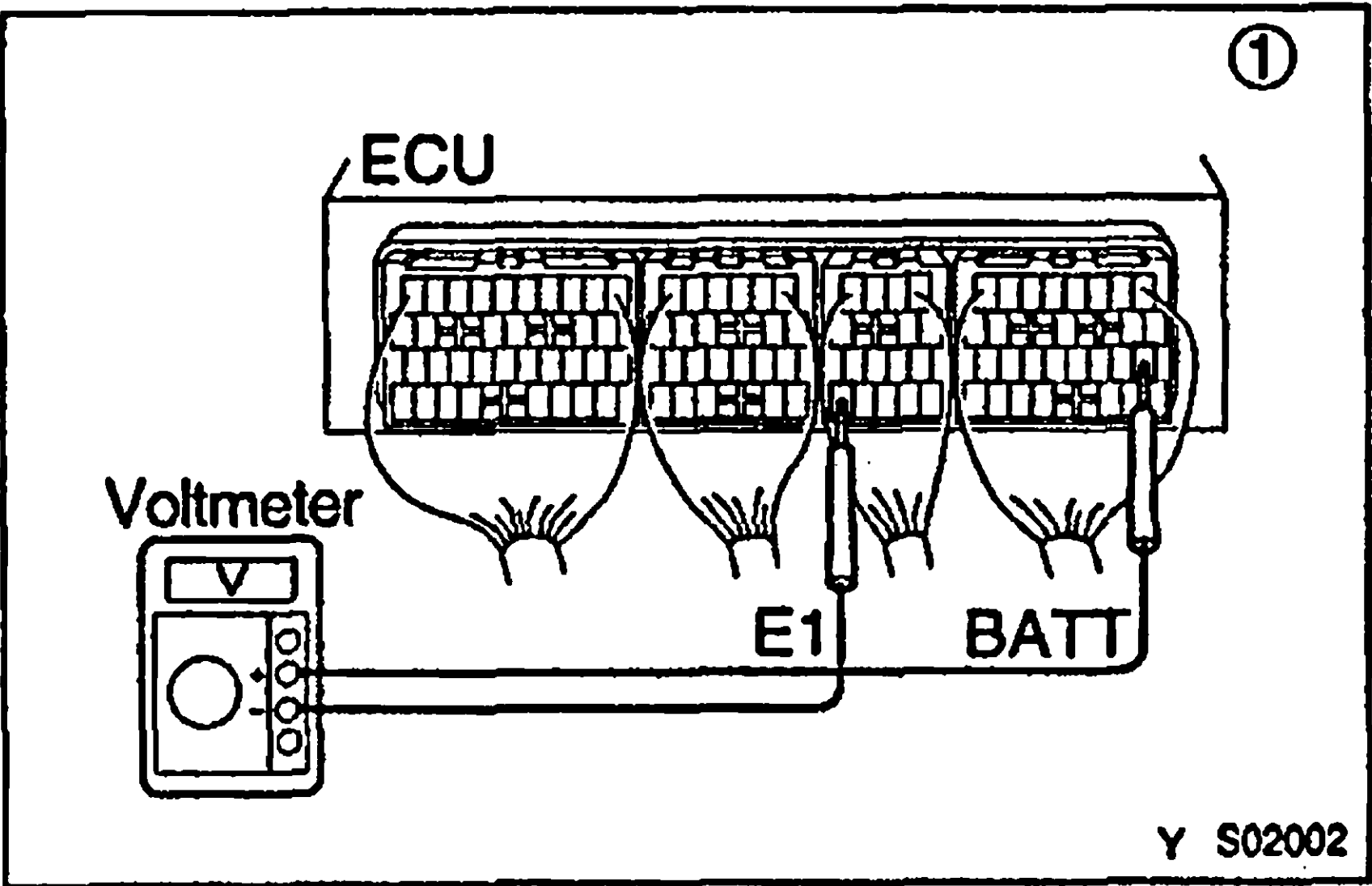
V08150



V08193

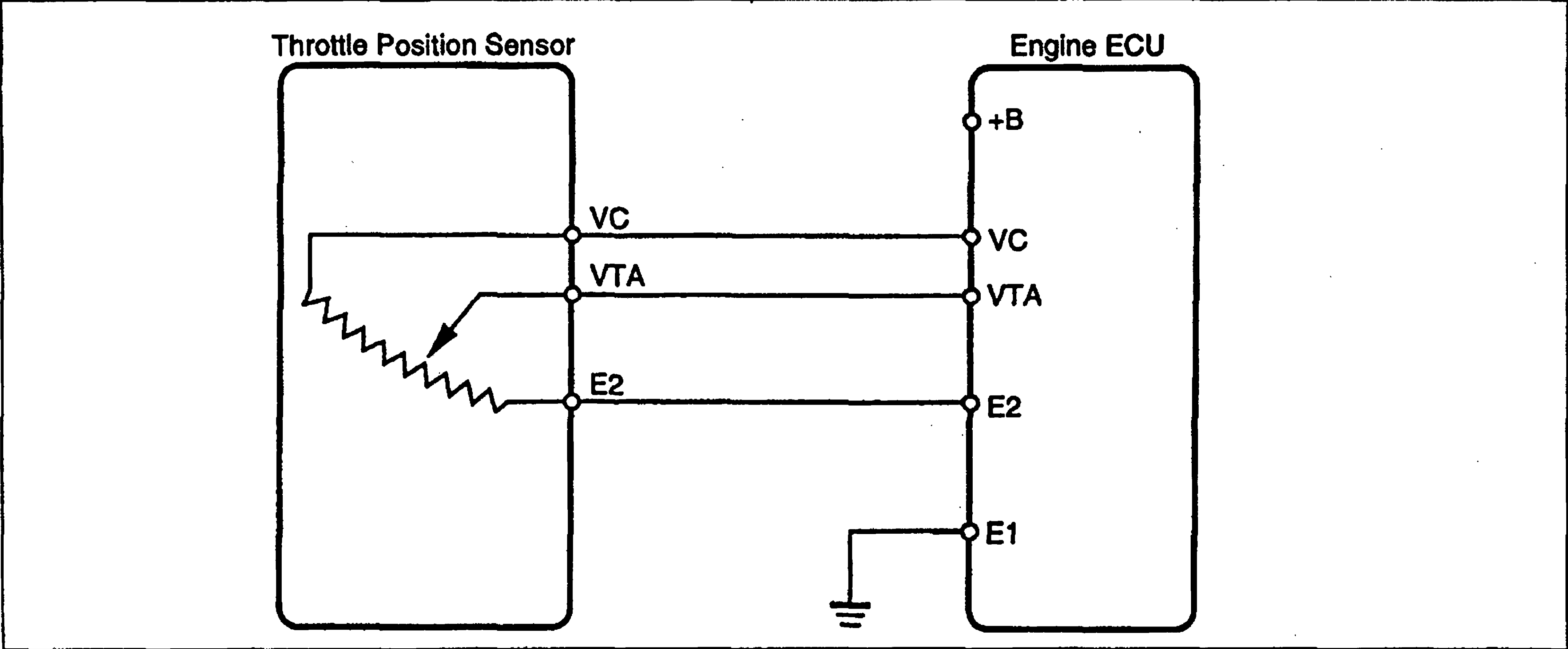


V08131

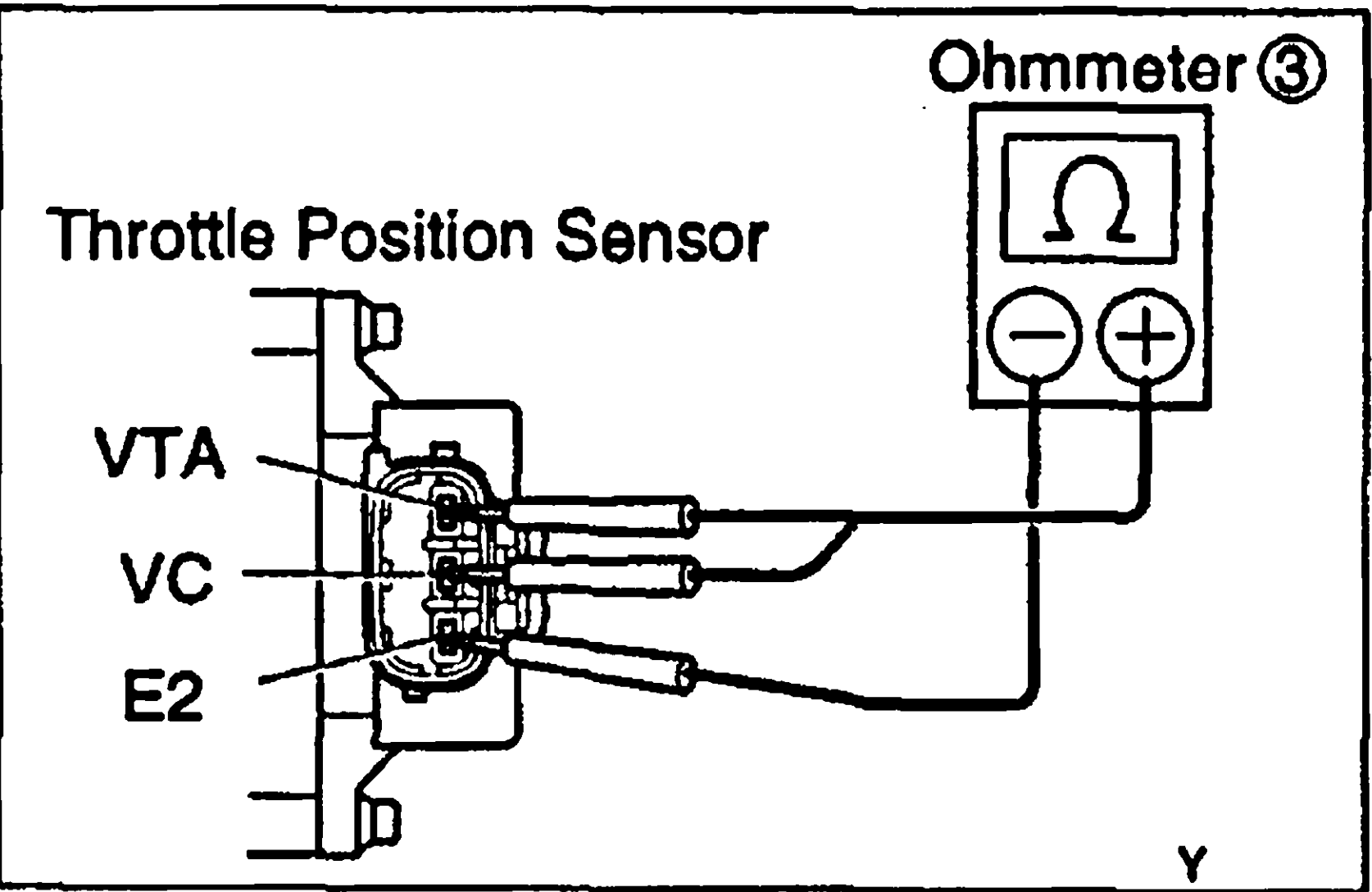
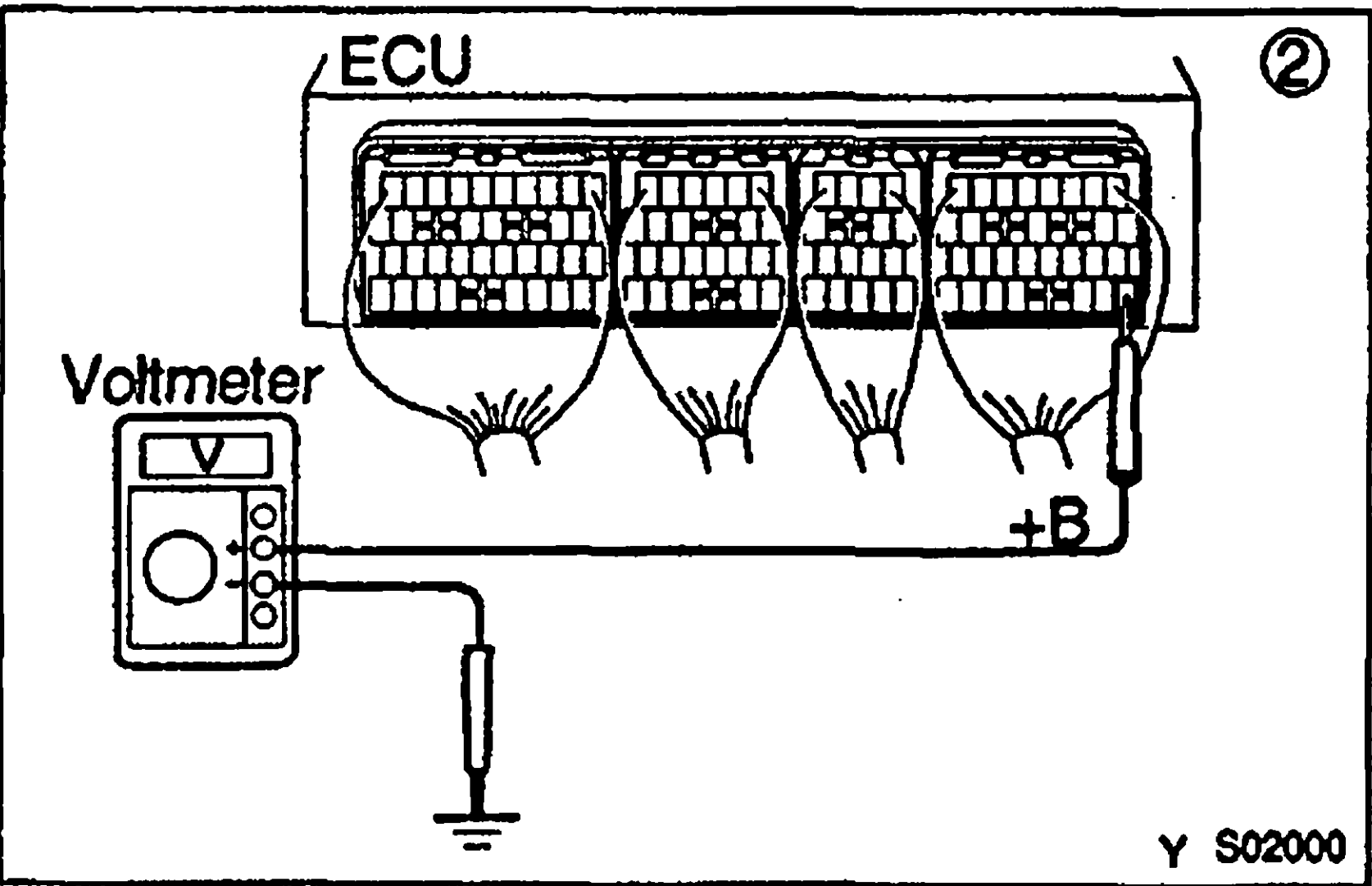
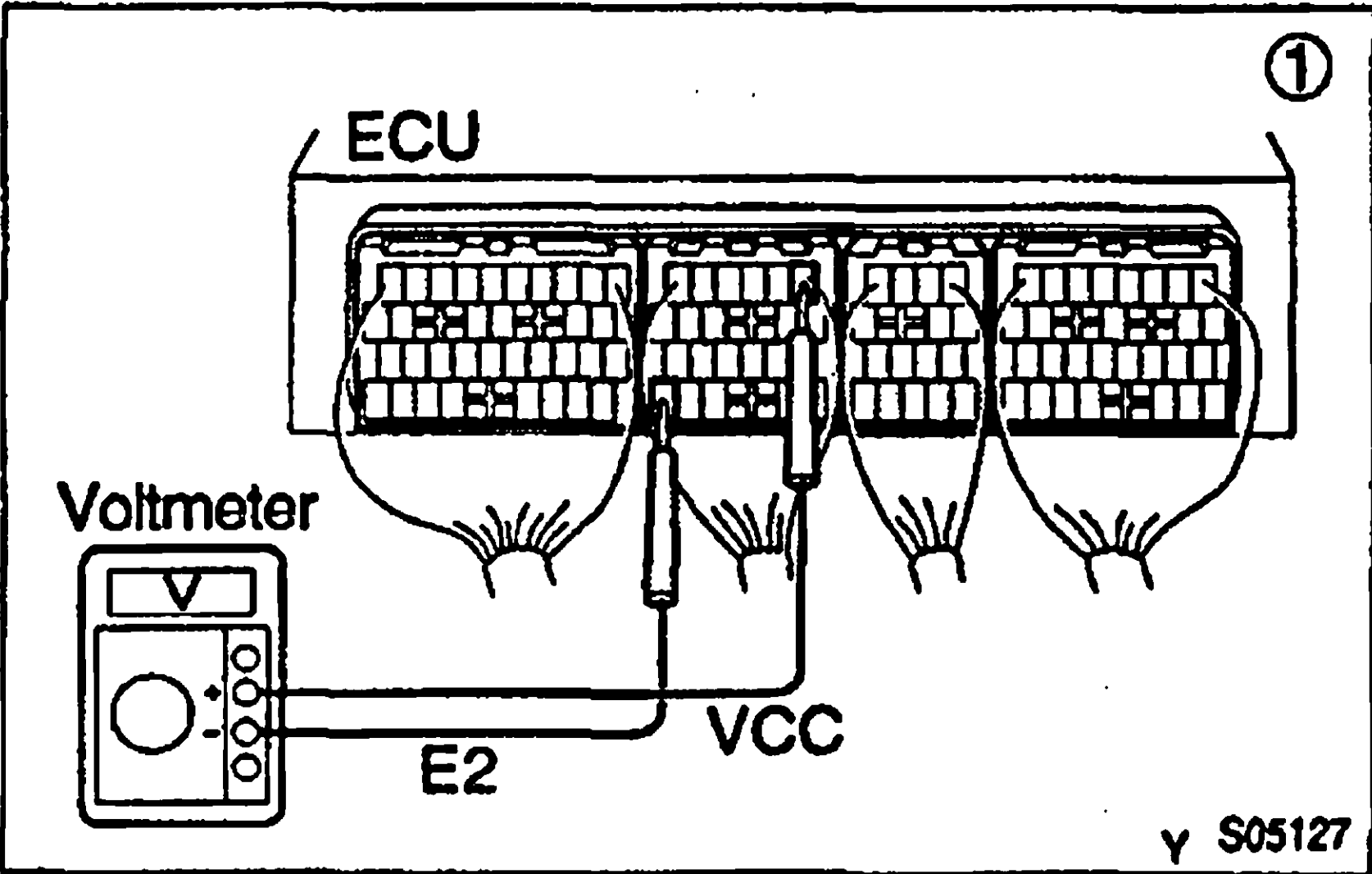


Y V07515

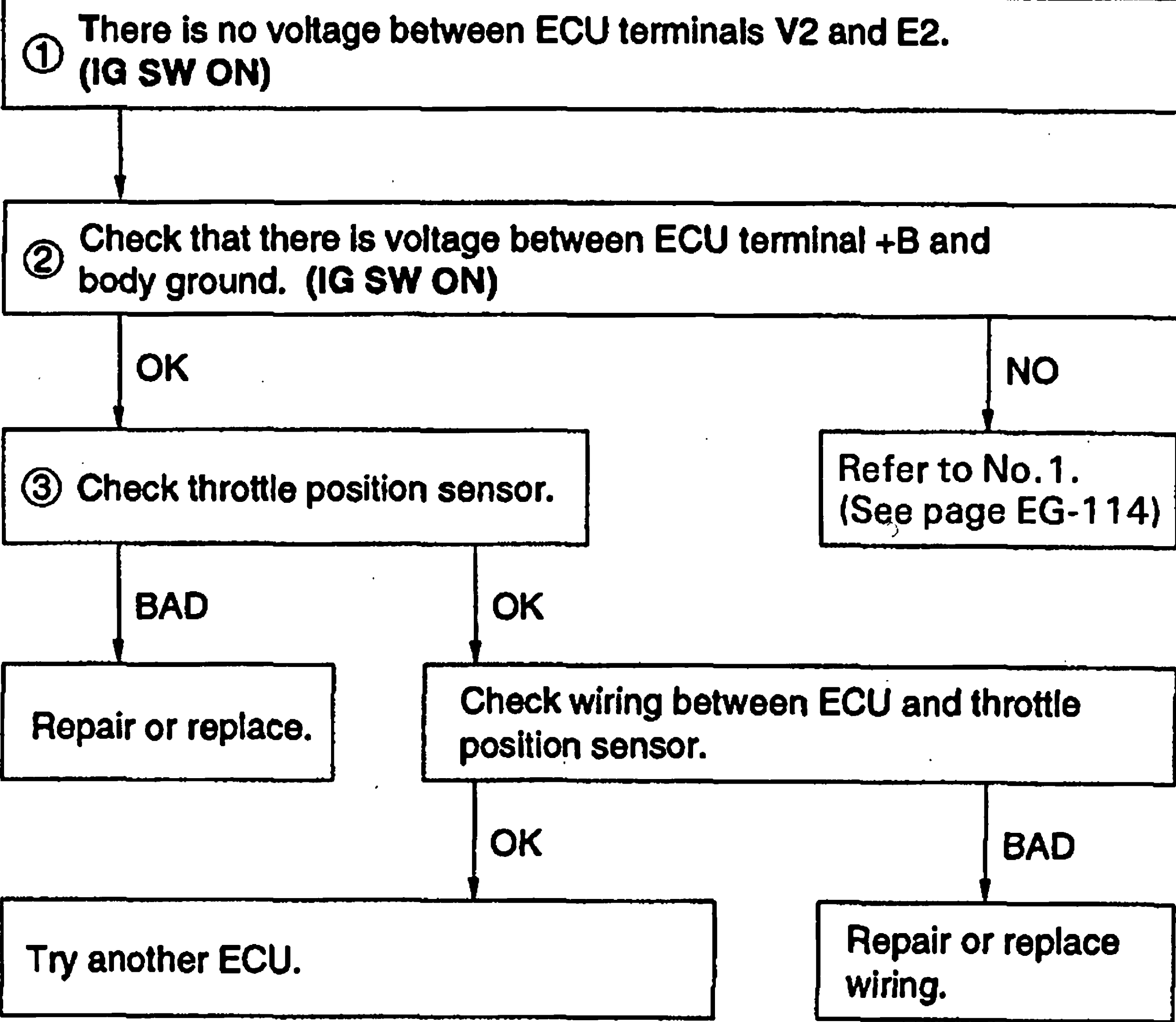
No.	Terminals	Trouble	Condition		STD voltage
3	VCC - E2	No voltage	IG SW ON		4.5 - 5.5V
	Throttle valve fully closed			0.3 - 0.8V	
	Throttle valve fully open			2.7 - 5.2V	



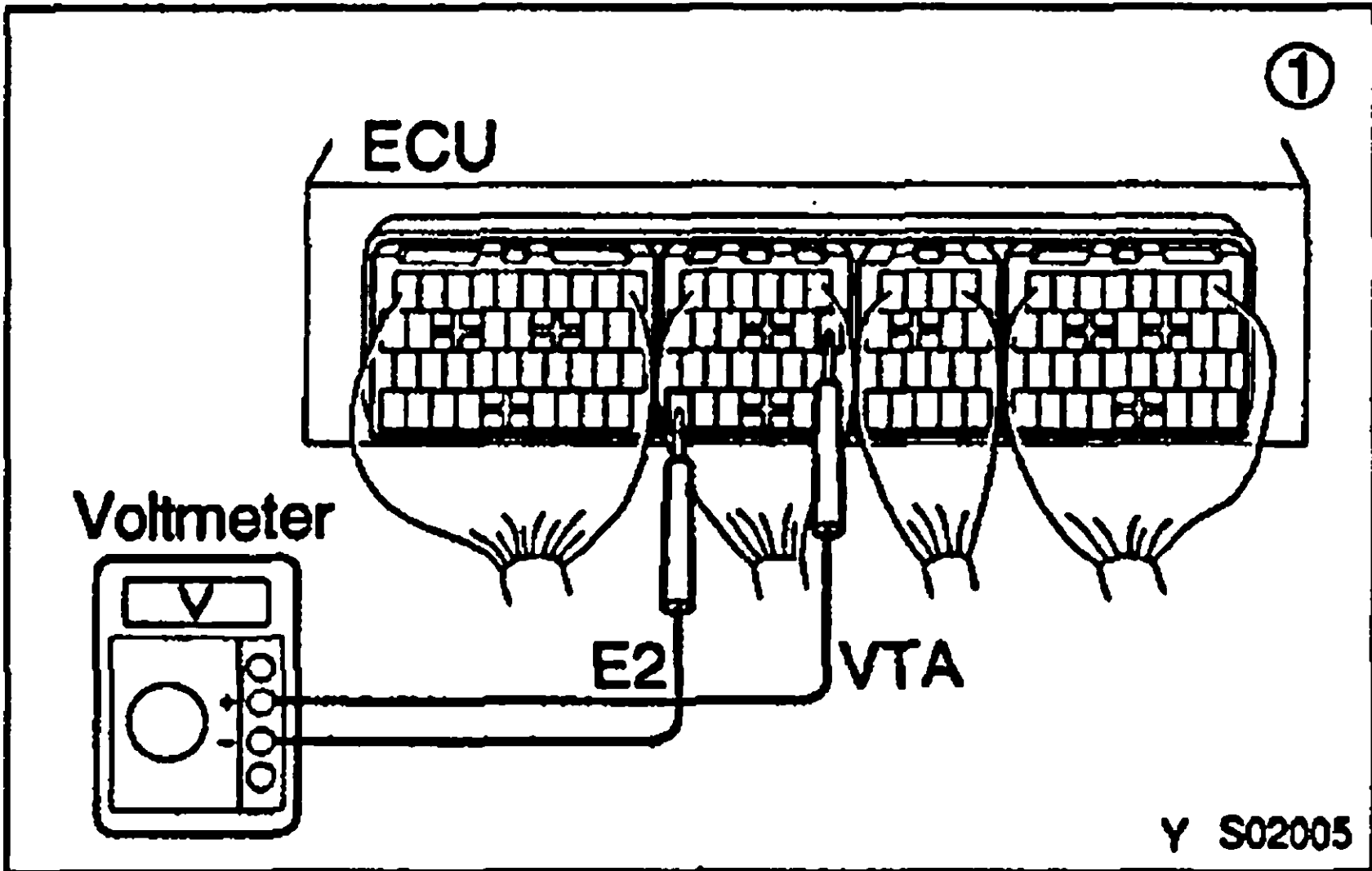
V08158



• VCC - E2



V08190



• 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

OK

Refer to VCC-E2 trouble section.

OK

③ Check throttle position sensor.

BAD

Repair or replace.

OK

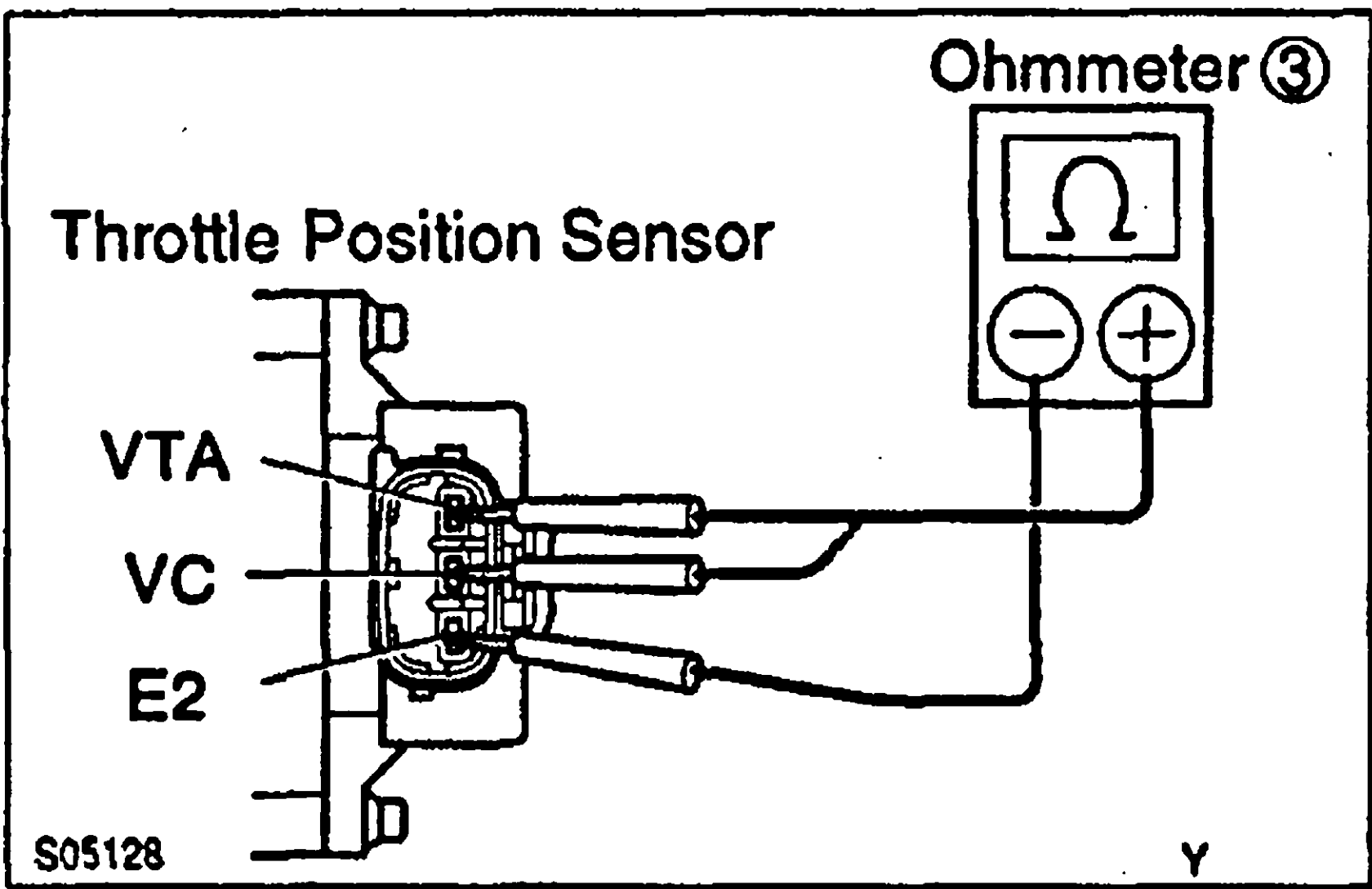
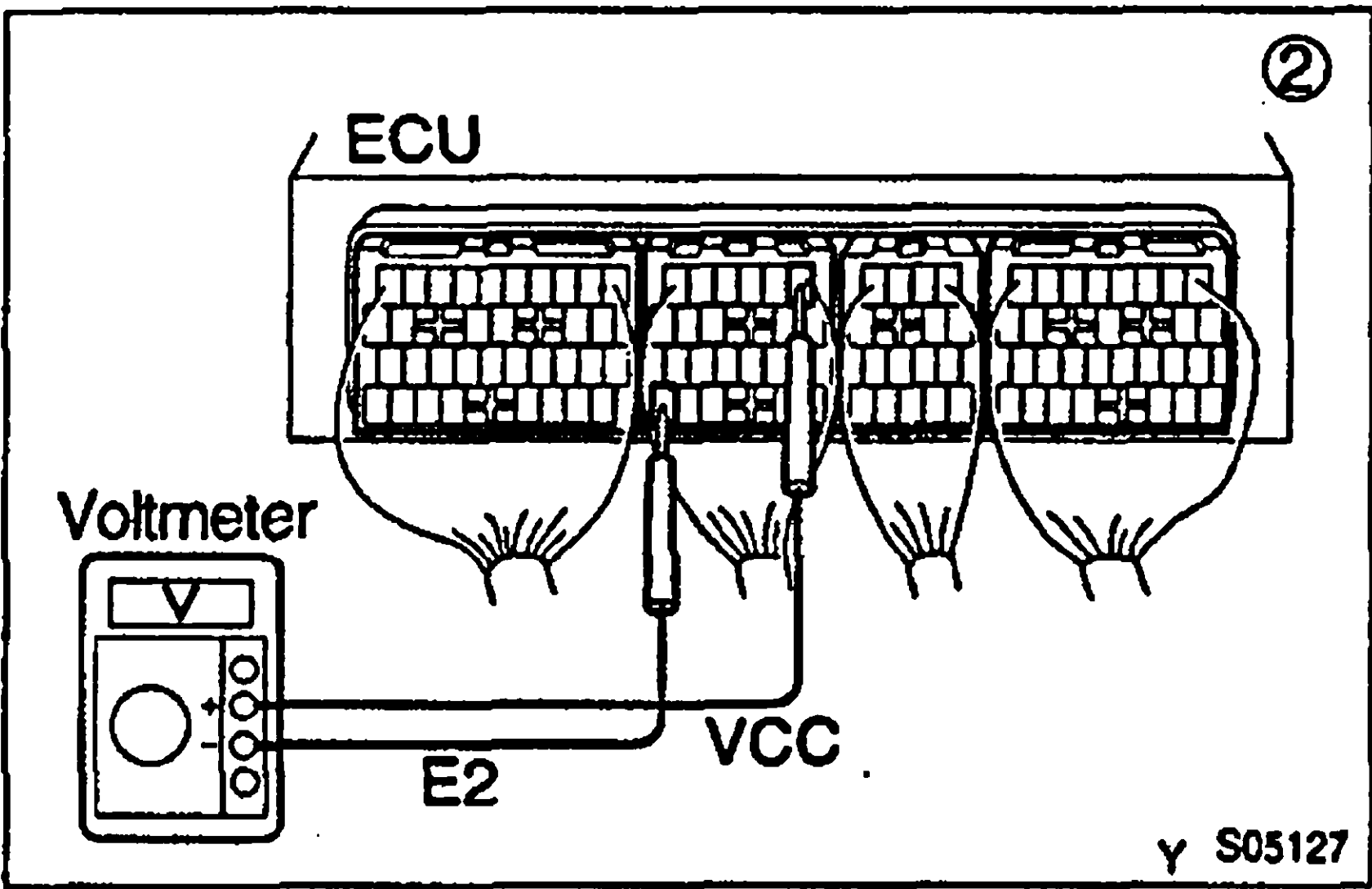
Check wiring between ECU and throttle position sensor.

BAD

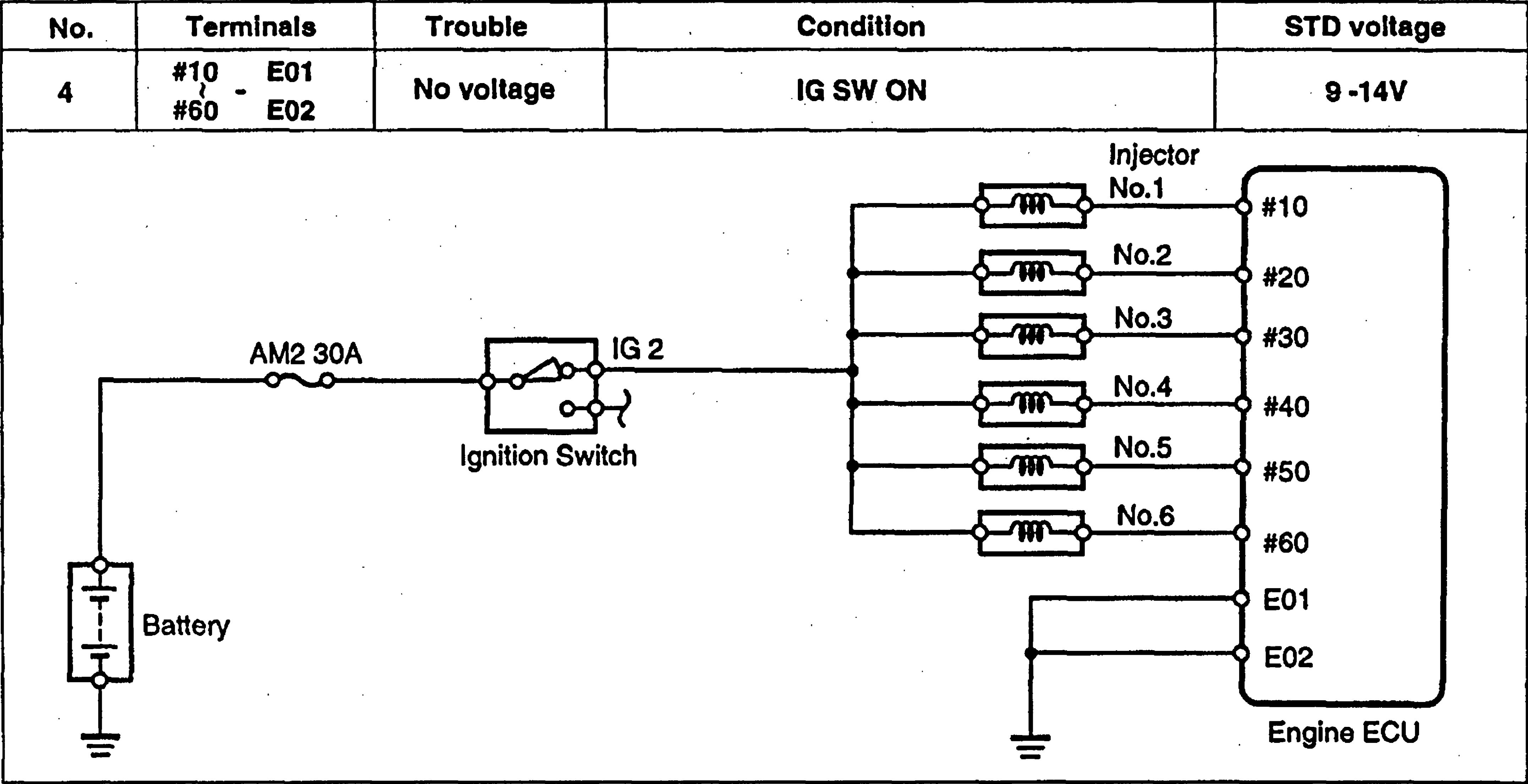
Repair or replace.

OK

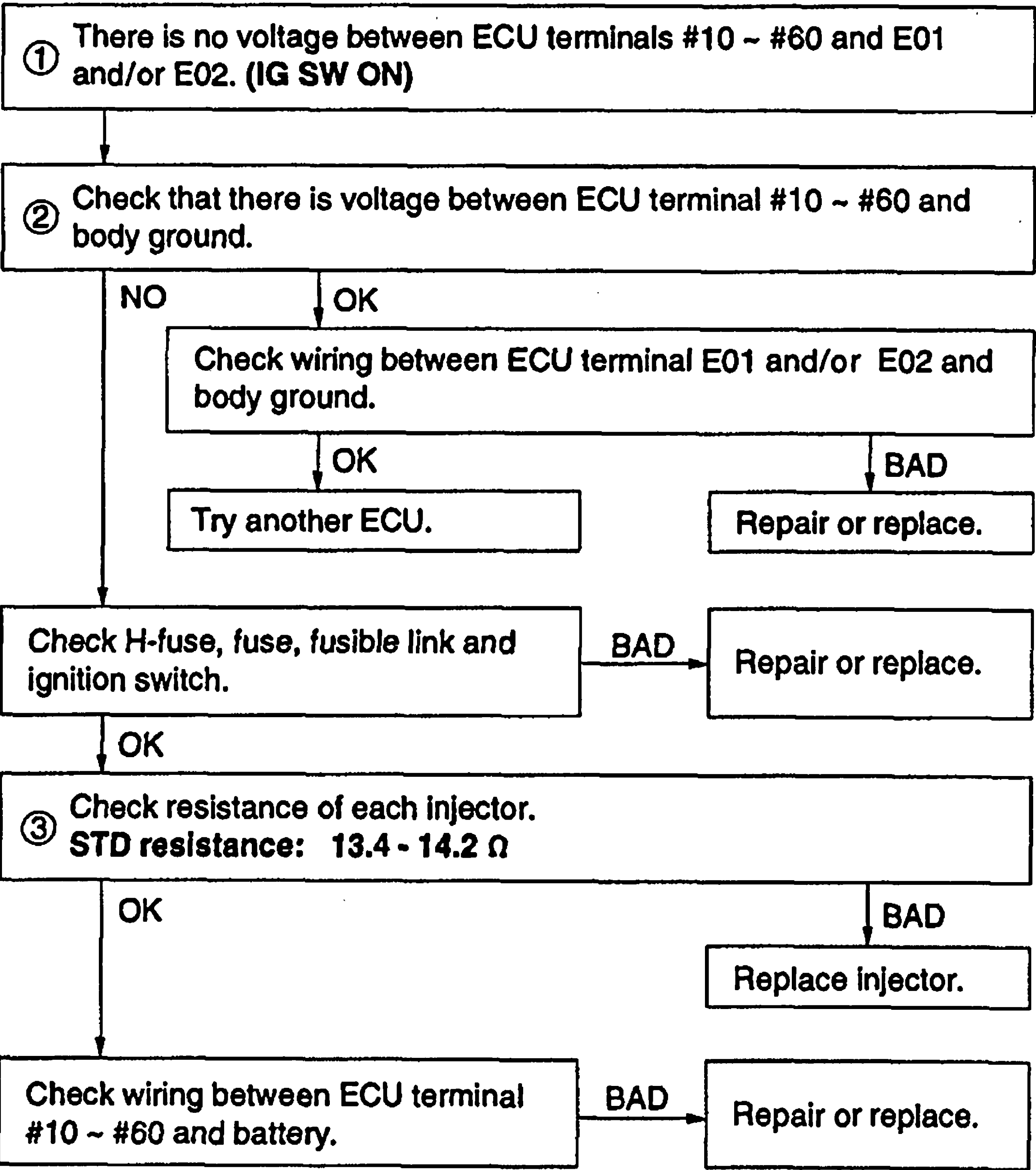
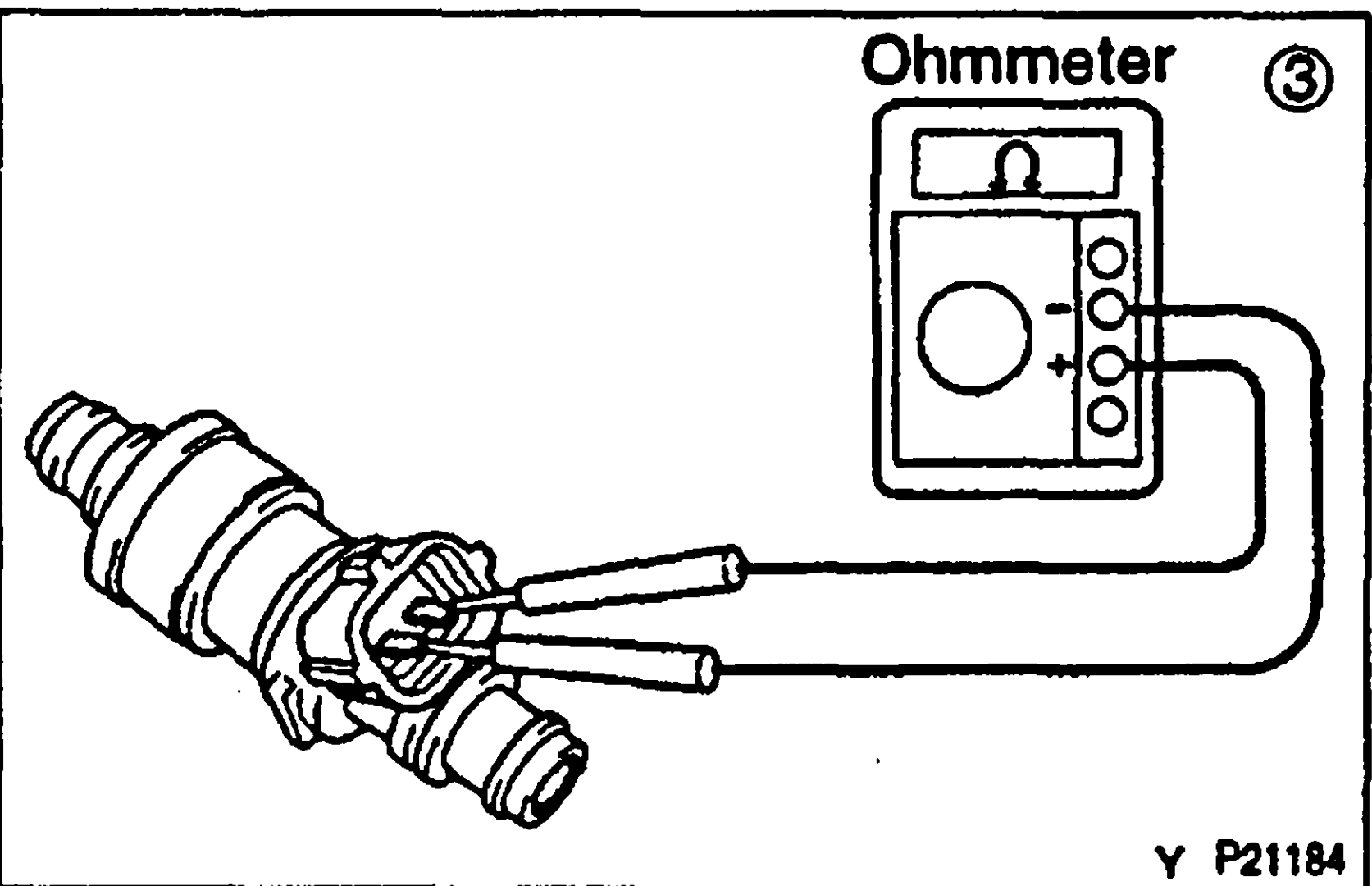
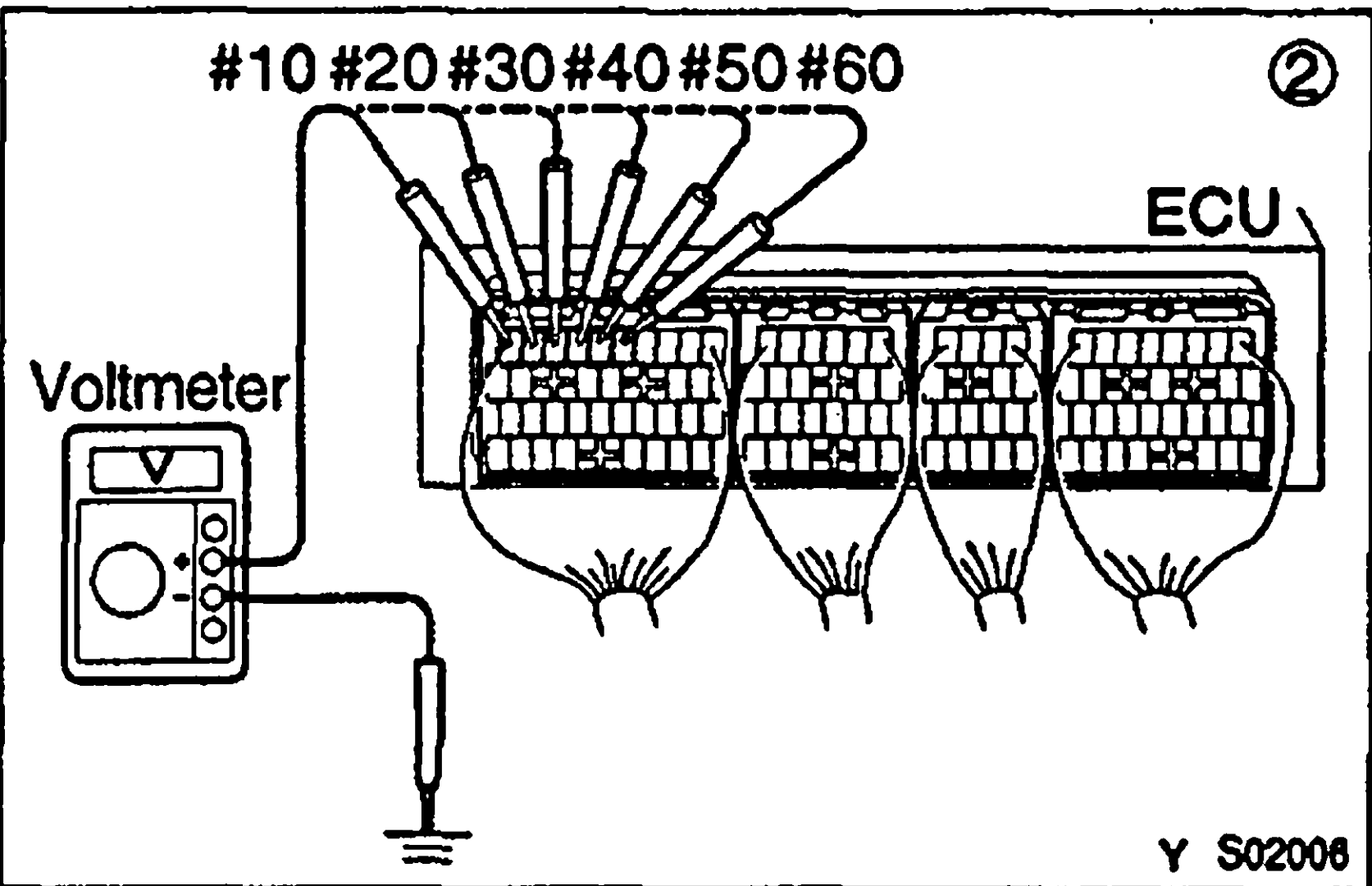
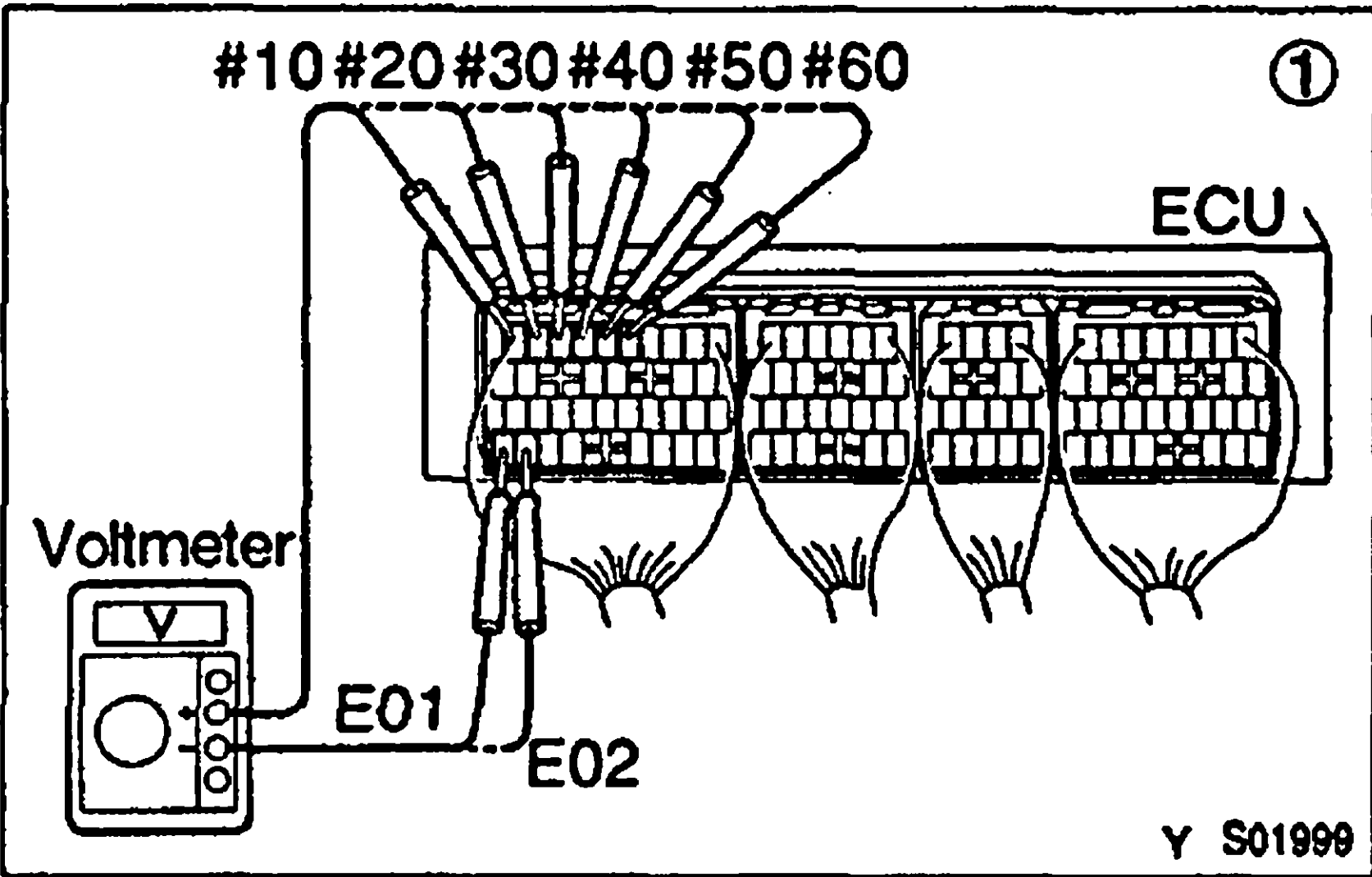
Try another ECU.



EG

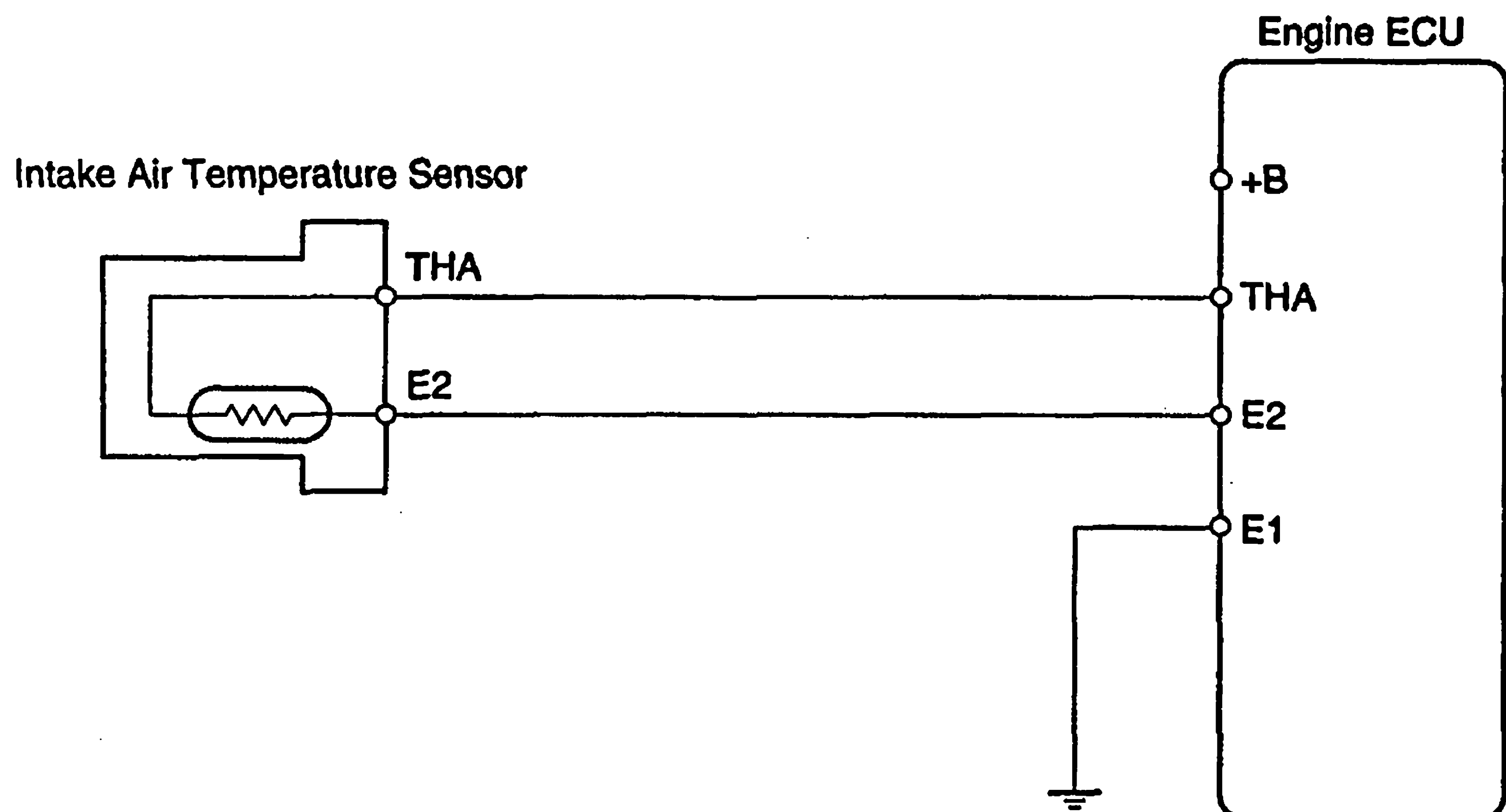


V08130



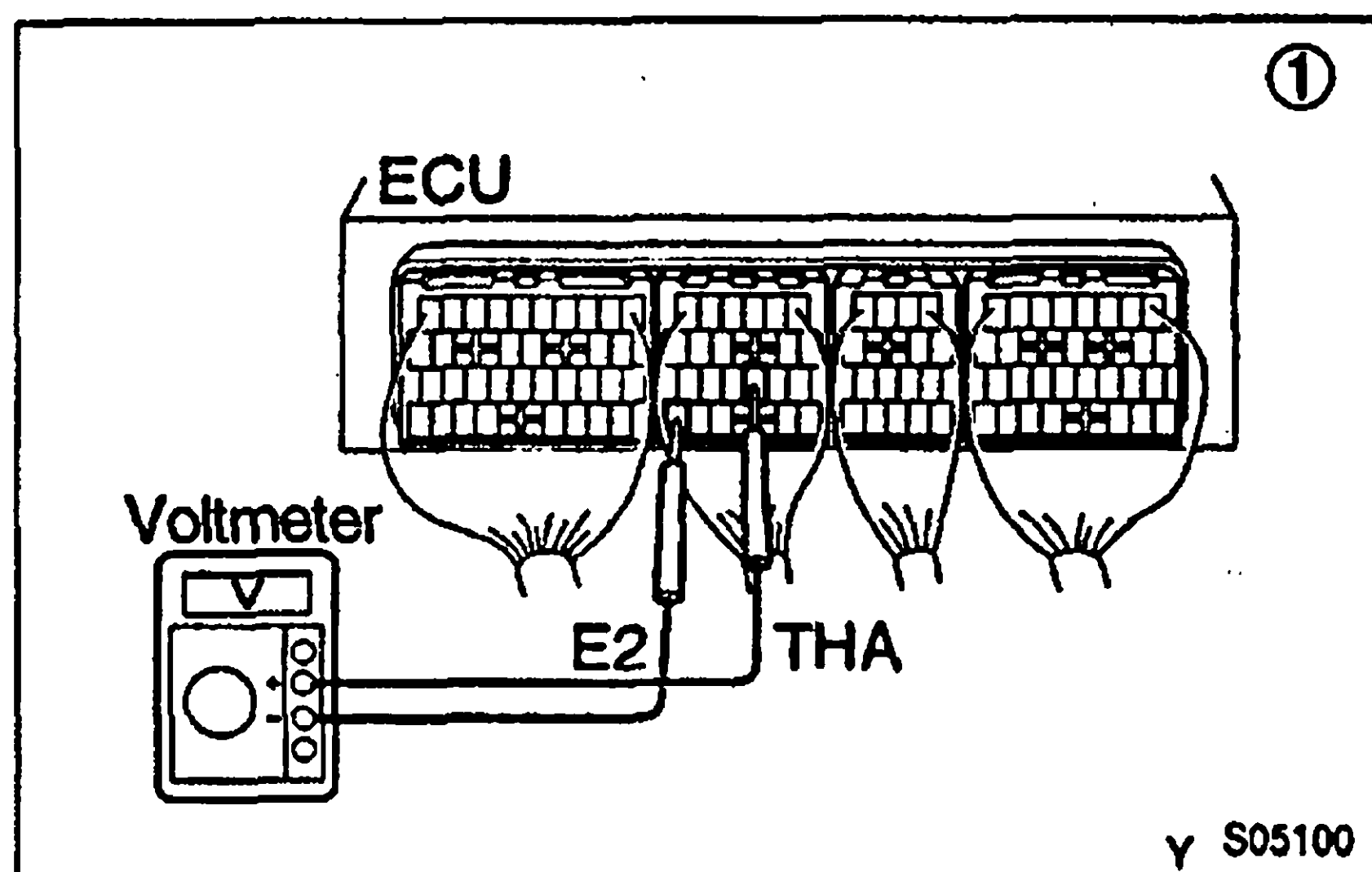
V08197

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



F13572

V07532



①

Y S05100

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

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

OK

NO

Refer to No. 1.
(See page EG-114)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check intake air temp. sensor.

BAD

OK

Replace intake
air temp. sensor.

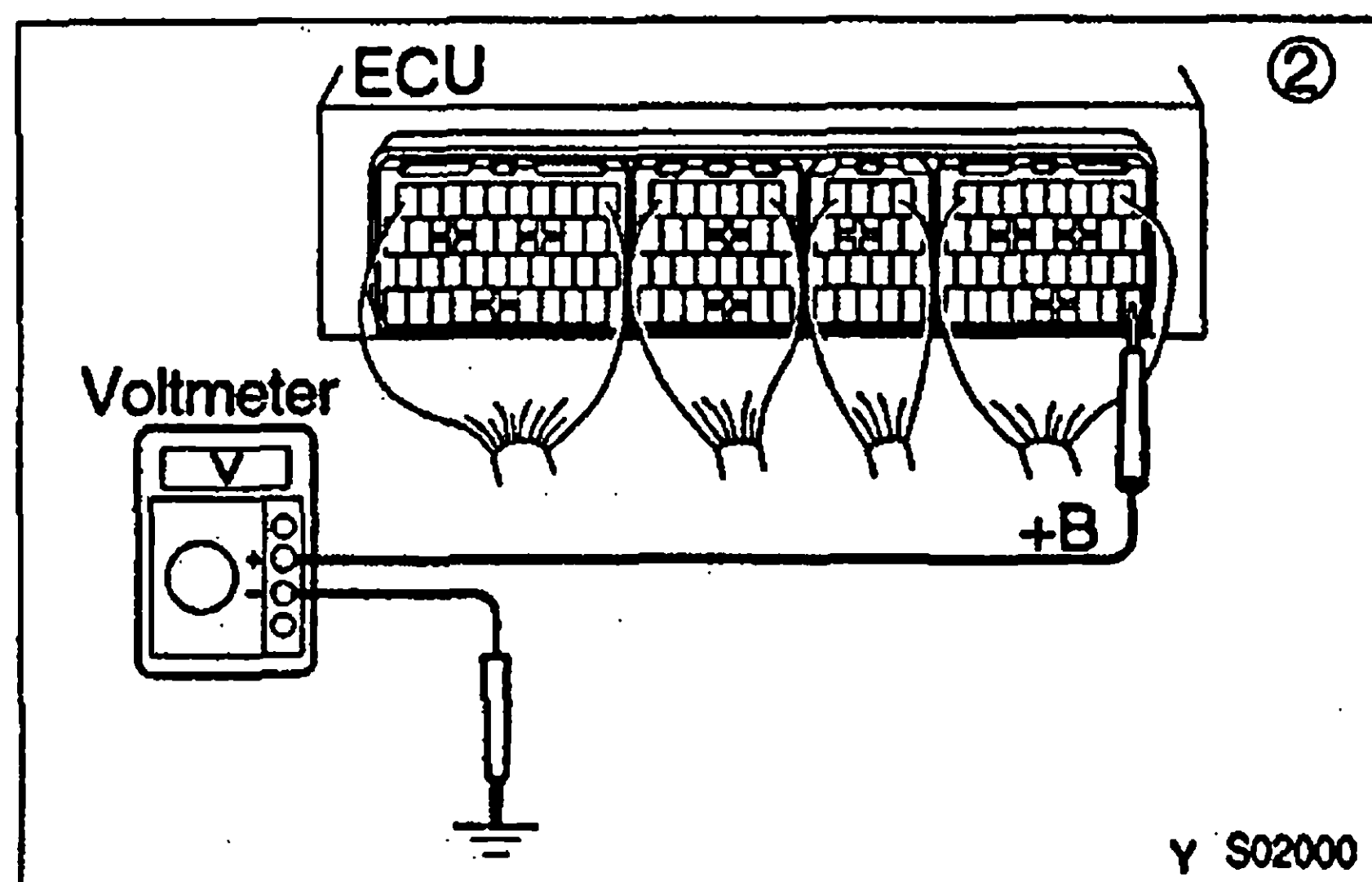
Check wiring between ECU and air temp.
sensor.

OK

BAD

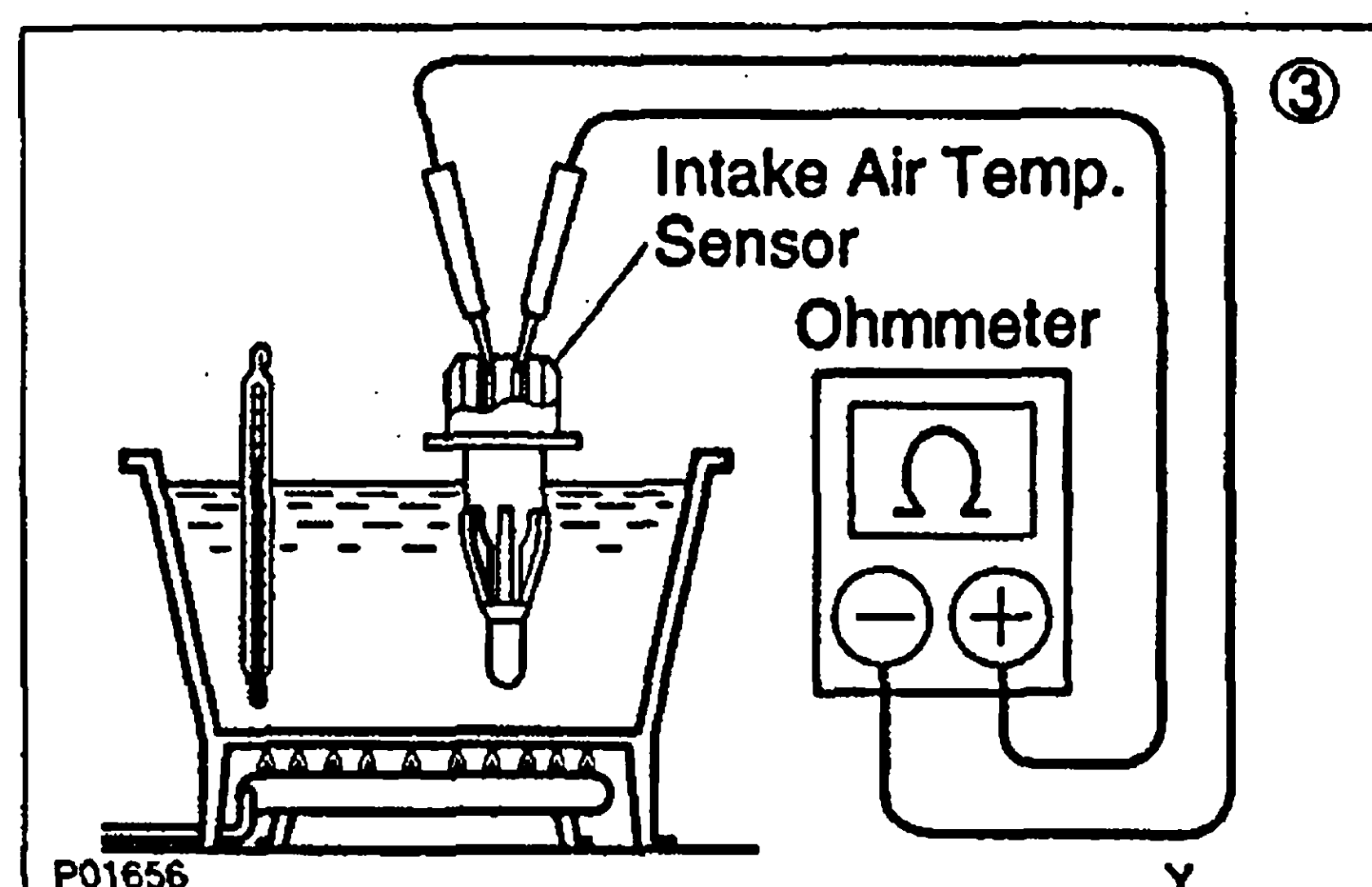
Try another ECU.

Repair or replace.



②

Y S02000

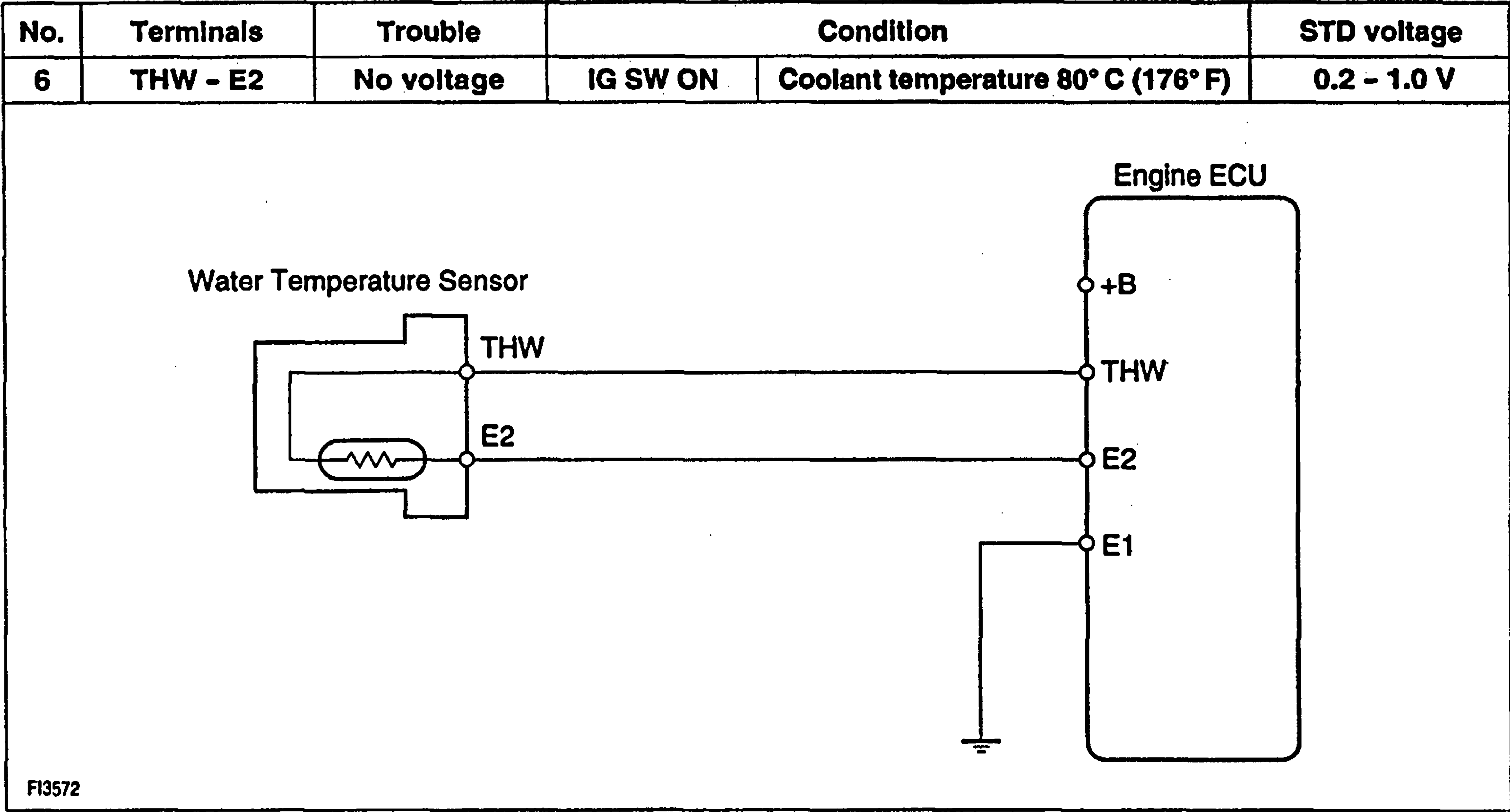


③

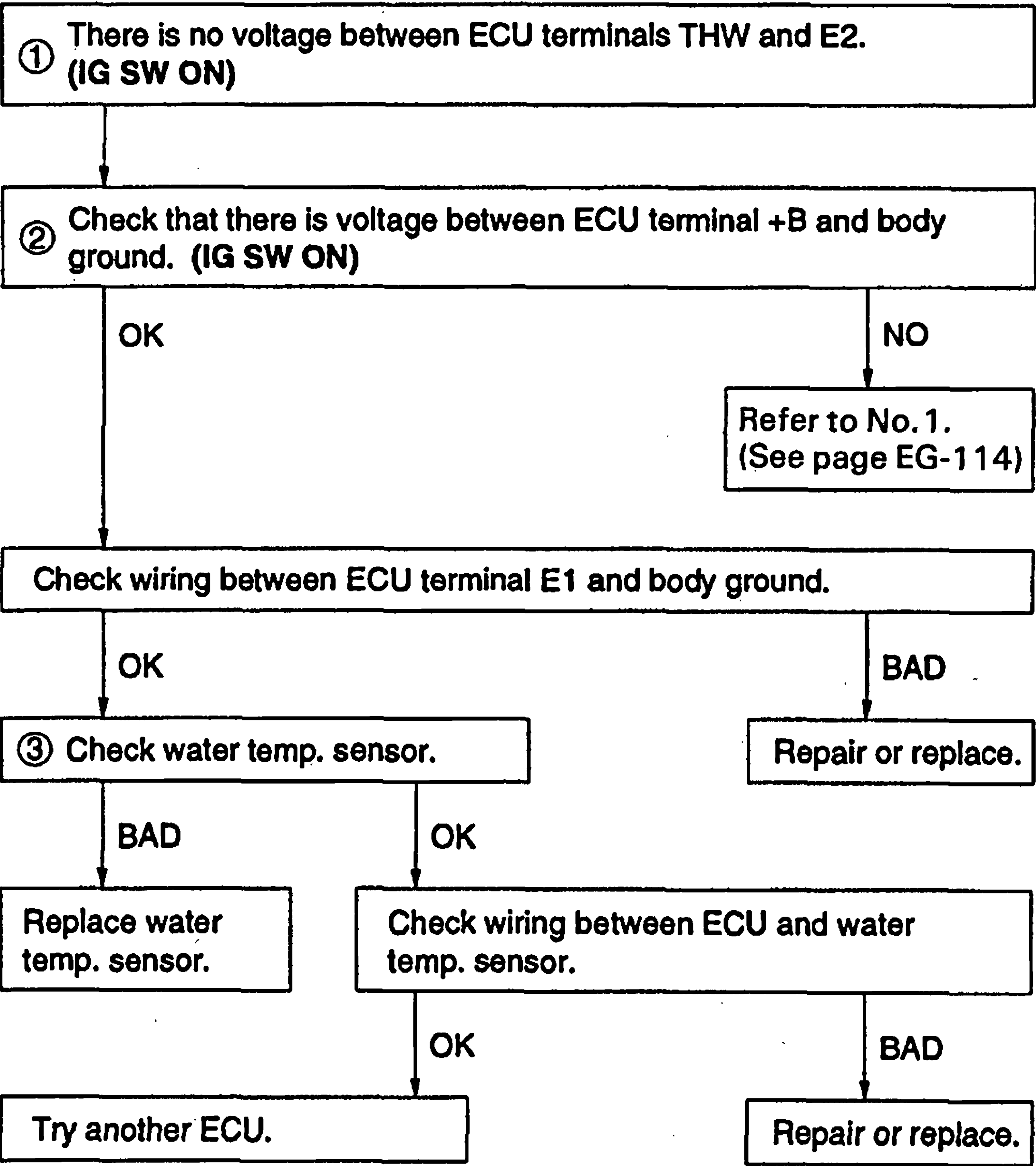
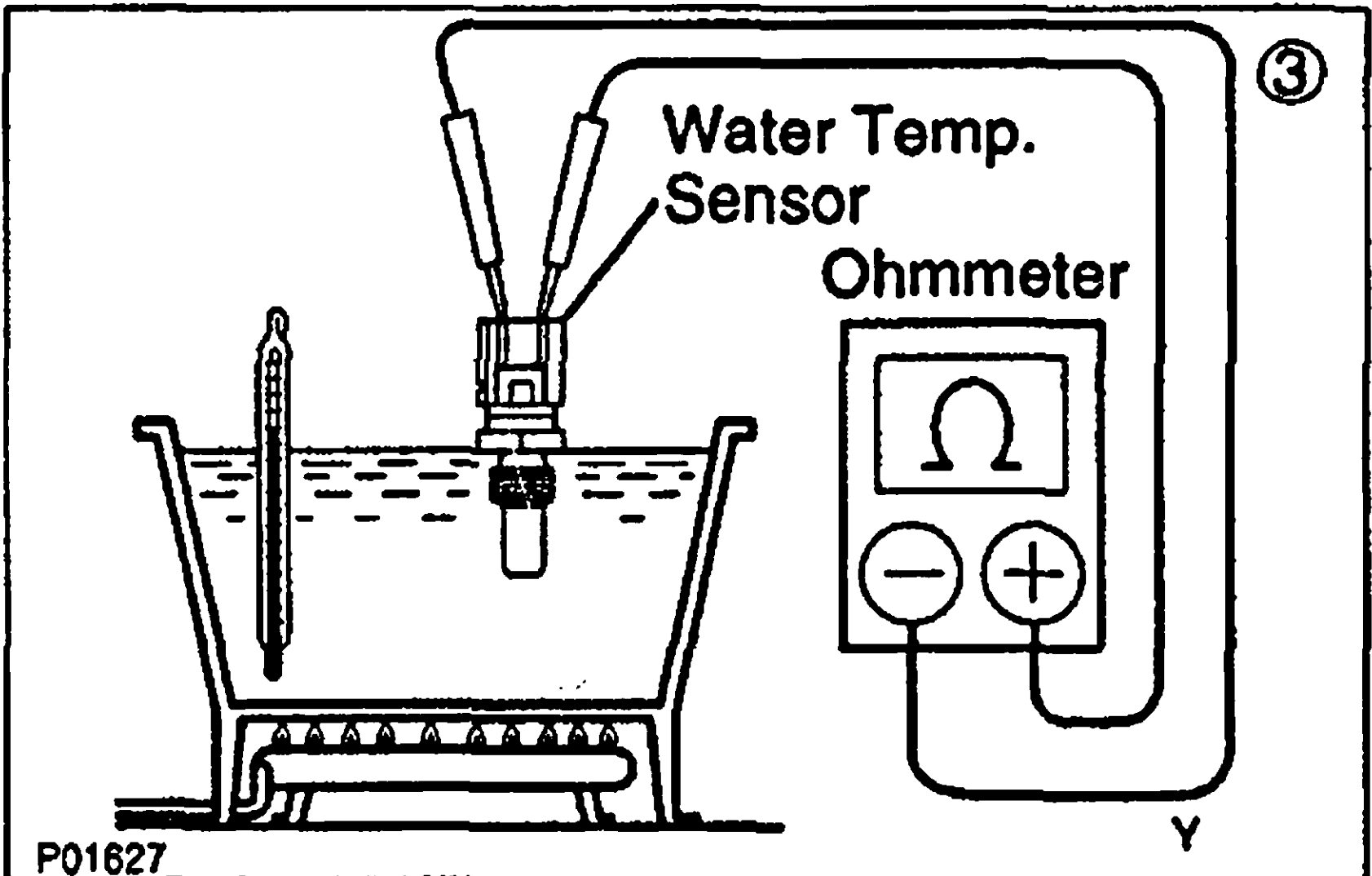
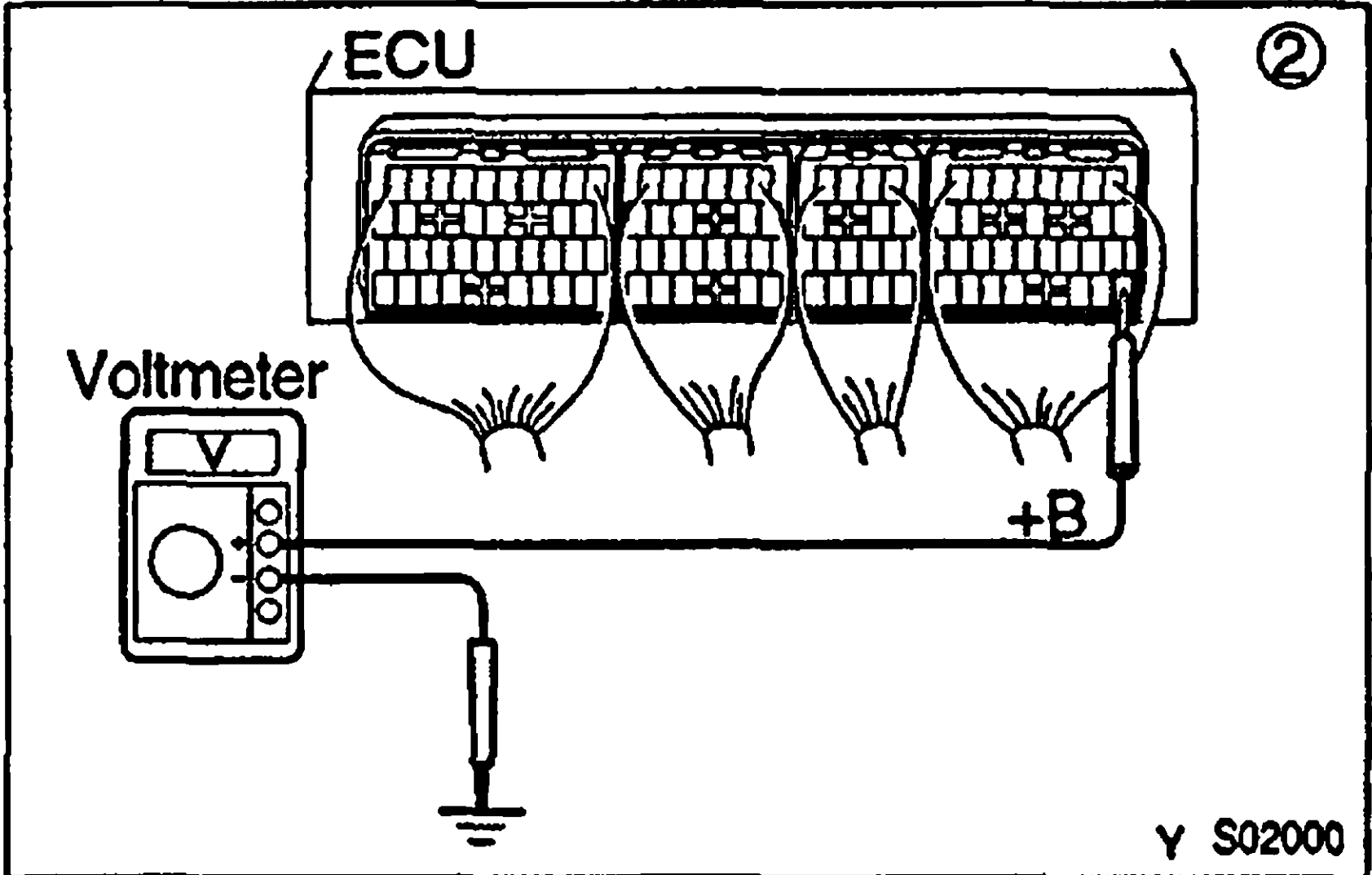
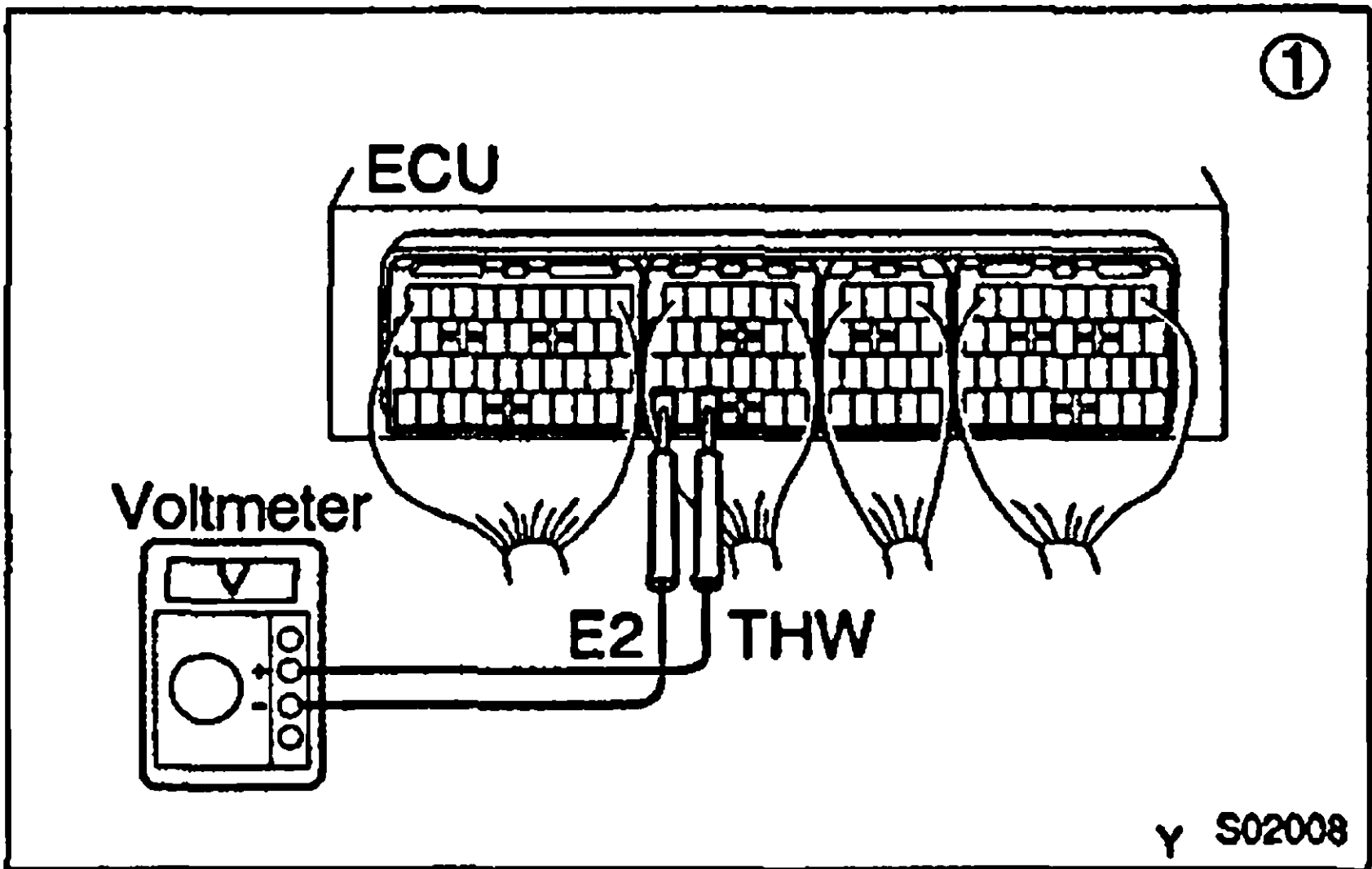
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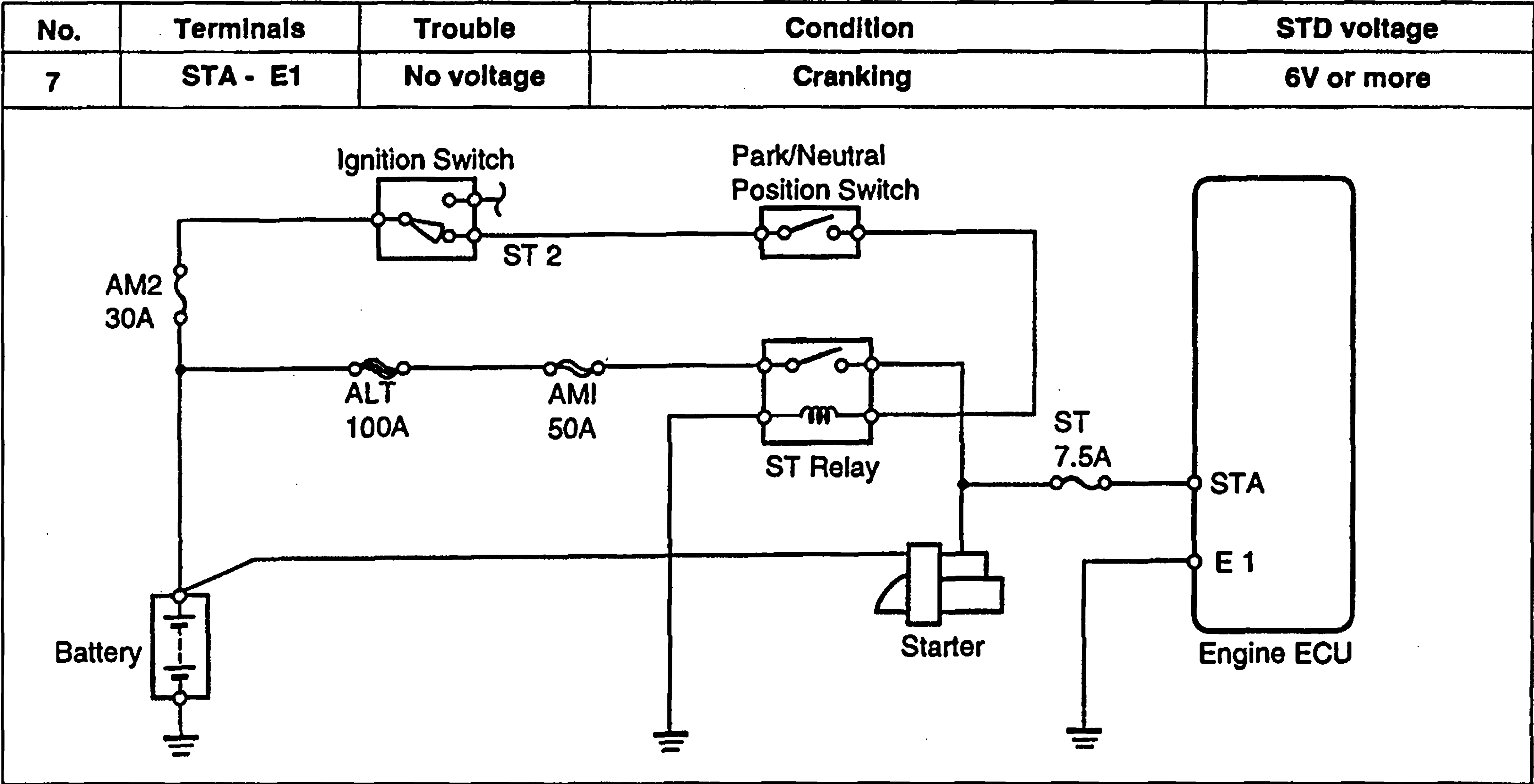
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EG

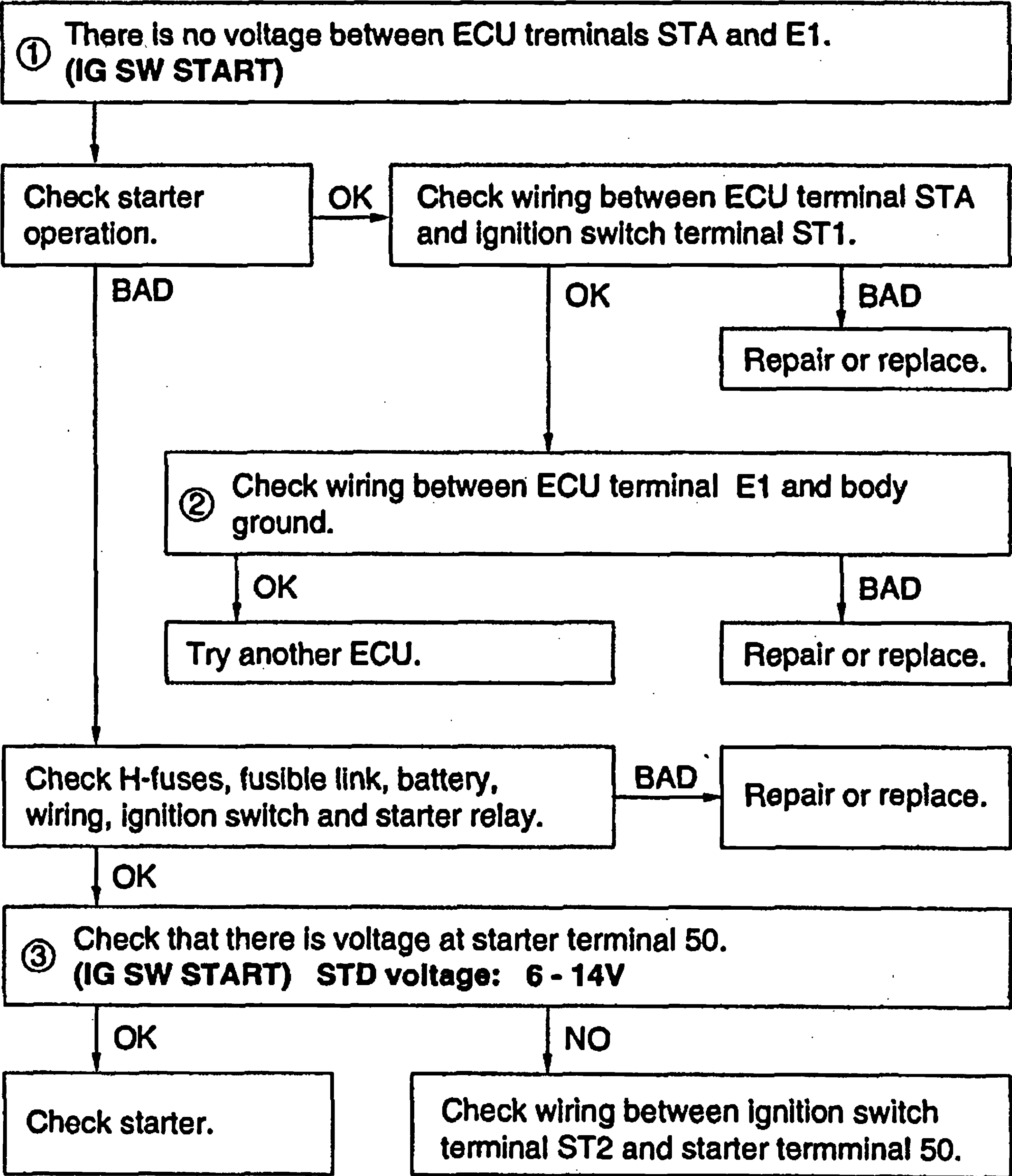
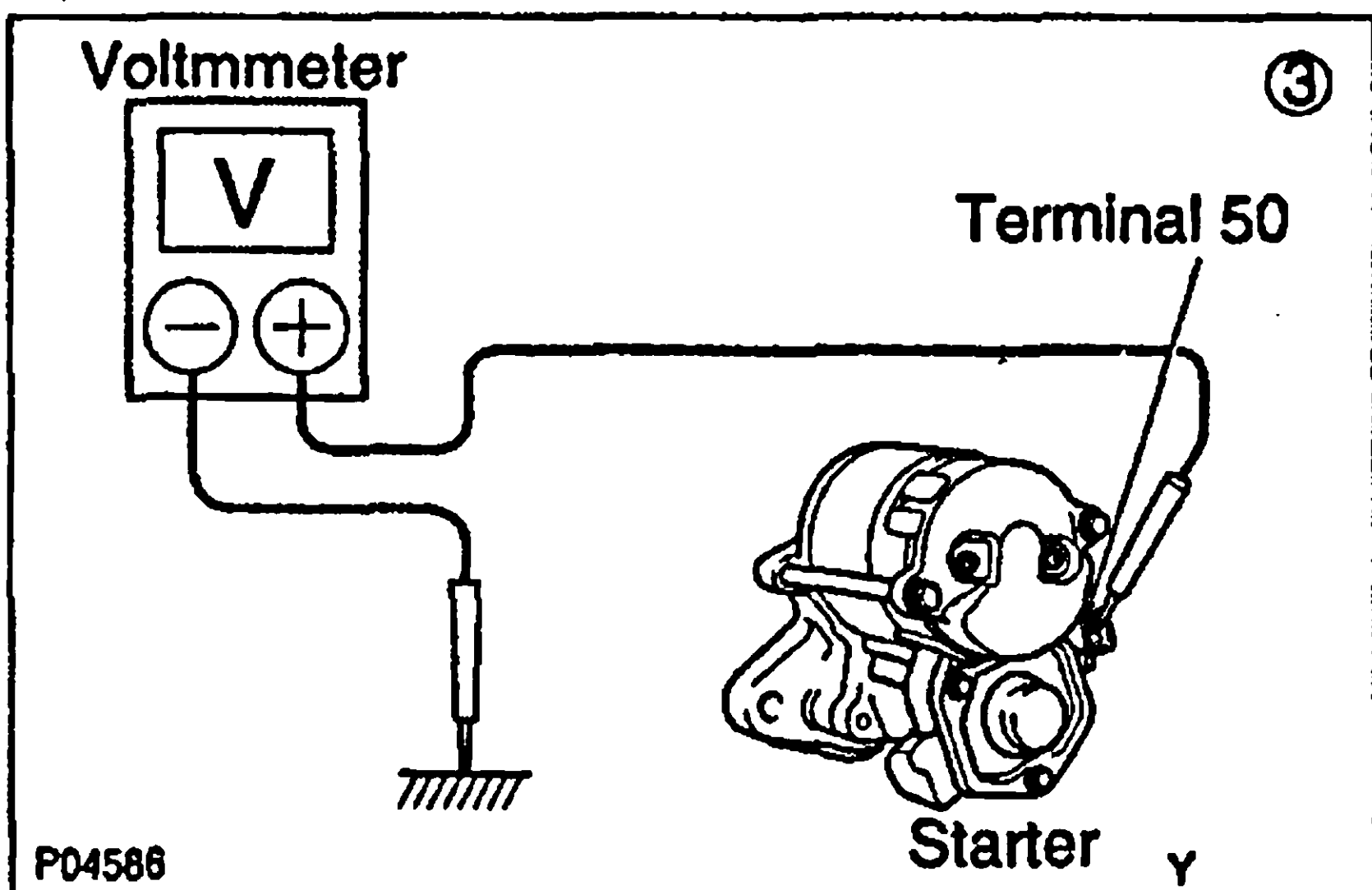
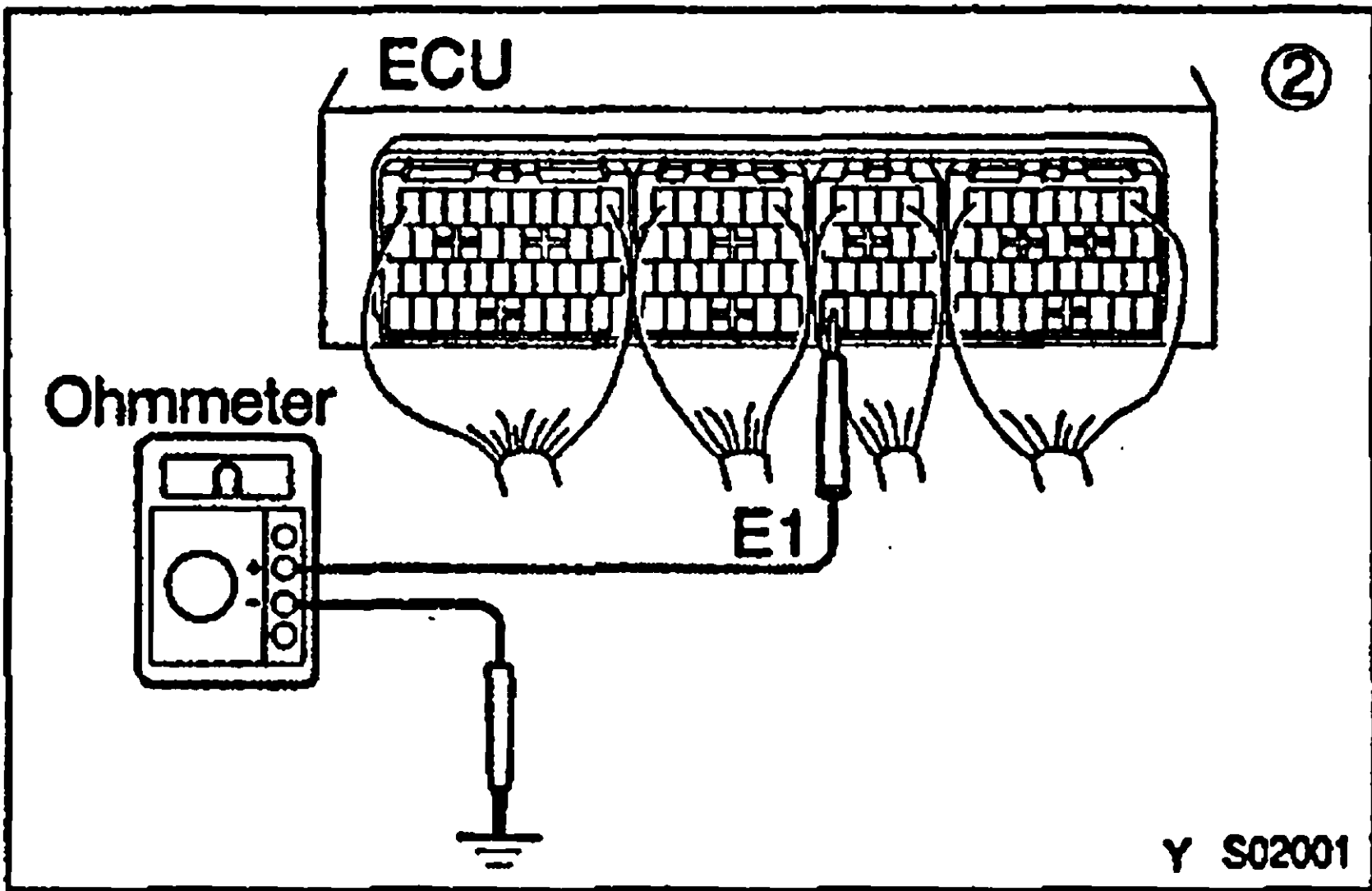
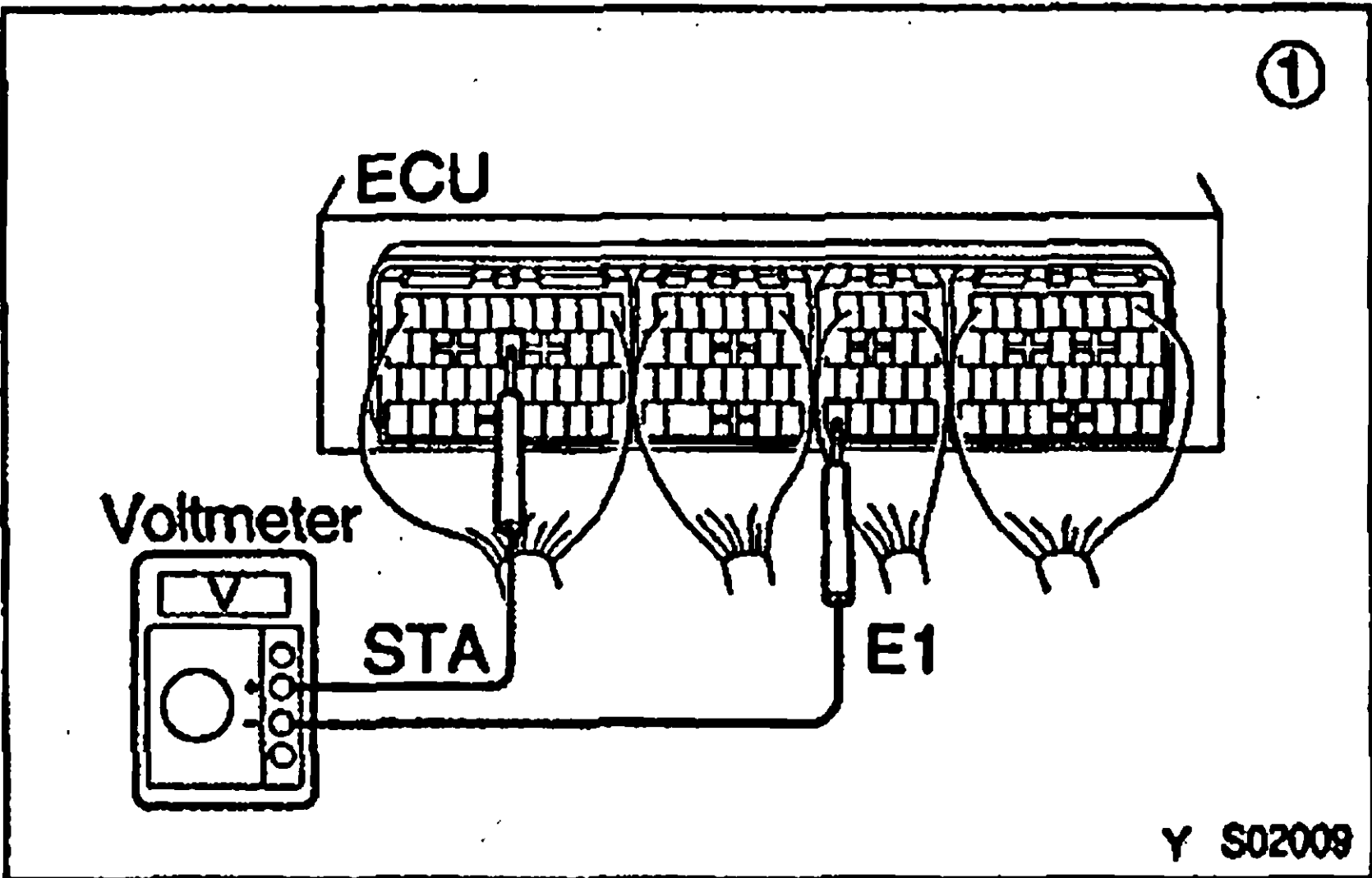


Y V07518

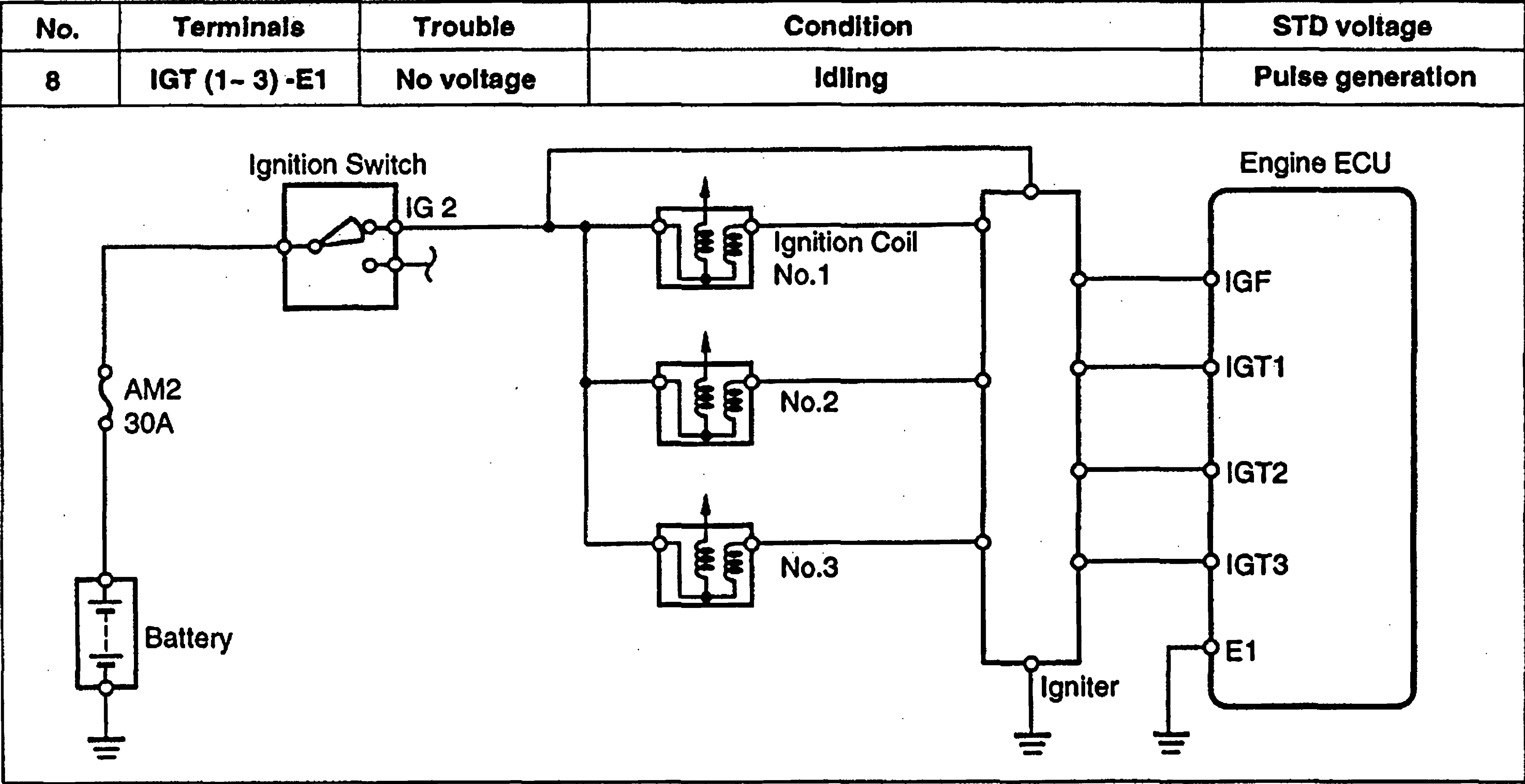




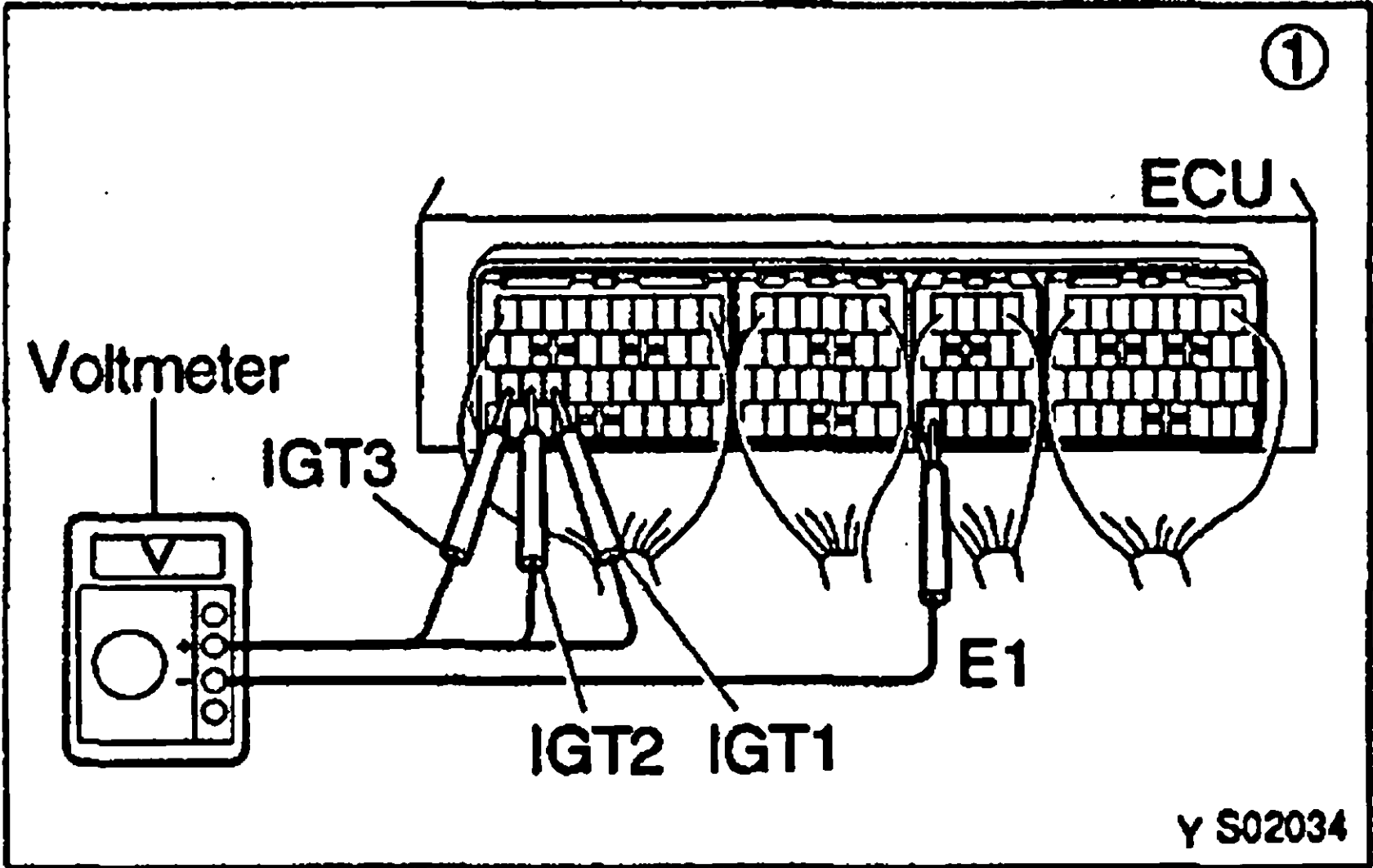
V08151



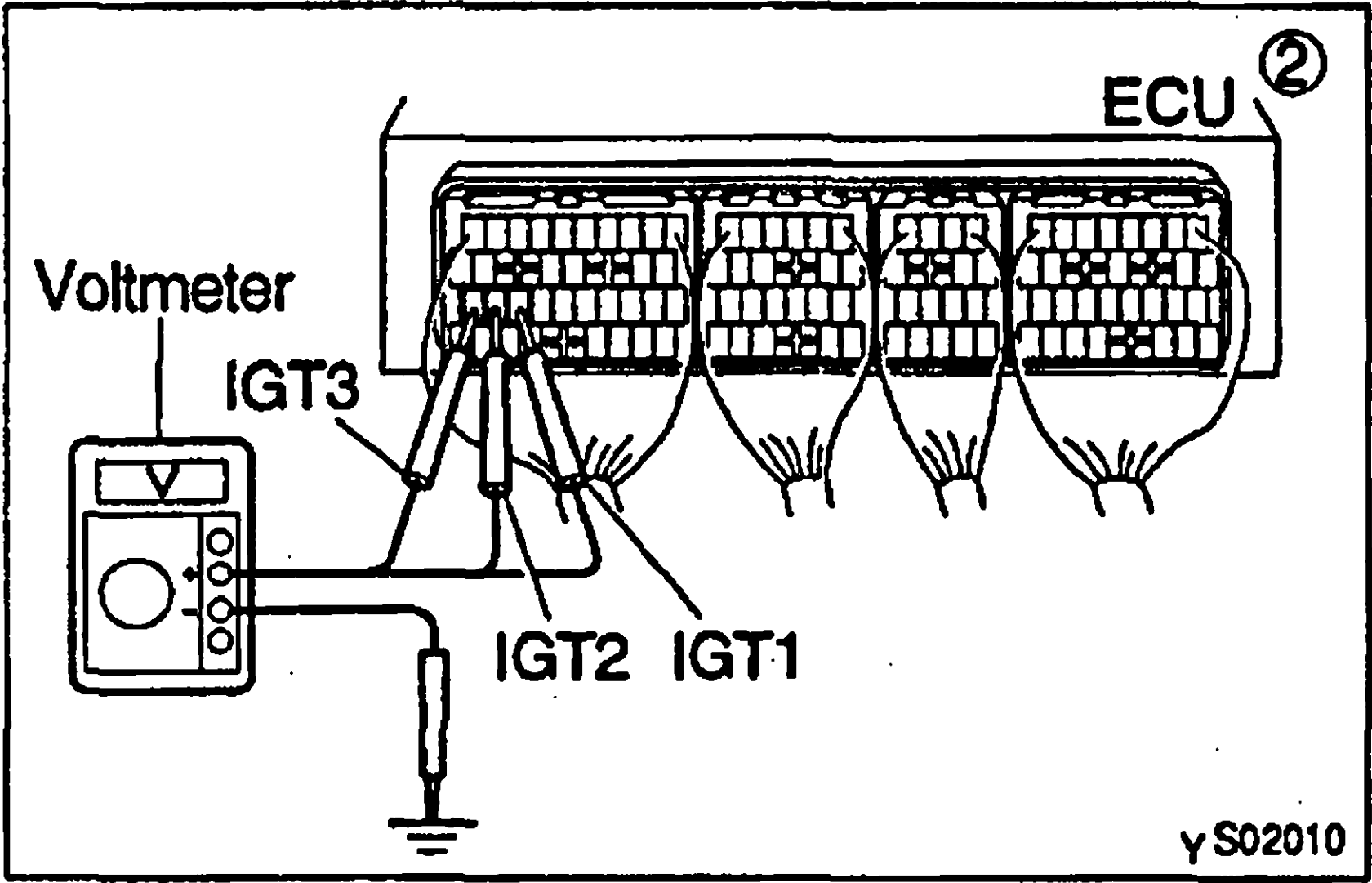
Y V07520



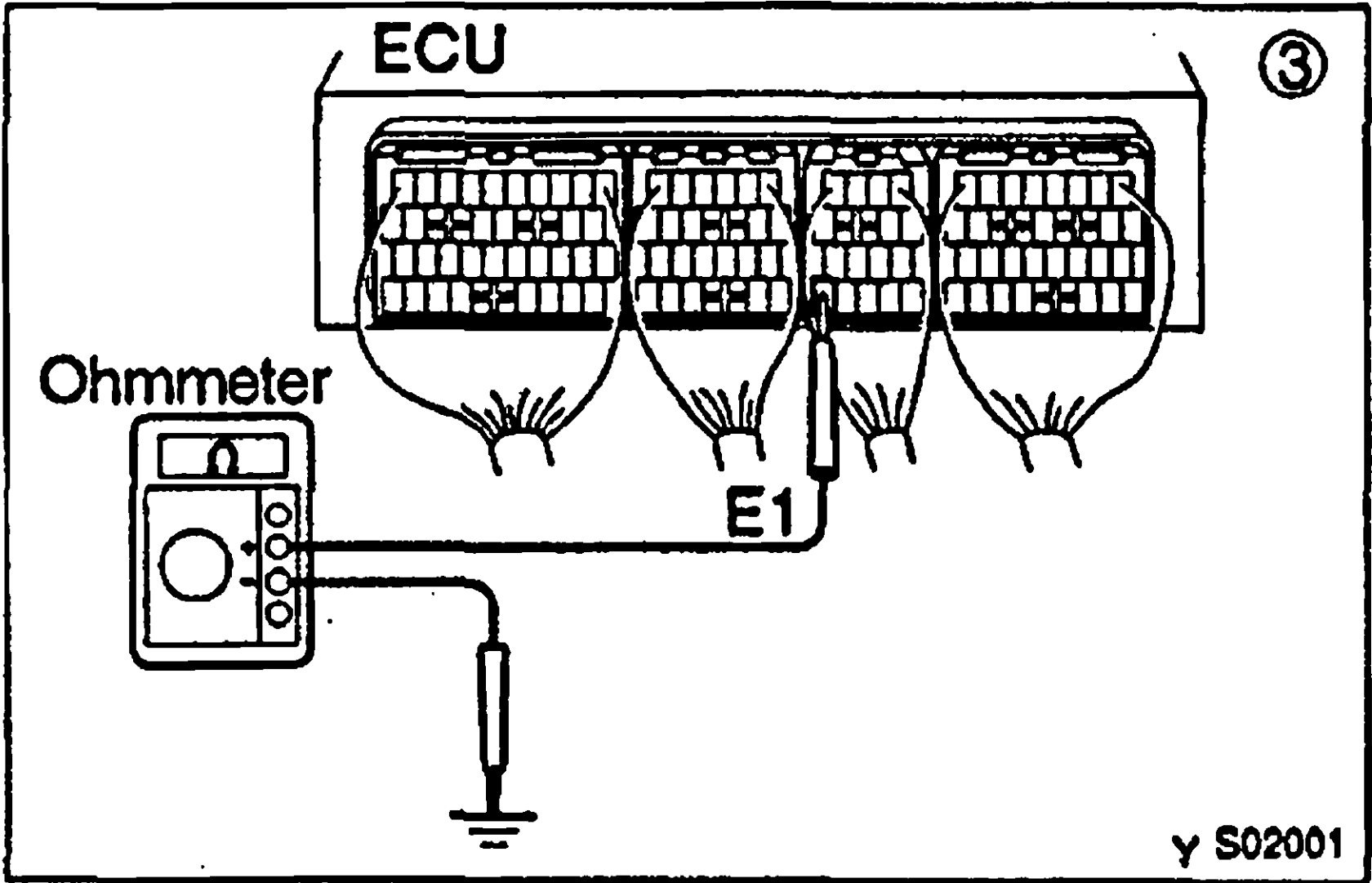
V08153



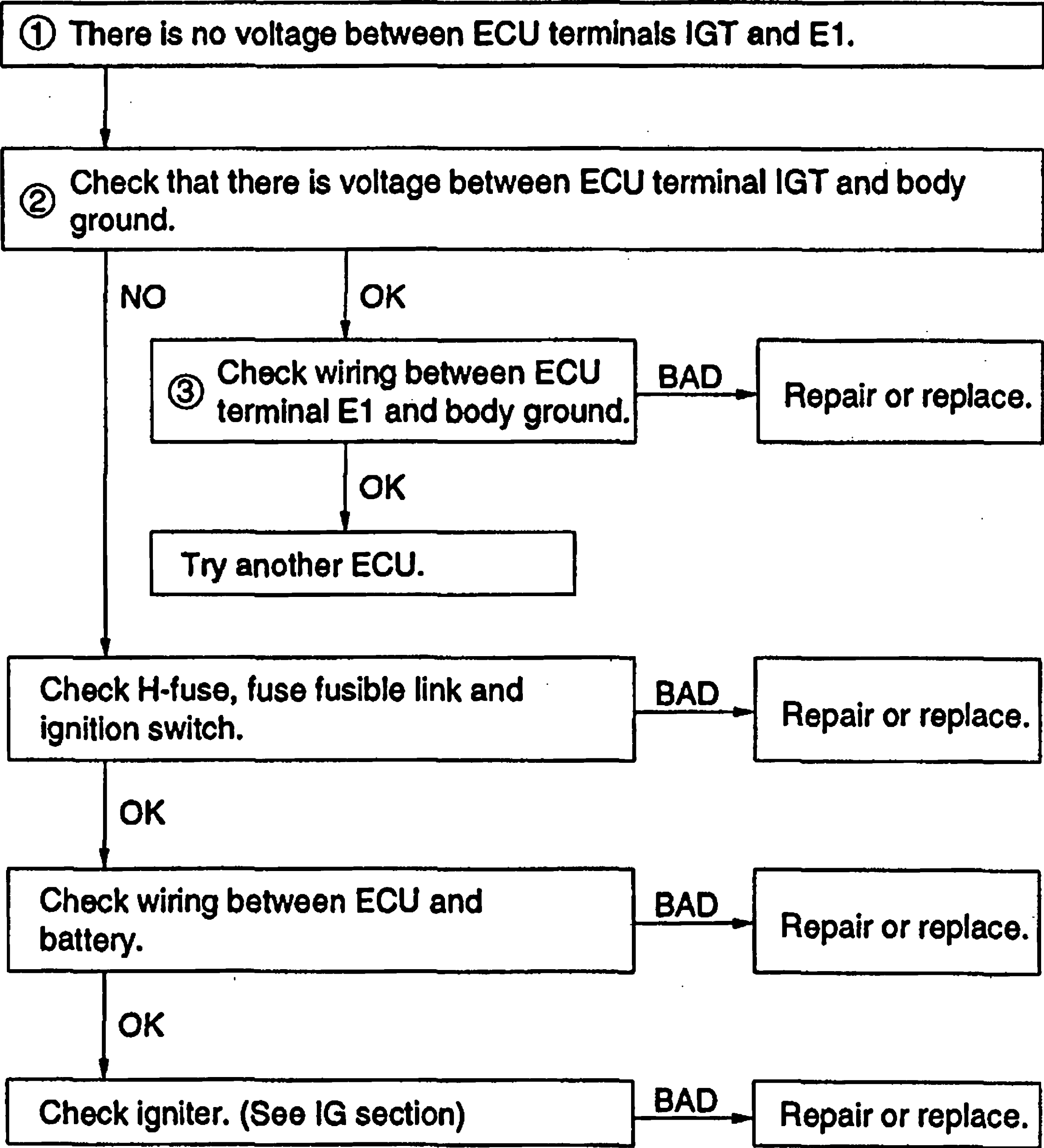
Y S02034



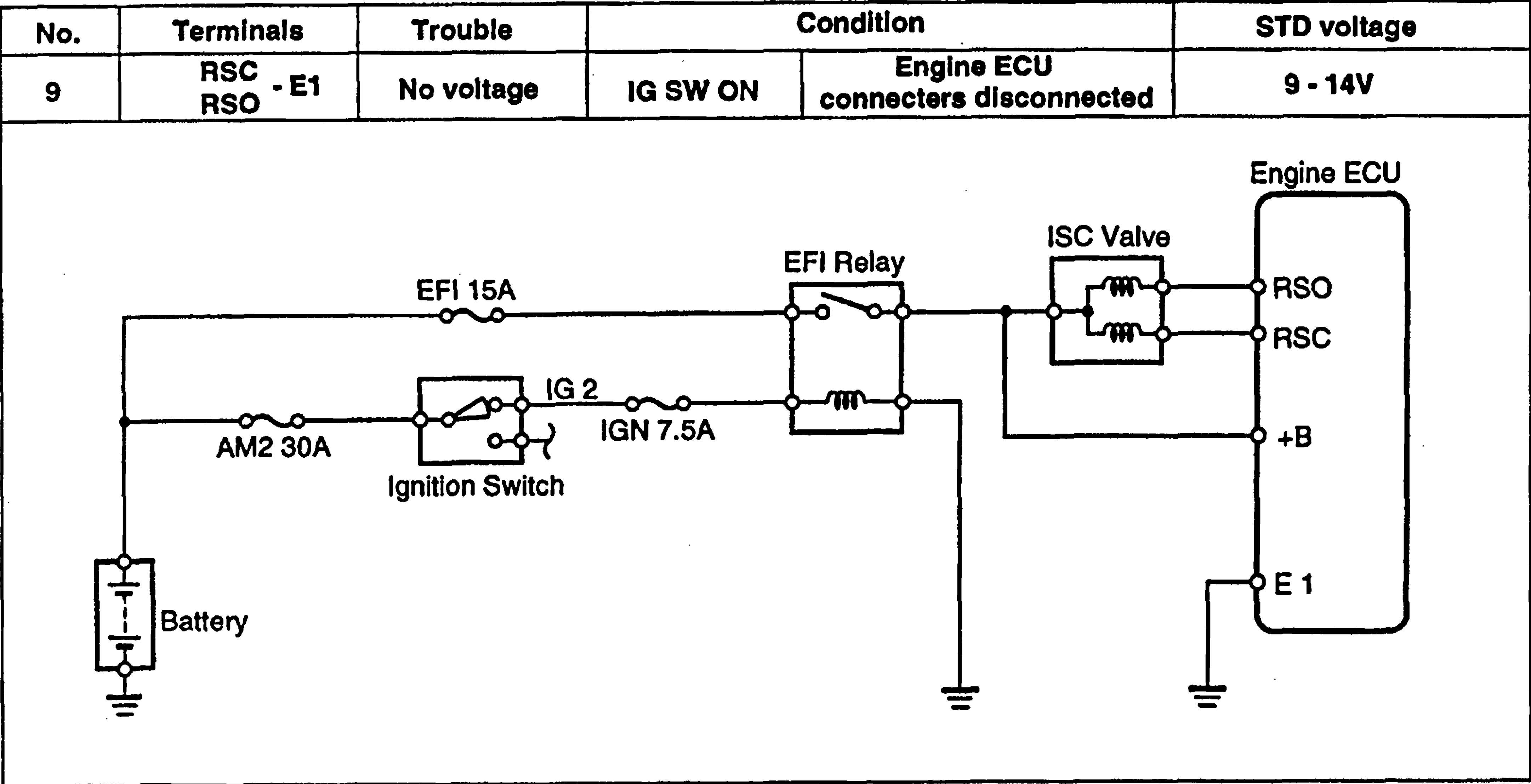
Y S02010



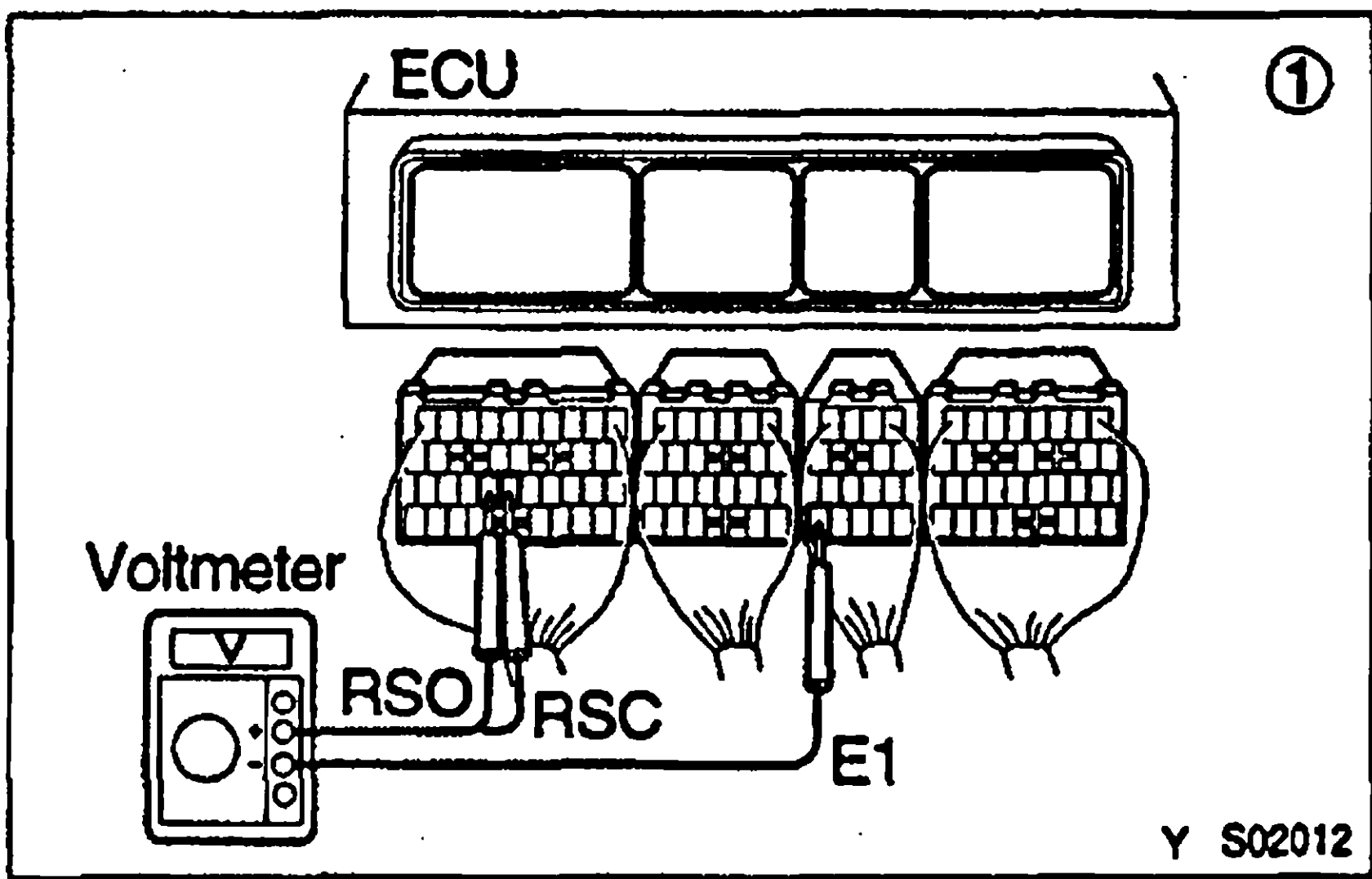
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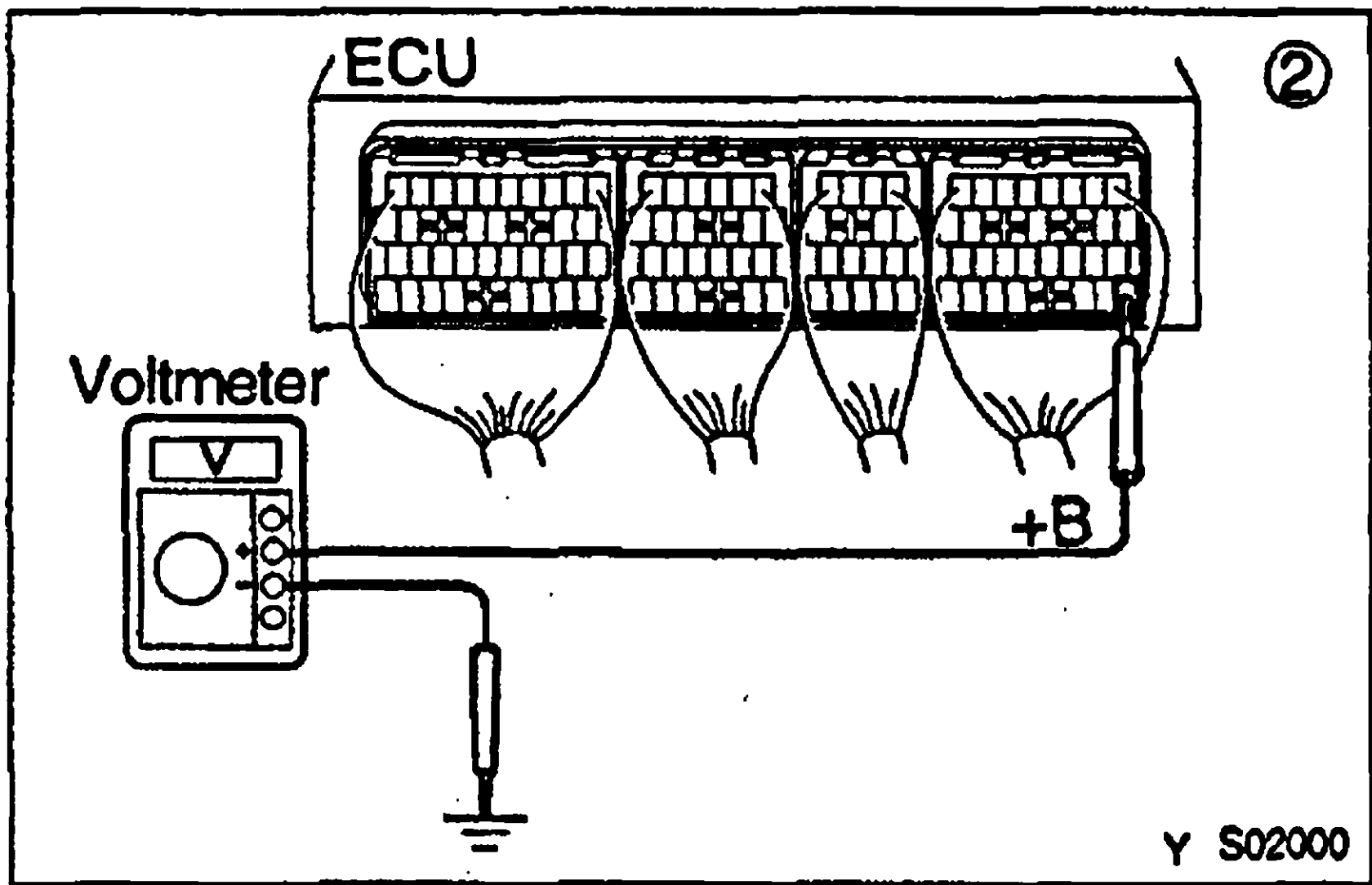
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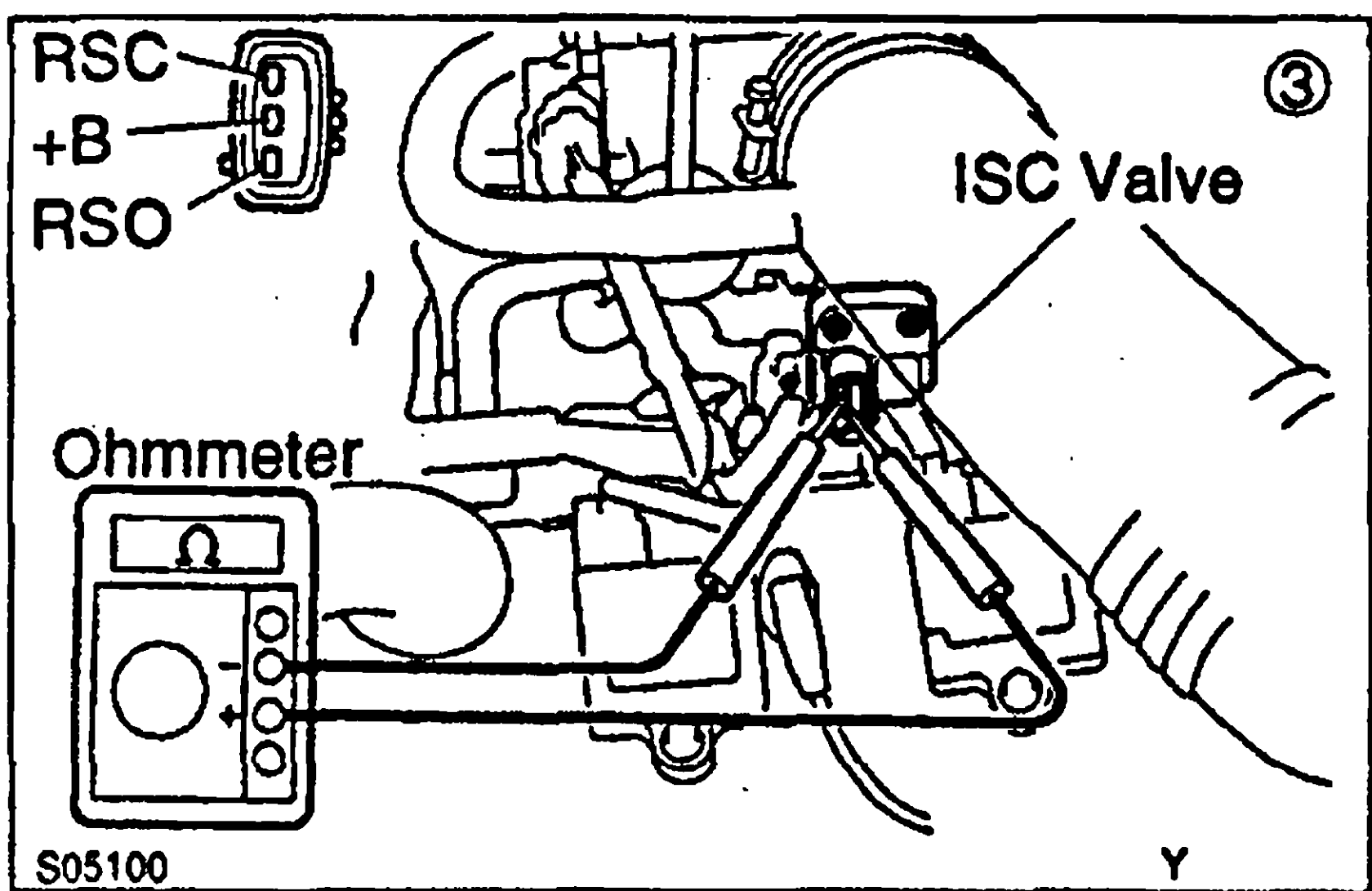
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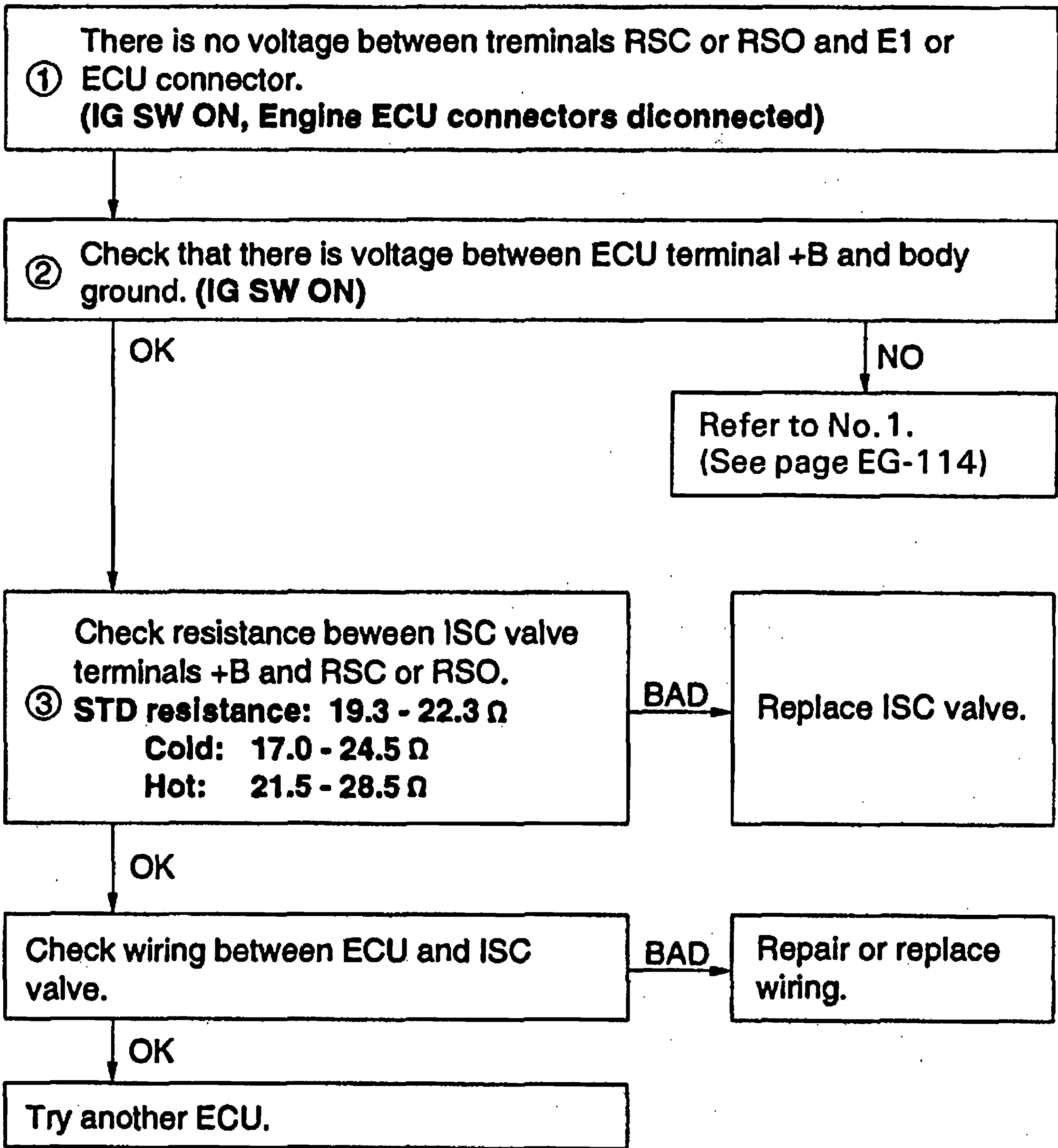


Y S02000



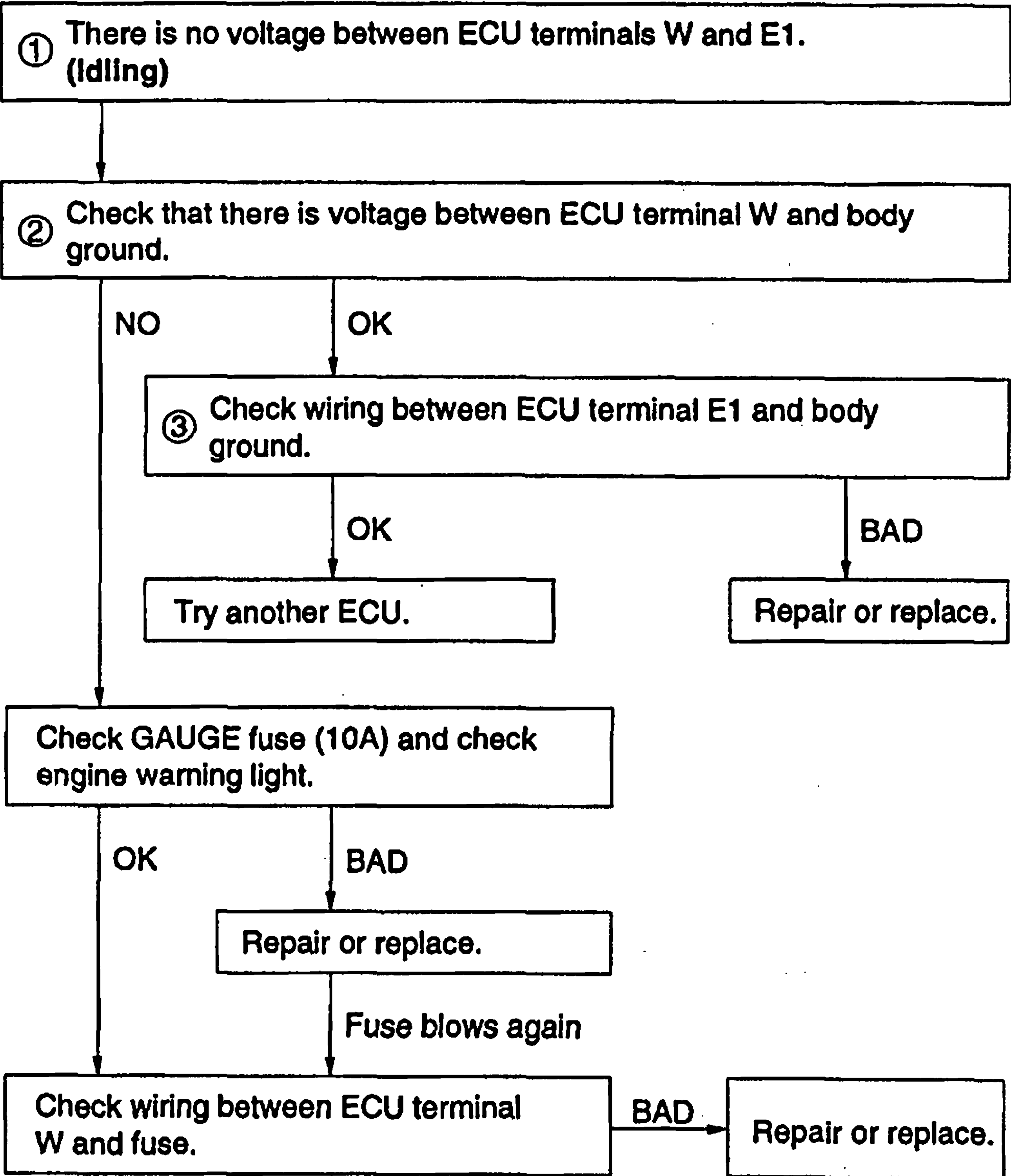
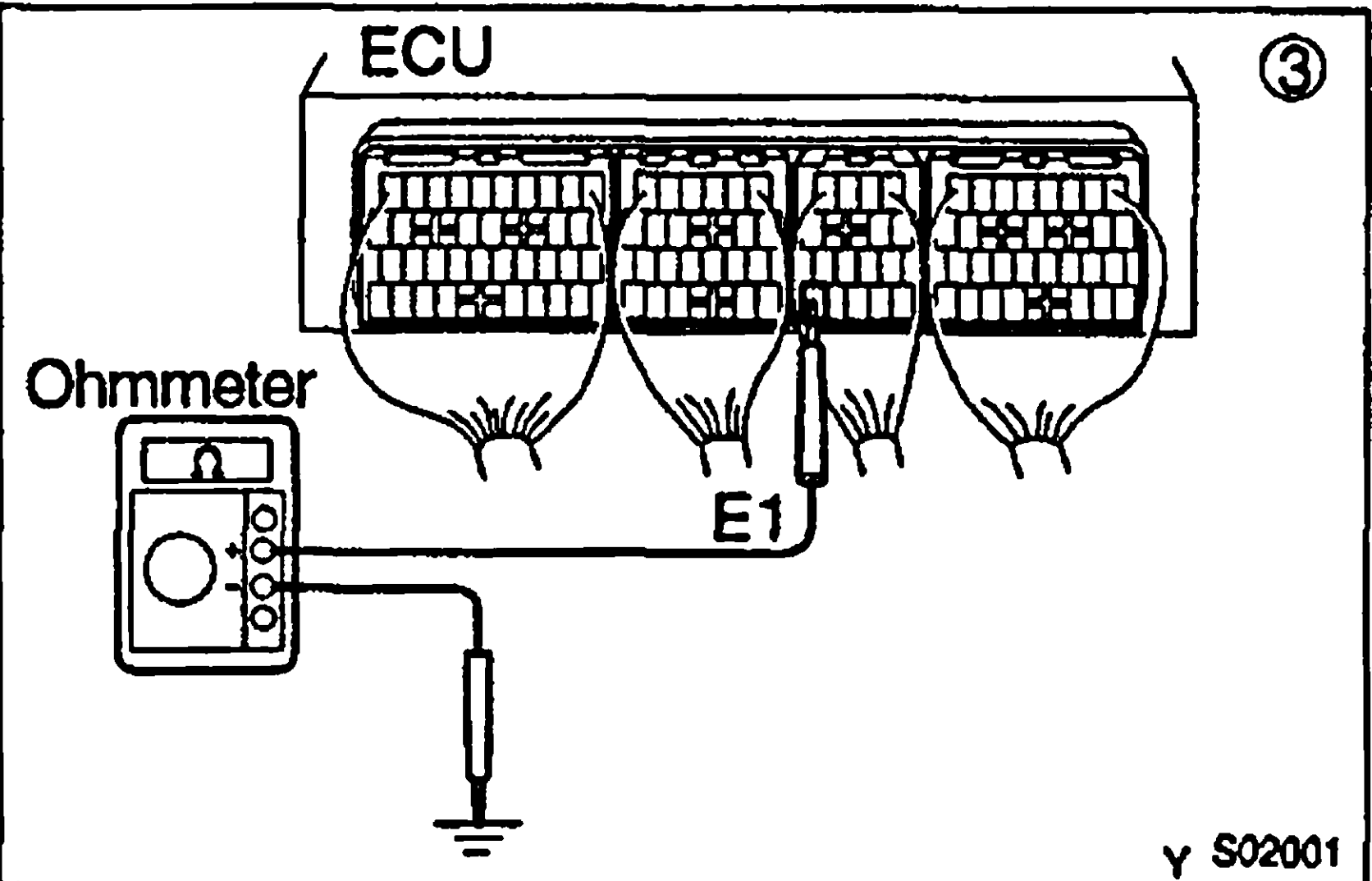
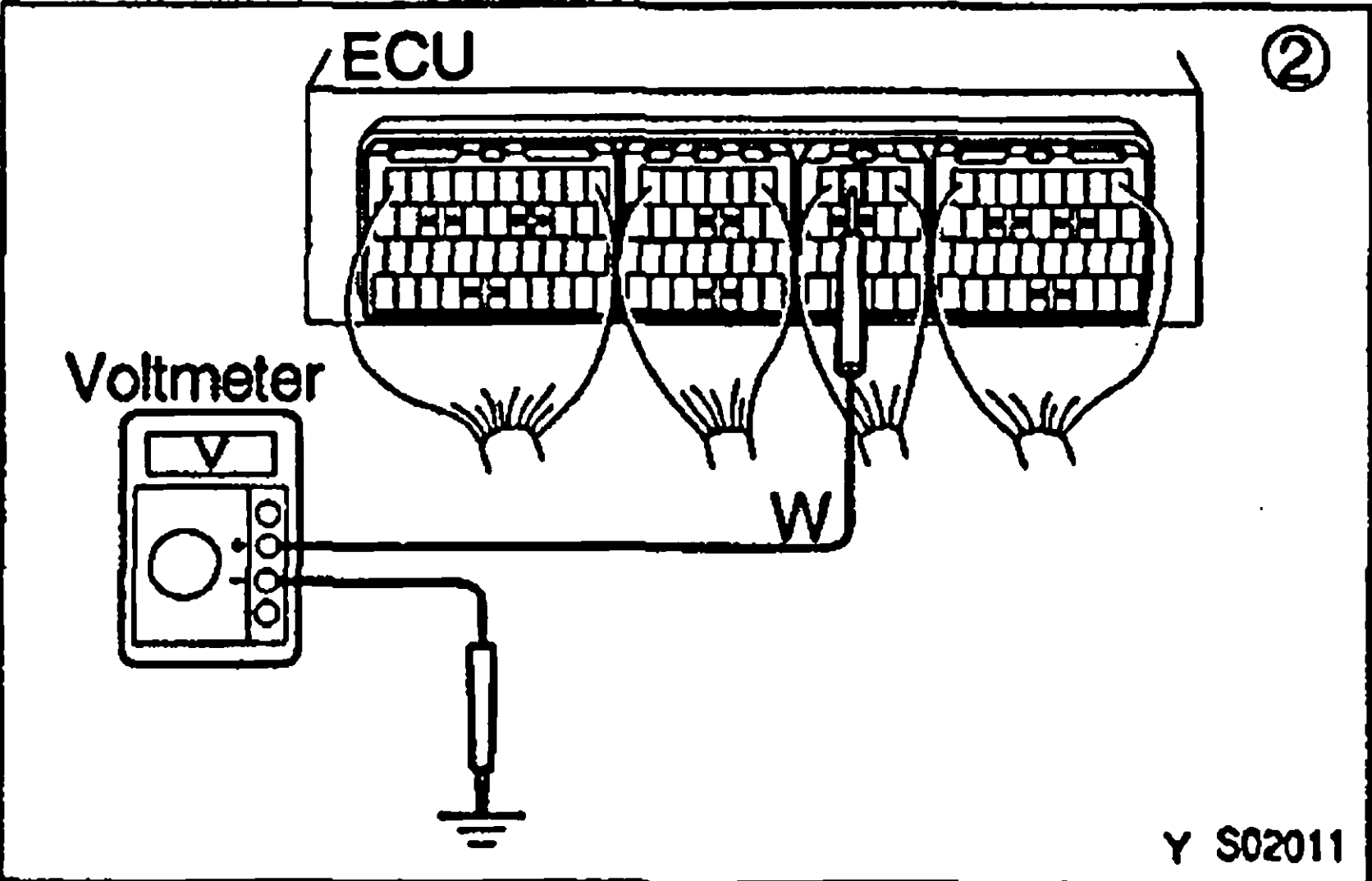
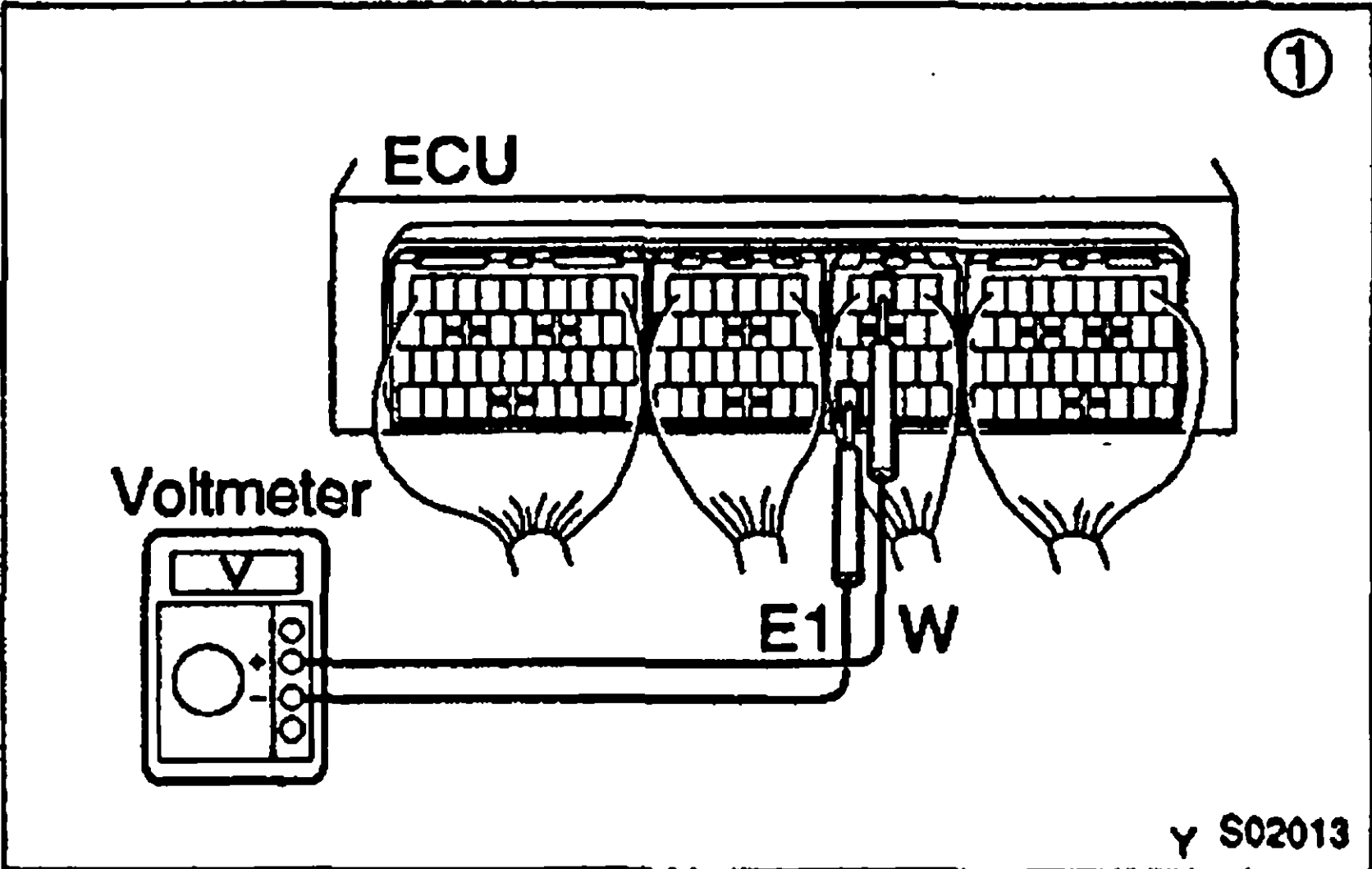
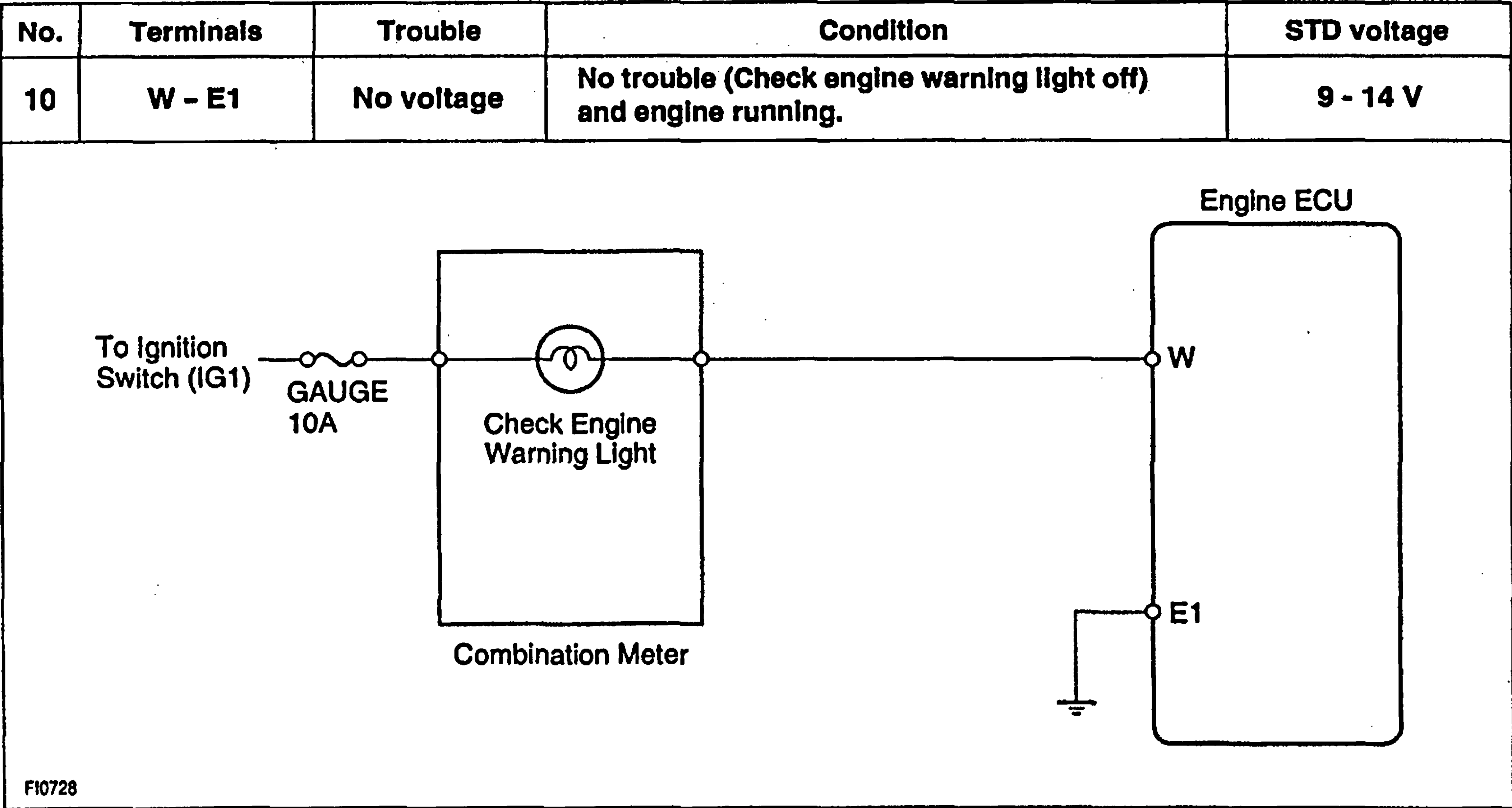
S05100

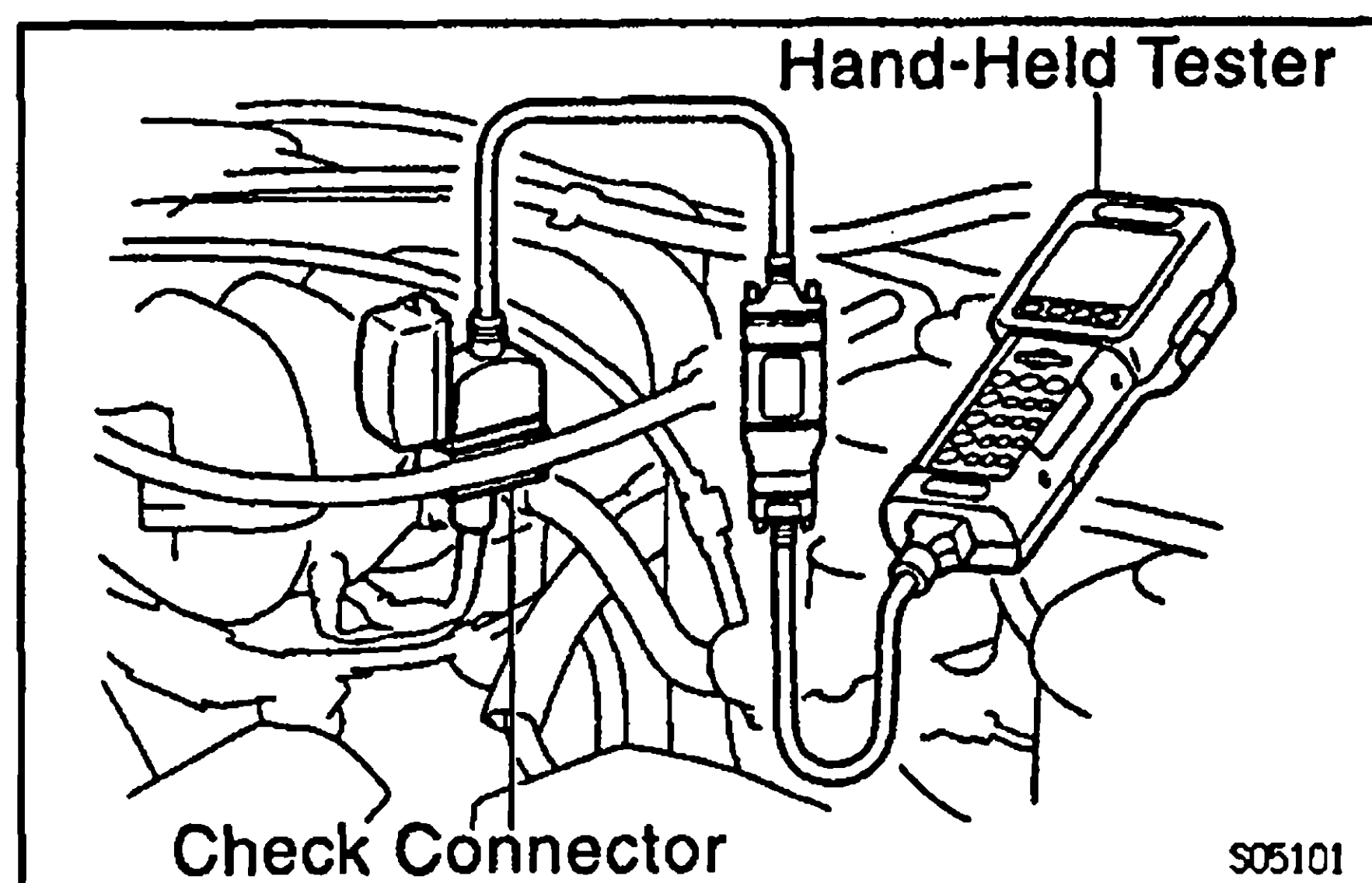
Y



V08198

EG





REFERENCE VALUE OF ENGINE ECU DATA

HINT: Engine ECU data can be monitored by hand-held tester. EG392-00

1. Hook up the hand-held tester to the check connector.
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.

EG

REFERENCE VALUE FOR ENGINE ECU DATA

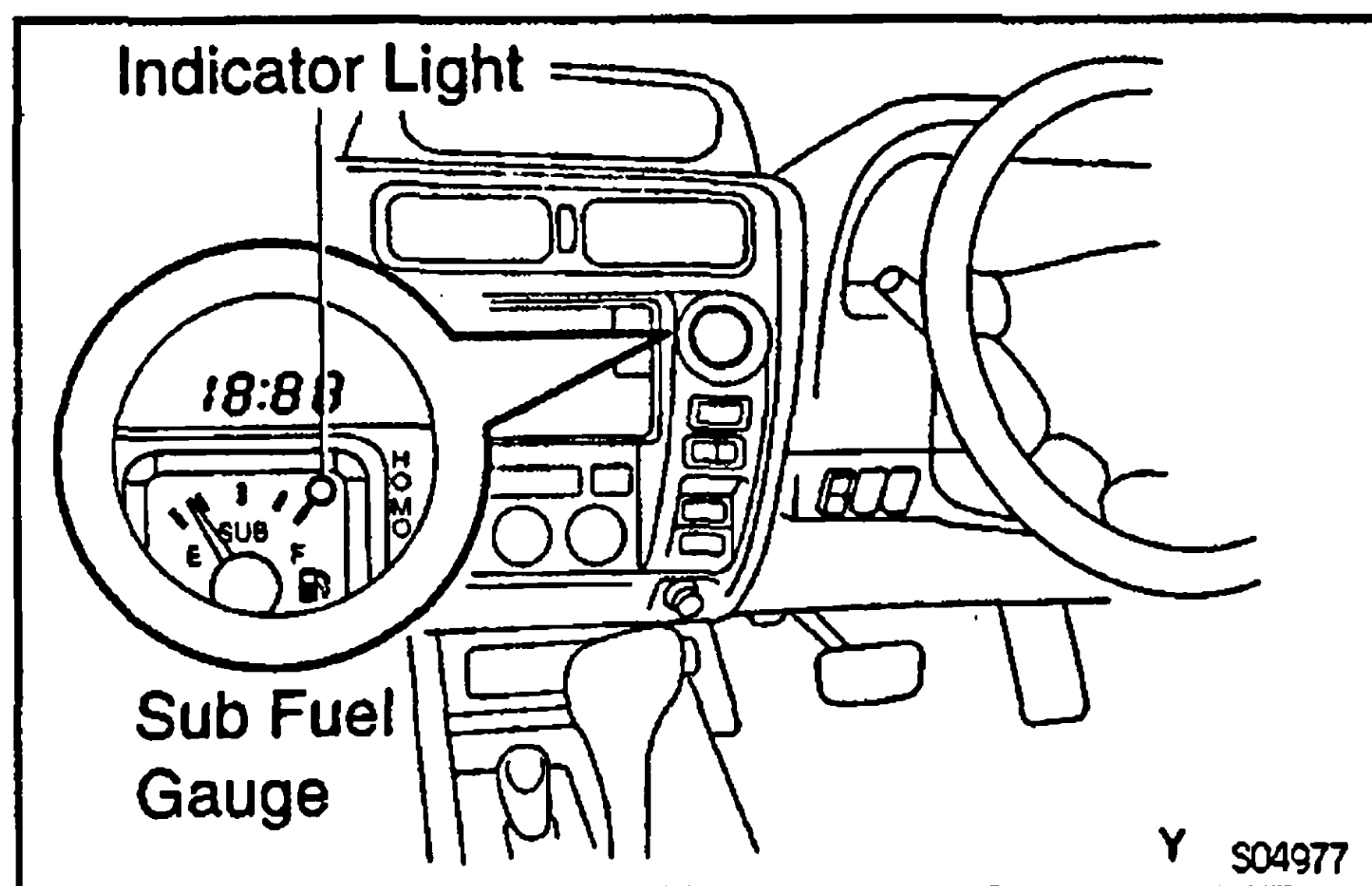
EG384-00

(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. 1.8 — 3.0 msec
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 Ignition switch ON (Do not start engine.)	Approx. 22 — 46 % Duty ratio increases Duty ratio increases Approx. 28 — 70 %
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.	80 — 95°C (176 — 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 L *3	Engine idling at normal operating temperature	2.50 ± 1.25 V *4
A/F FB LEFT *3	RPM stable at 2,500 rpm with normal operating temp.	ON
STA SIGNAL	During cranking	ON
IDL SIGNAL	Closed throttle position	ON
A/C SIGNAL	A/C switch ON	ON
NSW SIGNAL *5	When shifting from "P" or "N" position into a position other than "P" or "N".	GEAR
Ox L *3	RPM stable at 2,500 rpm	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: w/ oxygen sensor only.
- *4: When feedback control is forbidden, 0 V is displayed.
- *5: A/T only.

