

# DAIHATSU

# L500, L501

**EM**

ED-10, ED-20, EF-EL

## ENGINE MECHANICALS

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## ABBREVIATION CODES

The abbreviation codes that appear in this service manual stand for the following, respectively.

Ay	Assembly
API	American Petroleum Institute
BDC	Bottom Dead Center
BTDC	Before Top Dead Center
BVSV	Bimetal Vacuum Switching Valve
CW	Choke warning
C/O	Choke opener
CB	Chock Braker
ECU	Electronic Control Unit
EFI	Electronic Fuel Injection
EX	Exhaust (Manifold, Valve)
EVAP	Fuel evaporative emission control
FL	Fusible Link
HIC	Hot Idle Compensator
IN	Intake (Manifold, Valve)
ITC	Intake air Temperature Compensating valve
ISO	International Organization for Standardization
LH	Left Hand side
LHD, L.H.D	Left Hand Drive
LLC	Long Life Coolant
L/	Less
MP	Multipurpose
M/T, MT	Manual Transmission
O/S	Over Size
PCV	Positive Crankcase Ventilation
PVSV	Pressure Vacuum Switching Valve
RH	Right Hand side
RHD, R.H.D	Right Hand Drive
SST	Special Service Tool
STD	Standard
SD	Spark delay
S/A	Sub-Assembly
SAE	Society Automotive Engineers
TDC	Top Dead Center
TP	Throttle positioner
TWC	Three-way catalyst
T	Torque
TVSV	Thermostatic vacuum switching valve
U/S	Under size
VSV	Vacuum Switching Valve
VTV	Vacuum Transmitting Valve
W/	With
W/O	without

## ENGINE SPECIFICATIONS

Engine type		ED-10	ED-20	EF-EL				
Displacement		847		659				
Specification		General	ECE & EEC	Aus & Hong Kong				
The engine proper	Kind		Gasoline, 4-cycle					
	Mounting location		Front					
	Number of cylinders and arrangement		3 cylinder-in-line, mounted transversely					
	Combustion chamber type		Multi-sphere type					
	Valve mechanism cylinder liner type		Belt driven, overhead camshaft integral with cylinder block					
	Bore x stroke		66.6 x 81.0	68.0 x 60.5				
	Compression ratio		9.5 ± 0.3		9.8 ± 0.3			
	Compression pressure		1471 - 300 (15.0 - 300)		1412 - 400 (14.4 - 400)			
	Maximum output	DIN	ps/rpm kw/rpm	40.8/5500 30/5500	43.5/5600 32/5600	42.1/6800 31/6800		
	Maximum torque	DIN	kg-m/rpm Nm/rpm	6.6/3200 65/3200	6.8/3800 67/3800	5.2/4000 51/4000		
	Engine dimensions (Length x width x height)		mm	562 x 458 x 654	567 x 457 x 651	567 x 457 x 635		
	Service engine weight		kg	70	72			
	Number of piston rings	Compression ring		2				
		Oil ring		1				
	Valve timing	Intake		Open Close	B.T.D.C. 8° A.B.D.C. 44°		B.T.D.C. 10° A.B.D.C. 34°	
		Exhaust		Open Close	B.B.D.C. 41° A.T.D.C. 17°		B.B.D.C. 38° A.T.D.C. 6°	
Valve clearance (Hot)		mm	Intake	0.25		Exhaust	0.30	0.35
Idle speed		rpm	900 $\begin{smallmatrix} +100 \\ -50 \end{smallmatrix}$	900 ±50	800 ±50			
Blow-by gas recirculating system		Closed type						
Lubricating system	Lubricating method		Fully-forced method					
	Oil pump type		Trochoid type					
	Oil filter type		Fully-flow filter type, filter paper type					
	Lubrication capacity	Whole		2.6				
		When only oil is changed		2.2 (Low level: 1.4)				
When oil and oil filter are changed		2.48						
Recommended oil		(SE or higher)	10W - 30	5W - 30				
Cooling system	Cooling method		Water cooled, electromotor type					
	Radiator type		Corrugation type, forced circulation					
	Coolant capacity (including 0.6 liter for reserve tank)		dm3	3.4	M/T : 3.4 A/T : 3.3	M/T : 3.3 A/T : 3.5		
	Water pump type		Centrifugal type, V belt-driven					
	Thermostat type		Wax pellet type, bottom by-pass type					

# EM-4

Air cleaner	Type		Filter unwoven fabric type				
	Number		1				
Fuel system	Fuel tank	Capacity	32				
		Location	Mounted underneath rear seat floor				
	Fuel pipe material		Steel tube and rubber tube				
	Fuel pump type		Mecanical	Electric motor, in-tank type			
	Fuel filter type		Paper filter type				
	Carburetor	Type		Down-draft, 1 barrel			
Throttle bore diameter		mm	32				
Venturi diameter		mm	26				
Choke valve type		Manual type butterfly-shaped valve					
Engine Electrical system	Voltage		12 (Negative ground)				
	Type		Battery ignition type				
	Ignition timing B.T.D.C degree/rpm		$5^{\circ} \pm 2^{\circ} / 900 \begin{smallmatrix} +100 \\ -50 \end{smallmatrix}$	$5^{\circ} \pm 2^{\circ} / 900$	$5^{\circ} \pm 2^{\circ} / 800$		
	Firing order		1-2-3				
	Ignition system	Distributor type		Full-transistorized type	ESA		
		Spark plug type and gap mm	NIPPONDEN SO	W20EXR-U 0.7 - 0.8	W20EXR-U11 1.0 - 1.1	QL22TR-S 0.9 - 1.0	
			N.G.K	BPR6EY 0.8 - 0.9	BPR6EY-11 BPR6ES-11 1.1 - 1.2	BCPR7EKD 0.9 - 1.0	
			Bosch	WR7DC 0.8 - 0.9	WR7DCX 1.0 - 1.1		
			Champion	RN7YC 0.7 - 0.8	RN7YC4 1.0 - 1.1		
			Thread	M14 x 1.25			

LEM00003-00000

## **ENGINE TUNE-UP**

### **COOLANT**

1. Coolant level : (Refer to page MA-5 of the MA Engine section.)
2. Coolant leakage : (Refer to page MA-6 of the MA Engine section.)
3. Coolant change : (Refer to page MA-44 of the MA Engine section.)

### **RADIATOR CAP**

Function of radiator cap : (Refer to page MA-5 of the MA Engine section.)

### **DRIVE BELT (V-BELT)**

1. Visually check the drive belt for crack and damage. : (Refer to page MA-9 of the MA Engine section.)
2. Inspect and adjust the drive belt tension. : (Refer to page MA-9 of the MA Engine section.)

### **ENGINE OIL**

1. Engine oil level : (Refer to page MA-26 of the MA Engine section.)
2. Engine oil leakage : (Refer to page MA-26 of the MA Engine section.)
3. Engine oil change : (Refer to page MA-27 of the MA Engine section.)

### **AIR FILTER ELEMENT**

1. Cleaning of air filter element : (Refer to page MA-10 of the MA Engine section.)
2. Replacement of the air filter element : (Refer to page MA-10 of the MA Engine section.)

### **DISTRIBUTOR**

1. Check of the distributor cap and rotor : (Refer to page MA-31 of the MA Engine section.)
2. Check of the vacuum advancer : (Refer to page MA-15 of the MA Engine section.)

### **RESISTIVE CORDS**

Visually inspect the resistive cords for loose connection, deterioration, cracks or other damage.  
Securely connect or replace the parts, as required.

### **SPARK PLUGS**

Visually inspect the spark plugs for electrode wear, thread or insulator damage. Inspect the electrode gap. : (Refer to page MA-29 of the MA Engine section.)

### **VALVE CLEARANCES**

Inspection and adjustment of valve clearances : (Refer to page MA-32 of the MA Engine section.)

### **IGNITION TIMING**

Inspection of ignition timing : (Refer to page MA-38 of the MA Engine section.)

### **BATTERY**

Inspection of the battery : (Refer to page MA-7 of the MA Engine section.)



## IDLE SPEED [ED-10 Engine]

Adjustment of idle speed : (Refer to page MA-41 of the MA Engine section.)

## IDLE CO/HC CONCENTRATIONS [ED-10 Engine]

Adjustment of idle CO/HC concentrations : (Refer to page MA-42 of the MA Engine section.)

## CHARCOAL CANISTER

Inspection of charcoal canister : (Refer to page MA-13 of the MA Engine section.)

## FUEL LINE & CONNECTION

Inspection of fuel line and connection :  
(Refer to page MA-23 of the MA Chassis section and page MA-12 of the MA Engine section.)

## EXHAUST PIPE

Inspection of exhaust pipe and mountings : (Refer to page MA-27 of the MA Chassis section.)

LEM00005-00000

## FAST IDLE SPEED ADJUSTMENT [ED-10 Engine]

### NOTE:

- Do not perform the engine fast idle speed adjustment while the fan motor is functioning.
- The adjustment should be performed in the shortest time.

Preparation to be made prior to fast idle adjustment

- Warm up the engine thoroughly. (Continue engine warming-up for another 10 minutes after the cooling fan motor has started its operation.)
- Ensure that all accessory switches are turned OFF.
- Ensure that the air cleaner element is installed.
- Ensure that all vacuum hoses are connected.
- Ensure that the intake system exhibits no air leakage.
- Ensure that the exhaust system exhibits no air leakage.
- Ensure that the gear shift lever is placed in the neutral range.
- Apply the parking brake fully.
- Ensure that the accelerator cable is adjusted properly.
- Ensure that the choke cable is adjusted properly.
- Ensure that the choke knob has been returned to its original position completely.

LEM00006-00000

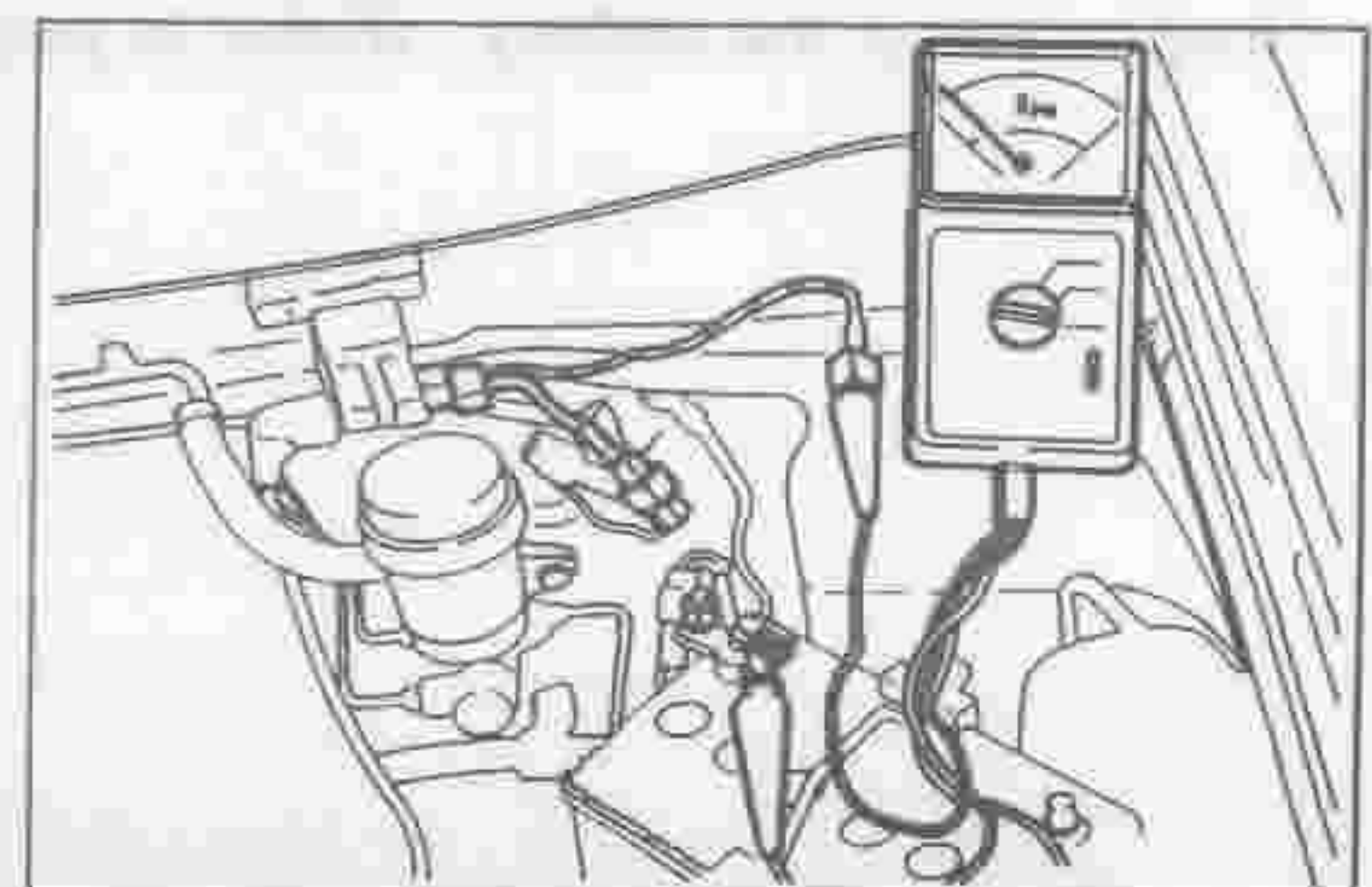
### 1. Connection of tachometer

Connect the measuring terminal of a tachometer to the engine.

#### NOTE:

- If your tachometer is of such a type as to be connected to the negative terminal of the ignition coil, connect the following SST to the ignition coil connector. Then, connect the measuring terminal of the tachometer to the SST.

SST: 09991-87604-000



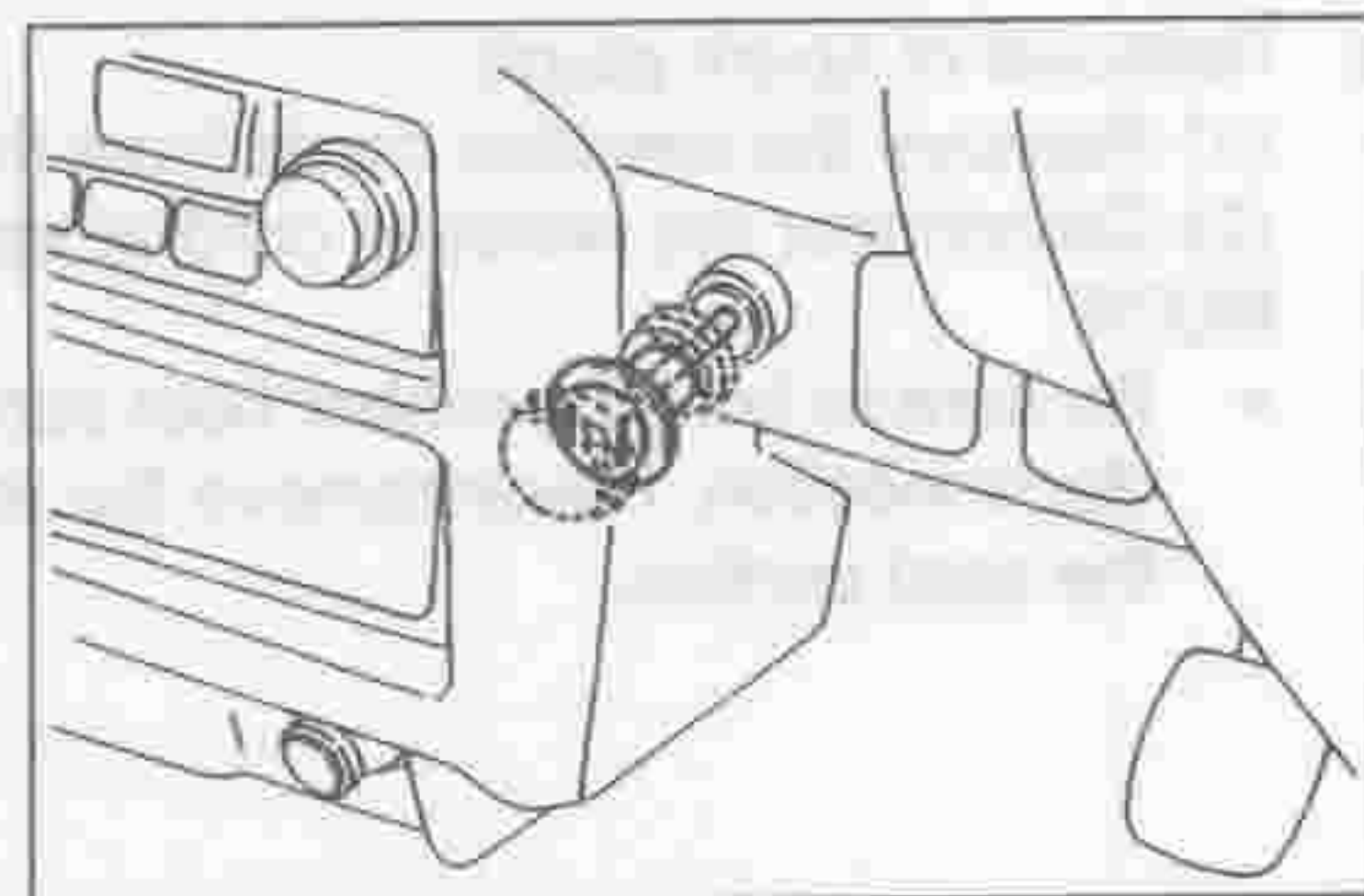
LEM00007-00001

**CAUTION:**

- Never allow the tachometer terminal to touch with the ground as it could result in damage to the ignition coil.
- As some tachometers are not compatible with this ignition system, it is imperative to confirm the compatibility of your tachometer before it is used.

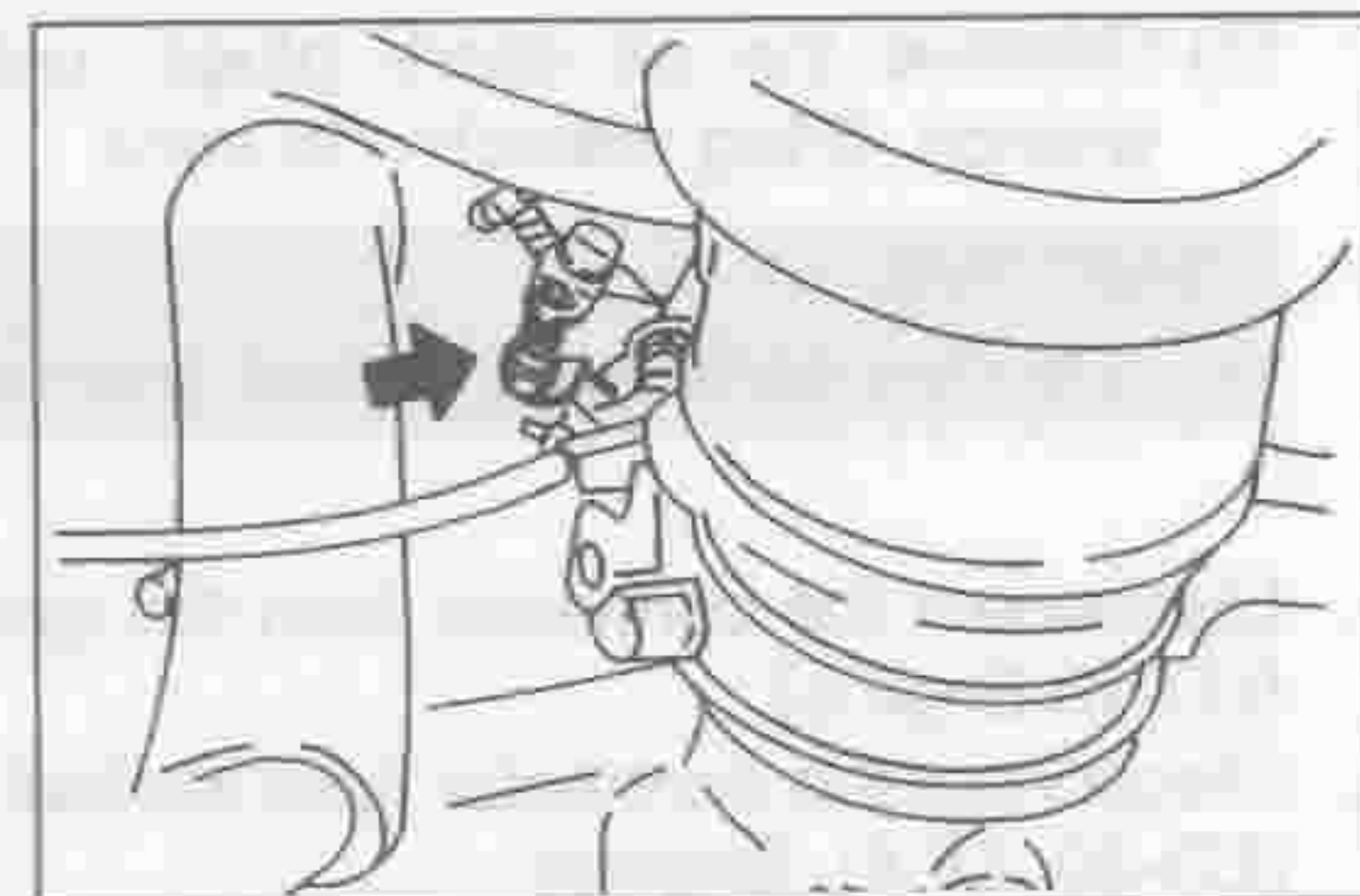
LEM00008-00000

2. Pull the choke button to the half position, (until you feel a positive strain).
3. Start the engine.
4. Ensure that the fast idle speed is the specified value.  
Specified Fast Idle Speed: 2600 rpm



LEM00009-00002

5. Adjustment of fast idle speed  
(As required)  
Turn the fast idle speed adjusting screw, until the engine runs at the specified rpm.



LEM00010-00003

6. Ensure that the engine revolution speed returns to the idle speed when the choke button is returned to its original position.
7. Remove the tachometer and SST (if so installed).

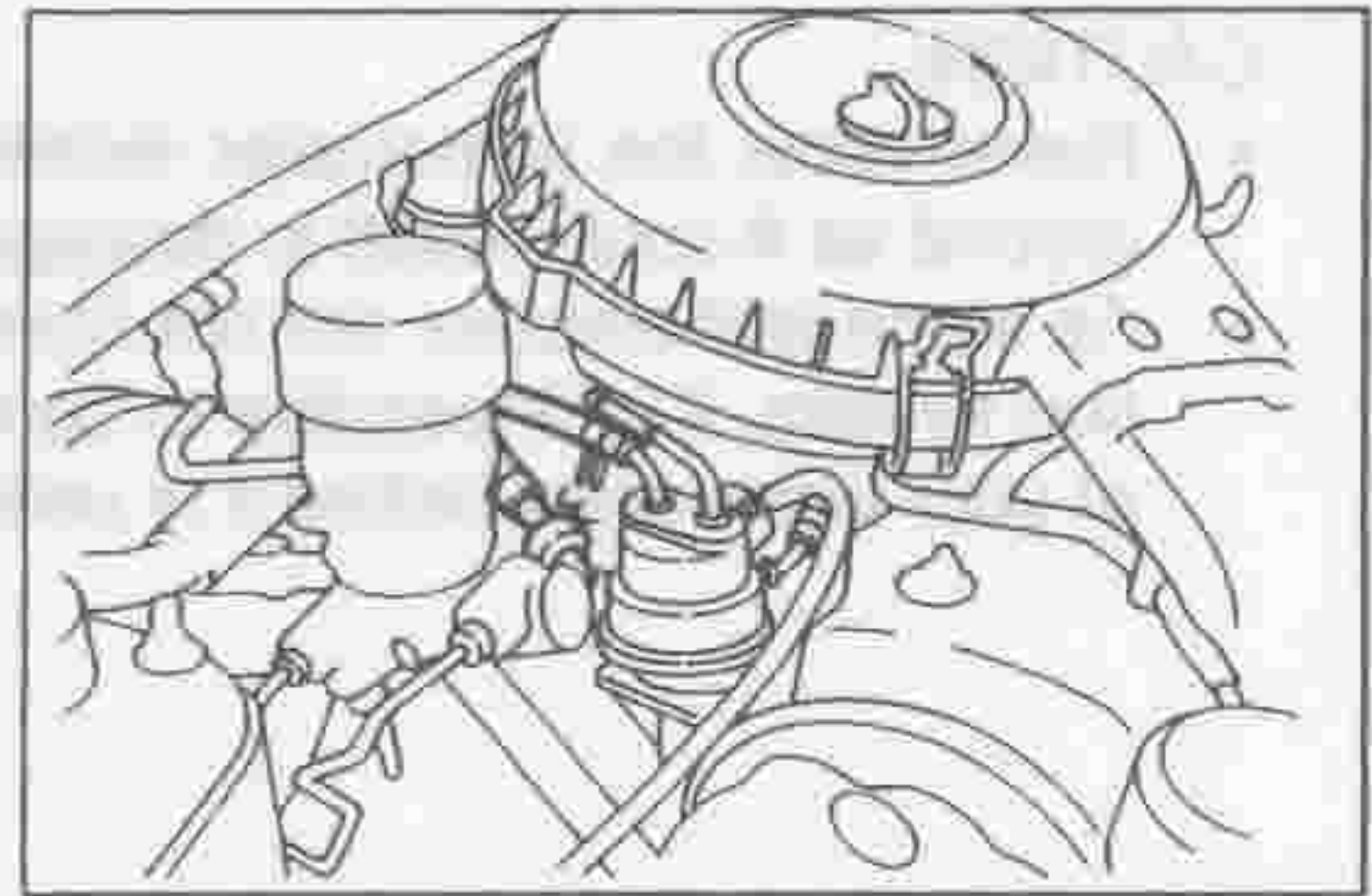
LEM00011-00000

**COMPRESSION CHECK****NOTE**

- After completion of the engine turn-up, if the engine exhibits lack of power, excessive oil consumption or poor fuel economy, measure the cylinder compression pressure.

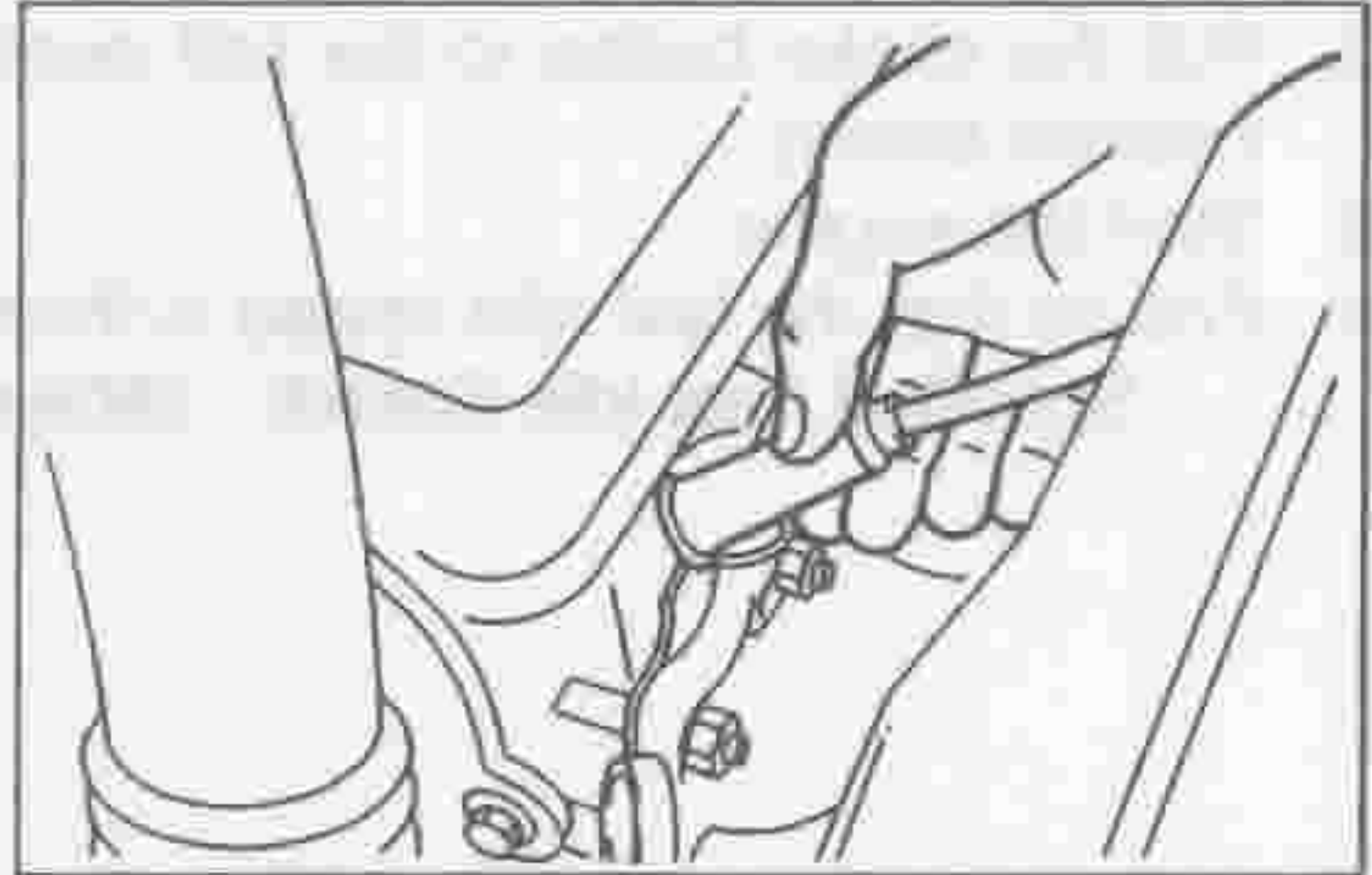
LEM00012-00000

1. Warm up the engine thoroughly.
2. Turn OFF the ignition key switch.
3. Release the fuel tank inner pressure by opening the fuel filler cap. Then, close the fuel filler cap. [ED-10 Engine]
4. Disconnect the fuel inlet hose from the fuel pump. Attach the plug to the disconnected hose. [ED-10 Engine]
5. Start the engine. Run the engine until it stalls. [ED-10 Engine]



LEM00013-00004

6. Removal of spark plugs
  - (1) Remove the resistive cords from the clamp.
  - (2) Disconnect the resistive cord at spark plug side.



LEM00014-00005

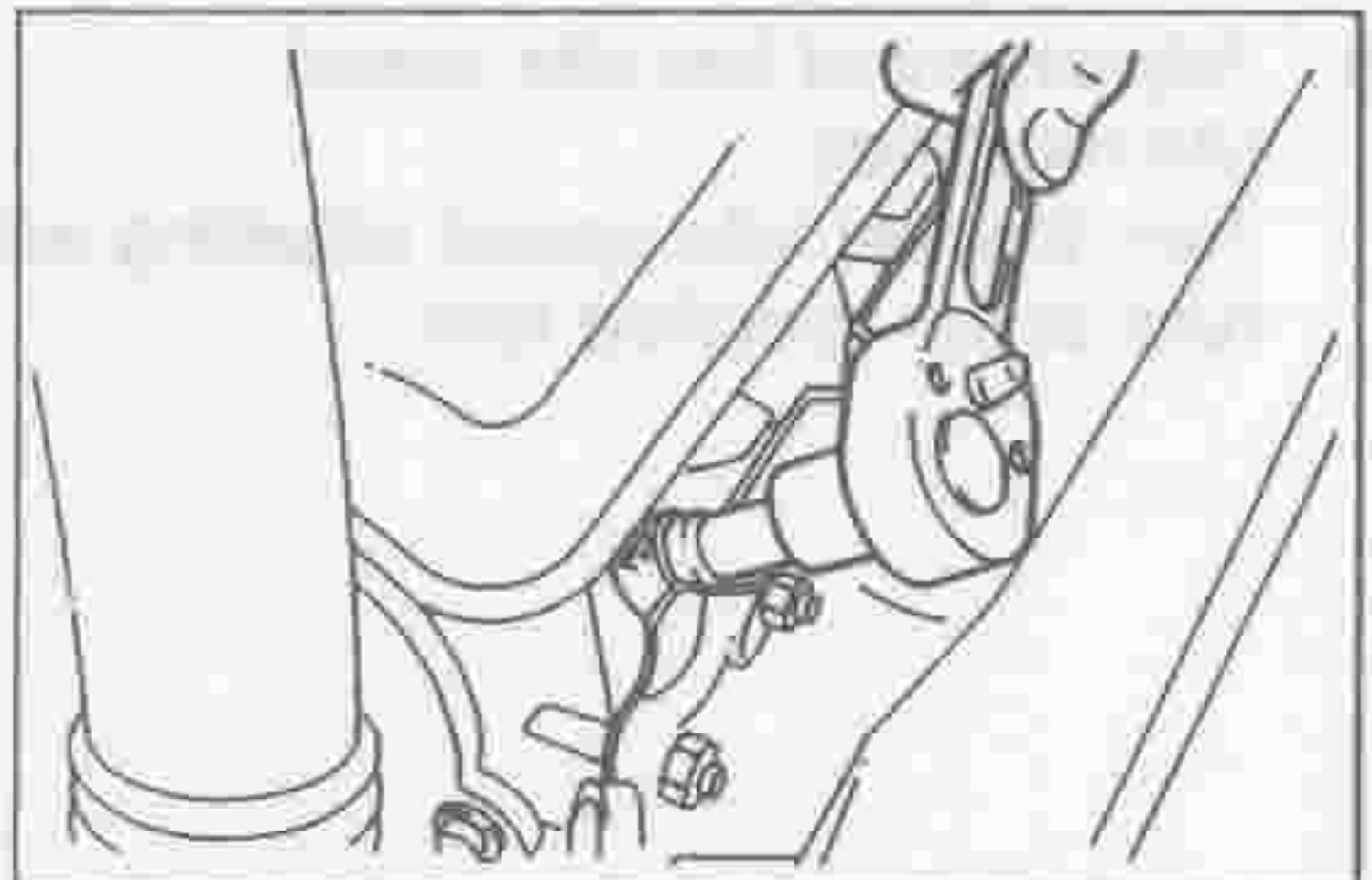
#### NOTE

- Be sure to hold the rubber boot during the resistive cord disconnection. Never remove the resistive cord, holding the cord portion.

- (3) Remove the all spark plugs, using the spark plug wrench. (Plug wrench : 16 mm)

#### WARNING:

- Be very careful not to burn yourself.

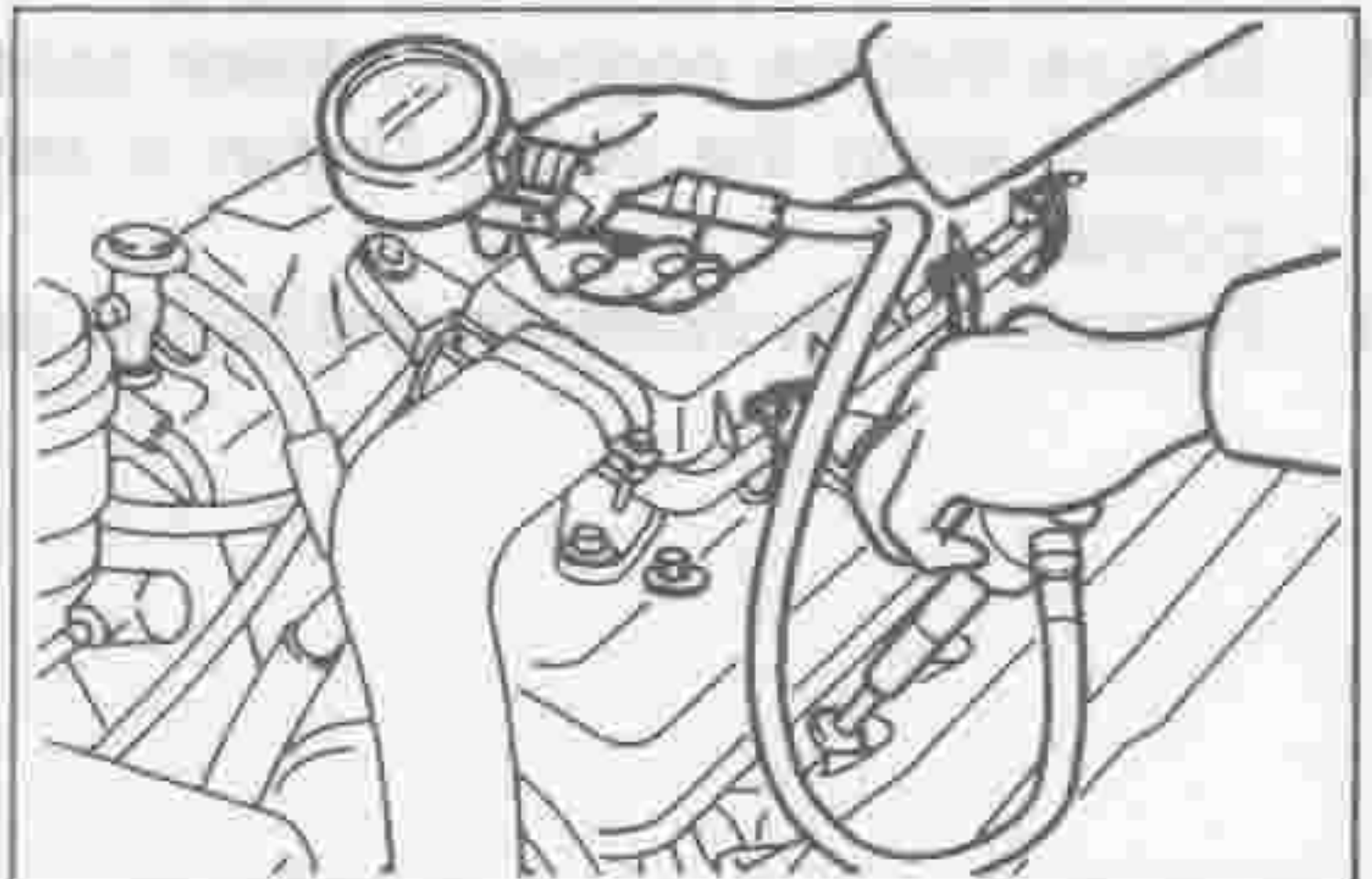


LEM00015-00006

7. Disconnect the connector from the ignition coil. [ED-10 Engine]
8. Disconnect the connector from the fuel pump control relay. [ED-20, EF-EL Engine]

9. Measurement of cylinder compression pressure
- #### NOTE:

- Make sure that the choke valve is fully opened. [ED-10 Engine]
- Perform the measurement in the shortest possible time.
- Crank the engine for the same duration for each cylinder.
- Always use a fully charged battery so that at least a revolution speed of 400 rpm is attained.



LEM00016-00007

- (1) Insert a compression gauge into the spark plug hole.
- (2) Depress the accelerator pedal fully.

- (3) While cranking the engine, measure the compression pressure.
- #### Compression Pressure:

- 1471kPa (15.0 kgf/cm<sup>2</sup>) at 300 rpm [ED-10,20 Engine]
- 1412kPa (14.4 kgf/cm<sup>2</sup>) at 400 rpm [EF-EL Engine]

#### Minimum Pressure:

- 1177kPa (12.0 kgf/cm<sup>2</sup>) at 300 rpm [ED-10,20 Engine]
- 1079kPa (11.0 kgf/cm<sup>2</sup>) at 400 rpm [EF-EL Engine]

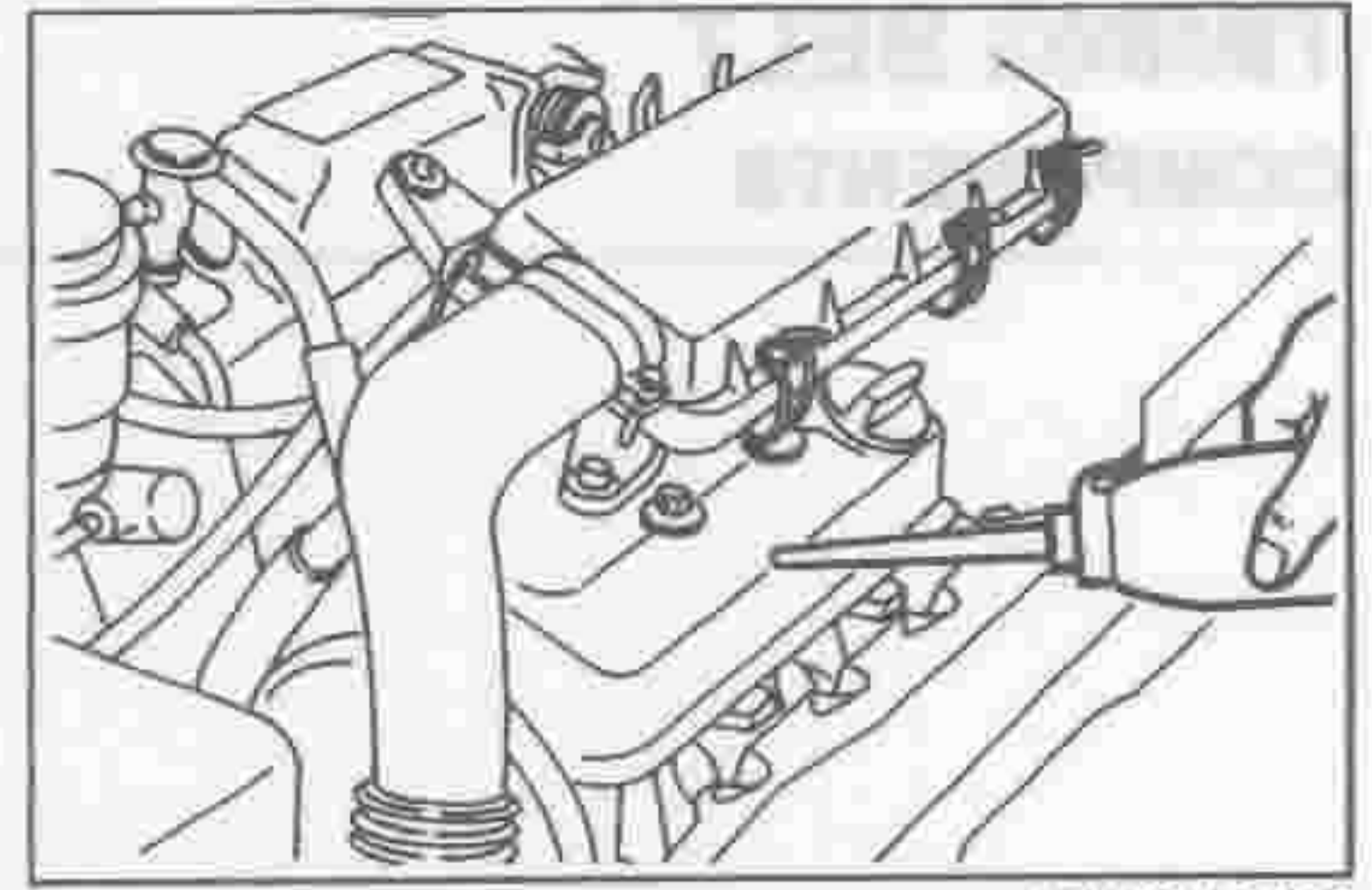
#### Difference Between Cylinders:

- 147kPa (1.5 kgf/cm<sup>2</sup>) at 300 rpm [ED-10,20 Engine]
- 147kPa (1.5 kgf/cm<sup>2</sup>) at 400 rpm [EF-EL Engine]

LEM00017-00000

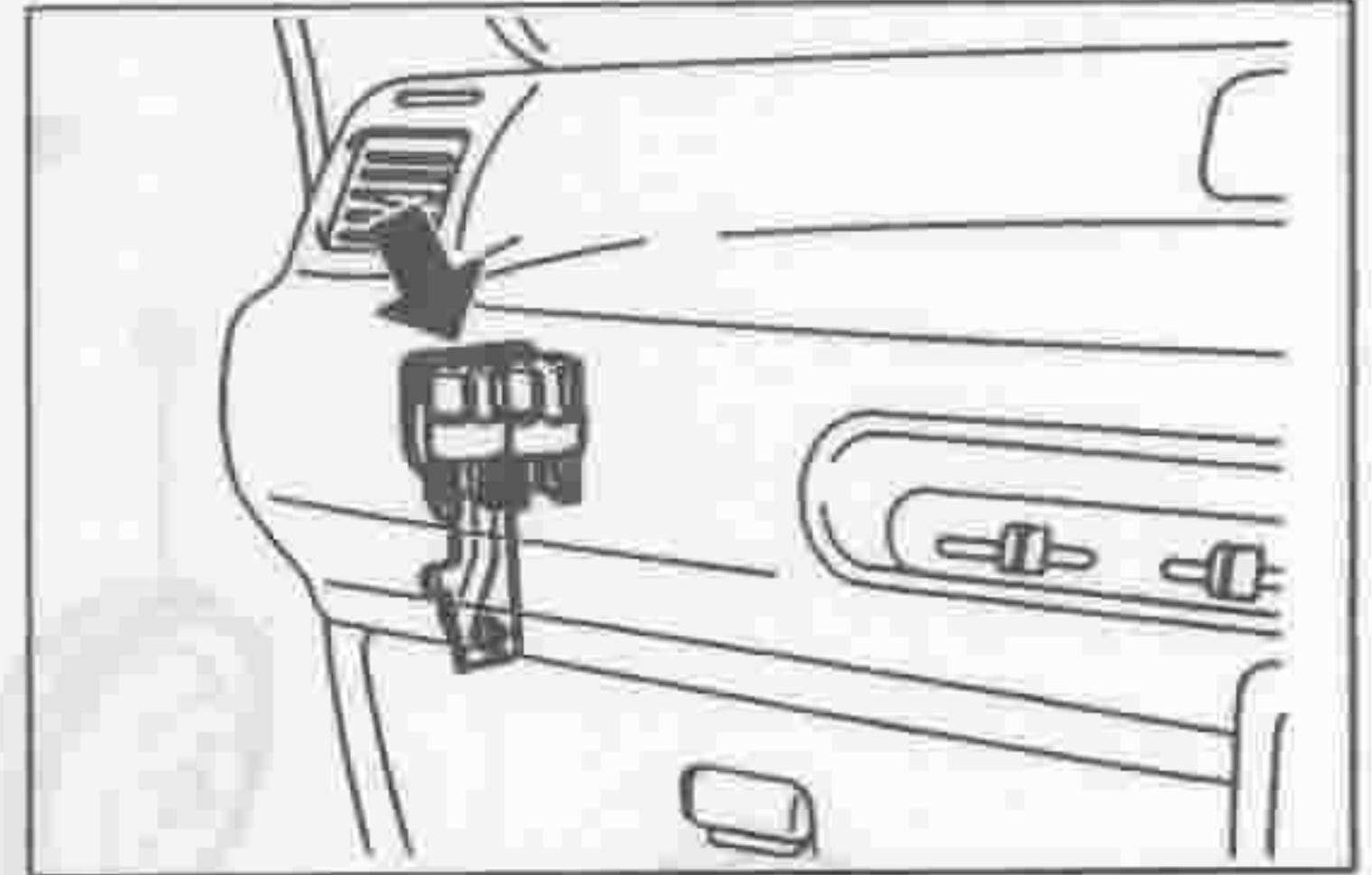


- (4) Repeat the steps (1) through (3) for each cylinder.
- (5) If the compression of one or more cylinders is low, pour a small amount of engine oil into that cylinder through the spark plug hole and repeat the steps (1) through (3) for the cylinder with low compression.
- If adding oil helps the compression to improve, chances are that the piston rings and/or cylinder bores are worn or damaged.
  - If the pressure remains low after the operation described in the step (5) has been performed, the valve may be sticking or seated improperly, or there may be leakage past the gasket.



LEM00018-00008

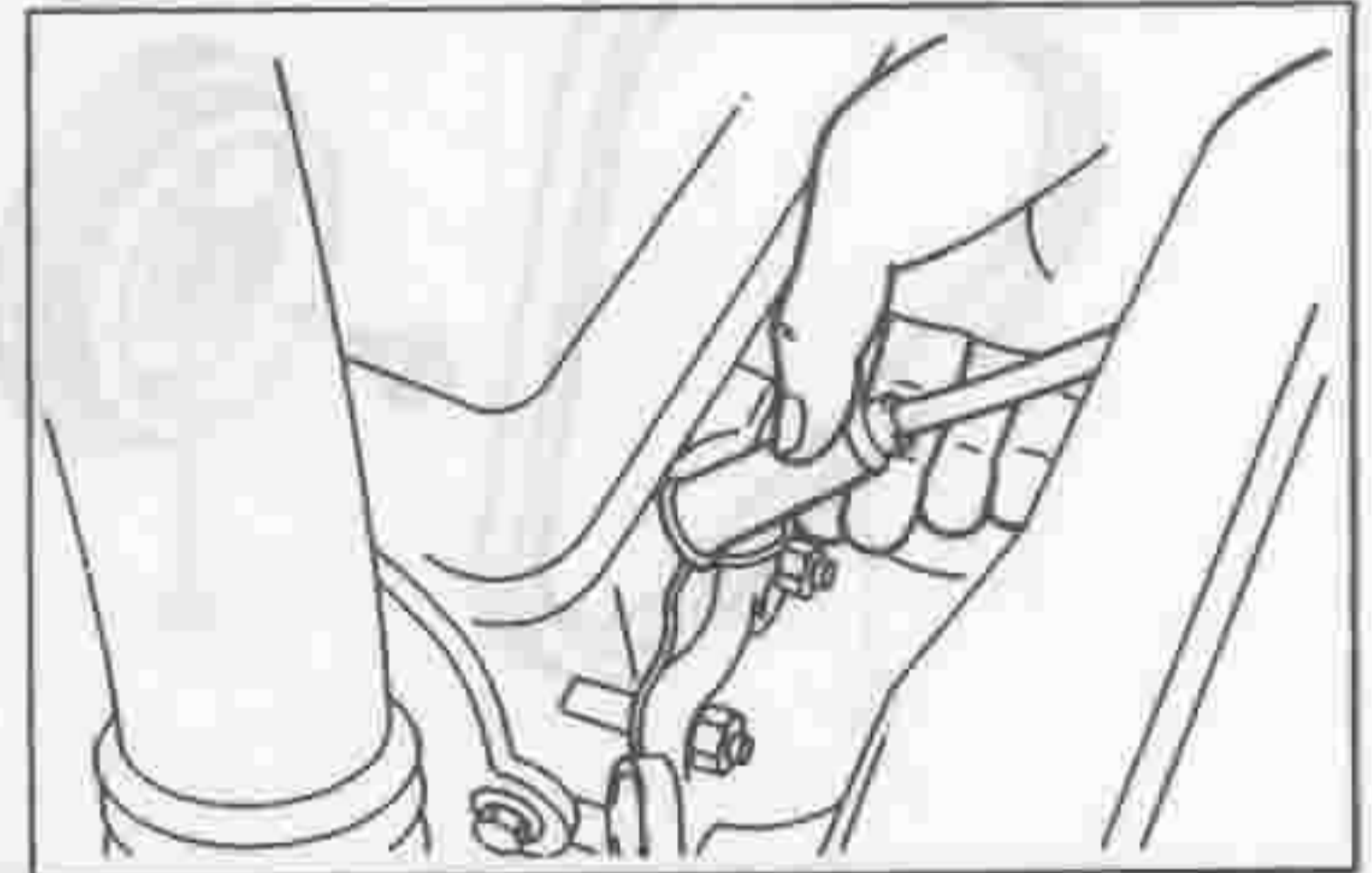
- (6) Connect the connector to the ignition coil.  
[ED-10 Engine]
- (7) Connect the connector to the fuel pump control relay.  
[ED-20, EF-EL Engine]
- (8) Install the spark plugs.  
Tightening Torque:  $17.7 \pm 2.9$  N·m  
( $1.80 \pm 0.30$  kgf·m)



LEM00019-00009

- (9) Connect the resistive cords to the spark plugs.  
NOTE:

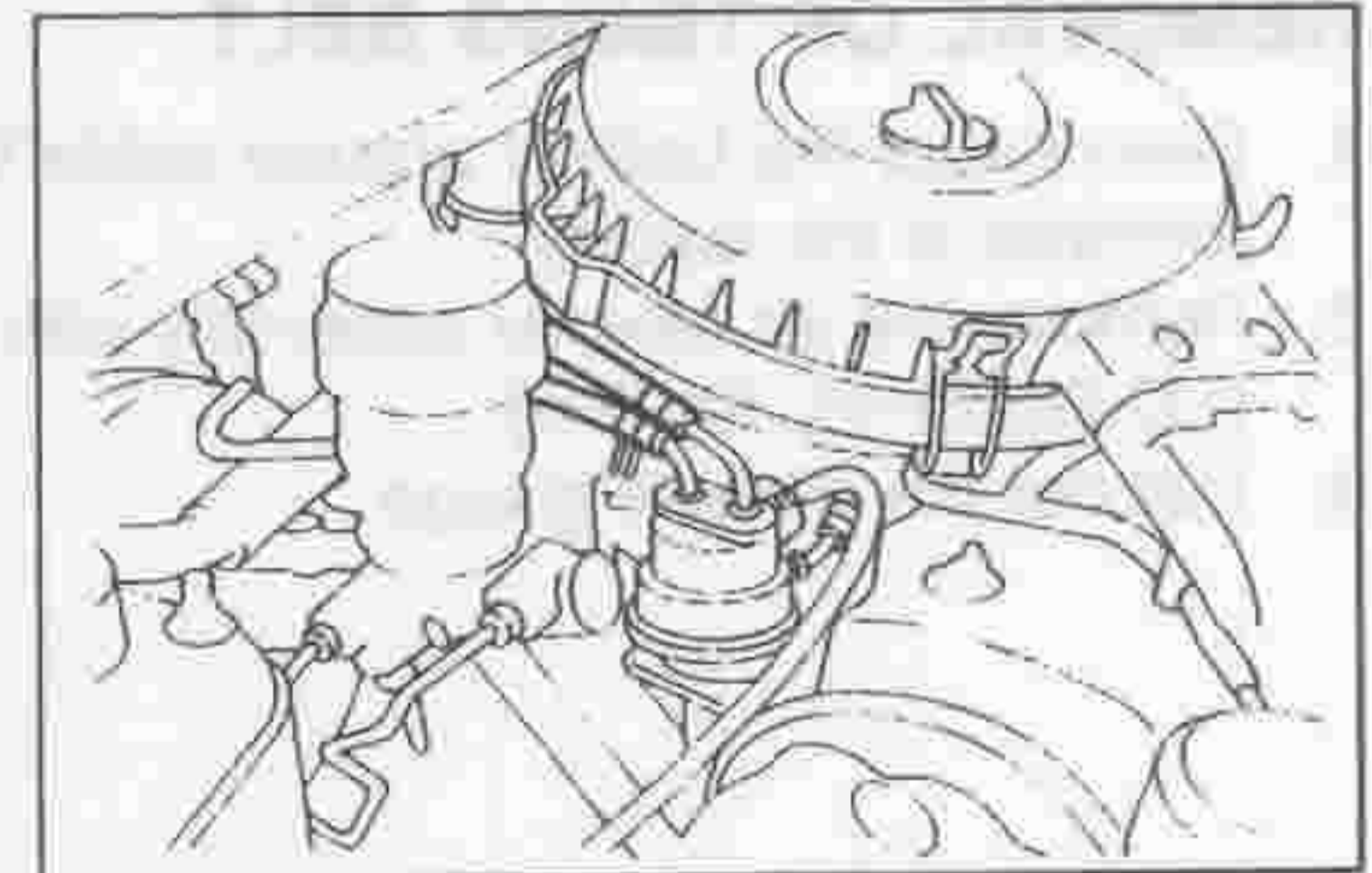
- Be sure that the resistive cord is connected securely to each spark plug.
- Care should be exercised not to damage the resistive cord with the spark plug tube.



LEM00020-00010

- (10) Attach the resistive cords to the clamp.

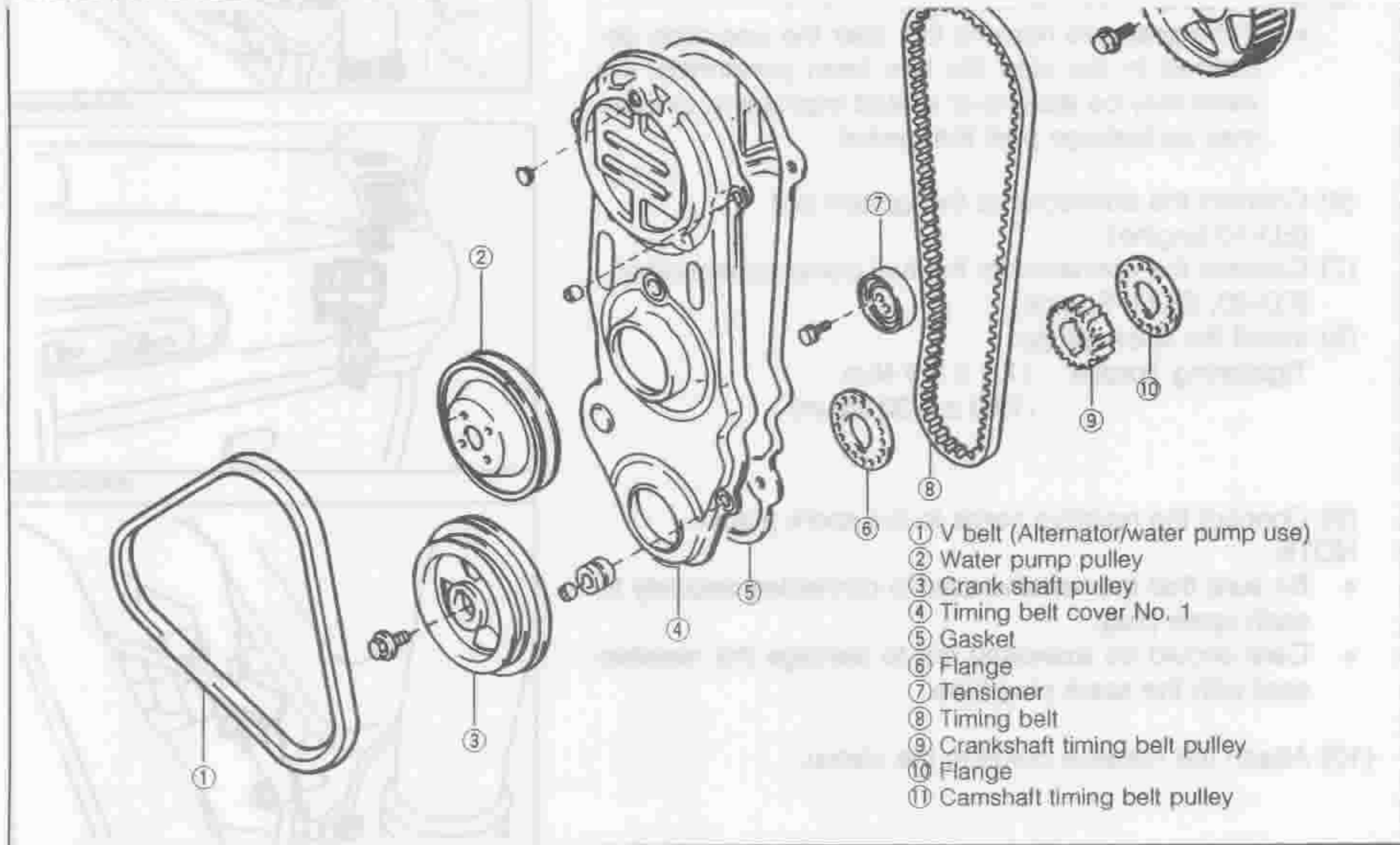
- (11) Connect the fuel inlet hose to the fuel pump.  
Install the new clamp. [ED-10 Engine]



LEM00021-00011

# EM-10

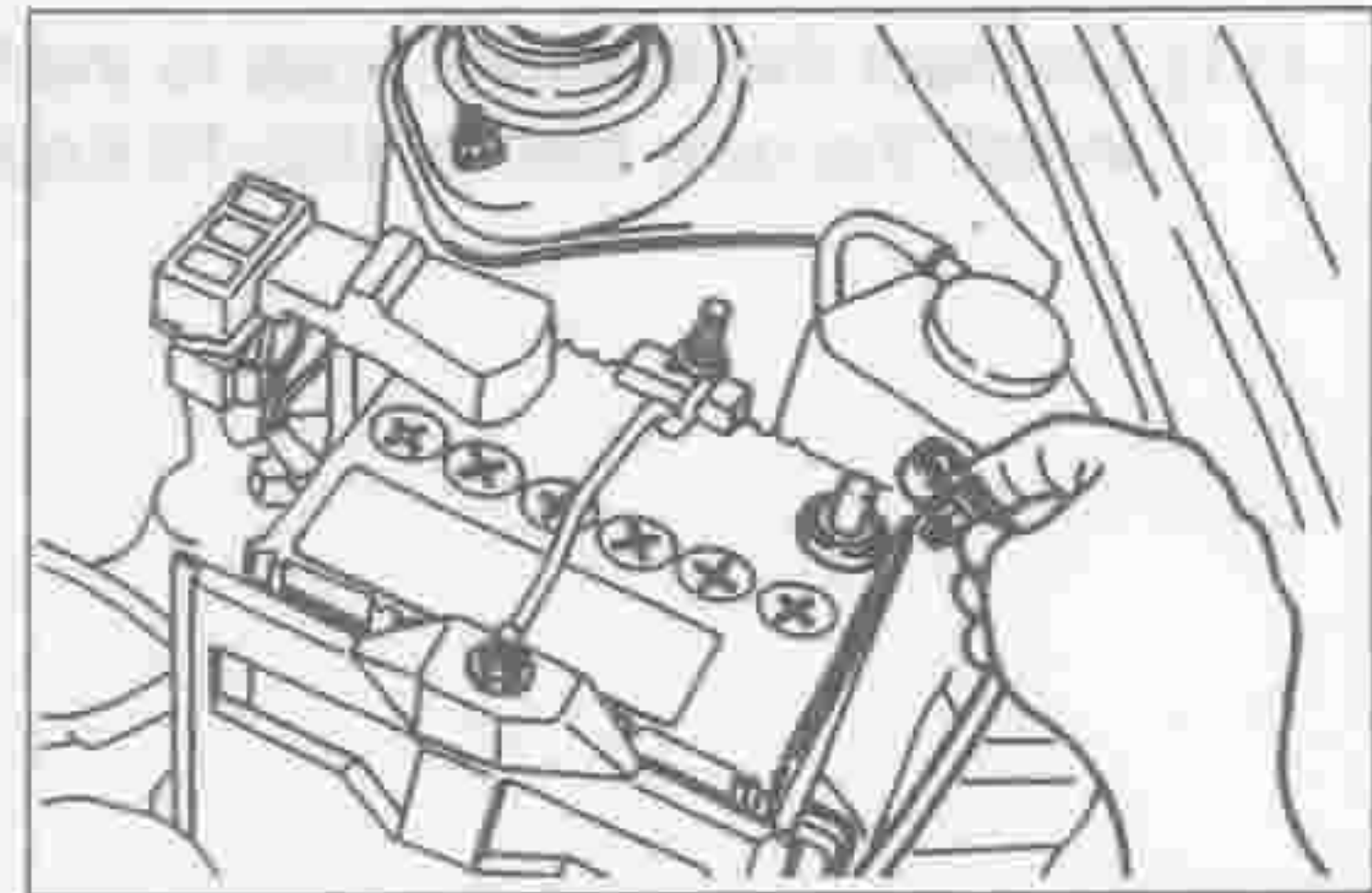
## TIMING BELT



LEM00022-00012

## REMOVAL OF TIMING BELT

1. Disconnect the battery ground cable from the negative (-) terminal of the battery.
2. Remove the air cleaner assembly with air intake duct.  
[ED-20, EF-EL Engine]
3. Pull out the oil level gauge.

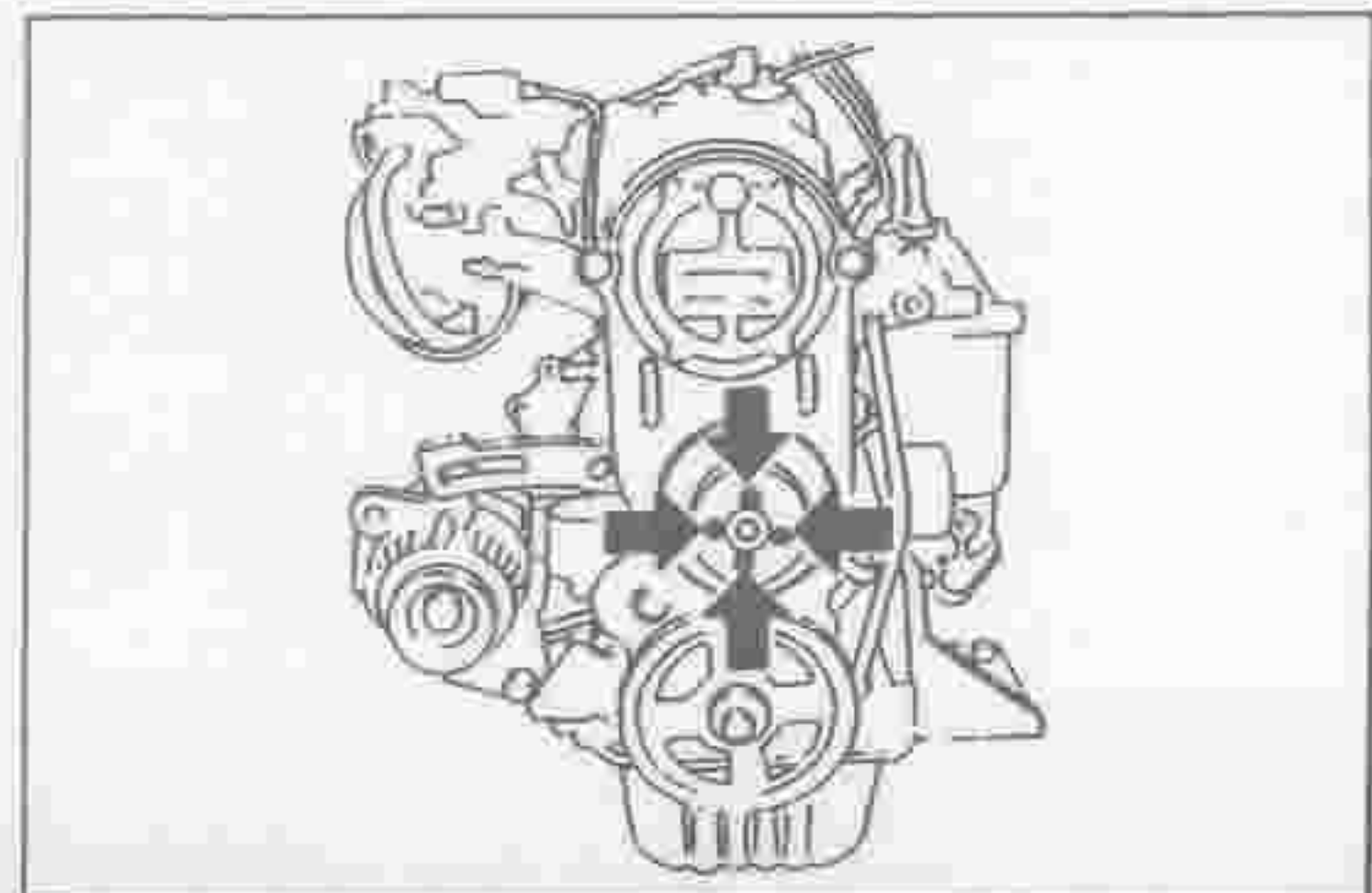


LEM00023-00013

4. Loosen the all attaching bolts of the water pump pulley, utilizing the tension of the drive belt.
5. Loosen the alternator attaching bolts.
6. Remove the alternator drive belt.

### NOTE:

- Be very careful not to allow any oil or dust to get to the belt.

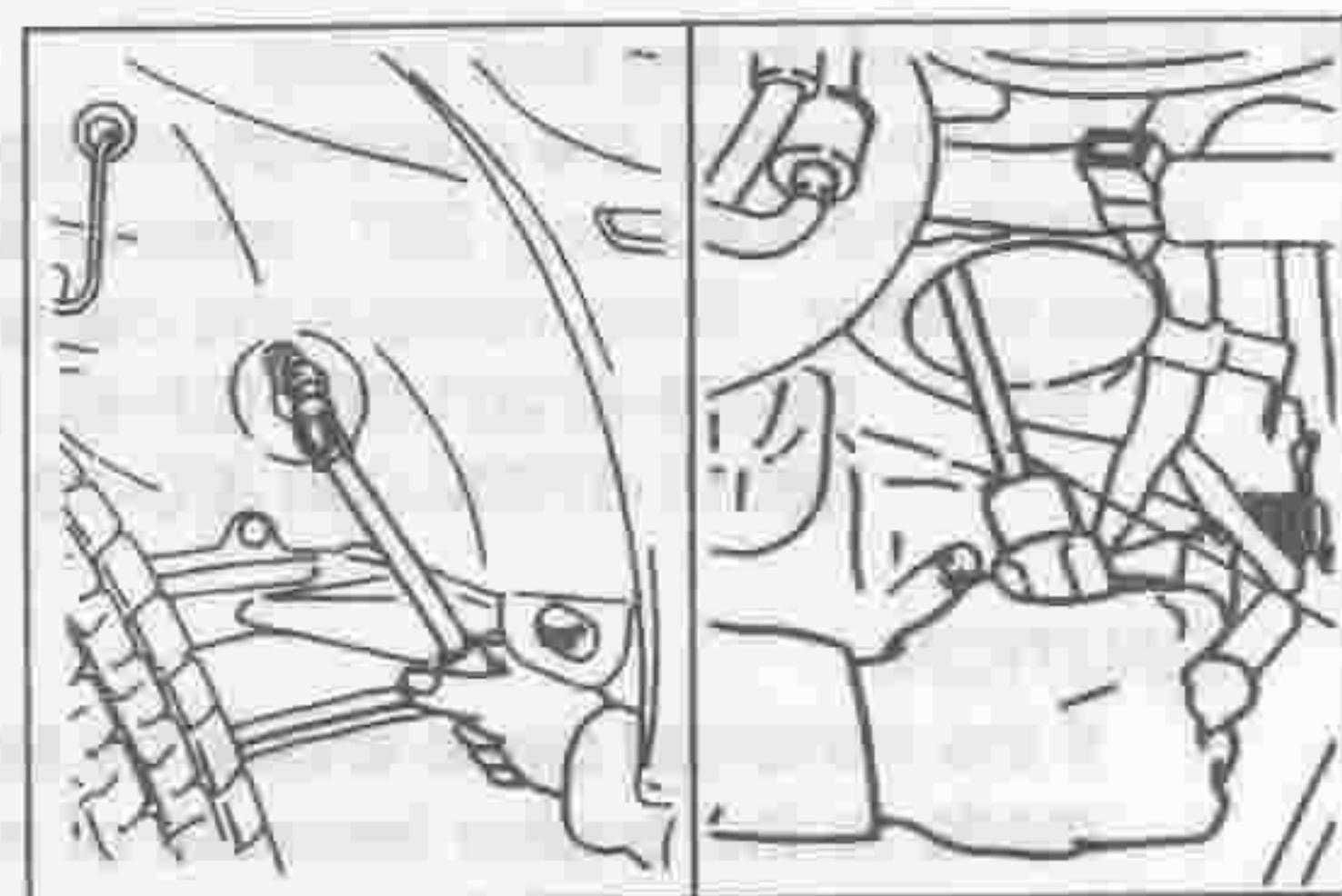


LEM00024-00014

7. Remove the water pump pulley.
8. Removal of crankshaft pulley
  - (1) Remove the starter assembly from the clutch housing.
  - (2) Remove the crankshaft pulley bolt while supporting the ring gear by using the screwdriver.

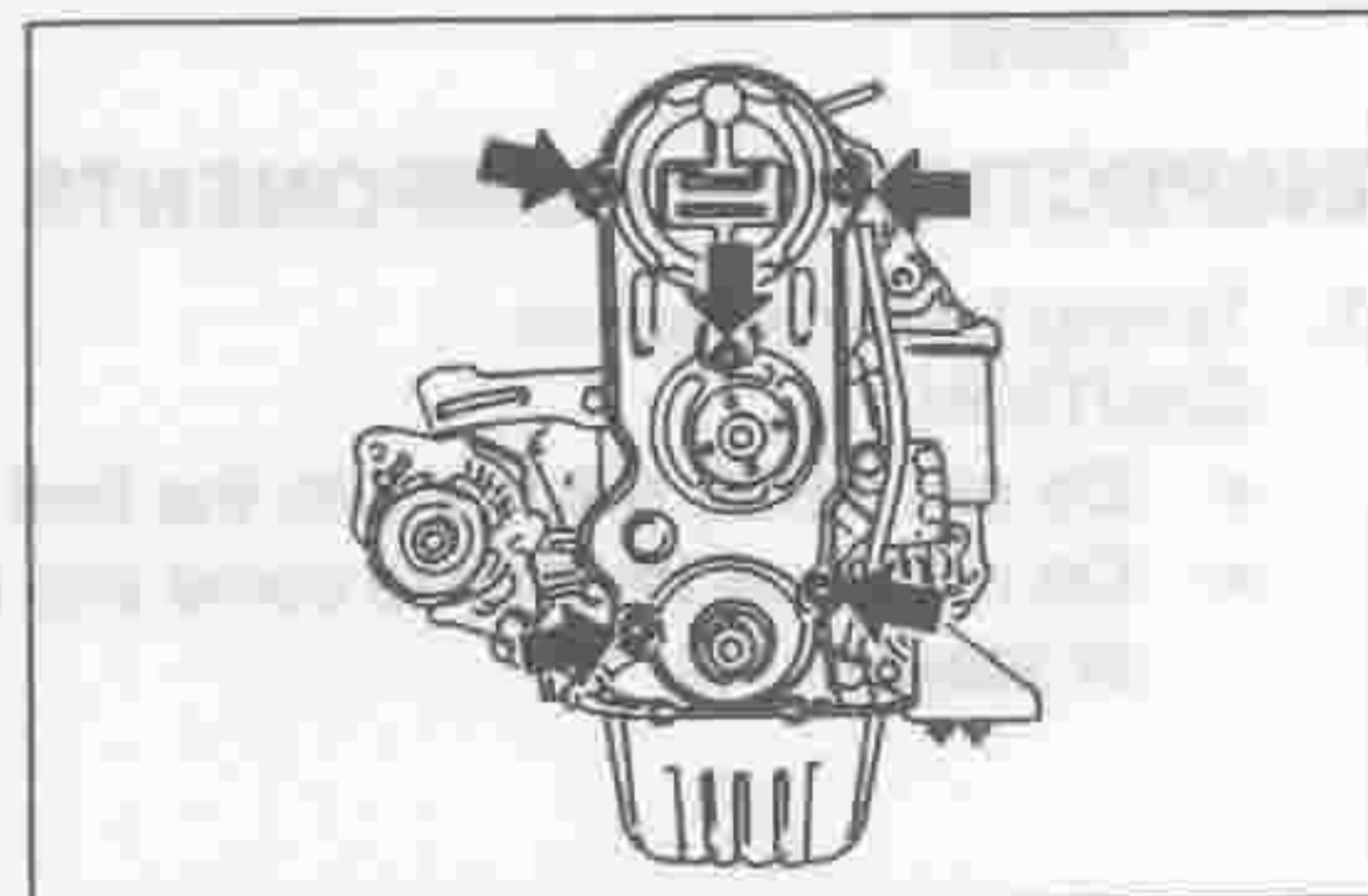
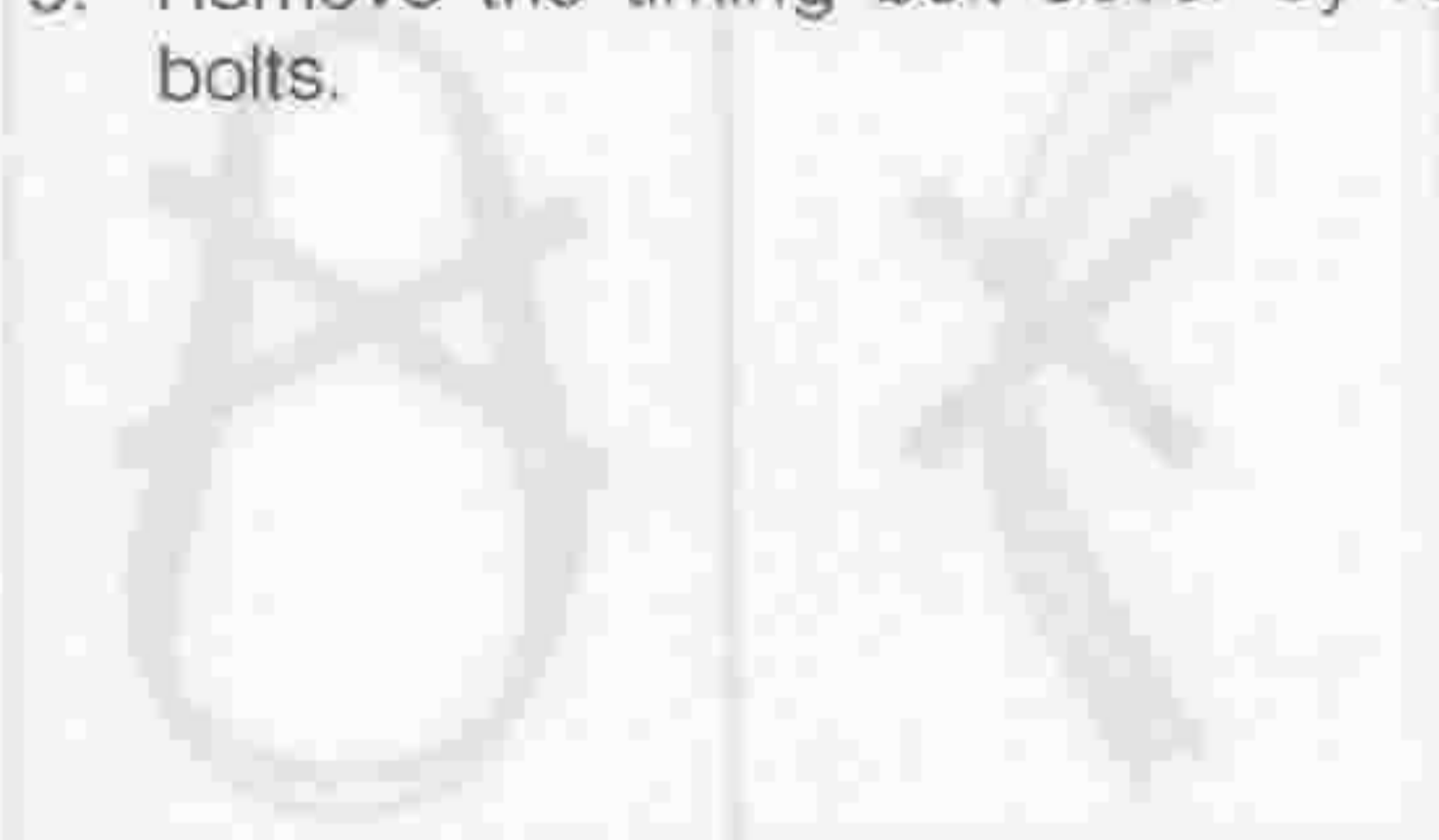
**CAUTION:**

- Be careful not to damage the starter installation surface.



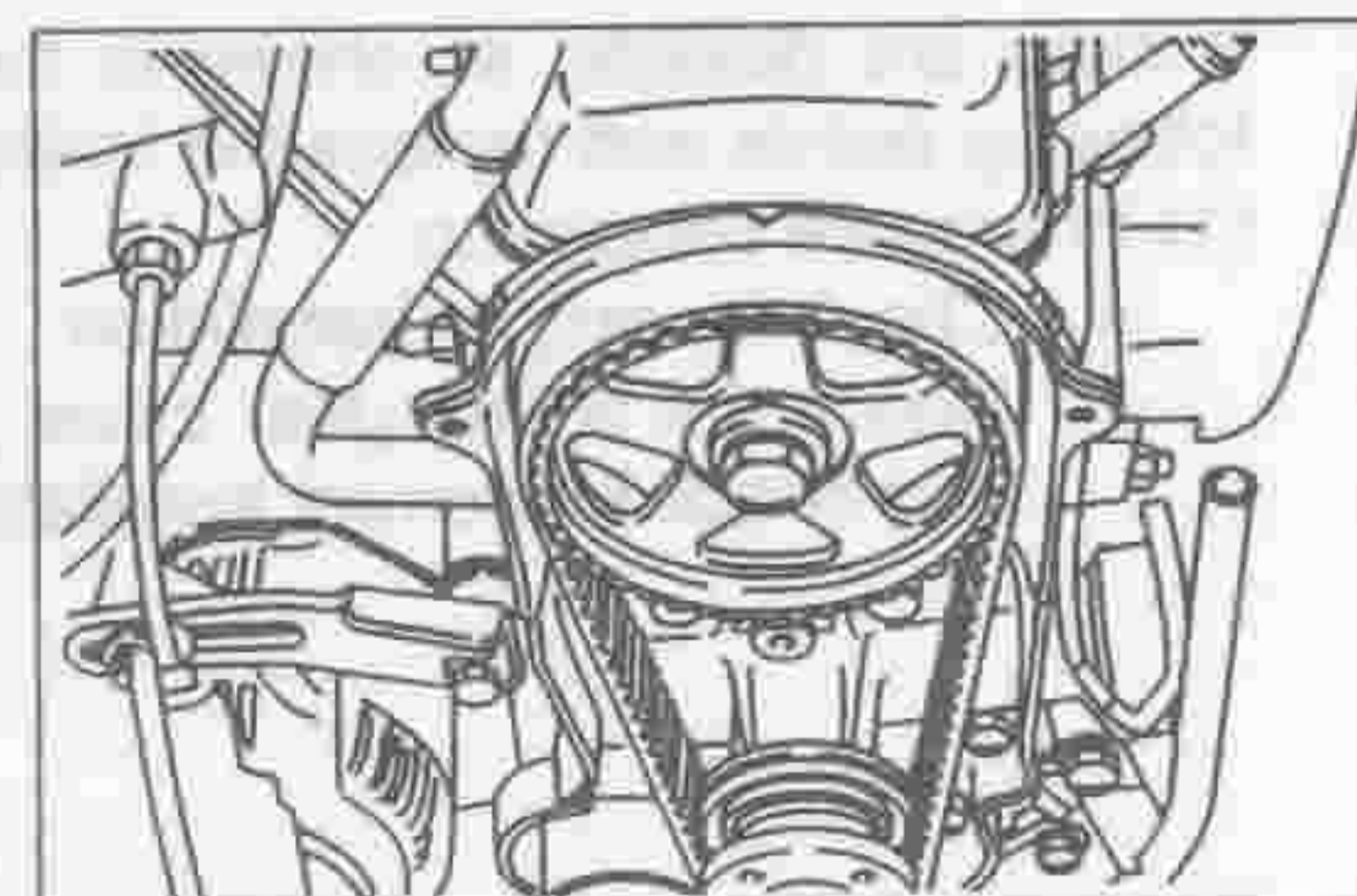
LEM00025-00015

9. Remove the timing belt cover by removing the attaching bolts.



LEM00026-00016

10. Temporarily install the crankshaft pulley attaching bolt.
11. Turn the crankshaft, until the drilled hole of the camshaft timing belt pulley is aligned with the pressed mark of the timing belt cover.
12. Remove the crankshaft pulley bolt, pulley flange and the timing belt tensioner.

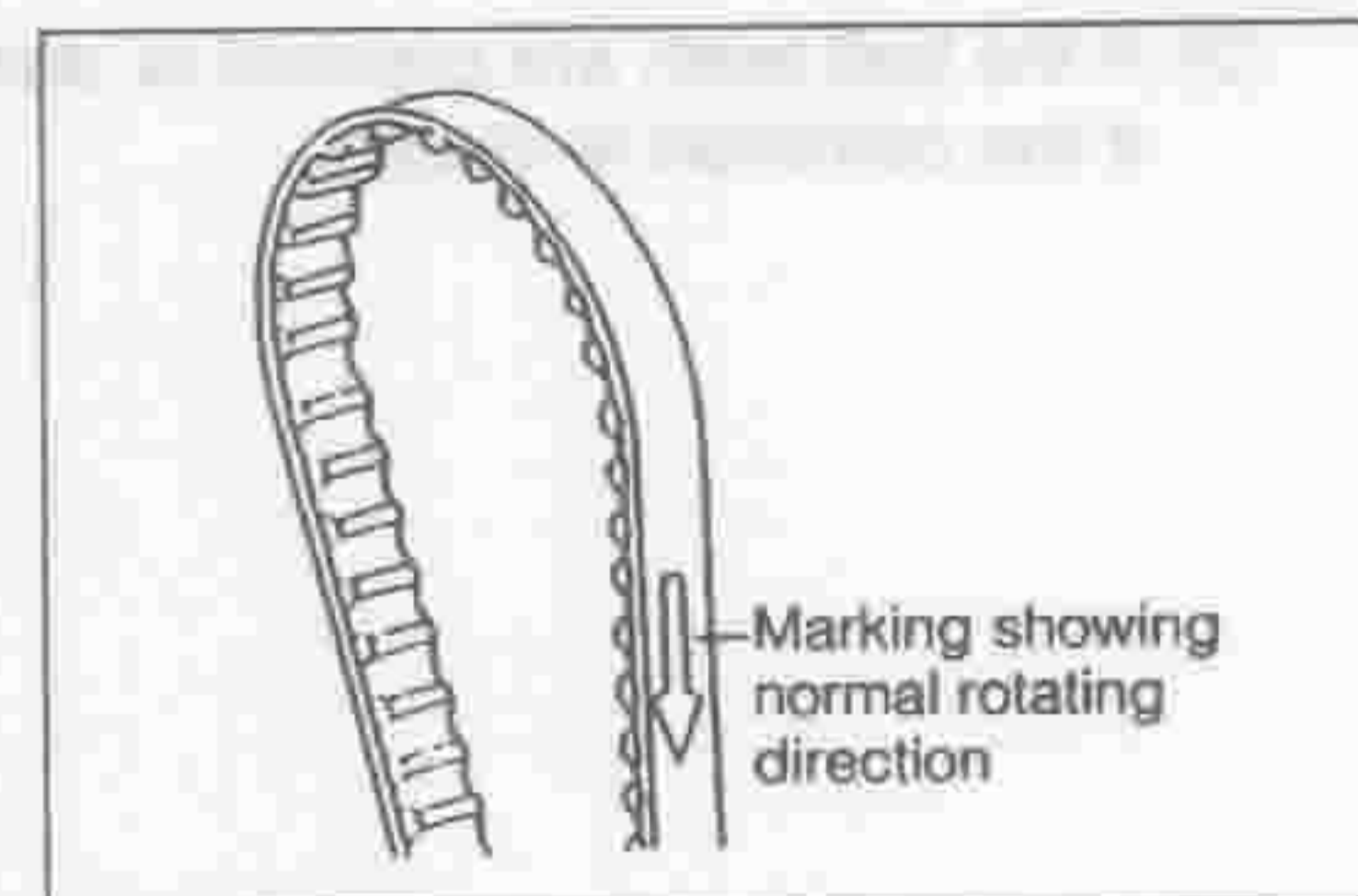


LEM00027-00017

13. Remove the timing belt.

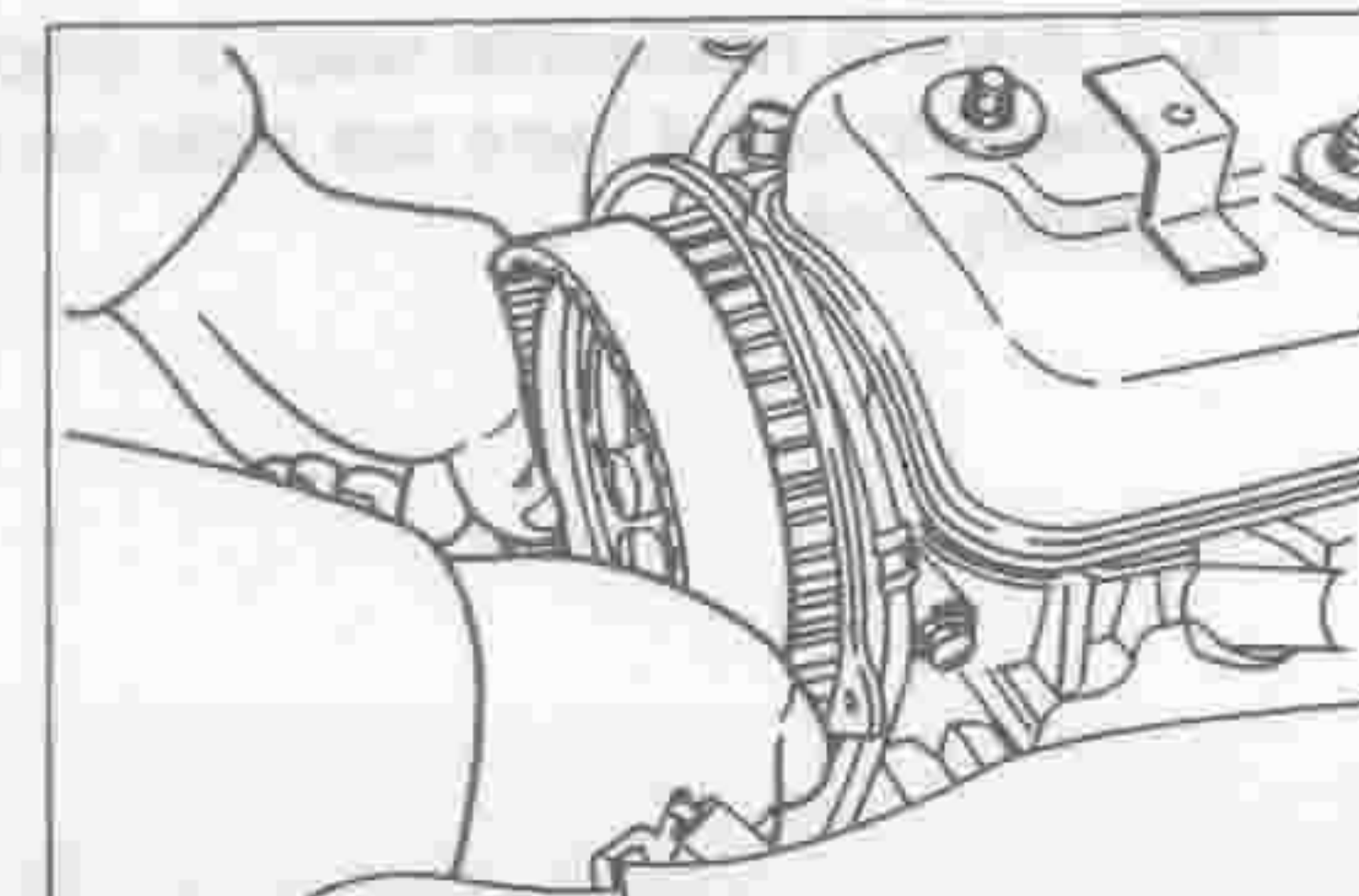
**NOTE:**

- Prior to removal of the timing belt, put an arrow mark indicating the normal rotating direction on the belt, using a chalk or the like.
- Do not try to pry the timing belt with a screwdriver or the like during the removal or installation.
- Do not allow the timing belt to come into contact with oil, water or dust.
- Do not bend the timing belt at a sharp angle or turn the timing belt inside out, for it is very vulnerable to bending.
- Do not utilize the tension of the timing belt pulley when loosening the set bolt of the camshaft timing belt pulley.
- Never turn the camshaft or crankshaft independently before the timing belt installation is completed.



LEM00028-00018

14. Remove the crankshaft timing belt pulley and flange.



LEM00029-00019

## 15. Removal of timing belt pulley

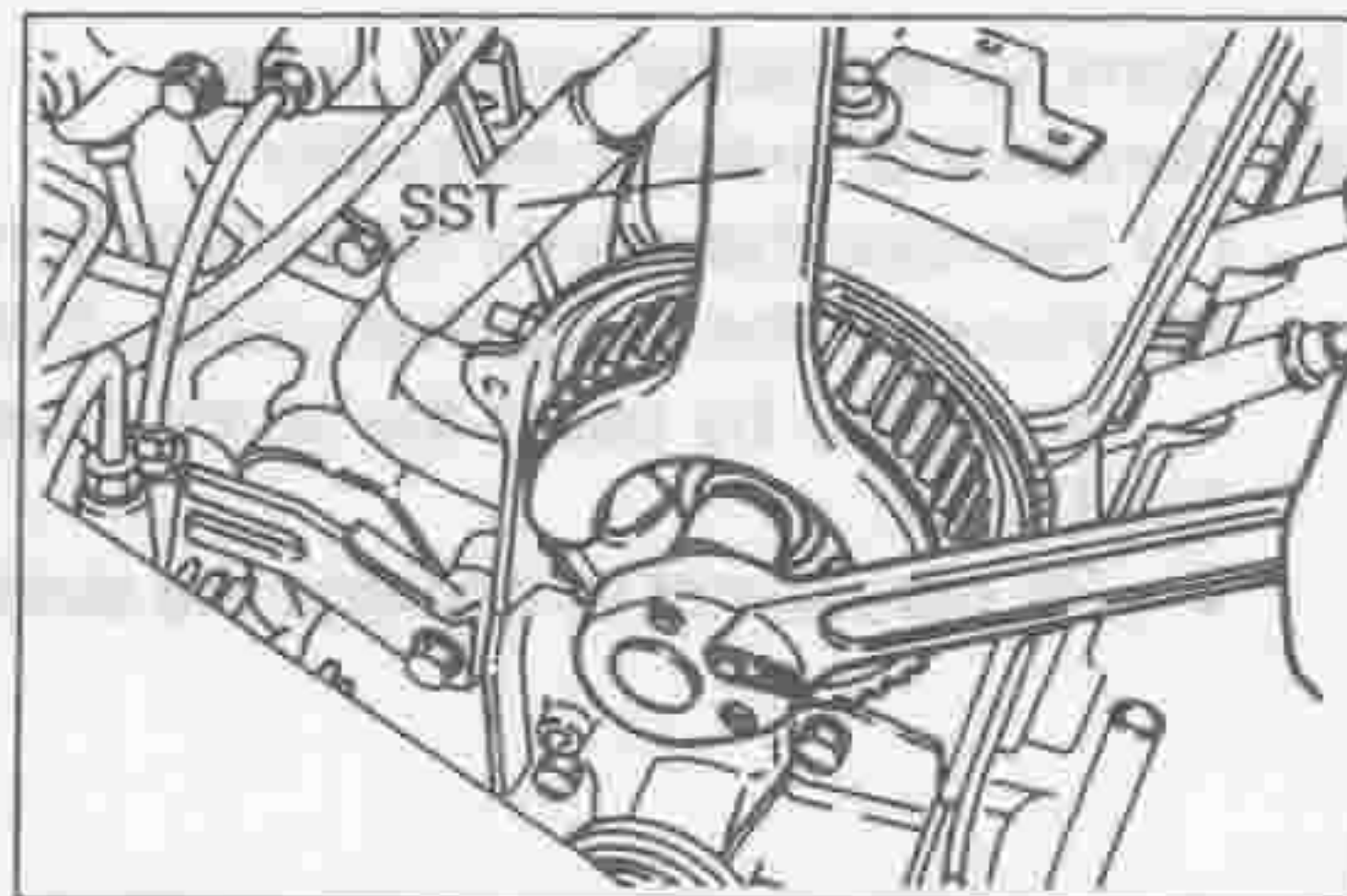
While preventing the camshaft timing belt pulley from turning with the following SST, remove the attaching bolt and plate washer. Then, remove the camshaft timing belt pulley.

SST: 09278-87201-000 [EF-EL Engine]

09511-87202-000 [ED-10, ED-20 Engine]

### CAUTION:

- If the camshaft alone should be turned, damage may be made to the engine because of interference of the pistons with the valves. Hence, never turn the camshaft alone.



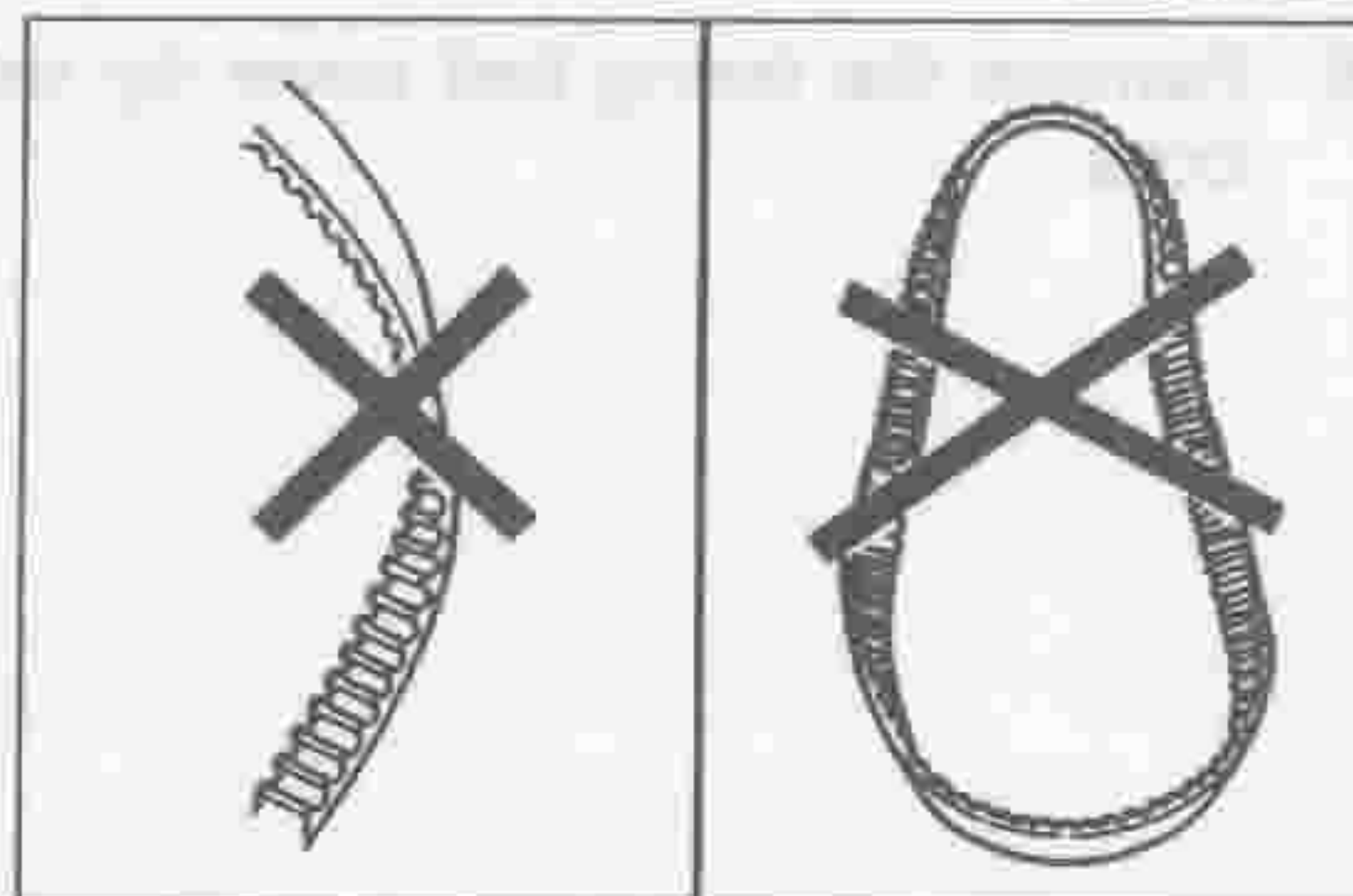
LEM00030-00020

## INSPECTION OF COMPONENTS

### 1. Timing belt inspection

#### CAUTION:

- Do not bend, twist or turn the belt inside out.
- Do not allow the belt to come into contact with oil, water or steam.

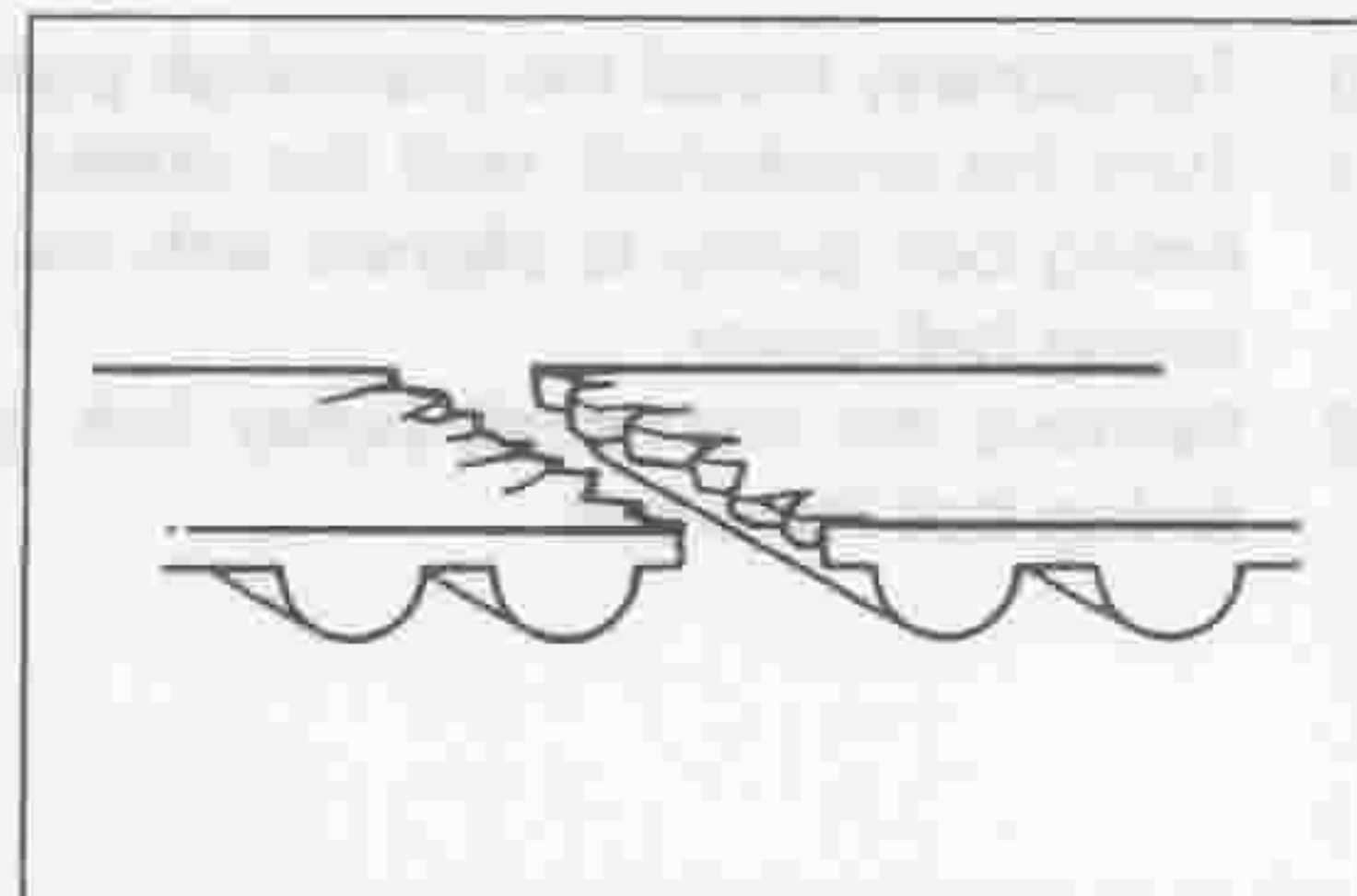


LEM00031-00021

If there are defects, as shown in the figures, check the following points and replace the timing belt, if necessary.

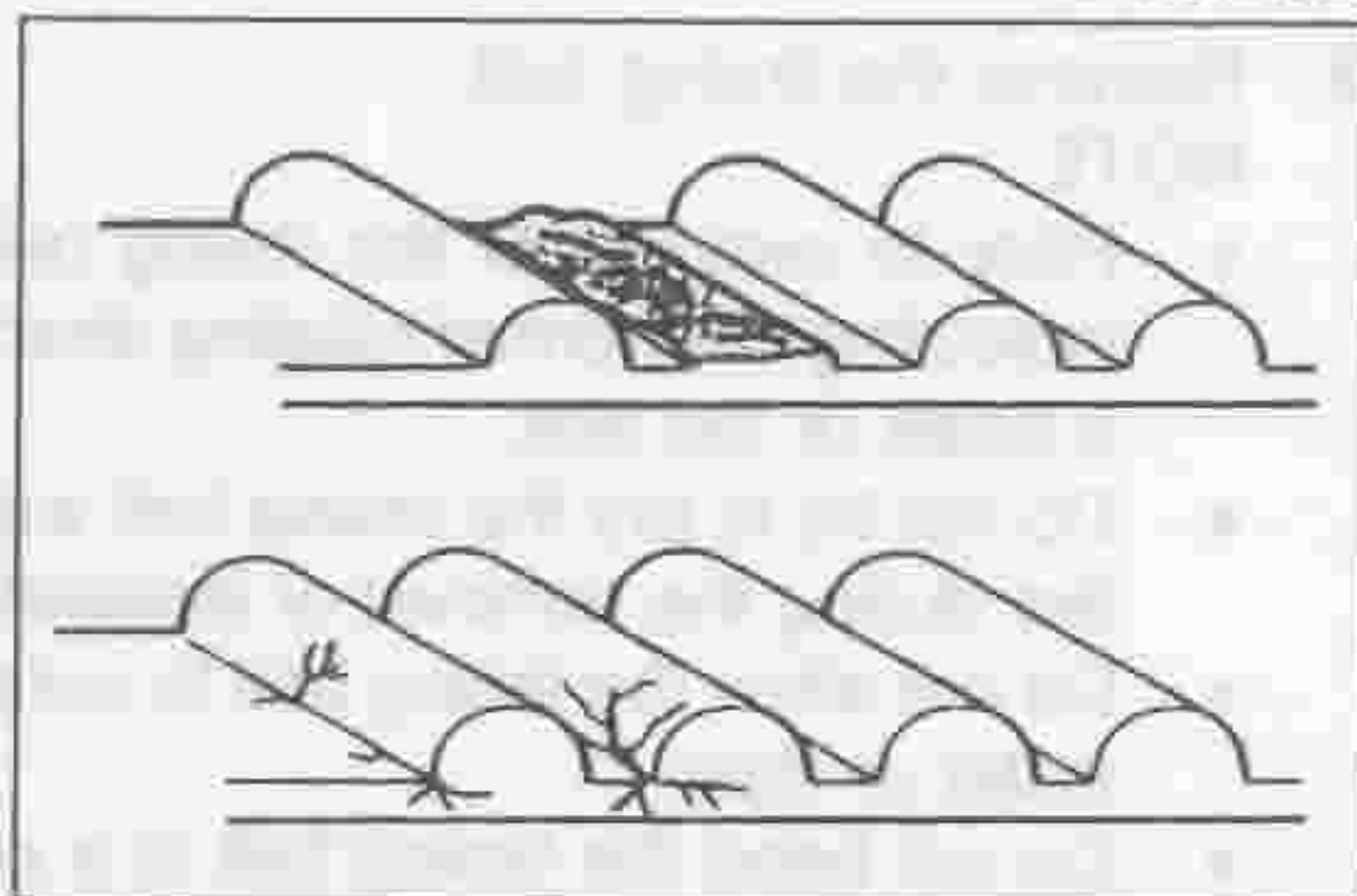
#### (1) Premature separation

- Check for proper installation.
- Check the timing gear cover gaskets for damage and check for correct installation.



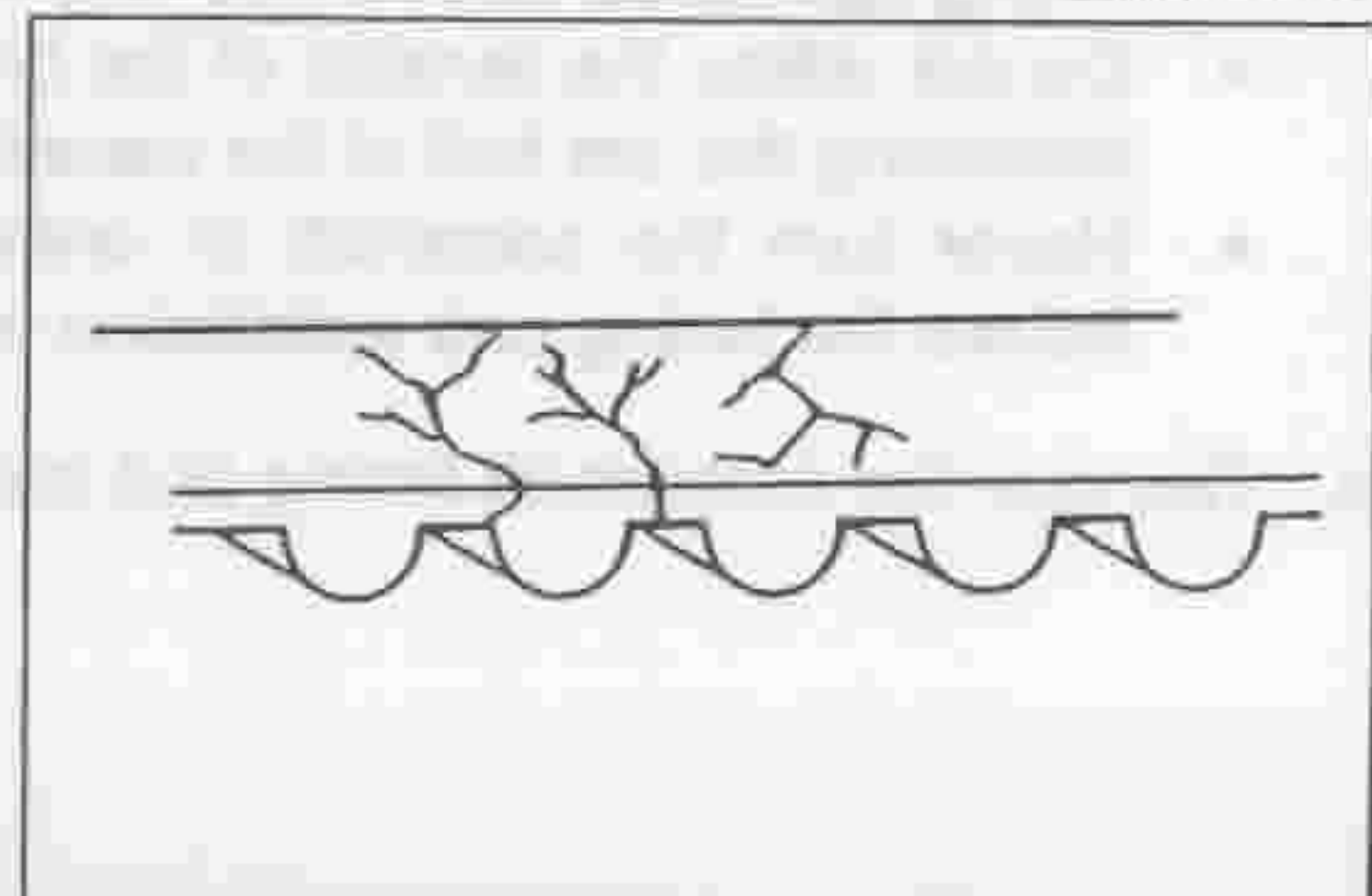
LEM00032-00022

#### (2) If the belt teeth are cracked or damaged, check to see if the camshaft is seized.



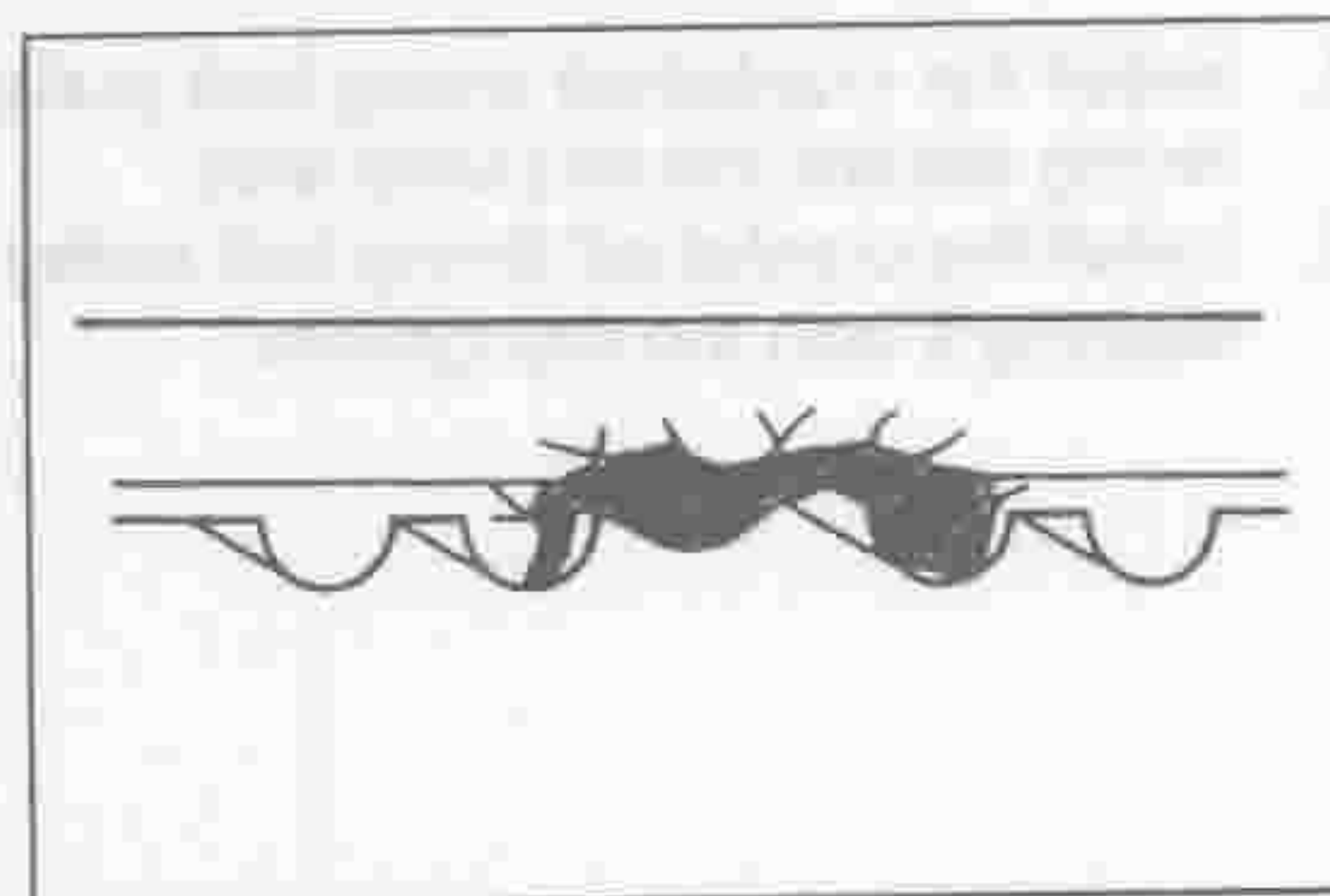
LEM00033-00023

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



LEM00034-00024

- (4) If there is wear or damage on only one side of the belt, check the pulley flange.



LEM00035-00025

## 2. Inspection of timing belt pulley

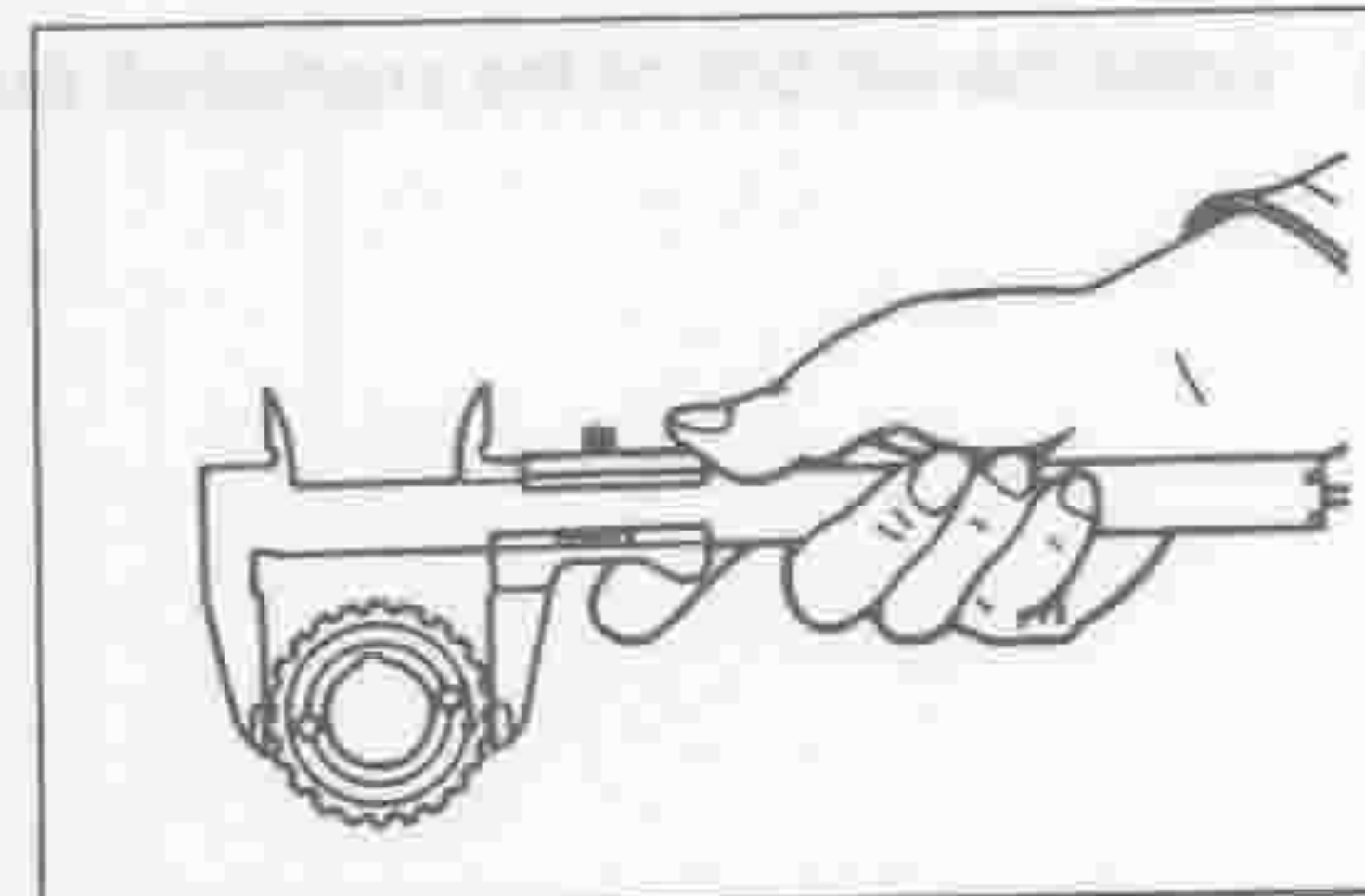
- (1) Measure the maximum width of the timing belt pulley, using vernier calipers.

Wear Limit of Timing Belt Pulley:

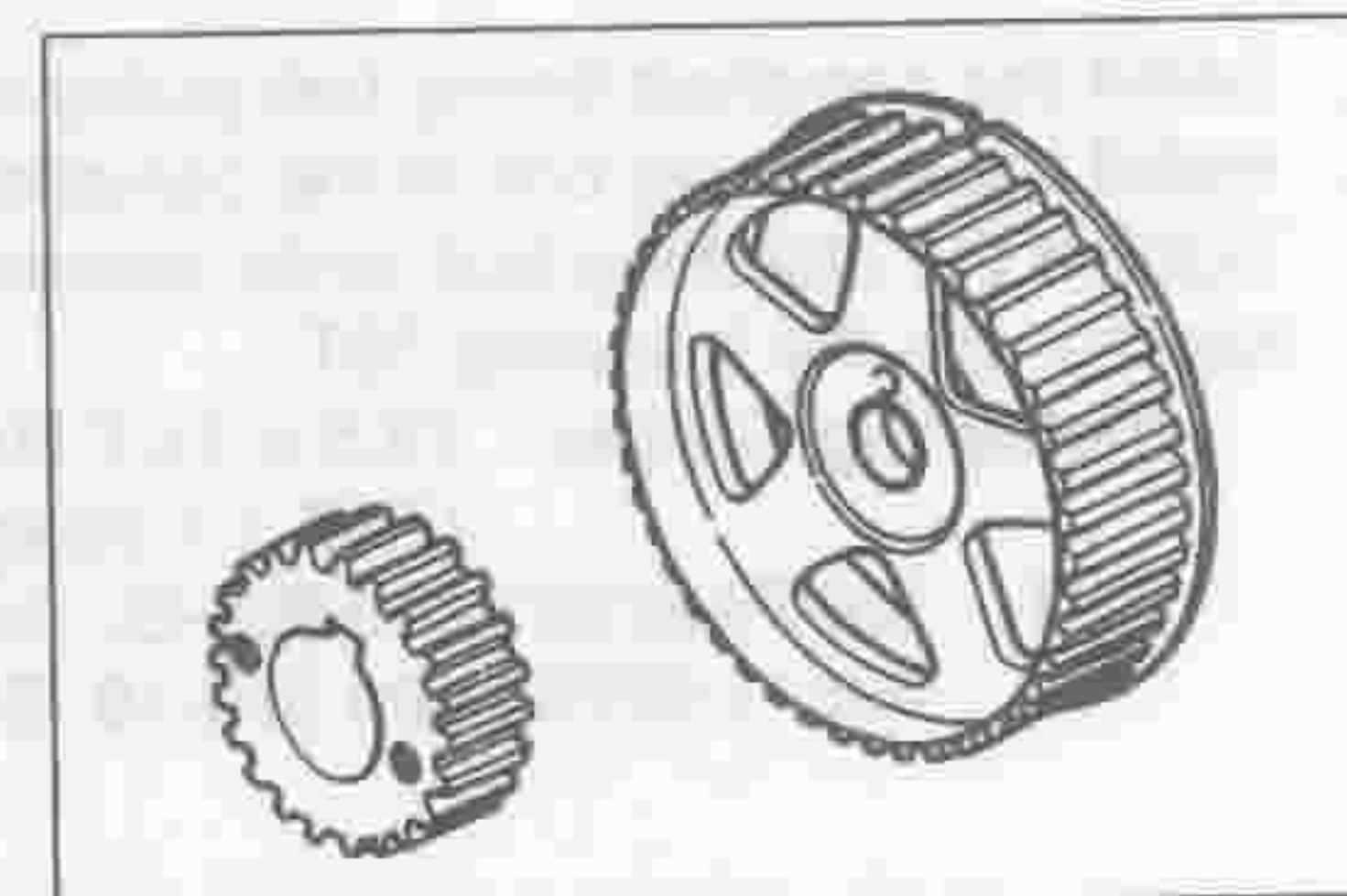
Camshaft timing belt pulley:	110.62 mm [EF-EL Engine] 110.57 mm [ED-10, 20 Engine]
Crankshaft timing belt pulley:	54.60 mm [EF-EL Engine] 54.64 mm [ED-10, 20 Engine]

If the measured value is less than the specified value, replace the timing belt pulley.

- (2) Visually inspect the timing belt pulley for damage. If necessary, replace the timing belt pulley.

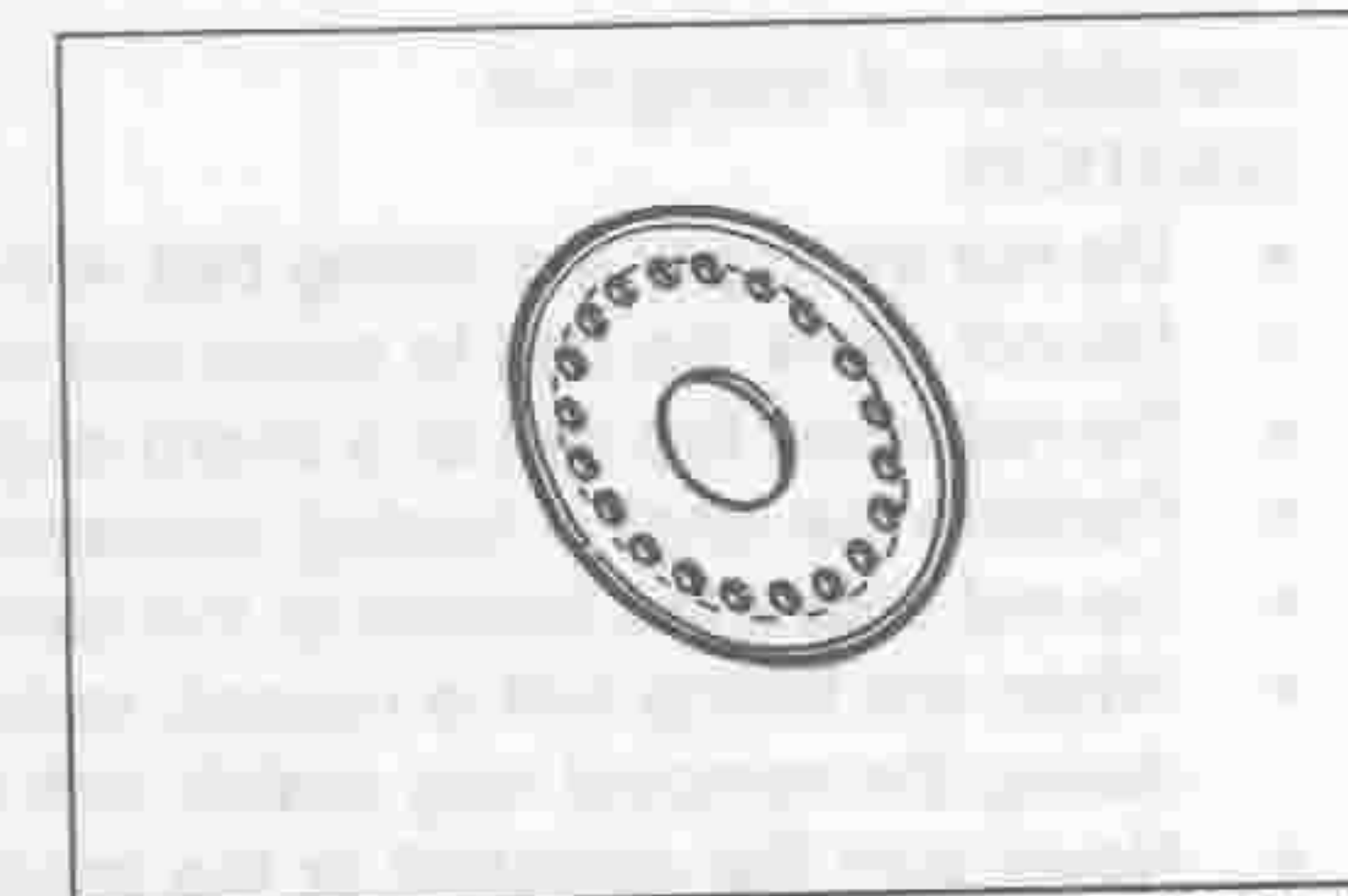


LEM00036-00026



LEM00037-00027

3. Inspection of crankshaft timing belt pulley flange  
Check the crankshaft timing belt pulley flange for bend, damage and wear.  
If necessary, replace the crankshaft timing belt pulley flange.



LEM00038-00028

## INSTALLATION OF TIMING BELT

### NOTE:

- Check the water pump for water leakage and the oil seal for oil leakage.

Repair any water leakage or oil leakage, if necessary.

LEM00039-00000

# EM-14

3. Install the set bolt of the crankshaft pulley temporarily.

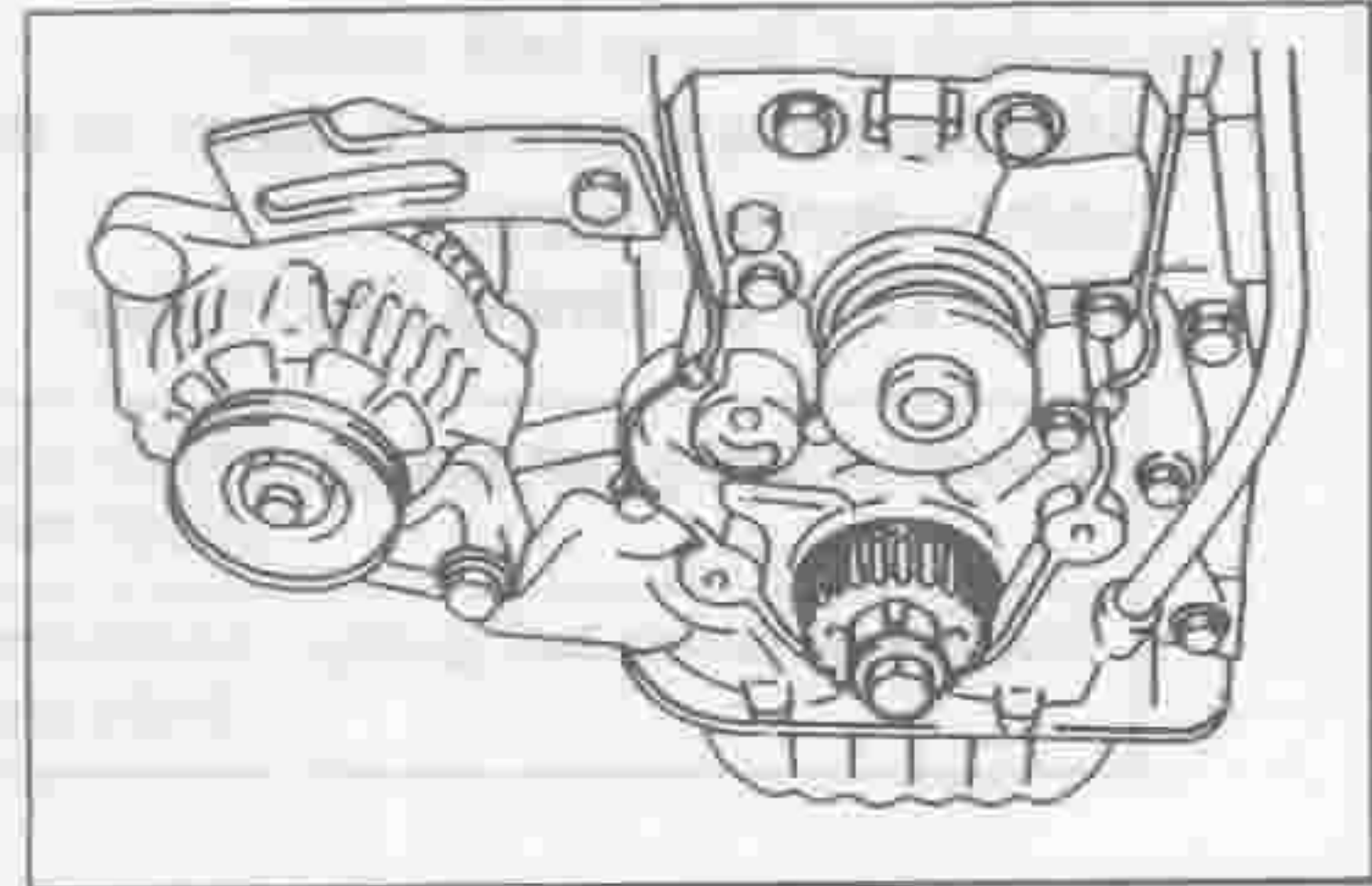


LEM00040-00029

4. Install the camshaft timing belt pulley on the camshaft.  
5. Install the attaching bolt of the camshaft timing belt pulley. Tighten the attaching bolt while preventing the pulley from turning with the following SST.

Tightening Torque:  $73.5 \pm 14.7$  N·m  
( $7.50 \pm 1.50$  kgf·m)

SST: 09278-87201-000 [EF-EL Engine]  
09511-87202-000 [ED-10, ED-20 Engine]

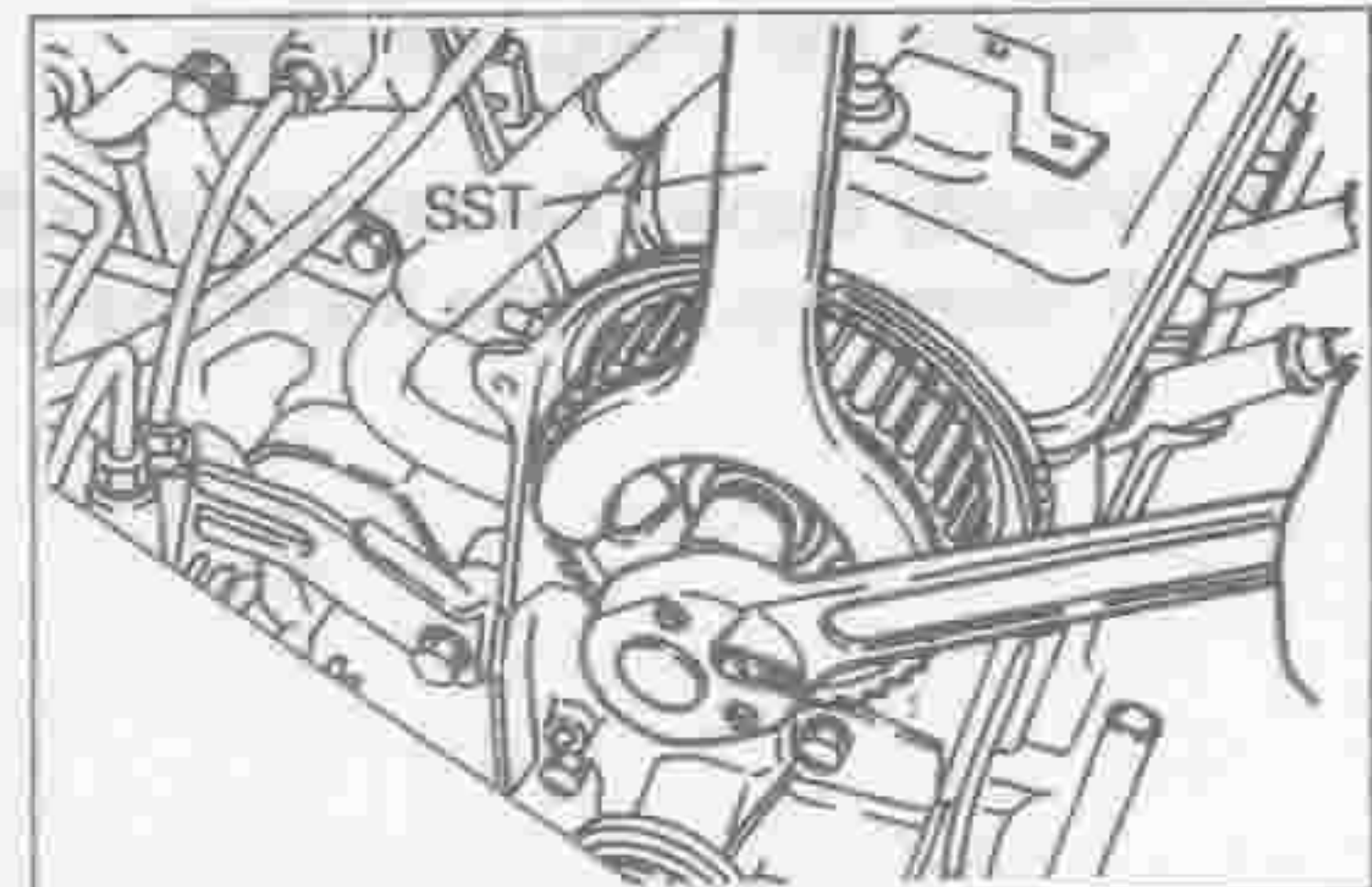


LEM00041-00030

6. Installation of timing belt

## CAUTION:

- Do not try to pry the timing belt with a screwdriver or the like.
- Do not allow the belt to come into contact with oil, water or dust.
- Do not bend the belt at a sharp angle or turn the belt inside out.
- Perform the engine turning operation at the crankshaft side.
- Do not utilize the tension of the timing belt when tightening the set bolt of the timing belt pulley.
- When the timing belt is reused, install the timing belt in such a way that the direction of the arrow put during the removal may match with the engine rotation direction.
- Never turn the camshaft or the crankshaft alone.



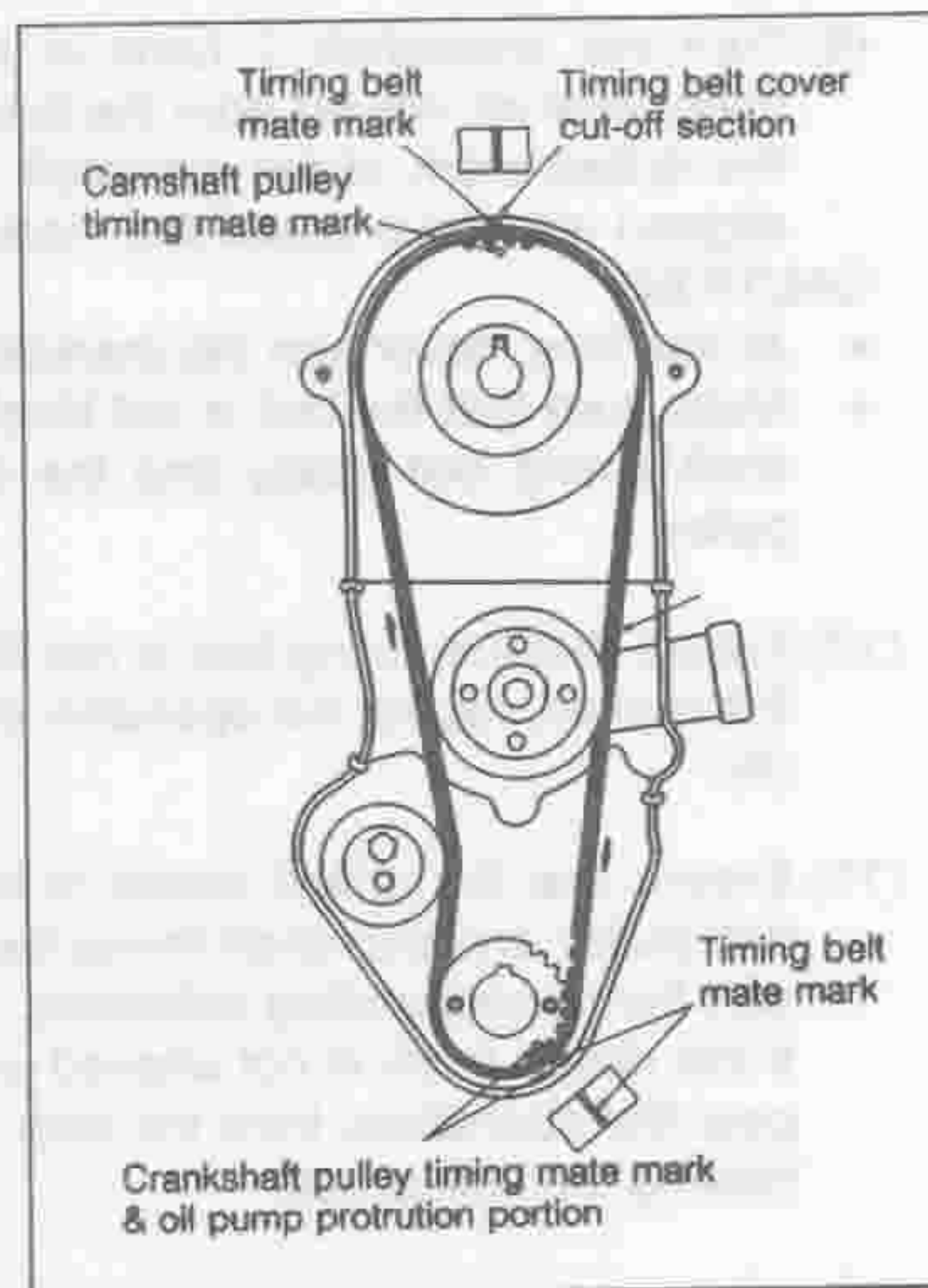
LEM00042-00031

LEM00043-00000

- (1) Align the drilled mark of the camshaft timing belt pulley with the pressed line mark of the timing belt cover.
- (2) Align the drilled mark of the crankshaft timing belt pulley with the indicator.
- (3) Assemble the timing belt in such a way that the two mating marks on the timing belt may be aligned with the corresponding drilled marks on the crankshaft timing belt pulley and camshaft timing belt pulley.

## NOTE:

- When the timing belt is reused, install the timing belt in such a way that there exist teeth of the belt between the drilled marks of the crankshaft timing belt pulley and camshaft timing belt pulley.
- When the timing belt is reused, install the timing belt in such a way that the arrowhead which was put during disassembly comes rotational direction of the timing belt.

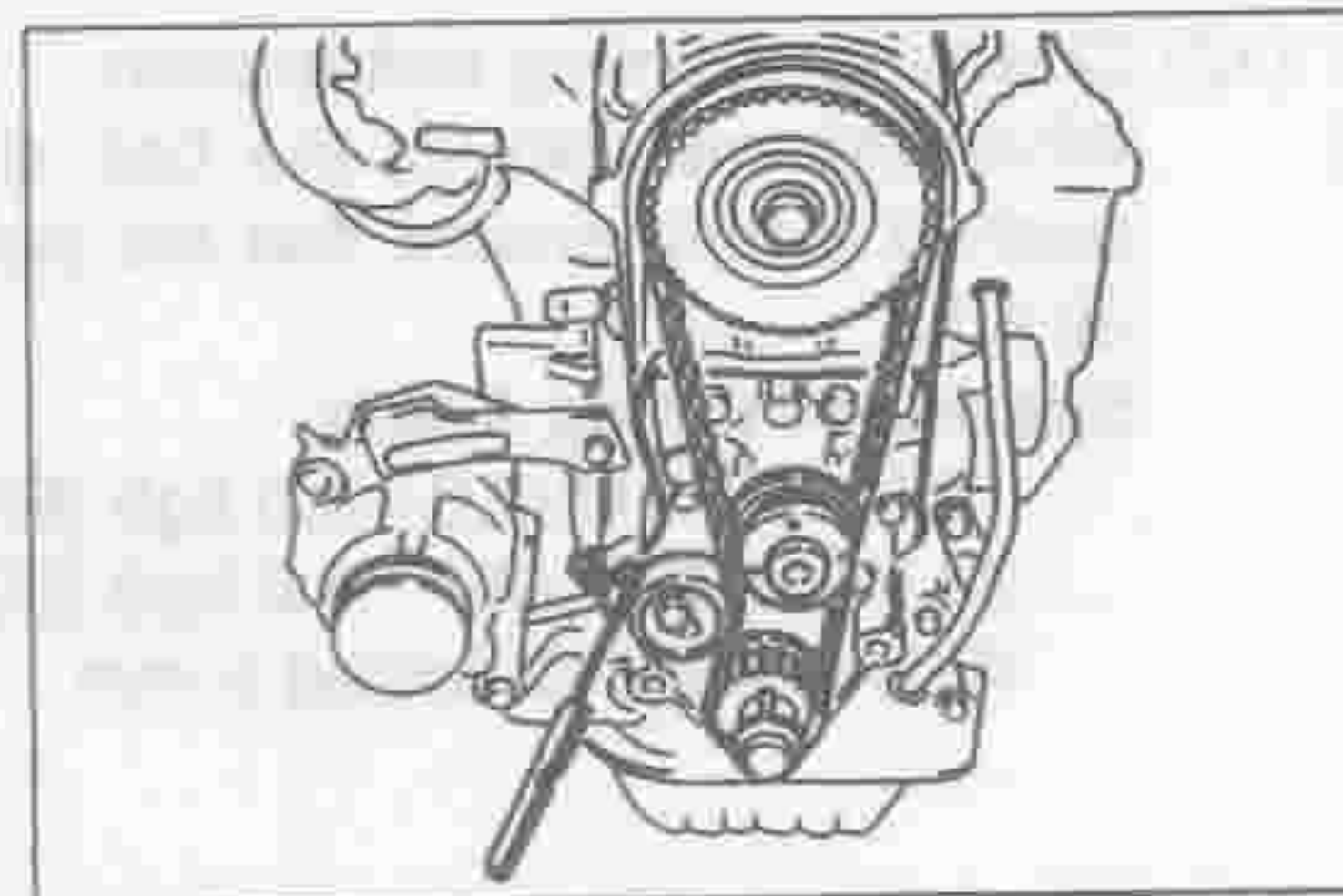


LEM00044-00032

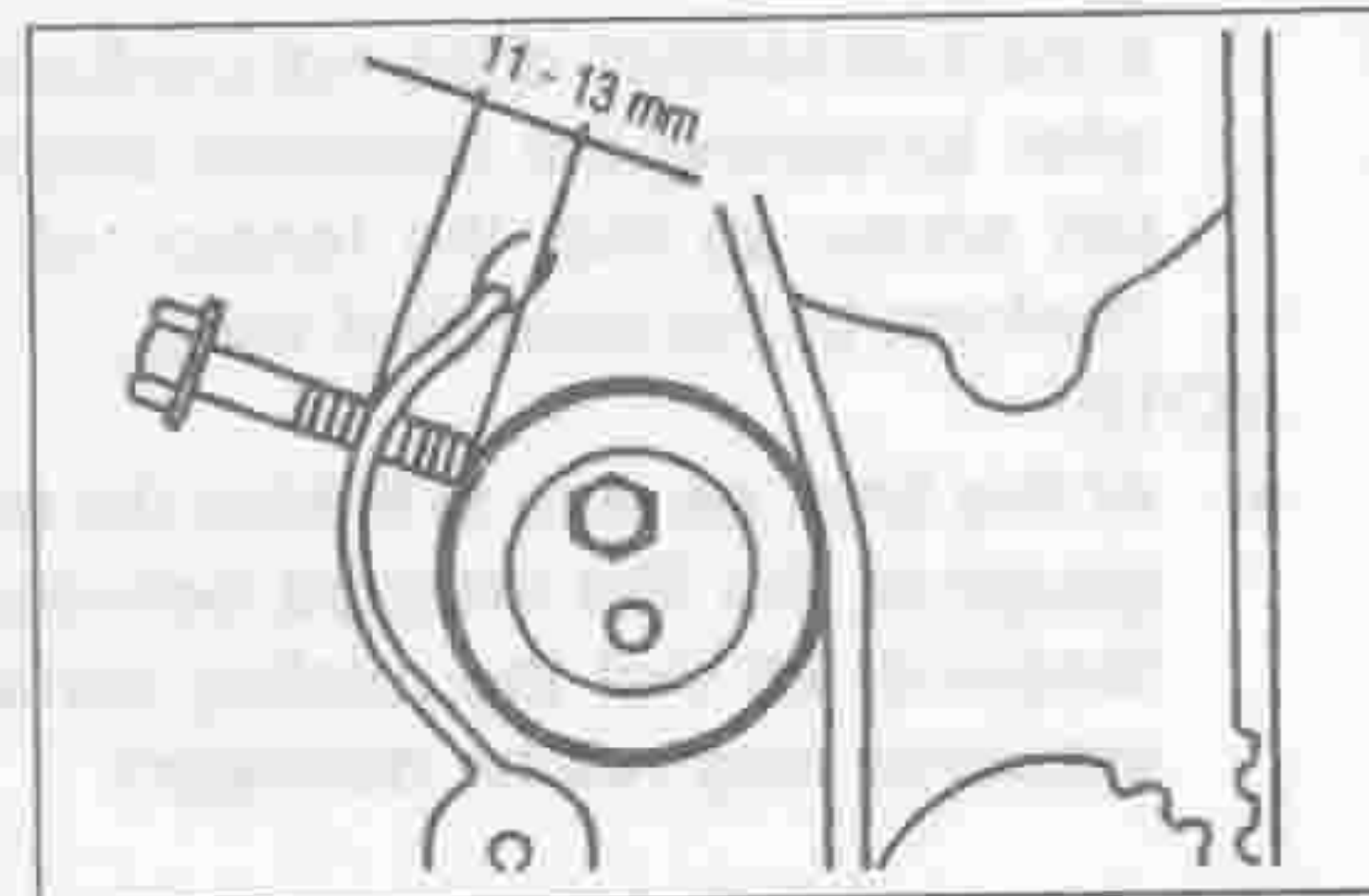
- (4) Remove the resin plug.
- (5) Install the timing belt tensioner temporarily.

