

TOYOTA

1HD-FE ENGINE

REPAIR MANUAL SUPPLEMENT

May, 1996

FOREWORD

This repair manual has been prepared to provide information covering general service repairs for the 1HD-FT engine equipped in the TOYOTA LAND CRUISER.

Applicable models: HDJ80 series

For basic engine service repair, refer to the following repair manual.

1HD-FT Engine Repair Manual (Pub. No. RM437E)

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

Manual Name	Pub. No.
• LAND CRUISER	NCF064E

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

NOTE: The following screen toning letters section refer to
1 HD-FT Repeir Munual (Pub.No.RM 437 E).

INTRODUCTION
ENGINE
STARTING
CHARGING

IN

EG

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INTRODUCTION

HOW TO USE THIS MANUAL	IN— 2
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IN

HOW TO USE THIS MANUAL

INDEX

IN002-1F

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

IN

GENERAL DESCRIPTION

At the beginning of each section, a General Description is given that pertains to all repair operations contained in that section.

Read these precautions before starting any repair task.

TROUBLESHOOTING

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

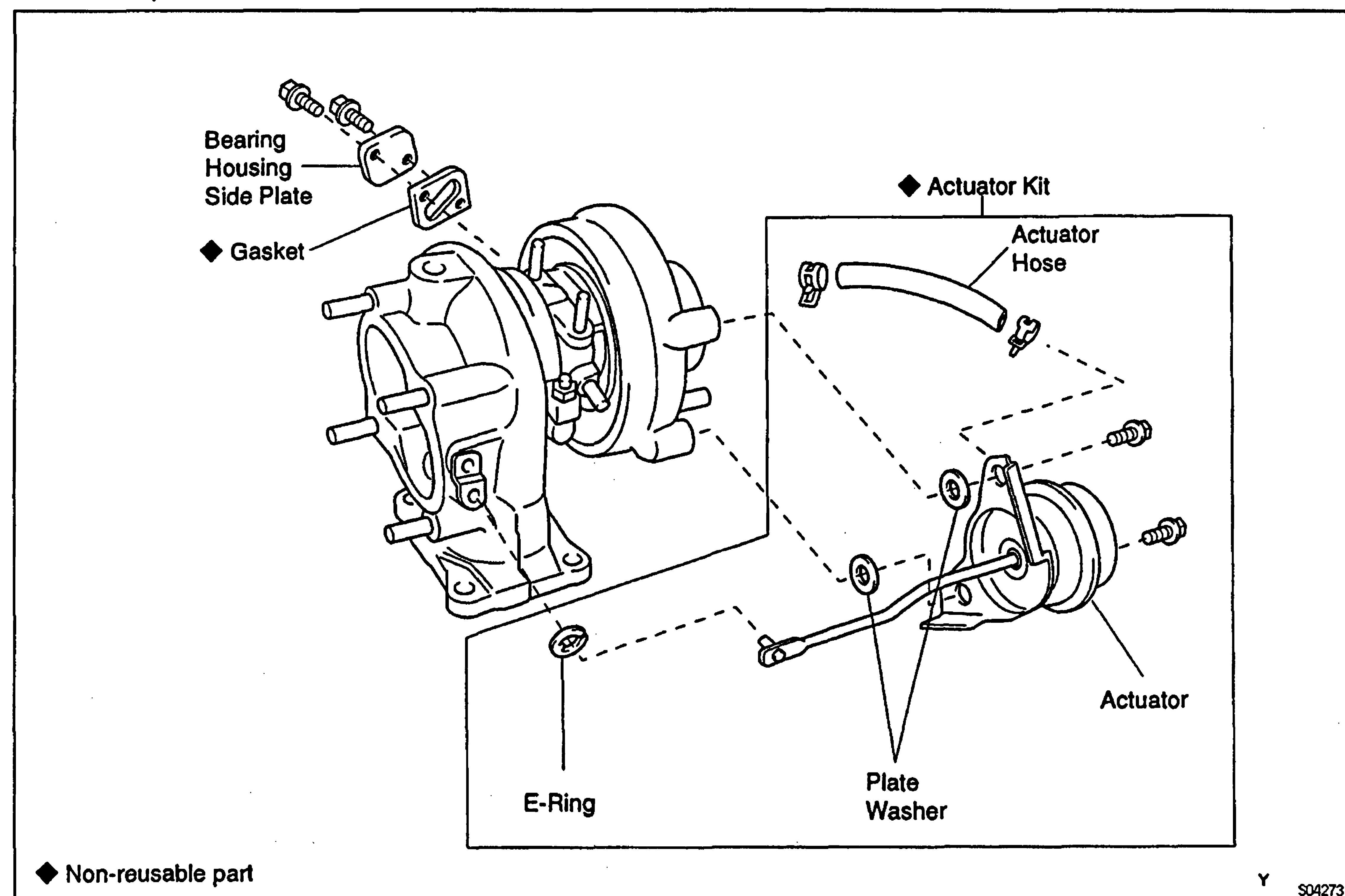
PREPARATION

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

REPAIR PROCEDURES

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

Example:



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

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

Example:



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

REFERENCES

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

SPECIFICATIONS

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

CAUTIONS, NOTICES, HINTS:

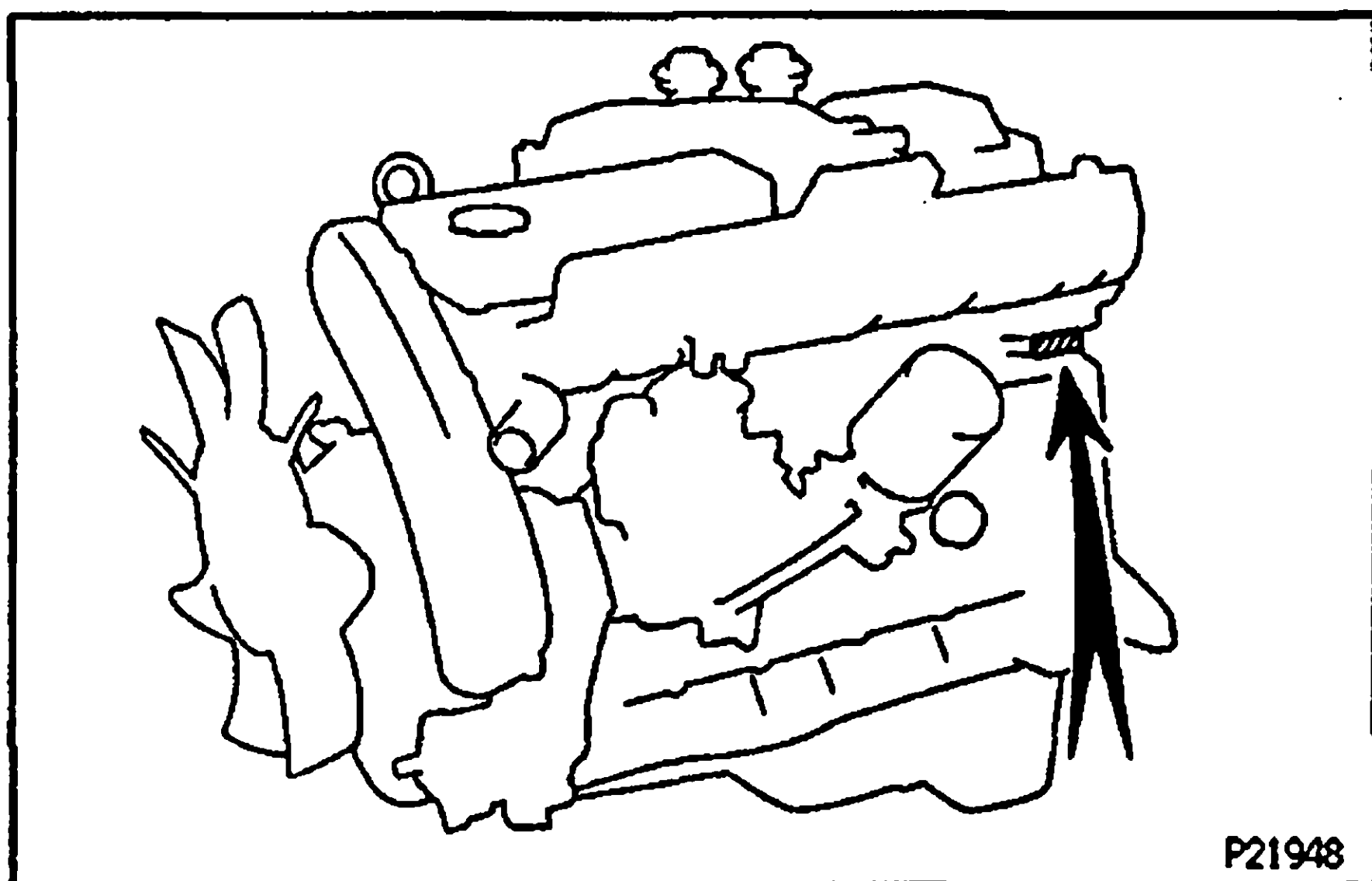
- **CAUTIONS** are presented in bold type, and indicate there is a possibility of injury to you or other people.
- **NOTICES** are also presented in bold type, and indicate the possibility of damage to the components being repaired.
- **HINTS** are separated from the text but do not appear in bold. They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

SI UNIT

The **UNITS** given in this manual are primarily expressed according to the **SI UNIT**(International System of Unit), and alternately expressed in the metric system and in the English System.

Example:

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

**IDENTIFICATION INFORMATION
ENGINE SERIAL NUMBER**

IN01A-00

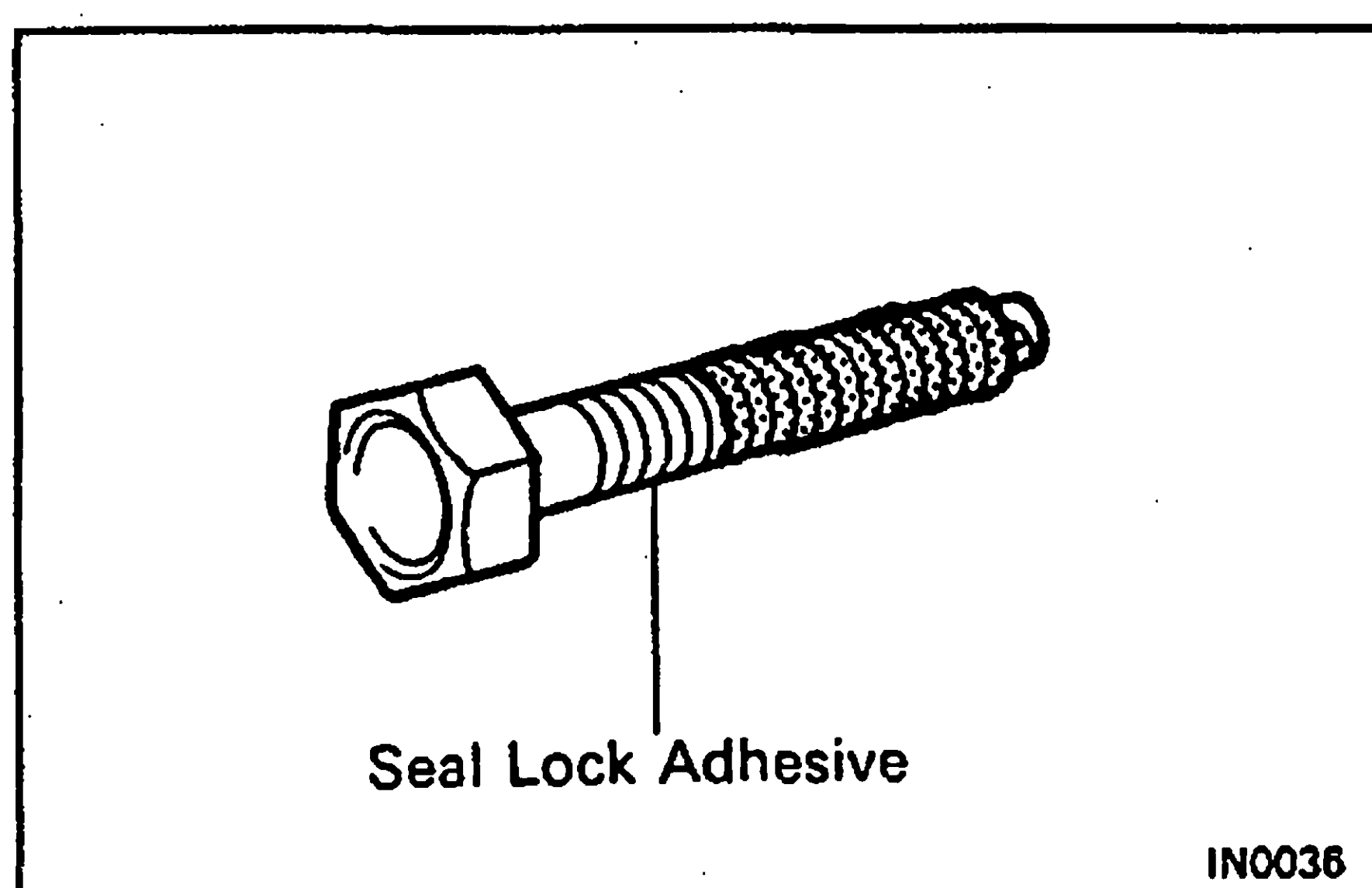
The engine serial number is stamped on the engine block as shown.

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

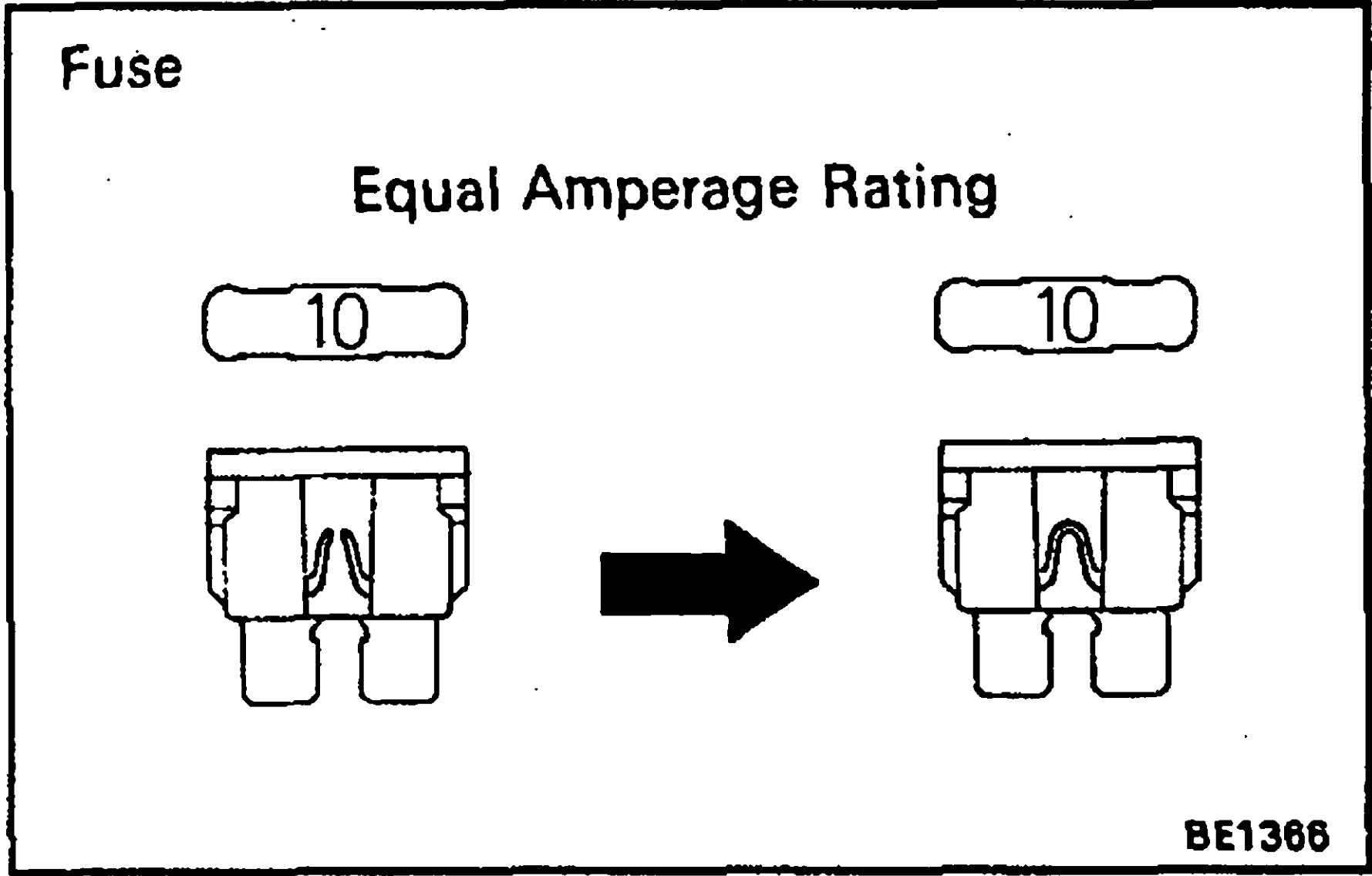
Precoated parts are bolts and nuts, etc. that are coated with a seal lock adhesive at the factory.

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



IN

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



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

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

V00076

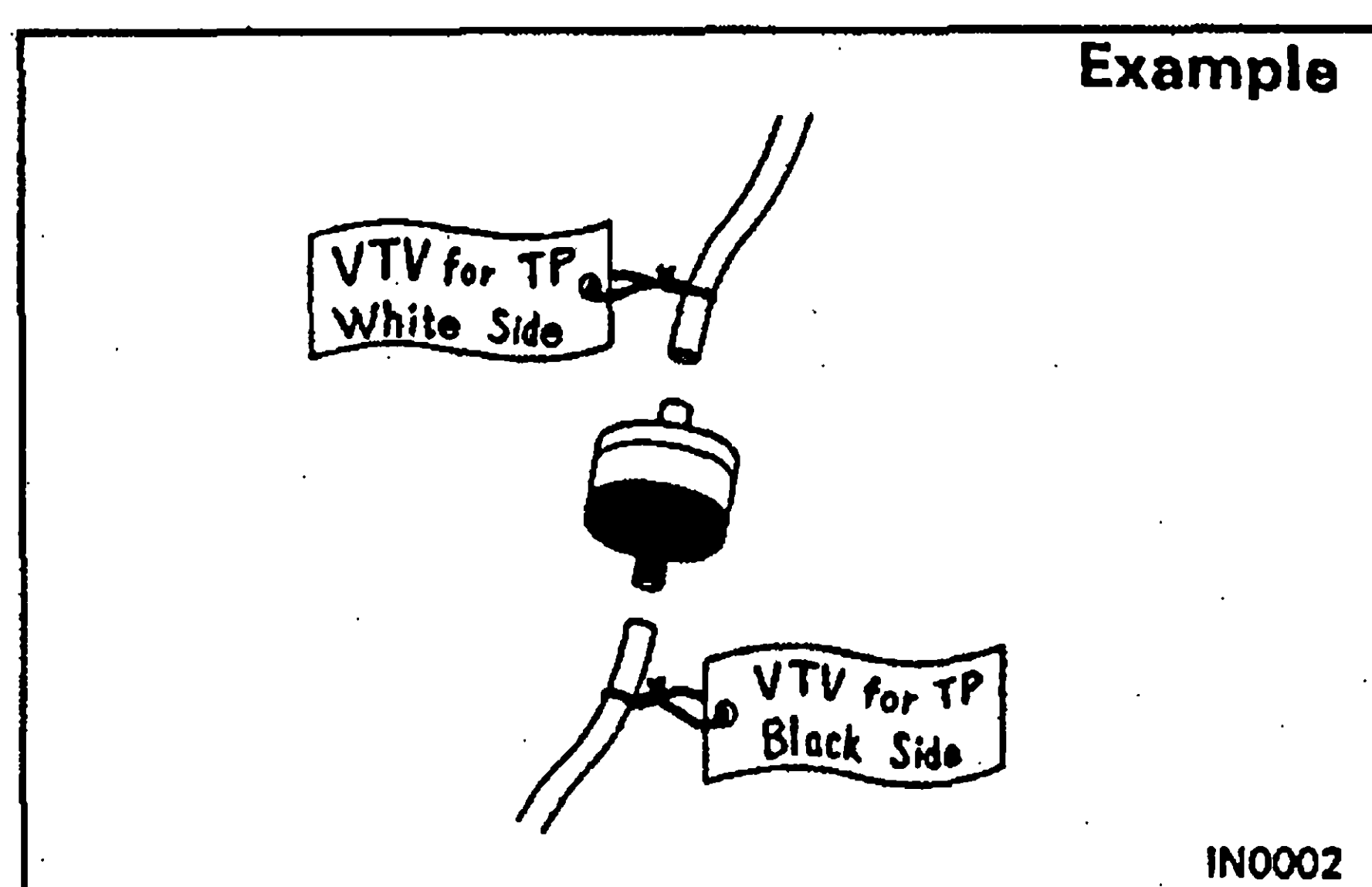
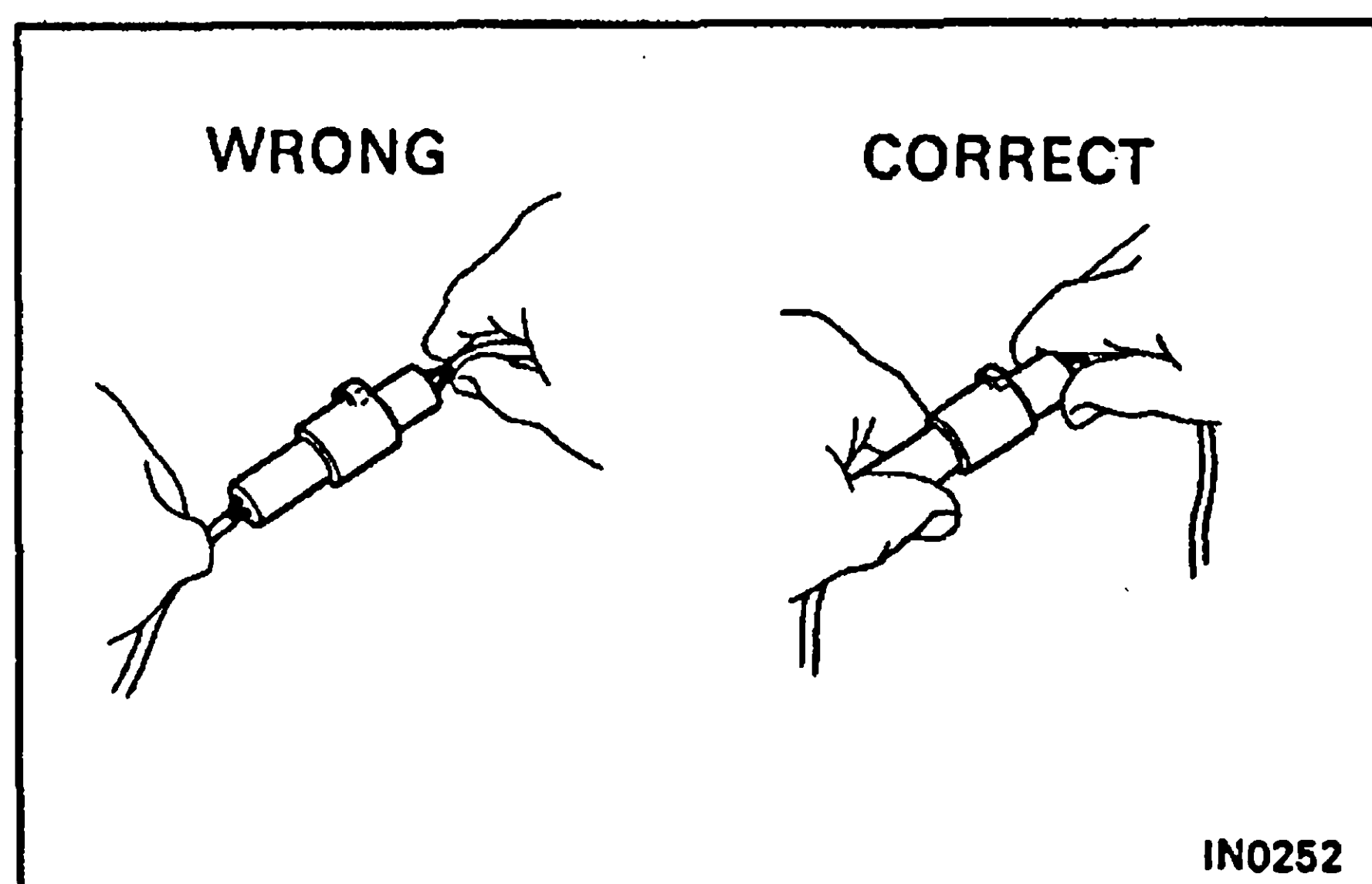
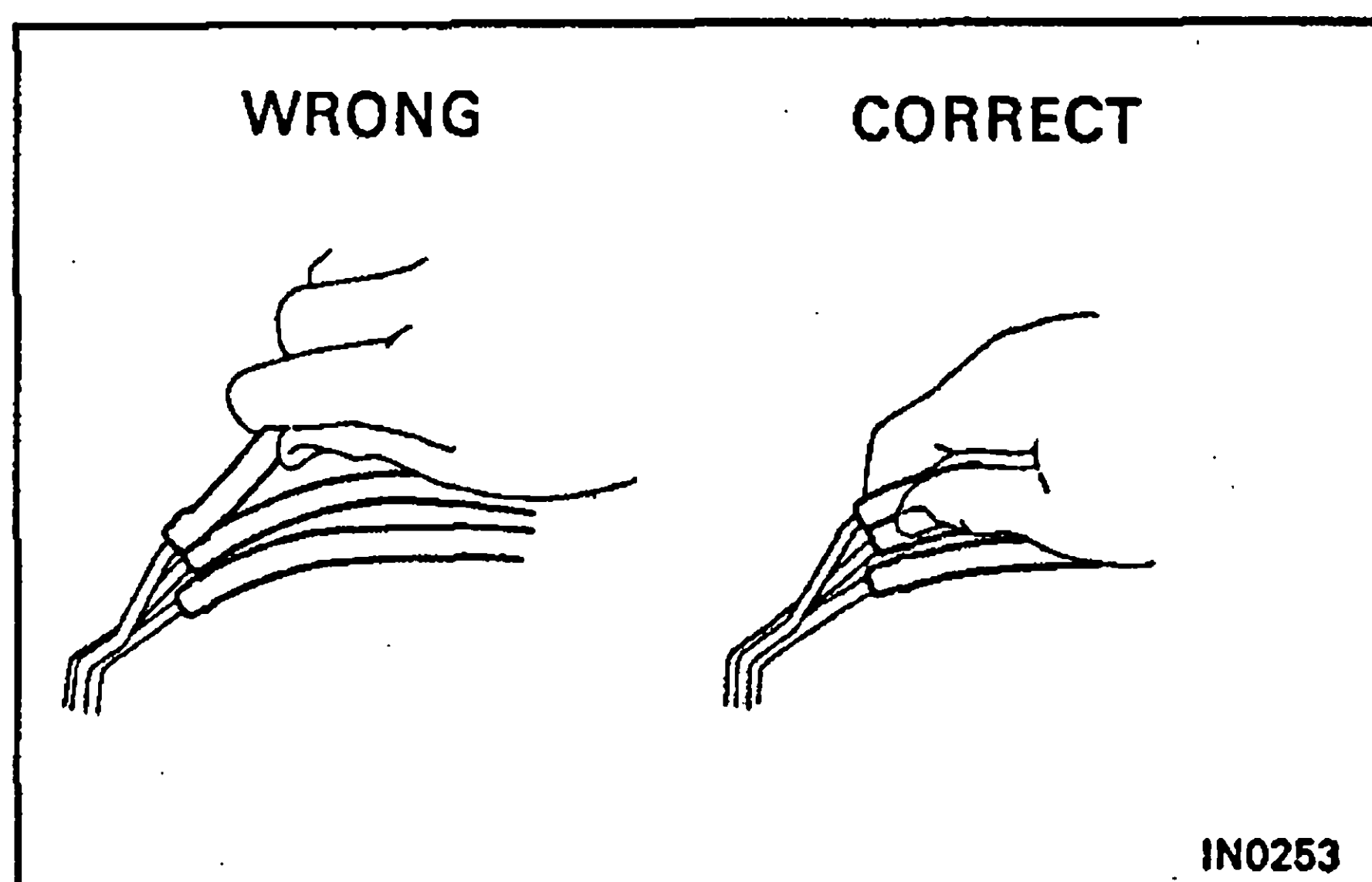
11. Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.

(a) If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels at the opposite end in order to ensure safety.

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

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

- (a) Do not open the cover or case of the ECU unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)
- (b) To disconnect vacuum hoses, pull on the end, not the middle of the hose.
- (c) To pull apart electrical connectors, pull on the connector itself, not the wires.
- (d) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.
- (e) When steam cleaning an engine, protect the distributor, air filter, and VCV from water.
- (f) Never use an impact wrench to remove or install temperature switches or temperature sensors.
- (g) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.
- (h) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step-down adapter instead. Once the hose has been stretched, it may leak.



13. Tag hoses before disconnecting them:

- (a) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.
- (b) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.

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

ABBREVIATIONS USED IN THIS MANUAL

IN060-01

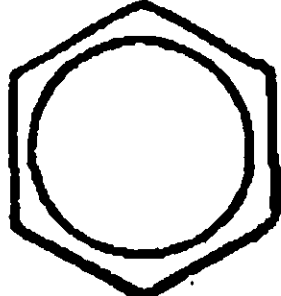
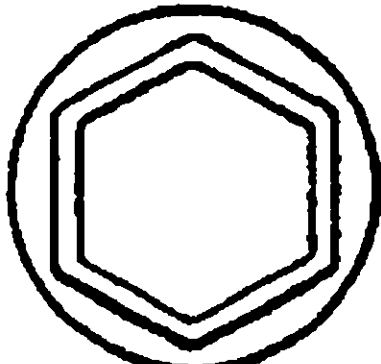
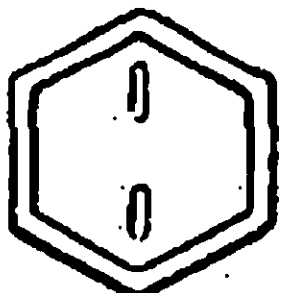
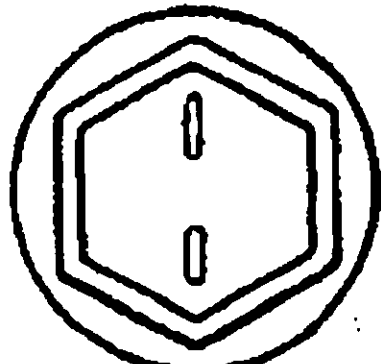
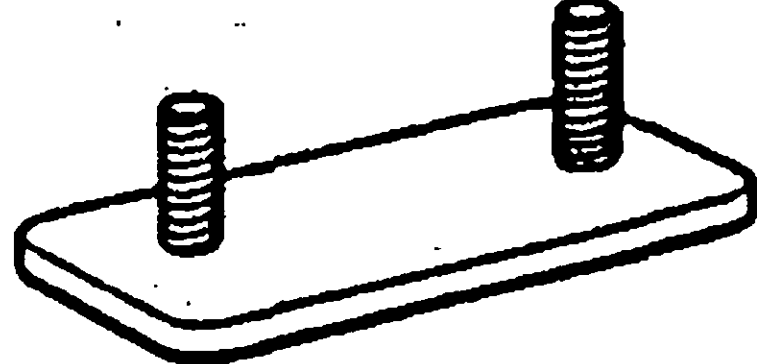
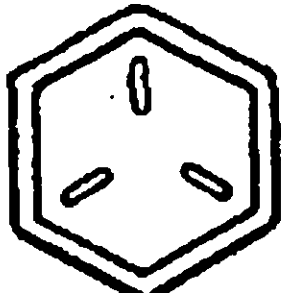
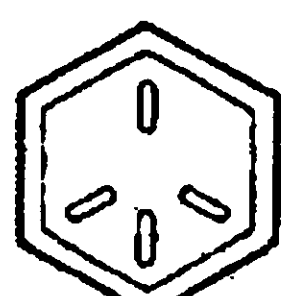
A/C	Air Conditioner
ACV	Air Control Valve
ACSD	Automatic Cold Start Device
Approx.	Approximately
A/T	Automatic Transmission
BACS	Boost and Altitude Compensation Stopper
BDC	Bottom Dead Center
ECU	Electronic Control Unit
EGR	Exhaust Gas Recirculation
FIPG	Formed in Place Gasket
LHD	Left—Hand Drive
LST	Load Sensing Timer
MP	Multipurpose
M/T	Manual Transmission
OHC	Over Head Camshaft
O/S	Oversized
PCS	Power Control System
PCV	Positive Crankcase Ventilation
PS	Power Steering
RHD	Right—Hand Drive
SICS	Starting Injection Control System
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch
TDC	Top Dead Center
TEMP.	Temperature
U/S	Undersize
VSV	Vacuum Switching Valve
w/	With
w/o	Without

STANDARD BOLT TORQUE SPECIFICATIONS

MO06-06

HOW TO DETERMINE BOLT STRENGTH

IN

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

SPECIFIED TORQUE FOR STANDARD BOLTS

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

ENGINE

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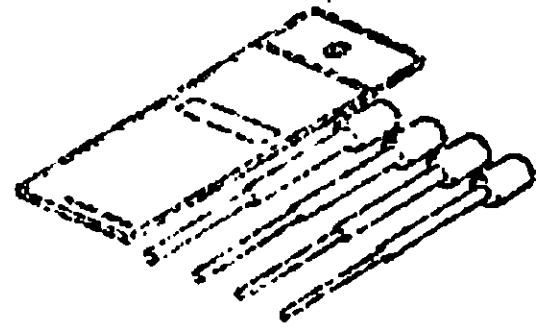
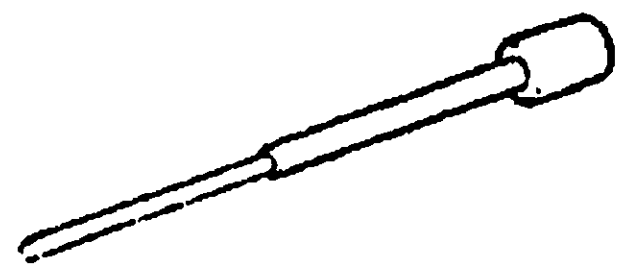
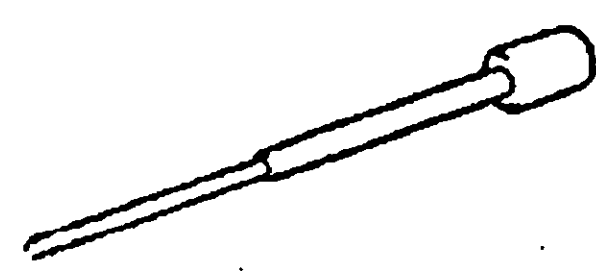
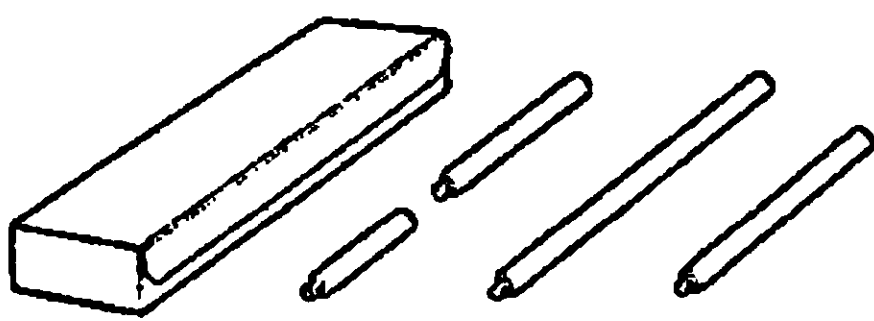
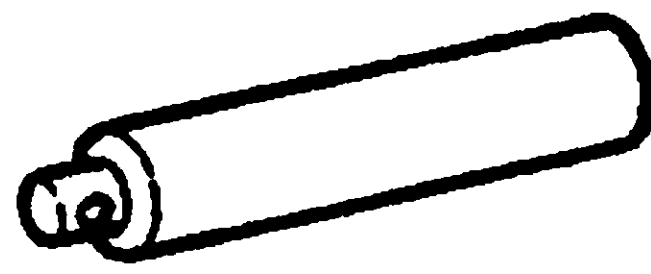
EG

ENGINE MECHANICAL

PREPARATION

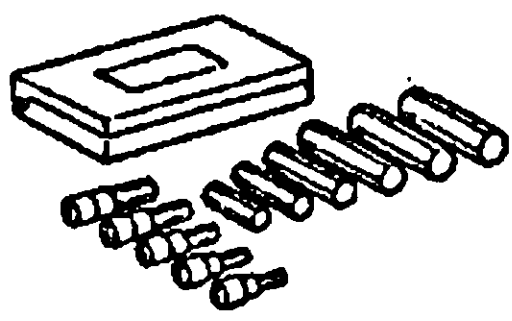
SST (SPECIAL SERVICE TOOLS)

EG04Y-28

	09201-10000 Valve Guide Bushing Remover & Replacer Set	
	(09201-01070) Valve Guide Bushing Remover & Replacer 7	
	(09201-01080) Valve Guide Bushing Remover & Replacer 8	
	09950-70010 Handle Set	
	(09951-07100) Handle 100	Valve guide bushing

RECOMMENDED TOOLS

EG04Z-12

	09040-00010 Hexagon Wrench Set .	
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EQUIPMENT

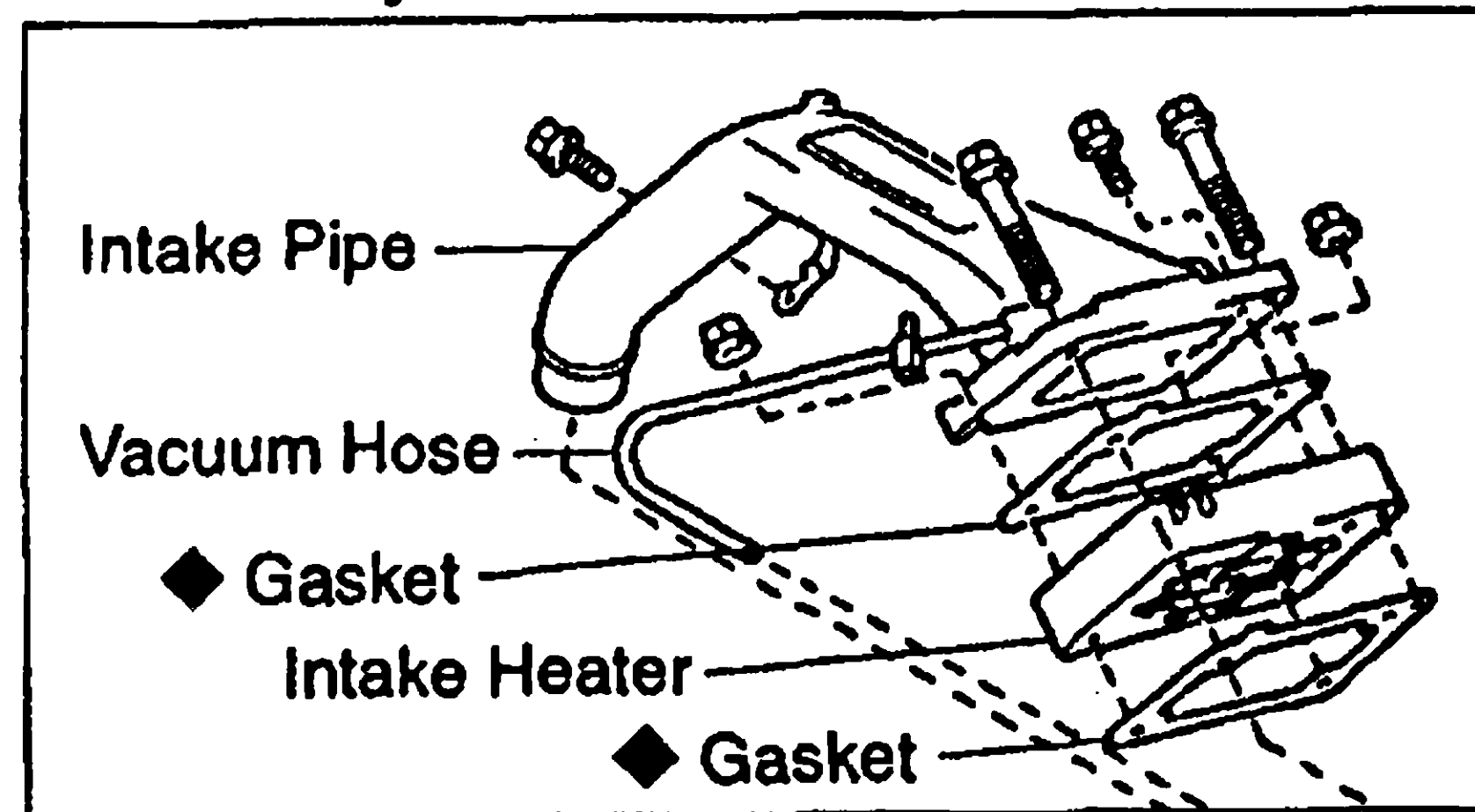
EG080-22

Caliper gauge	
Micrometer	
Plastigage	
Precision straight edge	
Spring tester	Valve spring
Steel square	Valve spring
Torque wrench	
Vernier calipers	

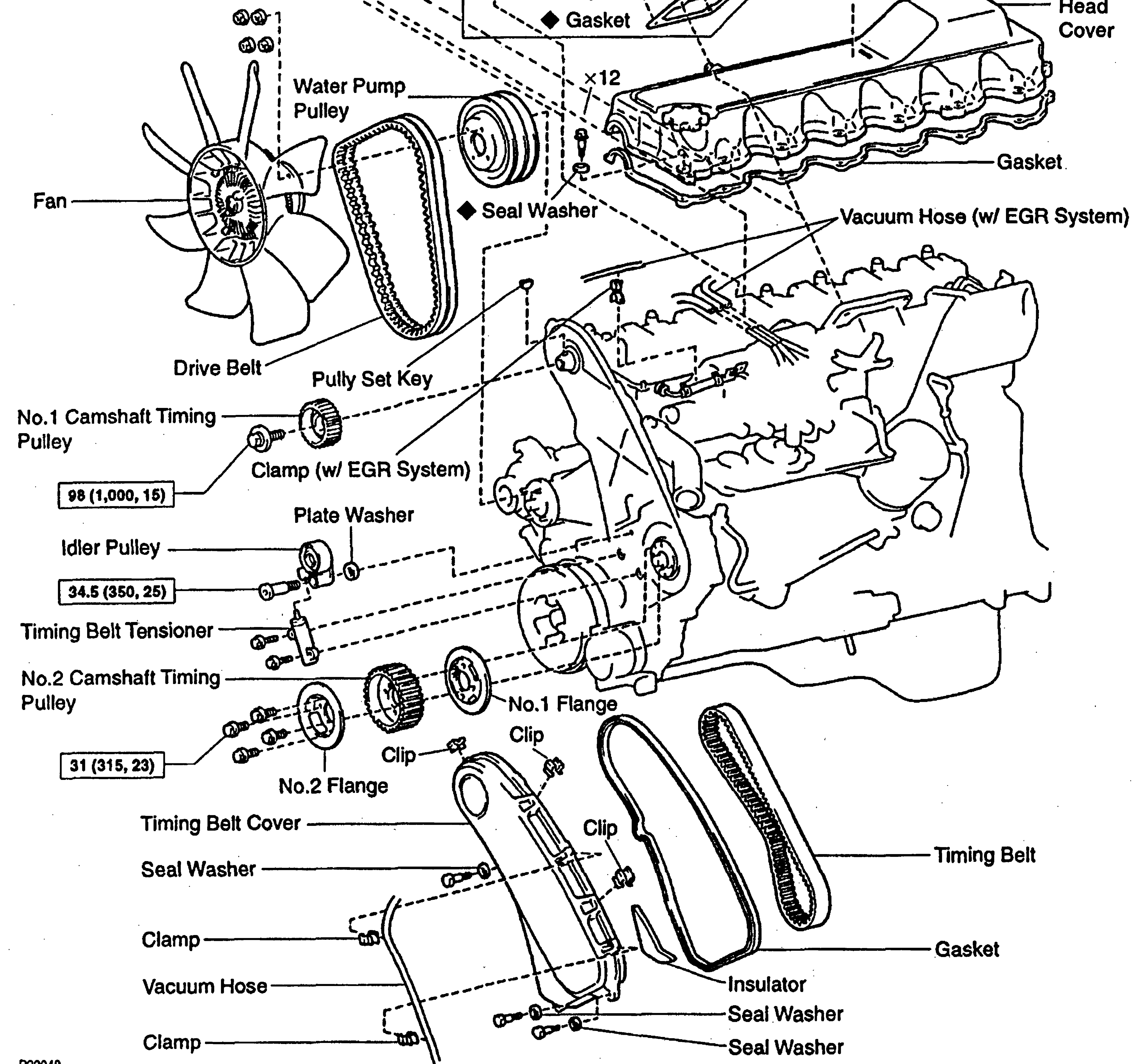
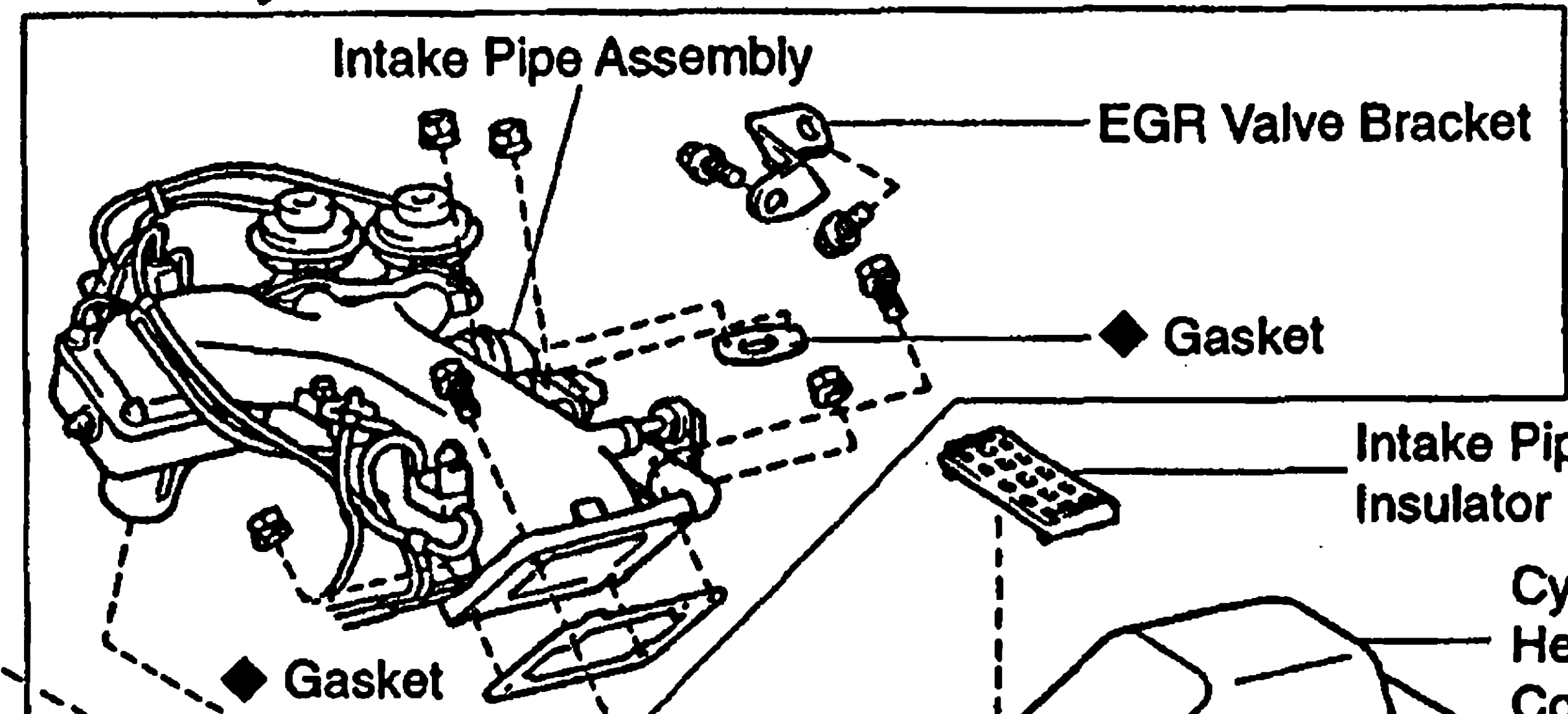
TIMING GEAR COMPONENTS FOR REMOVAL AND INSTALLATION

EGRE-02

w/o EGR System



w/ EGR System



P22049

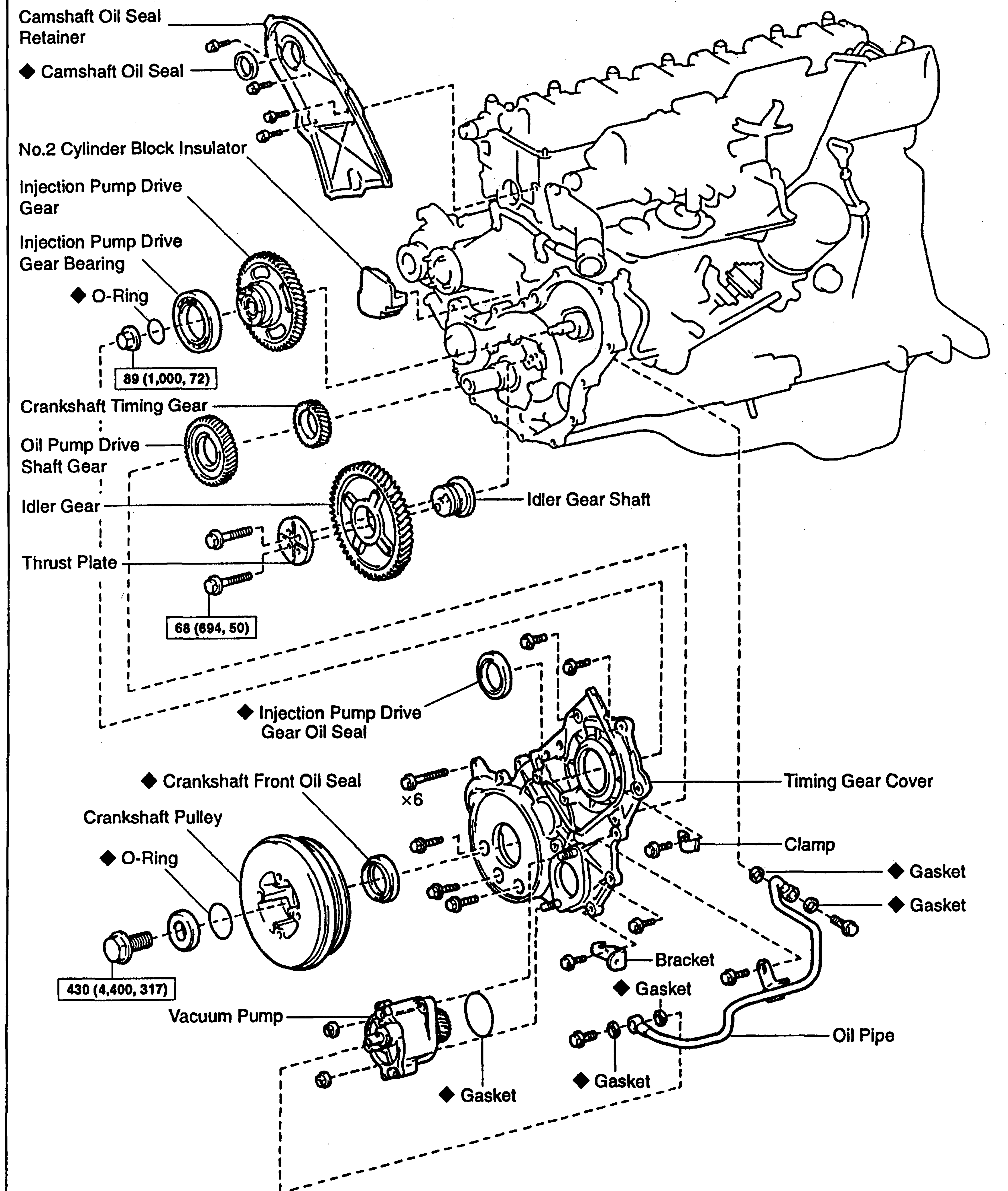
N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

Y

Z18432

EG

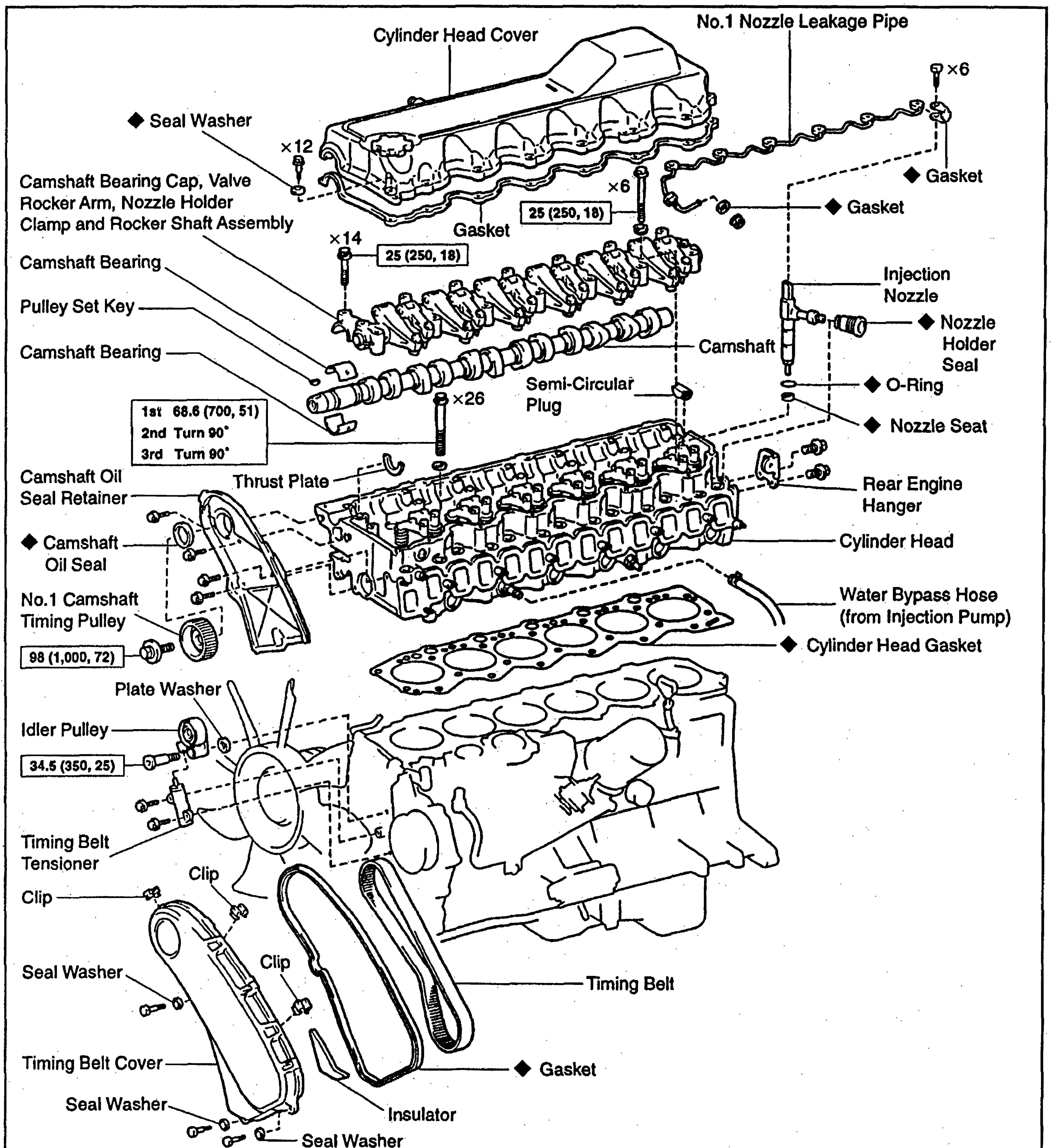


N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

CYLINDER HEAD COMPONENTS FOR REMOVAL AND INSTALLATION

EG7C8-01



P22035

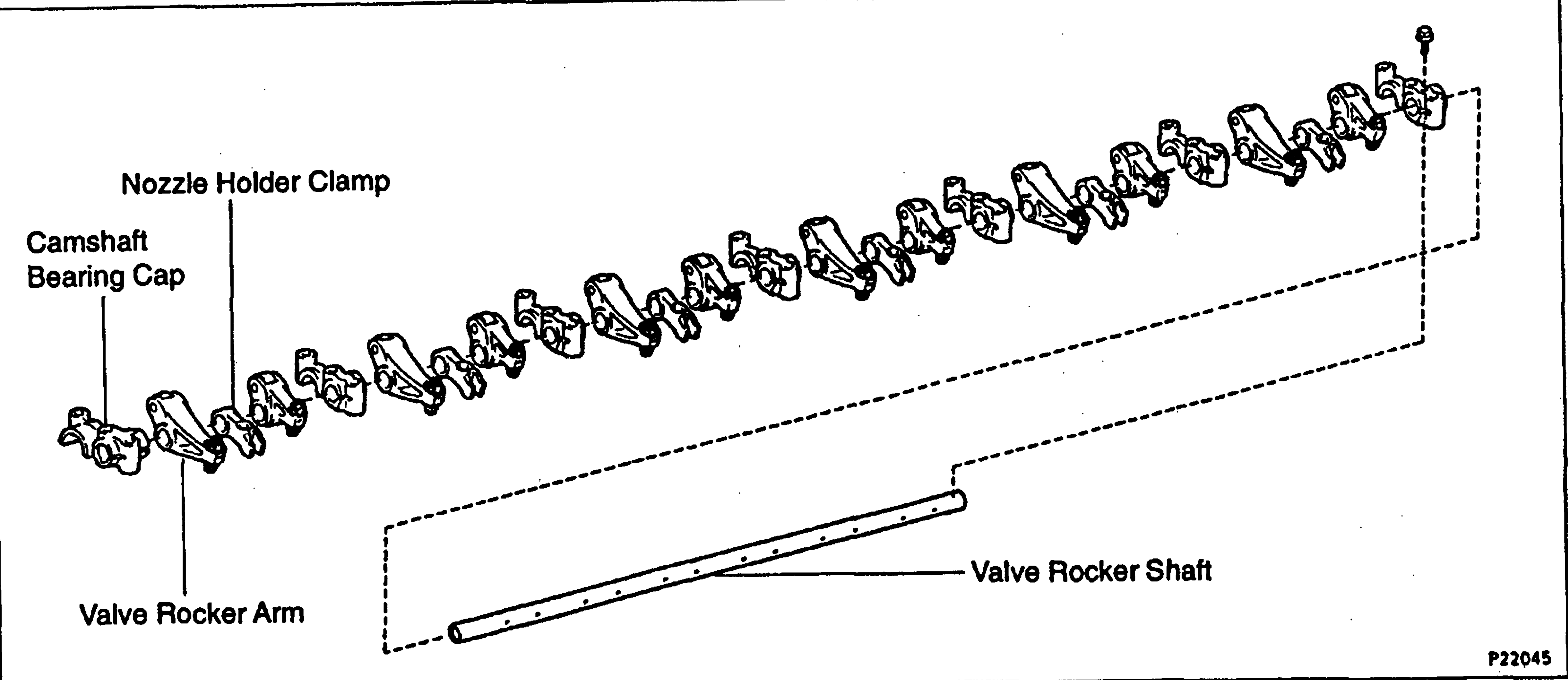
N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

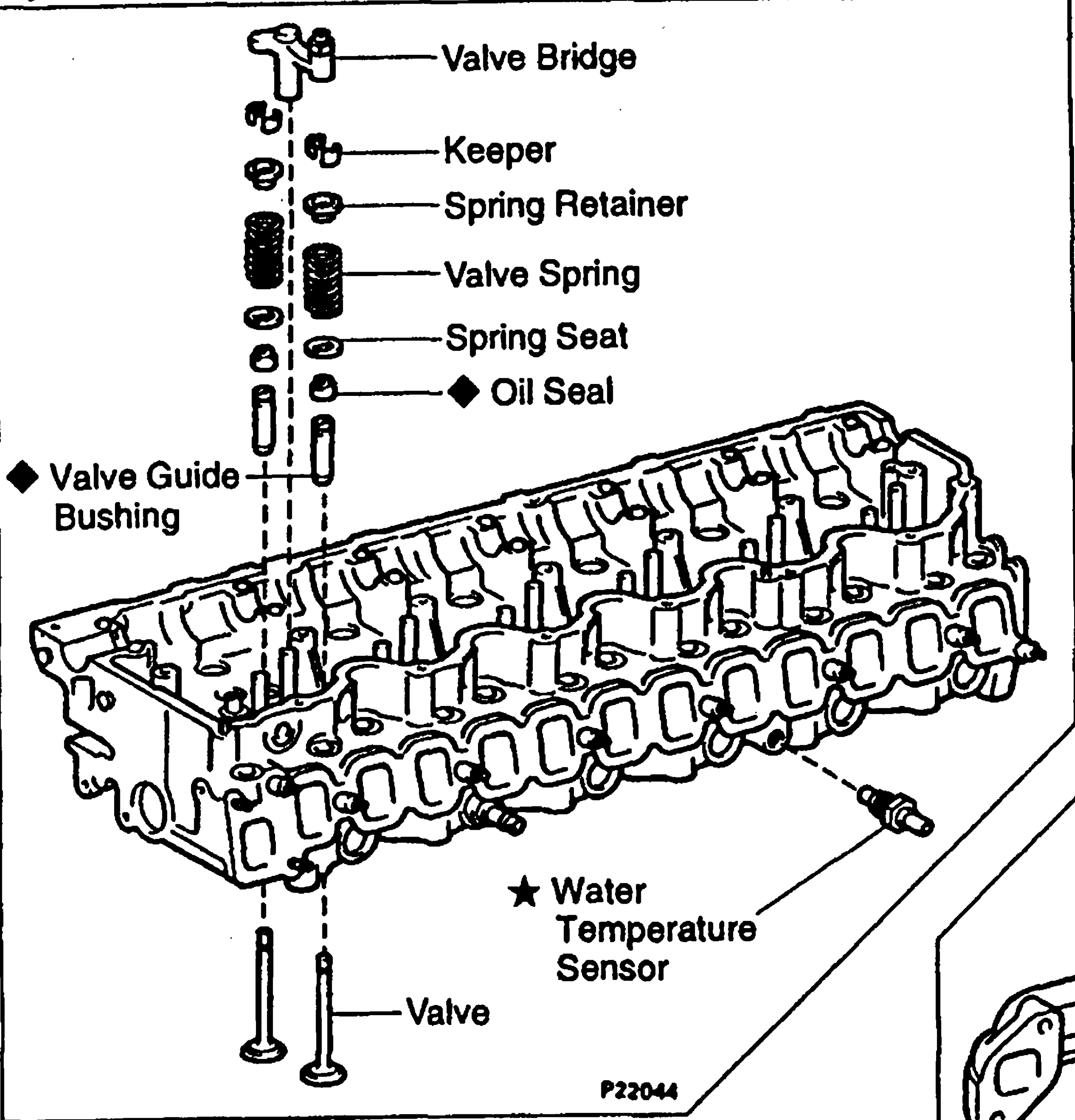
Y

Z18431

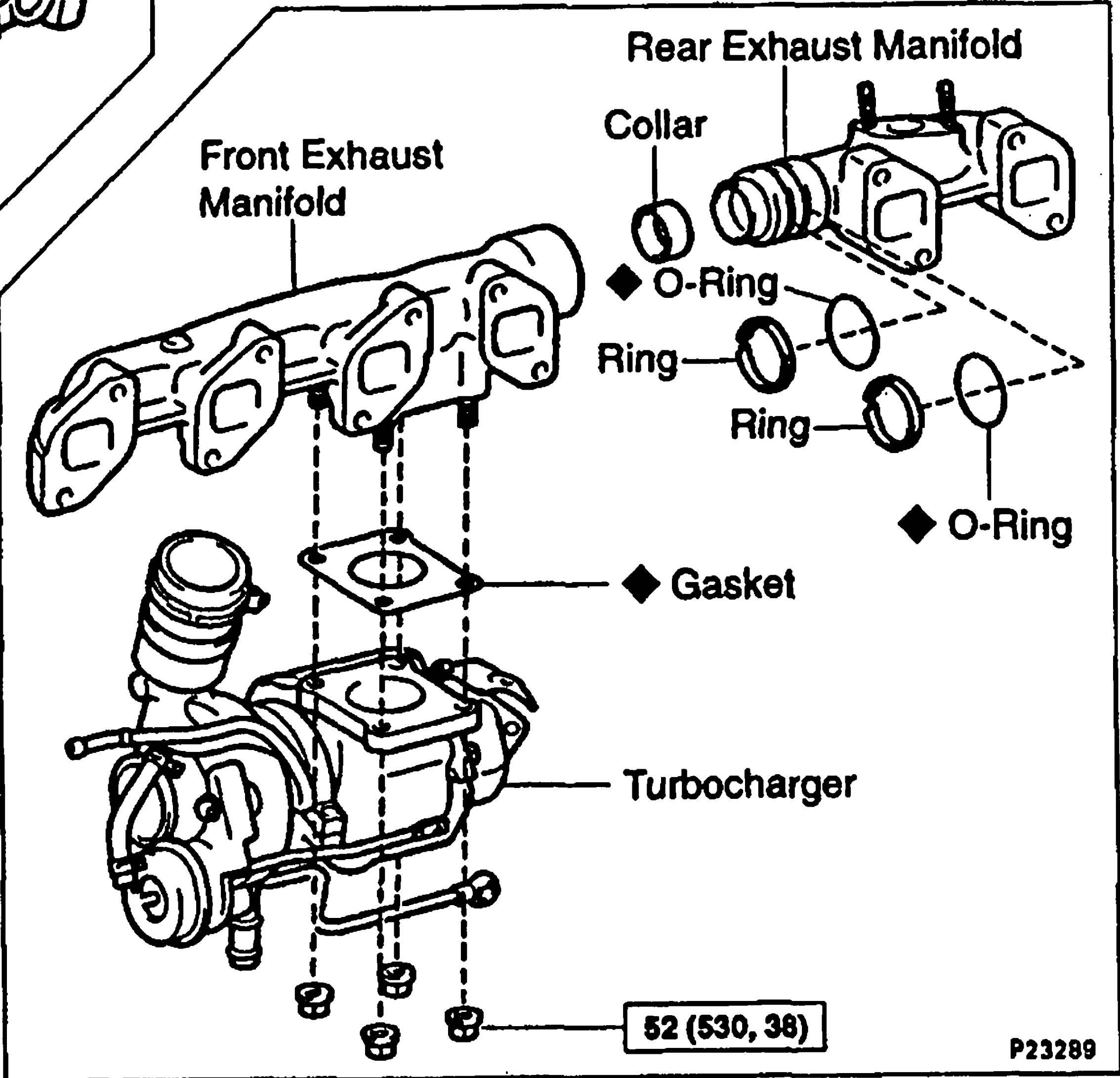
Camshaft Bearing Cap, Valve Rocker Arm, Nozzle Holder Clamp and Rocker Shaft Assembly



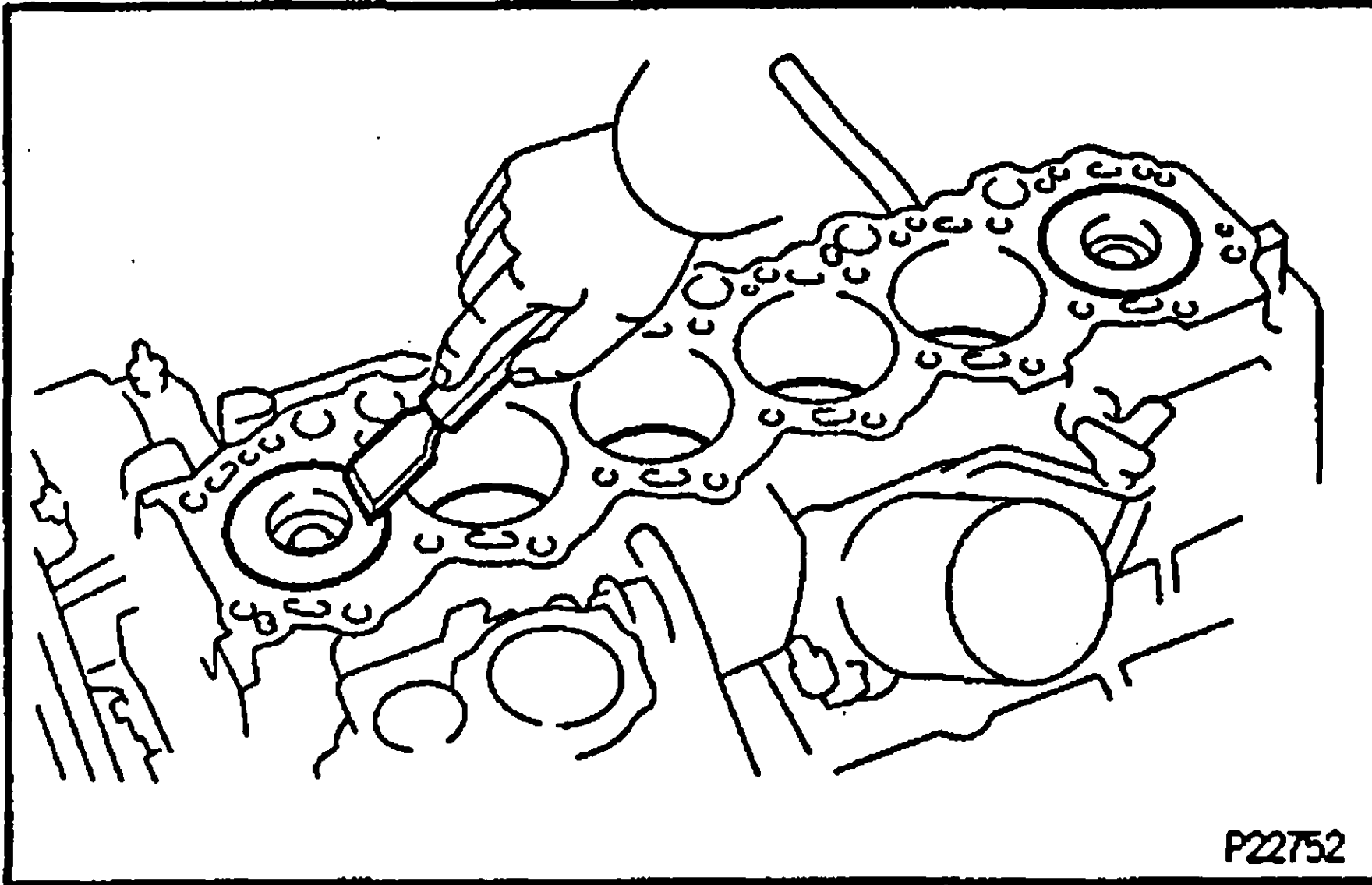
Cylinder Head Assembly



Turbocharger and Exhaust Manifold Assembly



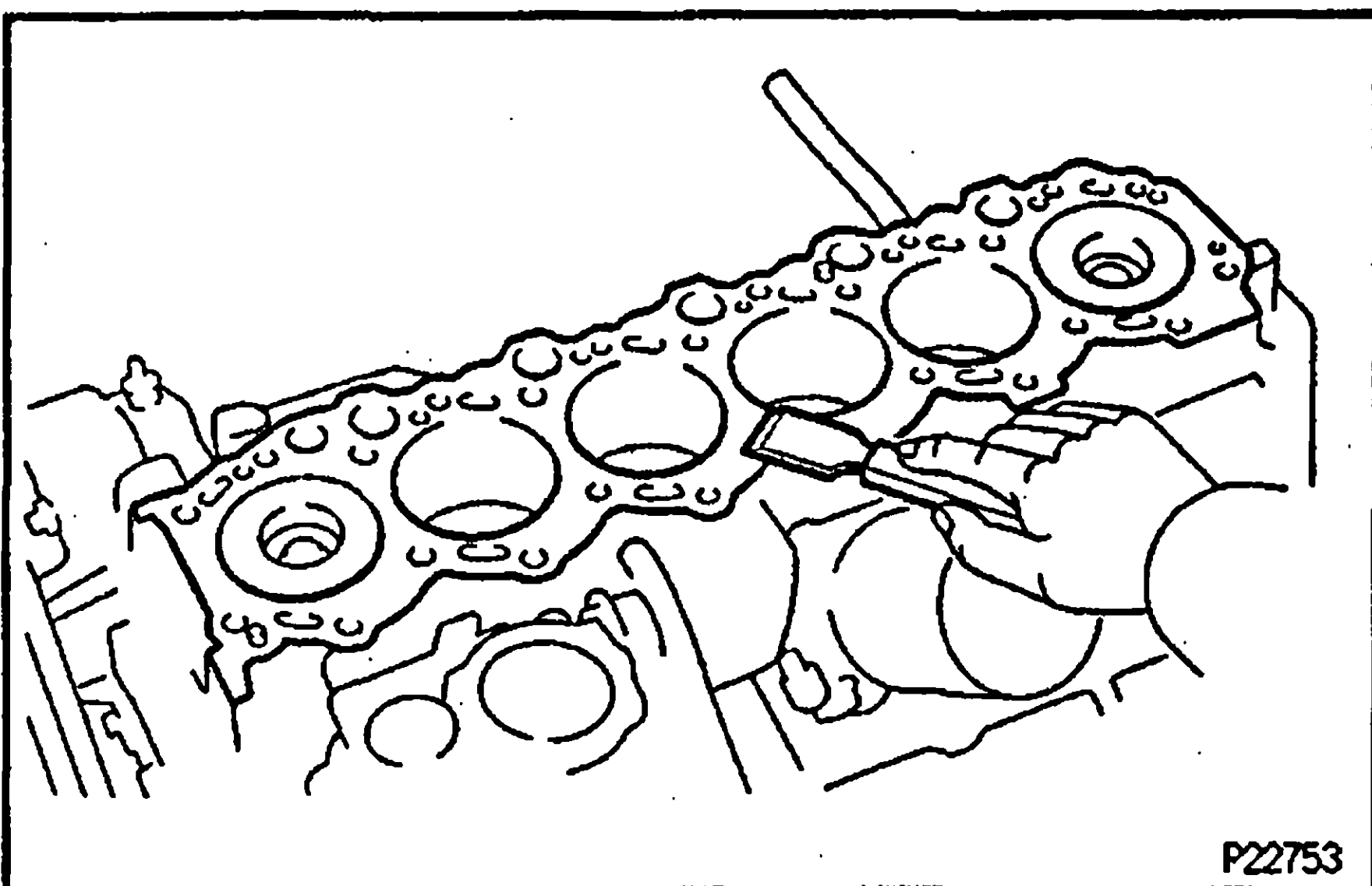
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
★ Precoated part



CYLINDER HEAD COMPONENTS INSPECTION AND REPAIR

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

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

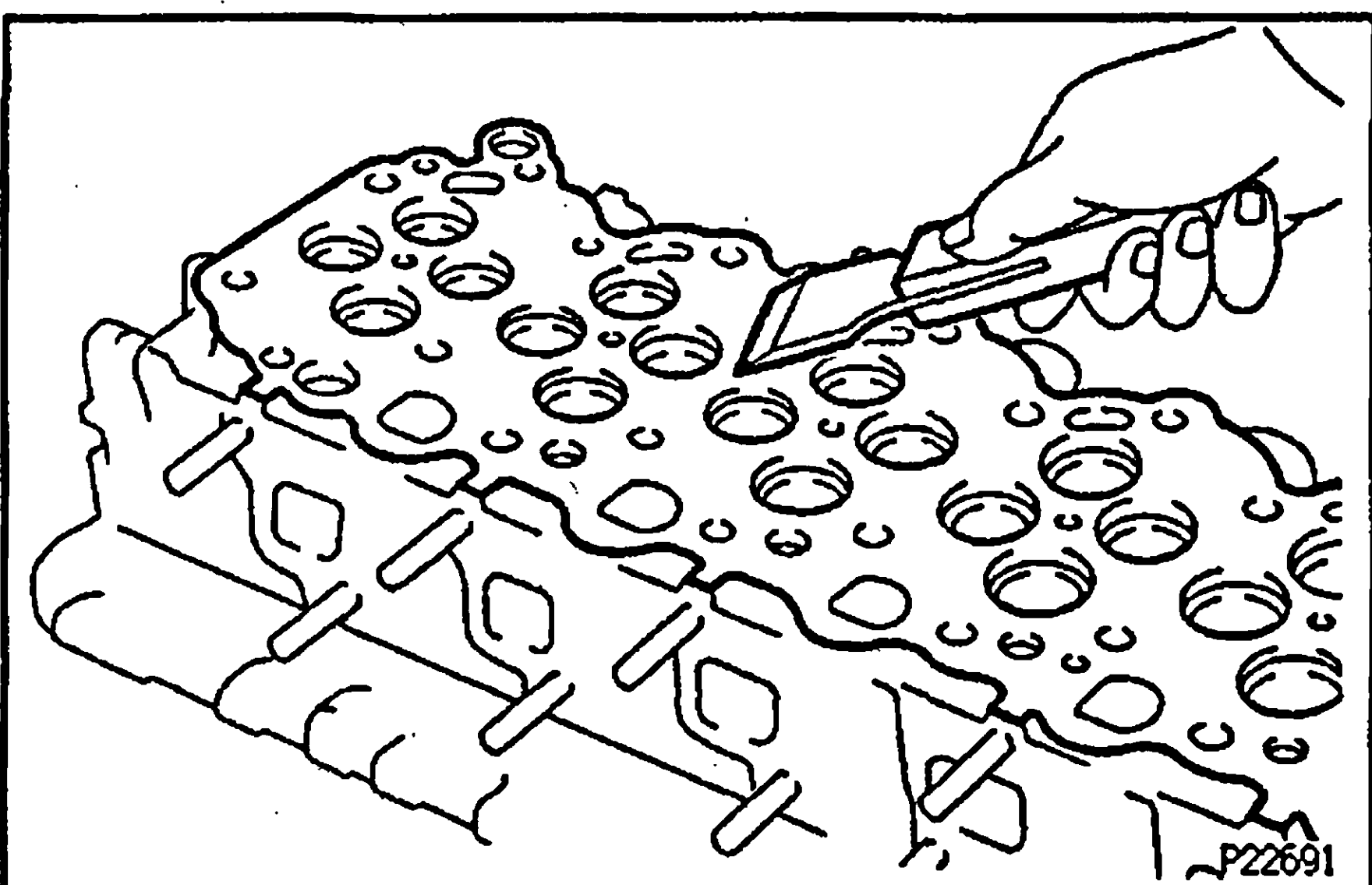


- (b) Remove all the gasket material from the top of the cylinder block.

NOTICE: Be careful not to scratch the surfaces.

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

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

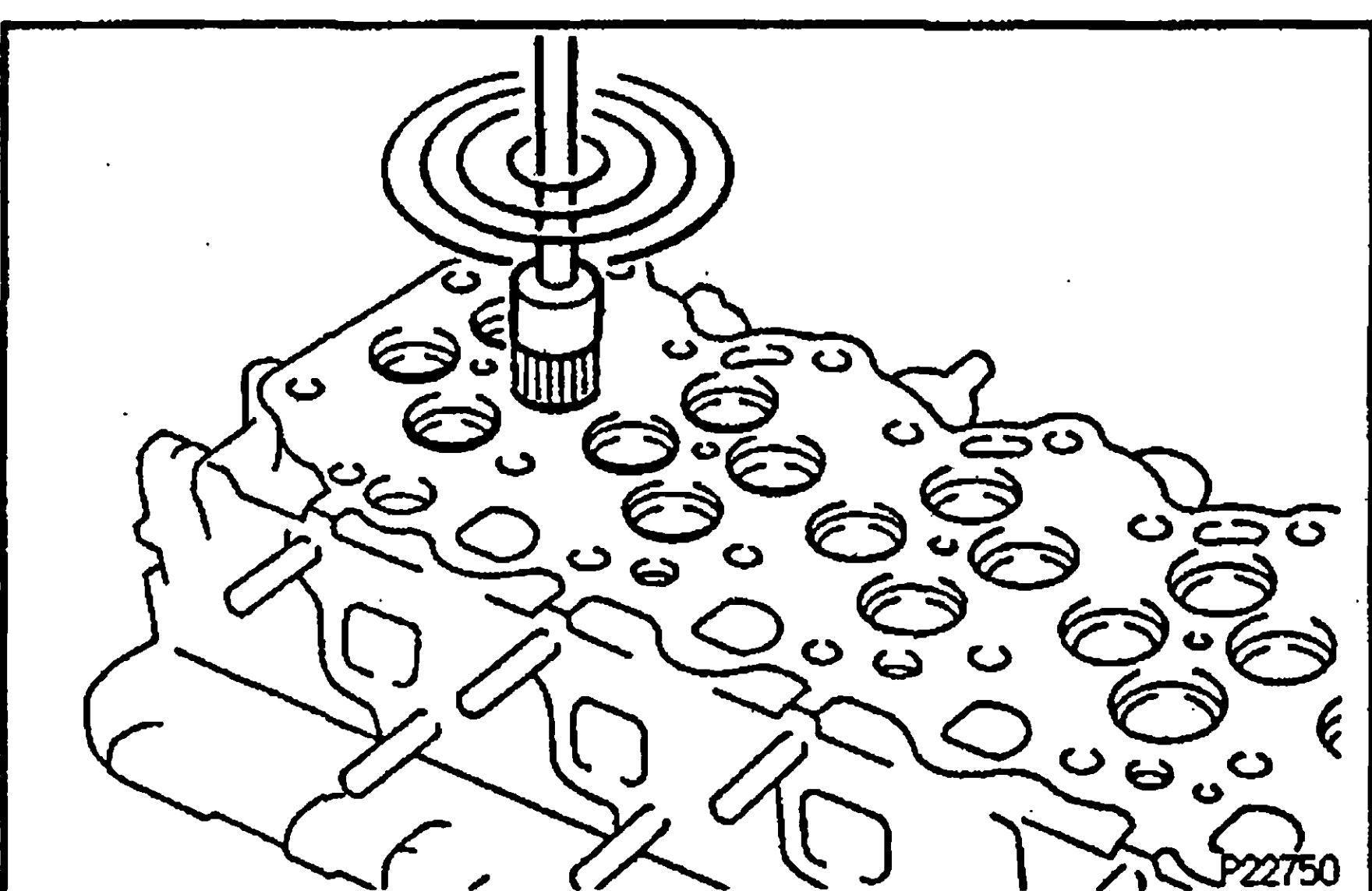


2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

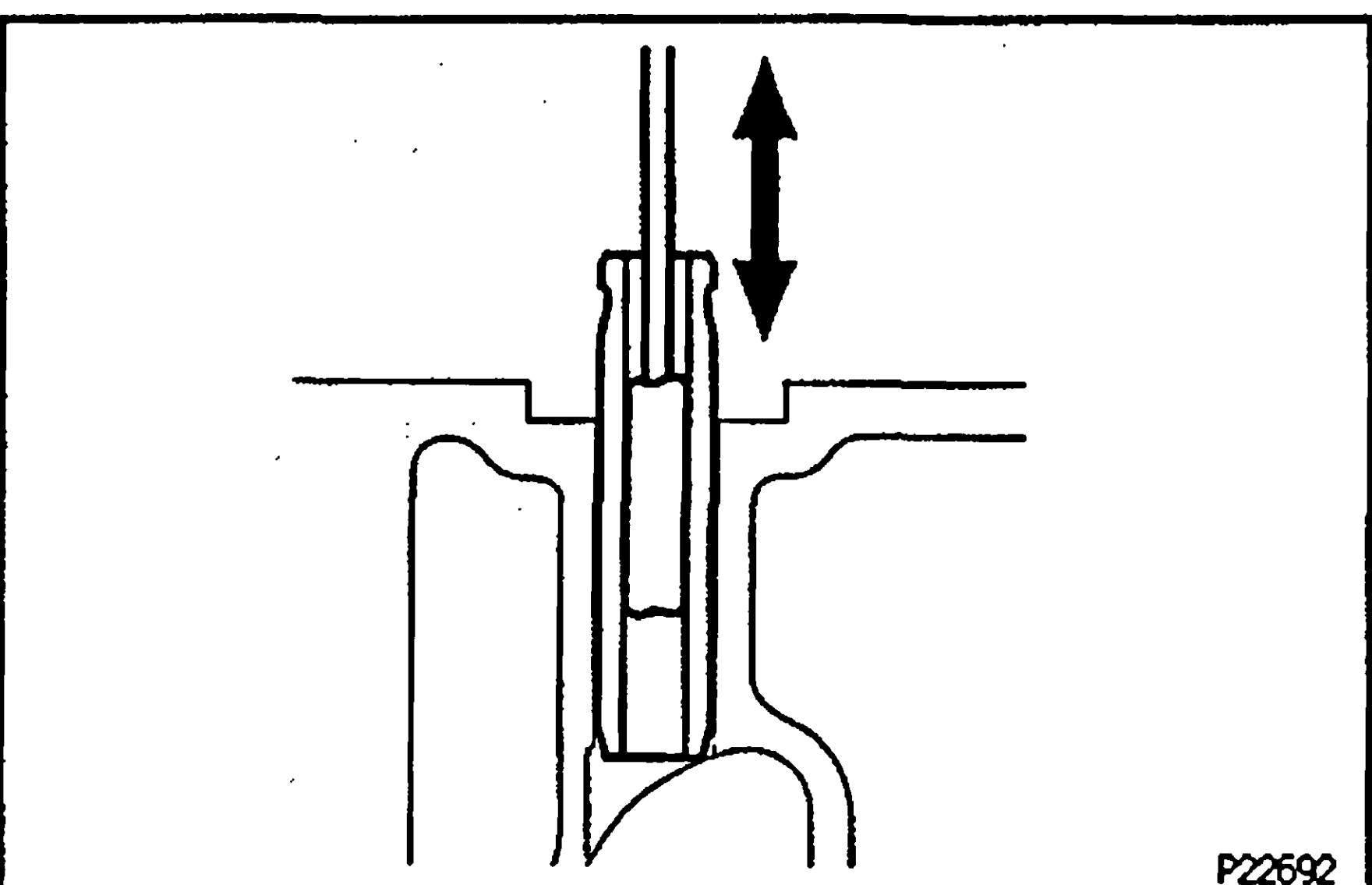
NOTICE: Be careful not to scratch the cylinder block contact surface.



B. Clean intake and exhaust ports

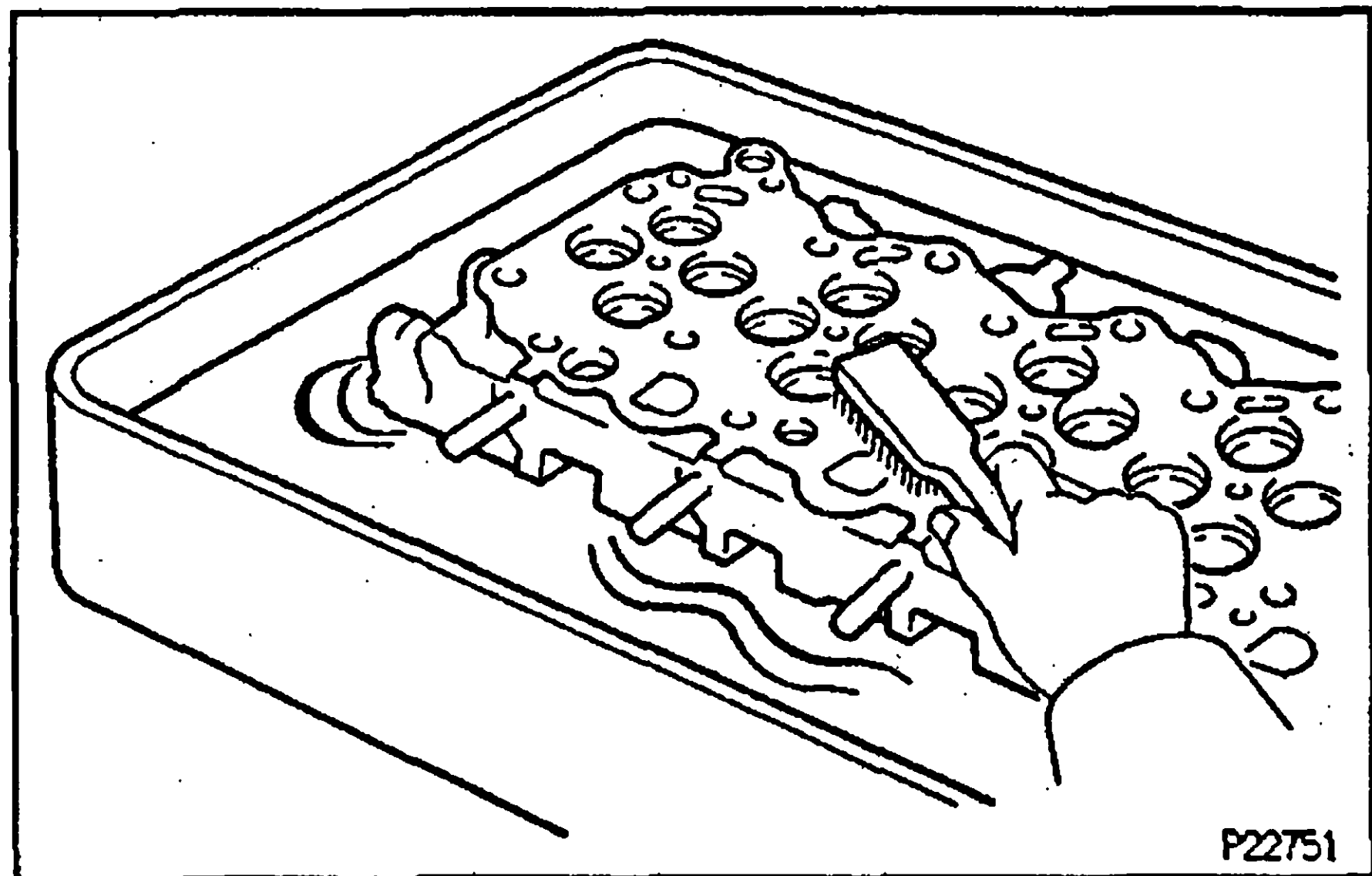
Using a wire brush, remove all the carbon from the intake and exhaust ports.

NOTICE: Be careful not to scratch the valve contact surface.

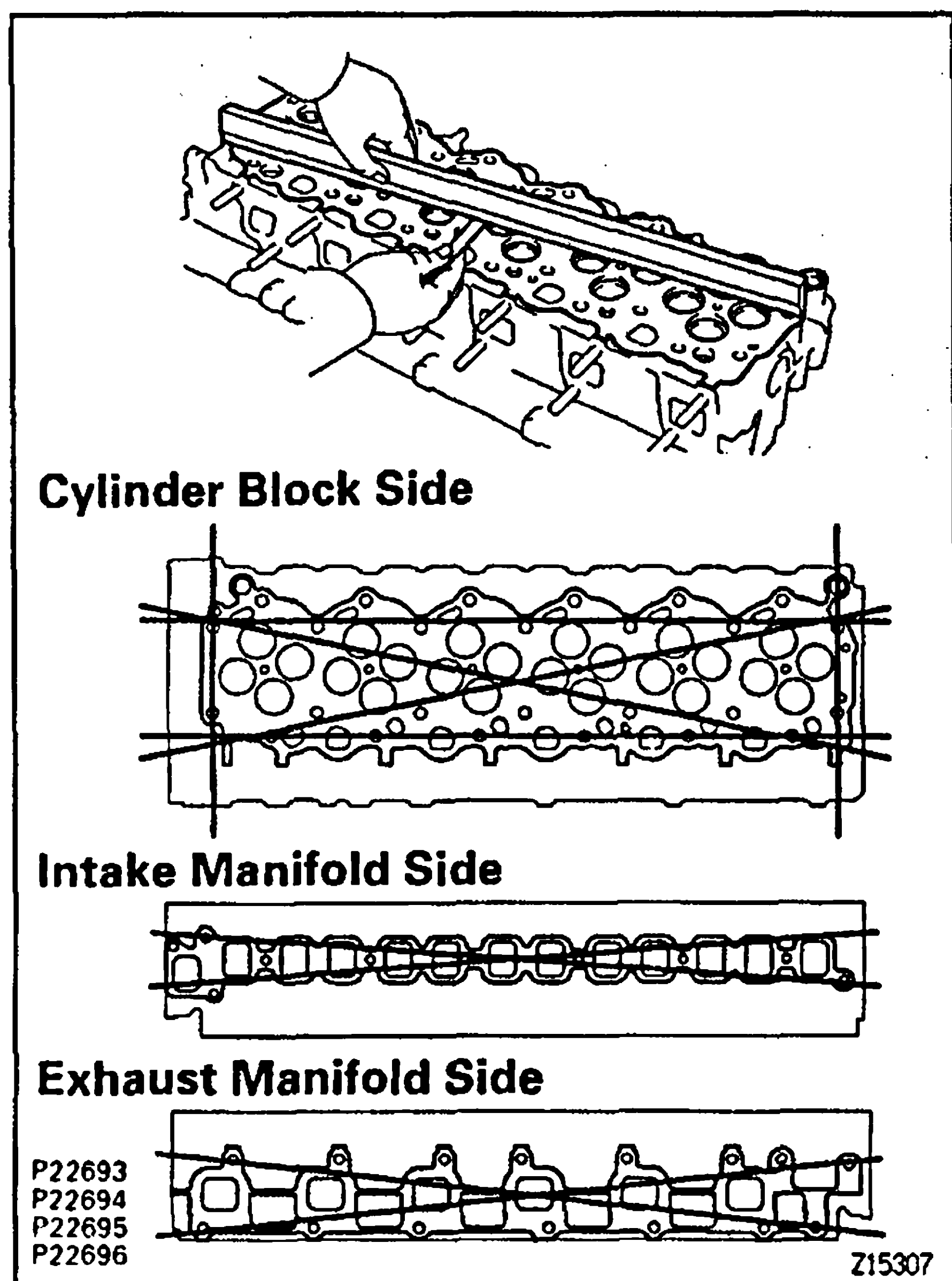


C. Clean valve guide bushings

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

**D. Clean cylinder head**

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

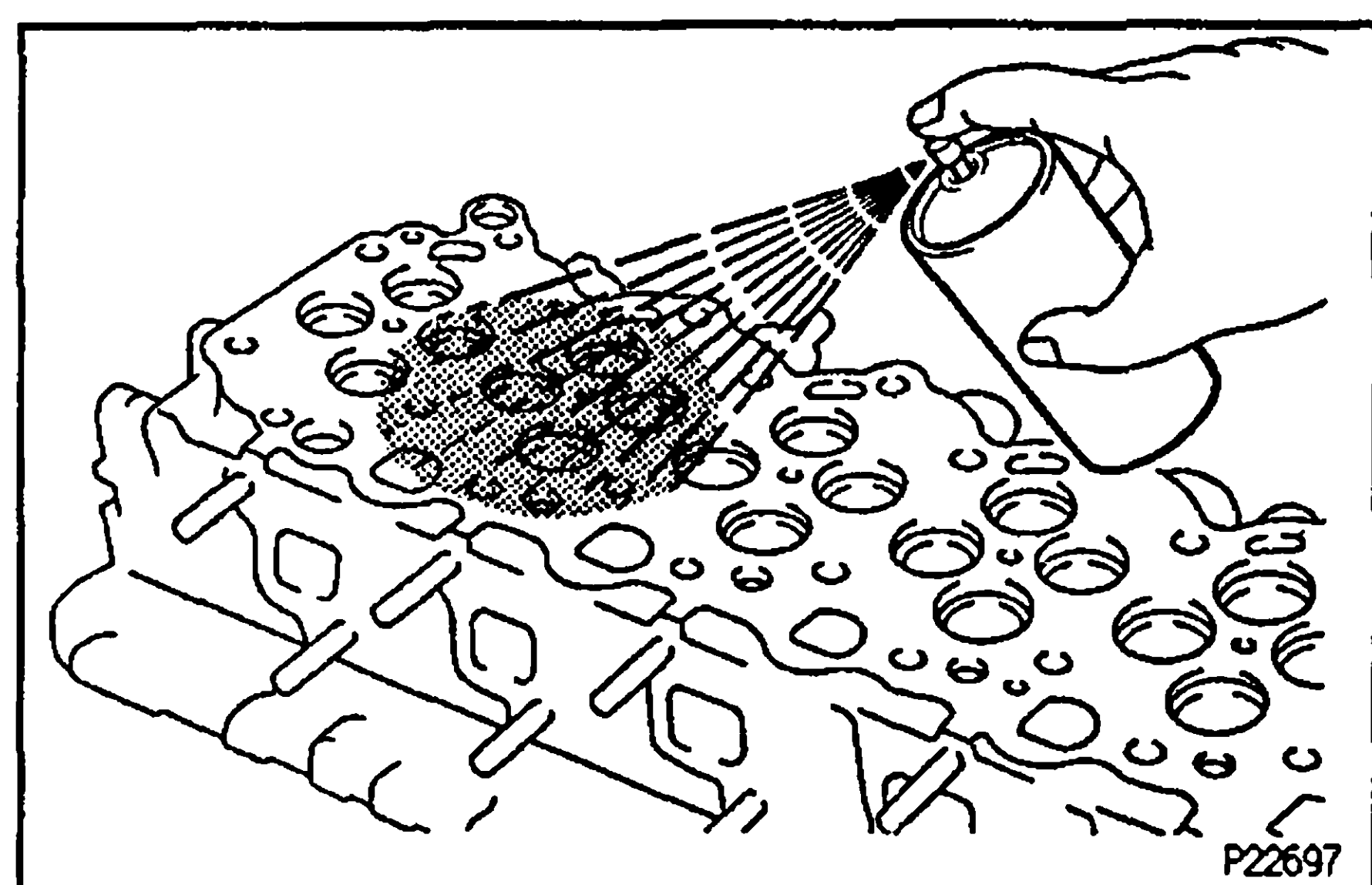
**3. INSPECT CYLINDER HEAD****A. Inspect for flatness**

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

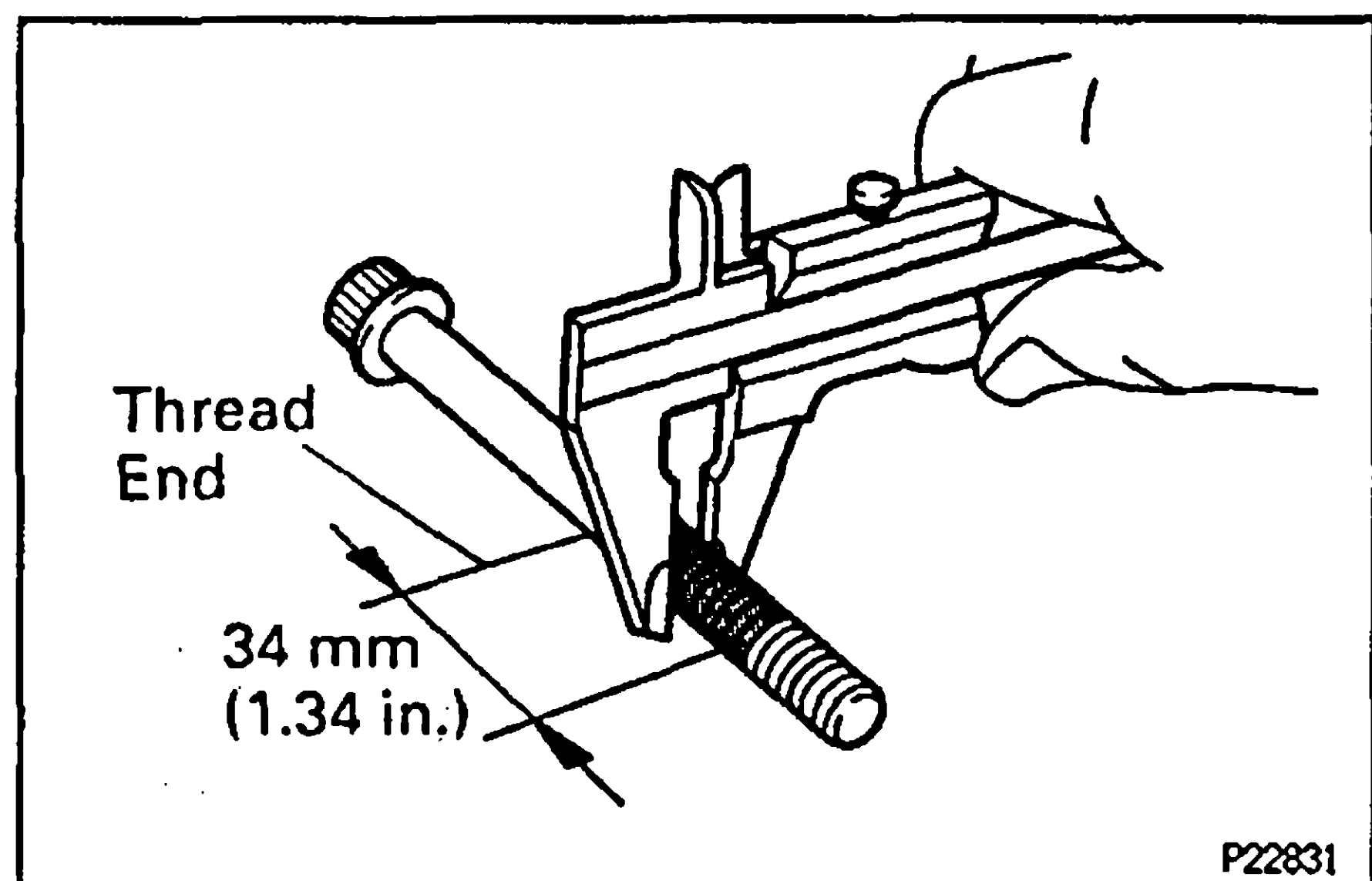
Maximum warpage:

0.20 mm (0.0079 in.)

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

**B. Inspect for cracks**

Using a dye penetrant, check the intake ports, exhaust ports and surface contacting the cylinder block. If cracked, replace the cylinder head.

**C. Inspect cylinder head bolts**

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

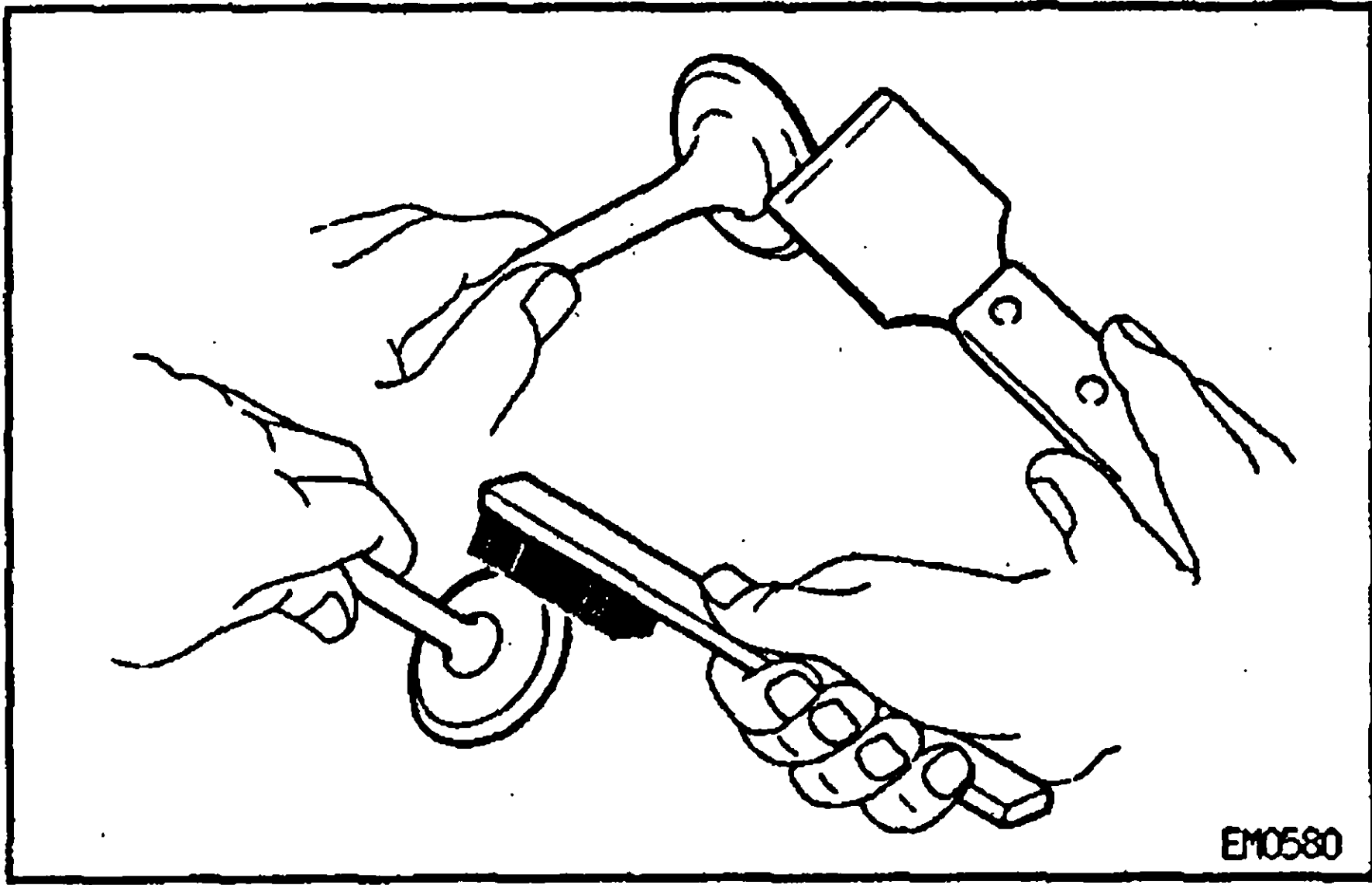
Standard outer diameter:

10.800 — 11.000 mm (0.4252 — 0.4331 in.)

Minimum outer diameter:

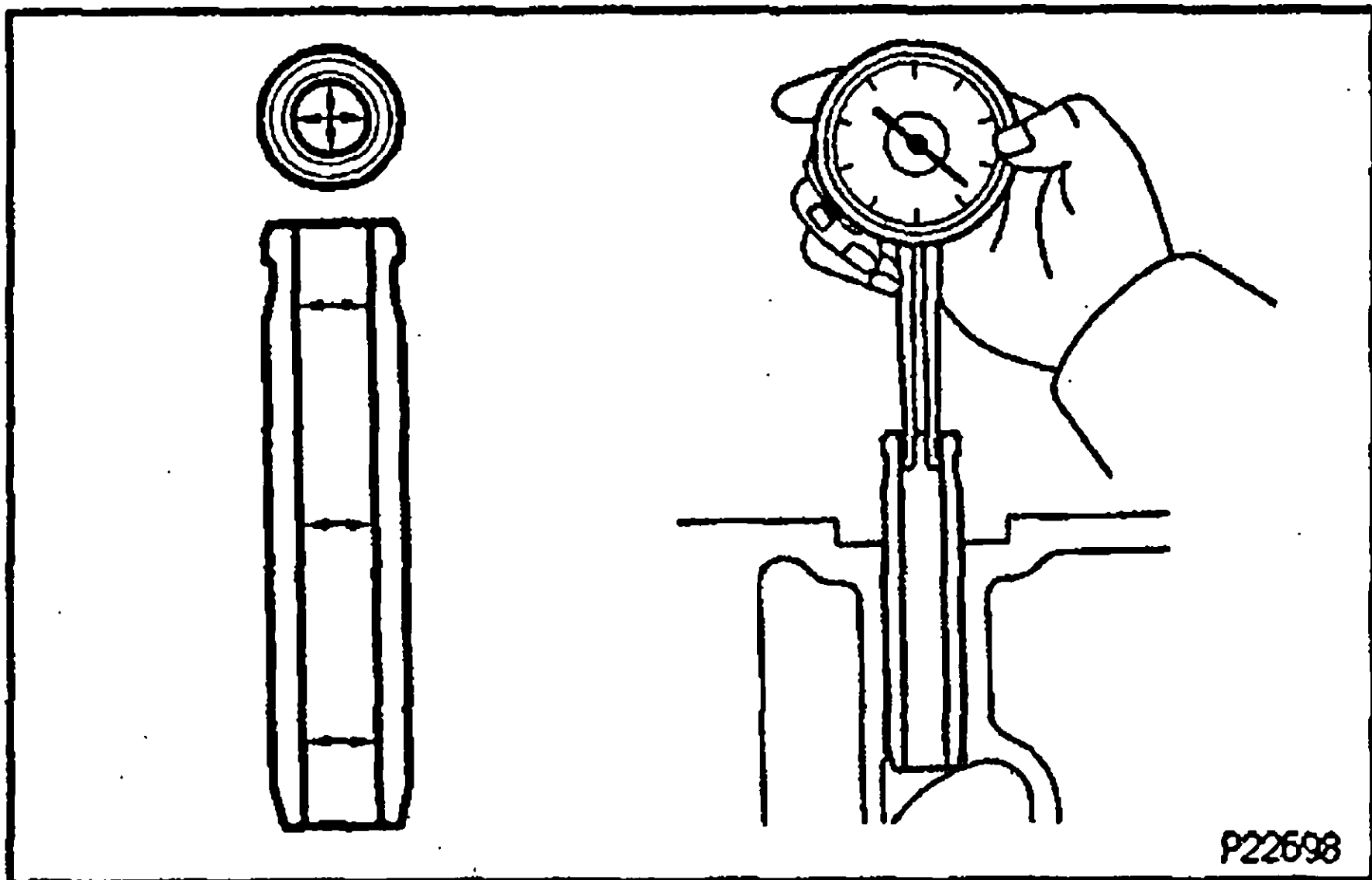
10.55 mm (0.4154 in.)

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



4. CLEAN VALVES

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

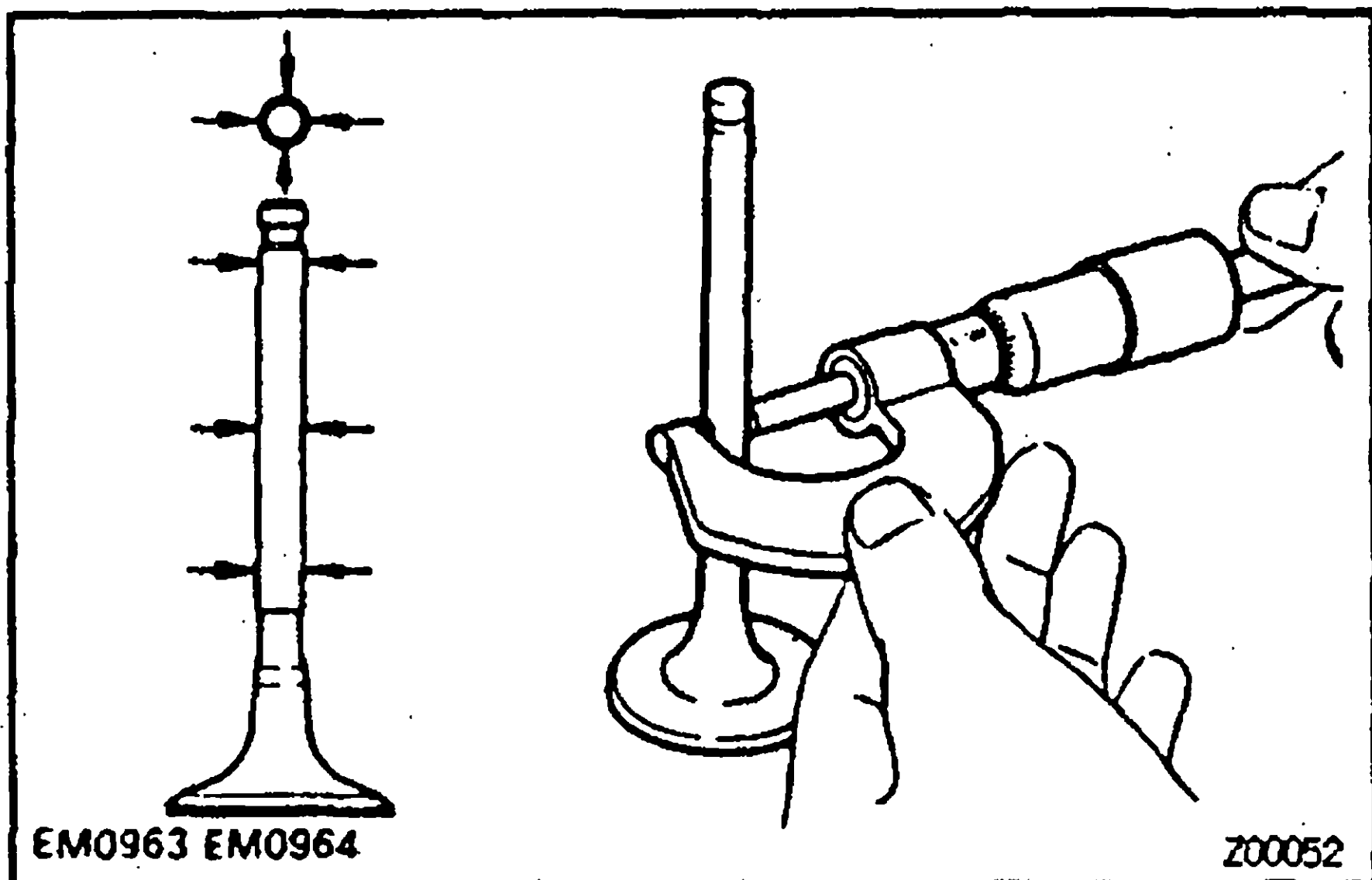


5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

7.010 — 7.030 mm (0.2760 — 0.2768 in.)



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

Valve stem diameter:

Intake:

6.970 — 6.985 mm (0.2744 — 0.2750 in.)

Exhaust:

6.960 — 6.975 mm (0.2740 — 0.2746 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:

0.035 — 0.070 mm (0.0014 — 0.0028 in.)

Maximum oil clearance:

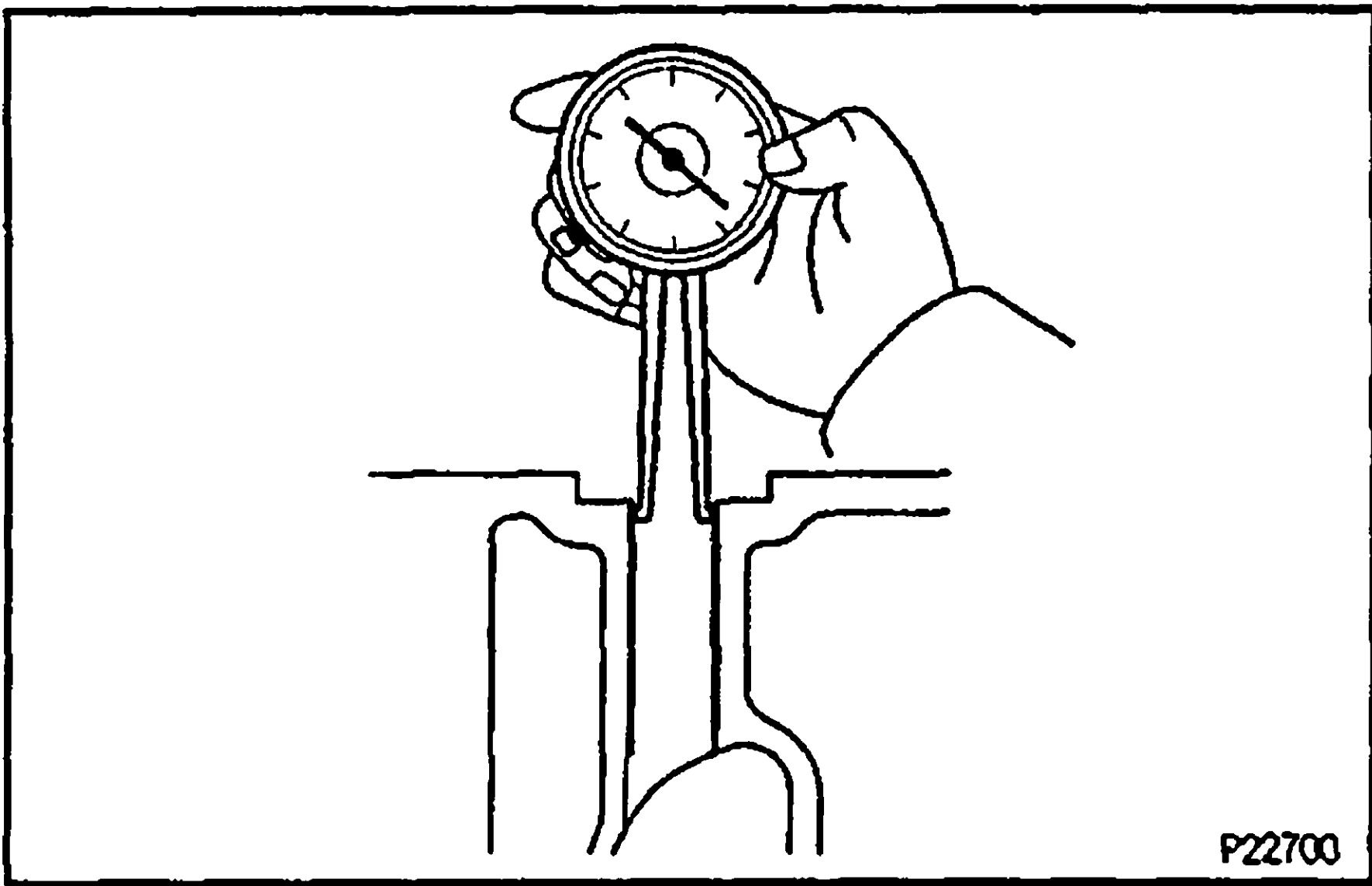
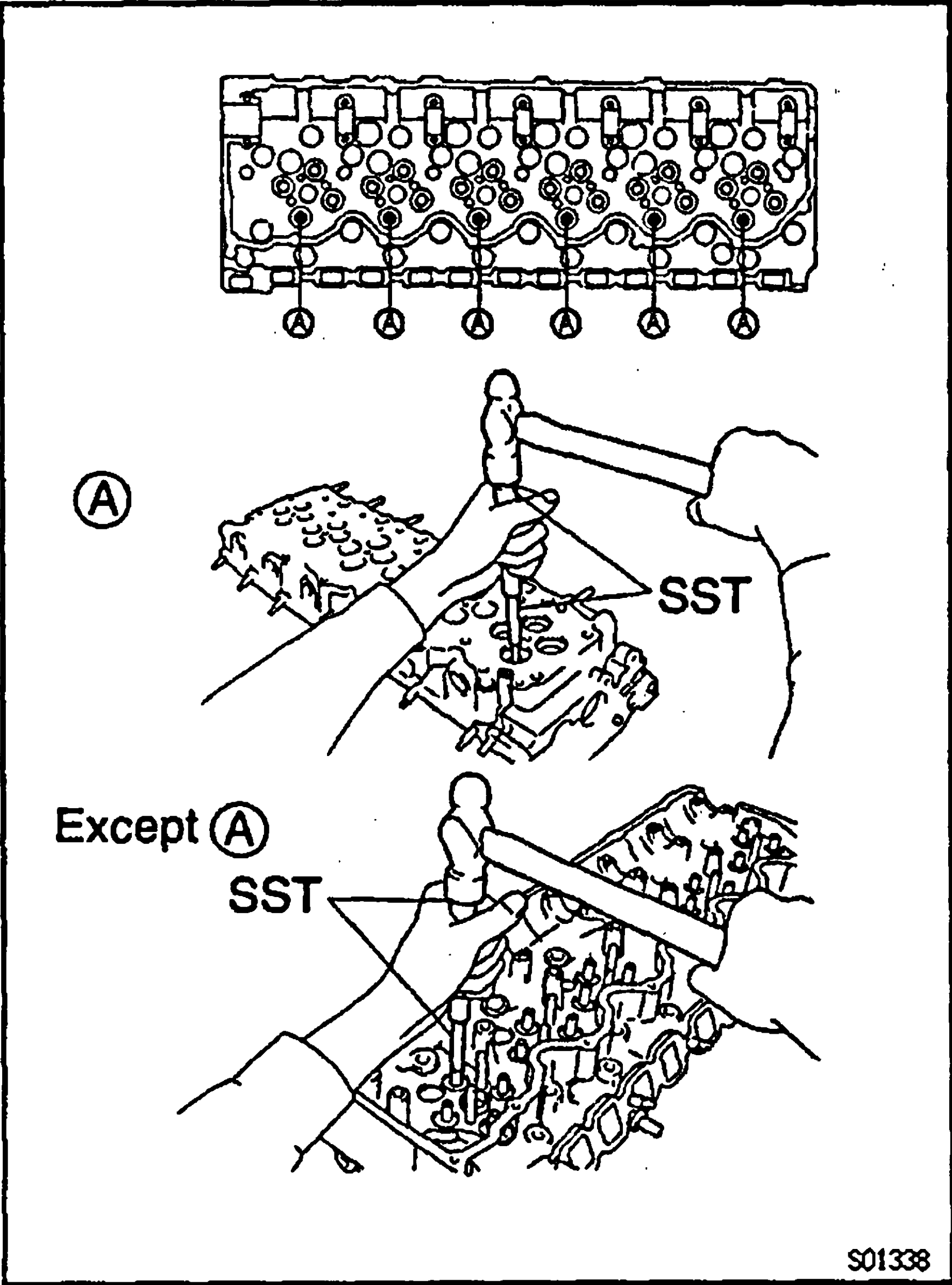
Intake:

0.08 mm (0.0031 in.)

Exhaust:

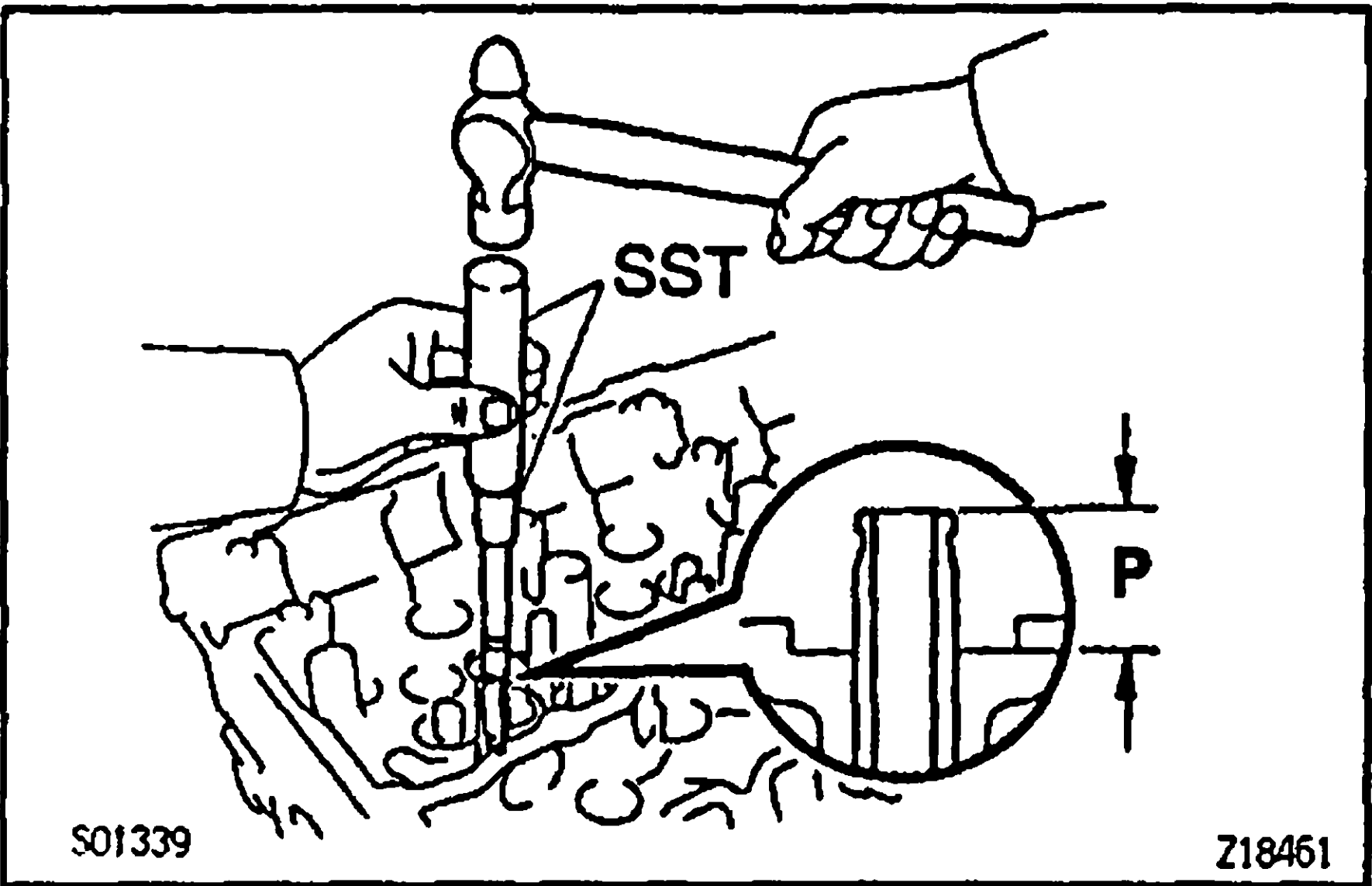
0.10 mm (0.0039 in.)

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



Bushing bore diameter mm (in.)	Bushing size
11.504 – 11.525 (0.4529 – 0.4537)	Use STD
11.554 – 11.575 (0.4549 – 0.4557)	Use O/S 0.05

V06580



6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

- (a) Using SST and a hammer, tap out the guide bushings (at position A in the illustration) from the combustion chamber side.

SST 09201 – 10000 (09201 – 01080),
09950 – 70010 (09951 – 07100)

- (b) Using SST and a hammer, tap out the guide bushings (at the positions other than A) toward the combustion chamber side.

SST 09201 – 10000 (09201 – 01070),
09950 – 70010 (09951 – 07100)

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

- (d) Select a new guide bushing (STD or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 11.525 mm (0.4537 in.), machine the bushing bore to the following dimension:

Rebored cylinder head bushing bore dimension:

11.554 – 11.575 mm (0.4549 – 0.4557 in.)

If the bushing bore diameter of the cylinder head is greater than 11.575 mm (0.4557 in.), replace the cylinder head.

- (e) Using SST and a hammer, tap in a new guide bushing to the standard effecting amount.

Protrusion (P):

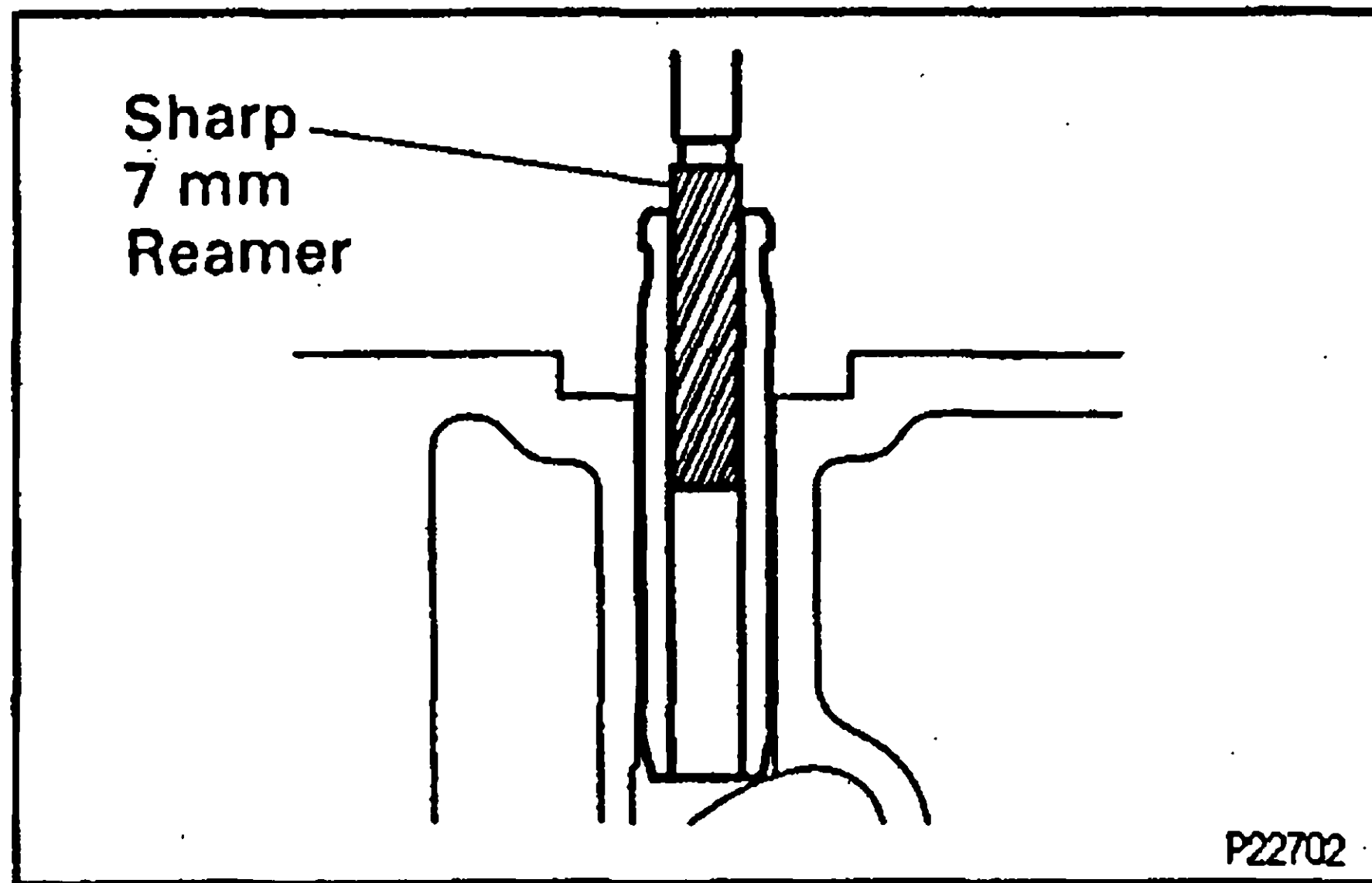
Intake:

17.5 – 17.9 mm (0.689 – 0.705 in.)

Exhaust:

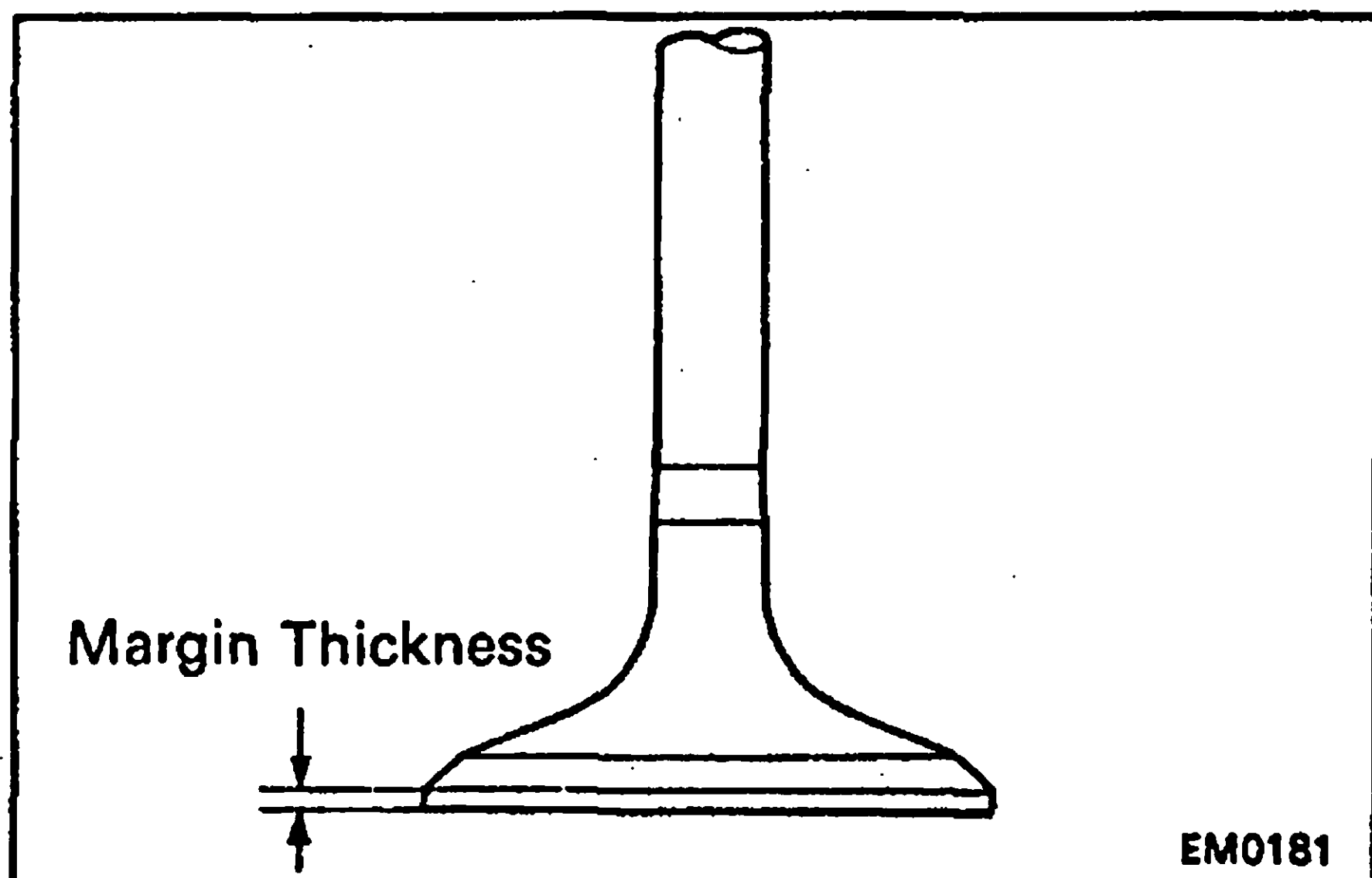
14.5 – 14.9 mm (0.571 – 0.587 in.)

SST 09201 – 10000 (09201 – 01070),
09950 – 70010 (09951 – 07100)



- (f) Using a sharp 7 mm reamer, ream the guide bushing to obtain the standard specified clearance (See step 5 above) between the guide bushing and valve stem.

EG



7. INSPECT AND GRIND VALVES

- (a) Check the valve face for wear.
If the valve face is worn, replace the valve.
- (b) Check the valve head margin thickness.

Standard margin thickness:

1.00 mm (0.0394 in.)

Minimum margin thickness:

0.83 mm (0.0327 in.)

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

- (c) Check the valve overall length.

Standard overall length:

Intake:

126.85 – 127.45 mm (4.9941 – 5.0177 in.)

Exhaust:

126.43 – 127.03 mm (4.9775 – 5.0012 in.)

Minimum overall length:

Intake:

126.85 mm (4.9941 in.)

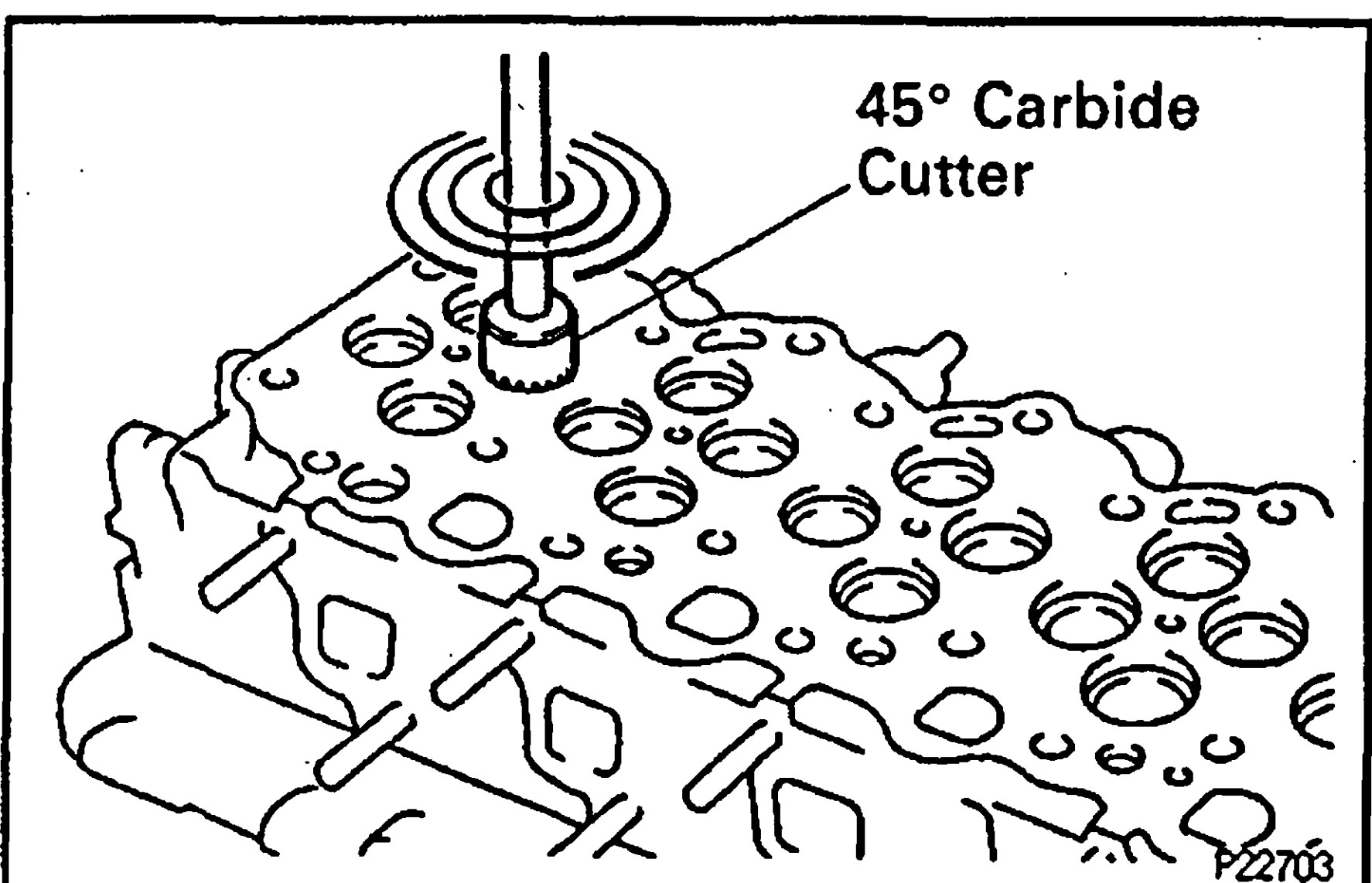
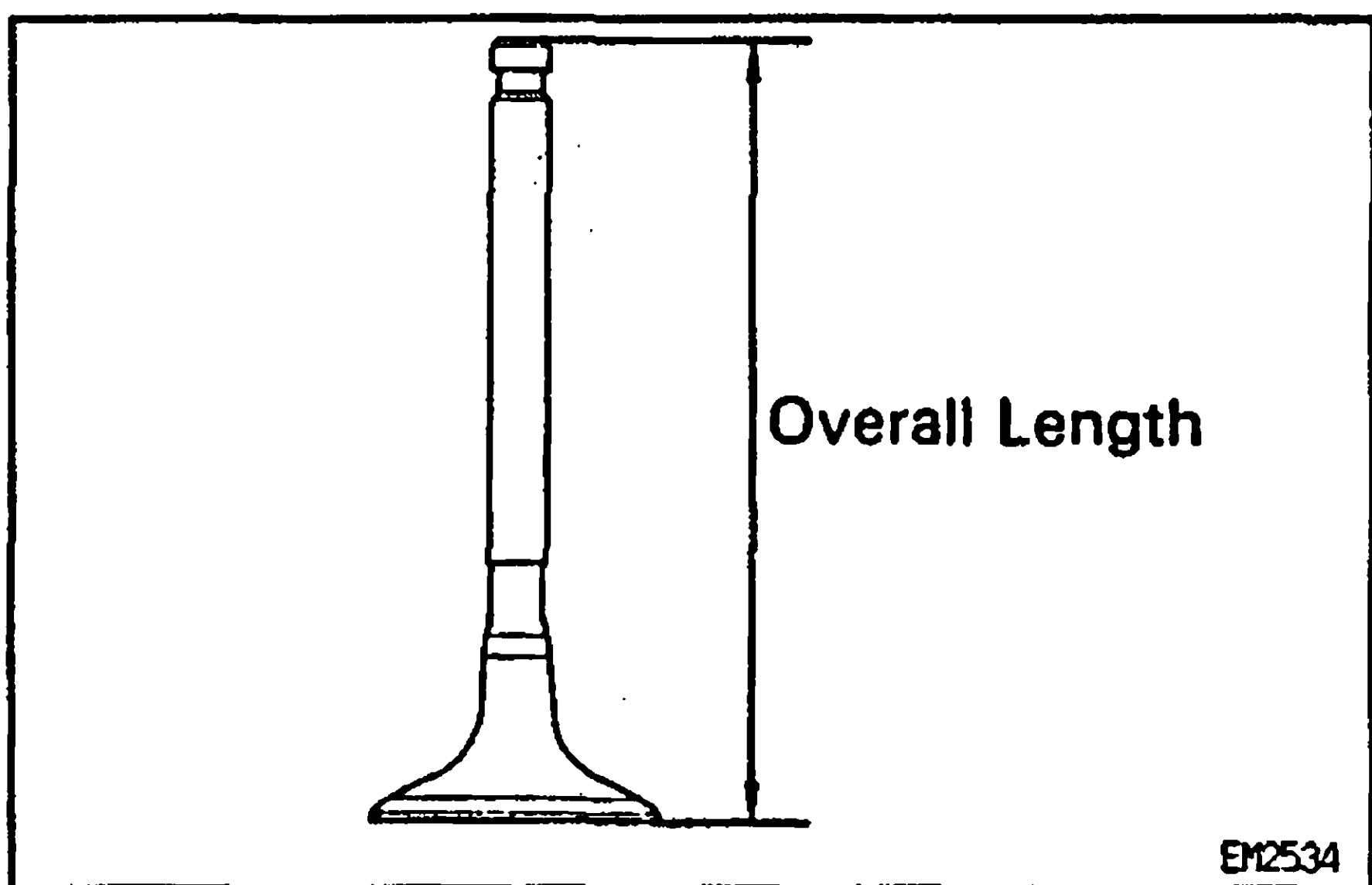
Exhaust:

126.43 mm (4.9775 in.)