EG



DOUBLE TANK SYSTEM FUEL LEVEL WARNING LIGHT CHECK

S0707-01

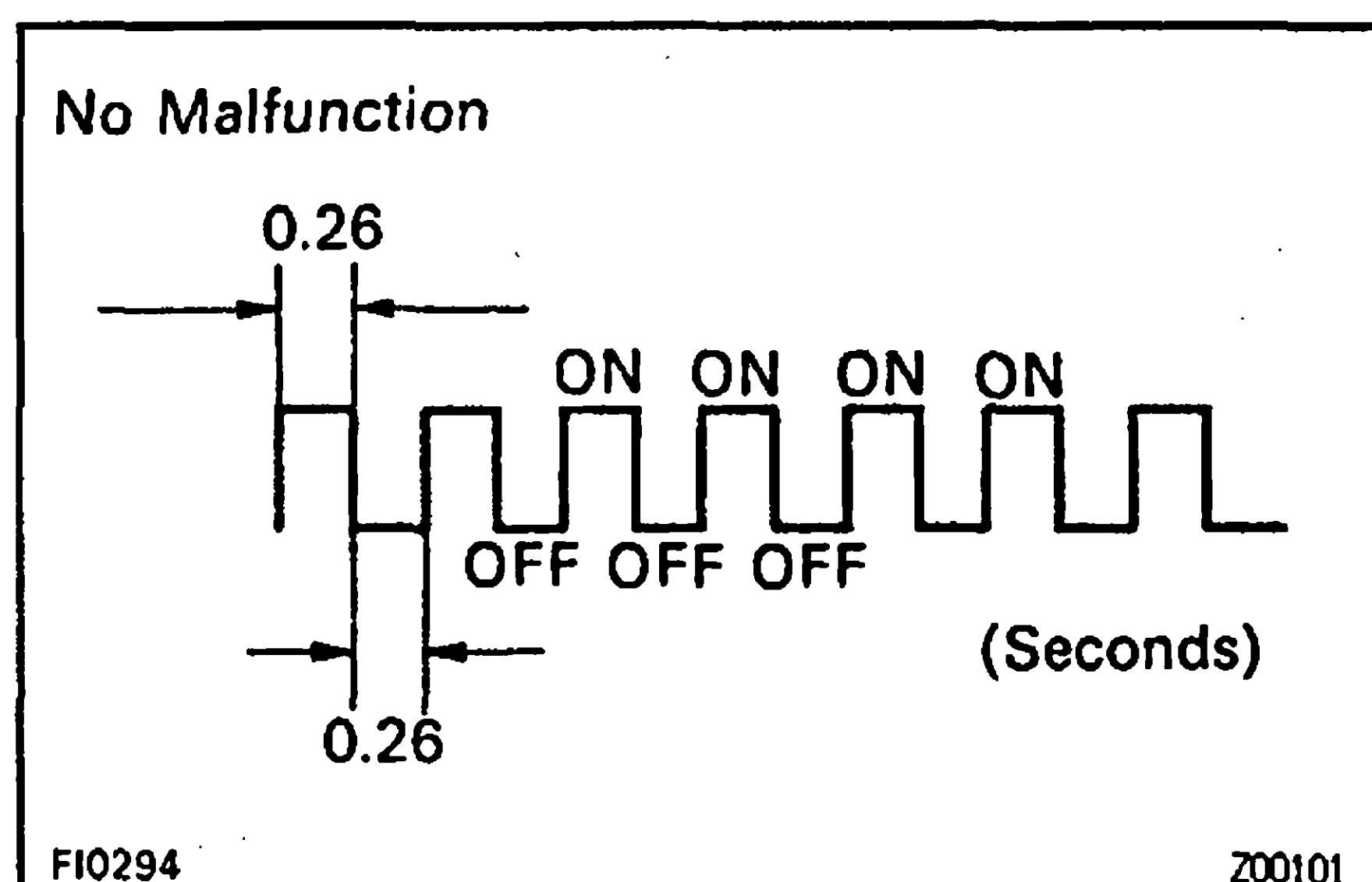
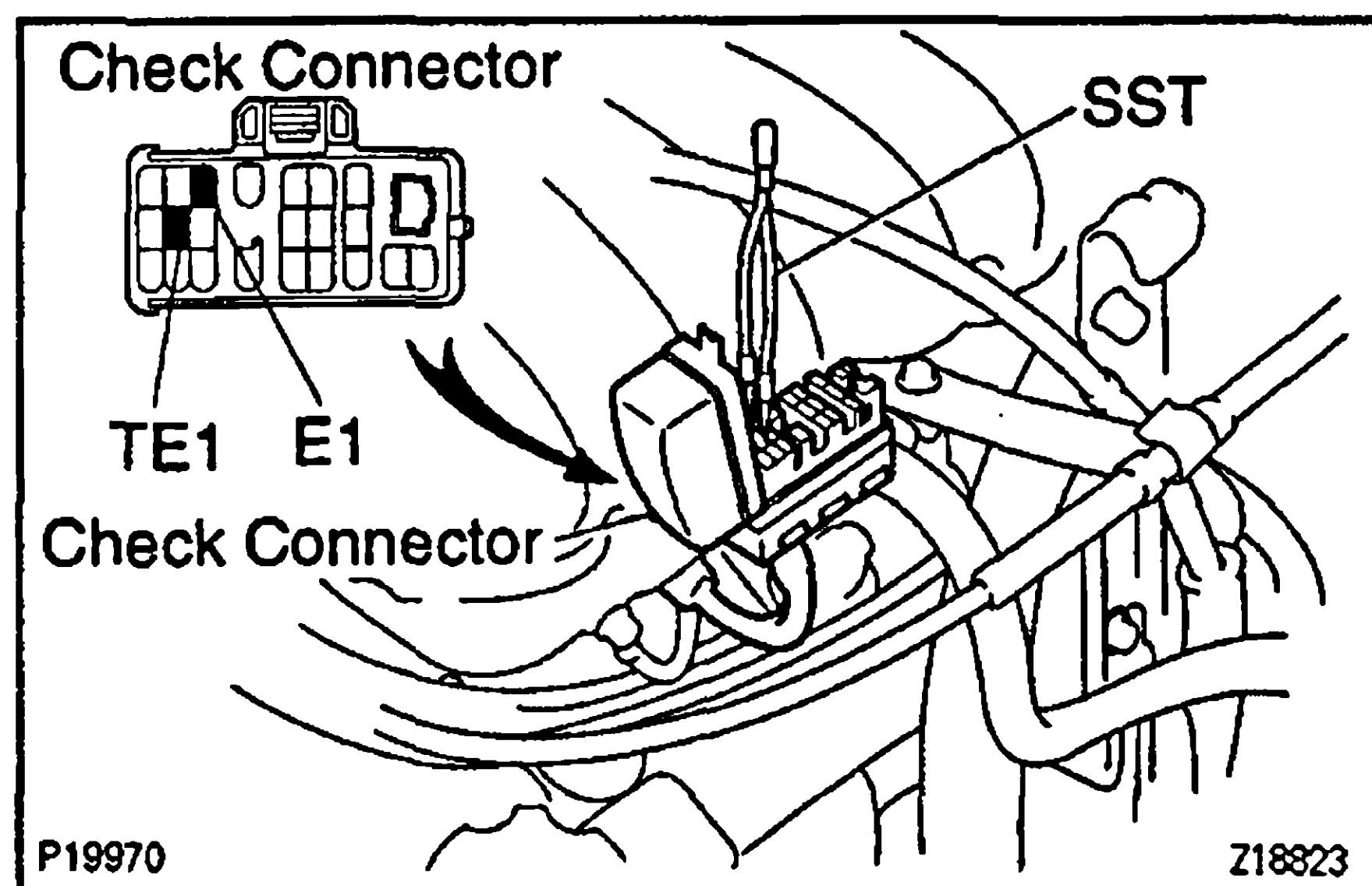
1. The option tank light will come on when the ignition switch is at ON and the engine is not running.
2. When the engine is started, the option tank warning light should go in case the fuel tank changeover switch is off. If the light blinks on, the double tank system has detected a malfunction or abnormality in the system.

S07CP-01

DIAGNOSTIC CODES OUTPUT

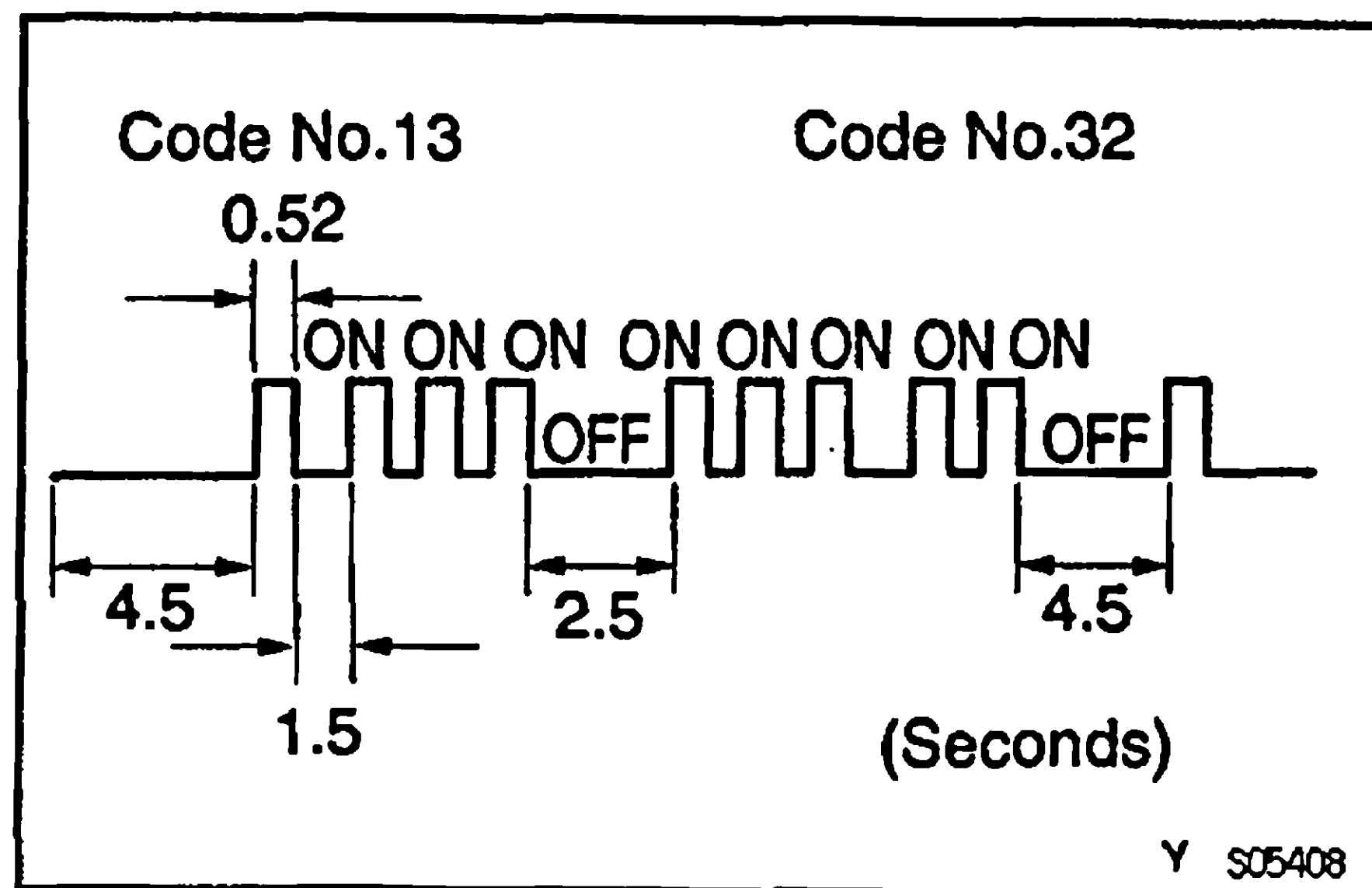
To obtain an output of diagnostic codes, proceed as follows:

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



Diagnostic 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.

DIAGNOSTIC CODES

EG79C-02

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 occurred 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 harness system
13	 FI1607	• When fuel tank changeover switch in "OFF". • Fuel tank select relay in always "ON".	• Fuel tank select relay

Code No.	Number of Blinks of Check Engine Warning 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 harnese system.
44	 S04180	• When fuel tank changeover switch in "ON". • Main fuel pump wire harnese is short to power subly line.	• Main fuel pump wire harnese system.

Y V08122

E200V-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.

Engine (& ECT) ECU Terminals

E279D-03

(See EFI system check procedure in Troubleshooting w/volt,Ohmmeter.)

EG79E-03

Engine (& ECT) ECU Terminals

(See engine (& ECT) ECU terminals in Troubleshooting w/volt, Ohmmeter.)

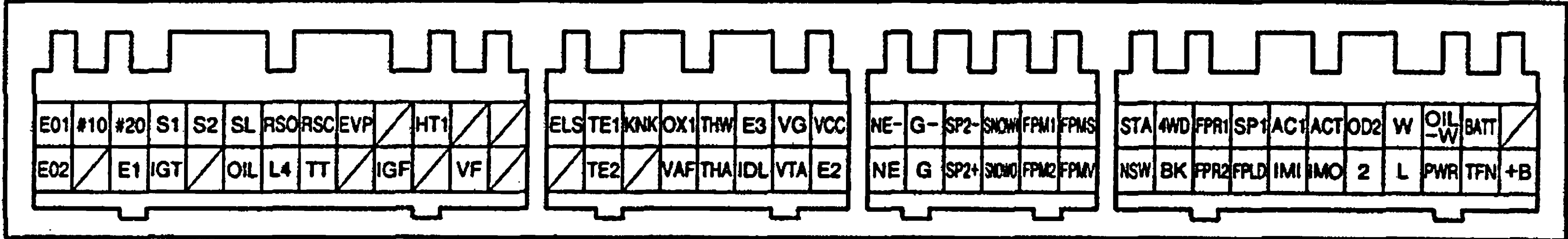
EG97D-08

Engine (& ECT) ECU Wiring Connectors Voltage

EG

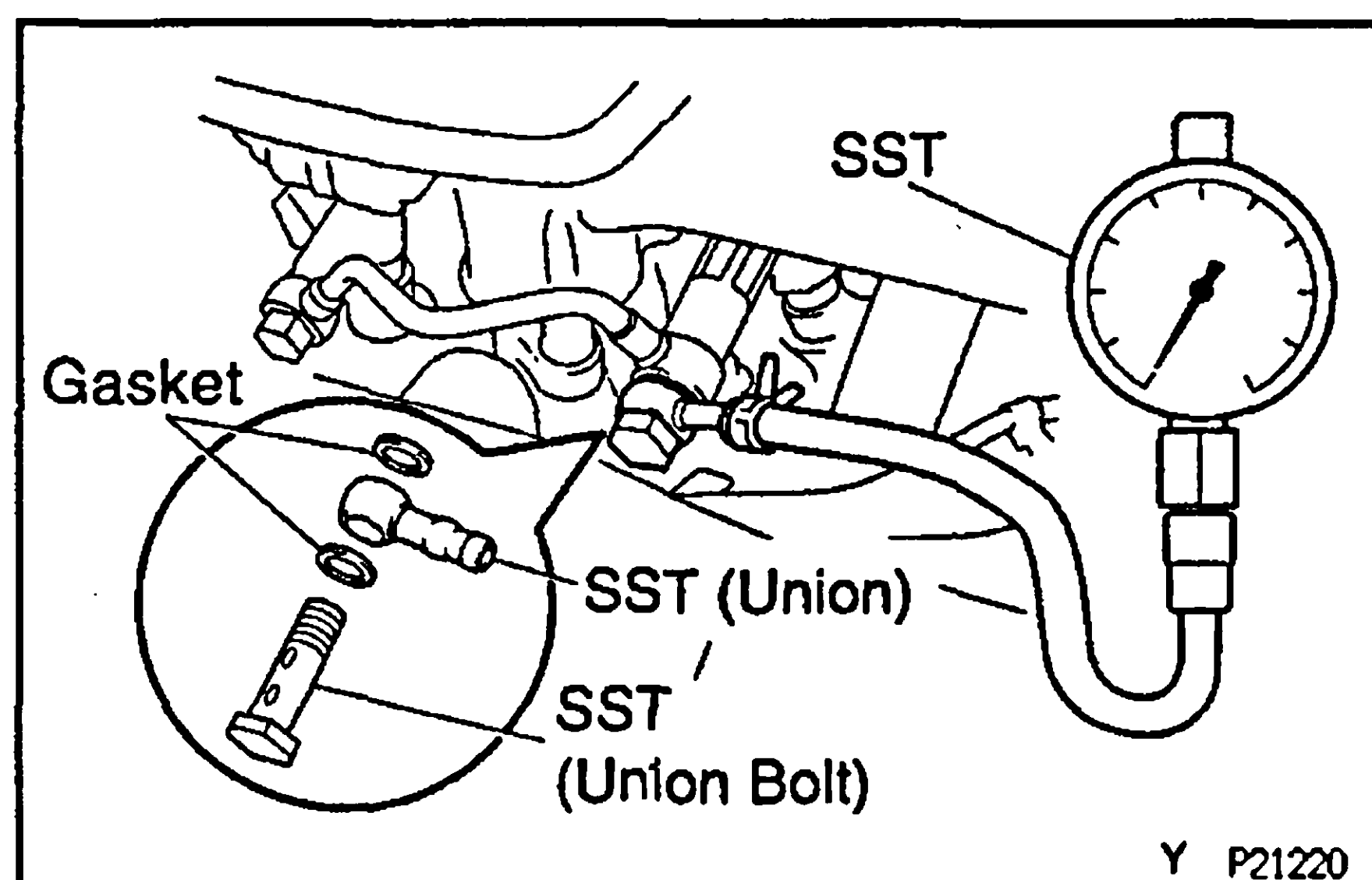
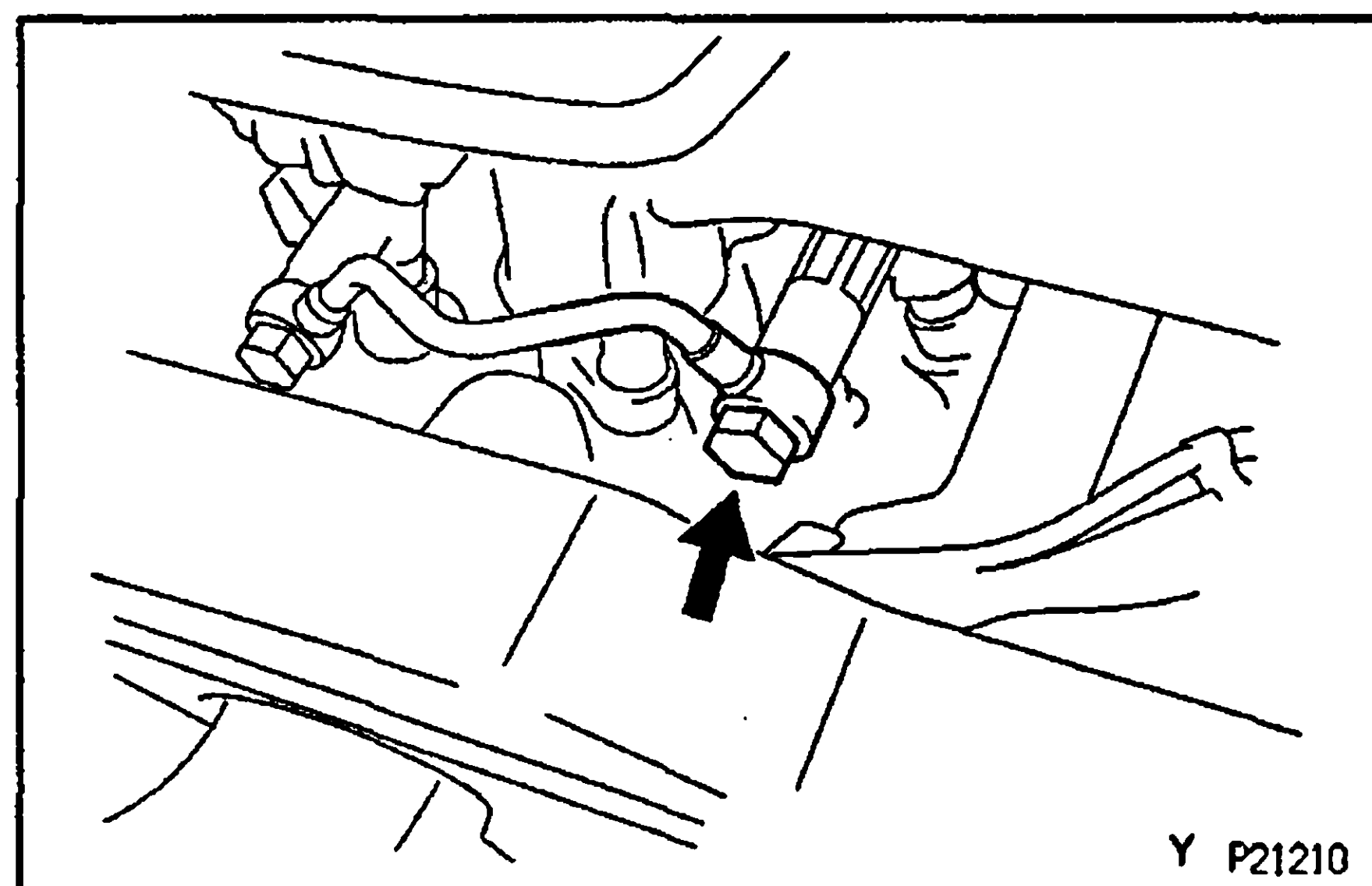
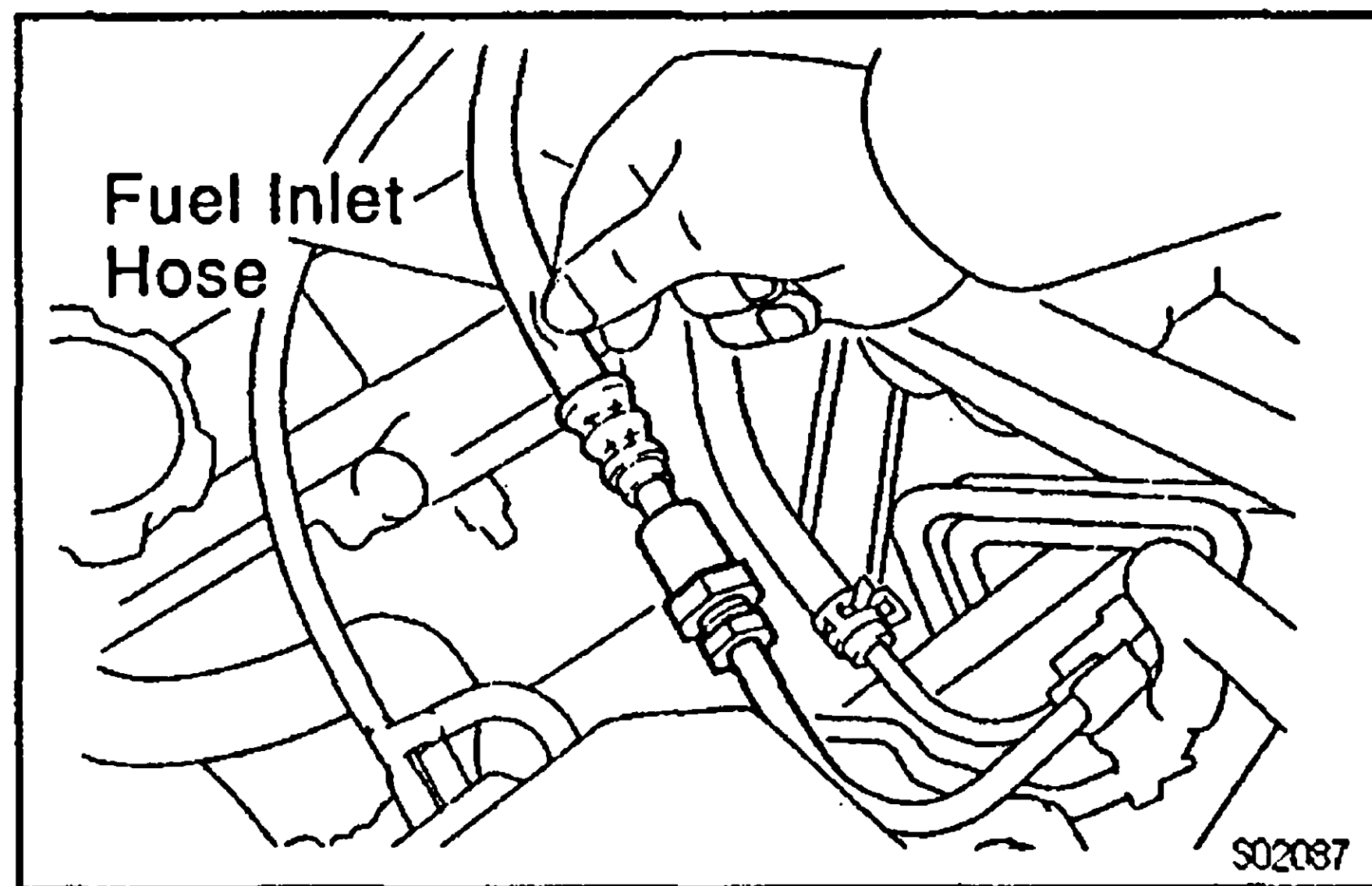
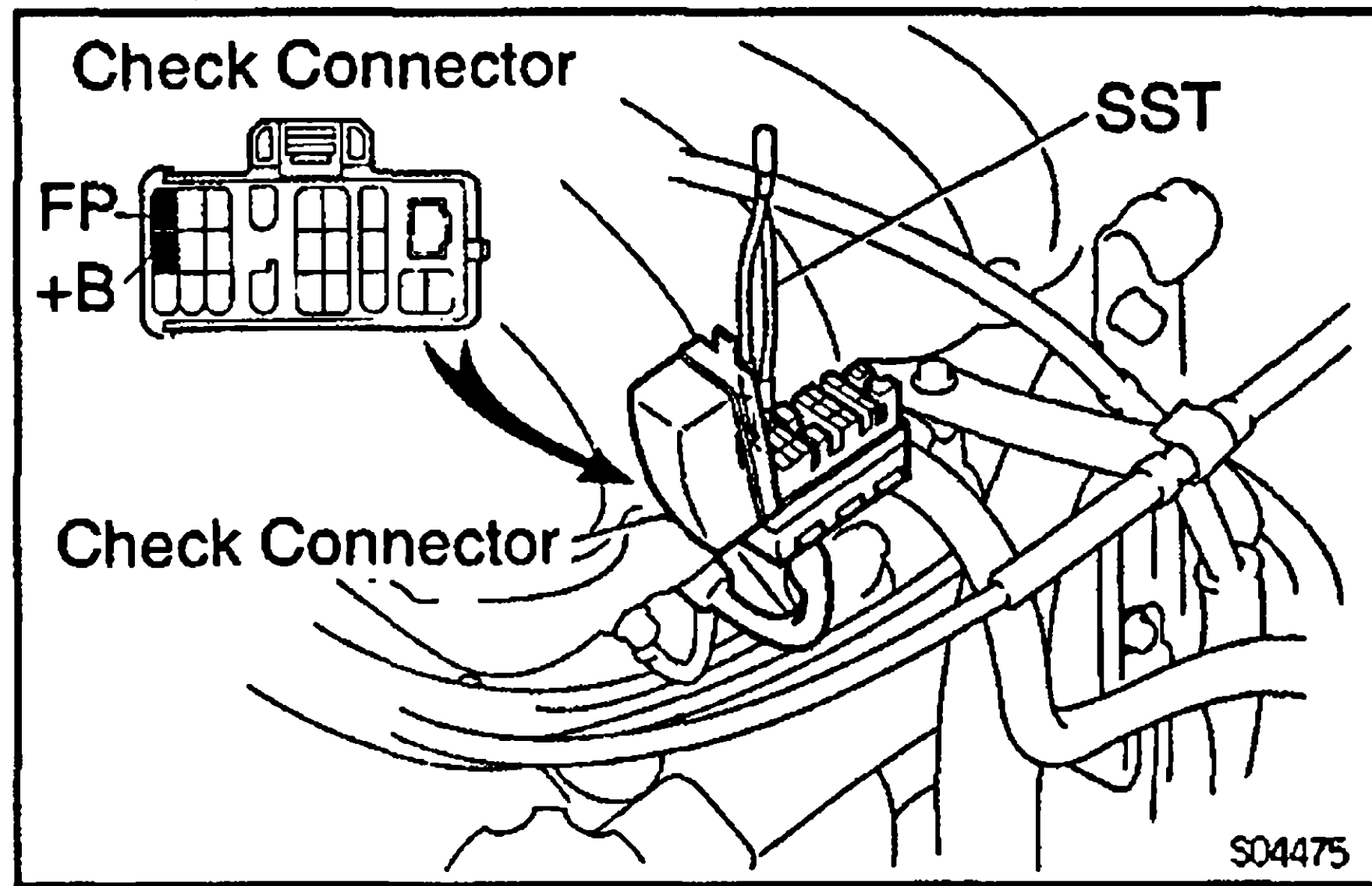
Terminals	Condition			STD voltage (V)
FPMV – E01	Fuel tank change over switch		is ON	9 – 14
			is OFF	0 – 2
FPMS – E01	Idling			9 – 14
FPR2 – E01	Idling			9 – 14
FPM1 – E01	Idling	Fuel tank change over switch	is ON	9 – 14
			is OFF	0 – 2
FPM2 – E01	Idling	Fuel tank change over switch	is ON	9 – 14
			is OFF	0 – 2
FPR1 – E01	Idling			0 – 2
FPLD – E01	Idling	Fuel tank change over switch	is ON	9 – 14
			is OFF	0 – 3

Engine Terminal's



S01399

T



FUEL PUMP ON—VEHICLE INSPECTION

EG425-02

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 fuel inlet hose from the fuel filter.

HINT: If there is fuel pressure, you will hear the sound of fuel flowing.

If there is no pressure, check these parts:

- H—fuse (ALT 100A)
- M—fuse (AM1 40A, AM2 30A)
- Fuses (EFI 15A, IGN 7.5A)
- EFI main relay
- Circuit opening relay
- Fuel pump
- Engine ECU
- Wiring connections

- (d) Turn the ignition switch to LOCK.

- (e) Remove the SST from the check connector.

SST 09843—18020

2. CHECK FUEL PRESSURE

- (a) Check the battery positive voltage is above 12 V.

- (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 fuel filter outlet.

CAUTION:

- Put a shop towel under the fuel filter.
- Slowly loosen the union bolt.

- (d) Install the fuel inlet hose and SST (pressure gauge) to the fuel filter outlet with the 3 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) Reconnect the negative (—) terminal cable to the battery.

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

SST 09843—18020

- (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
- VSV for fuel pressure control

- (j) Remove the SST from the check connector.

SST 09843—18020

- (k) Reinstall the No.2 timing belt cover with the bolts.

Torque: 9 N·m (90 kgf·cm, 80 in·lbf)

- (l) Start the engine.

- (m) Disconnect the vacuum sensing hose from the fuel pressure regulator, and plug the hose end.

- (n) Measure the fuel pressure at idle.

Fuel pressure:

265 — 304 kPa (2.7 — 3.1 kgf/cm², 38 — 44 psi)

- (o) Reconnect the vacuum sensing hose to the fuel pressure regulator.

- (p) Measure the fuel pressure at idle.

Fuel pressure:

226 — 265 kPa (2.3 — 2.7 kgf/cm², 33 — 38 psi)

If pressure is not within the specification, check the vacuum sensing hose and fuel pressure regulator.

- (q) Stop the engine.

- (r) Check that the fuel pressure remains as specified for 5 minutes after the engine has stopped.

Fuel pressure:

147 kPa (1.5 kgf/cm², 21 psi) or more

If pressure is not within the specification, check the fuel pump, pressure regulator and/or injectors.

- (s) After checking fuel pressure, disconnect the negative (—) terminal cable from the battery and carefully remove the SST to prevent gasoline from splashing.

SST 09268—45012

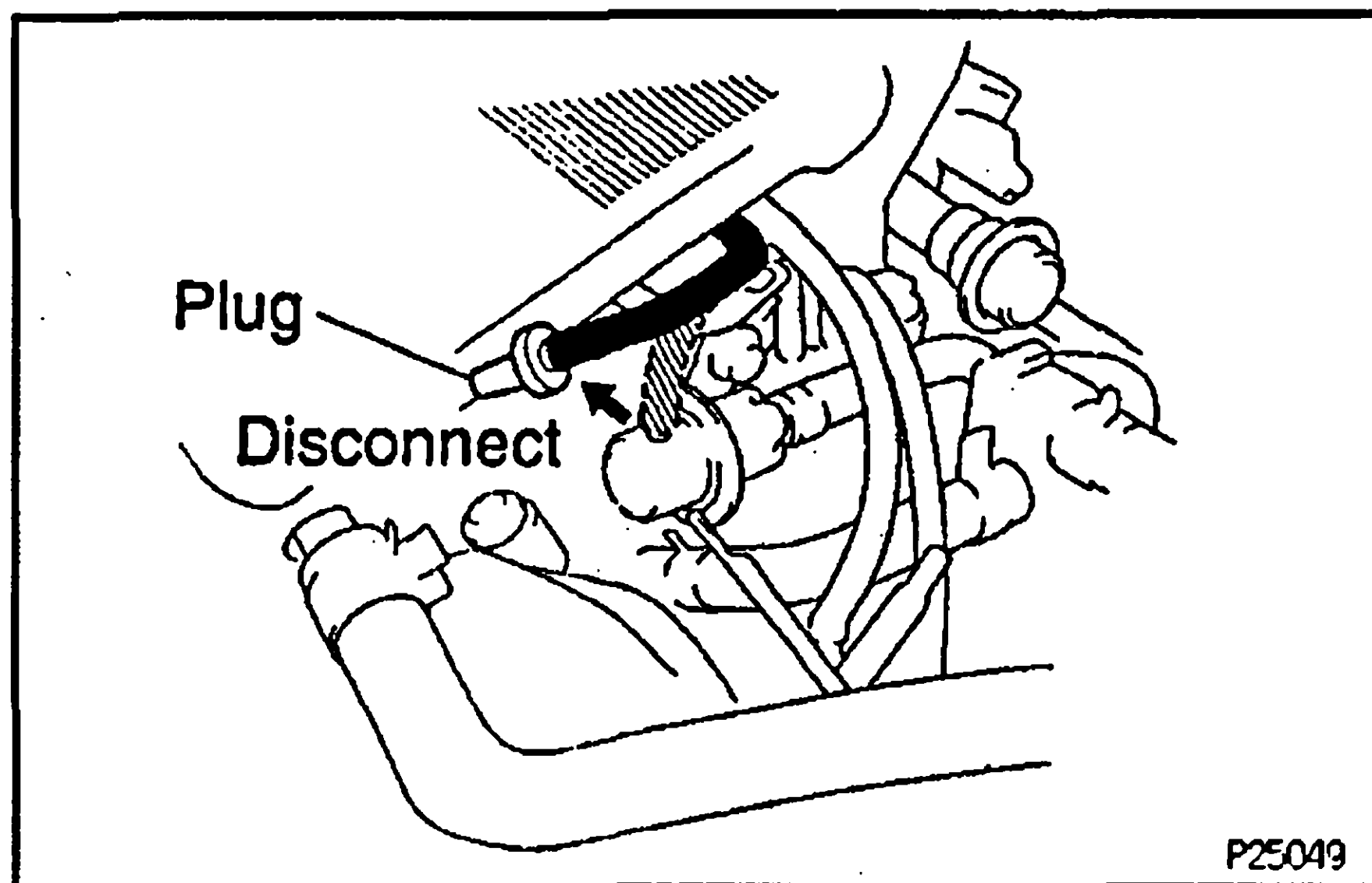
- (t) Remove the other union bolt, 3 gaskets and fuel pipe from the delivery pipes.

- (u) Reinstall the fuel pipe with 4 new gaskets and the 2 union bolts.

Torque: 34.3 N·m (350 kgf·cm, 25 ft·lbf)

- (v) Reconnect the negative (—) terminal cable to the battery.

- (w) Check for fuel leakage.

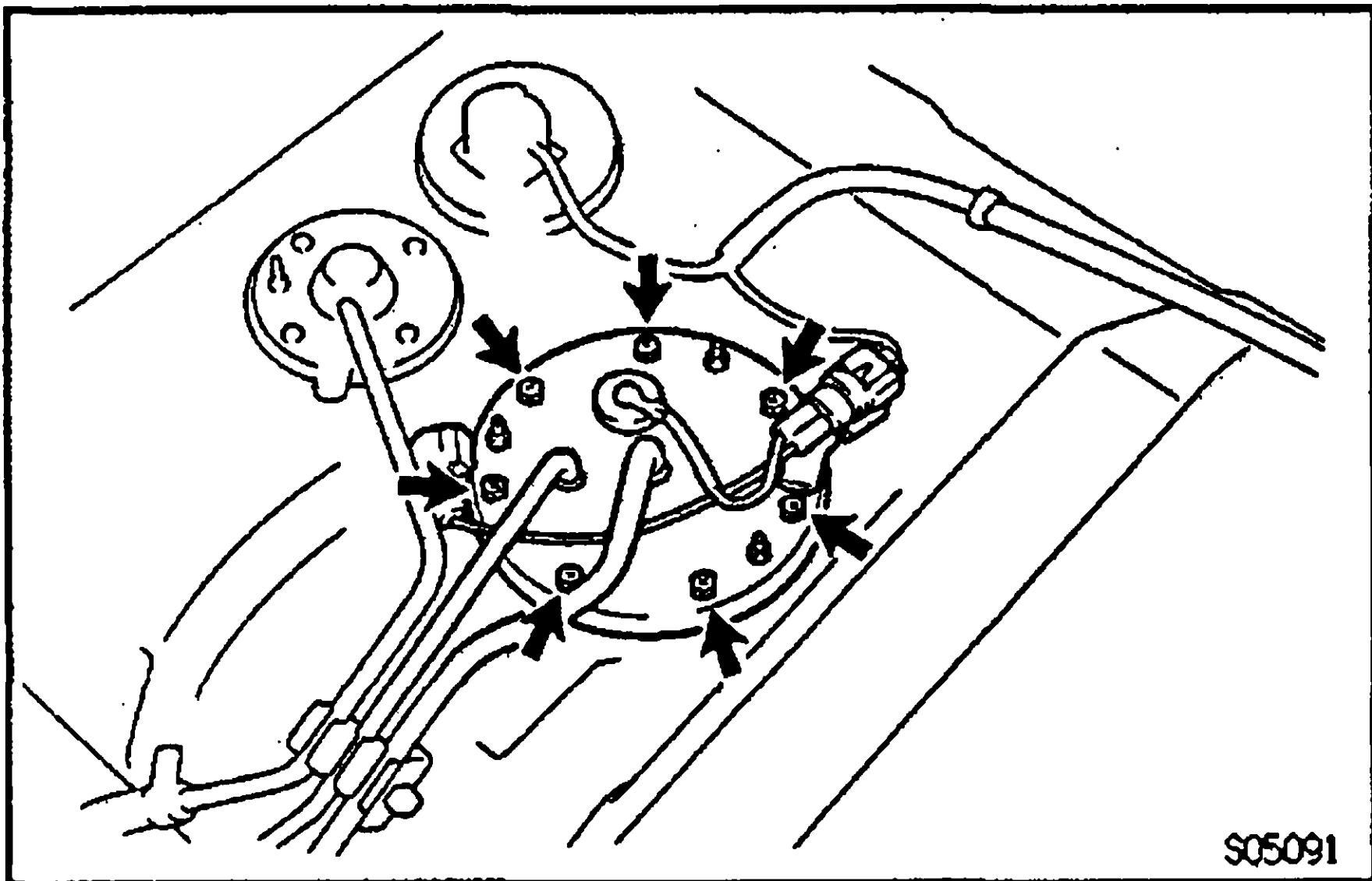


FUEL PUMP INSPECTION

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

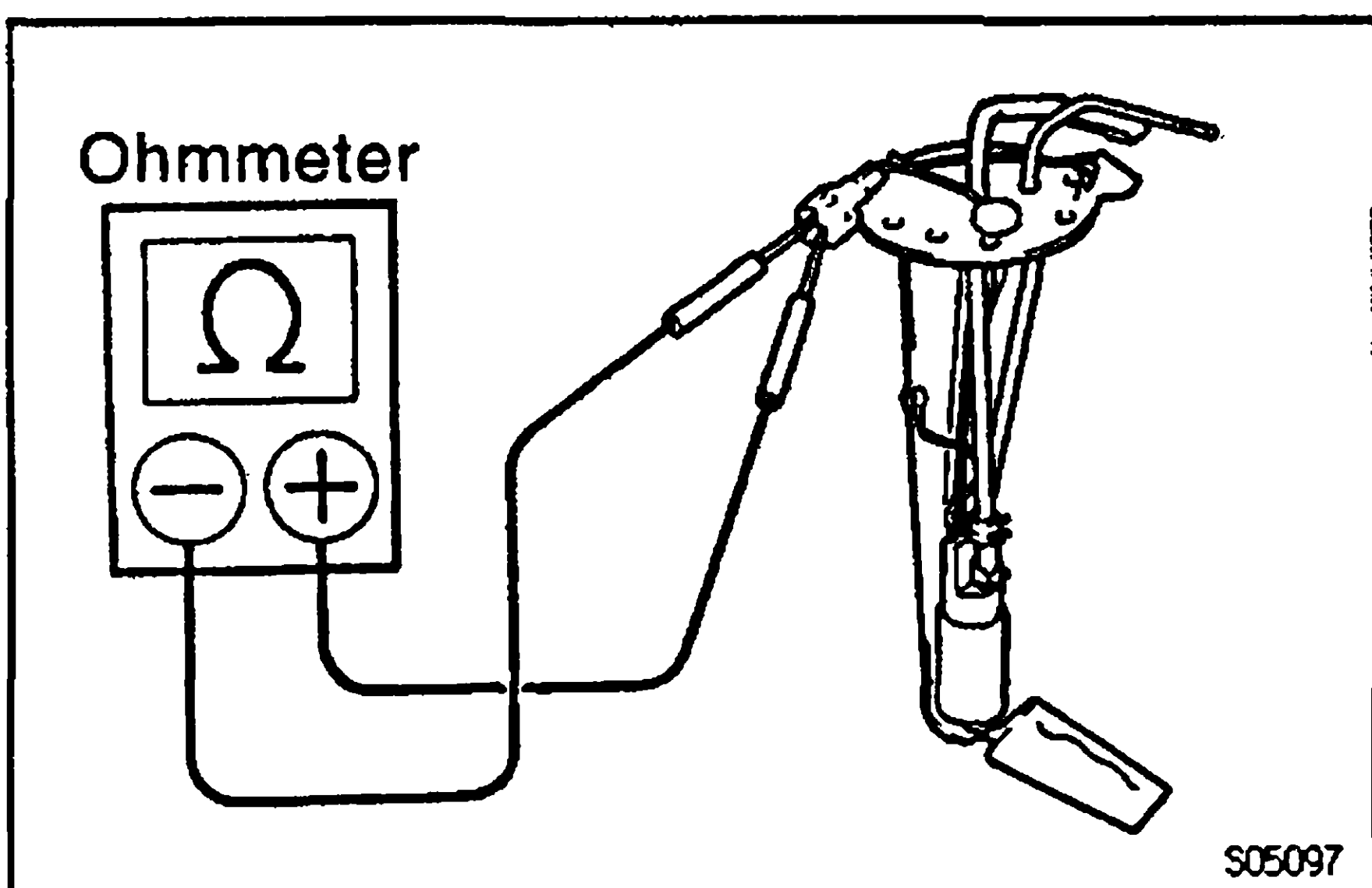
1. REMOVE FUEL TANK

(See Pub. No. RM517E on page BO-79)



2. REMOVE FUEL PUMP BRACKET ASSEMBLY FROM FUEL TANK

- (a) Disconnect the fuel pump connector.
- (b) Remove the 7 bolts.
- (c) Pull out the pump bracket assembly.
- (d) Remove the gasket from the pump bracket.



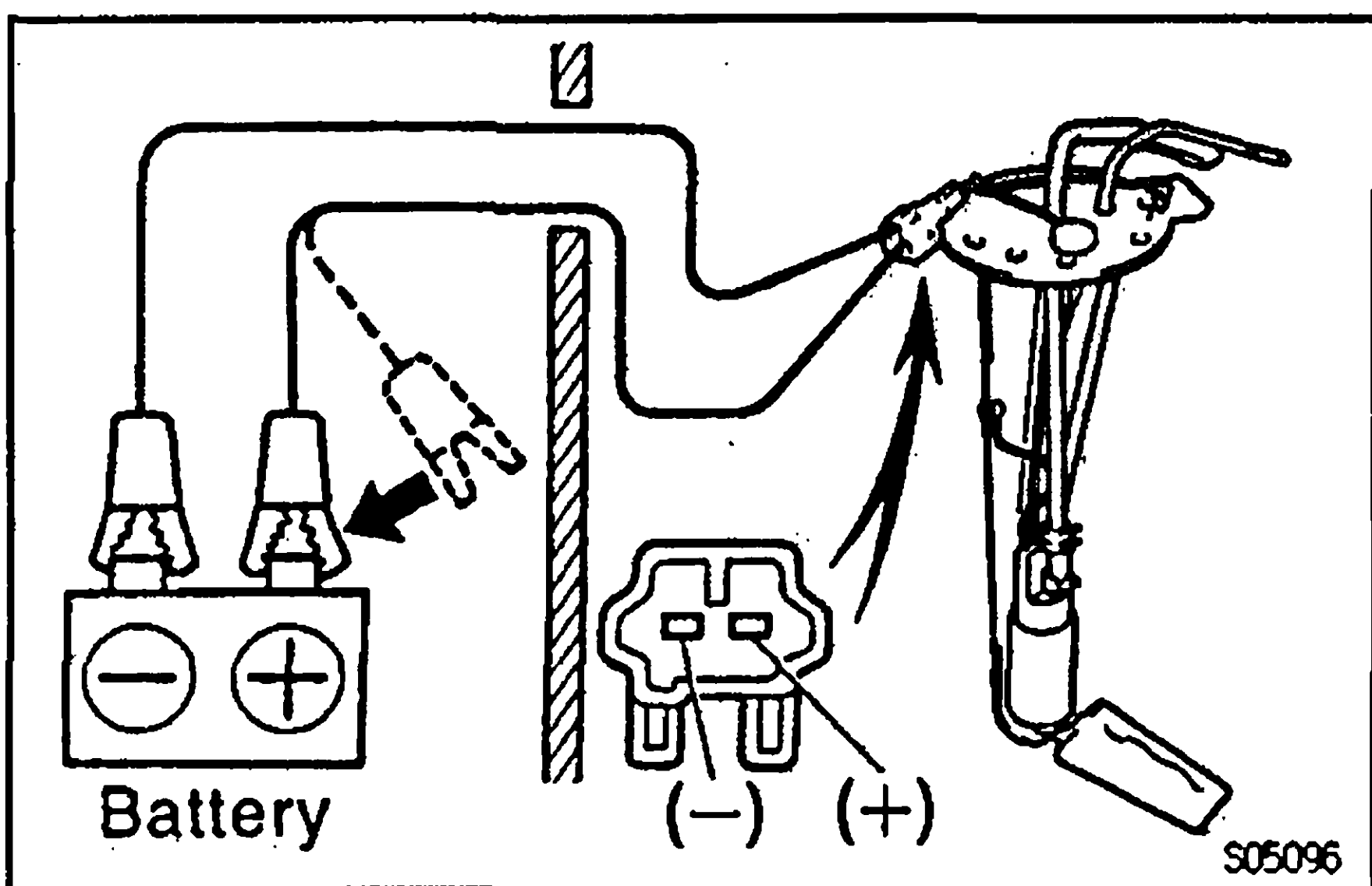
3. INSPECT FUEL PUMP

A. INSPECT FUEL PUMP RESISTANCE

- (a) Using an ohmmeter, measure the resistance between the terminals.

Resistance: At 20° (68°F): 0.2–0.3 Ω

If the resistance is not as specified, replace the fuel and/or set plate.



B. INSPECT FUEL PUMP OPERATION

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

NOTICE:

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

If operation is not as specified, replace the fuel pump and/or plate.

**3. REINSTALL FUEL PUMP BRACKET ASSEMBLY
FROM FUEL TANK**

- (a) Install a new gasket to the pump bracket.
- (b) Pull in the pump bracket assembly.
- (c) Install the 7 bolts.

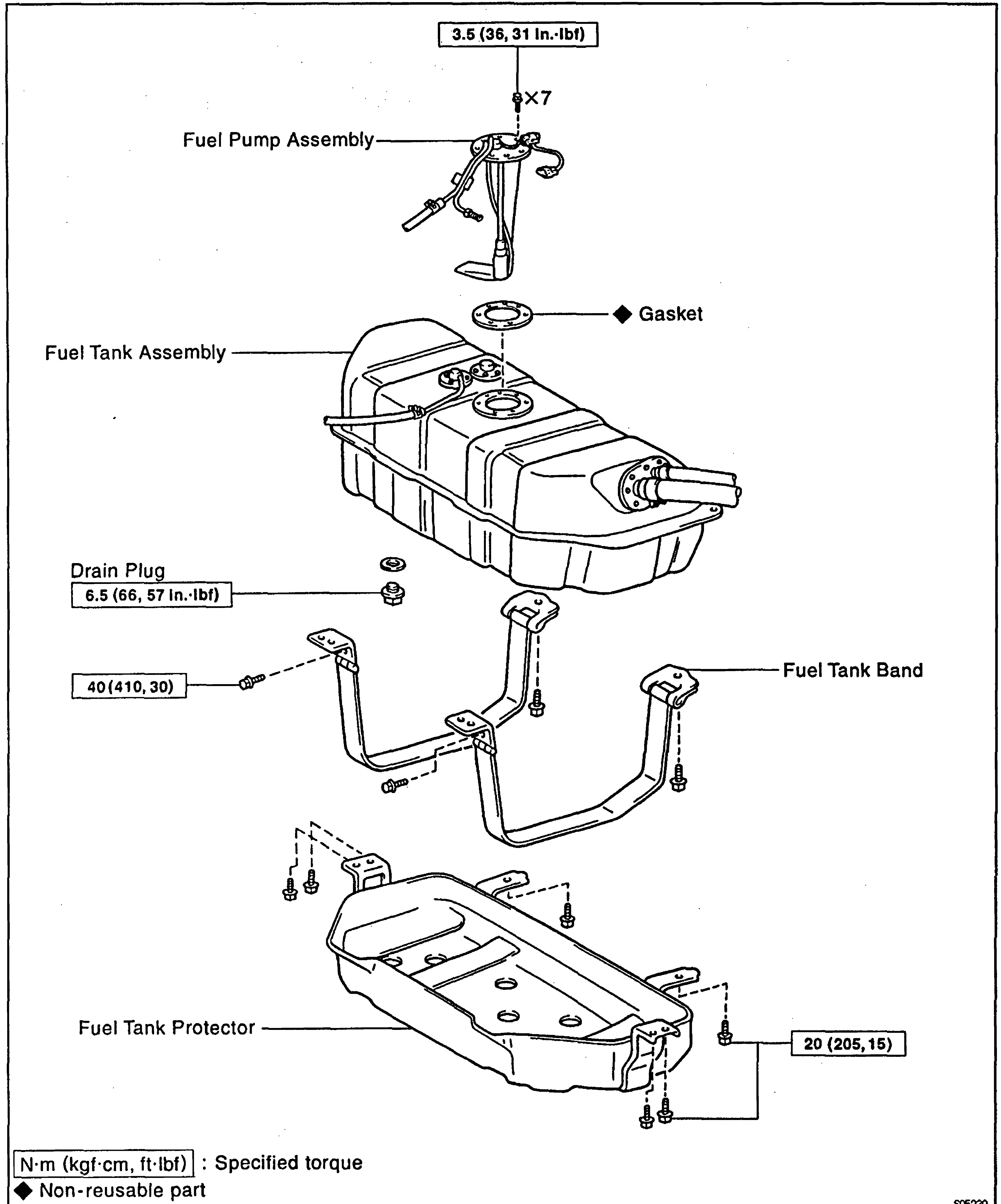
Torque: 3.5 N·m (35 kgf·cm, 30 in·lbf)

- (d) Connect the fuel pump connector.

4. REINSTALL FUEL TANK

(See Pub. No. RM517E on page BO-79)

COMPONENTS FOR REMOVAL AND INSTALLATION

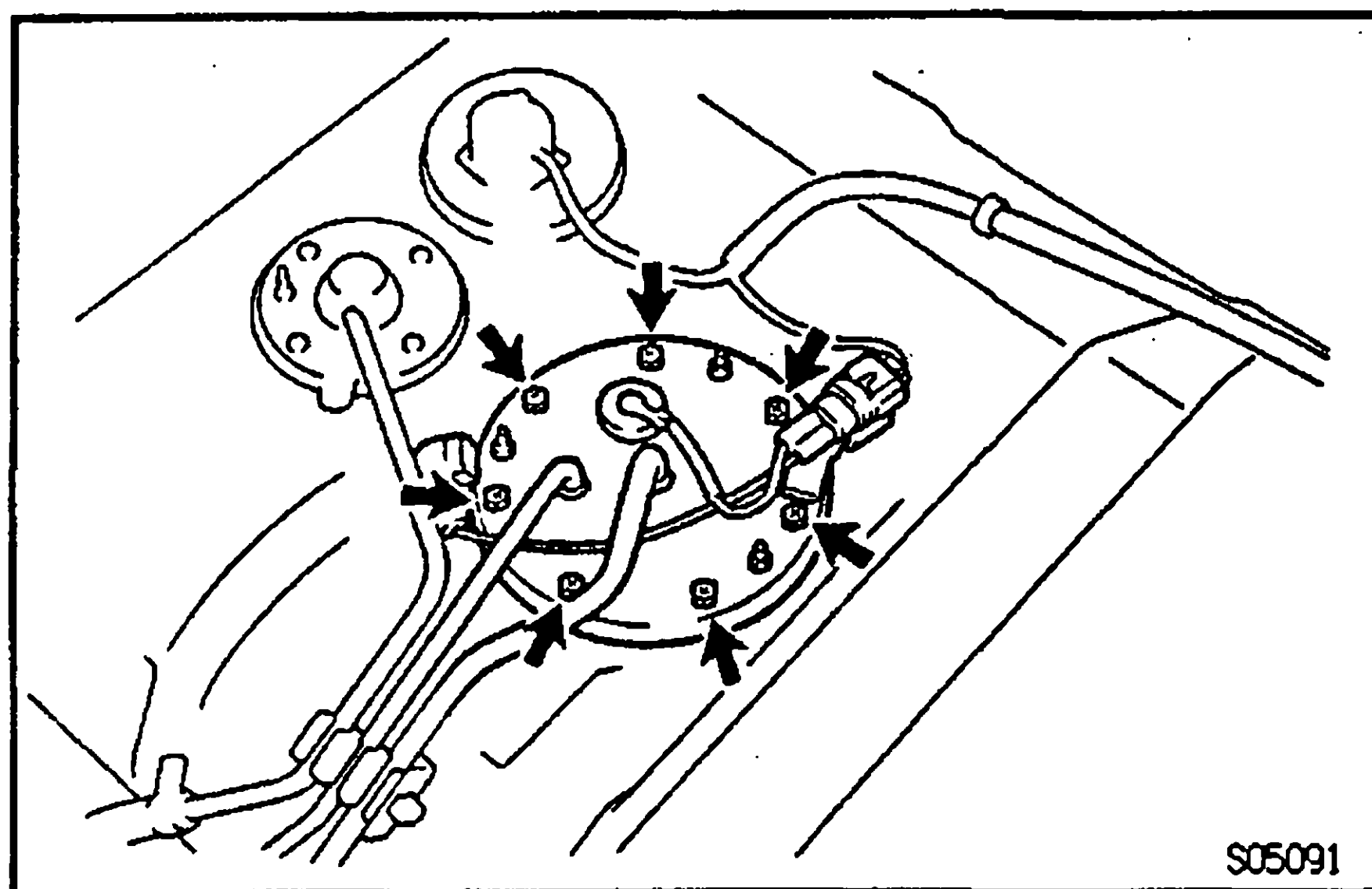


FUEL PUMP REMOVAL

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

1. **REMOVE FUEL TANK**
(See Pub. No. RM517E on page BO-79)
2. **DISCONNECT FUEL PUMP CONNECTOR**

EG

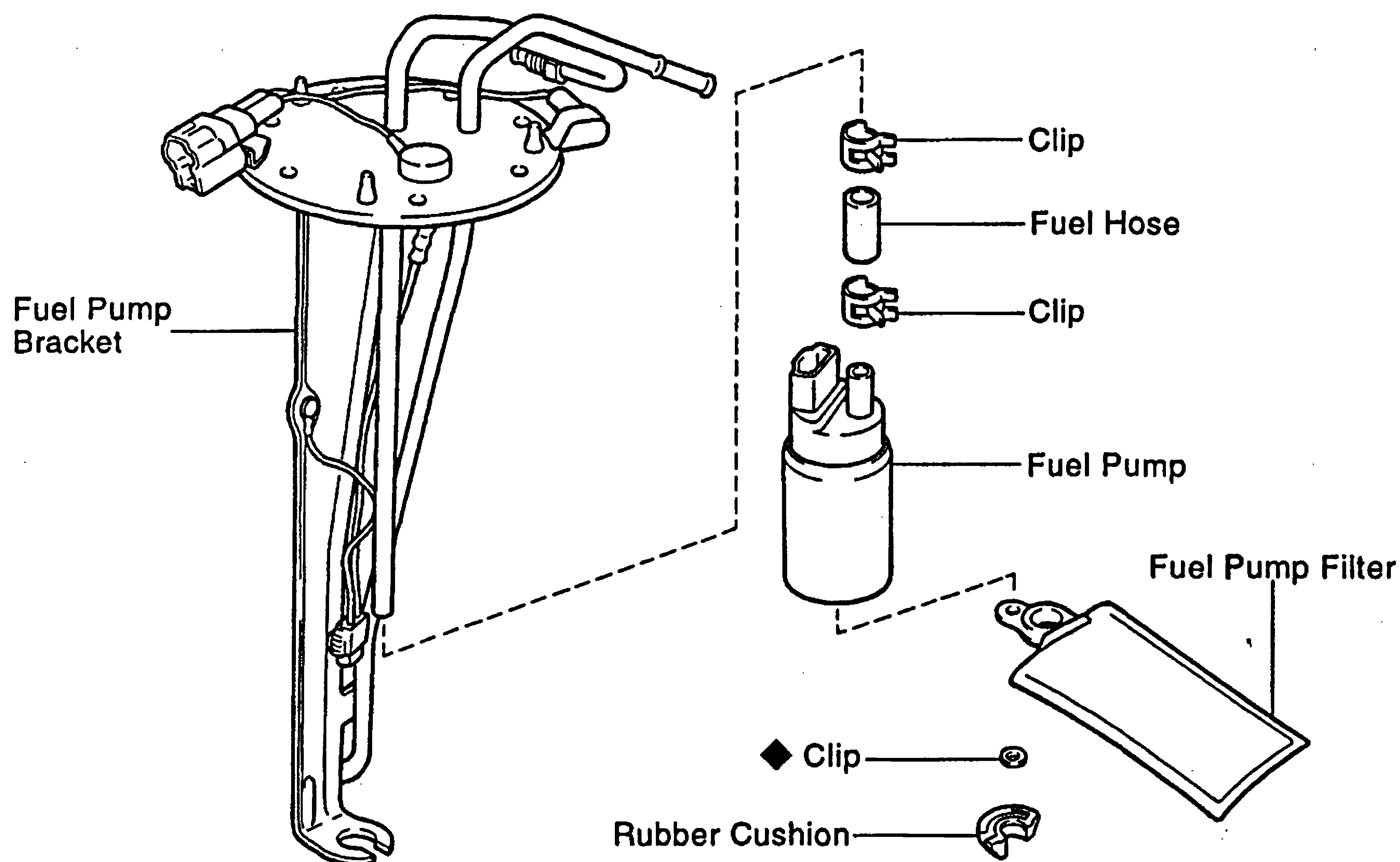


3. **REMOVE FUEL PUMP BRACKET ASSEMBLY FROM FUEL TANK**

- (a) Remove the 7 bolts.
Torque: 3.5 N·m (36 kgf·cm, 31 in.-lbf)
- (b) Pull out the pump bracket assembly.
- (c) Remove the gasket from the pump bracket.
NOTICE: Do not damage the fuel pump filter.

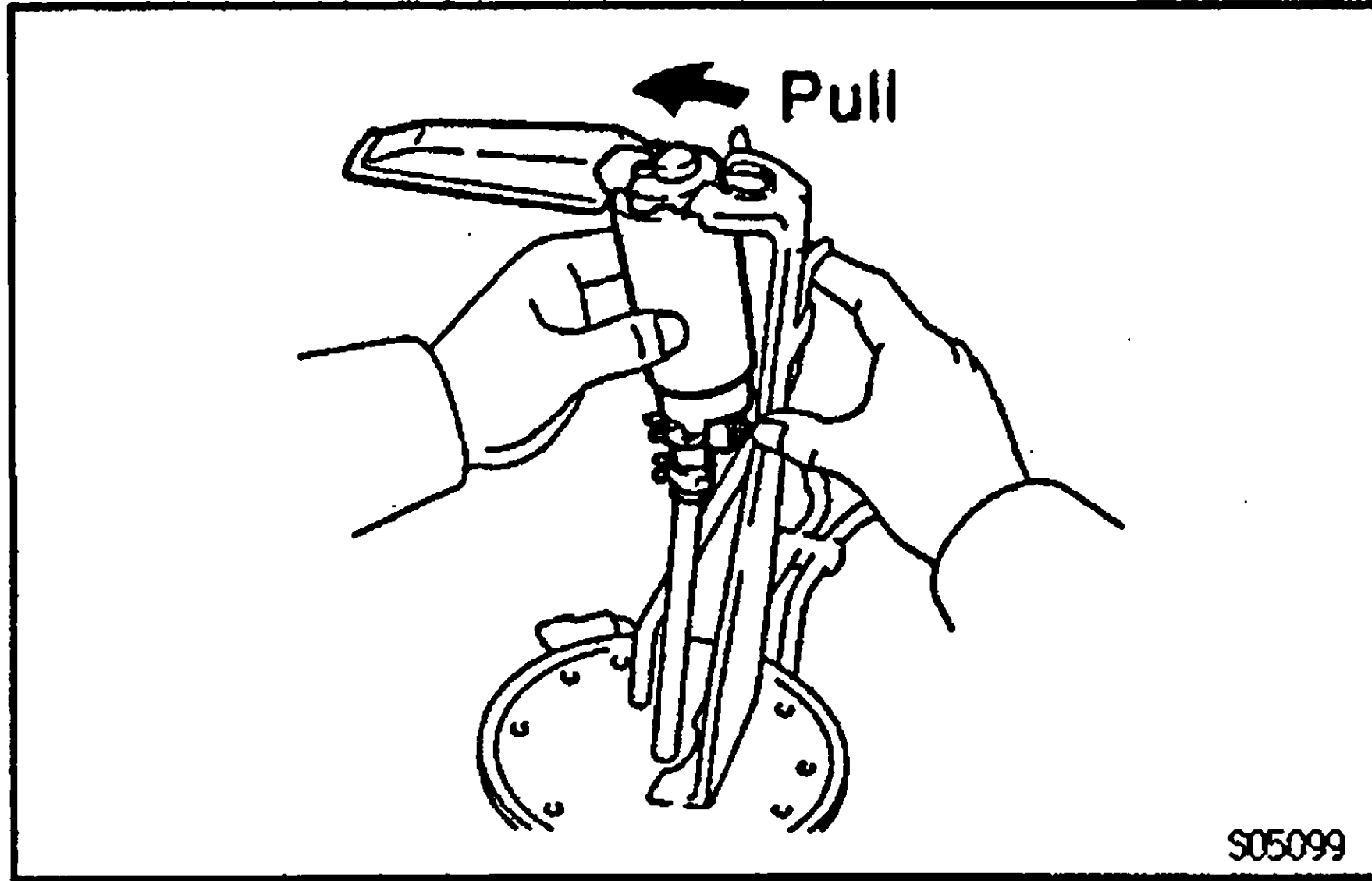
COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EG00H-03

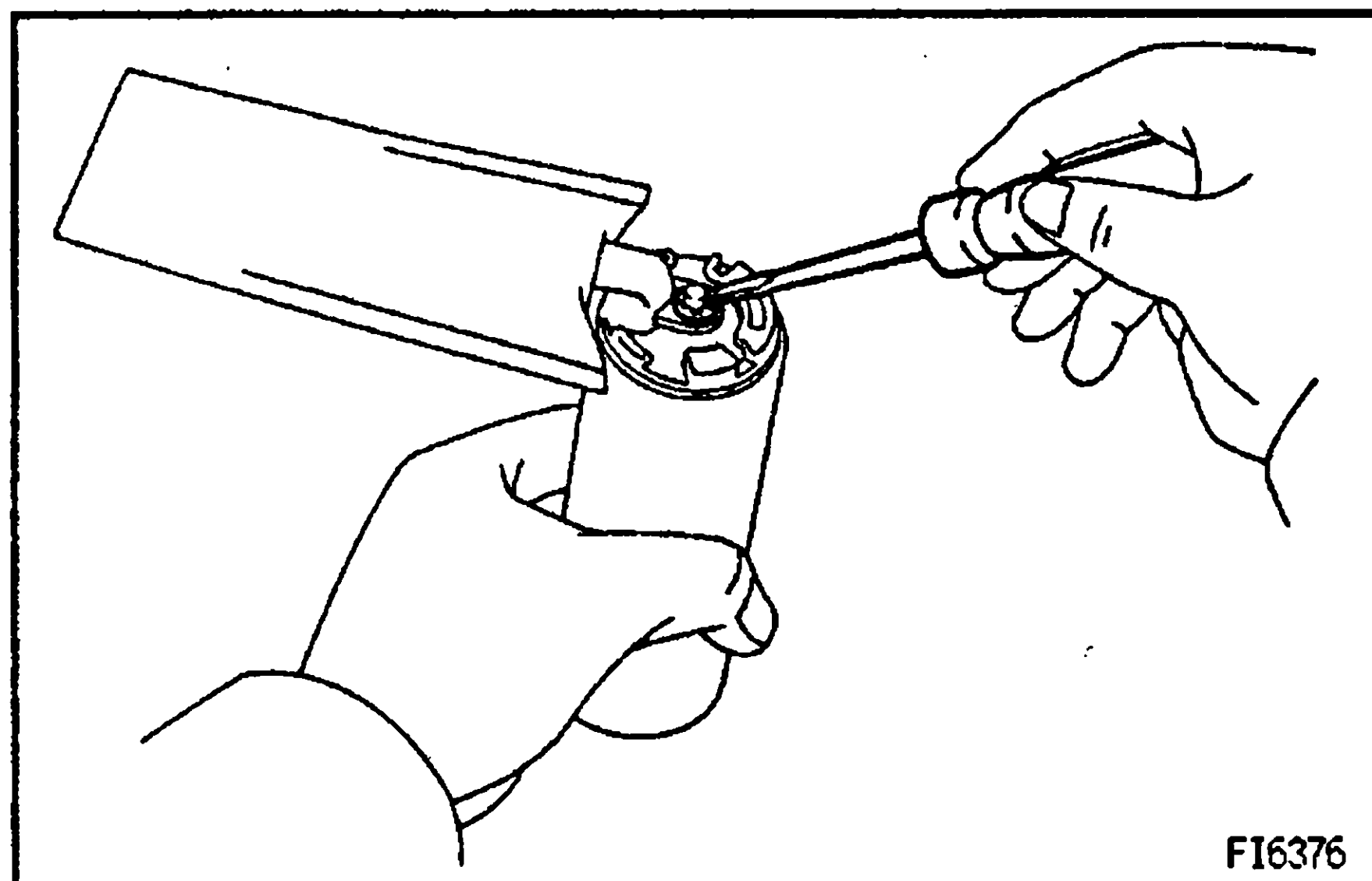


◆ Non-reusable part

FUEL PUMP DISASSEMBLY



1. **REMOVE FUEL PUMP FROM FUEL PUMP BRACKET**
 - (a) Pull off the lower side of the fuel pump from the pump bracket.
 - (b) Disconnect the fuel pump connector.
 - (c) Disconnect the fuel hose from the fuel pump, and remove the fuel pump.
 - (d) Remove the rubber cushion from the fuel pump.



2. **REMOVE FUEL PUMP FILTER FROM FUEL PUMP**
 - (a) Using a small screwdriver, remove the clip.
 - (b) Pull out the pump filter.

ASSEMBLY HINT: Install the pump filter with a new clip.

FUEL PUMP ASSEMBLY

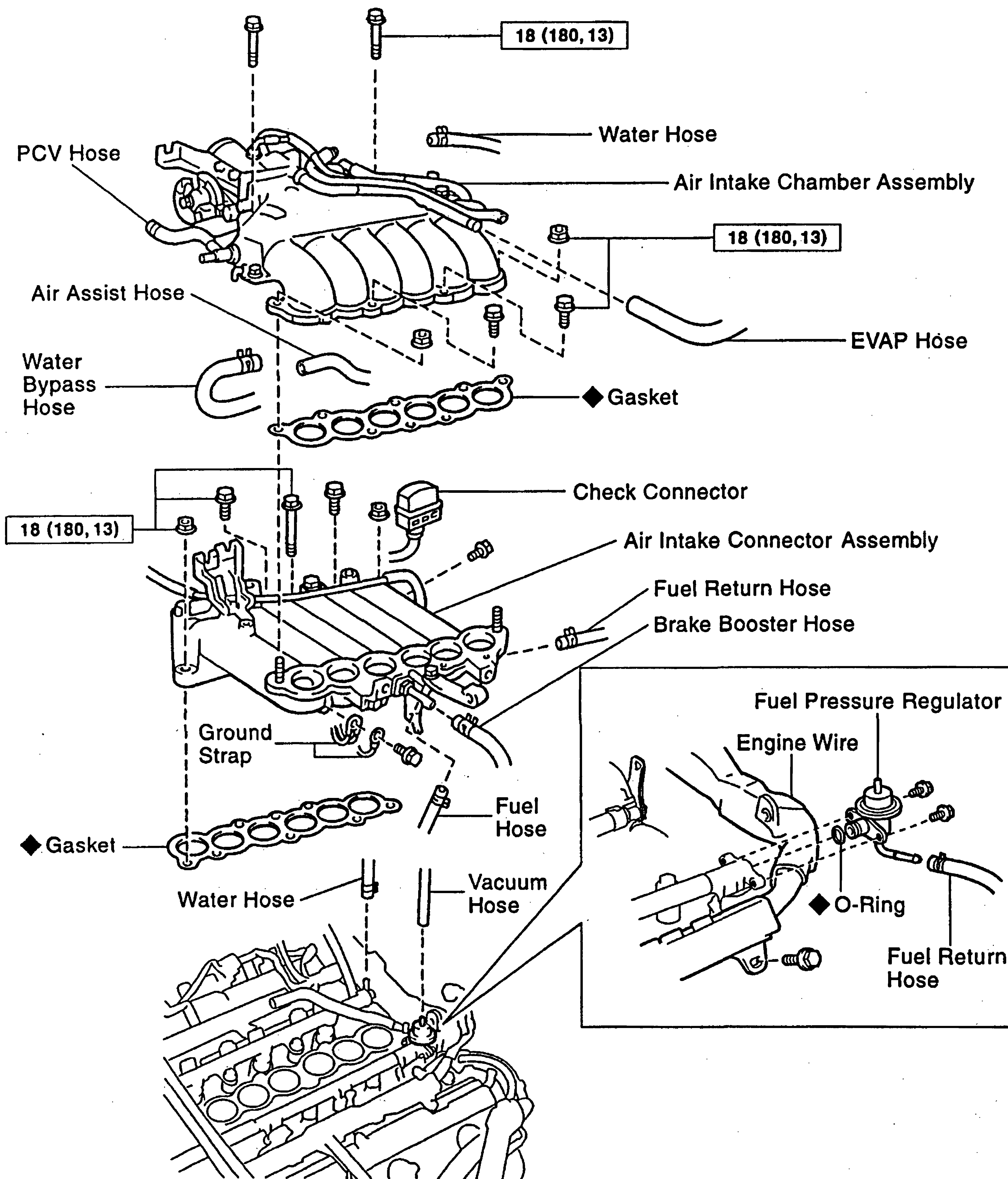
Assembly is in the reverse order of disassembly.

FUEL PUMP INSTALLATION

Installation is in the reverse order of removal.

FUEL PRESSURE REGULATOR COMPONENTS FOR REMOVAL AND INSTALLATION

E01AC-1N



FUEL PRESSURE REGULATOR REMOVAL

E07GT-01

1. REMOVE INTAKE CONNECTOR

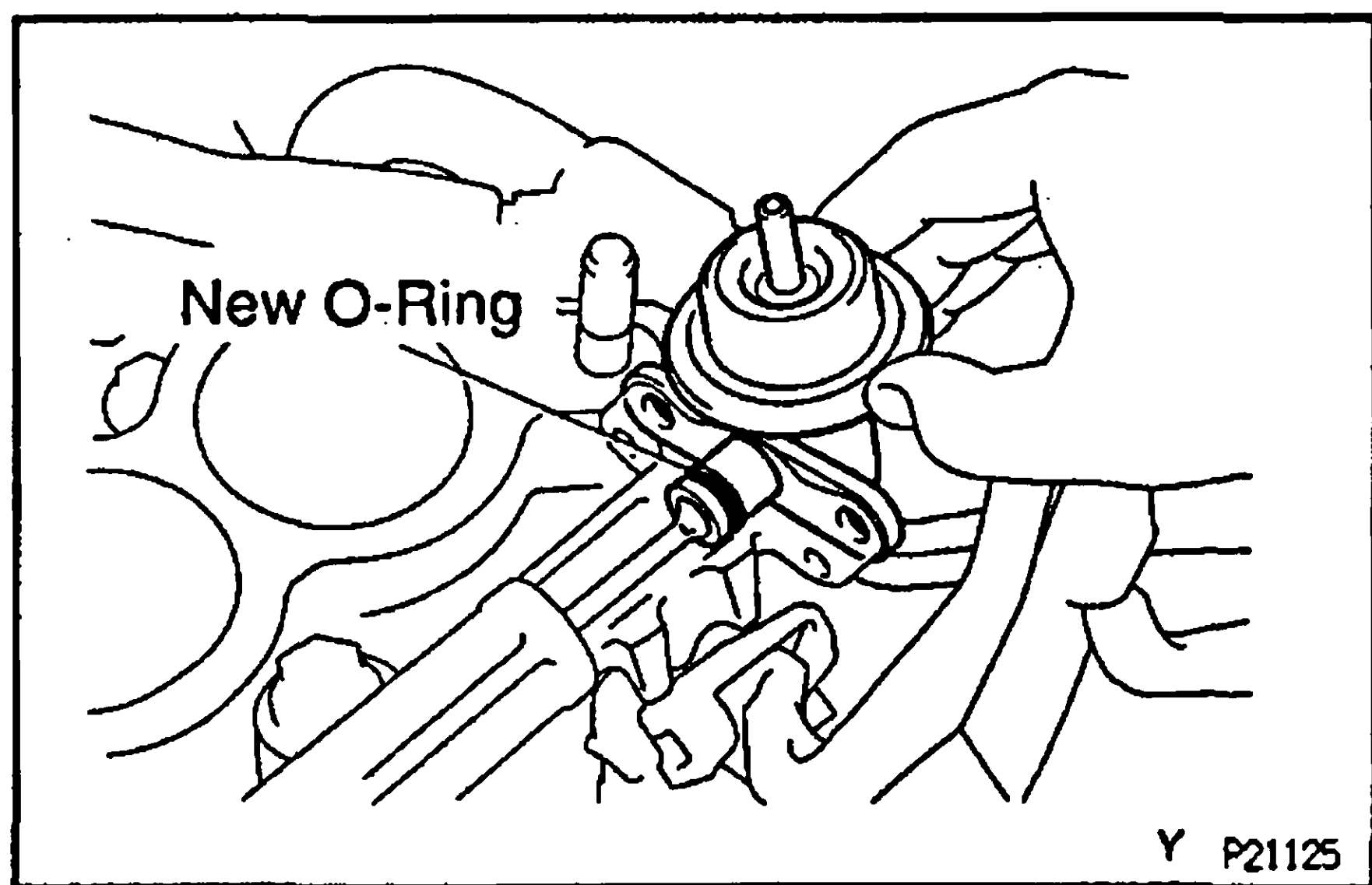
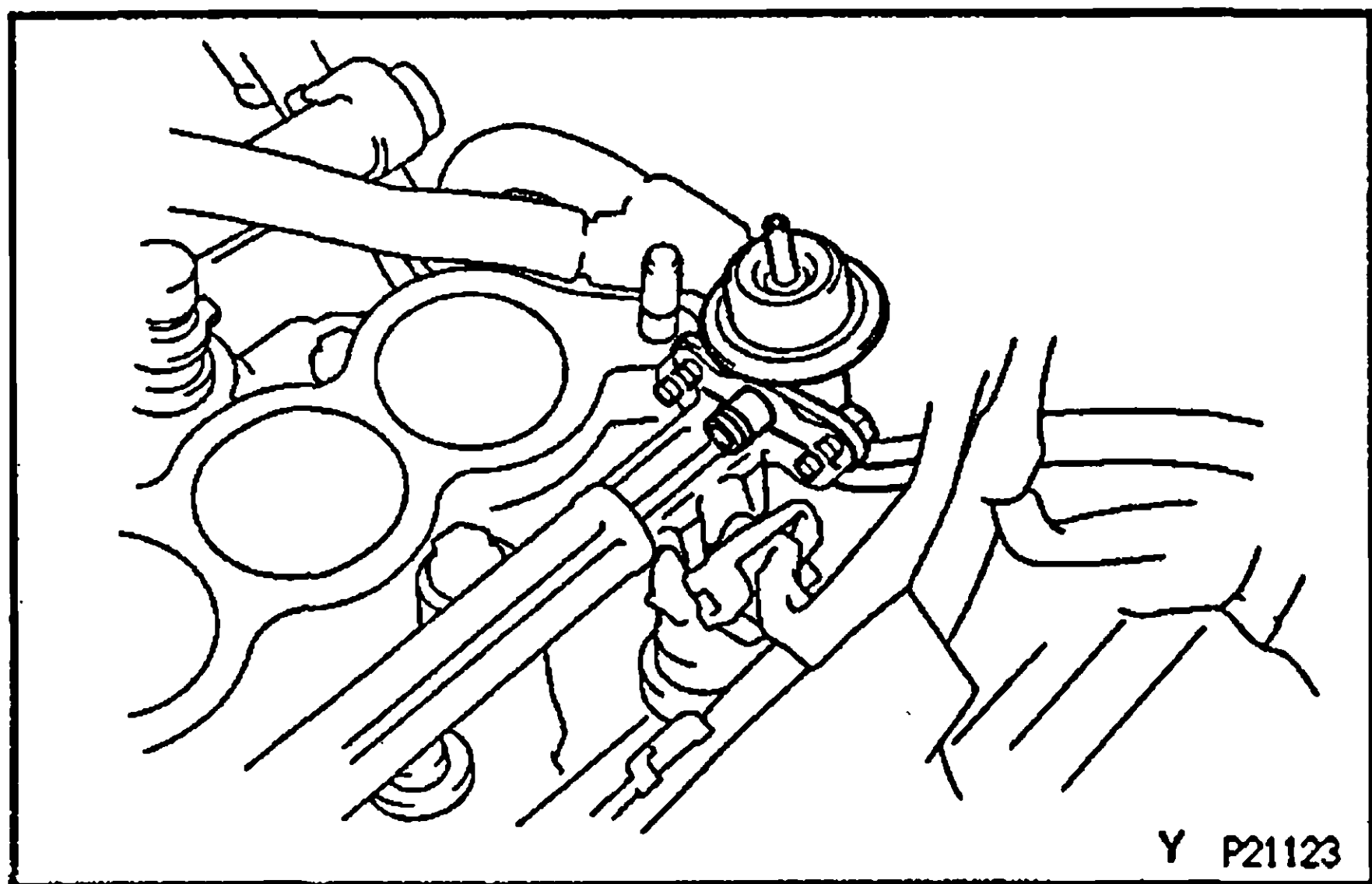
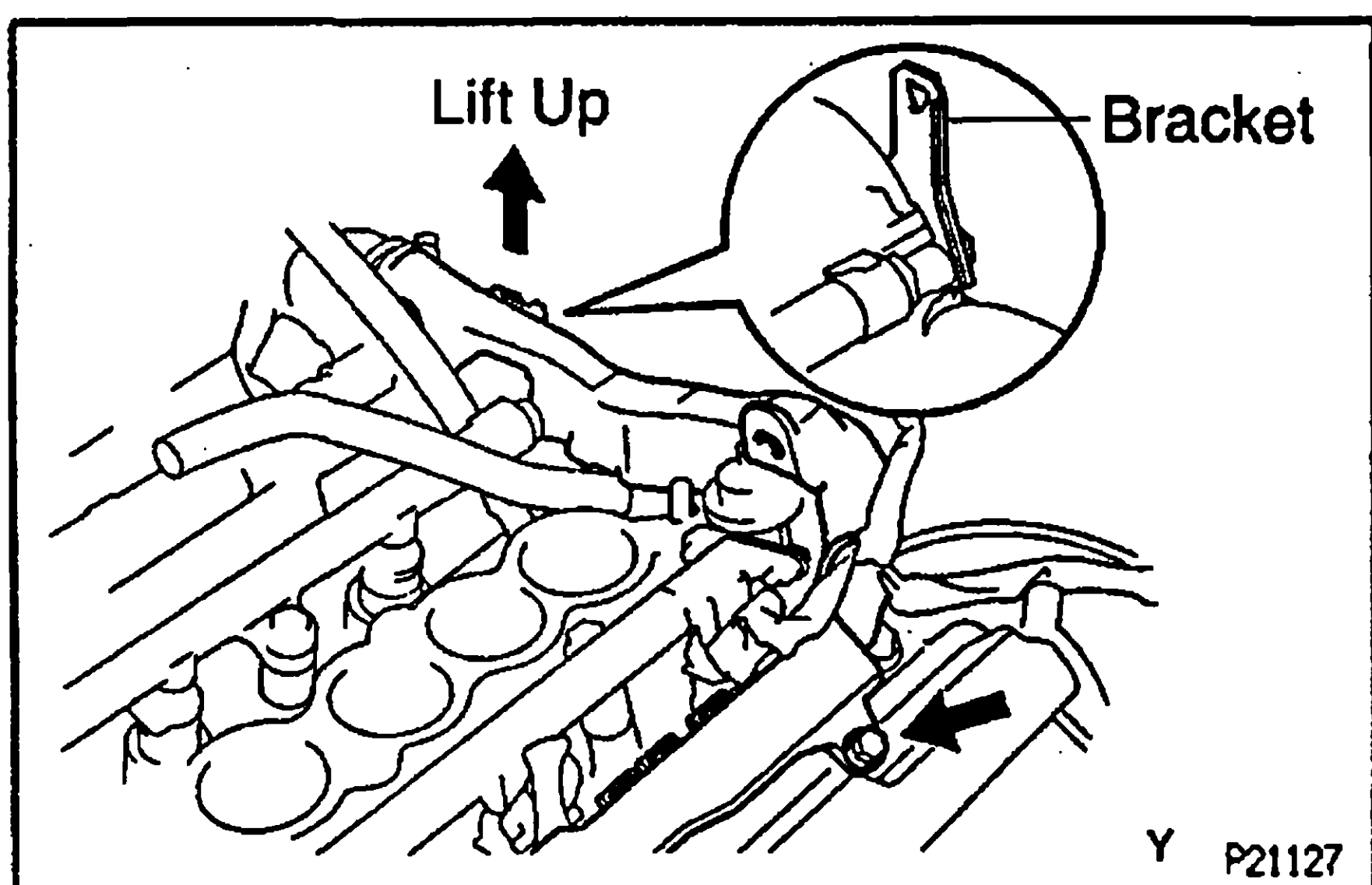
(See cylinder heads removal in Engine Mechanical)

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

- Remove holding bolt the engine wire to the LH cylinder head cover.
- Disconnect the protector from the bracket on the RH cylinder head cover, and lift up the engine wire.
- Remove the 2 bolts, and pull out the pressure regulator.
- Remove the O-ring from the pressure regulator.

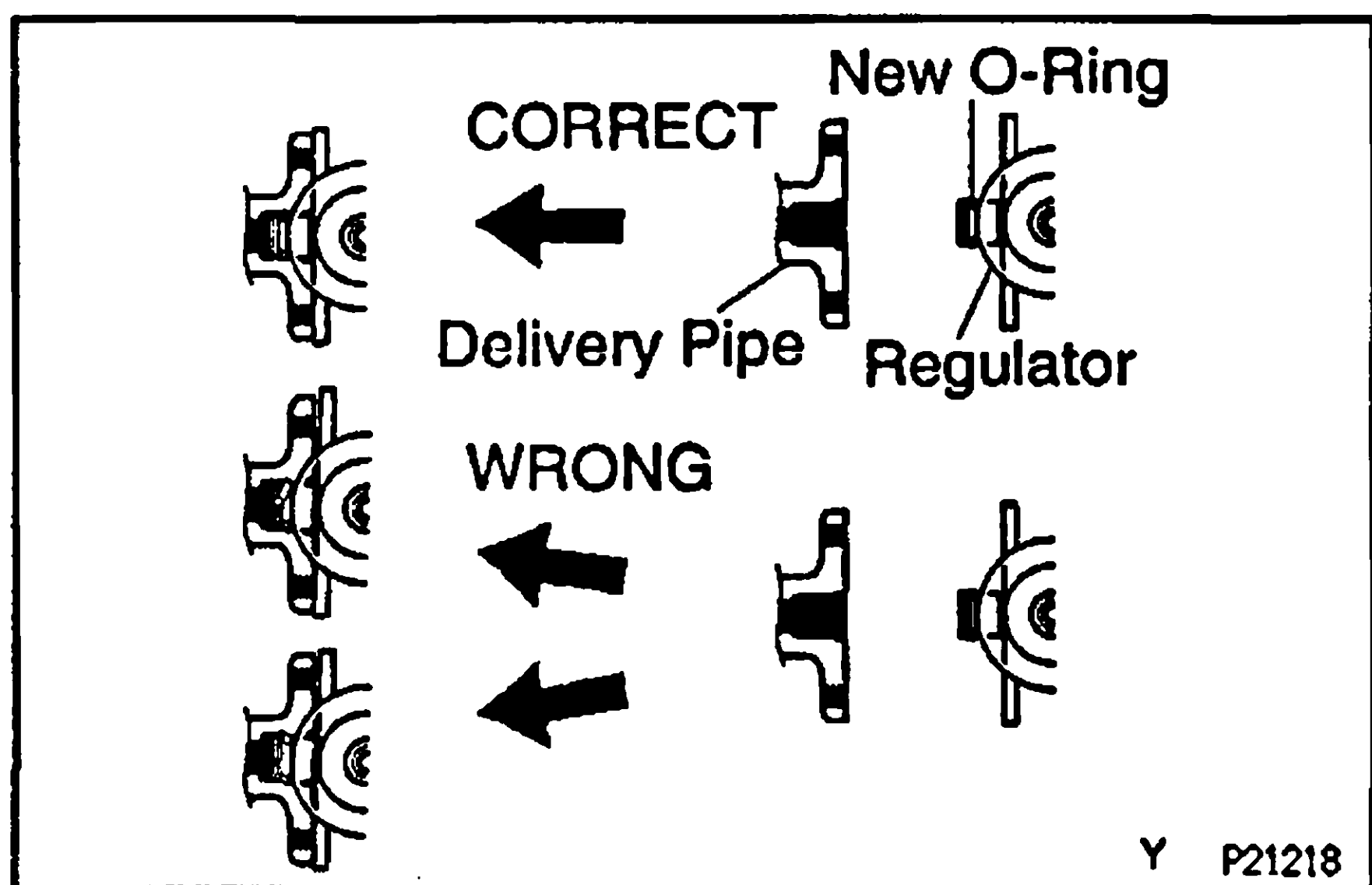


FUEL PRESSURE REGULATOR INSTALLATION

B07CU-01

1. INSTALL FUEL PRESSURE REGULATOR

- Apply a light coat of gasoline to a new O-ring, and install it to the pressure regulator.
- Attach the pressure regulator to the LH delivery pipe.
- Check that the pressure regulator rotates smoothly. **NOTICE:** If it does not rotate smoothly, the O-ring may be pinched, so remove the pressure regulator and repeat steps (a) to (c) above.
- Install the pressure regulator with the 2 bolts. **Torque:** 8 N·m (80 kgf·cm, 71 in.-lbf)
- Install the engine wire with the bolt.



2. CONNECT FUEL RETURN HOSE TO FUEL PRESSURE REGULATOR

NOTICE: Be sure to insert the hose up to the stopper and clip it.

3. INSTALL INTAKE AIR CONNECTOR

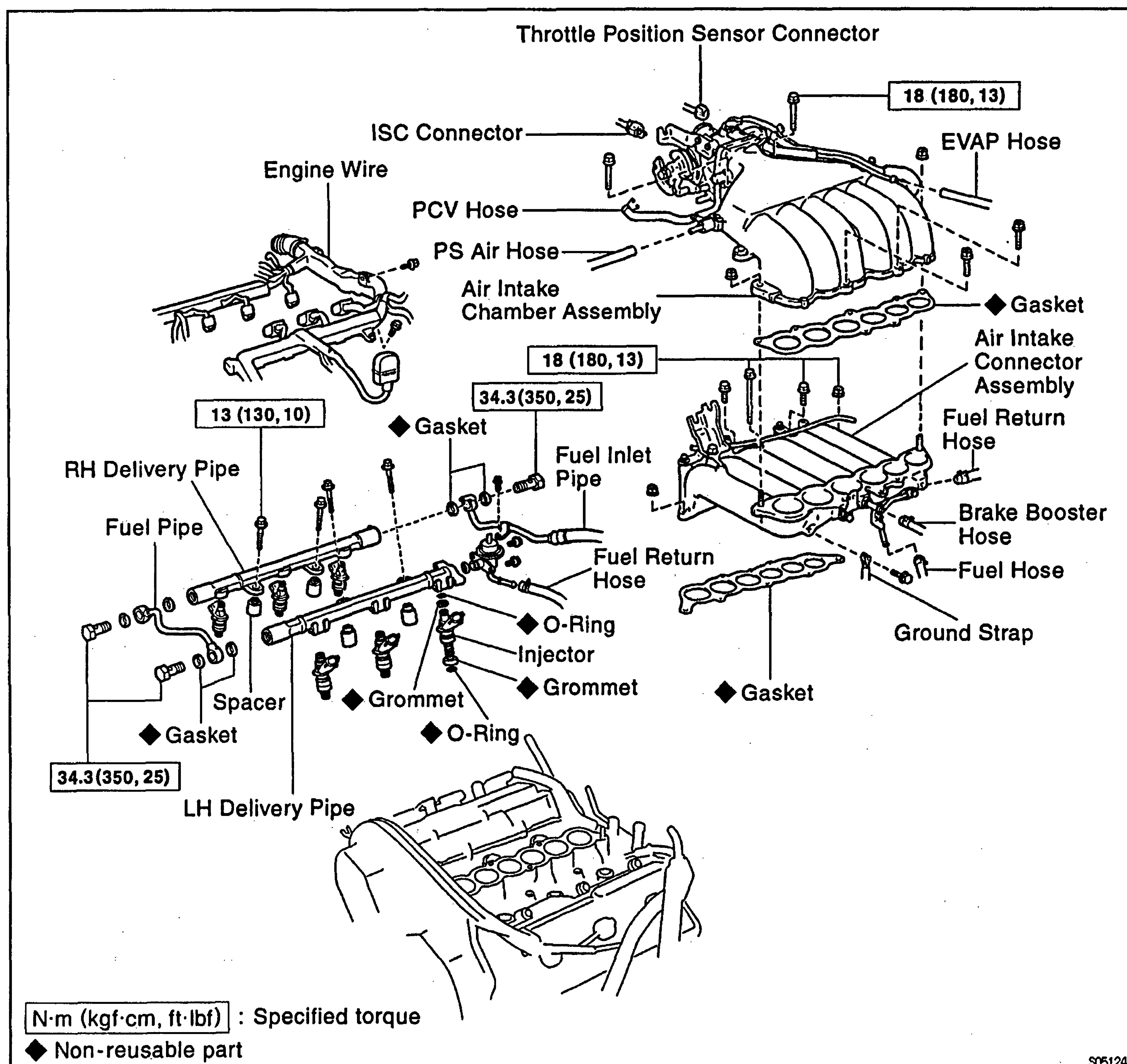
(See cylinder heads installation in Engine Mechanical)

4. CHECK FOR FUEL LEAKS

EG

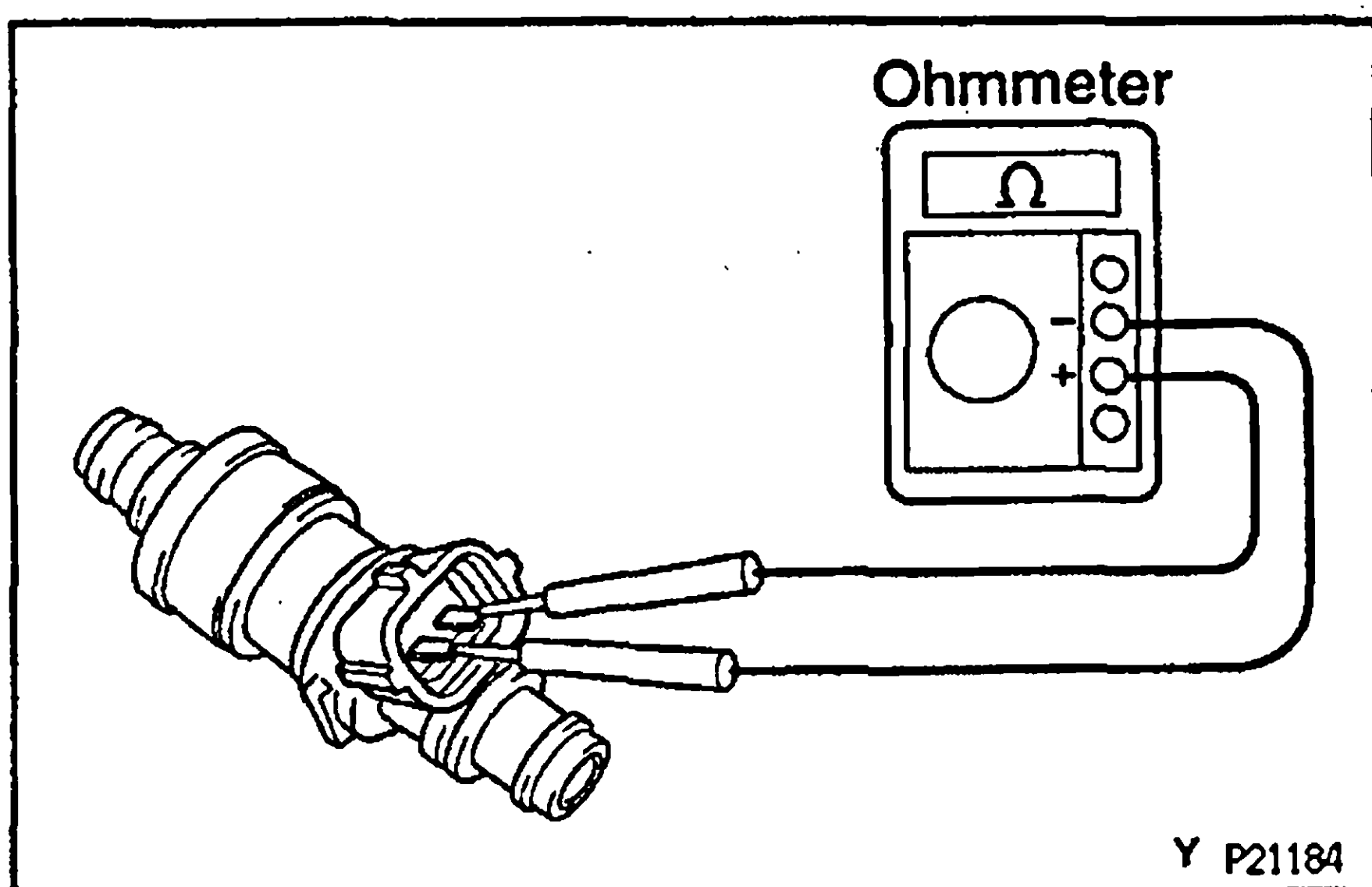
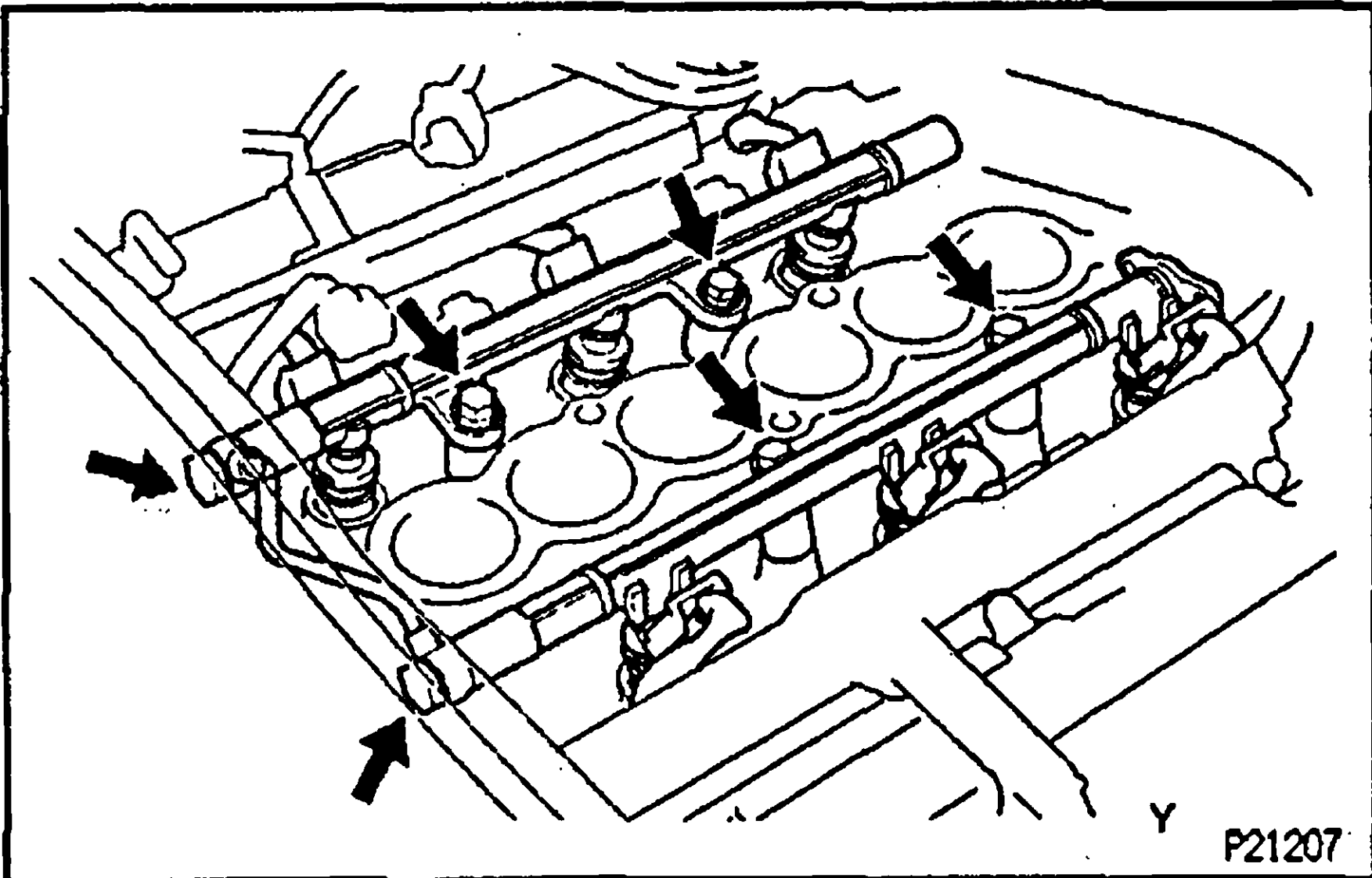
INJECTOR COMPONENTS FOR REMOVAL AND INSTALLATION

EG380-12



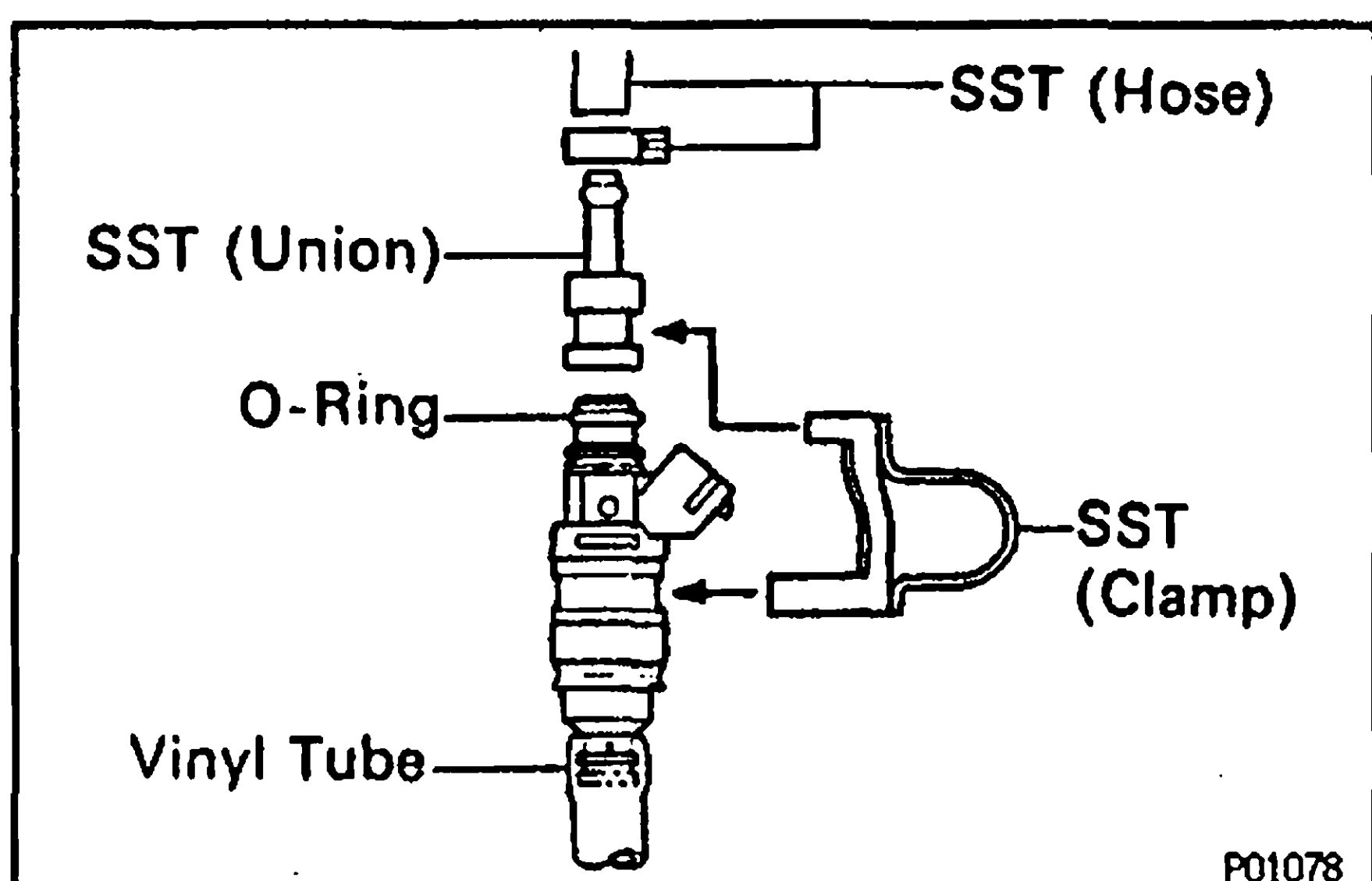
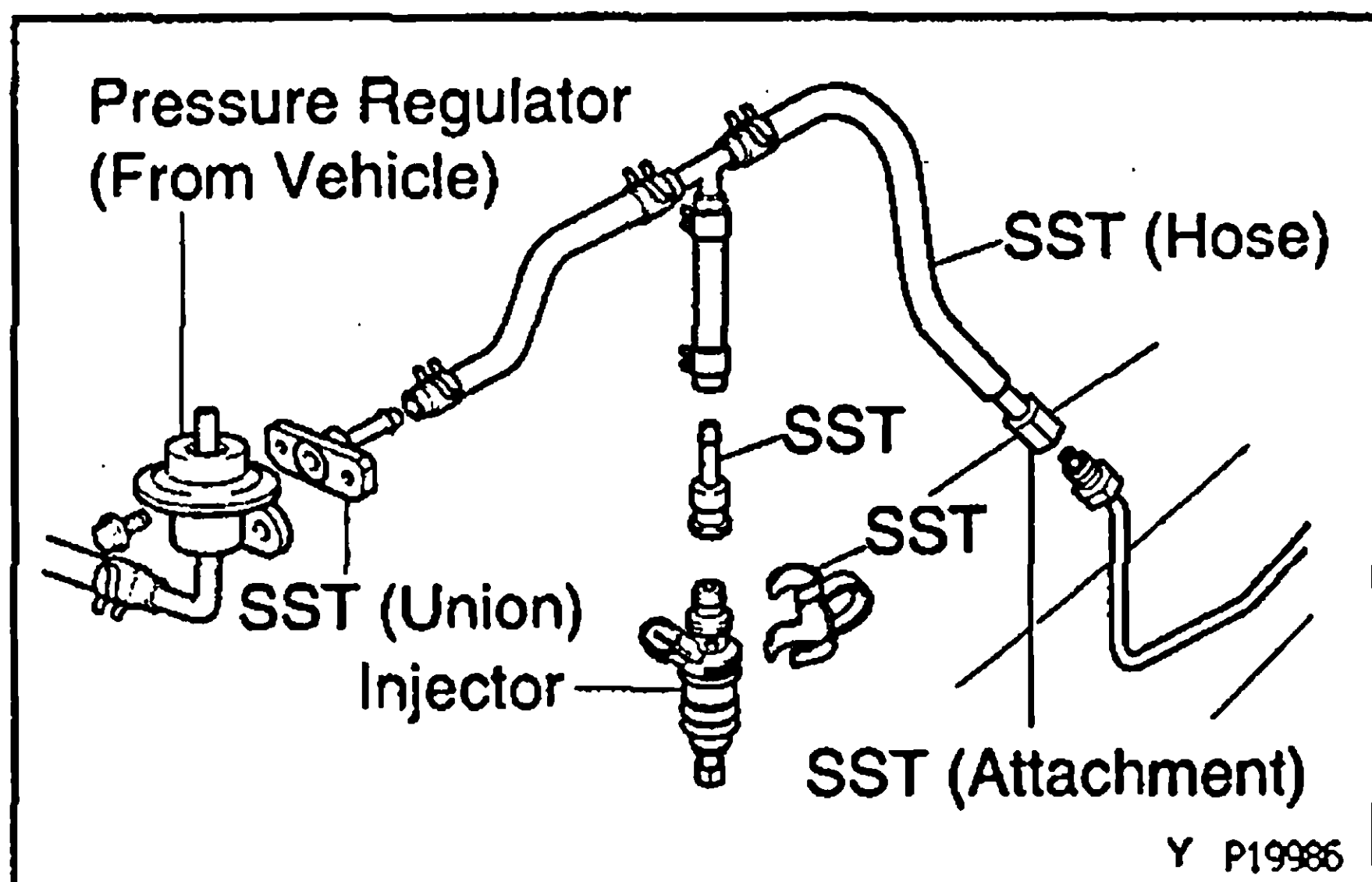
INJECTORS REMOVAL

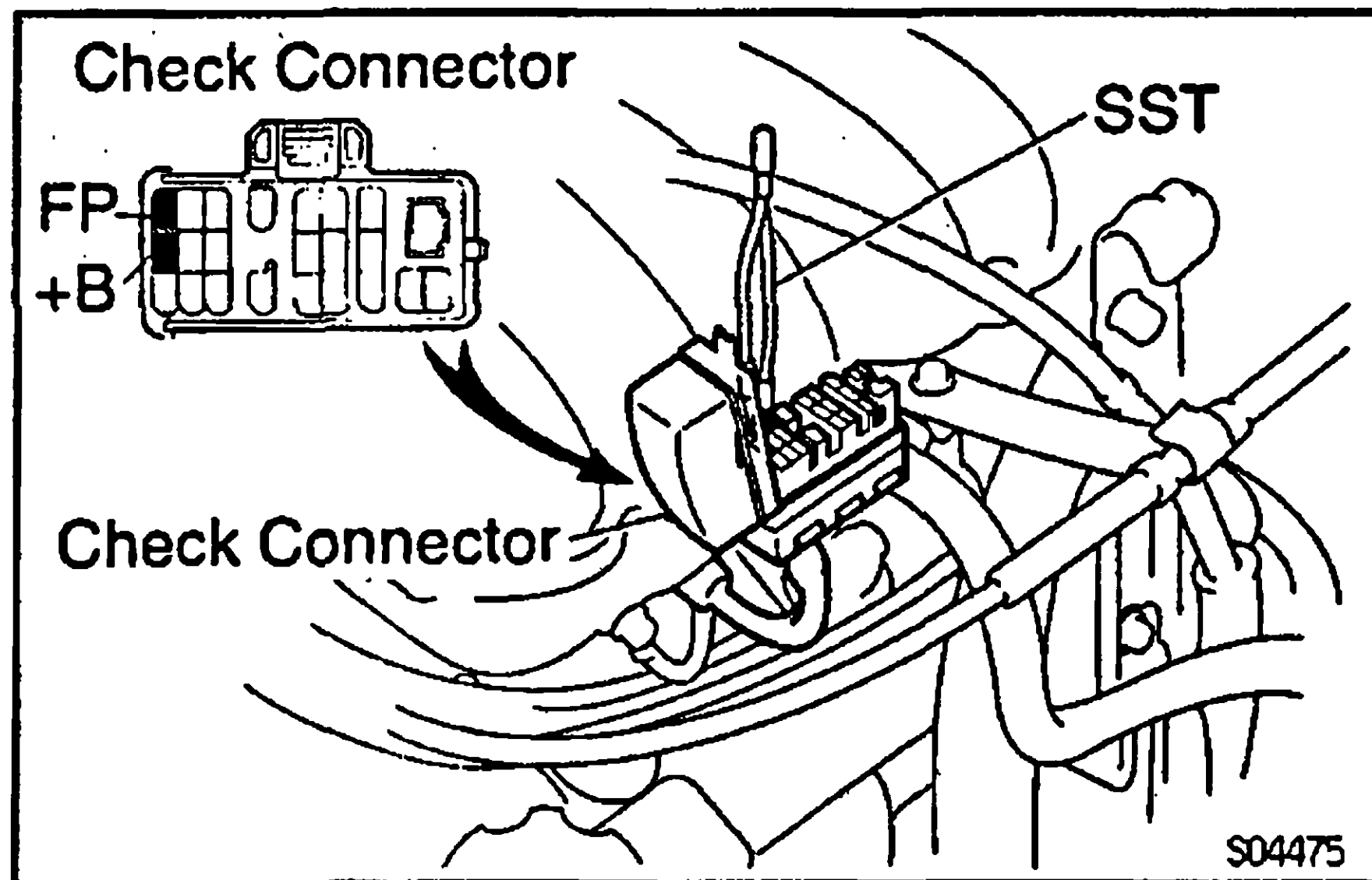
1. REMOVE AIR INTAKE CHAMBER ASSEMBLY
(See cylinder heads removal in Engine Mechanical)
 2. REMOVE FUEL PRESSURE REGULATOR
(See fuel pressure regulator removal)
 3. DISCONNECT FUEL INLET PIPE
CAUTION: Catch leaking fuel in a container.
 4. REMOVE FUEL PIPE
 5. DISCONNECT INJECTOR CONNECTORS
 6. REMOVE DELIVERY PIPES AND INJECTORS
NOTICE: Be careful not to drop the injectors when removing the delivery pipes.
- (a) Remove the 4 bolts, delivery pipes together with the 6 injectors.
 - (b) Remove the 4 spacers from the intake manifold.
 - (c) Pull out the 6 injectors from the delivery pipes.
 - (d) Remove the 2 O-rings and 2 grommets from each injector.



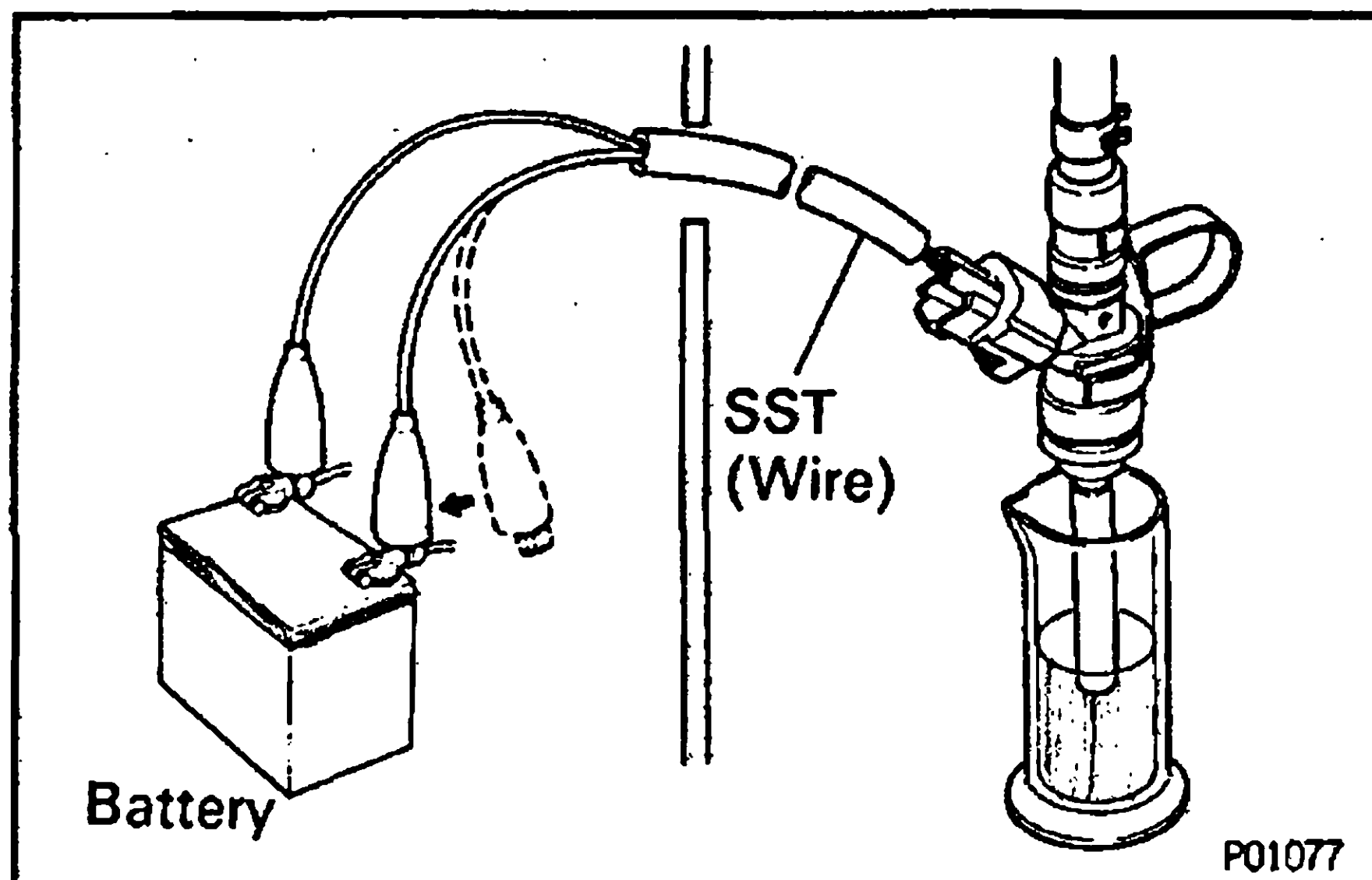
INJECTIONS INSPECTION

1. INSPECT INJECTOR RESISTANCE
Using an ohmmeter, measure the resistance between the terminals.
Resistance:
At 20°C (68°F): Approx. 13.8 Ω
If the resistance is not as specified, replace the injector.
 2. INSPECT INJECTOR INJECTION
CAUTION: Keep injector clear of sparks during the test.
- (a) Disconnect the fuel inlet pipe from the fuel tube.
 - (b) Connect SST (attachment and hose) to the fuel tube.
SST 09268-41046 (09268-52011)
 - (c) Connect the fuel return hose, SST (union) and SST (hose) to the fuel pressure regulator.
SST 09268-41046 (09268-41091)
 - (d) Install the O-ring to the injector.
 - (e) Connect SST (union and hose) to the injector, and hold the injector and union with SST (clamp).
SST 09268-41046
 - (f) Put the injector into the graduated cylinder.
HINT: Install a suitable vinyl hose onto the injector to prevent gasoline from splashing out.





- (g) Using SST, connect terminals +B and FP of the check connector.
SST 09843-18020
- (h) Turn the ignition switch ON.
NOTICE: Do not start the engine.



- (i) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.
SST 09842-30070

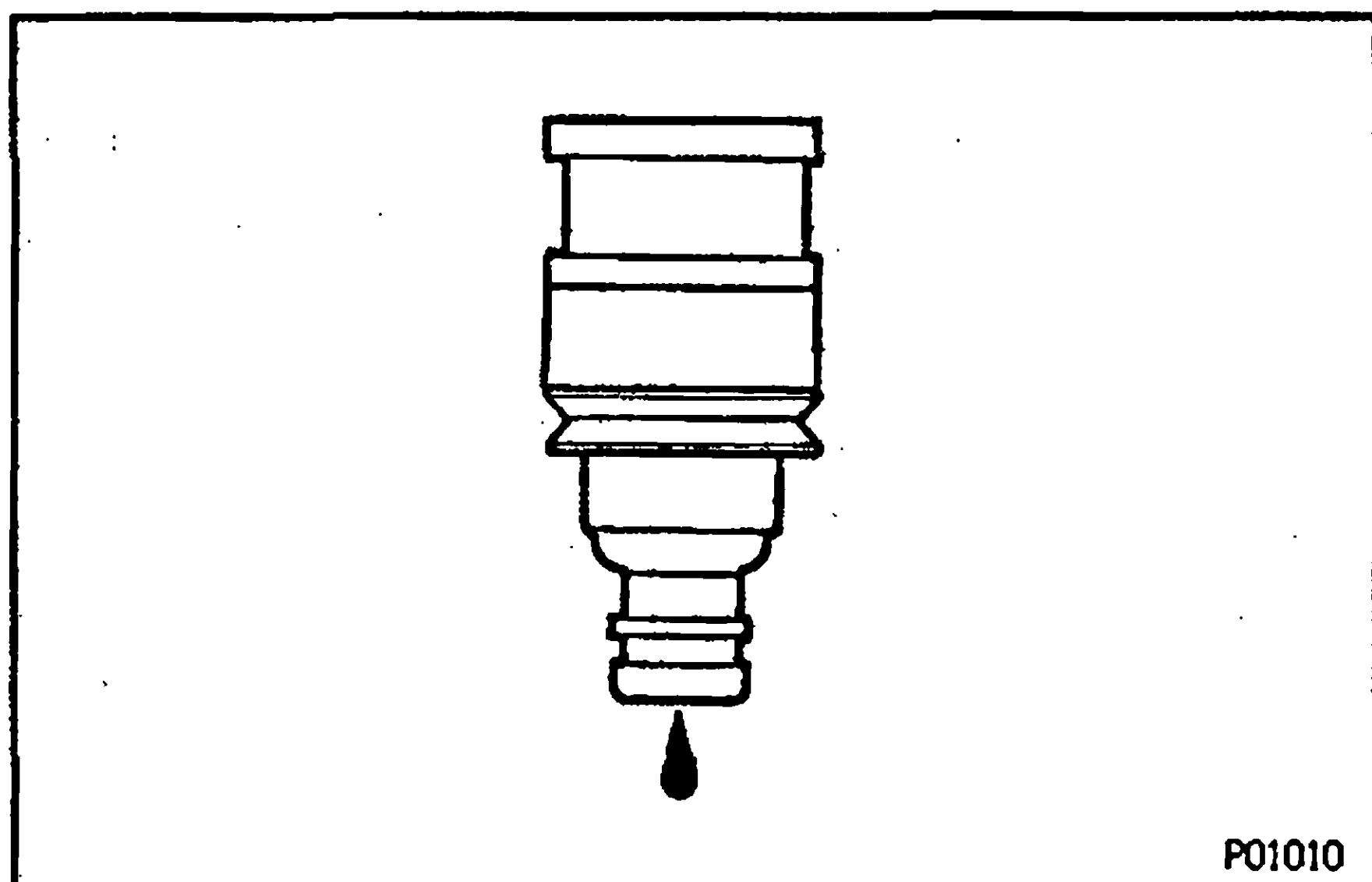
Volume:

55 — 70 cm³ (3.3 — 4.3 cu in.) per 15 sec.

Difference between each injector:

6 cm³ (0.4 cu in.) or less

If the injection volume is not as specified, replace the injector.



3. INSPECT LEAKAGE

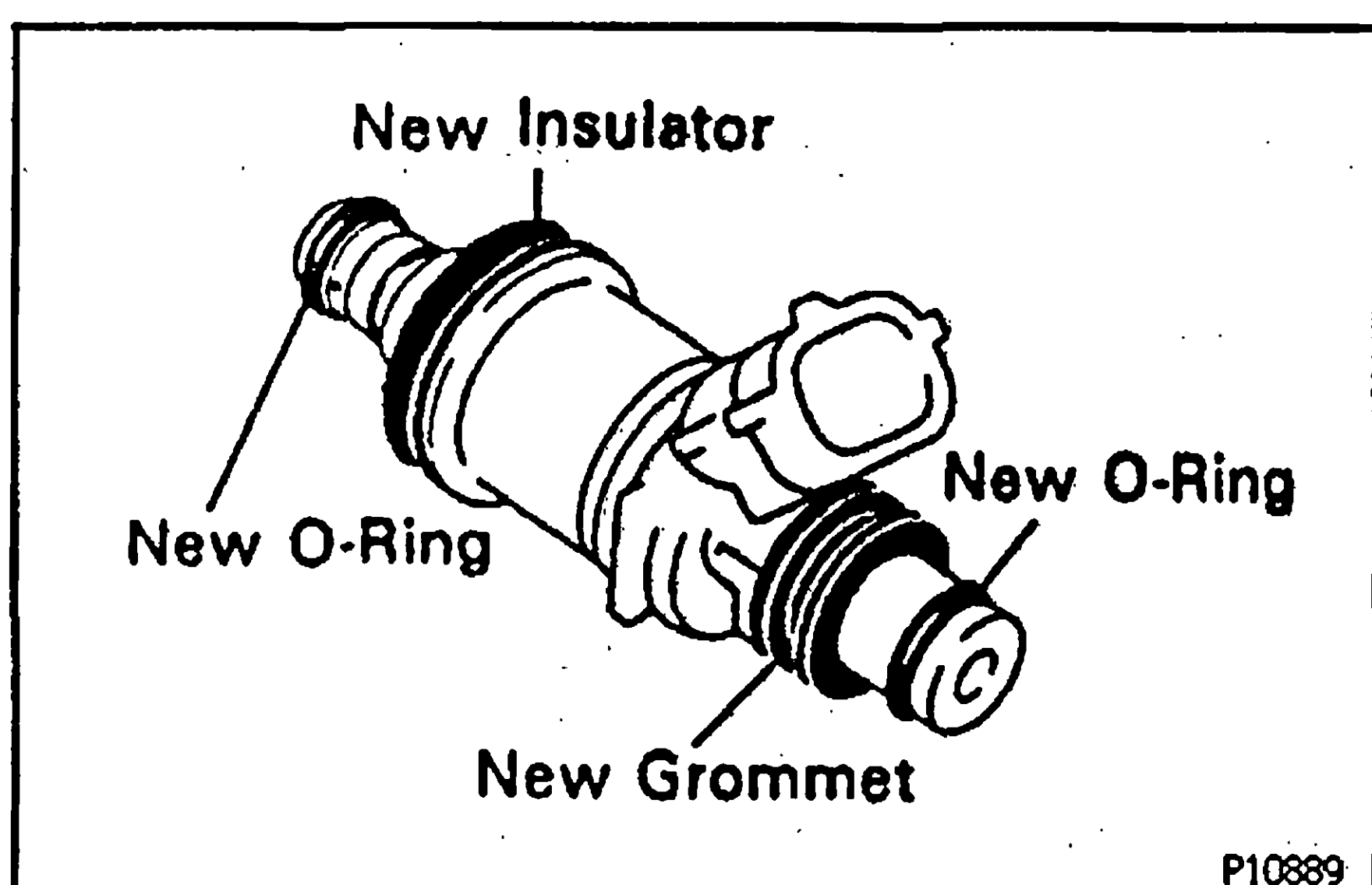
- (a) In the condition above, disconnect the test probes of SST (wire) from the battery and check the fuel leakage from the injector.

SST 09842-30070

Fuel drop:

1 drop or less per minute

- (b) Turn the ignition switch to LOCK.
- (c) Disconnect the negative (—) terminal cable from the battery.
- (d) Remove the SST.
SST 09268-41045
- (e) Remove the SST from the check connector.
SST 09843-18020

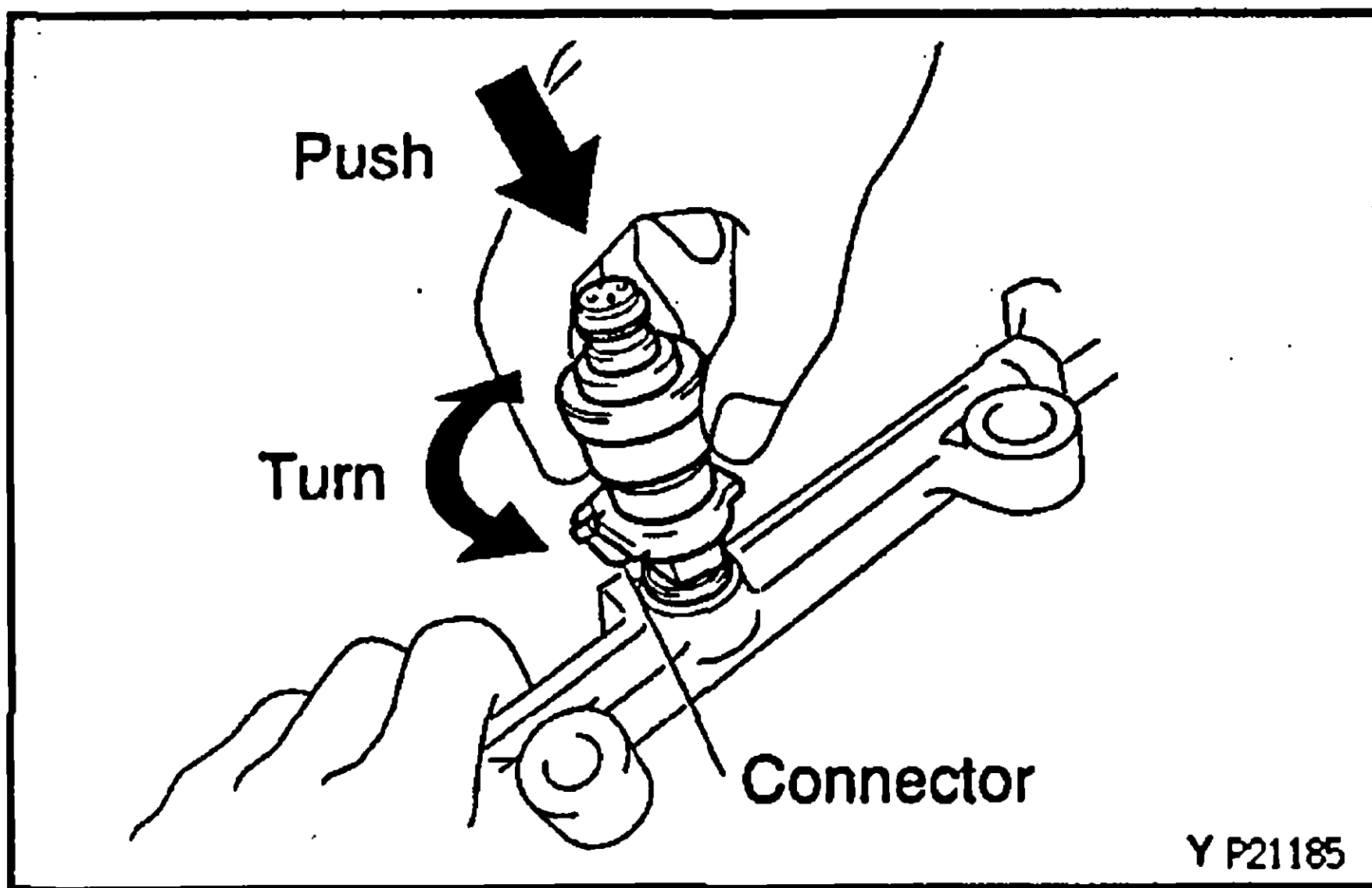


INJECTIONS INSTALLATION

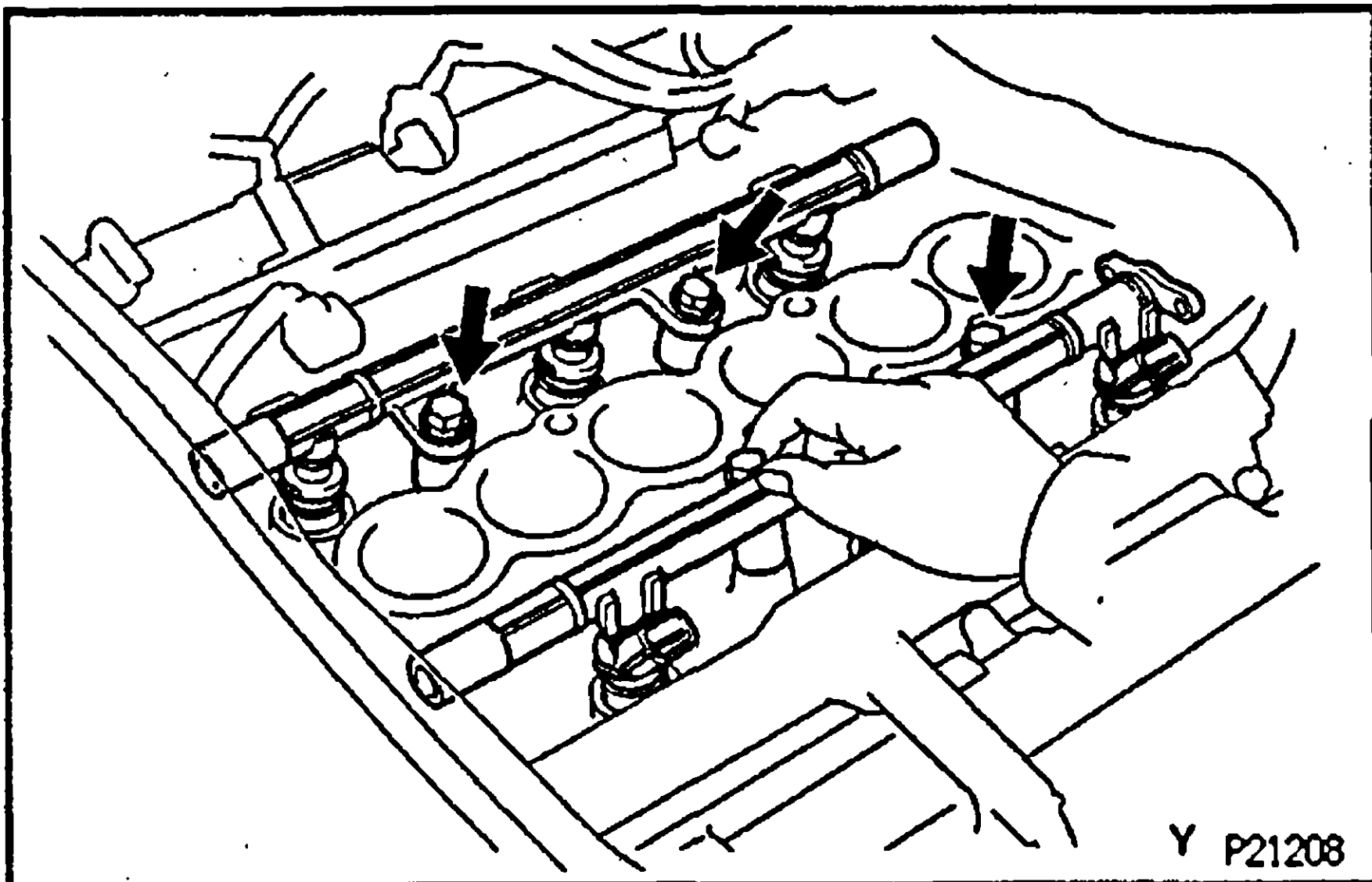
B07CX-01

1. TEMPORARILY INSTALL INJECTORS AND DELIVERY PIPES

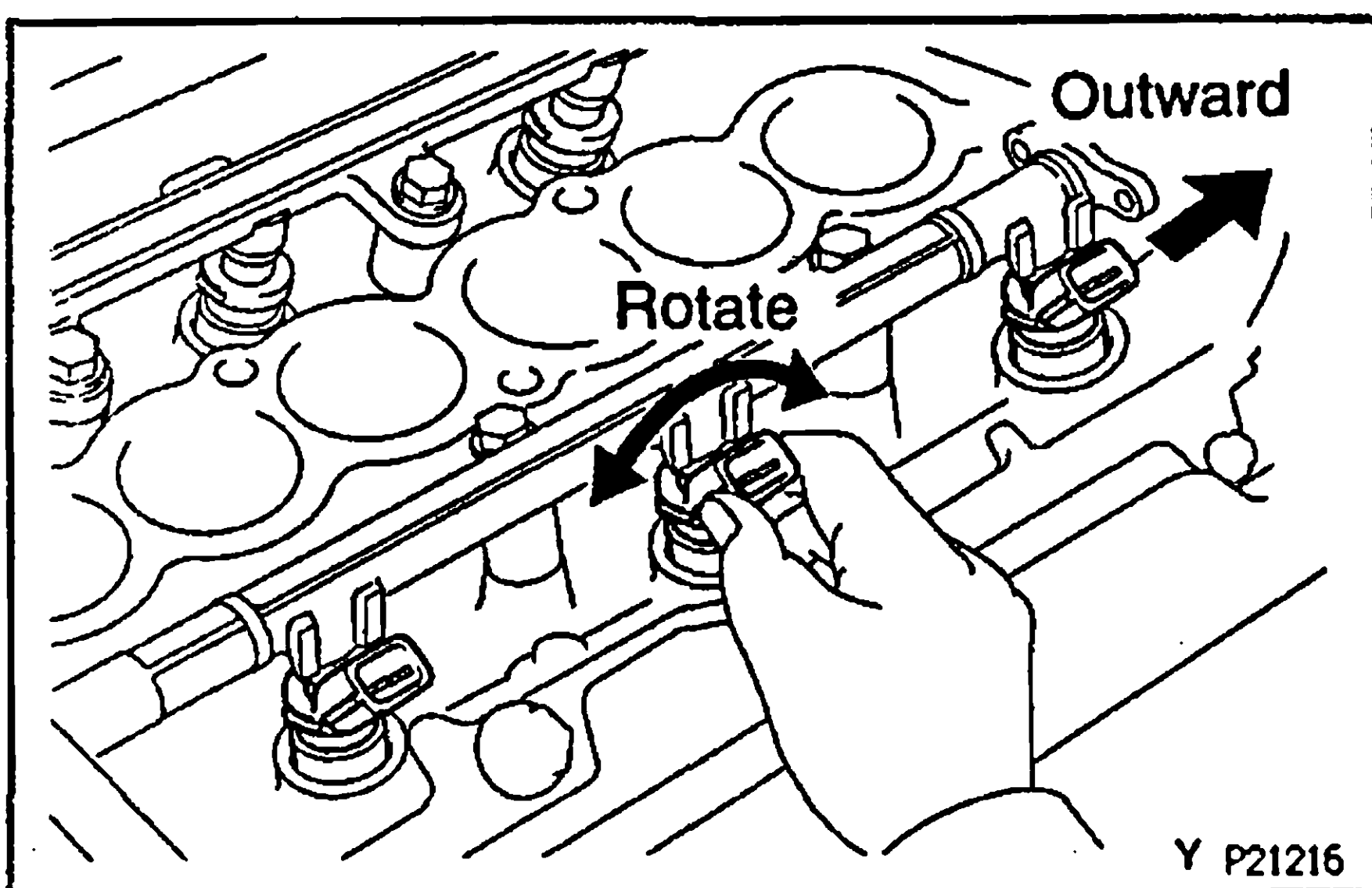
- (a) Install 2 new grommets to each injector.
- (b) Apply a light coat of spindle oil or gasoline to 2 new O-rings and install them to each injector.