## NOTE:

- Make sure that the tensioner moves freely.
- (6) Using your hand, install a M6 screw (with a pitch of 1 mm and a length of 20 to 30 mm) fully into the hole from which the resin plug has been removed.
- NOTE:
- Before this screw is installed, be certain to insert a thickness gauge between the screw and the tensioner in order that no damage may be made to the turning surface of the timing belt tensioner.
  - Measure the distance between the outside of the oil pump body and the tensioner.  
Specified Distance: 11 - 13 mm



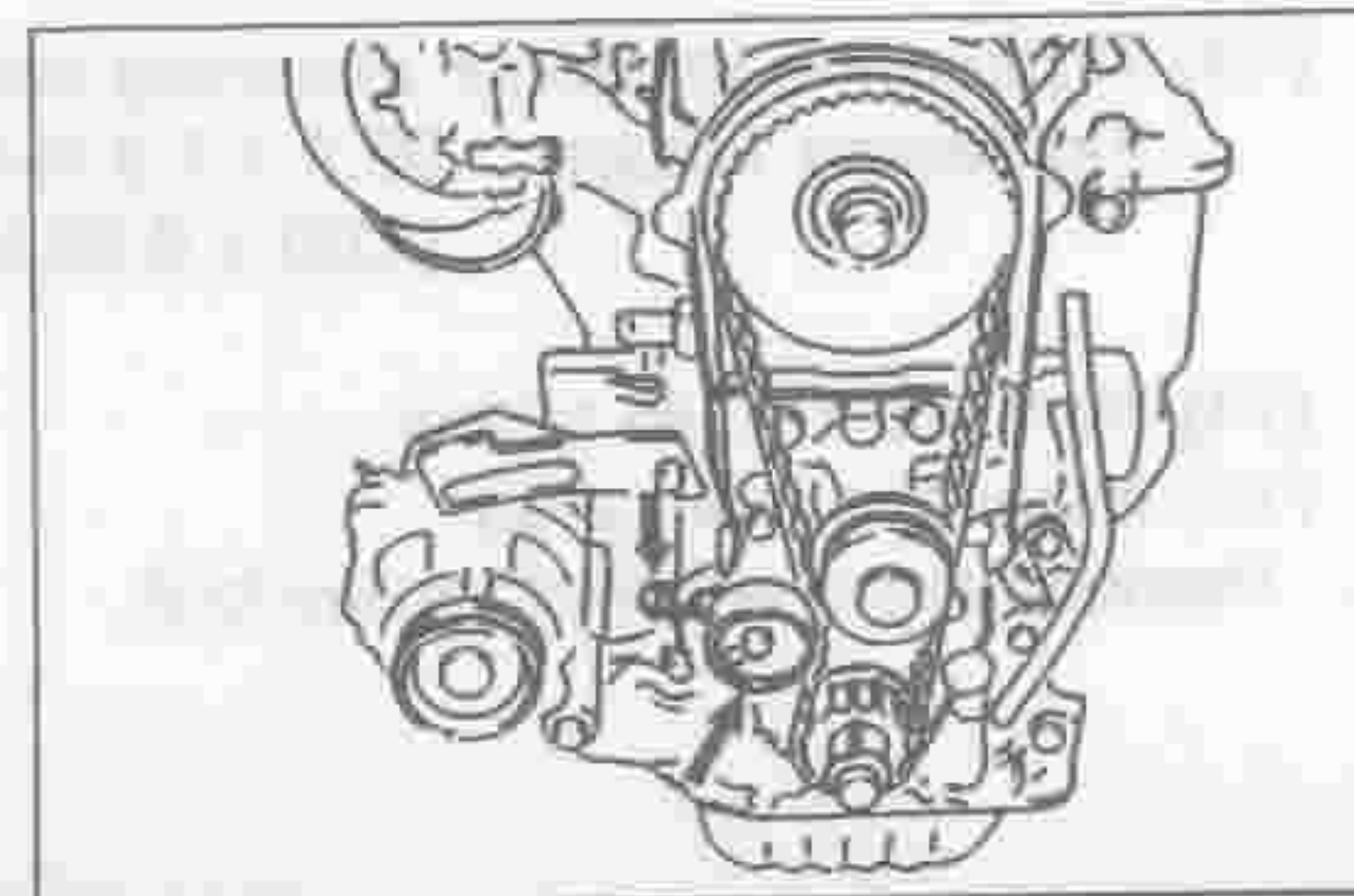
LEM00045-00033



LEM00046-00034

- (7) Tighten the timing belt tensioner attaching bolt.  
Tightening Torque:  $39.2 \pm 7.8$  N·m  
( $4.00 \pm 0.80$  kgf·m)

- (8) Back off the M6 screw two or three turns so that the screw may not interfere with the tensioner.

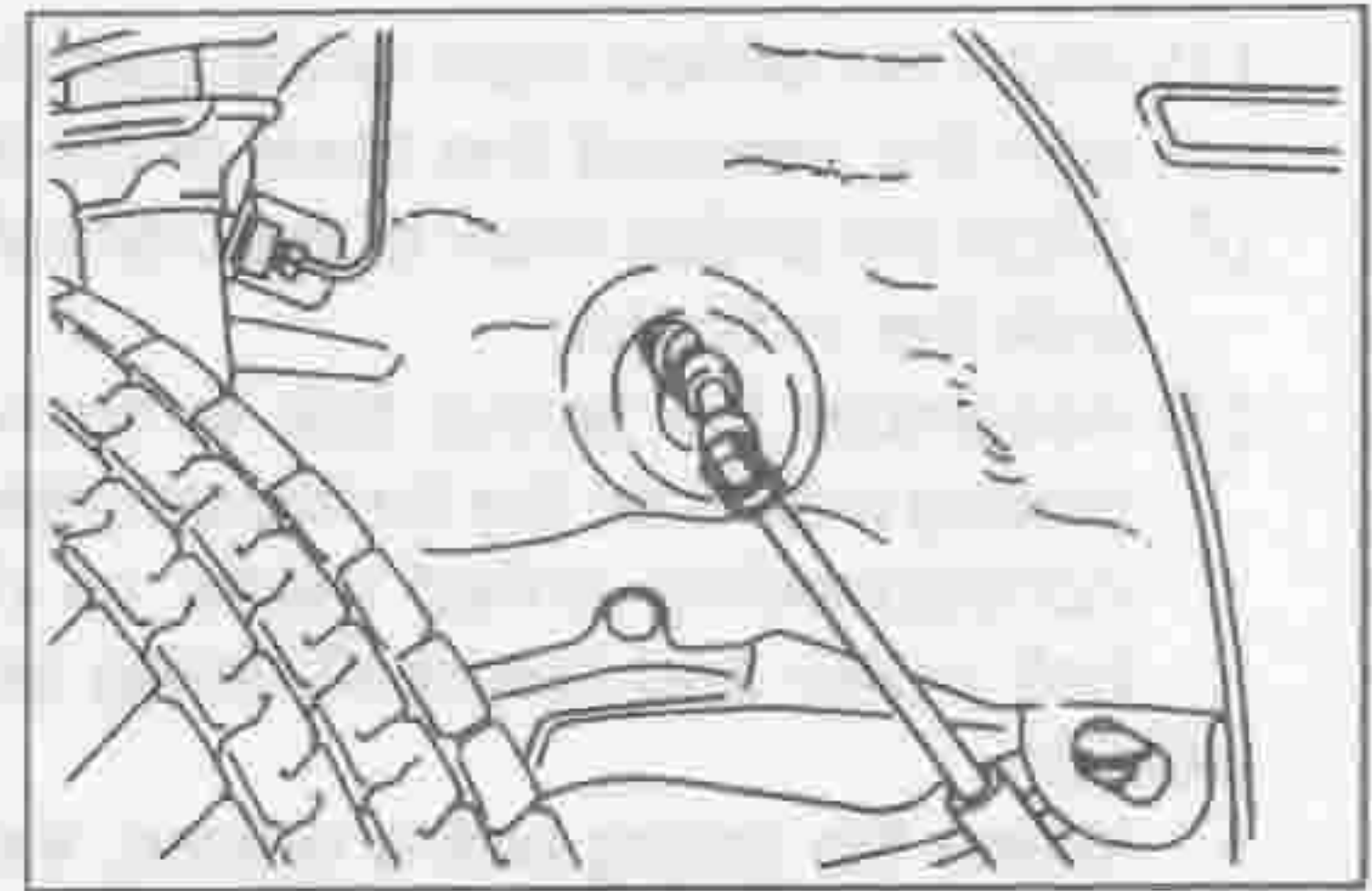


LEM00047-00035

- (9) Turn the crankshaft 2 turns in the normal direction (clockwise as viewed from the timing belt side) so that the drilled mark of the camshaft timing belt pulley is aligned with the pressed line mark of the timing belt.

**CAUTION:**

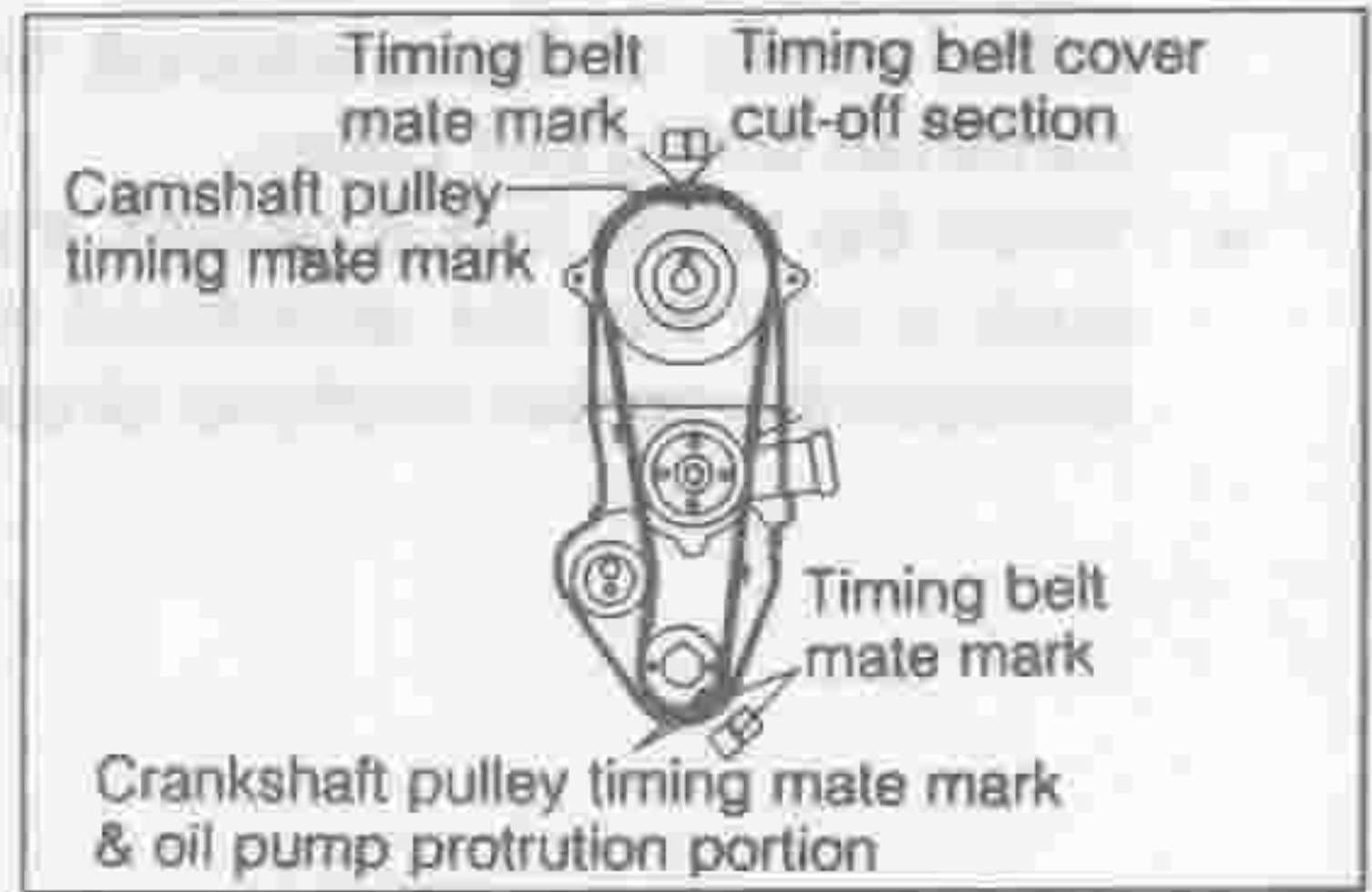
- At this time, never turn the crankshaft reversely.
- Make sure that the belt is not tilted between the crankshaft timing belt pulley and the camshaft timing belt pulley.



LEM00048-00036

- (10) Ensure that the timing belt is not tilted. If it is tilted, repeat the operation described in the step (9).

- (11) Ensure that the drilled marks of the crankshaft timing belt pulley and camshaft timing belt pulley are aligned with the corresponding indicators. If the drilled mark is not aligned with the indicator, repeat the operations from the step (1) onward after removing the timing belt.

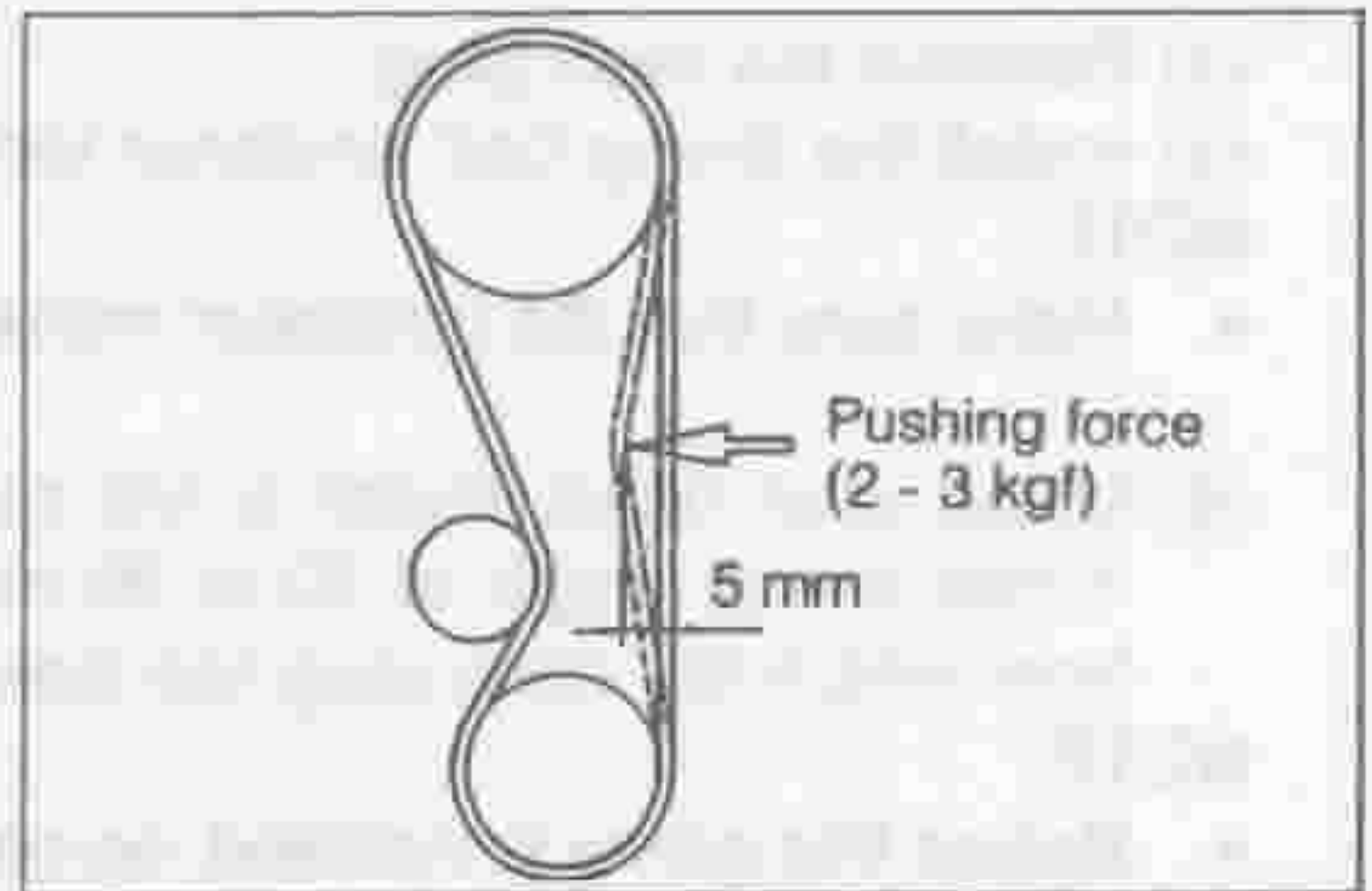


LEM00049-00037

- (12) Checking of timing belt tension  
When the midpoint of the belt at the tension side is pushed 5 mm, ensure that the pushing force is 19.6 - 29.4 N.

**Specified Pushing Force:**

- 19.6 - 29.4 N (2.0 - 3.0 kgf) [EF-EL Engine]
  - 26.4 - 39.2 N (2.7 - 4.0 kgf) [ED-10, ED-20 Engine]
- When belt is deflected 5 mm

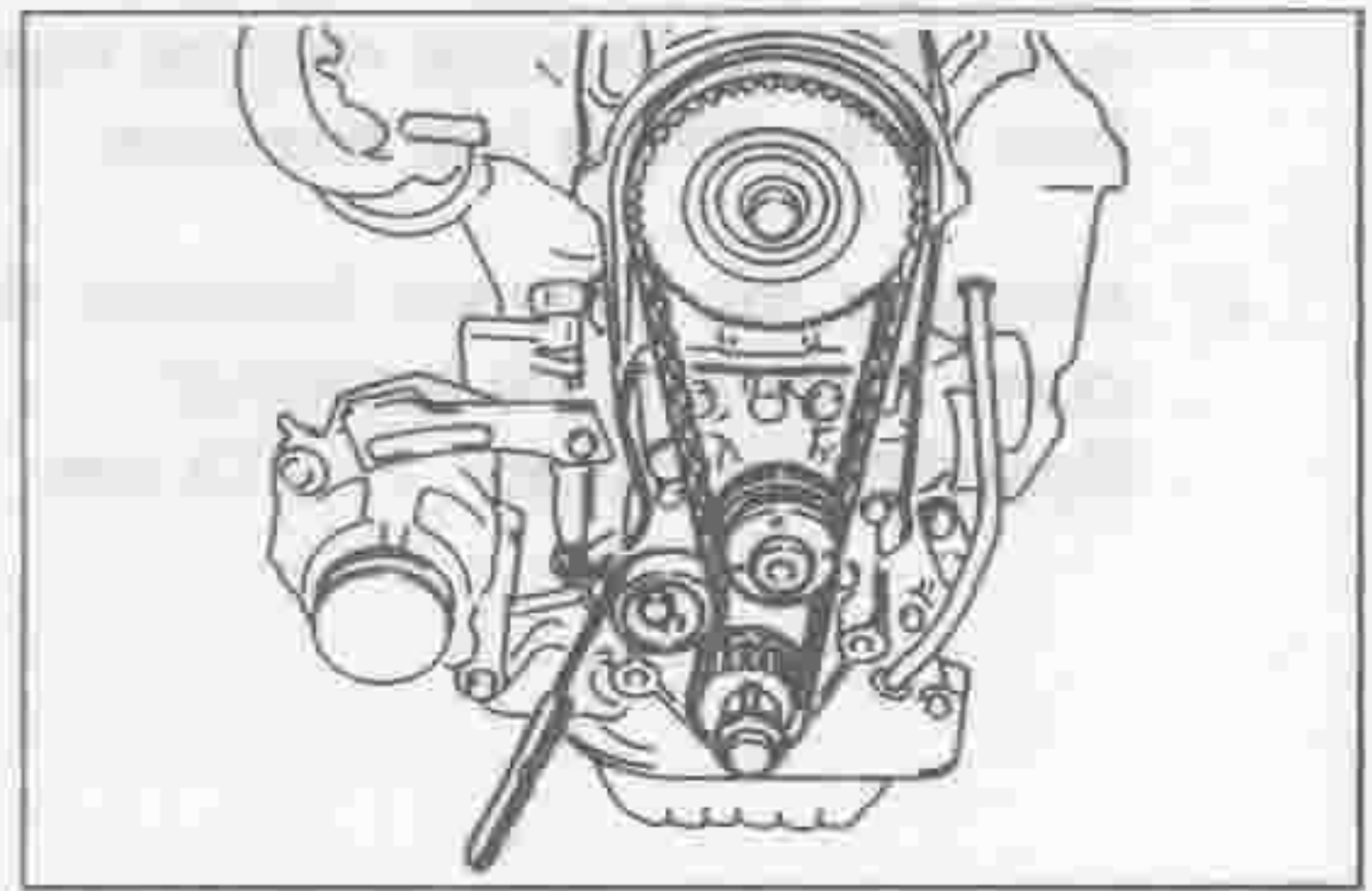


LEM00050-00038

If the belt tension does not conform to the specification, after loosening the tensioner attaching bolt, adjust the M6 screw so that the tension of the timing belt may conform to the specified value.

**NOTE:**

- At this time, be sure to tighten the screw with a thickness gauge or the like inserted between the screw and the tensioner so that the rotating surface of the timing belt tensioner may not be damaged.



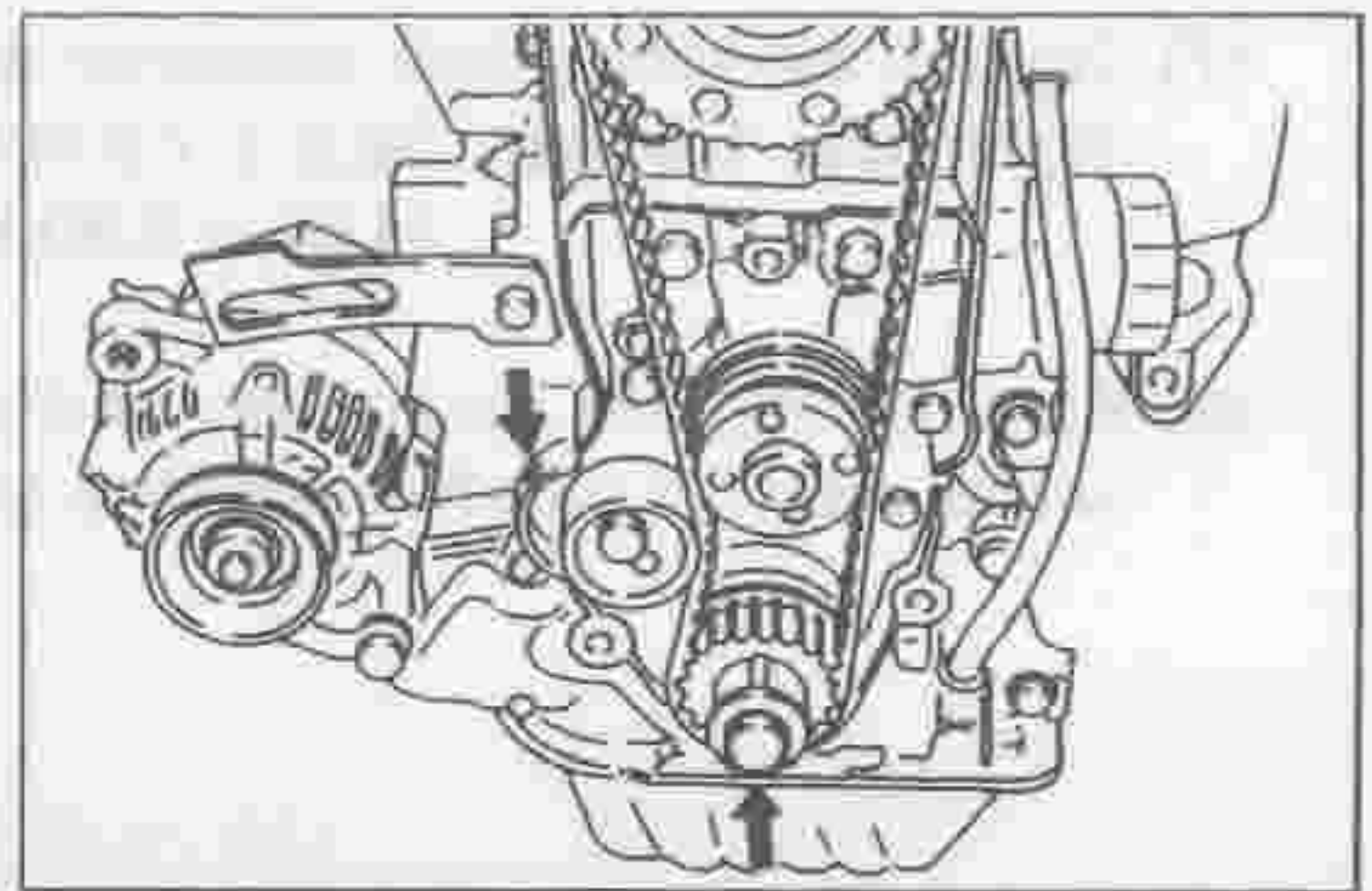
LEM00051-00039

- (13) Tighten the tensioner attaching bolt.  
Tightening Torque:  $39.2 \pm 7.8$  N·m  
( $4.00 \pm 0.80$  kgf·m)

- (14) Remove the M6 screw.

- (15) Install the resin plug.

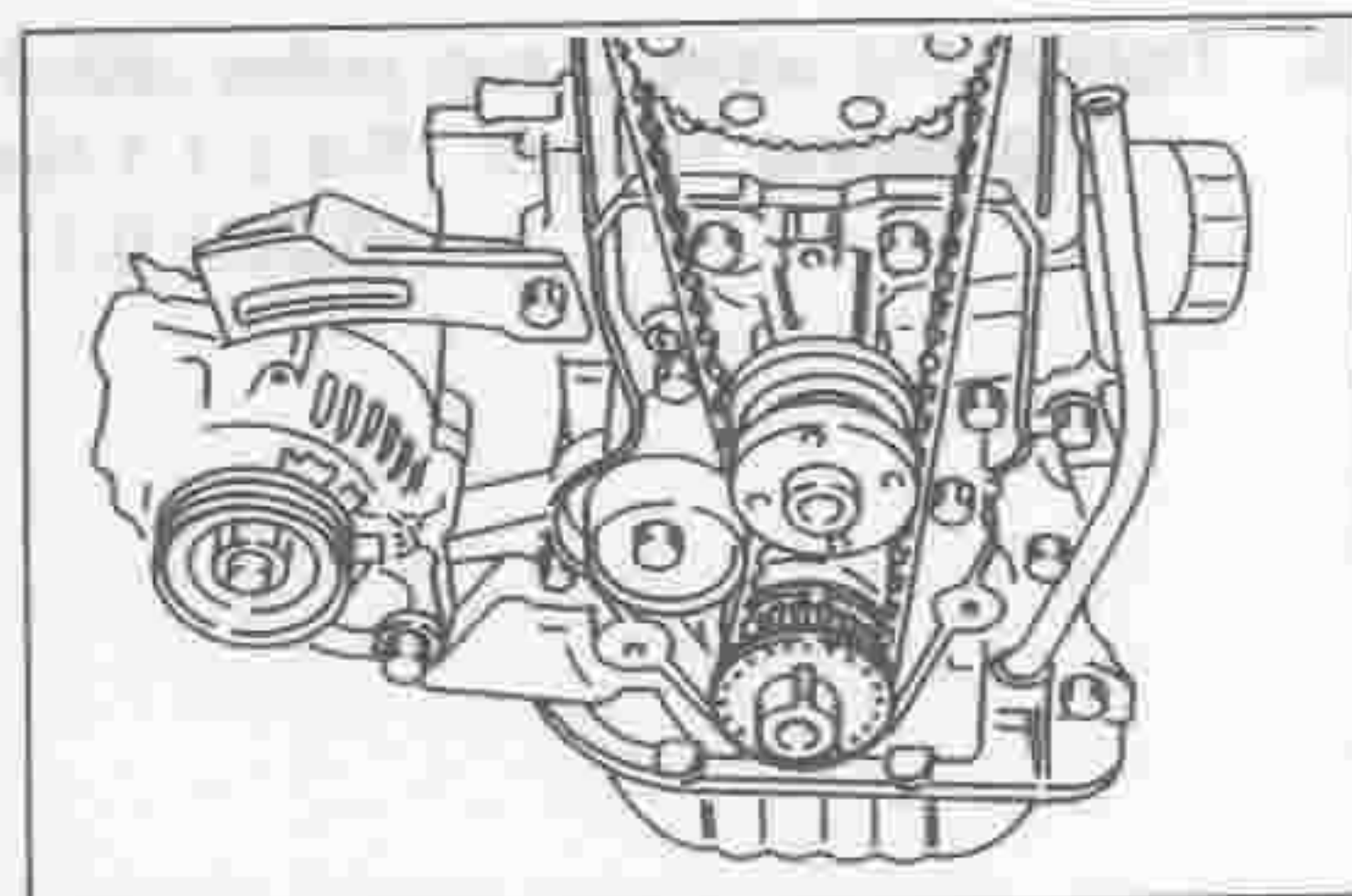
7. Remove the crankshaft pulley bolt.



LEM00052-00040



8. Install the crankshaft timing belt pulley flange with its protruding side facing toward the timing belt pulley.

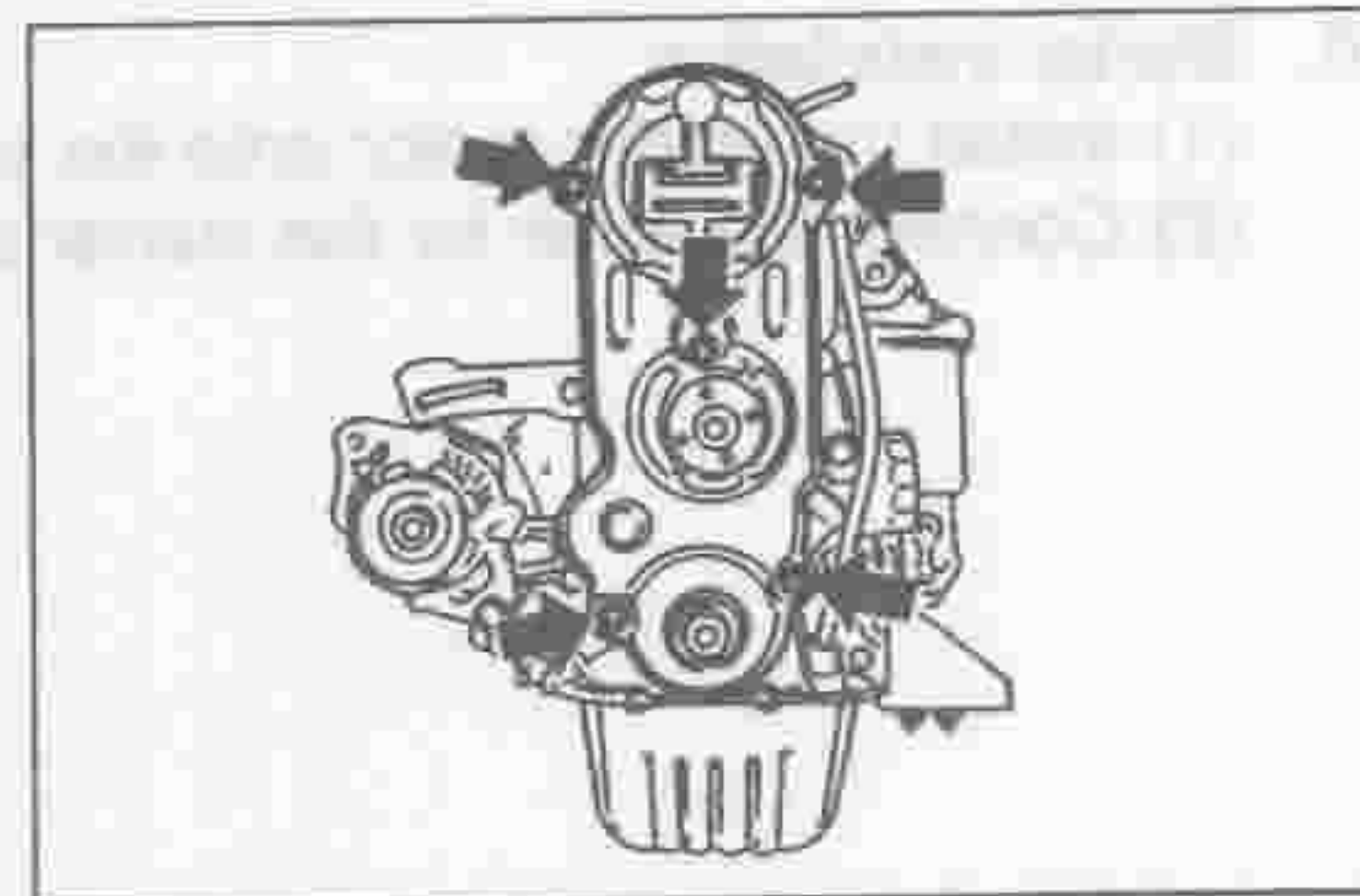


LEM00053-00041

9. Install the timing belt cover.  
Tightening Torque:  $5.4 \pm 1.1$  N·m  
( $0.55 \pm 0.11$  kgf-m)

## NOTE:

- Ensure that the gasket exhibits no damage. If the gasket is damaged, replace it with a new one. Affix the gasket onto the cover, using an adhesive agent.

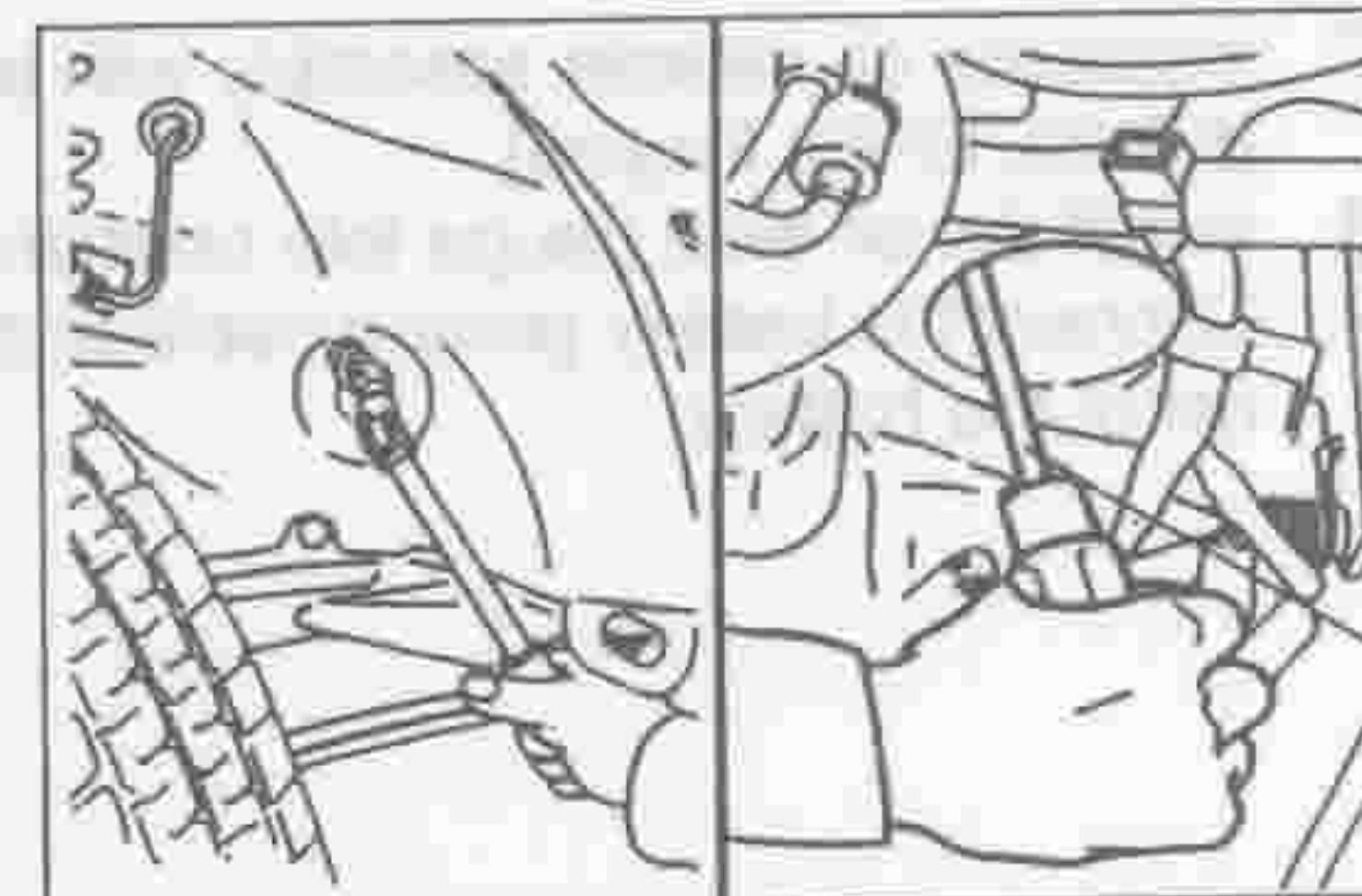


LEM00054-00042

10. Installation of crankshaft pulley bolt  
(1) Install the crankshaft pulley.  
(2) Tighten the crankshaft pulley bolt while preventing the ring gear from turning with the screwdriver.

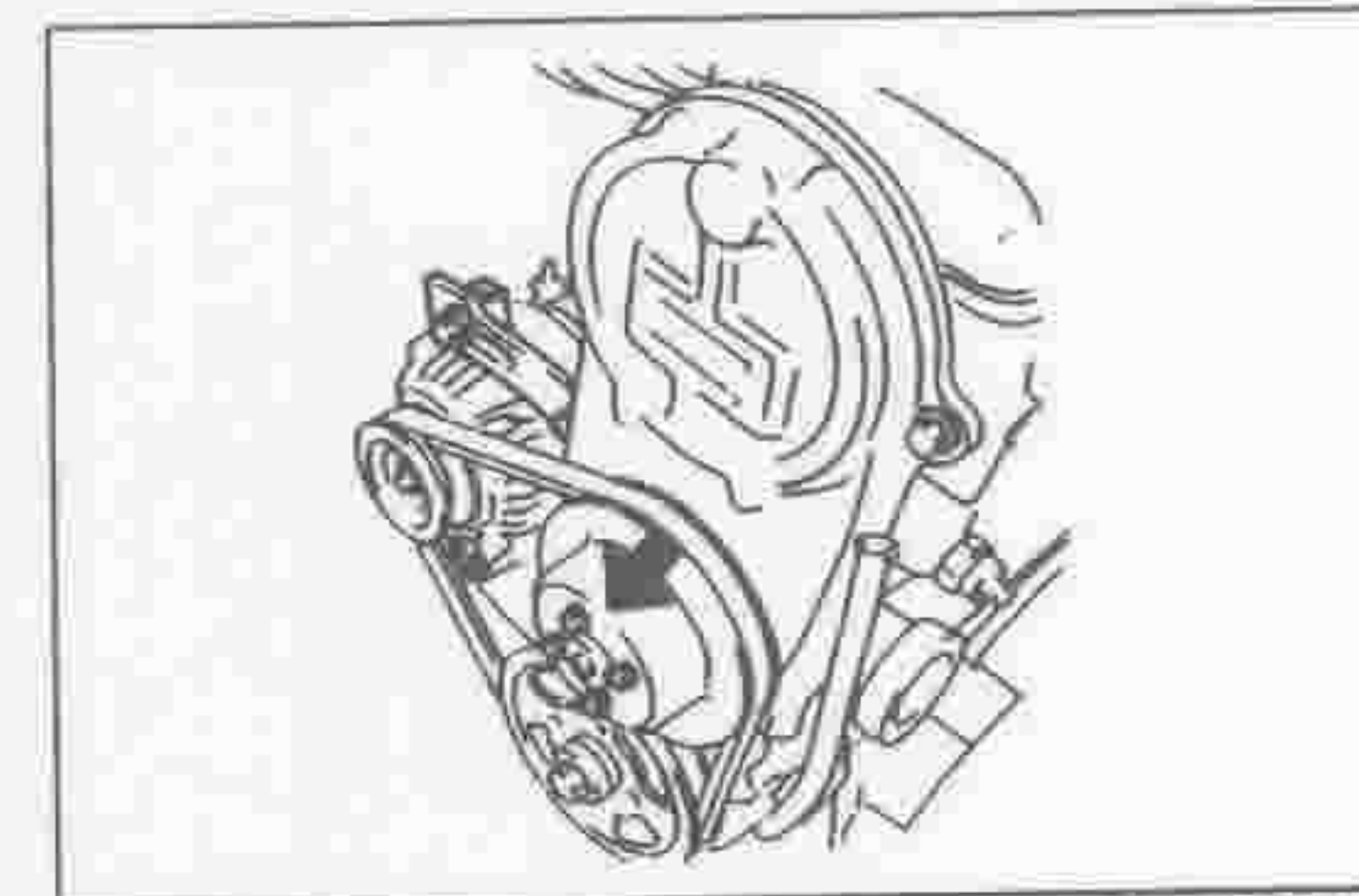
## CAUTION:

- Be careful not to damage the starter installation surface.  
Tightening Torque:  $98.0 \pm 9.8$  N·m  
( $10.00 \pm 1.00$  kgf-m)



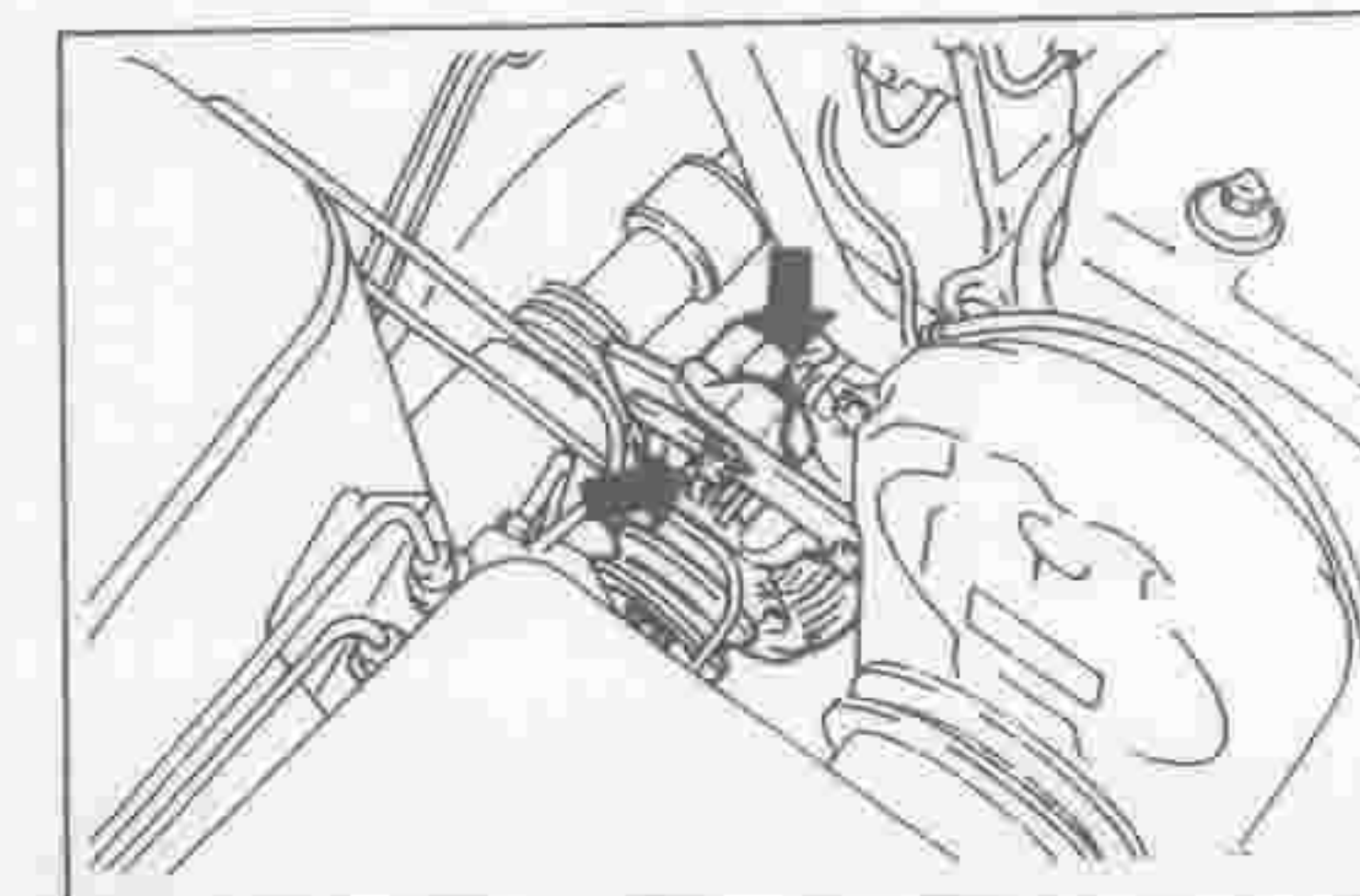
LEM00055-00043

11. Temporarily install the water pump pulley with the four bolts.



LEM00056-00044

12. Install the alternator, adjusting bar side bolt and nut.  
13. Install the V-belt.  
14. Adjust the V-belt tension.  
(Refer to page MA-9 of the MA Engine section.)



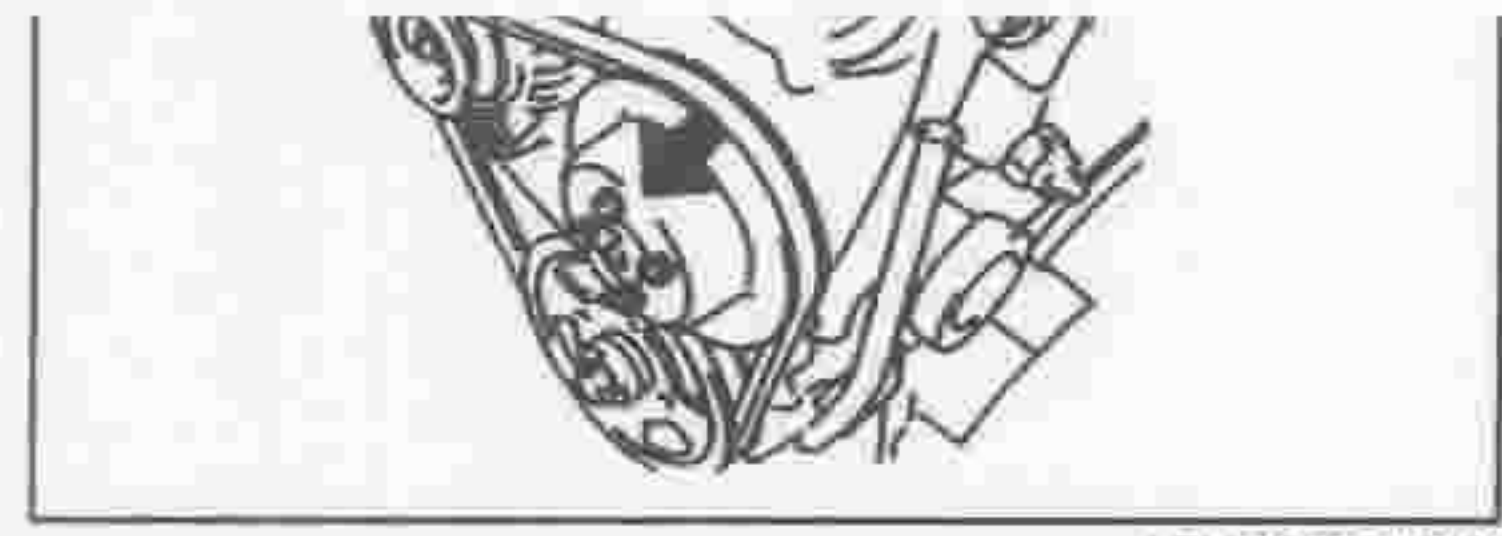
LEM00057-00045

# FM-18

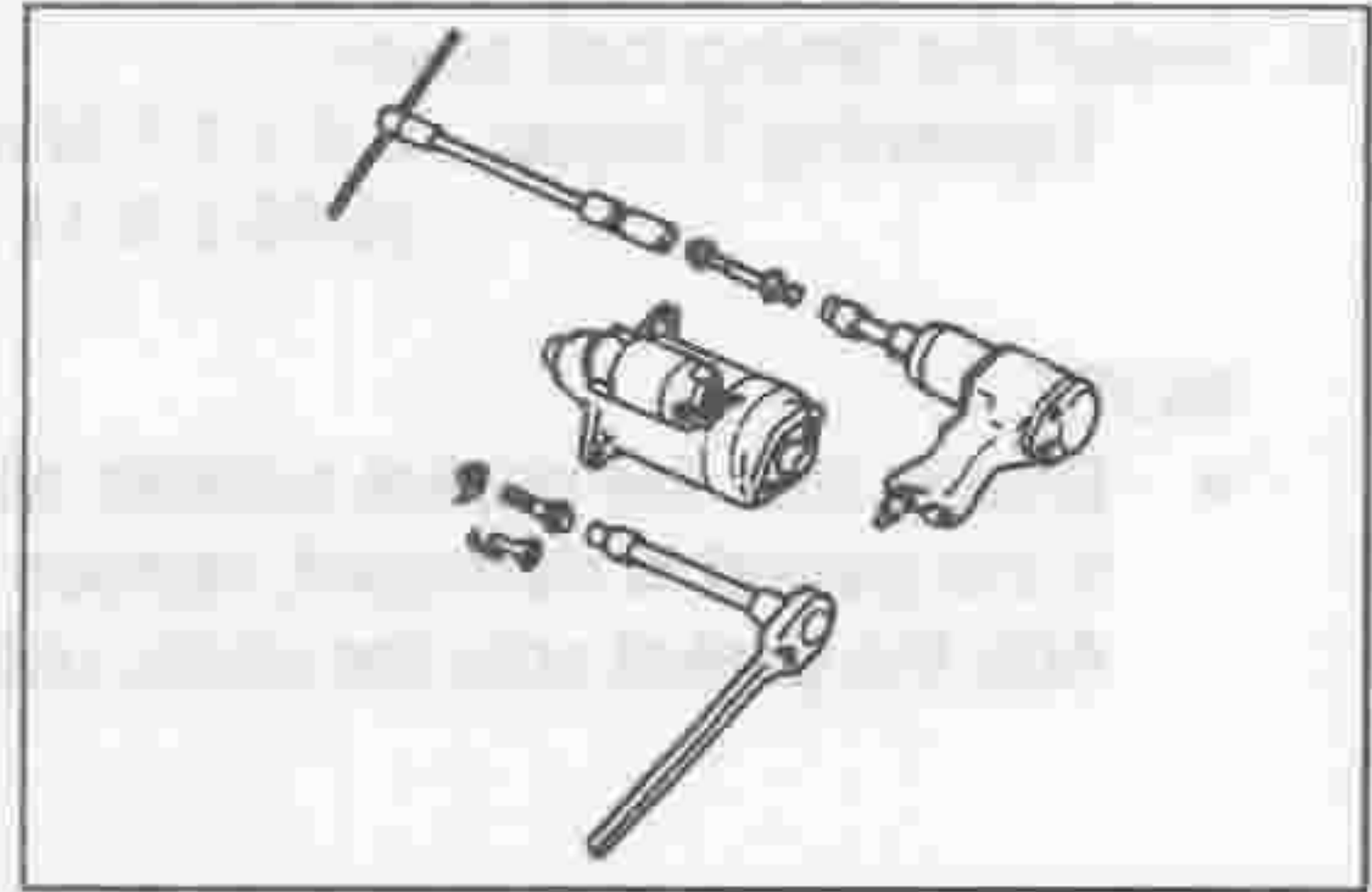


## 16. Starter installation

- (1) Install the starter motor onto the clutch housing.
- (2) Connect the wires for the starter circuit.



LEM00058-00046

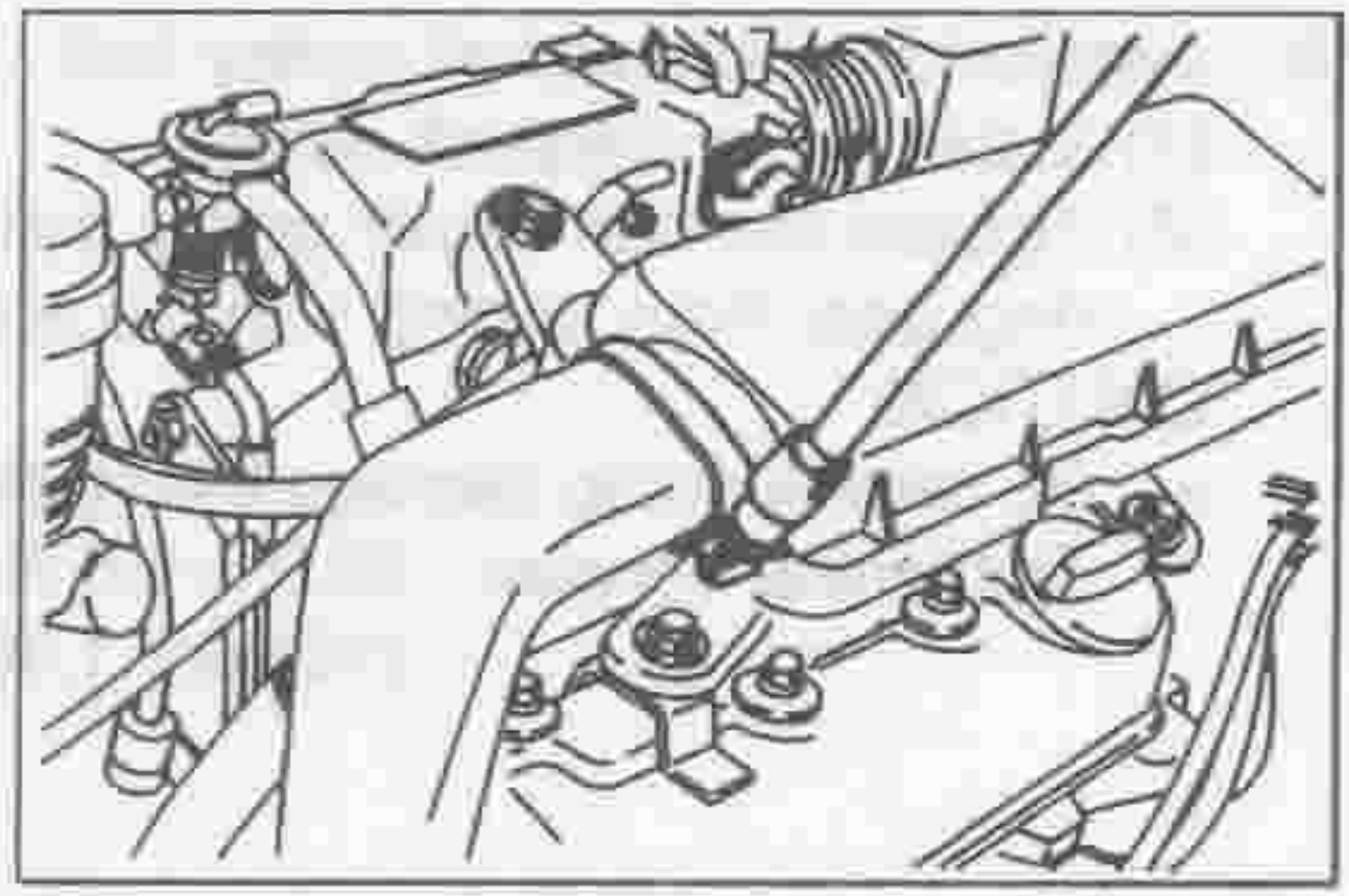


LEM00059-00047

## 17. Install the air cleaner assembly with air intake duct. [ED-20, EF-EL Engine]

## 18. Install the oil level gauge into position.

## 19. Connect the battery ground cable to the negative (-) terminal of the battery.

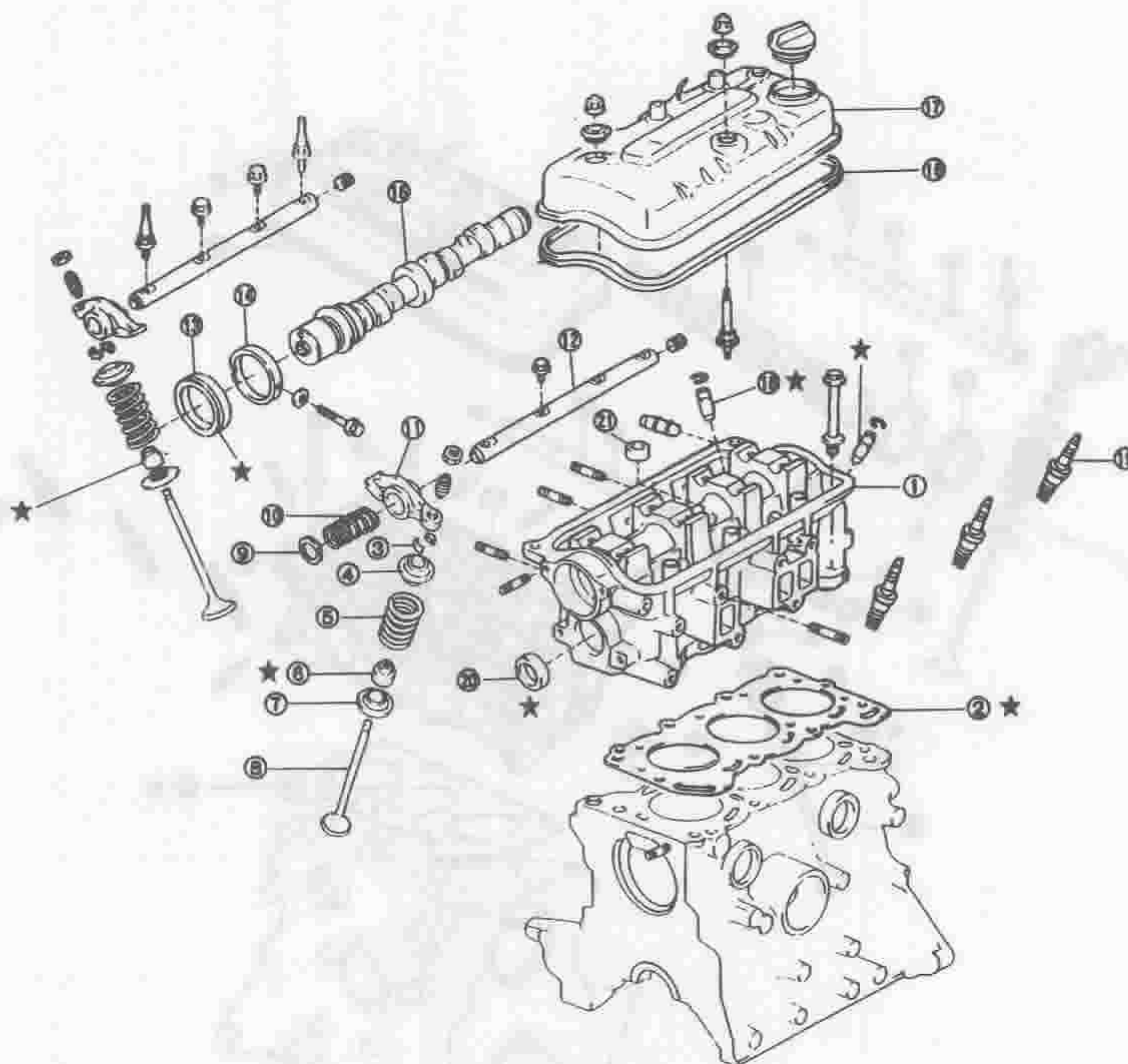


LEM00060-00048



# CYLINDER HEAD COMPONENTS [ED-10, ED-20 Engine]

★ : Non-reusable parts



- ① Cylinder head
- ② Cylinder head gasket
- ③ Valve spring retainer lock
- ④ Valve spring retainer
- ⑤ Valve spring
- ⑥ Valve stem oil seal
- ⑦ Valve spring seat
- ⑧ Valve
- ⑨ Washer
- ⑩ Valve rocker spring

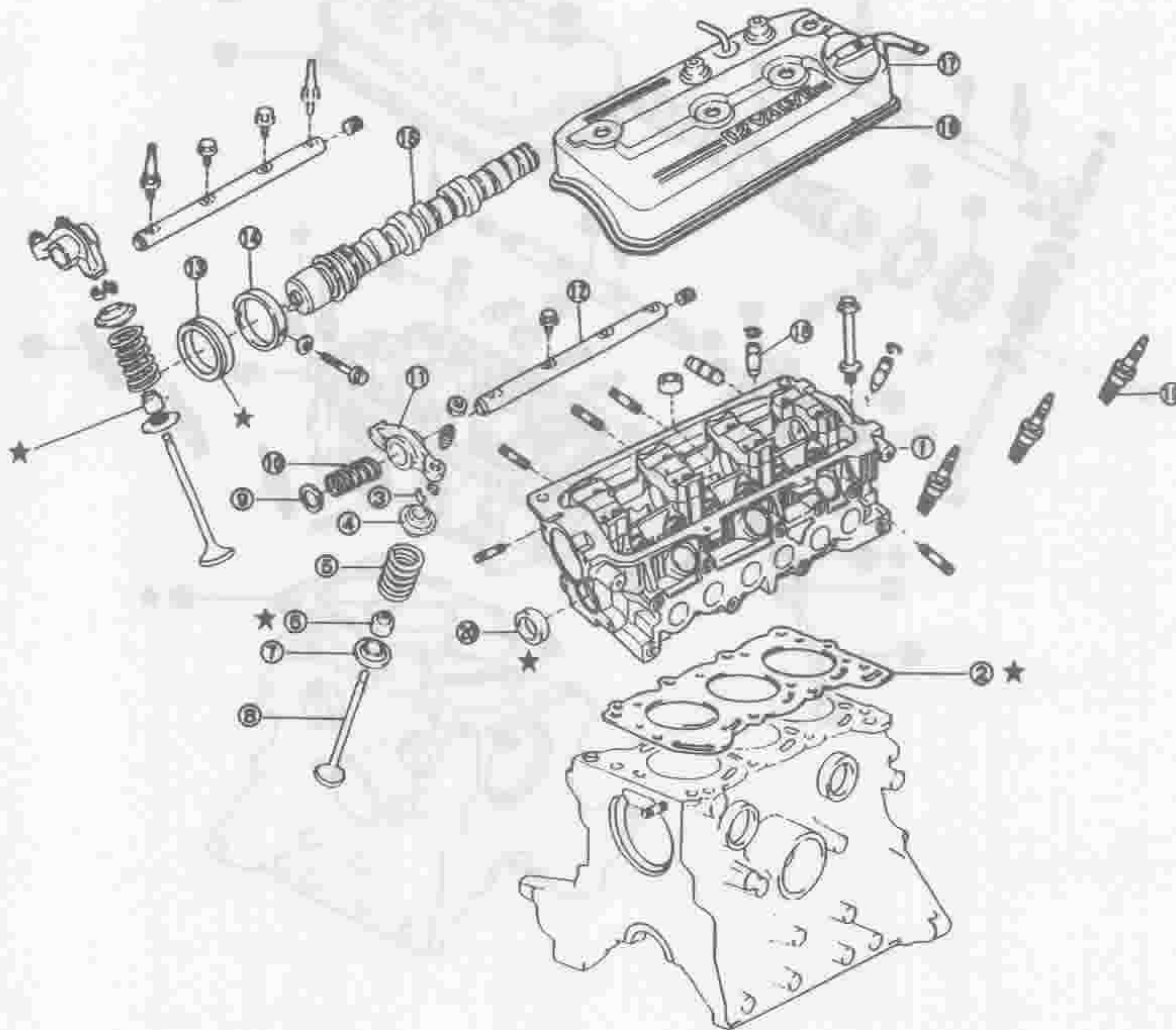
- ⑪ Valve rocker arm
- ⑫ Valve rocker shaft
- ⑬ Camshaft oil seal
- ⑭ Thrust ring
- ⑮ Camshaft
- ⑯ Gasket
- ⑰ Cylinder head cover
- ⑱ Valve stem guide
- ⑲ Spark plug
- ⑳ Plug
- ㉑ Plug

## COMPONENTS [EF-EL Engine]

CYLINDER HEAD

COMPONENTS [EF-EL Engine]

★ : Non-reusable parts



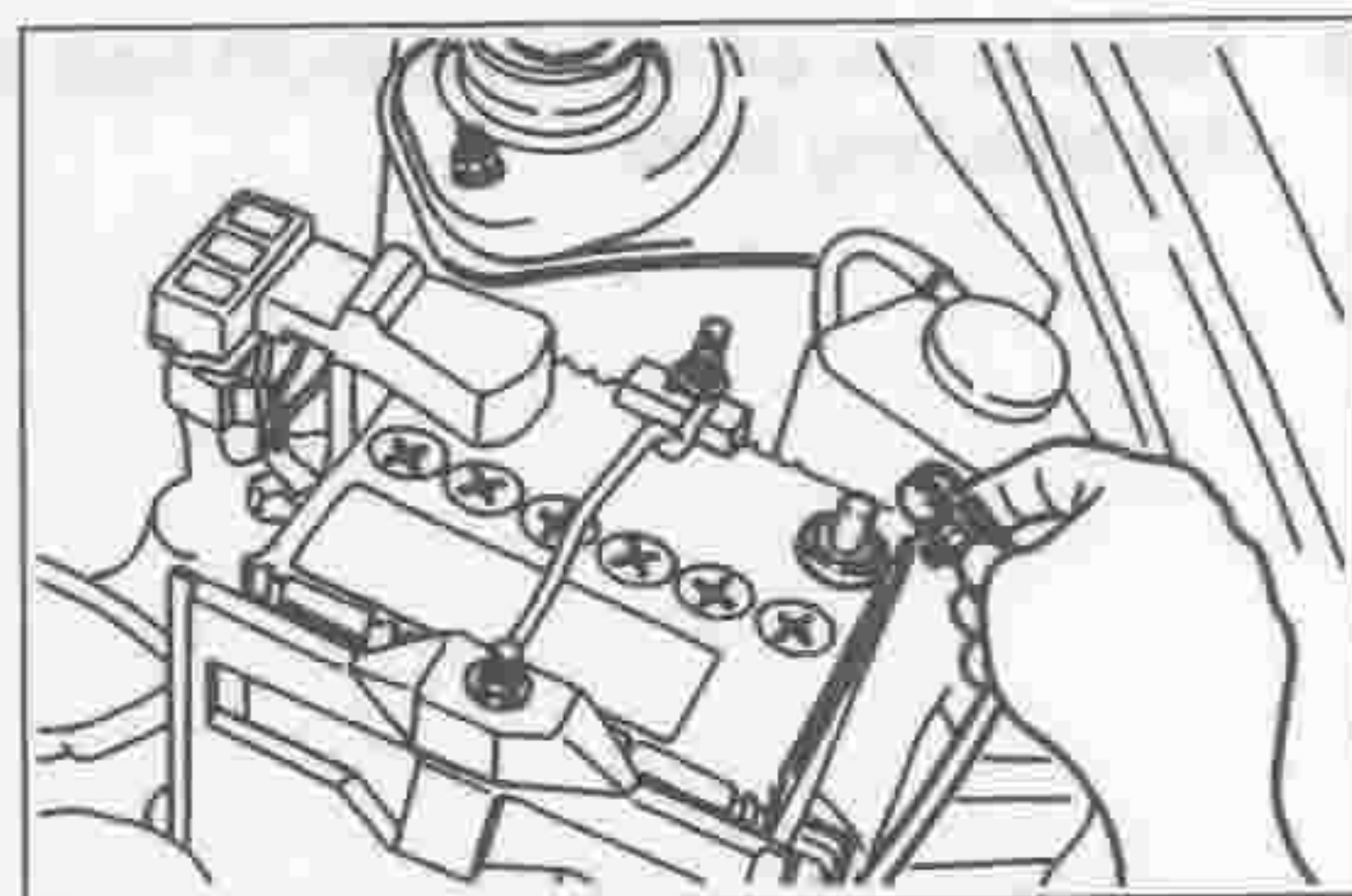
- ① Cylinder head
- ② Cylinder head gasket
- ③ Valve spring retainer lock
- ④ Valve spring retainer
- ⑤ Valve spring
- ⑥ Valve stem oil seal
- ⑦ Valve spring seat
- ⑧ Valve
- ⑨ Washer
- ⑩ Valve rocker spring

- ⑪ Valve rocker arm
- ⑫ Valve rocker shaft
- ⑬ Camshaft oil seal
- ⑭ Thrust ring
- ⑮ Camshaft
- ⑯ Gasket
- ⑰ Cylinder head cover
- ⑱ Valve stem guide
- ⑲ Spark plug
- ⑳ Plug

## REMOVAL OF CYLINDER HEAD

### [ED-20, EF-EL Engine]

1. Disconnect the battery ground cable terminal from the negative (-) terminal of the battery.
2. Drain the coolant
3. Remove the timing belt.  
(See page EM-10.)



LEM00063-00051

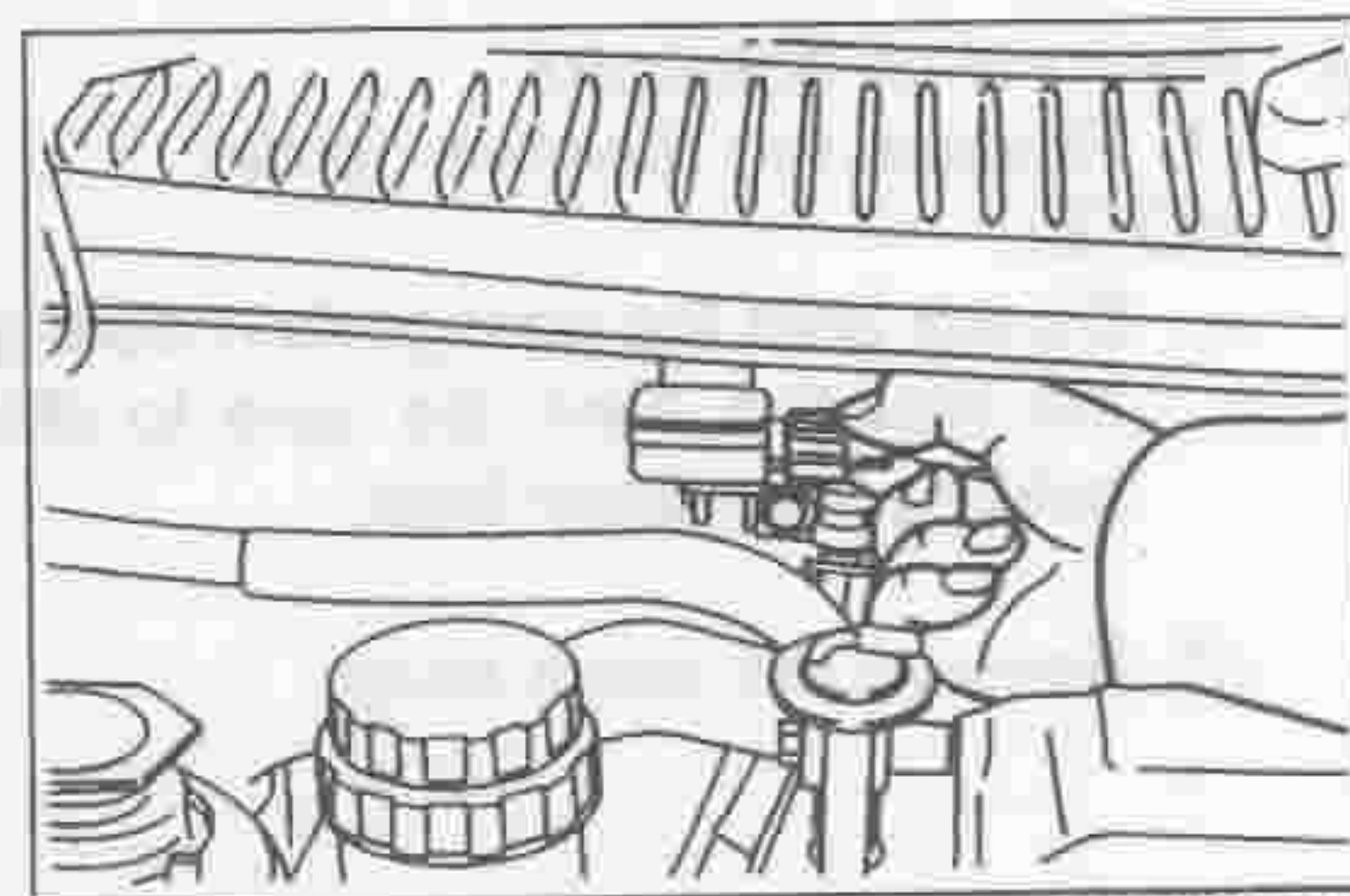
4. Remove the front bumper.  
(Refer to the BO section.)

LEM00064-00000

5. Remove the following vacuum hoses from the surge tank.
  - (1) For pressure sensor
  - (2) For PCV
  - (3) For brake booster
  - (4) For ISC VSV
  - (5) For charcoal canister

LEM00065-00000

6. Removal of engine wire from cylinder head related parts
  - (1) Disconnect the connector of the pressure sensor.
  - (2) Disconnect the connector of the injectors.
  - (3) Disconnect the connector of the throttle position sensor.
  - (4) Disconnect the connector of the ISC VSV.
  - (5) Disconnect the connector of the oil pressure switch.
  - (6) Disconnect the connector of the intake air temperature sensor. [ED-20 Engine]
  - (7) Detach the engine wire clamps.



LEM00066-00053

7. Remove the fuel hose and fuel return hose from the delivery pipe.

#### CAUTION:

- Release the inner pressure of the fuel tank by removing the fuel filler cap in advance.
- Since the fuel will flow out, be certain to place a suitable container or cloth, etc. under the pressure regulator so that no fuel may get to the alternator.

8. Remove the intake manifold stay attaching bolt.

LEM00067-00000

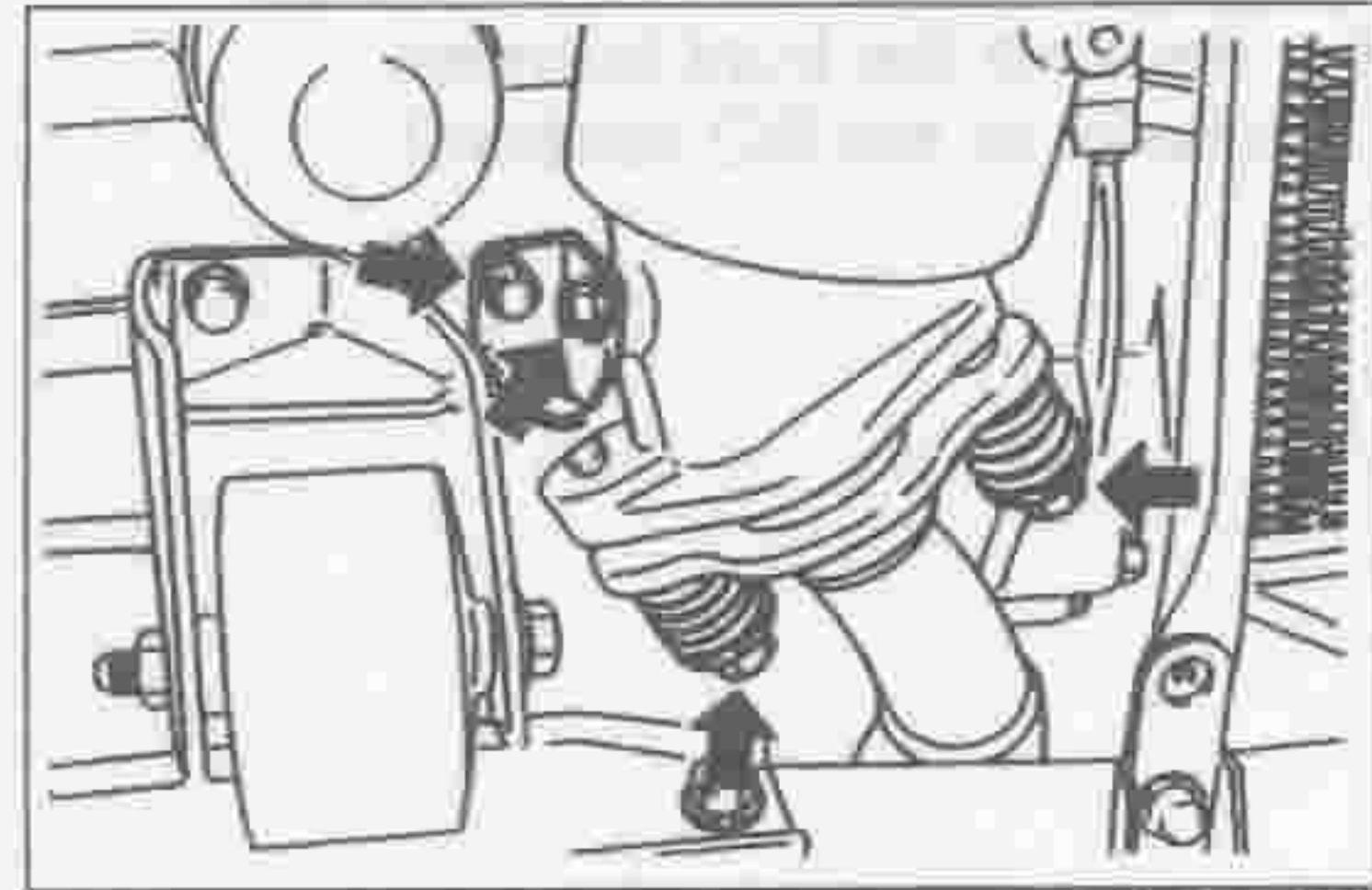
# EM-22

9. Remove the exhaust manifold heat insulator by removing



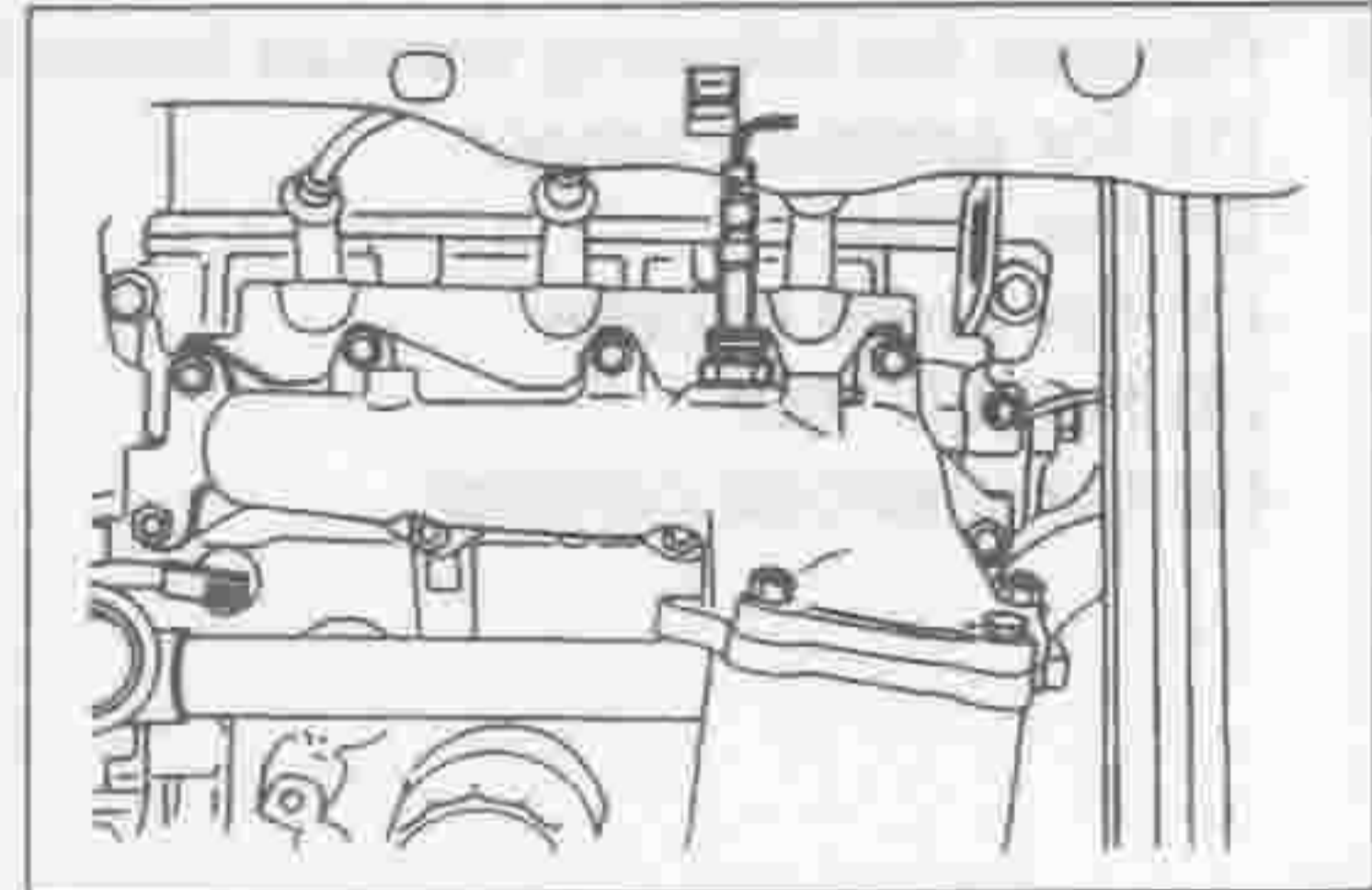
LEM00068-00055

10. Remove the exhaust manifold stay.  
11. Remove the exhaust pipe from the exhaust manifold.



LEM00069-00056

12. Disconnect the connectors of the oxygen sensor and exhaust gas temperature sensor.



LEM00070-00057

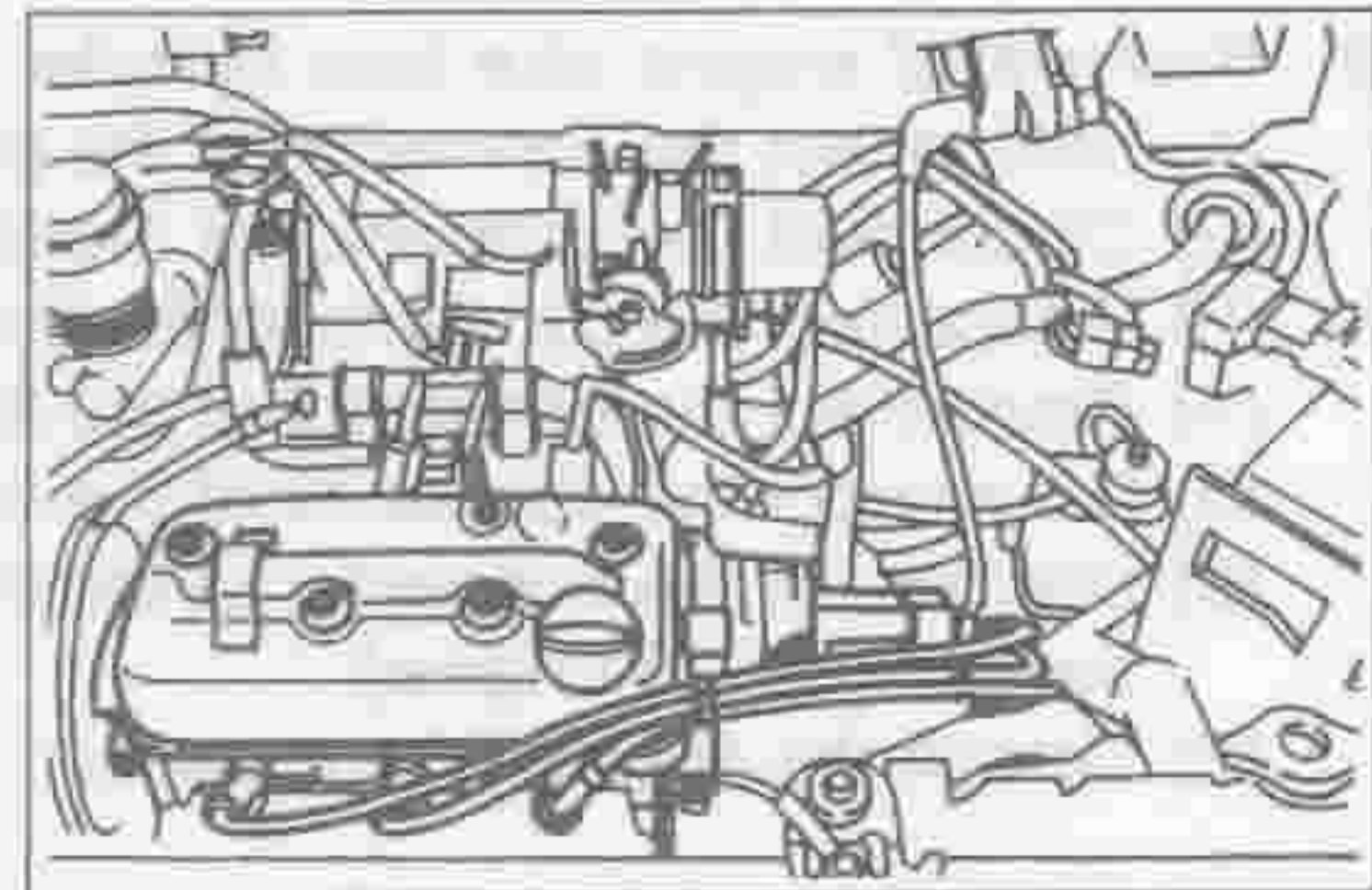
13. Removal of distributor

(1) Remove the resistive cords.

NOTE:

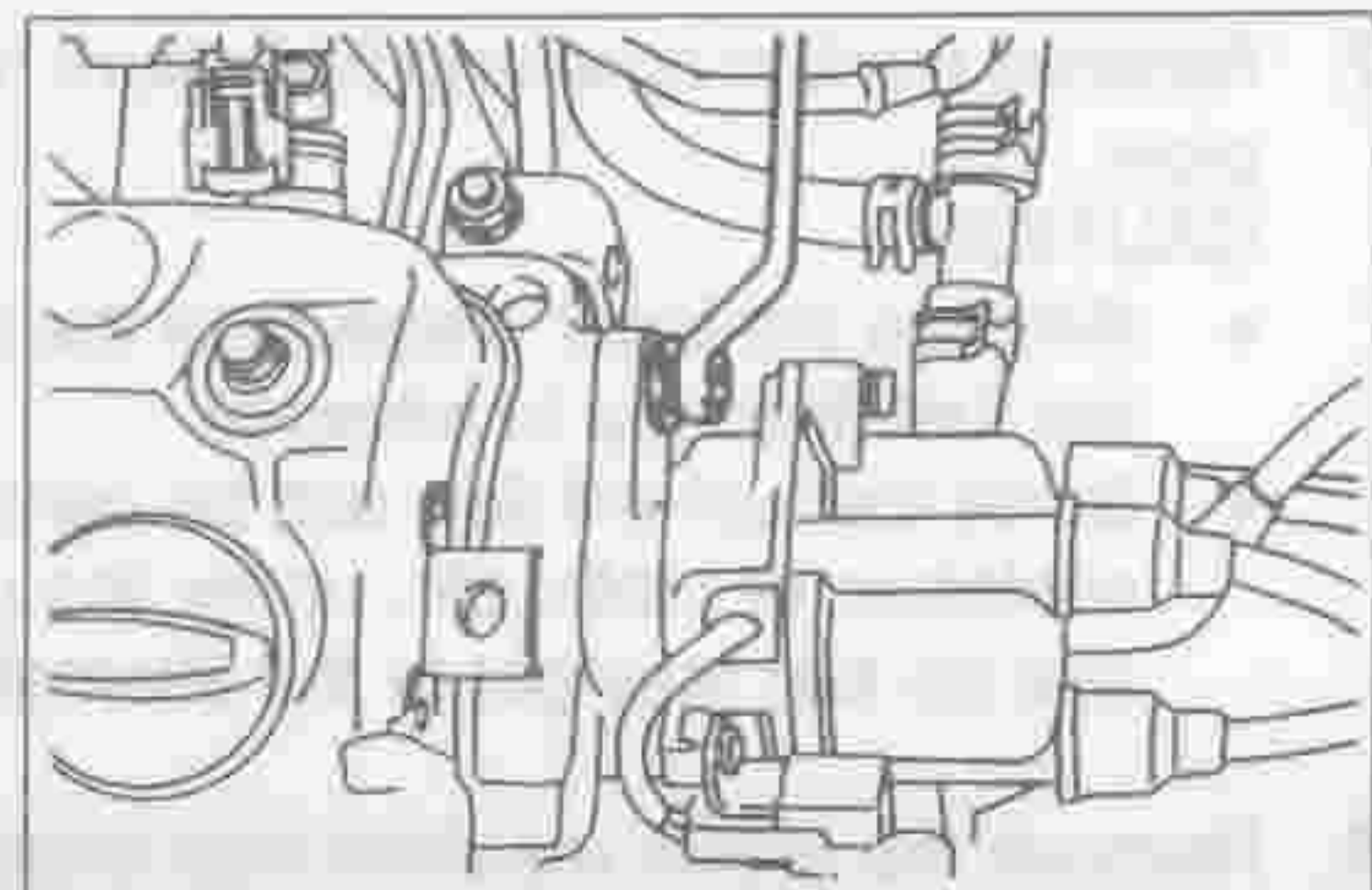
- Do not hold the cord portion during the disconnection of the resistive cord. Be sure to disconnect the cord by holding the rubber boot.

(2) Remove the spark plugs.



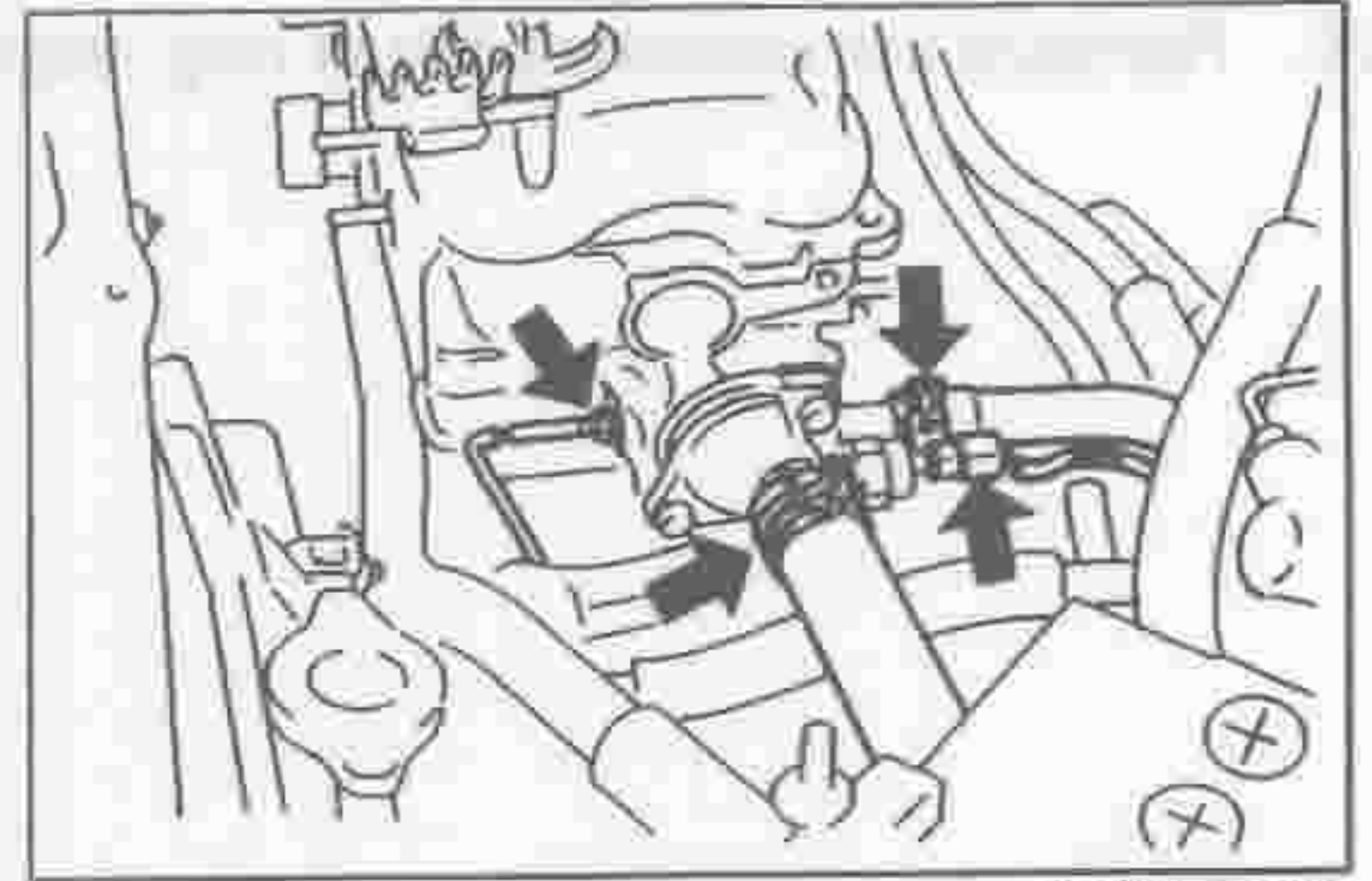
LEM00071-00058

- (3) Disconnect the connector of the distributor.  
(4) Remove the distributor.



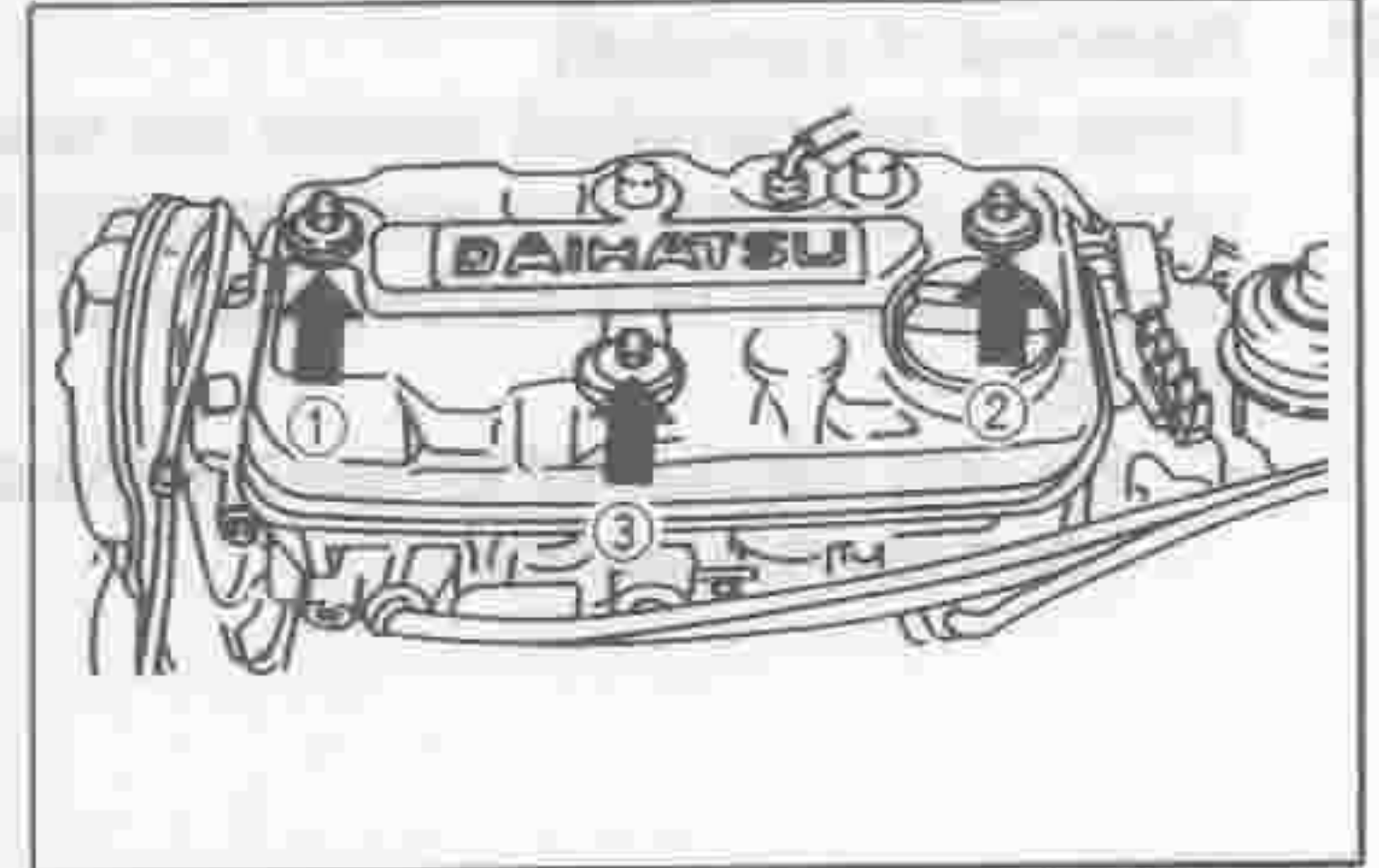
LEM00072-00059

14. Disconnect the water hoses from the cylinder head.
15. Disconnect the water temperature sender gauge connector.
16. Disconnect the fan motor control switch connector.



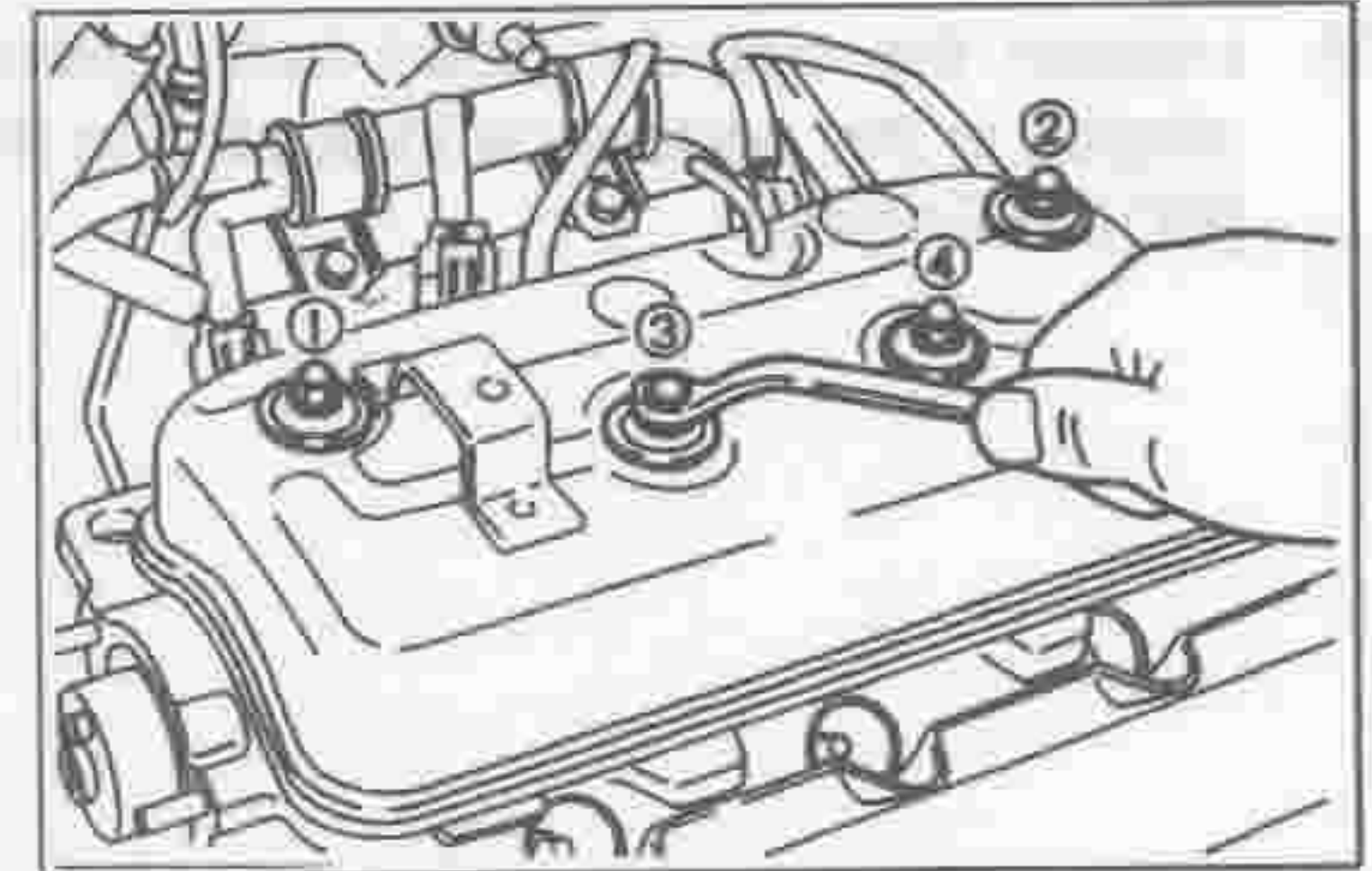
LEM00073-00060

17. Remove the cylinder head cover by removing the attaching nut in the sequence in the right figure.  
[ED-20 Engine]



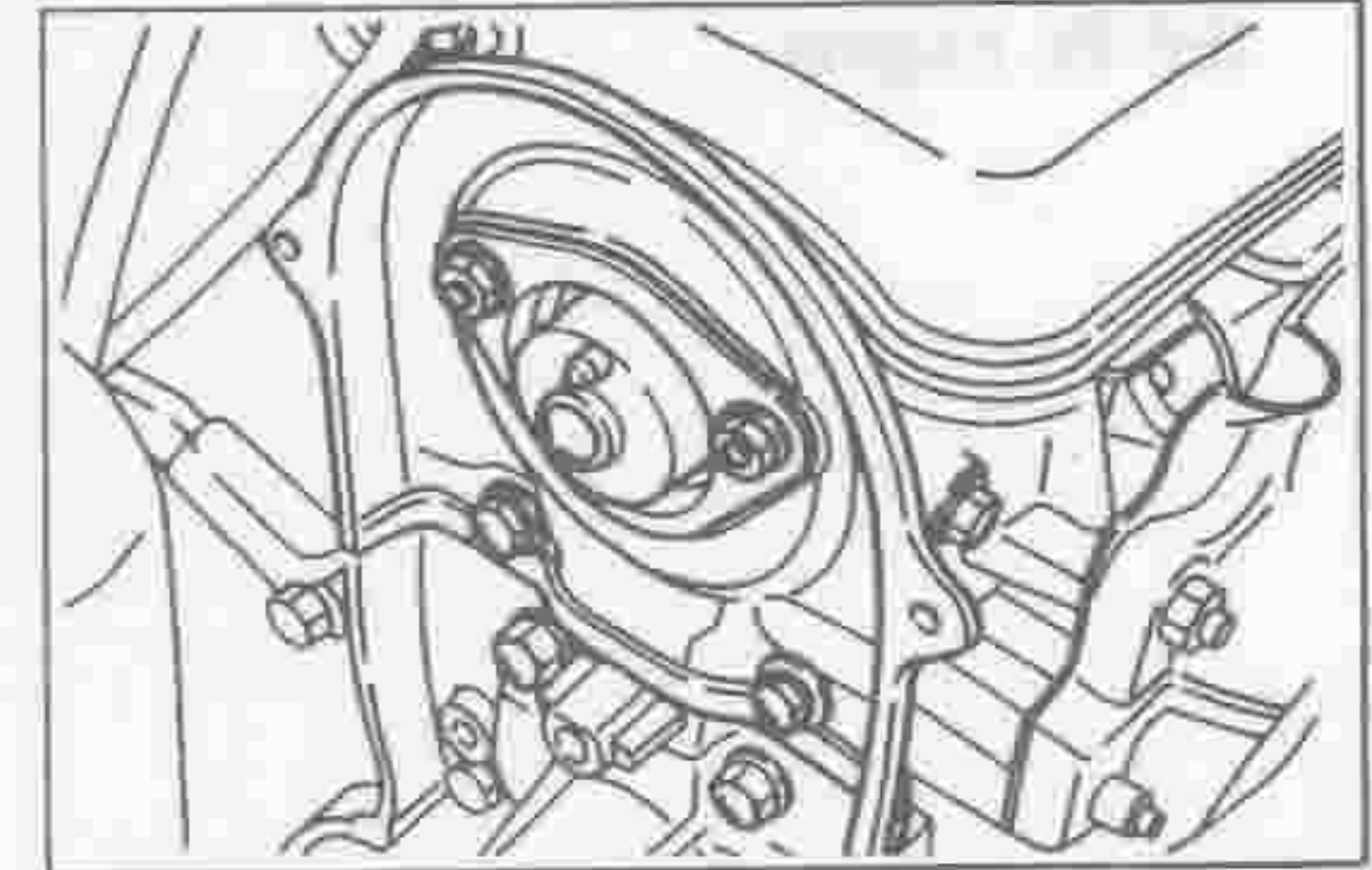
LEM00074-00061

[EF-EL Engine]



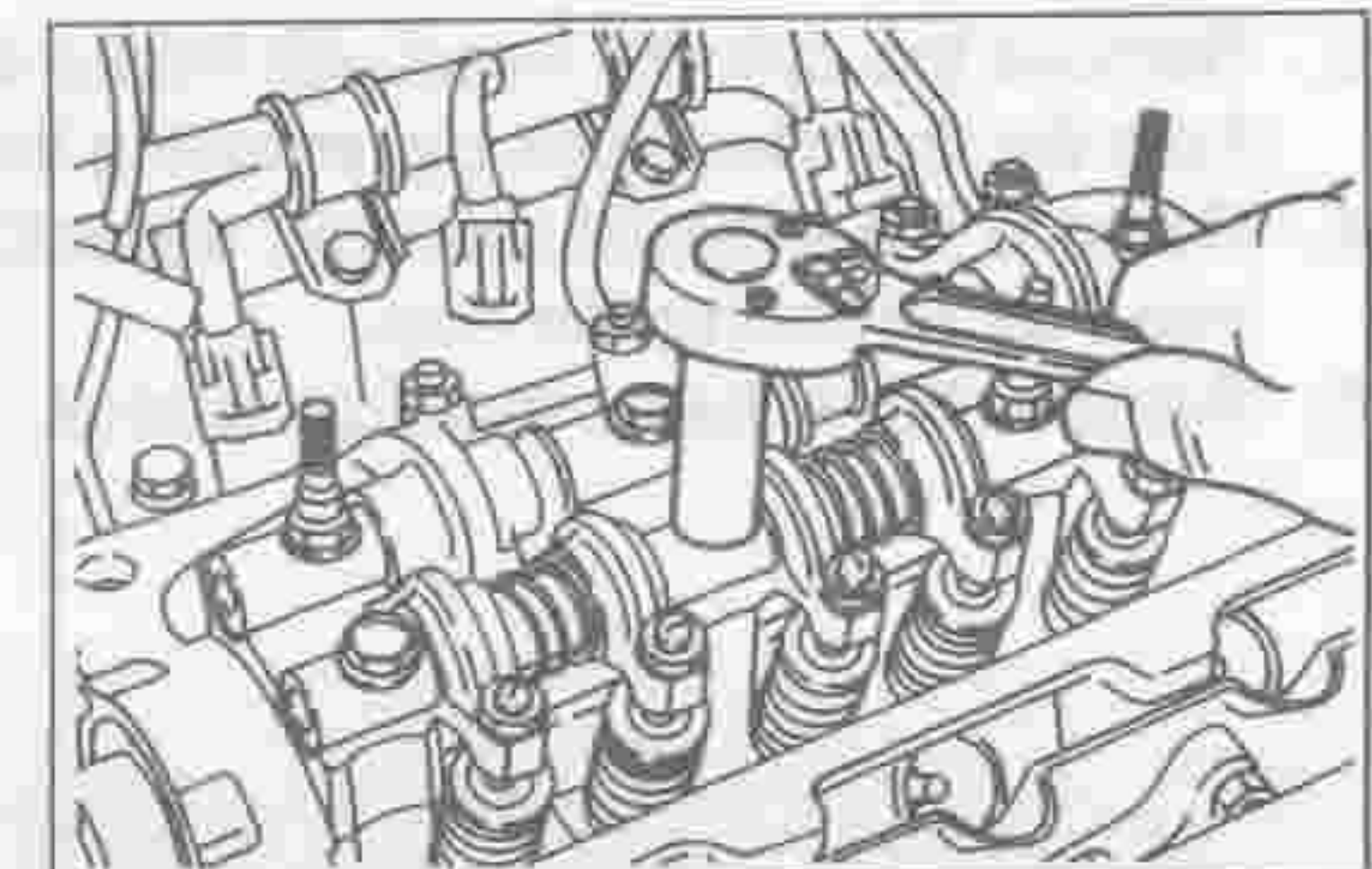
LEM00075-00062

18. Remove the timing belt inside cover by removing the bolts and nuts.



LEM00076-00063

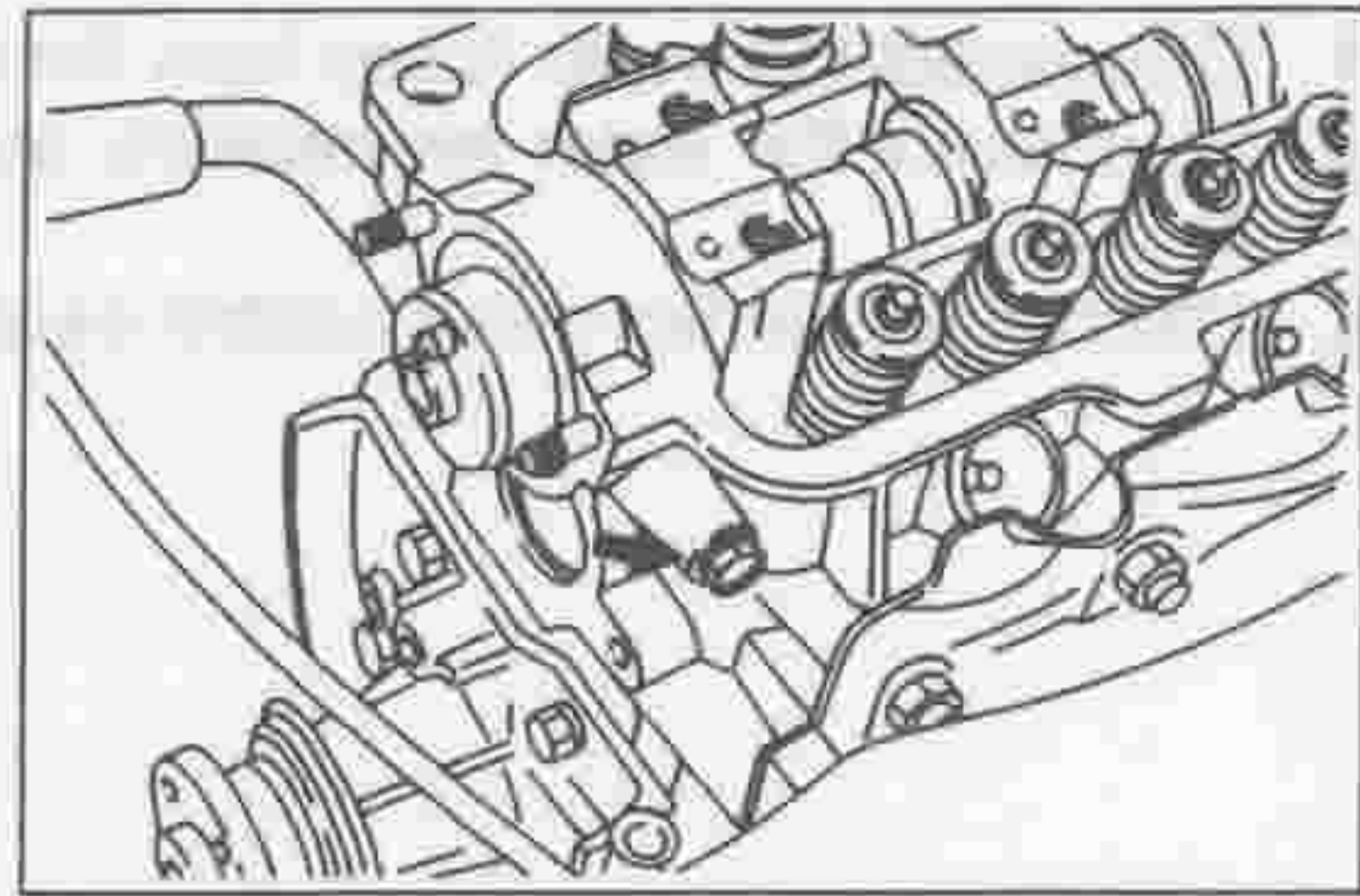
19. Remove the valve rocker shafts from the cylinder head by loosening the retaining bolts evenly over two or three stages.



LEM00077-00064

# EM-24

20. Remove the camshaft thrust ring retaining bolt.



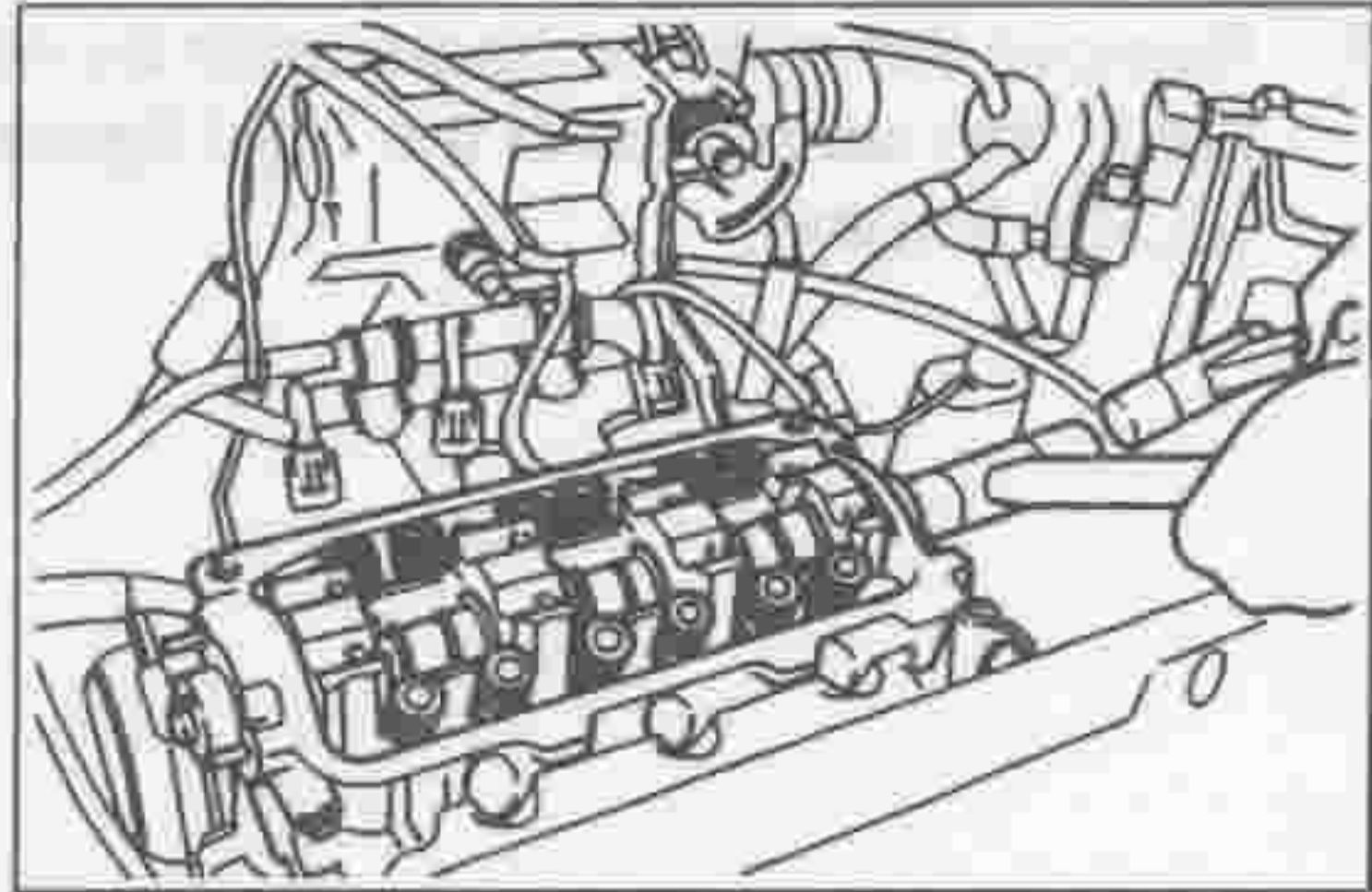
LEM00078-00065

21. Removal of camshaft

Drive off the camshaft toward the timing belt side by tapping the camshaft rear end (installing the distributor) with a plastic hammer or a rubber hammer.

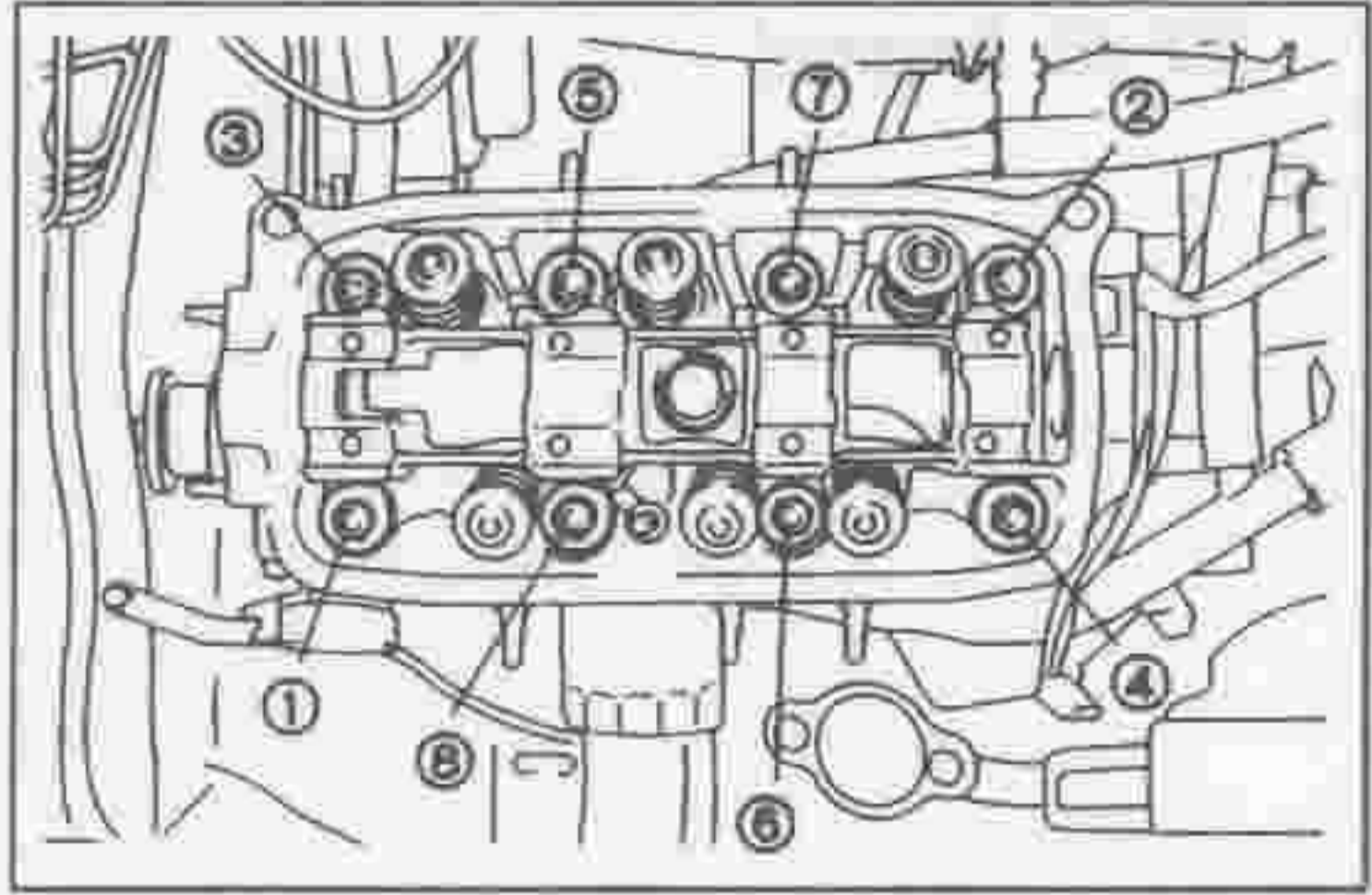
NOTE:

- Be very careful not to damage the camshaft and cylinder head journal sections.



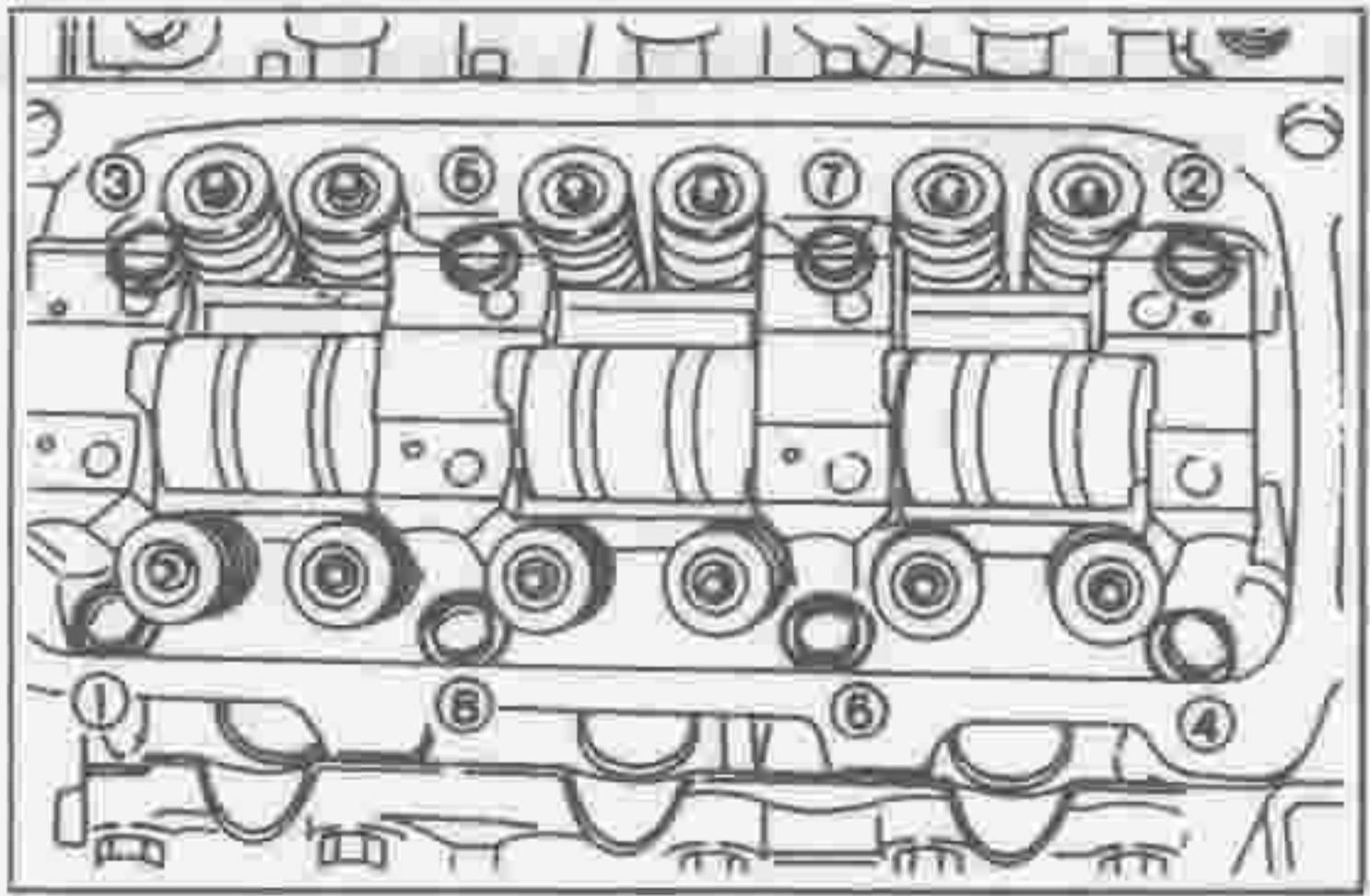
LEM00079-00066

22. Loosen the cylinder head bolts evenly over two or three stages in the sequence indicated in the right figure.  
[ED-20 Engine]



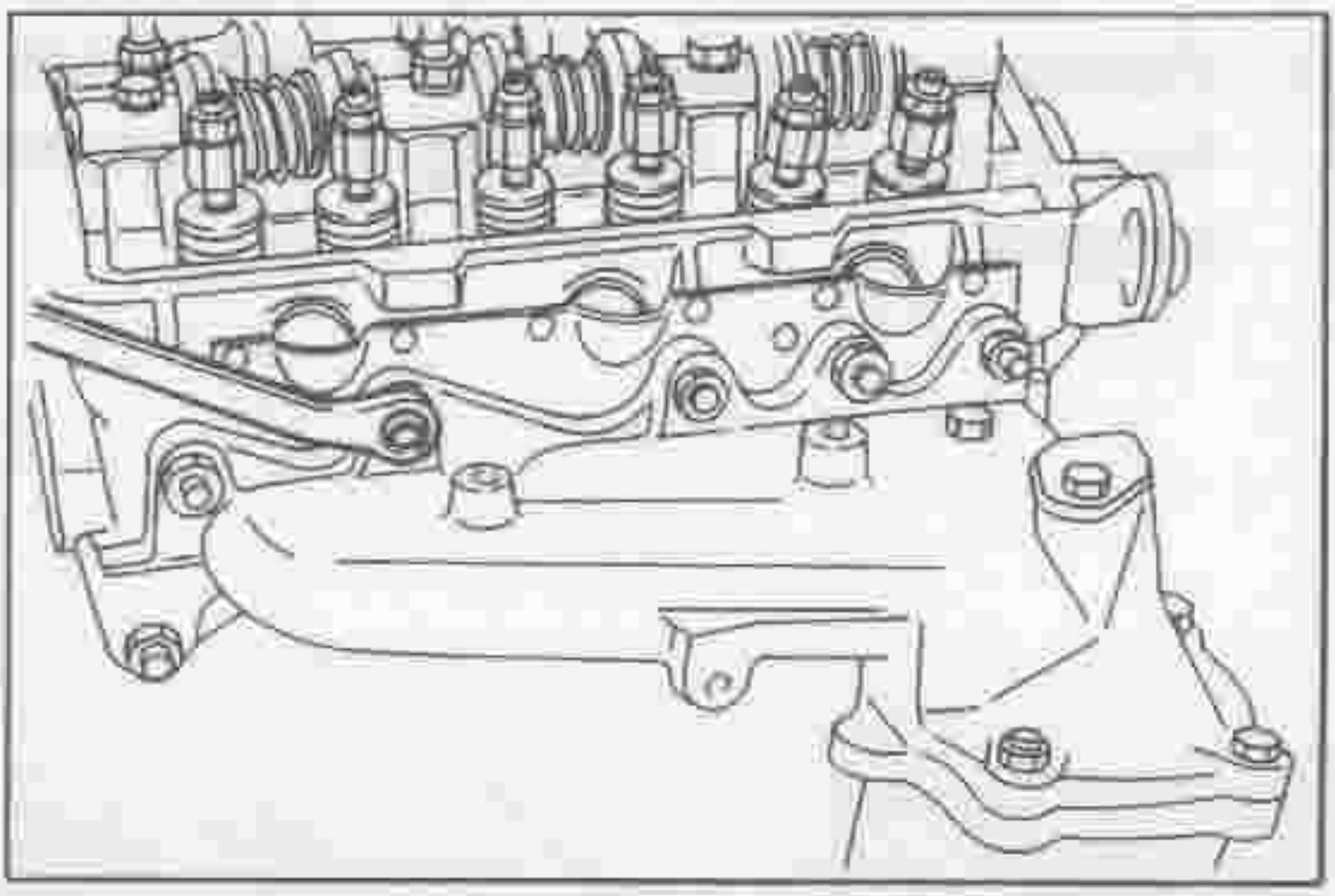
LEM00080-00067

[EF-EL Engine]



LEM00081-00068

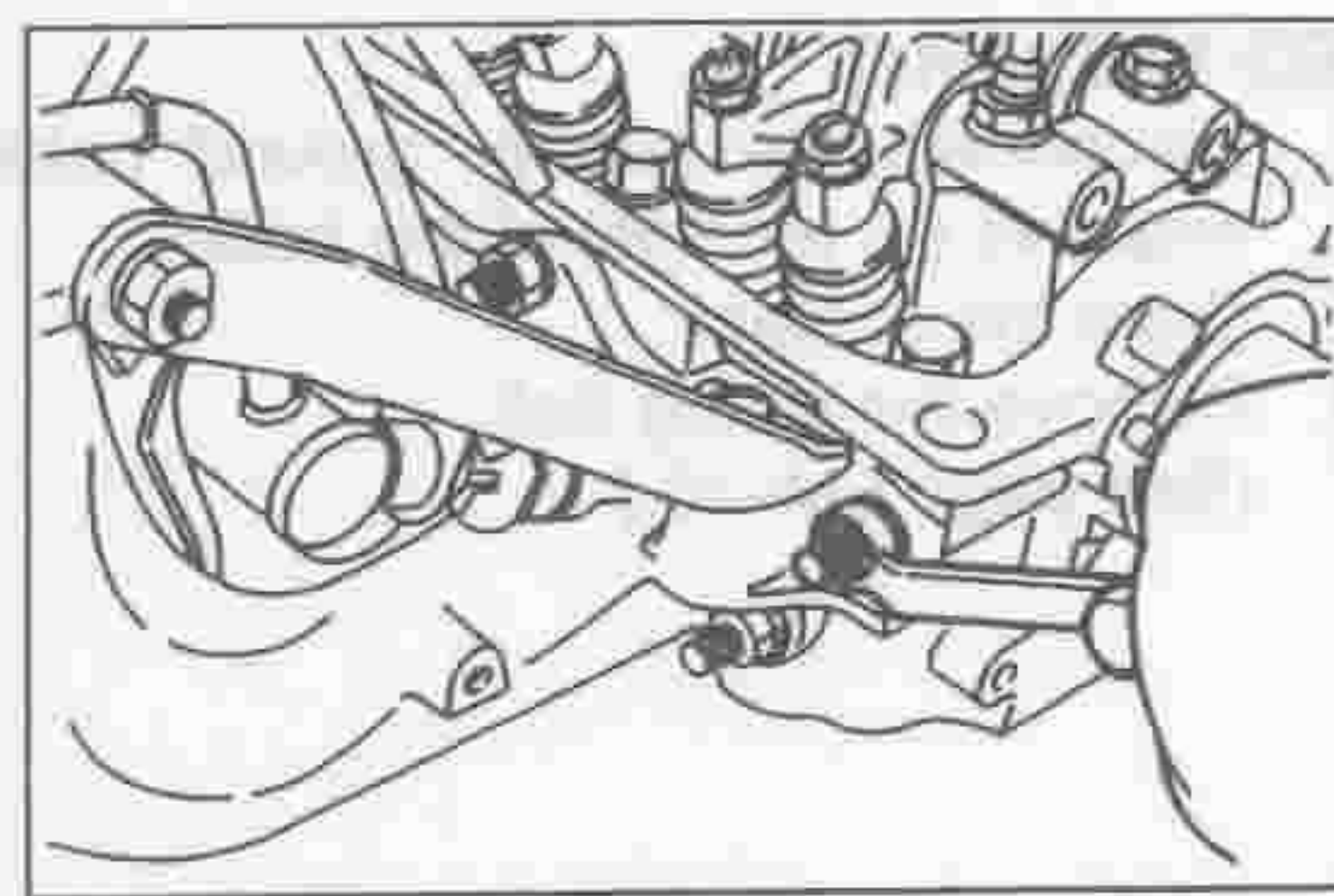
23. Remove the cylinder head with intake and exhaust manifold from the cylinder block by removing the cylinder head bolt.  
24. Remove the exhaust manifold assembly from the cylinder head by removing the nuts.  
25. Remove the exhaust manifold gasket.



LEM00082-00069

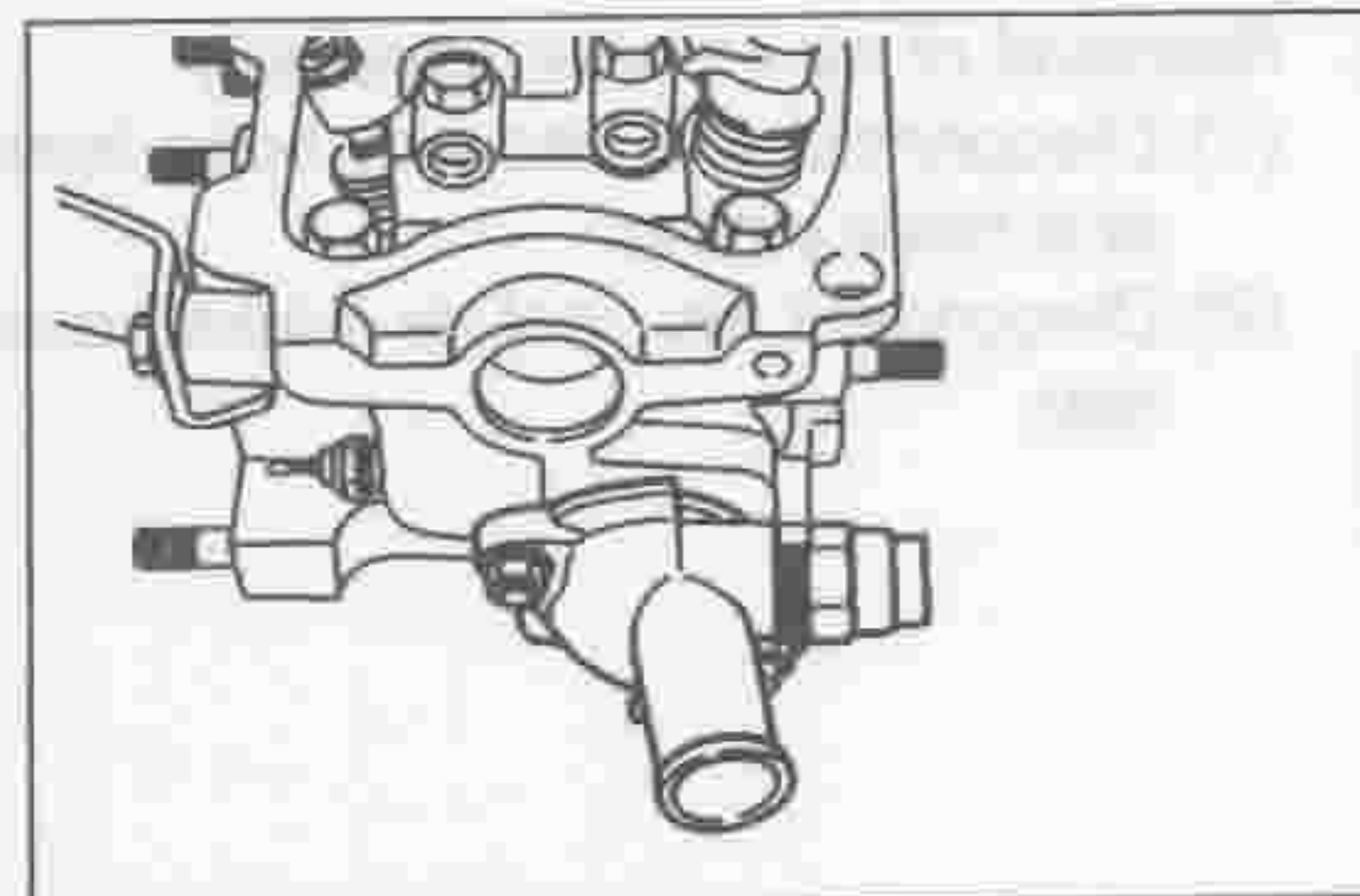


26. Remove the intake manifold assembly from the cylinder head by removing the nuts.
27. Remove the intake manifold gasket.



LEM00083-00070

28. Remove the fan motor control switch.
29. Remove the water temperature sender gauge.
30. Remove the water outlet.
31. Remove the water outlet gasket and gasket material from the water outlet and cylinder head.
32. Remove the spark plugs from the cylinder head.



LEM00084-00071



## [ED-10 Engine]

1. Disconnect the battery ground cable terminal from the negative (-) terminal of the battery.
2. Drain the coolant
3. Remove the timing belt.  
(See page EM-10.)

4. Removal of air cleaner assembly
  - (1) Disconnect the vacuum hose from the vacuum motor and hose clamp.
  - (2) Disconnect the cool air intake hose from the air cleaner cap.

- (3) Remove the wing nut and detach the clamps.
- (4) Remove the air cleaner cap.

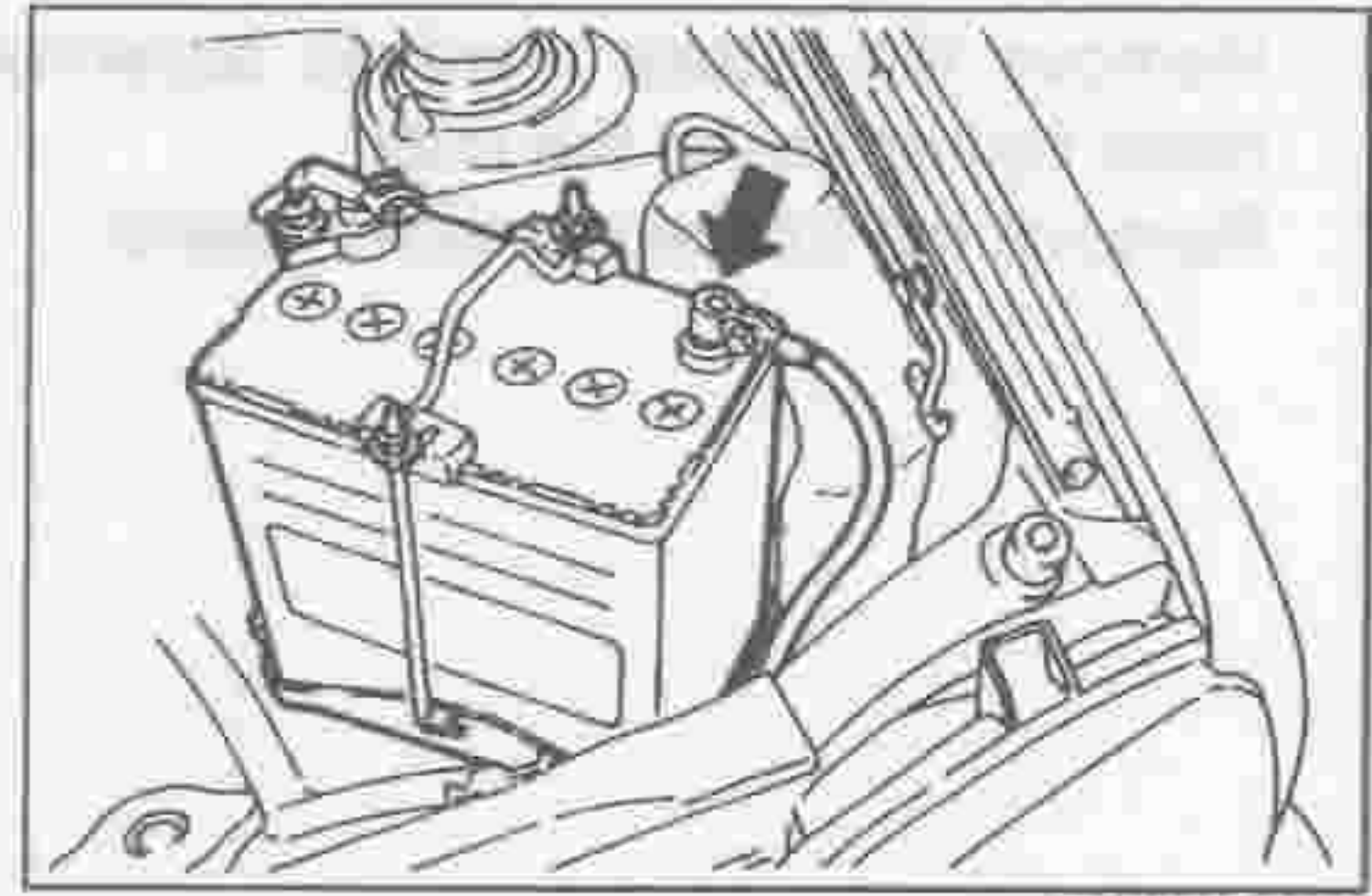
### NOTE:

- Be very careful not to damage the hot air intake hose during the removal.

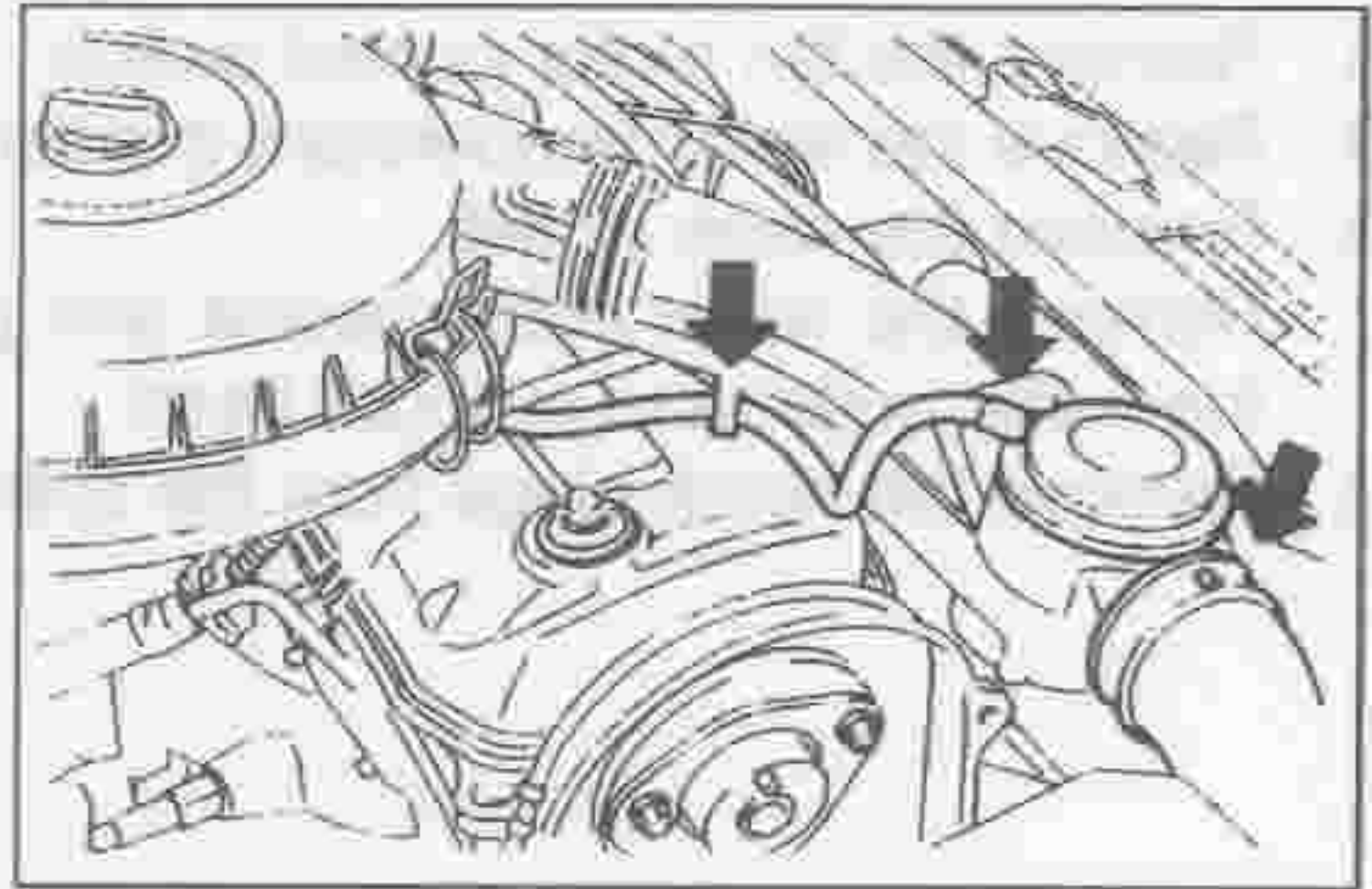
- (5) Remove the air filter element.

- (6) Remove the air cleaner case attaching bolts.

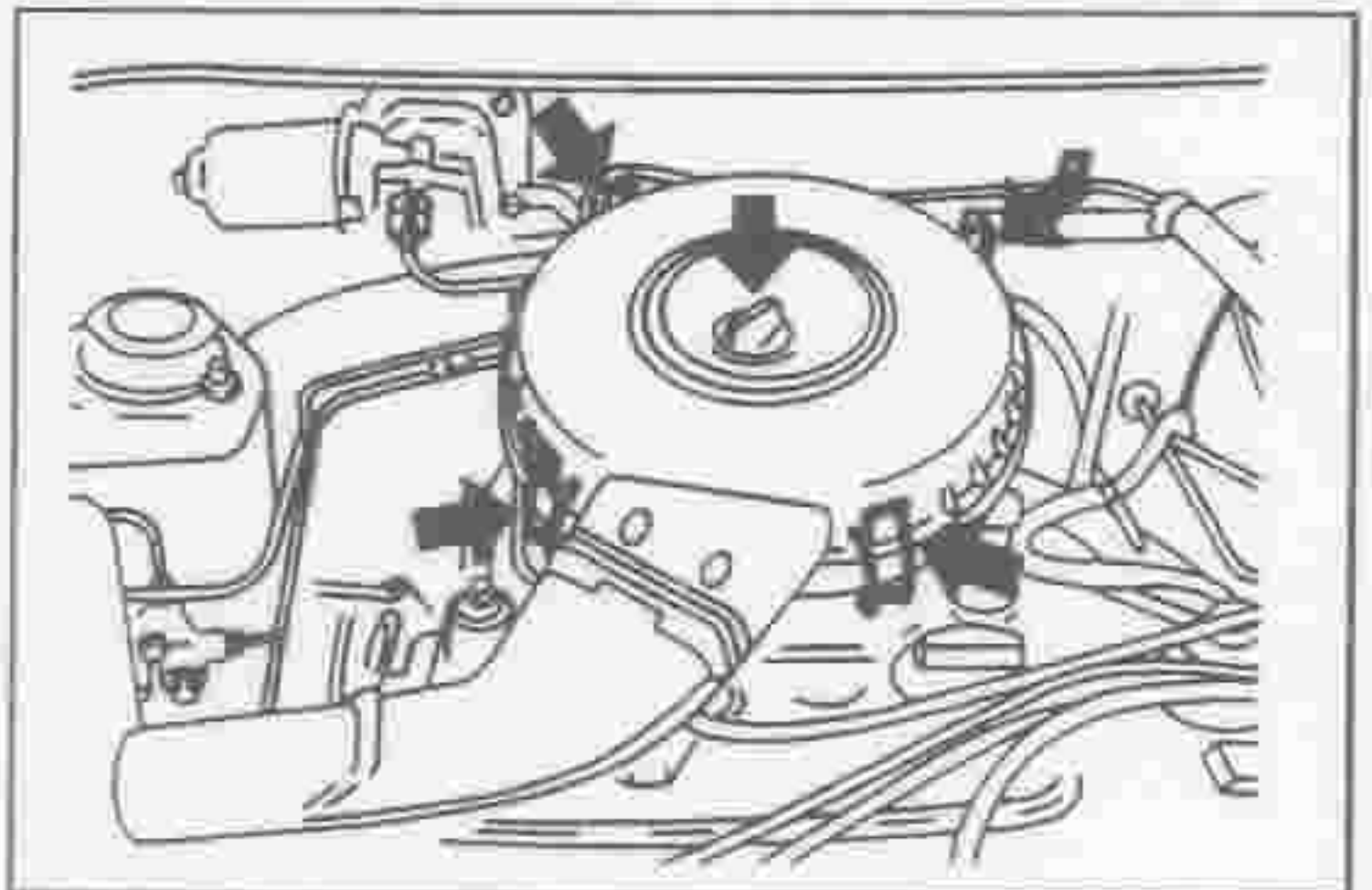
- (7) Raise the air cleaner case slowly.
- (8) Disconnect the PCV hose and vacuum hose from the air cleaner case.