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

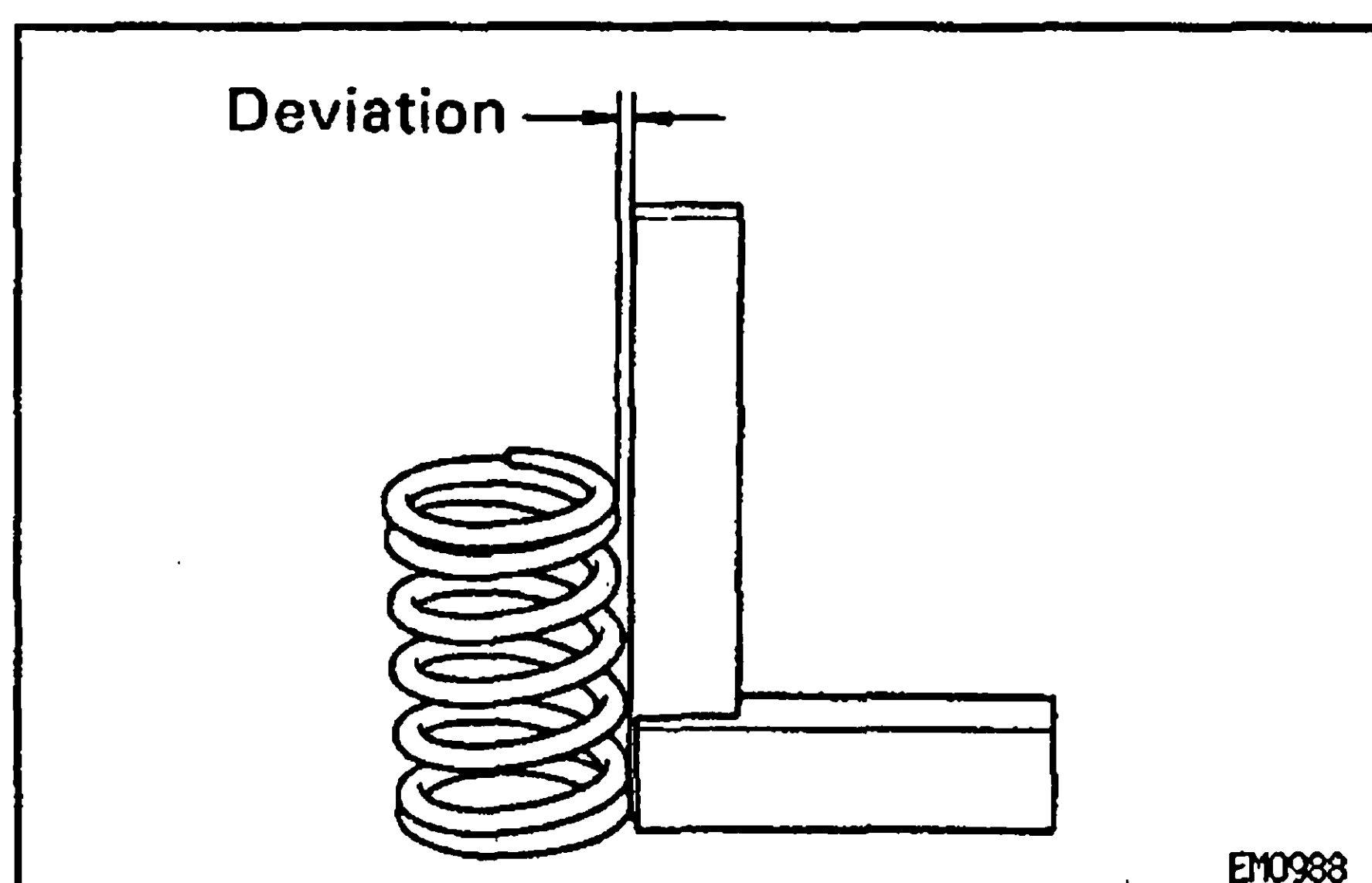
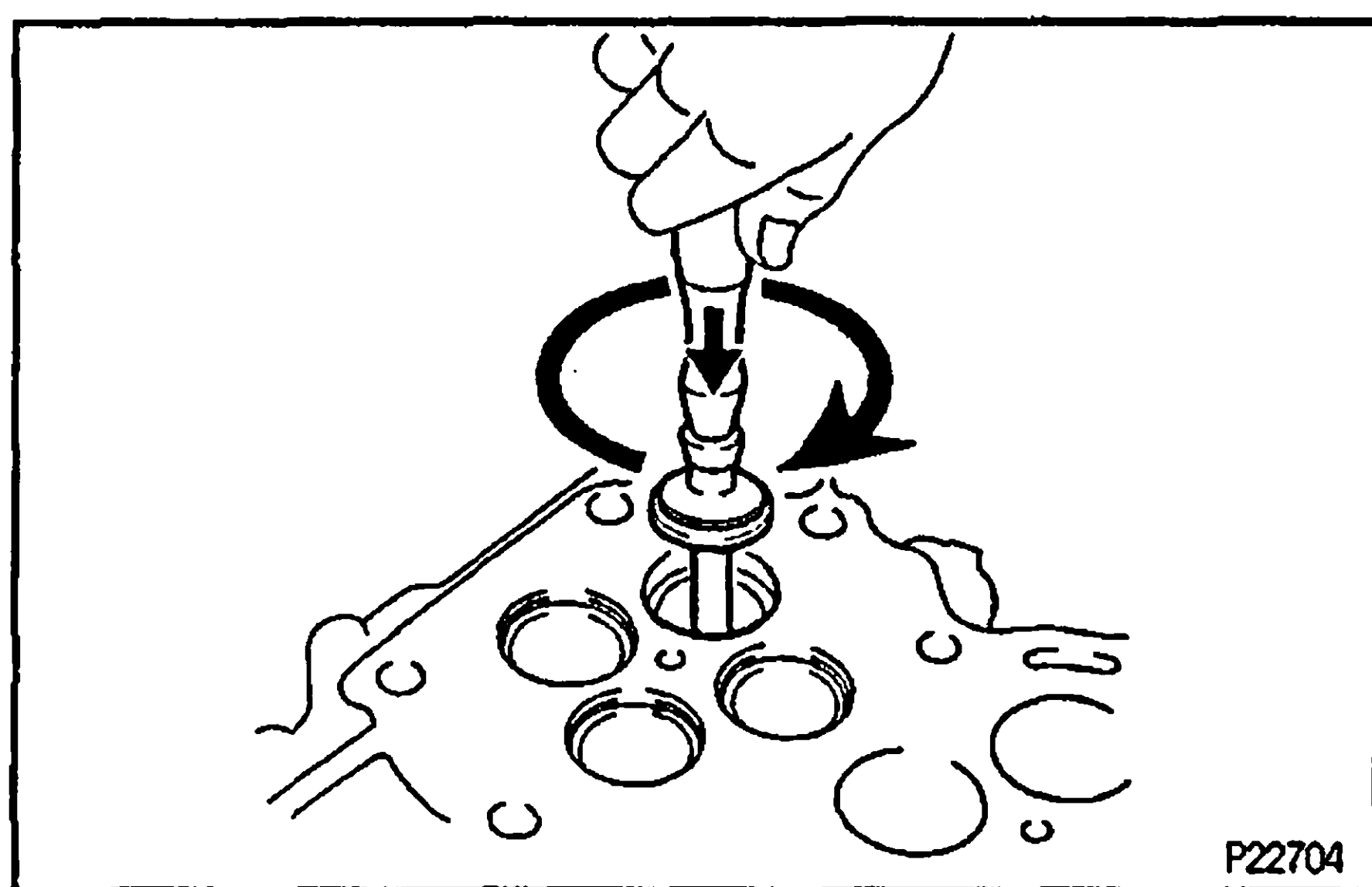
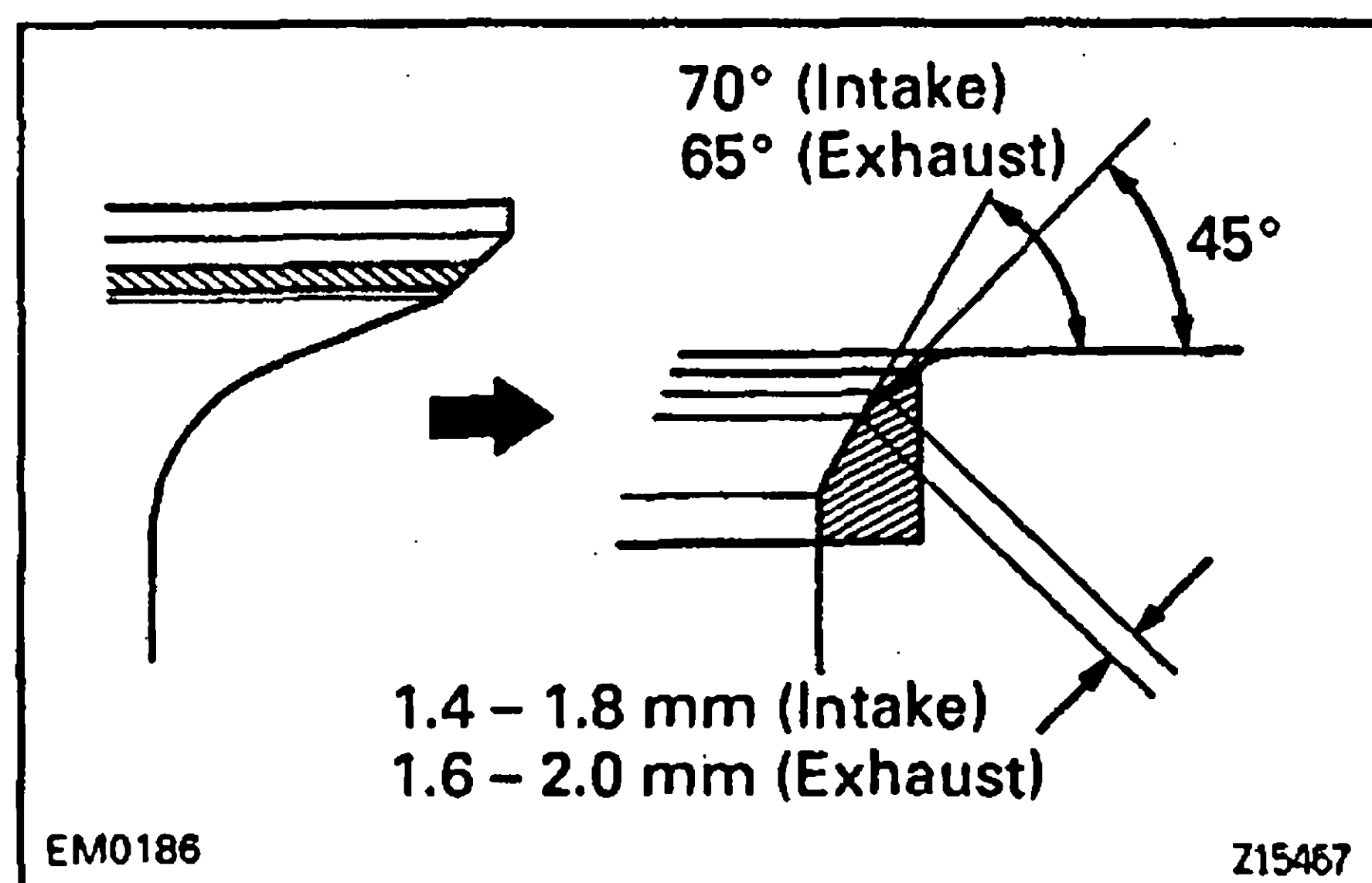
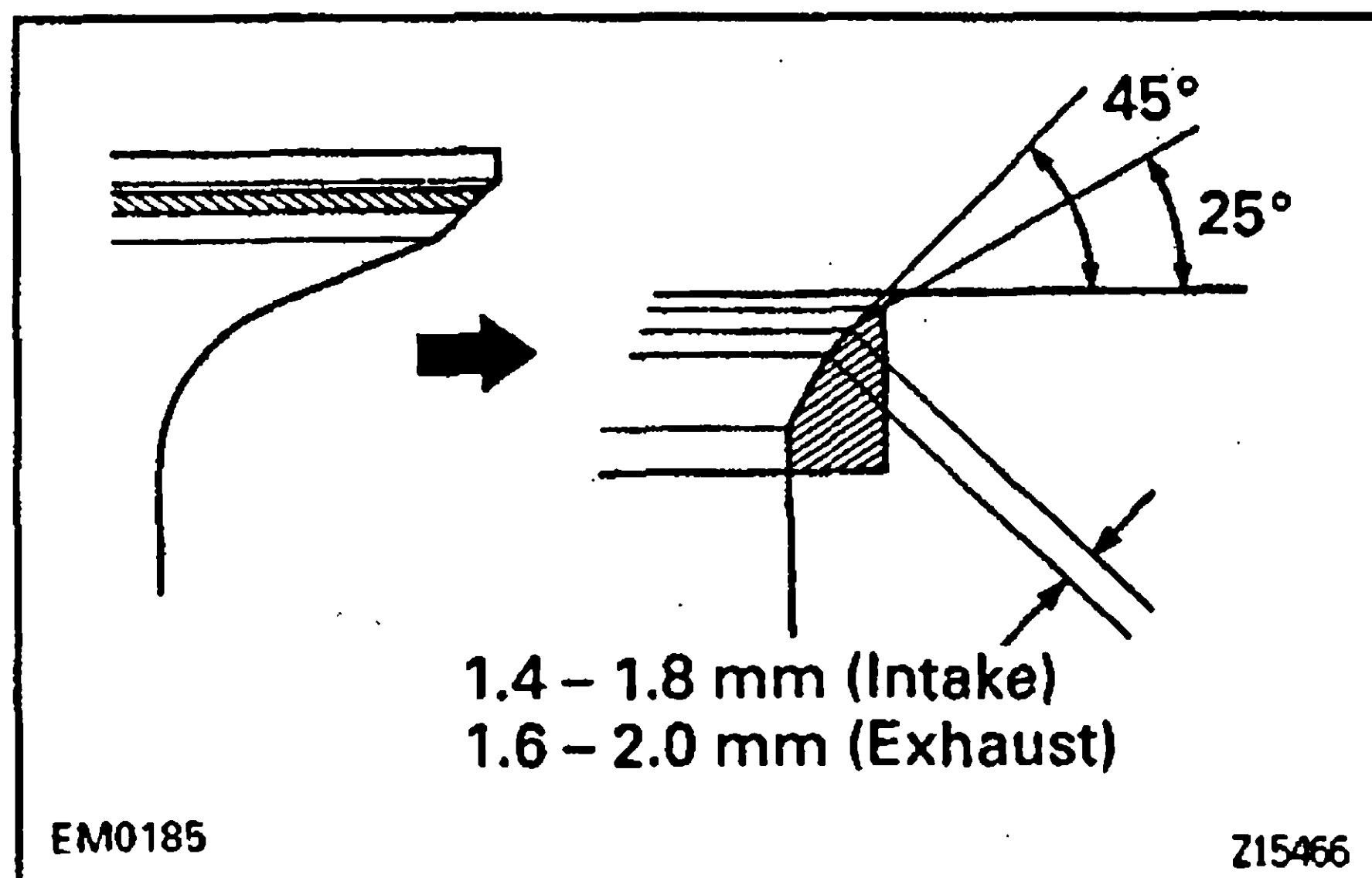
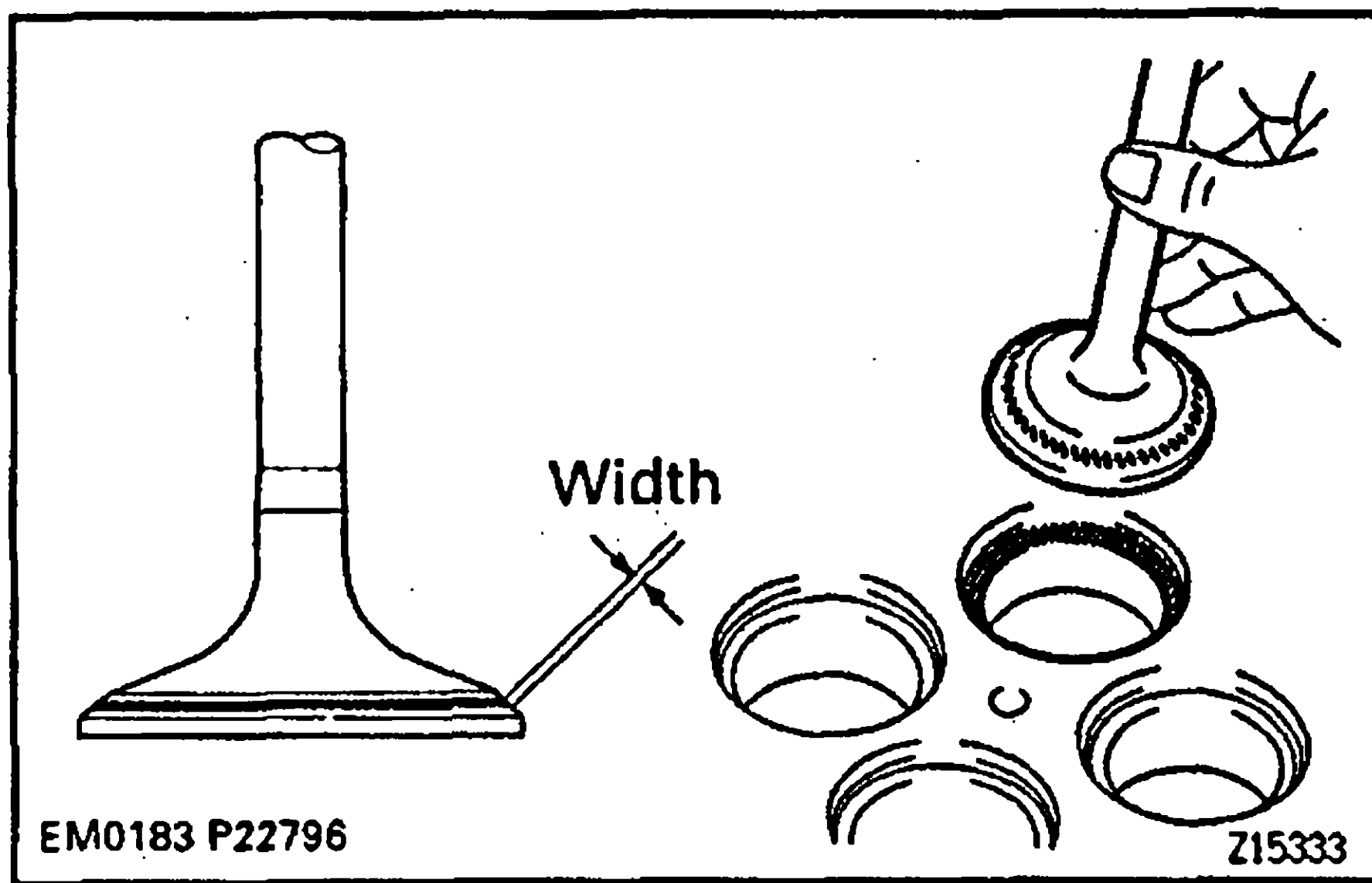
- (d) Check the valve stem tip for wear.

If the valve stem tip is worn, replace the valve.



8. INSPECT AND CLEAN VALVE SEATS

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



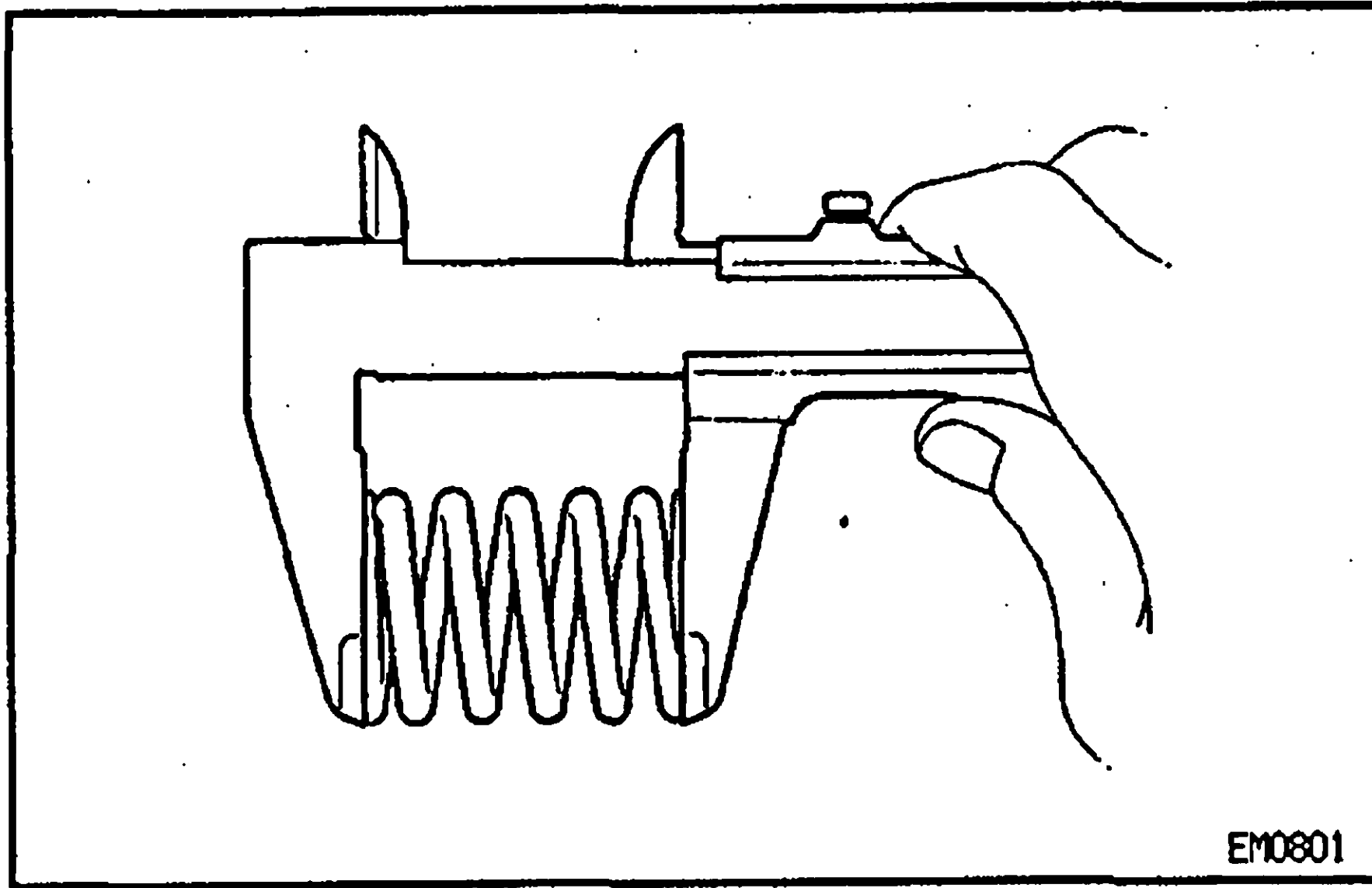
- (b) Check the valve seating position.
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.
- (c) Check the valve face and seat for the following:
- If blue appears 360° around the valve face, the valve is concentric. If not, replace the valve.
 - If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
 - Check that the seat contact is in the middle of the valve face with the following width:
Intake:
1.4 – 1.8 mm (0.055 – 0.071 in.)
Exhaust:
1.6 – 2.0 mm (0.063 – 0.079 in.)
- If not, correct the valve seats as follows:
- (1) If the seating is too high on the valve face, use 25° and 45° cutters to correct the seat.

- (2) If the seating is too low on the valve face, use 70° (intake) or 65° (exhaust) and 45° cutters to correct the seat.

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

9. INSPECT VALVE SPRINGS

- (a) Using a steel square, measure the deviation of the valve spring.
- Maximum deviation:
2.0 mm (0.079 in.)
- If the deviation is greater than maximum, replace the valve spring.

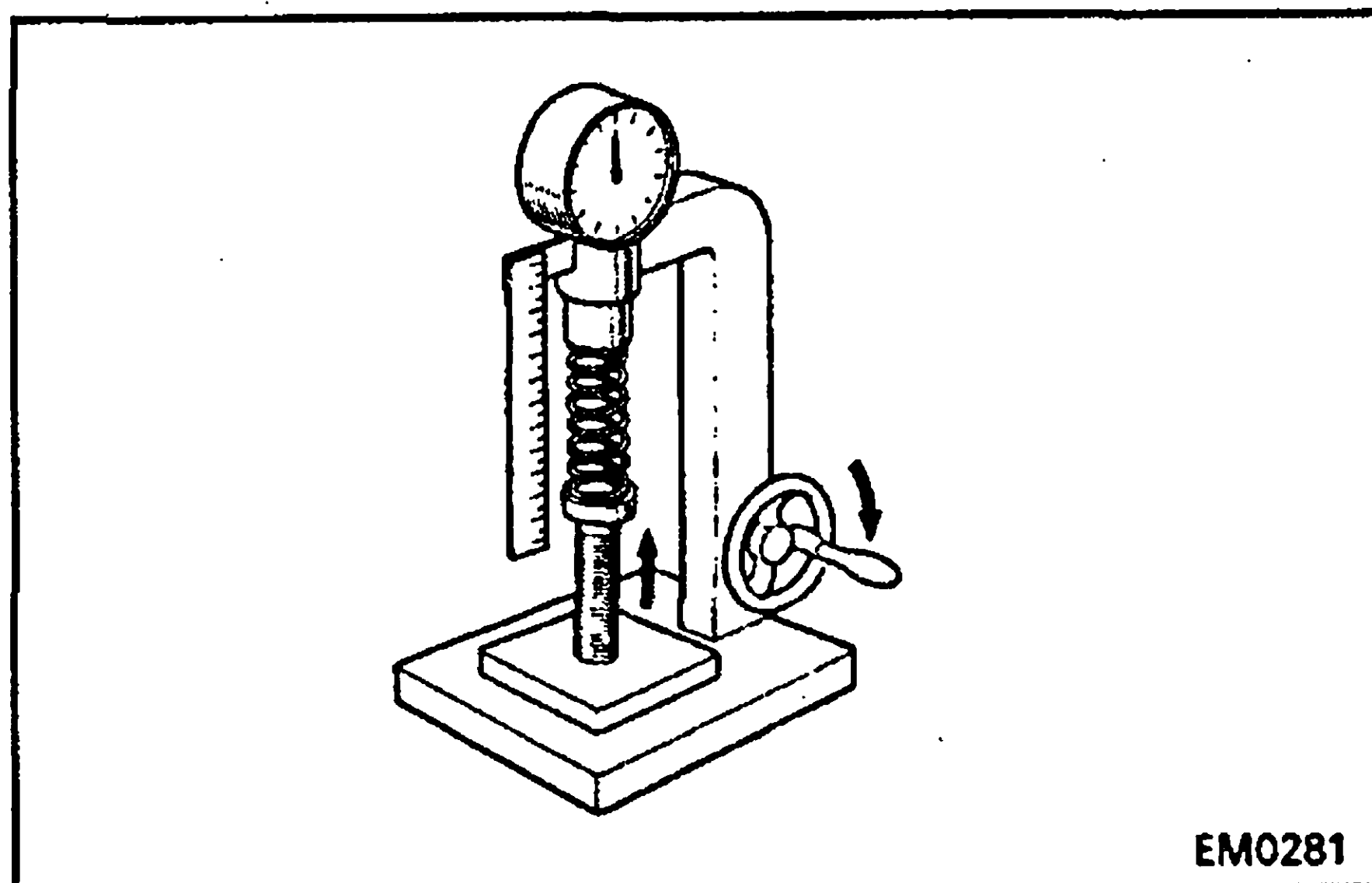


- (b) Using vernier calipers, measure the free length of the valve spring.

Free length:

49.6 mm (1.9527 in.)

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



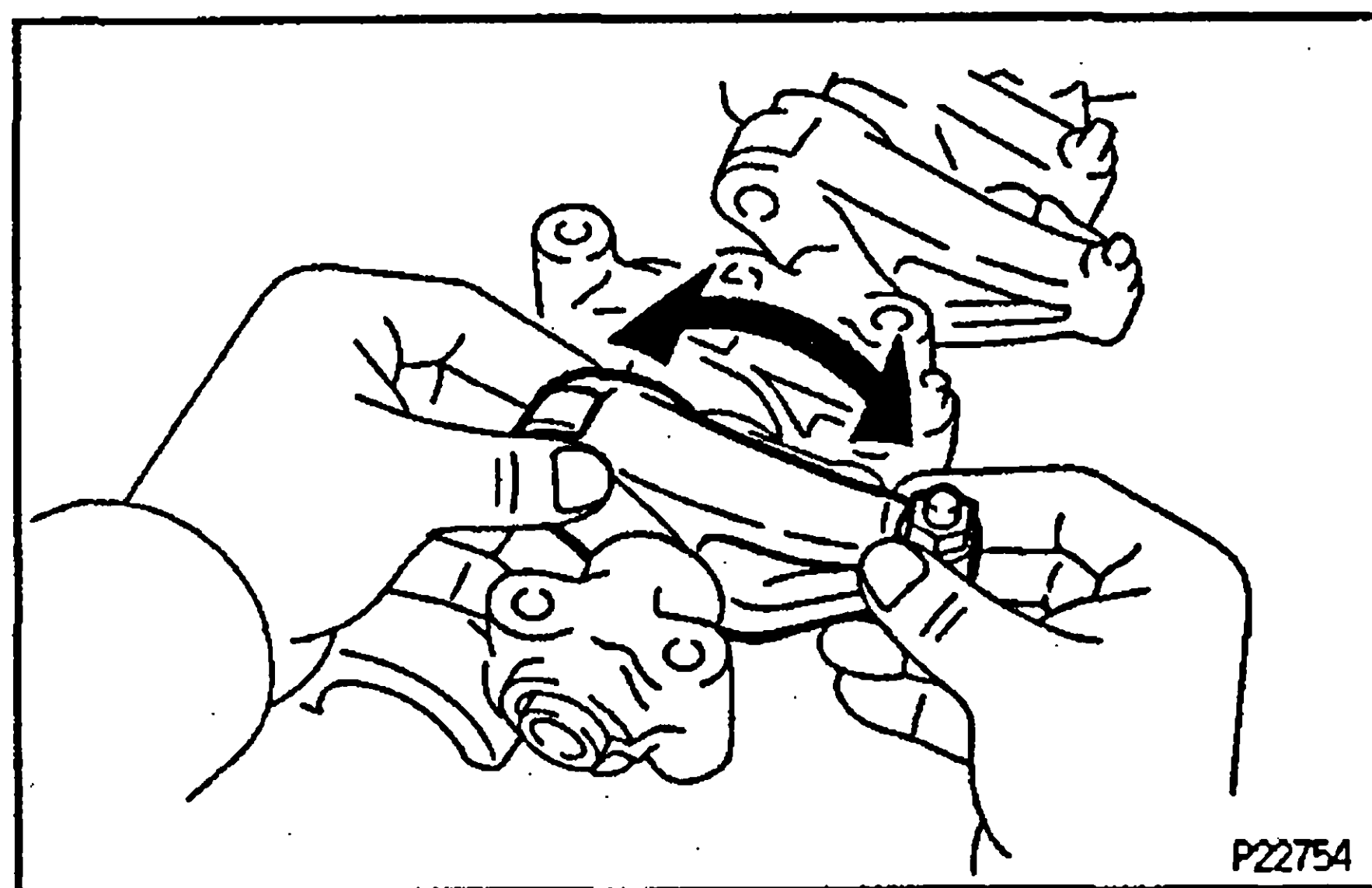
- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

237 — 263 N (24.2 — 26.8 kgf, 53.4 — 59.1 lbf)

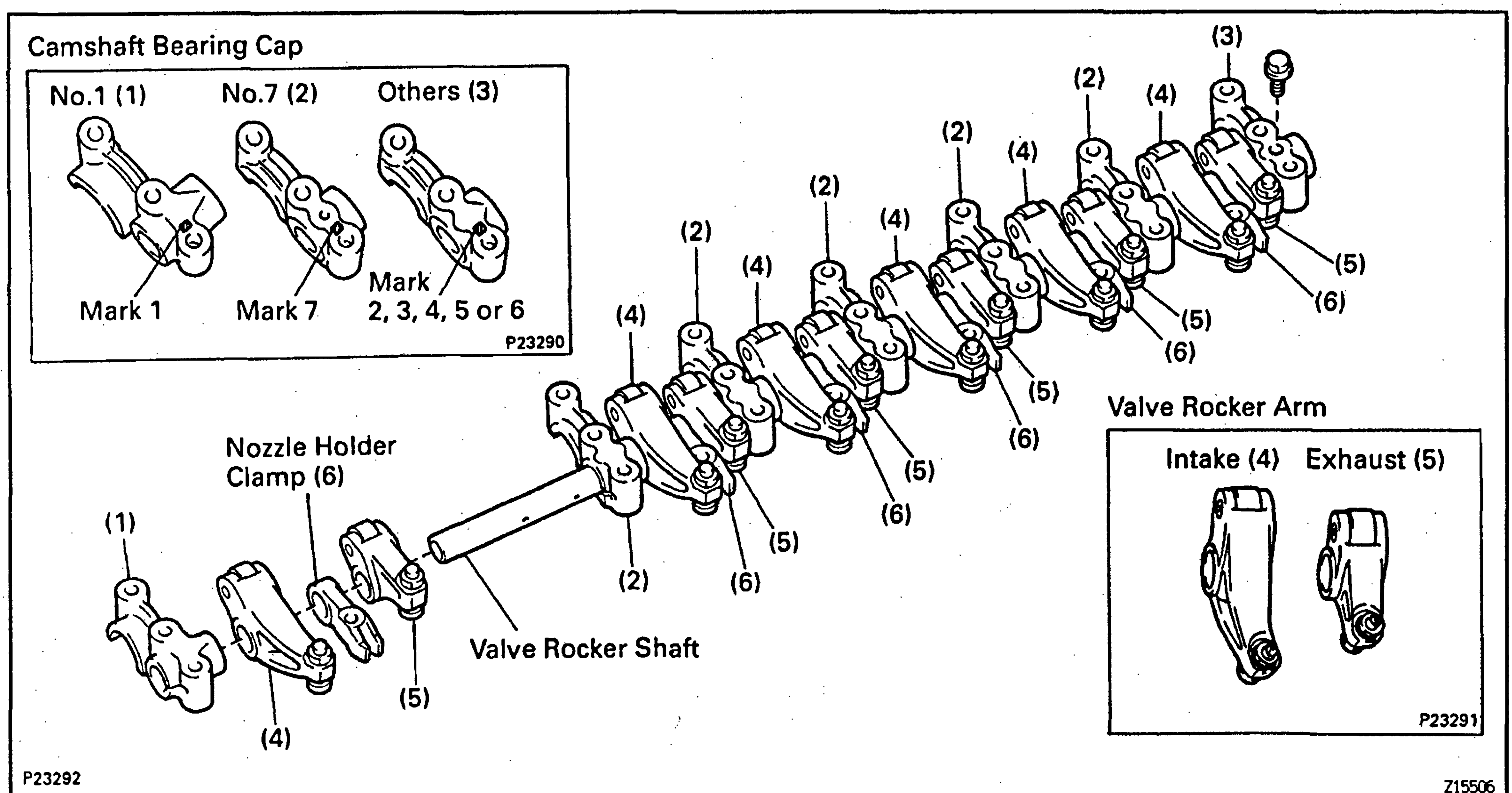
At 39.5 mm (1.555 in.)

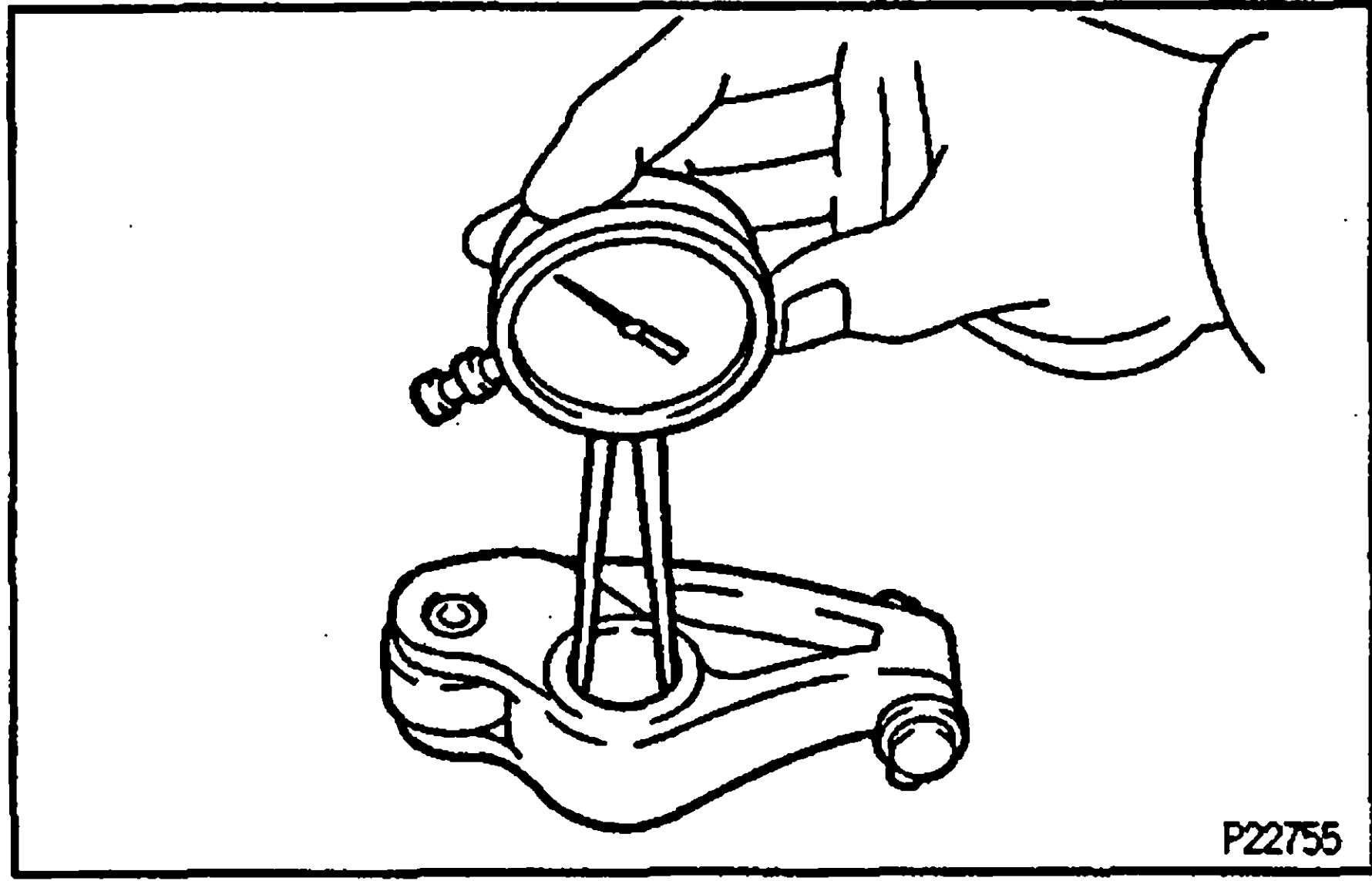
If the installed tension is not as specified, replace the valve spring.



10. INSPECT VALVE ROCKER ARM AND SHAFT

- (a) Check that each rocker arm turns smoothly. If movement is felt, disassemble and check.
- (b) Remove the bolt, and disassemble the parts.
- HINT:** Arrange the disassembled parts in correct order.

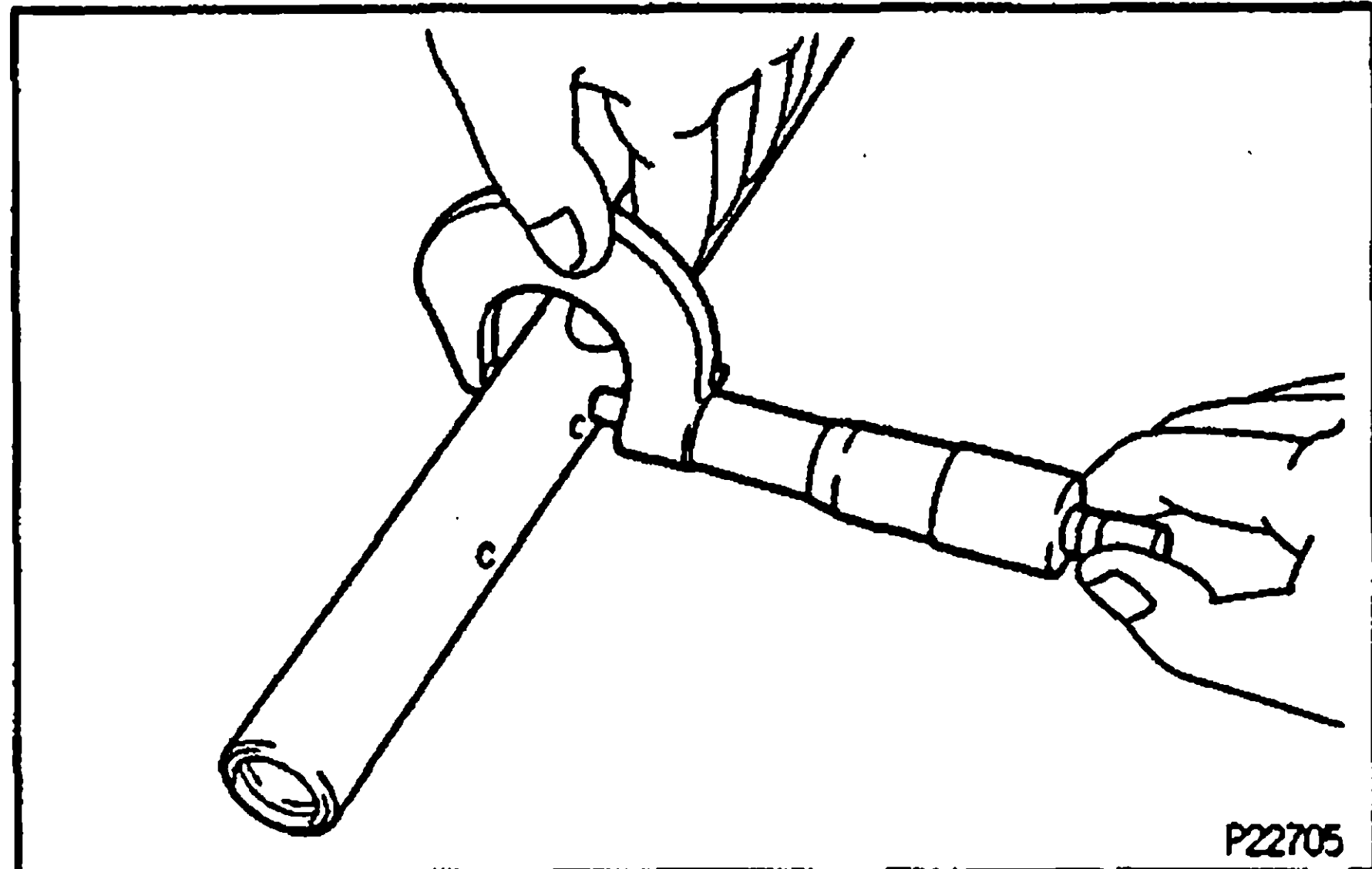




- (c) Using a caliper gauge, measure the inside diameter of the rocker arm.

Rocker arm inside diameter:

20.012 – 20.033 mm (0.7879 – 0.7887 in.)



- (d) Using a micrometer, measure the diameter of the rocker arm shaft.

Shaft diameter:

19.972 – 19.993 mm (0.7863 – 0.7871 in.)

- (e) Subtract the rocker arm shaft measurement from the rocker arm measurement.

Standard oil clearance:

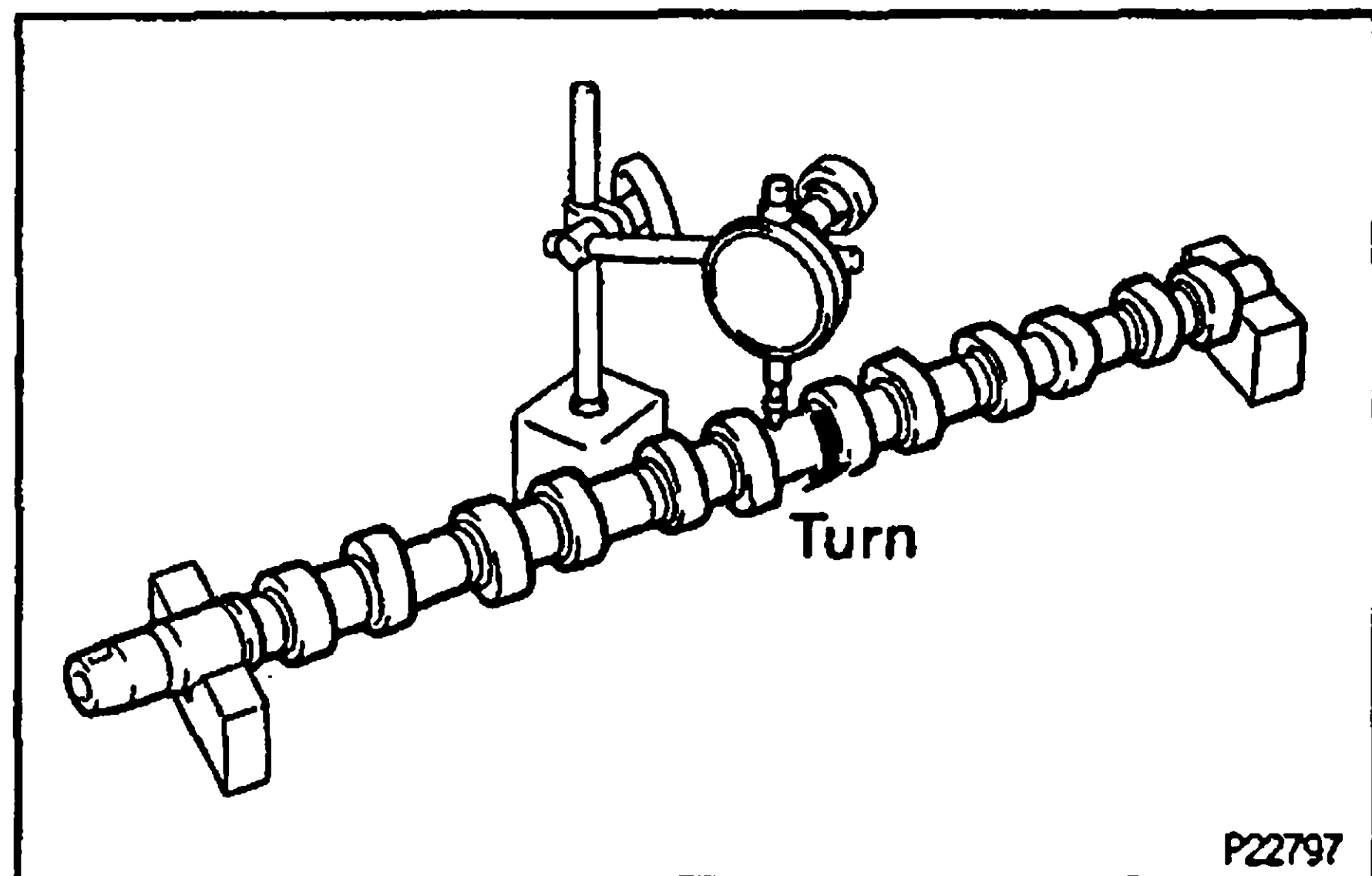
0.019 – 0.061 mm (0.0007 – 0.0024 in.)

Maximum oil clearance:

0.10 mm (0.0039 in.)

If the clearance is greater than maximum, replace the rocker shaft and shaft.

- (f) Assemble the parts as shown in the illustration.
(See step (b) above)



11. INSPECT CAMSHAFTS AND BEARINGS

A. Inspect camshaft for runout

- (a) Place the camshaft on V-blocks.
(b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:

0.10 mm (0.0039 in.)

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

B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake:

48.498 – 48.598 mm (1.9094 – 1.9133 in.)

Exhaust:

50.734 – 50.834 mm (1.9974 – 2.0013 in.)

Minimum cam lobe height:

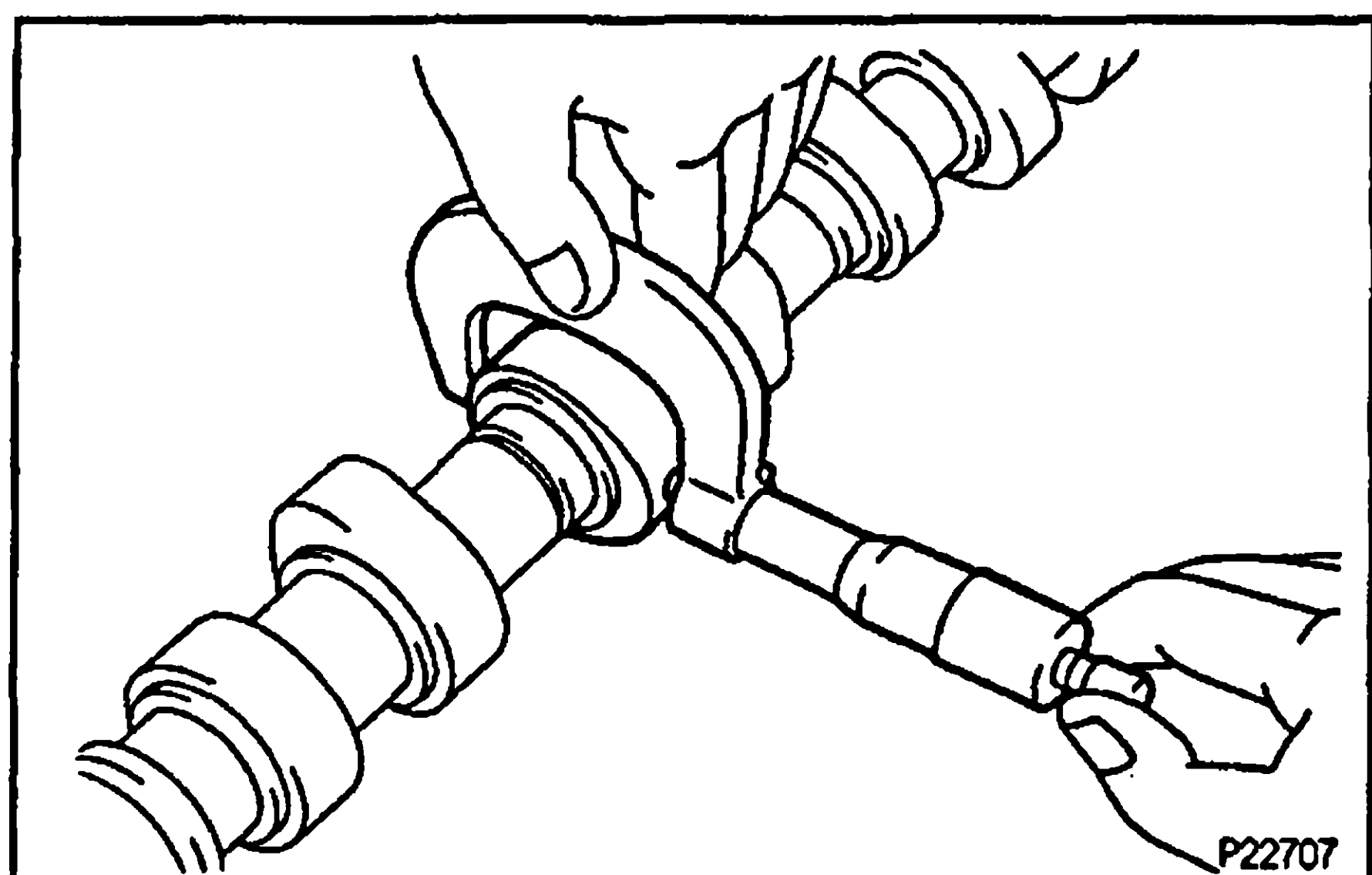
Intake:

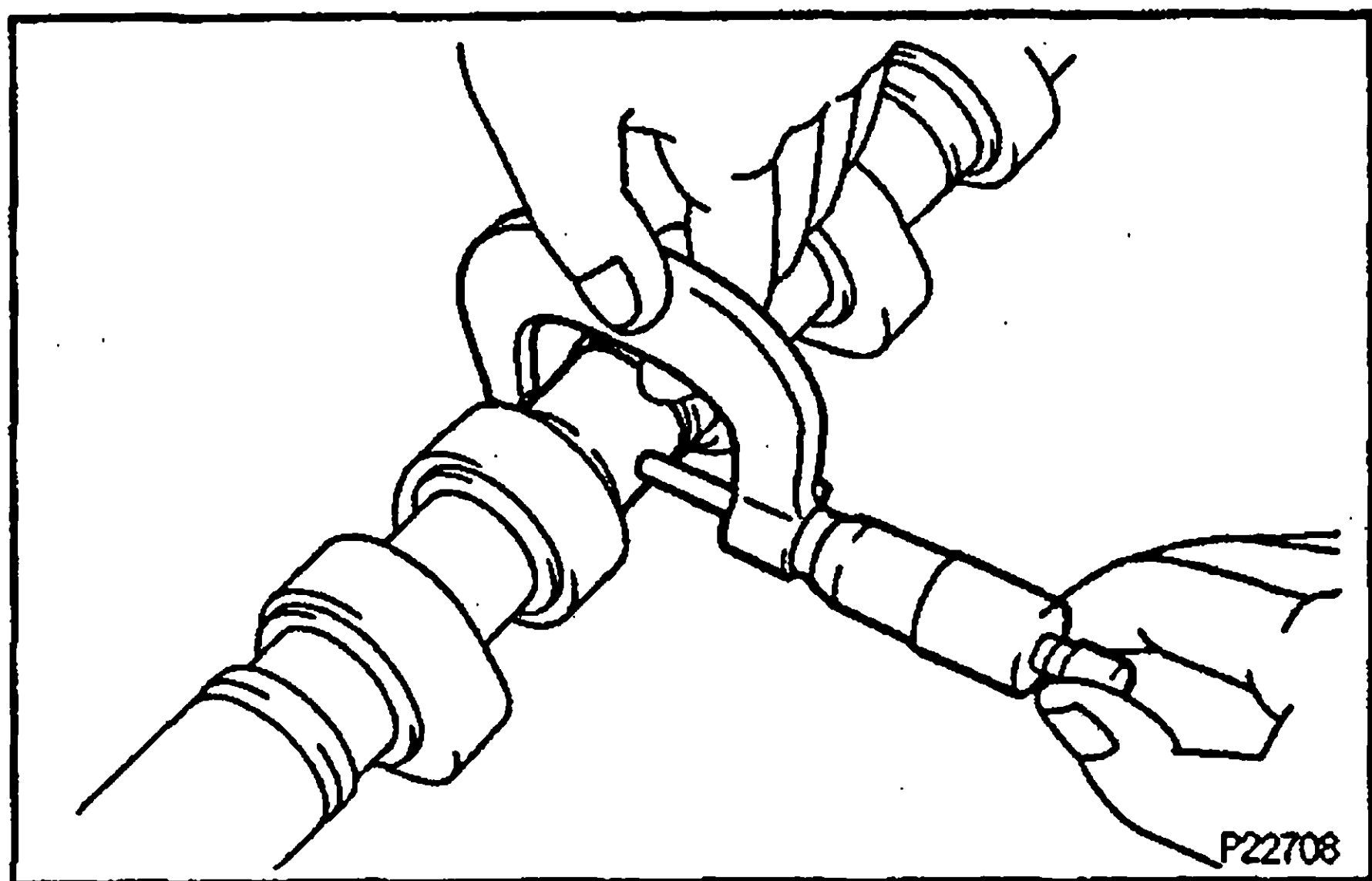
47.998 mm (1.8897 in.)

Exhaust:

50.234 mm (1.9777 in.)

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



**C. Inspect camshaft journals**

Using a micrometer, measure the journal diameter.

Journal diameter:

No.1:

34.969 — 34.985 mm (1.3767 — 1.3774 in.)

Others:

27.986 — 27.998 mm (1.1018 — 1.1023 in.)

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

D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

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

E. Inspect camshaft journal oil clearance

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshaft on the cylinder head.

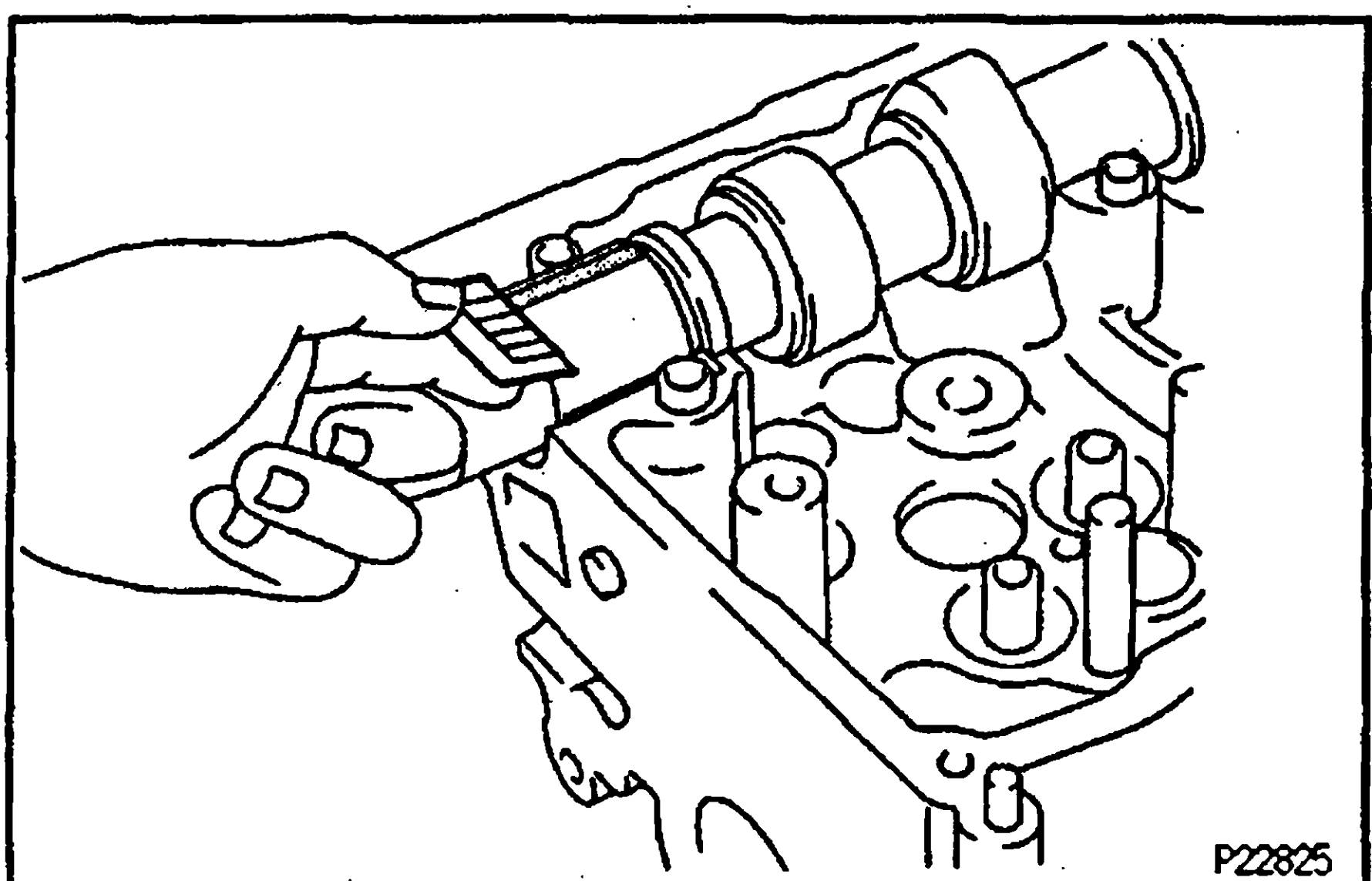
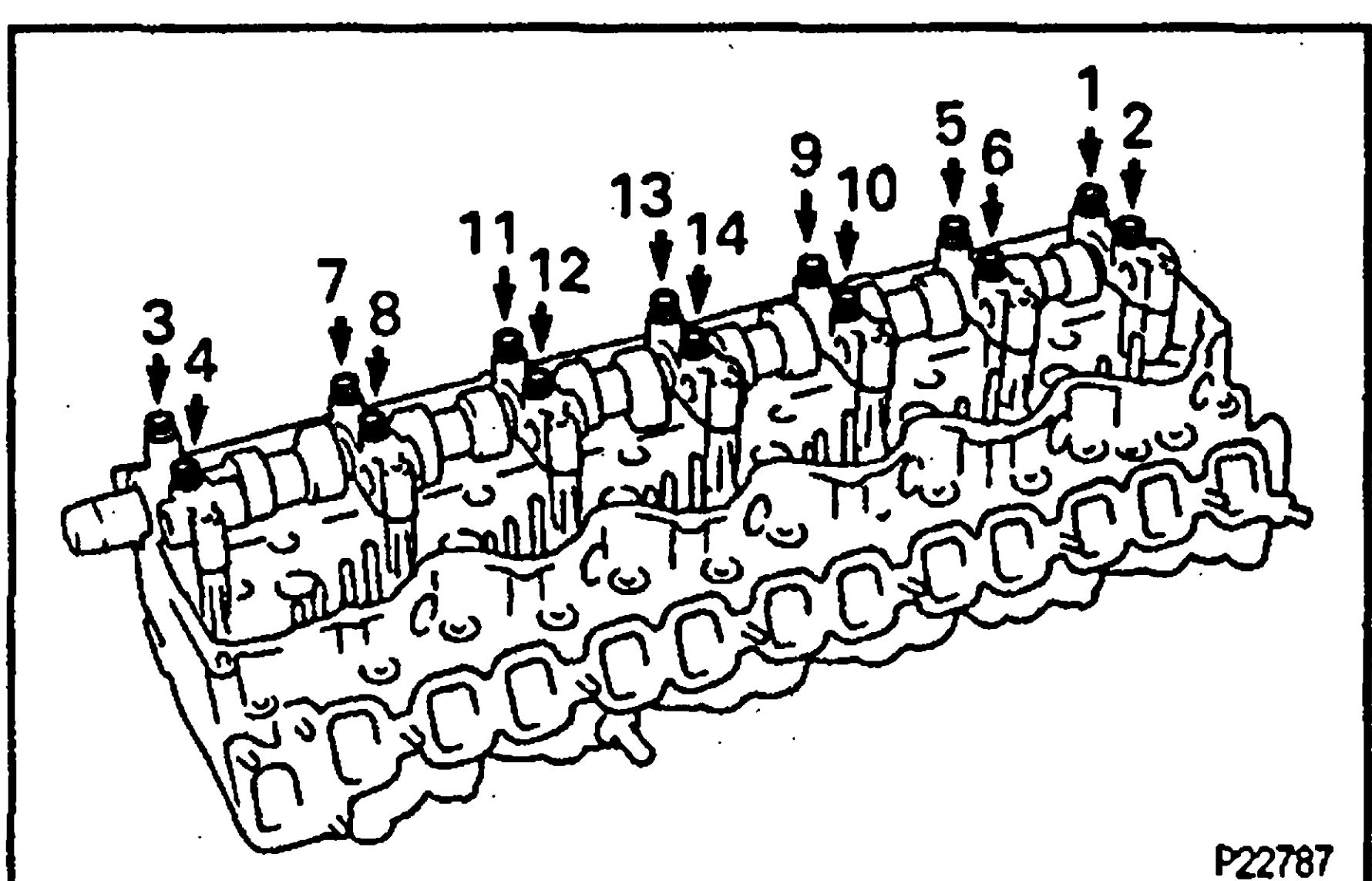
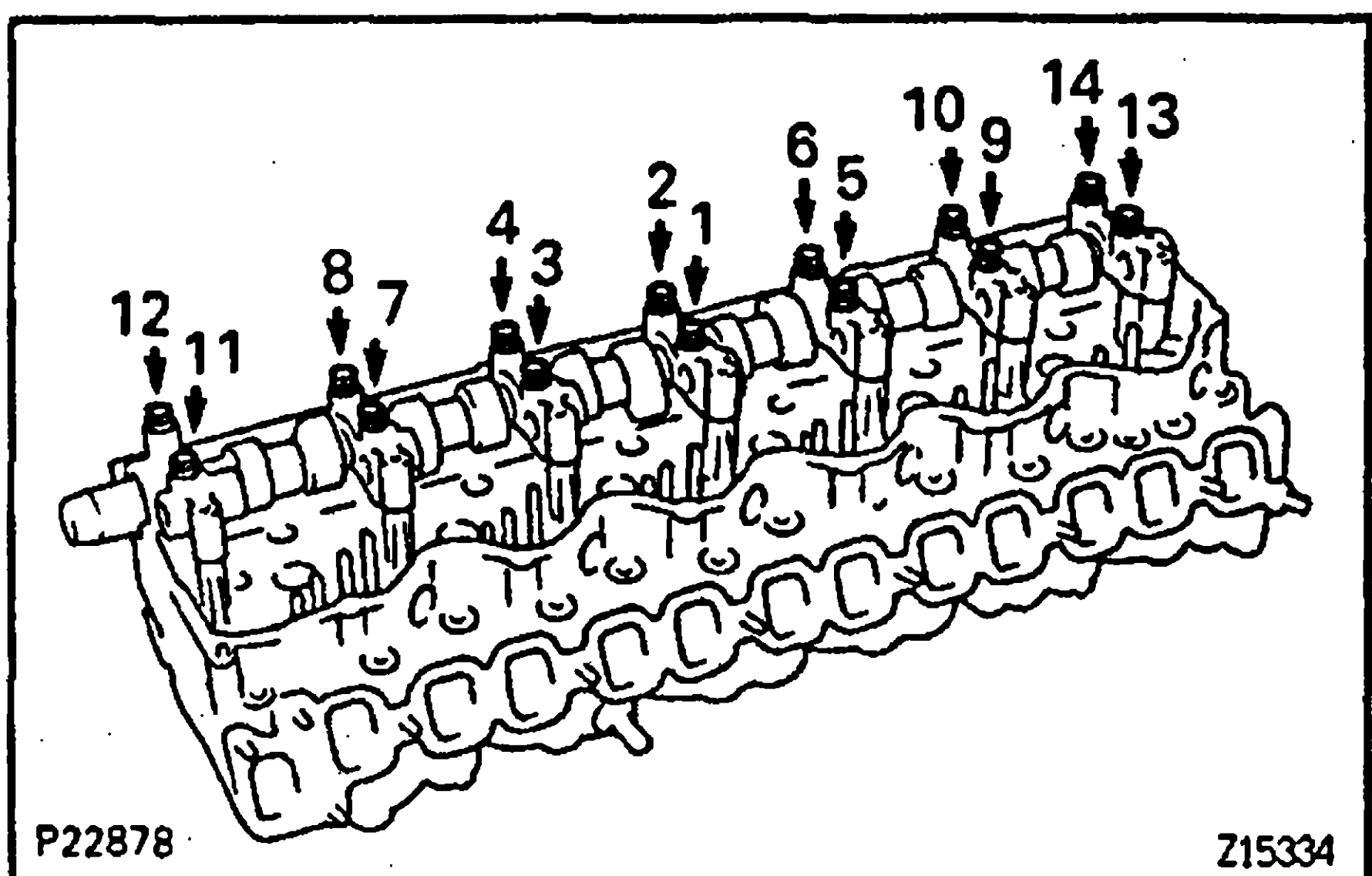
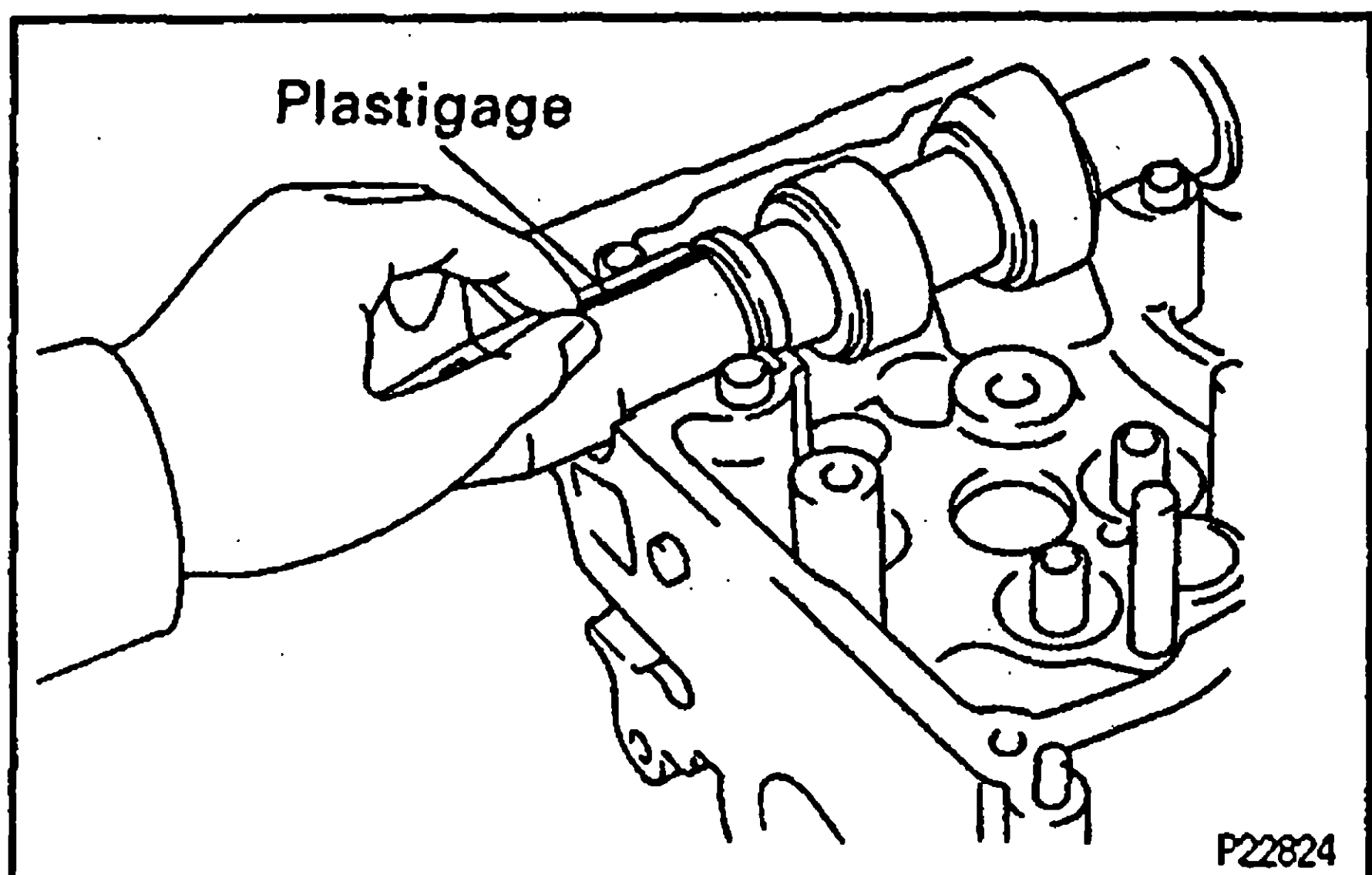
(c) Lay a strip of Plastigage across each of the camshaft journals.

(d) Remove the 7 bearing caps from the valve rocker shaft. (See item E above)

(e) Install the 7 bearing caps with the 14 bolts. Uniformly tighten the bolts in several passes, in the sequence shown.

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

NOTICE: Do not turn the camshaft.



(f) Uniformly loosen and remove the 14 bolts in several passes, in the sequence shown.

(g) Remove the 7 bearing caps.

(h) Measure the Plastigage at its widest point.

Standard oil clearance:

No.1:

0.022 — 0.074 mm (0.0009 — 0.0029 in.)

Others:

0.023 — 0.075 mm (0.0009 — 0.0030 in.)

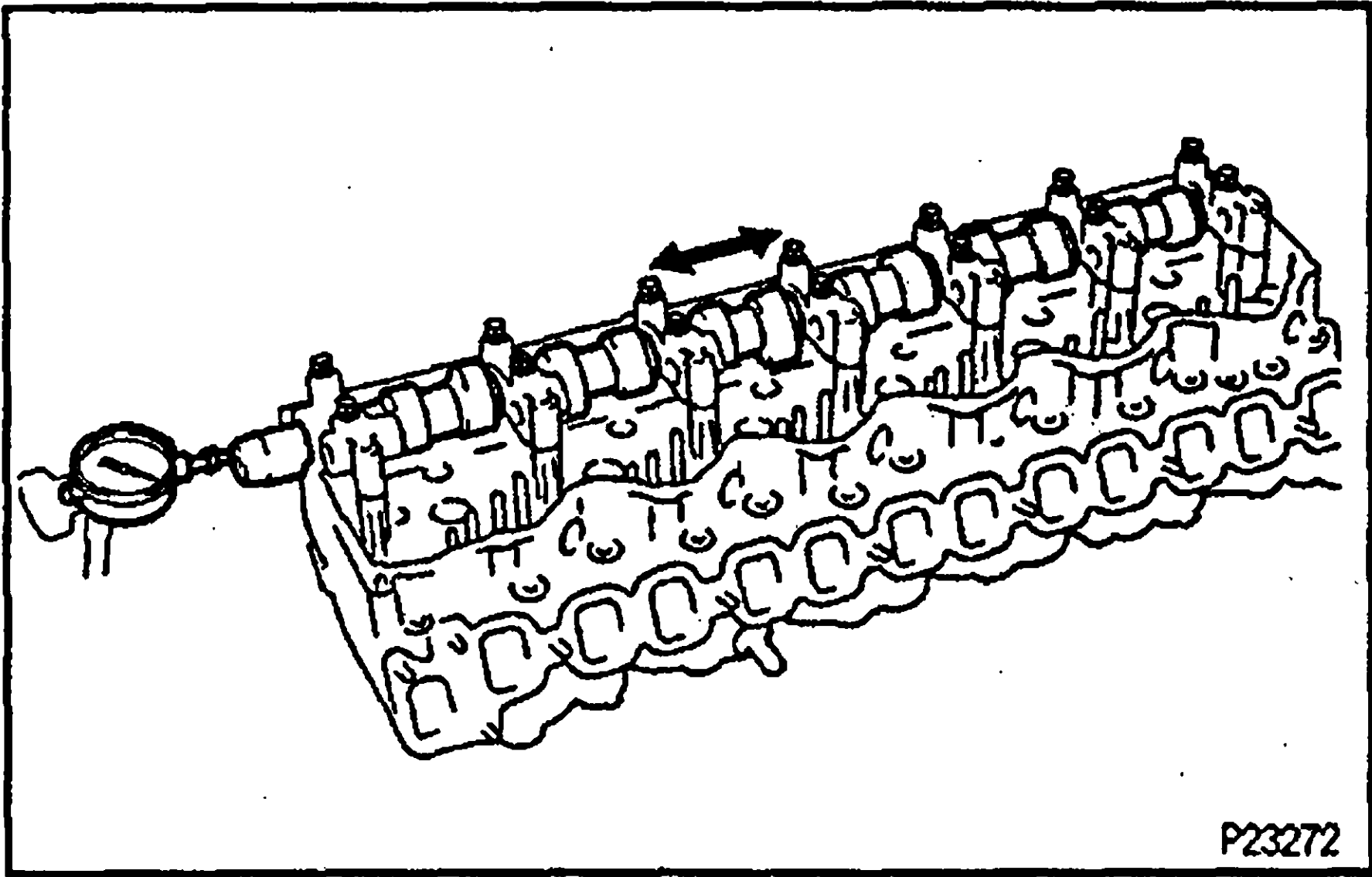
Maximum oil clearance:

0.10 mm (0.0039 in.)

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

(i) Completely remove the Plastigage.

(j) Install the 7 bearing caps to the valve rocker shaft. (See item E above)

**F. Inspect camshaft thrust clearance**

- (a) Install the camshaft.
(See procedure in item E above)
- (b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:

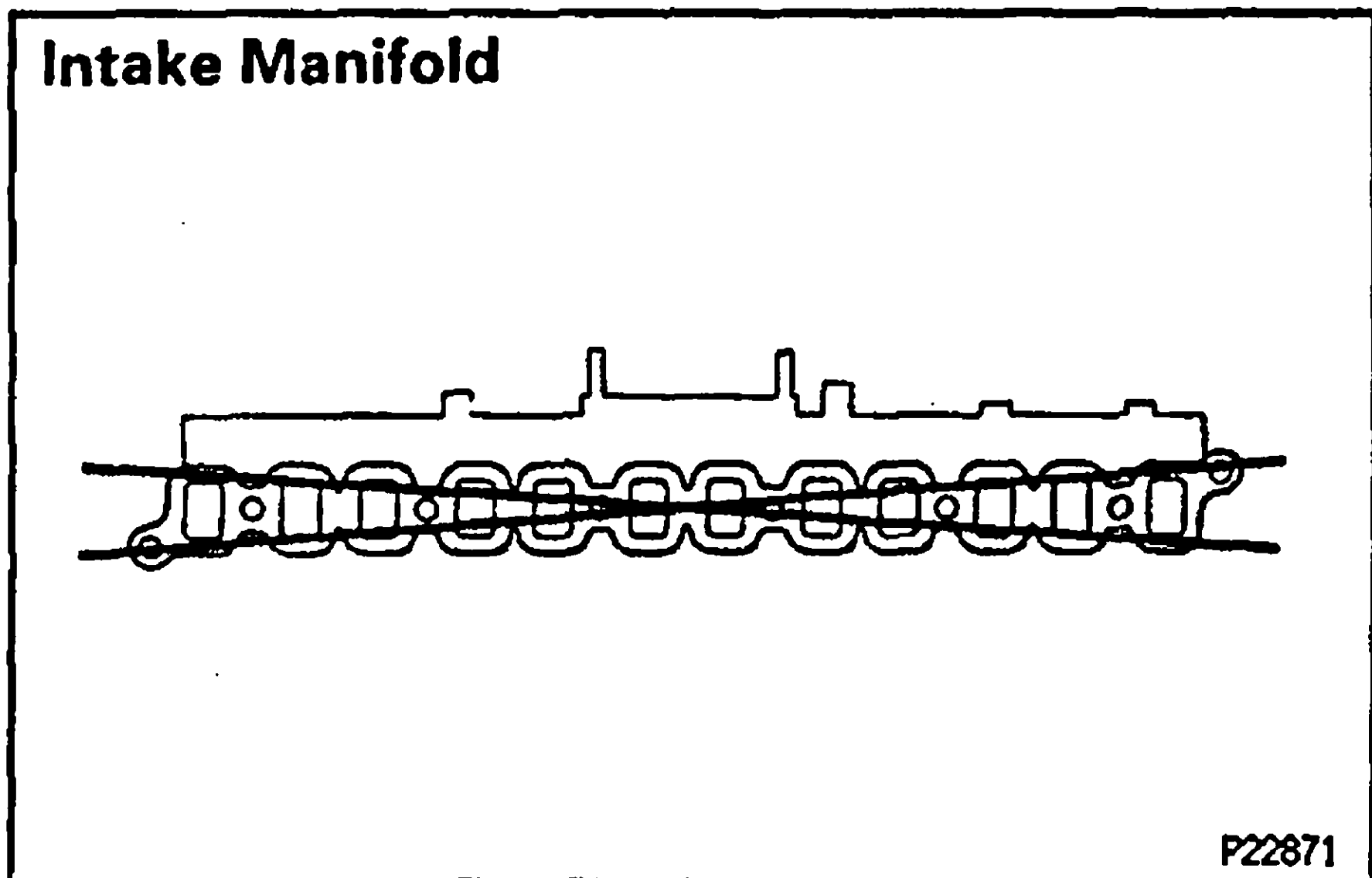
0.100 — 0.200 mm (0.0039 — 0.0079 in.)

Maximum thrust clearance:

0.30 mm (0.0118 in.)

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

- (c) Remove the camshaft.

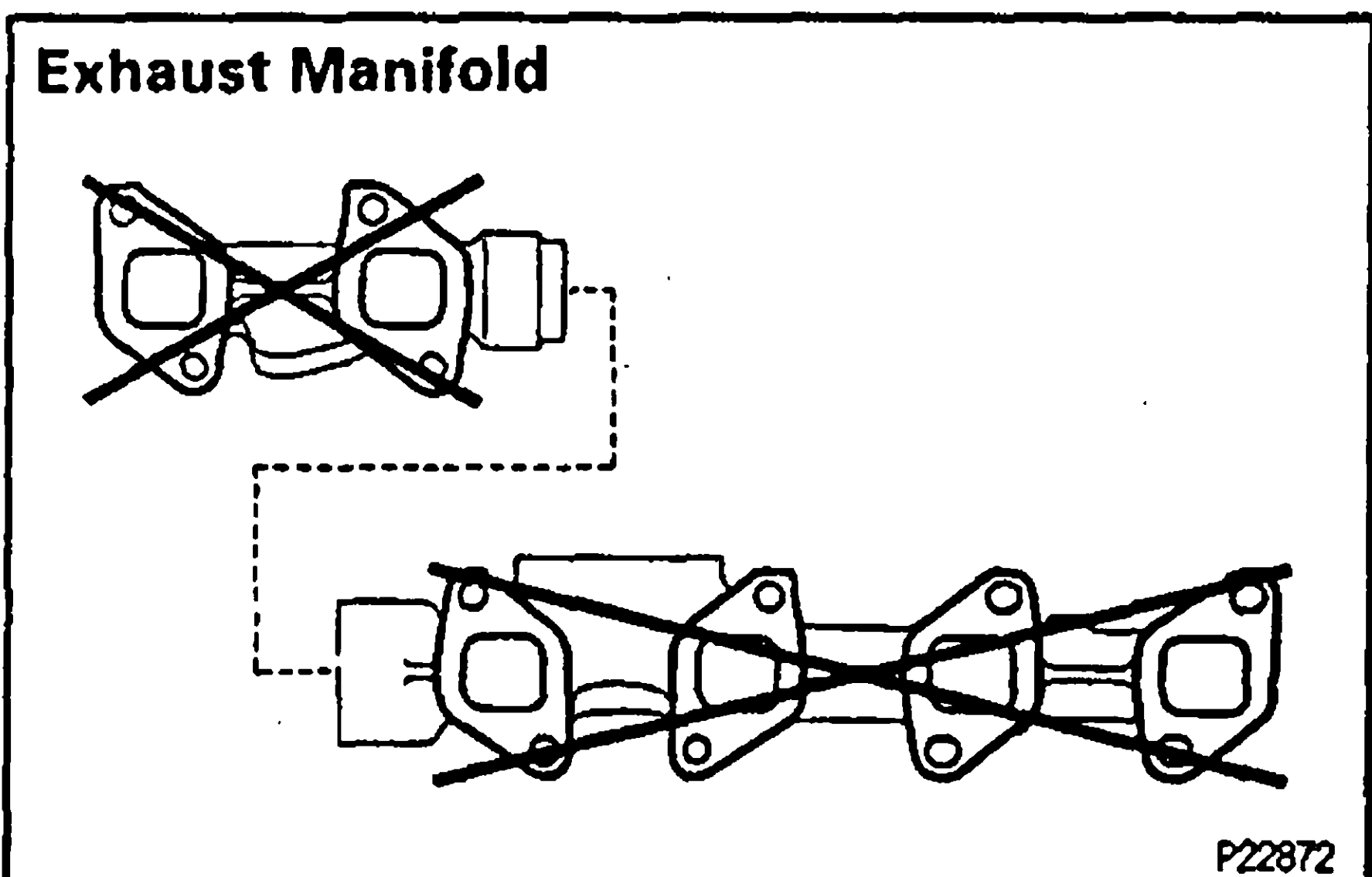
Intake Manifold**12. INSPECT INTAKE MANIFOLD**

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

Maximum warpage:

0.40 mm (0.0157 in.)

If warpage is greater than maximum, replace the manifold.

Exhaust Manifold**13. INSPECT EXHAUST MANIFOLD**

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

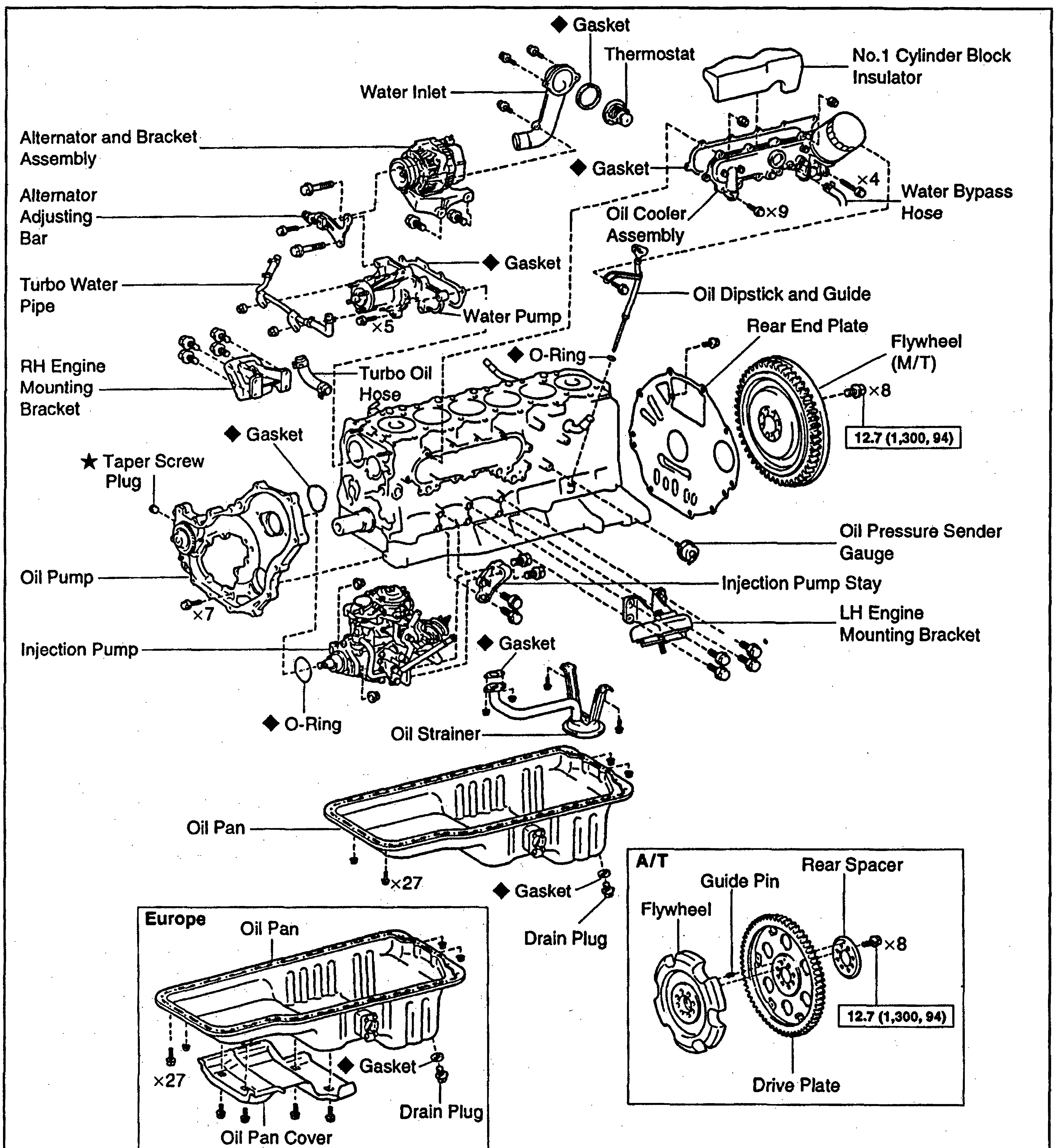
Maximum warpage:

0.40 mm (0.0157 in.)

If warpage is greater than maximum, replace the manifold.

CYLINDER BLOCK COMPONENTS FOR PREPARATION AND AFTER ASSEMBLY

EGS80-09



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

◆ Non-reusable part

★ Precoated part

Y

SERVICE SPECIFICATIONS

SERVICE DATA

B00C6-12

Compression pressure	at 250 rpm STD Minimum Difference of pressure between each cylinder	3,432 kPa (35.0 kgf/cm ² , 498 psi) or more 2,452 kPa (25.0 kgf/cm ² , 356 psi) 490 kPa (5.0 kgf/cm ² , 71 psi) or less
Valve clearance	at cold Intake Exhaust	0.17 — 0.23 mm (0.007 — 0.009 in.) 0.47 — 0.53 mm (0.019 — 0.021 in.)
Injection timing	Plunger stroke Europe Australia	1.52 — 1.58 mm (0.0598 — 0.0622 in.) 1.37 — 1.43 mm (0.0539 — 0.0563 in.)
Idle speed	M/T A/T	700 ± 50 rpm 800 ± 50 rpm
Maximum speed	—	4,400 ± 100 rpm
PS idle—up speed	—	650 — 750 rpm
A/C idle—up speed	—	775 — 850 rpm
Timing belt tensioner	Protrusion from housing end	9.0 — 9.8 mm (0.354 — 0.386 in.)
Timing gear	Idler gear thrust clearance STD Maximum Idler gear inside diameter Idler gear shaft diameter Idler gear oil clearance STD Maximum Gear backlash STD Maximum	0.05 — 0.15 mm (0.0020 — 0.0059 in.) 0.30 mm (0.0118 in.) 45.000 — 45.025 mm (1.7717 — 1.7726 in.) 44.950 — 44.975 mm (1.7697 — 1.7707 in.) 0.025 — 0.075 mm (0.0010 — 0.0030 in.) 0.20 mm (0.0079 in.) 0.05 — 0.15 mm (0.0020 — 0.0059 in.) 0.30 mm (0.0118 in.)
Cylinder head	Warpage Maximum Valve seat Refacing angle Intake Exhaust Contacting angle Contacting width Intake Exhaust Cylinder head bolt thread outside diameter STD Minimum	0.20 mm (0.079 in.) 25°, 45°, 70° 25°, 45°, 65° 45° 1.4 — 1.8 mm (0.055 — 0.071 in.) 1.6 — 2.0 mm (0.063 — 0.079 in.) 10.800 — 11.000 mm (0.4252 — 0.4331 in.) 10.55 mm (0.4154 in.)
Valve guide bushing	Inside diameter	7.010 — 7.030 mm (0.2760 — 0.2768 in.)
Valve	Valve overall length STD Intake Exhaust Minimum Intake Exhaust Stem diameter Intake Exhaust	126.85 — 127.45 mm (4.9941 — 5.0177 in.) 126.43 — 127.03 mm (4.9775 — 5.0012 in.) 126.85 mm (4.9941 in.) 126.43 mm (4.9775 in.) 6.970 — 6.985 mm (0.2744 — 0.2750 in.) 6.960 — 6.975 mm (0.2740 — 0.2746 in.)

Valve (cont'd)	Stem oil clearance	STD Intake	0.025 — 0.060 mm (0.0010 — 0.0024 in.)
		Exhaust	0.035 — 0.070 mm (0.0014 — 0.0028 in.)
		Maximum Intake	0.08 mm (0.0031 in.)
		Exhaust	0.10 mm (0.0039 in.)
	Margin thickness	STD	1.00 mm (0.0394 in.)
		Minimum	0.83 mm (0.0327 in.)
Valve spring	Deviation	Maximum	2.0 mm (0.079 in.)
	Free length		49.6 mm (1.9527 in.)
	Installed tension at 32.9 mm (1.295 in.)		237 — 263 N (24.2 — 26.8 kgf, 53.4 — 59.1 lbf)
Valve rocker arm and shaft	Valve rocker arm inside diameter		20.012 — 20.033 mm (0.7879 — 0.7887 in.)
	Valve rocker shaft diameter		19.972 — 19.993 mm (0.7863 — 0.7871 in.)
	Oil clearance	STD	0.019 — 0.061 mm (0.0007 — 0.0024 in.)
		Maximum	0.10 mm (0.0039 in.)
Camshaft	Thrust clearance	STD	0.100 — 0.200 mm (0.0039 — 0.0079 in.)
		Maximum	0.30 mm (0.0118 in.)
	Journal oil clearance	STD No.1	0.022 — 0.074 mm (0.0009 — 0.0029 in.)
		Others	0.023 — 0.075 mm (0.0009 — 0.0030 in.)
		Maximum	0.10 mm (0.0039 in.)
	Journal diameter	No.1	34.969 — 34.985 mm (1.3767 — 1.3774 in.)
		Others	27.986 — 27.998 mm (1.1018 — 1.1023 in.)
	Circle runout	Maximum	0.10 mm (0.0039 in.)
	Cam lobe height	STD Intake	48.498 — 48.598 mm (1.9094 — 1.9133 in.)
		Exhaust	50.734 — 50.834 mm (1.9974 — 2.0013 in.)
		Minimum Intake	47.998 mm (1.8897 in.)
		Exhaust	50.234 mm (1.9777 in.)
Manifold	Warpage	Maximum	0.40 mm (0.0157 in.)
Cylinder block	Cylinder head surface warpage	Maximum	0.20 mm (0.0079 in.)
	Cylinder bore diameter	STD STD Mark 1	94.000 — 94.010 mm (3.7001 — 3.7012 in.)
		Mark 2	94.010 — 94.020 mm (3.7012 — 3.7016 in.)
		Mark 3	94.020 — 94.030 mm (3.7016 — 3.7020 in.)
		Maximum STD	94.23 mm (3.7098 in.)
		O/S 0.50	94.73 mm (3.7295 in.)
	Main bearing cap stud bolt tension portion diameter		
		STD	11.800 — 12.000 mm (0.4646 — 0.4724 in.)
	Minimum	11.50 mm (0.4528 in.)	
Piston and piston ring	Piston diameter	STD Mark 1	93.845 — 93.855 mm (3.6947 — 3.6951 in.)
		Mark 2	93.855 — 93.865 mm (3.6951 — 3.6955 in.)
		Mark 3	93.865 — 93.875 mm (3.6955 — 3.6959 in.)
		O/S 0.50	94.345 — 94.375 mm (3.7144 — 3.7155 in.)
	Piston oil clearance	STD	0.145 — 0.165 mm (0.0057 — 0.0065 in.)
		Minimum	0.215 mm (0.0085 in.)
	Piston ring groove clearance	STD No.1	0.050 — 0.095 mm (0.0020 — 0.0037 in.)
		No.2	0.060 — 0.100 mm (0.0024 — 0.0039 in.)
		Oil	0.030 — 0.070 mm (0.0012 — 0.0028 in.)
		Maximum	0.20 mm (0.0079 in.)

Piston and piston ring (cont'd)	Piston ring end gap	STD No.1	0.270 — 0.470 mm (0.0106 — 0.0185 in.)
		No.2	0.400 — 0.650 mm (0.0157 — 0.0256 in.)
		Oil	0.200 — 0.500 mm (0.0079 — 0.0197 in.)
		Maximum No.1	0.85 mm (0.0335 in.)
		No.2	0.90 mm (0.0354 in.)
		Oil	0.88 mm (0.0346 in.)
Connecting rod	Thrust clearance	STD	0.100 — 0.200 mm (0.0039 — 0.0079 in.)
		Maximum	0.30 mm (0.0118 in.)
	Connecting rod oil clearance	STD	0.036 — 0.054 mm (0.0014 — 0.0021 in.)
		U/S 0.25, U/S 0.50	0.037 — 0.077 mm (0.0015 — 0.0030 in.)
		Maximum	0.10 mm (0.0039 in.)
	Connecting rod bearing center wall thickness (Reference)	STD Mark 2	1.484 — 1.489 mm (0.0585 — 0.0586 in.)
		Mark 3	1.489 — 1.492 mm (0.0586 — 0.0587 in.)
		Mark 4	1.492 — 1.495 mm (0.0587 — 0.0589 in.)
		Mark 5	1.495 — 1.498 mm (0.0589 — 0.0590 in.)
		Mark 6	1.498 — 1.501 mm (0.0590 — 0.0591 in.)
	Rod bend	Maximum per 100 mm (3.94 in.)	0.03 mm (0.0012 in.)
	Rod twist	Maximum per 100 mm (3.94 in.)	0.15 mm (0.0059 in.)
	Bushing inside diameter		33.008 — 33.020 mm (1.2995 — 1.3000 in.)
	Piston pin diameter		33.000 — 33.012 mm (1.2992 — 1.2997 in.)
	Bushing oil clearance	STD	0.004 — 0.012 mm (0.0002 — 0.0005 in.)
		Maximum	0.03 mm (0.0012 in.)
	Connecting rod bolt tension portion diameter	STD	8.300 — 8.400 mm (0.3268 — 0.3307 in.)
		Minimum	7.95 mm (0.3130 in.)
Crankshaft	Thrust clearance	STD	0.040 — 0.240 mm (0.0016 — 0.0094 in.)
		Maximum	0.30 mm (0.0118 in.)
	Thrust washer thickness		2.930 — 2.980 mm (0.1154 — 0.1173 in.)
	Main journal oil clearance	STD	0.036 — 0.054 mm (0.0014 — 0.0021 in.)
		U/S 0.25, U/S 0.50	0.037 — 0.077 mm (0.0015 — 0.0030 in.)
		Maximum	0.10 mm (0.0039 in.)
	Main journal diameter	STD	66.982 — 67.000 mm (2.6371 — 2.6378 in.)
		U/S 0.25	66.745 — 66.755 mm (2.6278 — 2.6281 in.)
		U/S 0.50	66.495 — 66.505 mm (2.6179 — 2.6183 in.)
	Main bearing center wall thickness (Reference)	STD Mark 2	1.979 — 1.982 mm (0.0779 — 0.0780 in.)
		Mark 3	1.982 — 1.985 mm (0.0780 — 0.0781 in.)
		Mark 4	1.985 — 1.988 mm (0.0781 — 0.0783 in.)
		Mark 5	1.988 — 1.991 mm (0.0783 — 0.0784 in.)
		Mark 6	1.991 — 1.994 mm (0.0784 — 0.0785 in.)
	Crank pin diameter	STD	58.982 — 59.000 mm (2.3221 — 2.3228 in.)
		U/S 0.25	58.745 — 58.755 mm (2.3128 — 2.3132 in.)
		U/S 0.50	58.495 — 58.505 mm (2.3029 — 2.3033 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 SPECIFICATION

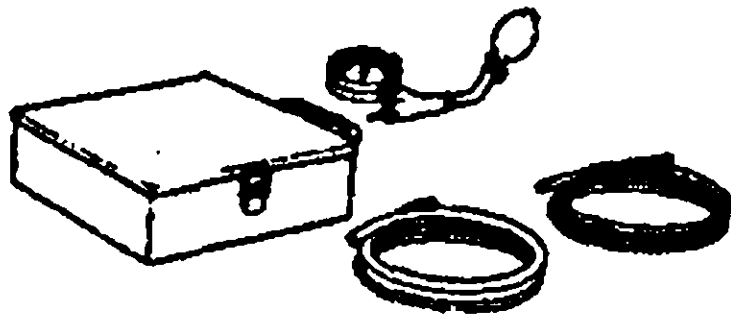
Part tightened	N-m	kgf-cm	ft-lbf
Injection pump x Timing gear case	18	185	13
Injection pump x Injection pump stay	69	700	51
Plug bolt x Distributive head plug on injection pump	25.5	260	19
Injection pipe x Injection pump	24.5	250	18
No.1 camshaft timing pulley x Camshaft	98	1,000	72
No.2 camshaft timing pulley x Injection pump drive gear	31	315	23
Idler pulley x Timing gear cover	34.5	350	25
Timing belt tensioner x Timing gear cover	13	130	10
Injection pump drive gear x Injection pump	98	1,000	72
Idler gear x Cylinder block	68	694	50
Timing gear cover, Oil pipe x Timing gear case	19.6	200	14
Vacuum pump x Timing gear cover	39	400	29
Oil pipe x Vacuum pump, Cylinder block	18	185	13
Crankshaft pulley x Crankshaft	430	4,400	317
Cylinder head x Cylinder block	1st	68.6	700
	2nd	Turn 90°	Turn 90°
	3rd	Turn 90°	Turn 90°
Camshaft bearing cap x Cylinder head	25	250	18
Camshaft oil seal retainer x Cylinder head	19.6	200	14
Cylinder head cover x Cylinder head	6.4	65	57 in.-lbf
Rear engine hanger x Cylinder head	39.2	400	29
Water outlet x Cylinder head	19.6	200	14
Intake manifold x Cylinder head	19.6	200	14
Intake pipe x Intake manifold	19.6	200	14
EGR valve adapter x Exhaust manifold	40	400	26
EGR valve bracket x EGR valve dapter, Cylinder head (w/ EGR system)	20	200	15
Intake pipe x Intake heater (w/o EGR system)	7.5	75	66 in.-lbf
Main bearing cap x Cylinder block	12 pointed head 1st	103	1,050
	2nd	Turn 90°	Turn 90°
	6 pointed head	18.1	185
Connecting rod cap x Connecting rod	1st	36.8	375
	2nd	Turn 90°	Turn 90°
Rear oil seal retainer x Cylinder block, Main bearing cap	6.4	65	57 in.-lbf
Engine mounting bracket x Cylinder block	68.6	700	51
Injection pump stay x Cylinder block	69	700	51
Alternator bracket x Cylinder block	68.6	700	51
Rear end plate x Cylinder block	18.1	185	13
Flywheel (M/T), Drive plate (A/T) x Crankshaft	127.4	1,300	94

TURBOCHARGER SYSTEM

PREPARATION

SST (SPECIAL SERVICE TOOLS)

IG00R-0M

EG  09992-00241 Turbocharger Pressure Gauge	
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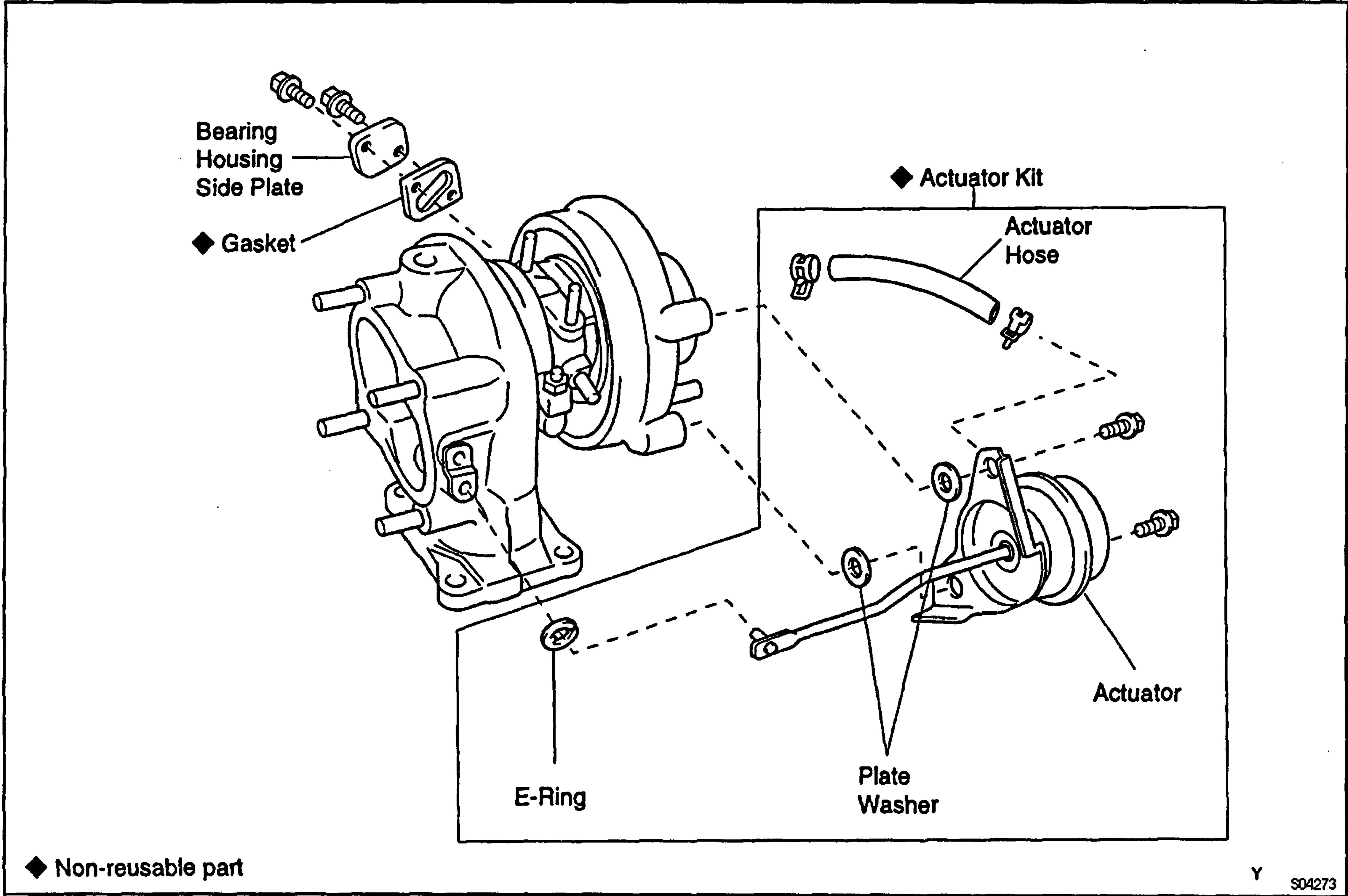
EQUIPMENT

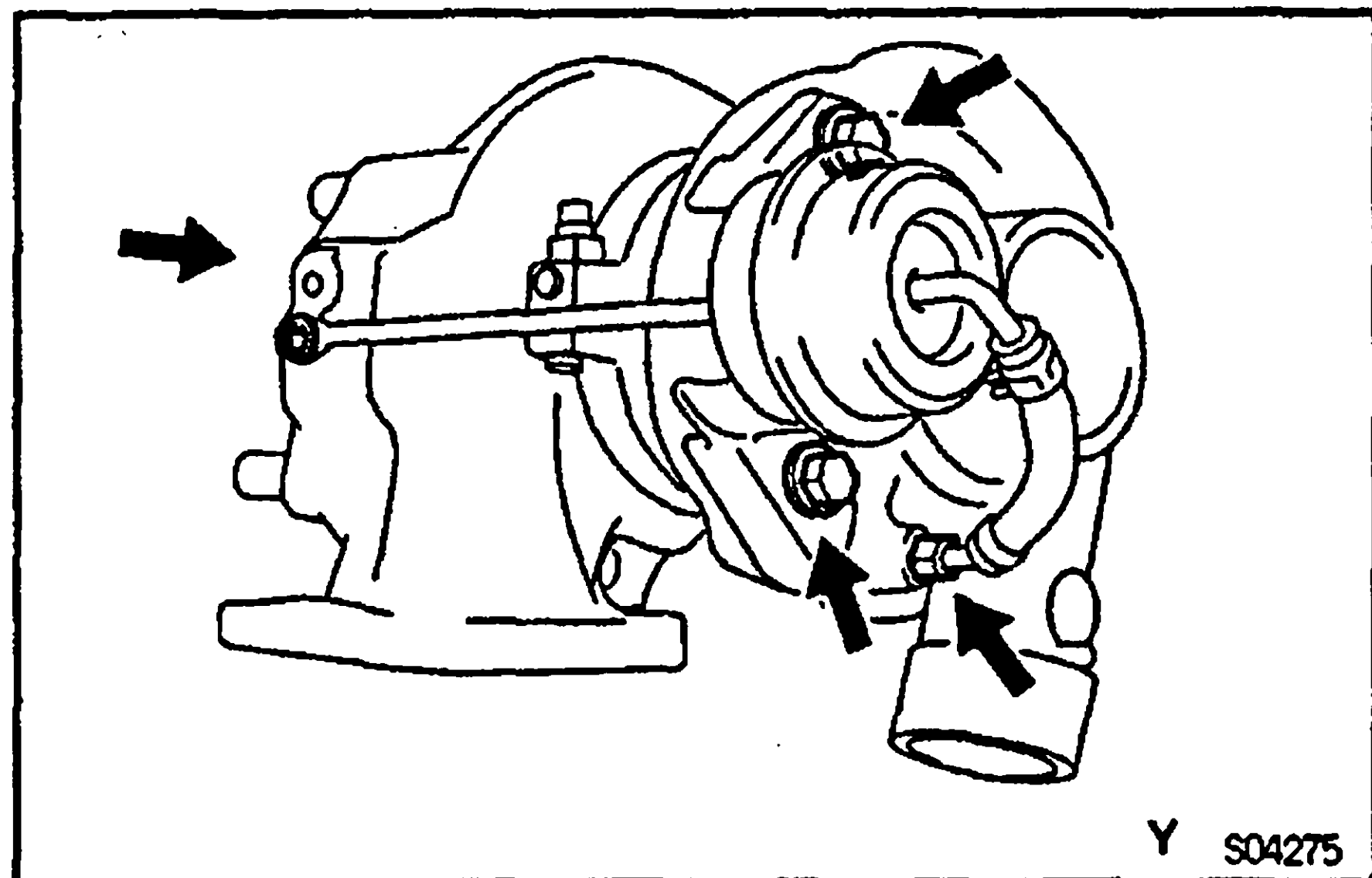
IG00T-10

Dial indicator	
Torque wrench	

TURBOCHARGER
COMPONENTS FOR REPLACEMENT

E07CA-01

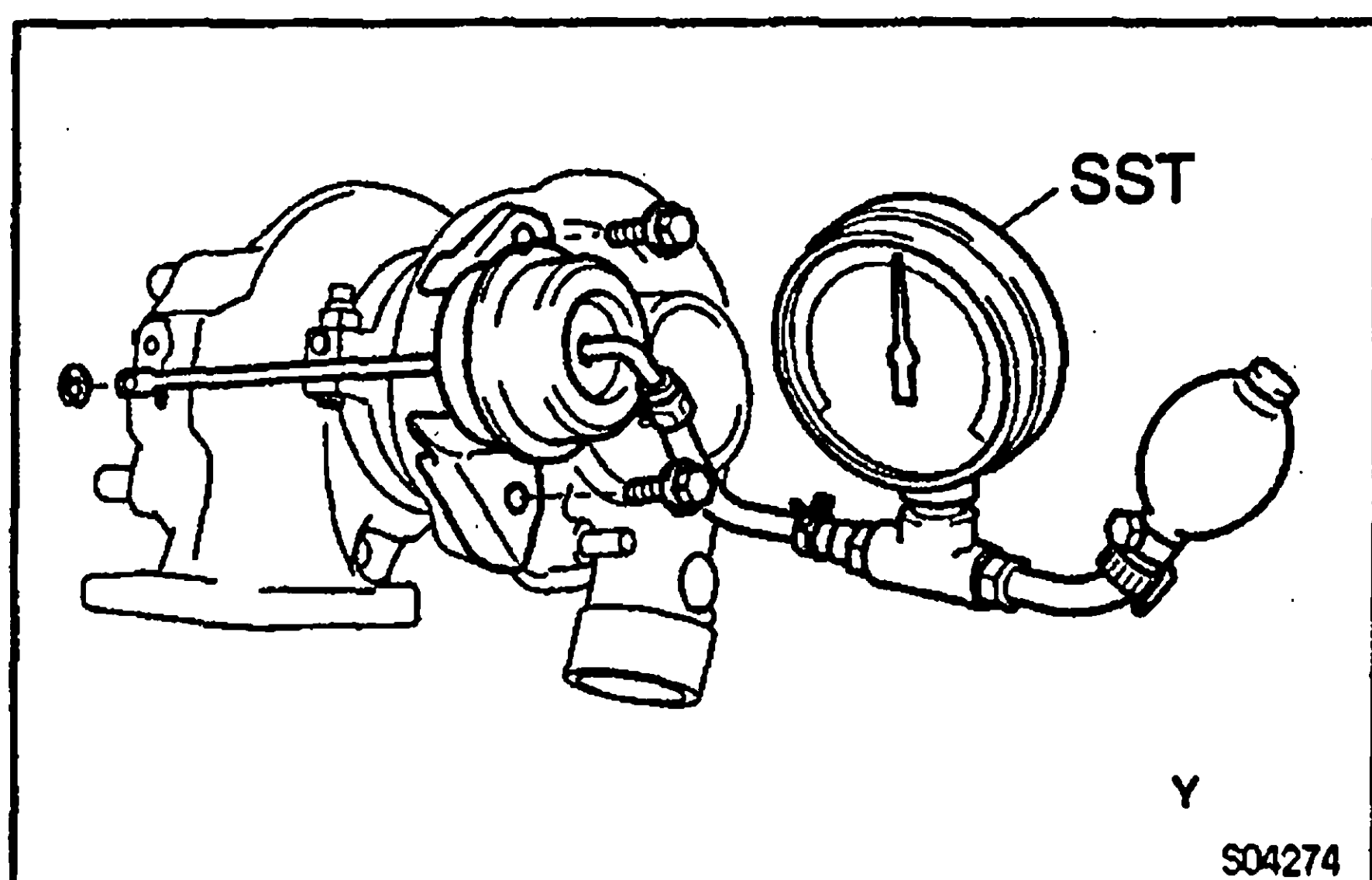




ACTUATOR REPLACEMENT

1. REMOVE ACTUATOR

- Remove the actuator hose.
- Remove the 2 bolts holding the actuator to the compressor housing.
- Remove the E-ring holding the actuator push rod to the waste gate valve link, and remove the actuator.



2. INSTALL ACTUATOR

- Using SST, apply approx. 101.3 kPa (1.03 kgf/cm², 14.6 psi) of pressure to a new actuator.
SST 09992-00241
- Connect the actuator push rod to the waste gate valve link with a new E-ring.

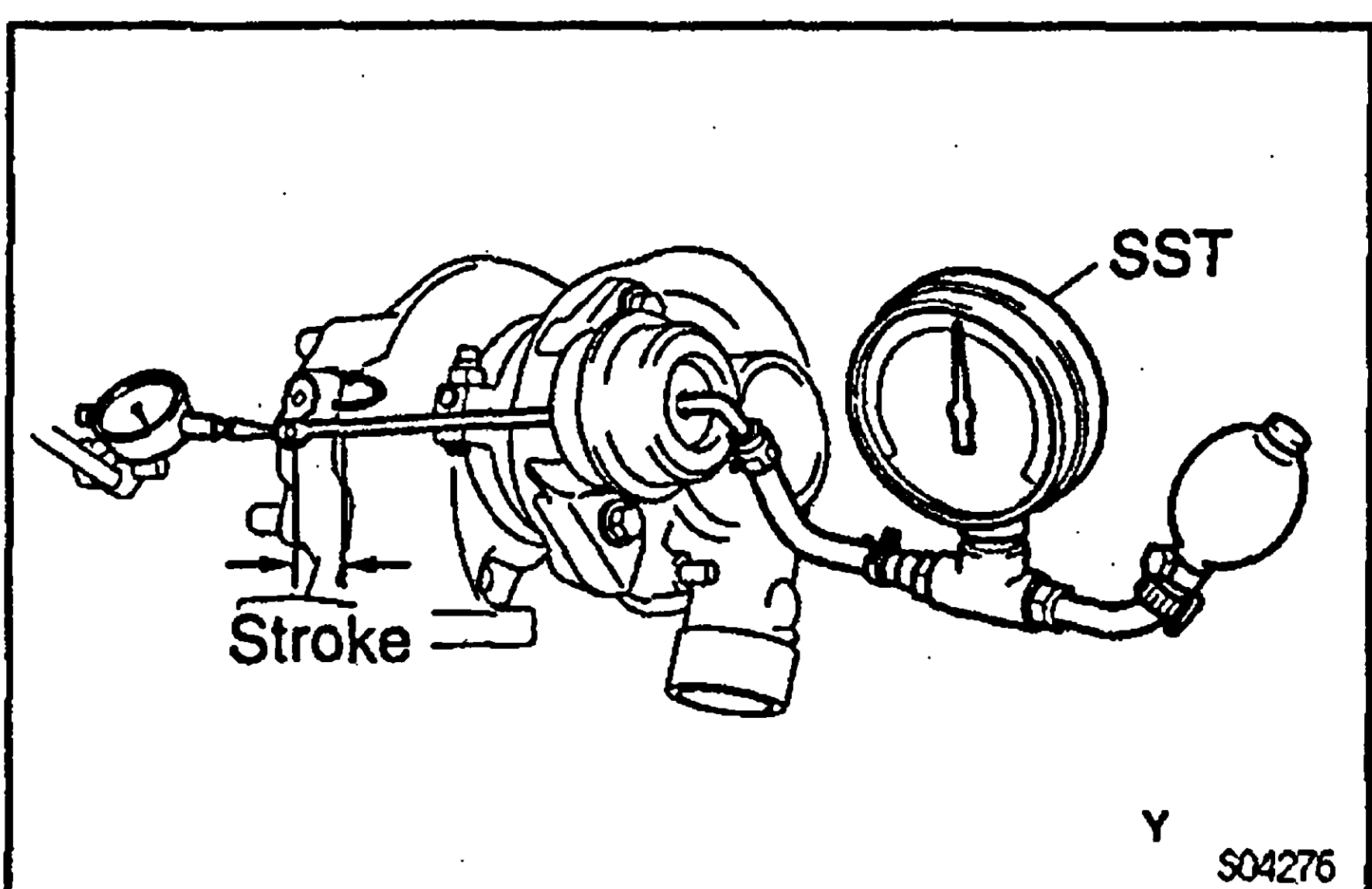
- Install the actuator to the compressor housing with the 2 bolts.

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

- Remove the SST.

NOTICE:

- Never apply more than 120 kPa (1.22 kgf/cm², 17.4 psi) of pressure to the actuator.
- Do not use a hammer, etc. to force the actuator push rod onto the waste gate valve link.



3. ADJUST ACTUATOR ROD STROKE

NOTICE: Never apply more than 120 kPa (1.22 kgf/cm², 17.4 psi) of pressure to the actuator.

- Using a dial indicator, set the dial indicator in a straight line with the actuator push rod.
- Using SST, apply 107.3 kPa (1.09 kgf/cm², 15.5 psi) of pressure to the actuator, and measure the actuator push rod stroke.

SST 09992-00241

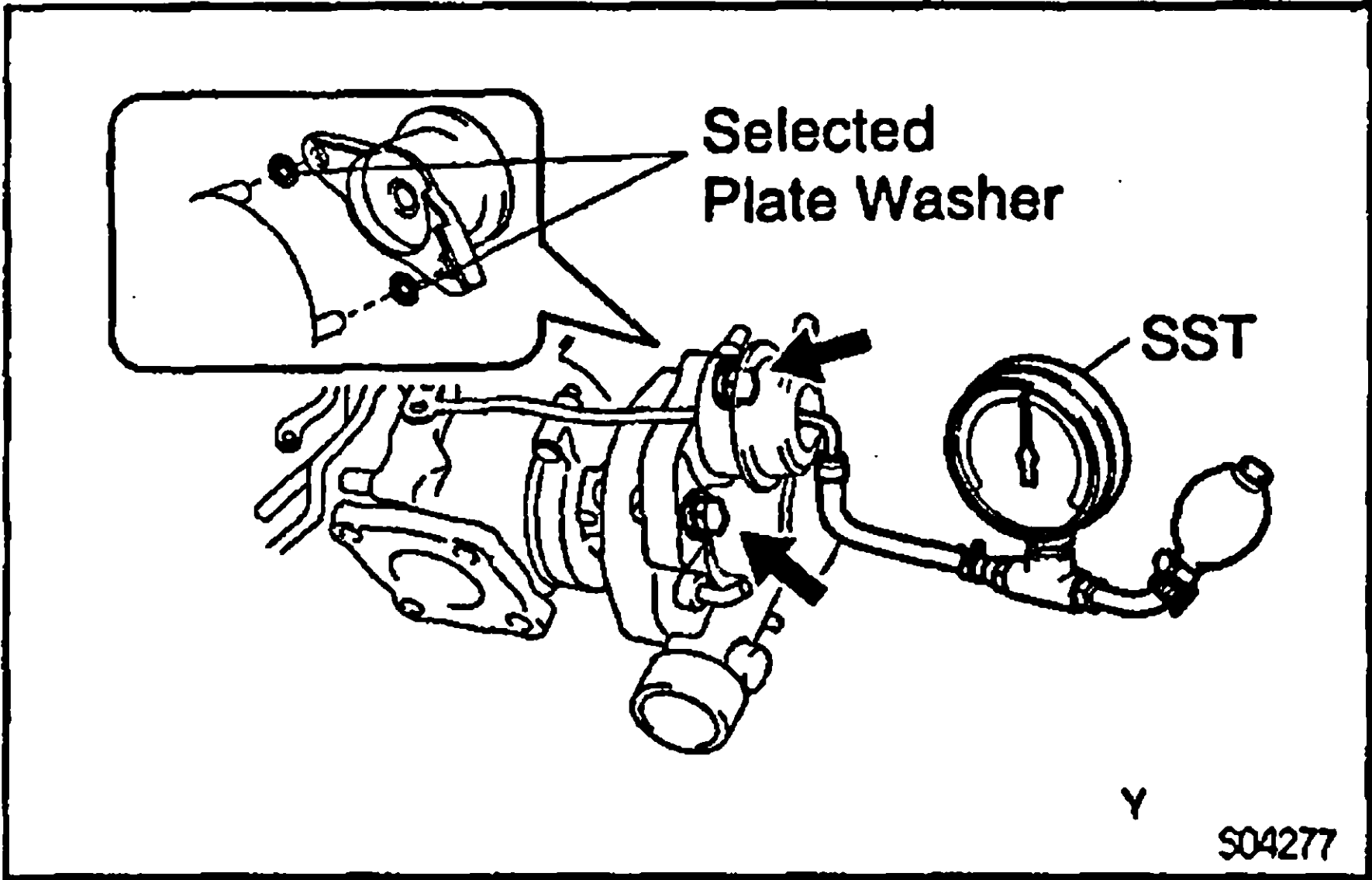
(c) From the table below select the plate washer thickness to match the stroke measured in (b) above.

Stroke measurement mm (in.)	Required plate washer thickness mm (in.)
1.20 – 1.70 (0.0472 – 0.0670)	None required
1.71 – 2.20 (0.0673 – 0.0866)	0.5 (0.020)
2.21 – 2.70 (0.0870 – 0.1063)	1.0 (0.039)
2.71 – 3.20 (0.1067 – 0.1260)	1.5 (0.059)
3.21 – 3.70 (0.1264 – 0.1457)	2.0 (0.079)
3.71 – 4.20 (0.1461 – 0.1654)	2.5 (0.098)
4.21 – 4.70 (0.1657 – 0.1850)	3.0 (0.118)
4.71 – 5.20 (0.1854 – 0.2047)	3.5 (0.138)
5.21 – 5.70 (0.2051 – 0.2244)	4.0 (0.157)
5.71 – 6.20 (0.2248 – 0.2441)	4.5 (0.177)
6.21 – 6.70 (0.2445 – 0.2638)	5.0 (0.197)
6.71 – 7.20 (0.2642 – 0.2827)	5.5 (0.217)
7.21 – 7.70 (0.2839 – 0.3031)	6.0 (0.236)
7.71 – 8.20 (0.3035 – 0.3228)	6.5 (0.256)

NOTICE:

- Use a combination of plate washers of 0.5 mm (0.020 in.), 1.0 mm (0.039 in.), 2.0 mm (0.079 in.) and 3.0 mm (0.118 in.) thickness to achieve the required thickness.
- Use the same thickness of plate washer for the 2 locations between the actuator and compressor housing.
- If the plate washer thickness exceeds 3.5 mm, (0.138 in.) replace the actuator installation bolts with the bolts from the kit part.

(d) Using SST, apply approx. 107.3 kPa (1.09 kgf/cm², 15.5 psi) of pressure to the actuator, and install the selected plate washers between the actuator and compressor housing with the 2 bolts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



(e) Using SST, apply 107.3 kPa (1.09 kgf/cm², 15.5 psi) of pressure to the actuator, and measure the actuator push rod stroke.

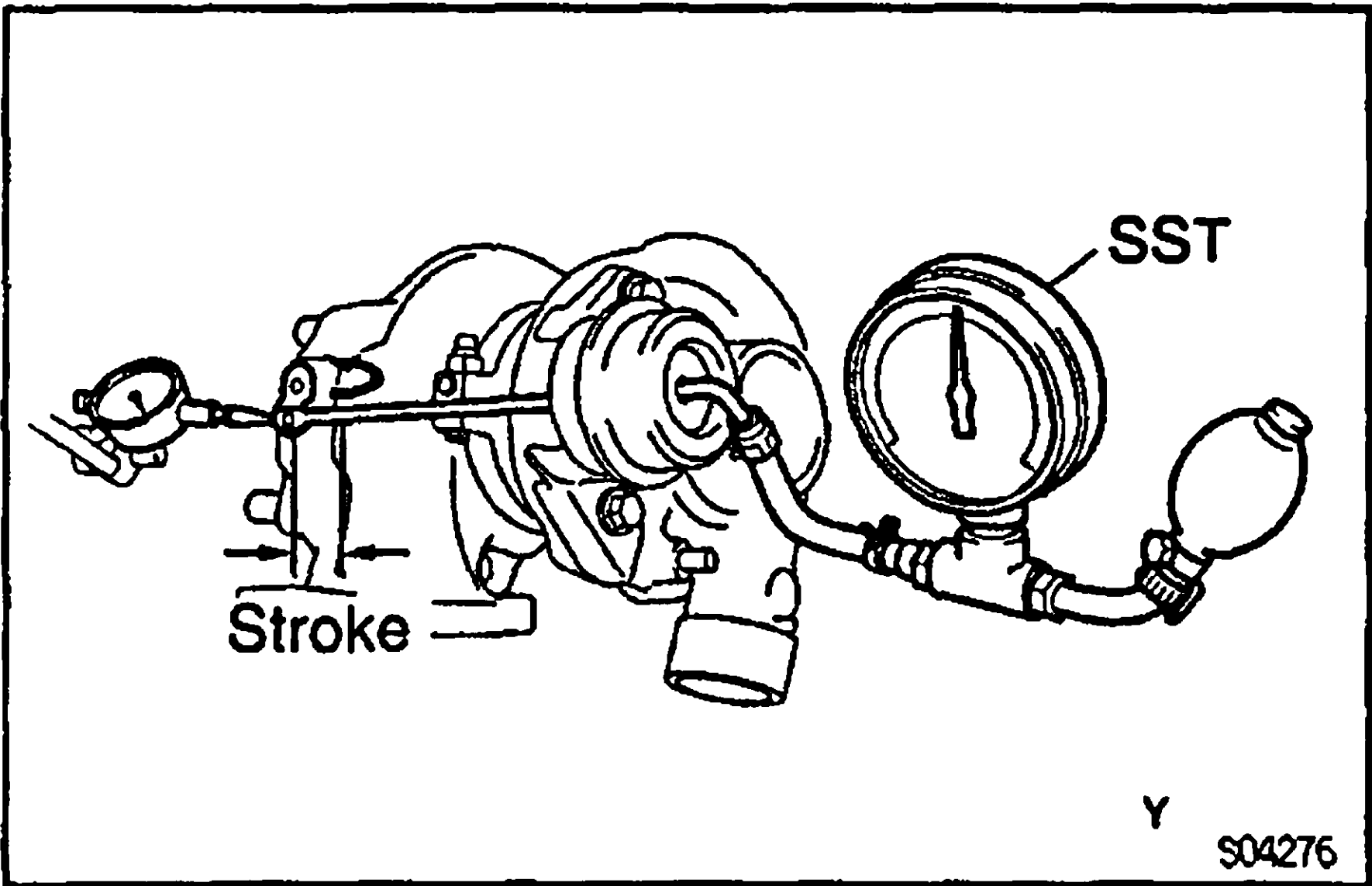
SST 09992–00241

Standard stroke:

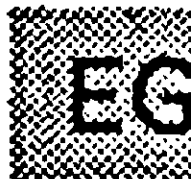
1.20 – 1.70 mm (0.0472 – 0.0669 in.)

If the stroke is outside specifications, reseal the plate washers.

4. INSTALL ACTUATOR HOSE



5. **APPLY YELLOW PAINT**
Apply yellow paint from the actuator bolts to the actuator bracket to indicate that they have been correctly installed.
6. **CHECK TURBOCHARGER PRESSURE**
(See pub. No. RM437E)



SERVICE SPECIFICATIONS
SERVICE DATA

EG0X8-0K

Turbocharger	Turbocharging pressure		38.6 — 50.0 kPa (0.39 — 0.50 kgf/cm ² , 5.6 — 7.3 psi)
	Impeller wheel axial play	Maximum	0.13 mm (0.0051 in.) or less
	Impeller wheel radial play	Maximum	0.18 mm (0.0071 in.) or less
	Actuator push rod stroke		1.20 — 1.70 mm (0.0472 — 0.0669 in.)
	Adjusting plate washer		0.5 mm (0.020 in.) 1.0 mm (0.039 in.) 2.0 mm (0.079 in.) 3.0 mm (0.118 in.)

EG0X9-0M

TORQUE SPECIFICATIONS

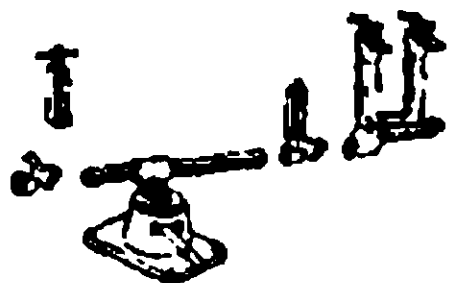
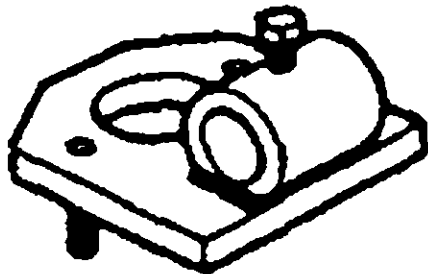
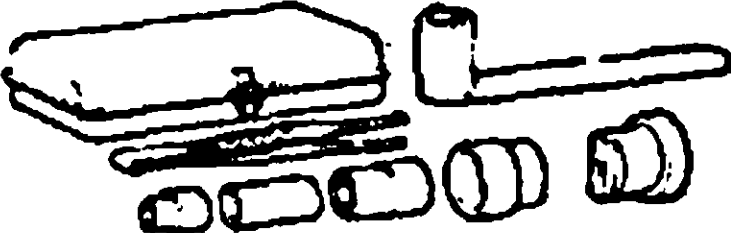
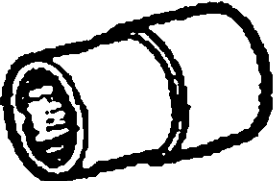
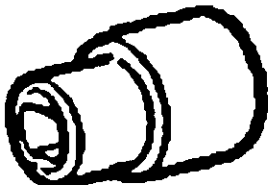
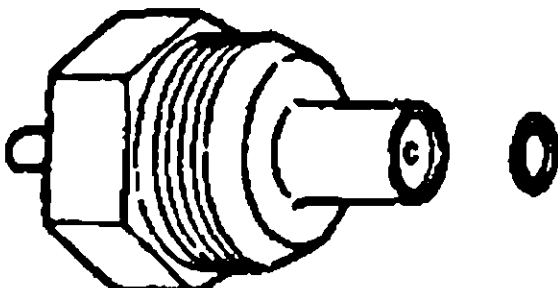
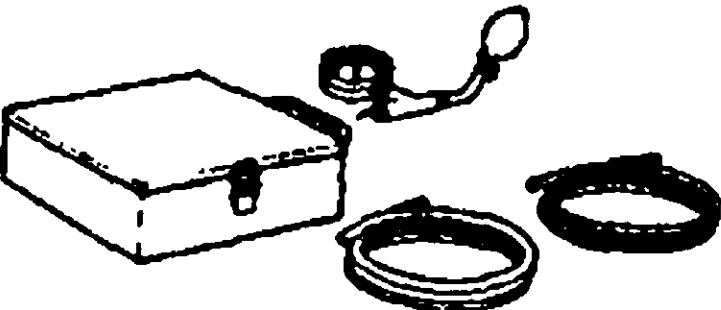
Part tightened	N·m	kgf·cm	ft·lbf
No.1 turbo water pipe, Turbocharger heat insulator x Turbocharger	7.8	80	69 in·lbf
Turbocharger x Exhaust manifold	52	530	38
Turbo oil pipe x Turbocharger	18.1	185	13
Exhaust manifold x Cylinder head	41.7	425	31
Turbo oil pipe x Cylinder block	24.5	250	18
Turbocharger stay x Turbocharger, Cylinder block	117.7	1,200	87
Turbine outlet elbow x Turbocharger	52	530	38
Exhaust manifold heat insulator x Exhaust manifold	18.1	185	13
Turbocharger actuator x Compressor housing	19	195	14

FUEL SYSTEM

PREPARATION

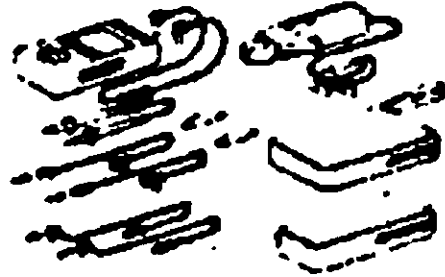
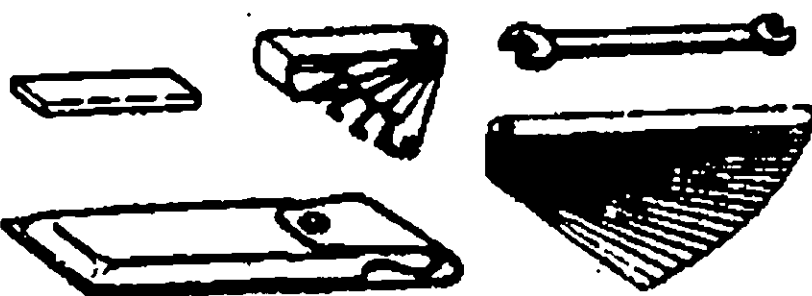
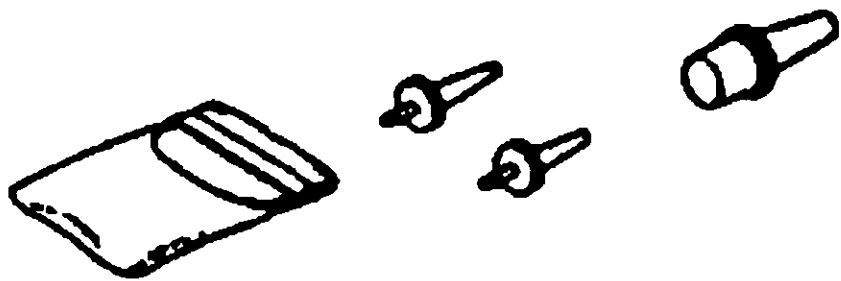
SST (SPECIAL SERVICE TOOLS)

EG0CF-28

	09236-00101 Water Pump Overhaul Tool Set	
	(09237-00070) Shaft "C"	Governor sleeve plug
	09241-76022 Injection Pump Stand Set	
	09245-54010 Injection Pump Stand Arm	
	09260-54012 Injection Pump Tool Set	
	(09269-54020) Socket 14 mm	
	(09269-54030) Tweezers	
	(09269-54040) Governor Lever Support Bolt Wrench	
	(09262-54020) Regulator Valve Wrench	
	09263-00010 Boring Guide	
	09275-17010 Pre-stroke Measuring Adapter	
	09992-00241 Turbocharger Pressure Gauge	

8T01G-0X

RECOMMENDED TOOLS

	09082-00050 TOYOTA Electrical Tester Set.	
	09200-00010 Engine Adjust Kit .	
	09258-00030 Hose Plug Set .	Plug for fuel hose

EG

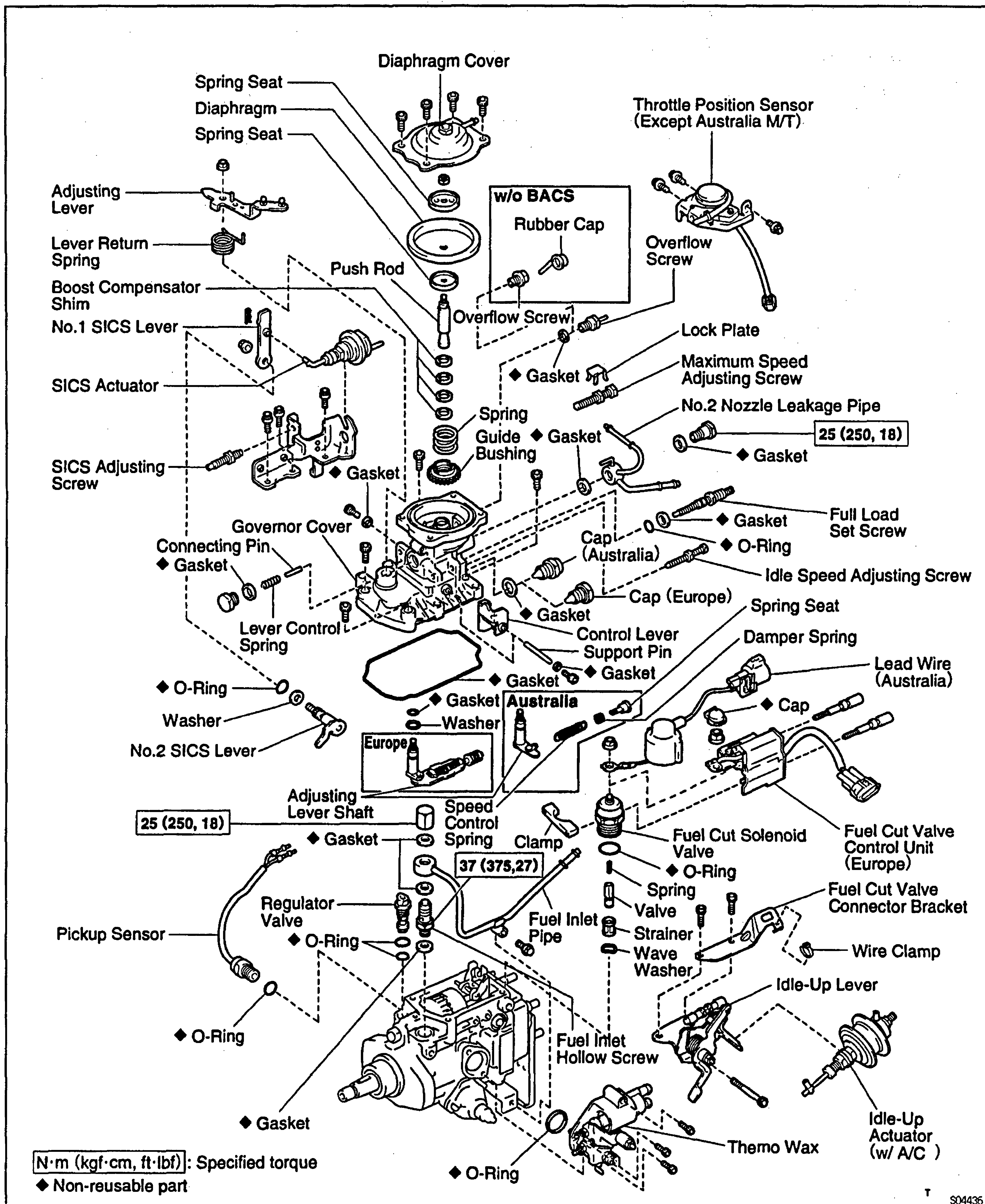
EG0CH-20

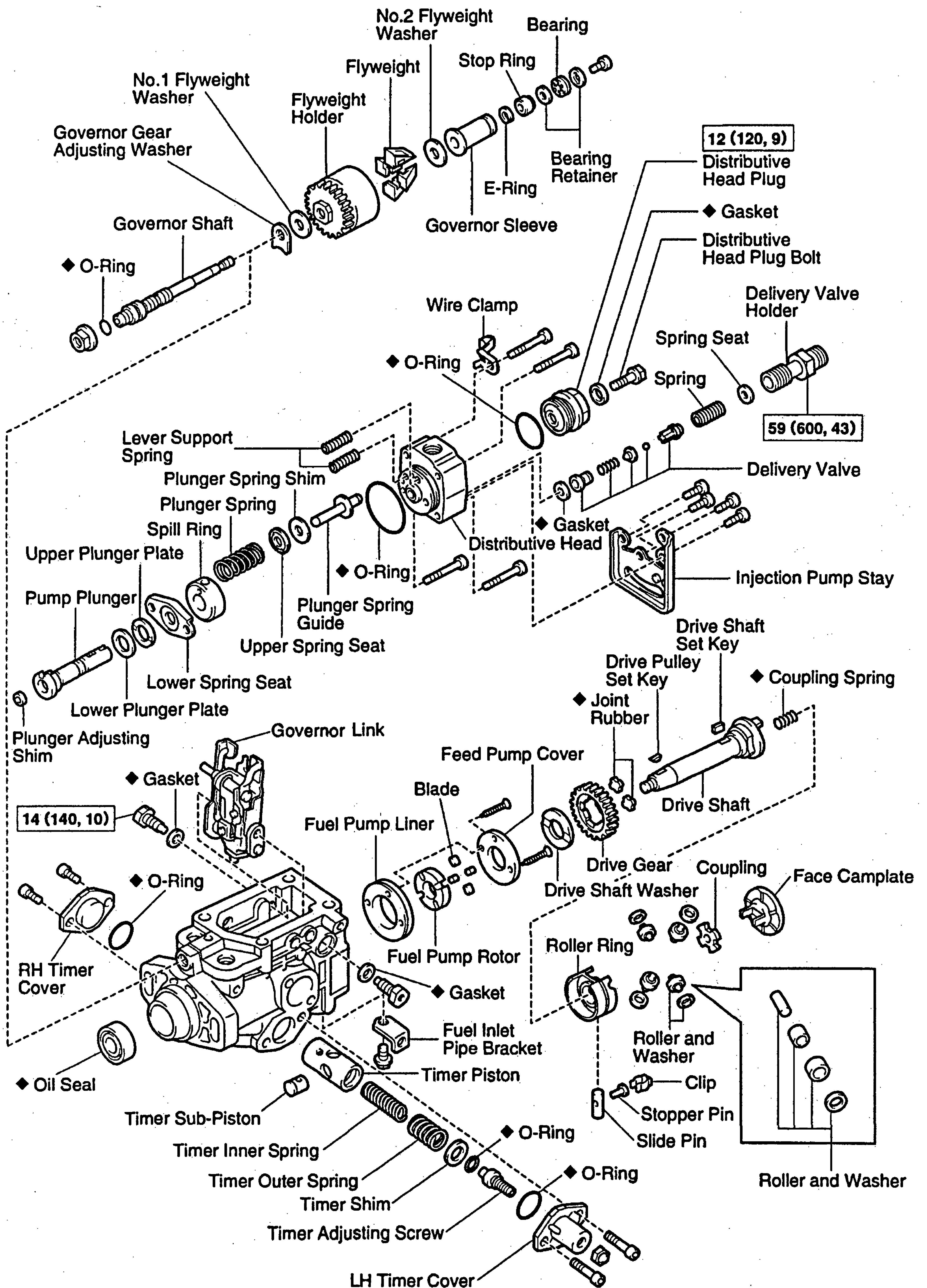
EQUIPMENT

Angle gauge	
Brass brush	
Dial indicator with magnetic base	
Graduated cylinder	
Injection pump tester	
Inner pressure gauge	
Micrometer	
Steel square	
Timer measuring device	
Torque wrench	
vernier calipers	
Wooden stick	

INJECTION PUMP COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

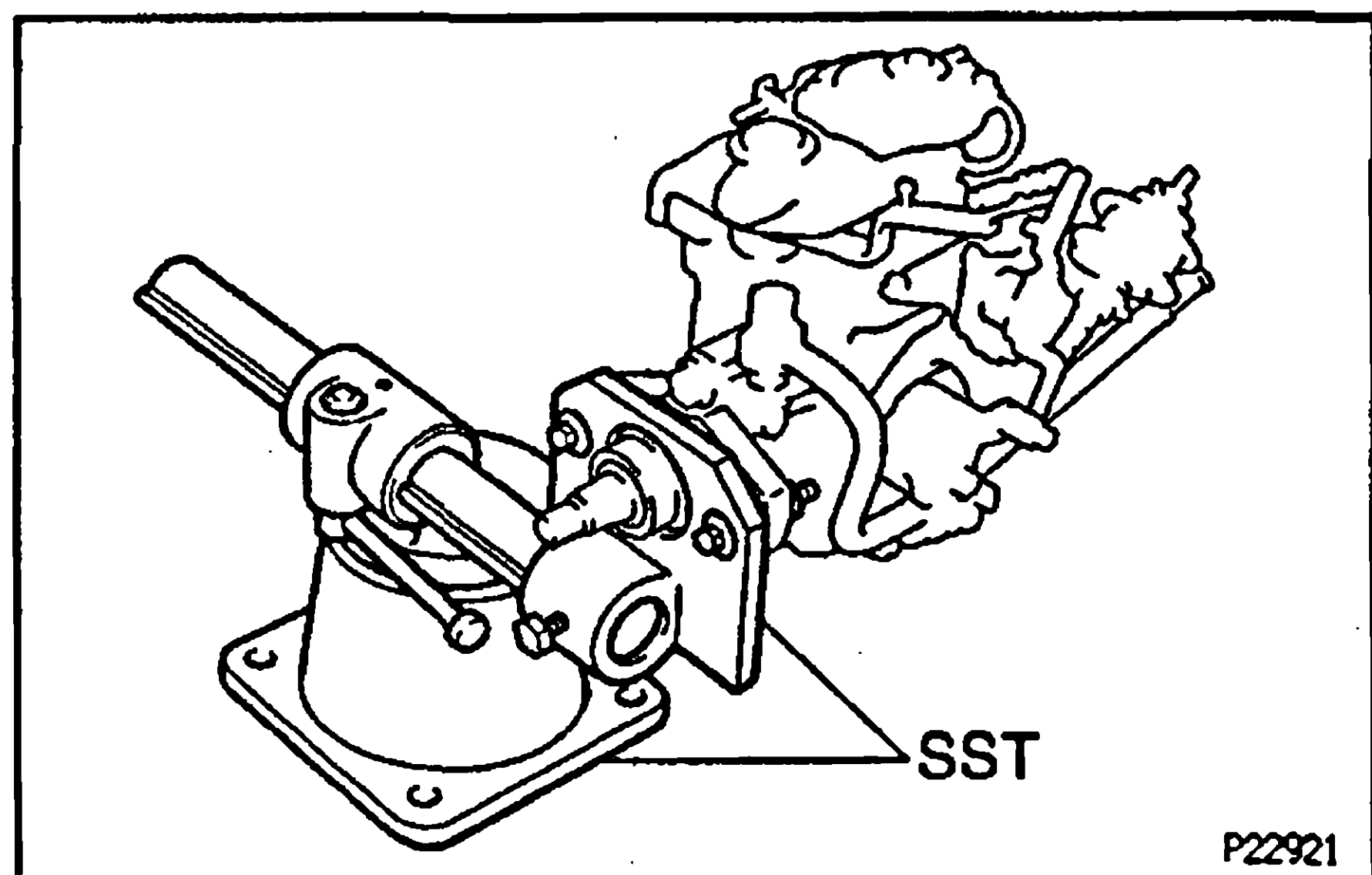
EG344-04





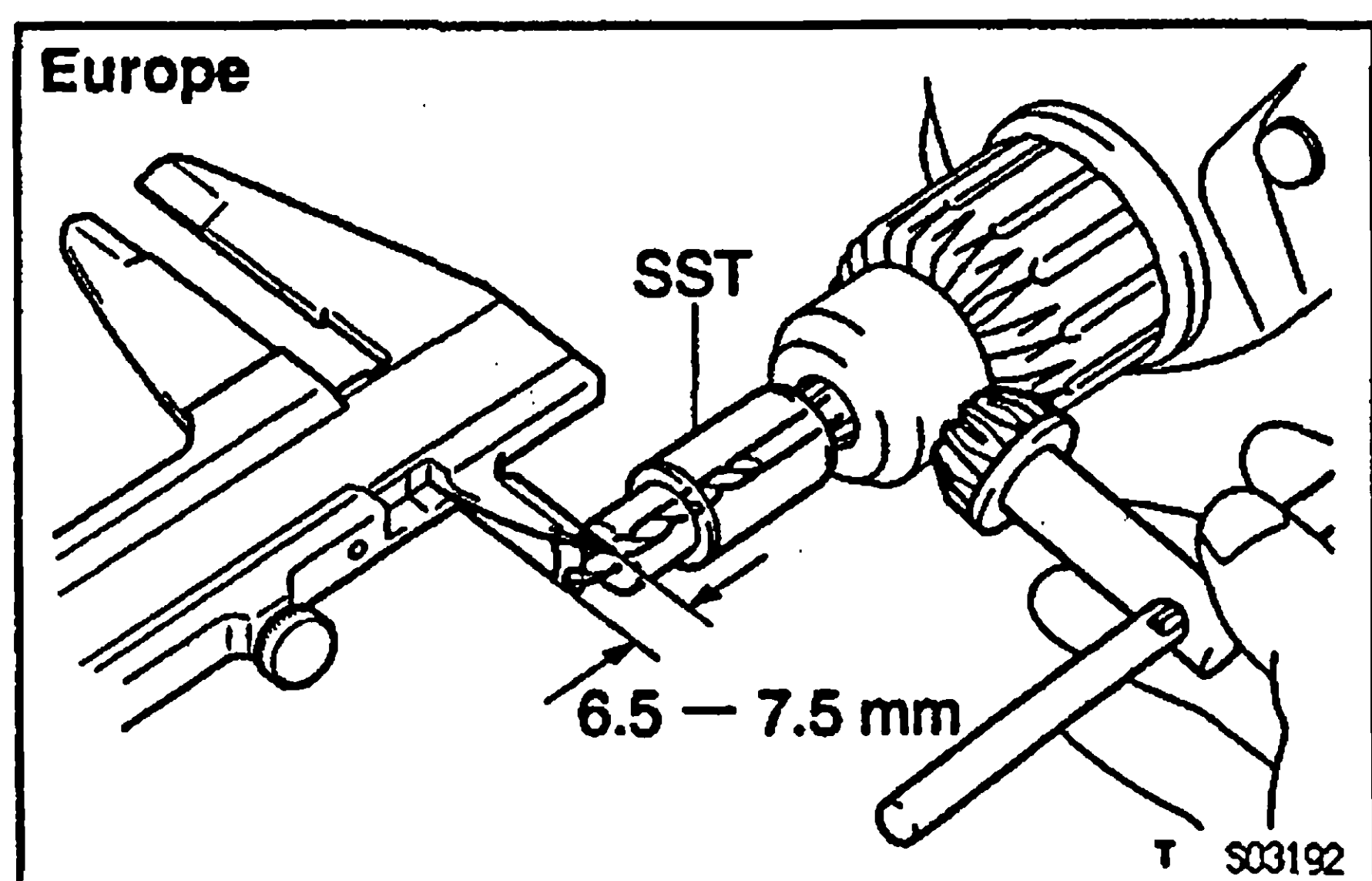
N·m (kgf·cm, ft·lbf): Specified torque

◆ Non-reusable part

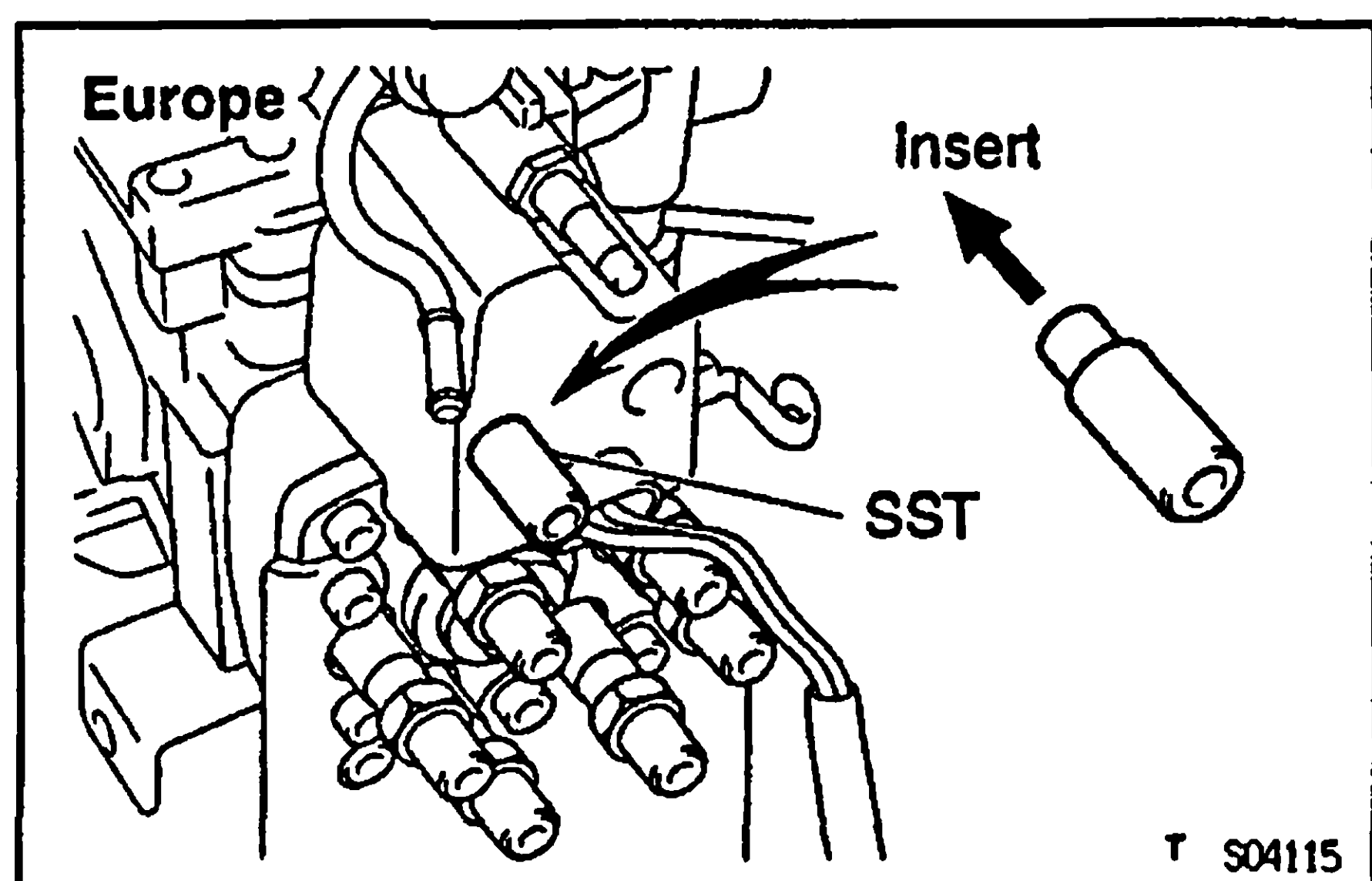


INJECTION PUMP DISASSEMBLY

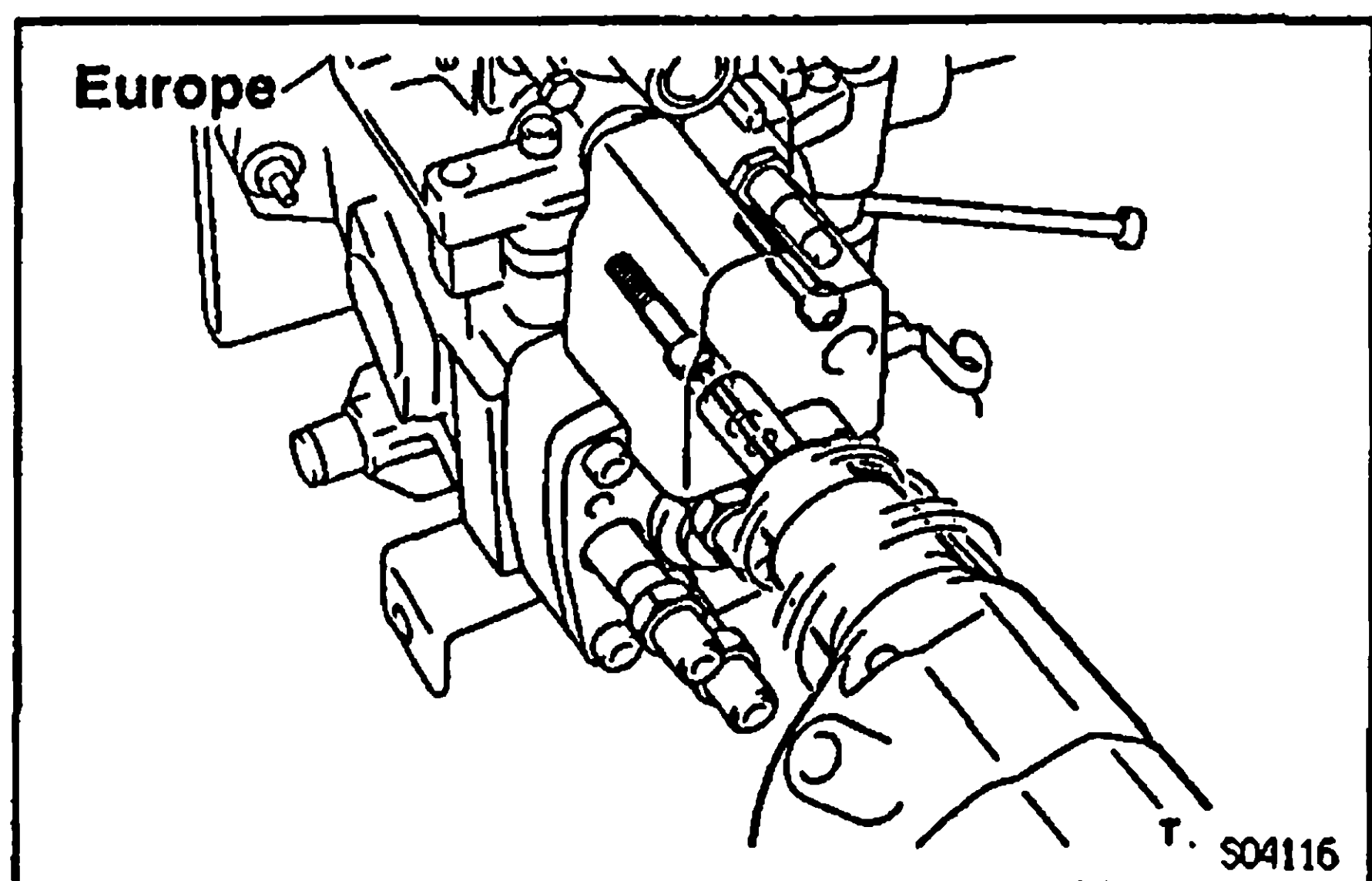
1. MOUNT PUMP ASSEMBLY TO SST (STAND)
SST 09241-76022, 09245-54010
2. REMOVE SET KEY OF DRIVE PULLEY FROM DRIVE SHAFT
3. w/ A/C:
REMOVE IDLE-UP ACTUATOR



4. Europe:
REMOVE FUEL CUT VALVE CONTROL UNIT
 - (a) Remove fuel cut valve connector and wire clamp.
 - (b) Attach a drill (diameter: 3.2 mm) and SST to a drill motor.
SST 09263-00010
 - (c) Protrude the drill tip 6.5 — 7.5 mm (0.256 — 0.295 in.) from the SST, and set it.