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

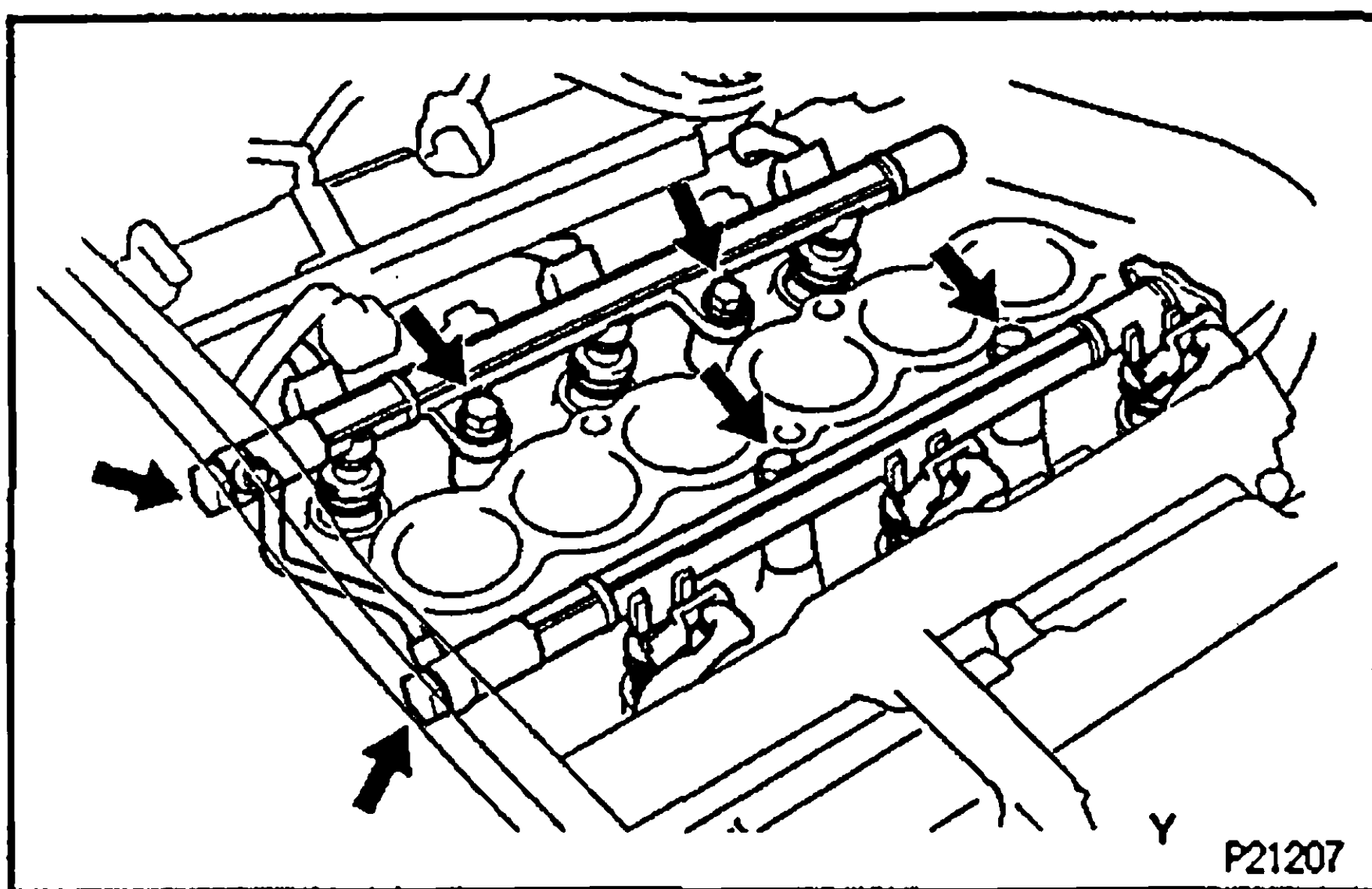


- (e) Place the 4 spacers in position on the intake manifold.
- (f) Place the delivery pipes with the 6 injectors in position on the intake manifold.
- (g) Temporarily install the 4 bolts holding the delivery pipes to the intake manifold.



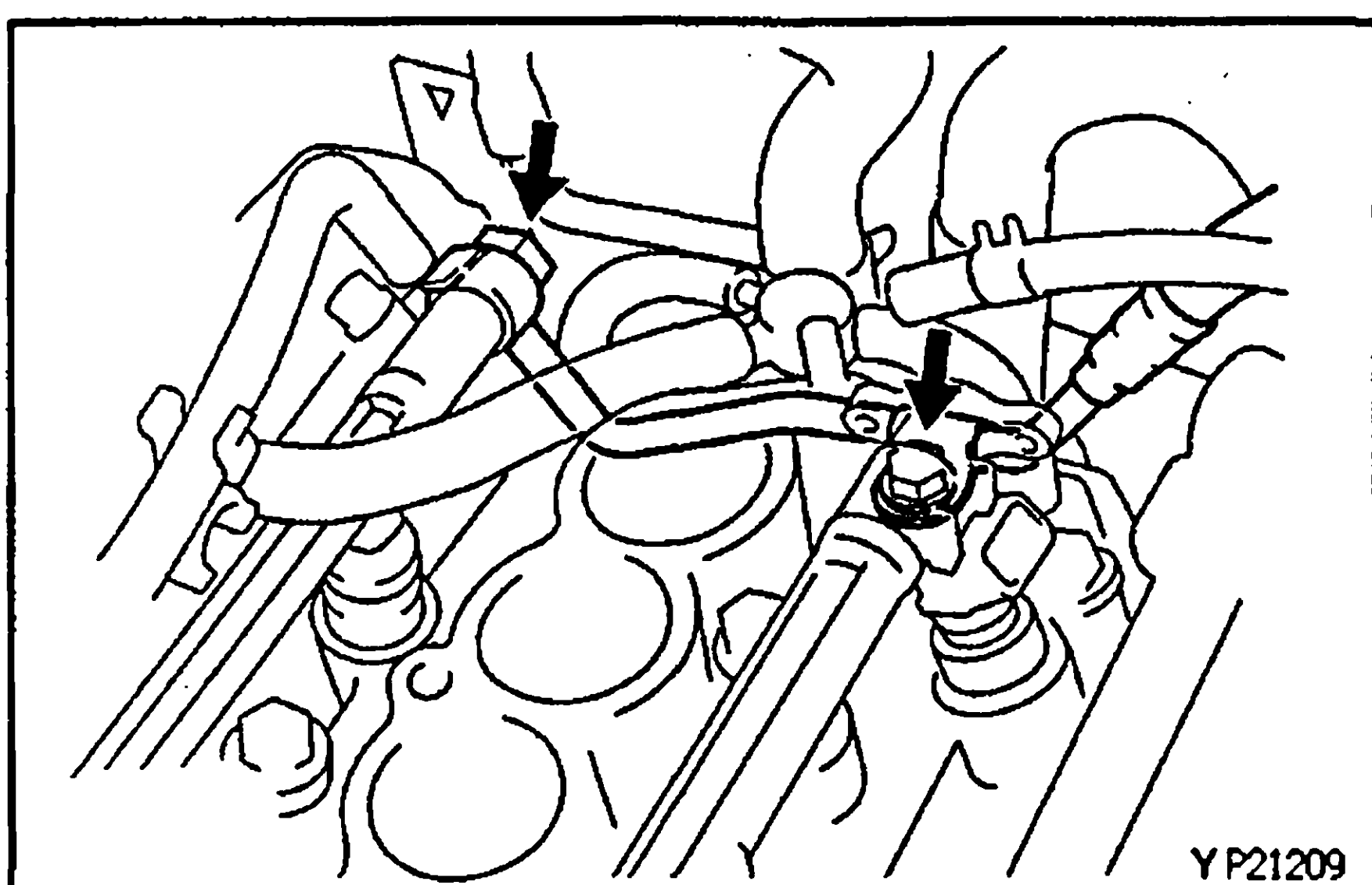
- (h) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O-rings. Replace the O-rings.
- (i) Position the injector connector outward.

2. CONNECT INJECTOR CONNECTORS



3. INSTALL FUEL PIPE AND TIGHTENING DELIVERY PIPE HOLDING BOLTS

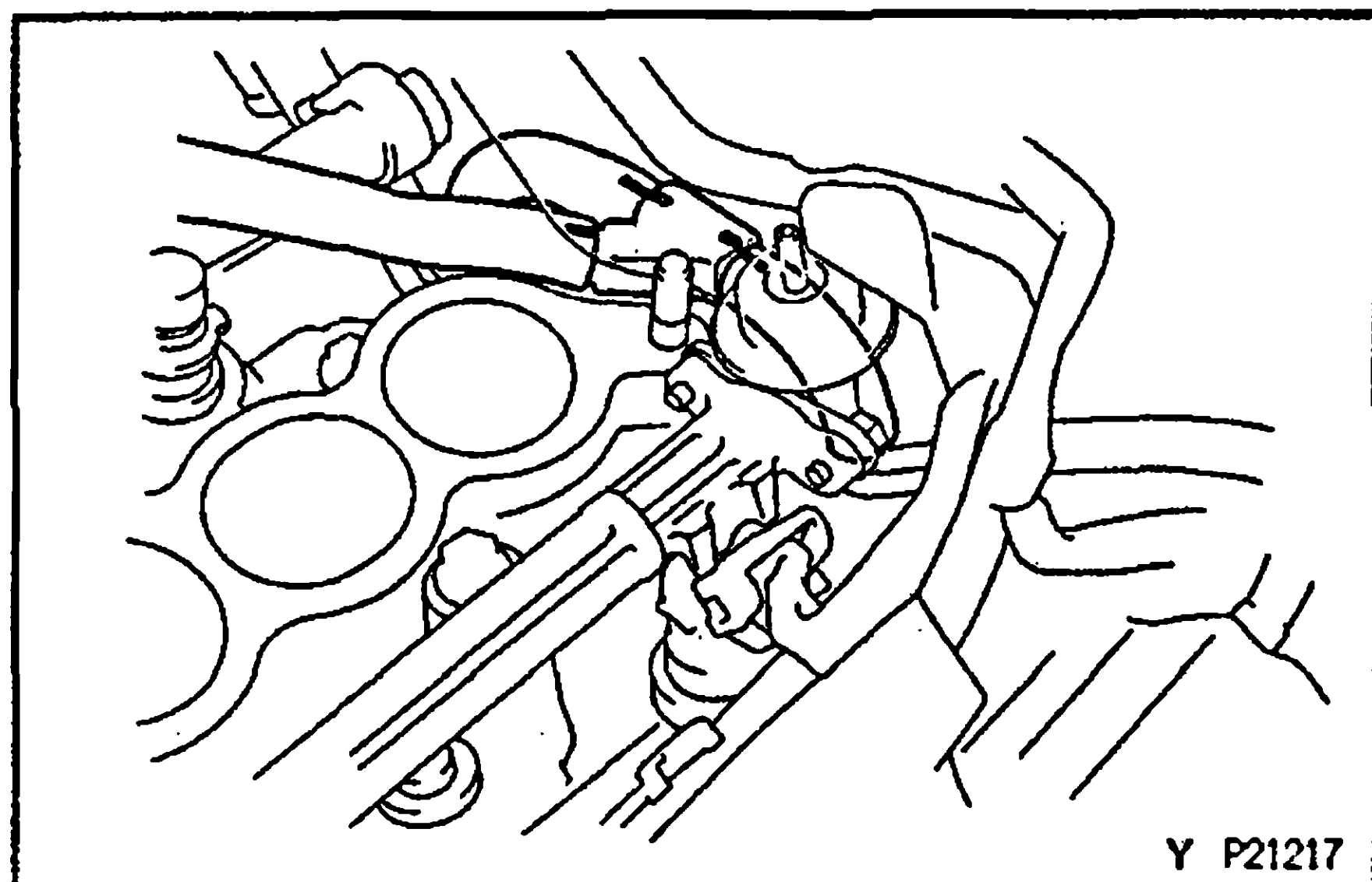
- (a) Install the fuel pipe with 4 new gaskets and the 2 union bolts.
Torque: 34.3 N·m (350 kgf·cm, 25 ft·lbf)
- (b) Tighten the 4 bolts holding the delivery pipes to the intake manifold.
Torque: 13 N·m (130 kgf·cm, 10 ft·lbf)



4. CONNECT FUEL INLET PIPE

- (a) Temporarily install the union and 2 new gaskets, and connect the fuel pipe.
- (b) Install the clamp bolt.
Torque: 8 N·m (80 kgf·cm, 71 in·lbf)
- (c) Tighten the union bolt.
Torque: 34.3 N·m (350 kgf·cm, 25 ft·lbf)

5. INSTALL FUEL PRESSURE REGULATOR (See fuel pressure regulator installation)

**6. VISUALLY INSPECT AIR ASSIST LINES AND CONNECTIONS**

Look for loose connections, sharp bends or damage.

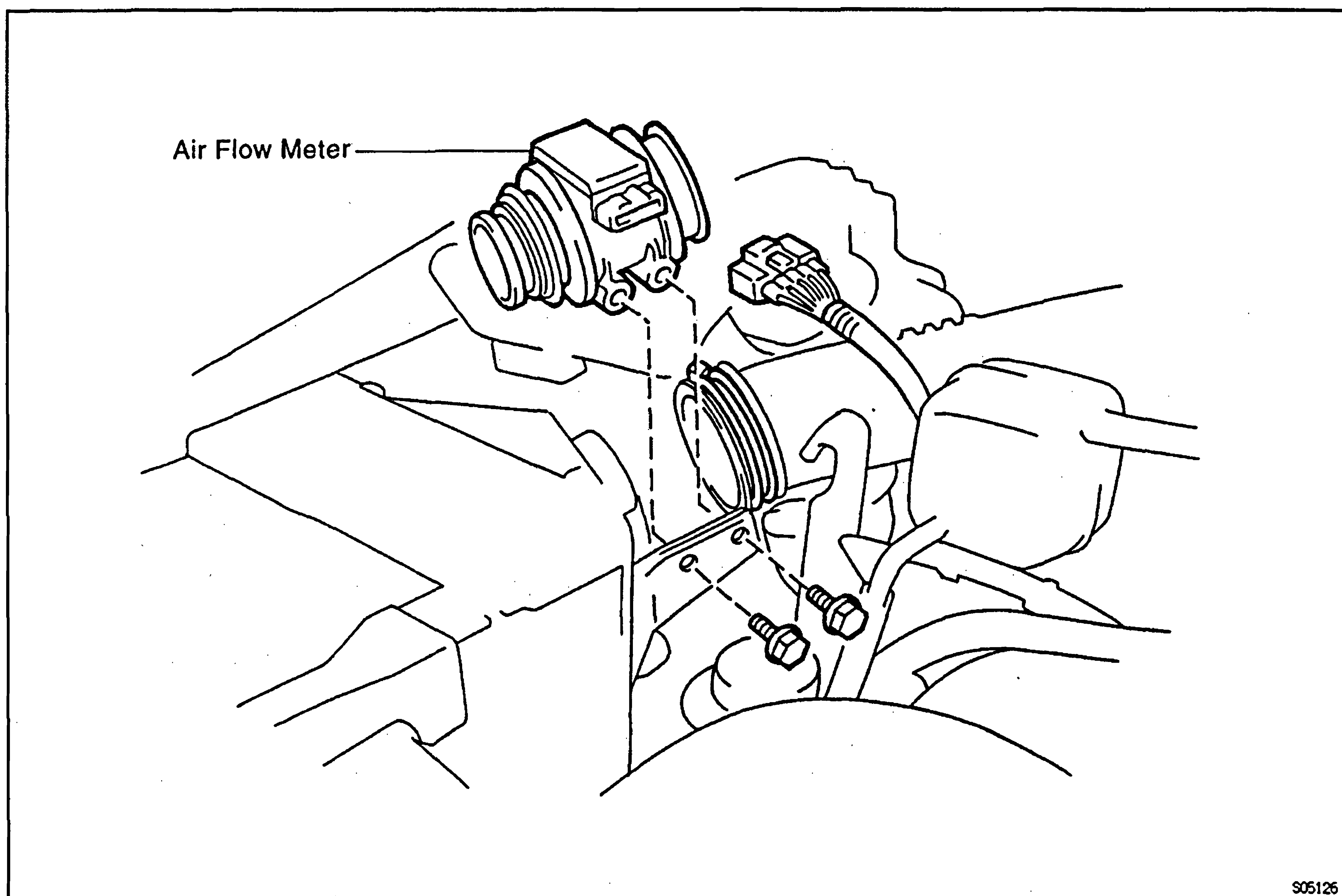
7. INSTALL INTAKE AIR CONNECTOR

(See cylinder heads installation in Engine Mechanical)

EG

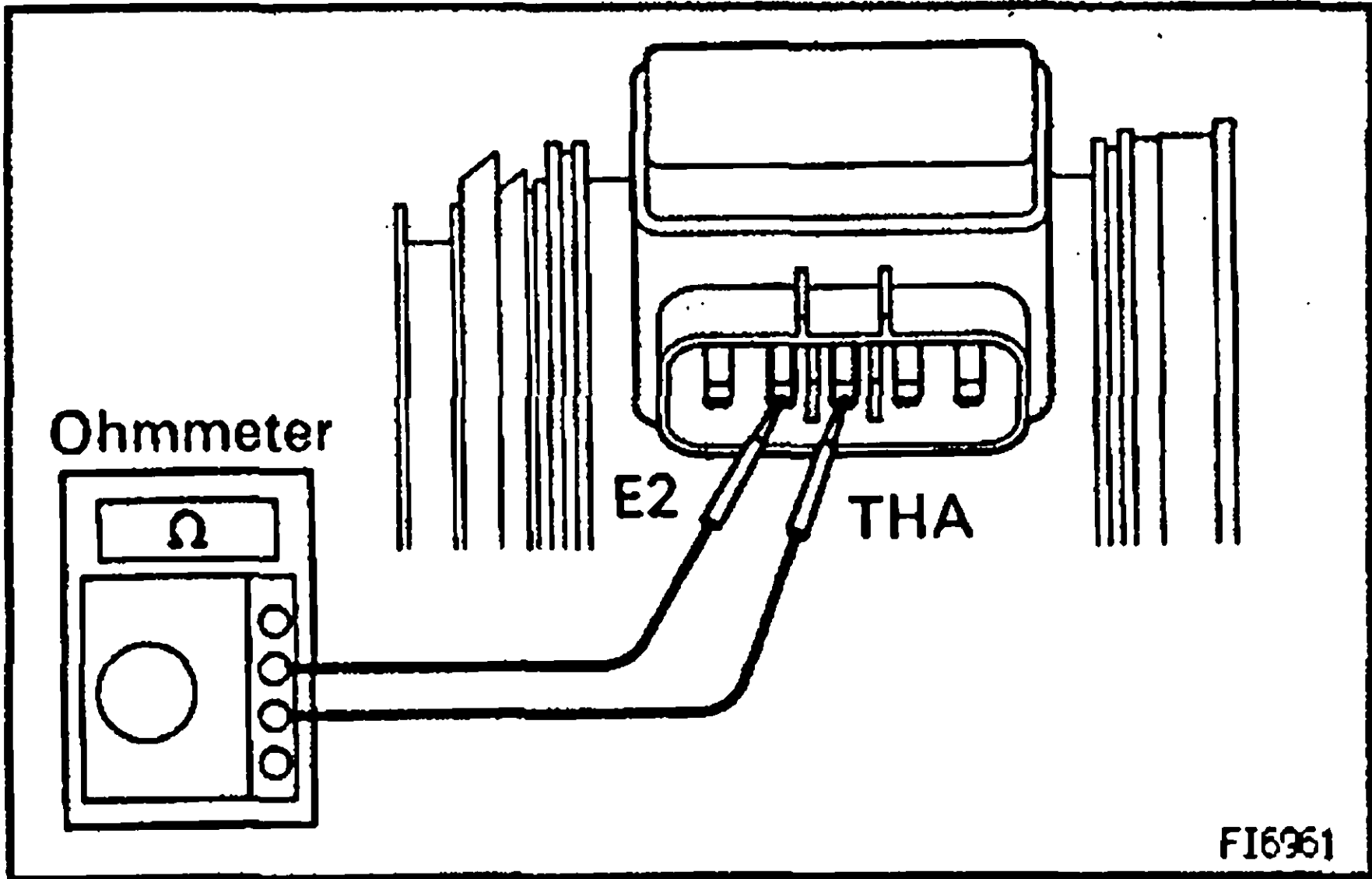
**AIR FLOW METER
COMPONENTS FOR REMOVAL AND
INSTALLATION**

E00YJ-18

**AIR FLOW METER REMOVAL**

E07CY-01

- 1. DISCONNECT AIR CLEANER HOSE FROM AIR FLOW**
- 2. REMOVE AIR FLOW METER**
 - (a) Disconnect the air flow meter connector.
 - (b) Remove the 2 bolts and air flow meter.
Torque: 6.9 N·m (70 kgf·cm, 61 in·lbf)



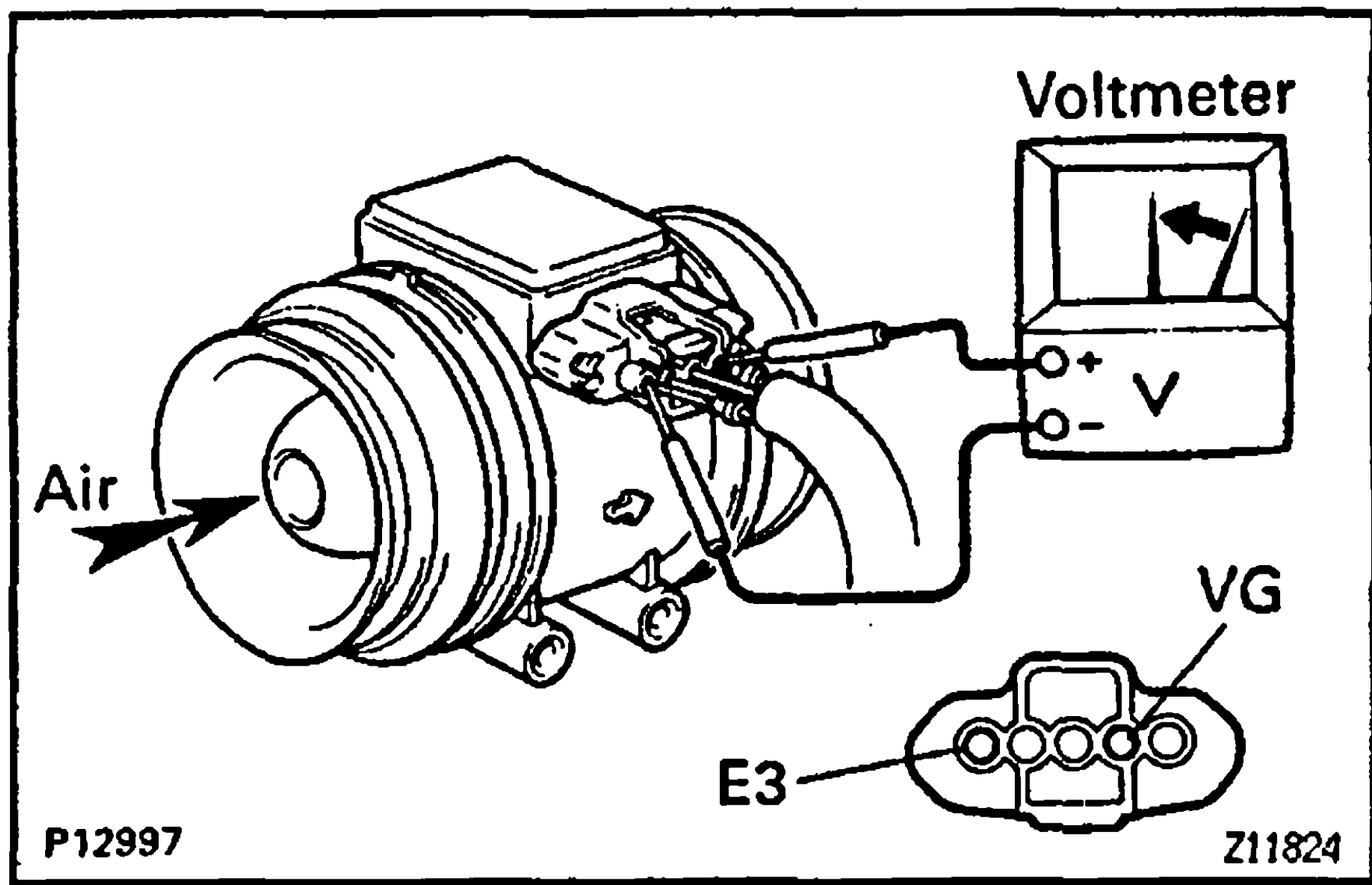
AIR FLOW METER INSPECTION

1. INSPECT AIR FLOW METER RESISTANCE

Using an ohmmeter, measure the resistance between terminals THA and E2.

Terminals	Resistance	Temperature
THA - E2	10 - 20 k Ω	-20°C (-4°F)
THA - E2	4 - 7 k Ω	0°C (32°F)
THA - E2	2 - 3 k Ω	20°C (68°F)
THA - E2	0.9 - 1.3 k Ω	40°C (104°F)
THA - E2	0.4 - 0.7 k Ω	60°C (140°F)
THA - E2	0.2 - 0.4 k Ω	80°C (176°F)

If the resistance is not as specified, replace the air flow meter.

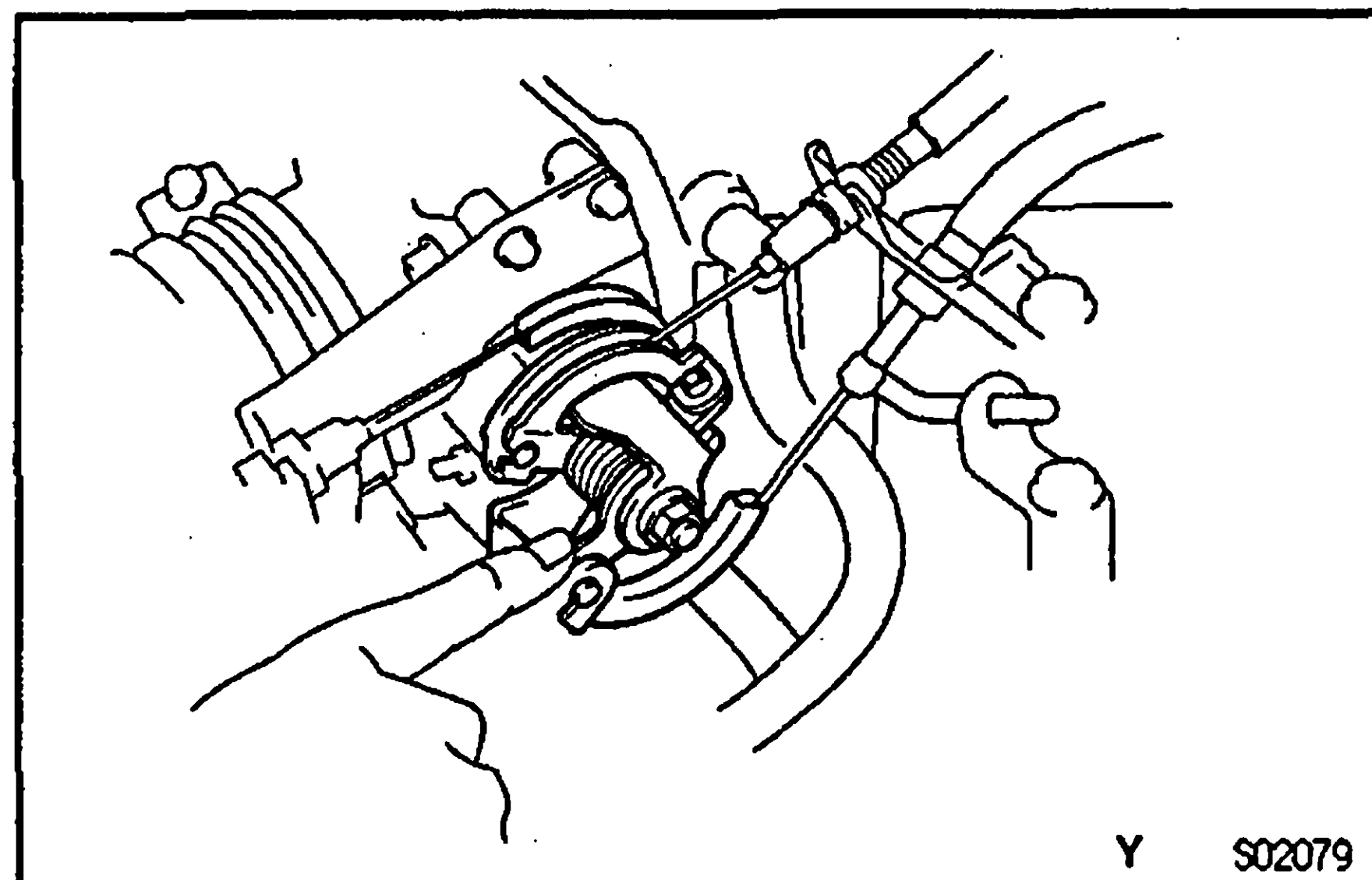


2. INSPECT AIR FLOW METER OPERATION

- Connect the air flow meter connector.
- Using a voltmeter, connect the positive (+) tester probe to terminal VG, and negative (-) tester probe to terminal E3.
- Blow air into the air flow meter, and check that the voltage fluctuates.
If operation is not as specified, replace the air flow meter.
- Disconnect the air flow meter connector.

AIR FLOW METER INSTALLATION

Installation is in the reverse order of removal.

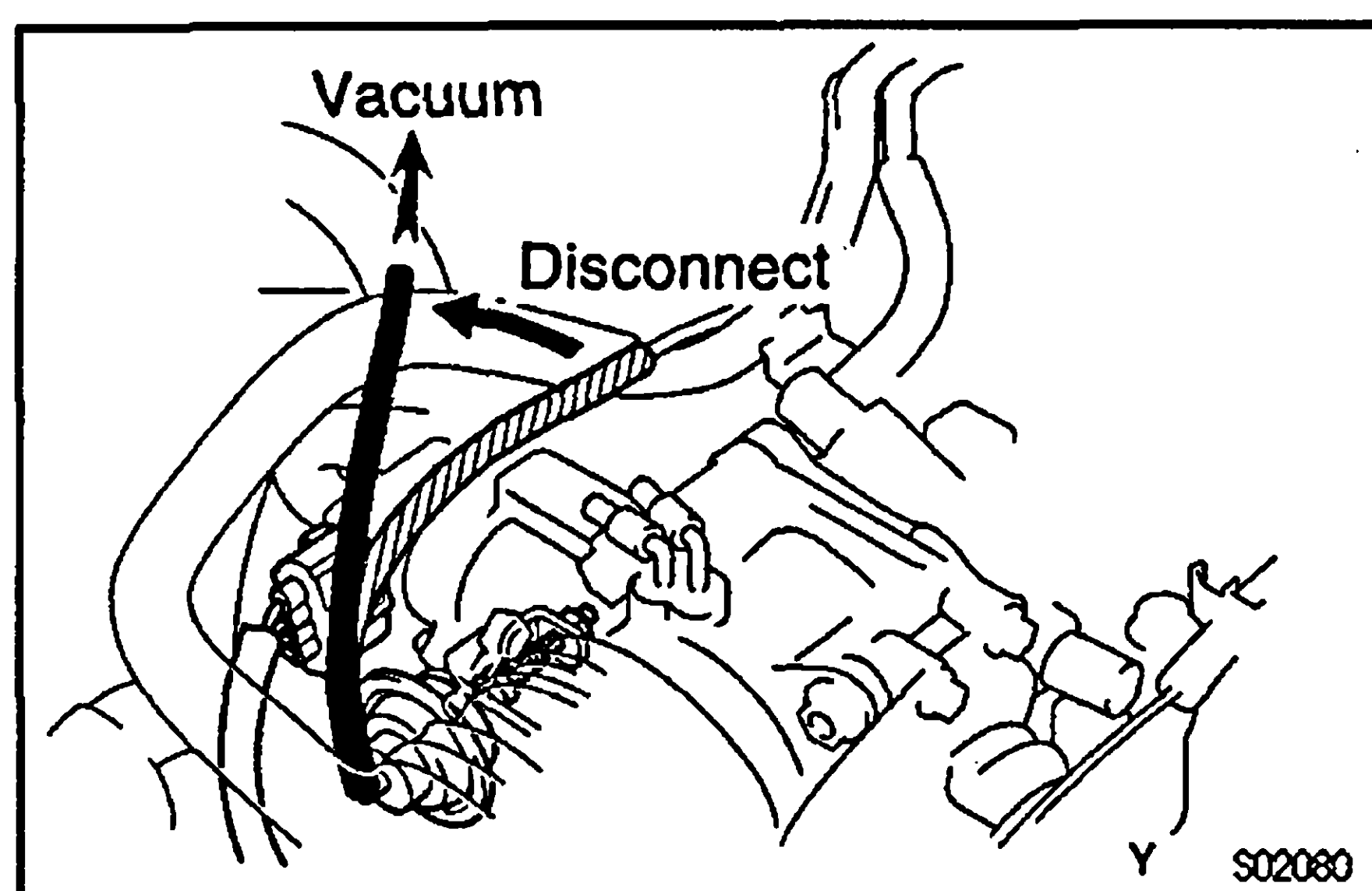


THROTTLE BODY ON-VEHICLE INSPECTION

EG7CZ-01

1. INSPECT THROTTLE BODY

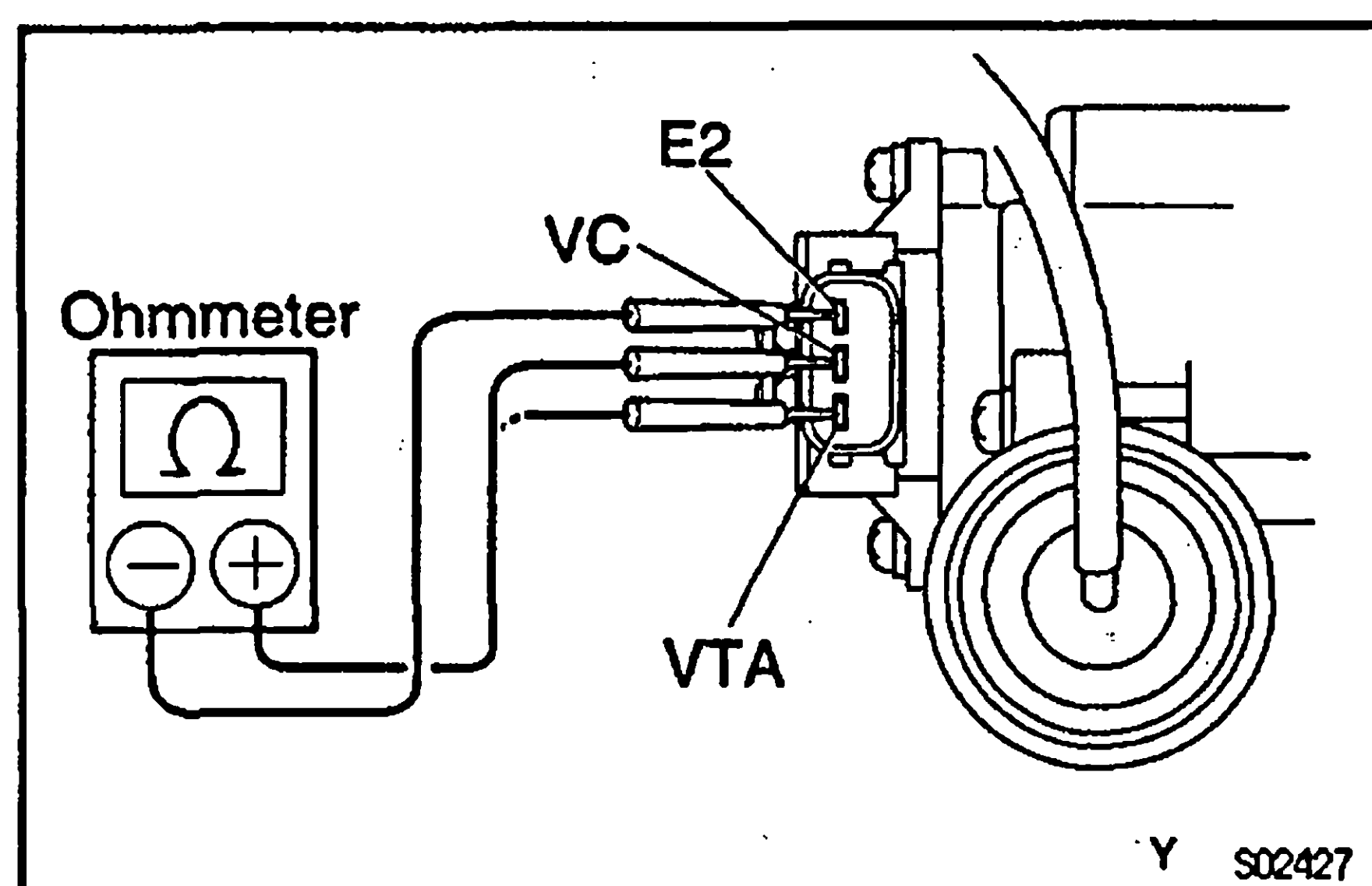
Check that the throttle linkage moves smoothly.



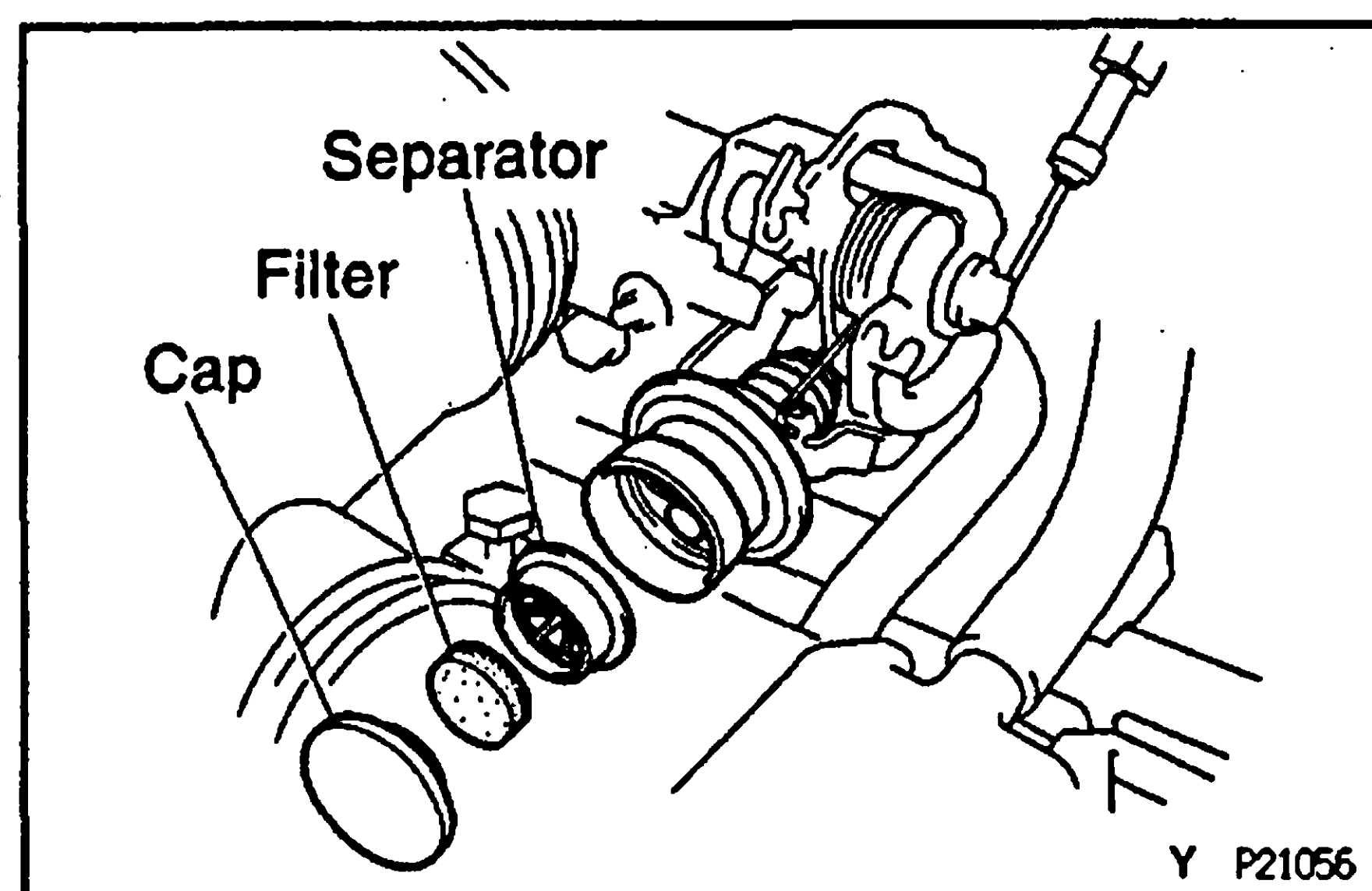
2. INSPECT THROTTLE POSITION SENSOR

- Apply vacuum to the throttle opener.
- Disconnect the sensor connector.
- Using an ohmmeter, measure the resistance between each terminal.

Throttle valve condition	Between terminals	Resistance
Fully closed	VTA — E2	0.28 — 6.4 k Ω
Fully open	VTA — E2	2.0 — 11.6 k Ω
—	VC — E2	2.7 — 7.7 k Ω



- Reconnect the sensor connector.



3. M/T:

INSPECT DASHPOT (DP)

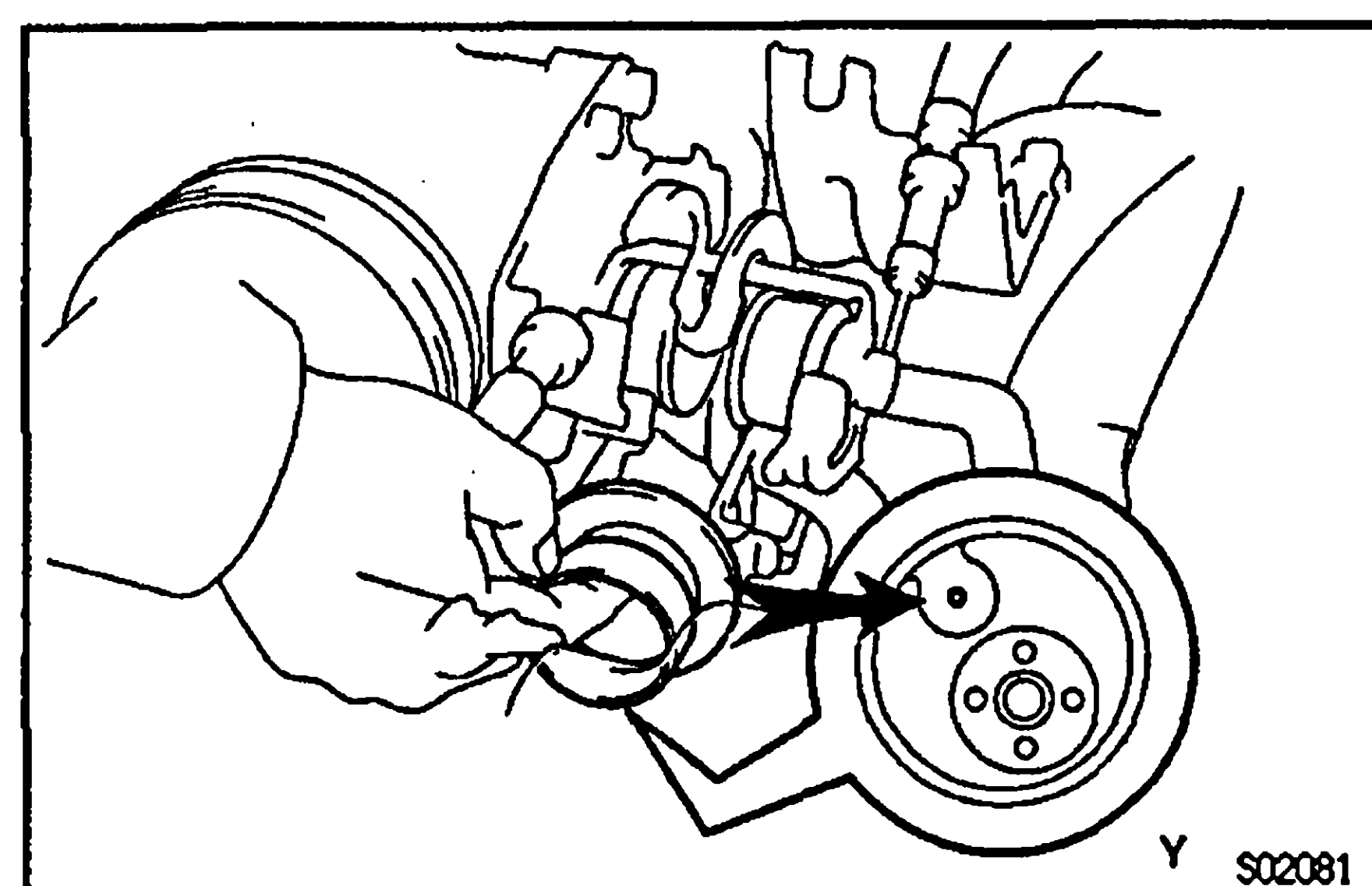
- Allow the engine to warm up to normal operating temperature.

- Check idle speed.

Idle speed:

700 ± 50 rpm

- Remove the cap, filter and separator from the DP.



- Maintain engine speed at 2,500 rpm or more.

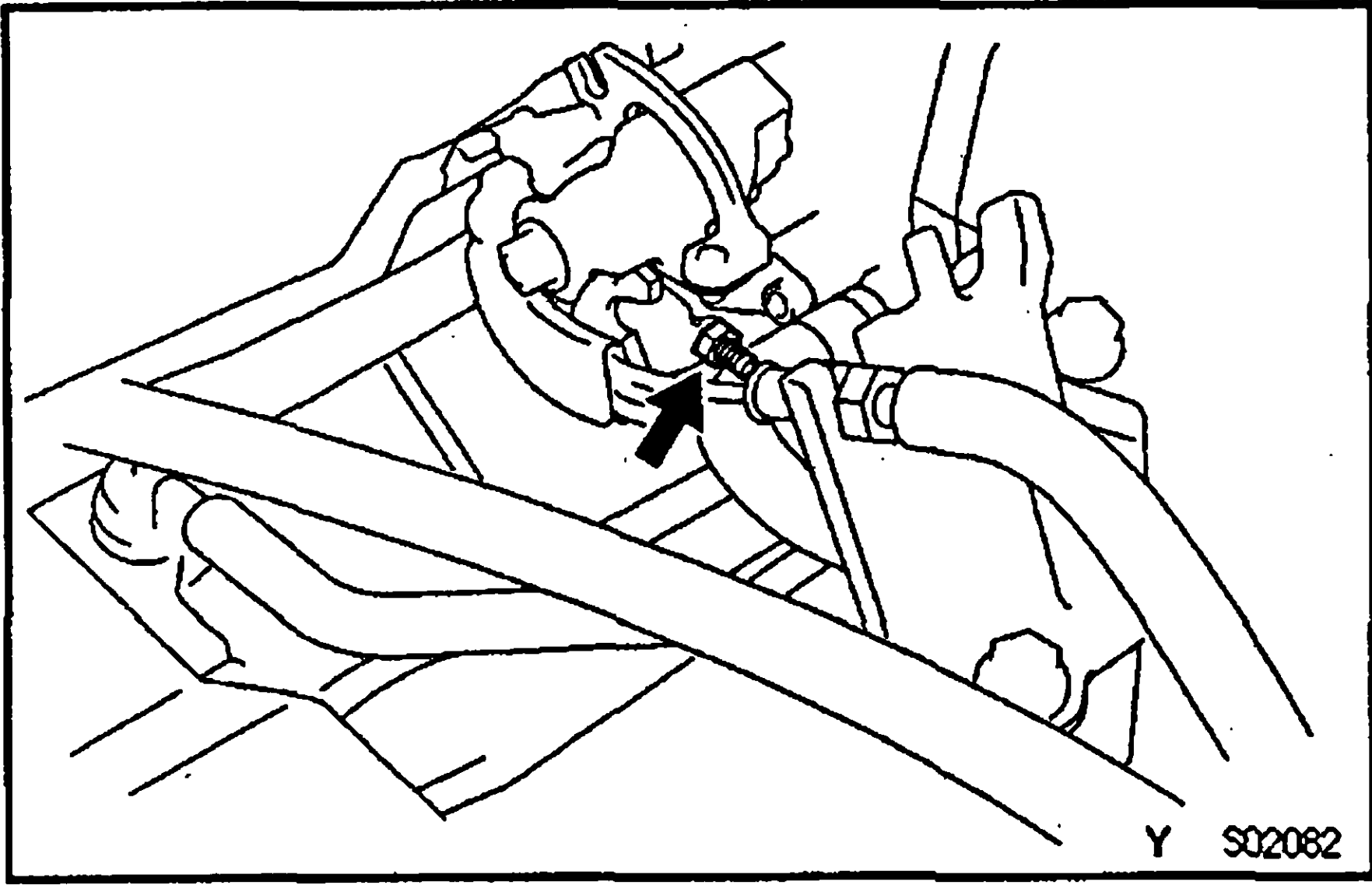
- Plug the VTV hole with your finger.

- Release the throttle valve.

- Check the DP is set.

DP setting speed:

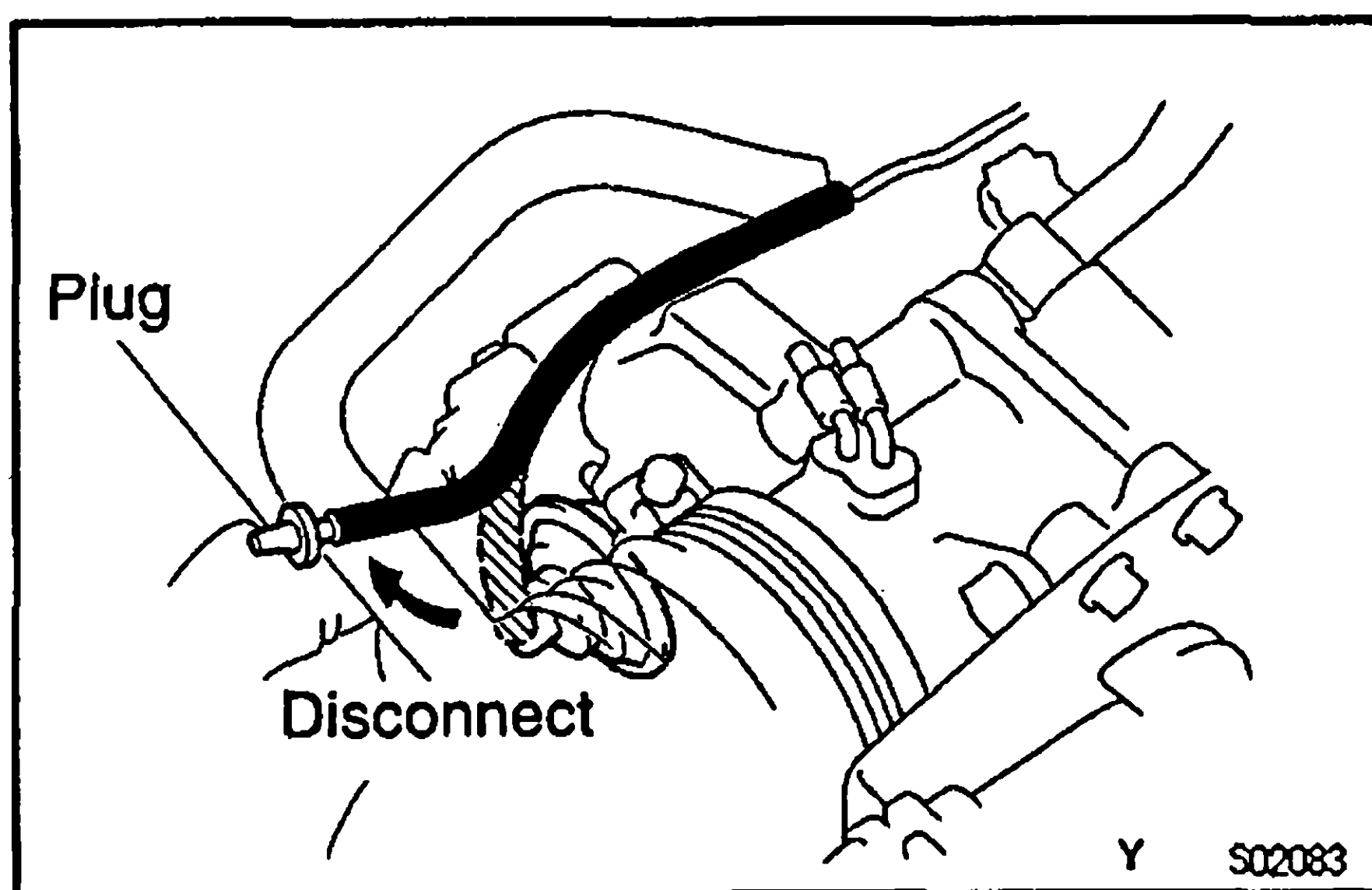
1,800 — 2,200 rpm



- (h) If the setting speed is not as specified, adjust it with the DP adjusting screw.
- (i) Remove your finger from the hole and check that the engine returns to idle speed in approx. 1 second.
- (j) Reinstall DP separator, filter and cap.
HINT: Install the filter with the coarser surface facing the atmospheric side (outward).

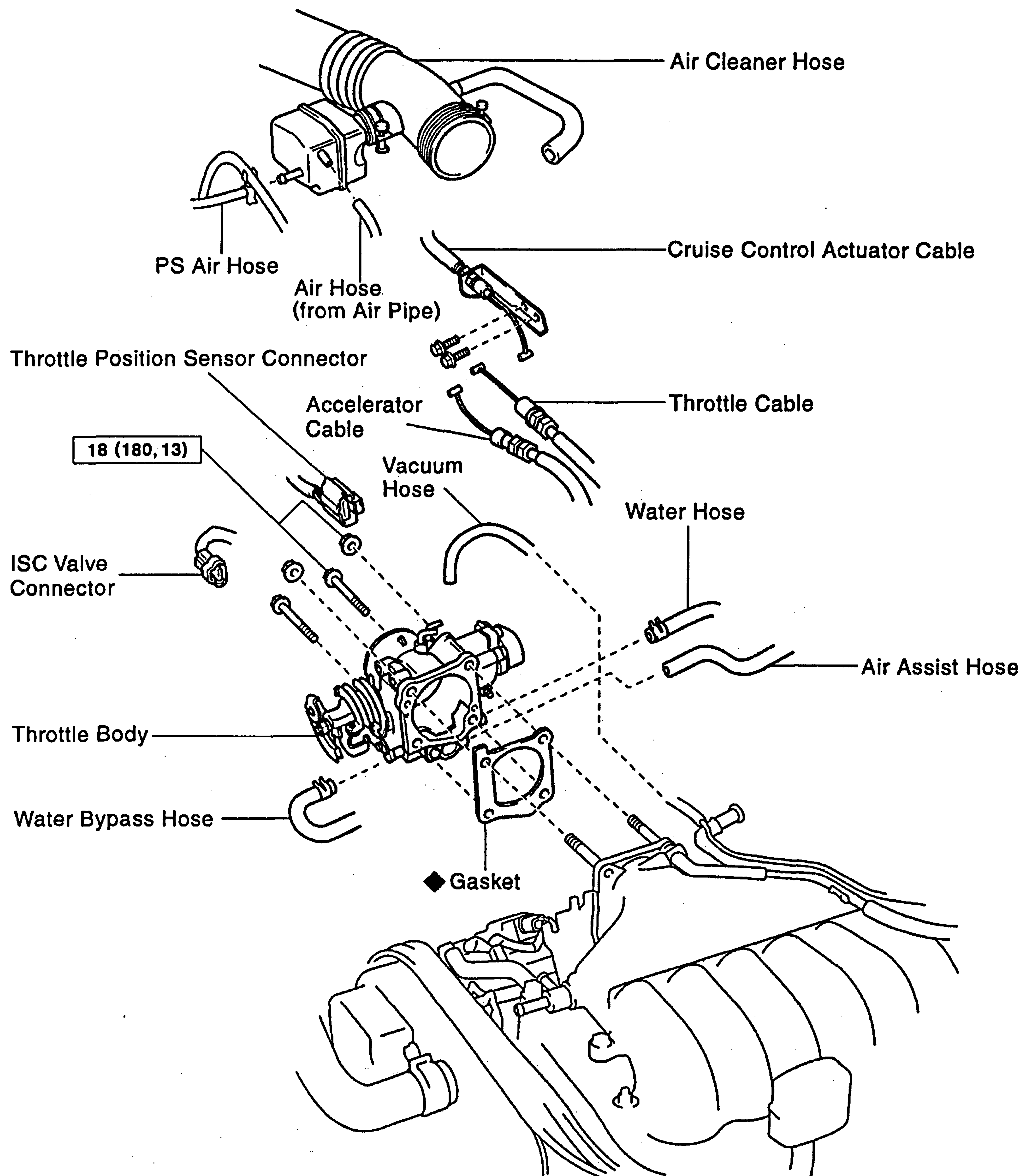
4. INSPECT THROTTLE OPENER

- (a) Allow the engine to warm up to normal operating temperature.
- (b) Check idle speed.
Idle speed:
 700 ± 50 rpm



- (c) Disconnect the vacuum hose from the throttle opener, and plug the hose end.
- (d) Check the throttle opener setting speed.
Throttle opener setting speed:
 $900 - 1,950$ rpm
If the throttle opener setting is not as specified, replace the throttle body.
- (e) Stop the engine.
- (f) Reconnect the vacuum hose to the throttle opener.
- (g) Start the engine and check that the idle speed returns to the correct speed.

COMPONENTS FOR REMOVAL AND INSTALLATION



S02101

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

◆ Non-reusable part

S05104

THROTTLE BODY REMOVAL

1. DRAIN ENGINE COOLANT

2. DISCONNECT CABLES

Disconnect these cables

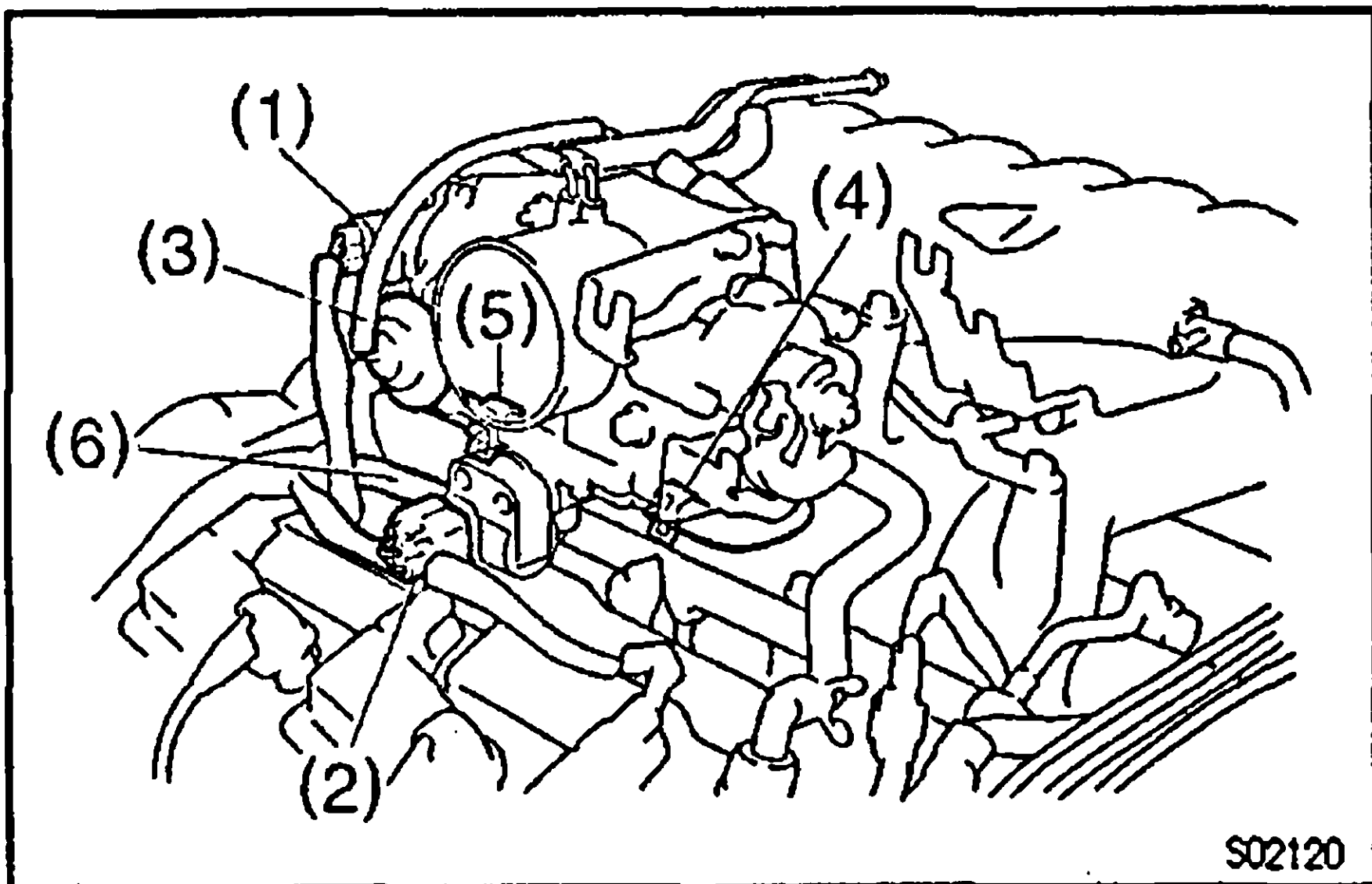
- (1) w/ Cruise control:
Cruise control actuator cable
- (2) Accelerator cable
- (3) A/T:
Throttle cable

3. REMOVE AIR CLEANER HOSE

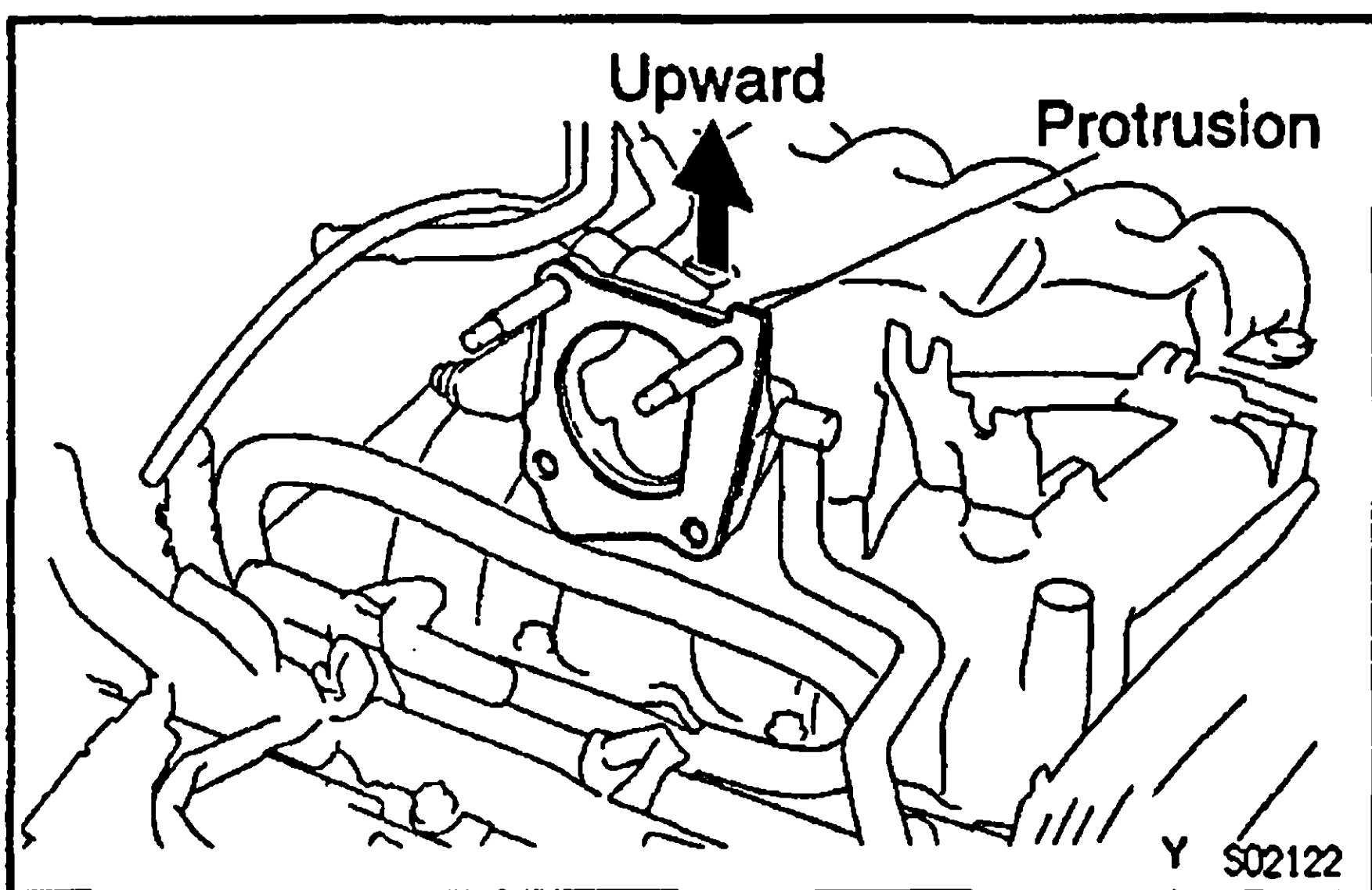
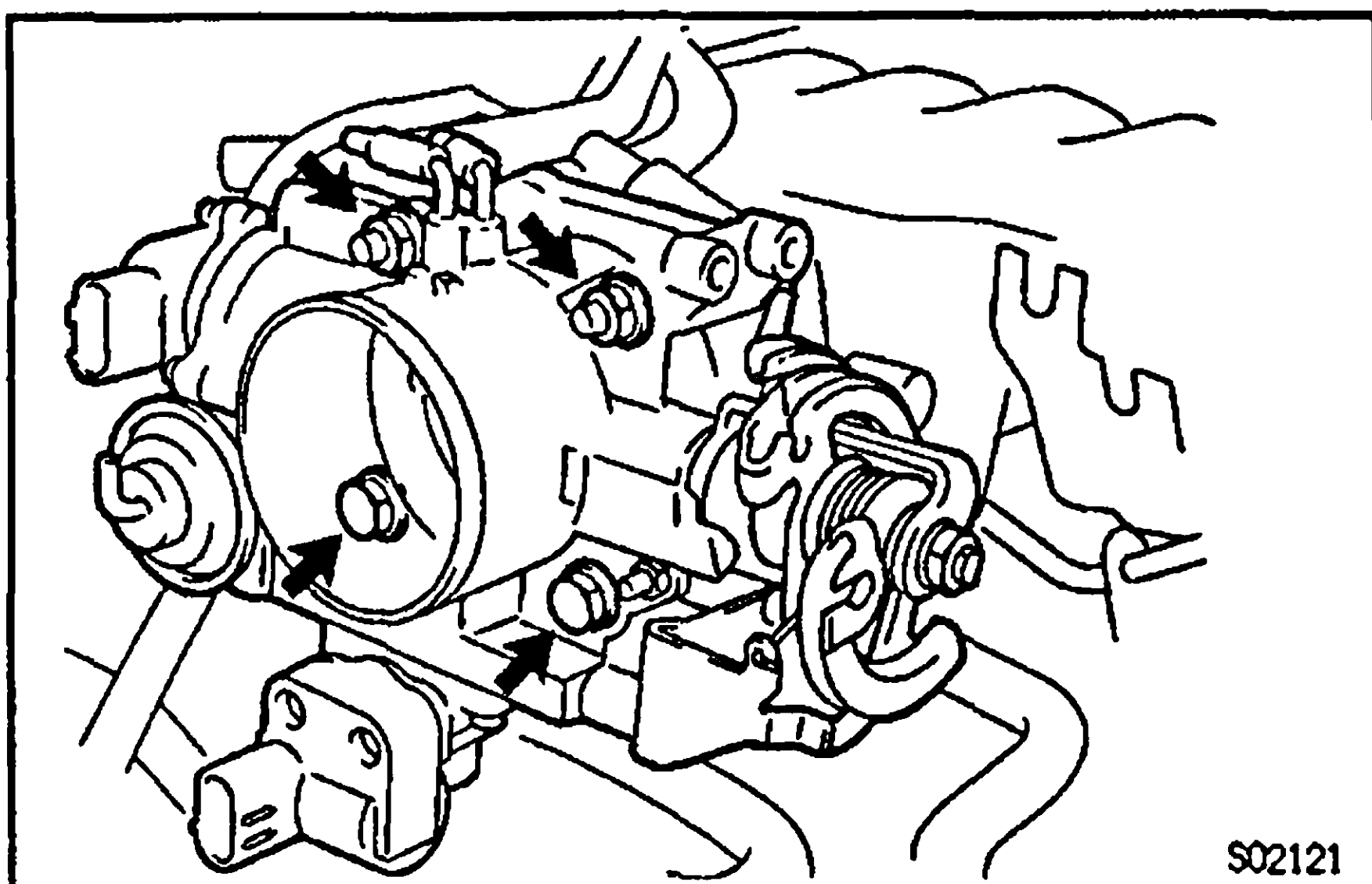
4. REMOVE THROTTLE BODY

(a) Disconnect these hoses and connectors:

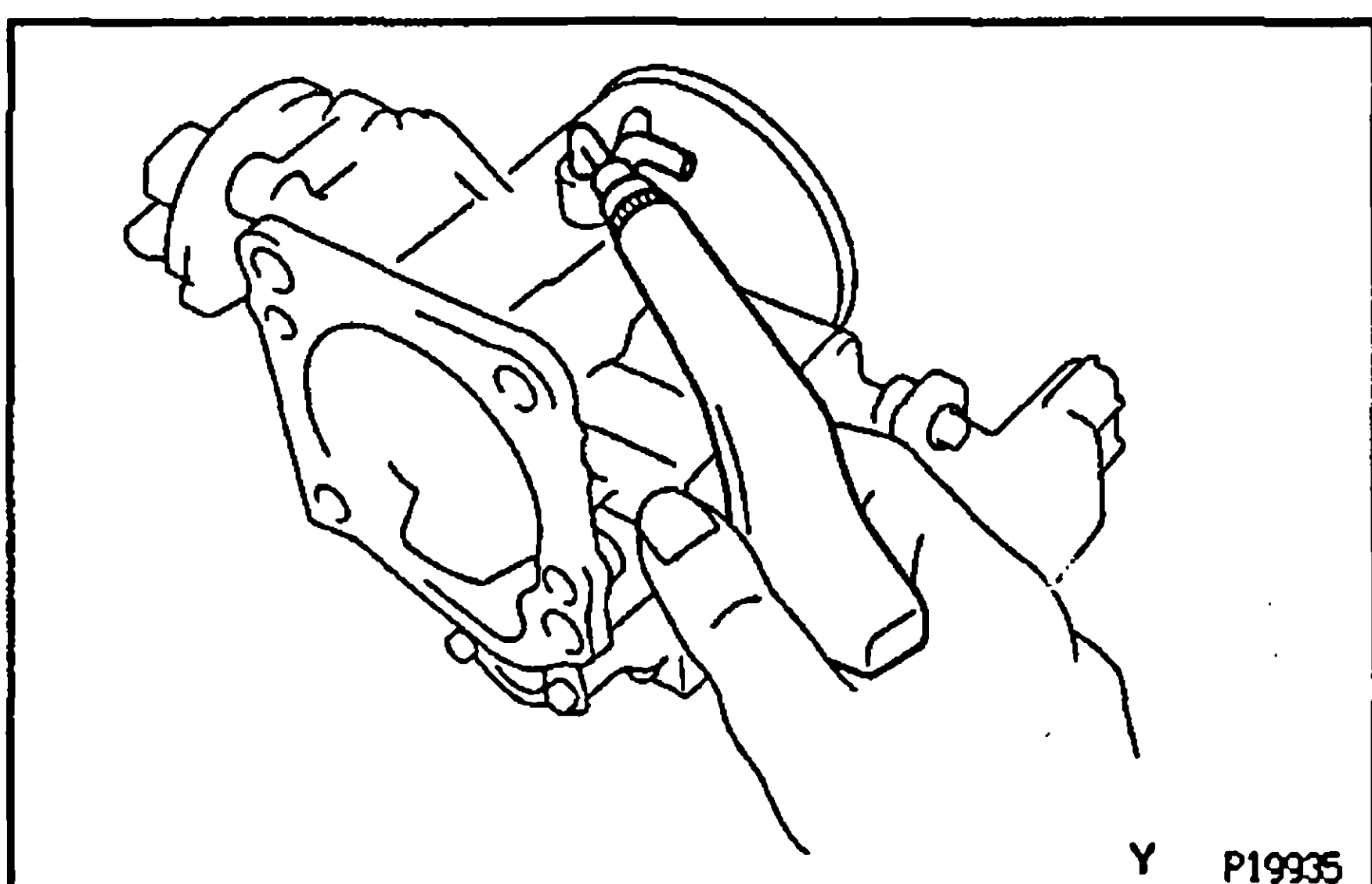
- (1) Throttle position sensor connector
- (2) ISC valve connector
- (3) Vacuum hose of throttle opener
- (4) Water bypass hose (from water bypass pipe)
- (5) Water hose (from intake manifold)
- (6) Air assist hose



- #### (b) Remove the 2 bolts, 2 nuts, throttle body and gasket. Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)



INSTALLATION HINT: Place a new gasket on the air intake chamber facing the protrusion upward.

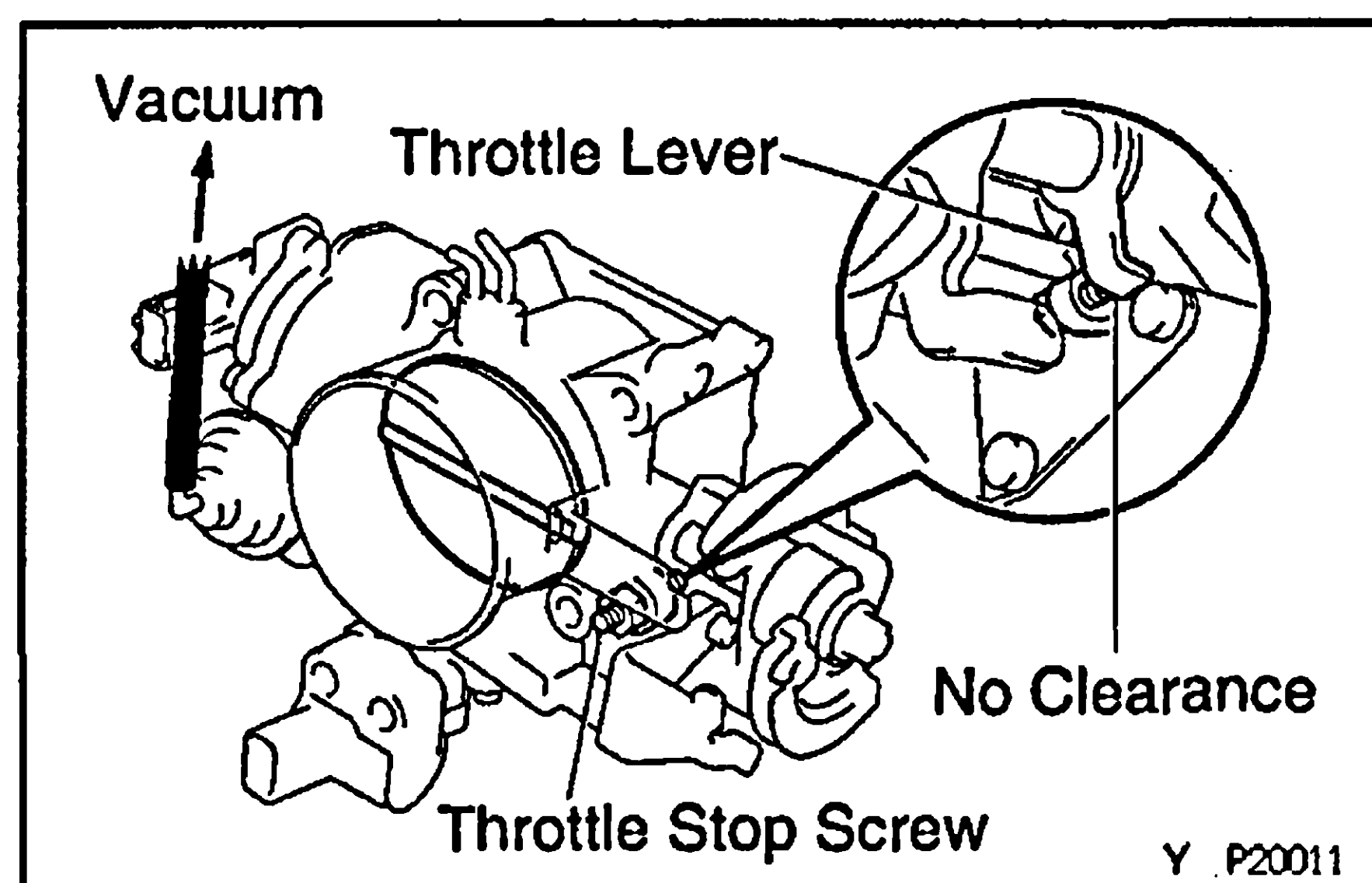


THROTTLE BODY INSPECTION

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.

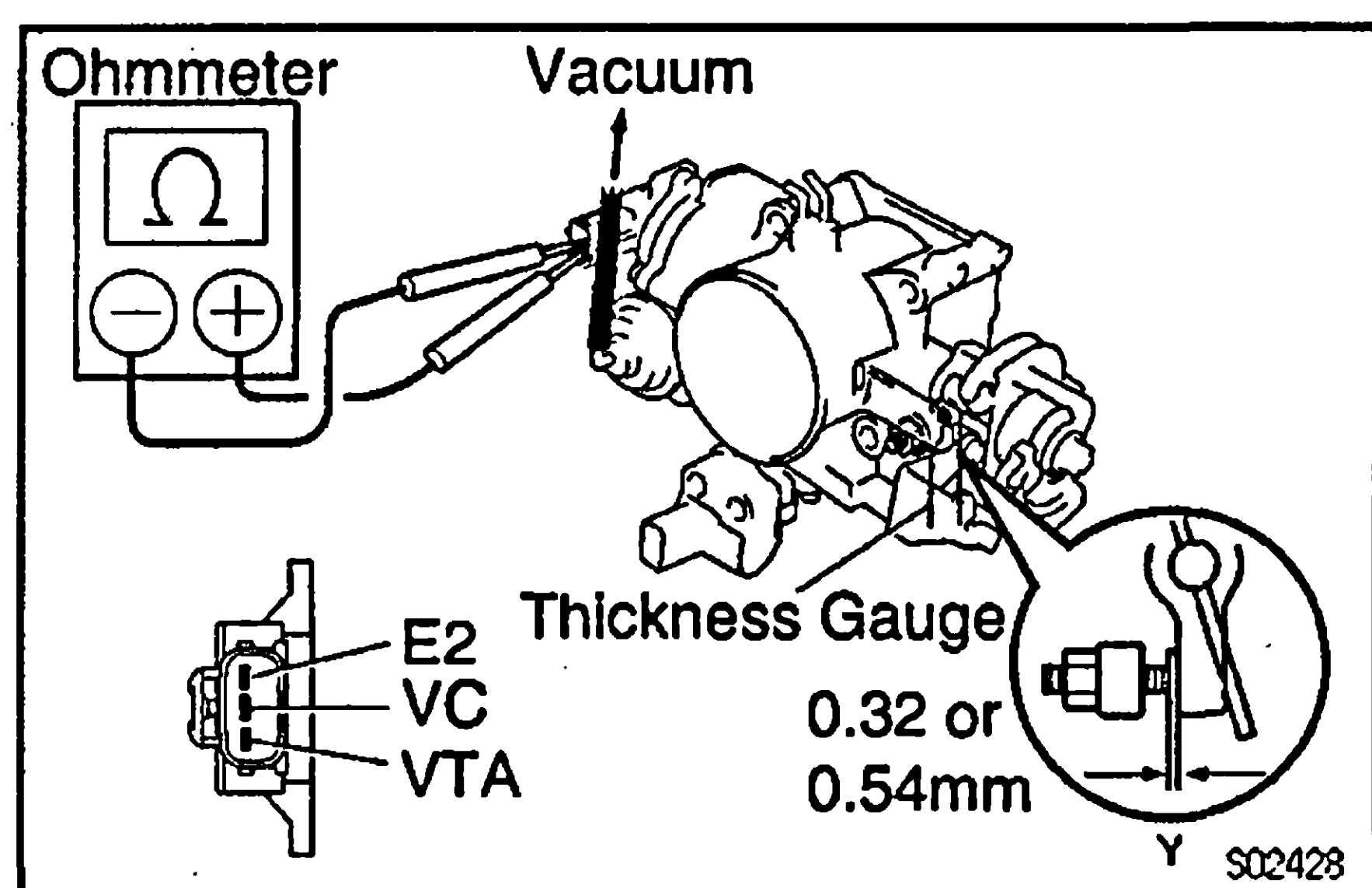
NOTICE: To prevent deterioration, do not clean the throttle position sensor and ISC valve.



2. INSPECT THROTTLE VALVE

- Apply vacuum to the throttle opener.
- Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.

Throttle valve fully closed angle: 10°



3. INSPECT THROTTLE POSITION SENSOR

- Apply vacuum to the throttle opener.
- Insert a thickness gauge between the throttle stop screw and stop lever.
- Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA — E2	0.28 — 6.4 kΩ
Throttle valve fully open	VTA — E2	2.0 — 11.6 kΩ
—	VC — E2	2.7 — 7.7 kΩ

THROTTLE BODY INSTALLATION

E048N-03

Installation is in the reverse order removal.

ISC VALVE ON—VEHICLE INSPECTION

E07D2-01

1. INSPECT ISC VALVE OPERATION

(a) Initial conditions:

- Engine at normal operating temperature
- Idle speed checked correctly
- Transmission in neutral position
- A/C switch OFF

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

SST 09843-18020

(c) After engine speed is kept at approx. 1,000 rpm for 5 seconds, check that it returns to idle speed.

If the engine speed operation is not as specified, check the ISC valve, wiring and ECU.

(d) Remove the SST from the check connector.

SST 09843-18020

2. 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).

(a) Disconnect the ISC valve connector.

(b) Using an ohmmeter, measure the resistance between terminal +B and other terminals (RSC, RSO).

Resistance:

Cold: $17.0 - 24.5 \Omega$ Hot: $21.5 - 28.5 \Omega$

If resistance is not as specified, replace the ISC valve.

(c) Reconnect the ISC valve connector.

3. INSPECT AIR ASSIST SYSTEM

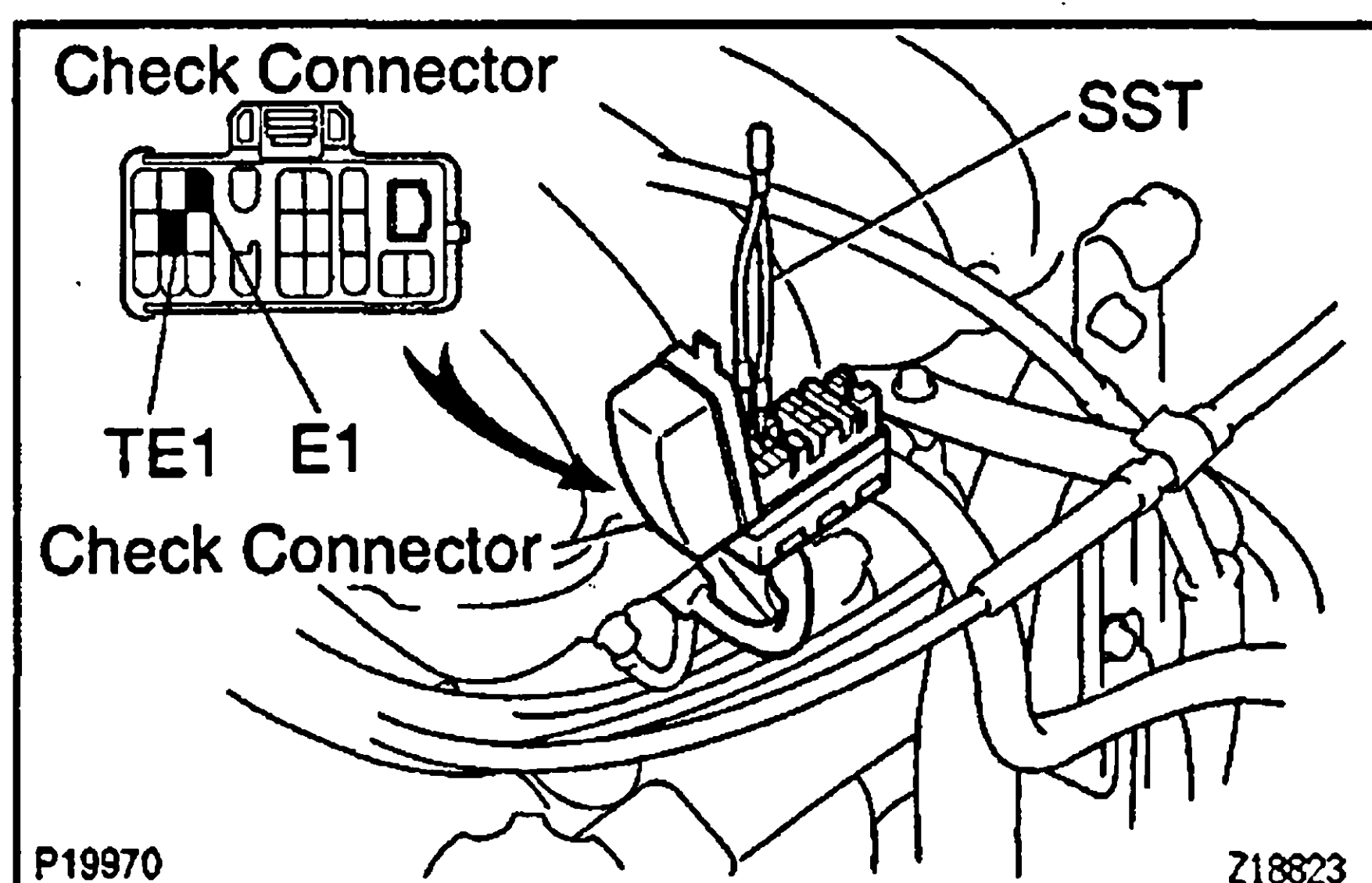
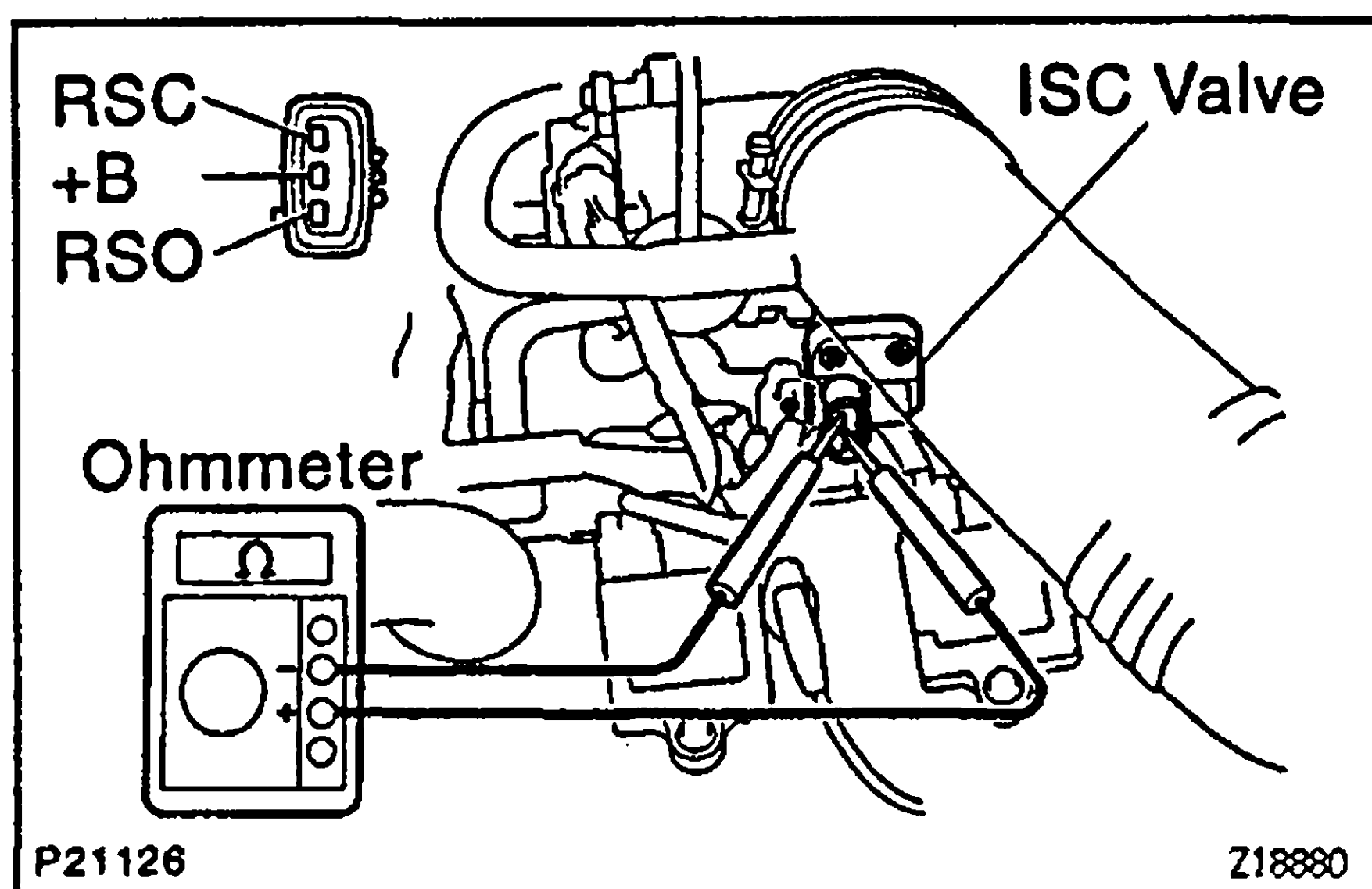
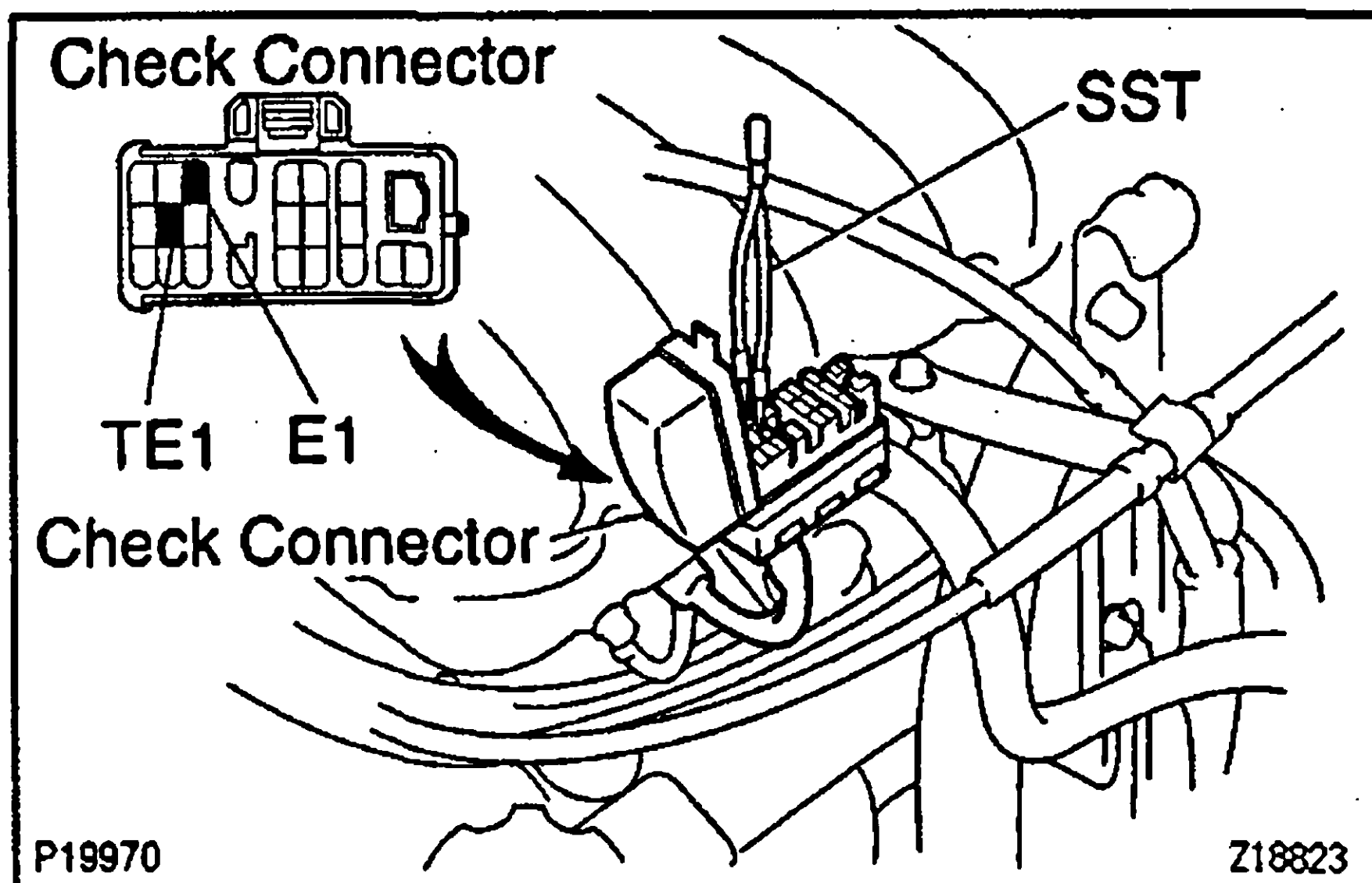
(a) Initial conditions:

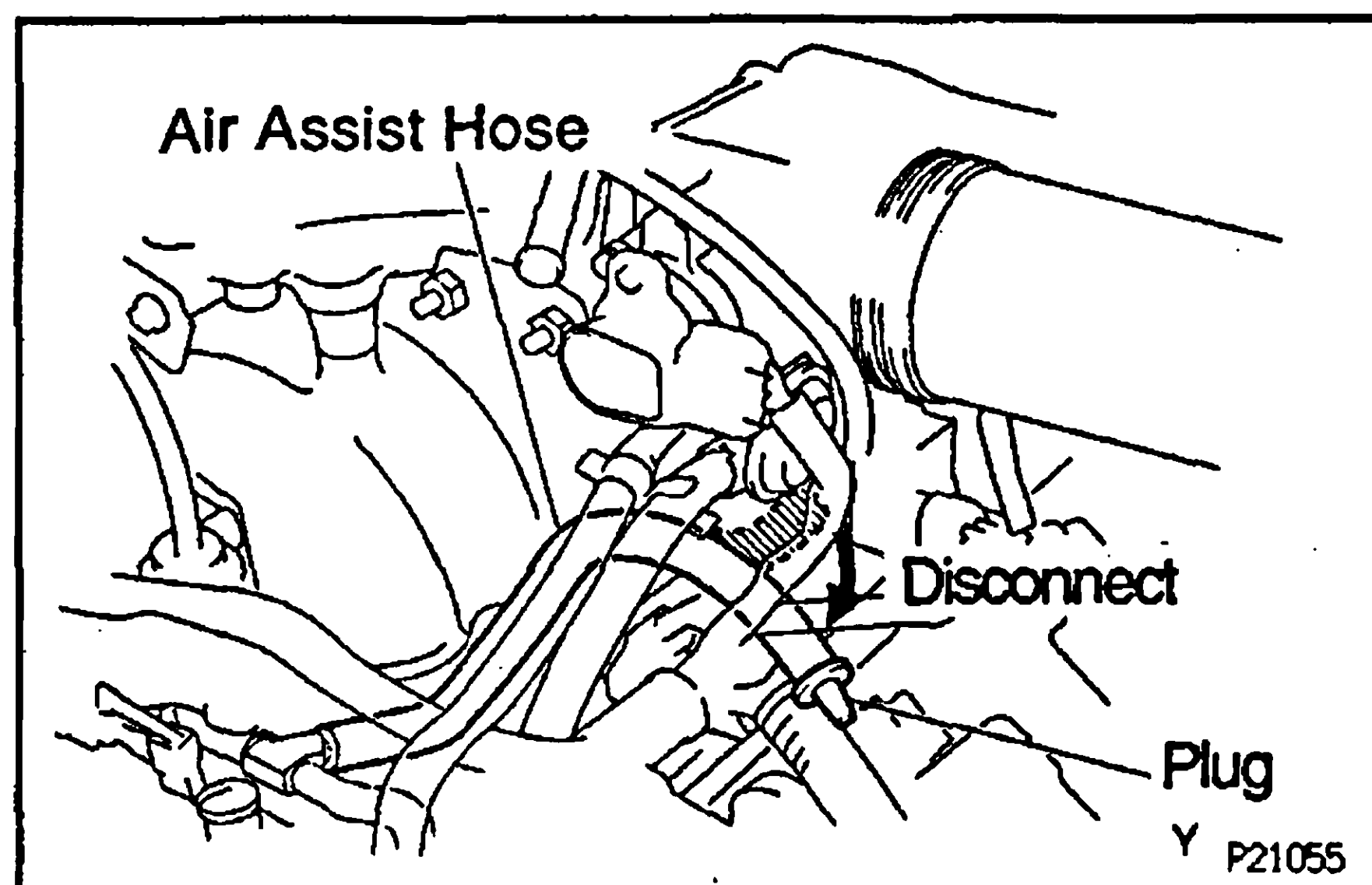
- Engine at normal operating temperature
- Idle speed checked correctly
- Transmission in neutral position
- A/C switch OFF

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

SST 09843-18020

(c) After engine speed is kept at 900 — 1,300 rpm for 10 seconds, check that it returns to idle speed.



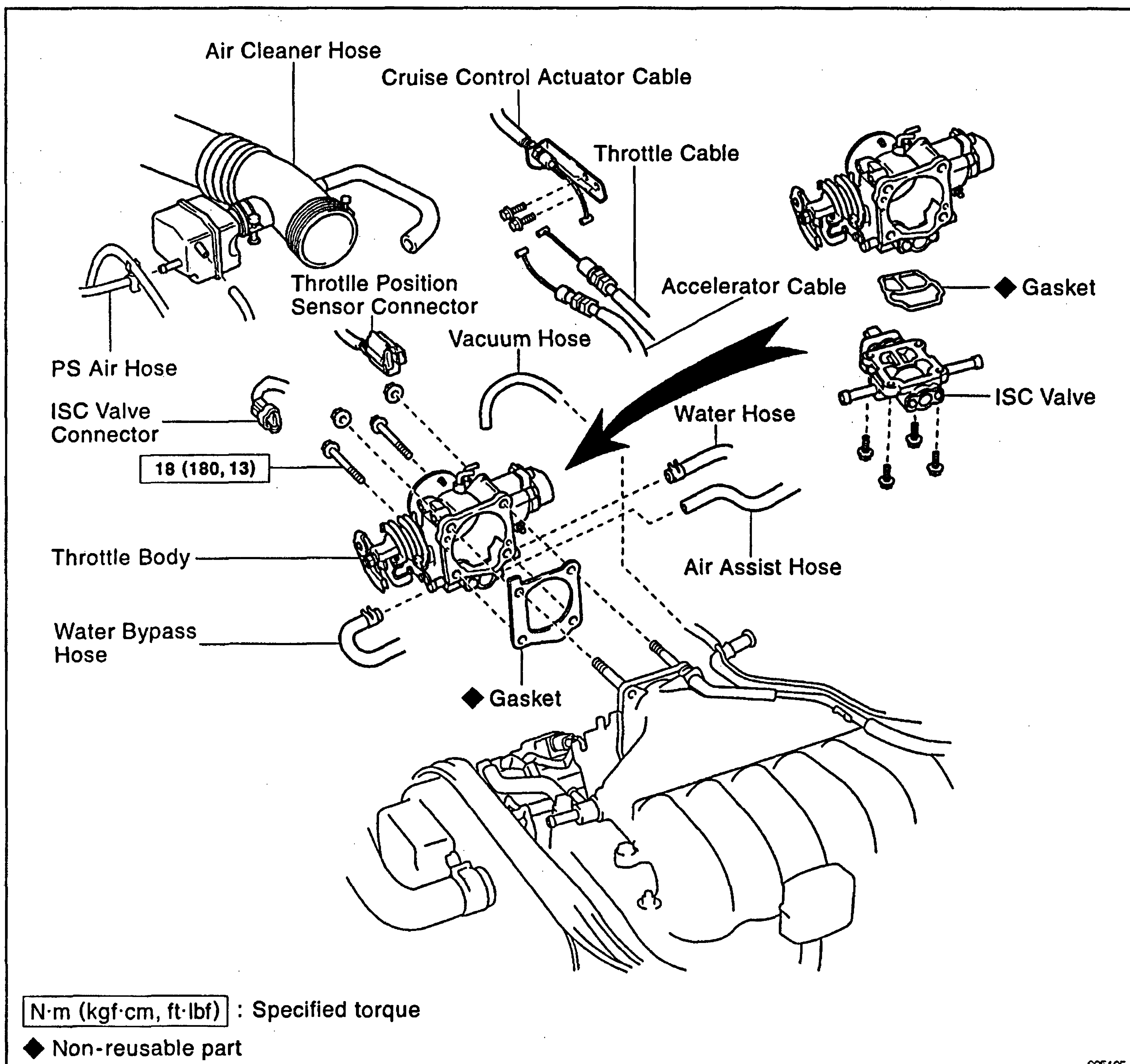


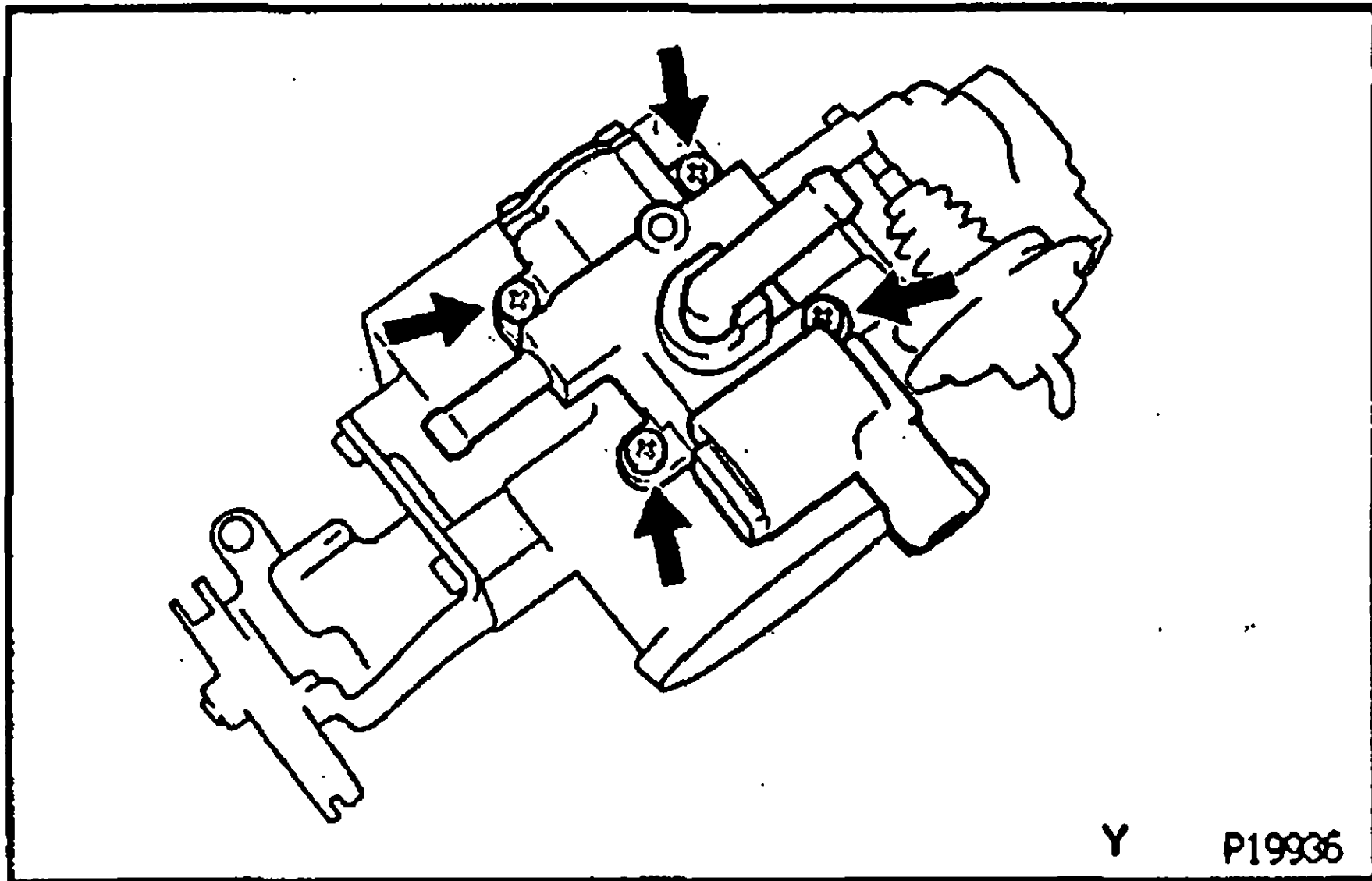
- (d) Stop the engine.
- (e) Disconnect the air assist hose from the ISC valve, and plug it.
- (f) Start the engine and check that the idle speed reaches 500 rpm or below (the engine may stall).
If the idle does not reach 500 rpm or below, check for a leak between the air assist hoses, pipe and injectors.
- (g) Remove the SST from the check connector.
SST 09843-18020
- (h) Reconnect the air assist hose to the ISC valve.

EG

EG13A-1D

COMPONENTS FOR REMOVAL AND INSTALLATION



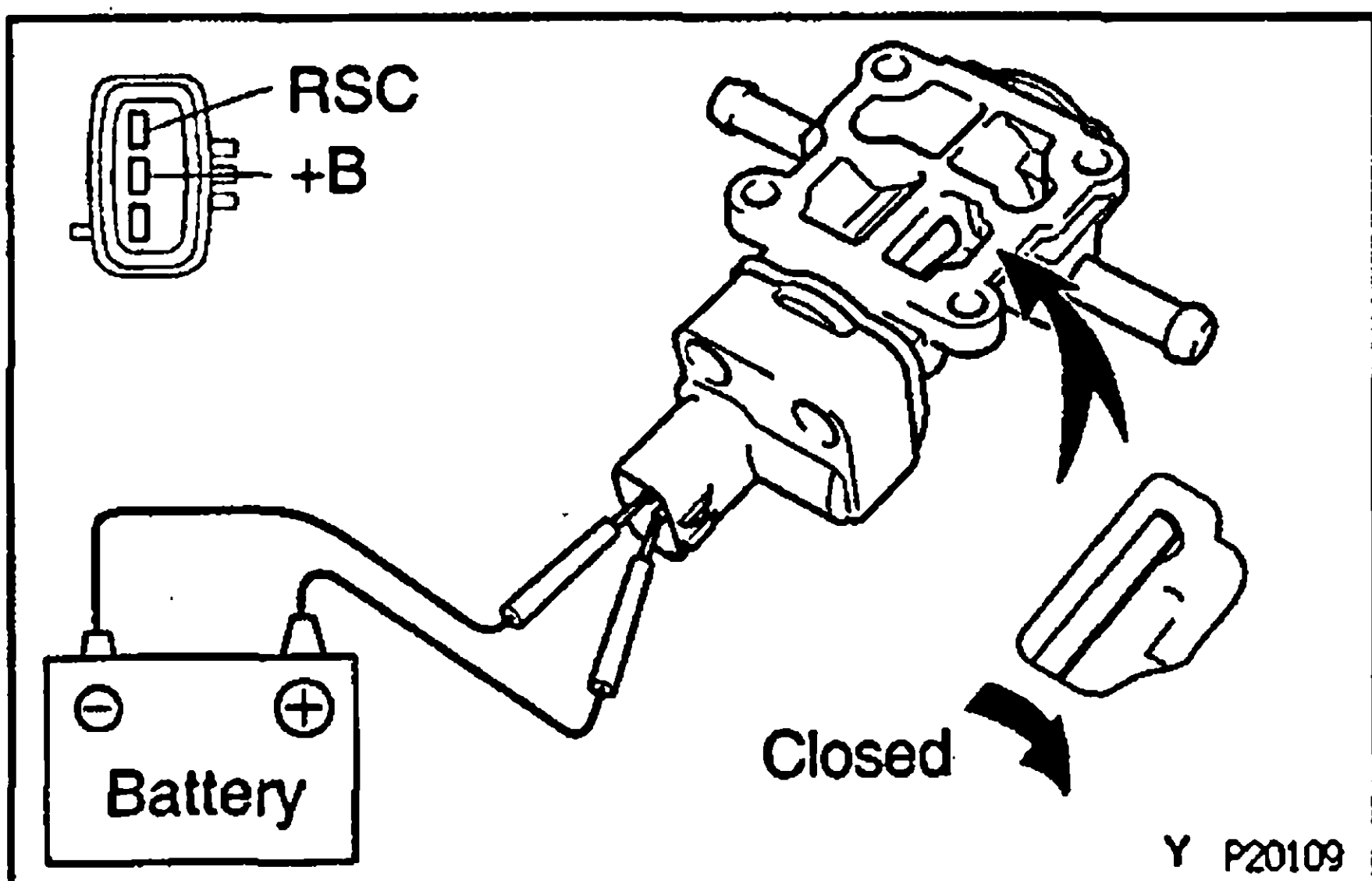


ISC VALVE REMOVAL

1. REMOVE THROTTLE BODY
(See throttle body removal)
2. REMOVE ISC VALVE

Remove the 4 screws, ISC valve and gasket.

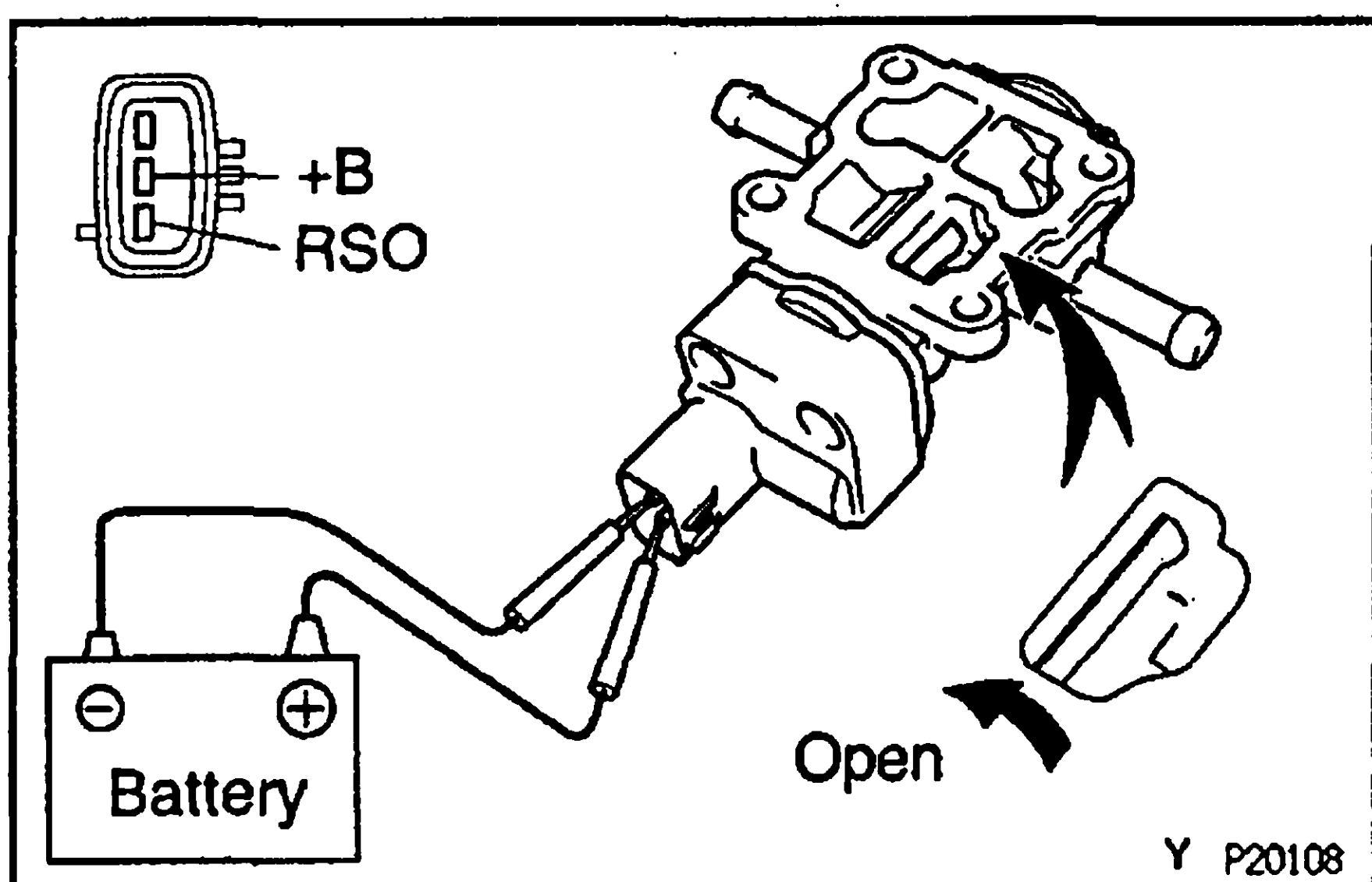
INSTALLATION HINT: Place a new gasket on the throttle body.



ISC VALVE INSPECTION

INSPECT ISC VALVE OPERATION

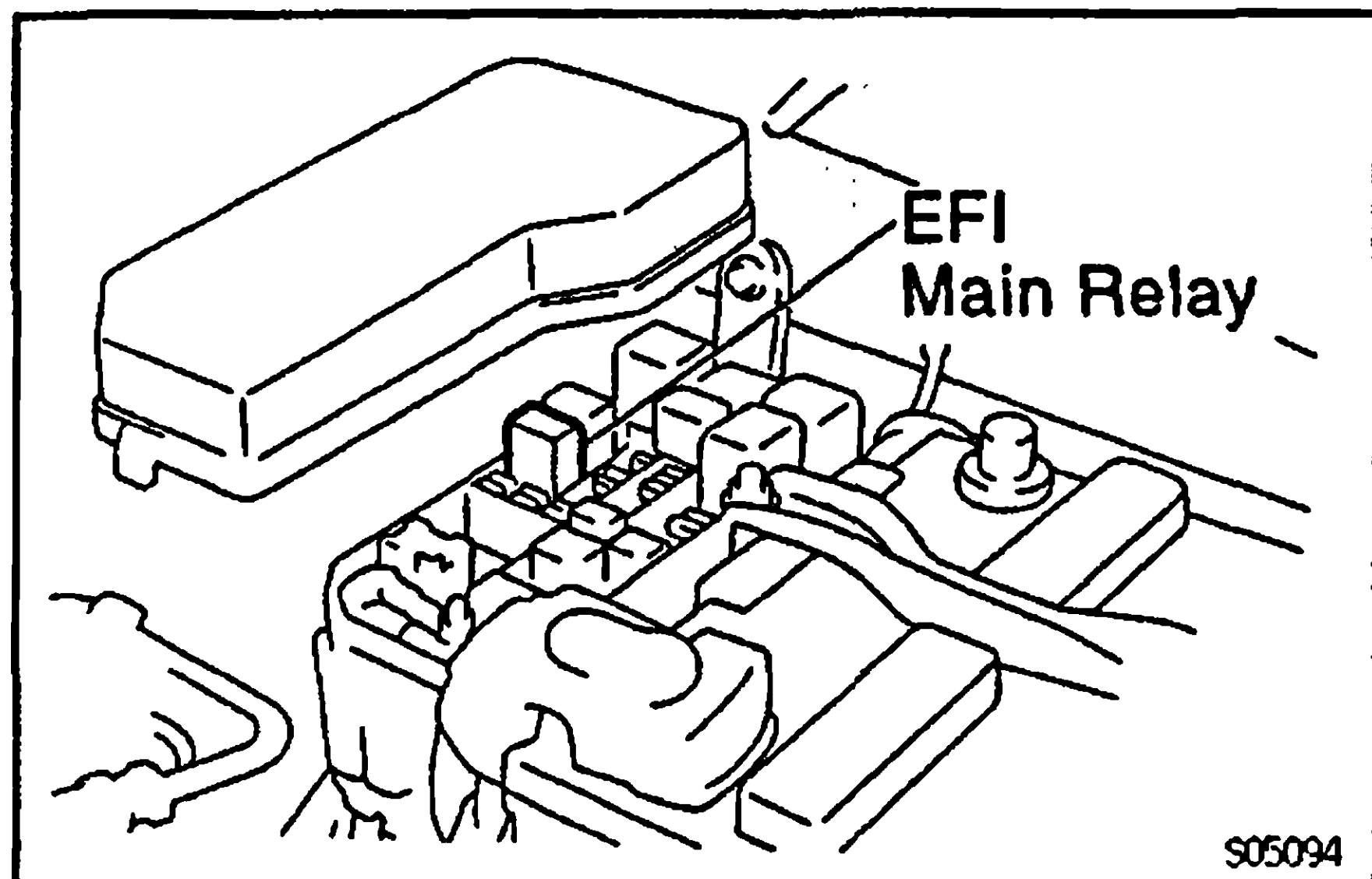
- (a) Connect the positive (+) lead from the battery to terminal +B and the negative (−) lead to terminal RSC, and check that the valve is closed.



- (b) Connect the positive (+) lead from the battery to terminal +B and negative (−) lead to terminal RSO, and check that the valve is open.
If operation is not as specified, replace the ISC valve.

ISC VALVE INSTALLATION

Installation is in the reverse order removal.



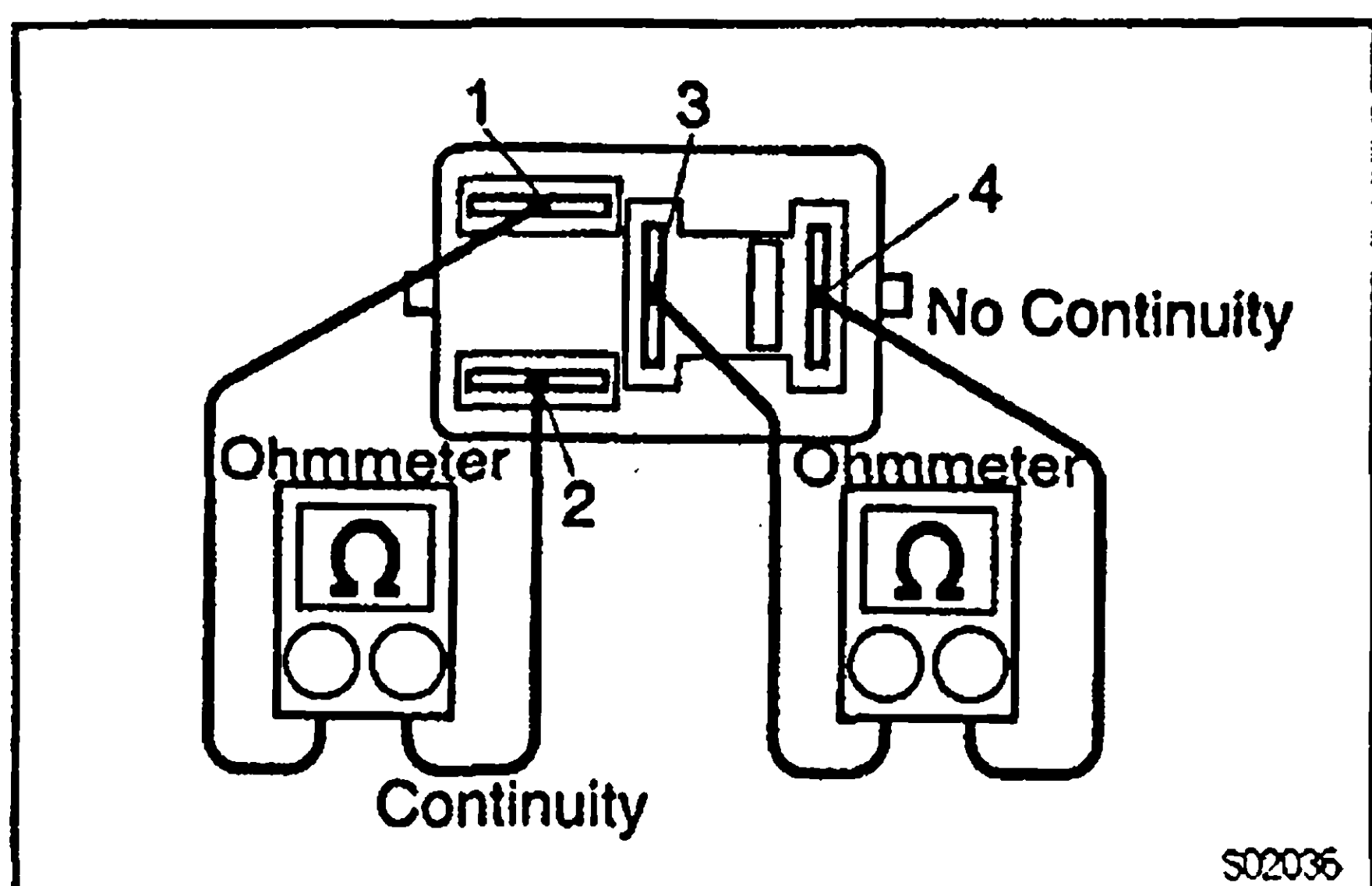
EFI MAIN RELAY

EFI MAIN RELAY (Marking: EFI)

INSPECTION

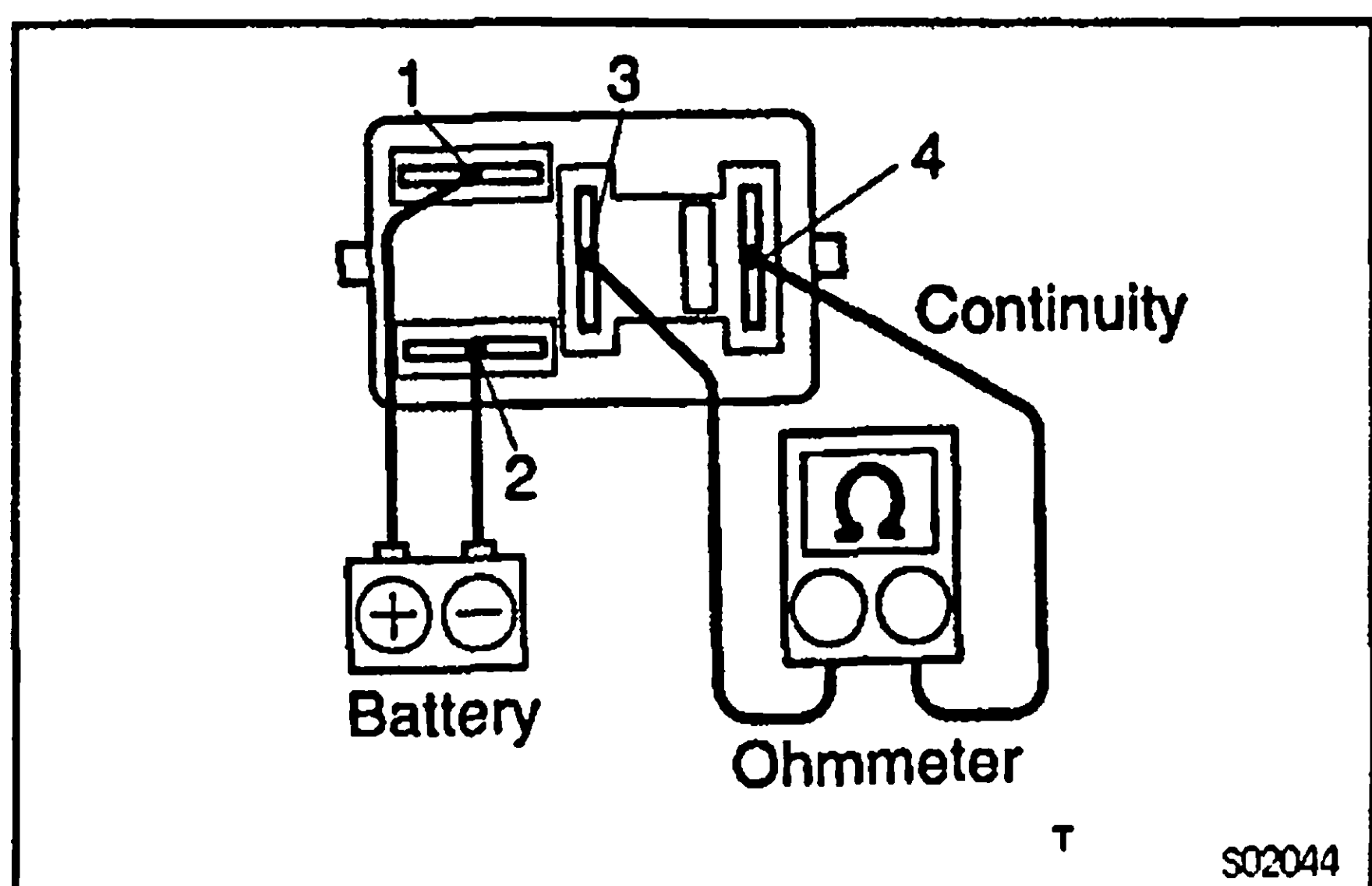
1. REMOVE EFI MAIN RELAY

LOCATION: In the engine compartment relay box.



2. INSPECT EFI MAIN RELAY CONTINUITY

- Using an ohmmeter, check that there is continuity between terminals 1 and 2.
If there is no continuity, replace the relay.
- Check that there is no continuity between terminals 3 and 4.
If there is continuity, replace the relay.



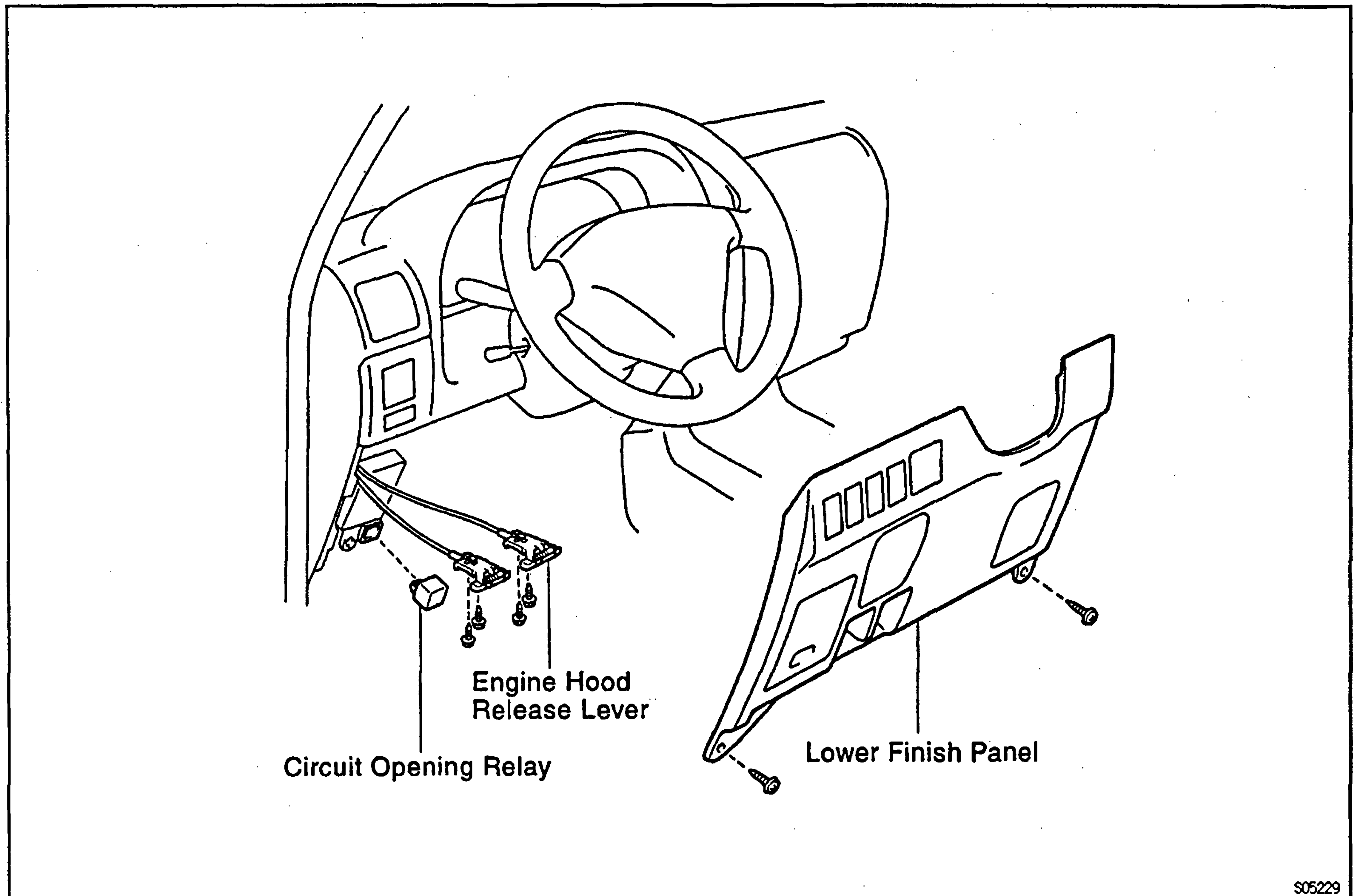
3. INSPECT EFI MAIN RELAY OPERATION

- Apply battery positive voltage across terminals 1 and 2.
- Using an ohmmeter, check that there is continuity between terminals 3 and 4.
If operation is not as specified, replace the relay.

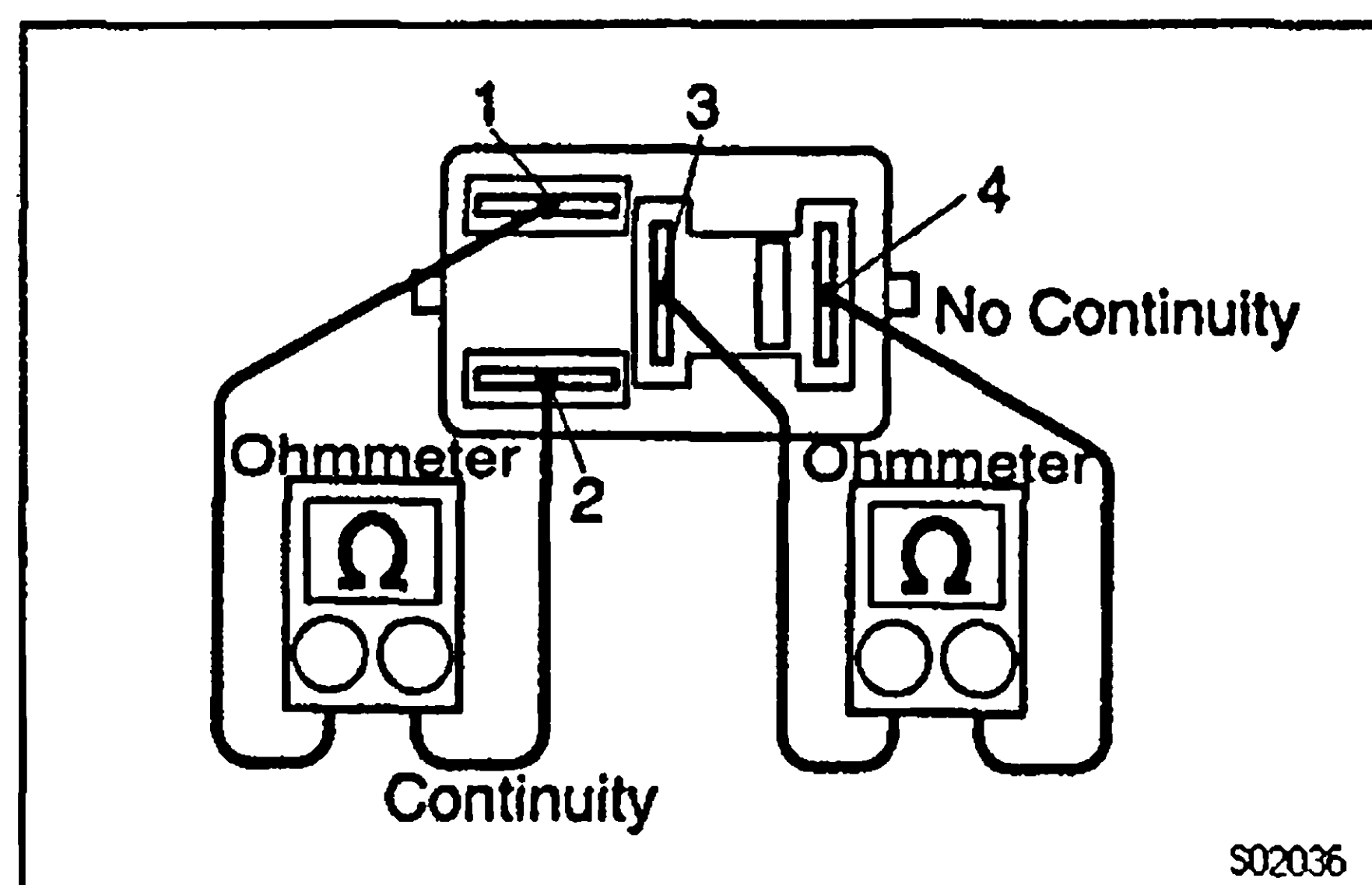
4. REINSTALL EFI MAIN RELAY

CIRCUIT OPENING RELAY COMPONENTS FOR REMOVAL AND INSTALLATION

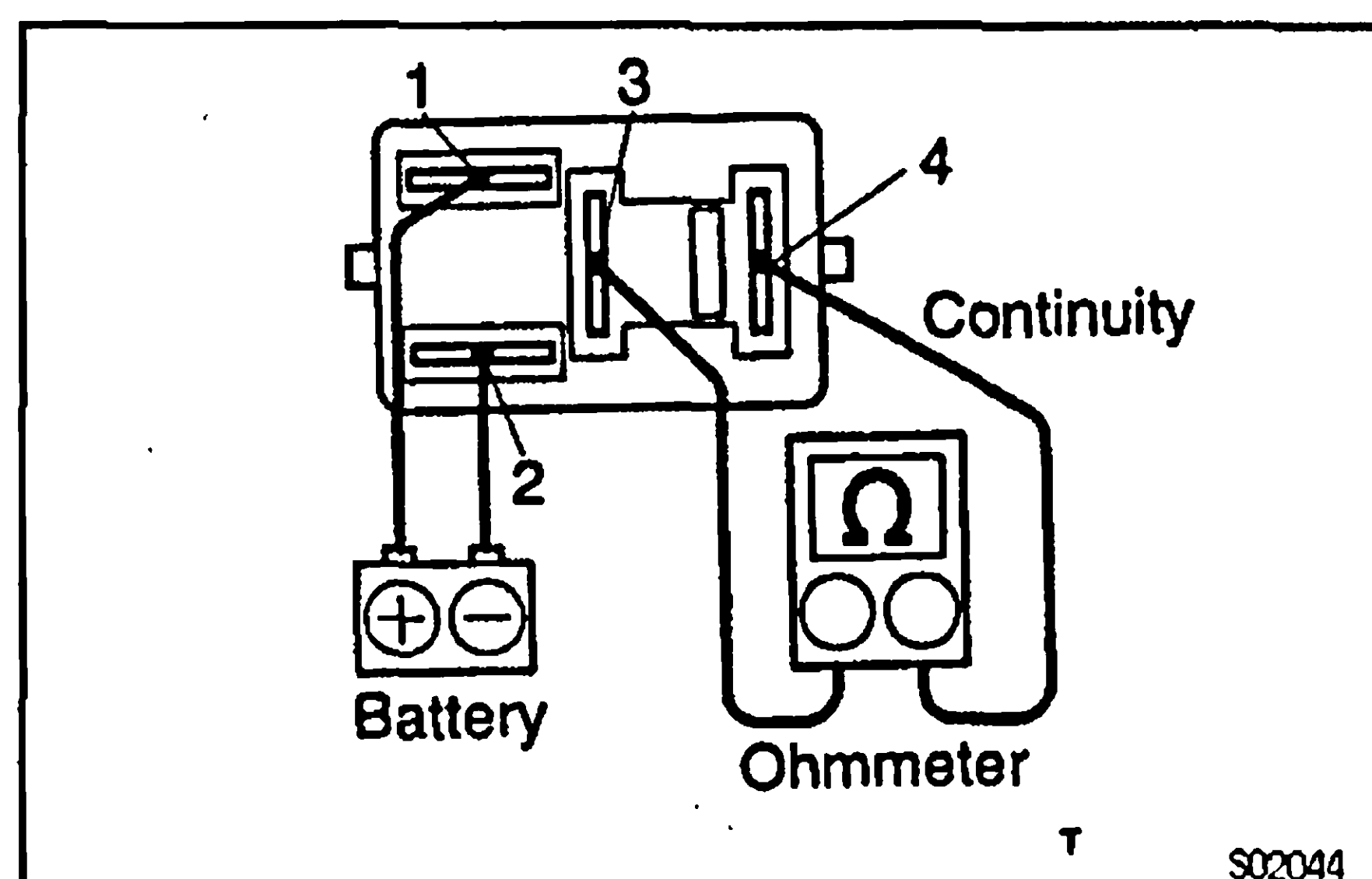
EG04M-OL



S05229



S02036



S02044

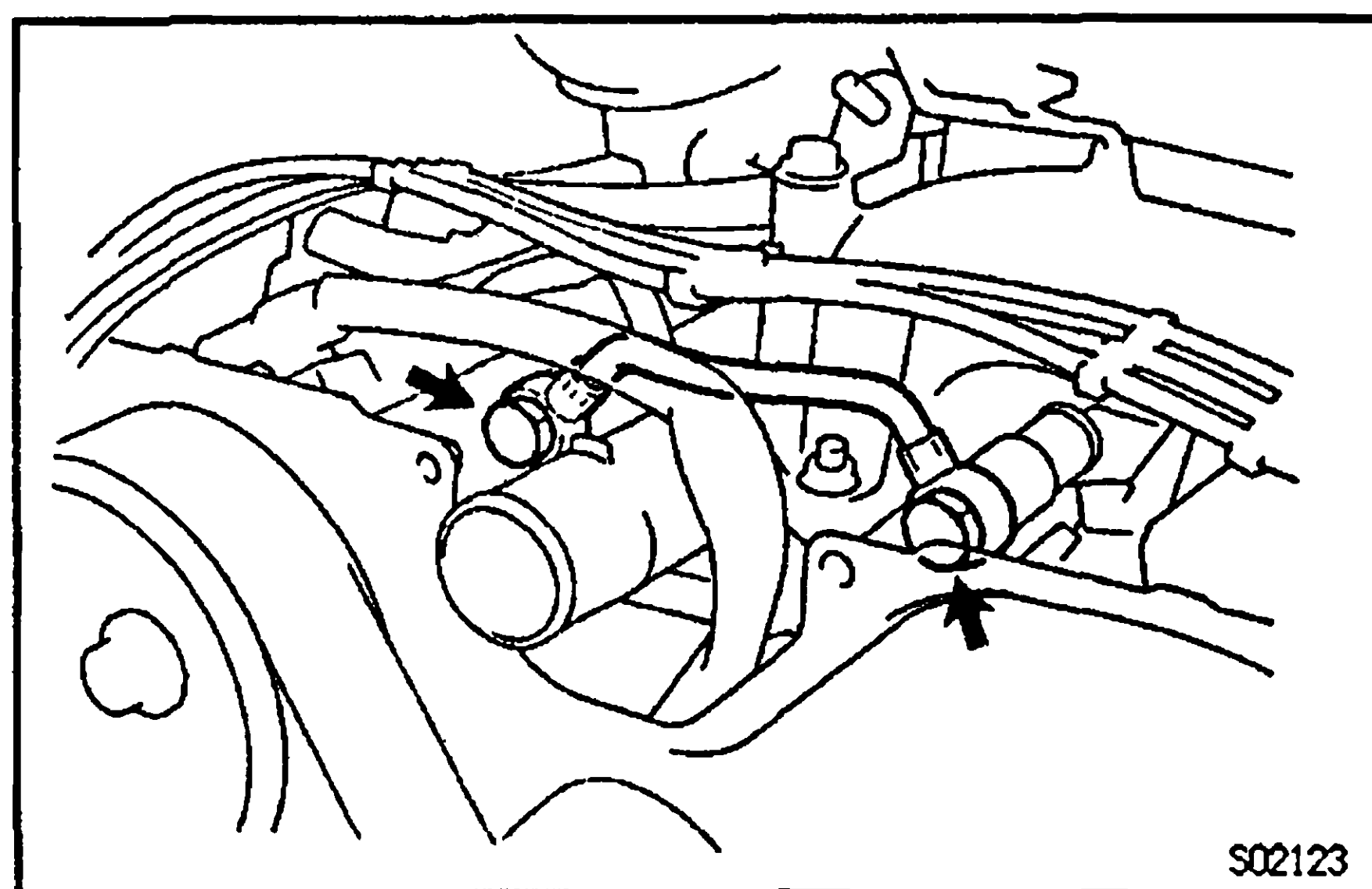
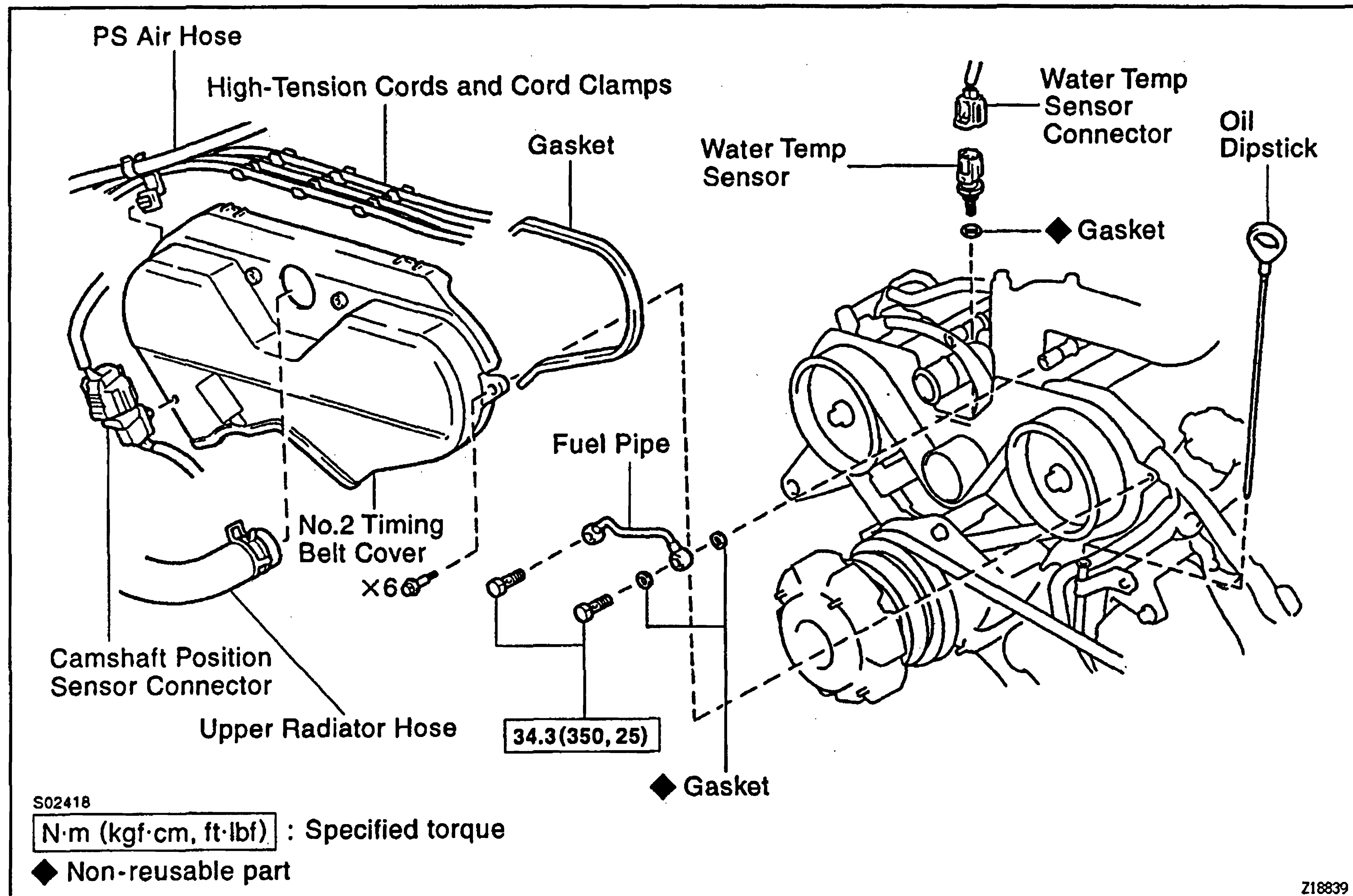
CIRCUIT OPENING RELAY INSPECTION

EG04FA-08

1. **REMOVE CIRCUIT OPENING RELAY**
2. **INSPECT CIRCUIT OPENING RELAY CONTINUITY**
 - (a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.
If there no continuity, replace the relay.
 - (b) Check that there is no continuity between terminals 3 and 4.
If there continuity, replace the relay.
3. **INSPECT CIRCUIT OPENING 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**

WATER TEMPERATURE SENSOR COMPONENTS FOR REMOVAL AND INSTALLATION

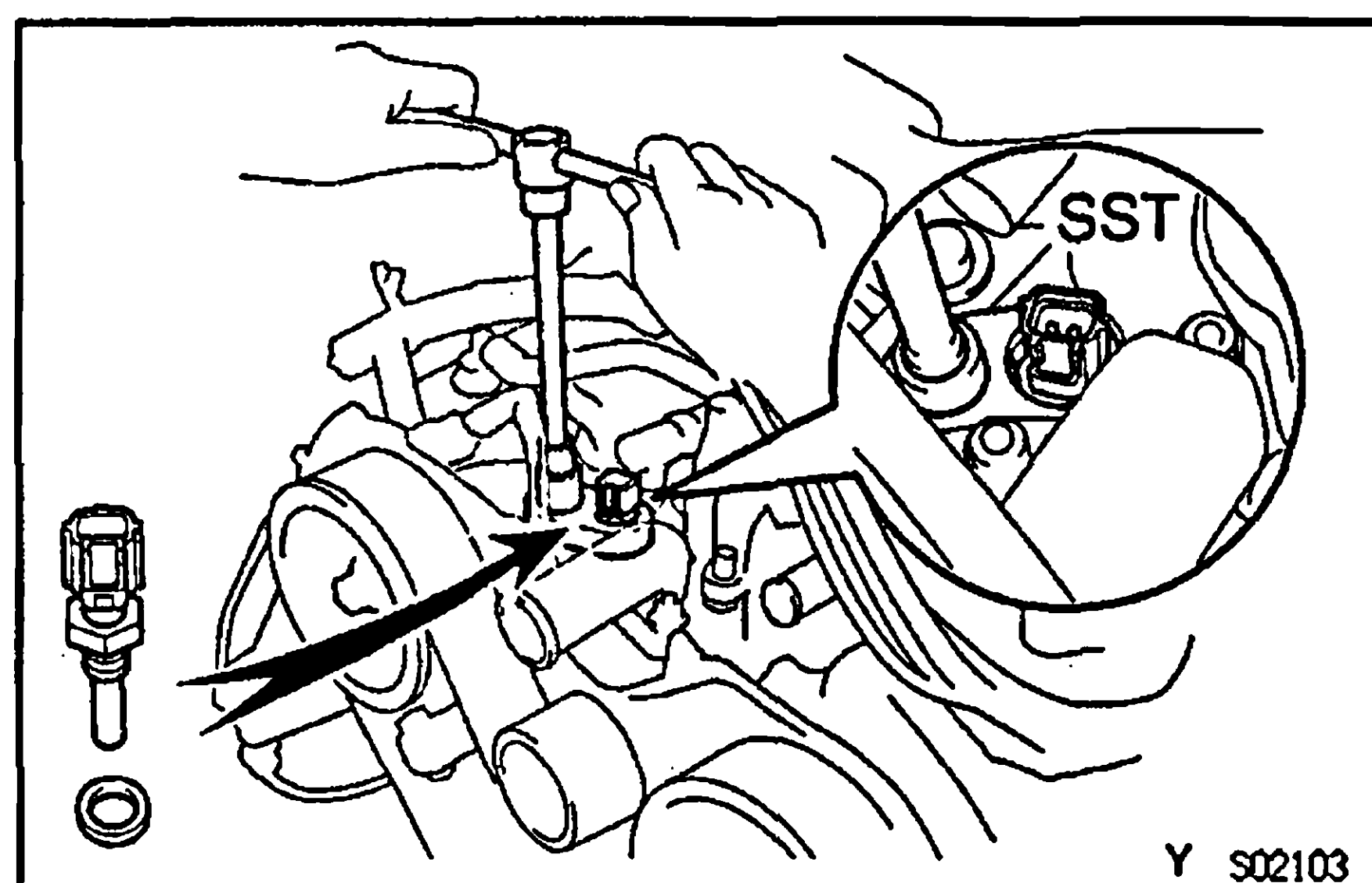
EG7D3-01

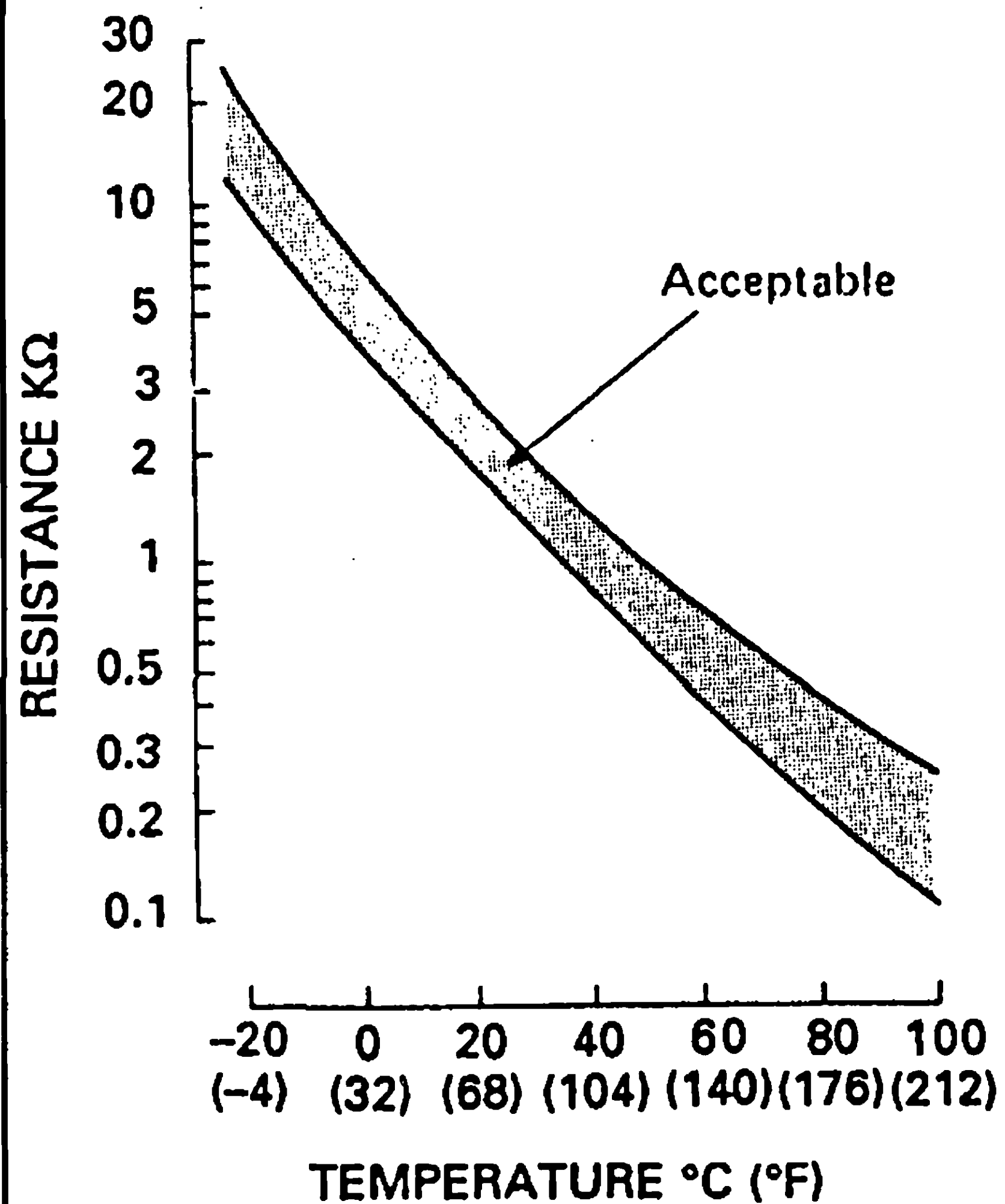
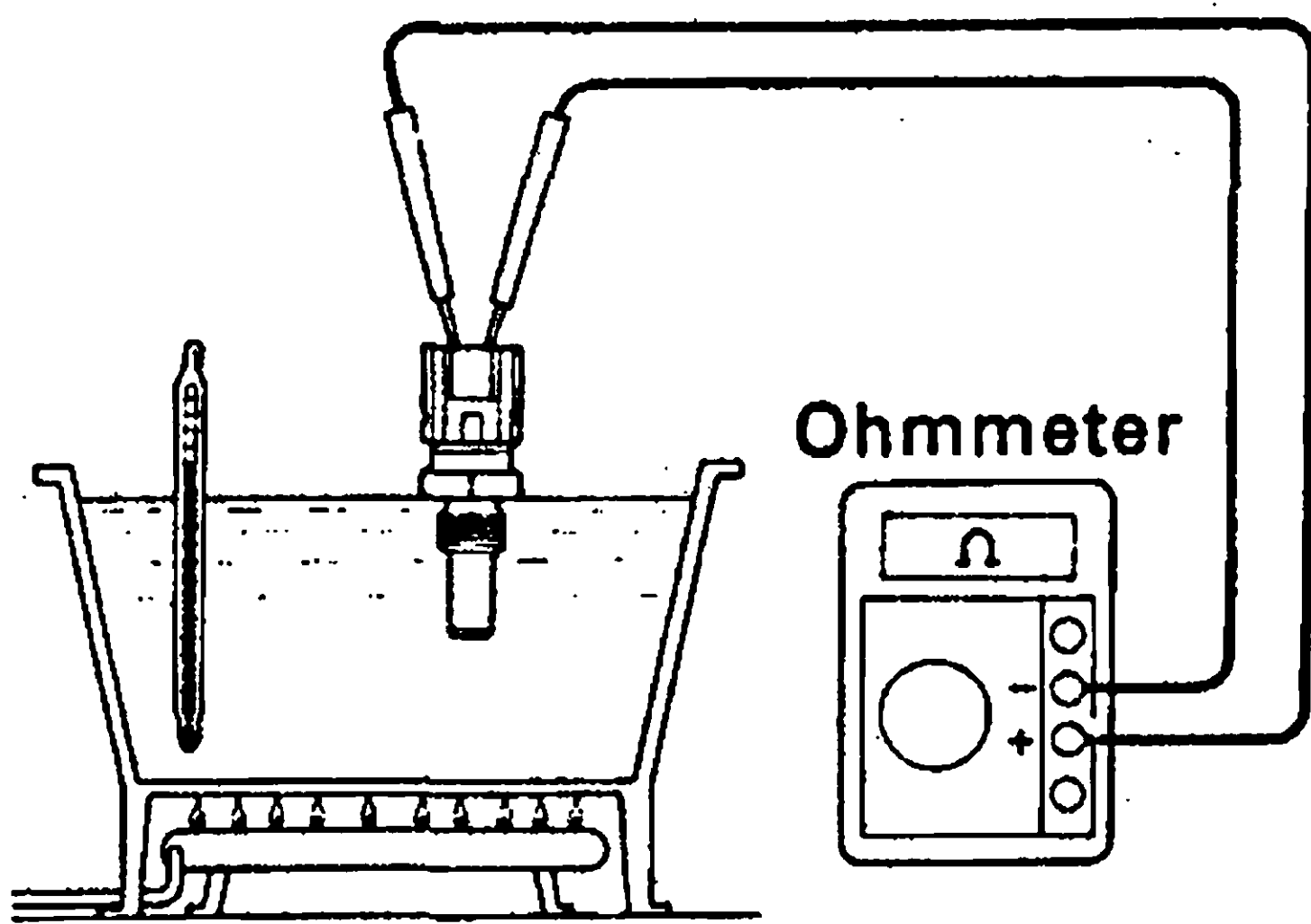


WATER TEMPERATURE SENSOR INSPECTION

EG7D4-01

1. DRAIN ENGINE COOLANT
2. DISCONNECT UPPER RADIATOR HOSE FROM WATER OUTLET
3. REMOVE NO.2 TIMING BELT COVER
(See timing belt removal in Engine Mechanical)
4. REMOVE FUEL PIPE
5. REMOVE WATER TEMPERATURE SENSOR
 - (a) Disconnect the water temperature sensor connector.
 - (b) Using SST, remove the water temperature sensor and gasket.
SST 09205-76030





P01627
FI4741

202917

6. INSPECT WATER TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

Refer to the graph

If the resistance is not as specified, replace the water temperature sensor.