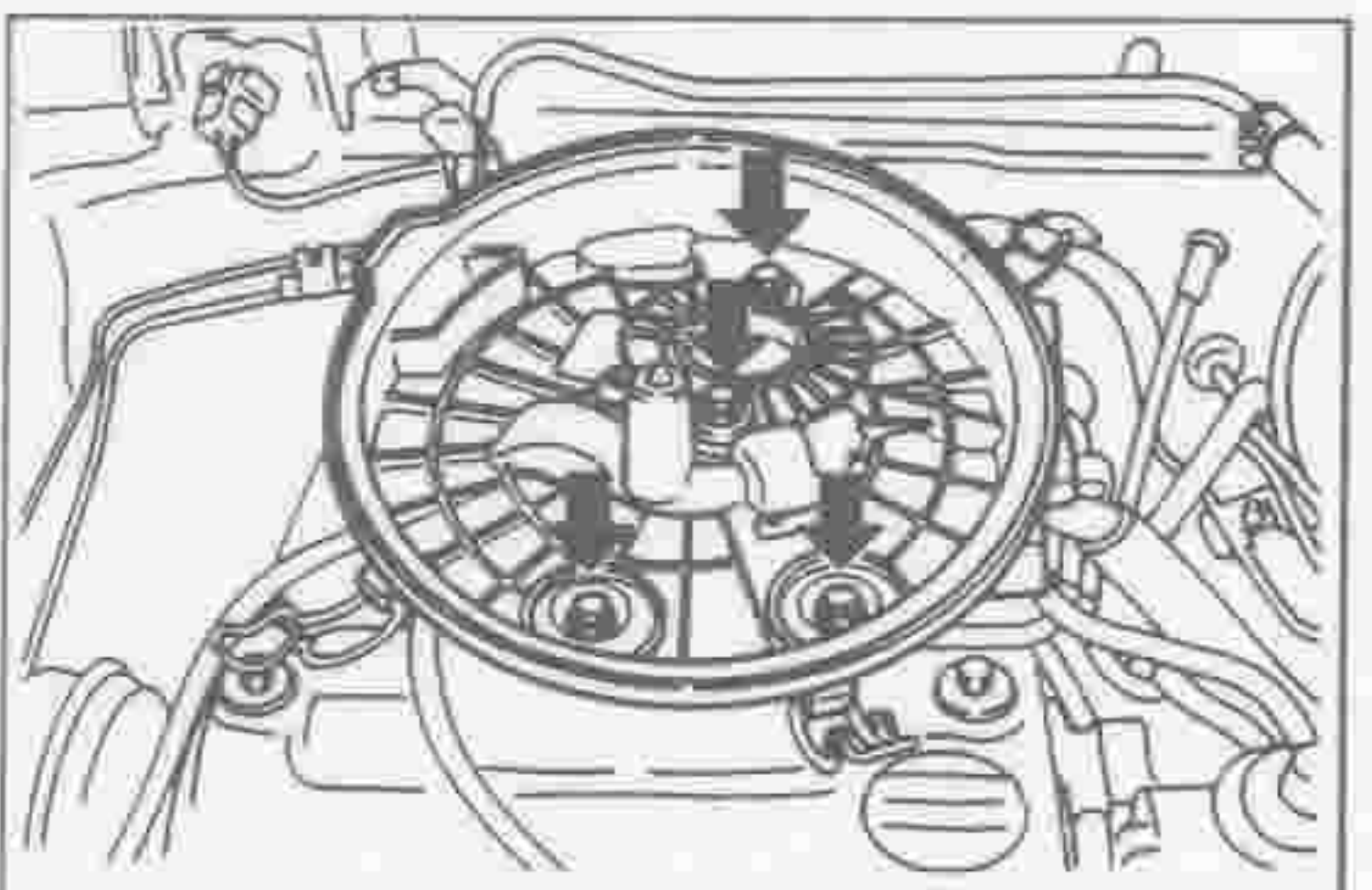
LEM00085-00072



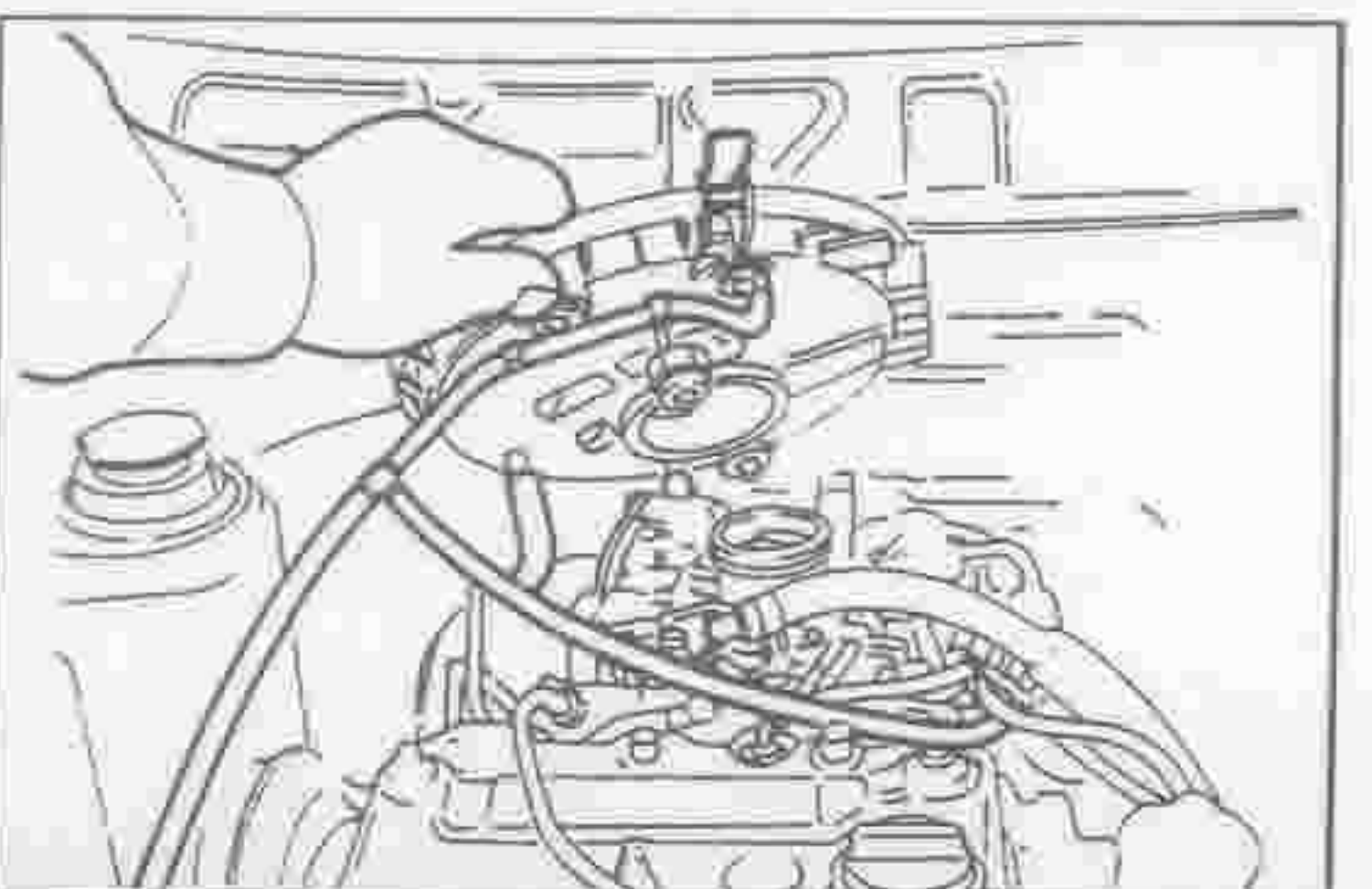
LEM00086-00073



LEM00087-00074



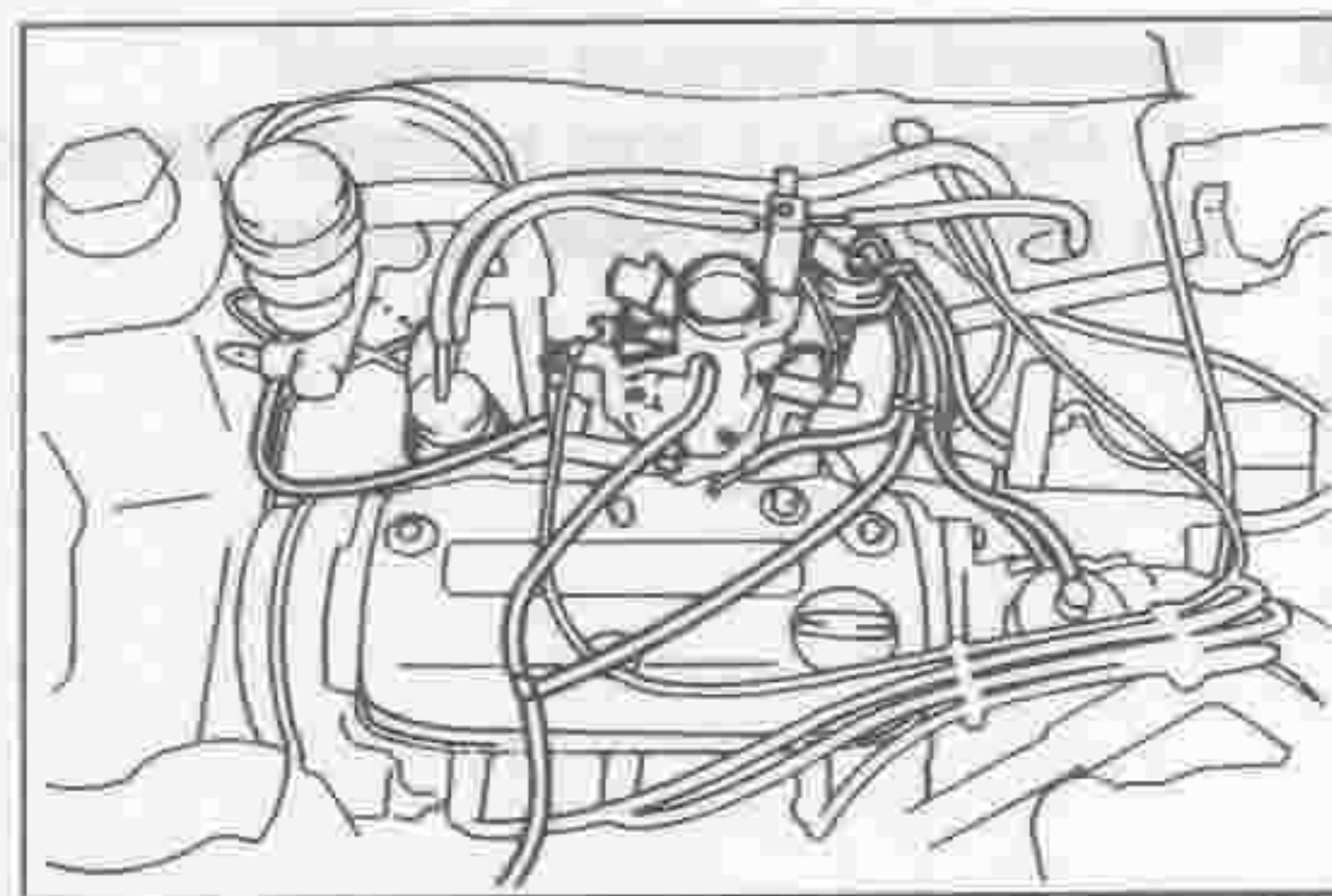
LEM00088-00075



LEM00089-00076

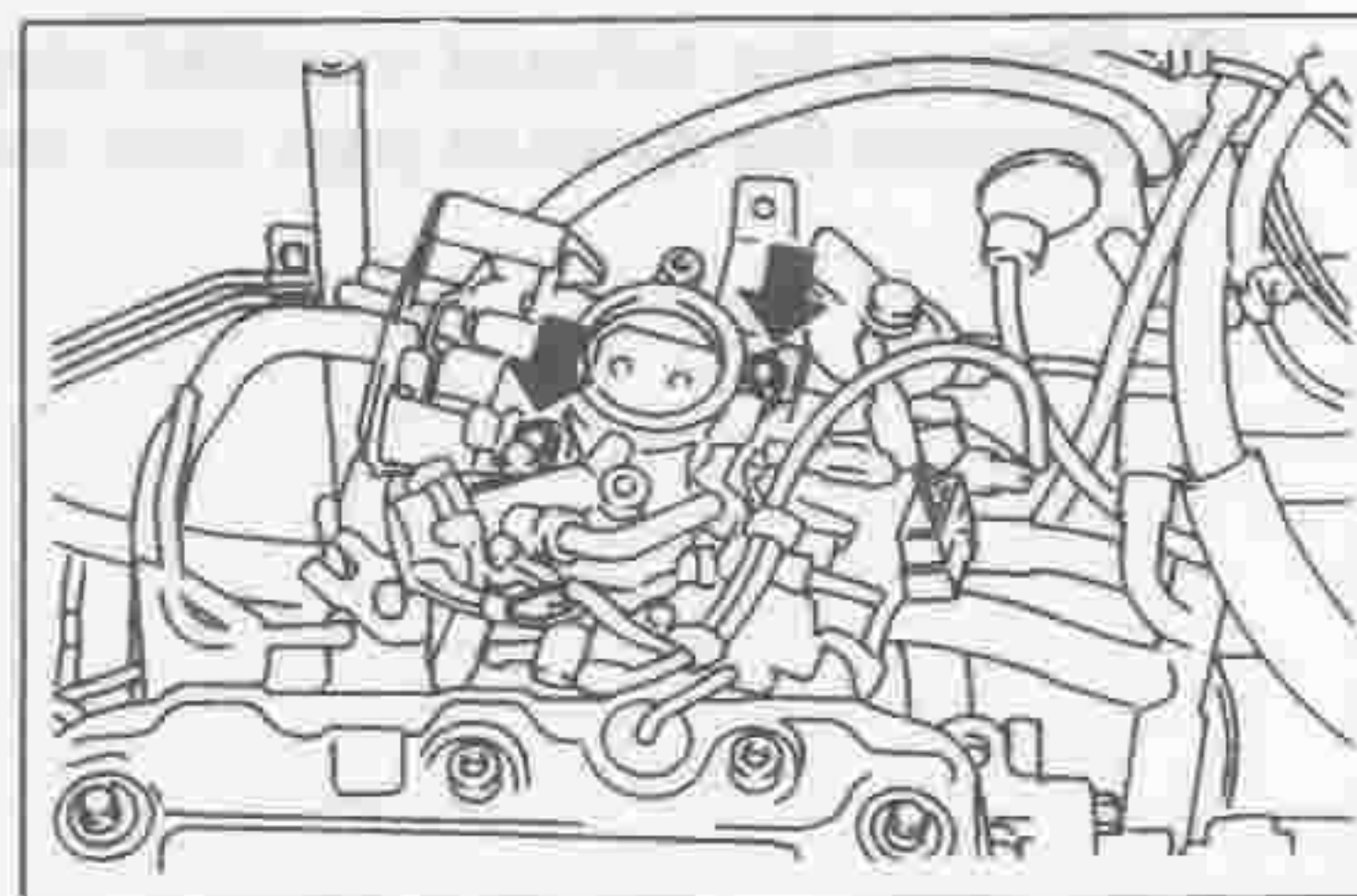
5. Remove the following parts from the carburetor.

- (1) Vacuum hoses
- (2) Fuel inlet hose
- (3) Choke cable
- (4) Accelerator cable



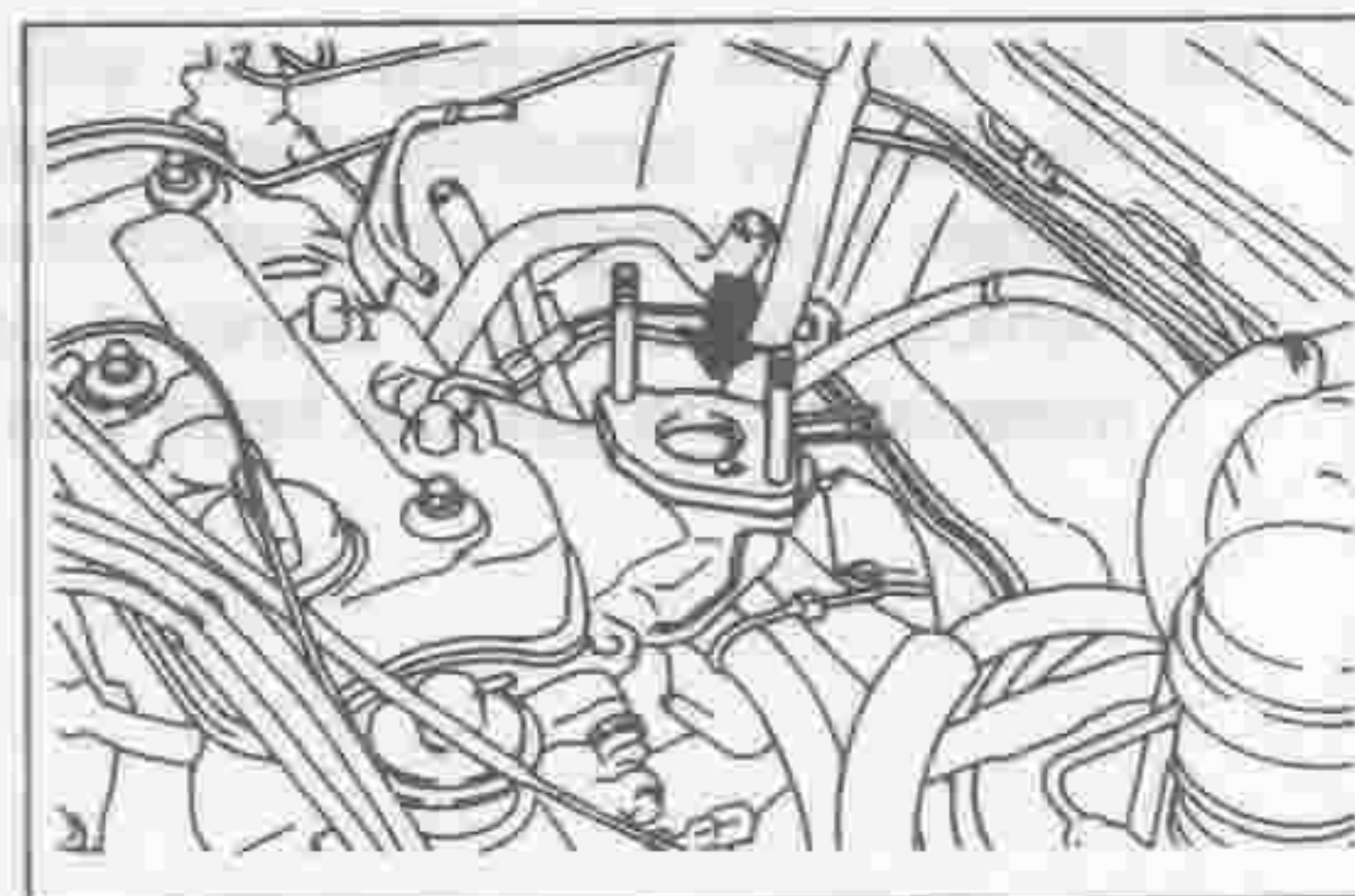
LEM00080-00077

6. Remove the carburetor by removing the two attaching nuts.  
7. Remove the carburetor.



LEM00081-00078

8. Remove the heat insulator.

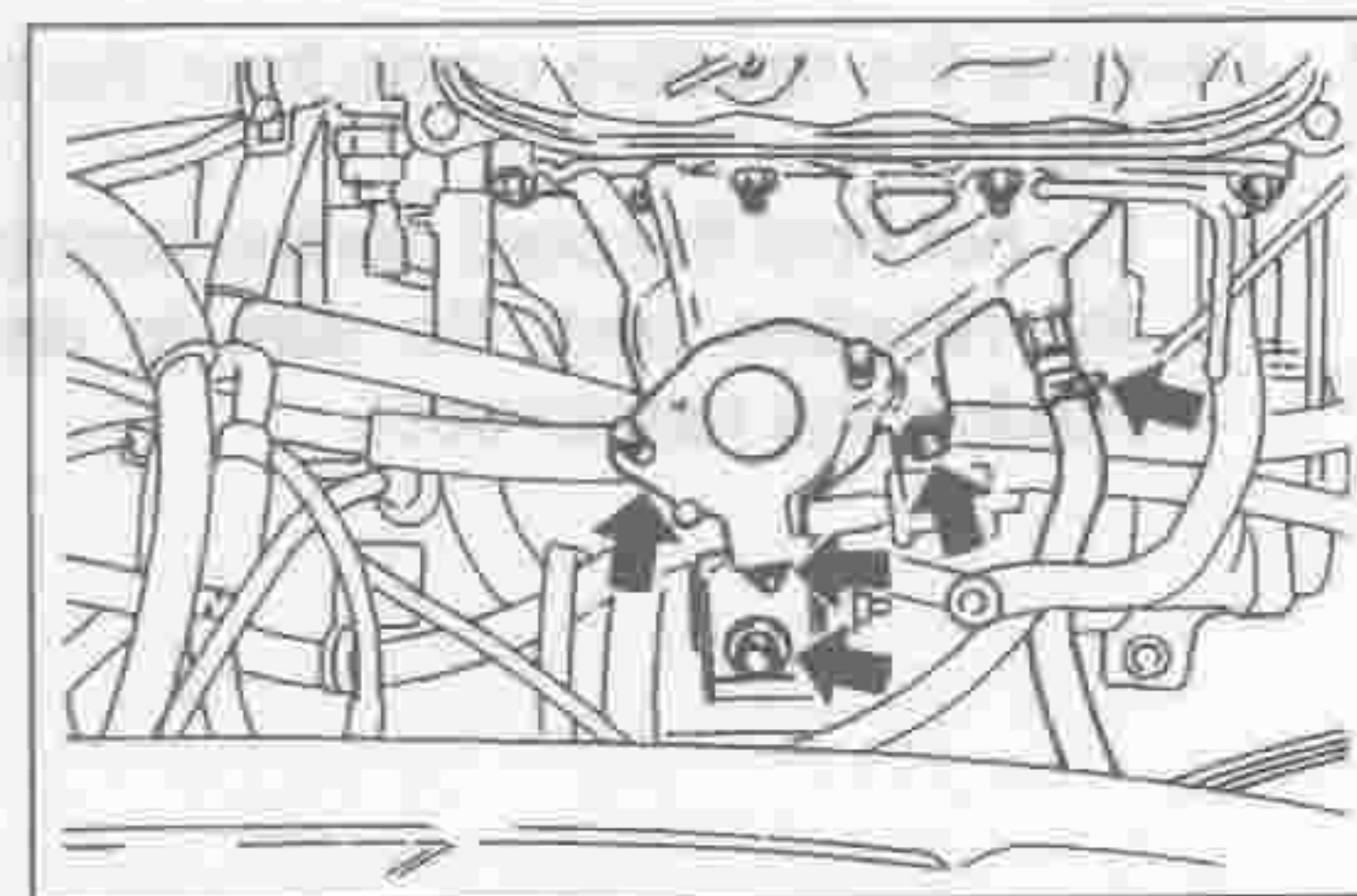


LEM00082-00079

9. Removal of intake manifold

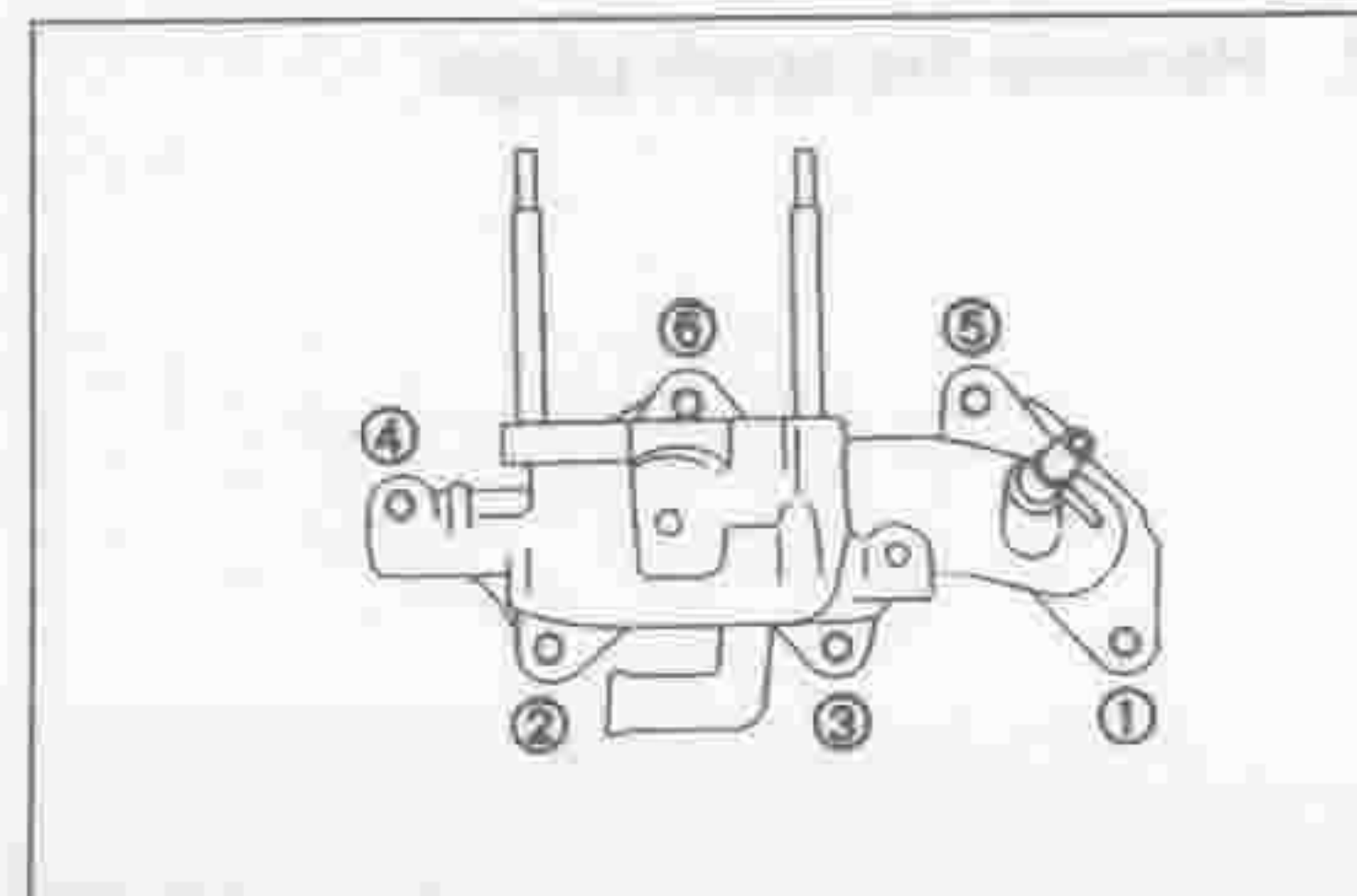
(1) Disconnect the following parts from the intake manifold.

- ① Booster hose
- ② Water hose
- ③ Intake manifold stay
- ④ Engine wire clamp



LEM00083-00080

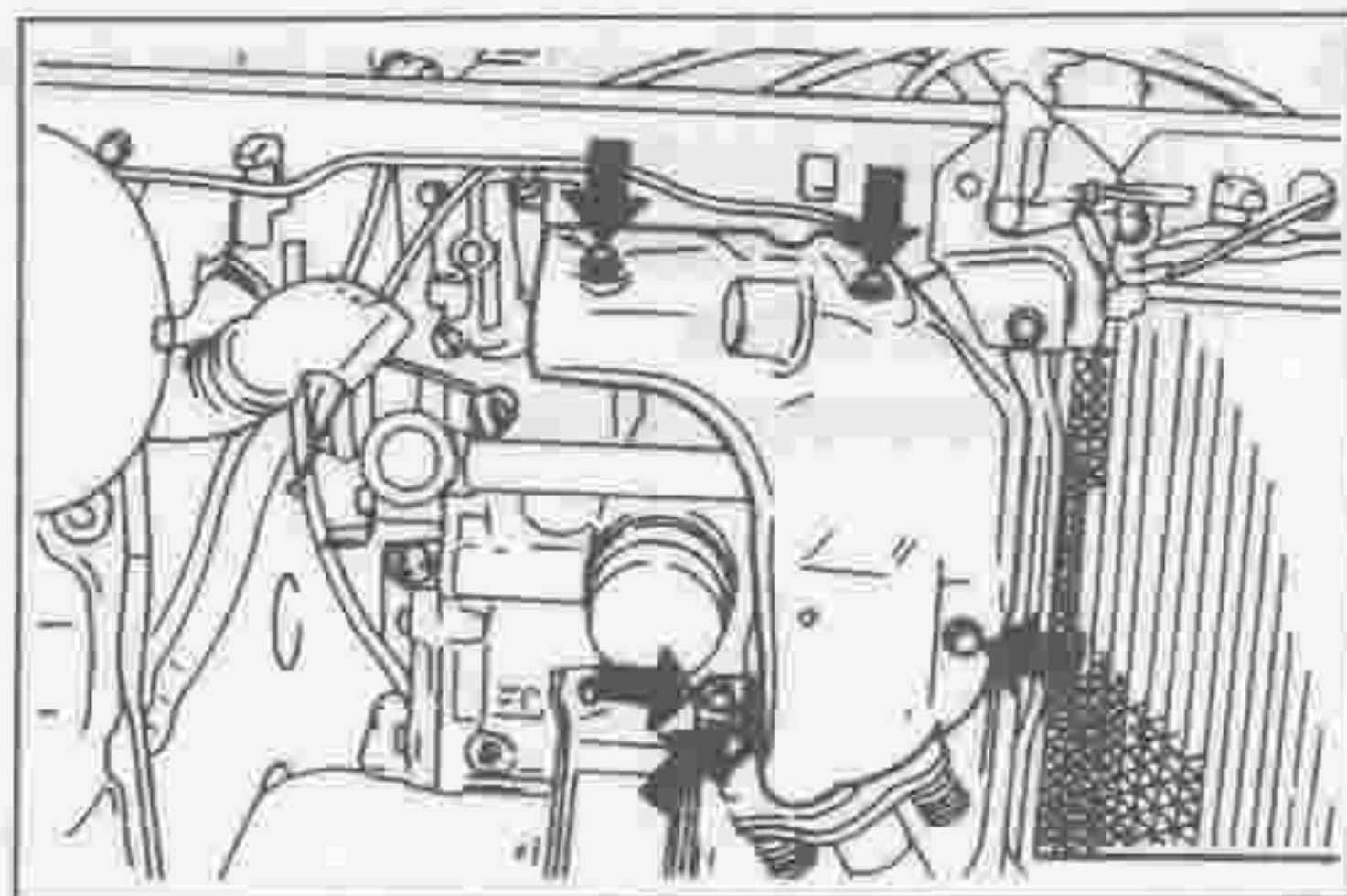
- (2) Loosen the intake manifold attaching bolts and nuts evenly over two or three stages in the sequence indicated in the right figure.
- (3) Remove the intake manifold by removing the attaching bolts.
- (4) Remove the intake manifold gasket and remaining material from the cylinder head and manifold.



LEM00084-00081

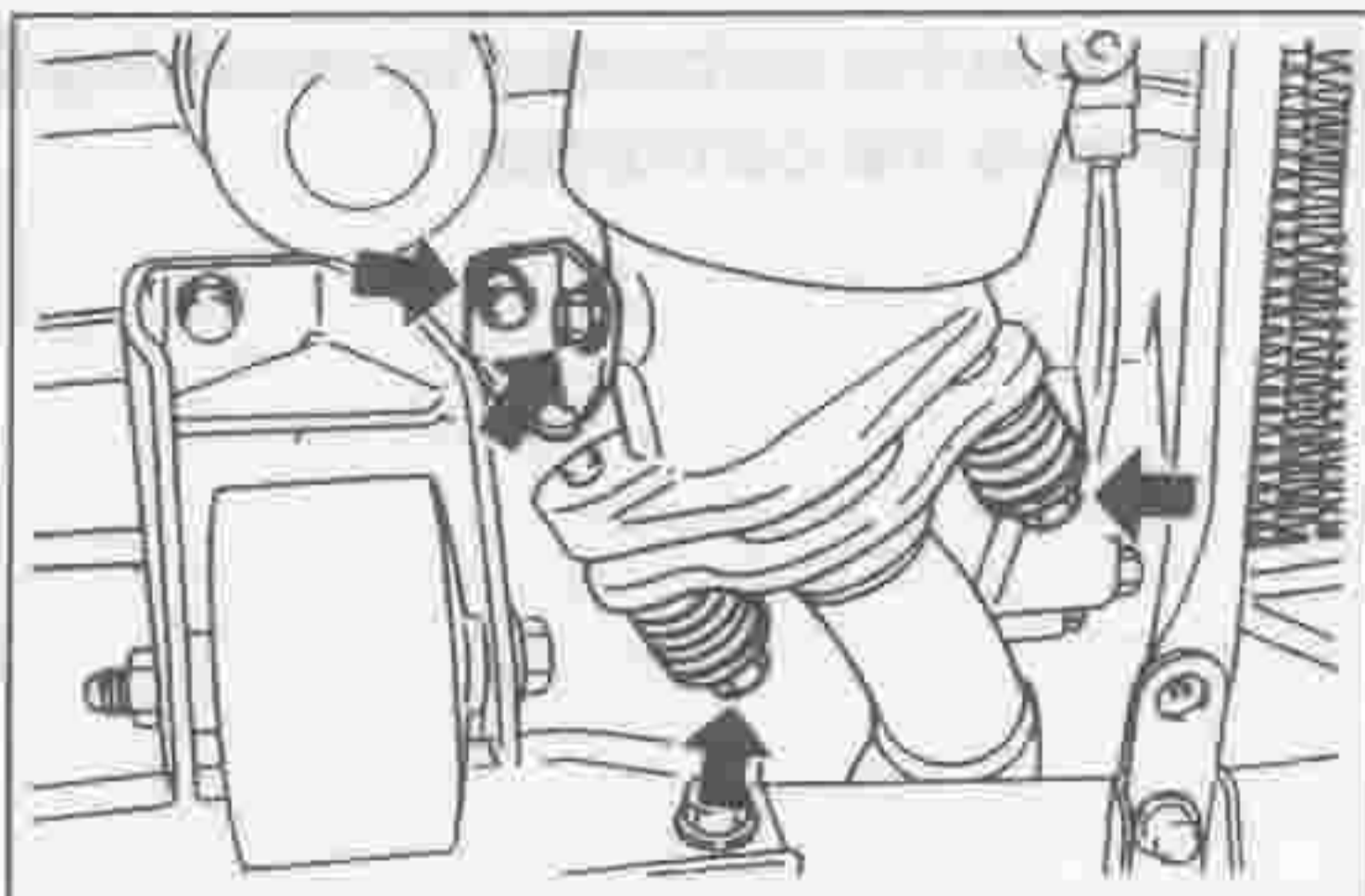
## 10. Removal of exhaust manifold

- (1) Removal of front bumper (Refer to the BO section)
- (2) Remove the heat insulator.



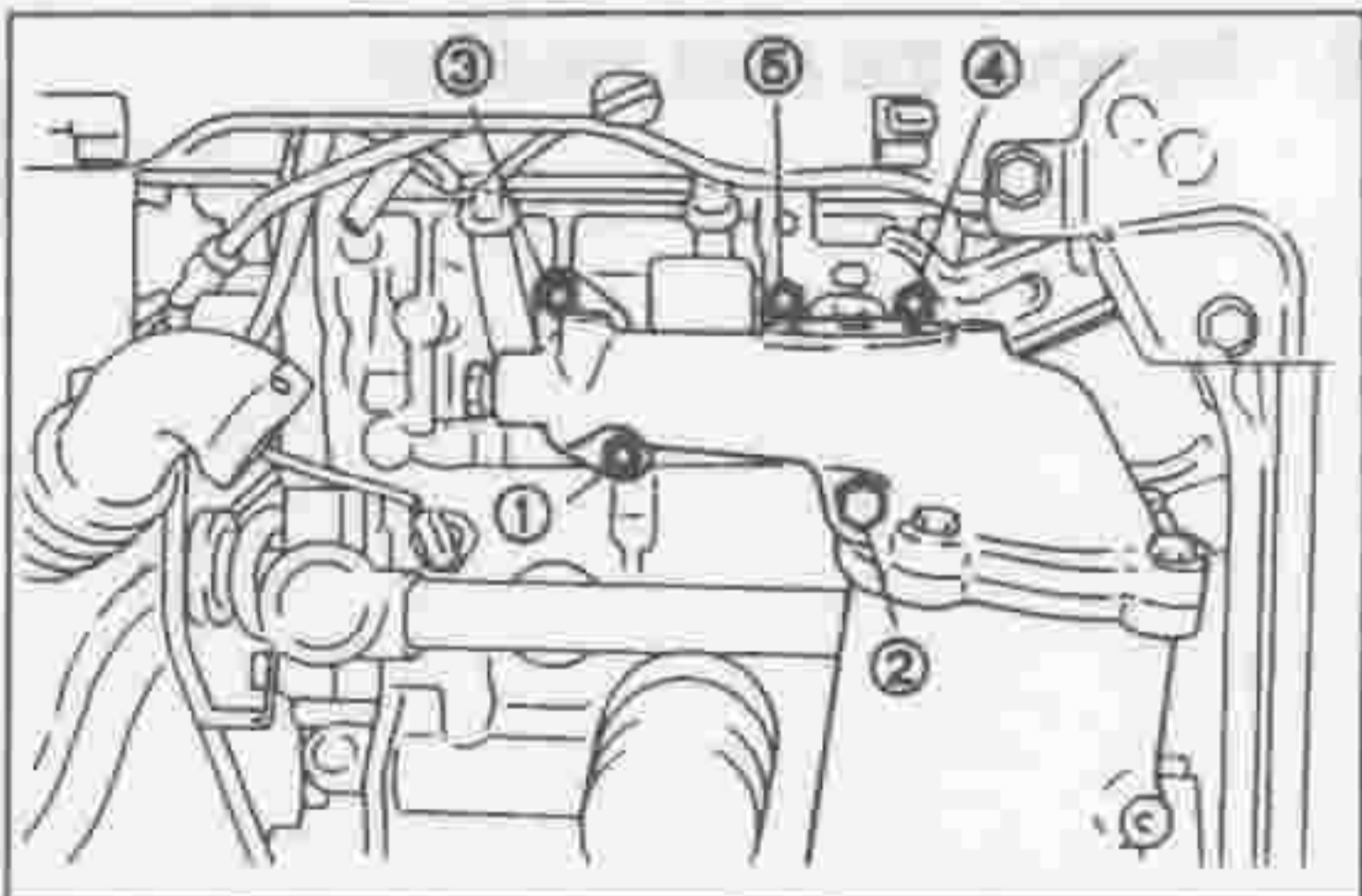
LEM00095-00082

- (3) Remove the exhaust manifold stay.
- (4) Remove the exhaust pipe from the exhaust manifold.



LEM00096-00083

- (5) Remove the attaching bolts and nuts of the exhaust manifold by loosening them evenly over two or three stages, following the sequence shown in the right figure.
- (6) Remove the exhaust manifold gasket and remaining material on the cylinder head and manifold.

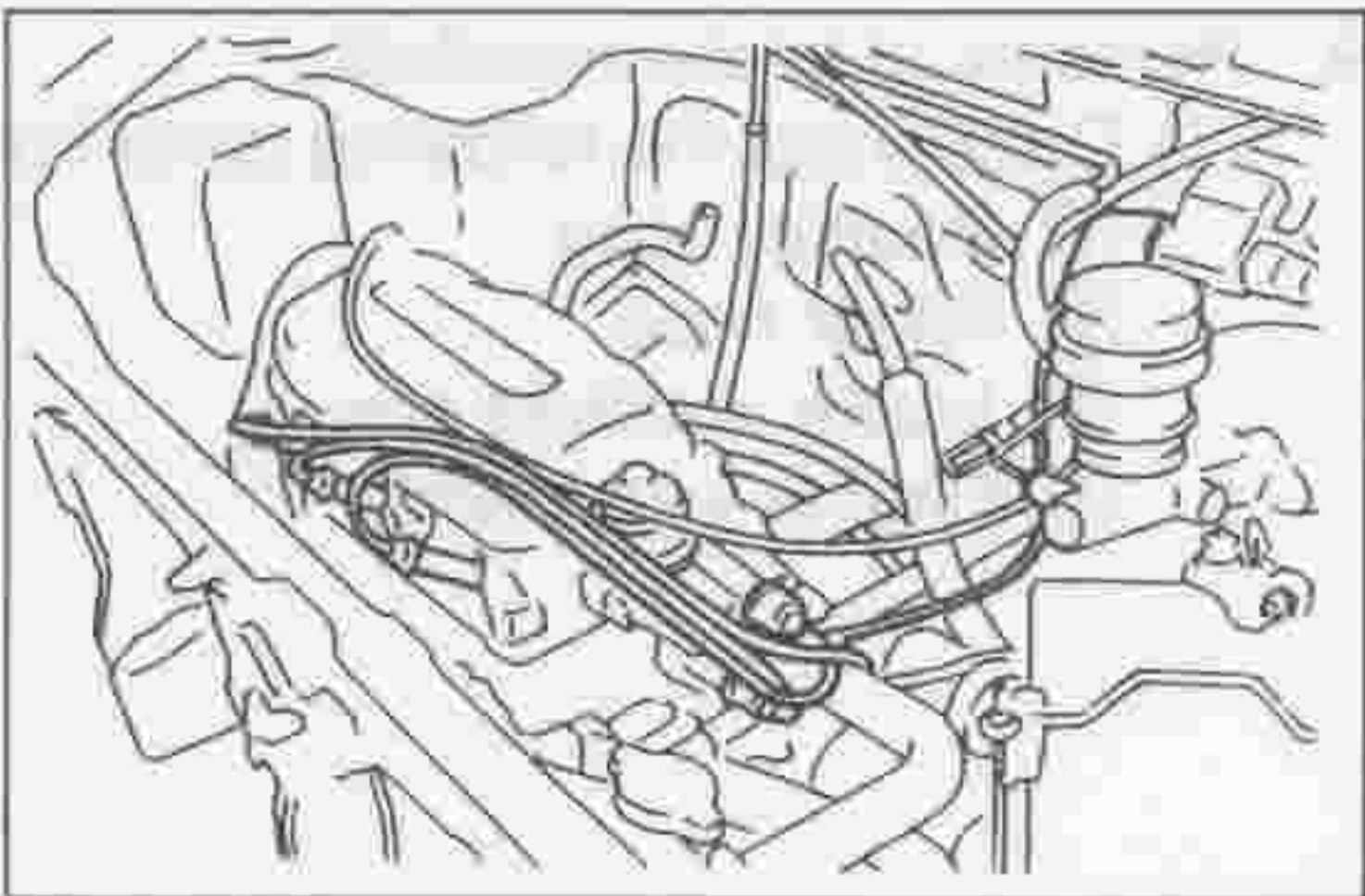


LEM00097-00084

## 11. Remove the resistive cords from the engine.

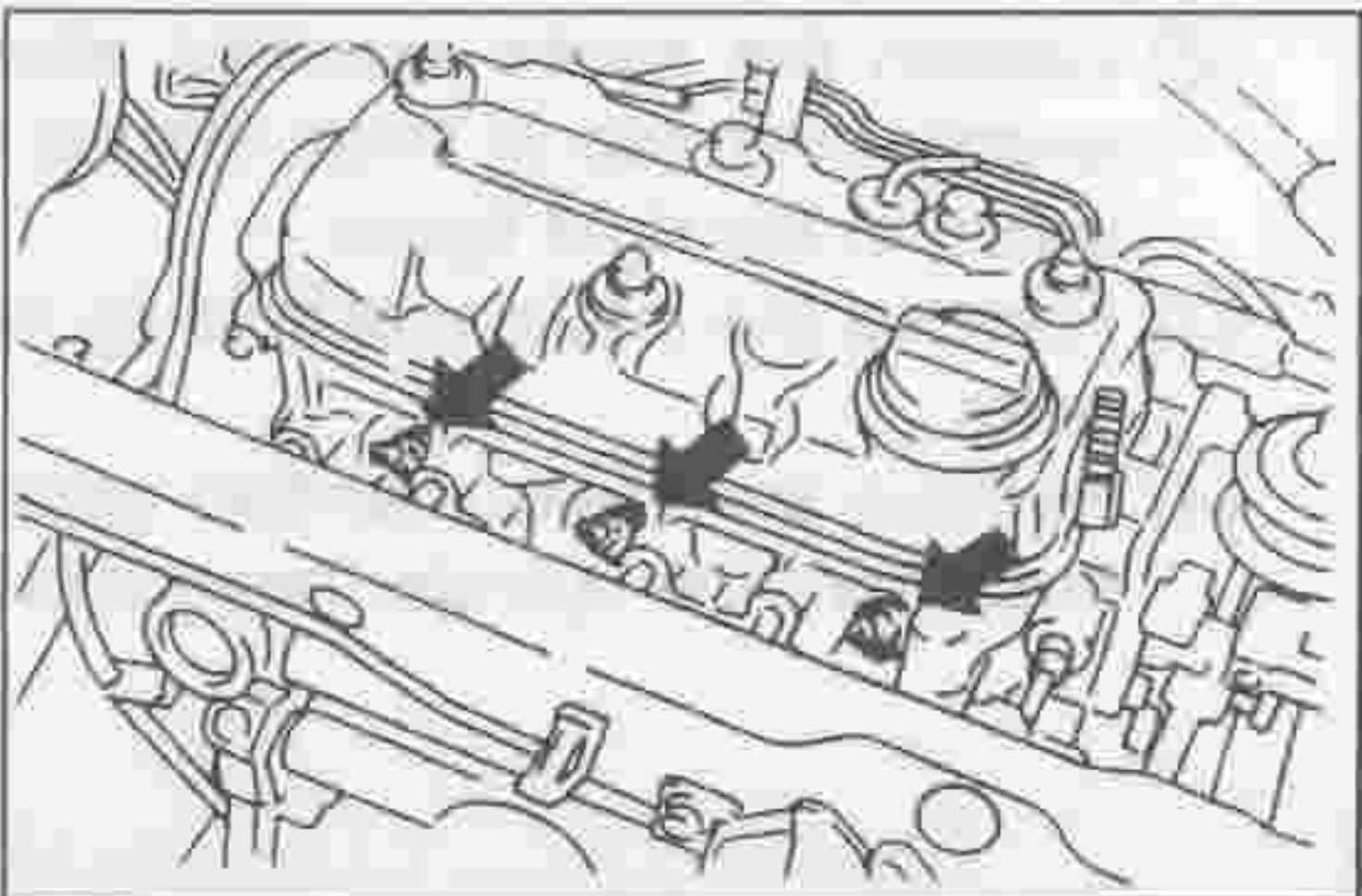
### NOTE:

- Do not hold the cord portion during the disconnection of the resistive cord. Be sure to disconnect the cord by holding the rubber boot.



LEM00098-00085

## 12. Remove the spark plugs.



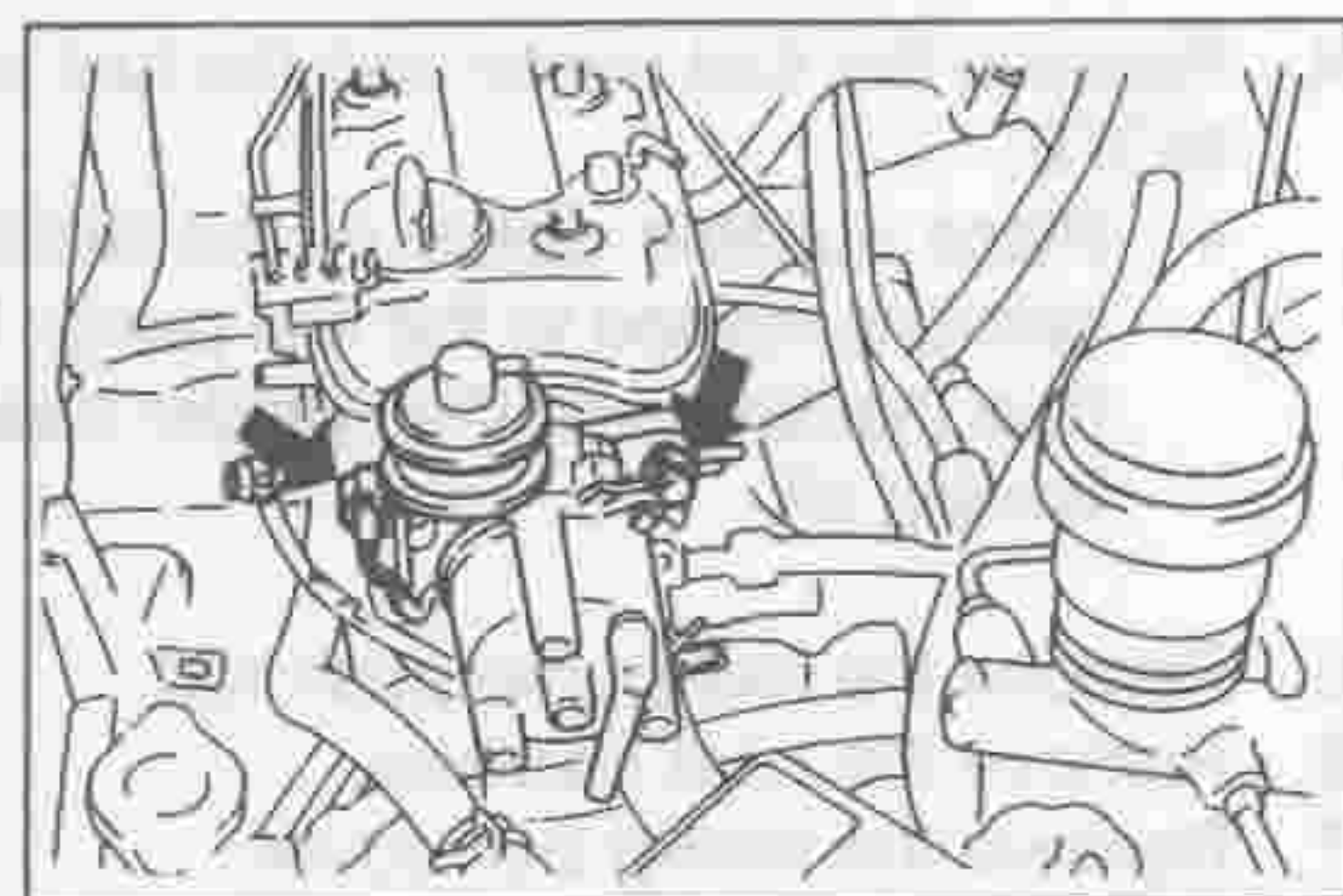
LEM00099-00086

## 13. Removal of distributor

- (1) Disconnect the connector of the distributor.
- (2) Remove the distributor retaining screw.
- (3) Pull out the distributor.

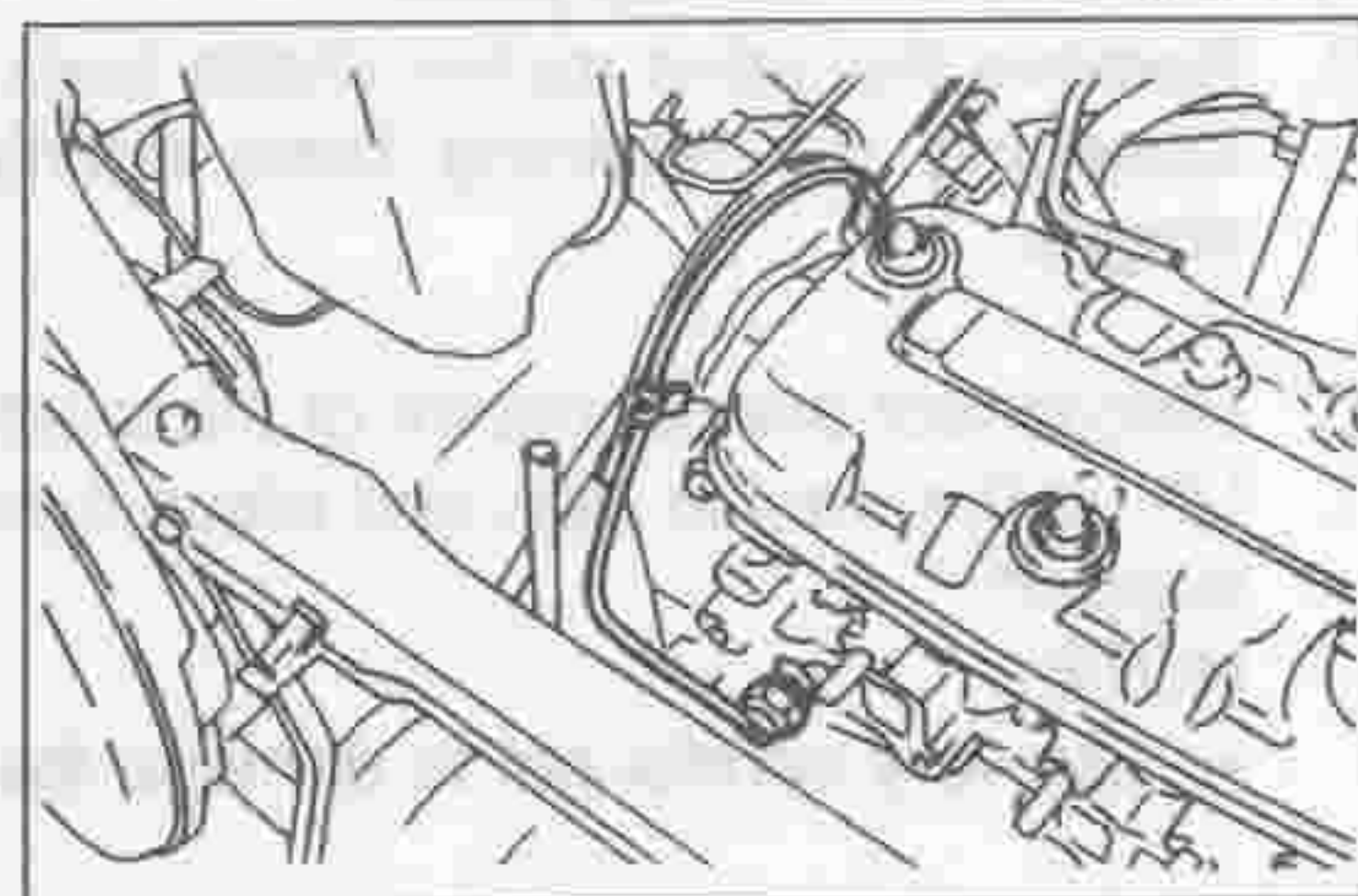
## NOTE:

- Place a suitable cloth or the like below the connecting section between the distributor and the cylinder head so as to receive any flowing oil.



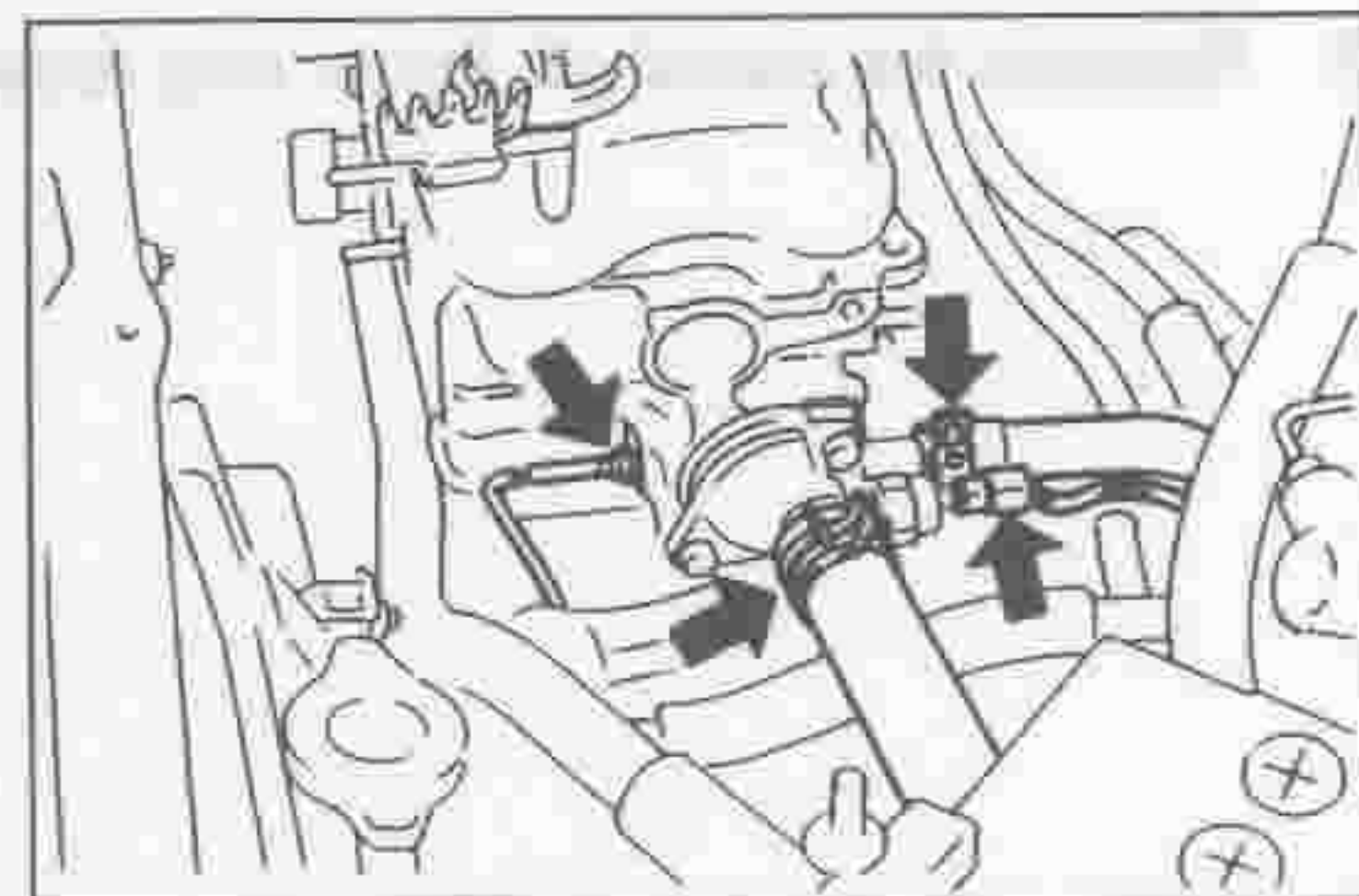
LEM00100-00087

14. Disconnect the connector from the oil pressure switch.
15. Disconnect the oil pressure switch wire from the clamp.



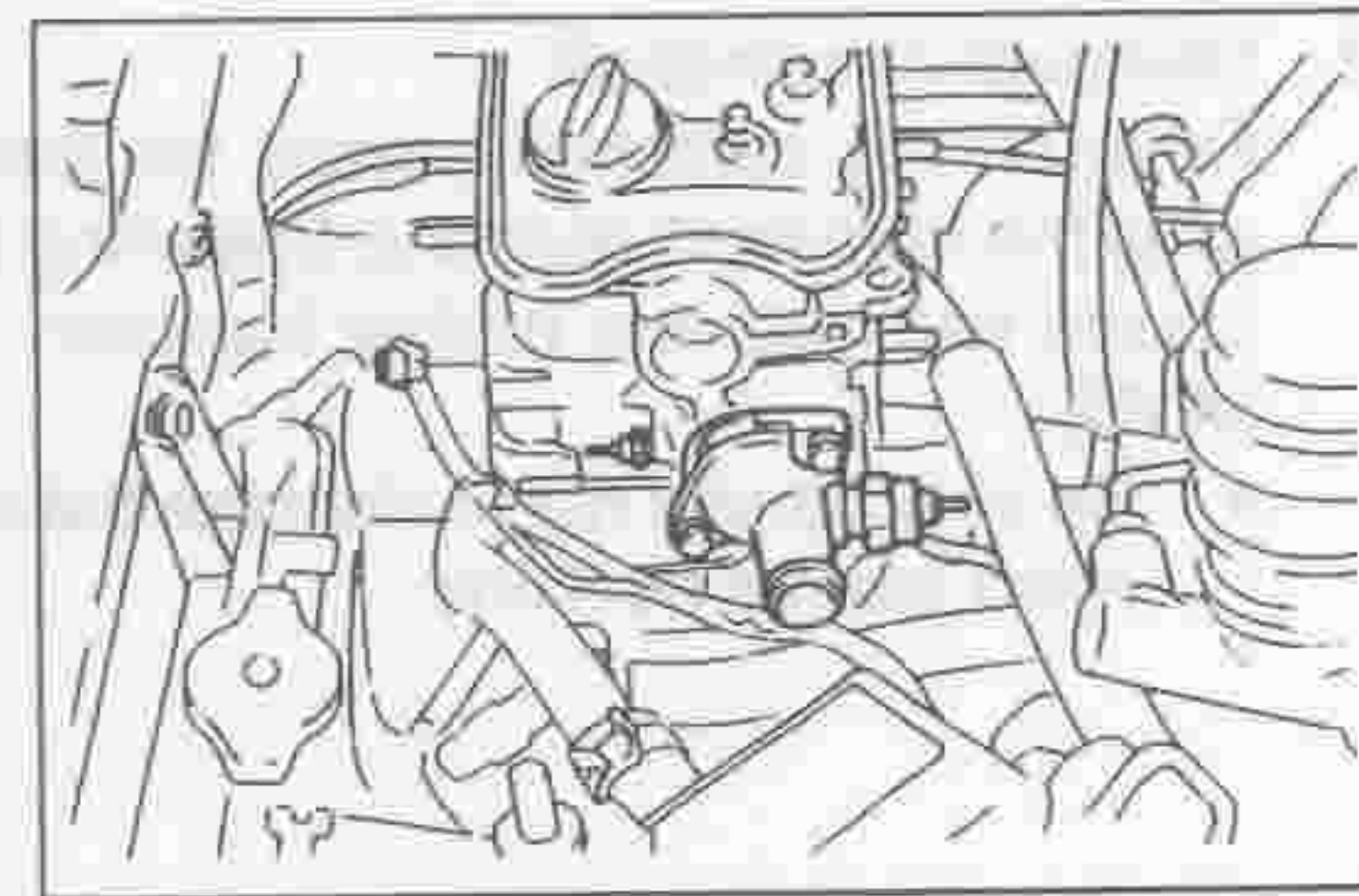
LEM00101-00088

16. Disconnect the water hoses from the cylinder head.
17. Disconnect the water temperature sender gauge connector.
18. Disconnect the fan motor control switch connector.



LEM00102-00089

19. Remove the fan motor control switch.
20. Remove the water temperature sender gauge.
21. Remove the water outlet.
22. Remove the water outlet gasket and gasket material from the water outlet and cylinder head.



LEM00103-00090

23. Remove the cylinder head cover by removing the attaching nut in the sequence in the right figure.

LEM00104-00000

# EM-30

24. Remove the fuel pump and the fuel pump hole cover.
25. Remove the fuel pump push rod.
26. Remove the heat insulator.
27. Remove the timing belt cover.
28. Remove the oil seal plate.
29. Remove the valve rocker shafts from the cylinder head by loosening the retaining bolts evenly over two or three stages.

30. Disconnect the connector of the washer tank.
31. Lift up the washer tank and place it on the front suspension support.

**NOTE:**

- Be very careful not to damage the washer hose.

32. Remove the camshaft thrust ring retaining bolt.

33. **Removal of camshaft**  
Drive off the camshaft toward the timing belt side by tapping the camshaft rear end (installing the distributor) with a plastic hammer or a rubber hammer.

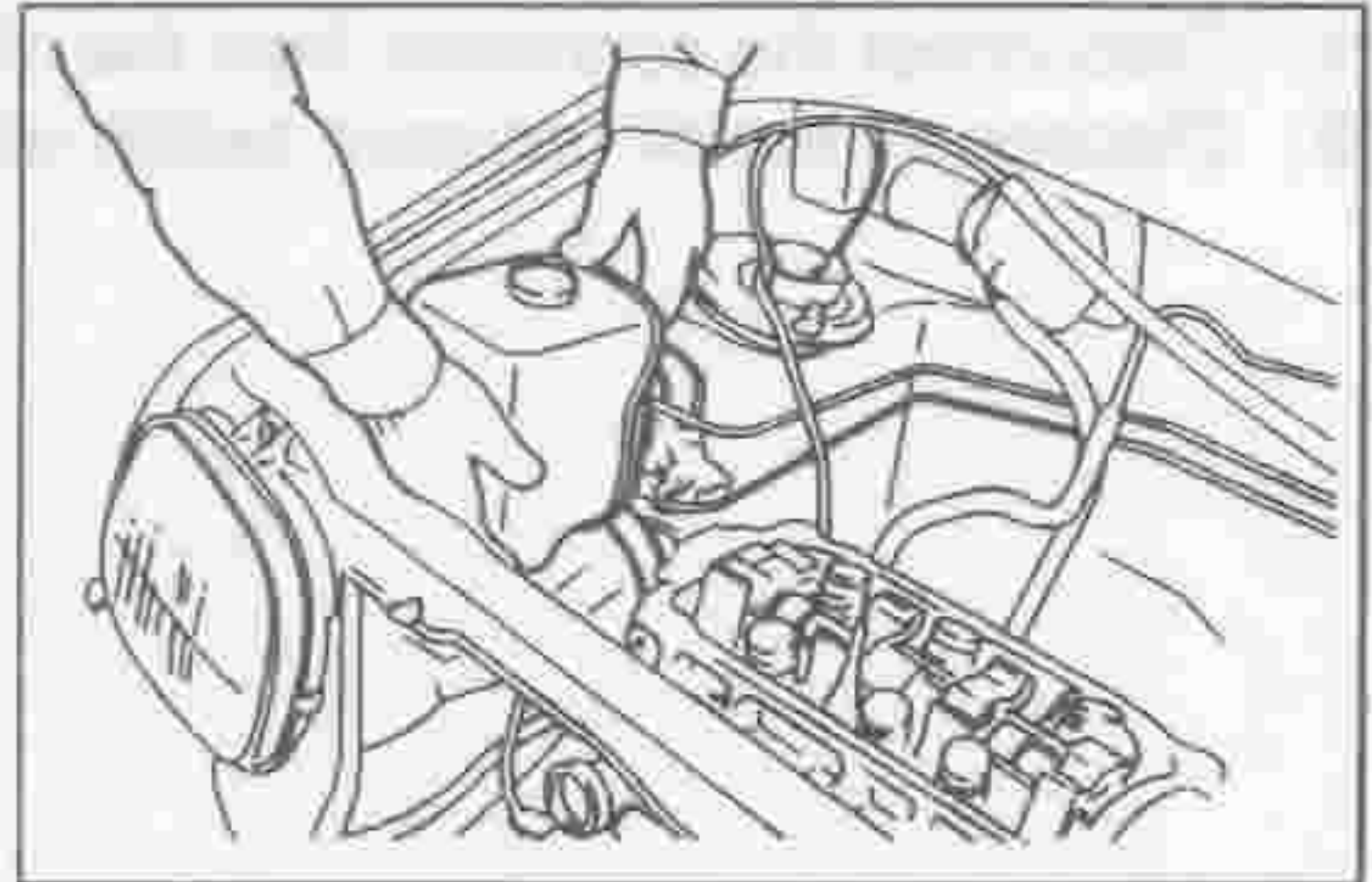
**NOTE:**

- Be very careful not to damage the camshaft and cylinder head journal sections.

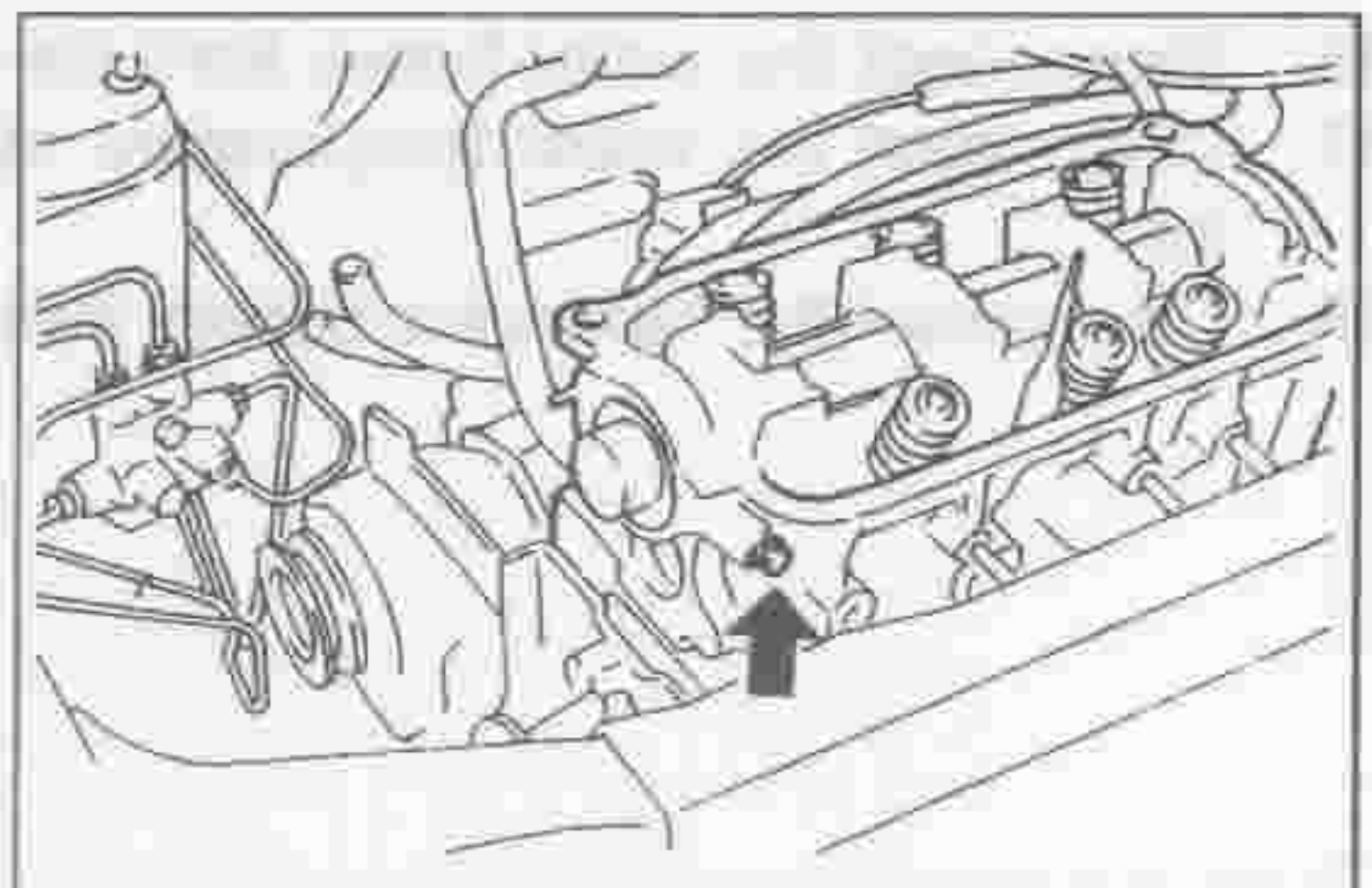
34. Loosen the cylinder head bolts evenly over two or three stages in the sequence indicated in the right figure.
35. Remove the cylinder head from the cylinder block by removing the cylinder head bolts.



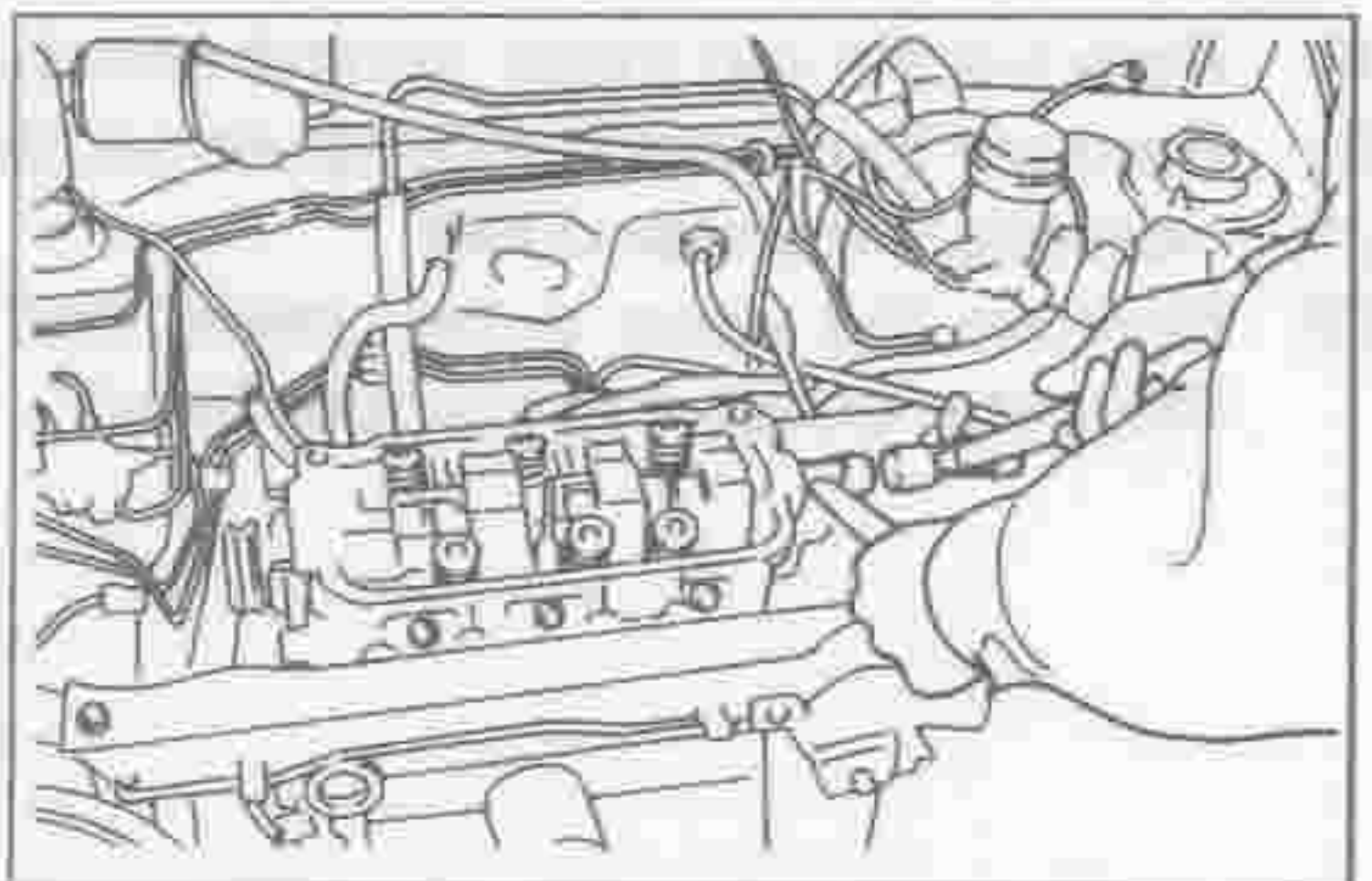
LEM00105-00092



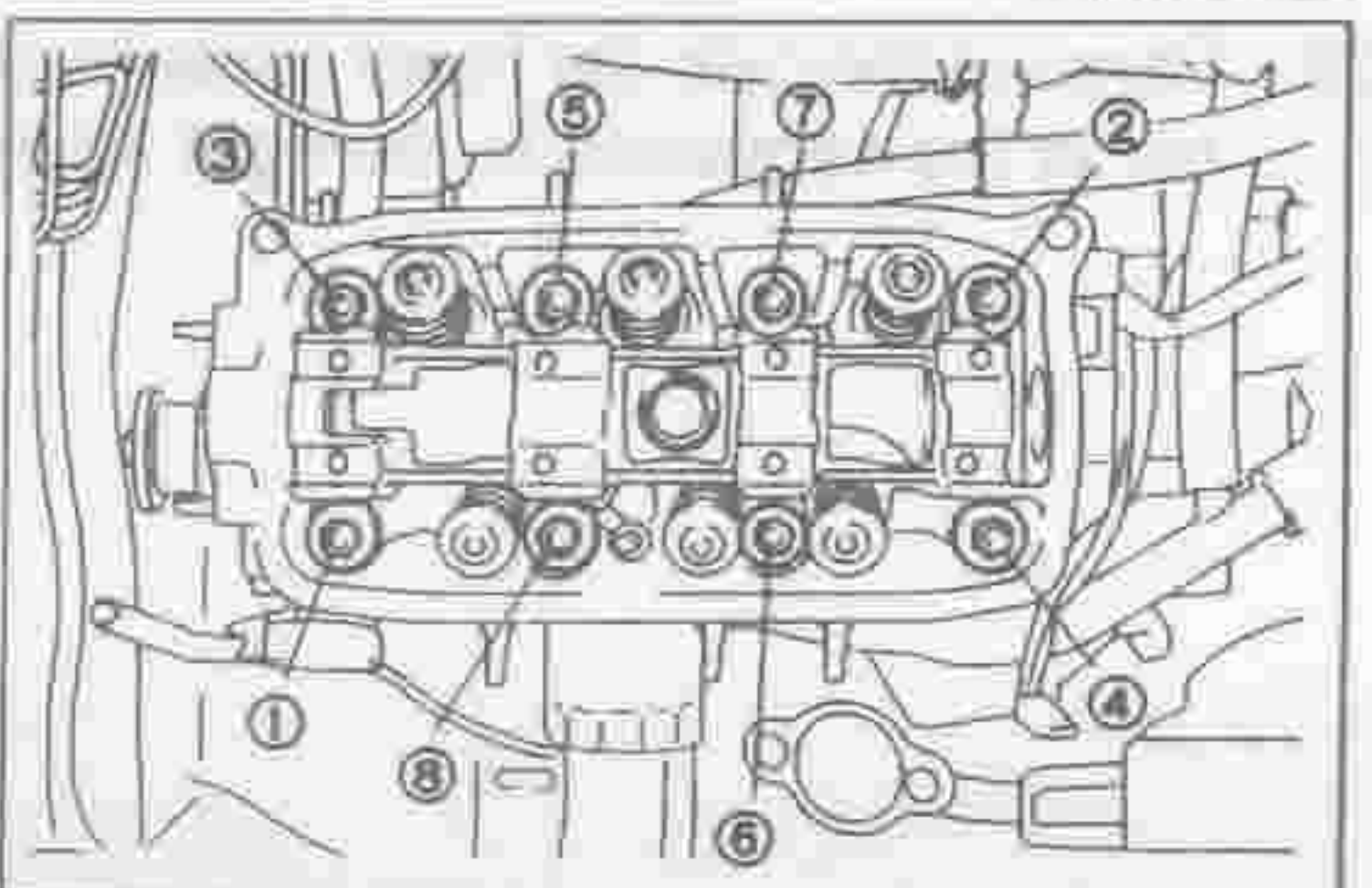
LEM00106-00093



LEM00107-00094



LEM00108-00095

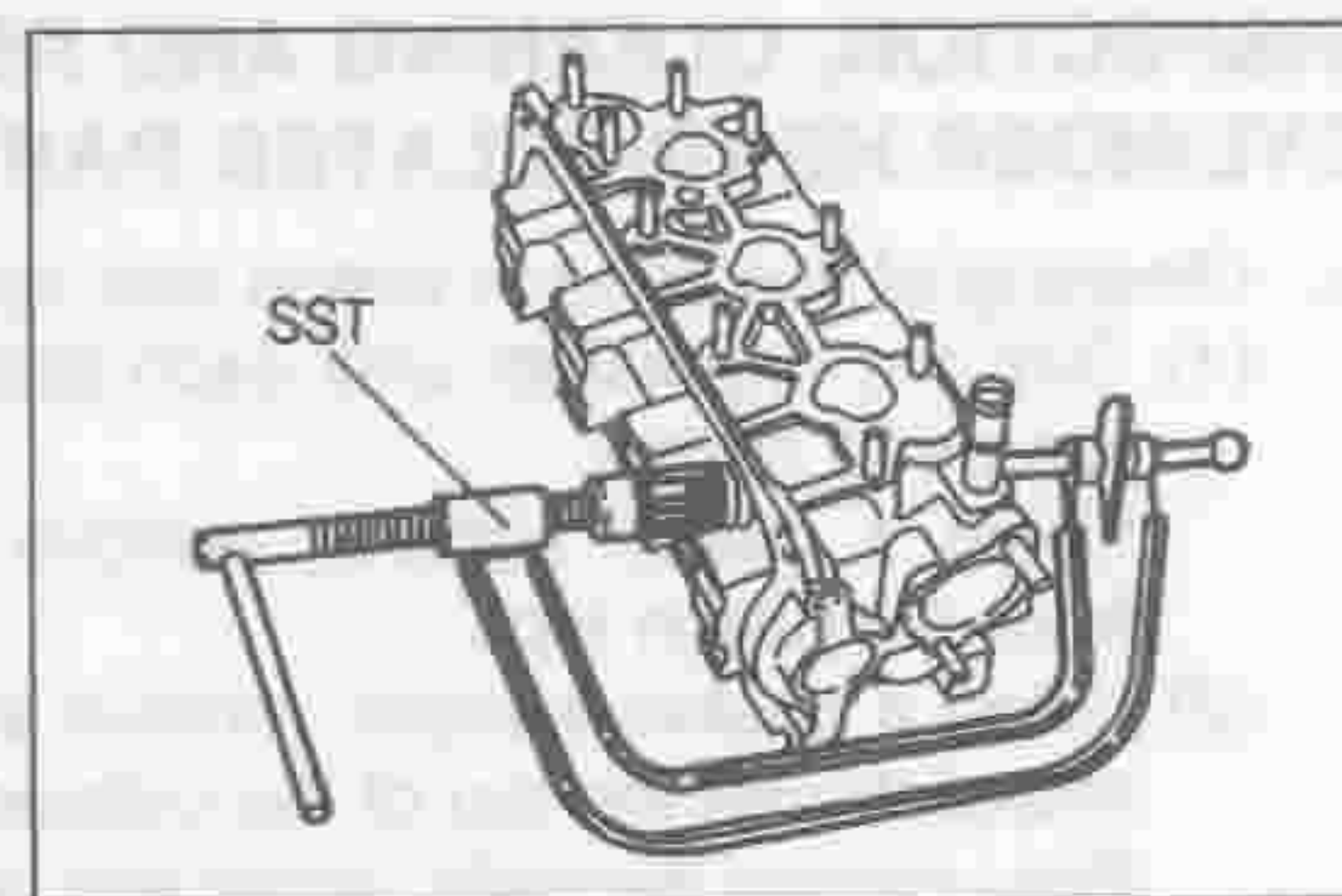


LEM00109-00096

## DISASSEMBLY OF CYLINDER HEAD

1. Remove the valve spring retainer locks, using the following SST.

SST: 09202-87002-000  
09202-87002-0A0

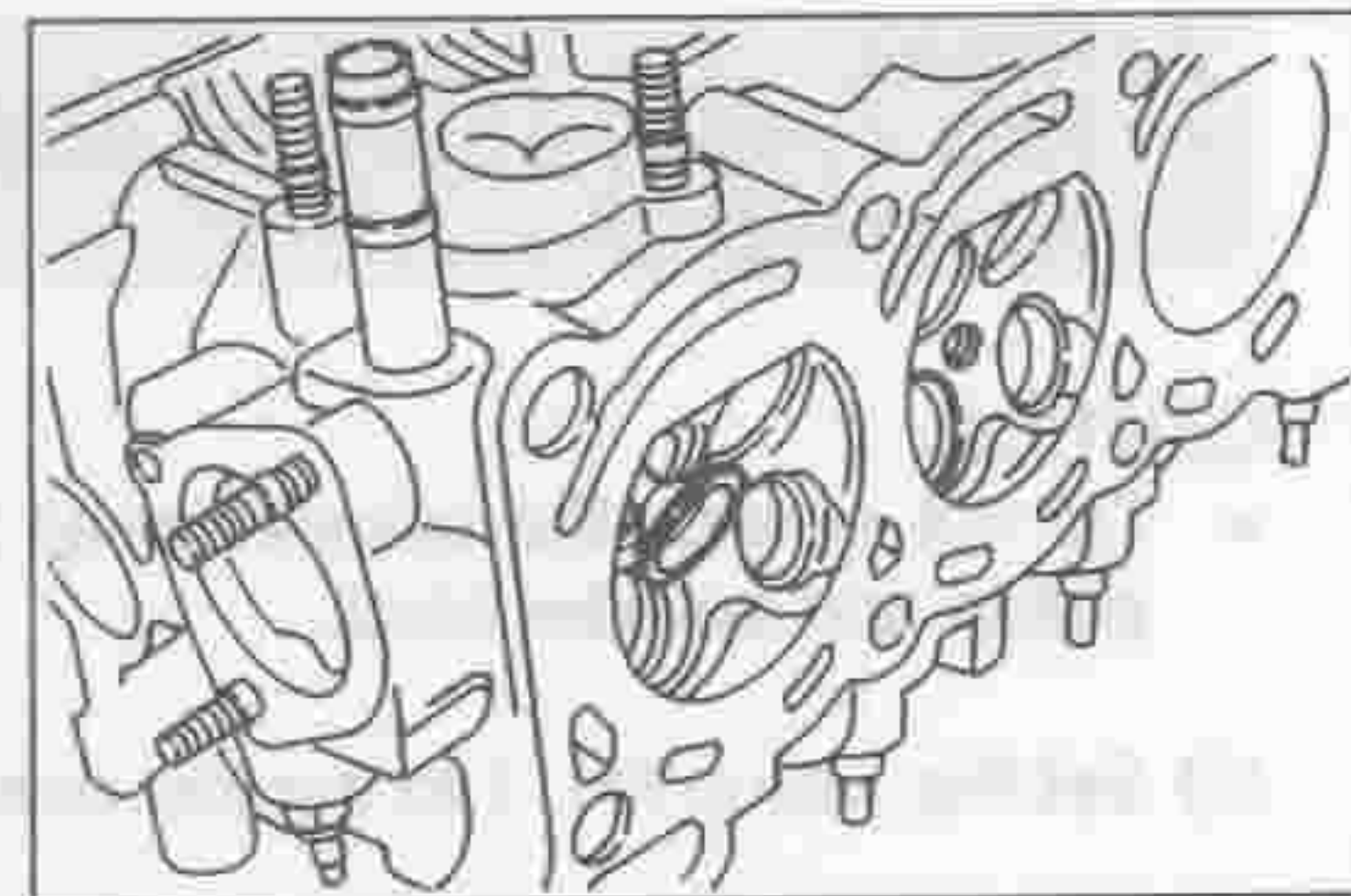


LEM00110-00097

2. Remove the valve spring retainers and valve springs.
3. Remove the valves.

**NOTE:**

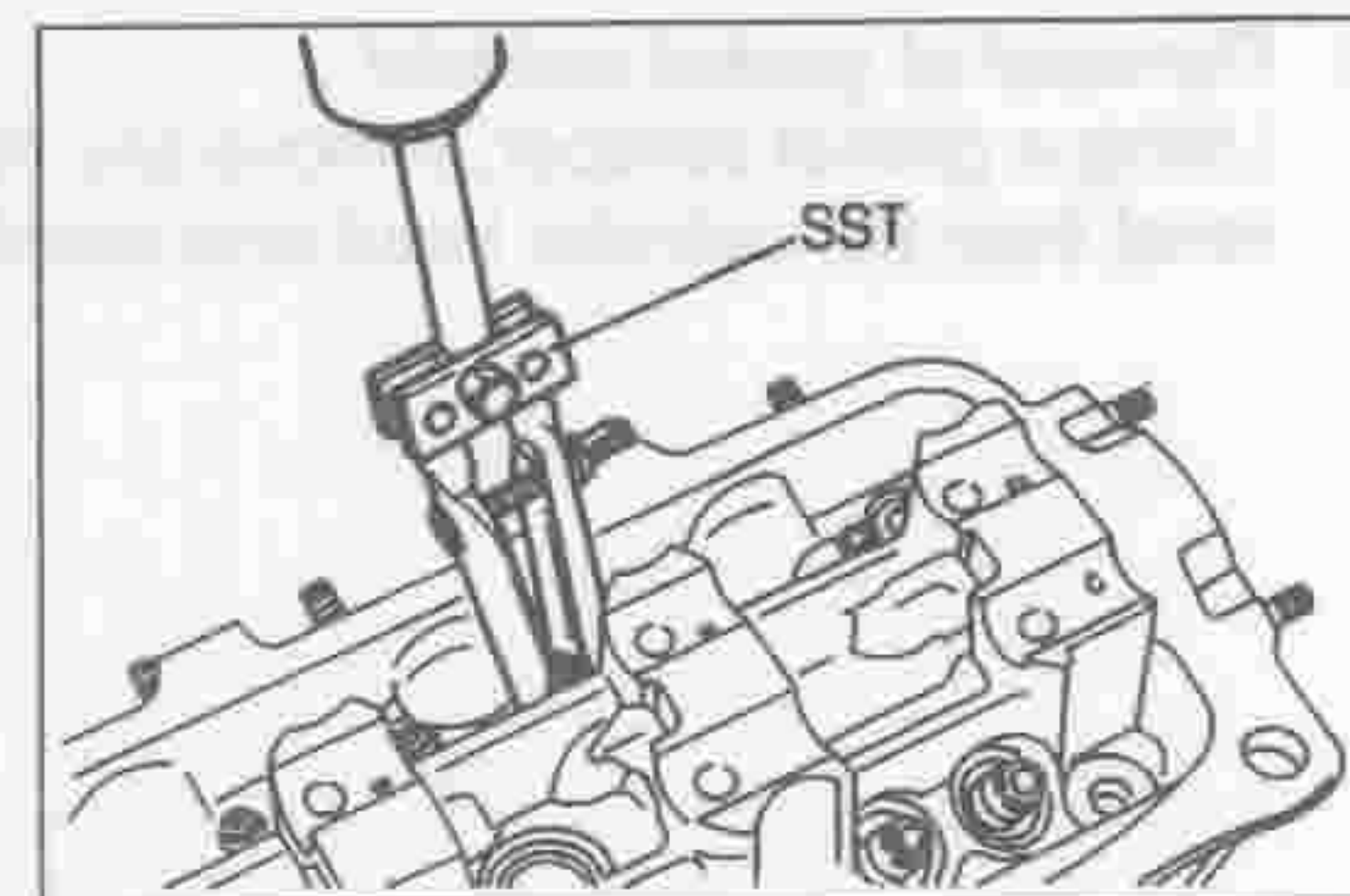
- Arrange the removed parts in order so that their installing positions may be known easily.



LEM00111-00098

4. Remove the valve stem oil seals, using the following SST.

SST: 09201-87704-000

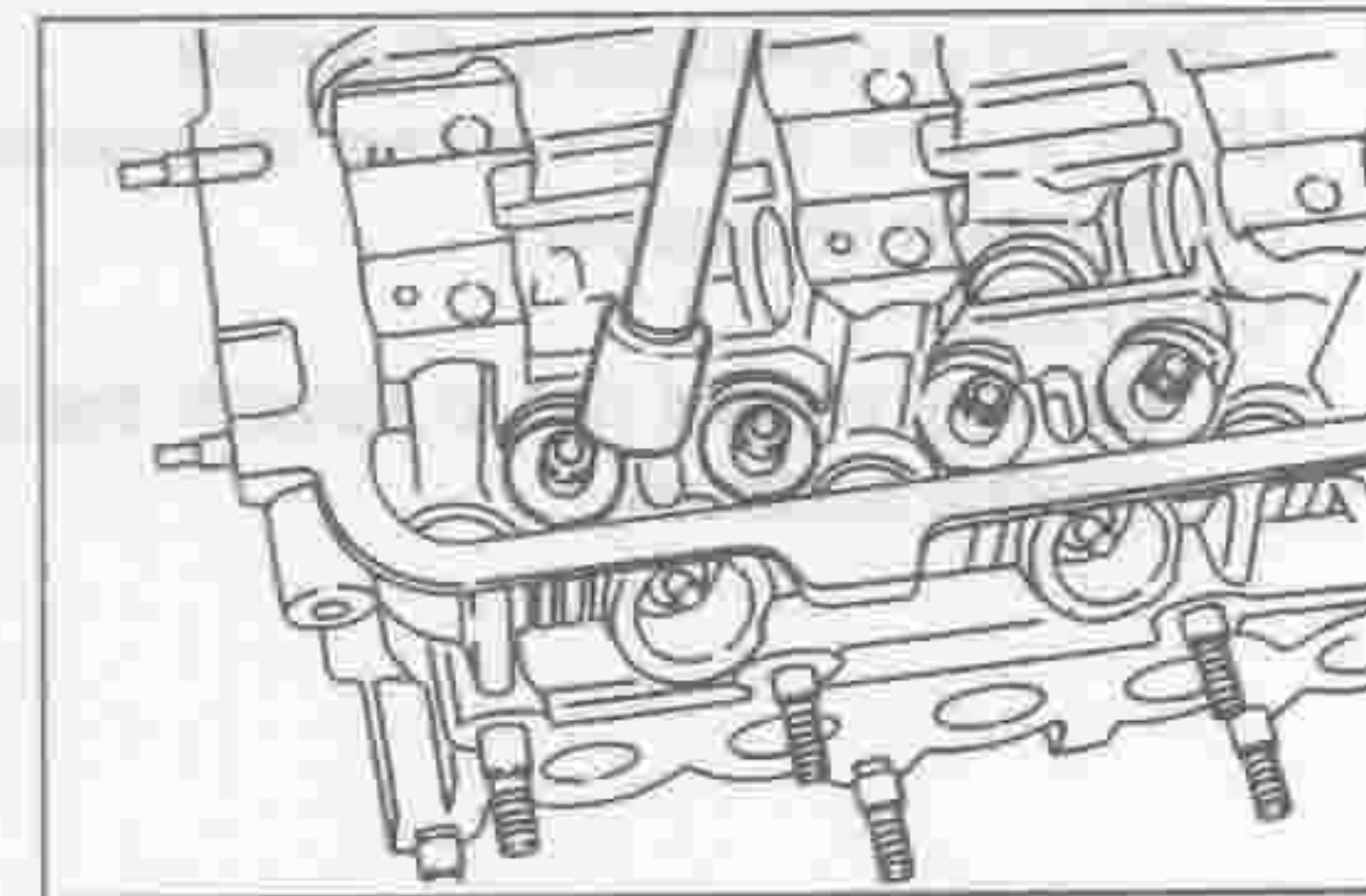


LEM00112-00099

5. Remove the valve spring seats.

**NOTE:**

- For the removal, use a magnet hand or the like.
- Arrange the removed parts in order so that their installing positions may be identified easily.



LEM00113-00100

## INSPECTION, CLEANING AND REPAIRS OF CYLINDER HEAD-RELATED PARTS

1. Cleaning of top of each piston and cylinder block
  - (1) Turn the crankshaft until each piston is brought to the top dead center.  
Using a gasket scraper, remove all carbon deposits from the piston tops.
  - (2) Using a gasket scraper, remove any remaining gasket material from the top of the cylinder block.  
Blow carbon deposits, water and oil from the bolt holes.

### WARNING:

- Protect your eyes during the cleaning operation using compressed air.

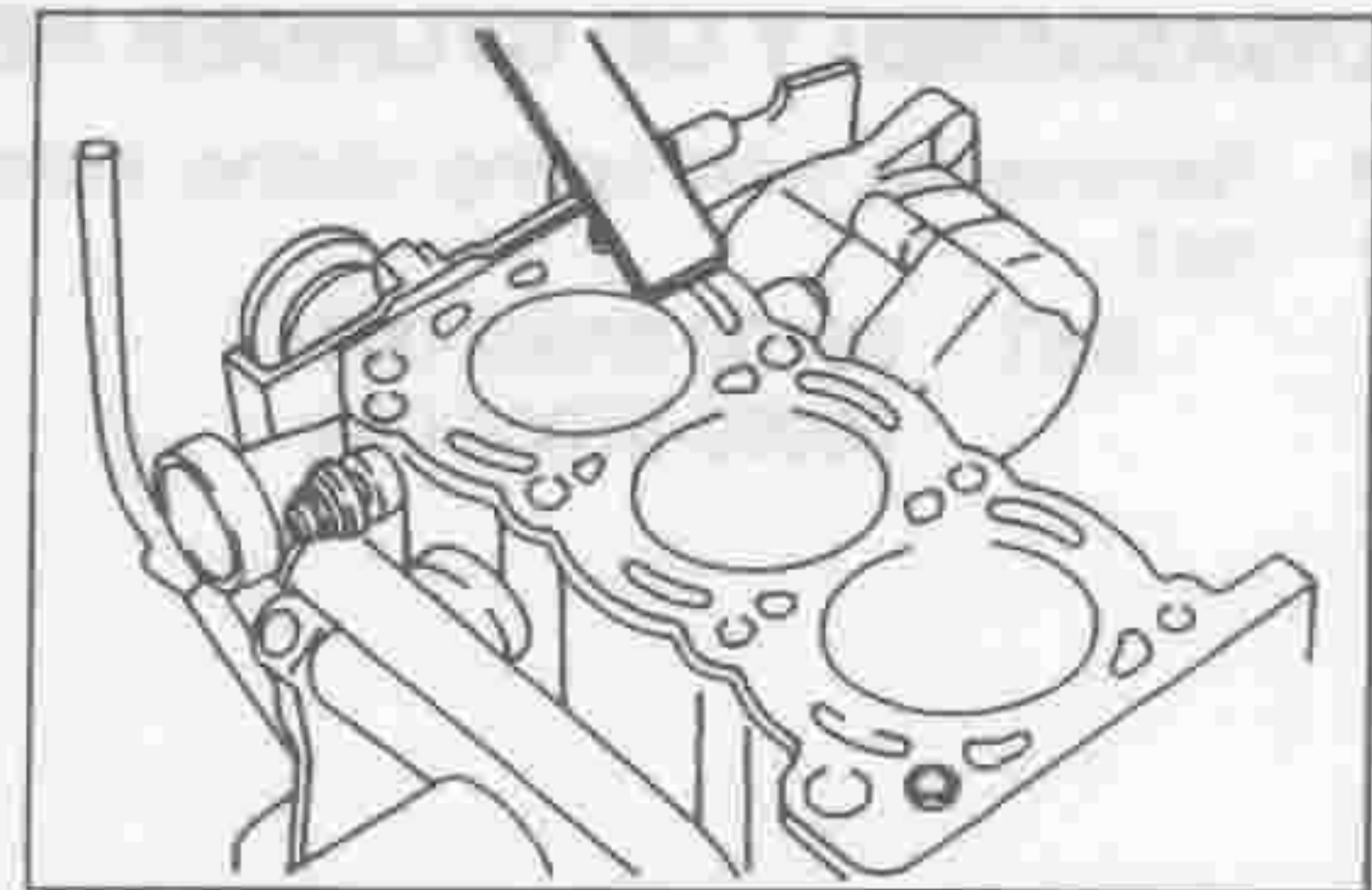
### CAUTION:

- Do not scratch the cylinder head side surfaces of the piston and cylinder block.

- (3) Set the piston No. 1 to the top dead center.

2. Removal of gasket material

Using a gasket scraper, remove any remaining gasket material from the cylinder head and manifold surfaces.



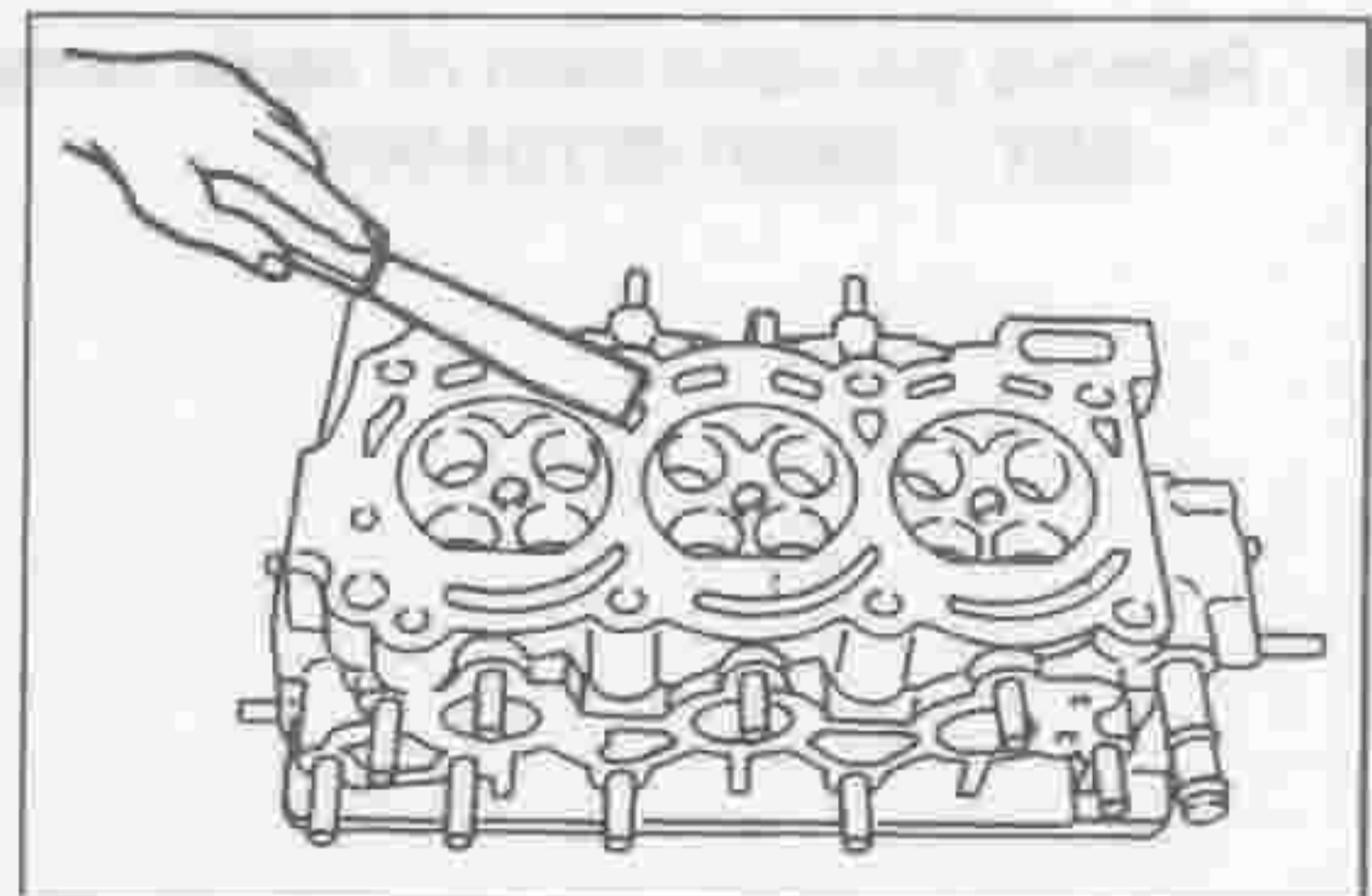
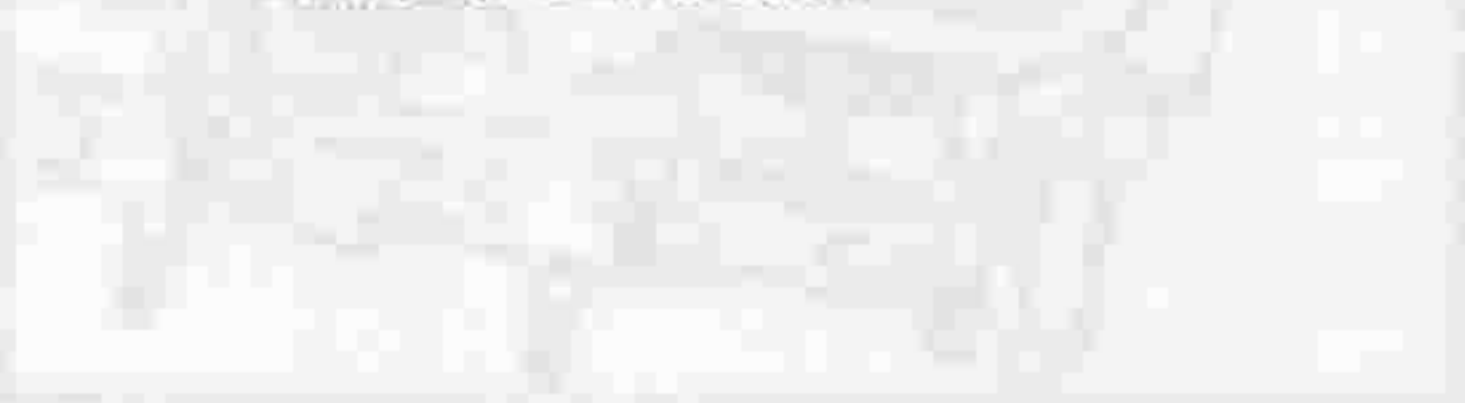
LEM00114-00101

3. Cleaning of combustion chamber

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

### CAUTION:

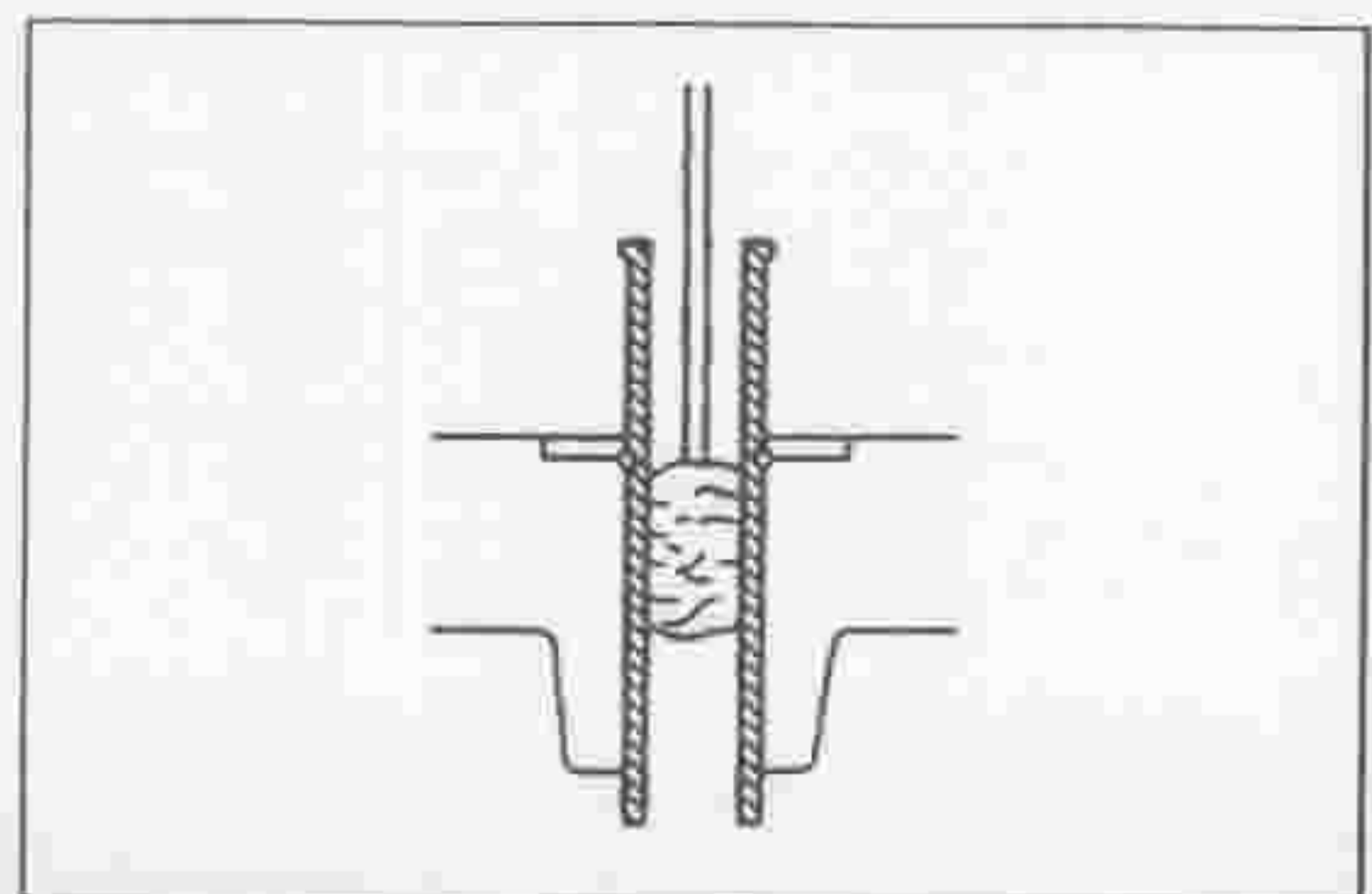
- Be very careful not to scratch the cylinder head gasket contact surfaces.



LEM00116-00102

4. Cleaning of valve guide bushings

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

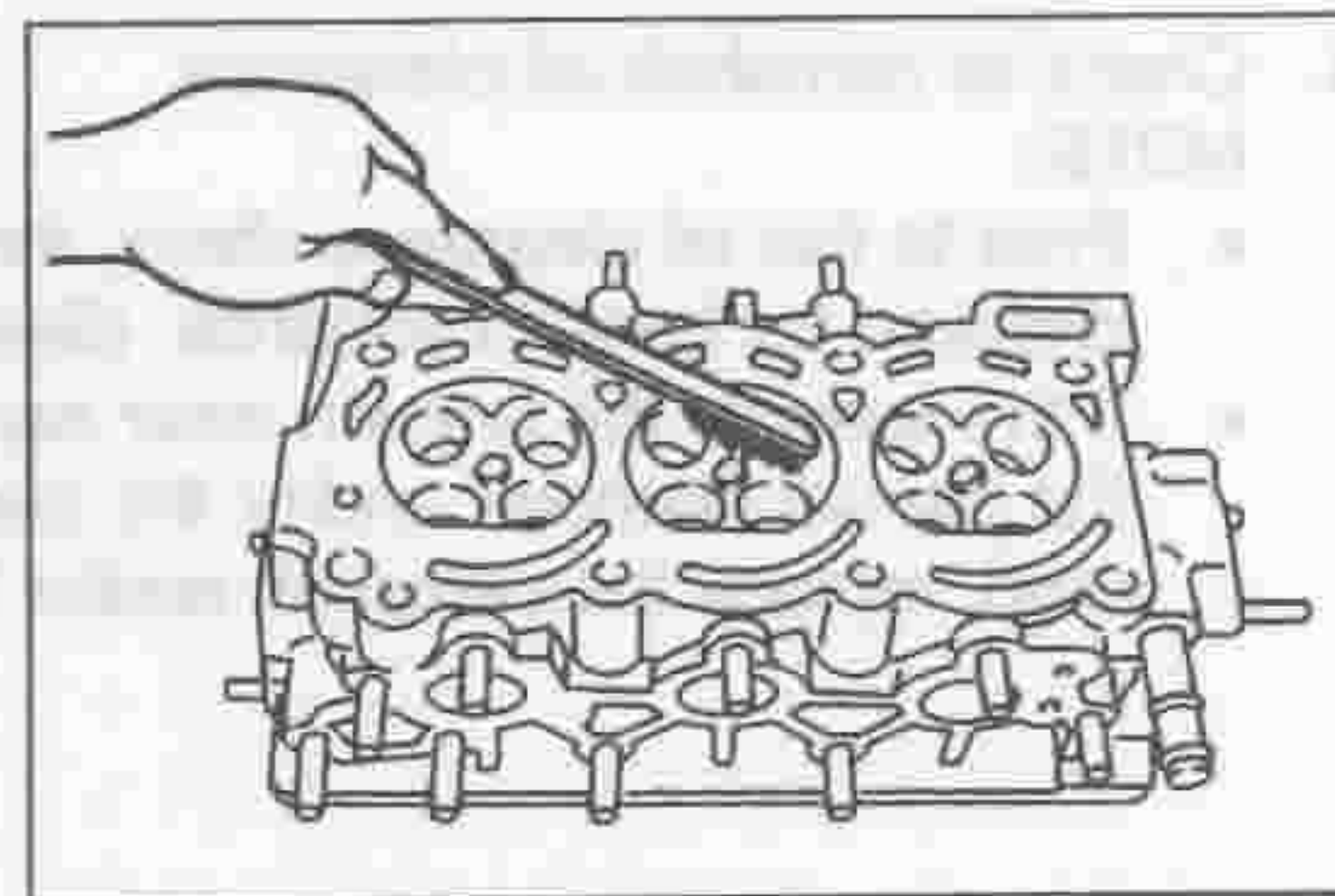


LEM00118-00104



## 5. Cleaning of cylinder head

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



LEM00119-00105

## 6. Check of cylinder head for flatness

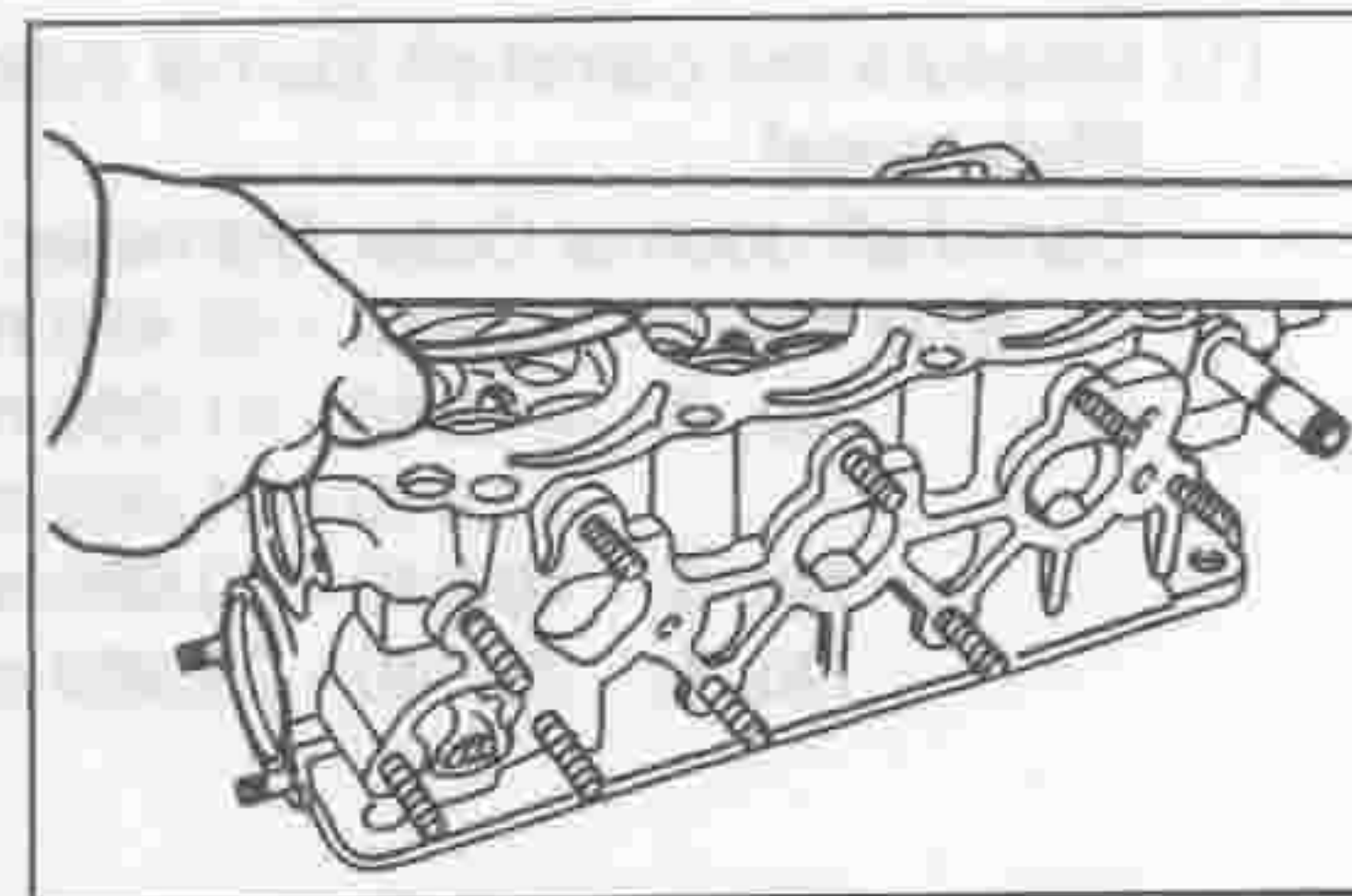
Using a precision straight edge and a feeler gauge, check the gasket surfaces contacting the cylinder block and manifolds for warpage.

Maximum Surface Warpage:

Cylinder Block Side: 0.10 mm

Intake Manifold Side: 0.10 mm

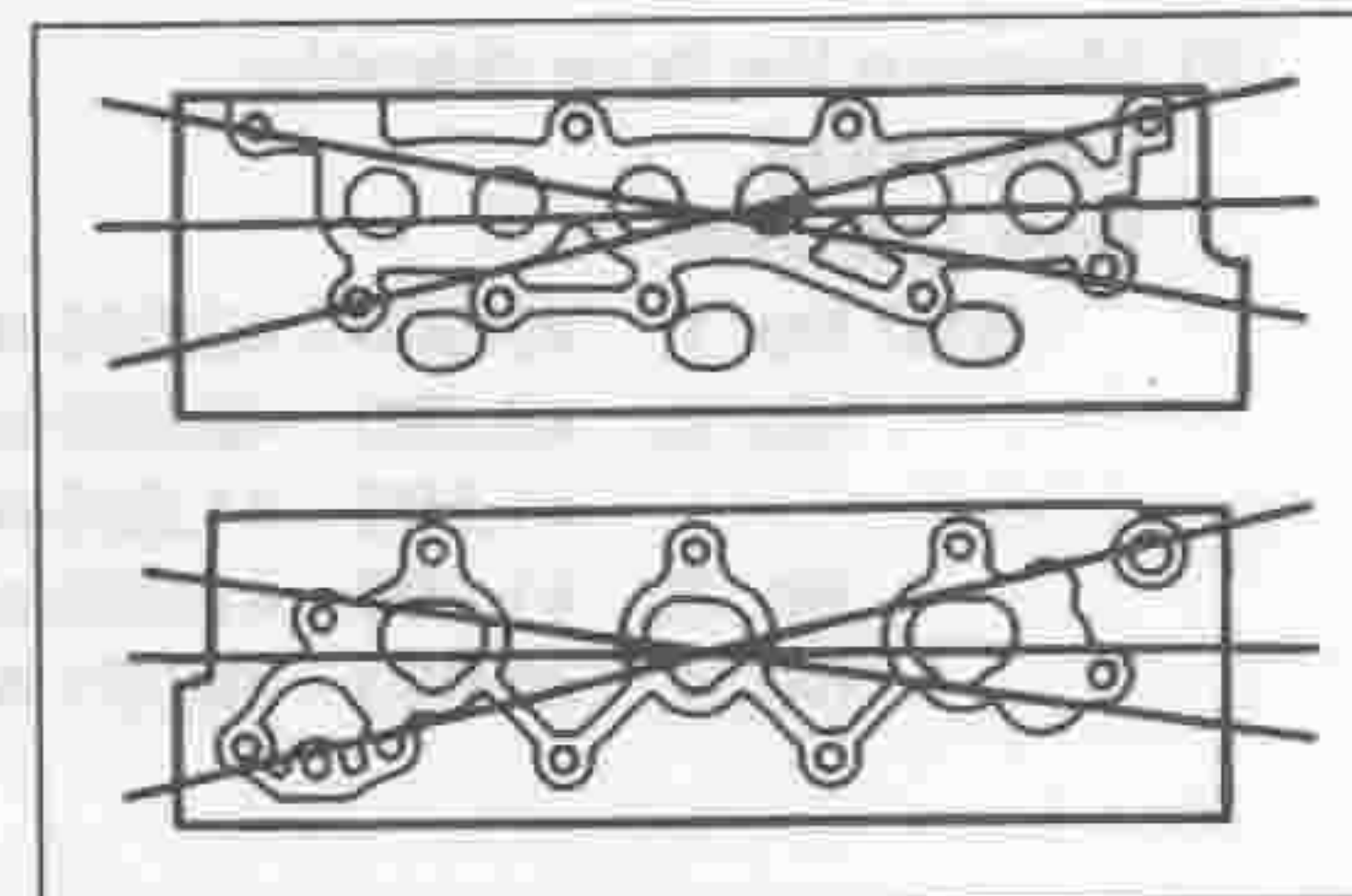
Exhaust Manifold Side: 0.10 mm



LEM00120-00106

If surface warpage of the cylinder block side exceeds the maximum limit, reface or replace the cylinder head.

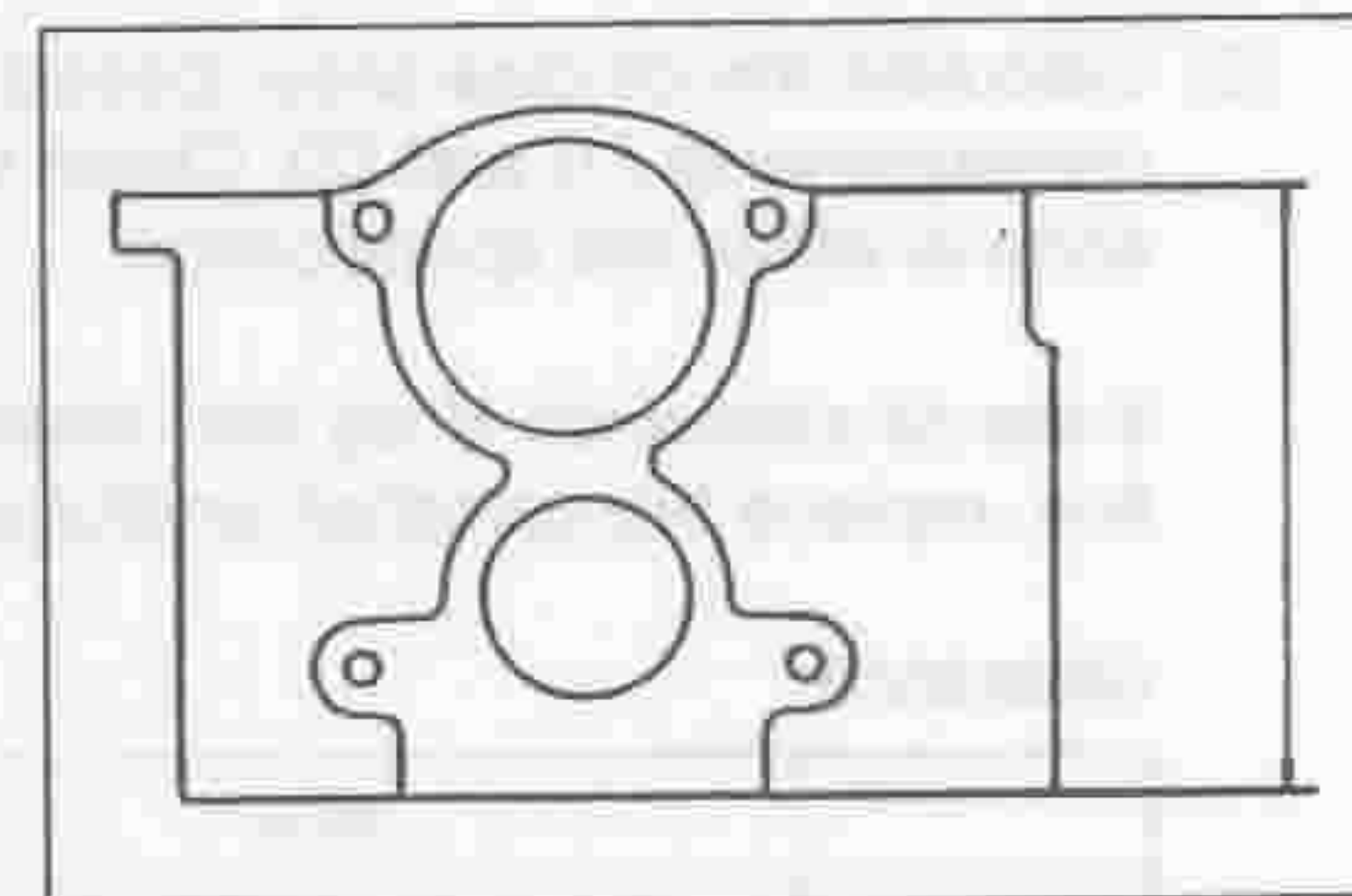
If surface warpage of the intake manifold and/or exhaust manifold side exceeds the maximum limit, replace the cylinder head.



LEM00121-00107

## NOTE:

- If the cylinder head surface warpage at the cylinder block side exceeds the maximum warpage, reface the cylinder head within the minimum thickness limit.  
Cylinder Head Height Limit: 99.8 mm

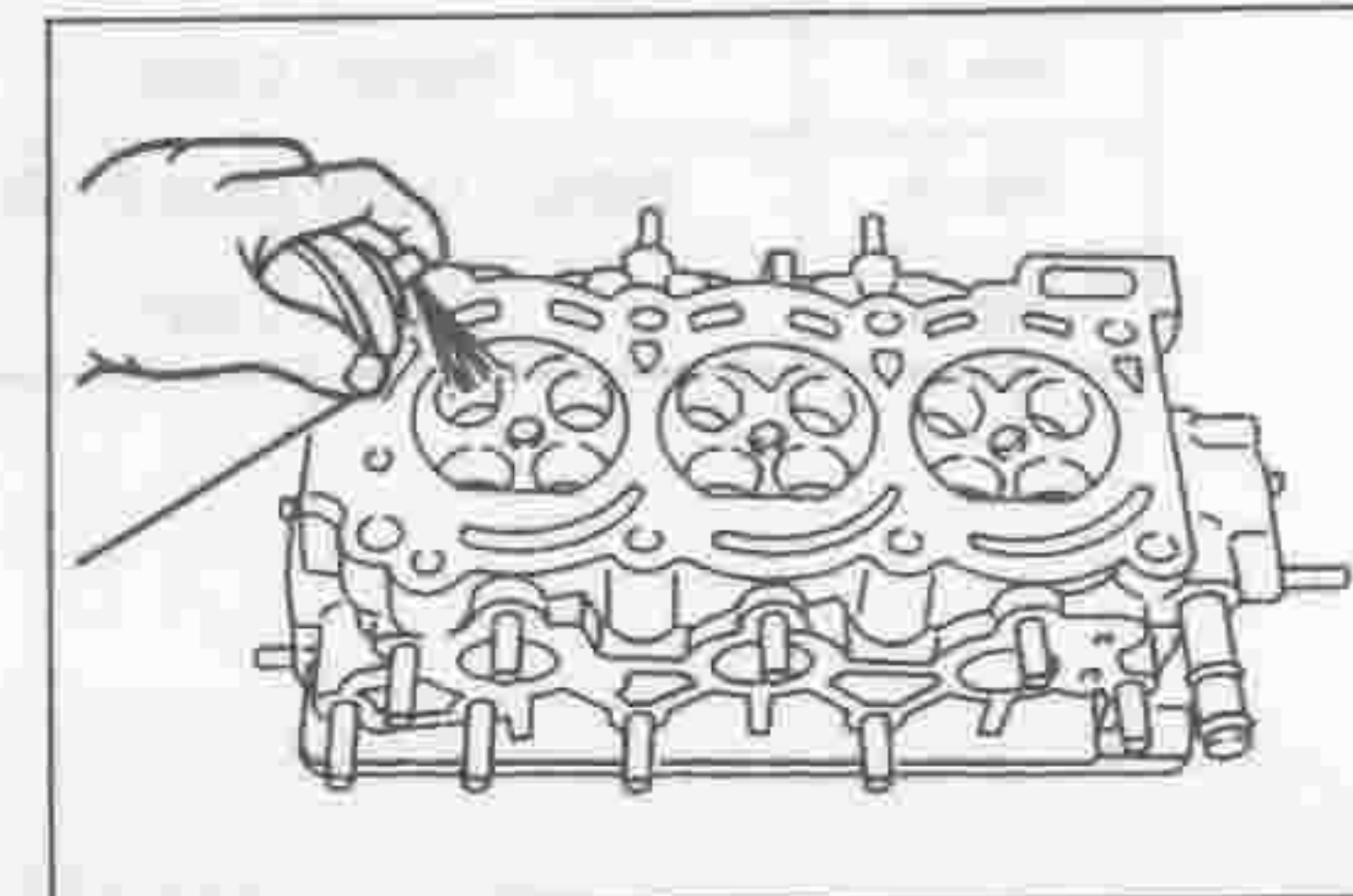


LEM00122-00108

## 7. Inspection of cylinder head for cracks

Using a dye penetration, check the combustion chamber, intake and exhaust ports, cylinder head surface and top of the cylinder head for cracks.

If a crack is found, replace the cylinder head.



LEM00123-00109

# EM-34

ured, replace the camshaft and/or the cylinder head.



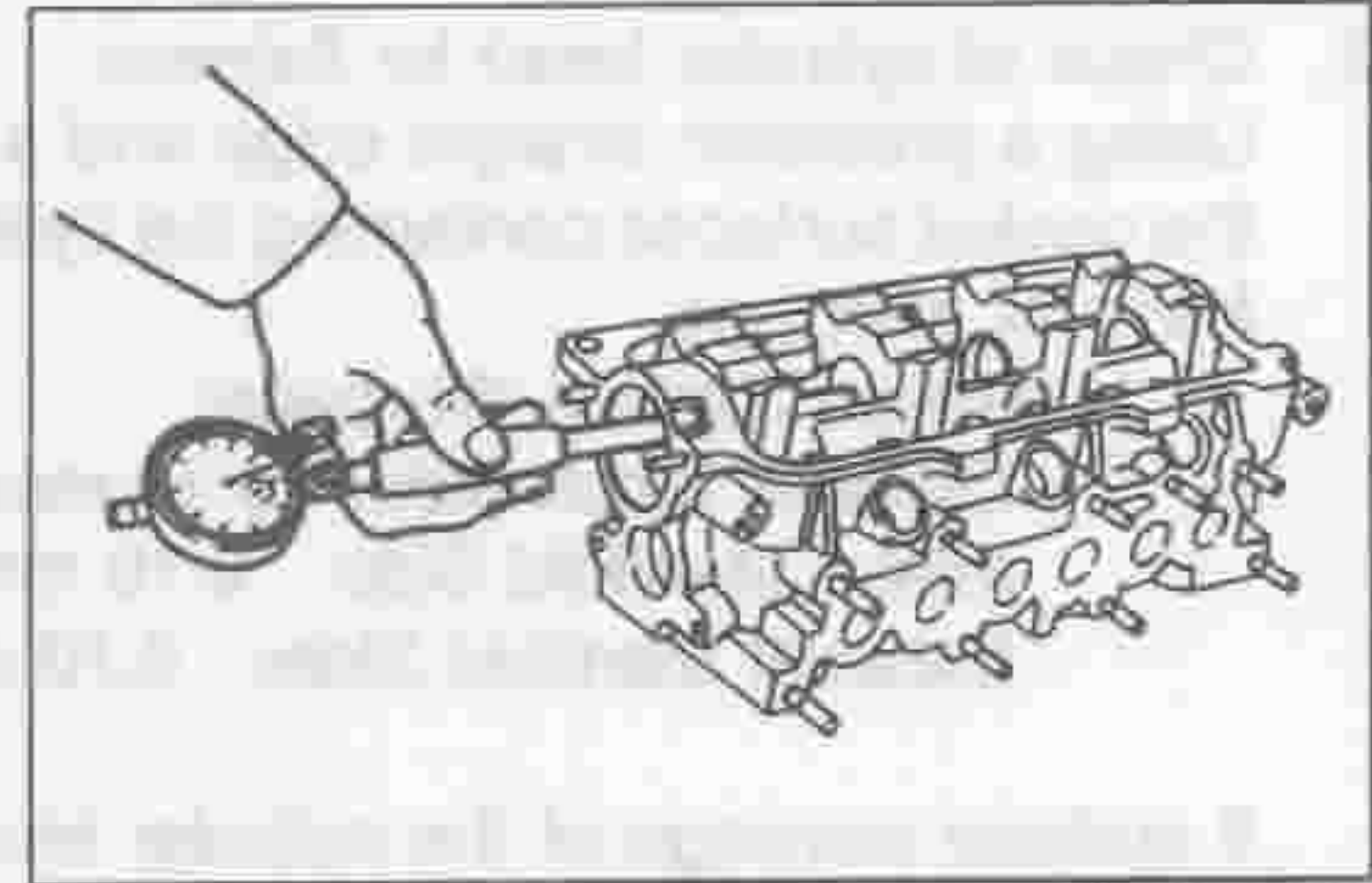
LEM00124-00110

(1) Measure the camshaft journal outer diameter.

[Reference]

Camshaft Journal Outer Diameter:

- STD No. 1: 42.440 - 42.460 mm
- No. 2: 41.940 - 41.960 mm [ED-10, 20]  
41.440 - 41.460 mm [EF-EL]
- No. 3: 40.940 - 40.960 mm [EF-EL]
- No. 4: 29.940 - 29.960 mm



LEM00125-00111

(2) Measure the bore diameter.

[Reference]

Bore Diameter:

- STD No. 1: 42.500 - 42.525 mm
- No. 2: 42.000 - 42.025 mm [ED-10, 20]  
41.500 - 41.525 mm [EF-EL]
- No. 3: 41.000 - 41.025 mm [EF-EL]
- No. 4: 30.000 - 30.021 mm

LEM00126-00000

(3) Calculate the oil clearance, based on the results of the measurements (1) and (2). Check to see if the oil clearance is within the specification.

If the oil clearance does not conform to the specification, replace the camshaft and/or cylinder head.

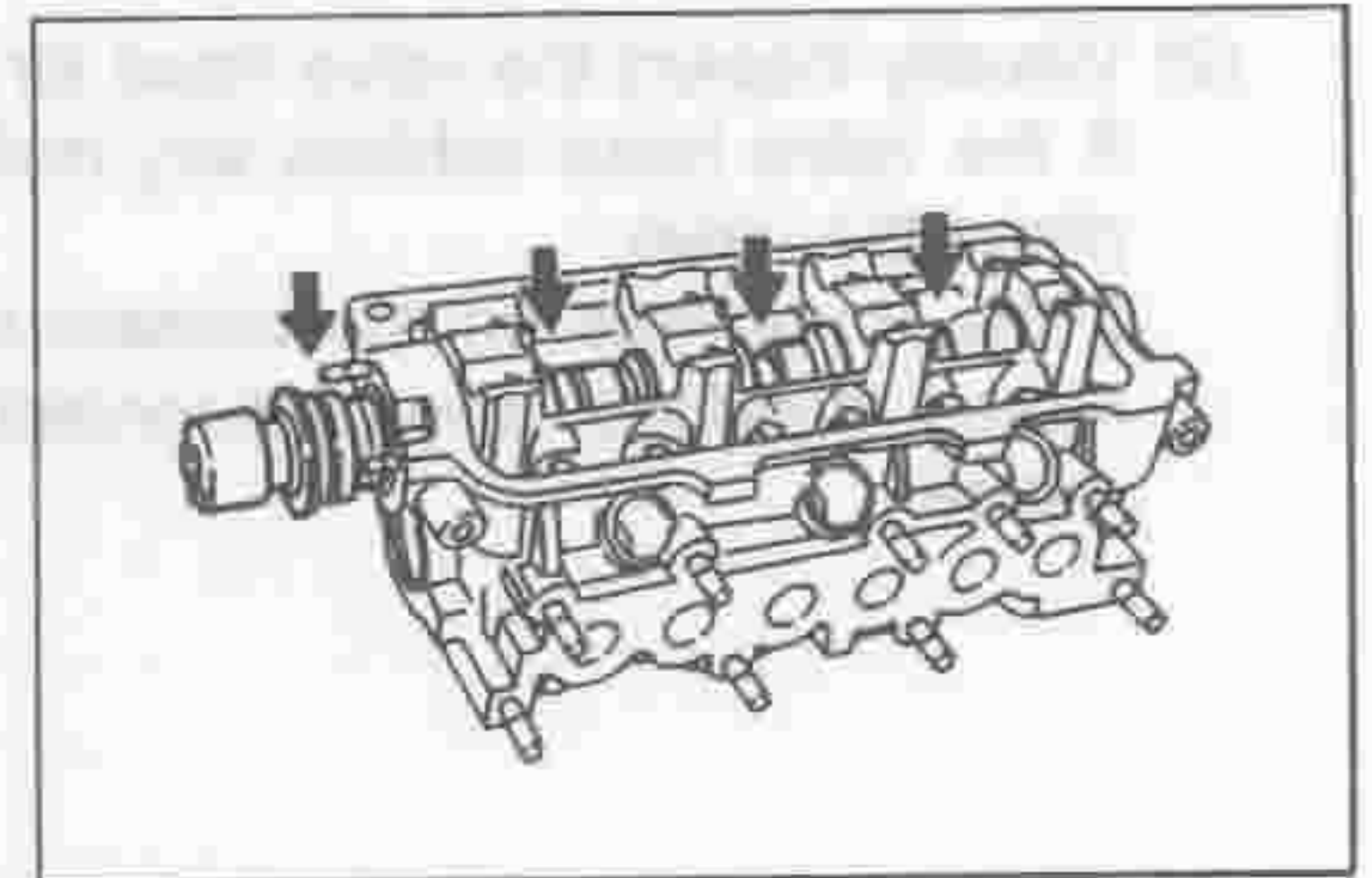
Clearance:

(mm)

	STD	Limit
No. 1	0.040 - 0.085	0.13
No. 2	0.040 - 0.085	0.13
No. 3	0.040 - 0.085 [only EF-EL]	0.13
No. 4	0.040 - 0.081	0.12

LEM00127-00000

9. Check of camshaft thrust clearance  
 (1) Apply engine oil to the camshaft journals.  
 (2) Install the camshaft to the cylinder head.



LEM00128-00112

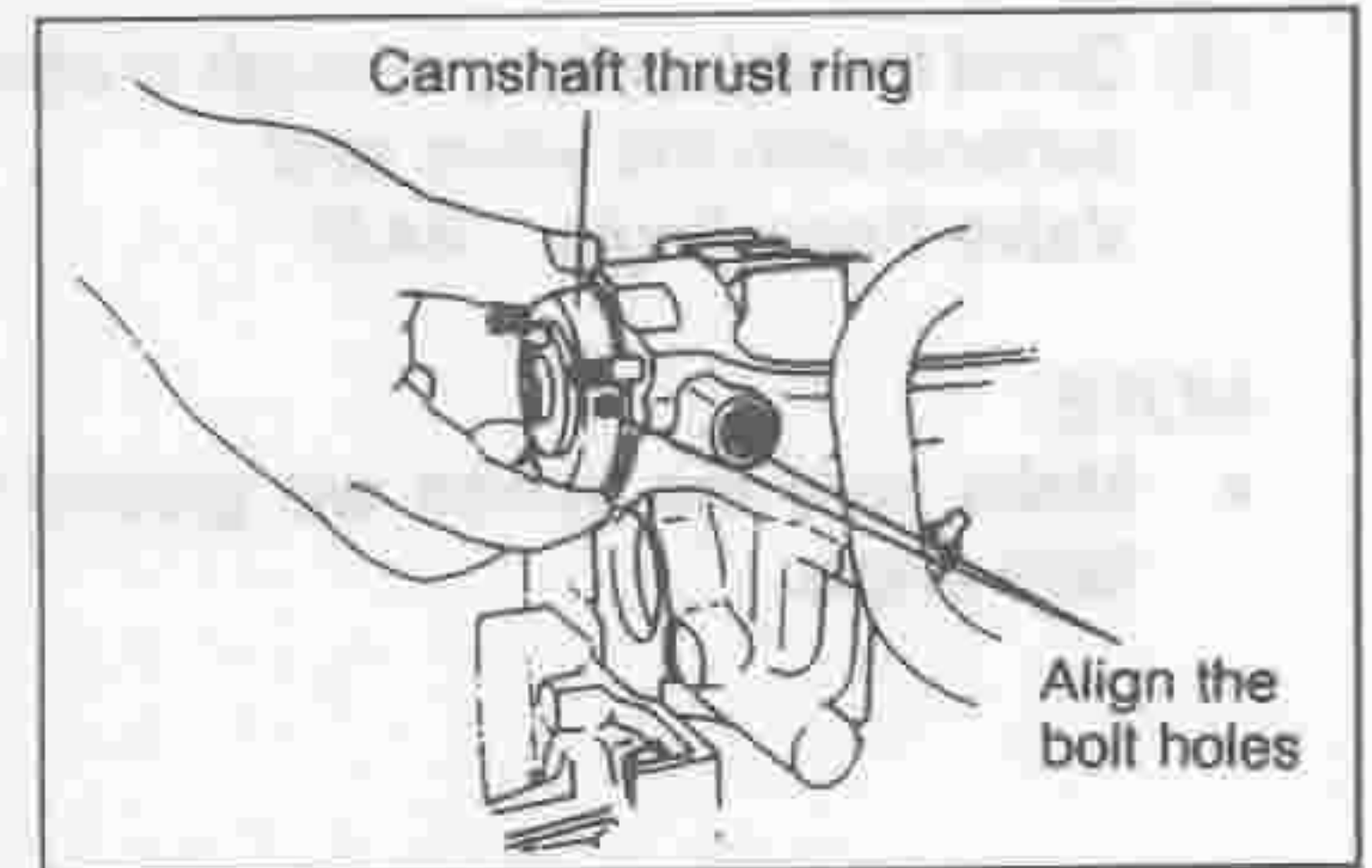
- (3) Install the camshaft thrust ring.

**NOTE:**

- Care must be exercised as to the direction of the attaching bolt hole of the camshaft thrust ring.

- (4) Install the camshaft thrust ring retaining screw and gasket.

Tightening Torque:  $8.8 \pm 1.8 \text{ N}\cdot\text{m}$   
 $(0.90 \pm 0.18 \text{ kgf}\cdot\text{m})$



LEM00129-00113

- (5) Ensure that the thrust clearance is within the specification.

**Specified Thrust Clearance:**

STD: 0.05 - 0.3 mm

Maximum Limit: 0.45 mm

If the camshaft thrust clearance exceeds the allowable limit, replace the thrust ring, camshaft and/or cylinder head, as required.

**[Reference]**

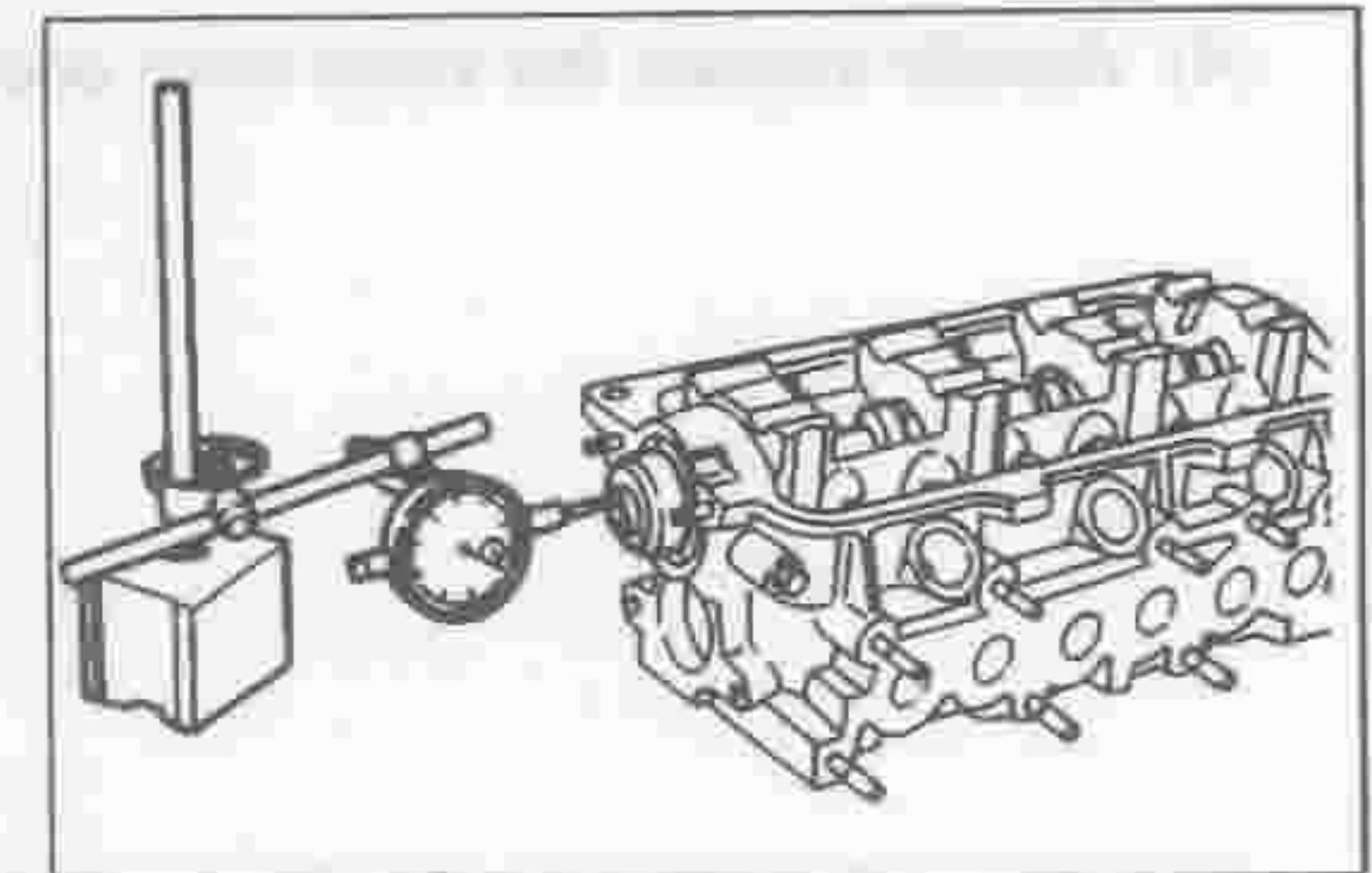
**Specified Width of Thrust Ring:**

9.97 - 10.03 mm [EF-EL Engine]

11.97 - 12.03 mm [ED-10, ED-20 Engine]

**Specified Width of Camshaft Thrust Surface:**

3.90 - 4.10 mm [ED-10, ED-20 Engine]



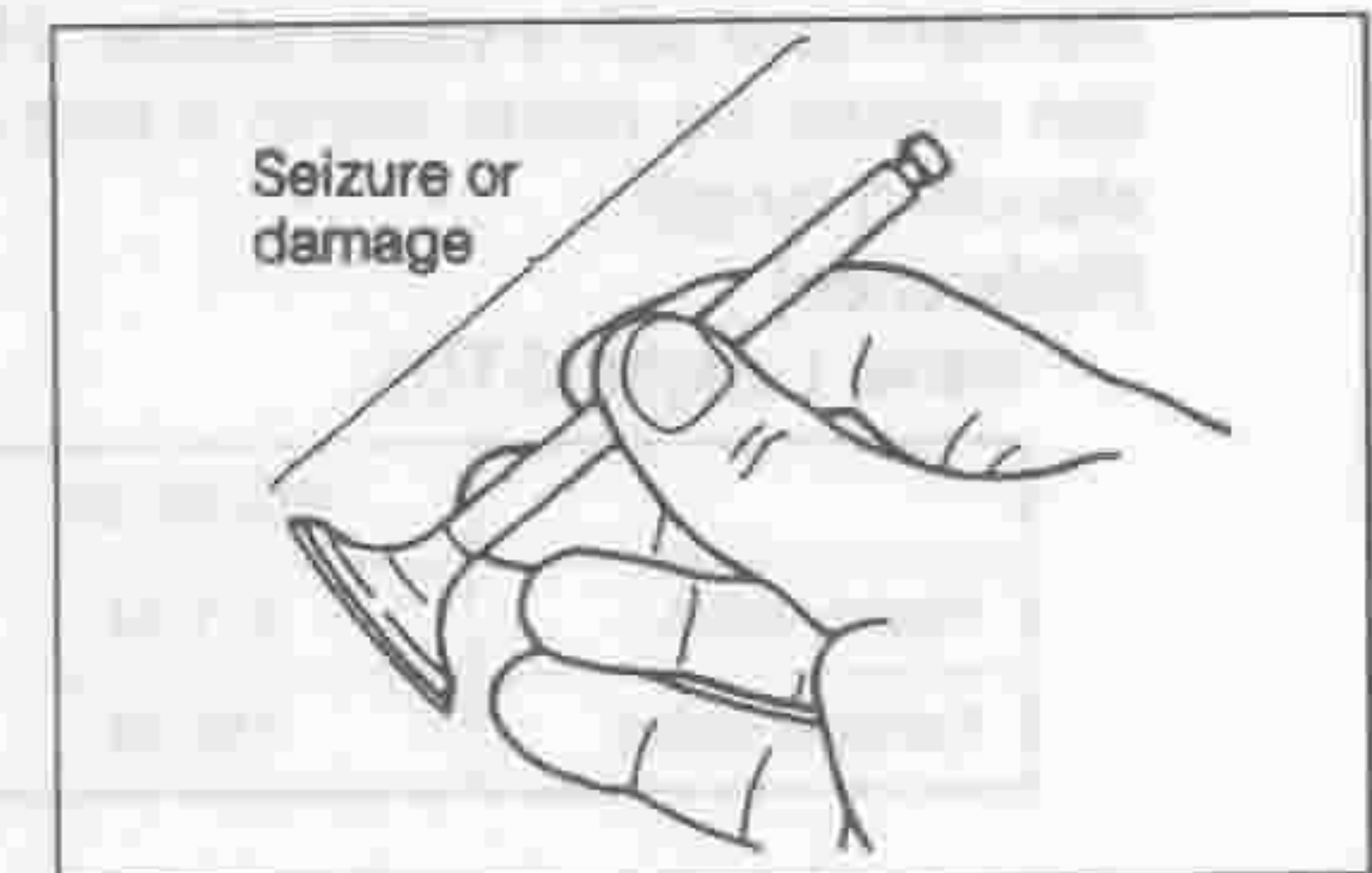
LEM00130-00114

10. Inspection and grinding of valves

- (1) Visually inspect the valve stem for seizure or damage.