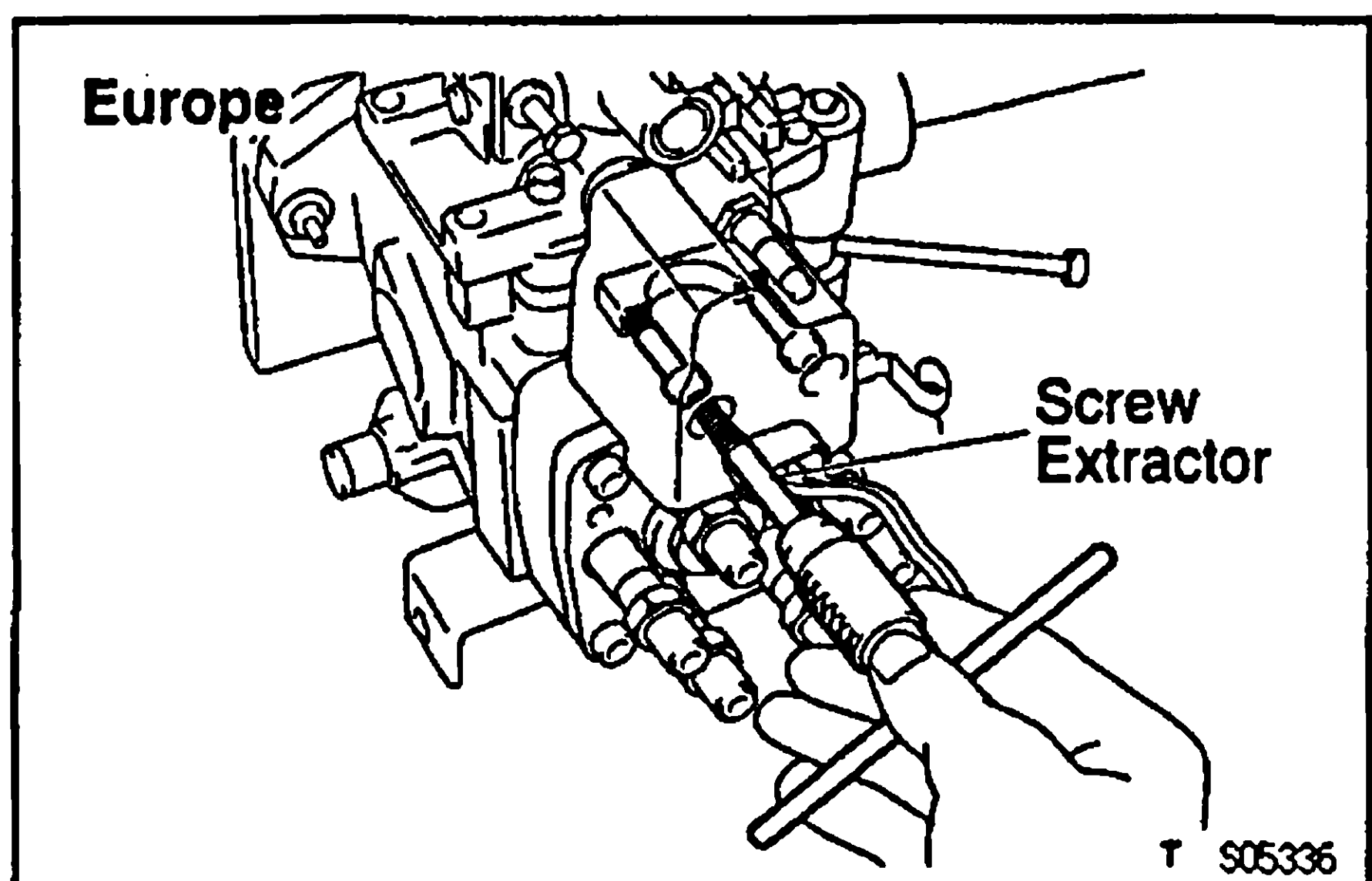


- (d) Attach the SST to the bolt hole of the fuel cut valve control unit as shown in the illustration.

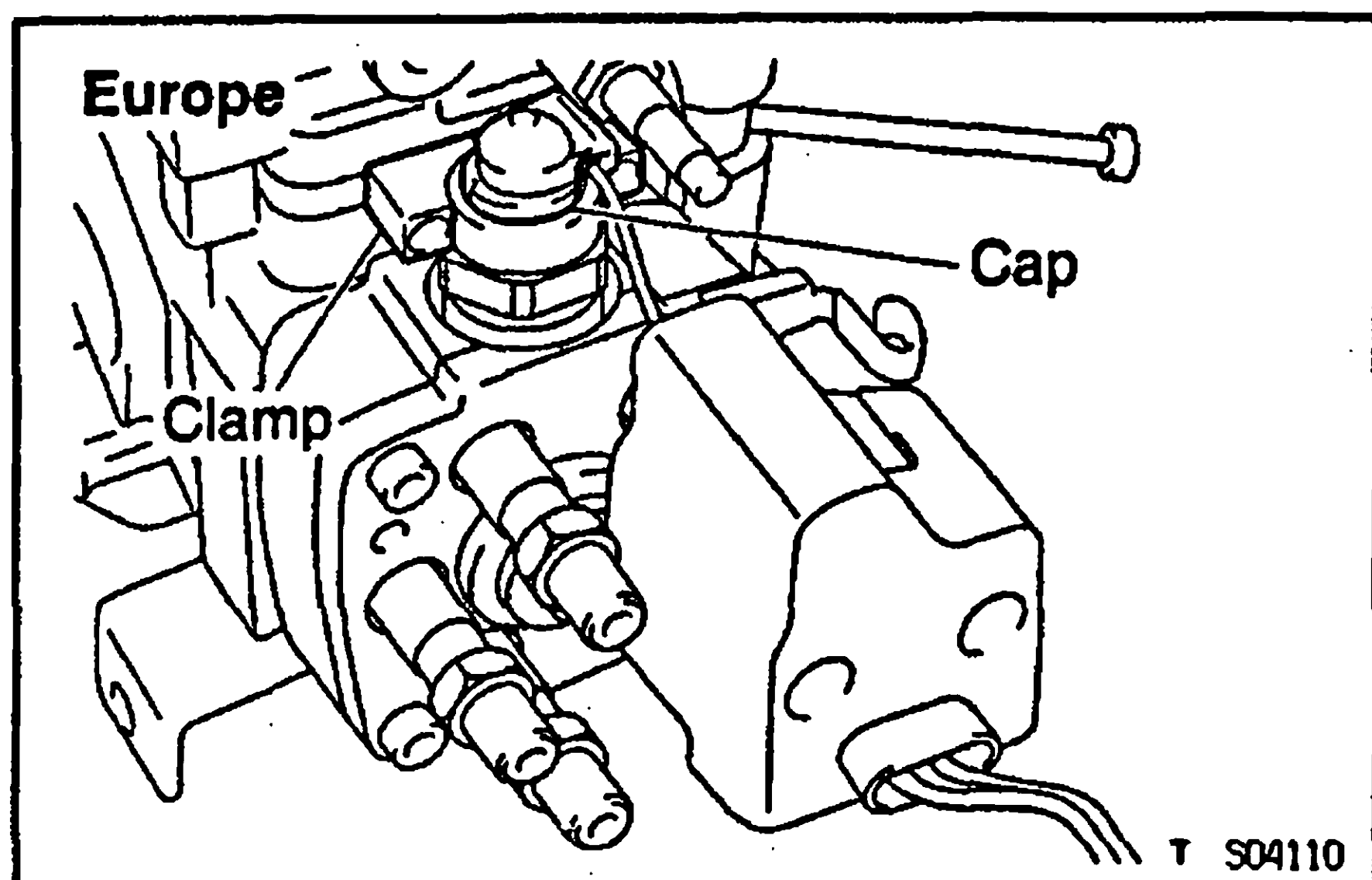


- (e) Drill the heads of the 2 bolts.
NOTICE:
 - Advance the drill bit slowly, making sure to drill a hole straight.
 - In addition to place a cap over the delivery valve holder, cover the area with a cloth to prevent the cutting chip from coming in contact with the delivery valve holder.

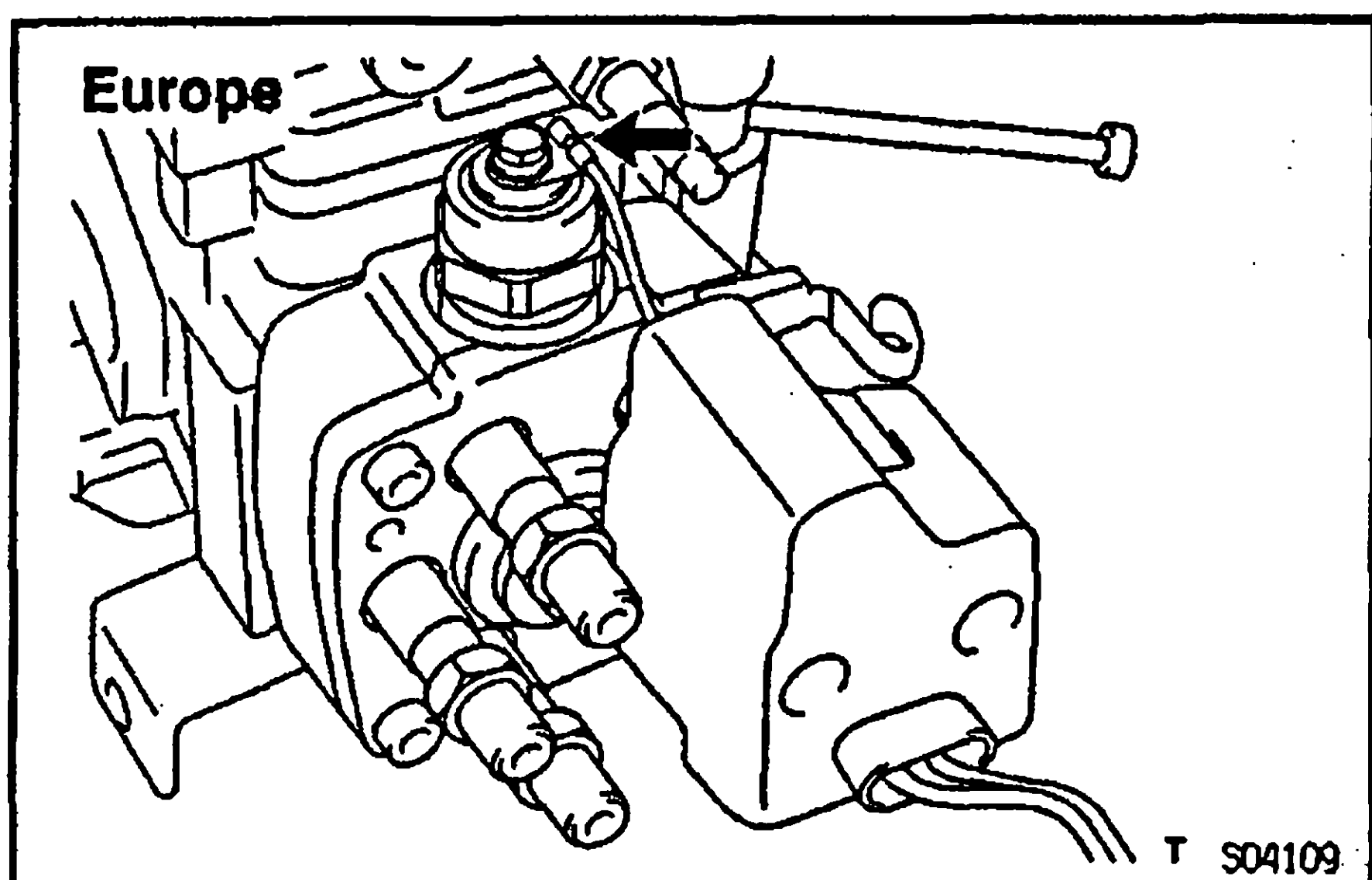
- (f) Remove the SST from the bolt hole.



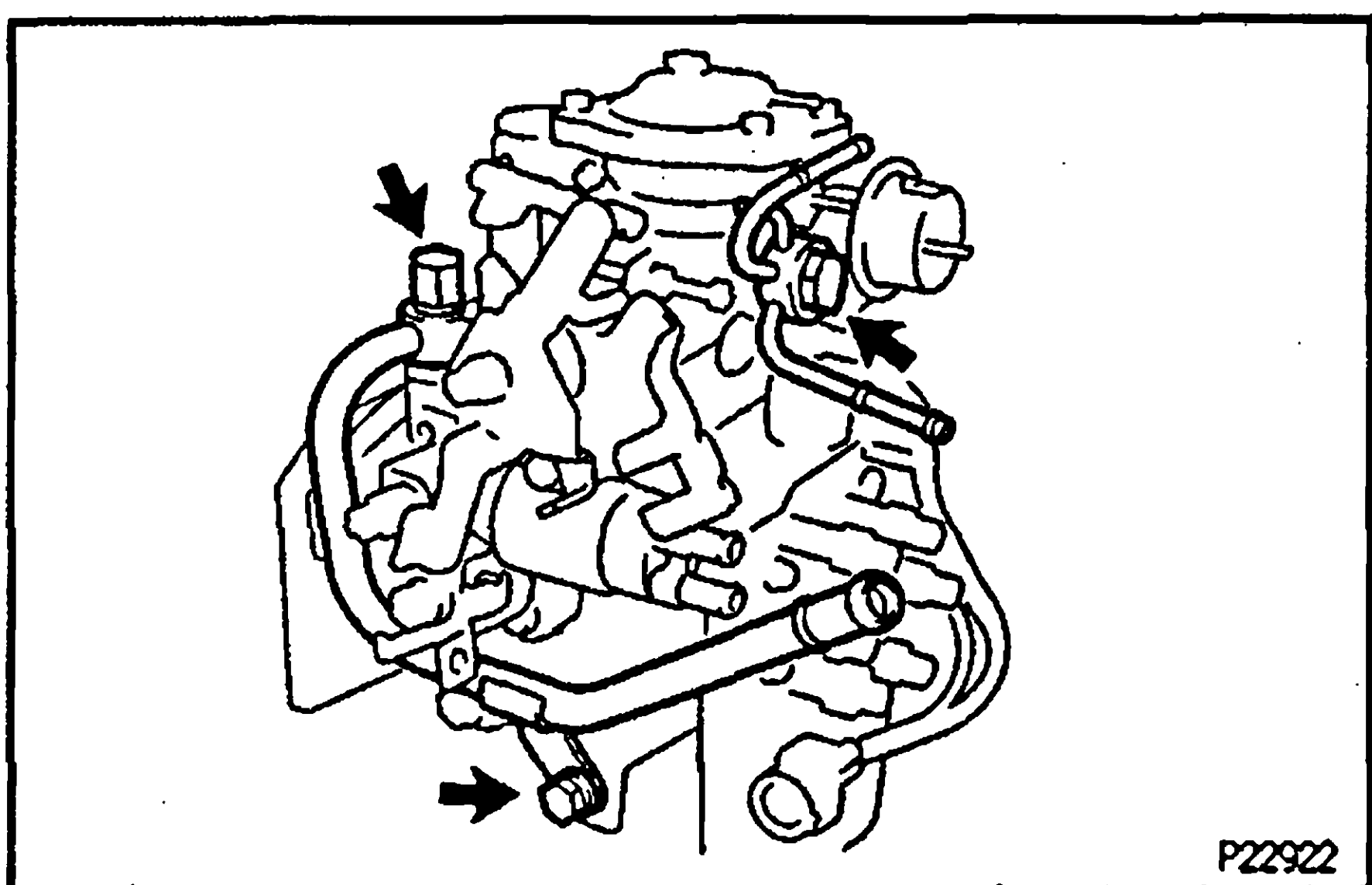
- (g) Using a screw extractor, remove the 2 bolts.
- (h) Disconnect the fuel cut valve control unit from the fuel cut solenoid.



- (i) Remove the cap and clamp.

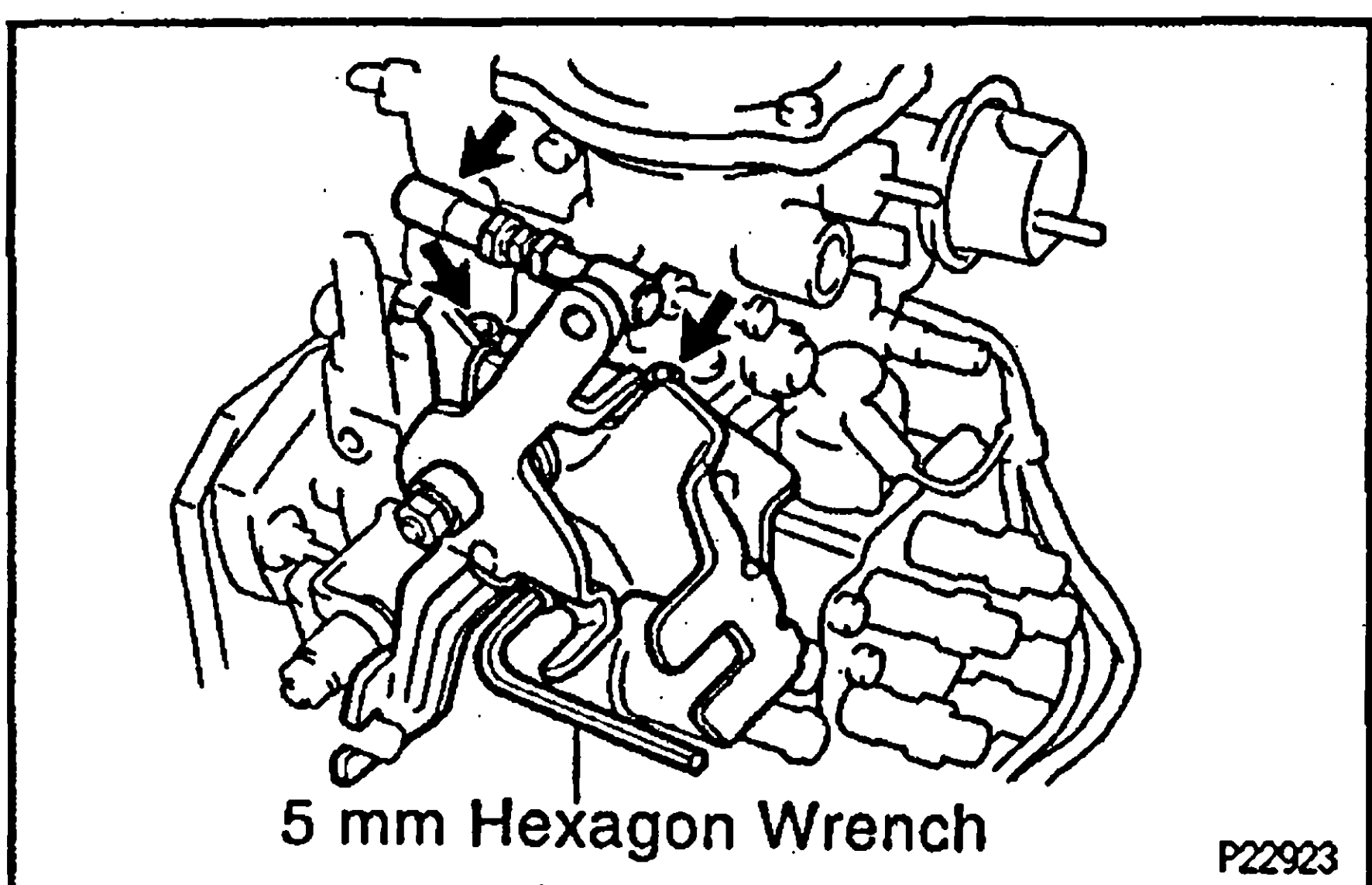


- (j) Remove the nut, and disconnect the lead wire from the fuel cut solenoid terminal. Remove the fuel cut valve control unit.
 (k) Clean the cutting tip from the bolt holes of the fuel cut valve control unit.



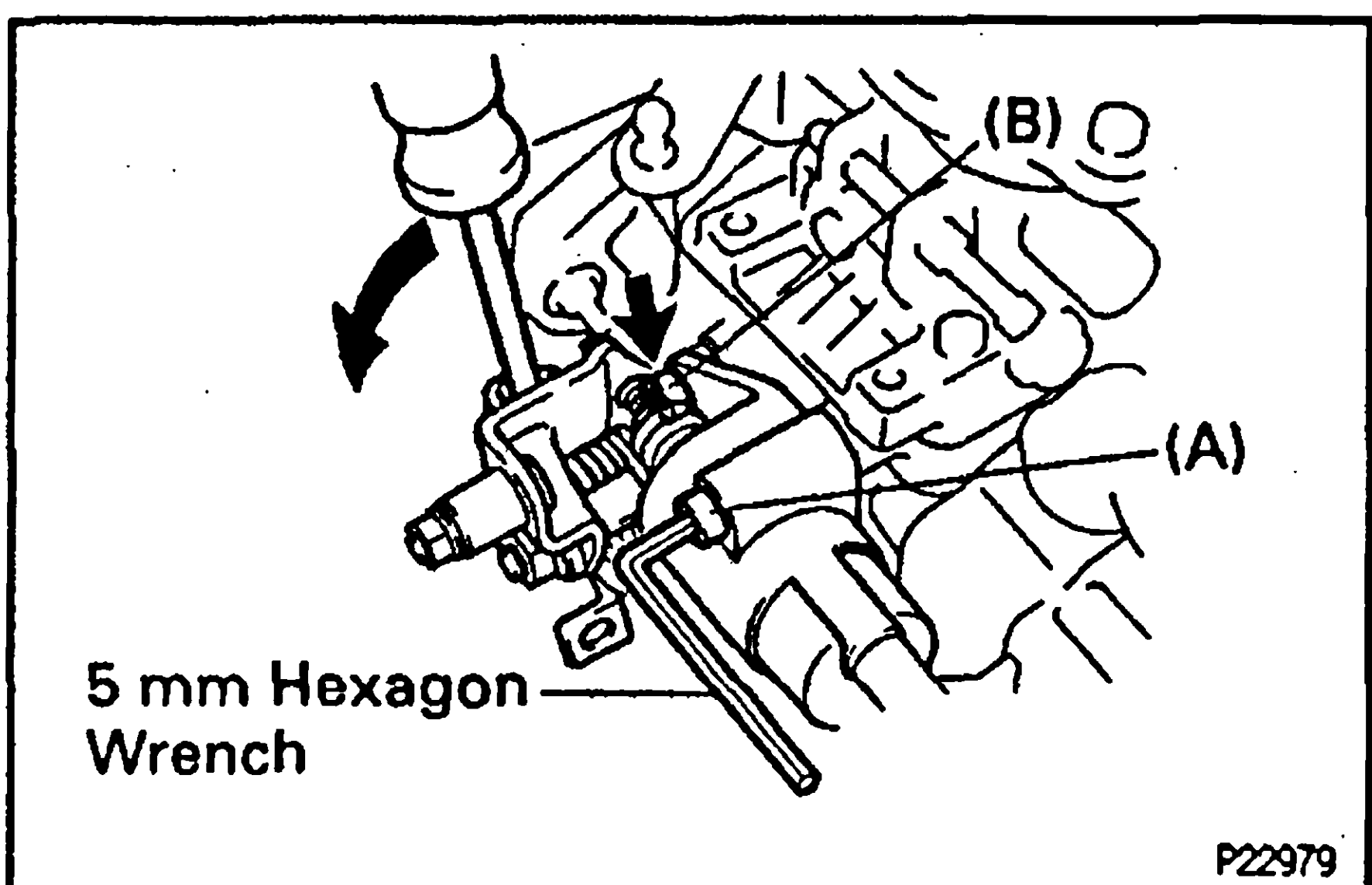
5. REMOVE FUEL PIPES

- (a) Remove the cap nut, bolts, fuel inlet pipe and 2 gaskets.
 (b) Remove the union bolt, No.2 nozzle leakage pipe and 2 gaskets.



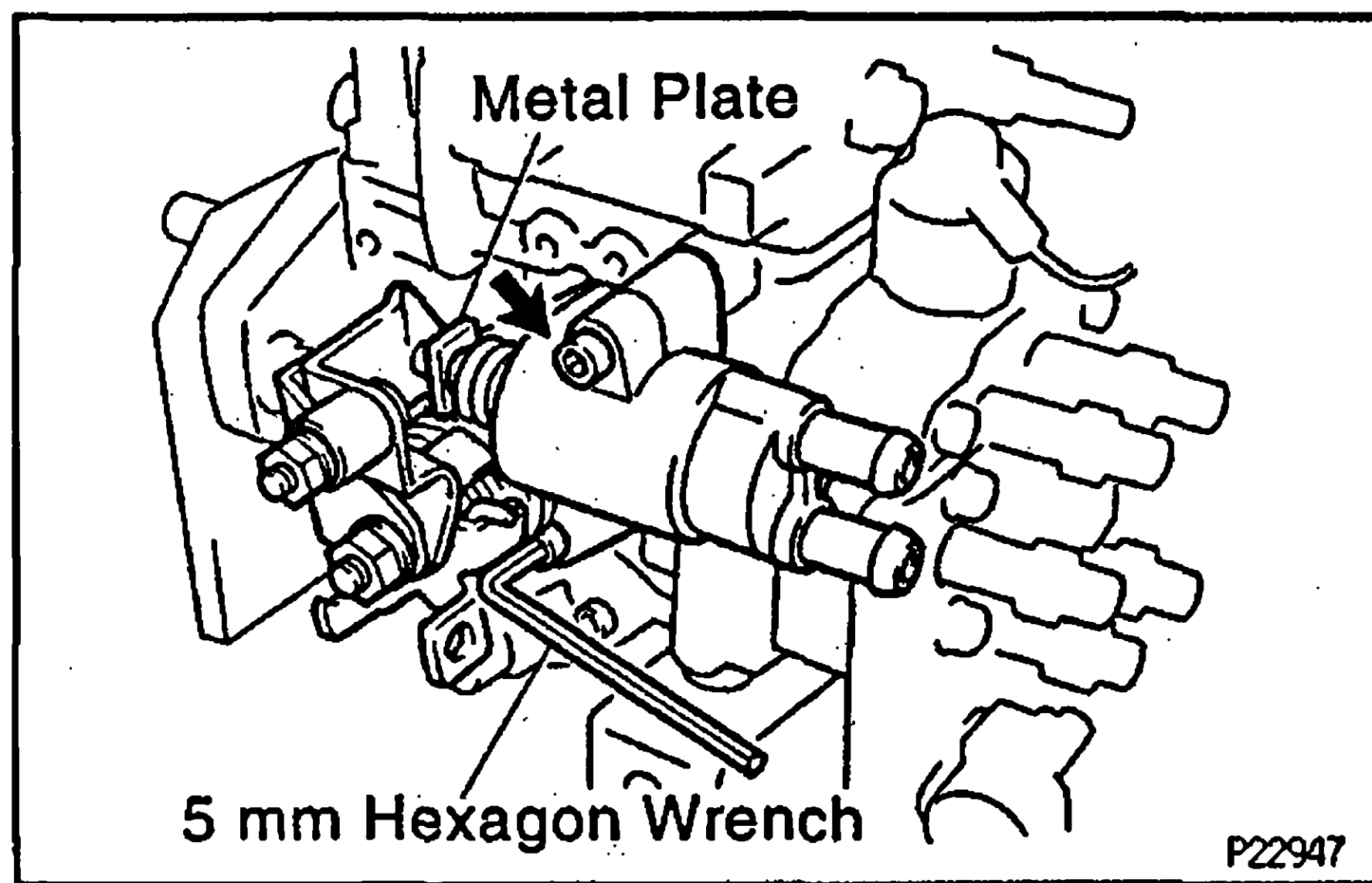
6. REMOVE IDLE—UP LEVER

- (a) Remove the idle—up lever link from the adjusting lever.
 (b) Using a 5 mm hexagon wrench, remove the 3 bolts and idle—up lever.
 (c) Europe:
 Remove Fuel cut valve connector bracket.

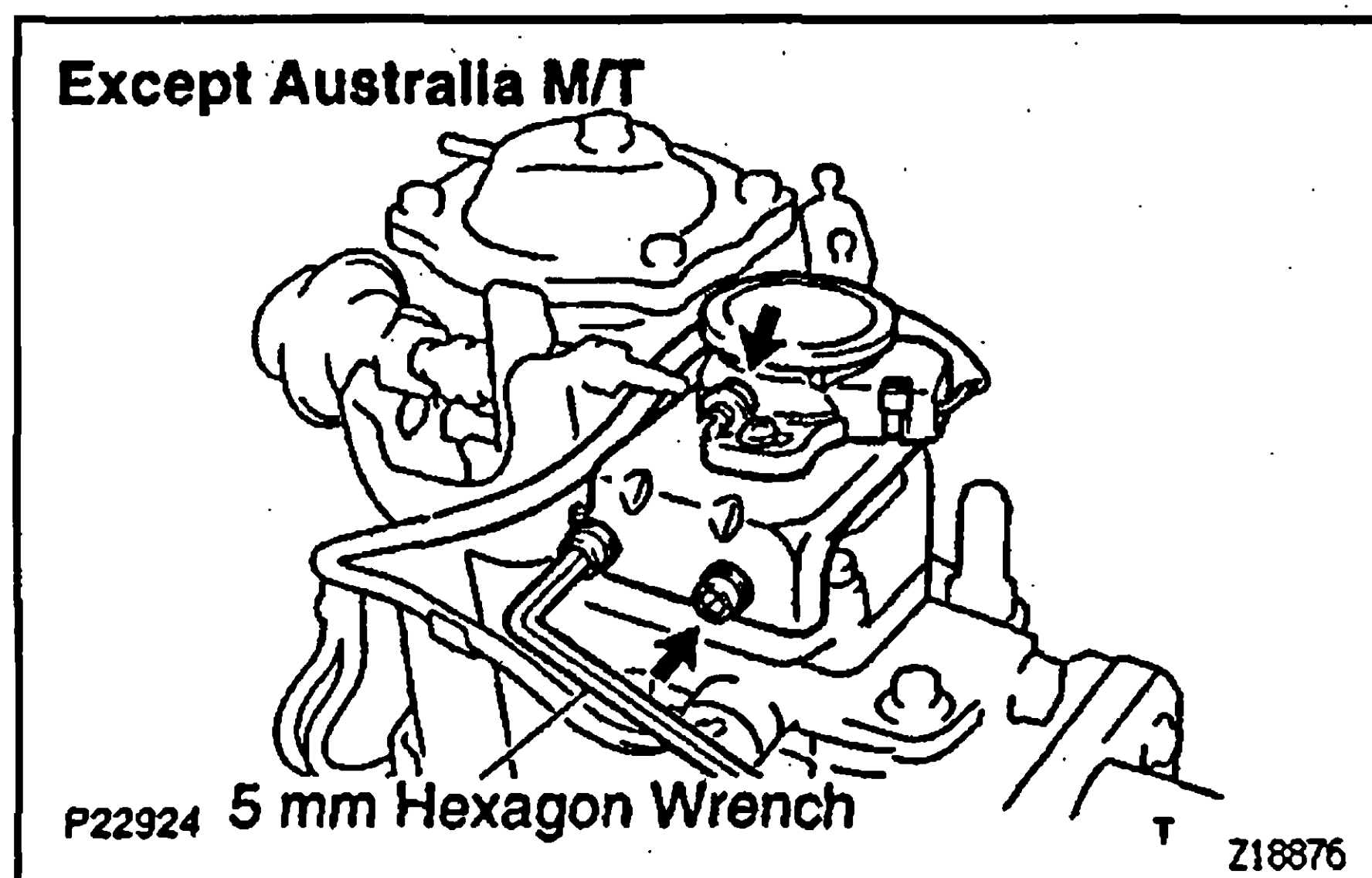


7. REMOVE THERMO WAX

- (a) Using a 5 mm hexagon wrench, temporarily install bolt (A).
 (b) Using a screwdriver, turn the cold starting lever counterclockwise.
 (c) Using a 5 mm hexagon wrench, remove bolt (B).

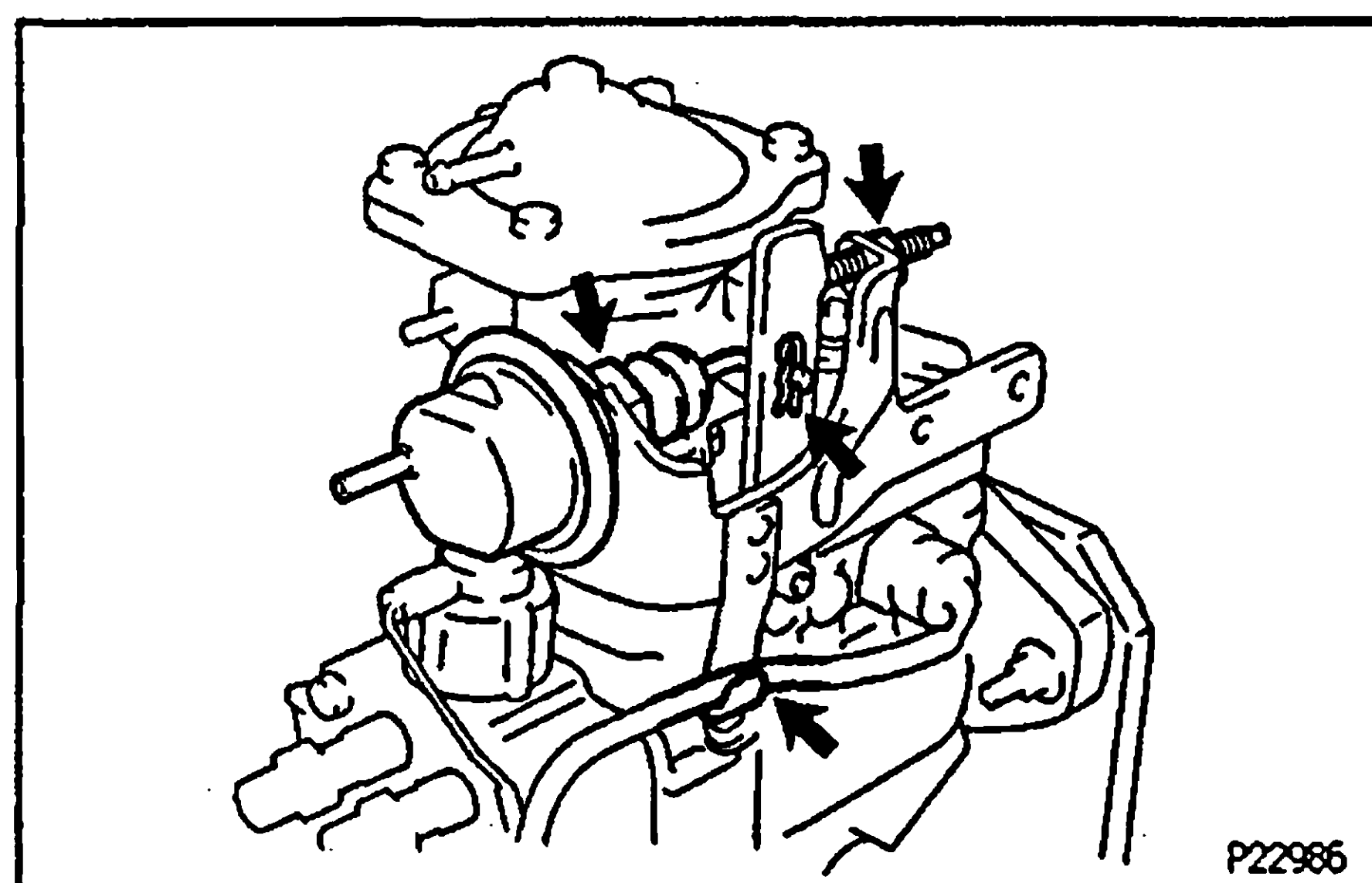


- (d) Put a metal plate (thickness of 5.0 — 8.0 mm (0.20 — 0.31 in.)) between the cold starting lever and thermo wax plunger.
- (e) Using a 5 mm hexagon wrench, remove the 2 bolts, thermo wax and O—ring.



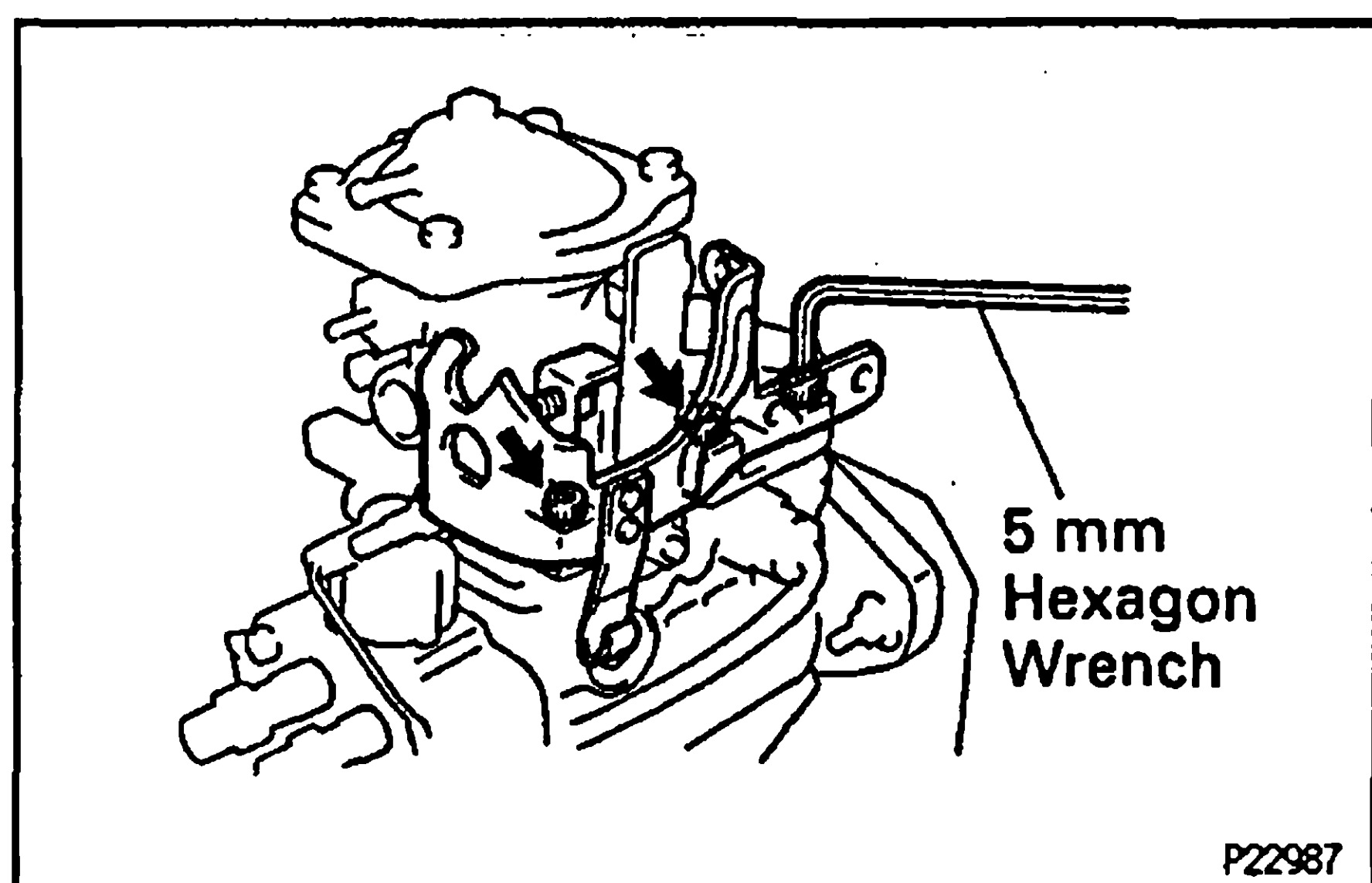
**8. Except Australia M/T:
REMOVE THROTTLE POSITION SENSOR AND
BRACKET ASSEMBLY**

Using a 5 mm hexagon wrench, remove the 3 bolts, the throttle position sensor and bracket assembly.

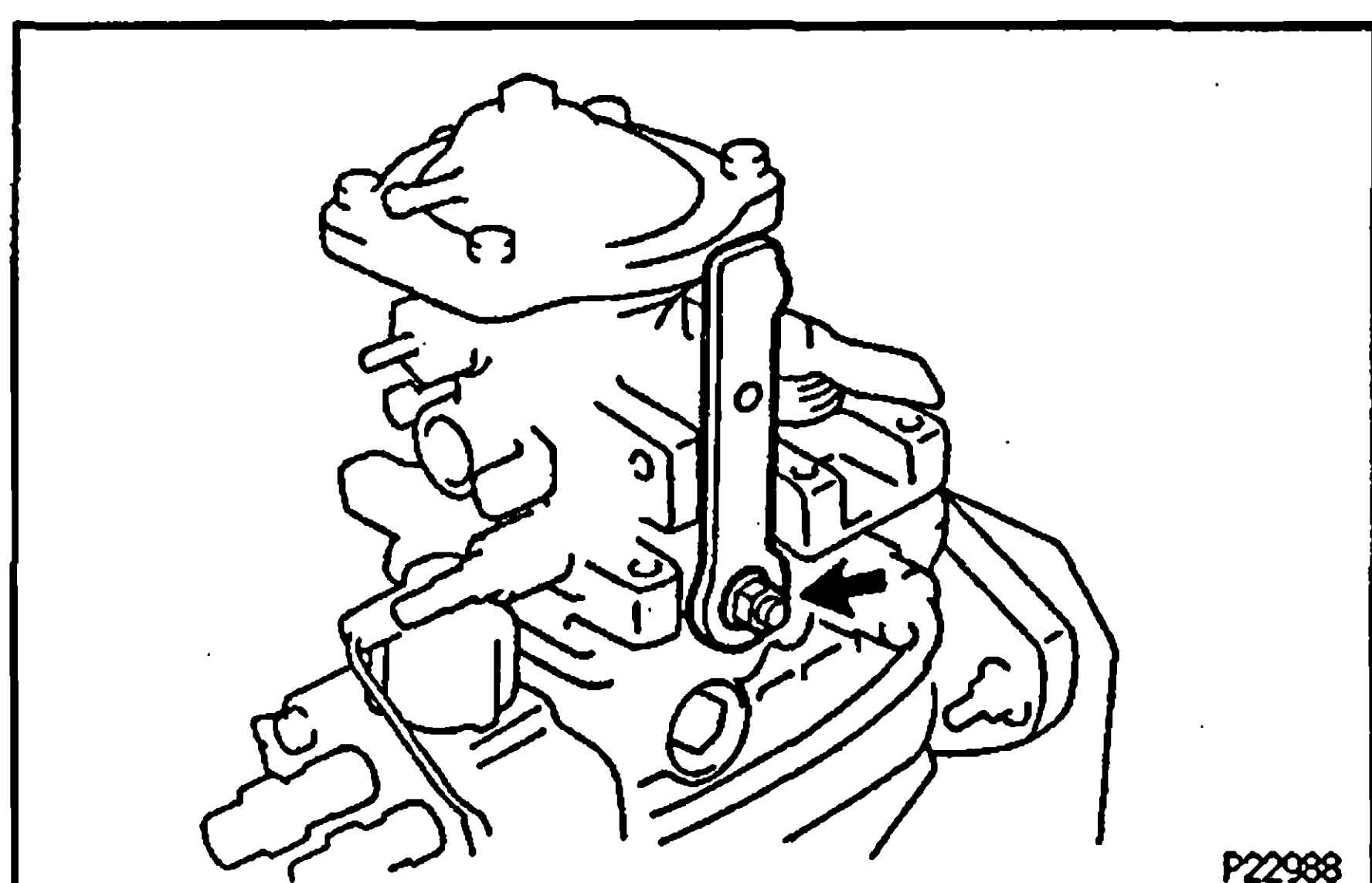


9. REMOVE SICS ACTUATOR

- (a) Remove the SICS adjusting screw.
- (b) Remove the clip.
- (c) Disconnect the wire harness.
- (d) Remove the nuts and SICS actuator.

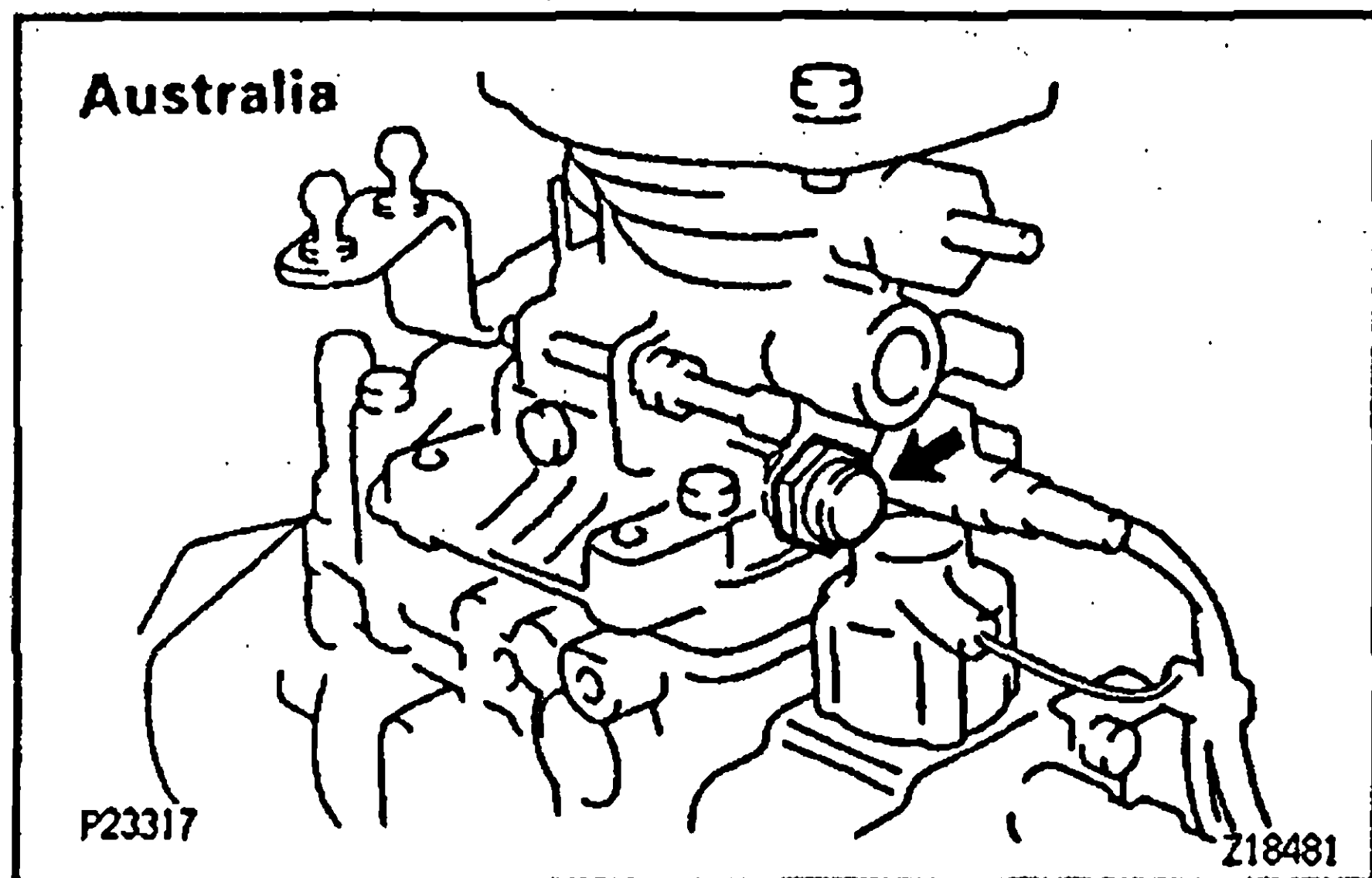


- (e) Remove the lock plate.
- (f) Remove the maximum speed adjusting screw.
- (g) Using a 5 mm hexagon wrench, remove the 3 bolts and SICS actuator bracket.



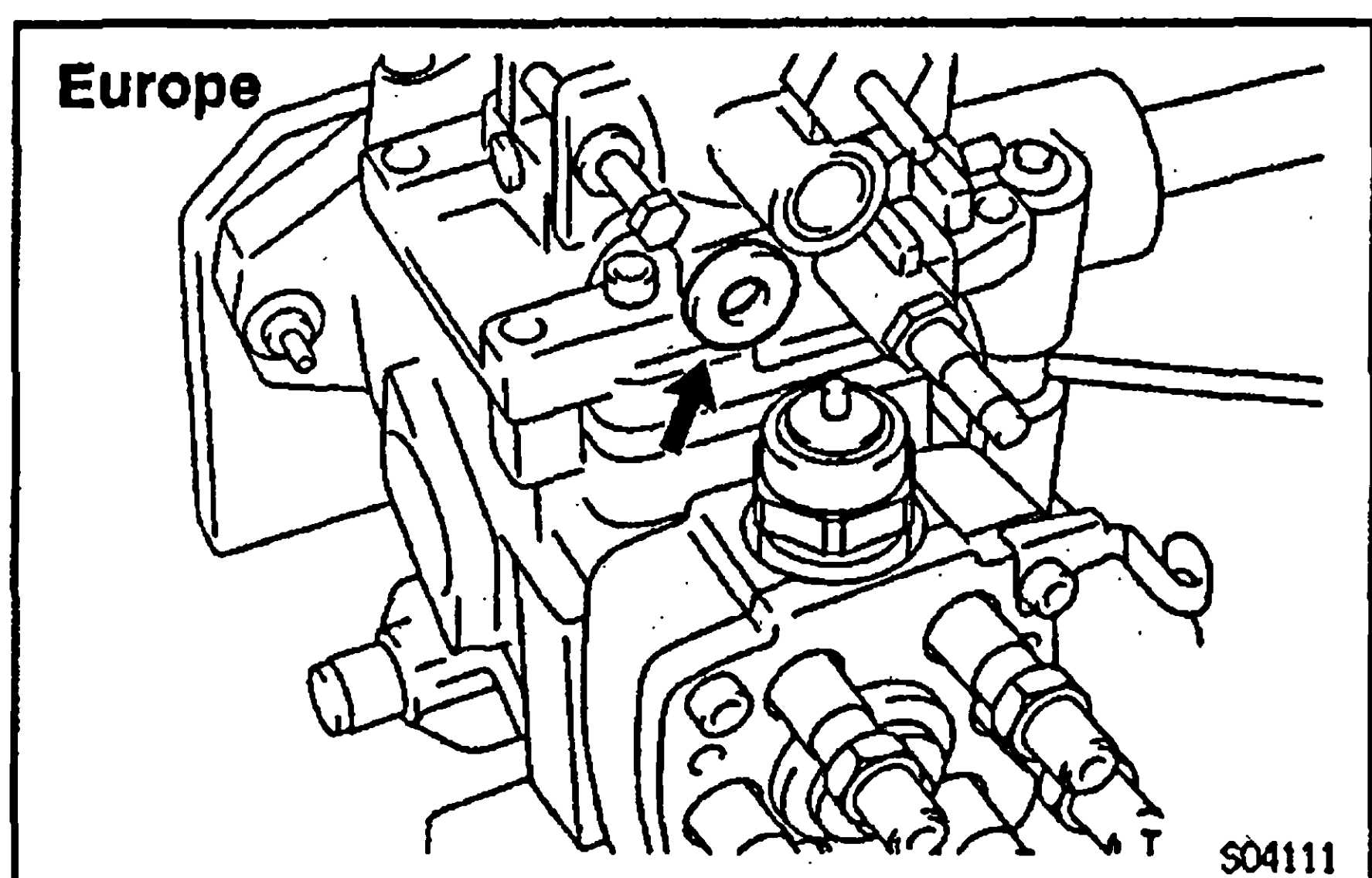
10. REMOVE NO.1 SICS LEVER

Remove the nut and No.1 SICS lever.

**11. REMOVE CAP**

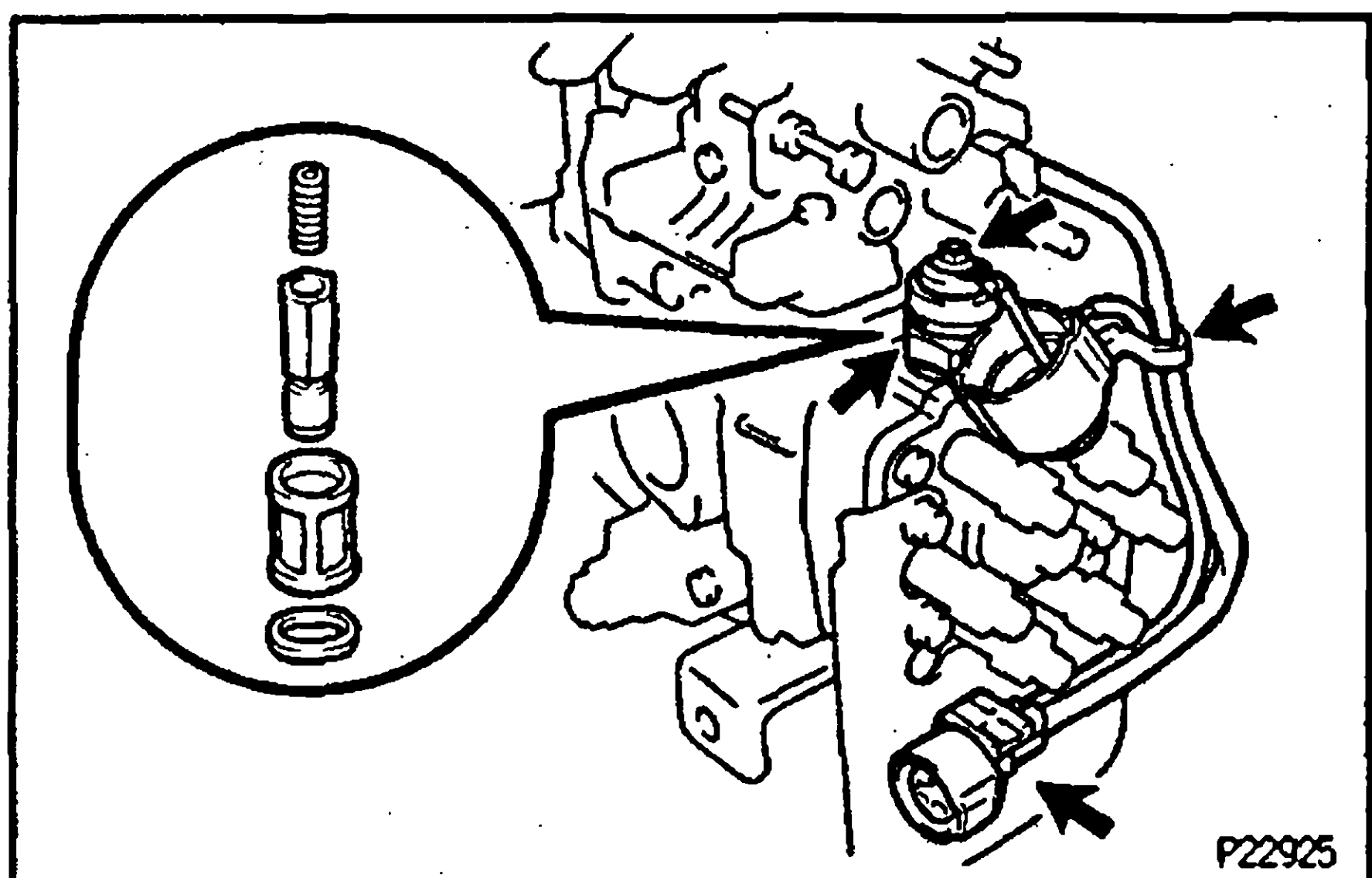
Australia:

Remove the cap and gasket.

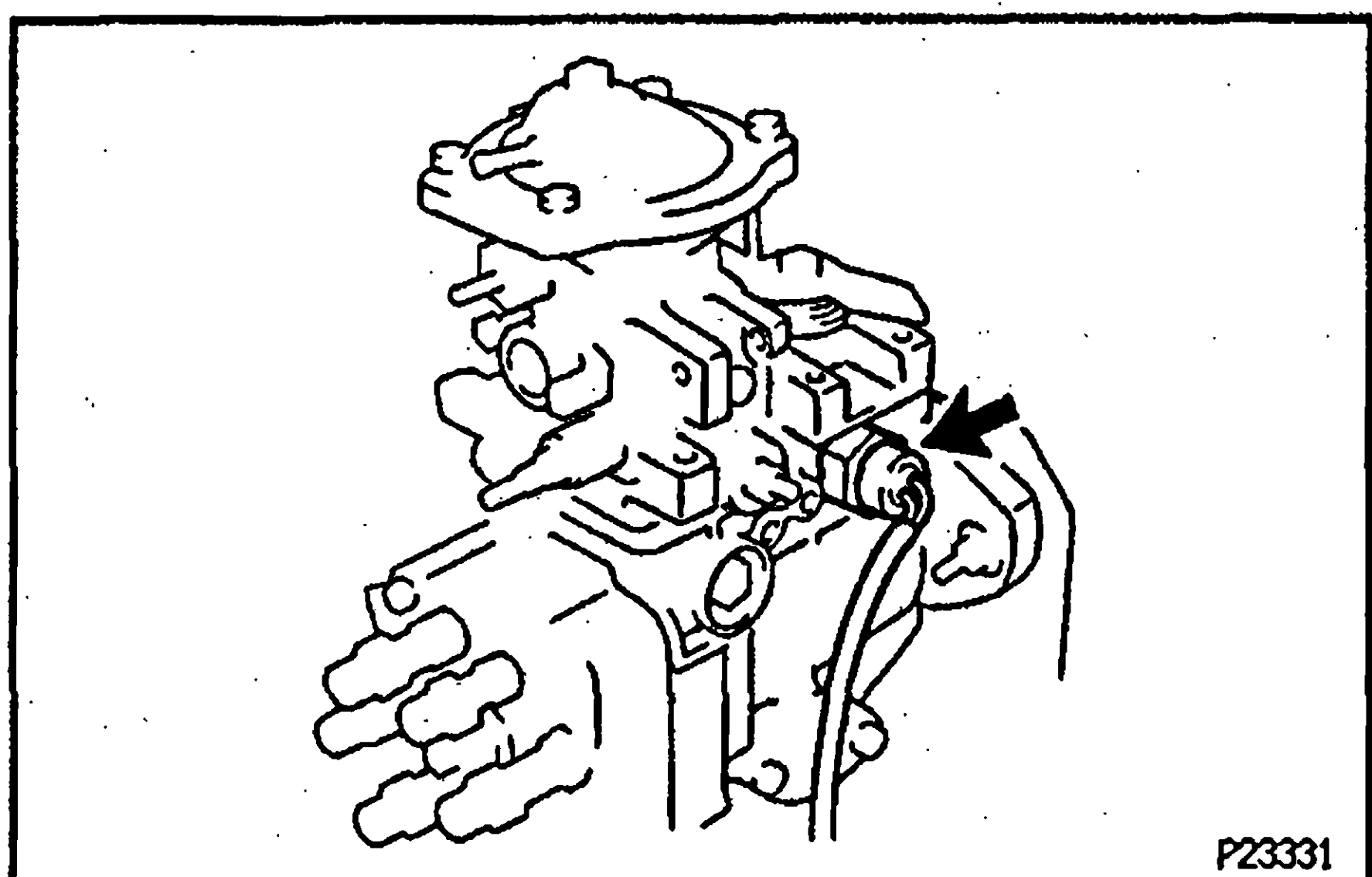


Europe:

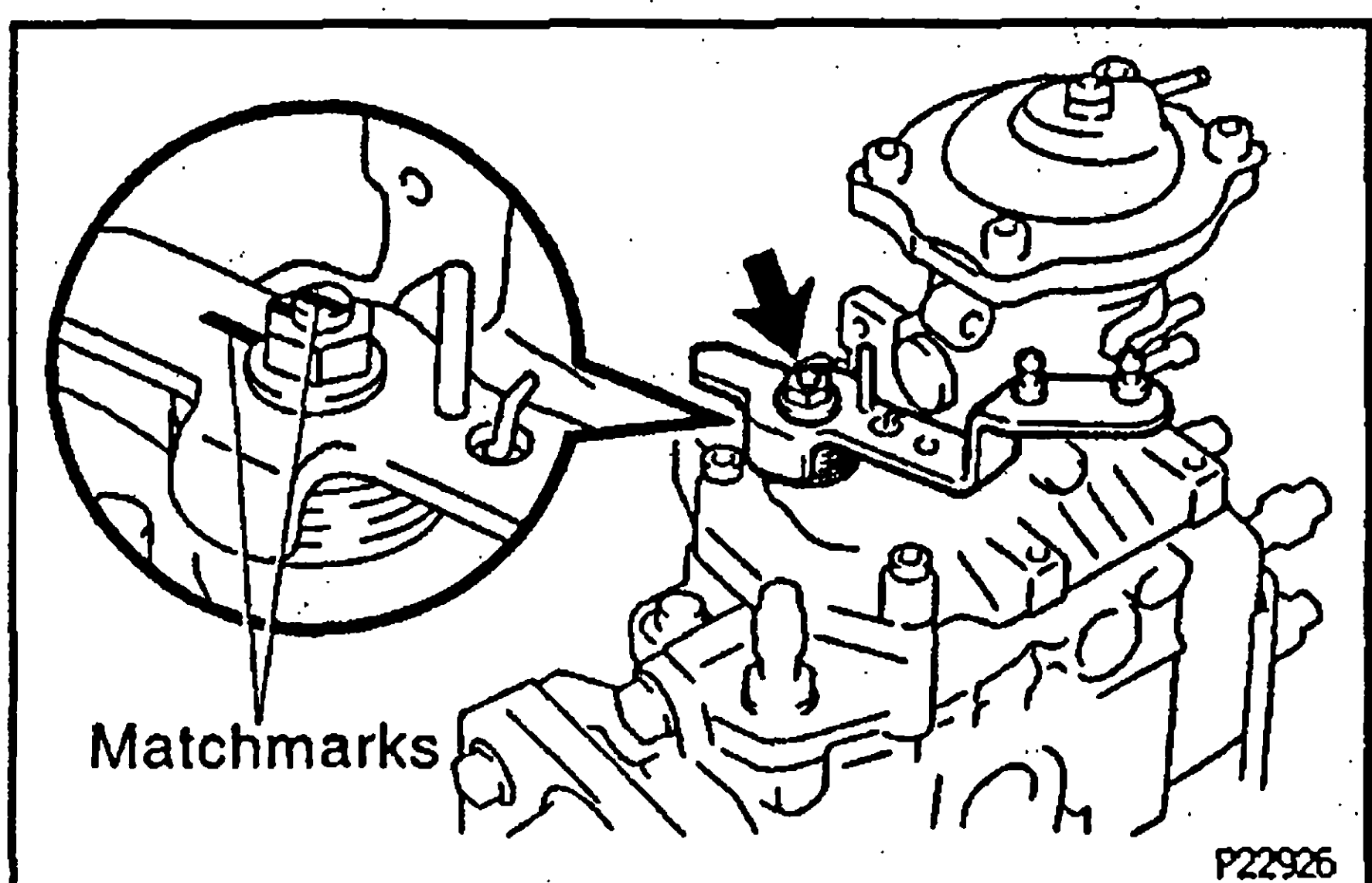
Remove the cap and gasket.

**12. REMOVE FUEL CUT SOLENOID**

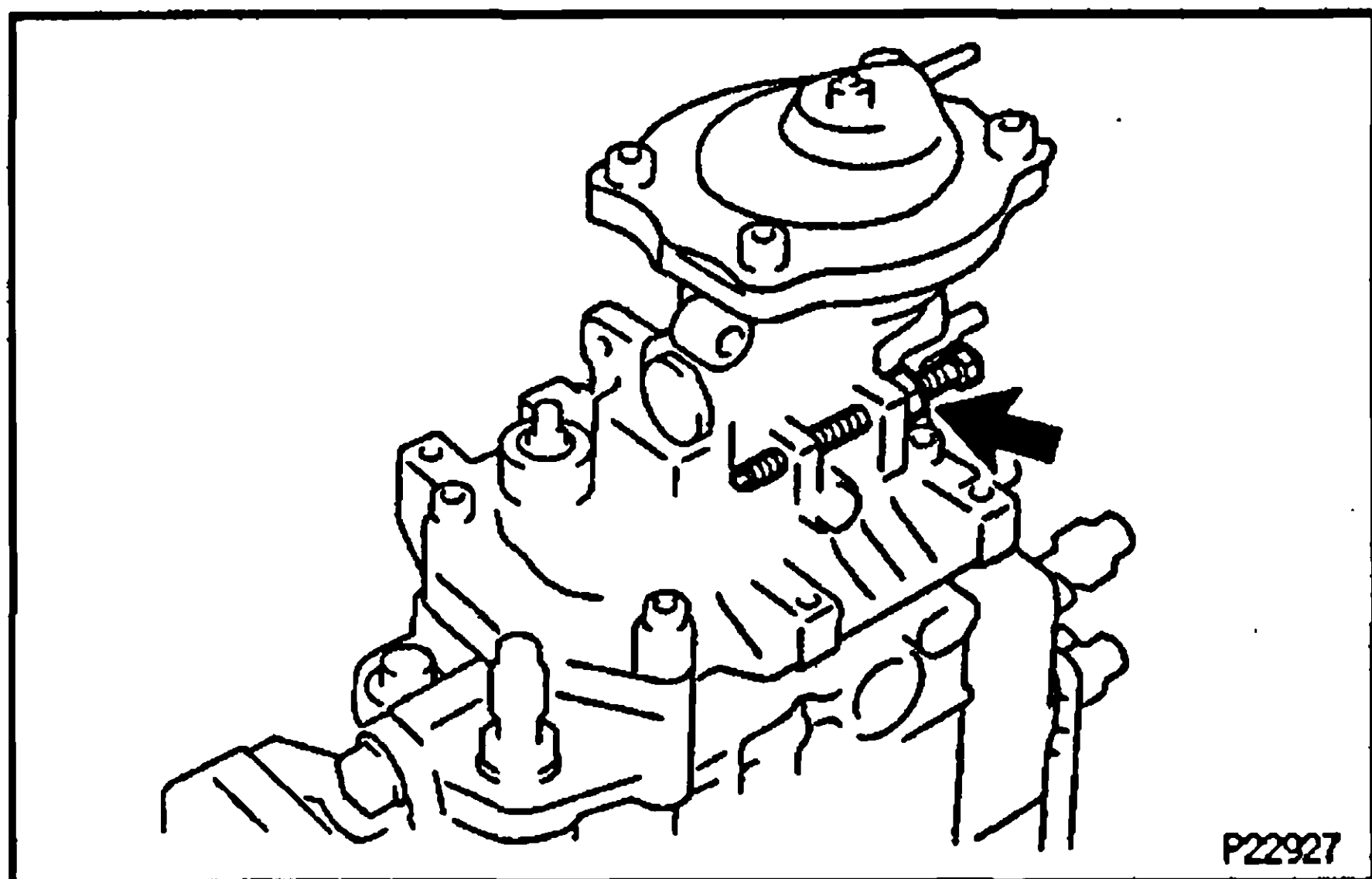
- (a) Except Europe:
Disconnect the lead wire connector from the bracket.
- (b) Except Europe:
Disconnect the wire harness from the wire clamp.
- (c) Except Europe:
Disconnect the dust cover from the fuel cut solenoid.
- (d) Except Europe:
Remove the nut, lead wire and dust cover.
- (e) Remove the fuel cut solenoid, O—ring, spring, valve, strainer and wave washer.

**13. REMOVE PICKUP SENSOR**

- (a) Remove the pickup sensor and O—ring.
- (b) Disconnect the sensor lead wires from the connector.

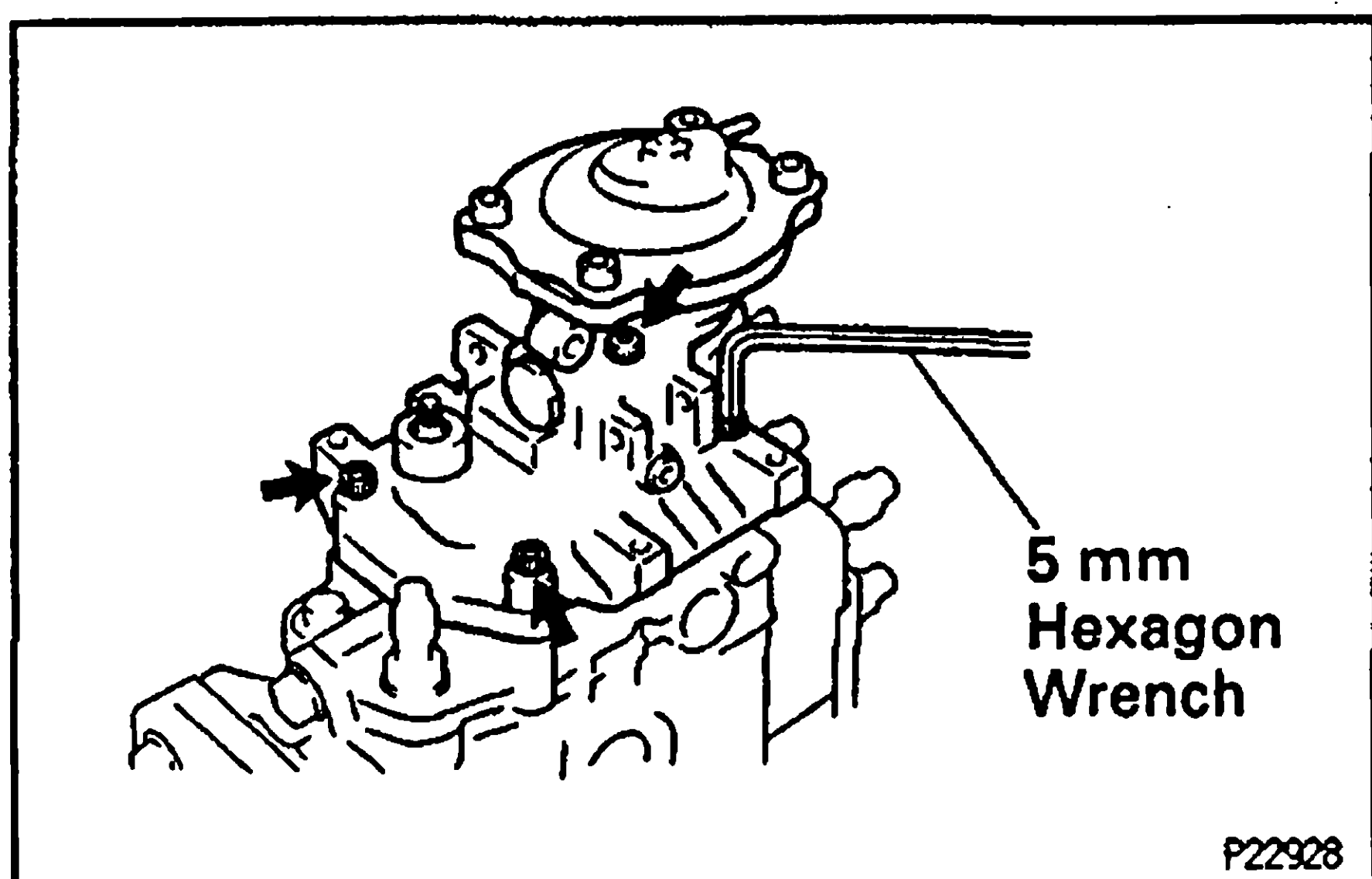
**14. REMOVE ADJUSTING LEVER**

- (a) Place the matchmarks on adjusting lever and shaft.
- (b) Remove the nut, adjusting lever and return spring.



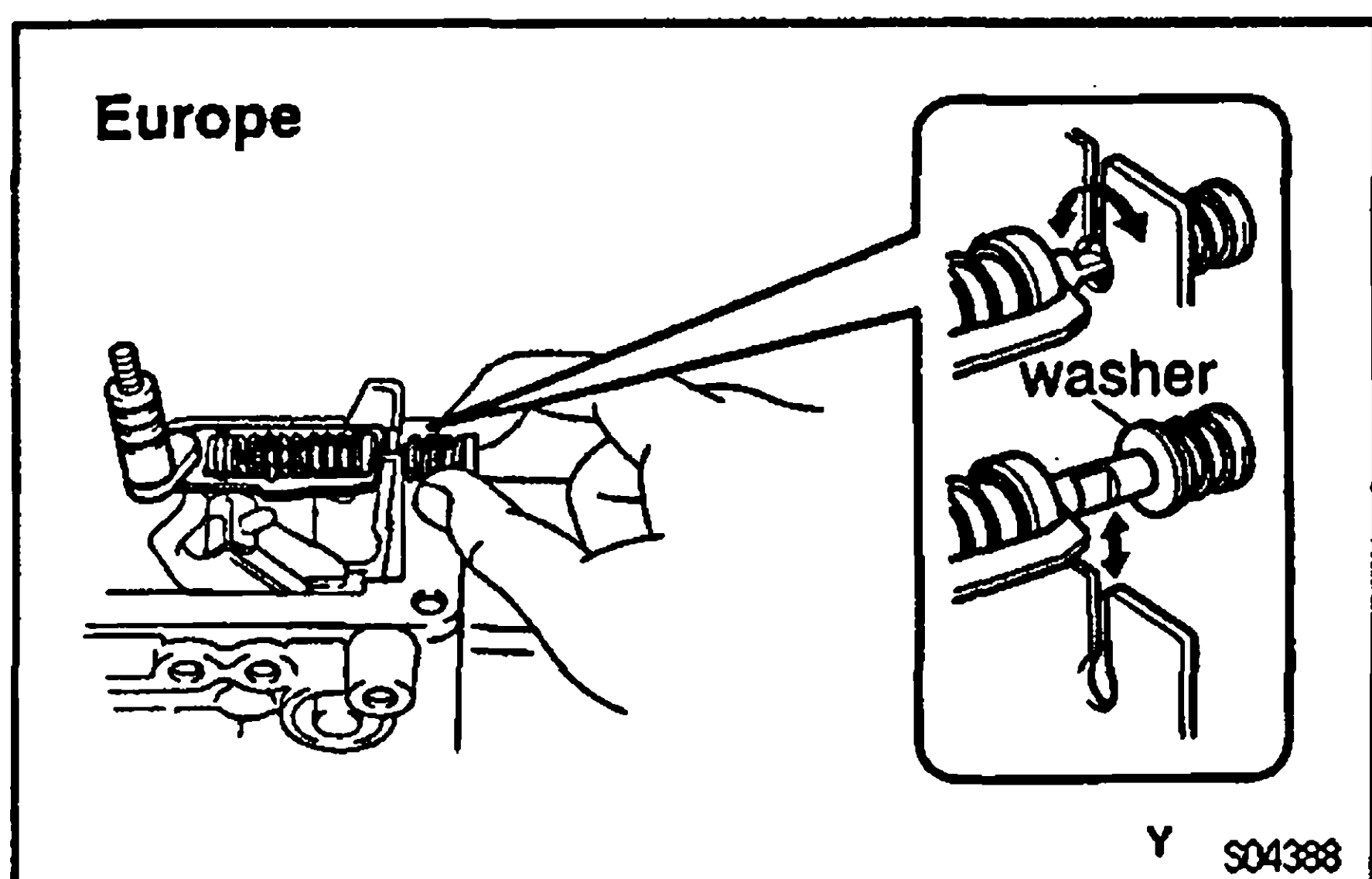
15. REMOVE GOVERNOR COVER

(a) Remove the lock nut and idle speed adjusting screw.



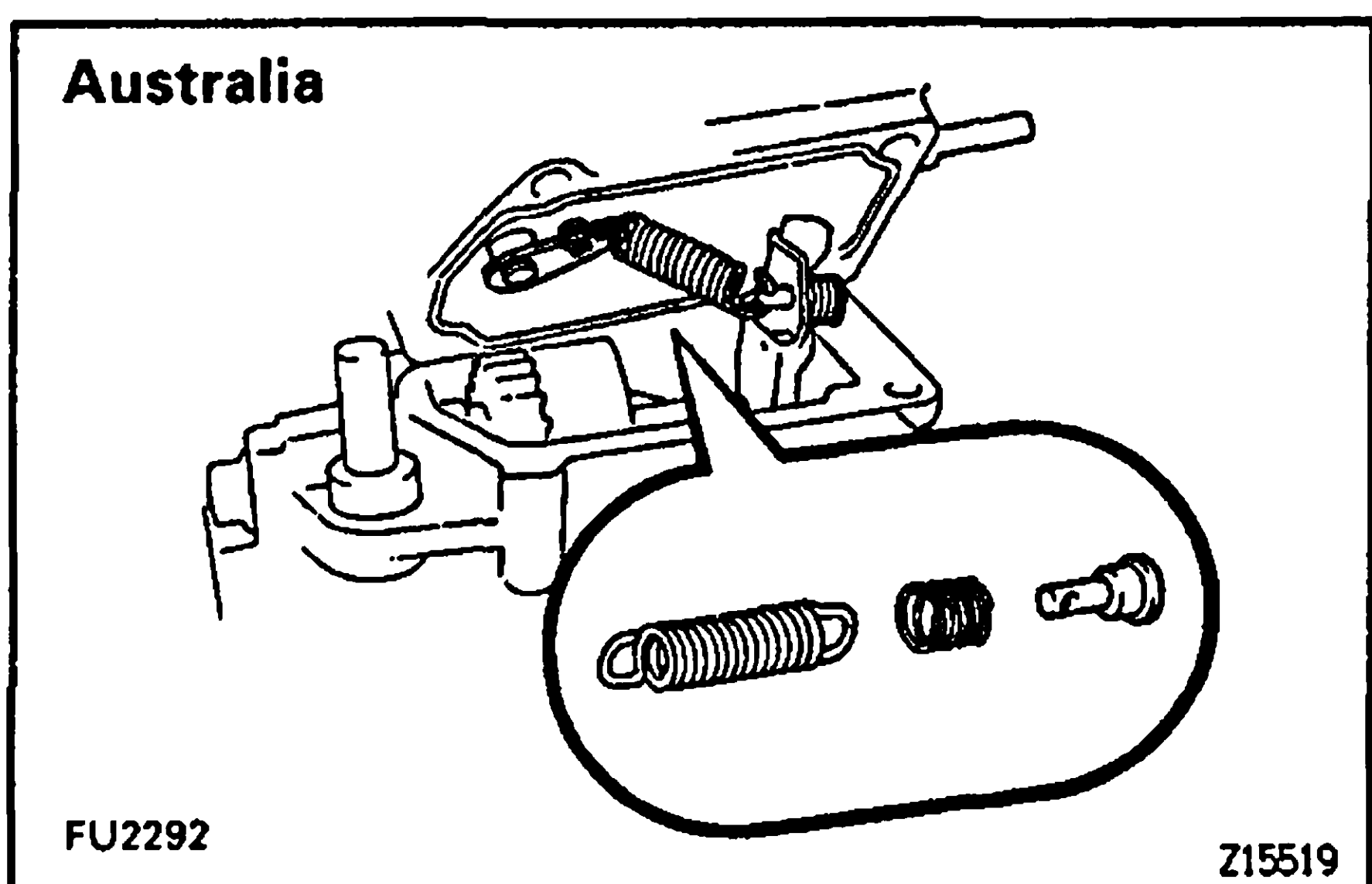
(b) Using a 5 mm hexagon wrench, remove the 4 bolts.

(c) Remove the adjusting lever shaft assembly from the governor cover.



(d) Europe:

Disconnect the adjusting lever shaft assembly from the governor link, and remove the governor cover and gasket.

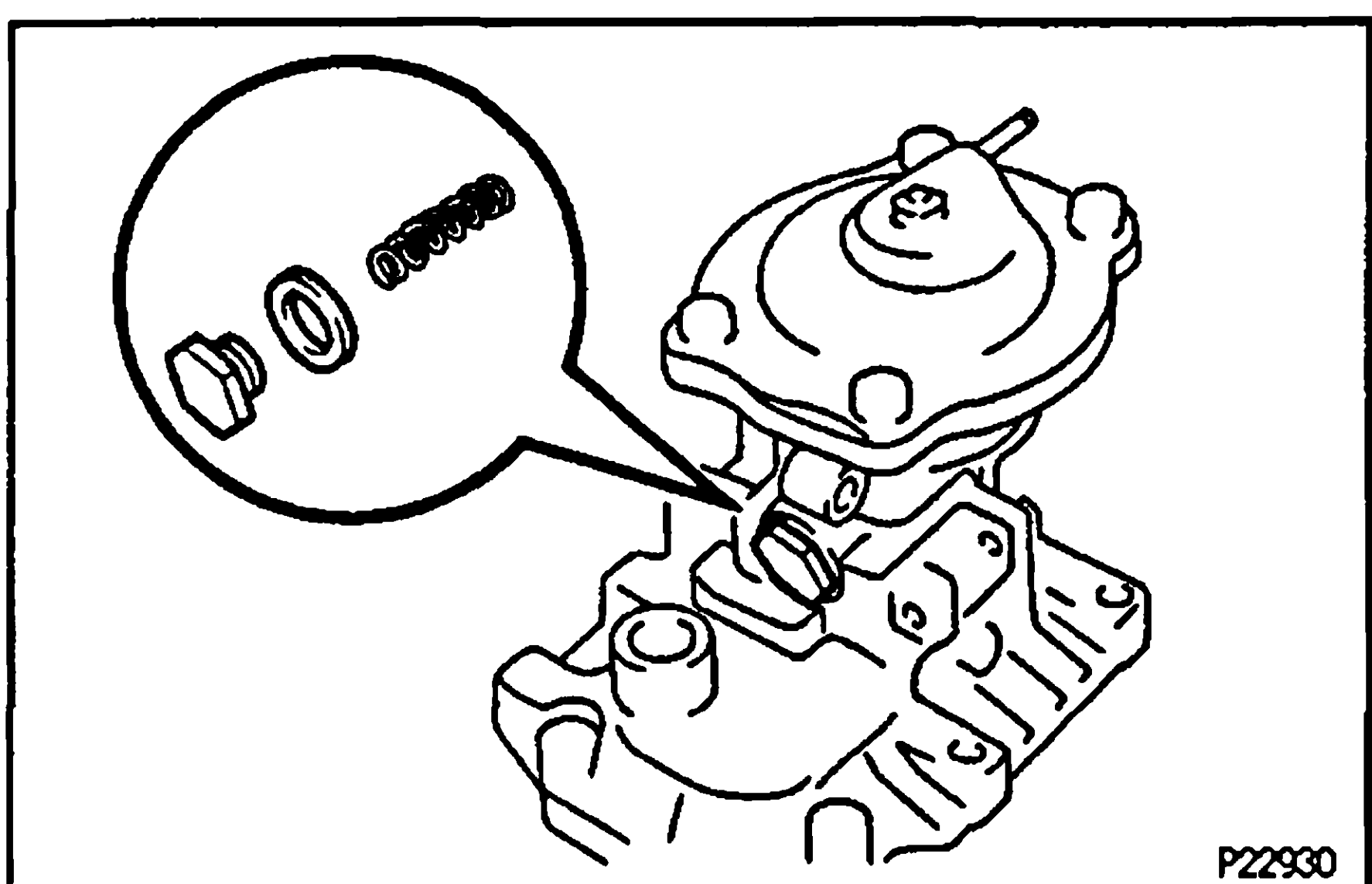


(e) Australia:

Disconnect the speed control spring from the spring seat, and remove the spring seat, damper spring, speed control spring, the governor cover, adjusting lever shaft assembly and gasket.

16. DISASSEMBLY THESE PARTS FROM ADJUSTING LEVER SHAFT

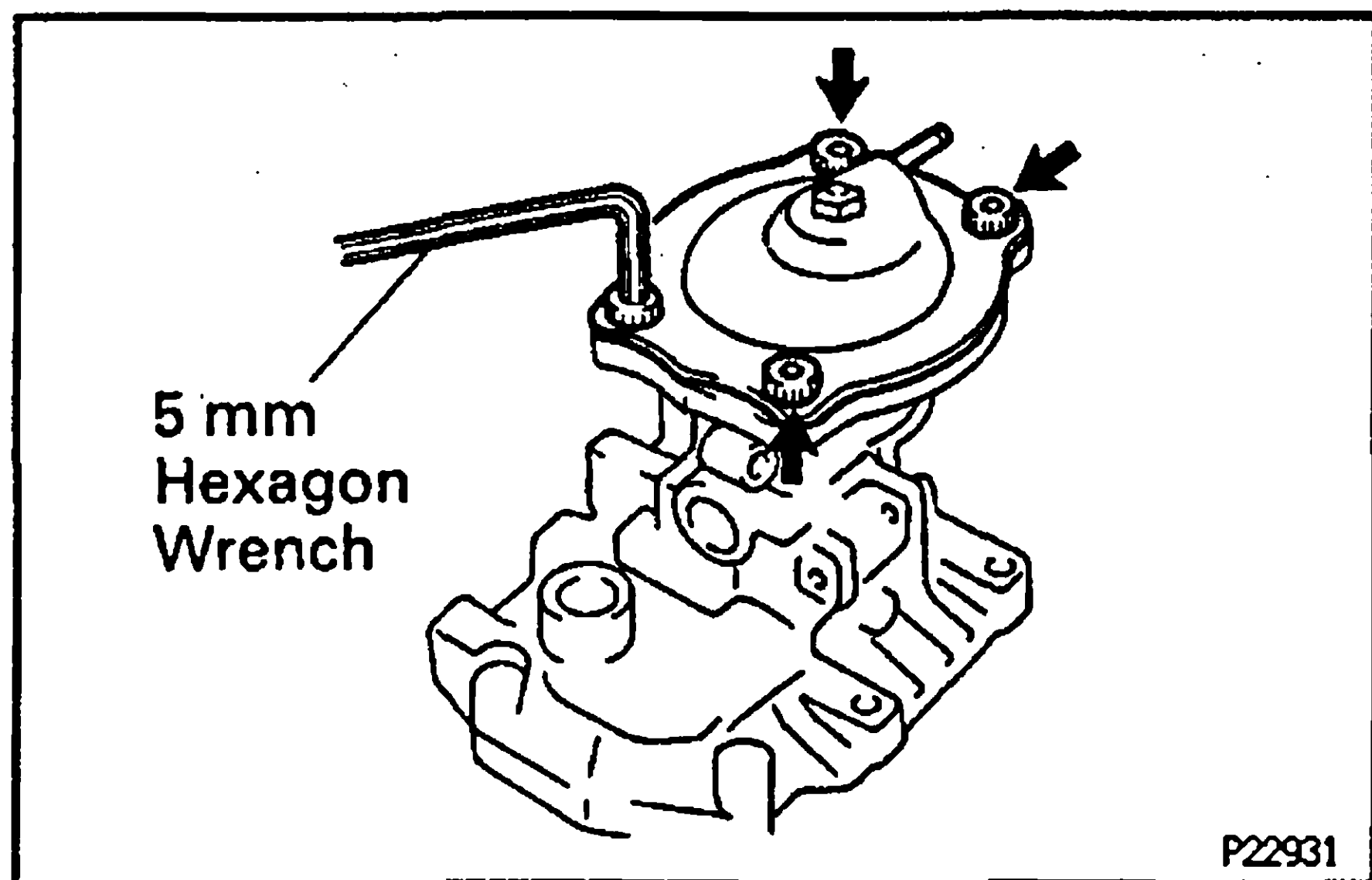
- O—ring
- Washer



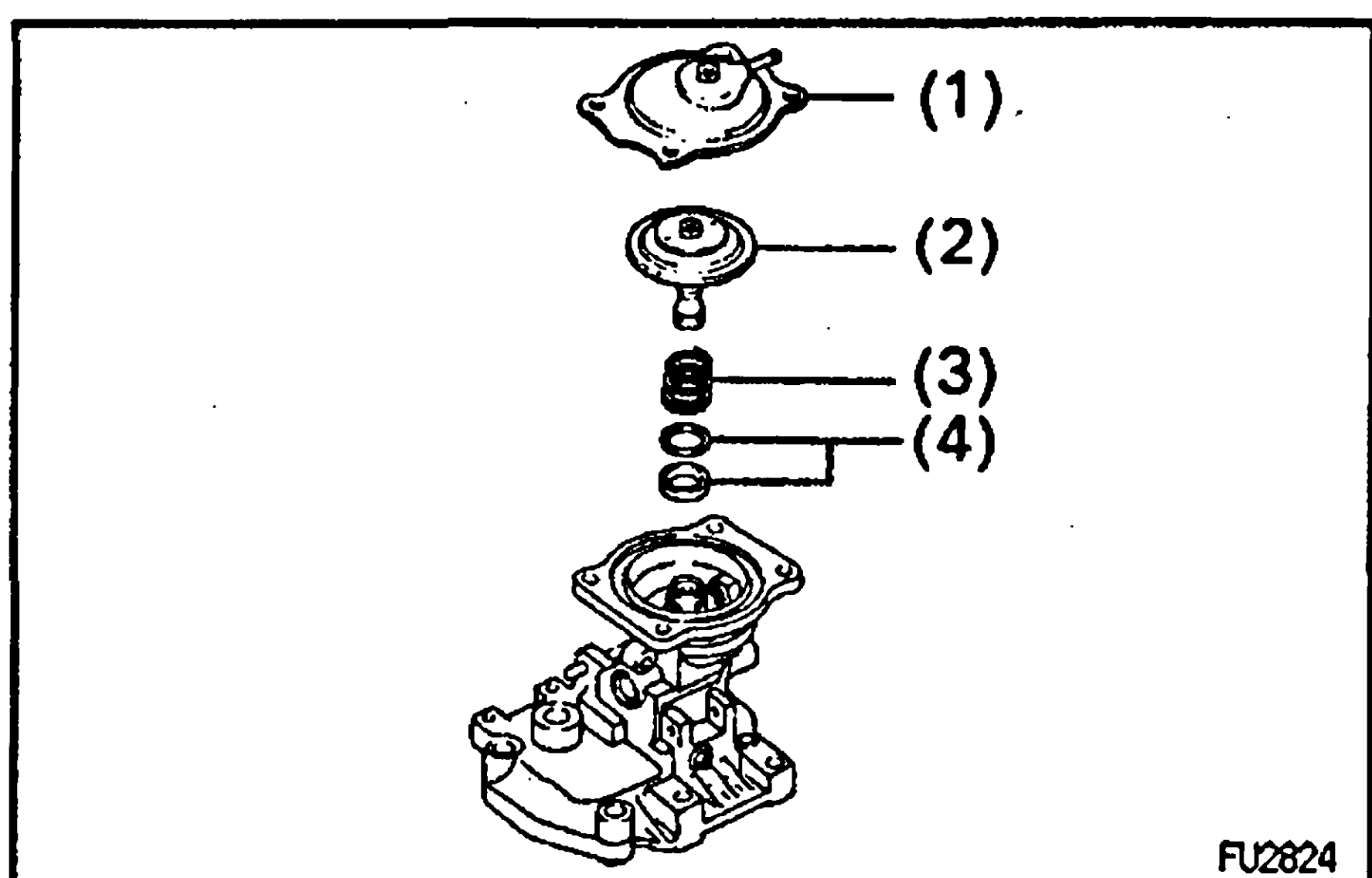
17. DISASSEMBLE BOOST COMPENSATOR

A. Remove lever control spring

Remove the bolt, gasket and lever control spring.

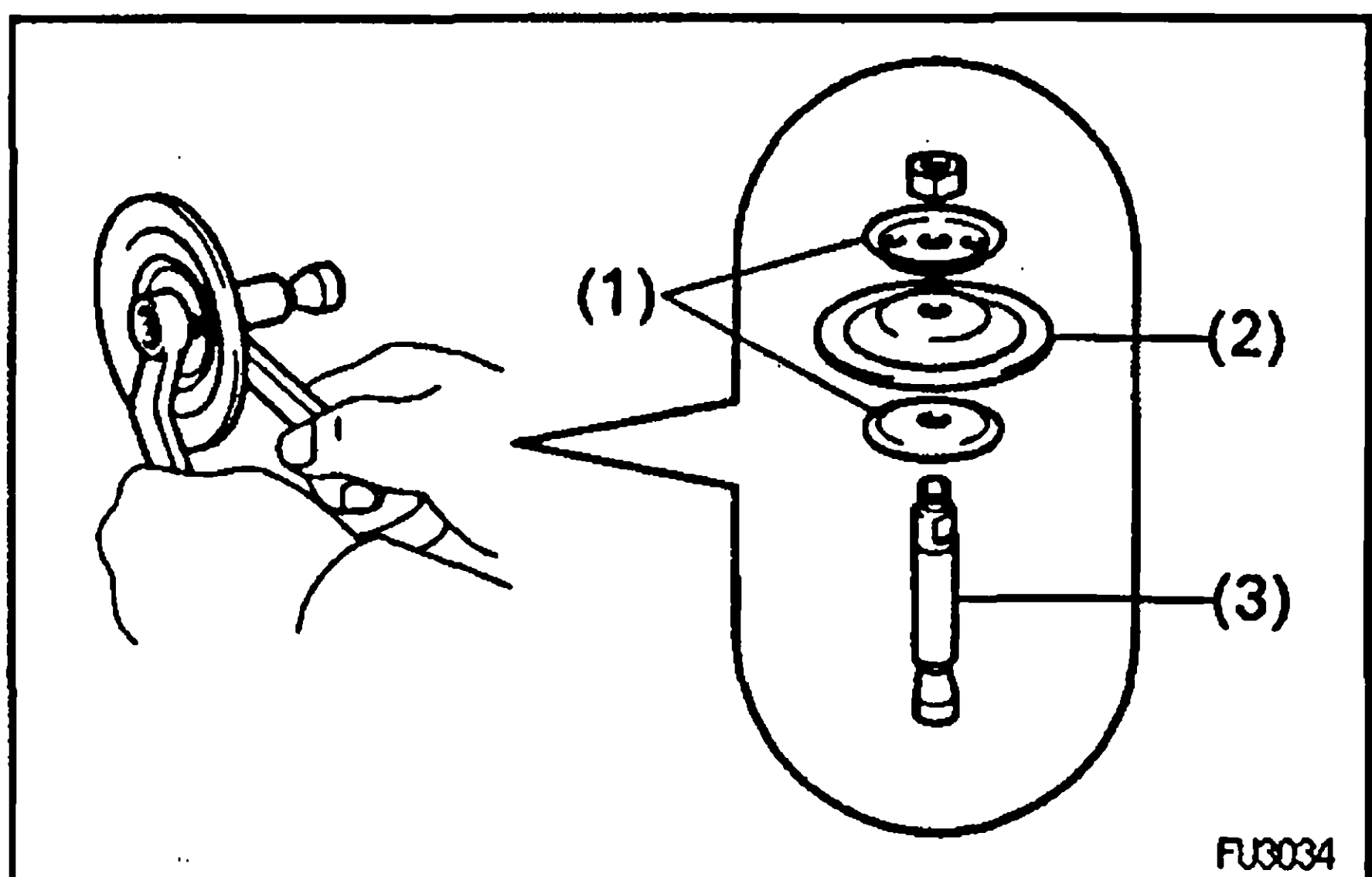
**B. Remove boost compensator diaphragm**

(a) Using a 5 mm hexagon wrench, remove the 4 bolts.



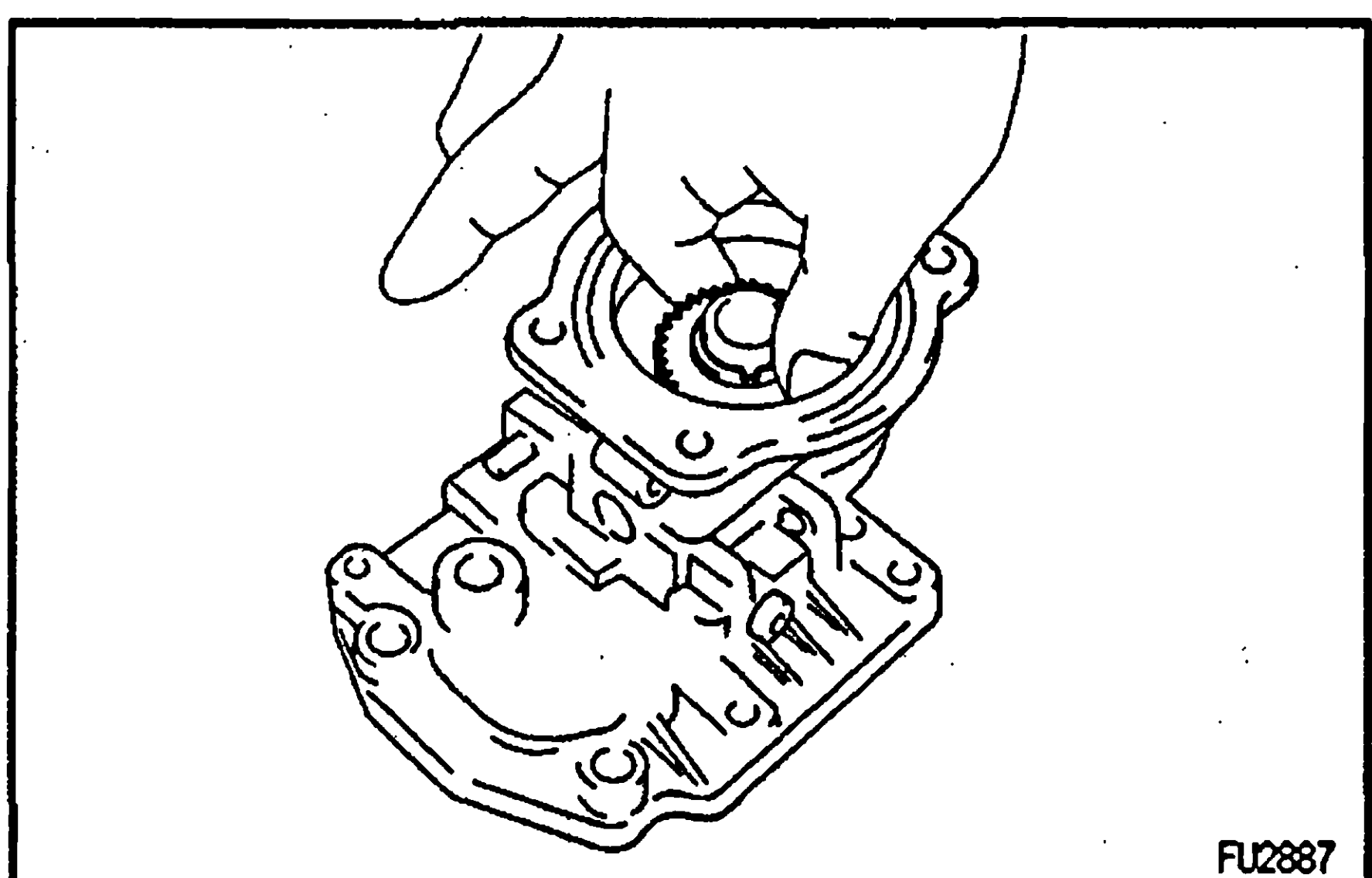
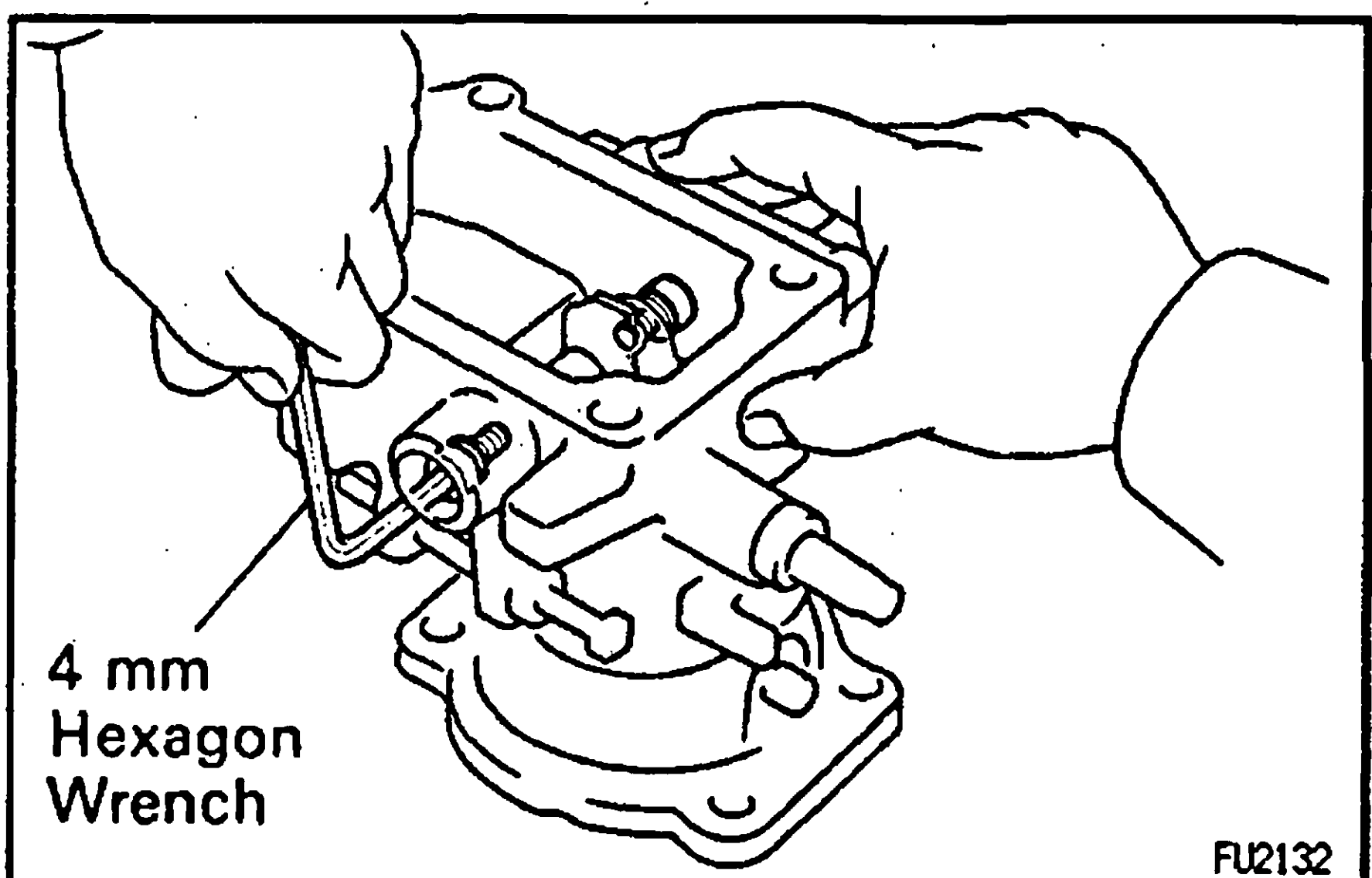
(b) Remove these parts:

- (1) Diaphragm cover
- (2) Diaphragm assembly
- (3) Spring
- (4) Boost compensator shim

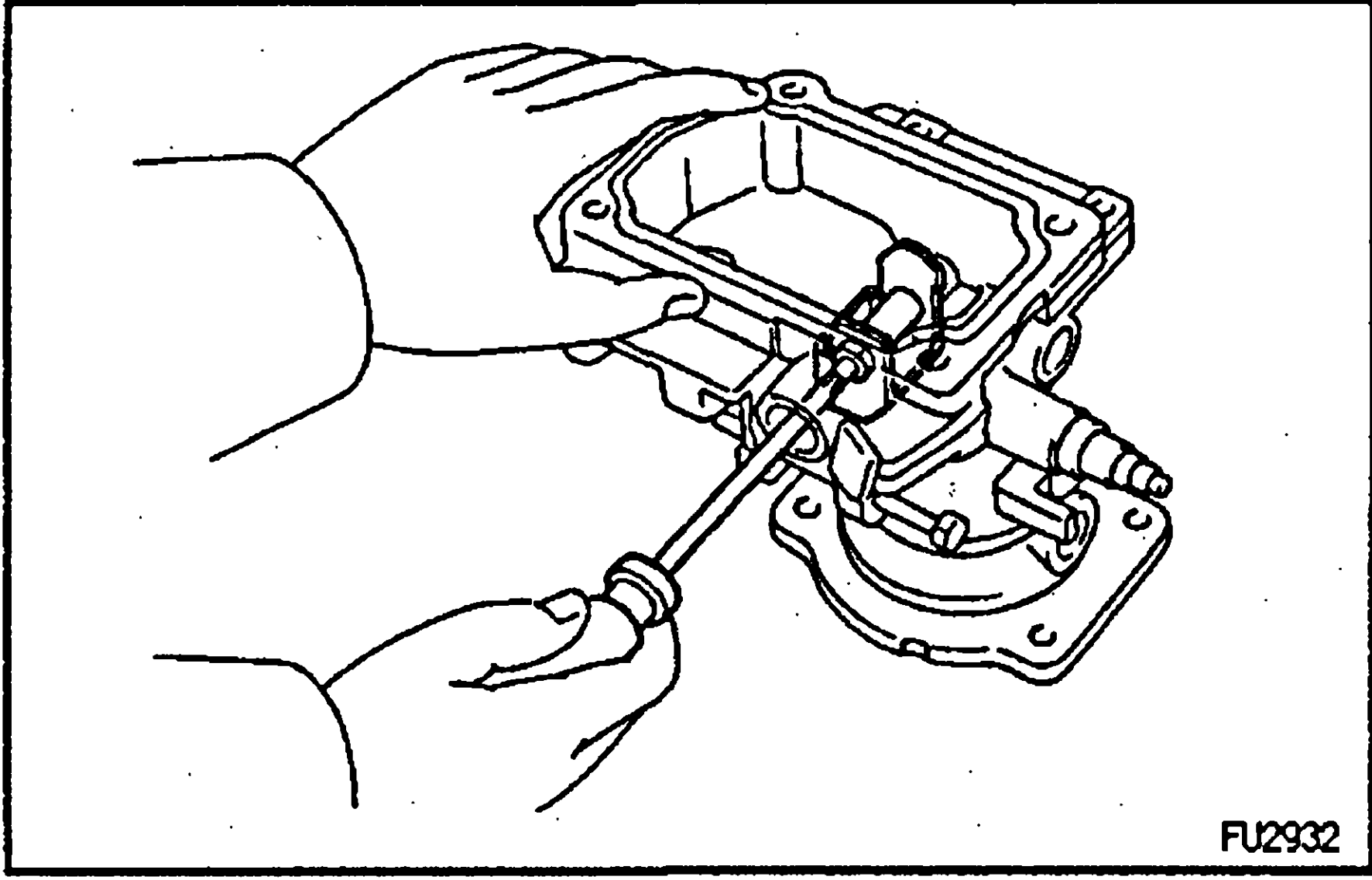


(c) Remove the nut, and disassemble these parts:

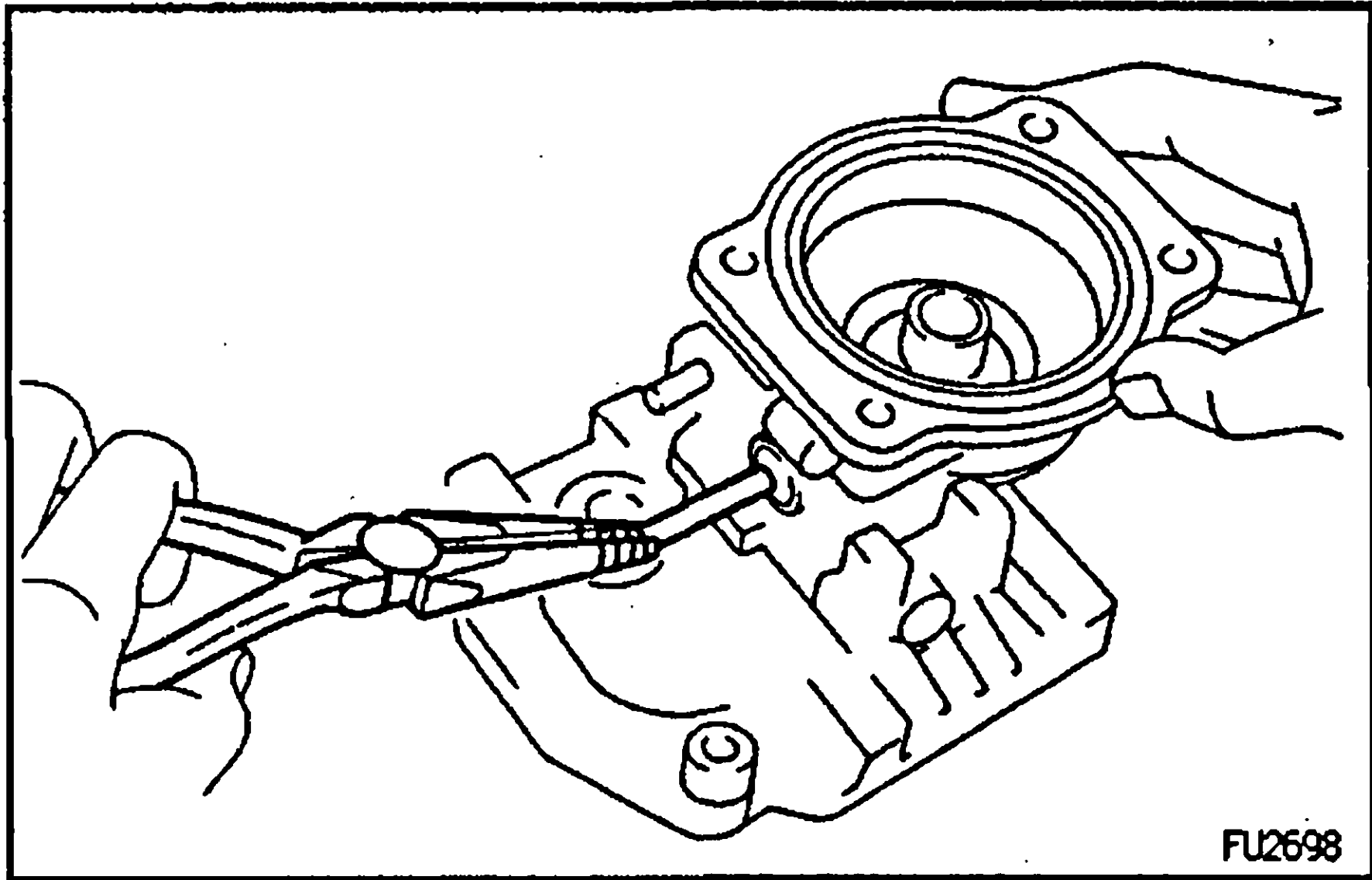
- (1) 2 spring seats
- (2) Diaphragm
- (3) Push rod

**C. Remove guide bushing****D. Remove control lever**

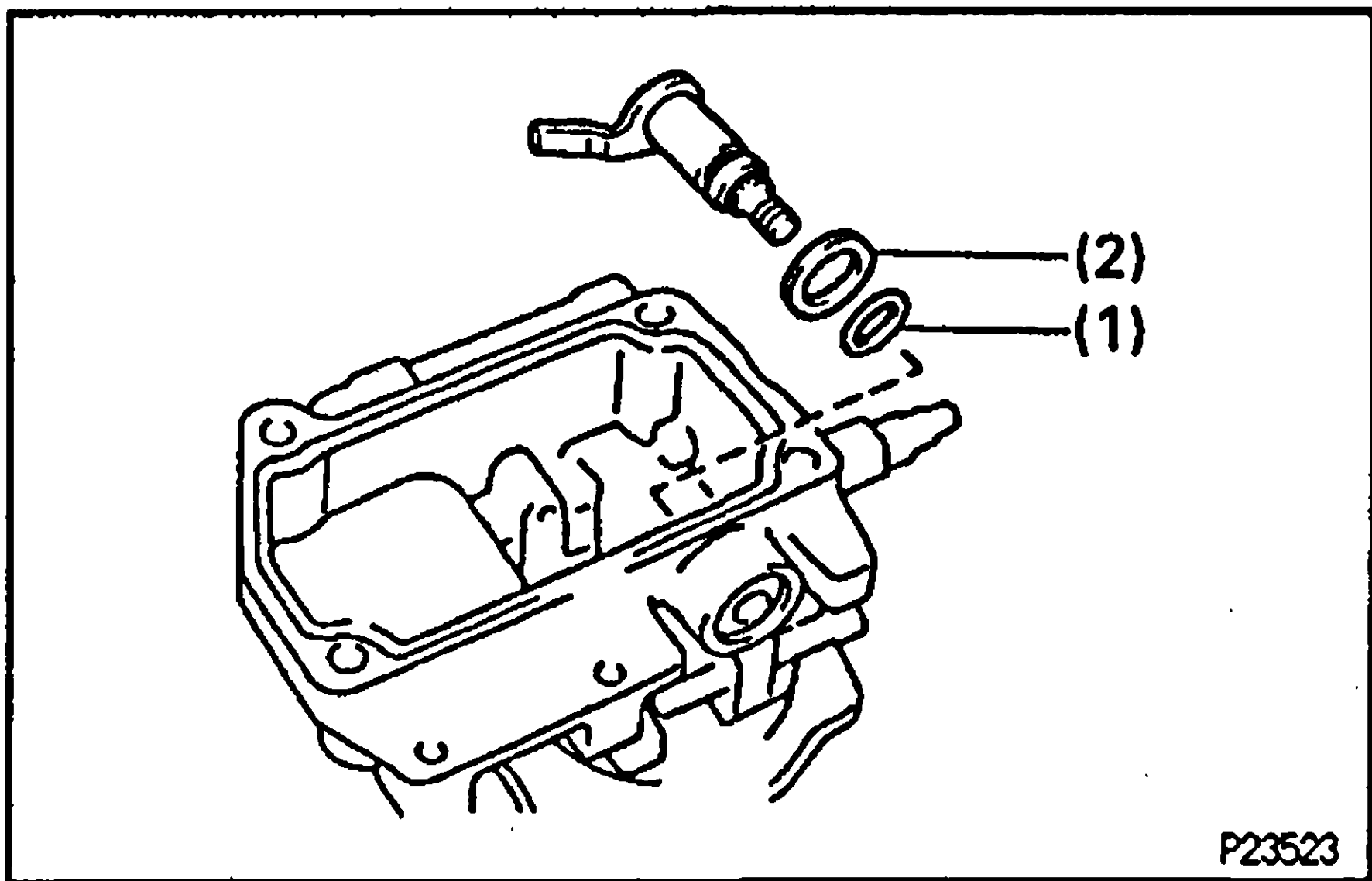
(a) Using a 4 mm hexagon wrench, remove the 2 bolts and gaskets.



- (b) Using a small screwdriver, push out the support pin and remove the control lever.

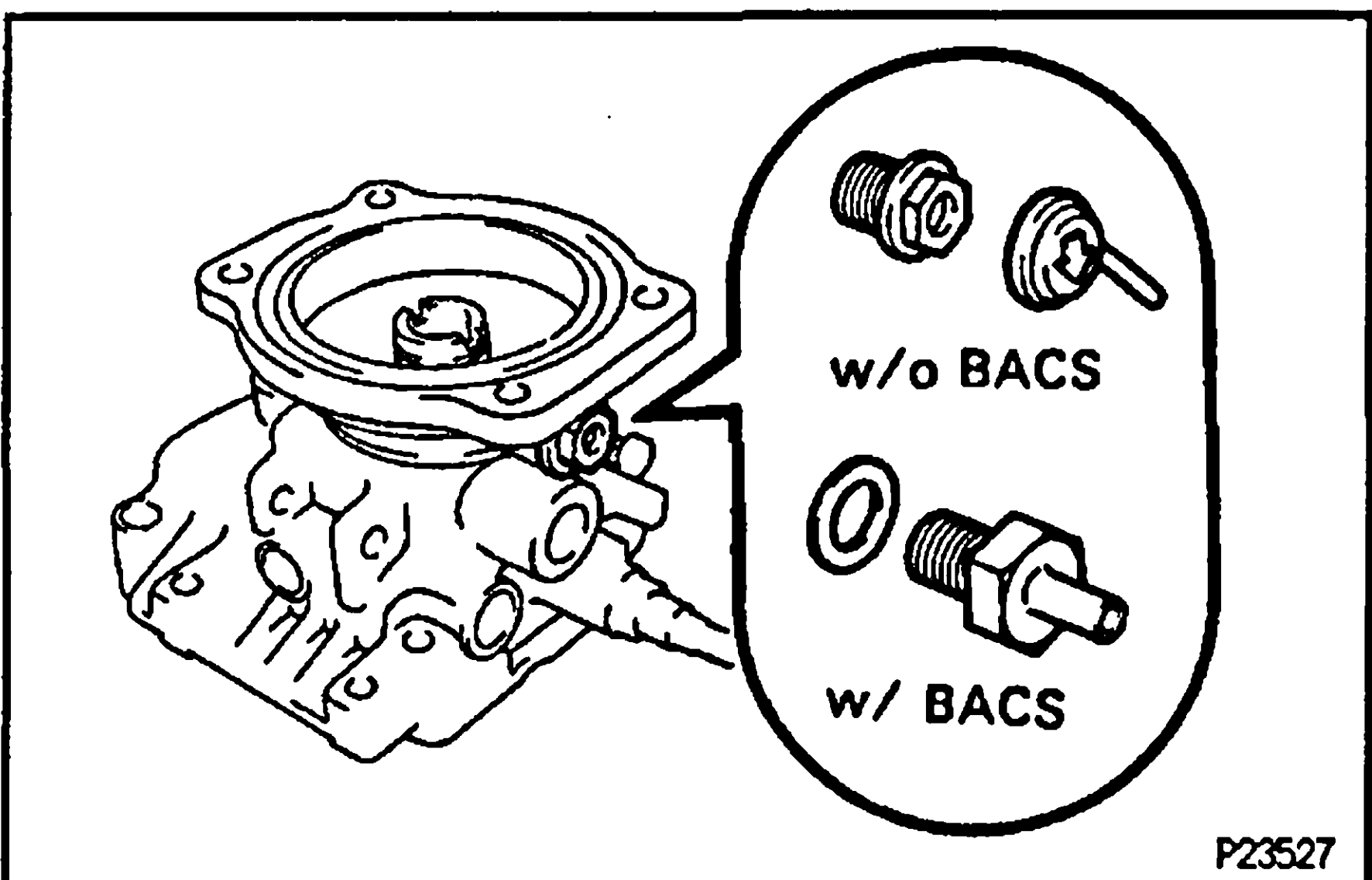


- (c) Using needle nose pliers, remove the connecting pin. **NOTICE:** Be careful not to damage the connecting pin. Tape the tip of the pliers.



E. Remove No.2 SICS lever

- (a) Remove the No.2 SICS lever, O-ring and washer assembly from the governor cover.
- (b) Disassemble these parts from the No.2 SICS lever, O-ring and washer assembly.
- (1) O-ring
- (2) Washer



F. Remove overflow screw

- w/o BACS:
Remove the rubber cap and overflow screw.
- w/ BACS:
Remove the overflow screw and gasket.

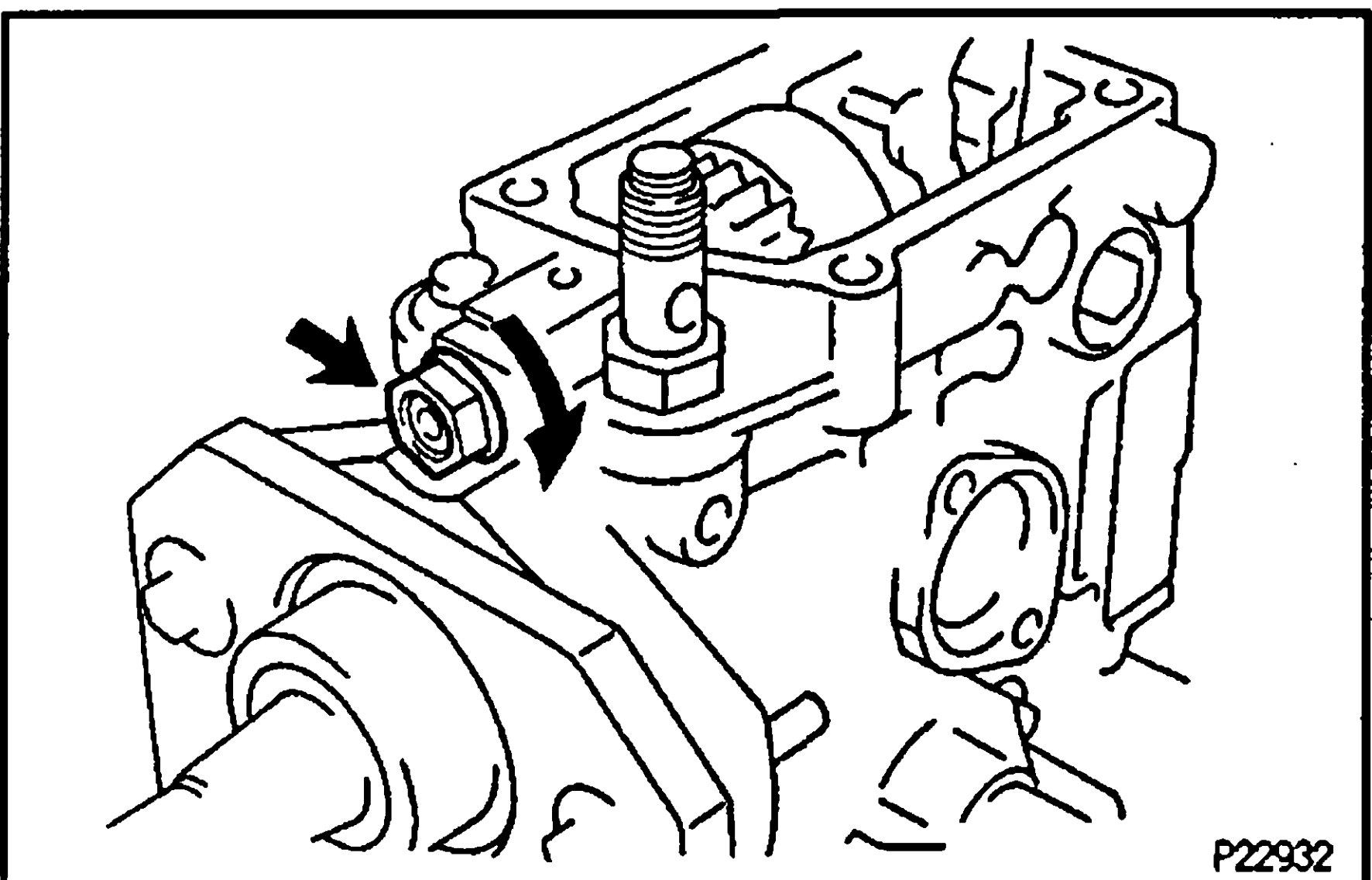
G. Remove full load set screw

18. CHECK FLYWEIGHT HOLDER THRUST CLEARANCE

(See step 16 in injection pump assembly)

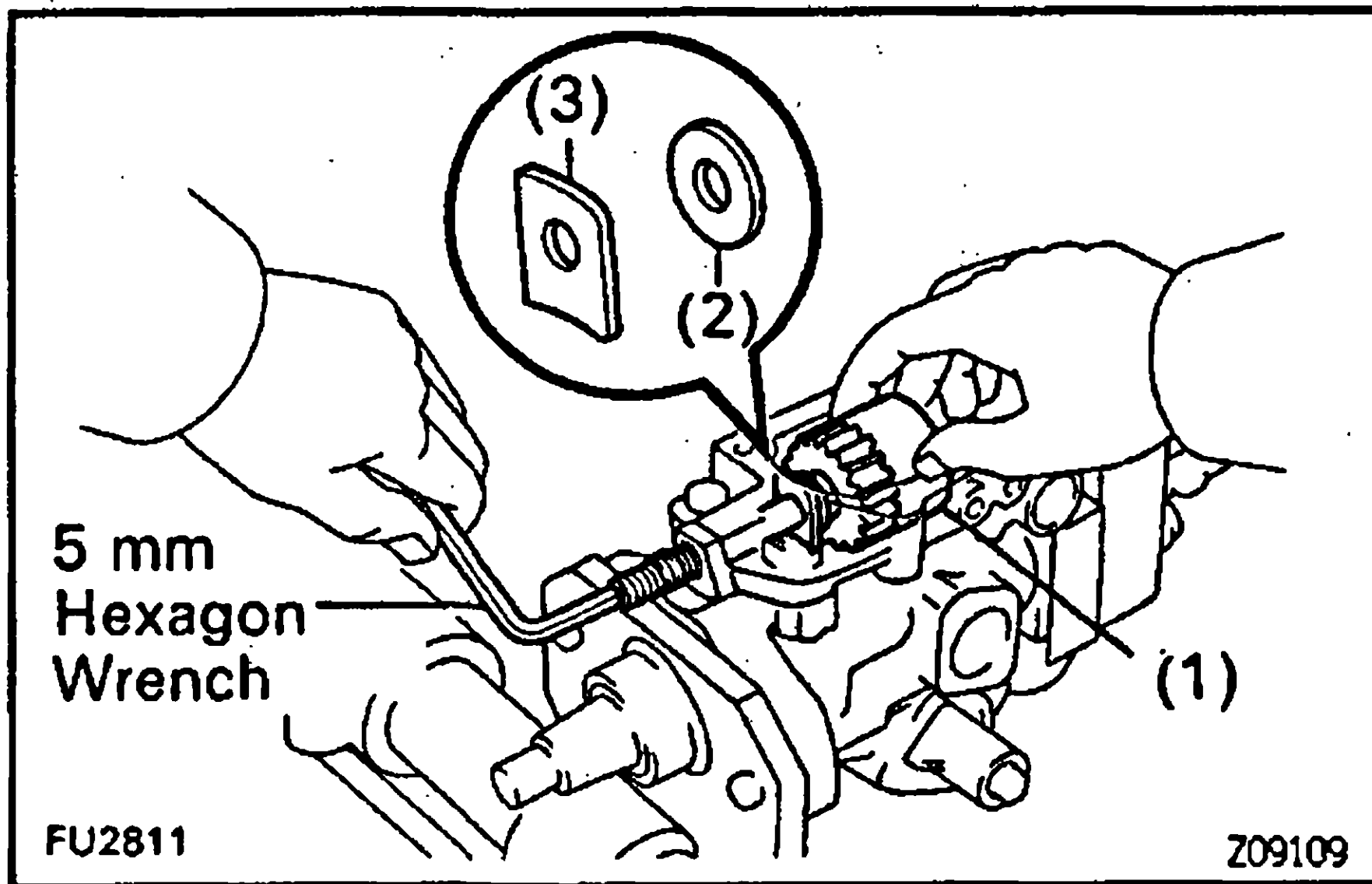
Thrust clearance:

0.15 – 0.35 mm (0.0059 – 0.0138 in.)



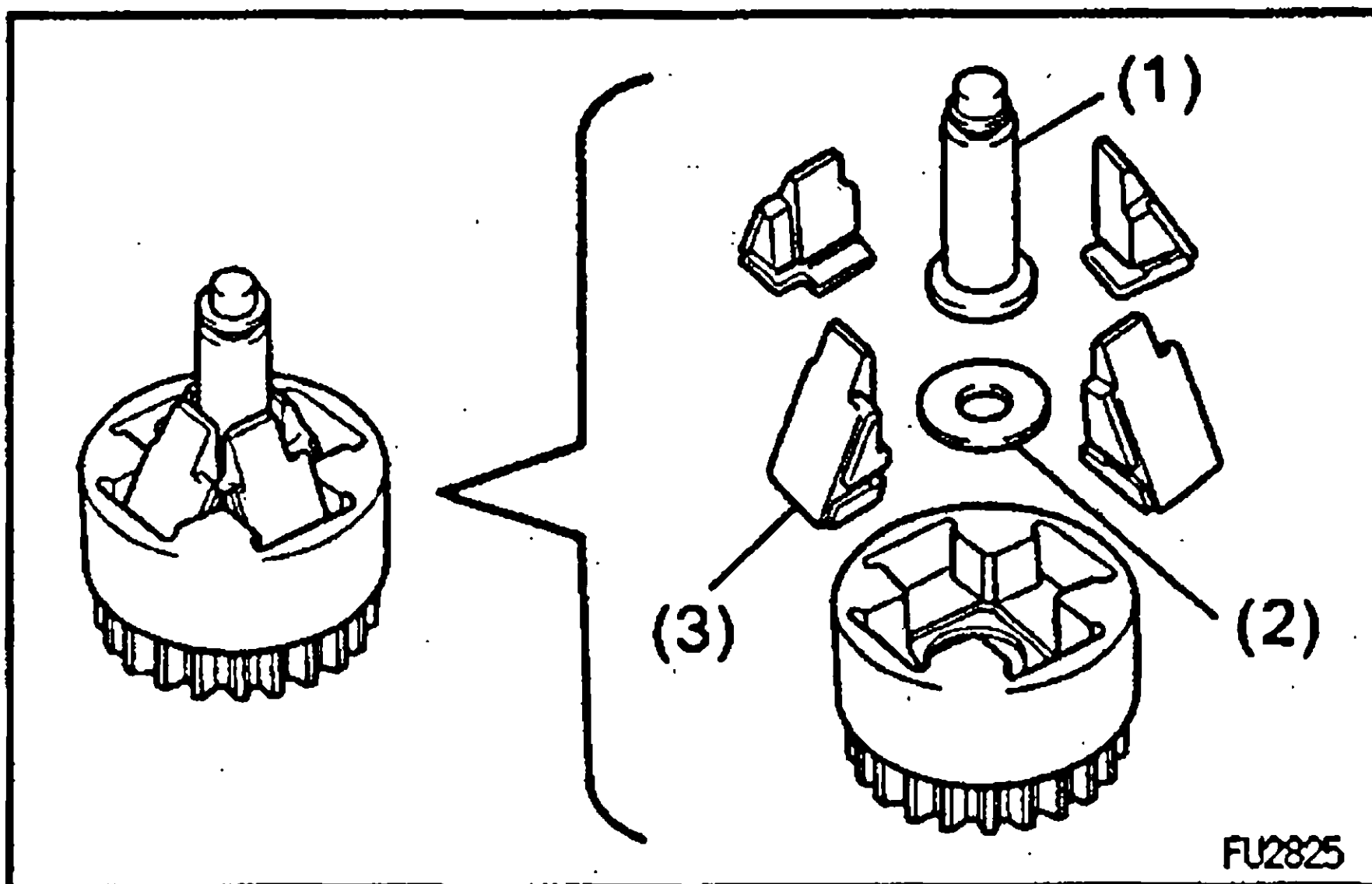
19. REMOVE GOVERNOR SHAFT AND FLYWEIGHT HOLDER

- (a) Remove the governor shaft lock nut by turning it clockwise.
- NOTICE:** The governor shaft and lock nut have LH threads.

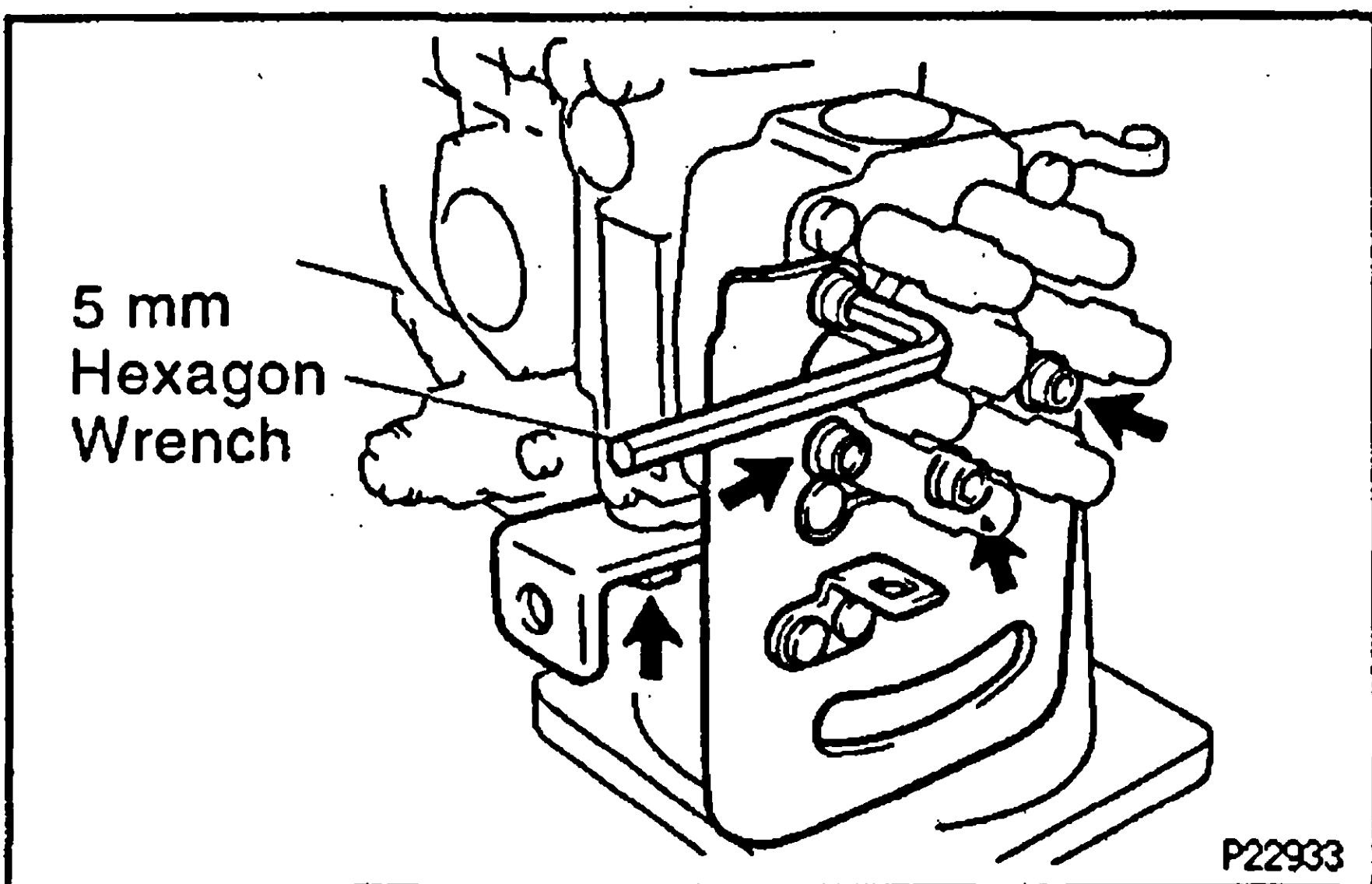


- (b) Using a 5 mm hexagon wrench, remove the governor shaft, O-ring clockwise and remove these parts:
- (1) Flyweight holder assembly
 - (2) No.1 flyweight washer
 - (3) Governor gear adjusting washer
- HINT: Be careful not to drop the 2 washers into the pump housing.

EG

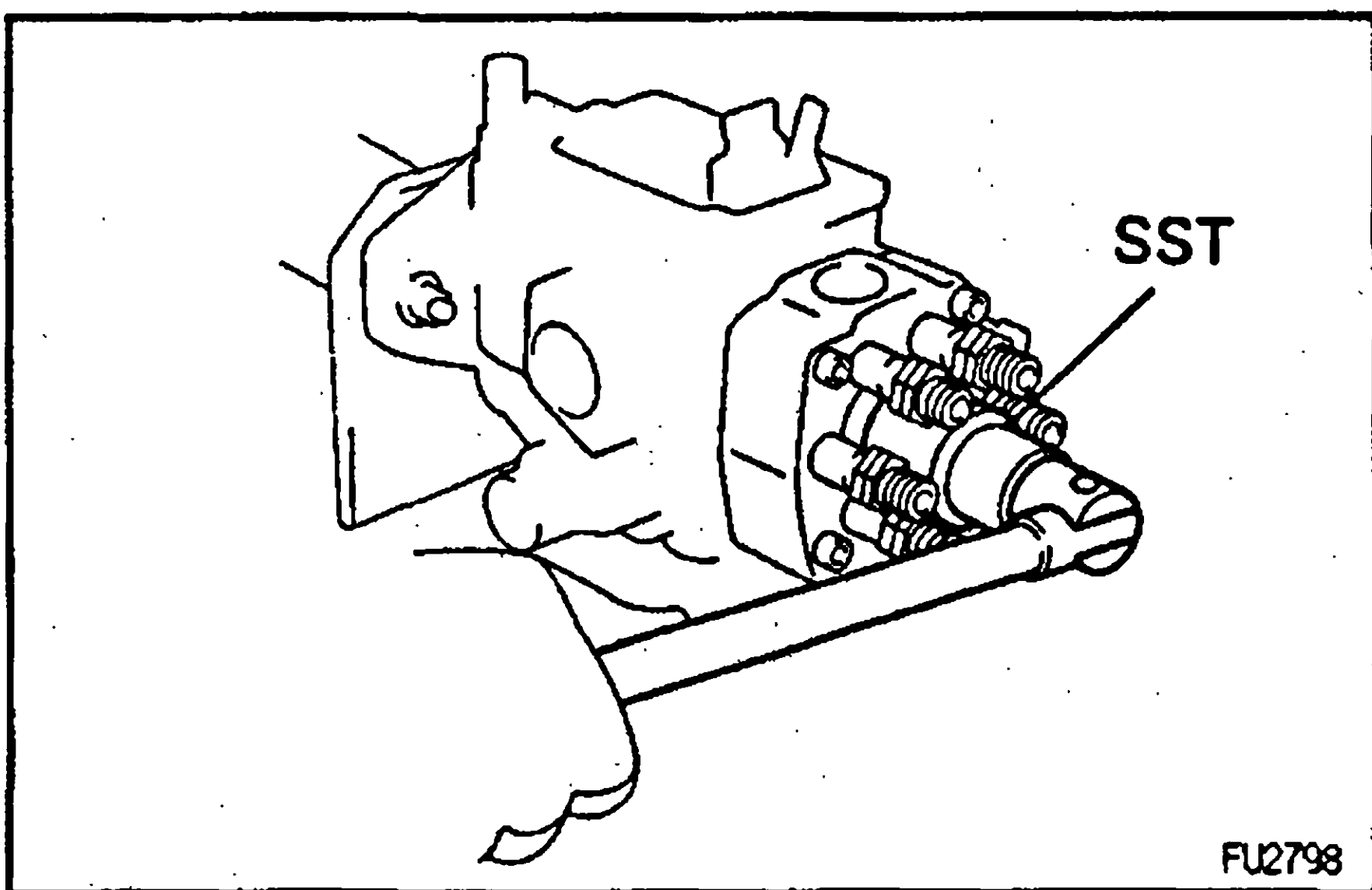


- (c) Remove these parts from the flyweight holder:
- (1) Governor sleeve
 - (2) No.2 flyweight washer
 - (3) 4 flyweights



20. REMOVE INJECTION PUMP STAY AND FUEL PIPE BRACKET

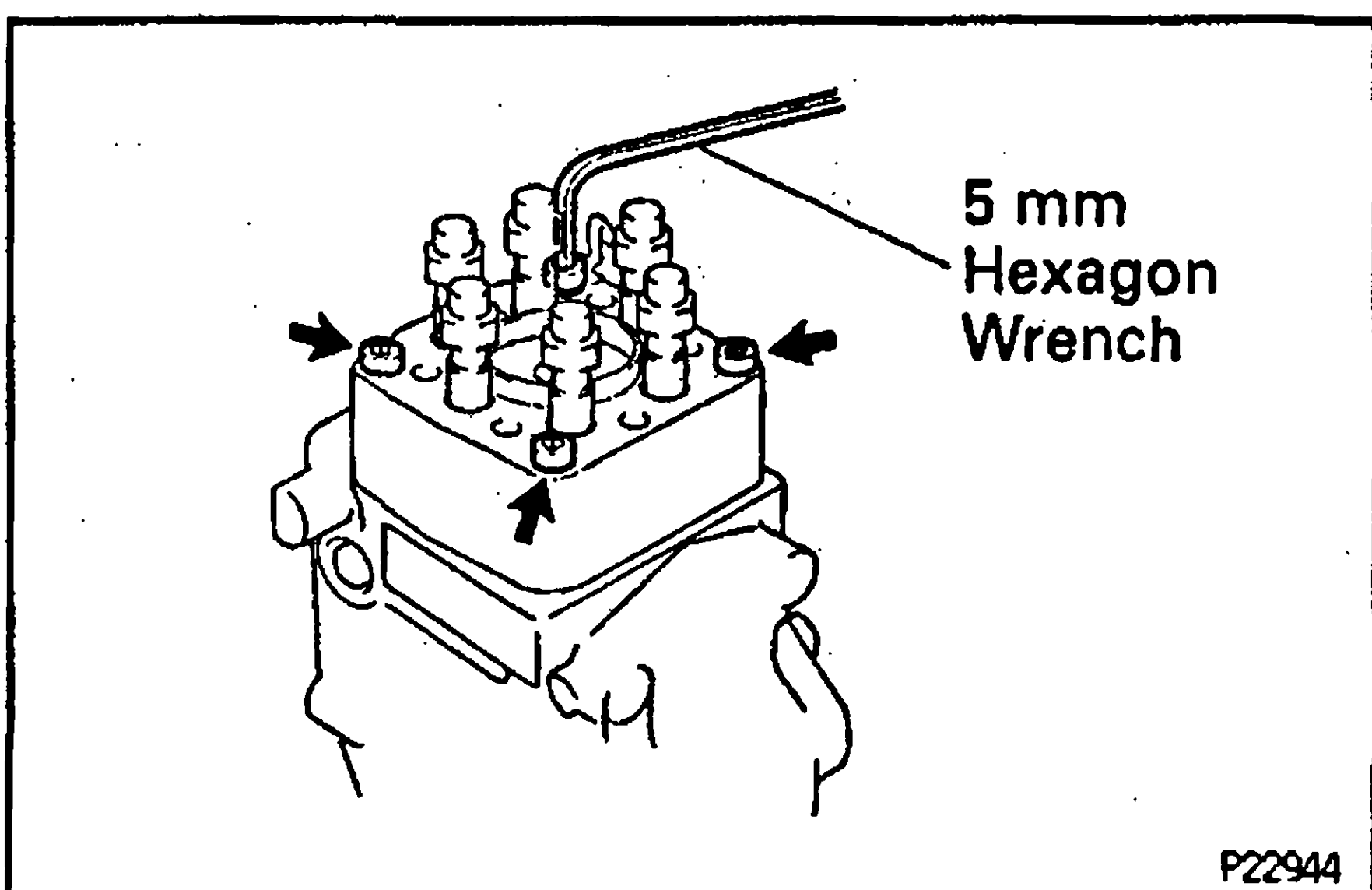
- (a) Using a 5 mm hexagon wrench, remove the 4 bolts and injection pump stay.
- (b) Remove the bolt and fuel pipe bracket.



21. REMOVE DISTRIBUTIVE HEAD PLUG

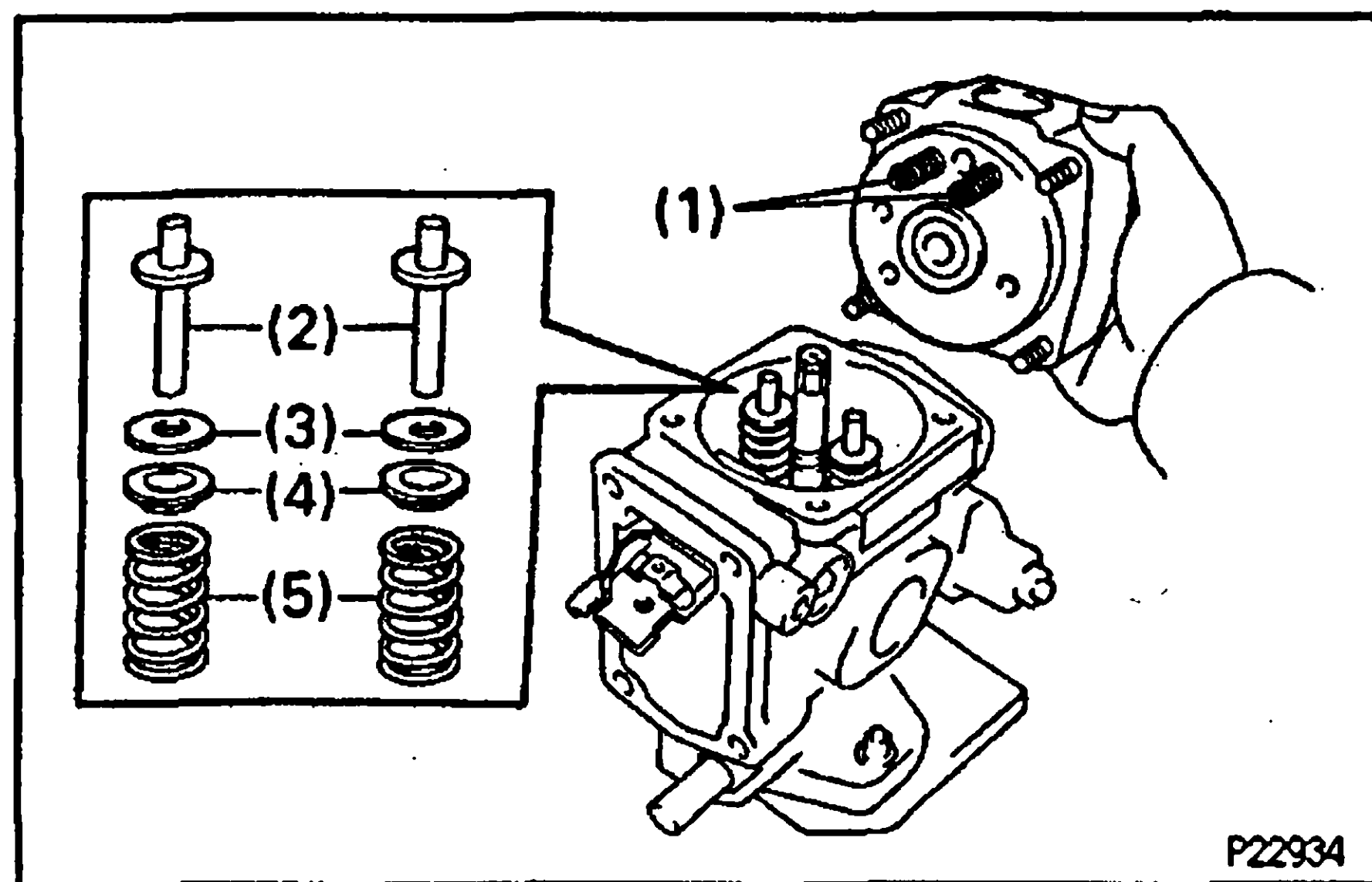
Using SST, remove the distributive head plug and O-ring.

SST 09260-54012 (09262-54010)



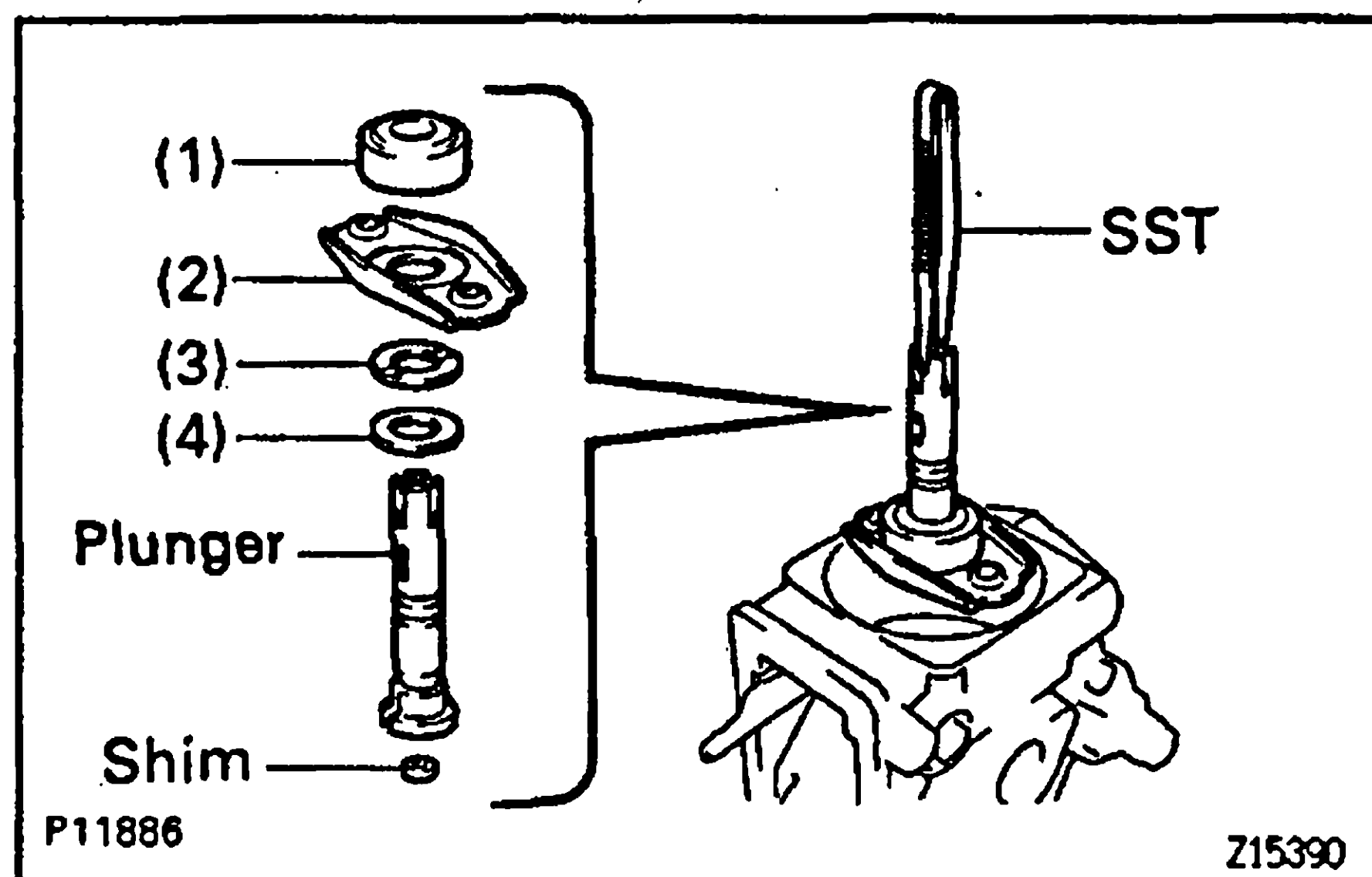
22. REMOVE DISTRIBUTIVE HEAD

- (a) Using a 5 mm hexagon wrench, remove the 4 bolts and wire clamp.