7. REINSTALL WATER TEMPERATURE SENSOR

- Install a new gasket to the water temperature sensor.
- Using SST, install the water temperature sensor.

SST 09205-76030

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

- Connect the water temperature sensor connector.

8. REINSTALL FUEL PIPE

Install the fuel pipe with 4 new gaskets and the 2 union bolts.

Torque: 34.3 N·m (350 kgf·cm, 25 ft·lbf)

9. REINSTALL NO.2 TIMING BELT COVER

(See timing belt removal in Engine Mechanical)

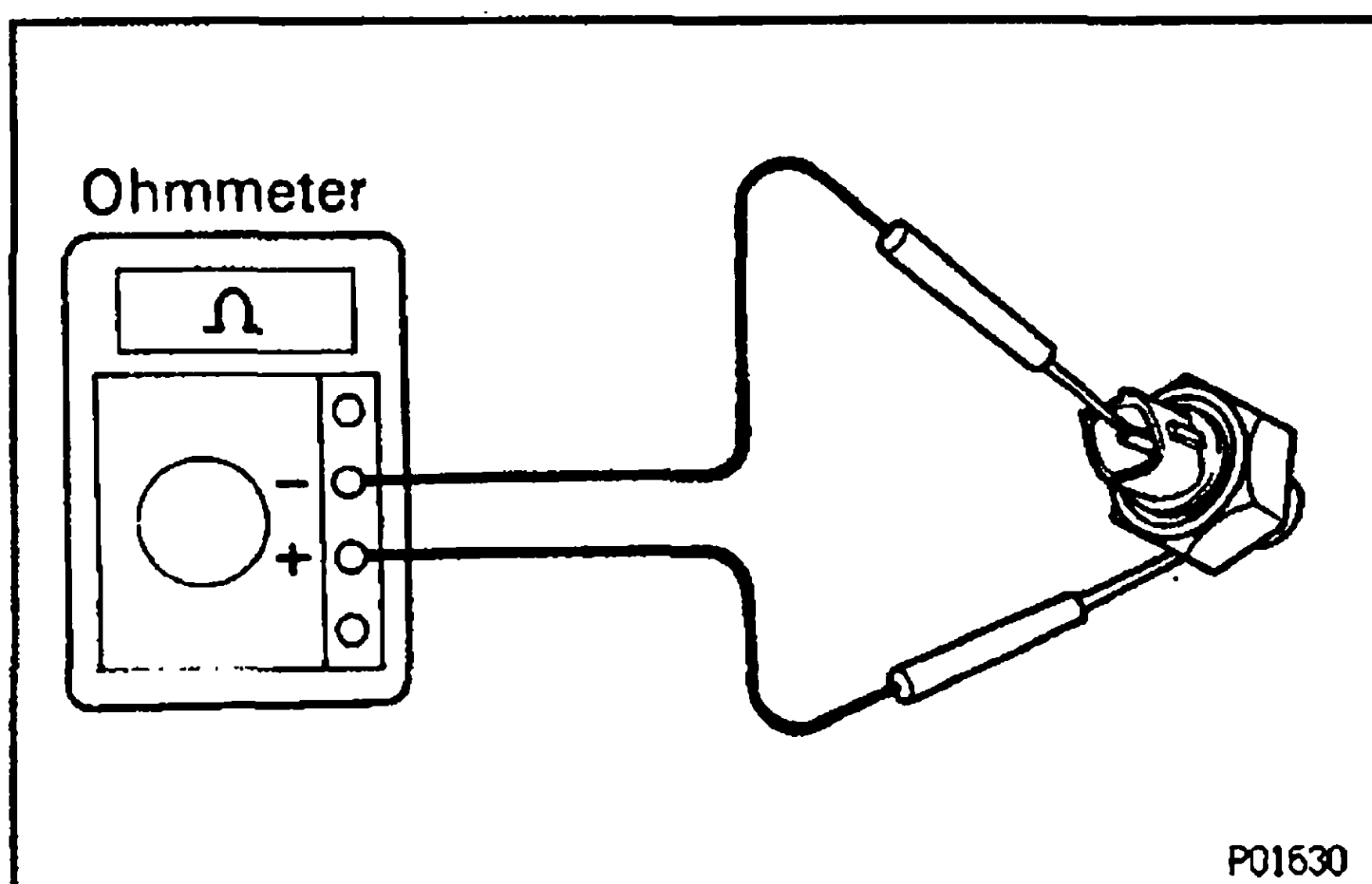
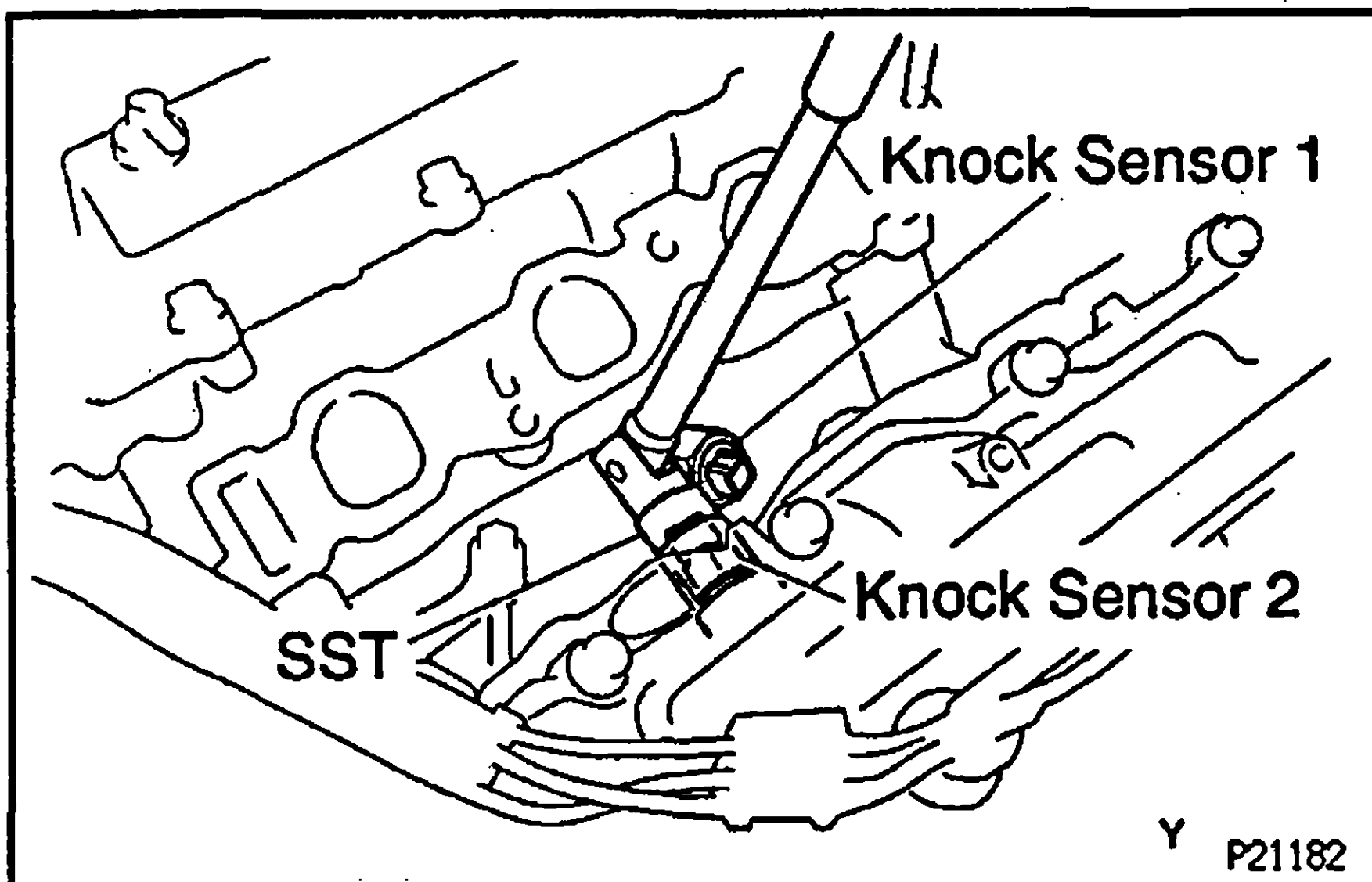
10. RECONNECT UPPER RADIATOR HOSE TO WATER OUTLET

11. REFILL WITH ENGINE COOLANT

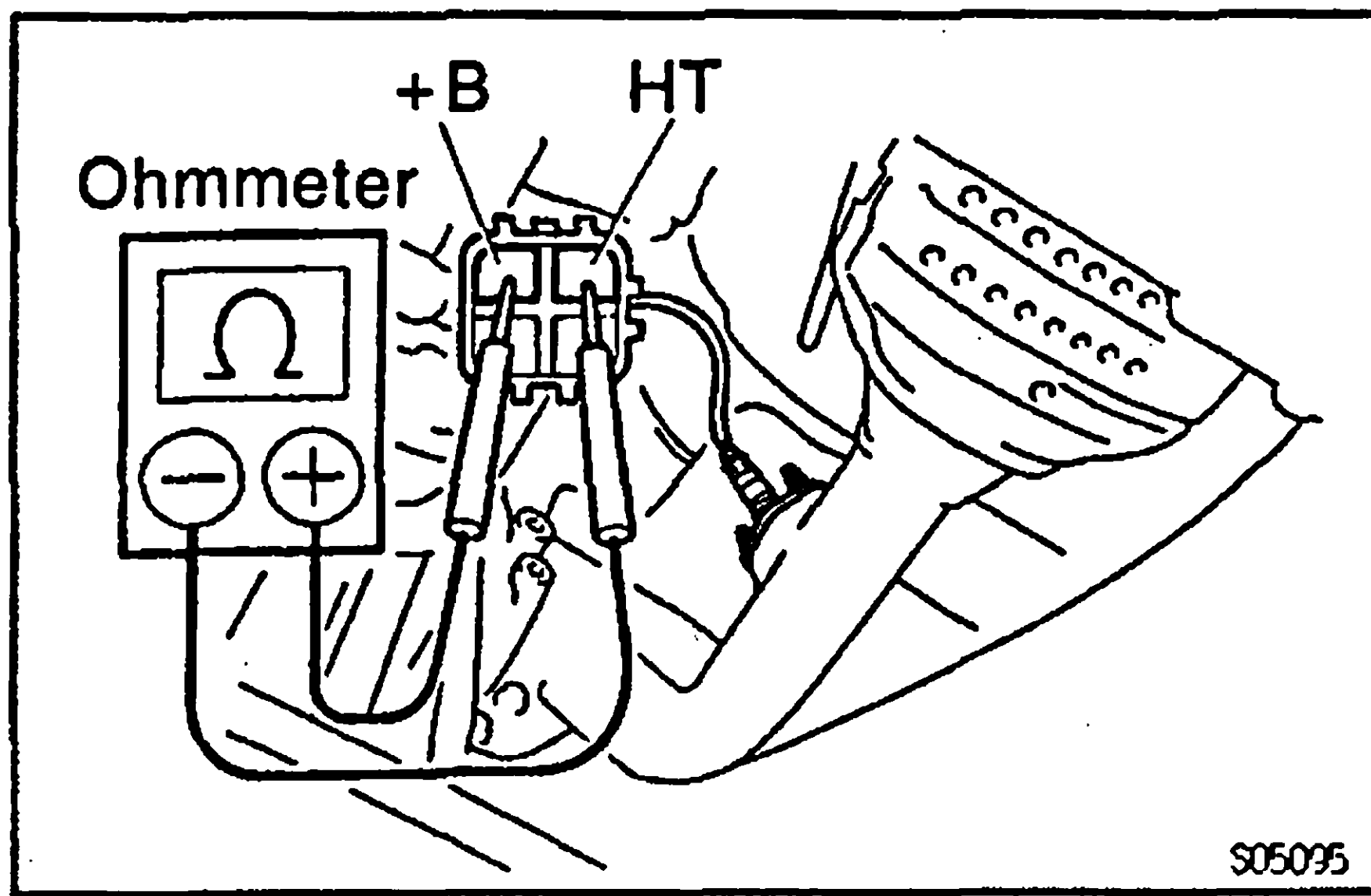
BOYY-2A

KNOCK SENSOR INSPECTION

1. **DRAIN ENGINE COOLANT**
2. **REMOVE NO.2 TIMING BELT COVER**
(See timing belt removal in Engine Mechanical)
3. **REMOVE INTAKE AIR CONNECTOR**
(See cylinder heads removal in Engine Mechanical)
4. **REMOVE FUEL PRESSURE REGULATOR**
(See fuel pressure regulator removal)
5. **REMOVE INTAKE MANIFOLD ASSEMBLY**
(See cylinder block removal in Engine Mechanical)
6. **REMOVE WATER BYPASS PIPE AND KNOCK SENSOR WIRE**
(See cylinder block removal in Engine Mechanical)
7. **REMOVE KNOCK SENSORS**
Using SST, remove the knock sensor.
SST 09817-16011



8. **INSPECT KNOCK SENSORS**
Using an ohmmeter, check that there is no continuity between the terminal and body.
If there is continuity, replace the sensor.
9. **REINSTALL KNOCK SENSORS**
Using SST, install the knock sensor.
SST 09817-16011
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)
10. **REINSTALL WATER BYPASS PIPE AND KNOCK SENSOR WIRE**
(See cylinder heads installation in Engine Mechanical)
11. **REINSTALL INTAKE MANIFOLD ASSEMBLY**
(See cylinder heads installation in Engine Mechanical)
12. **REINSTALL FUEL PRESSURE REGULATOR**
(See fuel pressure regulator installation)
13. **REINSTALL INTAKE AIR CONNECTOR**
(See cylinder heads installation in Engine Mechanical)
14. **REINSTALL NO.2 TIMING BELT COVER**
(See timing belt installation in Engine Mechanical)
15. **REFILL WITH ENGINE COOLANT**
16. **RECHECK ENGINE COOLANT LEVEL**



OXYGEN SENSOR (w/ TWC)

E07CK-01

OXYGEN SENSOR INSPECTION

INSPECT HEATER RESISTANCE OF HEATED OXYGEN SENSOR

- (a) Disconnect the oxygen sensor connector.
- (b) Using an ohmmeter, measure the resistance between the terminals +B and HT.

Resistance:

At 20°C (68°F): 11–16 Ω

If the resistance is not as specified, replace the sensor.

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

- (c) Reconnect the oxygen sensor connector.

EG

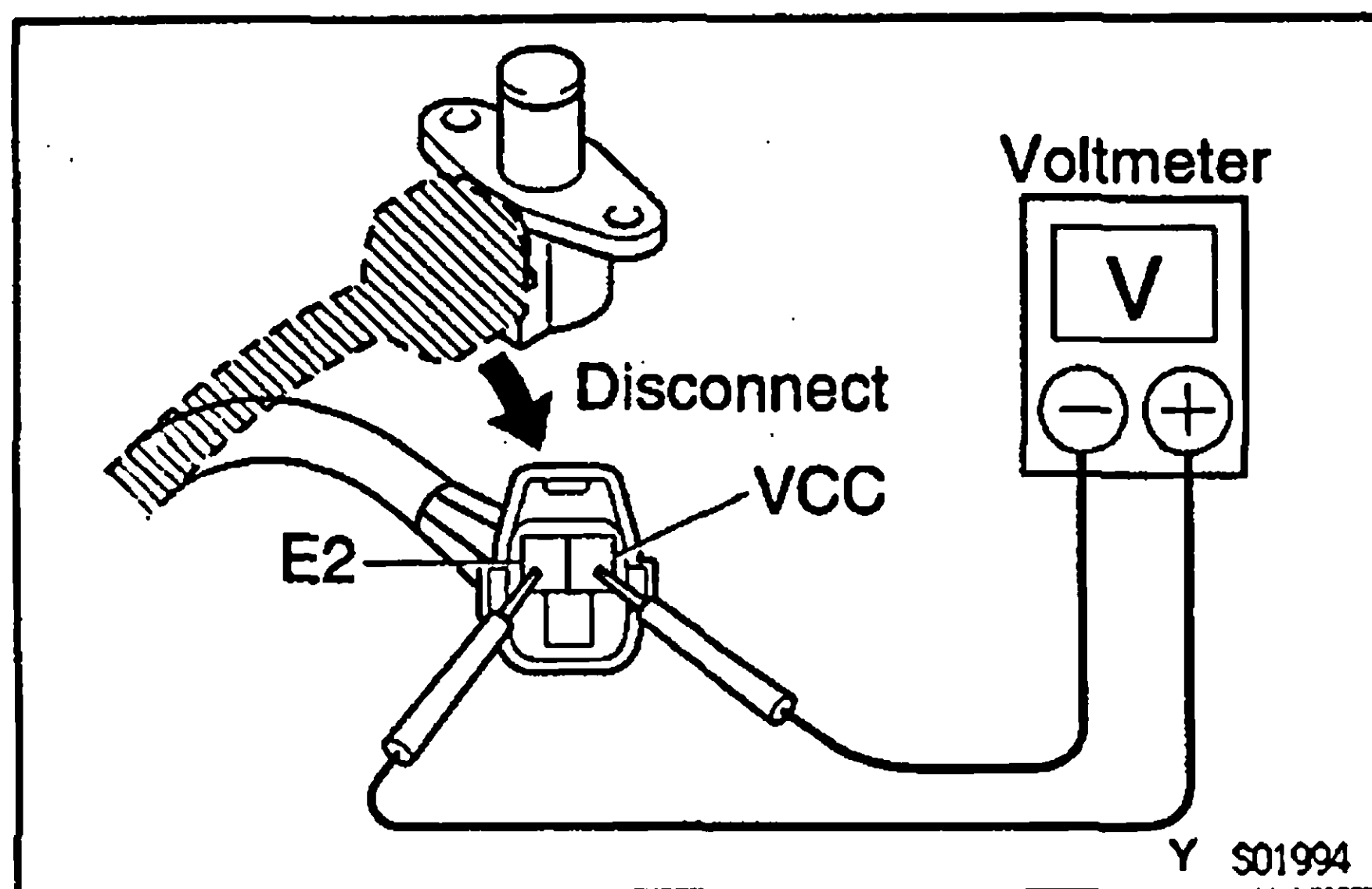
VARIABLE RESISTOR (w/o TWC)

EOAZC-02

VARIABLE RESISTOR INSPECTION

1. INSPECT POWER SOURCE VOLTAGE OF VARIABLE RESISTOR

- Disconnect the variable resistor connector.
- Turn the ignition switch ON.



- Using a voltmeter, measure the voltage between connector terminals VCC and E2 of the wiring harness side.

Voltage:

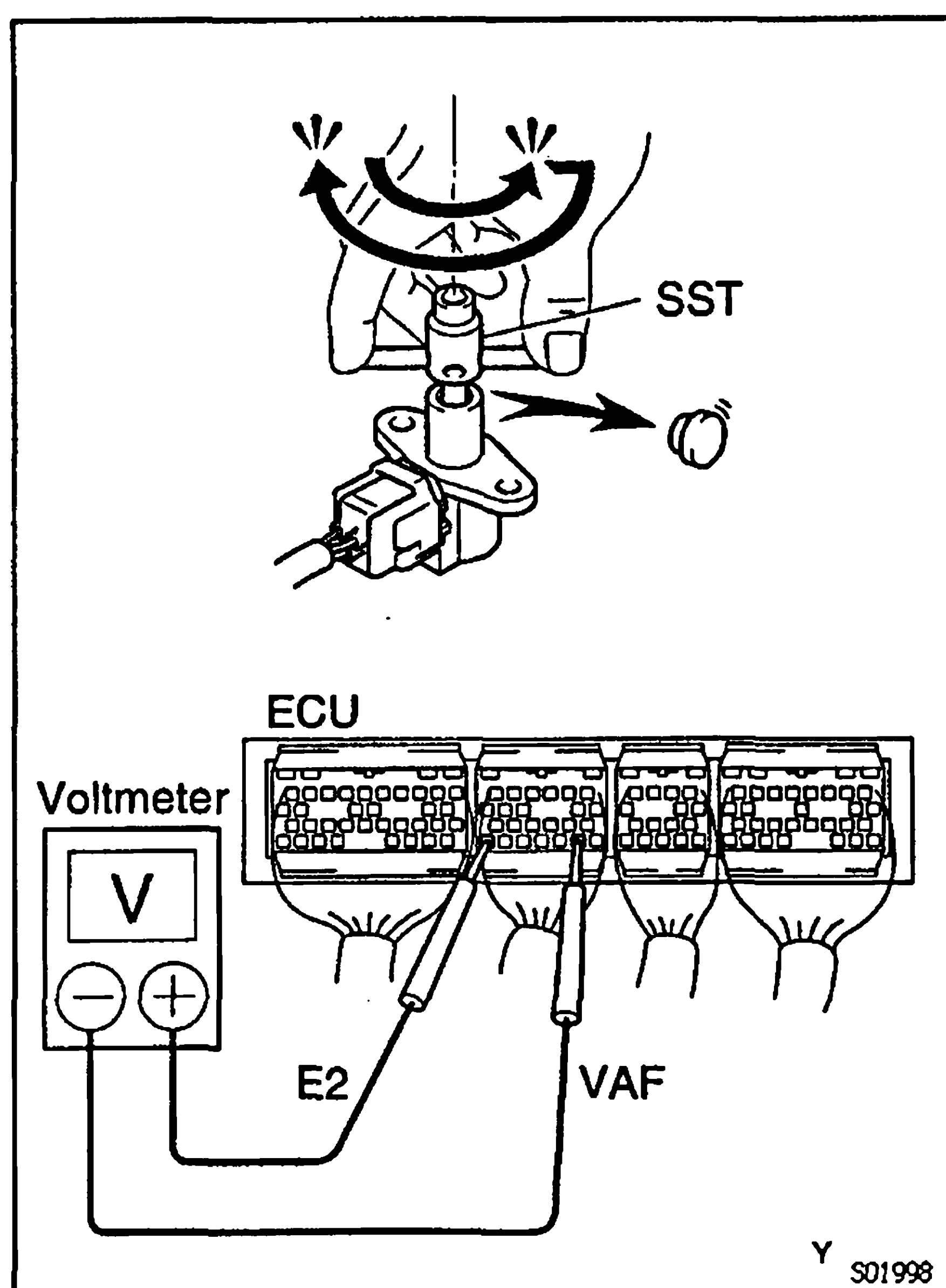
4.5 – 5.5 V

- Turn the ignition switch to LOCK.
- Reconnect the variable resistor connector.

2. INSPECT POWER OUTPUT OF VARIABLE RESISTOR

- Turn the ignition switch ON.
- 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 by using SST.
- 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.

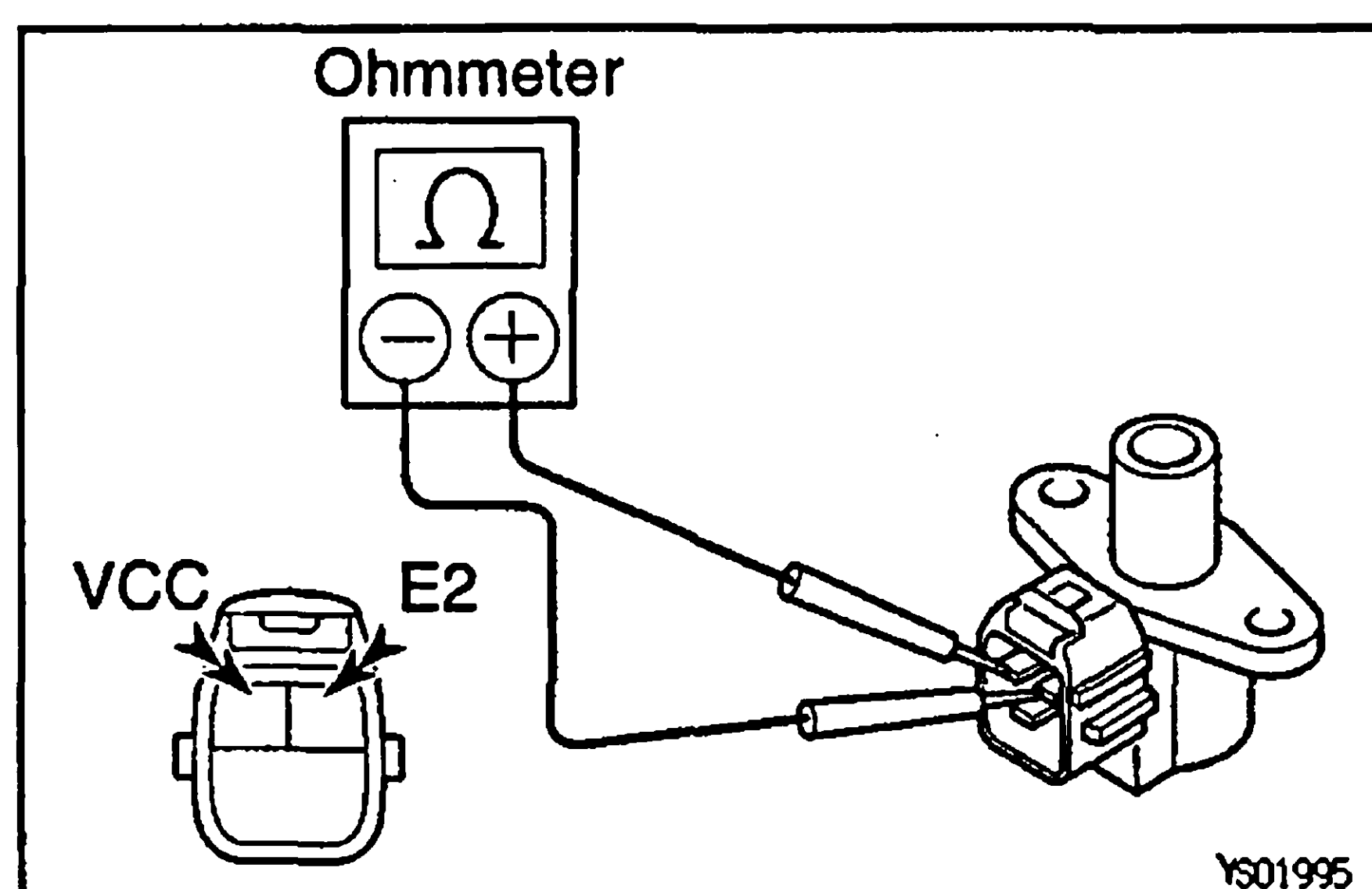


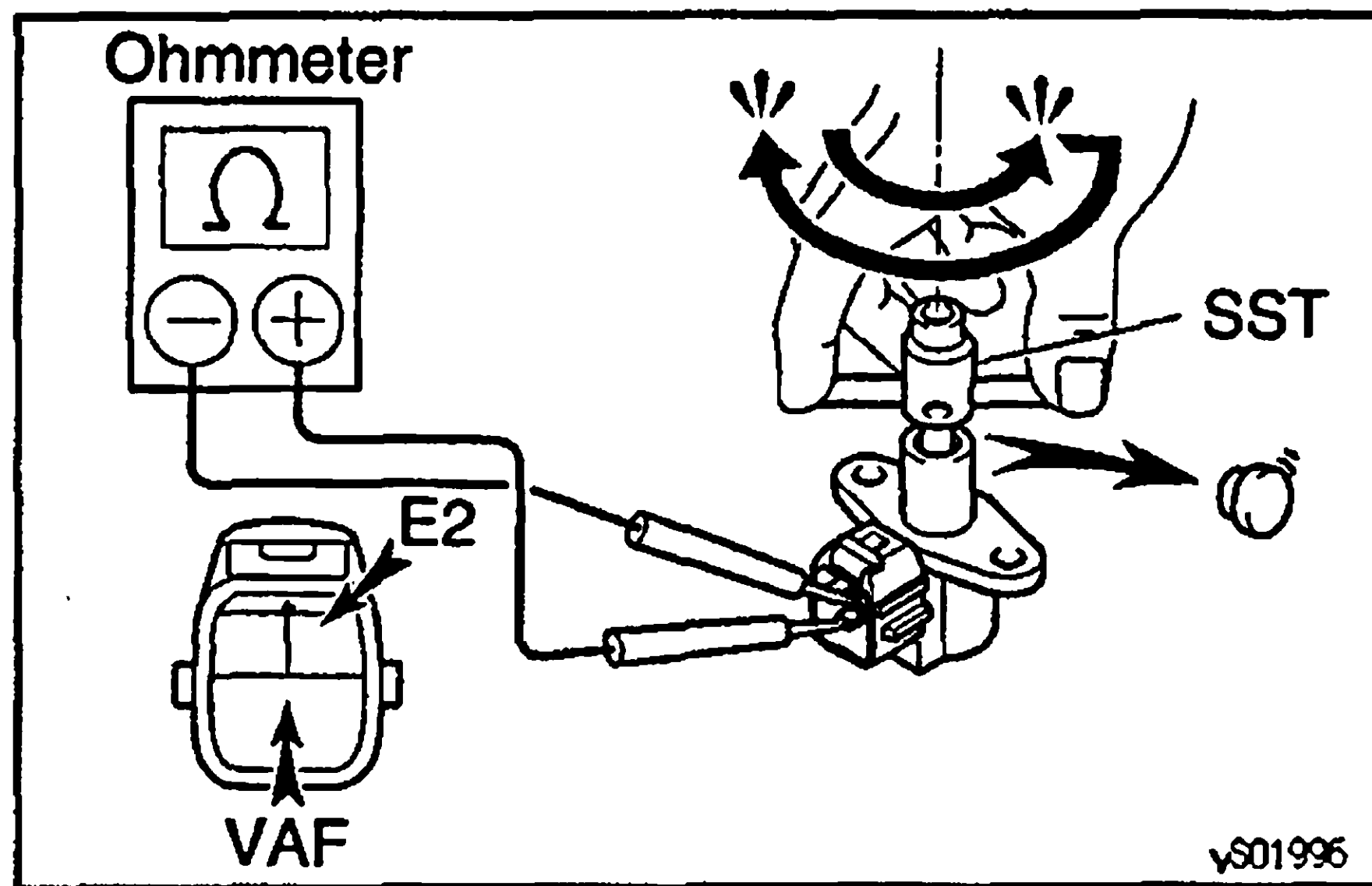
3. INSPECT RESISTANCE OF VARIABLE RESISTOR

- Disconnect the variable resistor connector.
- Using an ohmmeter, measure the resistance between terminals VCC and E2 of the variable resistor.

Resistance:

4 – 6 k Ω





- (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 k Ω to 0 k Ω accordingly.
- (e) Reconnect the variable resistor connector.

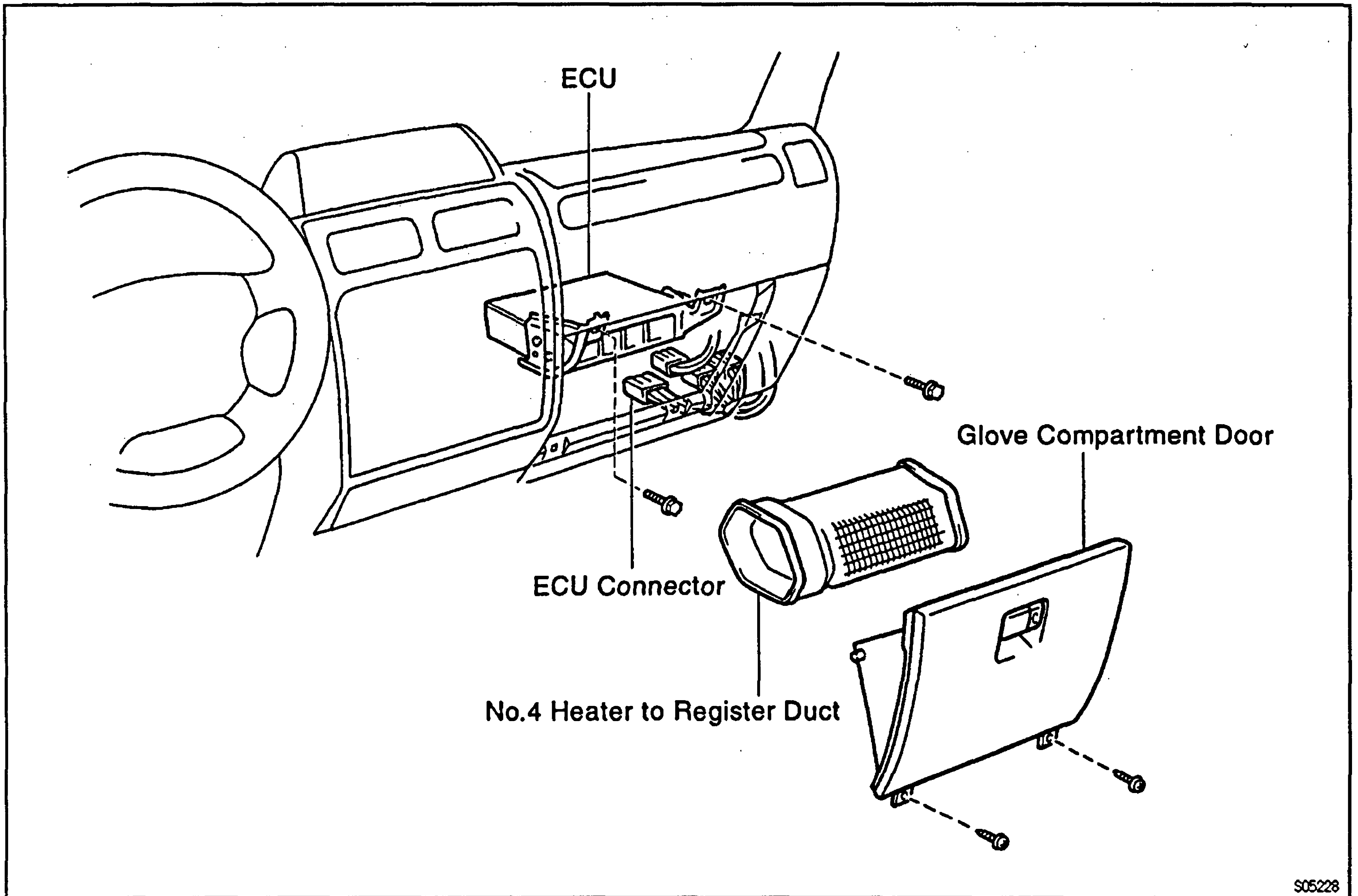
IDLE CO CHECK AND ADJUSTMENT

EG62D-04

CHECK AND ADJUST IDLE CO
(See idle CO check and adjust
in Engine Mechanical)

ECU COMPONENTS FOR REMOVAL AND INSTALLATION

S0068-01



ECU INSPECTION

S0104-00

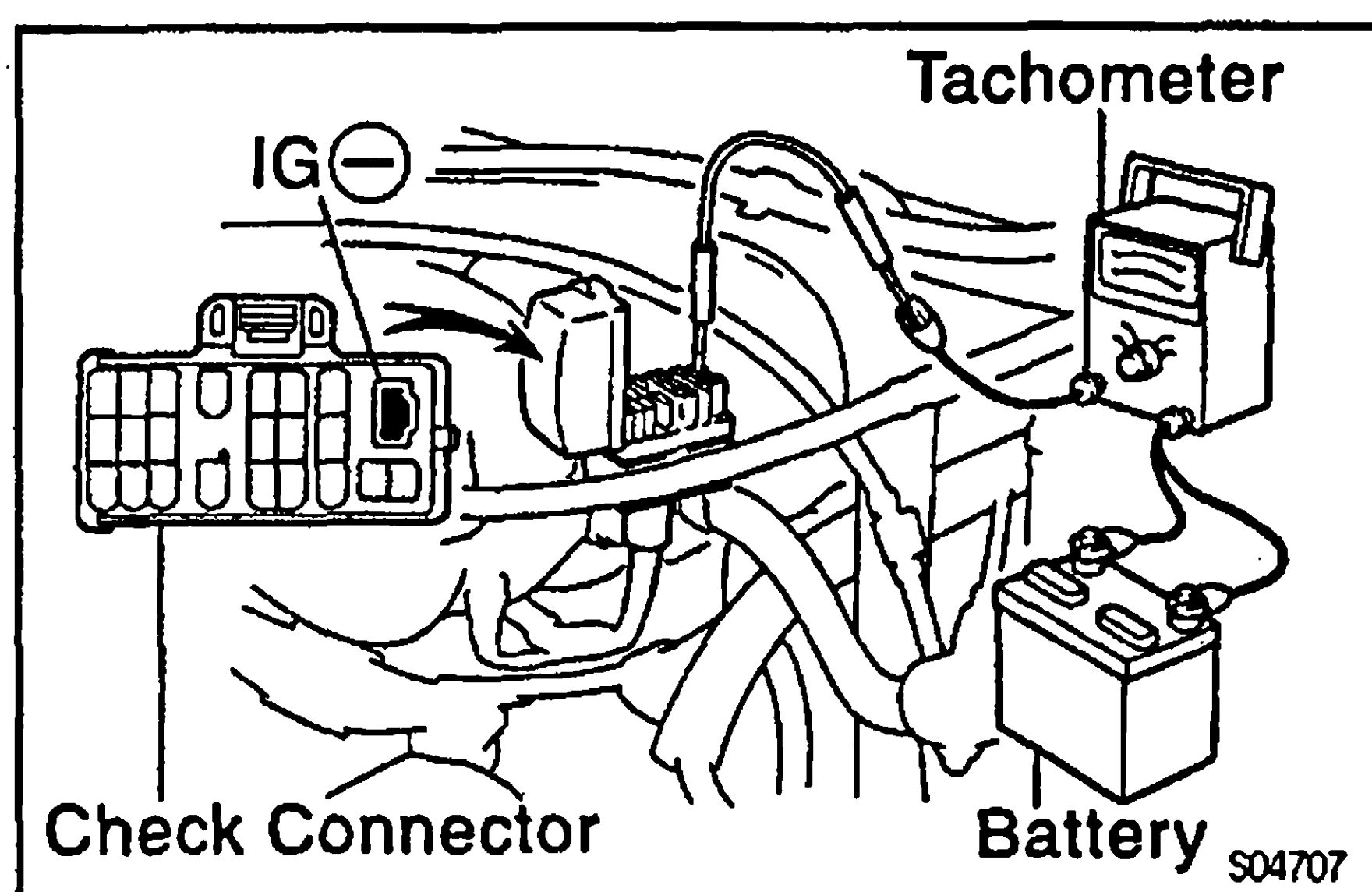
(See Troubleshooting in EFI System)

FUEL CUT RPM FUEL CUTOFF RPM INSPECTION

B07CJ-01

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.



2. CONNECT TACHOMETER TO ENGINE

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

NOTICE:

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

3. INSPECT FUEL CUT OFF RPM

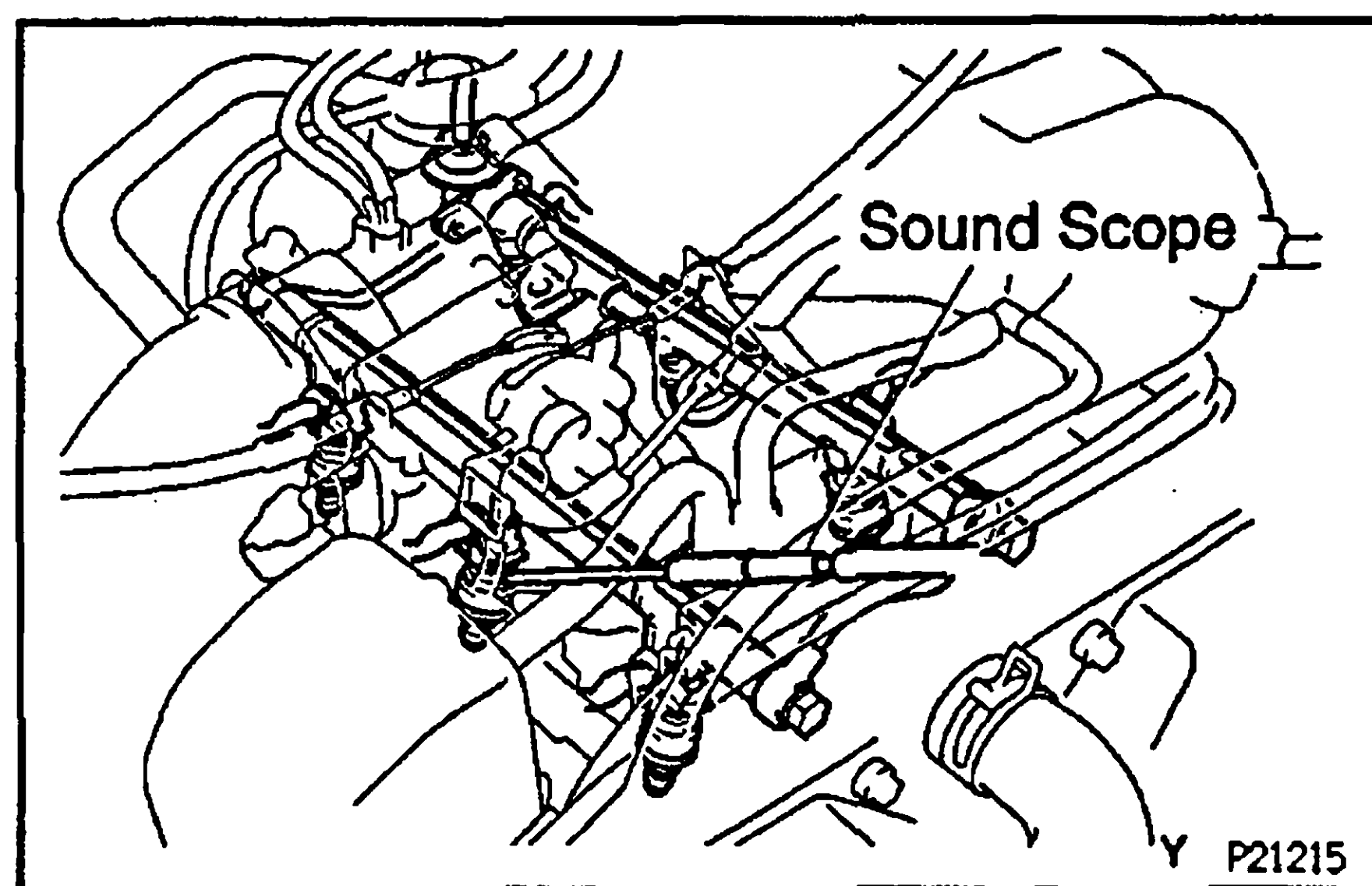
- (a) Increase the engine speed to at least 3,500 rpm.
 - (b) Using a sound scope, check for injector operating noise.
 - (c) Check that when the throttle lever is released, injector operation noise stops momentarily and then resumes.
- HINT: Measure with the A/C OFF.

Fuel return rpm:

1,500 rpm

(Vehicle speed less than 25 km/h (16 mph), with brake OFF)

4. DISCONNECT TACHOMETER FROM ENGINE



SERVICE SPECIFICATIONS
SERVICE DATA

E002A-15

Fuel pressure regulator	Fuel pressure at no vacuum	265 — 304 kPa (2.7 — 3.1 kgf/cm ² , 38 — 44 psi)
Fuel pump	Resistance at 20°C (68°F)	0.2 — 3.0 Ω
Injector	Resistance	Approx. 13.8 Ω
	Injection volume	55 — 70 cm ³ (3.3 — 4.3 cu in.) per 15 sec.
	Difference between each cylinder	6 cm ³ (0.31 cu in.) or less
	Fuel leakage	1 drop or less per minute
Air flow meter	Resistance (THA — E2) 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
Throttle body	Throttle valve fully closed angle	10°
	DP setting speed (M/T)	1,800 — 2,200 rpm
	Throttle opener setting speed	900 — 1,950 rpm
Throttle position sensor	Clearance between stop screw and lever 0 mm (0 in.) VTA — E2	0.28 — 6.4 kΩ
	Throttle valve fully open VTA — E2	2.0 — 11.6 kΩ
	— VC — E2	2.7 — 7.7 kΩ
ISC valve	Resistance (+B — RSO or RSC) at cold	17.0 — 24.5 Ω
	at hot	21.5 — 28.5 Ω
Water temp. sensor	Resistance at -20°C (-4°F)	10 — 20 kΩ
	at 0°C (32°F)	4 — 7 kΩ
	at 20°C (68°F)	2 — 3 kΩ
	at 40°C (104°F)	0.9 — 1.3 kΩ
	at 60°C (140°F)	0.4 — 0.7 kΩ
	at 80°C (176°F)	0.2 — 0.4 kΩ
Heated oxygen sensor	Heater coil resistance at 20°C (68°F)	11 — 16 Ω
Variable resistor	Voltage (VCC — E2)	4.5 — 5.5 V
	Resistance	4 — 6 kΩ
Fuel cut rpm	Fuel return rpm	1,500 rpm

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
Fuel line (Union bolt type)	34.3	350	25
Fuel line (Flare nut type) using SST	28	285	21
Fuel inlet pipe x Intake manifold	8	80	71 in·lbf
Fuel pressure regulator x LH delivery pipe	8	80	71 in·lbf
Delivery pipe x Intake manifold	13	130	10
Fuel pump bracket assembly x Fuel tank	3.5	35	30 in·lbf
Fuel pipe x Body	20	200	14
Fuel tank band x Body	40	410	30
Fuel tank protector x Fuel tank, Body	30	310	22
Fuel tube clamp bracket x Fuel tank	5.5	55	48 in·lbf
Fuel tank filler pipe x Fuel tank	3	30	27 in·lbf
Fuel evaporation vent tube x Fuel tank	1.5	15	13 in·lbf
Fuel pressure regulator x LH delivery pipe	8	80	71 in·lbf
Air flow meter x Air cleaner cap	6.9	72	61 in·lbf
Throttle body x Air intake chamber	18	180	13
Water temp. sensor x Intake manifold	20	200	14
Knock sensor x Cylinder block	39	400	29
Heated oxygen sensor x Front exhaust pipe, Center exhaust pipe	20	200	14

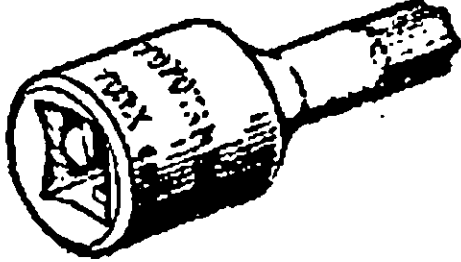
EG

COOLING SYSTEM

PREPARATION

RECOMMENDED TOOLS

R800Y-0H

	09042-00010 Torx Socket T30 .	Radiator support
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EQUIPMENT

E01D3-06

Heater	Thermostat
Radiator cap tester	
Thermometer	Thermostat
Torque wrench	

ENGINE COOLANT

E01D4-0E

Item	Capacity	Classification
w/o Rear Heater	8.0 liters (8.5 US qts, 7.0 Imp. qts)	Ethylene—glycol base
w/ Rear Heater	9.0 liters (9.5 US qts, 7.9 Imp. qts)	

SSM (SPECIAL SERVICE MATERIALS)

E01D6-04

08826-00100 Seal Packing 1282B, THREE BOND 1282B or equivalent (FIPG)	Water pump
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COOLANT CHECK

1. CHECK ENGINE COOLANT LEVEL AT RADIATOR^{EG7MF-01} RESERVOIR

The coolant level should be between the "L" and "F" lines, when the engine is cold.

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) Loosen the drain plugs, and drain engine coolant.

- (c) Close the drain plugs.

- (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:

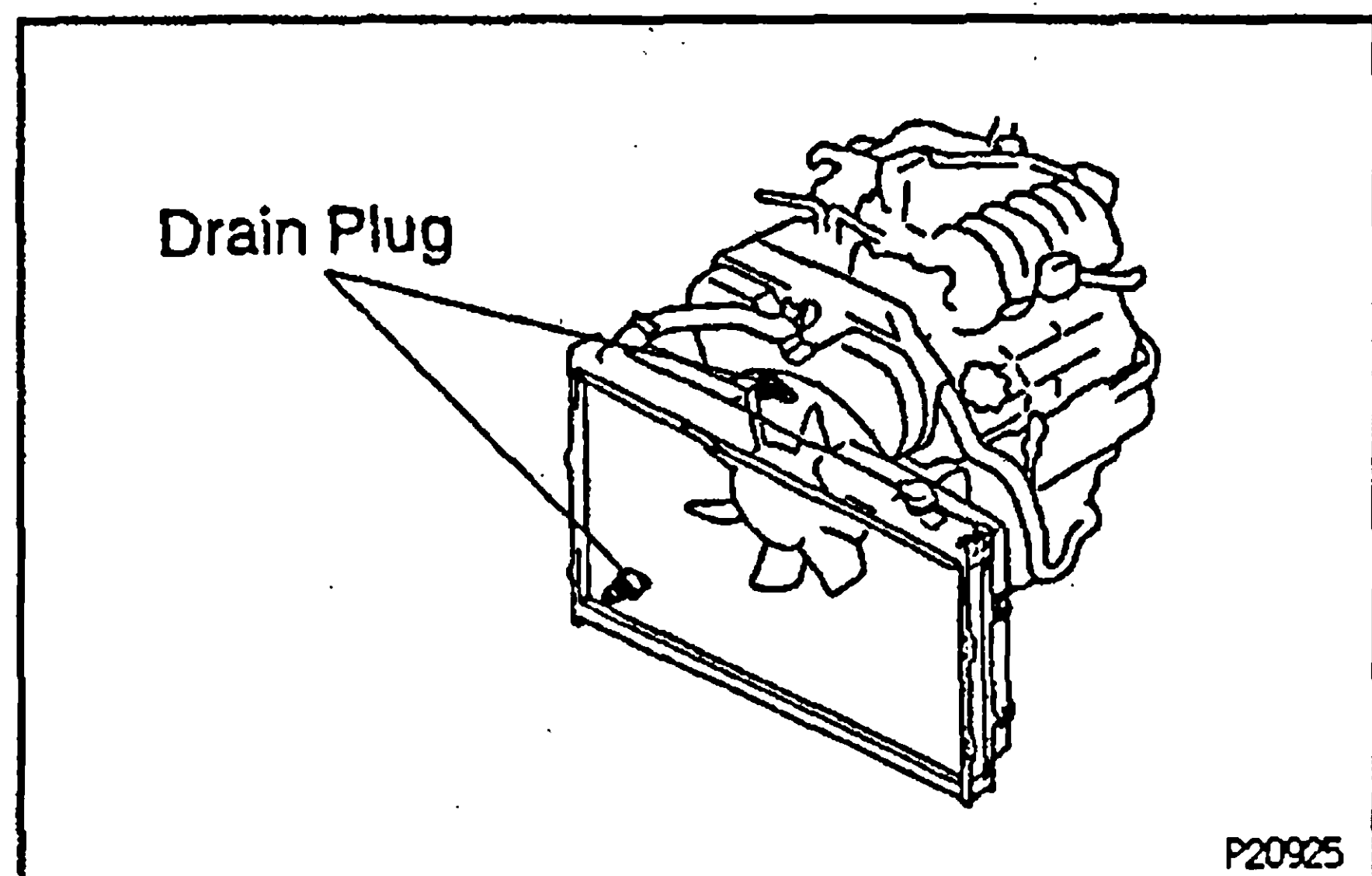
w/o Rear Heater

8.0 liters (8.5 US qts, 7.0 Imp. qts)

w/ Rear Heater

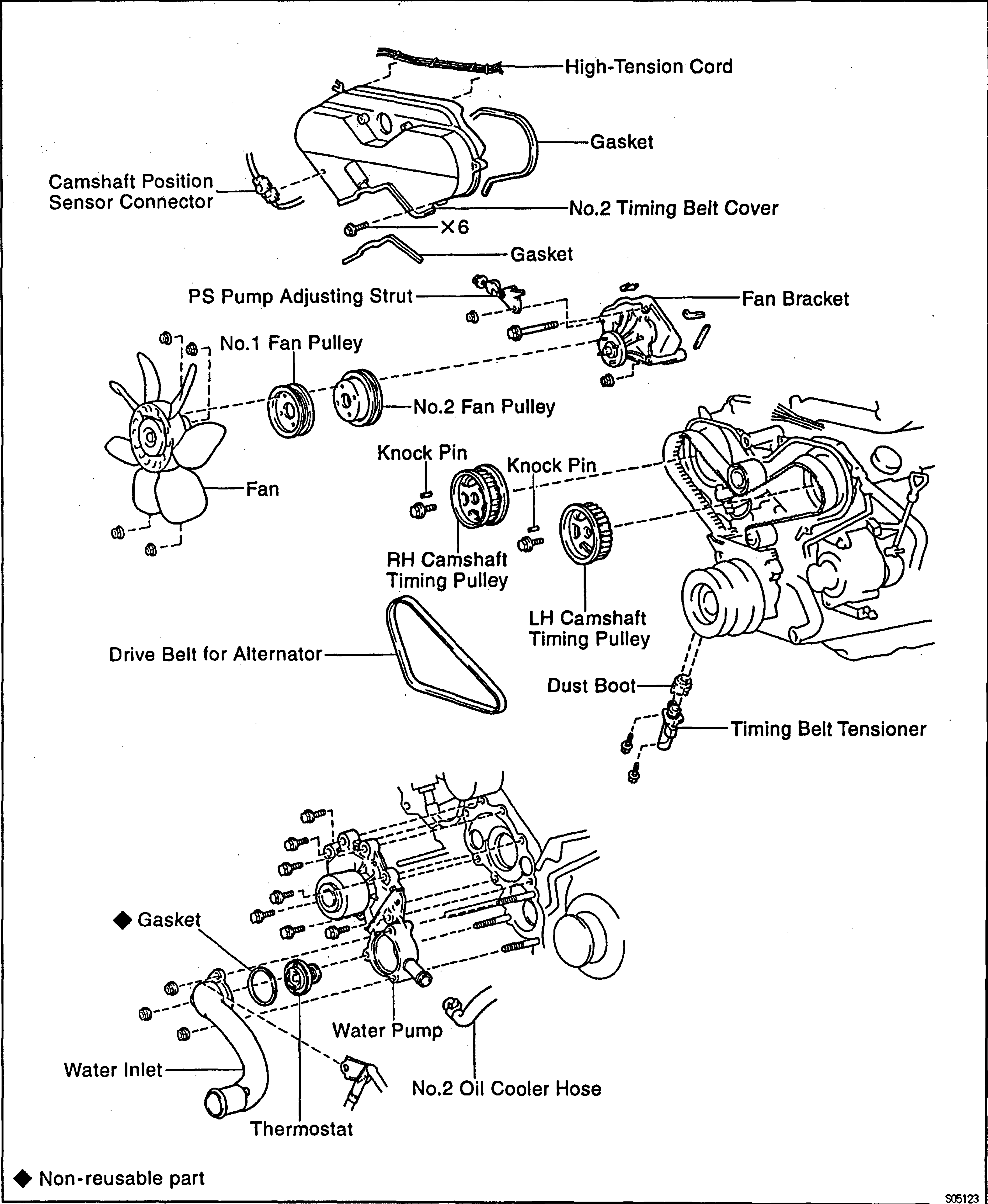
9.0 liters (9.5 US qts, 7.9 Imp. qts)

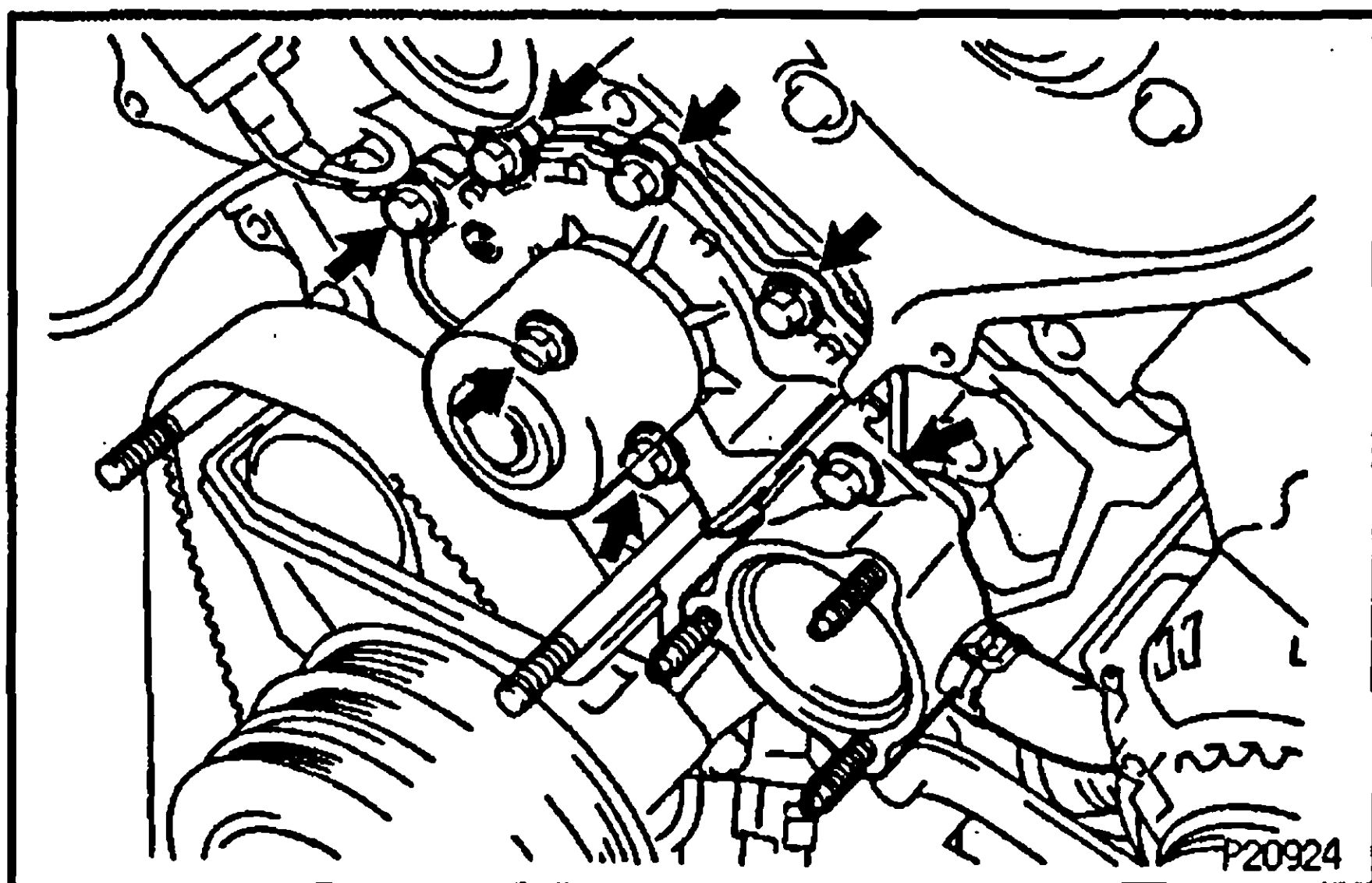
- (e) Reinstall the radiator cap.
- (f) Warm up the engine and check for leaks.
- (g) Recheck the coolant level and refill as necessary.



WATER PUMP
COMPONENTS FOR REMOVAL AND
INSTALLATION

80790-01

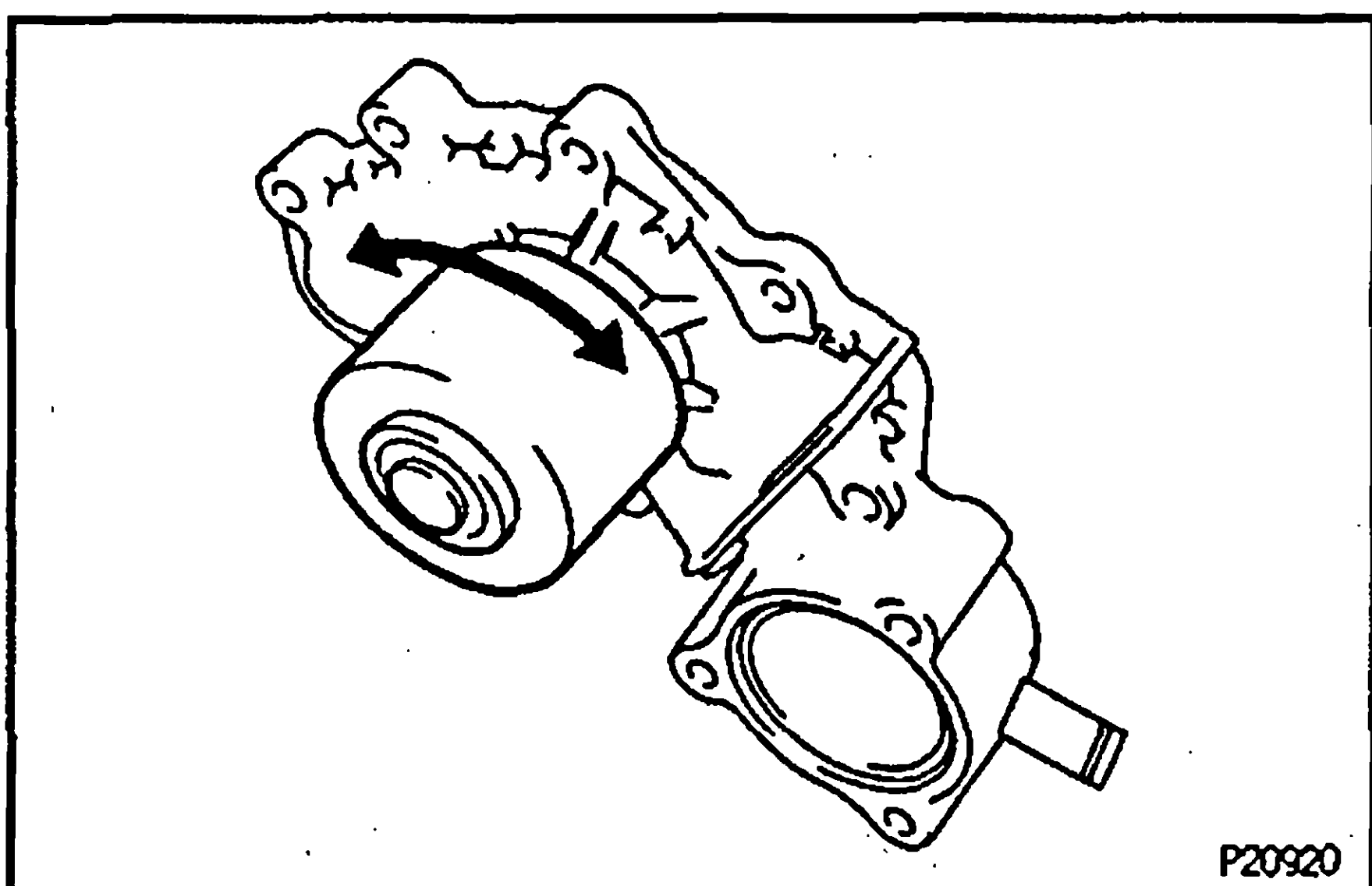




WATER PUMP REMOVAL

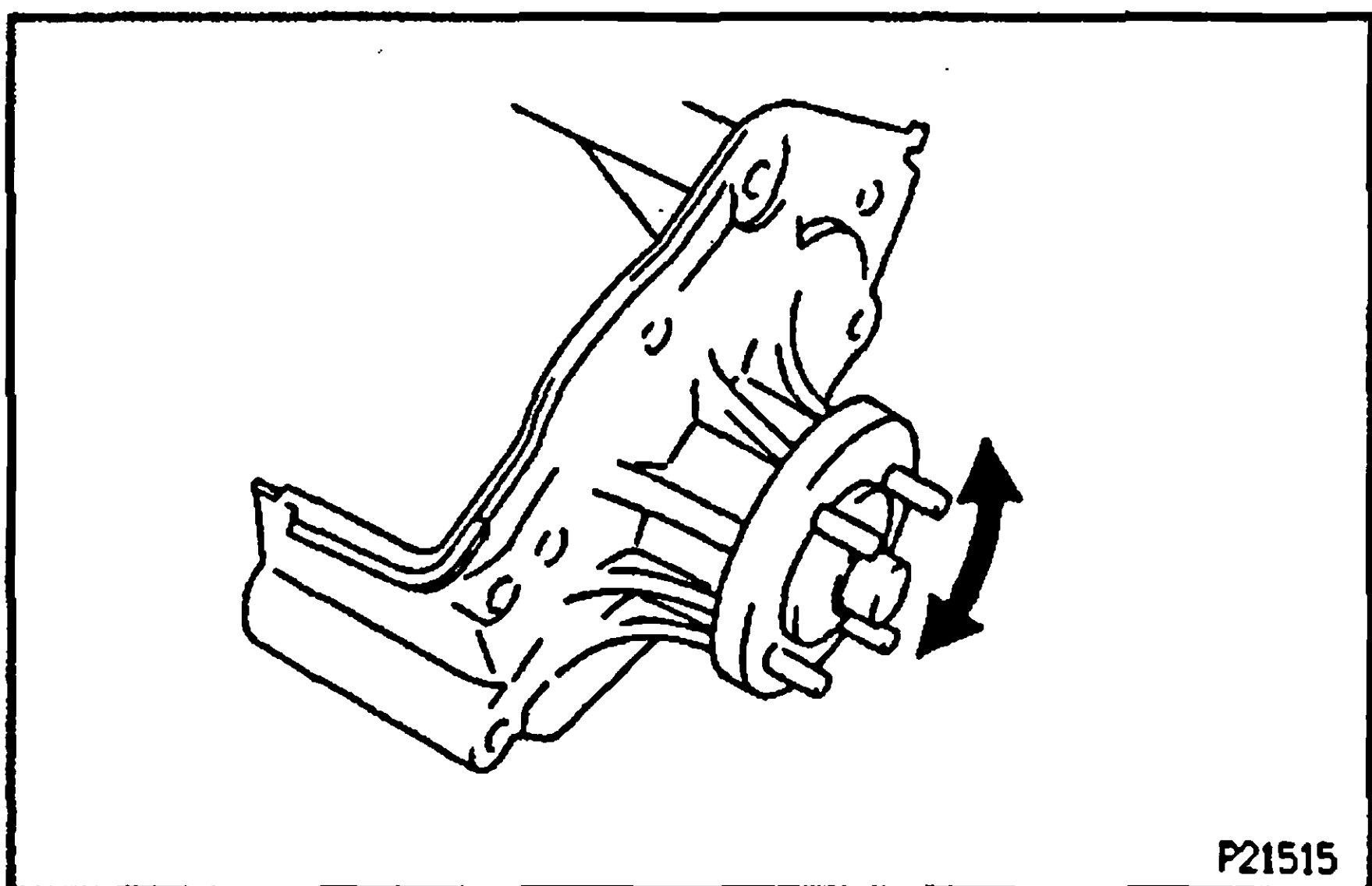
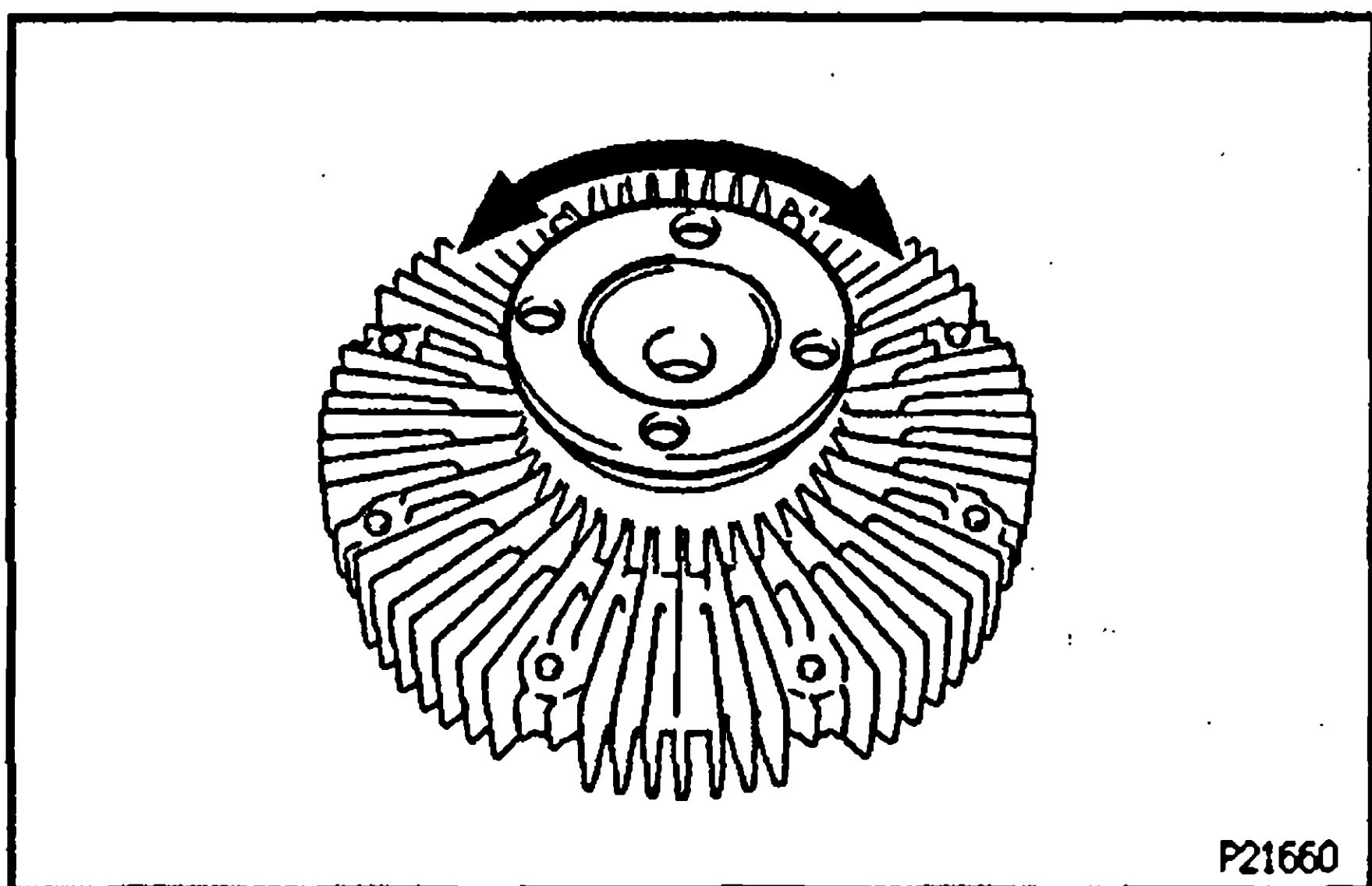
1. **REMOVE TIMING BELT**
(See timing belt removal in Engine Mechanical)
2. **REMOVE THERMOSTAT**
3. **DISCONNECT NO.2 OIL COOLER HOSE FROM WATER PUMP**
4. **REMOVE WATER PUMP**
Remove the 7 bolts and water pump.

EG



WATER PUMP INSPECTION

1. **INSPECT WATER PUMP**
 - (a) Visually check the air hole and water hole for coolant leakage.
If leakage is found, replace the water pump.
If engine coolant has leaked onto the timing belt, replace the timing belt.
 - (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 that the fluid coupling is not damaged and that no silicon oil leaks.
If necessary, replace the fluid coupling.



3. **INSPECT FAN PULLEY BRACKET**
 - (a) Check the turning smoothness of the fan pulley.
If necessary, replace the pulley bracket.
 - (b) Reinstall the fan to the fluid coupling with the 4 nuts.
Torque: 5.4 N·m (75 kgf·cm, 48 in.-lbf)

WATER PUMP INSTALLATION

1. INSTALL WATER PUMP

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

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

- (b) Apply seal packing to the water pump groove.

Seal packing:

Part No. 08826-00100 or equivalent

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

HINT: Avoid applying an excessive amount to the surface.

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

- (c) Install the water pump with the 7 bolts.

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

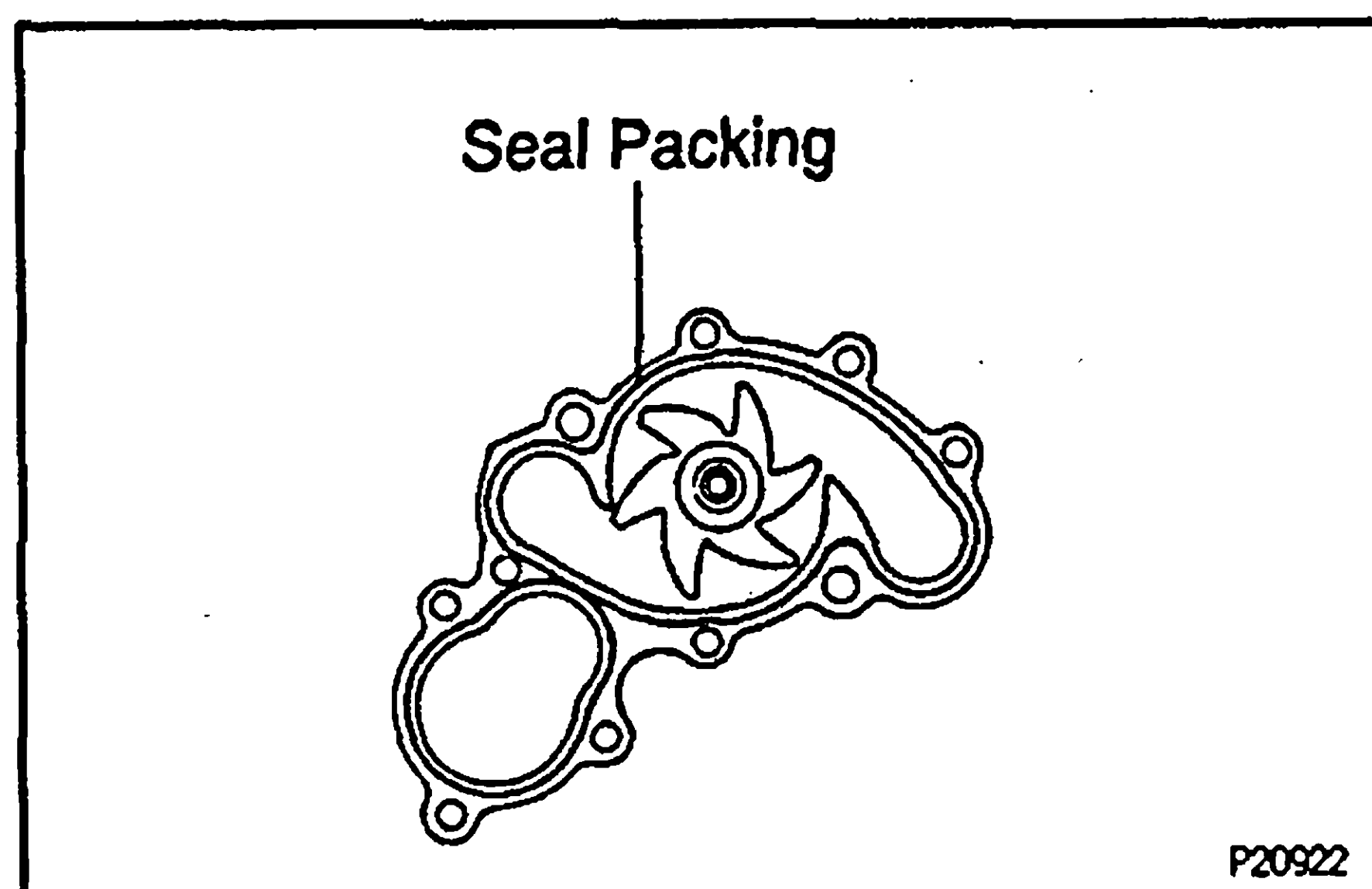
2. CONNECT NO.2 OIL COOLER HOSE

3. INSTALL THERMOSTAT

4. INSTALL TIMING BELT

(See timing belt installation in Engine Mechanical)

EG



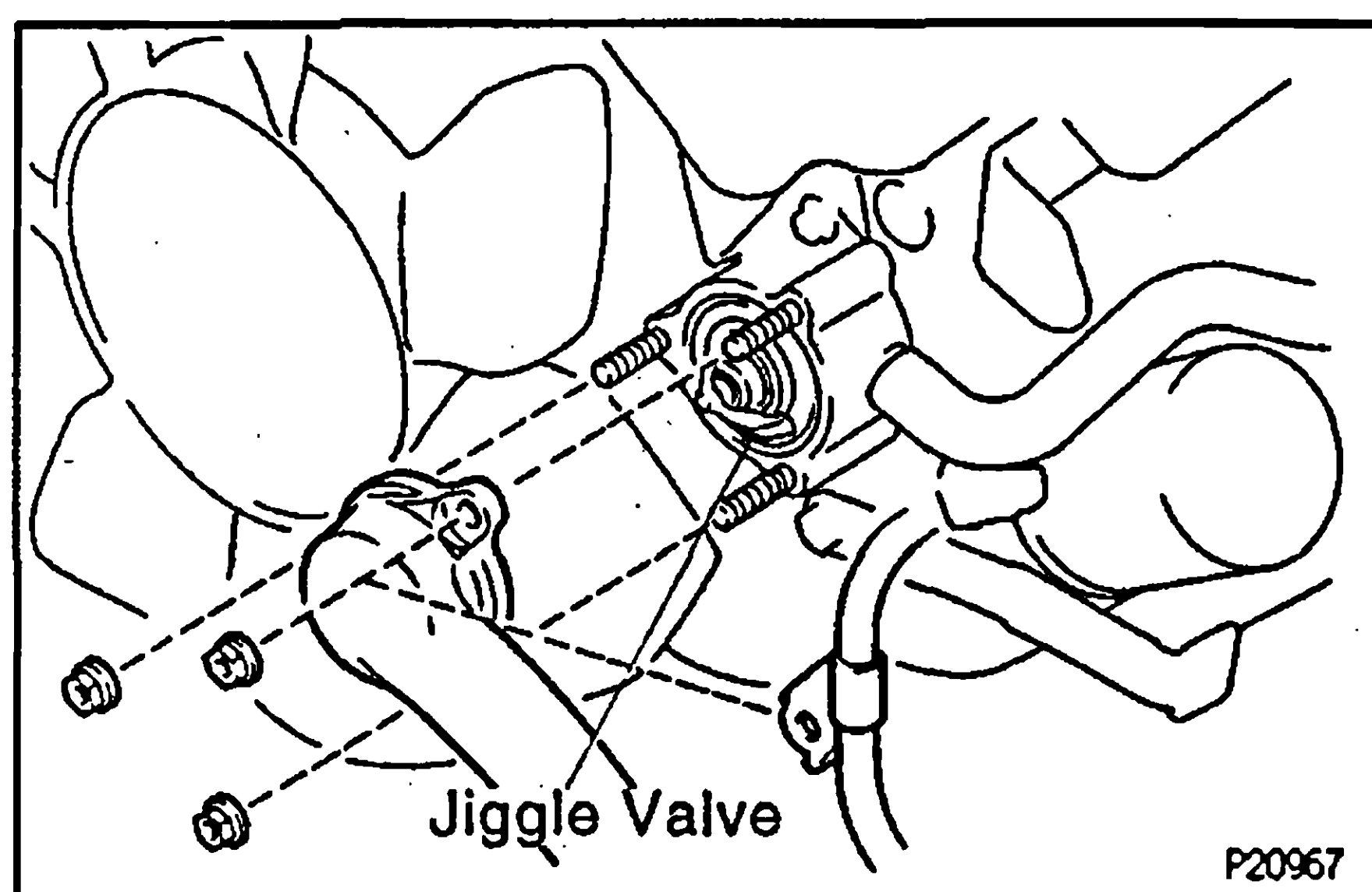
THERMOSTAT

THERMOSTAT REMOVAL

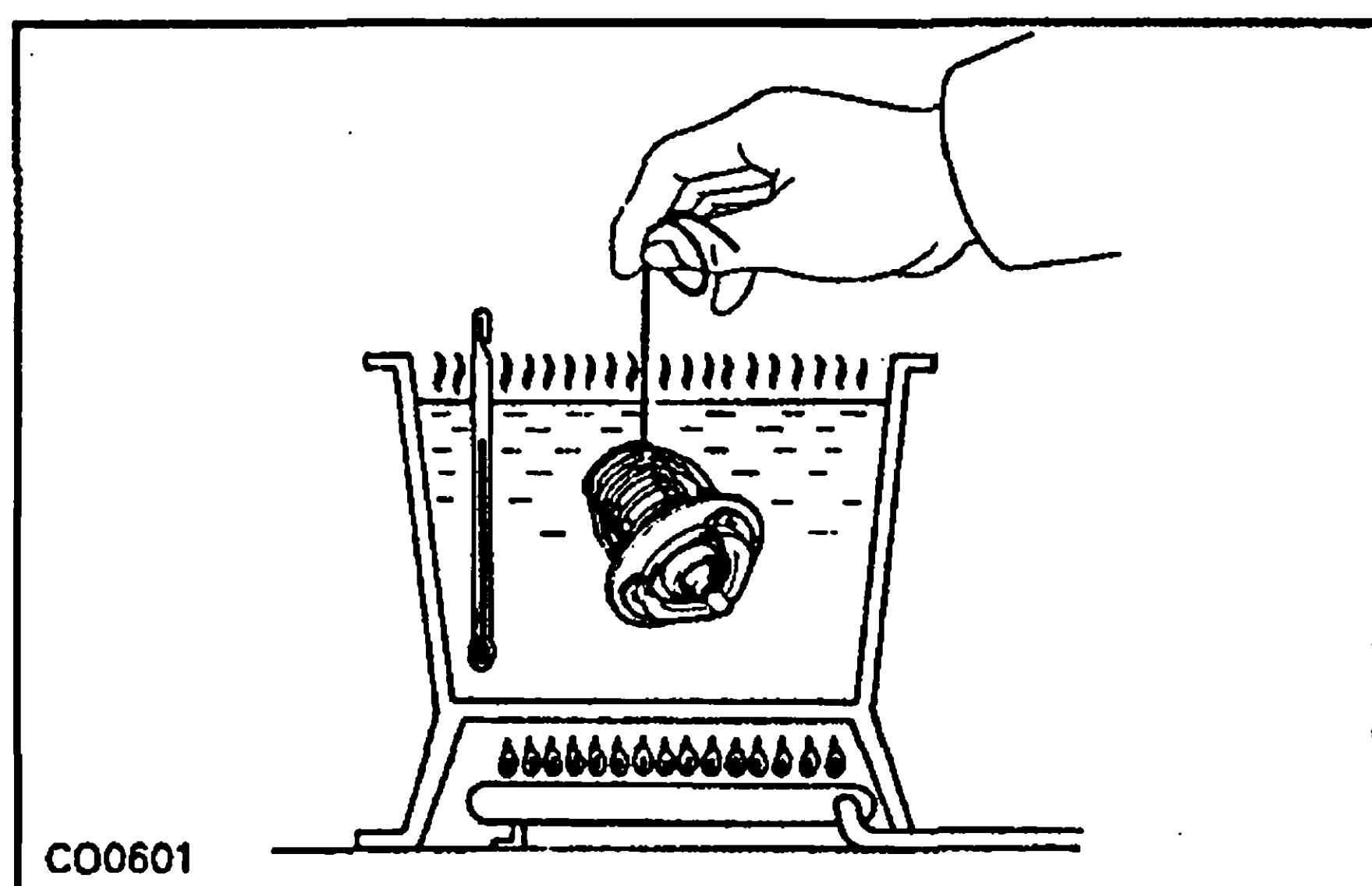
EG1DB-05

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 LOWER RADIATOR HOSE**



3. **REMOVE WATER INLET AND THERMOSTAT**
 - (a) Remove the 3 nuts, water inlet and thermostat with gasket from the water pump.
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)
INSTALLATION HINT: Install the thermostat with the jiggle valve downward.
 - (b) Remove the gasket from the thermostat.
INSTALLATION HINT: Use a new gasket.



THERMOSTAT INSPECTION

EG1DC-00

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.

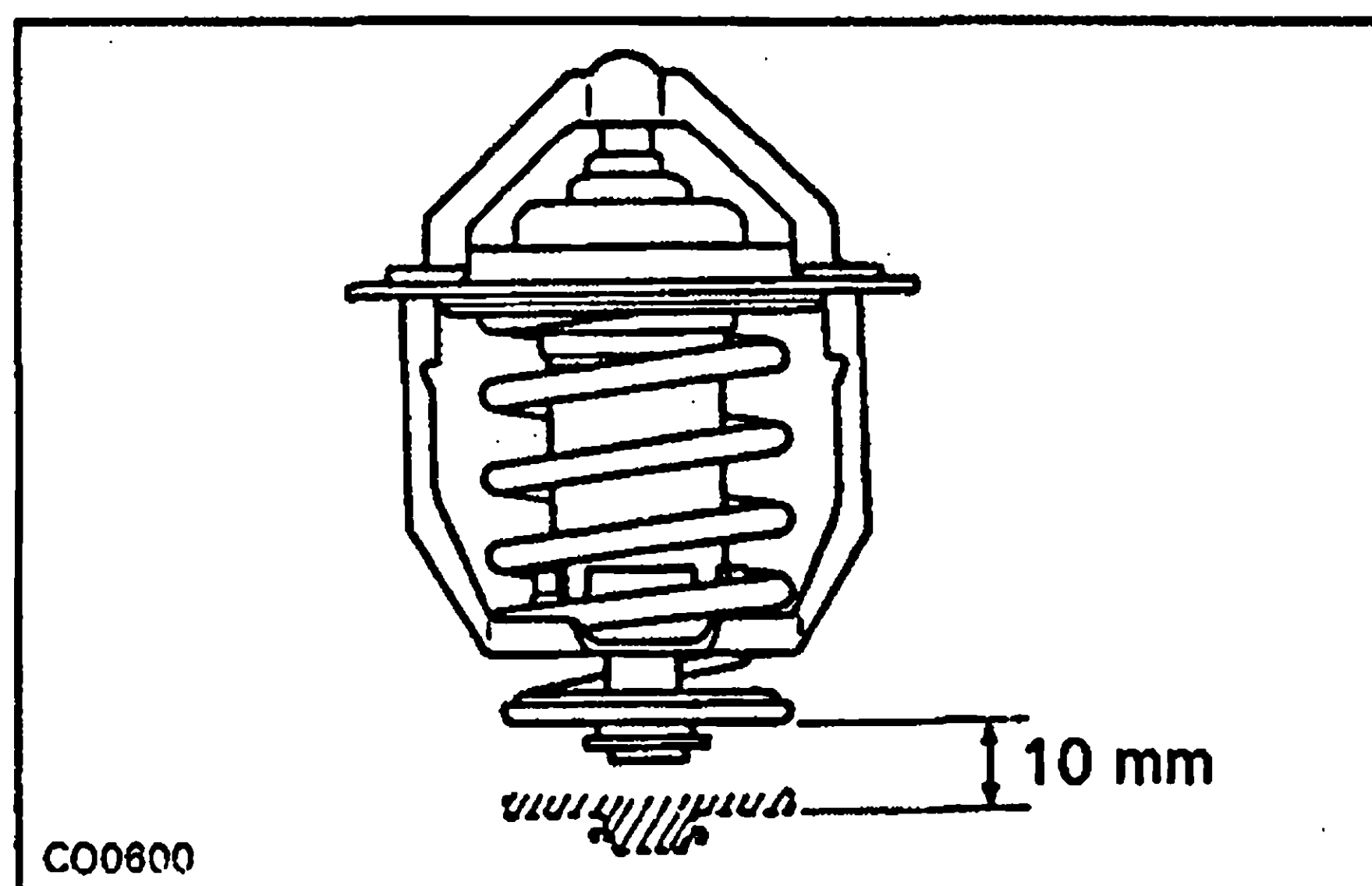
- (c) Check the valve lift.

Valve lift:

At 95°C (203°F): 8.5 mm (0.335 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.



THERMOSTAT INSTALLATION

EG1V3-01

Installation is in the reverse order of removal.

RADIATOR

RADIATOR CLEANING

EG074-0M

Using water or 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 and radiator core.)

RADIATOR INSPECTION

EG006-02

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 has contaminations, always rinse it with water.
- Before using a radiator cap tester, wet the relief valve and pressure valve with engine coolant or water.

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

Standard opening pressure:

74 — 103 kPa

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

Minimum opening pressure:

59 kPa (0.6 kgf/cm², 8.5 psi)

HINT: Use the tester's maximum reading as the opening pressure.

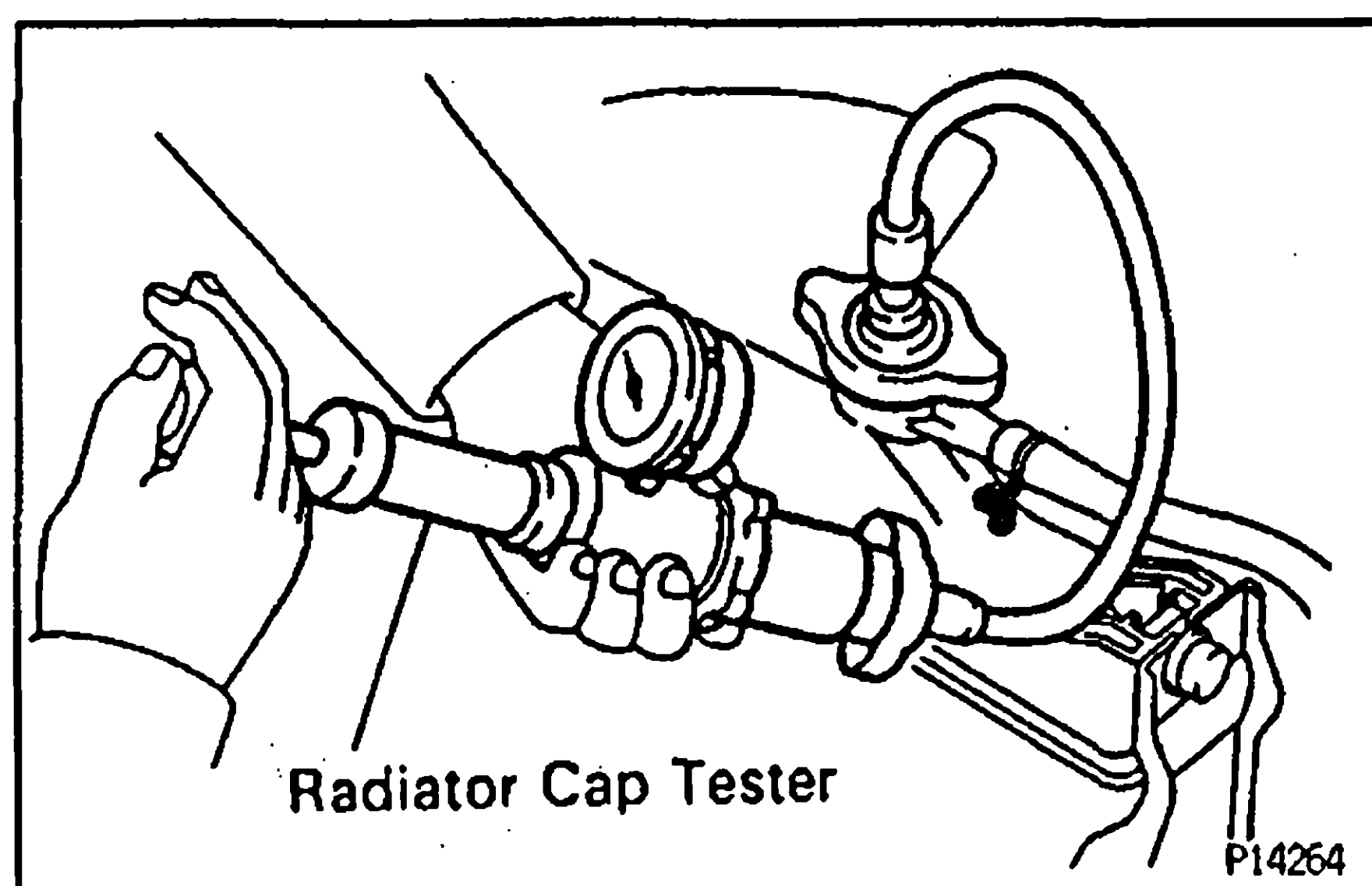
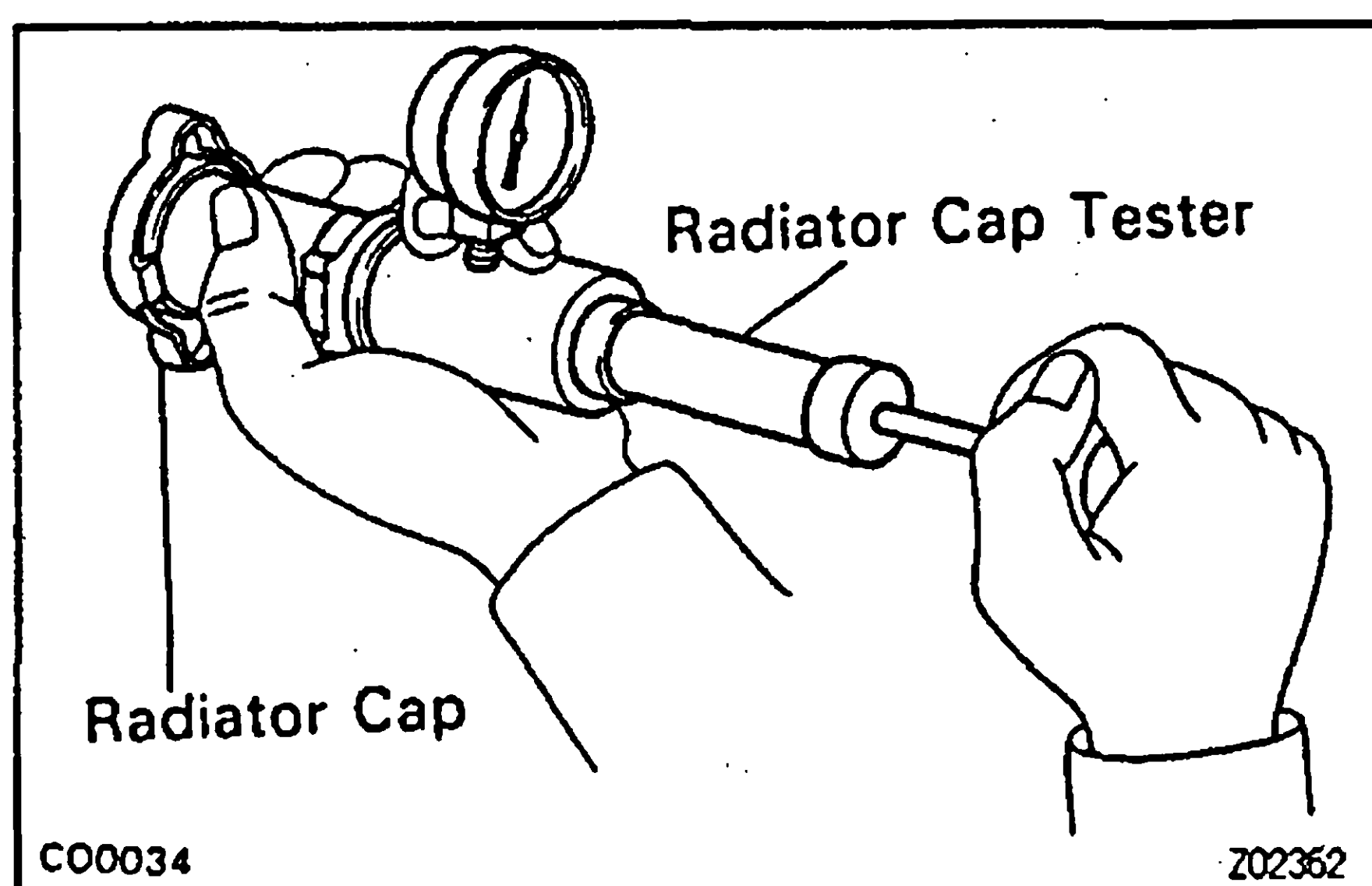
If the opening pressure is less than minimum, replace the radiator cap.

3. INSPECT COOLING SYSTEM FOR LEAKS

- Fill the radiator with coolant and attach a radiator cap tester.
- Warm up the engine.
- Pump it to 118 kPa (1.2 kgf/cm², 17.1 psi), and check that the pressure does not drop.

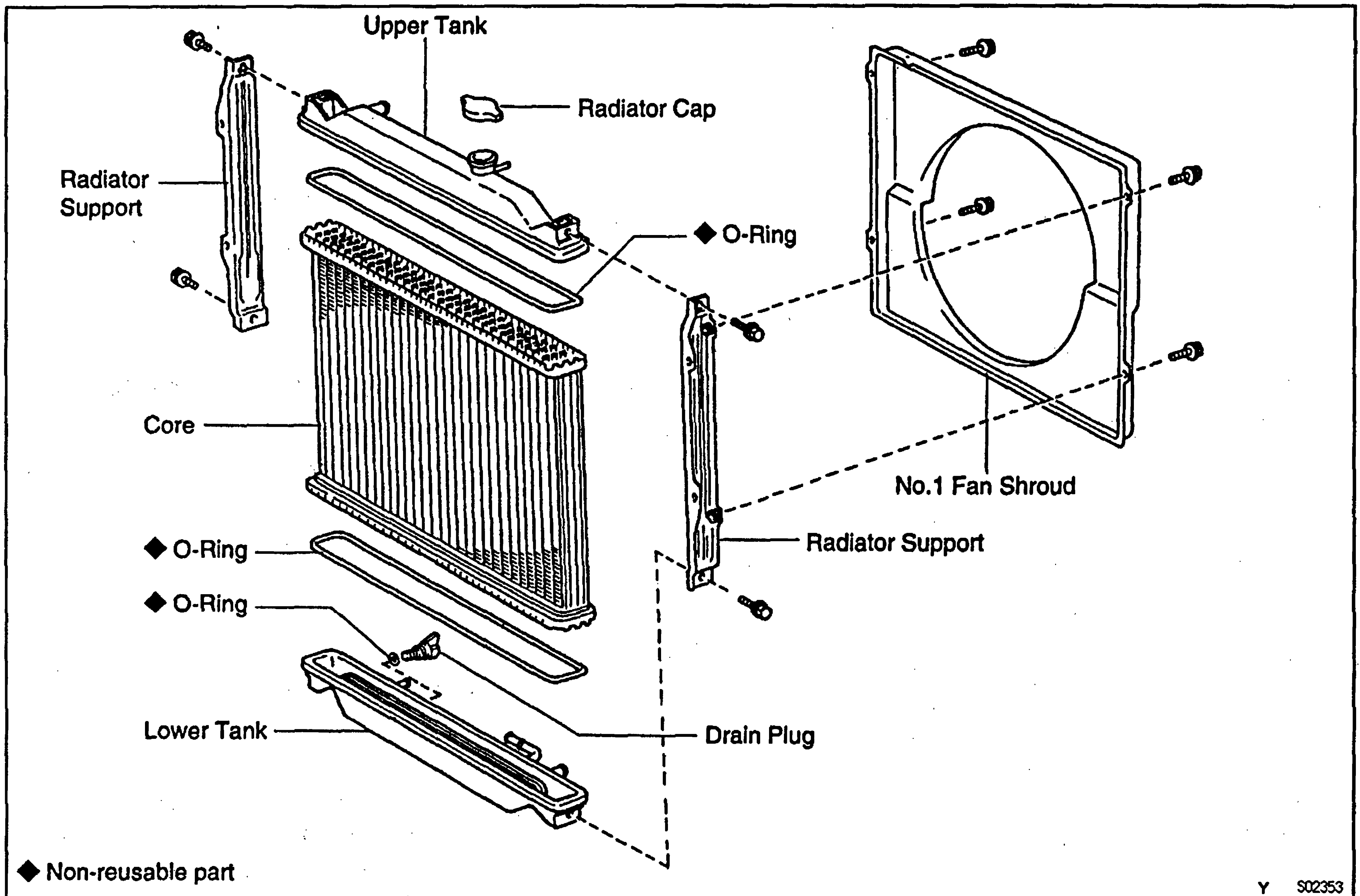
If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, cylinder block and head.

4. REINSTALL RADIATOR CAP

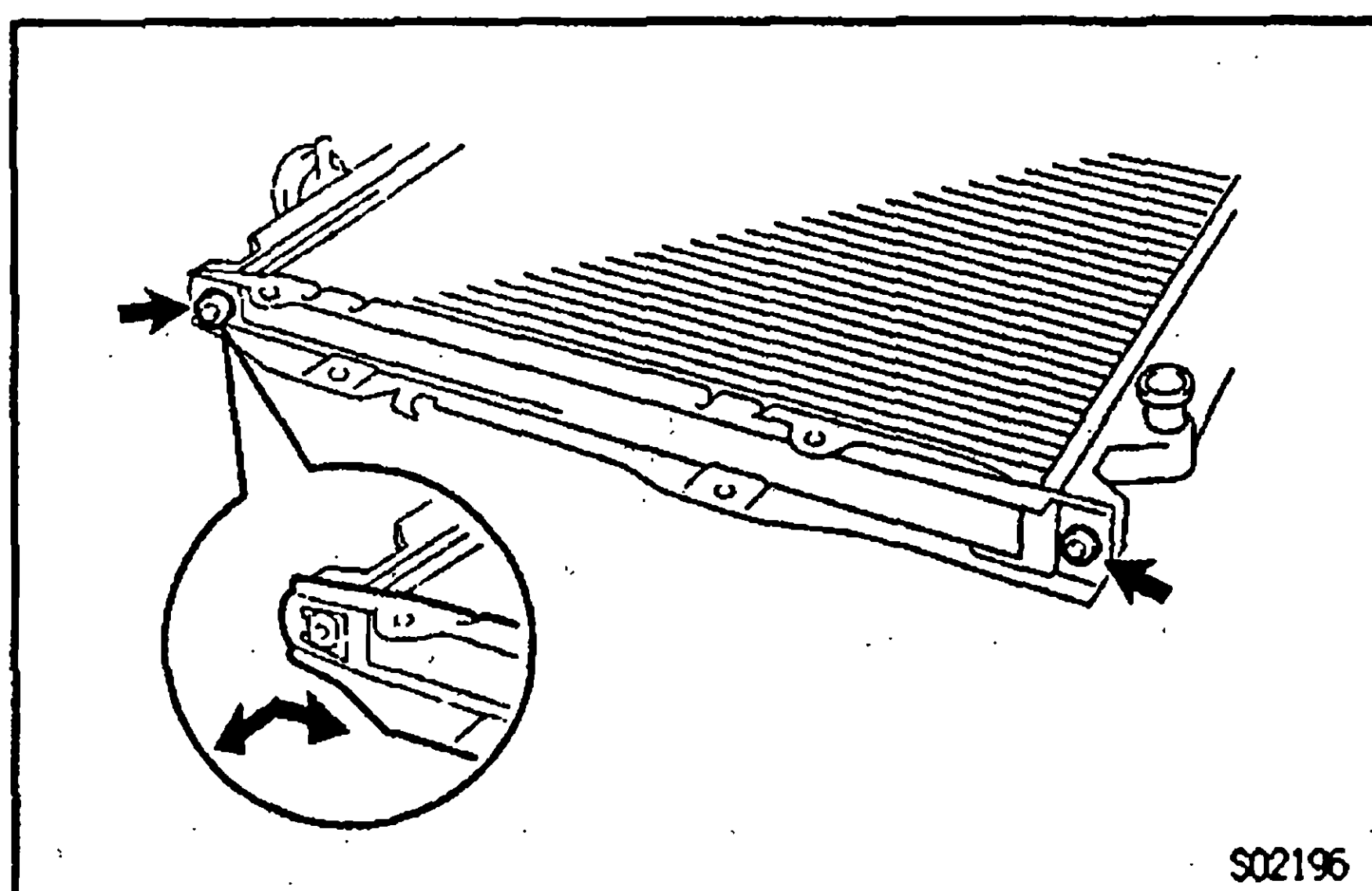


COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

E01J6-0H



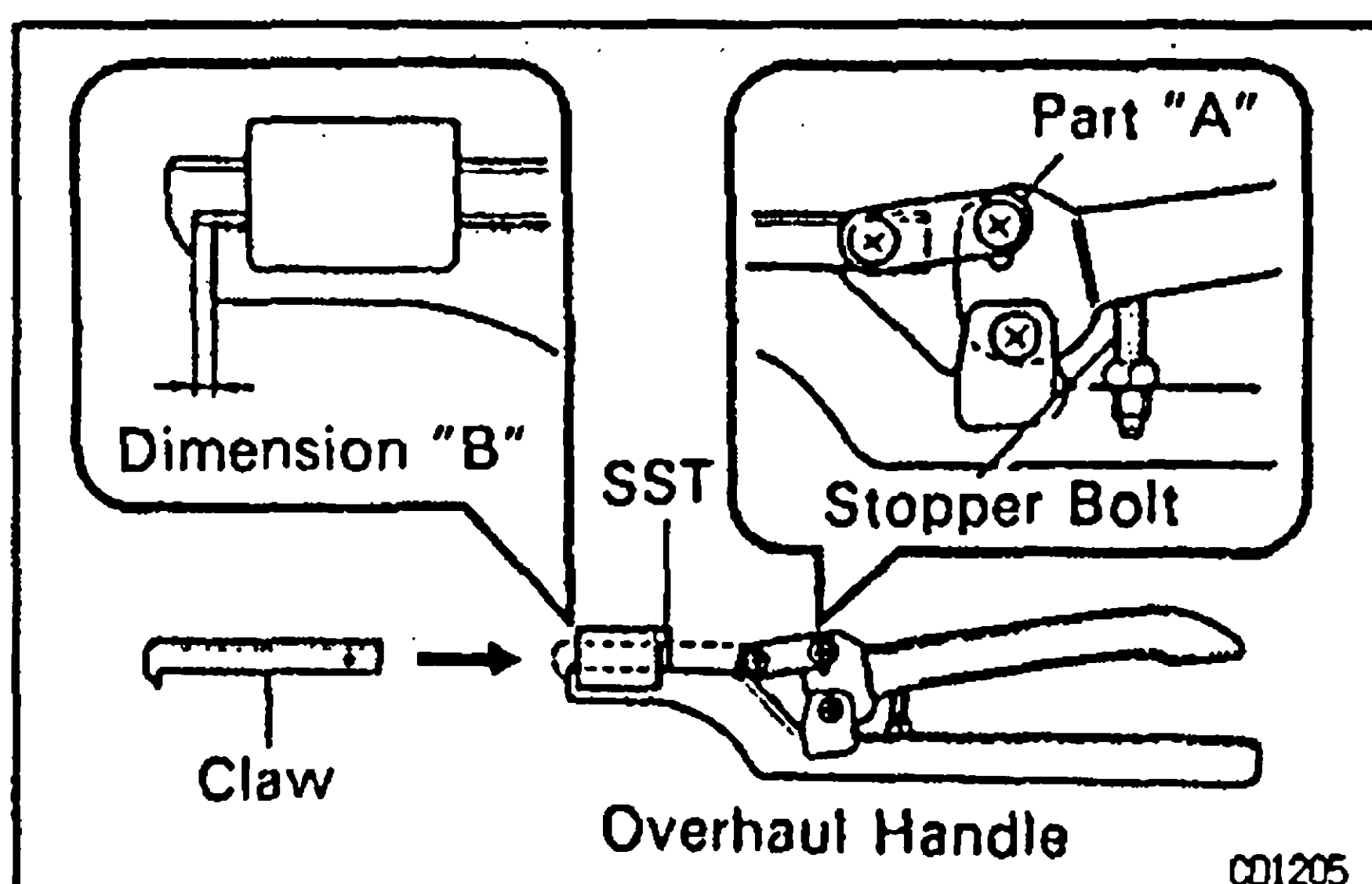
EG

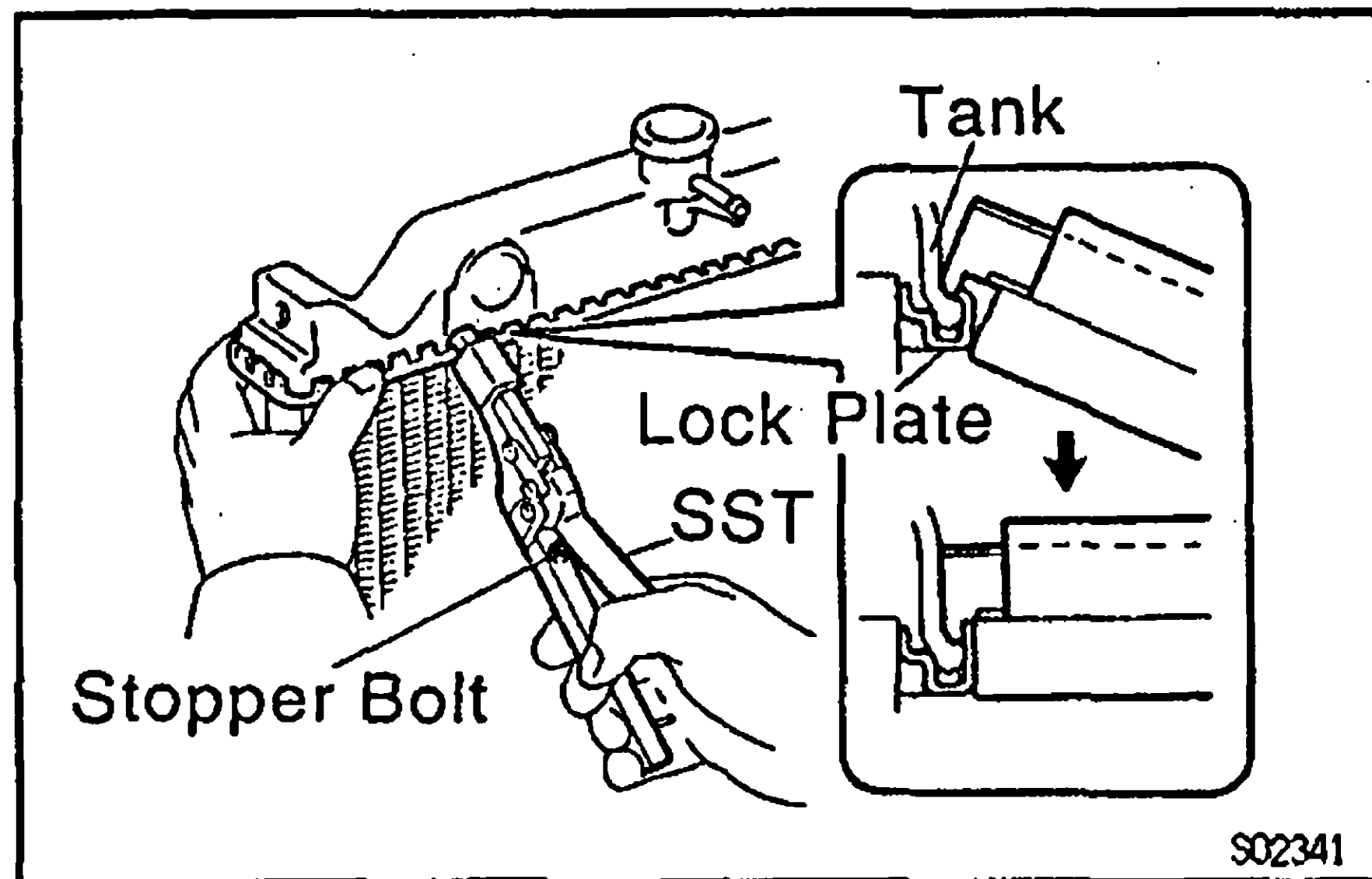


RADIATOR DISASSEMBLY

E078H-01

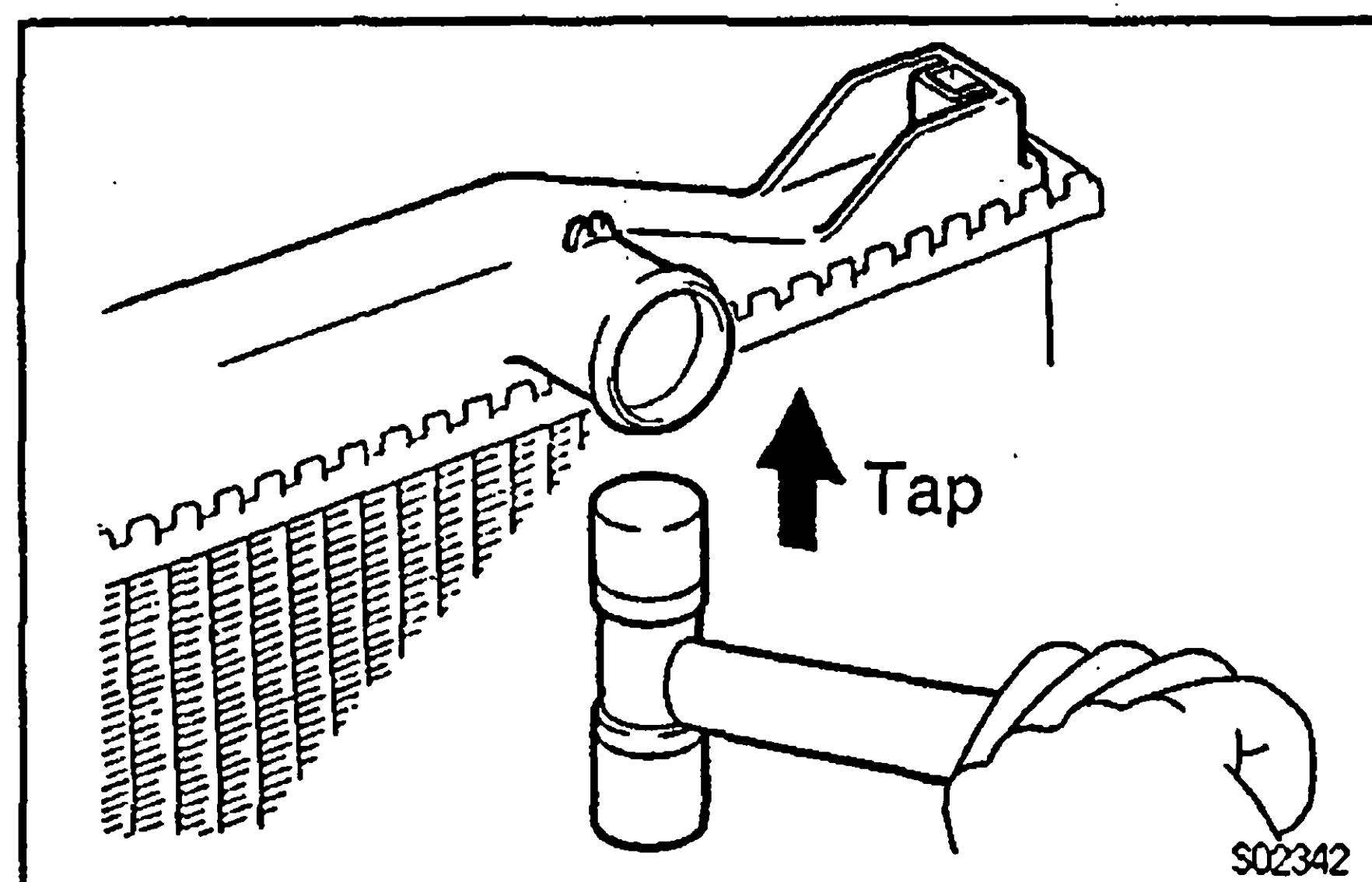
1. **REMOVE NO.1 FAN SHROUD**
Remove the 4 bolts and fan shroud.
2. **REMOVE RADIATOR SUPPORTS**
Remove the 4 screws and 2 radiator supports.
INSTALLATION HINT: Insert the tabs the radiator upper tank through the radiator support holes.
Torque: 13 N·m (130 kgf·cm, 9.6 ft·lbf)
3. **REMOVE DRAIN PLUG**
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.

7. A/T:**REMOVE OIL COOLER FROM LOWER TANK**

(a) Remove the 2 nuts and 2 pipes.

(b) Remove the 2 nuts, 2 spring washers, 2 plate washers and oil cooler.

(c) Remove the 2 O-rings from the oil cooler.

E078J-01

RADIATOR ASSEMBLY**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.

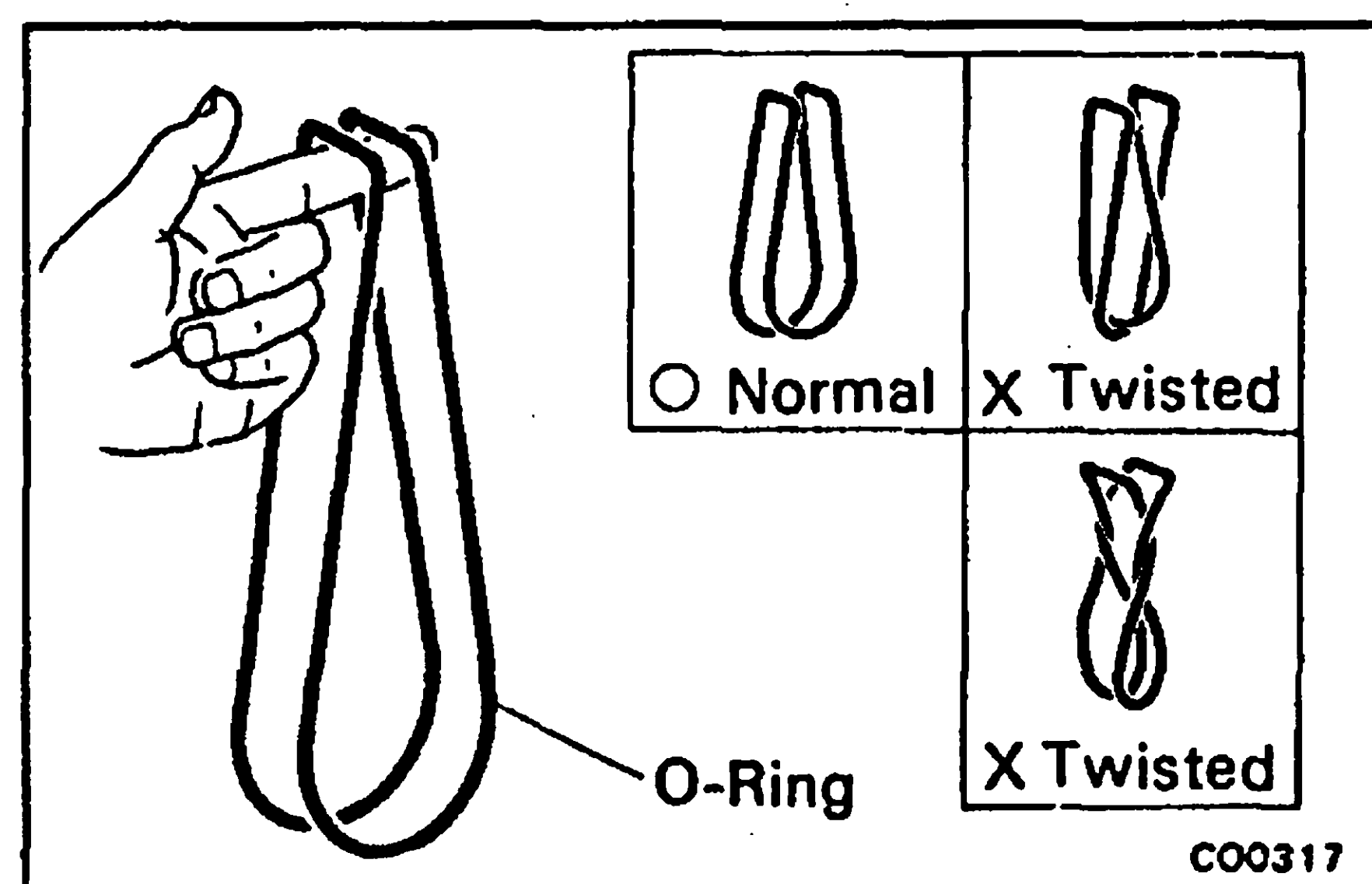
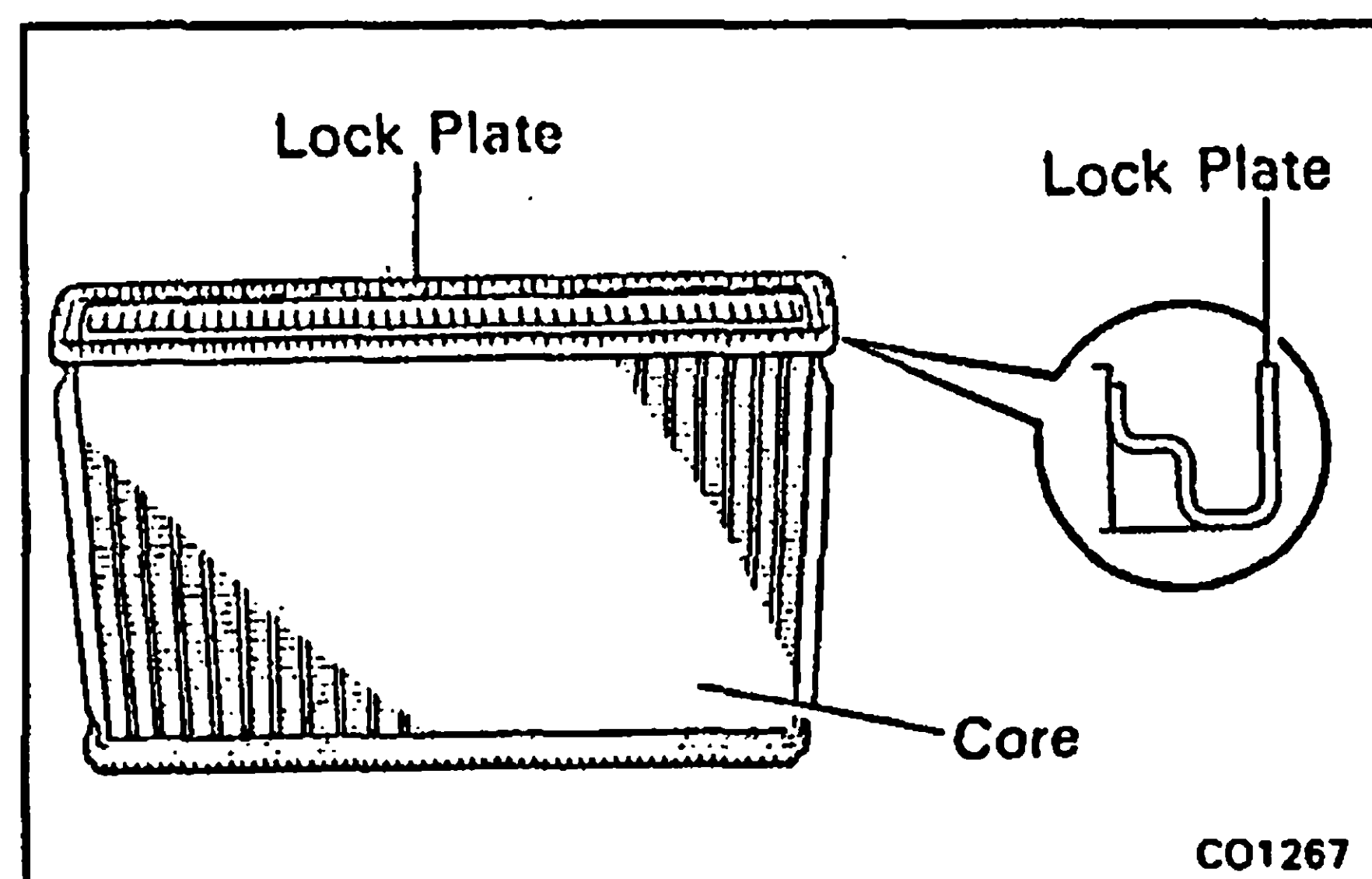
After the 2nd time, the radiator core must be replaced.

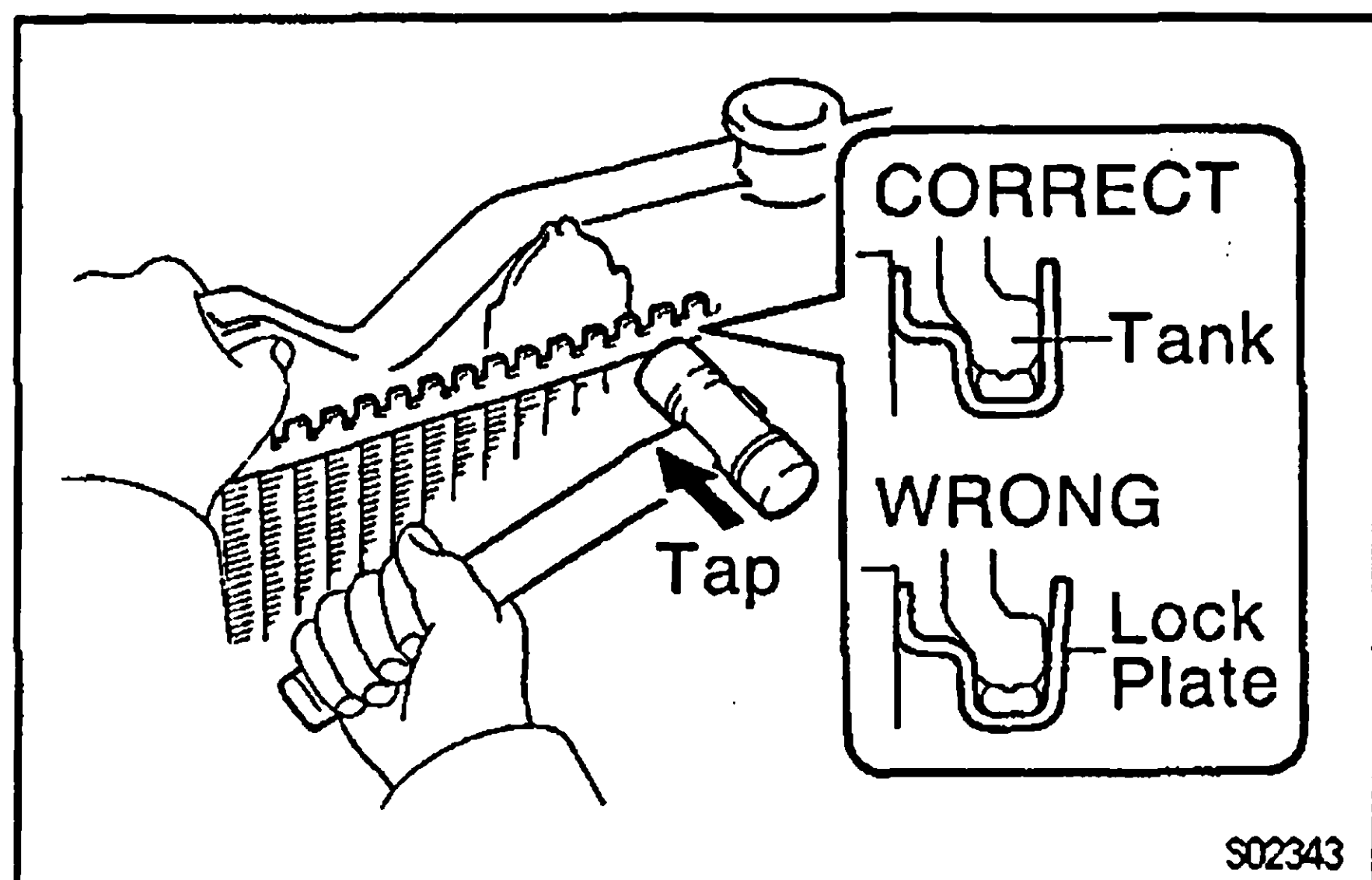
2. INSTALL NEW O-RINGS AND TANKS

(a) After checking that there are no foreign objects in the lock plate groove, install the new O-ring without twisting it.

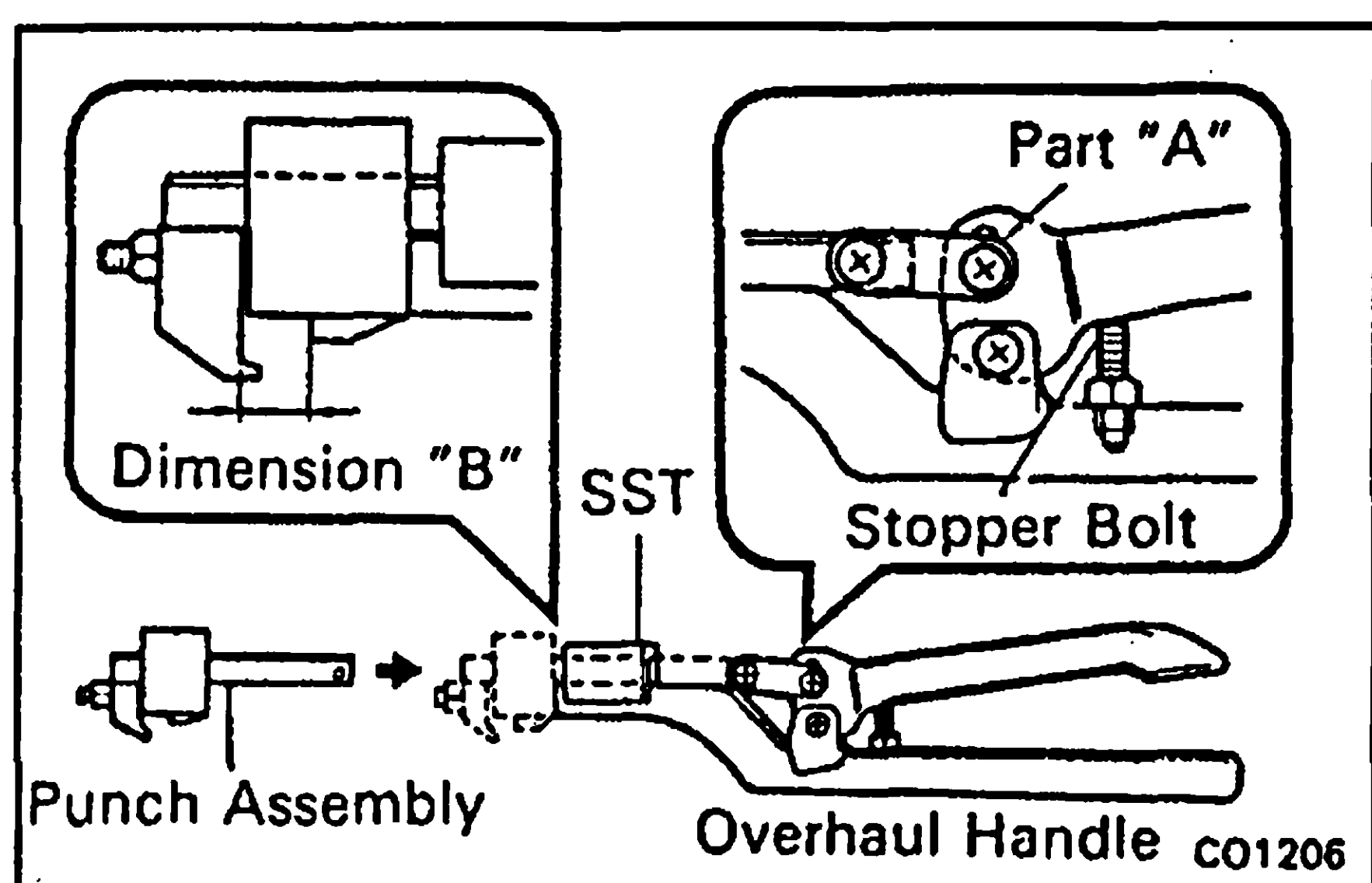
HINT: When cleaning the lock plate groove, lightly rub it with sand paper without scratching it.

(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

- (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.

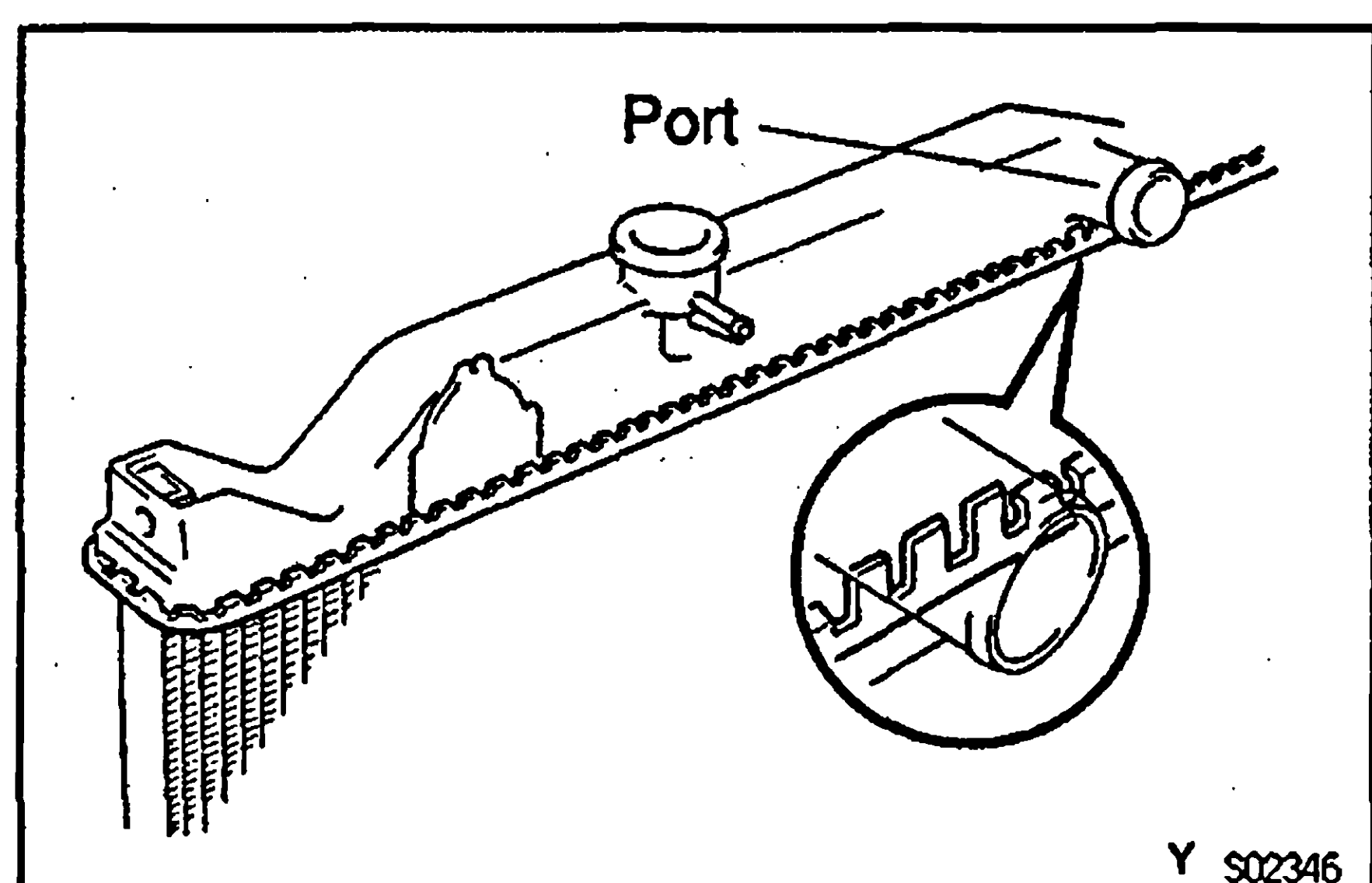
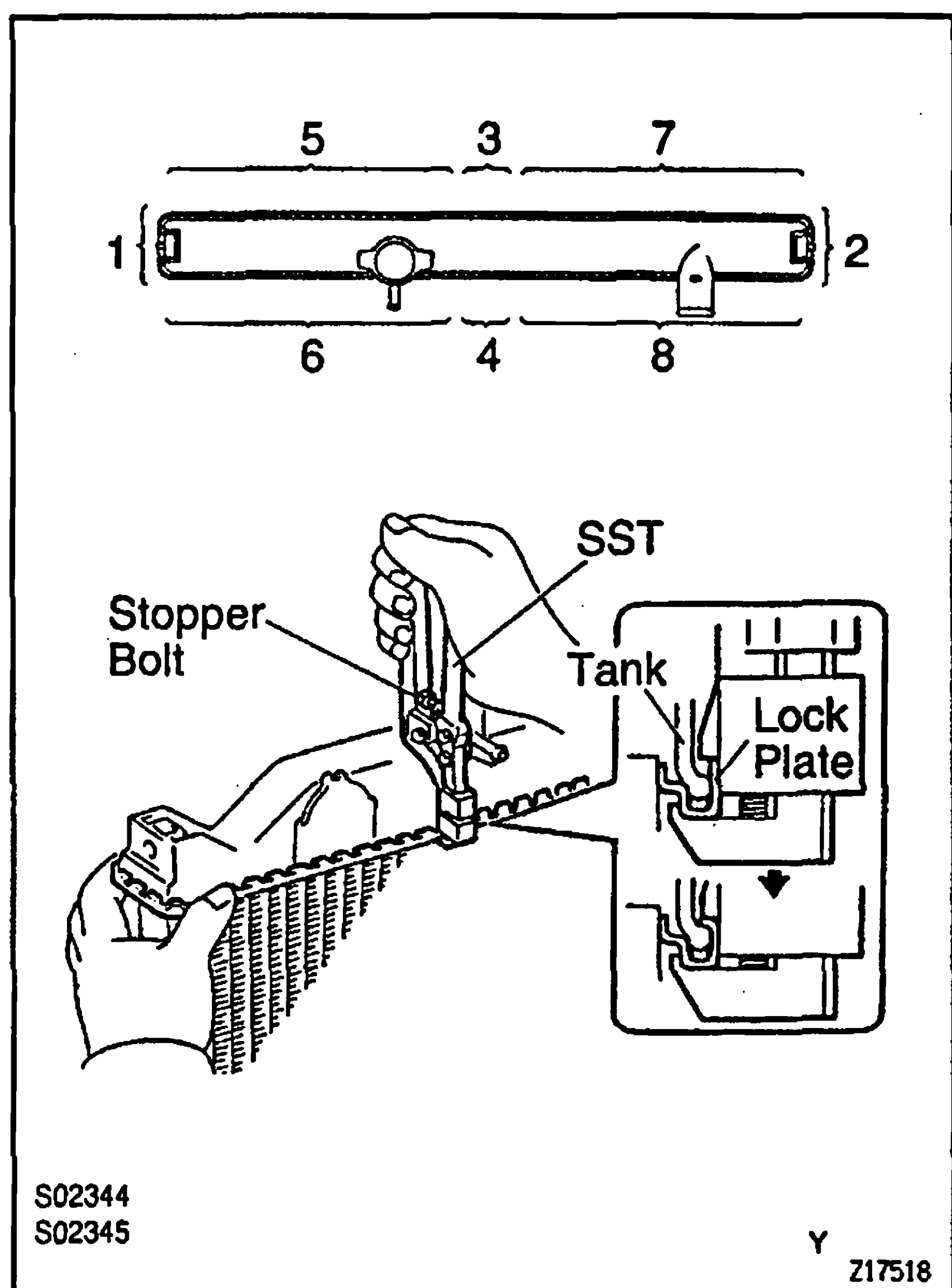
Dimension "B":

8.4 mm (0.34 in.)

4. CAULK LOCK PLATE

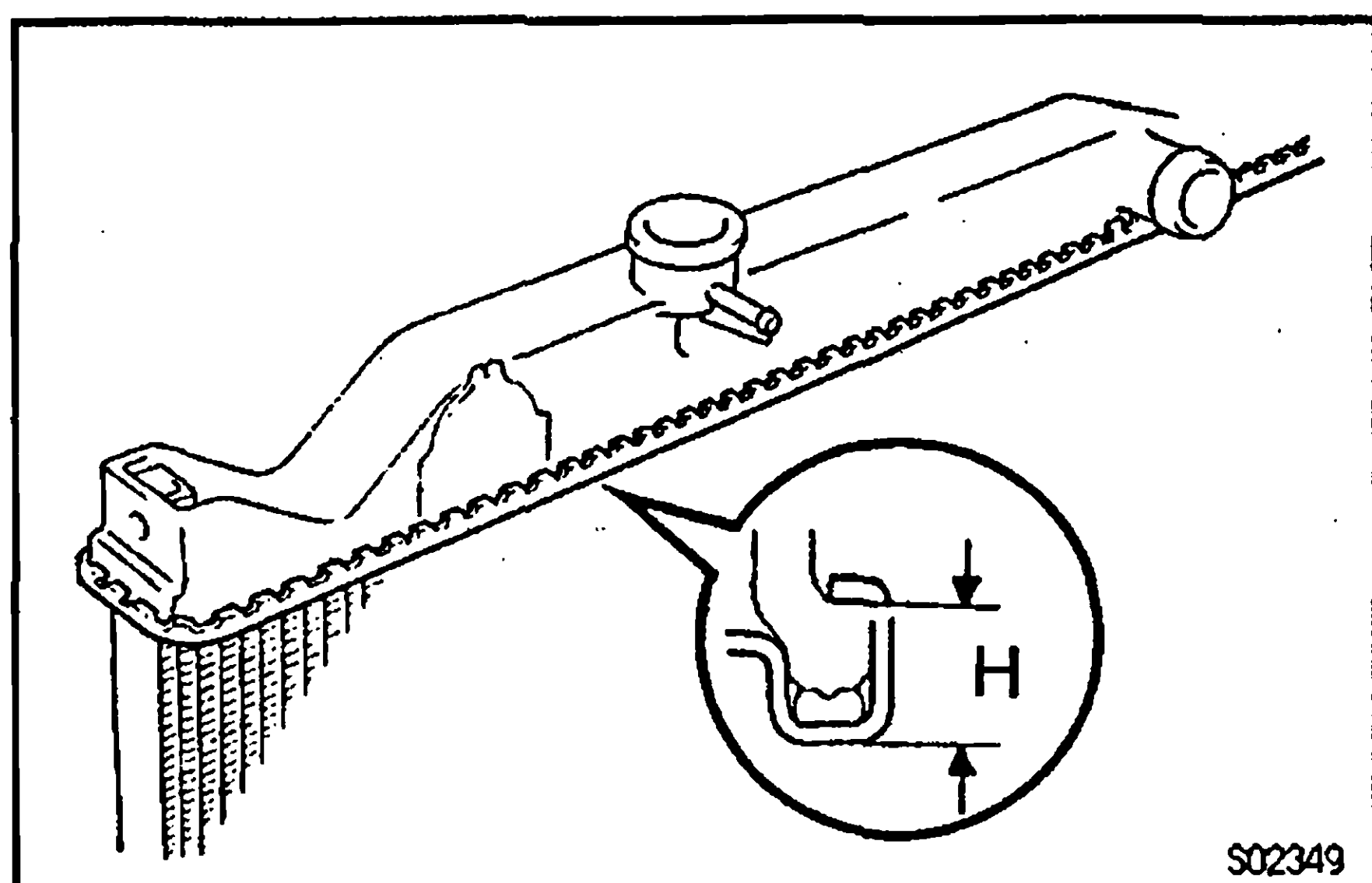
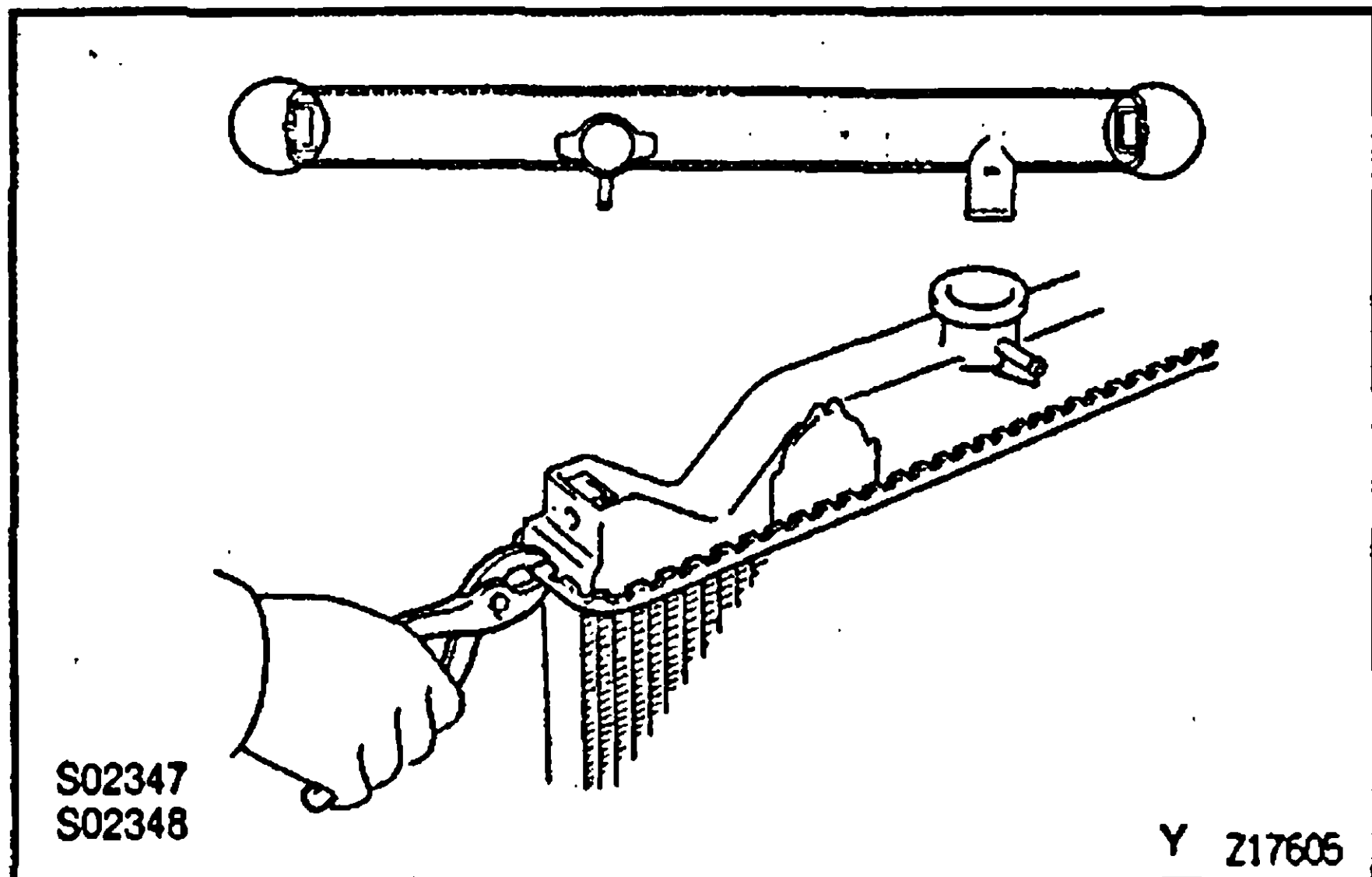
- (a) Lightly press SST against the lock plate in the order shown in the illustration. After repeating this a few times, fully caulk the lock plate by squeezing the handle until stopped by the stopper bolt.

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):

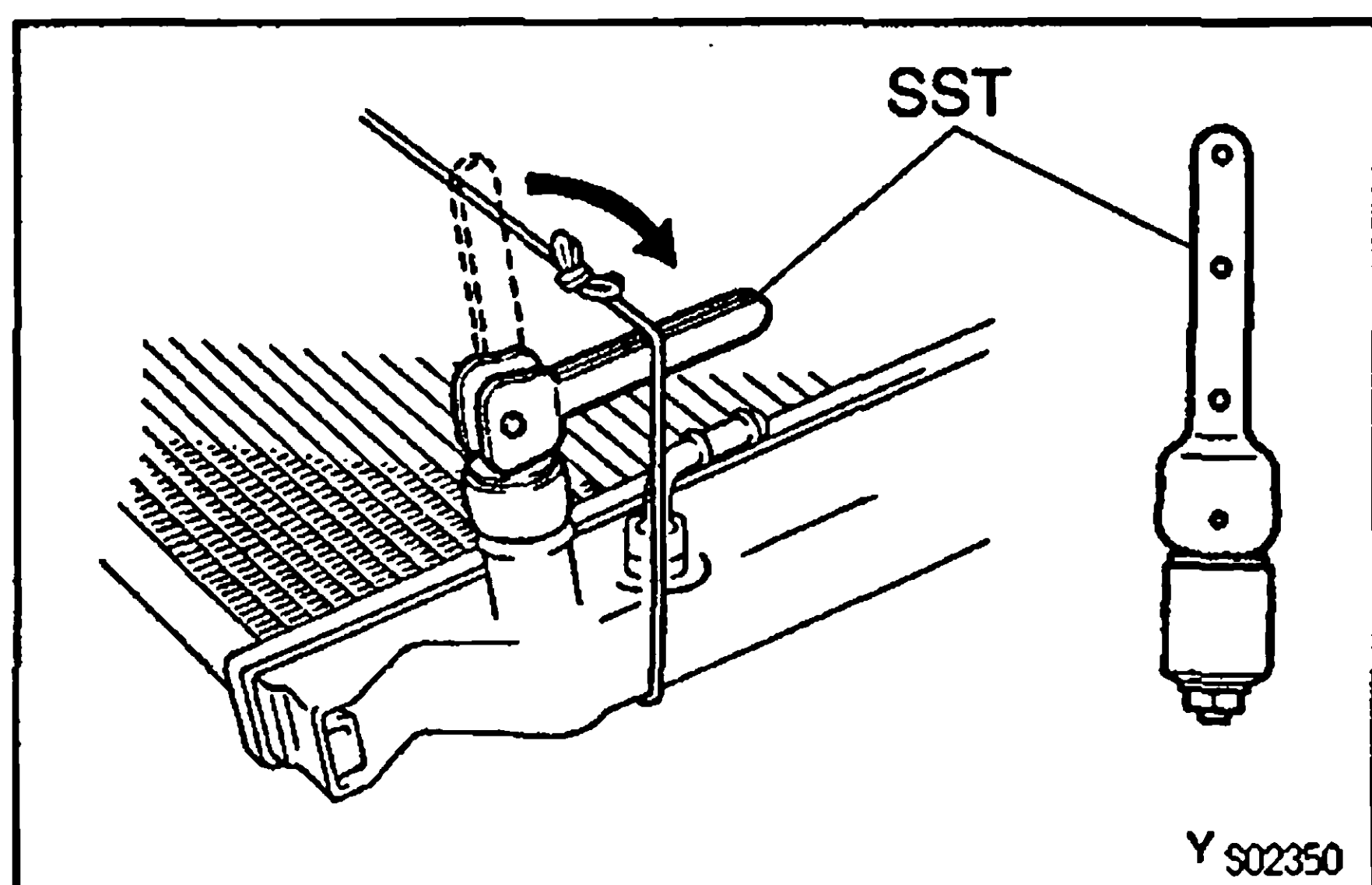
7.4 – 7.8 mm (0.2959 – 0.3119 in.)