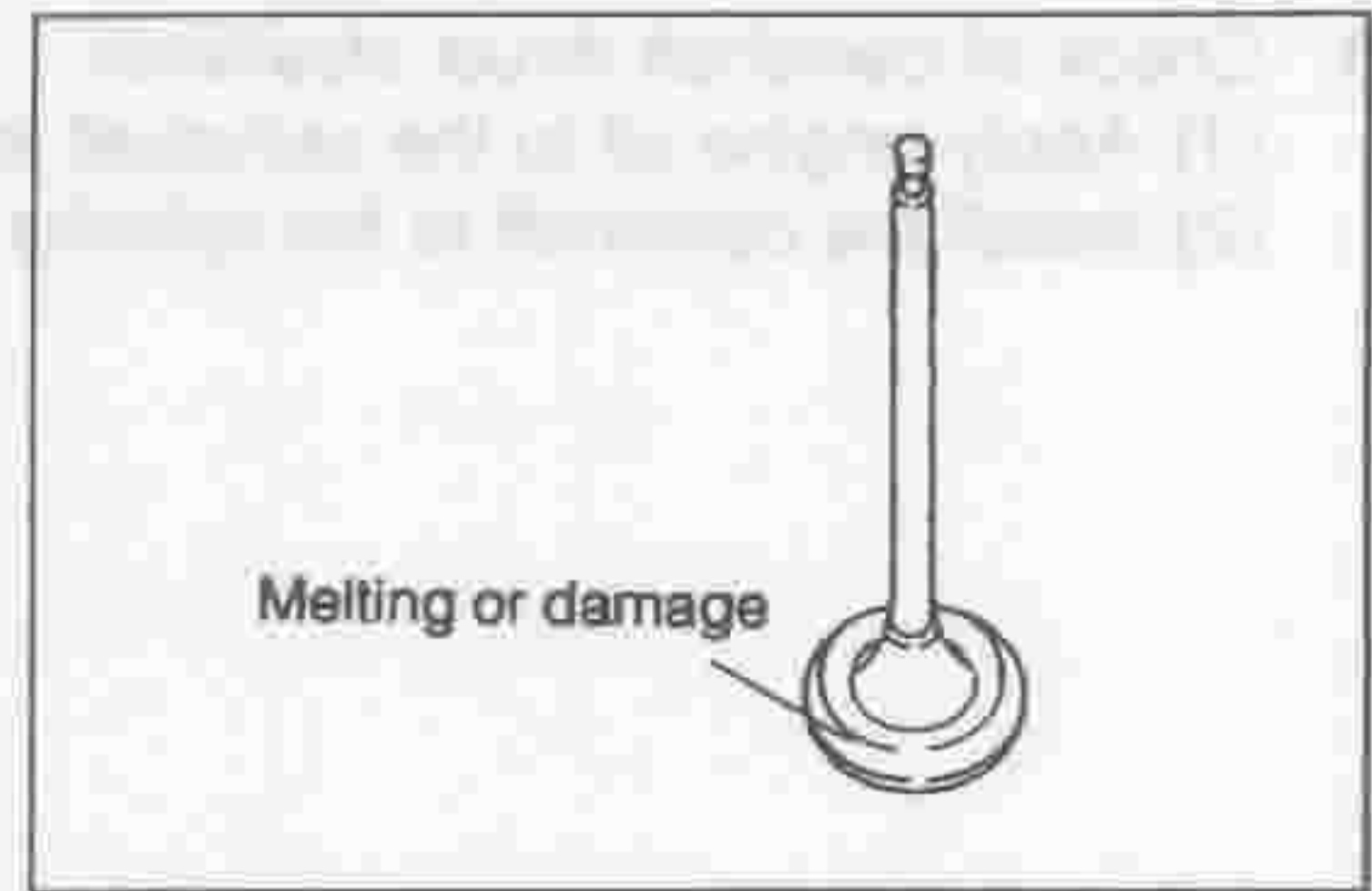
**NOTE:**

- If seizure or damage is found, replace the valve and valve guide bush as a set.
- However, this replacement should be performed only after the checks for the valve seat, valve stem and guide bush have been finished.
- The valve guide bush hole must be used for refacing the valve seat. Hence, if the valve guide bush hole exhibits any roughness due to seizure, etc., rectify the hole with an adjustable reamer.



LEM00131-00115

- (2) Visually inspect the valve head for melting or damage. If the valve head exhibits any melting or damage, replace the valve. If the roughness on the contact surface can be corrected, grind the valve seat contact surface with a valve refacer.

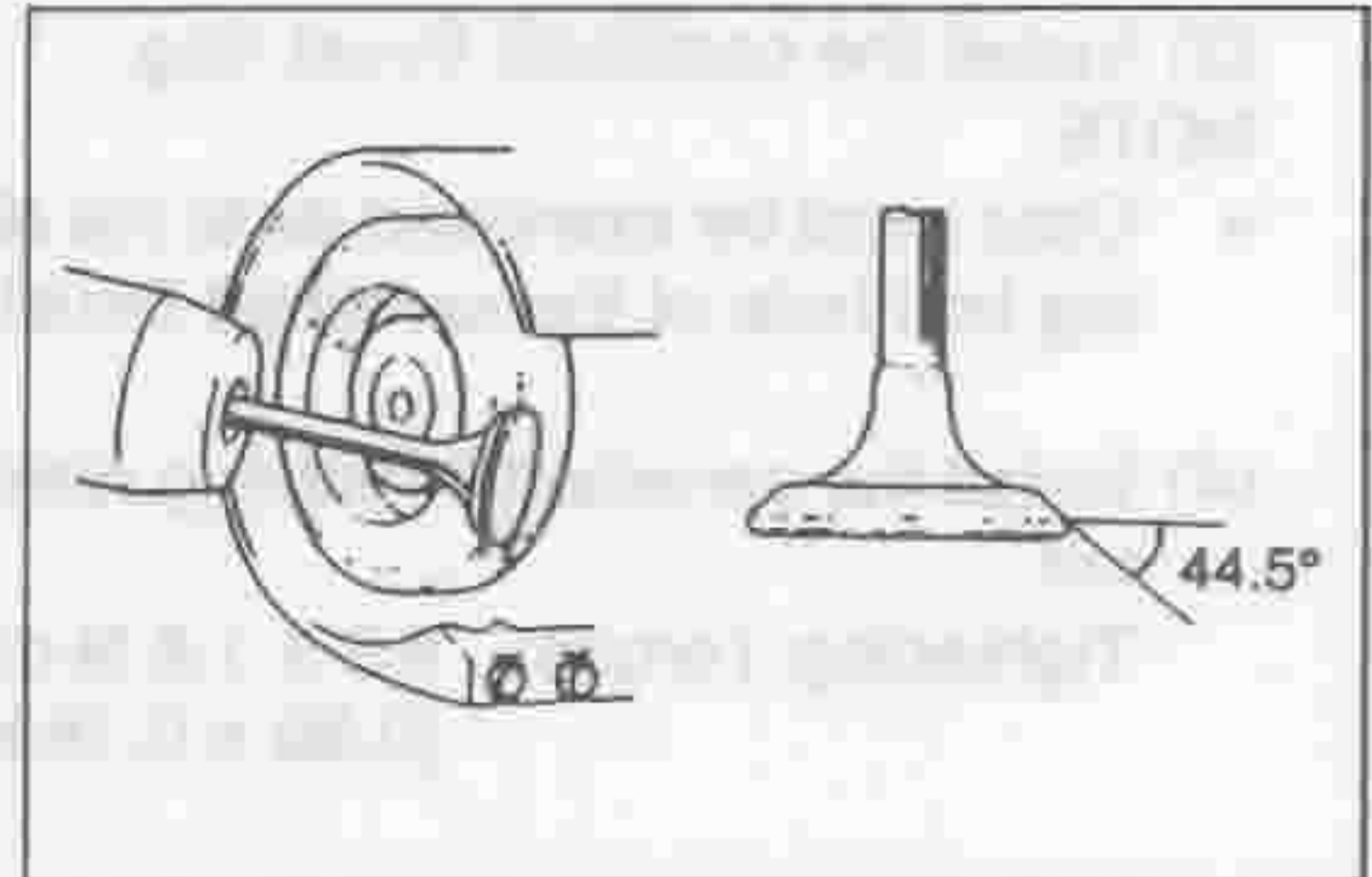


LEM00132-00116

- (3) Grind the valves only enough to obtain a smooth contact surface with the valve seat. Valve Face Angle: 44.5°

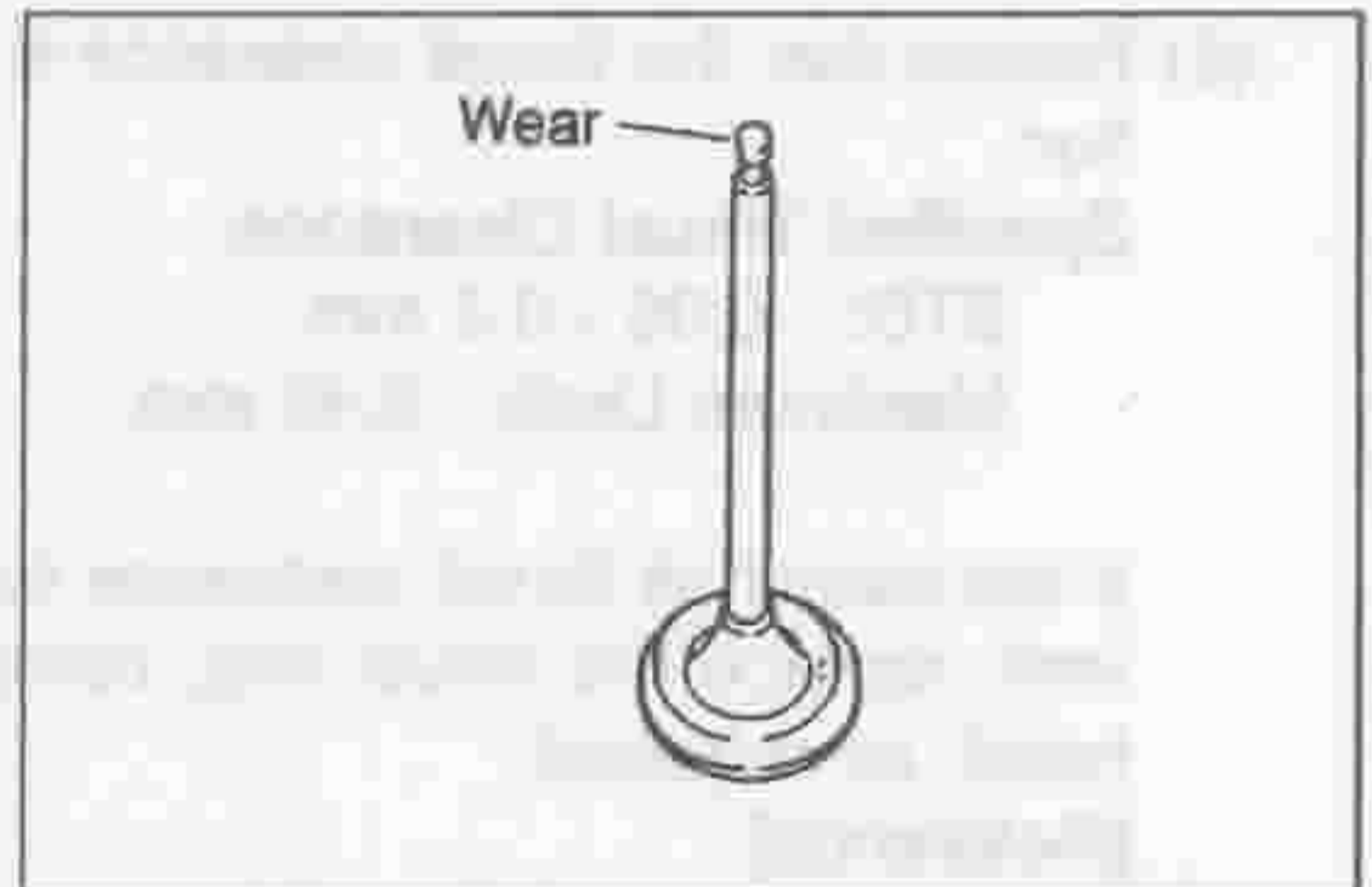
**NOTE:**

- Make sure the valves are ground to the correct valve face angle.



LEM00133-00117

- (4) Visually inspect the valve stem end for abnormal wear.



LEM00134-00118

If the valve stem end exhibits abnormal wear, correct the stem end with a valve refacer. However, this correction should be made within a limit of 0.2 mm from the standard length.

**[Reference]**

Valve Length (STD):

(mm)

	ED-10, 20	EF-EL
Intake valve	111.14	110.0
Exhaust valve	110.44	111.2

**NOTE:**

- Be very careful not to allow the valve to be overheated during grinding.

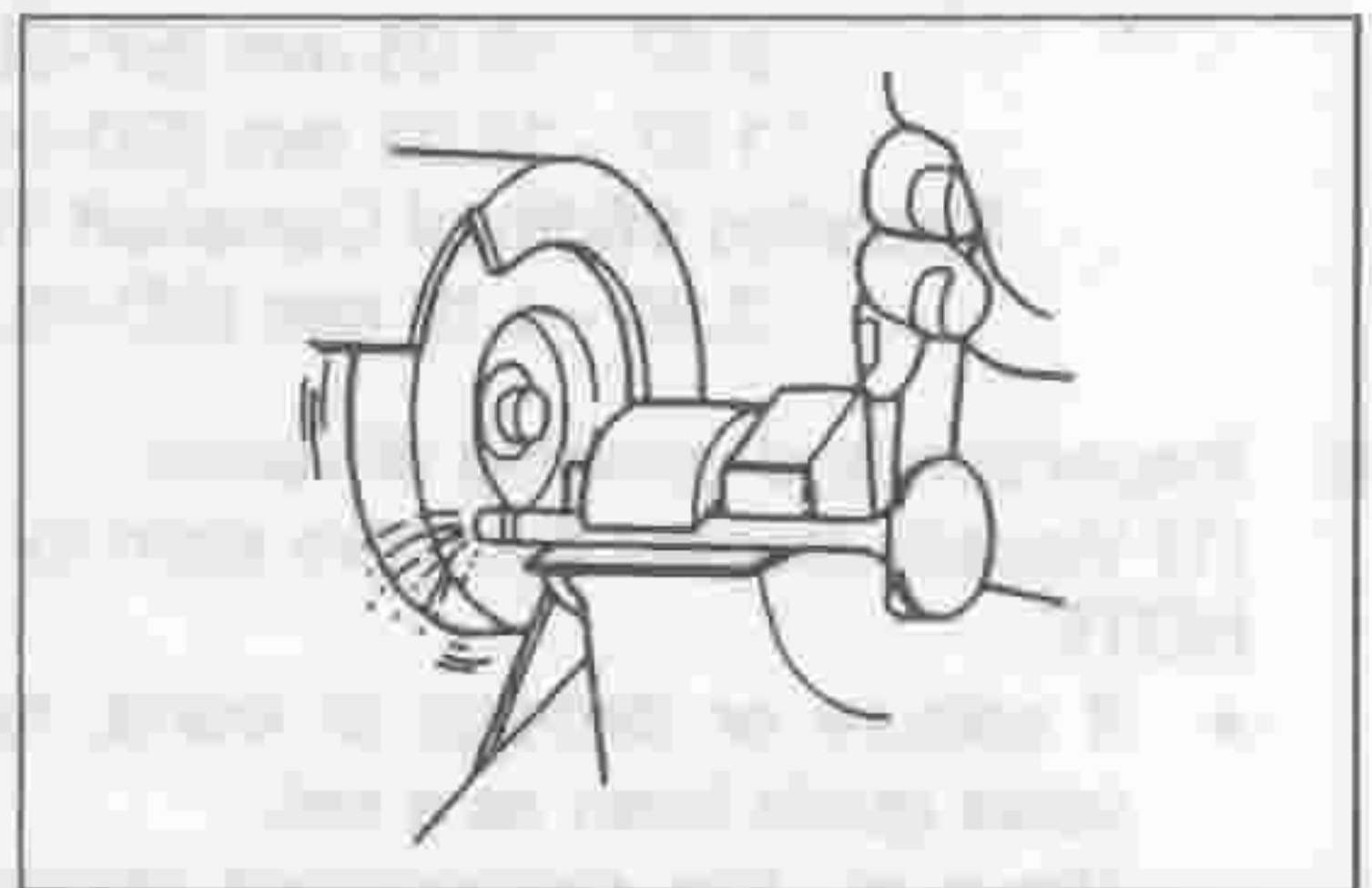
- (5) Inspect the valve head for its stock thickness.

Minimum Stock Thickness:

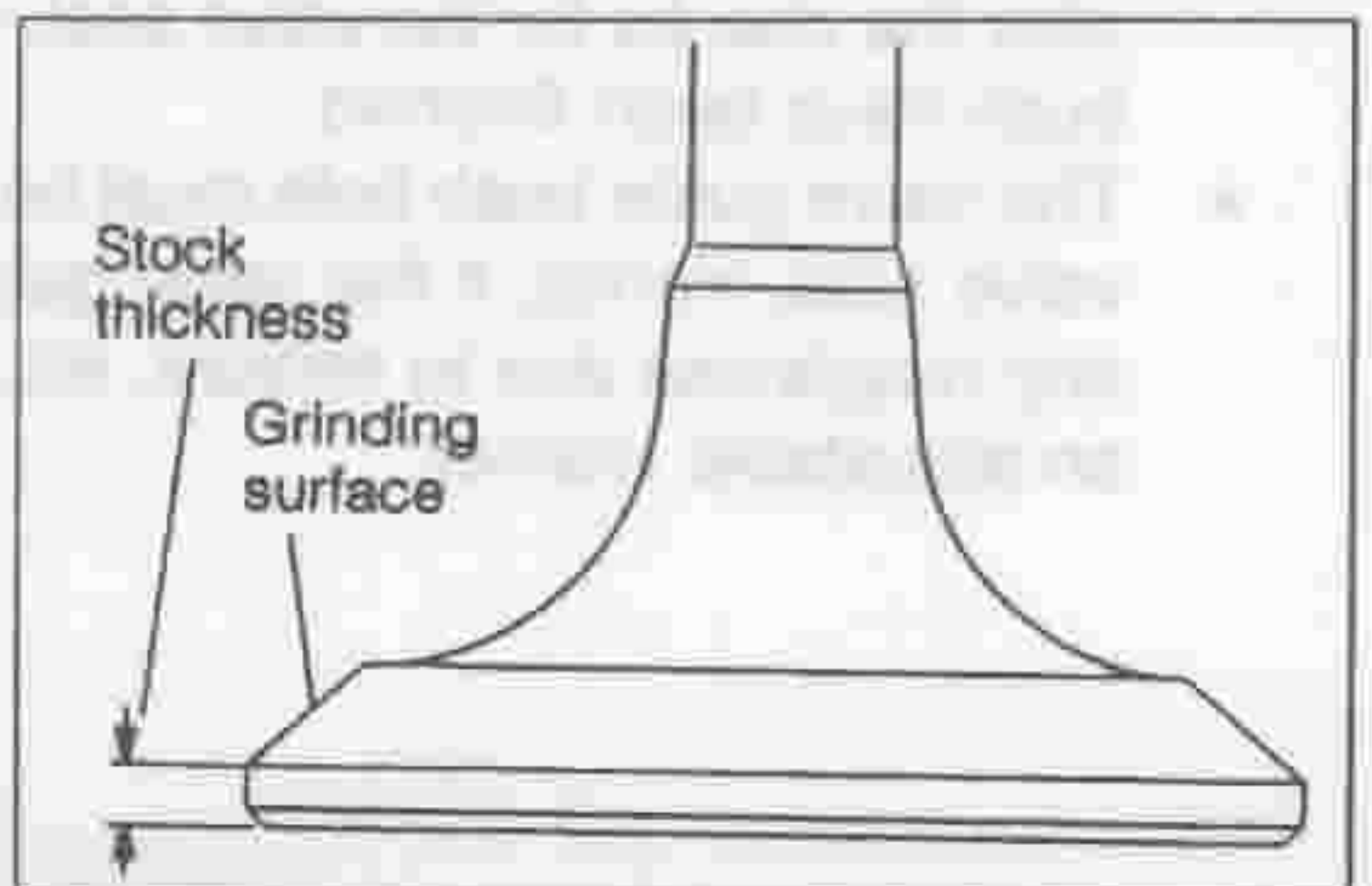
Intake Valve: 0.9 mm

Exhaust Valve: 1.1 mm

If the stock thickness of the valve head is less than the minimum stock thickness, replace it with a new one.



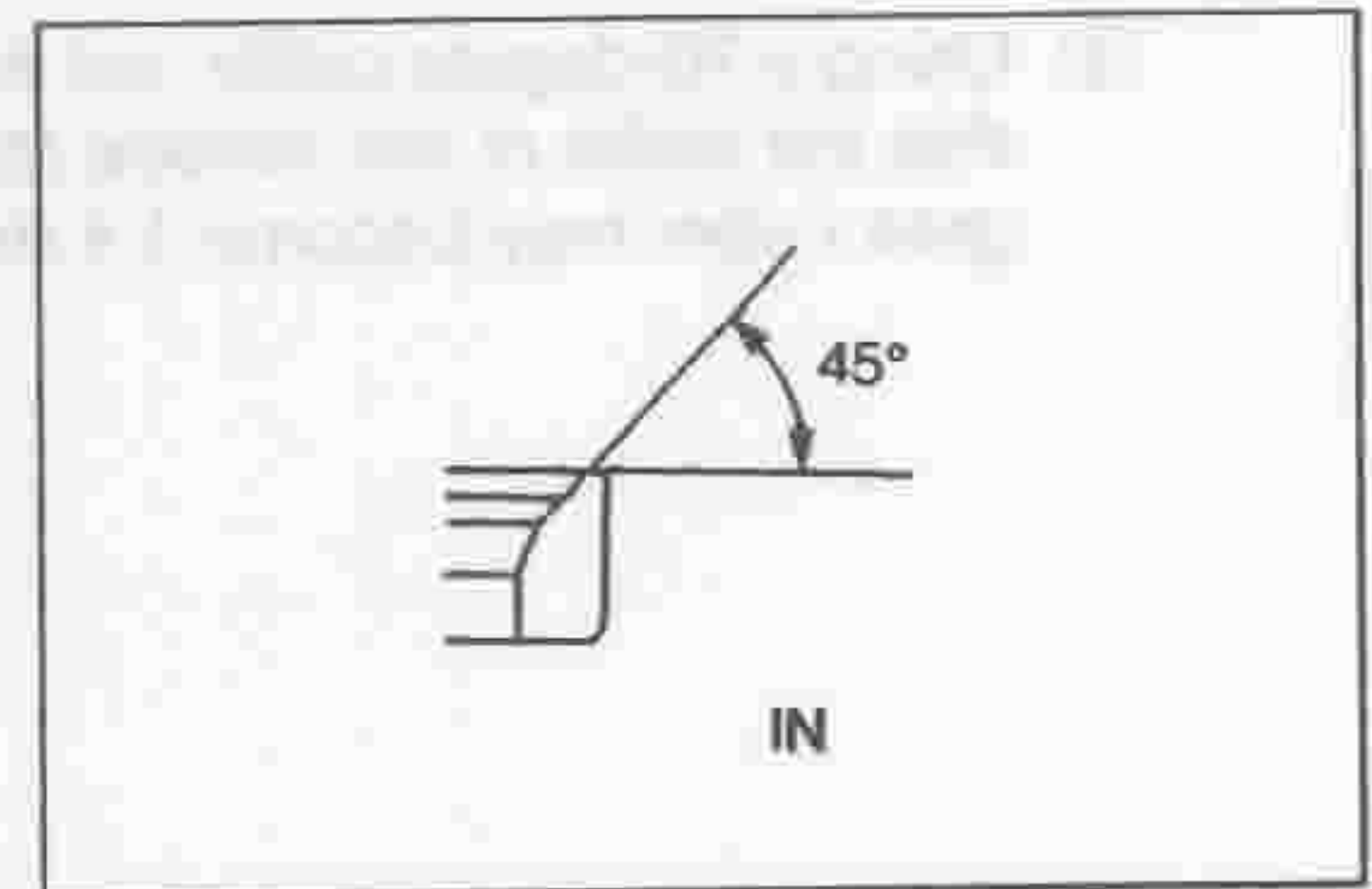
LEM00135-00119



LEM00136-00120

## 11. Inspection and cleaning of valve seats

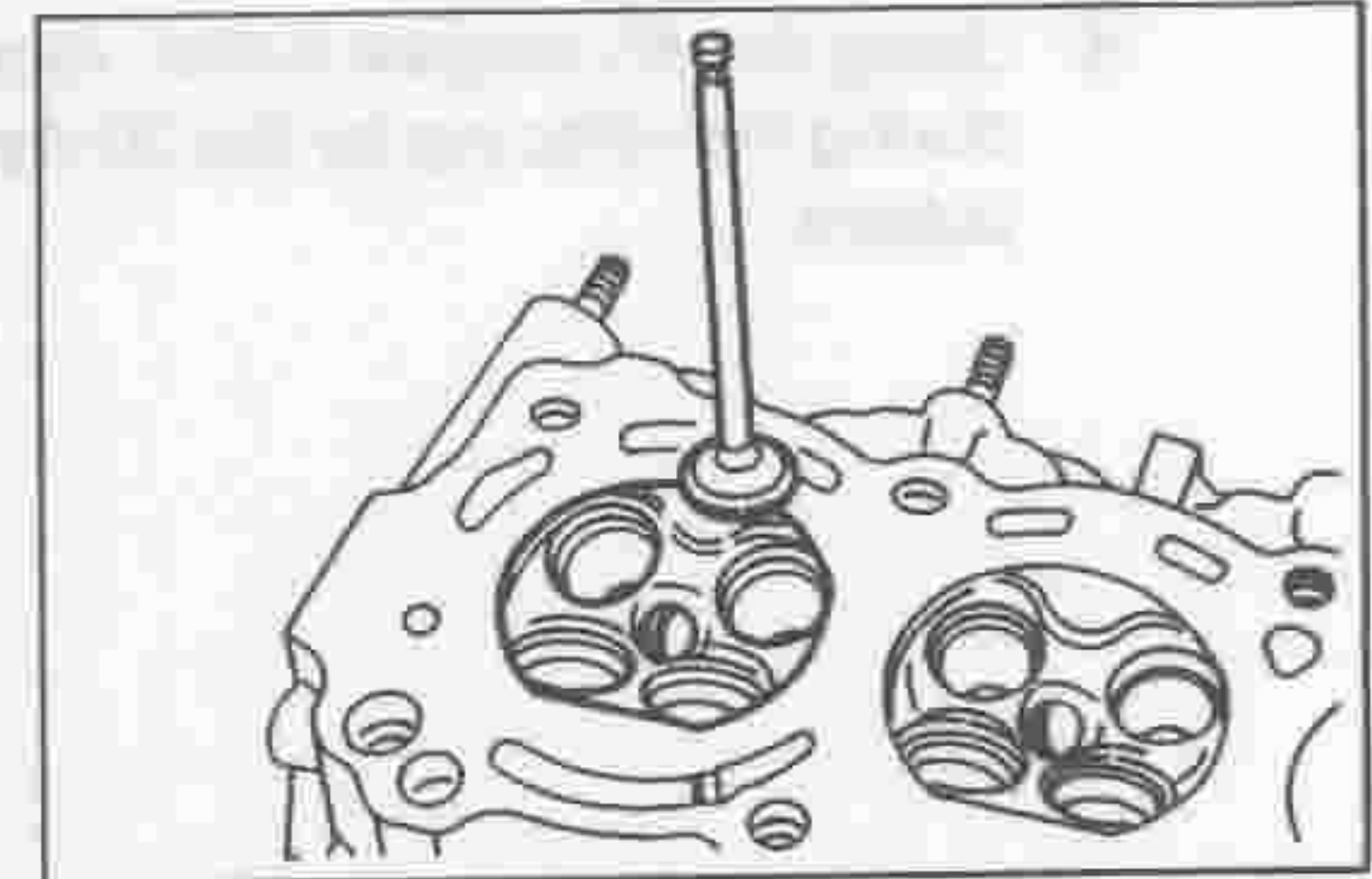
- (1) Using a 45-degree valve seat cutter, reface the valve seats. Remove only enough metal stock to clean the seats.
- (2) Apply a thin film of red lead (or white lead) to the valve seat.
- (3) Let the valve drop by its own weight onto the valve seat two or three times.
- (4) Take out the valve.



LEM00137-00121

### (5) Inspect the valve face and seat for the following items.

- ① Ensure that the valve seat contact surface of the valve is continuous over the whole circumference. If not, replace the valve.
- ② Ensure that the valve contact surface of the valve seat is continuous over the whole circumference. If not, reface the valve seat.

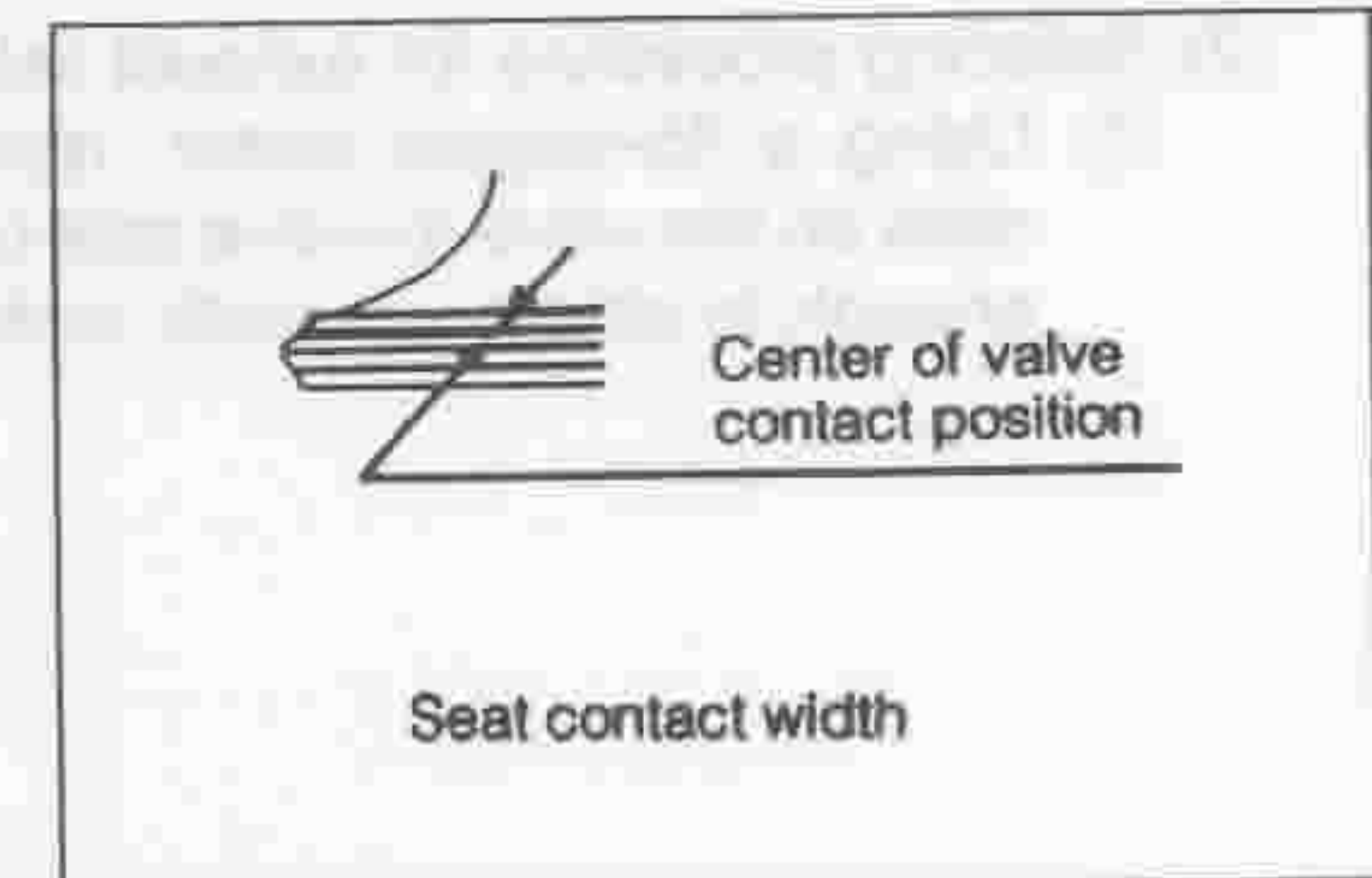


LEM00138-00122

- ③ Measure the width of the contact surface of valve seat.

Contact Surface of Valve Seat: 1.2 - 1.6 mm  
Maximum Limit: 2.3 mm

If not, reface the valve seat.

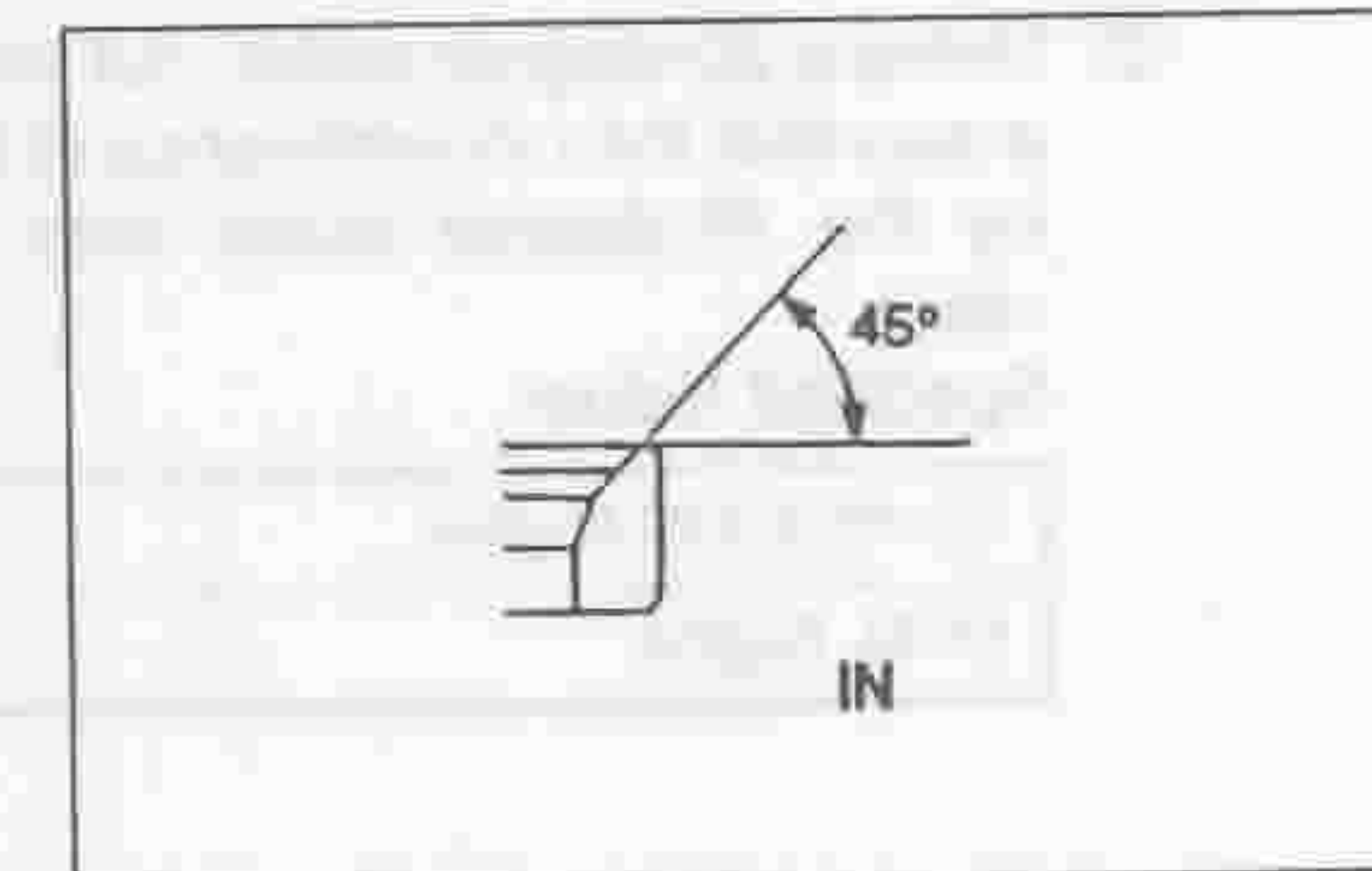


LEM00139-00123

## 12. Refacing of valve seat

### (1) Refacing procedure for intake valve seats

- ① Using a 45-degree cutter, recondition the roughness on the valve-to-valve seat contact surface, only enough to obtain a smooth surface.

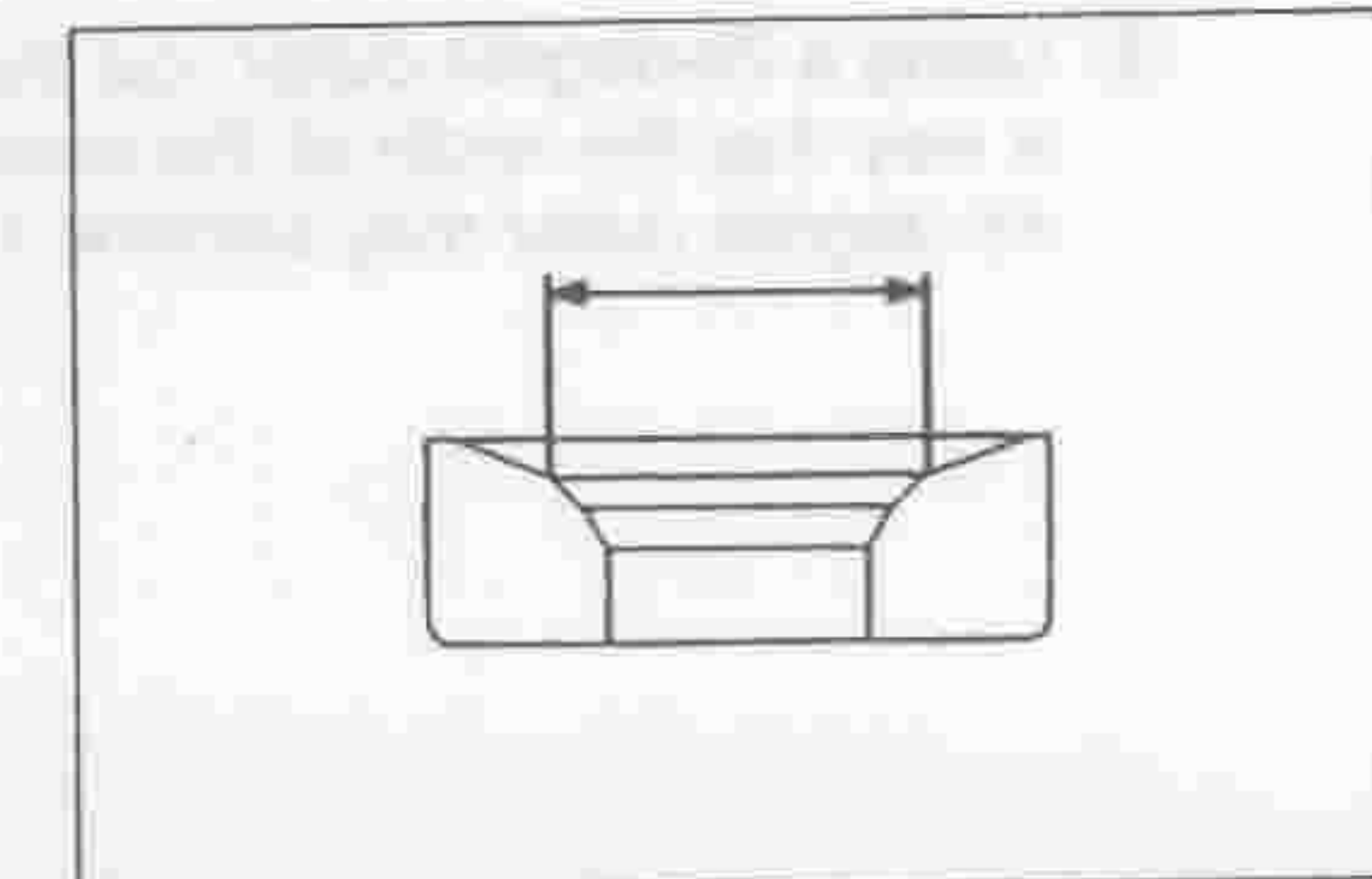


LEM00140-00124

- ② Using a 30-degree cutter, cut the valve seat in such a way that the circumference of the surface refaced by the 45-degree cutter may become specified value.

Specified Value: (mm)

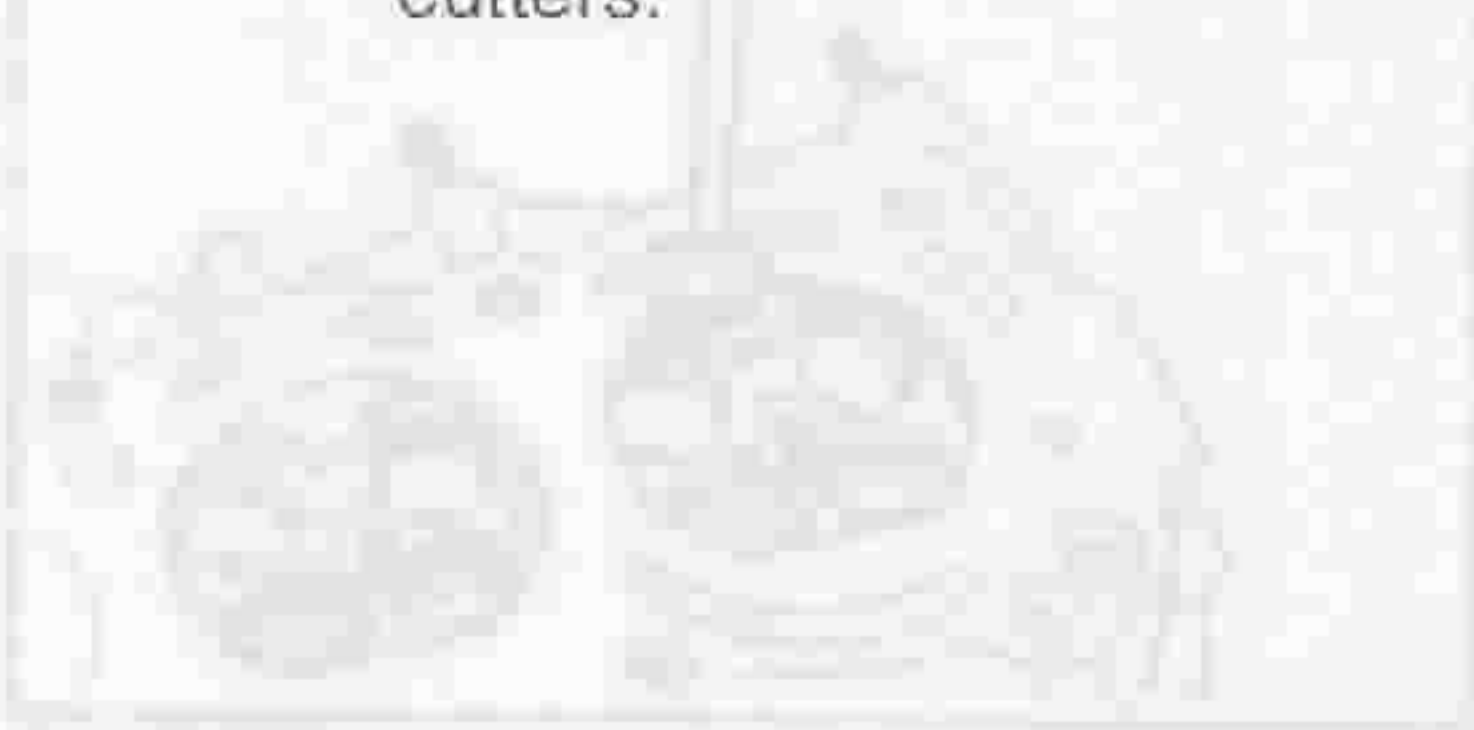
ED-10, ED-20 Engine	33 ± 0.1
EF-EL Engine	24 ± 0.1



LEM00141-00125

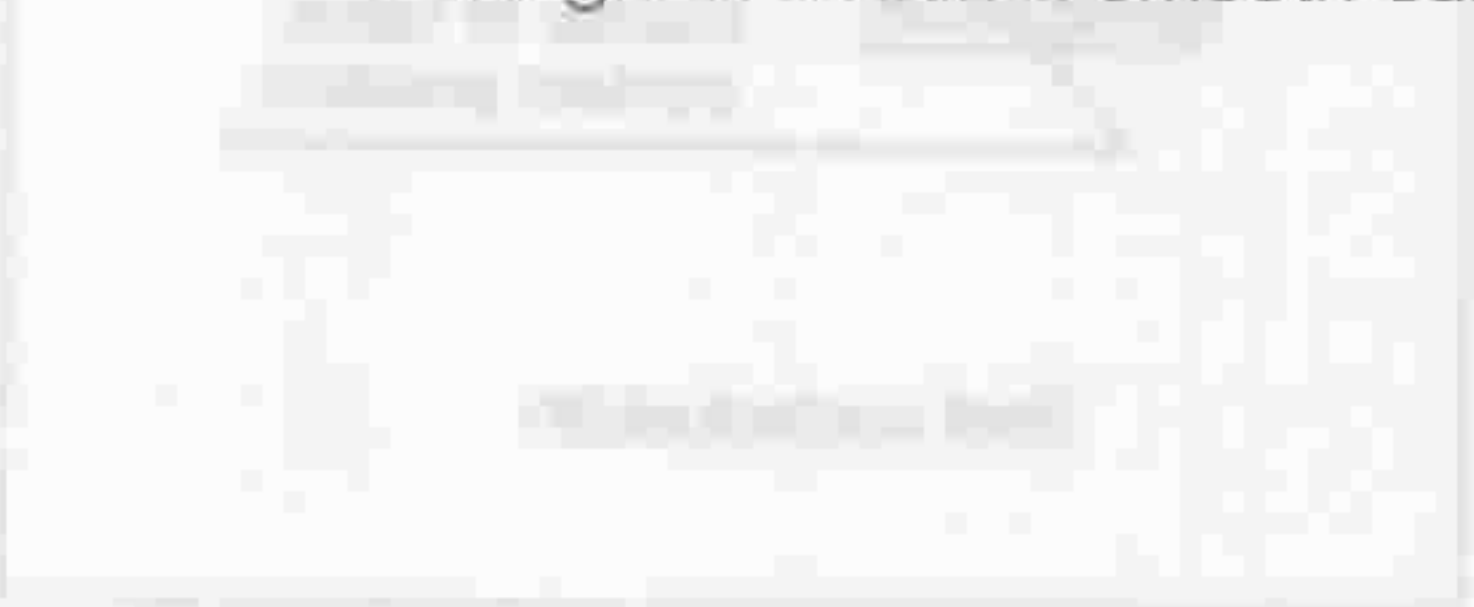


- ④ Using the 45-degree cutter, remove burrs produced during the refacing by the 30-degree and 70-degree cutters.



(2) Refacing procedure for exhaust valve seats

- ① Using a 45-degree cutter, recondition the roughness on the valve-to-valve seat contact surface, only enough to obtain a smooth surface.



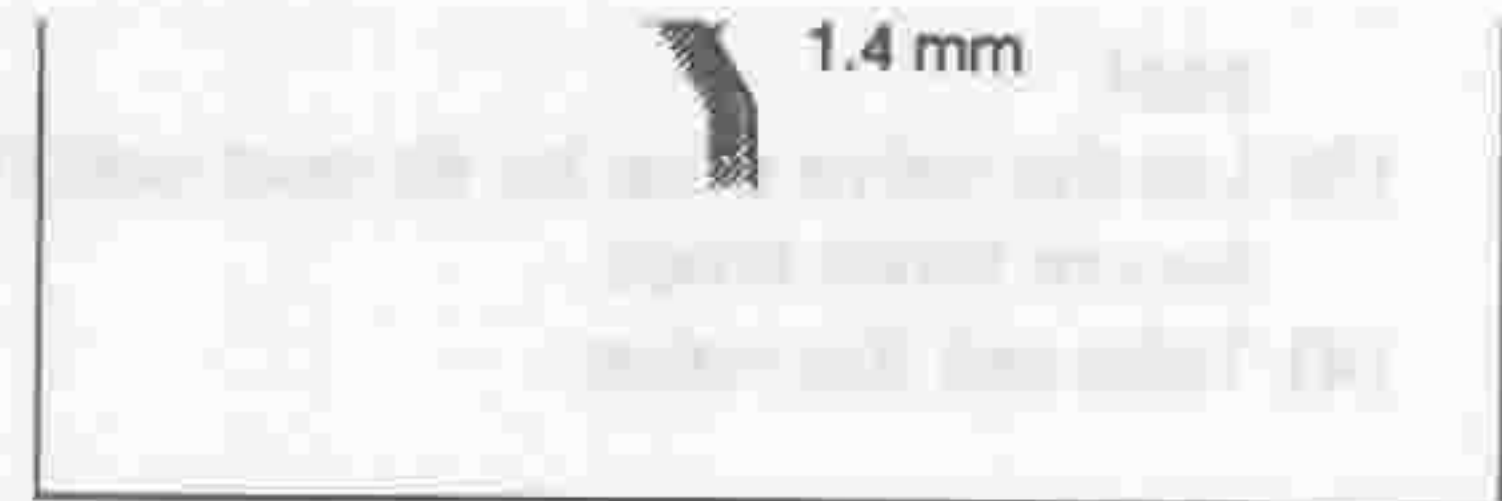
- ② Using a 20-degree cutter, cut the valve seat in such a way that the circumference of the surface refaced by the 45-degree cutter may become specified value.

Specified Value:

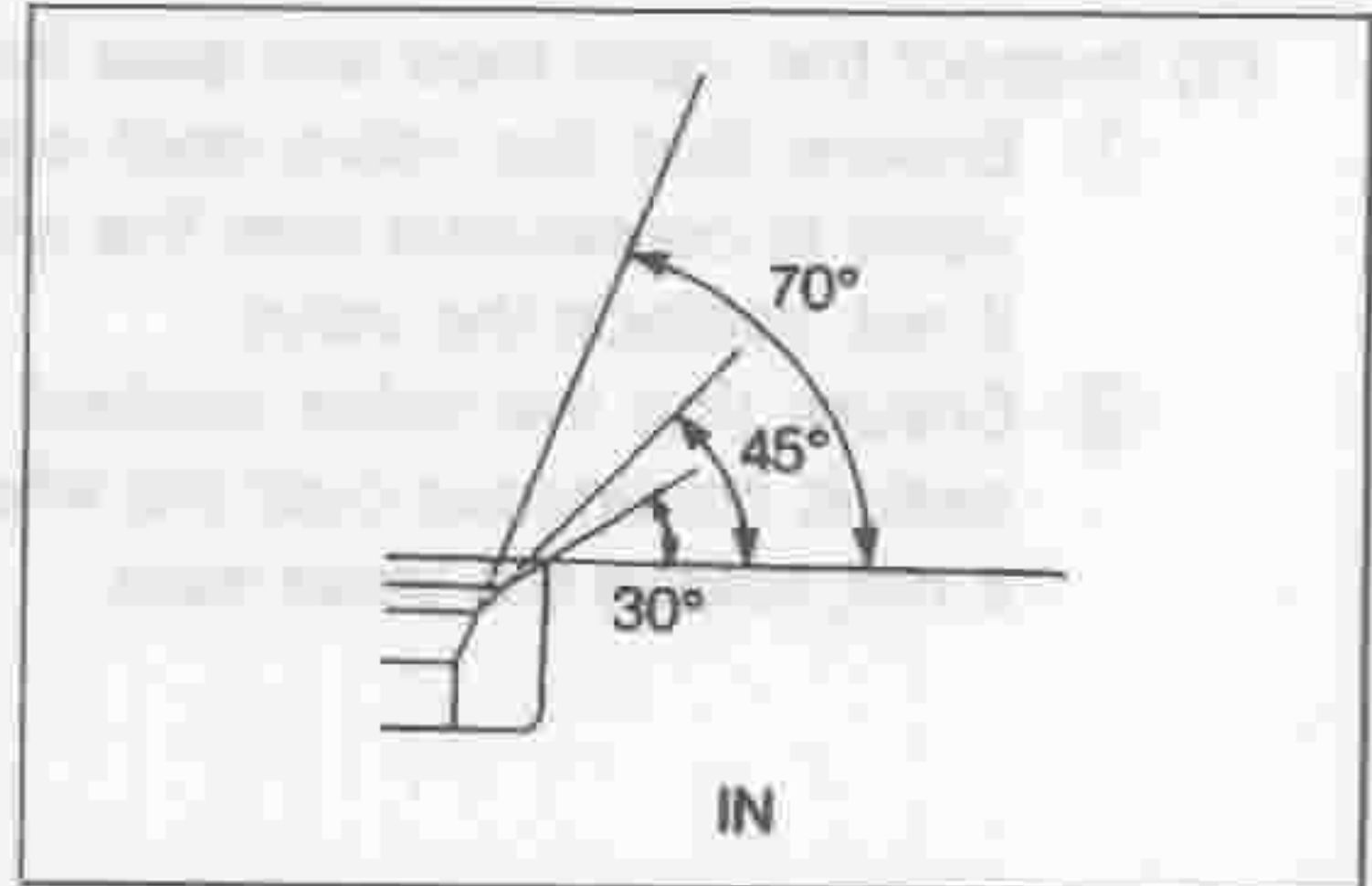
(mm)

ED-10, ED-20 Engine	$27.0 \pm 0.1$
EF-EL Engine	$20.5 \pm 0.1$

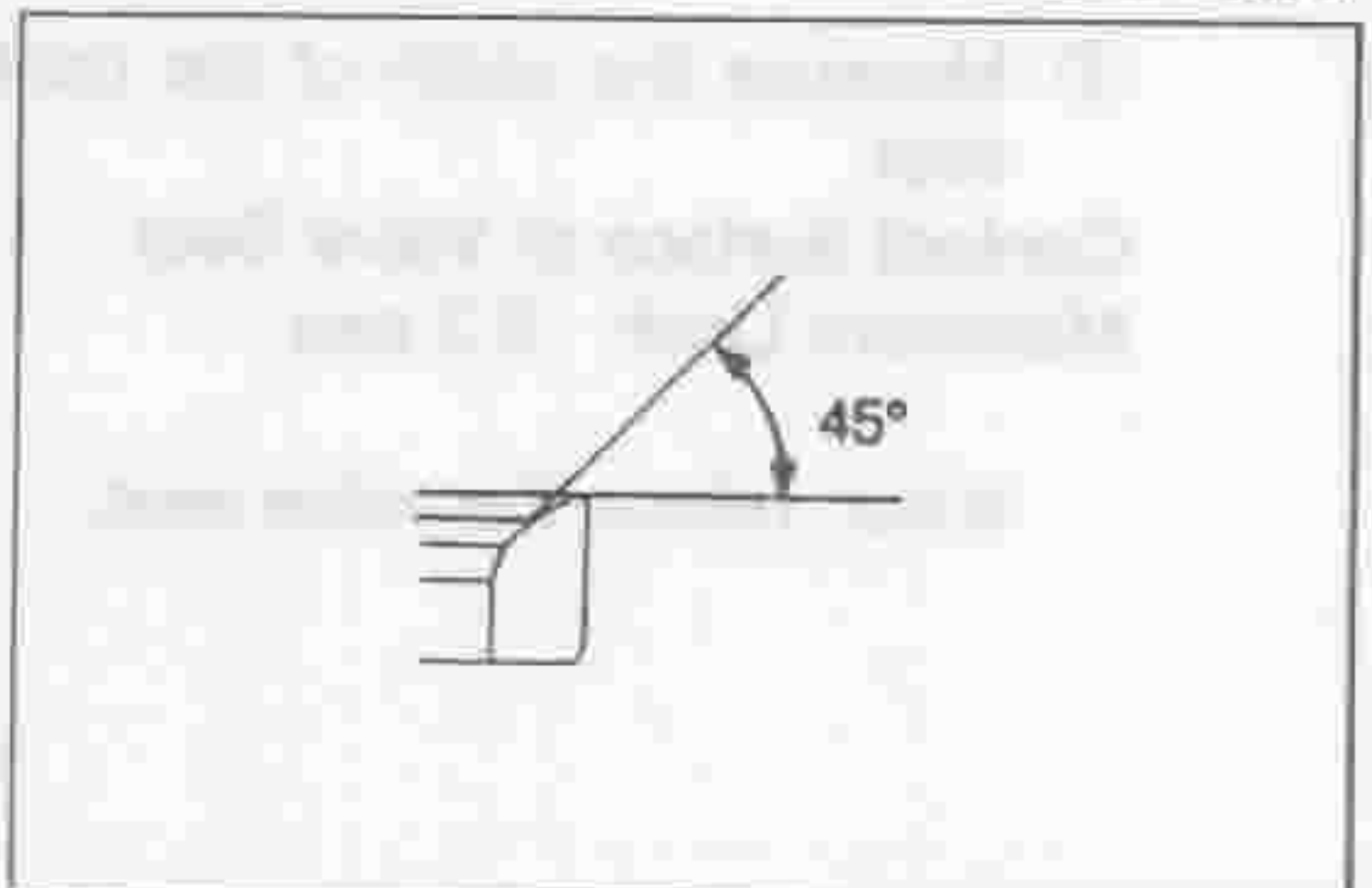
- ③ Using a 70-degree cutter, cut the valve seat in such a way that the width of the surface refaced by the 45-degree cutter may become 1.4 mm.



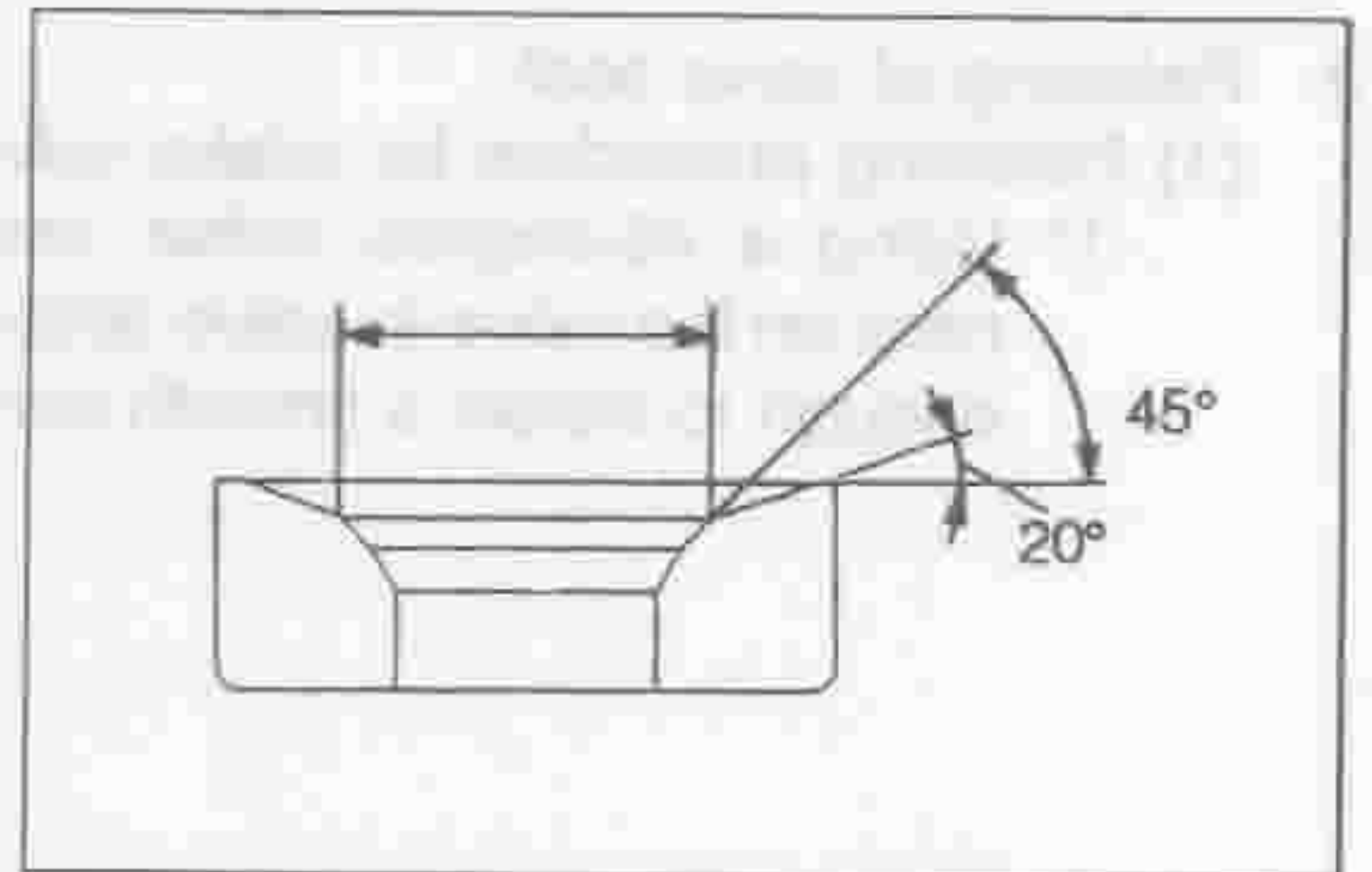
LEM00142-00126



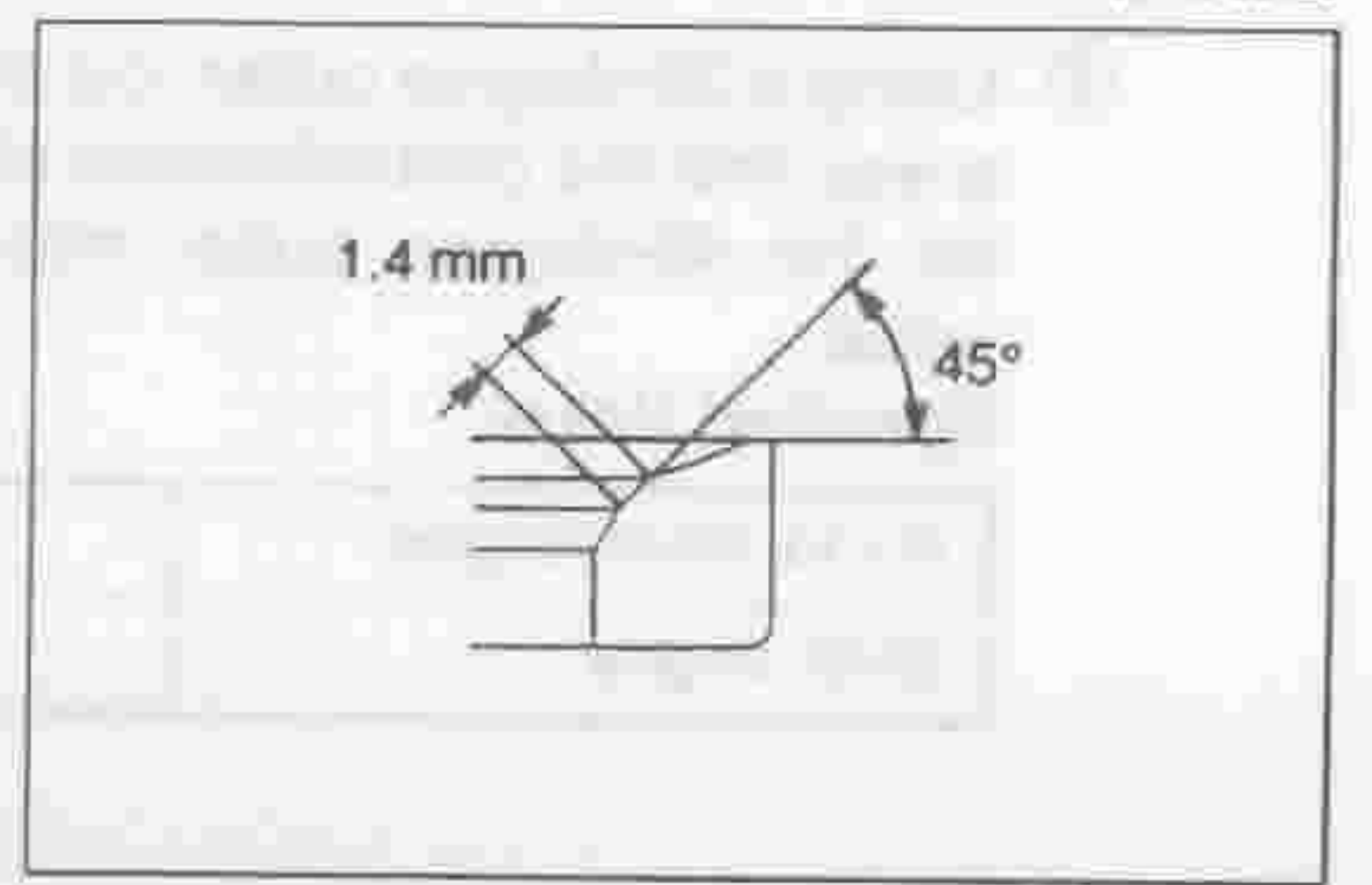
LEM00143-00127



LEM00144-00128

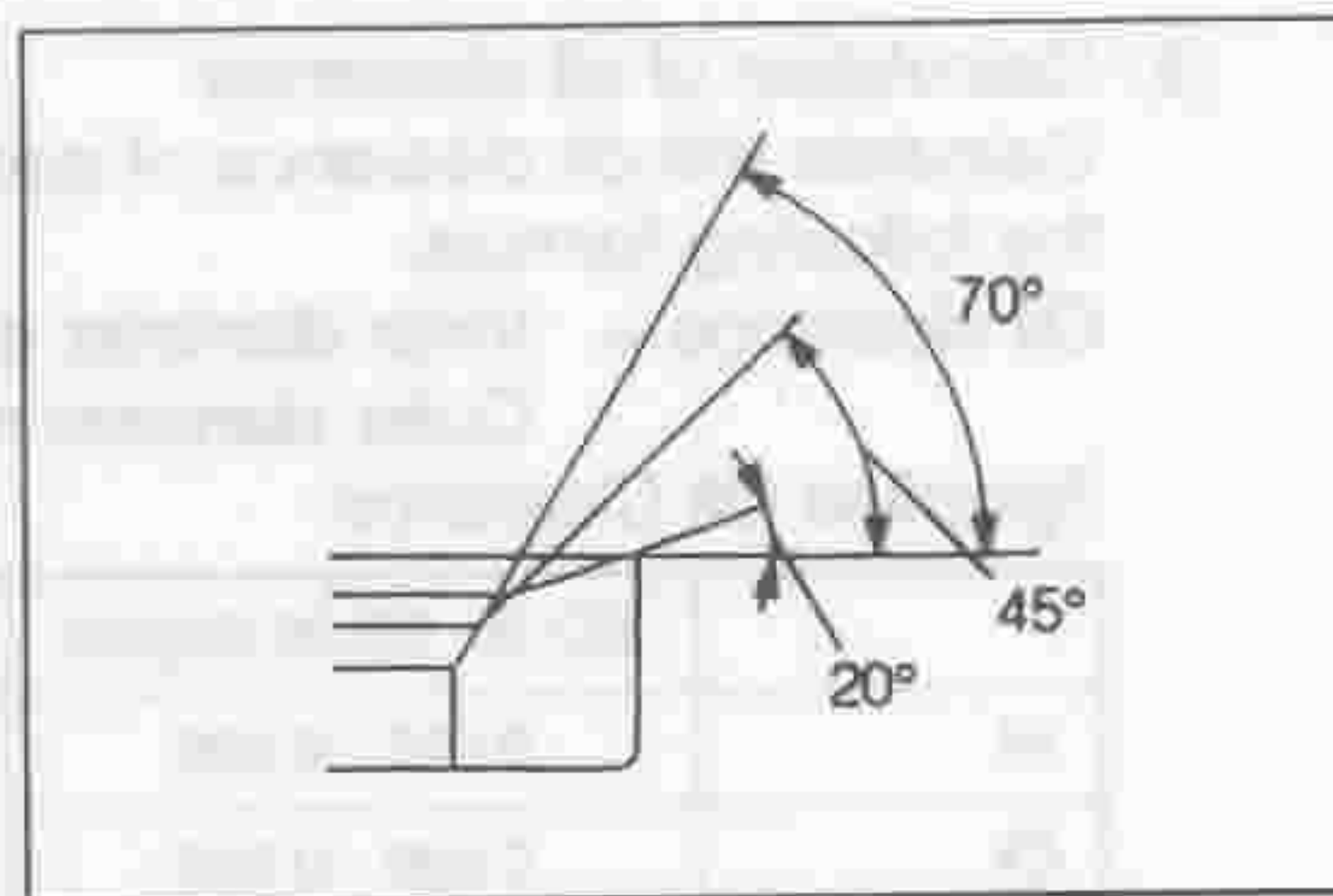


LEM00145-00129



LEM00146-00130

- ④ Using the 45-degree cutter, remove burrs produced during the refacing by the 20-degree and 70-degree cutters



LEM00147-00131

### 13. Hand lapping of valves

- (1) Perform hand lapping of the valves and valve seats, using an abrasive compound.
- (2) Clean the valves and valve seats after the hand lapping of the valves.



LEM00148-00000

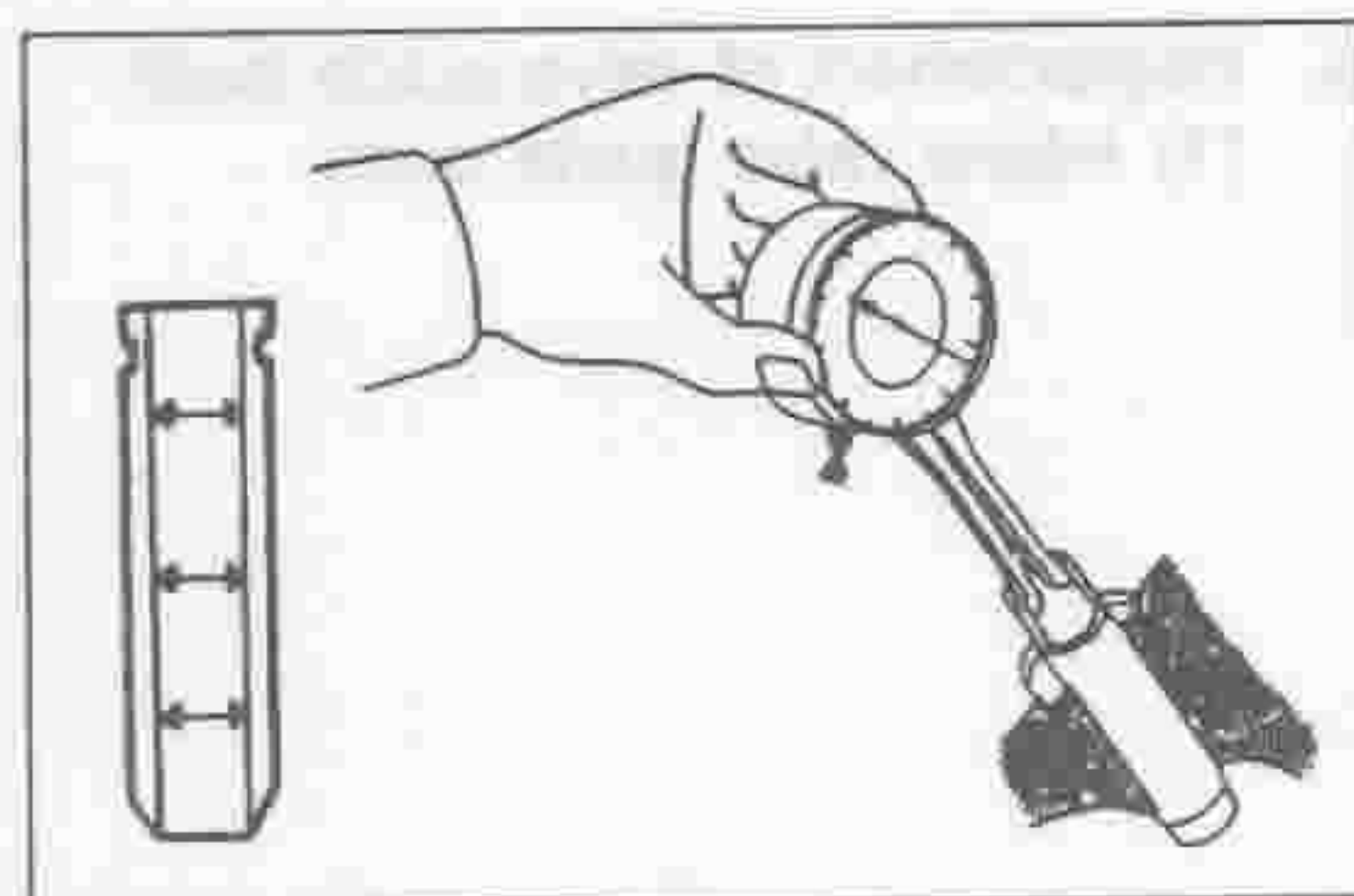
### 14. Inspection of valve stem-to-guide bushing oil clearance

- (1) Using a caliper gauge, measure the inner diameter of the valve guide at six points. Record the measured values.

[Reference]

(mm)

	ED-10, ED-20 Engine	EF-EL Engine
IN	7.000 - 7.020	5.500 - 5.520
EX	7.000 - 7.020	5.500 - 5.520



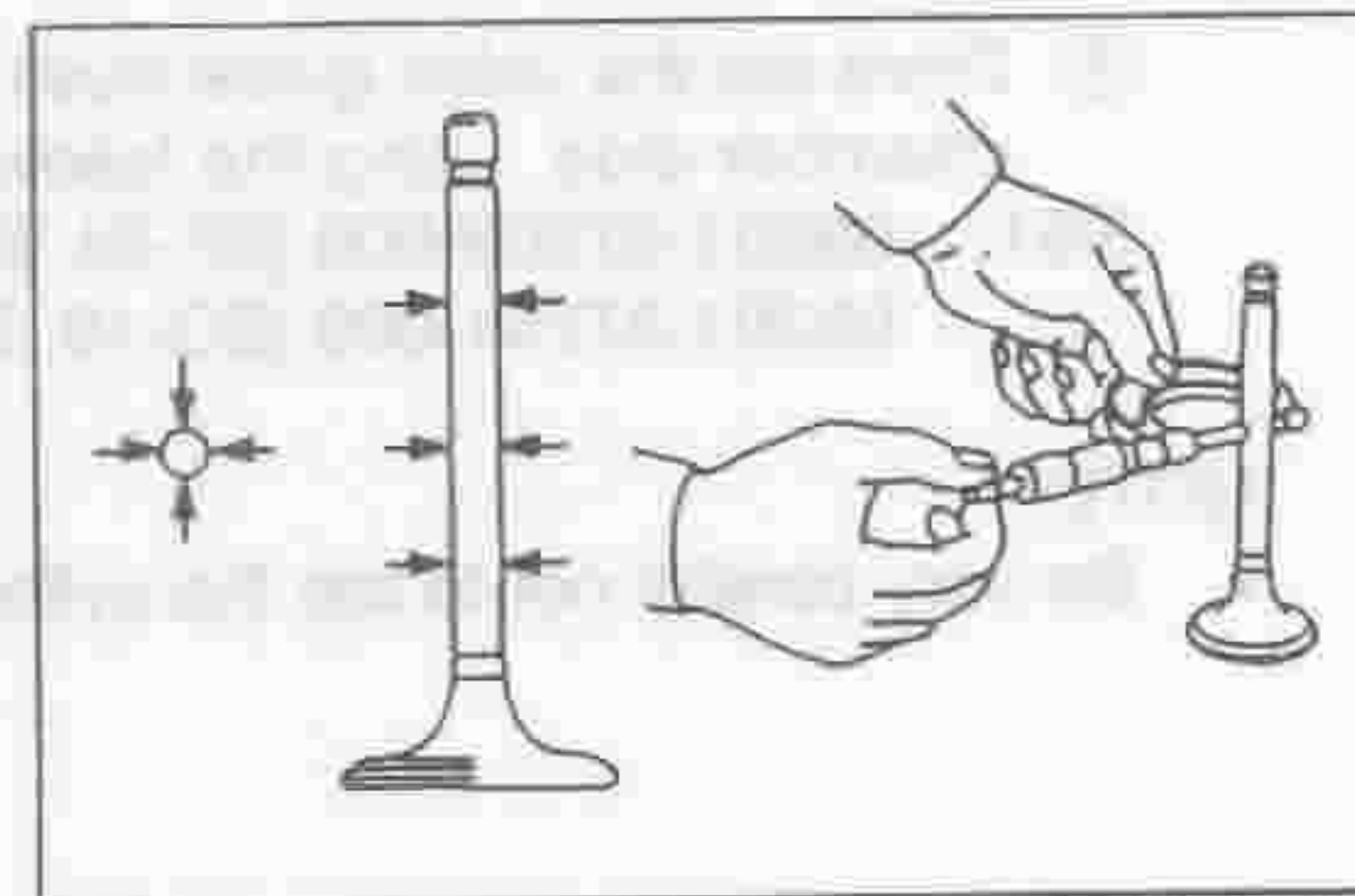
LEM00149-00132

- (2) Using a micrometer, measure the diameter of the valve stem at six points. Record the measured values.

[Reference]

(mm)

	ED-10, ED-20 Engine	EF-EL Engine
IN	6.960 - 6.975	5.468 - 5.483
EX	6.955 - 6.970	5.455 - 5.470



LEM00150-00133

(3) Calculation of oil clearance

Calculate the oil clearance of each valve according to the following formula.

$$\text{Oil clearance} = \text{Inner diameter of valve stem guide} - \text{Outer diameter of valve stem}$$

Specified Oil Clearance: (mm)

	ED-10, ED-20 Engine	EF-EL Engine
IN	0.025 - 0.060	0.017 - 0.052
EX	0.030 - 0.065	0.030 - 0.065

Allowable Limit: (mm)

	ED-10, ED-20 Engine	EF-EL Engine
IN	0.105	0.08
EX	0.110	0.08

If the calculated oil clearance exceeds the allowable limit, replace the valve guide bush and valve as a set.

15. Replacement of valve guide bush  
(1) Intake valve guide bush



① Drive out the valve guide bush from the combustion chamber side, using the following SST.

SST: 09201-87203-000 [EF-EL Engine]  
09201-87201-000 [ED-10, ED-20 Engine]

NOTE:

- Be very careful not to tap the cylinder head.

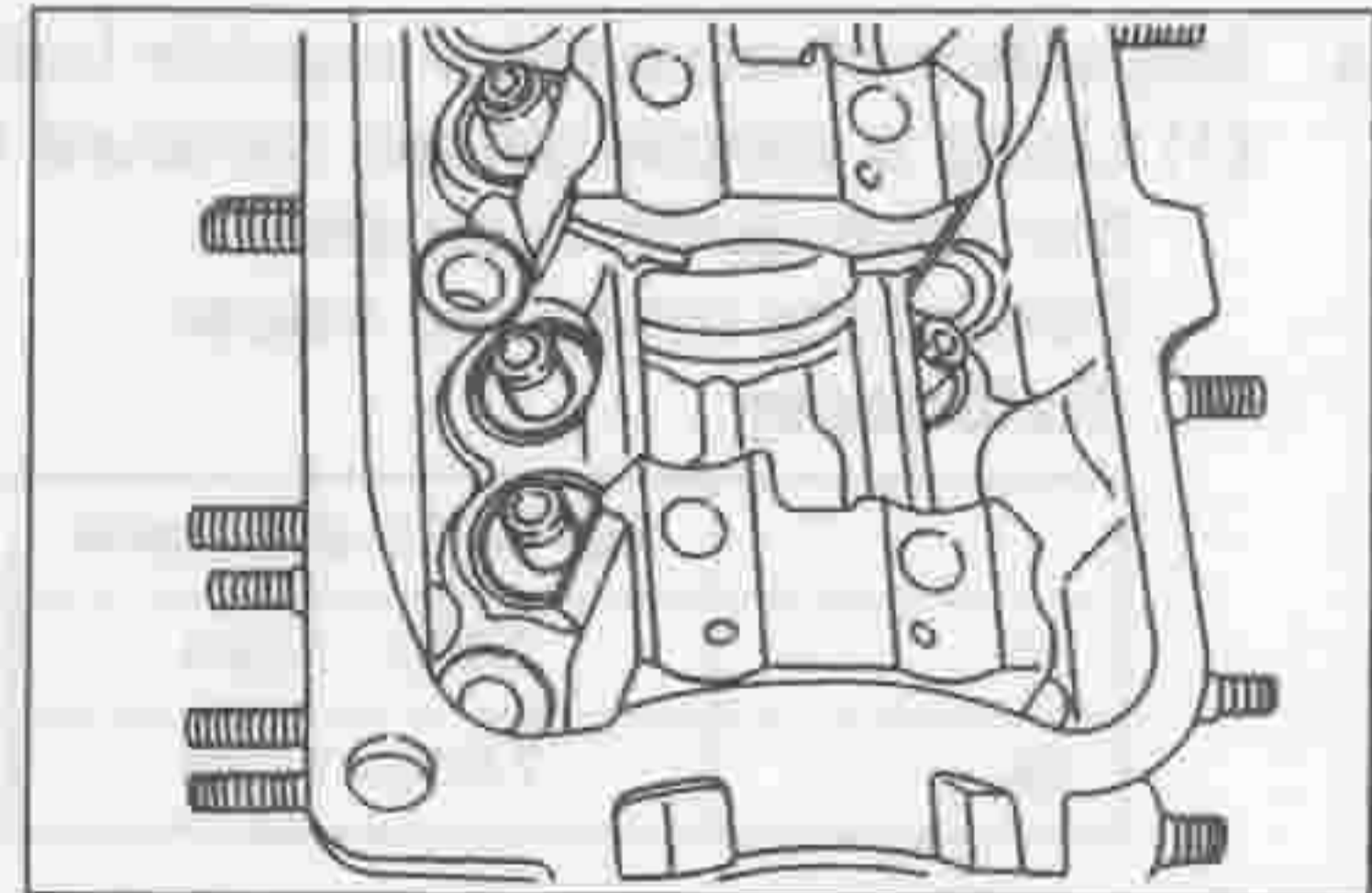
② Drive a new valve guide bush into position, until the snap ring contacts the cylinder head, using the following SST.

SST: 09201-87203-000 [EF-EL Engine]  
09201-87201-000 [ED-10, ED-20 Engine]

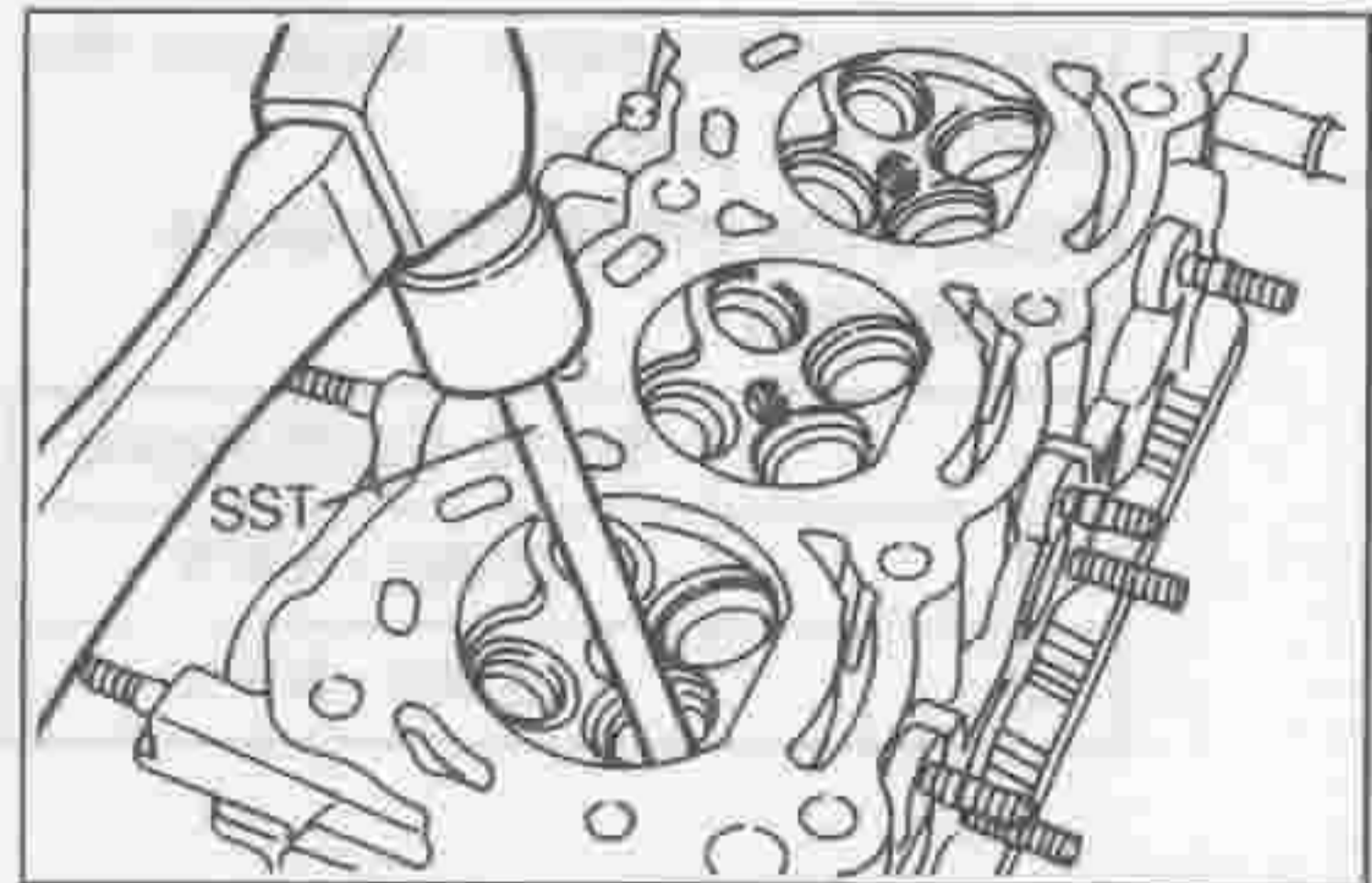
CAUTION:

- Be very careful not to give an excessive impact during the installation. Failure to observe this caution will result in valve guide bush cracks.
- Care should be exercised not to detach the snap ring due to driving the valve guide bush excessively.

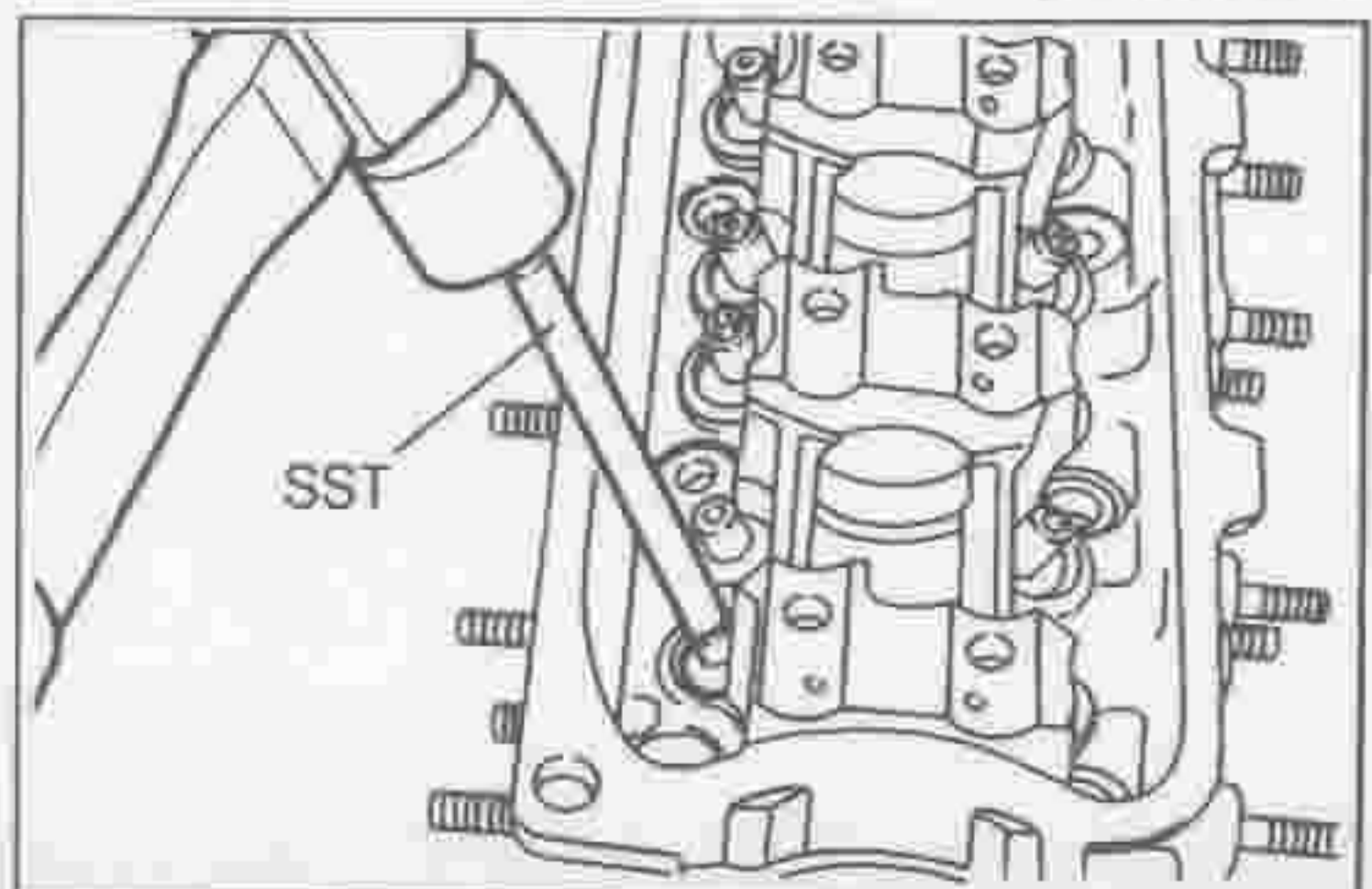
LEM00151-00000



LEM00152-00134



LEM00153-00135



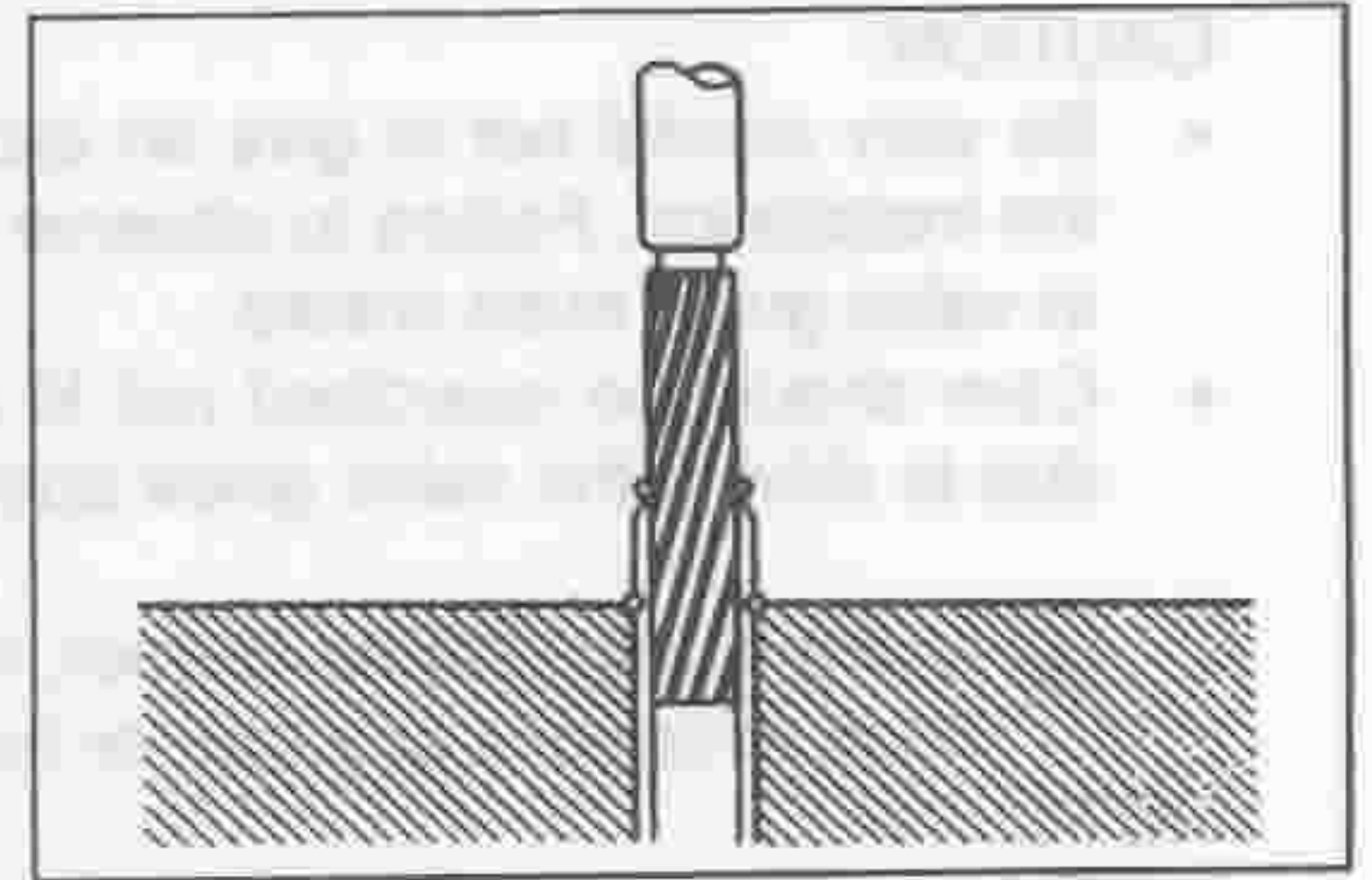
LEM00154-00136



- ③ Using an adjustable reamer, ream the valve guide bush to remove any burr or the like.

**NOTE:**

- This reaming should be made only enough to remove the burr or the like.



LEM00155-00137

- ④ Check of oil clearance  
Ensure that the oil clearance meets the specifications.

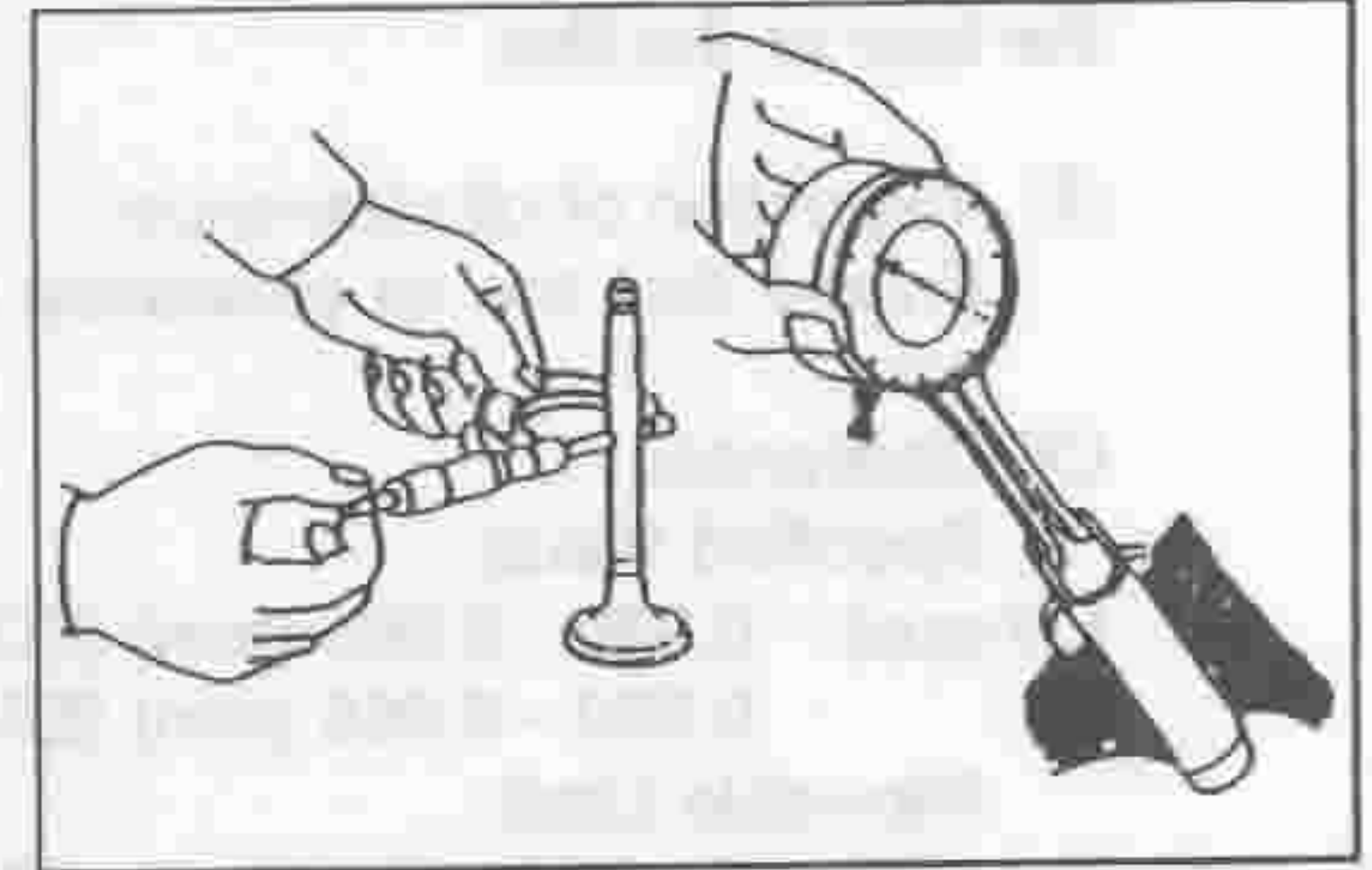
Oil Clearance:

Specified Value:

Intake: 0.025 - 0.060 (mm) [ED-10, ED-20 Engine]  
0.017 - 0.052 (mm) [EF-EL Engine]

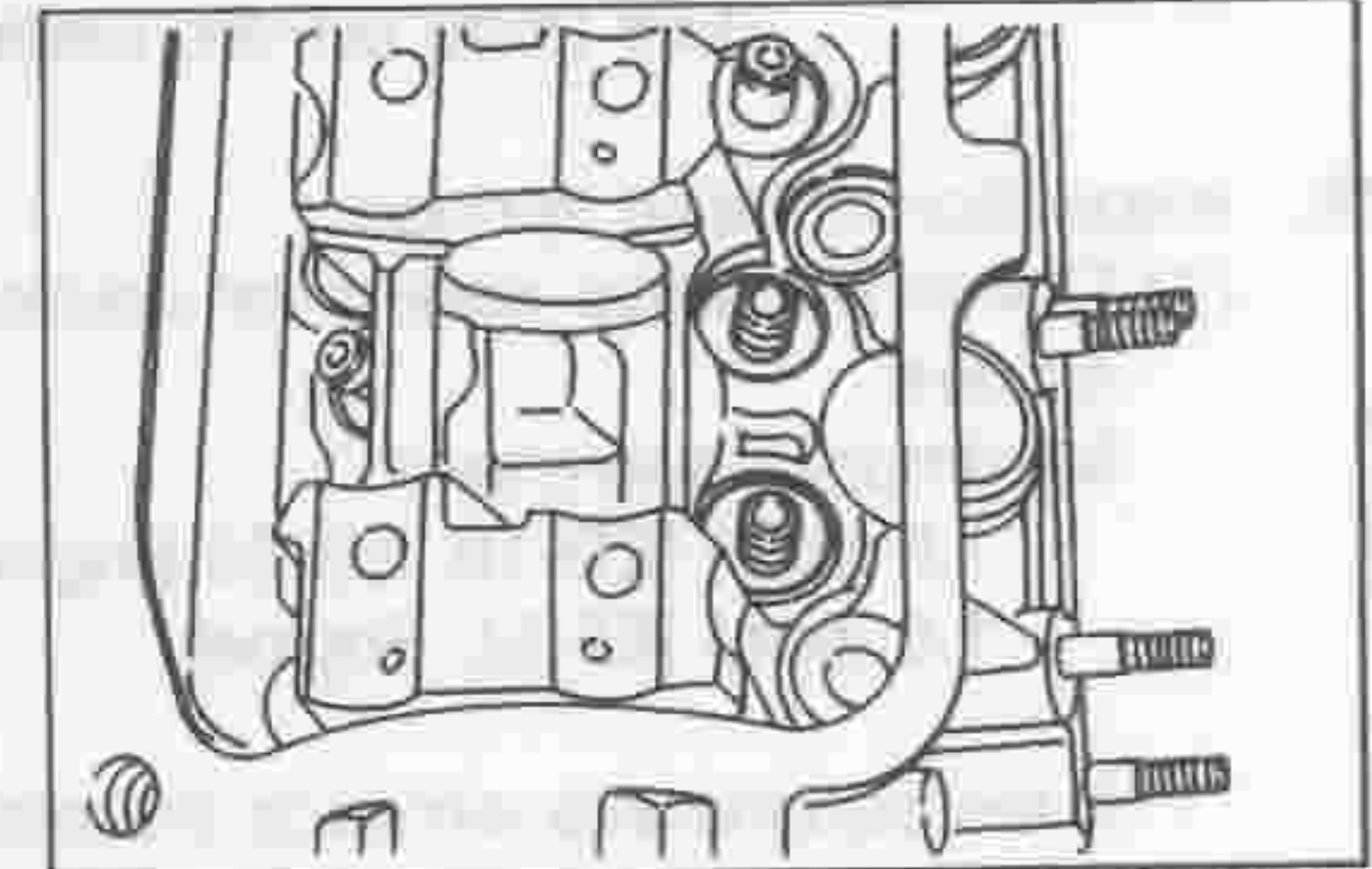
Allowable Limit:

Intake: 0.105 (mm) [ED-10, ED-20 Engine]  
0.08 (mm) [EF-EL Engine]



LEM00156-00138

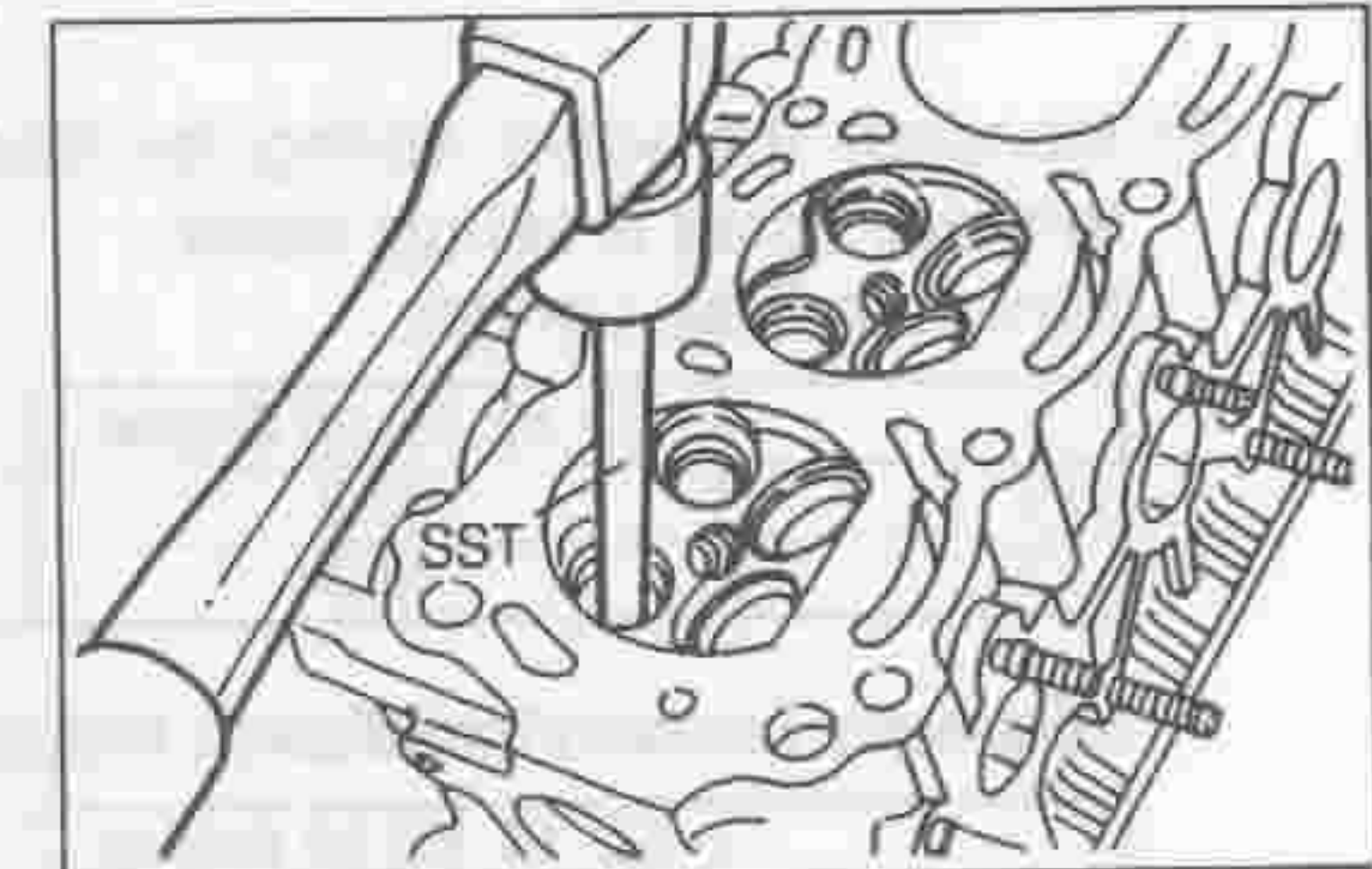
(2) Exhaust valve guide bush



LEM00157-00139

- ① Drive out the valve guide bush from the combustion chamber side, using the following SST.

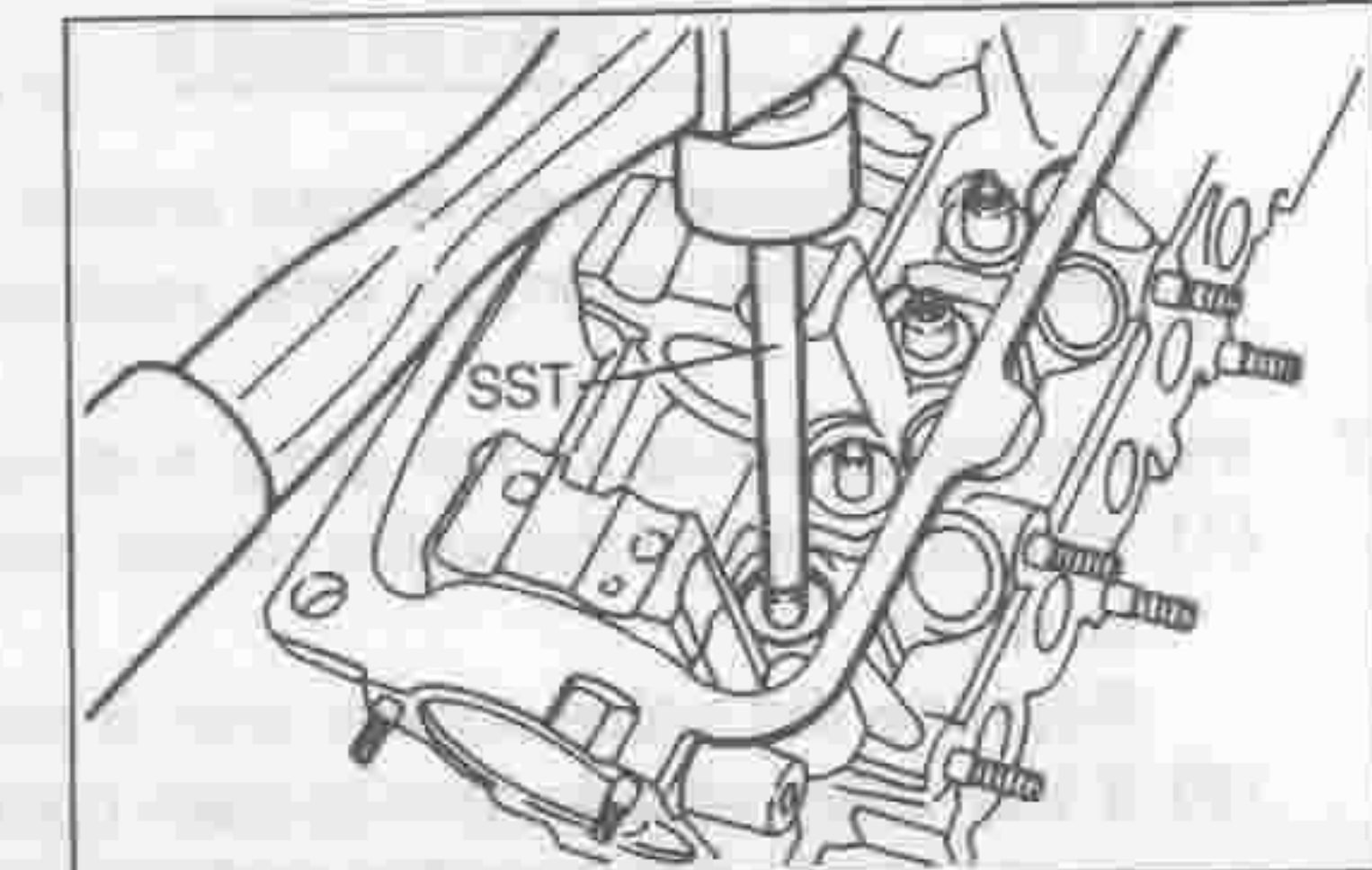
SST: 09201-87203-000 [EF-EL Engine]  
09201-87201-000 [ED-10, ED-20 Engine]



LEM00158-00140

- ② Drive a new valve guide bush into position, until the snap ring contacts the cylinder head, using the following SST.

SST: 09201-87203-000 [EF-EL Engine]  
09201-87201-000 [ED-10, ED-20 Engine]



LEM00159-00141

## CAUTION:

bush to remove any burr or the like.

## NOTE:

- This reaming should be made only enough to remove the burr or the like.

### ④ Inspection of oil clearance

Ensure that the oil clearance meets the specifications.

Oil Clearance:

Specified Value:

Exhaust: 0.030 - 0.065 (mm) [ED-10, ED-20 Engine]

0.030 - 0.065 (mm) [EF-EL Engine]

Allowable Limit:

Exhaust: 0.110 (mm) [ED-10, ED-20 Engine]

0.08 (mm) [EF-EL Engine]

## 16. Inspection of valve springs

- Check the valve spring for squareness, using a steel square.

Maximum Squareness:

1.6 (mm) [ED-10, ED-20 Engine]

1.5 (mm) [EF-EL Engine]

If the squareness exceeds the maximum limit, replace the valve spring.

- Measure the valve spring for free length and spring tension, using a spring tester.

Minimum Free Length:

	ED-10, ED-20 Engine	EF-EL Engine
IN	45.9	41.5
EX	45.9	41.0

Minimum Tension/Installation Height:

	ED-10, ED-20 Engine	EF-EL Engine
IN	273.6 (27.9)/38.0	88.2 (9.0)/39.0
EX	273.6 (27.9)/38.0	147.0 (15.0)/37.0

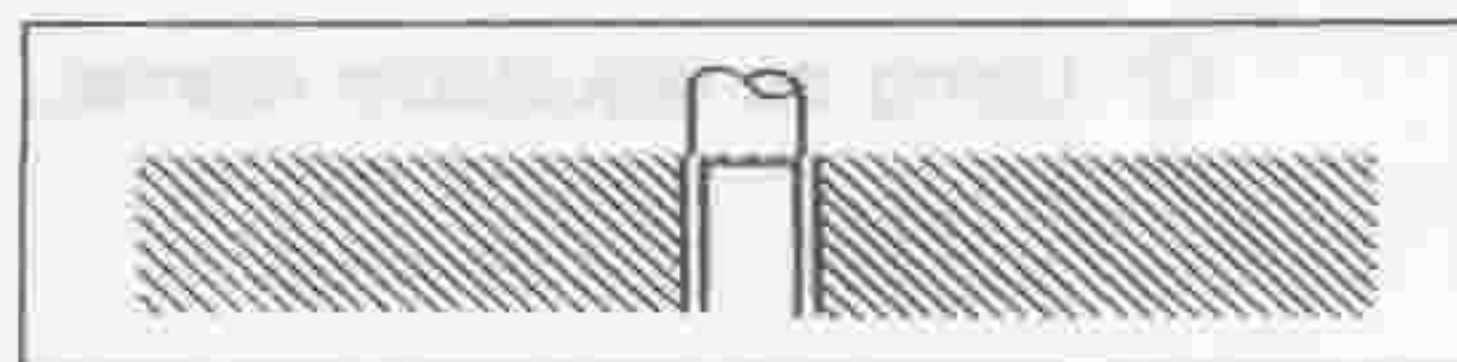
If the minimum free length and/or minimum tension is less than the minimum limit, replace the valve spring.

## 17. Inspection of valve rocker arms and valve rocker shaft

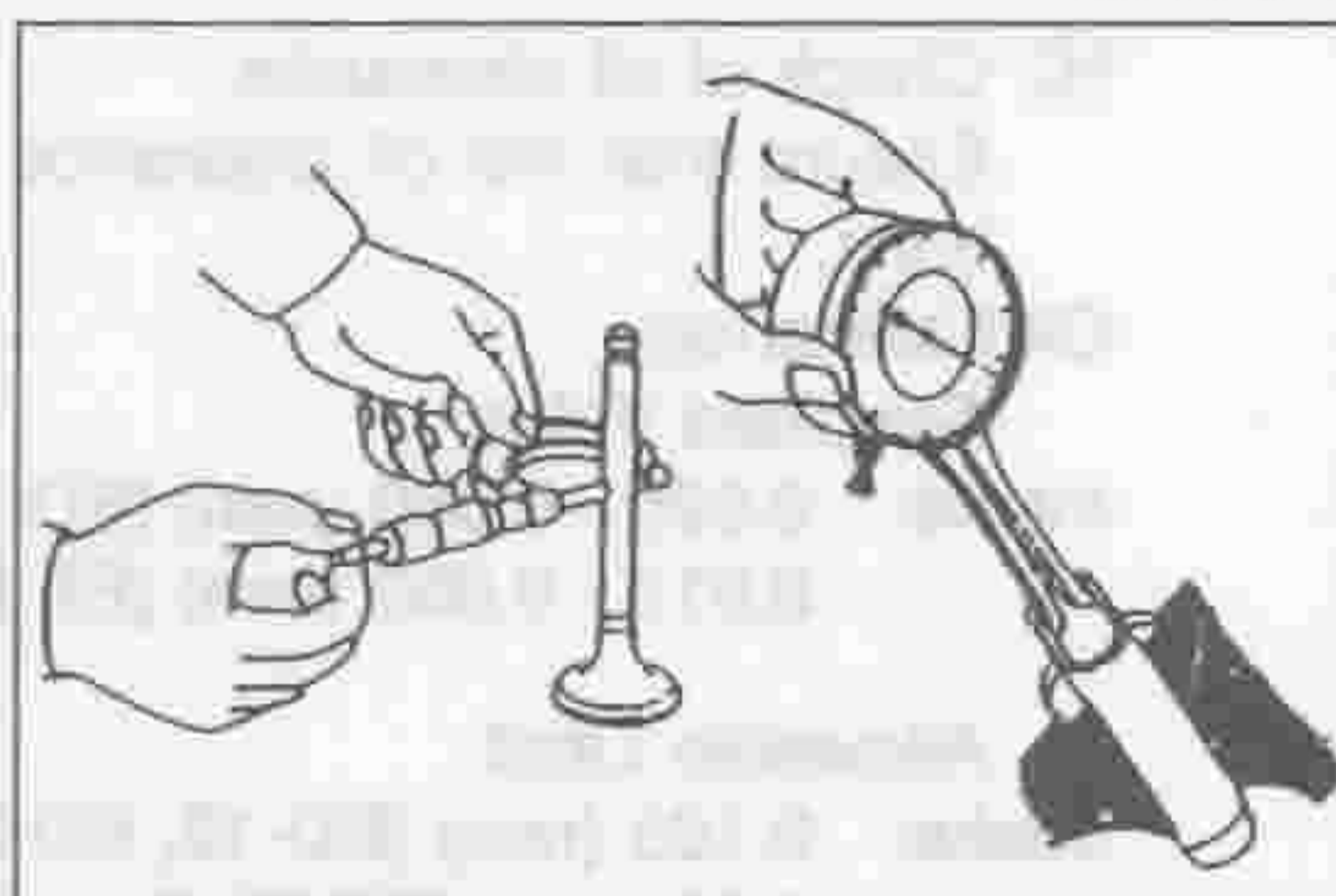
- Visually inspect the valve rocker arm for cracks, seizure or wear.

Replace the valve rocker arm, if necessary.

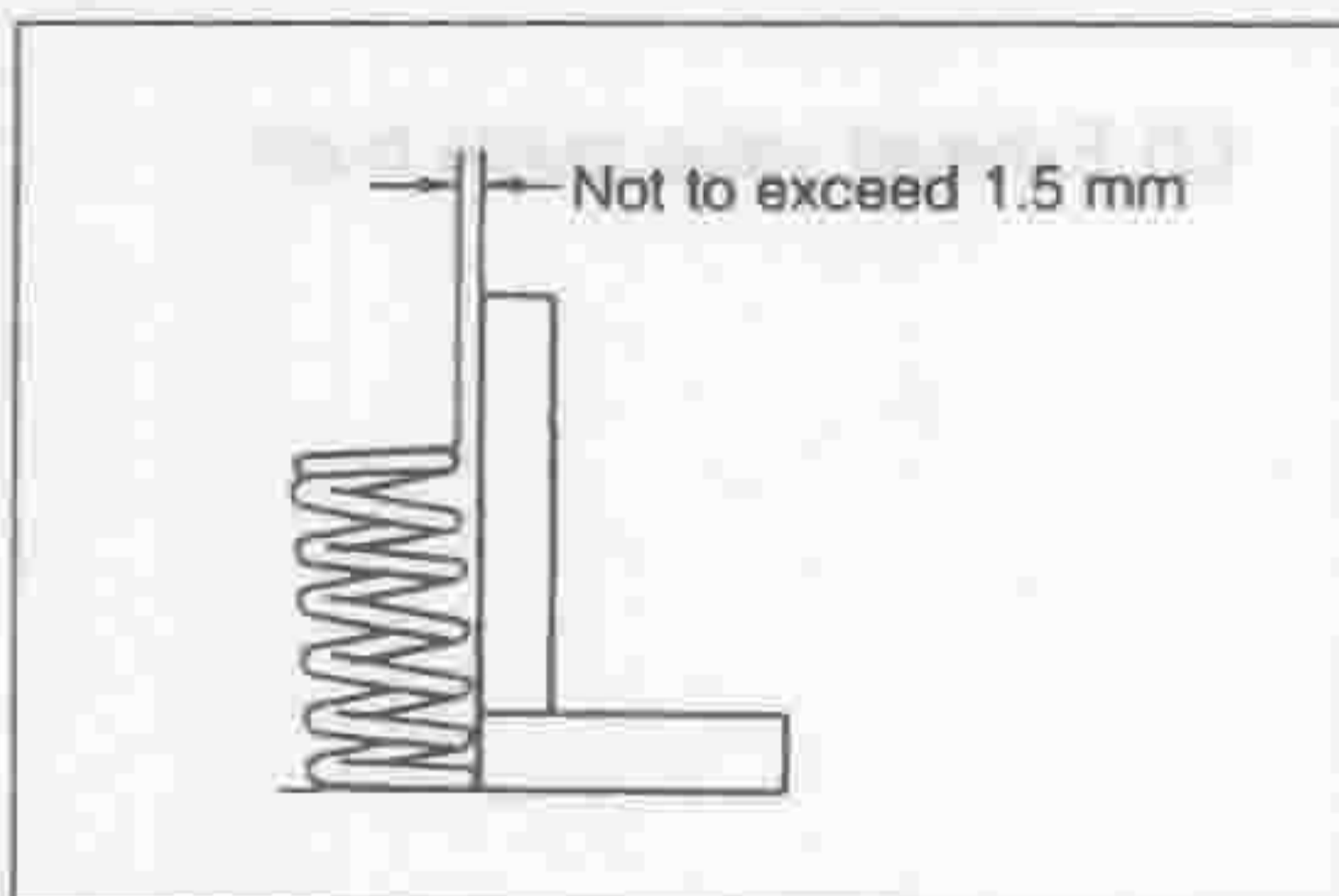
- If the valve rocker arm-to-cam contact surface is worn excessively, replace the rocker arm.



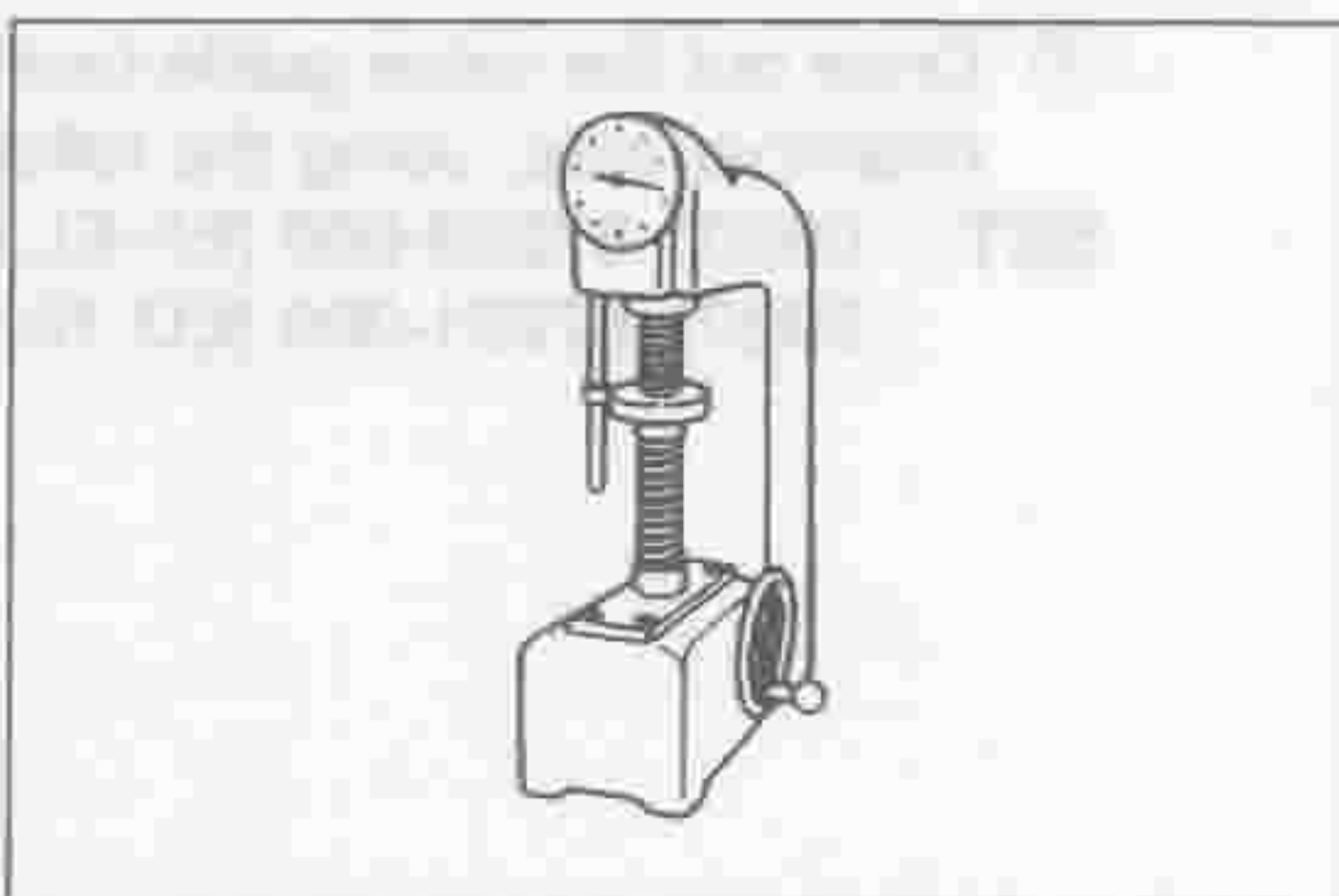
LEM00160-00142



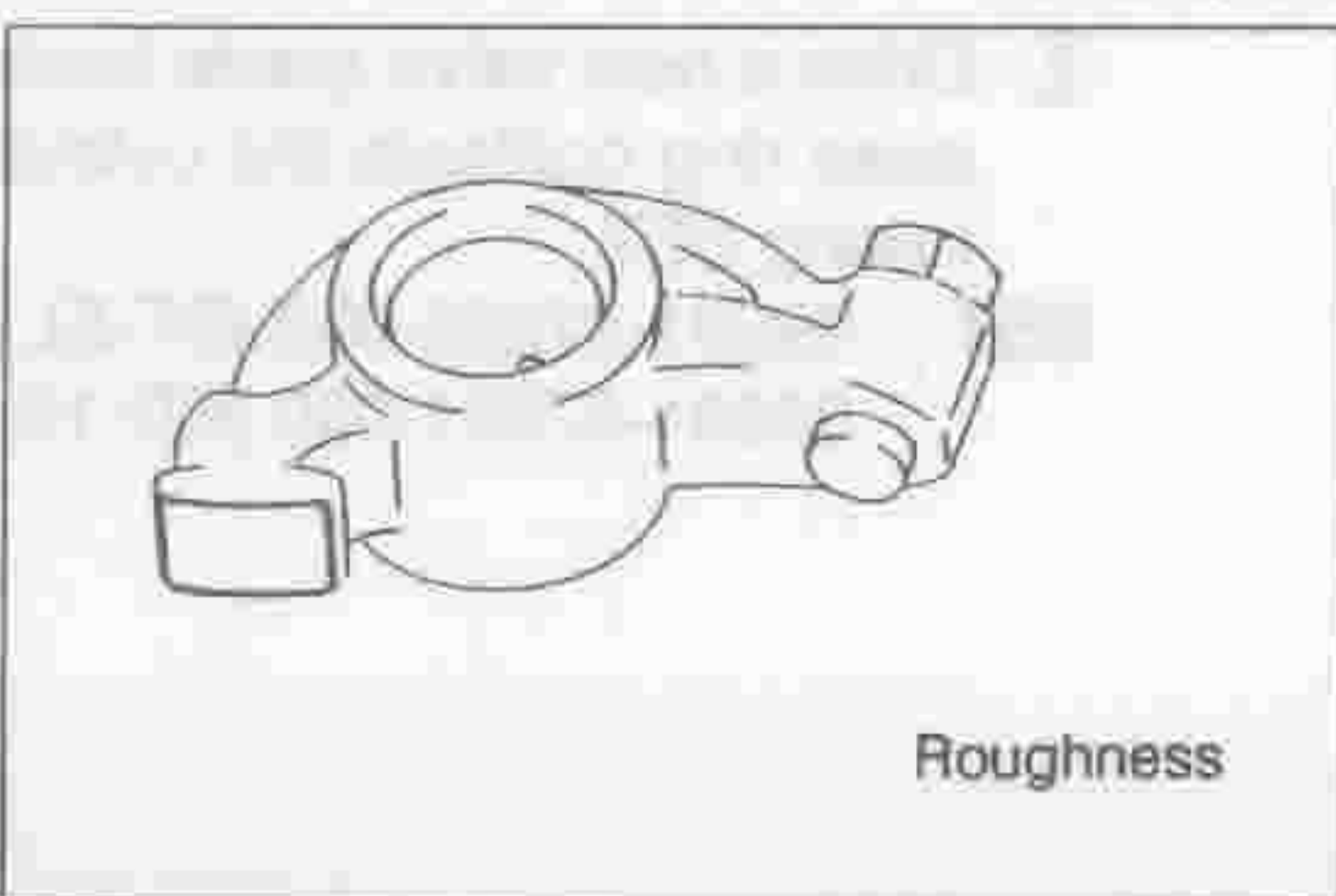
LEM00161-00143



LEM00162-00144



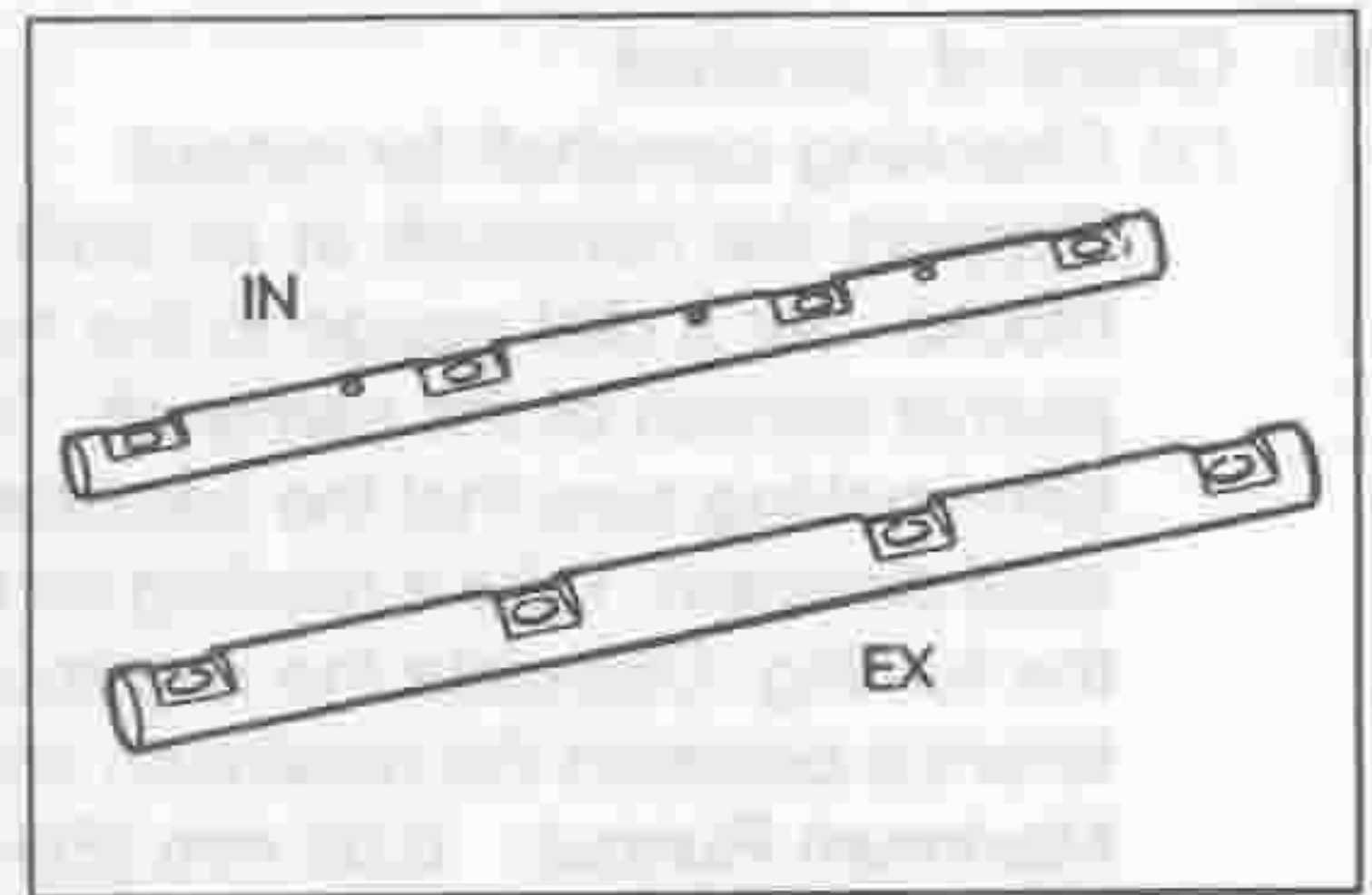
LEM00163-00145



LEM00164-00146

(3) Visually inspect the valve rocker shaft for cracks, seizure or wear.

Replace the valve rocker shaft, if necessary.



LEM00165-00147

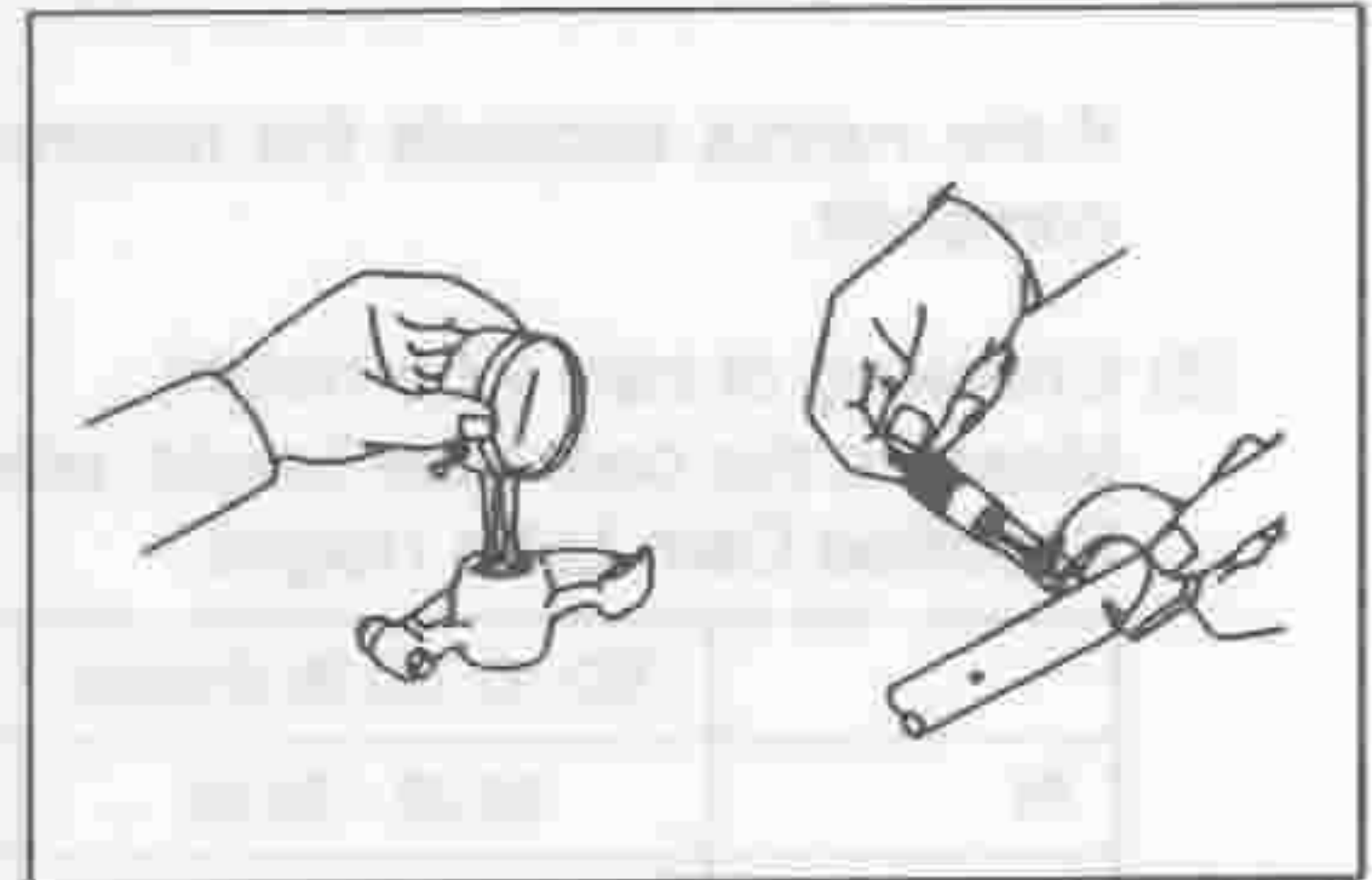
(4) Valve rocker shaft-to-valve rocker arm oil clearance

- Using a dial gauge, measure the inner diameter of the valve rocker arm in two directions, 90 degrees apart from each other.
- Using a micrometer, measure the outer diameter of the valve rocker arm attaching position of the valve rocker shaft in two directions, 90 degrees apart from each other.
- Calculate the oil clearance by subtracting the rocker shaft diameter from the rocker arm diameter.

Oil Clearance

Specified Value: 0.012 - 0.050 mm

Allowable Limit: 0.08 mm



LEM00166-00148

**NOTE:**

- The measurement of the rocker shaft outer diameter must be performed at the assembling position of each rocker shaft.

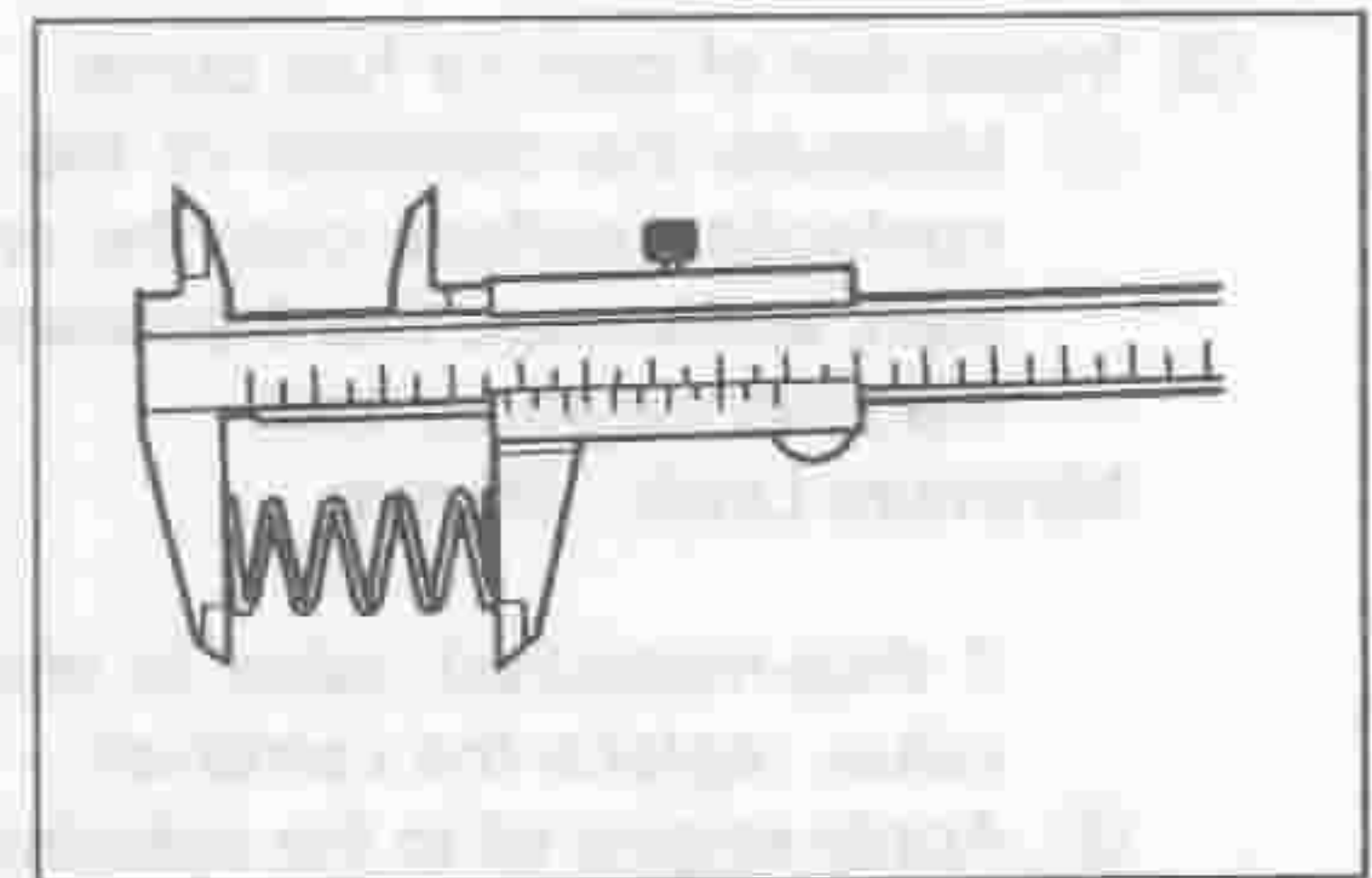
18. Inspection of valve rocker arm spring and washer

(1) Measure the free width of the spring, using vernier calipers.

Specified Free Length:

(mm)

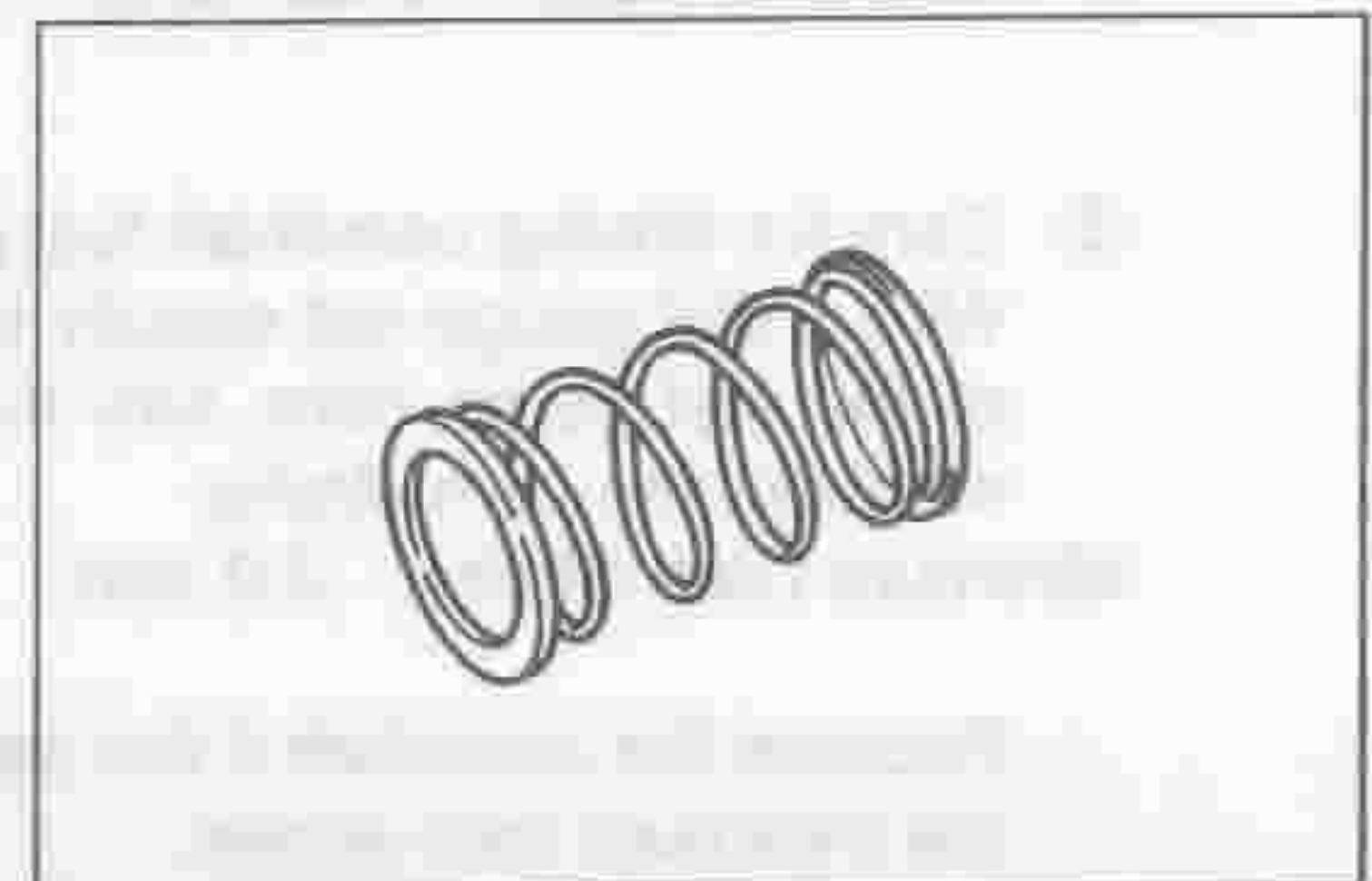
	ED-10, ED-20 Engine	EF-EL Engine
IN	33.0	24.0
EX	33.0	39.5



LEM00167-00149

(2) Visually inspect the spring and washer for damage and/or wear.

Replace the spring and/or washer, if necessary.