(b) Remove the distributive head and these parts:

- (1) 2 lever support springs
- (2) 2 plunger spring guides
- (3) 2 plunger spring shims
- (4) 2 upper spring seats
- (5) 2 plunger springs



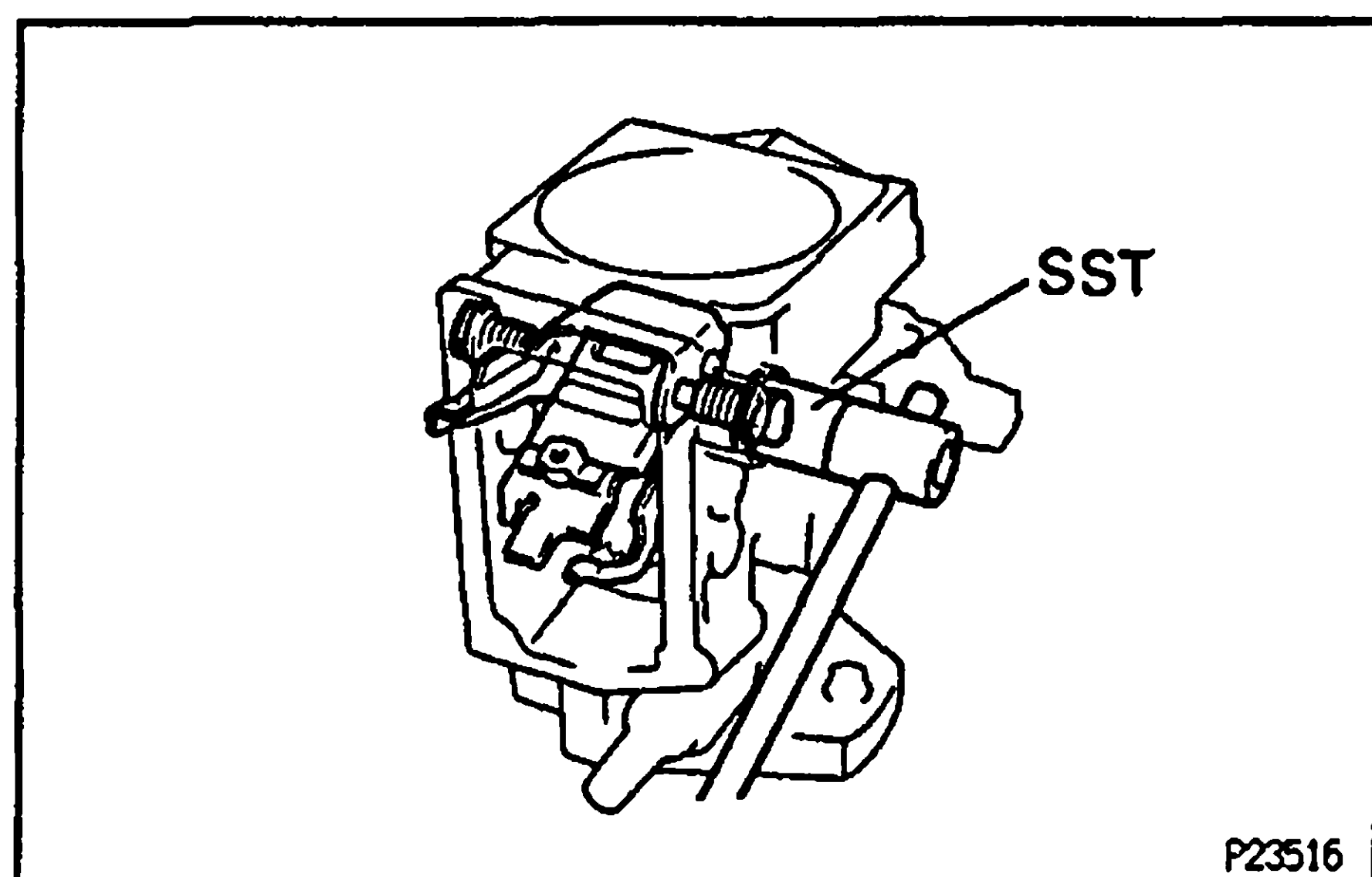
23. REMOVE PUMP PLUNGER

Using SST, remove the pump plunger and plunger adjusting shim together with these parts:

- (1) Spill ring
- (2) Lower spring seat
- (3) Upper plunger plate
- (4) Lower plunger plate

SST 09260-54012 (09269-54030)

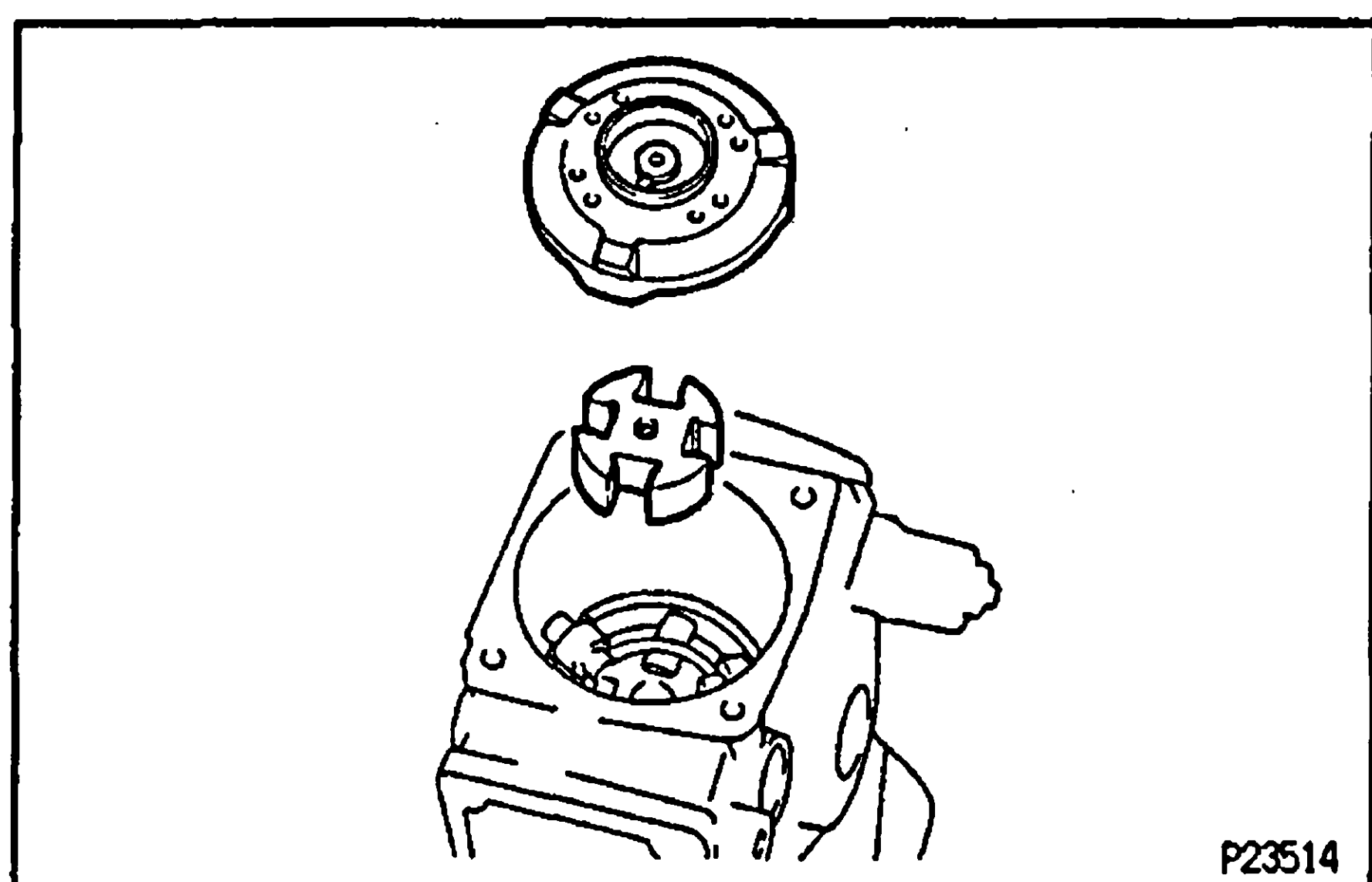
NOTICE: Do not touch the sliding surfaces of the pump plunger with your hand.



24. REMOVE GOVERNOR LINK

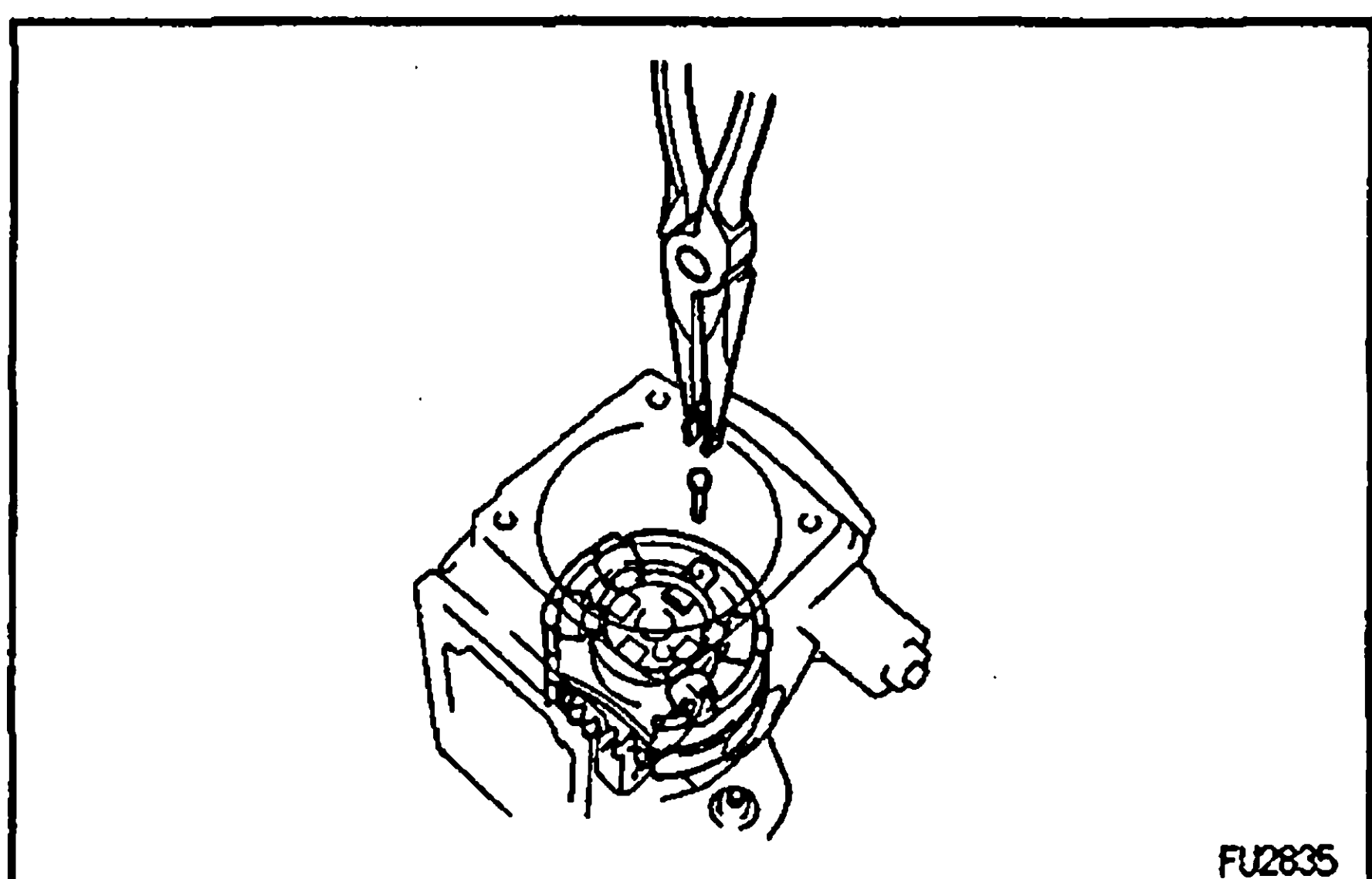
Using SST, remove the 2 support bolts, gaskets and governor link.

SST 09260-54012 (09269-54040)



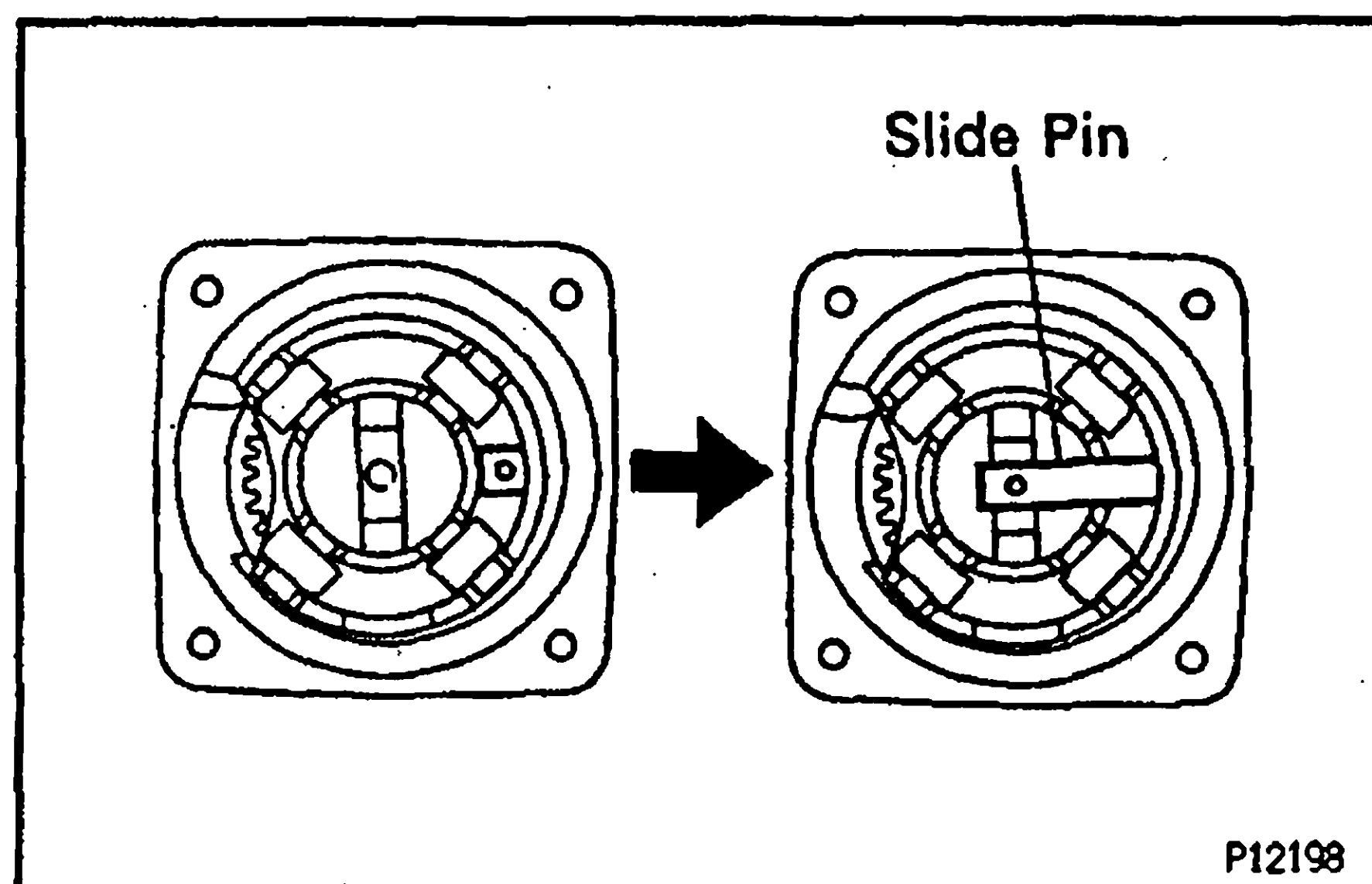
25. REMOVE FACE CAMPLATE AND COUPLING

Remove the face camplate and coupling.

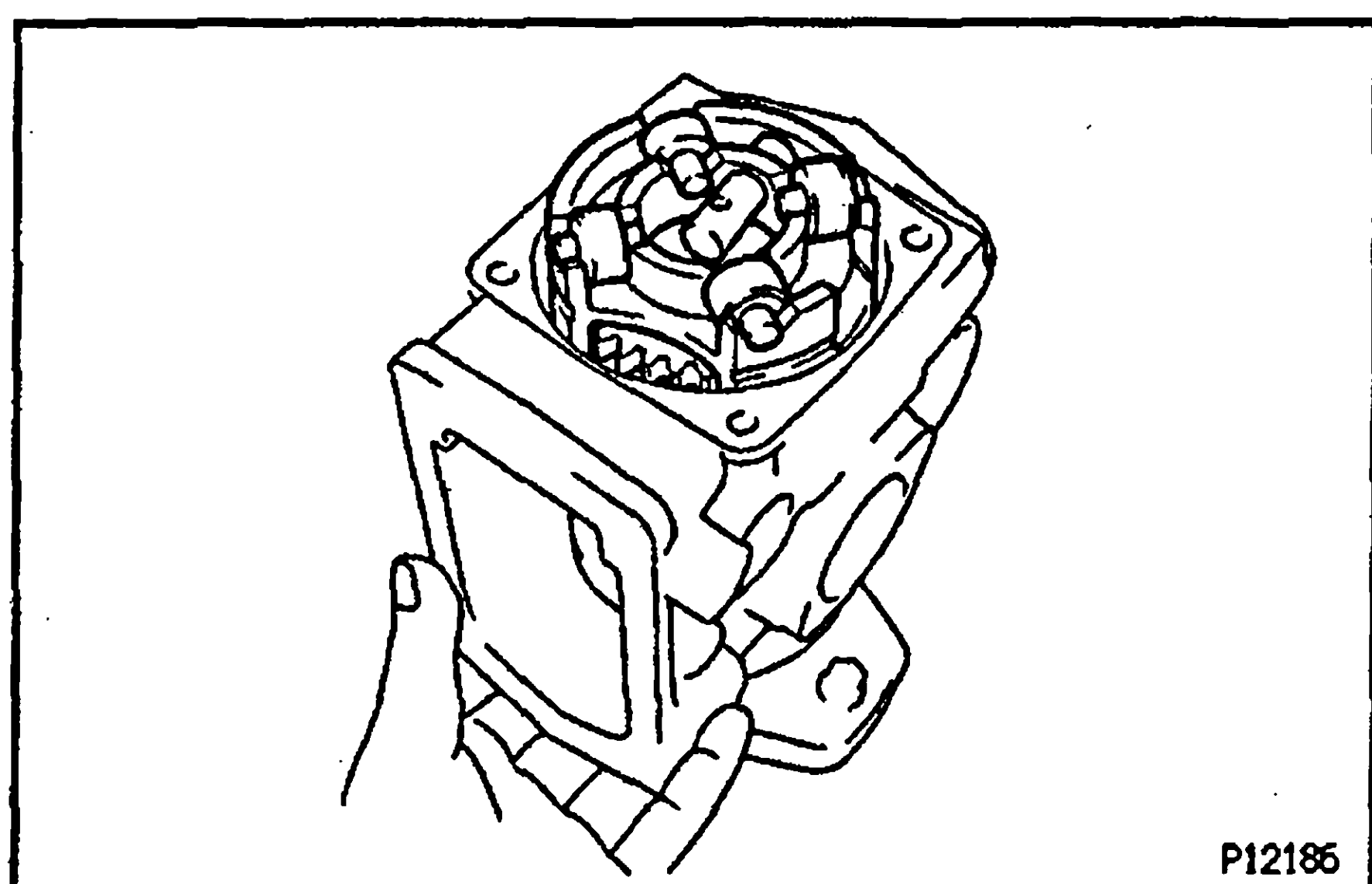


26. REMOVE ROLLER RING AND DRIVE SHAFT

(a) Remove the timer clip and stopper pin.



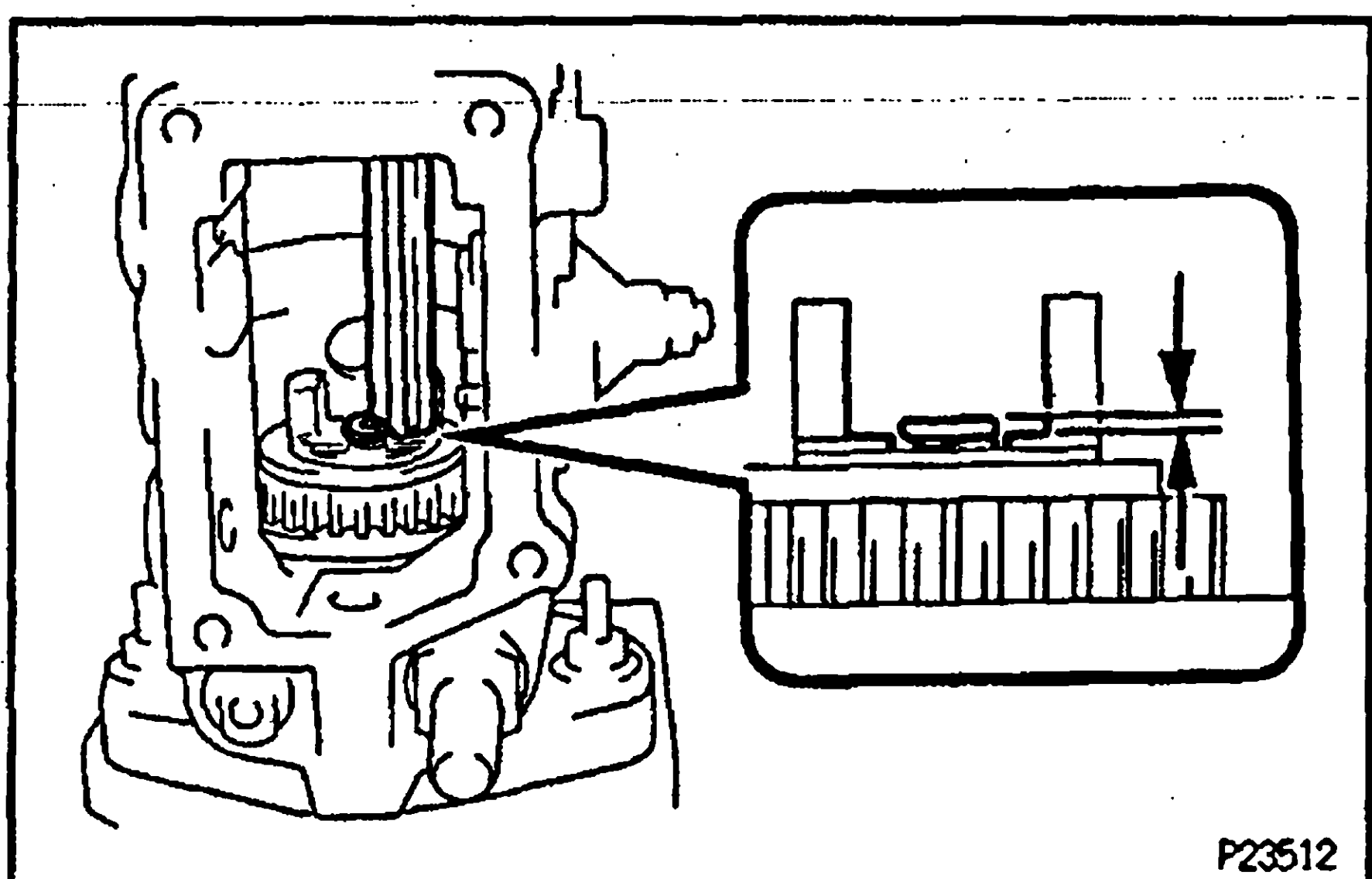
(b) Push the slide pin toward inside.



(c) Push the drive shaft, and remove the roller ring, 4 rollers and shims assembly.

NOTICE:

- Be careful not to drop the rollers.
- Do not alter the position or assembly of the rollers.



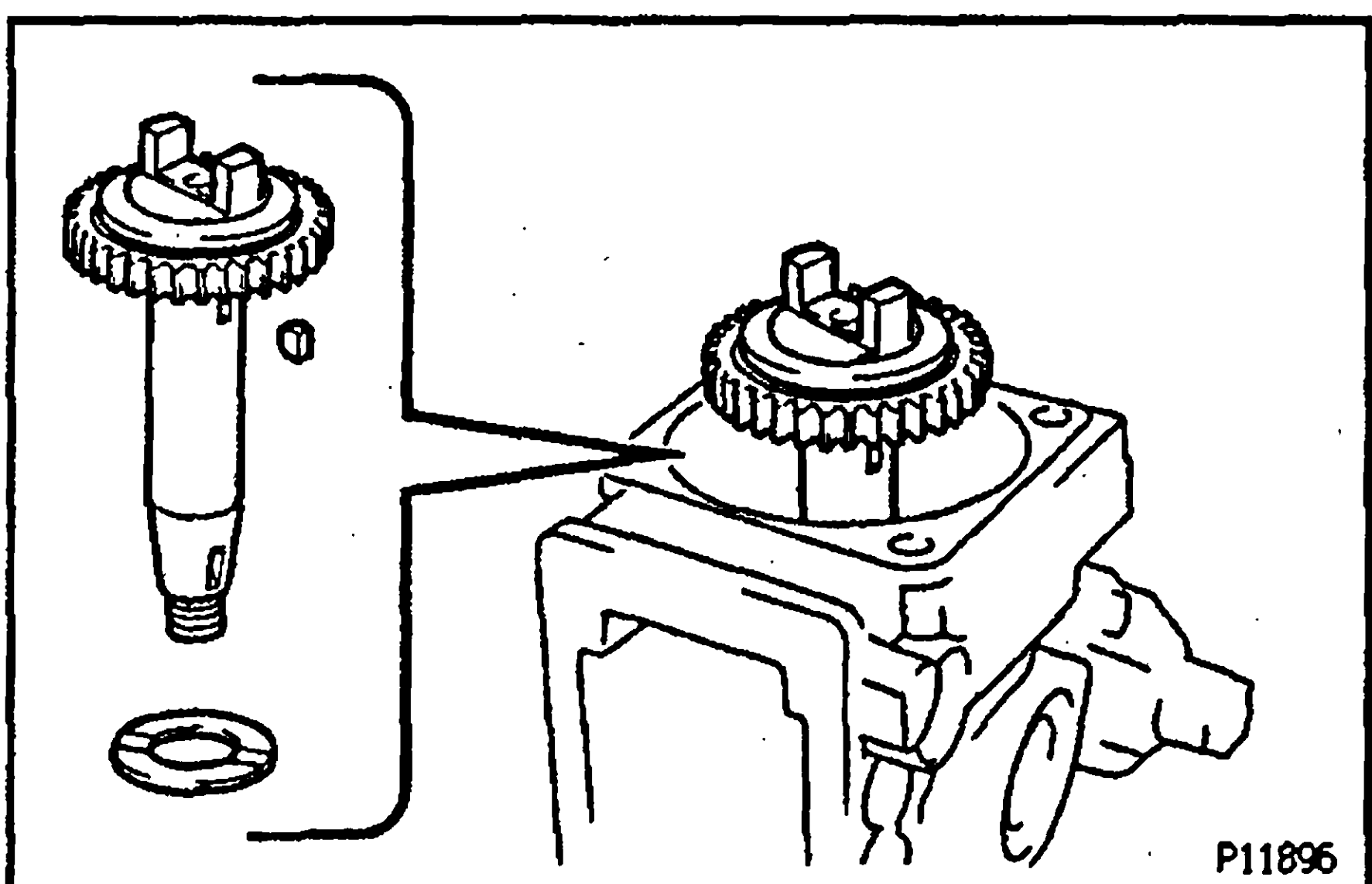
(d) Using vernier calipers, measure the protrusion of the coupling spring.

Protrusion:

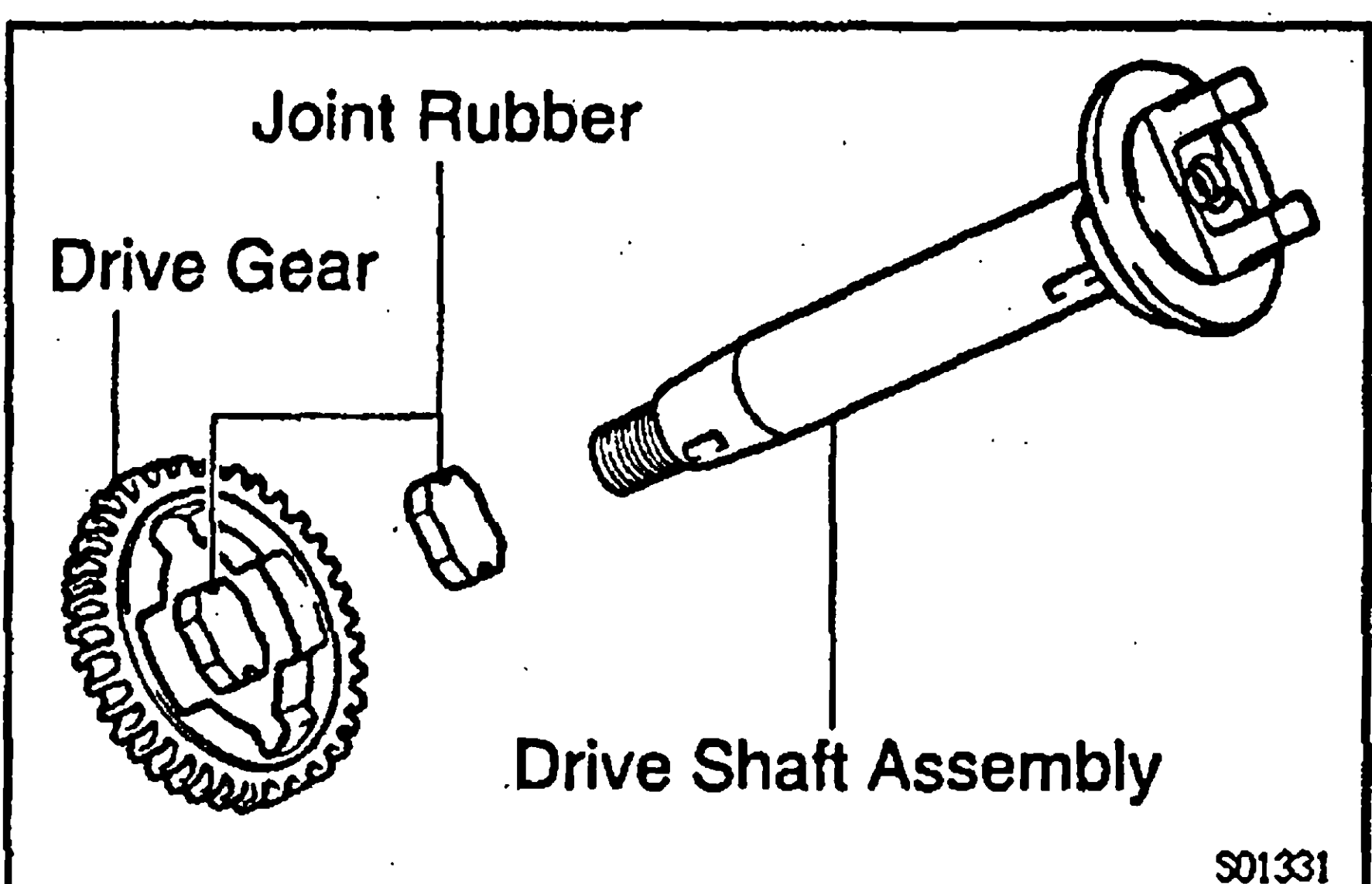
1.0 – 1.6 mm (0.039 – 0.063 in.)

If the protrusion is not as specified, replace the coupling spring.

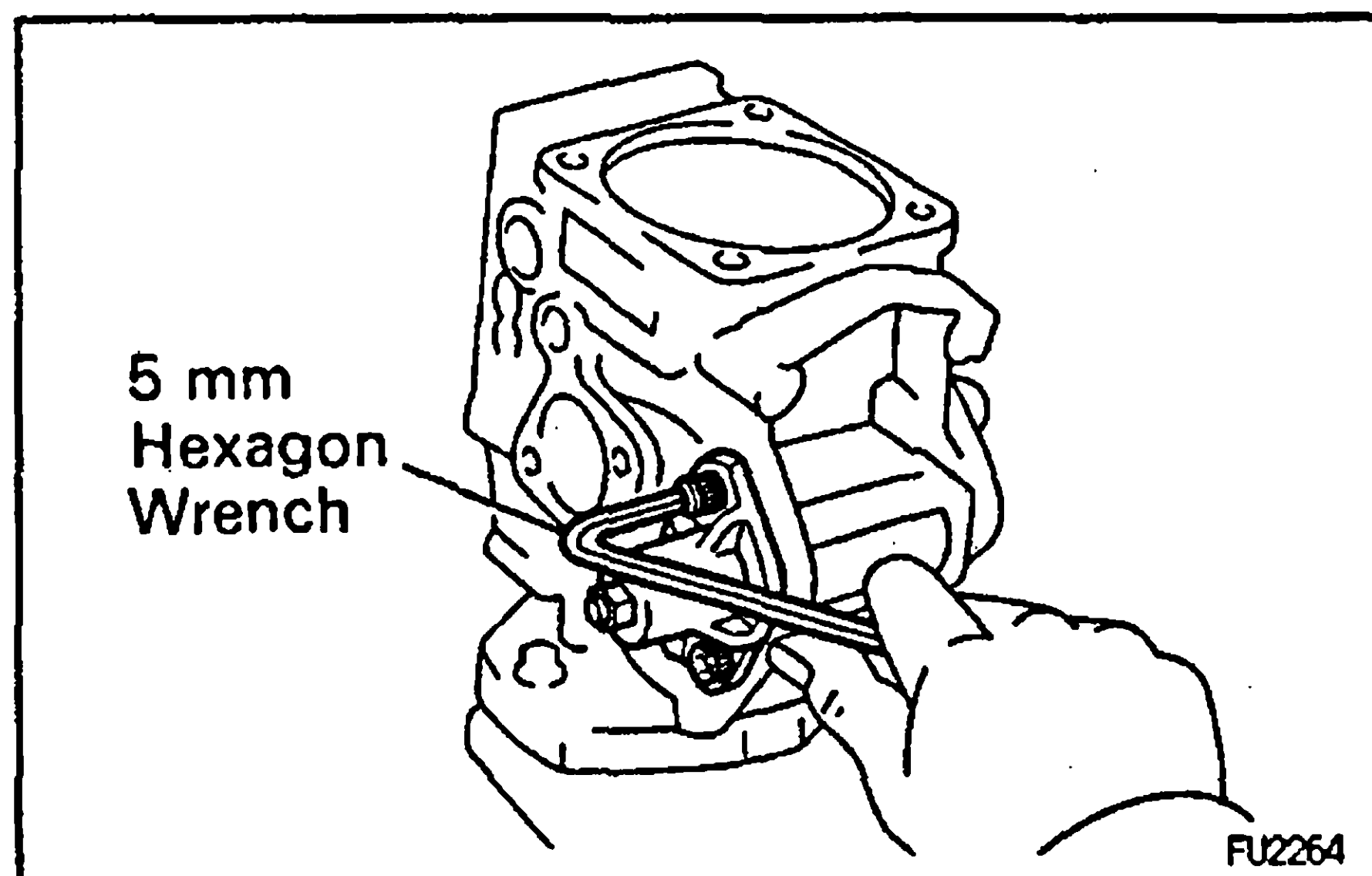
NOTICE: Do not remove the coupling spring unless necessary. If you remove the coupling spring, replace it with a new one.



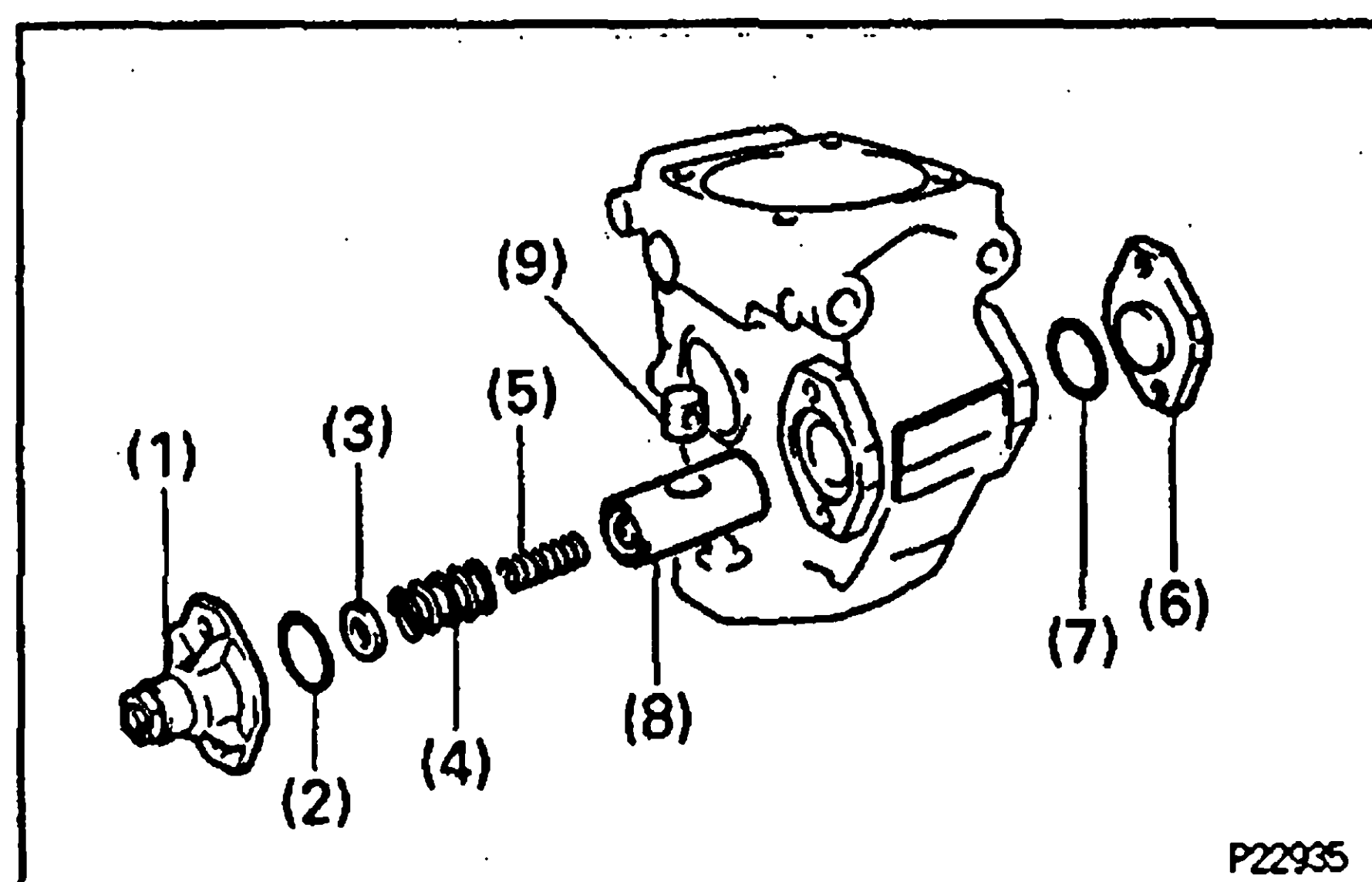
(e) Remove the drive shaft, governor drive gear, 2 joint rubbers assembly, set key and drive shaft washer.



(f) Remove the drive gear and 2 joint rubbers from the drive shaft assembly.

**27. REMOVE TIMER**

(a) Using a 5 mm hexagon wrench, remove the 4 bolts.



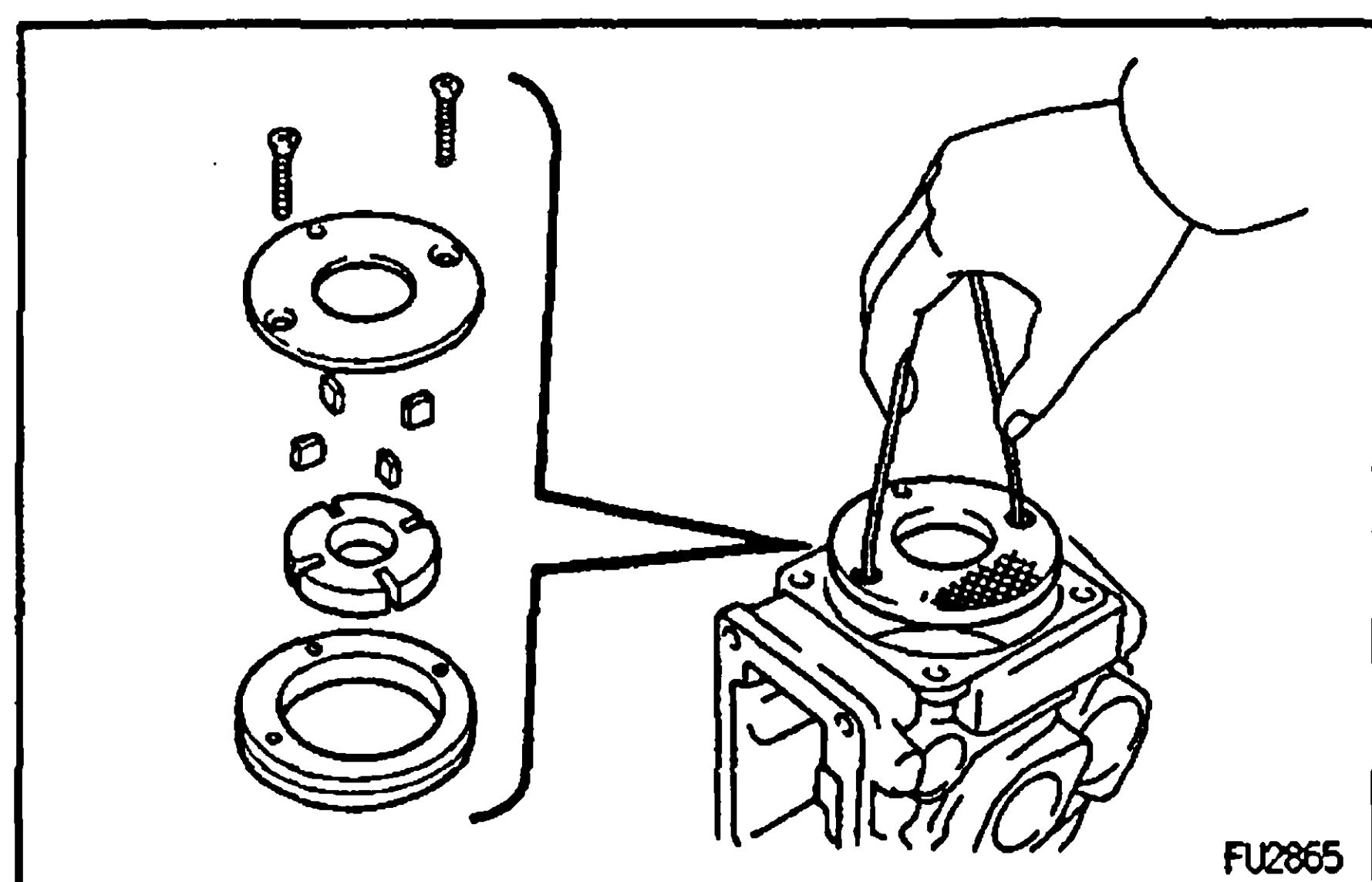
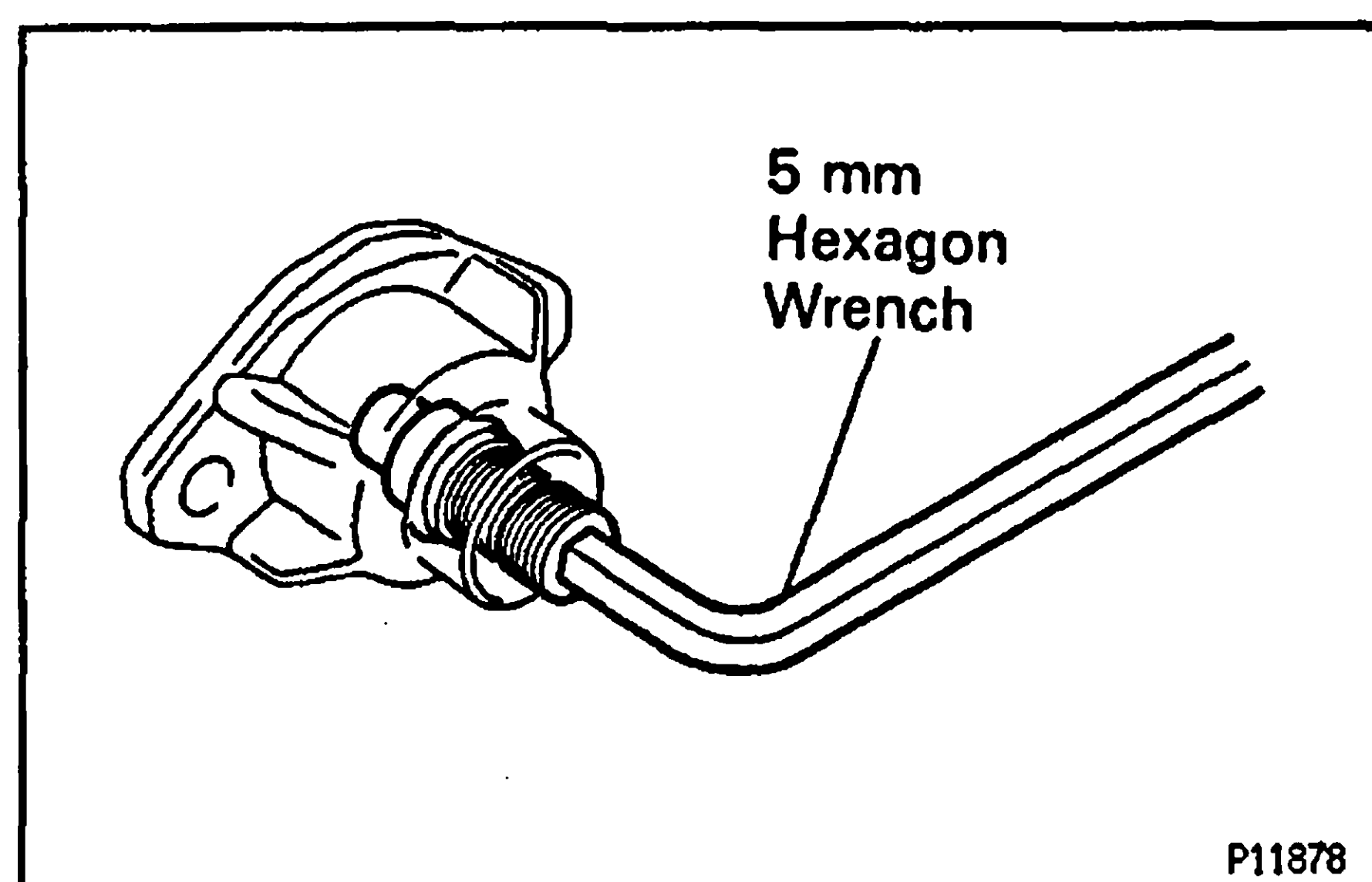
(b) Remove these parts:

- (1) LH timer cover, timer adjusting screw and nut assembly
- (2) O—ring
- (3) Shim
- (4) Outer spring
- (5) Inner spring
- (6) RH timer cover
- (7) O—ring
- (8) Piston
- (9) Sub—piston

(c) Remove the nut from the LH timer cover.

(d) Using a 5 mm hexagon wrench, remove the timer adjusting screw.

(e) Remove the O—ring from the timer adjusting ring.

**28. REMOVE FUEL FEED PUMP**

(a) Remove the 2 screws.

(b) Using a piece of wire, remove the feed pump cover.

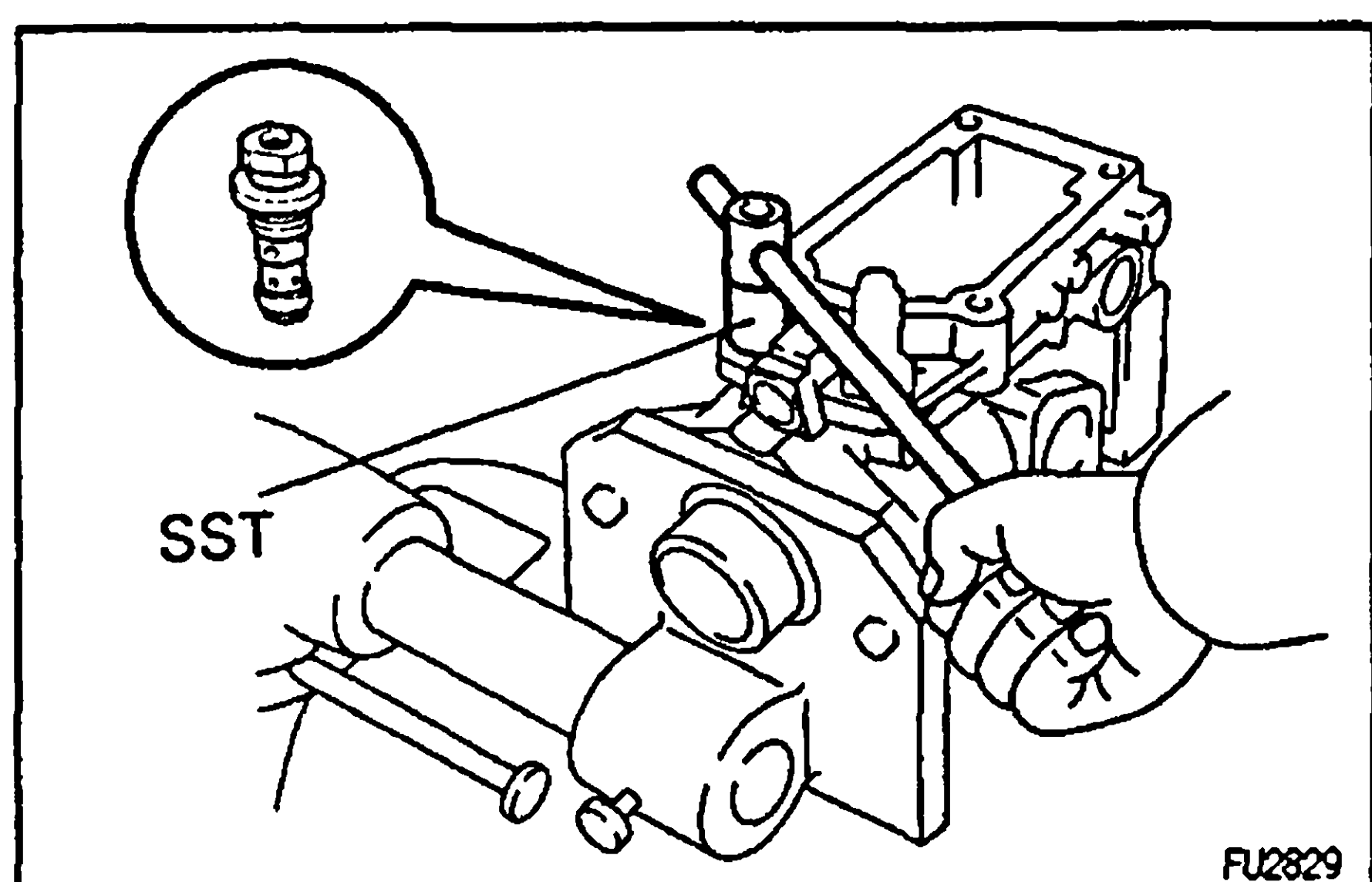
(c) Remove the feed pump rotor, 4 blades and liner.

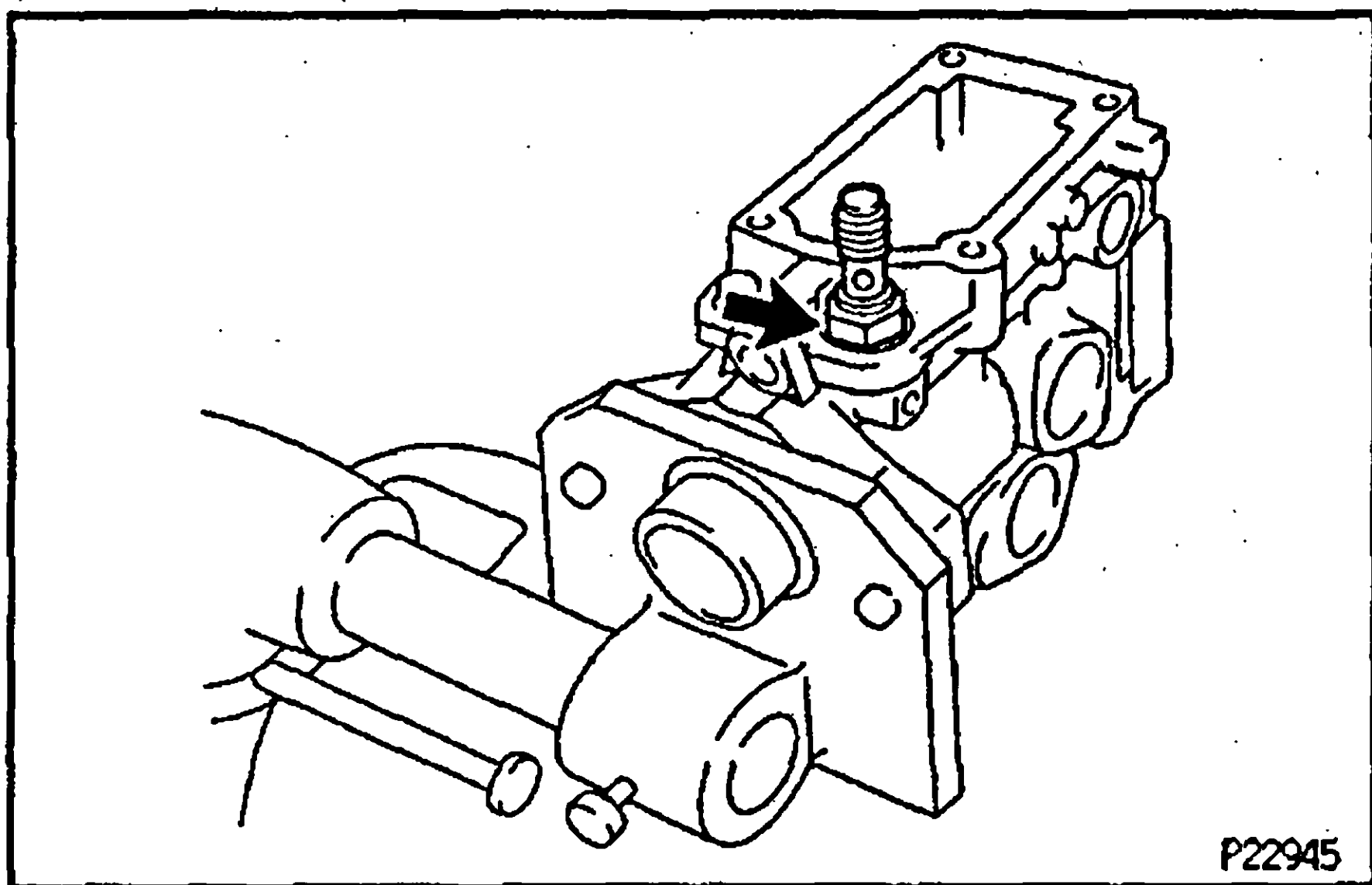
NOTICE:

- Be careful not to interchange the blade positions.
- Be careful not to damage the pump body.

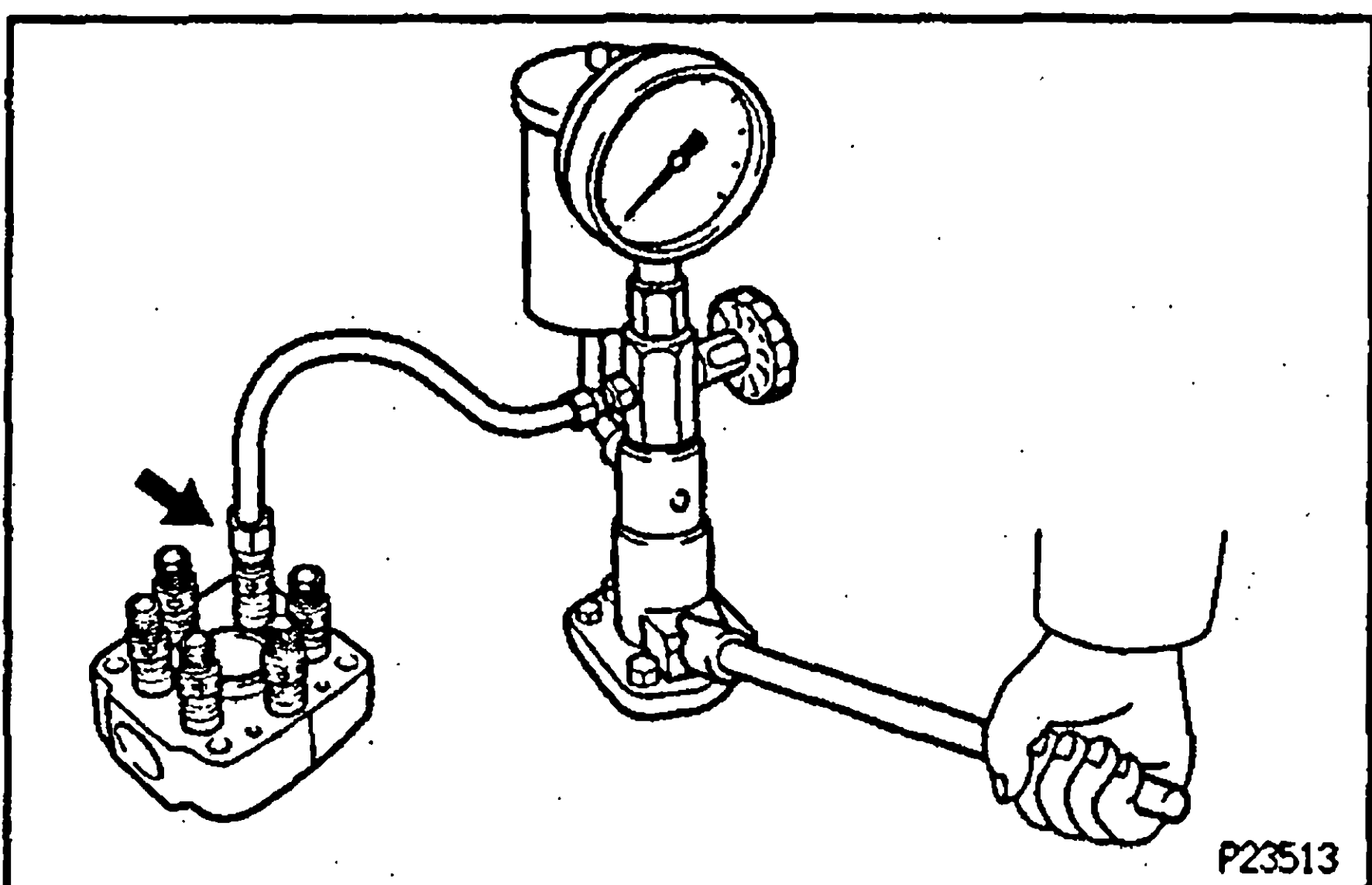
29. REMOVE REGULATOR VALVE

Using SST, remove the regulator valve and 2 O—rings.
SST 09260—54012 (09262—54020)



**30. REMOVE FUEL INLET HOLLOW SCREW**

Remove the hollow screw and gasket.

**INJECTION PUMP COMPONENTS INSPECTION****1. INSPECT DELIVERY VALVES**

- (a) Attach the nozzle tester to the delivery valve holder of the pipe you wish to measure.
- (b) Use the nozzle tester to check the valve opening pressure of the delivery valve.

Standard valve opening pressure:

7,350 — 8,330 kPa

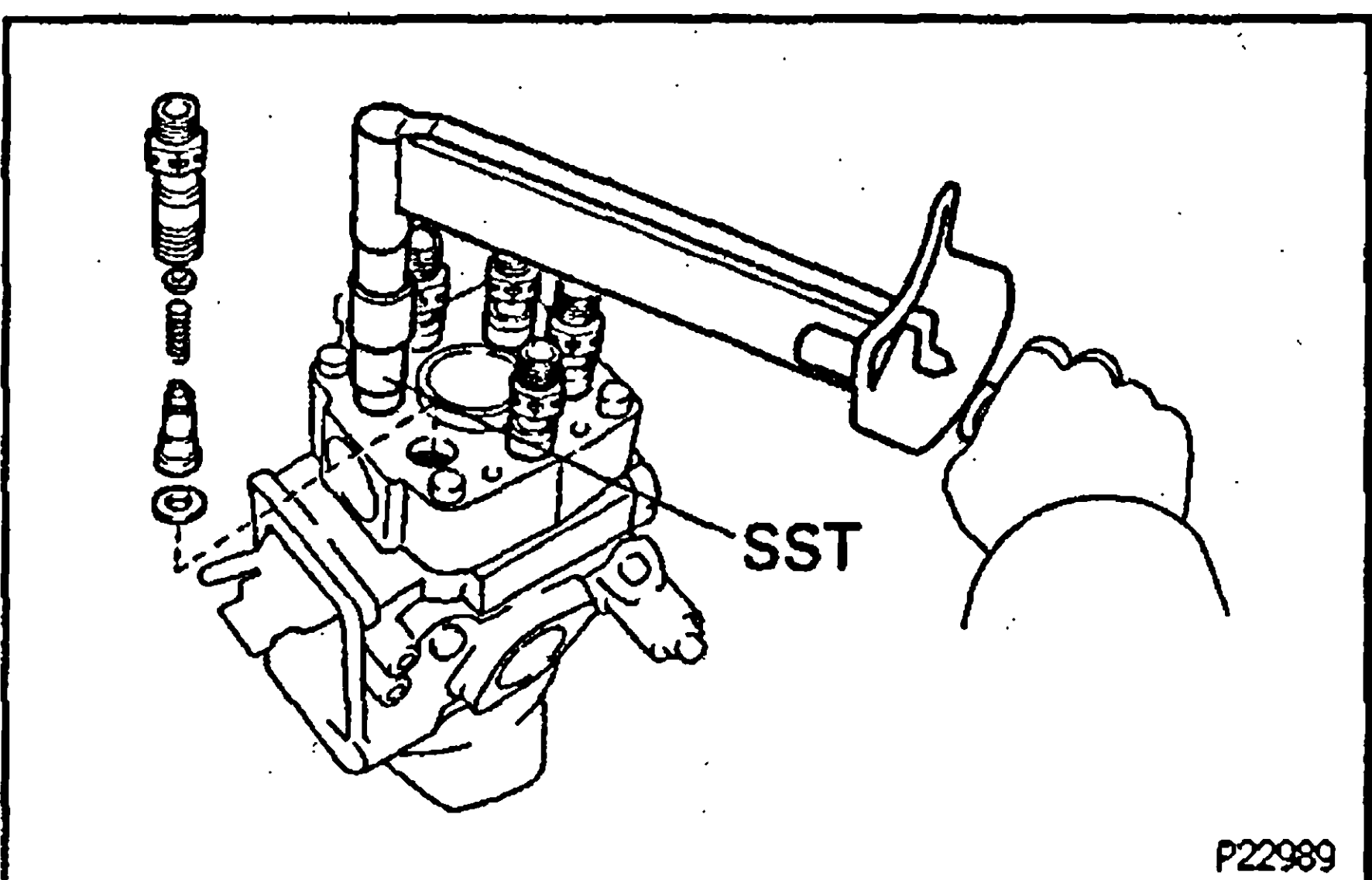
(75 — 85 kgf/cm², 1,067 — 1,209 psi)

If the valve opening pressure of the delivery valve is not within specification, replace the delivery valve assembly.

SST 09260—54012 (09269—54020)

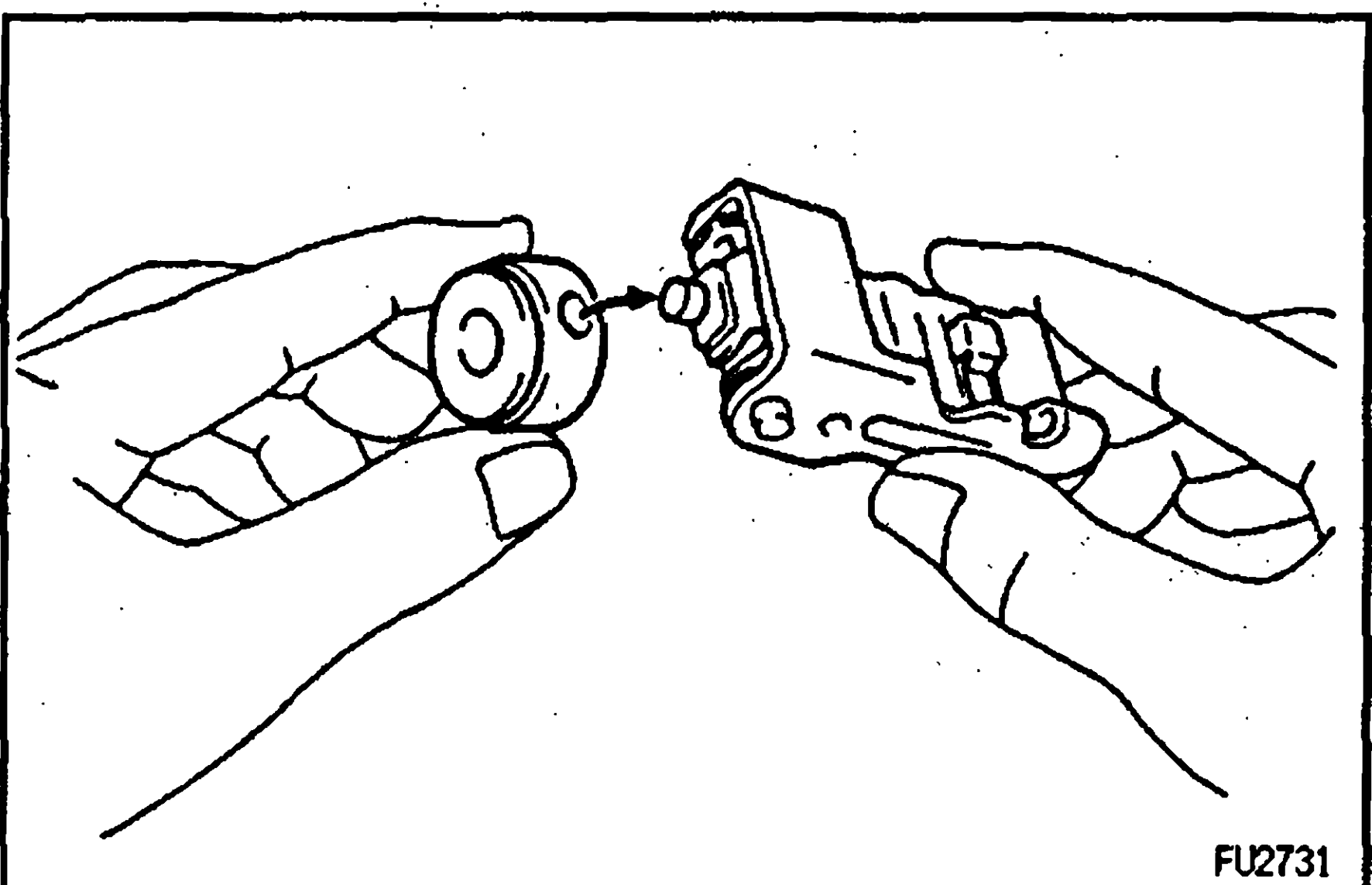
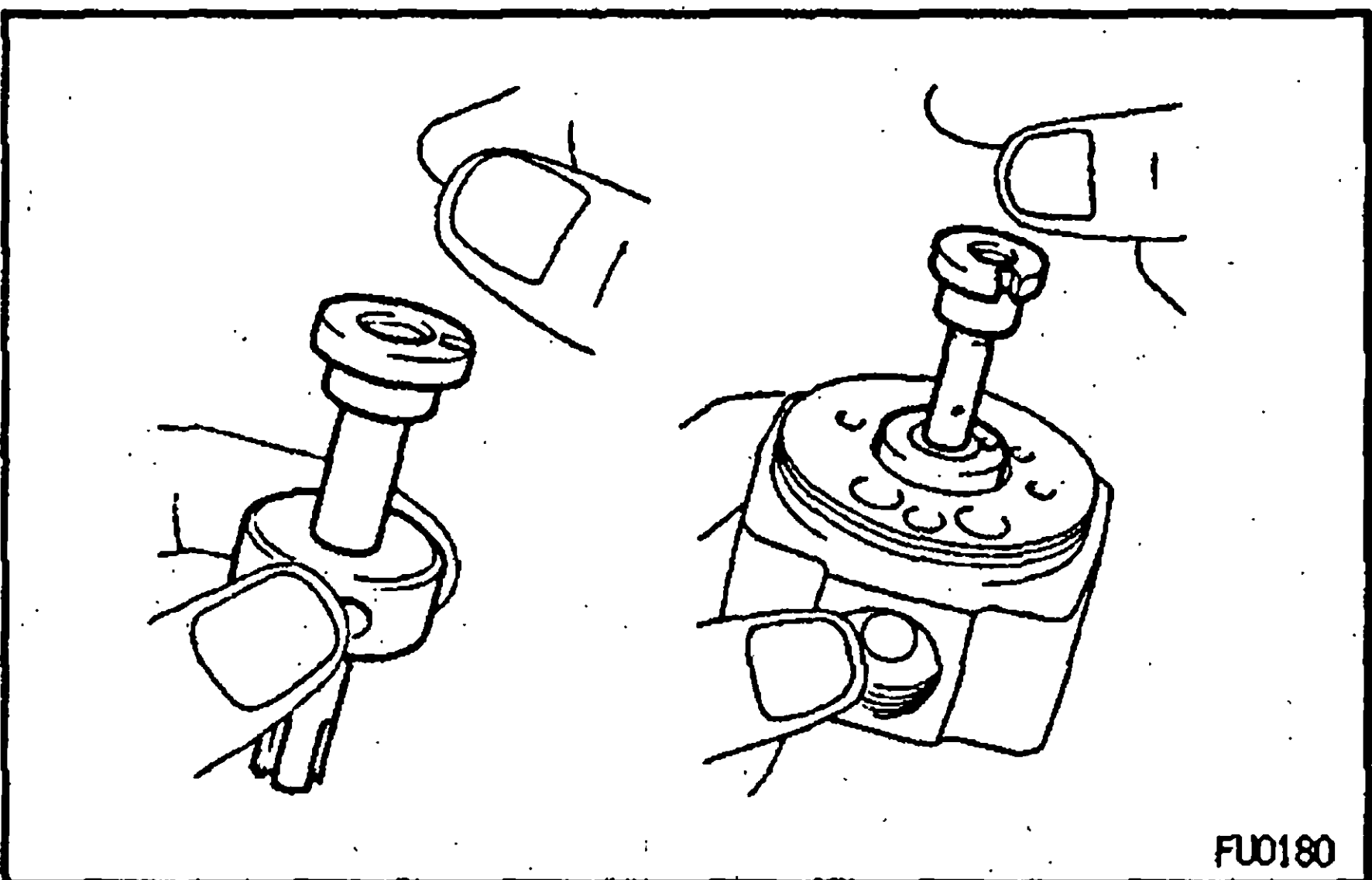
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)

NOTICE: Do not lose the steel ball when doing an overhaul.

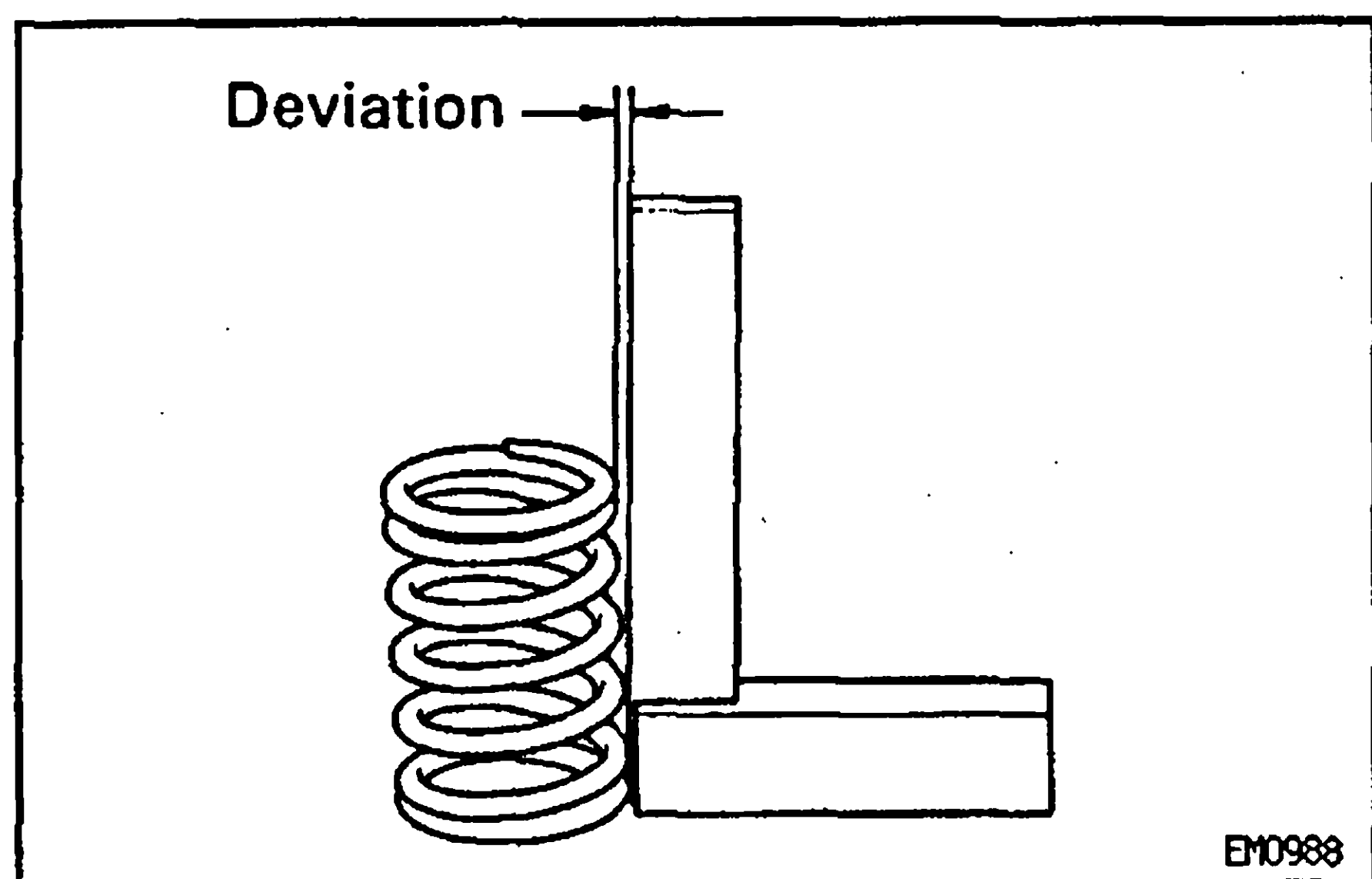
**2. INSPECT PUMP PLUNGER, SPILL RING AND DISTRIBUTIVE HEAD**

- (a) Tilt the spill ring (distributive head) slightly and pull out the plunger.
- (b) When released, the plunger should sink down smoothly into the spill ring (distributive head) by its own weight.
- (c) Rotate the plunger and repeat the test at various positions.

If the plunger sticks at any position, replace the parts as a set.



- (d) Insert the governor link ball pin into the spill ring and check that it moves smoothly without any play.



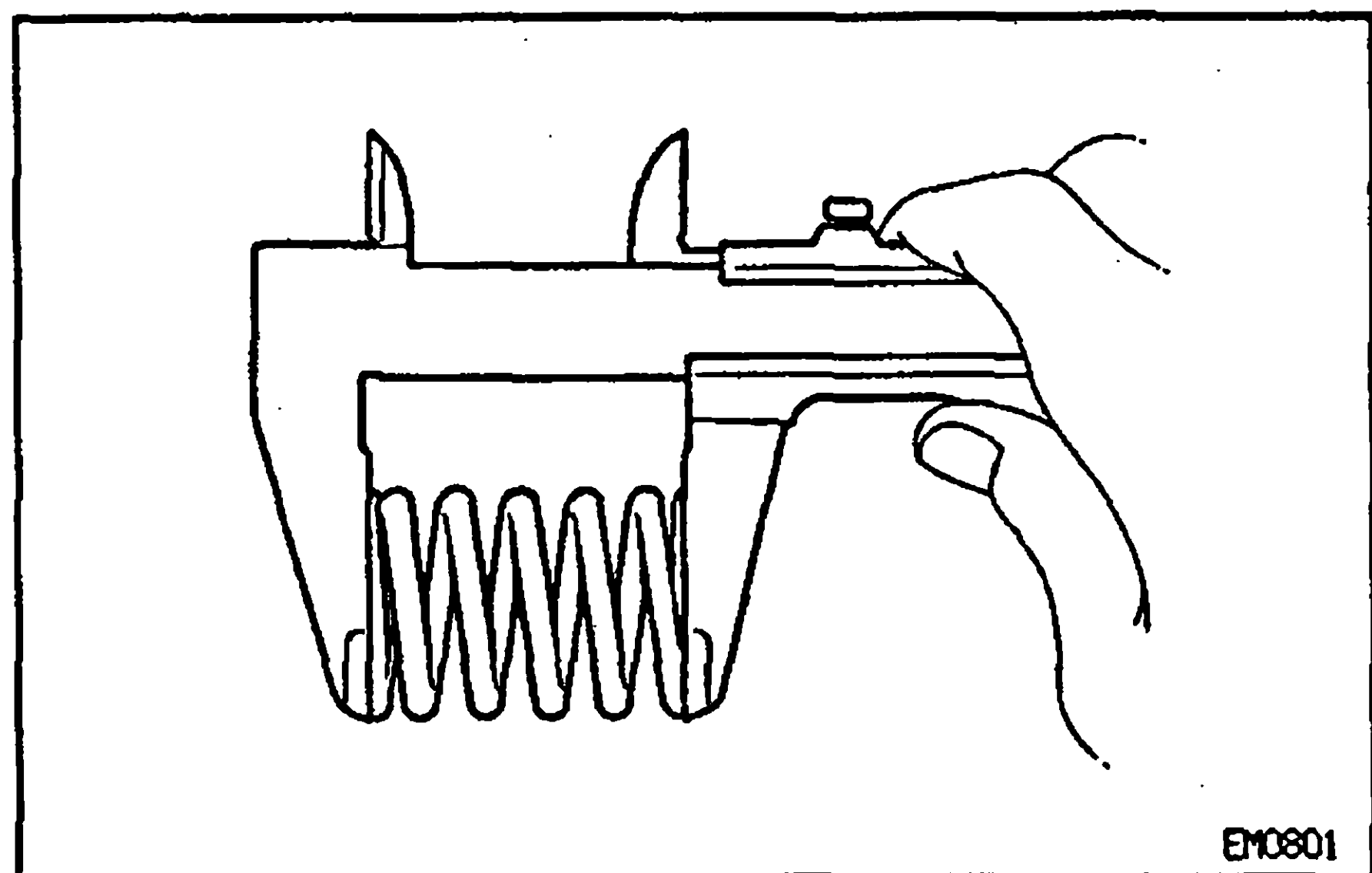
3. INSPECT PLUNGER SPRINGS FOR DEVIATION

Using a steel square, check the deviation of the plunger springs.

Maximum deviation:

2.0 mm (0.079 in.)

If deviation is greater than maximum, replace the springs.



4. INSPECT SPRING LENGTH

Using vernier calipers, measure the free length of each spring.

Spring free length:

Delivery valve spring

12.6 mm (0.496 in.)

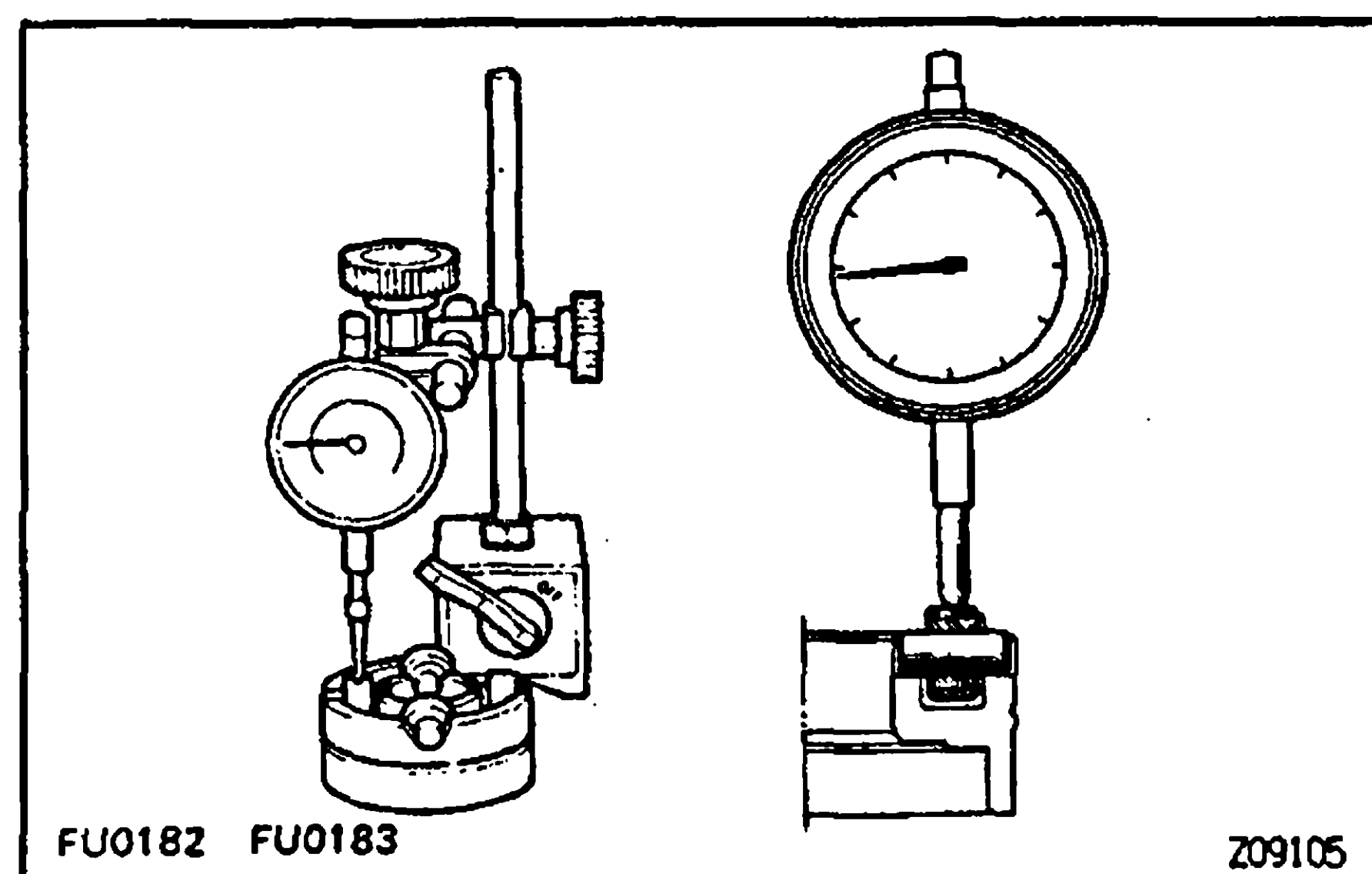
Plunger spring

34.09 mm (1.342 in.)

Boost compensator spring

19.4 mm (0.764 in.)

If the free length is not as specified, replace the spring(s).



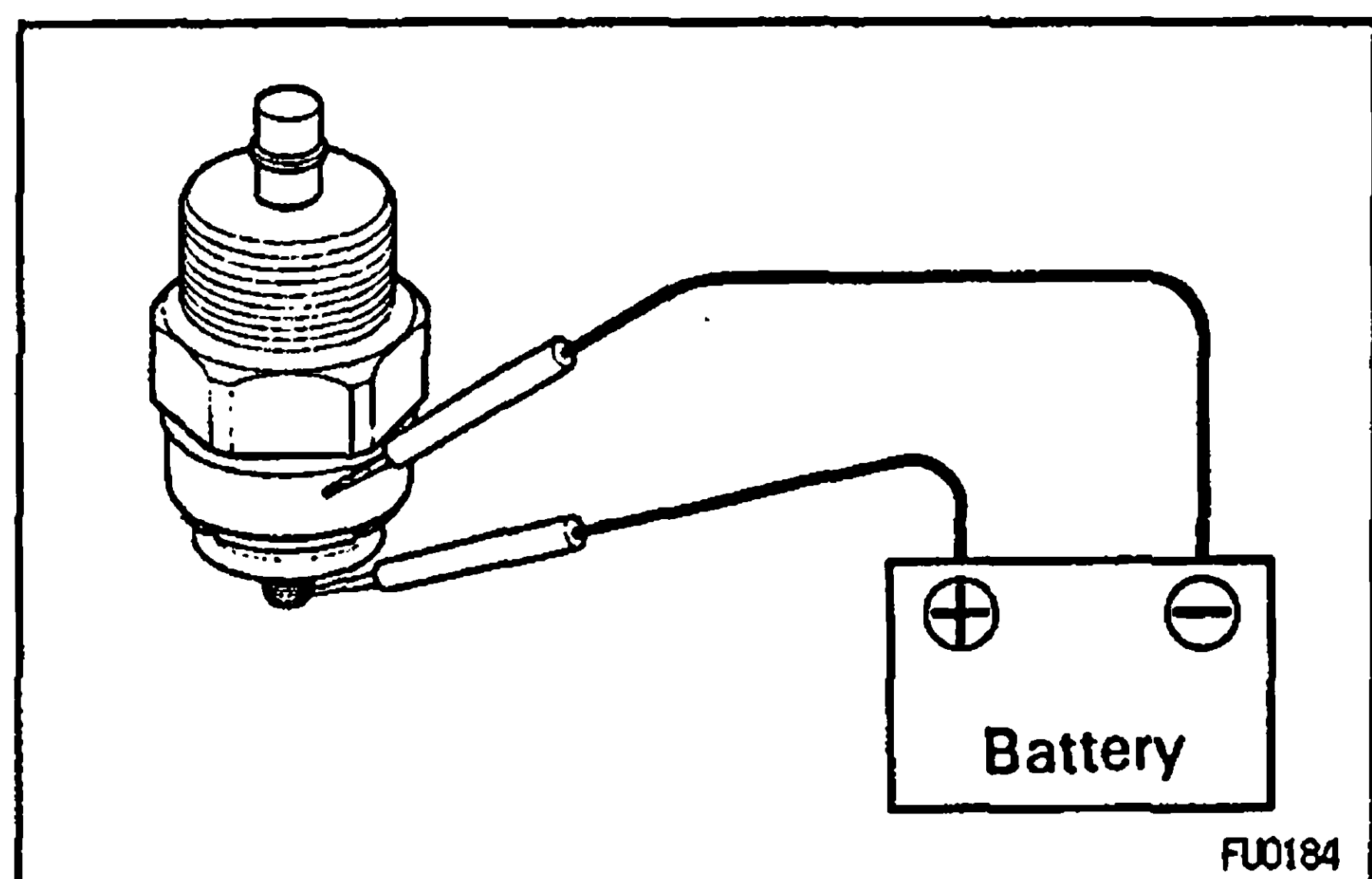
5. INSPECT ROLLER RING AND ROLLERS

Using a dial indicator, measure the roller height.

Maximum roller height variation:

0.02 mm (0.0008 in.)

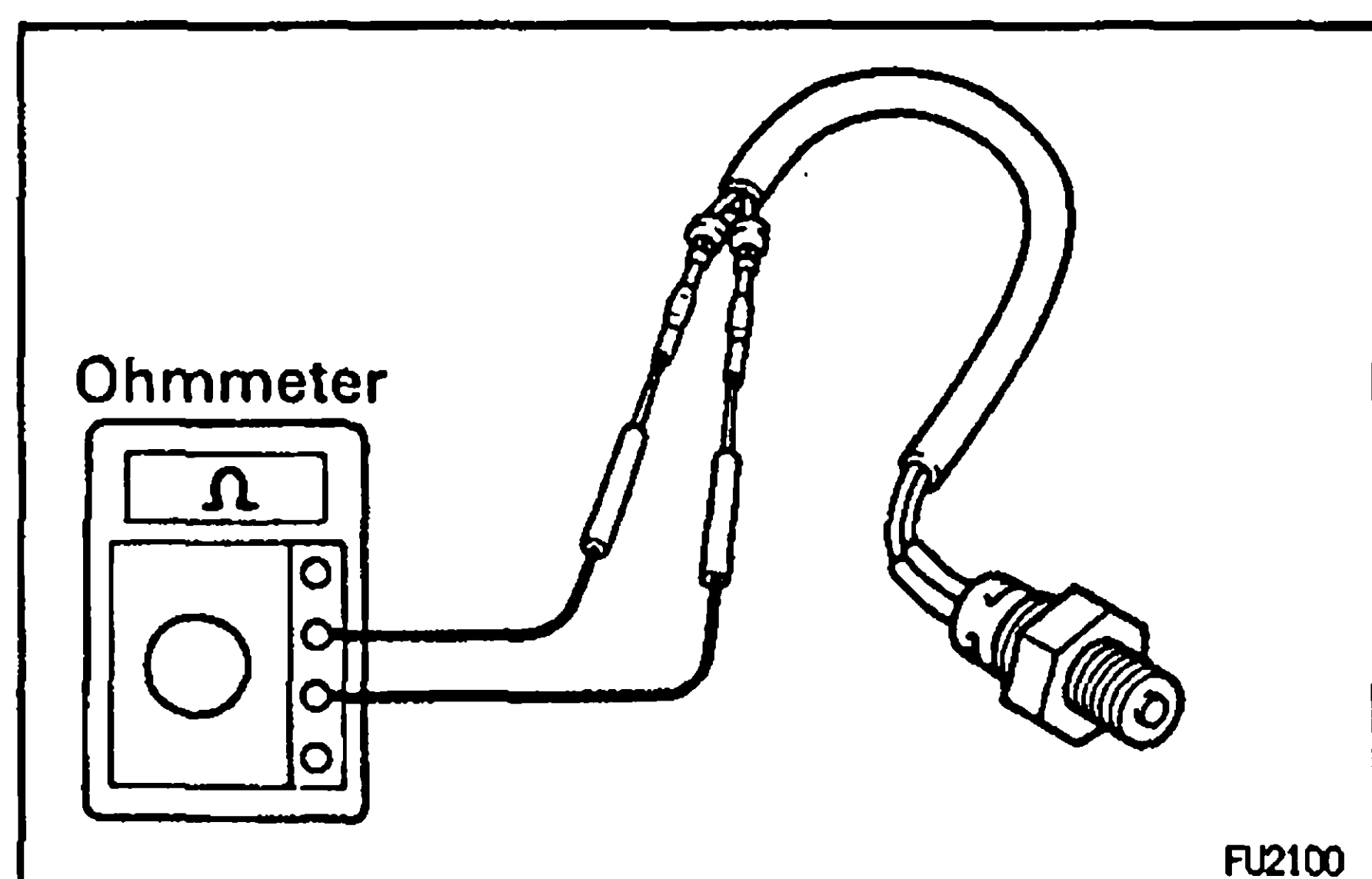
If the variation is greater than specification, replace the roller ring and roller as a set.



6. INSPECT FUEL CUT SOLENOID

(a) Connect the solenoid valve body and terminal to the battery terminals.

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



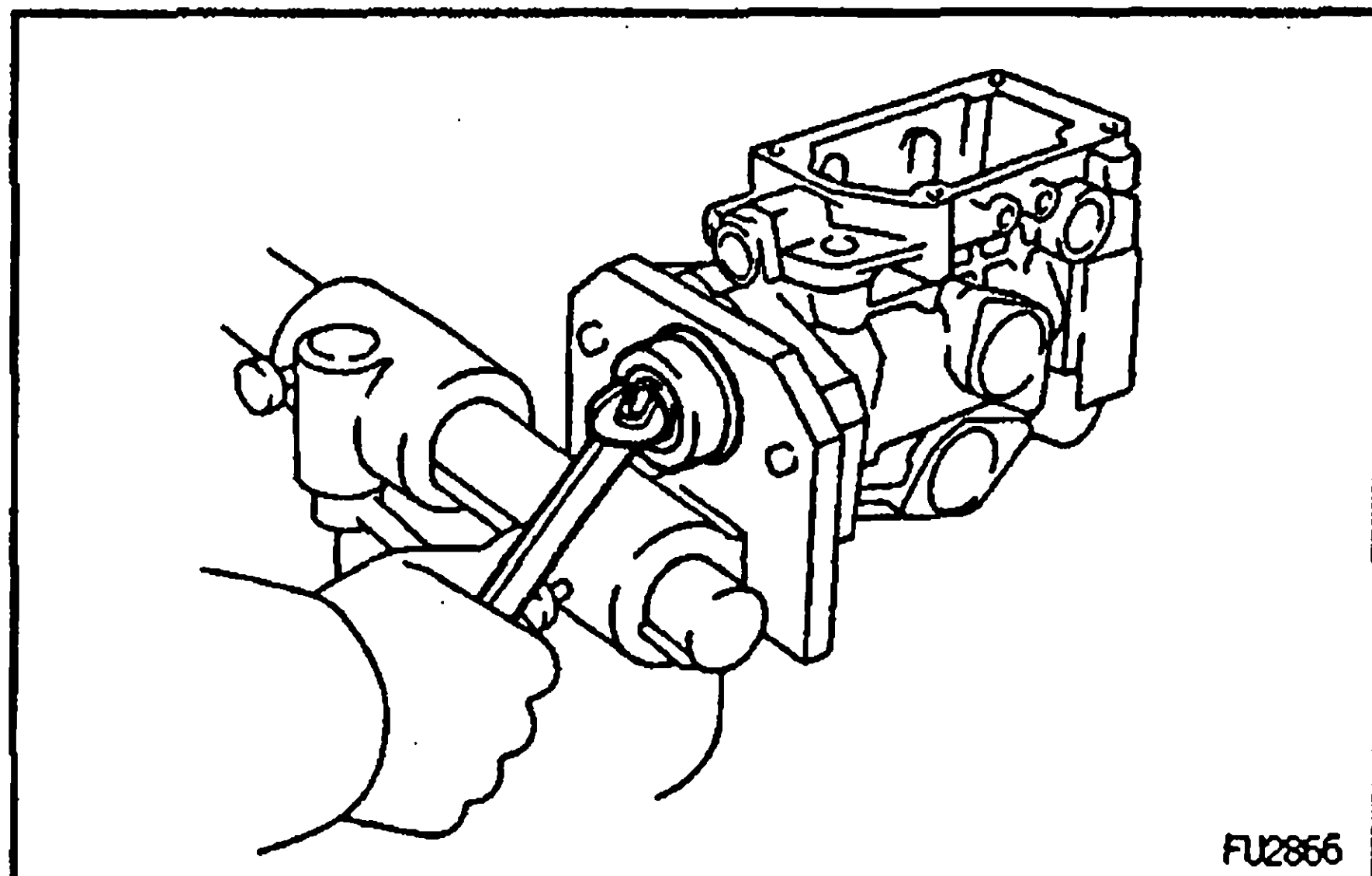
7. INSPECT PICKUP SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

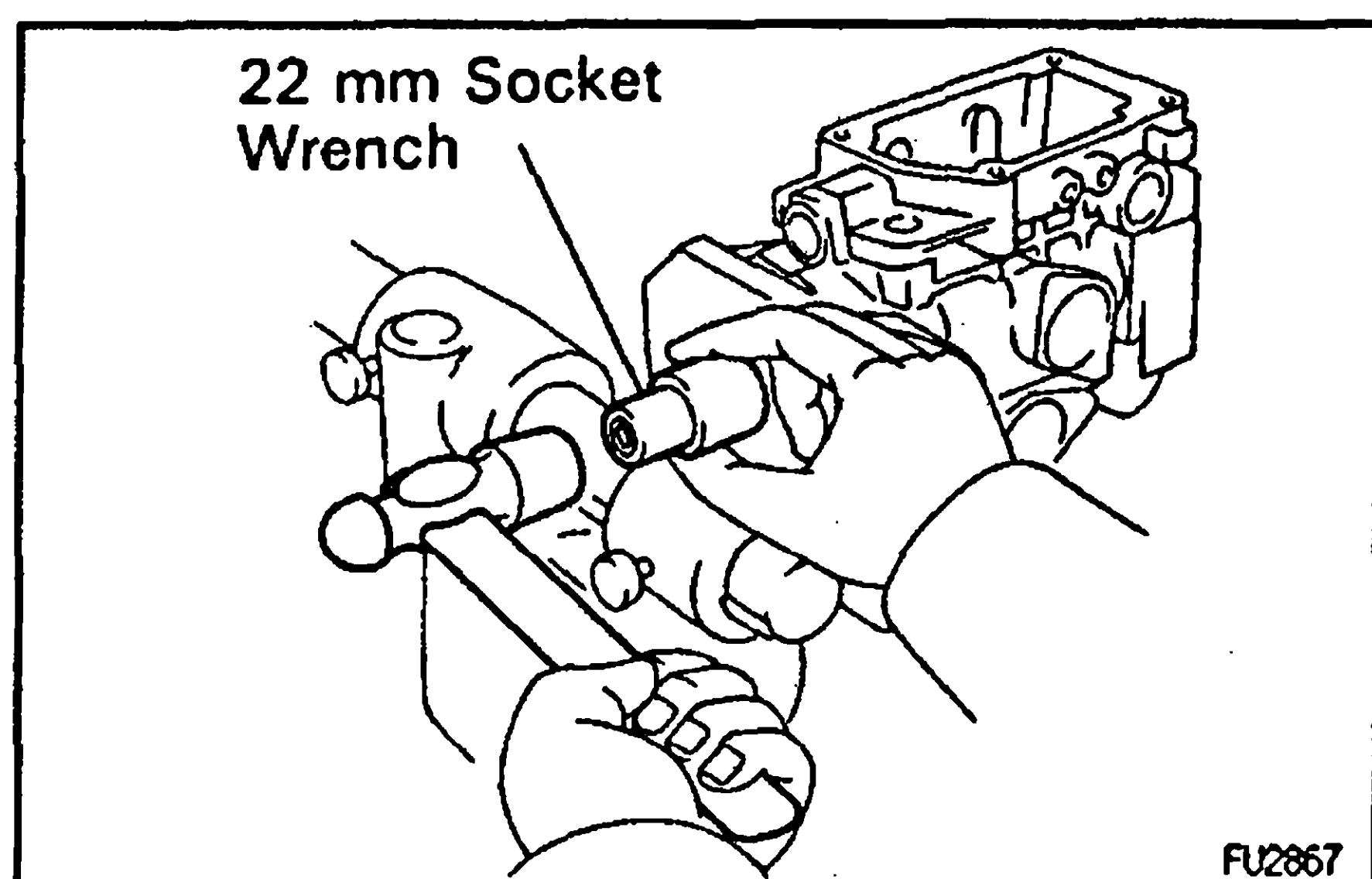
650 — 970 Ω

If resistance is not as specified, replace the sensor.

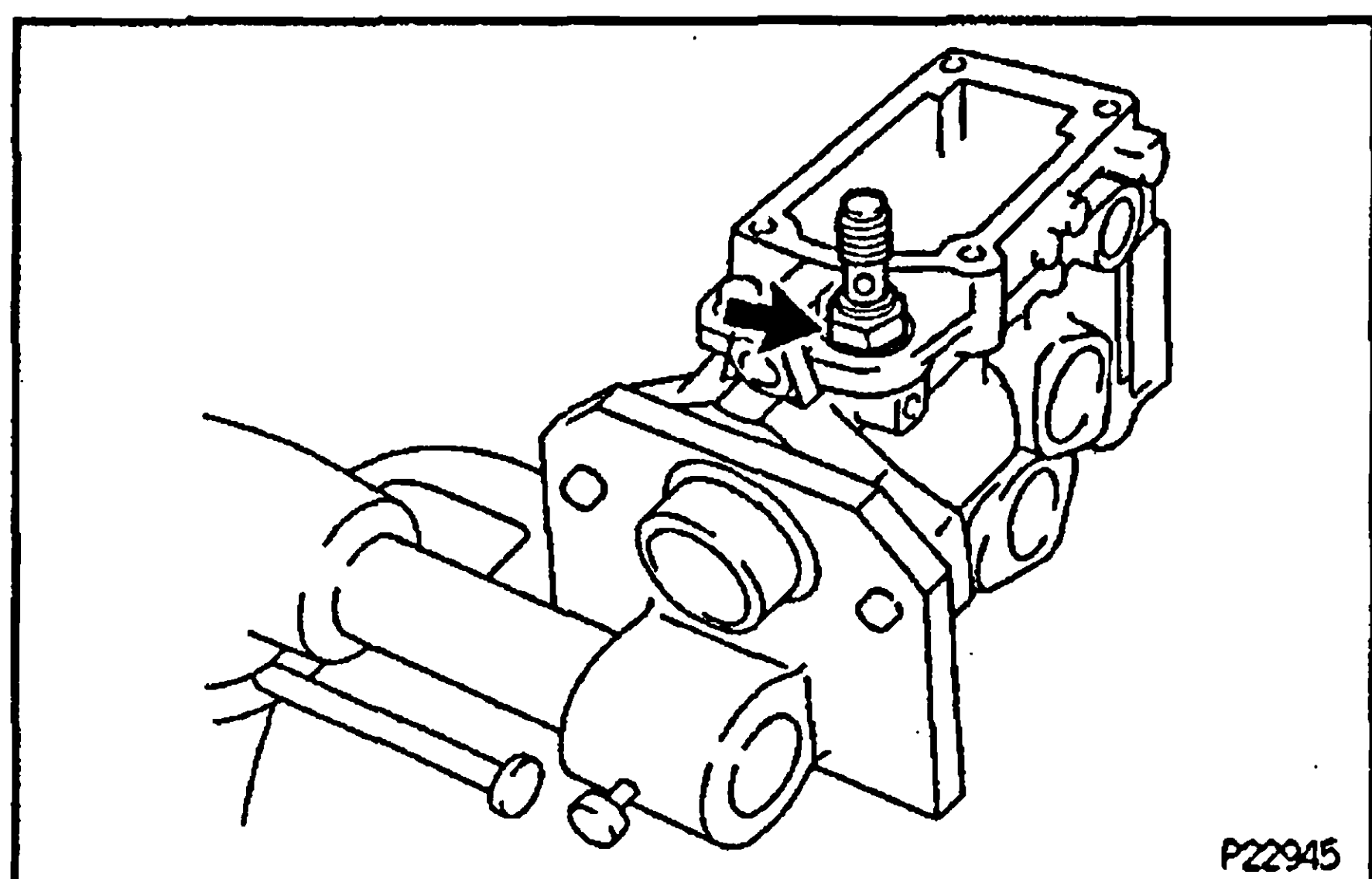


8. IF NECESSARY, REPLACE OIL SEAL

- (a) Using a wrench, pry out the oil seal.
NOTICE: Be careful not to damage to the pump body.



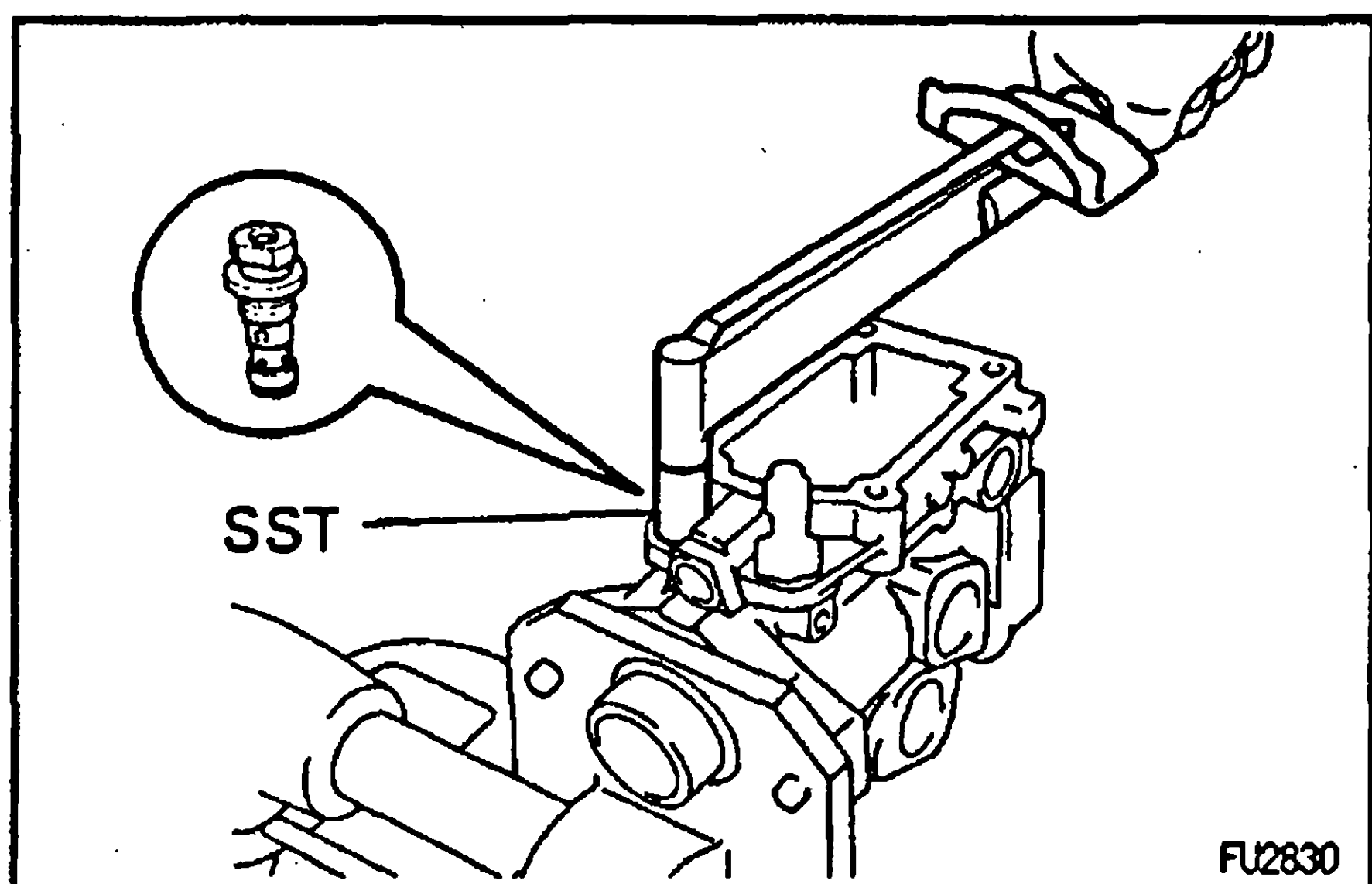
- (b) Apply MP grease to the lip of a new oil seal.
 (c) Using a 22 mm socket wrench, tap in the oil seal until its surface is flush with the pump housing.



INJECTION PUMP ASSEMBLY

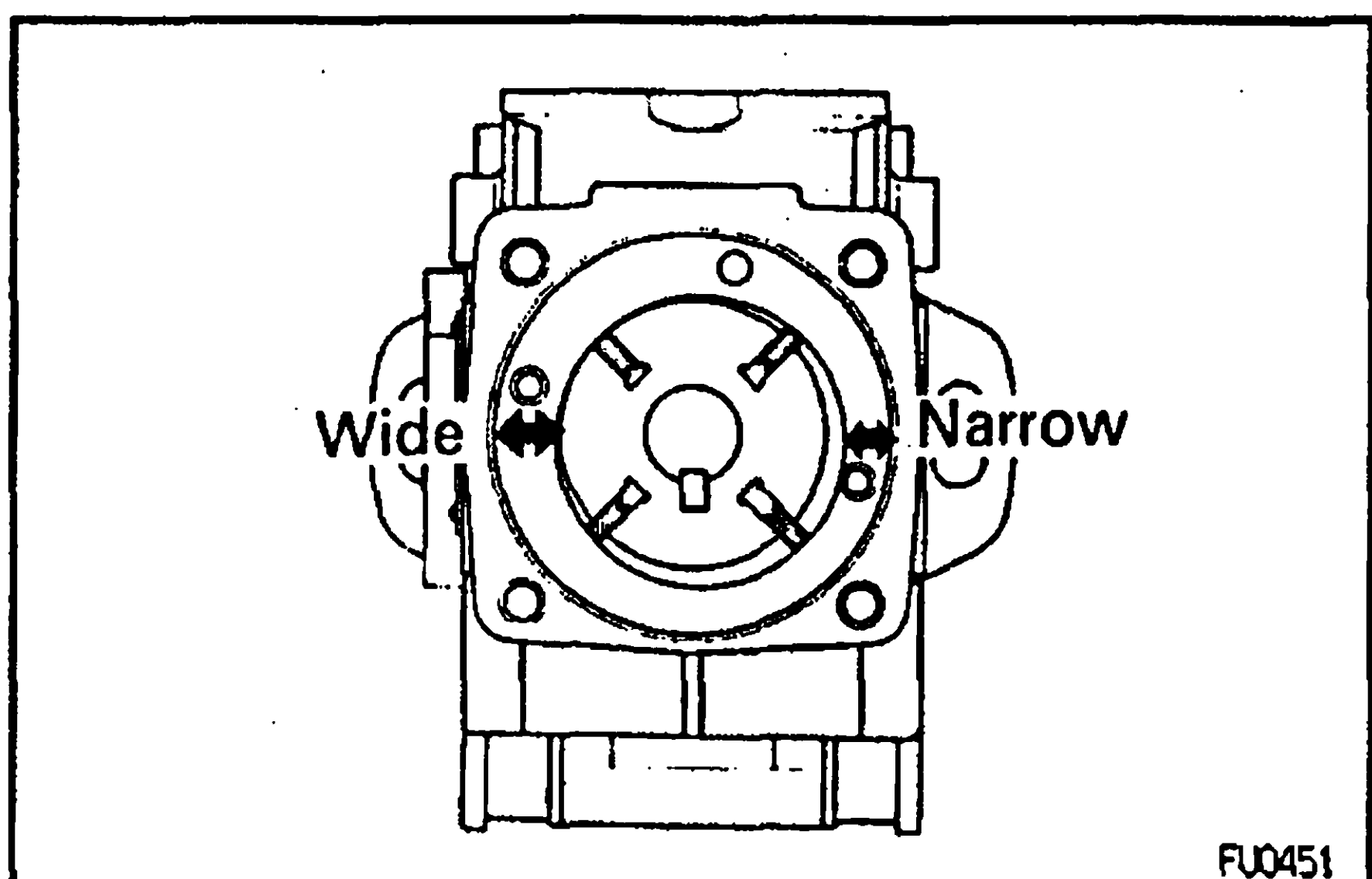
1. INSTALL FUEL INLET HOLLOW SCREW

Install a new gasket and the hollow screw.
 Torque: 37 N·m (375 kgf·cm, 27 ft·lbf)



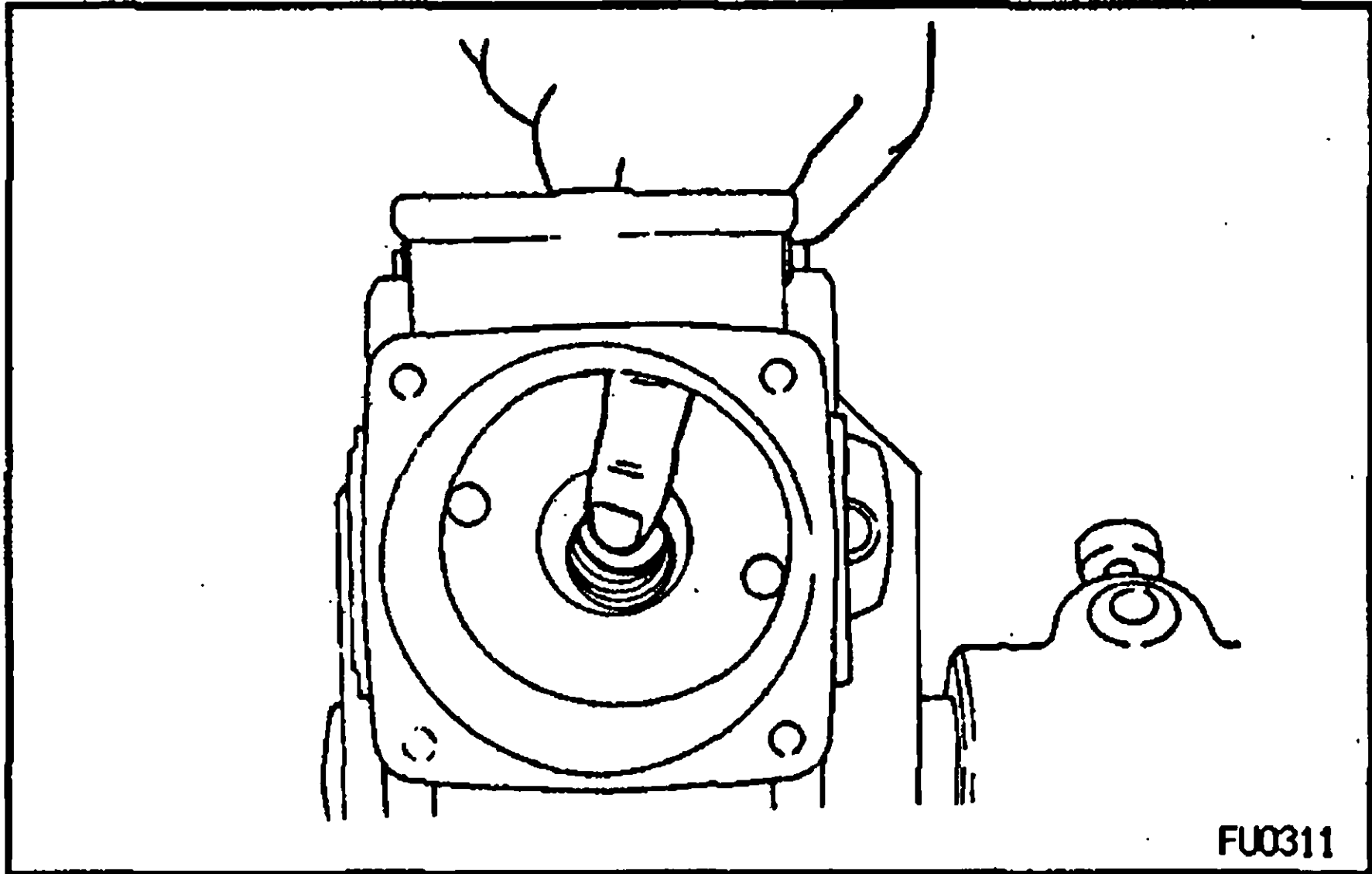
2. INSTALL REGULATOR VALVE

- (a) Install 2 new O-rings to the regulator valve.
 (b) Using SST, install the regulator valve.
 SST 09260-54012 (09262-54020)
 Torque: 8.8 N·m (90 kgf·cm, 78 in·lbf)

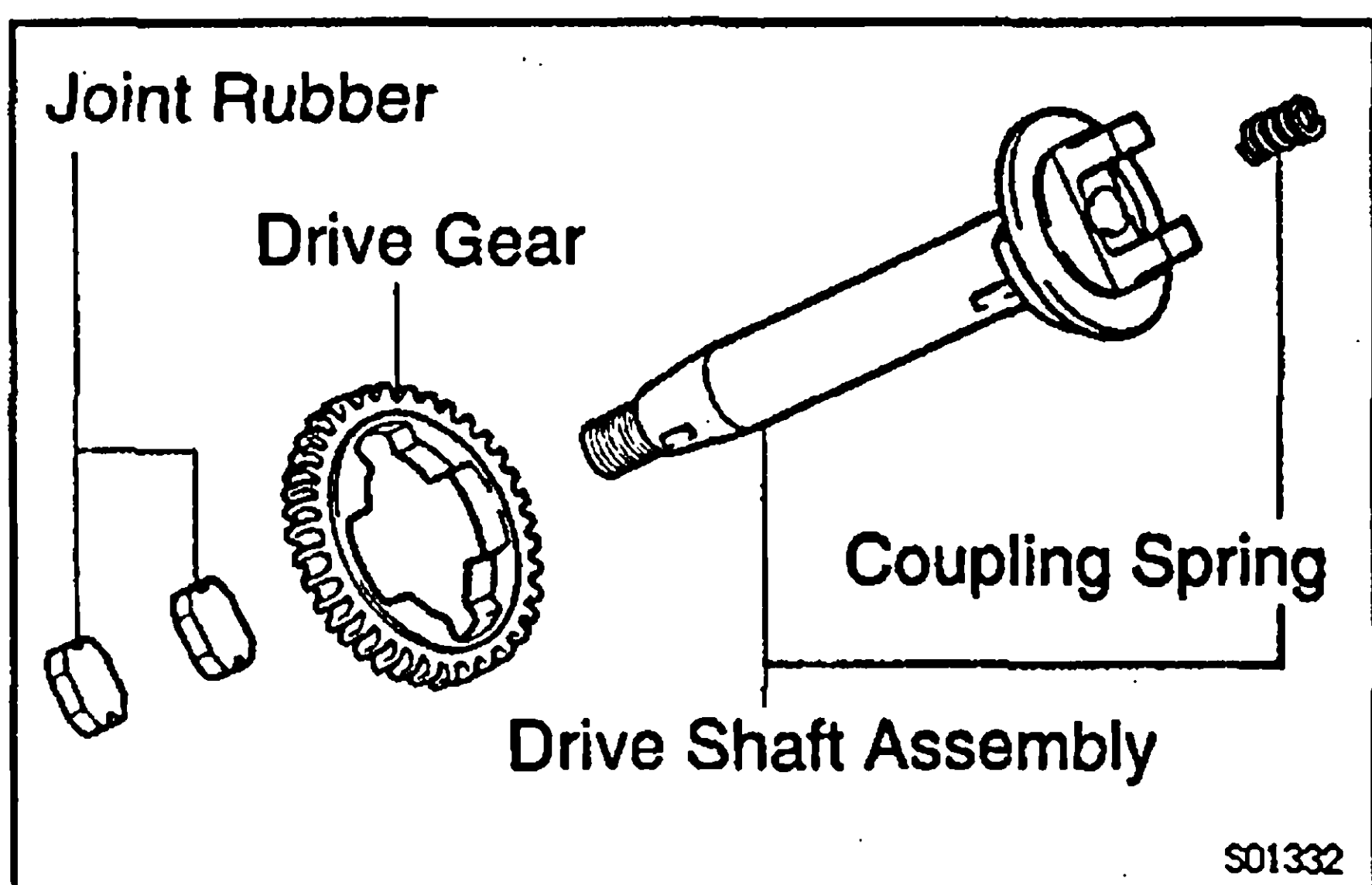


3. INSTALL FUEL FEED PUMP

- (a) Install the liner, rotor and 4 blades.
 (b) Check that the liner and blades are facing in the correct direction, as shown.
 (c) Check that the blades move smoothly.
 (d) Align the fuel outlet holes of the cover and liner.
 (e) Install the pump cover with the 2 screws.
 Torque: 3.0 N·m (31 kgf·cm, 27 in·lbf)



- (f) Check that the rotor moves smoothly.

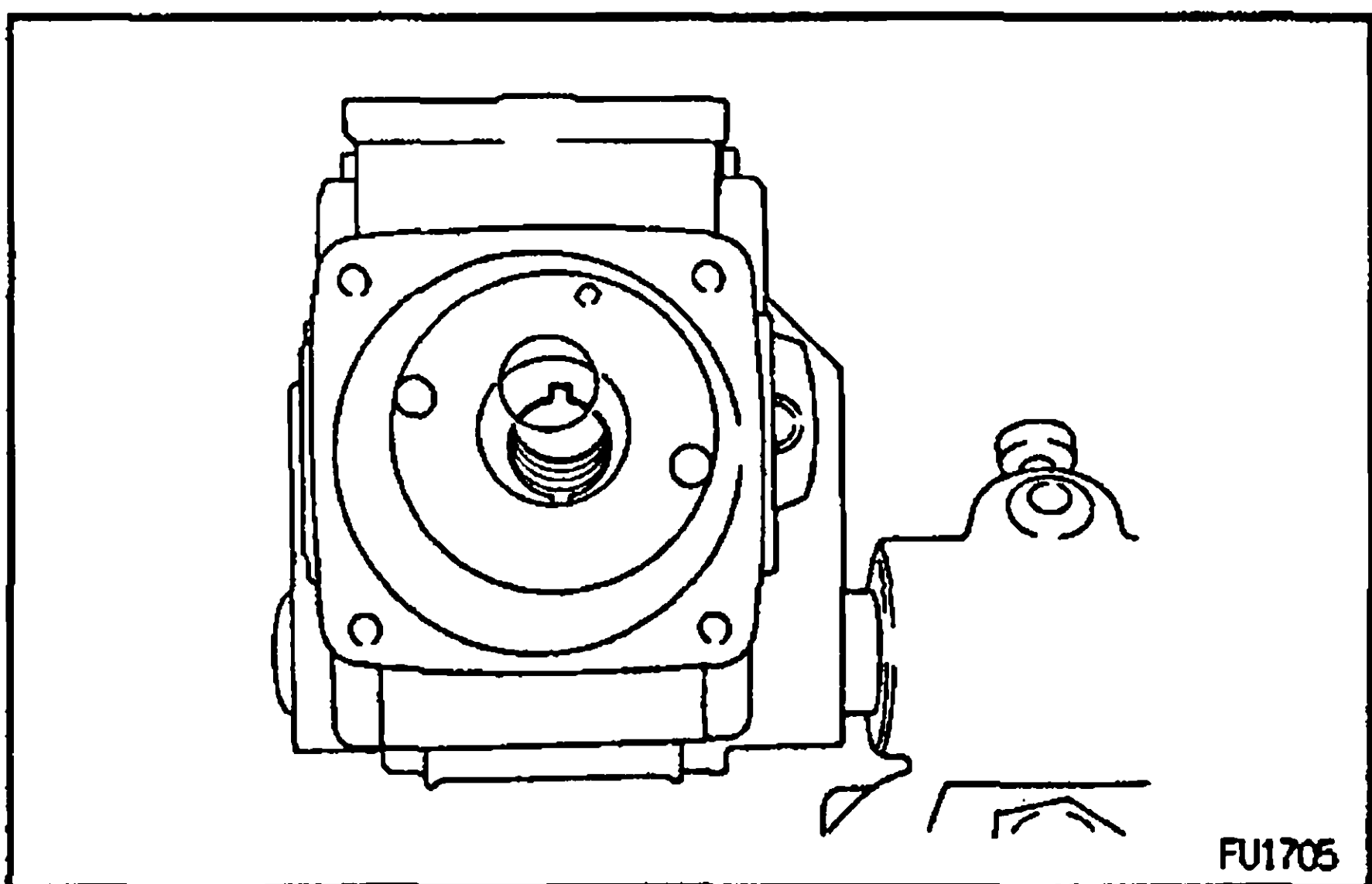


4. INSTALL DRIVE SHAFT

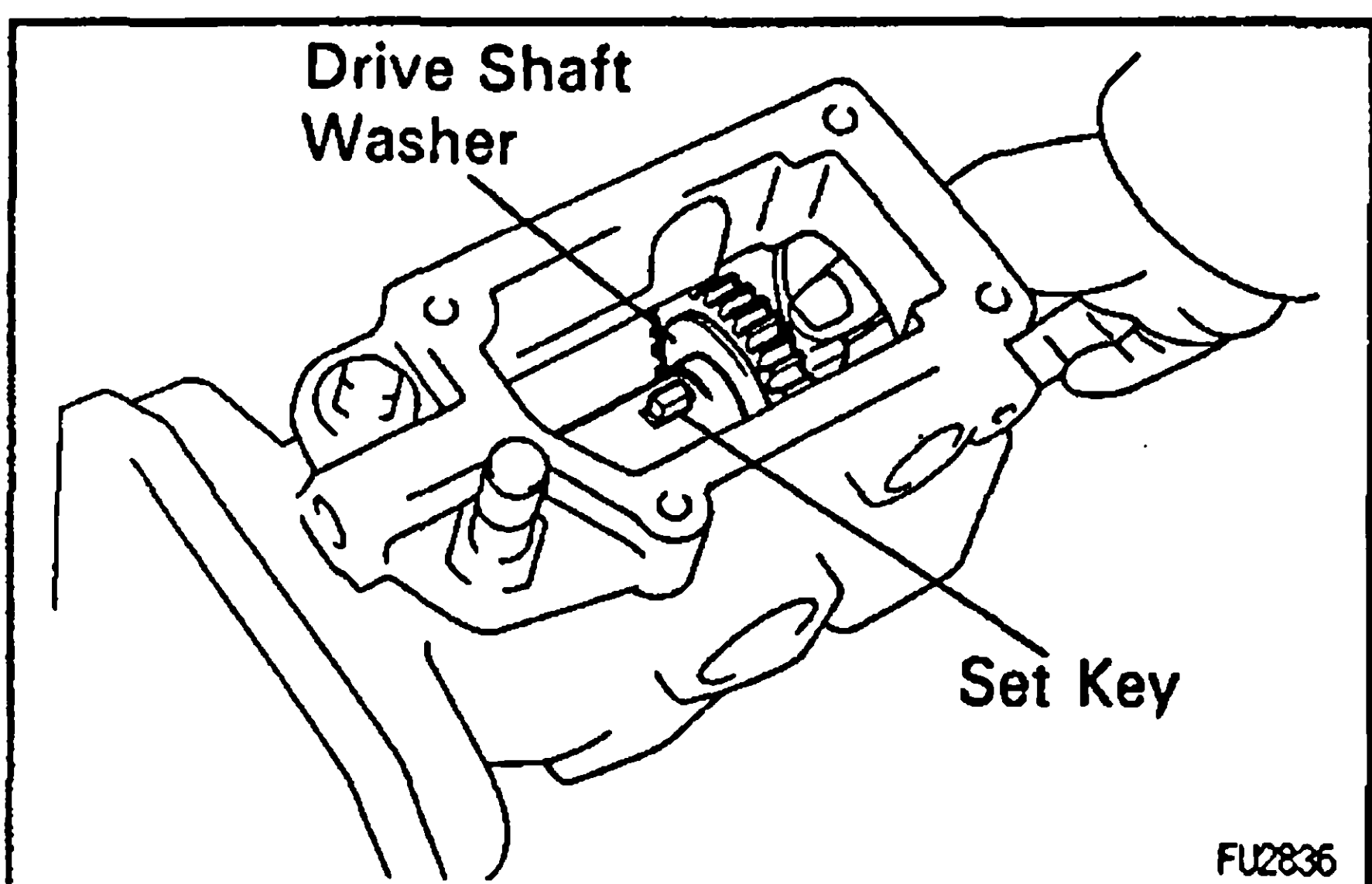
- (a) Install the drive gear on the drive shaft assembly as shown.

NOTICE: If the coupling spring is removed from the drive shaft, install a new coupling spring.

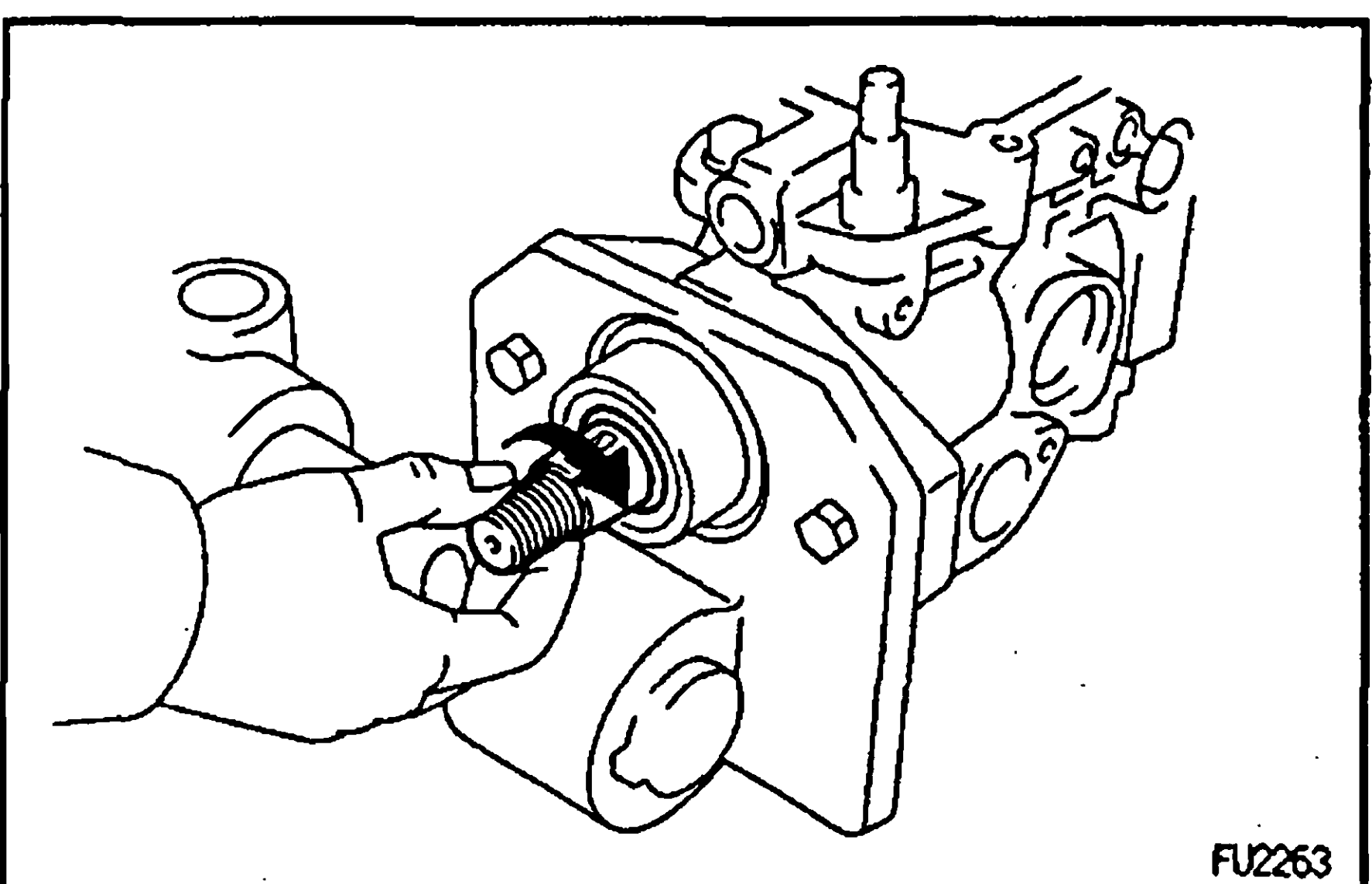
- (b) Install 2 new joint rubbers into the drive gear.



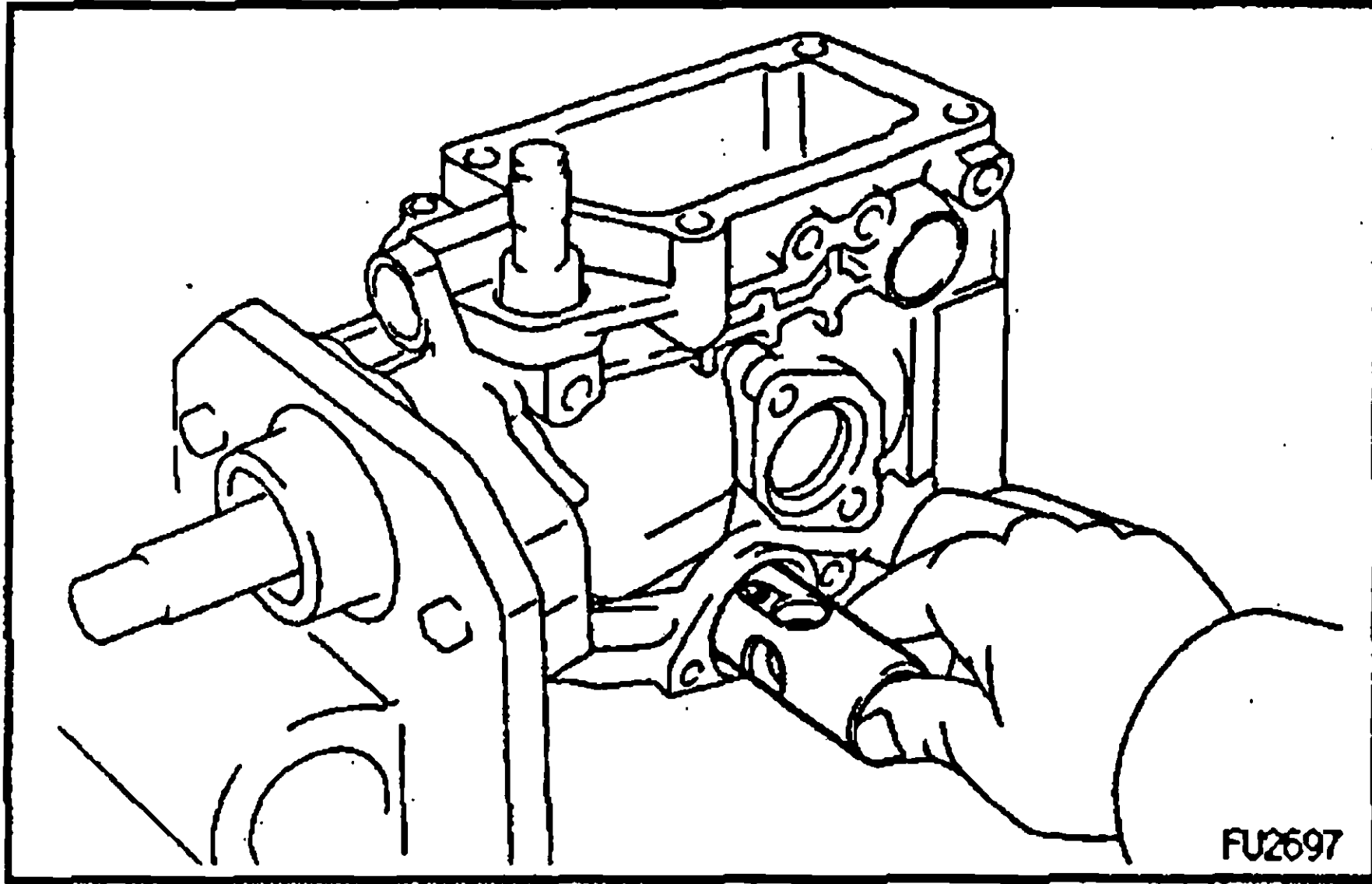
- (c) Position the key groove of the feed pump rotor upward.



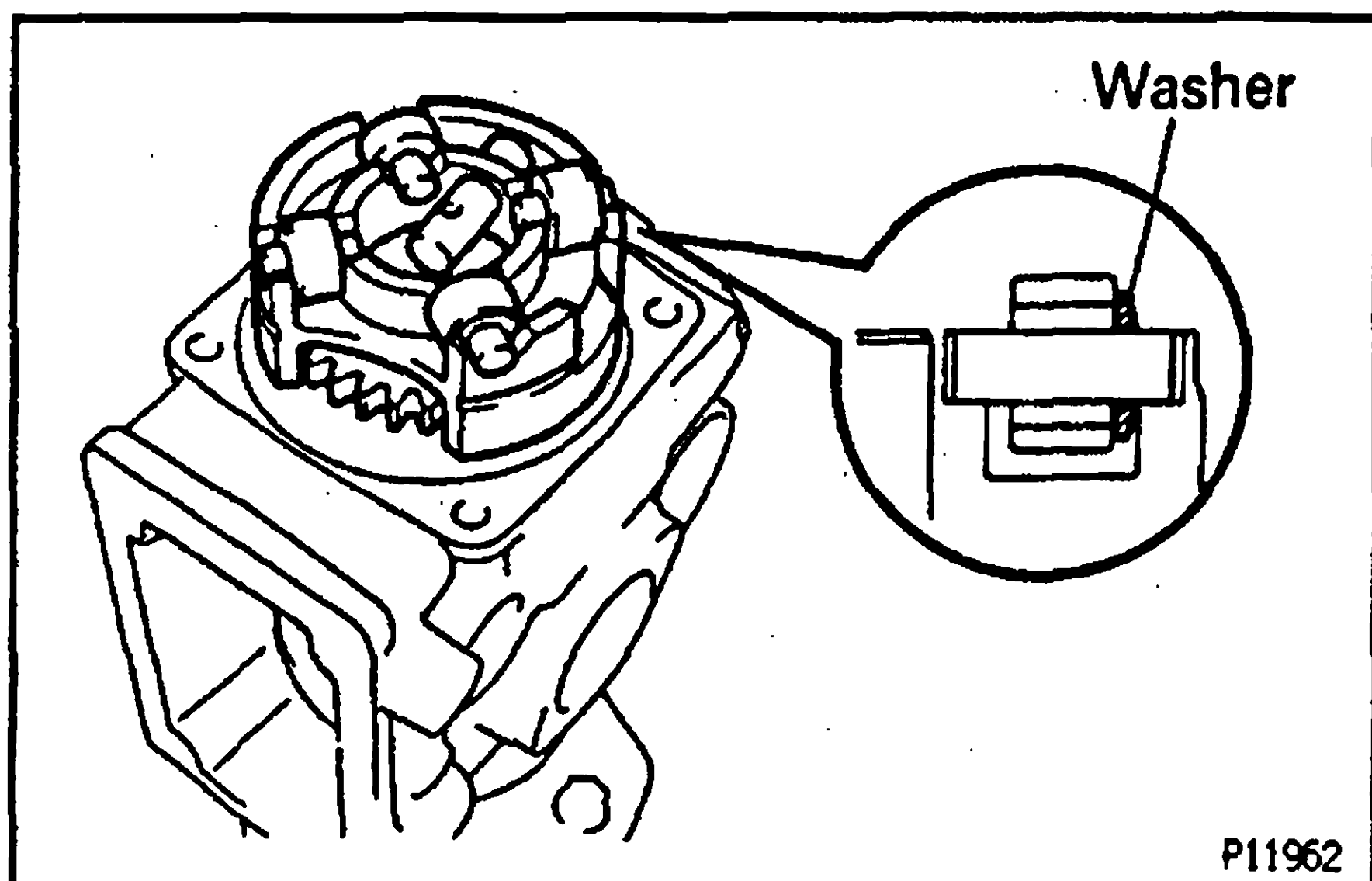
- (d) Install the drive shaft washer and set key on the drive shaft and insert the drive shaft assembly into the pump housing.



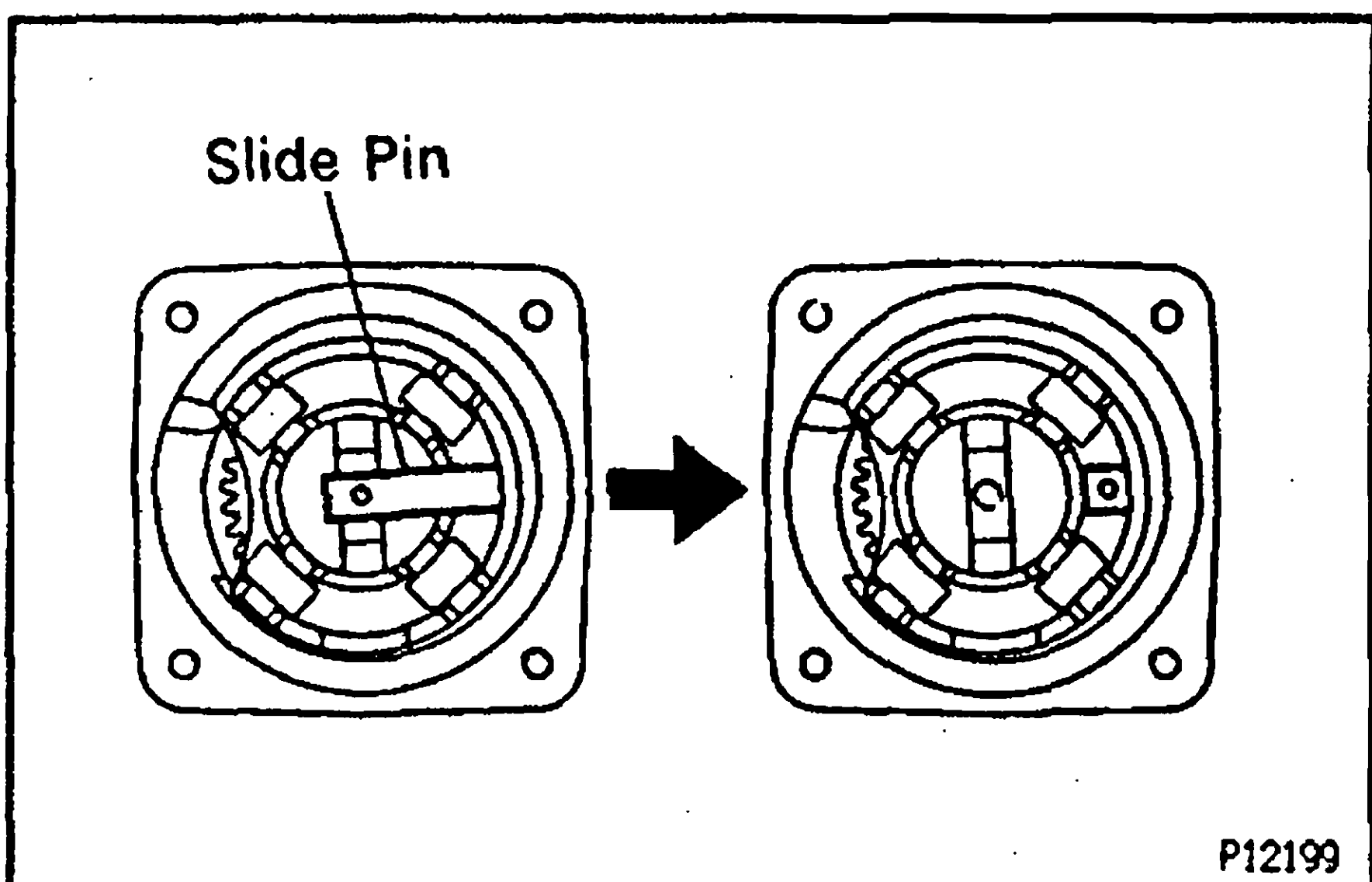
- (e) Check that the drive shaft turns without catching.

**5. INSTALL TIMER PISTON**

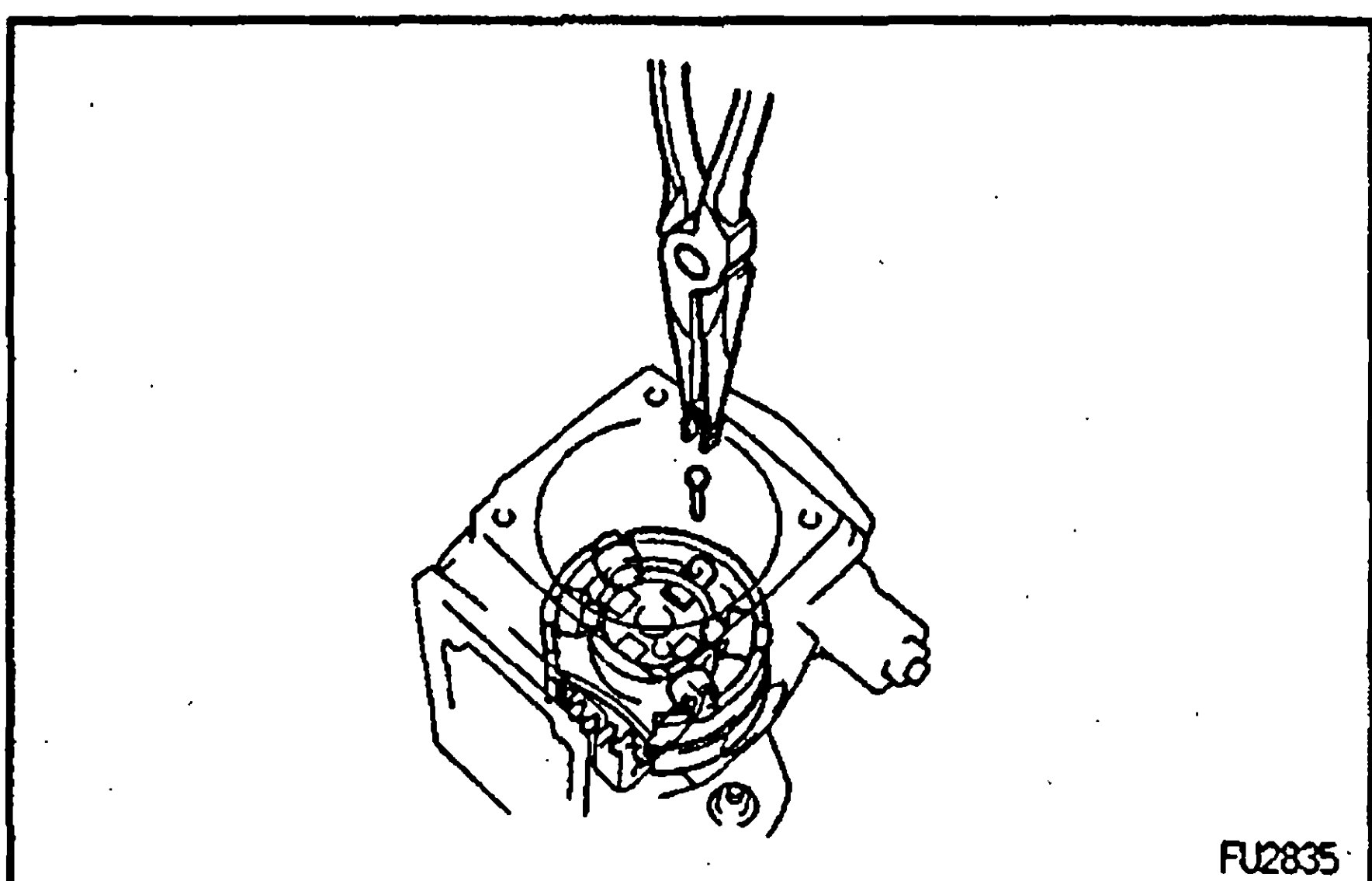
- (a) Apply grease to the timer piston.
- (b) Install the sub—piston into the timer piston.
- (c) Insert the timer piston into the pump housing.

**6. INSTALL ROLLER RING**

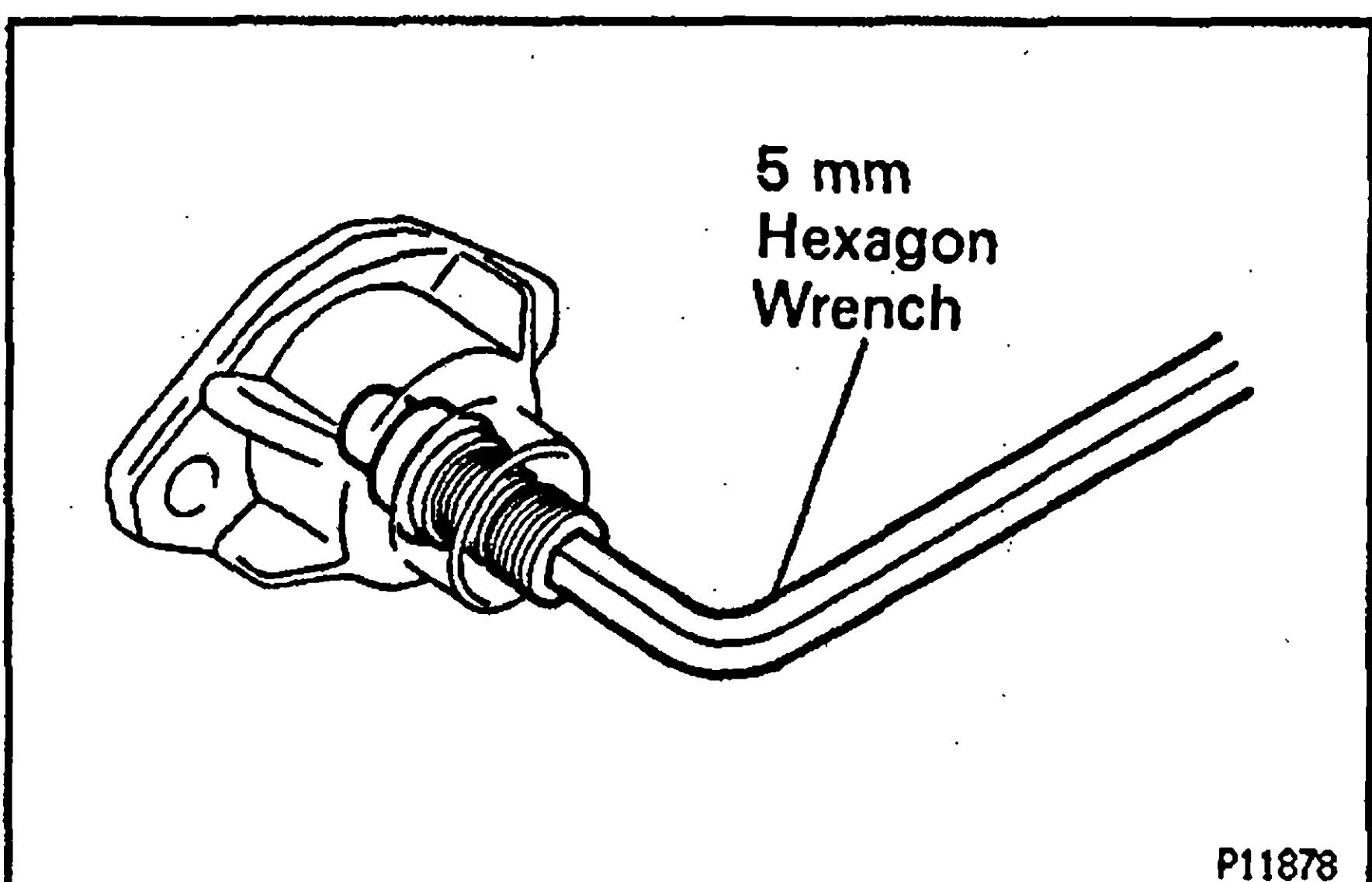
- (a) Install the slide pin, 4 rollers and 4 washers on the roller ring.
- (b) Check that the roller is facing the flat surface of the washer.
- (c) Install the roller ring into the pump housing.



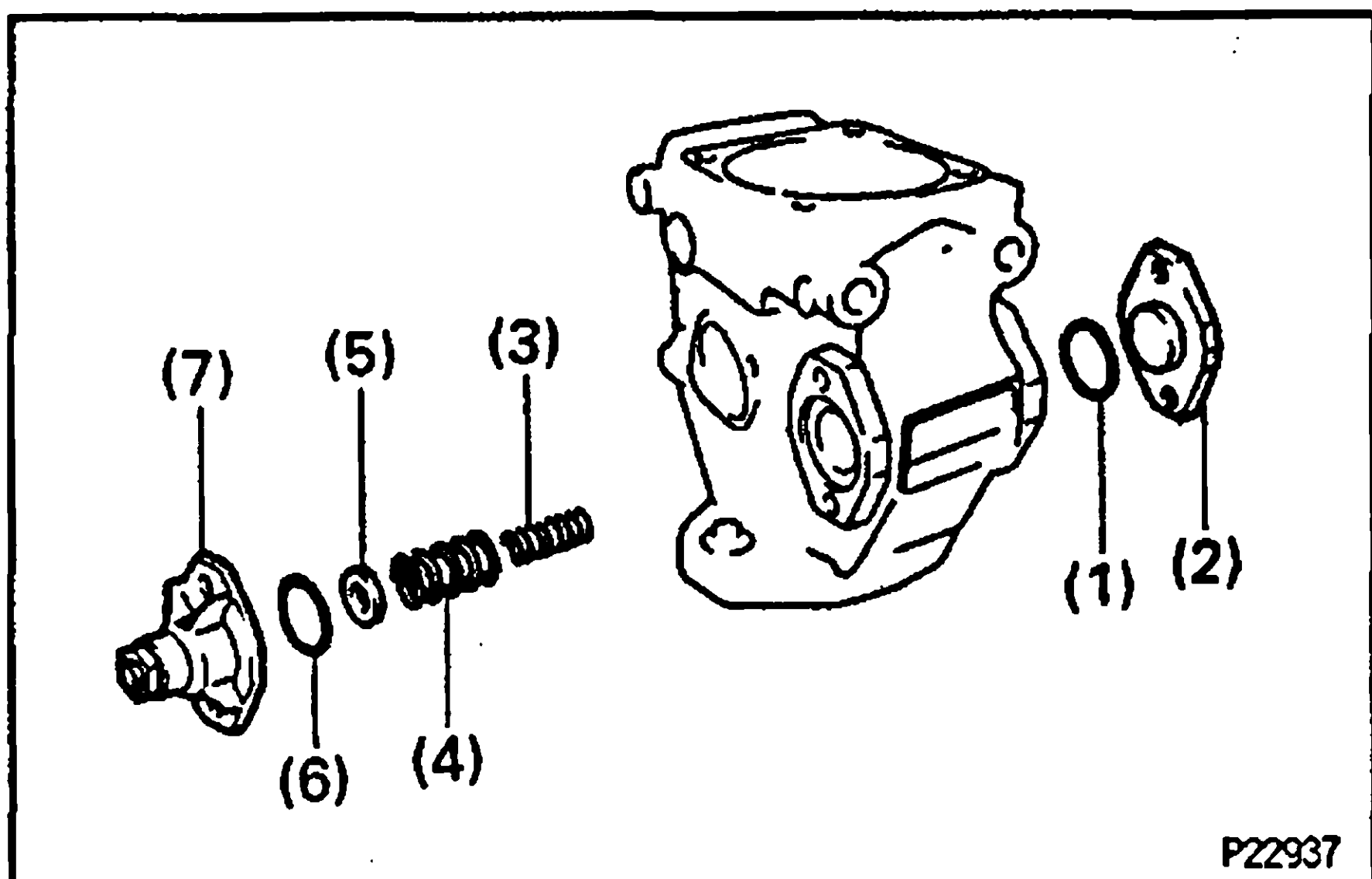
- (d) Carefully install the slide pin into the sub—piston.