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

- Install a new O—ring to the drain plug.
 - Apply soapy water to the O—ring.
 - Install the drain plug.
7. Reassembly except steps 1 to 7 is in the reverse order of disassembly.

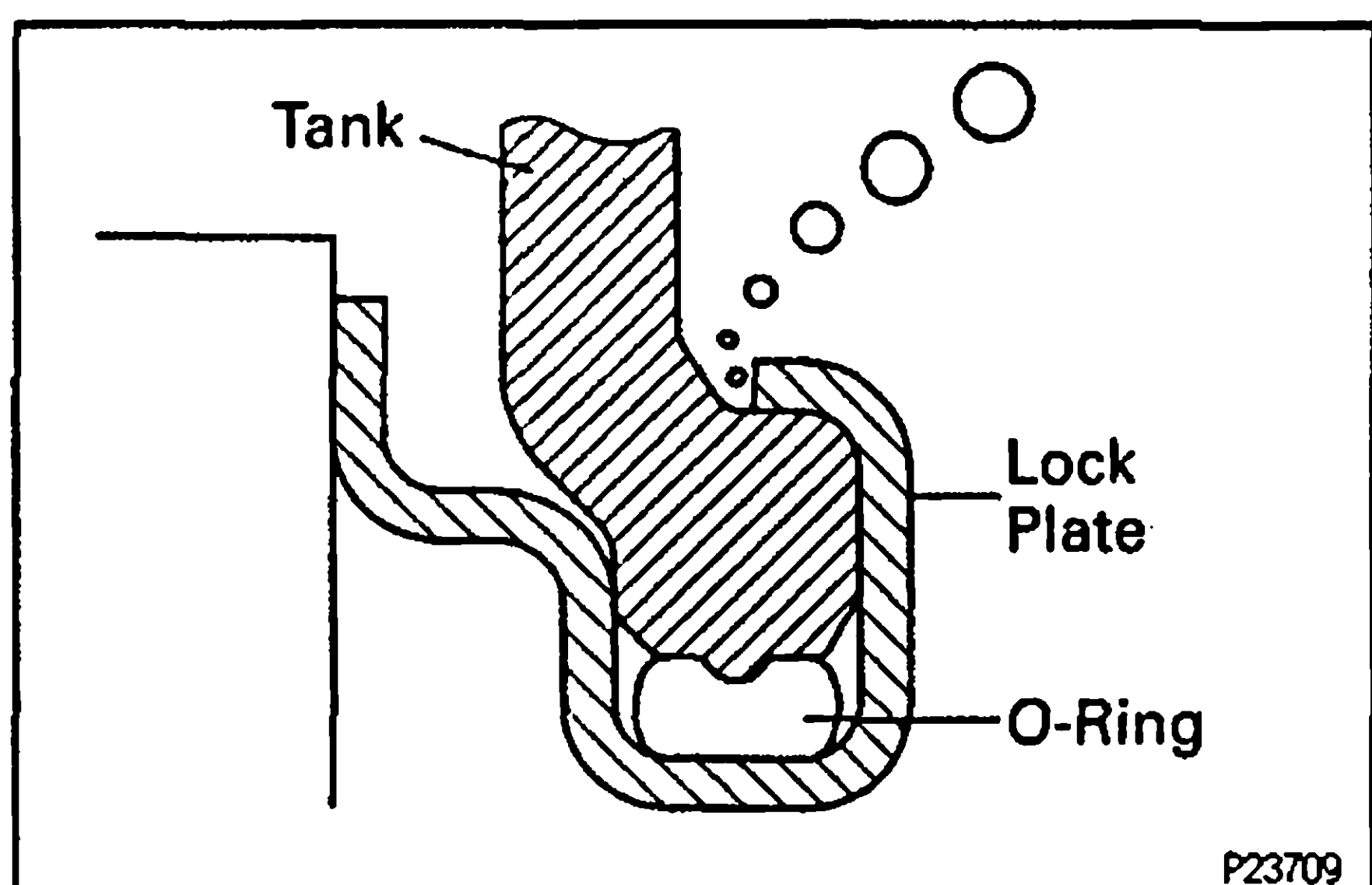


8. CHECK FOR WATER LEAKS

- Using SST, plug the inlet and outlet pipes of the radiator.
- Using a radiator cap tester, apply pressure to the radiator.

Test pressure:

177 kPa (1.8 kgf/cm², 26 psi)



- 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 swish the radiator around in the water until all air bubbles disappear.

RADIATOR INSTALLATION

EGSV7-01

Installation is in the reverse order of removal.

SERVICE SPECIFICATIONS
SERVICE DATA

EG1DJ-05

Thermostat	Valve opening pressure	80 — 84°C (176 — 183°F)
	Valve lift at 95°C (203°F)	8.5 mm (0.335 in.) or more
Radiator cap	Relief valve opening pressure STD	74 — 103 kPa (0.75 — 1.05 kgf/cm², 10.7 — 14.9 psi)
	Minumum	59 kPa (0.6 kgf/cm², 8.5 psi)

EG

TORQUE SPECIFICATIONS

EG1DK-05

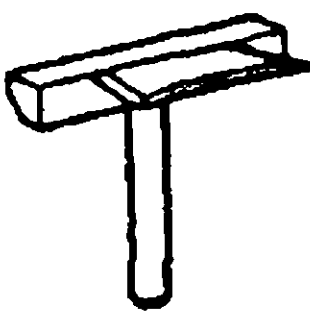
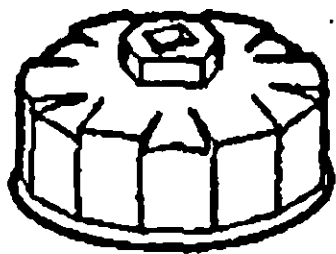
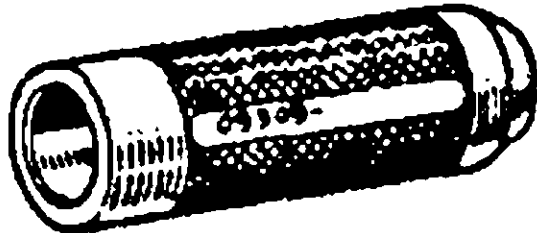
Part tightened	N·m	kgf·cm	ft·lbf
Fan x Fan pulley bracket	5.4	55	48 in·lbf
Water pump x Cylinder block — Short bolt	20	200	14
Water inlet x Water pump	20	200	14
Radiator support x Body	12	120	8.7

LUBRICATION SYSTEM

PREPARATION

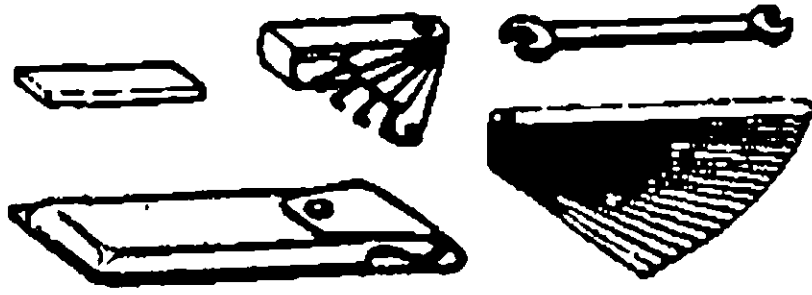
SST (SPECIAL SERVICE TOOLS)

EG1CR-06

	09032-00100 Oil Pan Seal Cutter	
	09228-07501 Oil Filter Wrench	
	09309-37010 Transmission Bearing Replacer	Camshaft front oil seal
	09816-30010 Oil Pressure Switch Socket	

RECOMMENDED TOOLS

EG1CS-04

	09200-00010 Engine Adjust Kit .	
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EQUIPMENT

EG1CT-04

Oil pressure gauge	
Precision straight edge	Oil pump
Torque wrench	

LUBRICANT

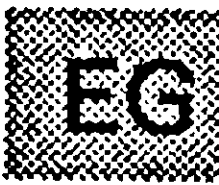
EG1CU-0X

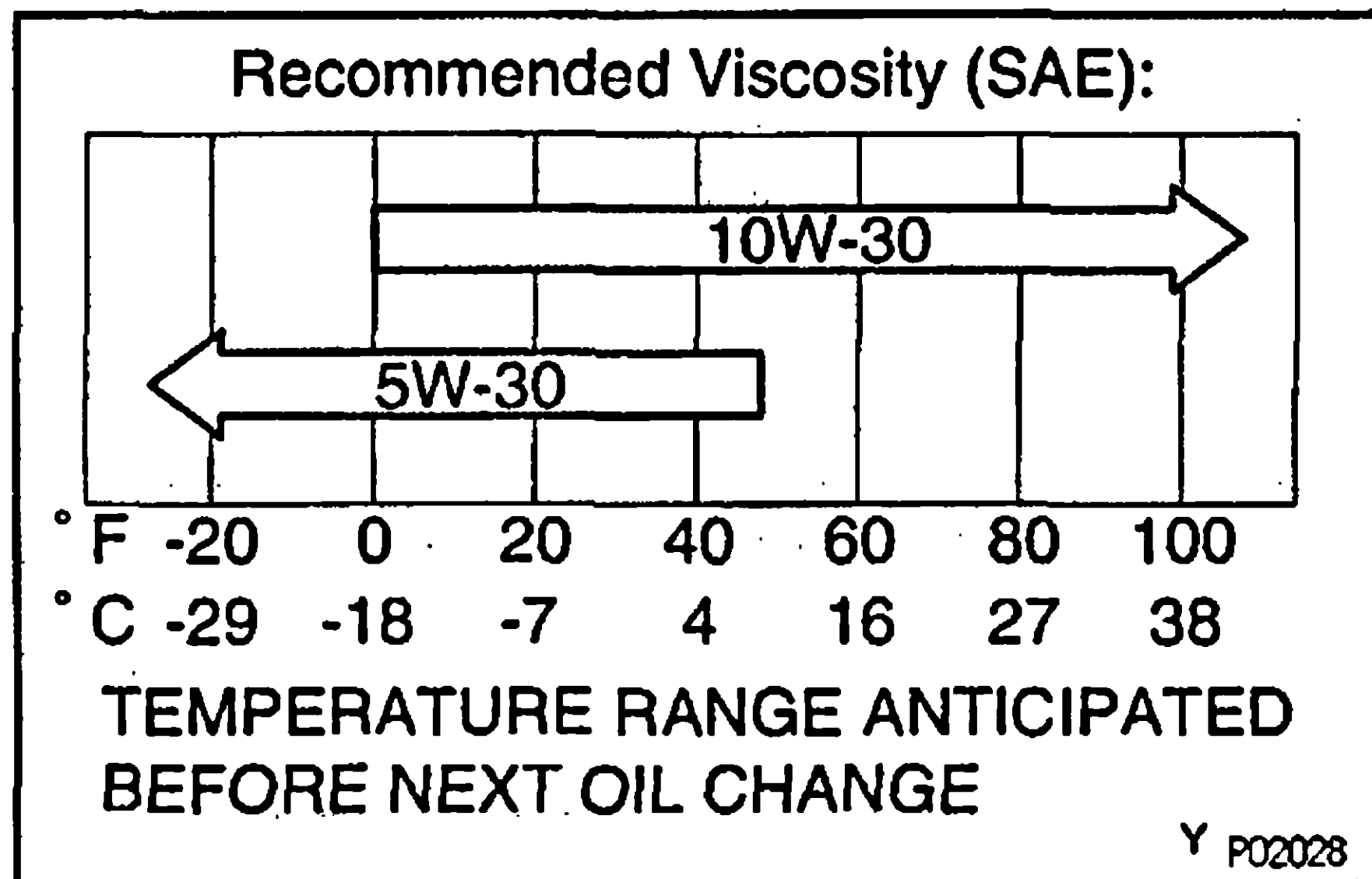
Item	Capacity	Classification
Engine oil		
Dry fill	5.9 liters (6.2 US qts, 5.2 Imp. qts)	
Drain and refill		
w/ Oil filter change	5.2 liters (5.5 US qts, 4.5 Imp. qts)	
w/o Oil filter change	4.9 liters (5.2 US qts, 4.3 Imp. qts)	API grade SH, Energy-Conserving II multigrade engine oil or ILSAC multigrade engine oil and recommended viscosity oil.

SSM (SPECIAL SERVICE MATERIALS)

EG1CV-07

08826-00080	Seal Packing Black or equivalent (FIPG)	Oil pump, Oil pan
08833-00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure sender gauge





OIL PRESSURE CHECK

EG78K-02

1. CHECK ENGINE OIL QUALITY

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

Oil grade:

API grade SH, Energy—Conserving II or ILSAC multigrade engine oil. Recommended viscosity is as shown in the illustration. If you use SAE 10W—30 engine oil in extremely low temperatures, the engine may become difficult to start, so SAE 5W—30 engine oil is recommended.

2. CHECK ENGINE OIL LEVEL

The oil level should be between the low level and full level marks on the dipstick.

If low, check for leakage and add oil up to the full level marks.

NOTICE:

- When inserting the oil dipstick, insert the curved tip of the dipstick facing the same direction as the curve of the guide.
- If the dipstick gets caught while inserting it, do not force it in. Reconfirm the direction of the dipstick.

3. REMOVE OIL PRESSURE SWITCH

Using SST, remove the oil pressure sender gauge.

SST 09816—30010

4. INSTALL OIL PRESSURE GAUGE

5. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

6. CHECK OIL PRESSURE

Oil pressure:

At idle speed

29 kPa (0.3 kgf/cm², 4.3 psi) or more

At 3,000 rpm

245 — 520 kPa (2.5 — 5.3 kgf/cm², 36 — 75 psi)

7. REMOVE OIL PRESSURE GAUGE

8. REINSTALL OIL PRESSURE SWITCH

- (a) Apply adhesive to 2 or 3 threads.

Adhesive:

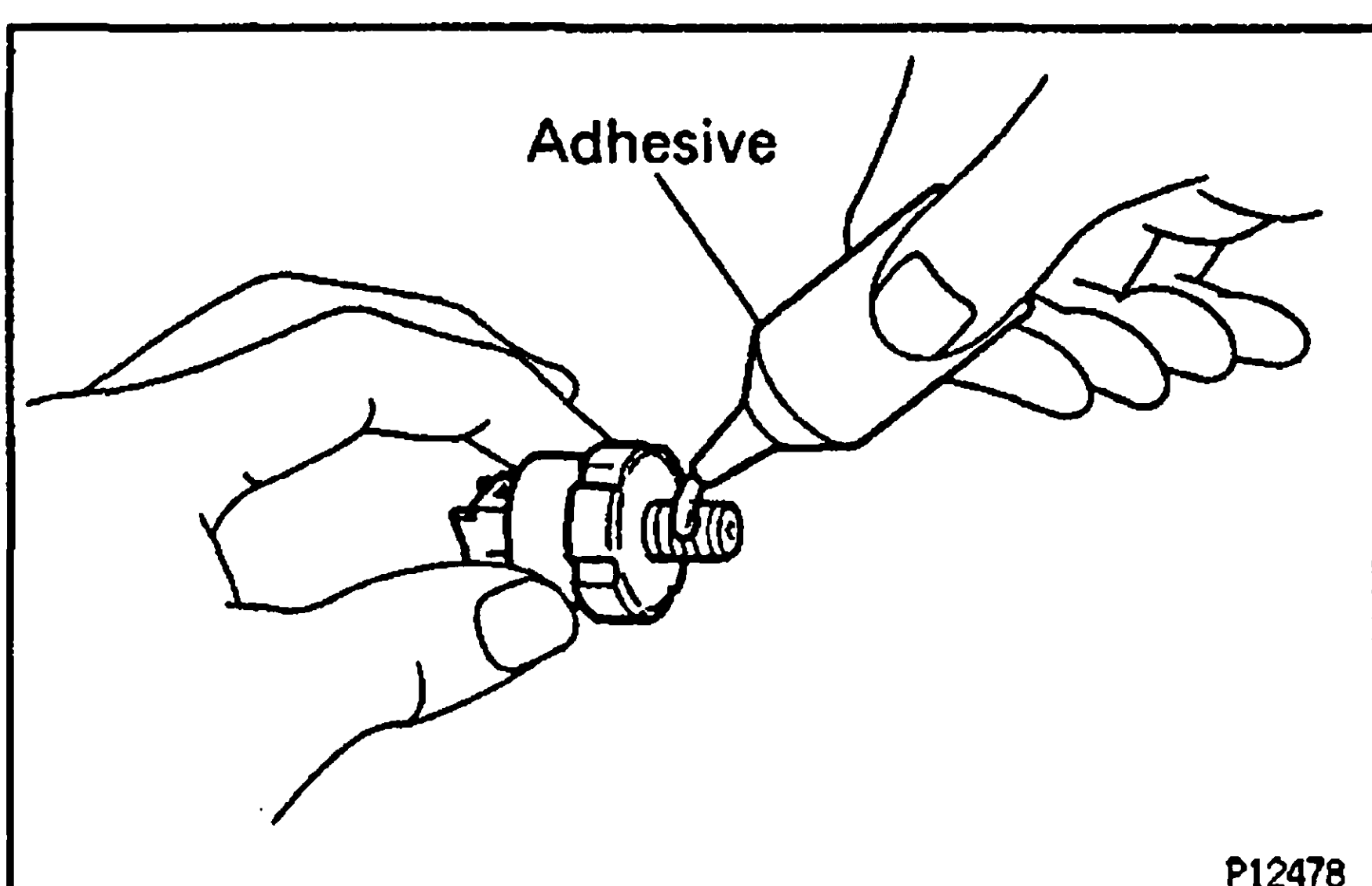
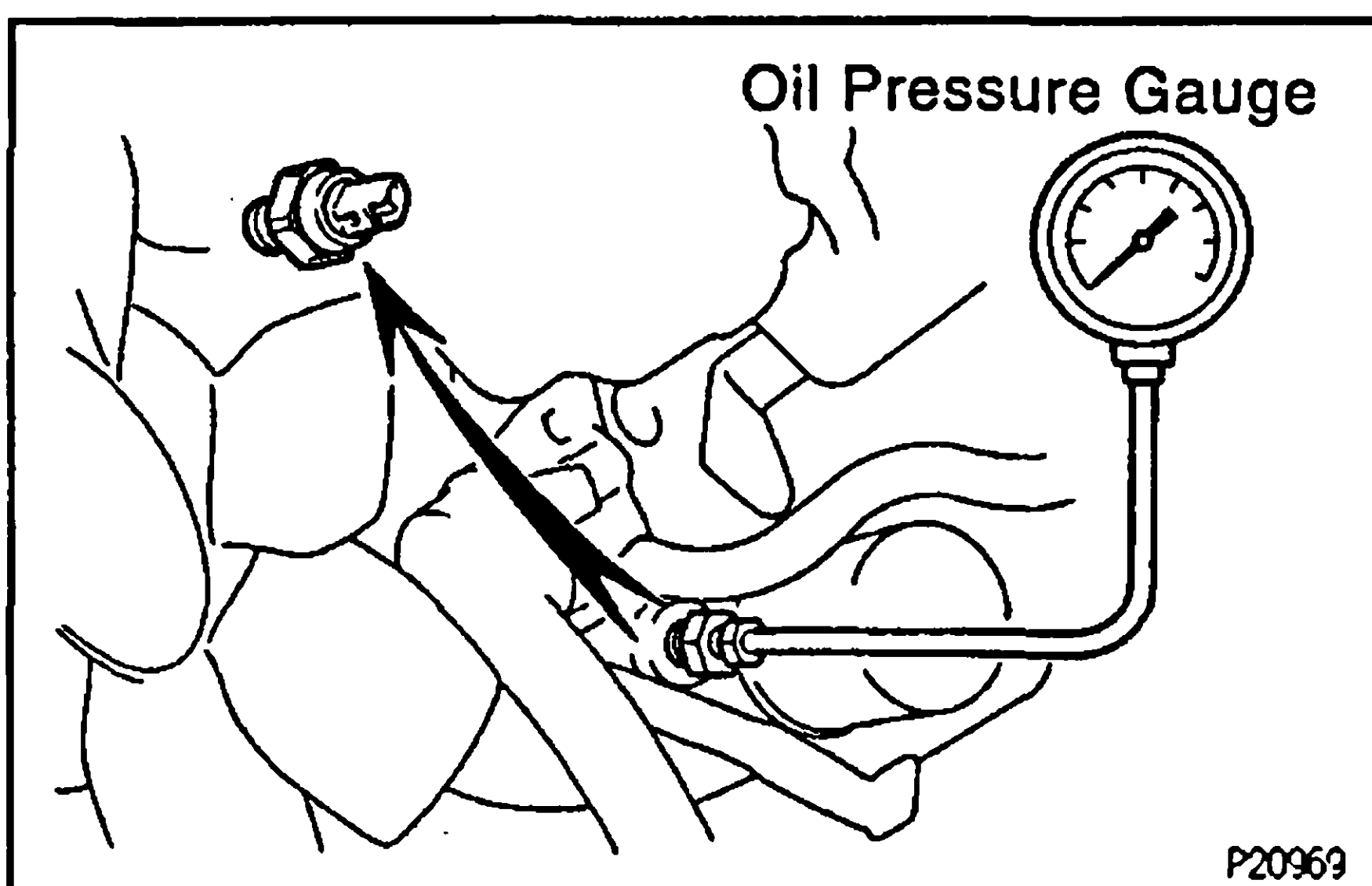
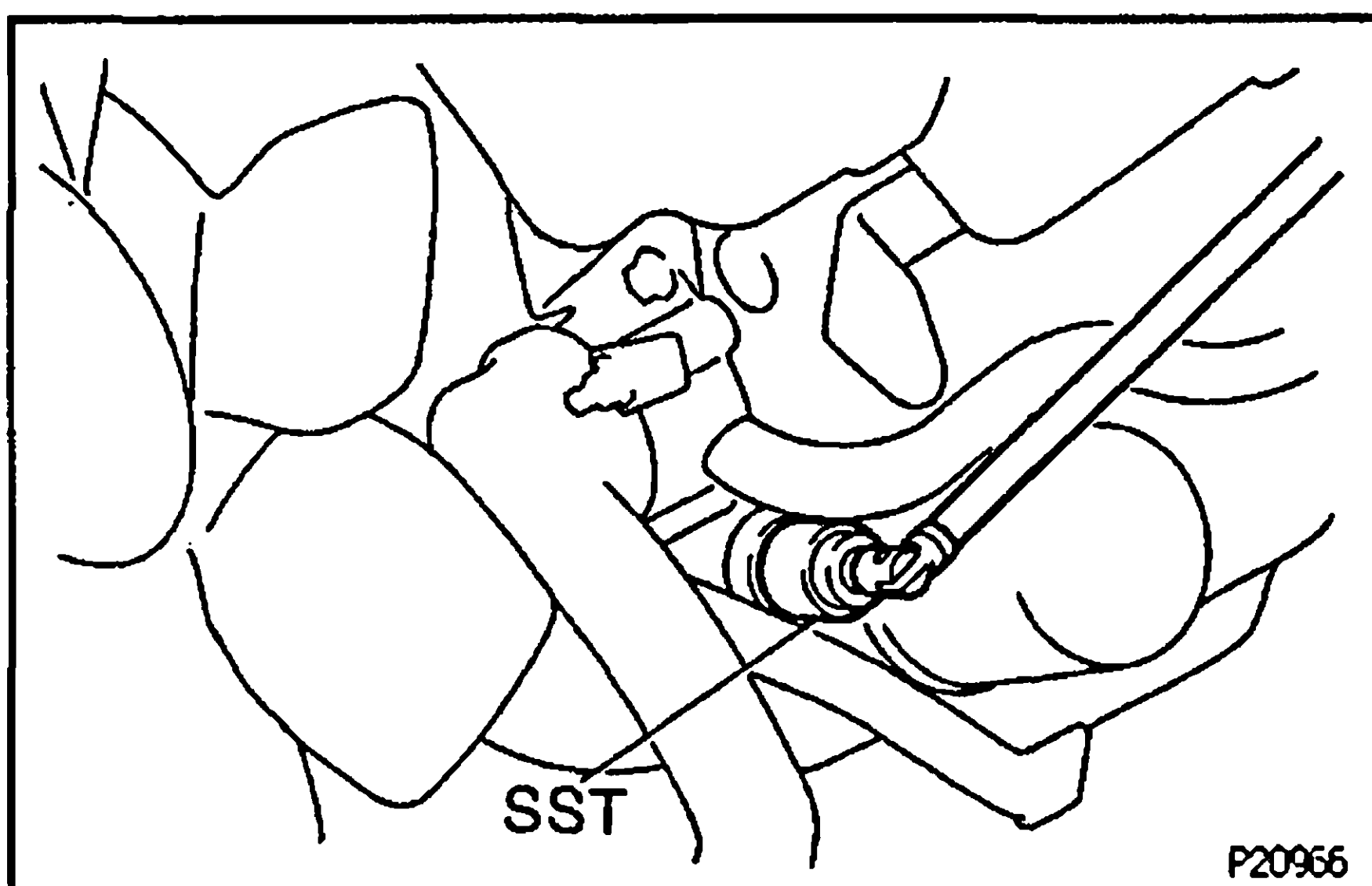
Part No. 08833—00080, THREE BOND 1344, LOCTITE 242 or equivalent

- (b) Using SST, install the oil pressure switch.

SST 09816—30010

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

9. START ENGINE AND CHECK FOR LEAKS



OIL AND FILTER REPLACEMENT

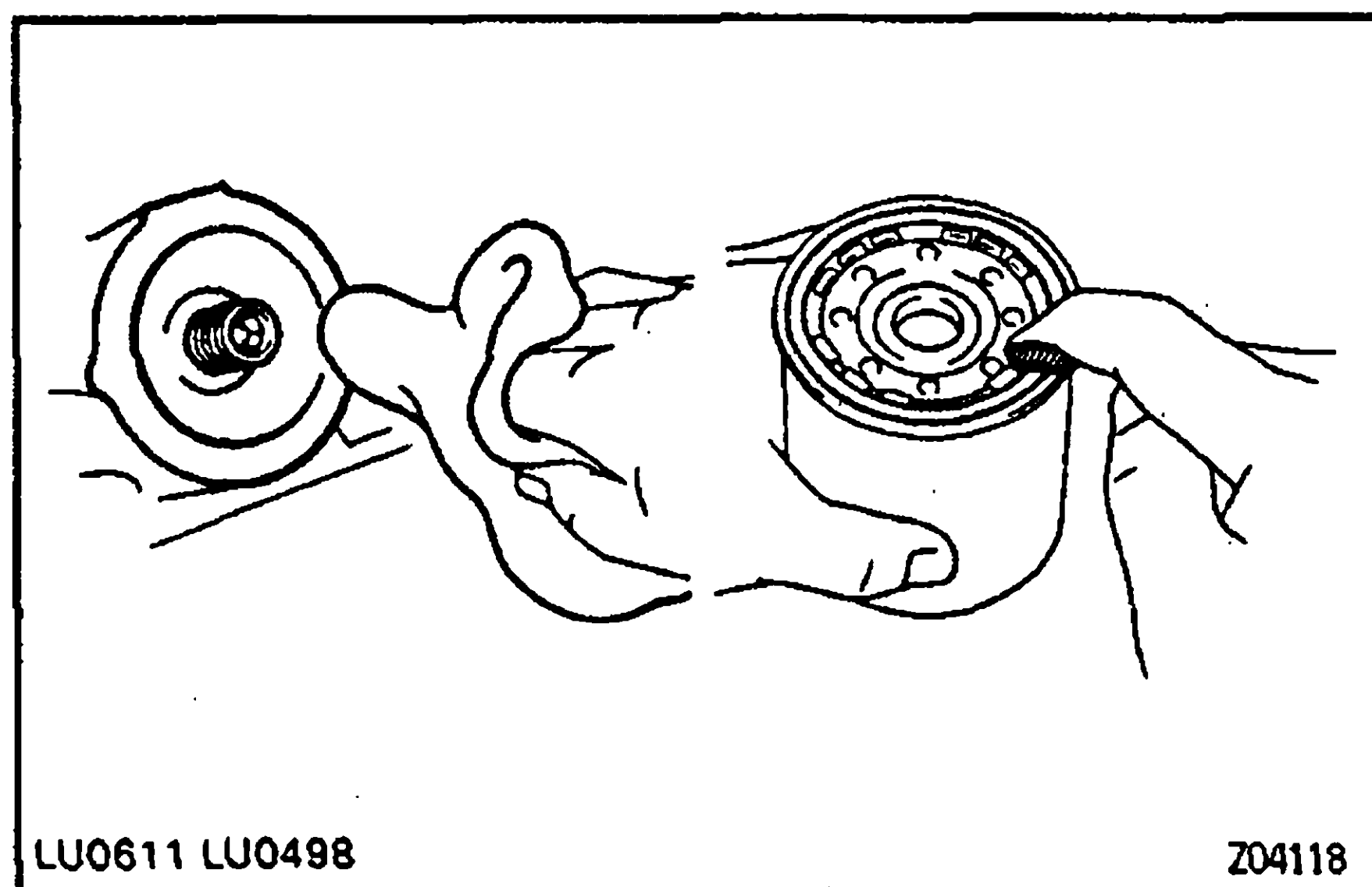
EG7BL-01

CAUTION:

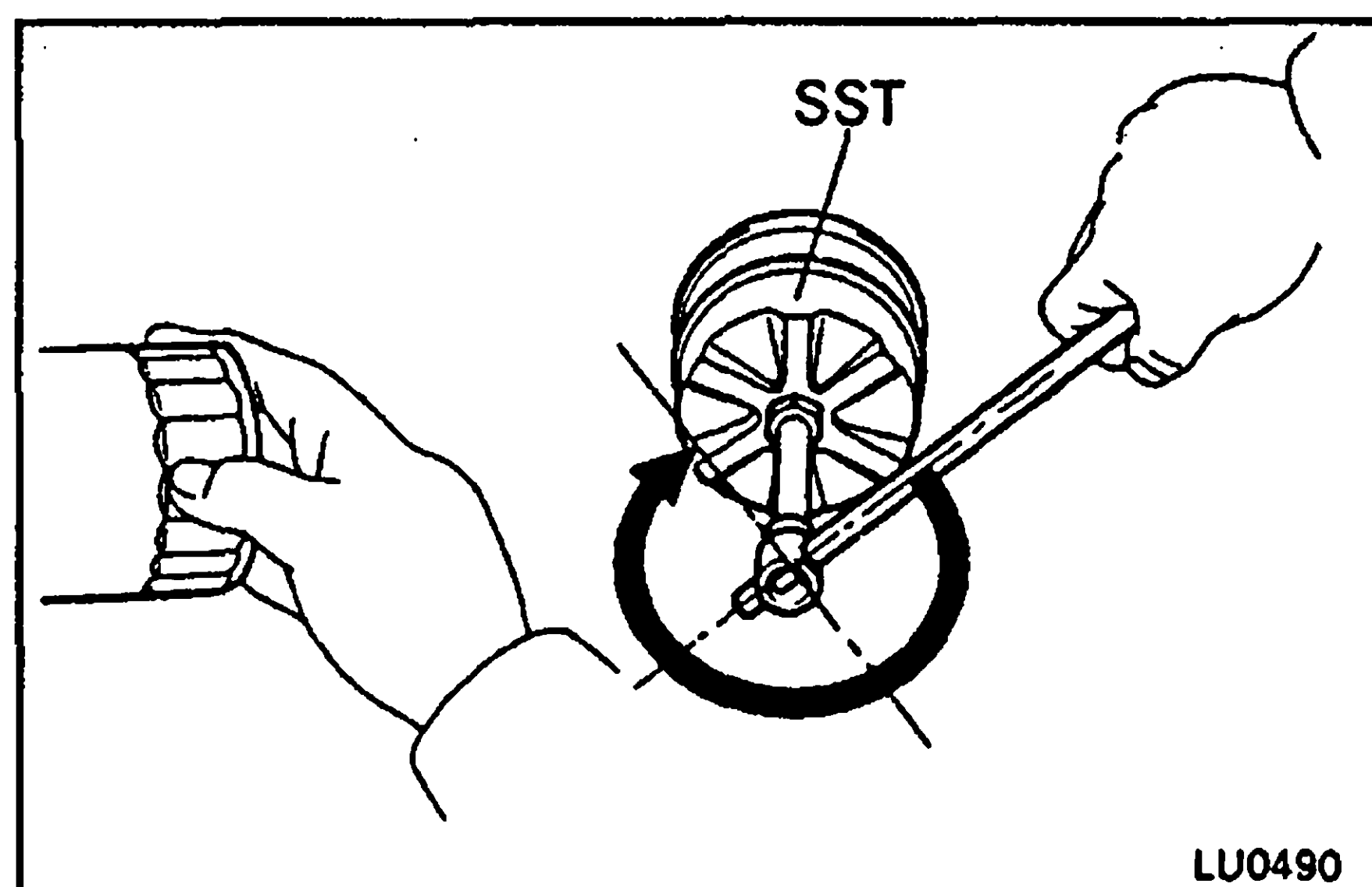
- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities should be provided.
- Care should be taken, therefore, when changing engine oil, to minimize the frequency and length of time your skin is exposed to used engine oil. Protective clothing and gloves, that cannot be penetrated by oil, should be worn. The skin should be thoroughly washed with soap and water, or use waterless hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filters must be disposed of only at designated disposal sites.

1. DRAIN ENGINE OIL

- (a) Remove the oil filler cap.
- (b) Remove the oil dipstick.
- (c) Remove the oil drain plug and drain the oil into a container.

**2. REPLACE OIL FILTER**

- (a) Using SST, remove the oil filter.
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.
- (b) Fill with fresh engine oil.

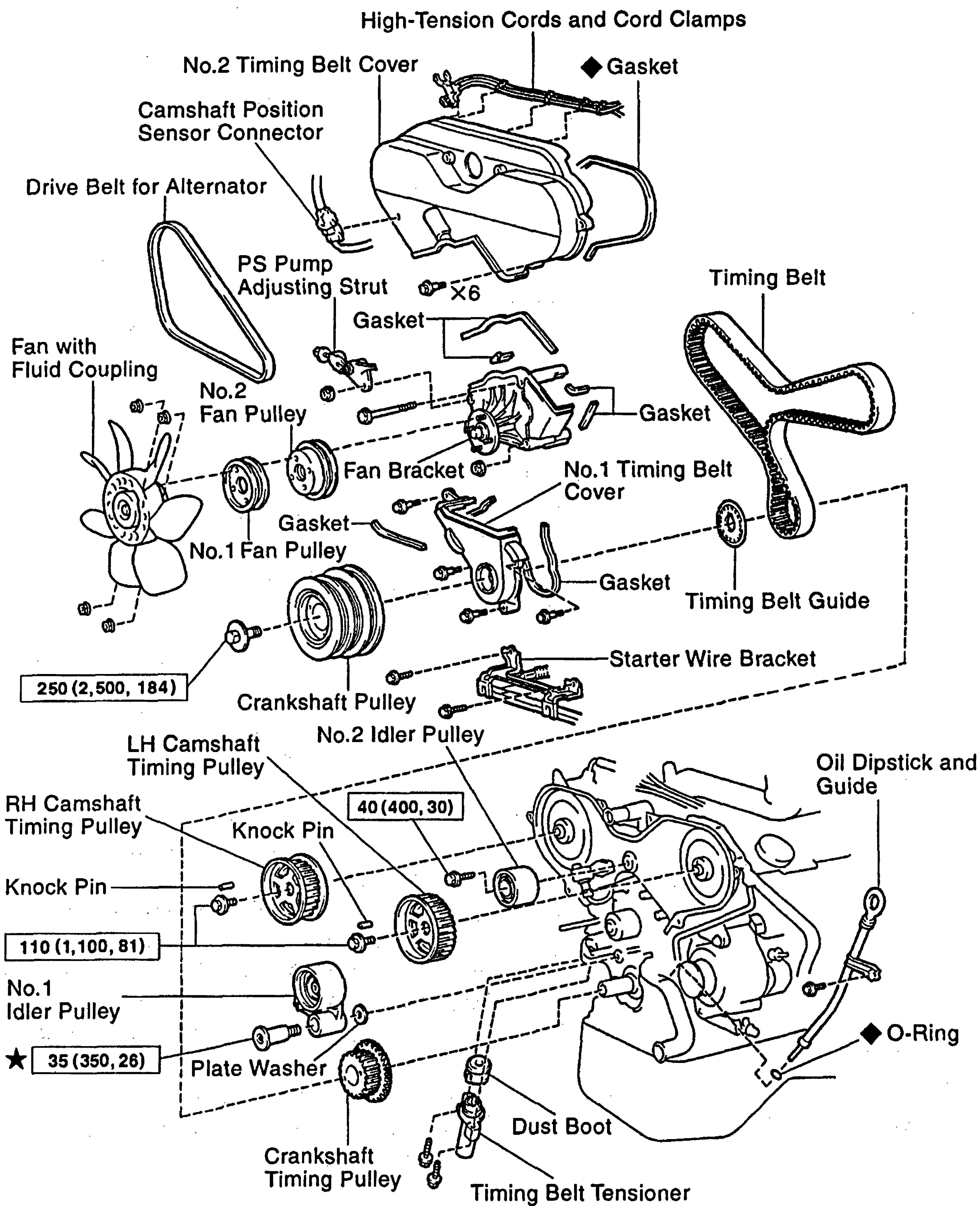
Oil capacity**Drain and refill****w/ Oil filter change****5.2 liters (5.5 US qts, 4.5 Imp. qts)****w/o Oil filter change****4.9 liters (5.2 US qts, 4.3 Imp. qts)****Dry fill****5.9 liters (6.2 US qts, 5.2 Imp. qts)**

- (c) Install the oil filler cap.

4. START ENGINE AND CHECK FOR OIL LEAKS**5. RECHECK ENGINE OIL LEVEL**

OIL PUMP COMPONENTS FOR REMOVAL AND INSTALLATION

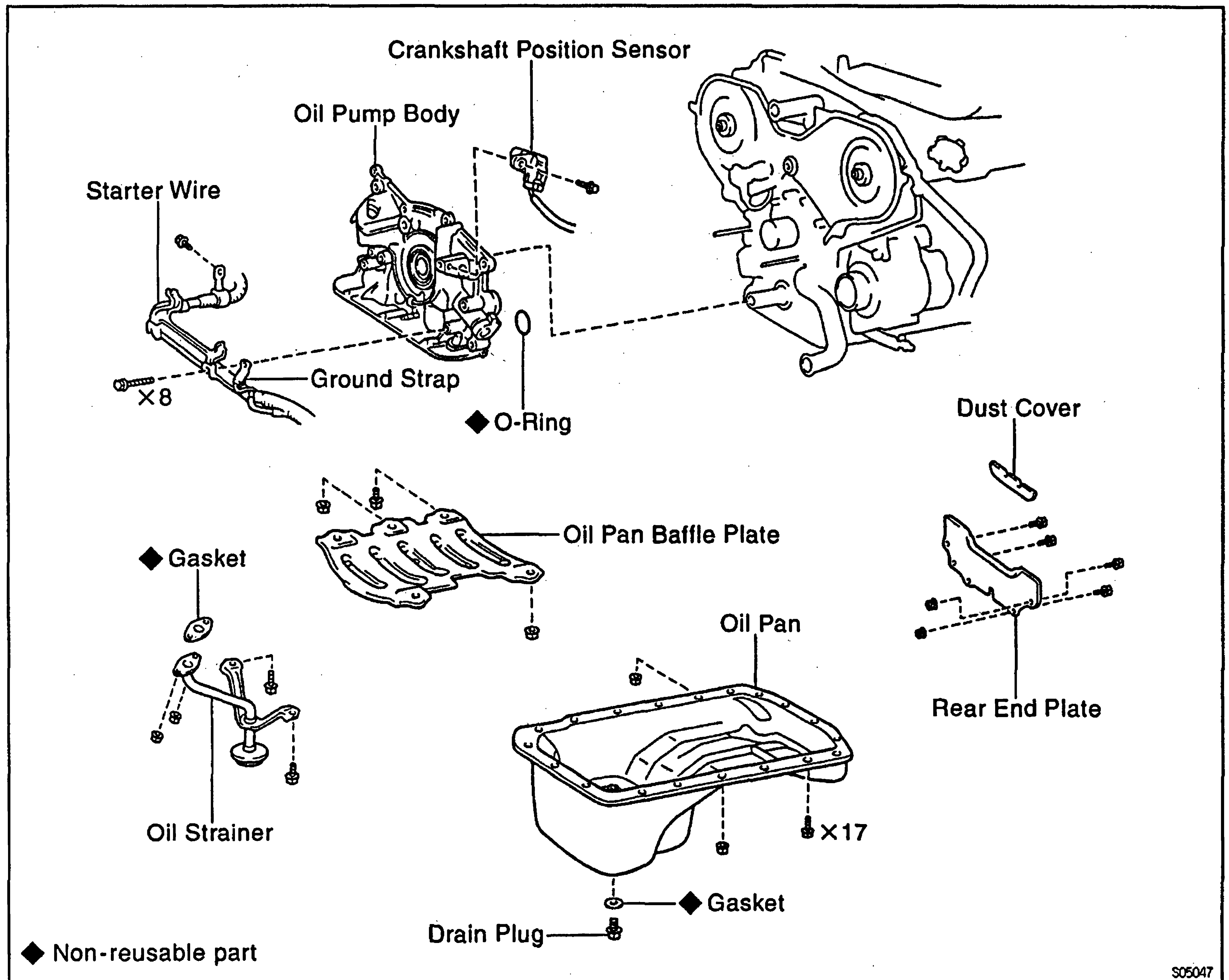
EG78M-01



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

◆ Non-reusable part

★ Precoated part



OIL PUMP REMOVAL

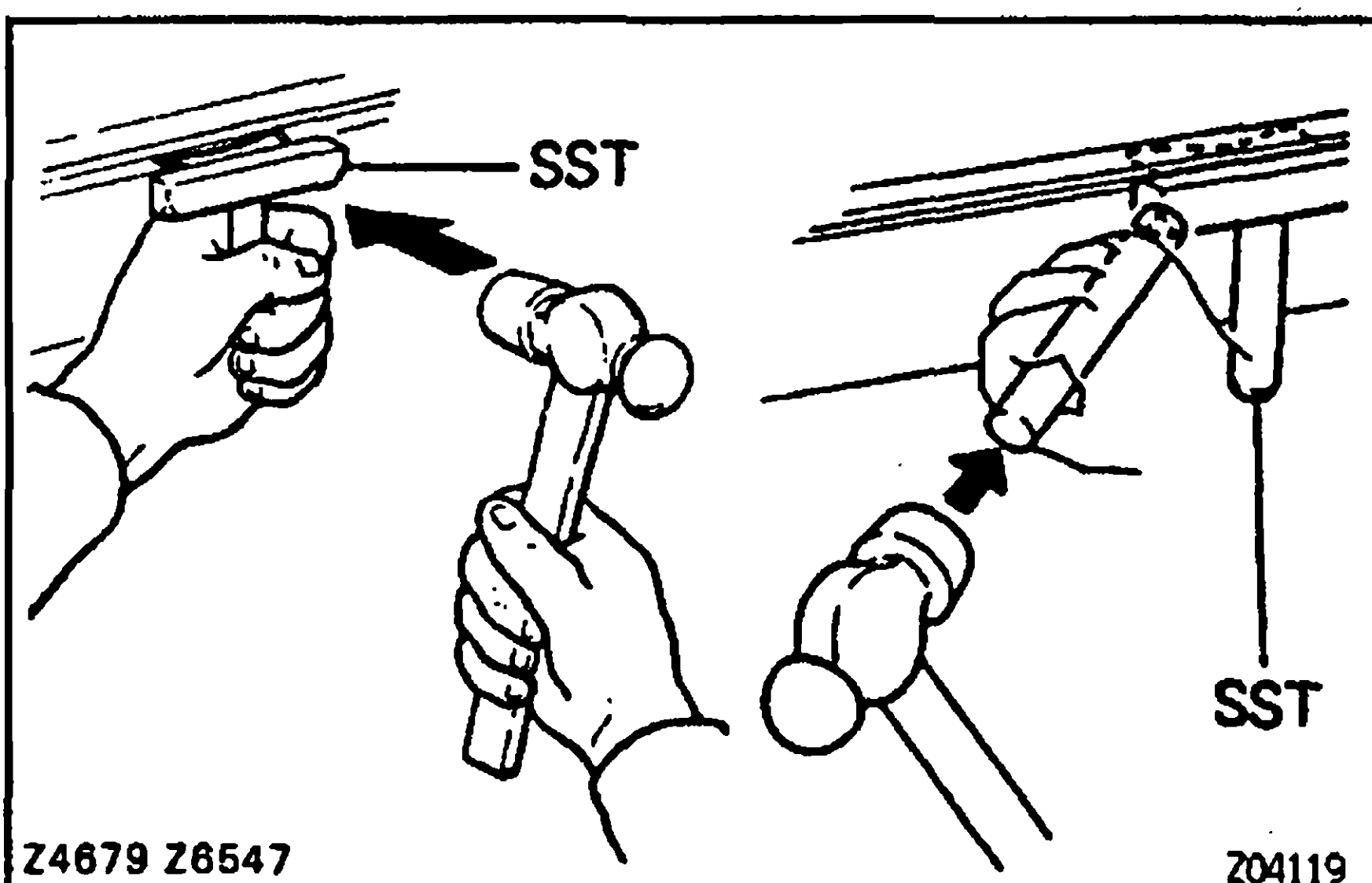
HINT: When repairing the oil pump, the oil pan and strainer should be removed and cleaned.

1. DRAIN ENGINE OIL
2. REMOVE CRANKSHAFT TIMING PULLEY
(See timing belt removal in Engine Mechanical)
3. REMOVE REAR END COVER AND DUST COVER
4. DISCONNECT STARTER WIRE CLAMP
5. REMOVE CRANKSHAFT POSITION SENSOR
6. REMOVE OIL PAN

- (a) Remove the 17 bolts and 2 nuts.
- (b) Using SST and a brass bar, separate the oil pan from the cylinder block.

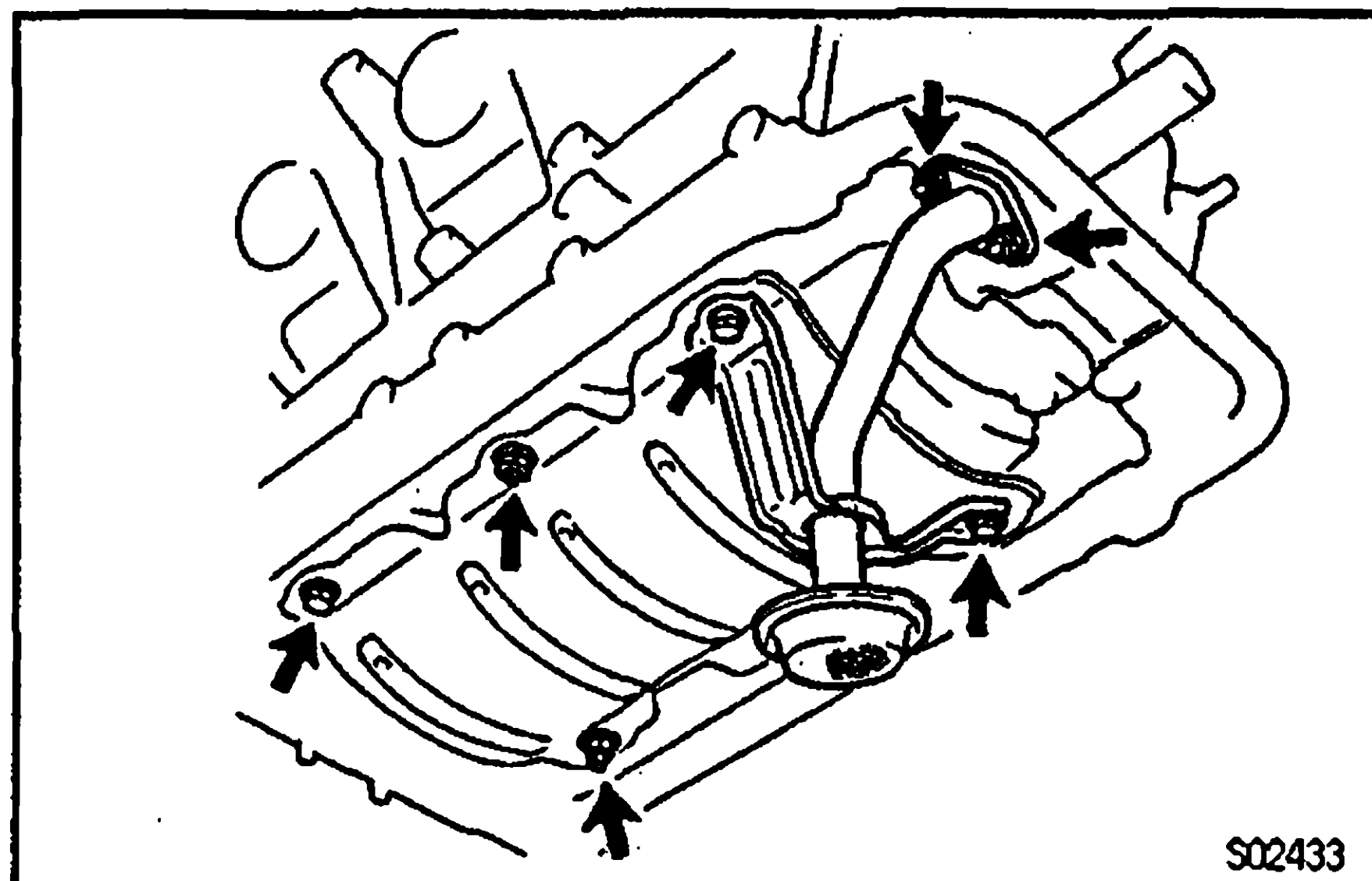
SST 09032-00100

HINT: When removing the oil pan, be careful not to damage the oil pan flange.



Z4679 Z8547

Z04119

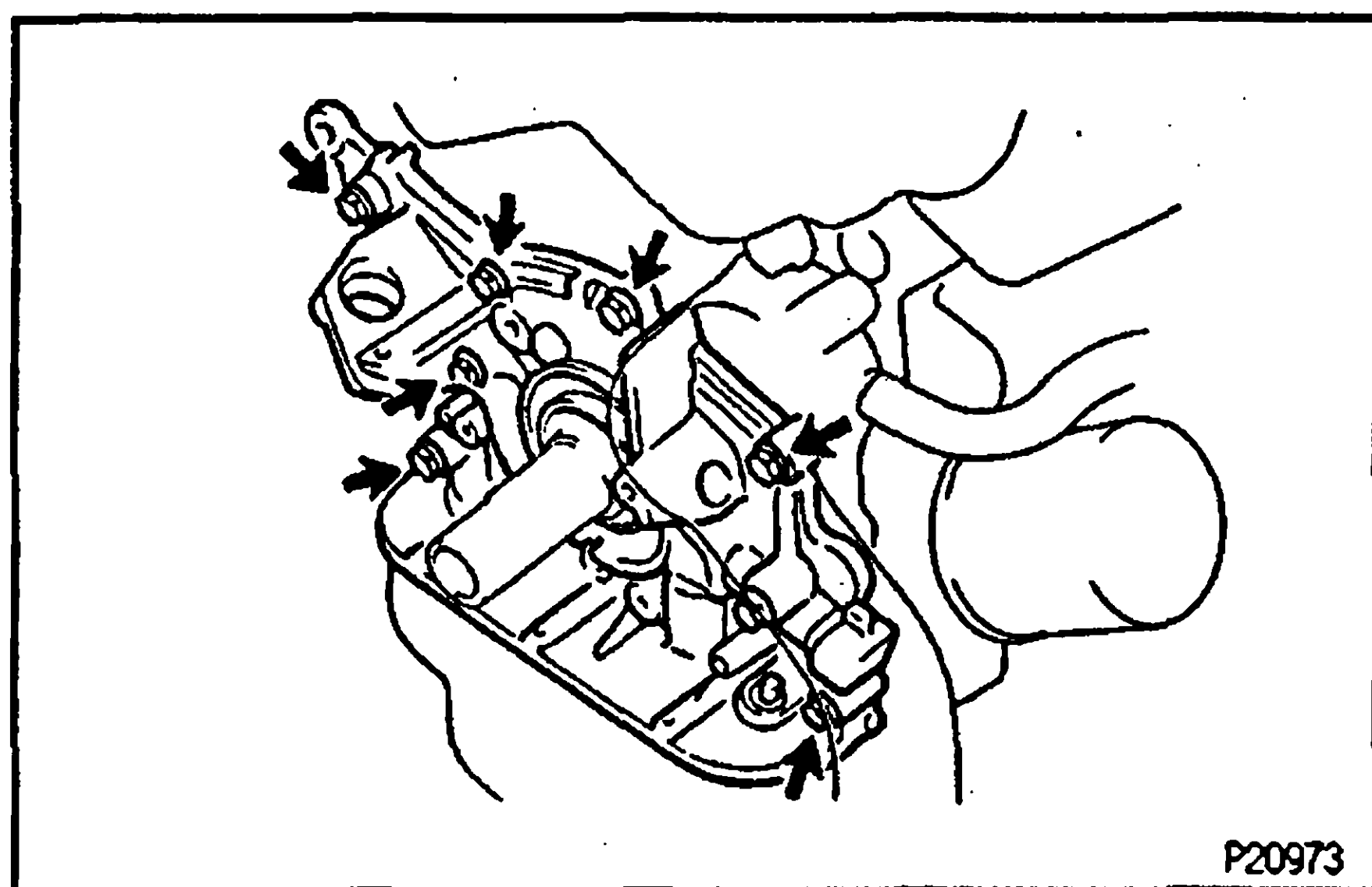
**7. REMOVE OIL STRAINER**

Remove the 2 bolts, nuts and oil strainer and gasket.

8. REMOVE OIL PAN BAFFLE PLATE

Remove the 2 bolt, nut and oil pan baffle plate.

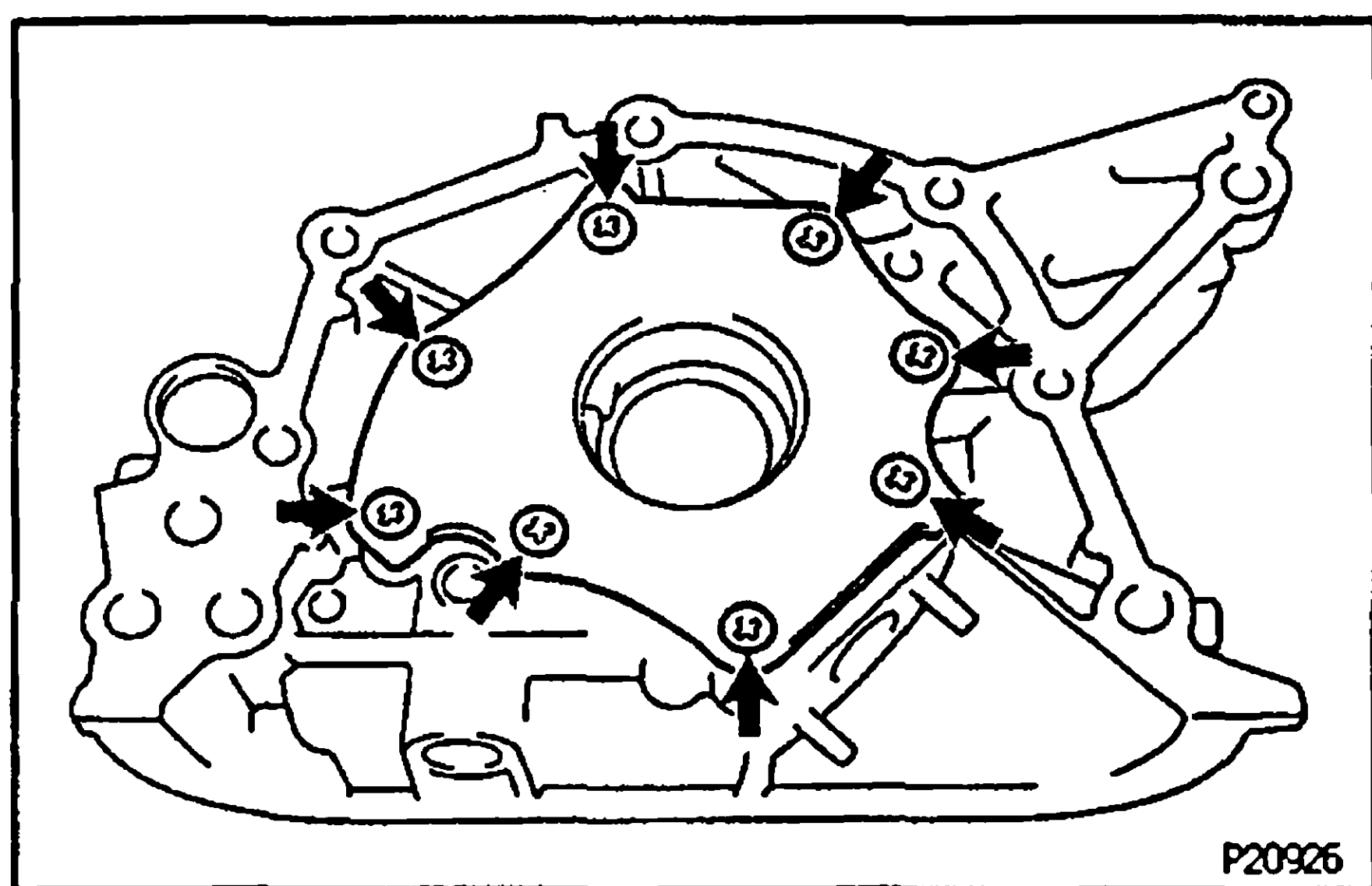
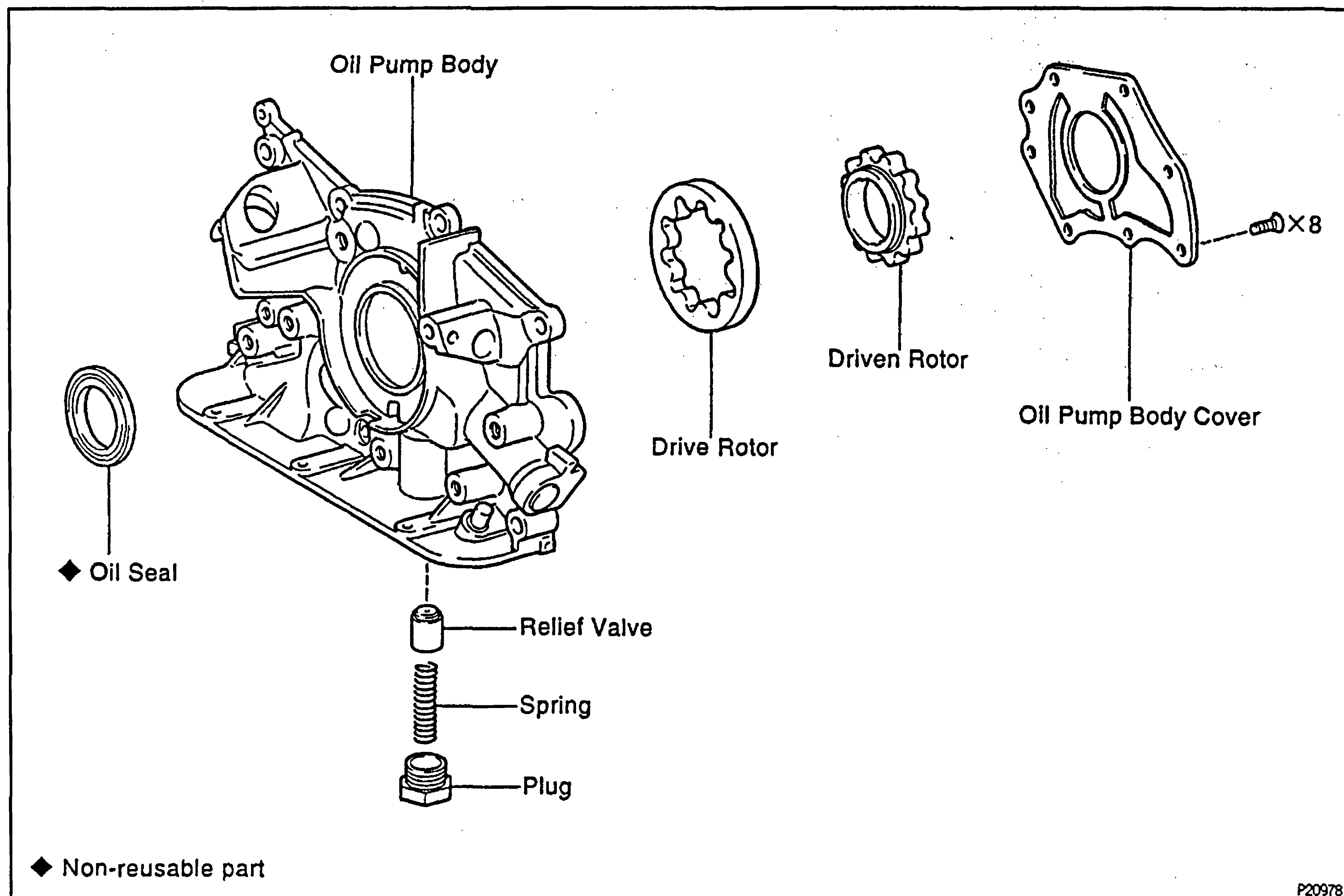
EG

**9. REMOVE OIL PUMP**

- (a) Remove the 8 bolts, ground strap and oil pump.
- (b) Using a plastic-faced hammer, carefully tap the oil pump body.
- (c) Remove the O-ring from the cylinder block.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

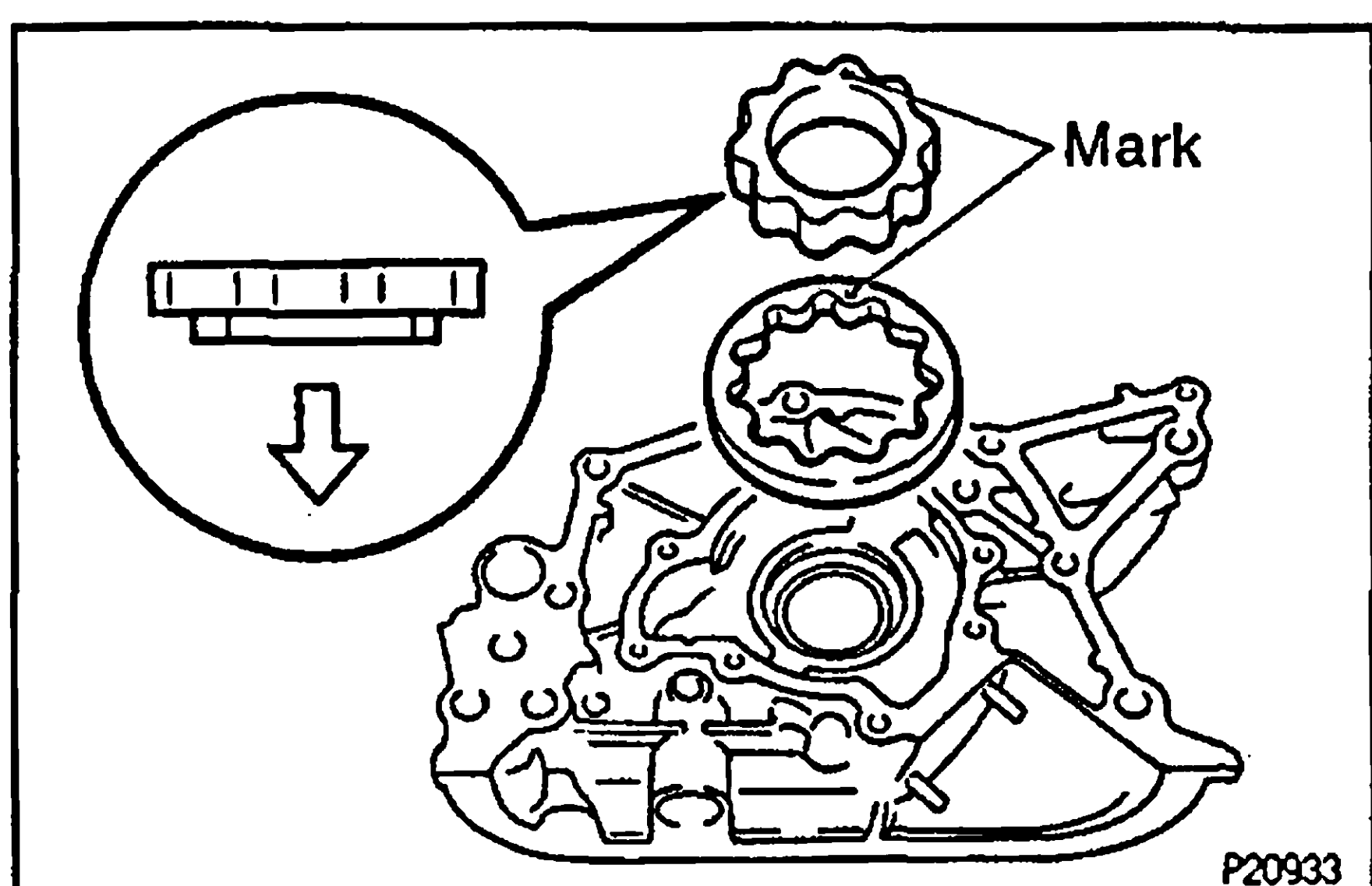
E0185-01



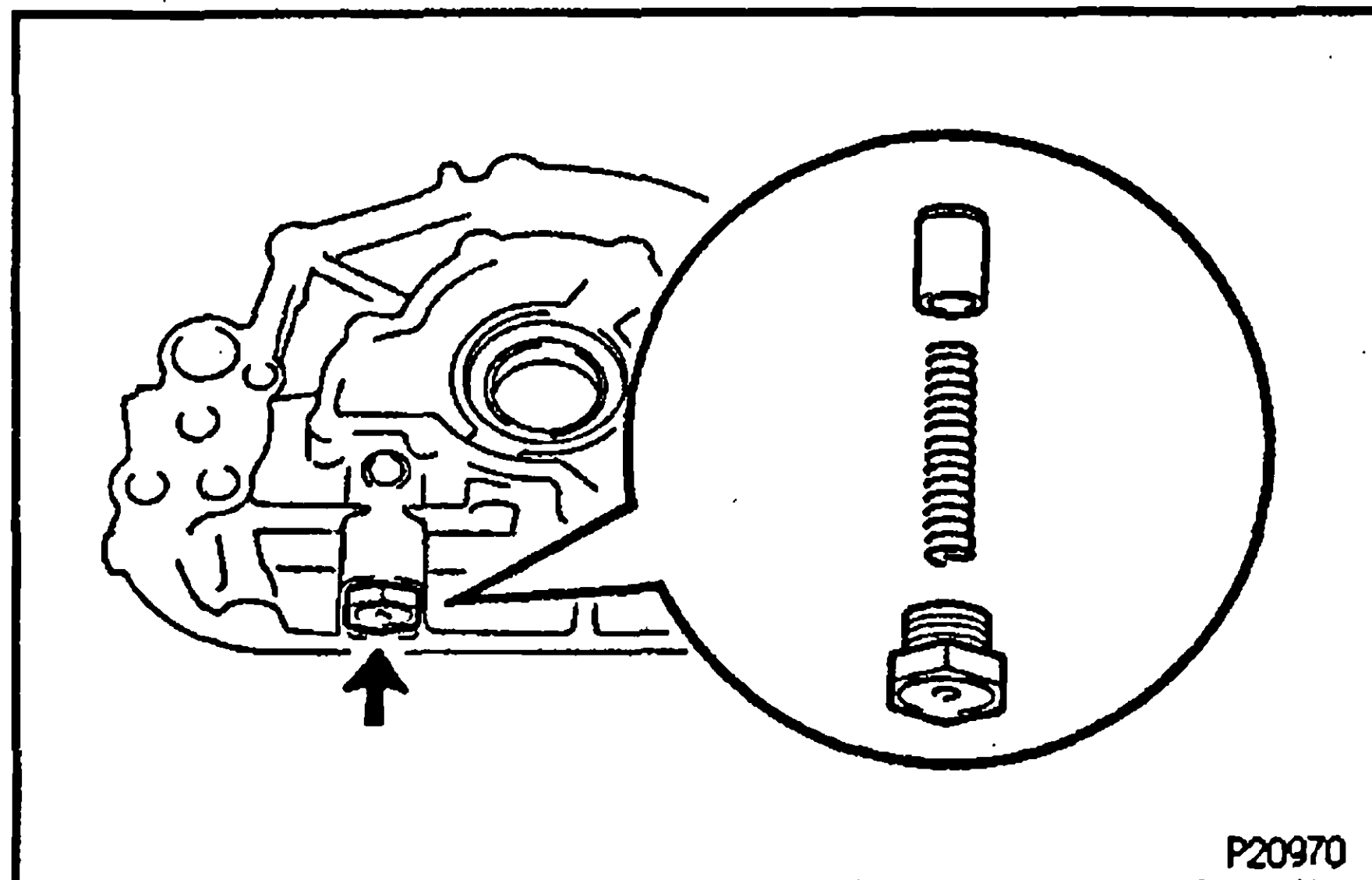
OIL PUMP DISASSEMBLY

E078N-01

1. REMOVE DRIVEN AND DRIVE ROTORS
 - (a) Remove the 8 screws and pump body cover.
Torque: 10 N·m (105 kgf·cm, 8 ft·lbf)
 - (b) Remove the drive and driven rotors.

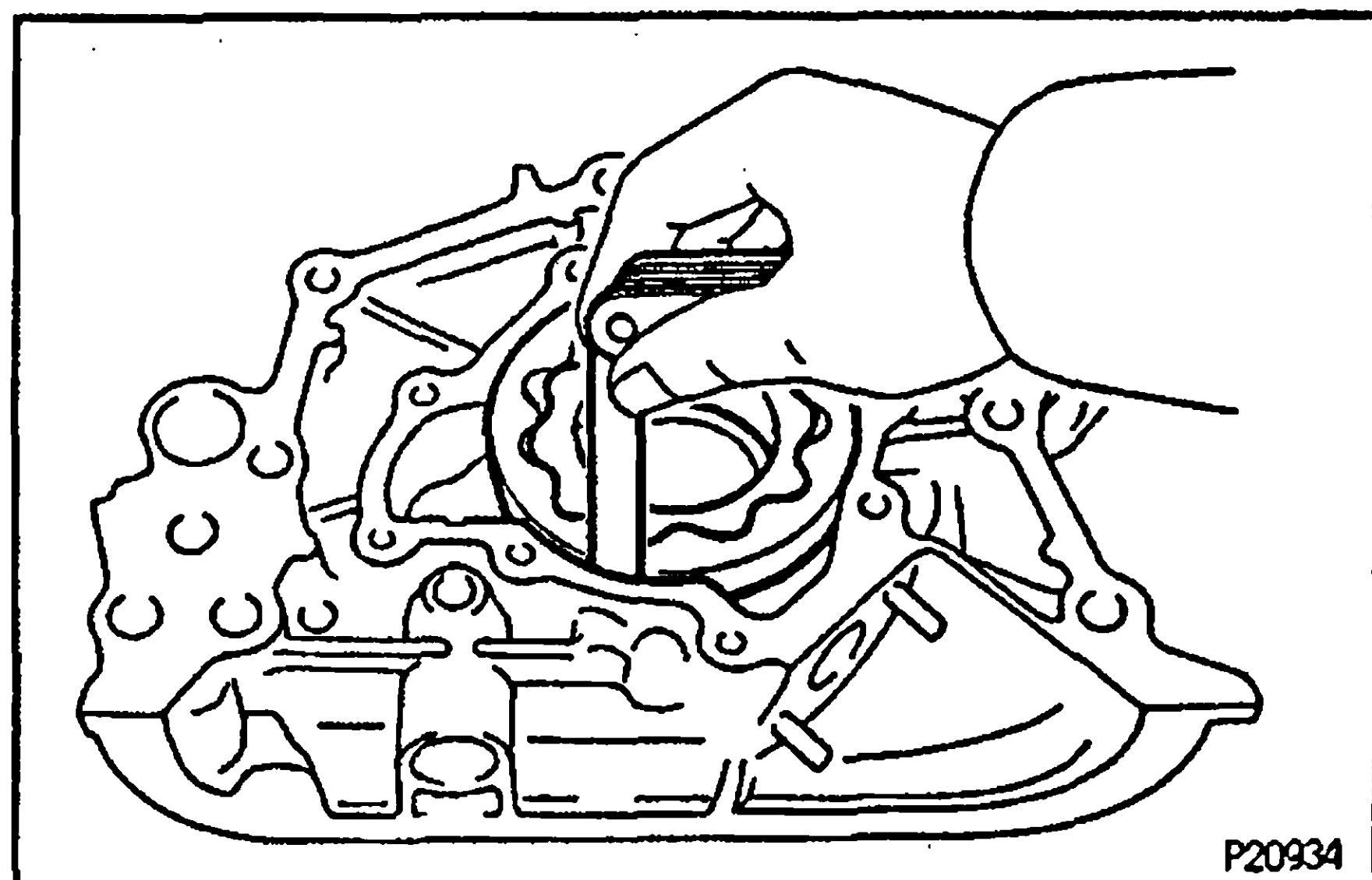


INSTALLATION HINT: Place the drive and driven rotor into pump body with the marks facing the pump body cover side.



2. REMOVE RELIEF VALVE

- (a) Unscrew the relief valve plug and gasket.
Torque: 37 N·m (375 kgf·cm, 27 ft·lbf)
- (b) Remove the spring and relief valve.



OIL PUMP INSPECTION

1. INSPECT BODY CLEARANCE

Using a thickness gauge, measure the clearance between the driven rotor and pump body.

Standard body clearance:

0.10 – 0.18 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 oil pump rotor set and/or pump body.

2. INSPECT TIP CLEARANCE

Using a thickness gauge, measure the clearance between the drive and driven rotors.

Standard tip clearance:

0.11 – 0.24 mm (0.0043 – 0.0094 in.)

Maximum tip clearance:

0.35 mm (0.0138 in.)

If the tip clearance is greater than maximum, replace the oil pump rotor set.

3. INSPECT SIDE CLEARANCE

Using a thickness gauge and precision straight edge, measure the side clearance, as shown.

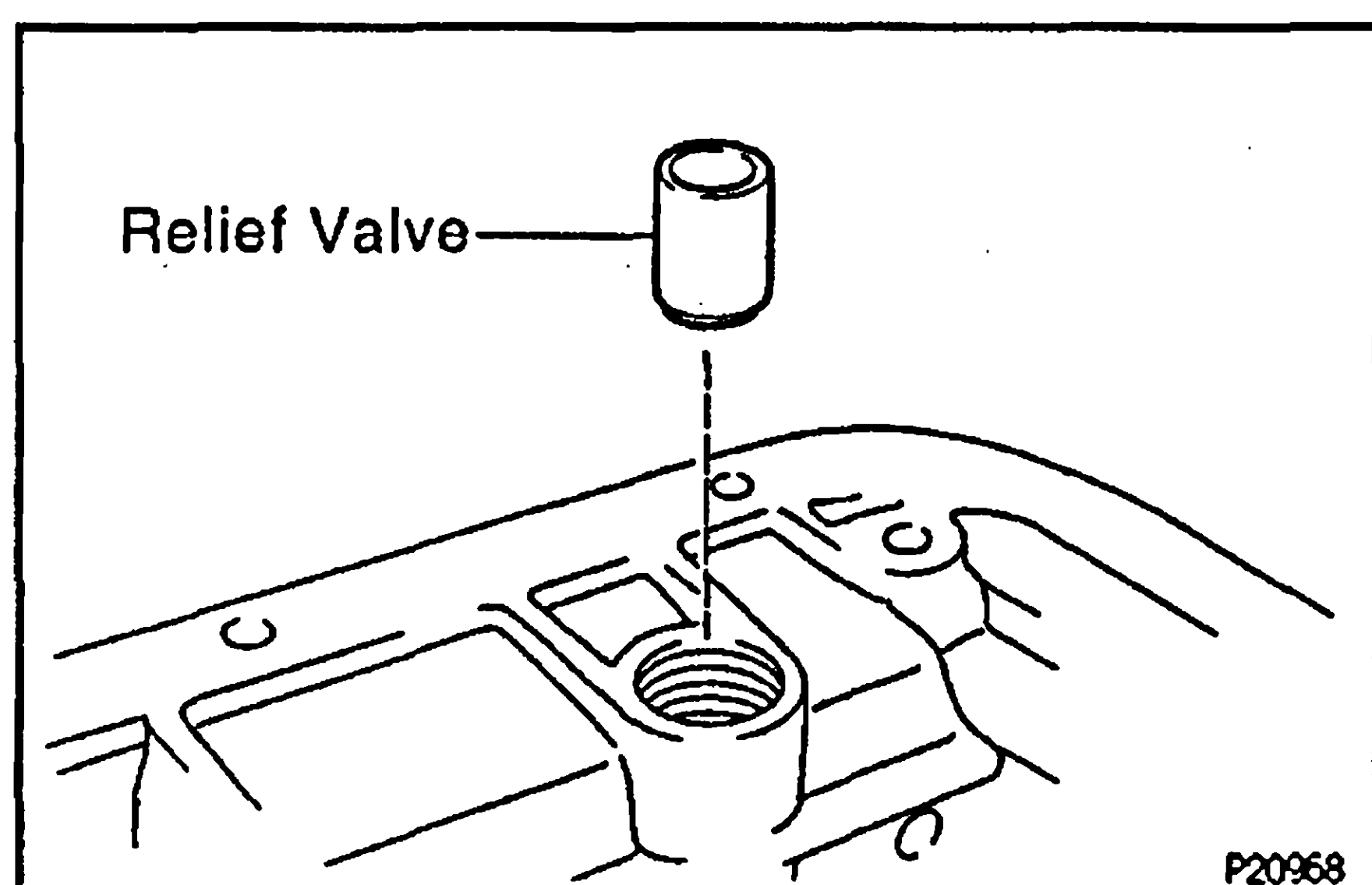
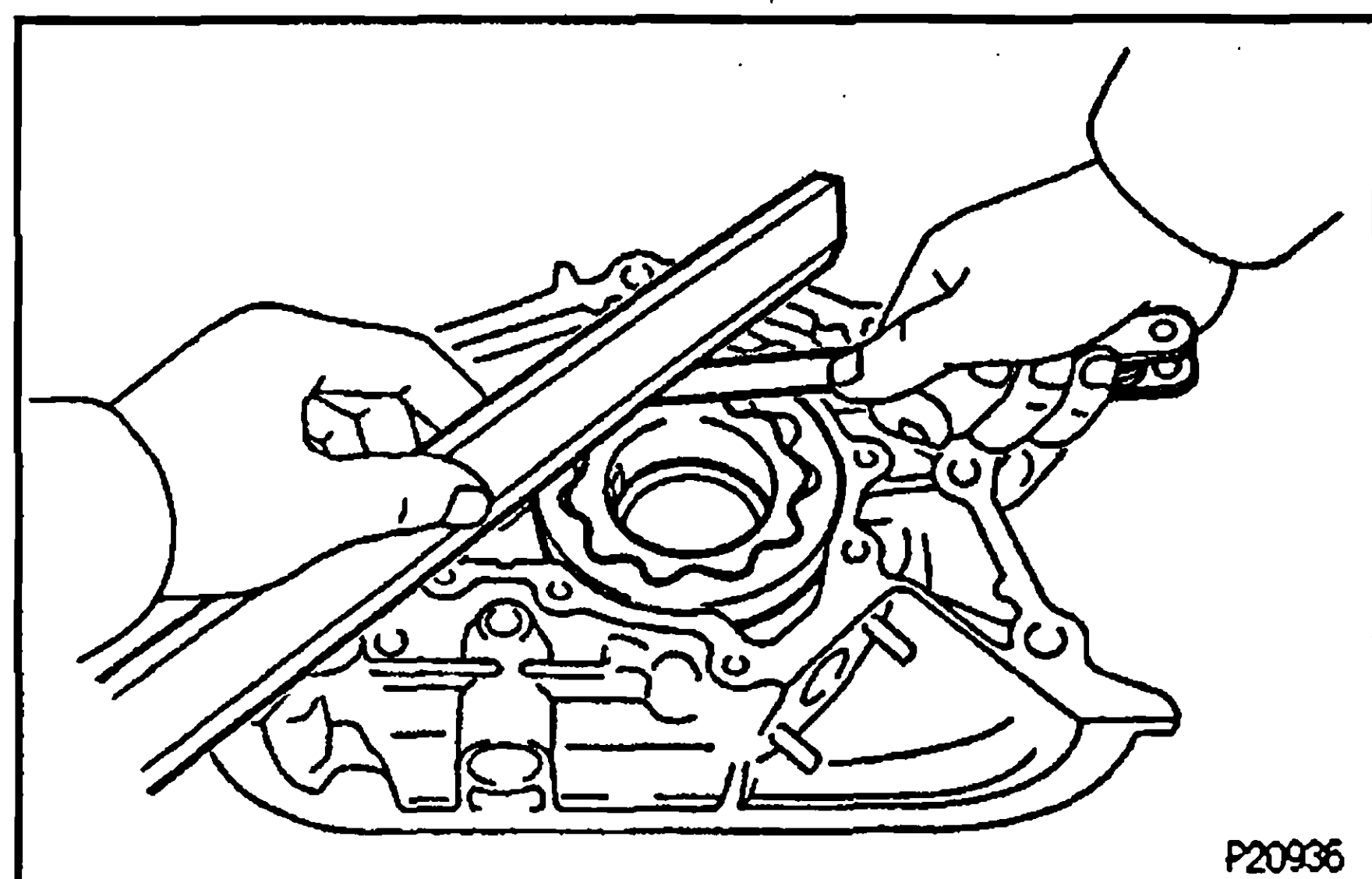
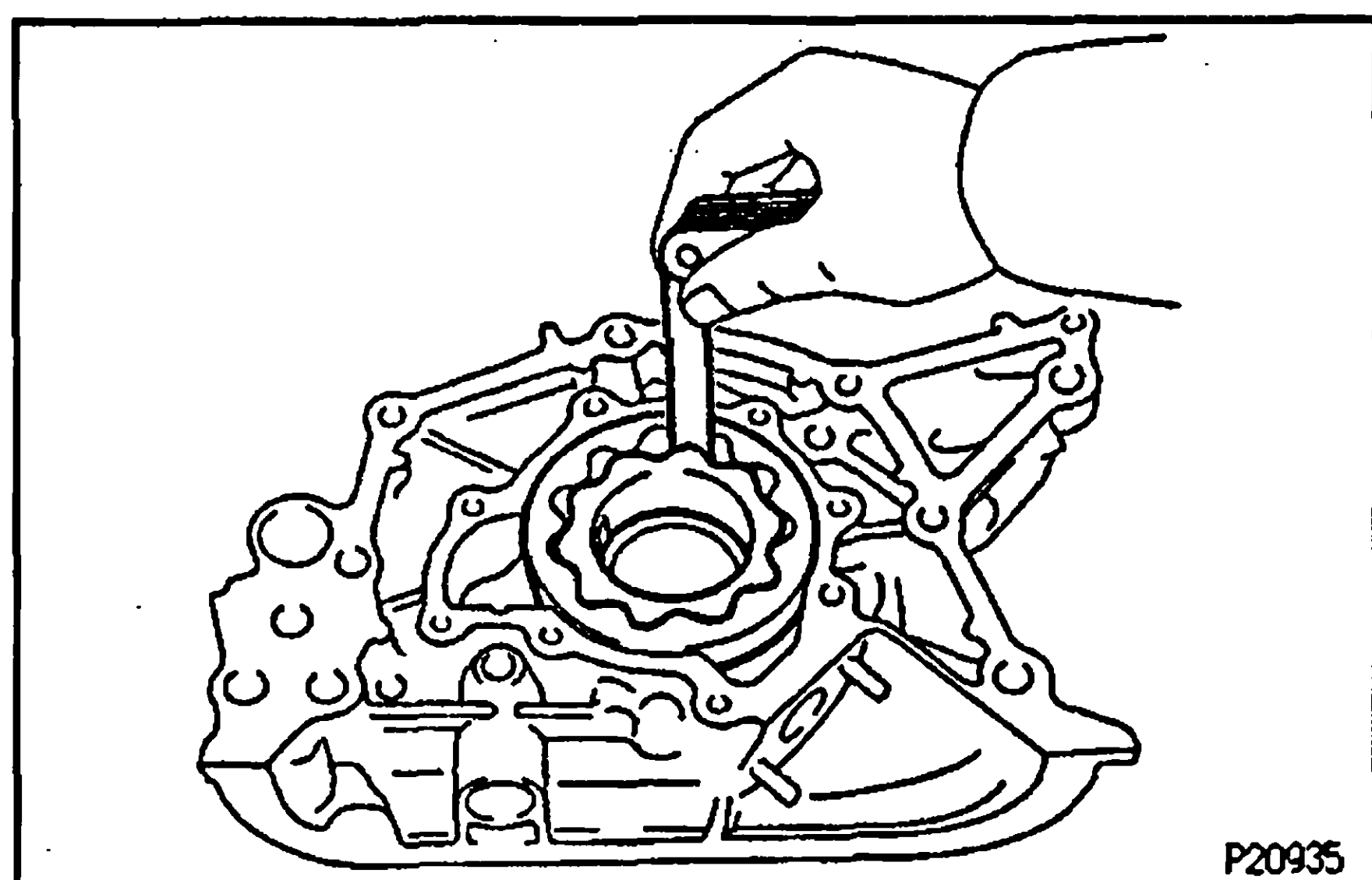
Standard side clearance:

0.03 – 0.09 mm (0.0012 – 0.0035 in.)

Maximum side clearance:

0.15 mm (0.0059 in.)

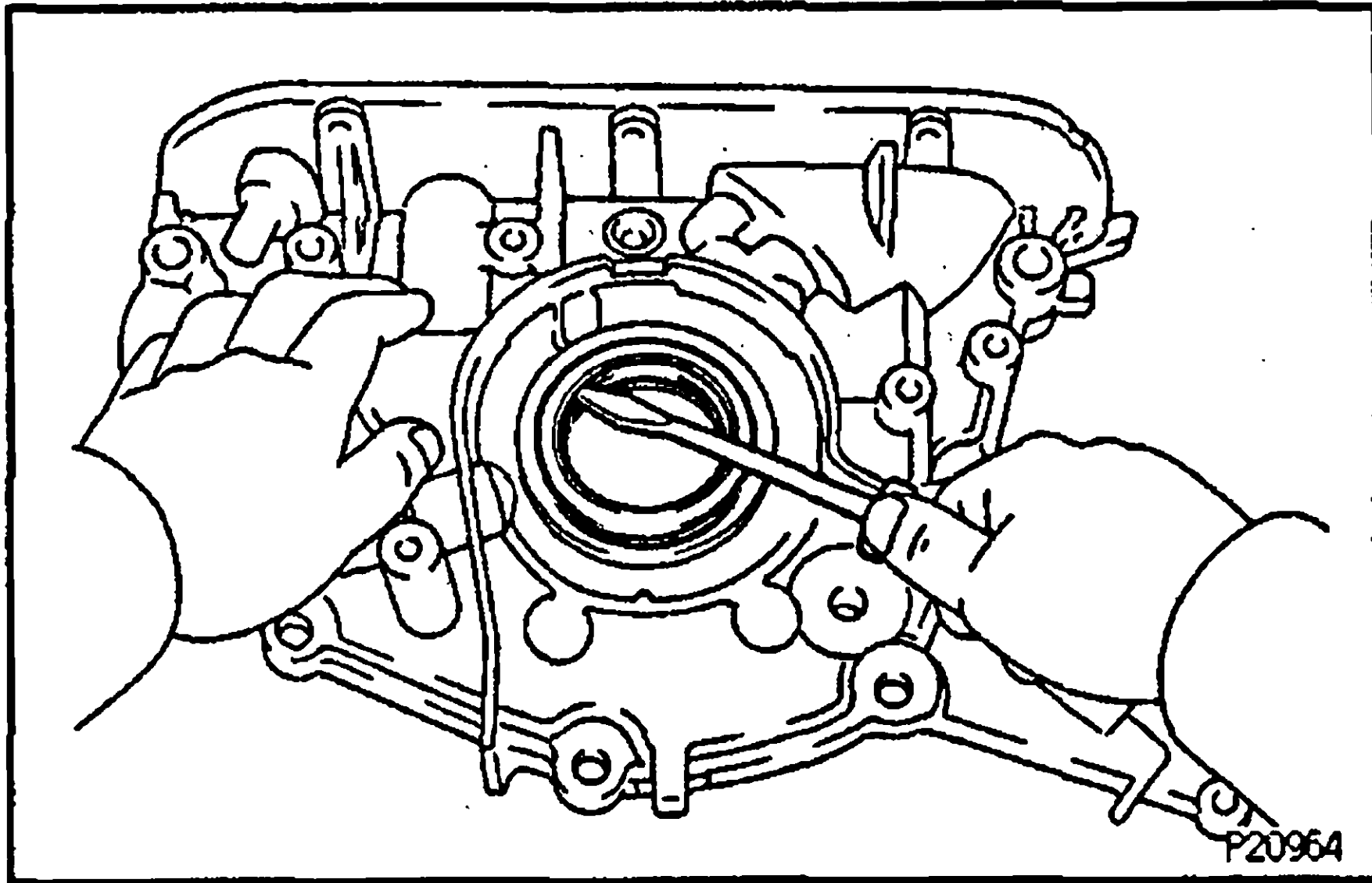
If the side clearance is greater than maximum, replace the oil pump rotor set and/or pump body.



4. 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 is not, replace the relief valve. If necessary, replace the oil pump assembly.



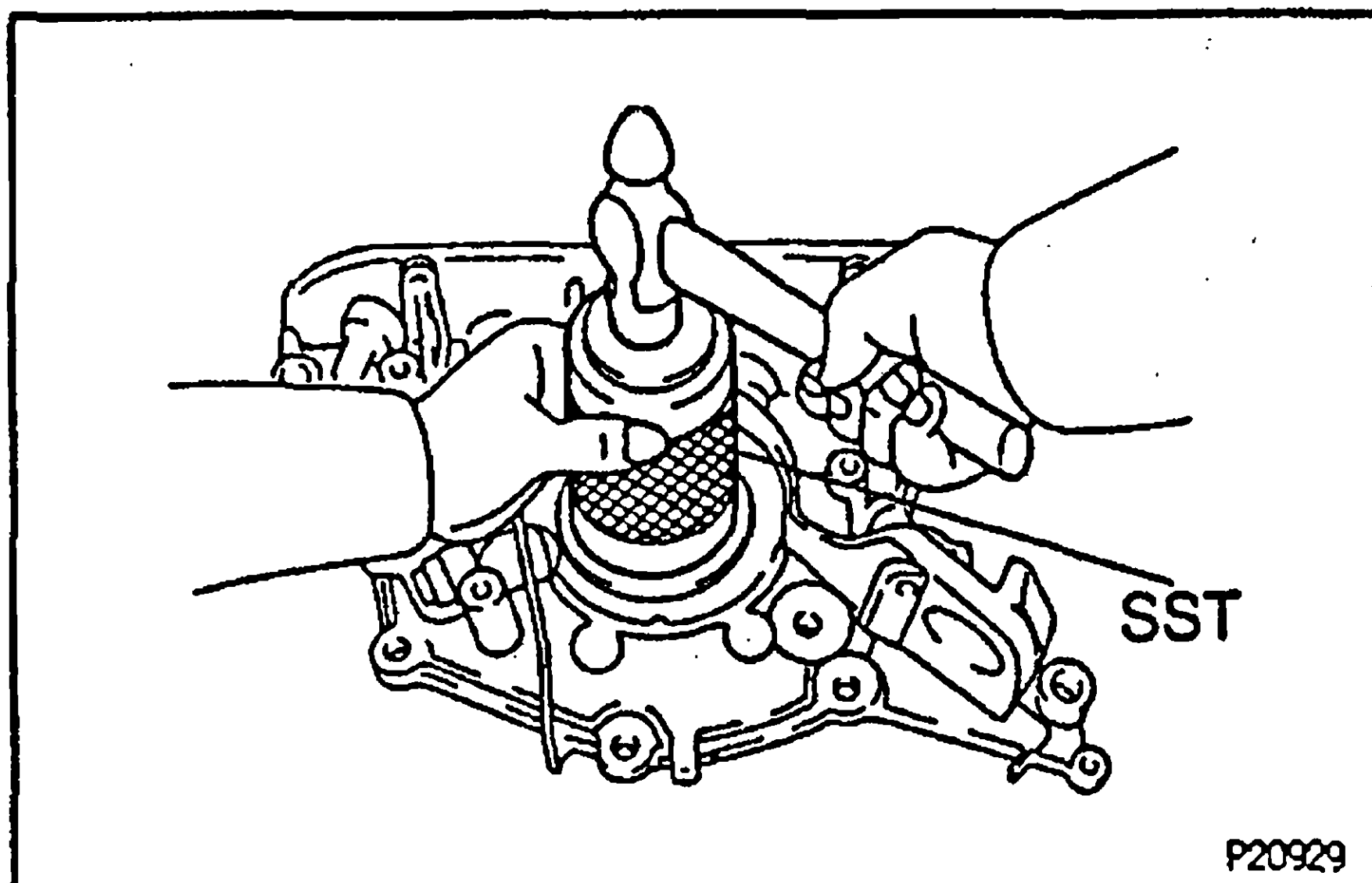
CRANKSHAFT FRONT OIL SEAL REPLACEMENT

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

REPLACE CRANKSHAFT FRONT OIL SEAL

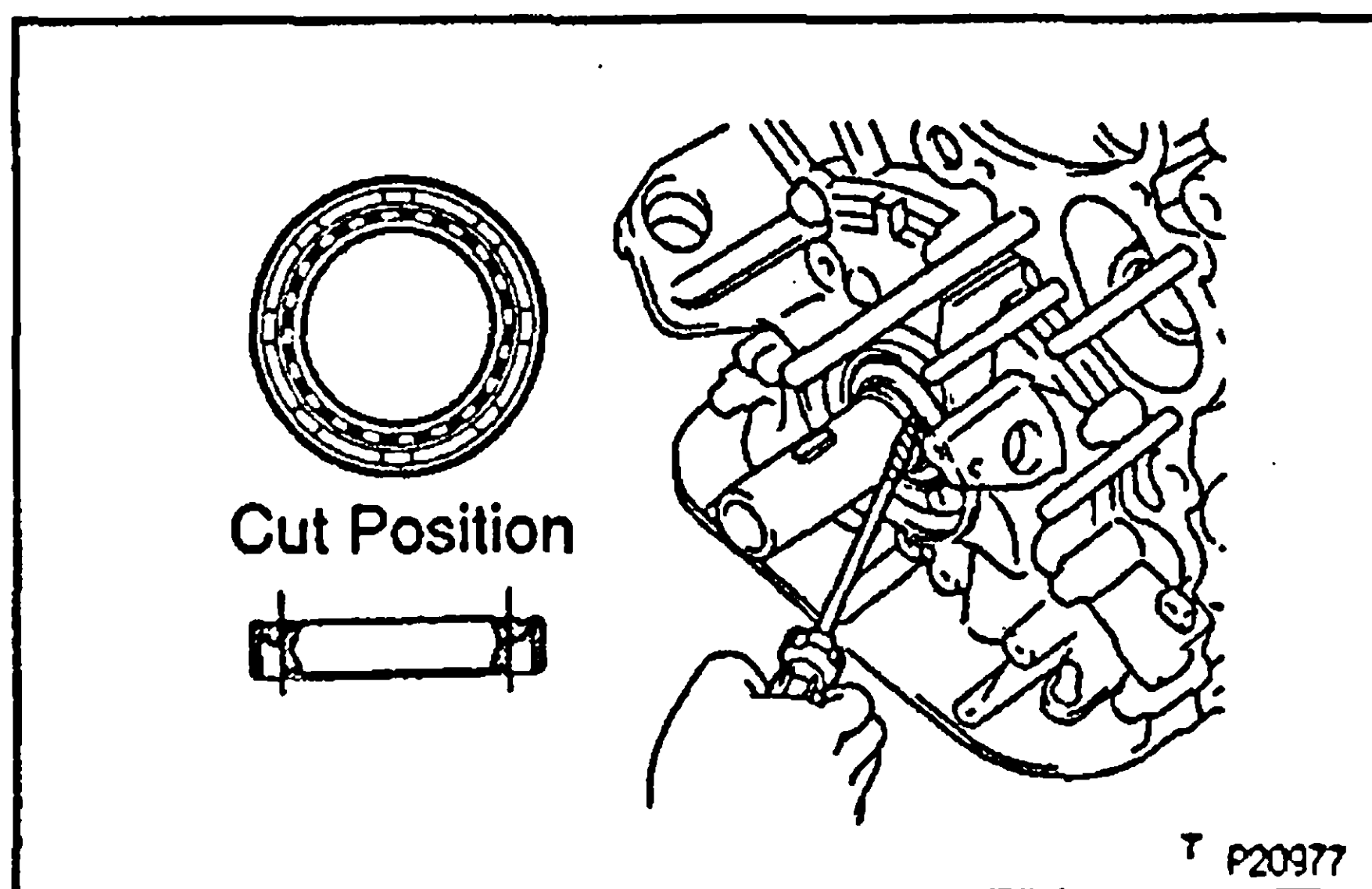
A. If oil pump is removed from cylinder block:

- (a) Using a screwdriver, pry out the oil seal.
- (b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump body edge.
SST 09309-37010
- (c) Apply MP grease to the oil seal lip.

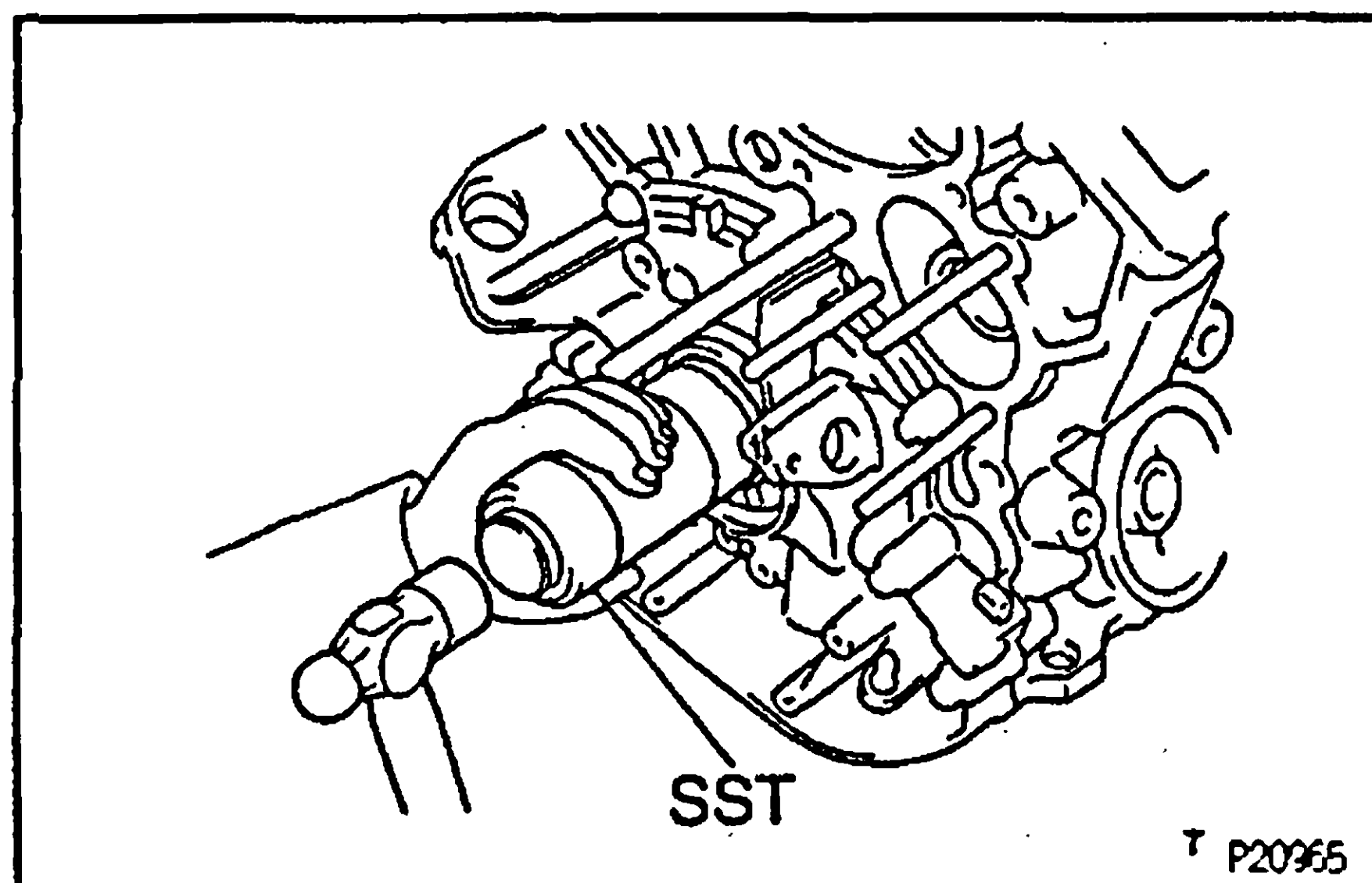


B. If oil pump is installed to the cylinder block:

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



- (c) Apply MP grease to a new oil seal lip.
- (d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump body edge.
SST 09306-37010



OIL PUMP ASSEMBLY

Assembly is in the reverse order of disassembly.

OIL PUMP INSTALLATION

1. INSTALL OIL PUMP

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

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

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

Seal packing:

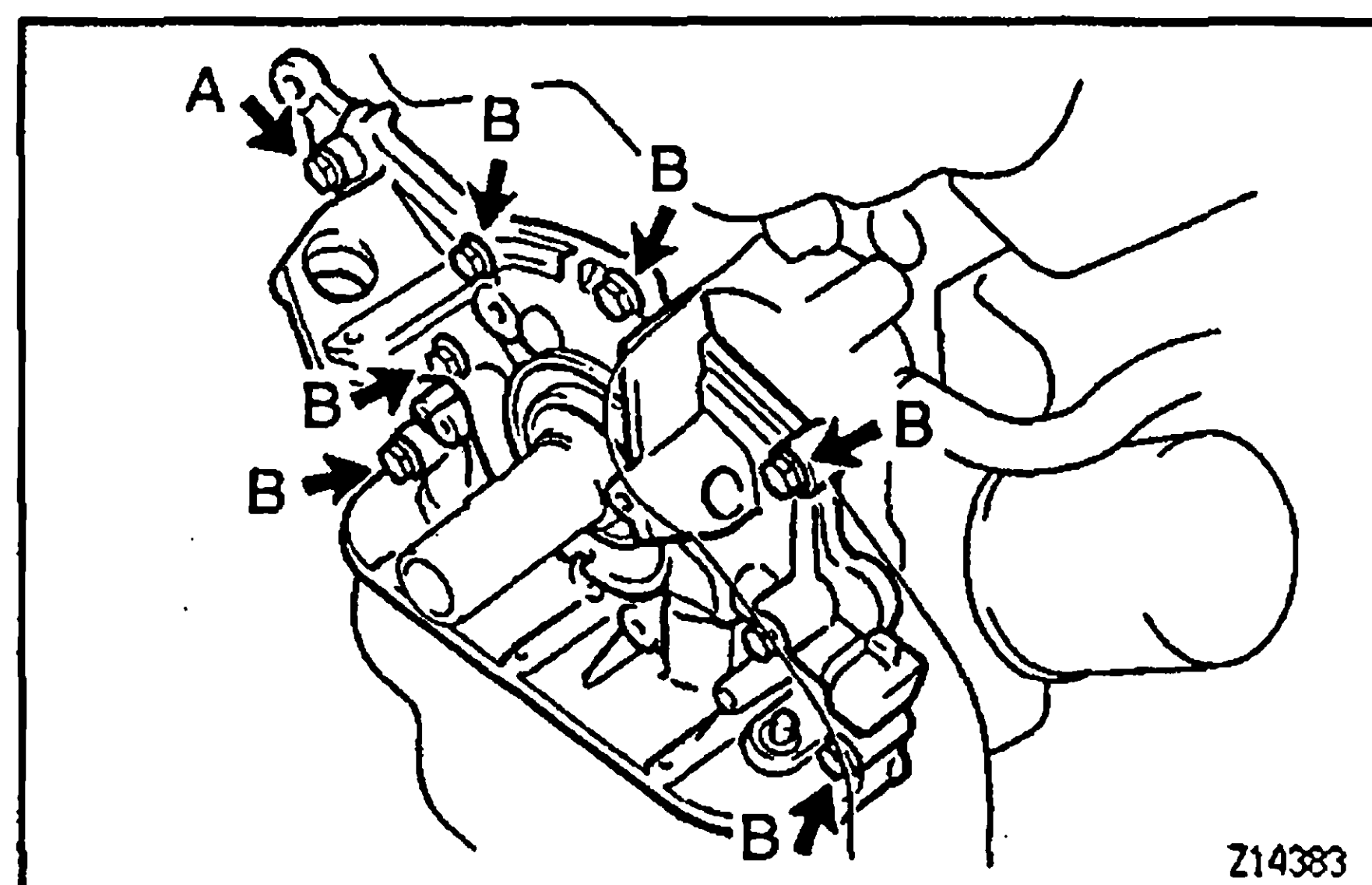
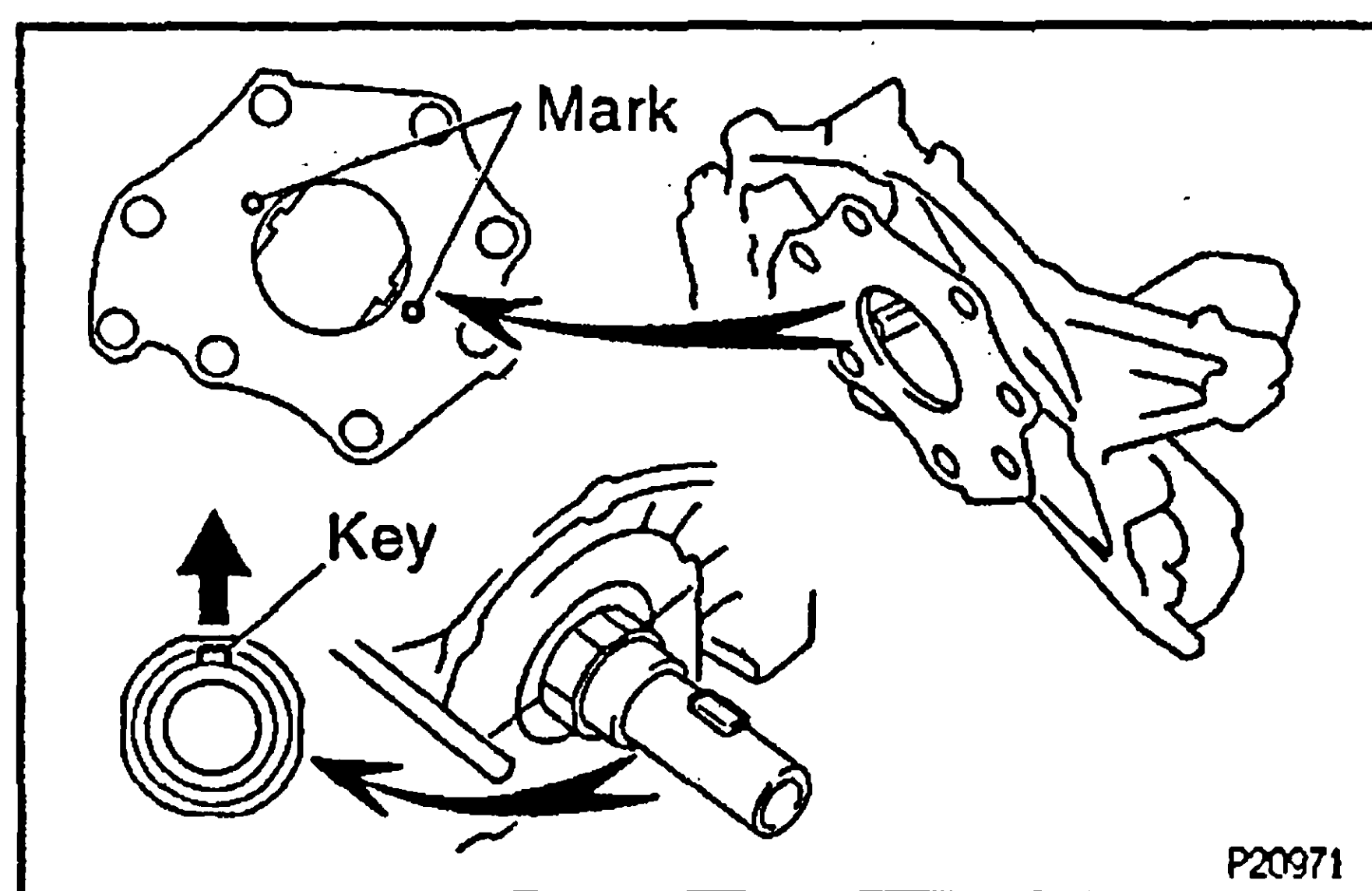
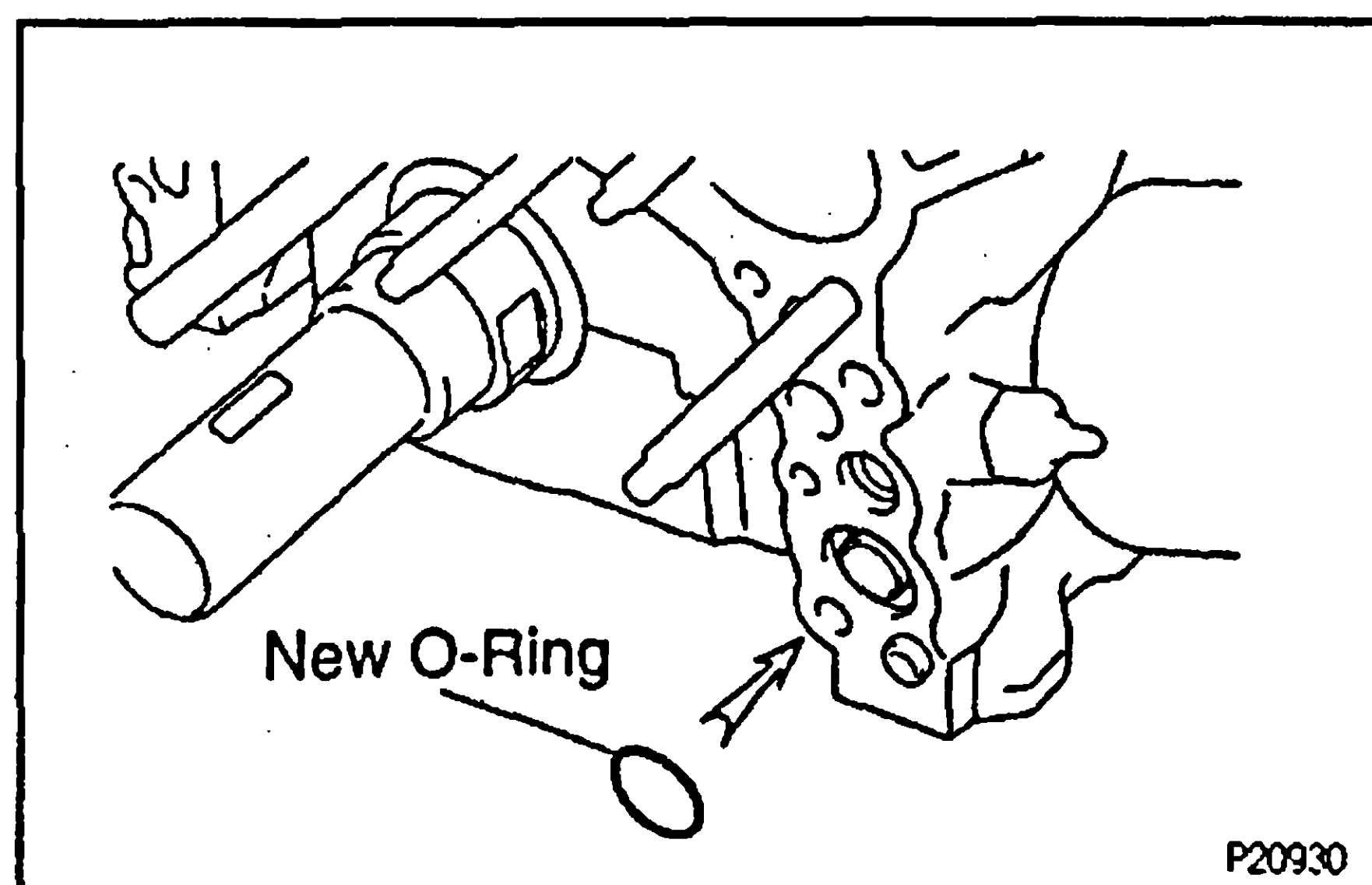
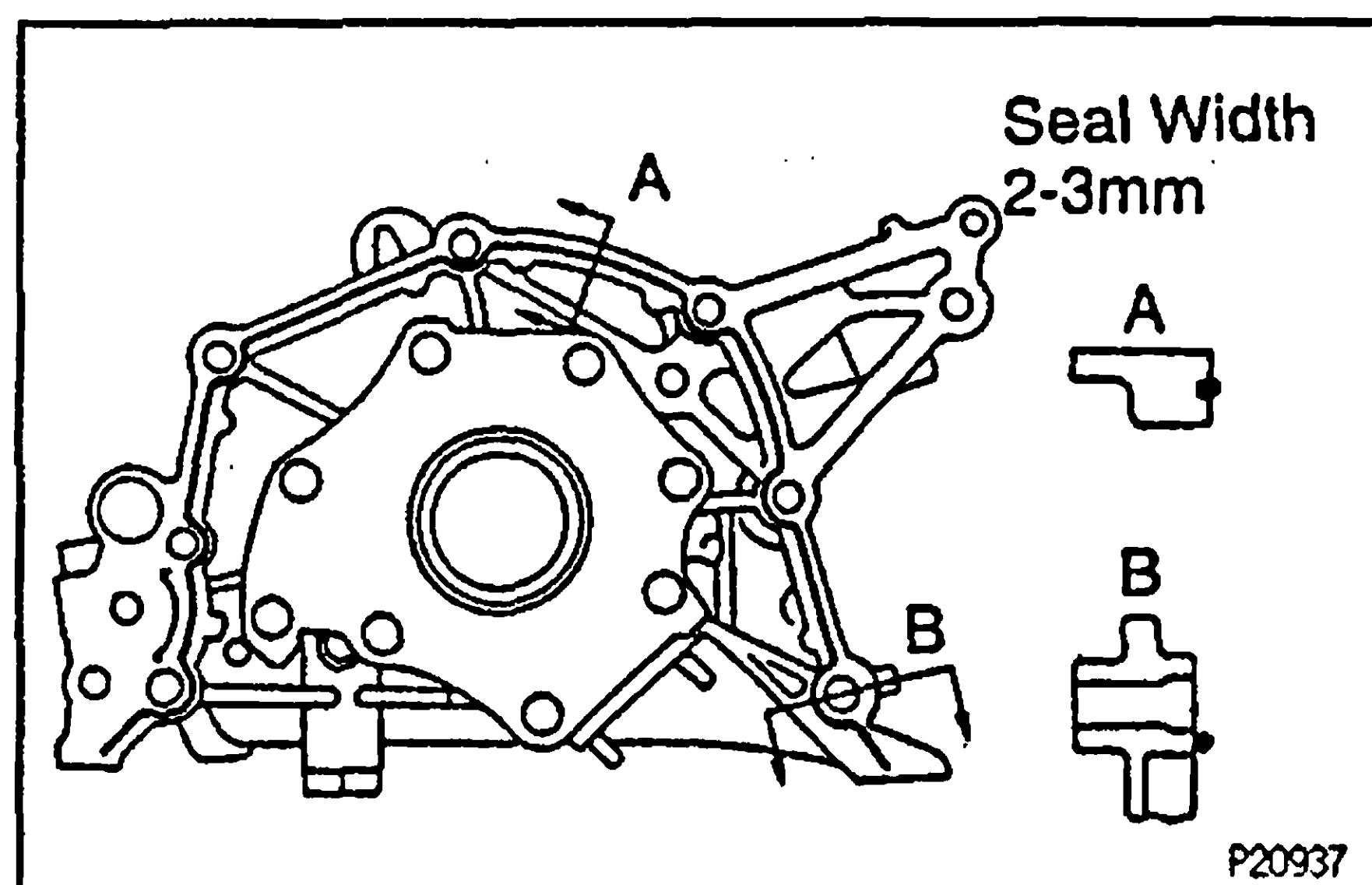
Part No. 08826-00080 or equivalent

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

HINT: Avoid applying an excessive amount to the surface.

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

- (c) Place a new O-ring into the groove of cylinder block.



- (d) Install the oil pump to the crankshaft with the spline teeth of the drive rotor engaged with the large teeth of the crankshaft.

- (e) Install the oil pump with the 8 bolts, and ground strap. Torque:

BoltⒶ: 20 N·m (200 kgf·cm, 15 ft·lbf)

BoltⒷ: 42 N·m (420 kgf·cm, 31 ft·lbf)

2. INSTALL CRANK SHAFT POSITION SENSOR

3. INSTALL OIL PAN BAFFLE PLATE

4. INSTALL OIL STRAINER

Place a new gasket and install the oil strainer.

Torque: 7.5 N·m (76 kgf·cm, 66 in.-lbf)

5. CLEAN OIL PAN

Remove any old packing (FIPG) material and be careful not to drop any oil on the contacting surfaces of the, oil pan and cylinder block.

- Using a razor blade and gasket scraper, remove all the remaining seal 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.

6. INSTALL OIL PAN

- (a) Apply seal packing to the oil pan, as shown in the illustration.

Seal packing:

Part No. 08826—00080 or equivalent

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

HINT: Avoid applying an excessive amount to the surface.

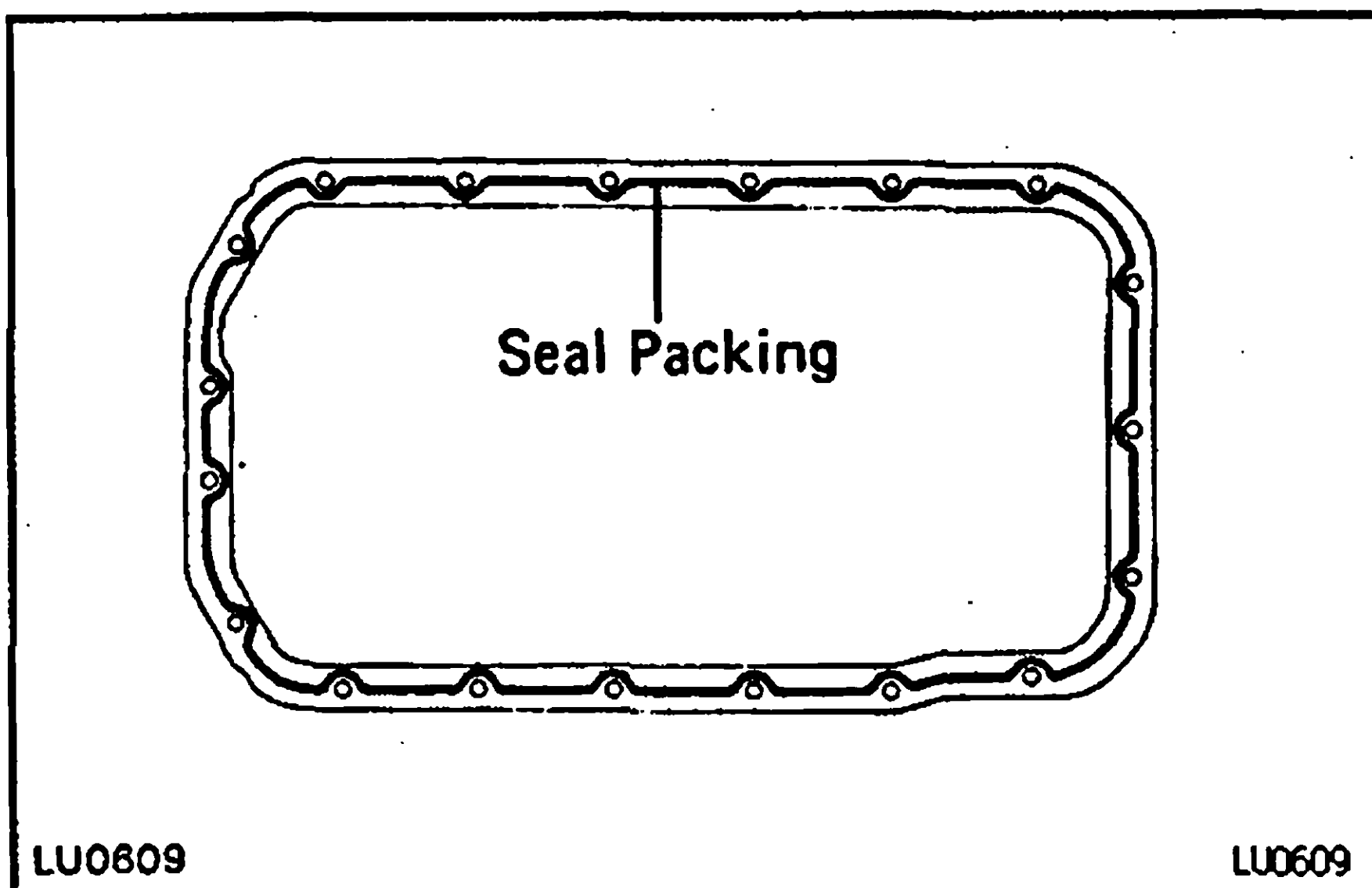
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove the nozzle from the tube and reinstall the cap after using the seal packing.

- (b) Install the oil pan with the 2 nuts and 17 bolts.

Torque: 7.6 N·m (78 kgf·cm, 67 in·lbf)

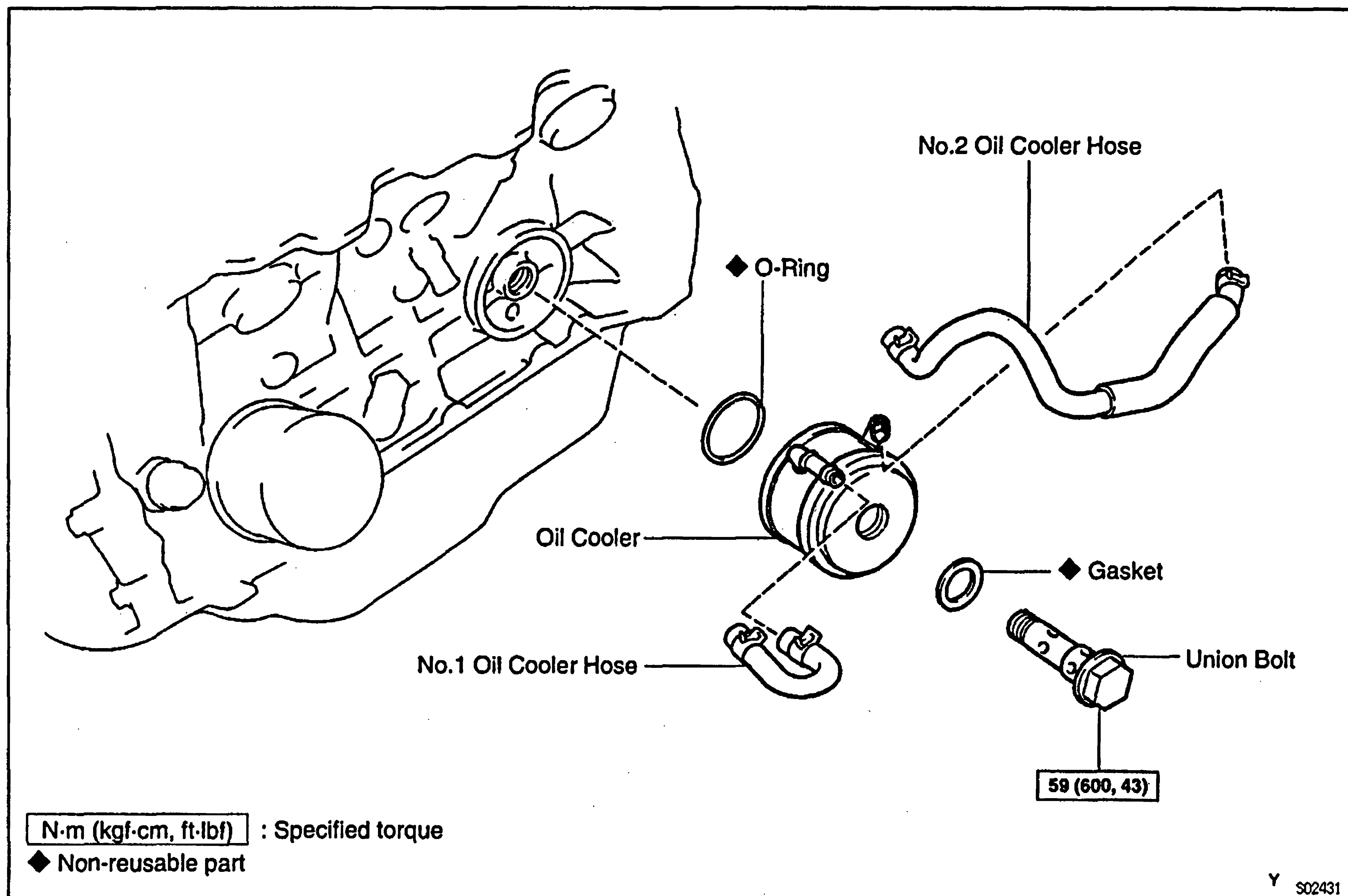
7. CONNECT STARTER WIRE CLAMP**8. INSTALL CRANKSHAFT TIMING PULLEY**

(See timing belt installation in Engine Mechanical)

9. FILL WITH ENGINE OIL**10. START ENGINE AND CHECK FOR LEAKS****11. RECHECK ENGINE OIL LEVEL**

OIL COOLER COMPONENTS FOR REMOVAL AND INSTALLATION

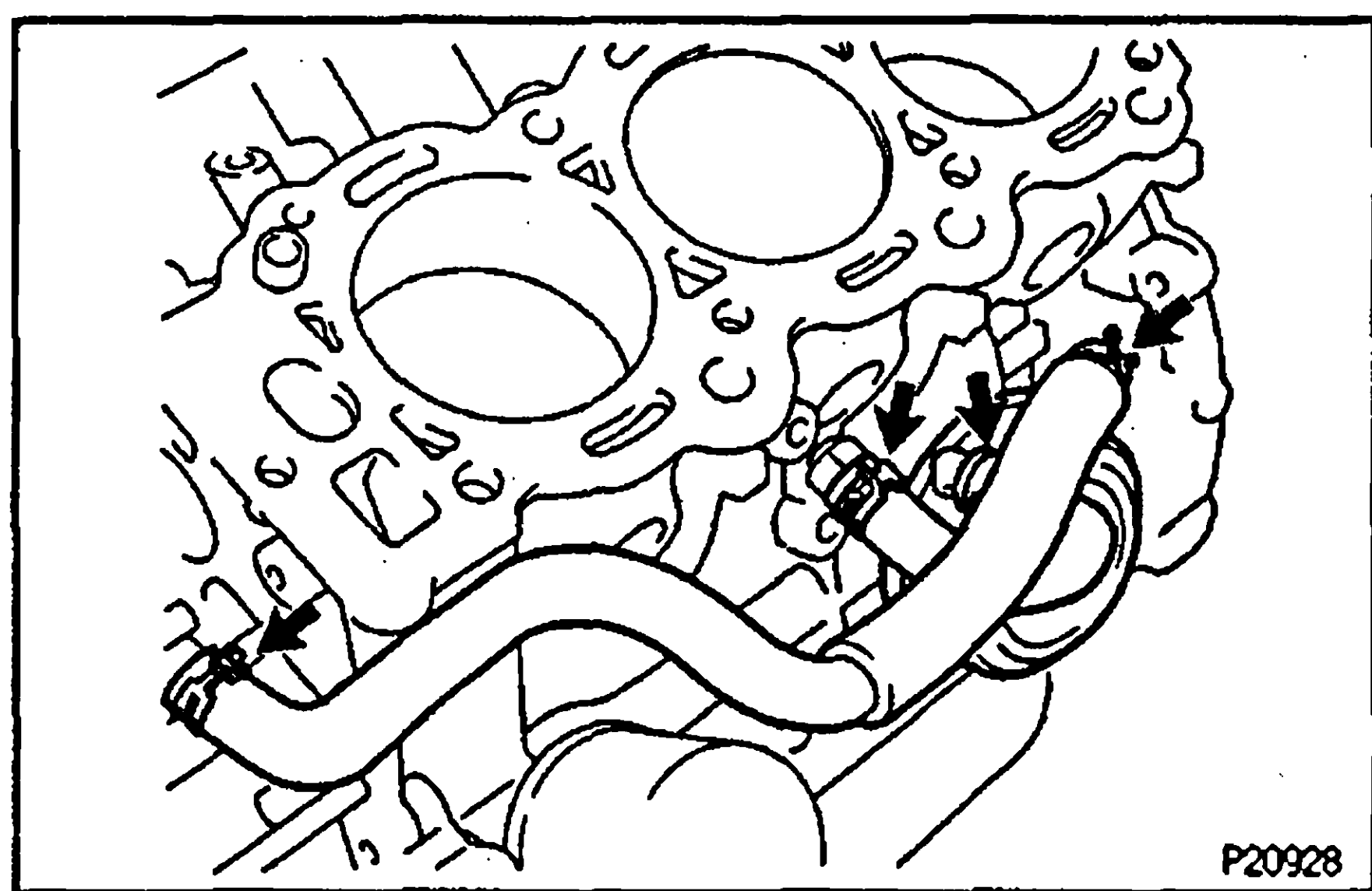
EG20M-0A



EG20M-0A

OIL COOLER REMOVAL

1. DRAIN ENGINE COOLANT
2. DISCONNECT OIL COOLER HOSES
Disconnect the No.1 and No.2 oil cooler hoses.

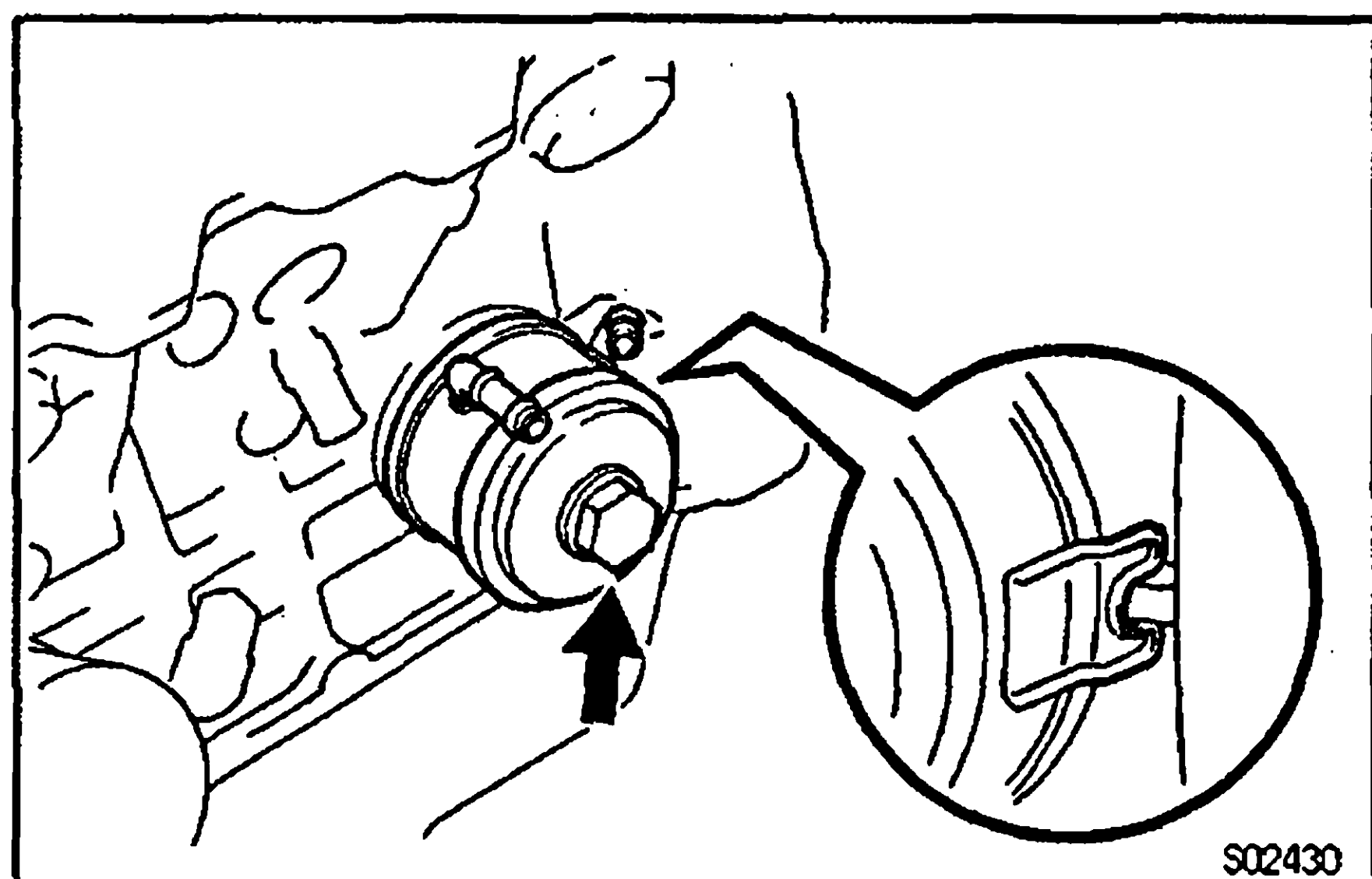


3. REMOVE OIL COOLER
Remove the union bolt, gaskets and oil cooler and O-ring.

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 relief valve.



OIL COOLER INSPECTION

INSPECT OIL COOLER

Check the oil cooler for damage or clogging.
If necessary, replace the oil cooler.

EG

OIL COOLER INSTALLATION

Installation is in the reverse order of removal.

SERVICE SPECIFICATIONS

SERVICE DATA

EG1D1-05

Oil pressure	At idle speed (normal operating temperature)	29 kPa (0.3 kgf/cm², 4.3 psi) or more	
	At 3,000 rpm (normal operating temperature)	245 — 520 kPa (2.5 — 5.3 kgf/cm², 36 — 75 psi)	
Oil pump	Body clearance	STD	0.10 — 0.18 mm (0.0039 — 0.0069 in.)
		Maximum	0.30 mm (0.0118 in.)
	Tip clearance	STD	0.11 — 0.24 mm (0.0043 — 0.0094 in.)
		Maximum	0.35 mm (0.0138 in.)
	Side clearance	STD	0.03 — 0.09 mm (0.0012 — 0.0035 in.)
		Maximum	0.15 mm (0.0059 in.)

EG

TORQUE SPECIFICATIONS

EG1D2-05

Part tightened	N·m	kgf·cm	ft·lbf
Oil pressure sender gauge x Cylinder block	15	150	11
Oil pump x Oil pump body cover	10	105	8
Oil pump x Cylinder block Bolt ①	20	200	14
Oil pump x Cylinder block Bolt ②	42	420	31
Oil pump x Relief valve	37	375	27
Oil strainer x Cylinder block	7.5	76	66 in·lbf
Oil pan x Cylinder block	7.6	78	67 in·lbf
Oil cooler x Cylinder block	59	600	43

IGNITION

PRECAUTION IG- 2

PREPARATION IG- 2

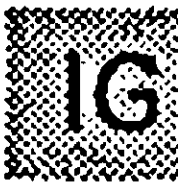
ON-VEHICLE INSPECTION..... IG- 3

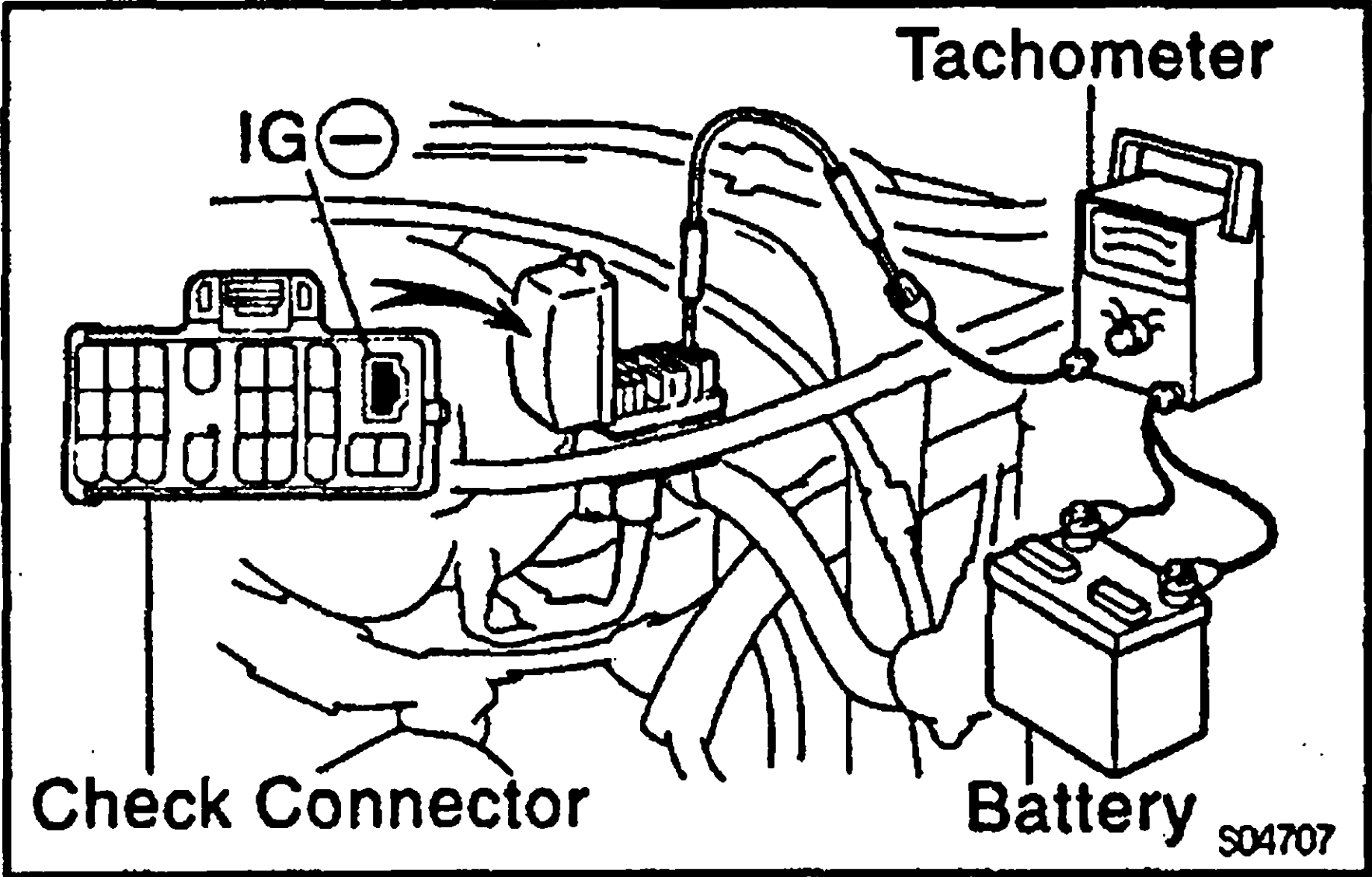
IGNITION COIL IG- 7

CAMSHAFT POSITION SENSOR IG- 8

CRANKSHAFT POSITION SENSOR IG- 9

SERVICE SPECIFICATIONS IG- 10





PRECAUTION

- 1. With a tachometer connected to the system, connect the test probe of the tachometer to terminal IG ⊖ of the check connector.
- 2. As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your before use.
- 3. Never allow the tachometer terminals to touch ground as it could result in damage to the igniter and/or ignition coil.
- 4. Do not disconnect the battery while the engine is running.
- 5. Check that the igniter is properly grounded to the body.

PREPARATION
RECOMMENDED TOOLS

	09082-00040 TOYOTA Electrical Tester.	
	09200-00010 Engine Adjust Kit .	

EQUIPMENT

Spark plug cleaner	
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ON — VEHICLE INSPECTION SPARK TEST

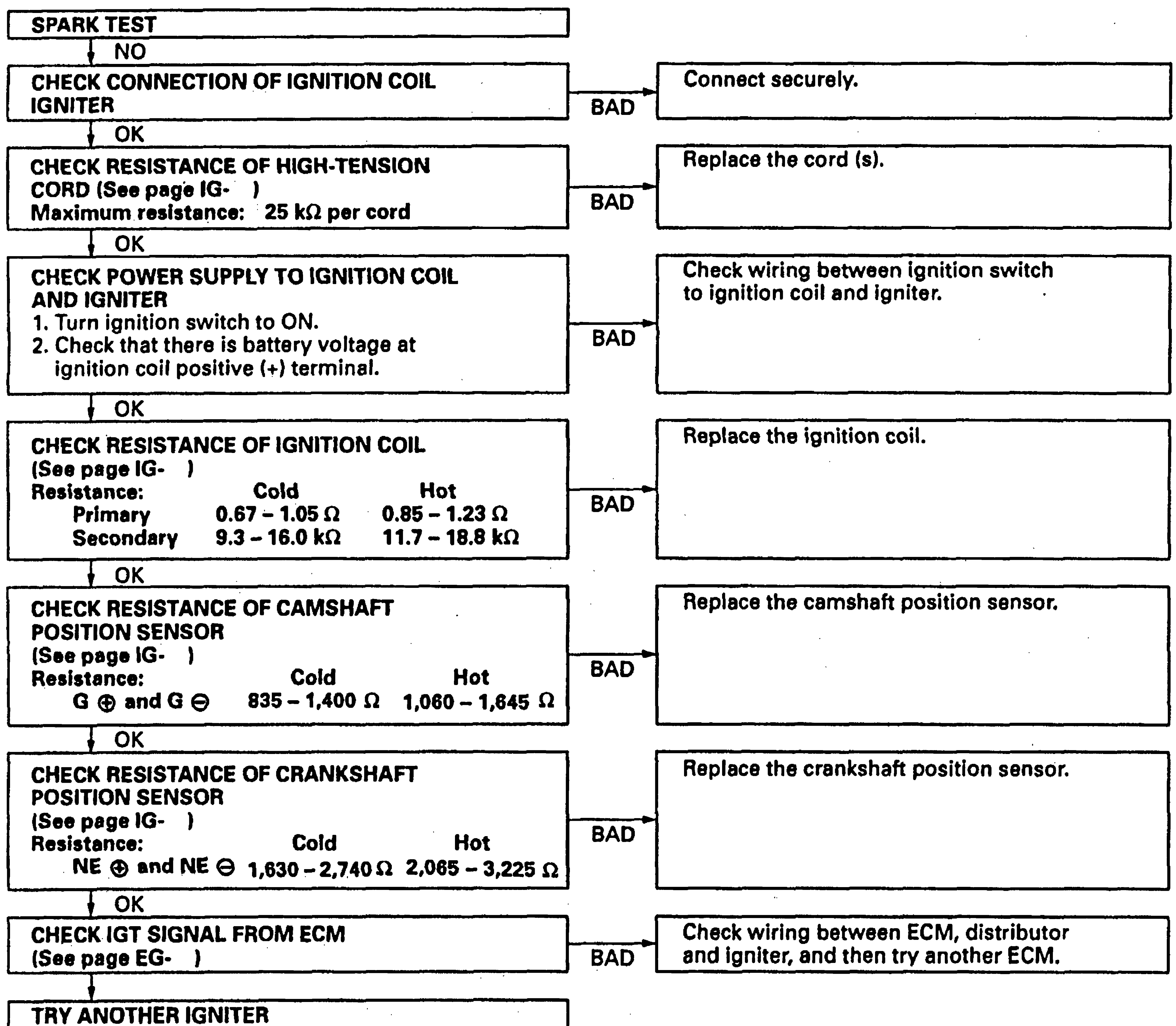
1000E-04

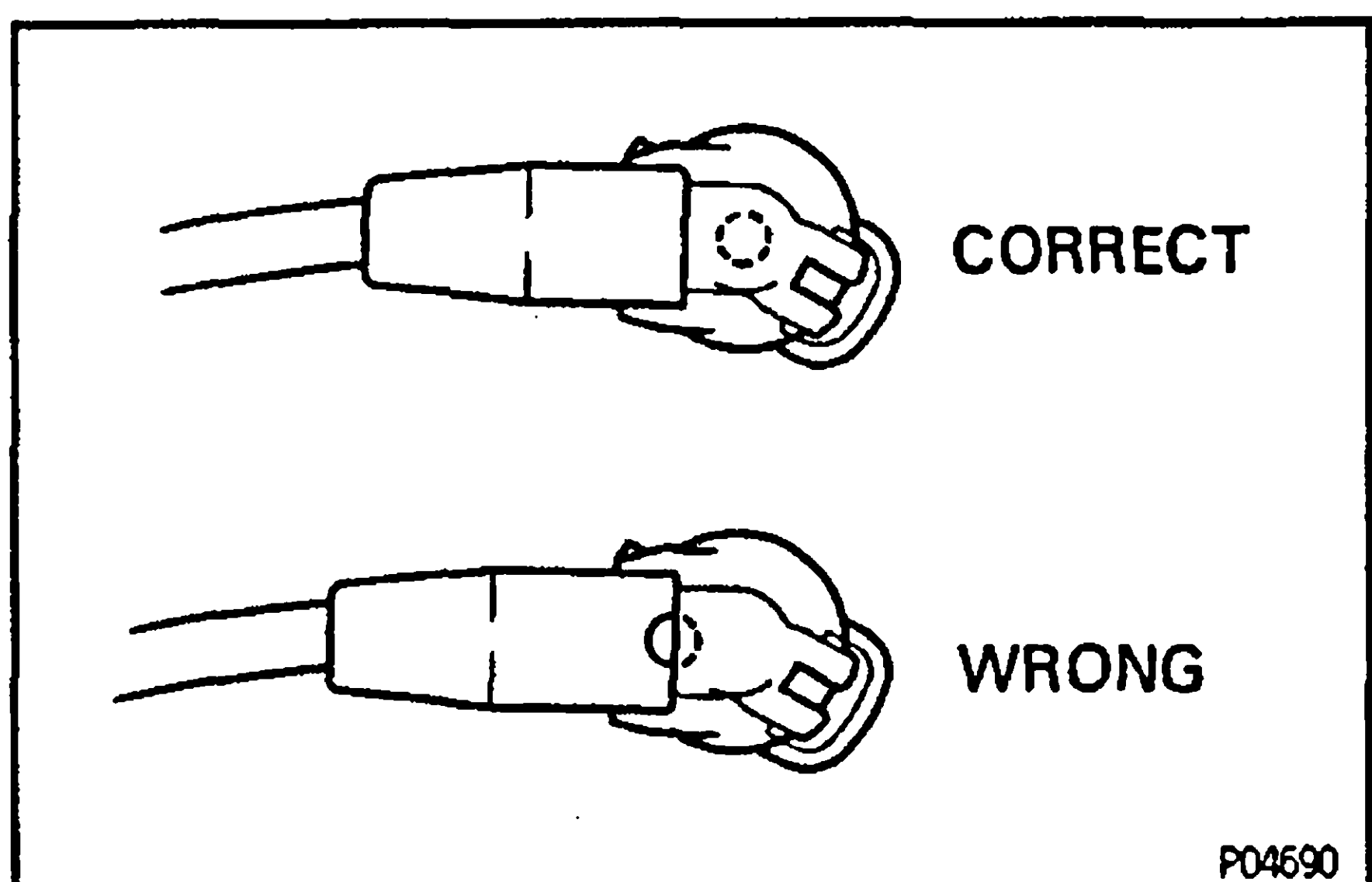
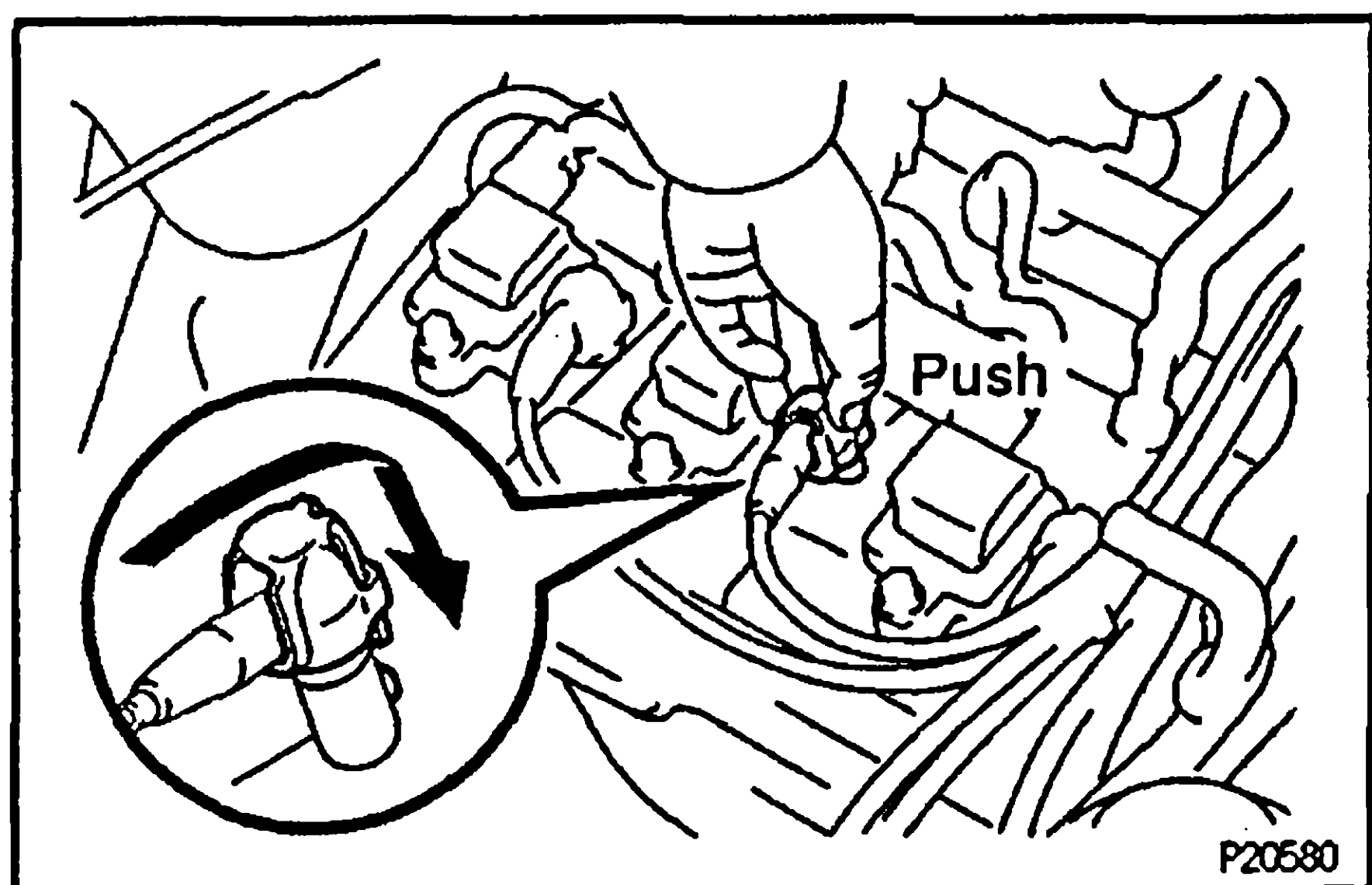
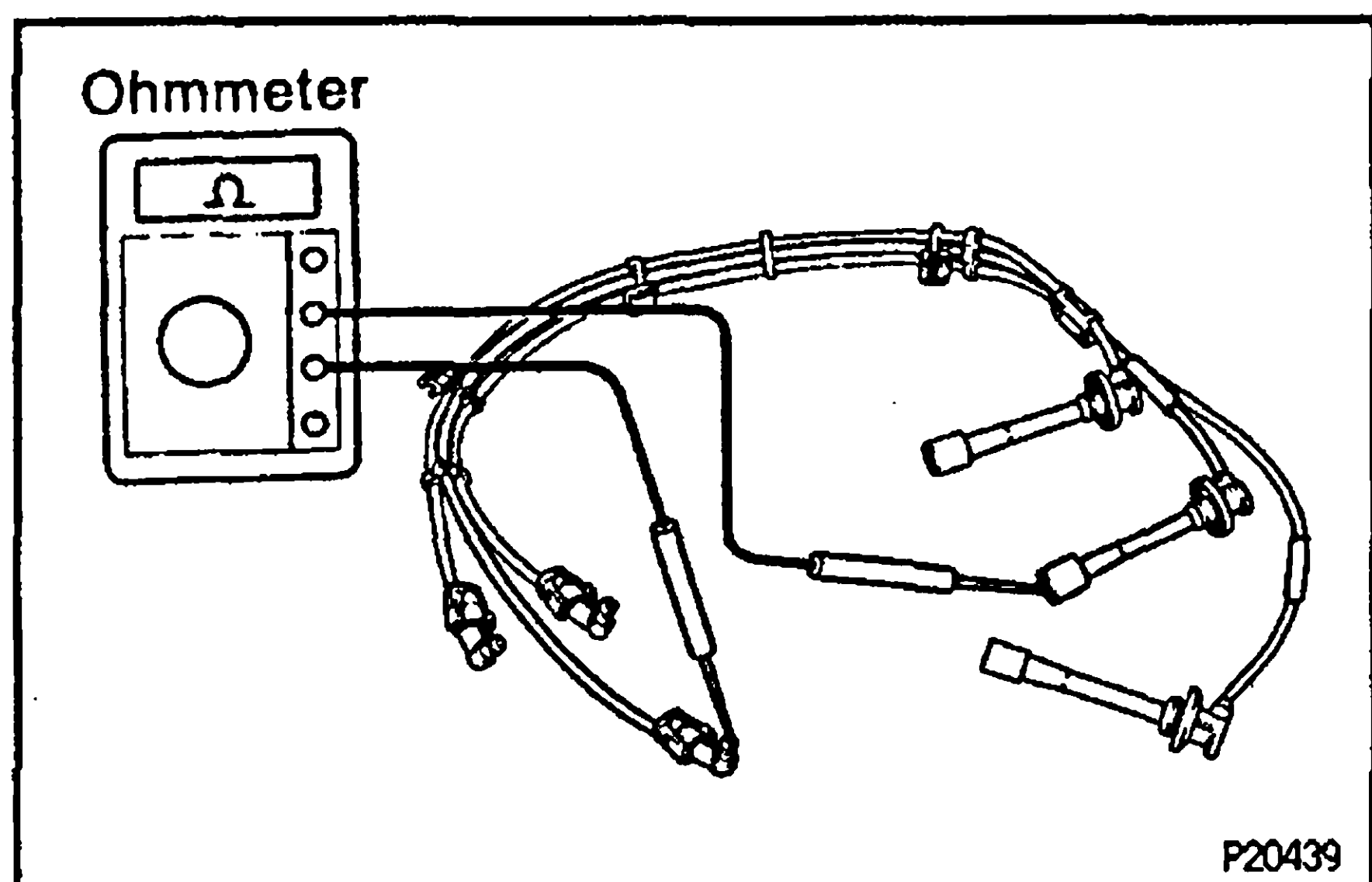
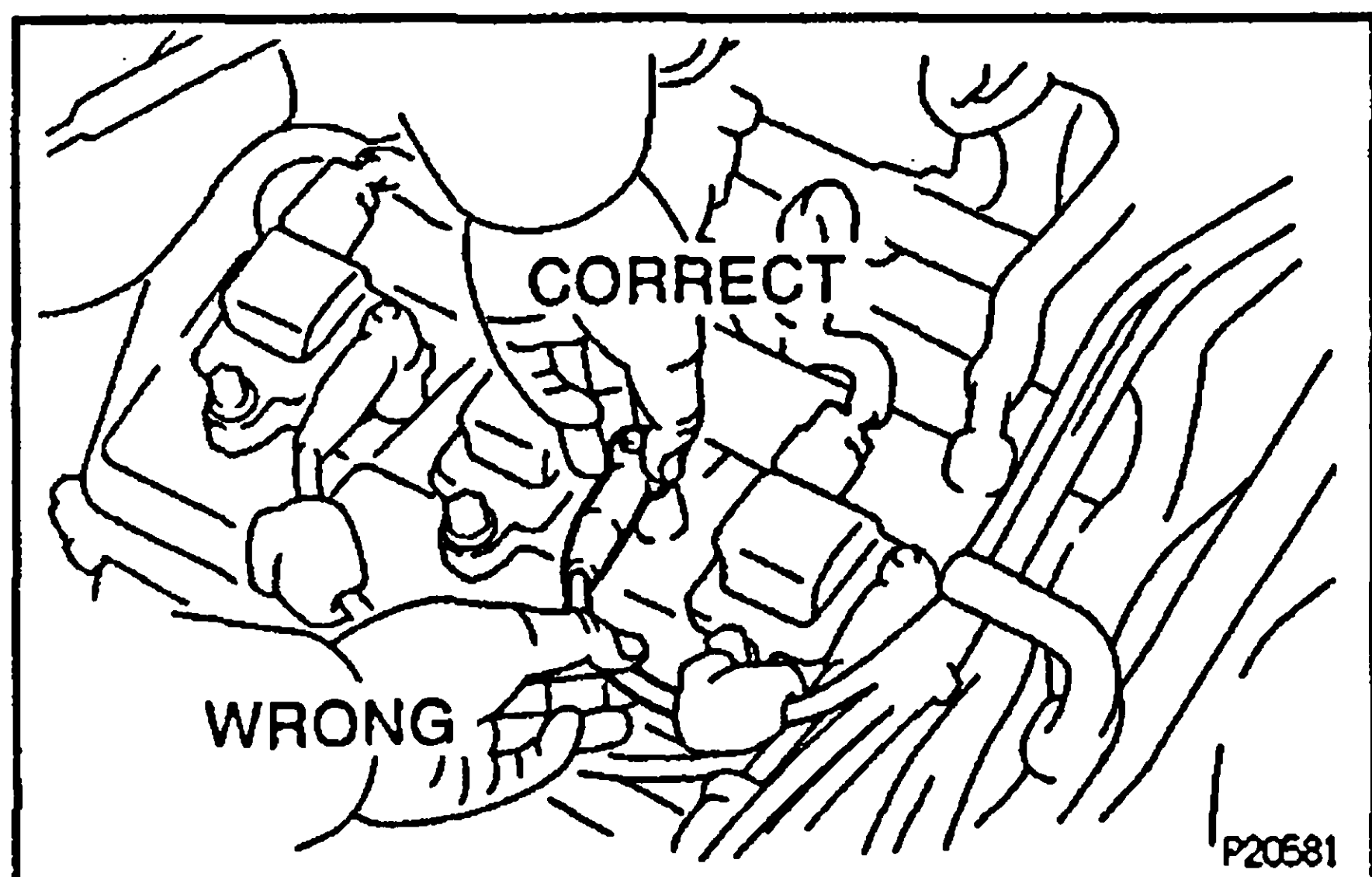
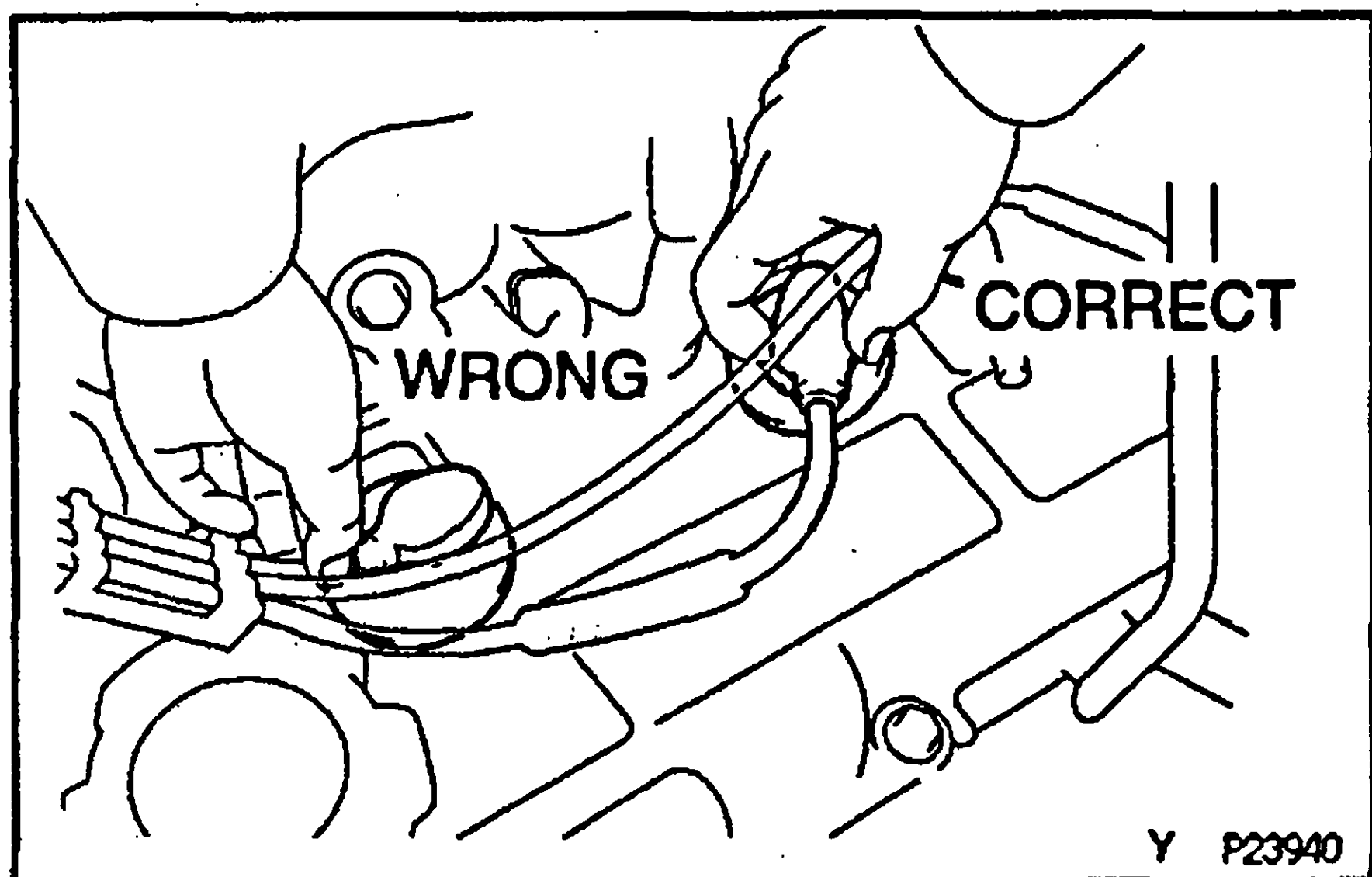
CHECK THAT SPARK OCCURS

- Disconnect high — tension cords from spark plug.
- Remove the spark plug.
- Install the spark plug to each high — tension cord.
- Ground the spark plug.
- Check if spark occurs while engine is being cranked.