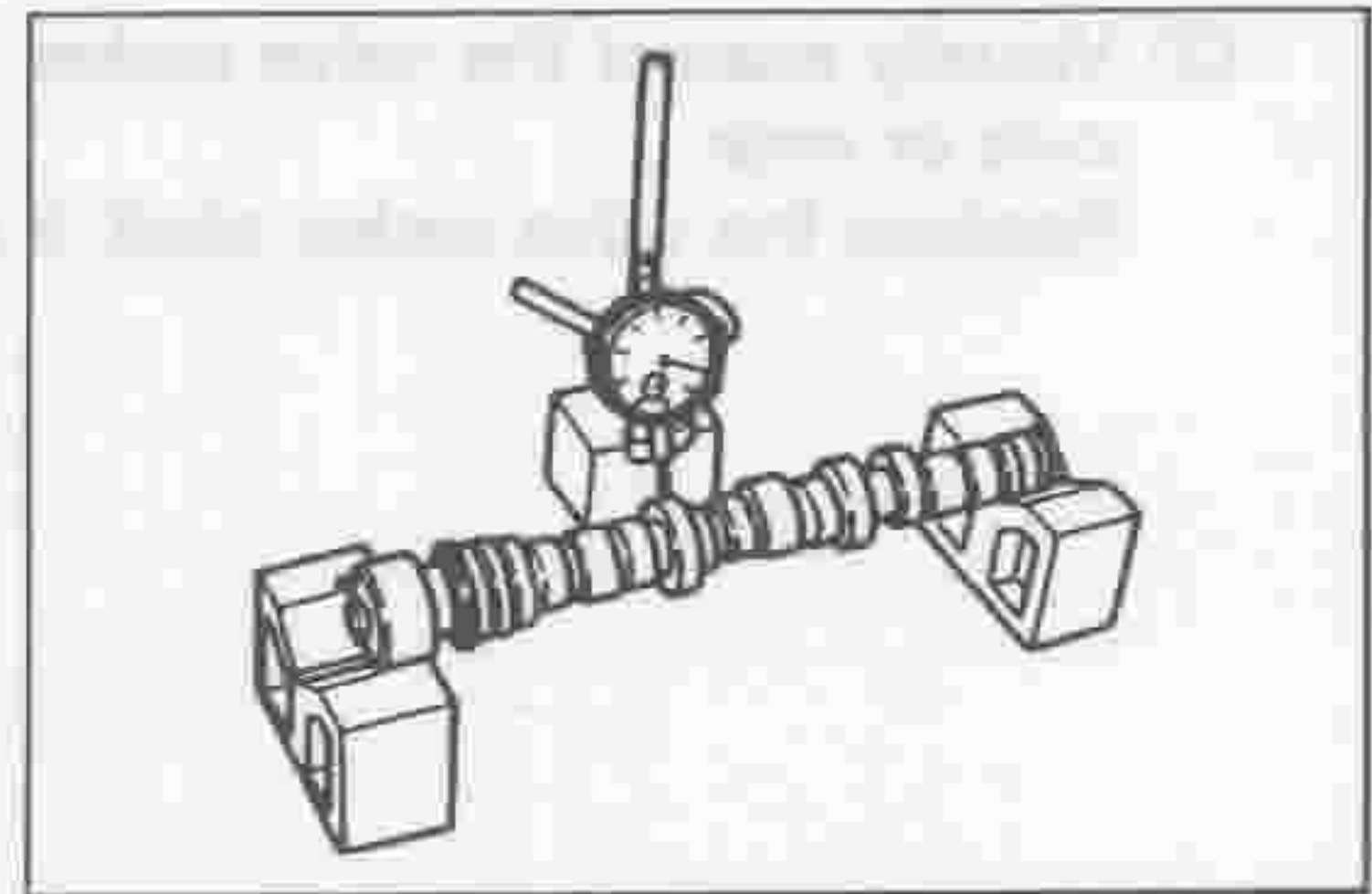
LEM00168-00150

## 19. Check of camshaft

### (1) Checking camshaft for runout

Support the camshaft at its both ends with V-shaped blocks. Set a dial gauge to the mid-point of the center journal section of the camshaft. Turn the camshaft one turn, making sure that the camshaft will not move in the axial direction. Take a reading on the dial gauge during the turning. Calculate the maximum runout, i.e. the difference between the maximum and minimum readings.

**Maximum Runout:** 0.03 mm [ED-10, ED-20 Engine]  
0.06 mm [EF-EL Engine]



LEM00169-00151

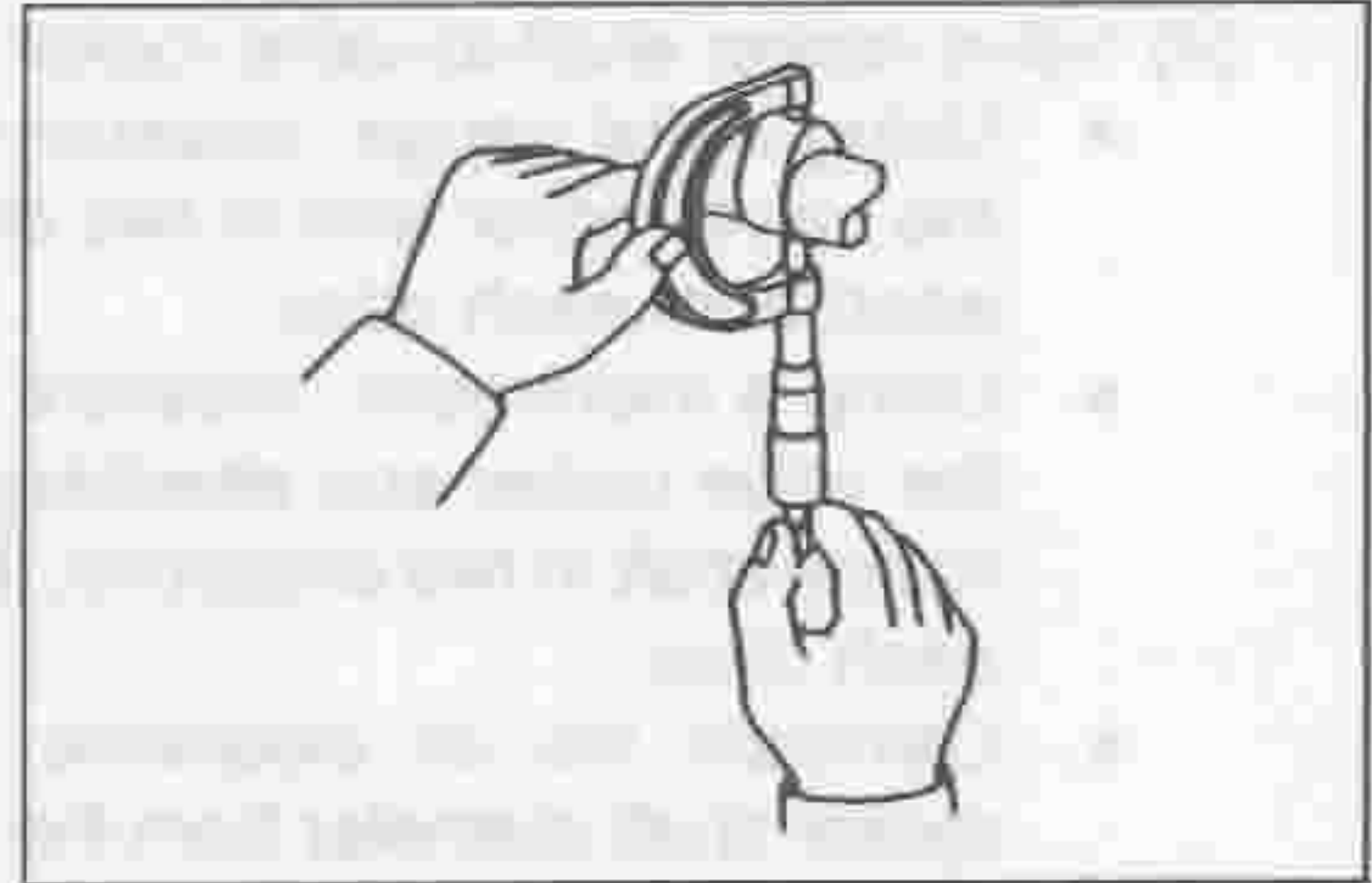
If the runout exceeds the maximum limit, replace the camshaft.

### (2) Checking of cam lobe height

Measure the cam lobe height, using a micrometer.

**Specified Cam Lobe Height:** (mm)

	ED-10, ED-20 Engine	EF-EL Engine
IN	35.32 - 35.46	33.60 - 33.74
EX	34.87 - 35.01	33.61 - 33.75



LEM00170-00152

**Minimum Limit:** (mm)

	ED-10, ED-20 Engine	EF-EL Engine
IN	35.22	33.50
EX	34.78	33.52

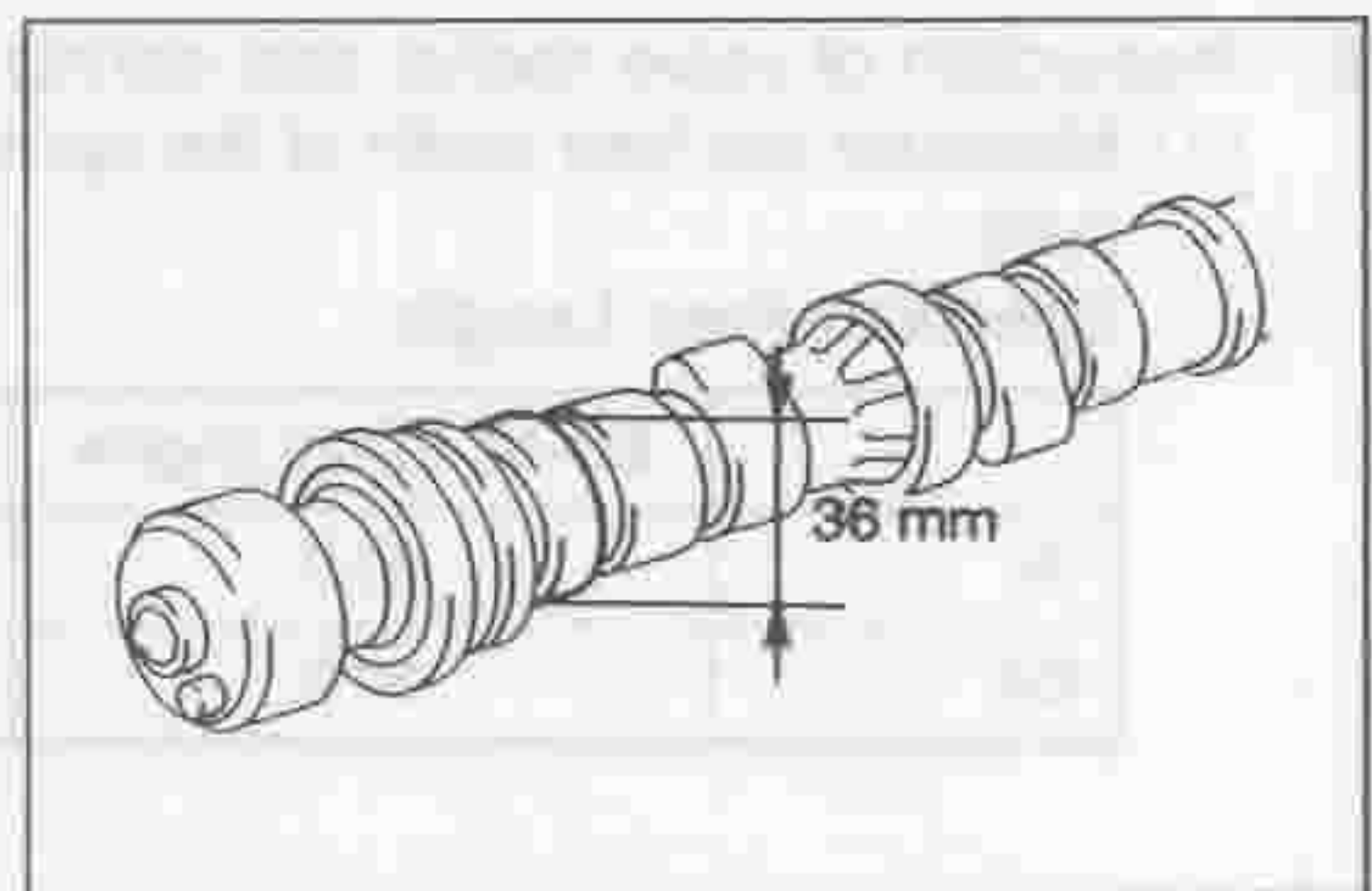
### (3) Inspection of cam for fuel pump

① Measure the diameter of the fuel pump cam rod contacting surface over the entire periphery of the cam, and ensure that the measured value is not less than the minimum limit.

**Minimum Limit:** 36 mm

If thus-measured value is less than the specified value, replace the camshaft.

② Apply engine oil to the cylinder head camshaft journals and install the camshaft.



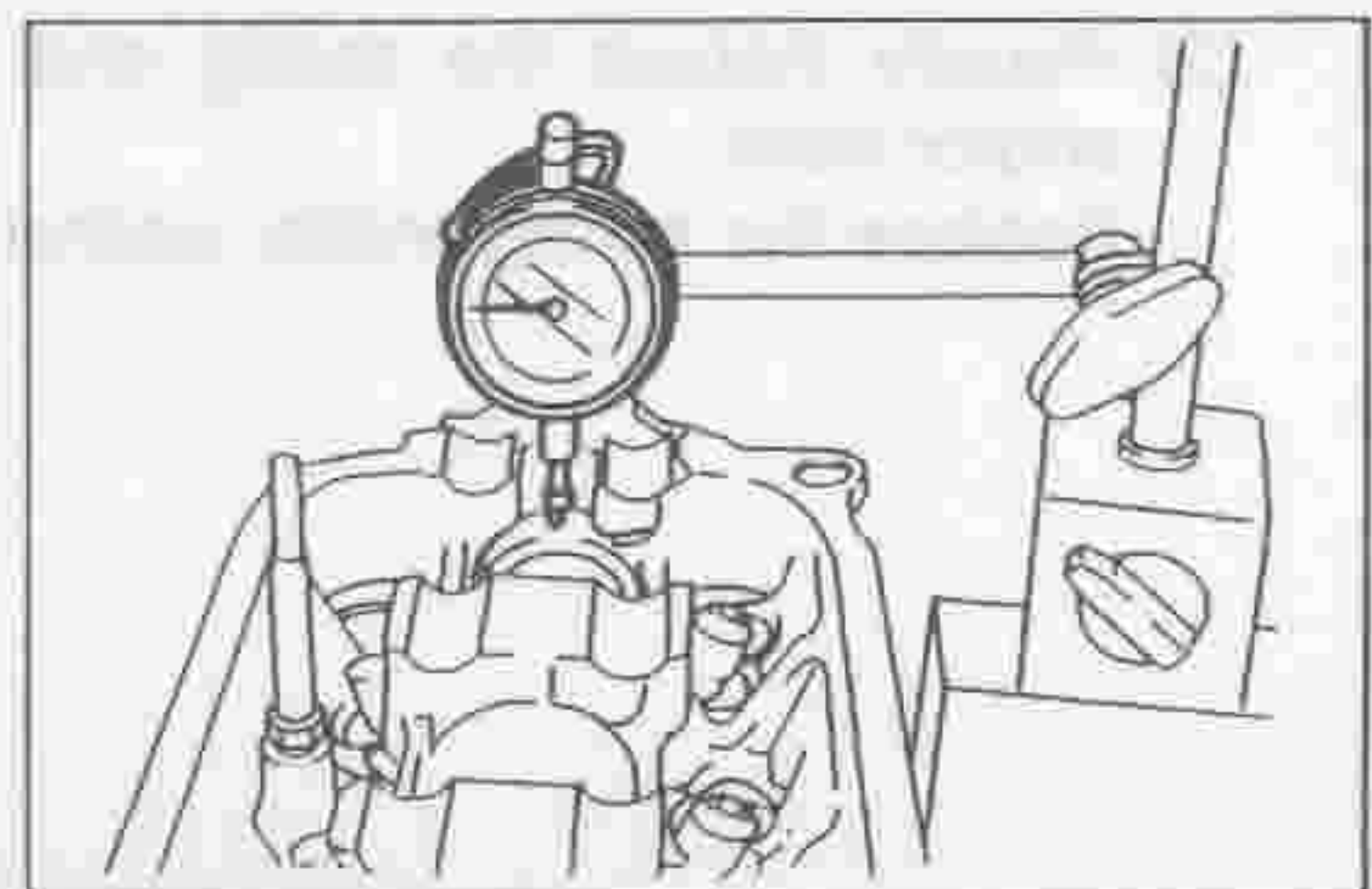
LEM00171-00153

### ③ Cam for driving camshaft fuel pump

With a dial gauge set exactly from the top direction of the fuel pump cam, turn the camshaft so as to measure the cam stroke.

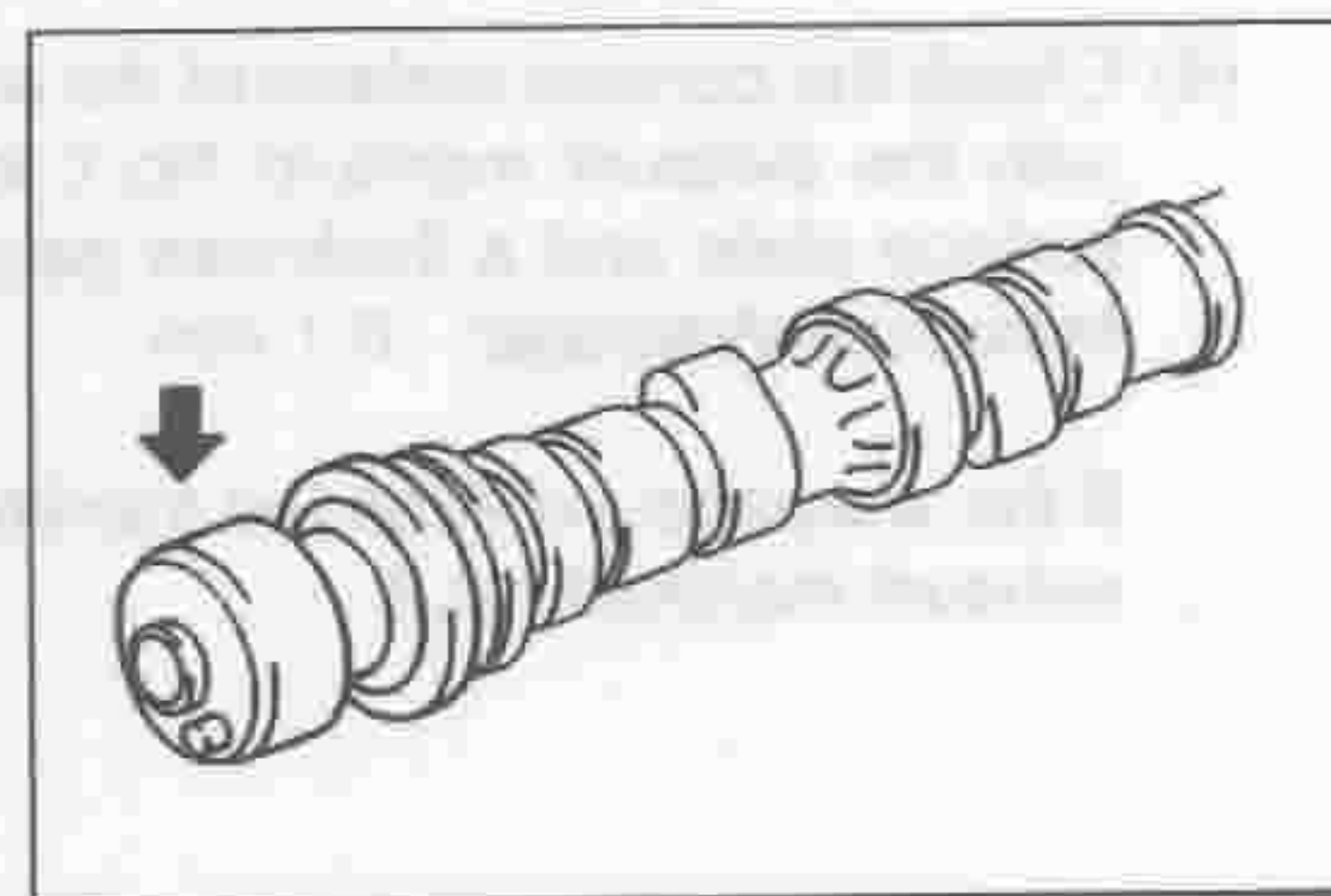
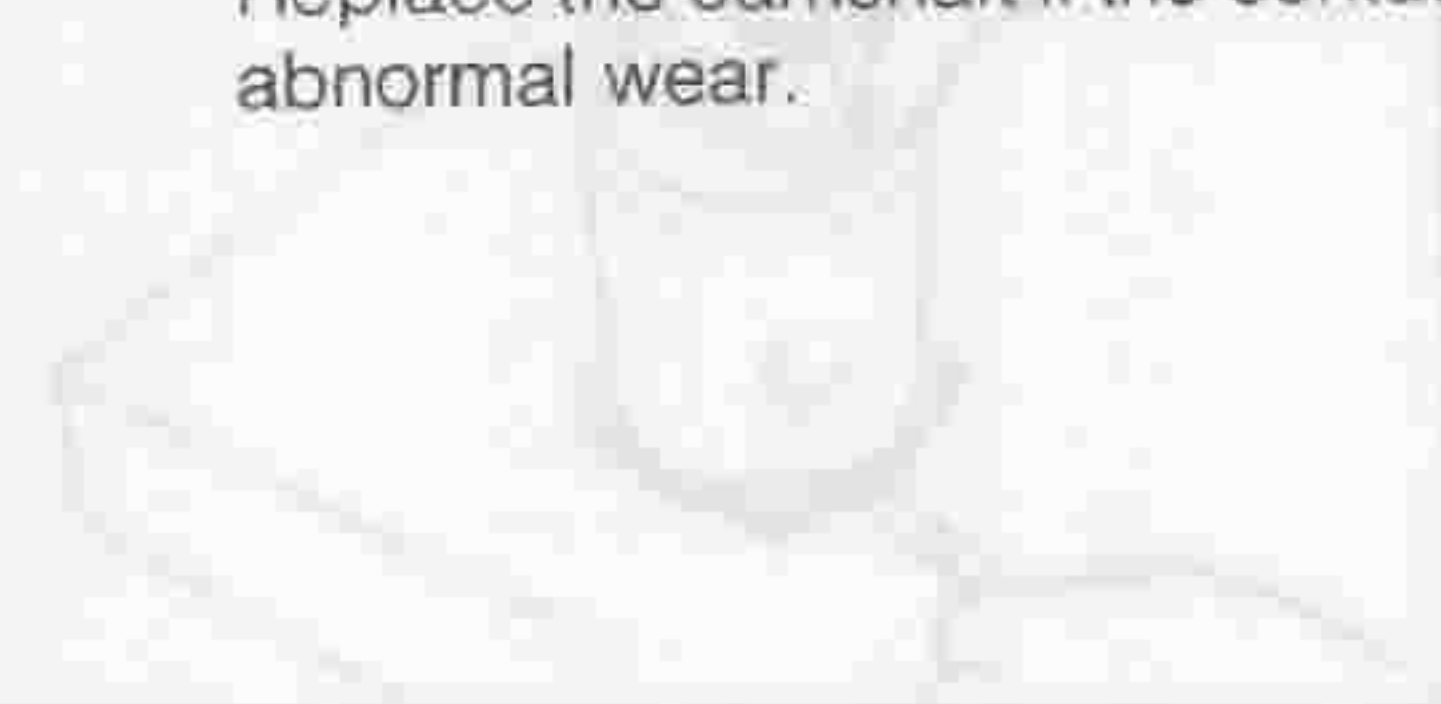
**Minimum Cam Stroke:** 3.0 mm

Replace the camshaft if the cam stroke is less than the minimum cam stroke.



LEM00172-00154

- (4) Inspection of oil seal contact surface  
Inspect the oil seal contact surface for abnormal wear.  
Replace the camshaft if the contact surface exhibits any abnormal wear.

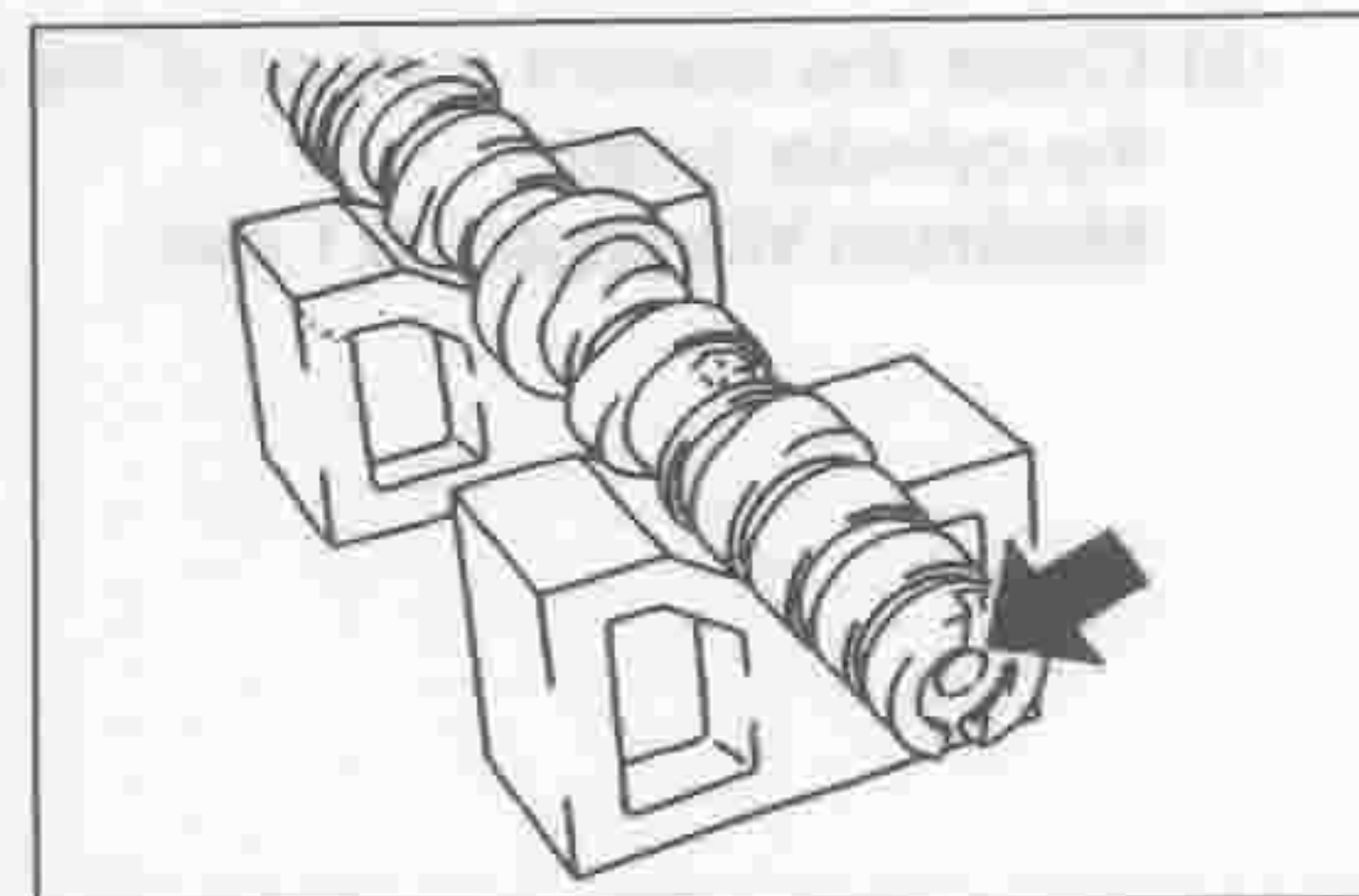
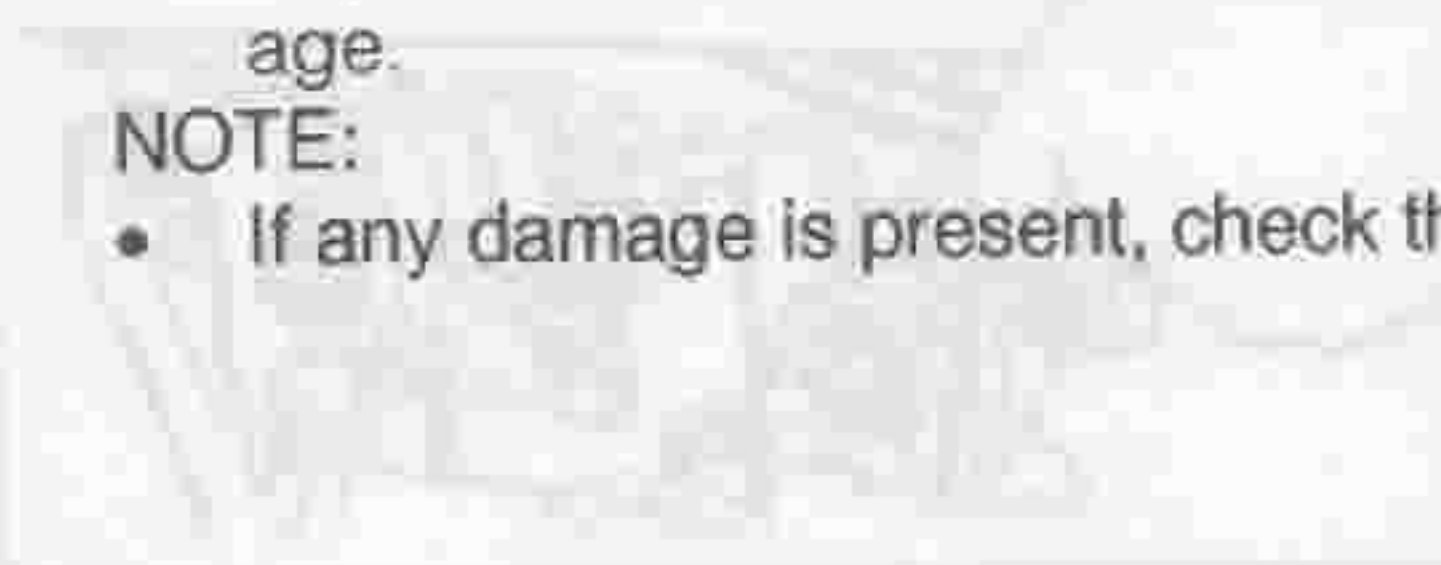


LEM00173-00155

- (5) Inspection of groove for driving distributor  
Visually inspect to see if any damage is present at the groove for driving the distributor.  
Replace the camshaft if the groove exhibits any damage.

## NOTE:

- If any damage is present, check the distributor side, too.



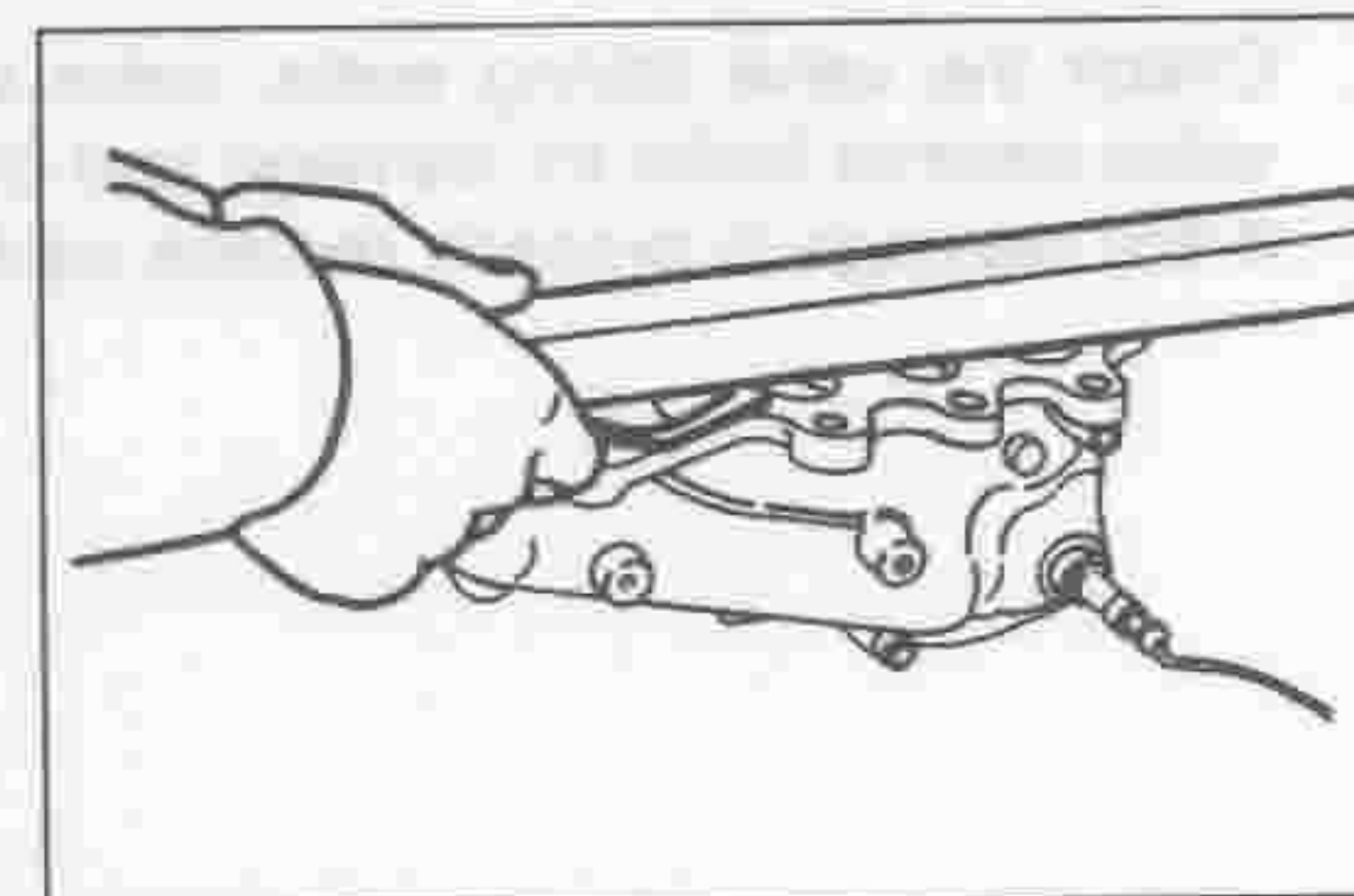
LEM00174-00156

## 20. Check of manifold

- (1) Check the cylinder head attaching surface of the exhaust manifold for warpage, using a straight edge and a thickness gauge.

Maximum Warpage: 0.1 mm

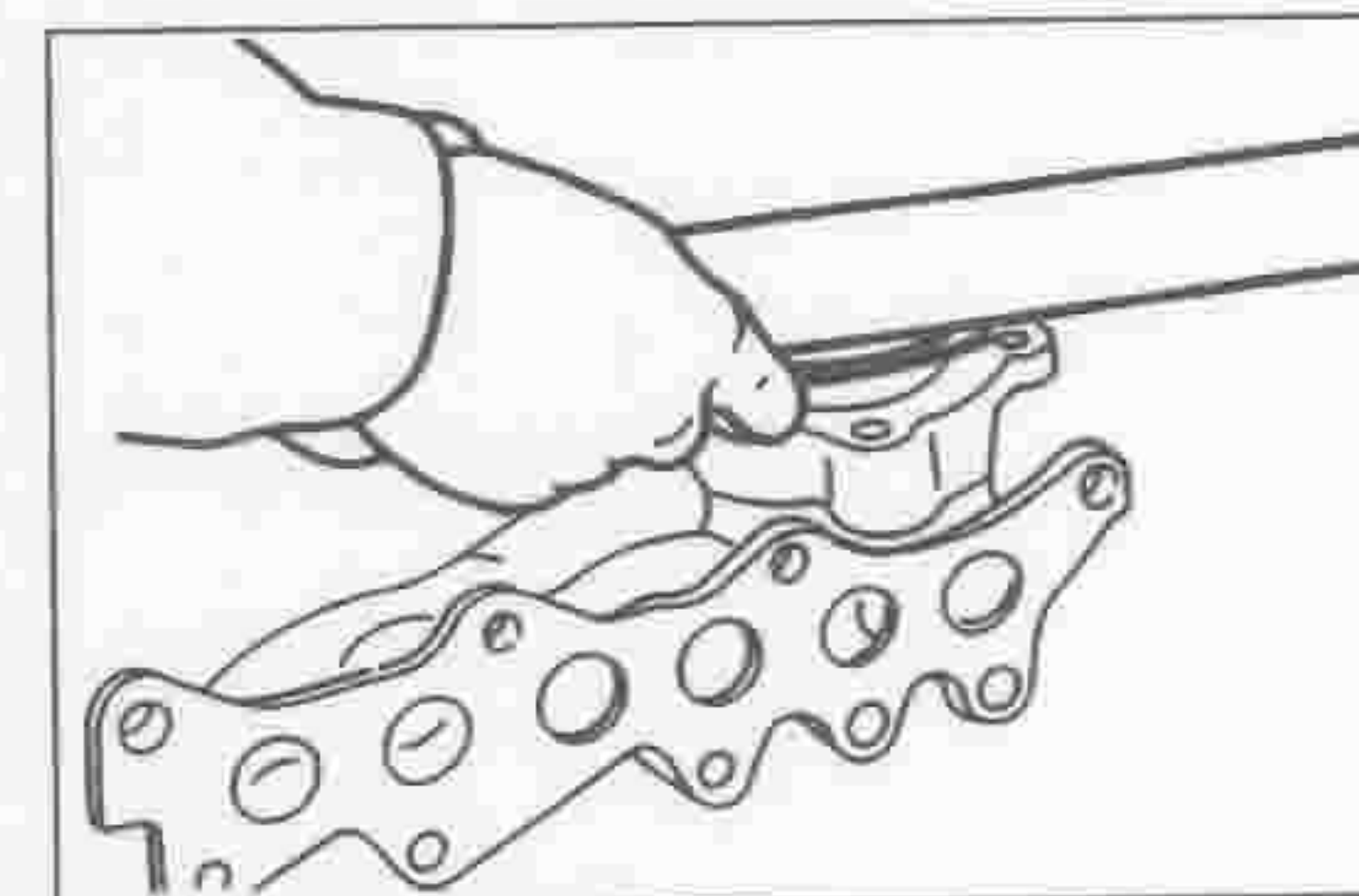
If the warpage exceeds the maximum limit, replace the exhaust manifold No.1.



LEM00175-00157

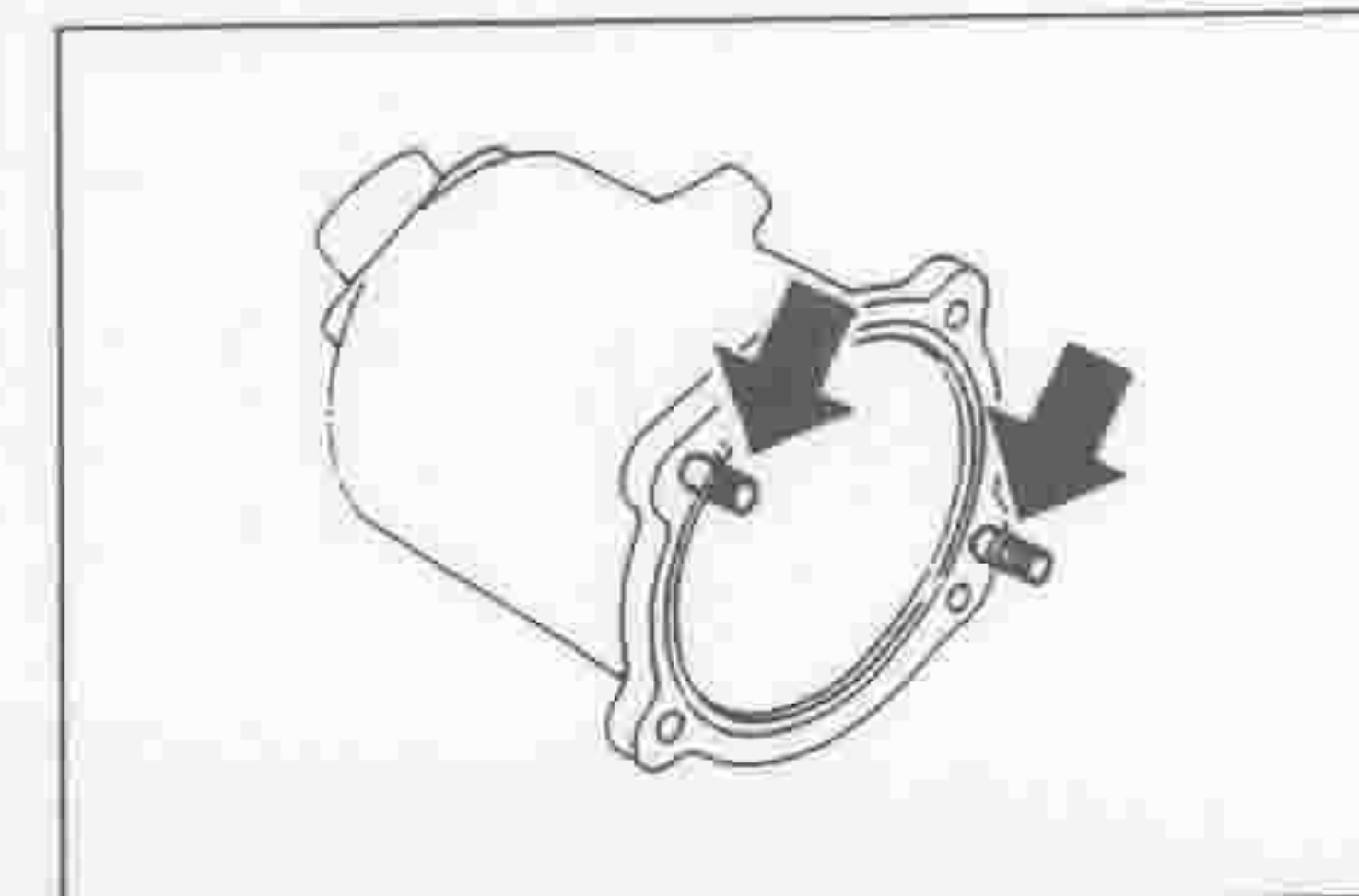
- (2) Disassemble the exhaust manifolds No.1 and No.2.  
Check the contact surface of the exhaust manifold No.1 with the exhaust manifold No.2 for warpage, using a surface plate and a thickness gauge.  
Maximum Warpage: 0.1 mm

If the warpage exceeds the maximum limit, replace the exhaust manifold No.1.



LEM00176-00158

- (3) Remove the stud bolt from the exhaust manifold No.2.

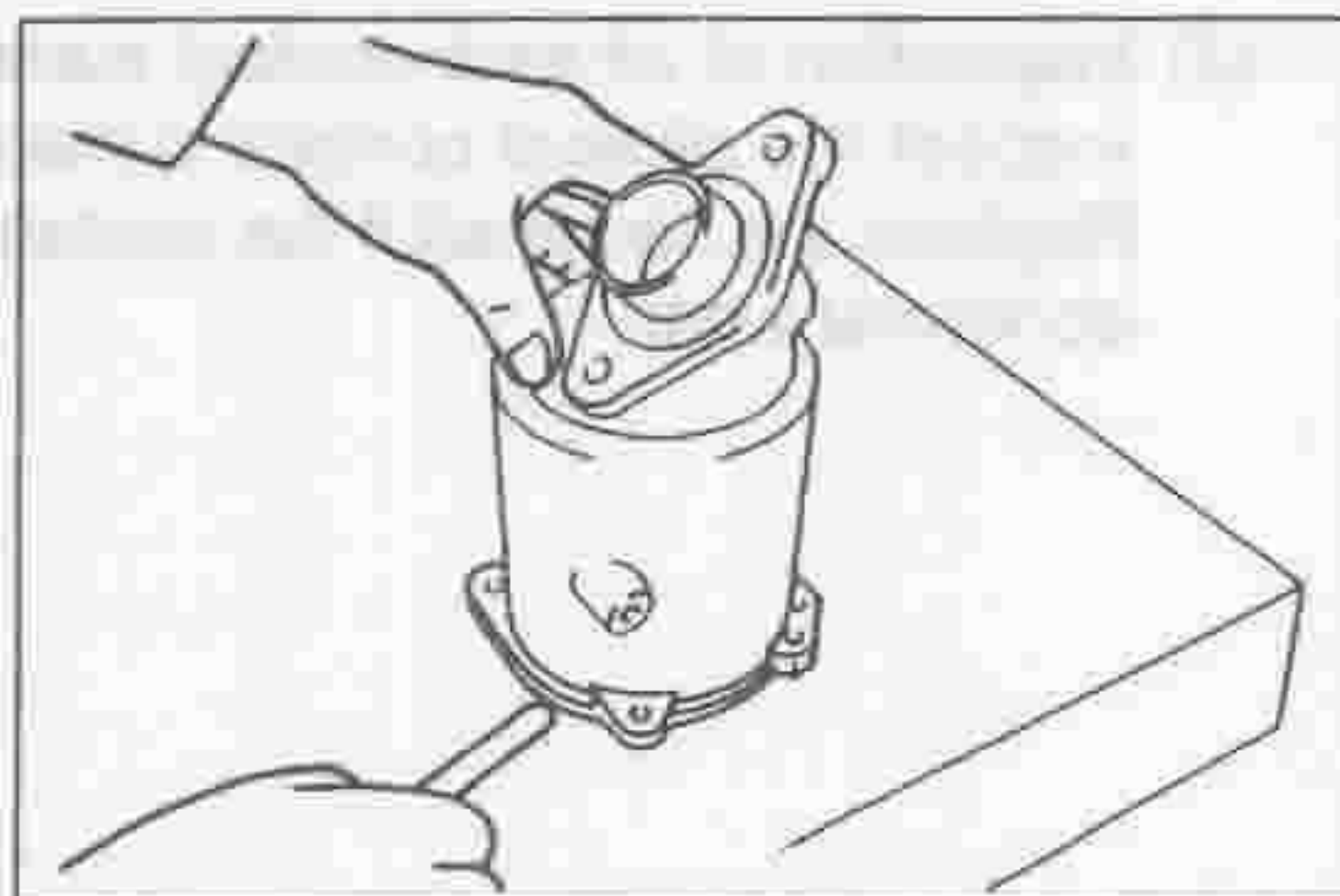


LEM00177-00159

- (4) Check the contact surface of the exhaust manifold No.2 with the exhaust manifold No.1 for warpage, using a surface plate and a thickness gauge.

Maximum Warpage: 0.1 mm

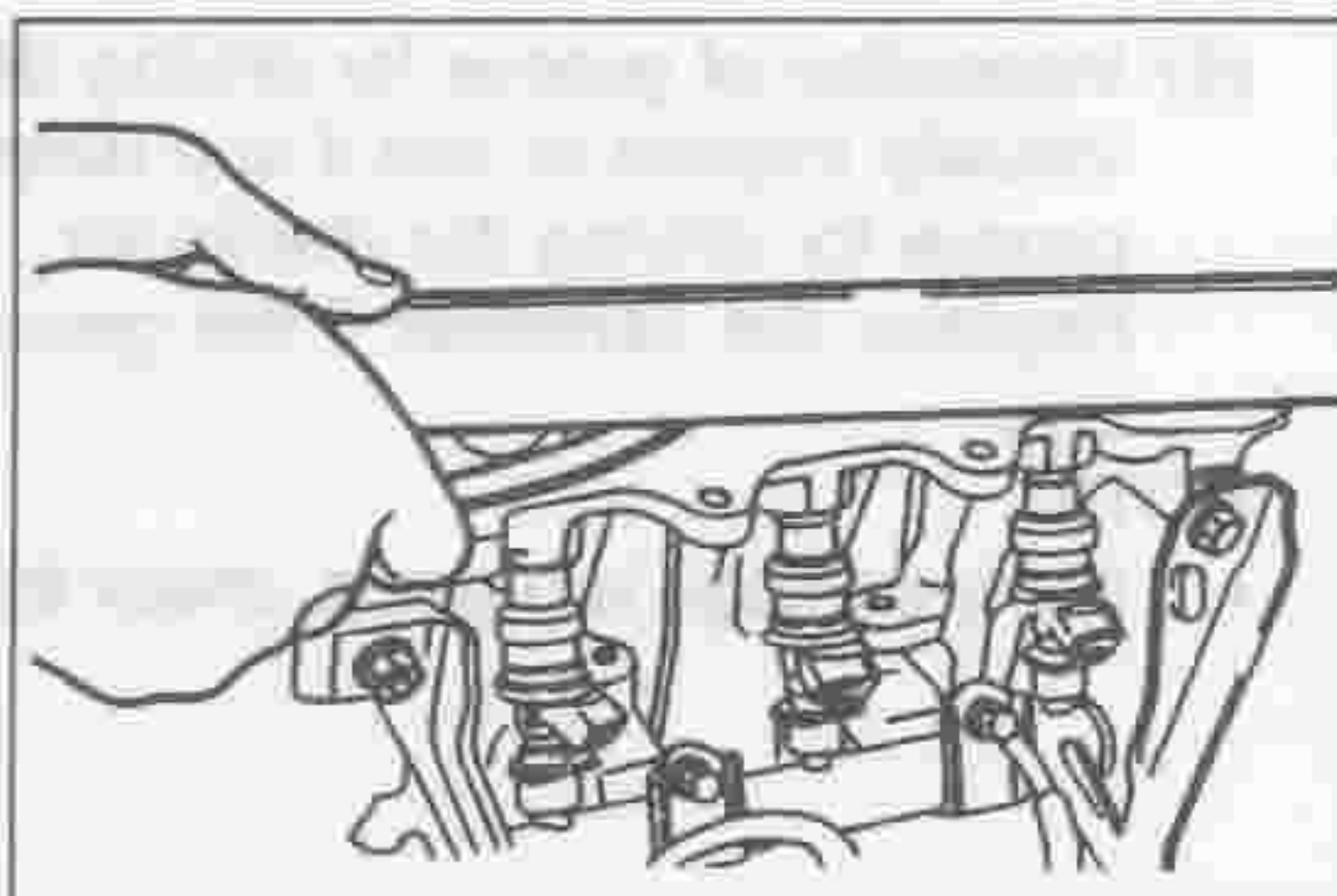
If the warpage exceeds the maximum limit, replace the exhaust manifold No.2.



LEM00178-00160

- (5) Check the contact surface of the intake manifold with the cylinder head.

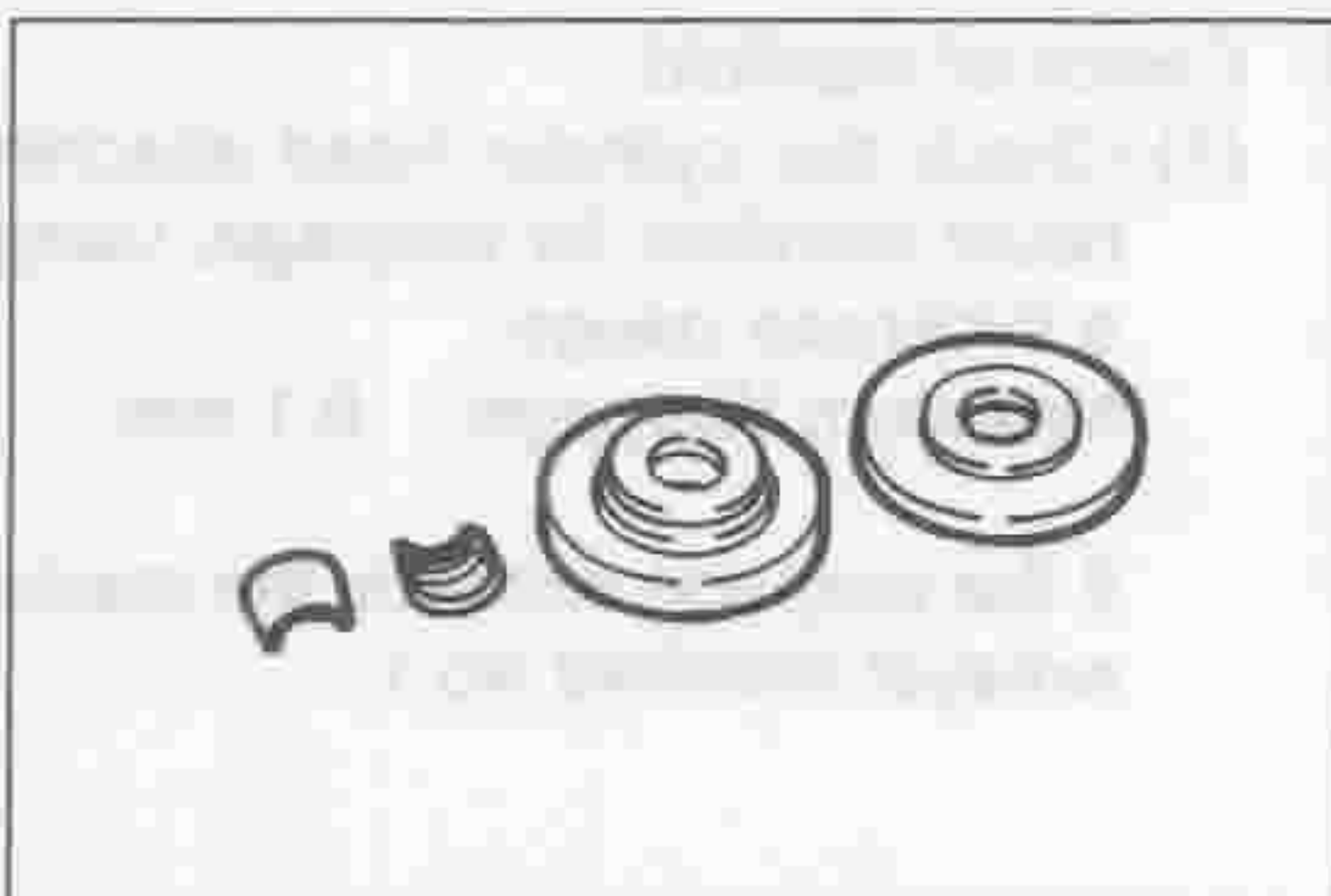
Maximum Warpage: 0.1 mm



LEM00179-00161

- (6) Check the valve spring seats, valve spring retainers and valve retainer locks for damage and cracks.

If any damage is present, replace such faulty parts.



LEM00180-00162

## ASSEMBLY OF CYLINDER HEAD

## NOTE:

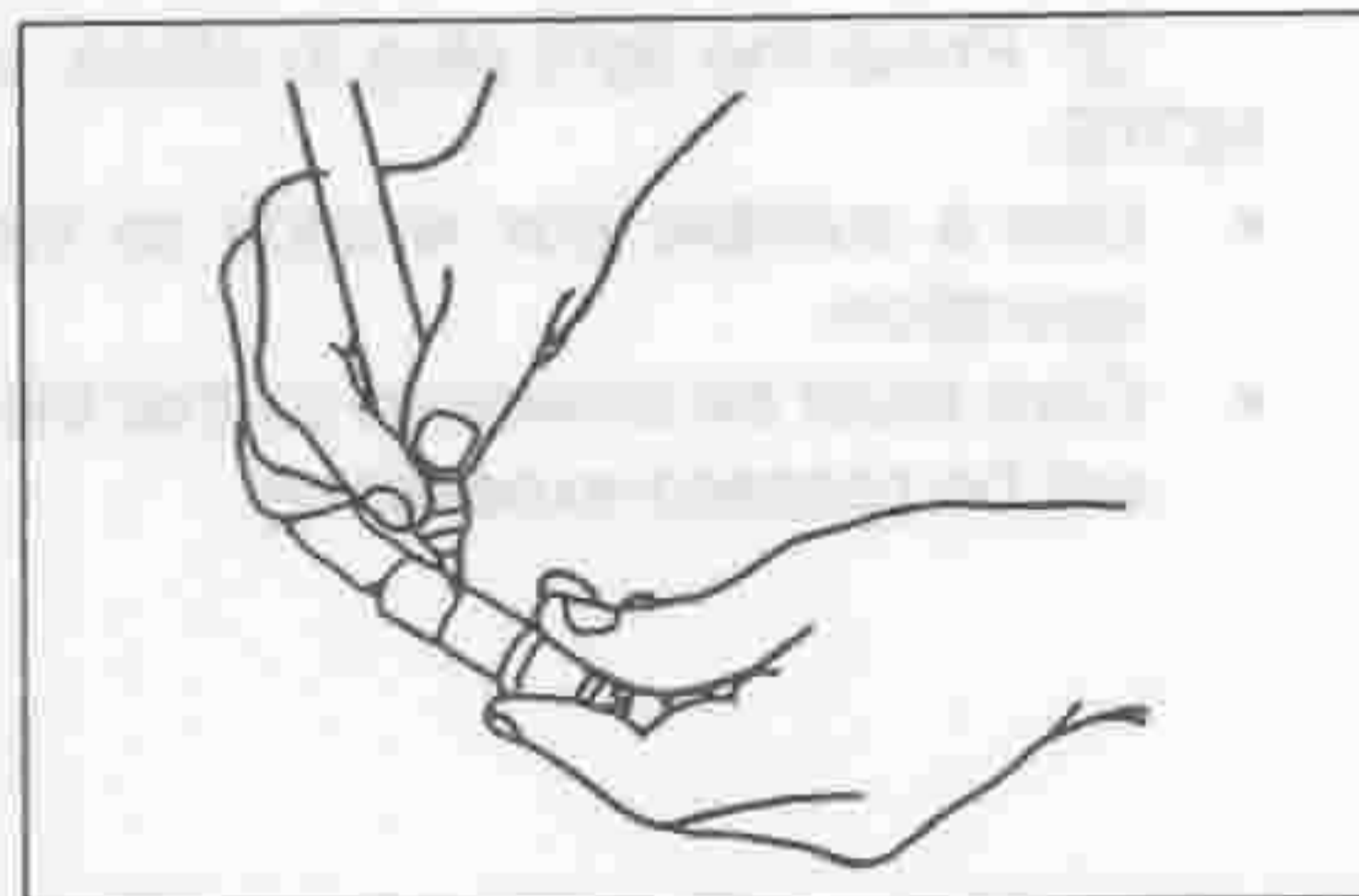
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.

LEM00181-00000

## 1. Assembly of cylinder head (When new cylinder head is installed:)

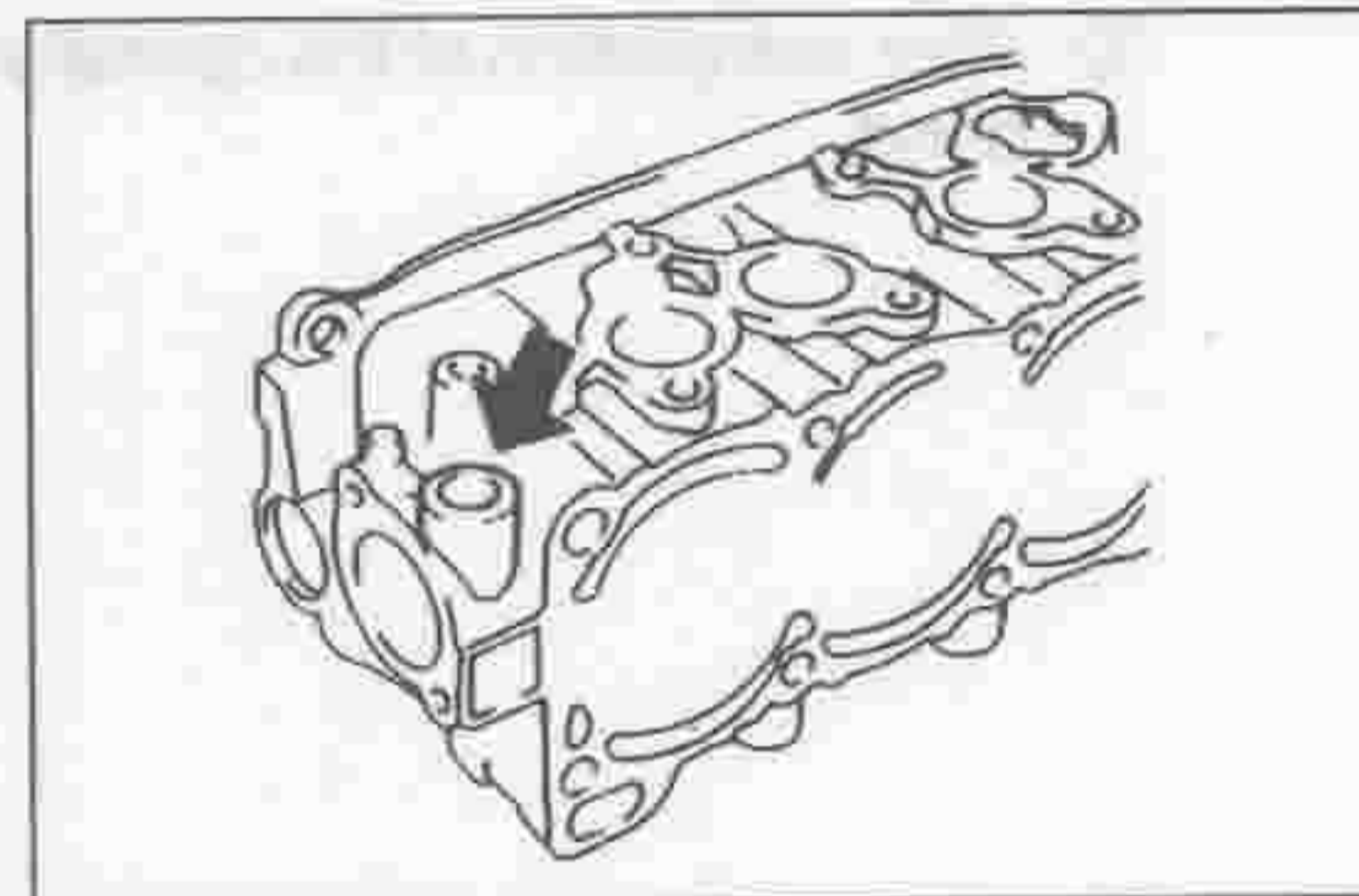
When a new cylinder head is installed, stud bolts, plugs and a heater outlet tube have been furnished separately. Assemble these parts, following the procedure given below.

- (1) Wash the cylinder head in cleaning solvent and dry it with compressed air.
- (2) Put a mark at a point  $50 \pm 1.0$  mm from the forward end of the heater outlet tube.



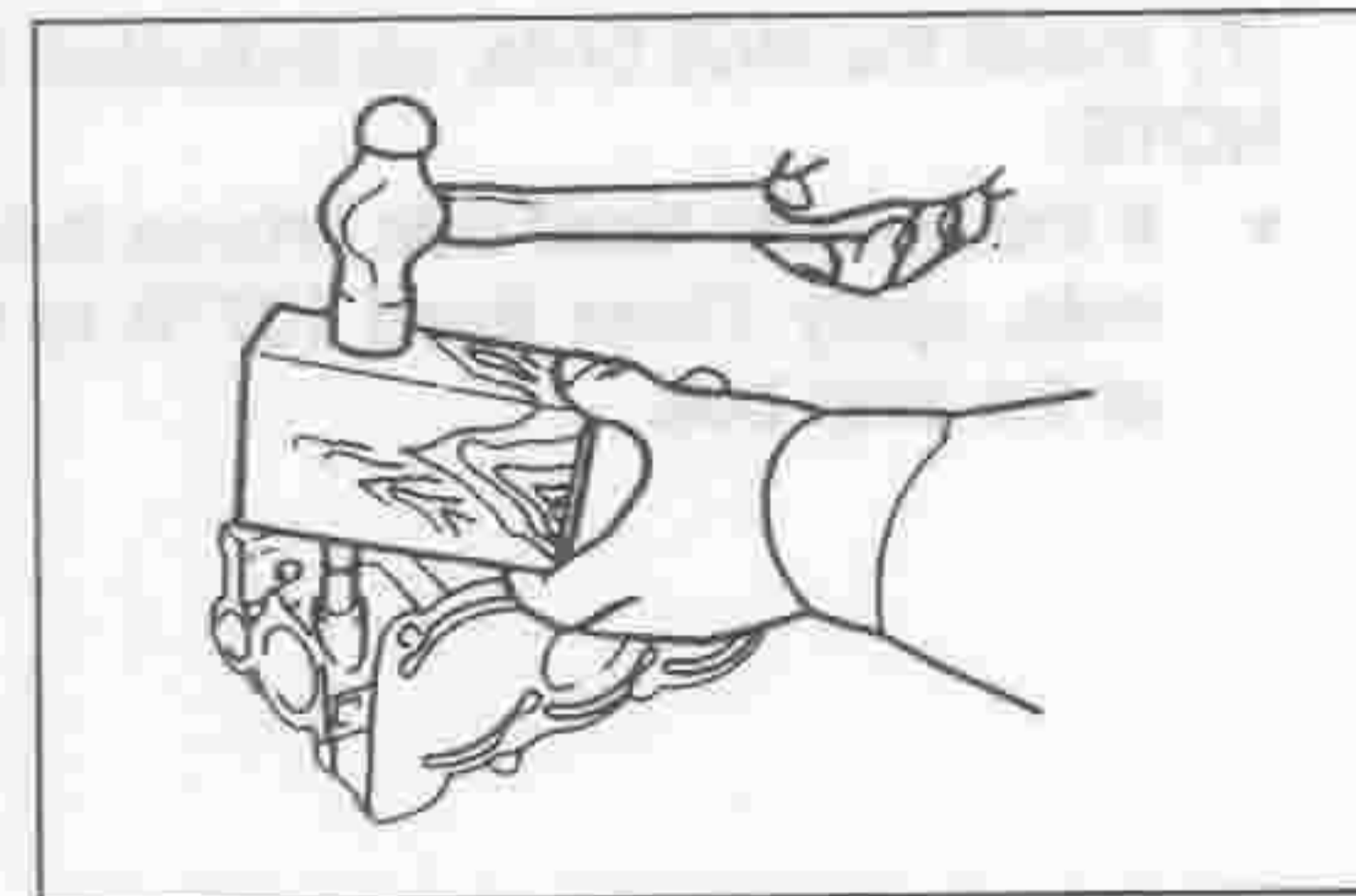
LEM00182-00163

- (3) Apply a thin film of the Three Bond 1377B to the attaching section for the heater outlet tube on the cylinder head.



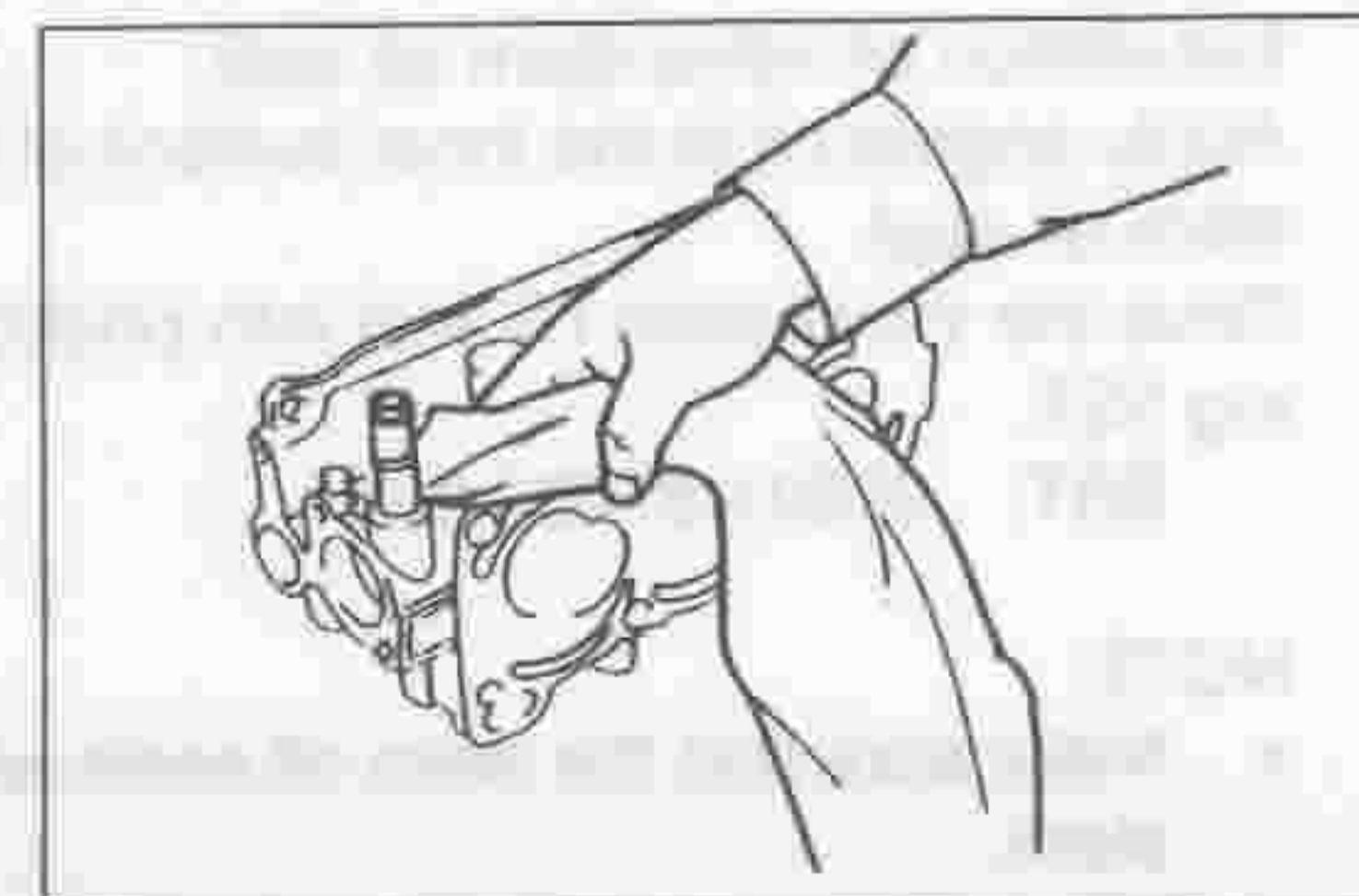
LEM00183-00164

- (4) With a wooden piece interposed, drive the heater outlet tube to the point marked in Step (2).



LEM00184-00165

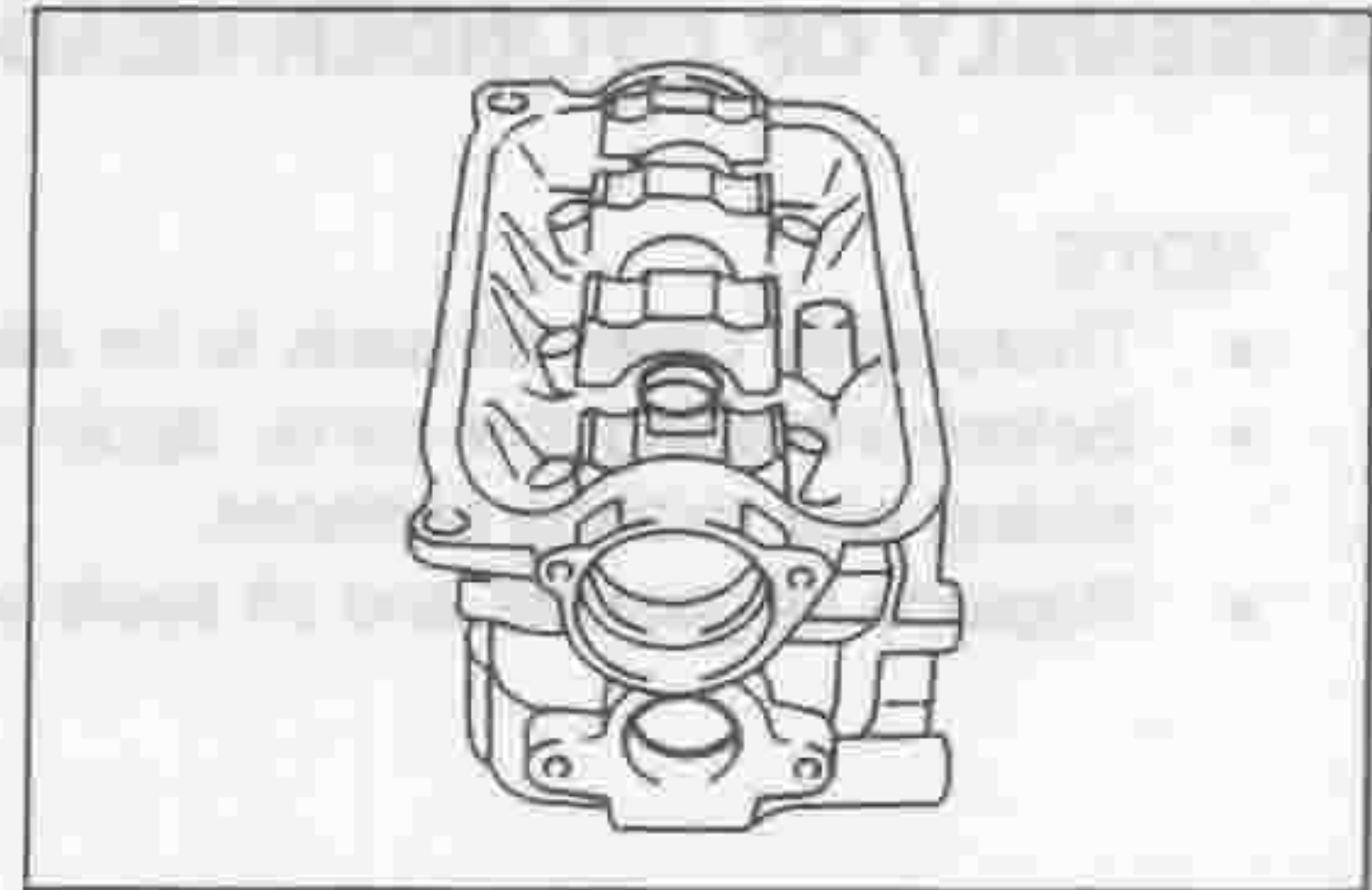
- (5) After completion of the operation, remove any oozed bond, wooden chips and so forth.



LEM00185-00166

## (6) Installation of tight plugs No. 1 and No. 2

- ① Apply Three Bond 1377B to the tight plug installation section.

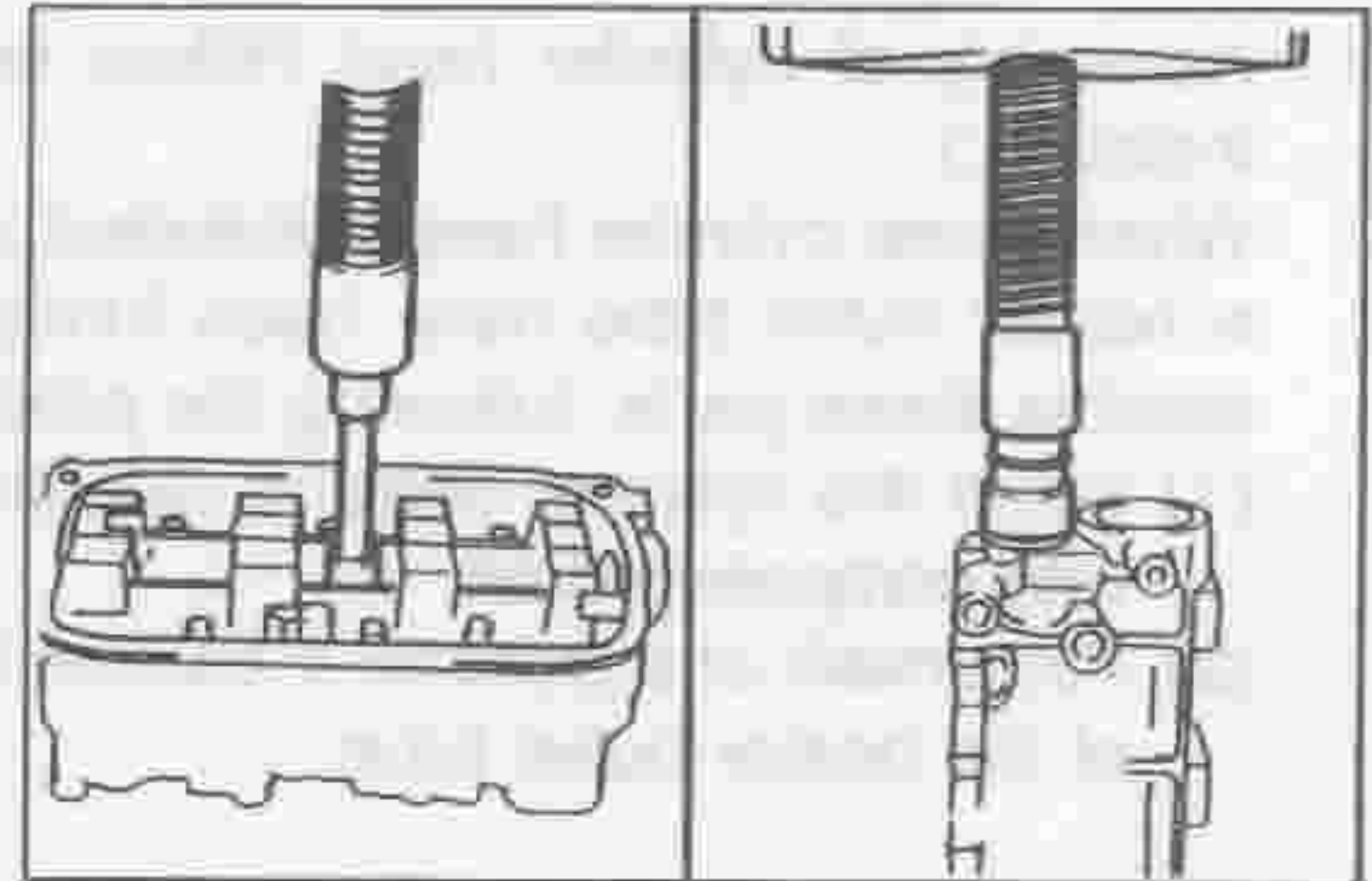


LEM00186-00167

- ② Press the tight plug in place, using a press.

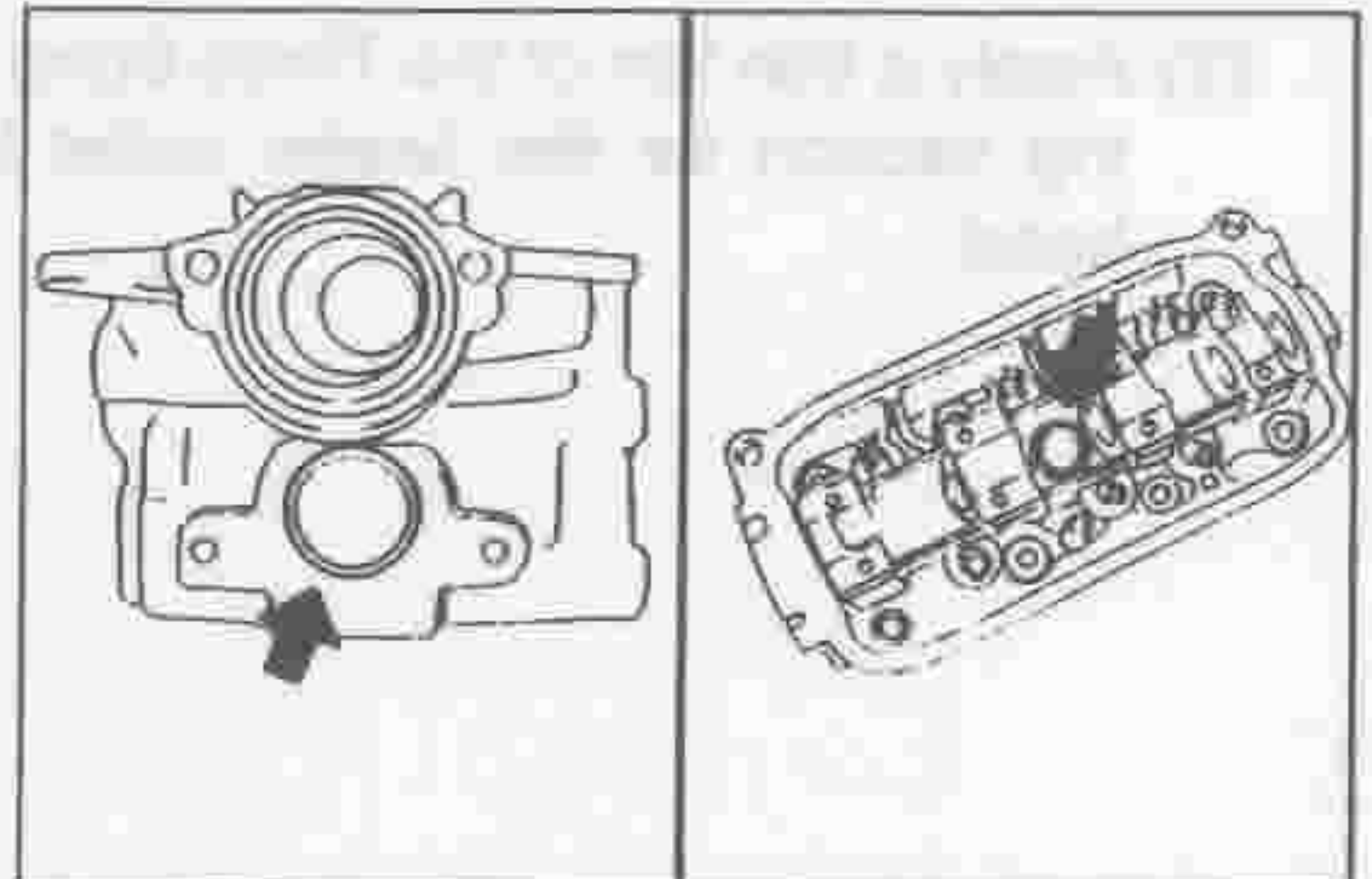
### NOTE:

- Use a suitable box wrench as the attachment for this operation.
- Care must be exercised so that the tight plug No. 2 may not be pressed excessively.



LEM00187-00168

- ③ After completion of the operation, remove any oozed bond.

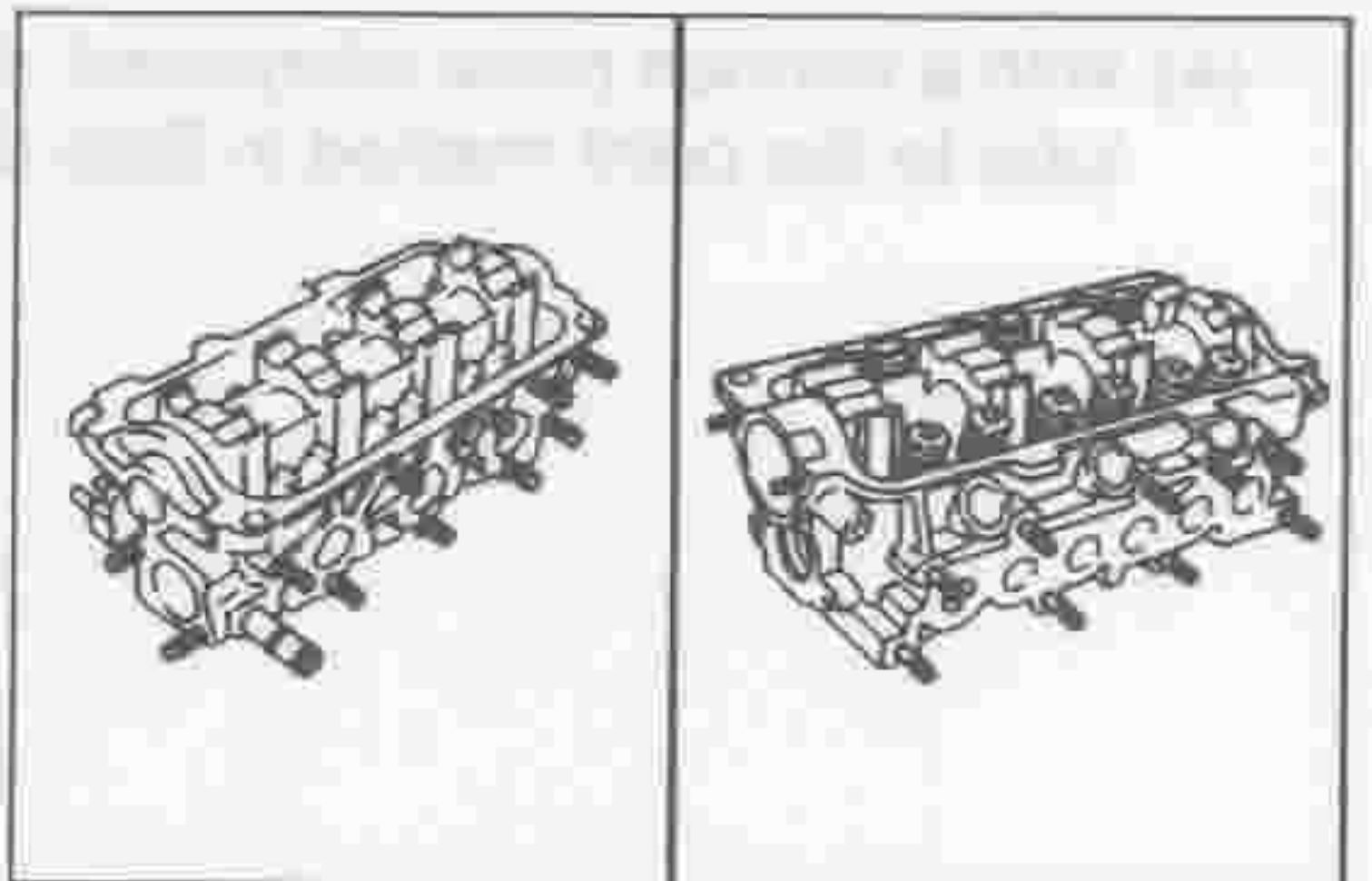


LEM00188-00169

## (7) Install the stud bolts, as indicated in the right figure.

### NOTE:

- If the cylinder head side proves to be a passing-through hole, apply Three Bond 1377B to the threaded portion of the stud bolt.



LEM00189-00170

## 2. Installation of valve stem oil seal

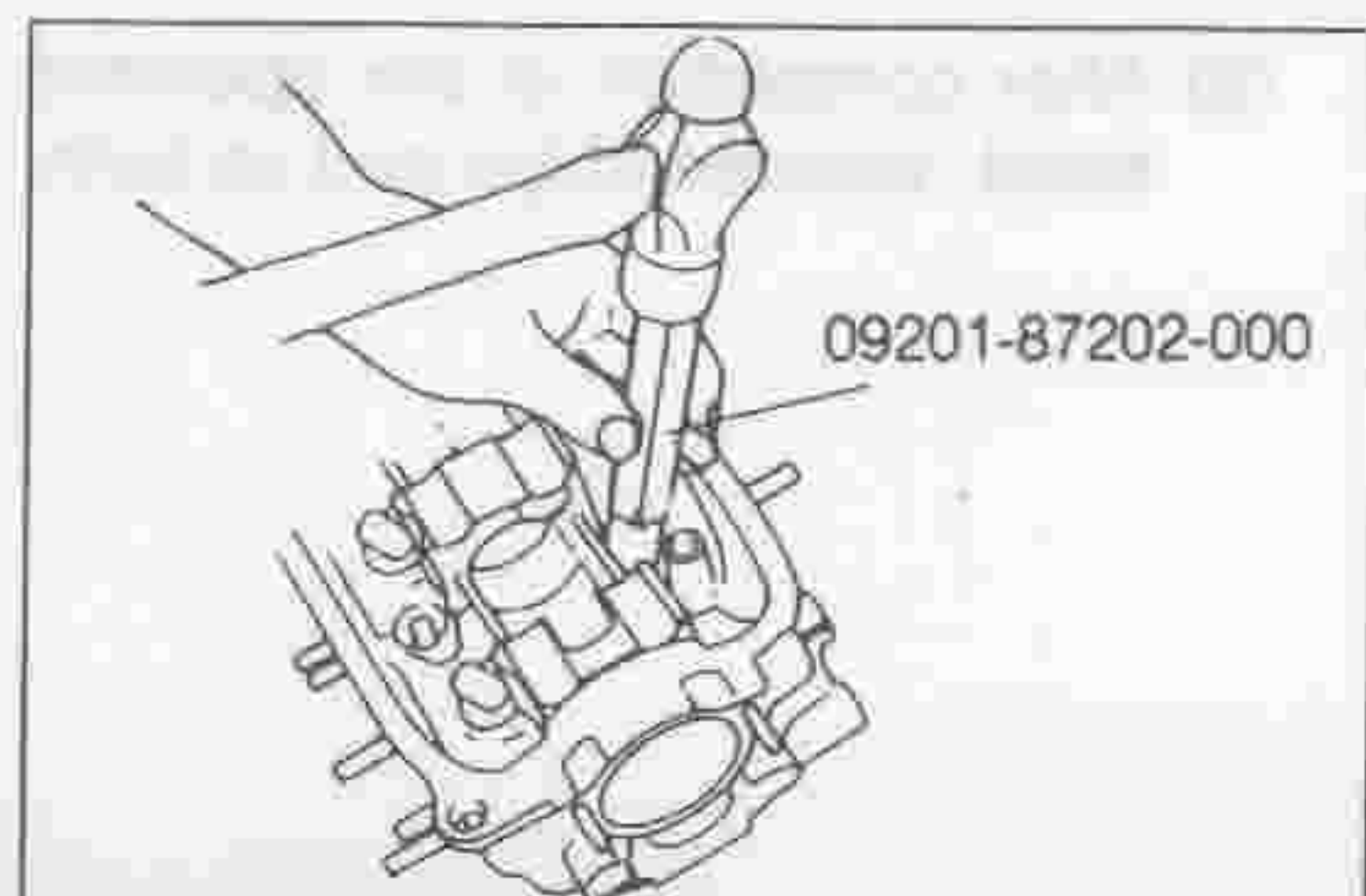
Apply engine oil to the inner surface of the metal ring of the stem oil seal.

Drive the valve stem oil seal into position, using the following SST.

SST: 09201-87202-000

### NOTE:

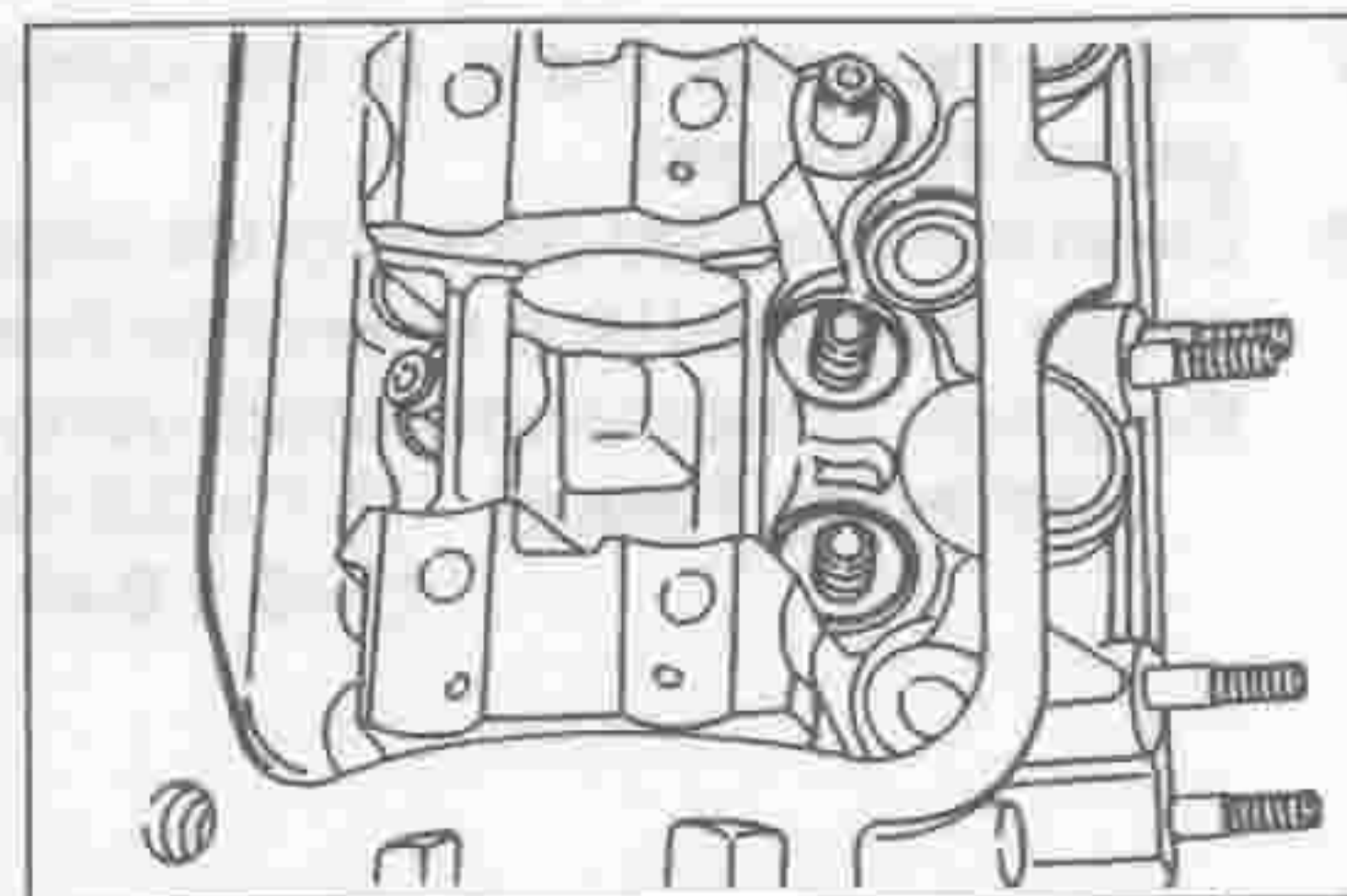
- Make sure that the stem oil seals will not tilt against the stem.



LEM00190-00171



3. Install the valve spring seats to the cylinder head.



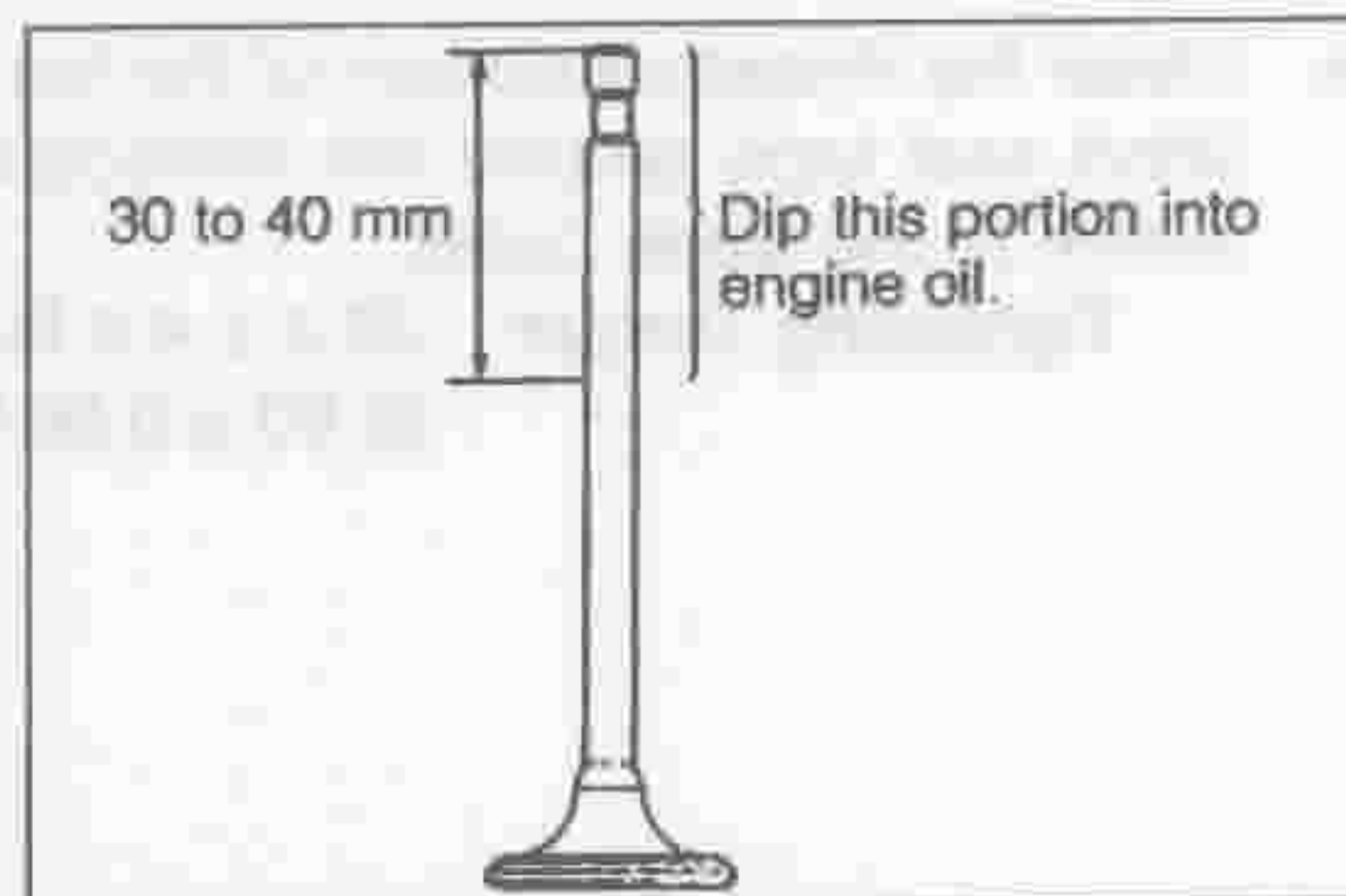
LEM00191-00172

4. Dip the 30 to 40 mm long portion of the valve stem end into engine oil.

5. Install the valve to the cylinder head.

**NOTE:**

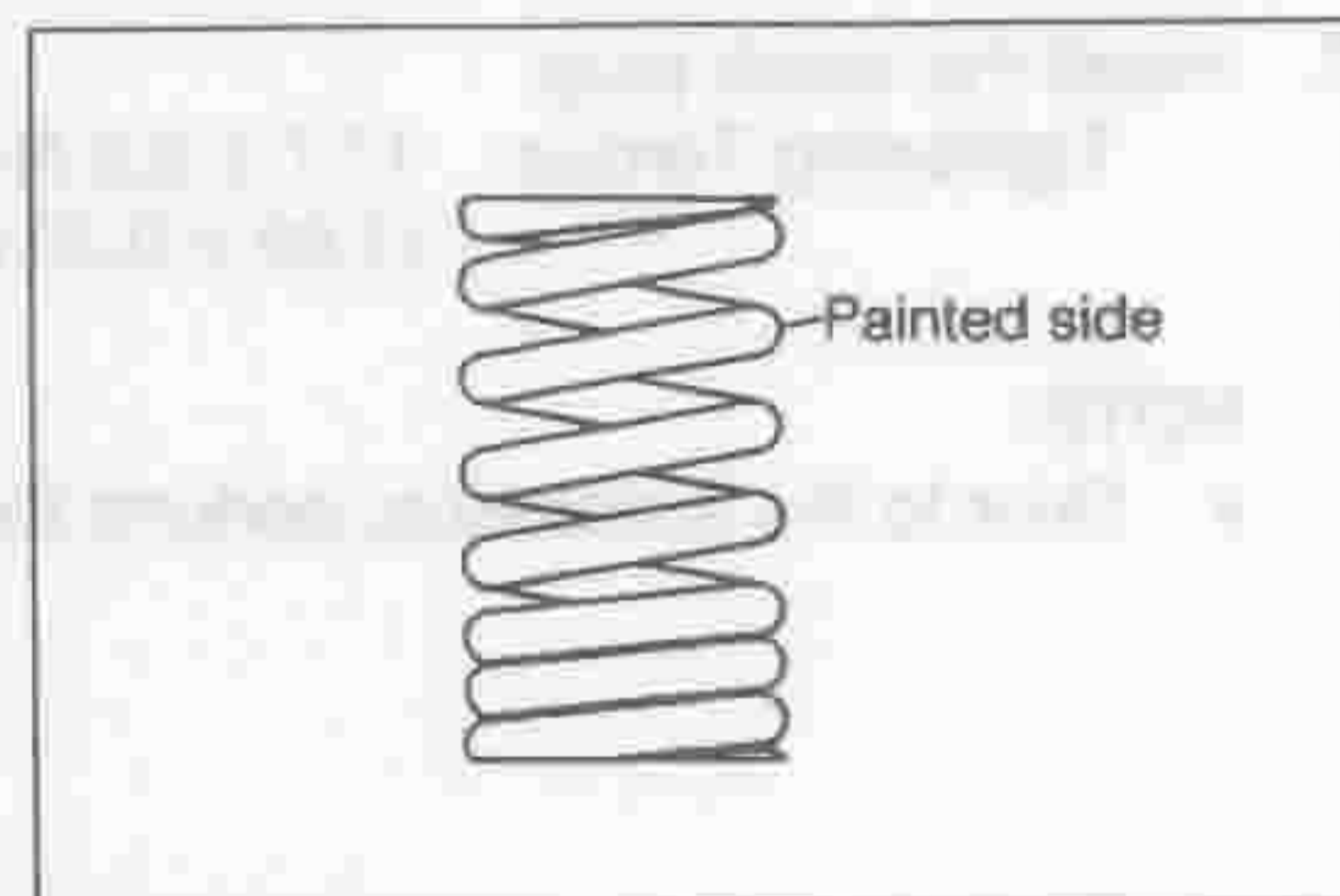
- Care must be exercised as to the installing position. Do not pull out the valve once it has been inserted.
- If the inserted valve should be pulled out, replace the valve stem oil seal with new one.



LEM00192-00173

6. Assembly of valve springs, valve spring retainers and valve spring retainer locks

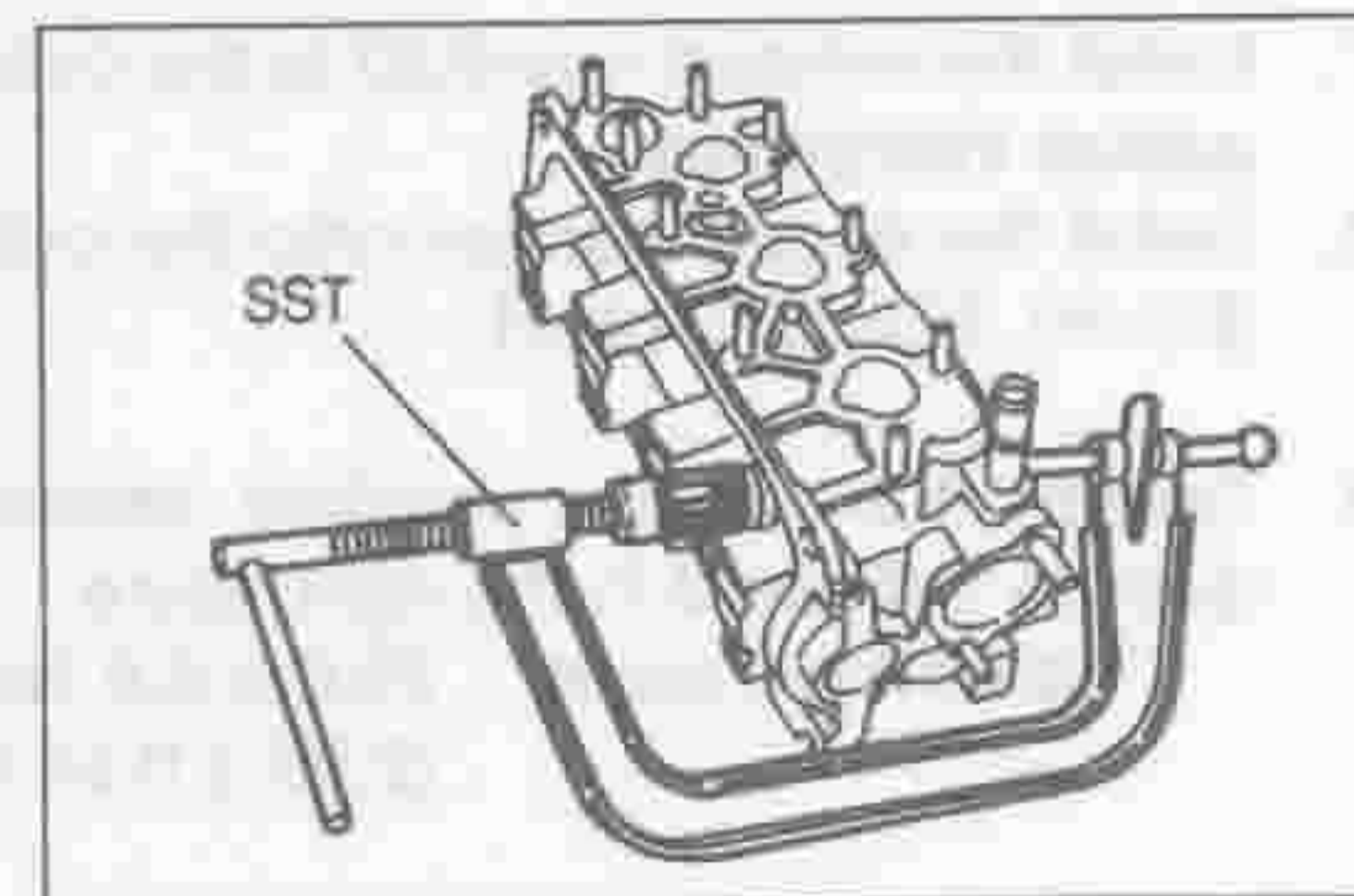
- (1) Assemble the valve spring in such a way that the painted side (the side having a larger pitch) comes at the valve spring retainer.



LEM00193-00174

- (2) Install the valve spring retainer to the valve spring. Install the valve spring retainer locks while compressing the valve spring retainer, using the following SST.

SST: 09202-87002-000  
09202-87002-0A0

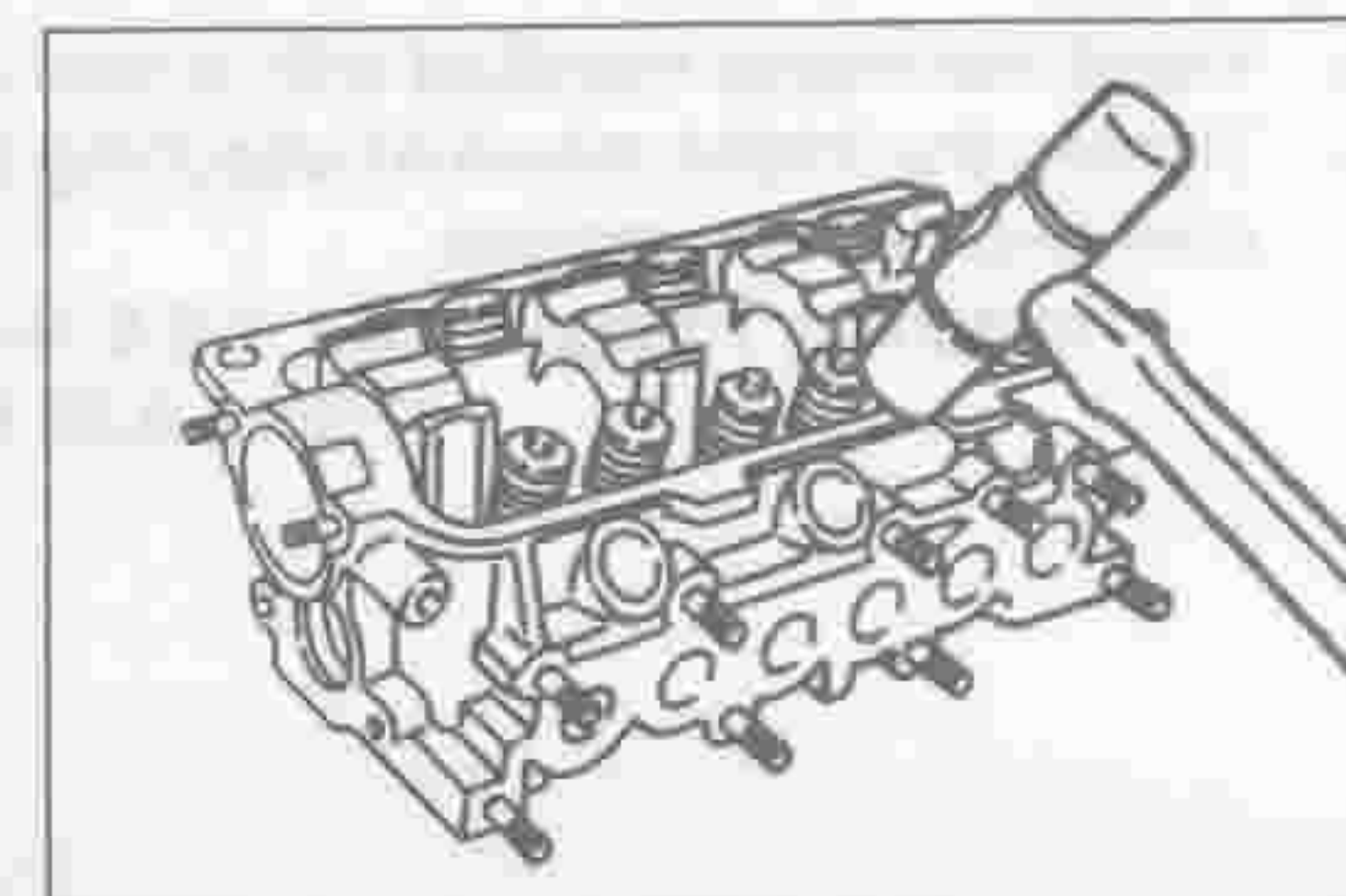


LEM00194-00175

- (3) After installing the valve spring retainer lock, lightly tap the valve spring retainer with a plastic hammer or the like so as to ensure that the valve spring retainer locks are installed securely.

**WARNING:**

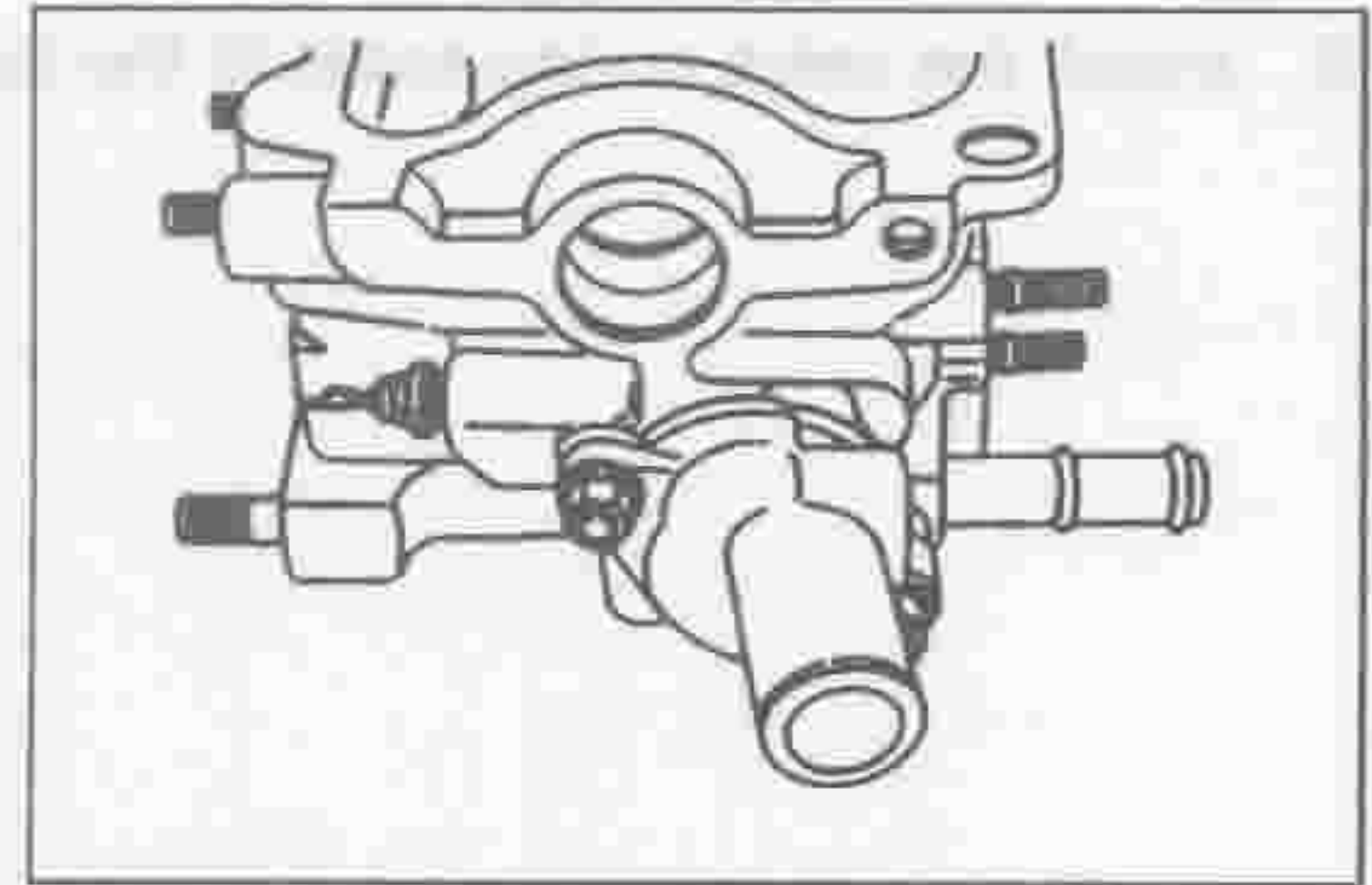
- During this operation, care must be exercised to ensure that the valve spring retainer or retainer locks may not be jumped out.
- Protect your eyes with safety goggles during this operation.



LEM00195-00176

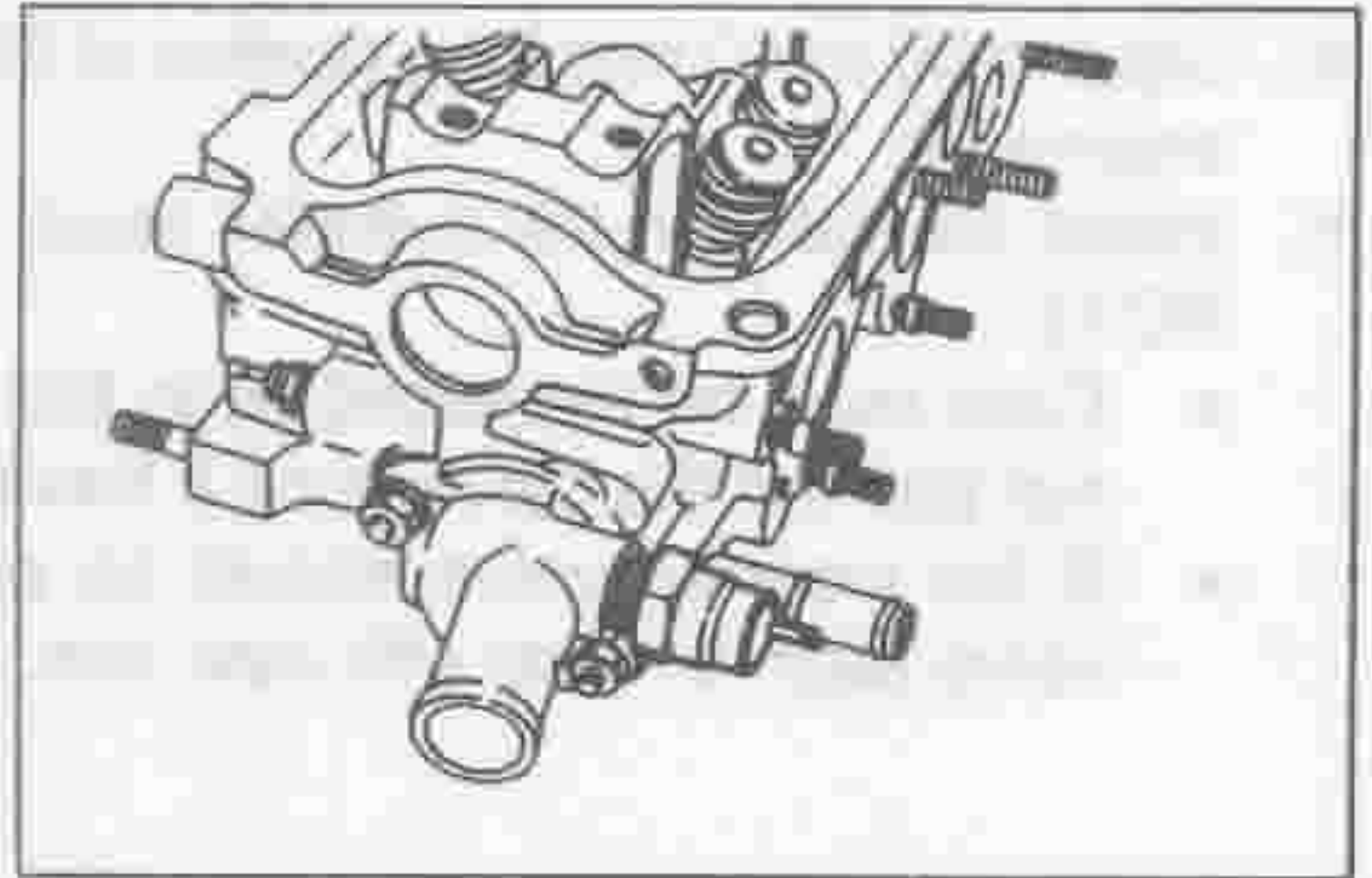
# EM-50

7. Install the water outlet to the cylinder head with a new gasket interposed.
8. Clean the threaded portion of the water temperature sender gauge. Wind seal tape around the threaded portion. Tighten the gauge to the cylinder head, using the long box wrench.  
Tightening Torque:  $13.7 \pm 3.9$  N·m  
( $1.40 \pm 0.40$  kgf·m)



LEM00196-00177

9. Clean the threaded portion of the fan motor control switch. Wind seal tape around the threaded portion. Tighten the switch to the water outlet.  
Tightening Torque:  $29.4 \pm 4.9$  N·m  
( $3.00 \pm 0.50$  kgf·m)

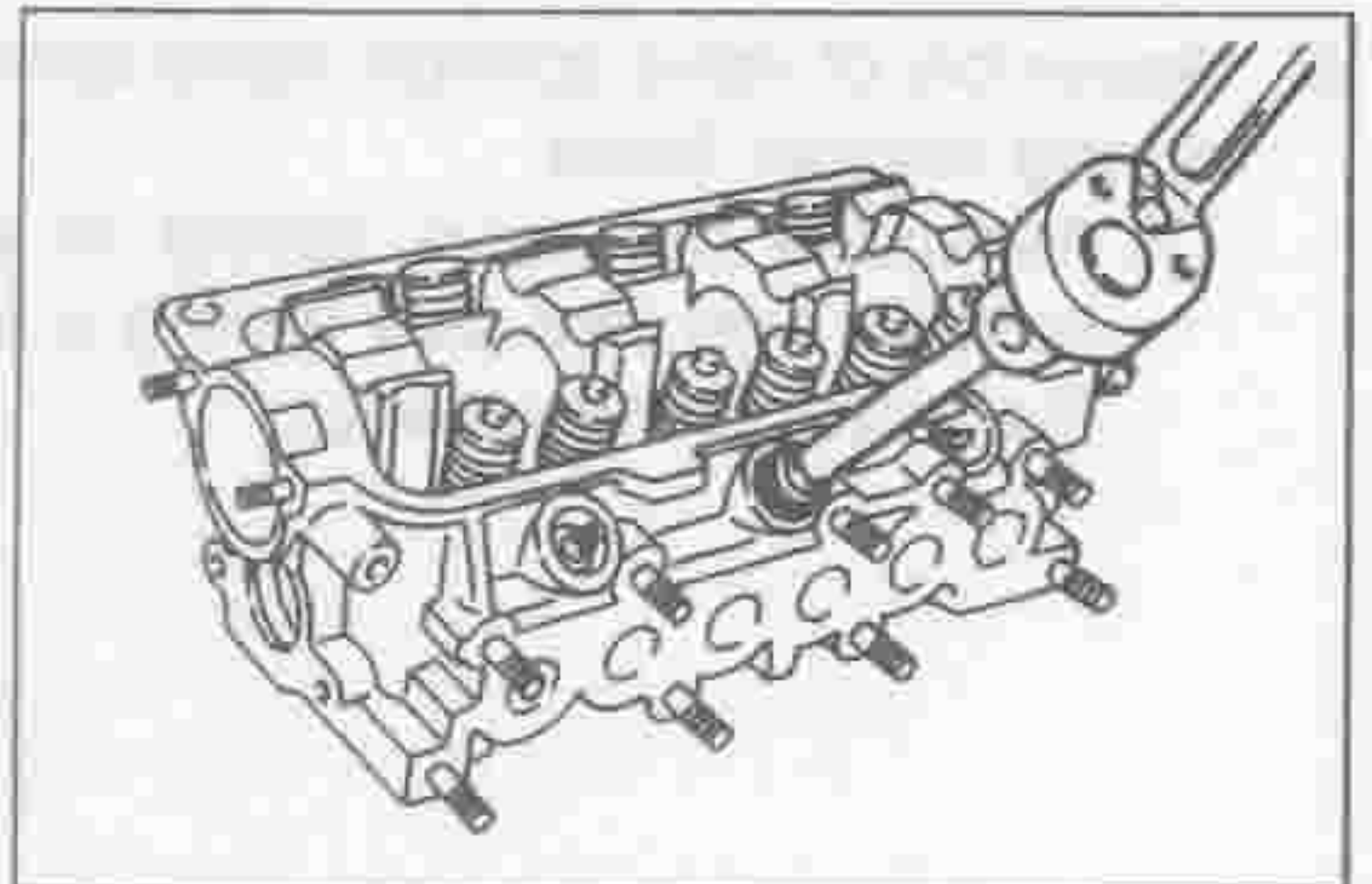


LEM00197-00178

10. Install the spark plug.  
Tightening Torque:  $17.7 \pm 2.9$  N·m  
( $1.80 \pm 0.30$  kgf·m)

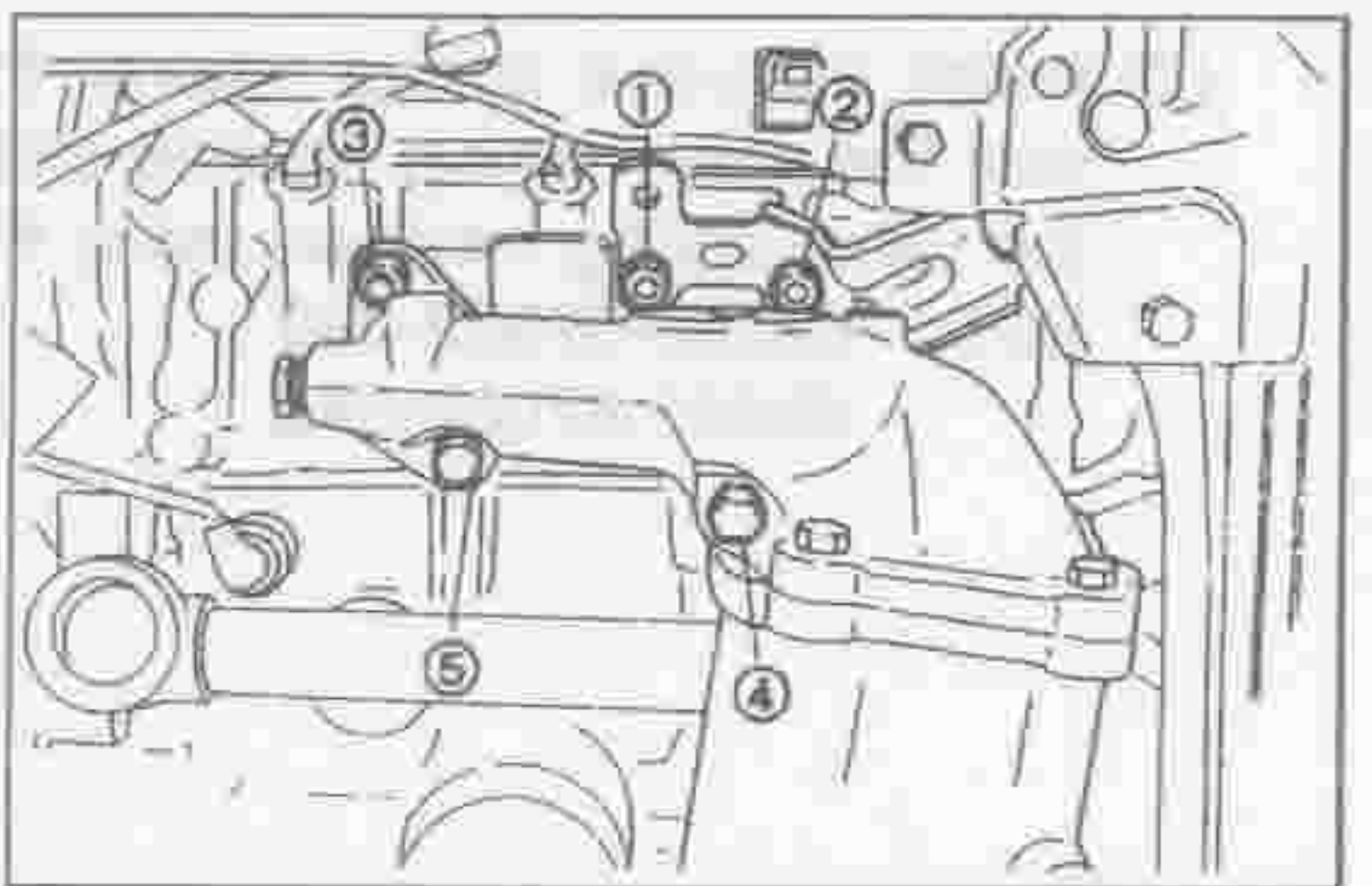
#### NOTE:

- Prior to the installation, perform the spark plug check.



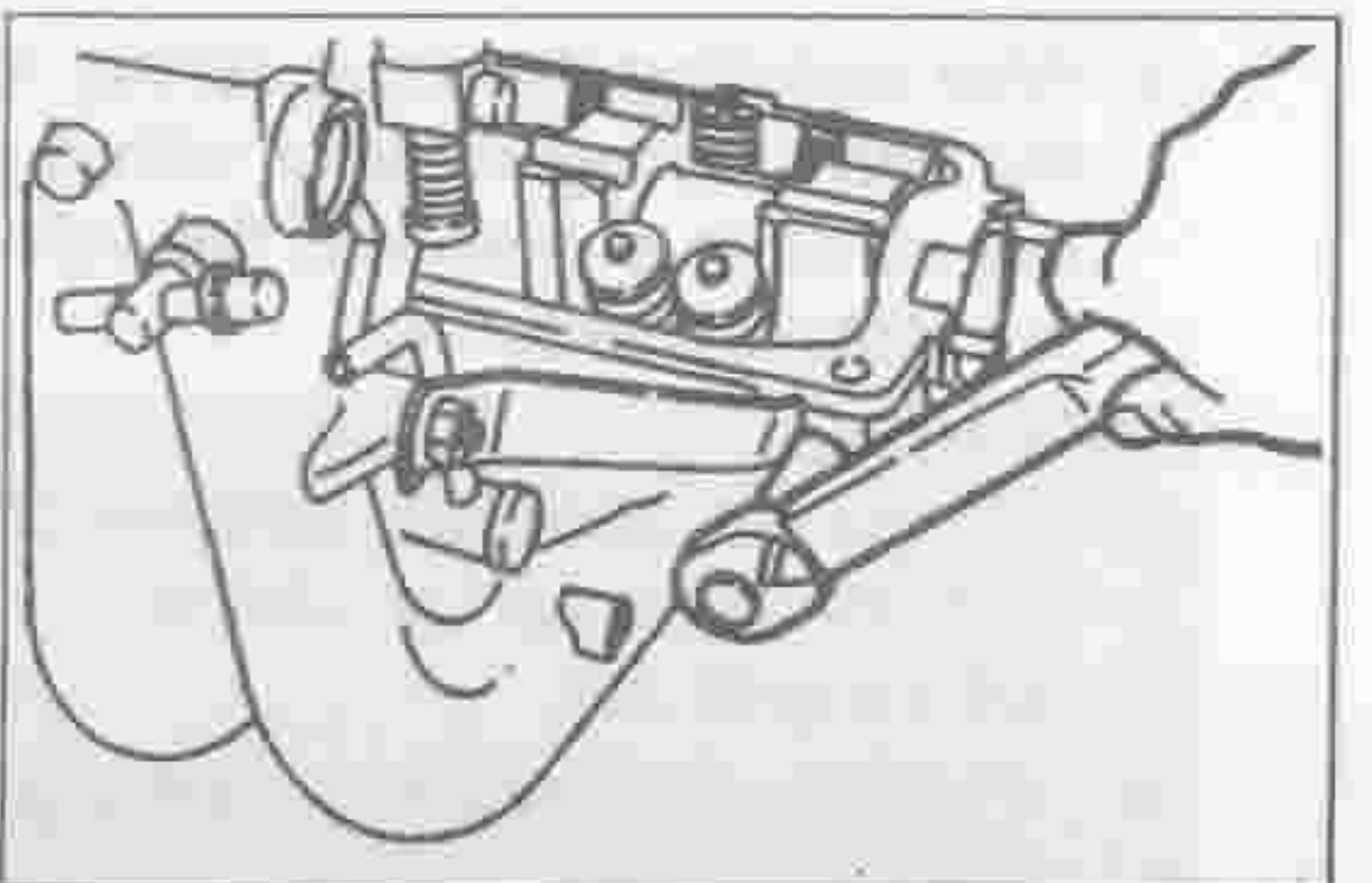
LEM00198-00179

11. Install the exhaust manifold to the cylinder head with a new gasket interposed.
12. Install the engine hanger onto the cylinder head.  
[ED-10, ED-20 Engine]
13. Tighten the exhaust manifold attaching bolts in the sequence indicated in the right figure.  
Tightening Torque:  $25.0 \pm 5.0$  N·m  
( $2.55 \pm 0.51$  kgf·m)



LEM00199-00180

14. Install the intake manifold with a new gasket interposed.
15. Tighten the intake manifold attaching bolts and nuts evenly over two or three stages.  
Tightening Torque:  $19.1 \pm 3.8$  N·m  
( $1.95 \pm 0.39$  kgf·m)



LEM00200-00181

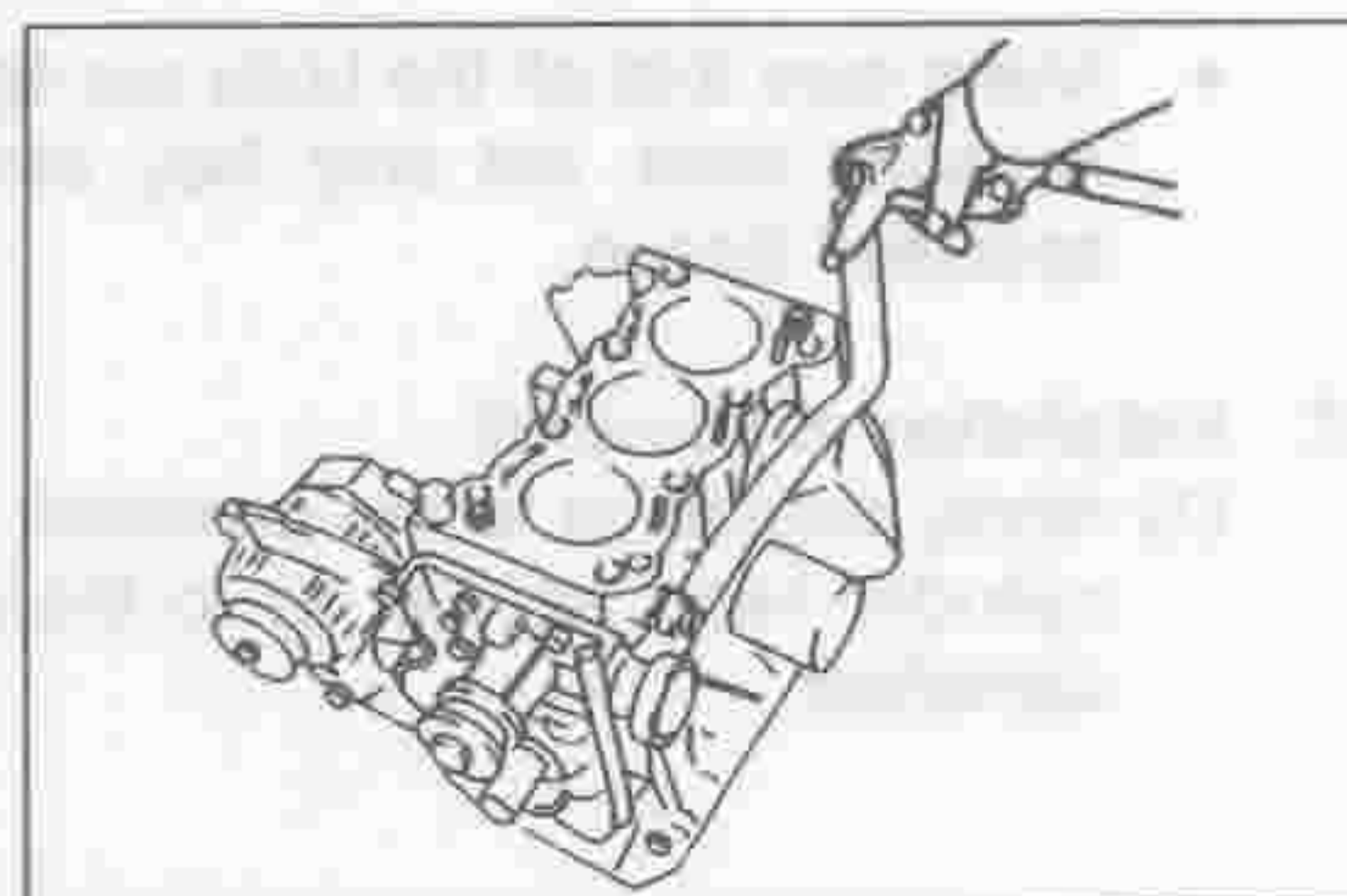
16. Clean the cylinder block head bolt holes.

**WARNING:**

- Protect your eyes with goggles when using compressed air.

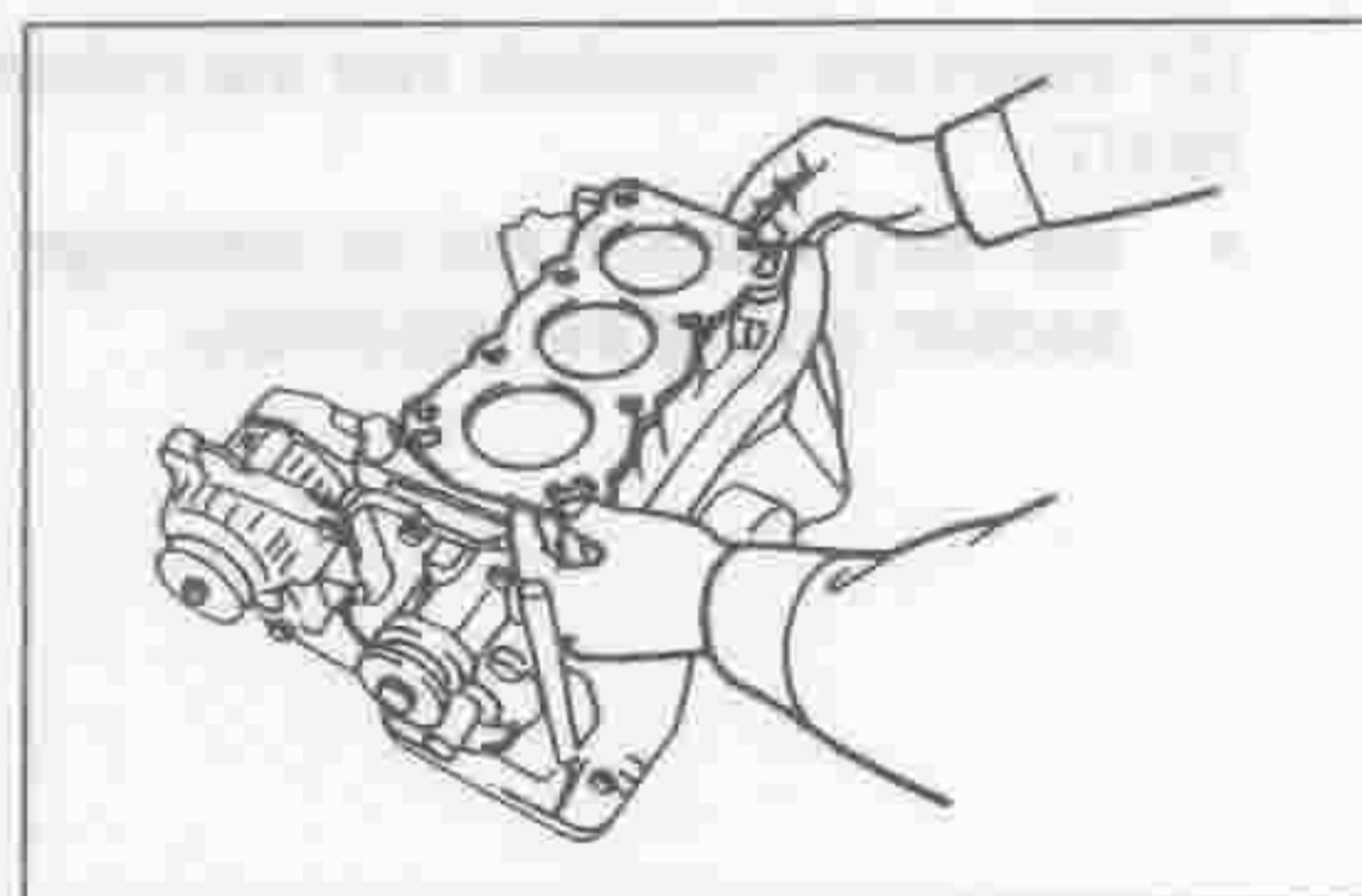
**NOTE:**

- At this point make sure that the pin rings are attached at the block side.



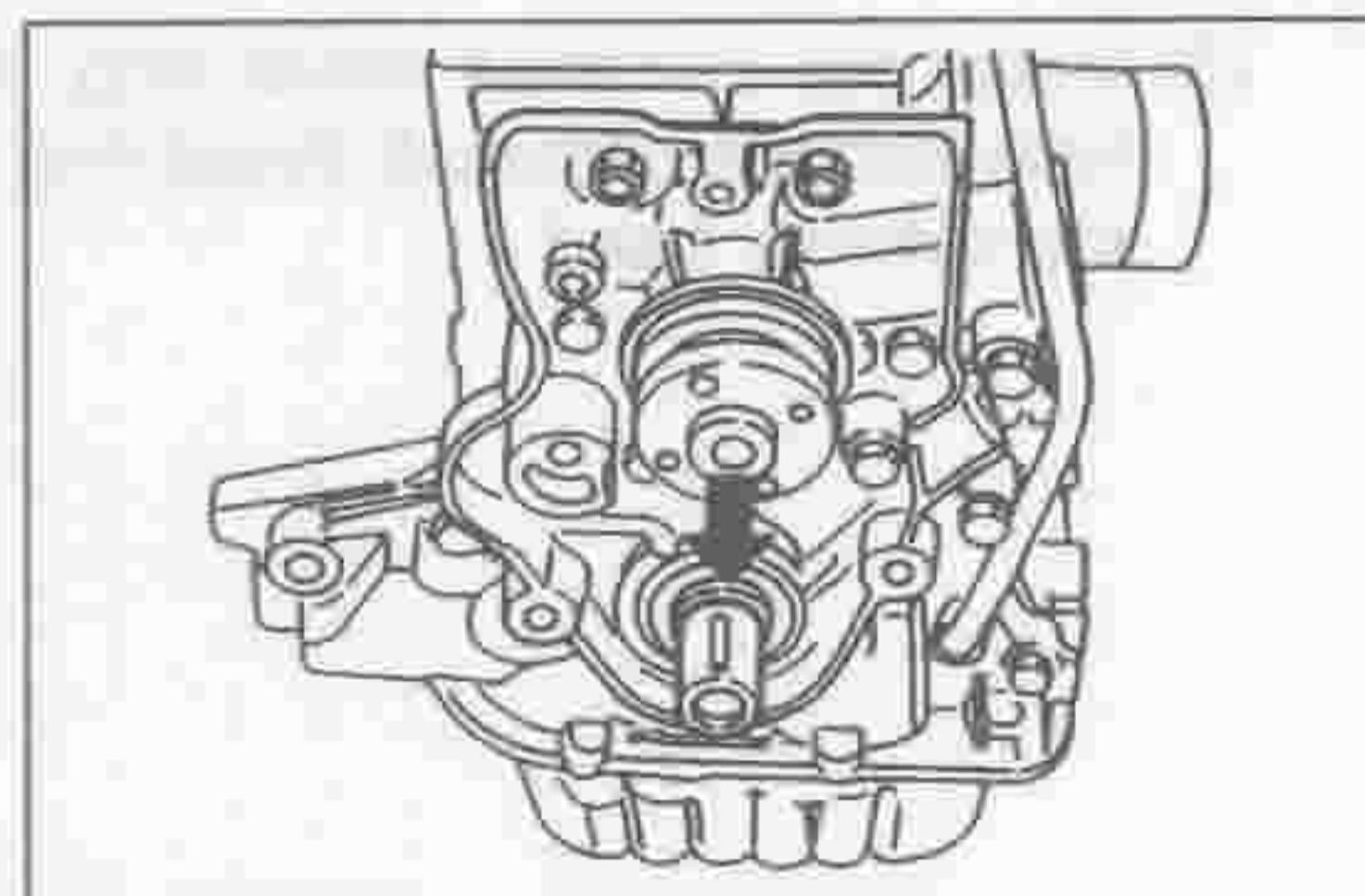
LEM00201-00182

17. Clean the cylinder block upper gasket surface. Install the cylinder head gasket, while aligning it with the pin ring for locating use.



LEM00202-00183

18. Temporarily install the crankshaft pulley bolt to the crankshaft.  
19. Turn the crankshaft so that the crankshaft key groove may come at the top position.

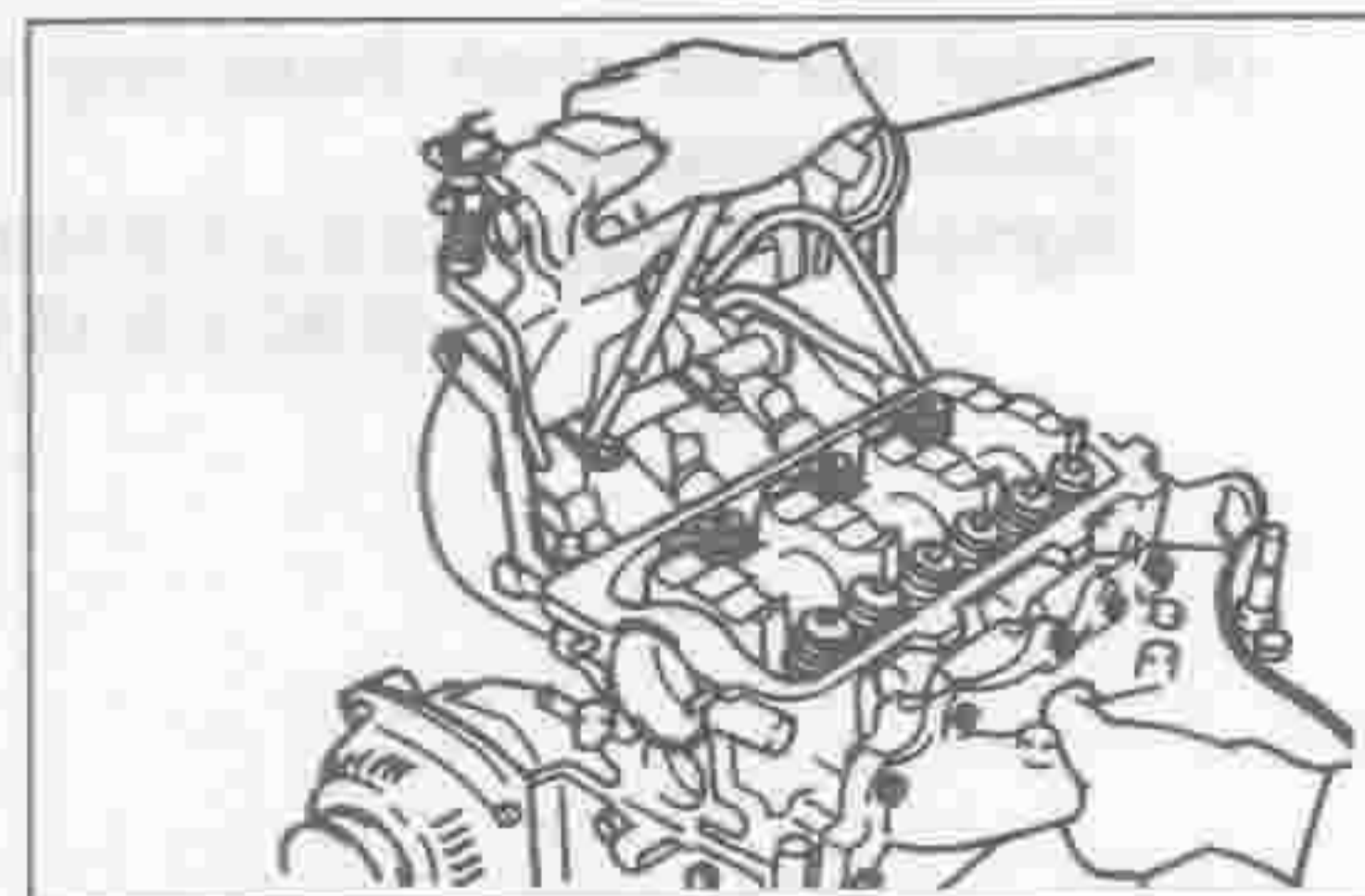


LEM00203-00184

20. Install the cylinder head on the cylinder block.

**NOTE:**

- Care must be exercised to ensure that no damage is made to the gasket surface of the cylinder head with the cylinder block.



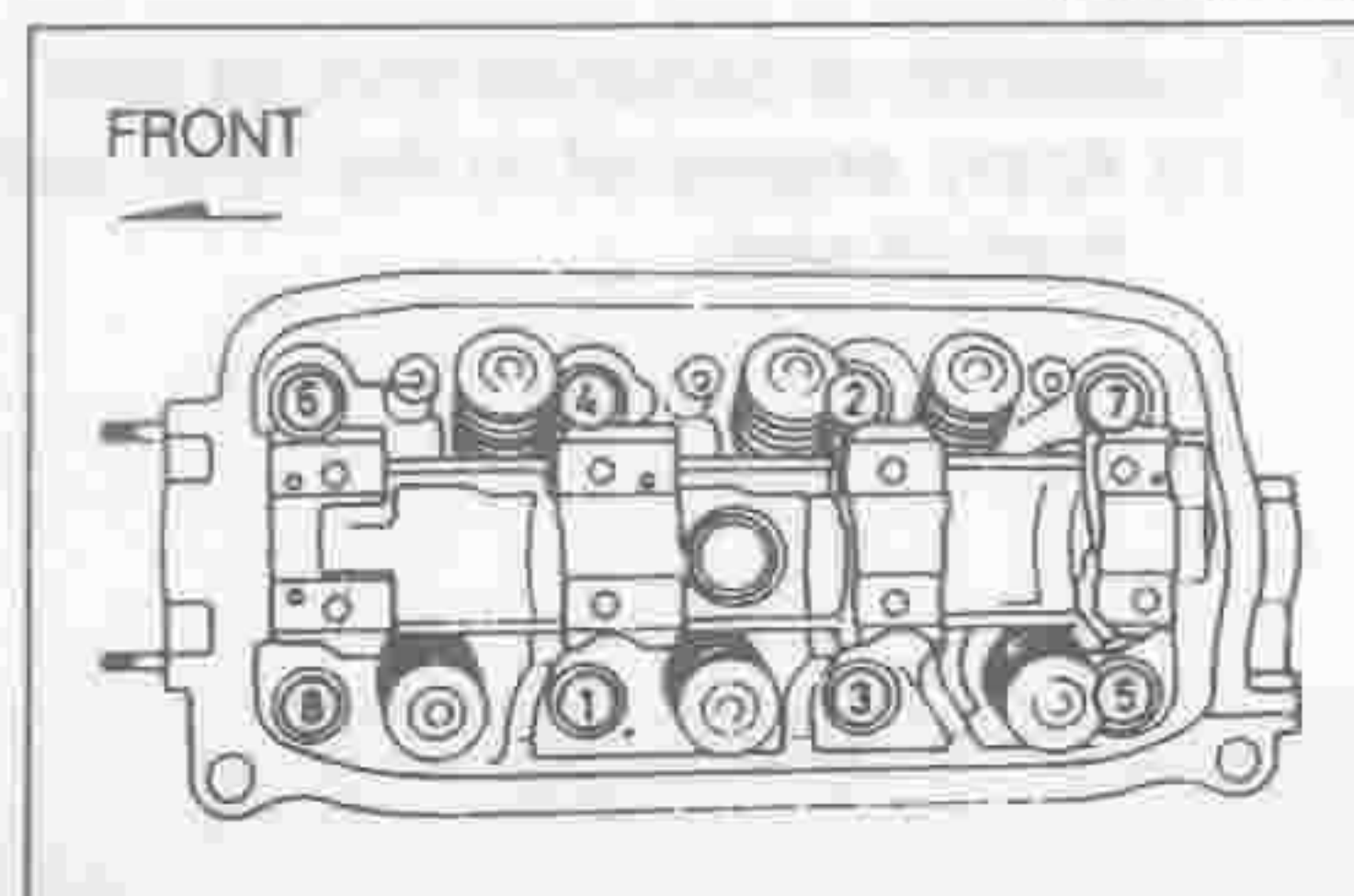
LEM00204-00185

21. Coat each cylinder head bolt with a thin film of engine oil. Using these bolts, install the cylinder head to the cylinder block. Tighten the bolts evenly over two or three stages, following the sequence shown in the right figure.