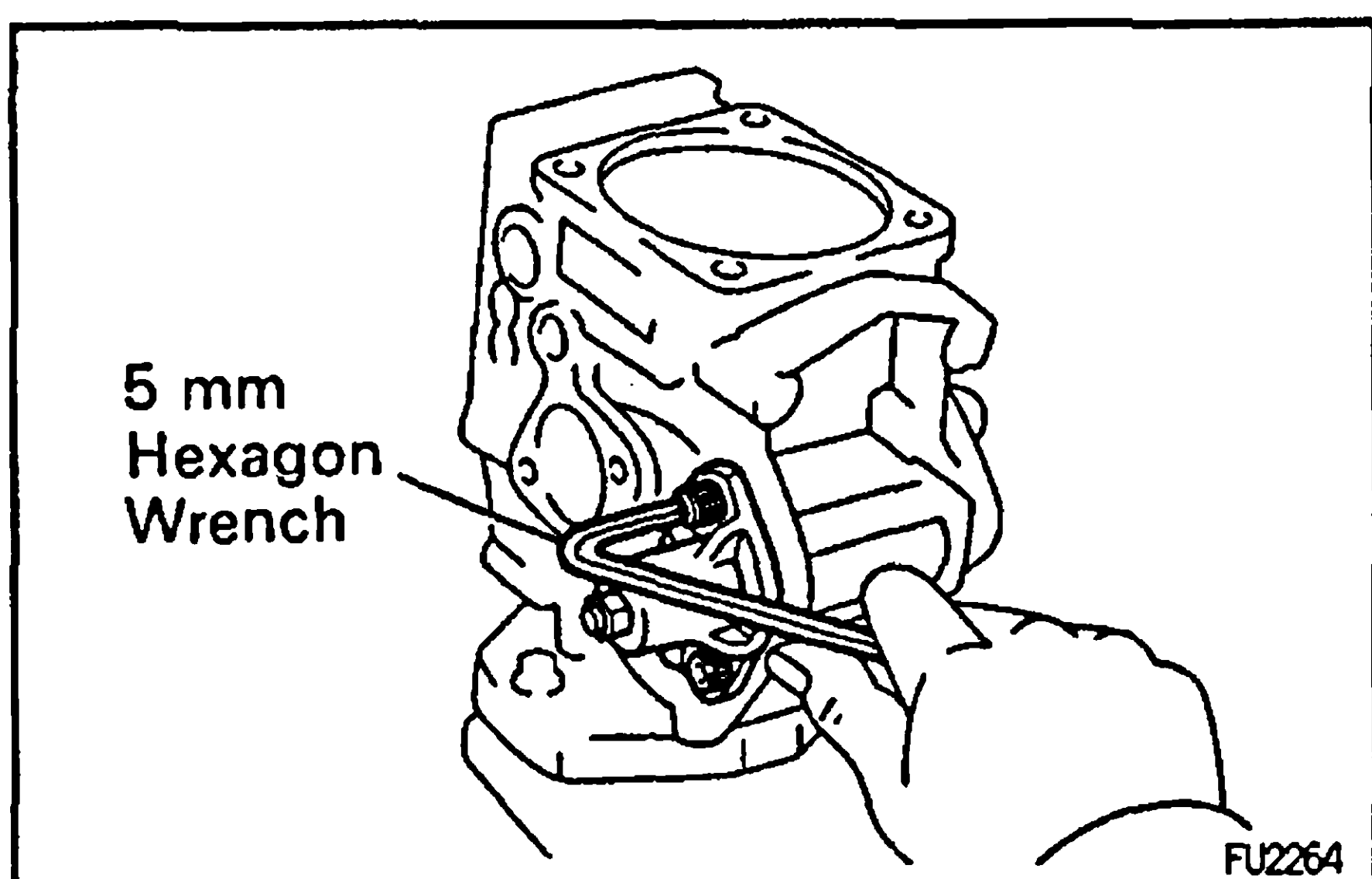
- (e) Install the stopper pin and clip.

**7. INSTALL TIMER SPRING**

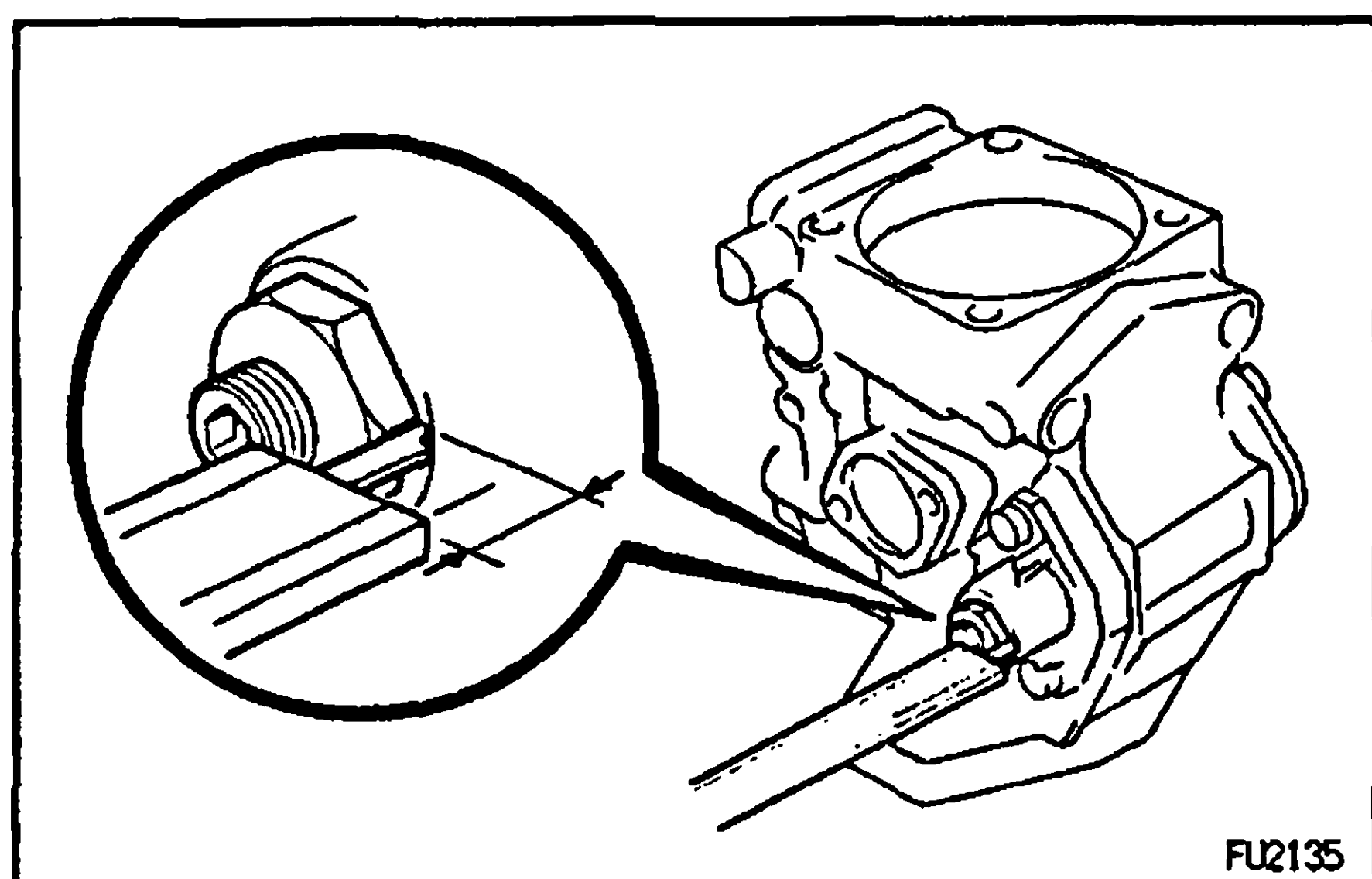
- (a) Install a new O—ring to the timer adjusting screw.
- (b) Using a 5 mm hexagon wrench, install the timer adjusting screw to the LH timer cover and temporarily install the nut.



- (c) Install these parts:
- (1) New O—ring
 - (2) RH timer cover
 - (3) Inner spring
 - (4) Outer spring
 - (5) Shim
 - (6) New O—ring
 - (7) LH timer cover, timer adjusting screw and nut assembly



- (d) Using a 5 mm hexagon wrench, install the 4 bolts.
Torque: 8.4 N·m (85 kgf·cm, 74 in·lbf)

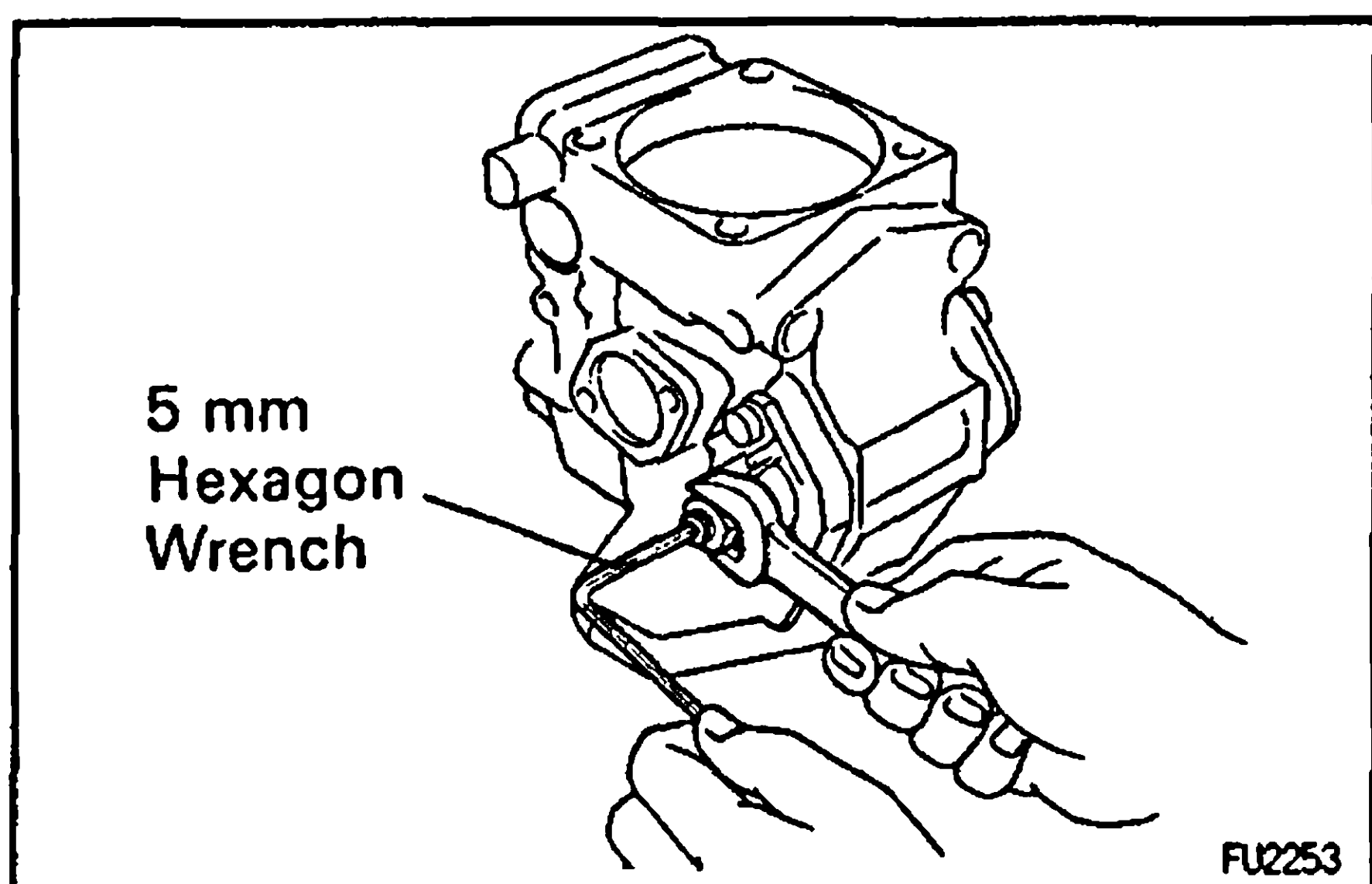


8. PRESET TIMER ADJUSTING SCREW

- (a) Using vernier calipers, measure the protrusion of the adjusting screw from the timer cover.

Protrusion:

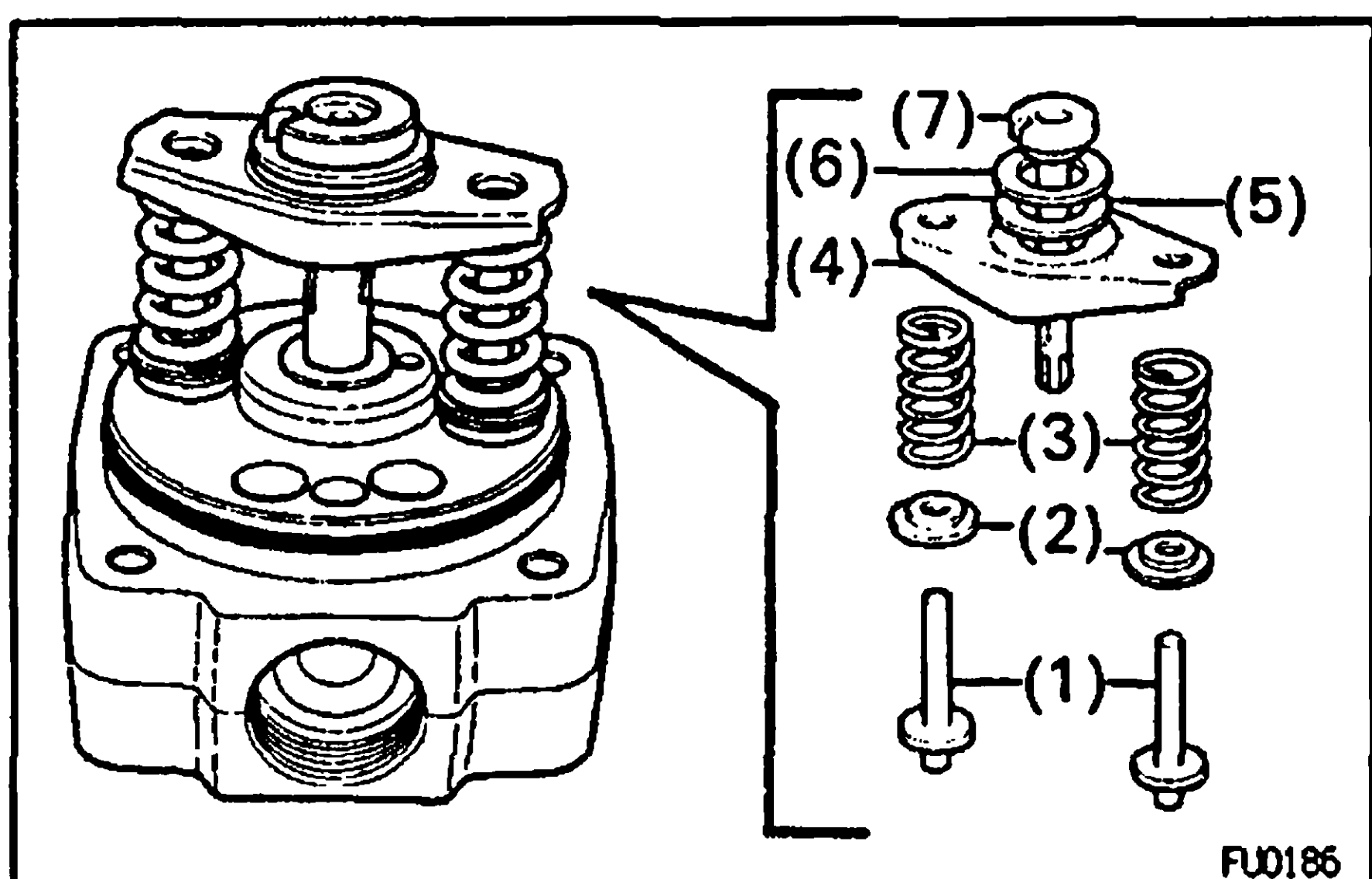
7.5 — 8.0 mm (0.295 — 0.315 in.)



- (b) Using a 5 mm hexagon wrench, adjust the protrusion of the adjusting screw from the timer cover.

- (c) Tighten the nut.

Torque: 14 N·m (145 kgf·cm, 11 ft·lbf)



9. ADJUST PLUNGER SPRING SHIM

- (a) Install these parts to the distributive head:

- (1) 2 plunger spring guides
- (2) 2 upper spring seats
- (3) 2 plunger springs
- (4) Lower spring seat
- (5) Upper plunger plate
- (6) Lower plunger plate
- (7) Pump plunger

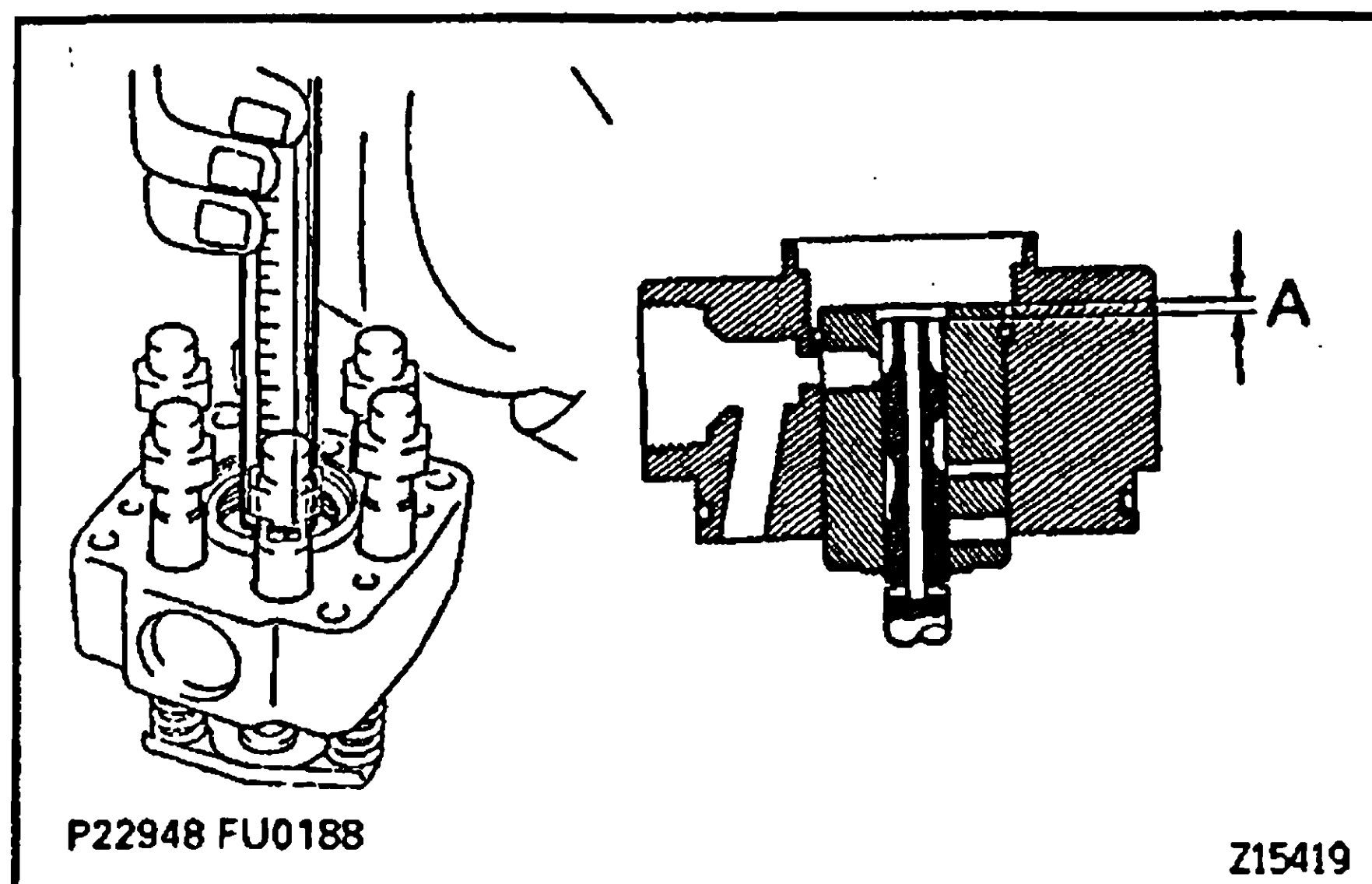
HINT: Do not assemble the plunger spring shims at this time.

- (b) Using vernier calipers, measure clearance A indicated in the illustration.
- (c) Determine the plunger spring shim size by using these formula and chart.

New plunger spring shim thickness = $7.1 - A$

A ... Measured plunger position

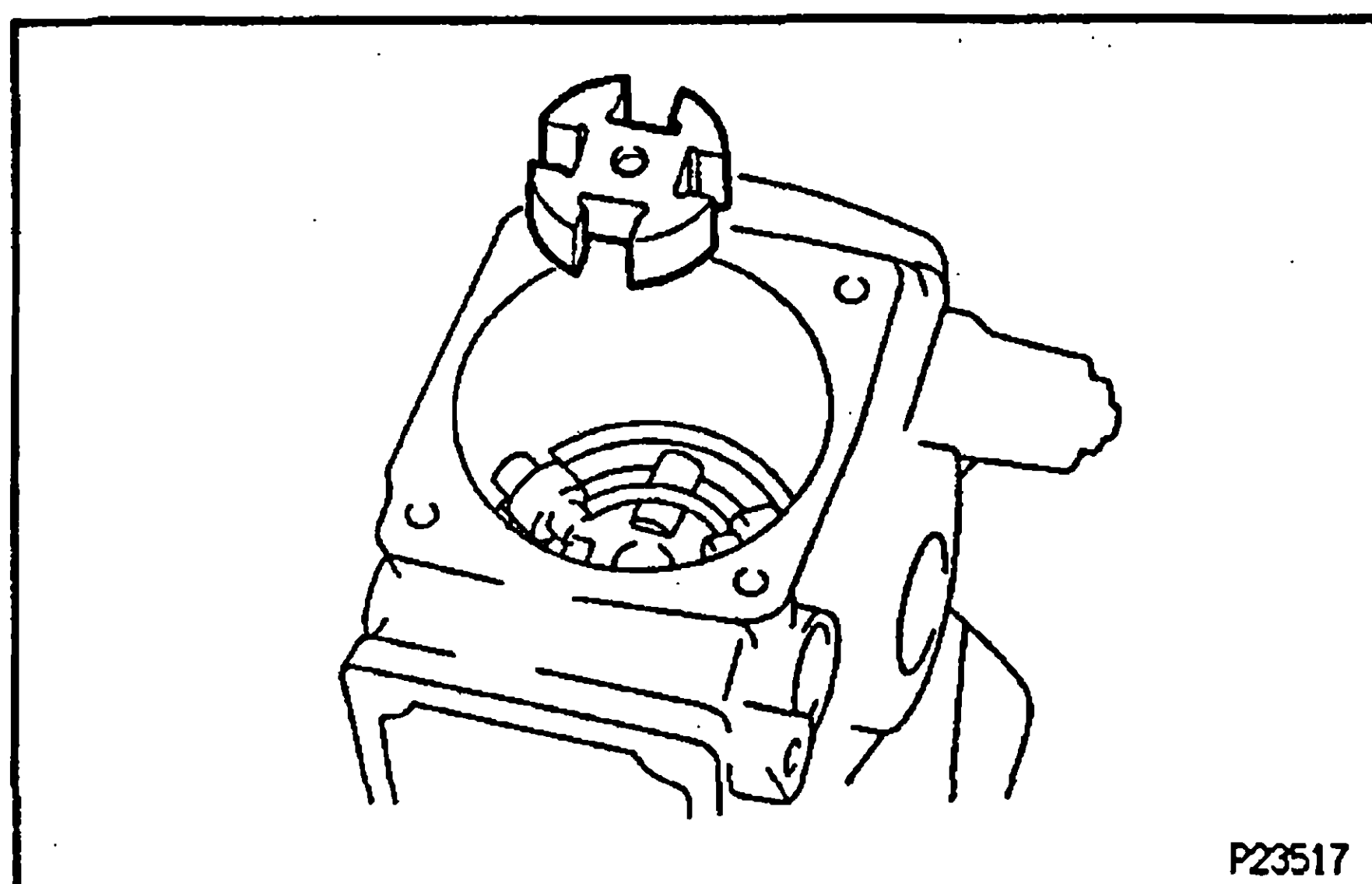
EG



Plunger spring shim selection chart:

mm (in.)

Measured clearance	Shim thickness
More than 6.6 (0.256)	0.5 (0.020)
6.3 – 6.5 (0.248 – 0.252)	0.8 (0.031)
6.1 – 6.2 (0.236 – 0.240)	1.0 (0.039)
5.9 – 6.0 (0.228 – 0.232)	1.2 (0.047)
5.6 – 5.8 (0.217 – 0.224)	1.5 (0.059)
5.3 – 5.5 (0.205 – 0.213)	1.8 (0.071)
Less than 5.1 (0.197)	2.0 (0.079)

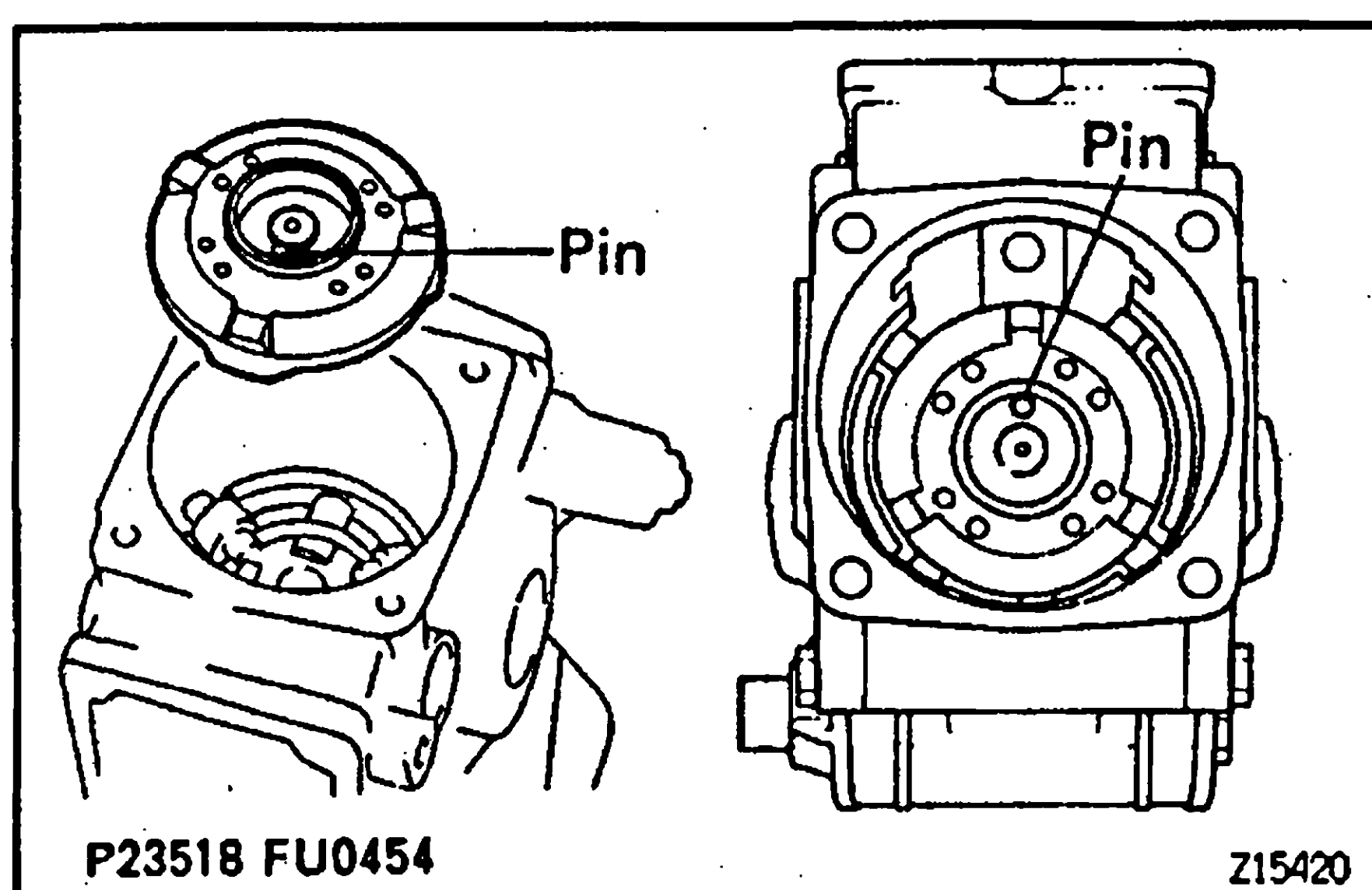


HINT:

- For a measurement between listed sizes, use the next larger size. For example, if thickness is 1.1 mm (0.043 in.) by calculation, use a 1.2 mm (0.047 in.) shim.
- Select 2 shims which have the same thickness.

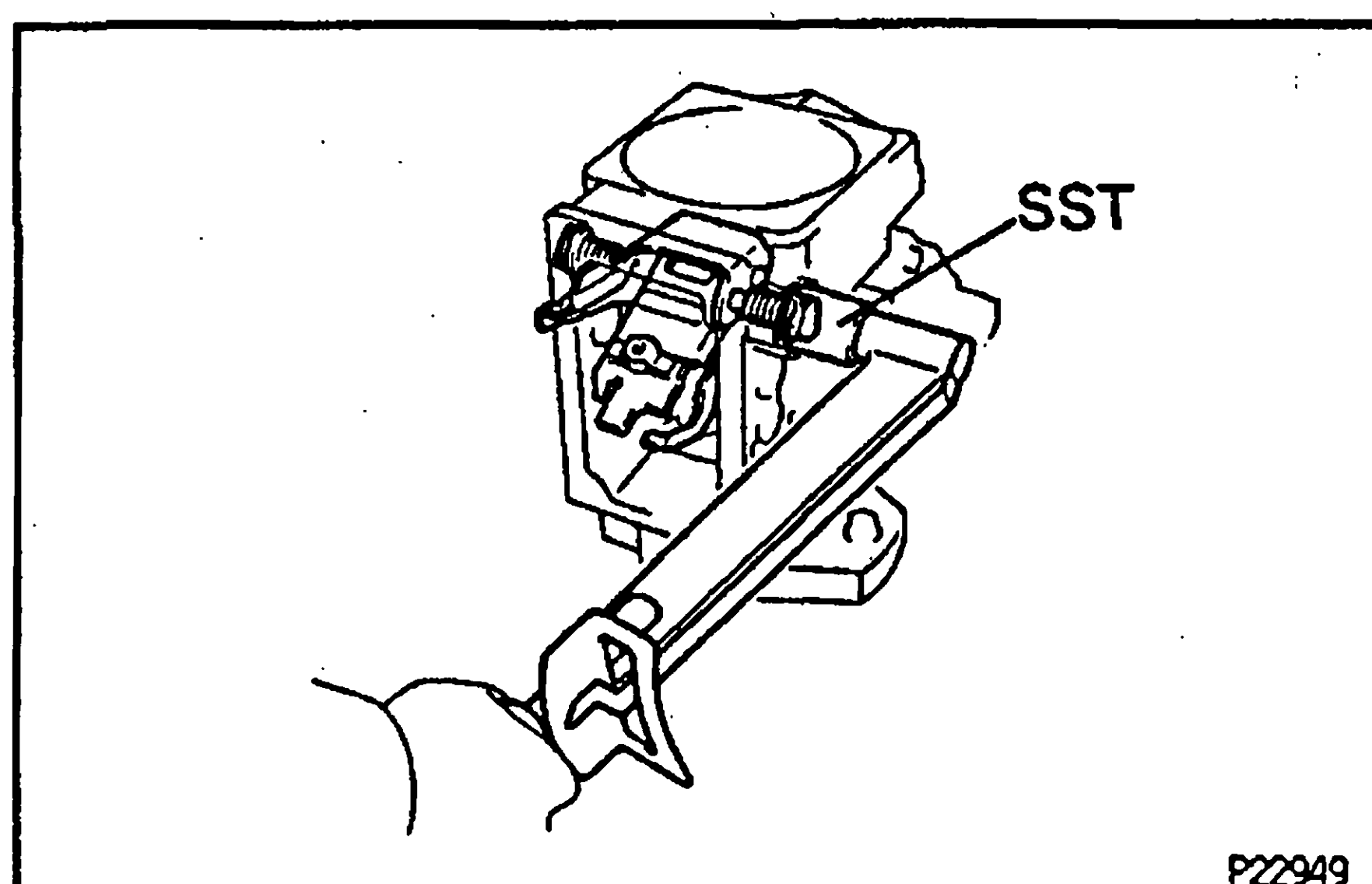
10. INSTALL COUPLING

Install the coupling.



11. INSTALL FACE CAMPLATE

- (a) Face the drive shaft with the key groove facing upward.
- (b) Install the camplate with the camplate pin facing the governor cover side.



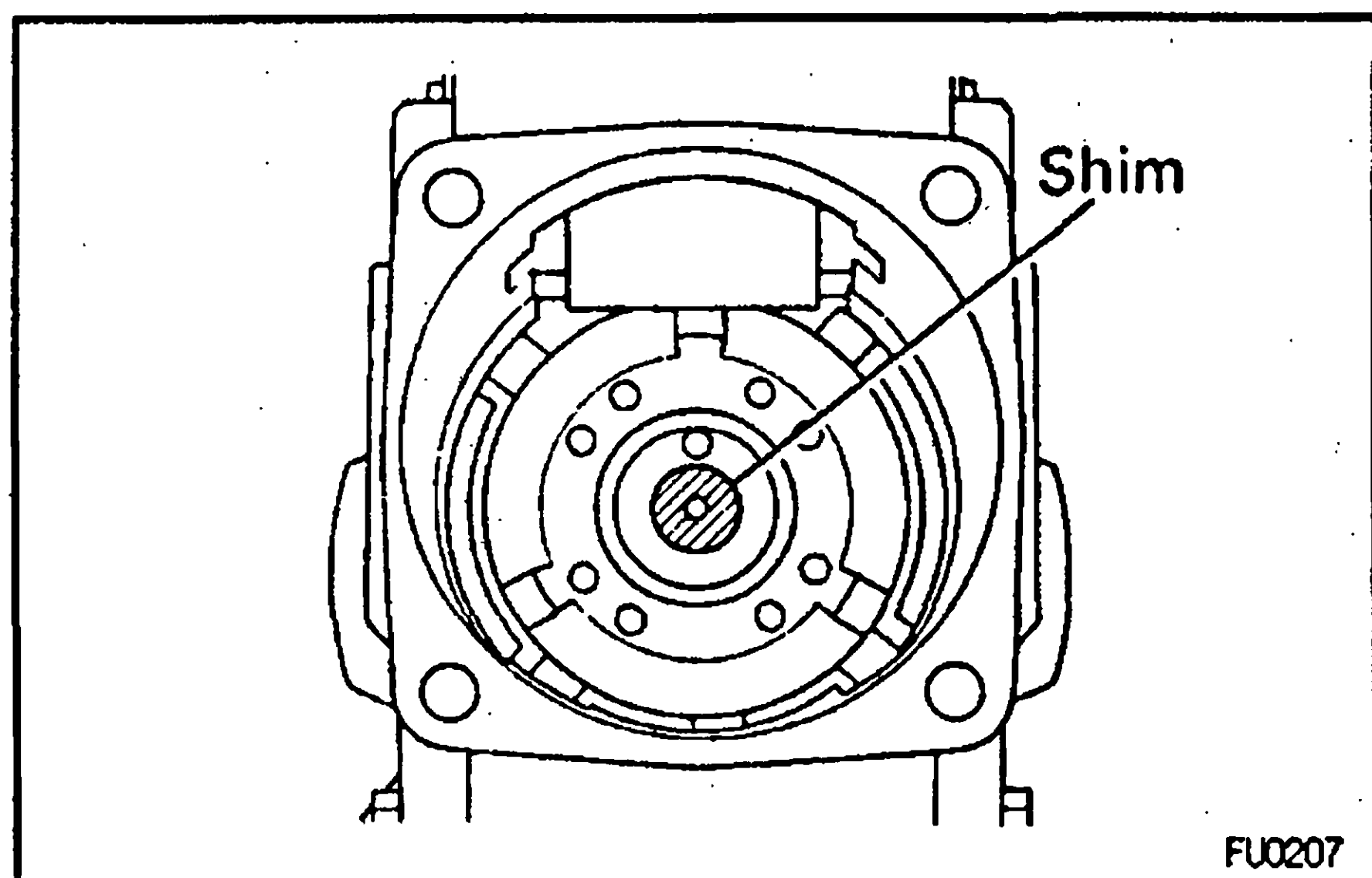
12. INSTALL GOVERNOR LINK

- (a) Using SST, install the governor link with 2 new gas-kets and the 2 support bolts.

Torque: 14 N·m (140 kgf·cm, 10 ft·lbf)

SST 09260–54012 (09269–54040)

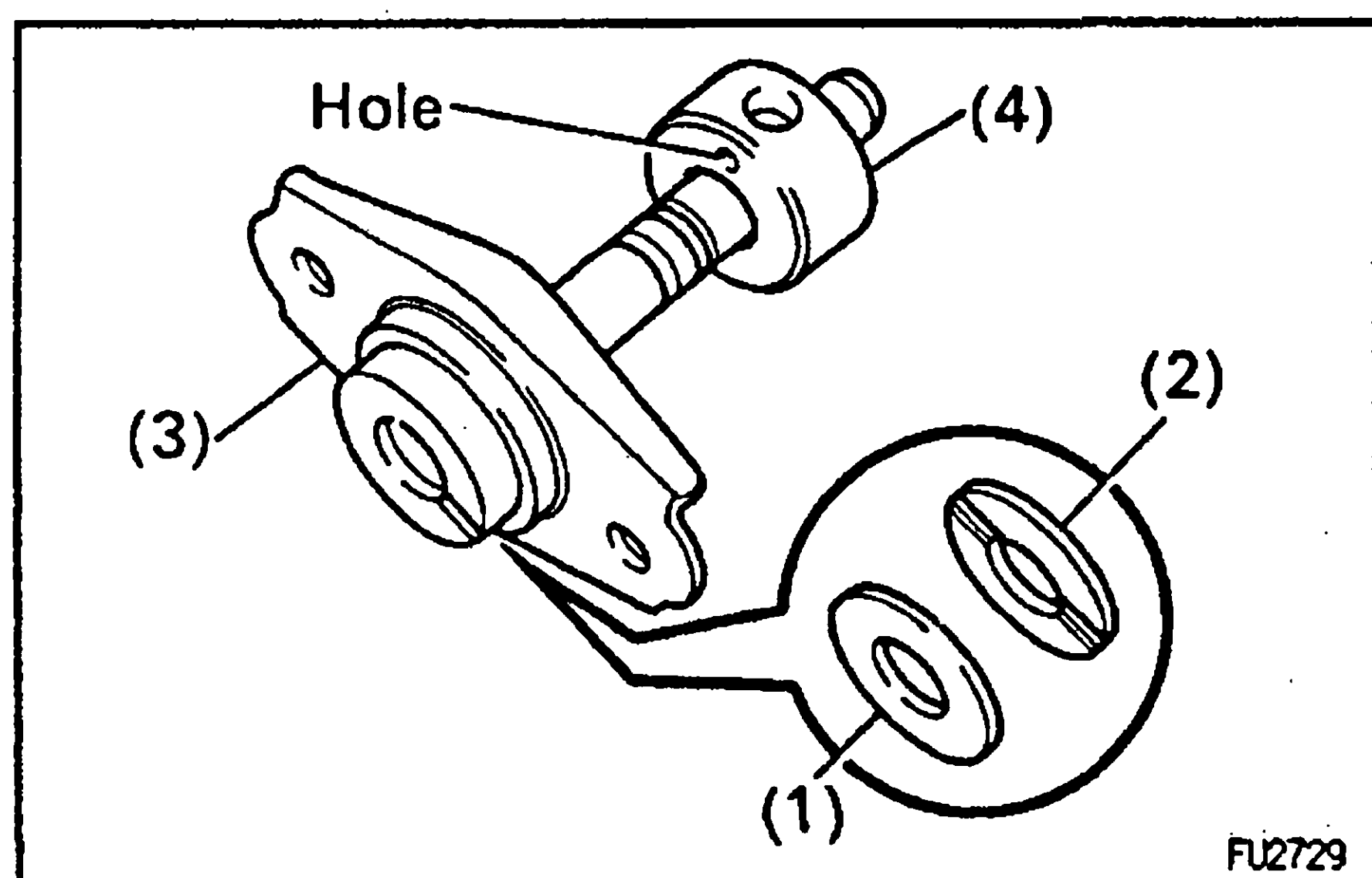
- (b) Check that the governor link moves smoothly.



13. INSTALL PUMP PLUNGER

- (a) Place the previously used plunger adjusting shim on the center of the camplate.

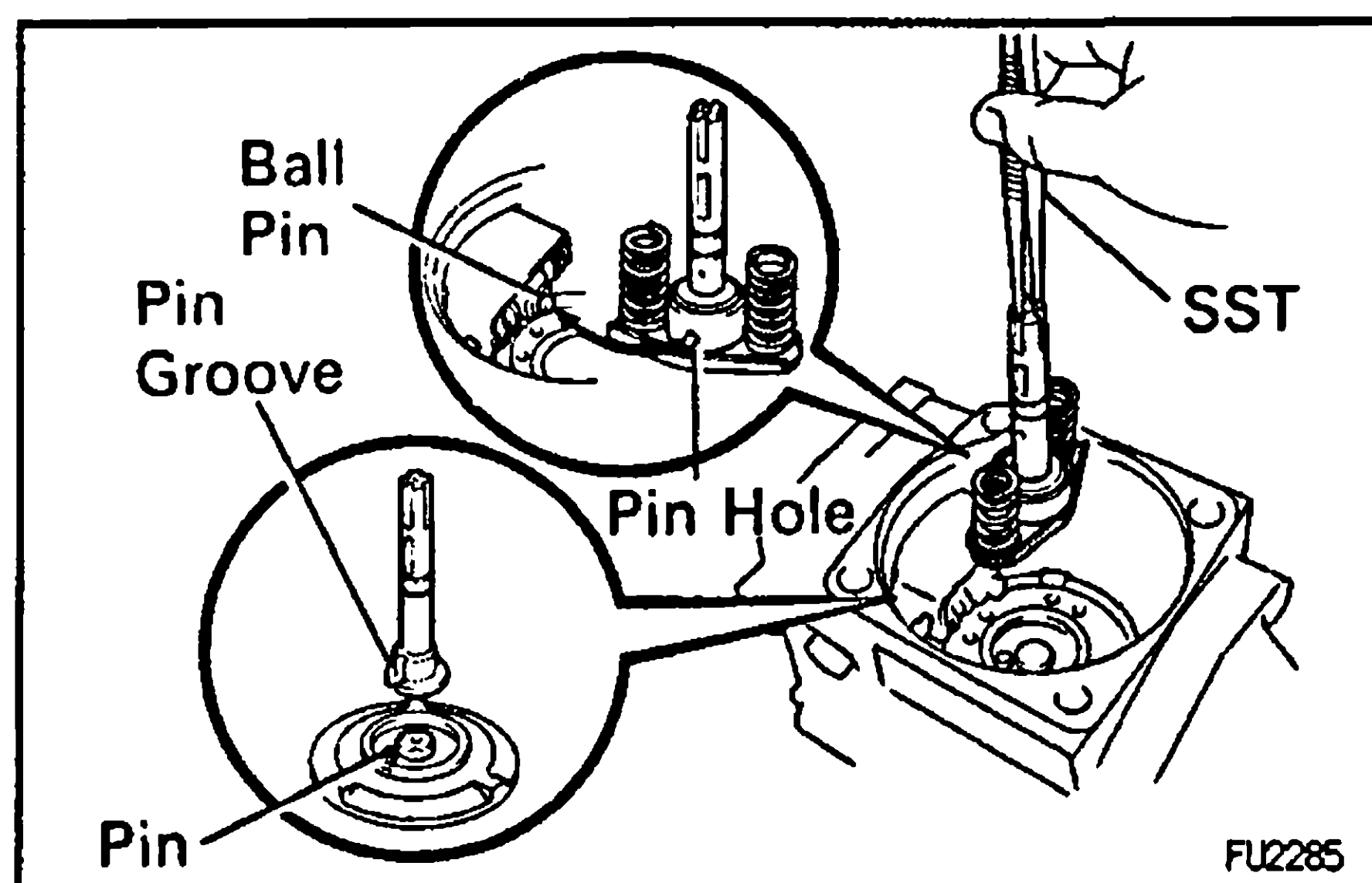
NOTICE: Do not apply grease to the shim.



- (b) Install these parts to the pump plunger:

- (1) Lower plunger plate
- (2) Upper plunger plate
- (3) Lower spring seat
- (4) Spill ring

HINT: Face the spill ring with the hole facing the lower spring seat.

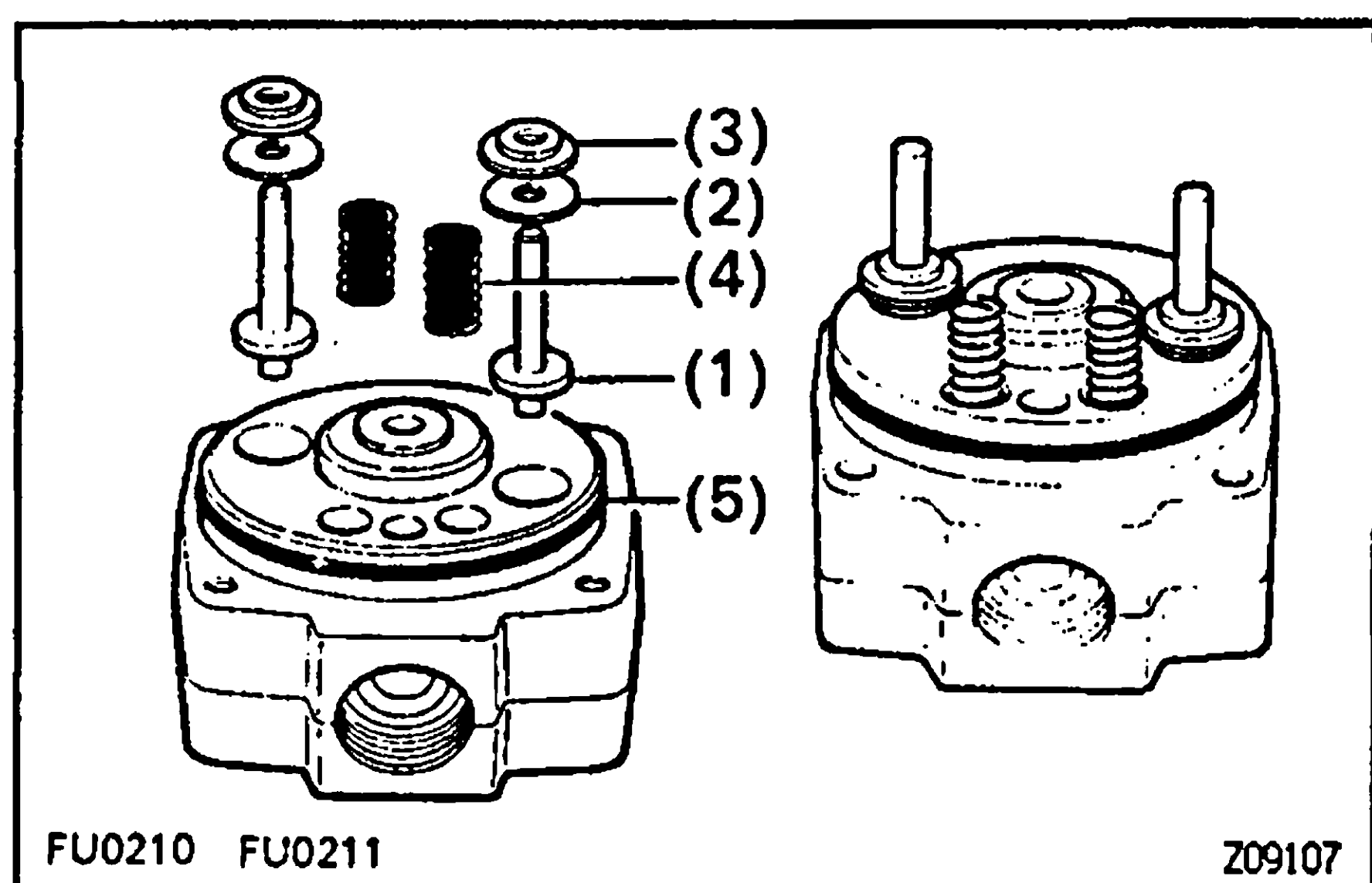


- (c) Align the pin groove of the plunger with the pin of the face camplate.

- (d) Align the ball pin of the governor link with the pin hole of the spill ring.

- (e) Using SST, install the pump plunger and 2 plunger springs.

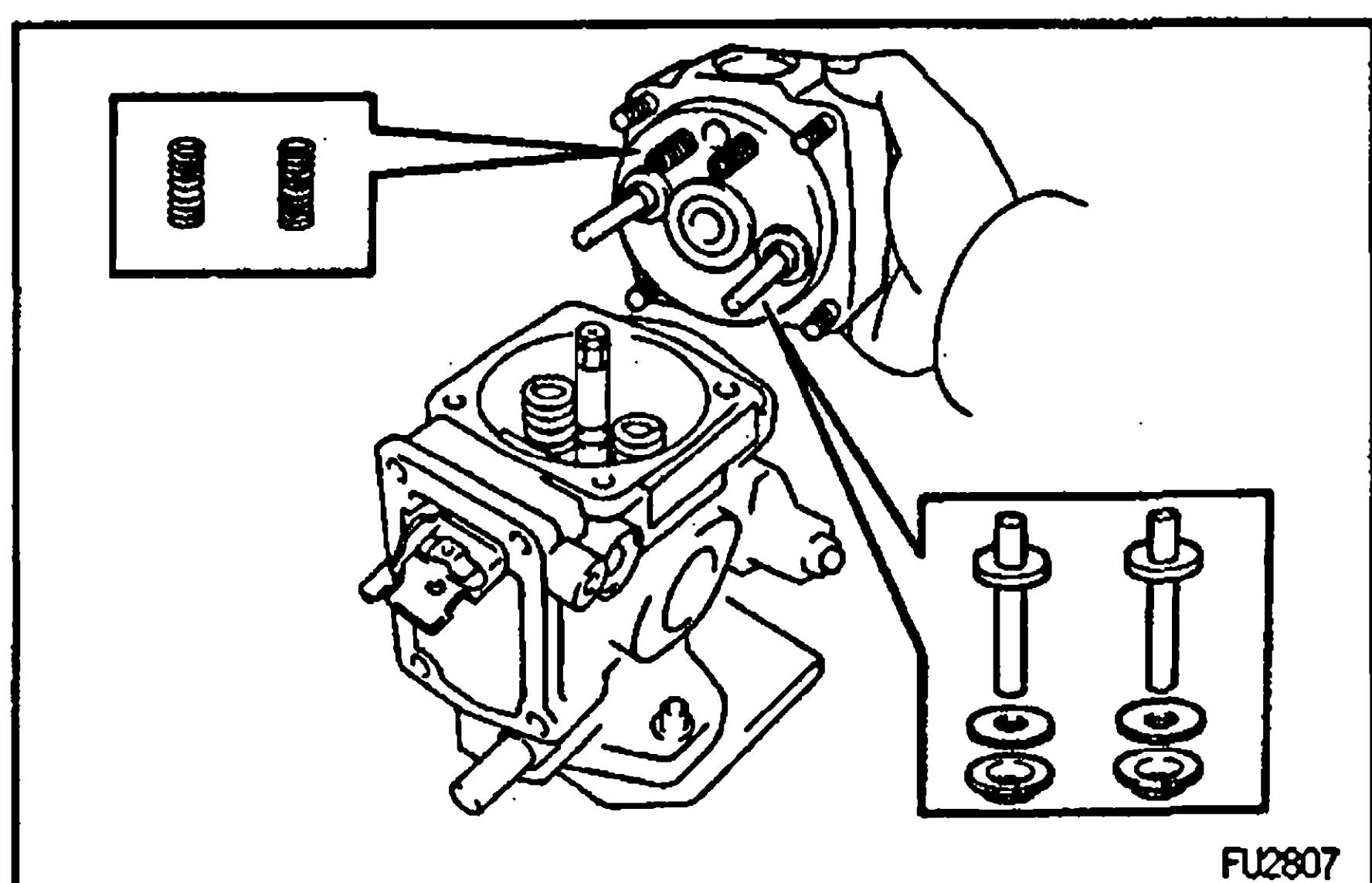
SST 09260-54012 (09269-54030)



14. INSTALL DISTRIBUTIVE HEAD

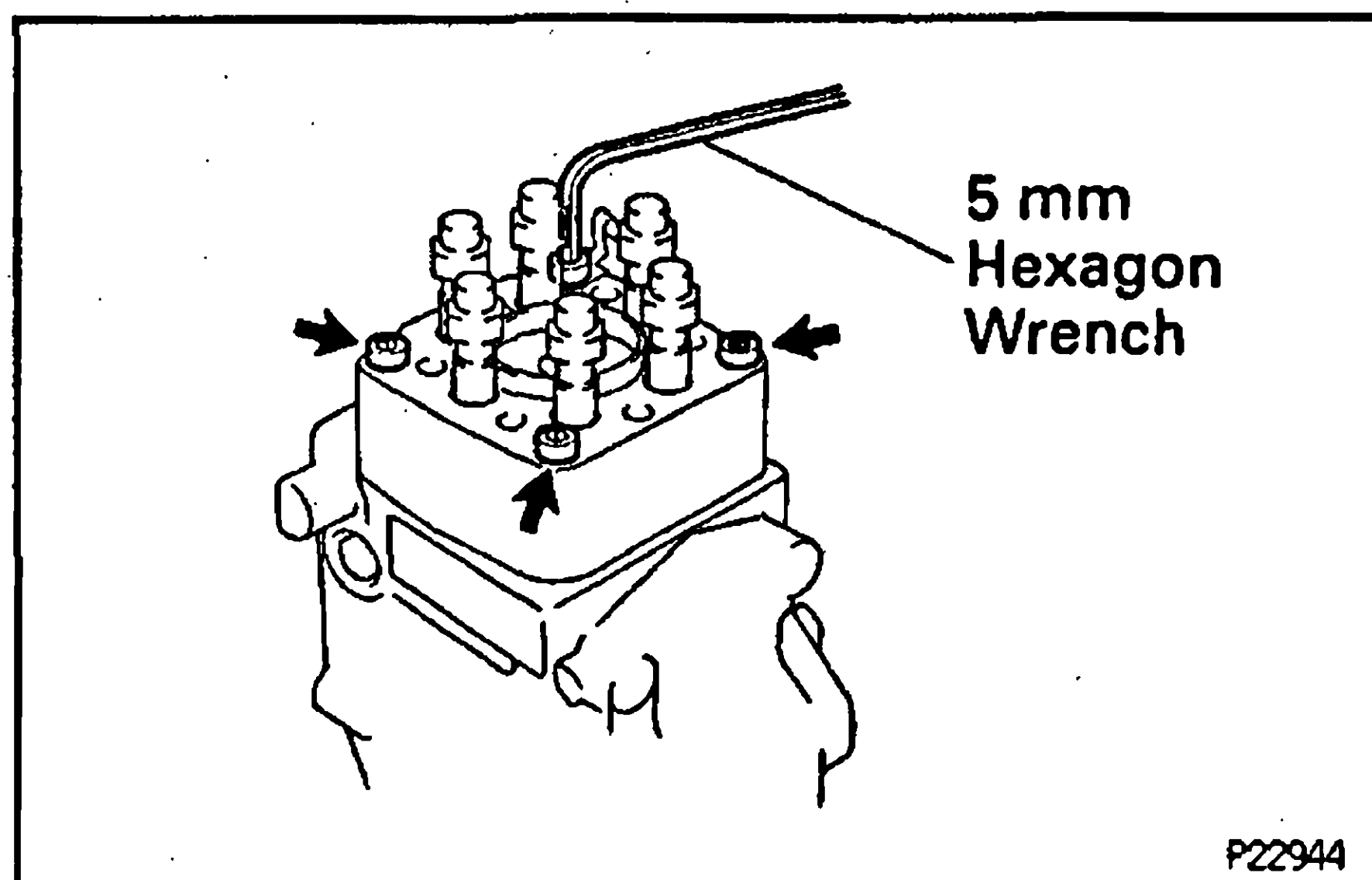
- (a) Apply grease to these parts and install them to the distributive head:

- (1) 2 plunger spring guides
- (2) 2 new selected plunger spring shims
- (3) 2 upper spring seats
- (4) 2 lever support springs
- (5) New O-ring

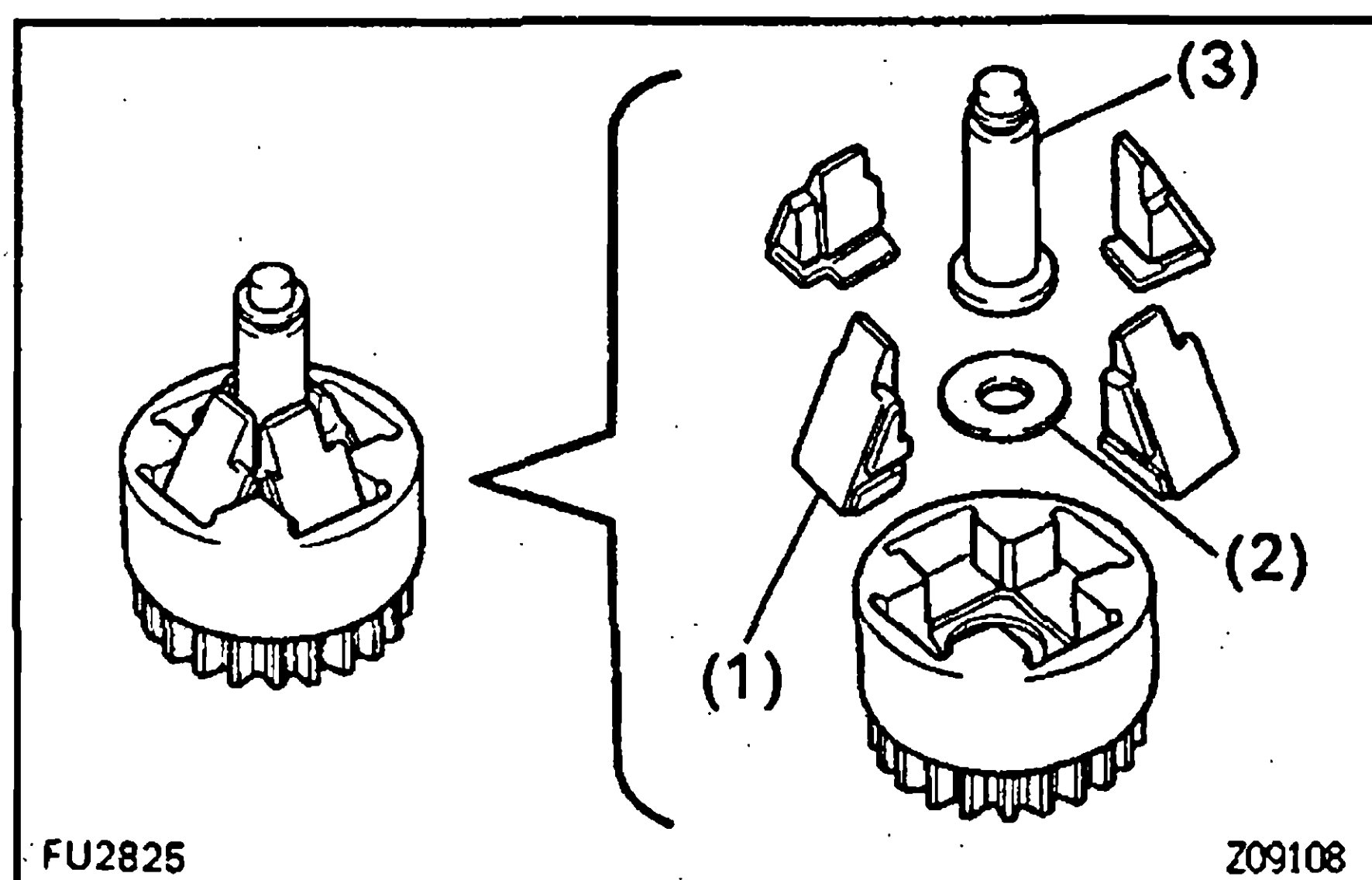


- (b) Install the distributive head.

NOTICE: Be careful not to damage the pump plunger.

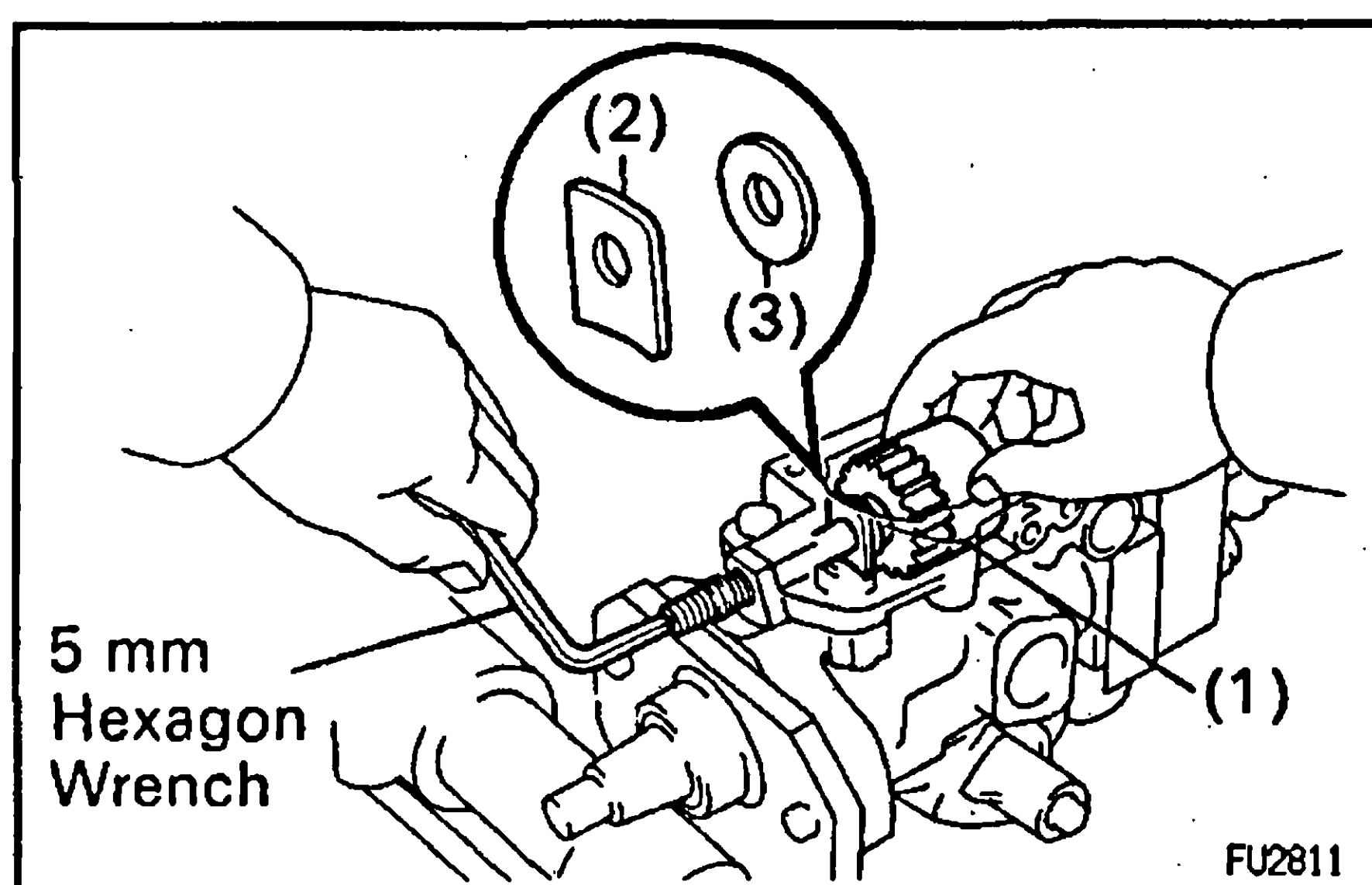


- (c) Using a 5 mm hexagon wrench, install the 4 bolts and wire clip.
Torque: 12 N·m (120 kgf·cm, 9 ft·lbf)
HINT: Use the bolt which is 45 mm (1.77 in.) in length.



15. INSTALL GOVERNOR SHAFT AND FLYWEIGHT HOLDER

- (a) Install these parts to the flyweight holder:
 (1) 4 flyweight
 (2) No.2 flyweight washer
 (3) Governor sleeve
HINT: Replace the 4 flyweights as a set.
- (b) Install a new O—ring to the governor shaft.
- (c) Place the flyweight holder assembly (1) in position, and install the governor gear adjusting washer (2) and No. 1 flyweight washer (3) between the flyweight holder and pump housing.
- (d) Install the governor shaft through the governor gear adjusting washer, No. 1 flyweight washer and flyweight holder assembly.
- (e) Using a 5 mm hexagon wrench, turn the governor shaft counterclockwise.



16. CHECK FLYWEIGHT HOLDER THRUST CLEARANCE

Using a thickness gauge, measure the thrust clearance between the housing pin and flyweight holder.

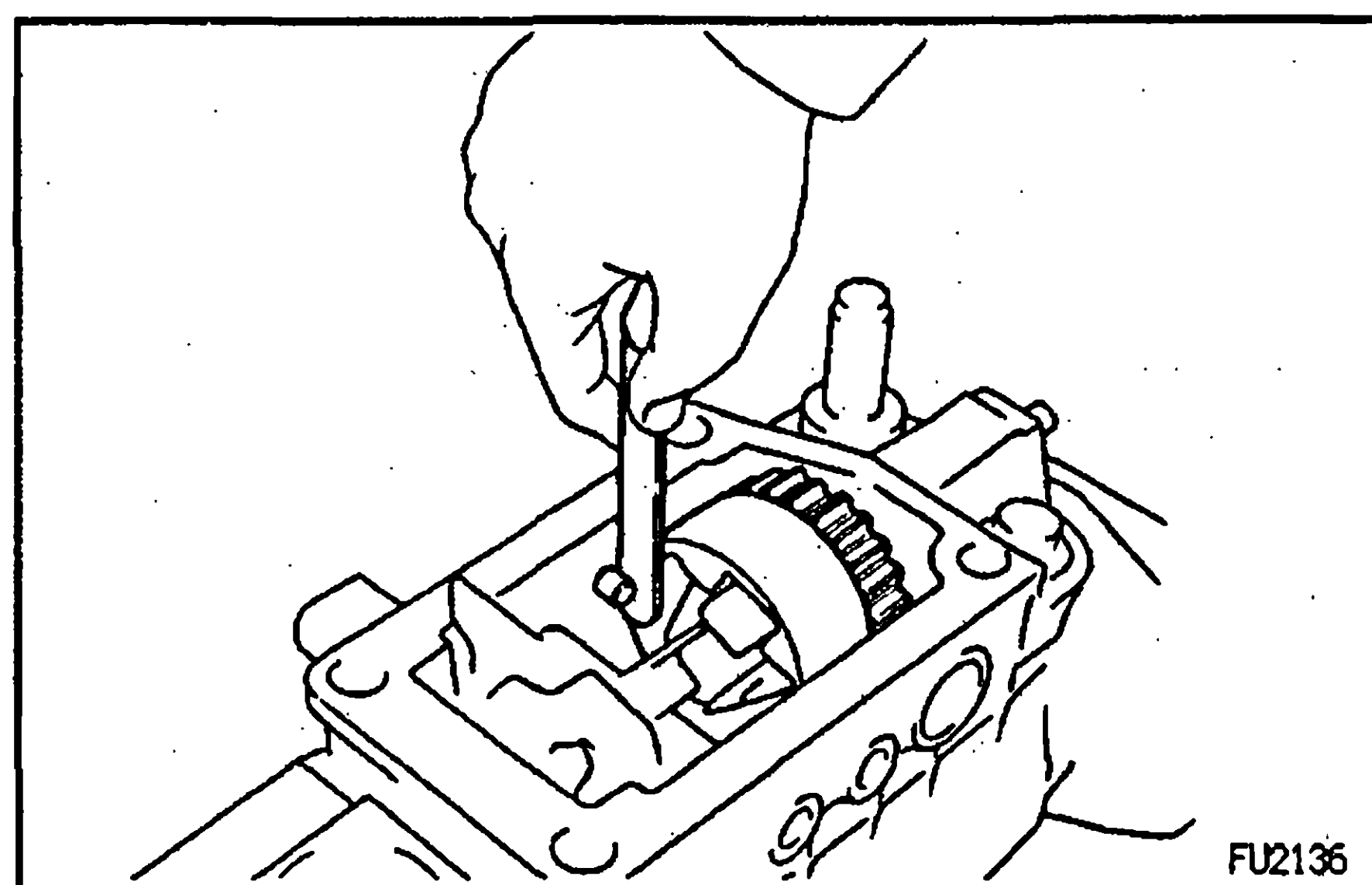
Thrust clearance:

0.15 — 0.35 mm (0.0059 — 0.0138 in.)

If the thrust clearance is not as specified, adjust with a governor gear adjusting washer.

Governor gear adjusting washer thickness: mm (in.)

1.05 (0.0413)	1.25 (0.0492)	1.45 (0.0571)
1.65 (0.0650)	1.85 (0.0728)	—



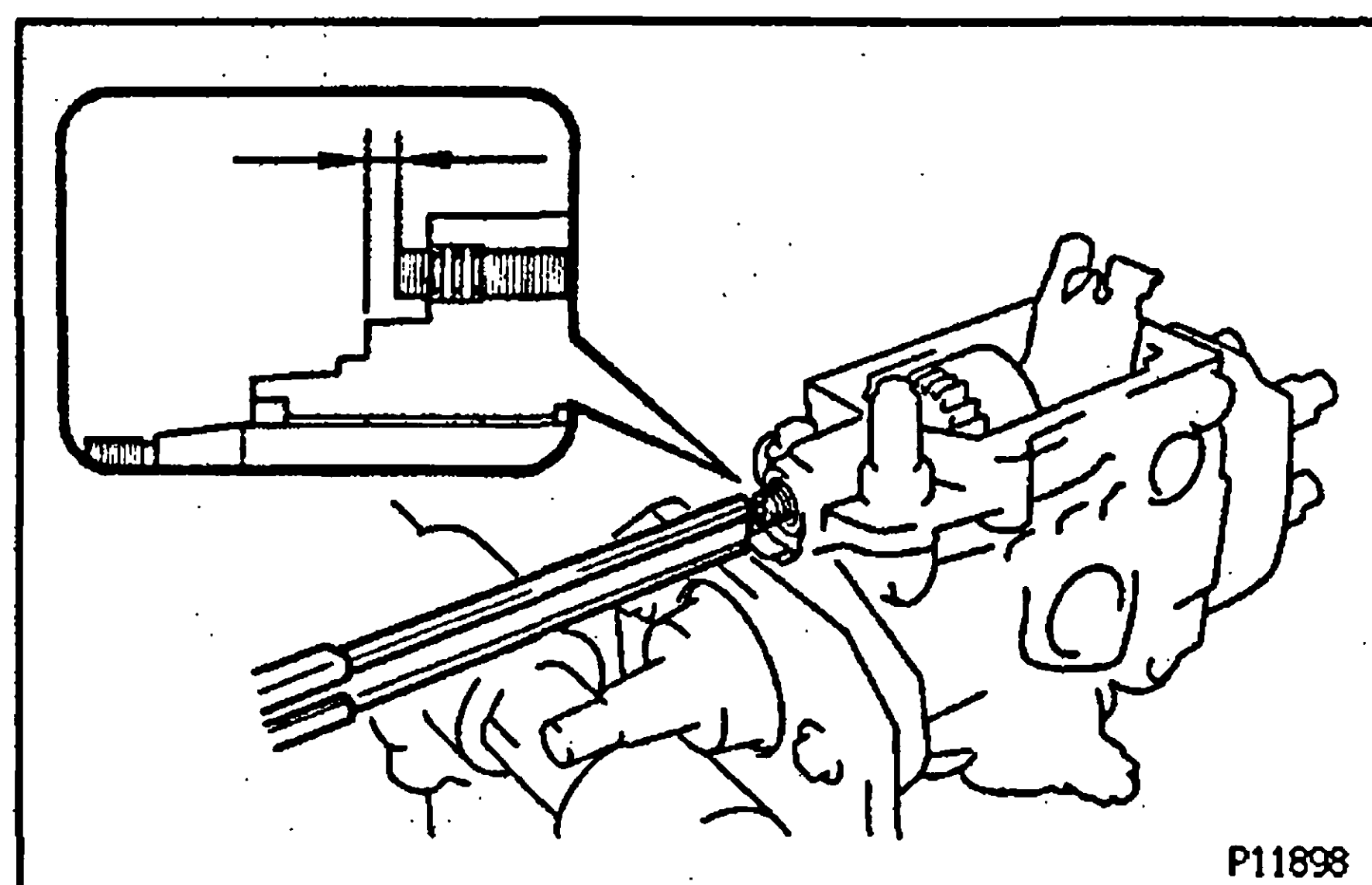
17. ADJUST PROTRUSION OF GOVERNOR SHAFT

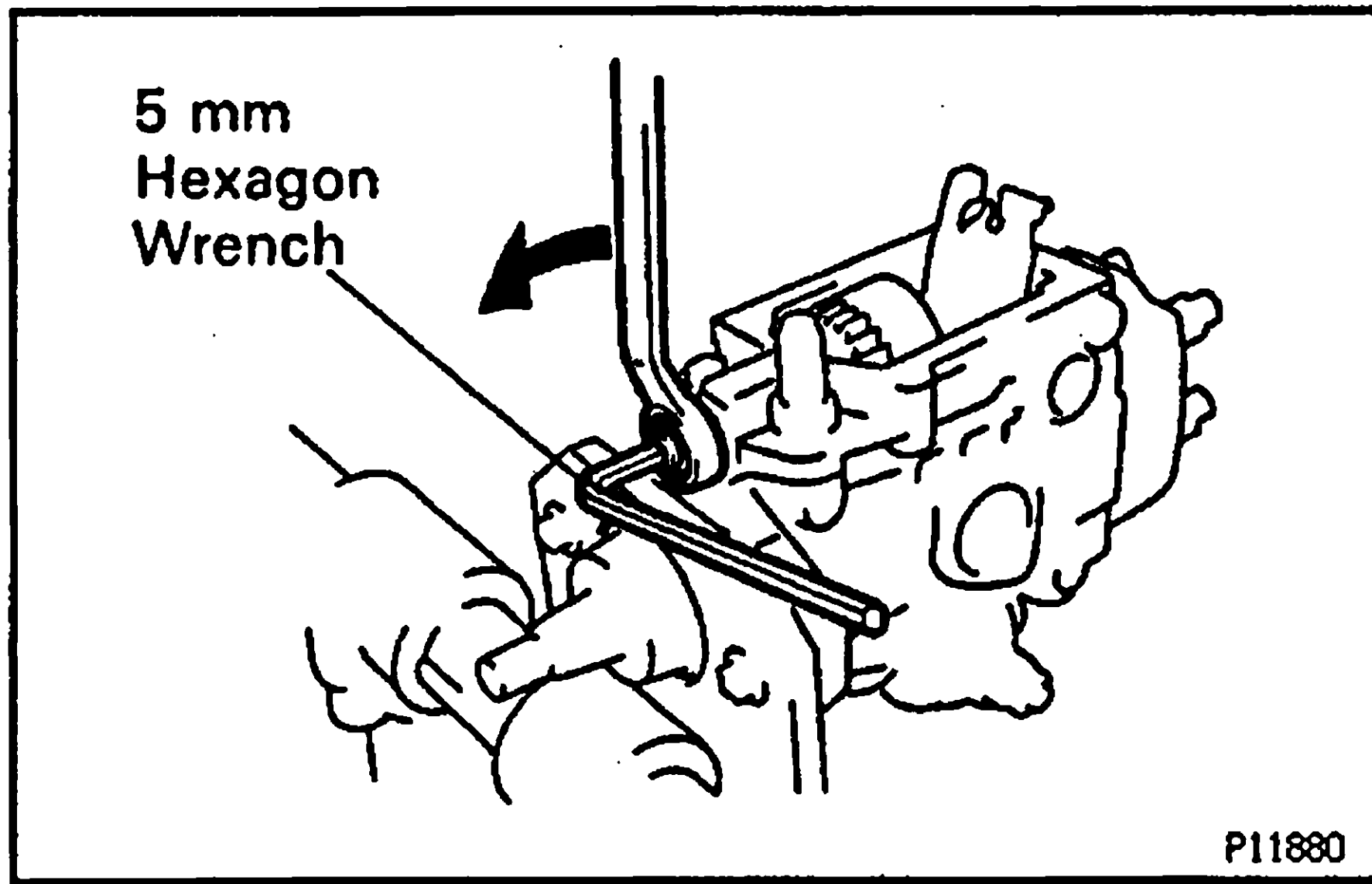
- (a) Using vernier calipers, measure the protrusion of the governor shaft.

Protrusion:

0.5 — 2.0 mm (0.020 — 0.079 in.)

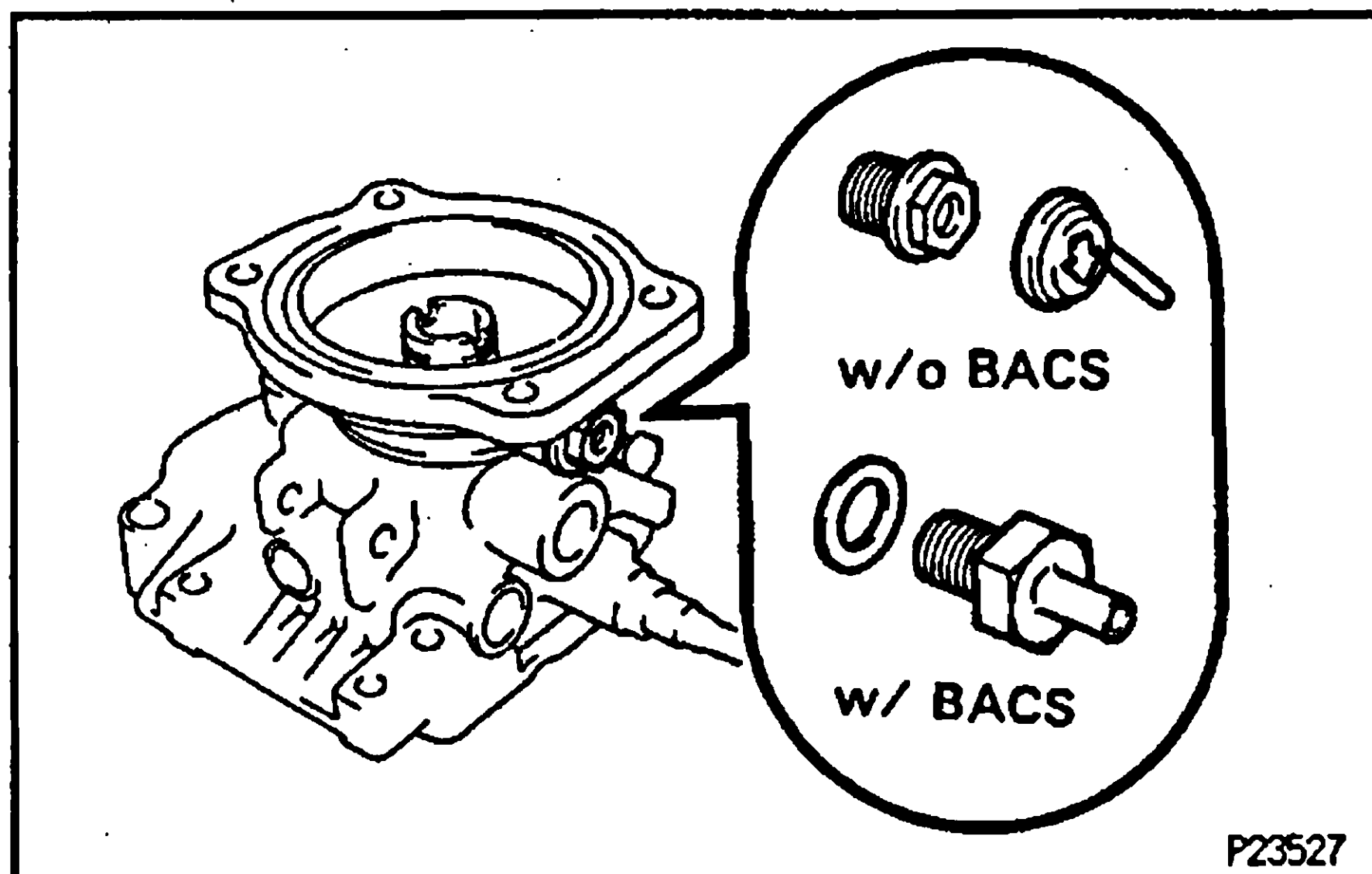
If the protrusion is not as specified, adjust by turning the governor shaft.





- (b) Using a 5 mm hexagon wrench, install and tighten the nut while holding the governor shaft with a 5 mm hexagon wrench.

Torque: 27 N·m (275 kgf·cm, 20 ft·lbf)



18. ASSEMBLE BOOST COMPENSATOR

A. Install overflow screw

- (a) w/ BACS:

Install the overflow screw with a new gasket.

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

- (b) w/o BACS:

Install the overflow screw.

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

- (c) w/o BACS:

Install the rubber cap facing the arrow downward.

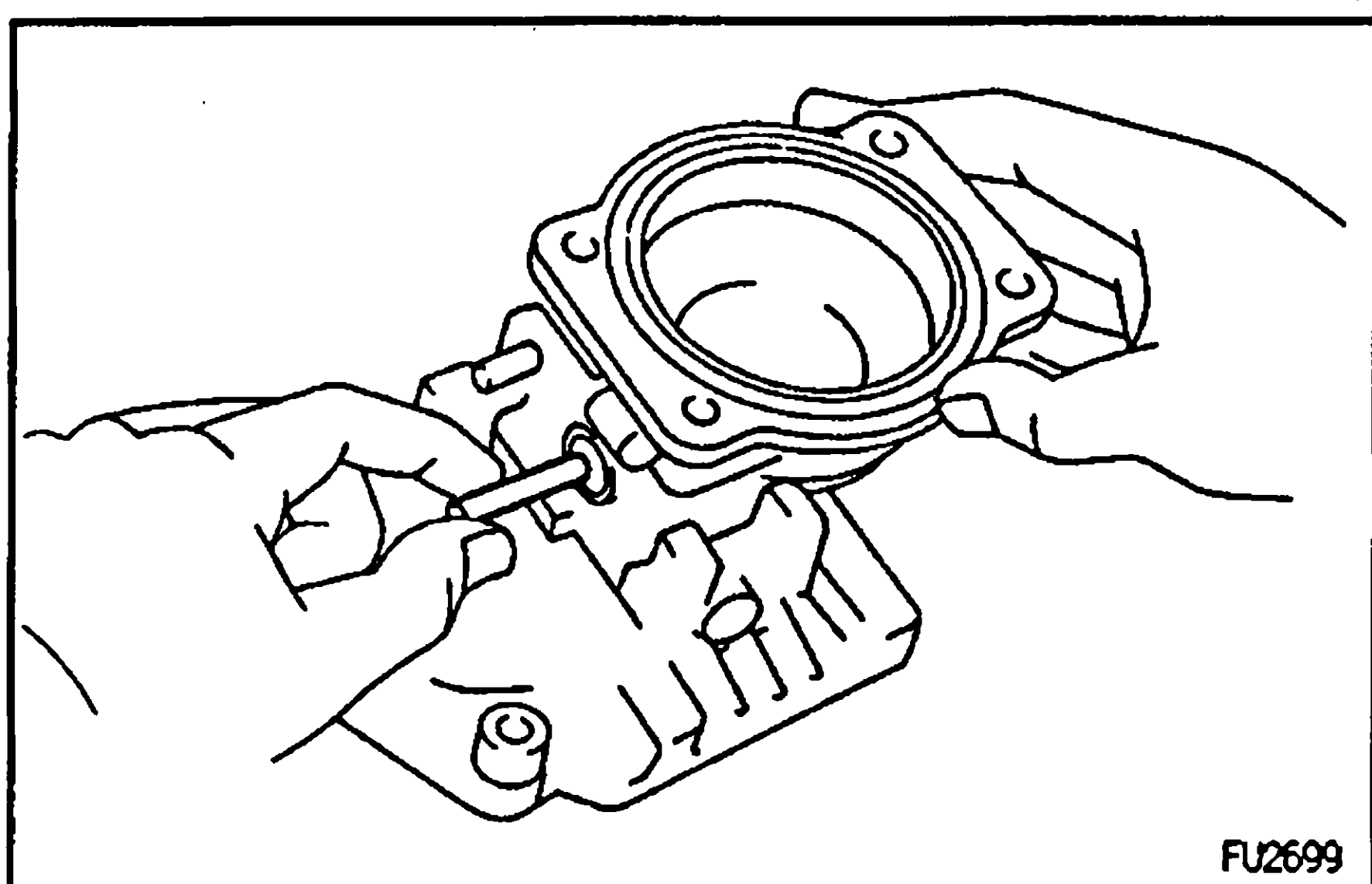
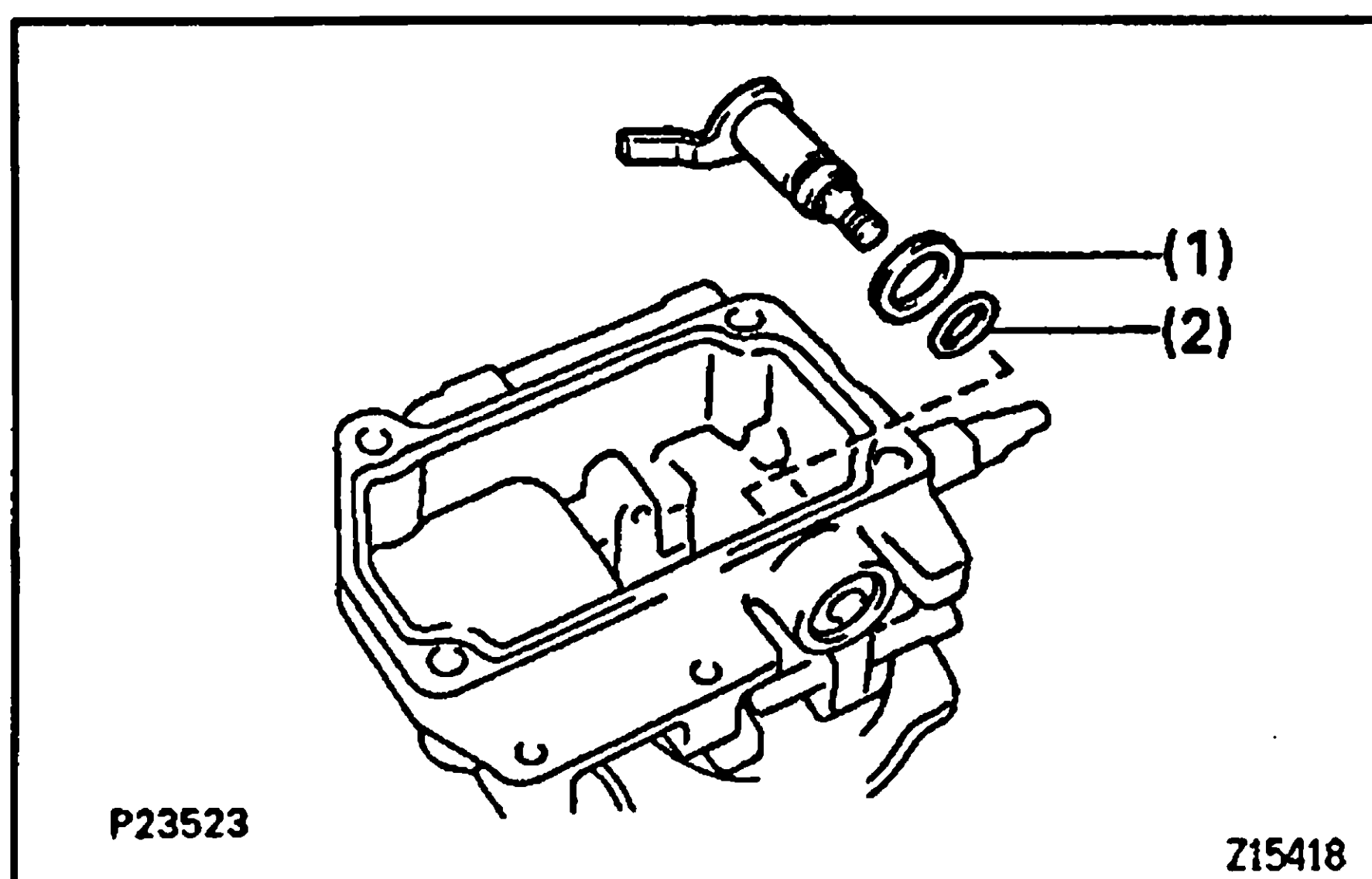
B. Install No.2 SICS lever

- (a) Assemble these parts to the No.2 SICS lever.

(1) Washer

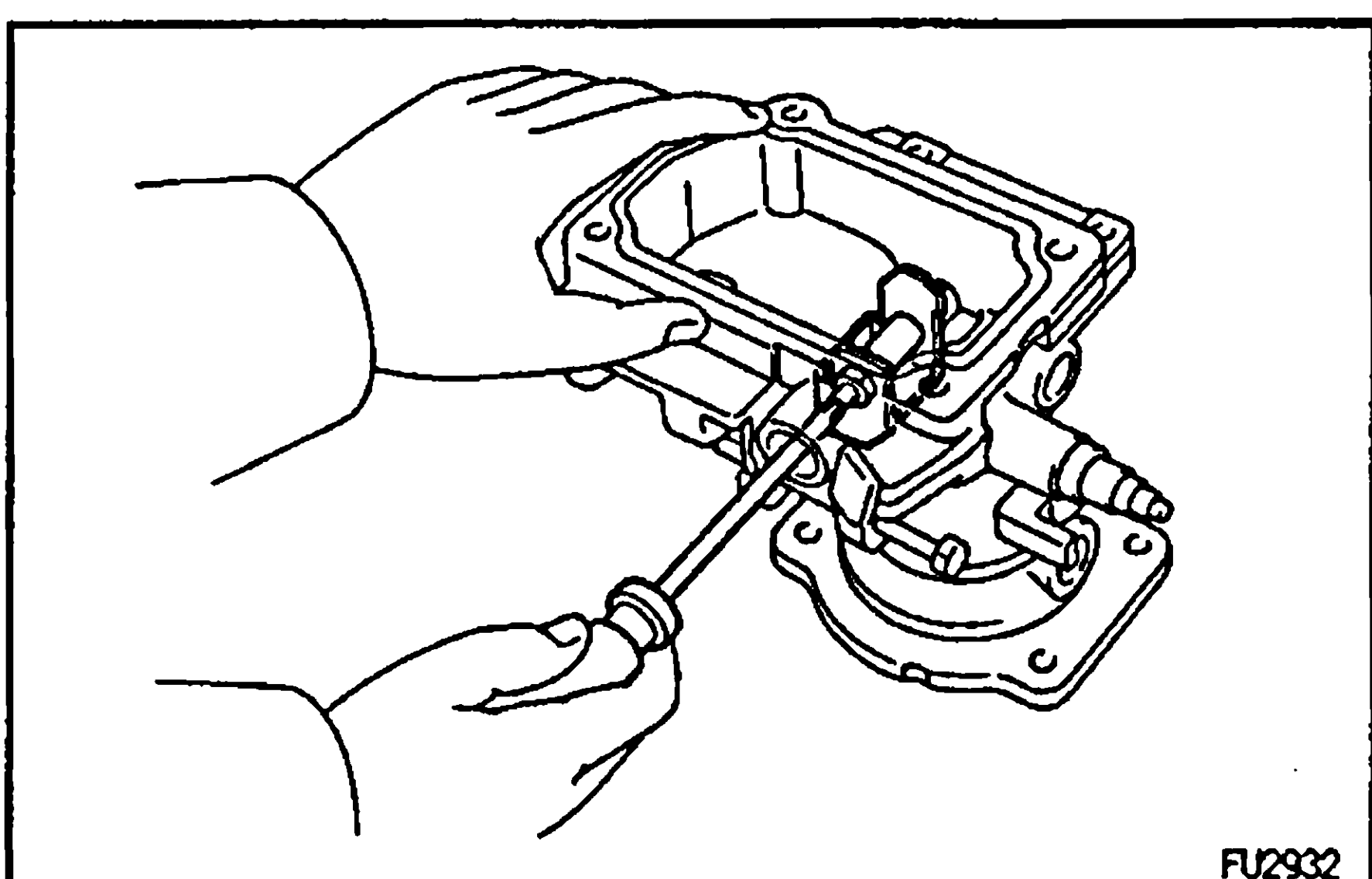
(2) New O—ring

- (b) Install the No.2 SICS lever, washer and O—ring assembly to the governor cover.

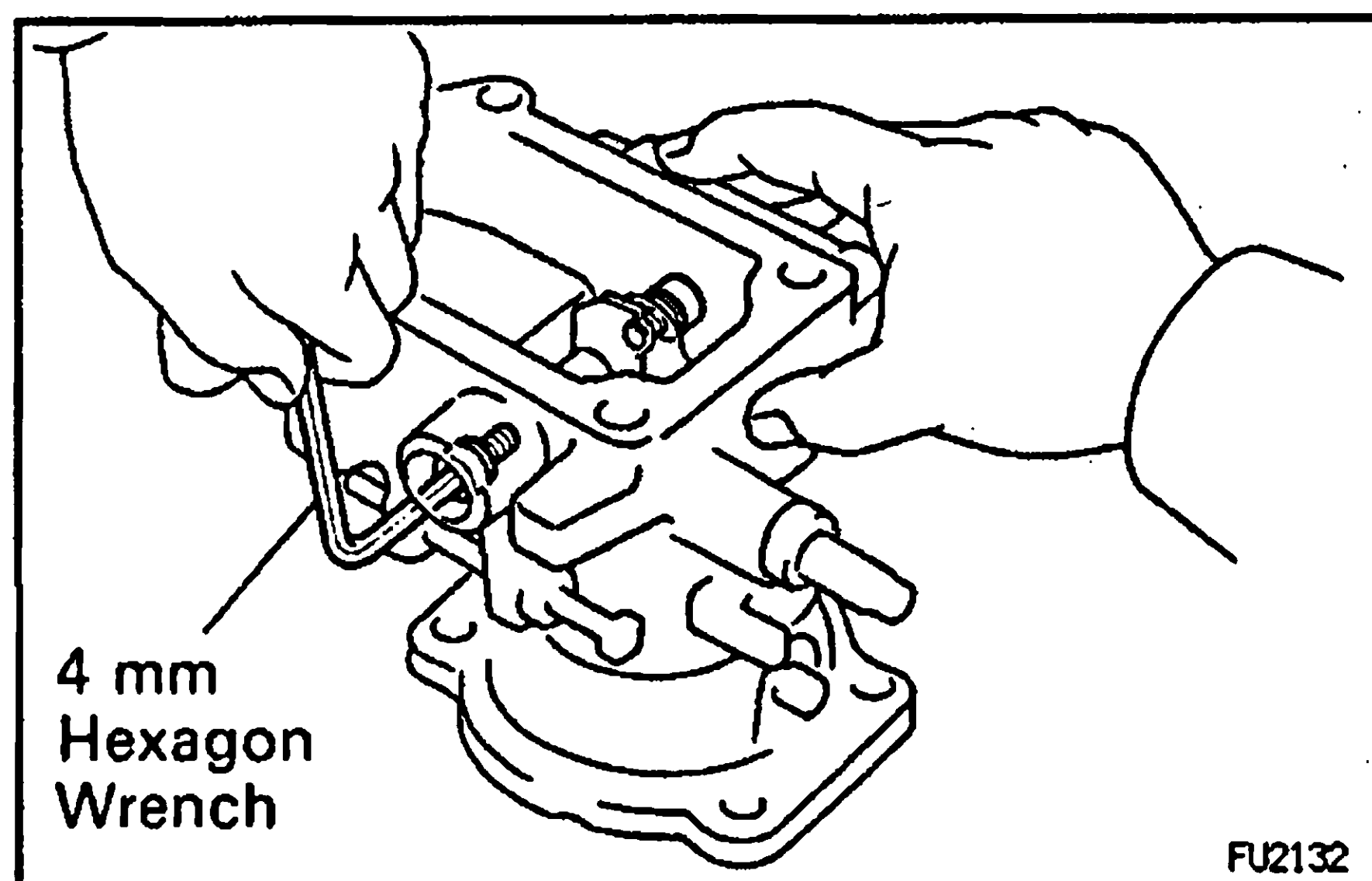


C. Install control lever

- (a) Insert the connecting pin into the governor cover.



- (b) Using a small screwdriver, install the control lever with the support pin.

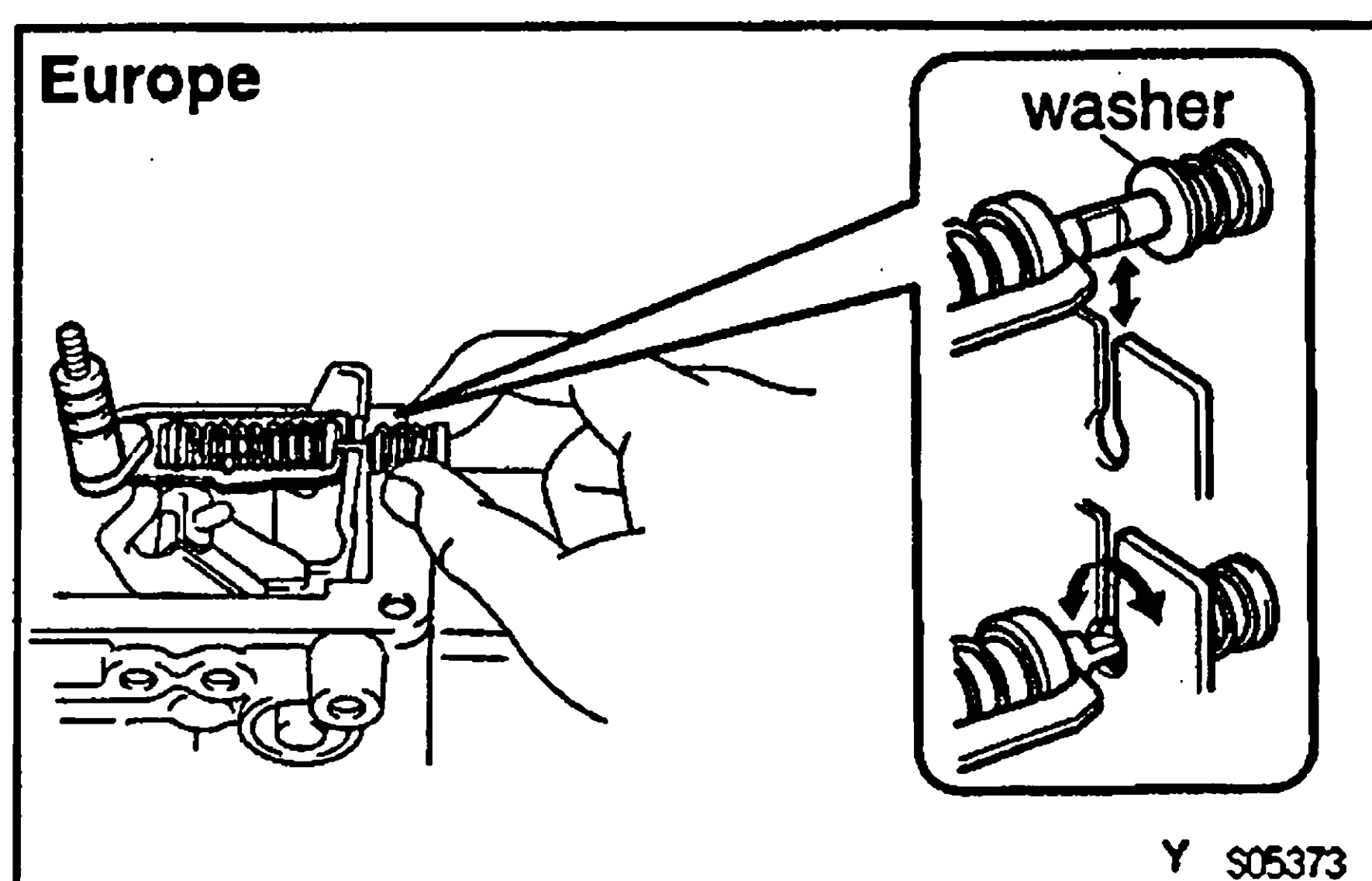


- (c) Using a 4 mm hexagon wrench, install 2 new gaskets and the 2 bolts.

Torque: 6.9 N·m (70 kgf·cm, 61 in·lbf)

19. INSTALL THESE PARTS FROM ADJUSTING LEVER SHAFT

- Washer
- New O—ring



20. INSTALL GOVERNOR COVER

- (a) Europe:

Install a new gasket to the groove of the governor cover.

- (b) Europe:

Connect the adjusting lever shaft to the governor link and twist the shaft lightly.

- (c) Australia:

Install the speed control spring to the adjusting shaft.

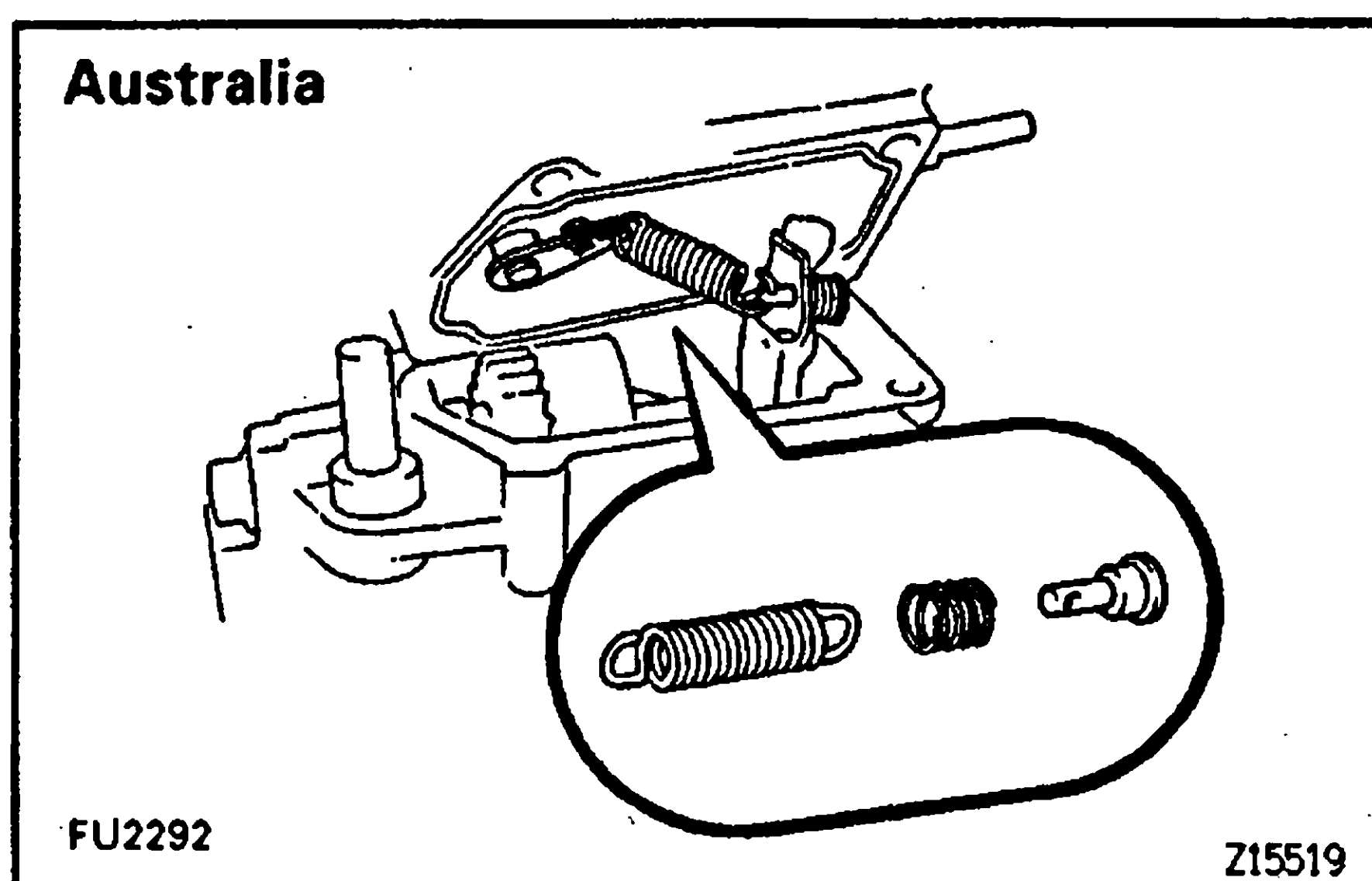
- (d) Australia:

Install a new gasket to the groove of the governor cover.

- (e) Australia:

Install the damper spring and spring seat, and connect the speed control spring to the spring seat.

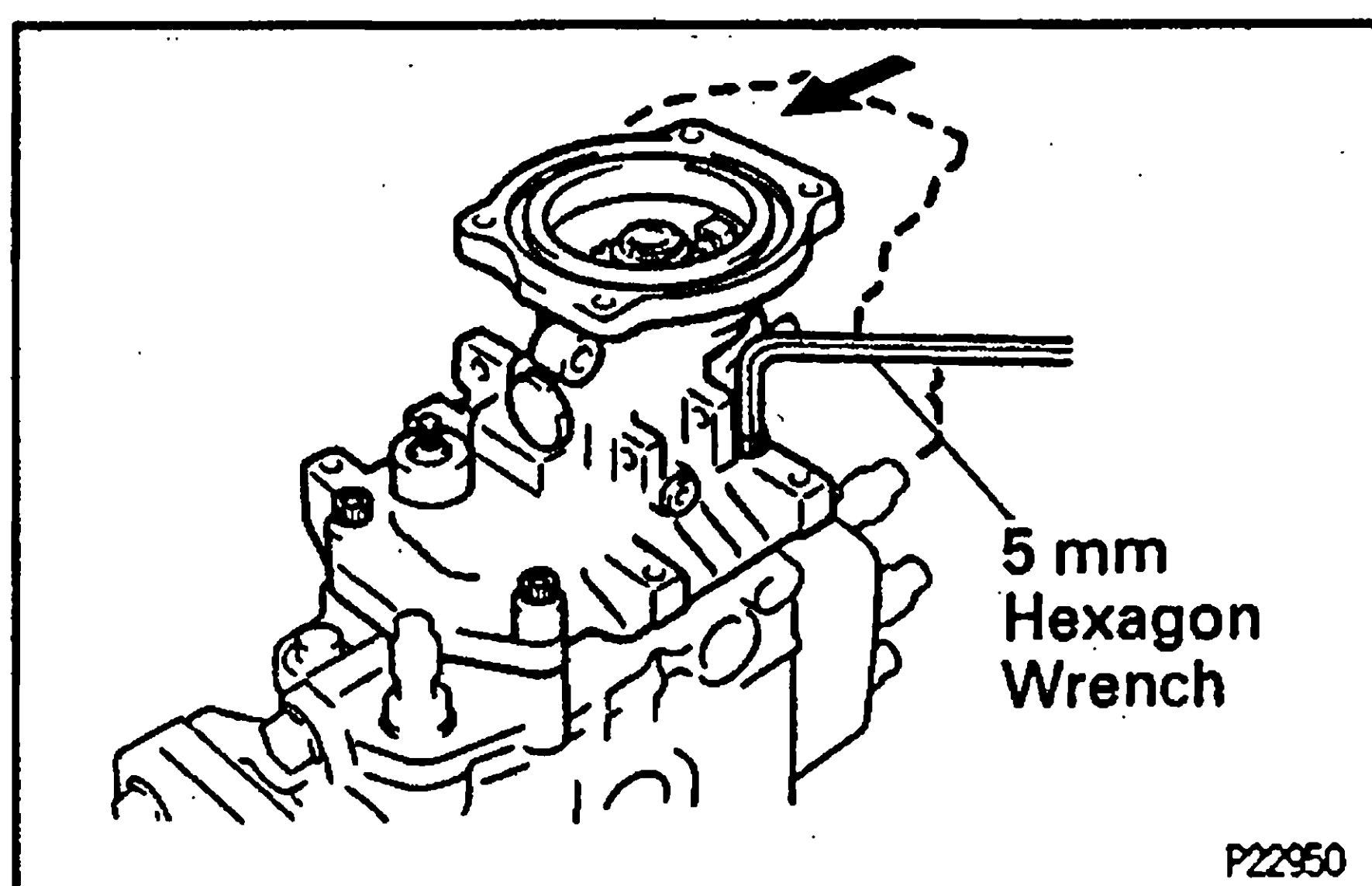
- (f) Install the adjusting lever shaft, washer and O—ring assembly to the governor cover.



- (g) Using a 5 mm hexagon wrench, install the governor cover with the 4 bolts.

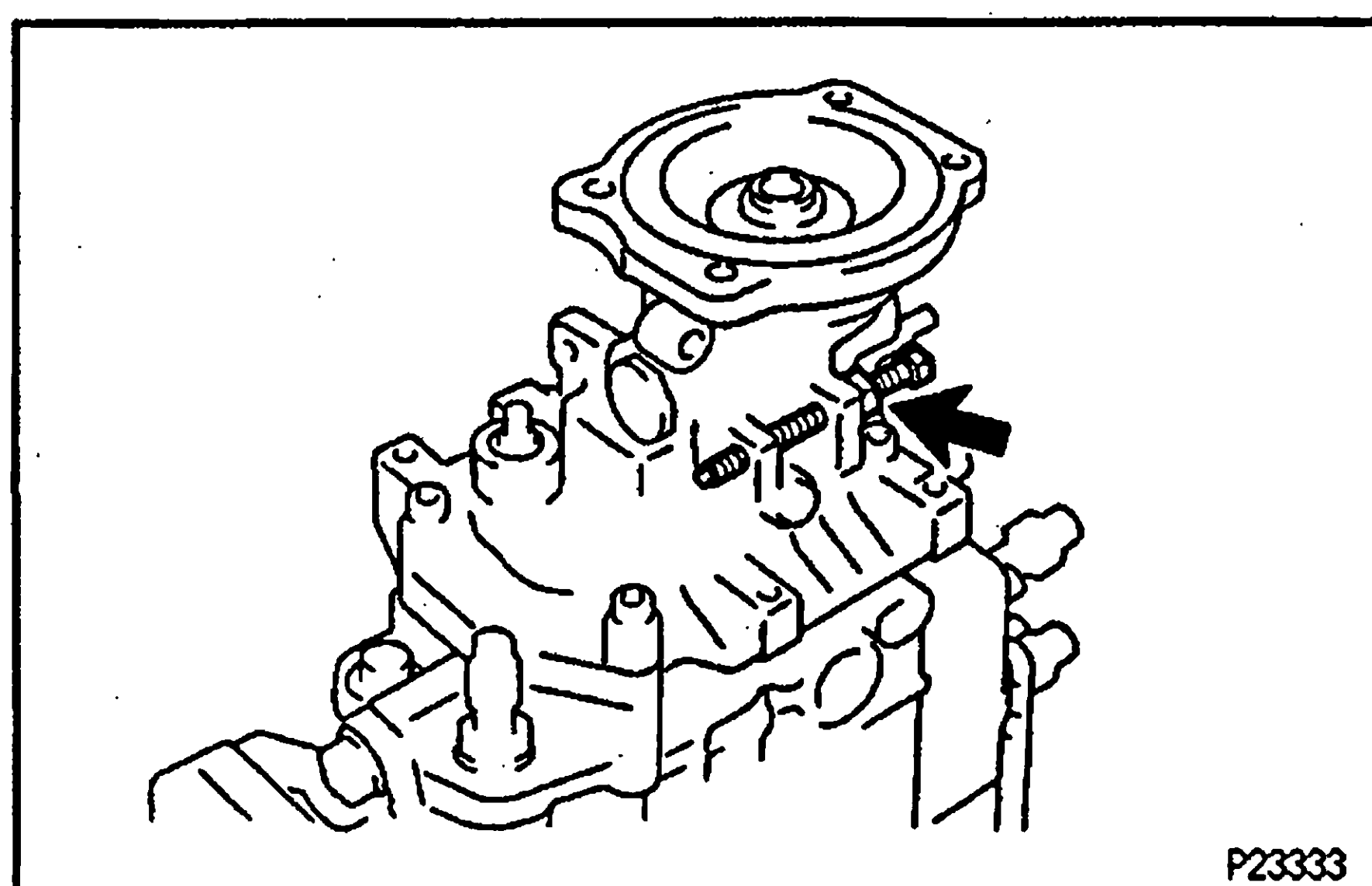
Torque: 8.3 N·m (85 kgf·cm, 74 in·lbf)

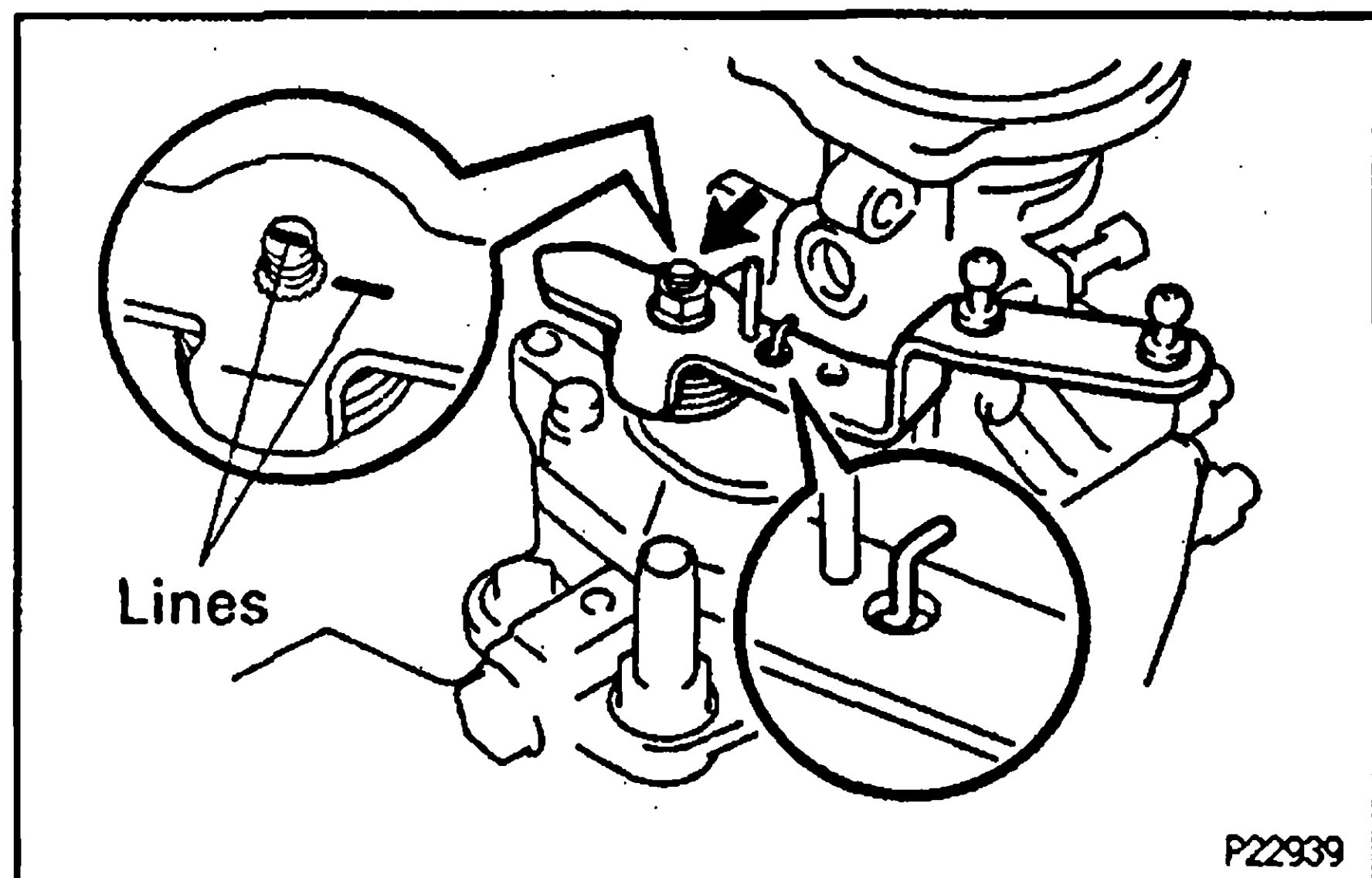
HINT: Use the bolt which is 35 mm (1.38 in.) length.



- (h) Install the idle speed adjusting screw and lock nut.

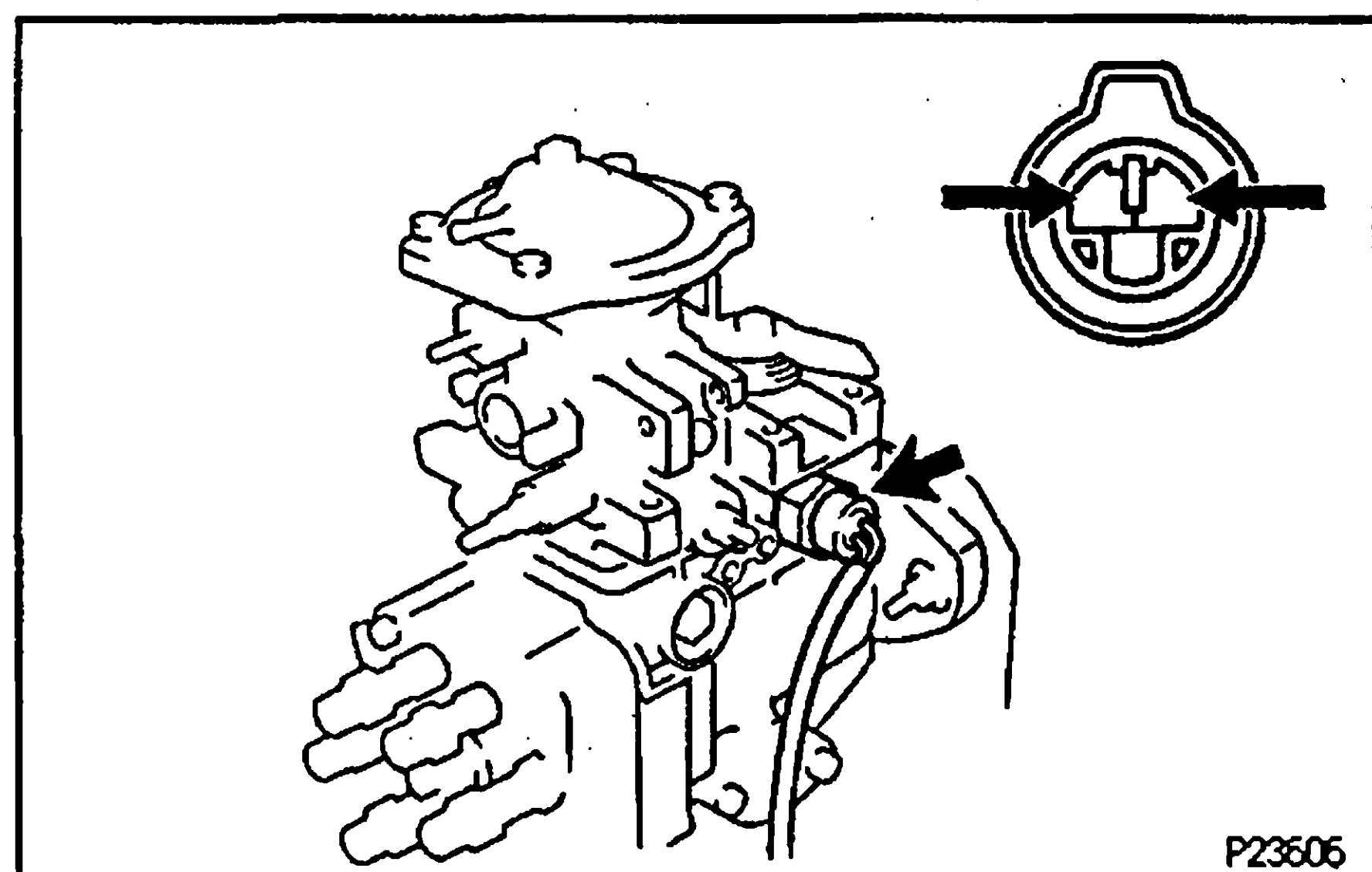
Torque: 6.9 N·m (70 kgf·cm, 61 in·lbf)



**21. INSTALL ADJUSTING LEVER**

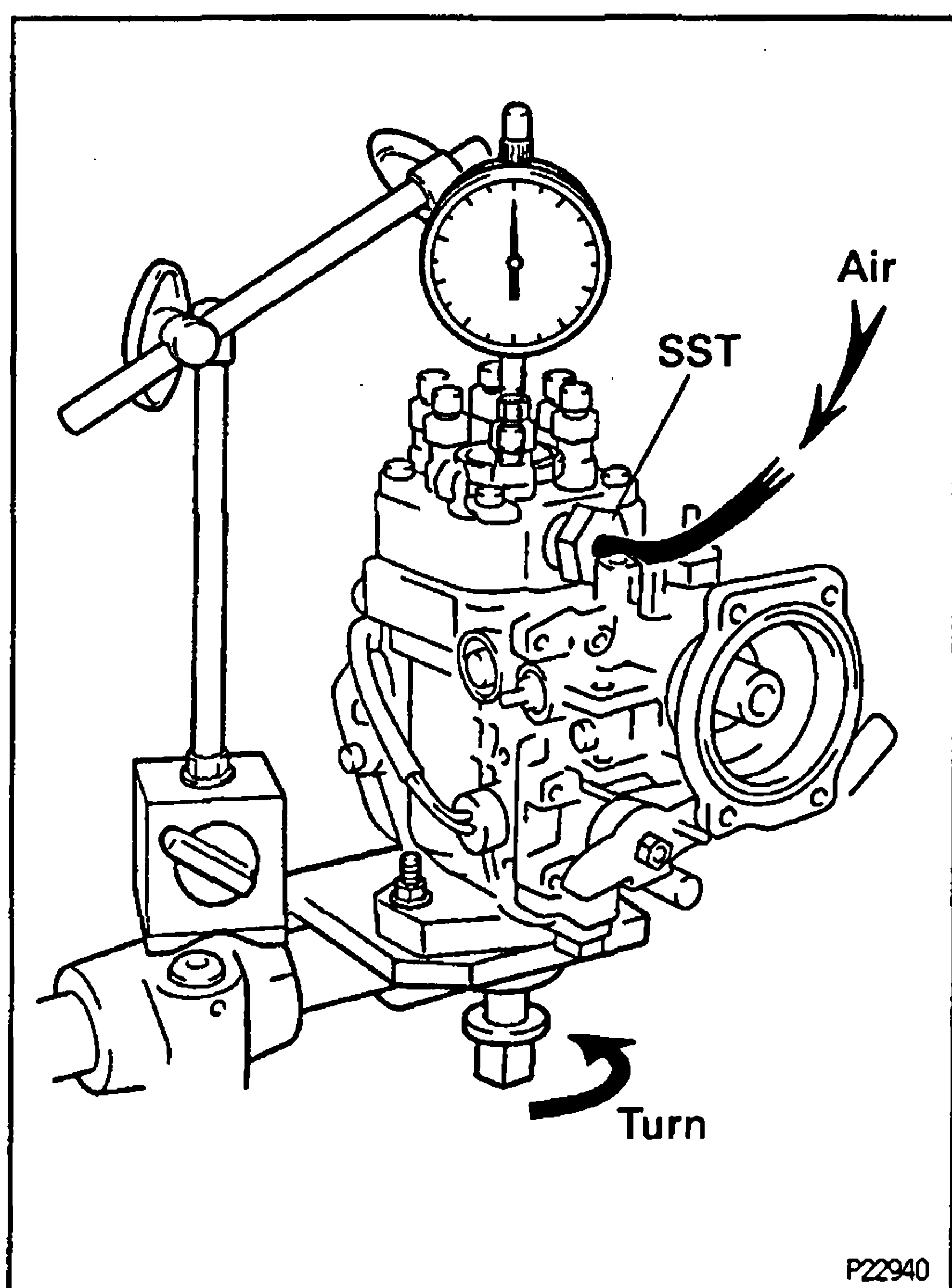
- Place the return spring on the governor cover.
- Hook the return spring to the adjusting lever, and turn and place the adjusting lever on the governor shaft.
- Align the lines of the adjusting lever shaft and adjusting lever.
- Install the nut.

Torque: 8.4 N·m (85 kgf·cm, 74 in.-lbf)

**22. INSTALL PICKUP SENSOR**

- Connect the sensor lead wires to the connector.
- Install a new O-ring and pickup sensor.

Torque: 22 N·m (225 kgf·cm, 16 ft-lbf)

**23. ADJUST PLUNGER PRE-STROKE**

- Install SST to the fuel cut solenoid installation screw section.
SST 09275-17010
- Set the dial indicator so that the tip of the dial indicator push rod touches the upper surface of the plunger.
- Install the set nut to the drive shaft.
- Rotate the drive shaft, set the plunger to BDC and set the scale on the dial indicator to 0 mm (0 in.).
- Apply a few drops of light oil (diesel fuel) to the top surface of the plunger, and when 49 kpa (0.1 kgf/cm², 1.4 psi) of air is applied to SST, bubbles appear on the upper surface of the plunger.
- Slowly rotate the drive shaft in the pump rotation direction (clockwise) and read the dial indicator when the bubbles on the top of the plunger disappear.

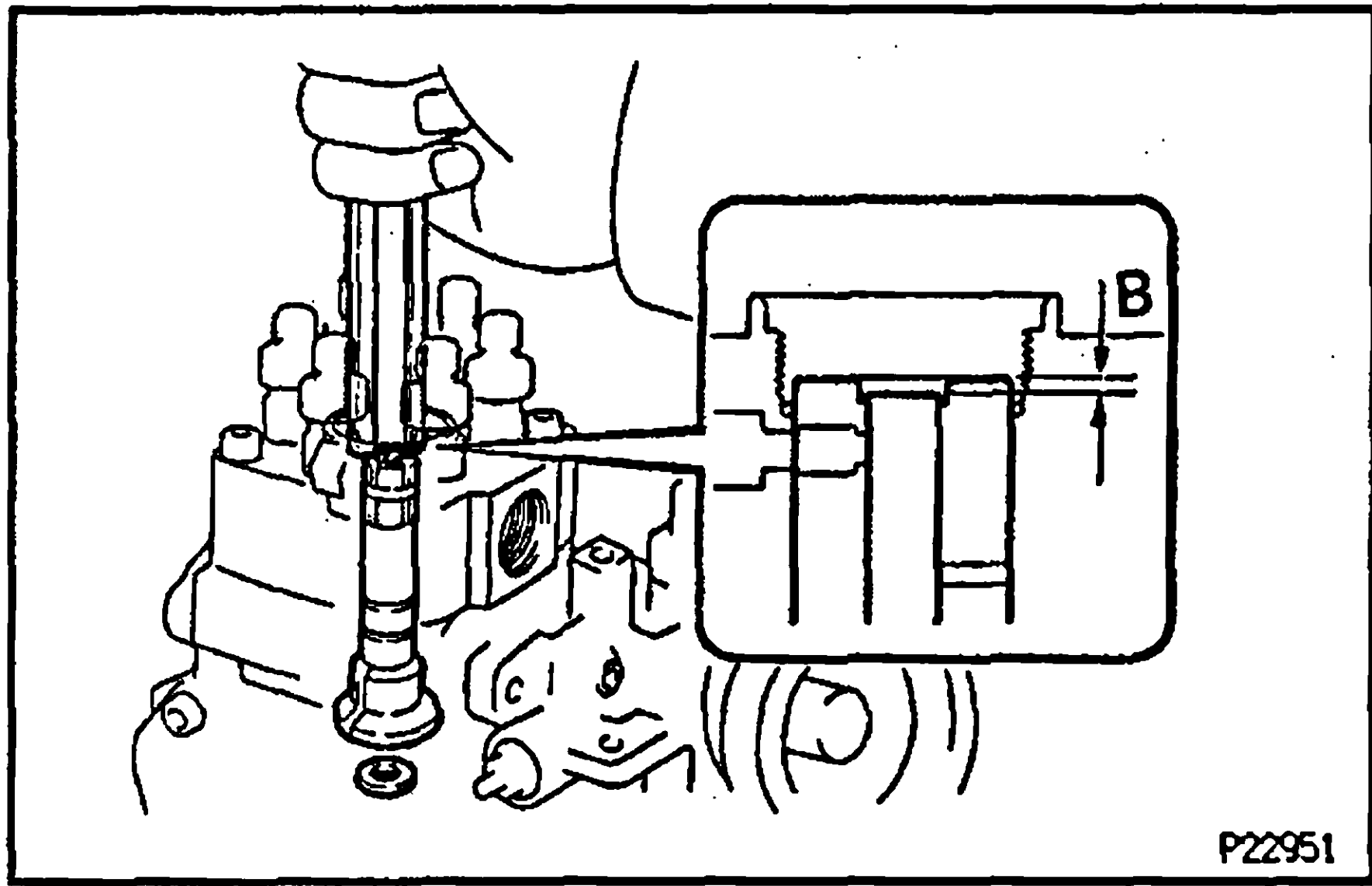
Pre-stroke:

0.48 — 0.52 mm (0.0189 — 0.0205 in.)

If the pre-stroke is not as specified, replace the plunger adjusting shim under the plunger with a different sized shim.

HINT:

- Shims are available in 131 sized in increments 0.01 mm (0.004 in.), from 1.90 mm (0.0748 in.) to 3.20 mm (0.1260 in.).
 - If the shim is made thicker, the pre-stroke is decreased.
- Remove the SST from the fuel cut solenoid installation screw section.
 - Remove the set nut from the drive shaft.

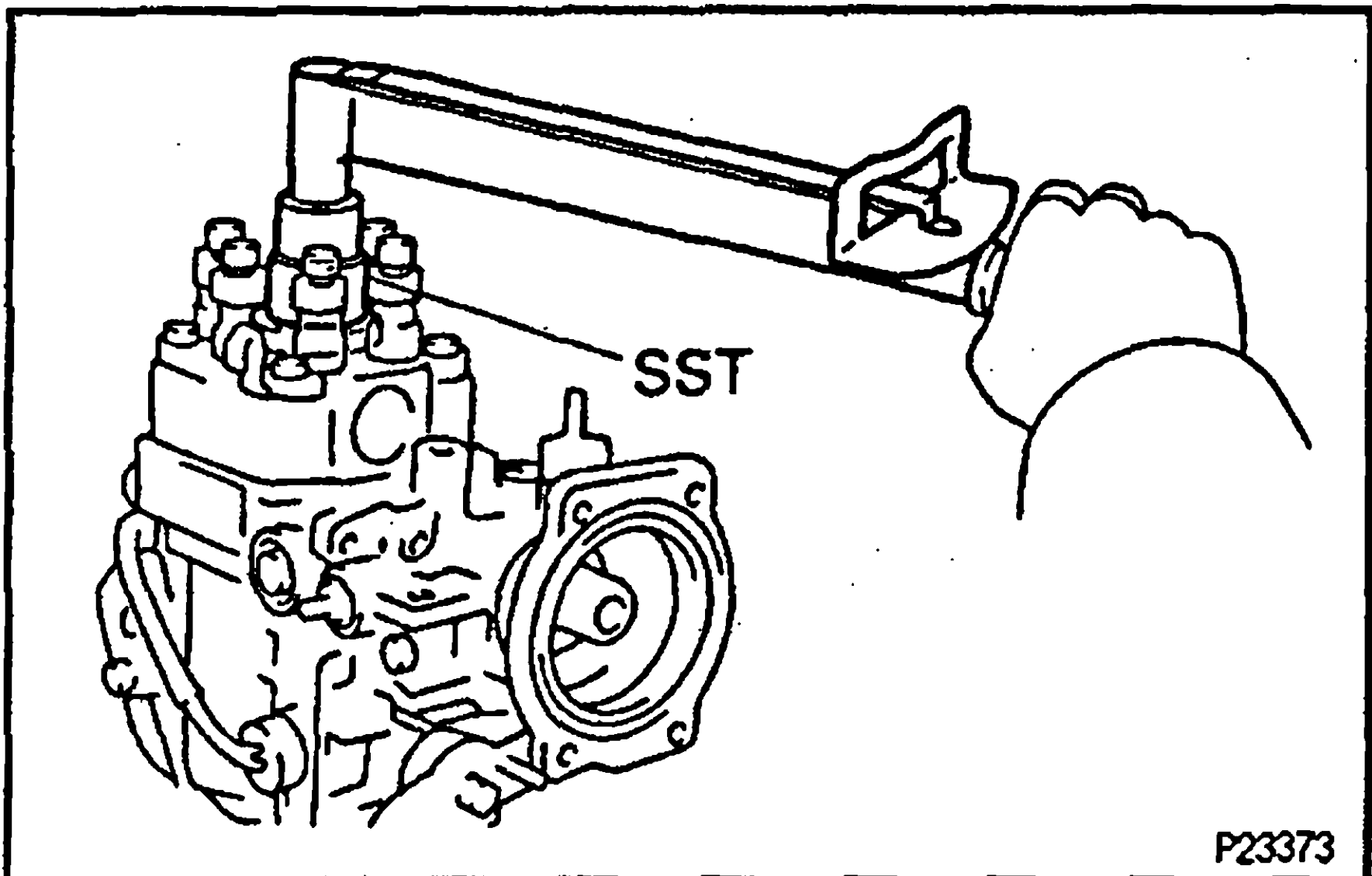


- (i) After completing the pre-stroke adjustment, check that dimension B is within the specifications.

Dimension B:

3.4 — 3.6 mm (0.134 — 0.142 in.)

If dimension B is not within the specification, replace the distributor head.

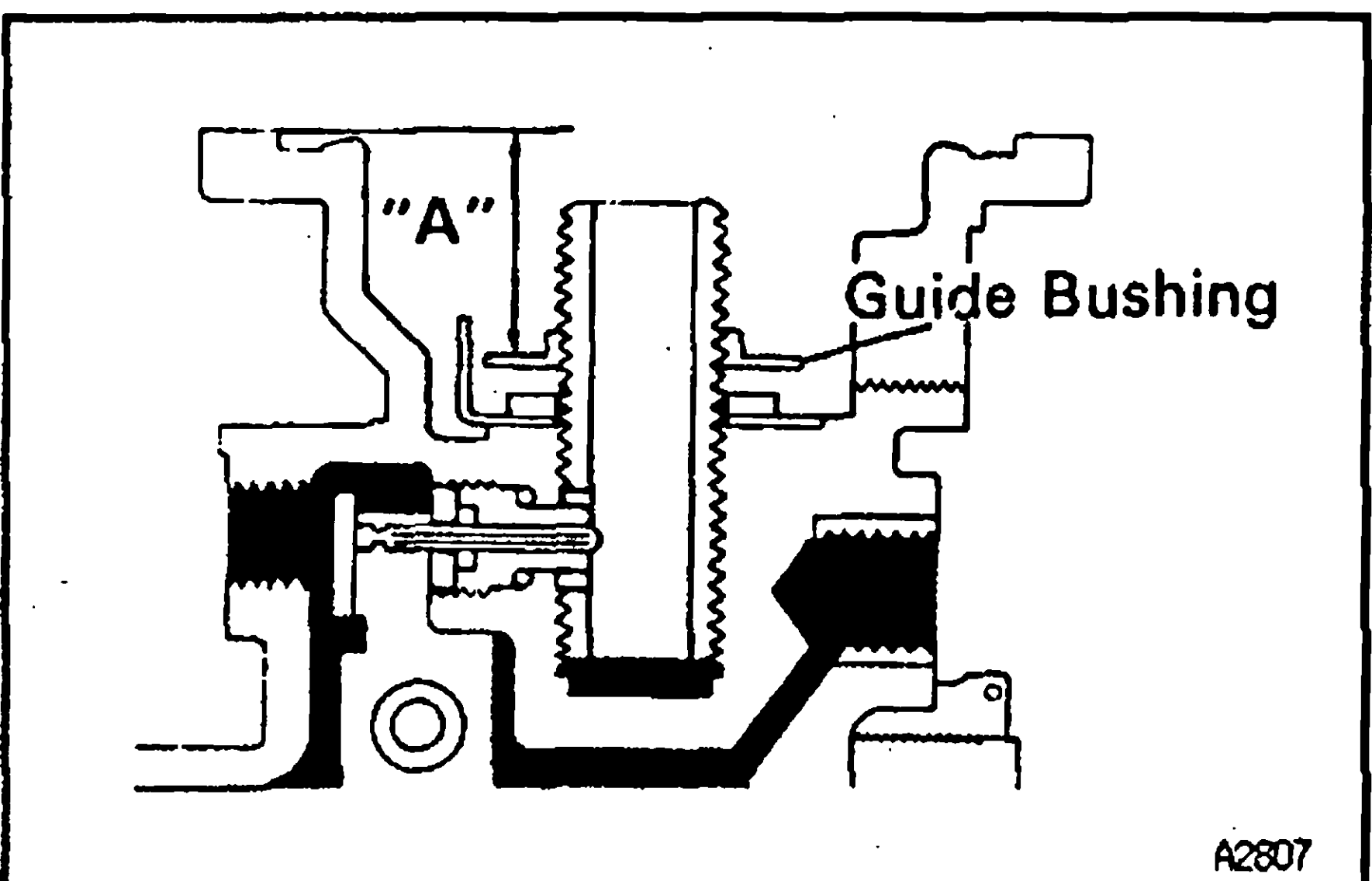


24. INSTALL DISTRIBUTIVE HEAD PLUG

- Install a new O-ring to the head plug.
- Using SST, install the head plug.

SST 09260-54012 (09262-54010)

Torque: 88 N·m (900 kgf·cm, 65 ft·lbf)



25. ASSEMBLE BOOST COMPENSATOR

A. Install guide bushing

Install and adjust the guide bushing to the dimension "A" as shown in the illustration.

Dimension "A":

Europe: 17.3 — 17.4 mm (0.681 — 0.685 in.)

Australia: 18.9 — 19.0 mm (0.744 — 0.748 in.)

B. Install boost compensator diaphragm

- Adjust boost compensator shim.

- Place the shim on the guide bushing.
- Using vernier calipers, measure the dimension "B" as shown in the illustration.

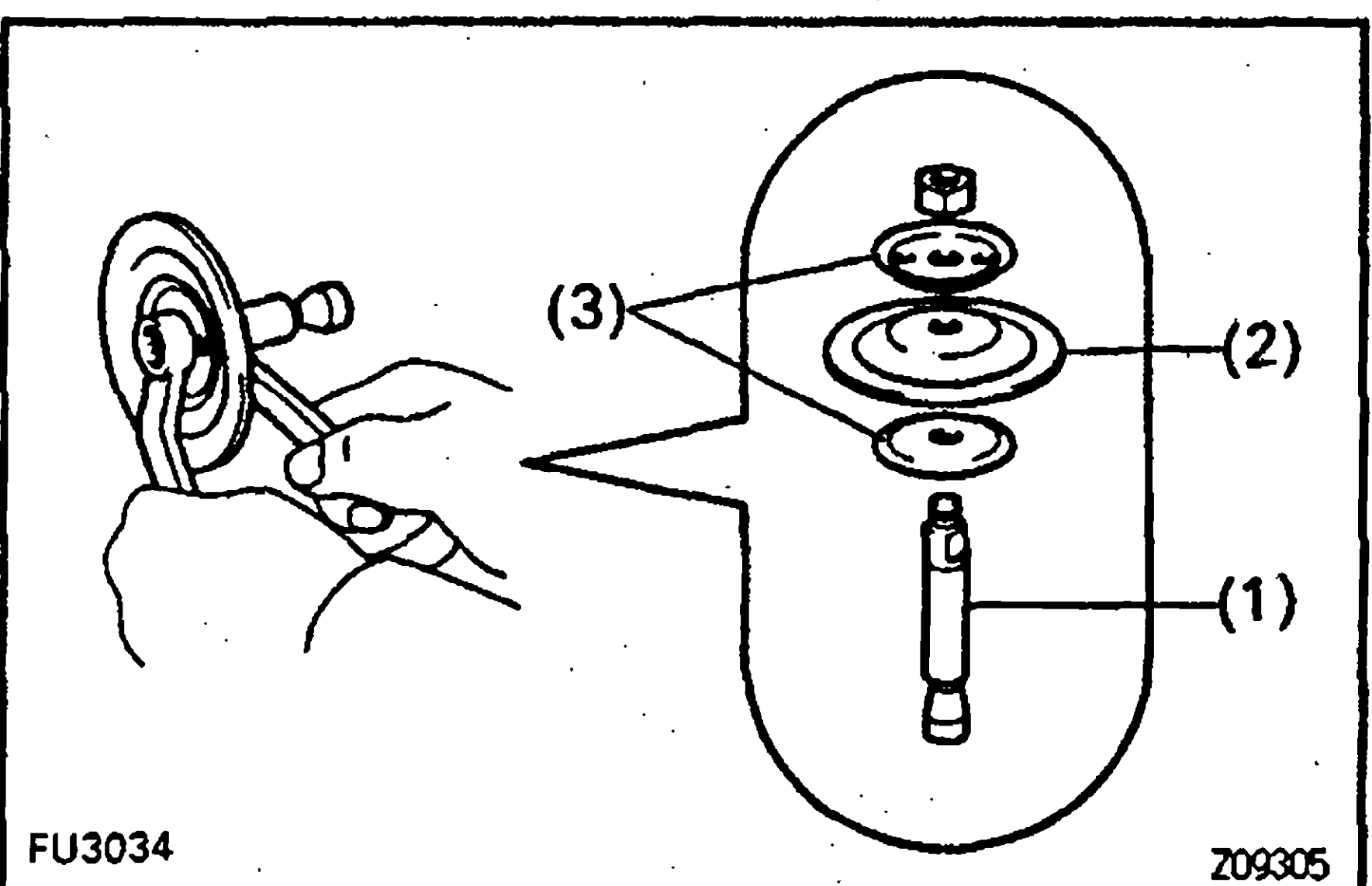
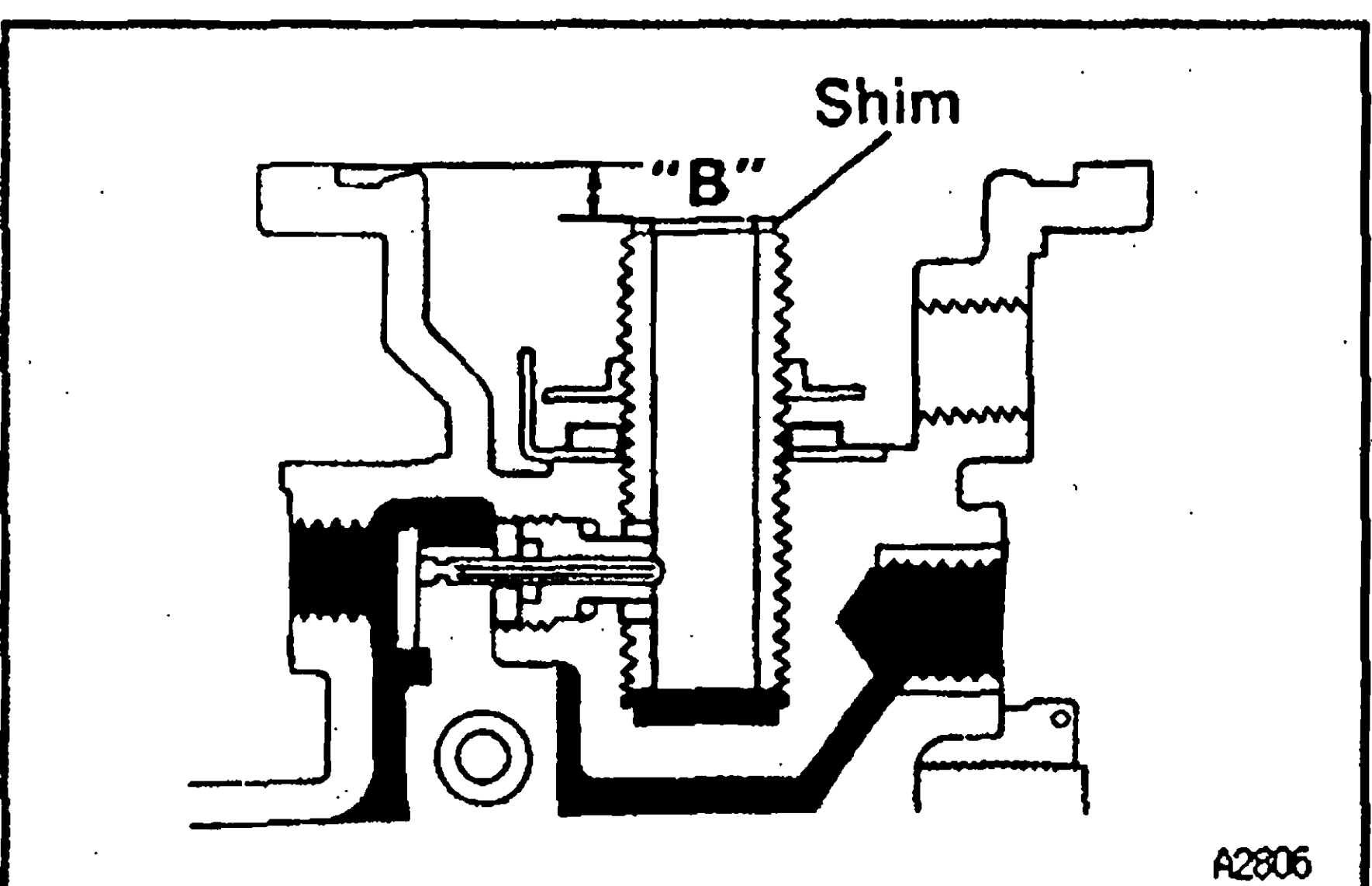
Dimension "B":

Europe: 3.6 — 3.8 mm (0.142 — 0.150 in.)

Australia: 3.1 — 3.3 mm (0.122 — 0.130 in.)

If the dimension is not within specification, select and install the correct shim.

HINT: Shim are available in sized in increments 0.2 mm (0.008 in.), from 1.1 mm (0.043 in.) to 3.3 mm (0.130 in.).



- Apply sealant to the push rod threads.

Sealant:

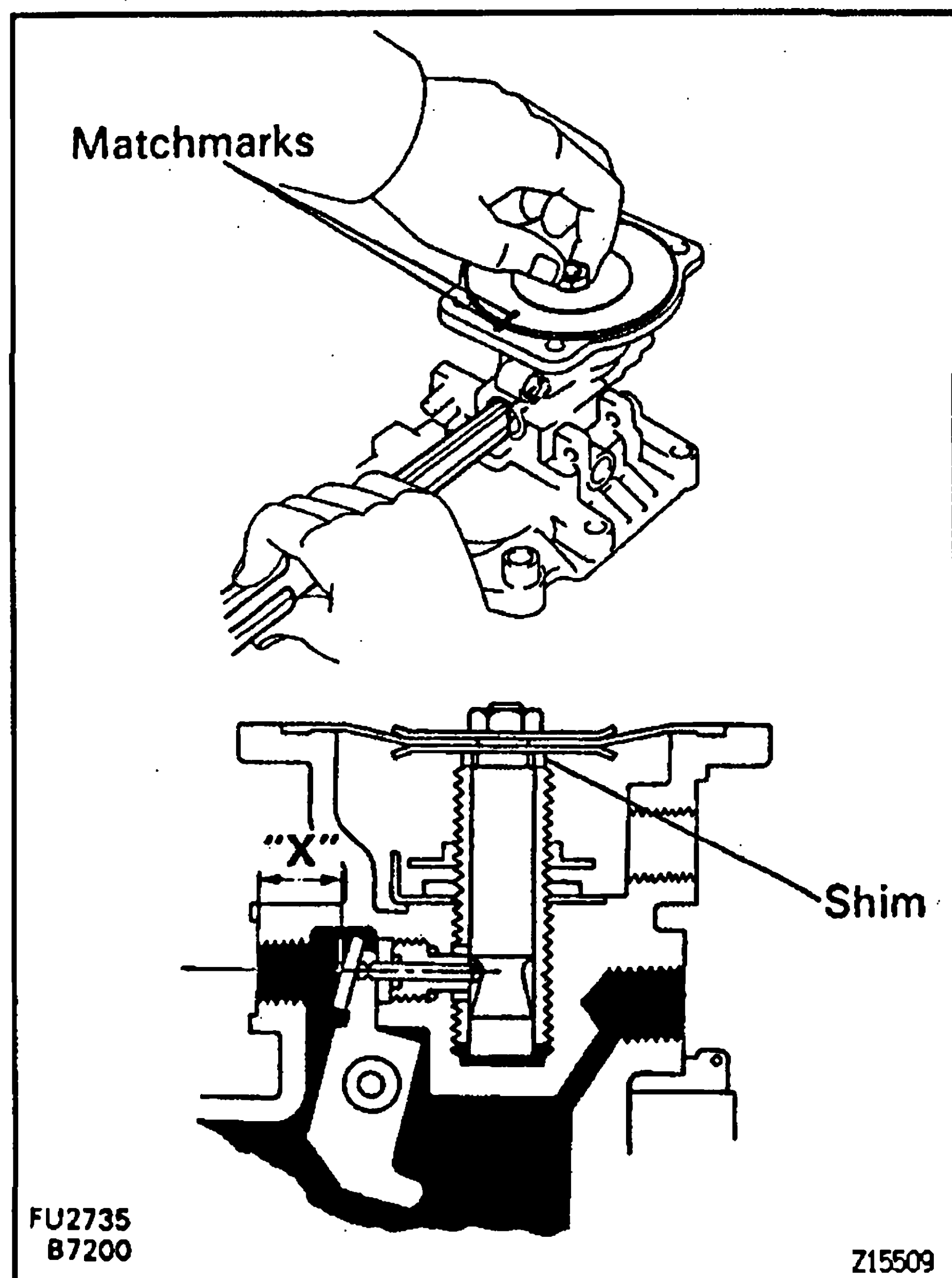
Part No. 08833-00080, THREE BOND 1344,

LOCTITE 242 or equivalent

- Assemble these parts with the nut.