HINT: To prevent gasoline from being injected from injectors during this test, crank the engine for no more than 1 — 2 seconds at time.

If the spark does not occur, do the test as next page:





HIGH—TENSION CORDS INSPECTION

1. REMOVE AIR CLEANER HOSE ASSEMBLY
2. 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.

3. DISCONNECT HIGH—TENSION CORDS FROM IGNITION COILS

(a) Using a screwdriver, lift up the lock claw and disconnect the holder from the ignition coils.

(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.

4. 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.

5. RECONNECT HIGH—TENSION CORDS TO IGNITION COILS

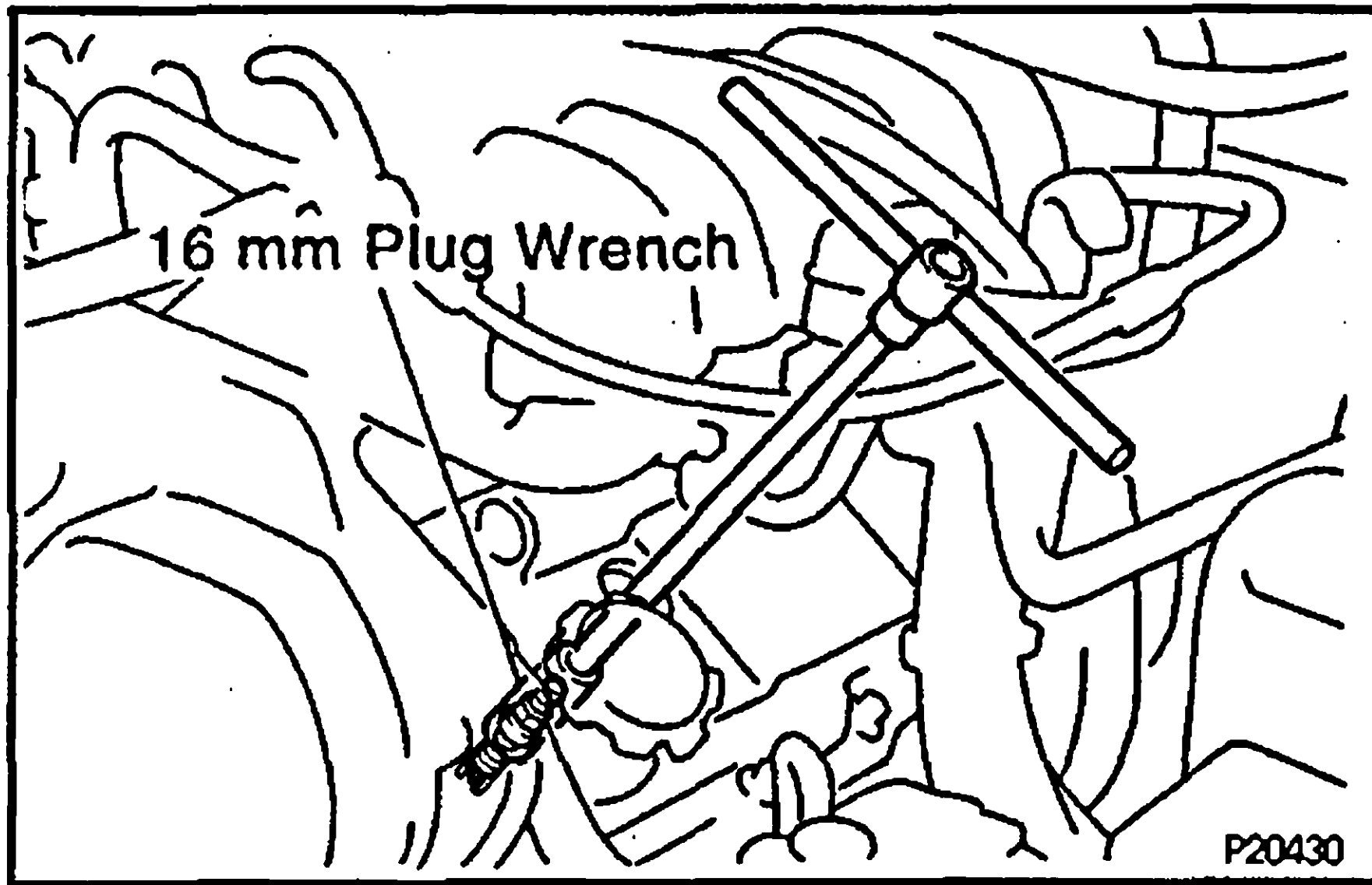
(a) Assemble the holder and grommet.

(b) Align the spline of the ignition coil with the spline of the holder, and push in the cord.

NOTICE: Check that the holder is correctly installed to the grommet and distributor cap as shown in the illustration.

(c) Check that the lock claw of the holder is engaged by lightly pulling the holder.

6. RECONNECT HIGH—TENSION CORDS TO SPARK PLUGS

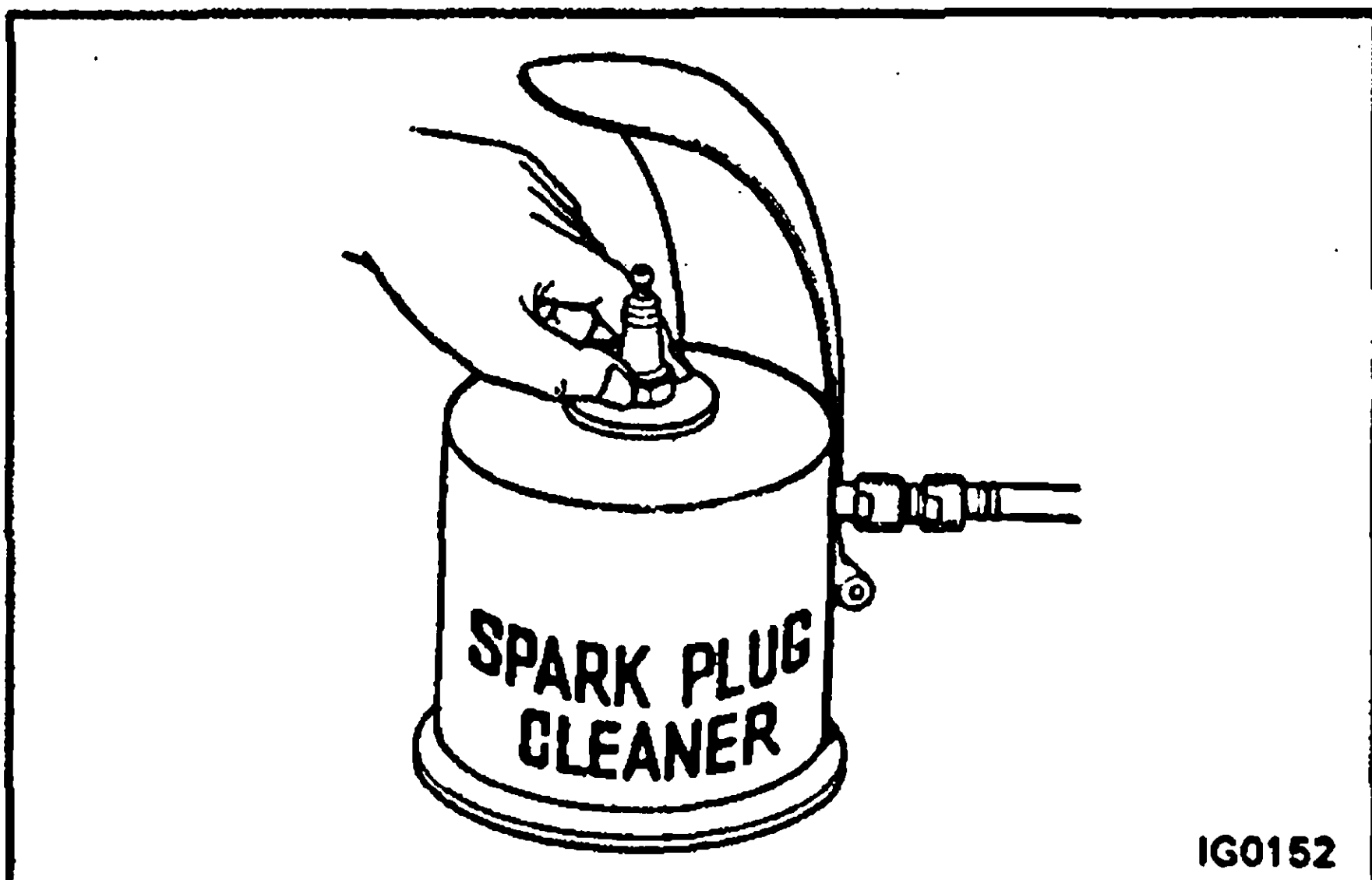


SPARK PLUGS INSPECTION

1. **REMOVE HIGH—TENSION CORDS AND IGNITION COILS**
(See ignition coil removal)

2. **REMOVE SPARK PLUGS**

Using a 16 mm plug wrench, remove the 6 spark plugs from the RH and LH cylinder heads.



3. **CLEAN SPARK PLUGS**

If the electrode has traces of wet carbon, allow it to dry and then clean with a spark plug cleaner.

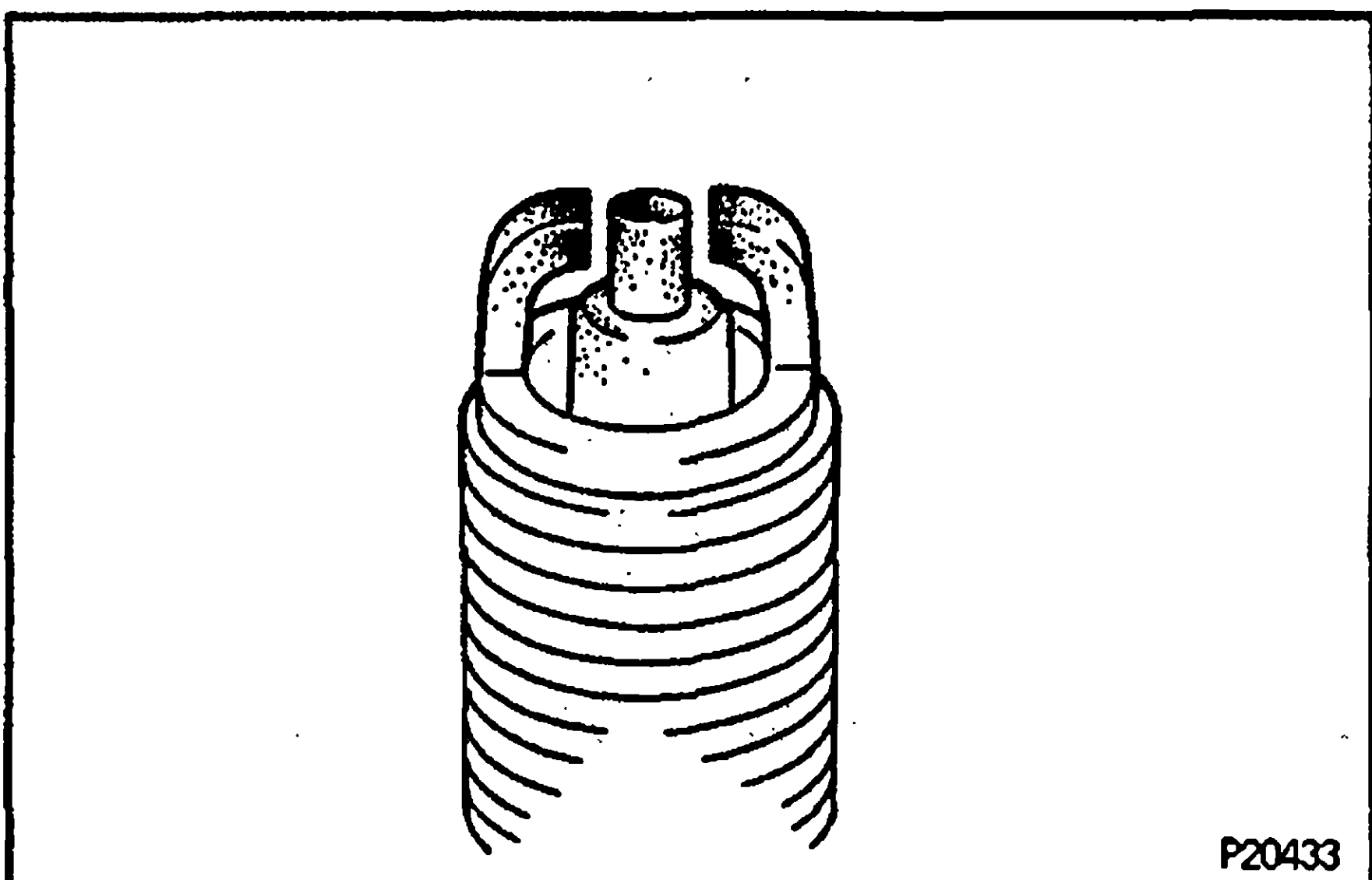
Air pressure:

Below 588 kPa (6 kgf/cm², 85 psi)

Duration:

20 seconds or less

HINT: If there are traces of oil, remove it with gasoline before using the spark plug cleaner.



4. **VISUALLY INSPECT SPARK PLUGS**

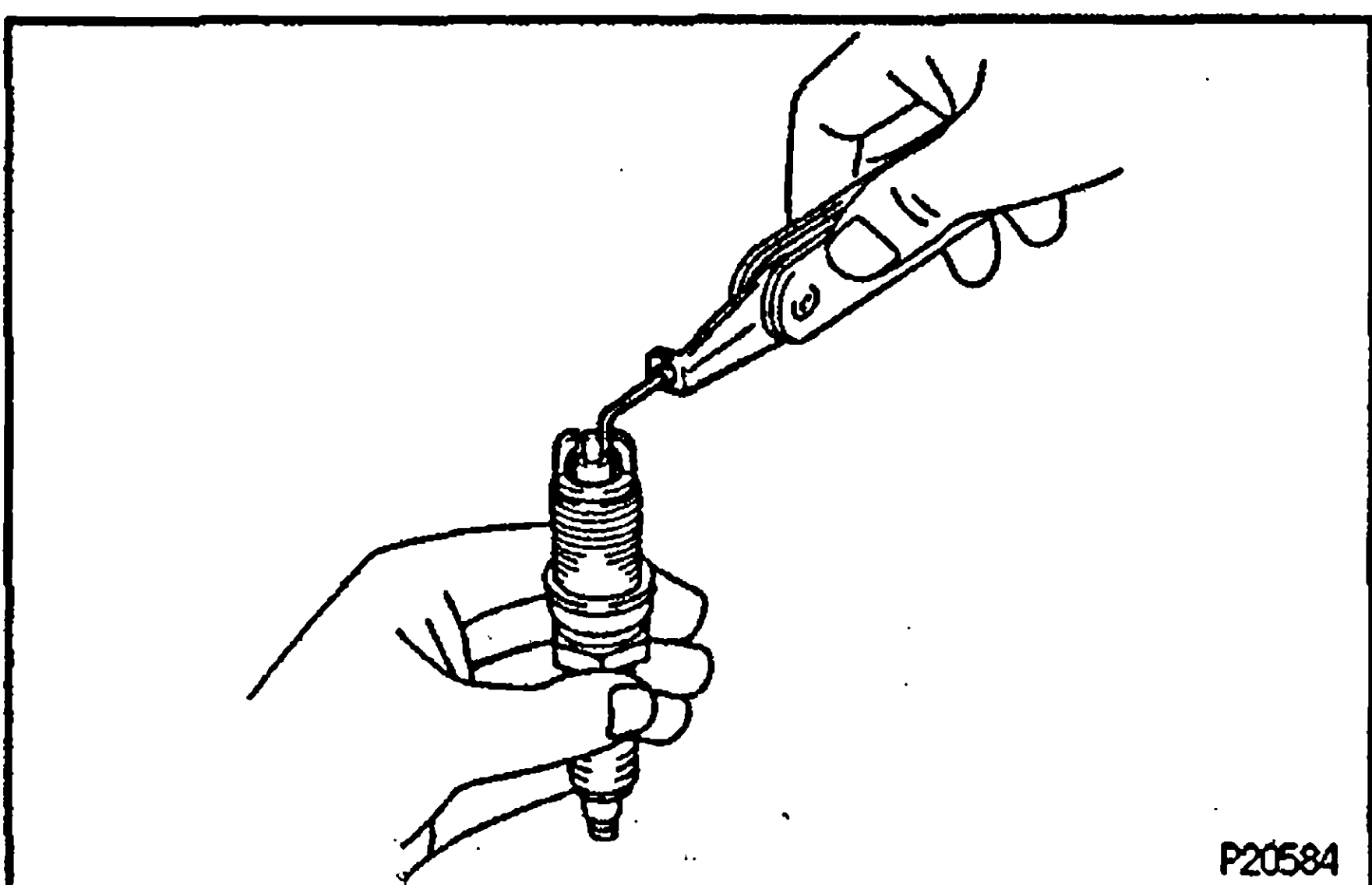
Check the spark plug for thread damage and insulator damage.

If abnormal, replace the spark plug.

Recommended spark plug:

ND: K16TR11

NGK: BKR5EKB—11



5. **ADJUST ELECTRODE GAP**

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

Correct electrode gap:

1.1 mm (0.043 in.)

6. **REINSTALL SPARK PLUGS**

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

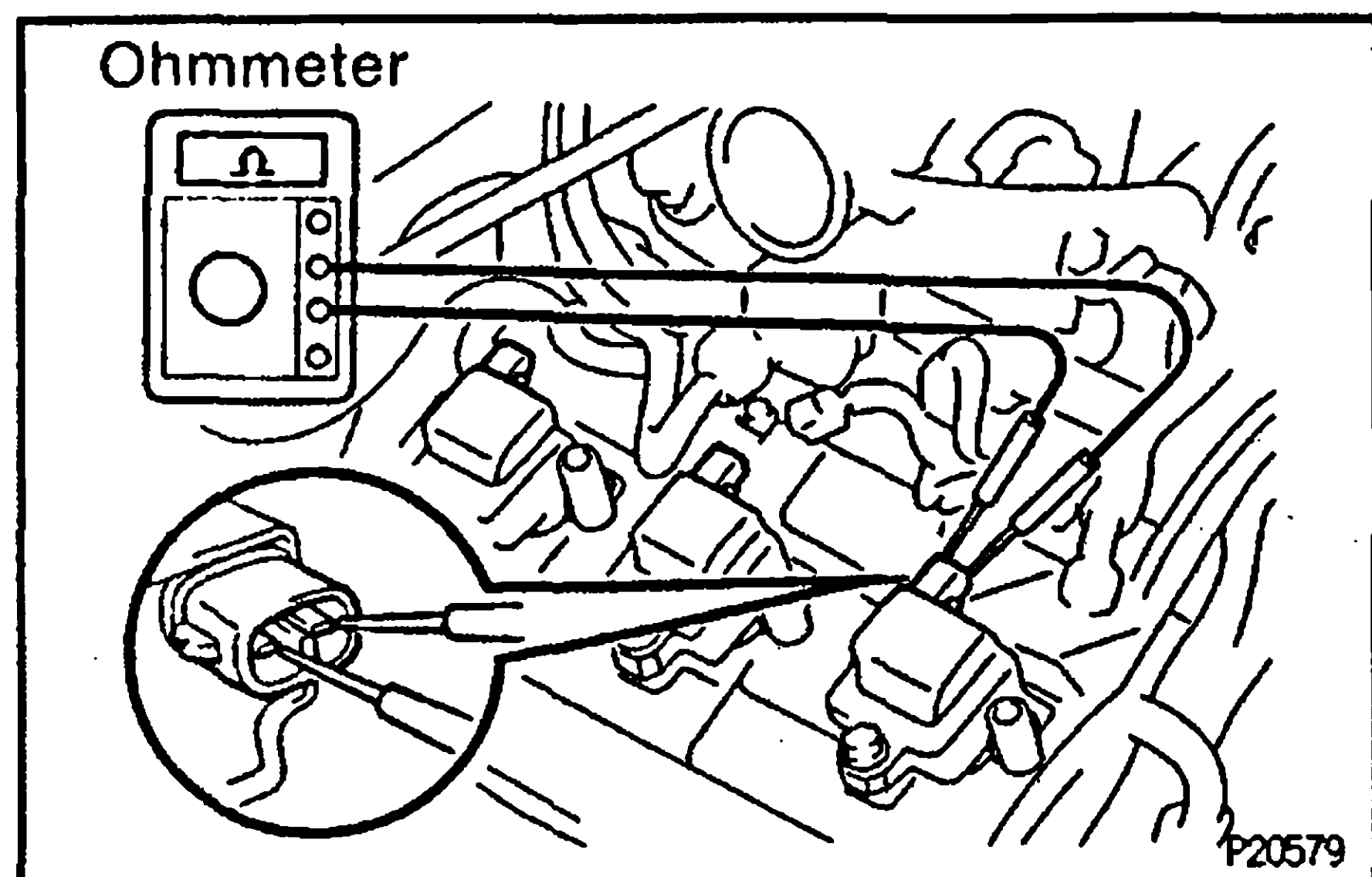
7. **REINSTALL IGNITION COILS AND HIGH—TENSION CORDS**

IGNITION COIL 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. **REMOVE AIR CLEANER HOSE ASSEMBLY**

2. **DISCONNECT HIGH—TENSION CORDS FROM IGNITION COILS**

**3. DISCONNECT IGNITION COIL CONNECTORS****4. INSPECT PRIMARY COIL RESISTANCE**

Using an ohmmeter, measure the resistance between the positive (+) and negative (—) terminals.

Primary coil resistance :

Cold: 0.67 — 1.05 Ω

Hot: 0.85 — 1.23 Ω

If the resistance is not as specified, replace the ignition coil.

5. RECONNECT IGNITION COIL CONNECTORS**6. RECONNECT HIGH—TENSION CORDS FROM IGNITION COILS****7. INSTALL AIR CLEANER HOSE ASSEMBLY**

CAMSHAFT POSITION SENSOR INSPECTION

1000E-01

NOTICE: "Cold" and "Hot" in the following sentences express the temperature of the sensor itself. "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 CAMSHAFT POSITION SENSOR CONNECTOR**2. INSPECT CAMSHAFT POSITION SENSOR RESISTANCE**

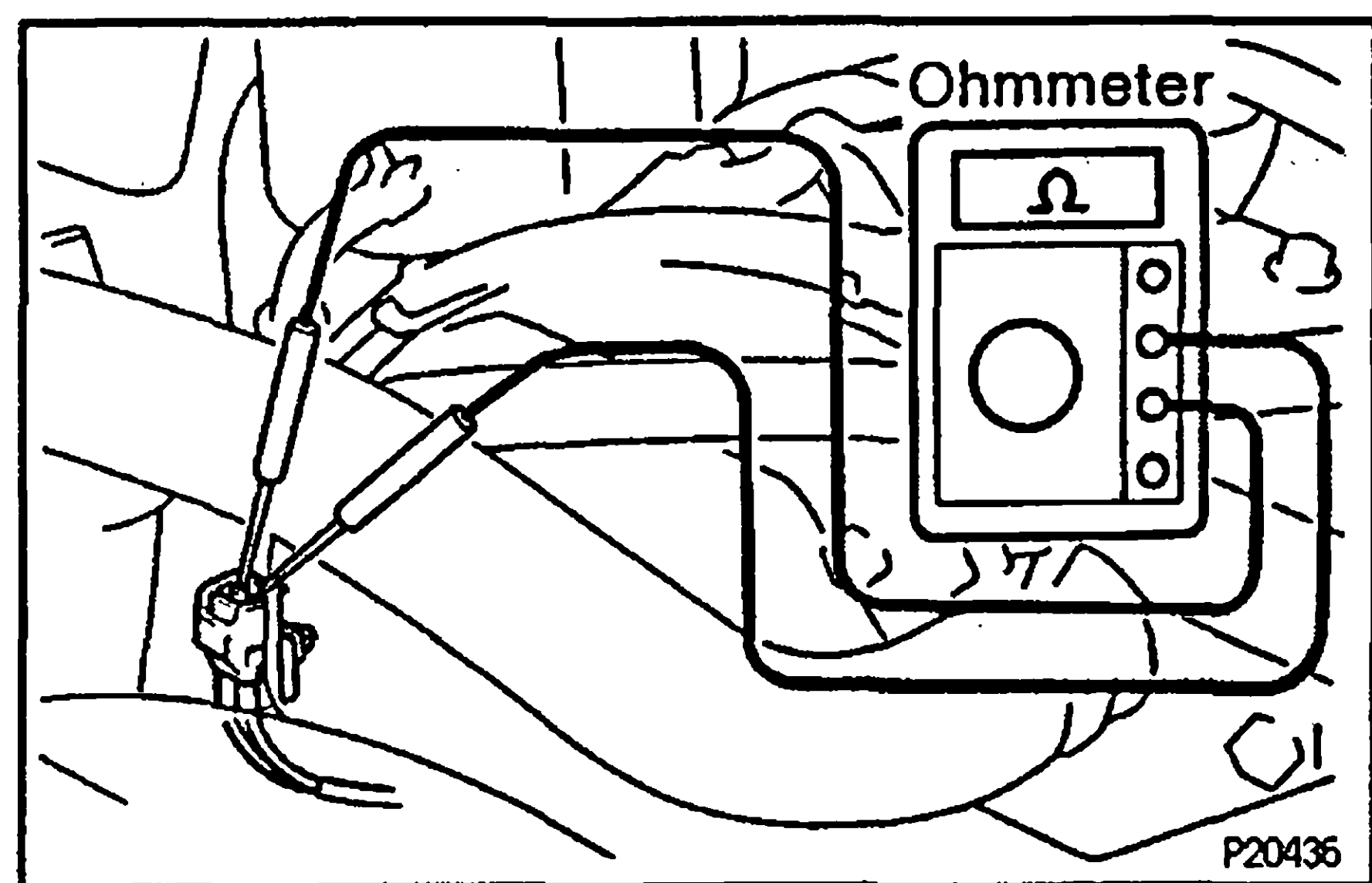
Using an ohmmeter, measure the resistance between terminals.

Resistance:

Cold: 835 — 1,400 Ω

Hot: 1,060 — 1,645 Ω

If the resistance is not as specified, replace the camshaft position sensor.

3. RECONNECT CAMSHAFT POSITION SENSOR CONNECTOR

IGNITER INSPECTION

1002W-0P

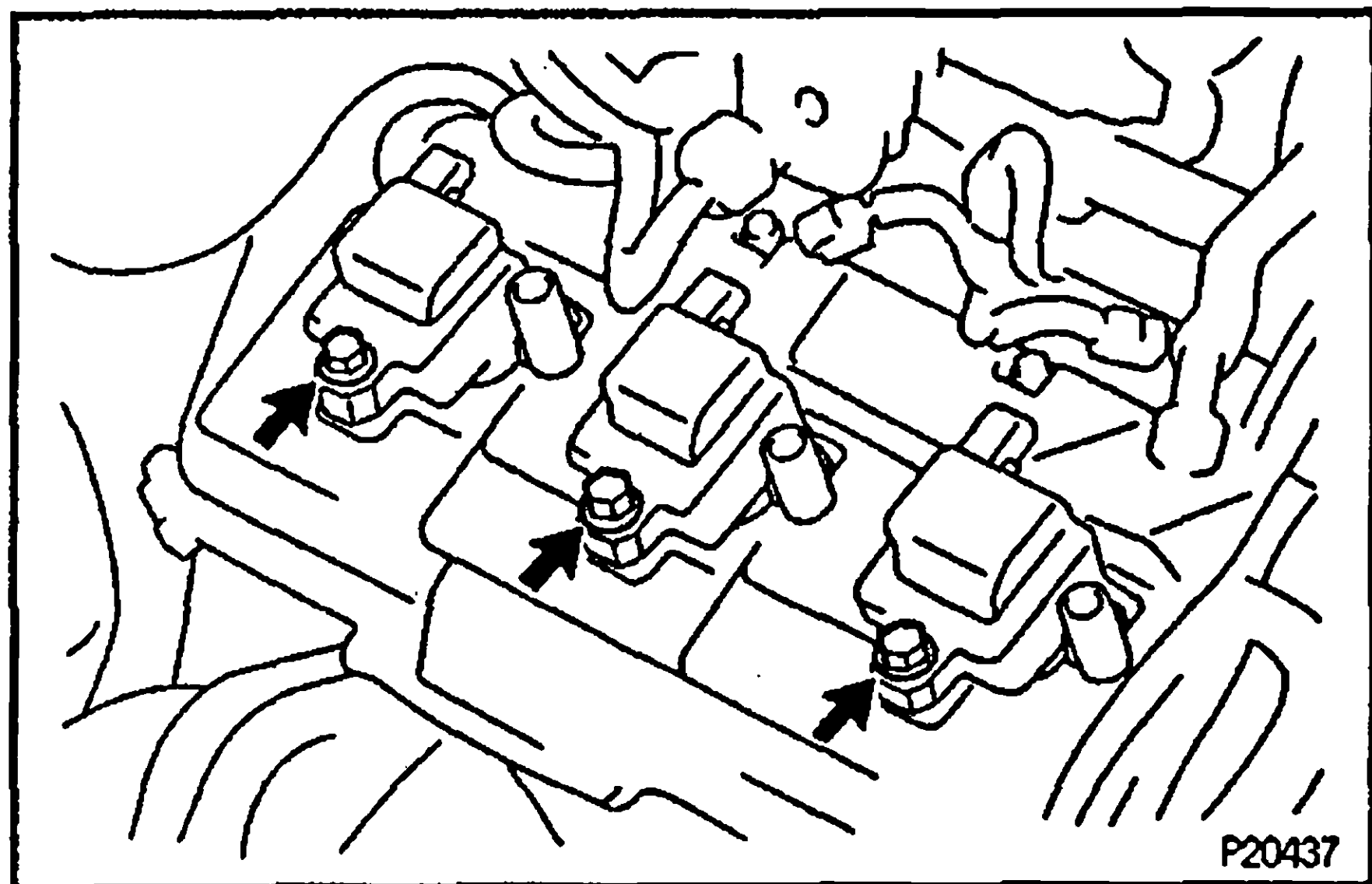
(See procedure Spark Test in on—vehicle inspection)

IGNITION COIL

IGNITION COILS REMOVAL

1002K-08

1. DISCONNECT HIGH—TENSION CORDS FROM IGNITION COILS



2. REMOVE IGNITION COILS

- (a) Disconnect the 3 connectors from the ignition coils.
- (b) Remove the 3 bolts and 3 ignition coils from the LH cylinder head.

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

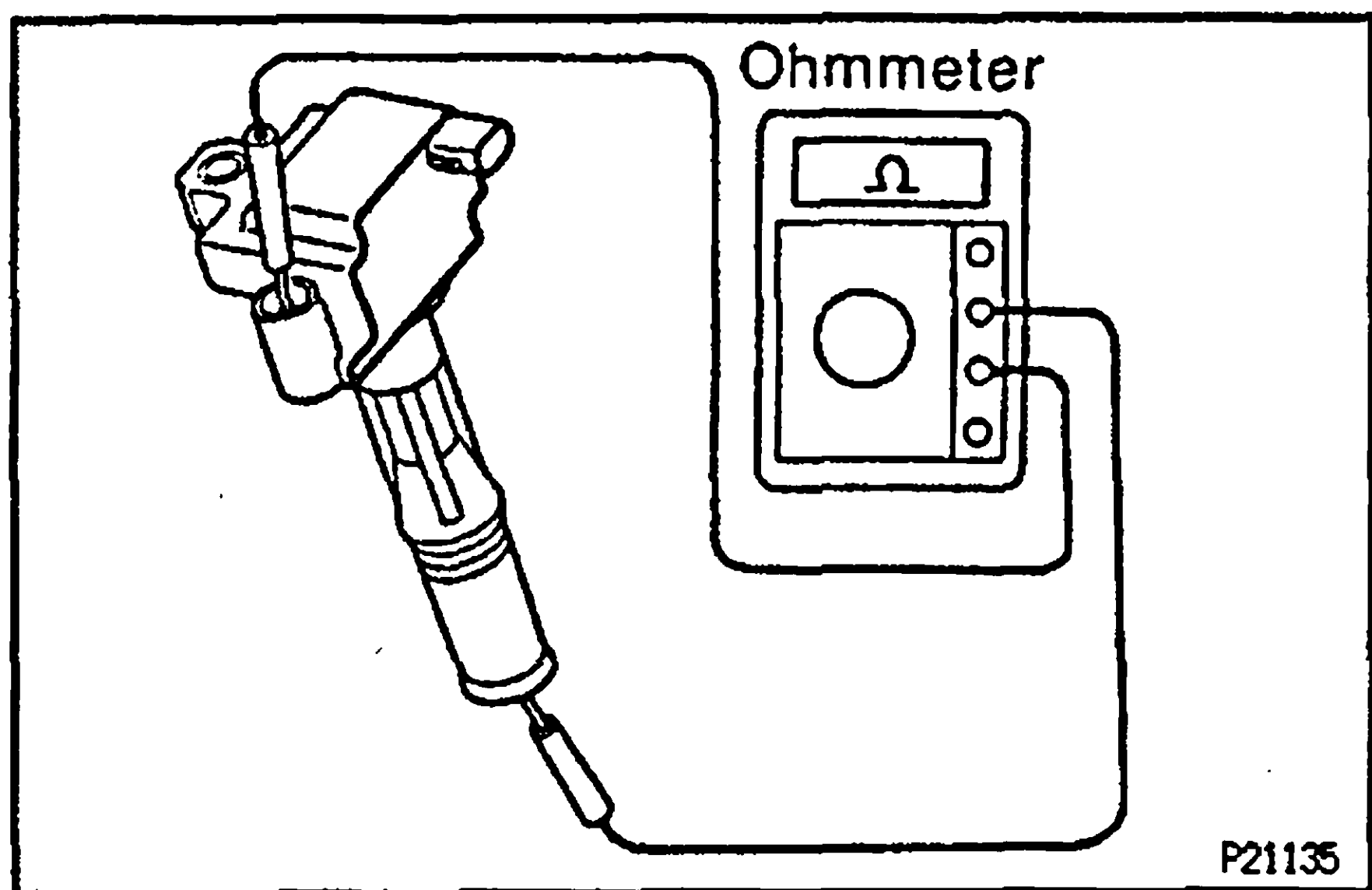
HINT: Arrange the ignition coils in correct order.

IG

IGNITION COILS INSPECTION

1000L-02

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).



INSPECT SECONDARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between the positive (+) and high—tension terminals.

Secondary coil resistance:

Cold: 9.3 — 16.0 k Ω

Hot: 11.7—18.8 k Ω

If the resistance is not as specified, replace the ignition coil.

IGNITION COILS INSTALLATION

10010-01

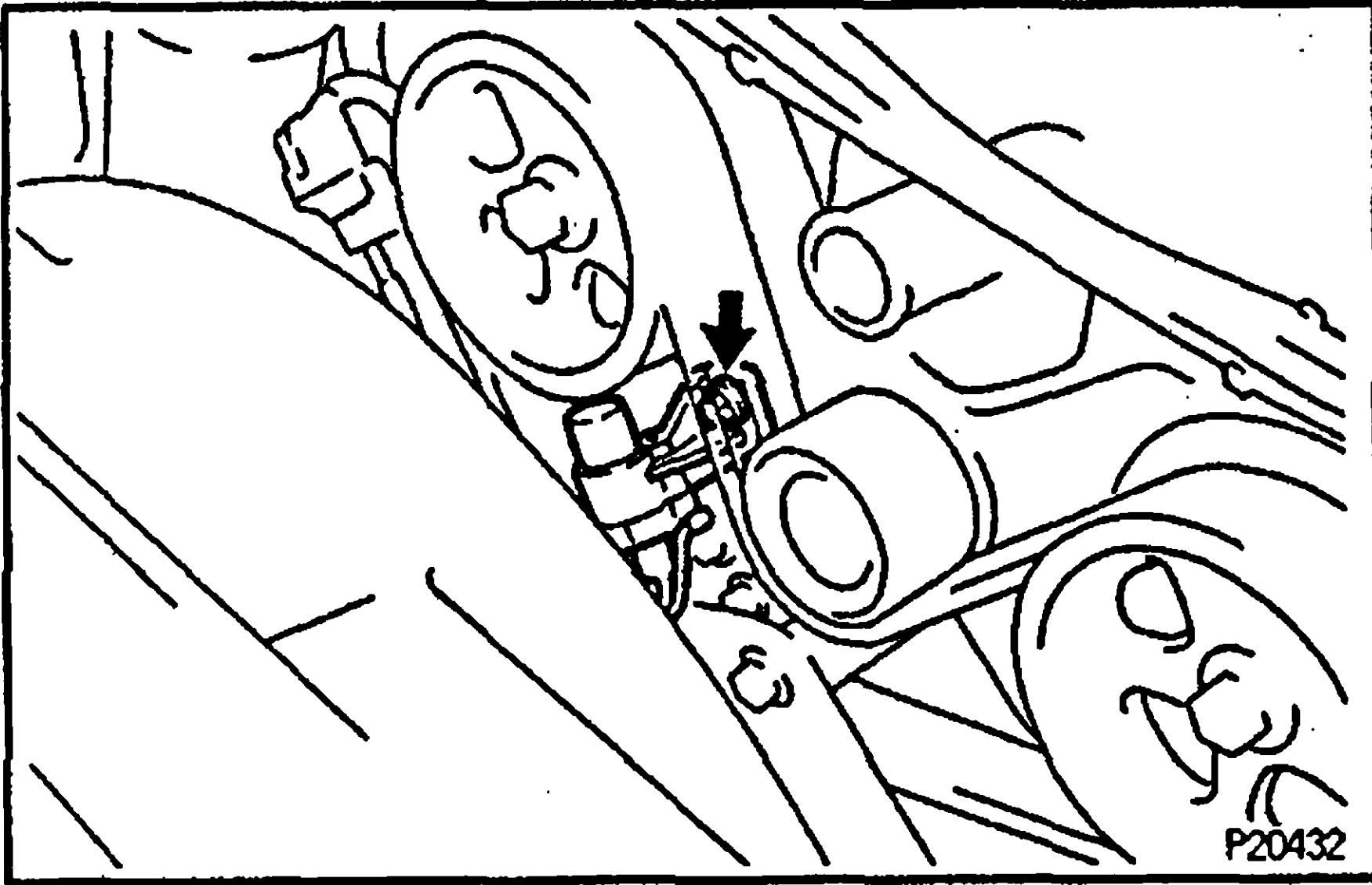
Installation is in the reverse order of removal.

CAMSHAFT POSITION SENSOR

CAMSHAFT POSITION SENSOR REMOVAL

1003M-04

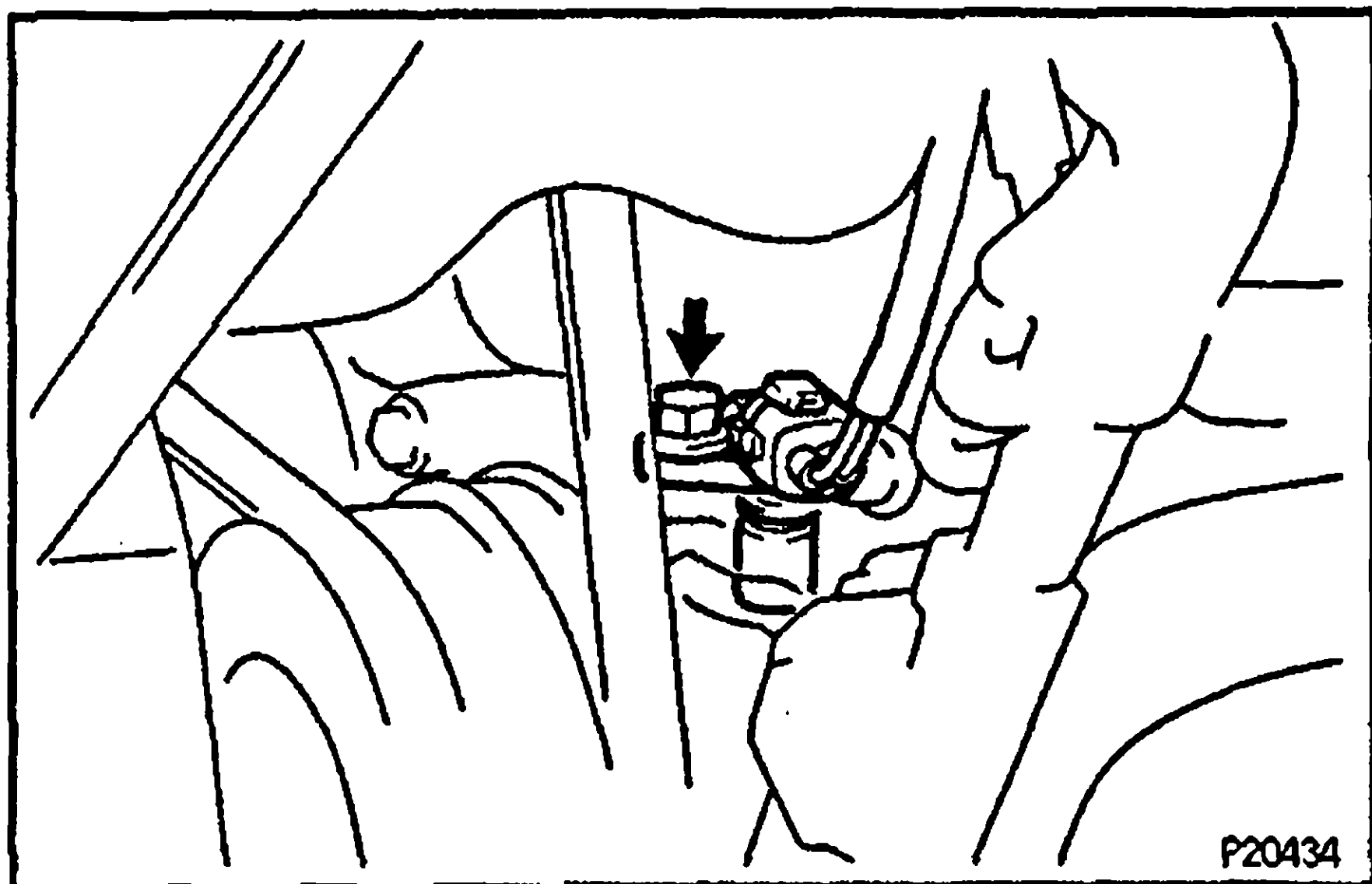
1. REMOVE UPPER RADIATOR HOSE
 2. REMOVE NO.2 TIMING BELT COVER
 - (a) Remove the high—tension cord clamps from the No.2 timing belt cover.
 - (b) Remove the PS pump hose from the No.2 timing belt cover clamp.
 - (c) Remove the 6 bolts and No.2 timing belt cover.
 3. REMOVE CAMSHAFT POSITION SENSOR
 - (a) Disconnect the camshaft position sensor connector.
 - (b) Remove the bolts and camshaft position sensor.
- Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)



CAMSHAFT POSITION SENSOR INSTALLATION

100JH-02

Installation is in the reverse order of removal.



CRANKSHAFT POSITION SENSOR CRANKSHAFT POSITION SENSOR REMOVAL

1000H-03

REMOVE CRANKSHAFT POSITION SENSOR

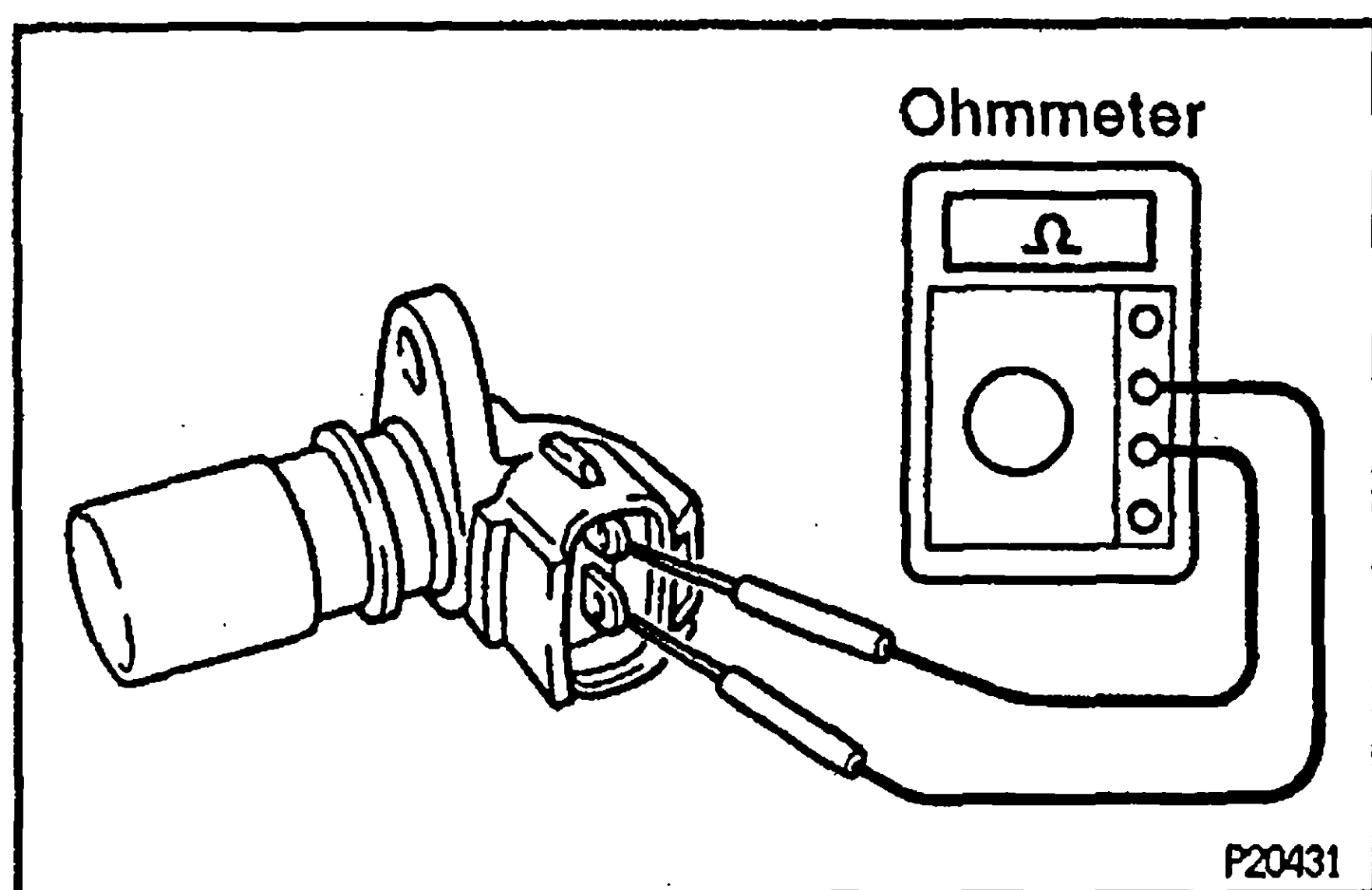
- Disconnect the crankshaft position sensor connector.
- Remove the bolt crankshaft position sensor.

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

CRANKSHAFT POSITION SENSOR INSPECTION

1000J-01

NOTICE: "Cold" and "Hot" in the following sentences express the temperature of the sensor itself. "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).



INSPECT CRANKSHAFT POSITION SENSOR RESISTANCE

Using an ohmmeter, measure the resistance between terminals.

Resistance:

Cold: 1,630 — 2,740 Ω

Hot: 2,065 — 3,225 Ω

If the resistance is not as specified, replace the crankshaft position sensor.

CRANKSHAFT POSITION SENSOR INSTALLATION

1000K-01

Installation is in the reverse order of removal.

SERVICE SPECIFICATIONS
SERVICE DATA

10082-0L

Firing order	—			1 — 2 — 3 — 4 — 5 — 6
Spark plug	Recommended spark plug		ND	K16TR11
			NGK	BKR5EKB—11
	Correct electrode gap for new plug			1.1 mm (0.043 in.)
Ignition coil	Primary coil resistance	Primary	at cold	0.67 — 1.05 Ω
			at hot	0.85 — 1.23 Ω
		Secondary	at cold	9.3 — 16.0 Ω
			at hot	11.7 — 18.8 Ω
Camshaft position sensor	Resistance		at cold	835 — 1,400 Ω
			at hot	1,060 — 1,645 Ω
Crankshaft position sensor	Resistance		at cold	1,630 — 2,740 Ω
			at hot	2,065 — 3,225 Ω

TORQUE SPECIFICATIONS

10087-0J

Part tightened	N·m	kgf·cm	ft·lbf
Spark plug x Cylinder head	18	180	13
Ignition coil x Cylinder head	7.8	80	69 in·lbf
Camshaft position sensor x Cylinder head	7.8	80	69 in·lbf
Crankshaft position sensor x Oil pump	7.8	80	69 in·lbf

STARTING

PREPARATION ST- 2

ON-VEHICLE INSPECTION ST- 2

STARTER ST- 3

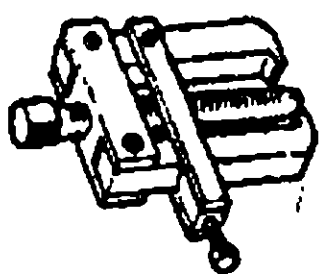
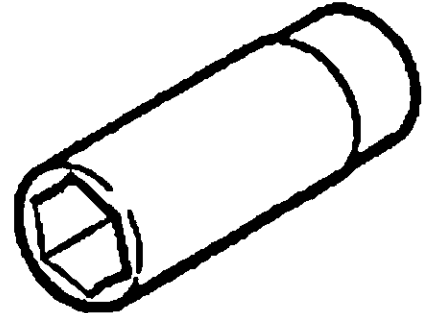
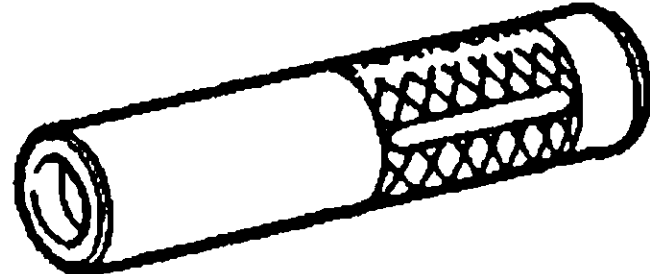
STARTER RELAY ST- 15

SERVICE SPECIFICATIONS ST- 16

ST

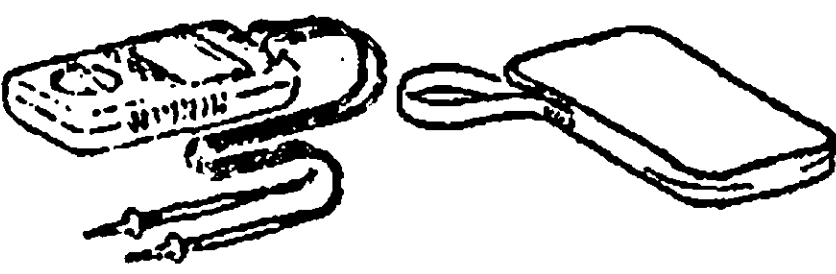
PREPARATION
SST (SPECIAL SERVICE TOOLS)

ST03P-0A

	09286-46011 Injection Pump Spline Shaft Puller	Armature bearing
	09810-38140 Starter Magnet Switch Nut Wrench 14	Terminal nut
	09201-41020 Valve Stem Oil Seal Replacer	Armature rear bearing

RECOMMENDED TOOLS

ST03Q-00

	09082-00040 TOYOTA Electrical Tester.	
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EQUIPMENT

ST03R-00

Dial indicator	Commutator
Magnetic finger	Steel ball
Pull scale	Brush spring
Sandpaper	Commutator
Torque wrench	
V—block	Commutator
Vernier calipers	Commutator, Brush
Press	Magnetic switch terminal kit

ON—VEHICLE INSPECTION

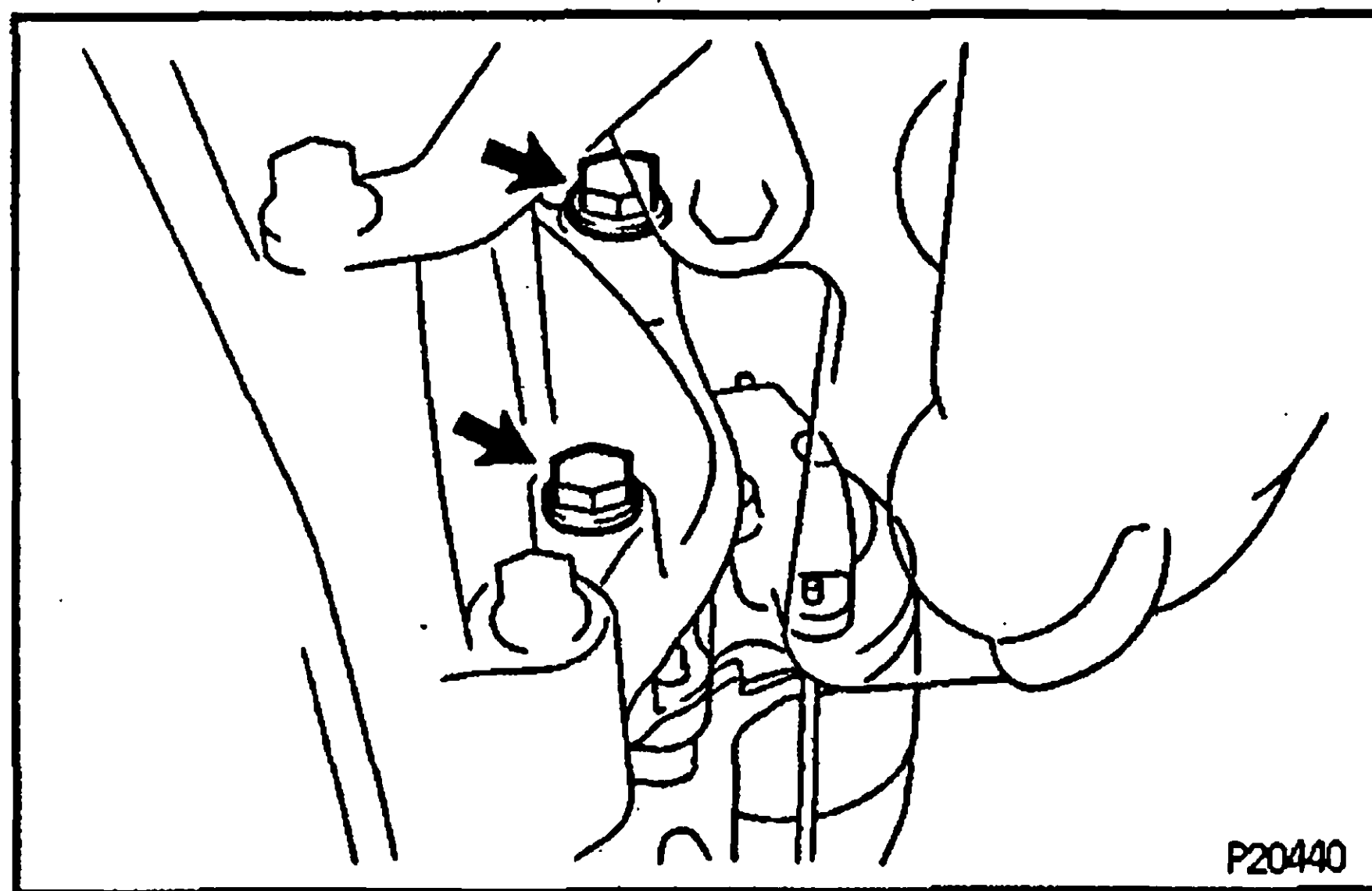
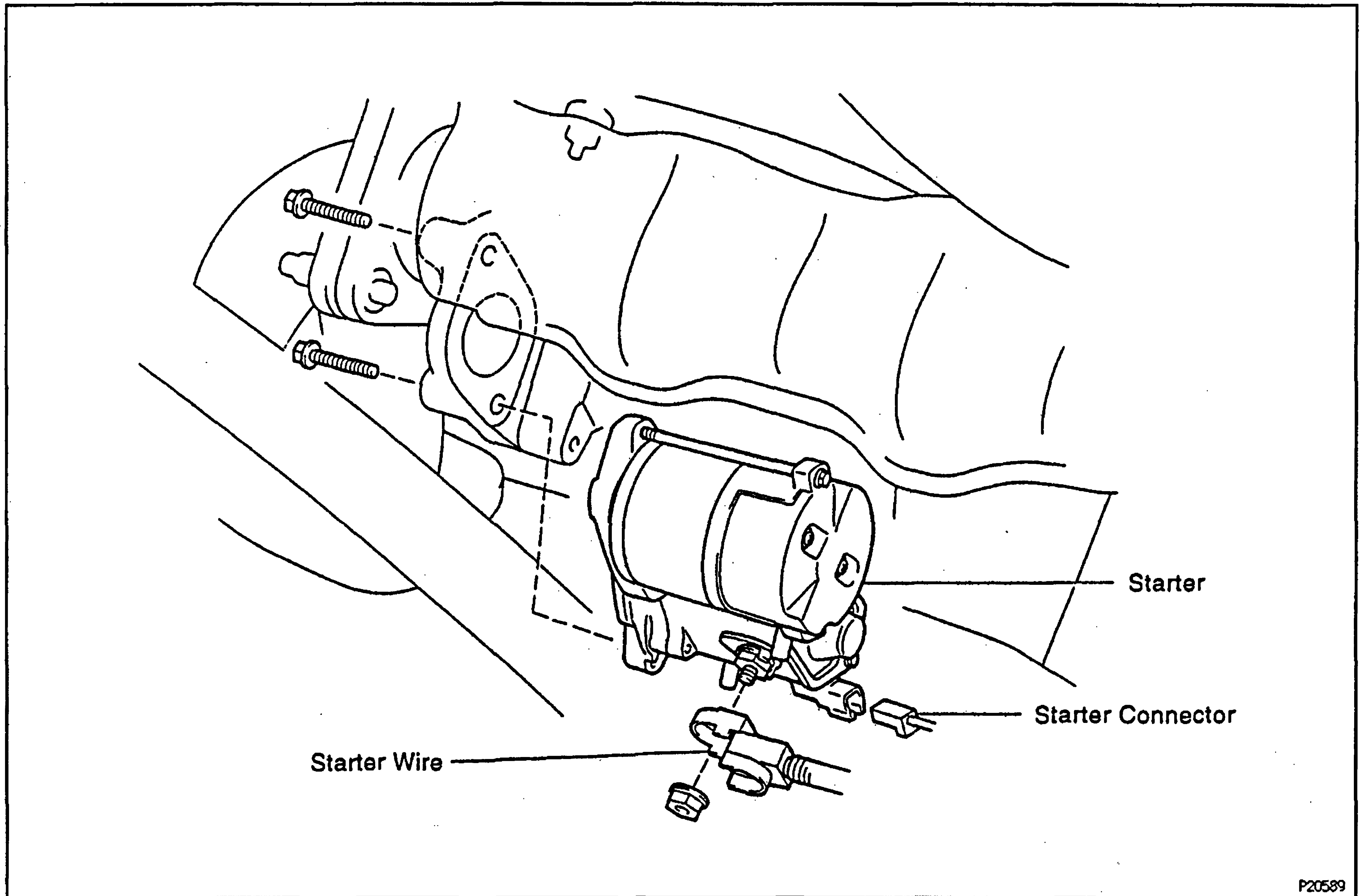
ST03K-0P

NOTICE: Before changing the starter, check the following items again:

- Connector connection
- Accessory installation, e.g.: theft deterrent system

STARTER COMPONENTS FOR REMOVAL AND INSTALLATION

ST00A-00



STARTER REMOVAL

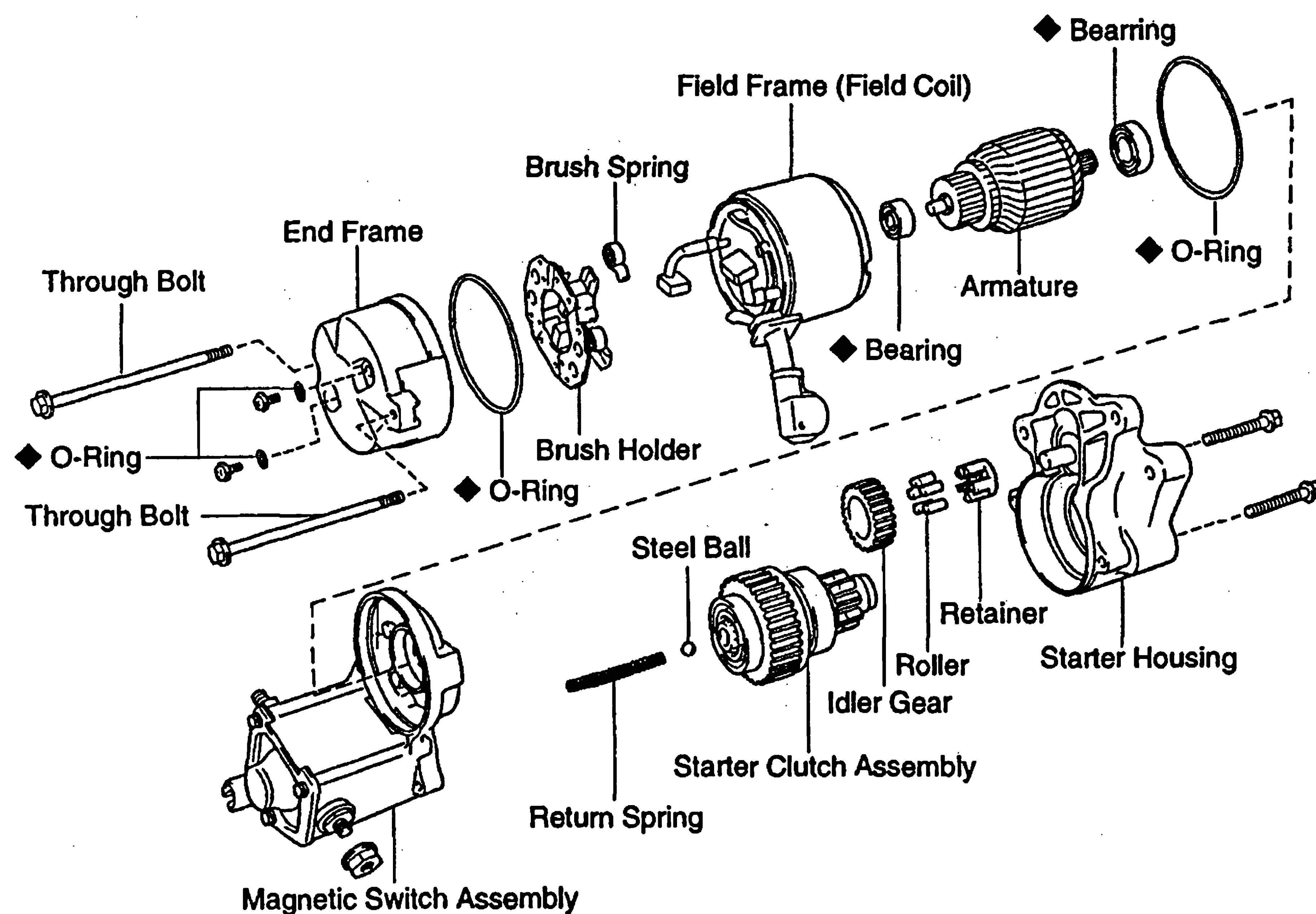
ST0C9-01

REMOVE STARTER

- Disconnect the starter connector.
- Remove the nut, and disconnect the starter wire.
Torque: 8.8 N·m (90 kgf·cm, 70 in·lbf)
- Remove the 2 bolts and starter.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

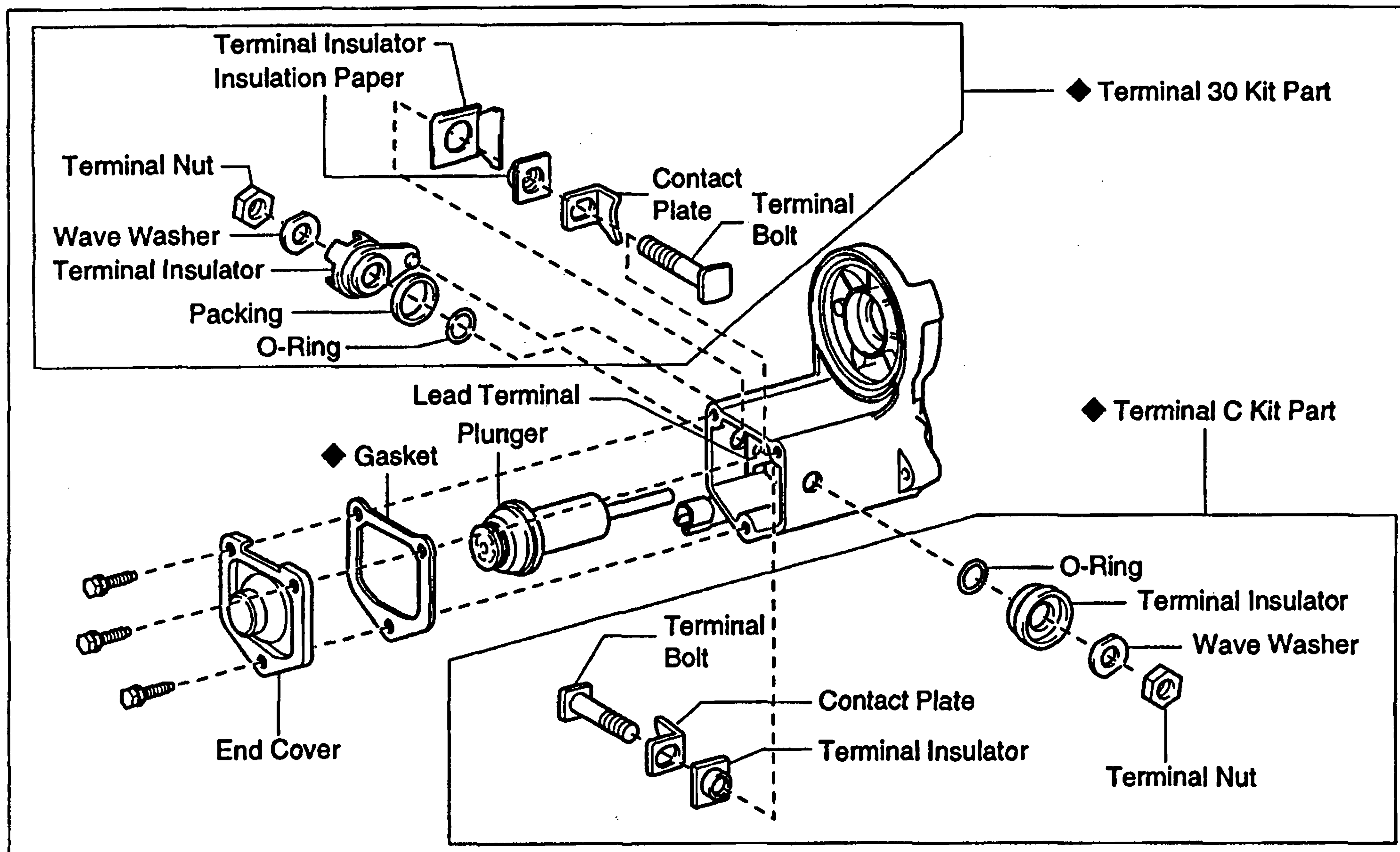
COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

STOCA-03



Magnetic Switch Assembly

P25573



◆ Non-reusable part

S05107
Y 218865

STARTER DISASSEMBLY

ASSEMBLY HINT: Use high—temperature grease to lubricate the bearings, gears, return spring and steel ball when assembling the starter.

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: 5.9 N·m (60 kgf·cm, 52 in.-lbf)

- (c) Pull out the field frame with the armature from the magnetic switch assembly.

ASSEMBLY NOTICE: Align the protrusion of the field frame with groove of the magnetic switch.

- (d) Remove the O—ring.

ASSEMBLY HINT: Use a new O—ring.

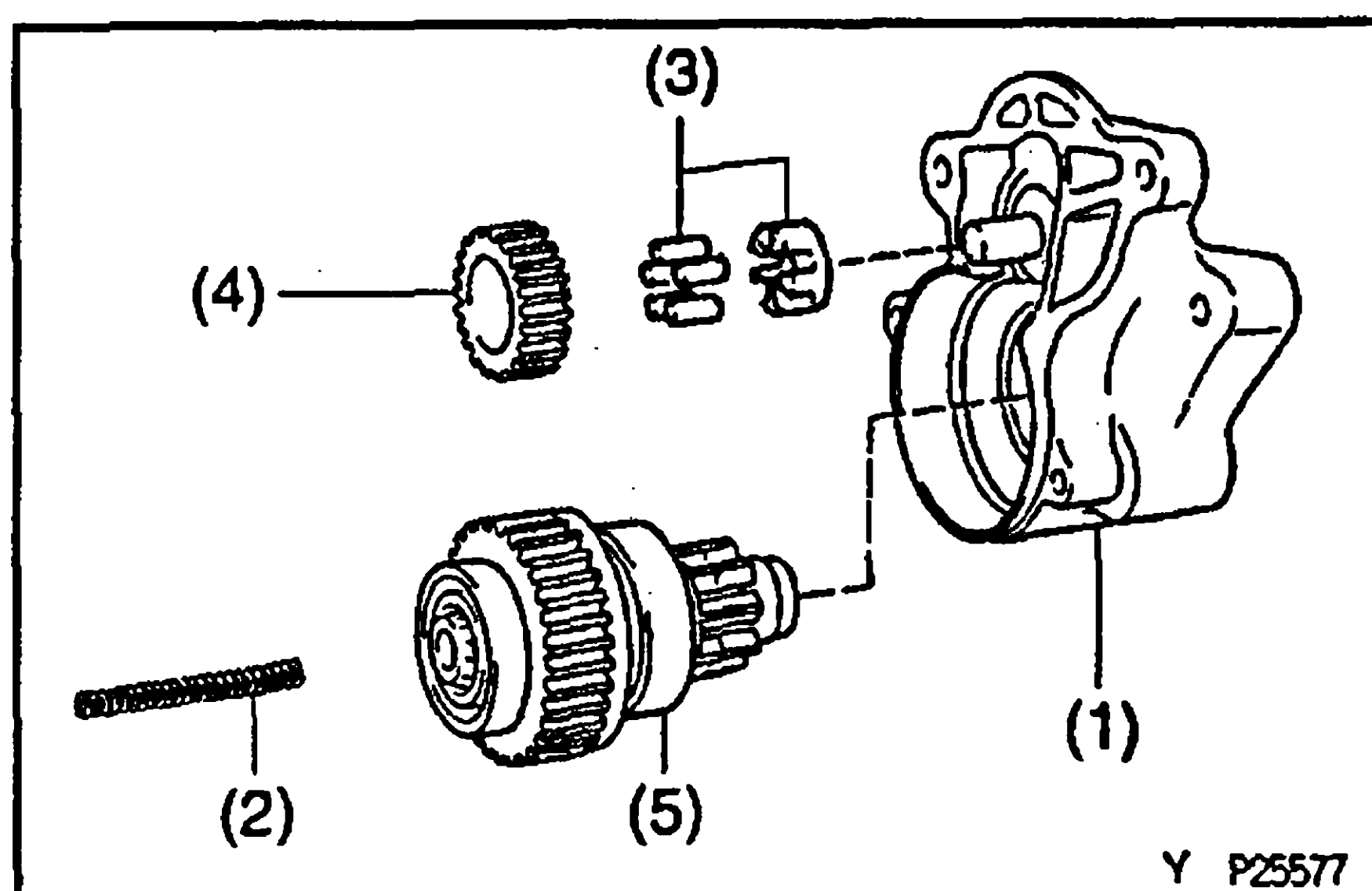
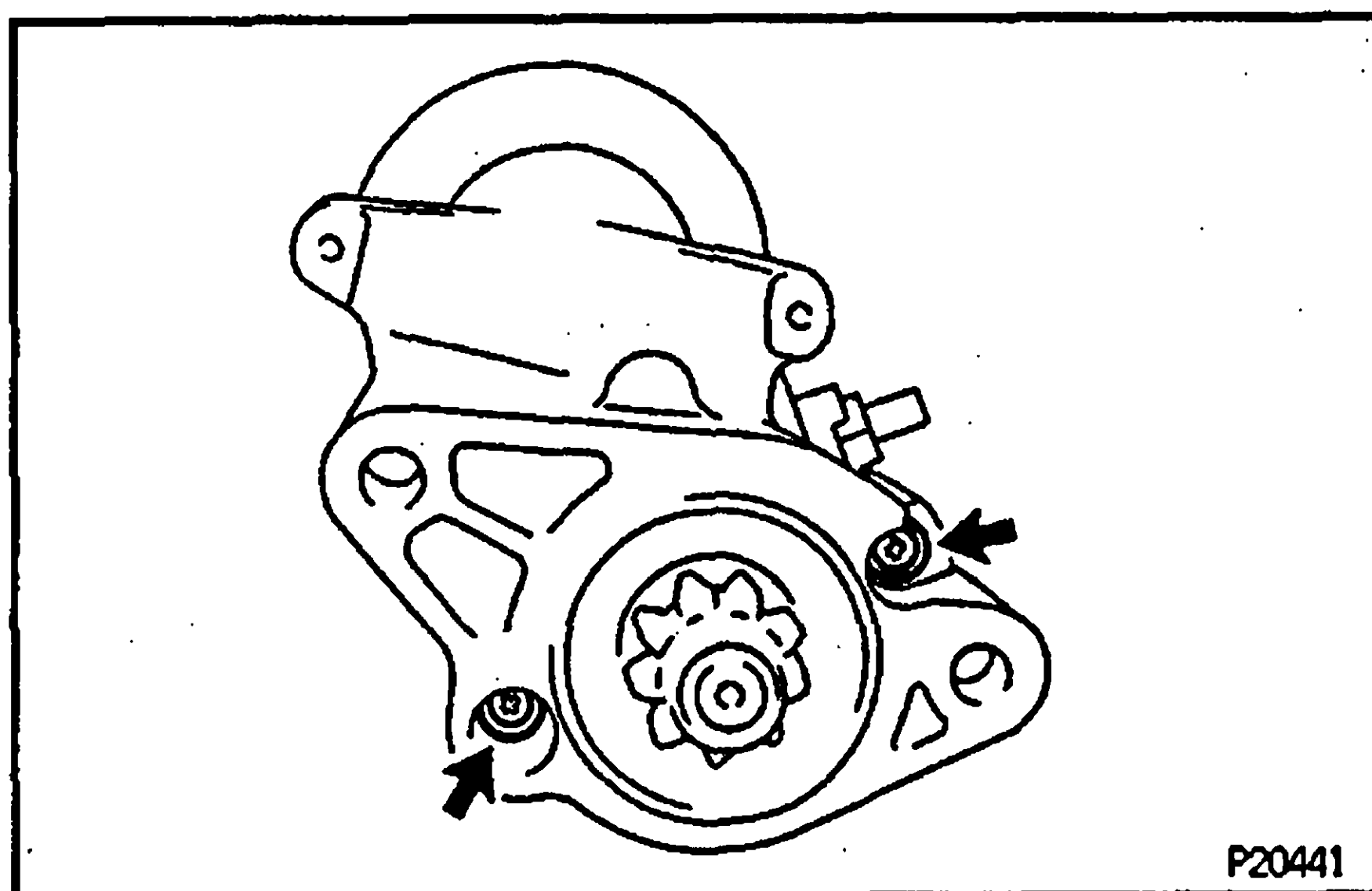
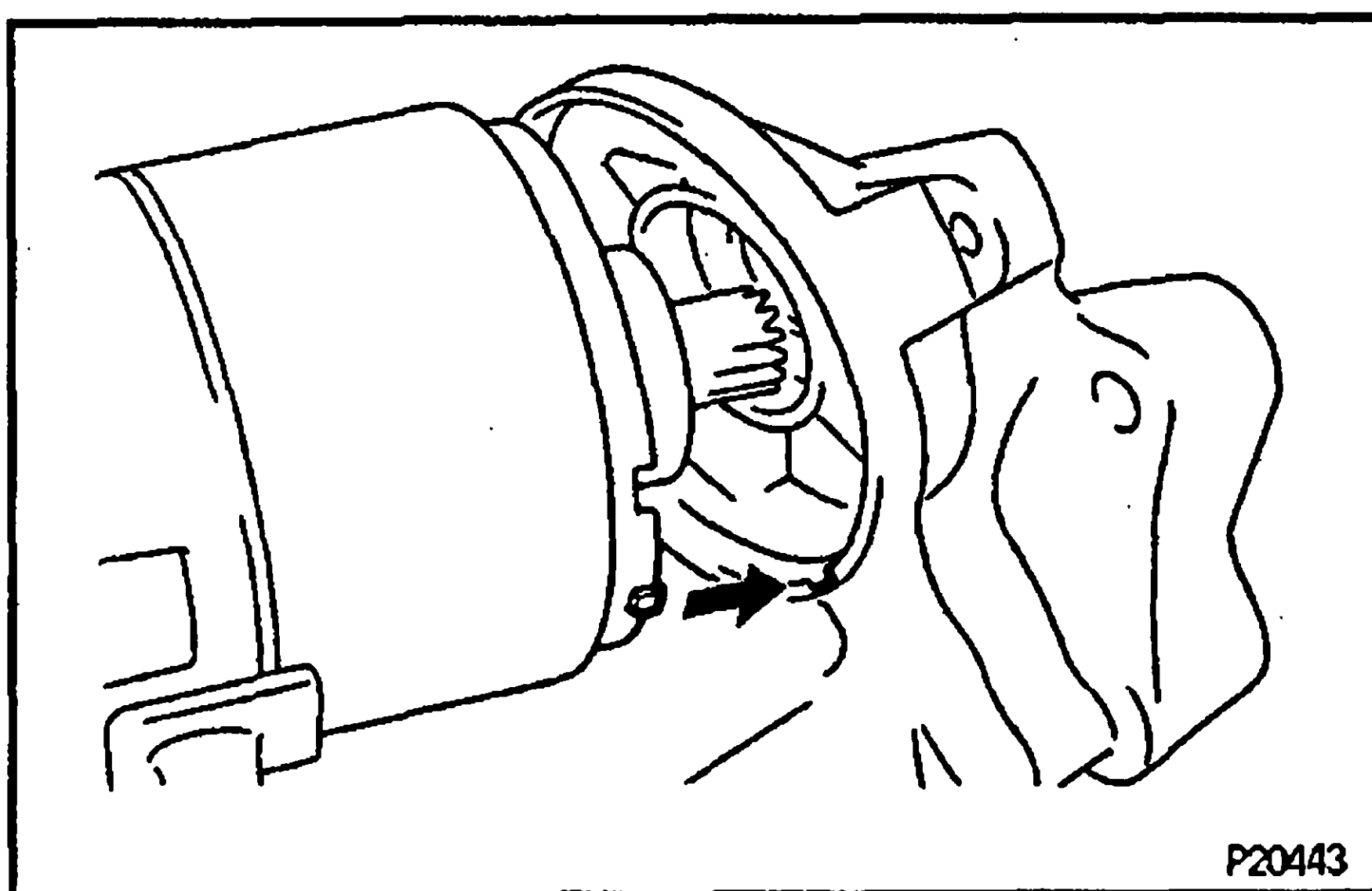
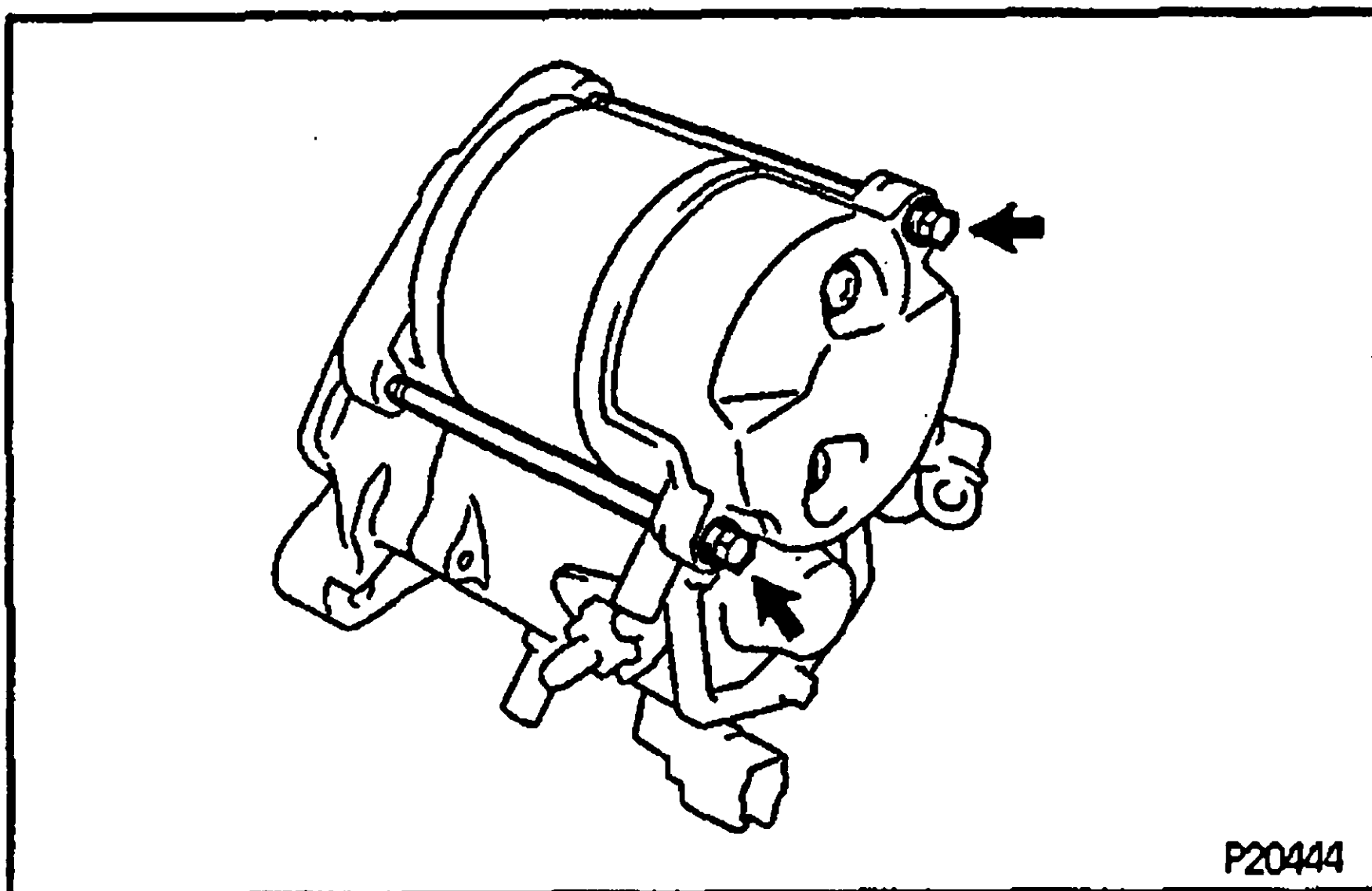
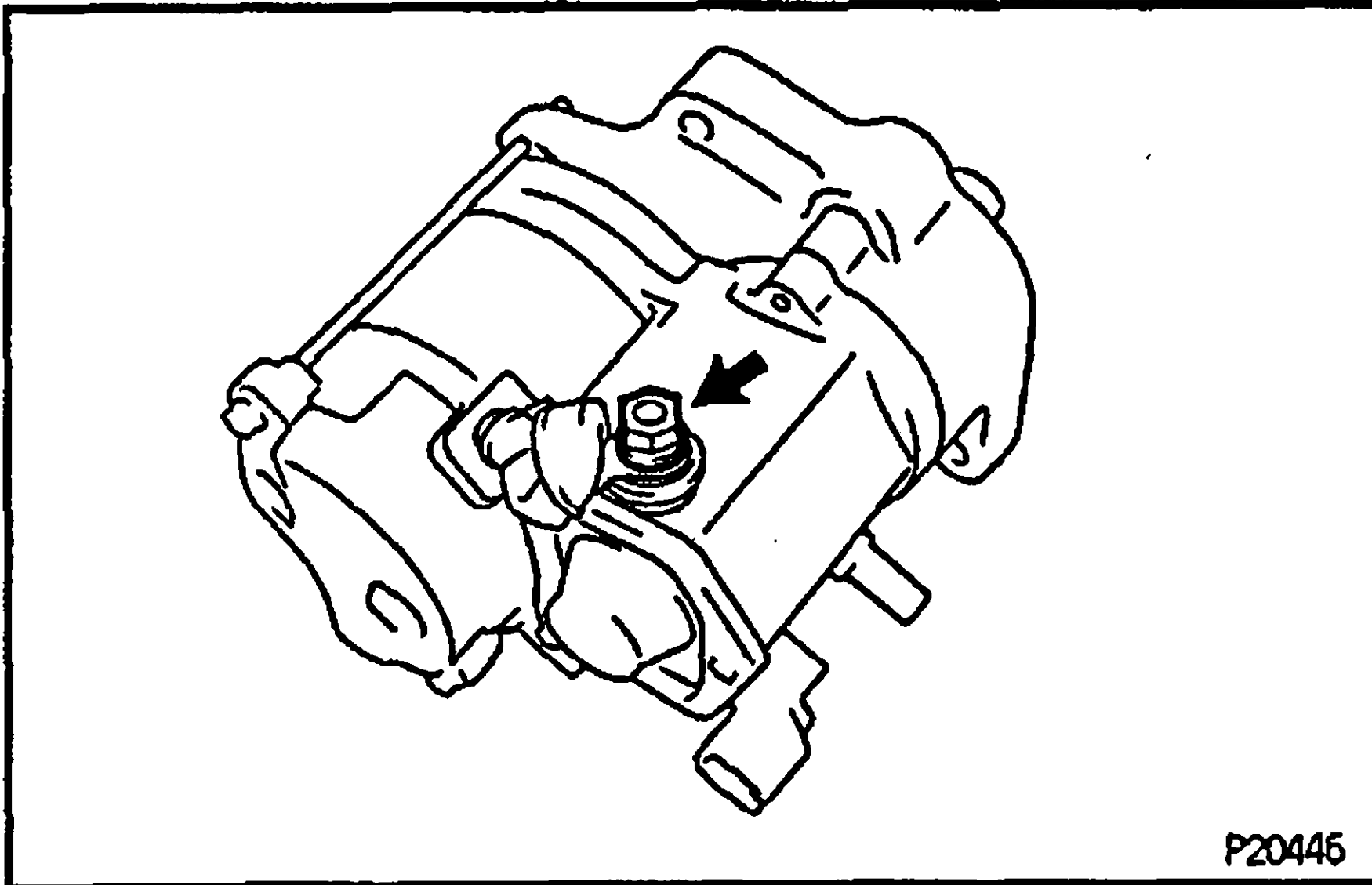
2. REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEAR

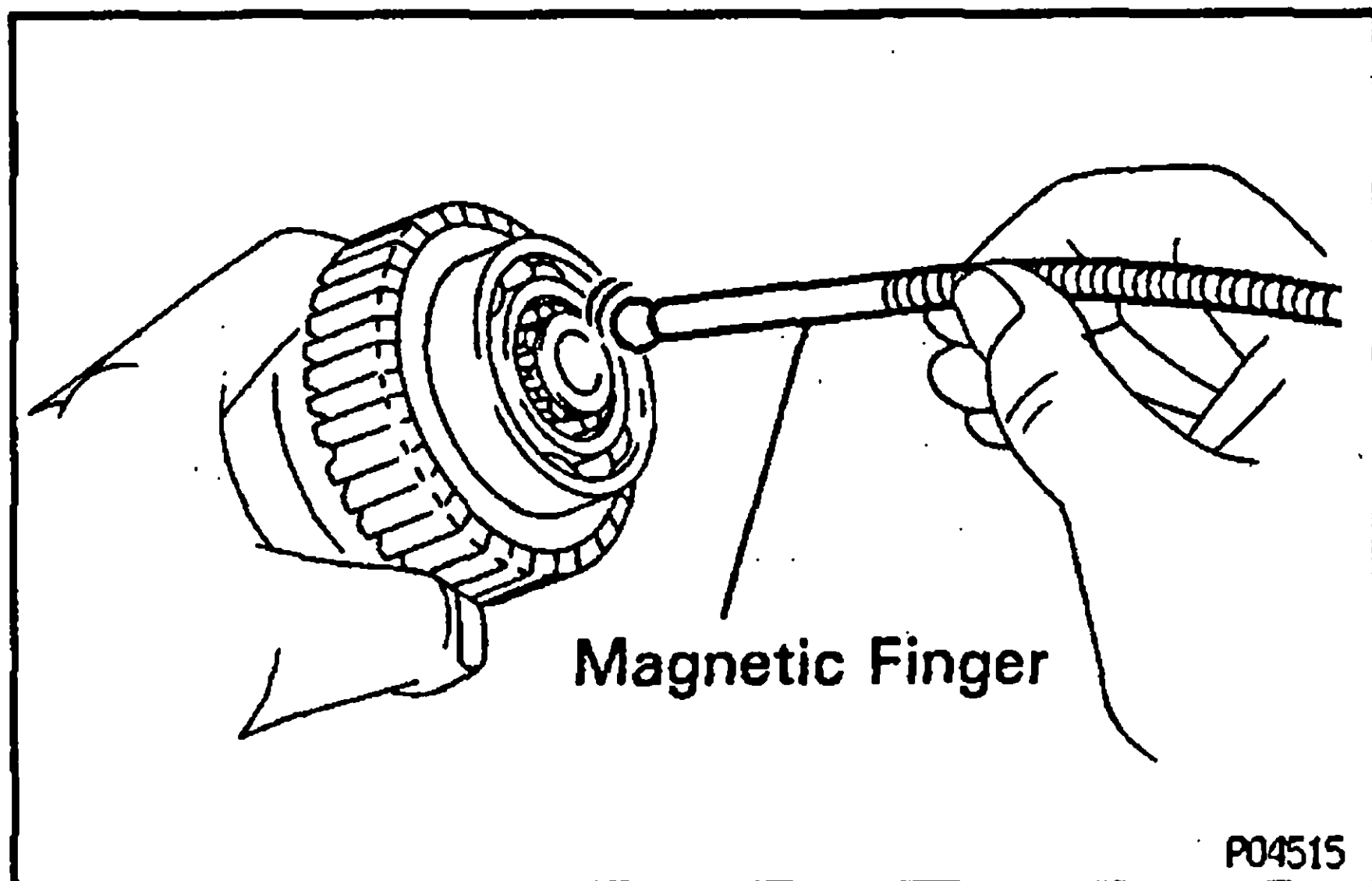
- (a) Remove the 2 screws.

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

- (b) Remove these parts from the magnetic switch

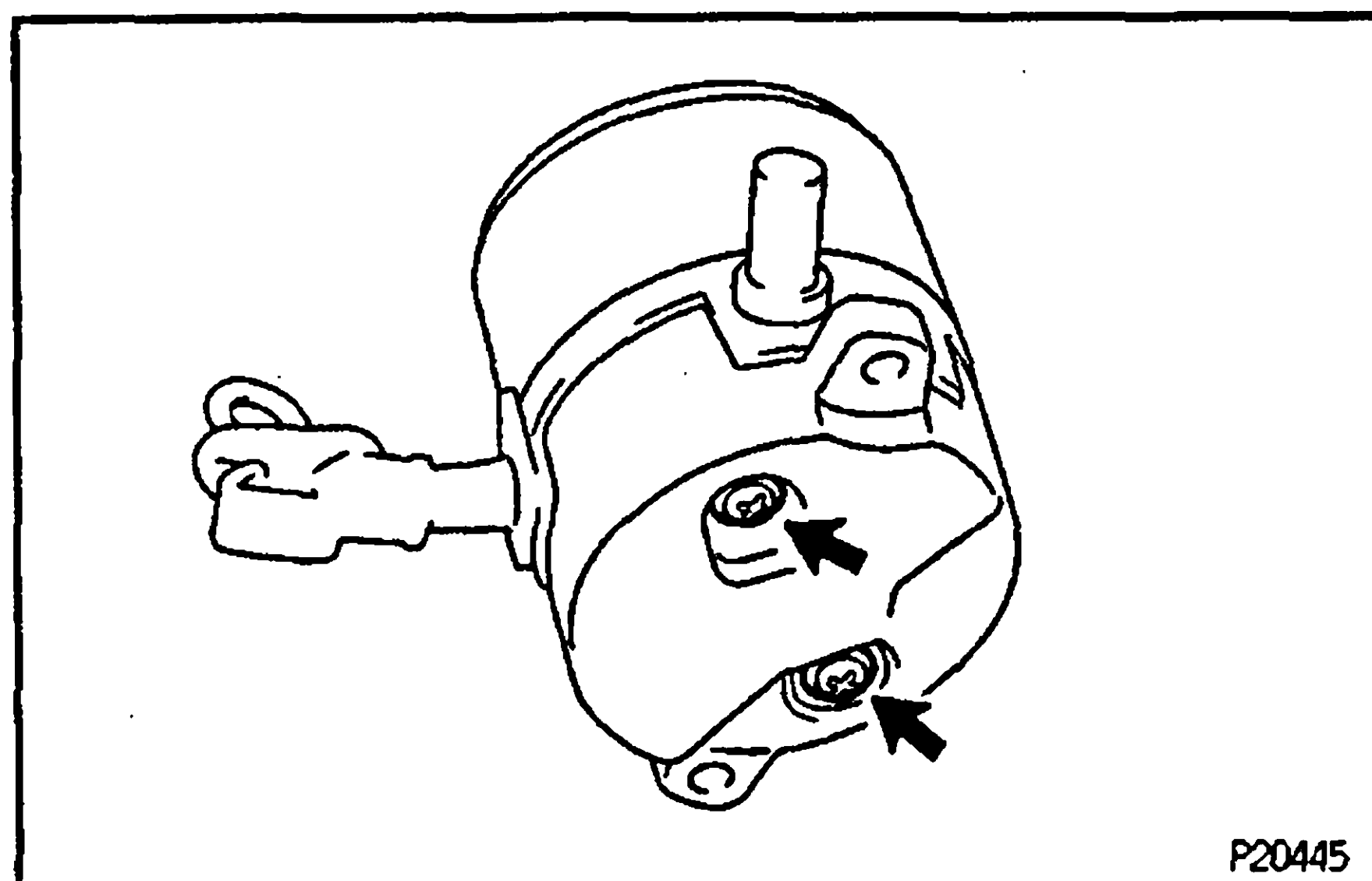
- (1) Starter housing
- (2) Return spring
- (3) Bearing
- (4) Idler Gear
- (5) Clutch assembly





3. REMOVE STEEL BALL

Using a magnetic finger, remove the steel ball from the clutch shaft hole.



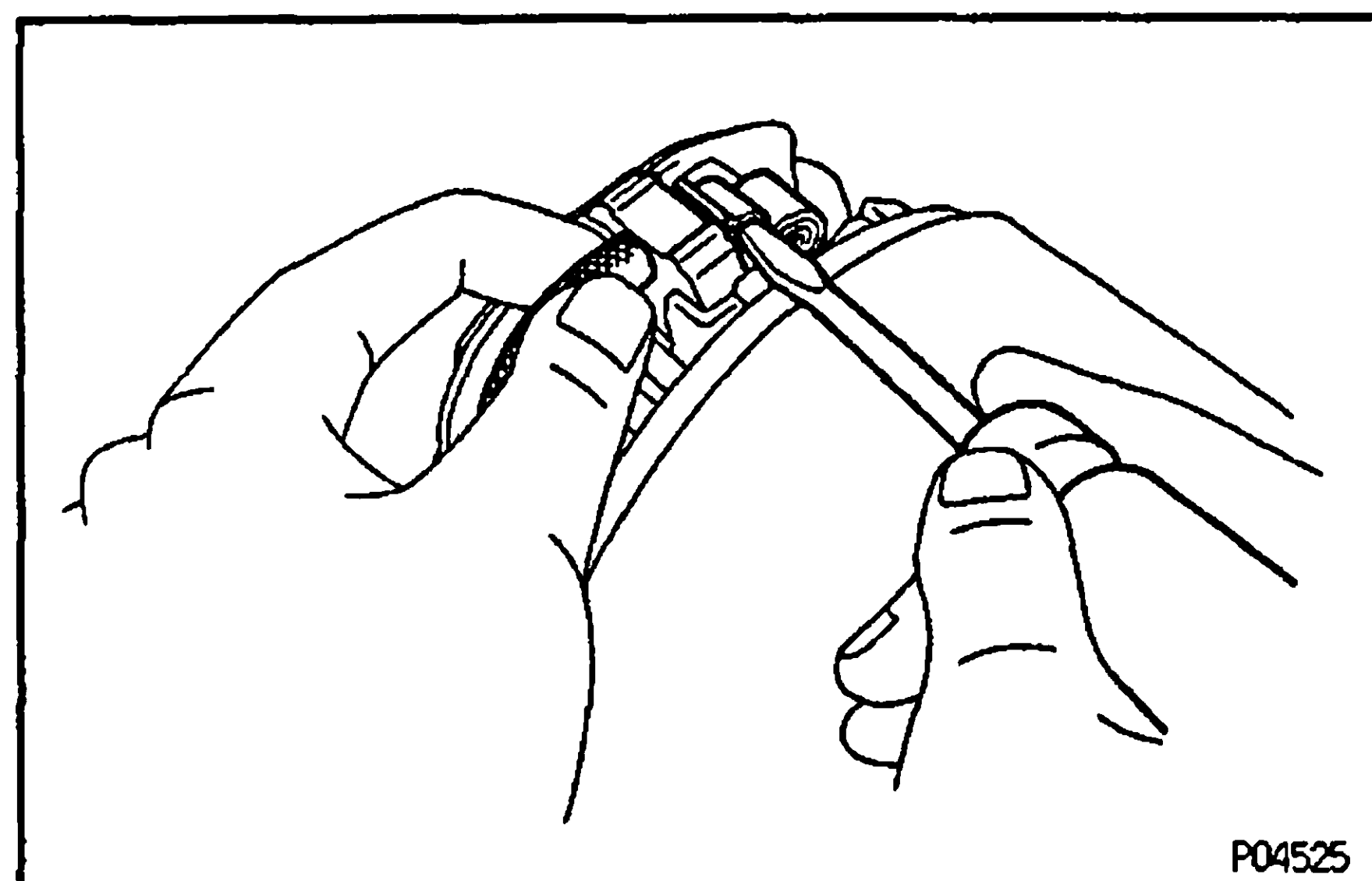
4. REMOVE BRUSH HOLDER

- (a) Remove the 2 screws and 2 O-rings, and pull the end cover from the field frame.

Torque: 1.5 N·m (15 kgf·cm, 13 in.-lbf)

- (b) Remove the O-ring from the field frame.

ASSEMBLY HINT: Use a new O-ring.

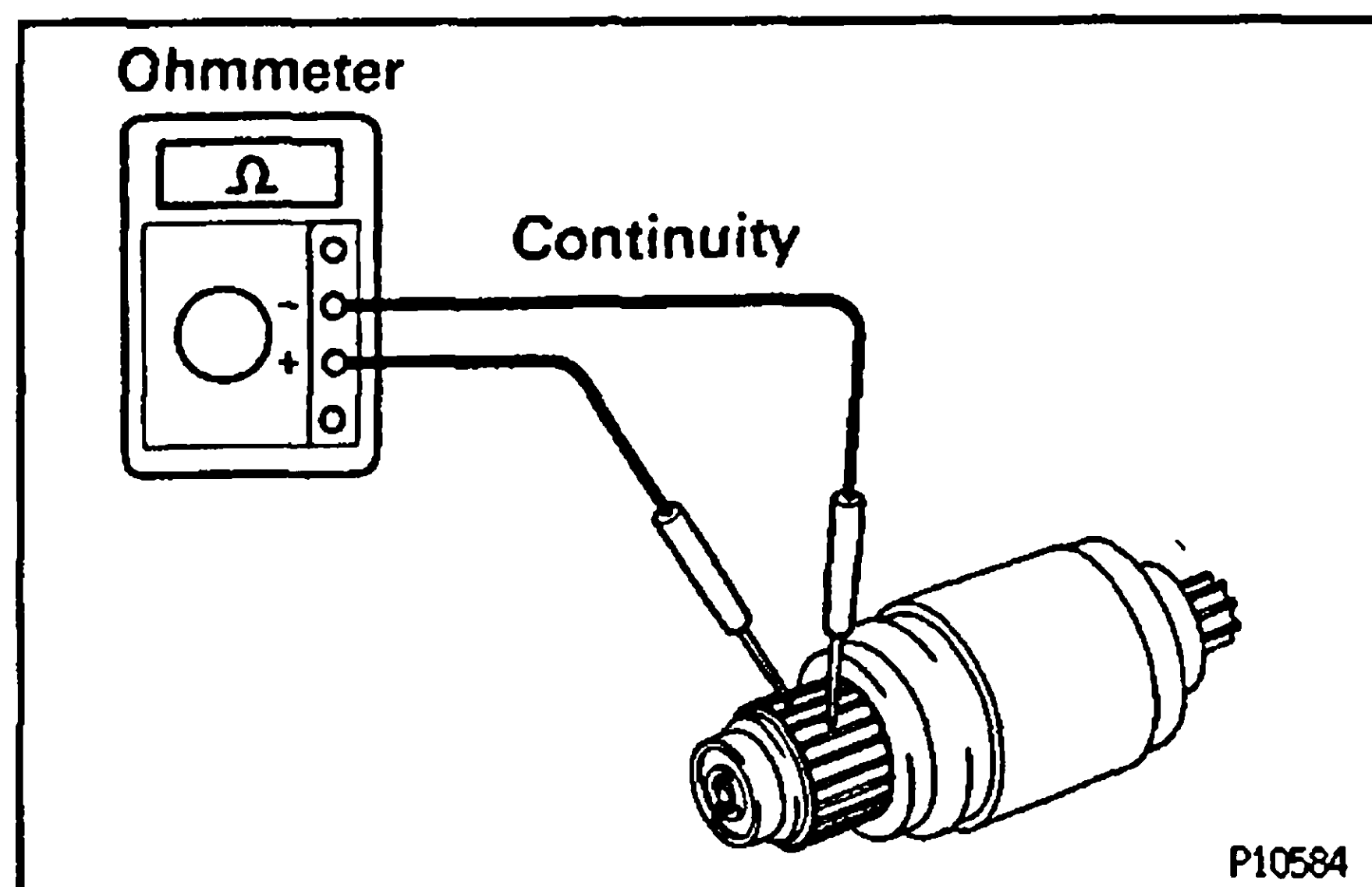


- (c) Using a screwdriver hold the spring back and disconnect the brush from the brush holder.

Disconnect the 4 brushes, and remove the brush holder.

ASSEMBLY NOTICE: Check that the positive (+) lead wires are not grounded.

5. REMOVE ARMATURE FROM FIELD FRAME



STARTER INSPECTION AND REPAIR

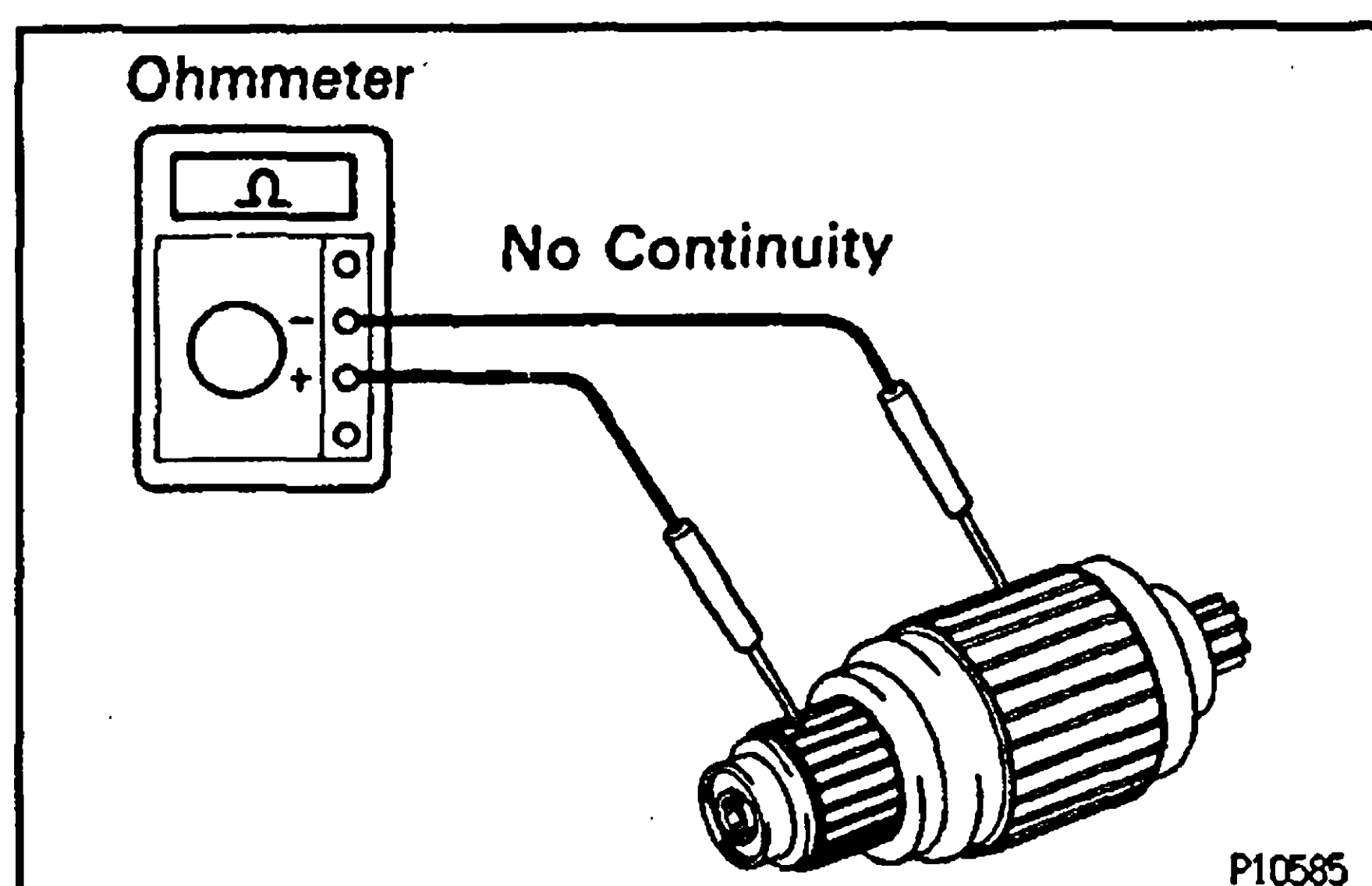
870AF-08

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

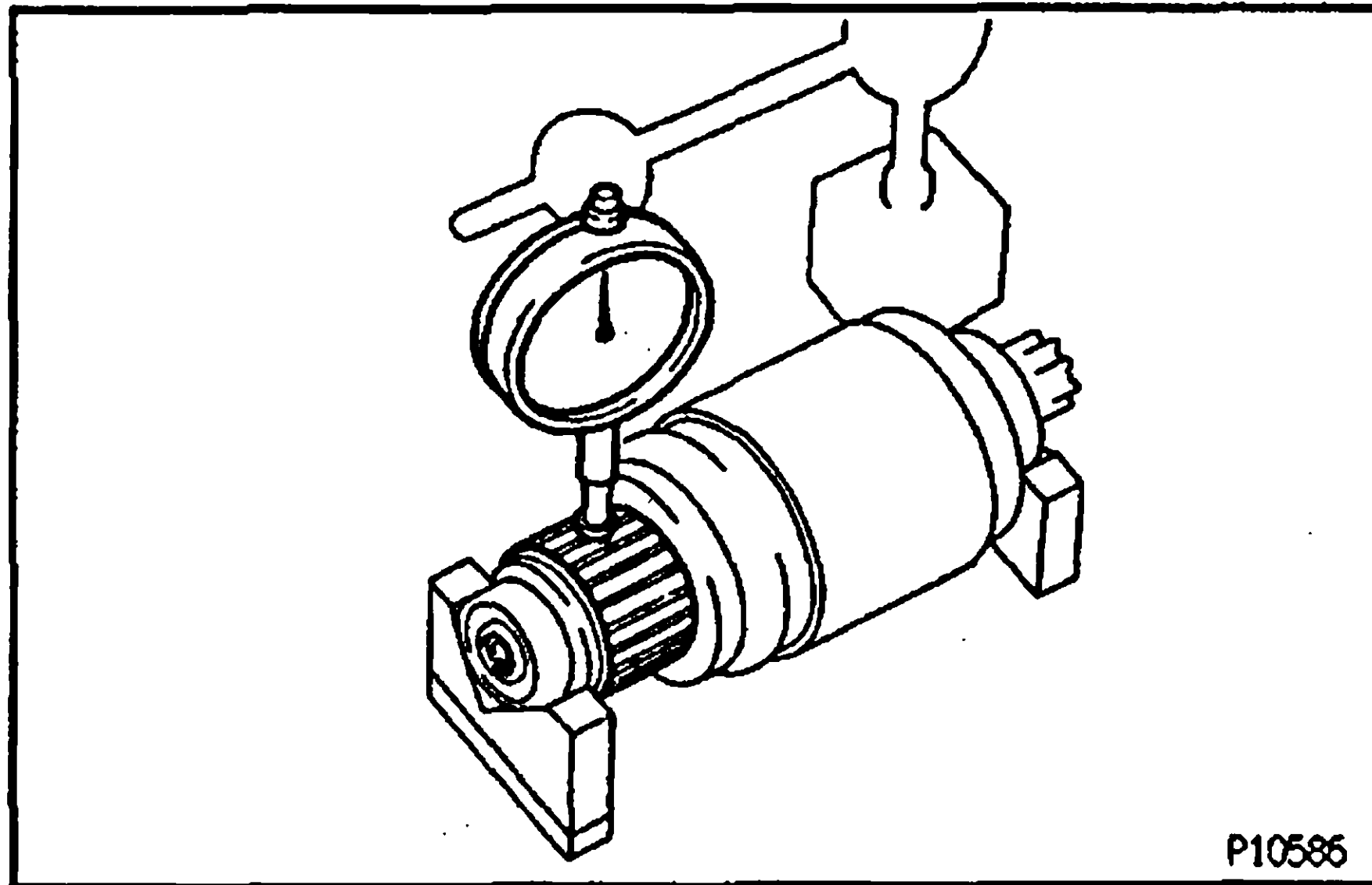
Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

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.



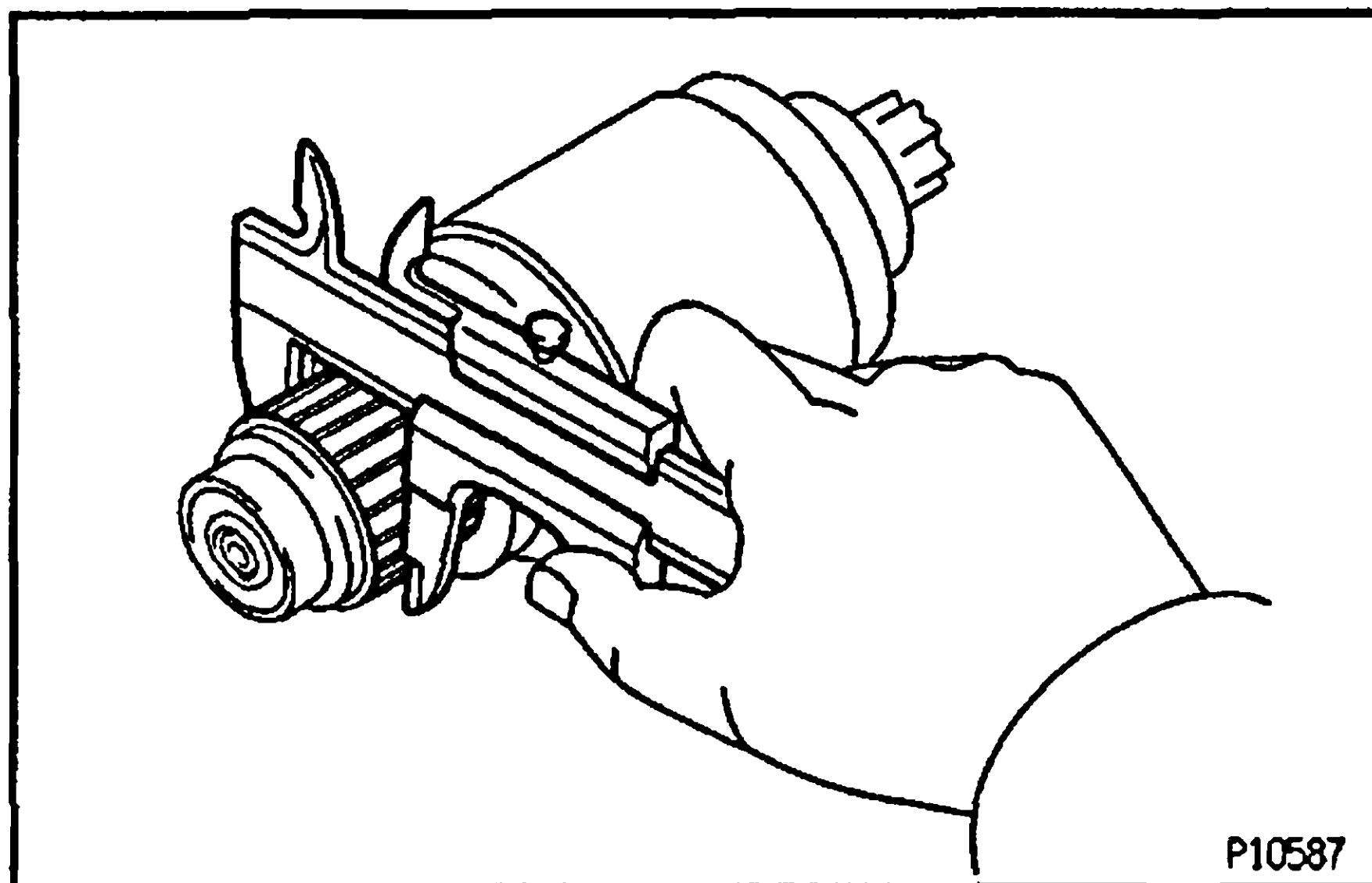
2. INSPECT COMMUTATOR CIRCLE RUNOUT

- Place the commutator on V—blocks.
- Using a dial gauge, measure the circle runout.

Maximum circle runout:

0.05 mm (0.0020 in.)

If the circle runout is greater than maximum, correct it on a lathe.



3. INSPECT COMMUTATOR DIAMETER

Using vernier caliper, measure the commutator diameter.

Standard diameter:

30.0 mm (1.181 in.)

Minimum diameter:

29.0 mm (1.142 in.)

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

4. INSPECT UNDERCUT DEPTH OF SEGMENT

Check that the undercut depth is clean and free of foreign material. Smooth out the edge.

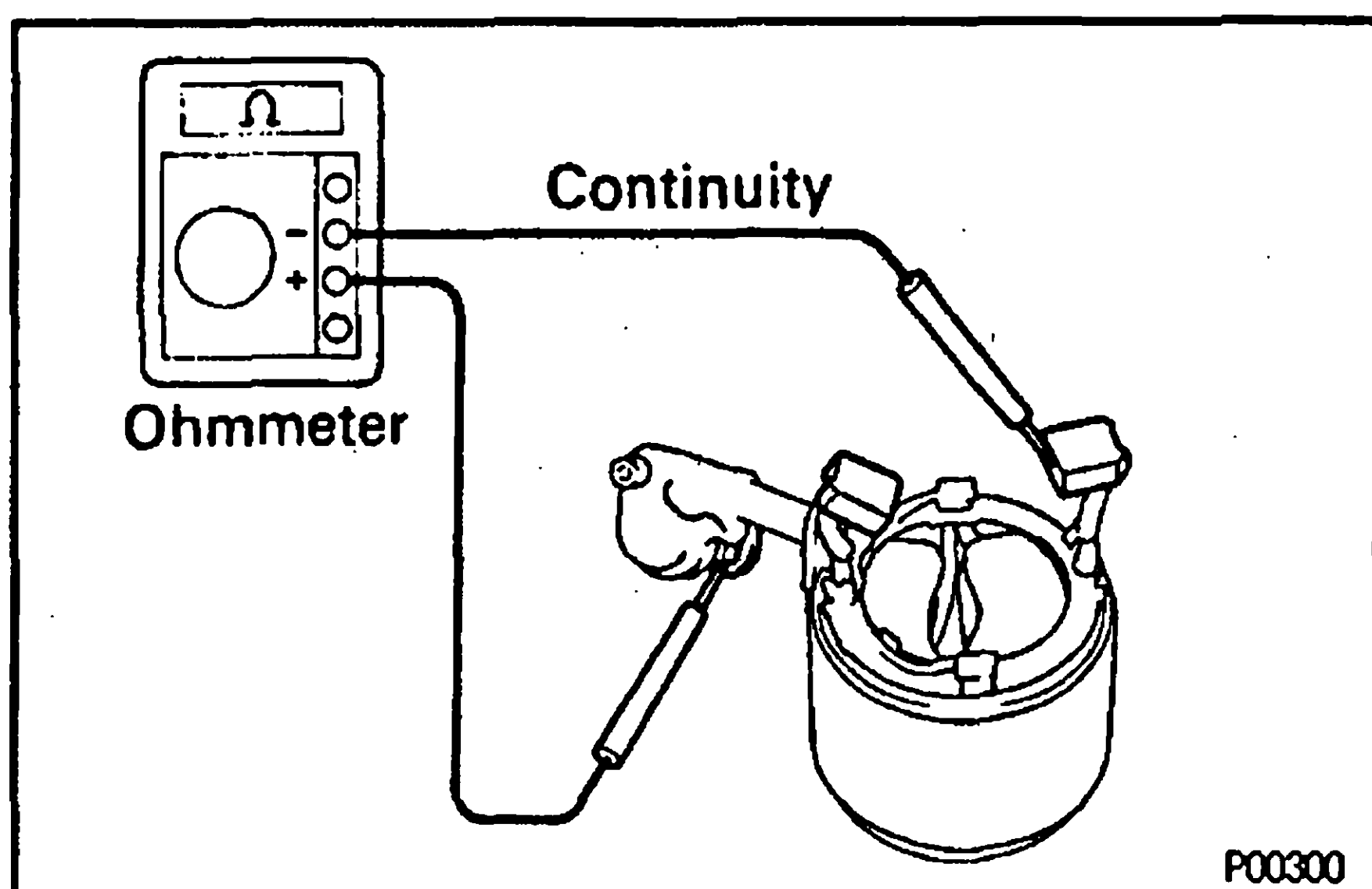
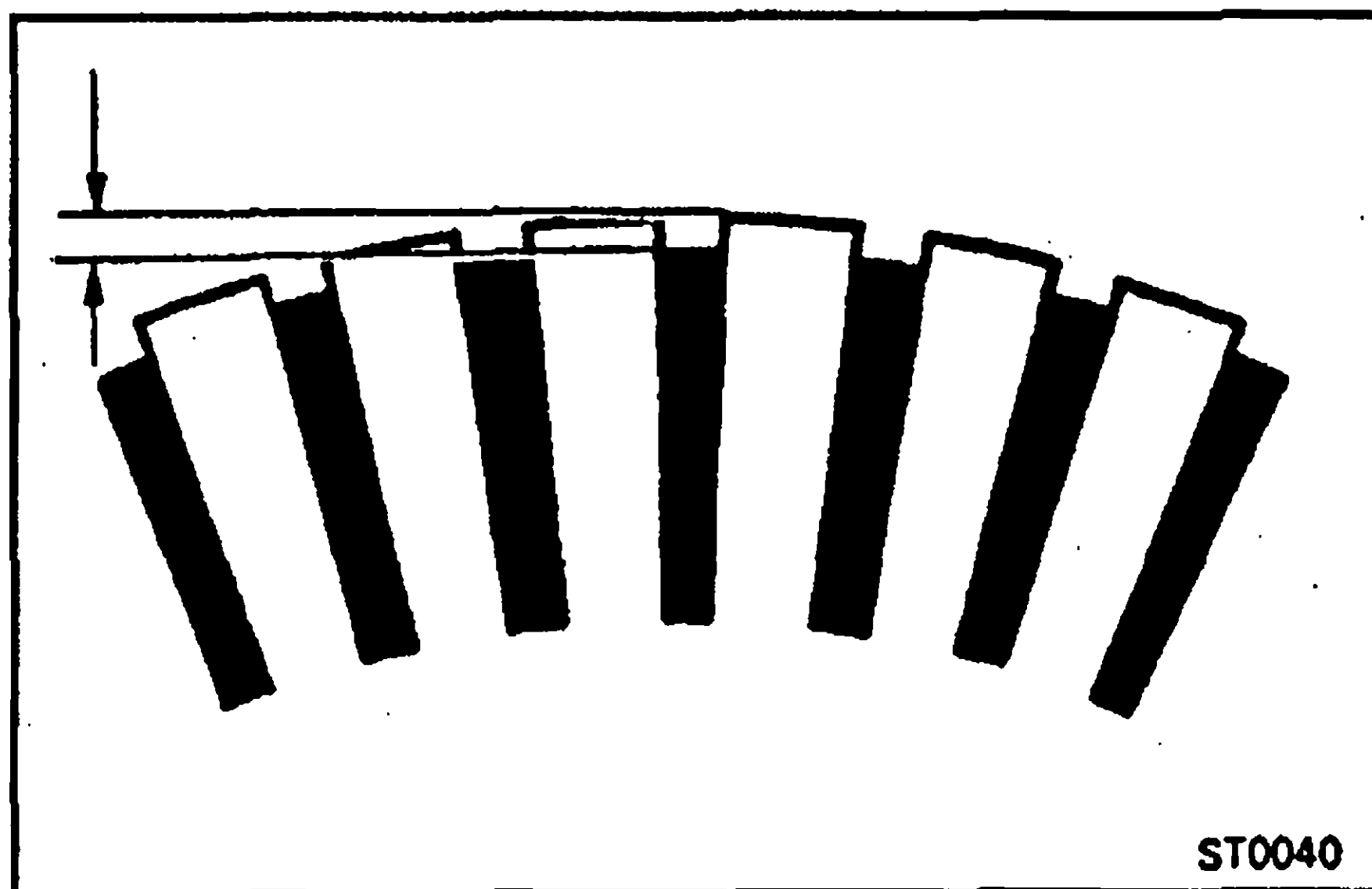
Standard undercut depth:

0.6 mm (0.024 in.)

Minimum undercut depth:

0.2 mm (0.008 in.)

If the undercut depth is less than minimum, correct it with a hacksaw blade.

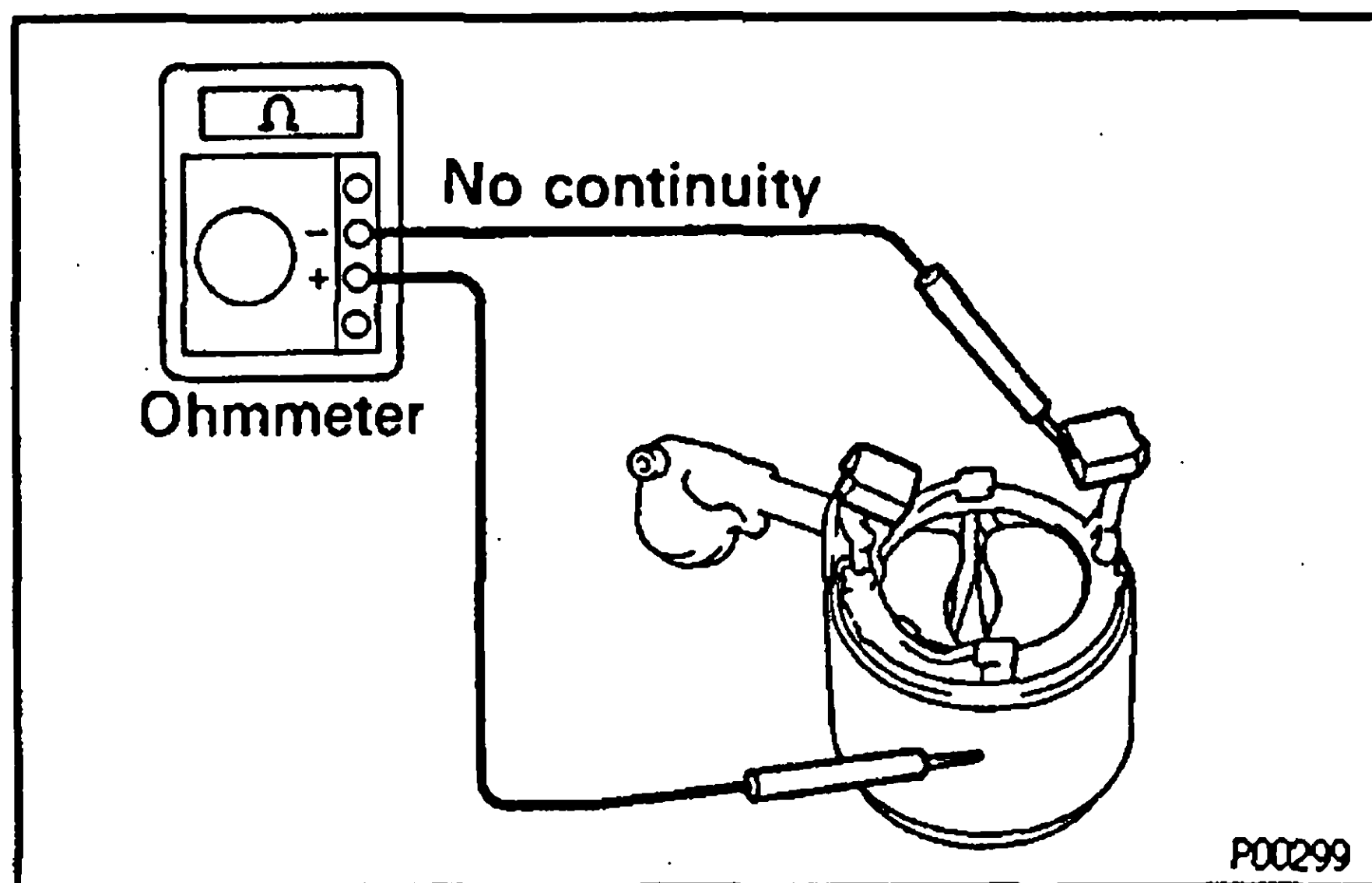


Field Frame (Field Coil)

1. INSPECT FIELD COIL FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

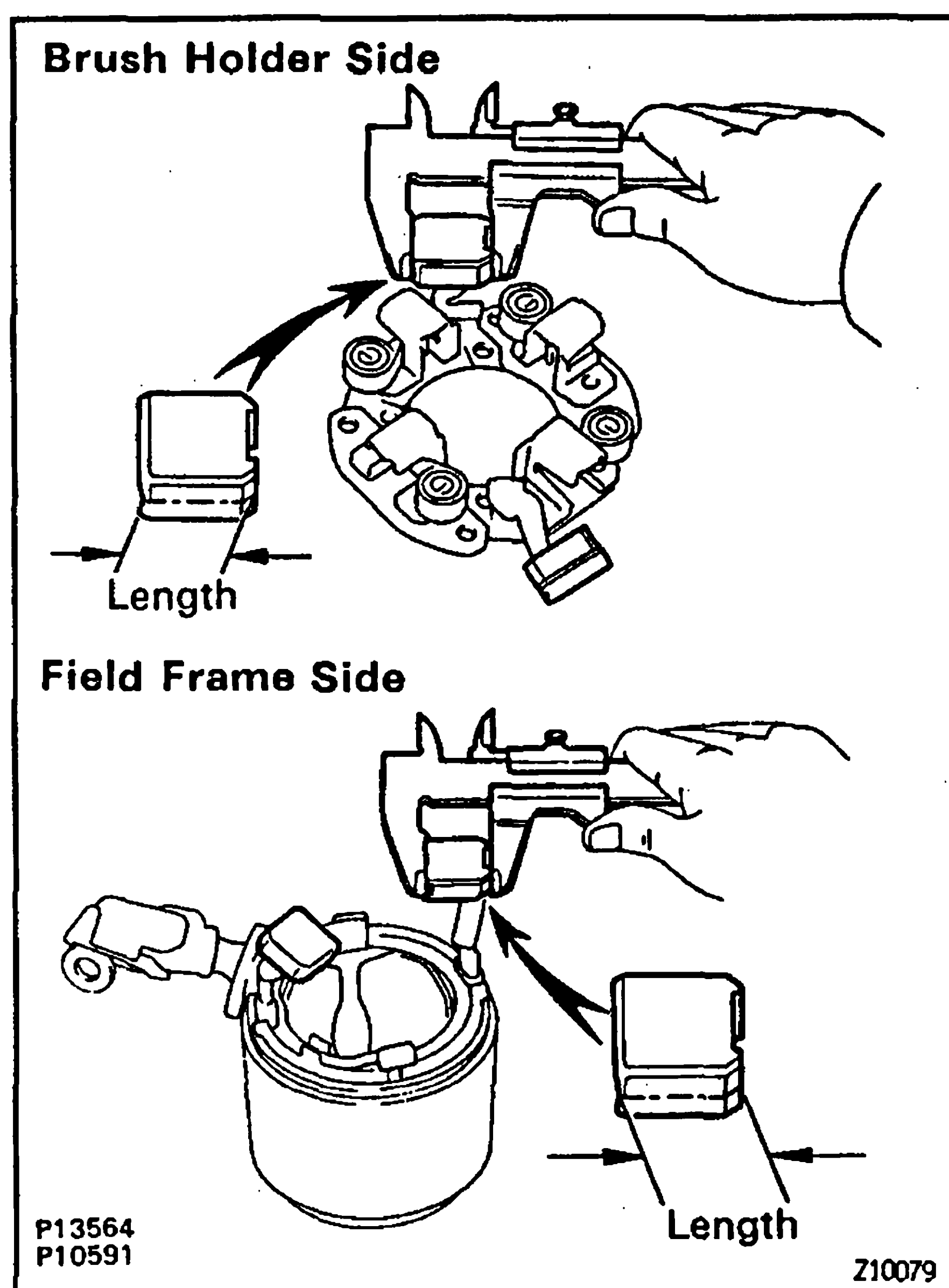
If there is no continuity, replace the field frame.



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.



Brushes

INSPECT BRUSH LENGTH

Using a vernier caliper, measure the brush length.

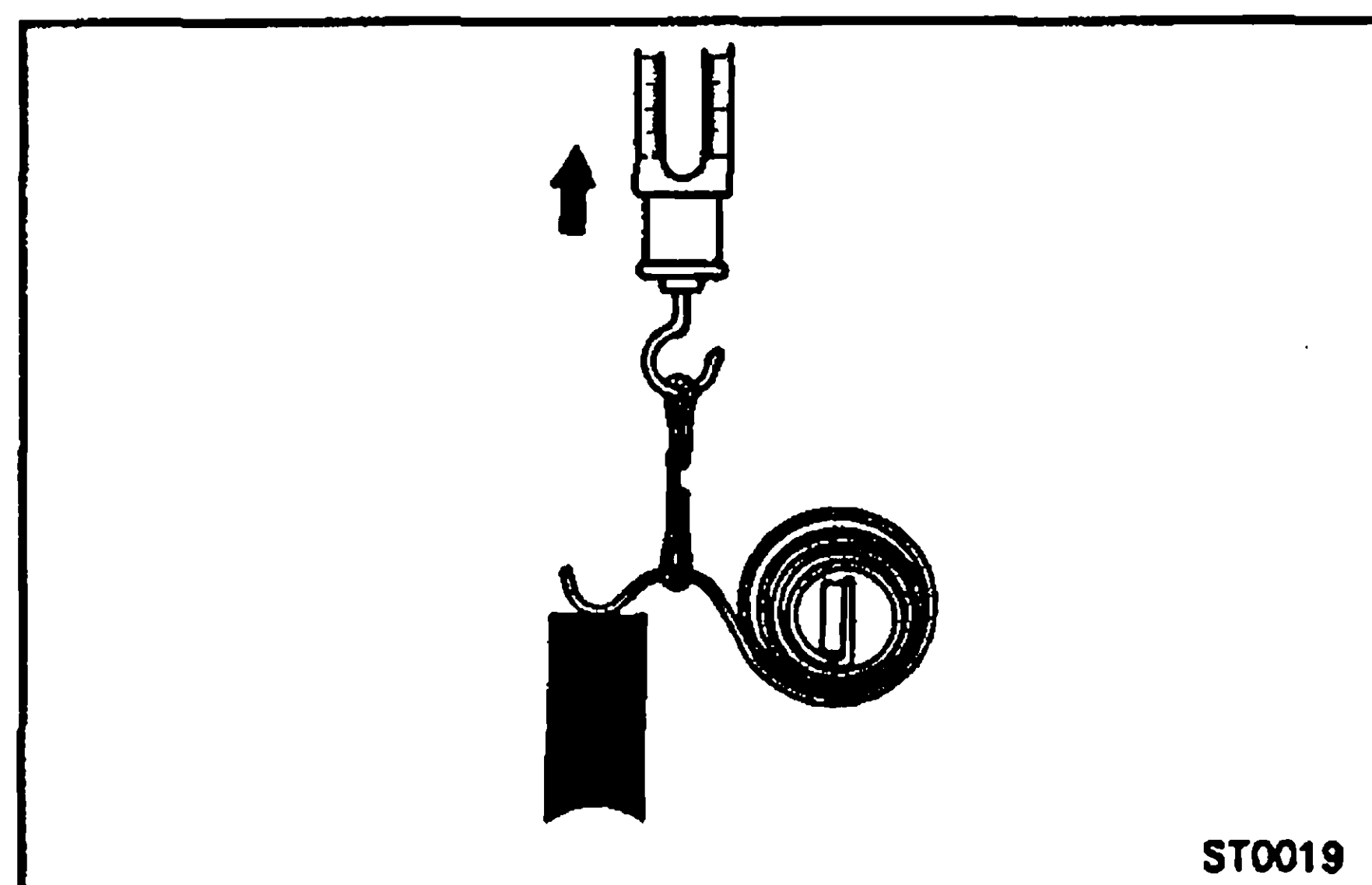
Standard length:

15.5 mm (0.610 in.)

Minimum length:

10.0 mm (0.394 in.)

If the length is less than 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.

Standard 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

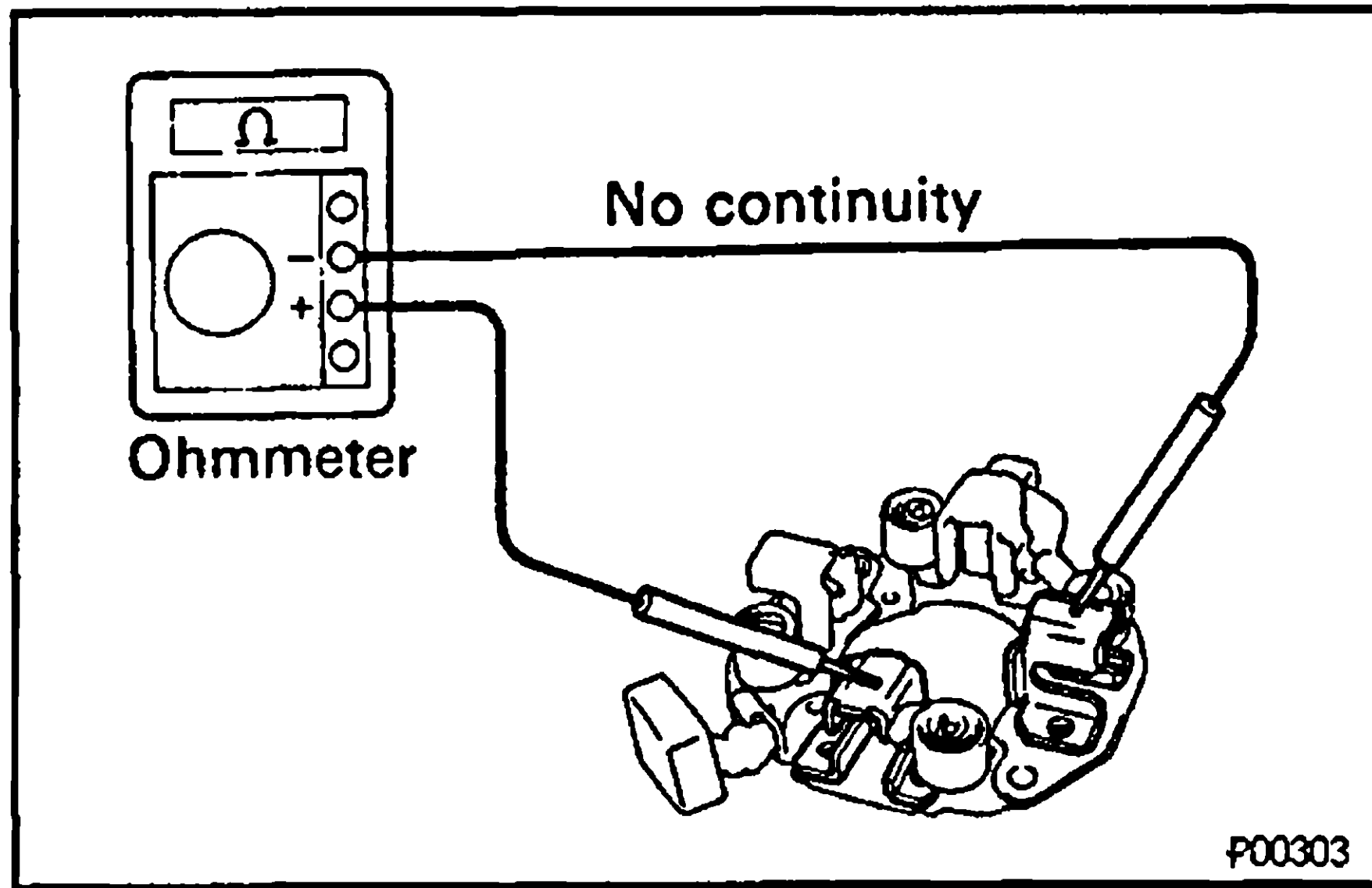
17.6 – 23.5 N (1.80 – 2.40 kgf, 4.0 – 5.3 lbf)

Minimum spring installed load:

1.2 kW type: 9.8 N (1.00 kgf, 2.2 lbf)

1.4 kW type: 11.8 N (1.20 kgf, 2.6 lbf)

If the installed load is less than minimum, 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

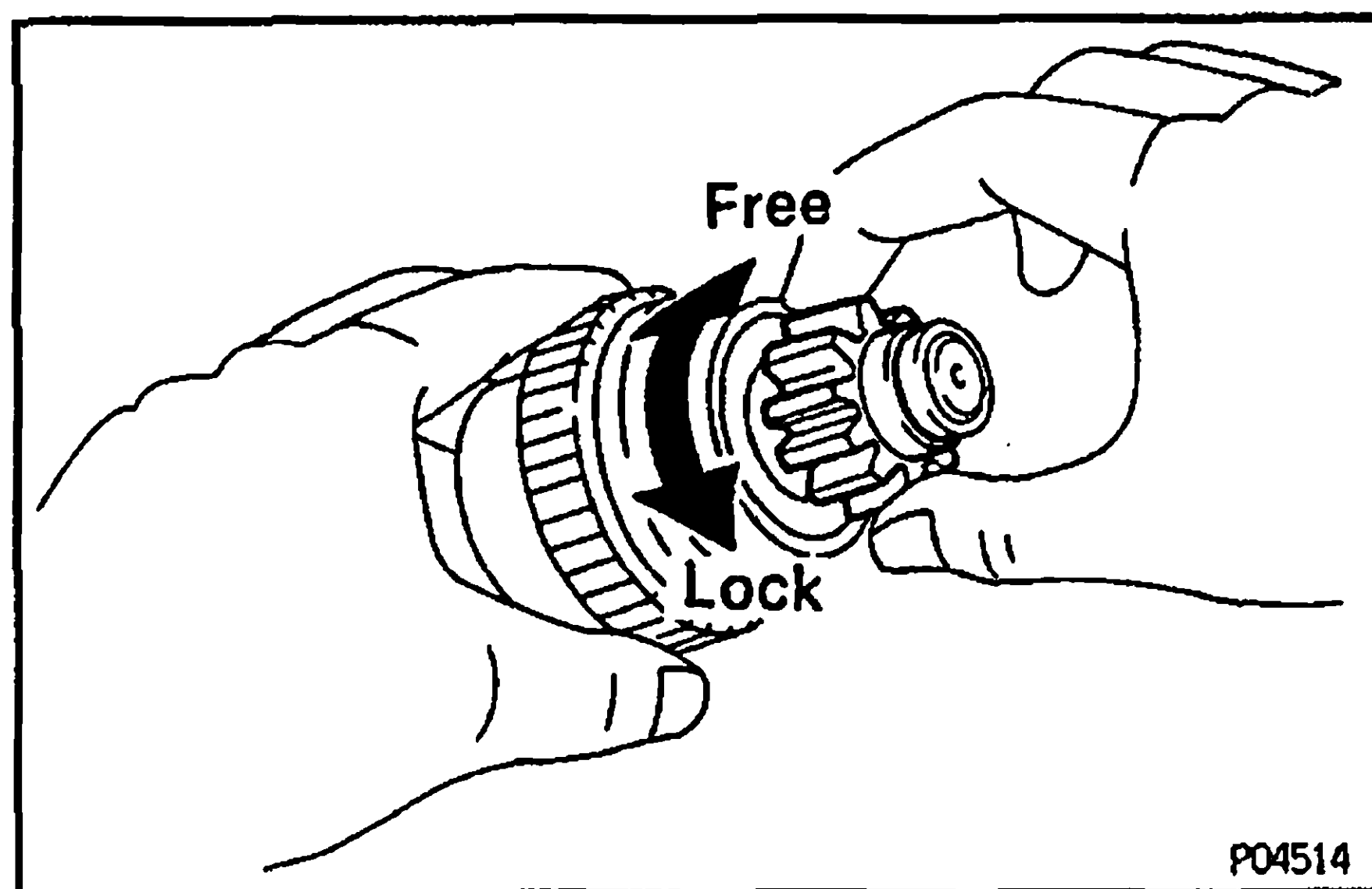
ST

1. INSPECT GEAR TEETH

Check the gear teeth on the pinion gear, idler gear and clutch assembly for wear or damage.

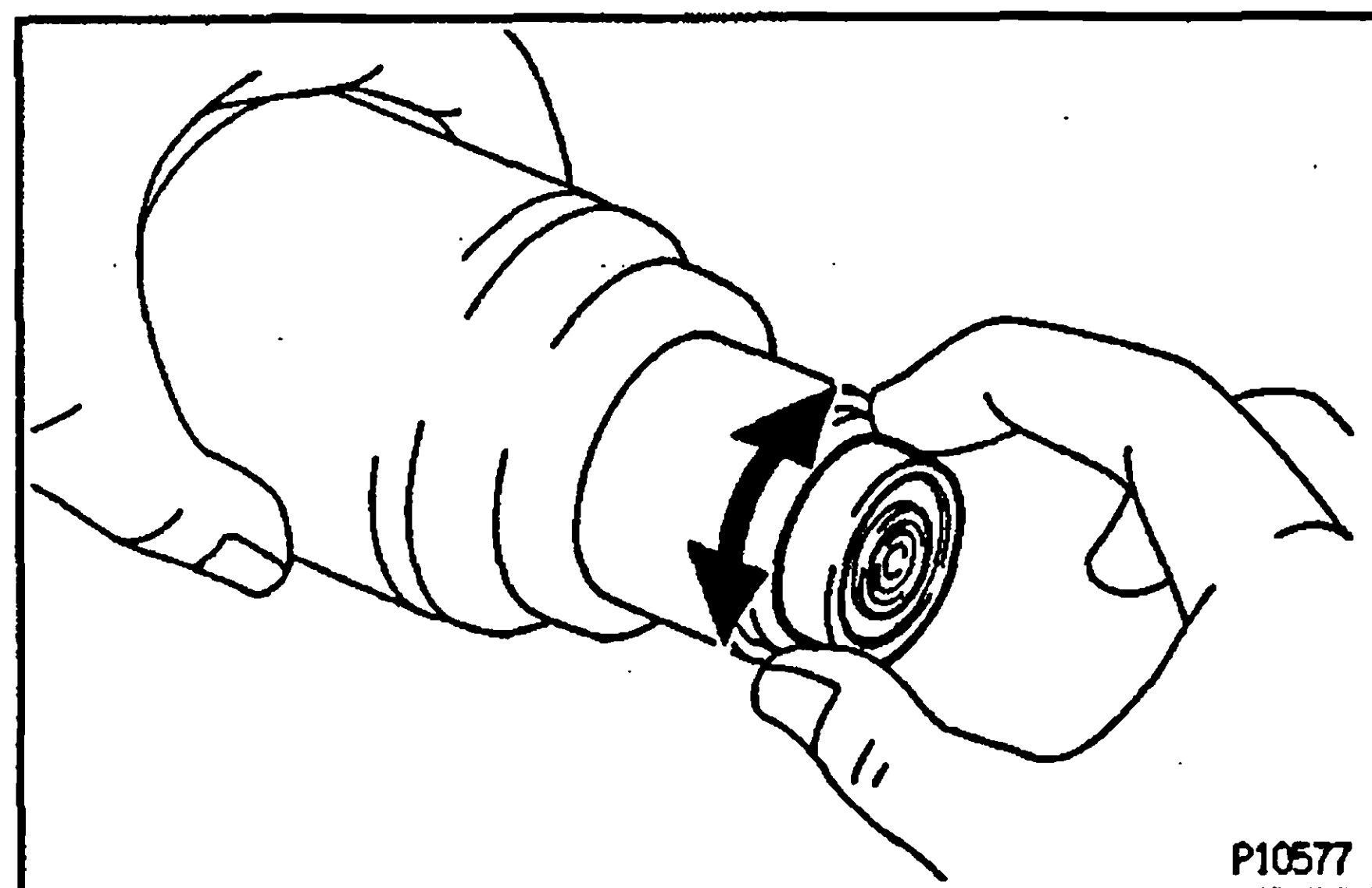
If damaged, replace the gear or clutch assembly.