Tightening Torque:  $53.9 \pm 4.9$  N·m  
( $5.50 \pm 0.50$  kgf·m)

**NOTE:**

- Failure to tighten the bolts evenly may cause cracks and distortion of the cylinder head, even leading to engine seizure.



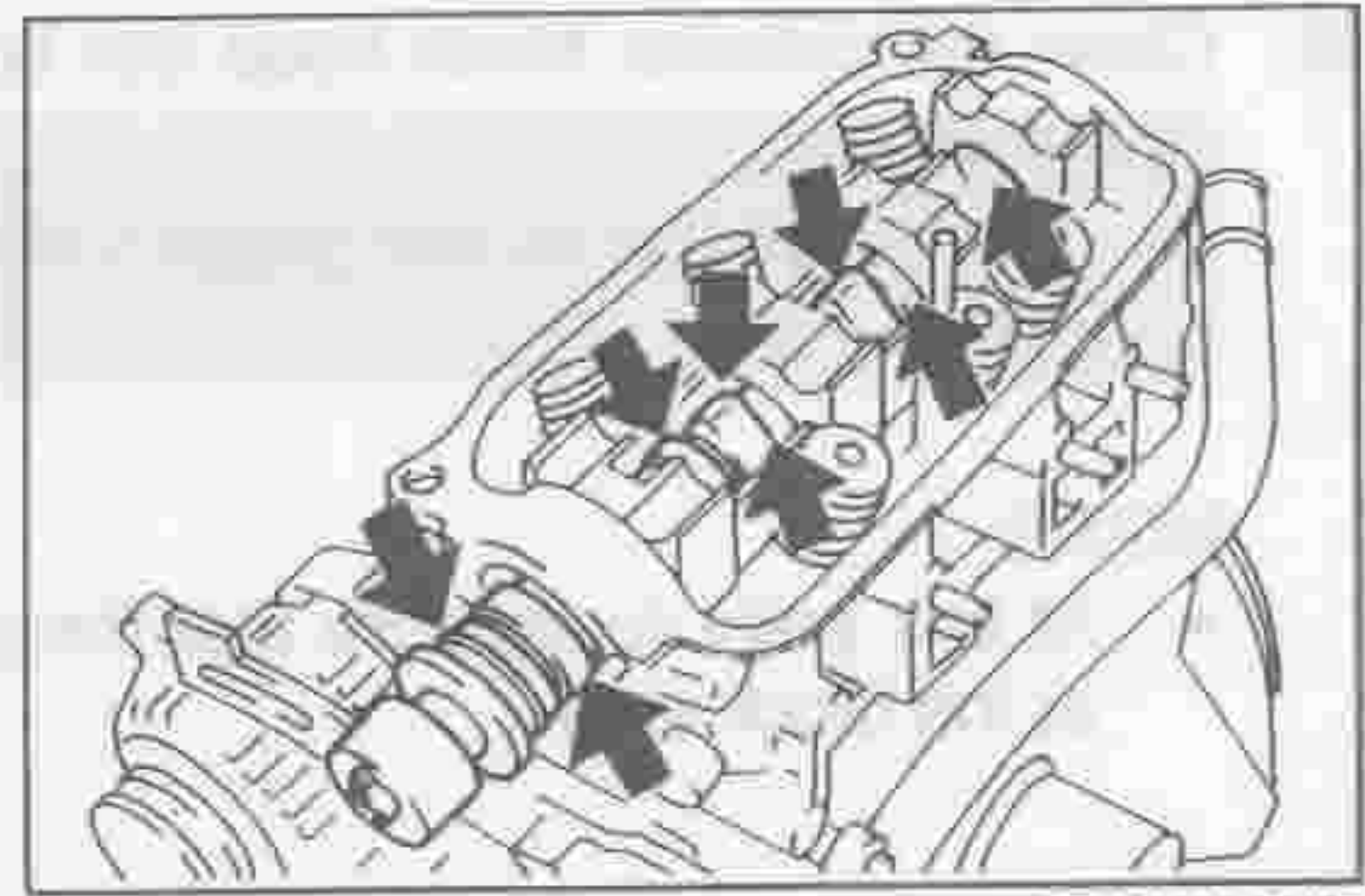
LEM00205-00186

# EM-52

- Make sure that all the bolts are tightened uniformly to a constant level, not only they are tightened within the specified torque.

## 22. Installation of camshaft

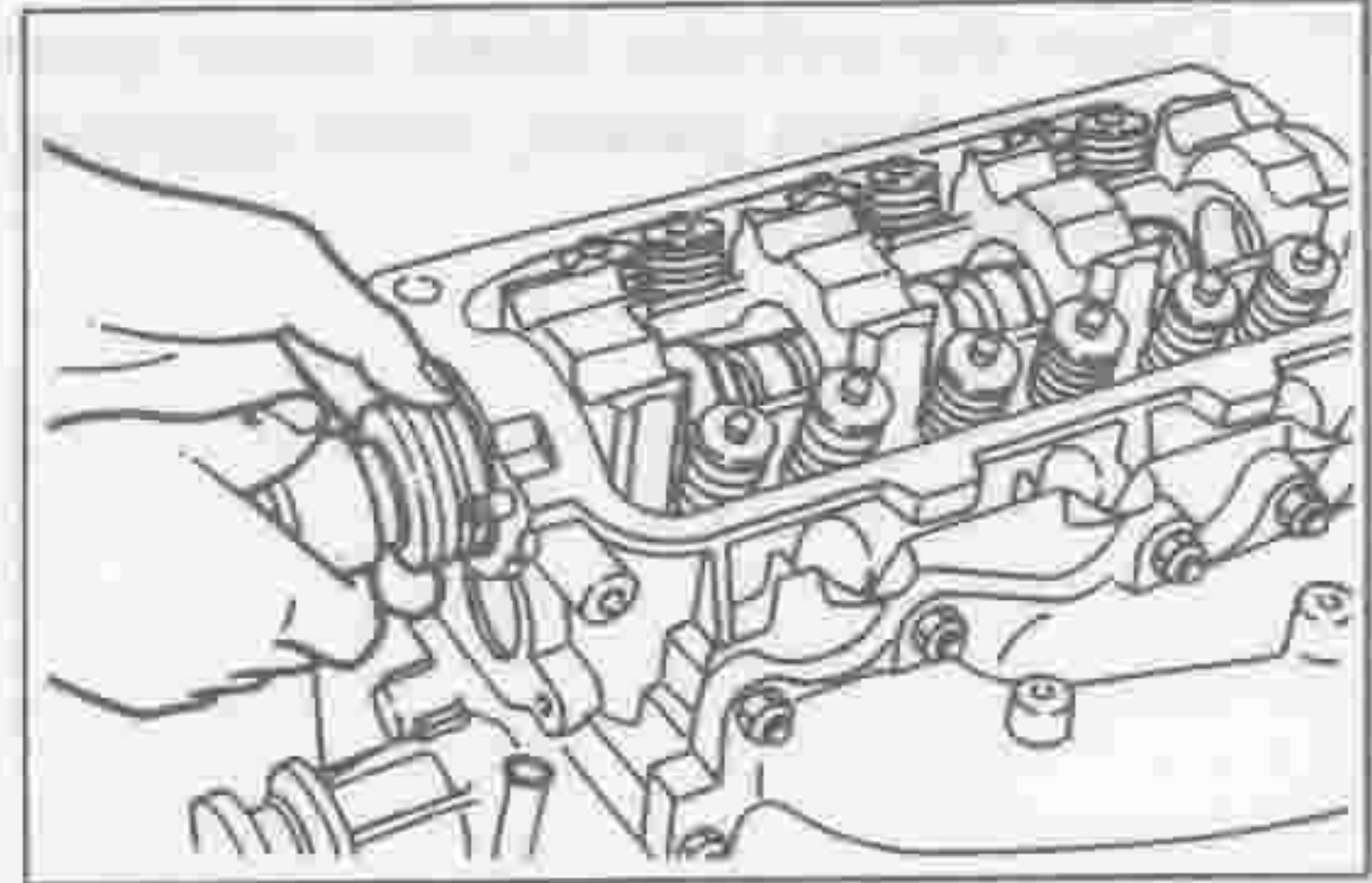
- (1) Apply engine oil to the camshaft journal section of the cylinder head as well as to the journal section of the camshaft.



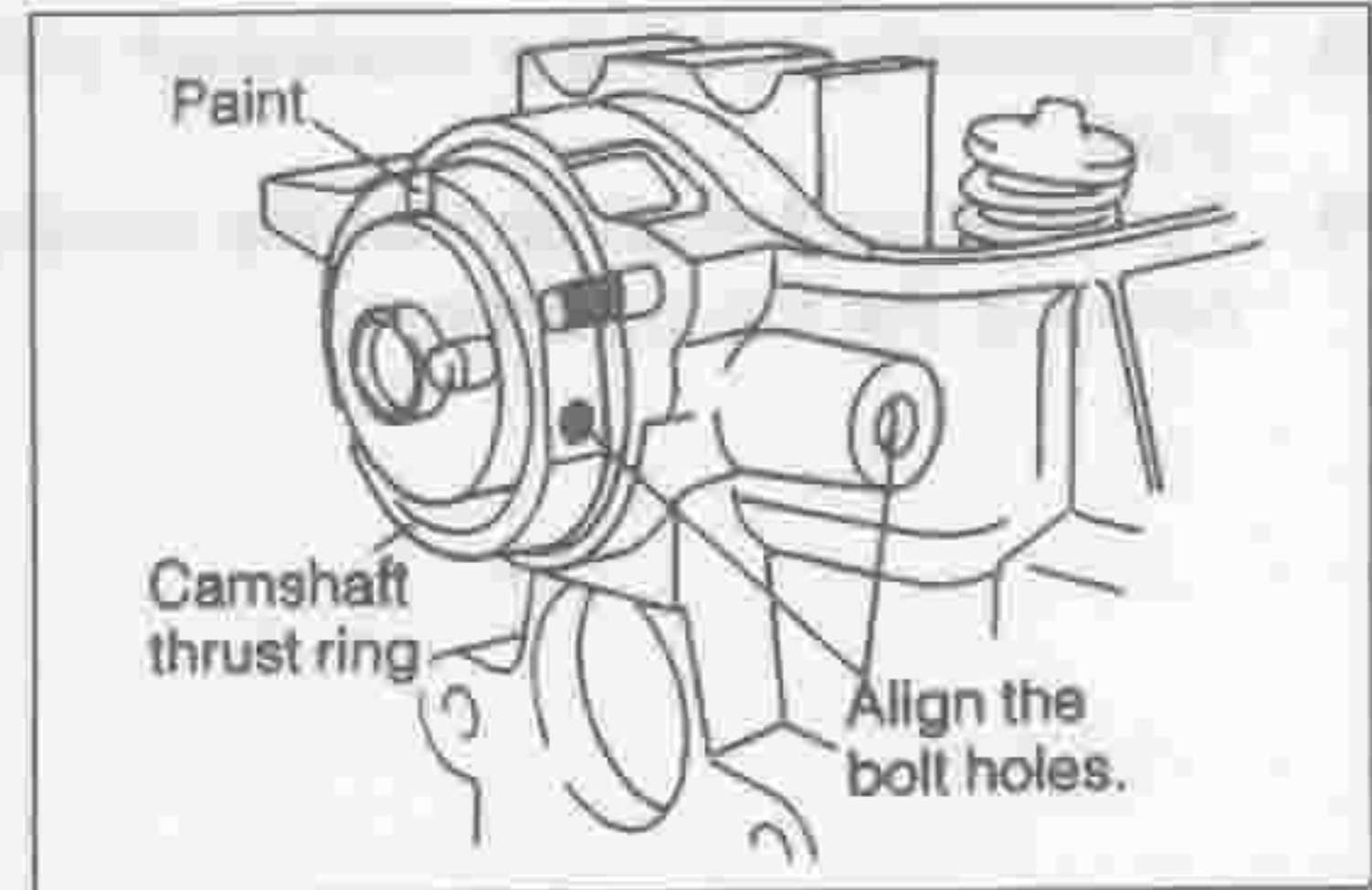
- (2) Insert the camshaft into the cylinder head.

### NOTE:

- Be very careful not to damage the camshaft journal section during the assembly.

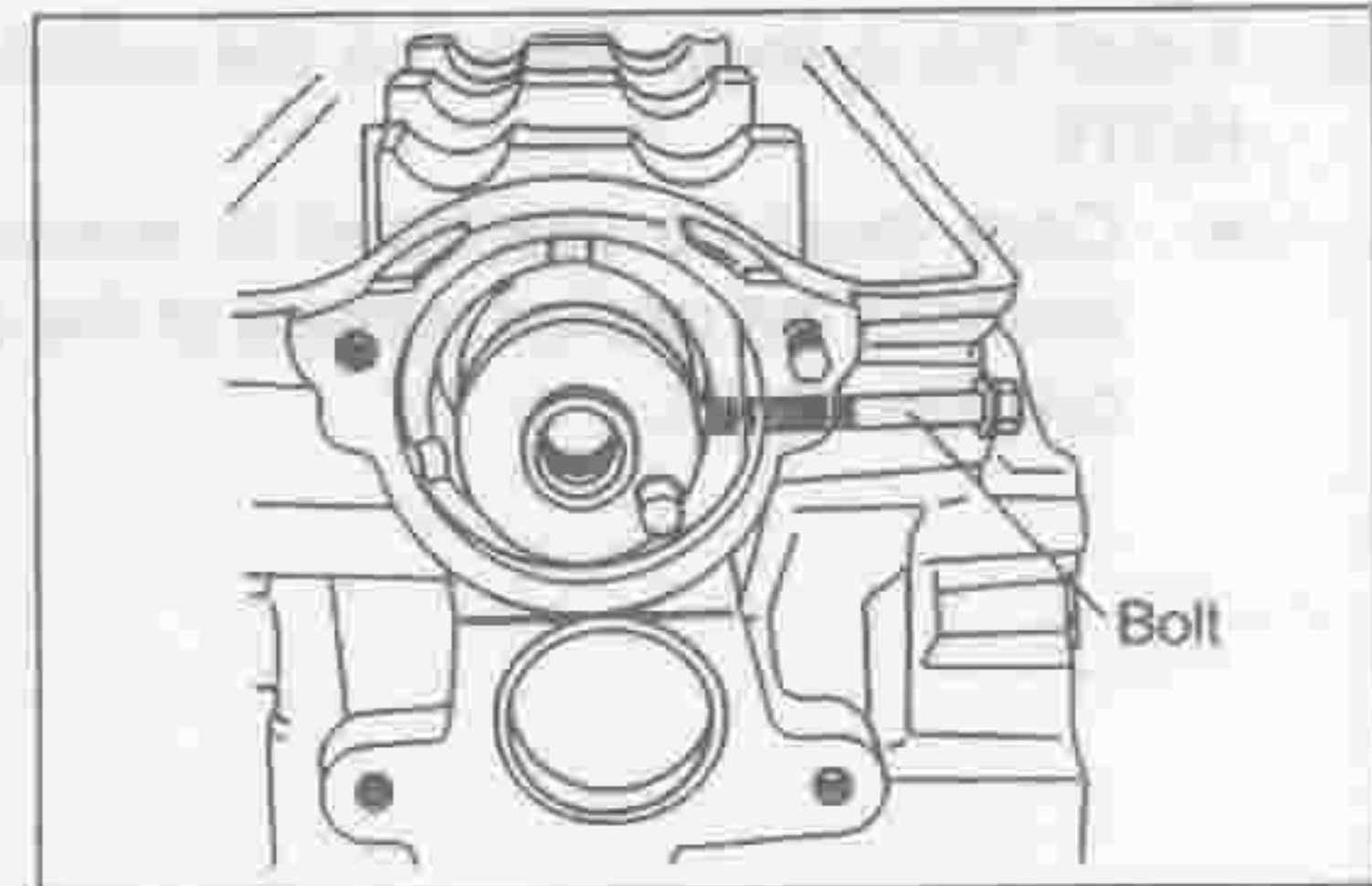


- (3) Install the camshaft thrust ring, while aligning its bolt hole with the camshaft thrust ring attaching bolt hole at the cylinder head.



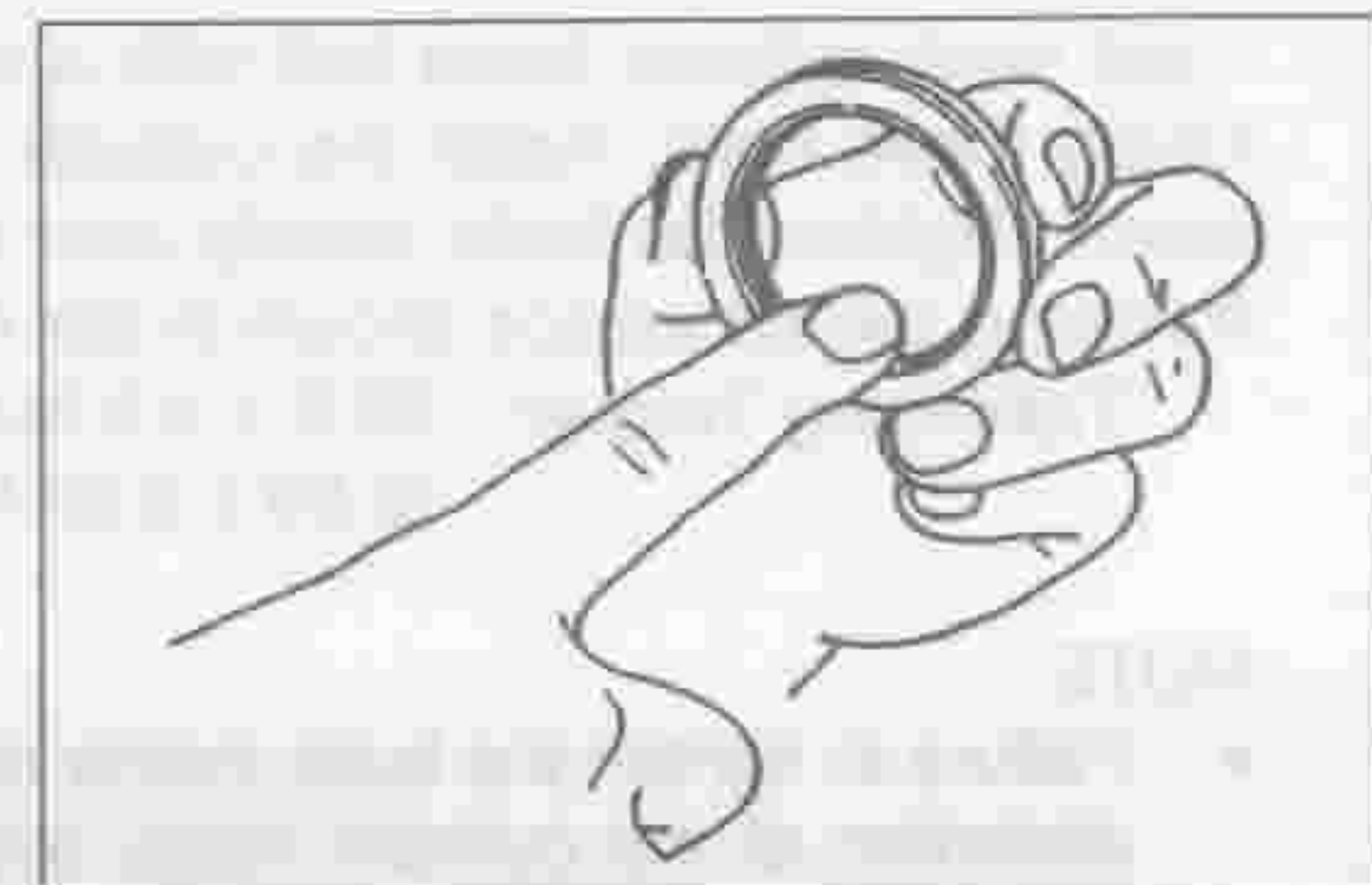
- (4) Install the camshaft thrust ring attaching bolt with a gasket interposed.

Tightening Torque:  $8.8 \pm 1.8$  N·m  
( $0.90 \pm 0.18$  kgf·m)



## 23. Installation of camshaft front oil seal

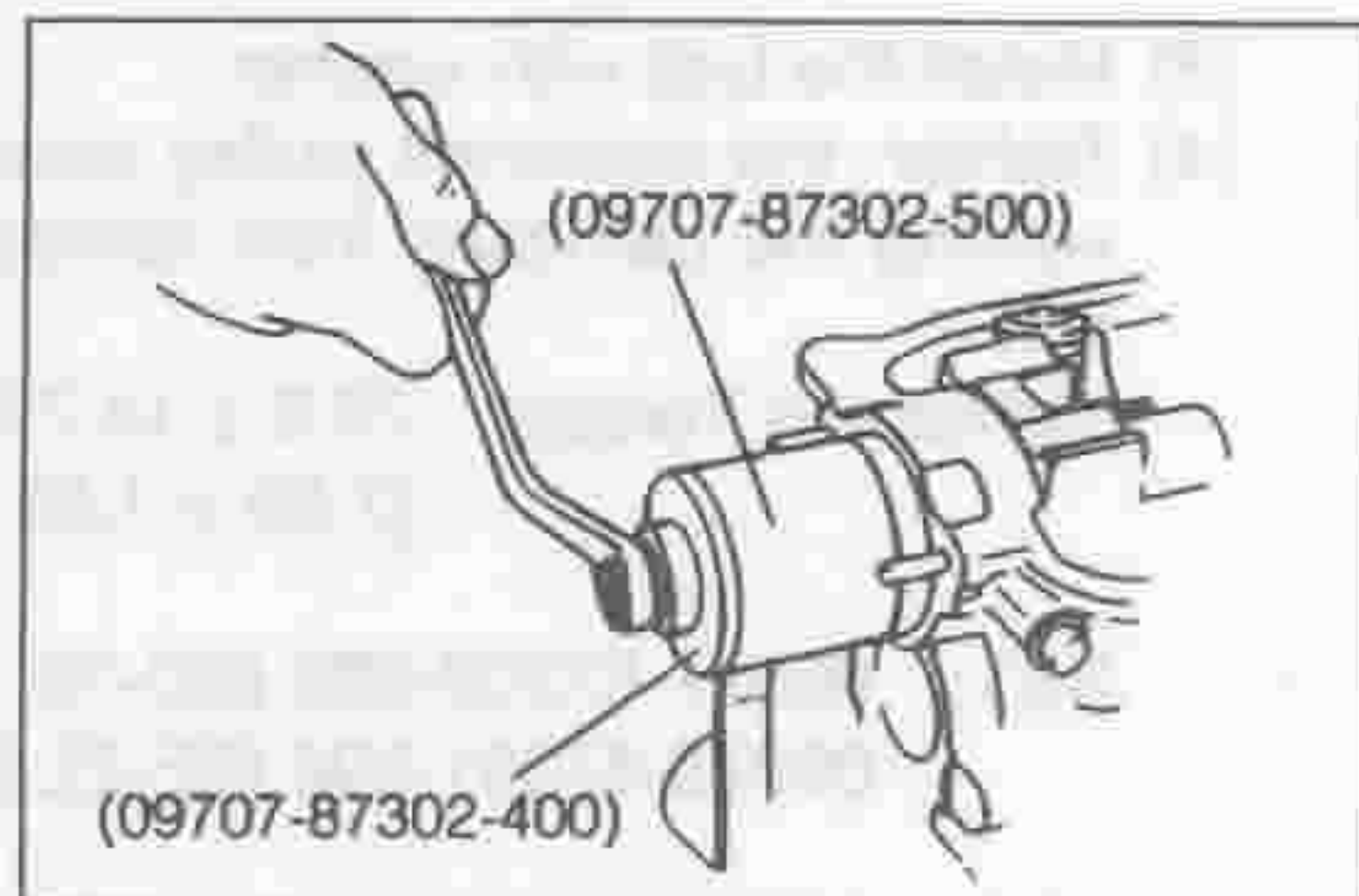
- (1) Apply engine oil to the inner surface of the camshaft front oil seal.



(2) Drive the oil seal into position with the M10 bolt in combination with the following SST.

**NOTE:**

- Be very careful not to allow the oil seal to tilt.
- SST: 09707-87302-000  
M10 Bolt:  
Pitch: 1.25 mm  
Length (Nominal effective length): 50 - 55 mm



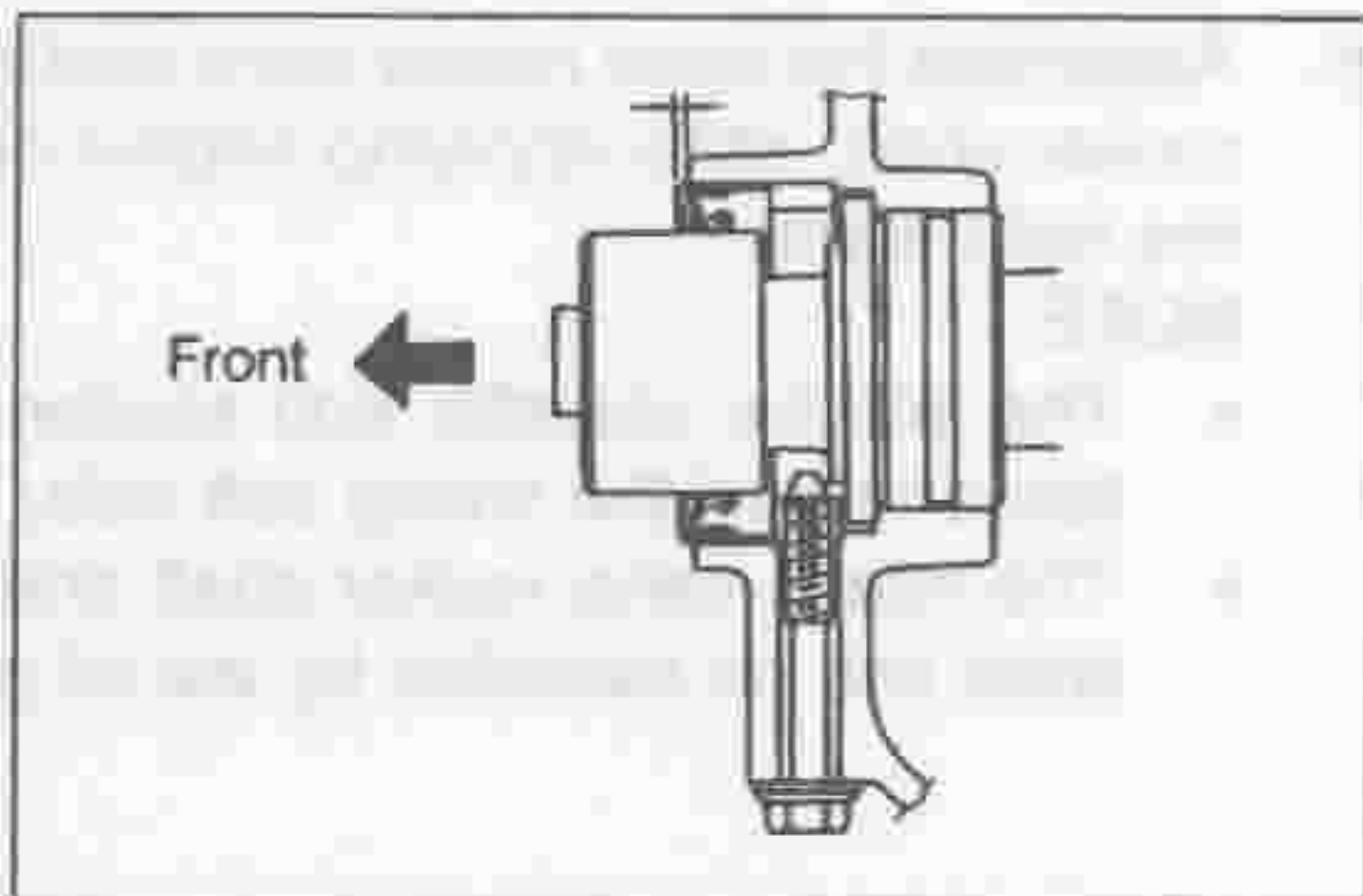
LEM00211-00192

(3) Remove the SST and bolt.

(4) Ensure that the oil seal's protrusion amount from the end surface of the cylinder head is within the specified value.

Oil Seal Protrusion Amount:  $0.20 \pm 0.25$  mm

If the protrusion amount does not meet the specification, take out the oil seal by removing the camshaft, and reassemble them. At this time, be sure to apply silicone bond to the periphery of the oil seal.



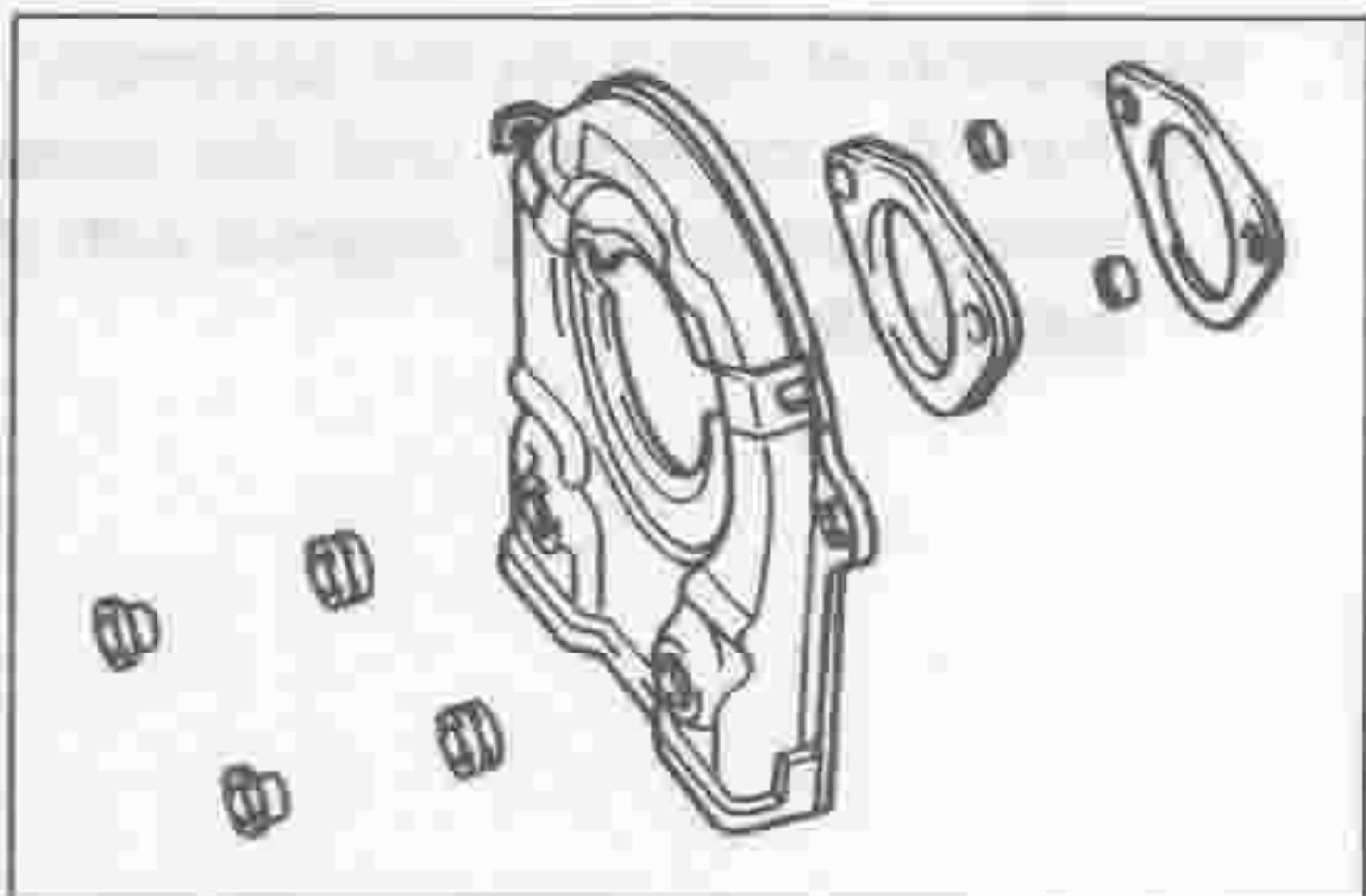
LEM00212-00193

**24. Installation of timing belt cover No. 2**

- (1) Install the oil seal plate.
- (2) Assemble the grommet No. 1 to the timing belt cover No. 2.

**NOTE:**

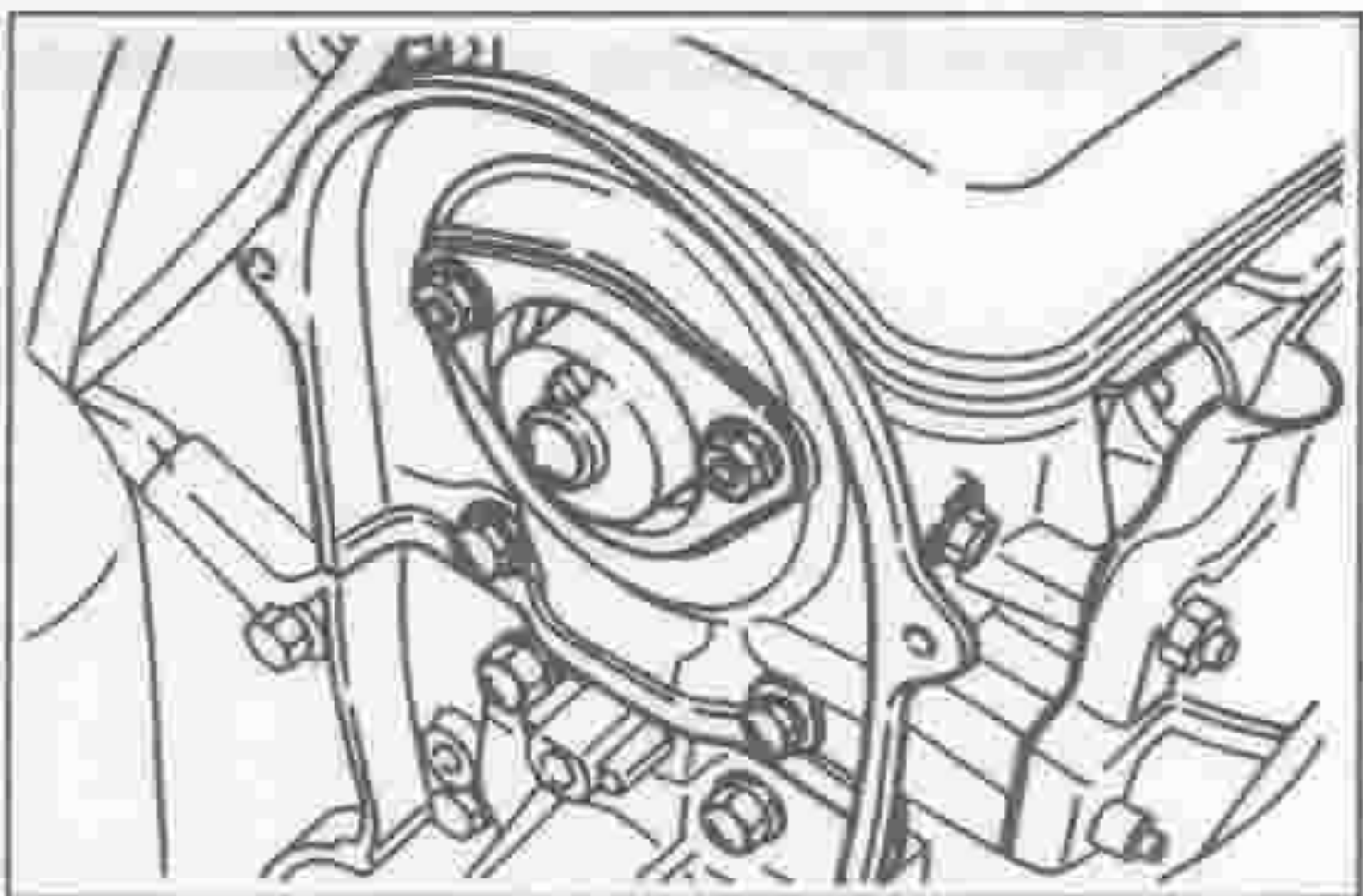
- If the grommet exhibits damage, replace it with a new part.



LEM00213-00194

- (3) Install the collars into the grommet.
- (4) Install the dust seal to the timing belt cover No. 2.
- (5) Install the timing belt cover No. 2 to the cylinder head.

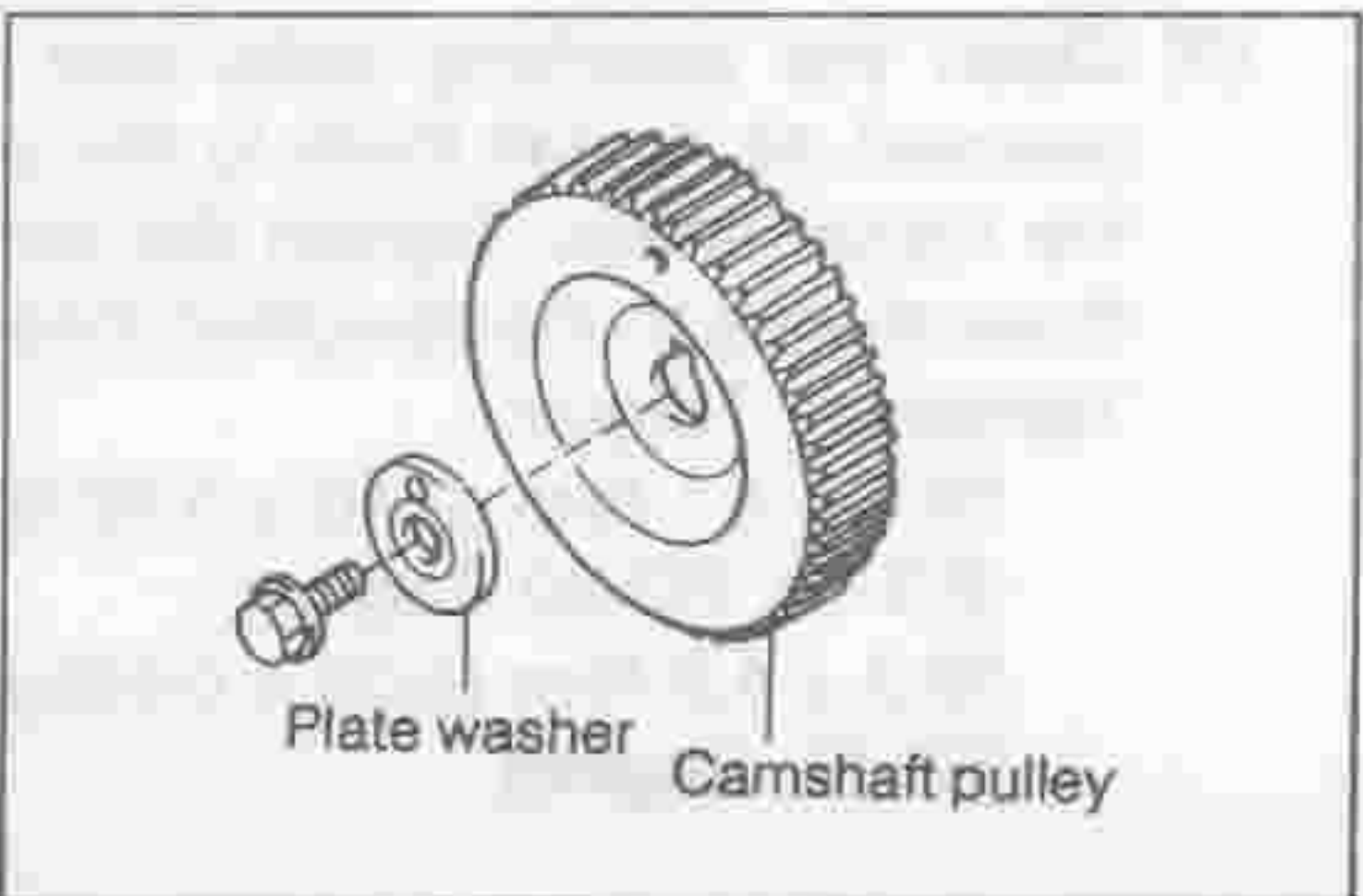
Tightening Torque:  $5.4 \pm 1.1$  N·m  
( $0.55 \pm 0.11$  kgf·m)



LEM00214-00195

**25. Installation of camshaft timing belt pulley**

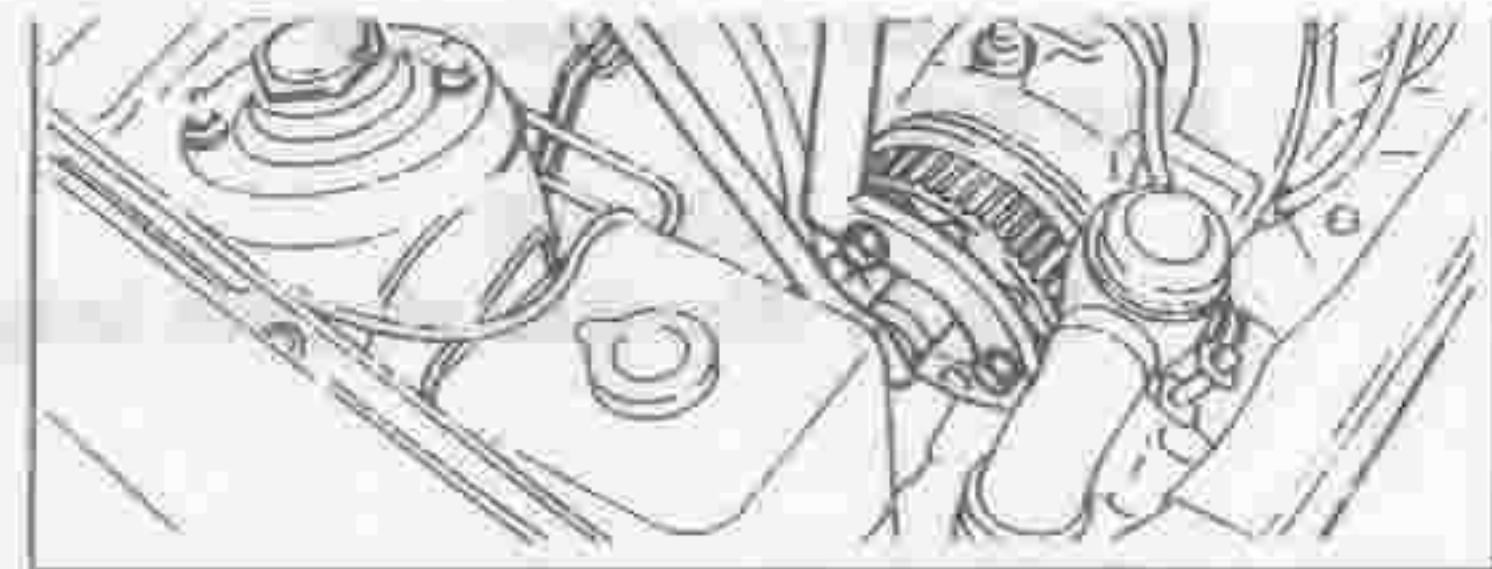
- (1) Install the camshaft pulley on the camshaft, aligning with the knock pin of the camshaft.
- (2) Install the washer plate. [ED-10, ED-20 Engine]



LEM00215-00196

Tightening torque:  $73.5 \pm 14.7$  N·m  
( $7.50 \pm 1.50$  kgf-m)

SST: 09511-87202-000 [ED-10, ED-20 Engine]  
09278-87201-000 [EF-EL Engine]

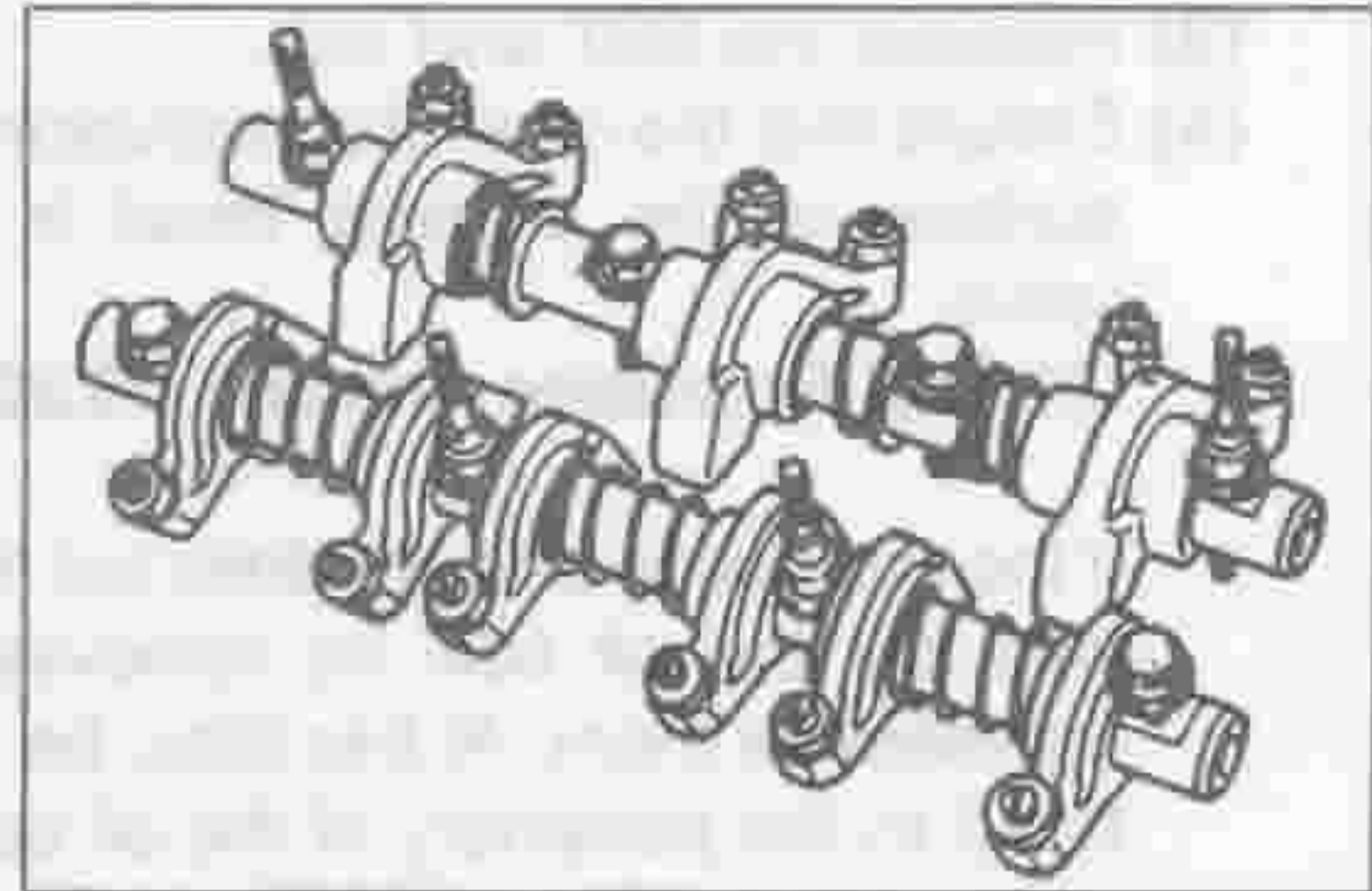


LEM00216-00197

26. Assemble the valve rocker arms and washers onto the valve rocker shaft, while applying engine oil liberally as shown in the right figure.

NOTE:

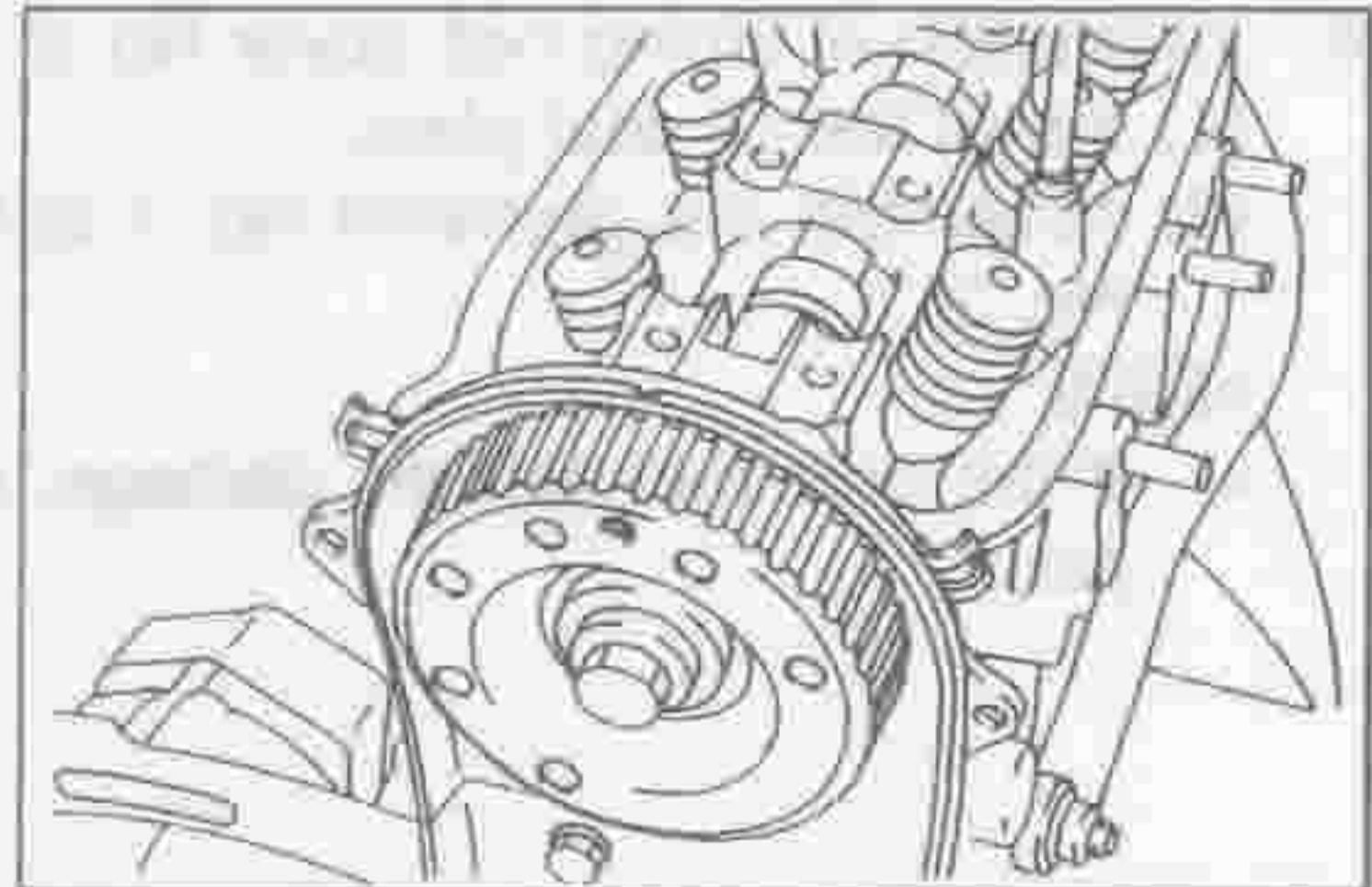
- The smaller chamfer end section of valve rocker shaft faces toward the timing belt side.
- The intake valve rocker shaft and exhaust valve rocker shaft can be identified by the oil passage position.



LEM00217-00198

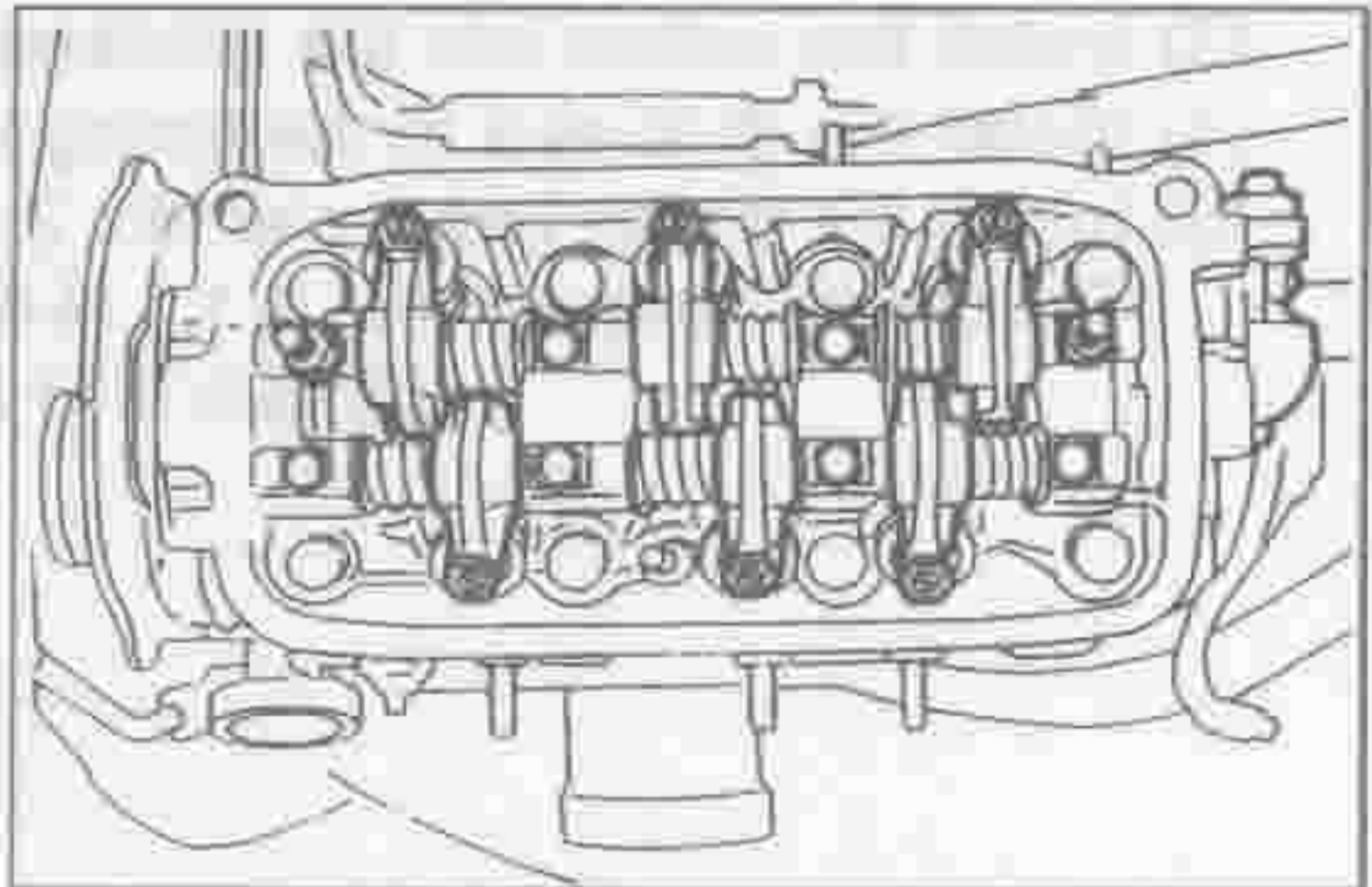
27. Installation of valve rocker assembly

- (1) Turn the camshaft until the pressed line mark on the timing belt cover is aligned with the drilled mark on the camshaft.



LEM00218-00199

- (2) Place the rocker arm assemblies on the cylinder head.



LEM00219-00200

- (3) Clean the attaching bolts and dry them with compressed air. Install them to the cylinder head through the rocker shafts. Tighten the bolts evenly over two or three stages to the specified torque.

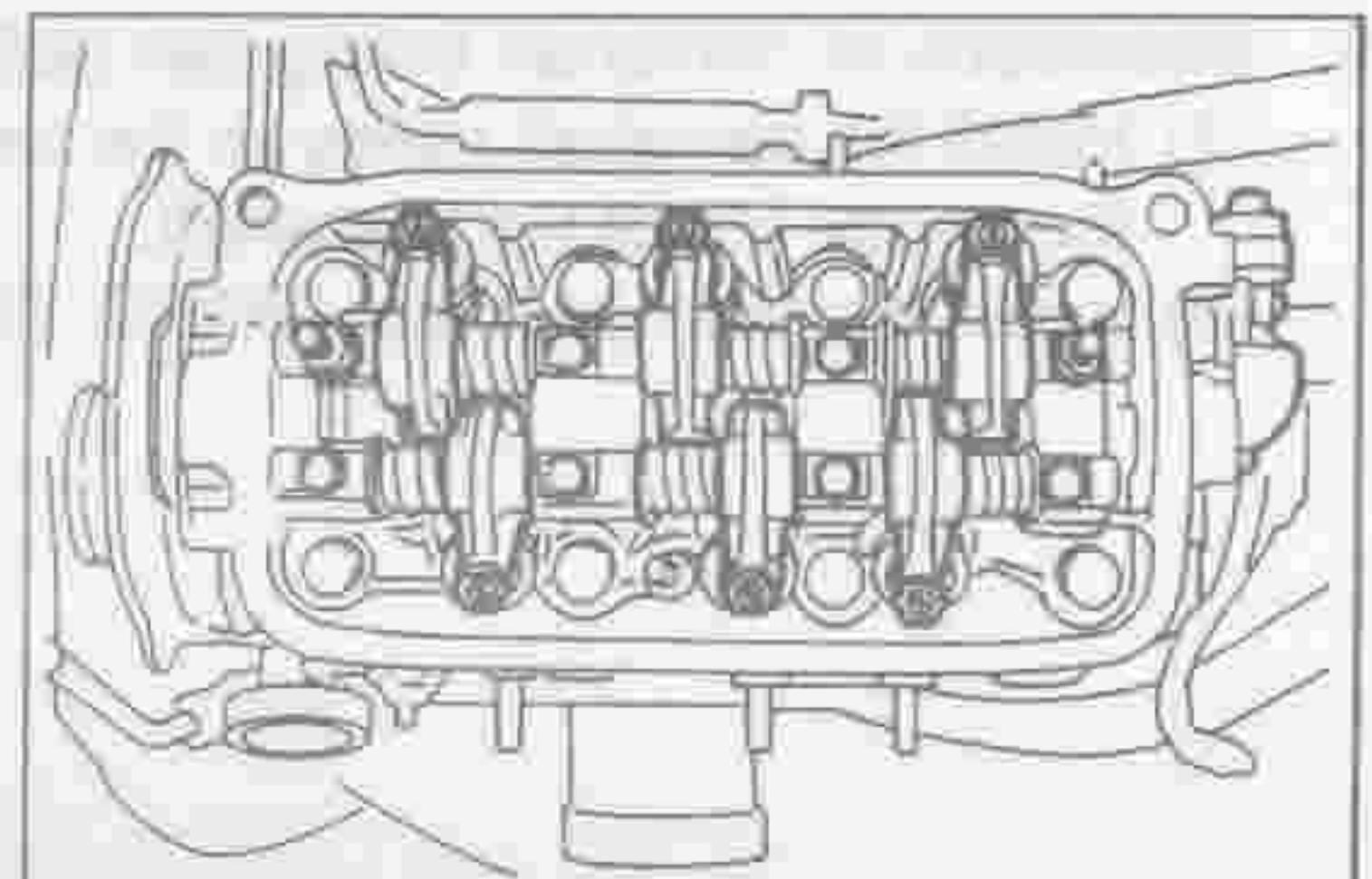
Tightening Torque:

$20.6 \pm 4.1$  N·m ( $2.10 \pm 0.42$  kgf-m)

[ED-10, ED-20 Engine]

$39.2 \pm 4.9$  N·m ( $4.00 \pm 0.50$  kgf-m)

[EF-EL Engine]



LEM00220-00201

## NOTE:

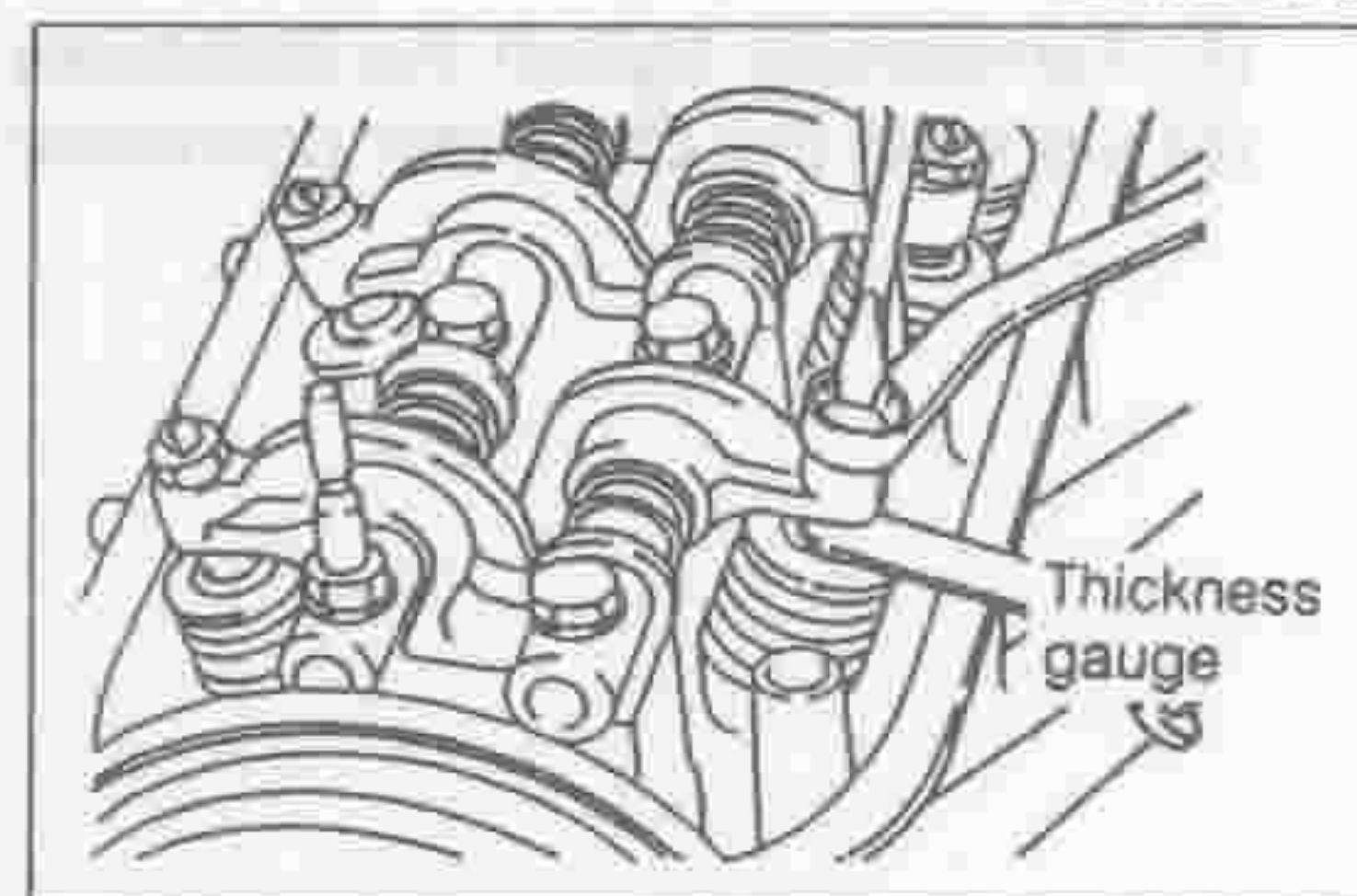
- Take a measure so as to prevent the camshaft from turning.
- Never exceed the specified tightening torque.
- The bolts and bolt holes should be dry when tightening the bolts.

## WARNING:

- When using compressed air, protect your eyes with safety goggles.

- (4) Adjust the valve clearances.
- (5) Apply about 50 cm<sup>3</sup> of engine oil to the camshaft section at the upper surface of the cylinder head.

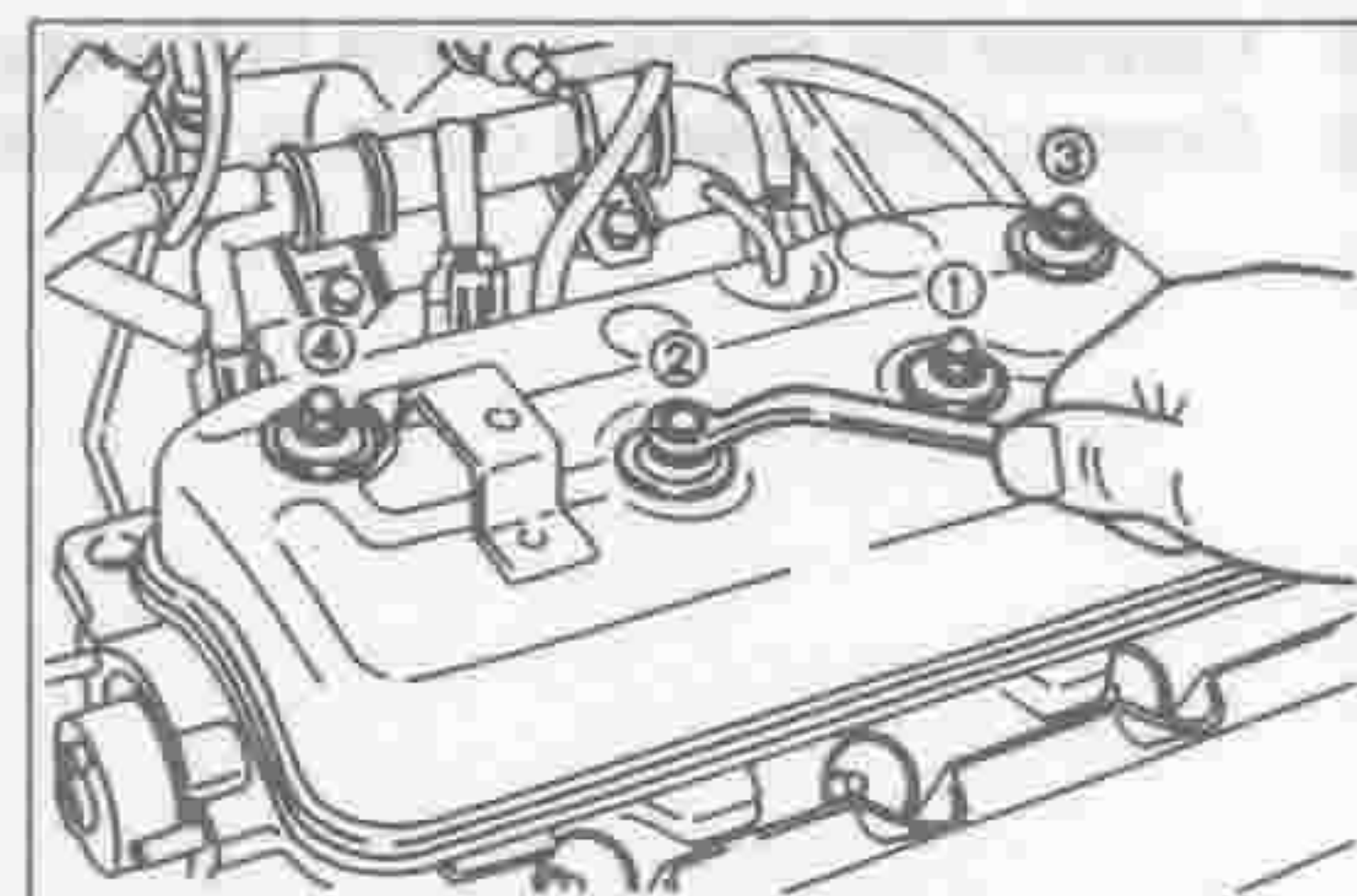
LEM00221-00000



LEM00222-00202

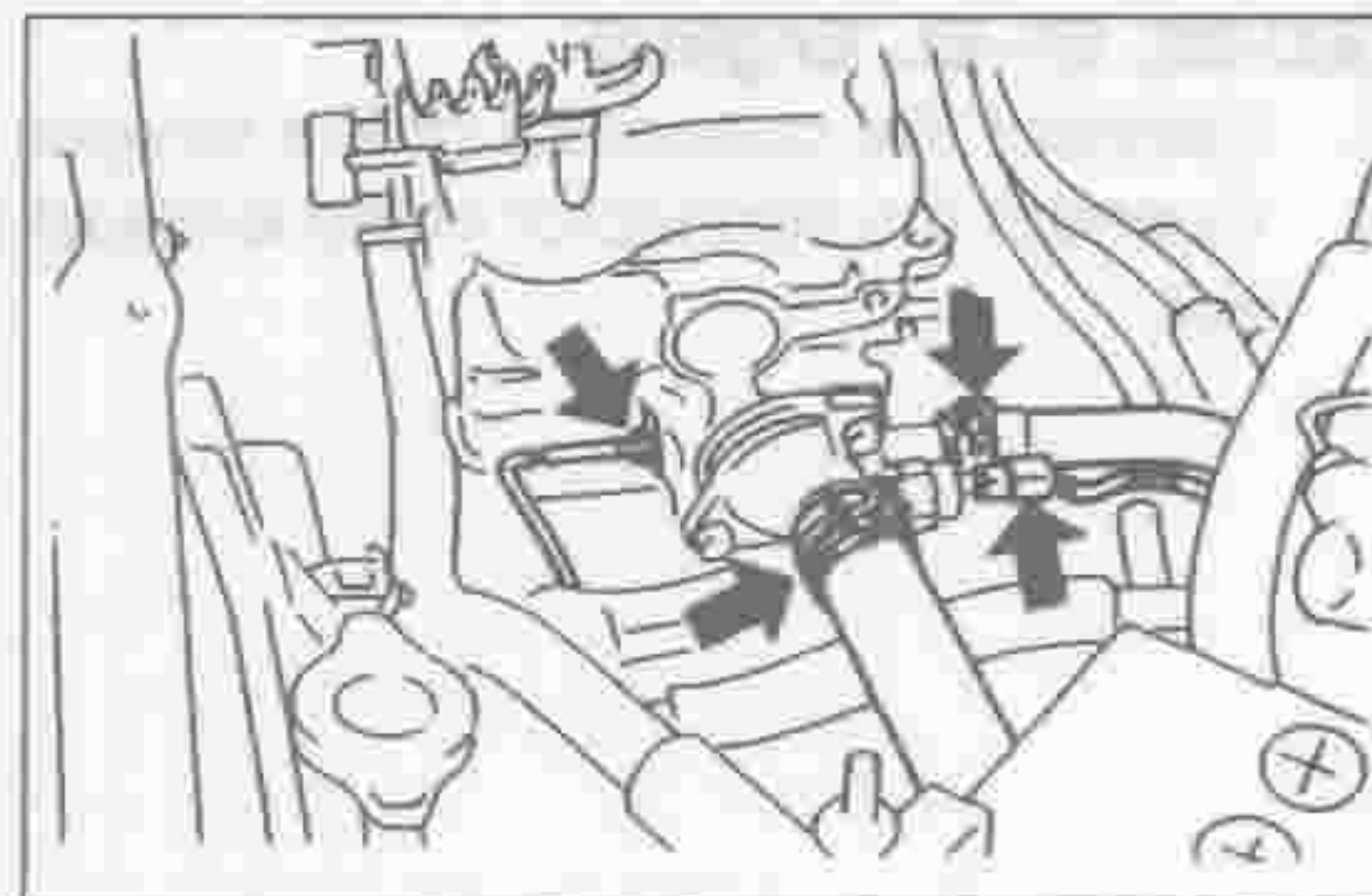
- (6) Install the cylinder head cover on the cylinder head. Tighten the cylinder head cover nuts over two or three stages in the sequence shown in the right figure, until they are tightened to the specified torque.

Tightening Torque:  $5.4 \pm 1.1$  N·m  
( $0.55 \pm 0.11$  kgf·m)



LEM00223-00203

28. Connect the water hoses and attach new hose bands.
29. Connect the fan motor switch connector.
30. Connect the water temperature sender gauge connector.



LEM00224-00204

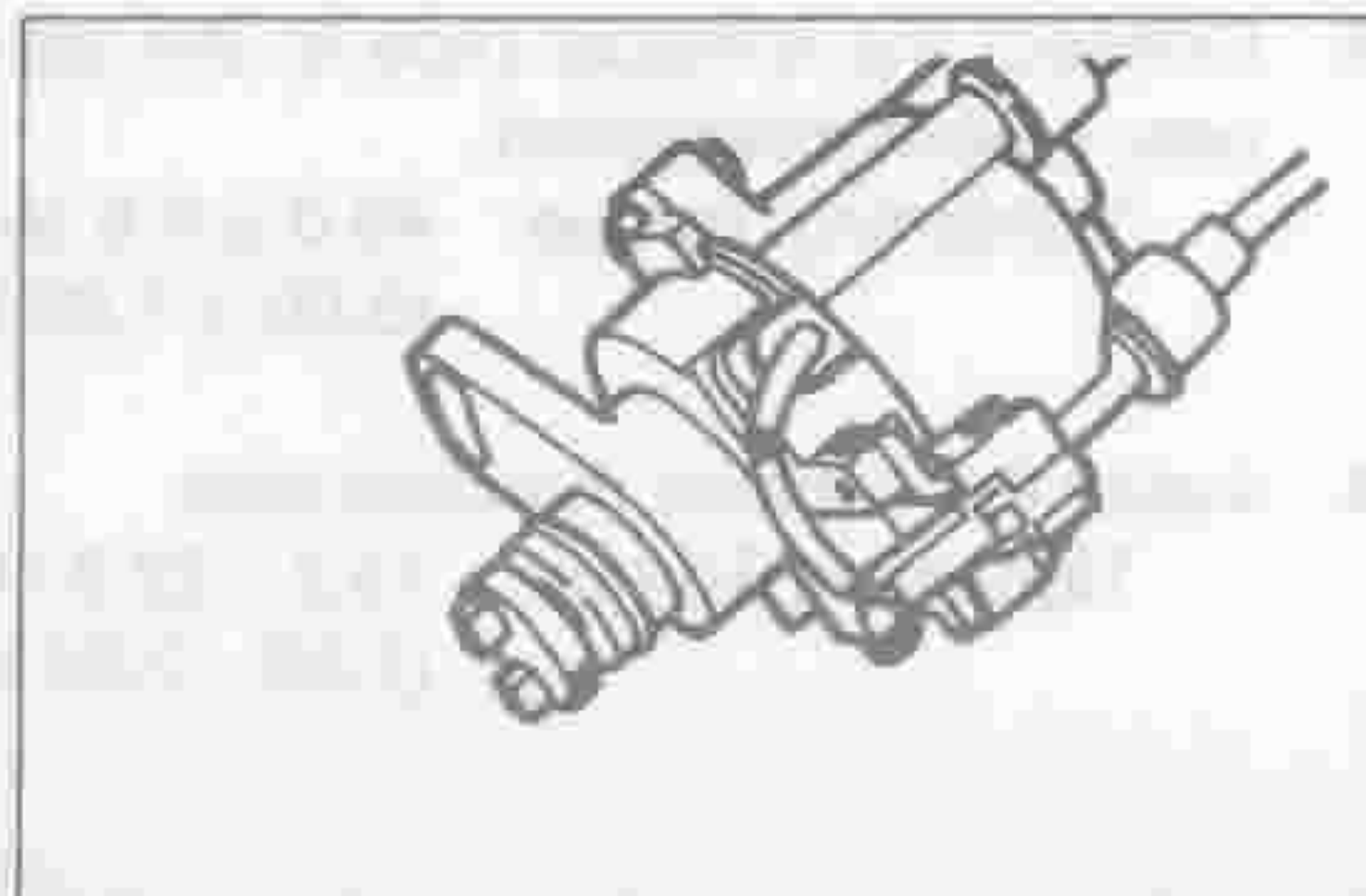
## 31. Installation of distributor

- (1) Replace the O-ring of the distributor body with a new one.

## NOTE:

- Care must be exercised to avoid scratching the new O-ring.

- (2) Apply engine oil to the O-ring.
- (3) Align the cut-out section of the distributor housing with the cut-out line of the coupling.



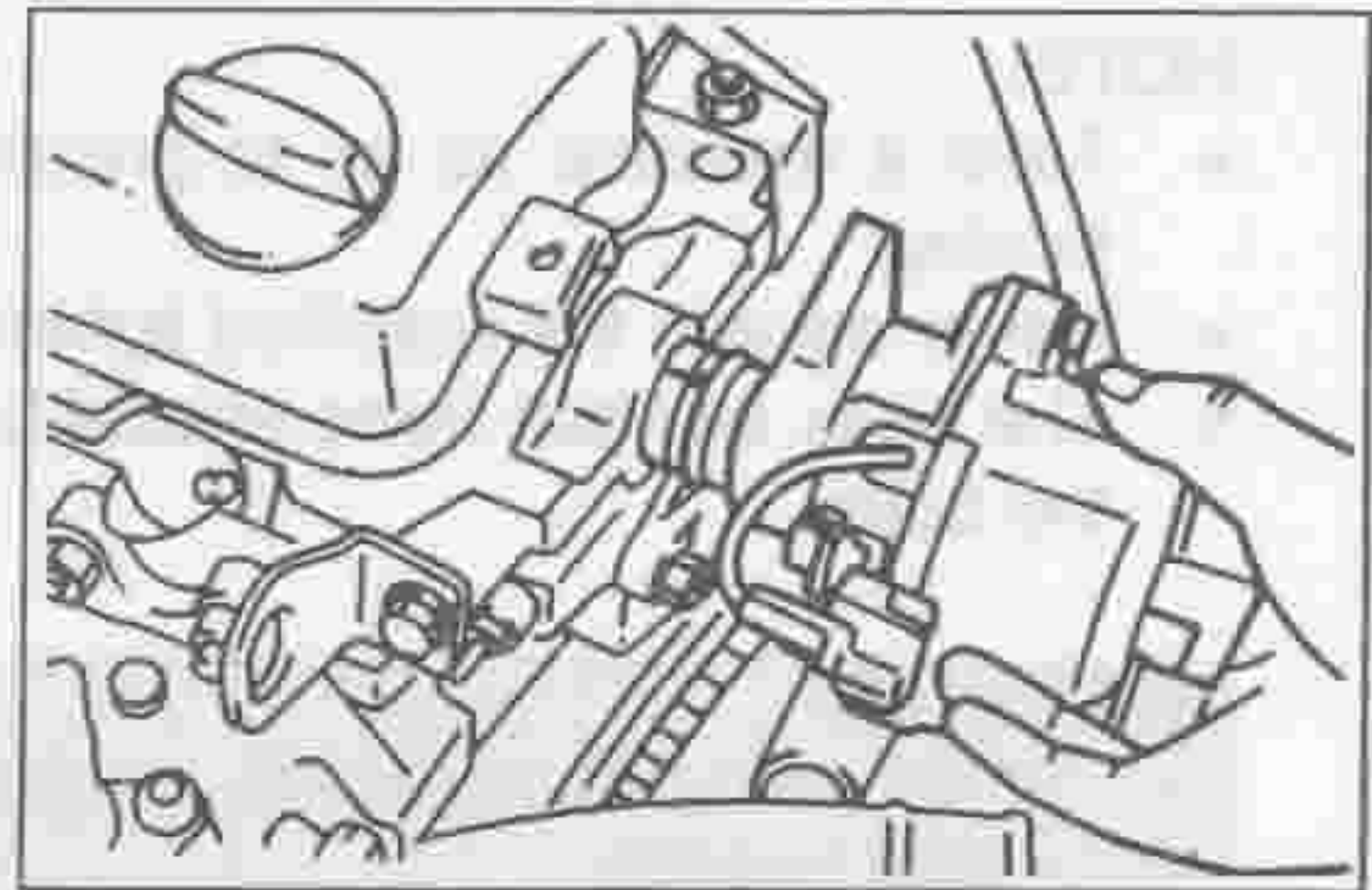
LEM00225-00205

# EM-56

- (4) Insert the distributor into the cylinder head, lining up the protrusion of the distributor with the camshaft groove. During this installation, the aligned cut-out sections must come at the top side of the engine.

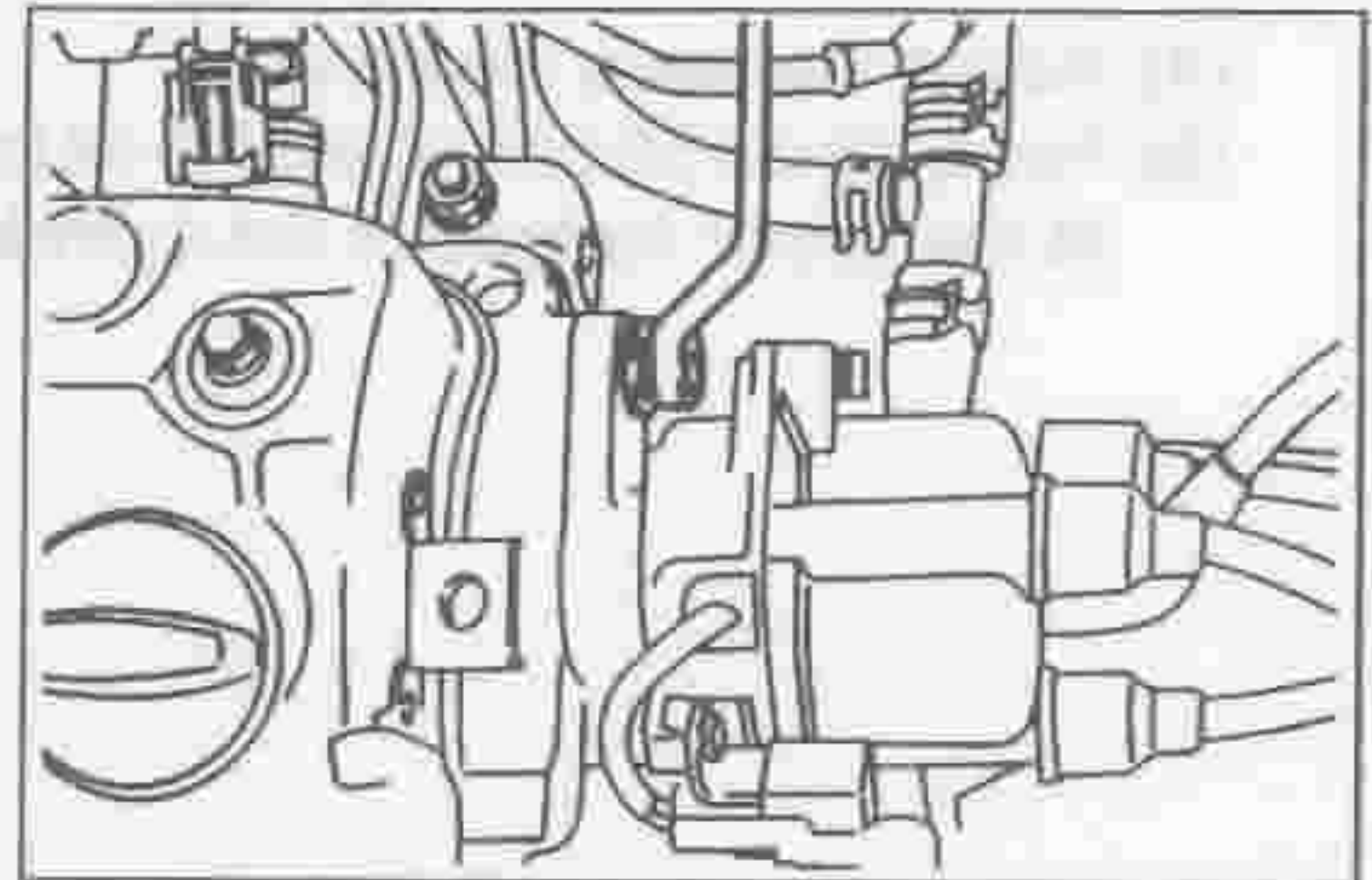
**NOTE:**

- At this time, ensure that the stamped line mark of the camshaft timing belt cover No.2 is aligned with the drilled mark of the camshaft timing belt pulley.



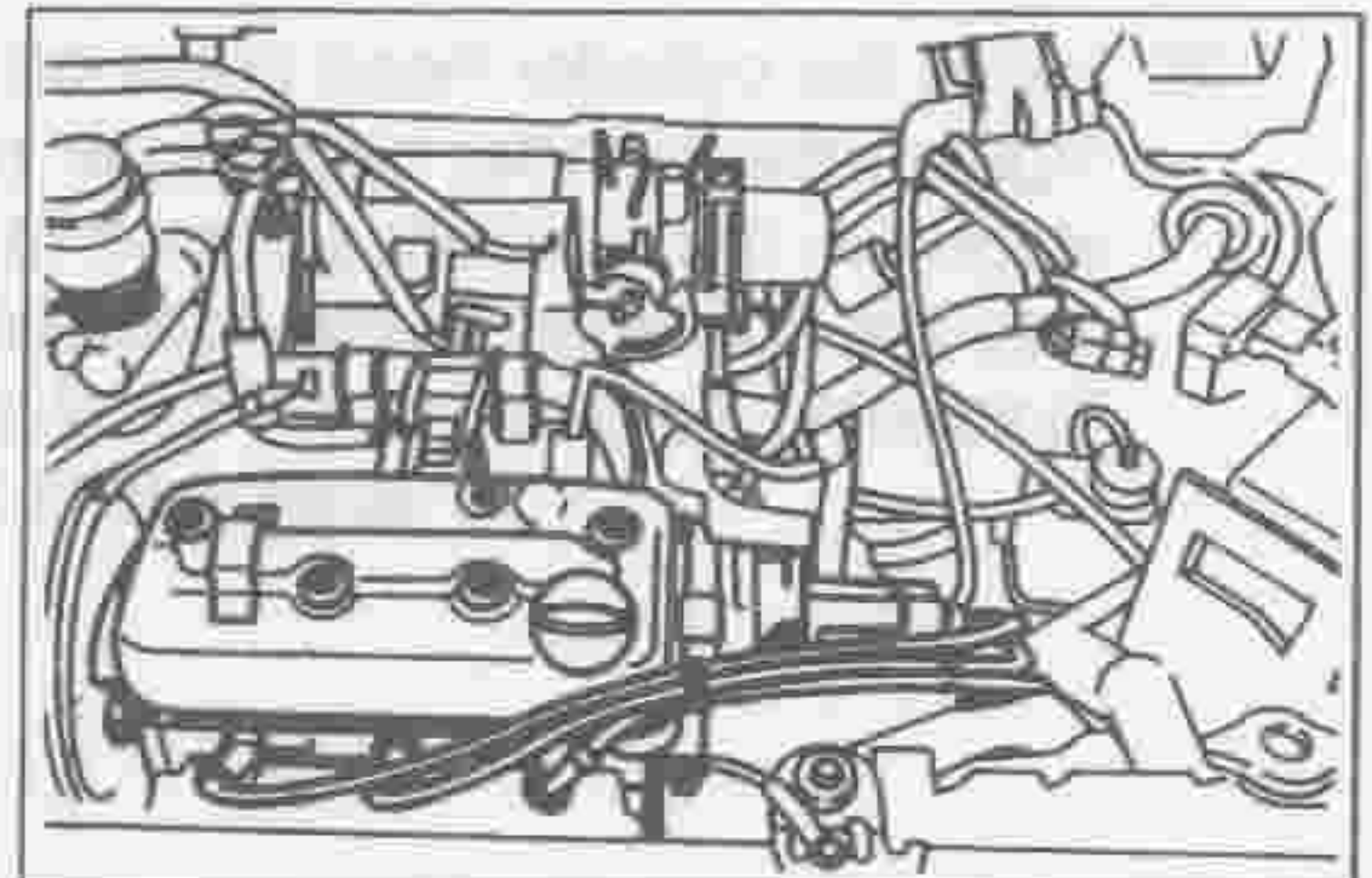
LEM00226-00206

- (5) Temporarily tighten the distributor retaining bolt.  
(6) Connect the distributor connector.



LEM00227-00207

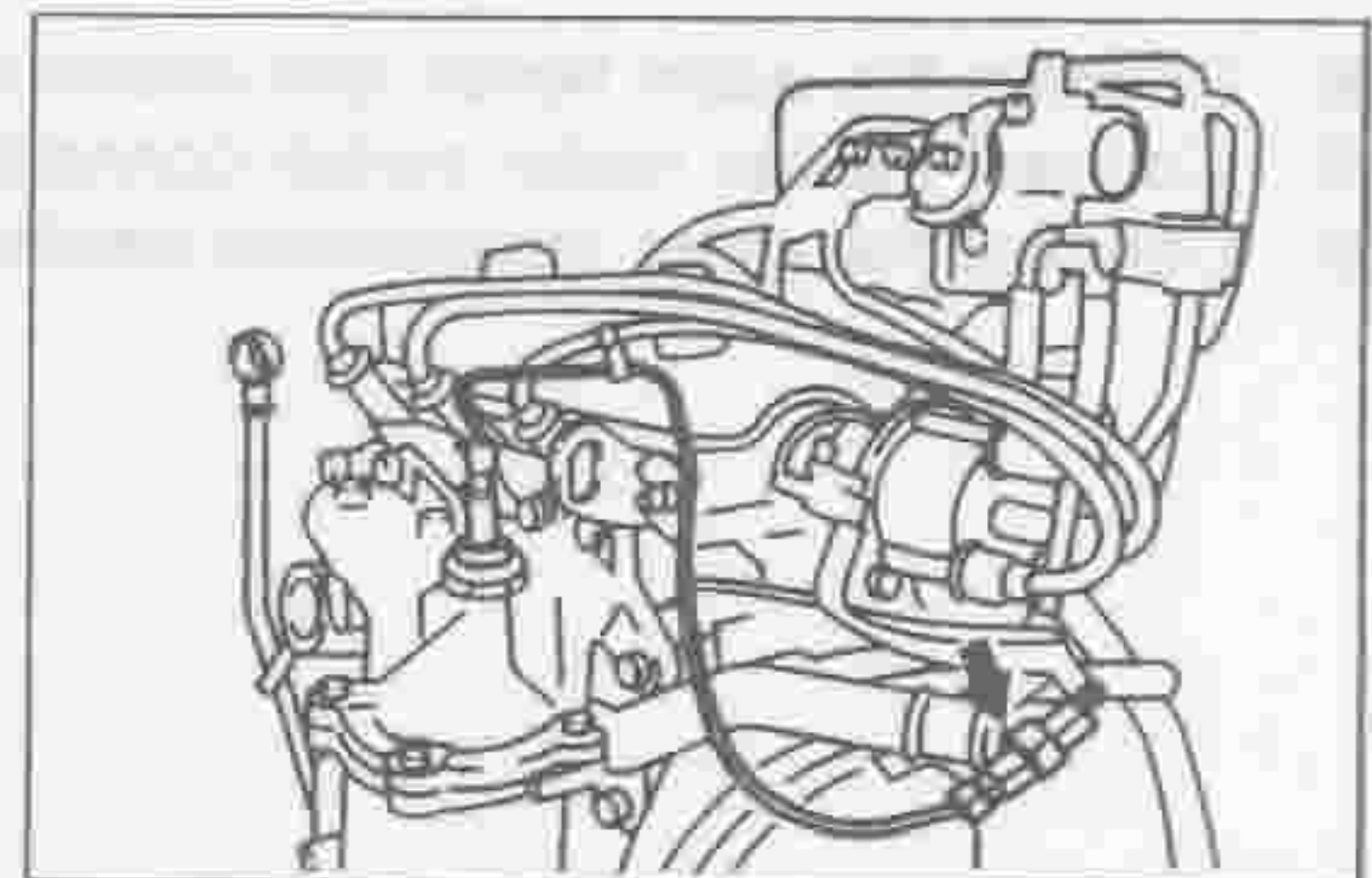
32. Connect the resistive cords to the engine.  
33. Connect the resistive cords to the clamp.



LEM00228-00208

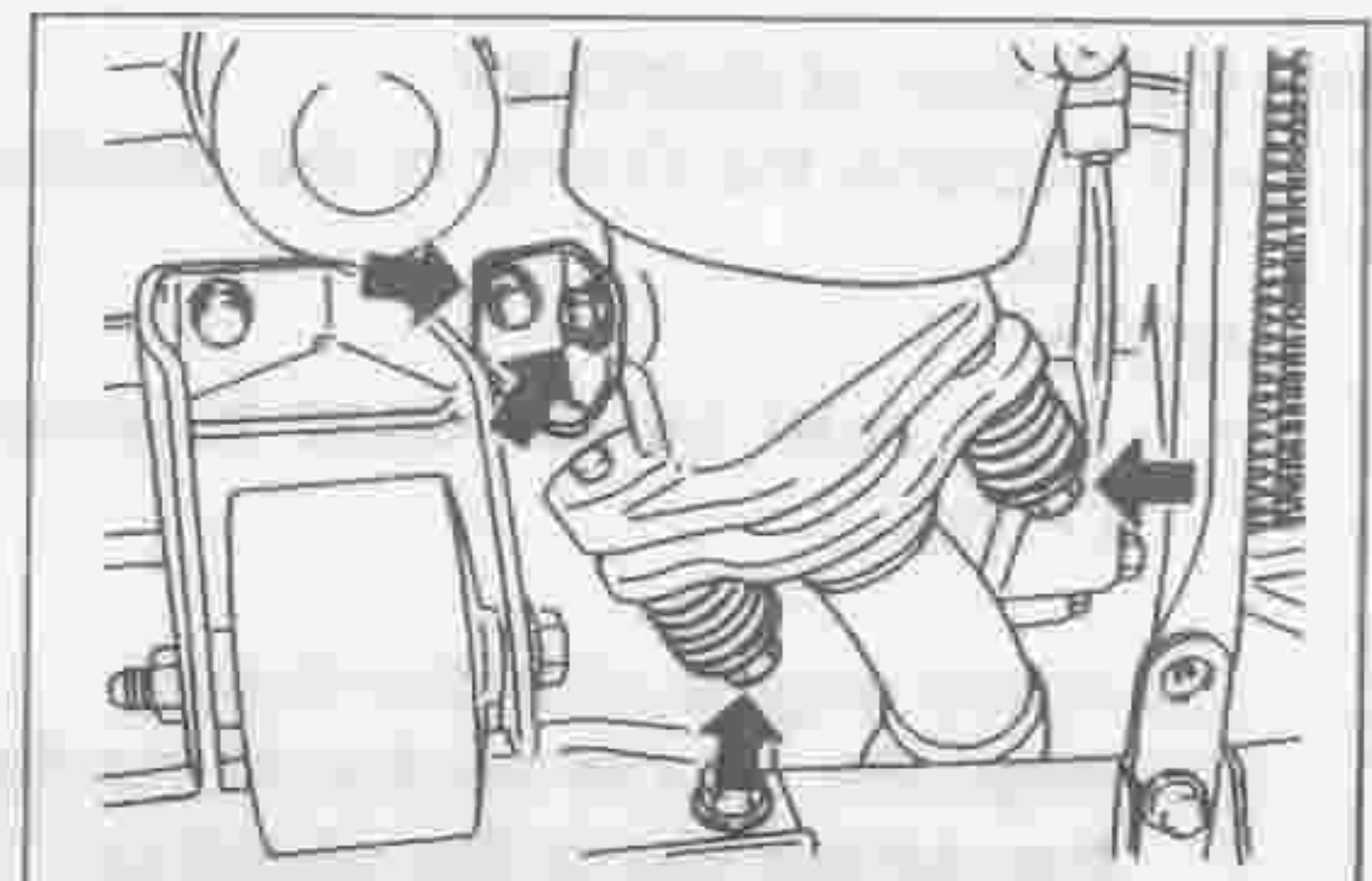
**[ED-20, EF-EL Engine]**

1. Connect the connector of the oxygen sensor.
2. Connect the connector of the exhaust gas temperature sensor.



LEM00229-00209

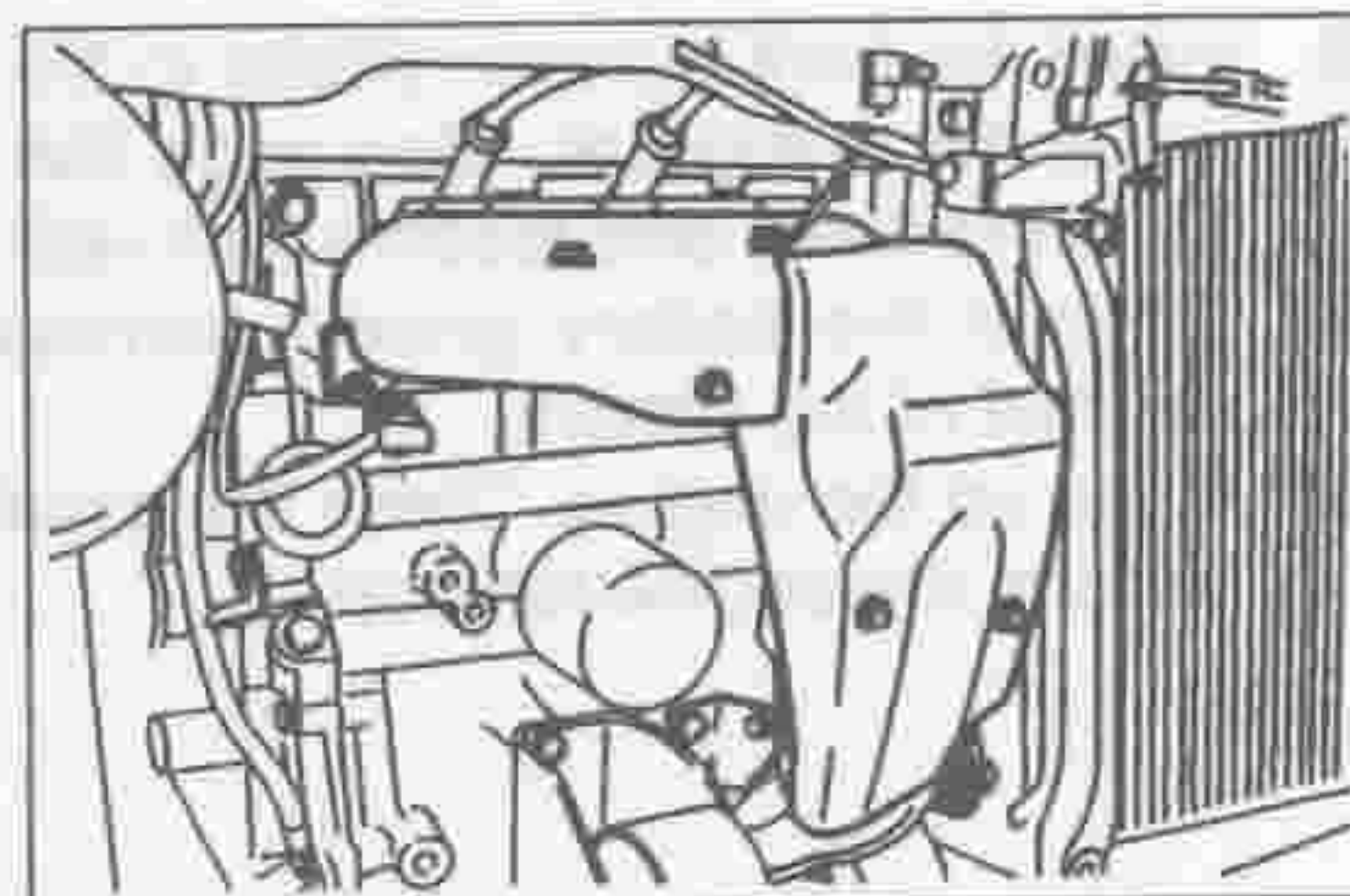
3. Connect the exhaust pipe to the exhaust manifold with a new gasket interposed.  
Tightening Torque:  $49.0 \pm 9.8$  N·m  
( $5.00 \pm 1.00$  kgf-m)
4. Install the exhaust manifold stay.  
Tightening Torque:  $15.2 - 22.8$  N·m  
( $1.56 - 2.34$  kgf-m)



LEM00230-00210

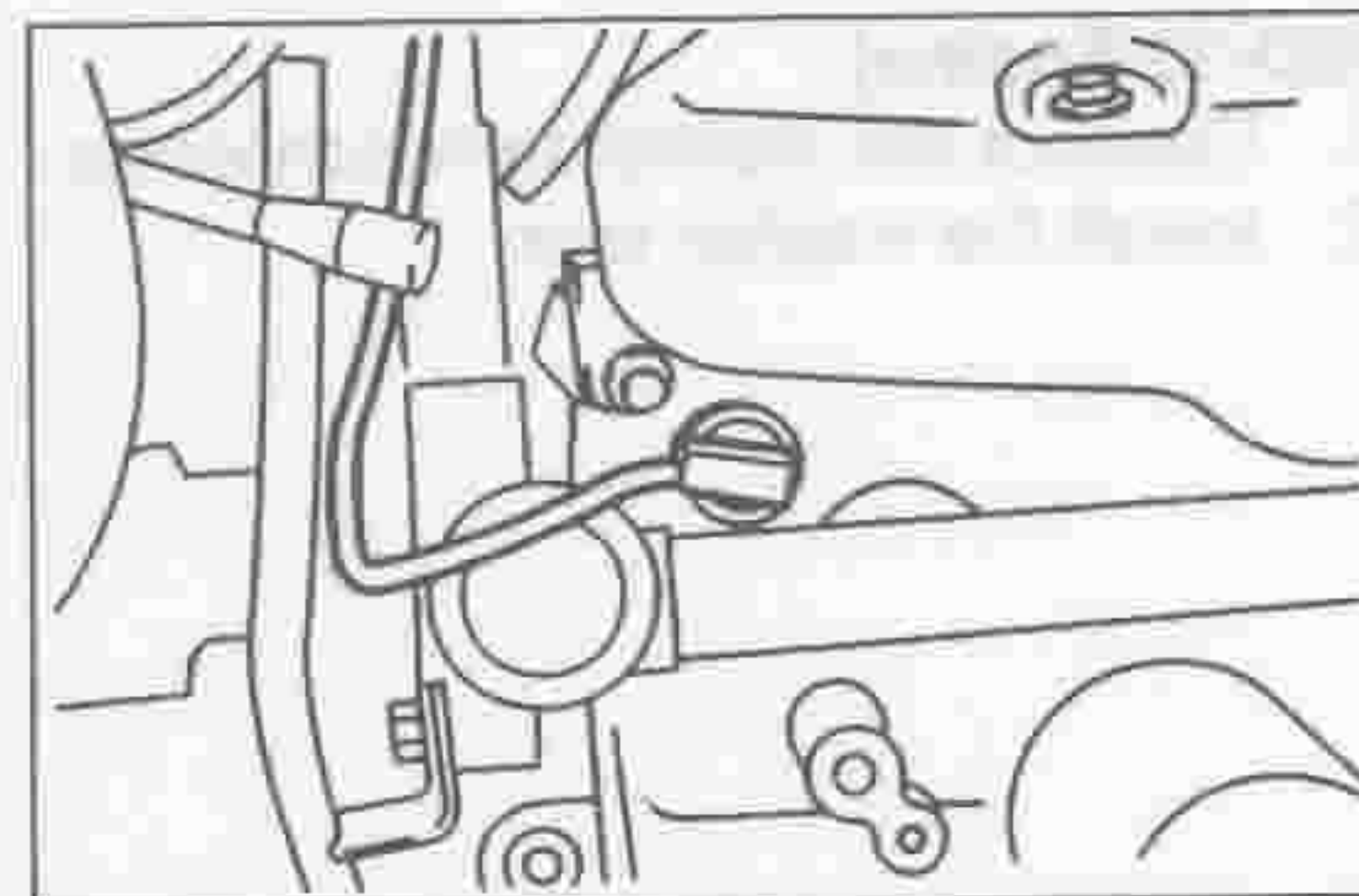


5. Install the heat insulator.  
Tightening Torque: 6.4 - 9.6 N·m  
(0.64 - 0.96 kgf·m)



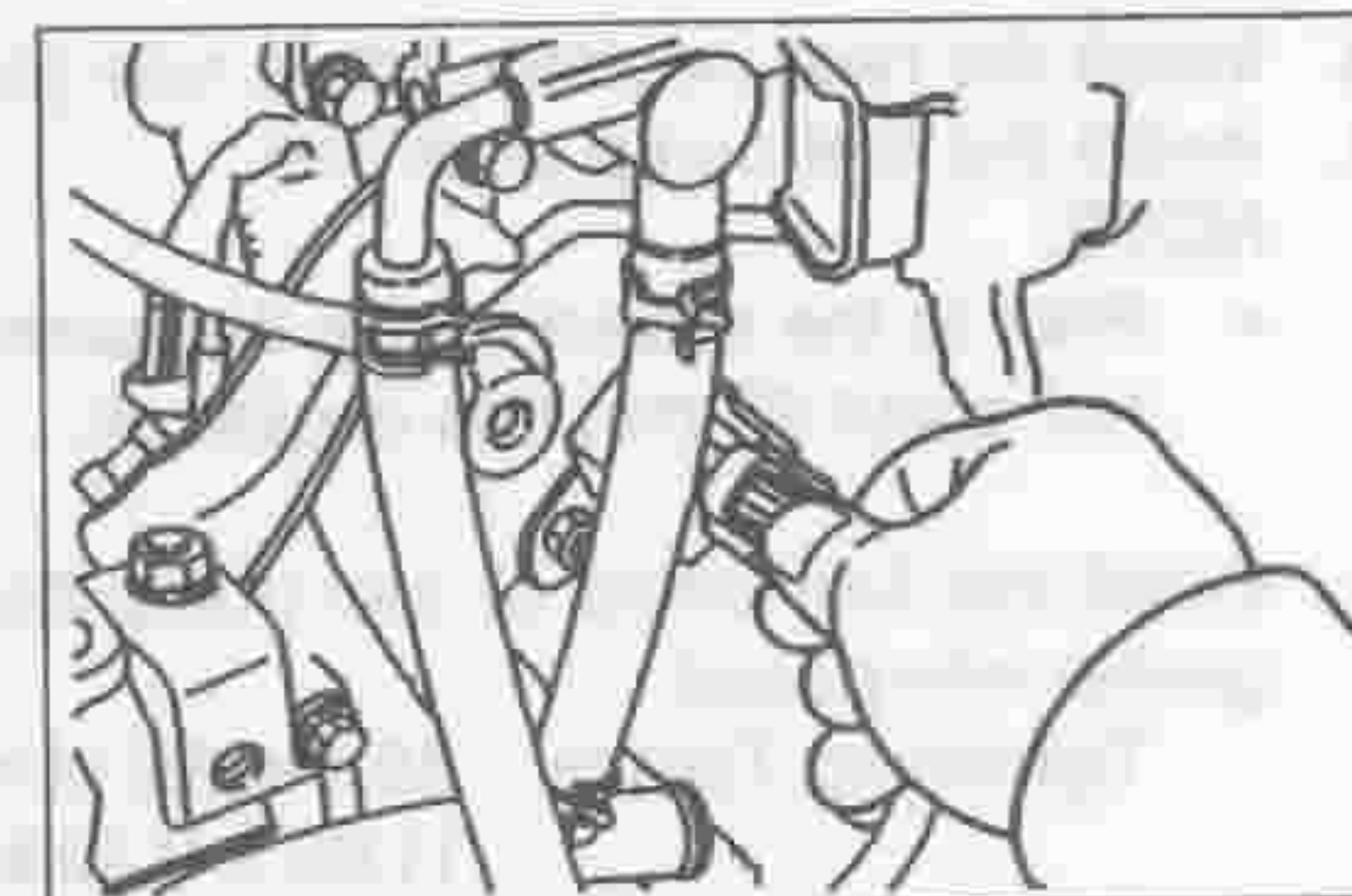
LEM00231-00211

6. Connect the fuel hose and fuel return hose to the delivery pipe.  
7. Installation of the engine wire to cylinder head related parts  
(1) Connect the connector of the oil pressure switch.  
Install the engine wire to the clamp.



LEM00232-00212

- (2) Connect the connector of the ISC VSV.  
(3) Connect the connector of the throttle position sensor.

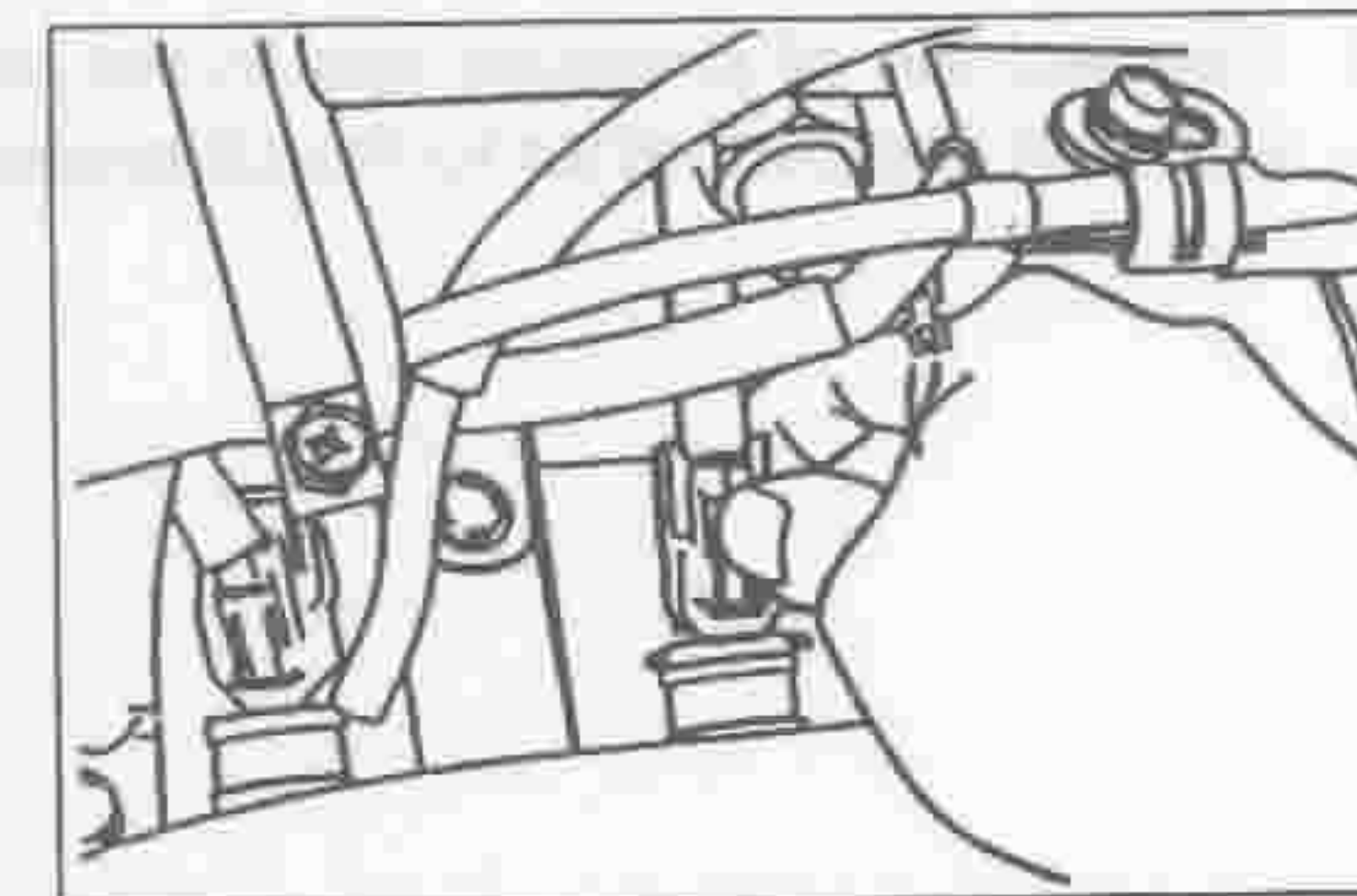


LEM00233-00213

- (4) Connect the connector of the injectors.  
(5) Connect the connector of the pressure sensor.  
(6) Connect the connector of the intake air temperature sensor. [ED-20 Engine]  
(7) Install the engine wire to the clamps.

## NOTE:

- Ensure that all connectors are securely connected.



LEM00234-00214

8. Install the following vacuum hoses to the surge tank.  
(1) For pressure sensor  
(2) For PCV  
(3) For brake booster  
(4) For ISC VSV  
(5) For charcoal canister

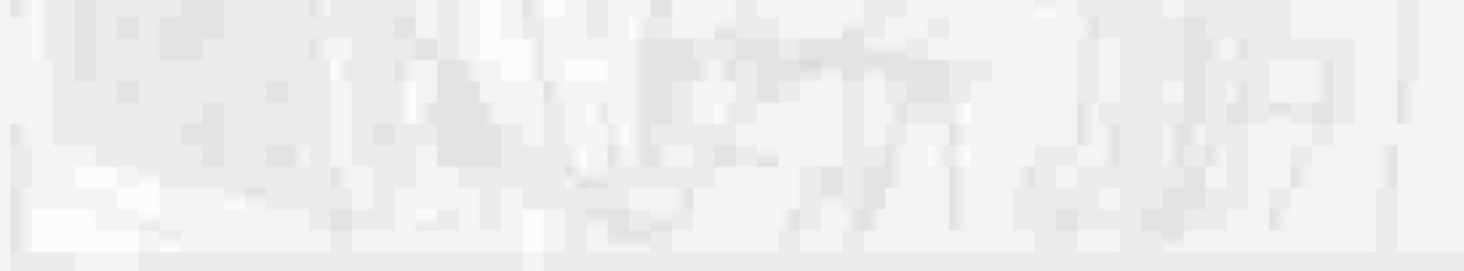
## NOTE:

- Ensure that the vacuum hoses are securely clamped with new one.

LEM00235-00000

# EM-58

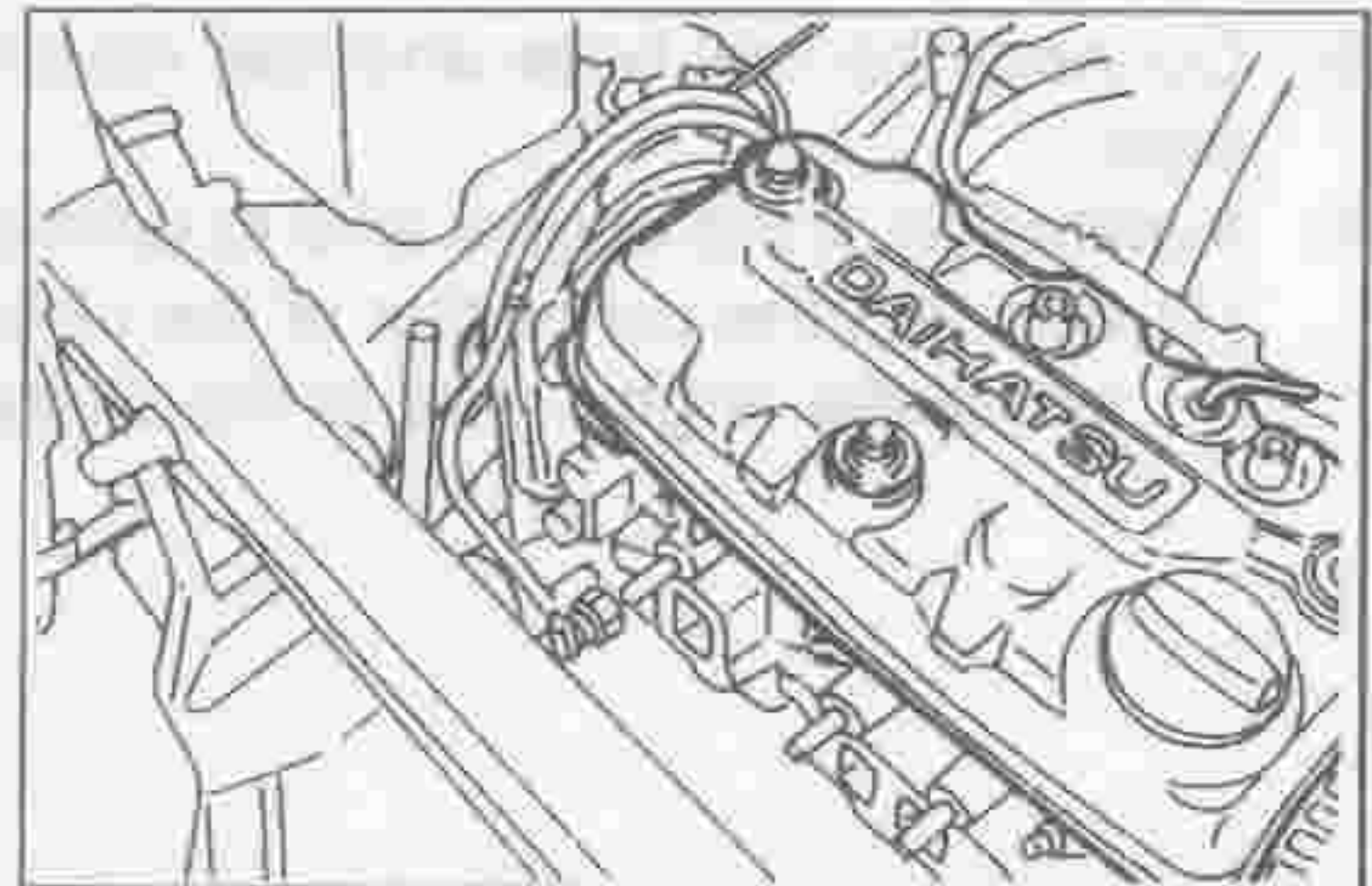
9. Install the front bumper. (Refer to the B0 section.)



LEM00236-00218

## [ED-10 Engine]

1. Connect the washer tank connector.
2. Install the washer tank.



LEM00237-00217

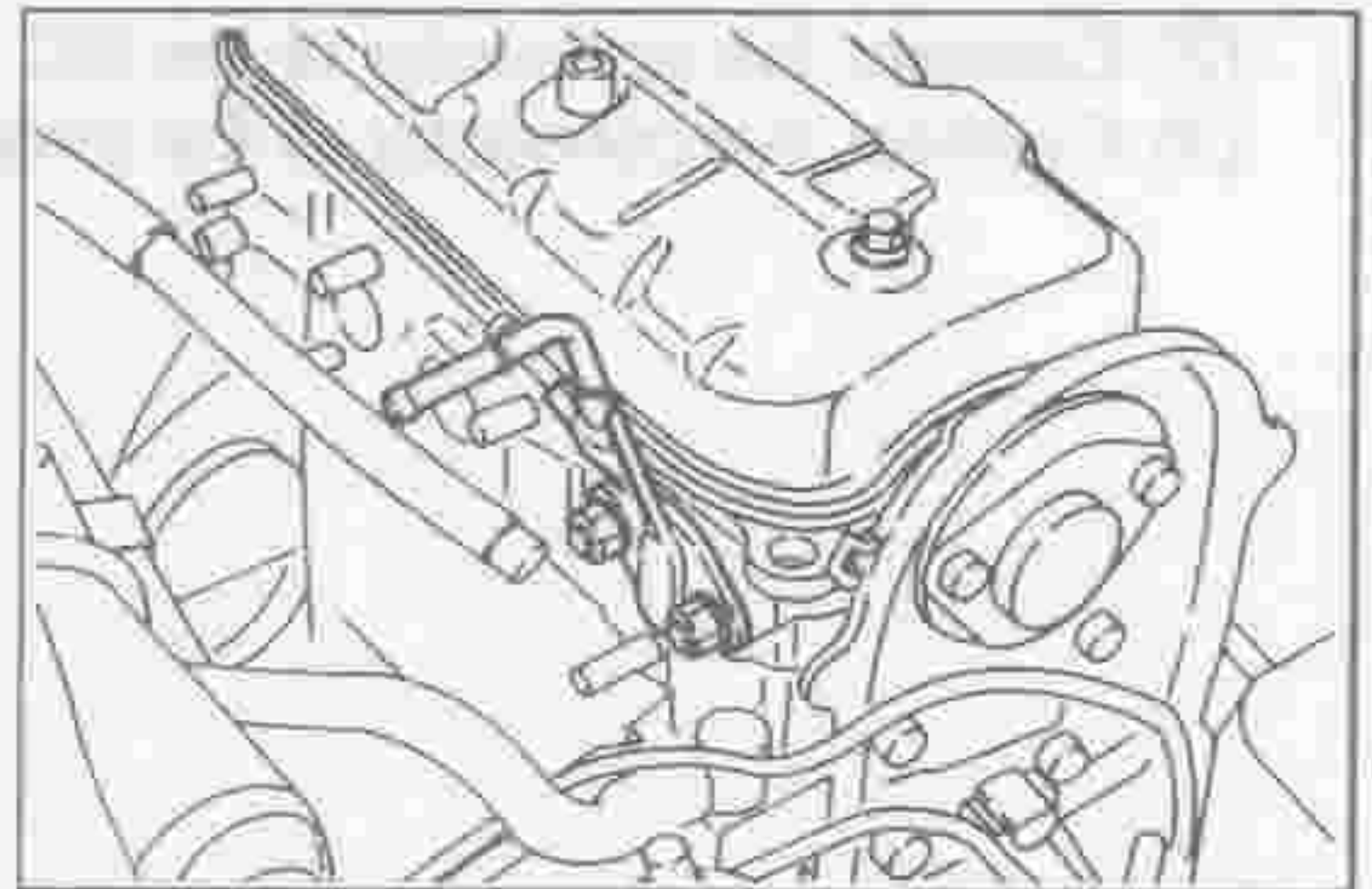
3. Install the heat insulator with a new gasket interposed.
4. Install the fuel pump push rod.

### NOTE:

- Prior to the assembly, dip the camshaft side of the push rod about 20 mm into engine oil.

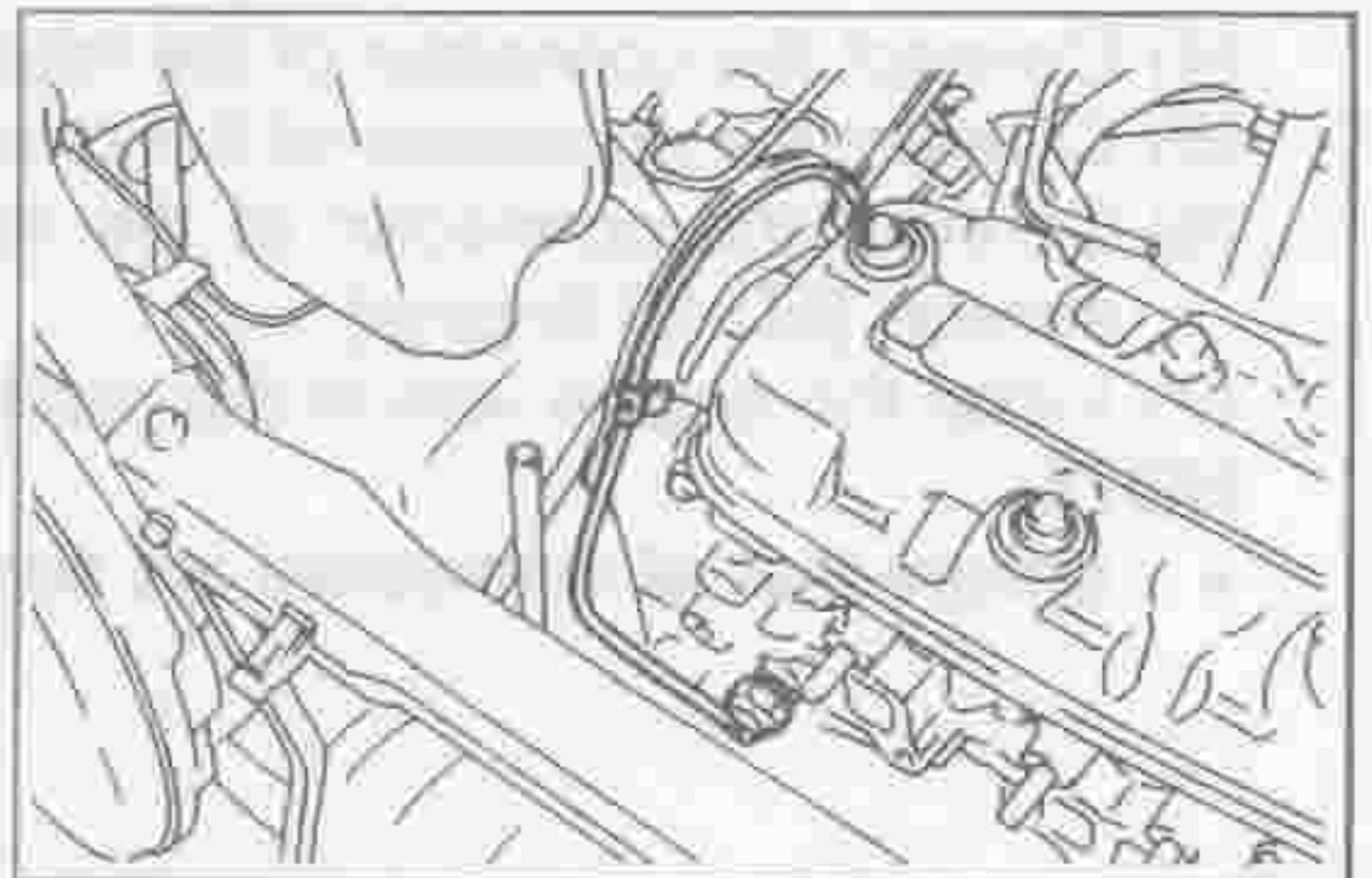
5. Install the fuel pump or fuel pump hole cover with a new gasket interposed.

Tightening Torque:  $19.1 \pm 3.8$  N·m  
( $1.95 \pm 0.39$  kgf·m)



LEM00238-00218

6. Connect the oil pressure wire to the clamps.
7. Connect the connector to the oil pressure switch.



LEM00239-00219

8. Connect the exhaust pipe to the exhaust manifold with a new gasket interposed.

Tightening Torque:  $49.0 \pm 9.8$  N·m  
( $5.00 \pm 1.00$  kgf·m)

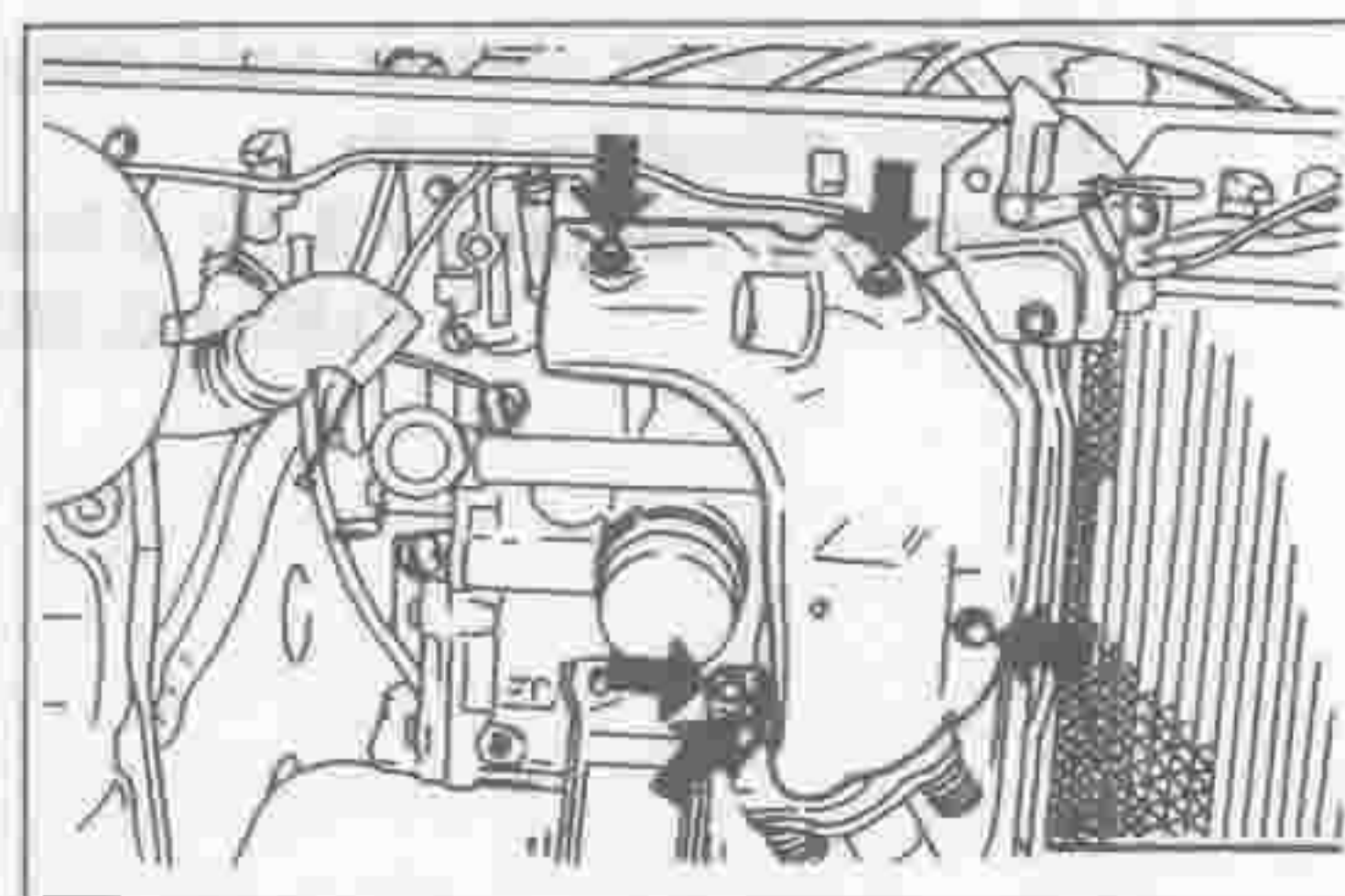
9. Install the exhaust manifold stay.

Tightening Torque:  $15.2 - 22.8$  N·m  
( $1.56 - 2.34$  kgf·m)

LEM00240-00000

10. Install the heat insulator.  
Tightening Torque: 6.4 - 9.6 N·m  
(0.64 - 0.96 kgf-m)

11. Install the front bumper. (Refer to the BO section.)

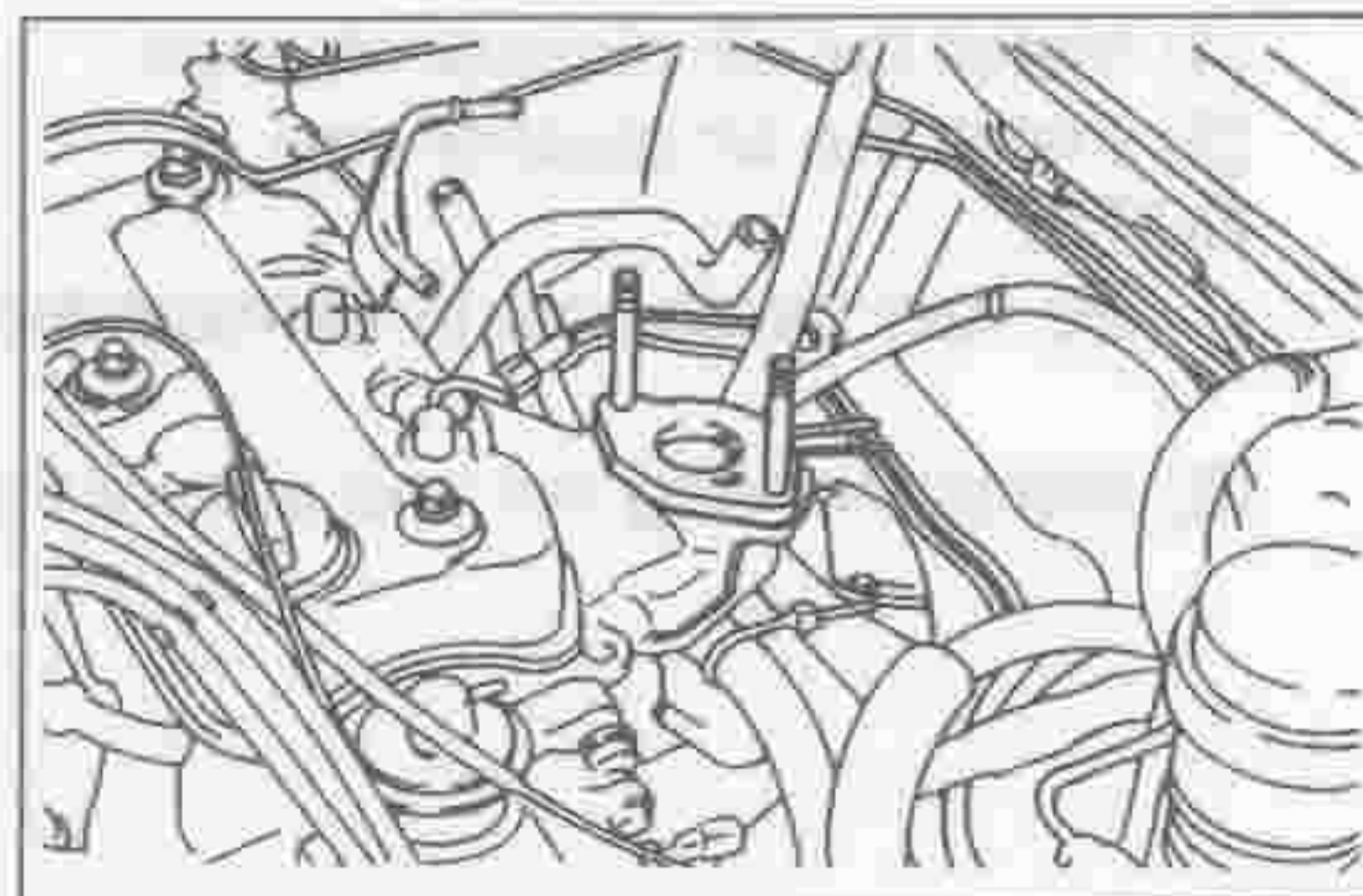


LEM00241-00221

12. Install the heat insulator on the carburetor.

**NOTE:**

- If the gasket surface exhibits damage, replace it with a new one.

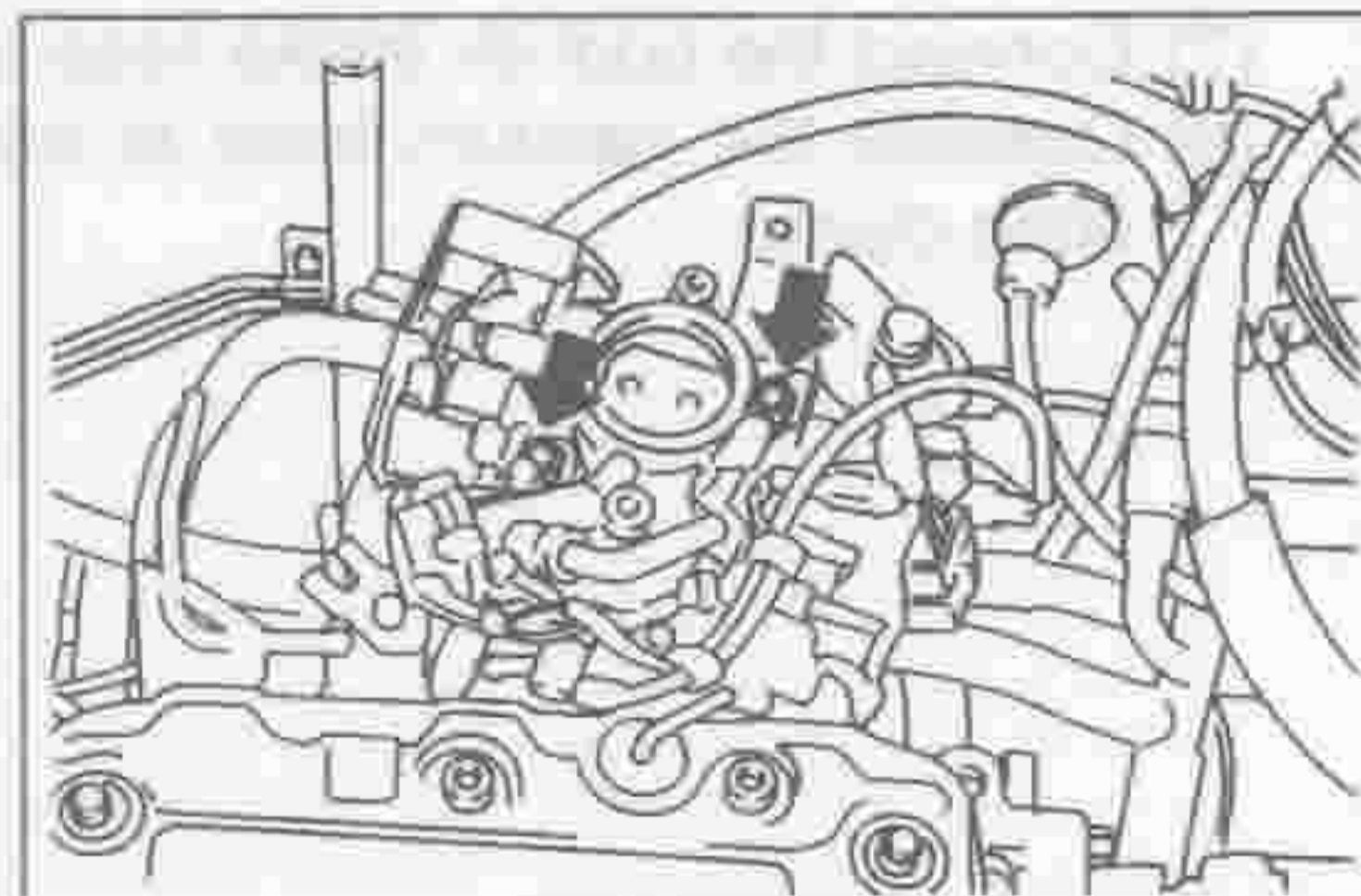


LEM00242-00222

13. Install the carburetor on the heat insulator.

14. Tighten the attaching nut.

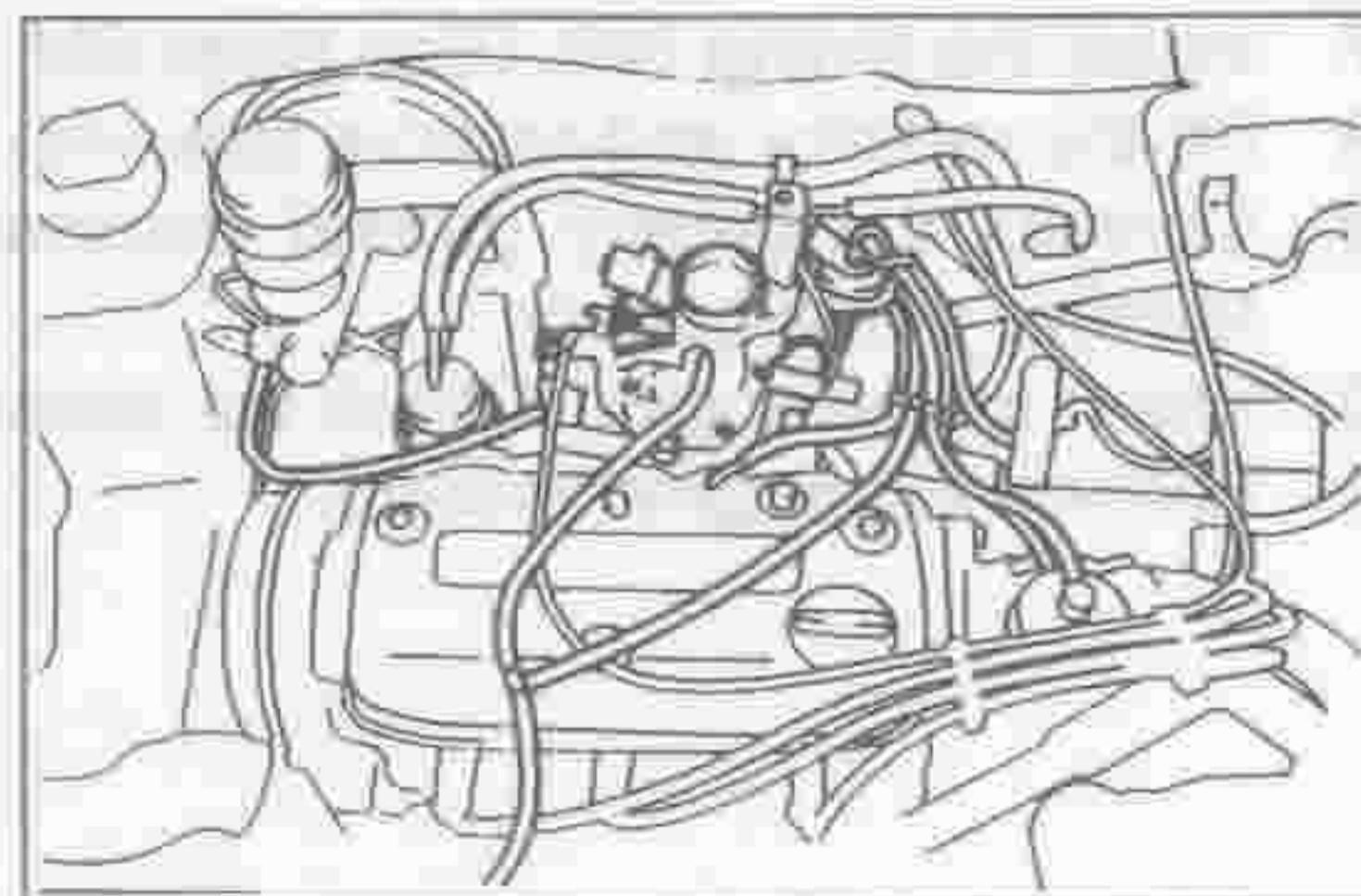
Tightening Torque:  $12.7 \pm 2.5$  N·m  
( $1.30 \pm 0.26$  kgf-m)



LEM00243-00223

15. Install or connect the following parts to the carburetor.

- (1) Vacuum hose
- (2) Fuel inlet hose
- (3) Choke cable
- (4) Accelerator cable



LEM00244-00224

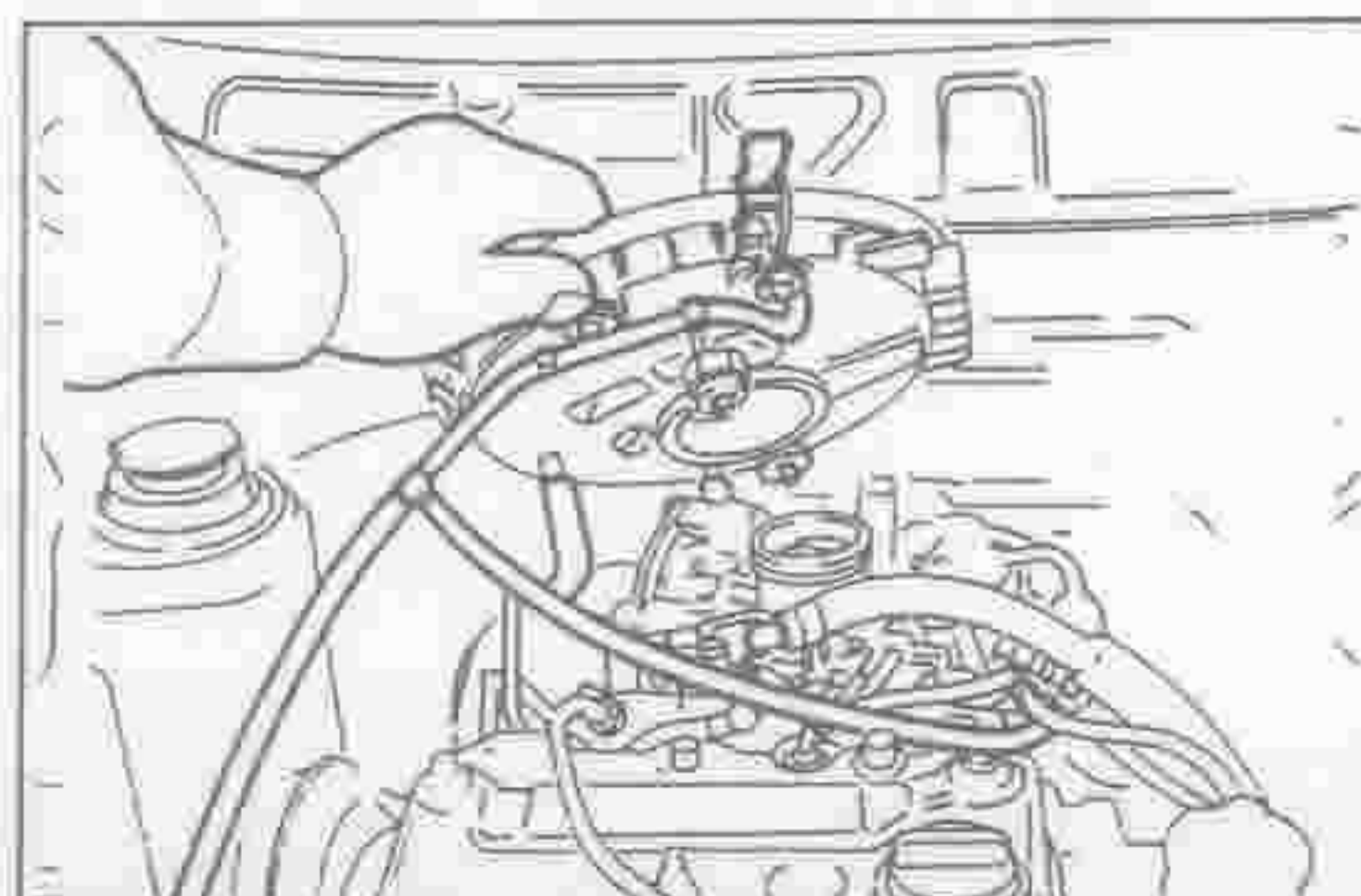
16. Installation of the air cleaner assembly

- (1) Install the gasket onto the carburetor.

**NOTE:**

- If the gasket is damaged, replace it with a new one.

- (2) Connect the PCV hose and vacuum hose to the air cleaner case.