Torque: 7.4 N·m (75 kgf·cm, 65 in·lbf)

- Push rod
- Diaphragm
- 2 spring seats



(d) Adjust the installation direction of boost compensator diaphragm assembly.

- Install the shim and diaphragm assembly.

HINT: Do not assemble the spring.

- Using vernier calipers, while pushing on the diaphragm assembly dimension "X" with vernier calipers as shown.

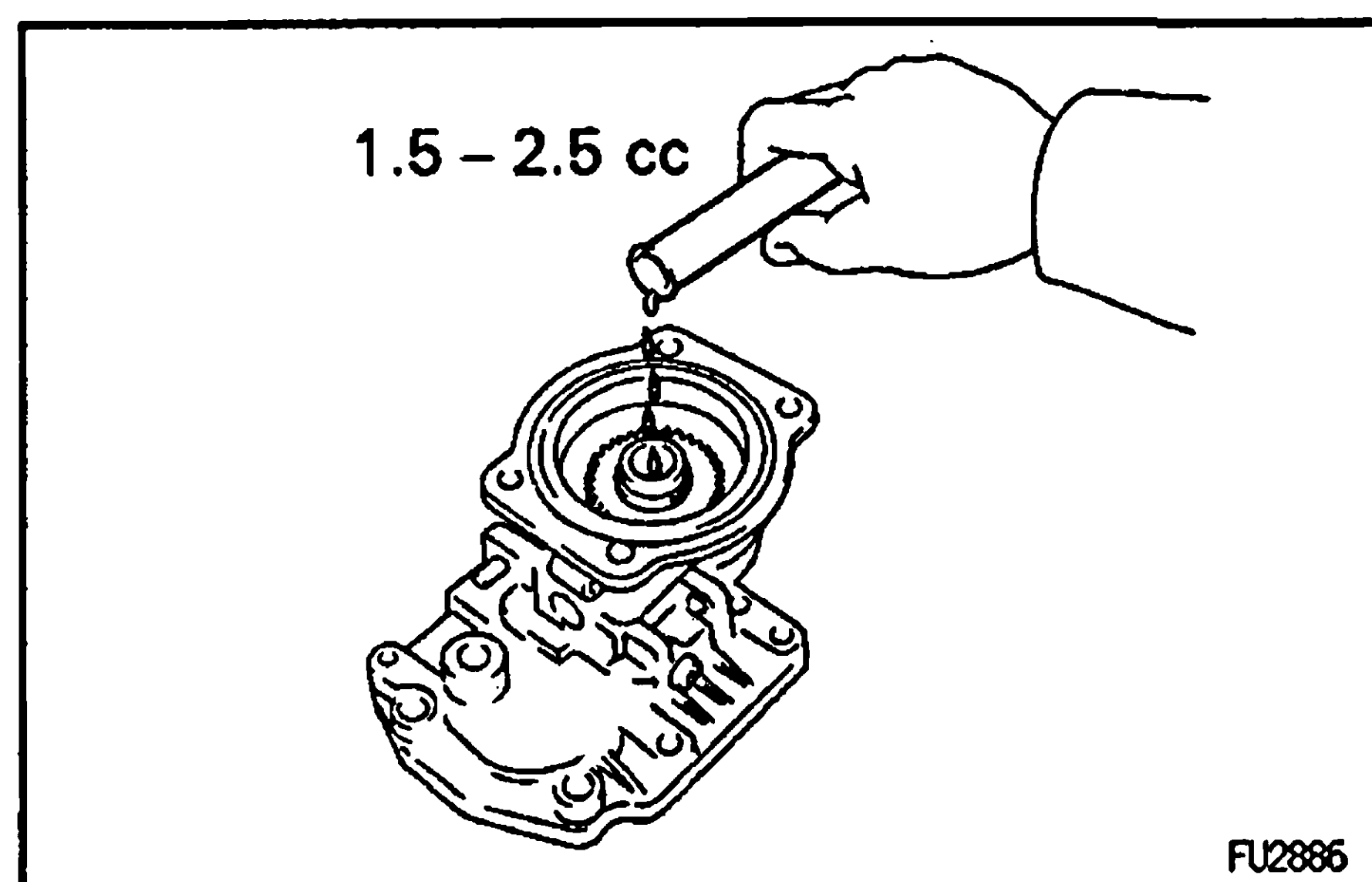
Dimension "X":

w/ BACS: 8.8 – 9.0 mm (0.346 – 0.354 in.)

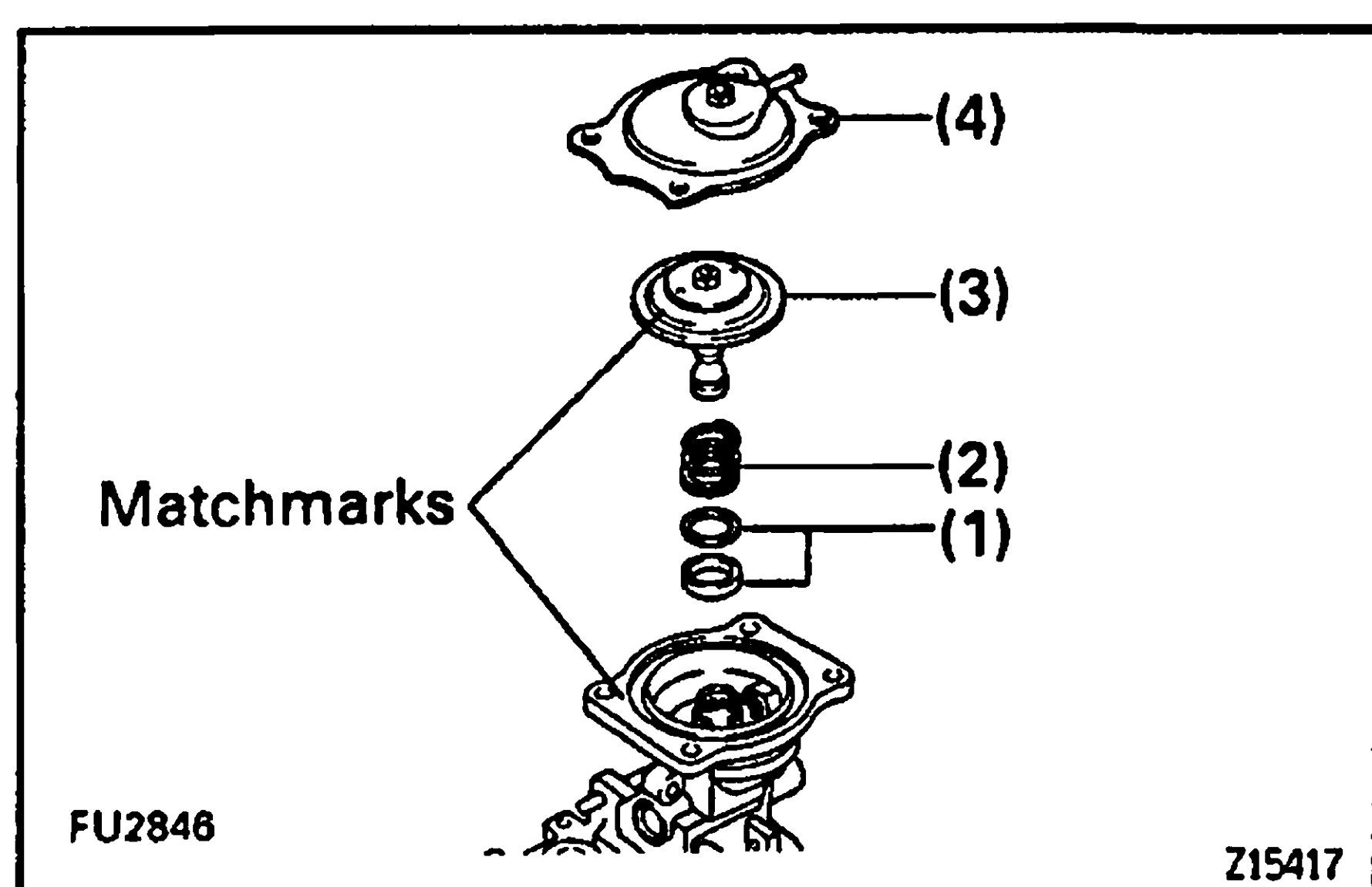
w/o BACS: 8.5 – 8.7 mm (0.335 – 0.343 in.)

HINT: Measure at the center of the hole.

- Place matchmarks on the diaphragm assembly and governor cover.
- Remove the diaphragm assembly.

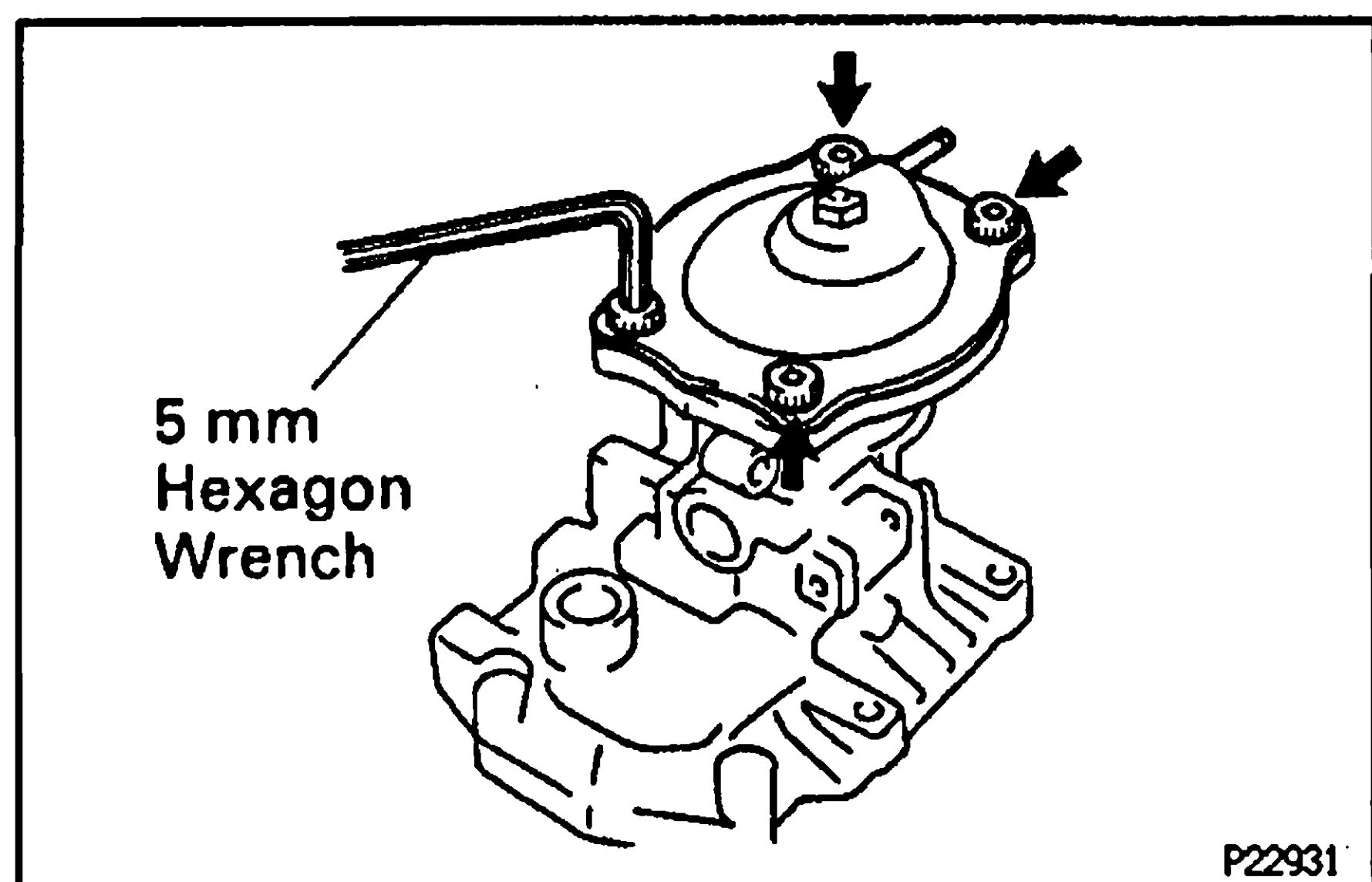


(e) Insert 1.5 – 2.5 cc (0.09 – 0.15 cu in.) of engine oil into the bushing hole.



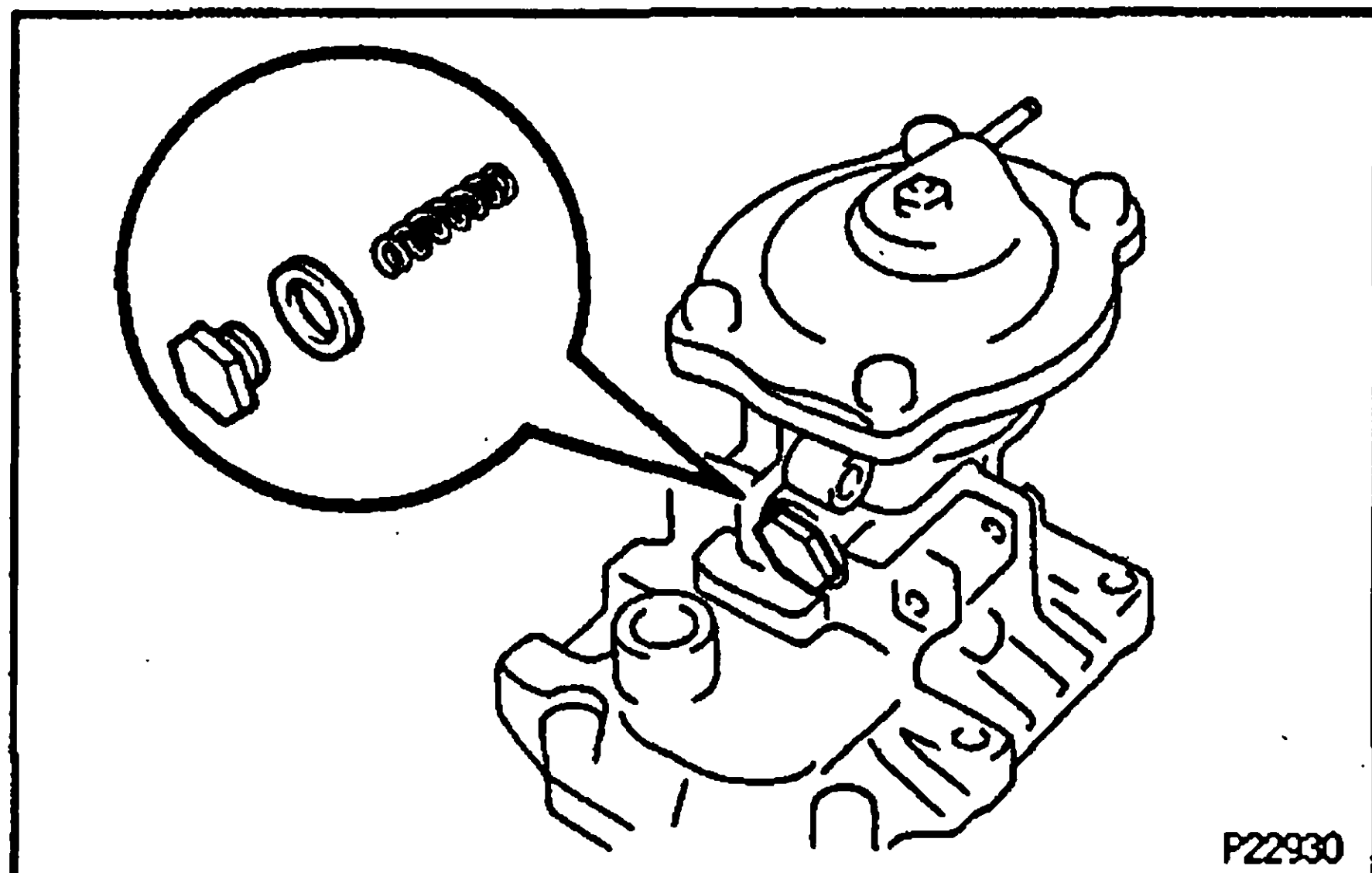
(f) Install these parts to the governor cover.

- (1) Boost compensator shim
- (2) Spring
- (3) Diaphragm assembly
- (4) Diaphragm cover



(g) Using a 5 mm hexagon wrench, install the diaphragm cover with the 4 bolts.

Torque: 7.4 N·m (75 kgf·cm, 65 in·lbf)

**C. Install lever control spring**

Install the lever control spring with a new gasket and the bolt.

Torque: 11 N·m (115 kgf·cm, 8 ft·lbf)

26. INSTALL INJECTION PUMP STAY

Torque: 8.4 N·m (85 kgf·cm, 74 in·lbf)

27. INSTALL FUEL CUT SOLENOID

- (a) Install a new O—ring on the fuel cut solenoid.
- (b) Install the wave washer, strainer, valve, spring and fuel cut solenoid.

Torque: 22 N·m (225 kgf·cm, 16 ft·lbf)

- (c) Except Europe:
Install the lead wire to the fuel cut solenoid with the nut.

Torque: 1.7 N·m (17 kgf·cm, 15 in·lbf)

- (d) Except Europe:
Install the dust cover to the fuel cut solenoid.

- (e) Except Europe:
Install the wire harness to the wire clip.

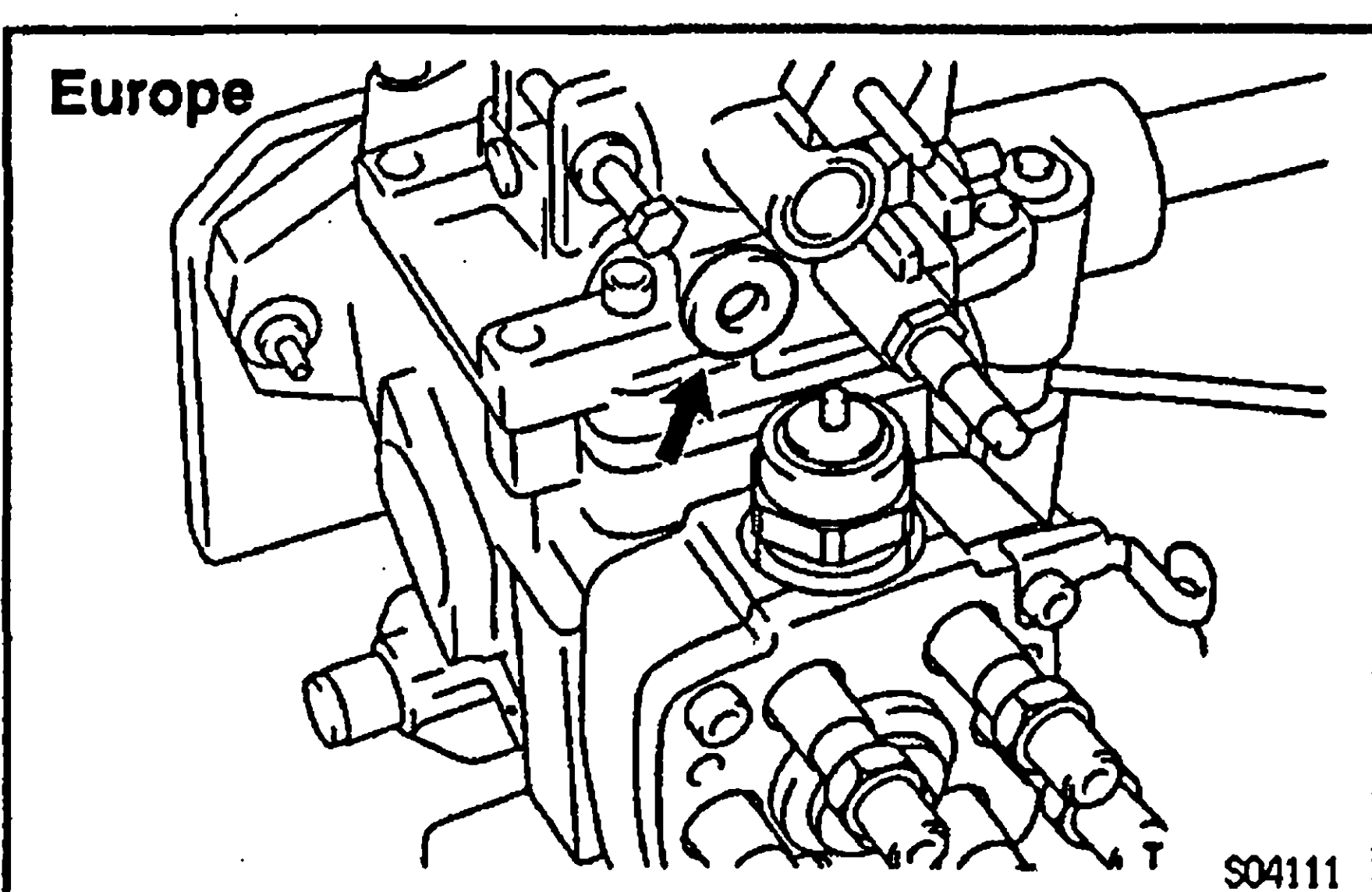
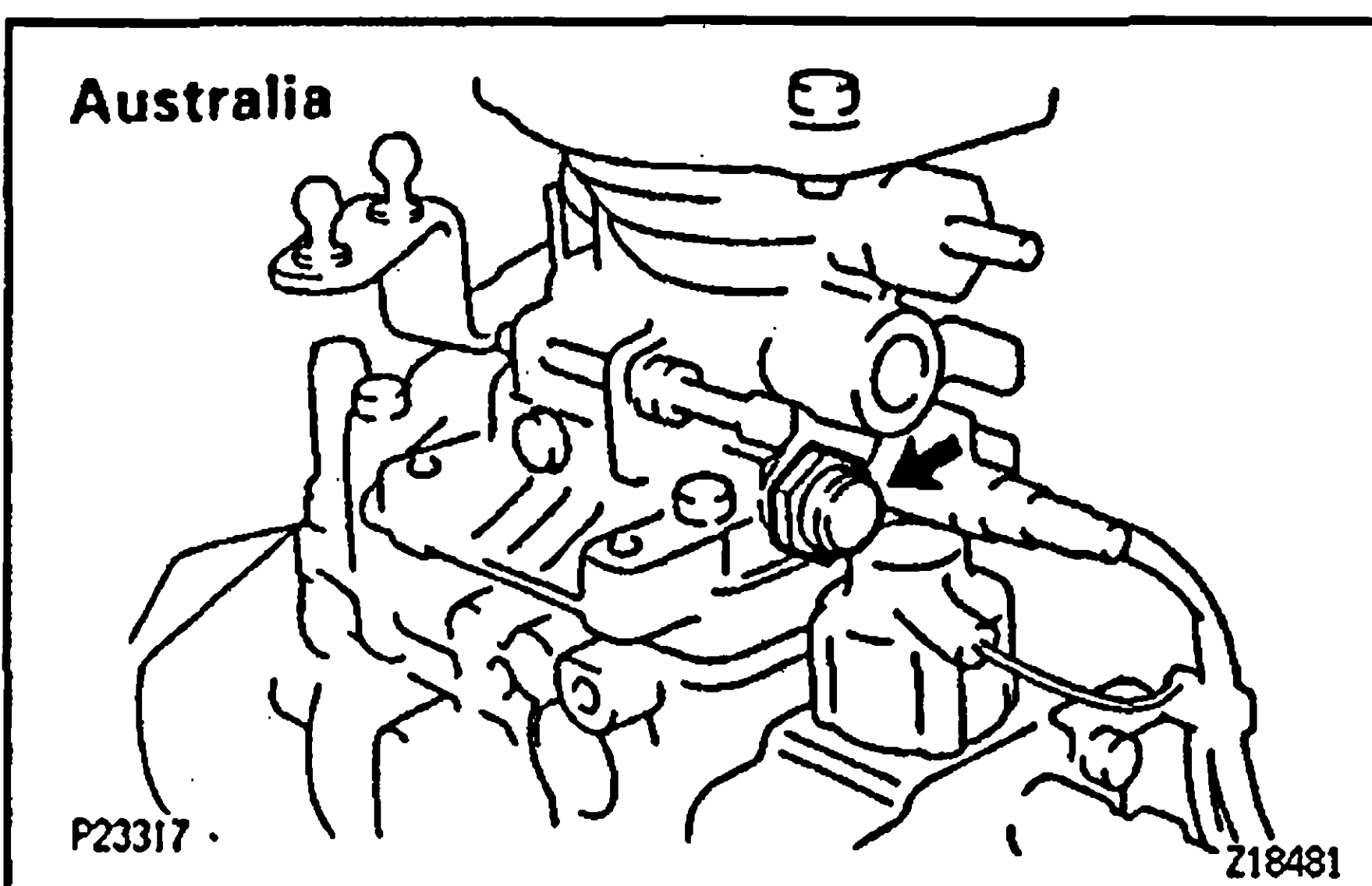
- (f) Except Europe:
Install the lead wire connector to the bracket.

28. INSTALL CAP

Australia:

Install a new gasket and the cap.

Torque: 11 N·m (115 kgf·cm, 8 ft·lbf)



Europe:

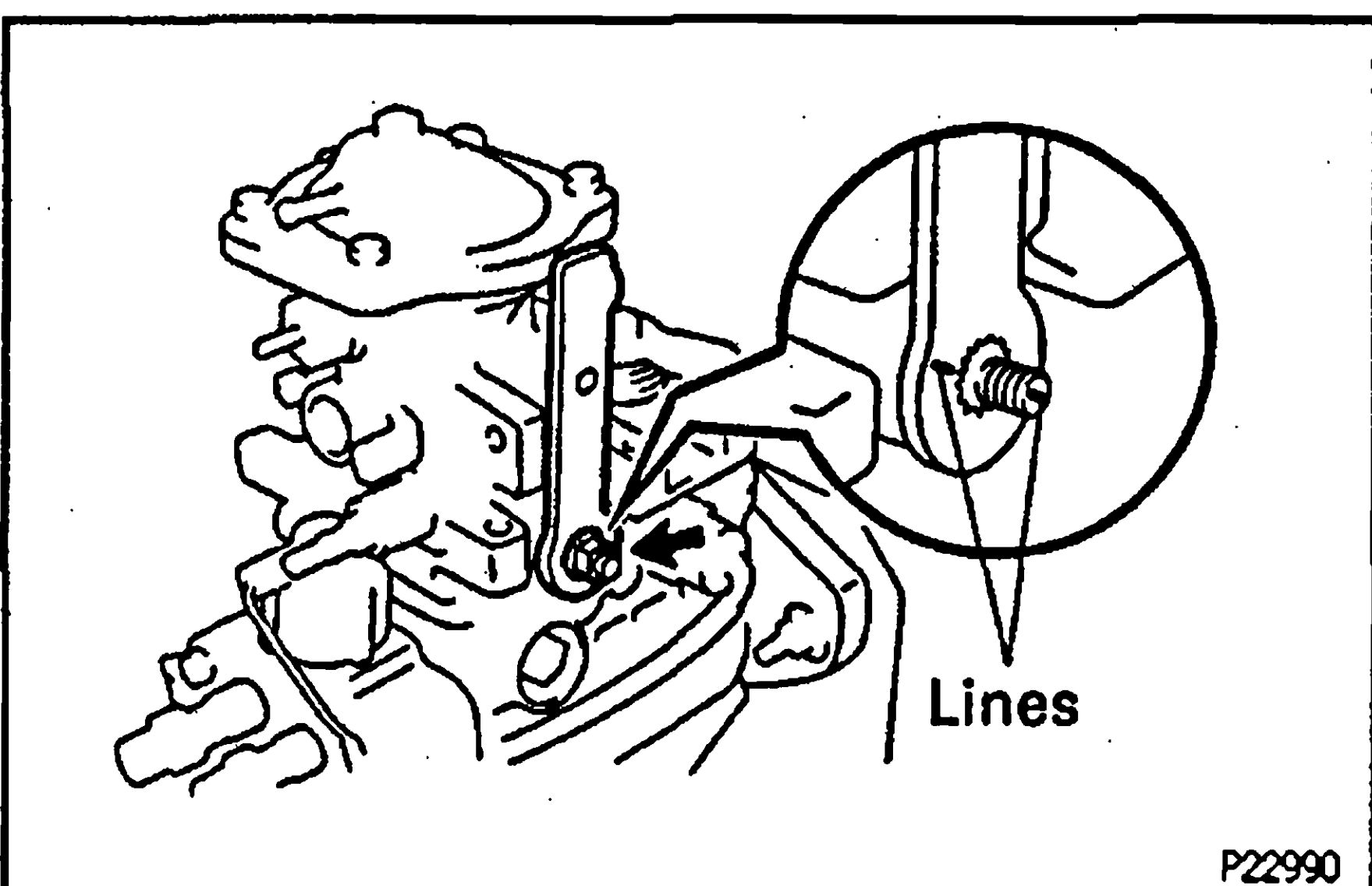
Install anew gasket and the cap

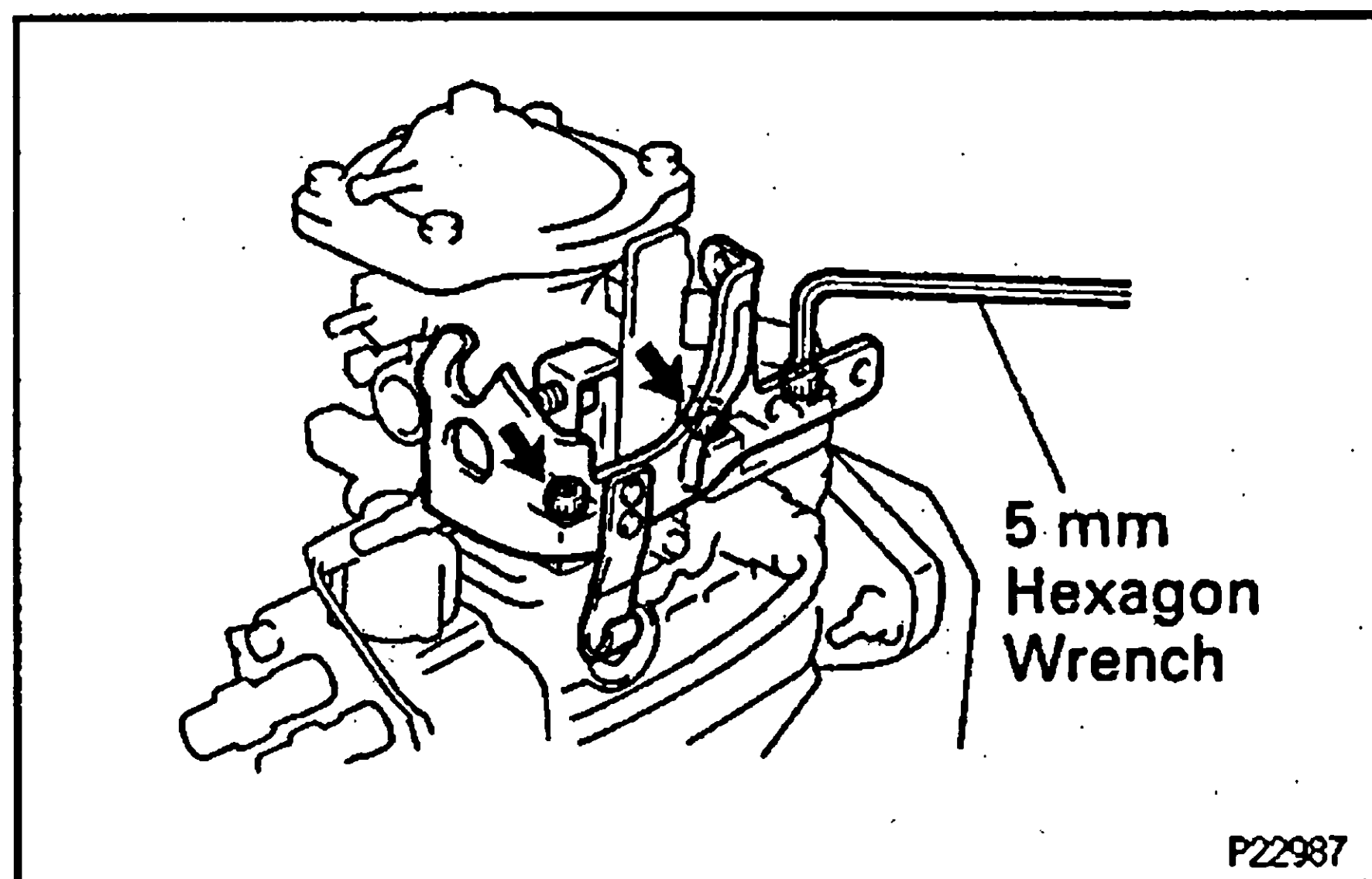
Torque: 11 N·m (115 kgf·cm, 8 ft·lbf)

29. INSTALL NO.1 SICS LEVER

- (a) Align the lines of the levers.
- (b) Install the nut.

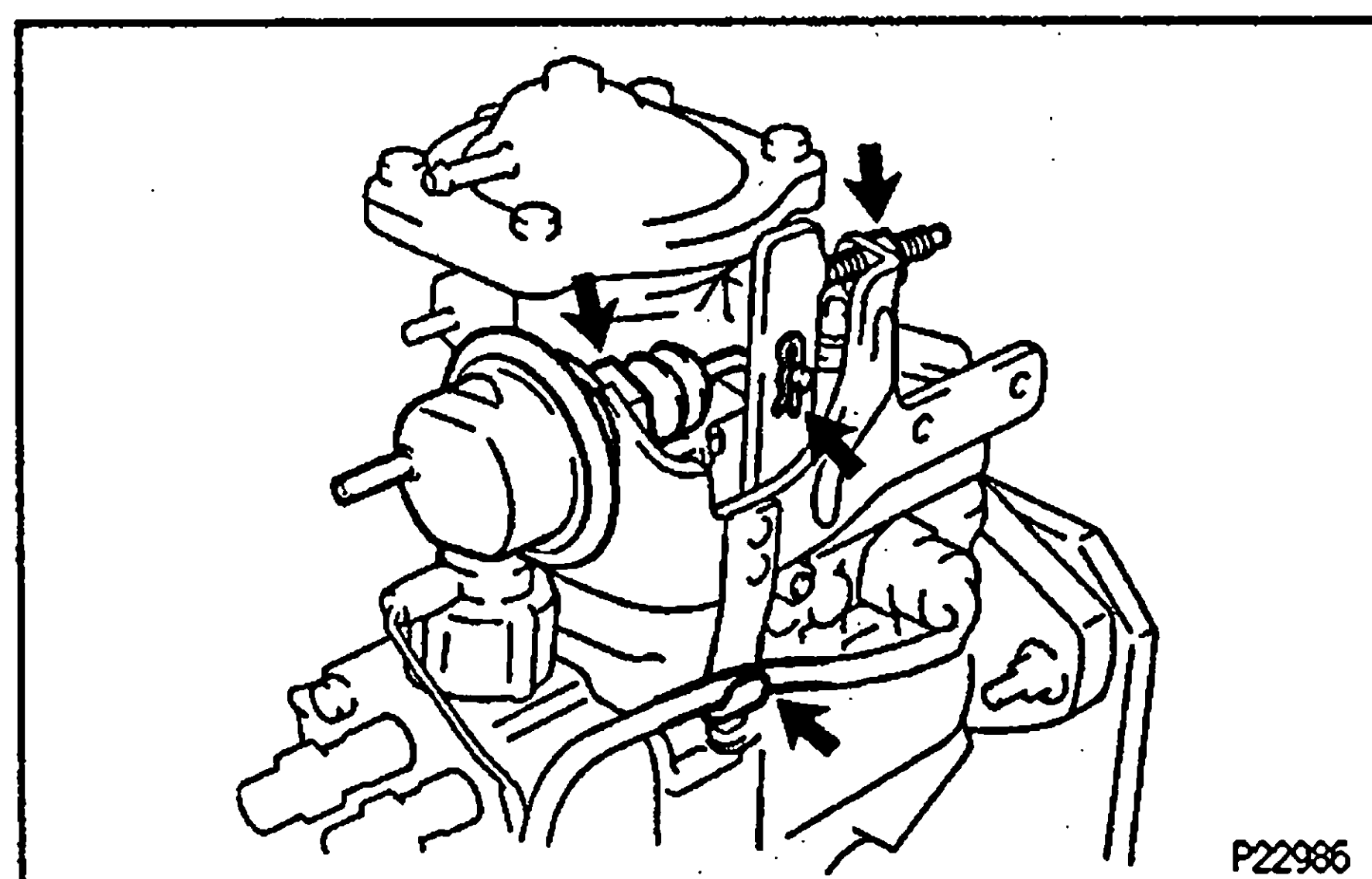
Torque: 6.9 N·m (70 kgf·cm, 61 in·lbf)



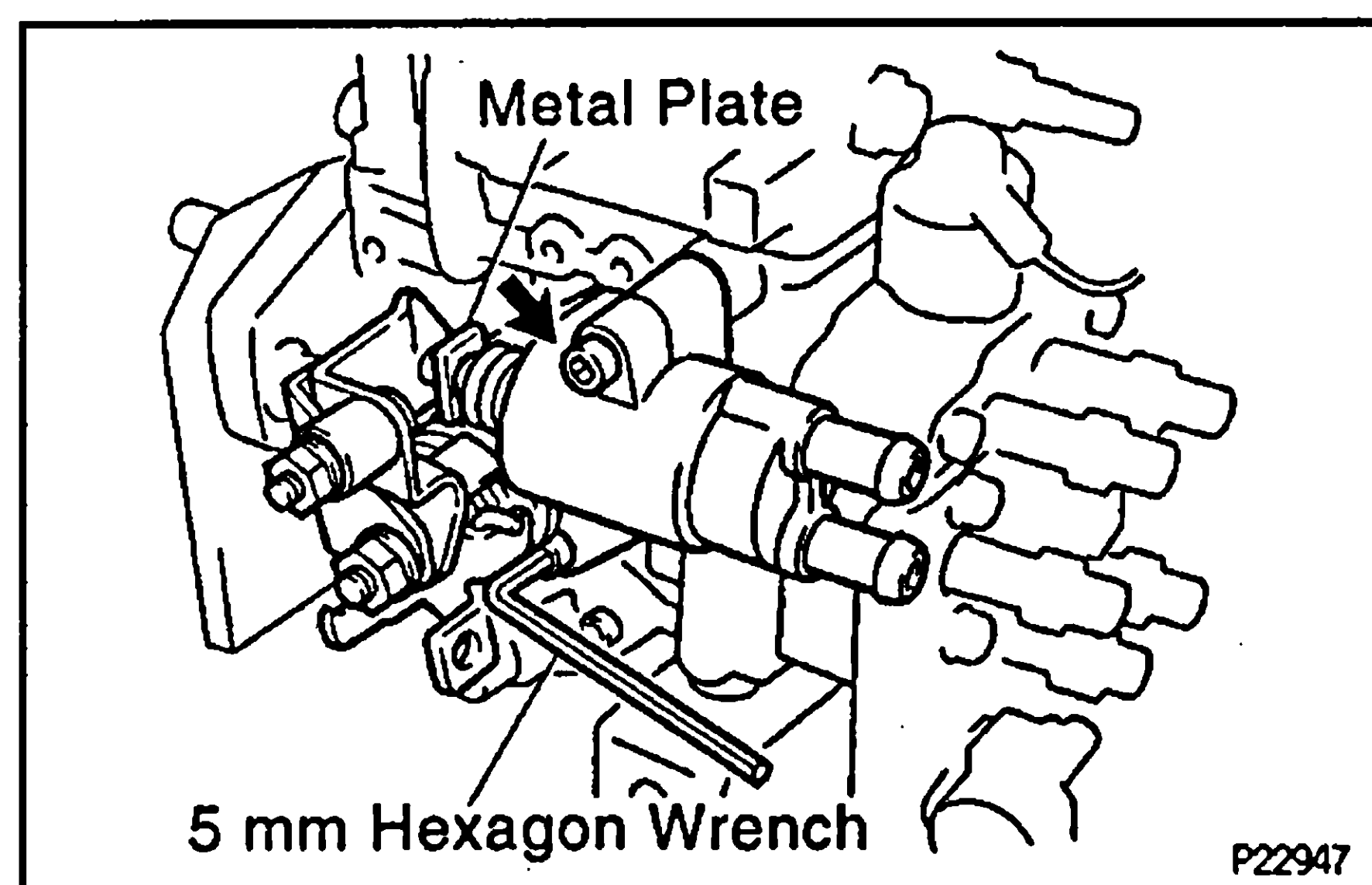


30. INSTALL SICS ACTUATOR

- (a) Using a 5 mm hexagon wrench, install the SICS actuator bracket with the 3 bolts.
Torque: 9.3 N·m (95 kgf·cm, 82 in·lbf)
- (b) Install the maximum speed adjusting screw.
- (c) Install the lock plate to the maximum speed adjusting screw.

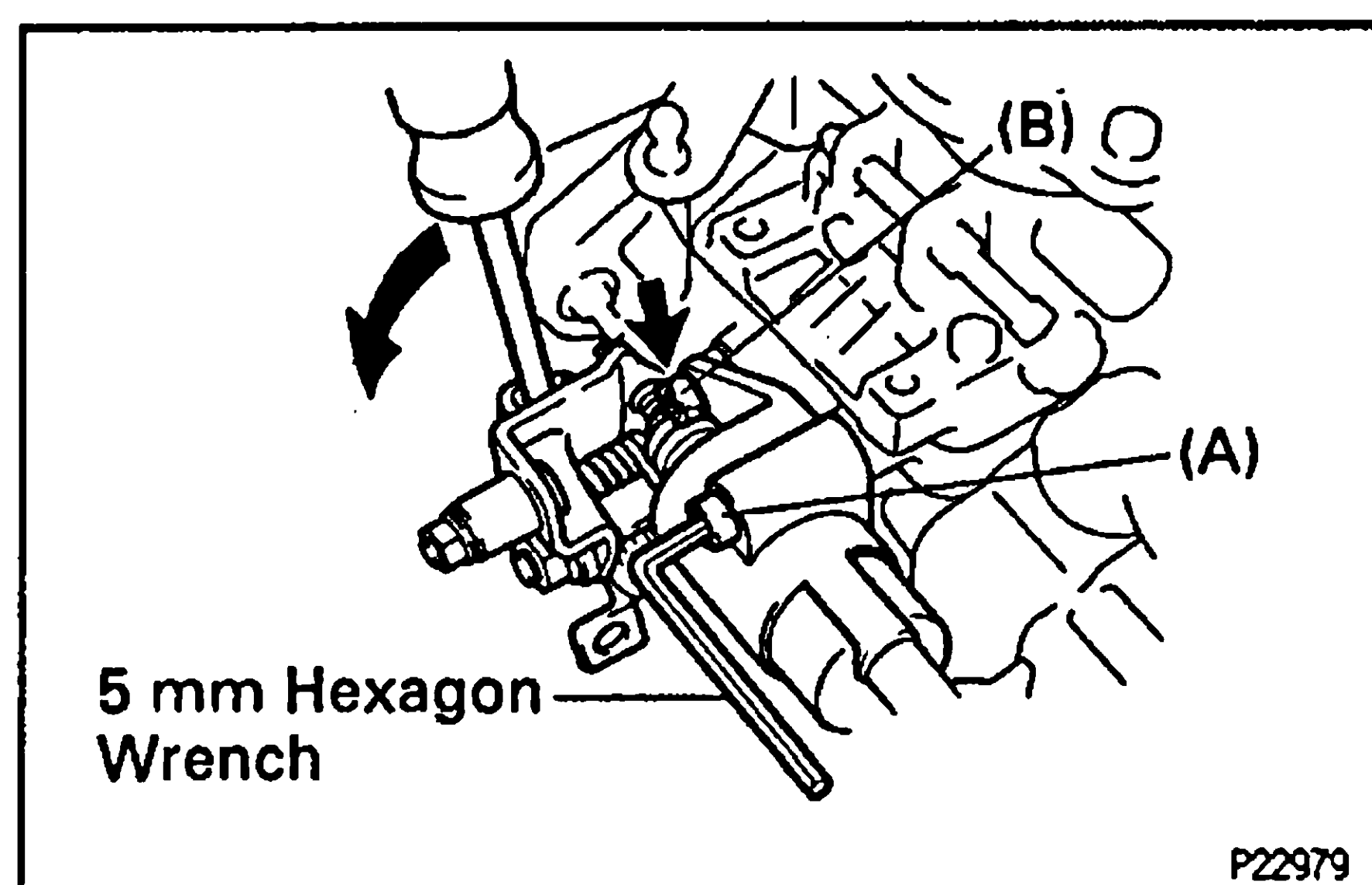


- (d) Install the SICS actuator with a nut.
Torque: 9.4 N·m (95 kgf·cm, 83 in·lbf)
NOTICE: Install 2 actuator adjusting washers on the side with the nut.
- (e) Install the clip.
- (f) Install the SICS adjusting screw.
Torque: 6.9 N·m (70 kgf·cm, 61 in·lbf)
- (g) Connect the wire harness.



31. INSTALL THERMO WAX

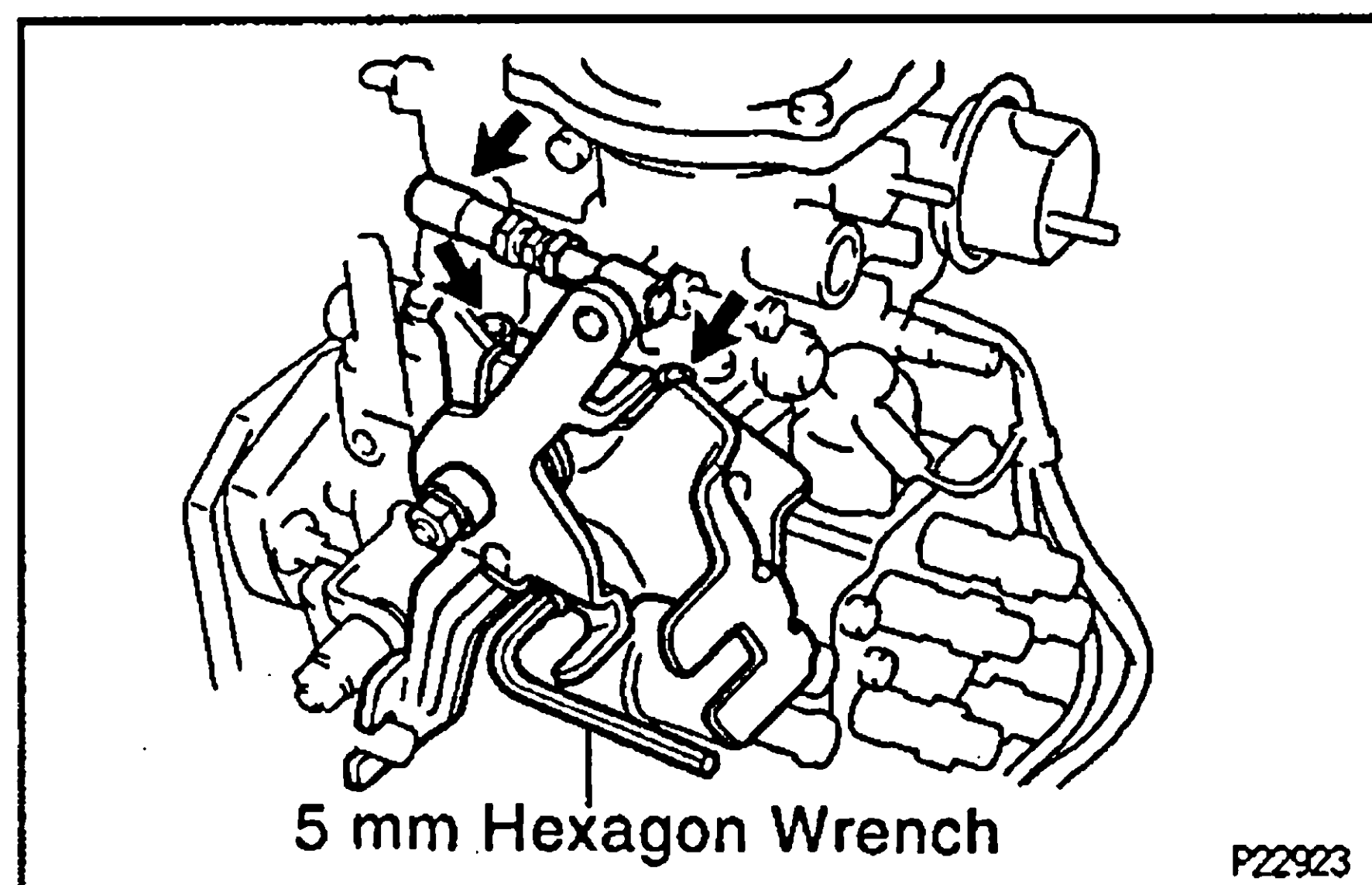
- (a) Using a screwdriver, turn the cold starting lever counterclockwise approx. 20°.
- (b) Put a metal plate (thickness of 5.0 — 8.0 mm (0.20 — 0.31 in.)) between the cold starting lever and thermo wax plunger.
- (c) Install a new O—ring to the pump body.
- (d) Using a 5 mm hexagon wrench, temporarily install the thermo wax with the 2 bolts.



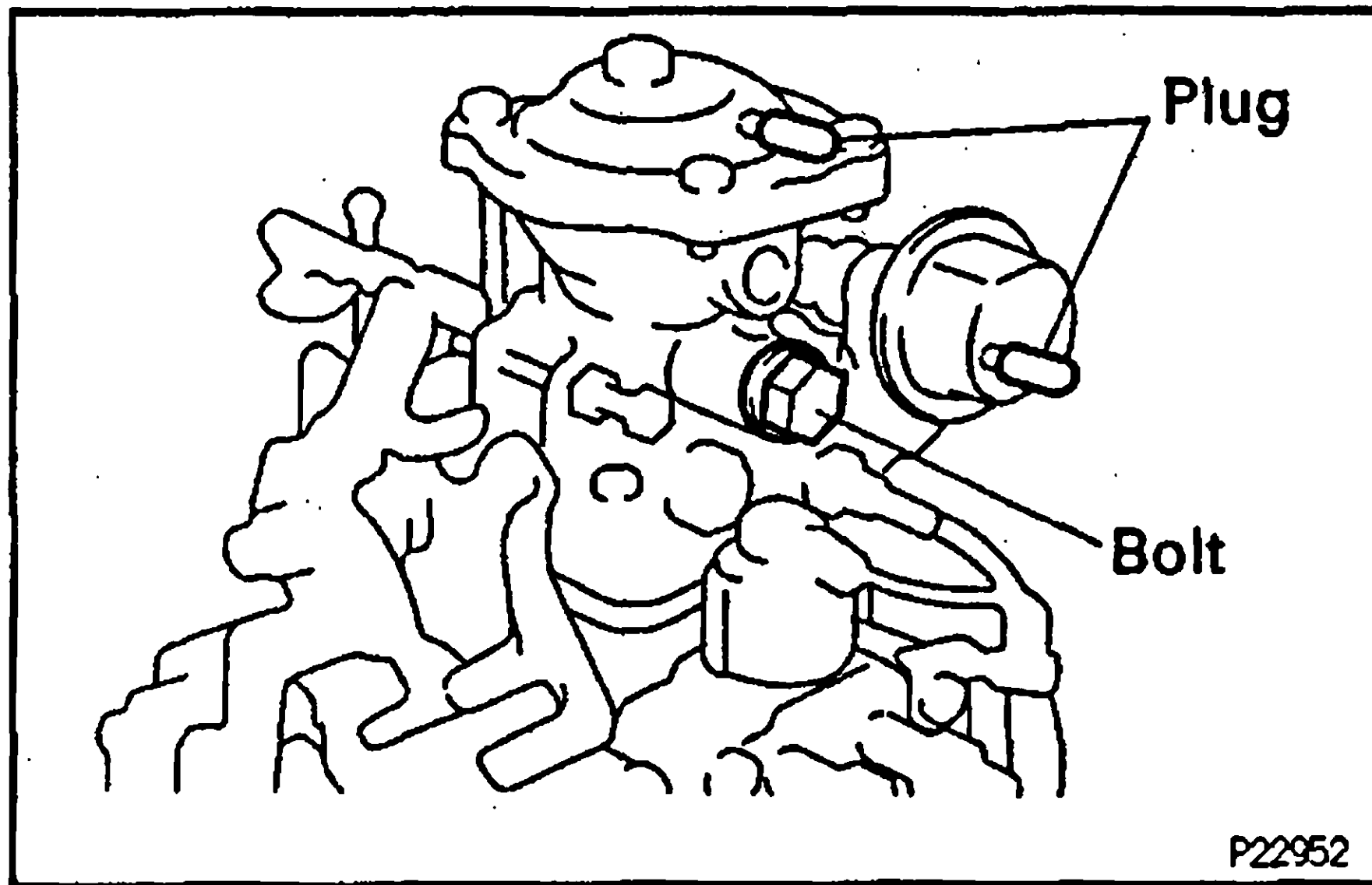
- (e) Using a screwdriver, turn the cold starting lever counterclockwise.
- (f) Using a 5 mm hexagon wrench, install the bolt (B), and remove the bolt (A).
Torque: 8.4 N·m (85 kgf·cm, 74 in·lbf)
- (g) Using a 5 mm hexagon wrench, tighten the bolt.
Torque: 8.4 N·m (85 kgf·cm, 74 in·lbf)

32. INSTALL IDLE—UP LEVER

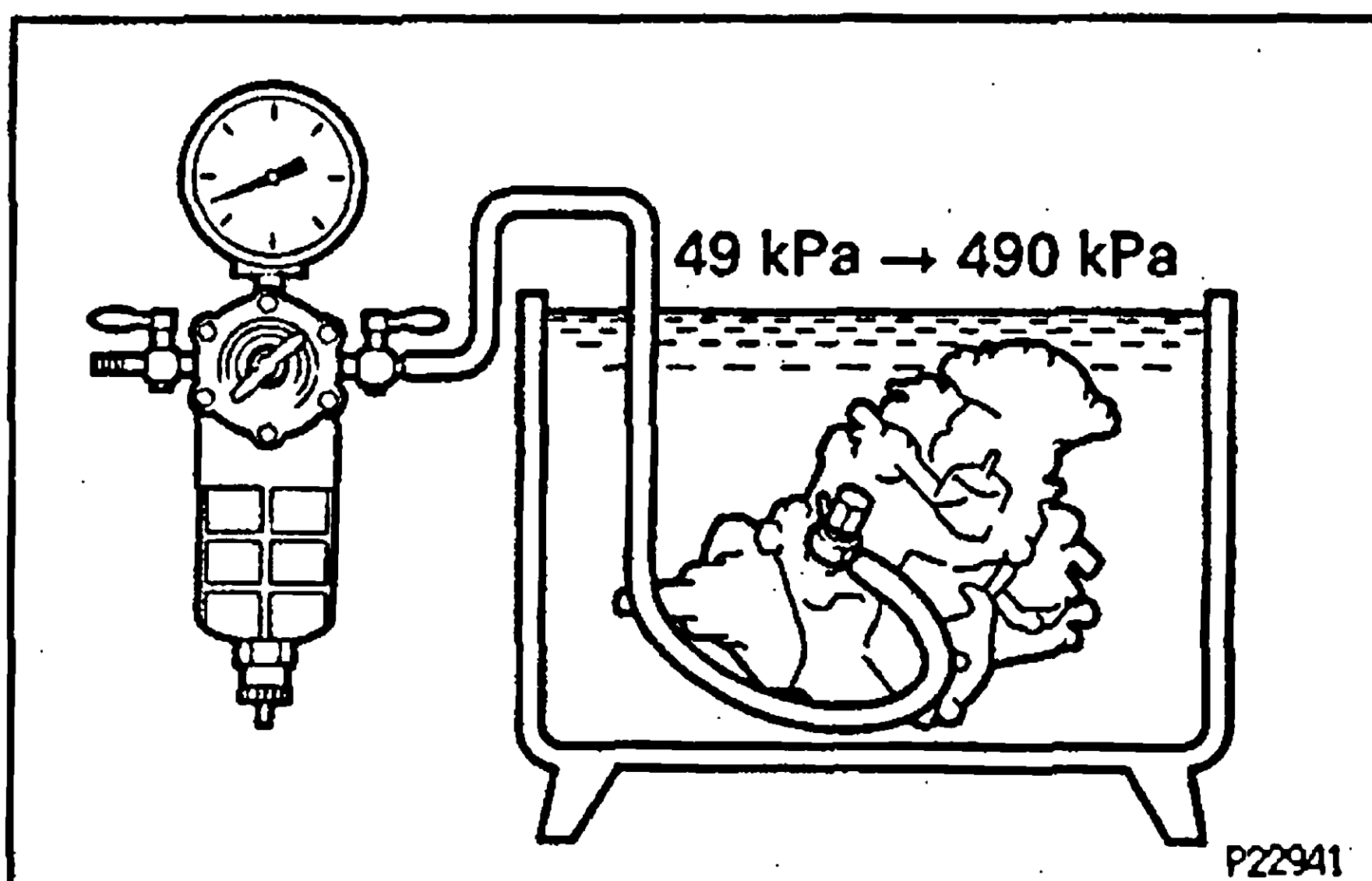
- (a) Europe:
Install the fuel cut valve connector bracket.
- (b) Using a 5 mm hexagon wrench, install the idle—up lever with the 3 bolts
Torque:
Short bolt: 8.4 N·m (85 kgf·cm, 74 in·lbf)
Long bolt: 12 N·m (120 kgf·cm, 9 ft·lbf)



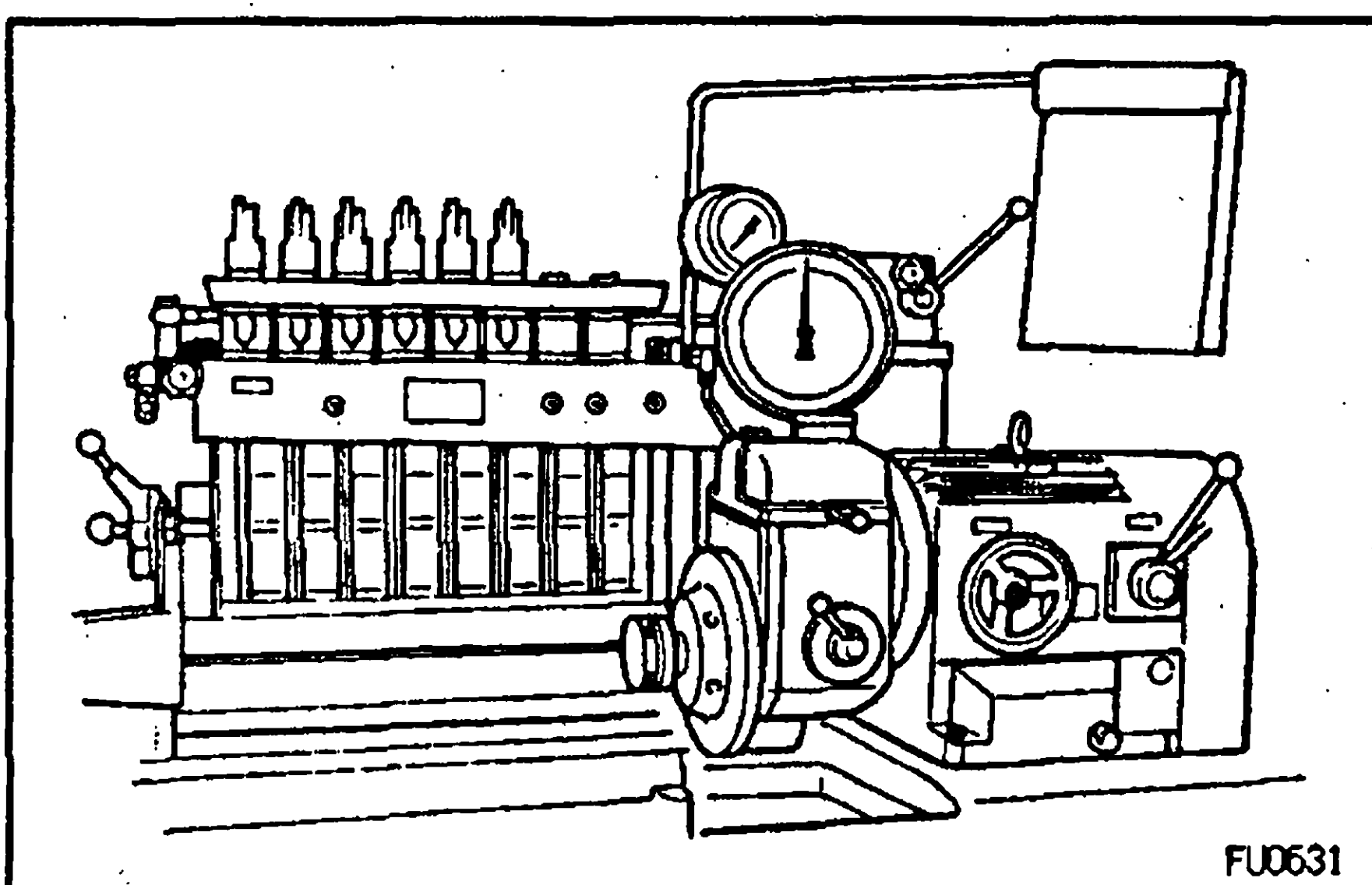
33. REMOVE INJECTION PUMP FROM SST (STAND)
SST 09241—76022, 09245—54010

**34. PERFORM AIR TIGHT TEST**

- (a) w/ BACS:
Install a gasket and bolt to the overflow port.
- (b) w/o BACS:
Install a bolt to the overflow port.
- (c) Install a plug to each port of the boost compensator and SICS actuator.



- (d) Connect an air hose to the fuel inlet pipe and place the injection pump into diesel fuel.
- (e) Apply 49 kPa (0.5 kgf/cm², 7 psi) of pressure and confirm that there are no leaks.
- (f) Next check that there are no leaks with 490 kPa (5.0 kgf/cm², 71 psi) of pressure applied.

35. INSTALL SET KEY OF INJECTION PUMP DRIVE PULLEY ON DRIVE SHAFT**INJECTION PUMP ADJUSTMENT**

EG7CF-01

1. PRE-TEST CHECK AND PREPARATION

- (a) The specifications for test nozzle and nozzle holders are as follows.

Test nozzle:

DN12SD12 (NIPPONDENSO)

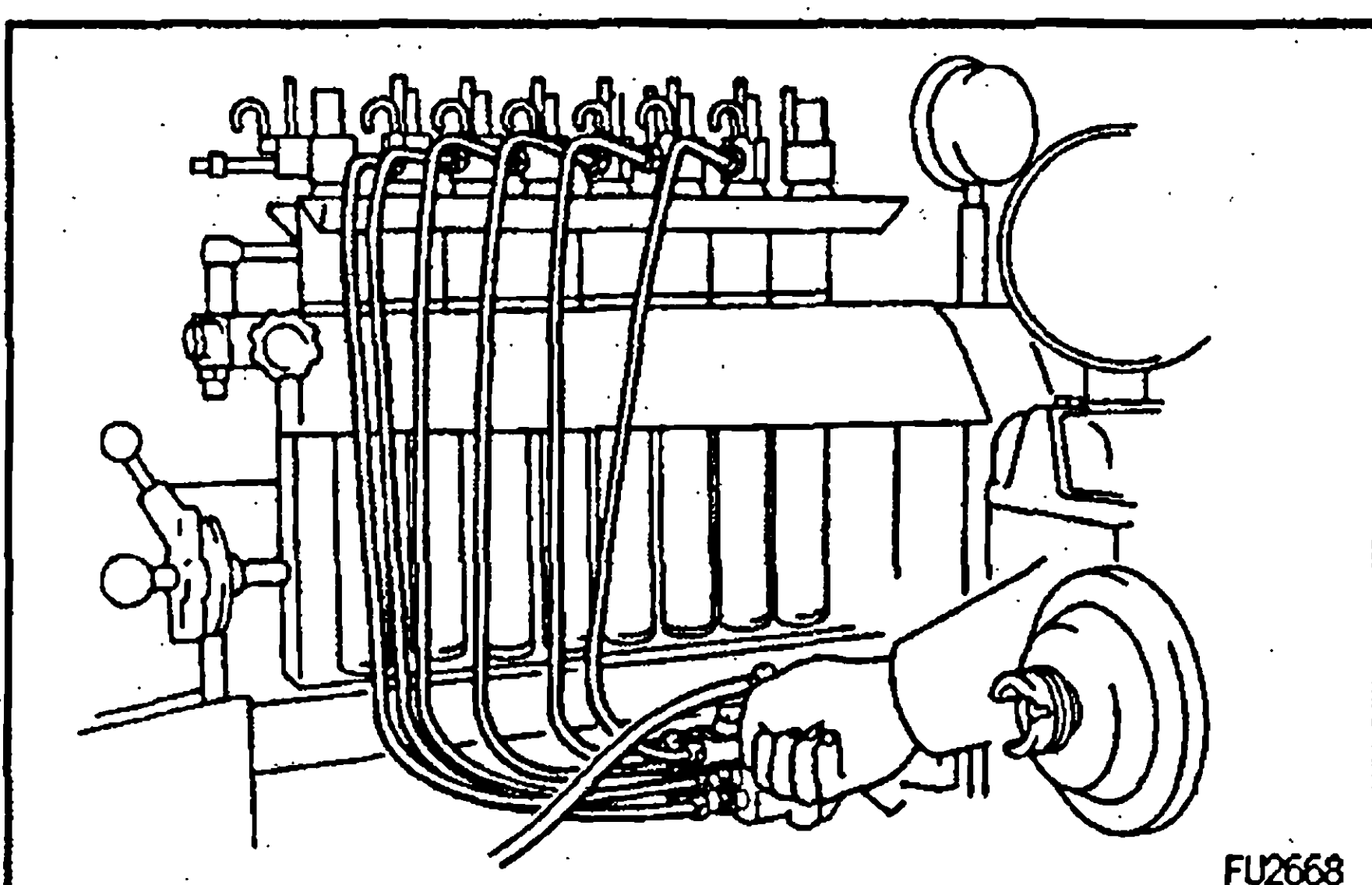
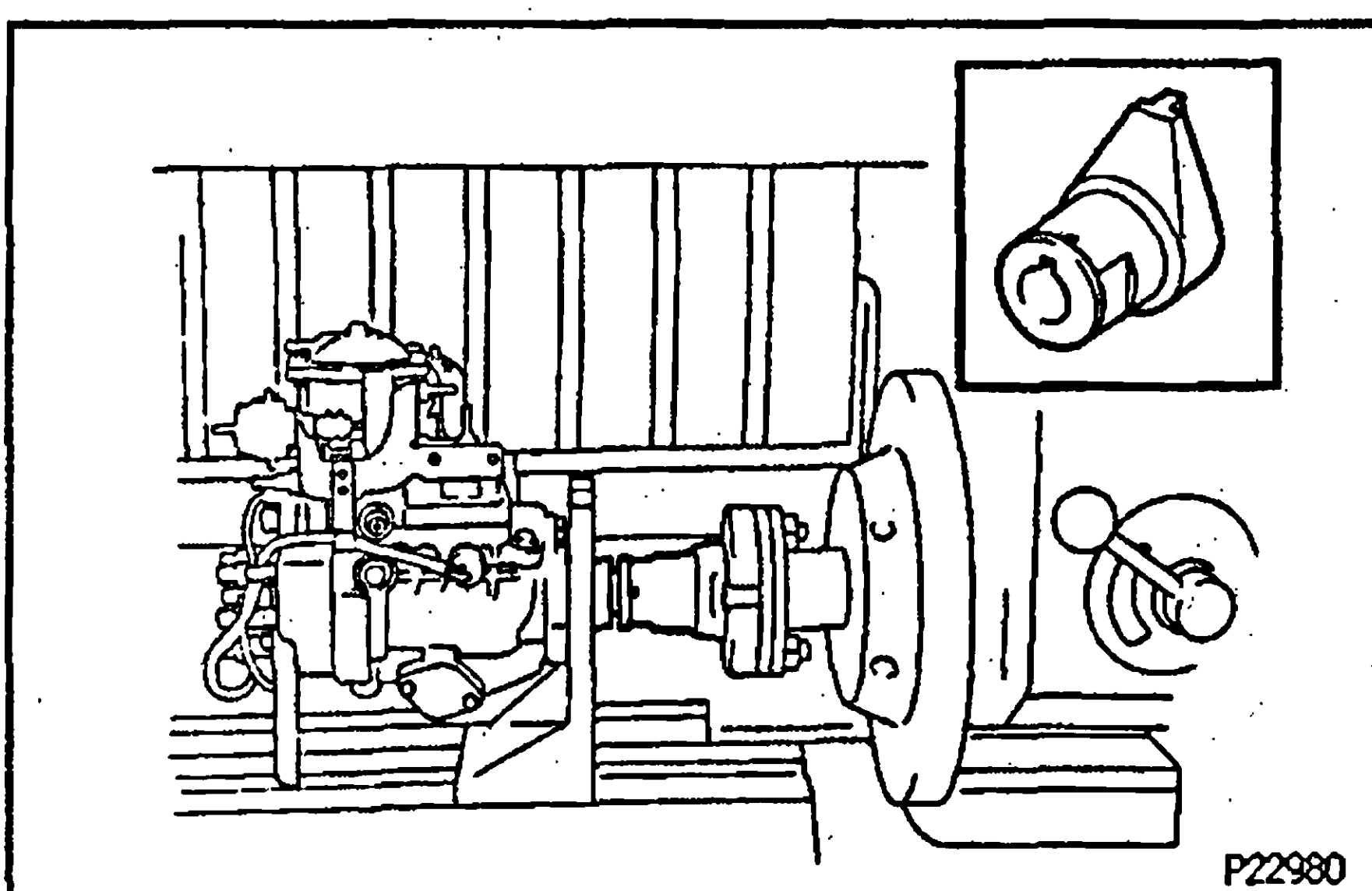
Test nozzle opening pressure:

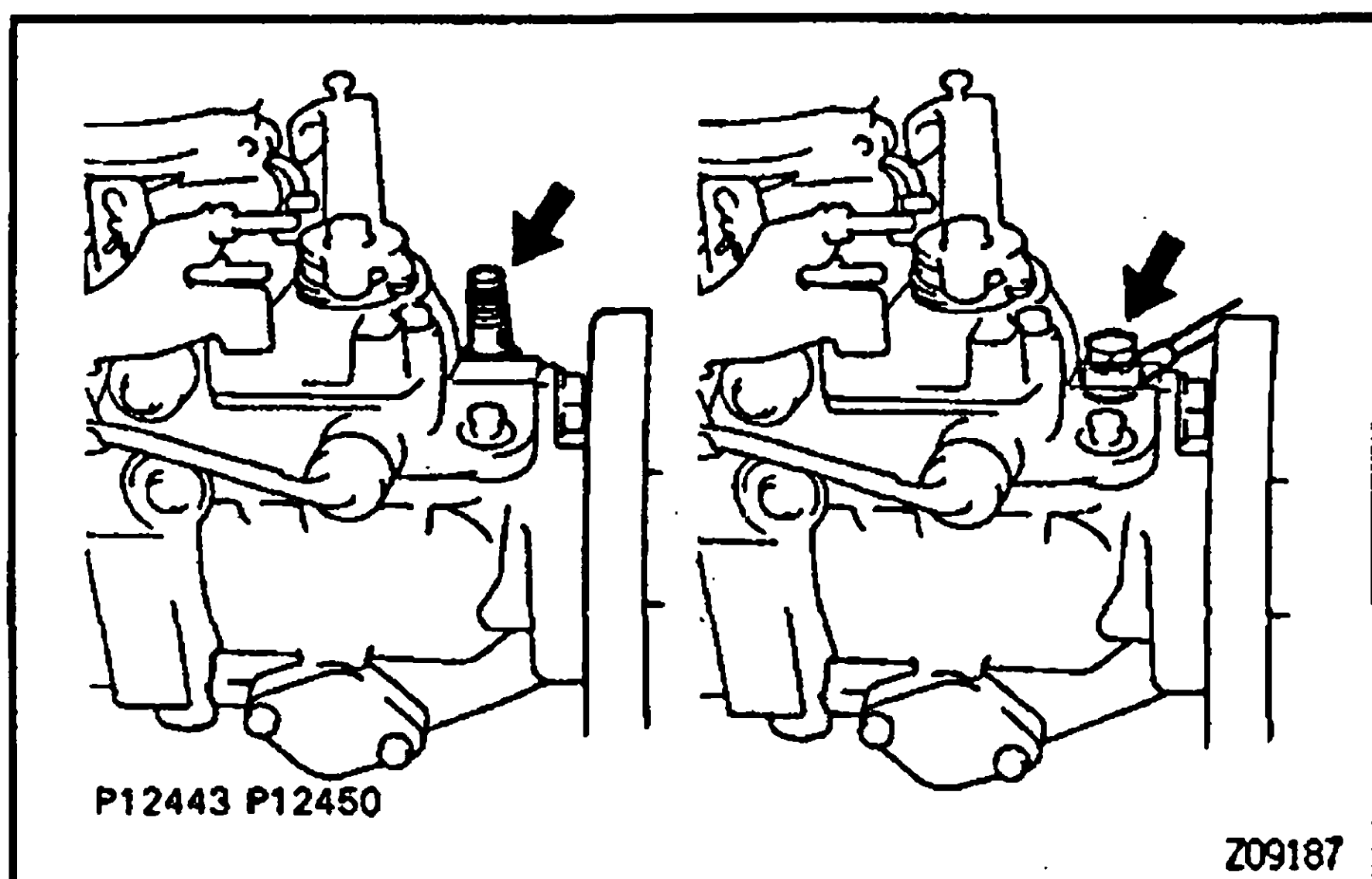
14,220 — 15,200 kPa**(145 — 155 kgf/cm², 2,062 — 2,205 psi)**

- (b) Check the accuracy of the tachometer.
Allowable error:
± 40 rpm
- (c) Install the angle gauge stand.
- (d) Mount the injection pump body on the pump tester.
HINT: Place a mark on the key groove portion of the coupling.
NOTICE: To prevent vibration or dislocation of the injection pump, fix in place the distributive head of the injection pump.
- (e) Install an injection pipe with these specifications.

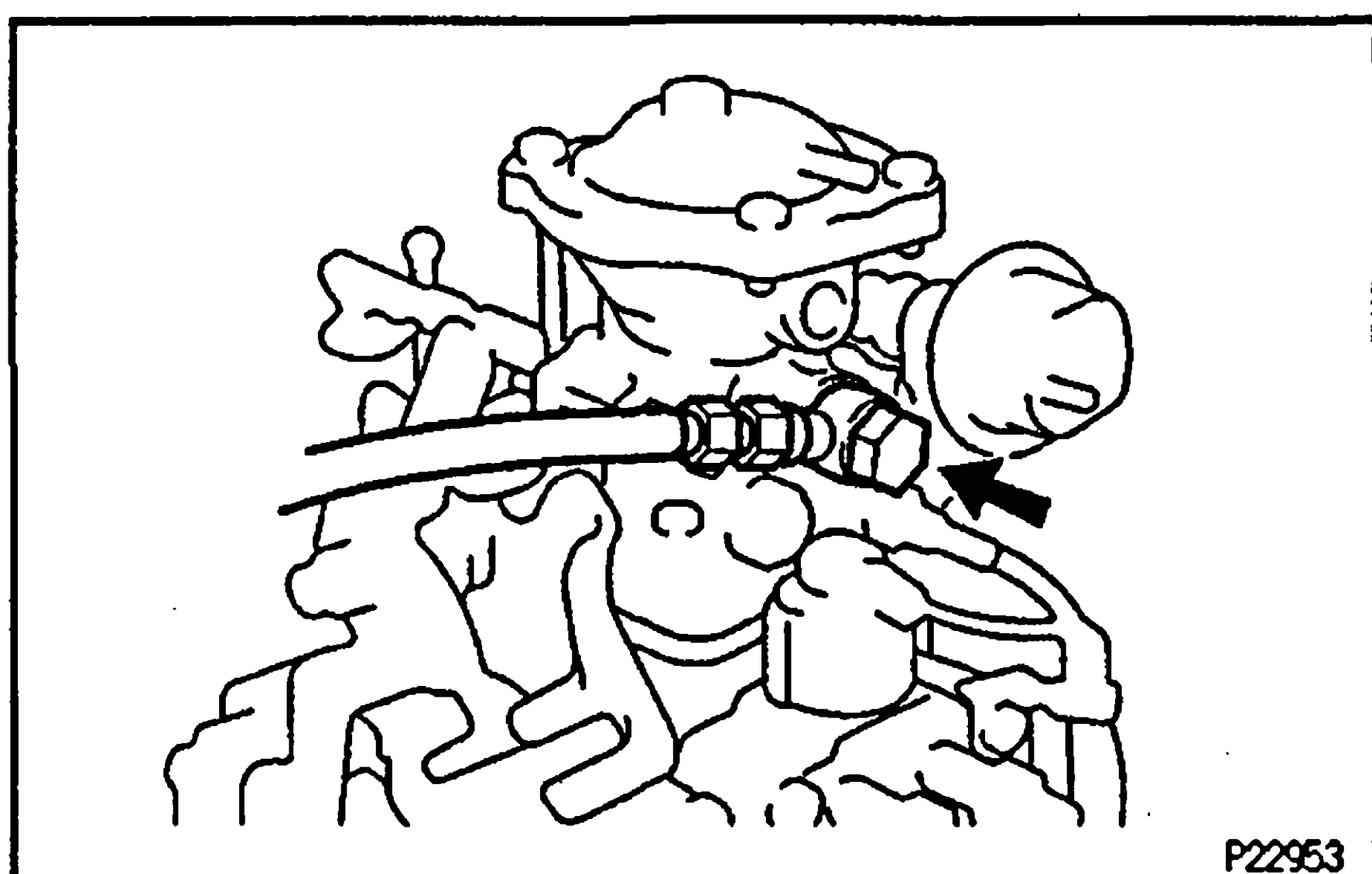
mm (in.)

Outer diameter	6.0 (0.236)
Inner diameter	2.0 (0.079)
Length	840 (33.07)
Minimum bending radius	25 (0.98) or more





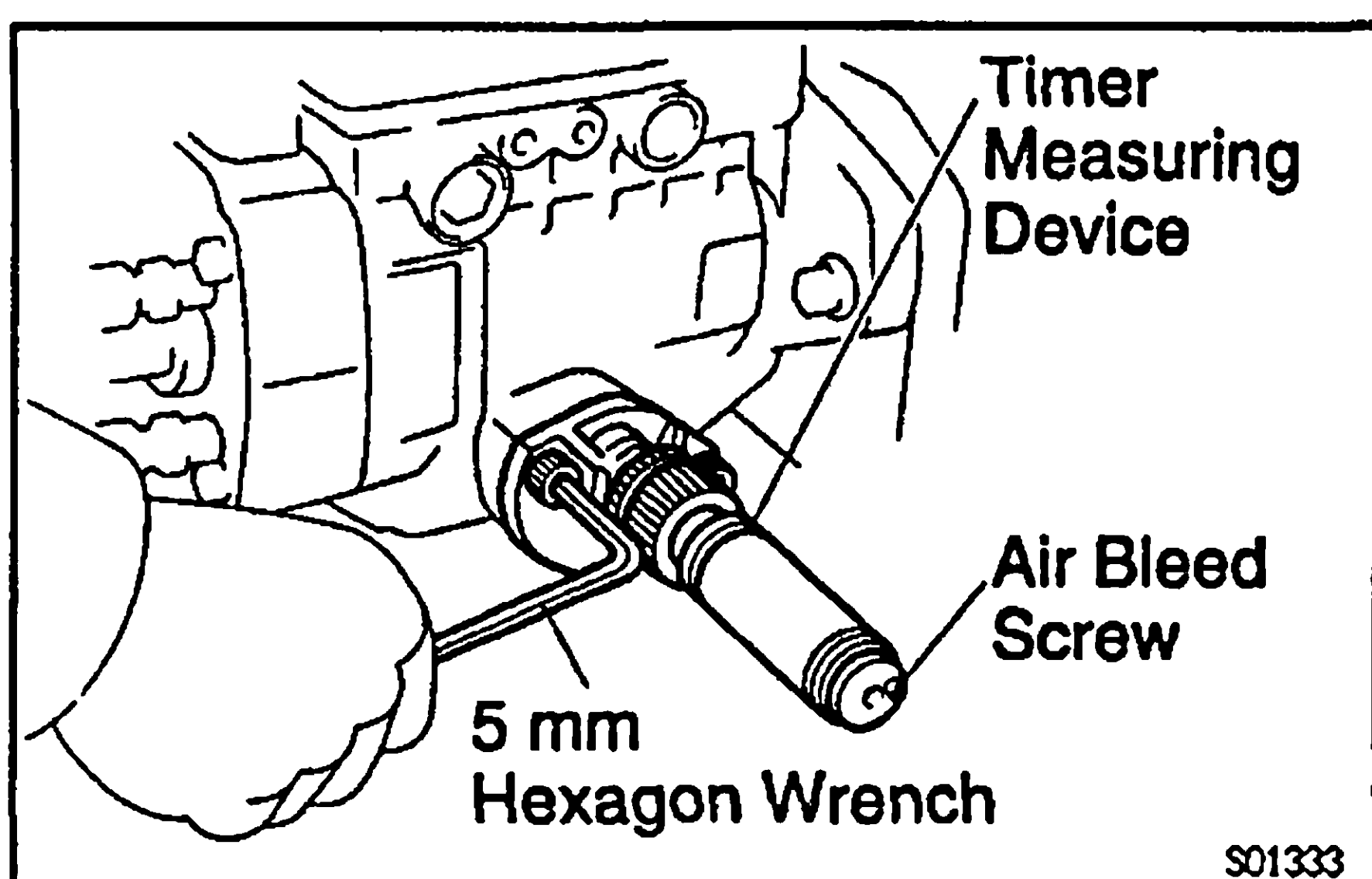
- (f) Remove the fuel inlet hollow screw.
- (g) Connect the fuel inlet pipe with an adapter.



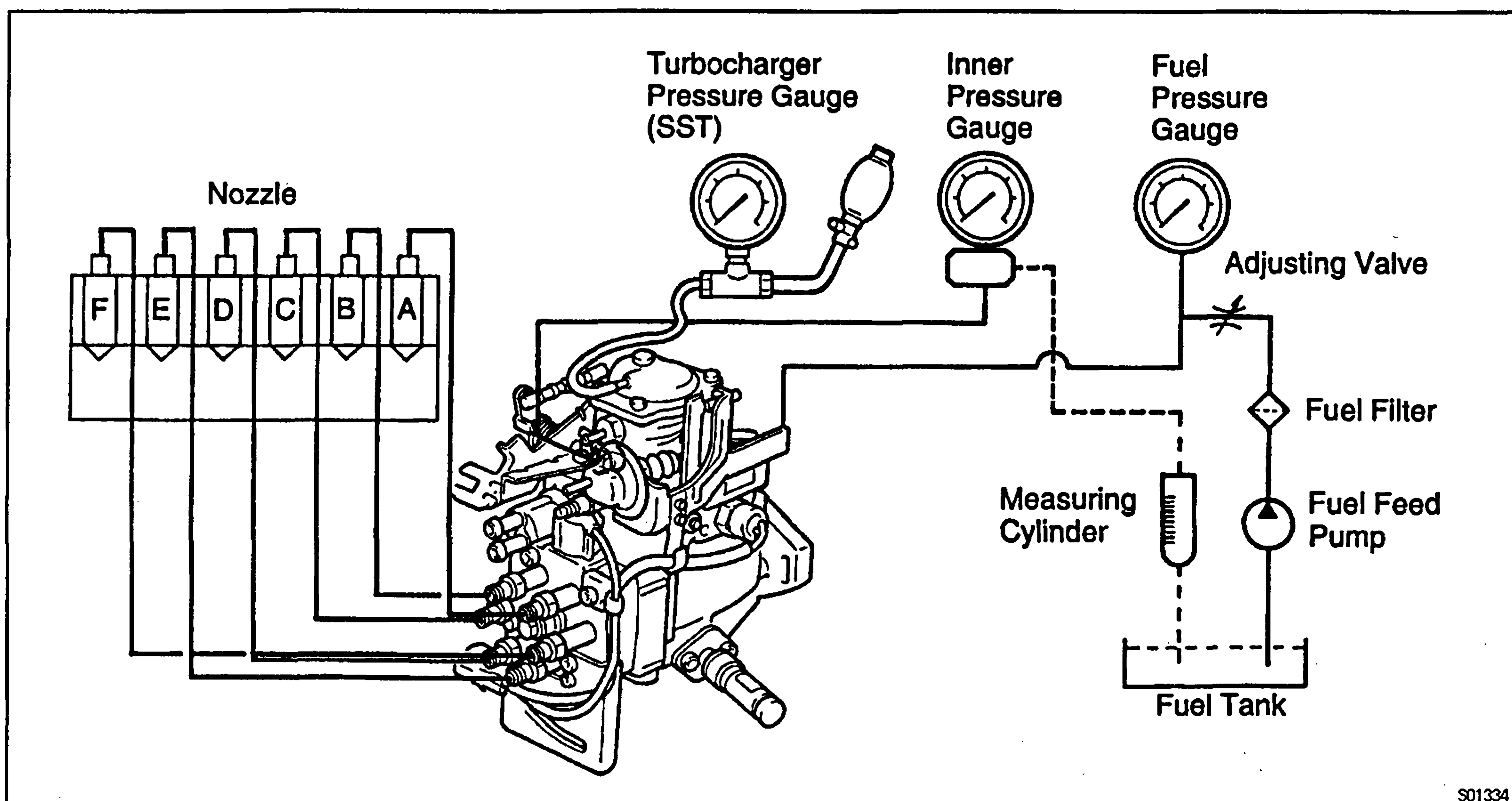
- (h) Install the inner pressure gauge with 2 gaskets and union bolt.

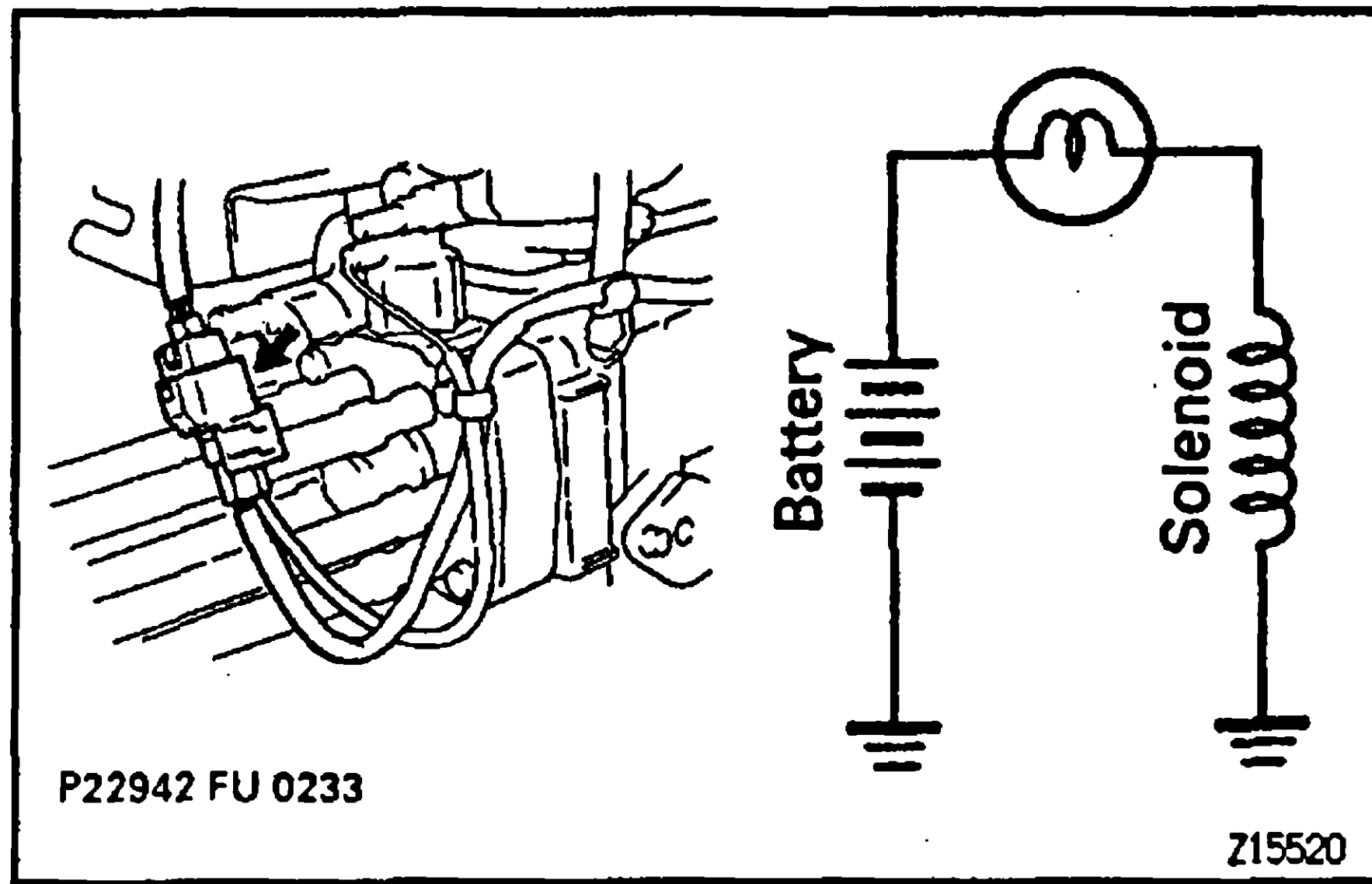
Part No. 95095-10480 (NIPPONDENSO)

HINT: Use the union bolt from the pressure gauge.



- (i) Using a 5 mm hexagon wrench, remove the 2 bolts and RH timer cover.
- (j) Replace the timer measure rod and timer measure spring of the timer measuring device.
Part No. 95095-40060, 95913-10090 (NIPPONDENSO)
- (k) Install the timer measuring device.
Part No. 95095-10222 (NIPPONDENSO)
- (l) Connect SST (turbocharger pressure gauge) to the boost compensator.
SST 09992-00241

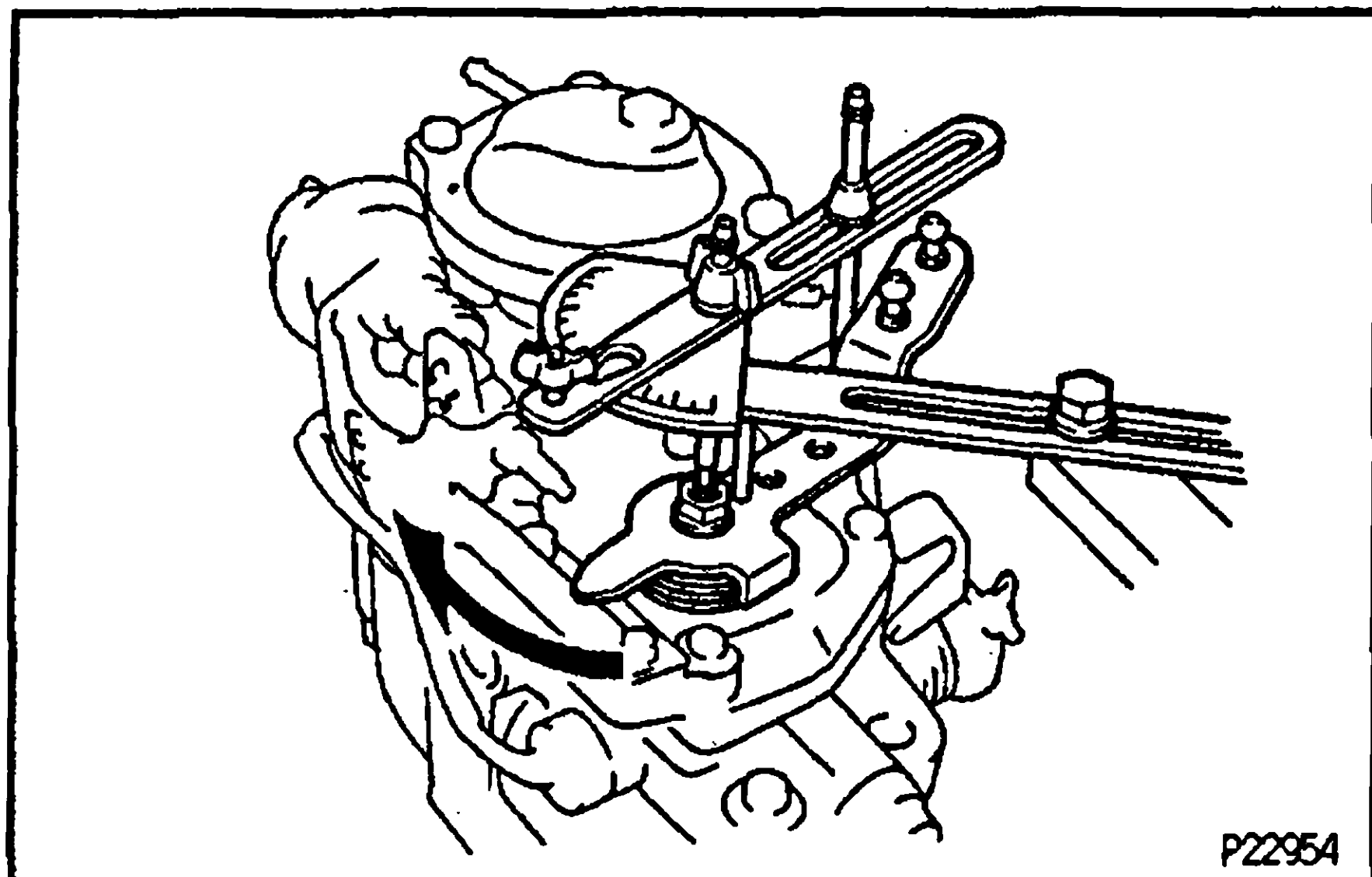




- (m) Apply about 6 volts of DC power to the fuel cut solenoid.

NOTICE:

- When applying voltage to the solenoid, position the battery as far away from the solenoid as possible so that a spark does not occur.
- When connecting the battery cable, connect the solenoid side first.

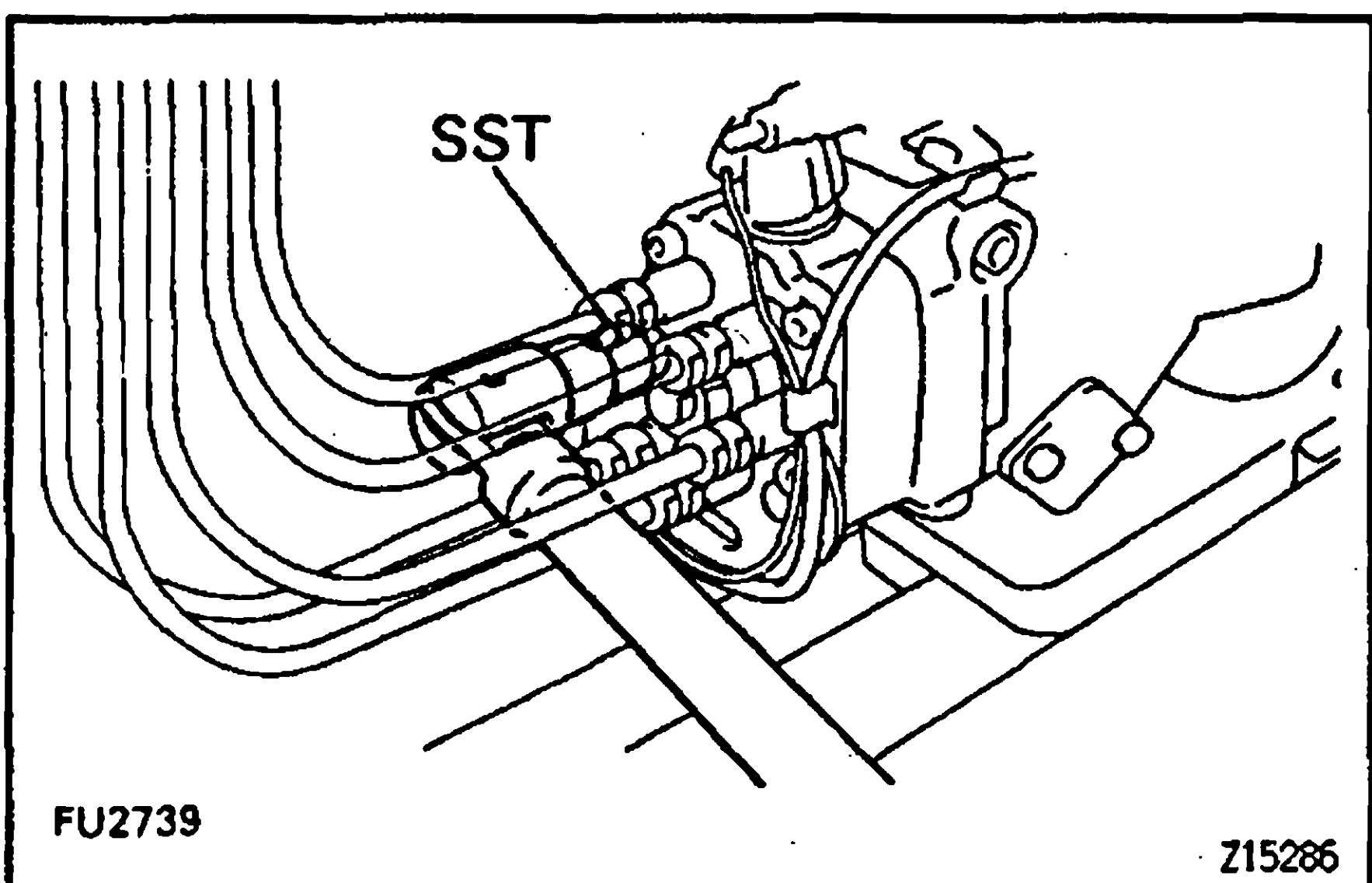


- (n) The pressure for feeding fuel to the injection pump should be 20 kPa (0.2 kgf/cm², 2.8 psi). The fuel temperature for pump testing should be 40 — 45°C (104 — 113°F).

- (o) Install an angle gauge to the stand and set it to the adjusting lever.

Part No. 95095—10360 (Stand w/ angle gauge)

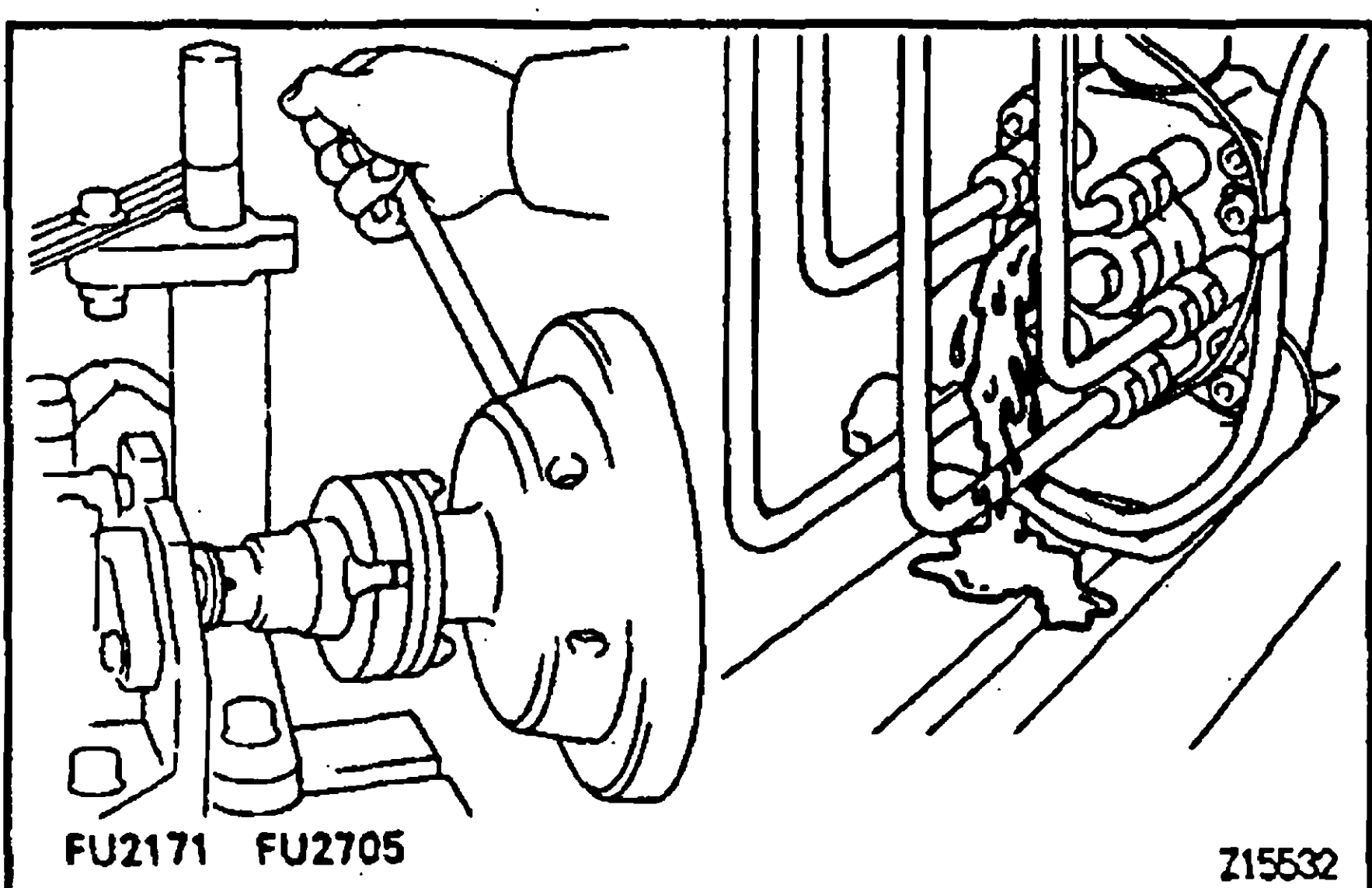
- (p) Secure the adjusting lever fully on the maximum speed side.



- (q) Check the installation direction of the camplate as follows:

- Disconnect the injection pipe from the position marked "C" on the distributive head.
- Using SST, remove the delivery valve holder assembly and gasket.

SST 09260—54012 (09269—54020)



- Check that fuel is flowing out when the mark is in the position shown in the illustration.

If not, it is improperly assembled.

- Disassemble and change the camplate position 180° in the opposite direction.

HINT: At this time, disconnect the fuel cut solenoid wire harness.

- Using SST, install a new gasket and the delivery valve holder assembly.

SST 09260—54012 (09269—54020)

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

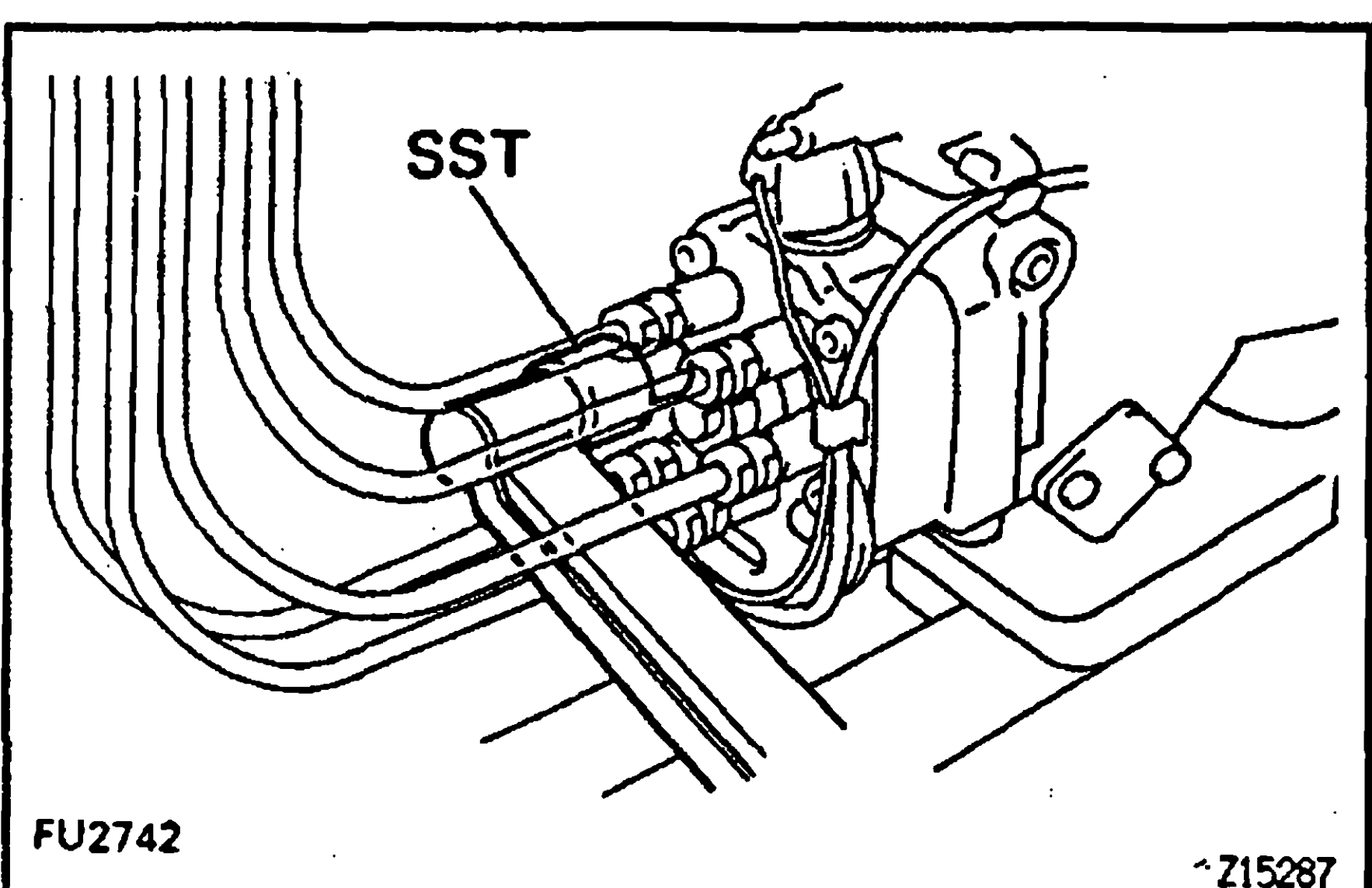
- Connect the injection pipe.

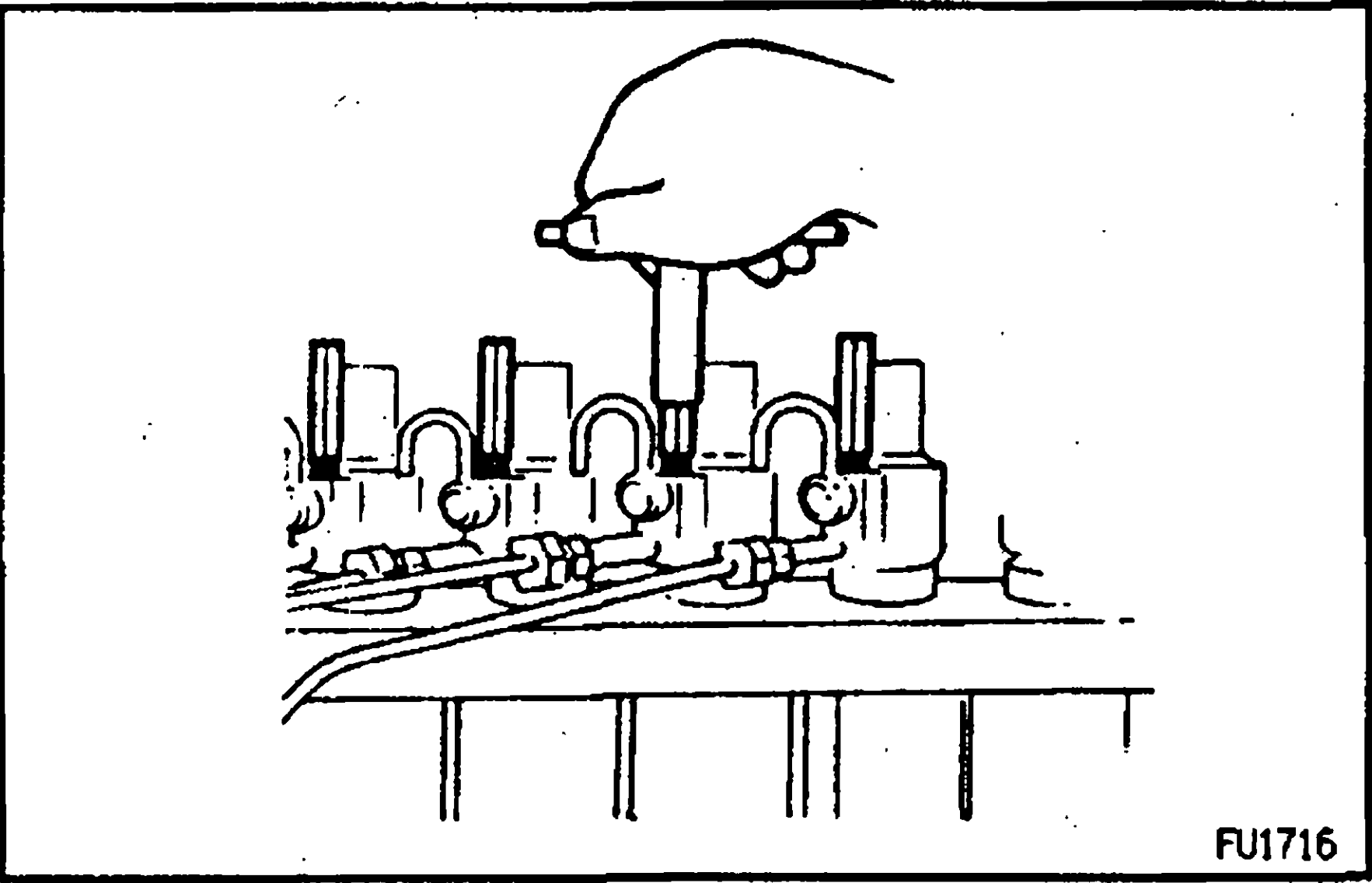
- (r) Bleed the air from the distributive head plug bolt.

HINT: Make sure the air is completely bled out of the timer measuring device.

NOTICE: Do not let the pump exceed 800 rpm until the air is completely bled out.

- (s) Bleed the air from the injection pipes.





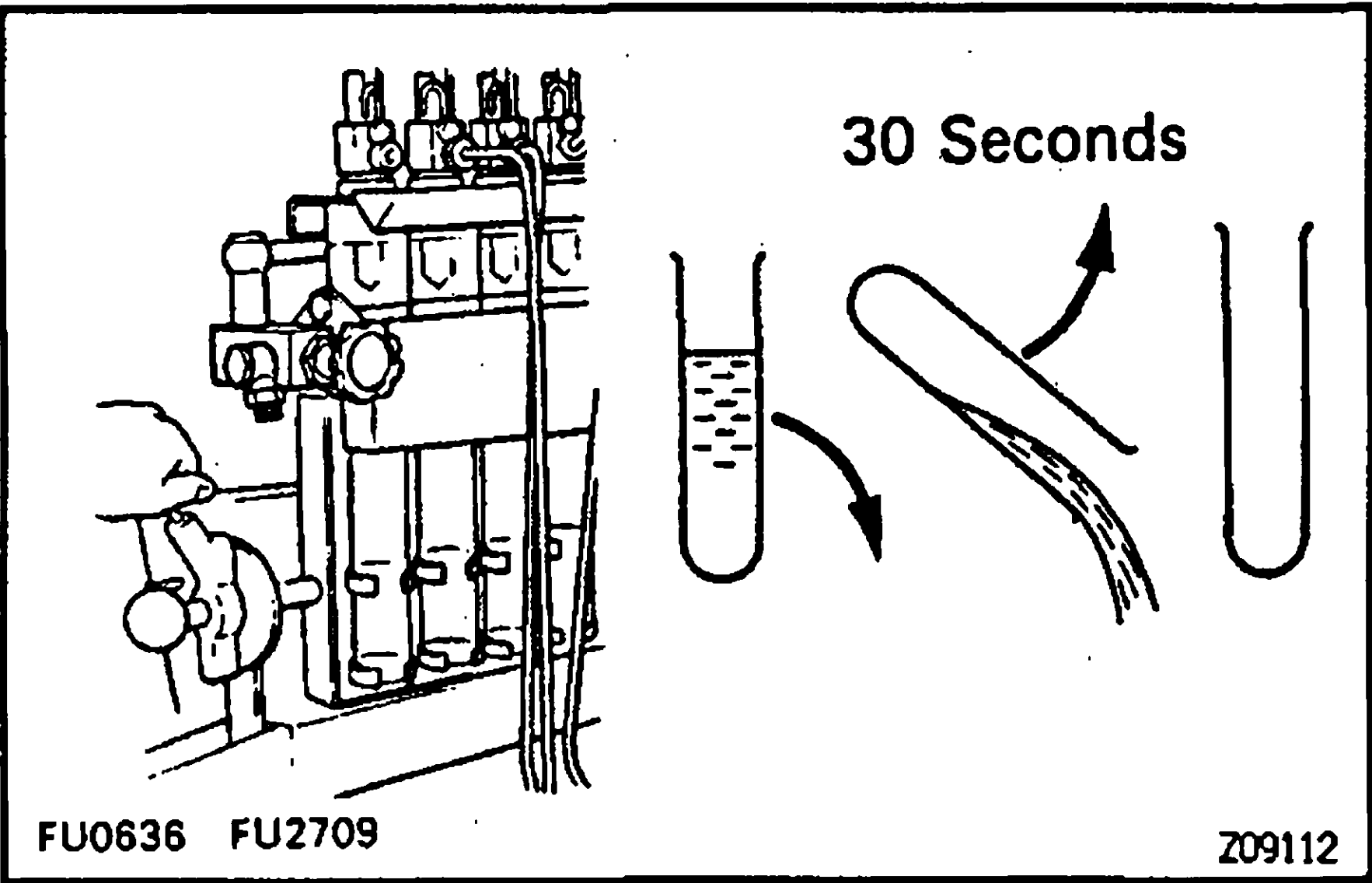
(t) Measure the injection volume.

Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
1,080	200	14.92 — 16.52 (0.91 — 1.01)

(u) Race the injection pump for 5 minutes at 1,200 rpm.
NOTICE: Check that there is no fuel leakage or abnormal noise.

HINT:

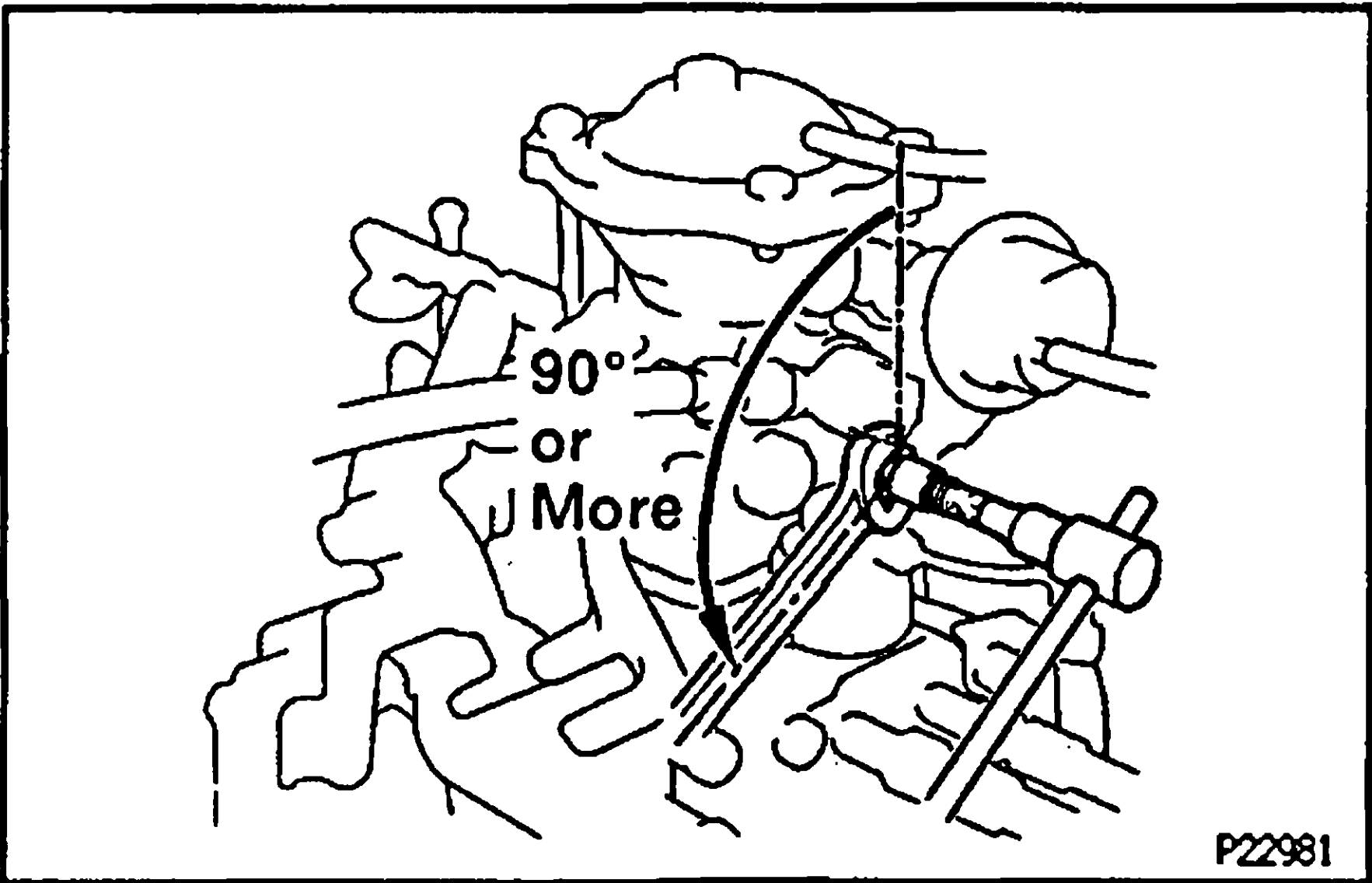
- Measure the volume of each injection cylinder with a measuring cylinder.
- Before measuring the injection volume, first hold the cylinder tilted for at least 30 seconds to discard all the fuel.



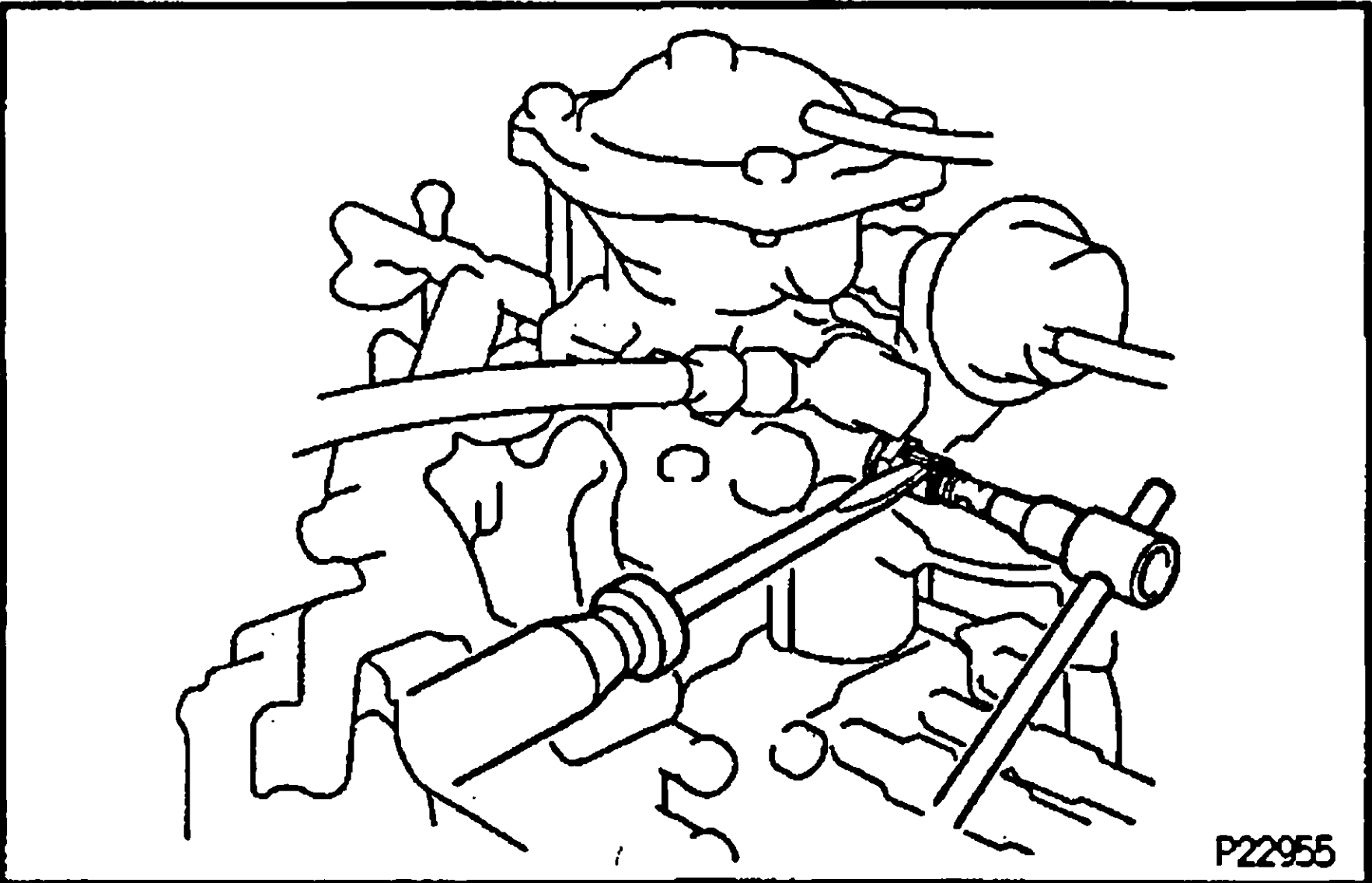
2. PRE—SET FULL LOAD INJECTION VOLUME

- (a) Set the adjusting lever to maximum position.
- (b) Apply 67.2 kPa (503.7 mmHg, 19.83 in.Hg) of vacuum to the SICS actuator.
- (c) w/o BACS:
Apply 80 kPa (0.81 kgf/cm², 11.5 psi) of pressure to the boost compensator.
- (d) w/ BACS:
Apply 121 kPa (1.24 kgf/cm², 17.7 psi) of pressure to the boost compensator.
- (e) Measure the injection volume.

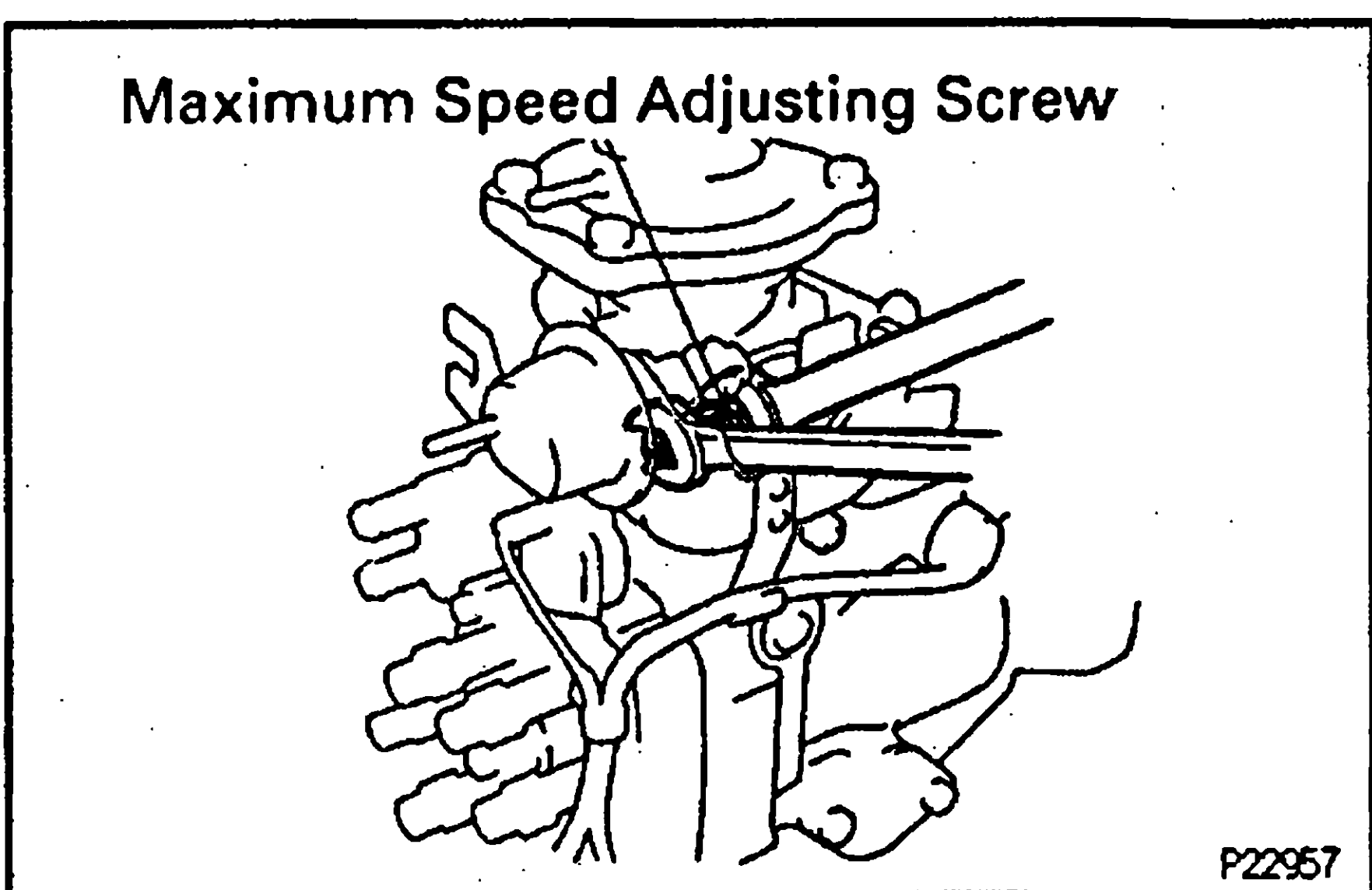
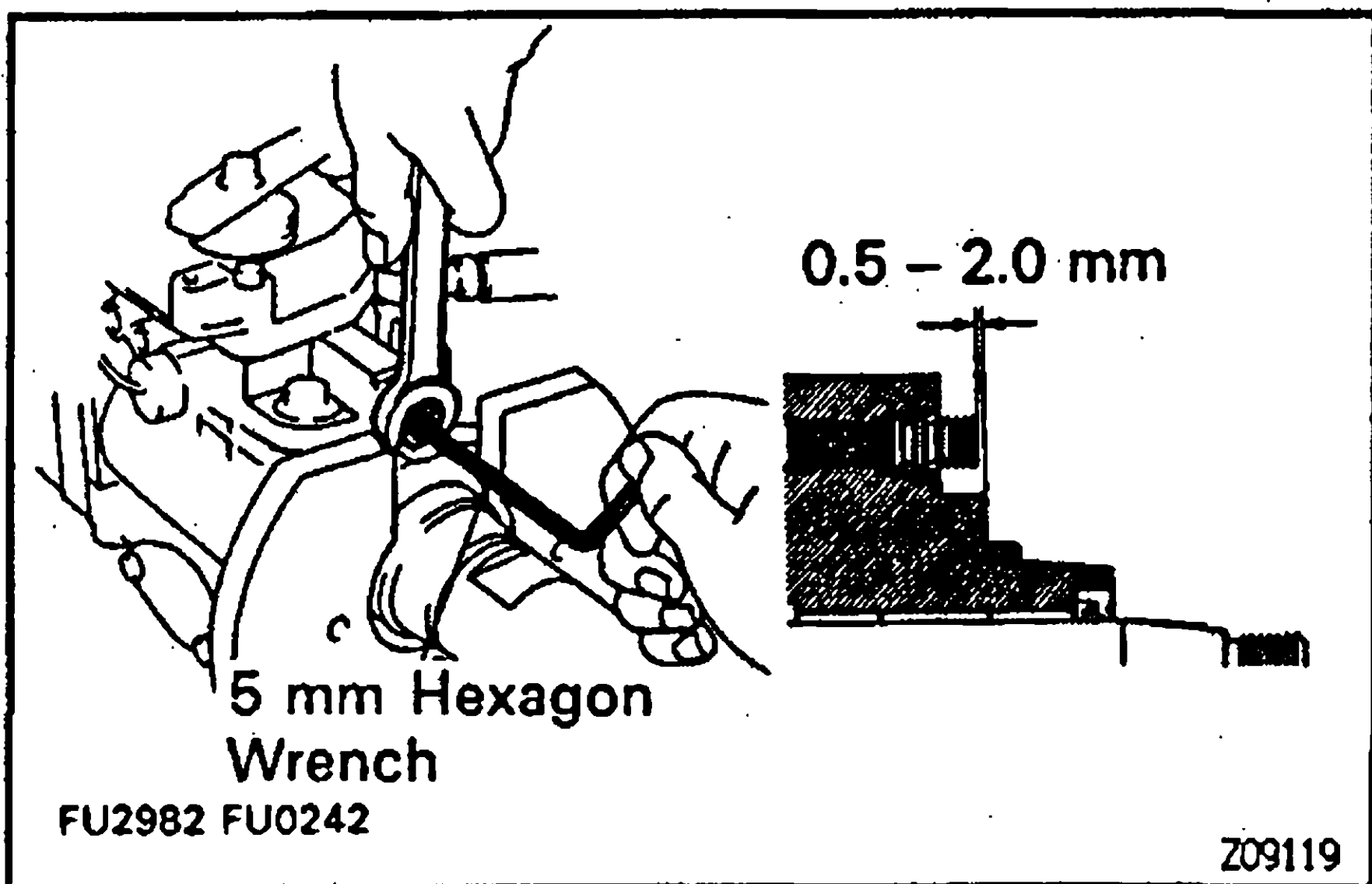
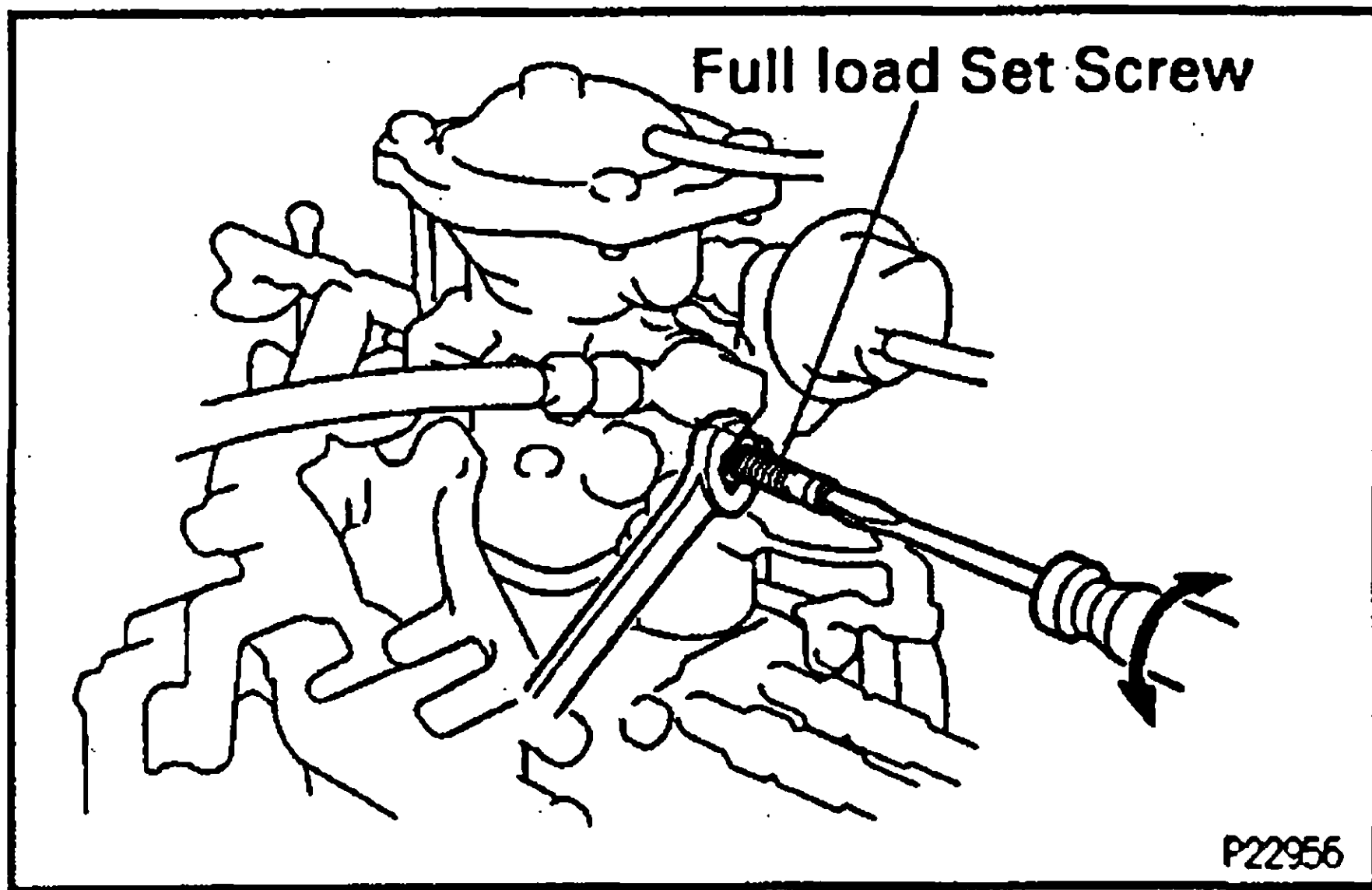
Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
1,080	200	14.92 — 16.52 (0.91 — 1.01)



- (f) Remove the collar seal as follows:
 - Hold the full load set screw, and release the collar seal from the spot weld by turning the lock nut counterclockwise by 90° or more.



- Using a screwdriver, pry out the collar seal.



- (g) Adjust by turning the full load set screw.
HINT: The injection volume will increase about 3 cc (0.18 cu in.) with each 1/2 turn of the screw.

3. w/o BACS:

PRE—SETTING OF LOAD SENSING TIMER

Using a 5 mm hexagon wrench, adjust the protrusion of the governor shaft.

Protrusion:

0.5 - 2.0 mm (0.020 - 0.079 in.)

4. PRE—SET MAXIMUM SPEED

- (a) Set the adjusting lever to maximum position.
(b) Apply 67.2 kPa (503.7 mmHg, 19.83 in.Hg) of vacuum to the SICS actuator.
(c) w/o BACS:
Apply 80 kPa (0.81 kgf/cm², 11.5 psi) of pressure to the boost compensator.
(d) w/ BACS:
Apply 121 kPa (1.24 kgf/cm², 17.7 psi) of pressure to the boost compensator.
(e) Measure the injection volume.

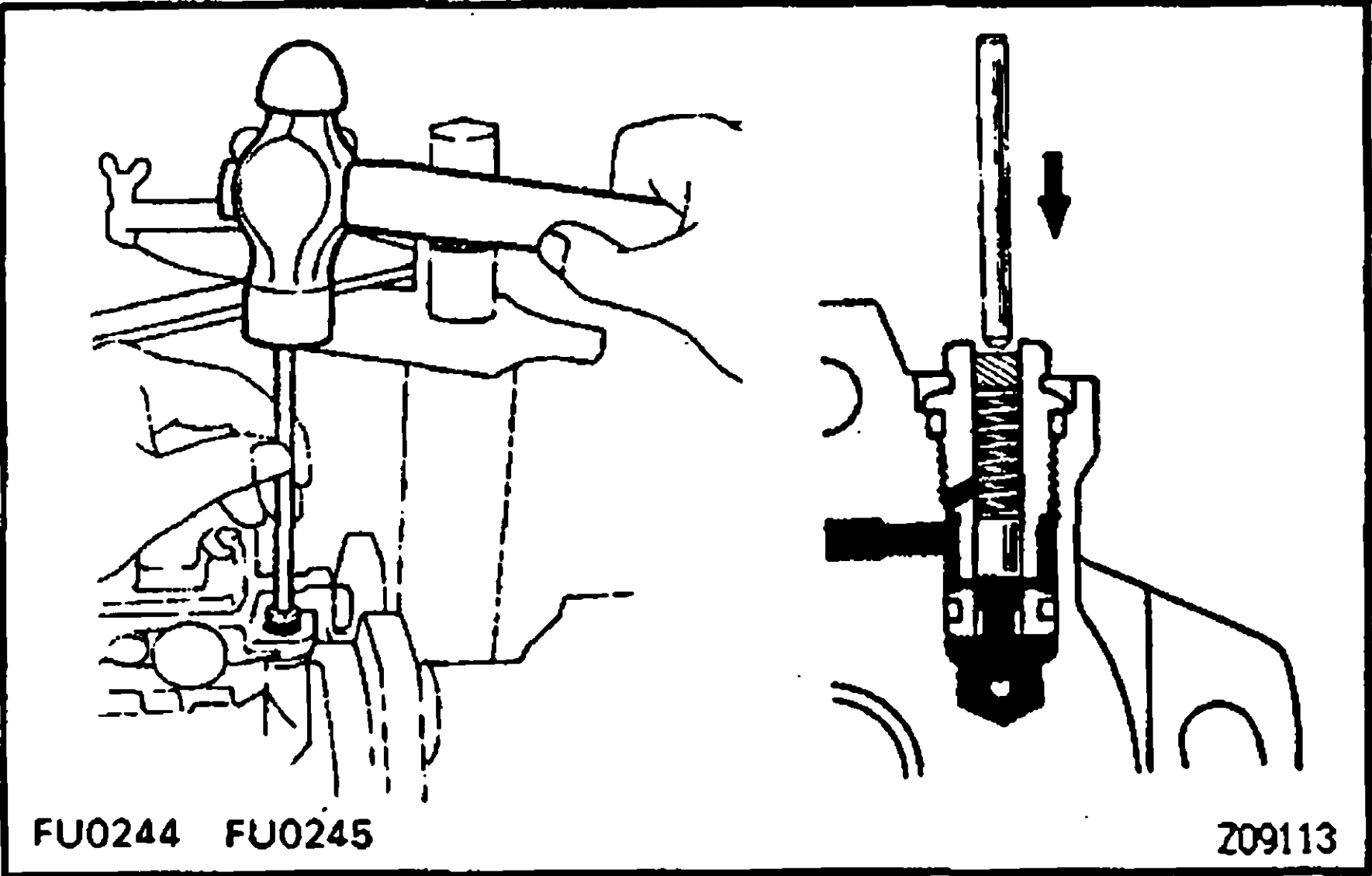
Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
2,200	200	4.0 - 6.0 (0.24 - 0.37)

- (f) Remove the lock plate.
(g) Adjust the injection volume with the maximum speed adjusting screw.

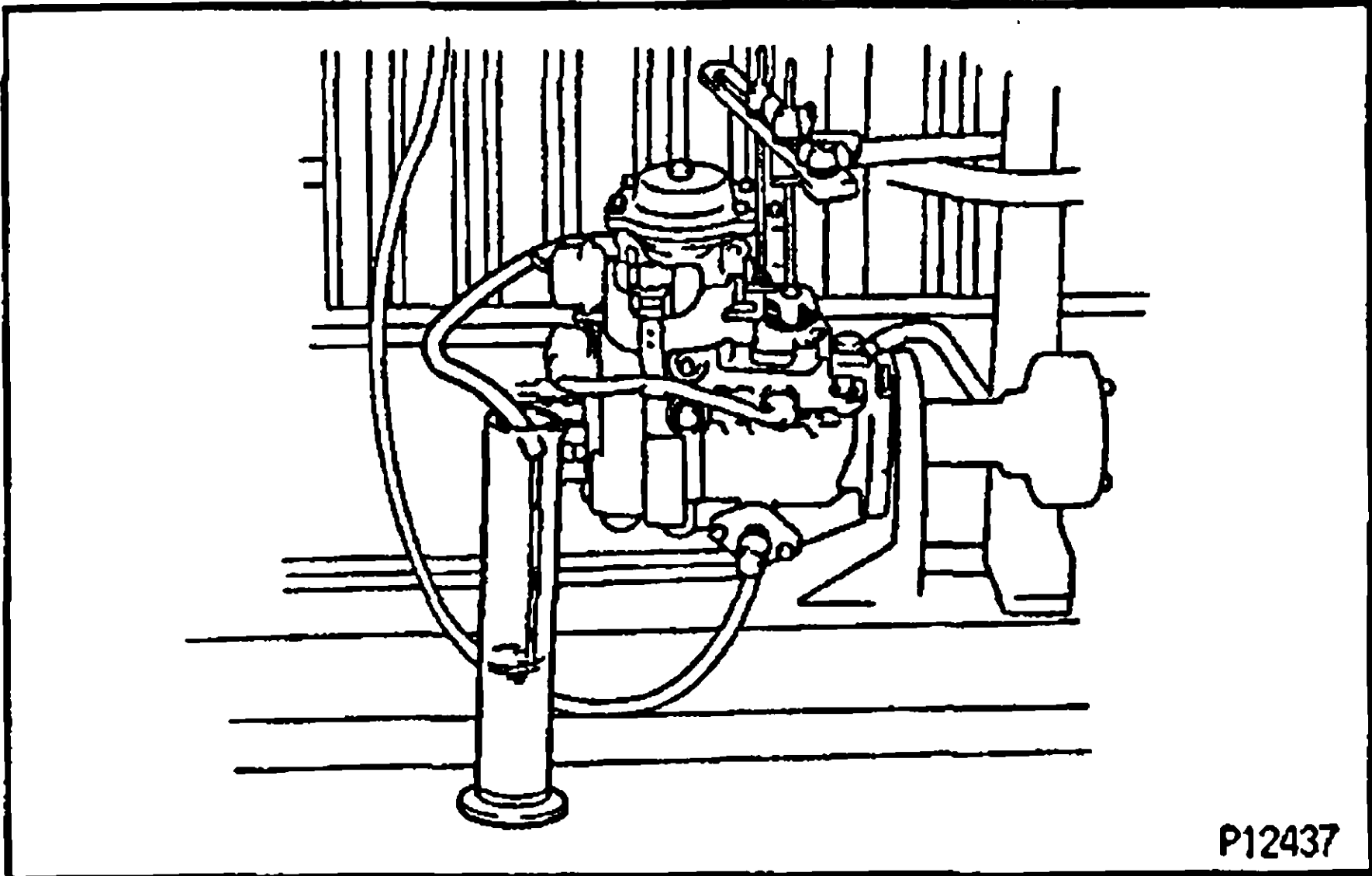
5. ADJUST PUMP INNER PRESSURE

- (a) The adjusting lever at idle position.
(b) Measure the pump inner pressure at the below listed rpm.
(c) w/o BACS:
Apply 80 kPa (0.81 kgf/cm², 11.5 psi) of pressure to the boost compensator.
(d) w/ BACS:
Apply 121 kPa (1.24 kgf/cm², 17.7 psi) of pressure to the boost compensator.
HINT: Check that the adjusting lever at idle position.

Pump rpm	Inner pressure kPa (kgf/cm ² , psi)
1,080	402.1 - 460.9 (4.1 - 4.7, 58.3 - 66.8)
1,800	813.9 - 872.8 (8.3 - 8.9, 118.3 - 126.8)



- (e) If the pressure is low, adjust by lightly tapping the regulator valve piston while watching the pressure gauge.
HINT: If the pressure is too high or if the regulator valve was tapped in too far, the regulator valve must be replaced.

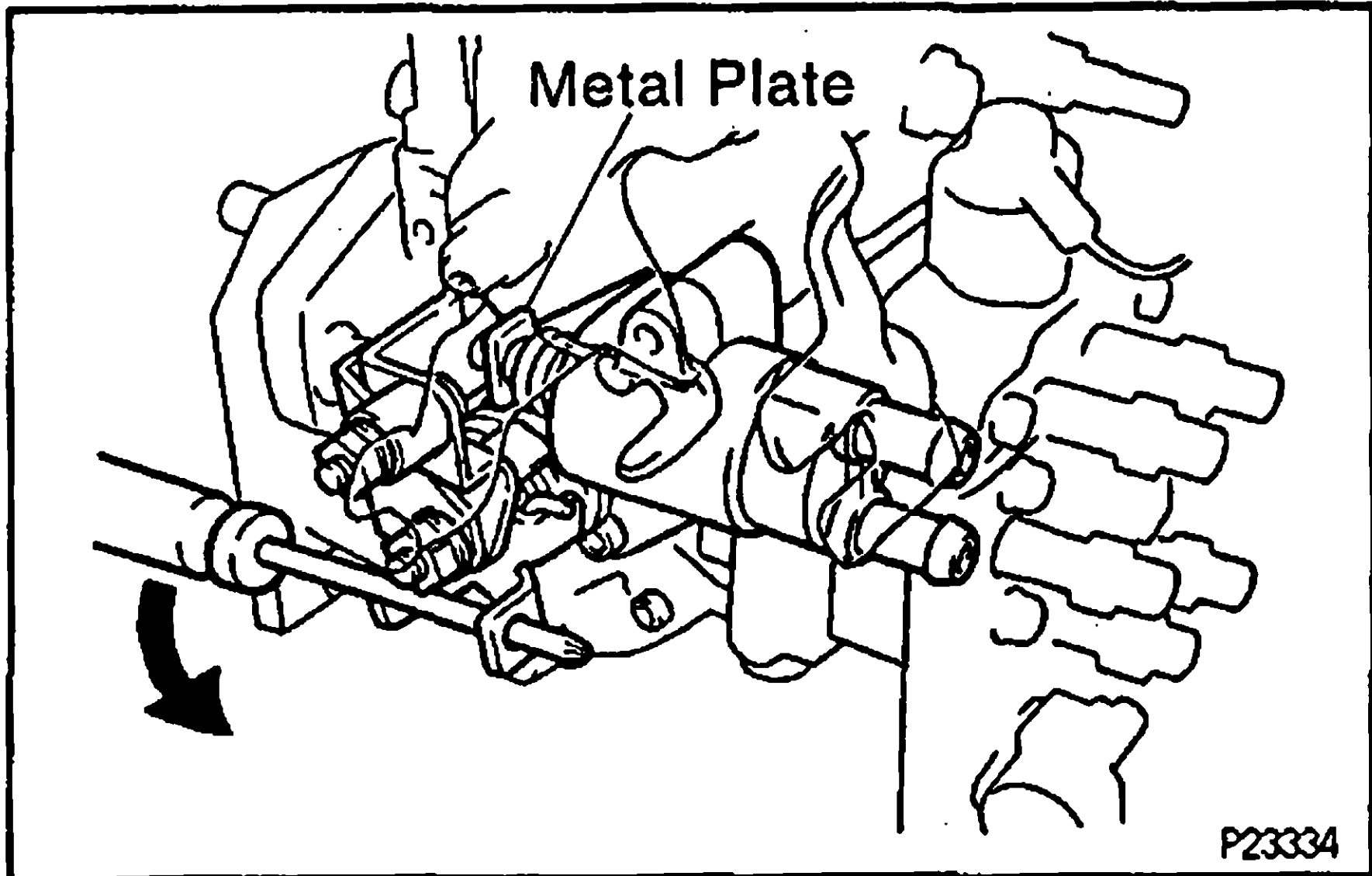


6. CHECK OVERFLOW VOLUME

- (a) w/o BACS:
Apply 80 kPa (0.81 kgf/cm², 11.5 psi) of pressure to the boost compensator.
- (b) w/ BACS:
Apply 121 kPa (1.24 kgf/cm², 17.7 psi) of pressure to the boost compensator.
Measure the overflow volume at the below listed rpm.

Pump rpm	Overflow volume cc/min. (cu in./min.)
1,800	1,292 – 1,942 (78.8 – 118.5)

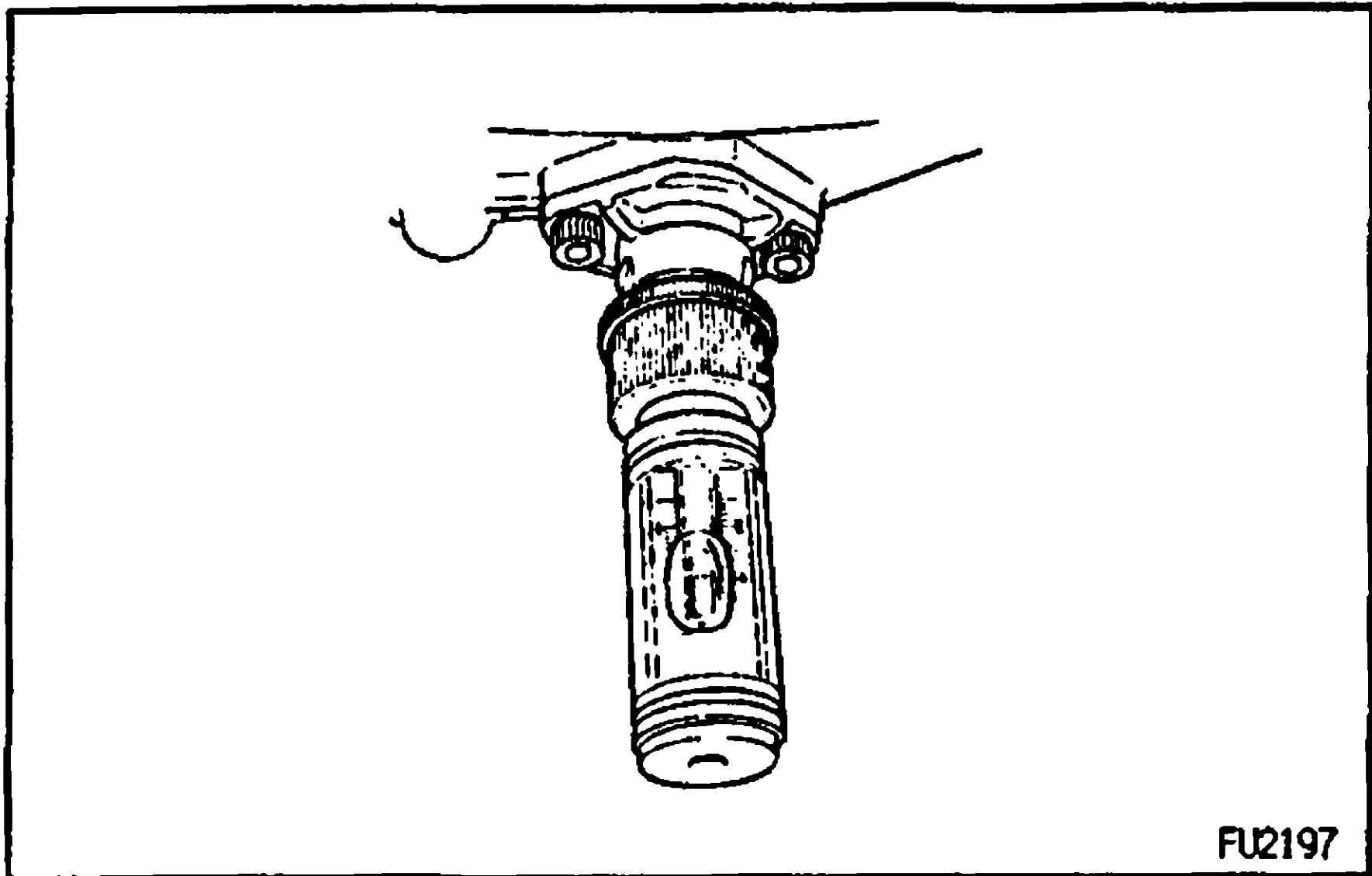
HINT: Always use the overflow screw installed on the pump to be adjusted.