If damaged, also check the flywheel or drive plate ring gear for wear or damage.



2. INSPECT CLUTCH PINION GEAR

Hold the starter clutch and rotate the clutch pinion gear clockwise and check that it turns freely. Try to rotate the clutch pinion counterclockwise and check that it locks. If necessary, replace the clutch assembly.



Bearings

1. INSPECT REAR BEARING

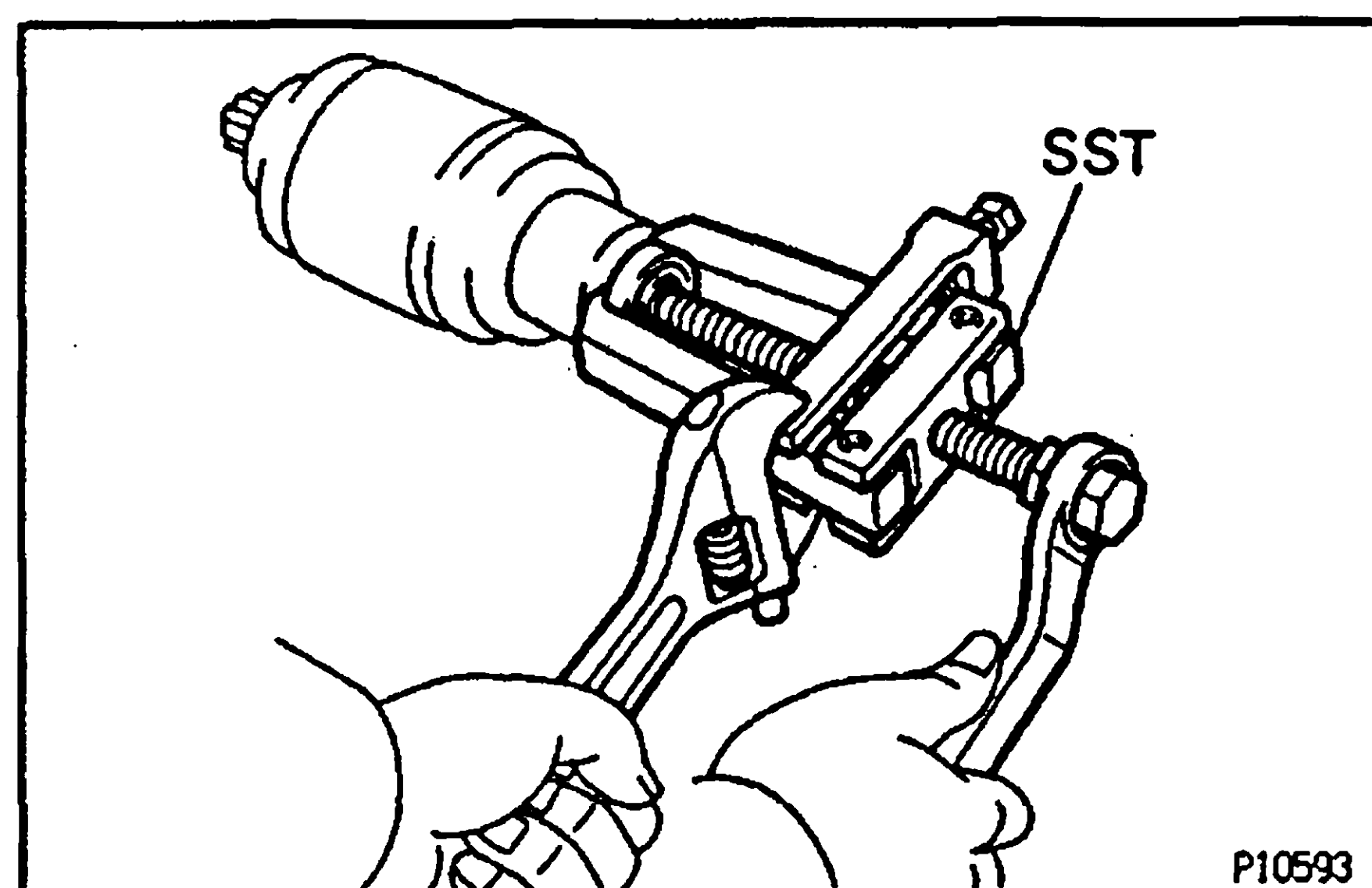
Turn each bearing by hand while applying inward force.

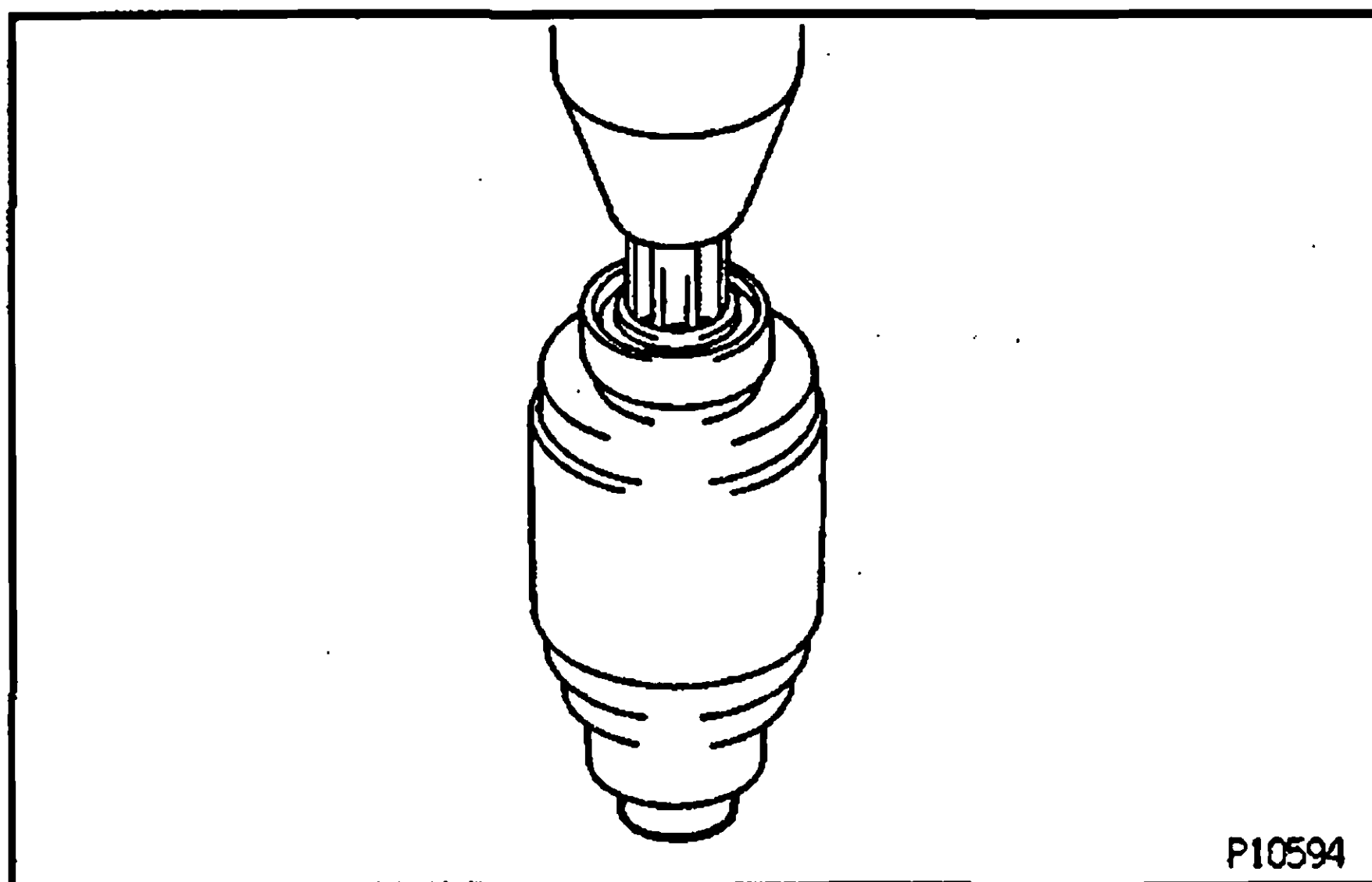
If the resistance is felt or if the bearing sticks, replace the bearing.

2. IF NECESSARY, REPLACE REAR BEARING

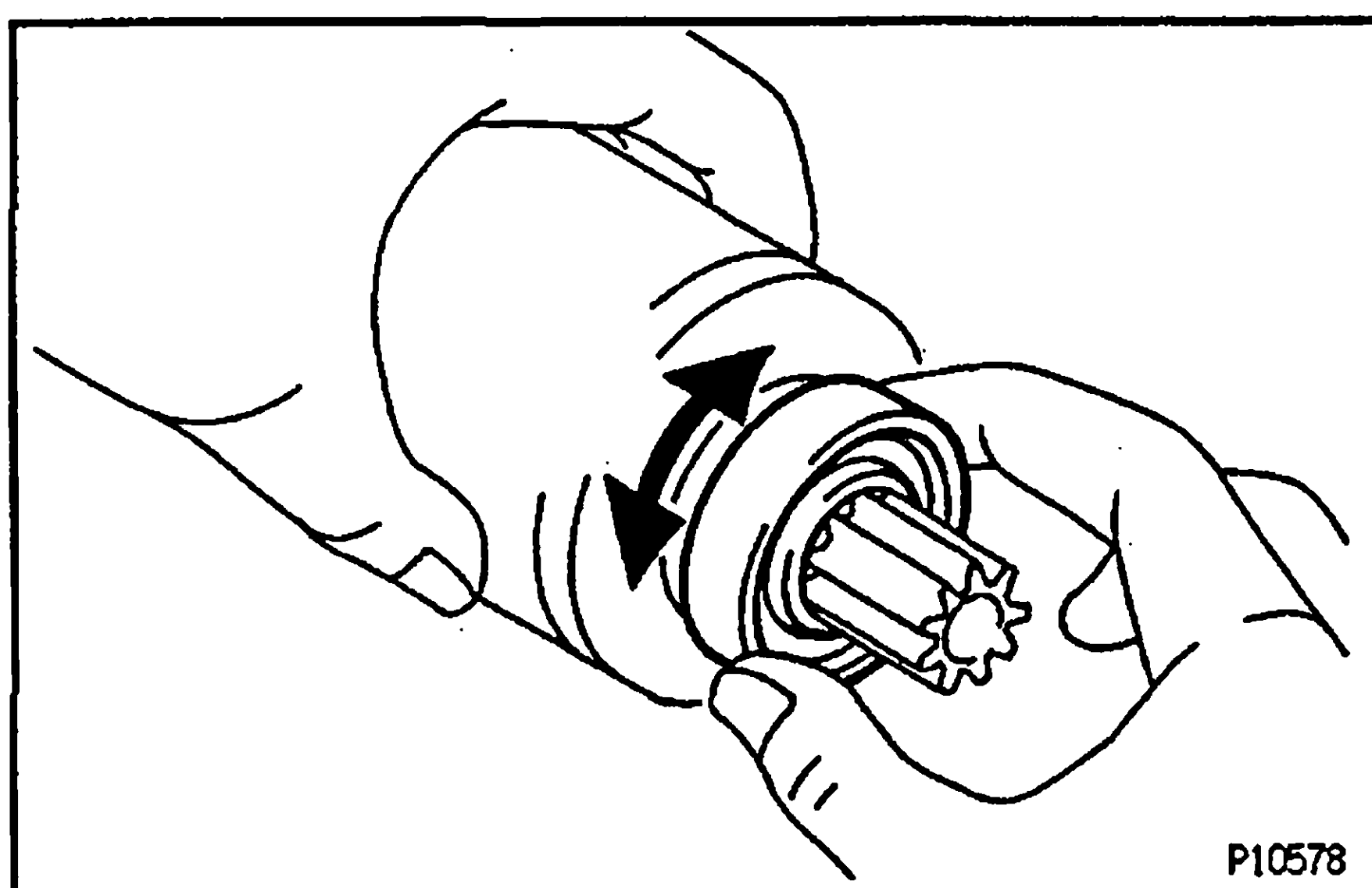
(a) Using SST, remove the bearing.

SST 09286-46011





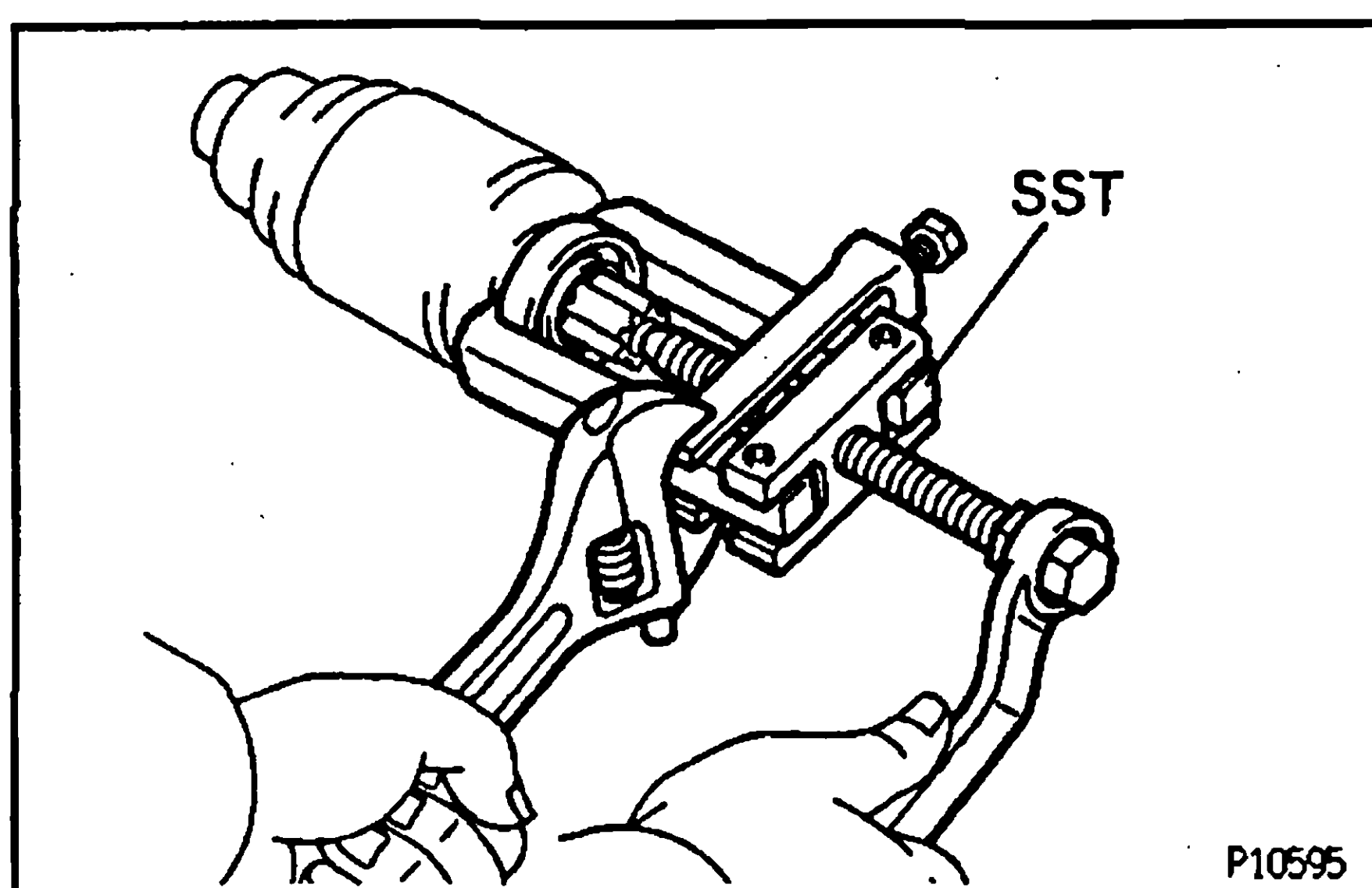
- (b) Using a press, press in a new rear bearing.



3. INSPECT FRONT BEARING

Turn each bearing by hand while applying inward force.

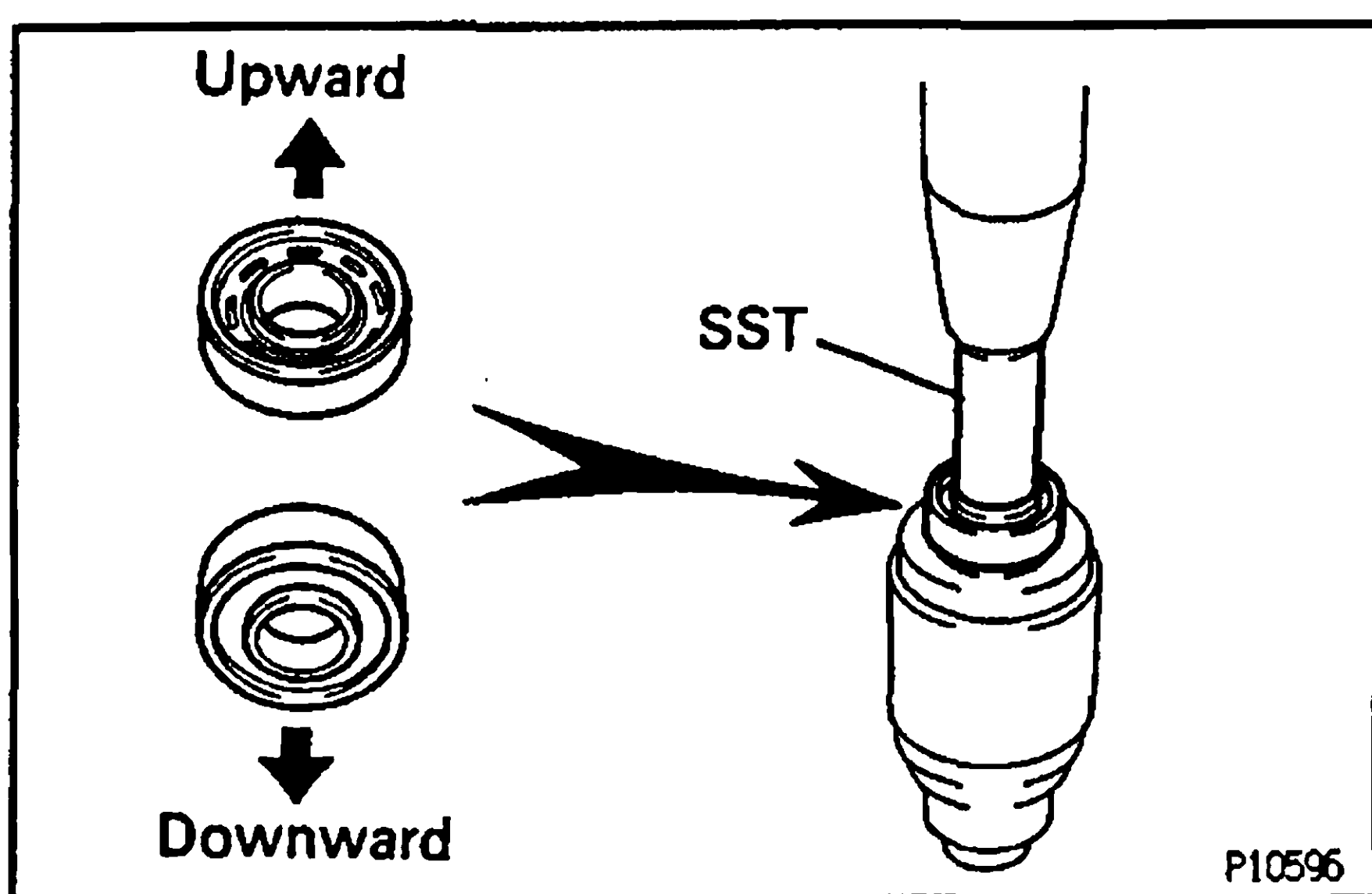
If the resistance is felt or if the bearing sticks, replace the bearing.



4. IF NECESSARY, REPLACE FRONT BEARING

- (a) Using SST, remove the bearing.

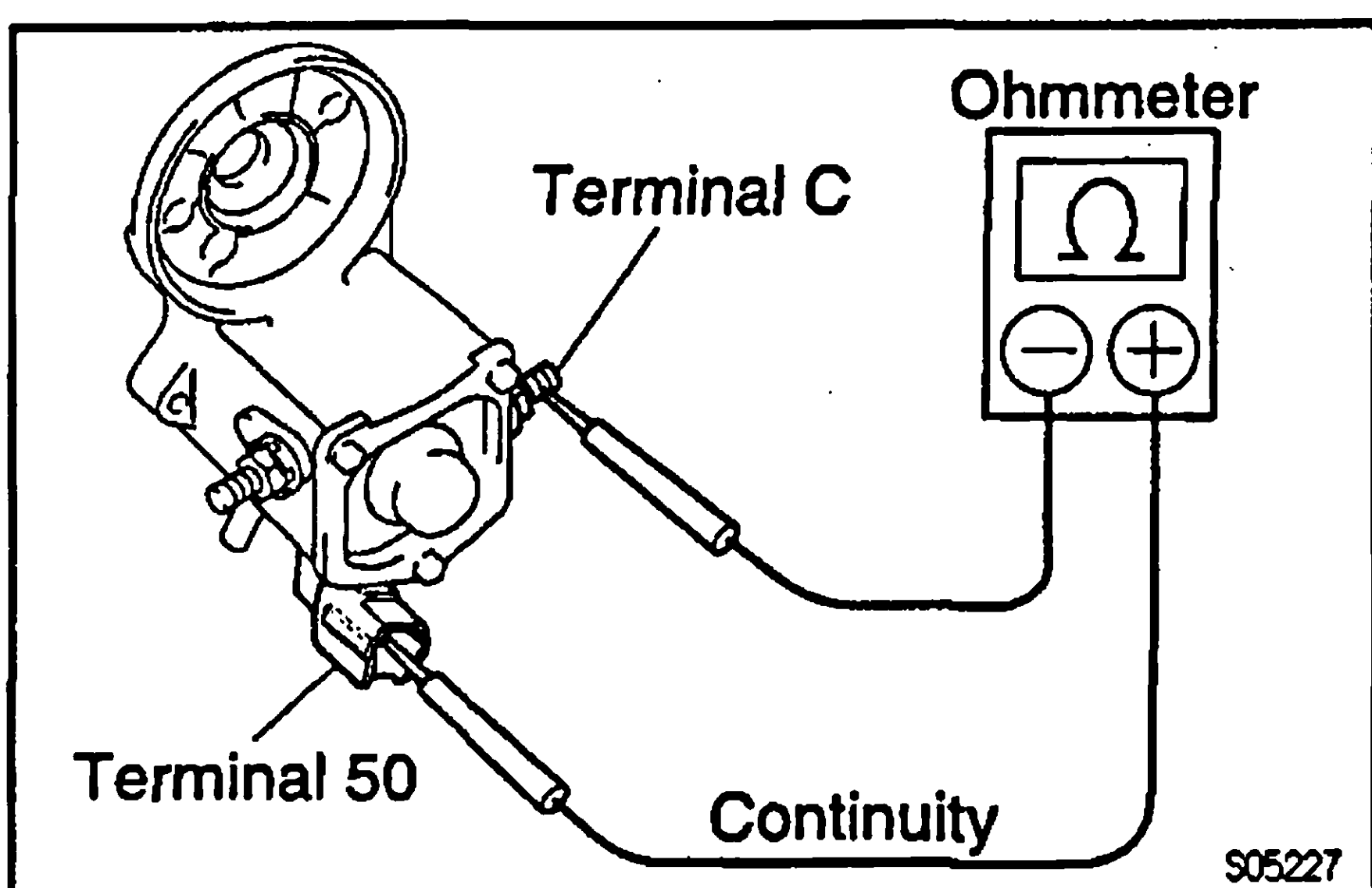
SST 09286-46011



- (b) Using SST and a press, press in a new front bearing.

SST 09820-00030

NOTICE: Be careful of the bearing installation direction.

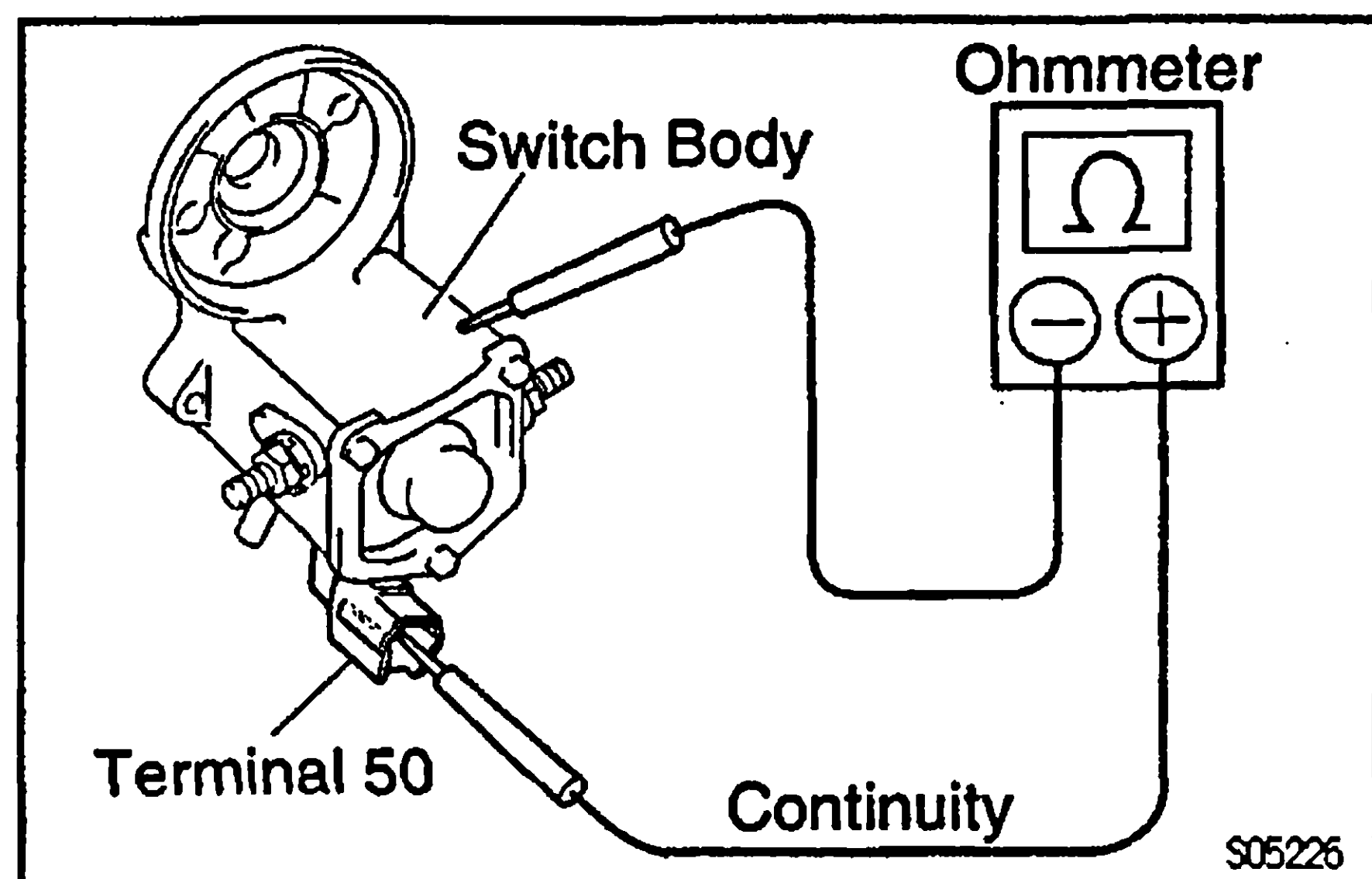


Magnetic Switch

1. PERFORM PULL-IN COIL OPEN CIRCUIT TEST

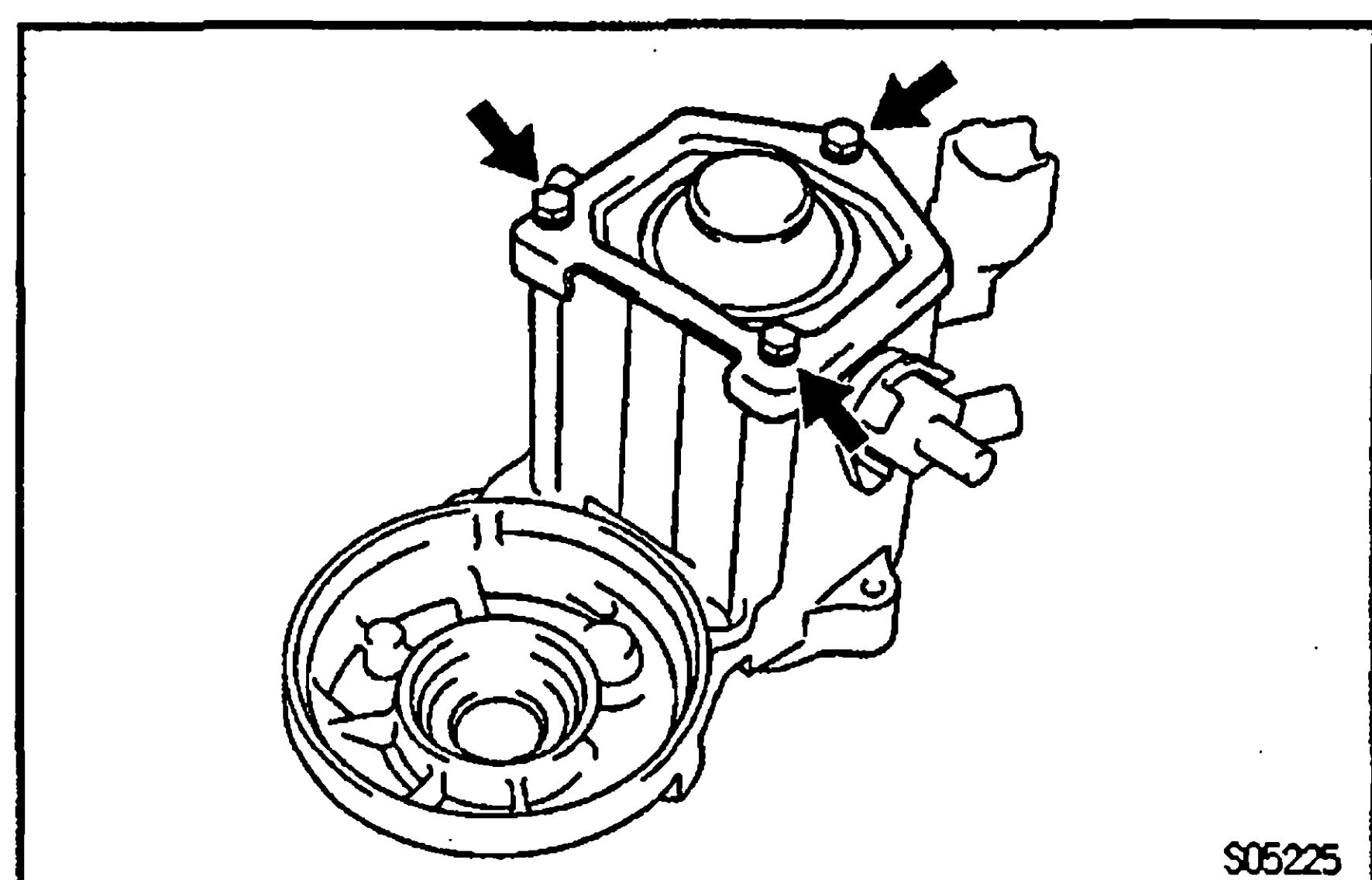
Using an ohmmeter, check that there is continuity between terminals 50 and C.

If there is no continuity, check and replace the magnetic switch.



2. PERFORM HOLD-IN COIL 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 assembly.



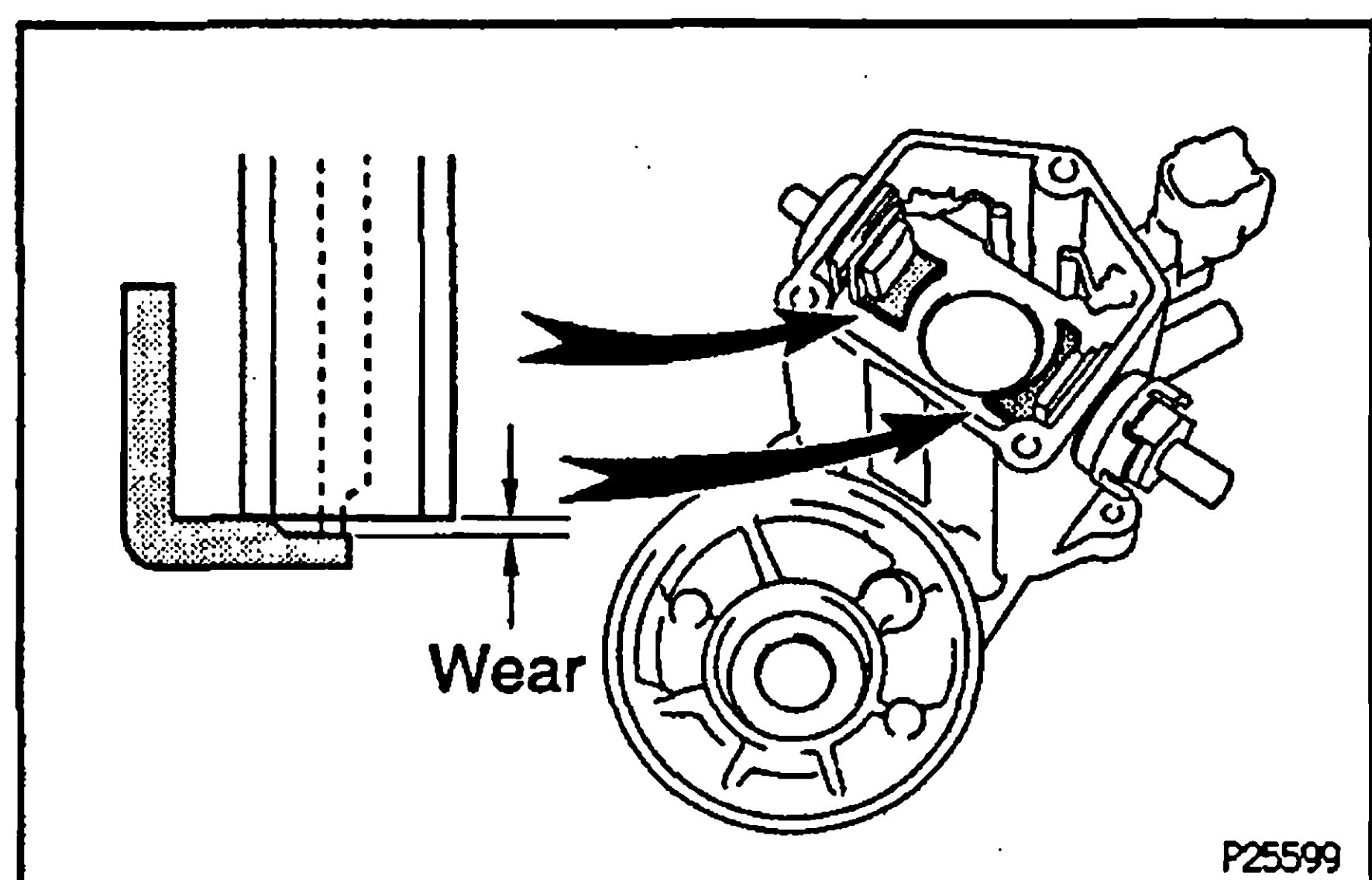
MAGNETIC SWITCH TERMINAL KIT PARTS REPLACEMENT

STOFM-01

ST

1. REMOVE MAGNETIC SWITCH END COVER

Remove the 3 bolts, lead clamp, end cover, gasket and plunger.



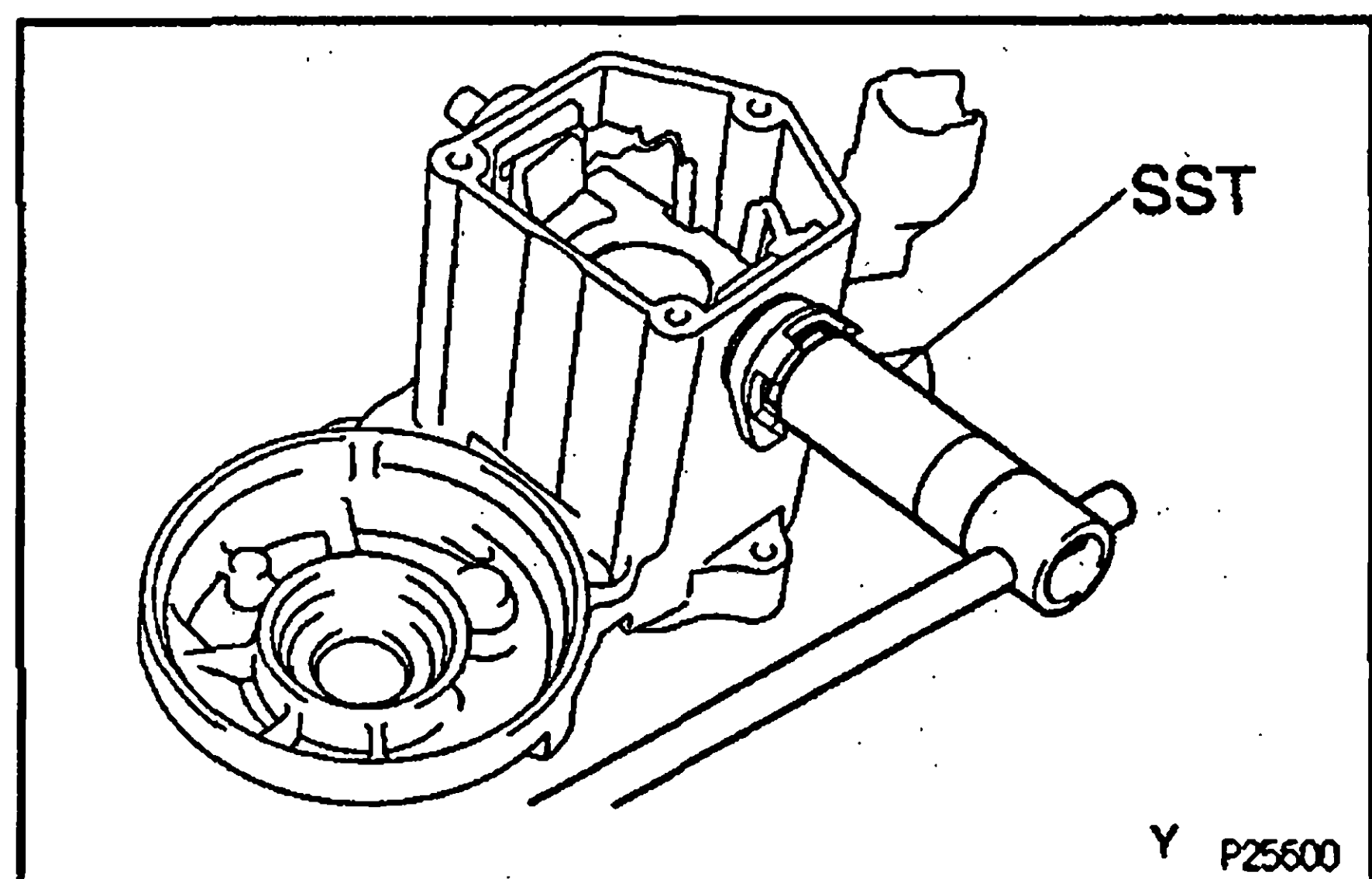
2. INSPECT CONTACT PLATE FOR WEAR

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:

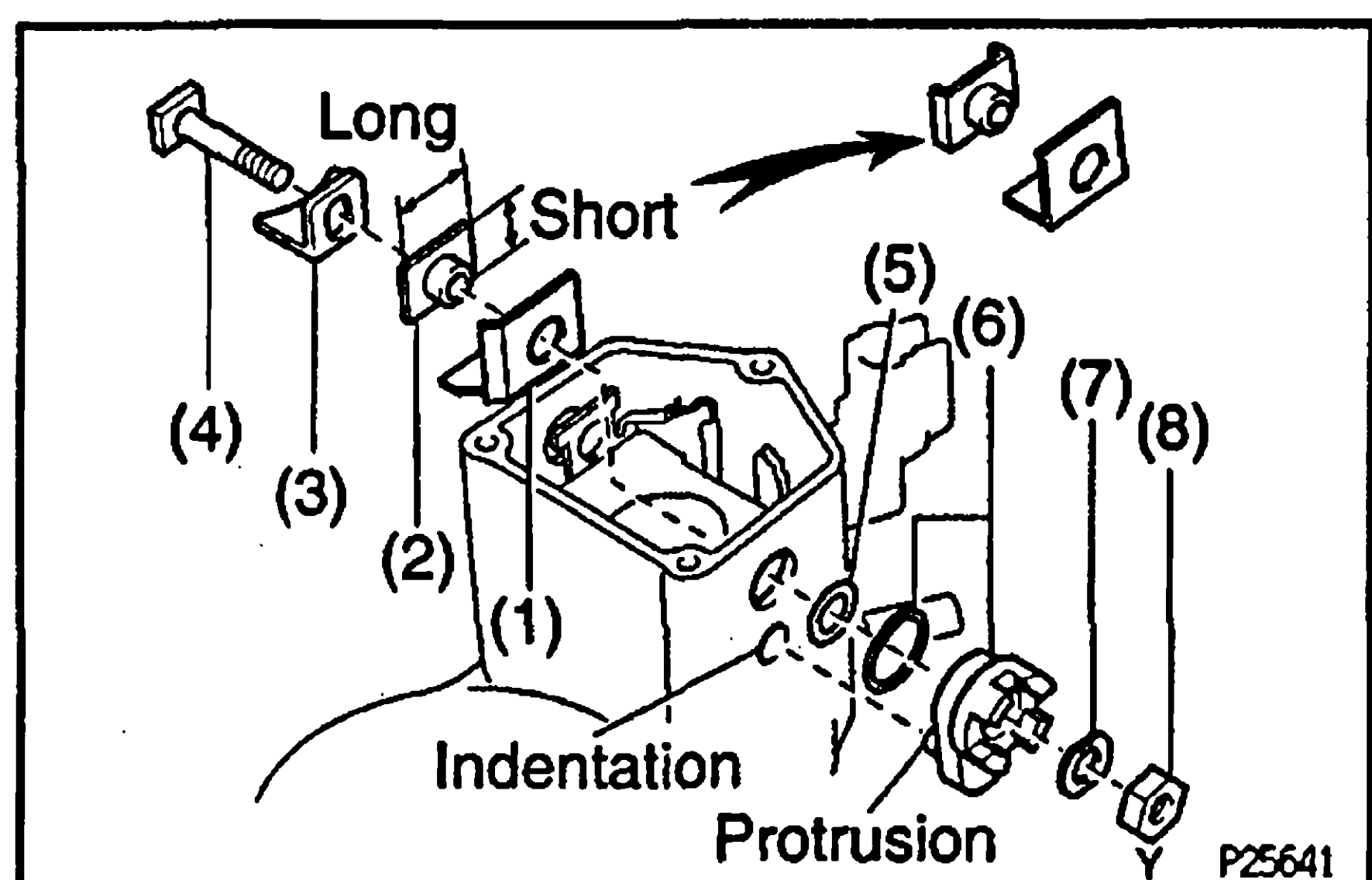
Terminal 30:

(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

NOTICE: Be careful to install the terminal insulators (inside) and wave washers in the correct direction.

Terminal C:

- (1) Terminal insulator (inside)
- (2) Contact plate
- (3) Terminal bolt
- (4) O—ring
- (5) Terminal insulator (outside)
- (6) Wave washer
- (7) Terminal nut

NOTICE: Be careful to install the terminal insulator (inside) in the correct direction.

- (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:

$$(\text{kgf/cm}^2) = \frac{100 \text{ kgf}}{\left(\frac{\text{Ram diameter (cm)}}{2} \right)^2 \times 3.14 (\pi)}$$

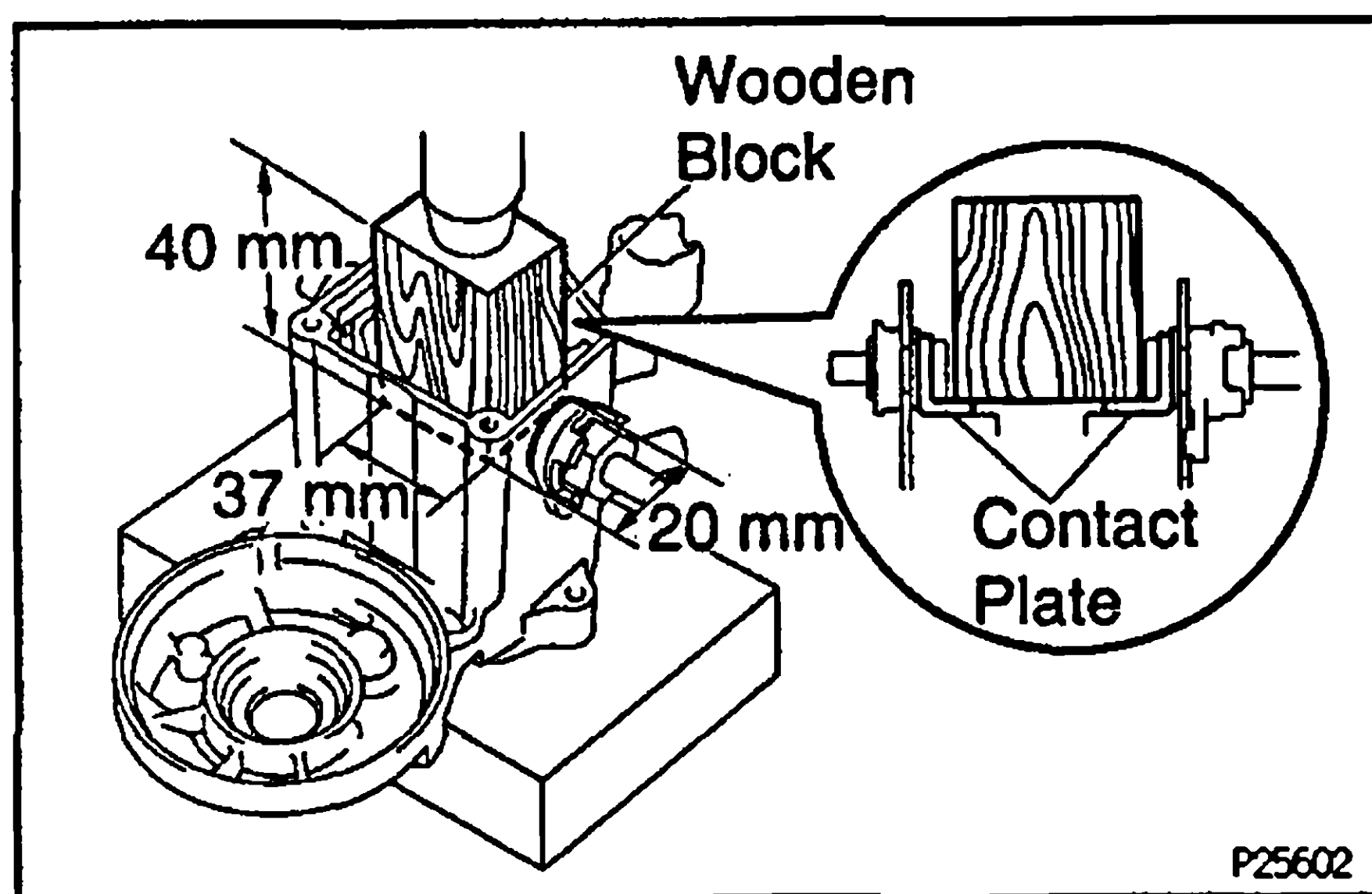
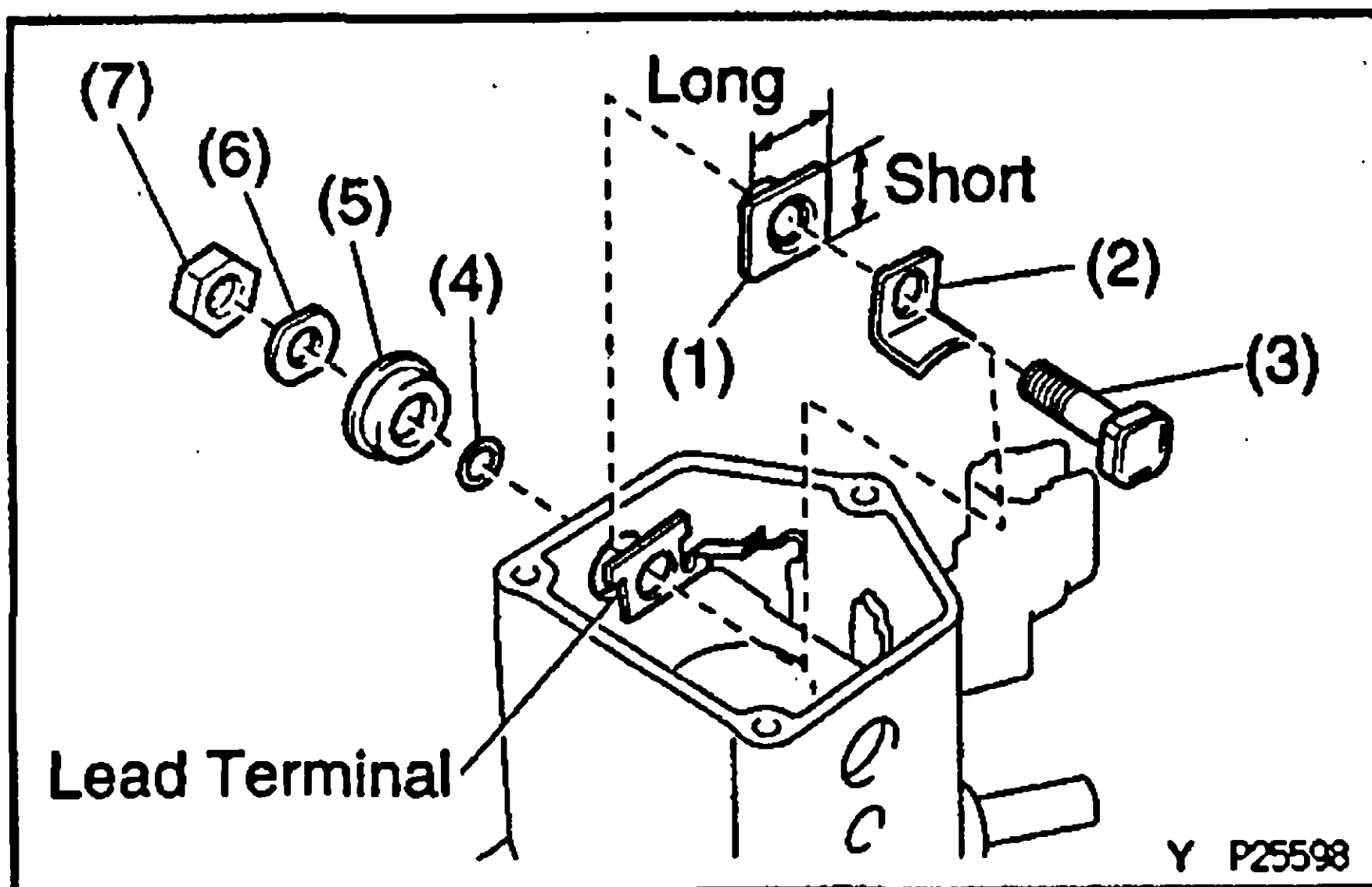
$$(\text{psi}) = \frac{221 \text{ lbf}}{\left(\frac{\text{Ram diameter (in.)}}{2} \right)^2 \times 3.14 (\pi)}$$

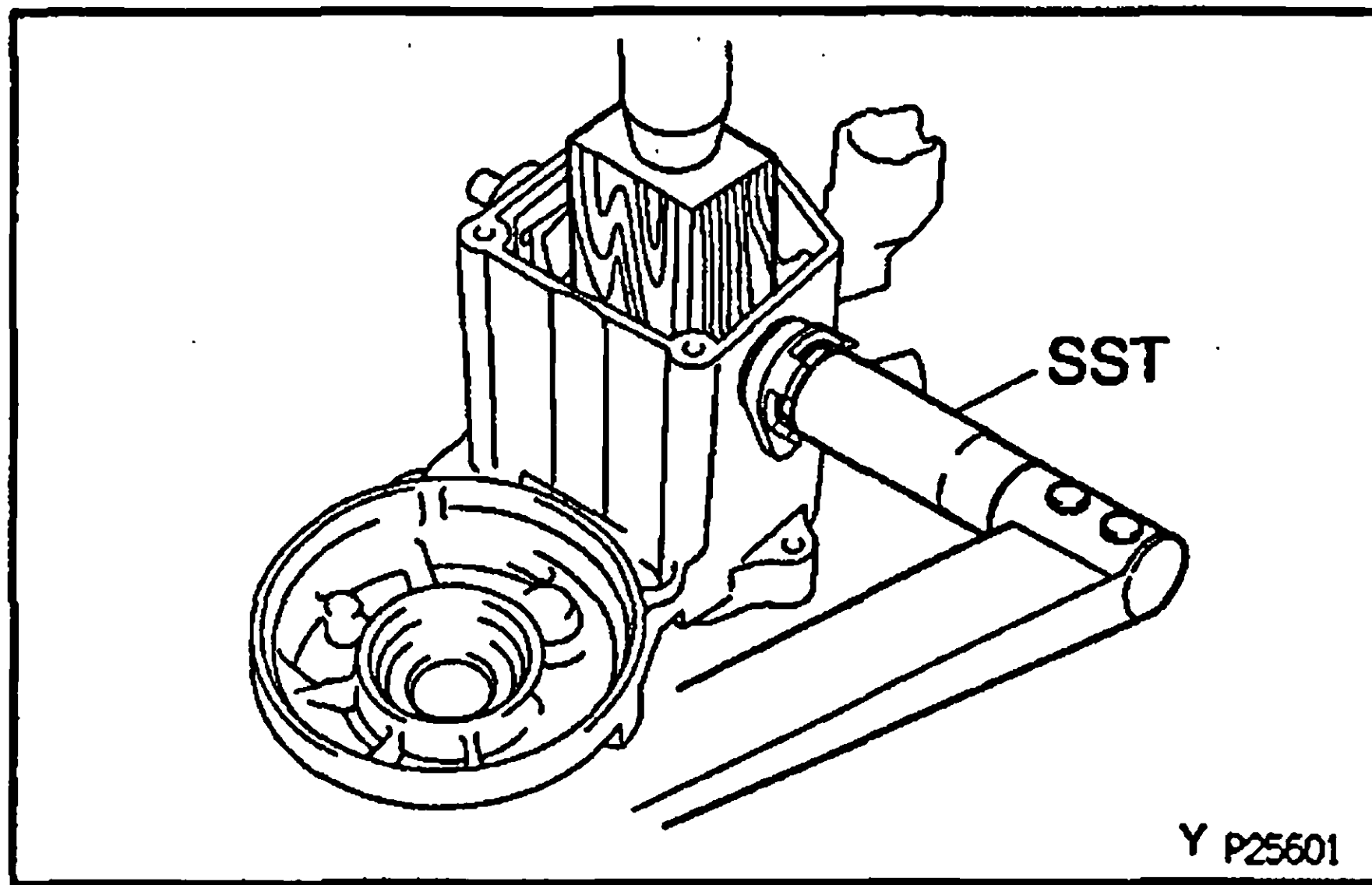
$$(\text{kPa}) = (\text{kgf/cm}^2) \times 98.1$$

$$(\text{kPa}) = (\text{psi}) \times 6.9$$

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.

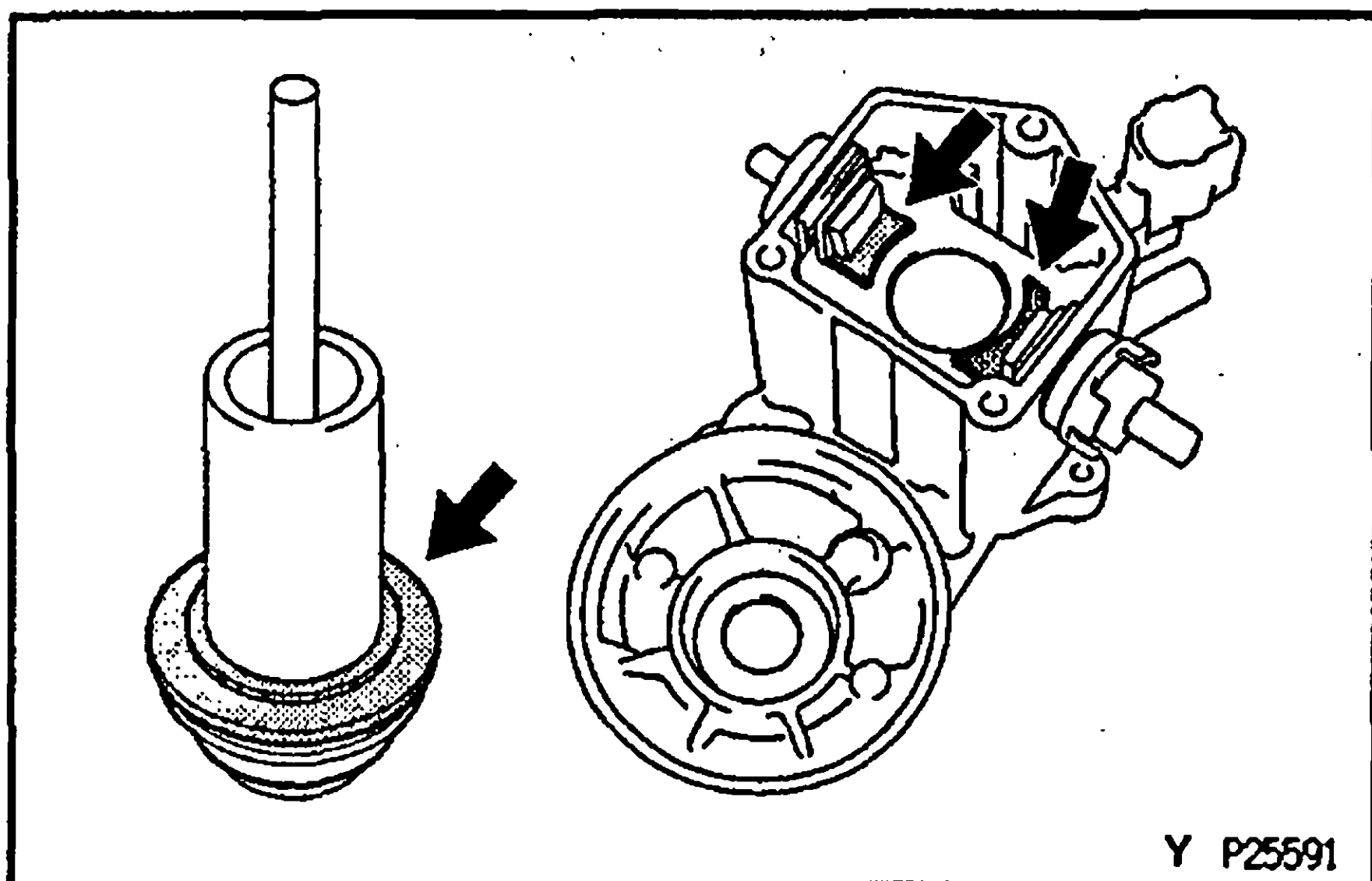
SST 09810-38140

Torque:

Terminal 30 and Terminal C

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

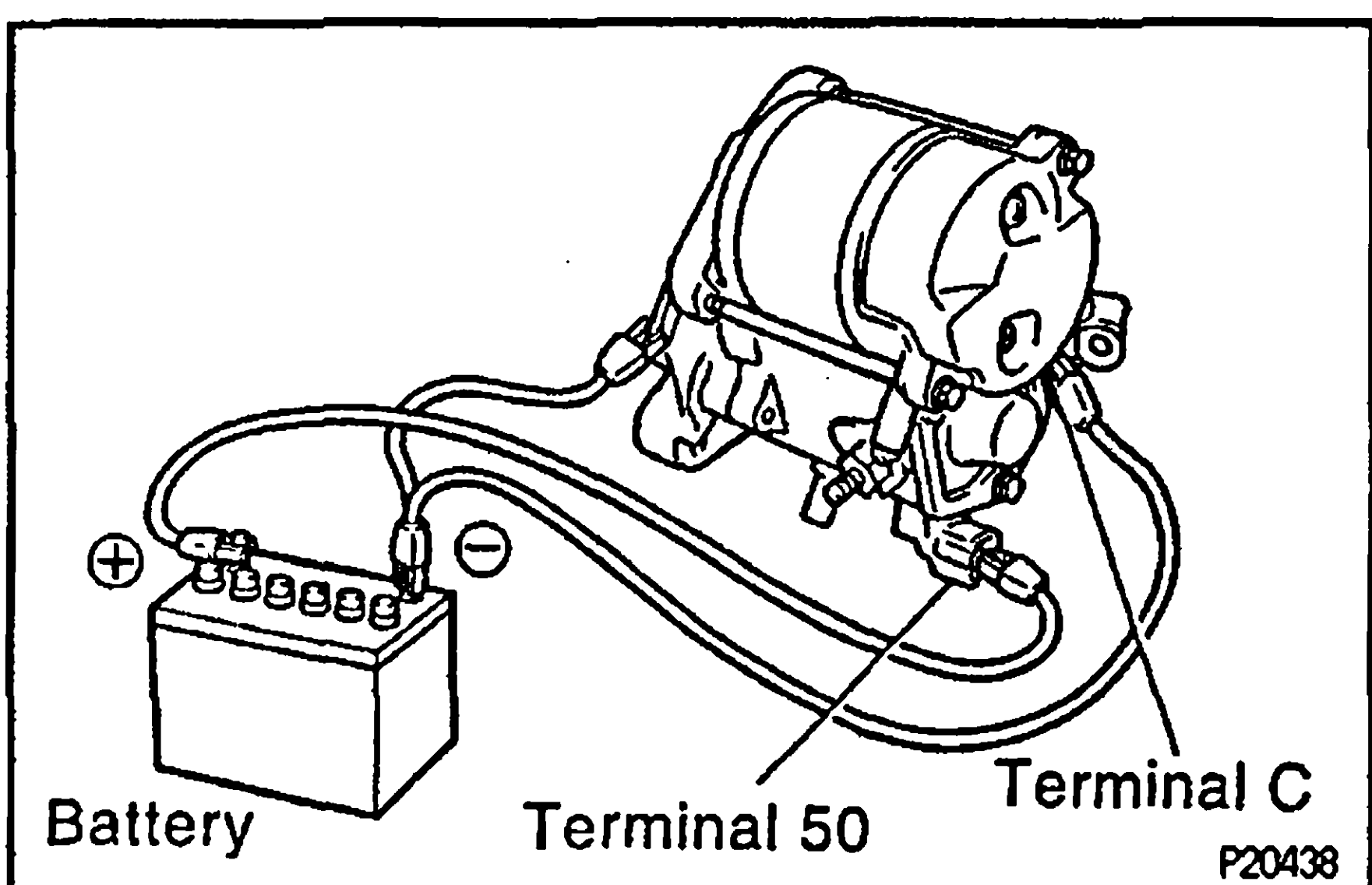
Install the plunger, new gasket, end cover and lead clamp with the 3 bolts.

Torque: 2.5 N·m (25 kgf·cm, 22 in·lbf)

STARTER ASSEMBLY

ST048-02

Assembly is in the reverse order of disassembly.



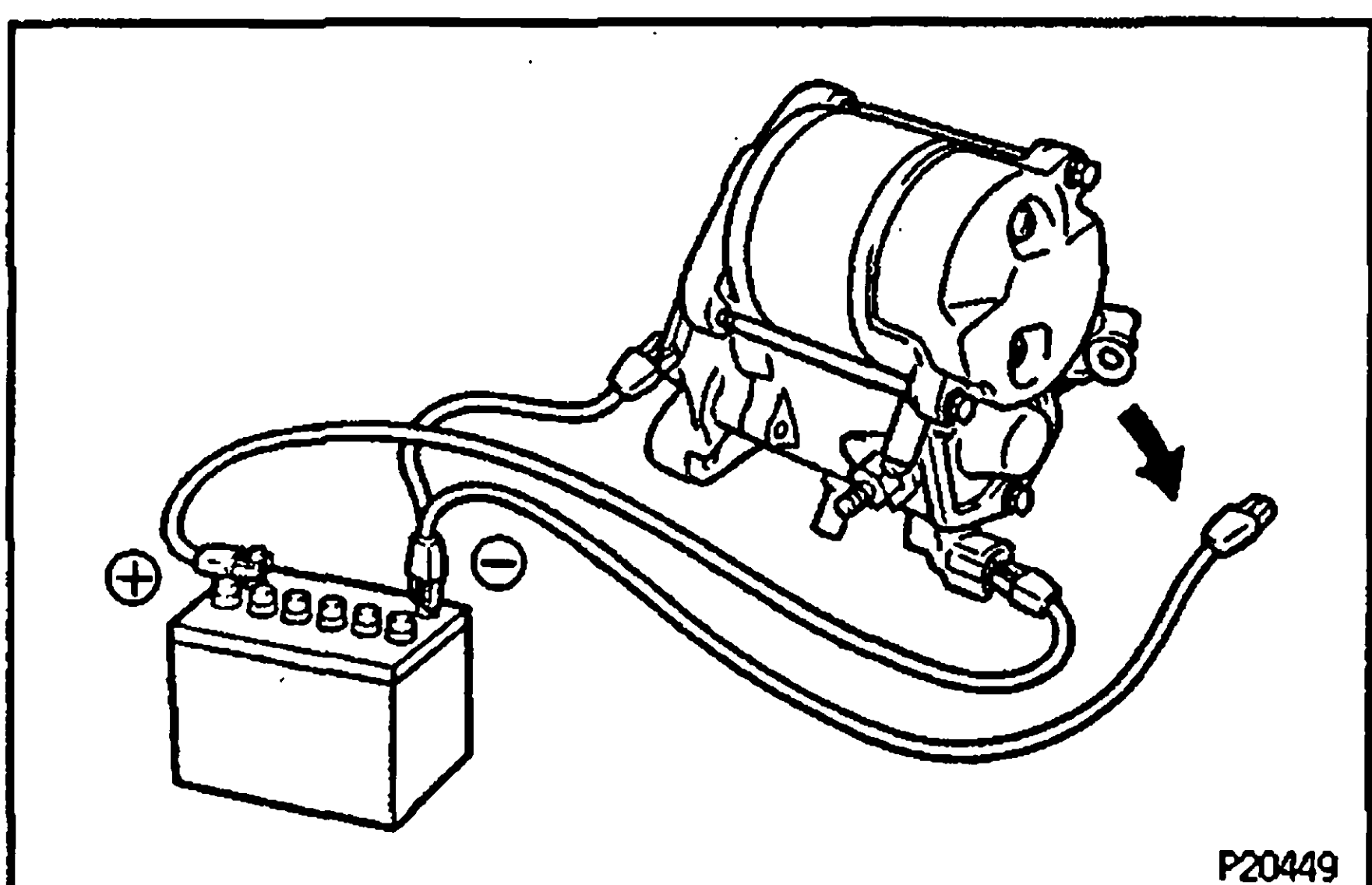
STARTER PERFORMANCE TEST

ST03X-0F

NOTICE: These tests must be done within 3 to 5 seconds to avoid burning out the coil.

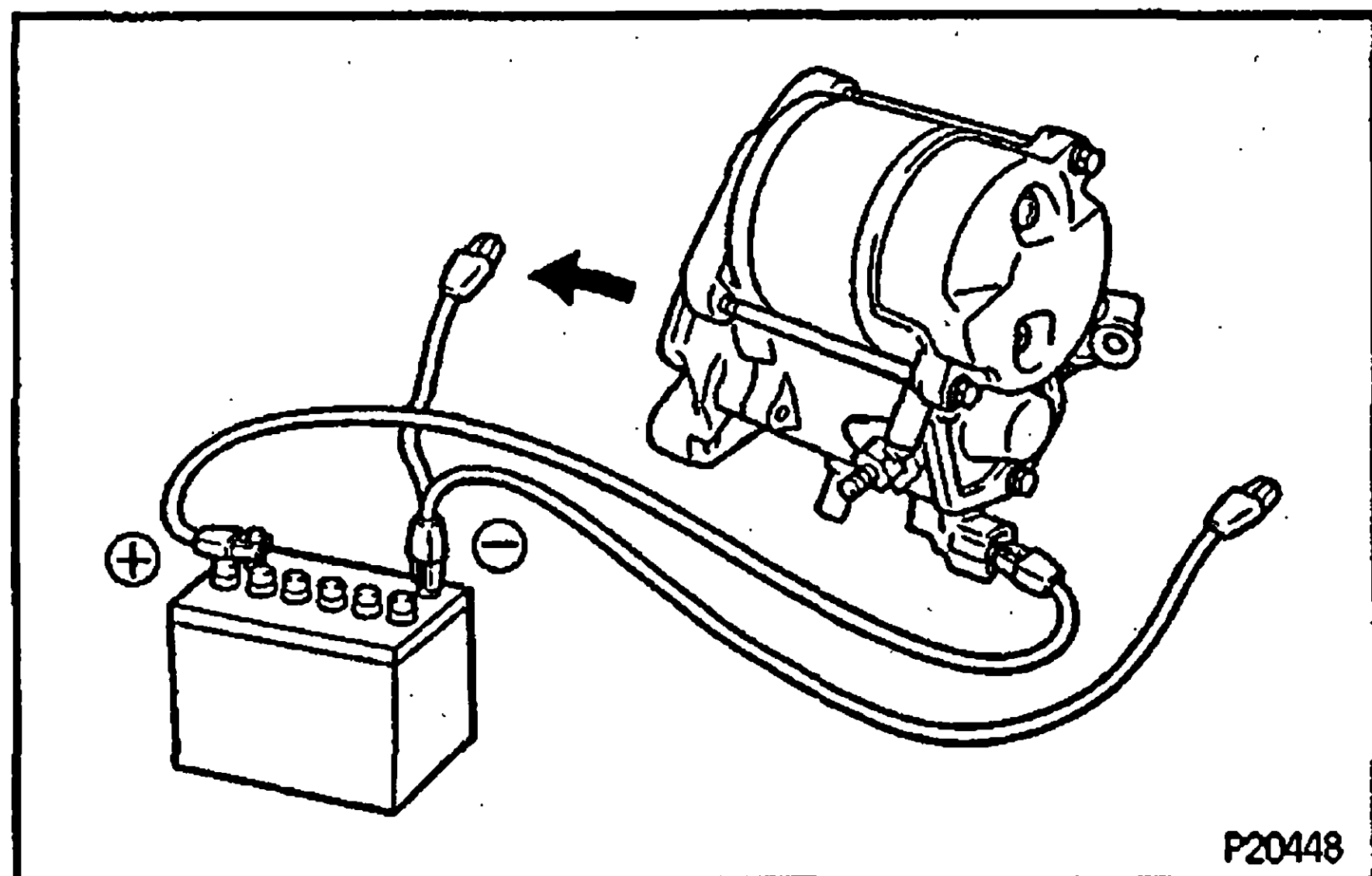
1. PERFORM PULL-IN TEST

- Disconnect the field coil lead wire from terminal C.
- Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.



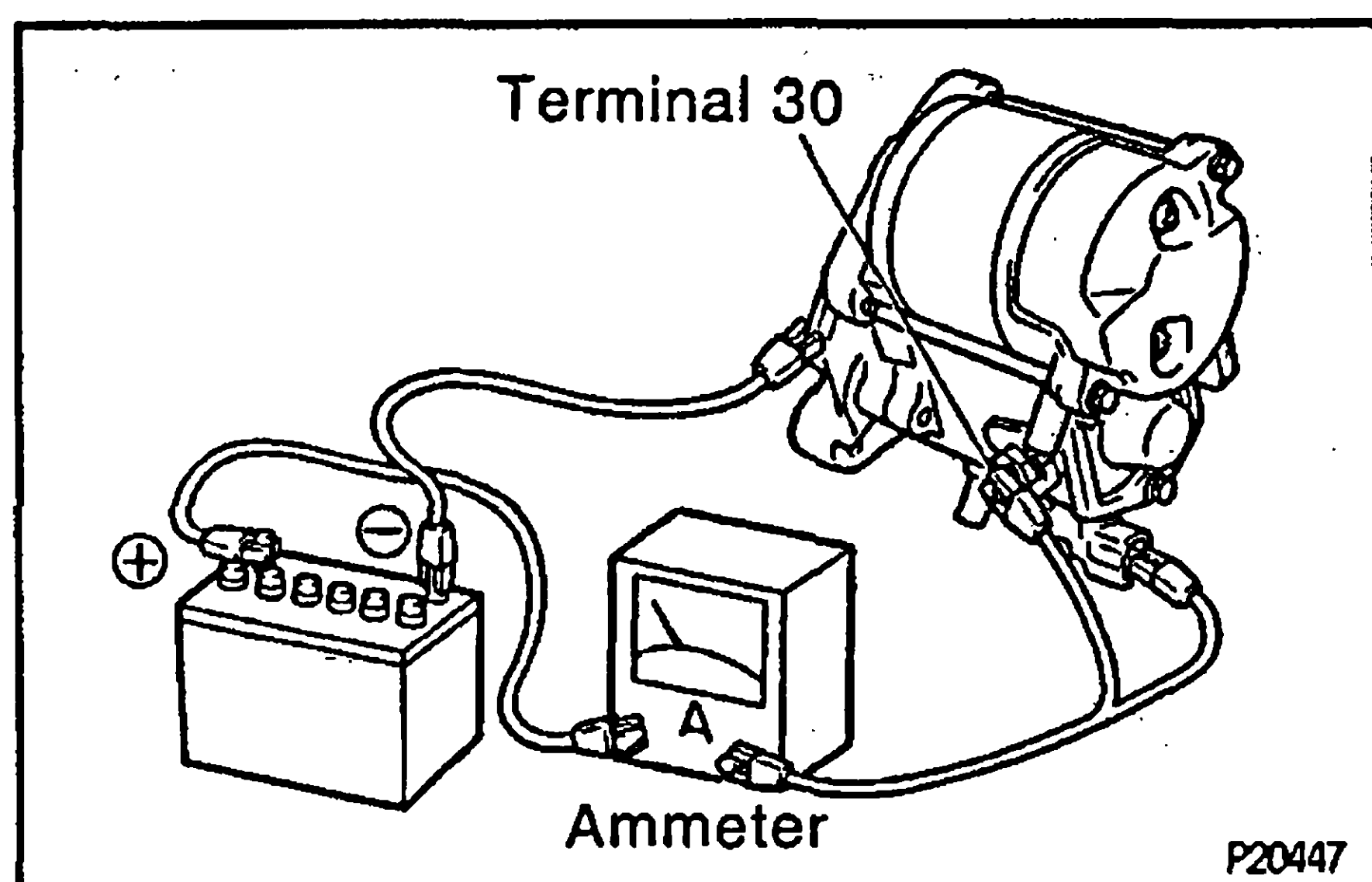
2. PERFORM HOLD-IN TEST

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. PERFORM 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 reads the specified current.

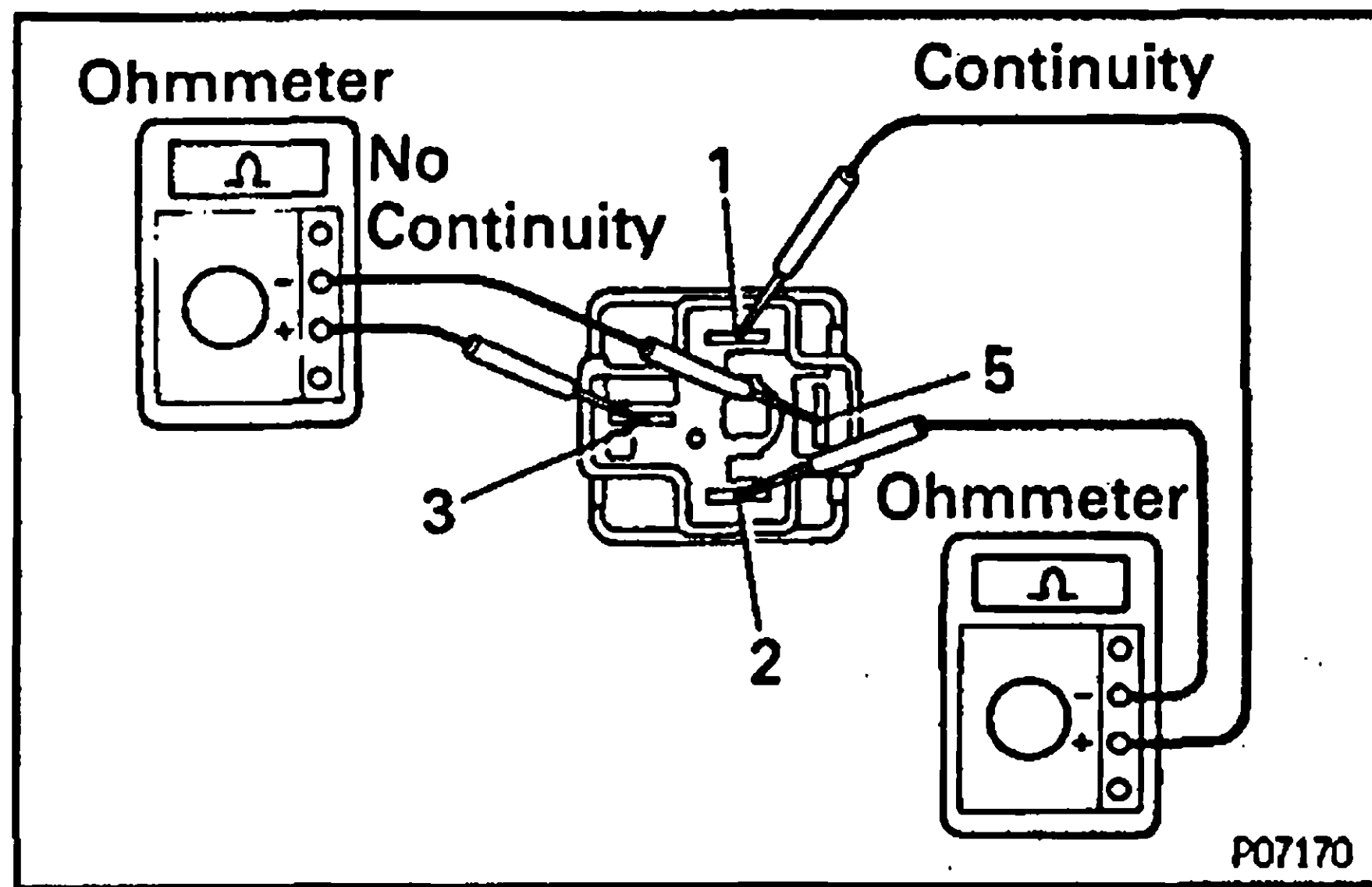
Specified current:

At 11.5 V: 90 A or less

STARTER INSTALLATION

STOAH-01

Installation is in the reverse order of removal.



STARTER RELAY

STARTER RELAY INSPECTION

ST000-07

1. REMOVE STARTER RELAY

LOCATION: In the engine compartment relay box. Remove the relay box cover and starter relay.

2. INSPECT STARTER RELAY

A. Inspect relay continuity

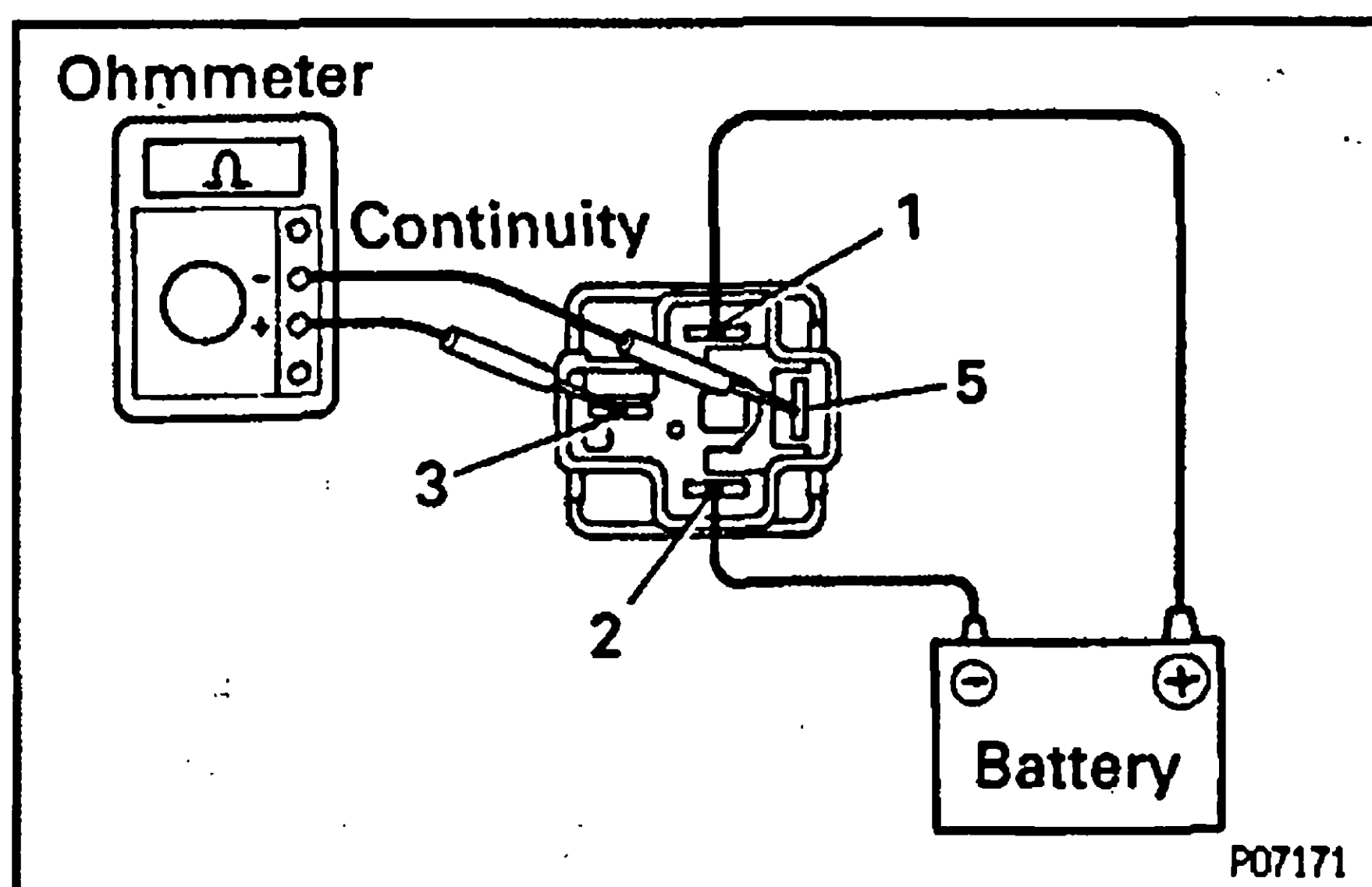
- (a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

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.

ST



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 there is no continuity, replace the relay.

3. REINSTALL STARTER RELAY

SERVICE SPECIFICATIONS
SERVICE DATA

STOCC-03

ST 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			
	1.2 kW type	STD	13.7 — 19.6 N (1.40 — 2.00 kgf, 3.1 — 4.4 lbf)	
		Minimum	9.8 N (1.00 kgf, 2.2 lbf)	
	1.4 kW type	STD	17.6 — 23.5 N (1.80 — 2.40 kgf, 4.0 — 5.3 lbf)	
		Minimum	11.8 N (1.20 kgf, 2.6 lbf)	
	Commutator			
	Diameter	STD	30.0 mm (1.181 in.)	
		Minimum	29.0 mm (1.412 in.)	
	Undercut depth	STD	0.6 mm (0.024 in.)	

TORQUE SPECIFICATIONS

STOCC-02

Part tightened	N·m	kgf·cm	ft·lbf
Starter mounting bolt	39	400	29
Starter wire mounting nut	8.8	90	78 in·lbf
Lead wire x Terminal C of starter	5.9	60	52 in·lbf
Field frame x Starter housing	5.9	60	52 in·lbf
Starter housing x Magnetic switch	5.9	60	52 in·lbf
End cover x Field frame	1.5	15	13 in·lbf
Terminal nut x Terminal 30 of starter	17	170	12
Terminal nut x Terminal C of starter	17	170	12
Magnetic switch end cover x Magnetic switch	2.5	25	22 in·lbf

CHARGING

PRECAUTION	CH- 2
PREPARATION	CH- 2
ON-VEHICLE INSPECTION	CH- 4
ALTERNATOR	CH- 7
SERVICE SPECIFICATIONS.....	CH- 18

CH

PRECAUTION

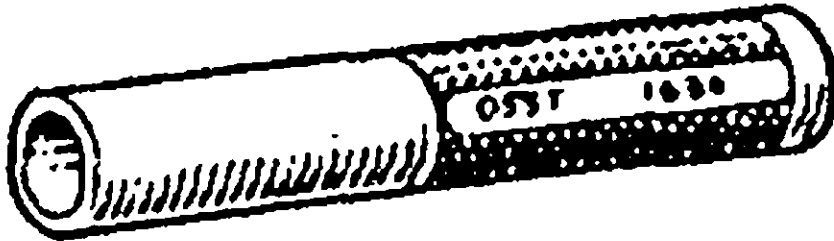
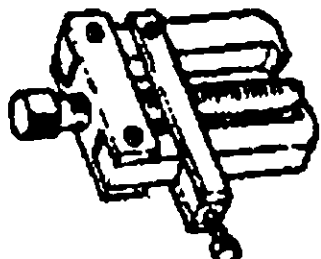
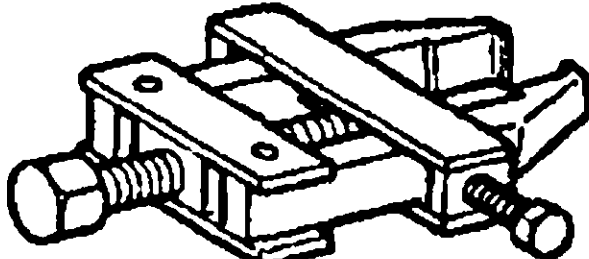
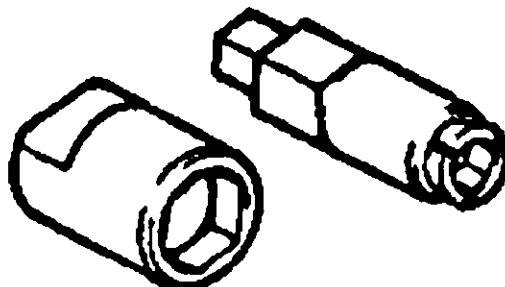
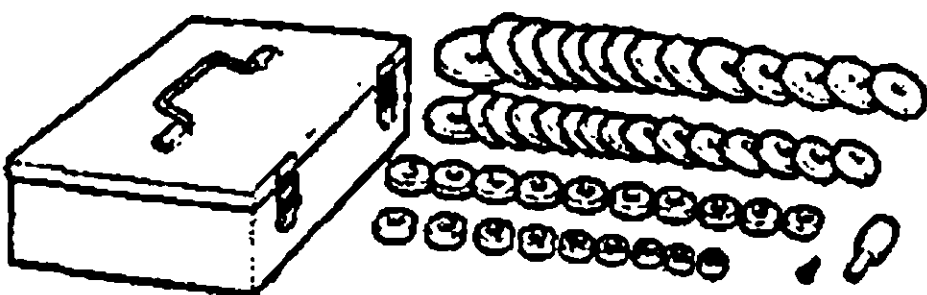
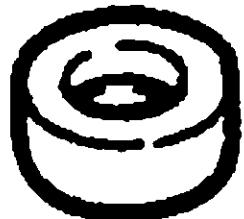
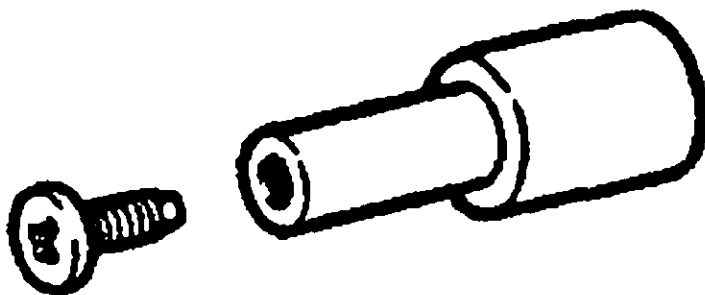
CH031-06

- 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

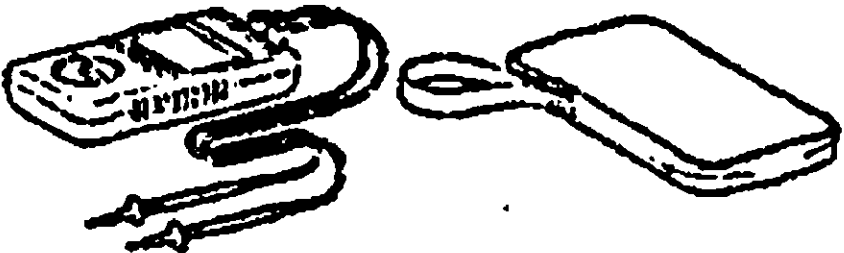
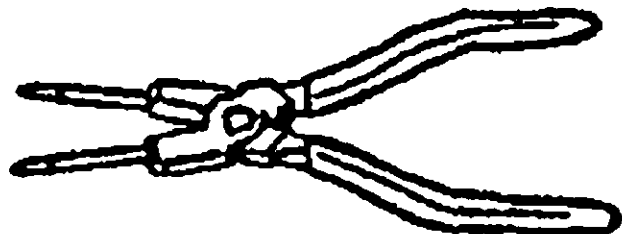
CH008-06

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	
	09820-63010 Alternator Pulley Set Nut Wrench Set	
	09950-60010 Replacer Set	
	(09951-00260) Replacer 26	Rotor front bearing
	(09951-00500) Replacer 50	Rotor front bearing
	(09952-06010) Adapter	Rotor front bearing

RECOMMENDED TOOLS

CH036-07

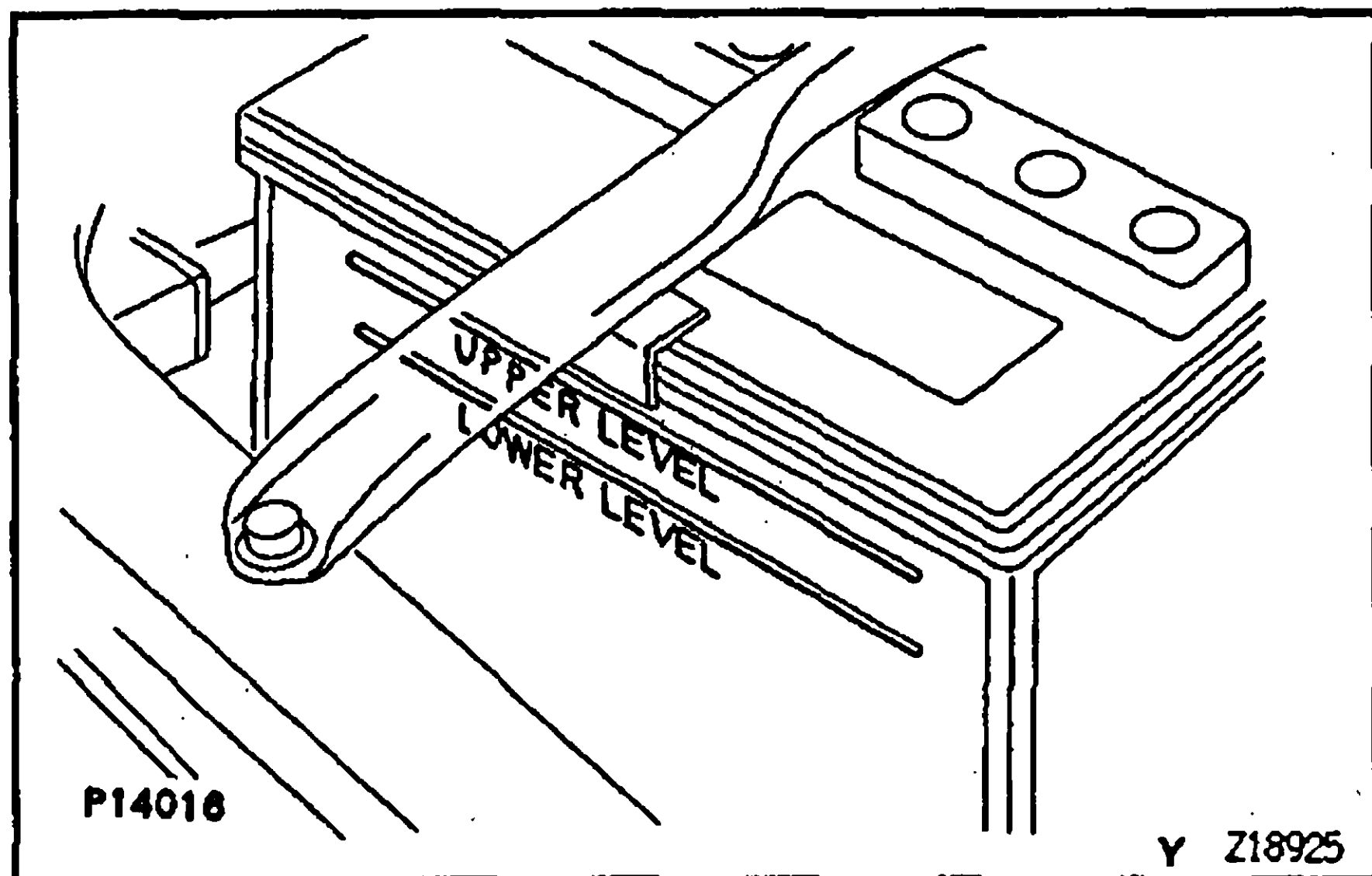
	09082-00040 TOYOTA Electrical Tester.	
	09905-00013 Snap Ring Pliers .	

EQUIPMENT

CH036-04

Ammeter (A)	
Belt tension gauge	
Torque wrench	
Vernier calipers	Rotor (Slip ring), Brush

CH



ON—VEHICLE INSPECTION

CH0E9-01

1. CHECK BATTERY ELECTROLYTE LEVEL

Check the electrolyte quantity of each cell.

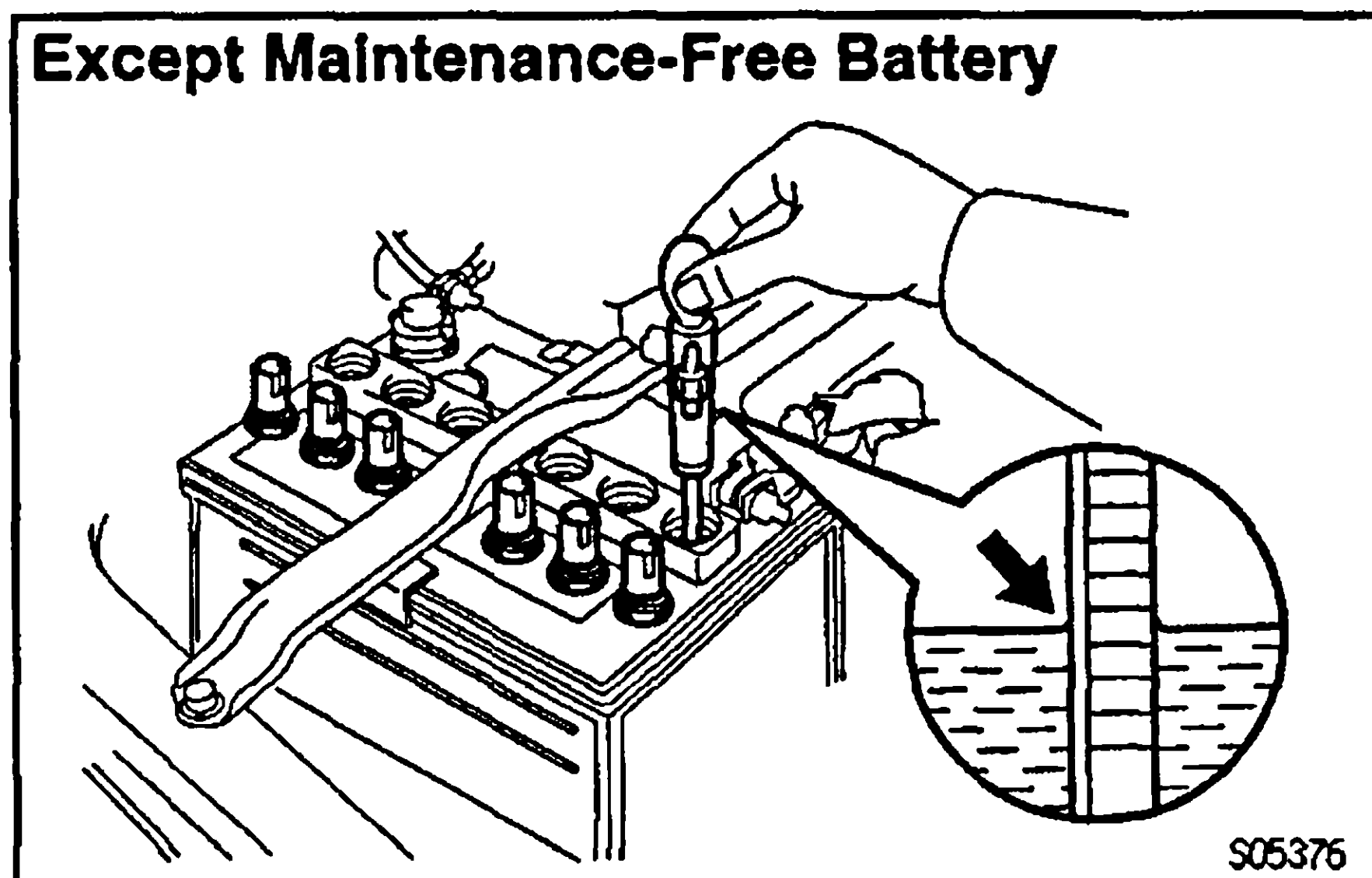
Maintenance—Free Battery:

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.

Except Maintenance-Free Battery



2. Except Maintenance—Free Battery: CHECK BATTERY SPECIFIC GRAVITY

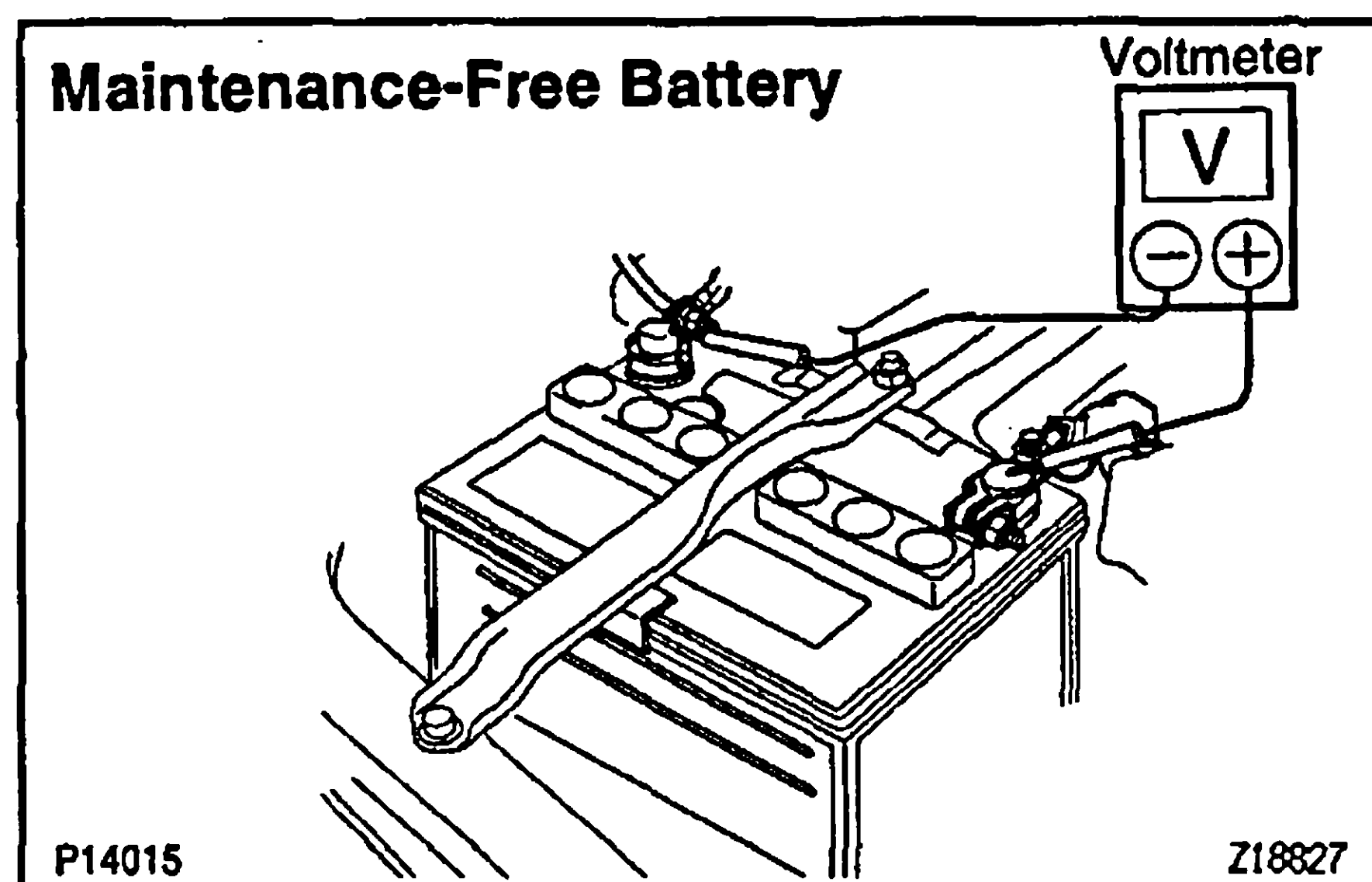
Check the specific gravity of each cell.

Standard specific gravity:

At 20°C (68°F): 1.25 — 1.29

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

Maintenance-Free Battery



3. Maintenance—Free Battery: CHECK BATTERY VOLTAGE

Measure the battery voltage between the negative (—) and positive (+) terminals of the battery.

Standard voltage:

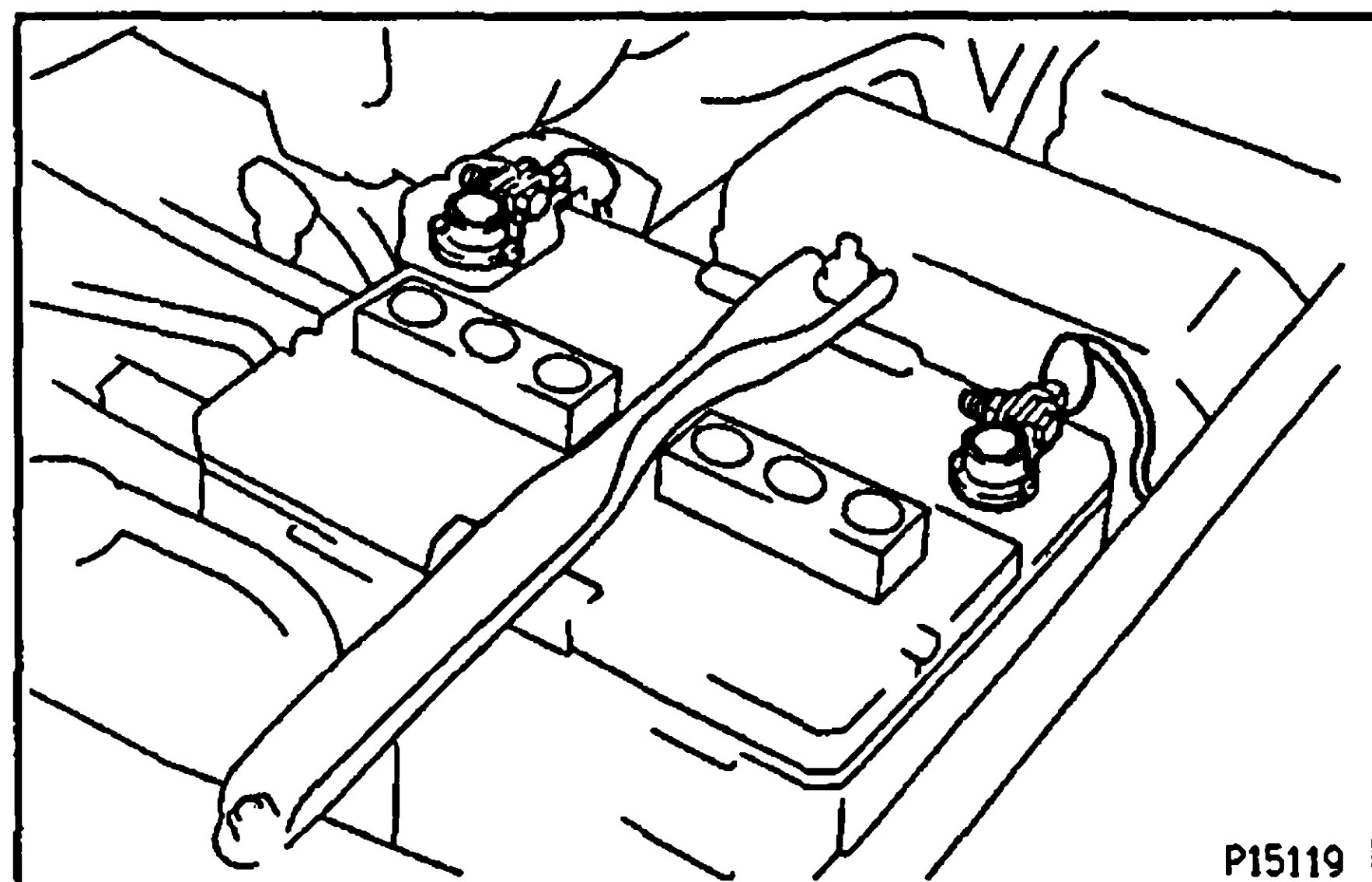
At 20°C (68°F): 12.5 — 12.9 V

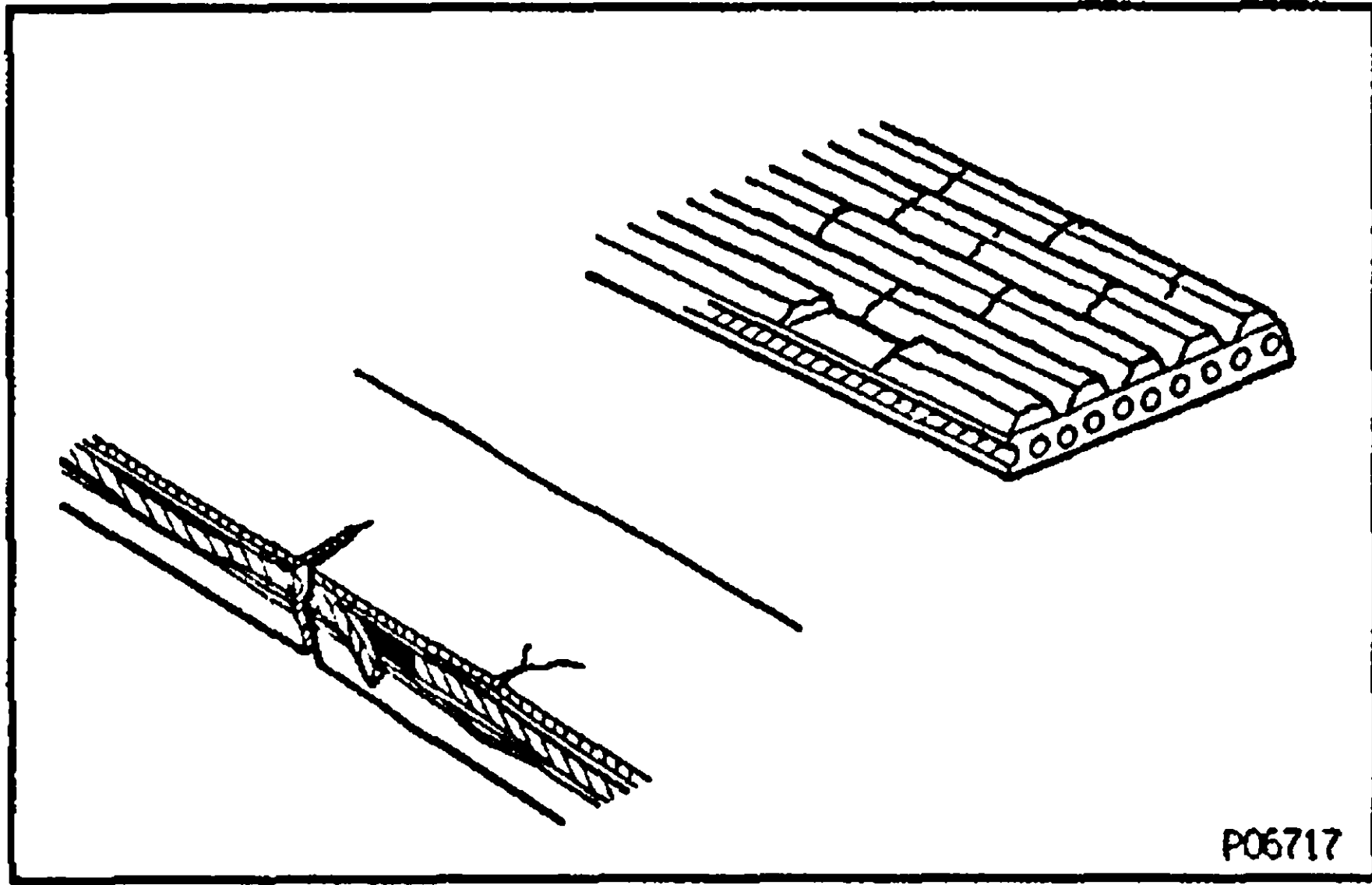
HINT:

- Before measuring the voltage, turn the ignition switch OFF and turn off the electrical systems (headlight, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.
- When measuring the voltage, however, turn the ignition switch OFF and turn off the electrical systems (headlight, blower motor, rear defogger etc.).

4. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

- Check that the battery terminals are not loose or corroded.
- Check the fusible link and fuses for continuity.



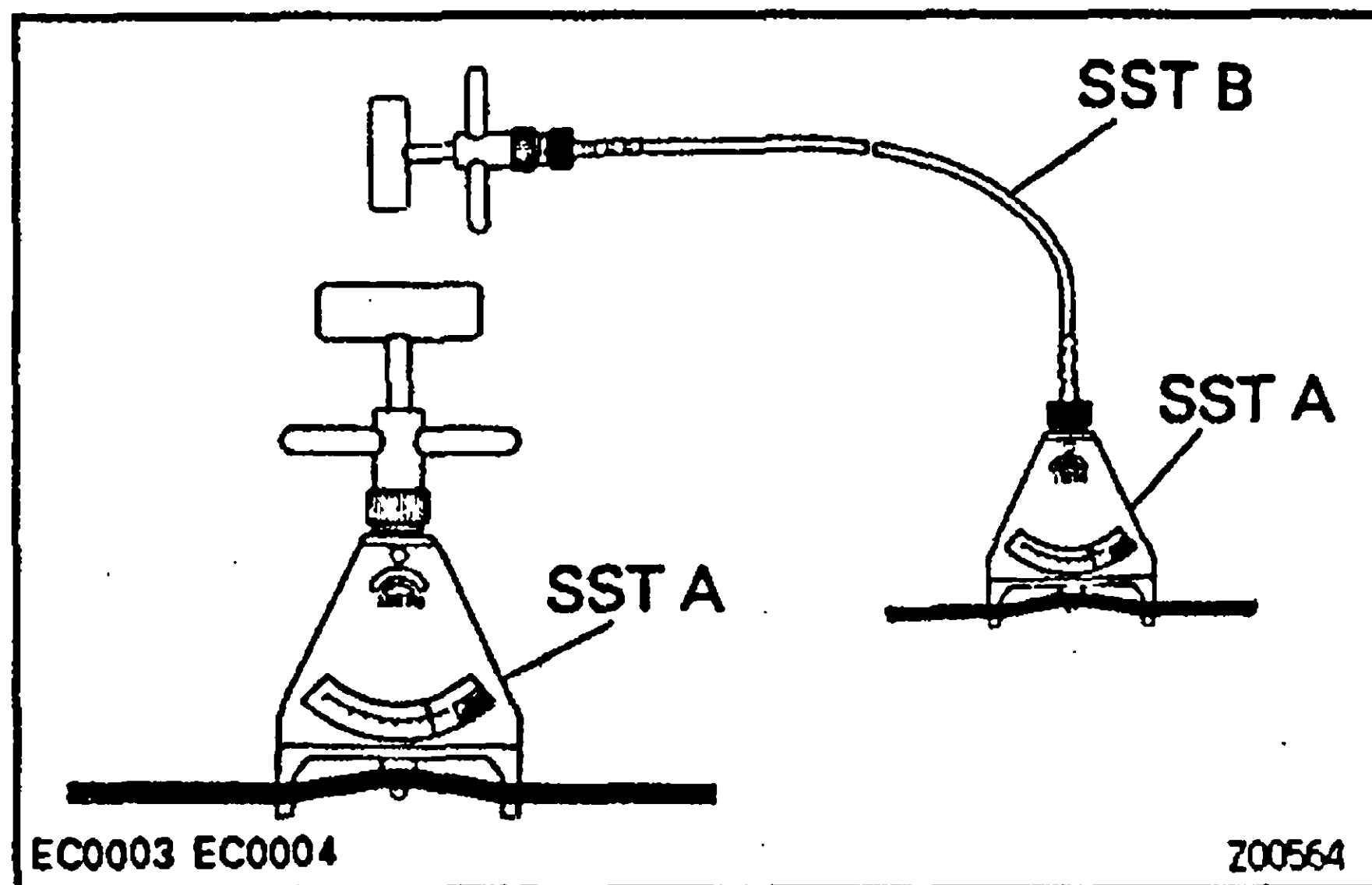


5. INSPECT DRIVE BELT

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

HINT: Cracks on the ribbed side of the belt are considered acceptable.

If the belt has chunks missing from the ribs, it should be replaced.



- (b) Using a belt tension gauge, check the drive belt tension.

Drive belt tension:

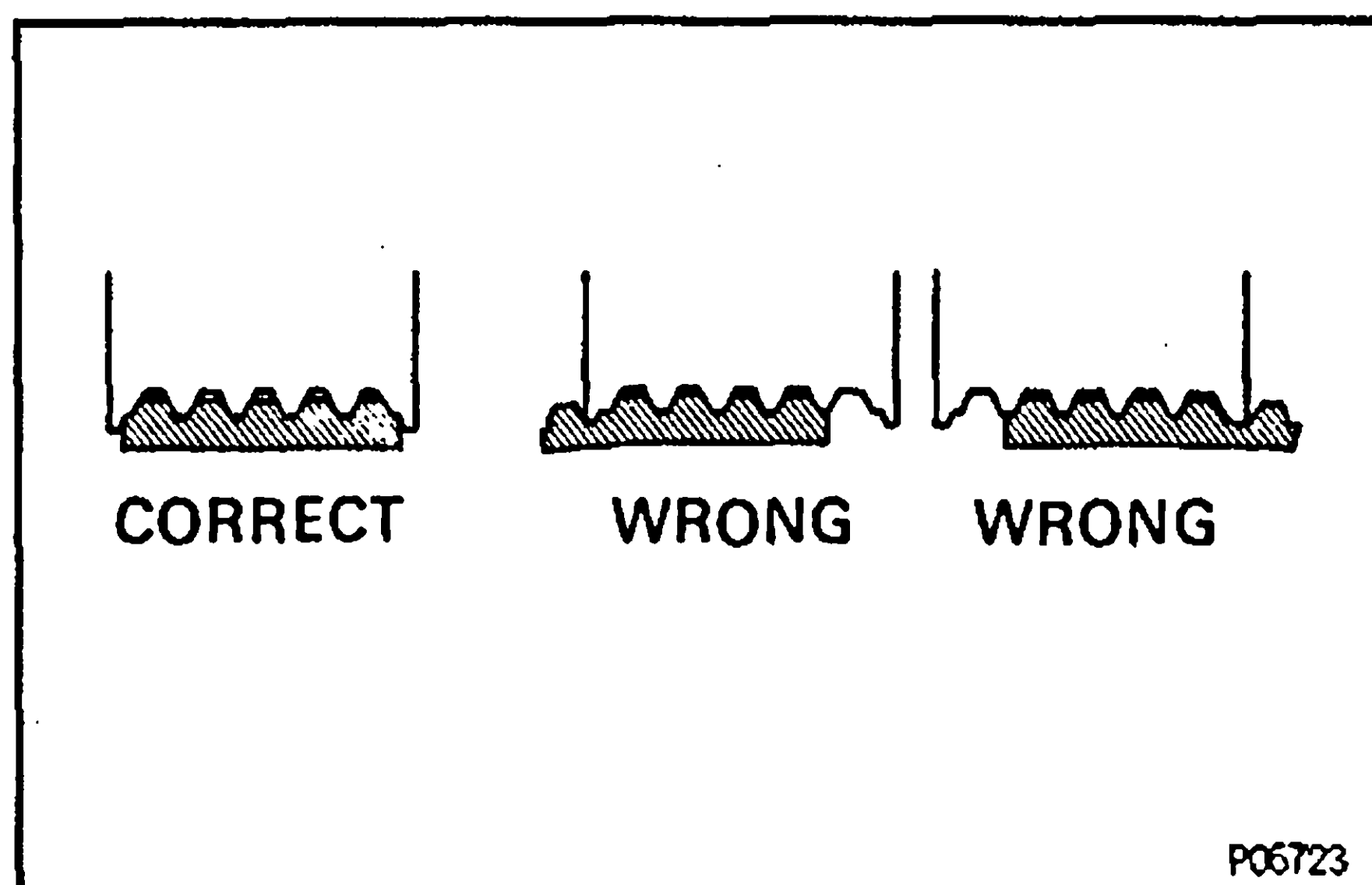
New belt

55—65 kgf

Used belt

25—40 kgf

If necessary, adjust the drive belt tension.



HINT:

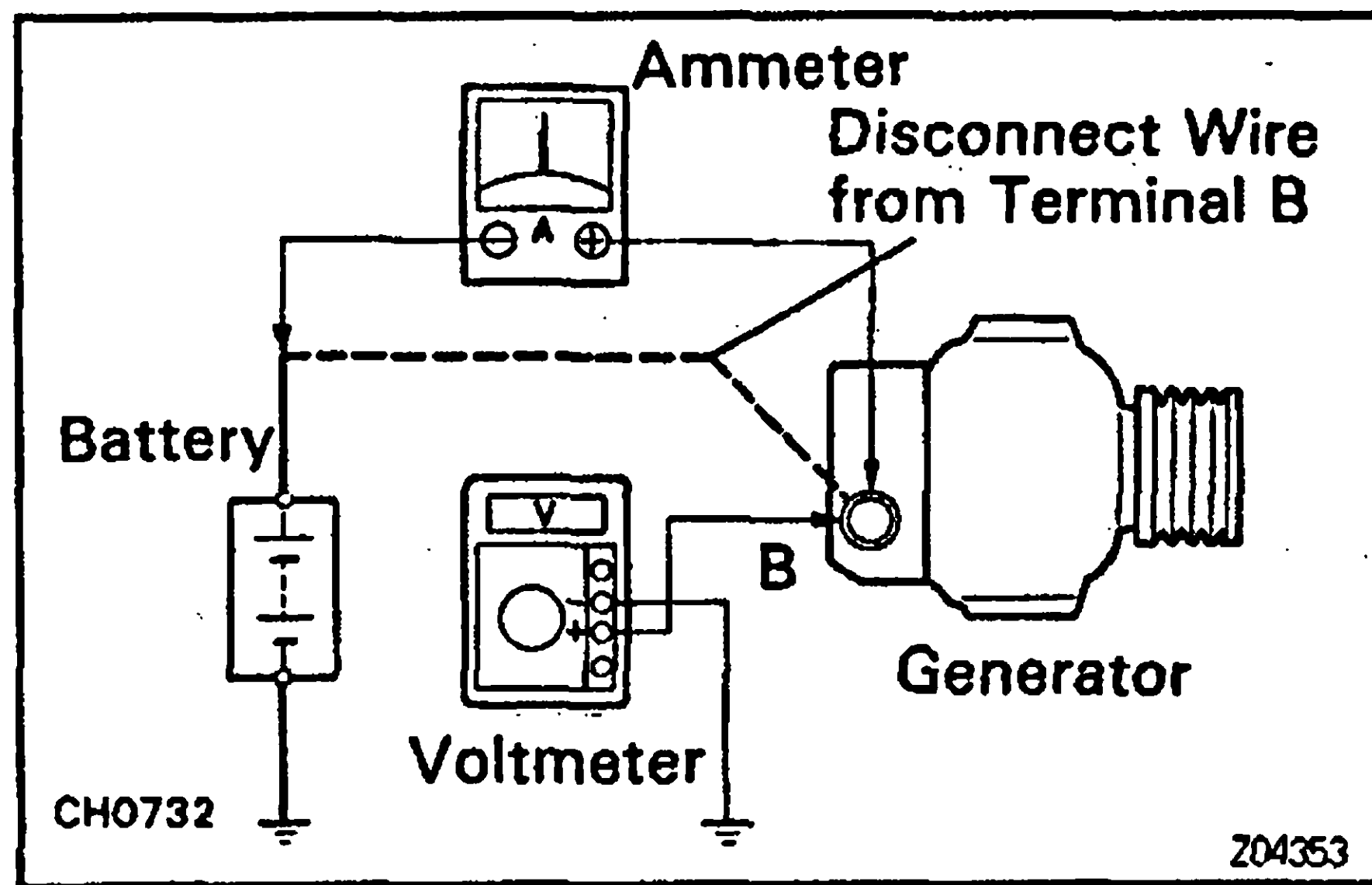
- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing the drive belt, check that it fits properly in the ribbed grooves. Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the crank pulley.
- After installing a new belt, run the engine for approx. 5 minutes and then recheck the 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 according to the 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 the wire to the negative (—) terminal of the ammeter.
- Connect the test lead from the positive (+) terminal 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 idling to 2,000 rpm, check the reading on the ammeter and voltmeter.

Standard amperage:

10 A or less

Standard voltage:

At 25°C (77°F): 13.7 — 14.8 V

At 115°C (239°F): 13.2 — 14.0 V

If the voltage reading is greater than standard voltage, replace the voltage regulator.

If the voltage reading is less than standard voltage, check the voltage regulator and as alternator follows:

- With terminal F grounded, start the engine and check the voltage reading of terminal B.
- If the voltage reading is higher than standard voltage, replace the voltage regulator.
- If the voltage reading is less than standard voltage, repair 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 fan control switch to HI.

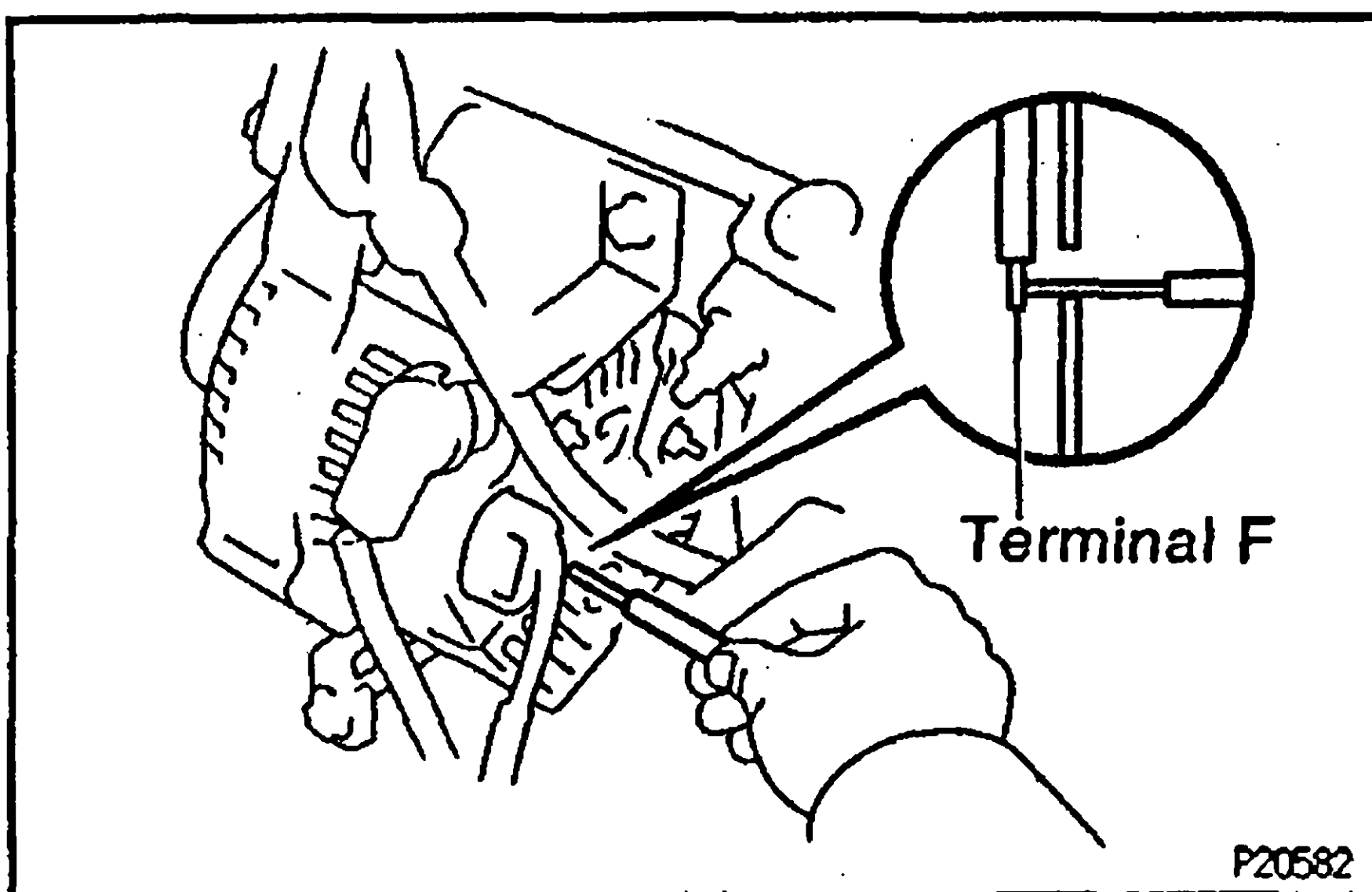
- (b) Check the reading on the ammeter.

Standard amperage:

30 A or more

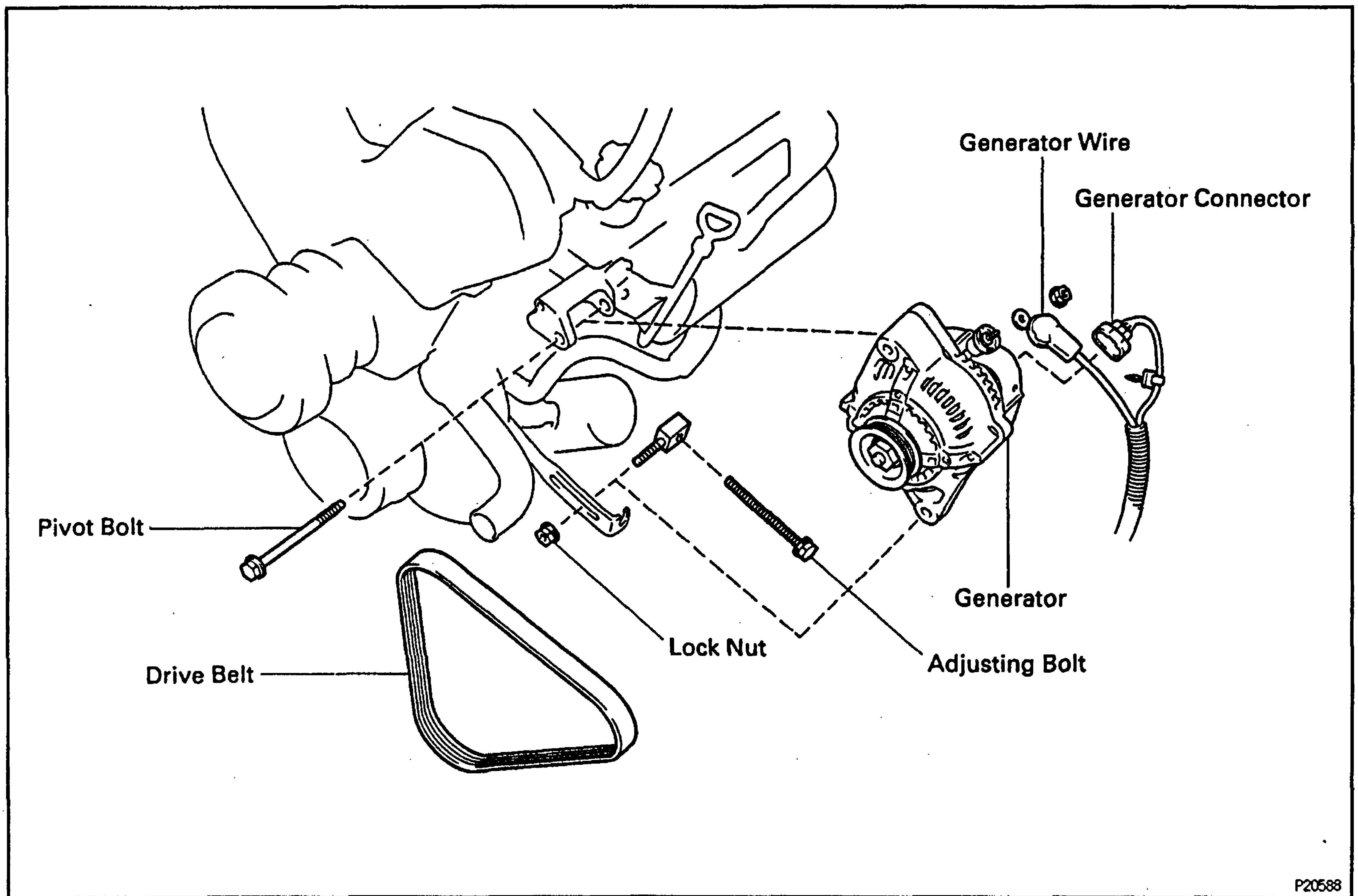
If the ammeter reading is less than standard amperage, repair the alternator.

HINT: If the battery is fully charged, the indication will sometimes be less than standard amperage.

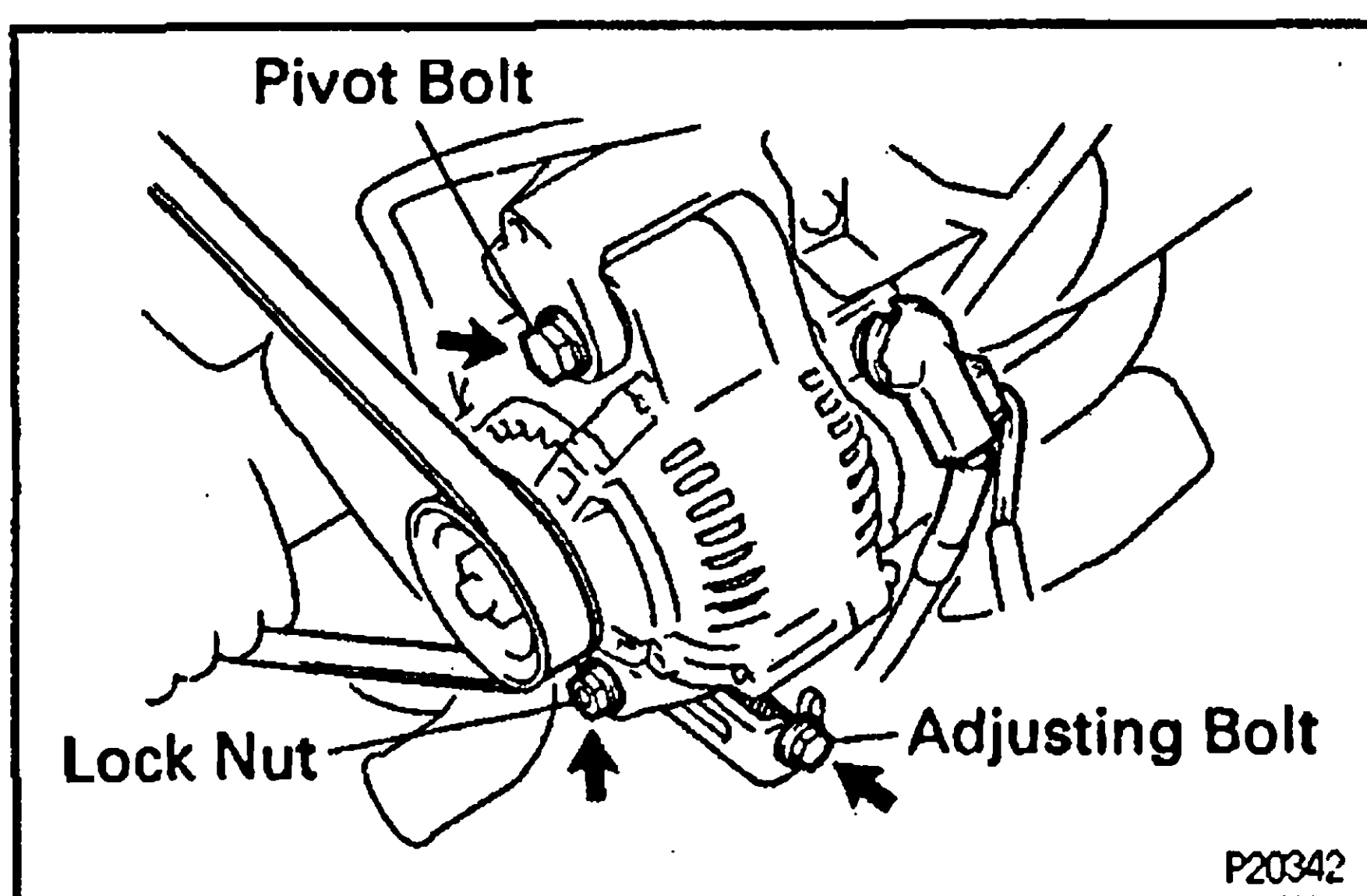


ALTERNATOR COMPONENTS FOR REMOVAL AND INSTALLATION

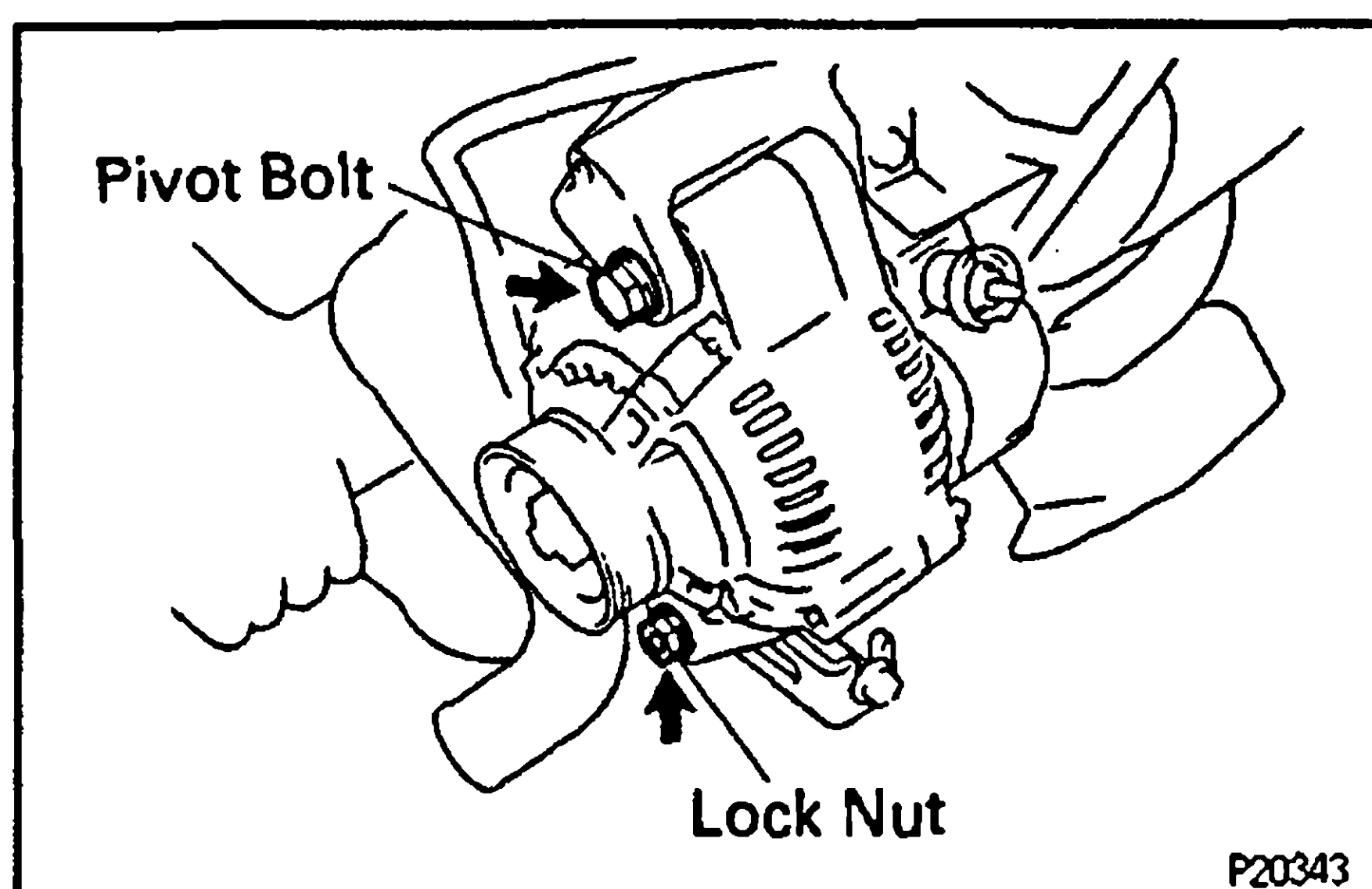
CH011-1F



P20588



P20342



P20343

ALTERNATOR REMOVAL

CH00E-06

1. DISCONNECT WIRING FROM ALTERNATOR

- (a) Disconnect the connector from the alternator.
- (b) Remove the nut and disconnect the wire from the alternator.

2. REMOVE ALTERNATOR DRIVE BELT

- (a) Loosen the adjust lock nut, adjusting bolt and pivot bolt.
- (b) Remove the drive belt.

3. REMOVE ALTERNATOR

- (a) Remove the pivot bolt and adjusting lock nut.
- (b) Remove the alternator.

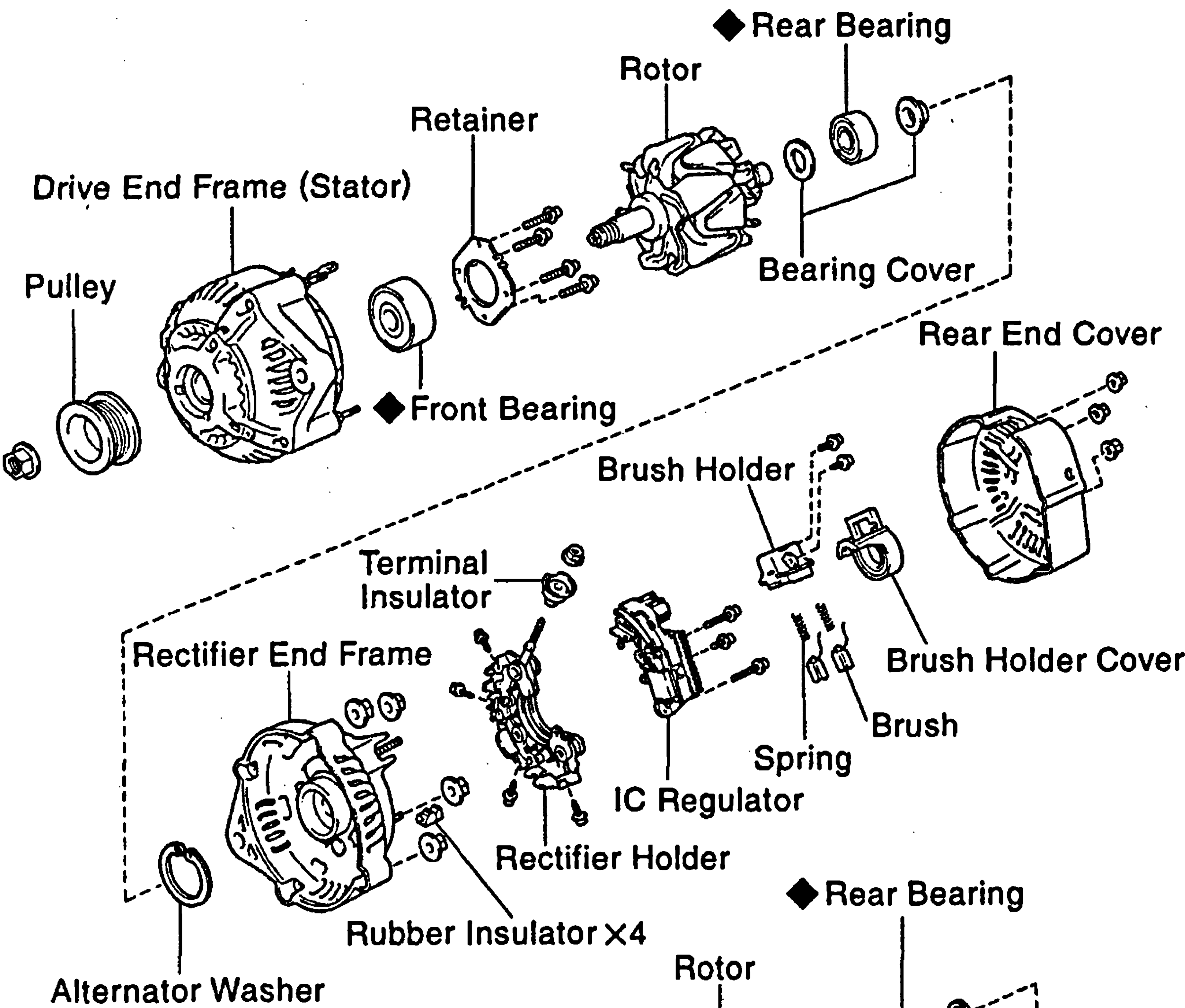
Torque:

Pivot bolt: 51 N·m (520kgf·cm, 38 ft·lbf)

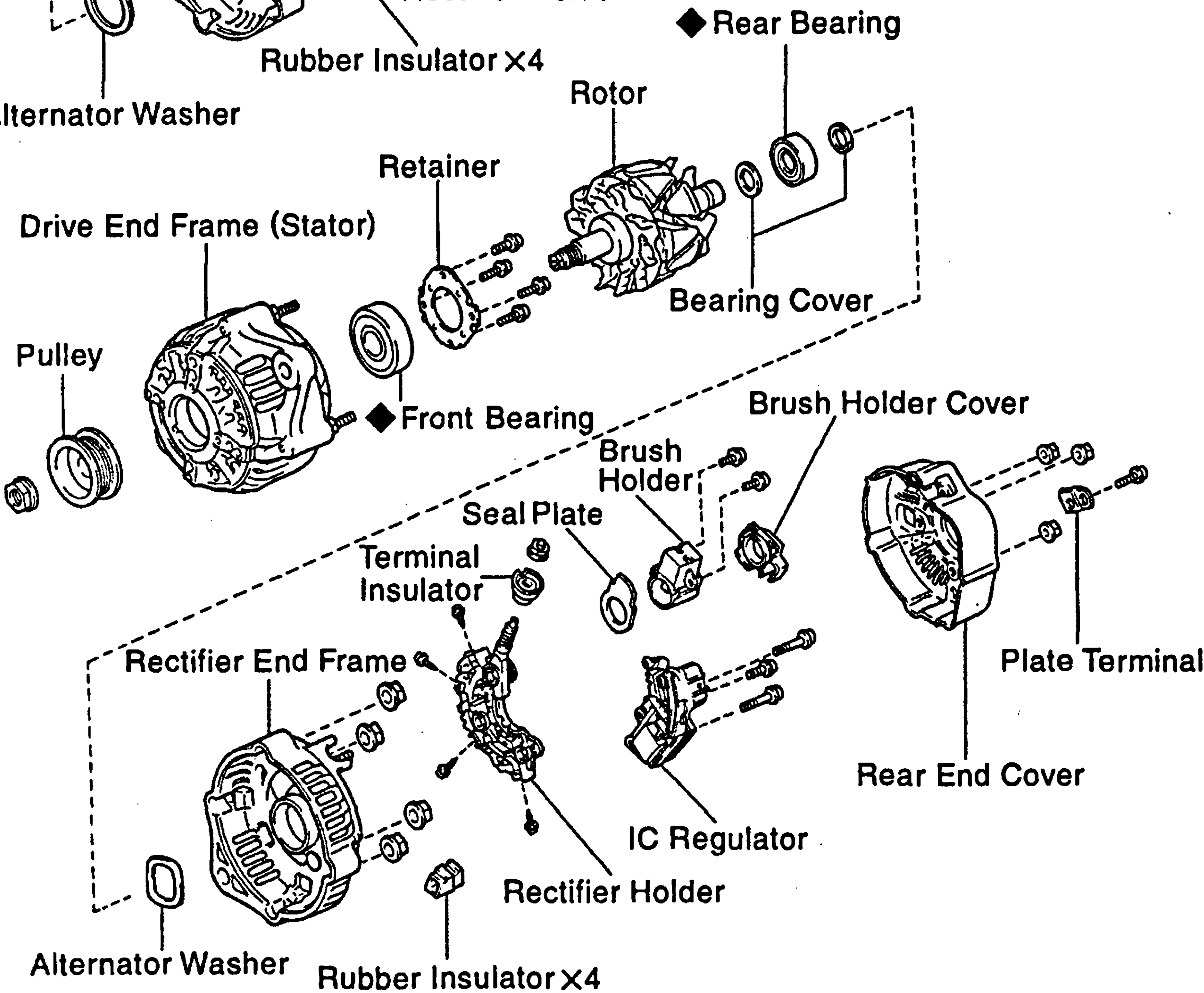
Lock Nut: 18.5 N·m (185kgf·cm, 14 ft·lbf)

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

70A

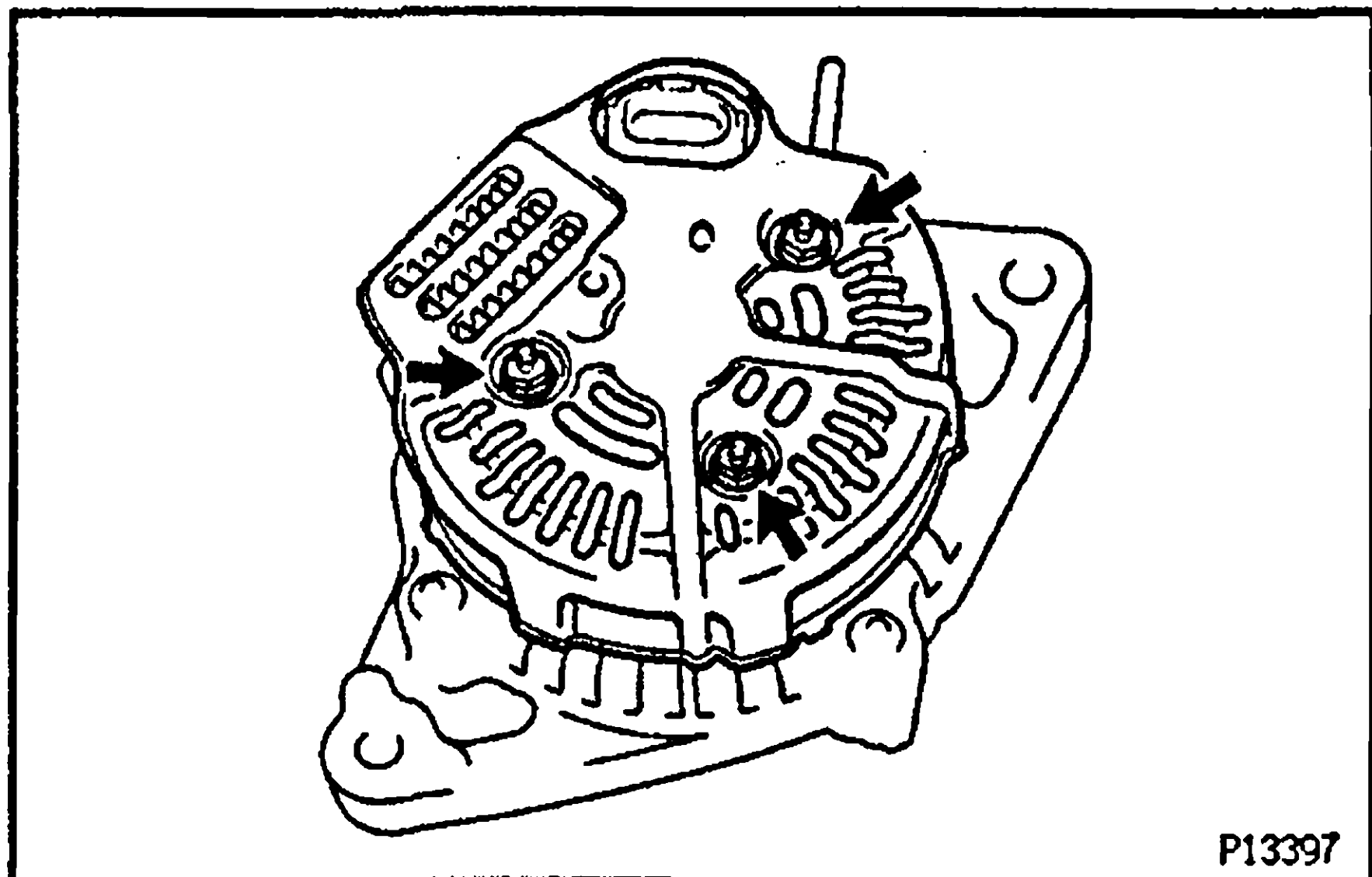


80A

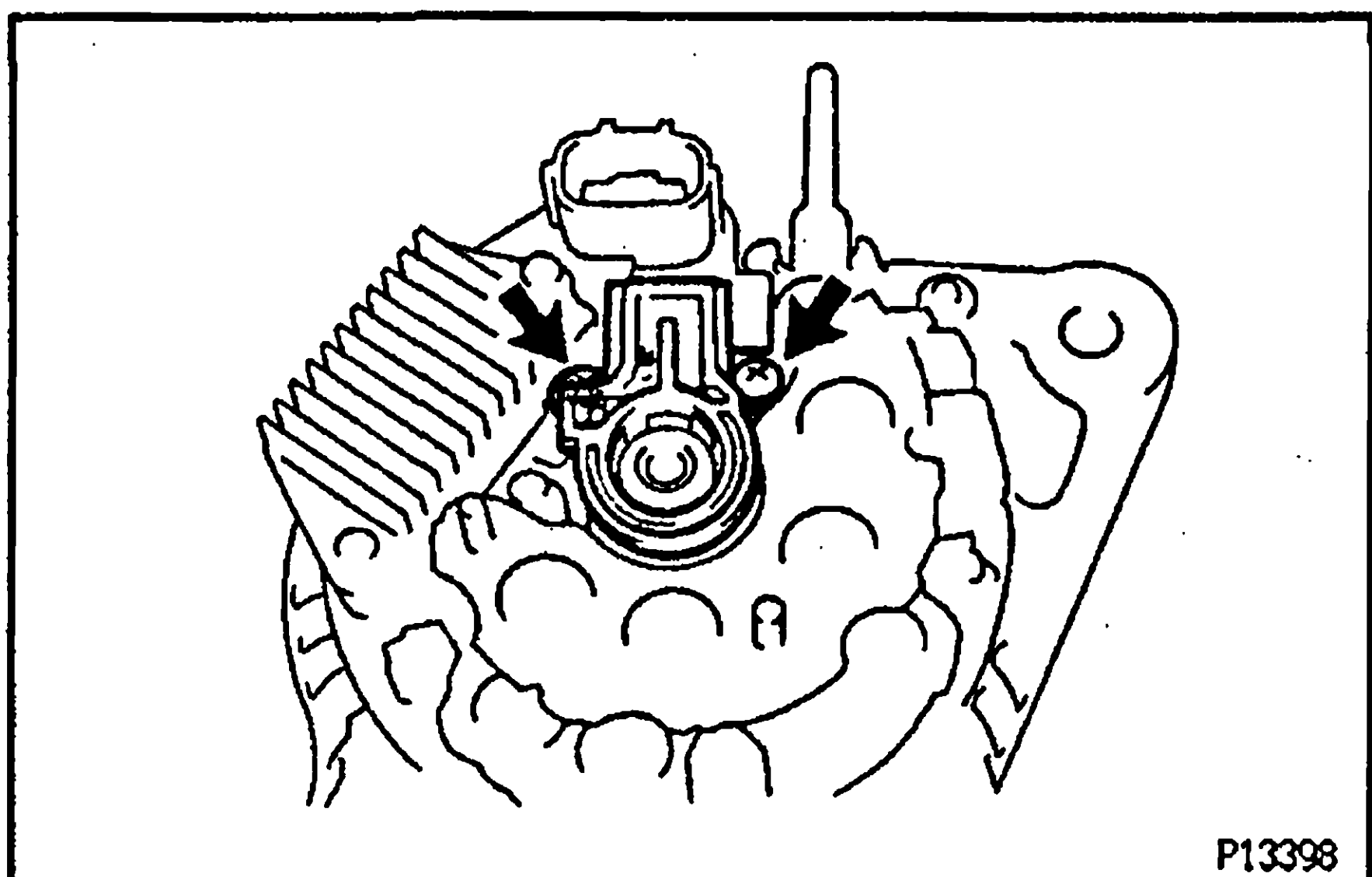


S05045
S05046

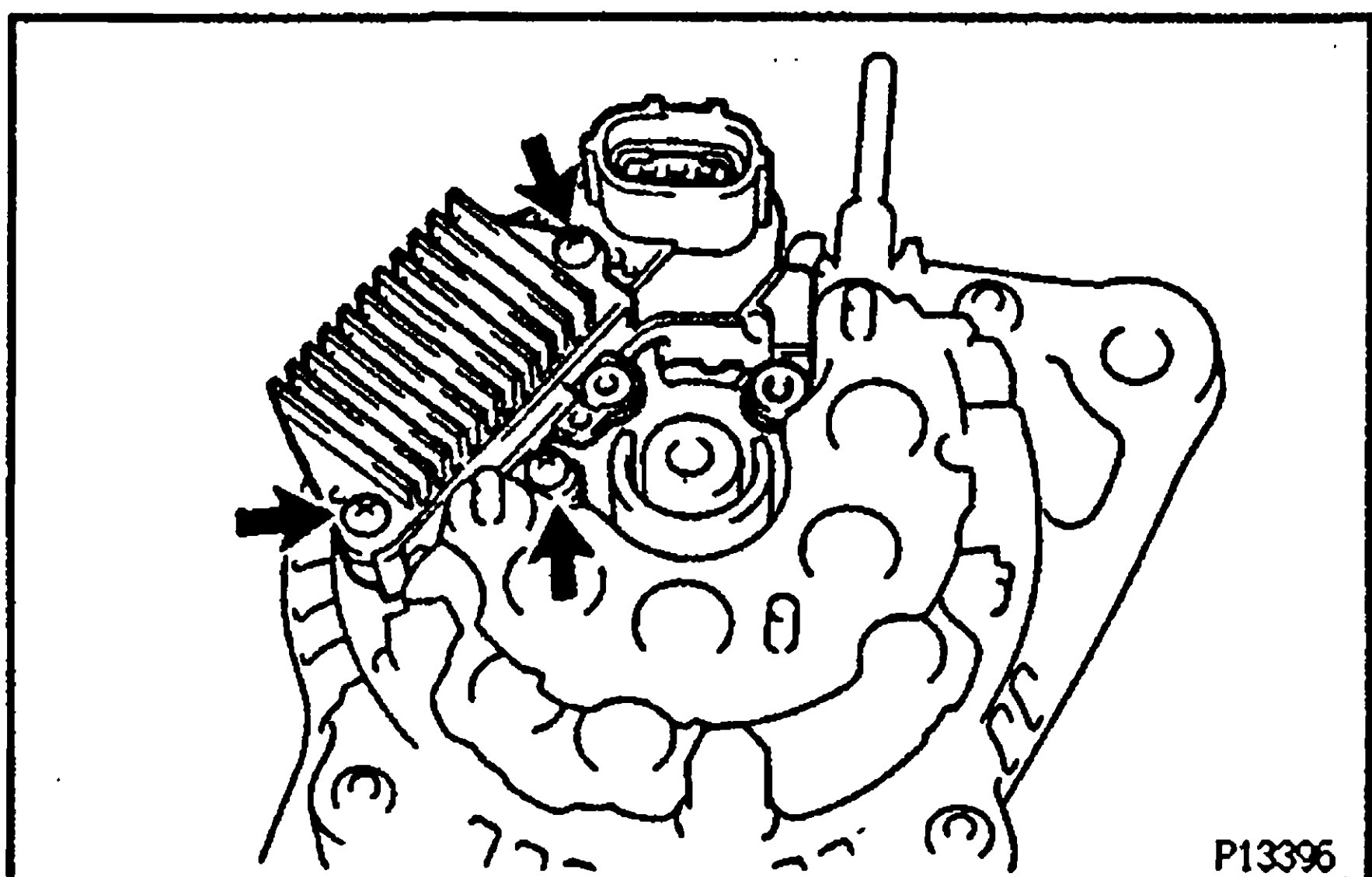
◆ Non-reusable part

ALTERNATOR DISASSEMBLY**1. REMOVE REAR END COVER**

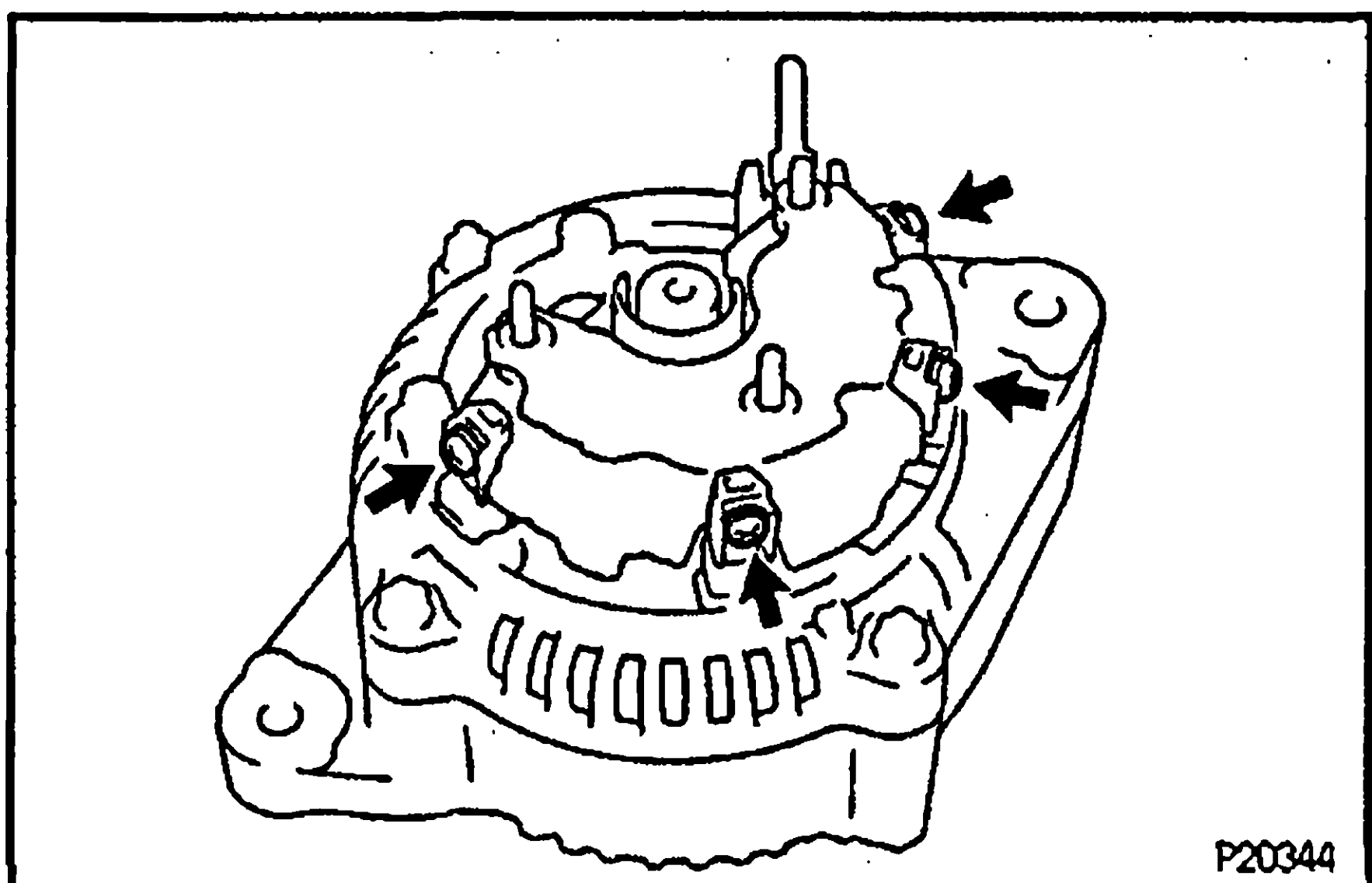
- (a) Remove the nut and terminal insulator.
- (b) 70 A:
Remove the 3 nuts and end cover.
80 A:
Remove the bolt, 3 nuts, plate terminal and end cover.