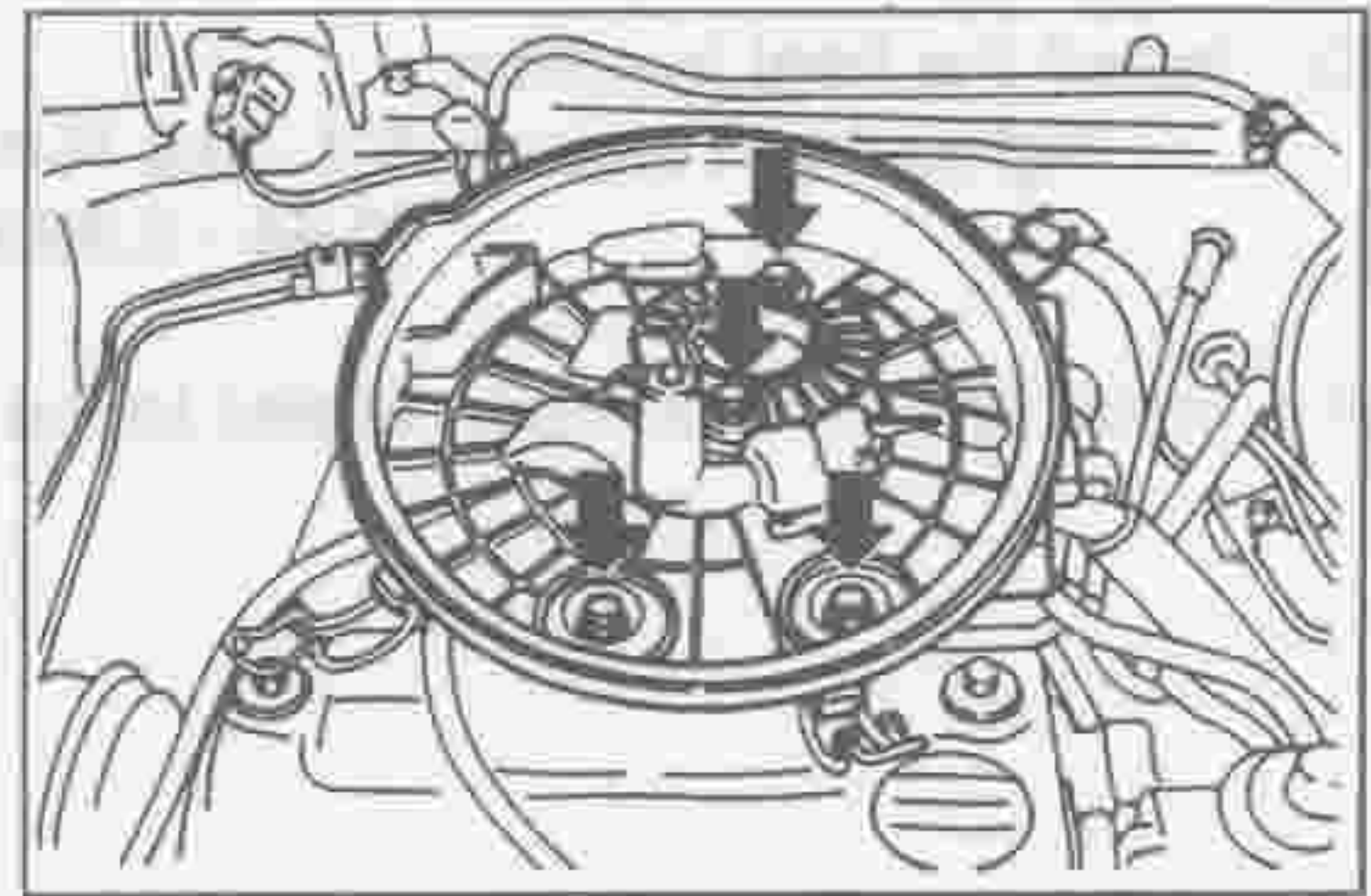


LEM00245-00225

# EM-60

- (3) Connect the air cleaner case onto the carburetor. Install the four attaching bolts.

Tightening Torque:  $7.8 \pm 1.6$  N·m  
( $0.80 \pm 0.16$  kgf·m)



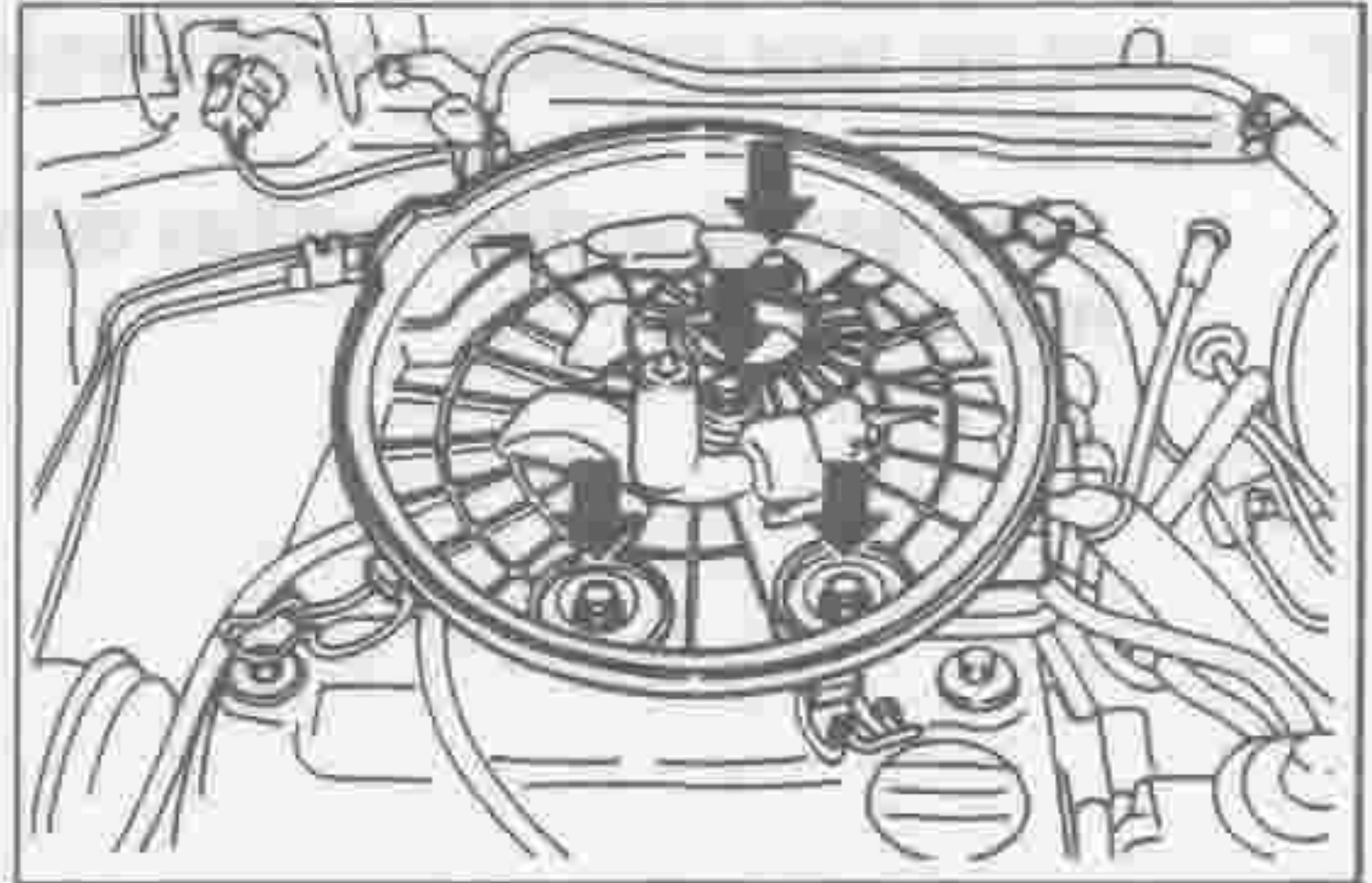
LEM00246-00226

- (4) Install the air cleaner element.
- (5) Install the air cleaner cap.

**NOTE:**

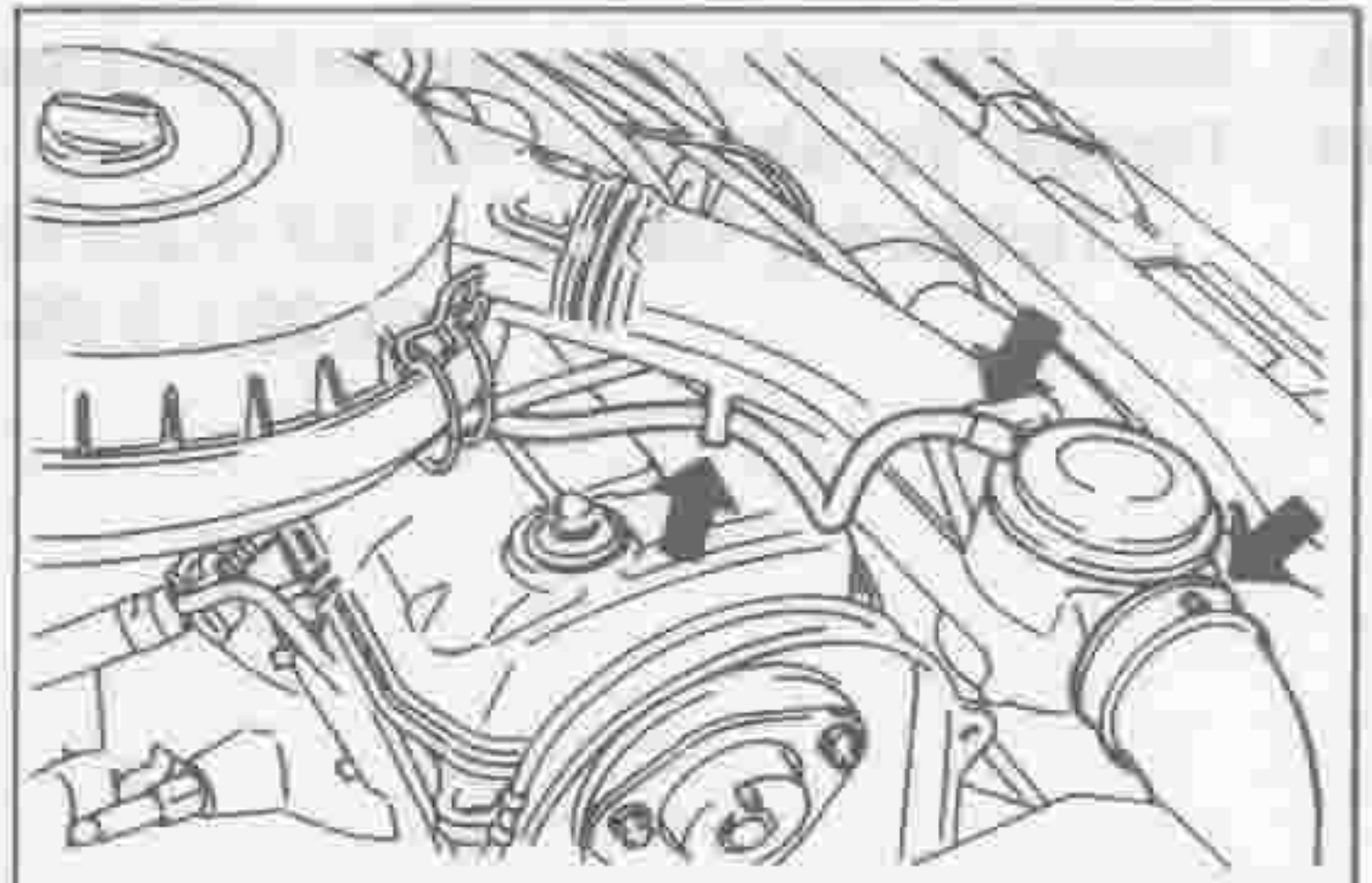
- Be very careful not to damage the hot air intake hose.

- (6) Install the wing nut and secure the clamps.



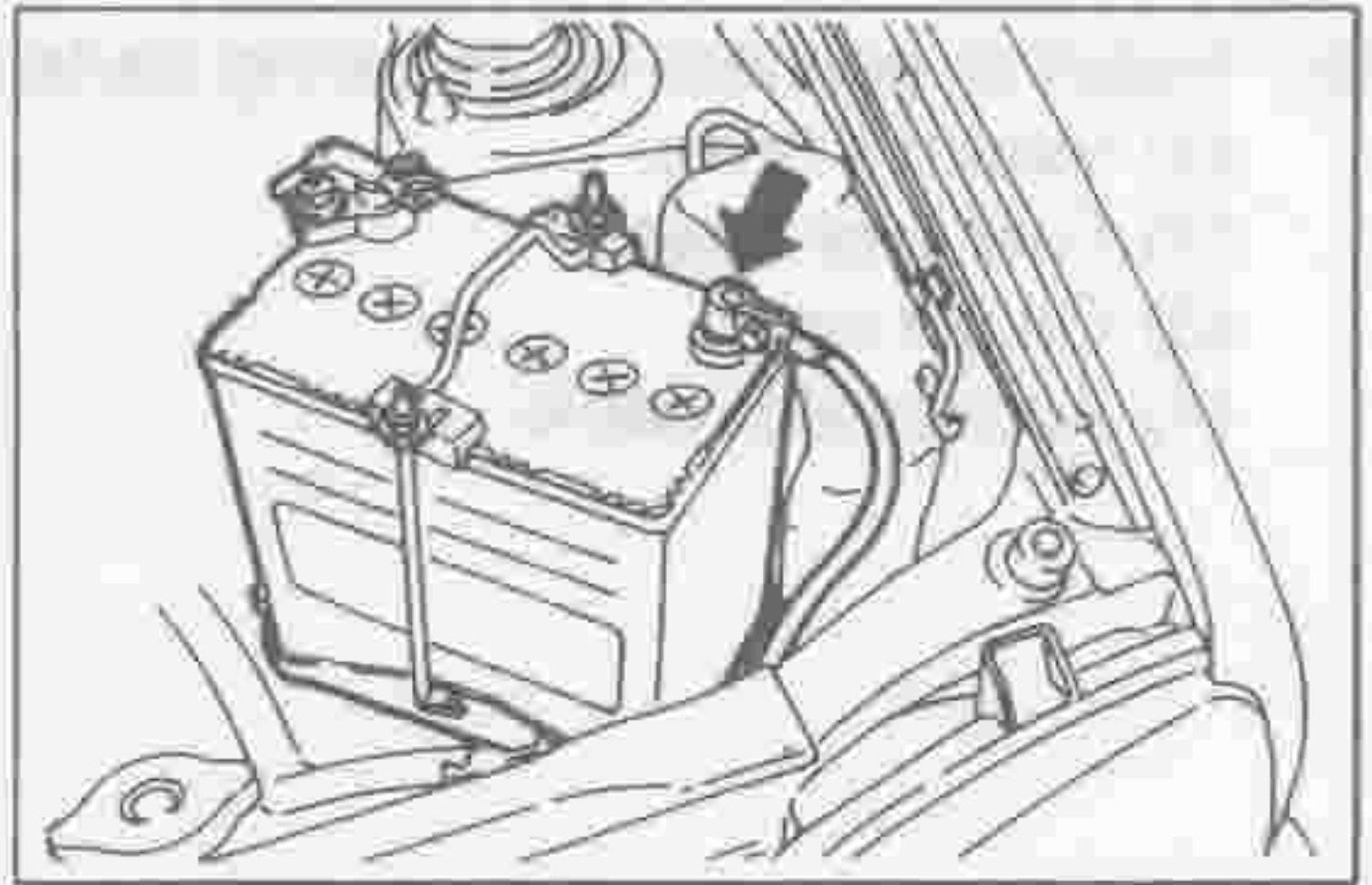
LEM00247-00227

- (7) Connect the cool air intake hose to the air cleaner cap.
- (8) Connect the vacuum hose to the vacuum motor and hose clamp.



LEM00248-00228

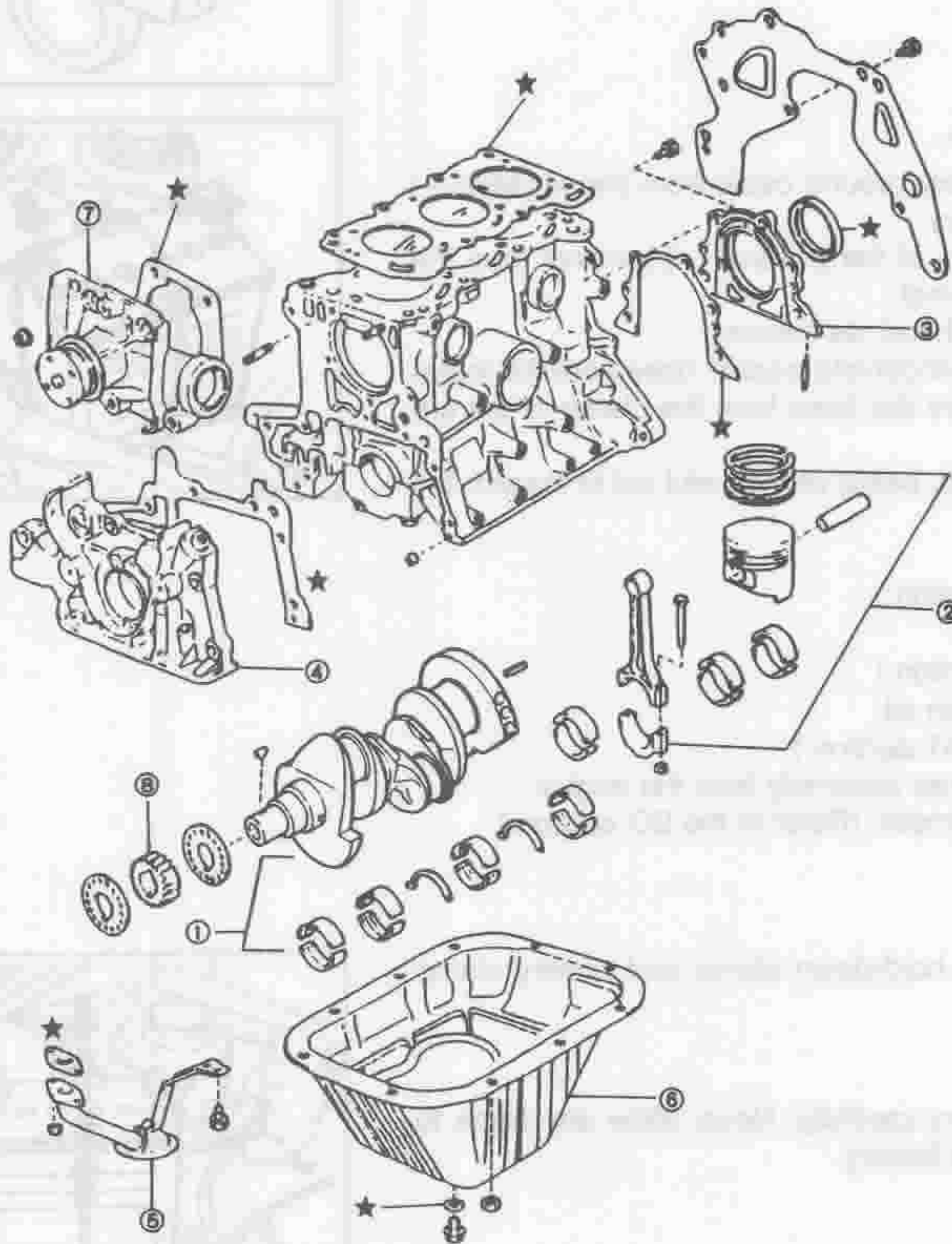
17. Install the timing belt. (See page EM-10.)
18. Fill the radiator and reserve tank with coolant.
19. Connect the battery ground terminal to the negative (-) terminal of the battery.
20. Warm up the engine. Check the accelerator cable for play.
21. Perform the engine tune-up.



LEM00249-00229

## CYLINDER BLOCK COMPONENTS

★ : Non-reusable parts

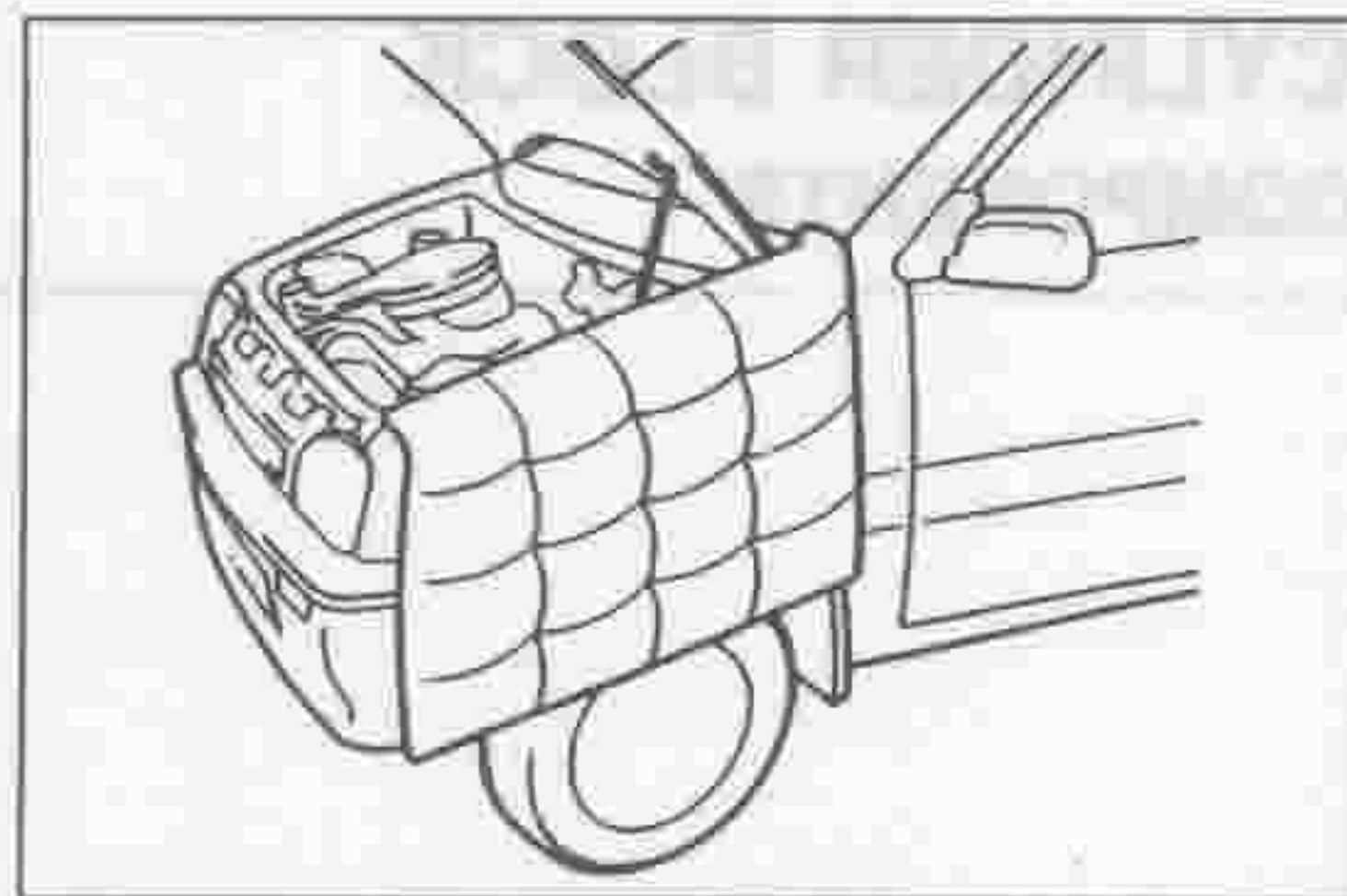


- ① Crankshaft and bearing
- ② Piston and connecting rod
- ③ Rear oil seal retainer
- ④ Oil pump

- ⑤ Oil strainer
- ⑥ Oil pan
- ⑦ Water pump
- ⑧ Crankshaft timing belt pulley

## INSTRUCTION PRIOR TO OPERATION

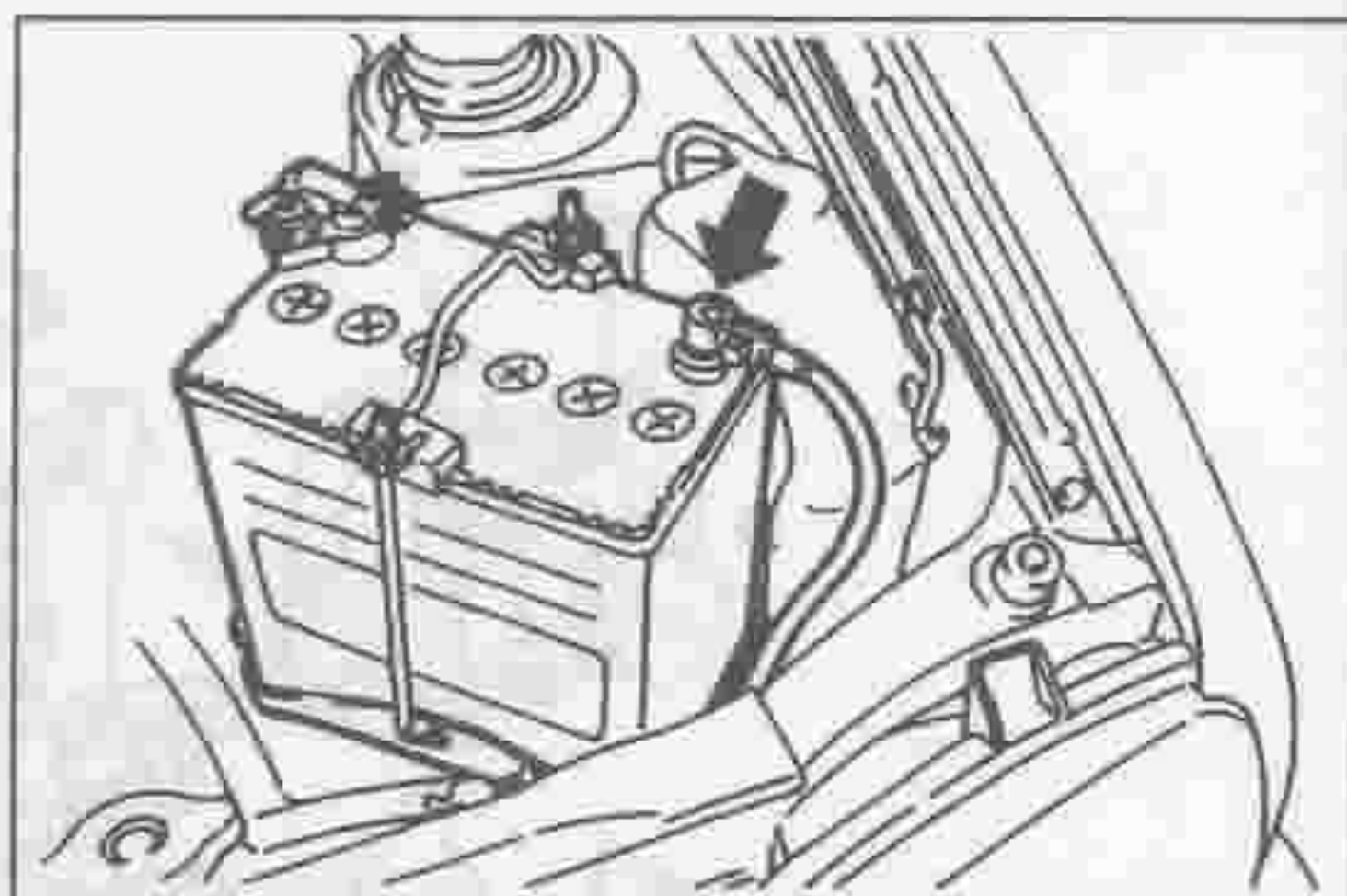
Install fender covers to the fenders so that no scratch may be made to the fenders.



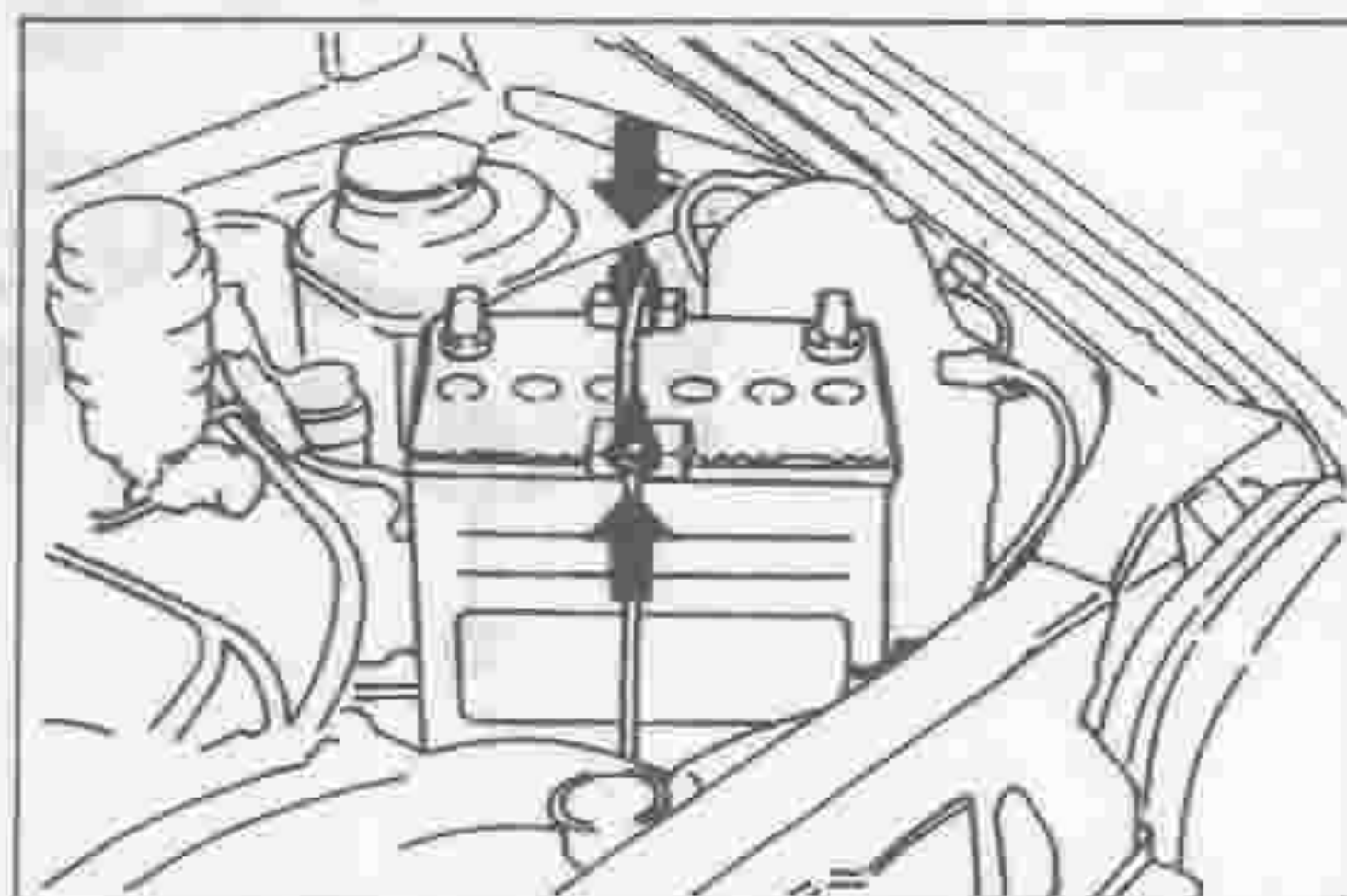
LEM00251-00231

## ENGINE REMOVAL

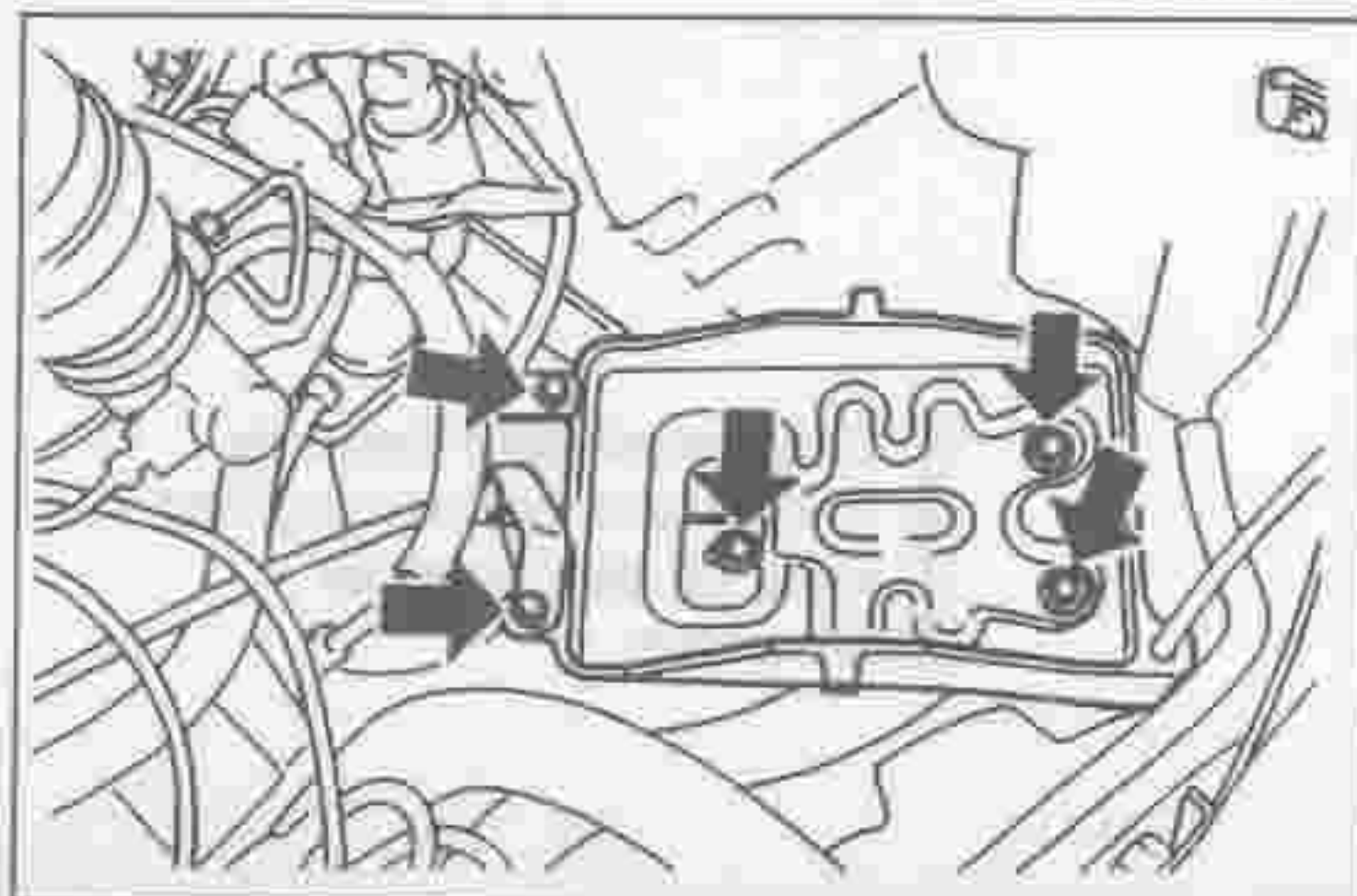
1. Disconnect the battery ground cable from the negative (-) terminal of the battery.
2. Disconnect the wires of the positive (+) terminal from the battery positive terminal.
3. Remove the engine hood, as follows:
  - (1) Disconnect the windshield washer hose from the three-way joint. Remove the hose from the clamp of the engine hood.
  - (2) Remove the hood, being very careful not to scratch the body and hood.
4. Drain the coolant.  
(Refer to the MA section.)
5. Drain the engine oil.  
(Refer to the MA section.)
6. Drain the transmission oil.  
(Refer to the MT or AT section.)
7. Remove the air cleaner assembly from the engine.
8. Remove the front bumper. (Refer to the BO section.)
  
9. Remove the battery hold-down clamp and battery clamp bolts.
10. Remove the battery.  
**CAUTION:**
  - Handle the battery carefully. Never allow any flame to be brought to the battery.
  
11. Removal of battery carrier
  - (1) Remove the wiring clamp bolt.
  - (2) Remove the ground cable from the clamp.
  - (3) Remove the speedometer cable clamp attaching screw.
  - (4) Remove the battery carrier by removing the three bolts.



LEM00252-00232

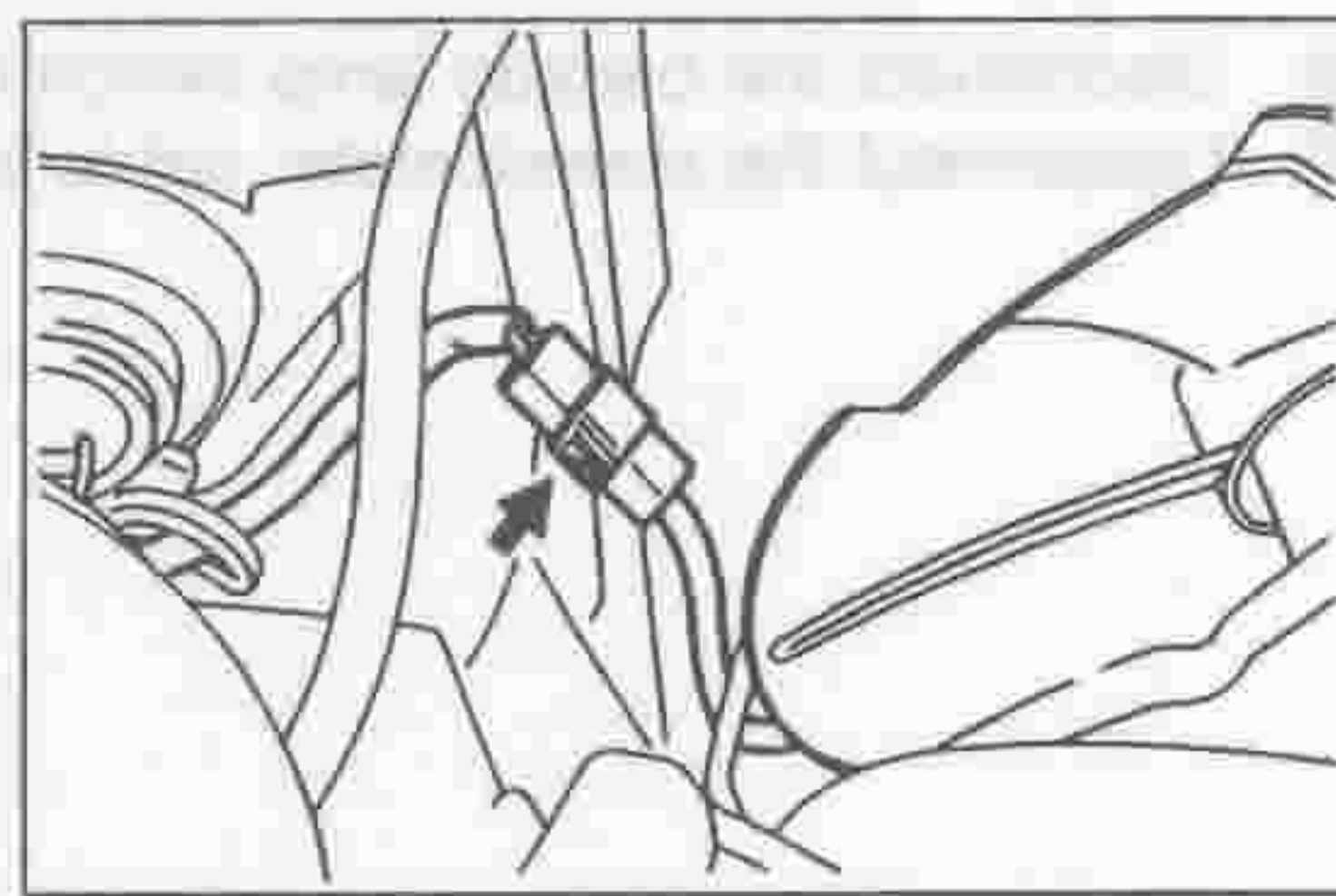


LEM00253-00233



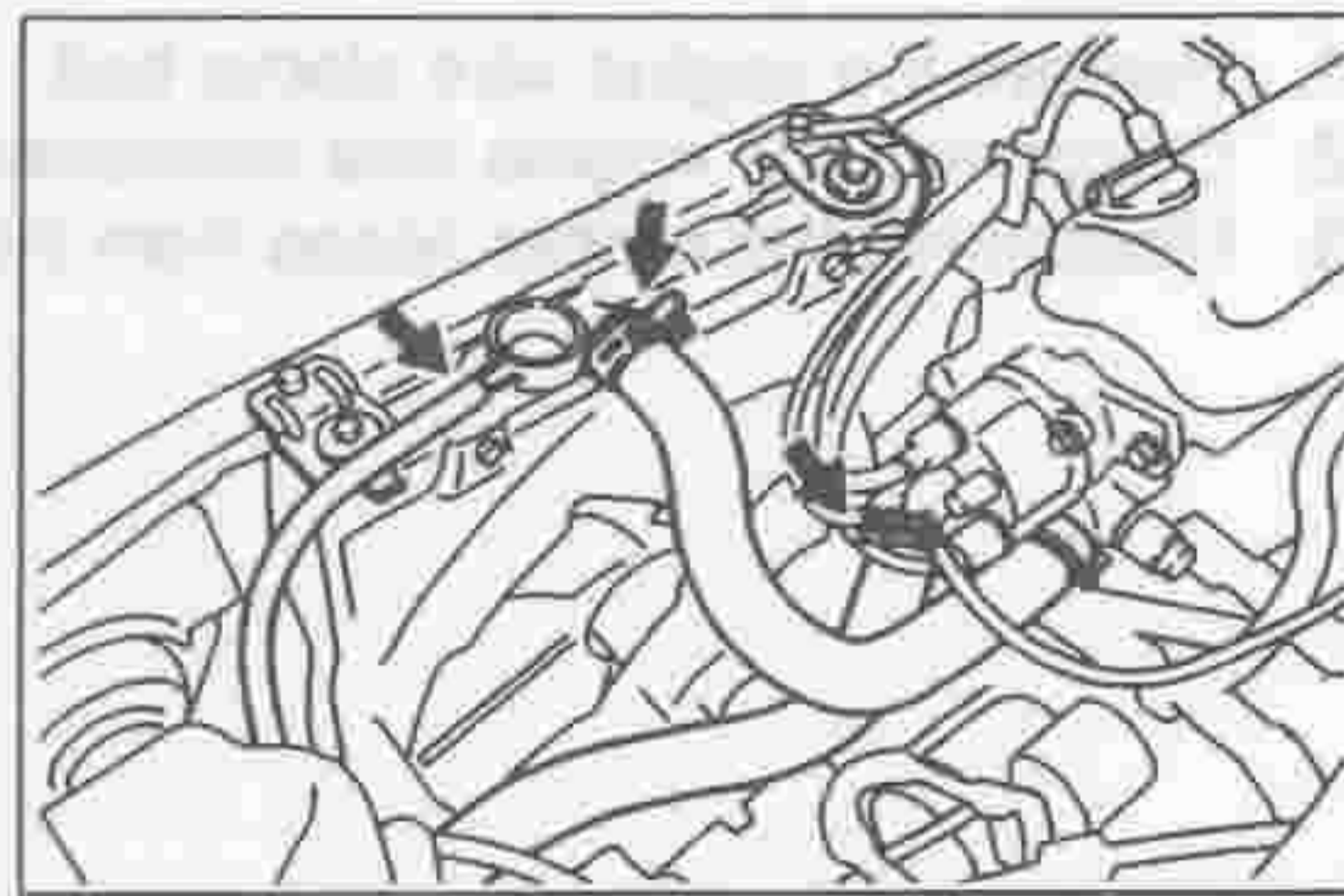
LEM00254-00234

12. Disconnect the fan motor connector.



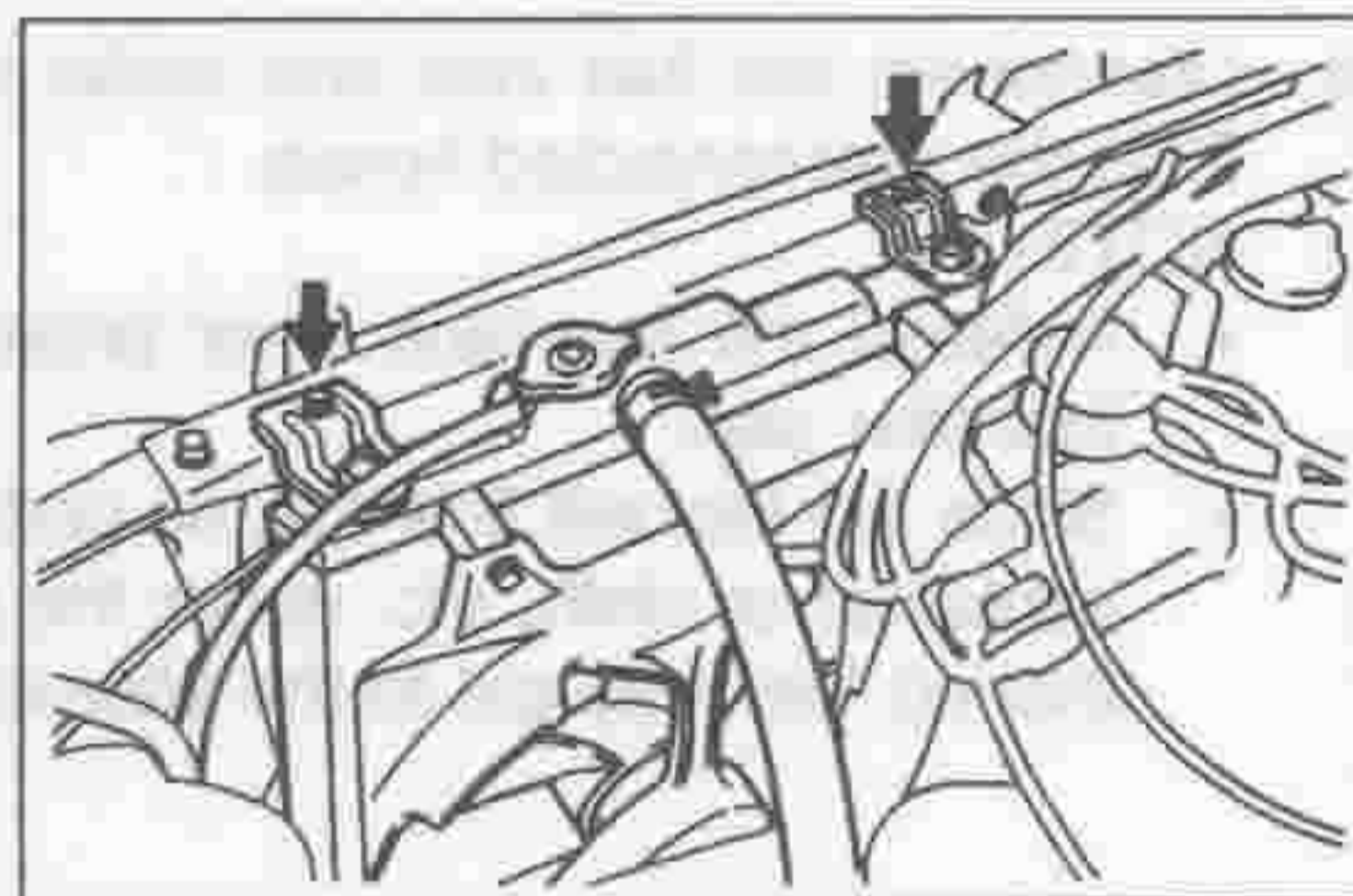
LEM00255-00235

13. Disconnect the radiator upper hose from the radiator.  
14. Disconnect the radiator lower hose from the water inlet pipe.  
15. Disconnect the radiator reserve tank hose from the radiator.



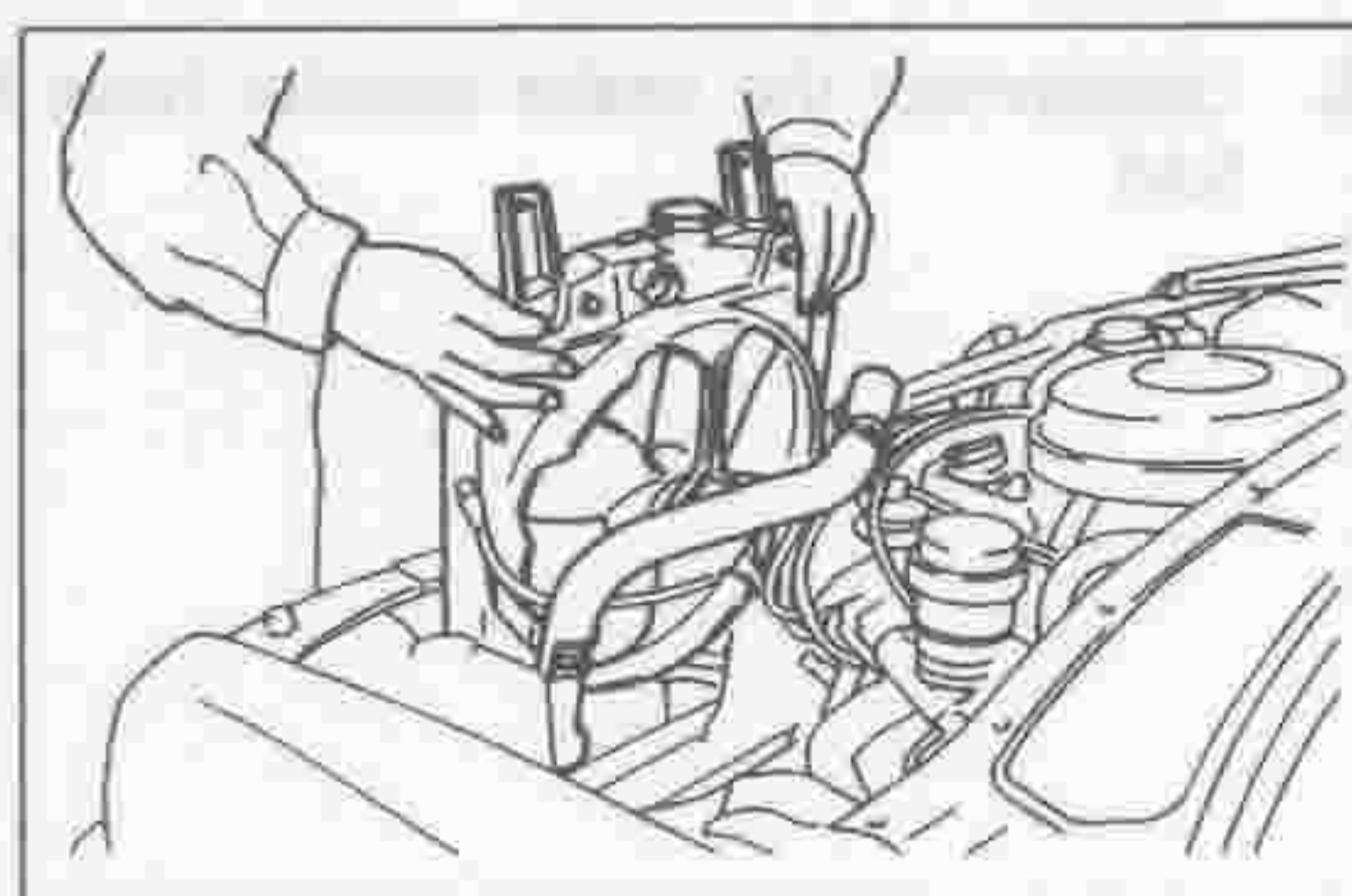
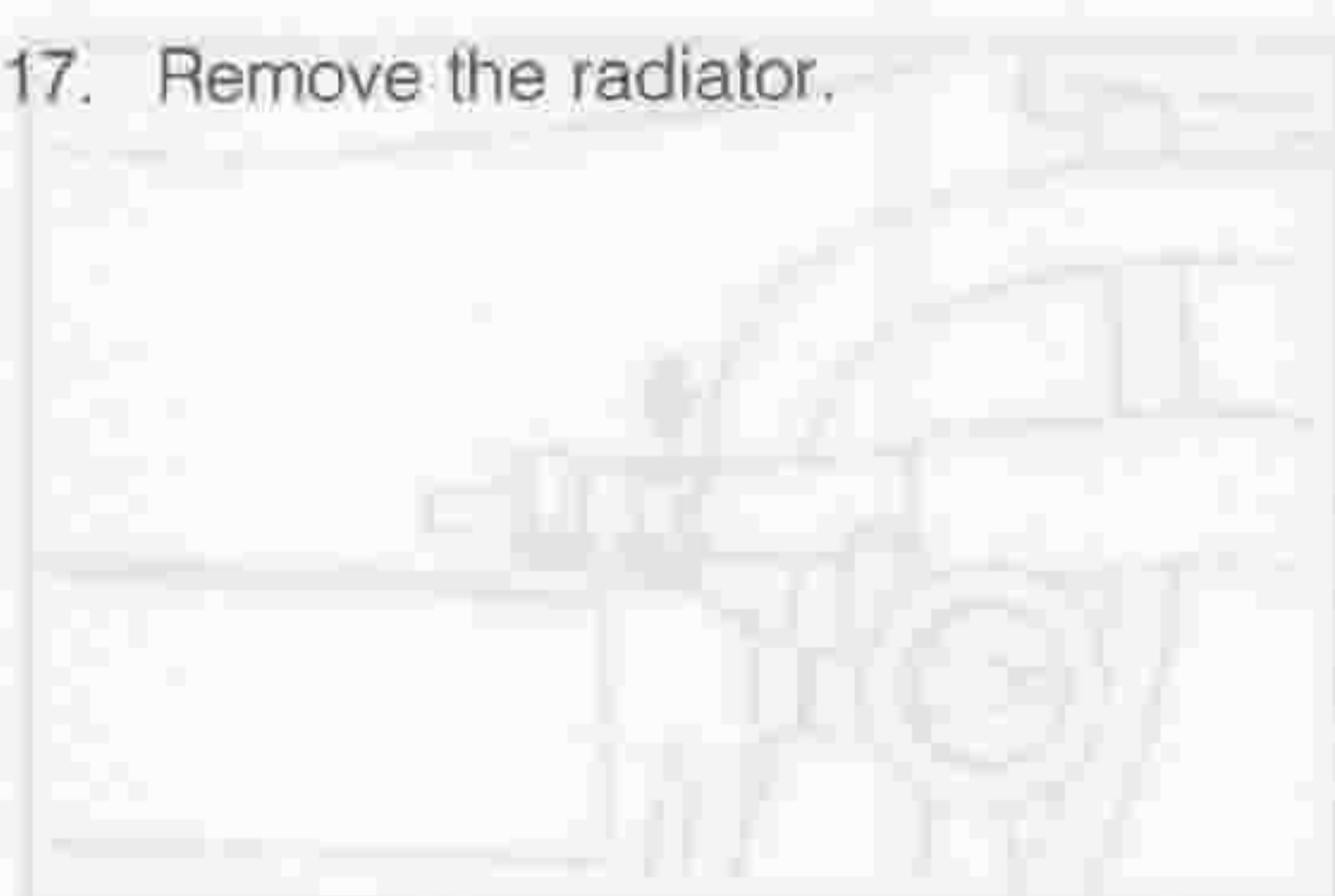
LEM00256-00236

16. Remove the radiator bracket retaining bolt.



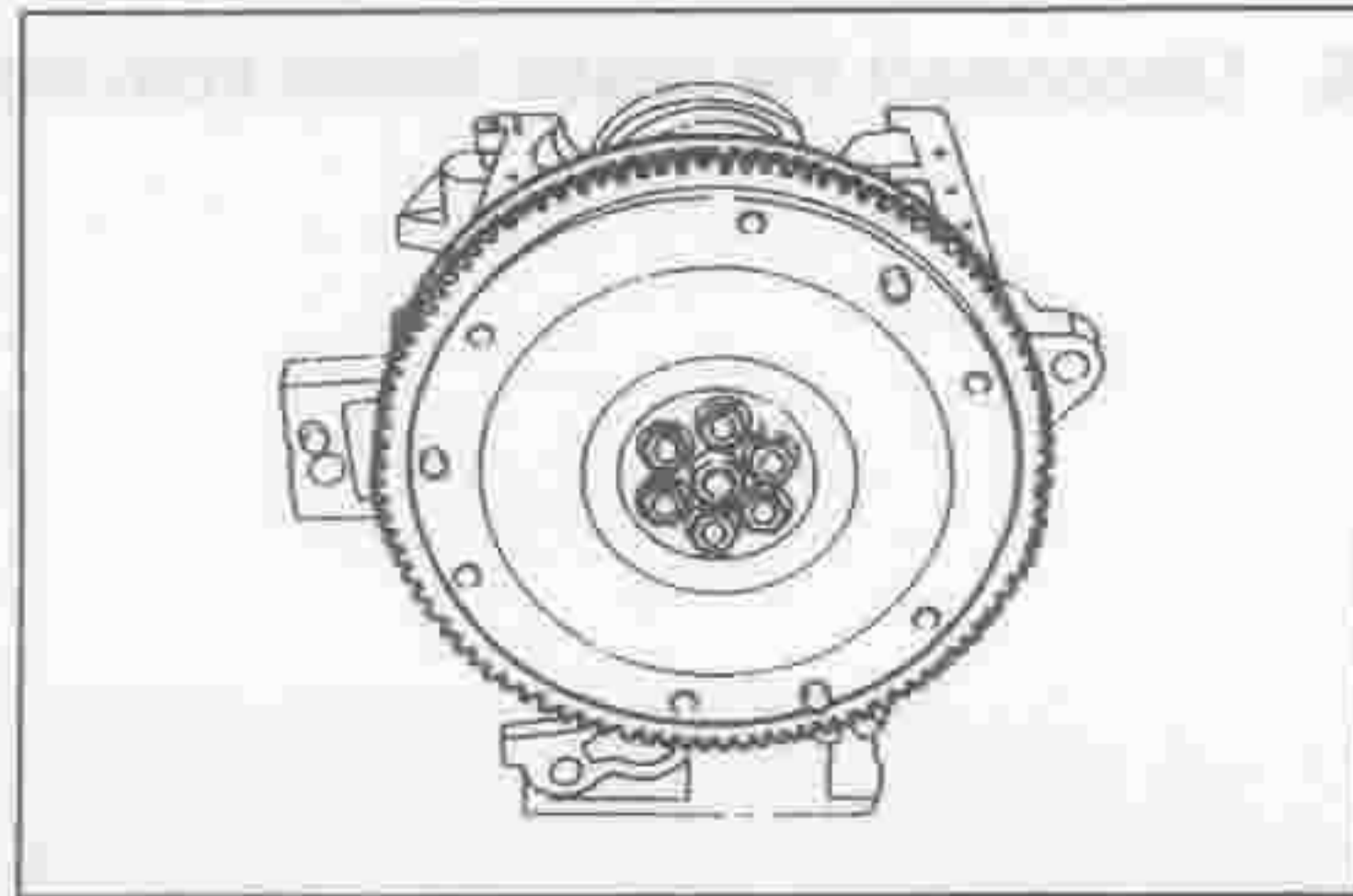
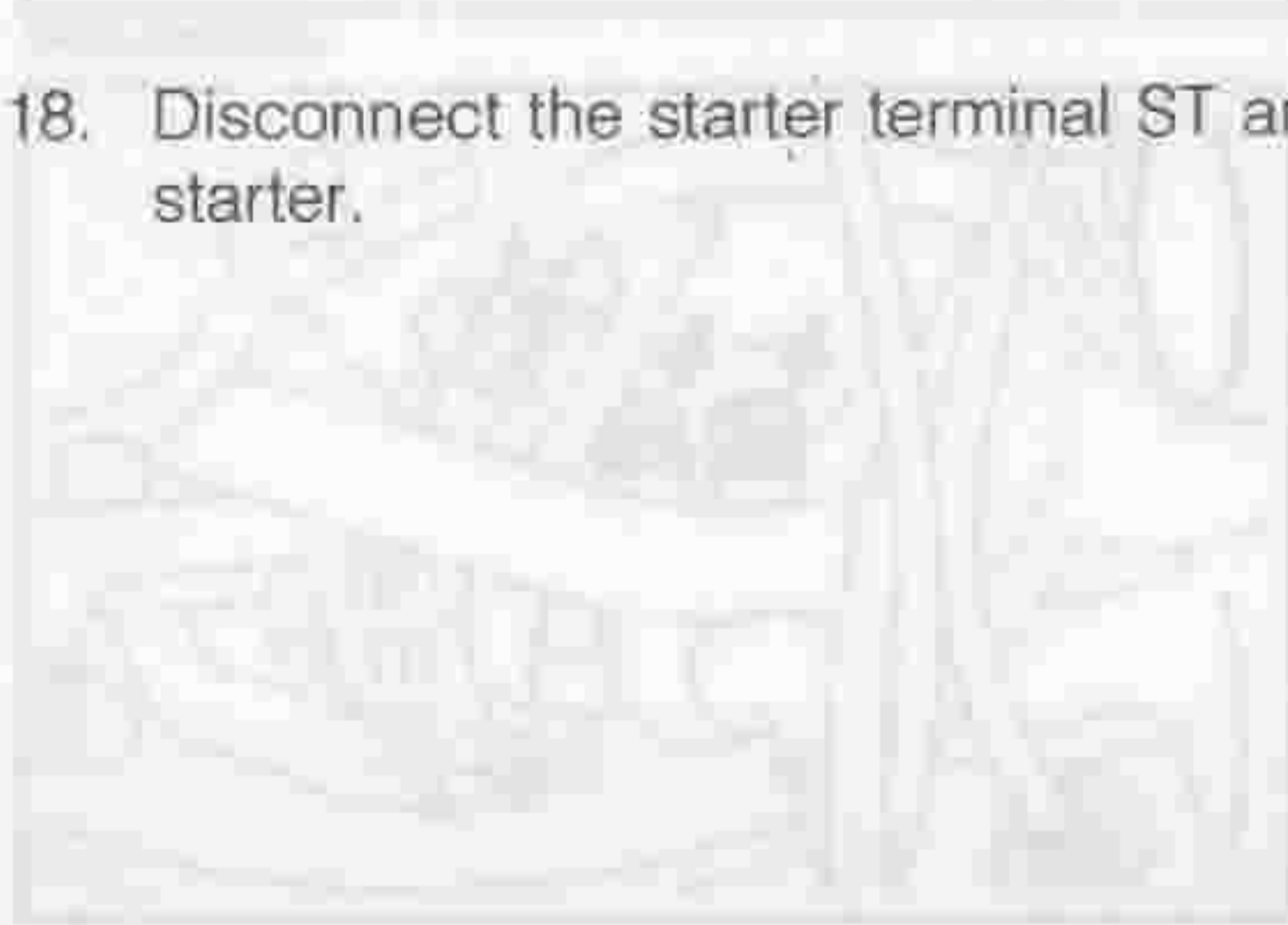
LEM00257-00237

17. Remove the radiator.



LEM00258-00238

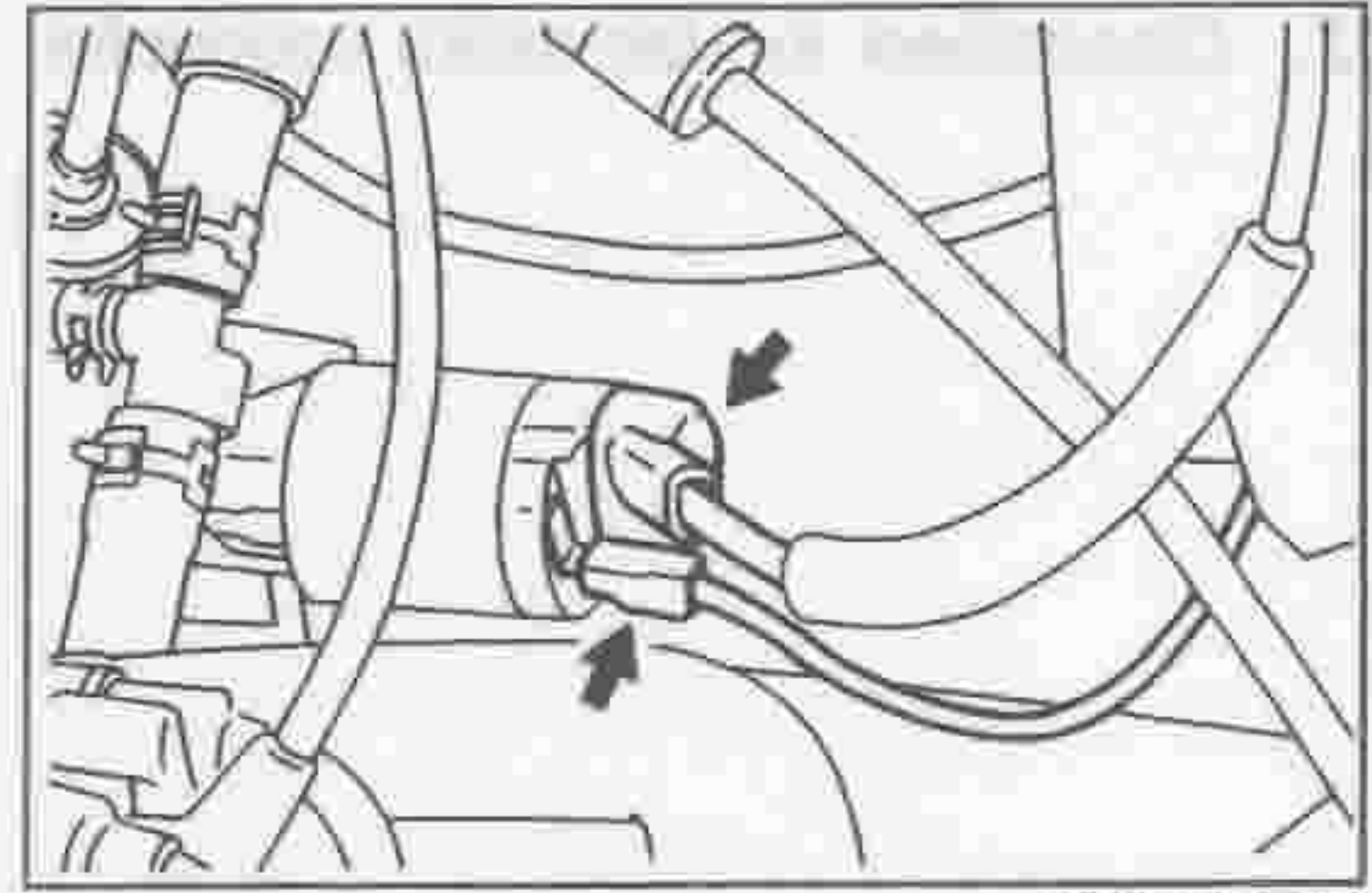
18. Disconnect the starter terminal ST and terminal B from the starter.



LEM00259-00239

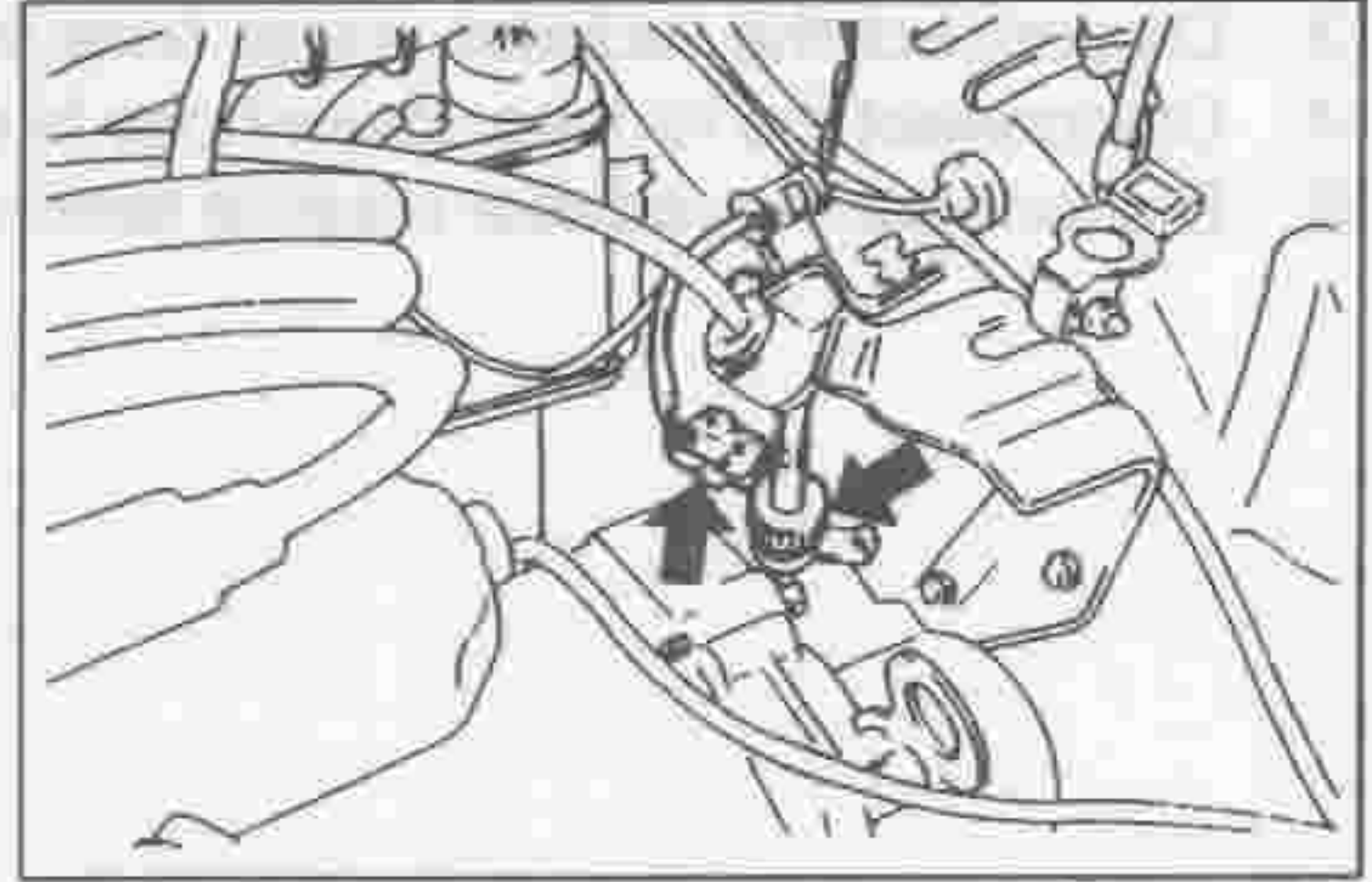
# EM-64

19. Disconnect the backup lamp switch connector.
20. Disconnect the speedometer cable from the transmission.



LEM00260-00240

21. Remove the engine wire clamp bolt.
22. Disconnect the engine wire connectors.
23. Disconnect the rubber hoses from the charcoal canister.

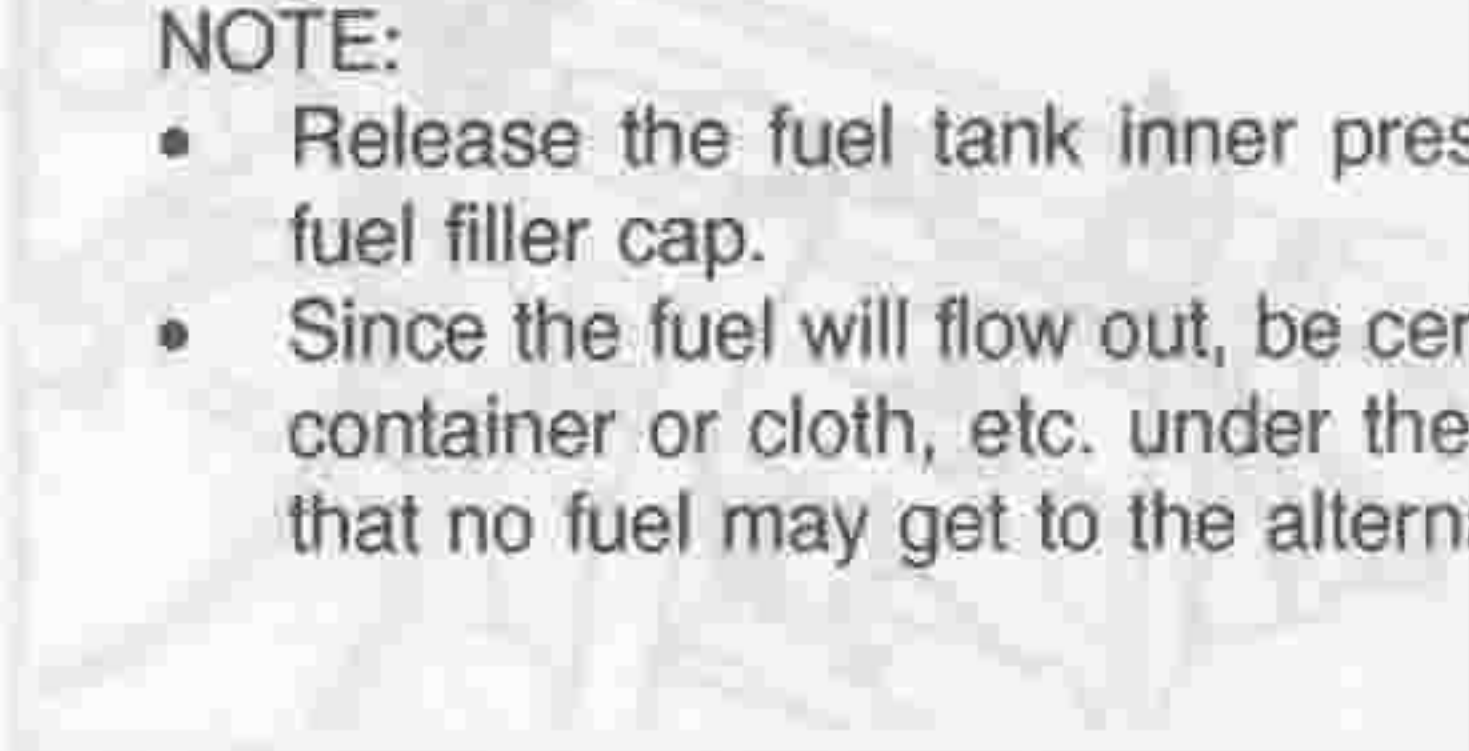


LEM00261-00241

24. Disconnect the fuel inlet and outlet from the engine side. Plug the disconnected hoses.

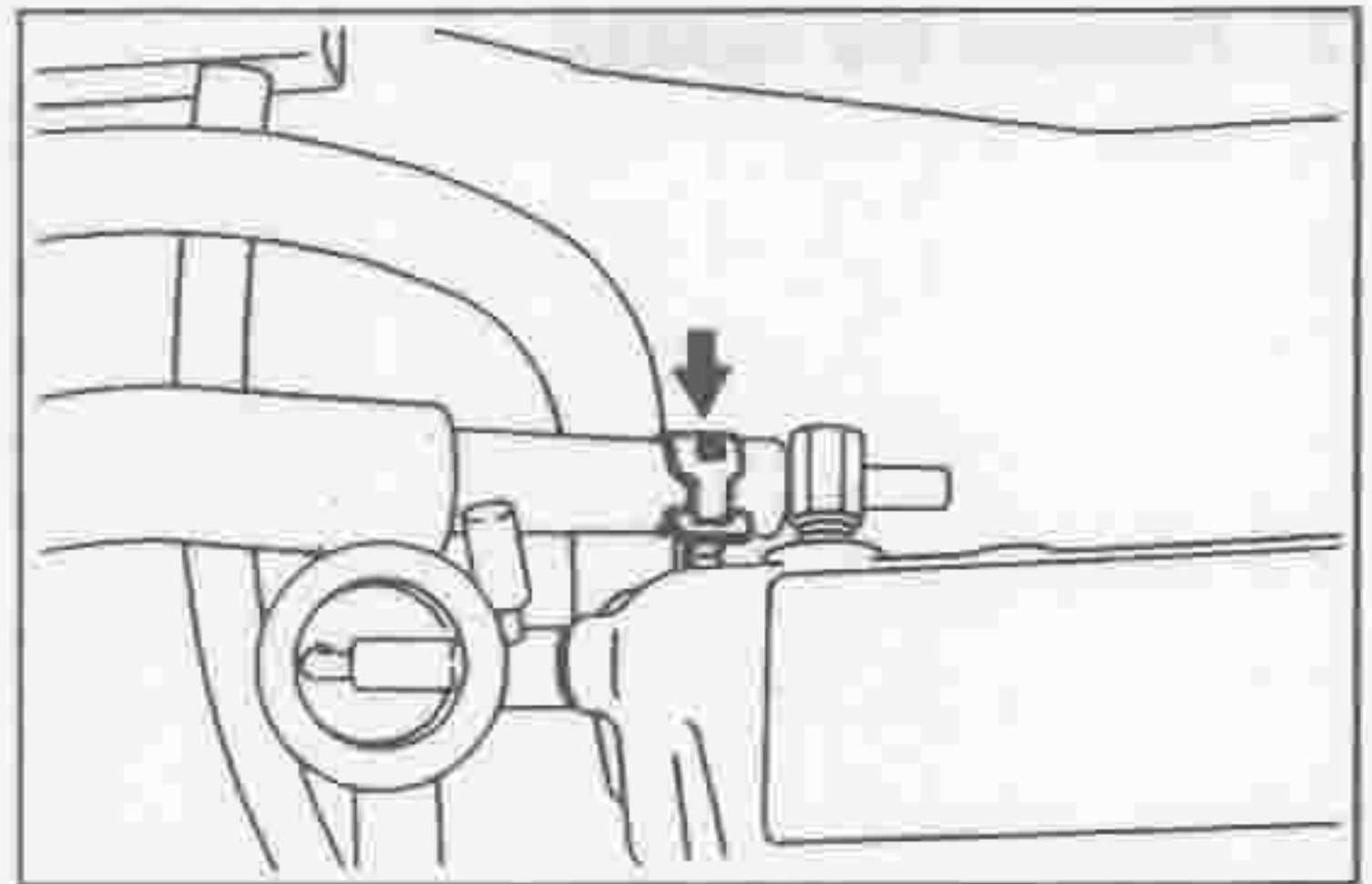
**NOTE:**

- Release the fuel tank inner pressure by removing the fuel filler cap.
- Since the fuel will flow out, be certain to place a suitable container or cloth, etc. under the pressure regulator so that no fuel may get to the alternator.



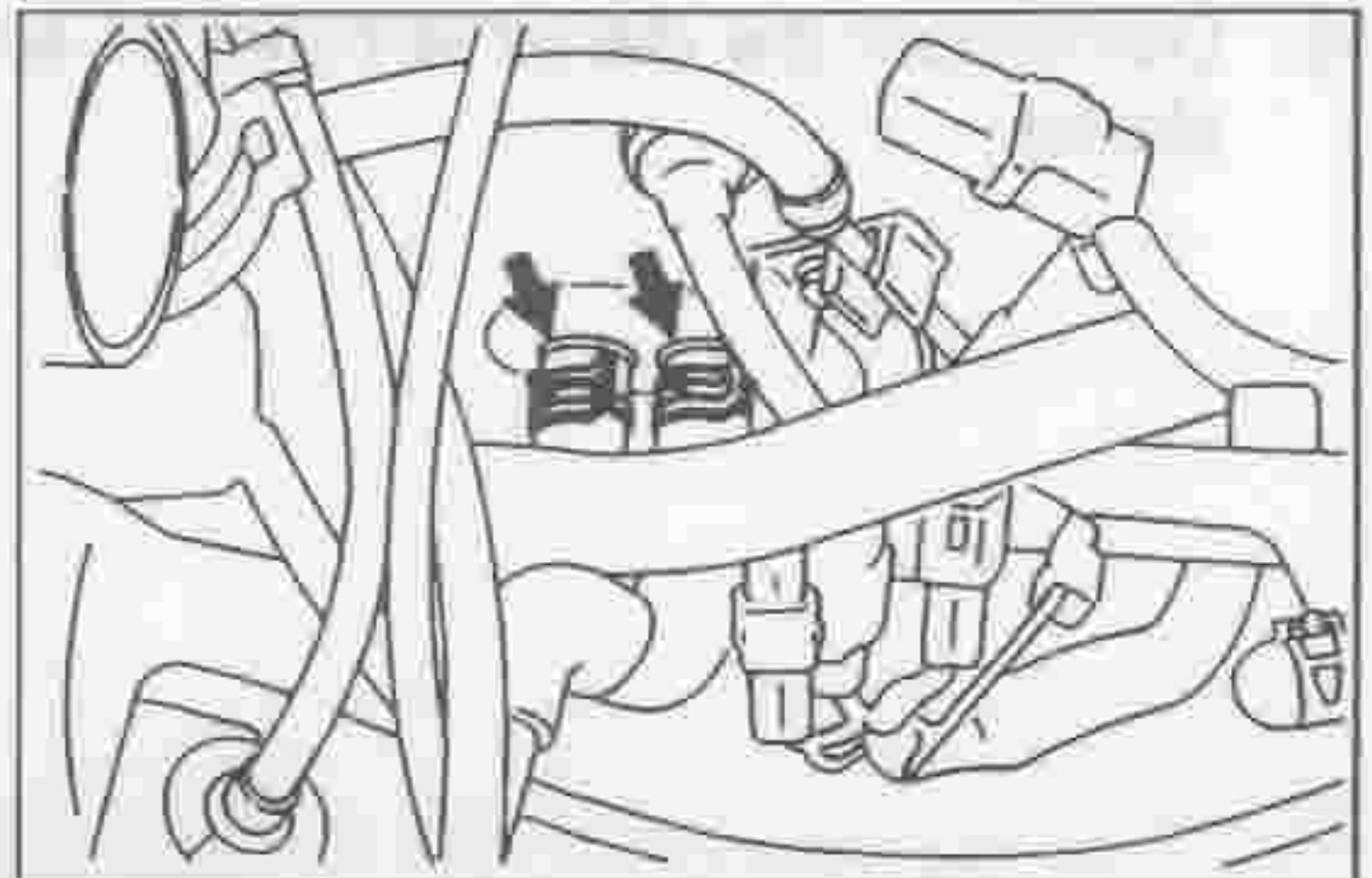
LEM00262-00000

25. Disconnect the brake booster hose from the intake manifold.



LEM00263-00243

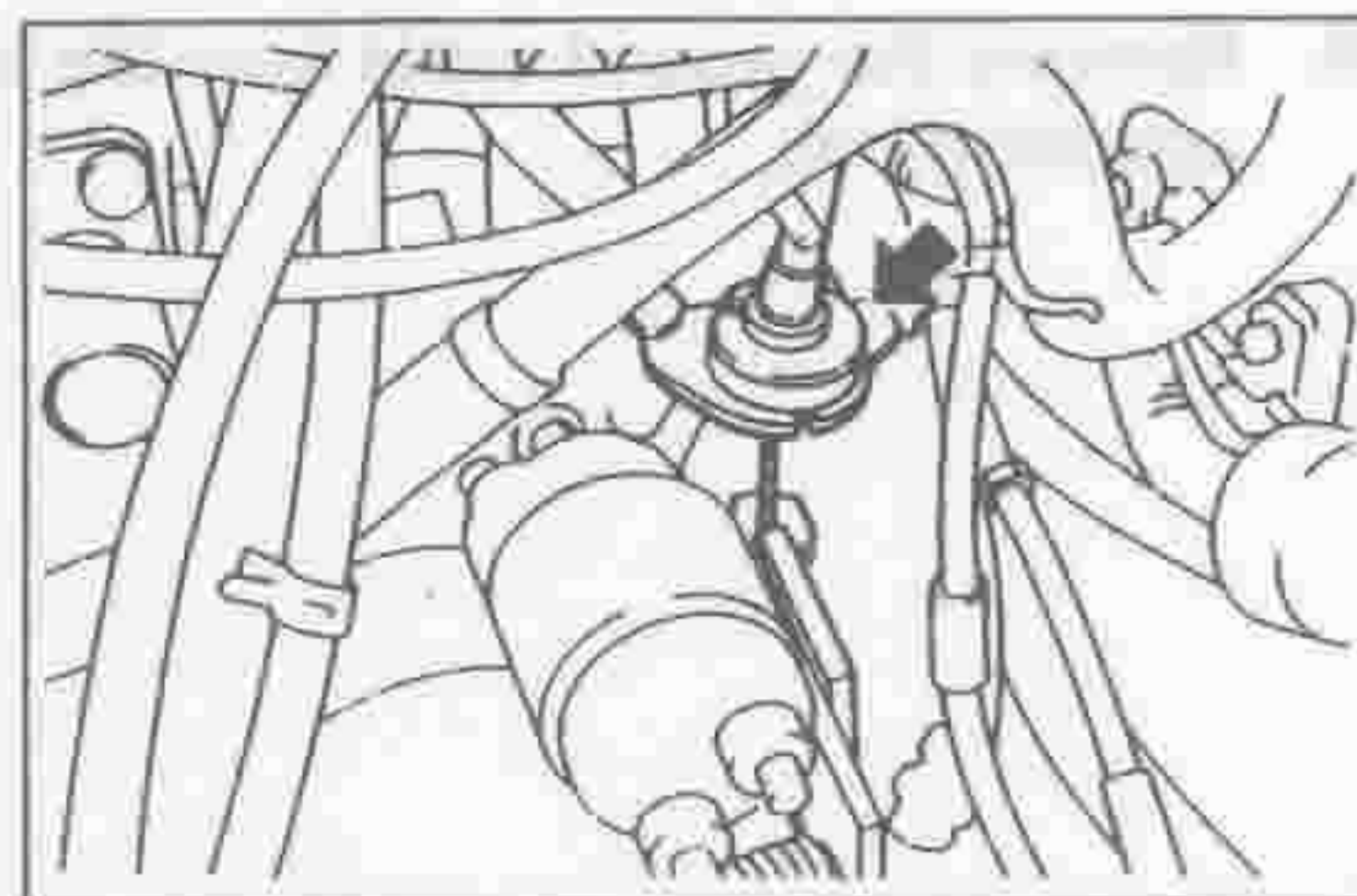
26. Disconnect the heater hoses from the heater.



LEM00264-00244

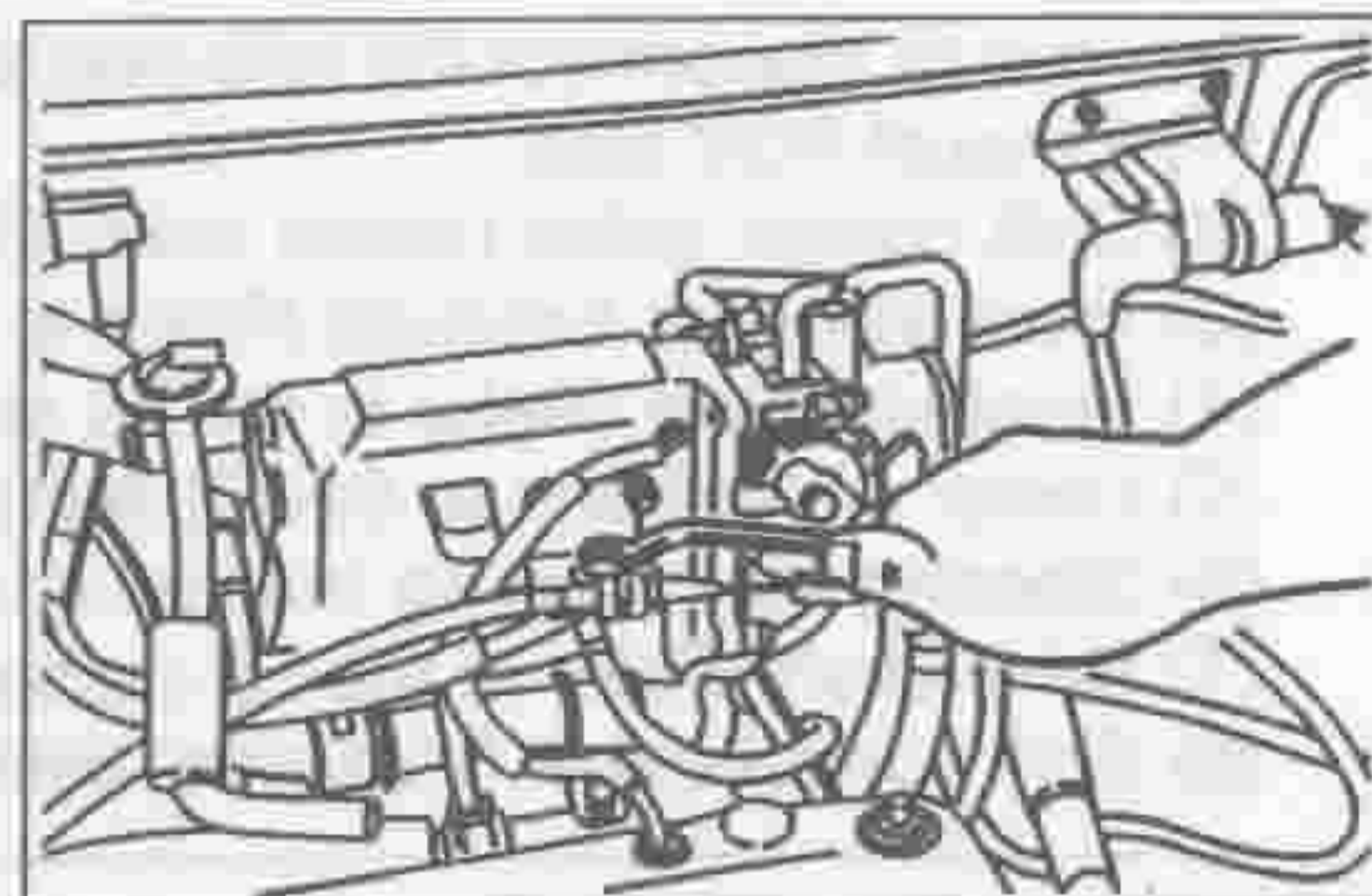


27. Disconnection of clutch cable  
(Refer to the CL section.)  
(1) Disconnect the clutch cable from the clutch pedal.  
(2) Disconnect the clutch cable from the transmission.



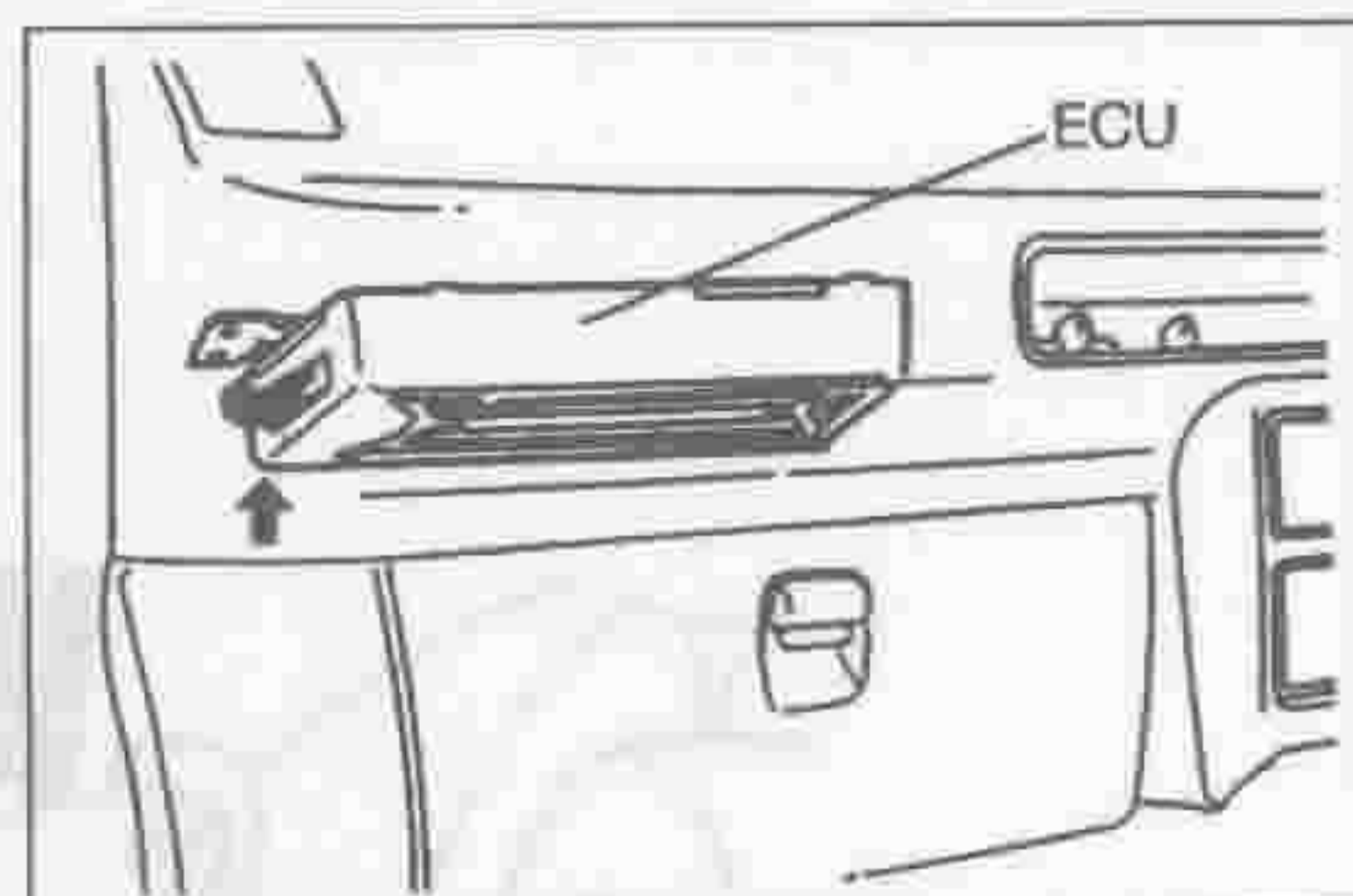
LEM00265-00245

28. Disconnect the accelerator cable from the engine.  
29. Disconnect the choke cable from the engine.  
[ED-10 Engine]



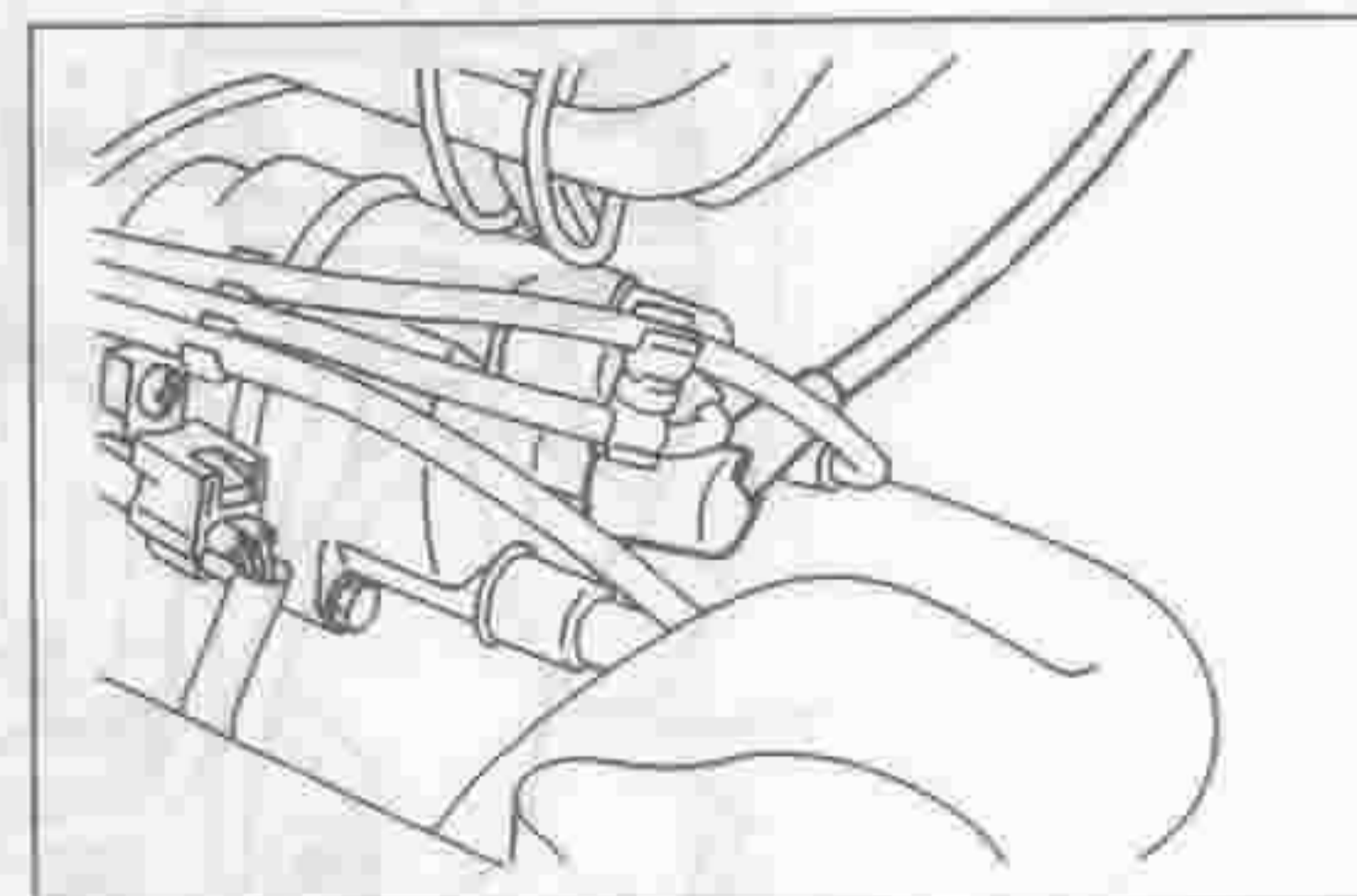
LEM00266-00246

30. Disconnect the connector of the pressure sensor.  
[ED-20, EF-EL Engine]  
31. Disconnect the connector of the intake air temperature sensor. [ED-20 Engine]  
32. Disconnect the connectors of the alternator.  
33. Disconnect the connectors of the EFI ECU.  
[ED-20, EF-EL Engine]



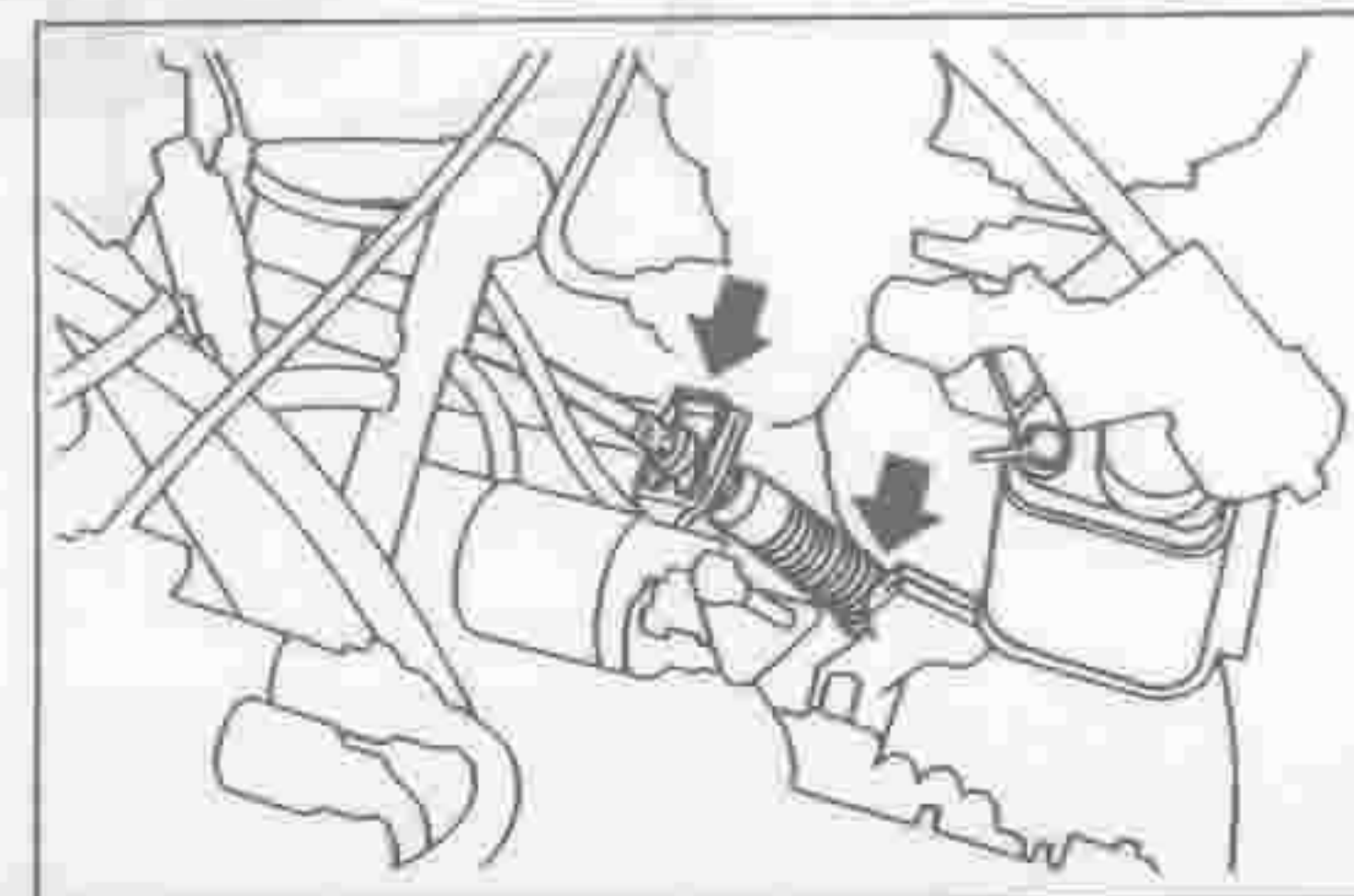
LEM00267-00247

34. Disconnect the resistive cord connecting the ignition coil with the distributor. This disconnection should be made at the distributor side.



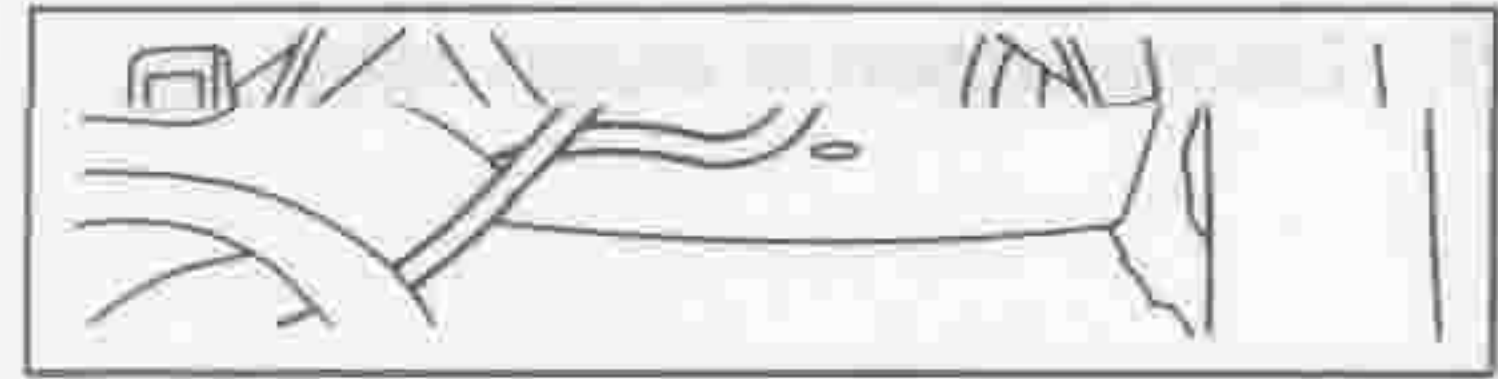
LEM00268-00248

35. Disconnection of shift control cable (shift side) from transmission  
(Refer to the MT section.)  
(1) Pull out the clip.  
(2) Remove the shift lever clip.  
(3) Disconnect the shift control cable.



LEM00269-00249

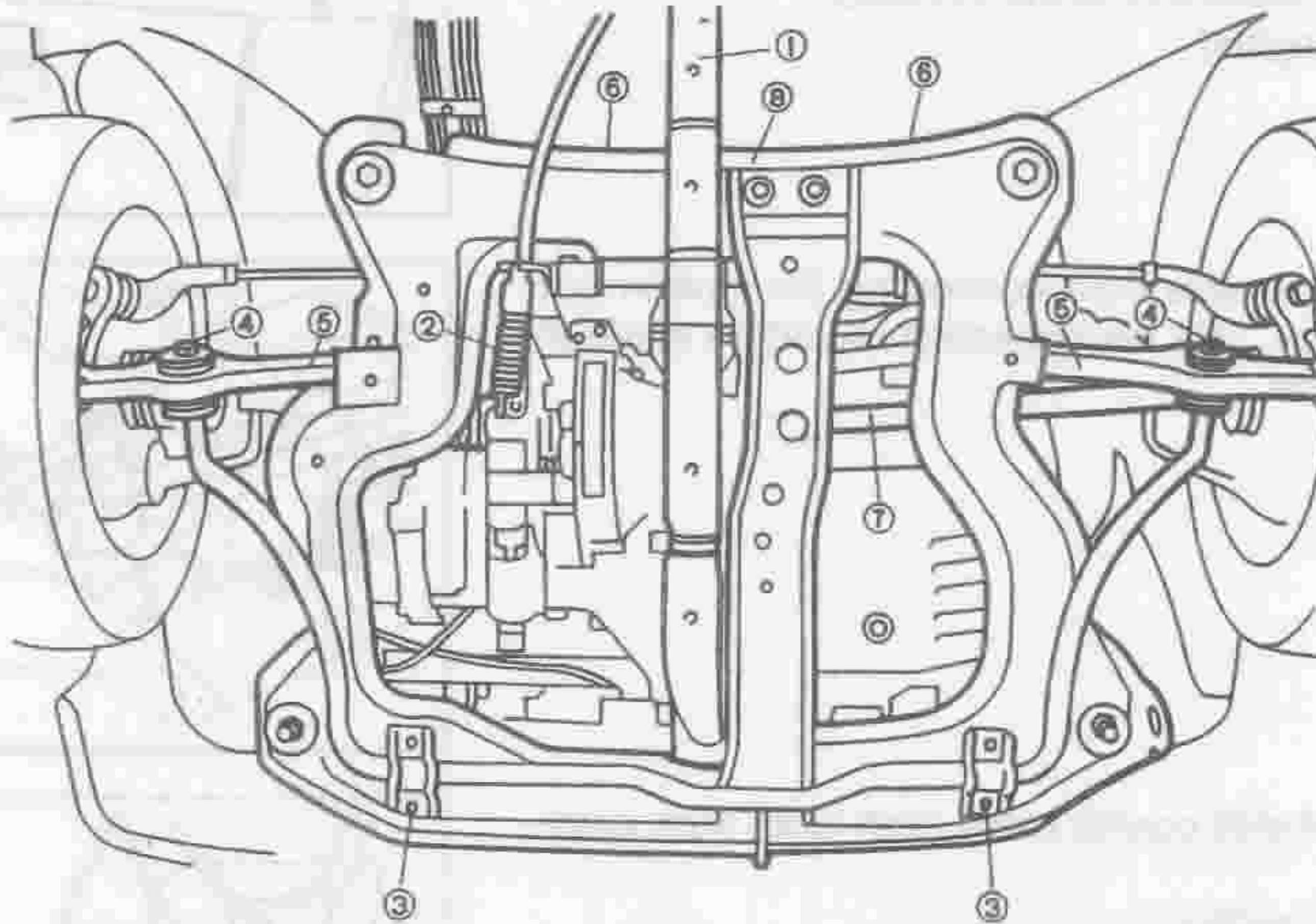
36. Remove the ground cable from the body by removing the



LEM00270-00250

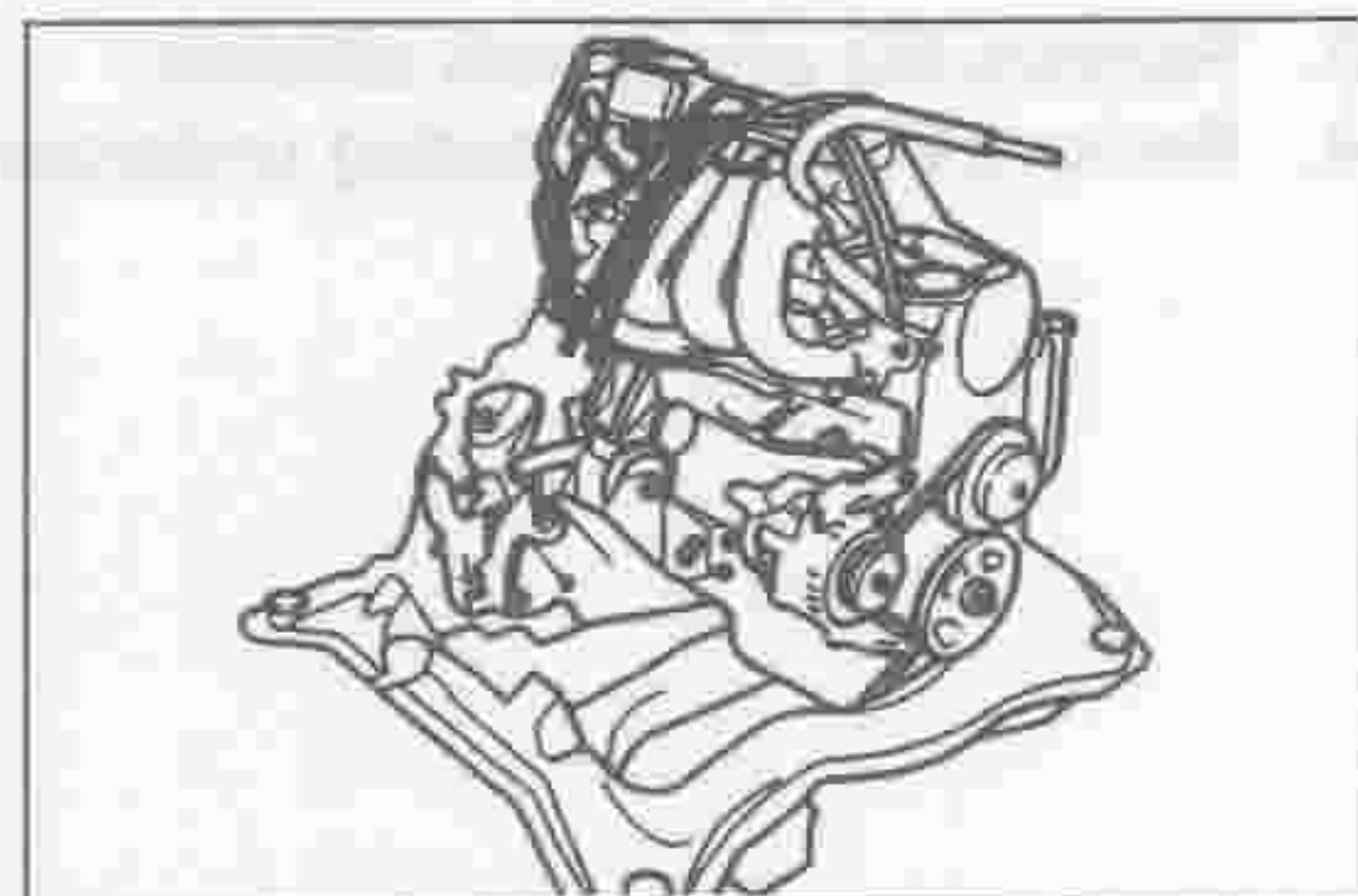
37. Remove or disconnect the following parts from the lower side of the vehicle.

- (1) Exhaust front pipe
- (2) Shift control cable (select side) (Refer to the MT section.)
- (3) Front stabilizer brackets (Refer to the FS section.)
- (4) Front stabilizer (Refer to the FS section.)
- (5) Lower arms (Refer to the FS section.)
- (6) Steering rack housing bracket attaching bolt (Refer to the SR section.)
- (7) Drive shaft (Refer to the FS section.)
- (8) Shift control cable (shift side) clamp bolt (Refer to the MT section.)



LEM00271-00251

38. While supporting the lower frame with safety stands or engine service jacks, lift the vehicle upward. Leave the engine installed on the frame.

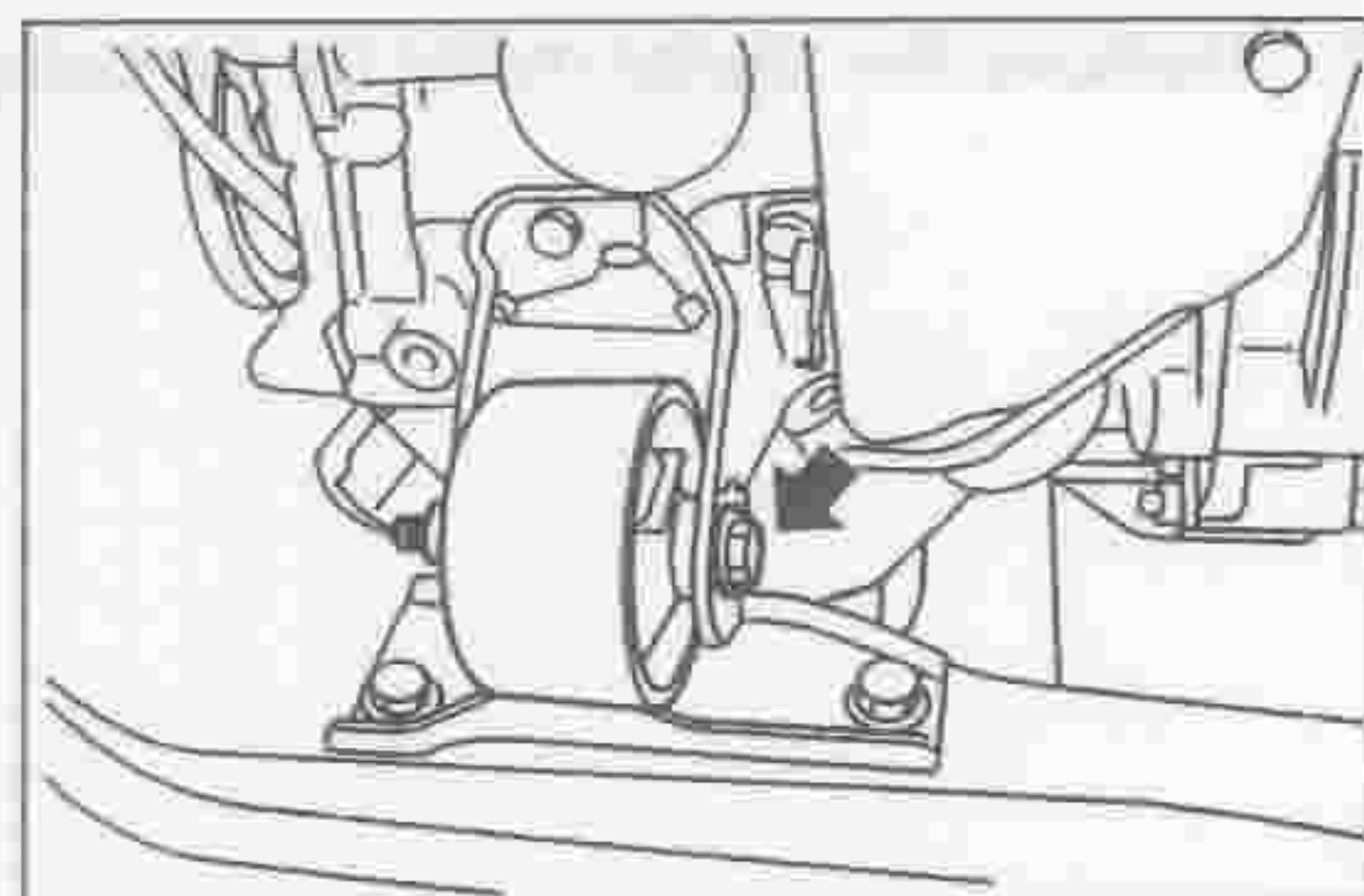


LEM00272-00252

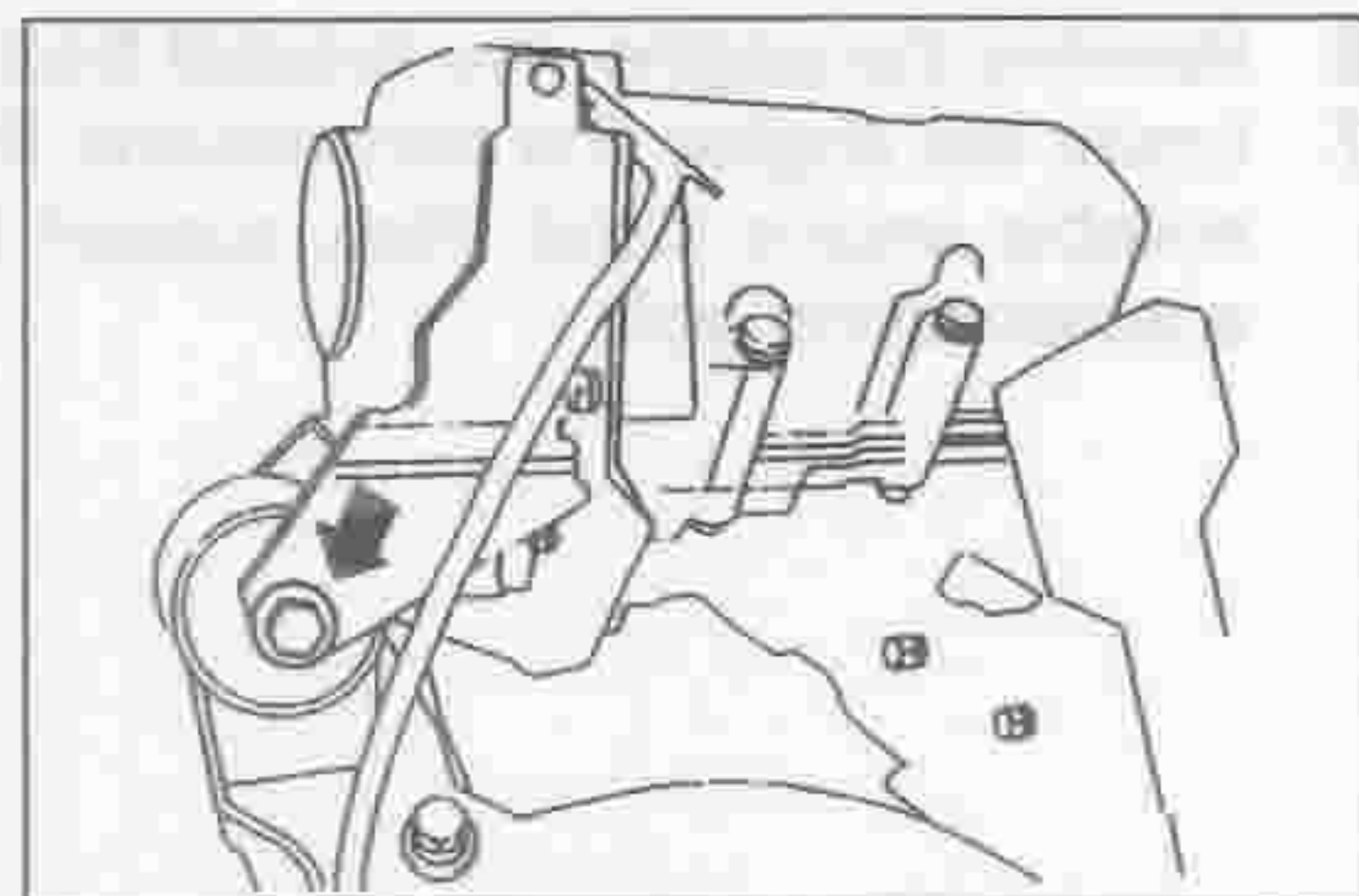
39. While holding the engine and transmission with a chain block, remove the mounting bolts.

**NOTE:**

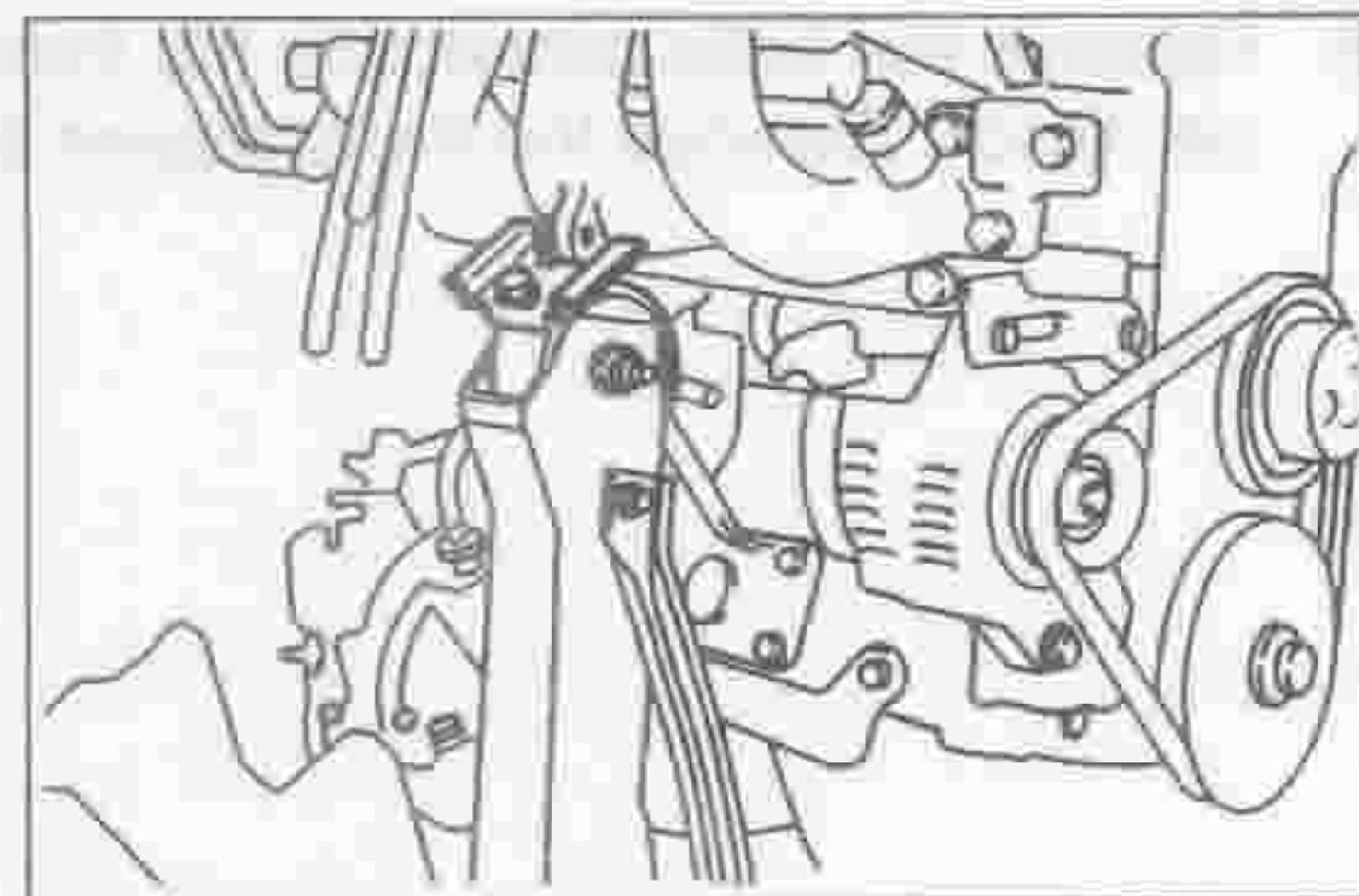
- Do not allow the frame to be lifted.



LEM00273-00253

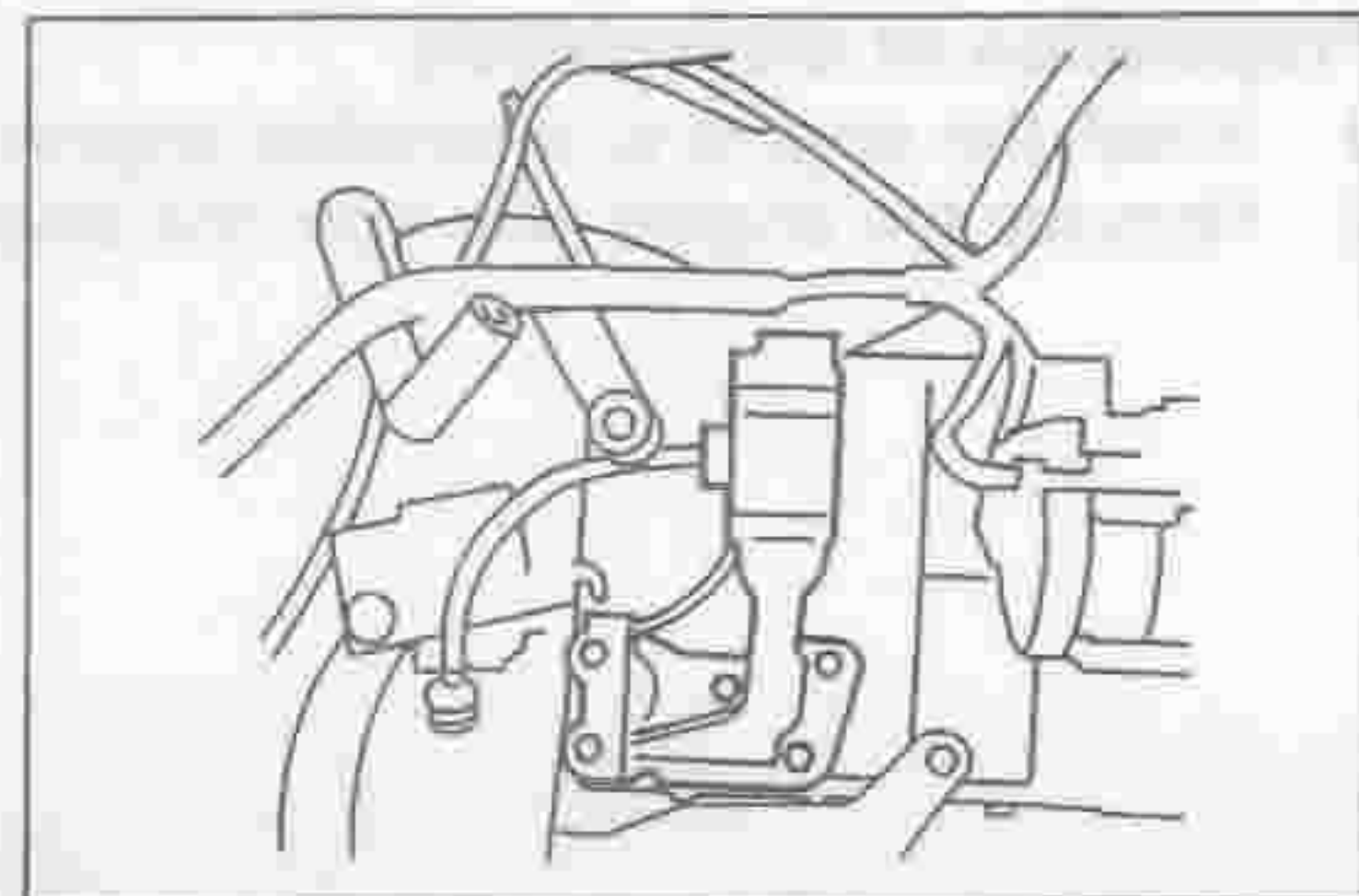


LEM00000-00254



LEM00000-00255

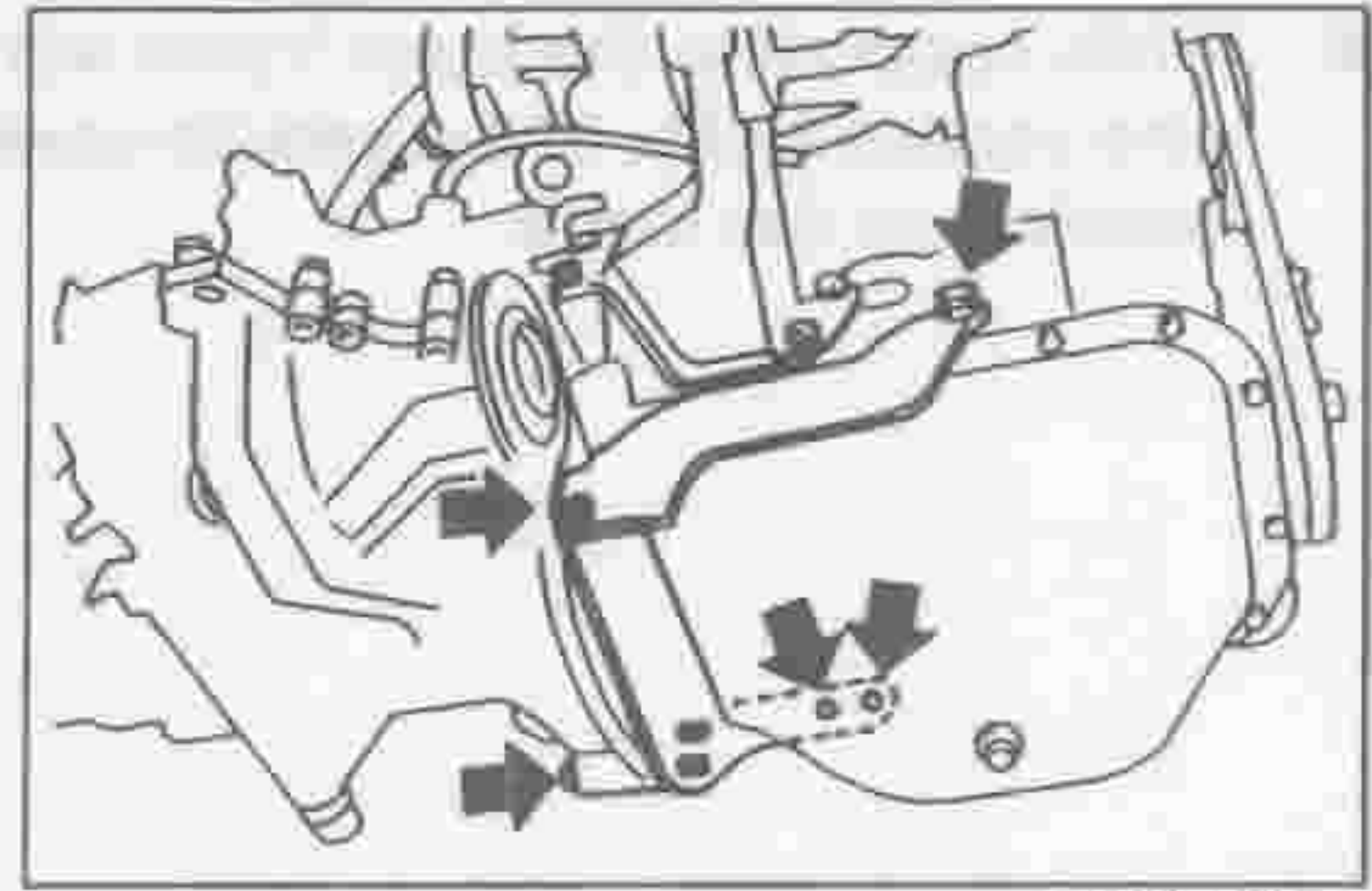
40. Sling the engine and transmission with a chain block.  
41. Remove the intake manifold stay.  
42. Remove the engine mounting rear bracket.



LEM00274-00256

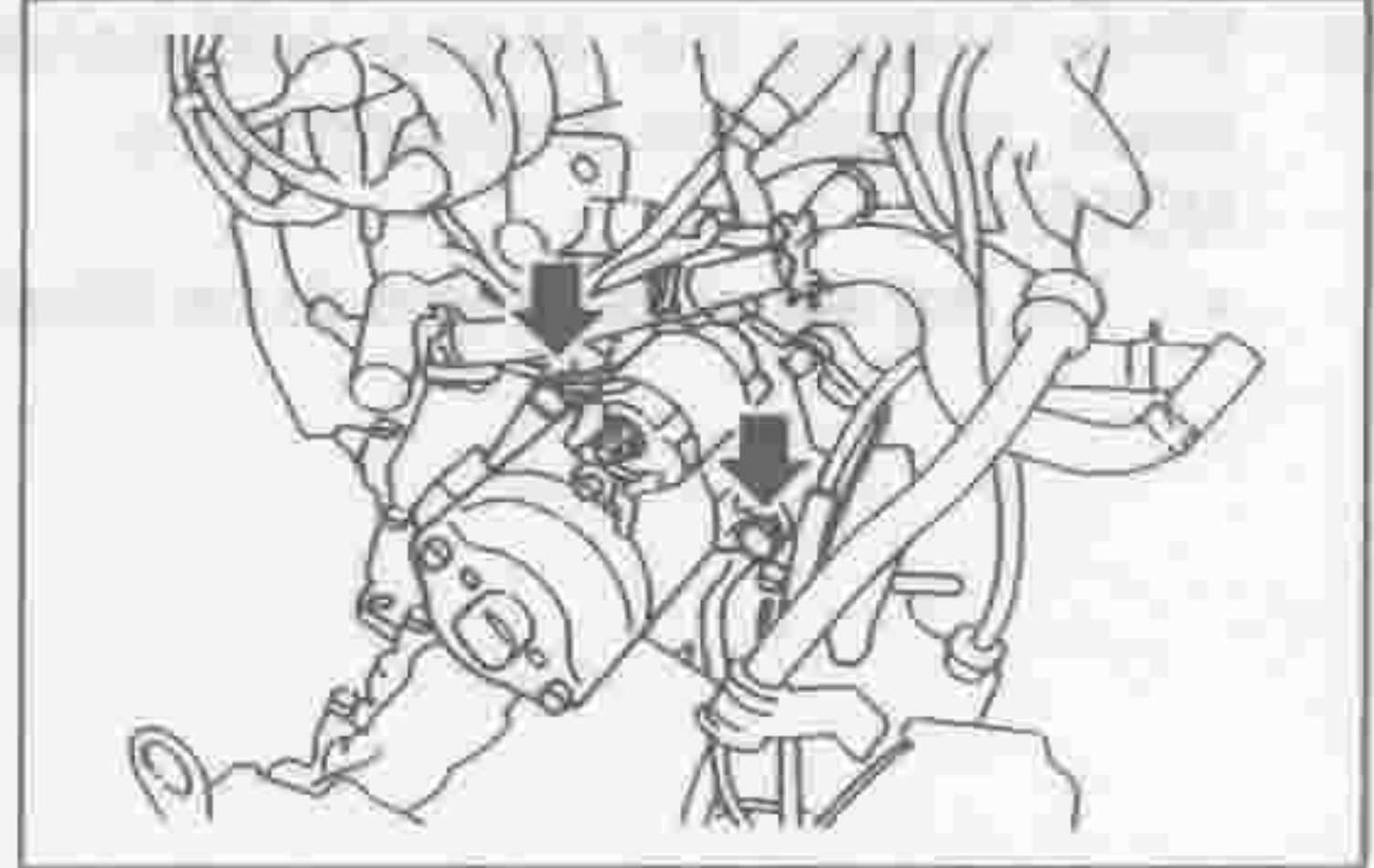
# EM-68

- 43. Remove the power train stiffener.
- 44. Remove the clutch housing undercover.



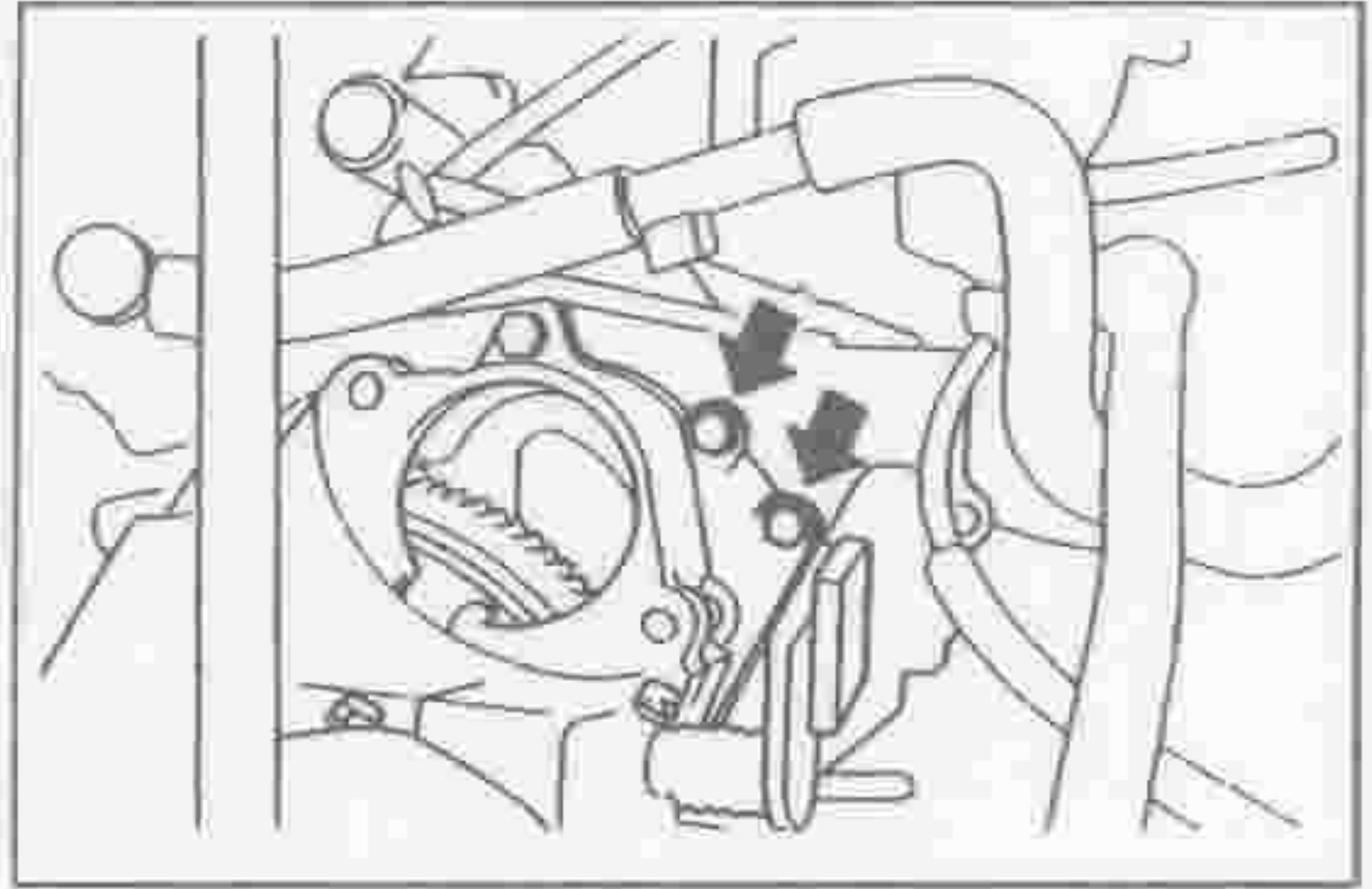
LEM00275-00257

- 45. Remove the starter motor by removing the attaching bolts.



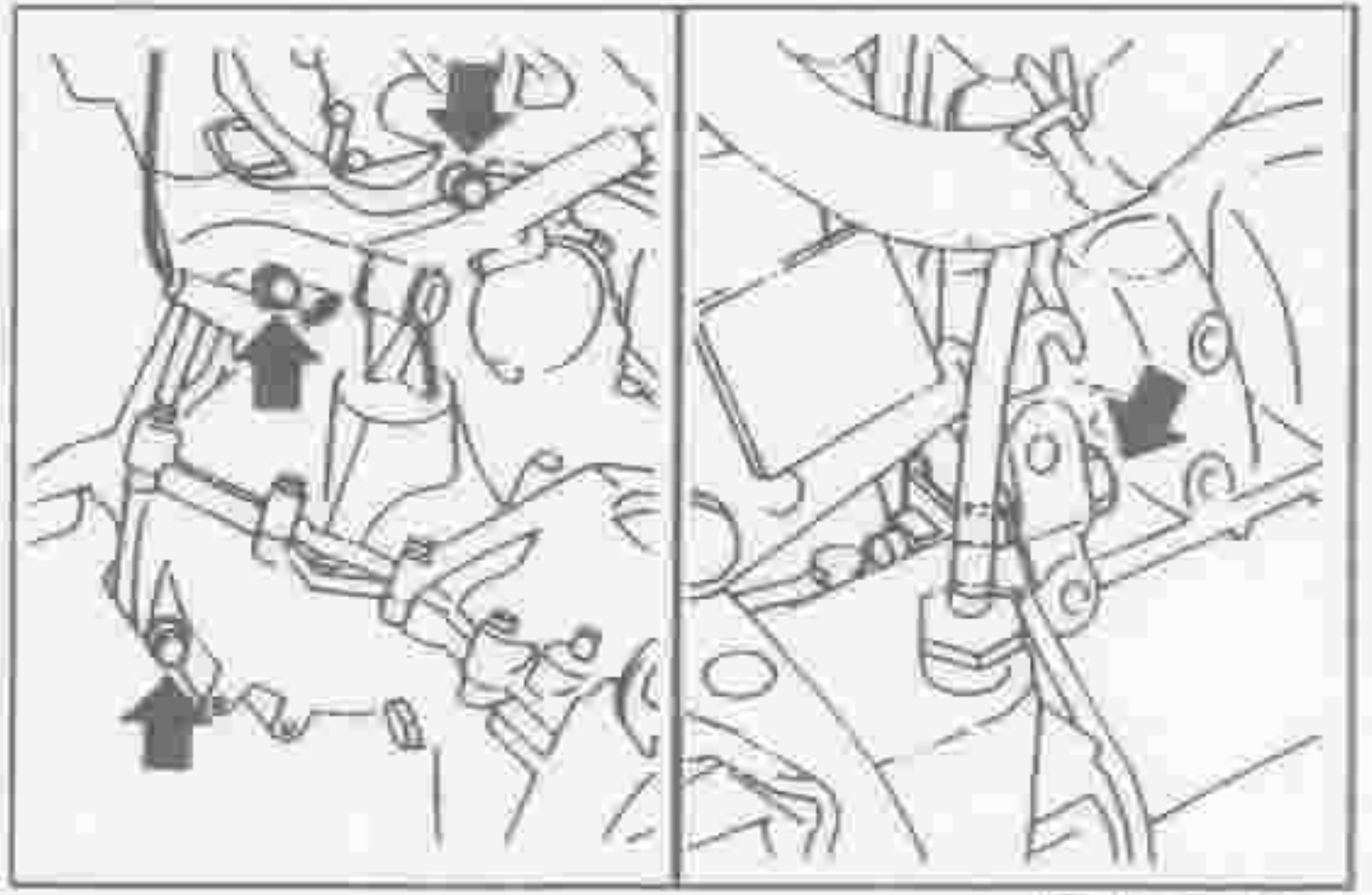
LEM00276-00258

- 46. Remove the engine wire bracket from the transmission.
- 47. Lower the engine and transmission. Place the engine on a suitable engine stand. Also, support the transmission with a transmission jack.



LEM00277-00259

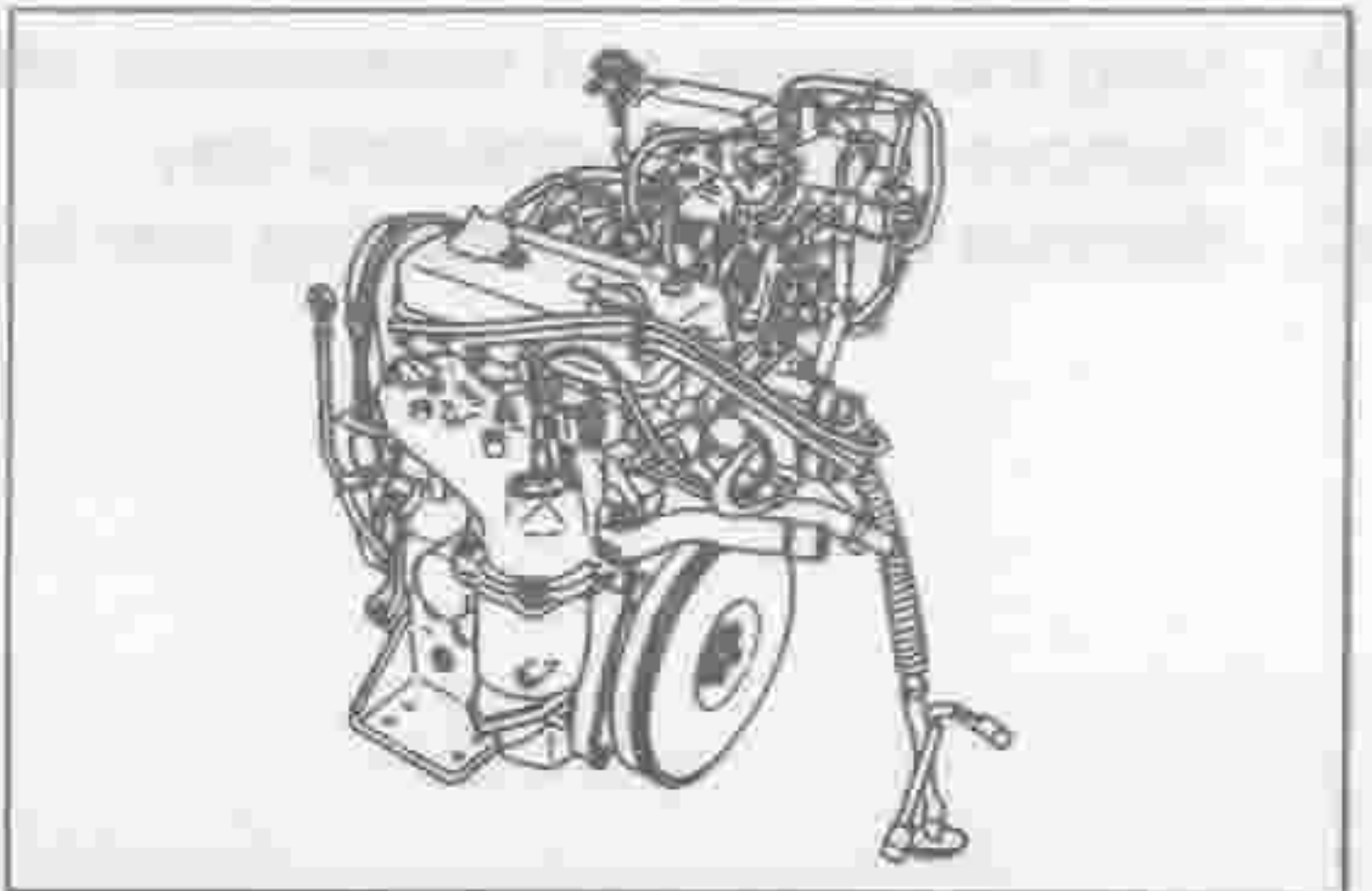
- 48. Remove the bolts connecting the transmission to the cylinder block. Remove the transmission from the engine.



LEM00278-00260

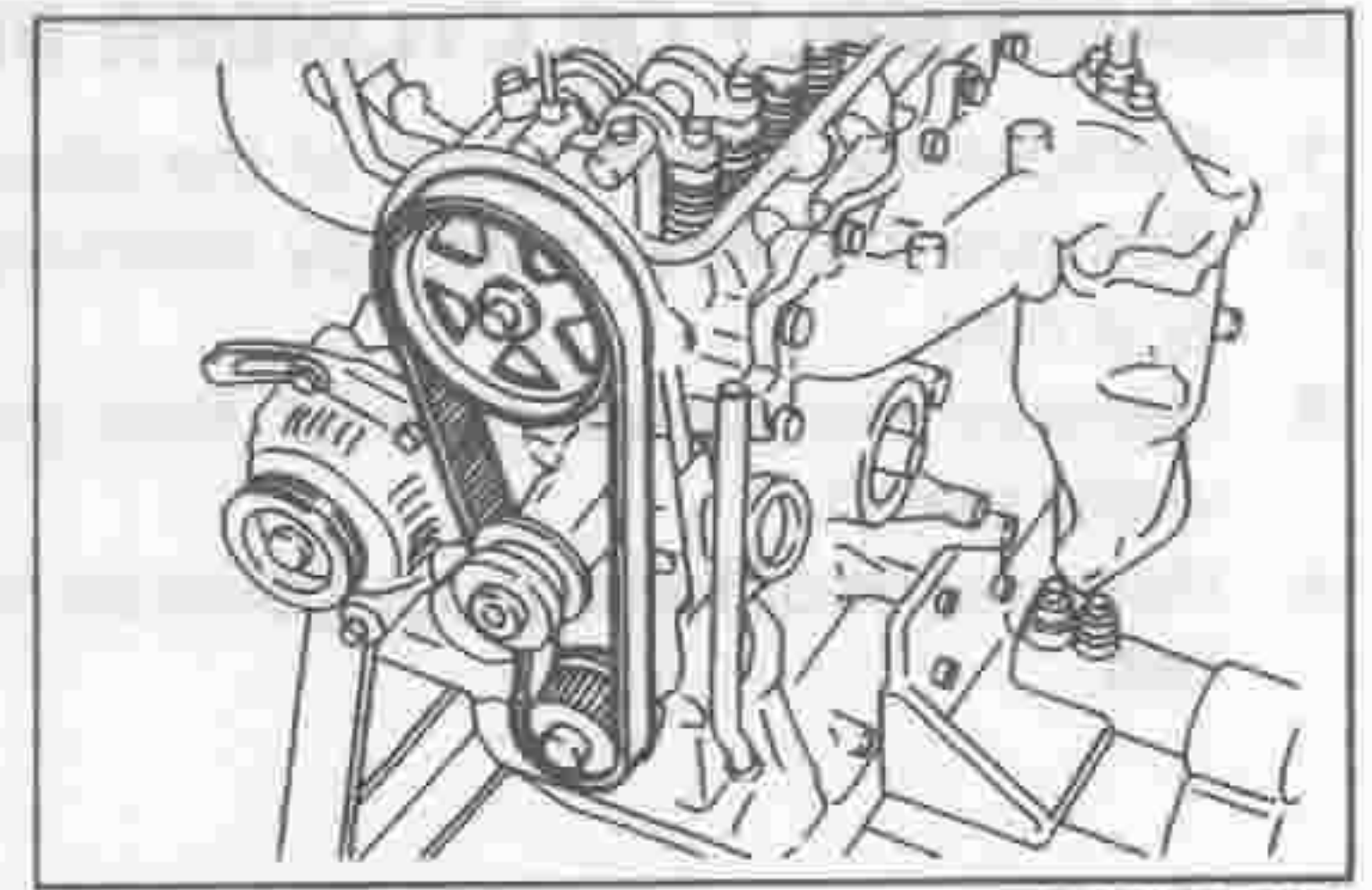
## Preparation of disassembly

- 1. Install the engine to a suitable engine stand.
- 2. Remove the engine wire from the engine.