7. RELEASE COLD STARTING SYSTEM FOR NEXT INSPECTIONS

- (a) Using a screwdriver, turn the cold starting lever counterclockwise approx. 20°.
- (b) Put a metal plate (thickness of 5.0 – 8.0 mm (0.20 – 0.31 in.)) between the cold starting lever and thermo wax plunger.

HINT: Keep the cold starting system released until all measurements and adjustments are finished.

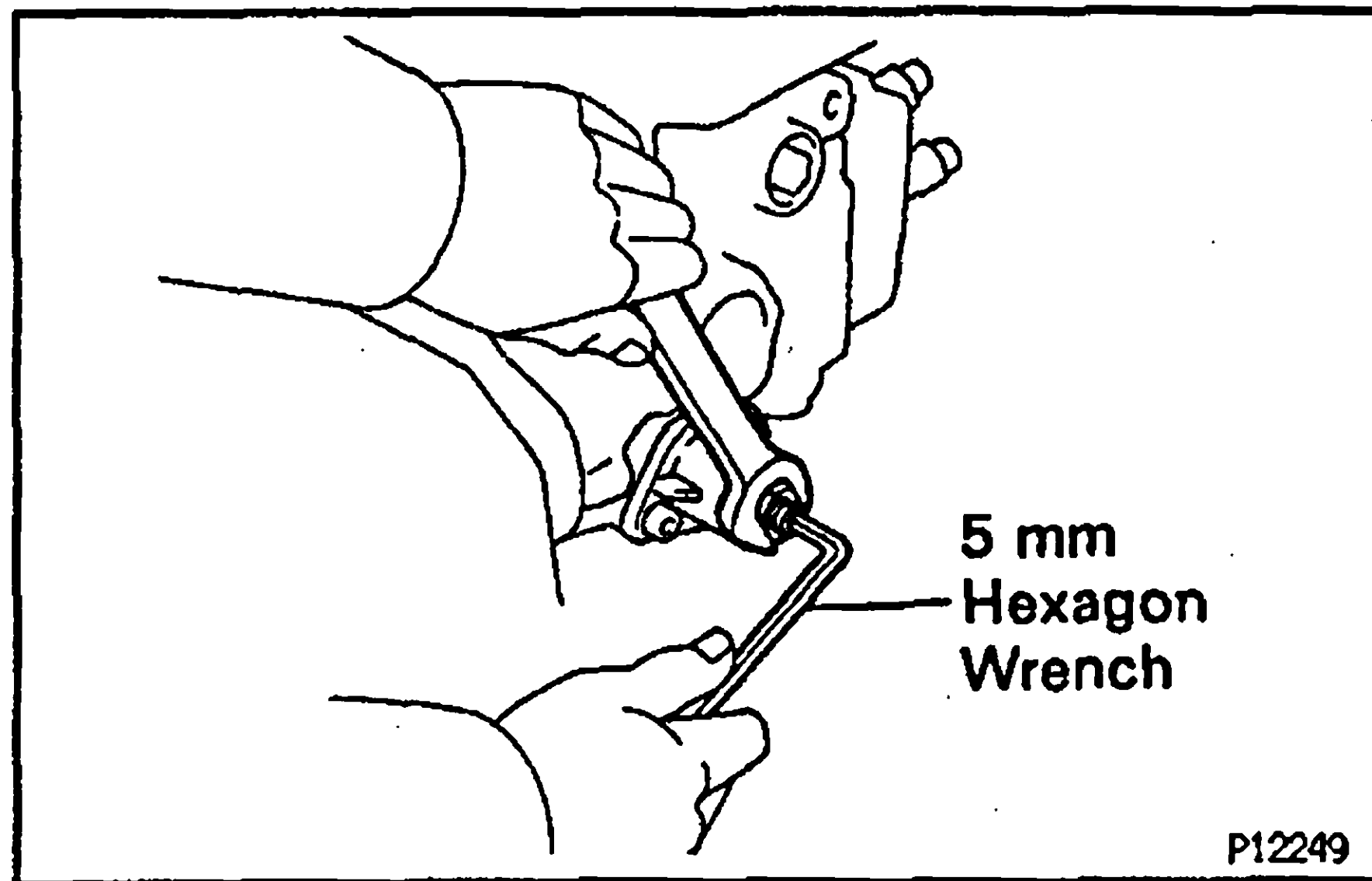


8. ADJUST TIMER

- (a) Set the timer measuring device at zero.
- (b) Measure the timer piston stroke at the below listed rpm.
HINT: Check that the hysteresis is within 0.3 mm (0.012 in.).

Item	Pump rpm	Piston Strokes mm (in)
w/o BACS	1,080	0.63 – 1.63 (0.025 – 0.064)
	1,440	3.24 – 4.24 (0.128 – 0.167)
	1,800	5.85 – 6.85 (0.230 – 0.270)
	2,000	7.7 – 8.7 (0.303 – 0.343)
w/ BACS	1,080	0.22 – 1.22 (0.009 – 0.048)*
	1,440	2.83 – 3.83 (0.111 – 0.151)
	1,800	5.44 – 6.44 (0.214 – 0.254)
	2,000	7.7 – 8.7 (0.303 – 0.343)*

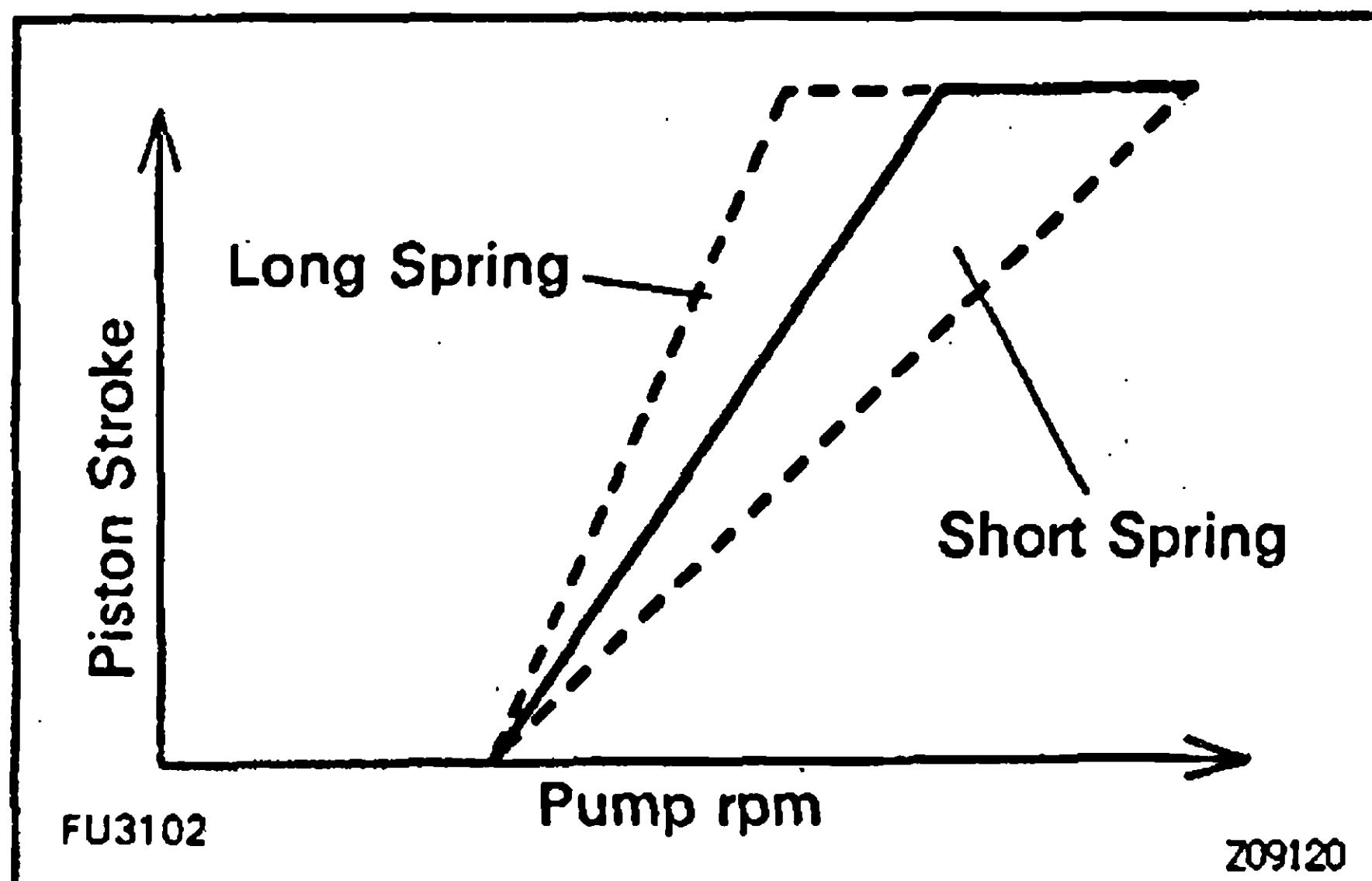
* Maximum stroke check (Load sensing timer non-operating)



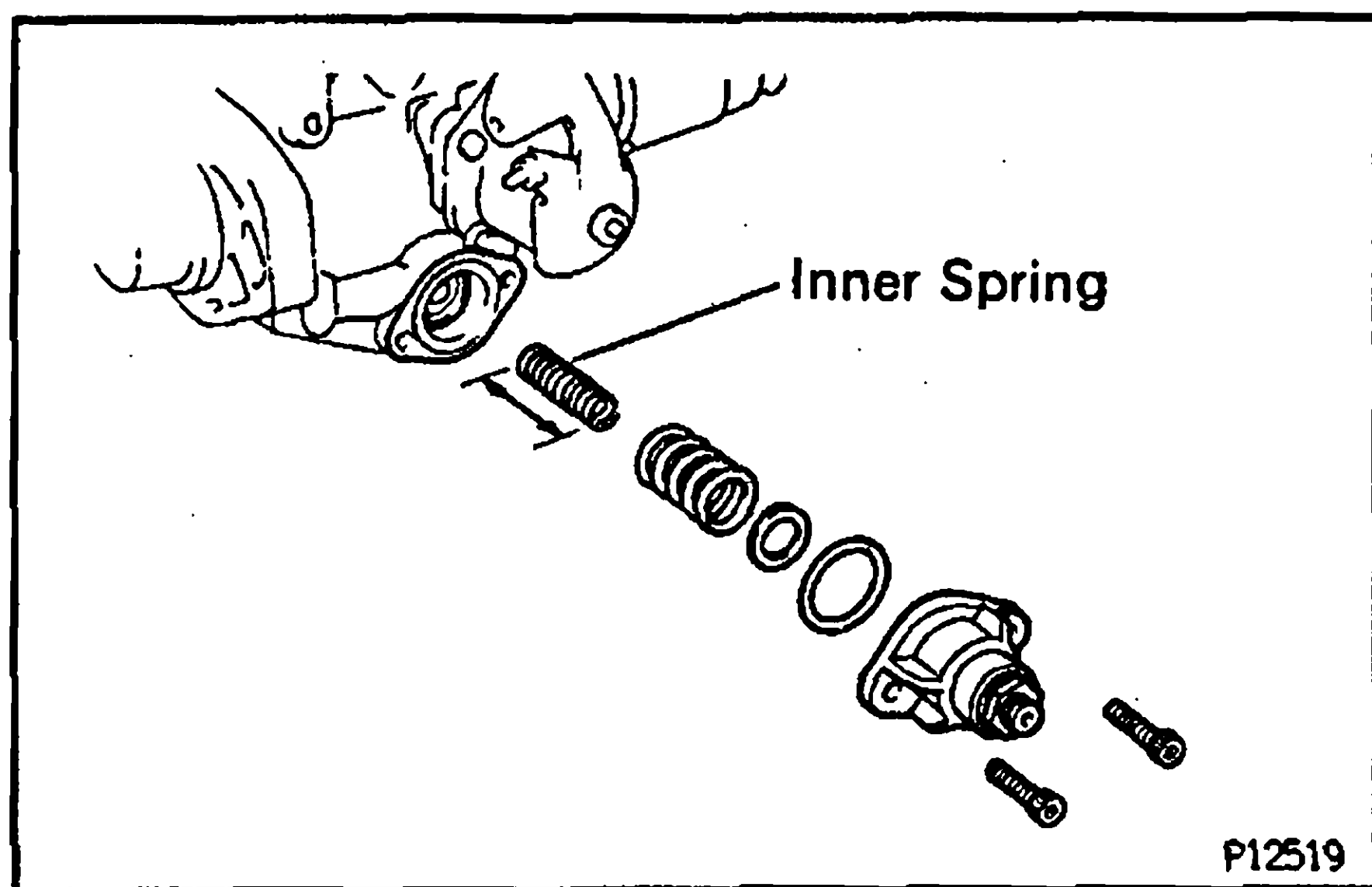
- (c) Using a 5 mm hexagon wrench, adjust by turning the timer adjusting screw.

HINT: Turn clockwise to reduce the stroke, turn counterclockwise to increase the stroke.

EG



- (d) Check the timer stroke for characteristic tendency.



If tendency is not as specified, select and replace the inner spring.

Timer spring free length:

34.4 mm (1.35 in.)

34.0 mm (1.34 in.)

33.6 mm (1.32 in.)

HINT: The timer stroke will increase with a long spring and decrease with a short spring.

9. CHECK BOOST COMPENSATOR FOR AIR TIGHTNESS

- (a) Apply 98 kPa (1.00 kgf/cm², 14.2 psi) of pressure to the boost compensator.
- (b) Measure the time it takes for pressure to drop to 95 kPa (0.97 kgf/cm², 13.8 psi).

Pressure drop:

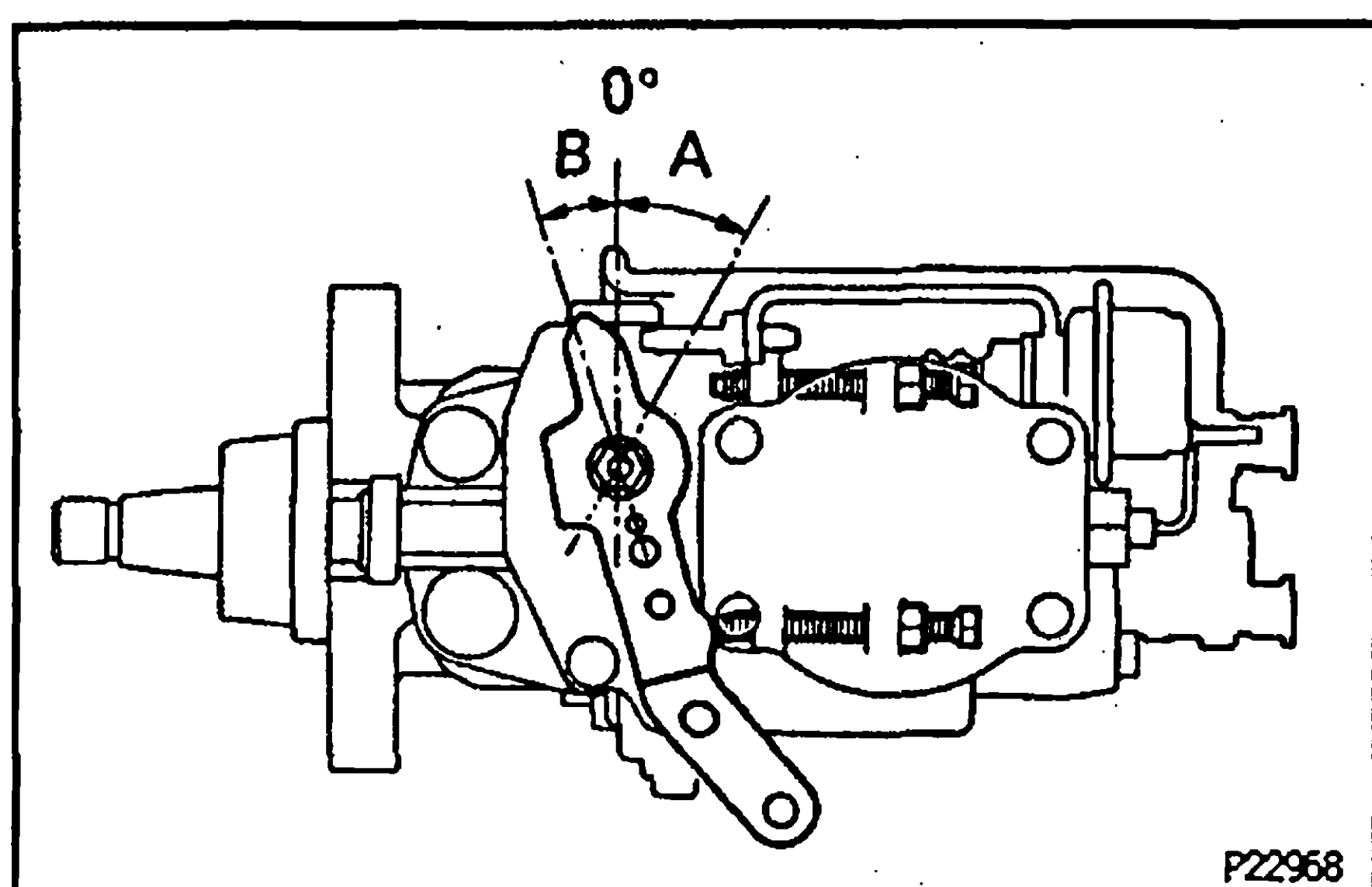
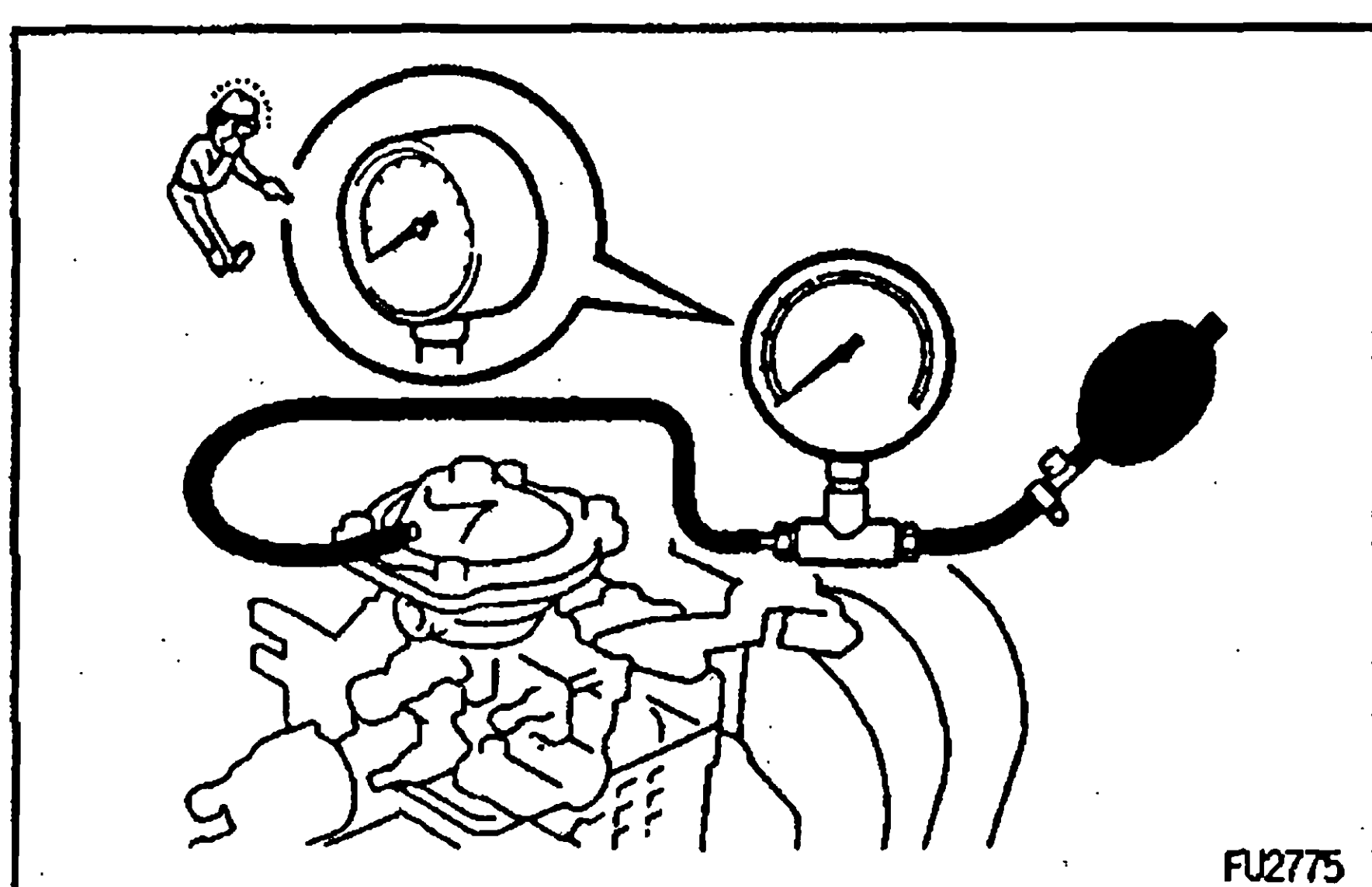
10 seconds or more

10. ADJUST FULL LOAD INJECTION VOLUME

- (a) The adjusting lever angle for the adjustment below should be as shown in the illustration.

Adjusting lever angle:

A (Maximum speed side)		B (Idle speed side)	
Plus	21 – 31°	Minus	12 – 22°



- (b) Apply 67.2 kPa (503.7 mmHg, 19.83 in.Hg) of vacuum to the SICS actuator.

- (c) w/o BACS:

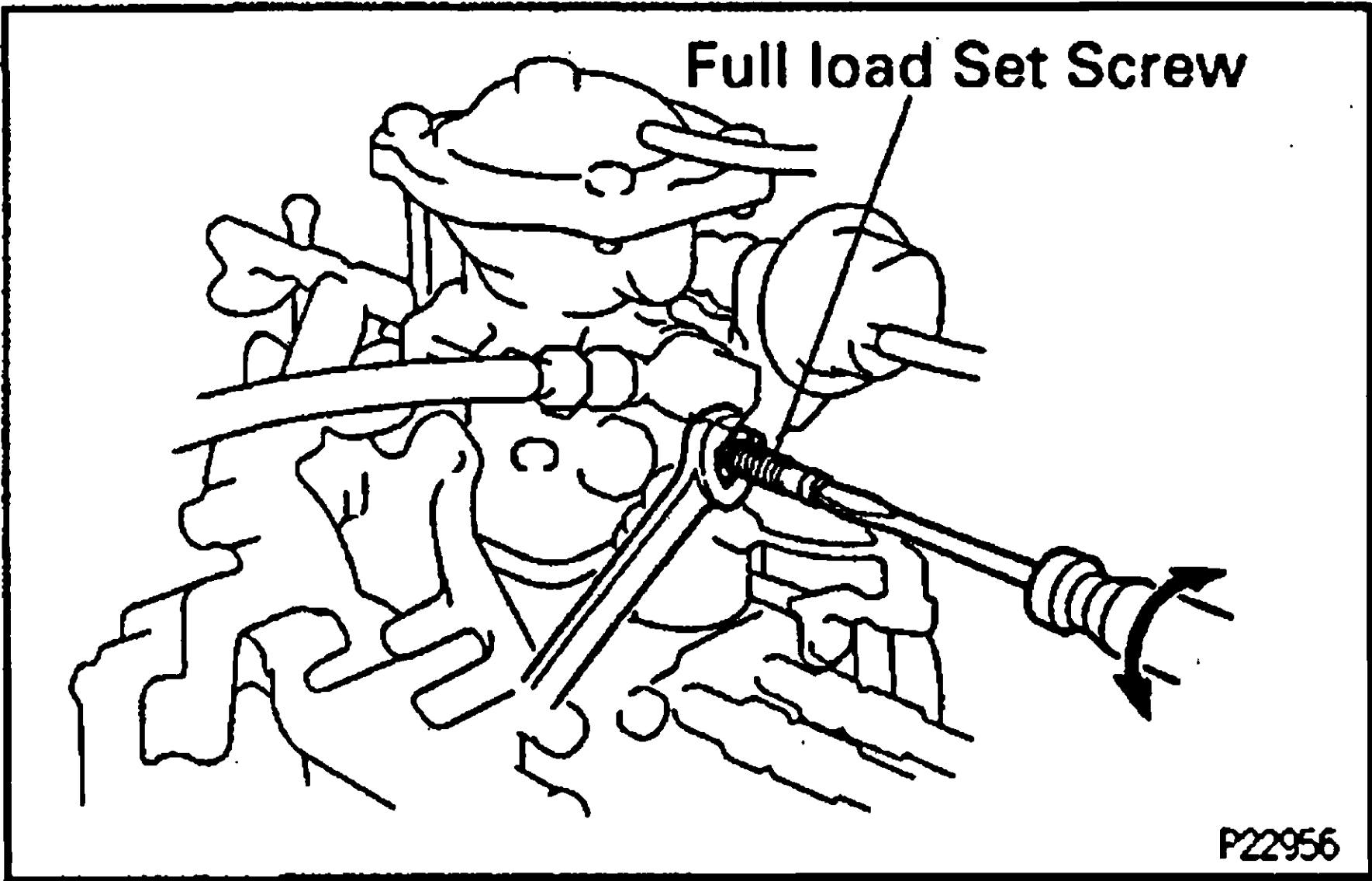
Apply 80 kPa (0.81 kgf/cm², 11.5 psi) of pressure to the boost compensator.

EG

V06637

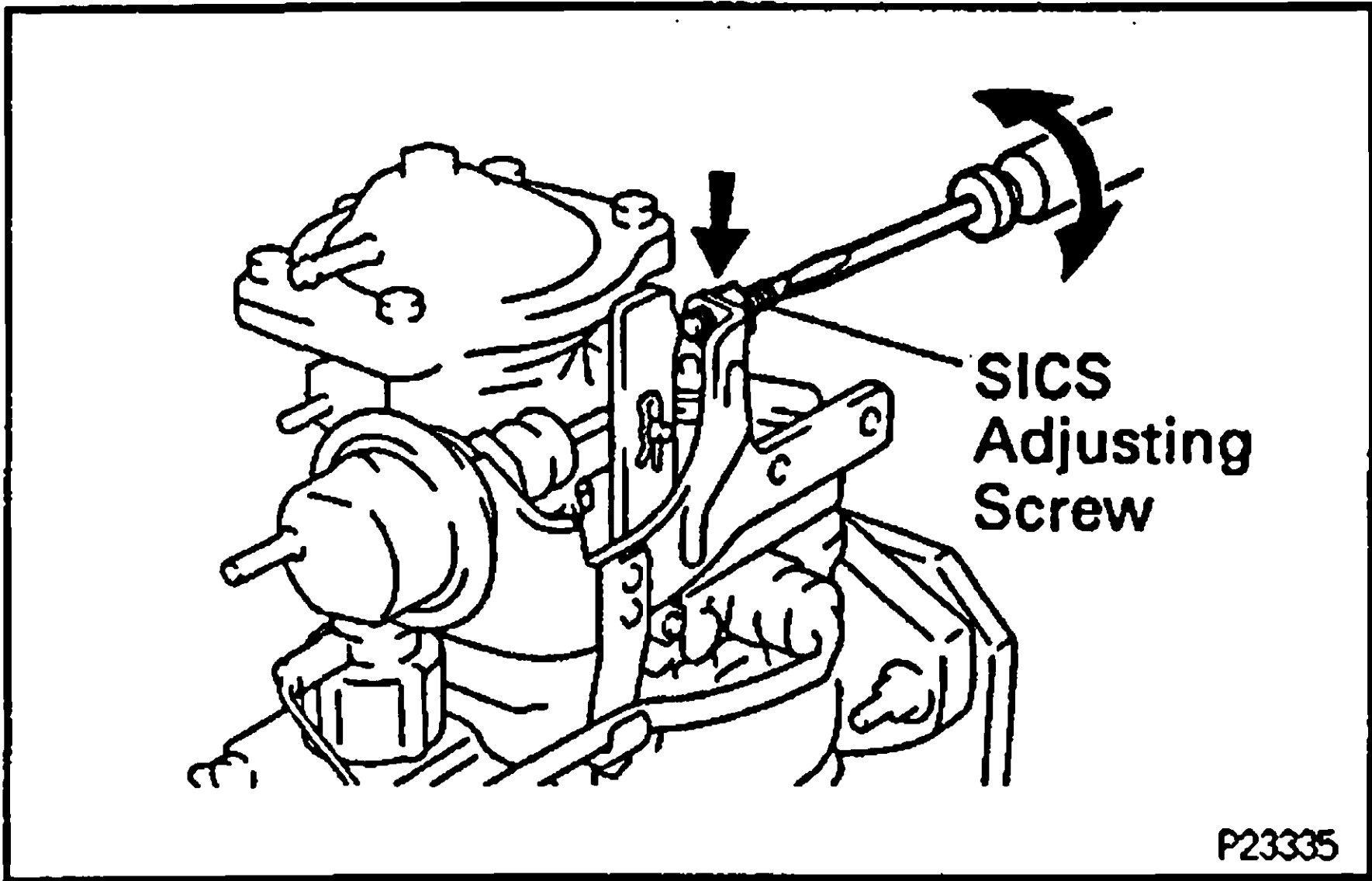
- (d) w/ BACS:
Apply 121 kPa (1.24 kgf/cm², 17.7 psi) of pressure to the boost compensator.
- (e) Measure the full load injection volume.

Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
Plus 21 – 31°	1,080	200	14.92 – 16.52 (0.91 – 1.01)

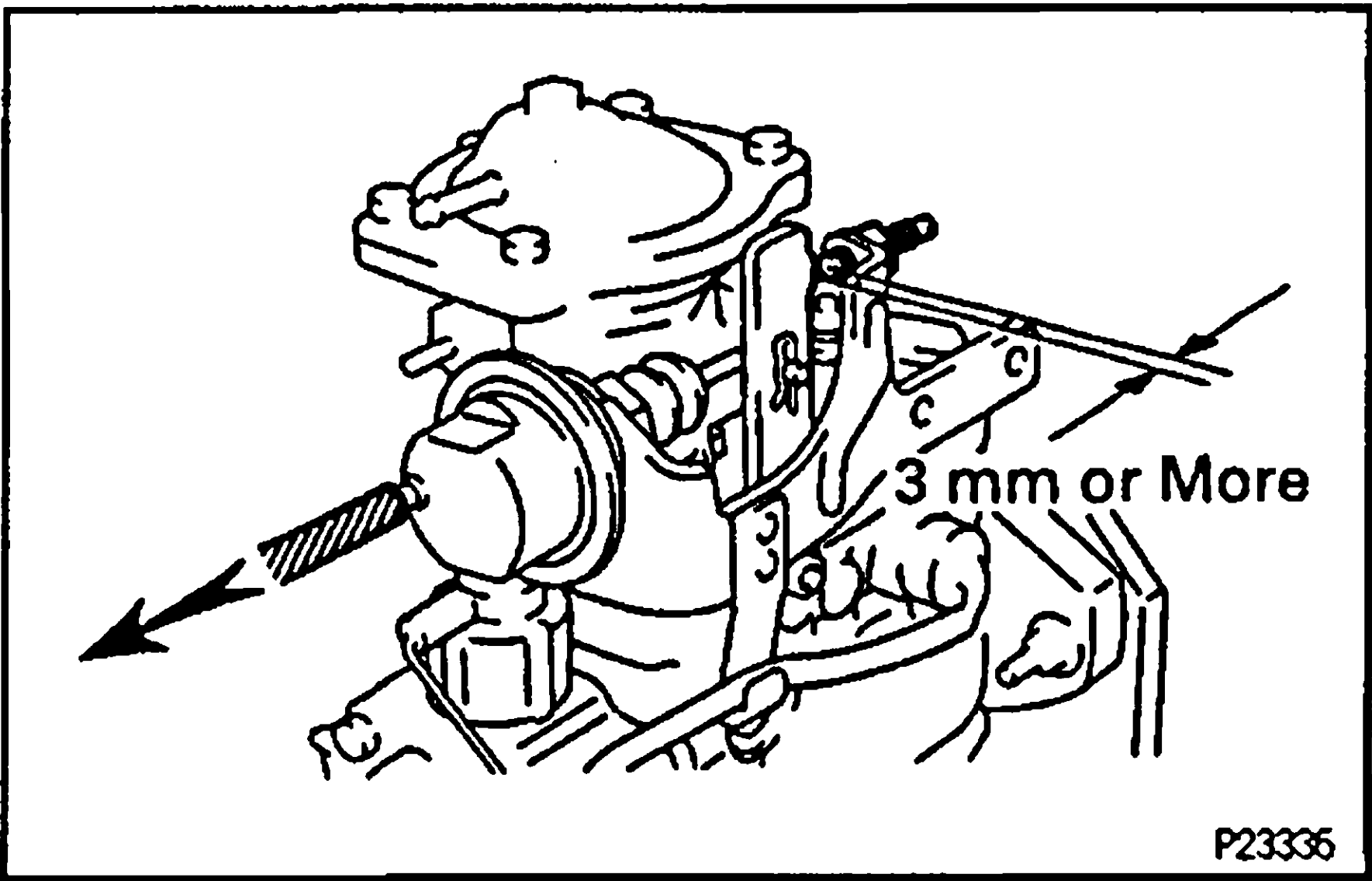


- (f) Adjust by turning the full load set screw.
HINT: The injection volume will increase about 3 cc (0.18 cu in.) with each 1/2 turn of the screw.
- (g) Release the vacuum from the SICS actuator.
- (h) Measure the injection volume.

Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
100	200	11.3 – 12.7 (0.69 – 0.77)



- (i) Adjust by turning the SICS adjusting screw.
HINT: By screwing in the adjusting screw, the injection volume is increased; unscrewing the adjusting screw decreases the injection volume.



- (j) Check that when the actuator rod for SICS is withdrawn the most, the gap between SICS lever and SICS adjusting screw is 3 mm or more. If it less than 3 mm, add 1 adjusting washer on the nut side and check that the gap is 3 mm or more.
- (k) Check that when the actuator is not operating, the gap between SICS lever and SICS adjusting screw is 0 mm.

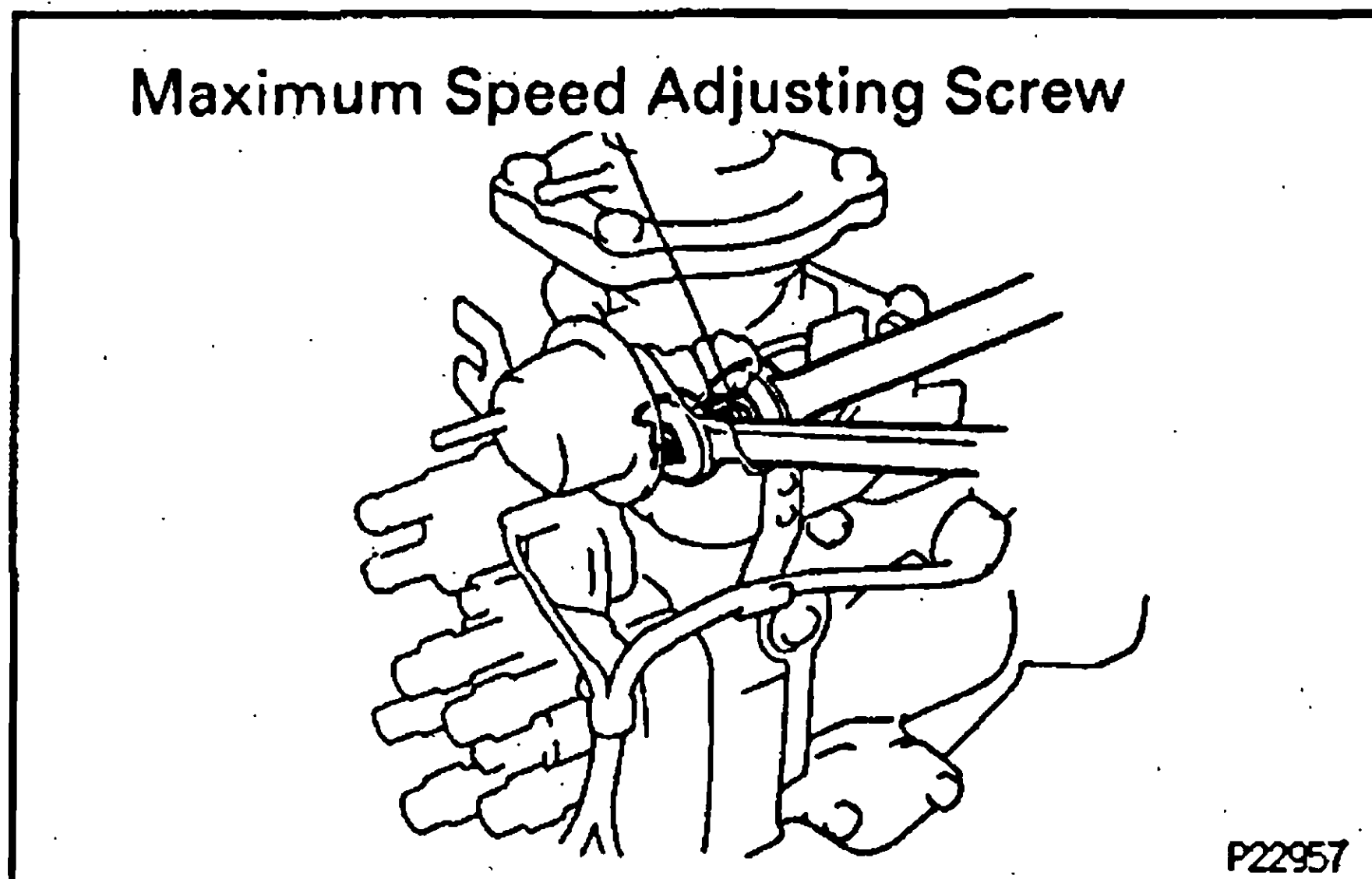
11. ADJUST MAXIMUM SPEED

- (a) w/o BACS:
Apply 80 kPa (0.81 kgf/cm², 11.5 psi) of pressure to the boost compensator.
- (b) w/ BACS:
Apply 121 kPa (1.24 kgf/cm², 17.7 psi) of pressure to the boost compensator.
- (c) Apply 67.2 kPa (503.8 mmHg, 19.83 in.Hg) of vacuum to the SICS actuator.
- (d) Measure the injection volume at each pump rpm.

Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Remarks
Plus 21 – 31°	2,200	200	4.0 – 6.0 (0.24 – 0.37)	Adjust
Minus 12 – 22°	2,200		1.0 (0.06) or less	–

V06638

EG



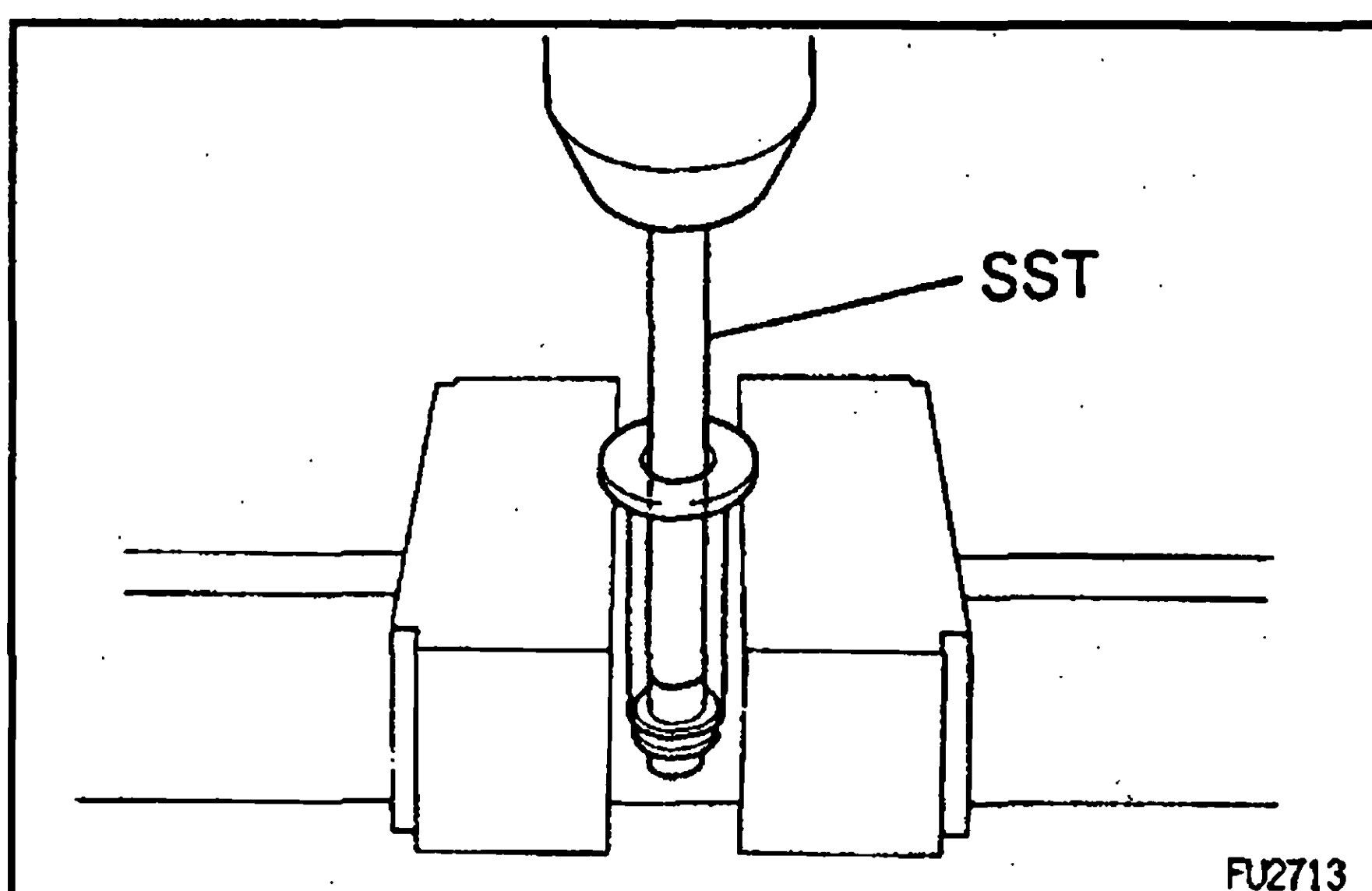
- (e) Adjust by turning the maximum speed adjusting screw.

12. CHECK INJECTION VOLUME

- (a) Apply 67.2 kPa (503.7 mmHg, 19.83 in.Hg) of vacuum to the SICS actuator.
- (b) Measure the injection volume at each pump rpm and boost pressure.

Item	Adjusting lever angle	Pump rpm	Boost pressure kPa (kgf/cm ² , psi)	No. of measuring strokes	Each injection volume cc (cu in.)	Variation limit cc (cu in.)	Remarks
w/ BACS	Plus 21 – 31°	1,080	121 (1.24, 17.7)	200	14.92 – 16.52 (0.91 – 1.01)	1.6 (0.10)	Basic full-load injection volume
		100	41.3 (0.42, 6.0)		15.60 – 19.60 (0.95 – 1.20)	–	Volume during starting
		720	0 (0, 0)		7.46 – 8.16 (0.46 – 0.50)	–	–
		1,800	121 (1.24, 17.7)		17.74 (1.08)	–	–
w/o BACS (M/T)	Plus 21 – 31°	1,080	80 (0.81, 11.5)	200	14.92 – 16.52 (0.91 – 1.01)	1.6 (0.10)	Basic full-load injection volume
		100	0 (0, 0)		14.00 – 18.00 (0.85 – 1.10)	–	Volume during starting
		720	0 (0, 0)		8.06 – 9.18 (0.50 – 0.57)	–	–
		1,800	80 (0.81, 11.5)		17.74 (1.08)	–	–
w/o BACS (A/T)	Plus 21 – 31°	1,080	80 (0.81, 11.5)	200	14.92 – 16.52 (0.91 – 1.01)	1.6 (0.10)	Basic full-load injection volume
		100	0 (0, 0)		14.00 – 18.00 (0.85 – 1.10)	–	Volume during starting
		720	0 (0, 0)		8.78 – 10.12 (0.54 – 0.62)	–	–
		1,800	80 (0.81, 11.5)		17.74 (1.08)	–	–

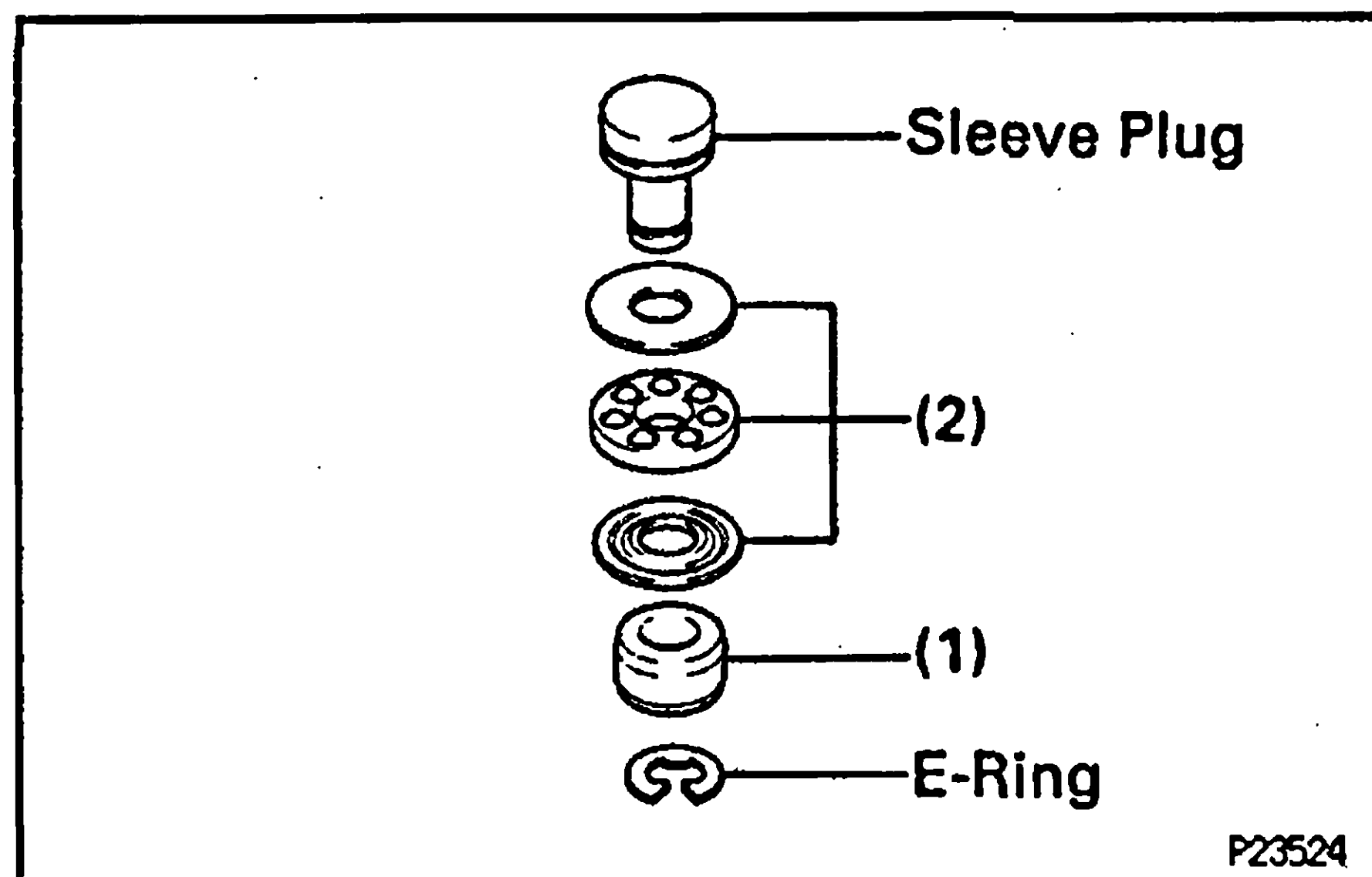
V08025



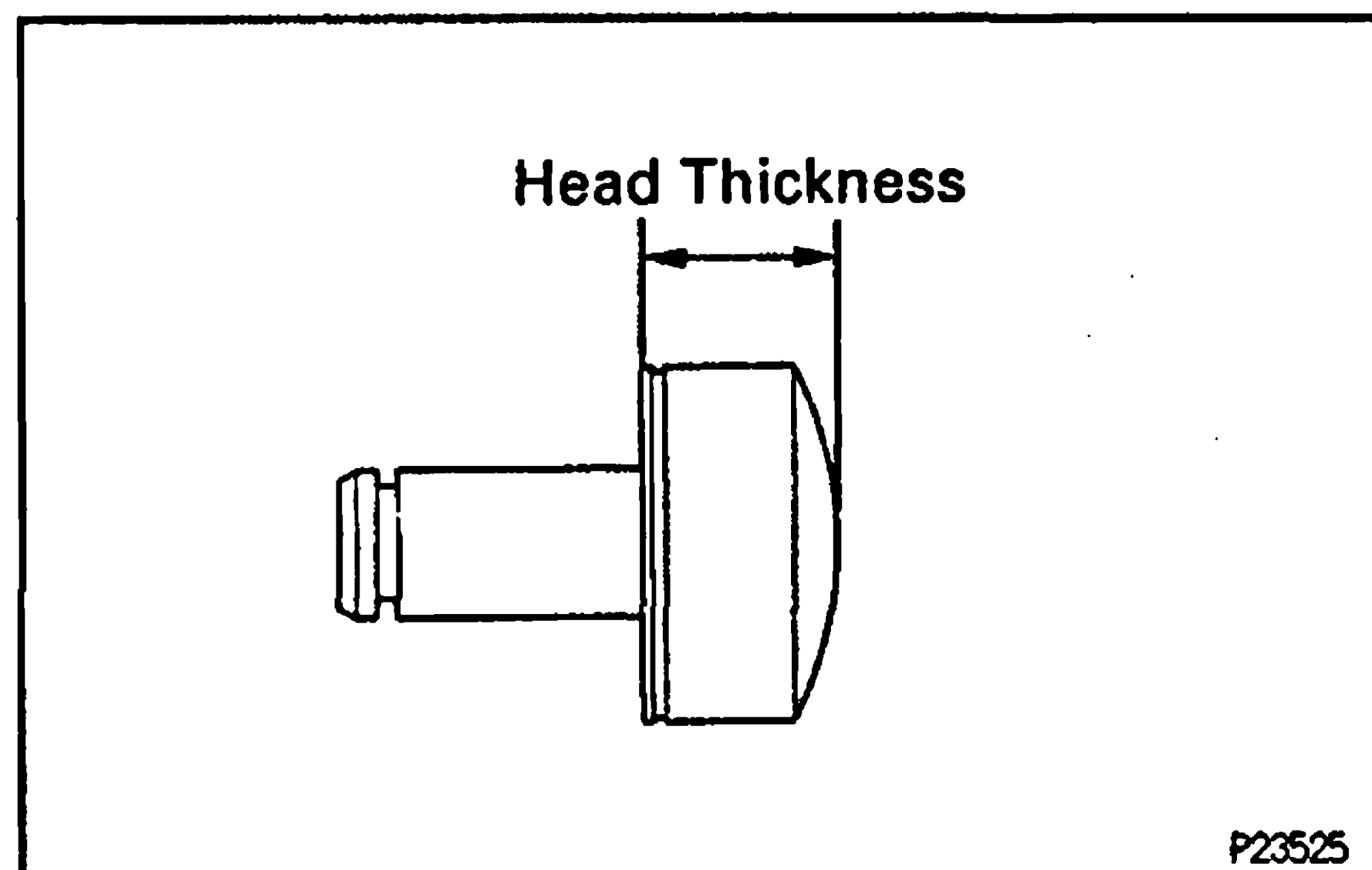
If the injection volume at 100 rpm is not as specified, replace the governor sleeve plug as follows:

- Using SST and a press, press out the sleeve plug assembly from the governor sleeve.

SST 09236–00101 (09237–00070)



- Remove the E—ring and following parts from the sleeve plug:
 - Stop ring
 - Bearing and 2 bearing retainers



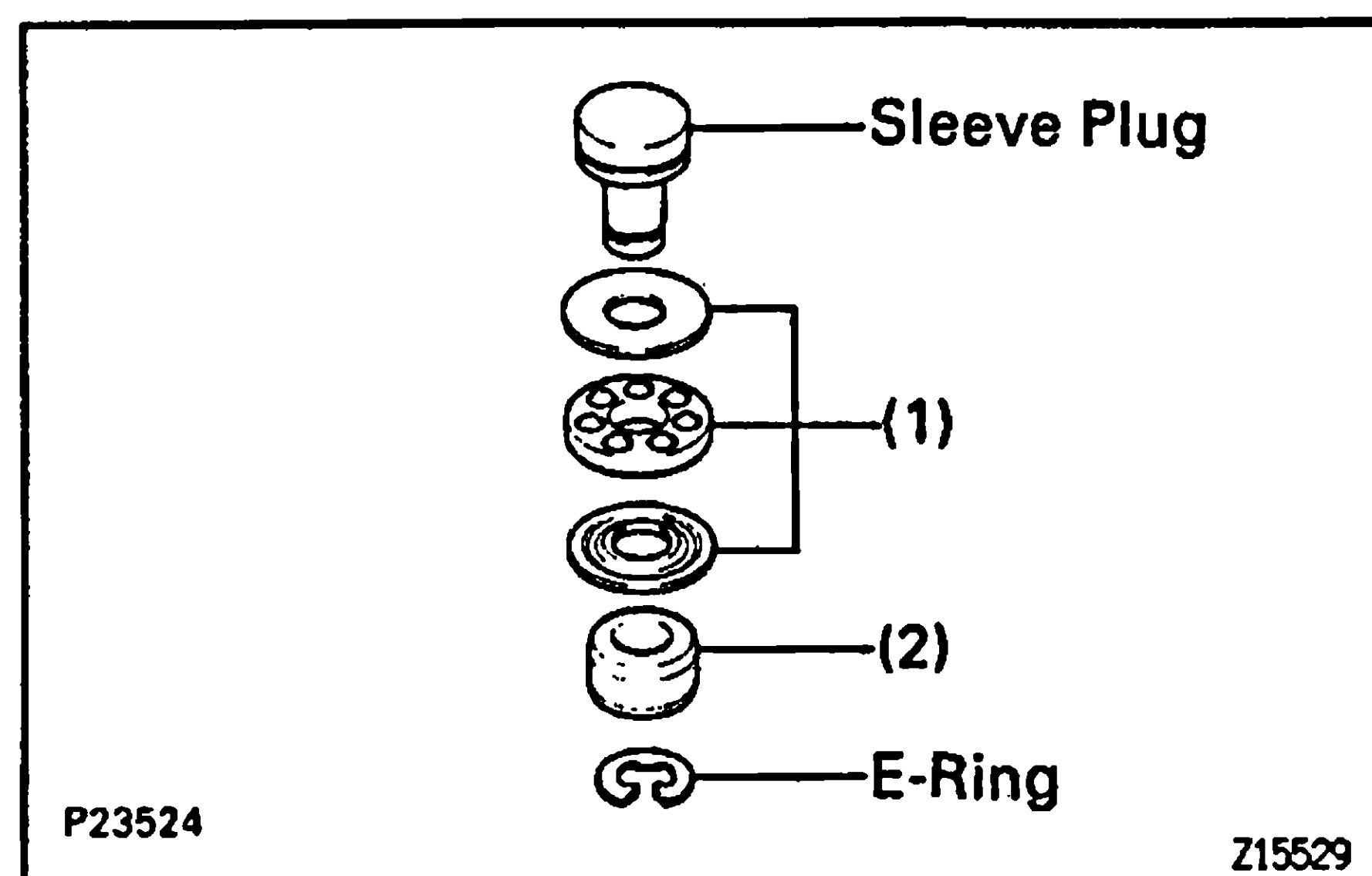
- Measure the head thickness of the sleeve plug, and select a new sleeve plug.

Governor sleeve plug head thickness: mm (in.)

1.3 (0.051)	1.7 (0.067)	2.1 (0.083)
2.5 (0.098)	2.9 (0.114)	3.3 (0.130)
3.7 (0.146)	4.1 (0.161)	4.5 (0.177)
4.9 (0.193)	—	—

HINT: Lengthening the plug by 0.1 mm (0.004 in.) will decrease injection volume by 0.6 cc (0.04 cu in.). If the variation limit is greater than specified, replace the delivery valve.

- Install these parts to the new sleeve plug with a new E—ring:
 - Bearing and 2 retainers
 - Stop ring

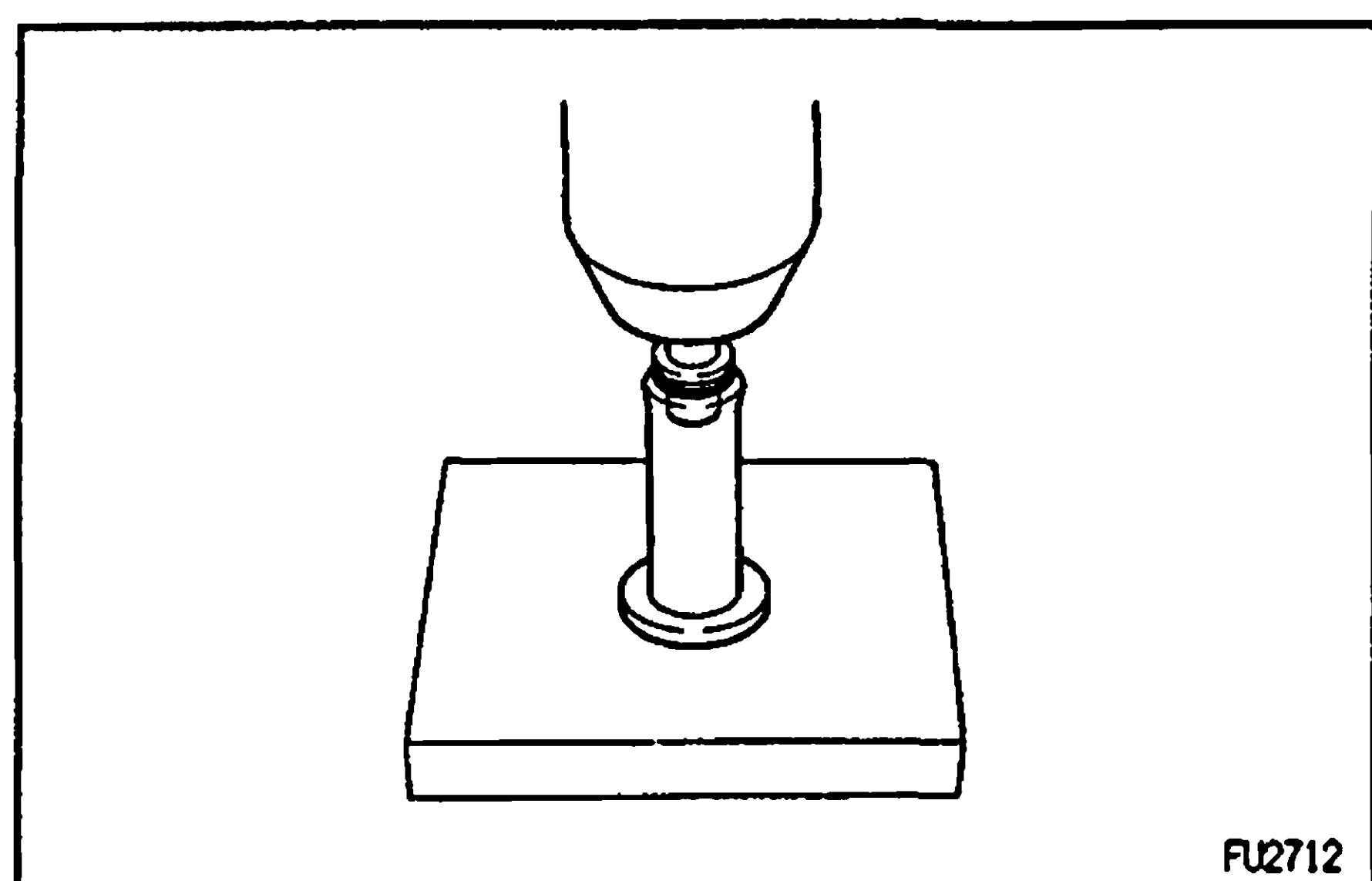


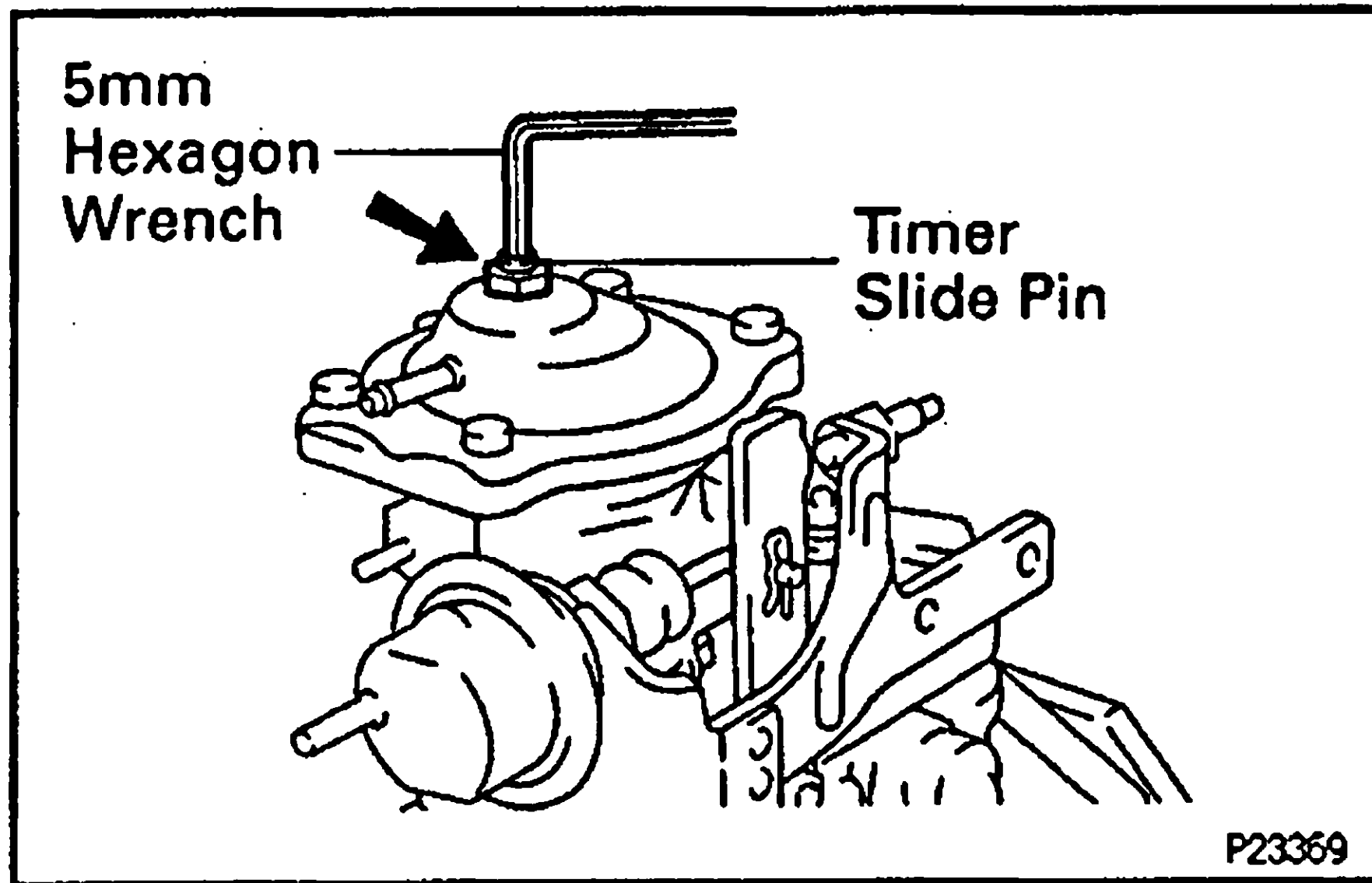
- Using a press, press in the sleeve plug assembly to the governor sleeve.

13. ADJUST FULL LOAD MINIMUM INJECTION VOLUME

- Set the adjusting lever to maximum position.
- Apply 67.2 kPa (503.7 mmHg, 19.83 in.Hg) of vacuum to the SICS actuator.
- w/o BACS:
Release the pressure from the boost compensator.
- w/ BACS:
Release the pressure from the boost compensator.
- Measure the injection volume.
w/ BACS:

Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
720	200	7.46 – 8.16 (0.46 – 0.50)



**w/o BACS:**

Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
720	200	M/T 8.06 – 9.19
		(0.50 – 0.57)
		A/T 8.78 – 10.12
		(0.54 – 0.62)

- (f) Using a 5 mm hexagon wrench, adjust by turning the timer slide pin.

14. ADJUST BOOST COMPENSATOR CHARACTERISTIC

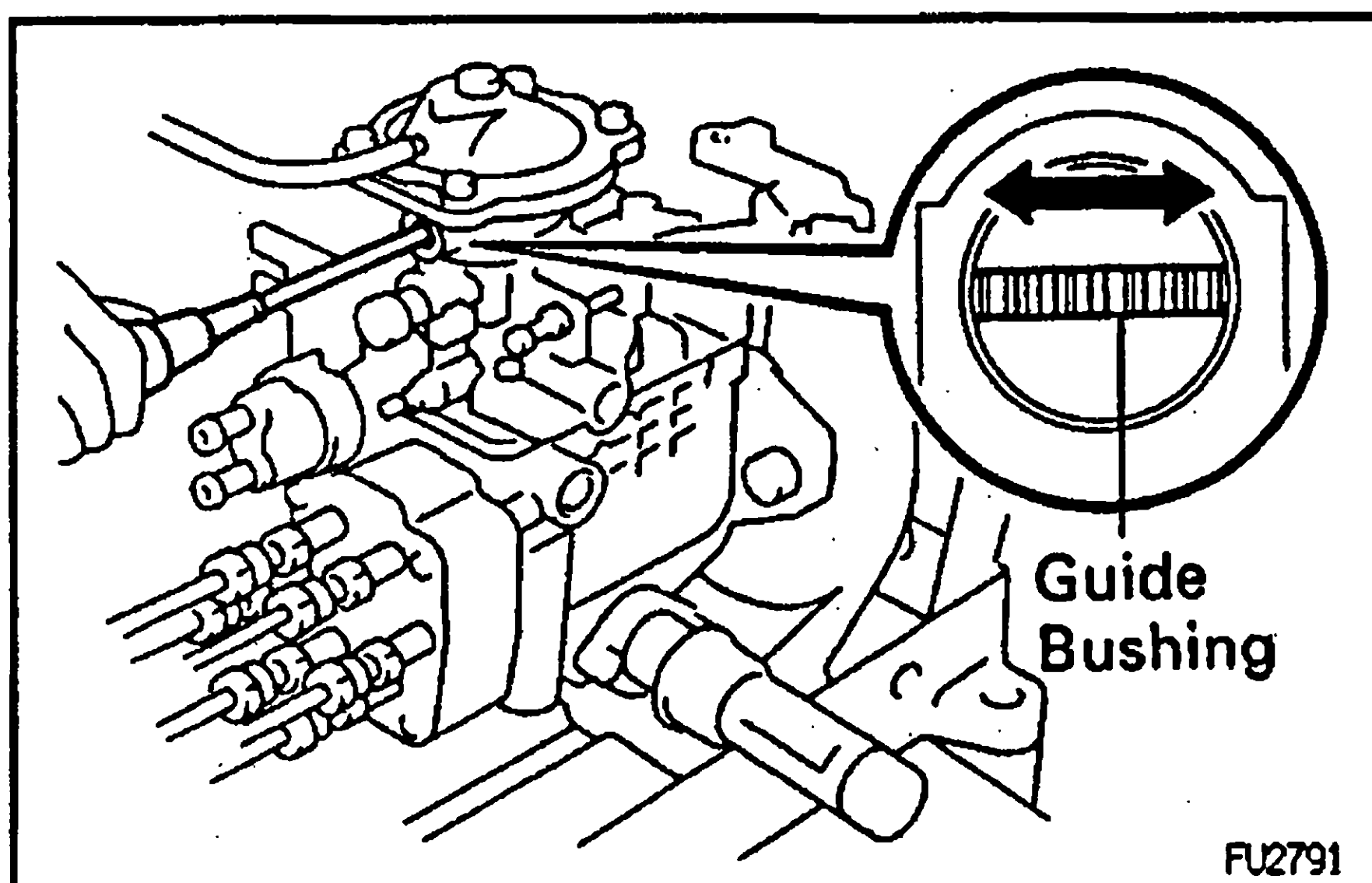
- (a) Apply 67.2 kPa (503.7 mmHg, 19.83 in.Hg) of vacuum to the SICS actuator.
- (b) w/o BACS:
Apply 40 kPa (0.41 kgf/cm², 5.8 psi) of pressure to the boost compensator.
- (c) w/ BACS:
Apply 80 kPa (0.81 kgf/cm², 11.5 psi) of pressure to the boost compensator.
- (d) Measure the injection volume.

w/ BACS:

Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
720	200	12.56 – 14.26
		(0.77 – 0.87)

w/o BACS:

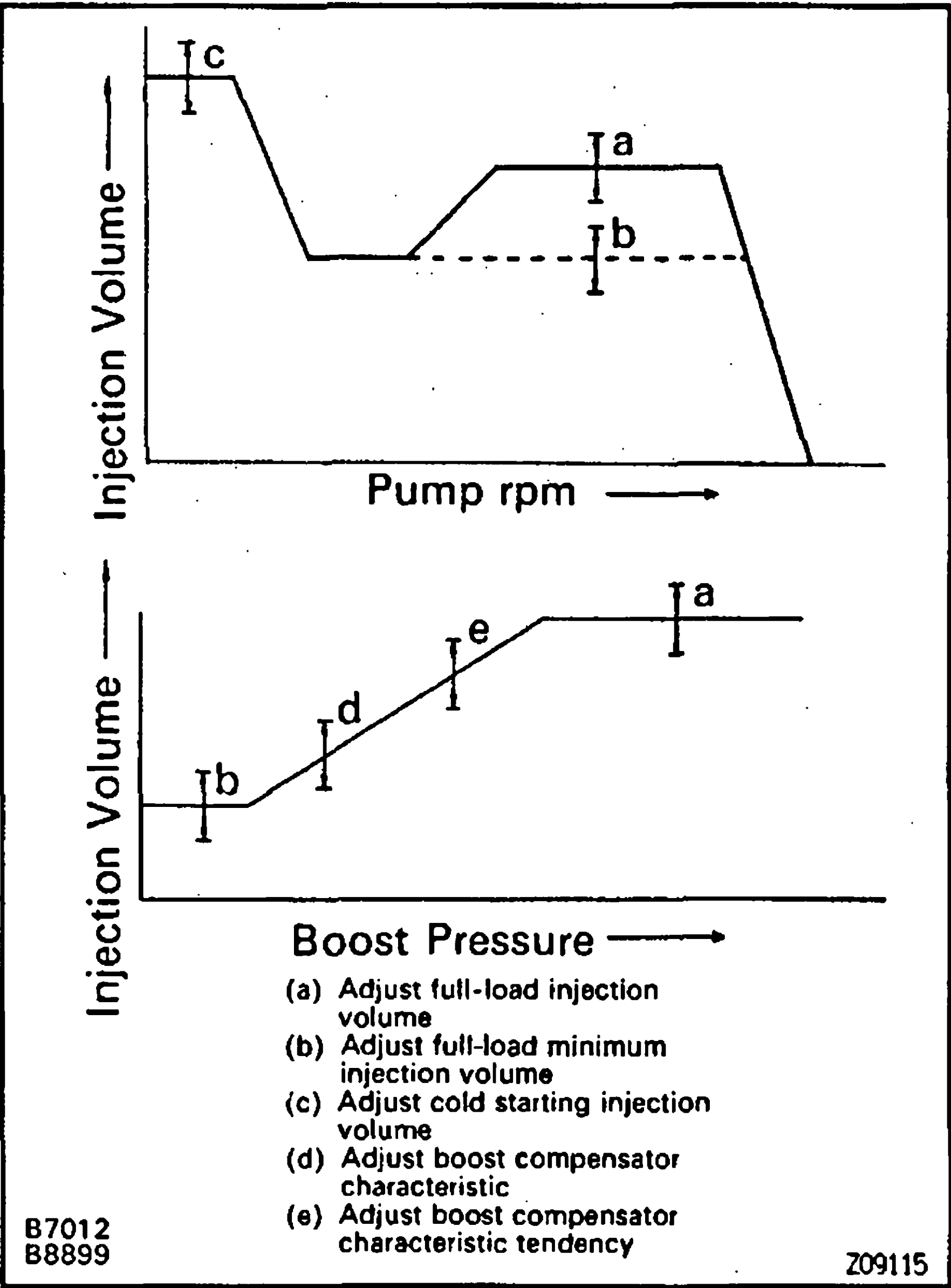
Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
720	200	12.70 – 14.38
		(0.78 – 0.88)



- (e) Using a screwdriver, adjust the injection volume by the guide bushing.
HINT: When the guide bushing is turned clockwise, as seen from above, the injection volume will increase.

15. CHECK FOR CHARACTERISTIC TENDENCY

- (a) Apply 67.2 kPa (503.7 mmHg, 19.83 in.Hg) of vacuum to the SICS actuator.
- (b) w/o BACS:
Apply 16.0 kPa (0.16 kgf/cm², 2.3 psi) of pressure to the boost compensator.
- (c) w/ BACS:
Apply 41.3 kPa (0.42 kgf/cm², 6.0 psi) of pressure to the boost compensator.



(d) Measure the injection volume.
w/ BACS:

Pump rpm	No. of measuring strokes	Each injection volume cc (cu in.)
720	200	8.06 – 9.18 (0.50 – 0.57)

w/o BACS:

Pump rpm	No. of measuring stroke	Pressure kPa(kgf/cm ² ,psi)	Each injection volume cc (cu in.)
720	200	M/T16(0.16, 2.3)	M/T 9.02 – 10.40 (0.56 – 0.64)
		A/T21.3(0.22, 3.1)	A/T 9.80 – 11.28 (0.60 – 0.70)

V08023

16. CHECK HYSTERESIS

(a) w/o BACS:

Compare the injection volume when the boost compensator pressure is lowered from 80 kPa (0.81 kgf/cm², 11.5 psi) to 0 kPa (0 kgf/cm², 0 psi) and, conversely, when it is raised from zero.

(b) w/ BACS:

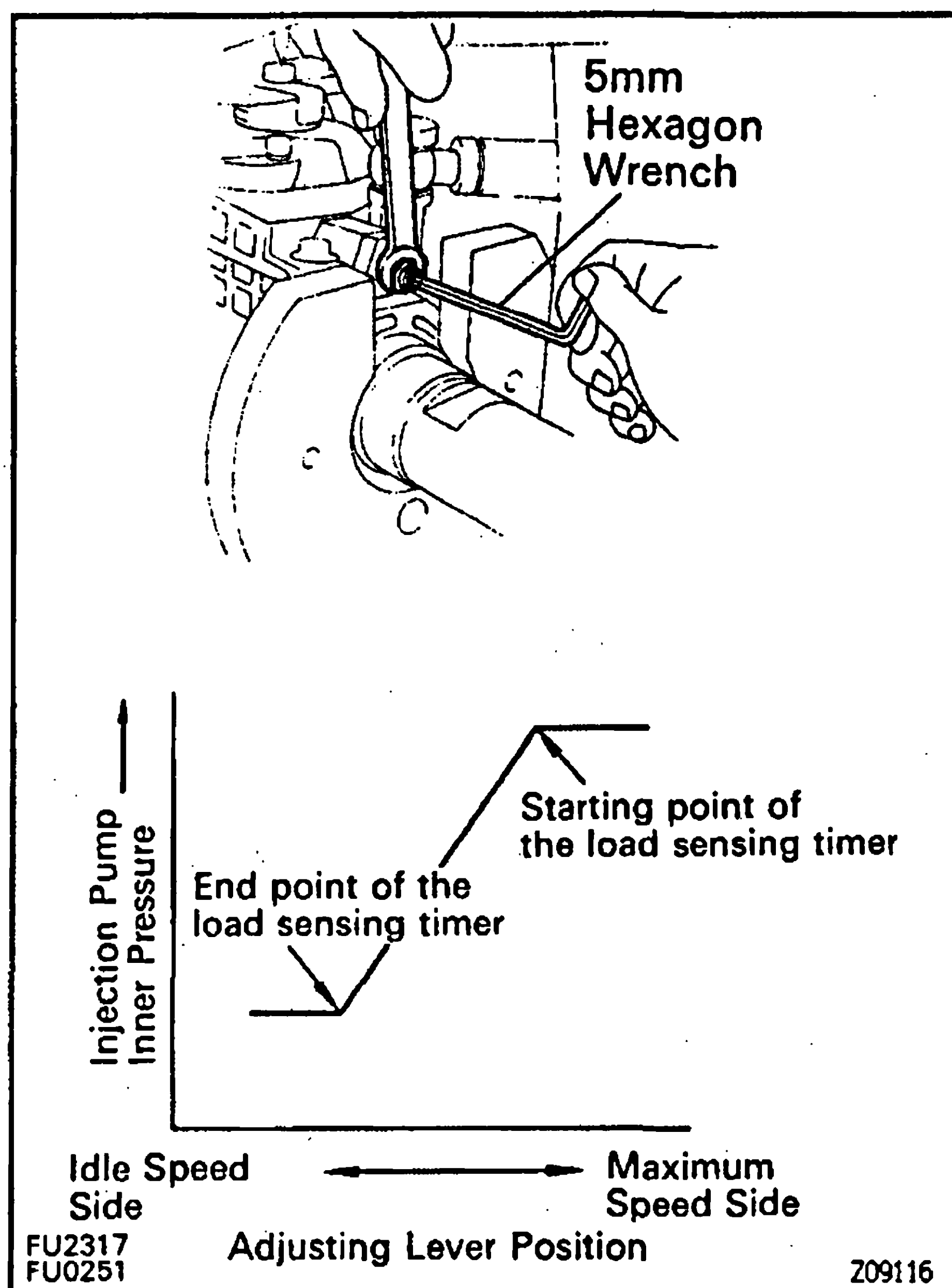
Compare the injection volume when the boost compensator pressure is lowered from 127 kPa (1.25 kgf/cm², 18.3 psi) to 0 kPa (0 kgf/cm², 0 psi) and, conversely, when it is raised from zero.

HINT: Make measurements after moving the adjusting lever between idle and maximum 3 times for each lowering of the pressure.

Item	Pump rpm	Boost pressure kPa (kgf/cm ² ,psi)	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Hysteresis cc (cu in.)
w/ BACS	720	121 (1.24, 17.7)	200	14.64 – 15.70 (0.90 – 0.97)	0.6 (0.10) or less
		80 (0.81, 11.5)		12.56 – 14.26 (0.77 – 0.88)	
		41.3 (0.42, 6.0)		8.06 – 9.18 (0.50 – 0.57)	
		0 (0, 0)		7.46 – 8.16 (0.46 – 0.50)	
w/o BACS (M/T)	720	80 (0.81, 11.5)	200	14.64 – 15.70 (0.90 – 0.97)	0.6 (0.10) or less
		40 (0.41, 5.8)		12.7 – 14.38 (0.78 – 0.89)	
		16 (0.16, 2.28)		9.02 – 10.40 (0.56 – 0.64)	
		0 (0, 0)		8.06 – 9.18 (0.50 – 0.57)	
w/o BACS (A/T)	720	80 (0.81, 11.5)	200	14.64 – 15.70 (0.90 – 0.97)	0.6 (0.10) or less
		4.0 (0.41, 5.8)		12.70 – 14.38 (0.78 – 0.89)	
		21.3 (0.22, 3.13)		9.80 – 11.28 (0.60 – 0.70)	
		0 (0, 0)		8.78 – 10.12 (0.54 – 0.62)	

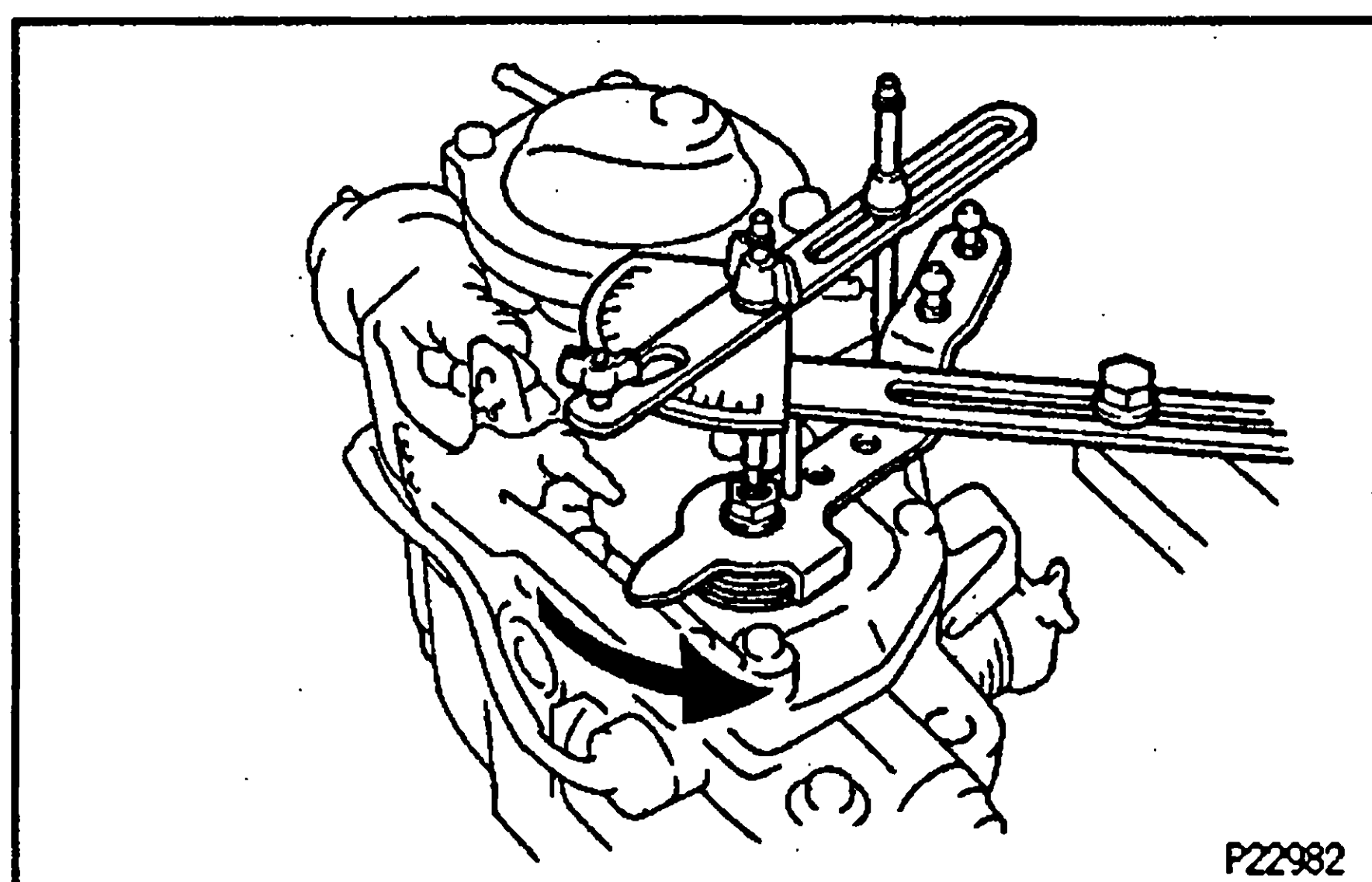
V08024

If not within standard value, check each sliding part of the boost compensator and check whether or not there is any oil.

**17. ADJUST LOAD SENSING TIMER**

- Using a 5 mm hexagon wrench, adjust the starting and end points of the load sensing timer by turning the governor shaft.
- Set the adjusting lever to maximum position.
- Apply 67.2 kPa (503.7 mmHg, 19.83 in.Hg) of vacuum to the SICS actuator.
- w/o BACS:
Apply 80 kPa (0.81 kgf/cm², 11.5 psi) of pressure to the boost compensator.
- w/ BACS:
Apply 121 kPa (1.24 kgf/cm², 17.7 psi) of pressure to the boost compensator.
- Measure the injection volume.

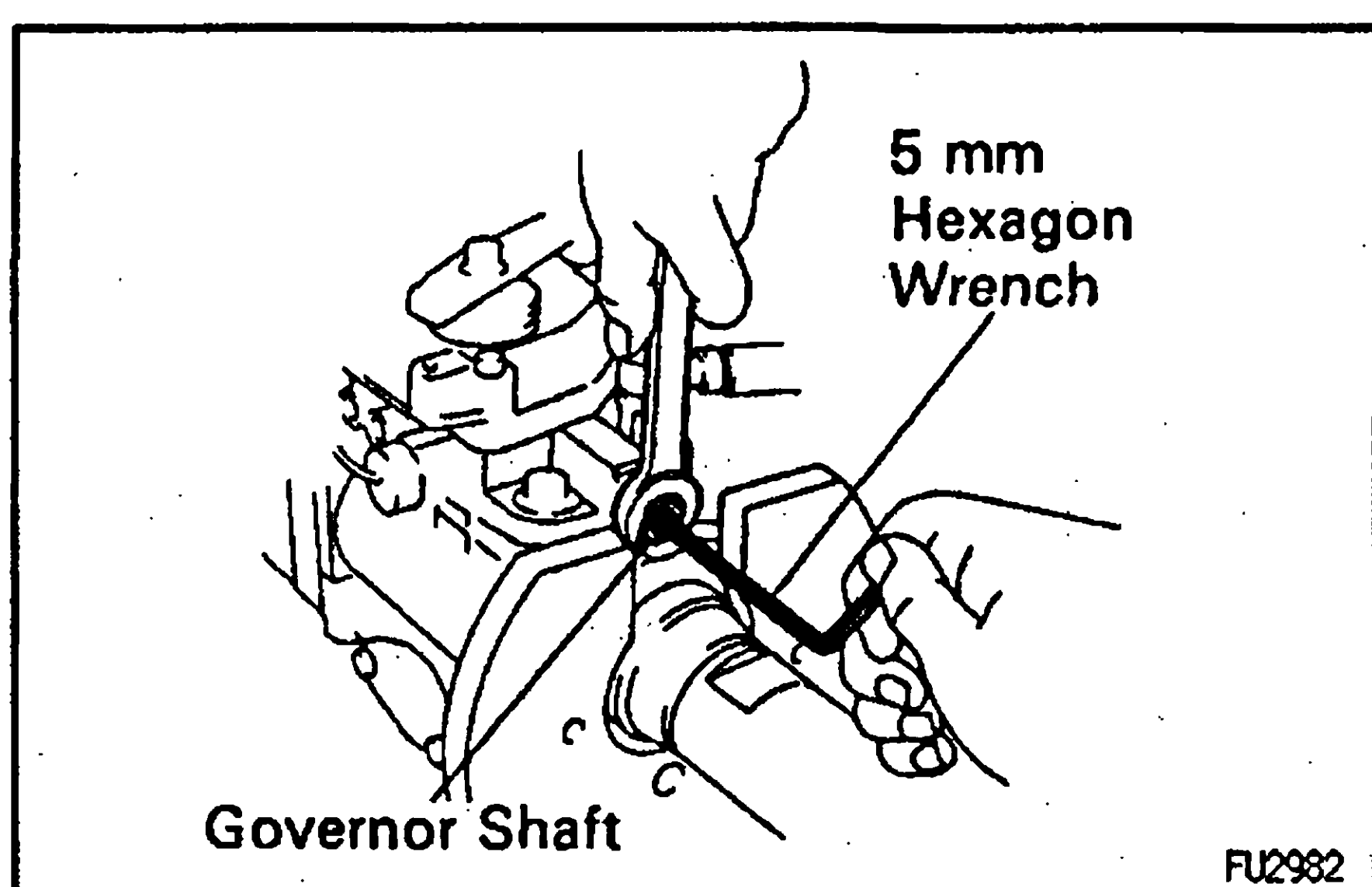
Adjusting lever position	Pump rpm	No. of measuring strokes
Maximum speed side	1,440 1,800	200



- Slowly move the adjusting lever from the maximum speed side to the idle speed side, and secure it at the point where the pump inner pressure begins to drop.
- Measure the injection volume at the drop point (starting point).

Pump rpm	No. of measuring strokes	Injection volumes of each cylinder cc (cu in.)
1,800	200	Measured value at step (f) minus 1.0 (0.06) ± 0.3 (0.02)

V06641



- Using a 5 mm hexagon wrench, adjust the load sensing timer by turning the governor shaft, and do the measurement again as specified.

HINT: The injection volume will increase approx. 3 cc (0.2 cu in.) with each 1/2 turn of the governor shaft.

Item	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Timer piston stroke mm (in.)
w/ BACS	1,440	200	Measured value at step (f) minus 3.8 (0.23) ± 1.0 (0.06)	1.56 – 2.56 (0.061 – 0.101)
w/o BACS	1,440	200	Measured value at step (f) minus 3.8 (0.23) ± 1.0 (0.06)	1.29 – 2.29 (0.051 – 0.090)

HINT: The end point is hard to identify, so use the methods used in the chart above.

- (j) When the adjusting lever is moved slowly from the maximum speed side to the idle speed side.

w/ BACS:

Pump rpm	Timer piston stroke mm (in.)
1,440	1.58 – 2.58 (0.061 – 0.101)

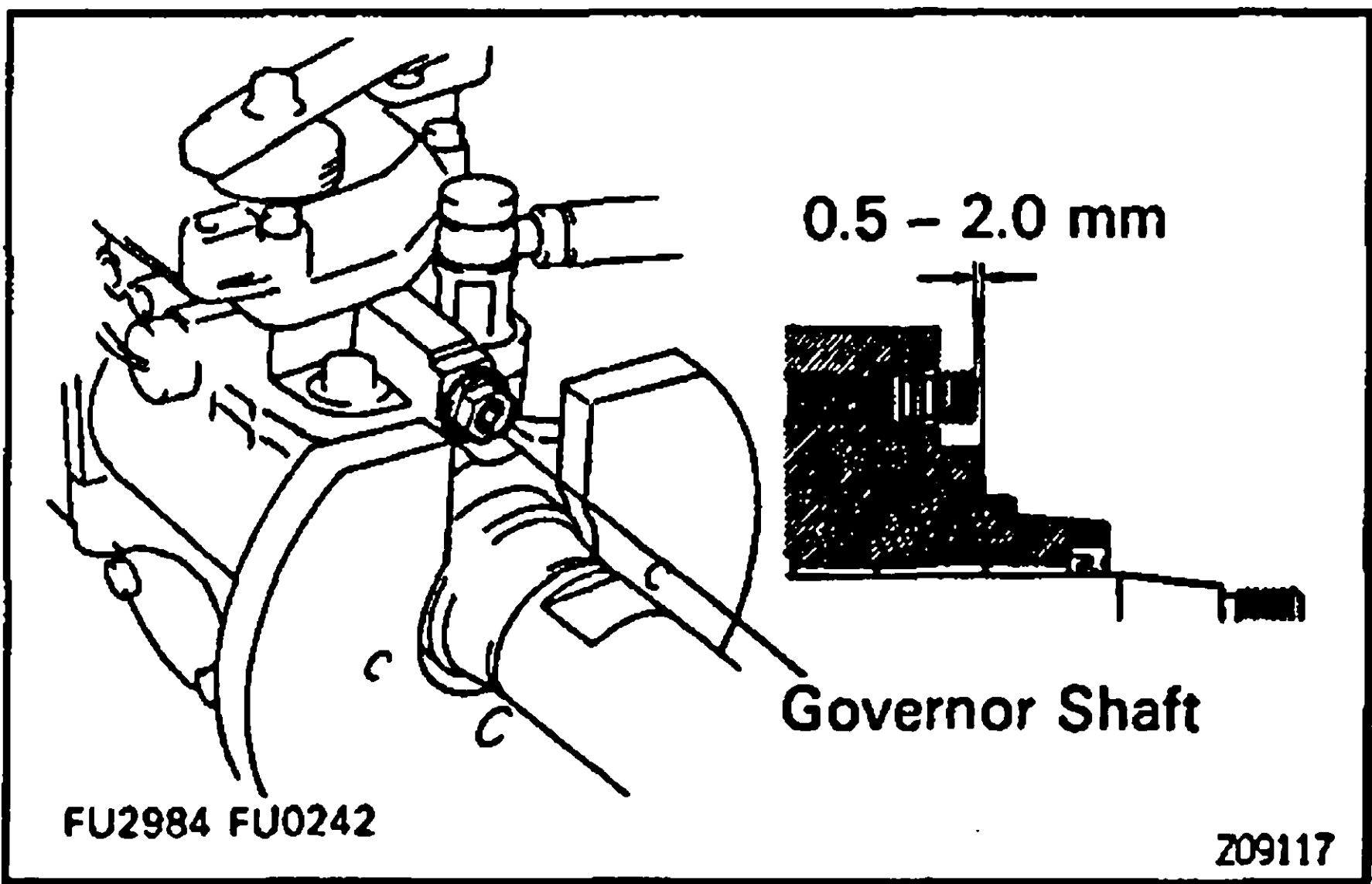
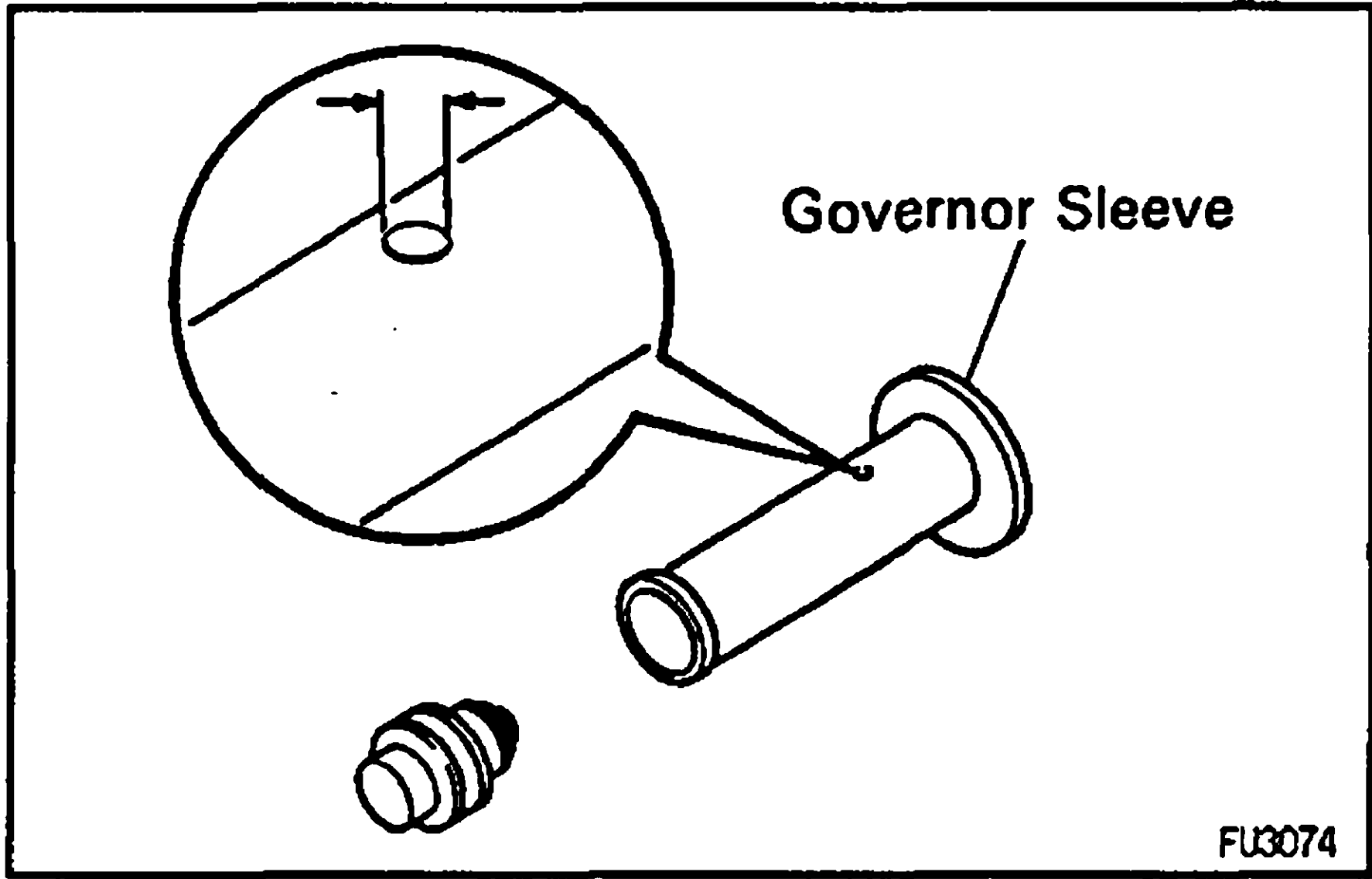
w/o BACS:

Pump rpm	Timer piston stroke mm (in.)
1,440	1.29 – 2.29 (0.051 – 0.090)

If the timer stroke is not as specified when the load sensing is at maximum retard angle, select a new governor sleeve.

Governor sleeve hole diameter:

Item	Diameter mm (in)	Item	Diameter mm (in)
Europe	0.45 (0.0177)	Australia	0.55 (0.0217)
	0.50 (0.0197)		0.60 (0.0236)
	0.55 (0.0217)		0.625 (0.0246)
			0.65 (0.0256)



HINT: A large hole diameter decreases the timer stroke and a smaller hole diameter increases the timer stroke.

- (k) Check the protrusion of the governor shaft.

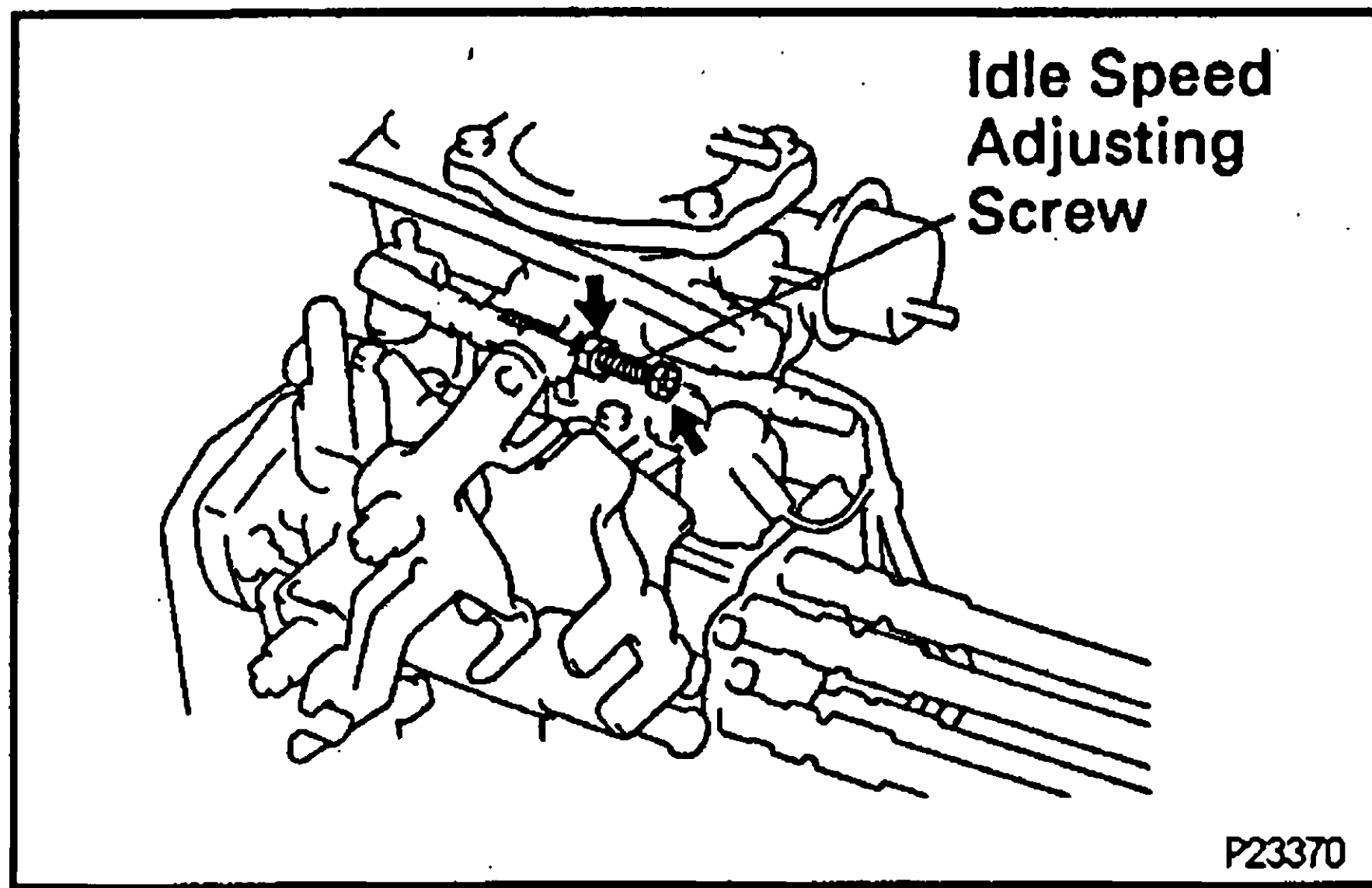
Protrusion:

0.5 – 2.0 mm (0.020 – 0.079 in.)

18. ADJUST IDLE SPEED

- (a) Measure the injection volume for each pump rpm.

Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)	Variation limit cc (cu in.)	Remarks
w/ BACS	Full position	400	200	7.86 – 10.66 (0.48 – 0.65)	–	–
	Minus 12 – 22°	350		q = 0.70 – 1.10 (0.04 – 0.07)	0.5 (0.03)	Adjust
w/o BACS (M/T)	Full position	400	200	7.86 – 10.66 (0.48 – 0.65)	–	–
	Minus 12 – 22°	350		q = 0.70 – 1.10 (0.04 – 0.07)	0.5 (0.03)	Adjust
w/o BACS (A/T)	Full position	400	200	7.86 – 10.66 (0.48 – 0.65)	–	–
	Minus 12 – 22°	400		q = 0.70 – 1.10 (0.04 – 0.07)	0.5 (0.03)	Adjust



- (b) Adjust injection volume by turning the idle speed adjusting screw.

EG

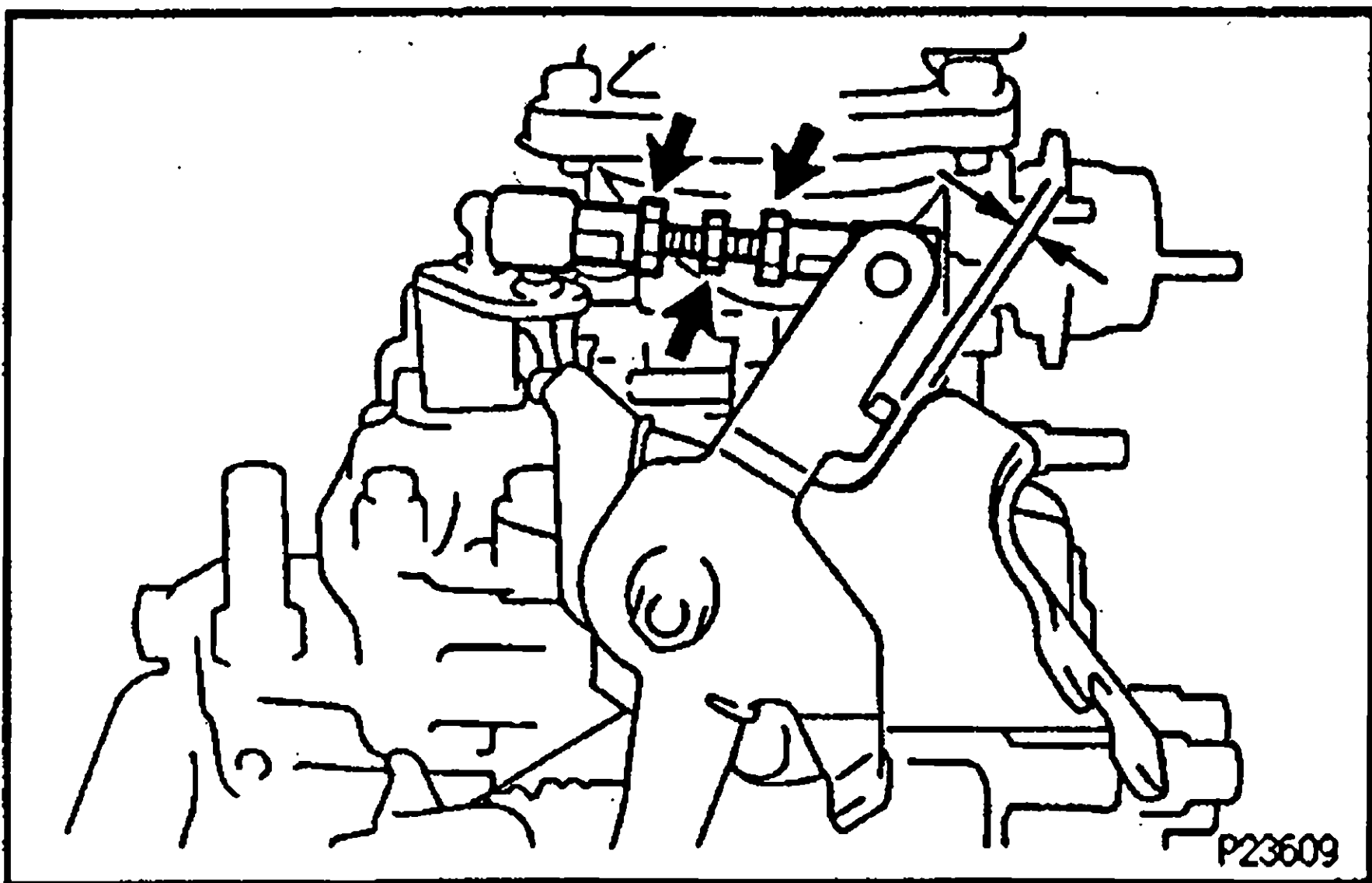
19. ADJUST COLD STARTING SYSTEM

- (a) Remove the overflow screw and check the fuel temperature in the fuel pump.

Fuel temperature:

15 — 35°C (59 — 95°F)

- (b) Check that the cam part of the camplate is not on top of the roller ring.
 (c) Set the scale of the timer measuring device to zero.
 (d) Check the adjusting lever opening angle and consider this angle as zero.

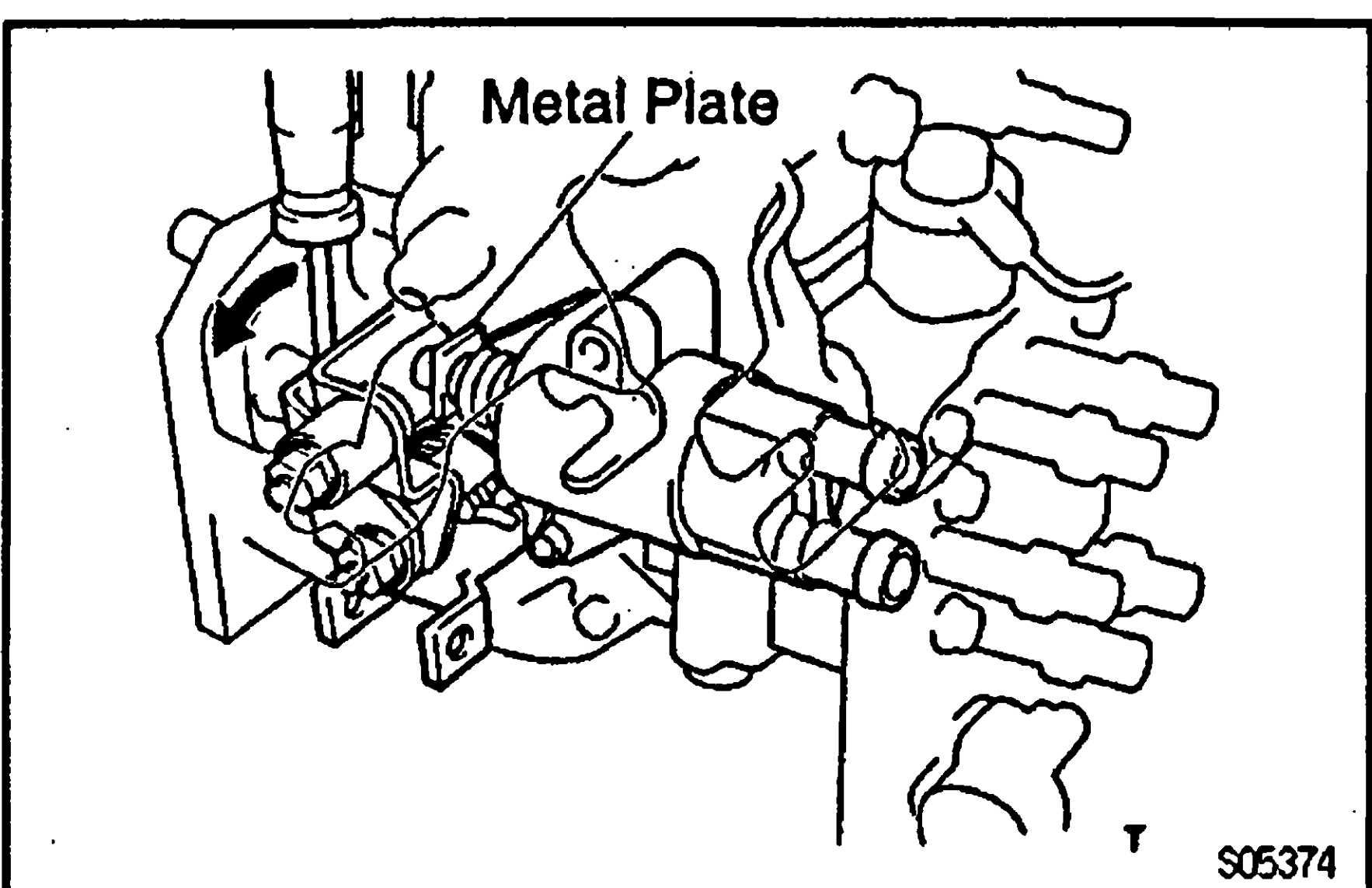


- (e) Measure the clearance between the idle-up lever and idle-up lever bracket.

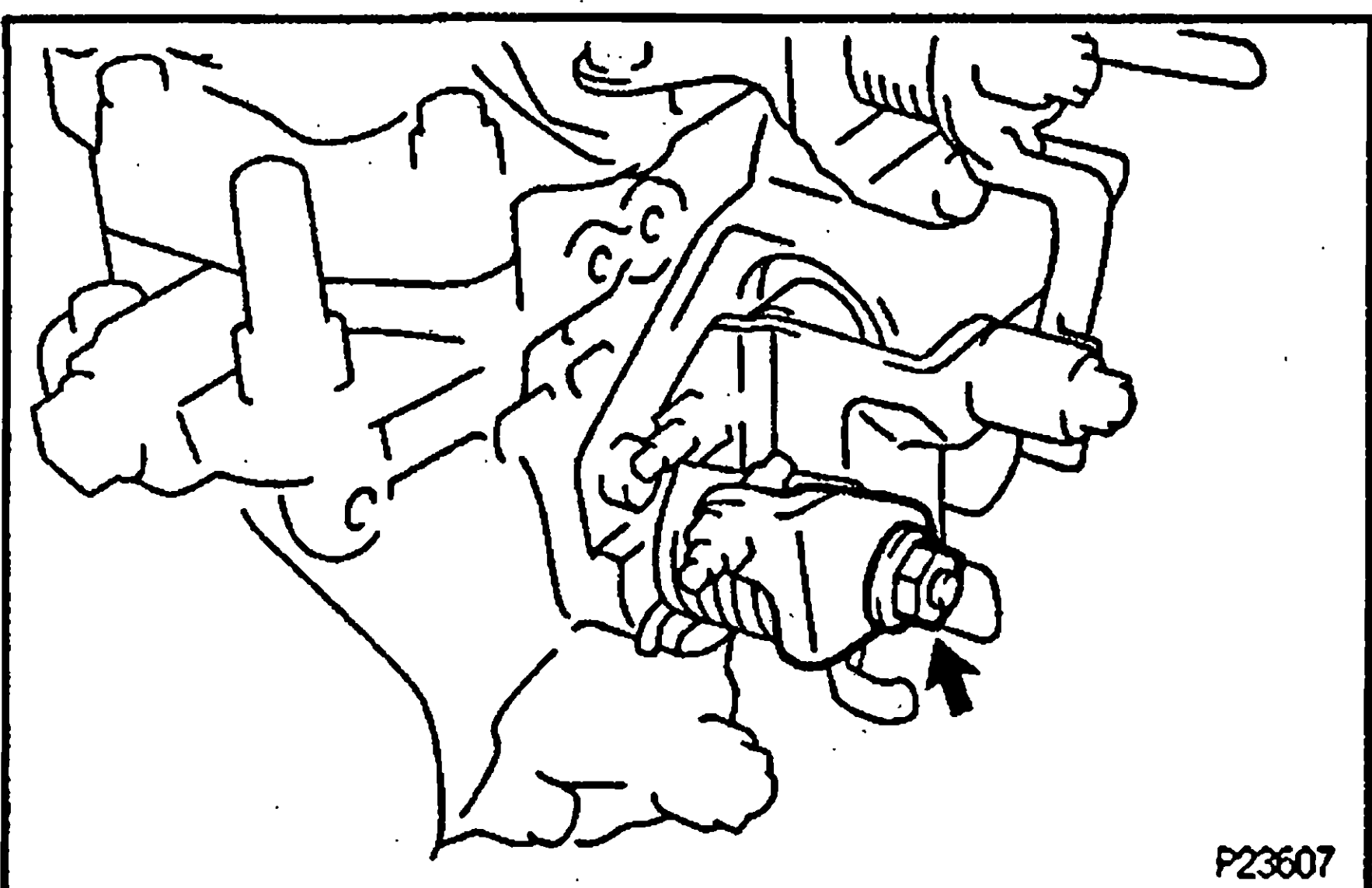
Clearance:

1.5 — 2.5 mm (0.059 — 0.098 in.)

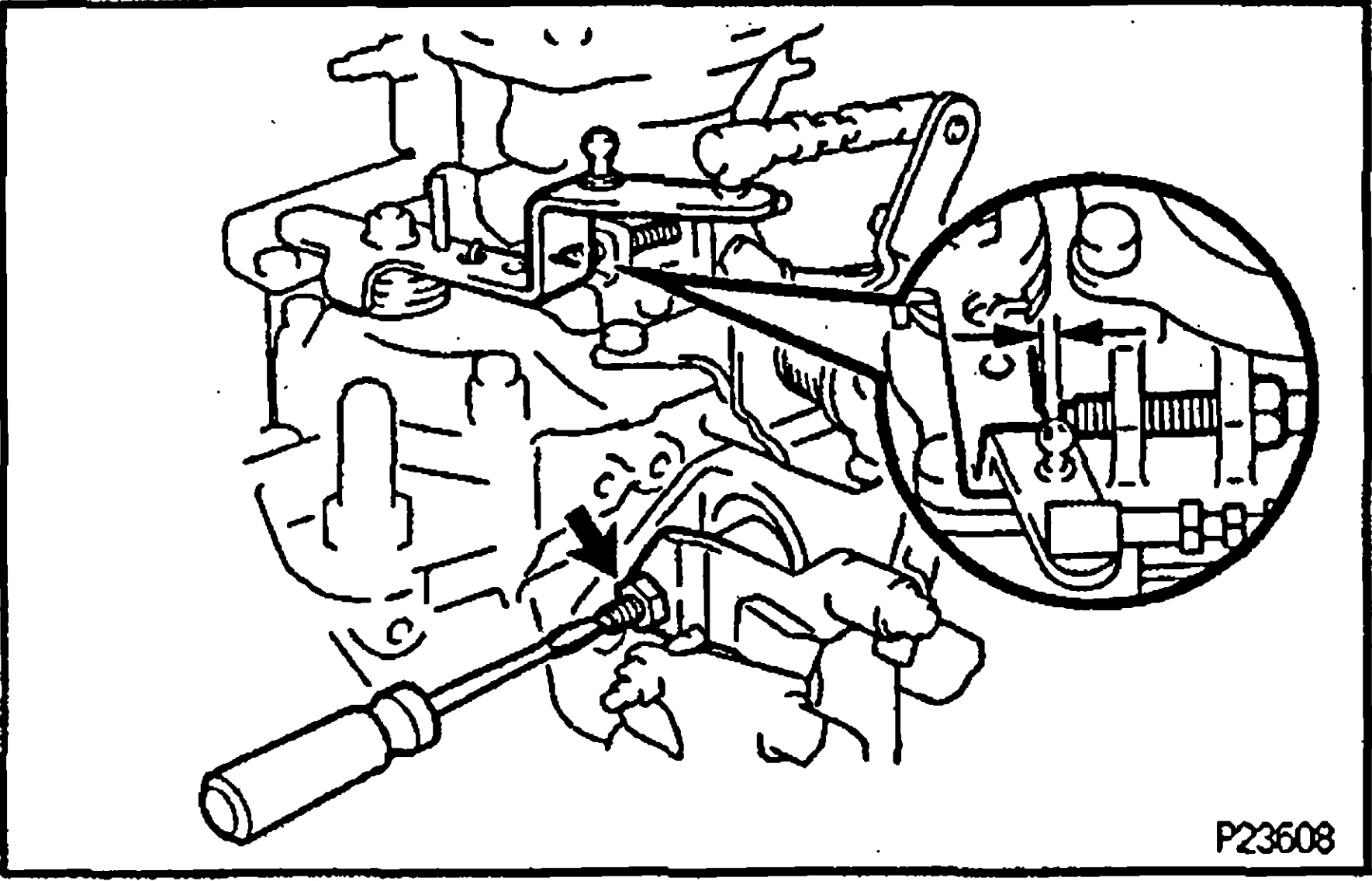
- (f) Adjust by turning the fast idle adjusting screw.



- (g) Remove the metal plate between the cold starting lever and thermo wax plunger.



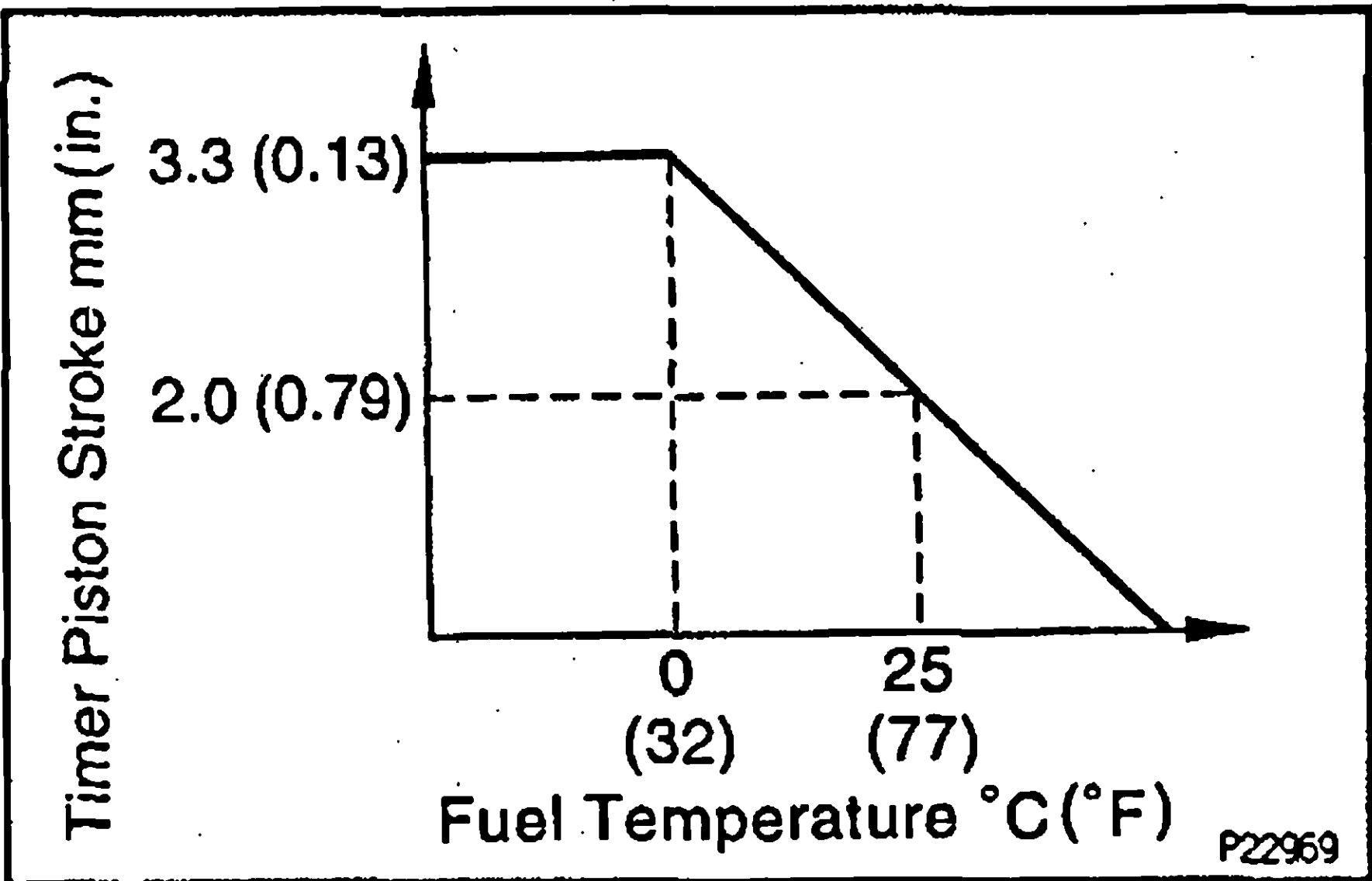
- (h) Loosen the nut of the cold starting lever.



- (i) Measure the clearance between the adjusting lever and idle speed adjusting screw.

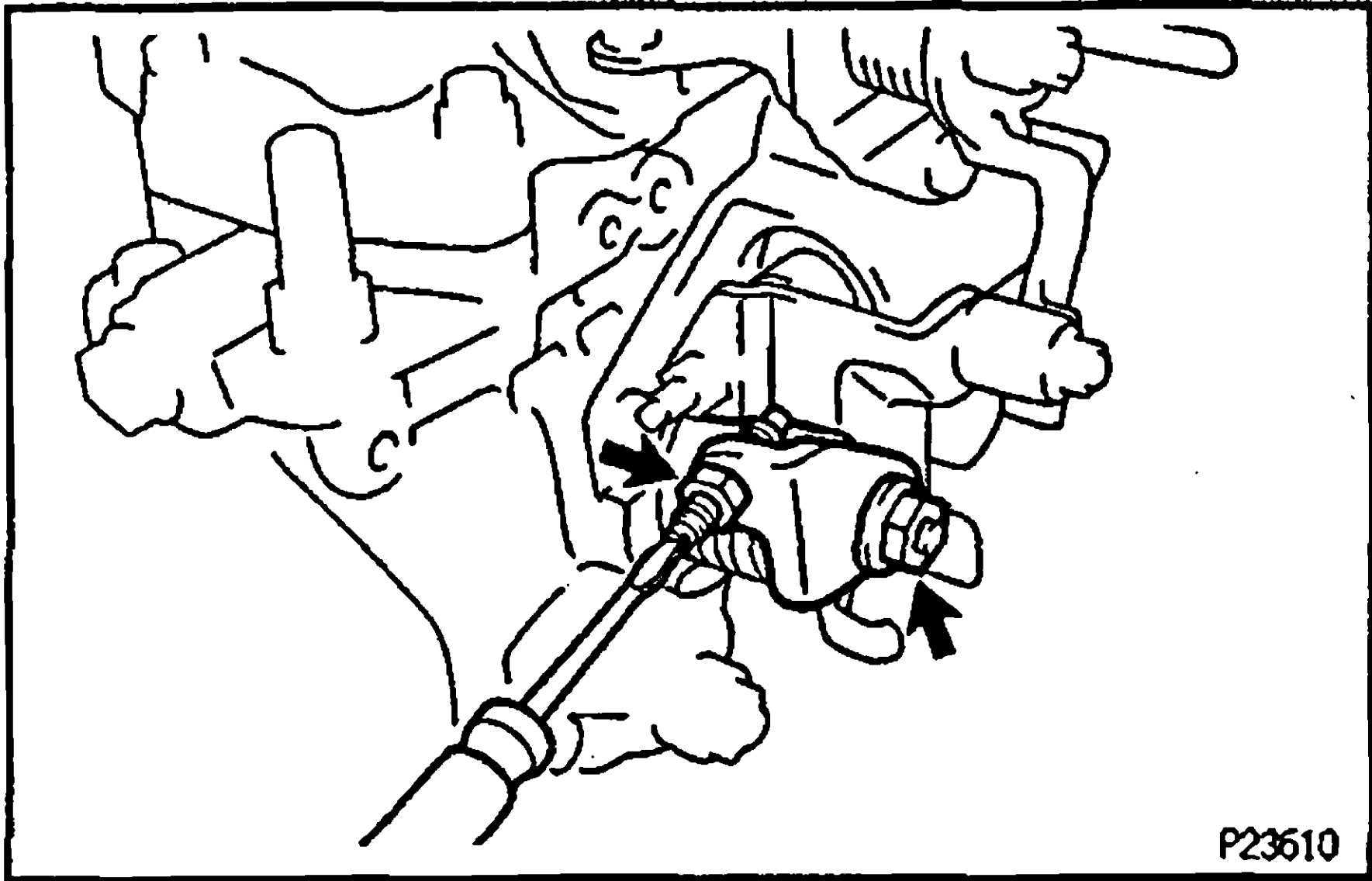
Fuel temperature	Clearance
25°C (68°F)	0.95 mm (0.037 in.)
50°C (122°F)	0 mm (0 in.)

- (j) Adjust by turning the cold starting adjusting screw.



- (k) Measure the timer piston stroke.

Fuel temperature	Timer piston stroke mm (in.)
25°C (77°F)	1.9 – 2.1 (0.075 – 0.083)

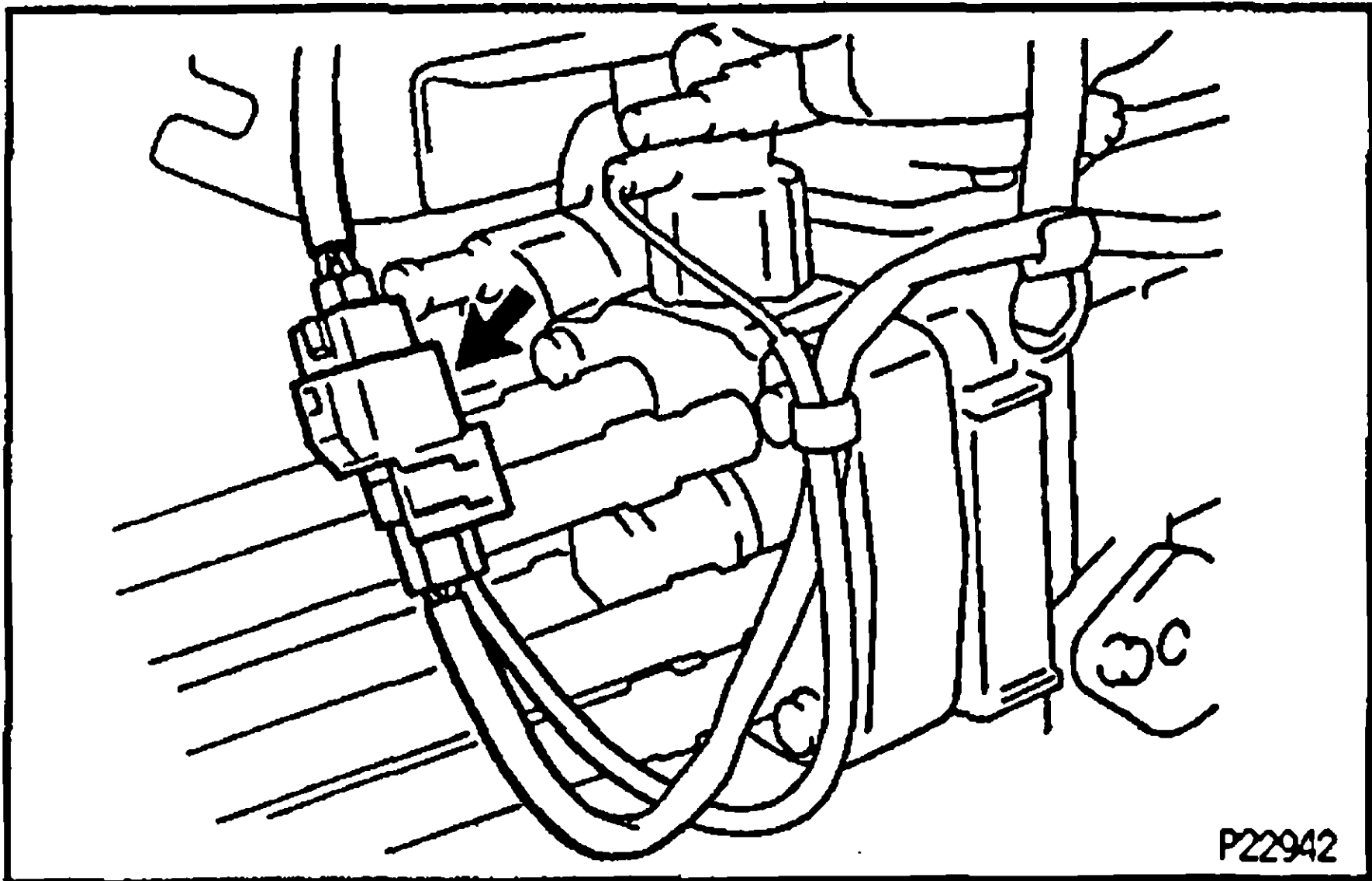


- (l) Adjust by turning the timer adjusting screw.

HINT: Screw in for stroke decrease.

- (m) Torque the nut to the cold starting lever.

Torque: 27 N·m (275 kgf·cm, 20 ft·lbf)



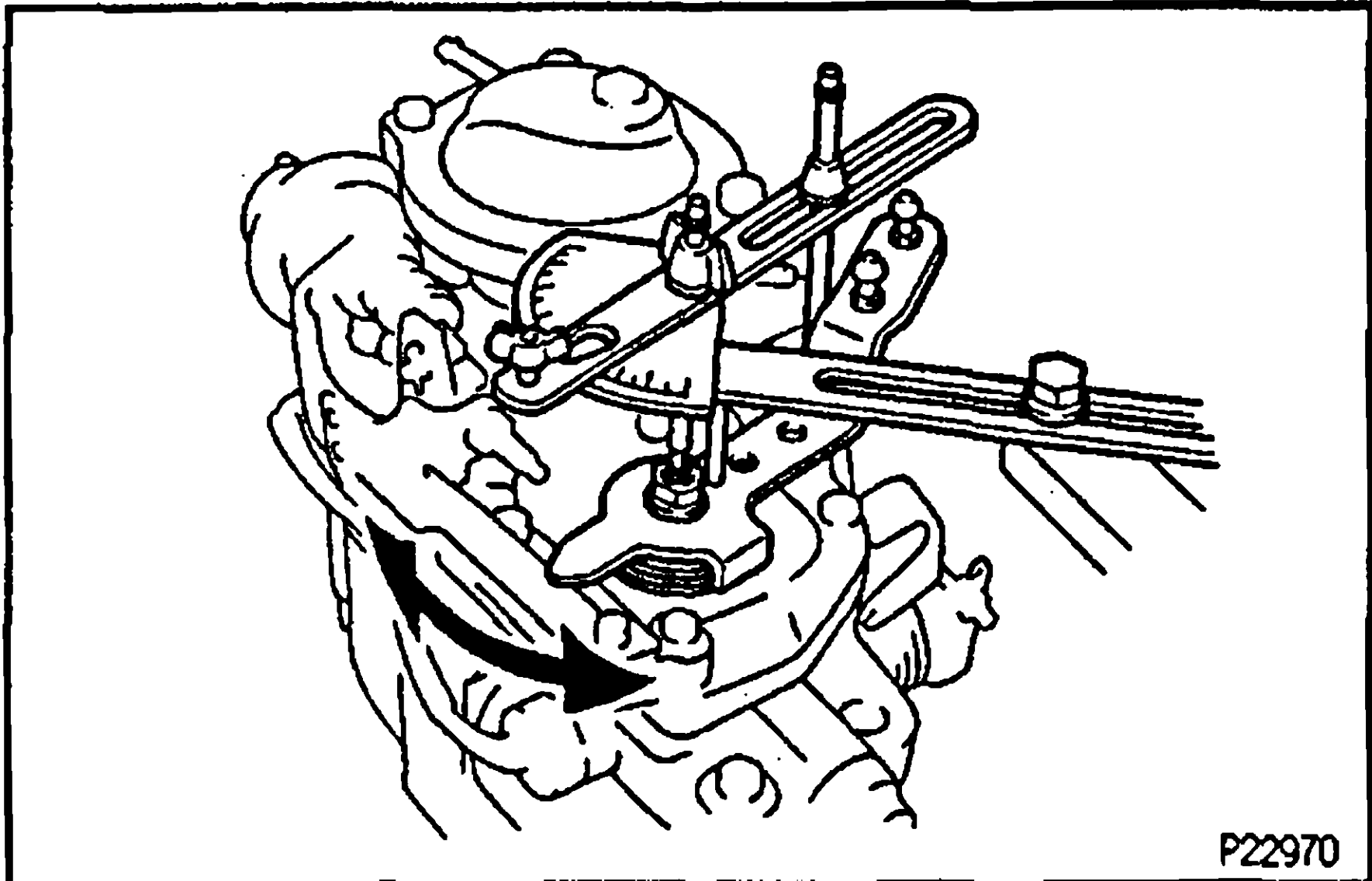
20. POST ADJUSTMENT CHECK

- (a) Check that injection stops when the fuel cut solenoid harness is removed.

Pump revolution:

150 rpm

q = 3.1 cc (0.19 cu in.) or less

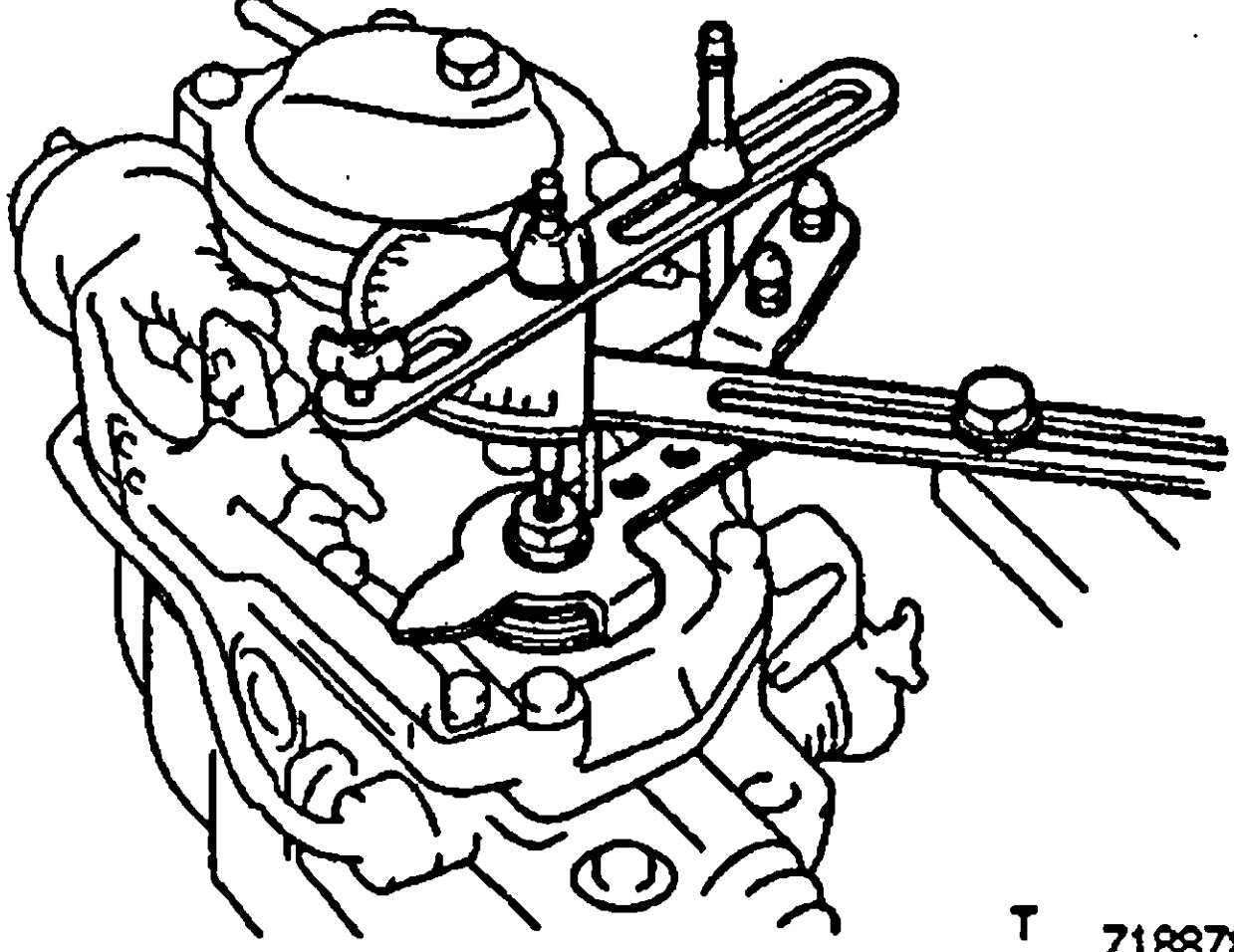


- (b) Check the adjusting lever movement.

Adjusting lever angle:

38 – 48°

Except Australia M/T



P22971

T Z18878

21. Except Australia M/T: INSTALL THROTTLE POSITION SENSOR AND BRACKET

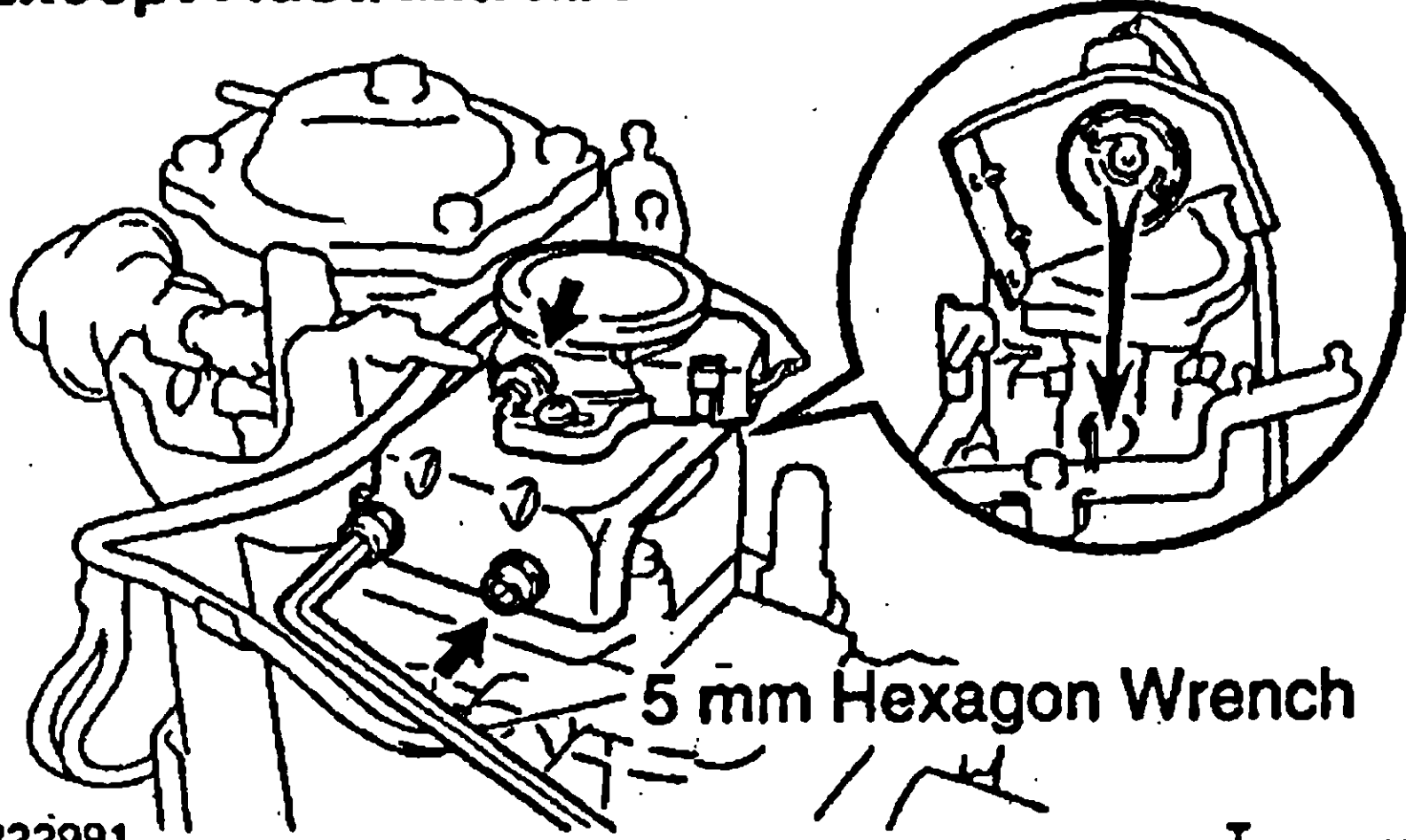
(a) Europe:

Set the adjusting lever to the angle for the injection volume shown below.

Pump	No. of measuring strokes	Injection volume of each cylinder cc (cu in.)
1,000	200	6.66 (0.406)

V06544

Except Australia M/T



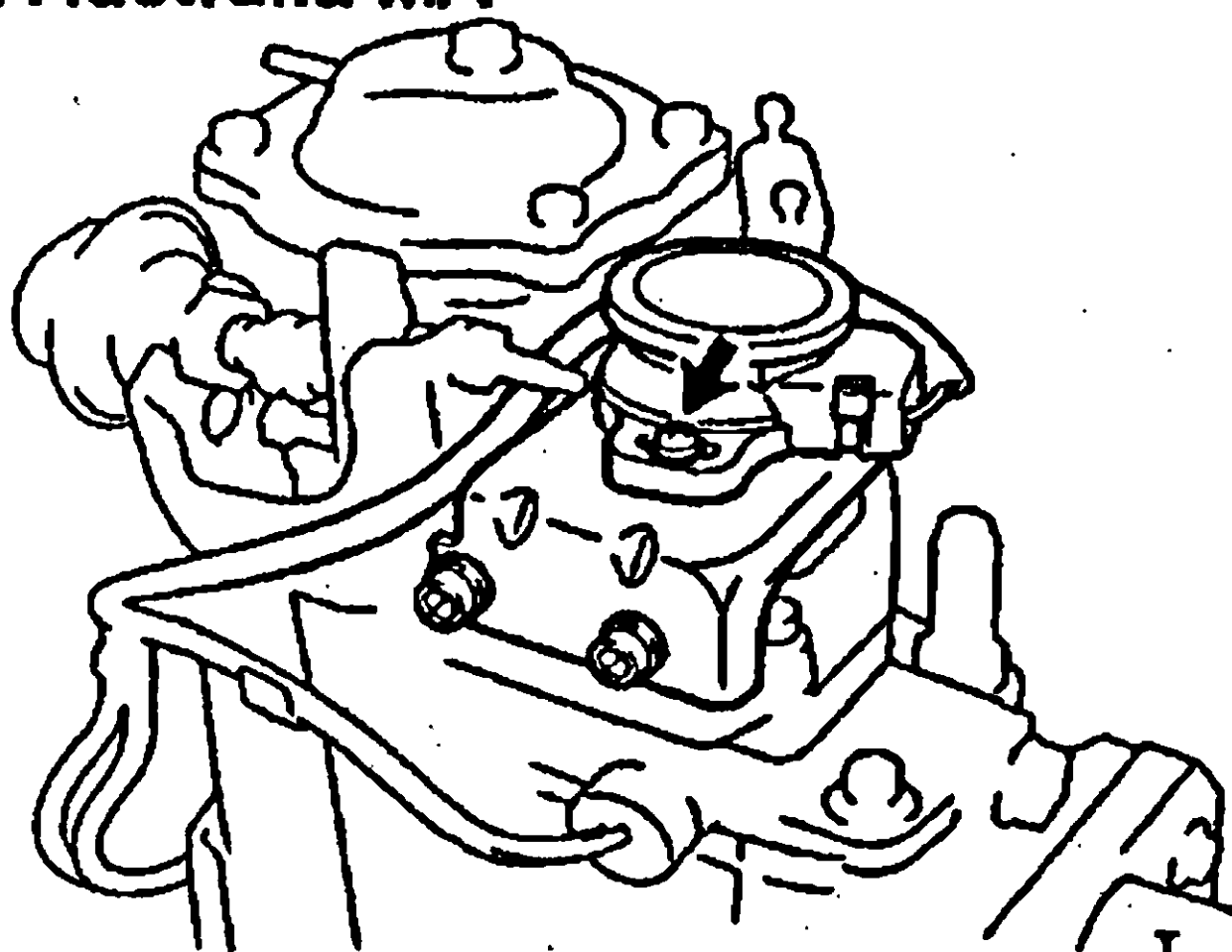
P22991

T Z18875

(b) Attach the portions of the throttle position sensor and adjusting lever.

(c) Using a 5 mm hexagon wrench, install the throttle position sensor with the 3 bolts.

Except Australia M/T

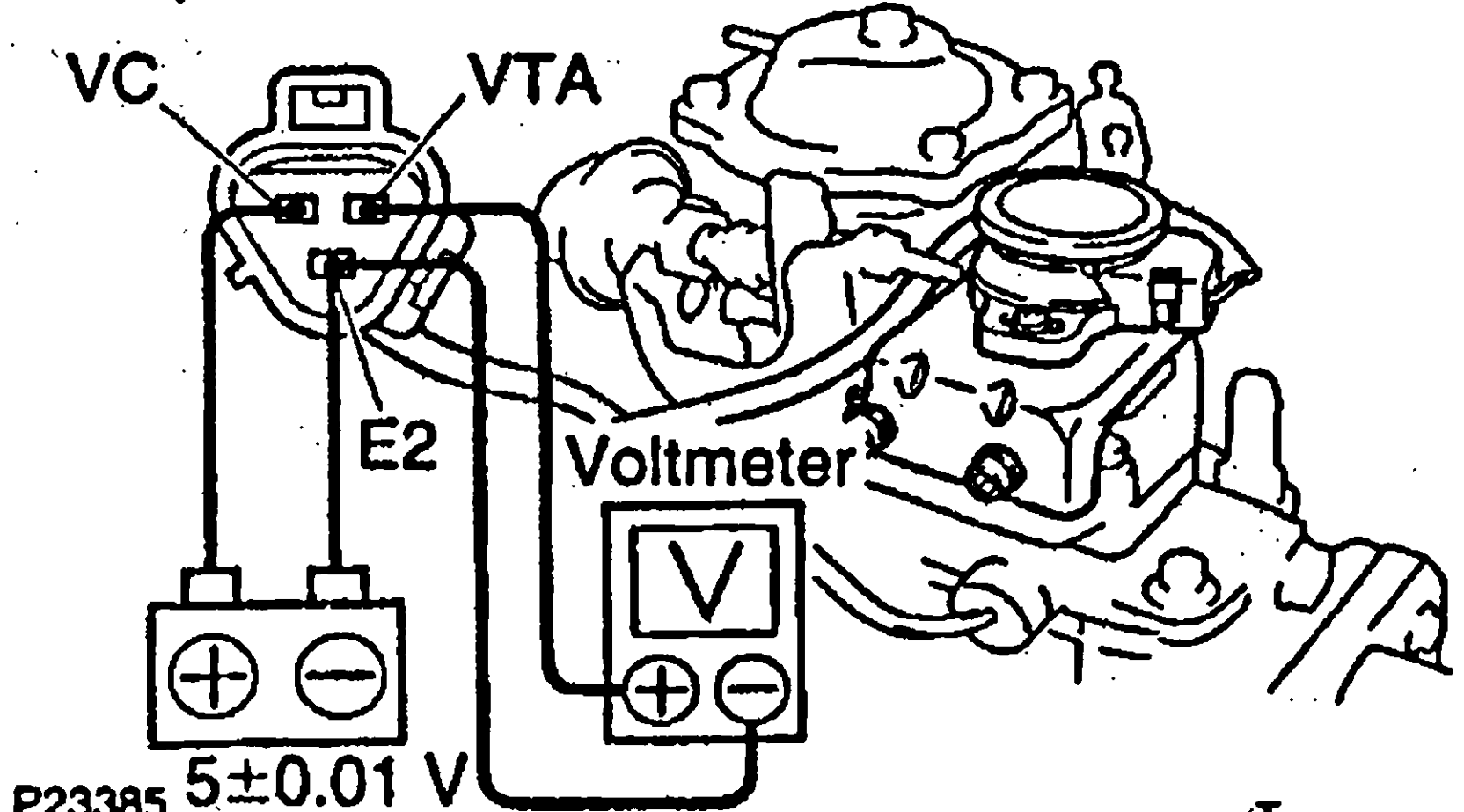


P23386

T Z18877

(d) Loosen the 2 screws holding the throttle position sensor to the bracket.

Except Australia M/T



P23385

T Z18874

(e) Apply 5 ± 0.01 V across terminals VC and E2.

(f) Connect the tester probes of a voltmeter to terminals VTA and E2 of the throttle position sensor.

(g) Europe:

With the adjusting lever set in the position required in (a) above, gradually turn the throttle position sensor so that its output will be 2.754 ± 0.025 V.

(h) Australia:

Secure the adjusting lever fully on the maximum speed side so that its output will be 0.6 ± 0.025 V.