**2. 70 A:****REMOVE BRUSH HOLDER**

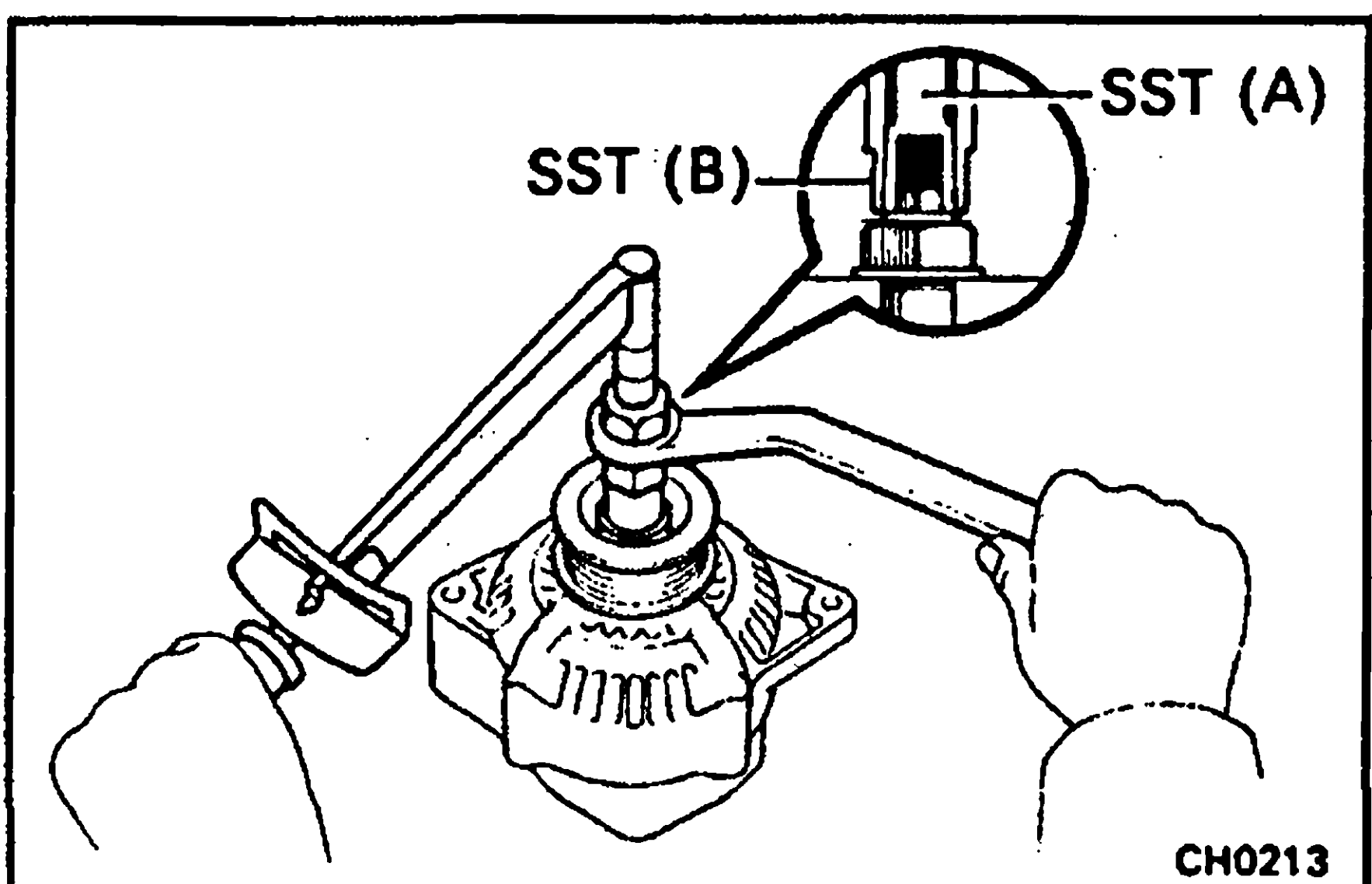
- (a) Remove the 2 screws, brush holder and cover.
- (b) Remove the brush holder cover from the brush holder.

**3. REMOVE IC REGULATOR**

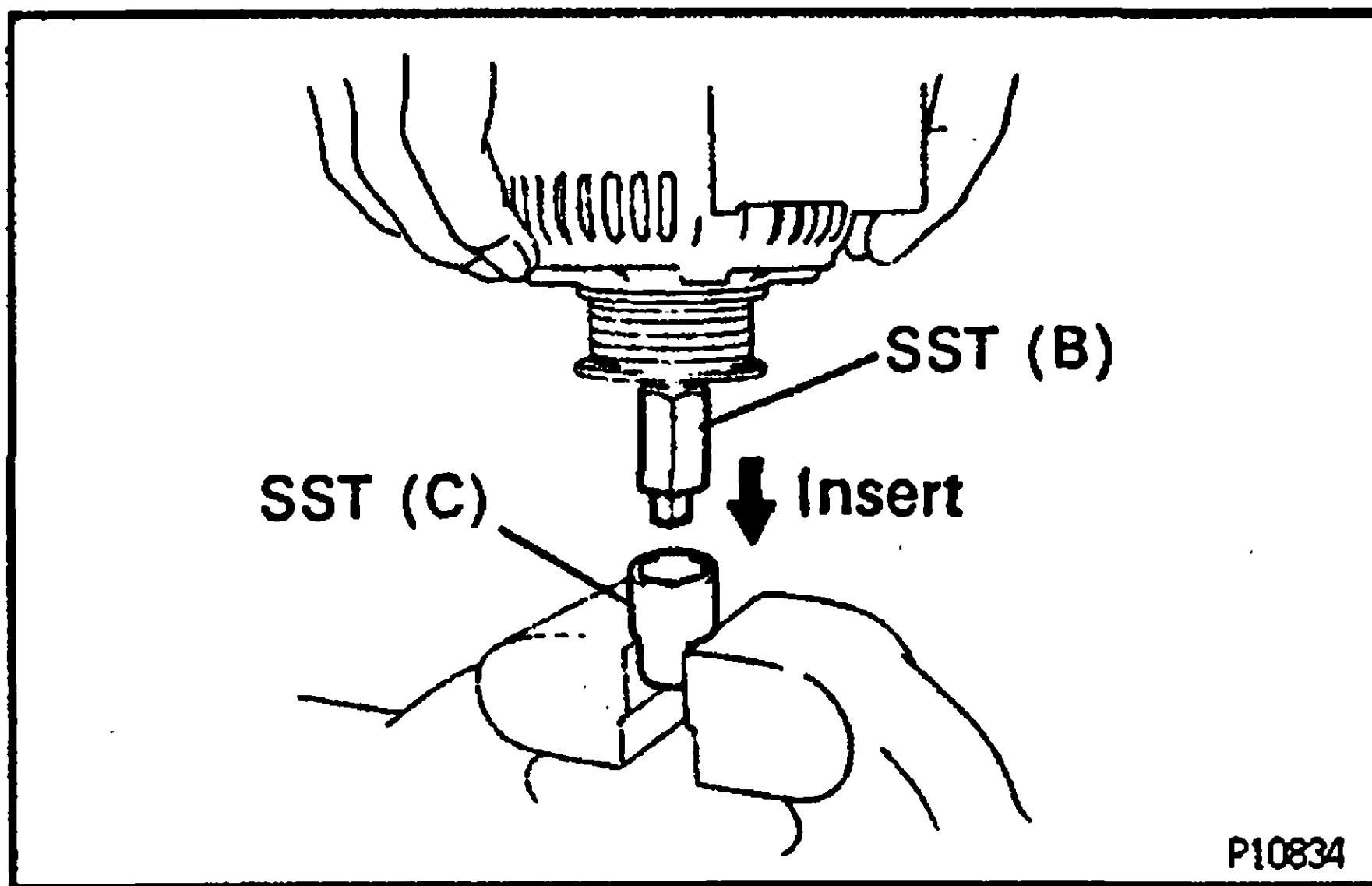
Remove the 3 screws and IC regulator.

**4. REMOVE RECTIFIER HOLDER**

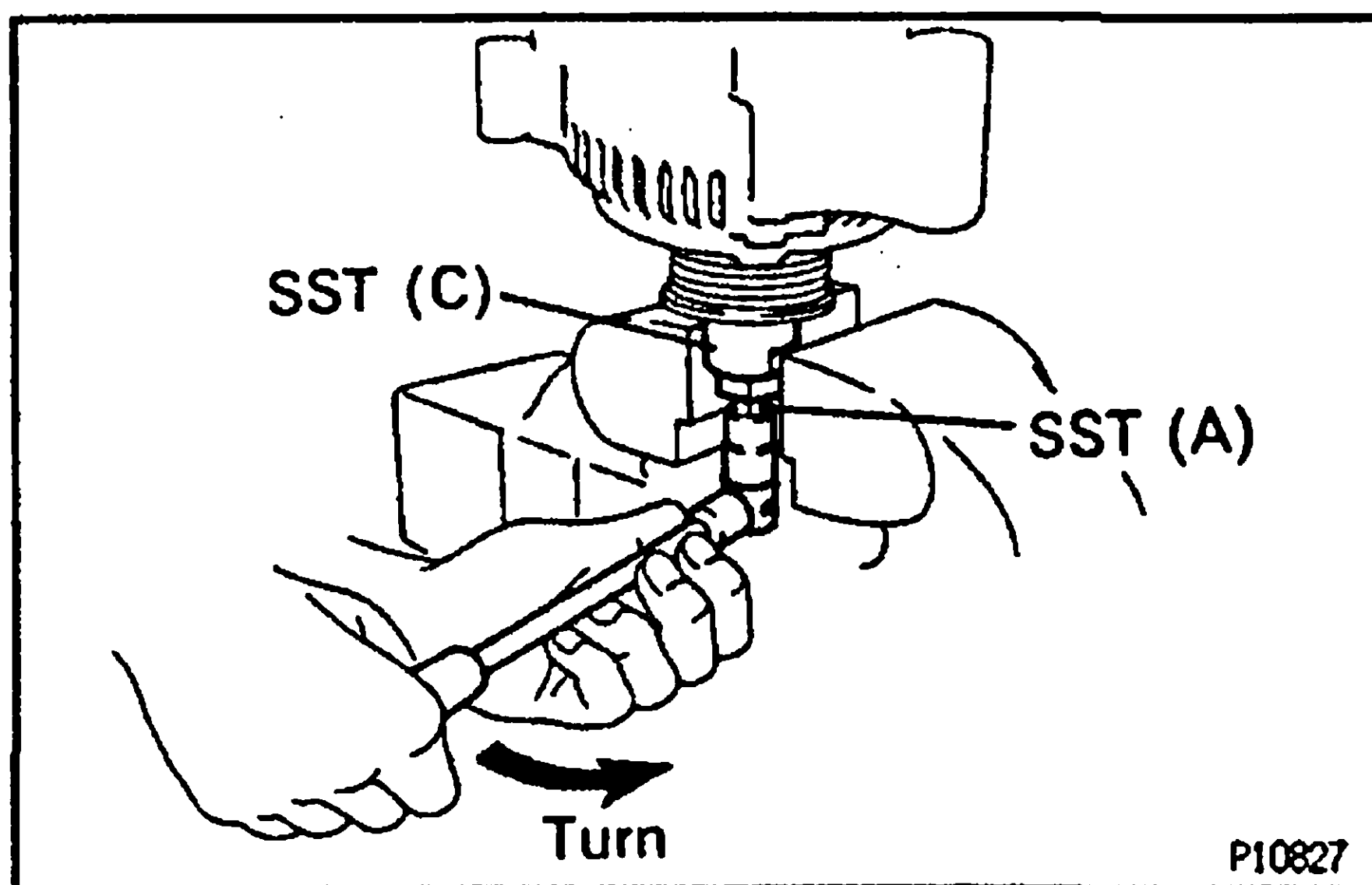
- (a) Remove the 4 screws and rectifier holder.
- (b) Remove the 4 rubber insulators.

**5. REMOVE PULLEY**

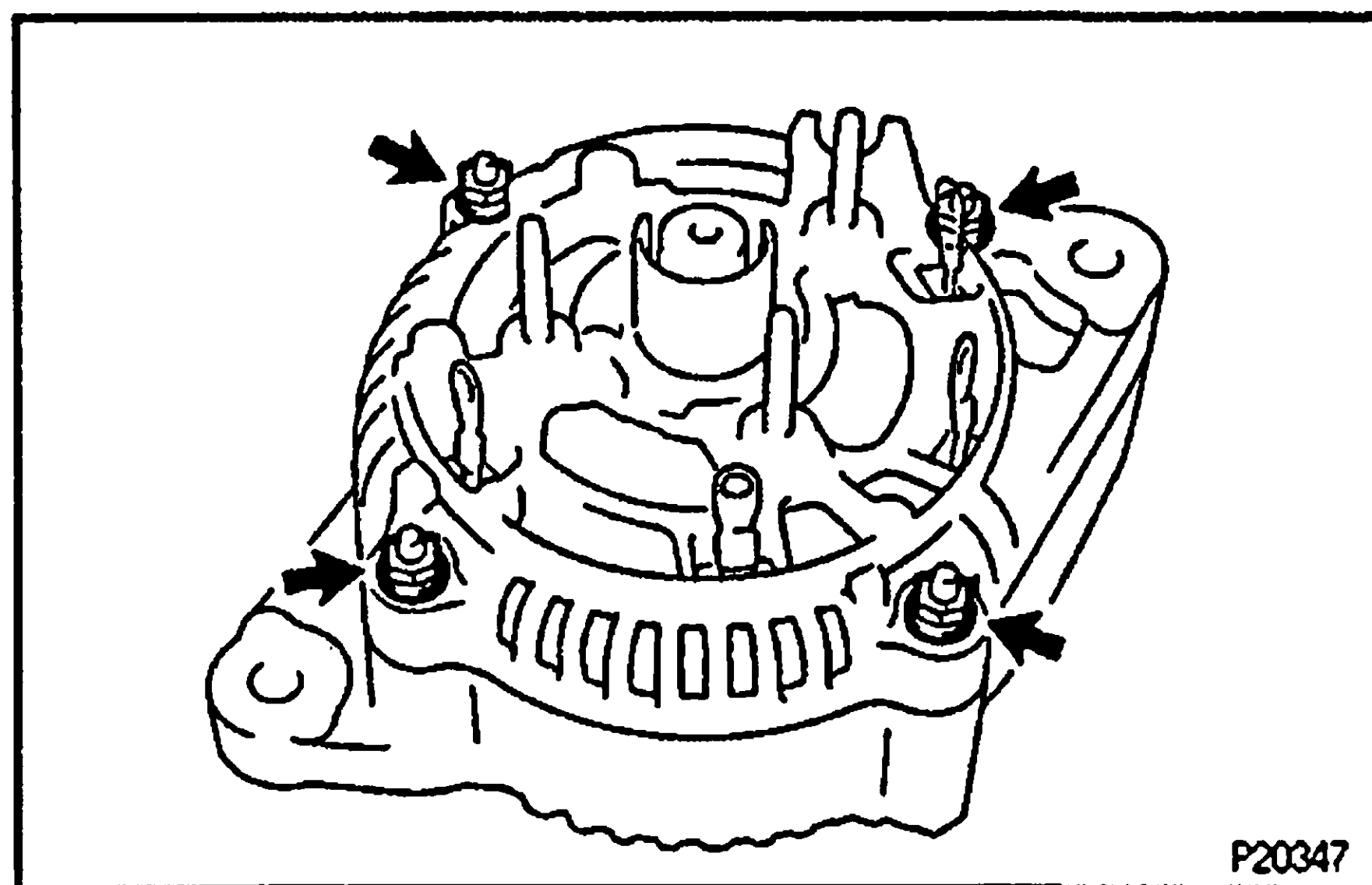
- (a) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.
SST 09820-63010
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)
- (b) Check that SST (A) is secured to the rotor shaft.



- (c) Mount SST (C) in a vise.
- (d) Insert SST (B) into SST (C), and attach the pulley nut to SST (C).

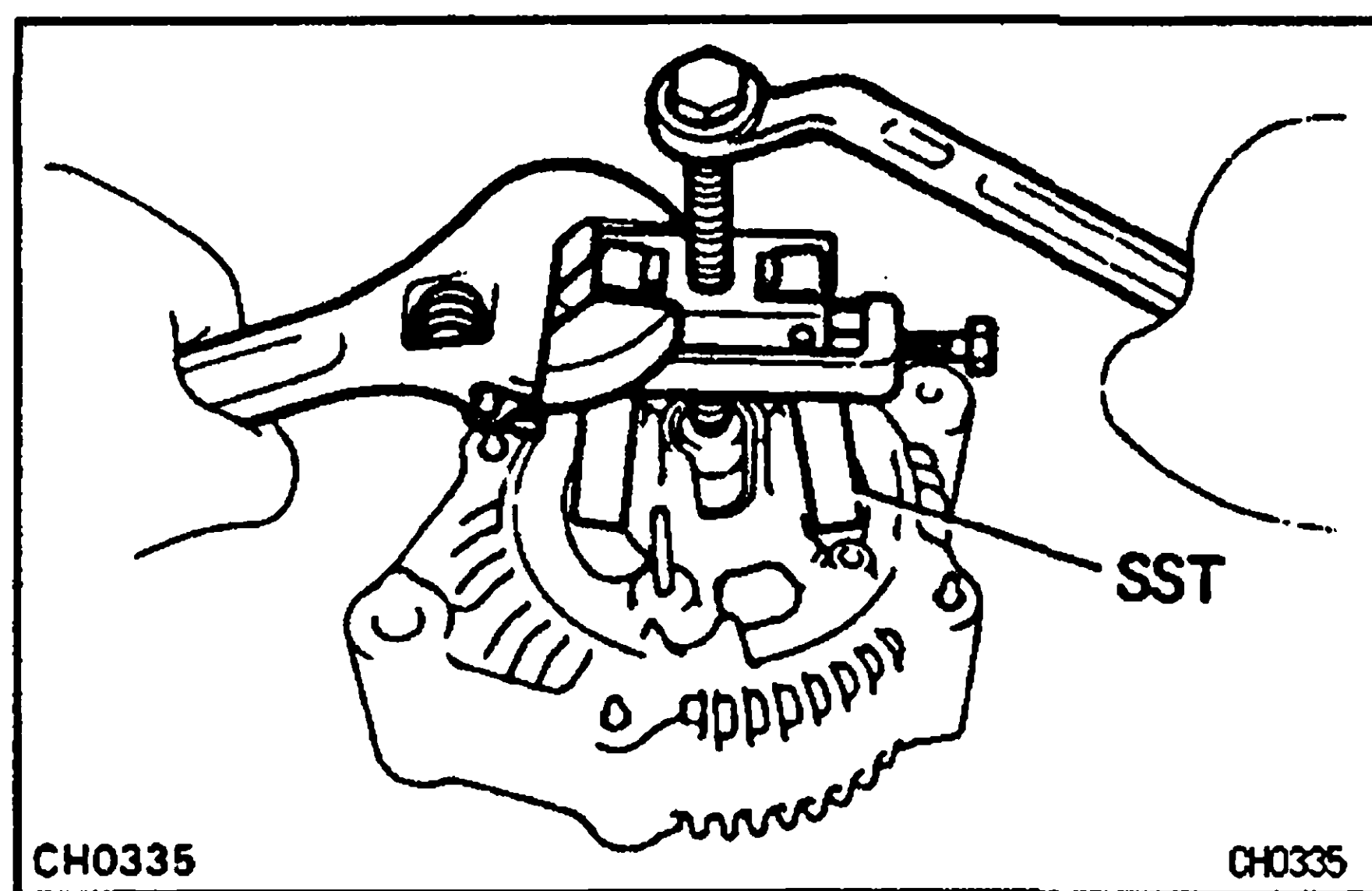


- (e) To loosen the pulley nut, turn SST (A) in the direction shown in the illustration.
NOTICE: To prevent damage to the rotor shaft, do not loosen the pulley nut more than one-half of a turn.
- (f) Remove the alternator from SST (C).
- (g) Turn SST (B), and remove SST (A and B).
- (h) Remove the pulley nut and pulley.

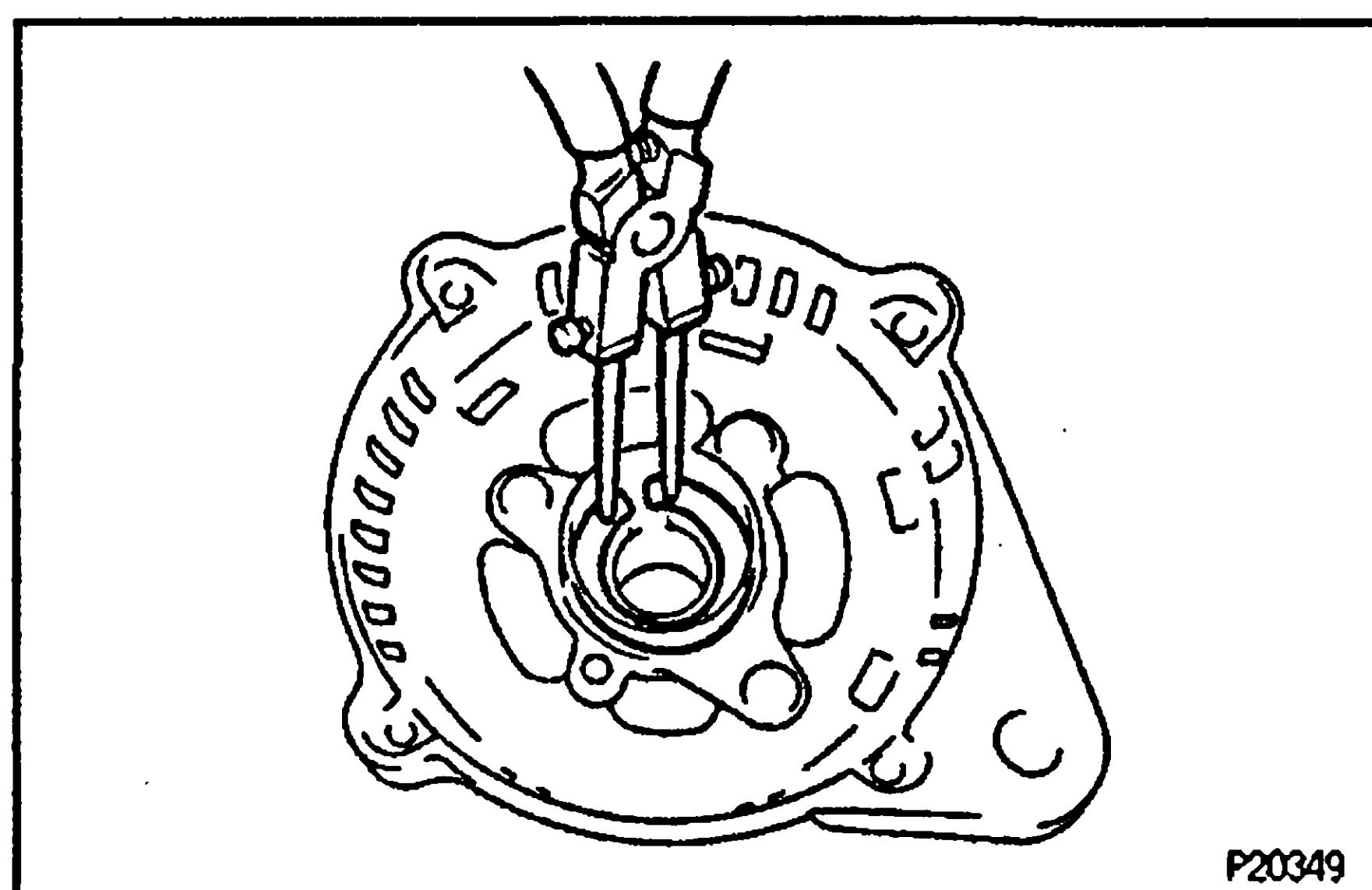


6. REMOVE RECTIFIER END FRAME

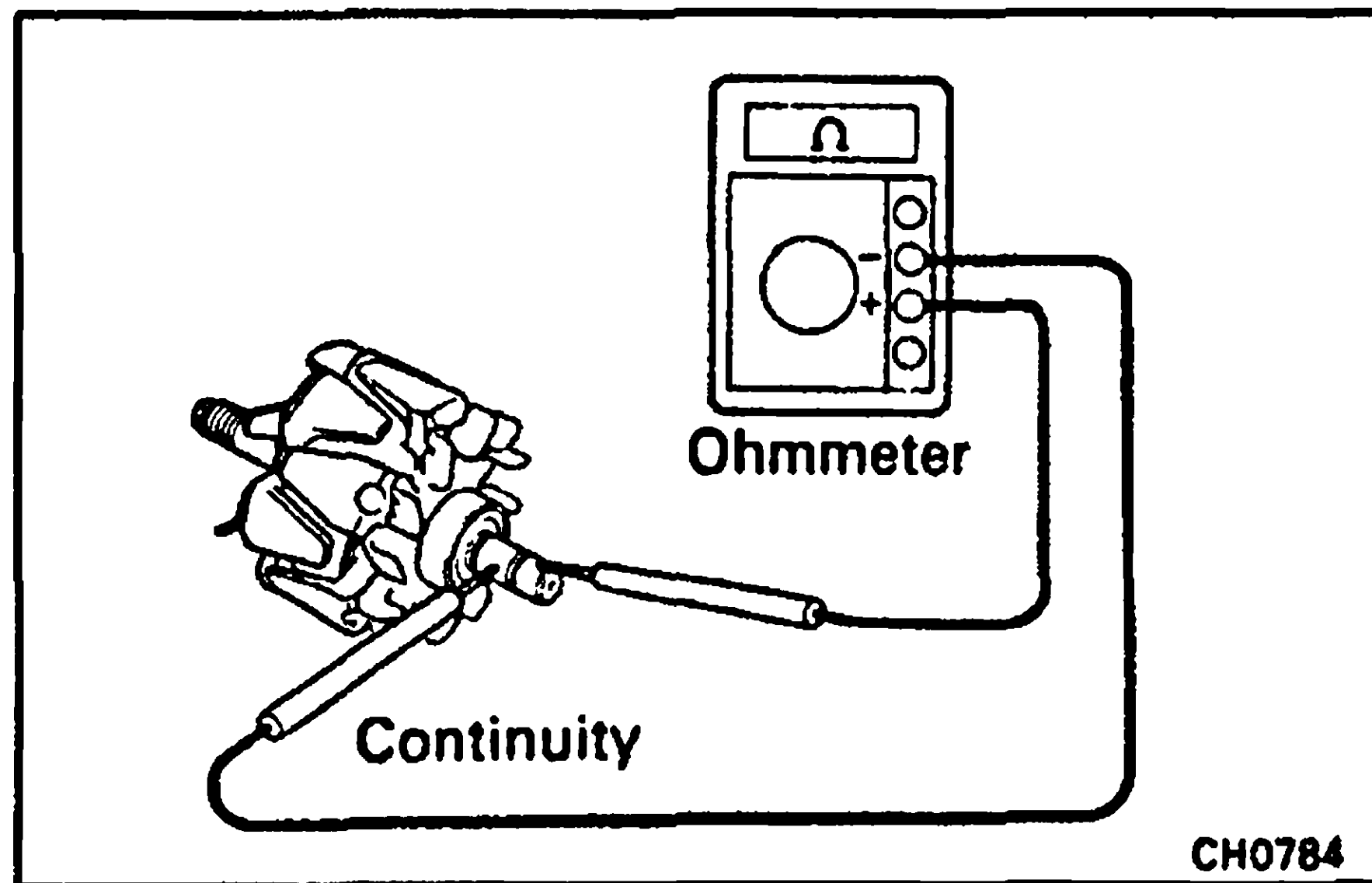
- (a) Remove the 4 nuts.



- (b) Using SST, remove the rectifier end frame.
SST 09286-46011



- (c) **70 A:**
Using snap ring pliers, remove the alternator washer from the rectifier end frame.
 - 80 A:**
Remove the alternator washer from the rotor.
- ## 7. REMOVE ROTOR FROM DRIVE END FRAME



ALTERNATOR INSPECTION AND REPAIR

CH08B-01

Rotor

1. INSPECT ROTOR FOR OPEN CIRCUIT

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

Standard resistance:

70 A: 2.8 — 3.0 Ω

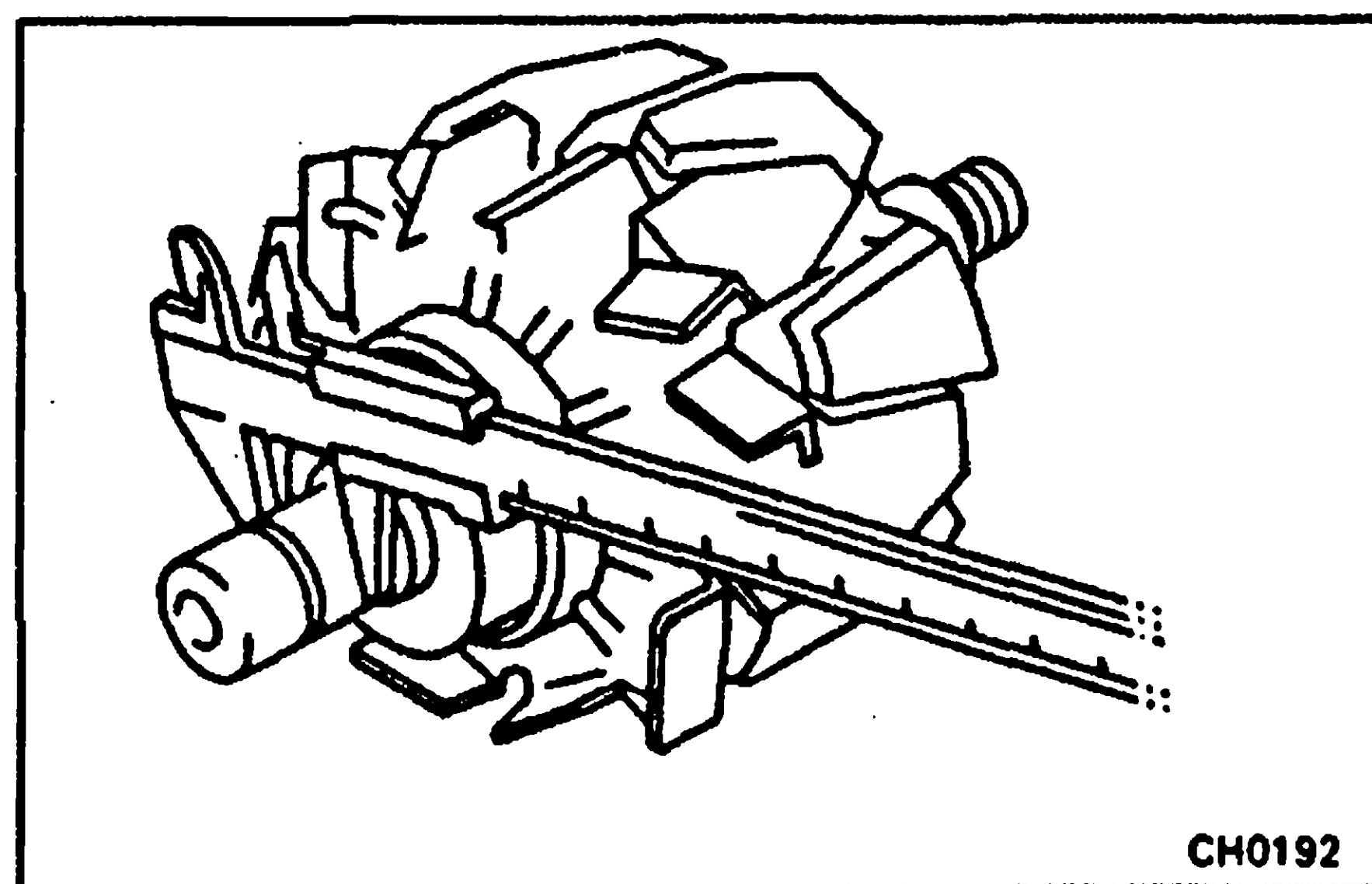
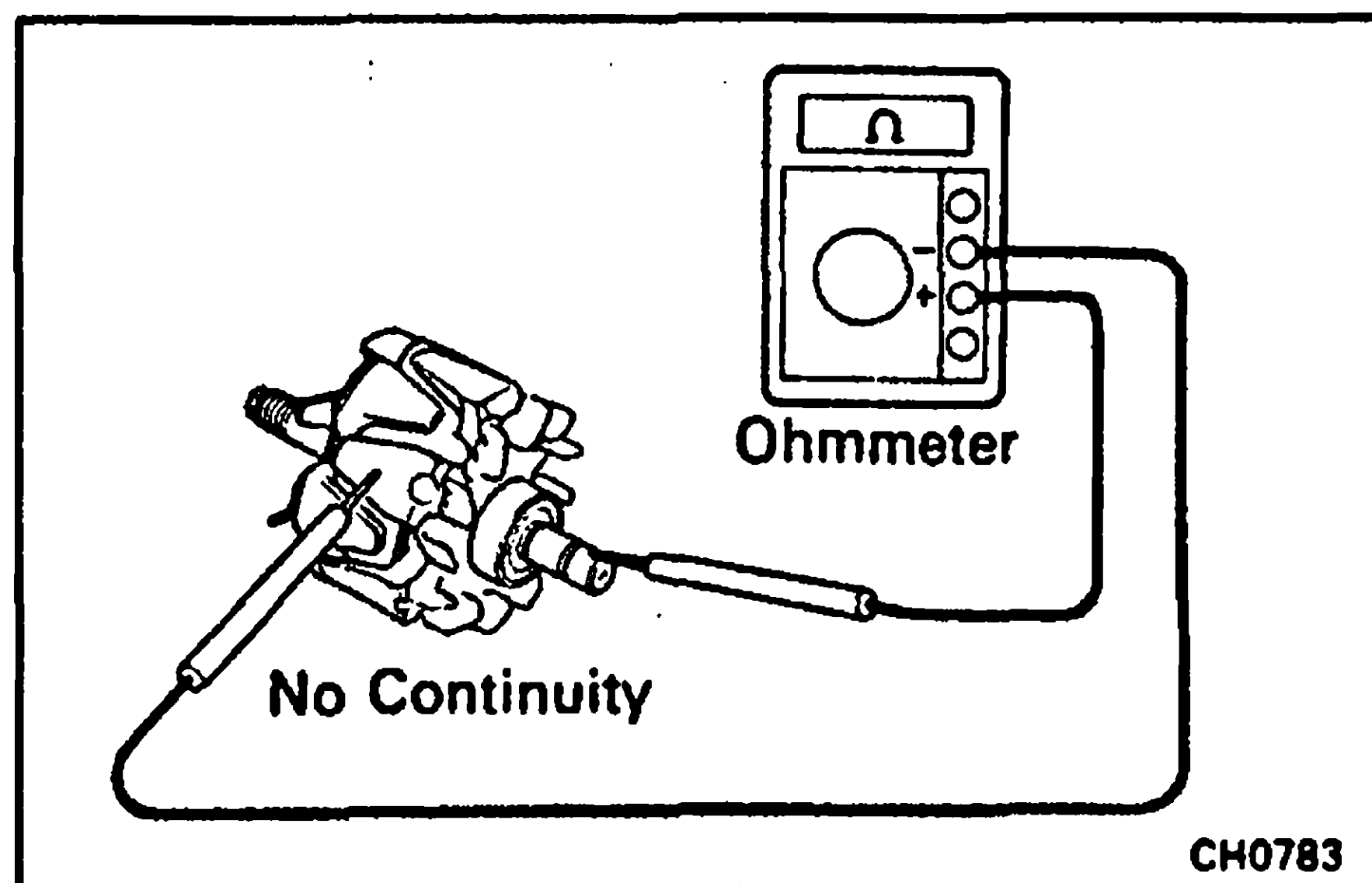
80 A: 2.1 — 2.5 Ω

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 vernier calipers, measure the slip ring diameters.

Standard diameter:

14.2 — 14.4 mm (0.559 — 0.567 in.)

Minimum diameter:

12.8 mm (0.504 in.)

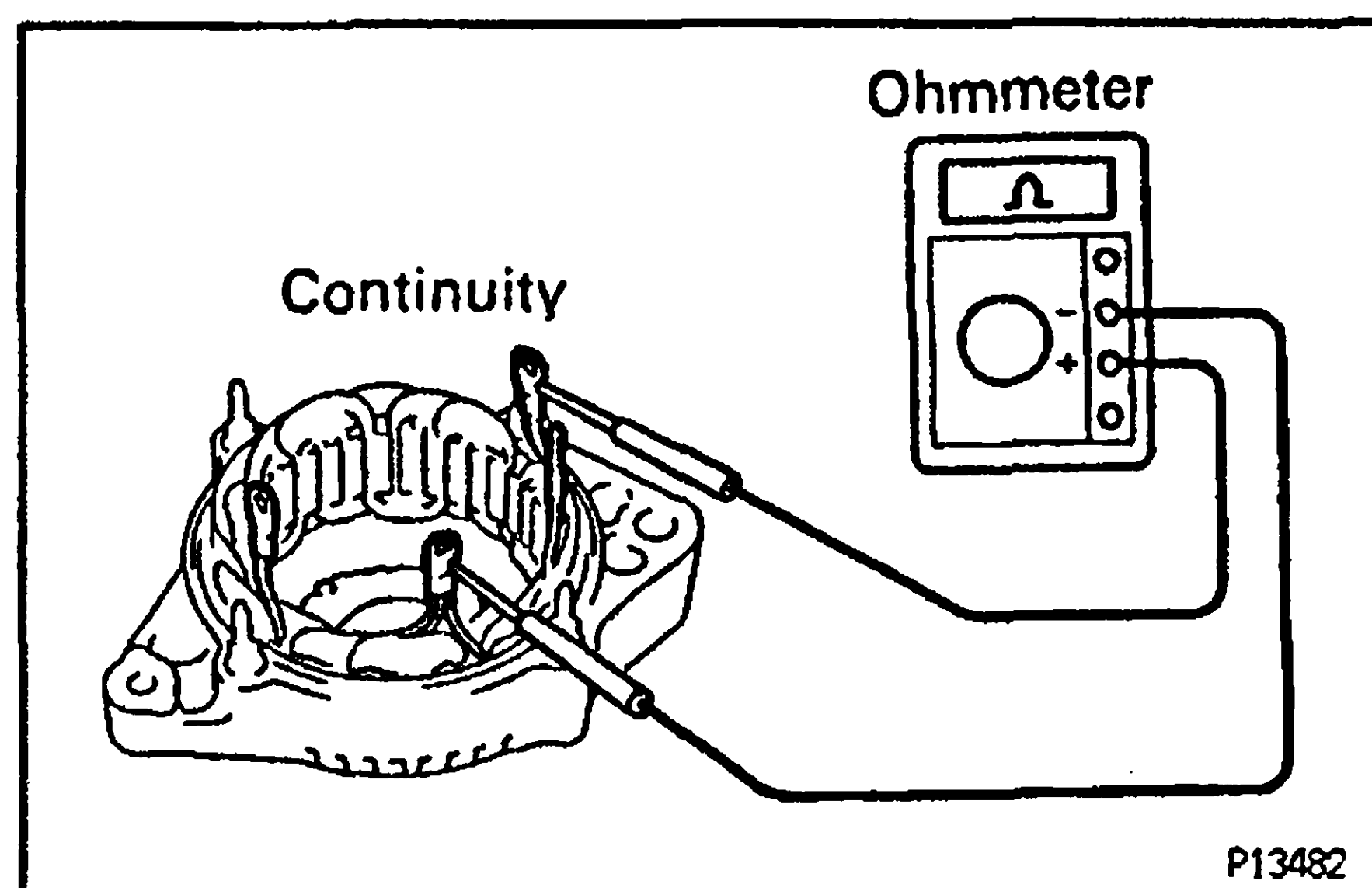
If the diameter is less than minimum, replace the rotor.

Stator (Drive End Frame)

1. INSPECT STATOR FOR OPEN CIRCUIT

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

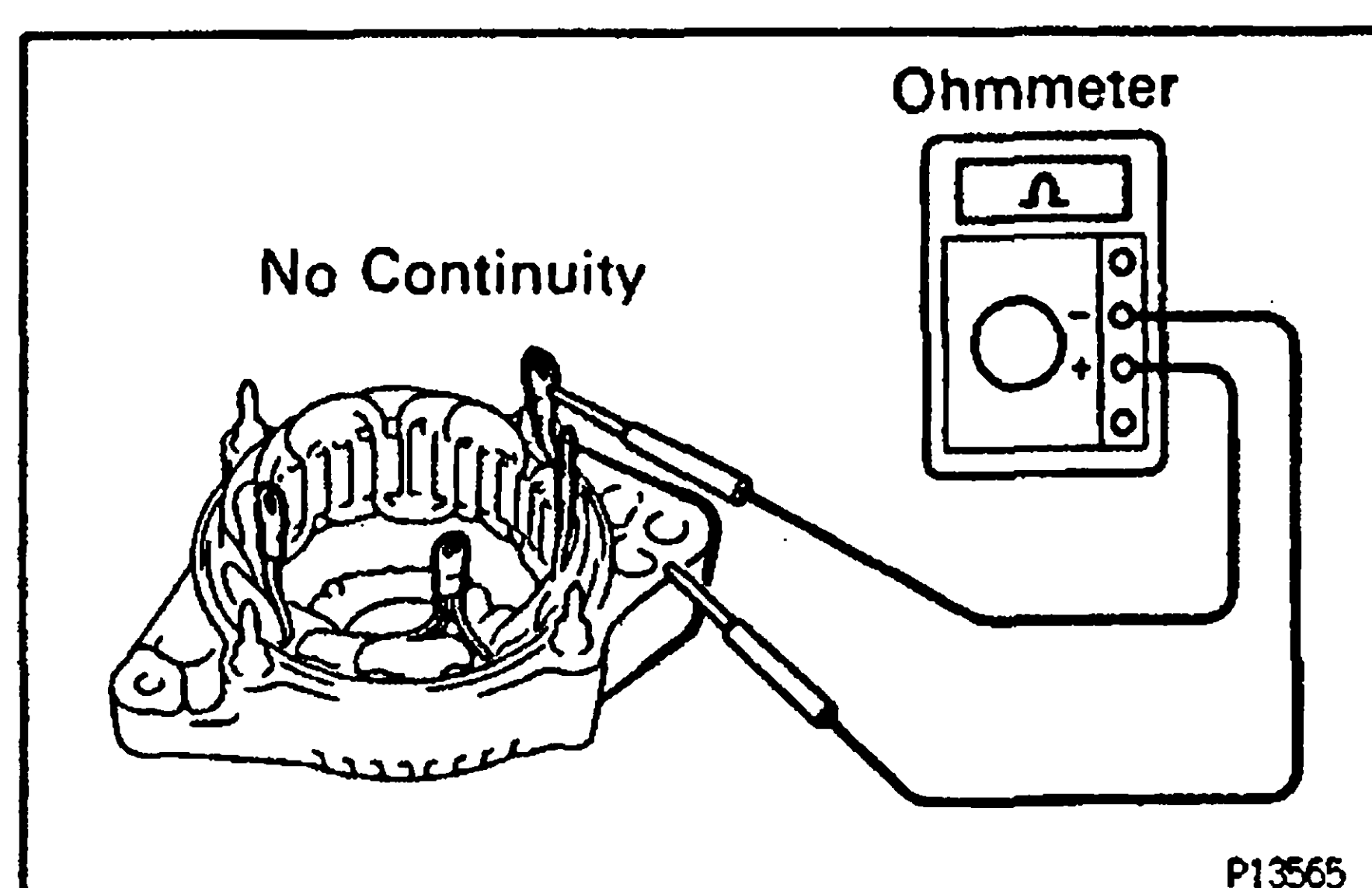
If there is no continuity, replace the drive end frame assembly.



2. INSPECT STATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil leads 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.

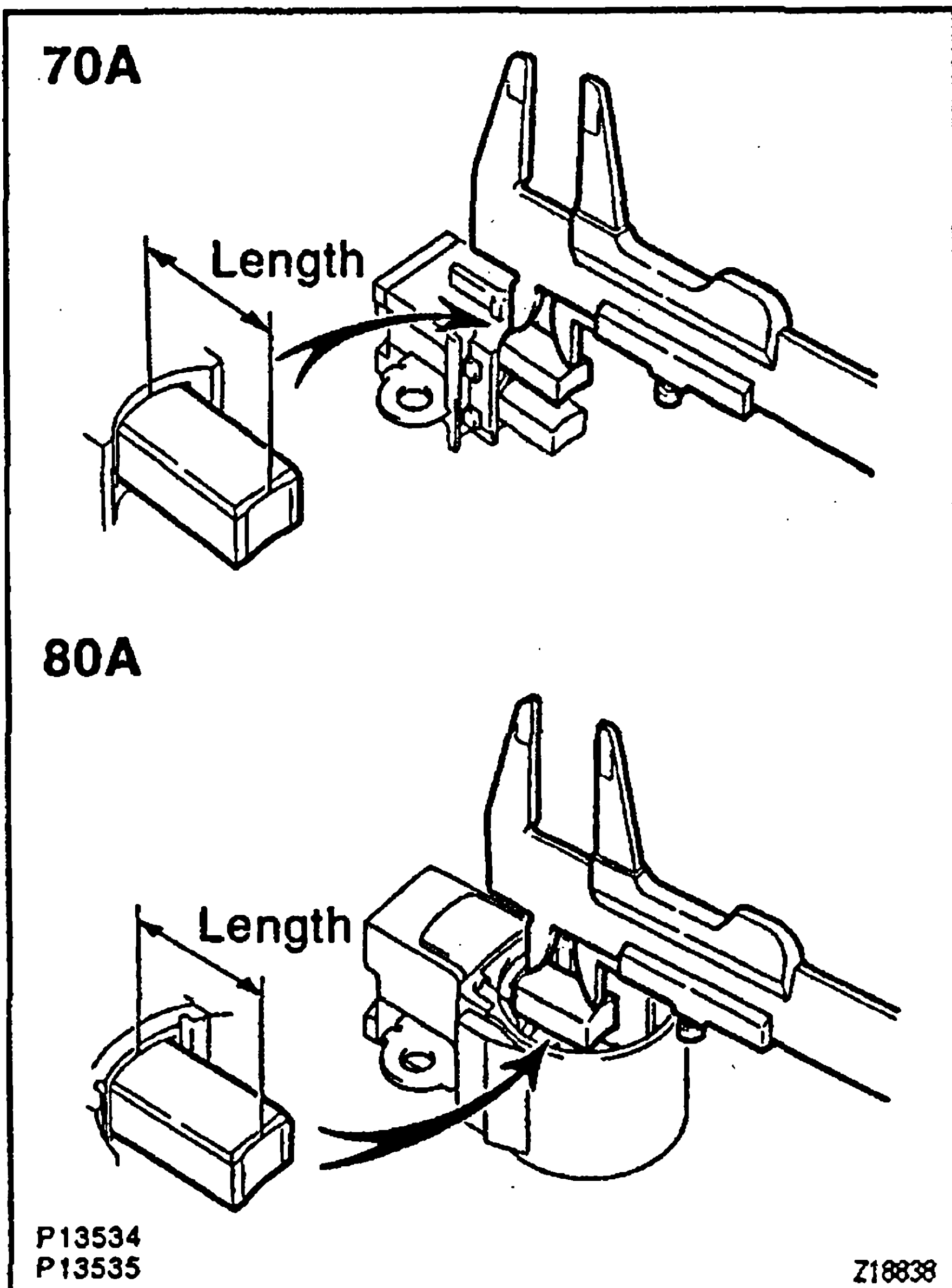
Standard exposed length:

10.5 mm (0.413 in.)

Minimum exposed length:

1.5 mm (0.059 in.)

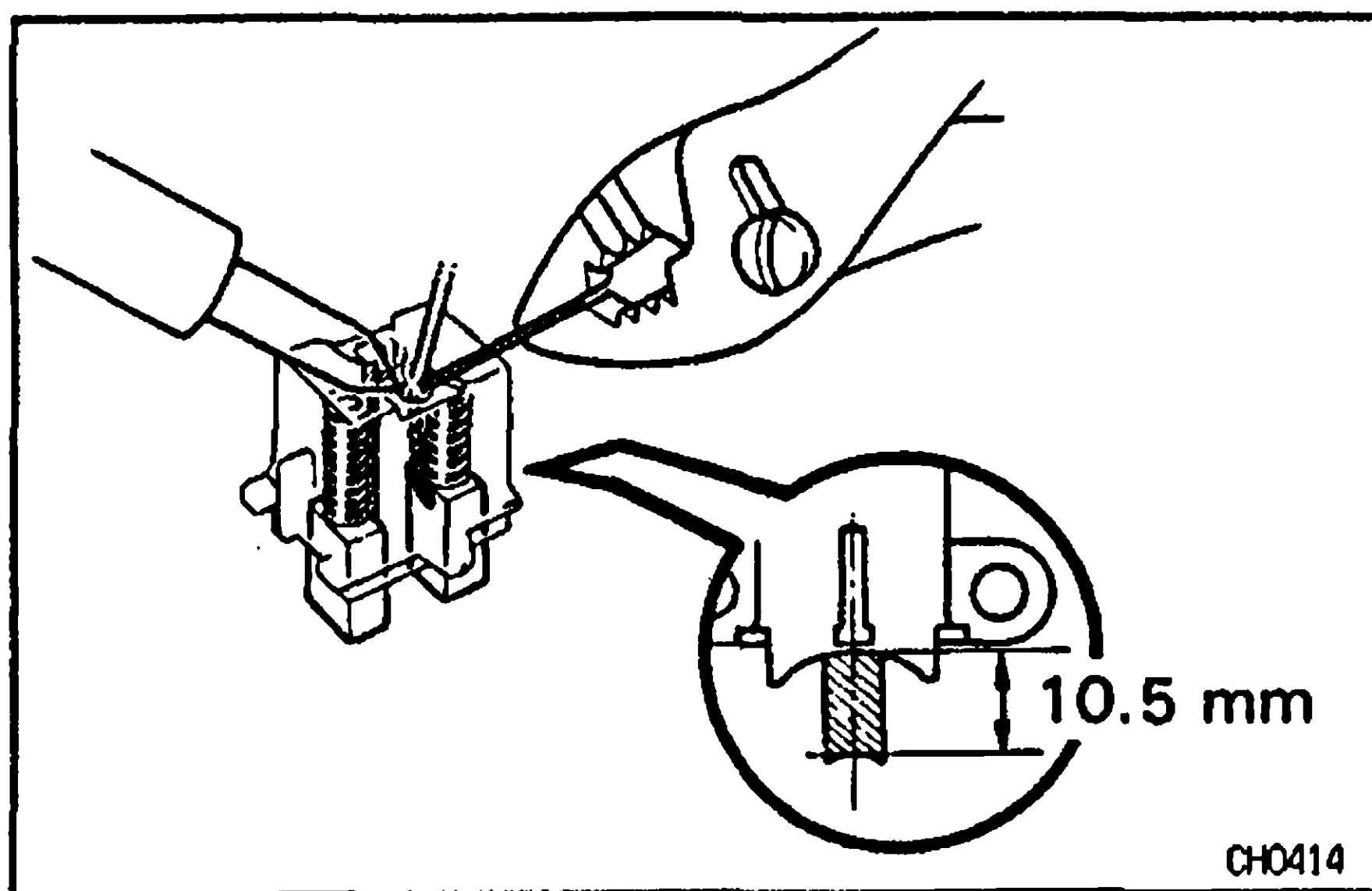
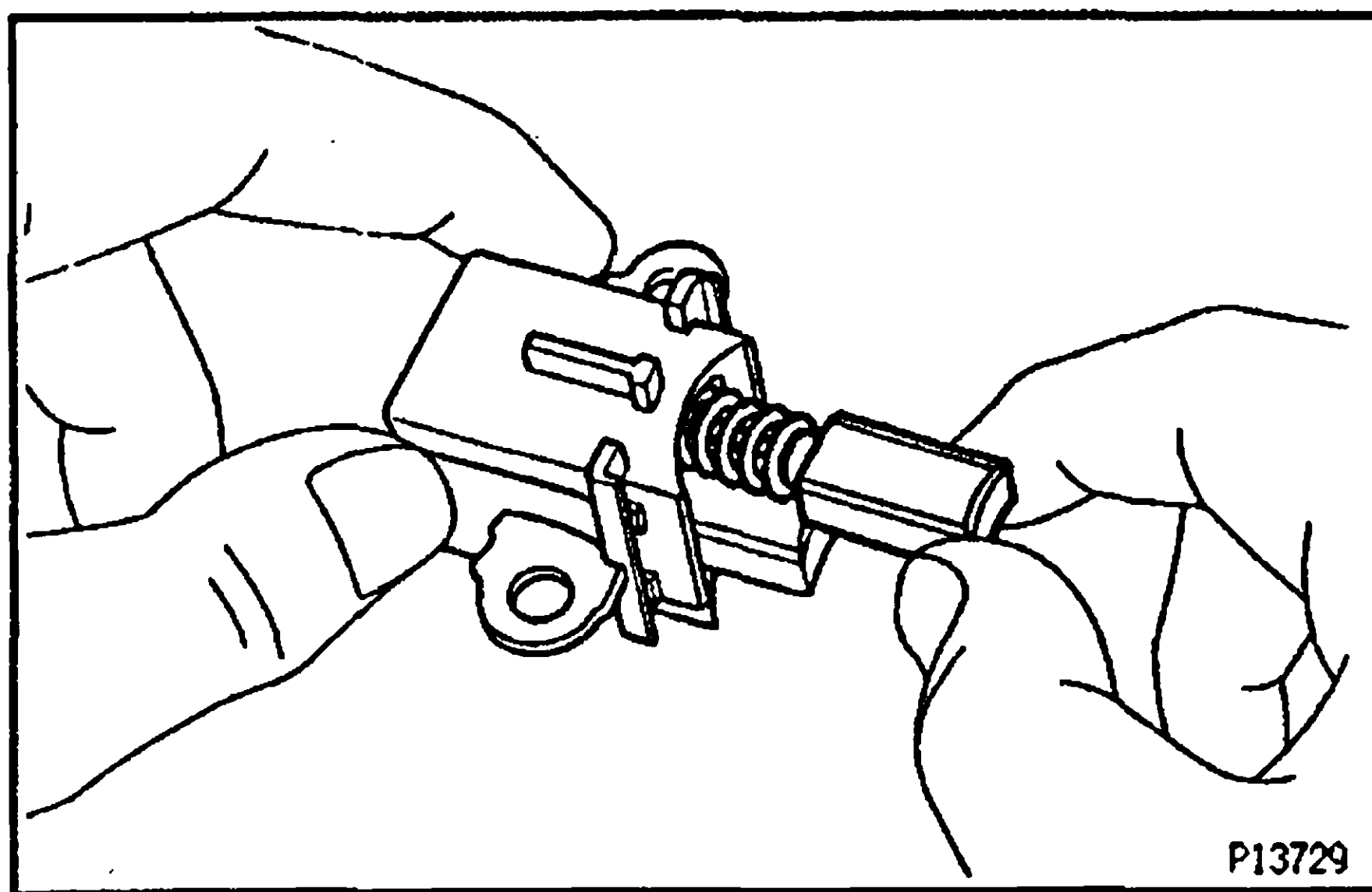
If the exposed length is less than minimum, replace the brushes (70 A) or brush holder assembly (80 A).

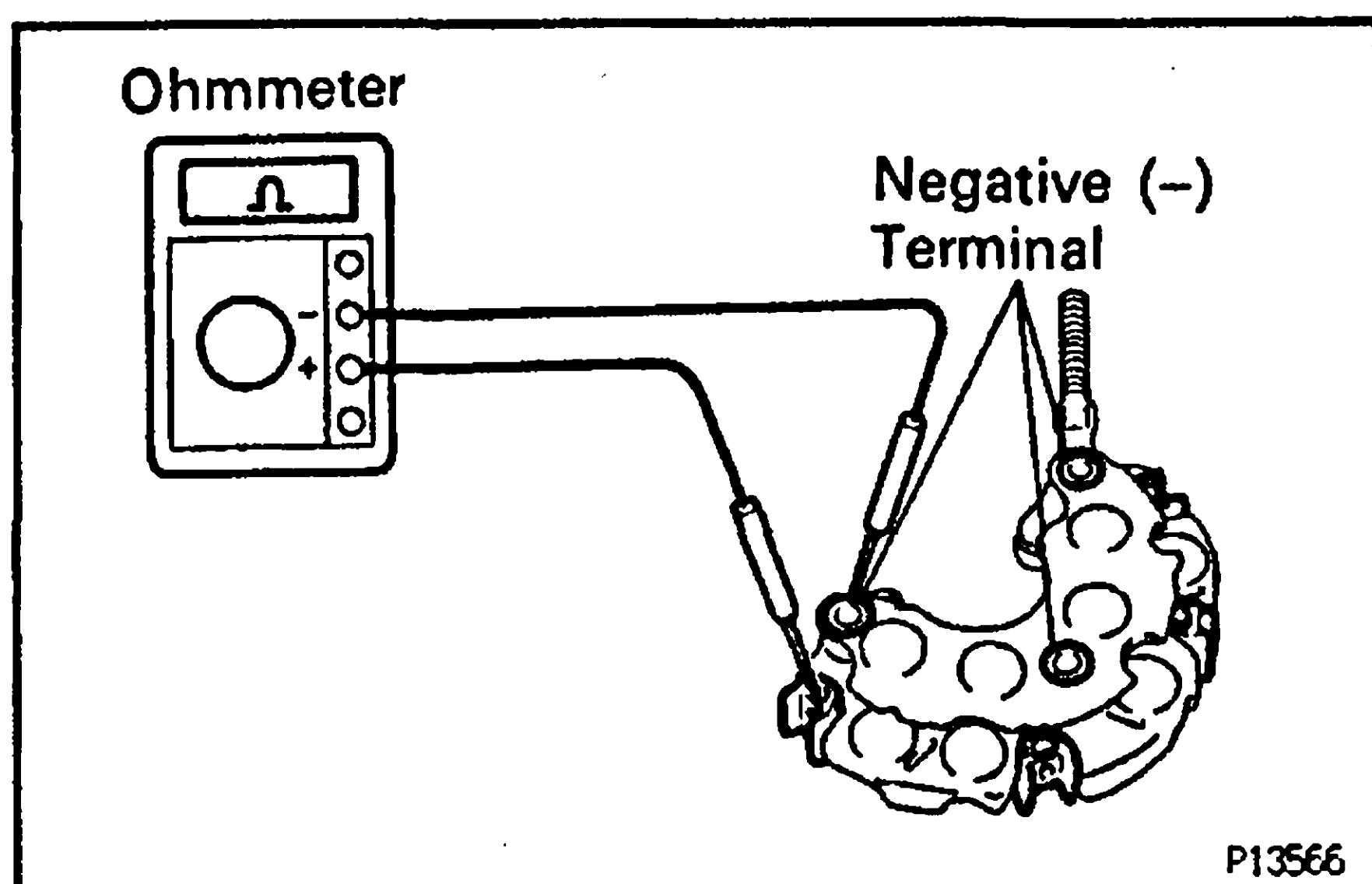
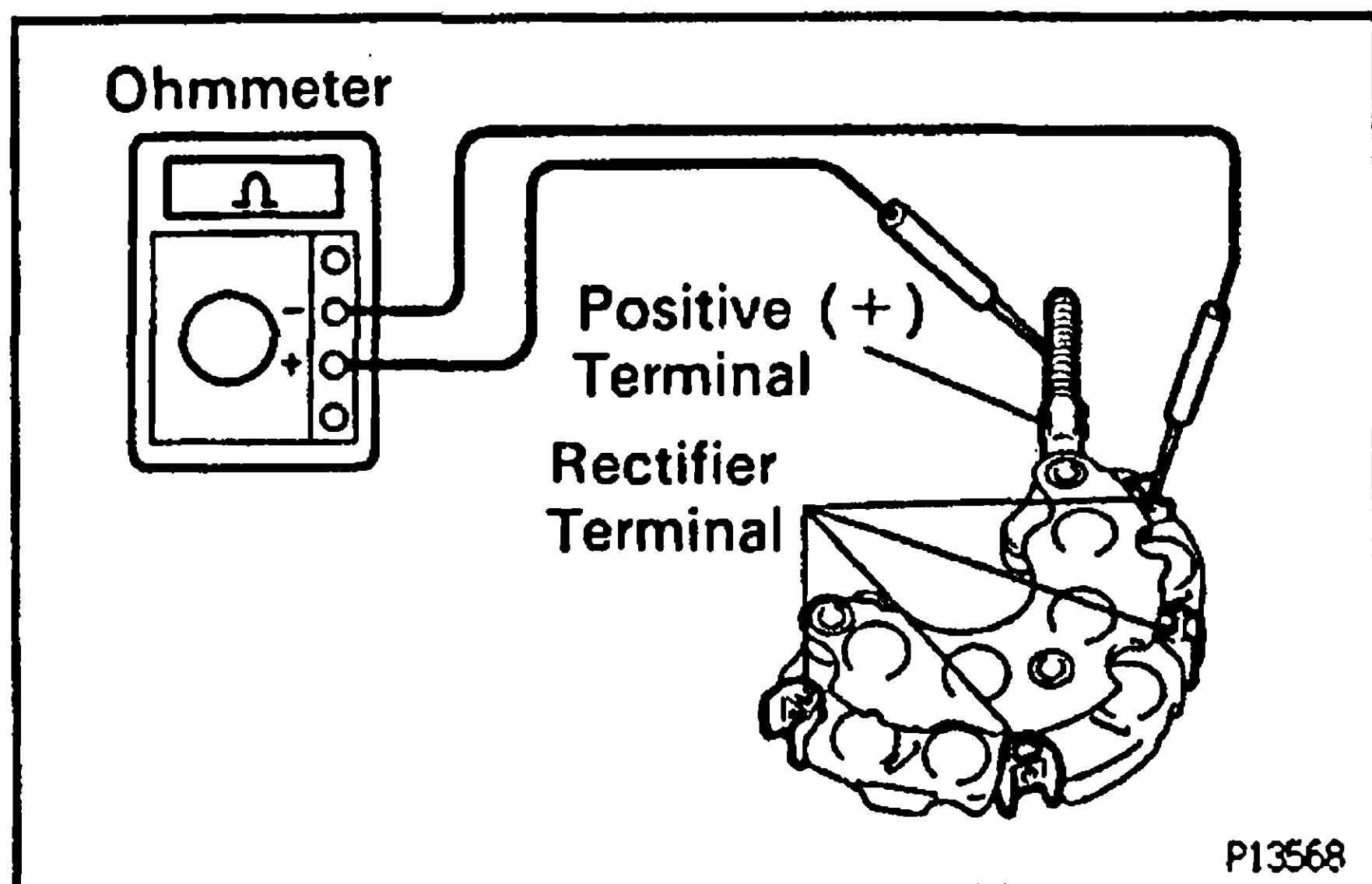


2. 70 A:

IF NECESSARY, REPLACE BRUSHES

- (a) Unsolder and remove the brush and spring.
- (b) Run the wire of the 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 the 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 point.





Rectifier (Rectifier Holder)

1. INSPECT POSITIVE RECTIFIER

- Using an ohmmeter, connect one tester probe to the positive (+) terminal and the other to each rectifier terminal.
- Reverse the polarity of the tester probes and repeat step (a).
- Check that one shows continuity and the other shows no continuity.

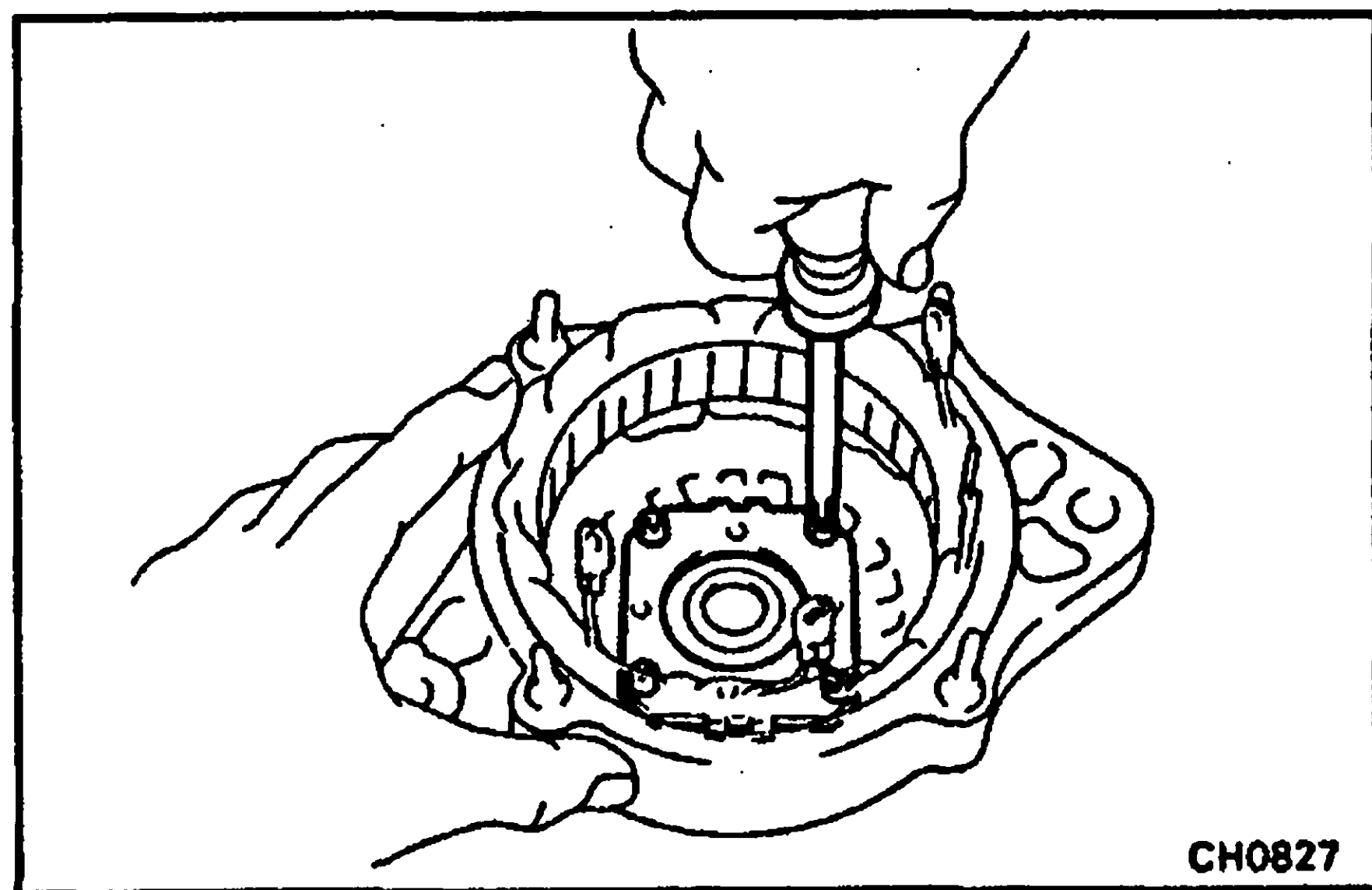
If continuity is not as specified, replace the rectifier holder.

2. INSPECT NEGATIVE RECTIFIER

- Using an ohmmeter, connect one tester probe to each negative (-) terminal and the other to each rectifier terminal.
- Reverse the polarity of the tester probes and repeat step (a).
- Check that one shows continuity and the other shows no continuity.

If continuity is not as specified, replace the rectifier holder.

CH



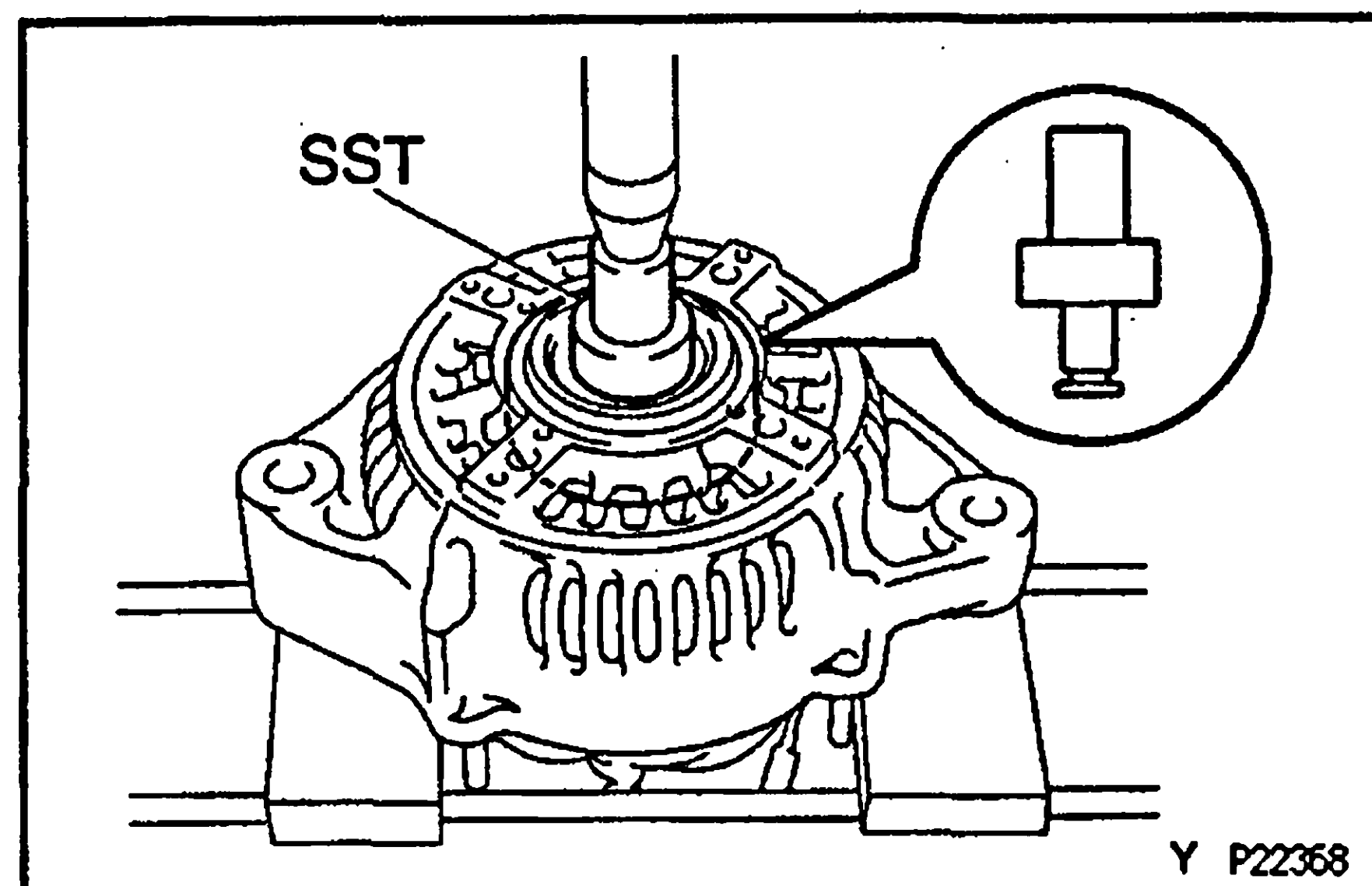
Bearings

1. INSPECT FRONT BEARING

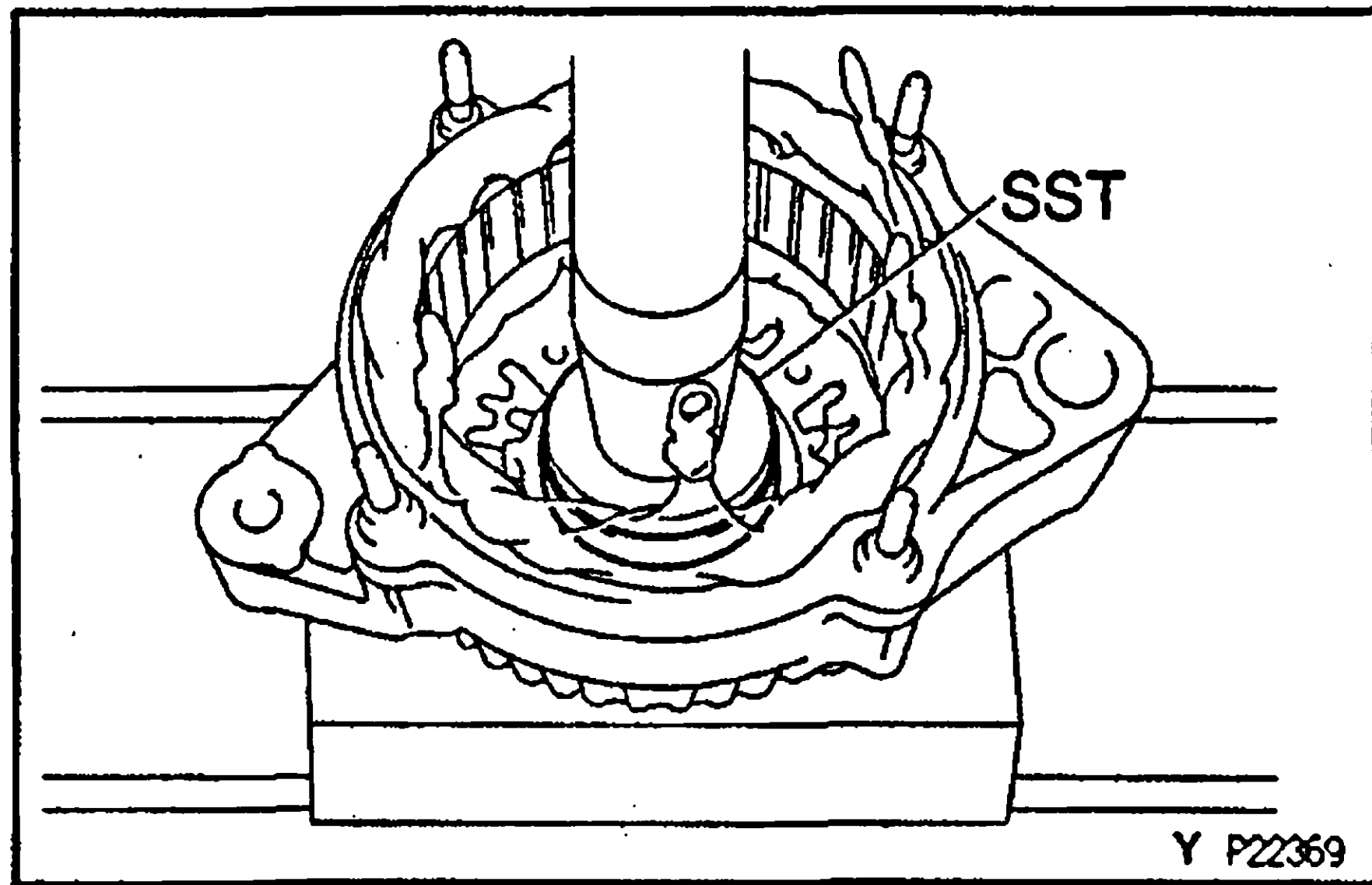
Check that the bearing is not rough or worn.

2. IF NECESSARY, REPLACE FRONT BEARING

- Remove the 4 screws and bearing retainer.



- Using SST and a 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.

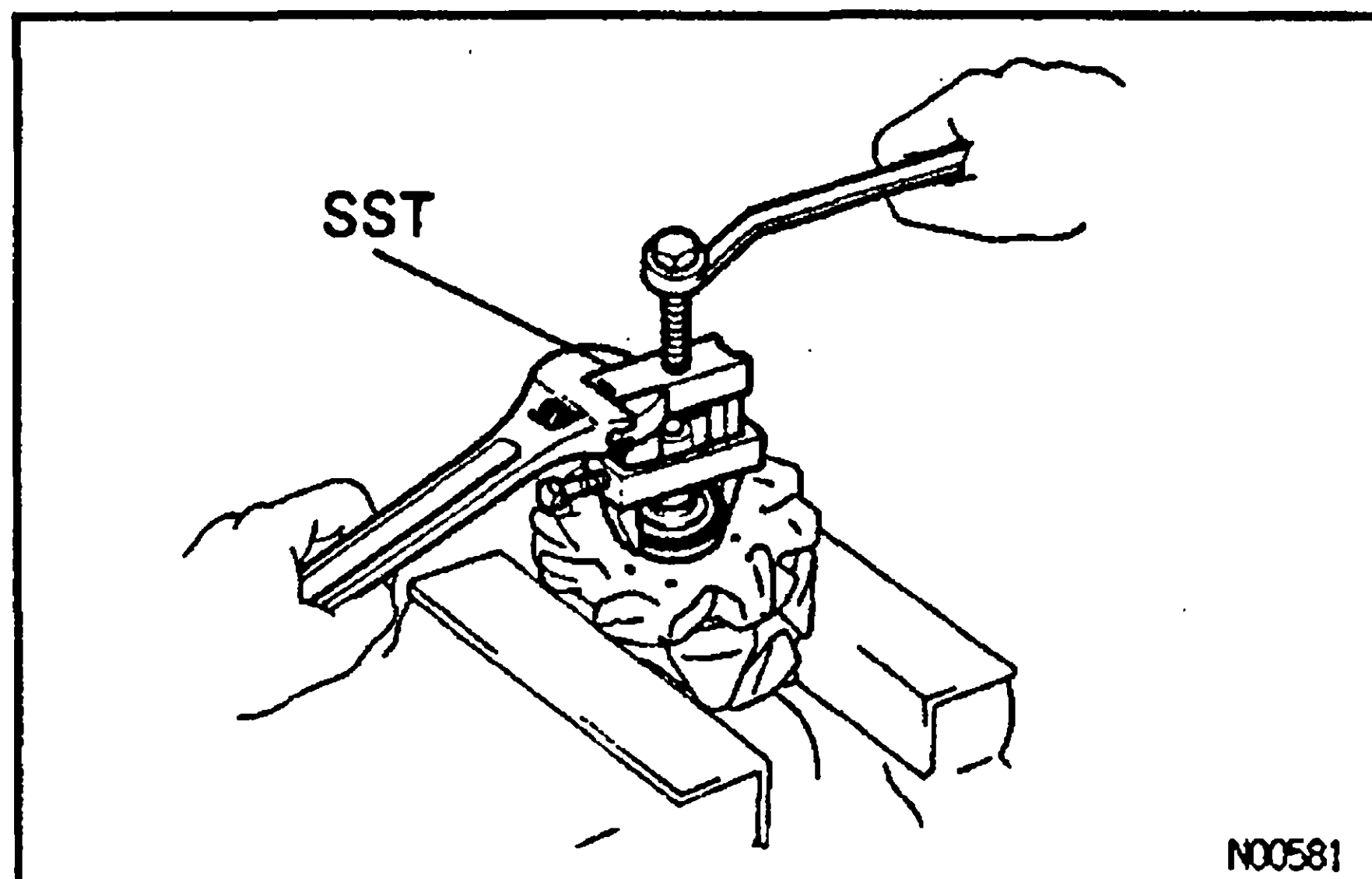
Torque:

70 A: 2.6 N·m (27 kgf·cm, 23 in.-lbf)

80 A: 2.9 N·m (30 kgf·cm, 25 in.-lbf)

3. INSPECT REAR BEARING

Check that the bearing is not rough or worn.

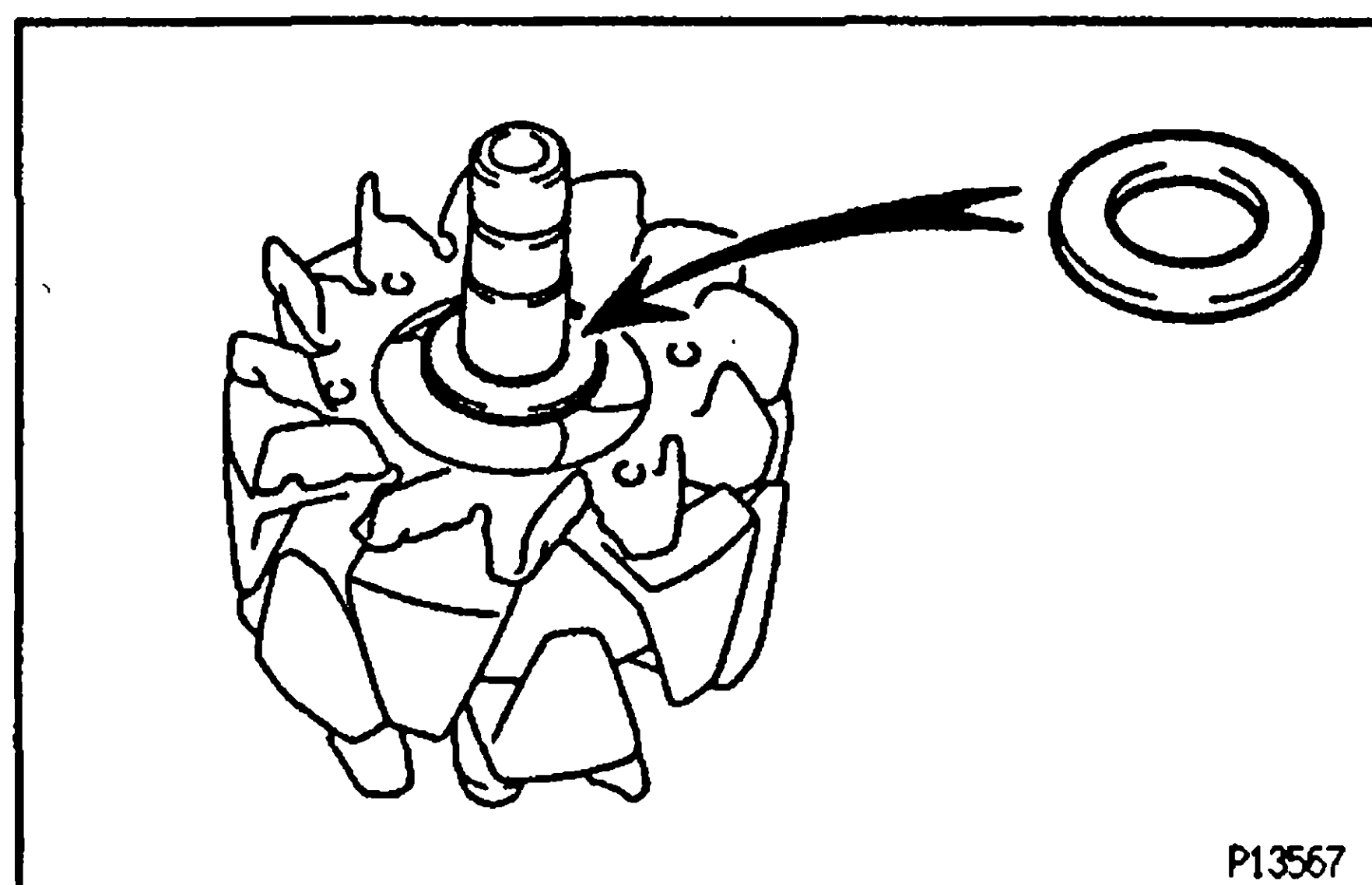


4. IF NECESSARY, REPLACE REAR BEARING

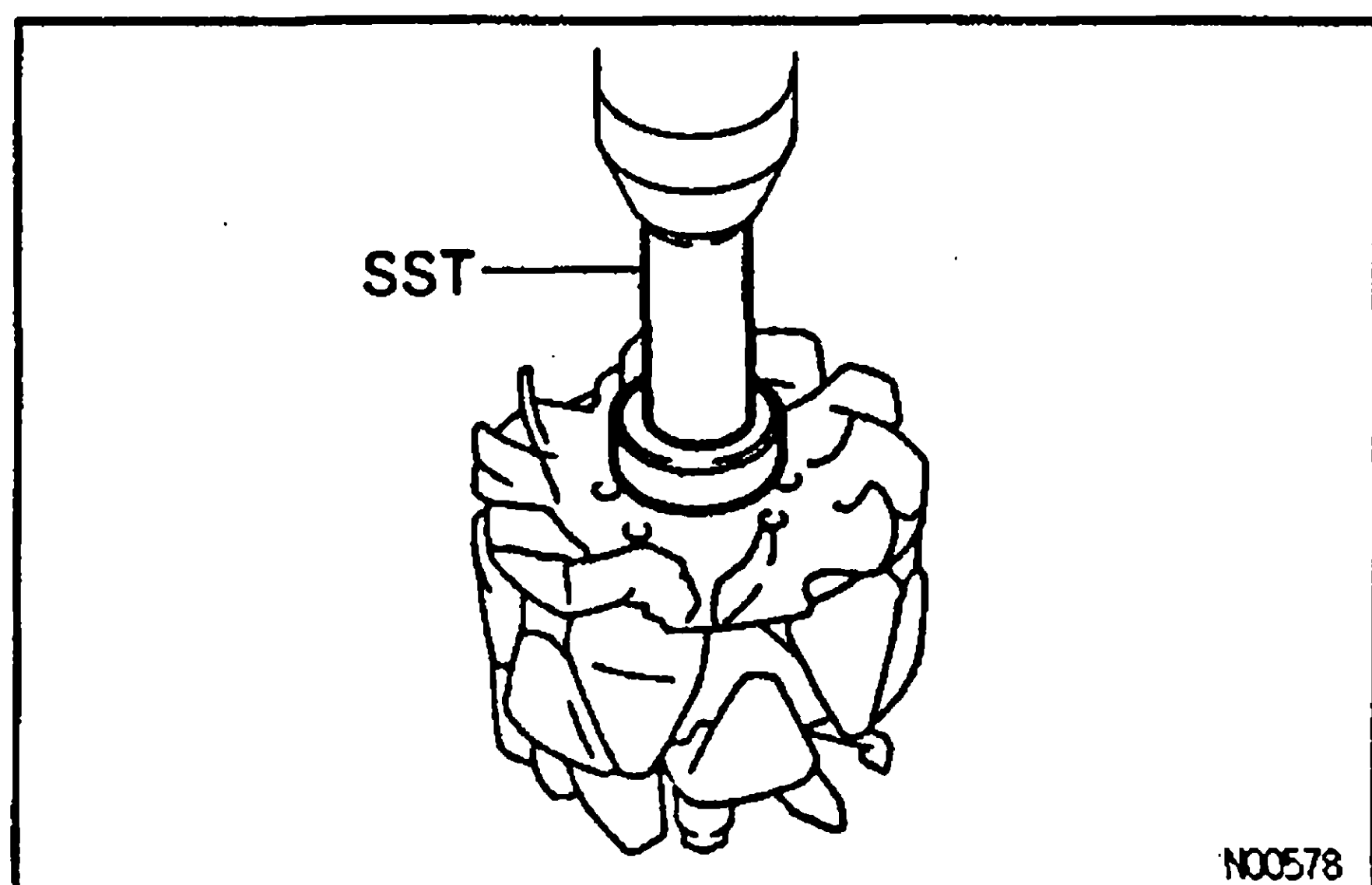
(a) Using SST, remove the bearing cover and bearing.
SST 09820-00021

NOTICE: Be careful not to damage the fan.

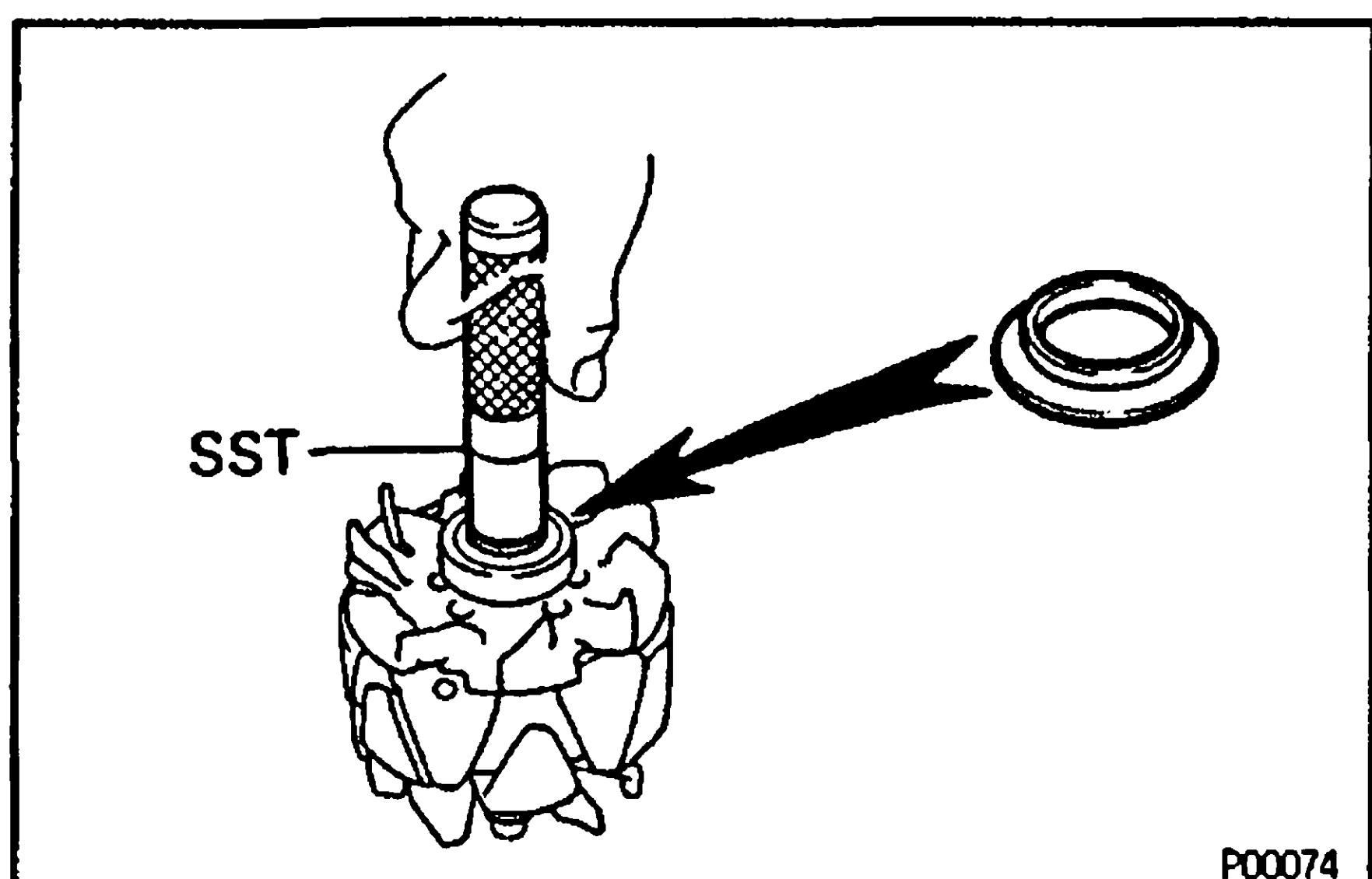
(b) Remove the bearing cover (inside).



(c) Place the bearing cover (inside) on the rotor.



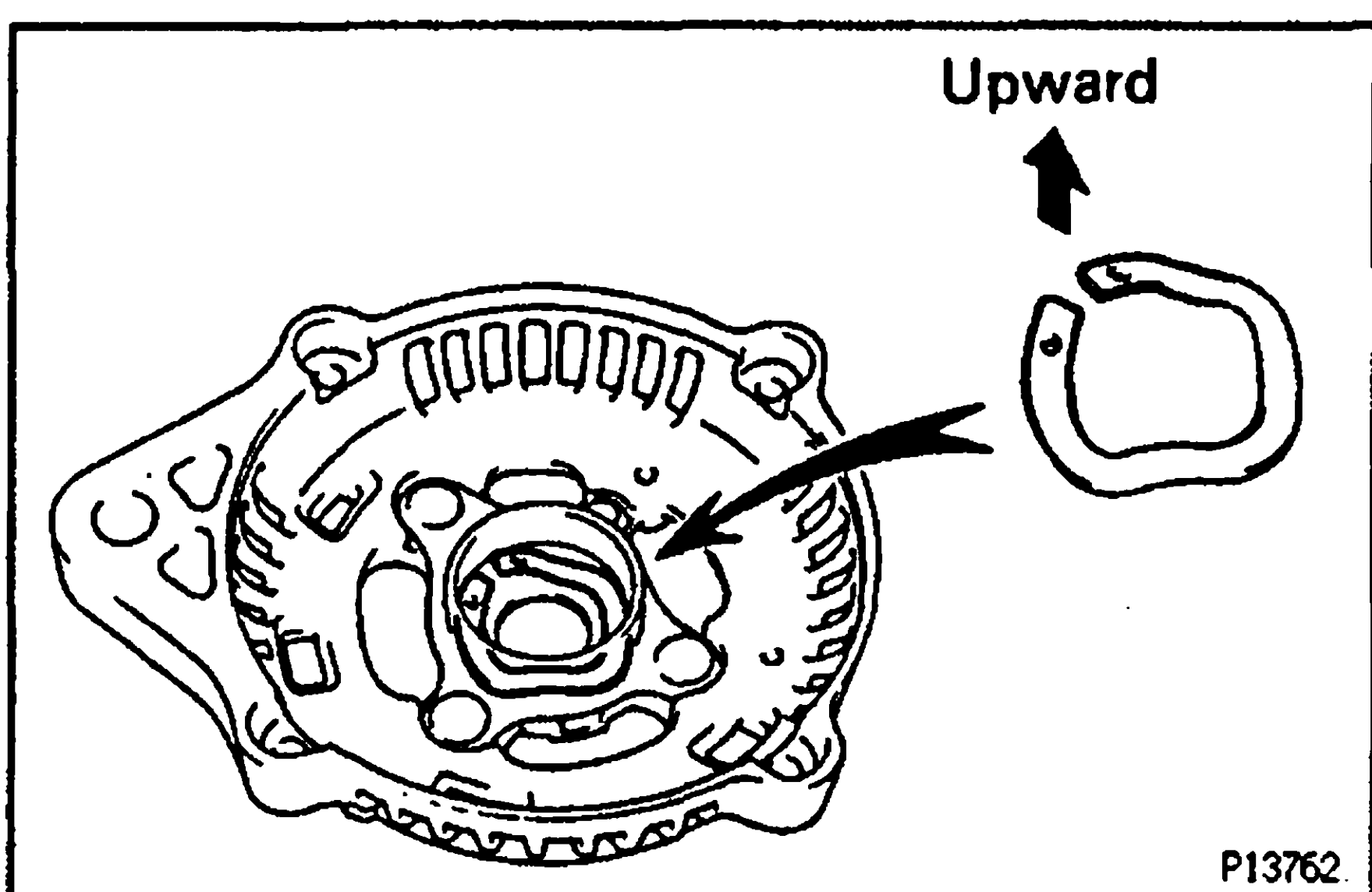
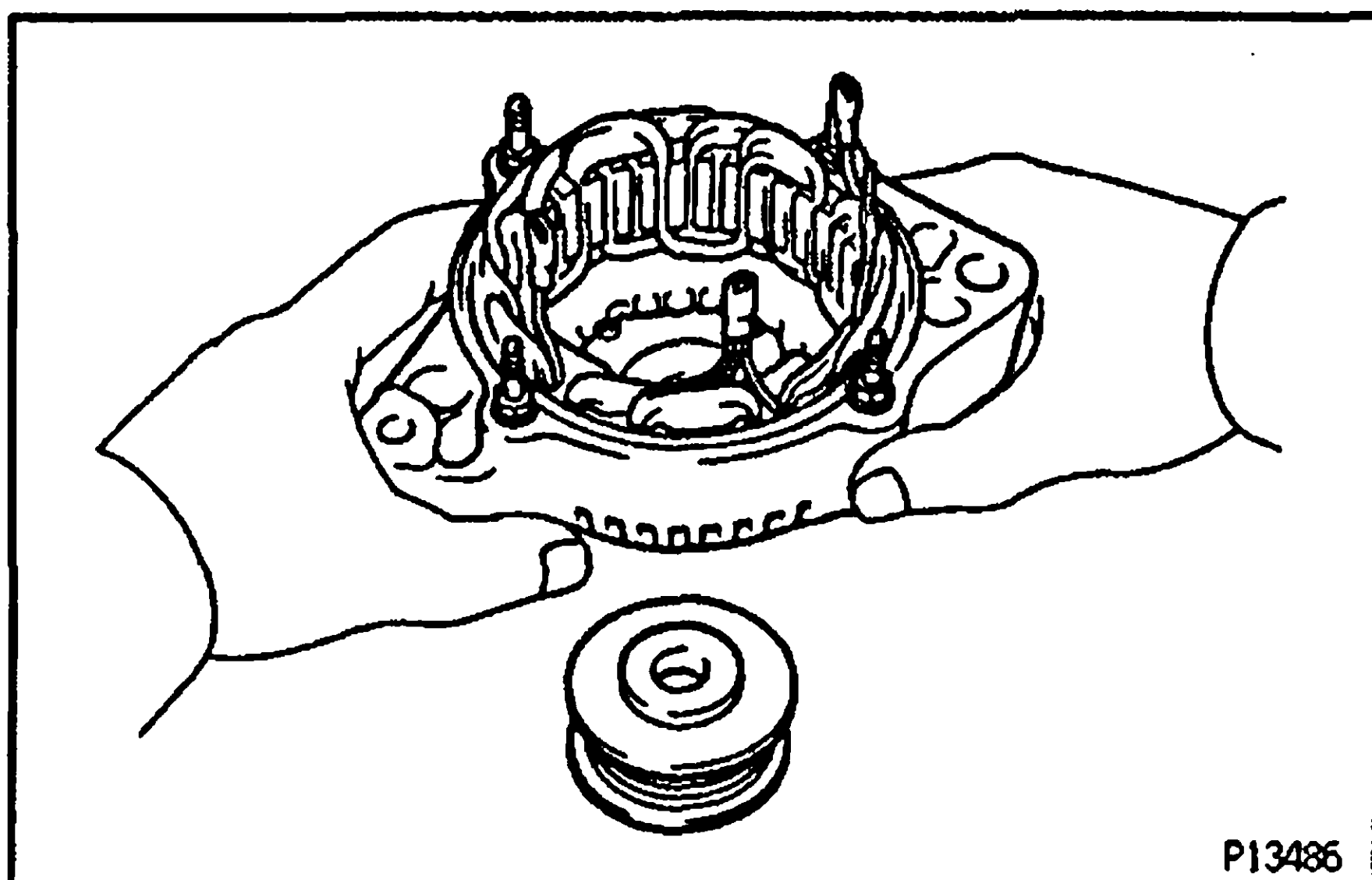
(d) Using SST and a press, press in a new bearing.
SST 09820-00030



(e) Using SST, push in the bearing cover (outside).
SST 09285-76010

ALTERNATOR ASSEMBLY

1. PLACE RECTIFIER END FRAME ON PULLEY
2. INSTALL ROTOR TO DRIVE END FRAME



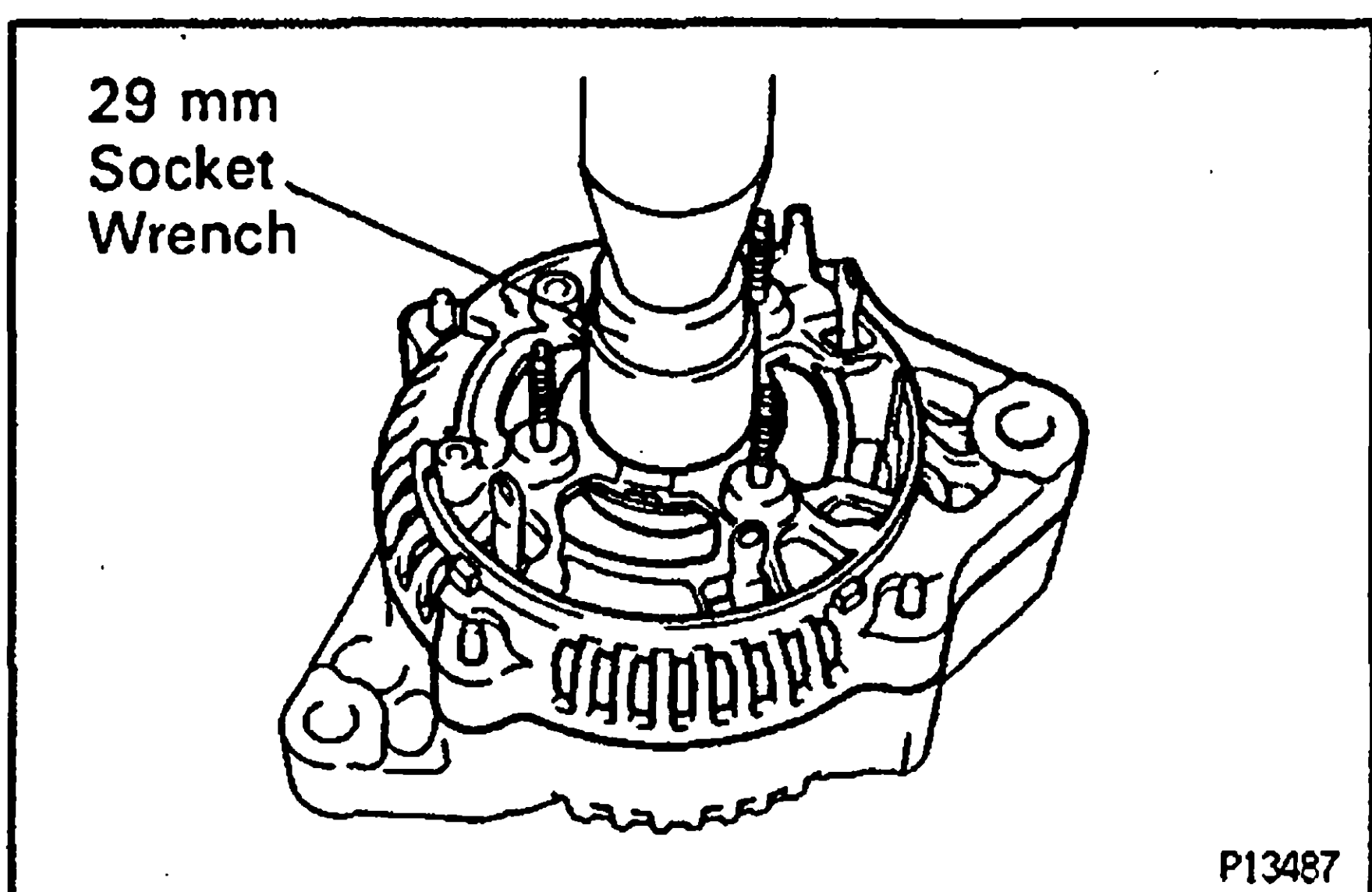
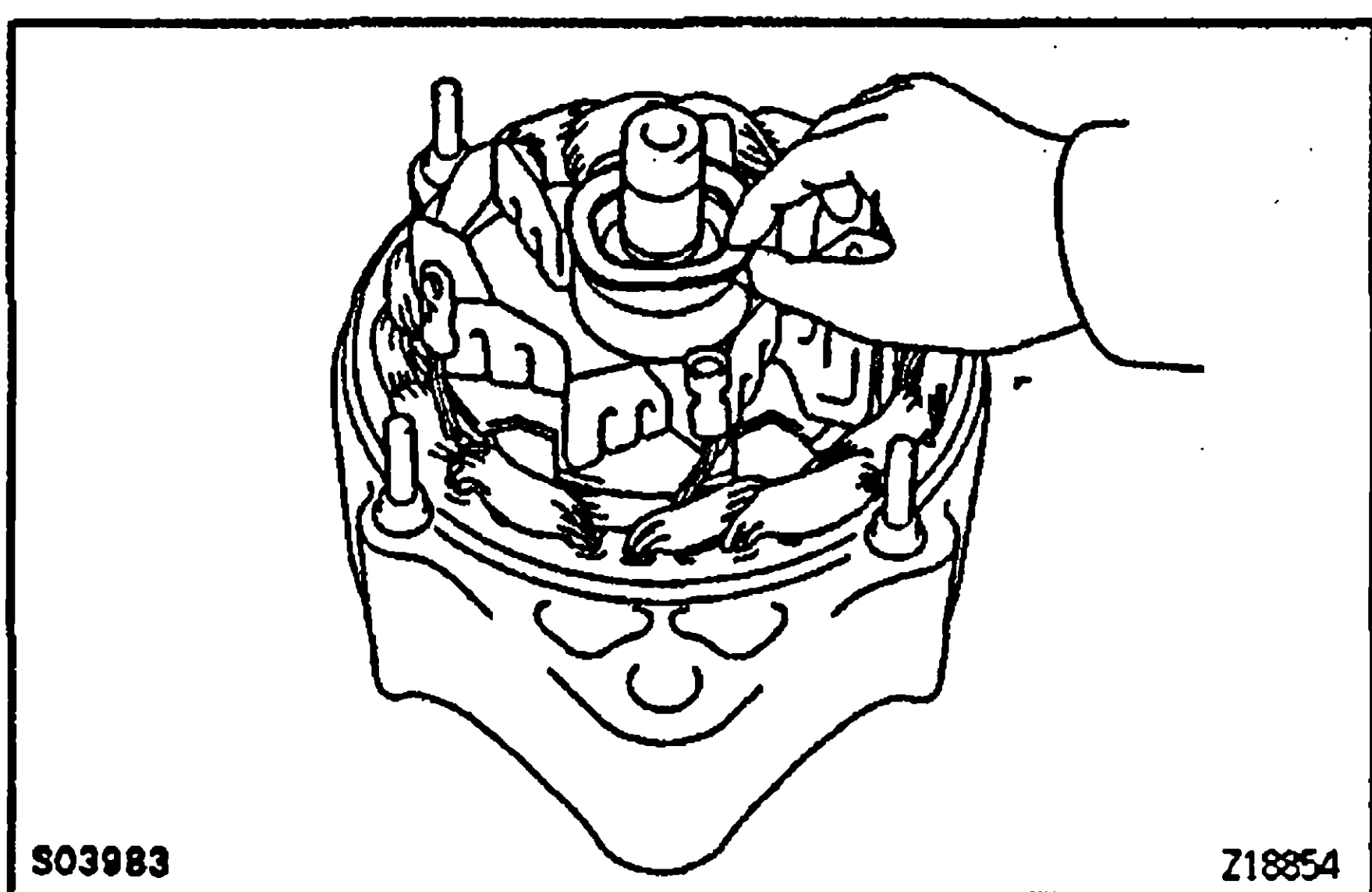
3. INSTALL RECTIFIER END FRAME

- (a) 70 A:

Install the alternator washer to the rectifier end frame.
NOTICE: Be careful of the alternator washer installation direction.

80 A:

Install 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, 39 in.-lbf)

4. INSTALL PULLEY

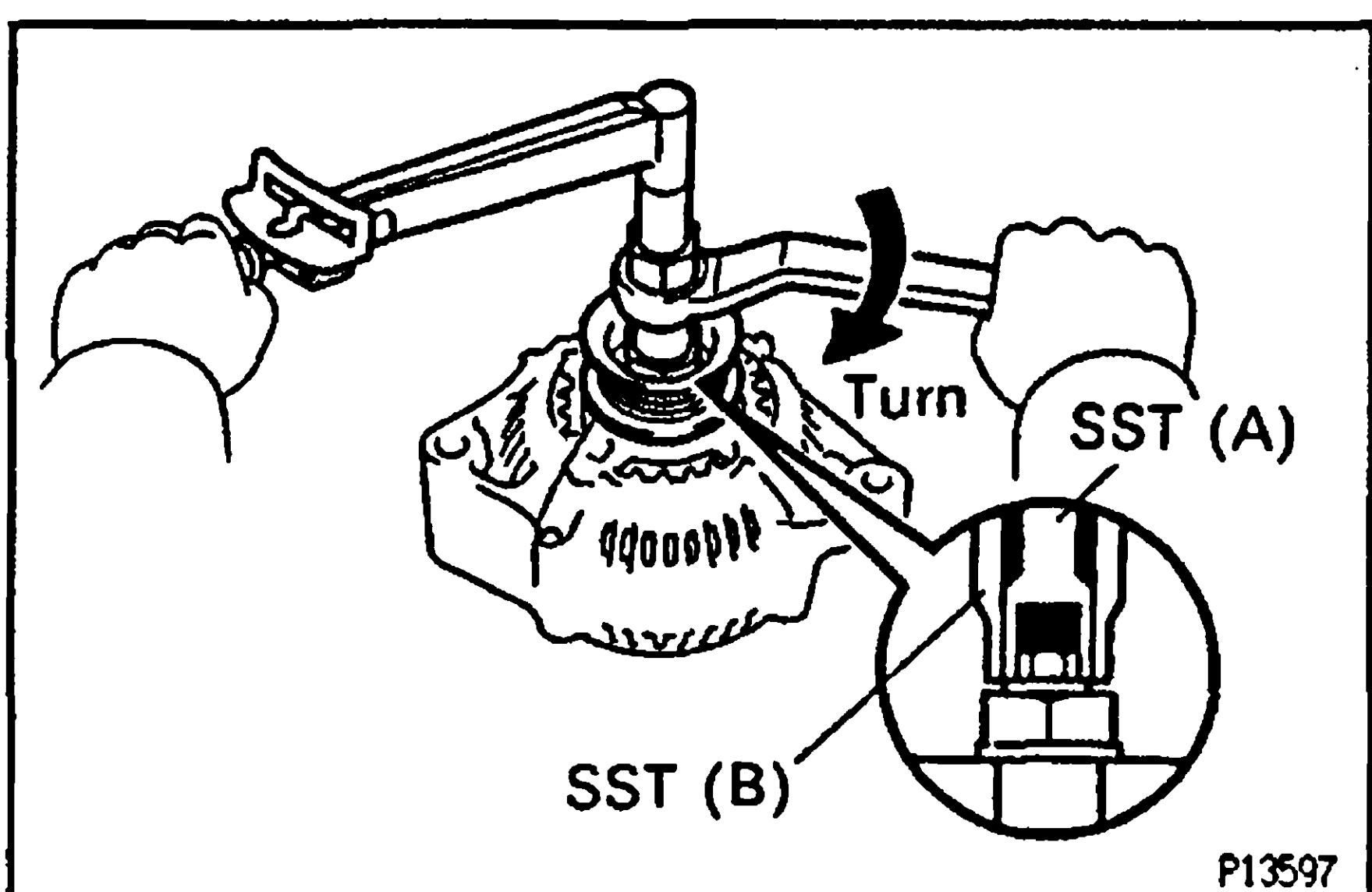
- (a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.

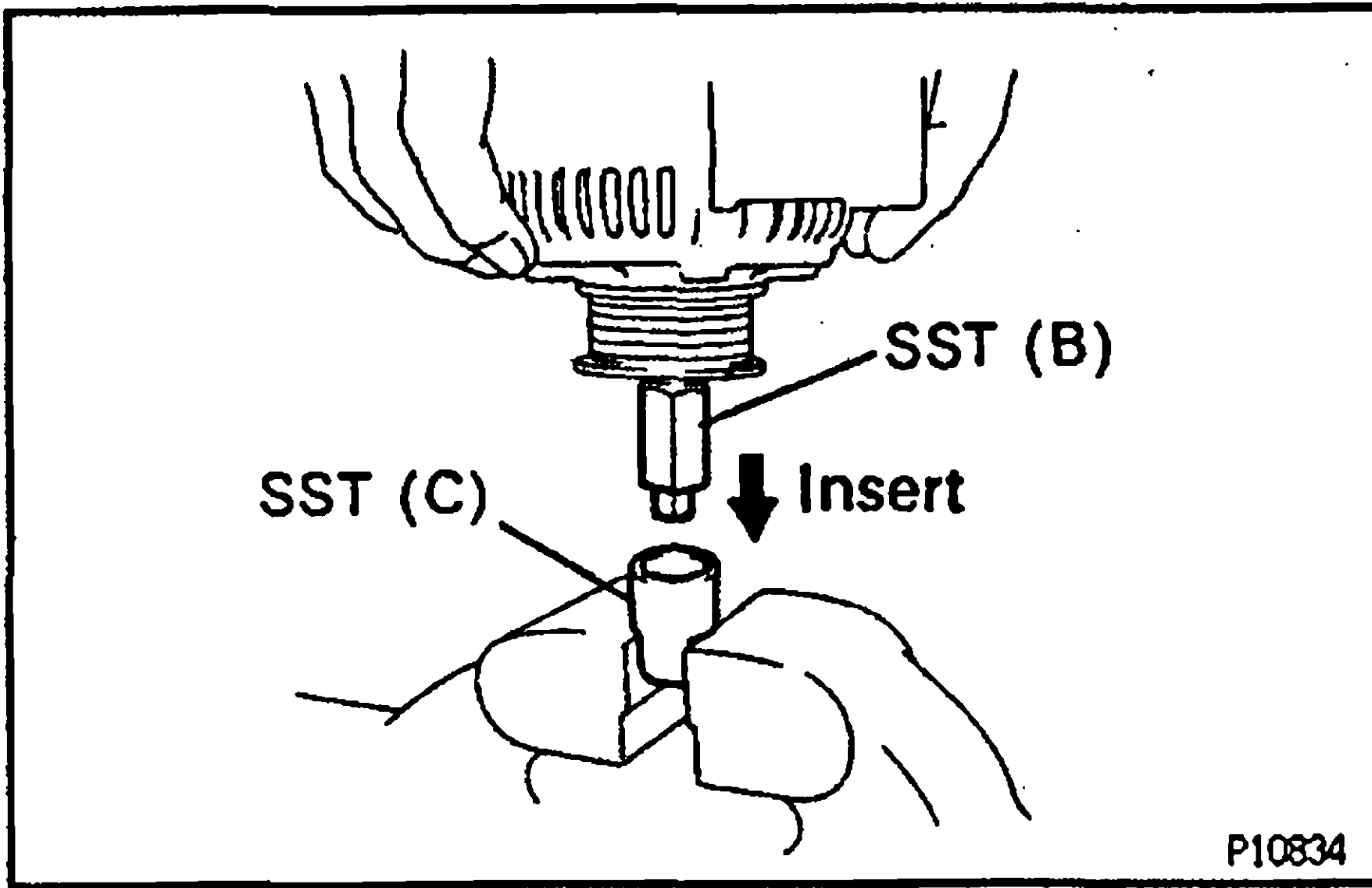
- (b) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.

SST 09820-63010

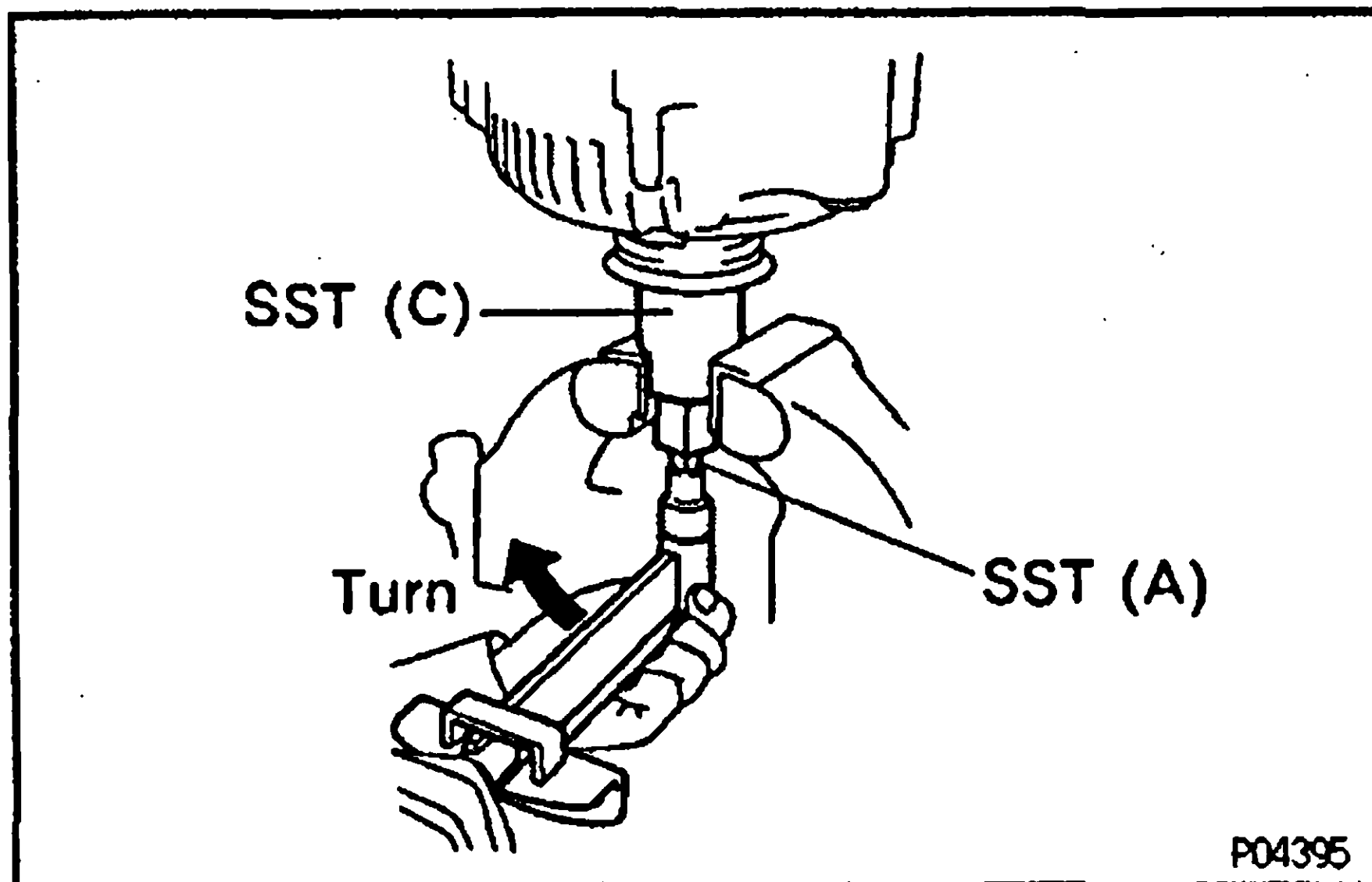
Torque: 39 N·m (400 kgf·cm, 29 ft-lbf)

- (c) Check that SST (A) is secured to the pulley shaft.

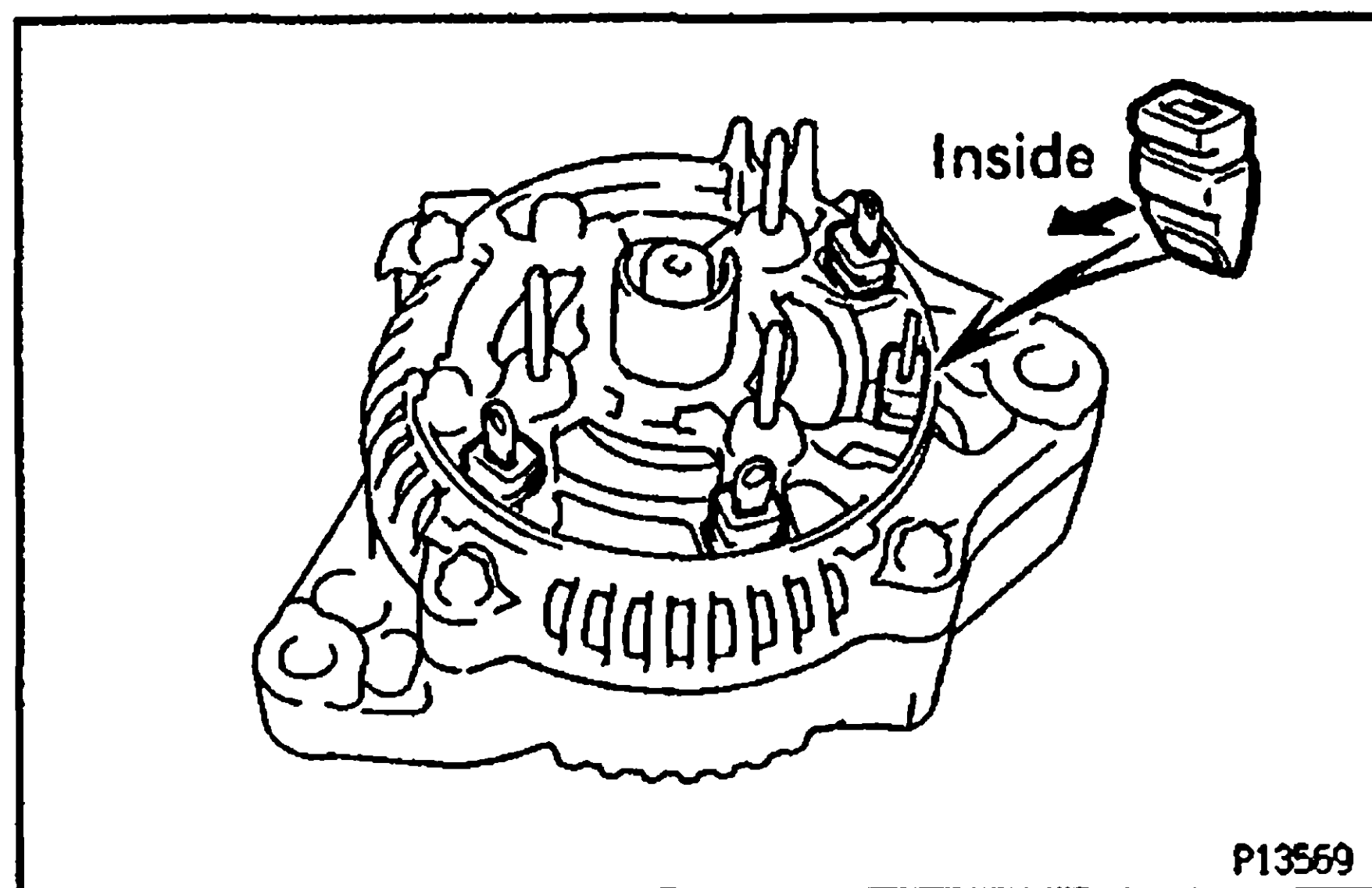




- (d) Mount SST (C) in a vise.
- (e) Insert SST (B) into SST (C), and attach the pulley nut to SST (C).

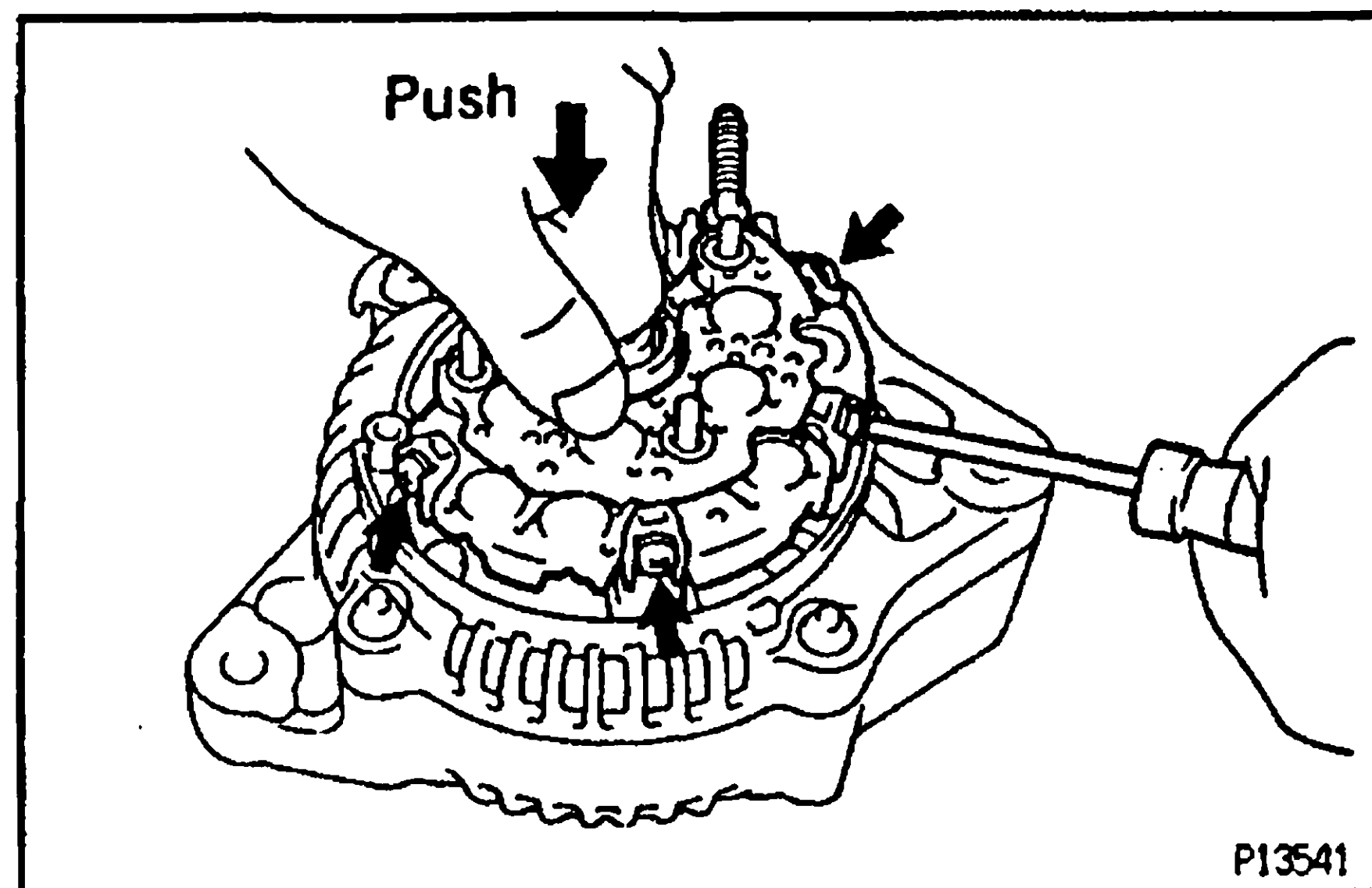


- (f) To torque the pulley nut, turn SST (A) in the direction shown in the illustration.
Torque: 110 N·m (1,125 kgf·cm, 81 ft·lbf)
- (g) Remove the alternator from SST (C).
- (h) Turn SST (B), and remove SST (A and B).

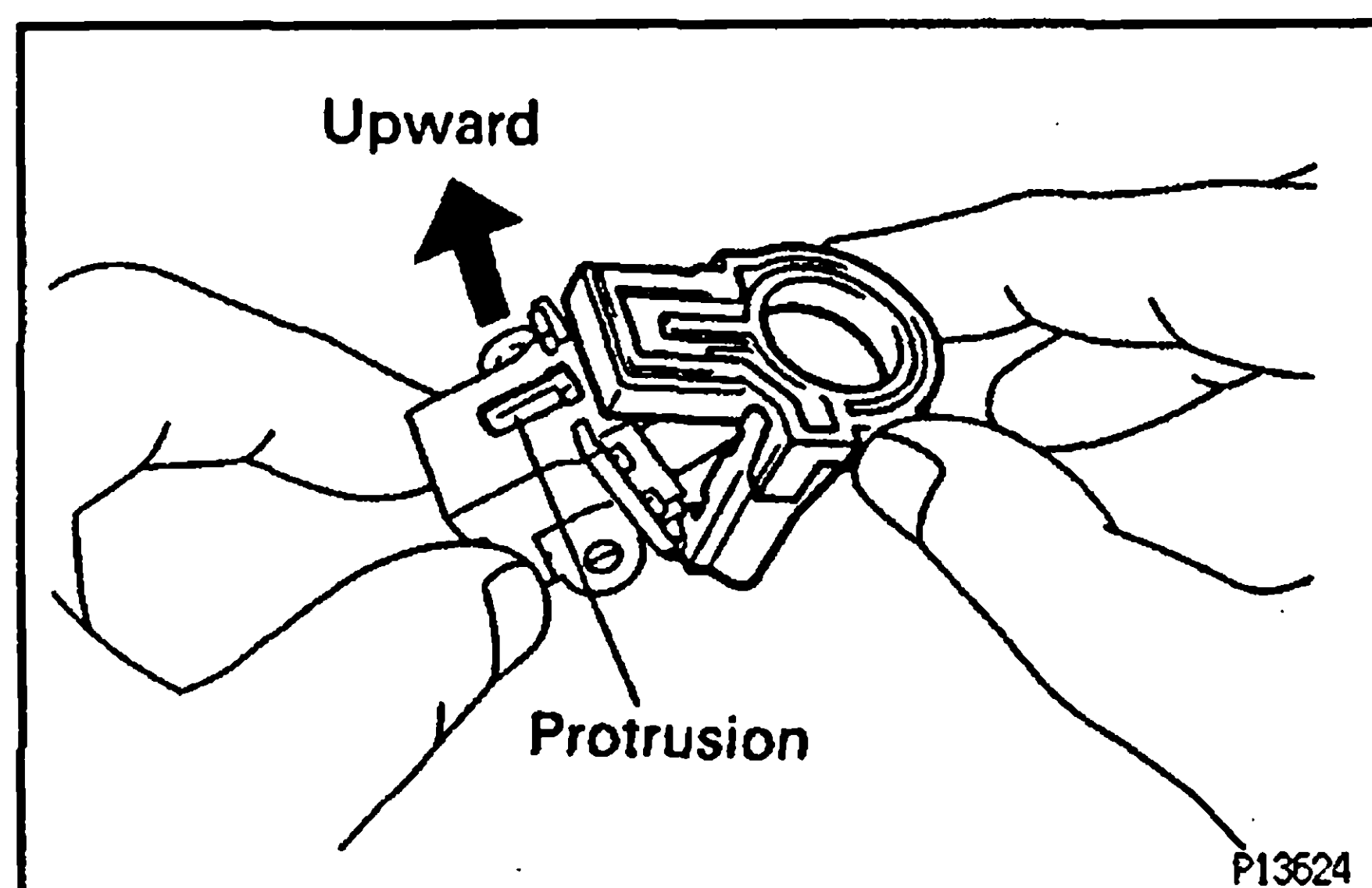


5. INSTALL RECTIFIER HOLDER

- (a) Install the 4 rubber insulators on the lead wires.
NOTICE: Be careful of the rubber insulators installation direction.

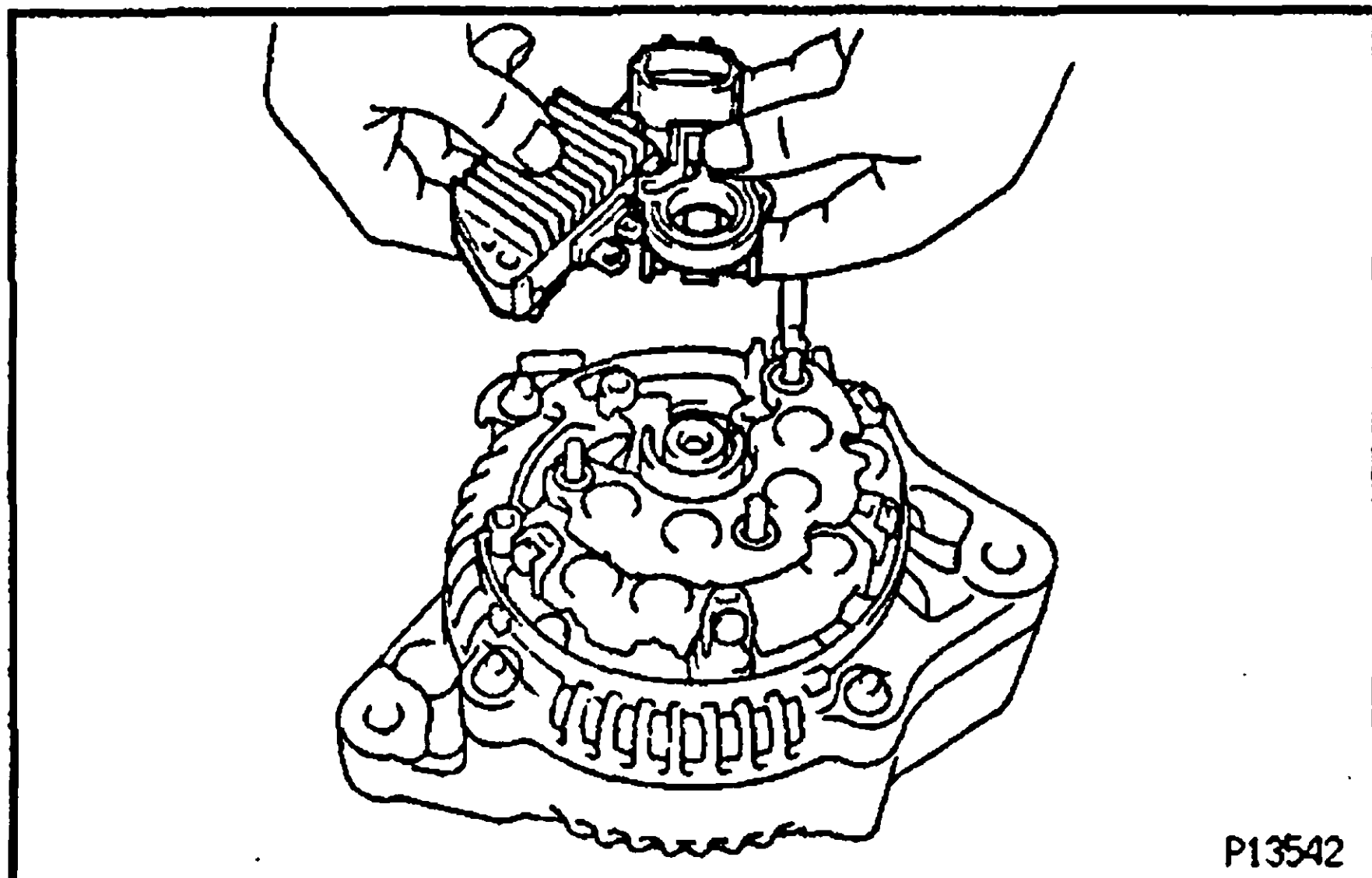


- (b) Install the rectifier with the 4 screws.
Torque:
70 A: 2.0 N·m (20 kgf·cm, 18 in·lbf)
80 A: 2.9 N·m (30 kgf·cm, 25 in·lbf)

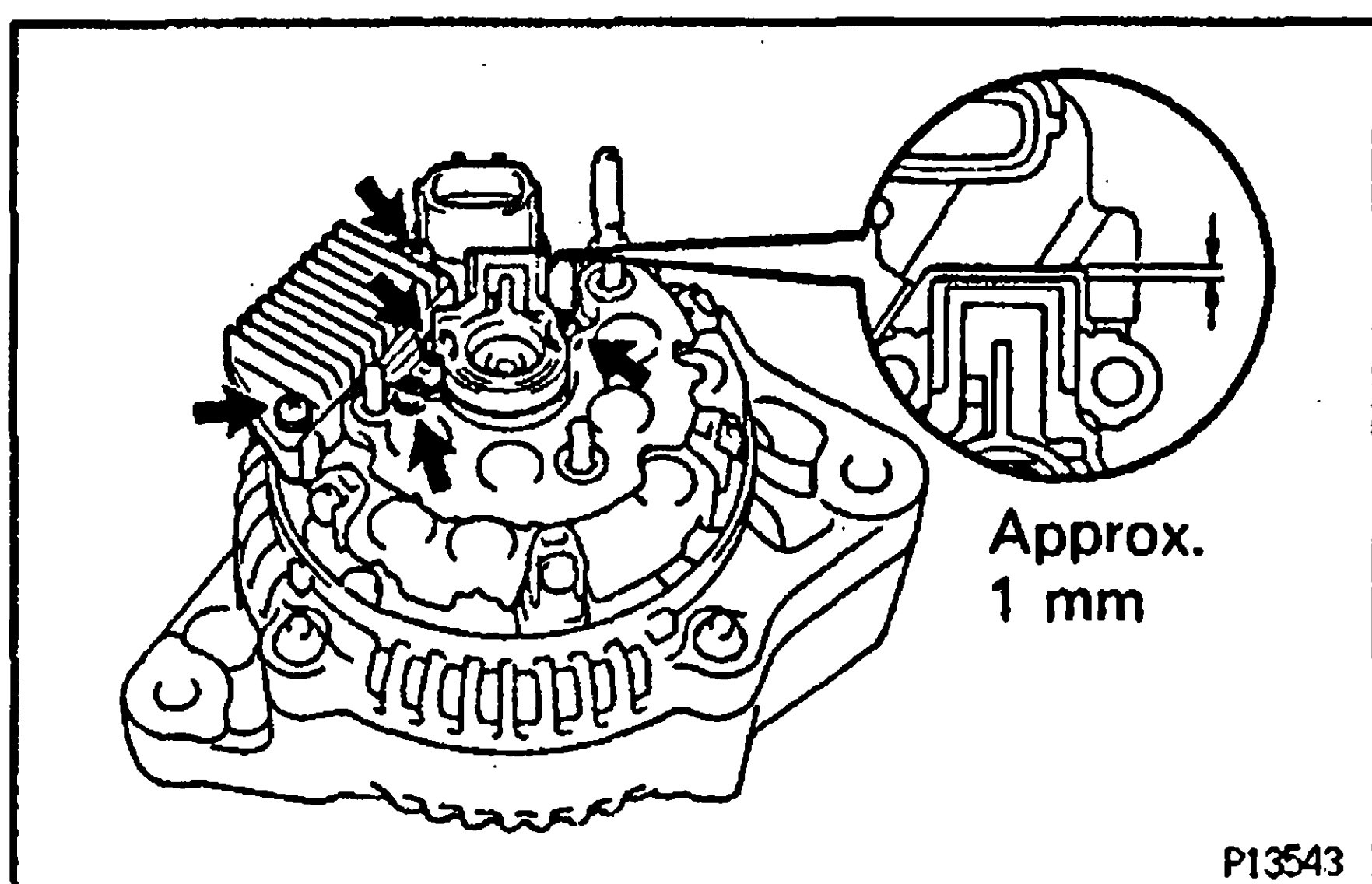


6. INSTALL BRUSH HOLDER AND IC REGULATOR

- (a) Install the brush holder cover to the brush holder.
NOTICE: Be careful of the holder installation direction.

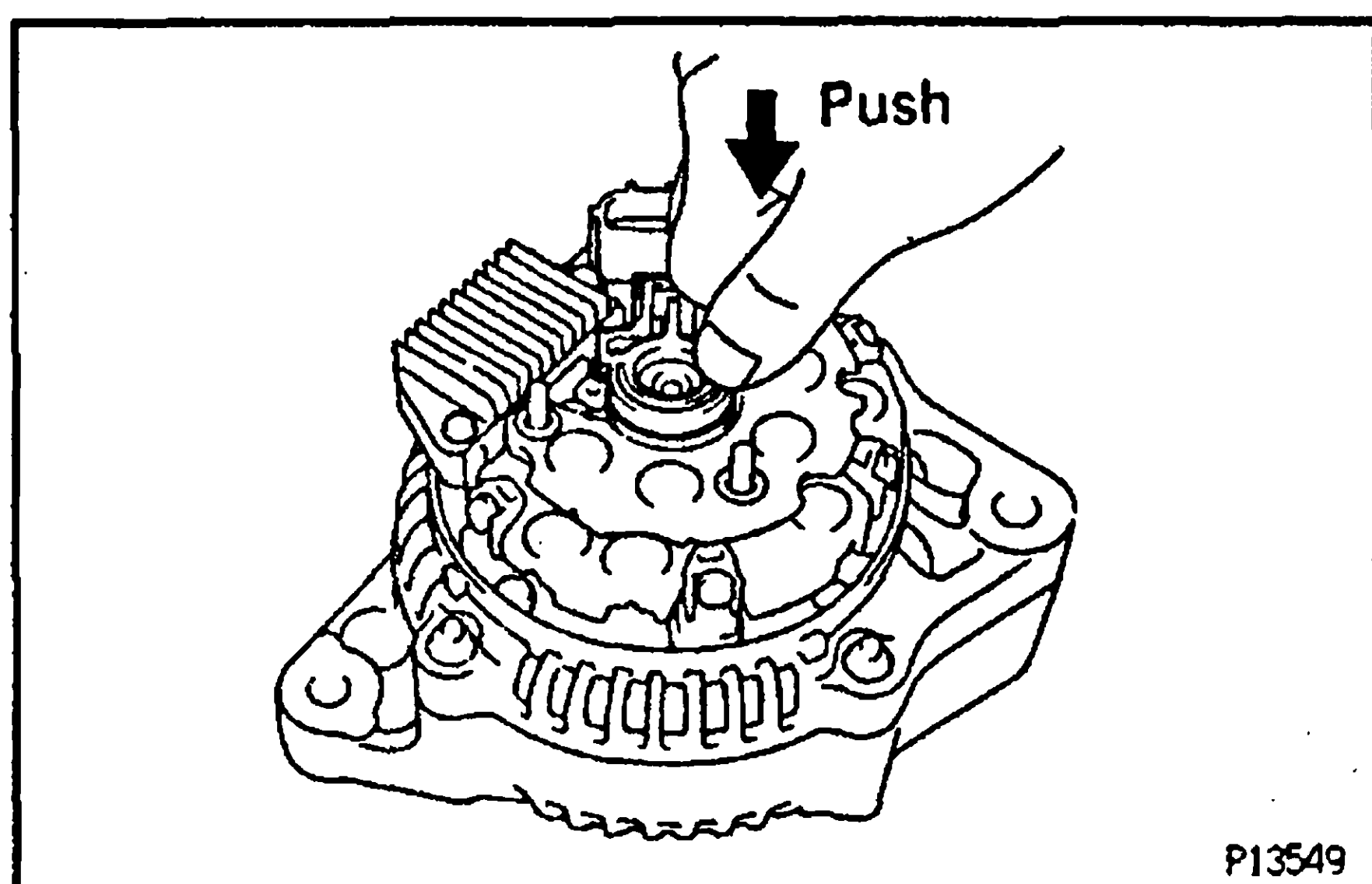


- (b) Place the IC regulator together with the brush holder horizontally on the rectifier end frame.



- (c) Install the 5 screws until there is a clearance of approx. 1 mm (0.04 in.) between the brush holder and IC regulator.

Torque: 2.0 N·m (20 kgf·cm, 18 in.-lbf)



- (d) Fit the brush holder cover.

7. INSTALL REAR END COVER

- (a) 70 A:

Install the end cover with the 3 nuts.

Torque: 4.5 N·m (46 kgf·cm, 40 in.-lbf)

80 A:

Install the end cover and plate terminal with the bolt and 3 nuts.

Torque:

Nut: 4.5 N·m (46 kgf·cm, 40 in.-lbf)

Bolt: 3.8 N·m (39 kgf·cm, 34 in.-lbf)

- (b) Install the terminal insulator with the nut.

Torque: 4.1 N·m (42 kgf·cm, 36 in.-lbf)

8. CHECK THAT ROTOR ROTATES SMOOTHLY

ALTERNATOR INSTALLATION

CH0AX-02

Installation is in the reverse order of removal.

SERVICE SPECIFICATIONS
SERVICE DATA

CH03M-0P

Battery	Voltage	at 20°C (68°F)	12.5 — 12.9 V
	Specific gravity	at 20°C (68°F)	1.25 — 1.29
Drive belt	Tension		
	New belt		55 — 65 kgf
	Used belt		25 — 40 kgf
Alternator	Rated output		12 V — 70 A, 80A
	Rotor coil resistance	70 A	At 20°C (68°F): 2.8 — 3.0 Ω
		80 A	At 20°C (68°F): 2.1 — 2.5 Ω
	Slip ring diameter	STD	14.2 mm — 14.4 mm (0.559 — 0.567 in.)
	Slip ring diameter	Minimum	12.8 mm (0.504 in.)
	Brush exposed length	STD	10.5 mm (0.413 in.)
	Brush exposed length	Minimum	1.5 mm (0.059 in.)
IC regulator	Regulating voltage	at 25°C (77°F)	13.7 — 14.8 V
	Regulating voltage	at 115°C (239°F)	13.2 — 14.0 V

TORQUE SPECIFICATIONS

CH04Y-02

Part tightened		N·m	kgf·cm	ft·lbf
Bearing retainer x Drive end frame	70 A	2.6	27	23 in·lbf
	80 A	2.9	30	25 in·lbf
Rectifier end frame x Drive end frame		4.5	46	40 in·lbf
Alternator pulley x Rotor		110	1,125	81
Rectifier holder x Coil lead on rectifier end frame		2.0	20	18 in·lbf
IC regulator and brush holder x Rectifier end frame	70 A	2.0	20	17 in·lbf
	80 A	2.9	30	25 in·lbf
Rear end cover x Rectifier holder	Nut	4.5	46	40 in·lbf
	Bolt	3.8	39	34 in·lbf
Terminal insulator x Rectifier holder		4.1	41.5	36 in·lbf
Alternator x Alternator bracket		51	520	38
Alternator x Adjusting bar		18.5	185	14