(i) Tighten the 2 screws holding the throttle position sensor to the bracket.

22. SEAL PARTS

(a) Seal the full load set screw with new lead seal.

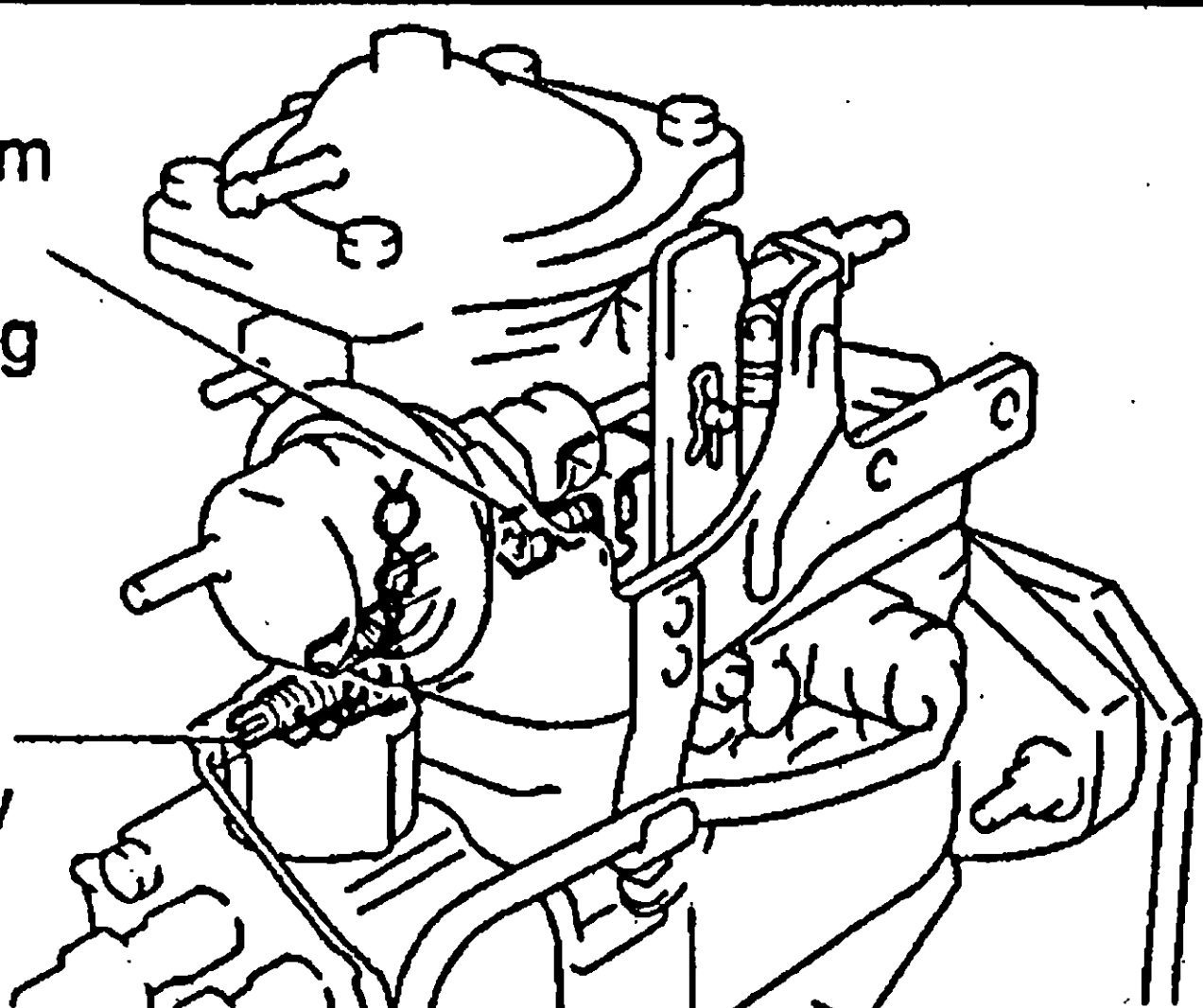
(b) Install the lock plate to the maximum speed adjusting screw.

23. INSTALL FUEL PIPE BRACKET

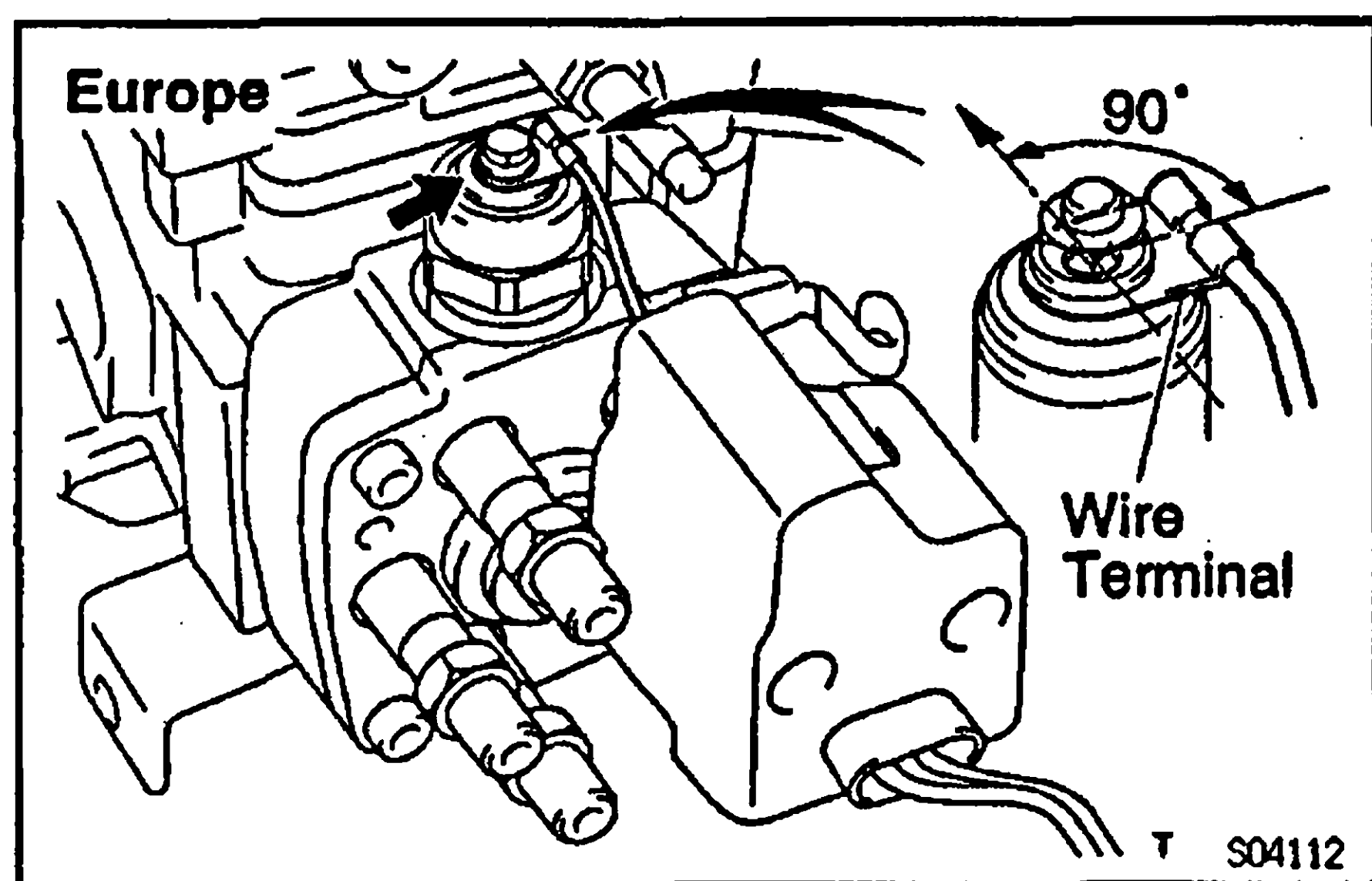
Install the fuel pipe bracket with a bolt.

Maximum
Speed
Adjusting
Screw

Full Load
Set Screw

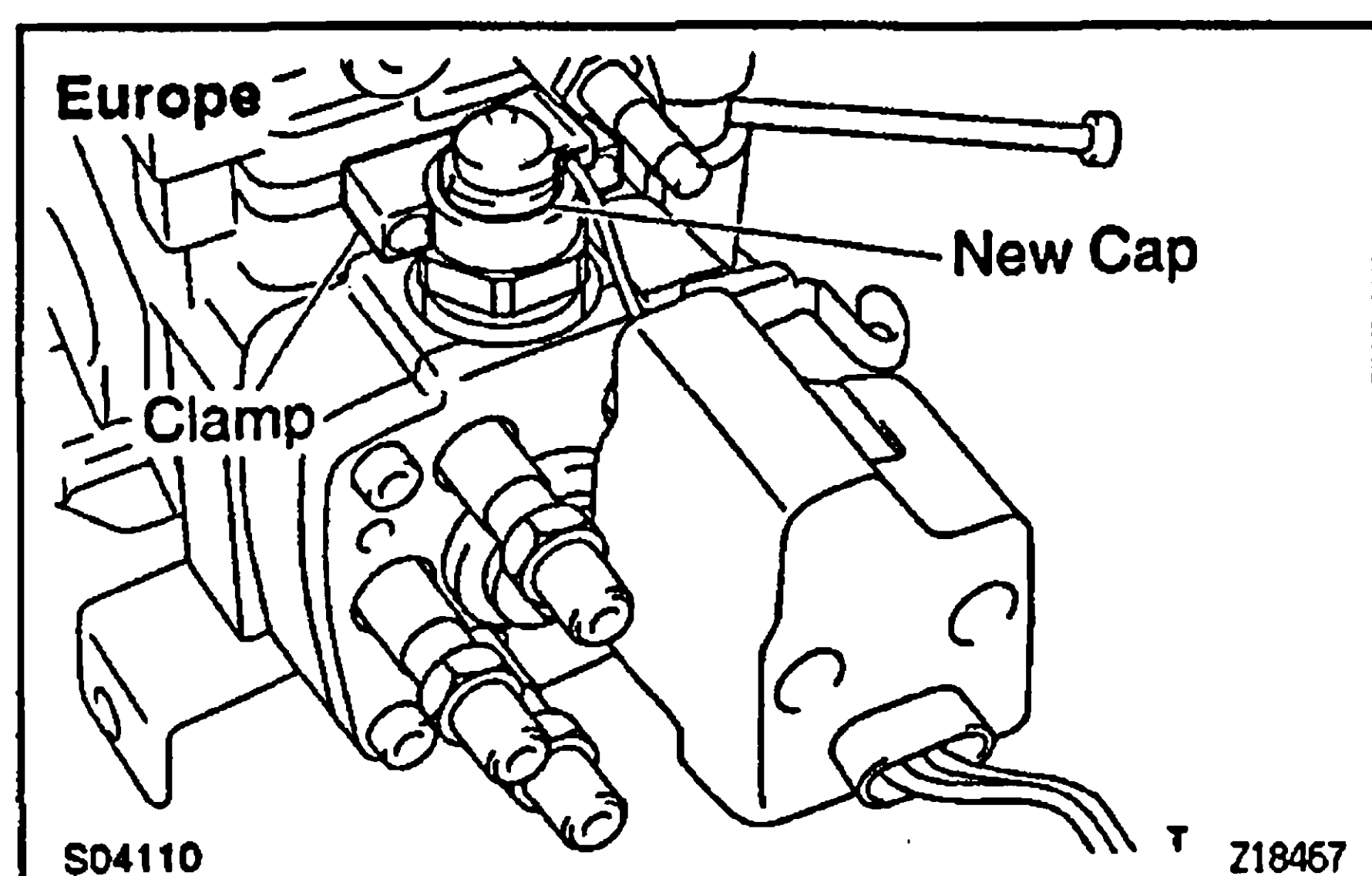


P23531

**24. Europe:****INSTALL FUEL CUT VALVE CONTROL UNIT**

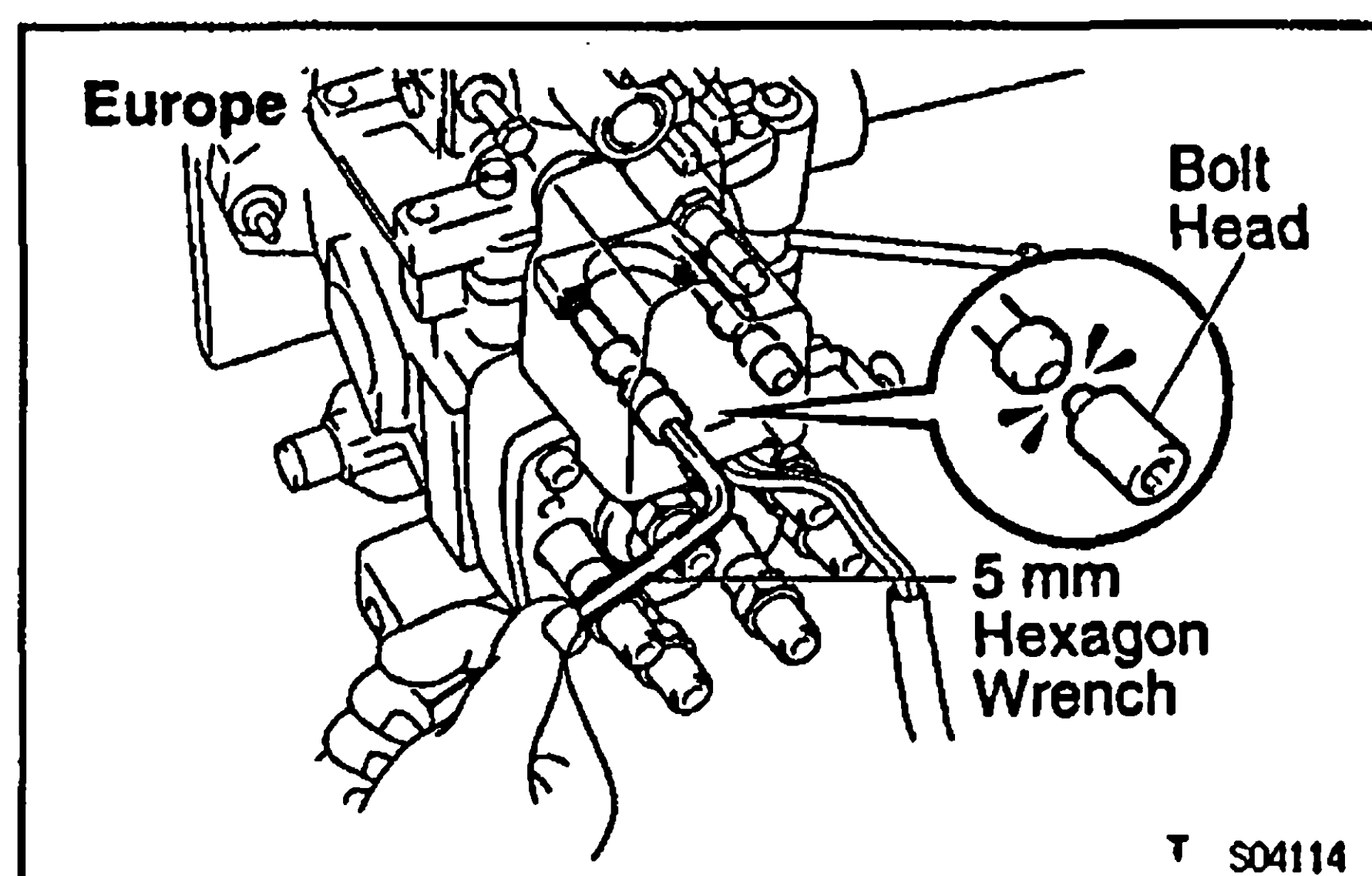
- (a) Install the lead wire of the fuel cut valve control unit to the fuel cut solenoid terminal with the nut.

NOTICE: Be careful of the wire terminal installation direction.



- (b) Install a new cap to the fuel cut solenoid terminal.

- (c) Place the clamp in position as shown in the illustration.



- (d) Attach the fuel cut valve control unit to the fuel cut solenoid.

- (e) Using 5 mm hexagon wrench, temporarily tighten the 2 new bolts.

NOTICE: Temporarily tighten the bolts while ensuring that the control unit is being placed securely.

- (f) Alternately tighten the 2 bolts until the bolt heads break off.

- (g) Install the wire clamp and fuel cut valve connector.

25. REMOVE INJECTION PUMP FROM SST (STAND)

SST 09241-76022, 09245-54010

26. INSTALL FUEL PIPES

- (a) Install the nozzle leakage pipe No.2 and 2 new gaskets with the union bolt.

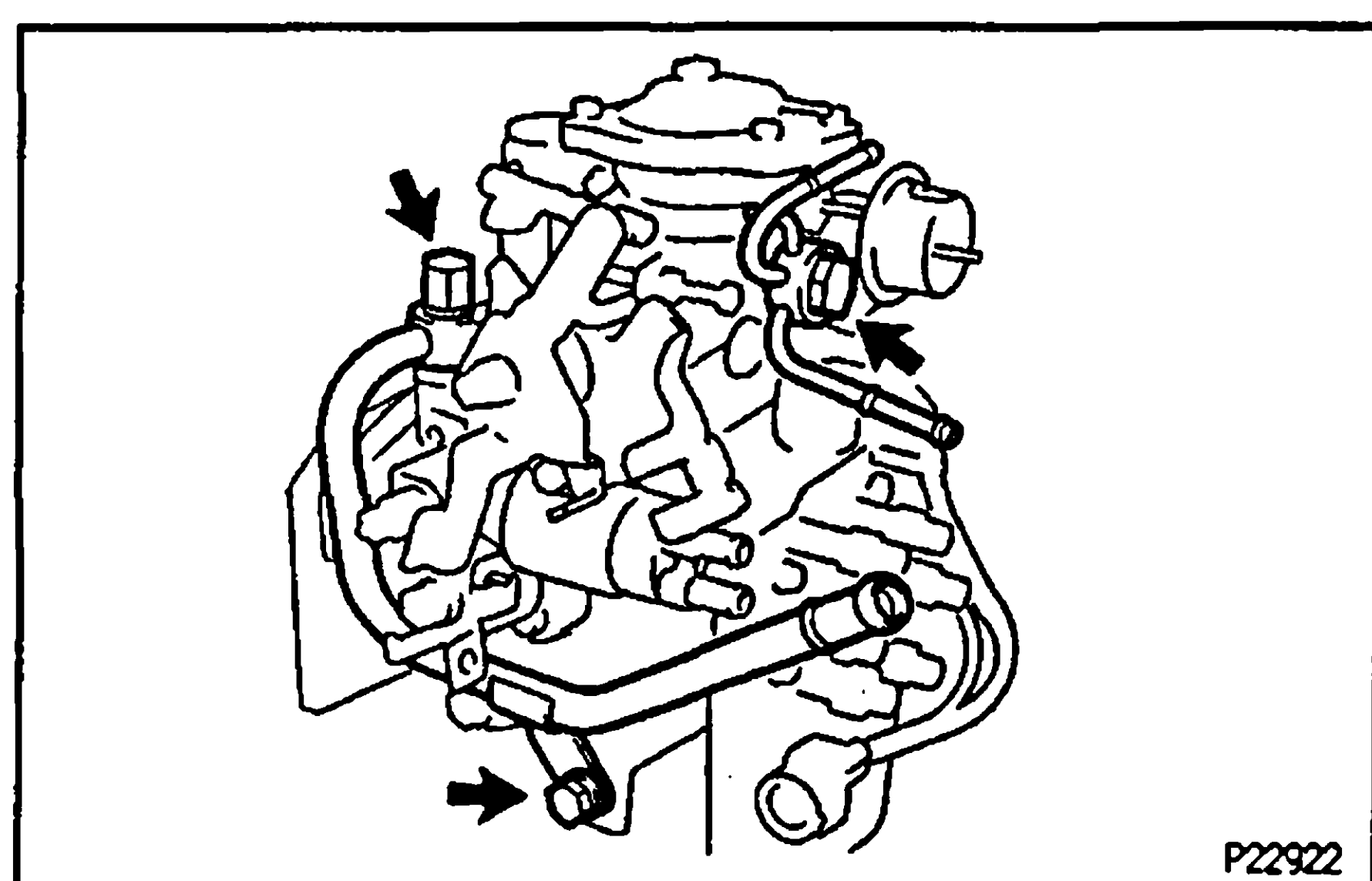
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

- (b) Install the fuel inlet pipe and 2 new gaskets with the cap nut and bolt.

Torque:

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

Bolt: 20 N·m (200 kgf·cm, 15 ft·lbf)

**27. w/ A/C:****INSTALL IDLE-UP ACTUATOR**

Torque: 9.4 N·m (95 kgf·cm, 83 in·lbf)

SERVICE SPECIFICATIONS

SERVICE DATA

EG87A-02

Fuel heater	Resistance	at 20°C (68°F)	0.5 — 2.0 Ω
Injection nozzles	Nozzle type		DLLA145P639
	Nozzle opening pressure	No.1	17,652 — 18,633 kPa (180 — 190 kgf/cm ² , 2,560 — 2,702 psi)
		No.2	23,144 — 24,124 kPa (236 — 246 kgf/cm ² , 3,356 — 3,498 psi)
	Needle—lift		0.23 — 0.28 mm (0.0091 — 0.0119 in.)
	Adjusting shim thickness		1.900 mm (0.0748 in.) 1.925 mm (0.0758 in.)
			1.950 mm (0.0768 in.) 1.975 mm (0.0778 in.)
			2.000 mm (0.0787 in.)
	Pre—lift		0.085 — 0.0105 mm (0.00335 — 0.00413 in.)
	Adjusting No.2 pressure spring seat thickness		3.09 mm (0.1217 in.) 3.12 mm (0.1228 in.)
			3.15 mm (0.1240 in.) 3.18 mm (0.1252 in.)
			3.21 mm (0.1264 in.) 3.24 mm (0.1276 in.)
			3.27 mm (0.1287 in.)
	No.2 opening pressure adjusting shim thickness		0.700 mm (0.0276 in.) 0.850 mm (0.0335 in.)
			1.000 mm (0.0394 in.) 1.025 mm (0.0404 in.)
			1.150 mm (0.0453 in.) 1.175 mm (0.0463 in.)
			1.275 mm (0.0502 in.) 1.300 mm (0.0512 in.)
			1.425 mm (0.0561 in.) 1.450 mm (0.0571 in.)
			1.575 mm (0.0620 in.) 1.600 mm (0.0630 in.)
			1.725 mm (0.0679 in.) 1.750 mm (0.0689 in.)
			1.900 mm (0.0748 in.) 2.050 mm (0.0807 in.)
	No.1 opening pressure adjusting shim thickness		0.825 mm (0.0325 in.) 0.900 mm (0.0354 in.)
			0.975 mm (0.0384 in.) 1.050 mm (0.0413 in.)
			1.125 mm (0.0443 in.) 1.200 mm (0.0472 in.)
			1.275 mm (0.0502 in.) 1.350 mm (0.0532 in.)
			1.425 mm (0.0561 in.) 1.500 mm (0.0591 in.)
			1.575 mm (0.0620 in.) 1.650 mm (0.0650 in.)
			1.725 mm (0.0679 in.) 1.800 mm (0.0709 in.)
			1.875 mm (0.0738 in.) 1.950 mm (0.0768 in.)
			2.000 mm (0.0787 in.) 2.100 mm (0.0827 in.)
			2.175 mm (0.0856 in.)

EG

TORQUE SPECIFICATIONS

Part tightened	N-m	kgf-cm	ft-lbf
Fuel filter x Fuel filter bracket	18	185	13
Fuel hose clamp x Fuel filter bracket	12	120	9
Nozzle holder body x Nozzle holder retaining nut	30	300	22
Injection nozzle x Cylinder head	25	255	18
Injection pipe x Injection nozzle, Injection pump	24.5	250	25
Injection pipe clamp x Intake manifold, Injection pipe clamp	6.4	65	56 in.·lbf
No.3 nozzle leakage pipe x Intake manifold	19.6	200	14
No.1 nozzle leakage pipe x Injection nozzle	18	176	13
No.1 nozzle leakage pipe x Cylinder head	19	186	14
Accelerator link assembly x intake manifold	19.6	200	14
Delivery valve holder x Distributive head	59	600	43
Fuel inlet hollow screw x Injection pump body	37	375	27
Regulator valve x Injection pump body	8.8	90	78 in.·lbf
Feed pump cover x Injection pump body	3.0	31	27 in.·lbf

ENGINE — FUEL SYSTEM

EG-77

Timer cover, Injection pump stay, Thermo wax x Injection pump body	8.35	85	74 in.·lbf	
Timer adjusting screw x Timer cover	14.2	145	11	
Governor link support x Injection pump body	14	140	10	
Distributive head x Injection pump body	12	120	9	
Governor shaft x Injection pump body	27	275	20	
Overflow screw x Governor cover	24.55	250	18	
Control lever x Governor cover	6.85	70	61 in.·lbf	
Governor cover x Injection pump body	8.3	85	74 in.·lbf	
Idle speed adjusting screw, No.1 SICS lever x Governor cover	6.9	70.4	61 in.·lbf	
Adjusting lever x Governor cover	8.35	85	74 in.·lbf	
Pickup sensor x Injection pump body	22.1	225	15.6	
Distributive head plug x Distributive head	88	900	65	
Diaphragm x Push rod	7.35	75	65 in.·lbf	
Diaphragm cover x Governor cover	7.35	75	65 in.·lbf	
Lever control spring x Governor cover	11.3	115	8	
Fuel cut solenoid x Distributive head	22	225	16	
Lead wire x Fuel cut solenoid	1.7	17	15 in.·lbf	
Cap x Injection pump	11	115	8	
SICS actuator bracket x Governor cover	9.3	95	82 in.·lbf	
SICS actuator x SICS actuator bracket	9.35	95	83 in.·lbf	
SICS adjusting screw x SICS actuator bracket	6.9	70	61 in.·lbf	
Idle—up lever x Injection pump body	Short bolt	8.35	85	74 in.·lbf
	Long bolt	11.75	120	9
No.2 nozzle leakage pipe, Fuel inlet pipe x Injection pump	24.55	250	18	
Fuel inlet pipe x Bracket	19.6	200	15	
Idle—up actuator x Idle—up lever	9.35	95	83 in.·lbf	
Injection pump x Timing gear case	18	185	13	
Pump stay x Injection pump	69	700	51	
Injection pump drive gear x Injection pump	103	1,050	76	

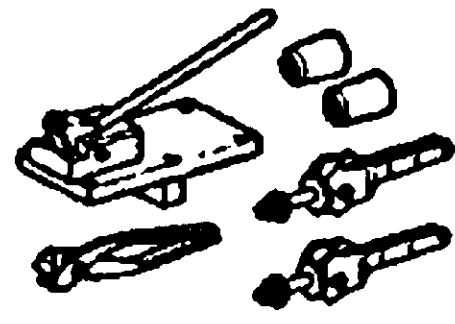
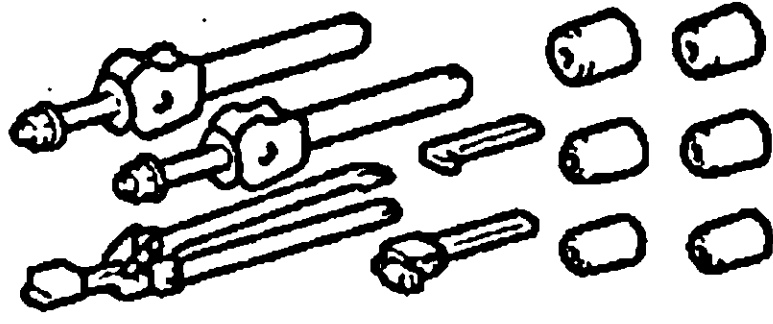
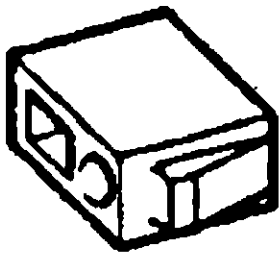
EG

COOLING SYSTEM

PREPARATION

SST (SPECIAL SERVICE TOOLS)

EG128-08

	09230-00010 Radiator Service Tool Set	
	09230-01010 Radiator Service Tool Set	
	(09231-00060) No.3 Plug	For inspection water leakage
	09231-14010 Punch	Alminum type radiator

EG12W-0T

EQUIPMENT

Torque wrench	
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EG12X-11

COOLANT

Item	Capacity	Classification
Engine coolant w/ Front and rear heaters w/ Front heater w/o Heater	M/T 12.5 liters (13.2 US qts, 11.0 Imp. qts)	Ethylene—glycol base
	A/T 12.0 liters (12.7 US qts, 10.6 Imp. qts)	
	M/T 11.5 liters (12.2 US qts, 10.1 Imp. qts)	
	A/T 11.0 liters (11.6 US qts, 9.7 Imp. qts)	
	M/T 10.7 liters (11.3 US qts, 9.4 Imp. qts)	
	A/T 10.2 liters (10.8 US qts, 9.0 Imp. qts)	

EG128-08

SSM (SERVICE SPECIAL MATERIALS)

08826-00100 Seal Packing 1282B, THREE BOND 1282B or equivalent (FIPG)	Engine drain plug on oil cooler cover
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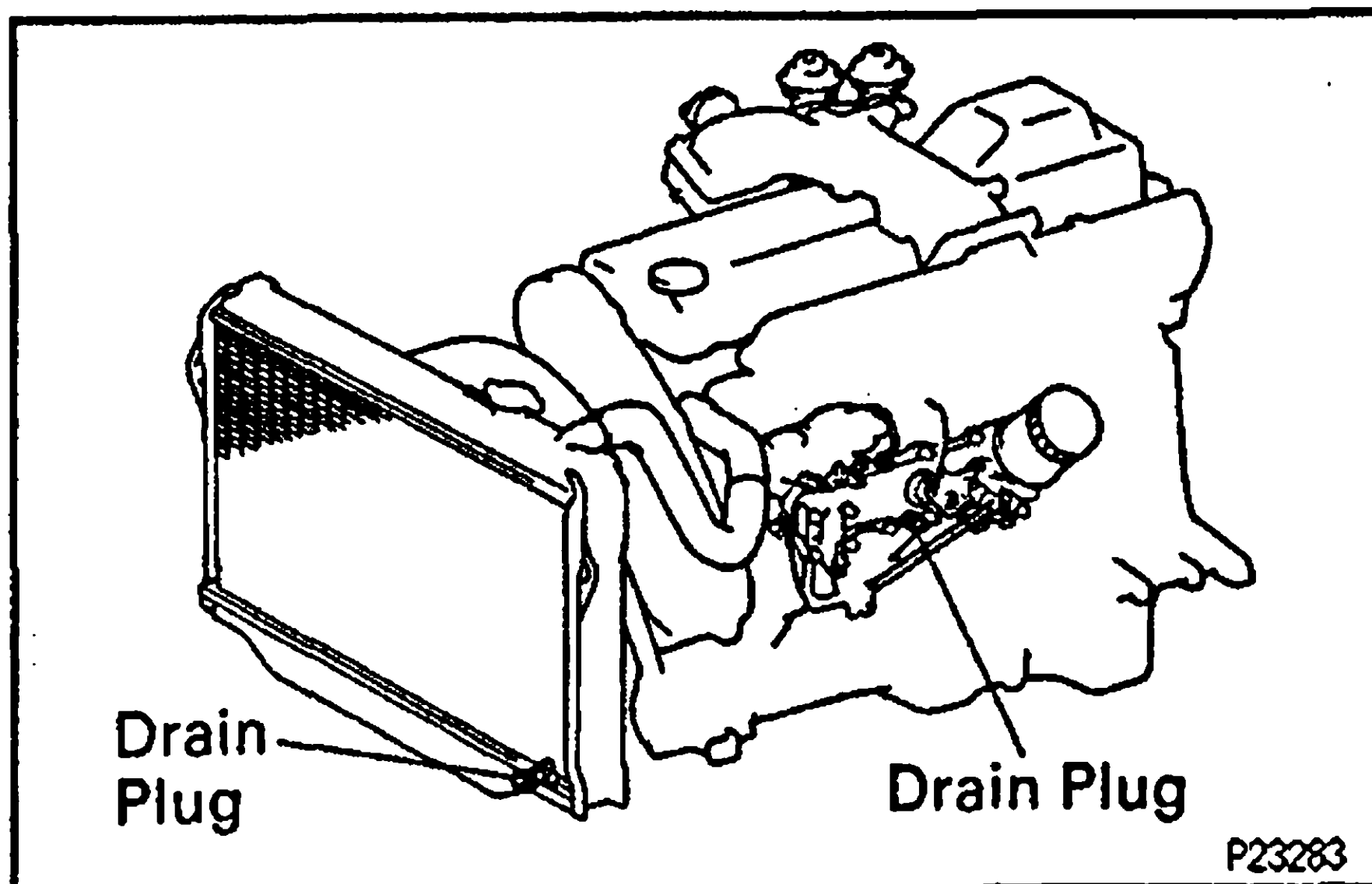
COOLANT REPLACEMENT

E07CC-01

1. DRAIN ENGINE COOLANT

- (a) Remove the radiator cap.

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



- (b) Loosen the radiator drain plug (on the left side of the radiator lower tank) and engine drain plug (on the oil cooler cover), and drain the coolant.

- (c) Apply seal packing to 2 or 3 threads of the engine drain plug.

Seal packing:

Part No. 08826-00100 or equivalent

- (d) Close the drain plugs.

Torque (Engine): 29.4 N·m (300 kgf·cm, 22 ft·lbf)

2. FILL ENGINE COOLANT

- (a) Slowly fill the system with coolant.

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

NOTICE:

- Do not use an alcohol type coolant.
- The coolant should be mixed with demineralized water or distilled water.

Capacity:

liters (US qts, Imp. qts)

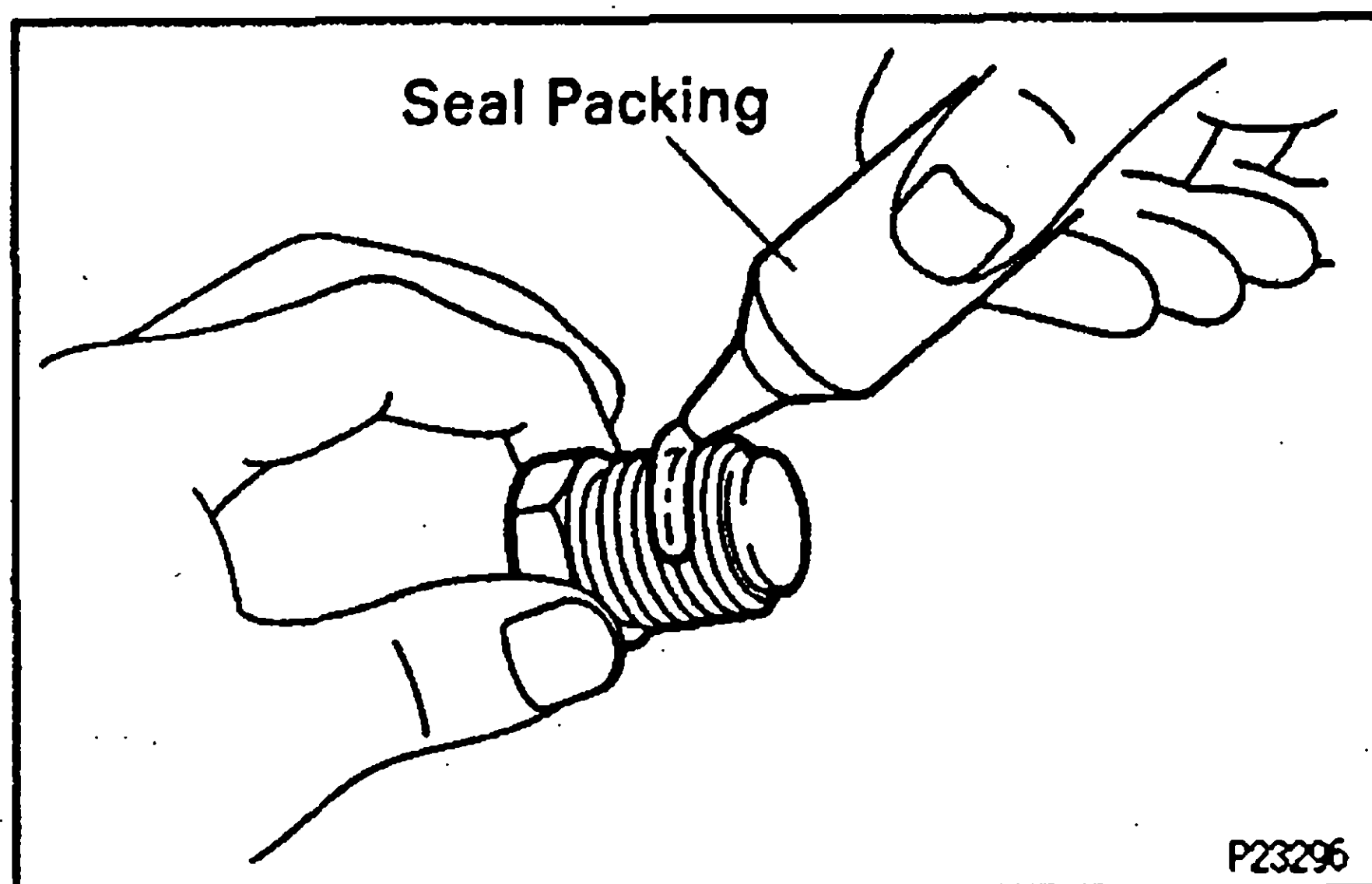
w/ Front and rear heaters	M/T	12.5 (13.2, 11.0)
	A/T	12.0 (12.7, 11.6)
w/ Front heater	M/T	11.5 (12.2, 10.1)
	A/T	11.0 (11.6, 9.7)
w/o Heater	M/T	10.7 (11.3, 9.4)
	A/T	10.2 (10.8, 9.0)

- (b) Install the radiator cap.

- (c) Start the engine, and bleed the cooling system.

- (d) Refill the radiator reservoir with coolant until it reaches the "FULL" line.

3. CHECK ENGINE COOLANT FOR LEAKS



RADIATOR RADIATOR CLEANING

EG8TL-02

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

NOTICE: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. If the cleaner nozzle pressure is 2,942 — 3,432 kPa (30 — 35 kgf/cm², 427 — 498 psi), keep a distance of at least 40 — 50 cm (15.75 — 19.69 in.) between the radiator core and cleaner nozzle.

RADIATOR INSPECTION

1. REMOVE RADIATOR CAP

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

2. INSPECT RADIATOR CAP

- If the radiator cap contains water or foreign substances, 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.

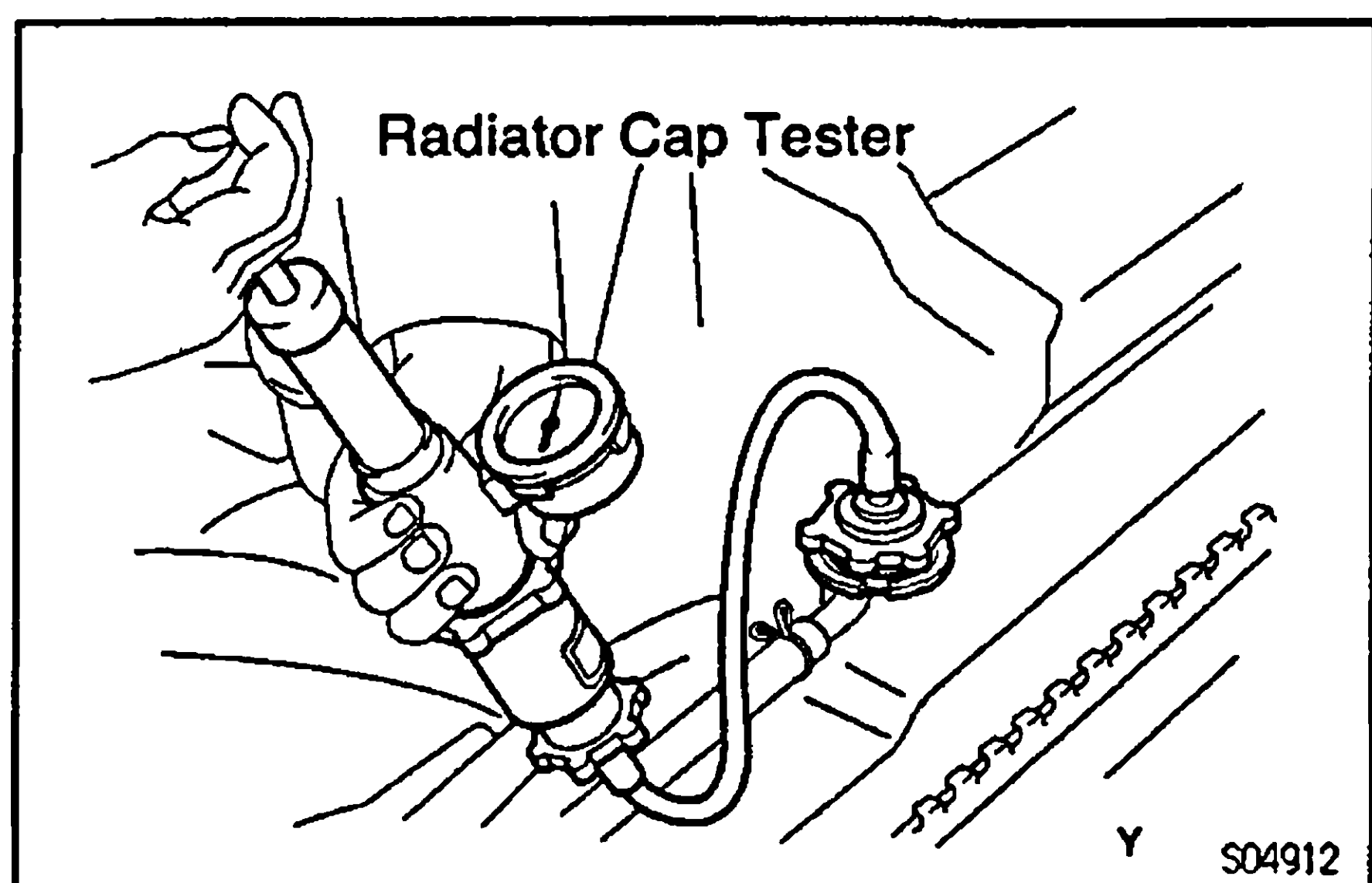
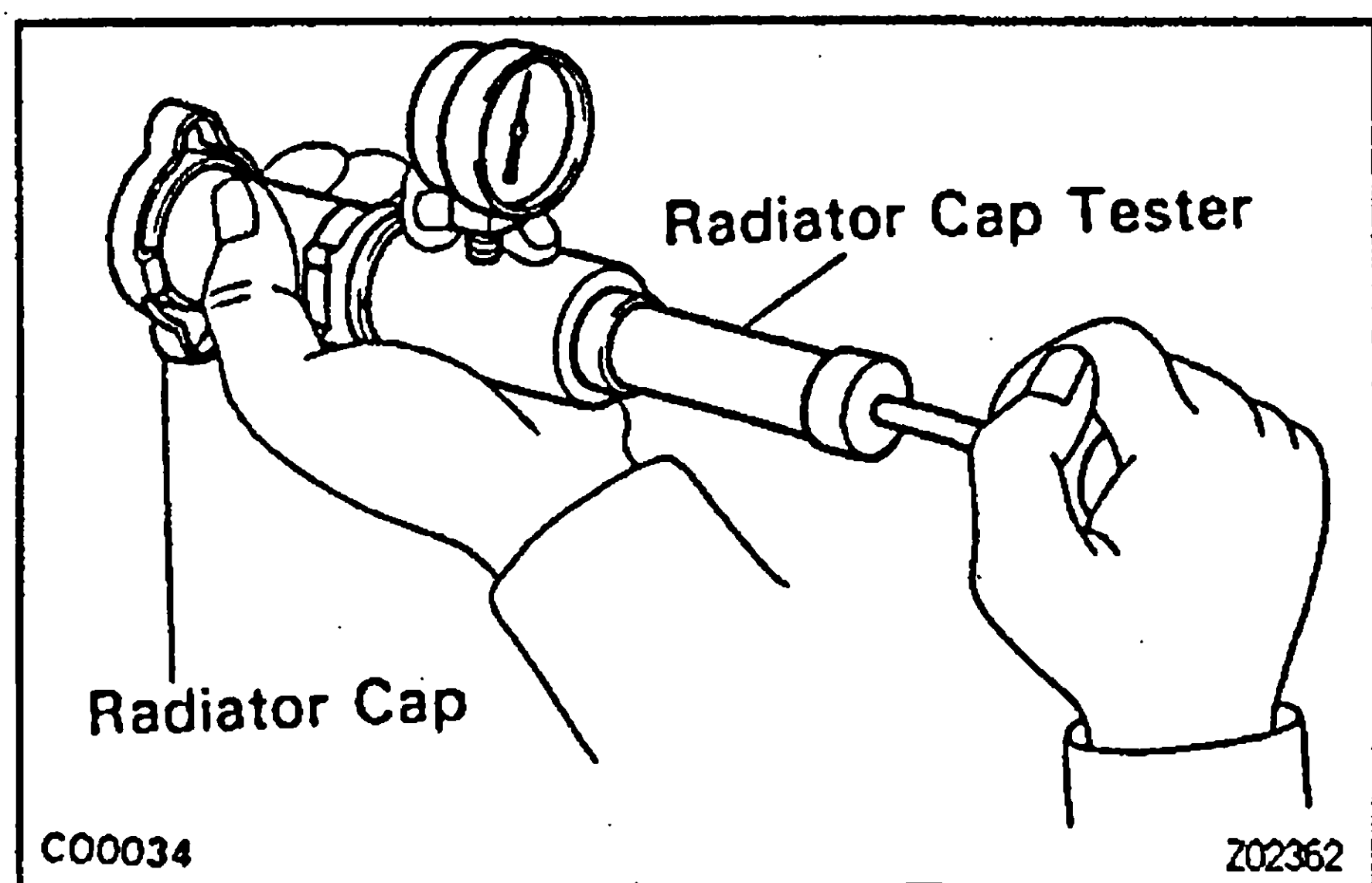
If the opening pressure is less than minimum, replace the radiator cap.

3. INSPECT COOLING SYSTEM FOR LEAKS

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

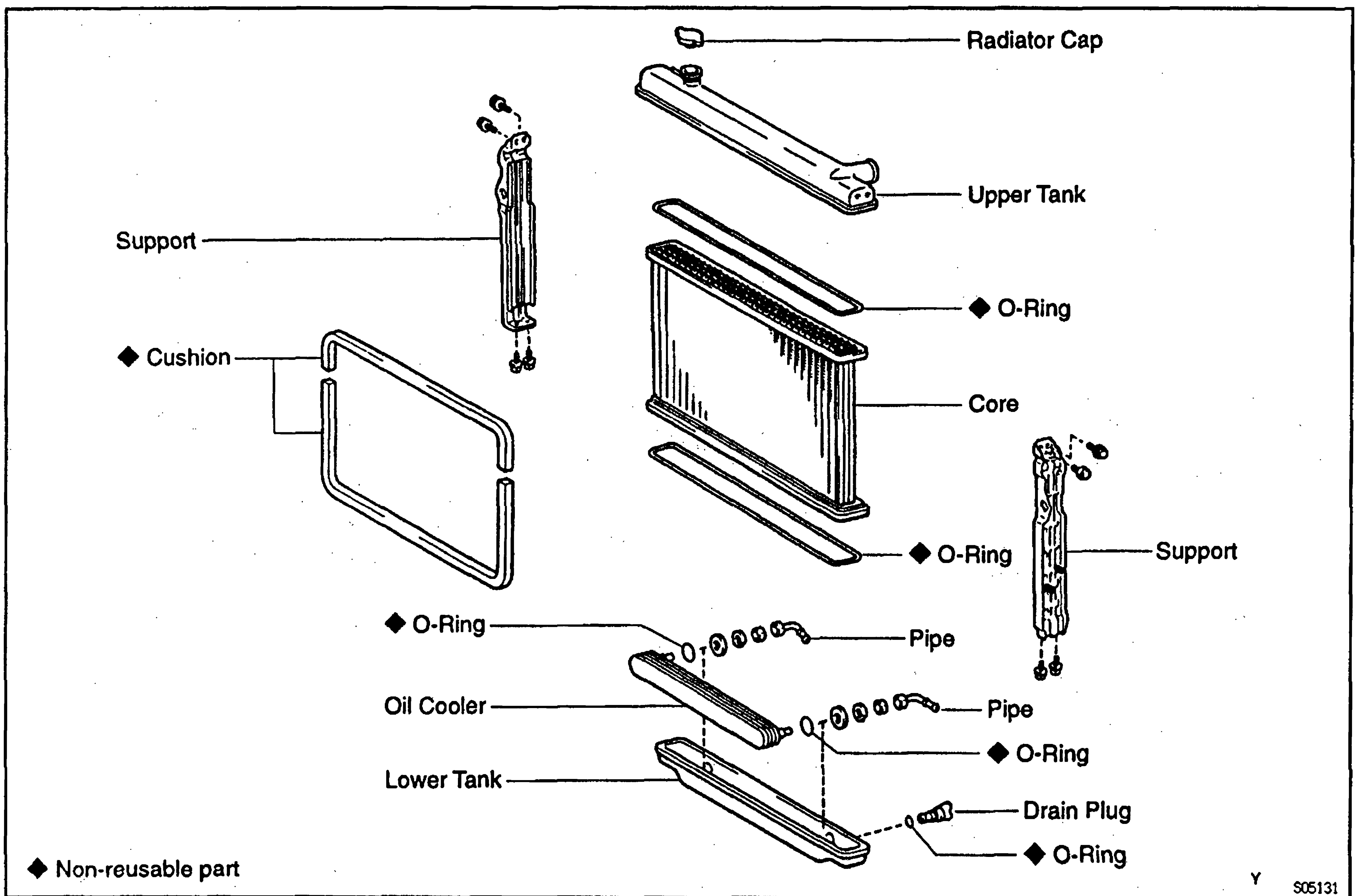
If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, cylinder block and cylinder head.

4. REINSTALL RADIATOR CAP



COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EG00A3-0K

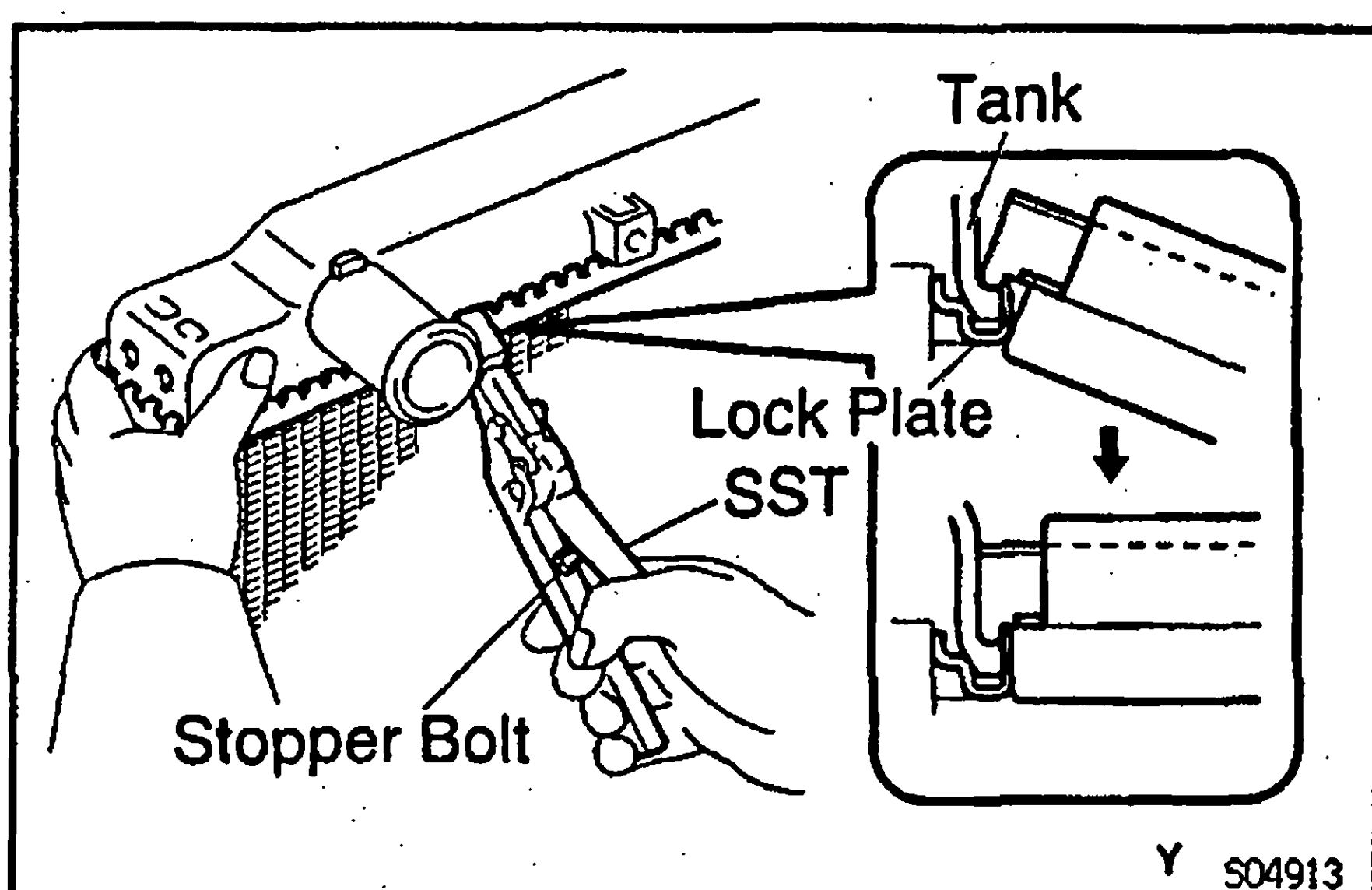
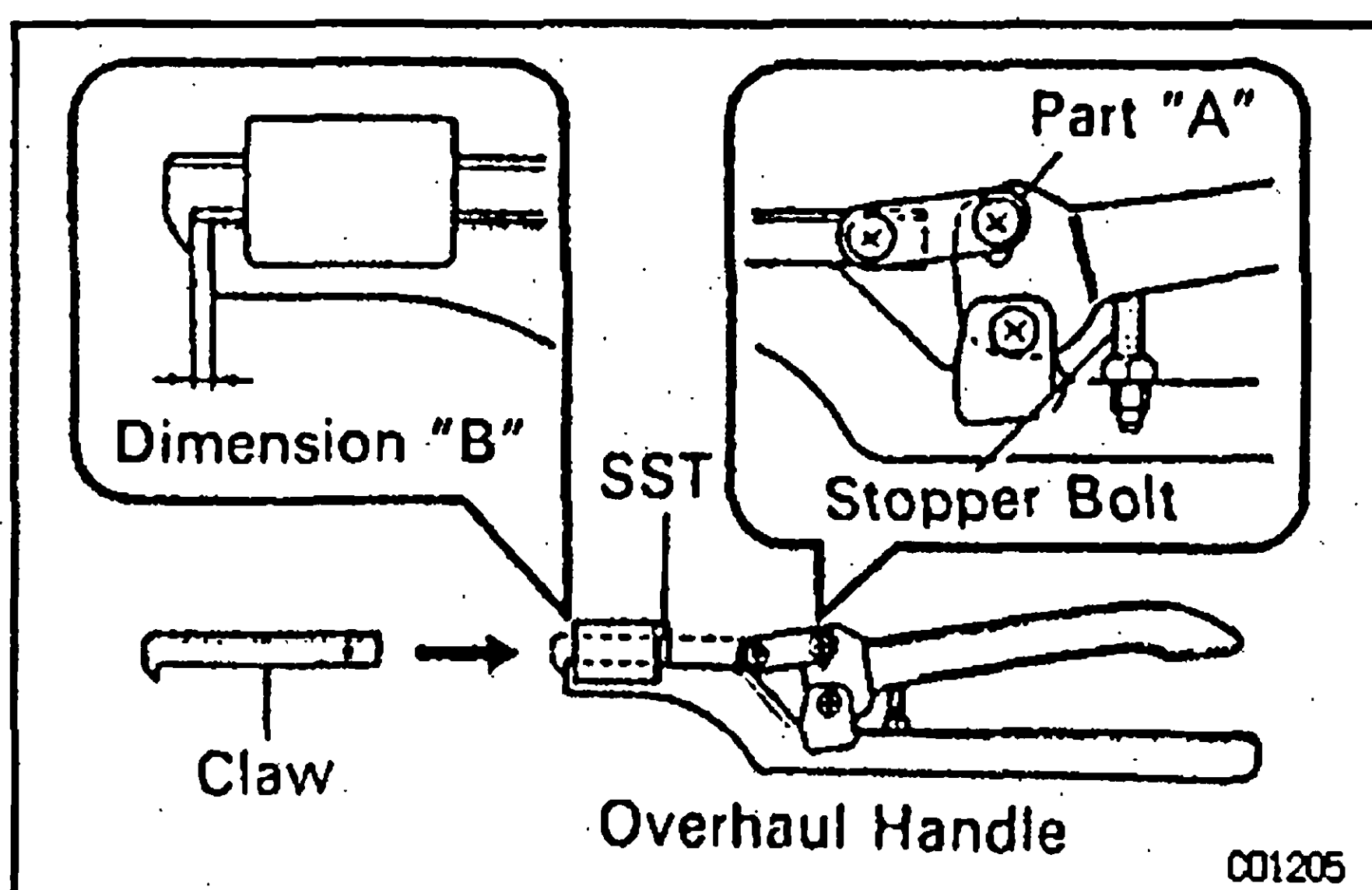


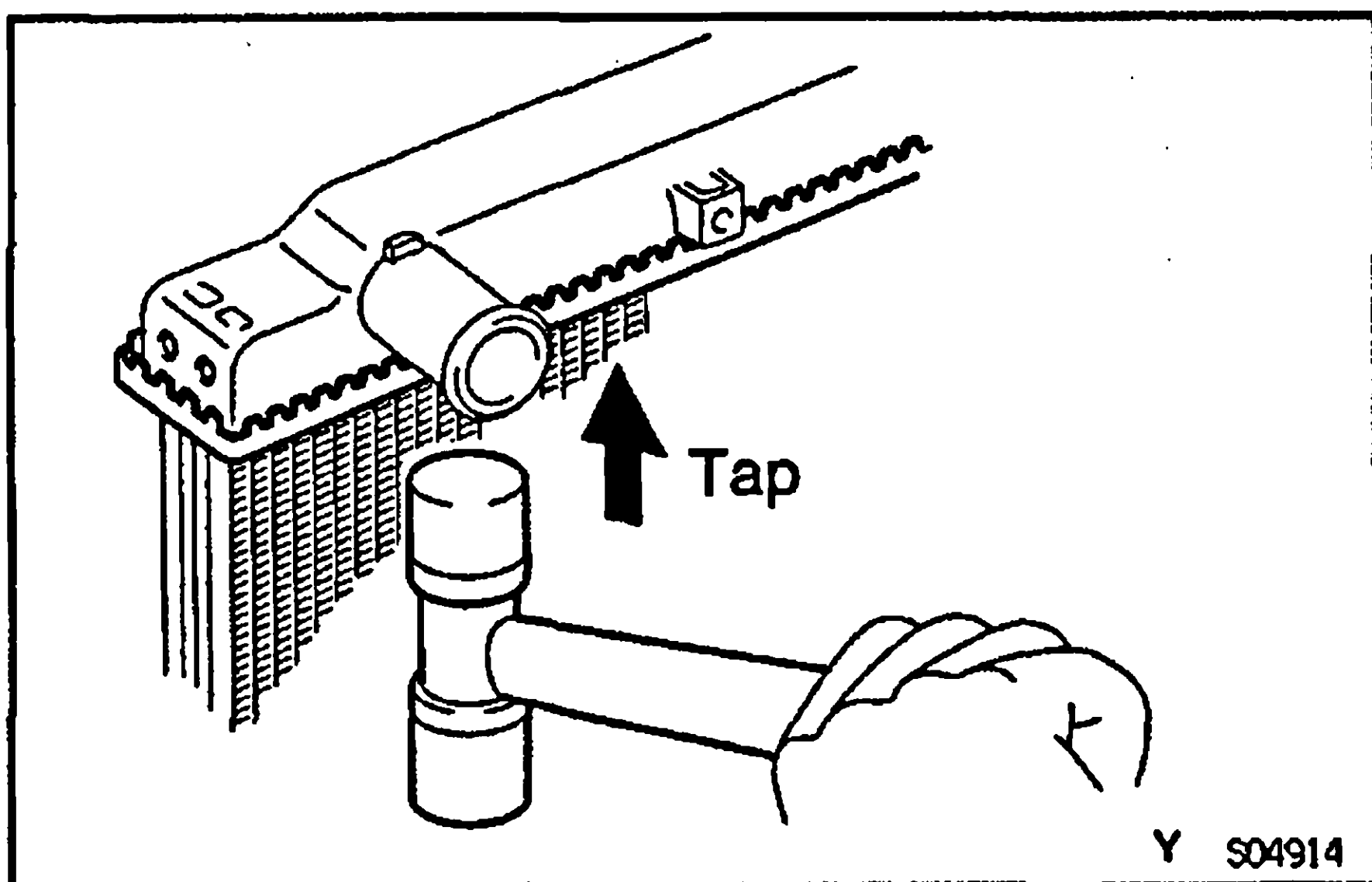
EG0006-08

RADIATOR DISASSEMBLY

1. REMOVE DRAIN PLUG
2. 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.
3. UNCAULK LOCK PLATES
 - Using SST to release the caulking, squeeze the handle until stopped by the stopper bolt.
 - SST 09230-01010





4. REMOVE TANKS AND O—RINGS

- Lightly tap the radiator port (inlet or outlet) with a soft—faced hammer, and remove the tank.
- Remove the O—ring.

5. A/T:

REMOVE OIL COOLER FROM LOWER TANK

- Remove the 2 nuts and 2 pipes.
- Remove the 2 nuts, 2 spring washers, 2 plate washers and oil cooler.
- Remove the 2 O—rings from the oil cooler.

EG7C0—01

RADIATOR ASSEMBLY

1. A/T:

INSTALL OIL COOLER TO LOWER TANK

- Install 2 new O—rings to the oil cooler.
- Install the oil cooler to the lower tank.
- Install the 2 plate washers, 2 spring washers and 2 nuts.

Torque: 10 N·m (100 kgf·cm, 7 ft·lbf)

- Install the 2 pipes and 2 nuts.

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

HINT: Face the pipes in the direction shown in the illustration.

2. INSPECT LOCK PLATE

Inspect the lock plate for damage.

HINT:

- If the sides of the lock plate groove are deformed, reassembly of the tank will be impossible.
- Therefore, first correct any deformation with pliers or similar object. Water leakage will result if the bottom of the lock plate groove is damaged or dented. Therefore, repair or replace if necessary.

NOTICE:

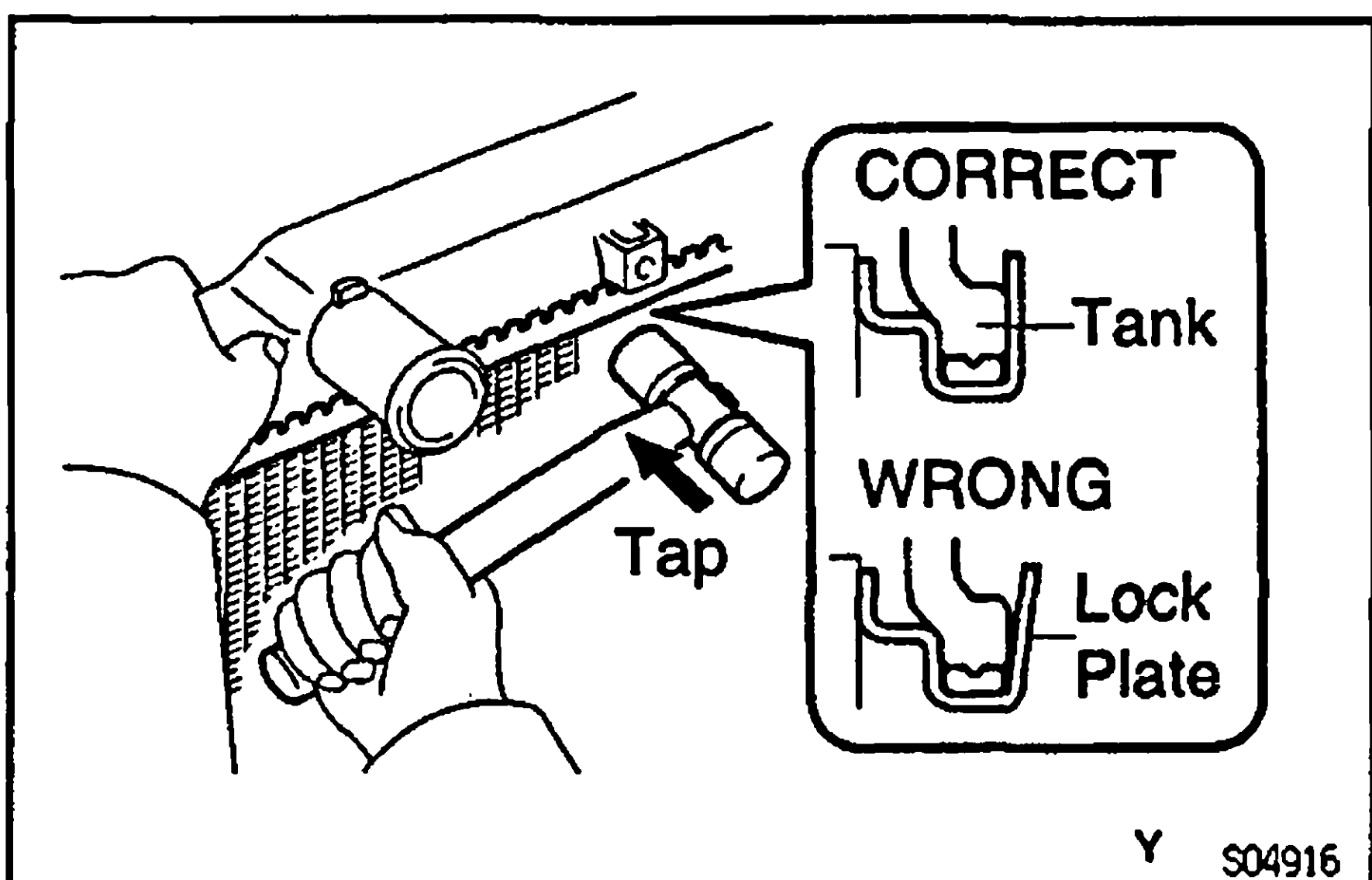
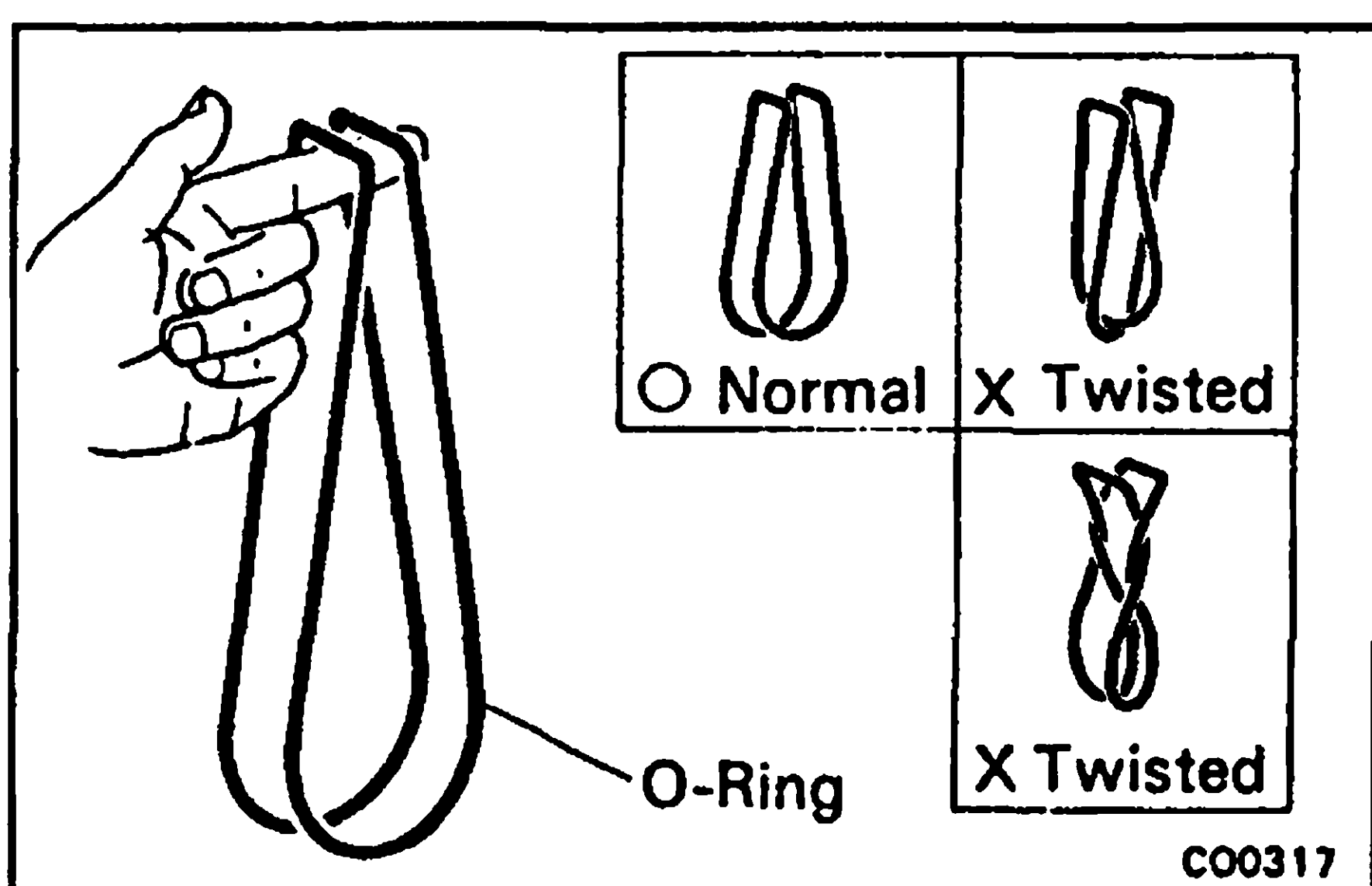
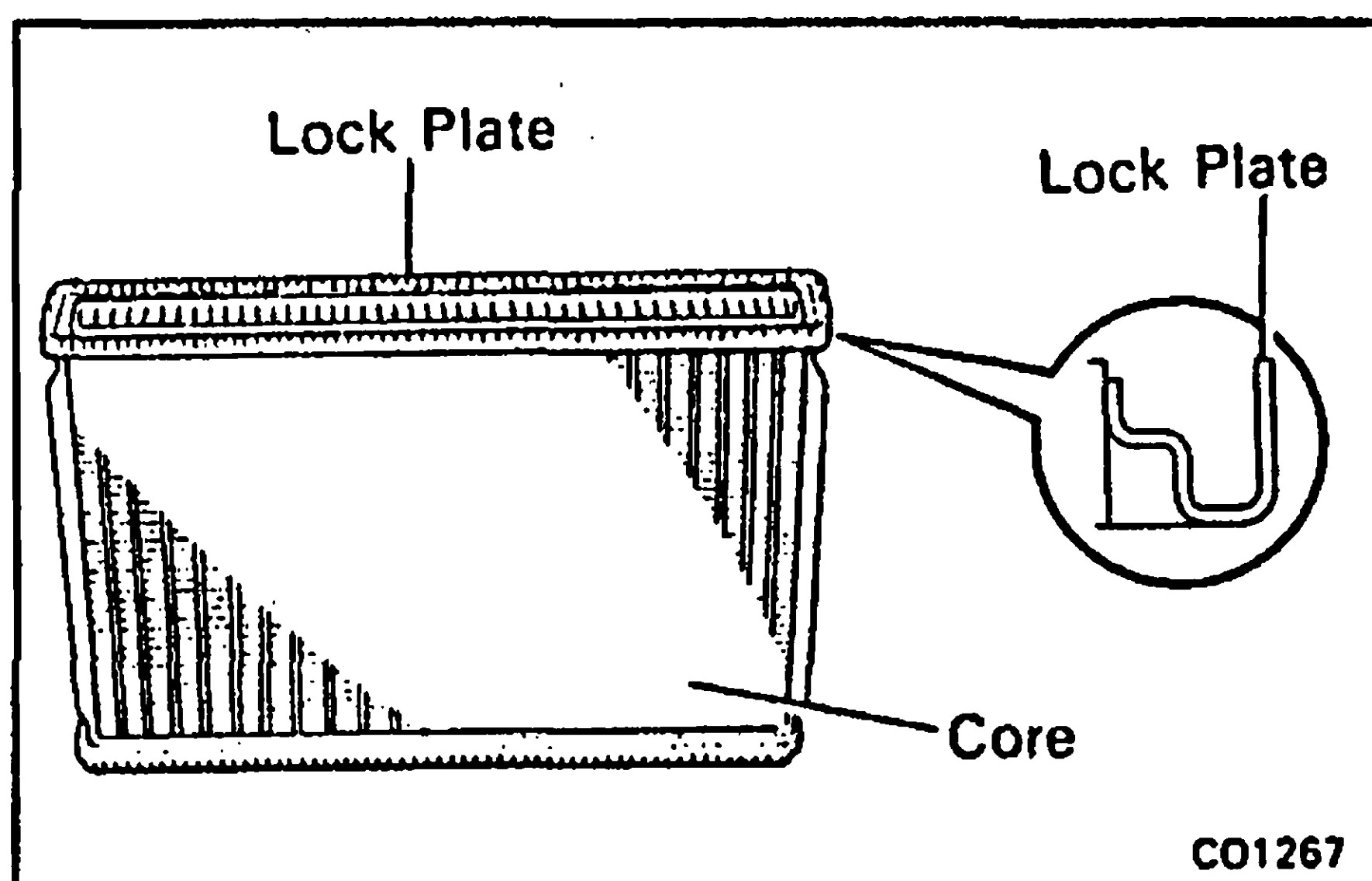
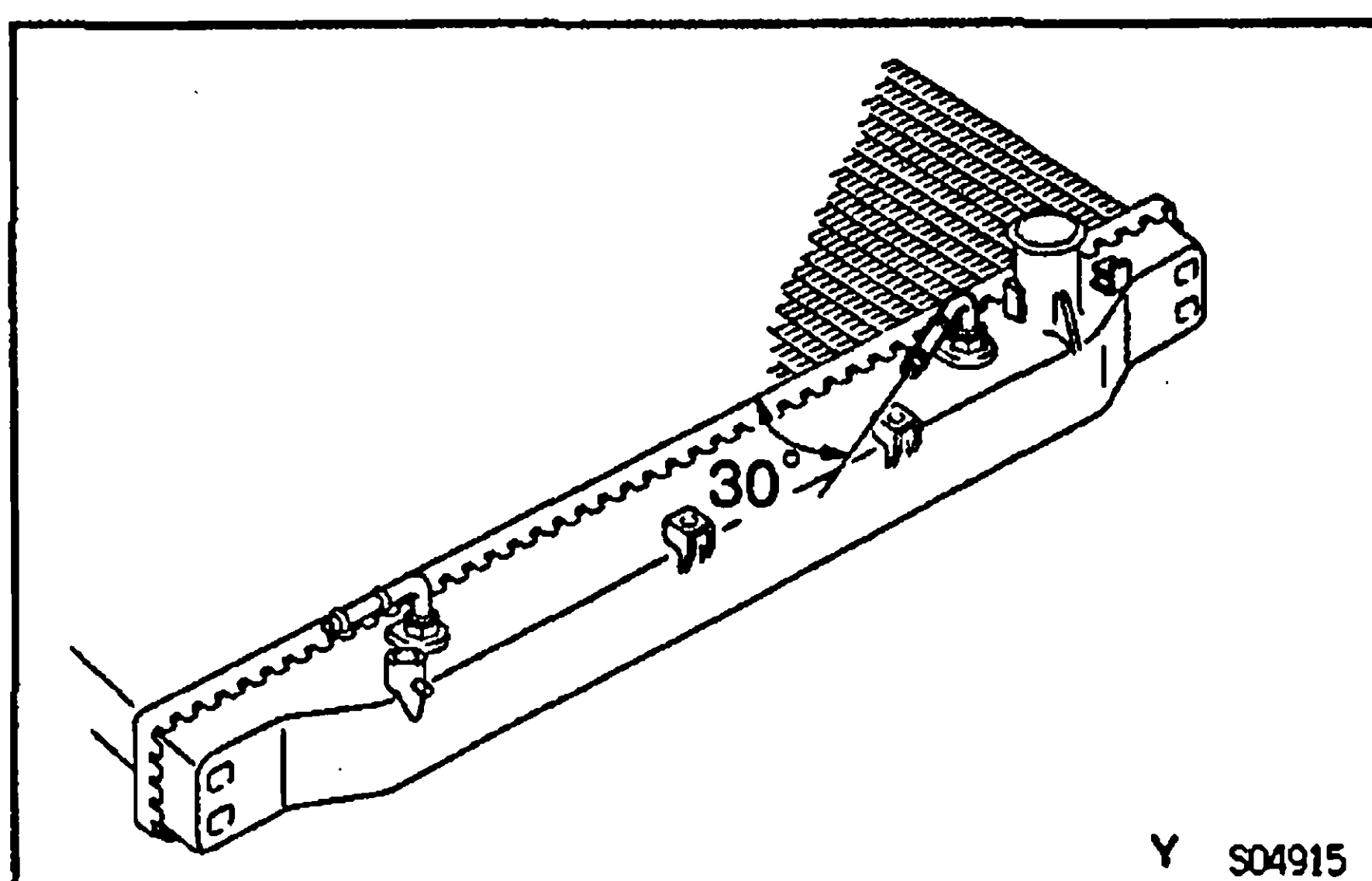
The radiator can only be recaulked 2 times. After the 2nd time, the radiator core must be replaced.

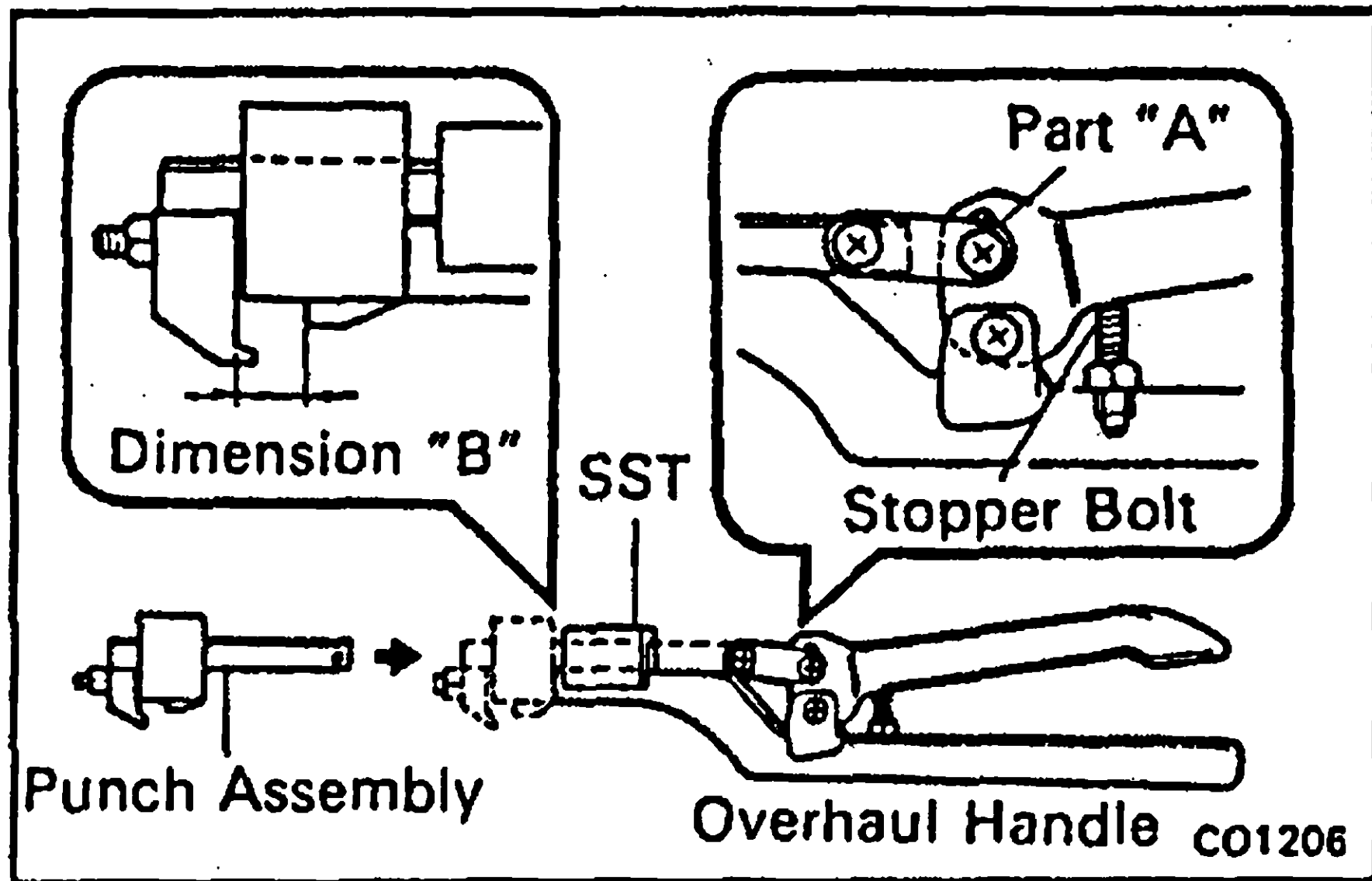
3. INSTALL NEW O—RINGS AND TANKS

- 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.

- Install the tank without damaging the O—ring.
- Tap the lock plate with a soft—faced hammer so that there is no gap between it and the tank.



**4. ASSEMBLE SST**

SST 09230-01010, 09231-14010

- Install the punch assembly to the overhaul handle, inserting it in the hole in part "A" as shown in the illustration.
- While gripping the handle, adjust the stopper bolt so that dimension "B" shown in the diagram.

Dimension "B":

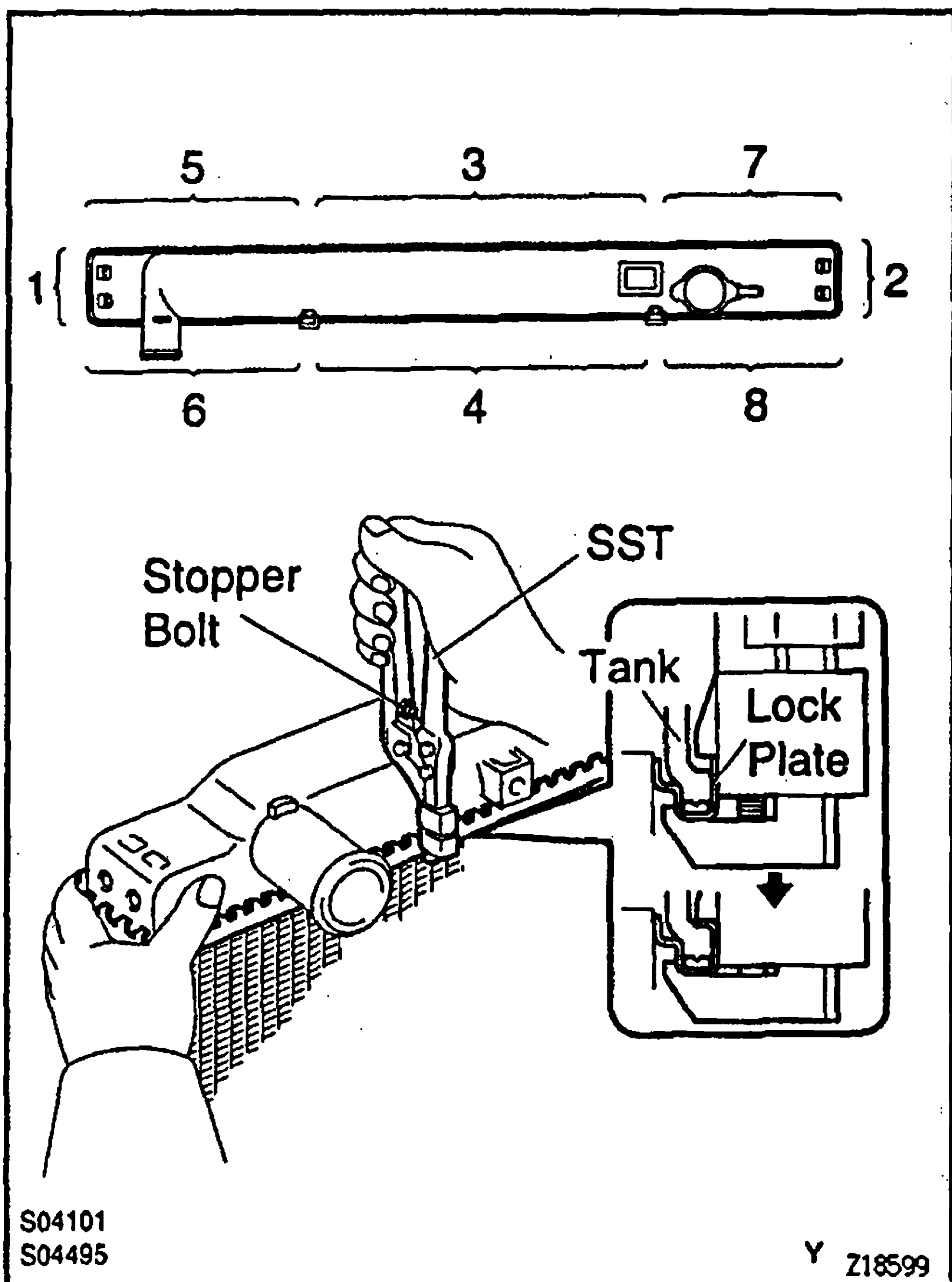
8.4 mm (0.331 in.)

EG

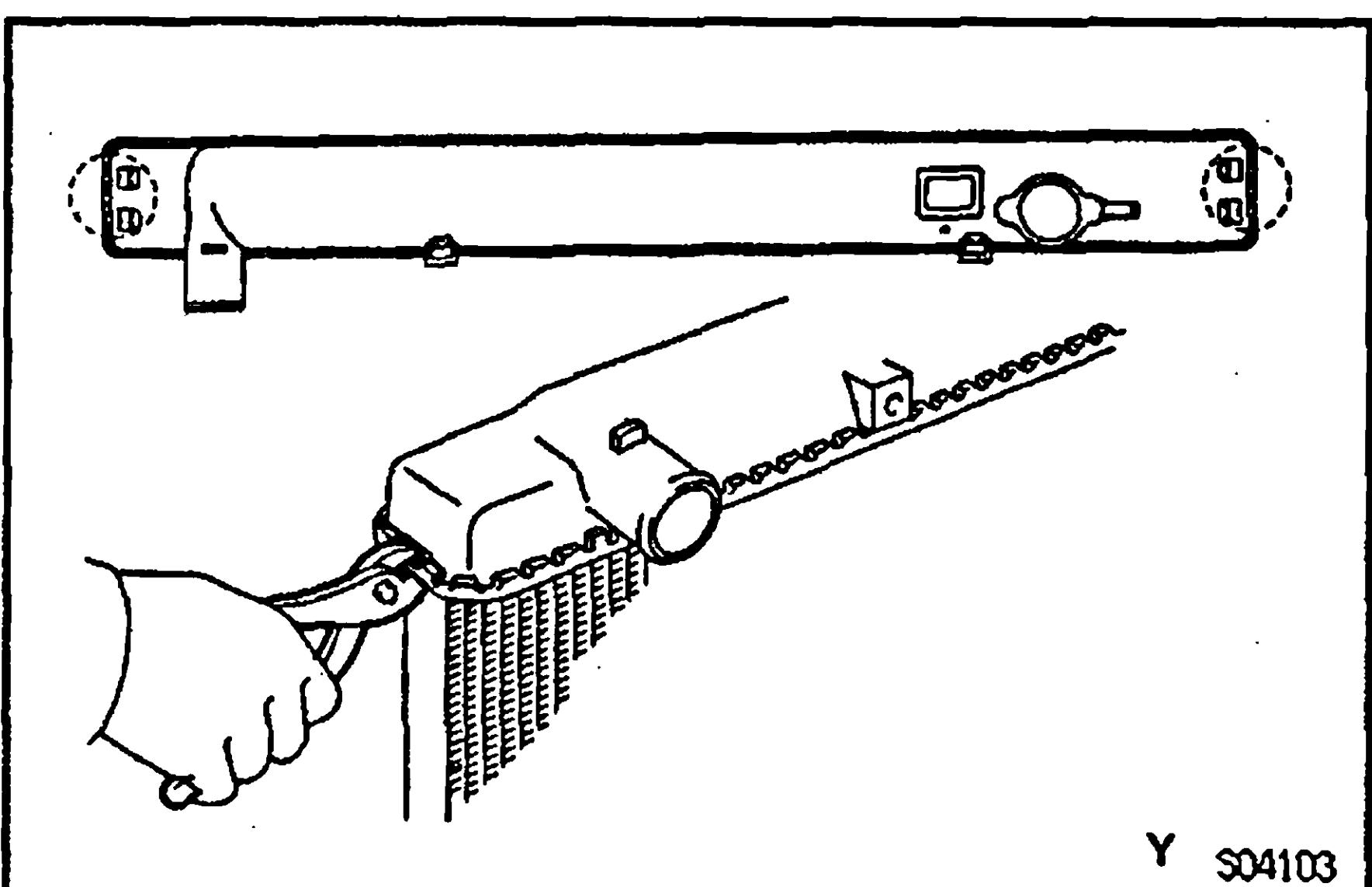
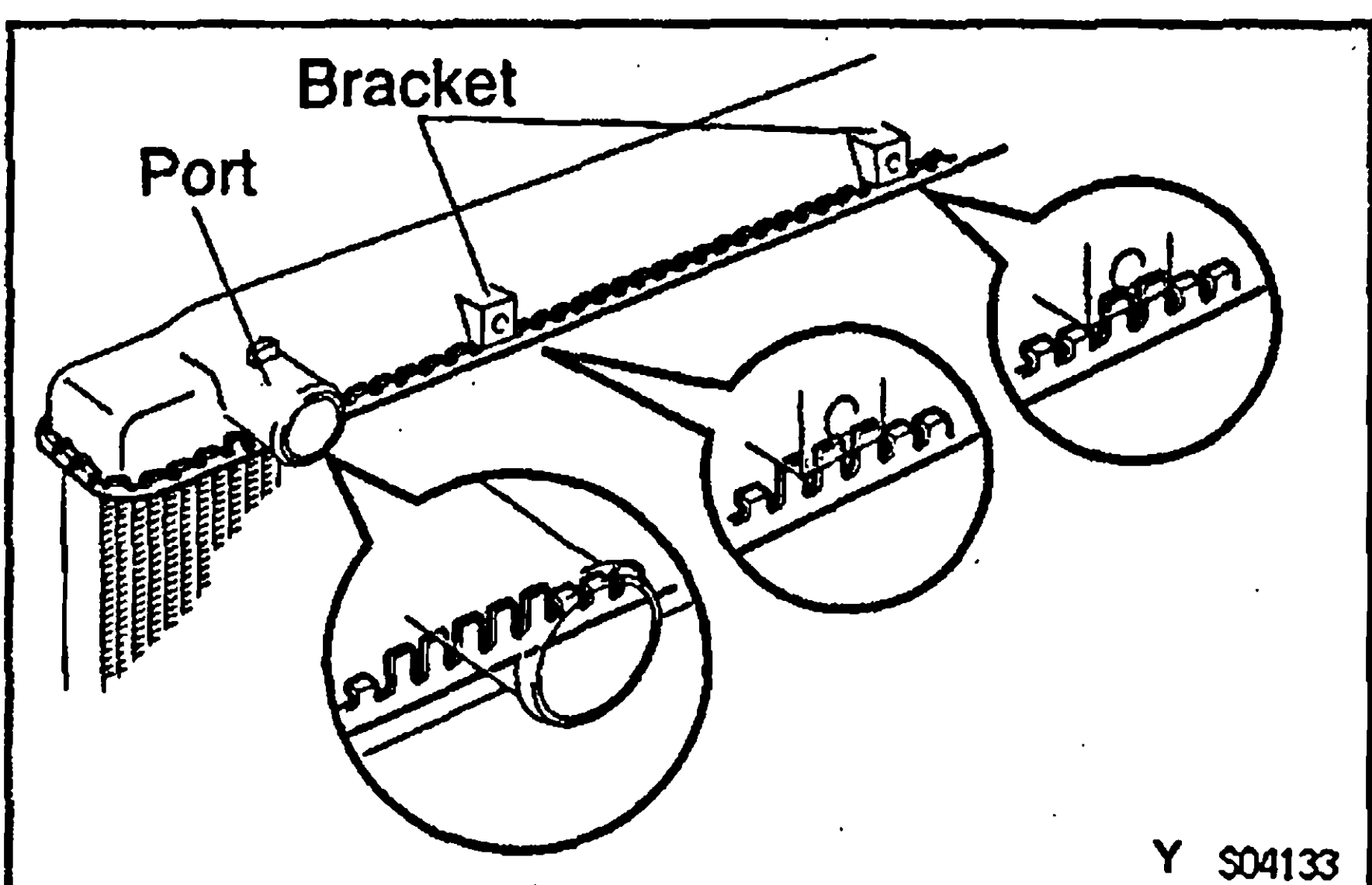
5. CAULK LOCK PLATE

- 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.

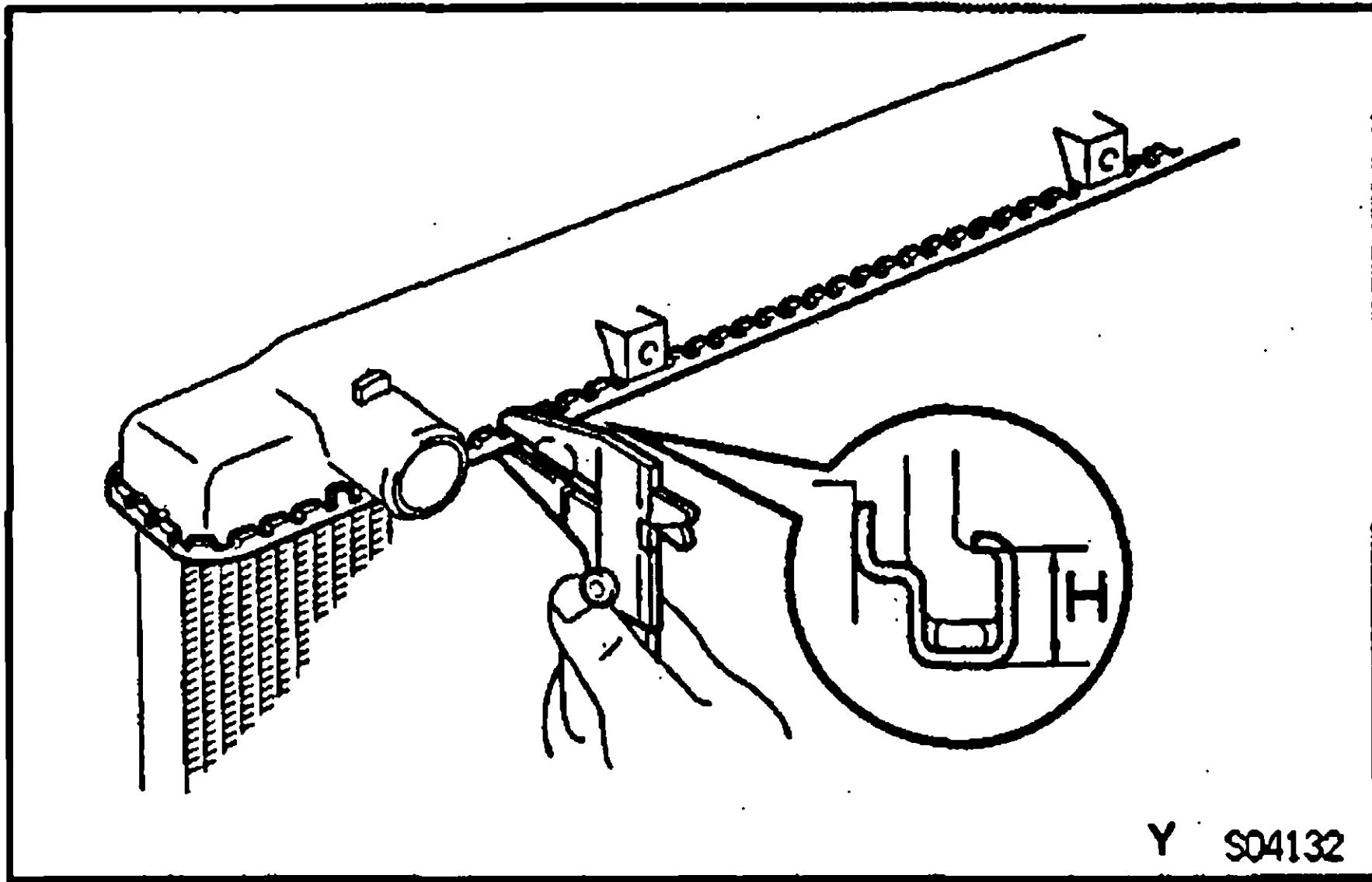
SST 09230-01010

**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 (0.296 – 0.312 in.)

If not within the specified height, adjust the stopper bolt of the handle again and caulk again.

6. PAINT LOCK PLATES

7. 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.

8. CHECK FOR WATER LEAKS

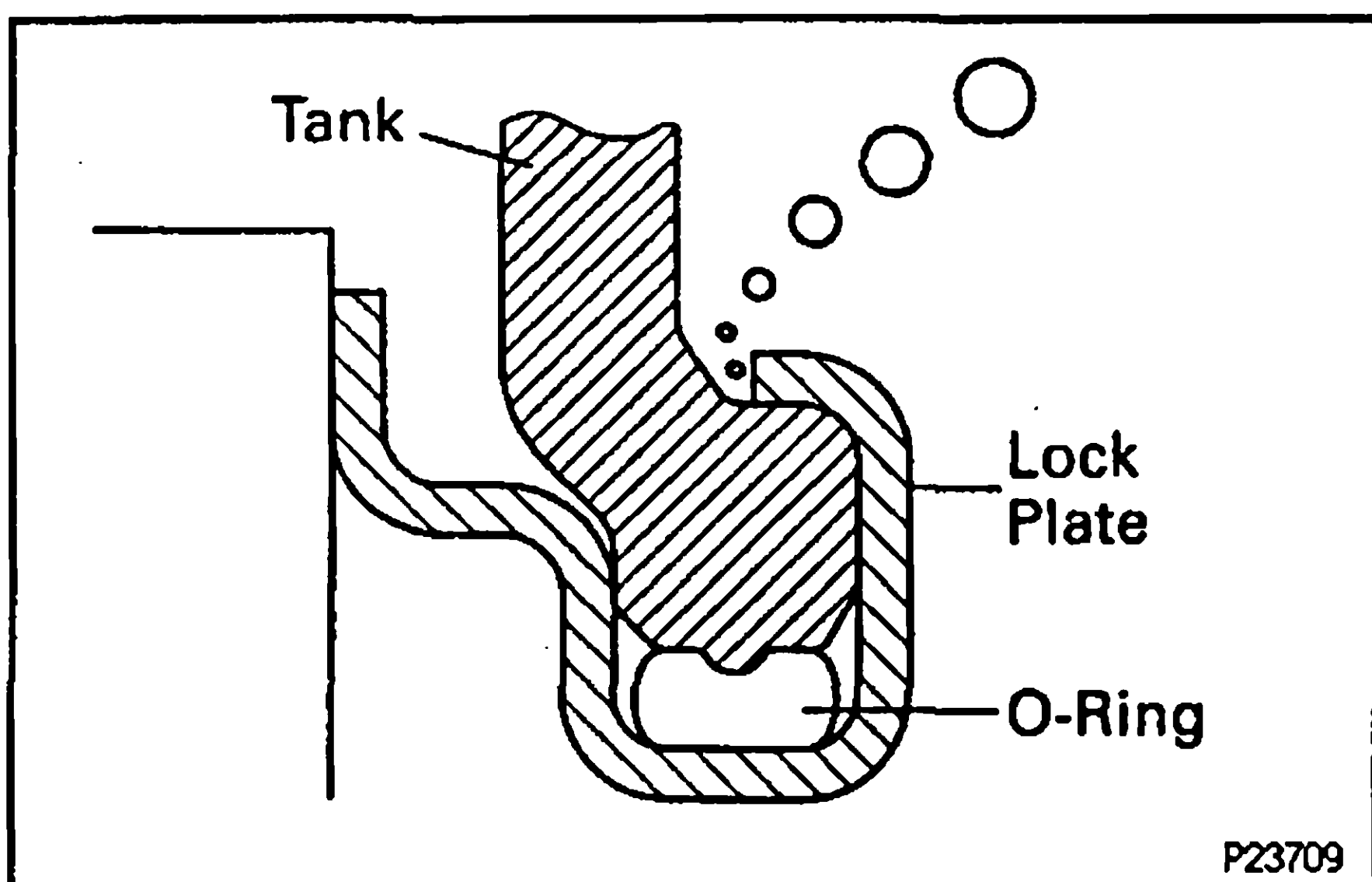
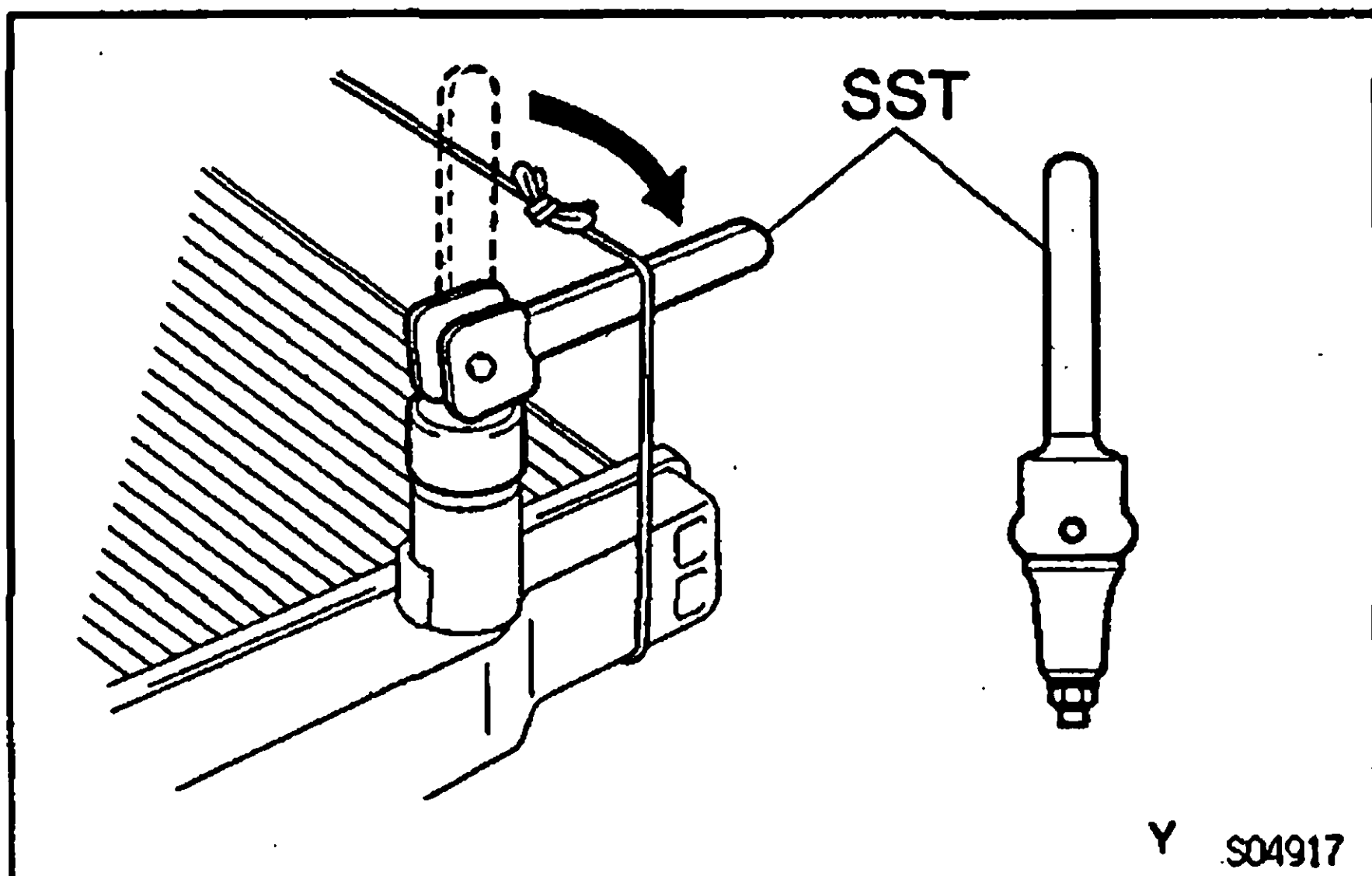
- Using SST, plug the inlet and outlet pipes of the radiator.

SST 09230—01010

- Using a radiator cap tester, apply pressure to the radiator.

Test pressure:

147 kPa (1.5 kgf/cm², 21 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 swirl the radiator around in the water until all air bubbles disappear.

SERVICE SPECIFICATIONS

SERVICE DATA

EG07L-28

Thermostat	Valve opening temperature	74 — 78°C (165 — 172°F)
	Valve lift at 90°C (194°F)	10 mm (0.39 in.) or more
Radiator cap	Relief valve opening pressure	74 — 103 kPa (0.75 — 1.05 kgf/cm ² , 10.7 — 14.9 psi)
	STD Minimum	59 kPa (0.6 kgf/cm ² , 8.5 psi)

EG

TORQUE SPECIFICATIONS

EG07M-28

Part tightened	N·m	kgf·cm	ft·lbf
Drain plug x Oil cooler cover	29.4	300	22
Water pump x Cylinder block	12 mm head	19.6	14
	14 mm head	39.2	29
Fan x Fluid coupling	6.4	65	57 in·lbf
Fluid coupling x Water pump pulley	19.6	200	14
Water inlet x Cylinder block	19.6	200	14
Water inlet x Alternator bracket	19.6	200	14
Oil cooler x Lower tank	10	100	7
Oil cooler pipe x Oil cooler	15	150	11
Support x Tank on radiator	12.7	130	9

STARTING

PREPARATION ST- 2

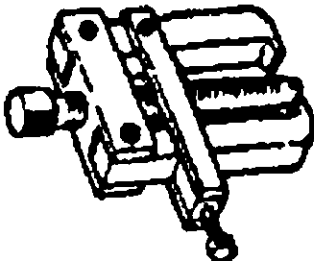
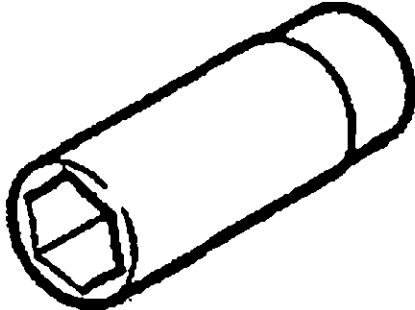
STARTER ST- 3

SERVICE SPECIFICATIONS ST- 6

ST

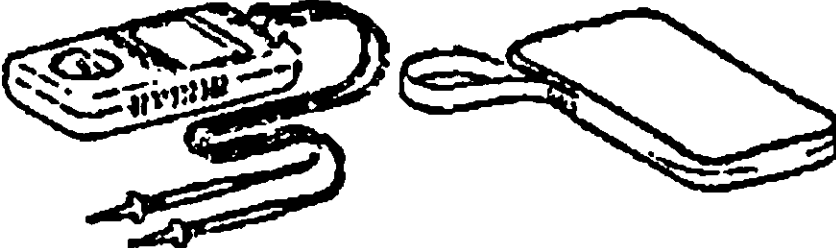
PREPARATION
SST (SPECIAL SERVICE TOOLS)

ST008-1G

	09286-46011 Injection Pump Spline Shaft Puller	
	09820-00030 Alternator Rear Bearing Replacer	Armature rear bearing
	09810-38170 Starter Magnet Switch Nut Wrench 17	

RECOMMENDED TOOLS

ST00T-1B

	09082-00040 TOYOTA Electrical Tester.	
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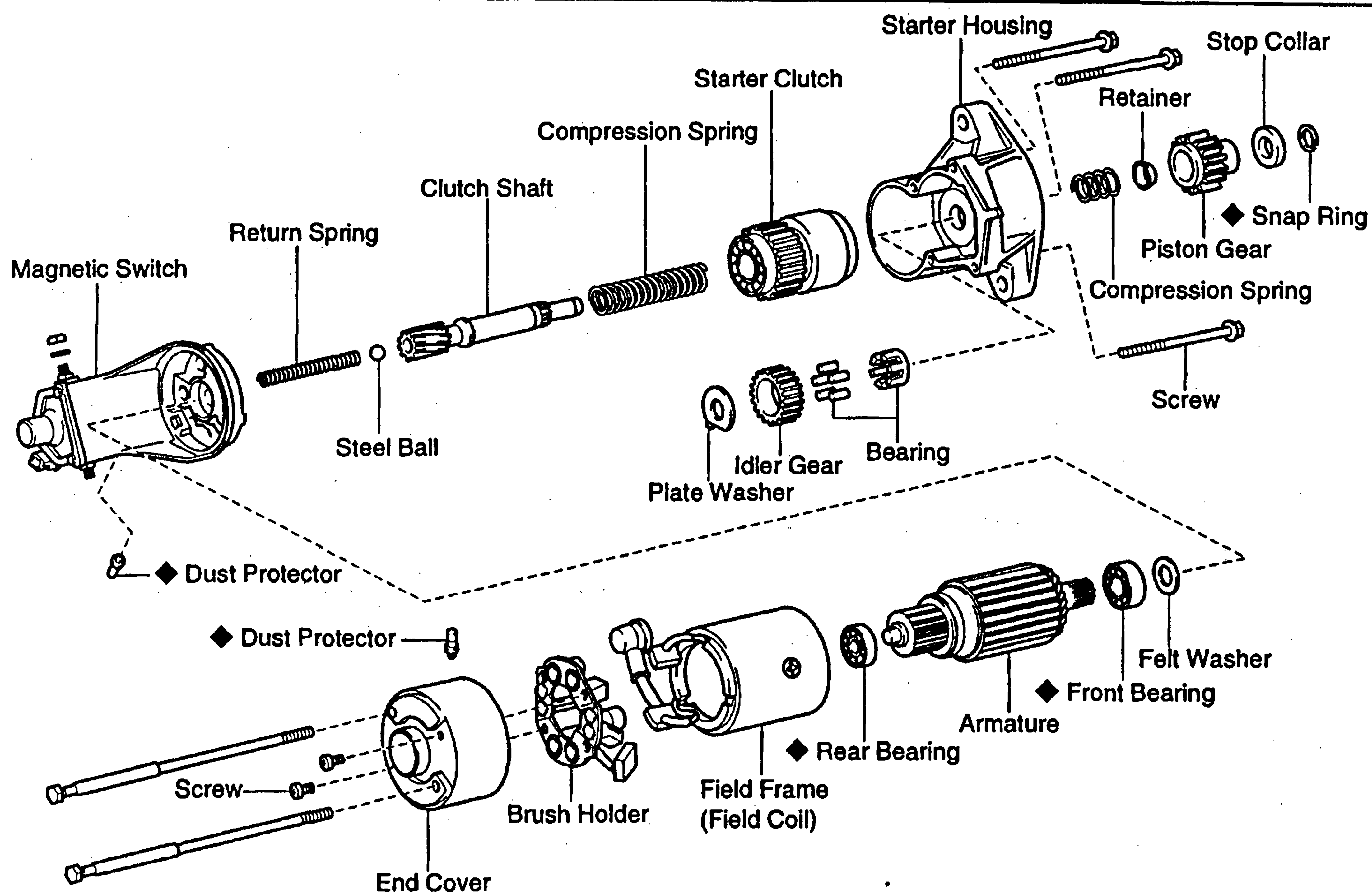
EQUIPMENT

ST00U-0V

Torque wrench	
Press	Magnetic switch terminal kit

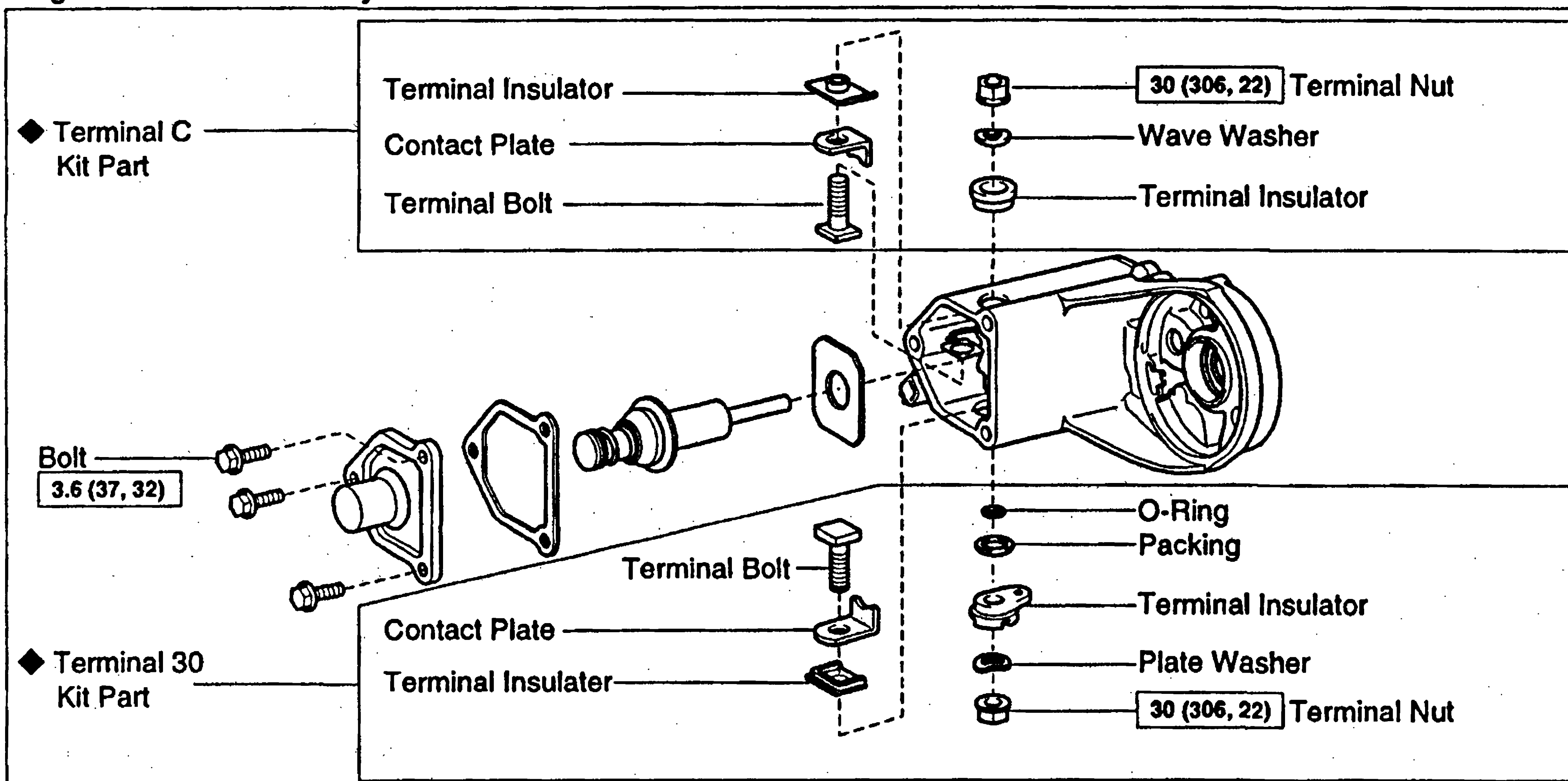
STARTER COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

ST00W-1X



Magnetic Switch Assembly

S04496

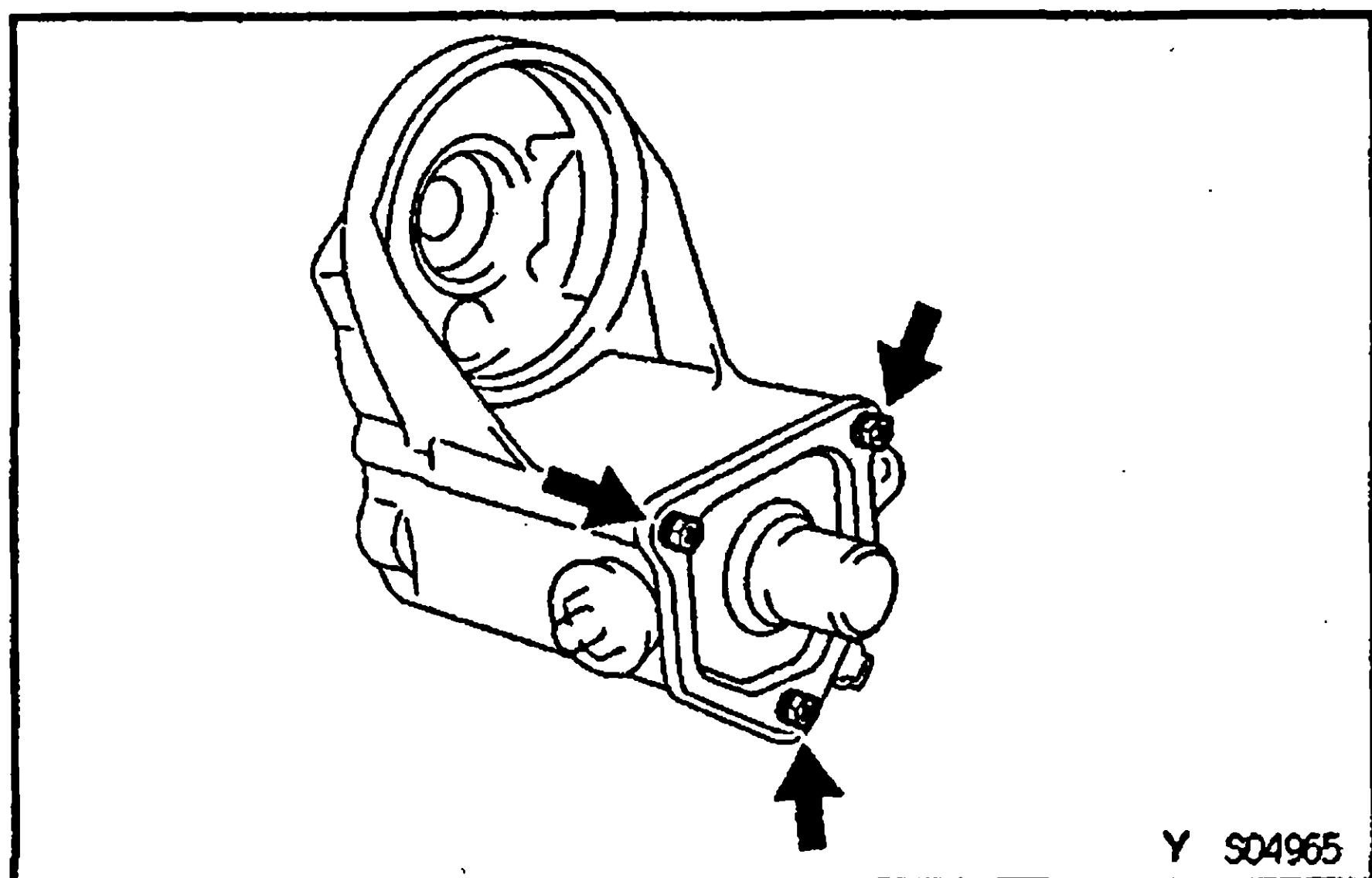


N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

Y

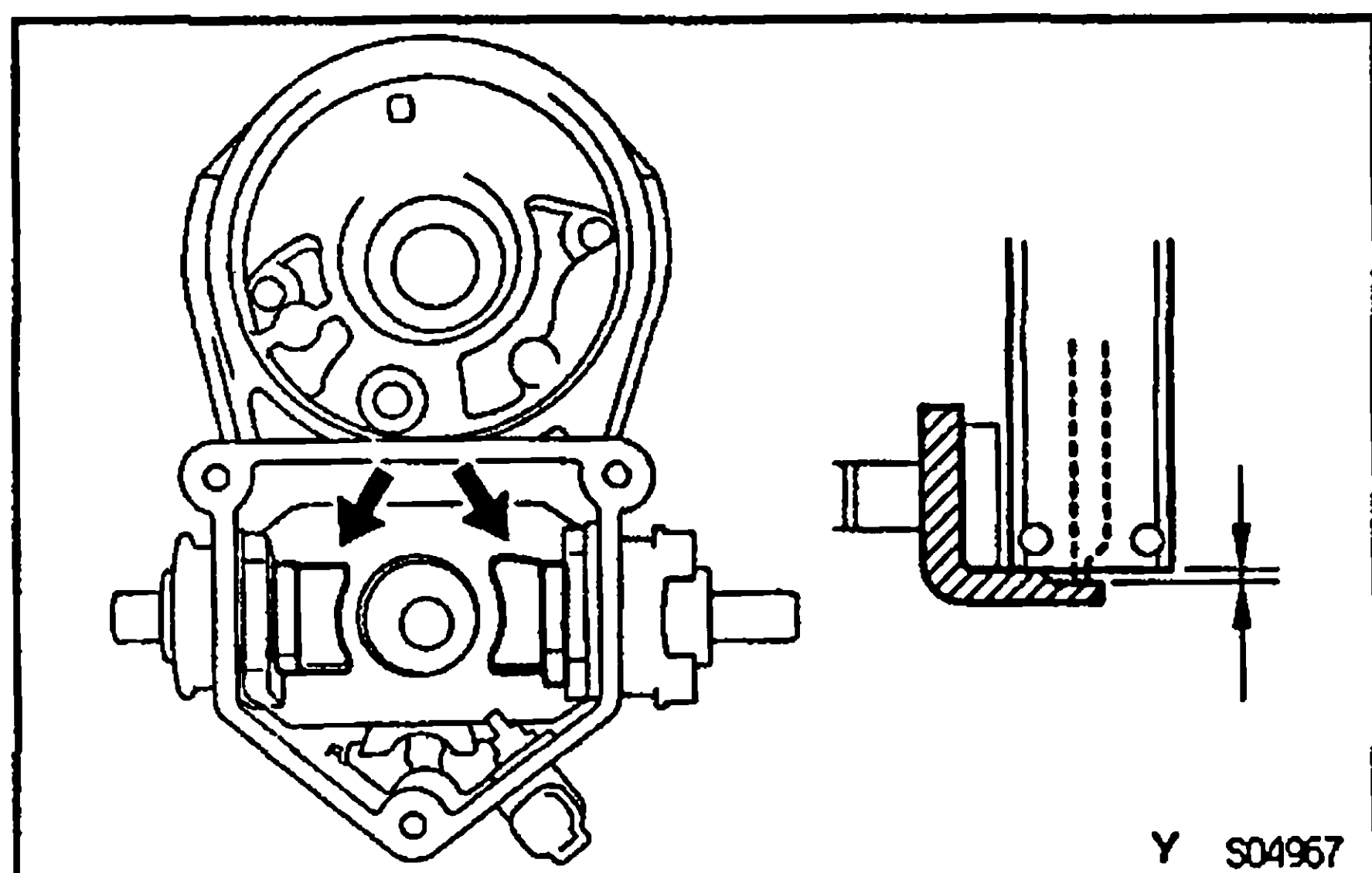
S05132



MAGNETIC SWITCH TERMINAL KIT PARTS REPLACEMENT

1. REMOVE MAGNETIC SWITCH END COVER

Remove the 3 bolts end cover, gasket and plunger.



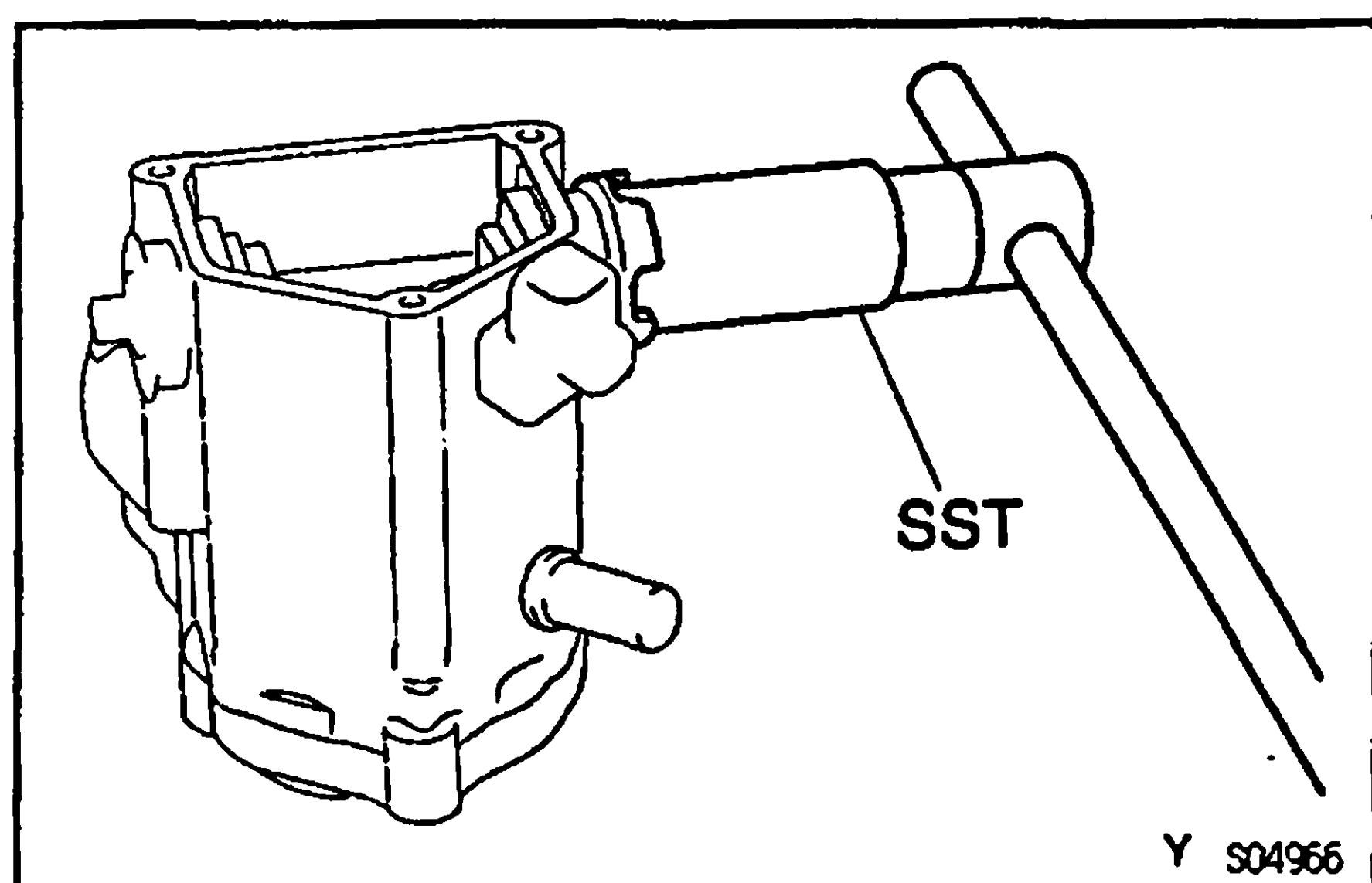
2. INSPECT CONTACT PLATE FOR WEAR

Using vernier calipers, measure the contact plate for depth of wear.

Maximum wear:

1.6 mm (0.063 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), 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 and terminal insulator (inside).

4. REINSTALL TERMINAL KIT PARTS

(a) Install these new parts:

Terminal 30:

(1) Terminal bolt

(2) Contact plate

(3) Terminal insulator (inside)

(4) O-ring

(5) Packing and terminal insulator (outside)

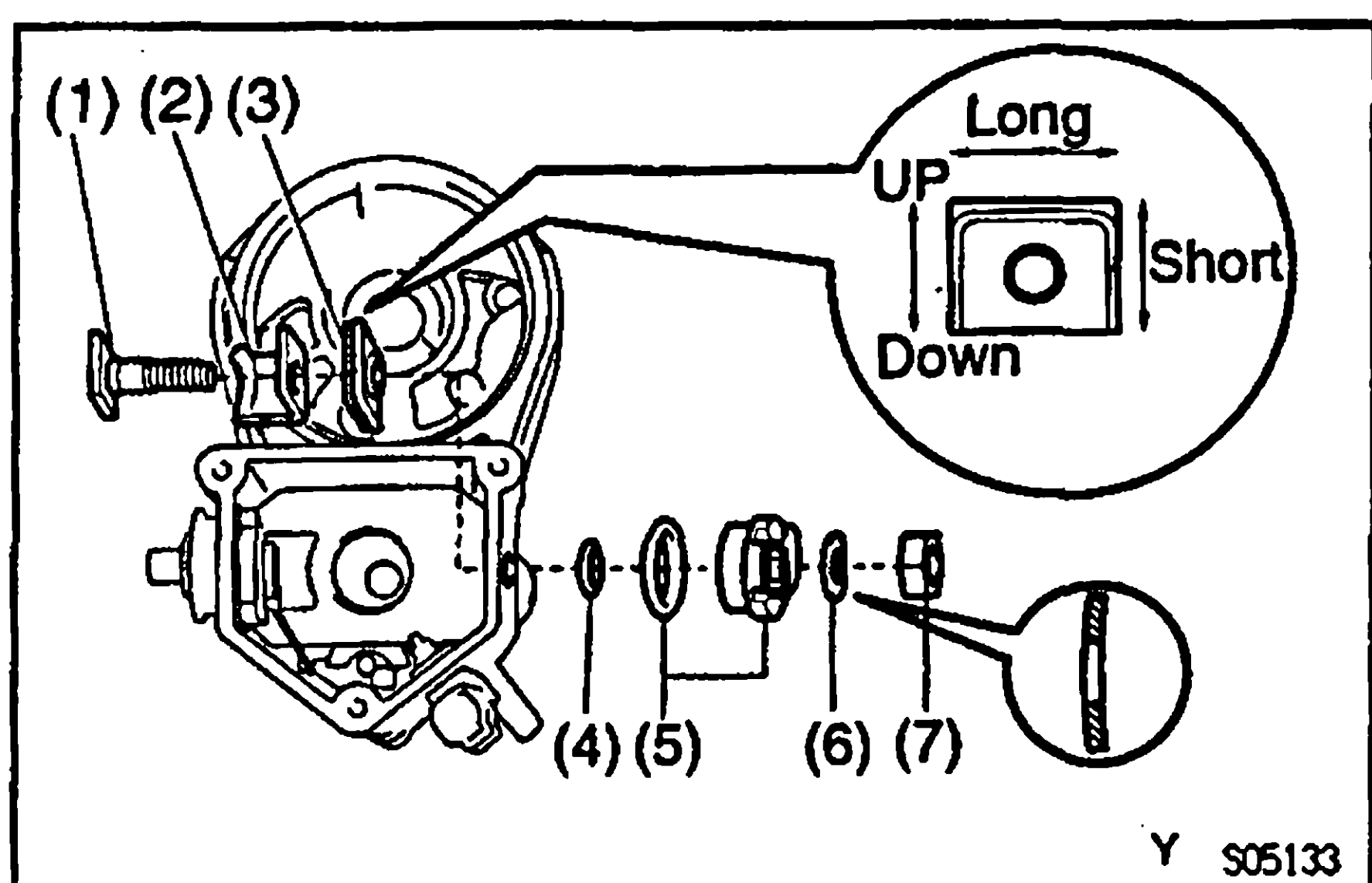
Install the packing to the terminal insulator, and install them.

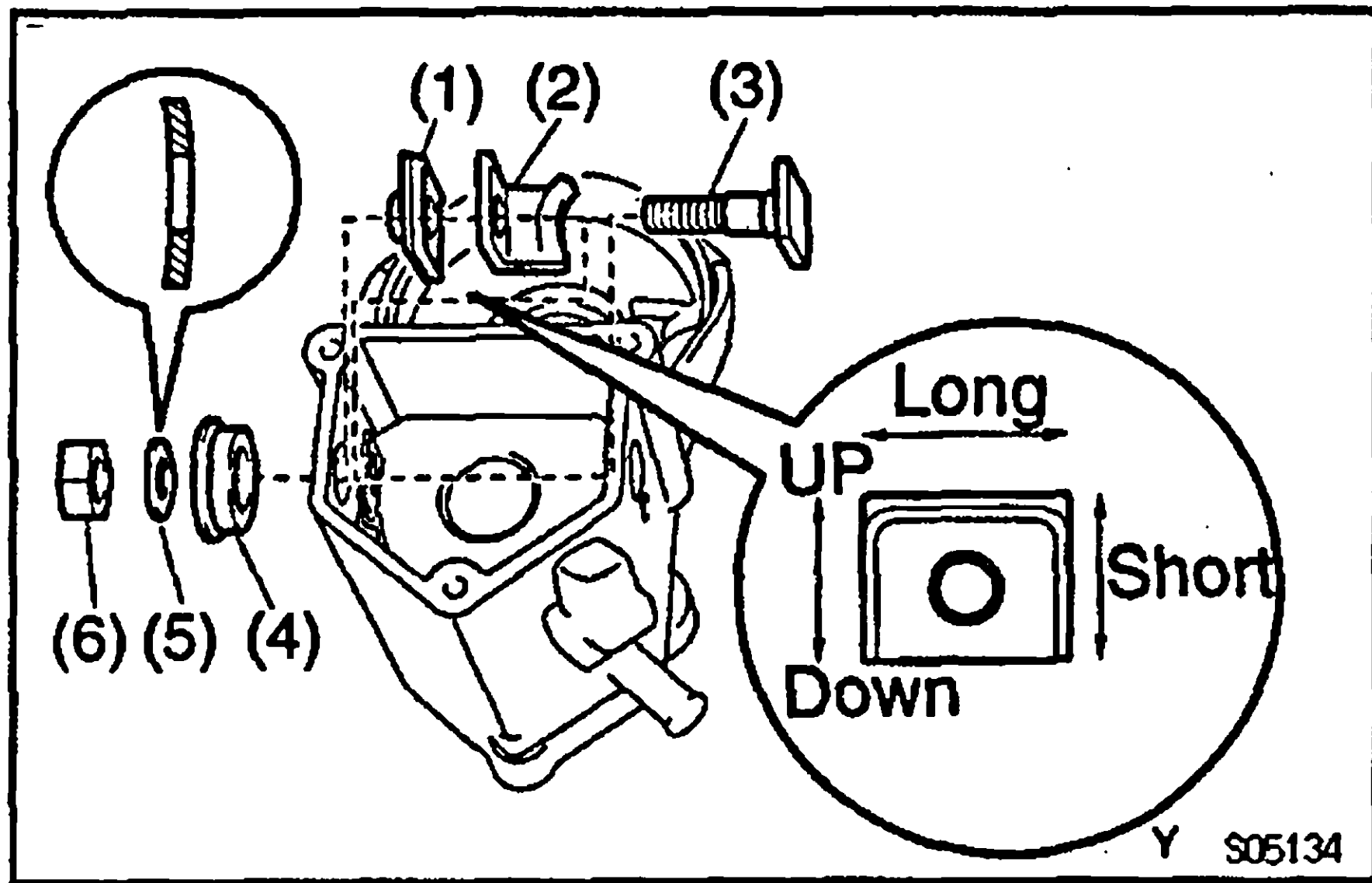
HINT: Match the protrusion of the insulator with the indentation of the housing.

(6) Wave washer

(7) Terminal nut

NOTICE: Be careful to install the terminal insulators (inside).





Terminal C:

- (1) Terminal insulator (inside)
- (2) Contact plate
- (3) Terminal bolt
- (4) Terminal insulator (outside)
- (5) Wave washer
- (6) Terminal nut

NOTICE: Be careful to install the terminal insulators (inside) and wave washers 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:

$$(\text{kgf/cm}^2) = \frac{100 \text{ kgf}}{\left(\frac{\text{Ram diameter (cm)}}{2} \right)^2 \times 3.14 (\pi)}$$

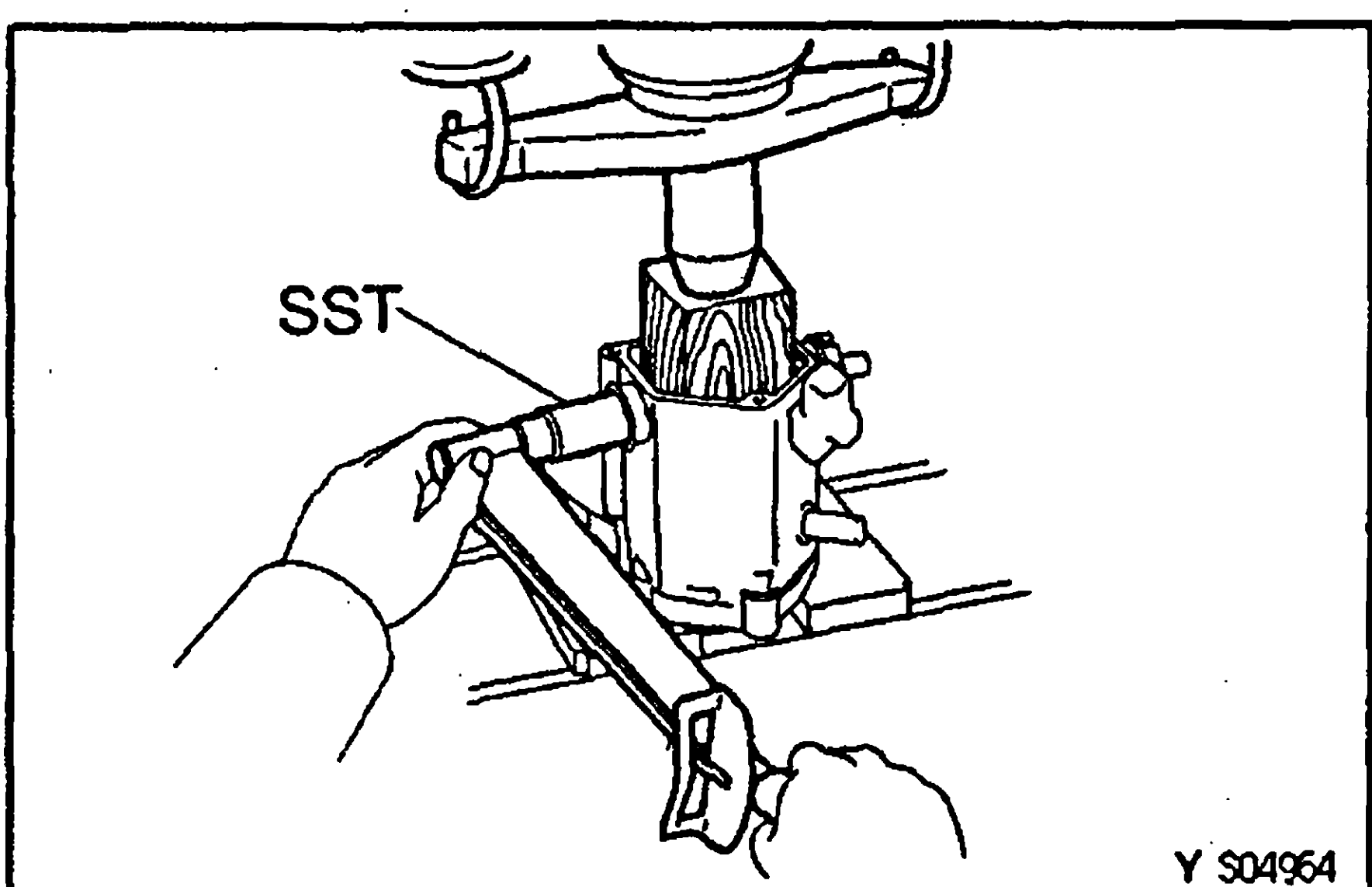
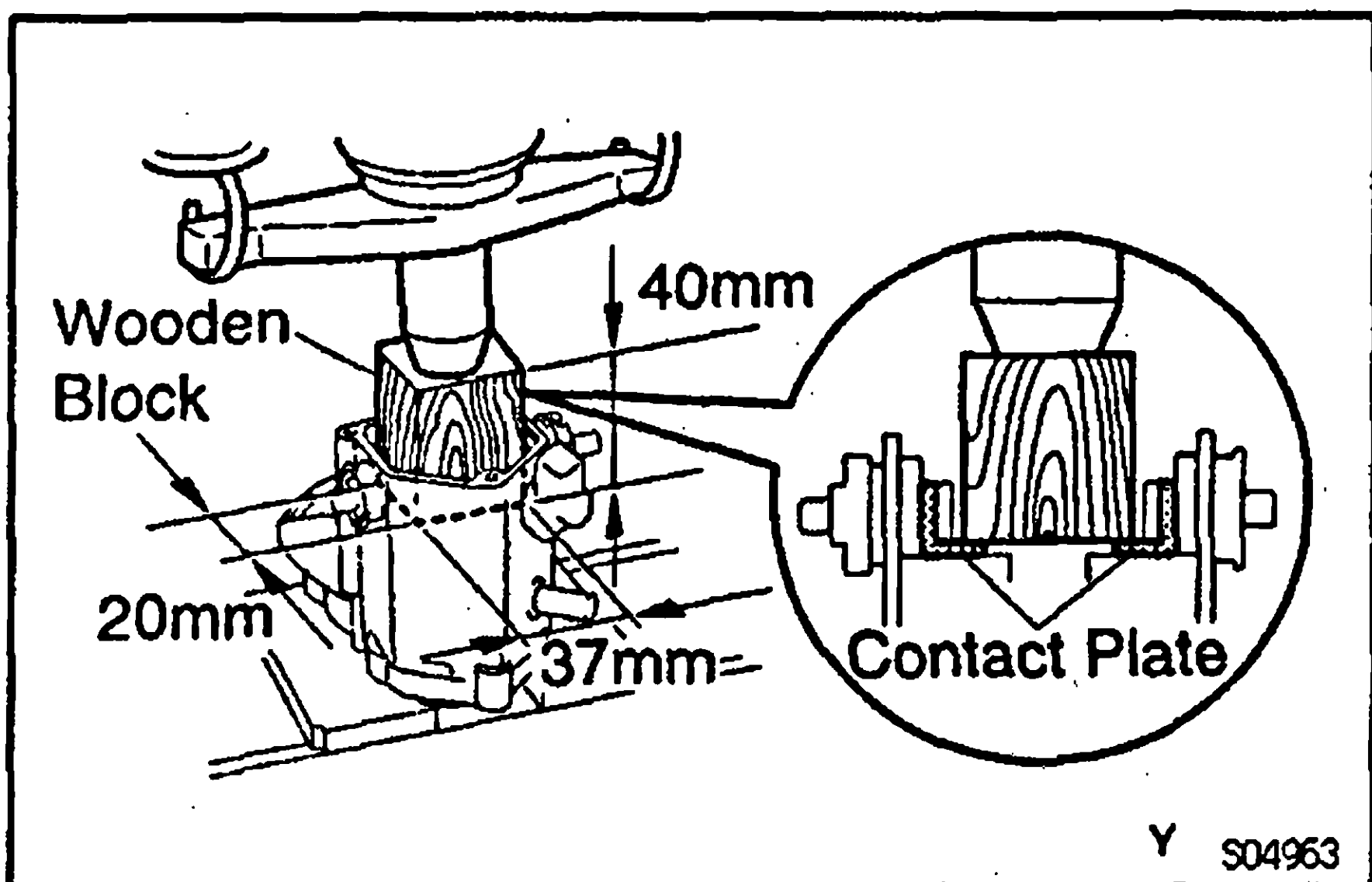
$$(\text{psi}) = \frac{221 \text{ lbf}}{\left(\frac{\text{Ram diameter (in.)}}{2} \right)^2 \times 3.14 (\pi)}$$

$$(\text{kPa}) = (\text{kgf/cm}^2) \times 98.1$$

$$(\text{kPa}) = (\text{psi}) \times 6.9$$

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.



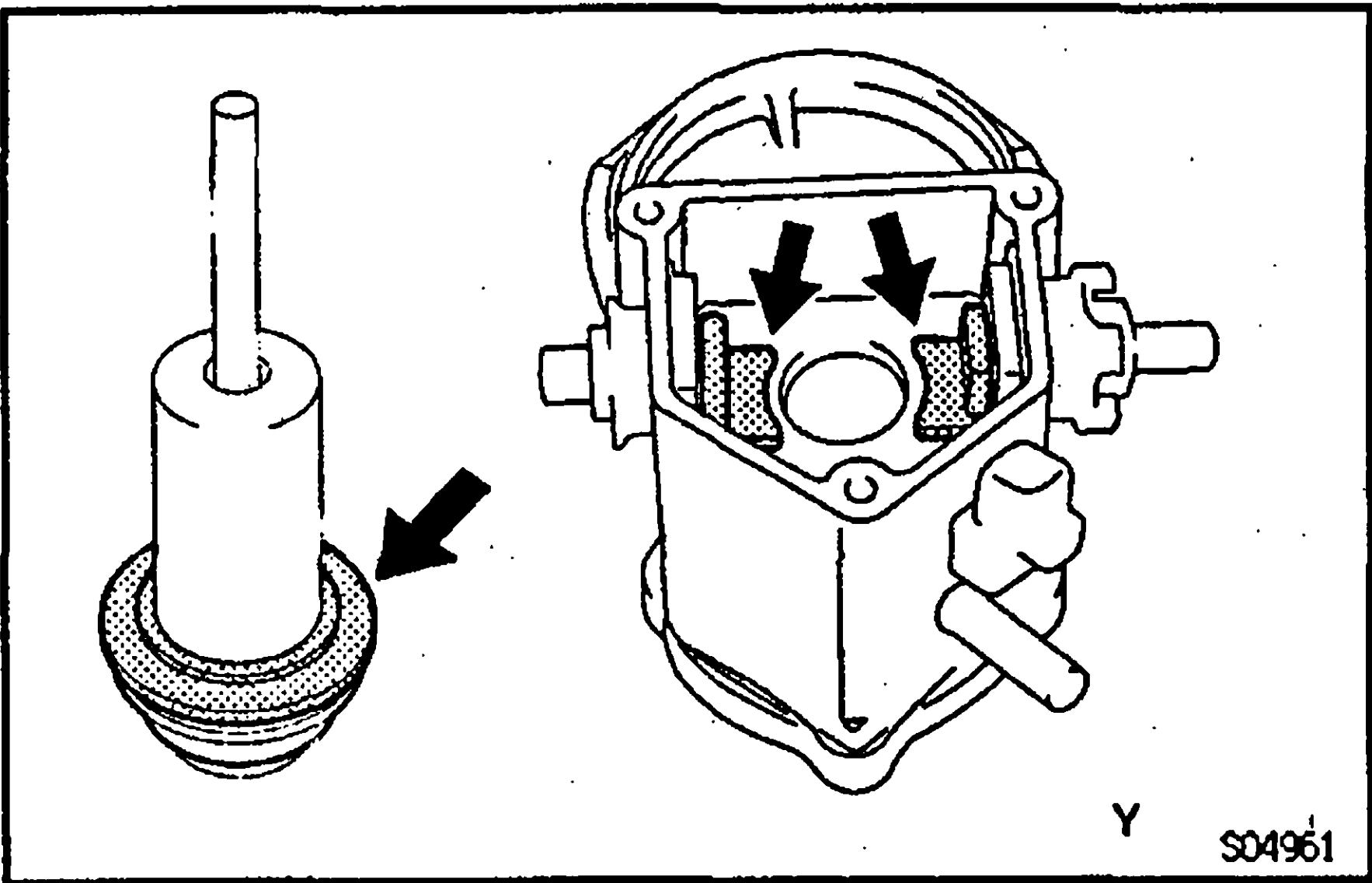
- (b) Using SST, tighten the nuts to the specified torque. SST 09810-38140

Torque:

Terminal C and Terminal 30

30 N·m (305 kgf·cm, 22 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 with the 3 bolts.

Torque: 3.6 N·m (37 kgf·cm, 32 in·lbf)

SERVICE SPECIFICATIONS

SERVICE DATA

ST01B-18

Starter	Rated voltage and output power			12 V 2.5 kW, 24 V 4.5 kW
	No-load characteristics	Current	12 V type	180 A or less at 11.0 V
			24 V type	90 A or less at 23.0 V
	Brush length		rpm	3,500 rpm or more
			STD	20.5 — 21.0 mm (0.807 — 0.827 in.)
			Minimum	11.0 mm (0.433 in.)
	Spring installed load	34.3 — 42.1 N (3.5 — 4.3 kgf, 7.7 — 9.5 lbf)		
	Commutator		STD	36.0 mm (1.417 in.)
			Minimum	35.0 mm (1.378 in.)
	Undercut depth		STD	0.7 — 0.9 mm (0.028 — 0.035 in.)
			Minimum	0.2 mm (0.008 in.)
	Circle runout	Maximum	0.05 mm (0.0020 in.)	
Magnetic switch				
Contact plate for wear			Maximum	1.6 mm (0.0063 in.)

ST01G-18

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
End cover x Starter housing	9.3	95	82 in·lbf
Lead wire x Terminal 50	3.6	27	32 in·lbf
Lead wire x Terminal C	24	240	18
Terminal Bolt x Terminal C . Terminal 30	30	305	22
End cover x Magnetic housing	3.6	37	32 in·lbf

CHARGING

SERVICE SPECIFICATIONS..... CH- 2

CH

SERVICE SPECIFICATIONS
SERVICE DATA

CH01B-1C

Battery	Specific gravity	
	at 20°C (68°F) 105D31L and 105D31R	1.27 — 1.29
	Others	1.25 — 1.27
Alternator	Rated output	12 V 100 A
	Rotor coil resistance	2.7 — 3.1 Ω
	Slip ring diameter	14.2 mm — 14.4 mm (0.559 — 0.567 in.)
	Minimum	12.8 mm (0.504 in.)
	Brush exposed length	10.5 mm (0.413 in.)
	Minimum	1.5 mm (0.059 in.)
IC Regulator	Regulating voltage	at 25°C (77°F)
		at 115°C (239°F)
		14.0 — 15.1 V
		13.5 — 14.3 V

CH01D-11

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
Bearing Cover x Drive end frame	3.1	31	27 in·lbf
Rectifier end frame x Drive end frame	4.5	46	40 in·lbf
Alternator pulley x Rotor	110.5	1,125	81
Rectifier holder x Coil lead on rectifier end frame	2.9	30	25 in·lbf
Voltage regulator x Rectifier end flame	2.0	20	17 in·lbf
Voltage regulator x Rectifier holder	2.0	20	17 in·lbf
Brush holder x Rectifier holder	2.0	20	17 in·lbf
Brush holder x Voltage regulator	2.0	20	17 in·lbf
Plate terminal x Rectifier holder	3.8	39	34 in·lbf
Rear end cover x Rectifier holder	4.4	45	39 in·lbf
Terminal insulator x Rectifier holder	6.5	67	58 in·lbf