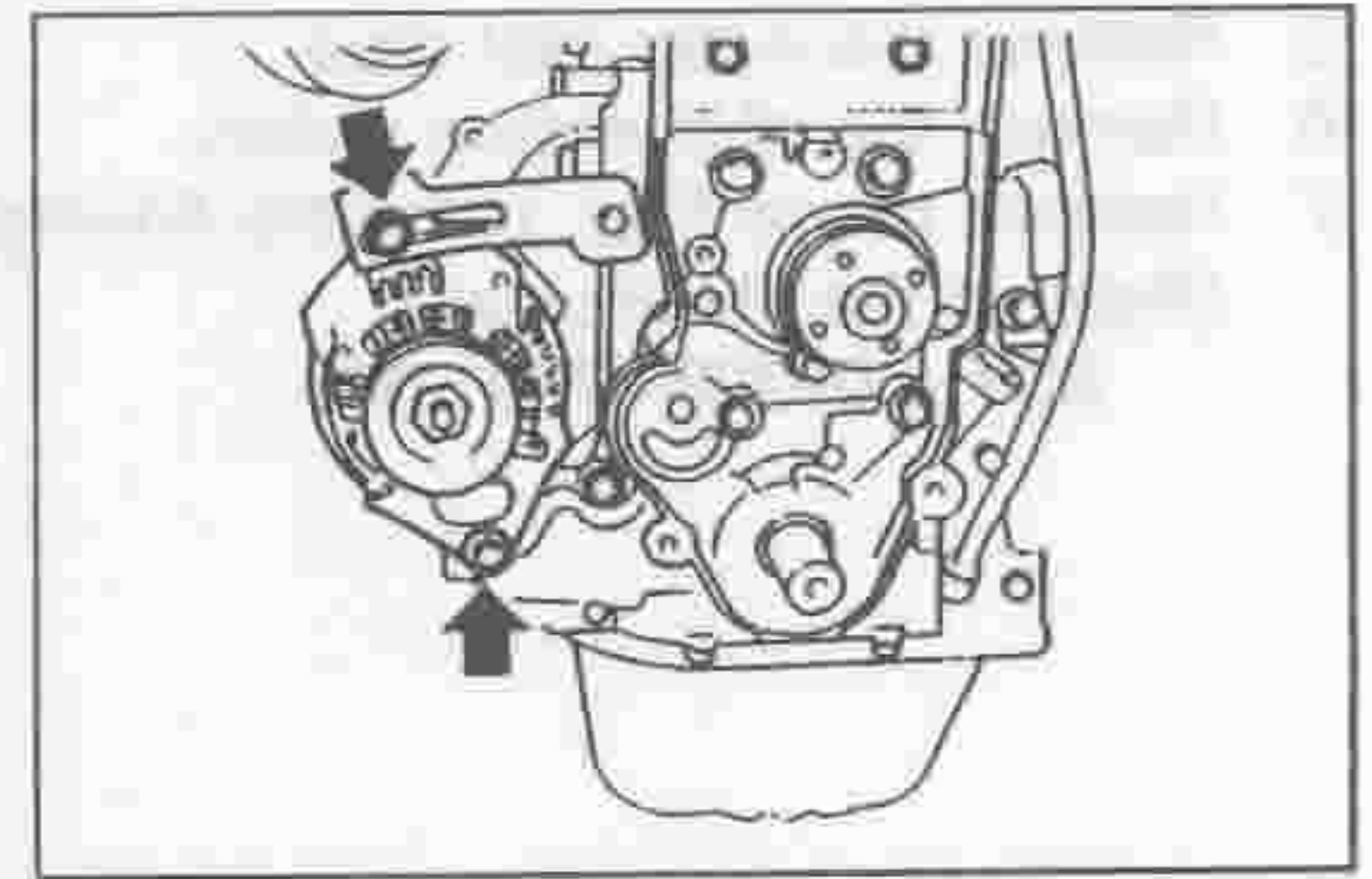
LEM00279-00261

3. Disconnect the water hose from the water inlet pipe.
4. Remove the drive belt.
5. Remove the timing belt. (See page EM-10.)



LEM00280-00262

6. Remove the alternator attaching bolt and remove the alternator.
7. Remove the exhaust manifold stay.



LEM00281-00263

8. Removal of cylinder head cover  
(See page EM-23 or EM-29.)



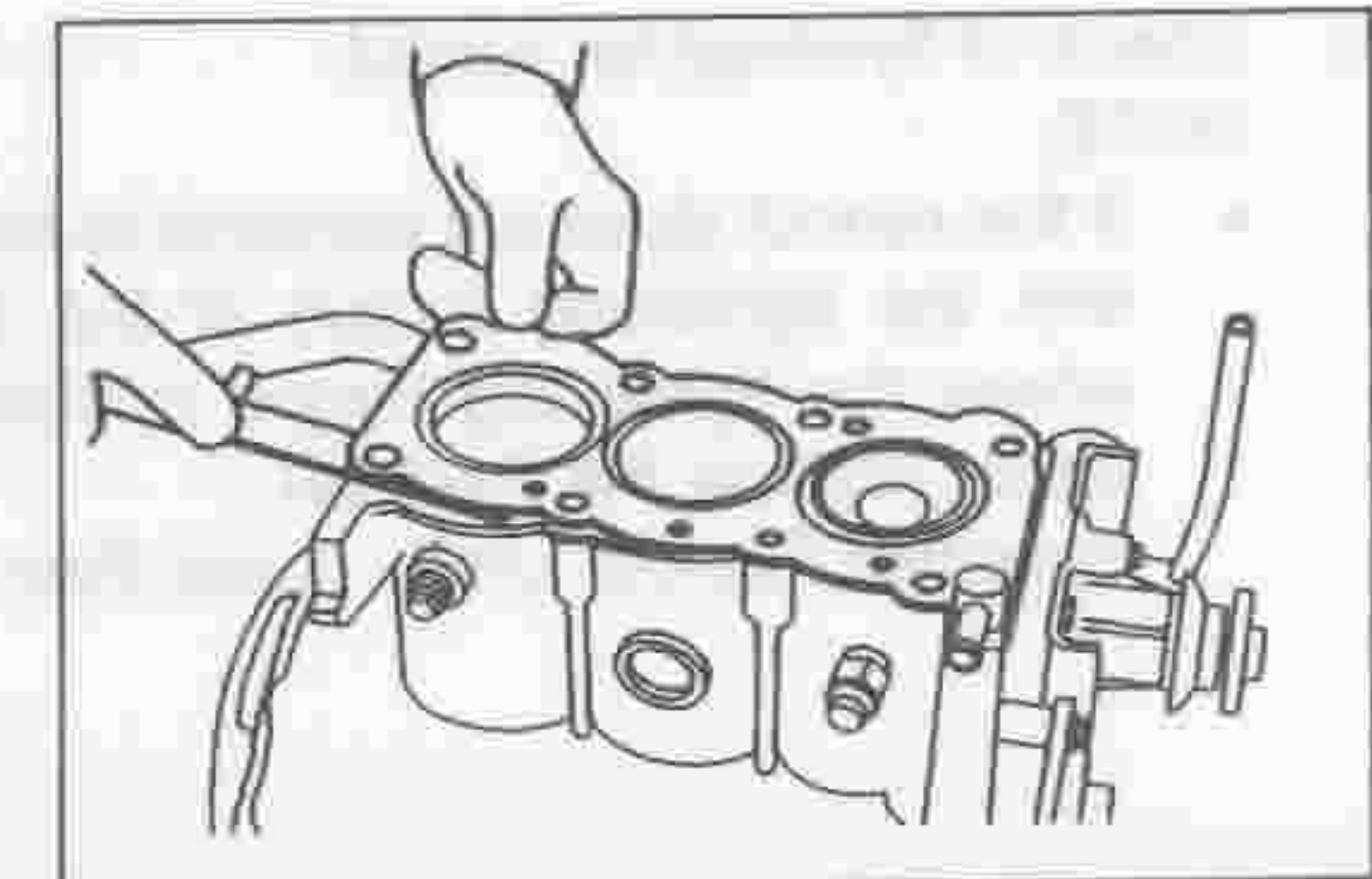
LEM00282-00000

9. Removal of cylinder head  
(See page EM-24 or EM-30.)



LEM00283-00000

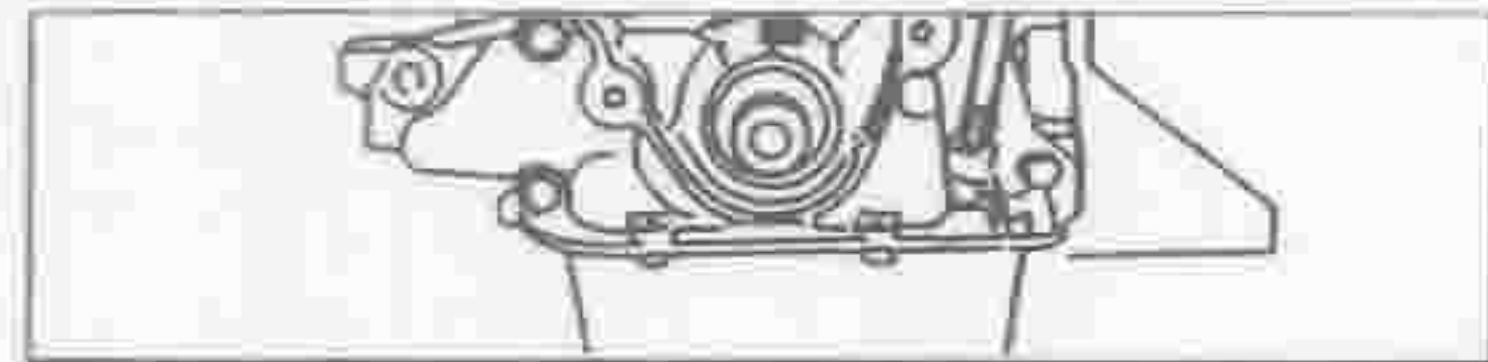
10. Remove the cylinder head gasket.



LEM00284-00266

# EM-70

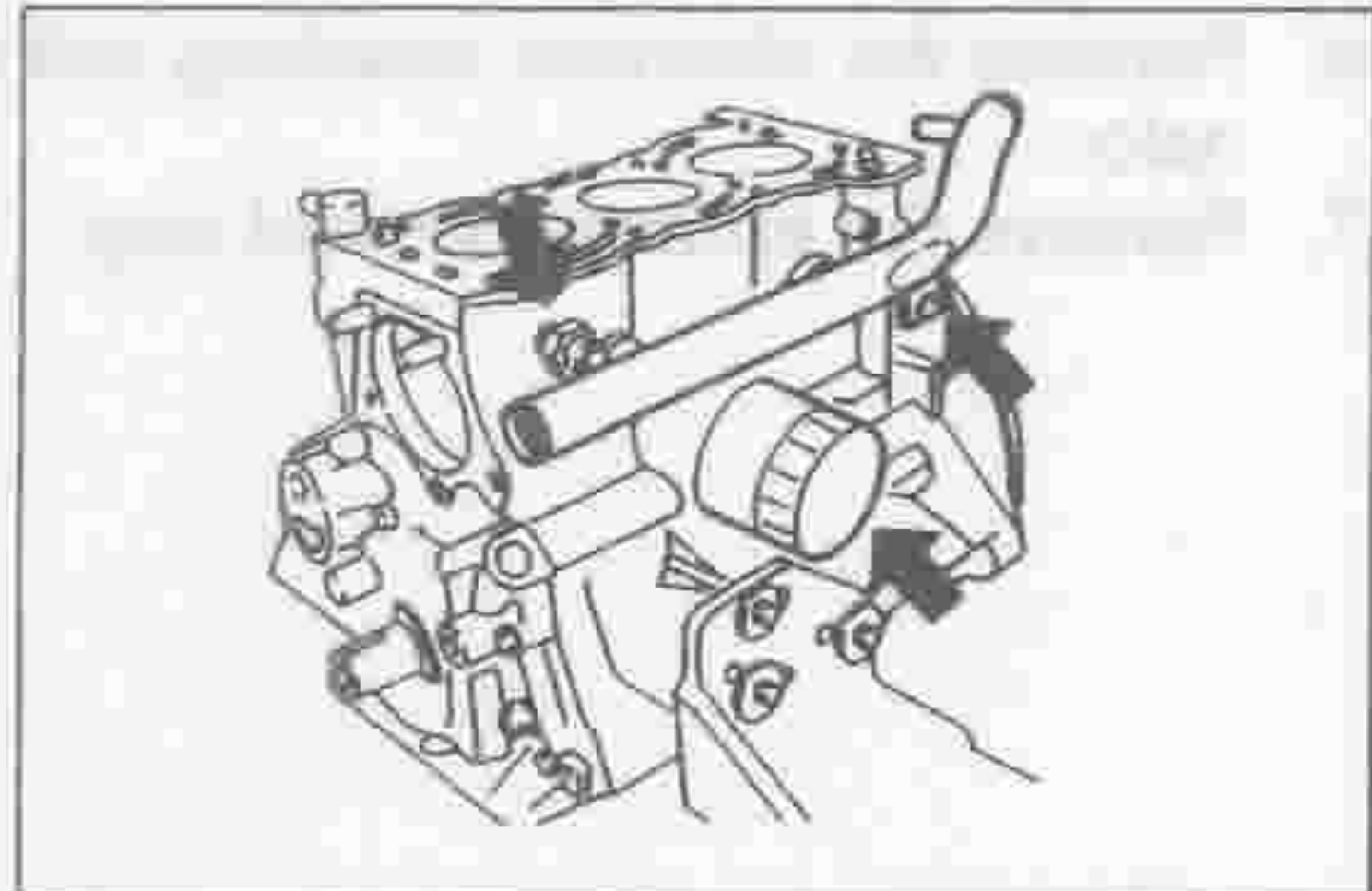
4. Remove the oil level gauge guide by removing the attaching bolt.



LEM00285-00267

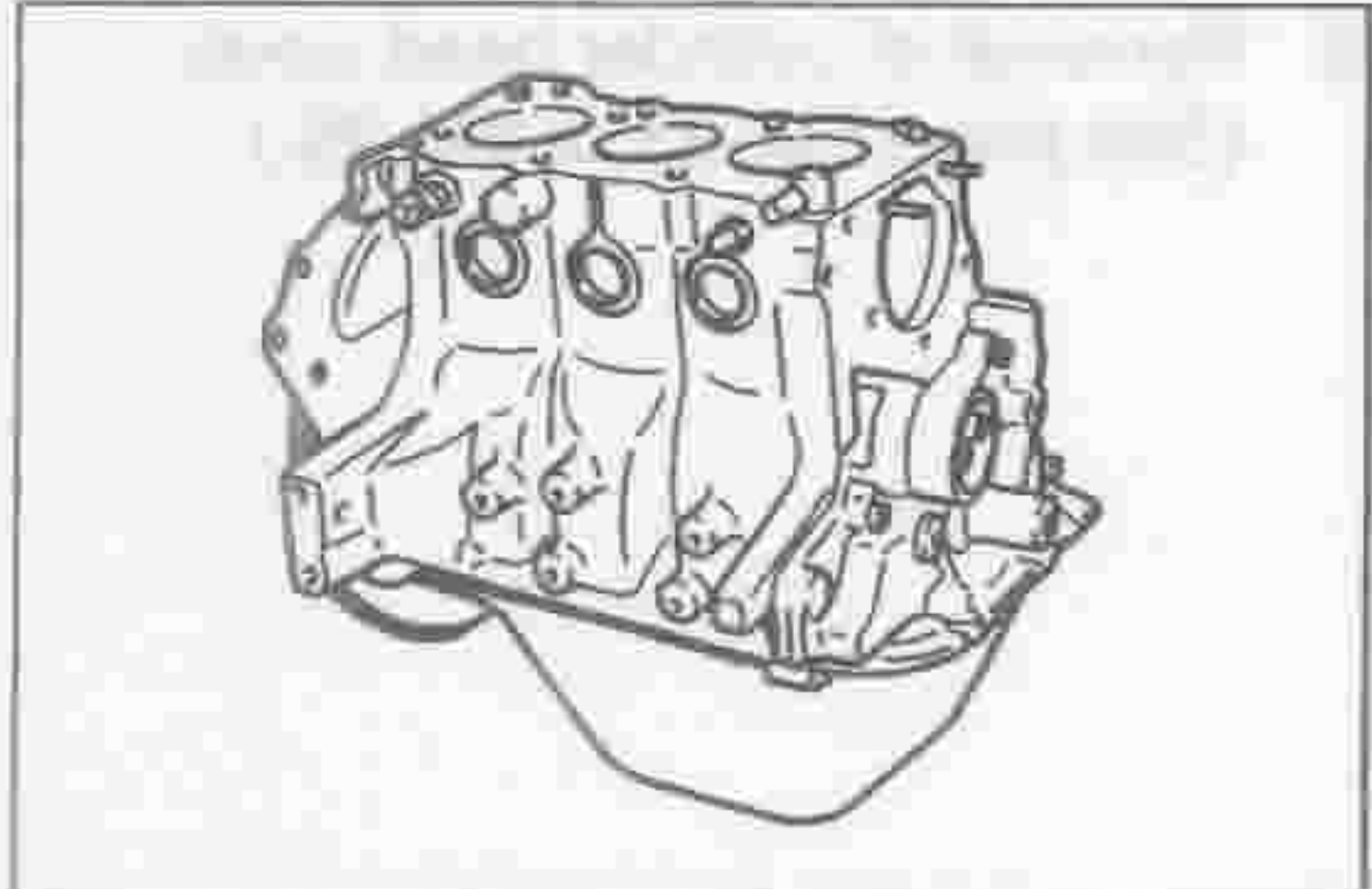
5. Remove the water inlet pipe.  
6. Remove the oil pressure switch.  
7. Remove the oil filter, using the following SST.  
(Refer to the LU section.)

SST: 09228-87201-000



LEM00286-00268

8. Remove the water temperature sensor.

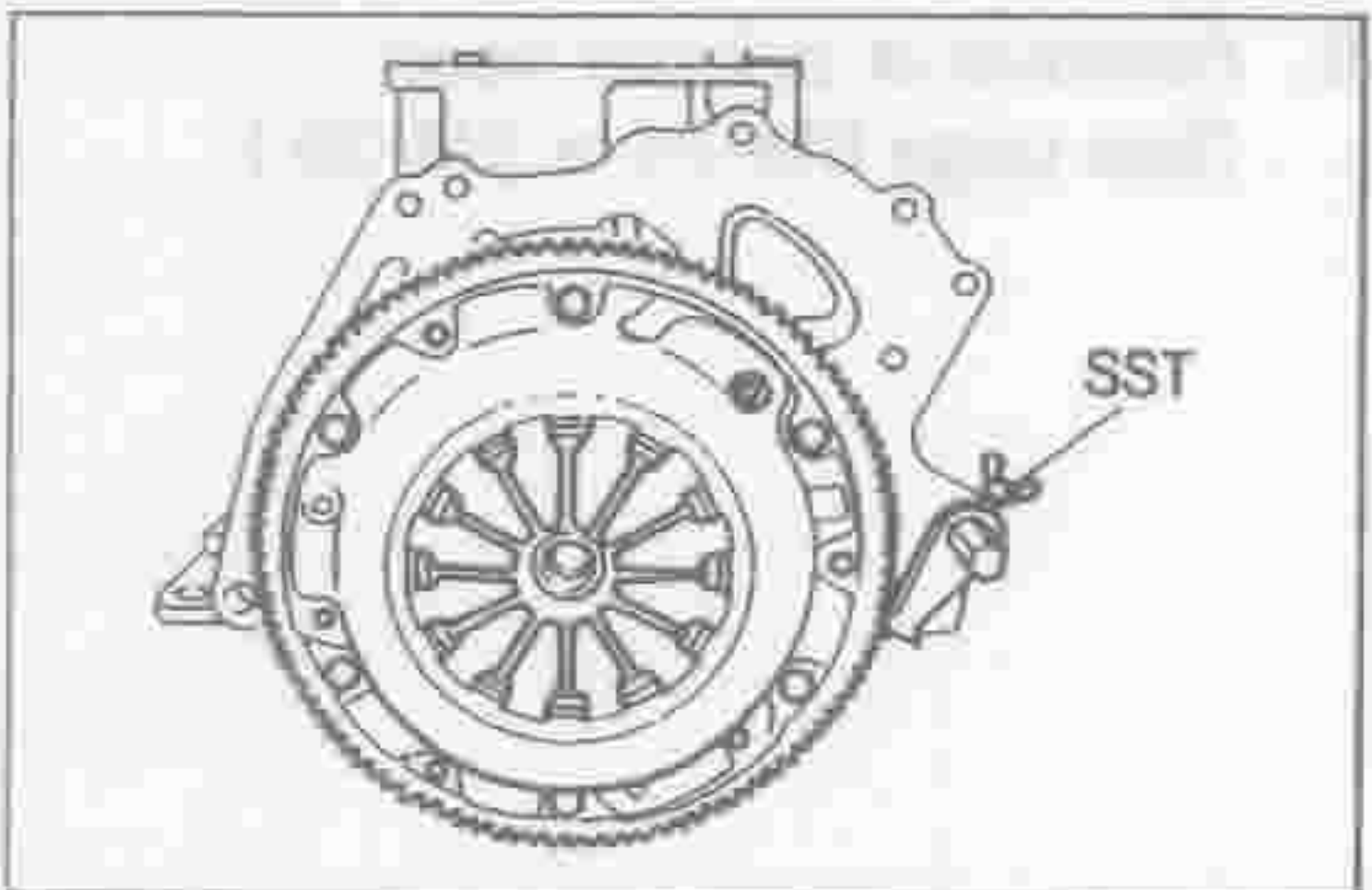


LEM00287-00269

9. Remove the pressure plate and clutch disc.  
NOTE:

- Prevent the pressure plate from turning, using the following SST.

SST: 09210-87701-000

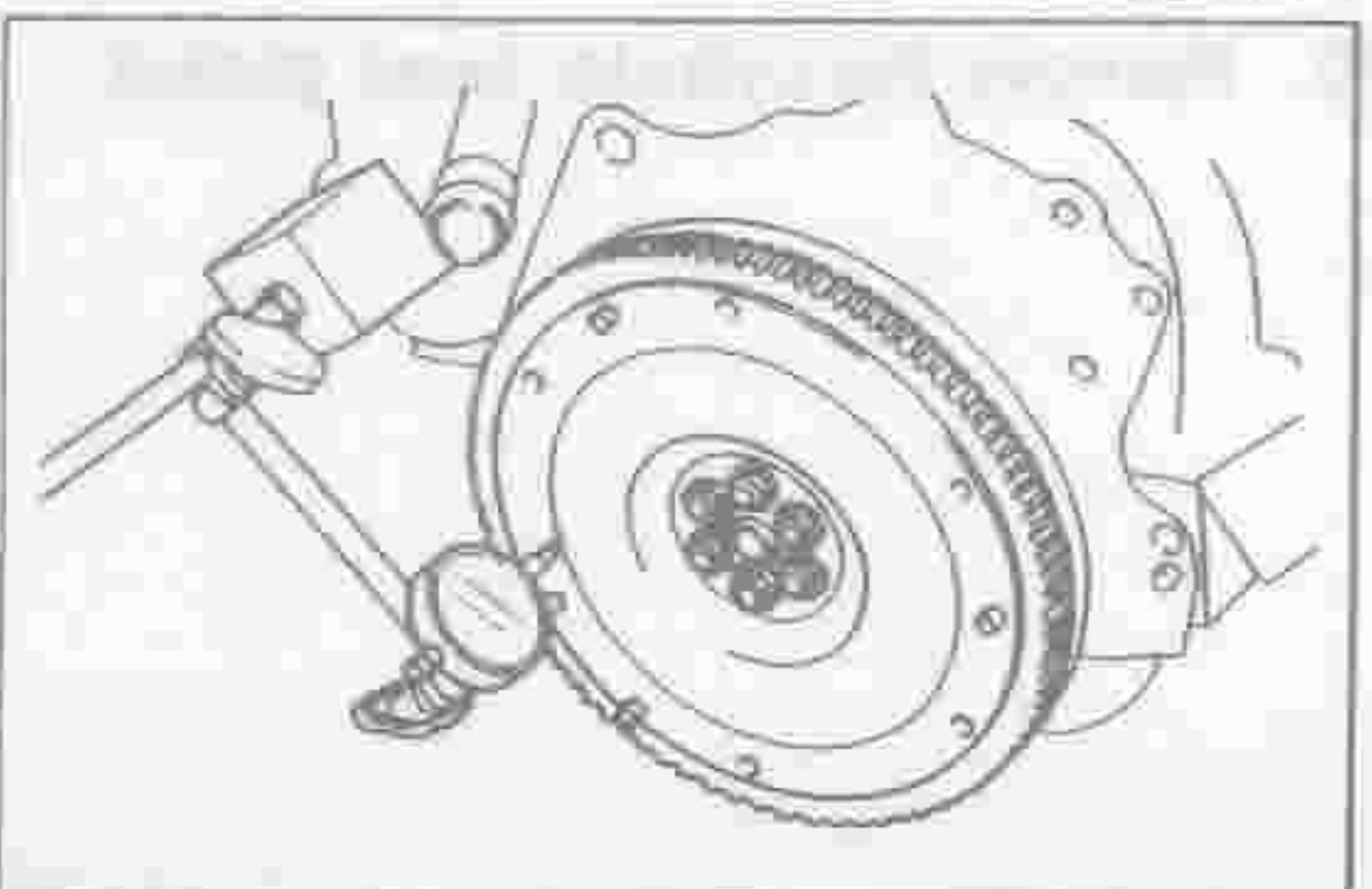


LEM00288-00270

10. Check of flywheel for runout  
NOTE:

- If the runout does not conform to the specification, confirm the tightening torque of the flywheel. Only case where the tightening torque conforms to the specified value, replace the flywheel.

Specified Runout Limit: Less than 0.1 mm

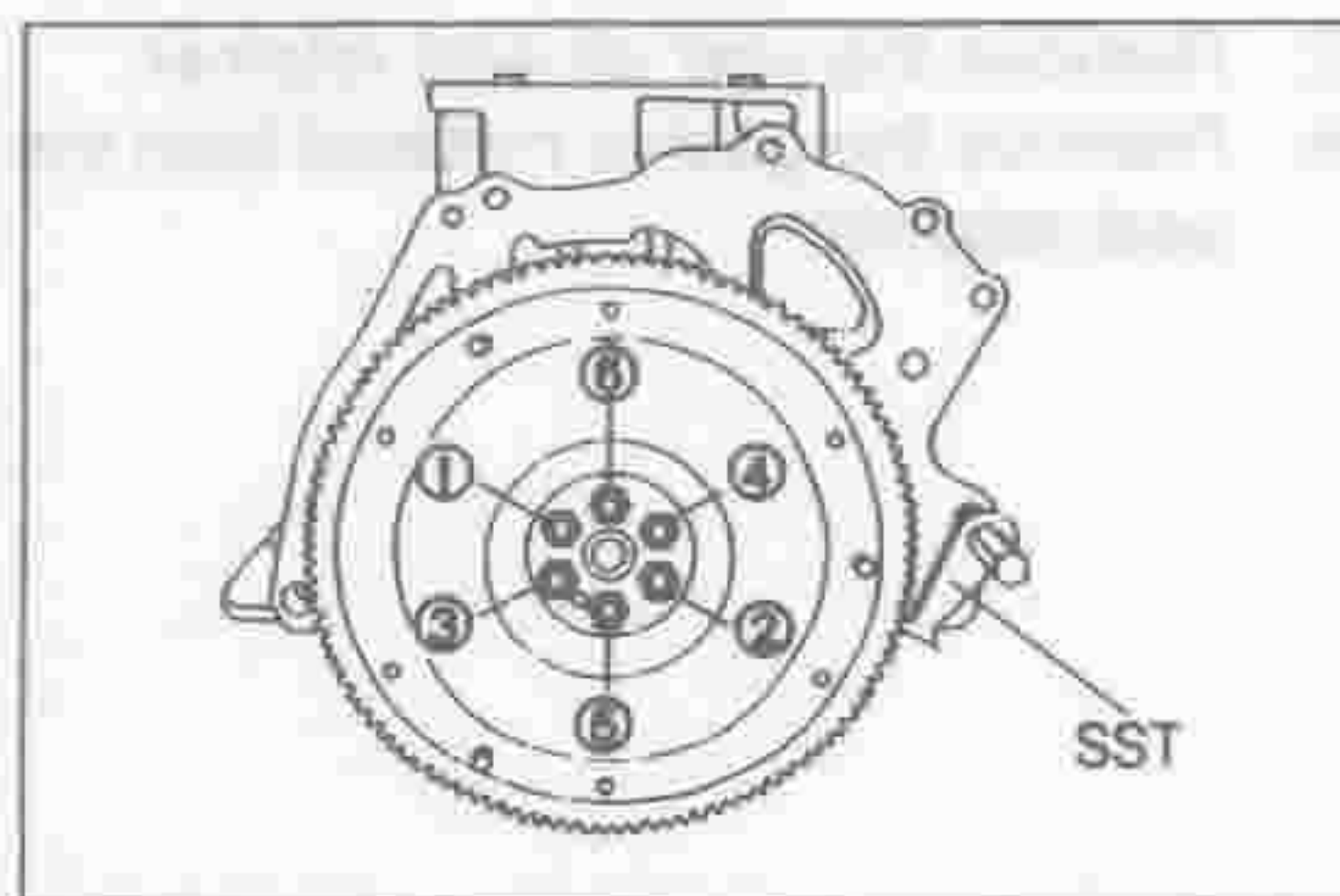


LEM00289-00271

11. Loosen the attaching bolts of the flywheel or drive plate in the sequence as indicated in the right figure. Remove the flywheel.

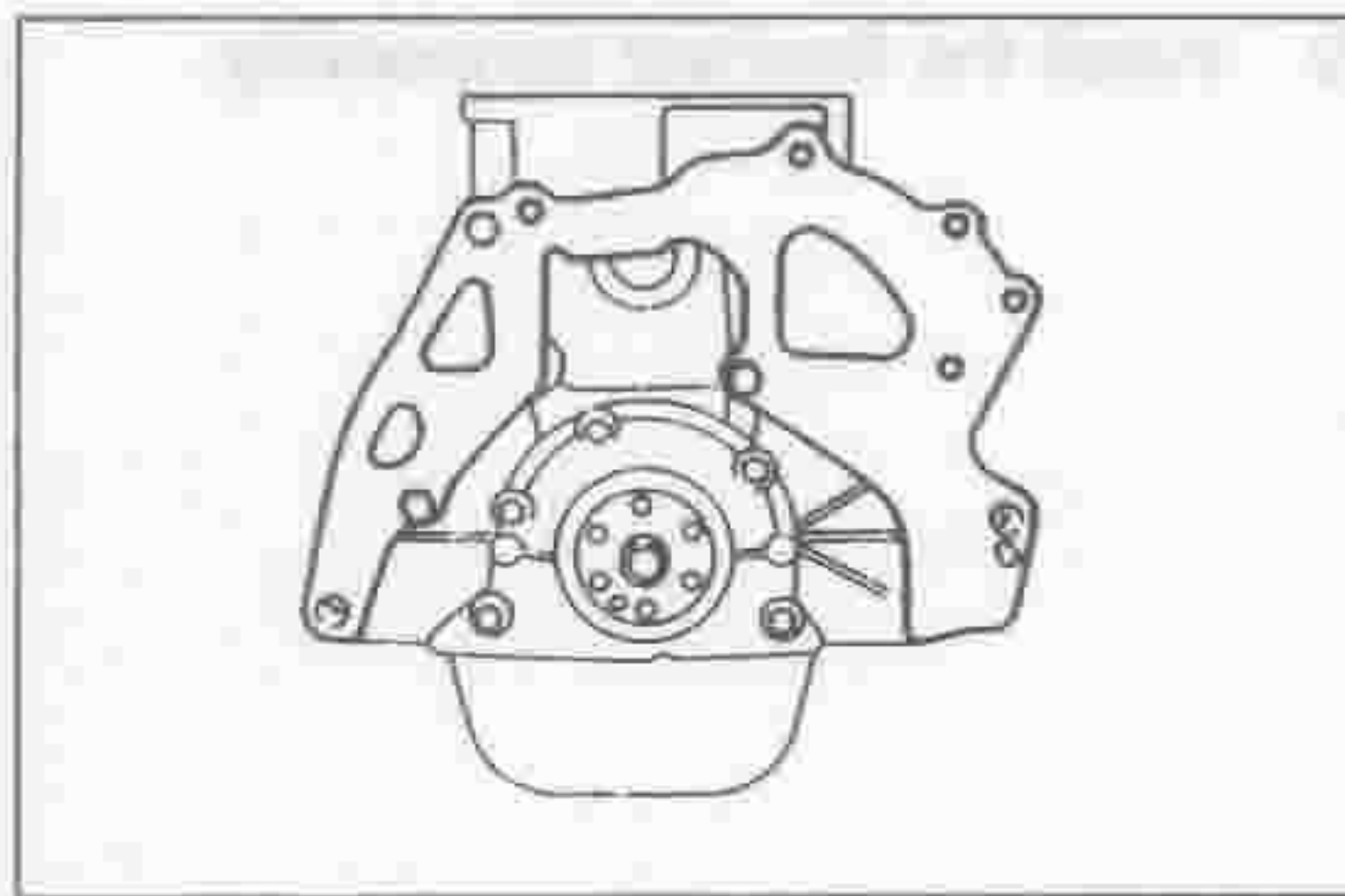
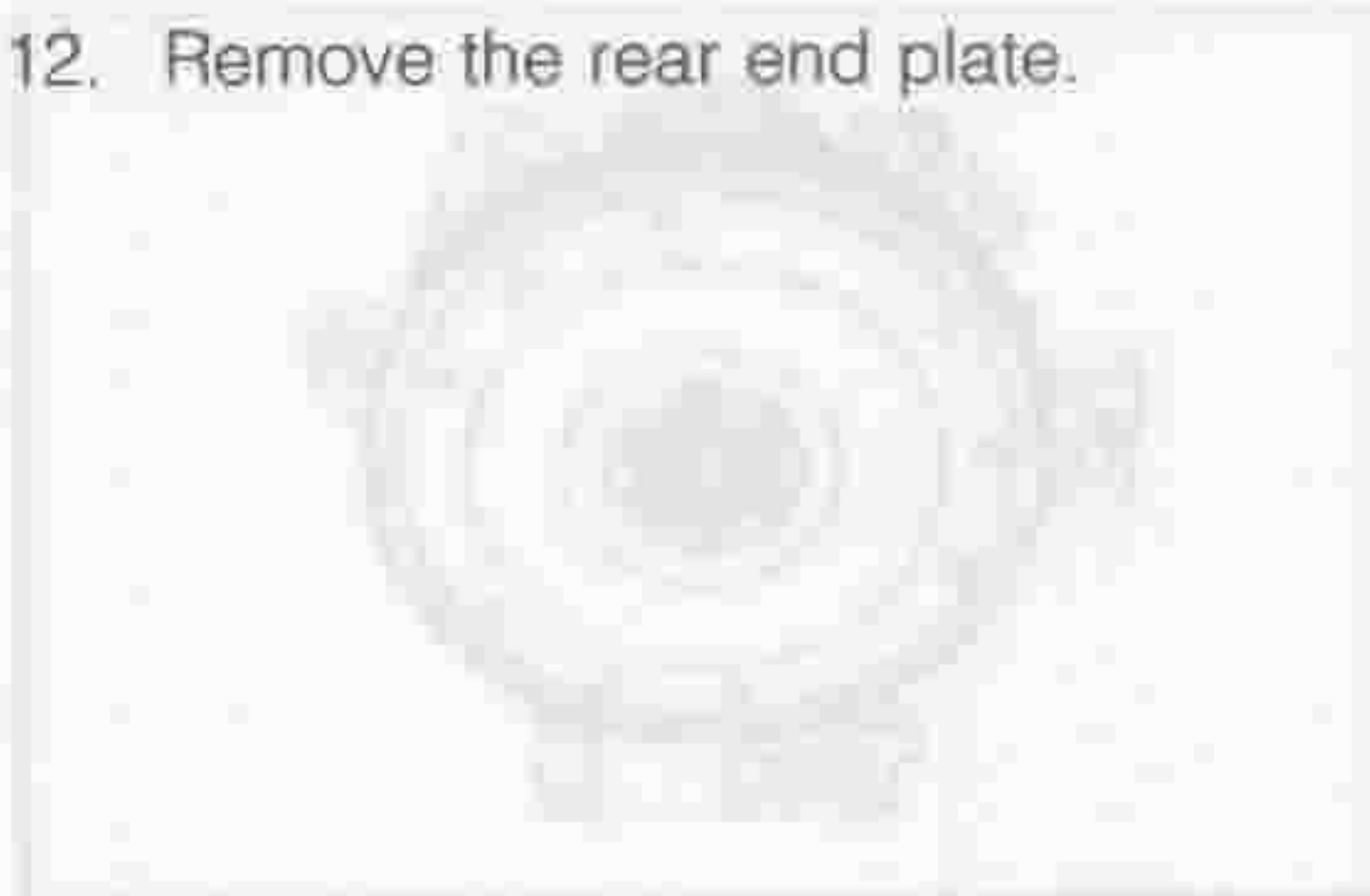
**NOTE:**

- Prevent the flywheel from turning, using the following SST.
- SST: 09210-87701-000



LEM00290-00272

12. Remove the rear end plate.

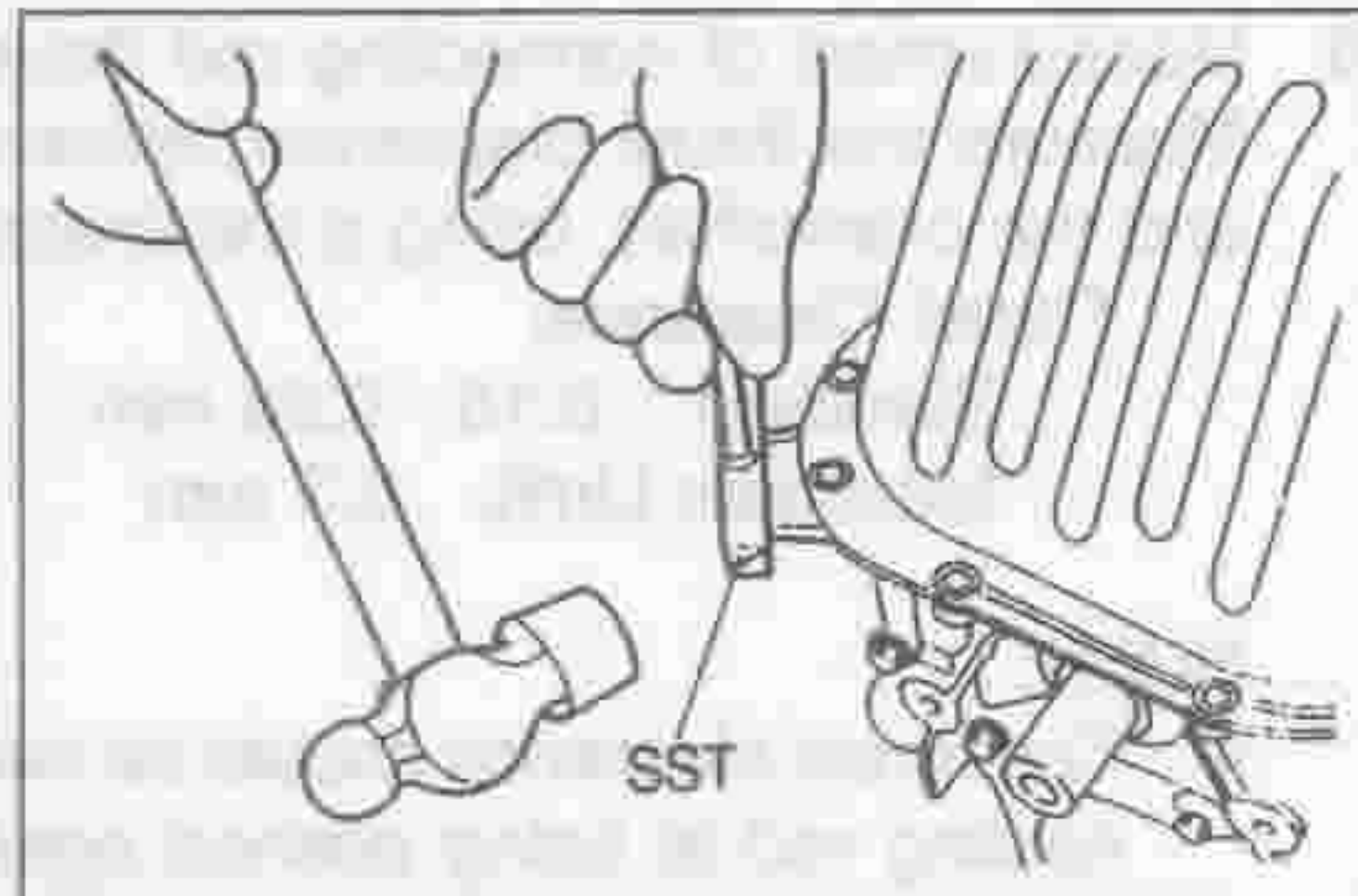


LEM00291-00273

13. Removal of oil pan

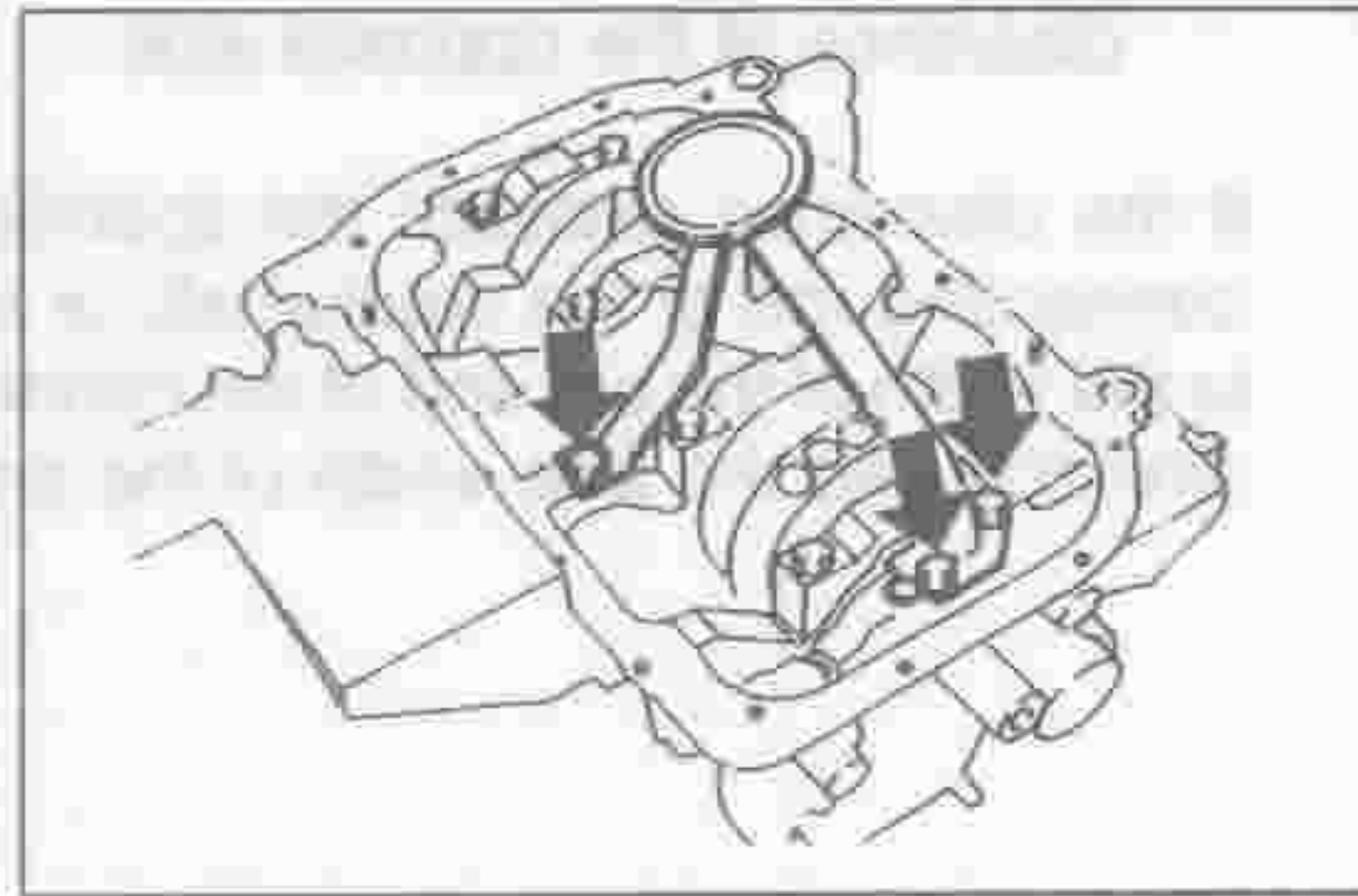
- (1) Loosen the attaching bolts and nuts of the oil pan over two or three stages. Pull out the bolts and nuts.
- (2) Separate the oil pan from the cylinder block by driving the following SST into between the cylinder block and the oil pan.

SST: 09032-00100-000



LEM00292-00274

14. Remove the oil strainer.



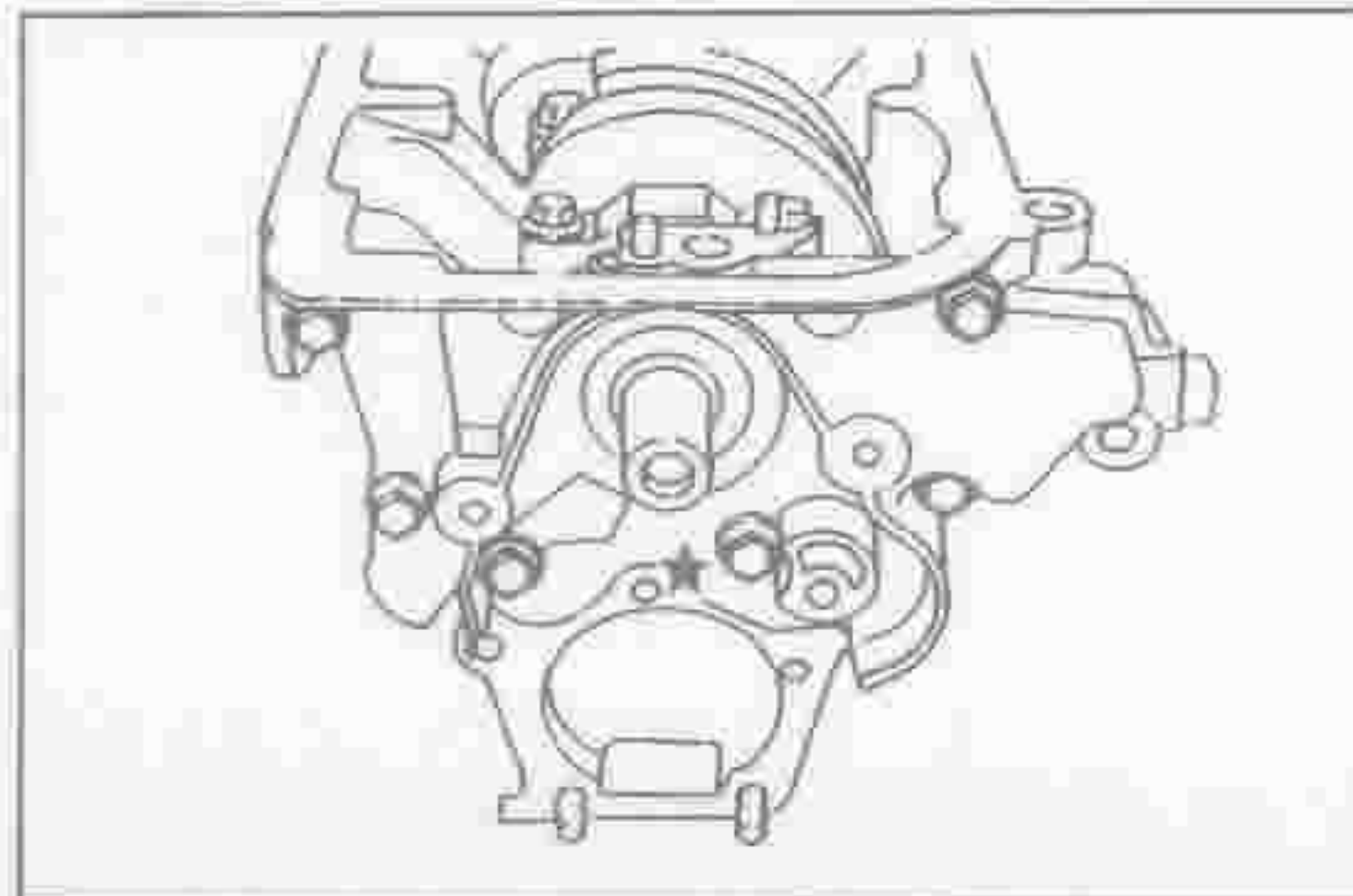
LEM00293-00275

15. Remove the oil pump.

16. Remove the gasket material from the cylinder block and oil pump.

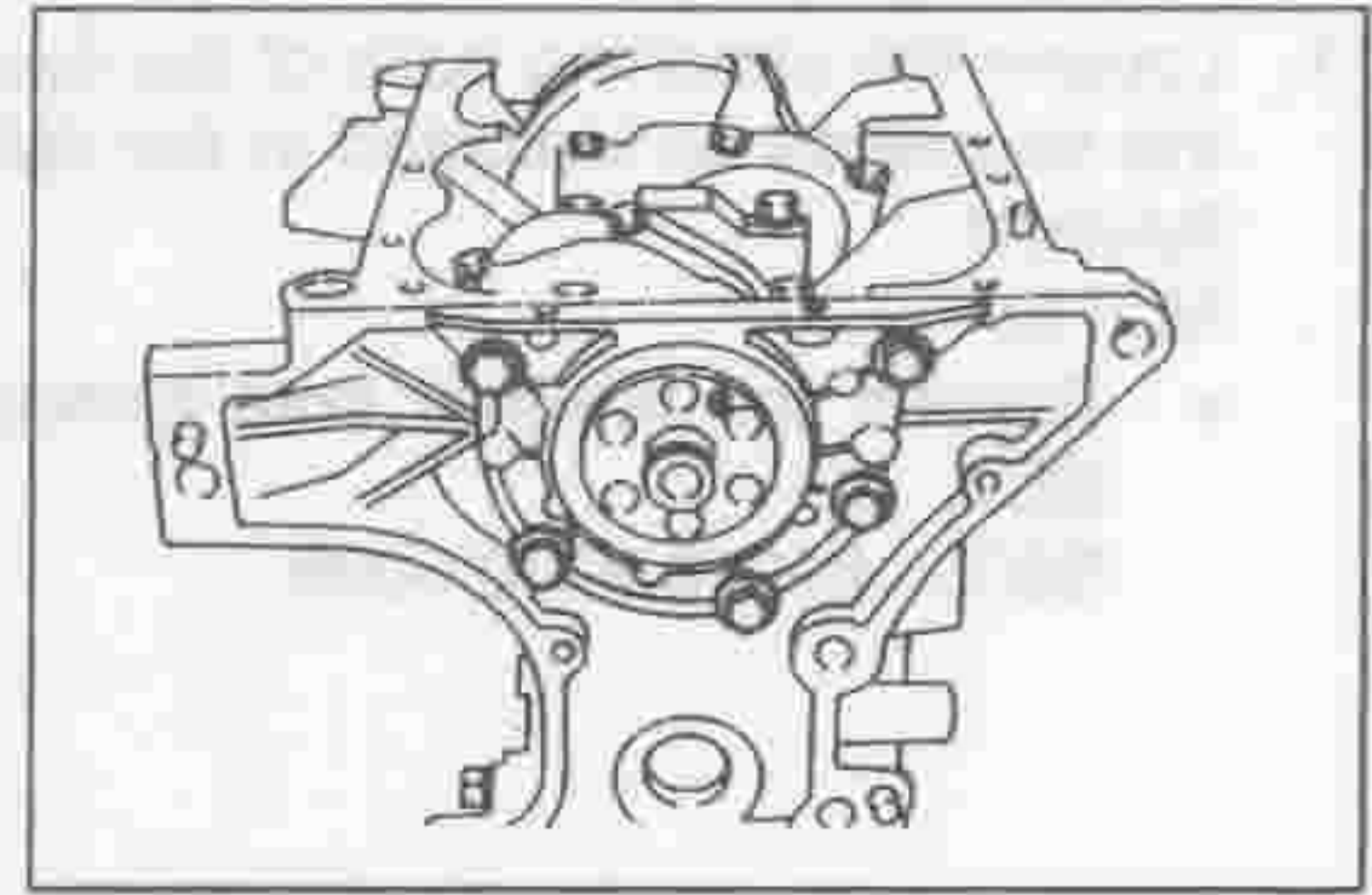
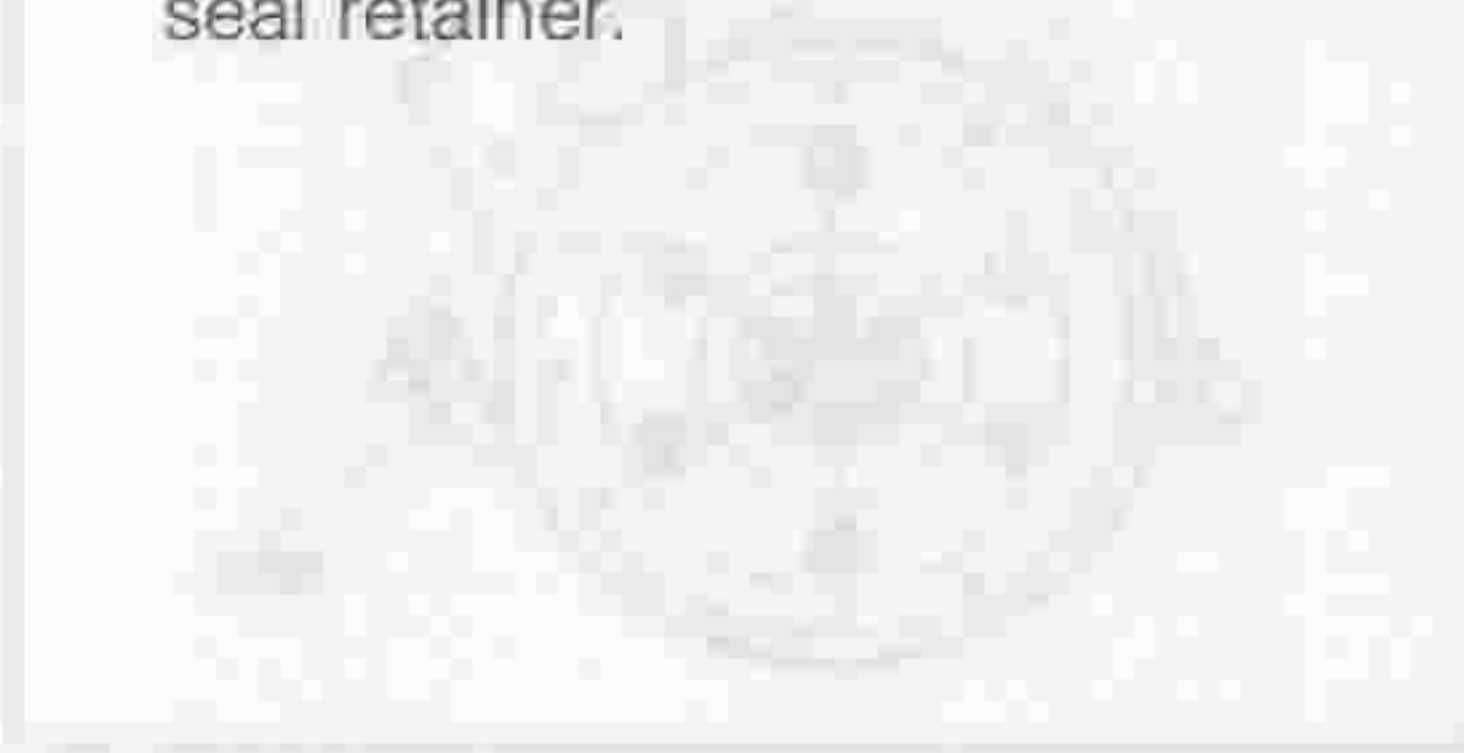
**NOTE:**

- Be sure to use a silver bolt at the asterisk (\*) mark.



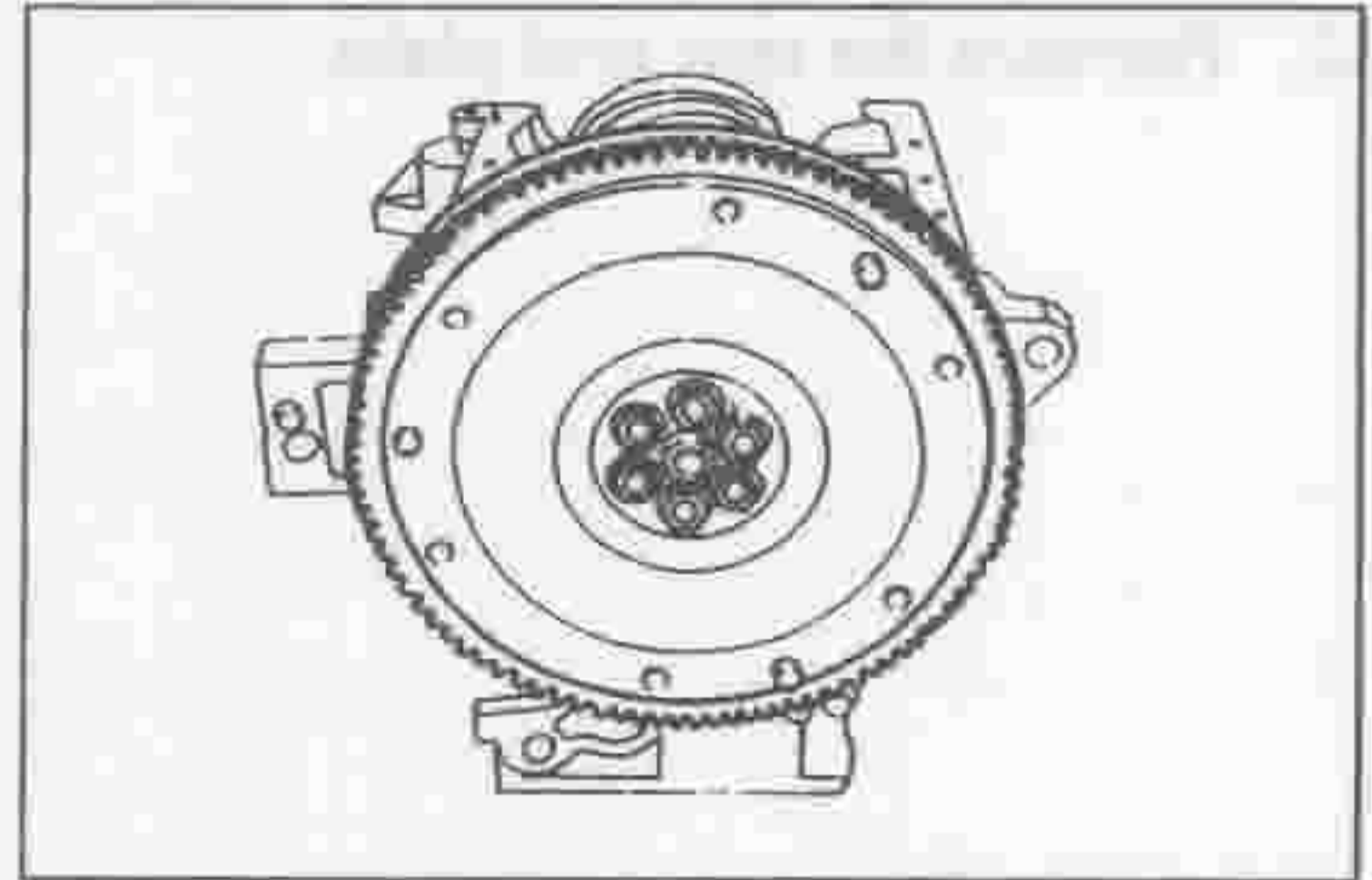
LEM00294-00276

17. Remove the rear oil seal retainer.
18. Remove the gasket material from the cylinder block and oil seal retainer.



LEM00295-00277

19. Install the flywheel temporarily.



LEM00296-00278

20. Measurement of connecting rod thrust clearance  
Measure the thrust clearance between the connecting rod and the crankshaft, using a thickness gauge.

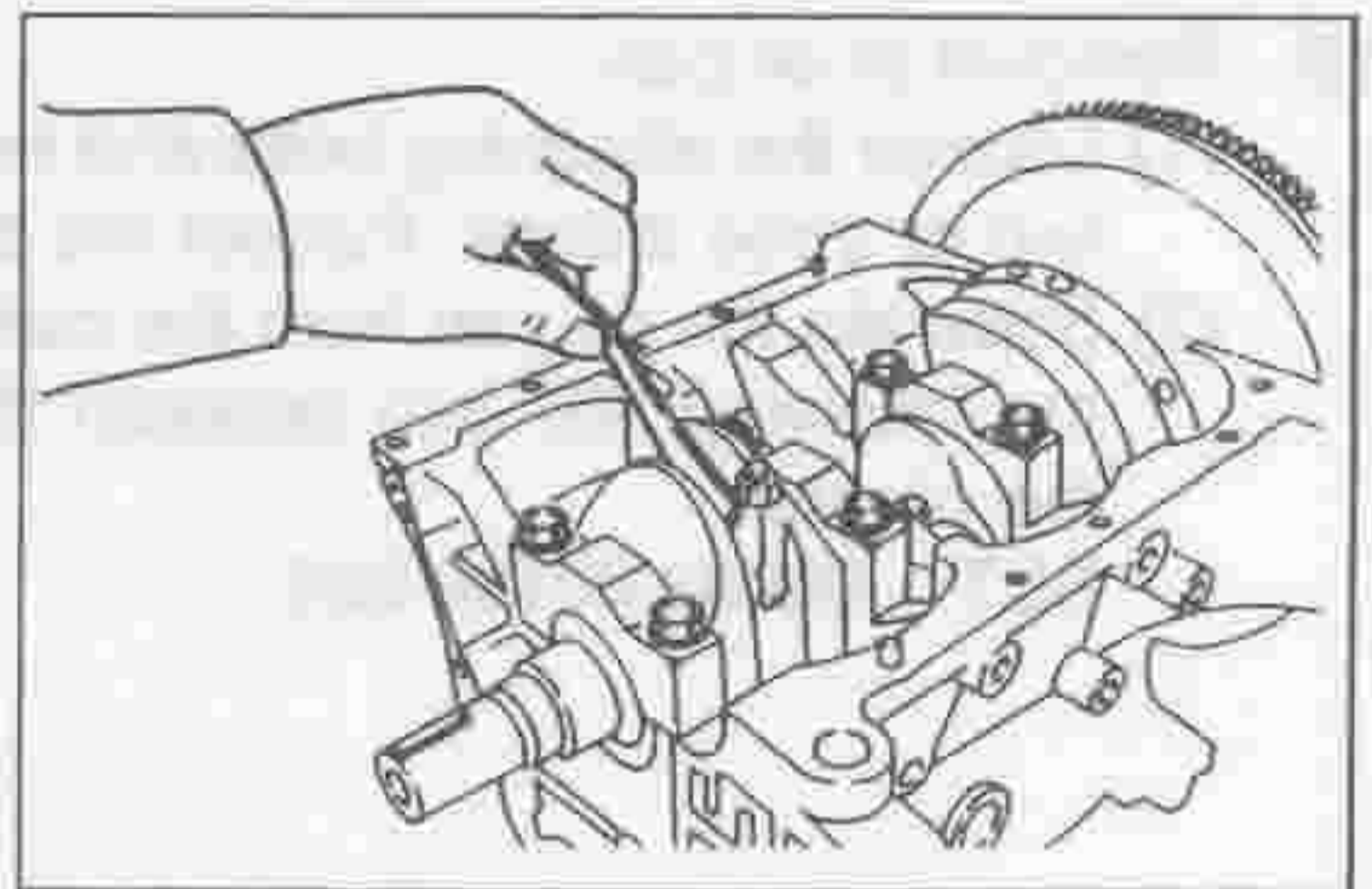
Thrust Clearance:

Standard: 0.15 - 0.25 mm

Maximum Limit: 0.3 mm

**NOTE:**

- The thrust clearance should be measured while the connecting rod is being pushed against either side of the crankshaft in the axial direction. Measure the thrust clearance at the opposite side.




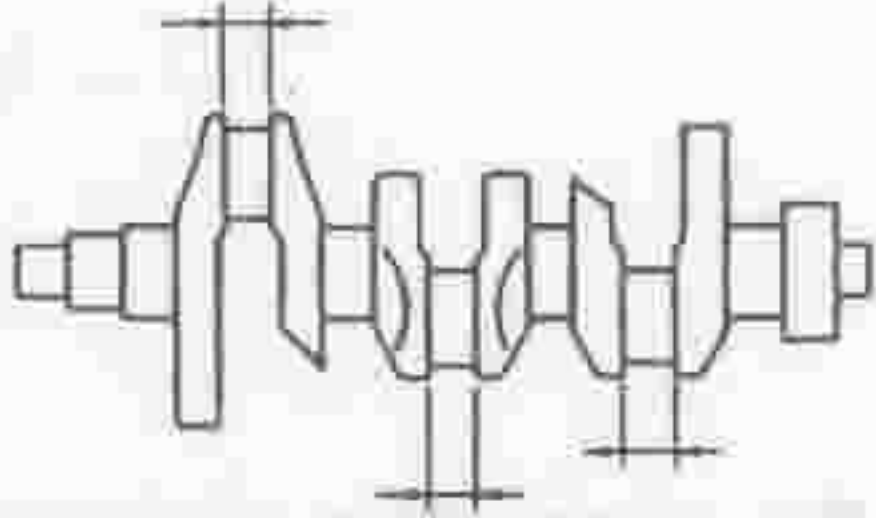
LEM00297-00279

If the clearance exceeds the specified value, replace the connecting rod or the crankshaft, or both of them, referring to the width of the big end of the connecting rod in the thrust direction and the side width of the crankpin journal.

LEM00298-00000



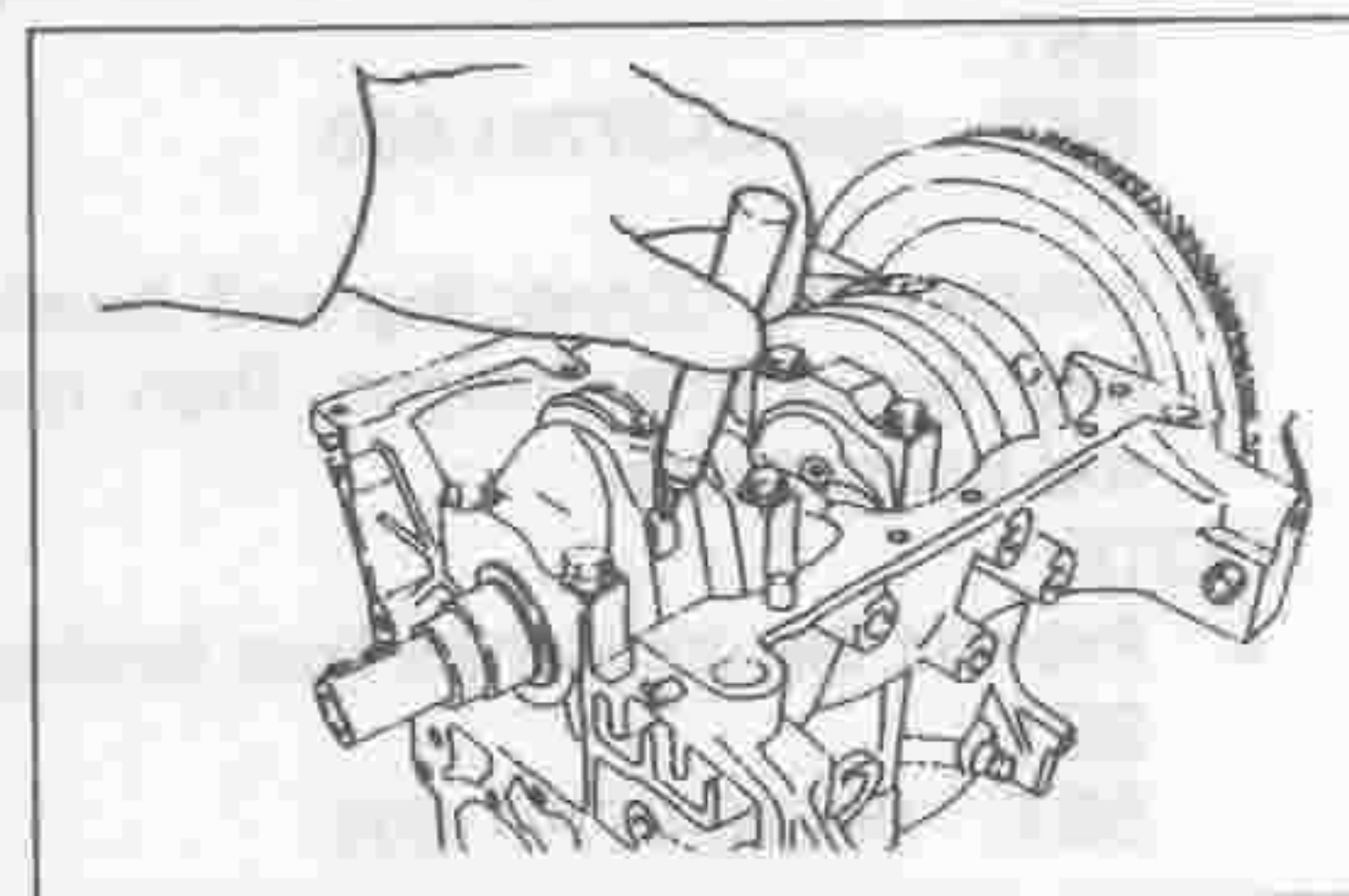
## Reference:

Width of big end of connecting rod in thrust direction	Side width of crankpin
19.80 - 19.85 mm	20.00 - 20.05 mm
	Crankshaft 

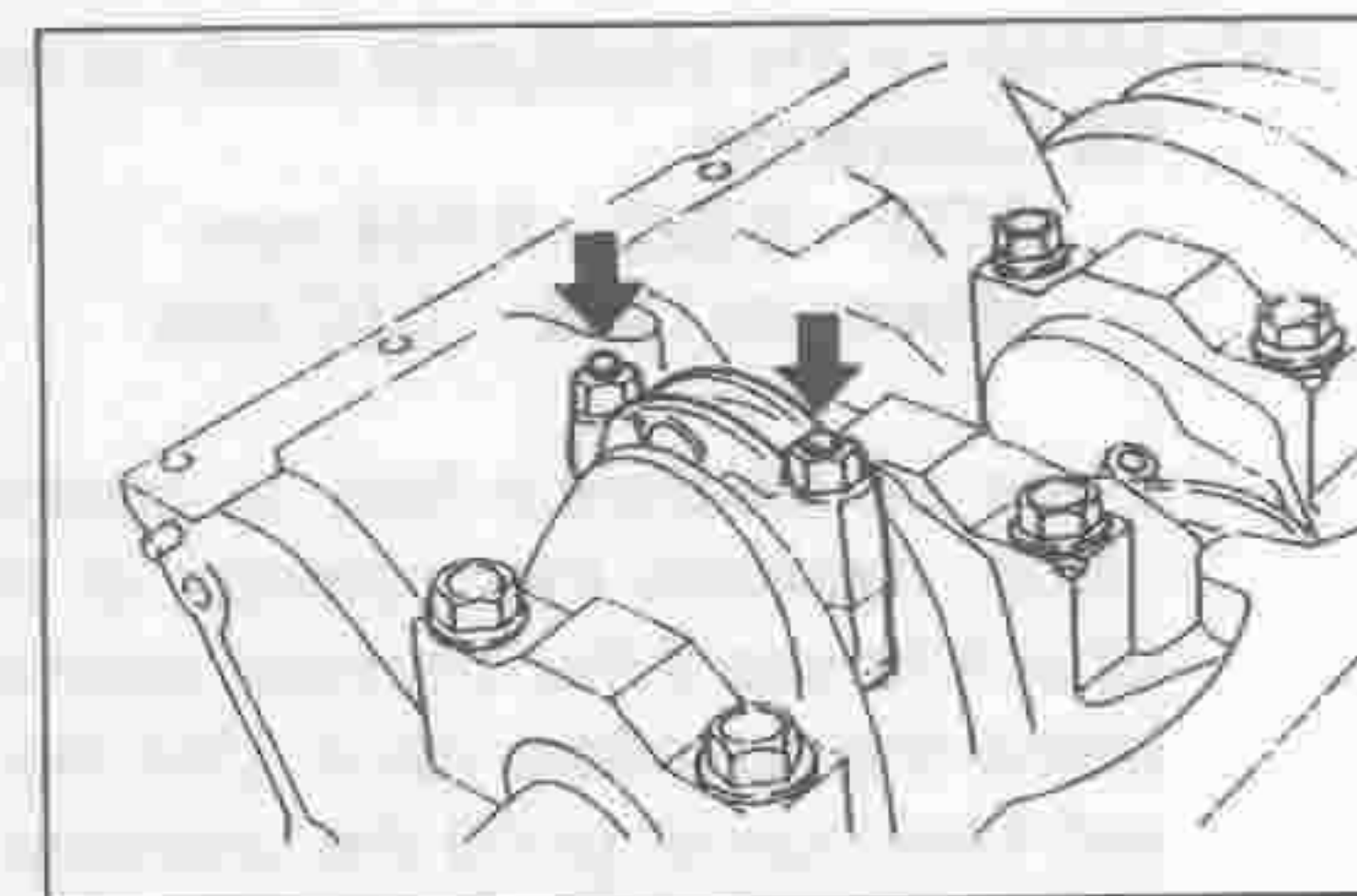
LEM00299-00280

## 21. Measurement of crankpin journal oil clearance

- (1) Wipe off any oil from the side of the mate surface between the connecting rod bearing cap and the connecting rod.
- (2) Daub a mate mark with an oily paint on the side so that the parts can be assembled correctly in the original combination.  
(Also, ensure that the cylinder number may be identified during the assembly.)
- (3) Turn the crankshaft, until the connecting rod bearing cap to be removed comes at the oil pan side.
- (4) Lock the flywheel to prevent the crankshaft from turning, using the following SST.  
SST: 09210-87701-000
- (5) Loosen the connecting rod bearing cap nuts evenly over two or three stages. Then, remove the connecting rod bearing cap nuts.



LEM00300-00281

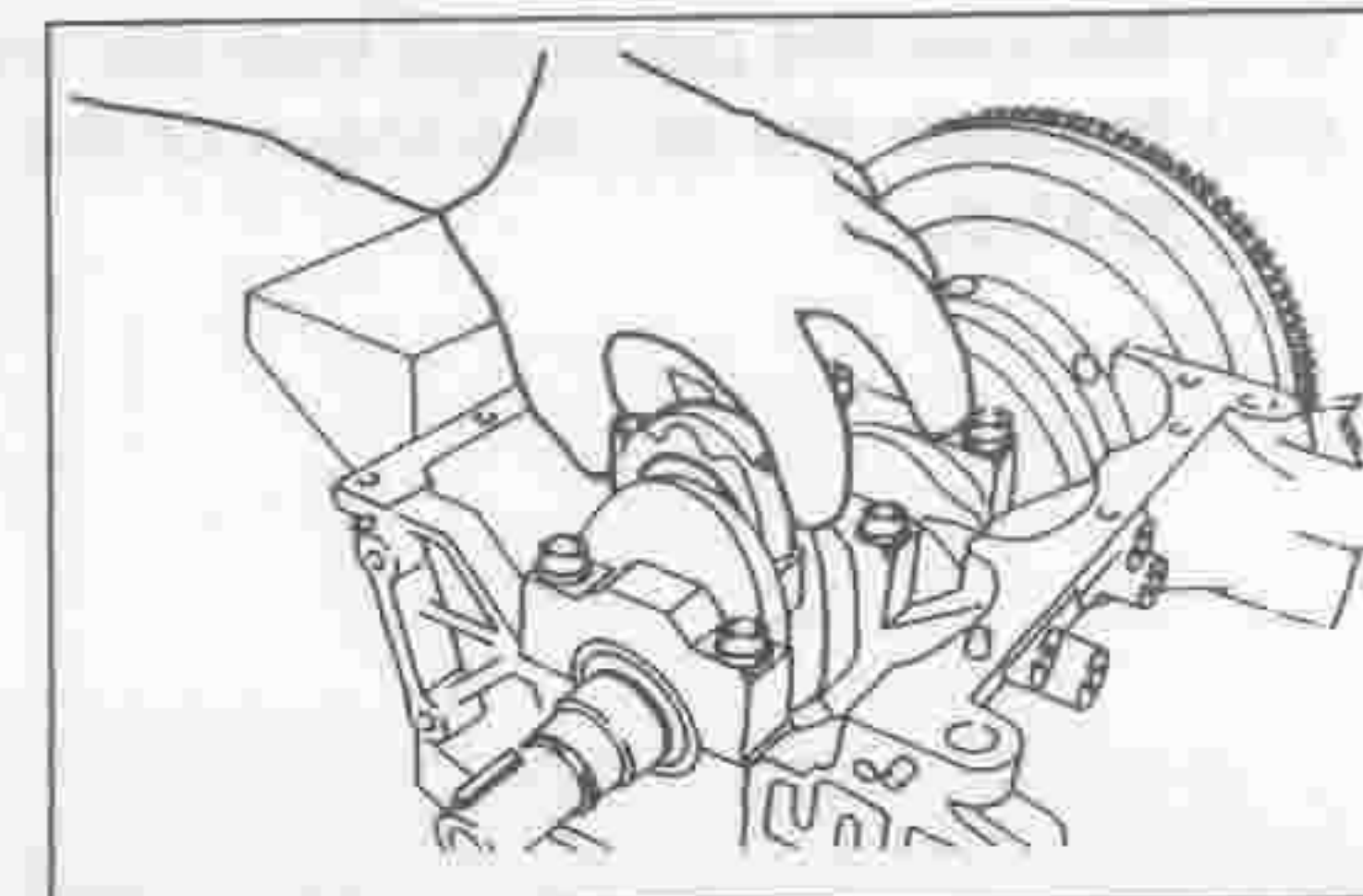


LEM00301-00282

- (6) Remove the bearing cap.

## NOTE:

- Repair or replace the crankshaft if the crankpin journals exhibit damages, such as seizure.



LEM00302-00283

# EM-74

- (8) Install the connecting rod cap, making sure that the mate marks are lined up. Tighten the connecting rod bearing cap nuts evenly over two or three stages to the specified torque.

Tightening Torque:  $36.3 \pm 5.9$  N·m  
( $3.70 \pm 0.60$  kgf·m)

## NOTE:

- When tightening the bearing cap nuts, apply engine oil to the bearing cap nuts.
- Prevent the crankshaft from turning, using the following SST.  
SST: 09210-87701-000

- (9) Loosen the connecting rod bearing cap nuts evenly over two or three stages. Then, remove the connecting rod bearing cap.

## NOTE:

- Prevent the crankshaft from turning, using the following SST.  
SST: 09210-87701-000

- (10) Measure the plastigage width at its widest point.

Oil Clearance:

STD: 0.020 - 0.044 mm

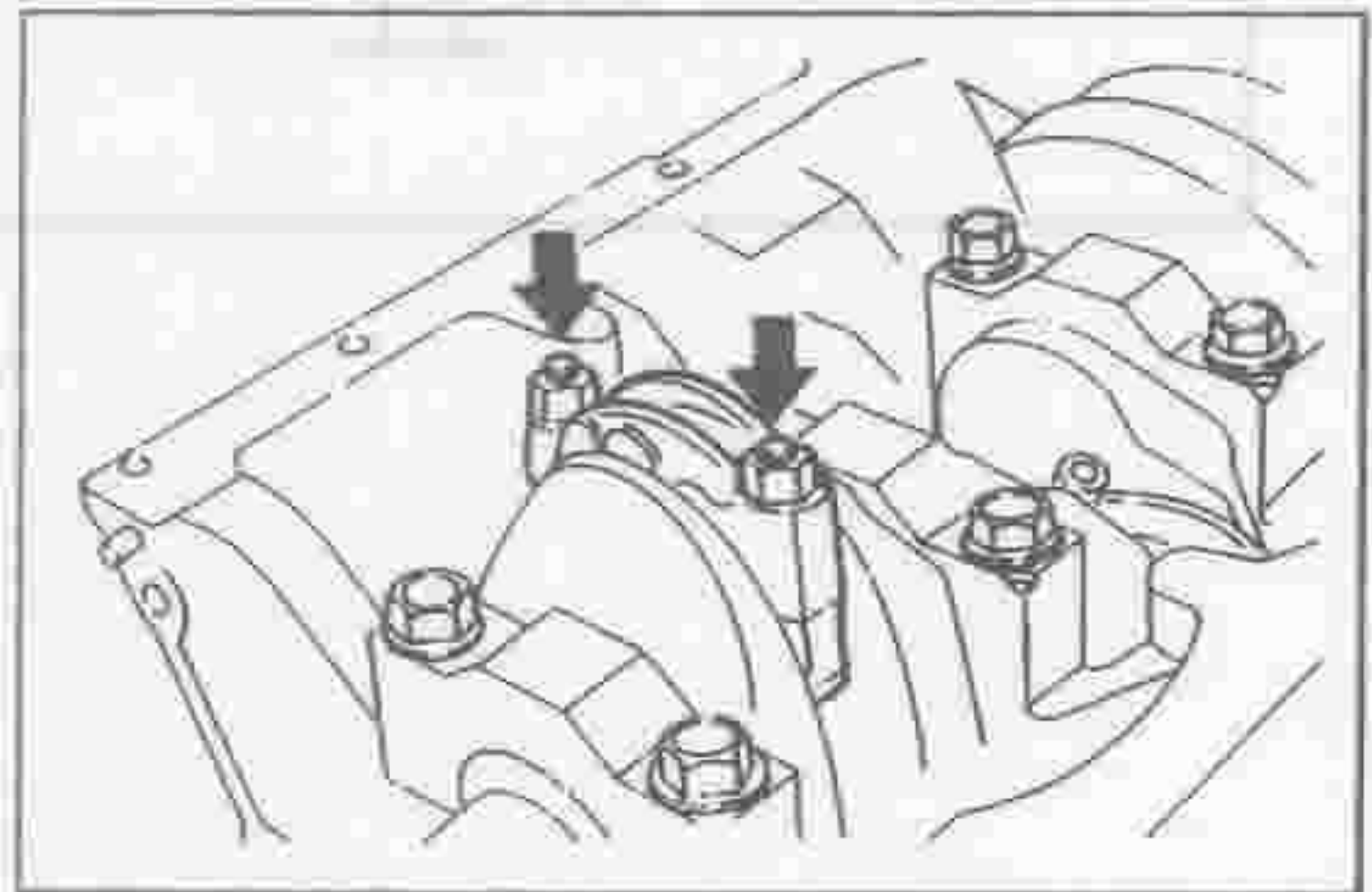
Maximum Limit: 0.07 mm

If the oil clearance fails to conform to the specified value, measure the diameter of the crankpin journal. Check to see if the crankpin journal has been worn out below the specified value. Use the replacement standard bearings or grind the crankpin journals so that the 0.25 undersized bearings may be used.

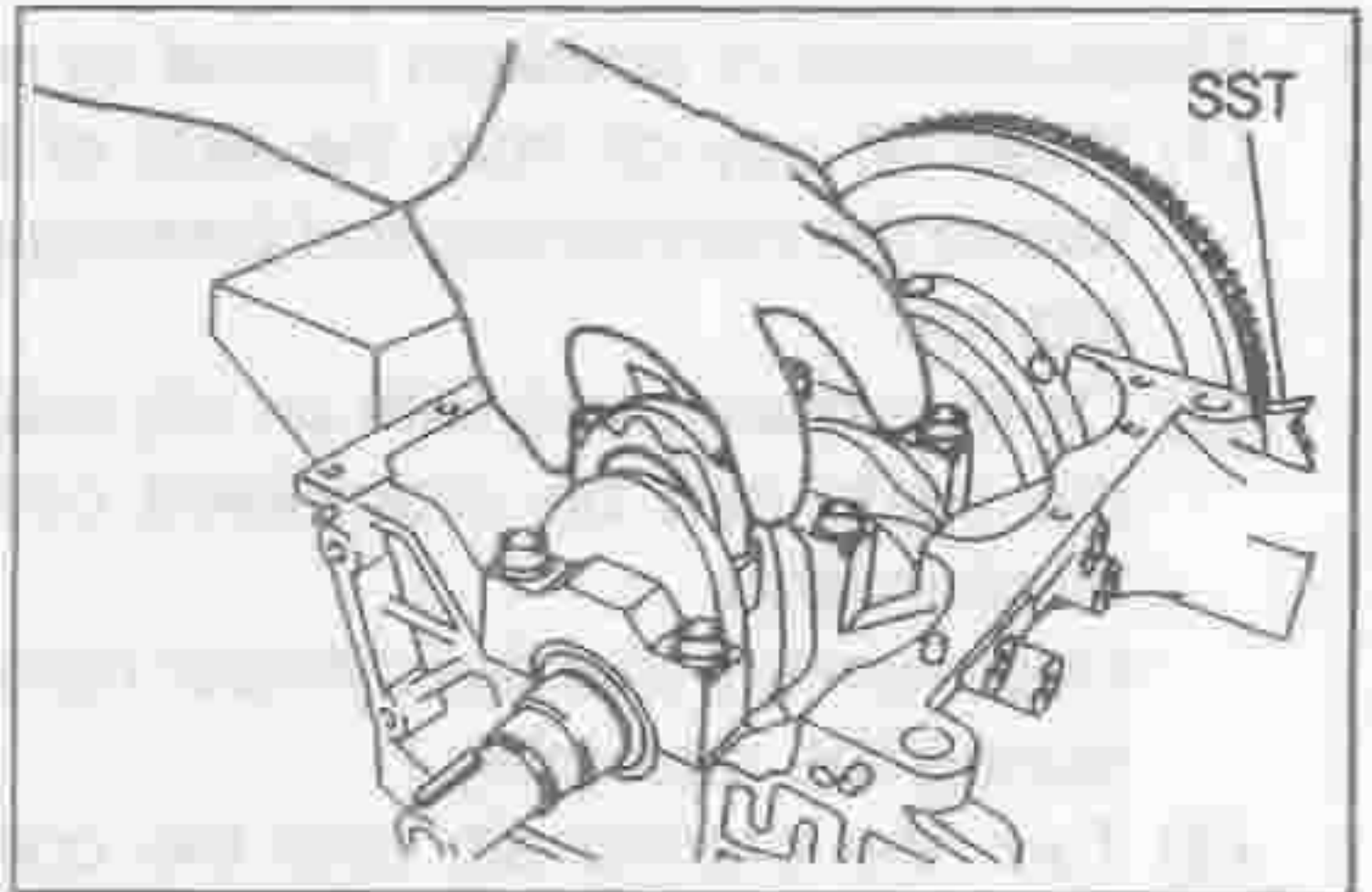
- (11) Remove the plastigage from the crankpin journal.  
(12) Measure the oil clearances of the remaining crankpin journals.



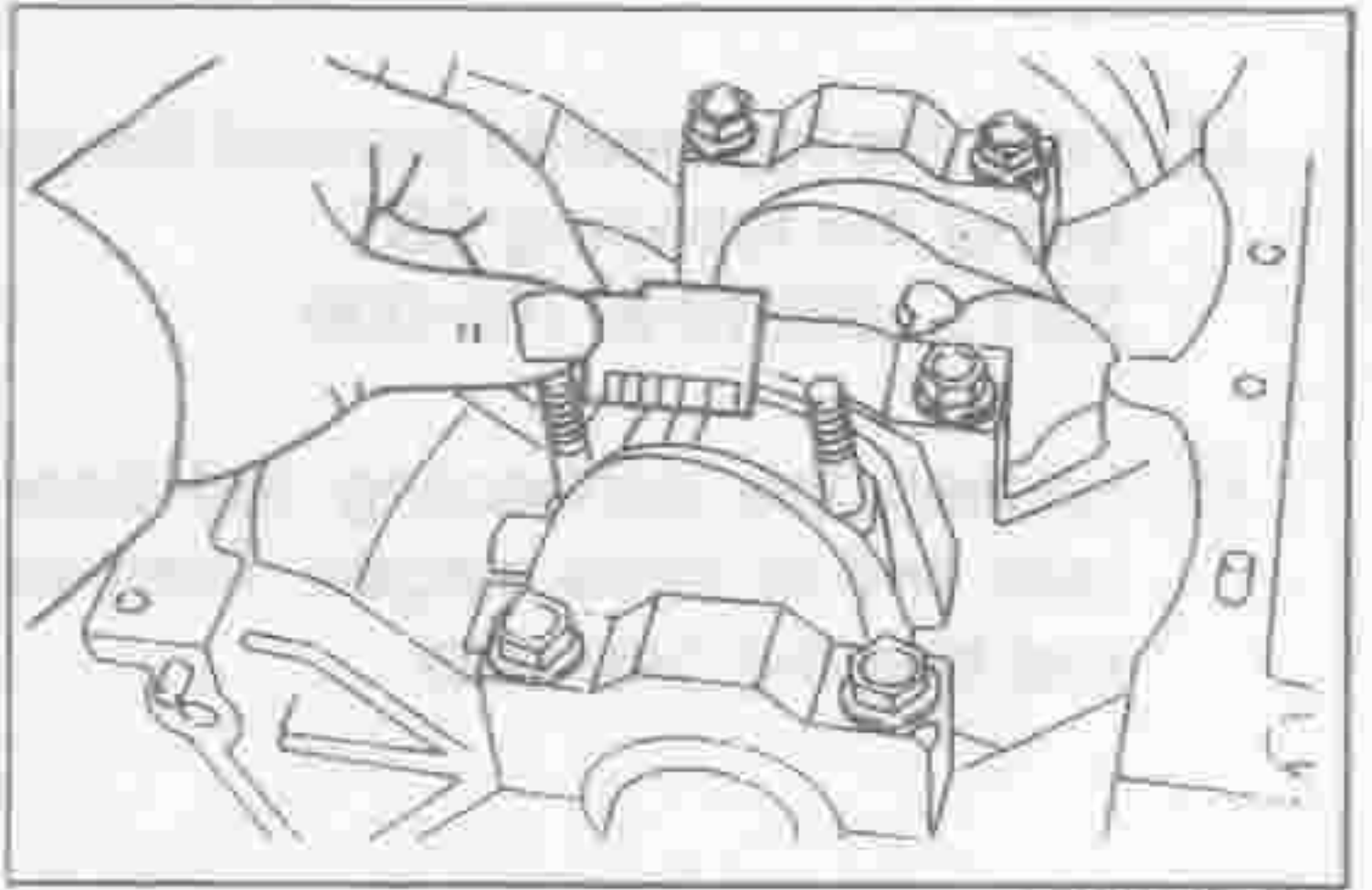
LEM00303-00284



LEM00304-00285



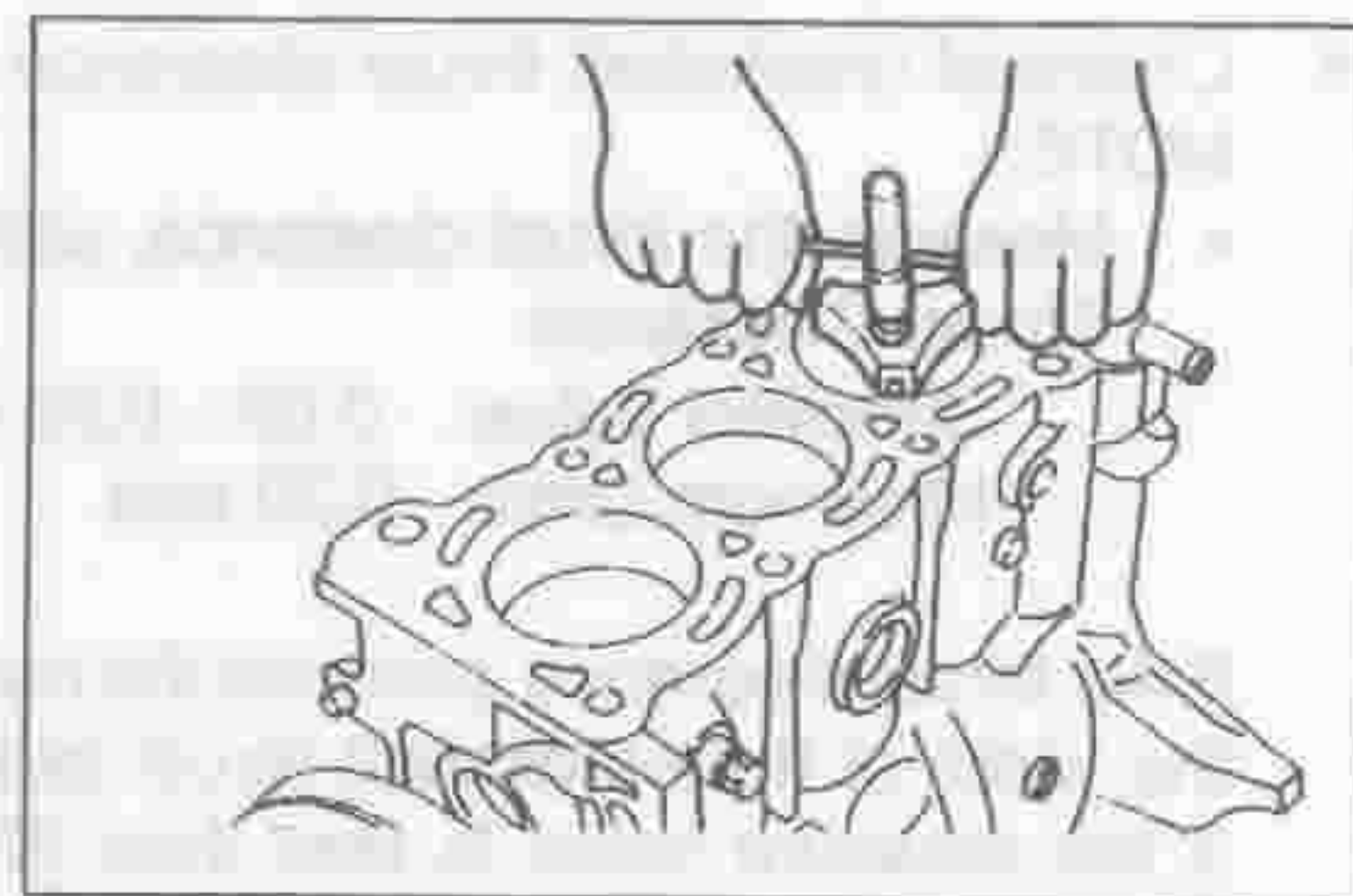
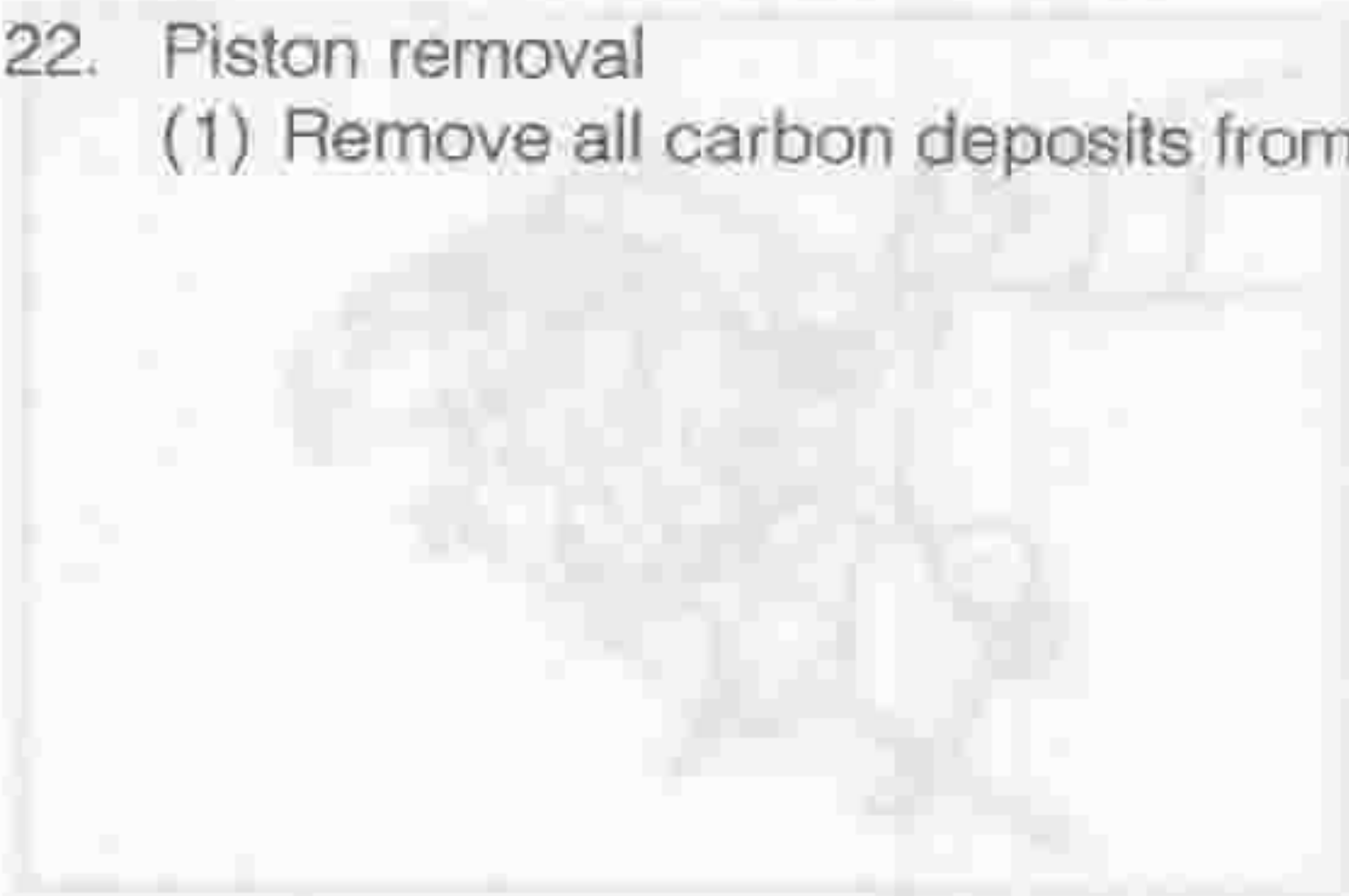
LEM00305-00286



LEM00306-00287

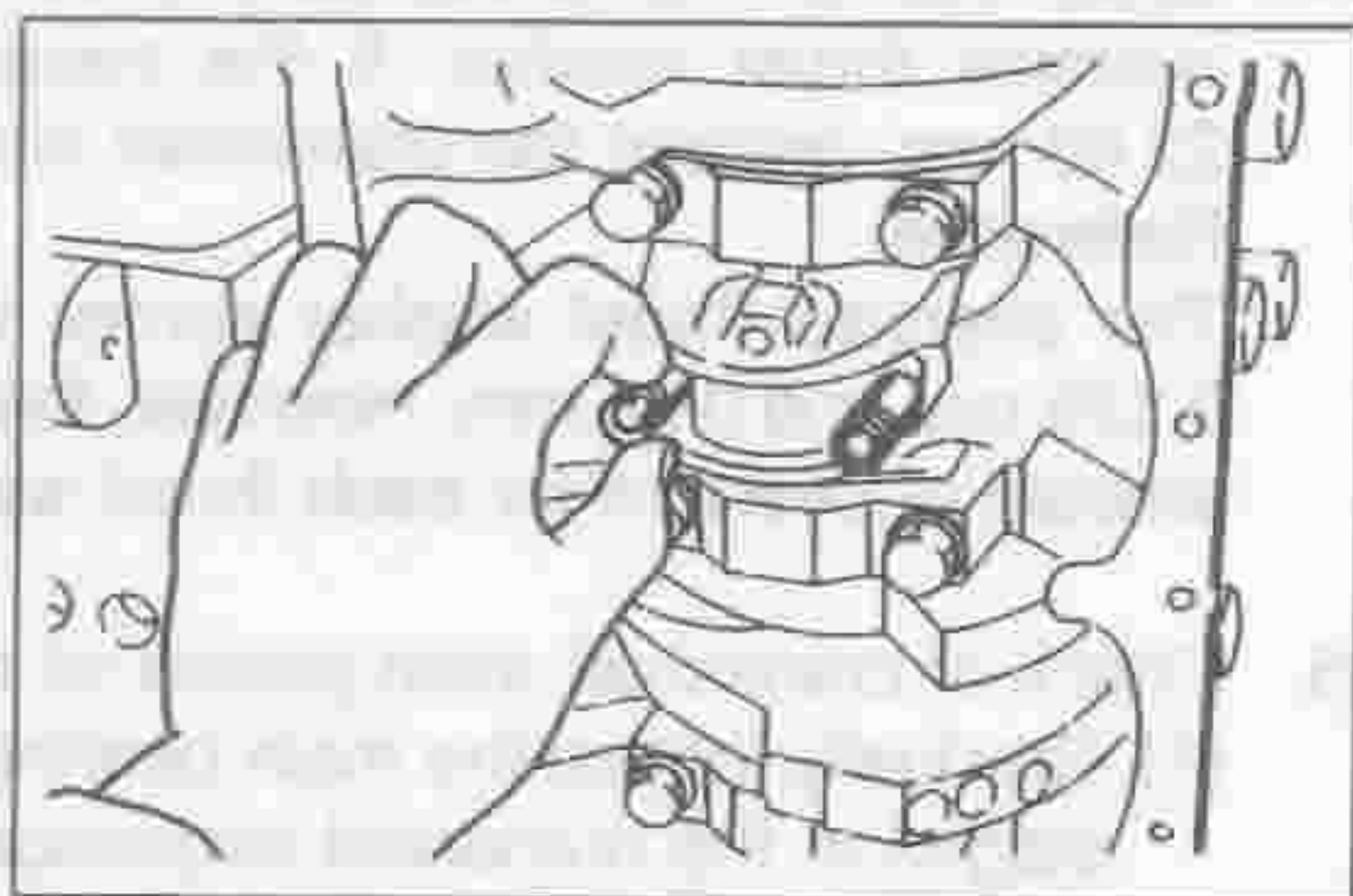
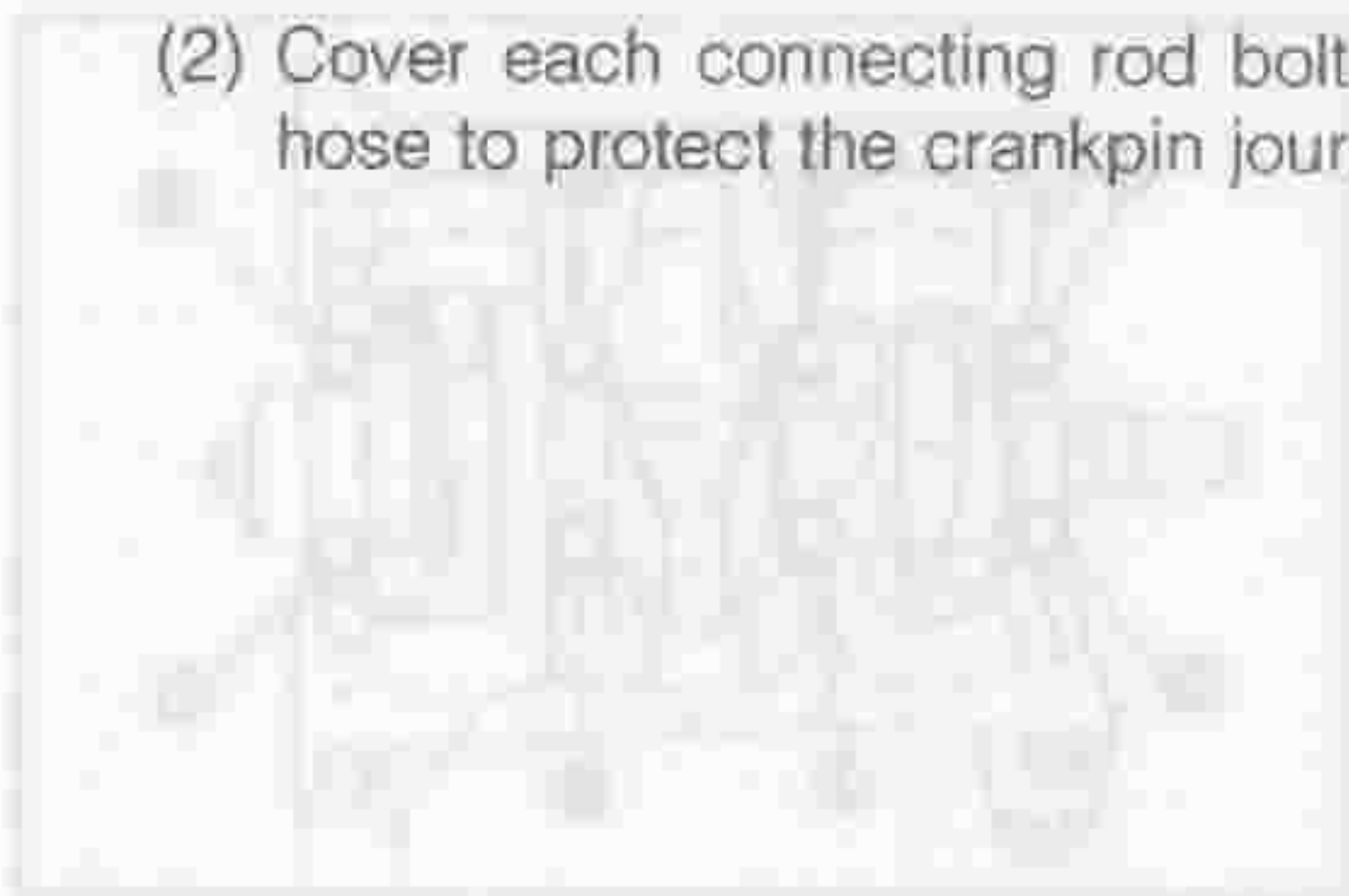
## 22. Piston removal

(1) Remove all carbon deposits from the piston ring ridges.



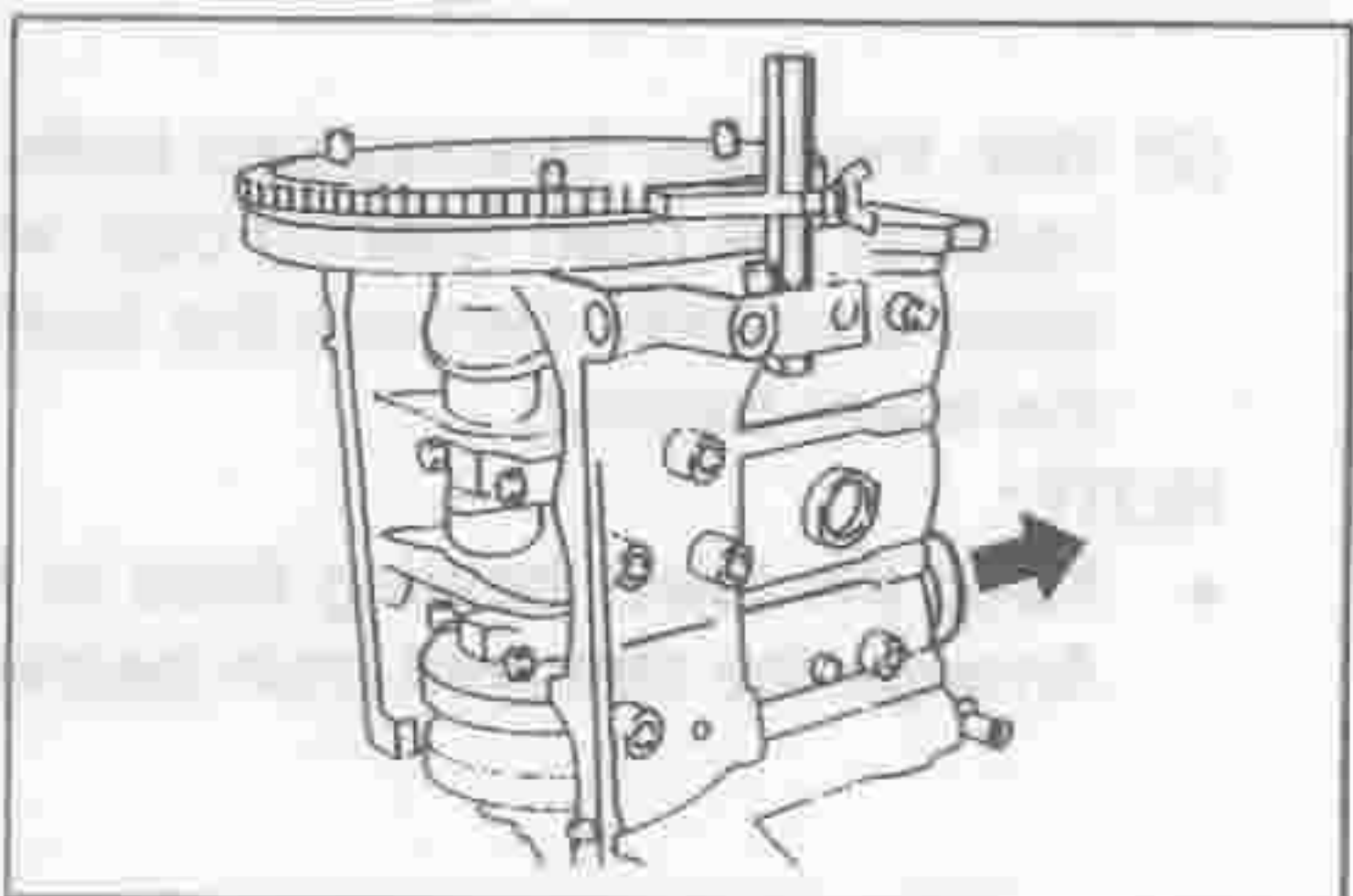
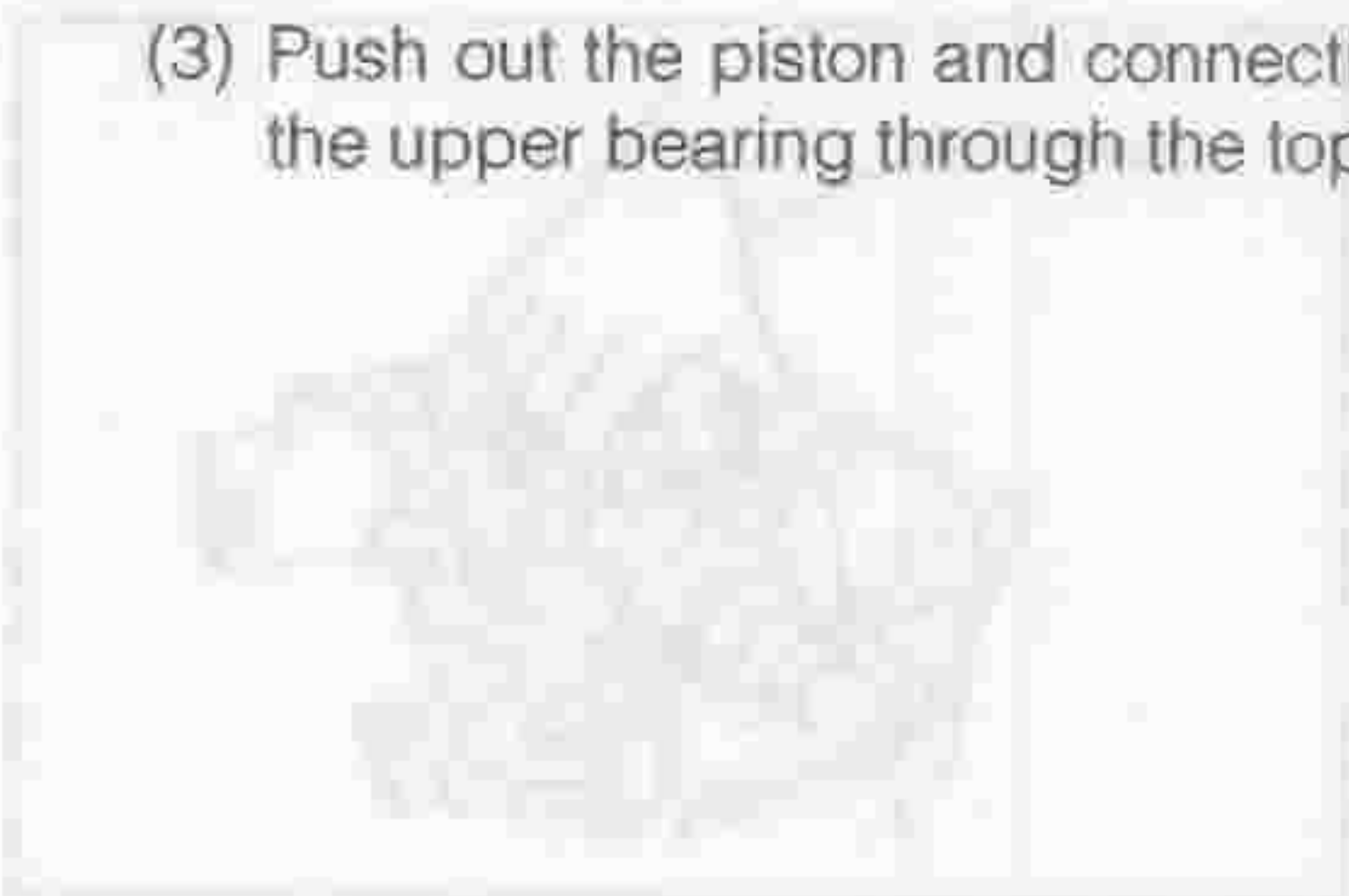
LEM00307-00288

(2) Cover each connecting rod bolt with a short piece of hose to protect the crankpin journal from damage.



LEM00308-00289

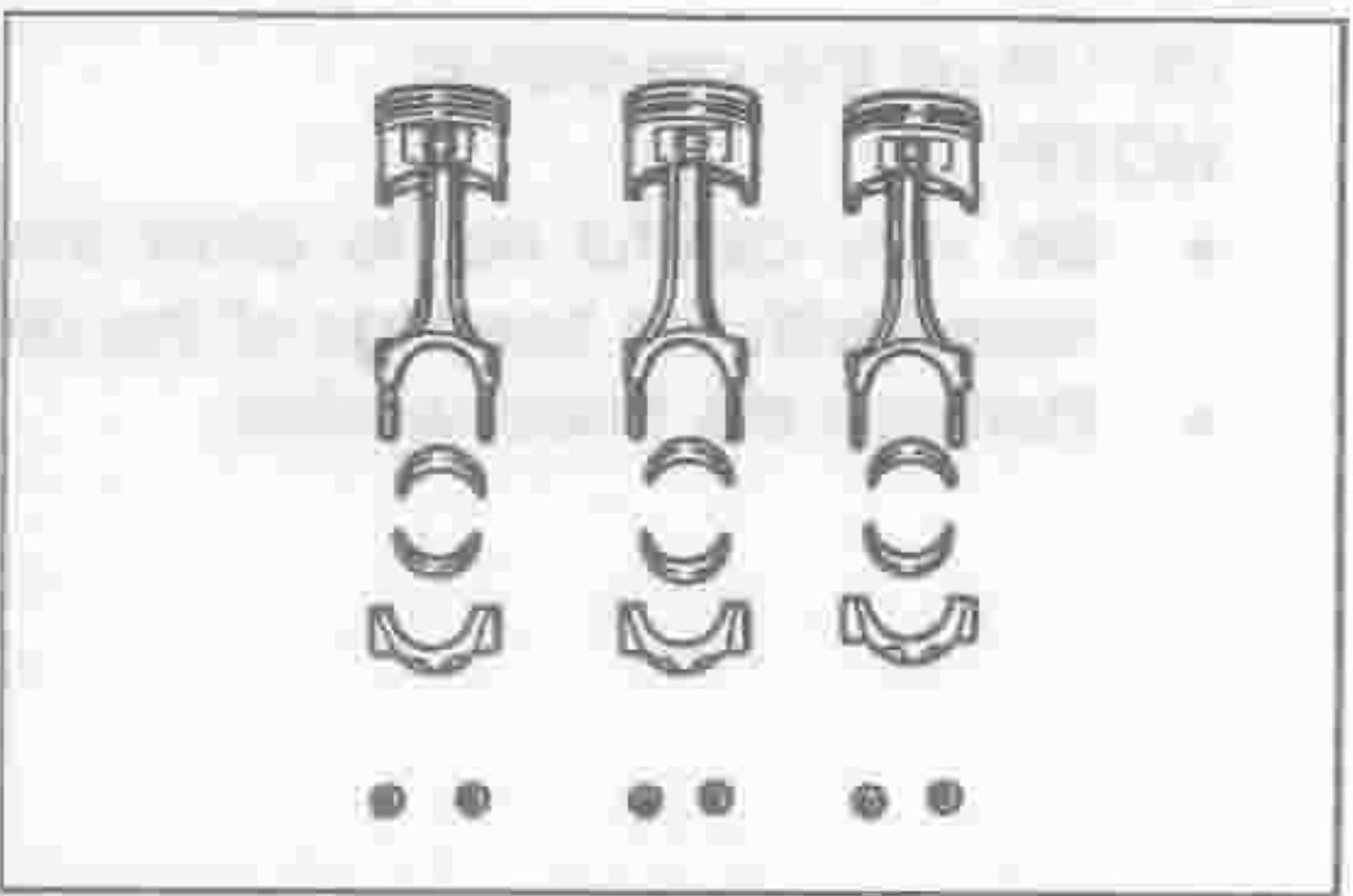
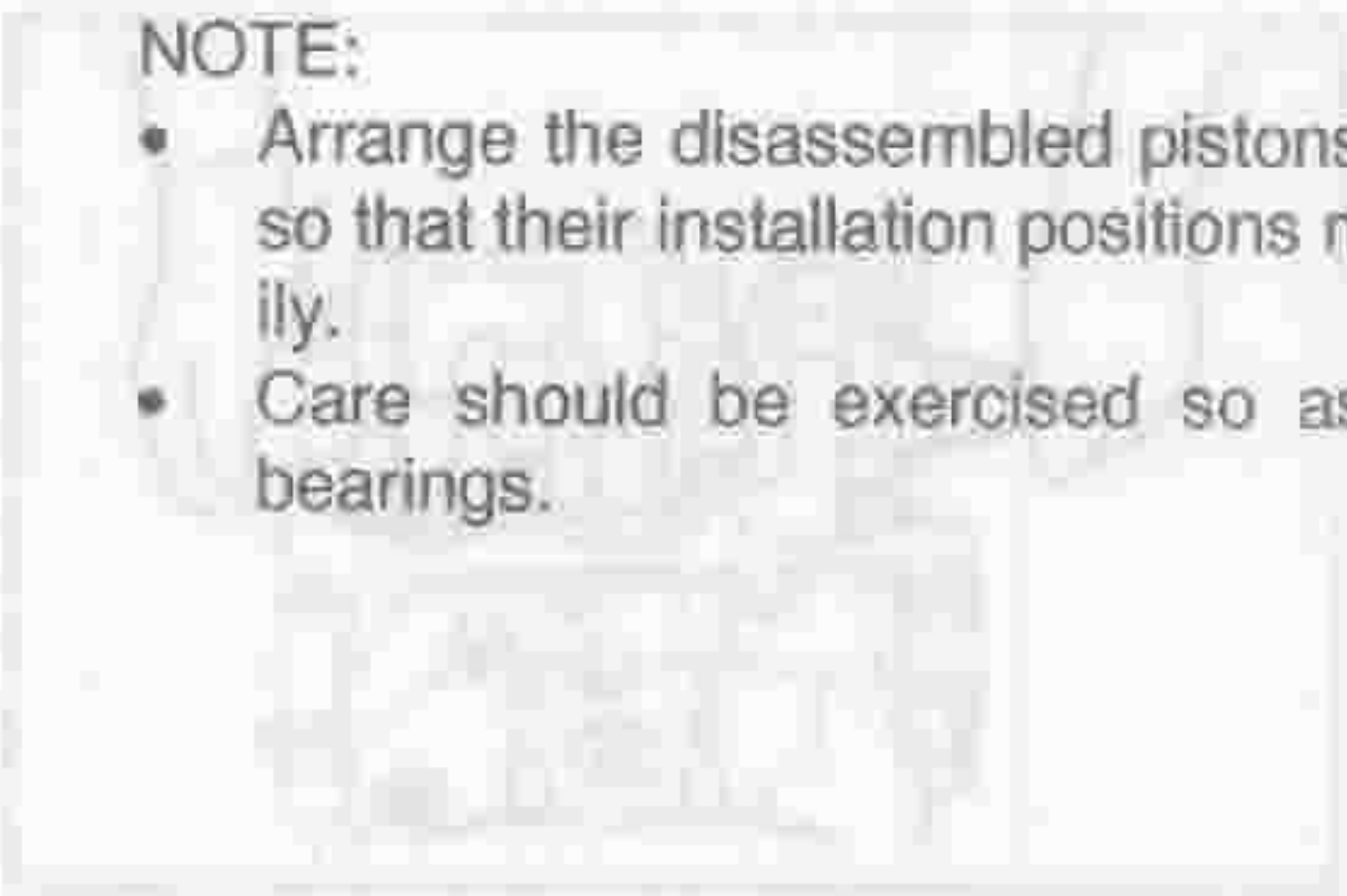
(3) Push out the piston and connecting rod assembly and the upper bearing through the top of the cylinder block.



LEM00309-00290

### NOTE:

- Arrange the disassembled pistons and connecting rods so that their installation positions may be identified readily.
- Care should be exercised so as not to damage the bearings.

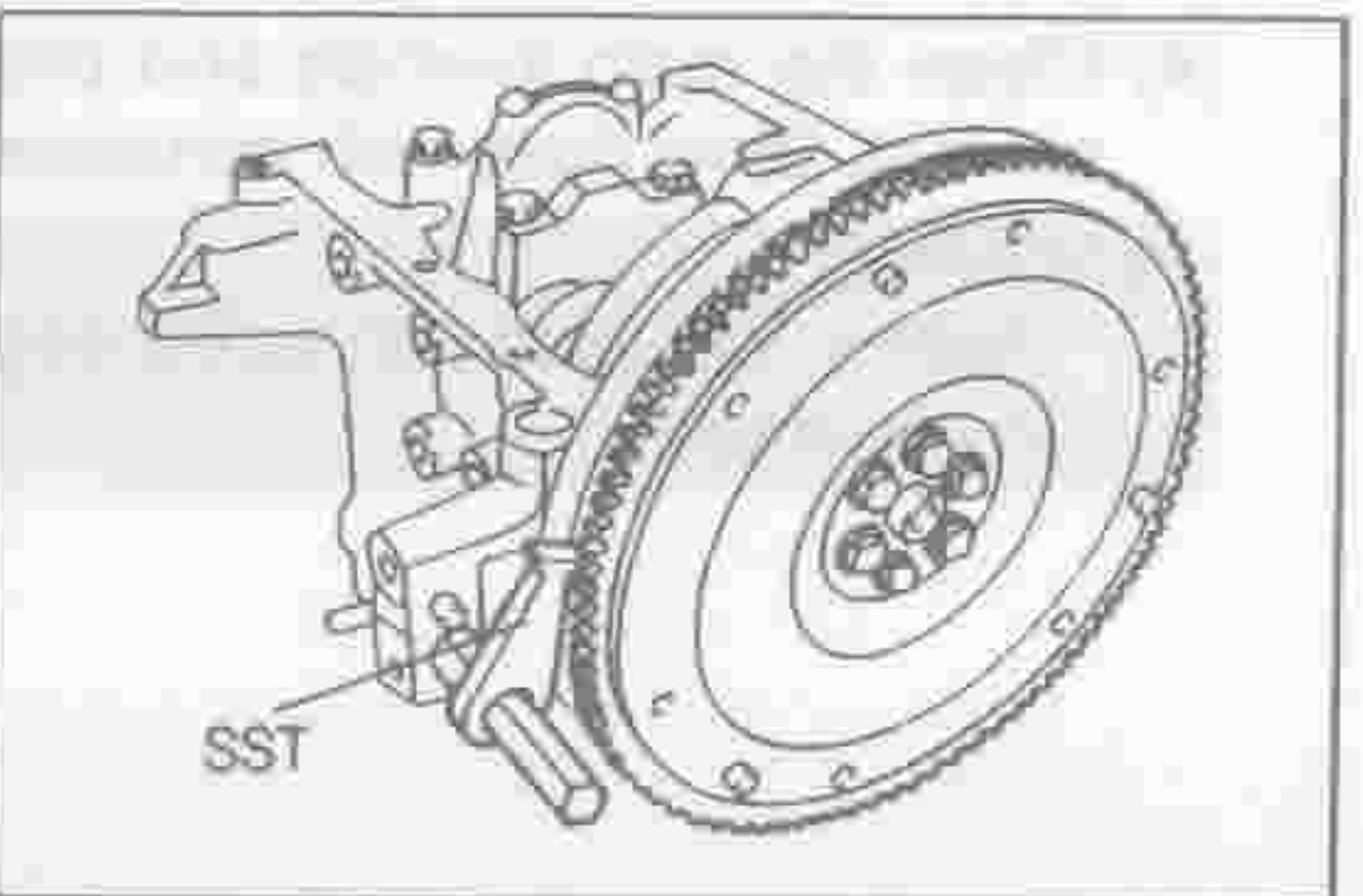


LEM00310-00291

## 23. Remove the flywheel.

### NOTE:

- Prevent the ring gear from turning with SST.  
SST: 09210-87701-000



LEM00311-00292

## 24. Check of crankshaft thrust clearance

### NOTE:

- Measure the thrust clearance, using a dial gauge.

### Thrust Clearance:

Specified Value: 0.02 - 0.22 mm

Maximum Limit: 0.30 mm

If the thrust clearance exceeds the maximum limit, measure the width of the crankshaft thrust bearing contact surface. If the measure value is less than 22.63 mm, replace the thrust washer with a standard thrust washer or a suitable oversize thrust washer. If the measured value exceeds 22.63 mm, replace the crankshaft and trust washer.

### Reference:

The oversize thrust washer comes in two thicknesses of 0.125 mm and 0.25 mm. However, this figure represents the amount of oversize for each thrust washer.

## 25. Check of crankshaft main journal oil clearance

- (1) Gradually loosen the main bearing cap bolts over three stages in the numerical sequence shown in the figure. Remove the bearing cap bolts.

- (2) With the main bearing cap bolts inserted into the bolt holes of the main bearing cap, wiggle the bearing cap back and forth. Remove the bearing cap together with the lower bearing.

### NOTE:

- Keep the lower bearing fitted to the main bearing cap. Arrange the removed main bearing caps in order.

- (3) Lift off the crankshaft.

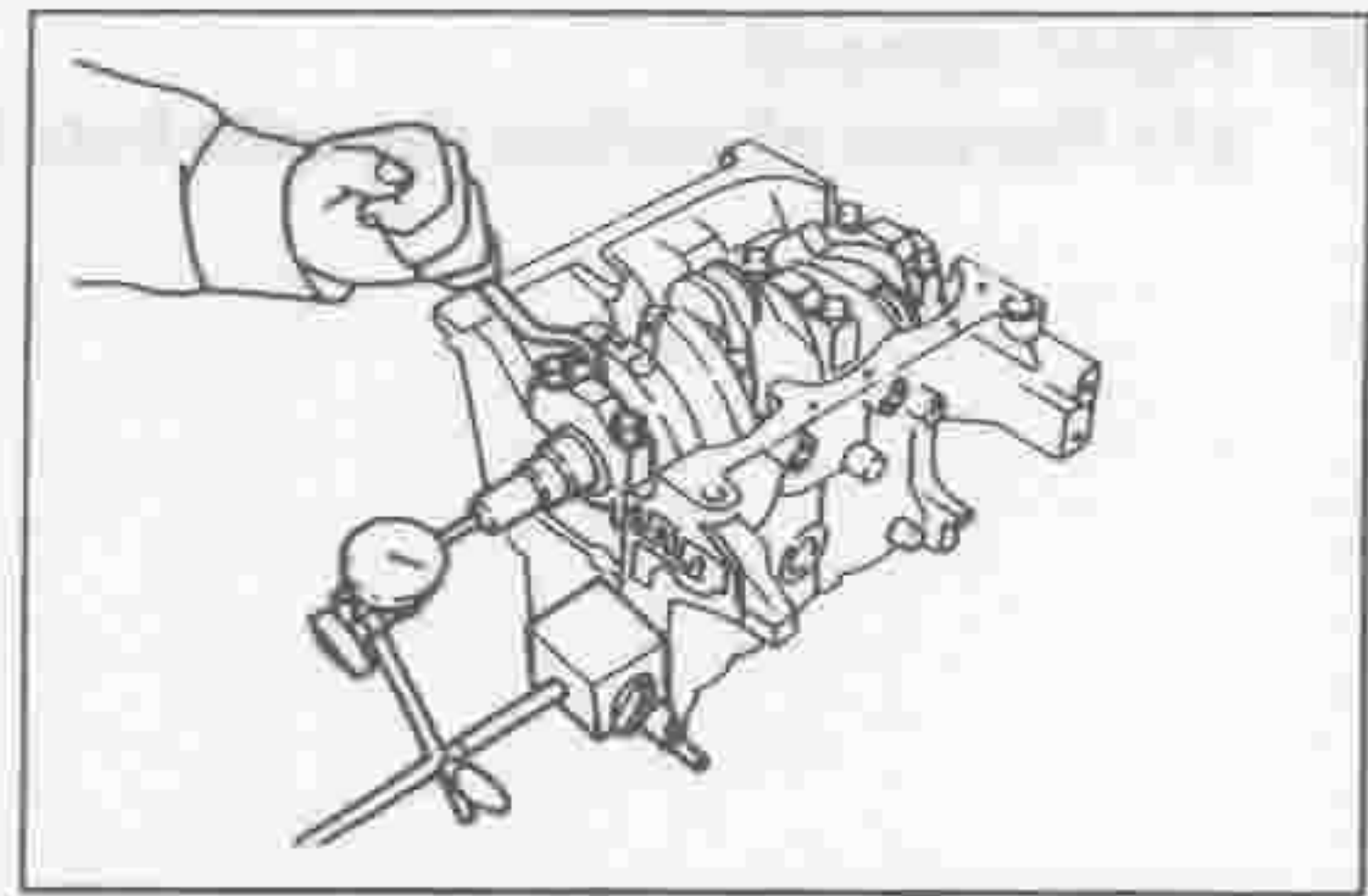
### NOTE:

- Be very careful not to allow the main bearings to be mixed with the bearings of the other cylinders.
- Remove the thrust washer.

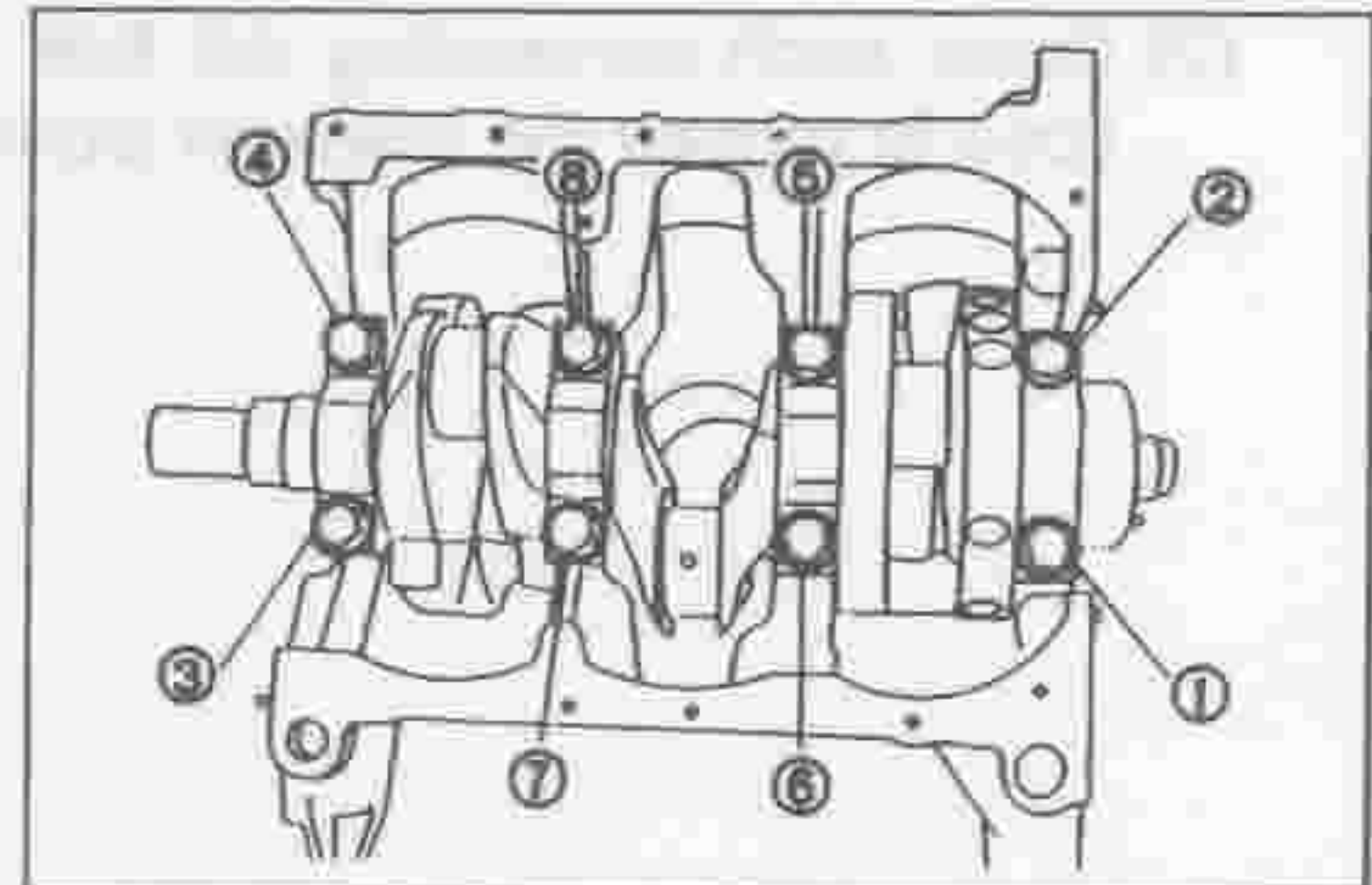
- (4) Clean the main journals and bearings, using cleaning solvent. Blow them with compressed air.

### WARNING:

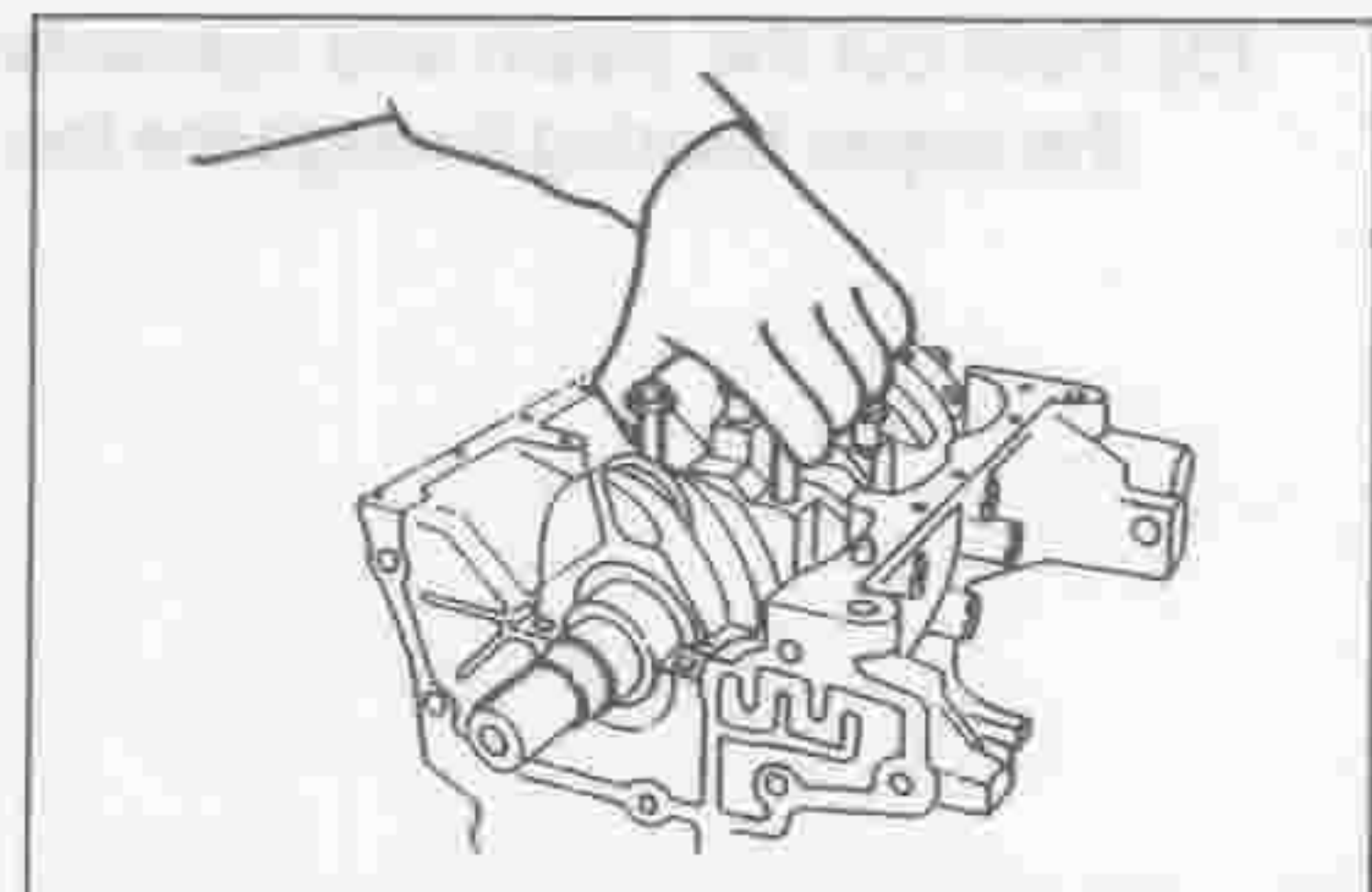
- Protect your eyes with safety goggles during the cleaning operation.



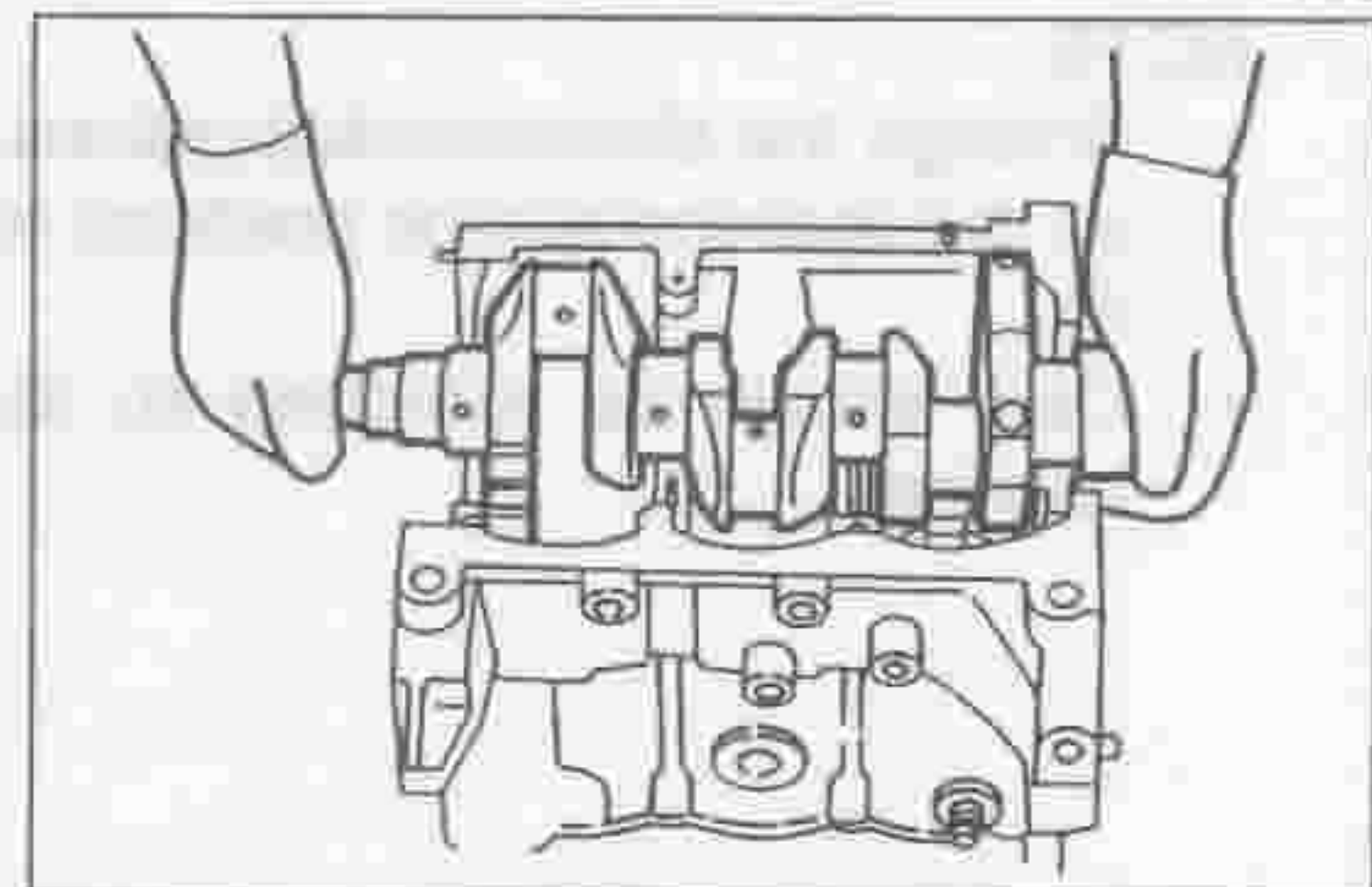
LEM00312-00293



LEM00313-00294



LEM00314-00295



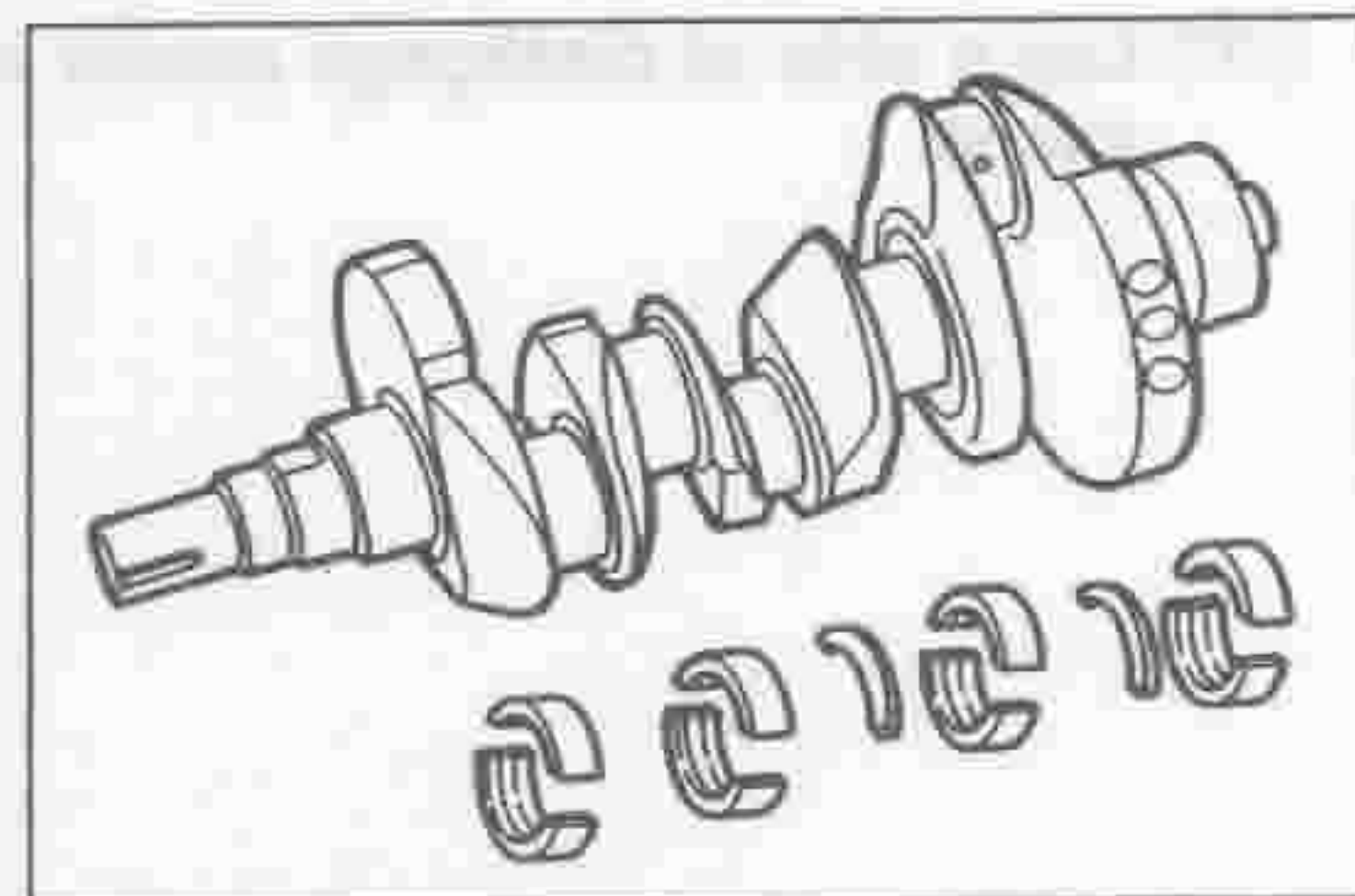
LEM00315-00296

LEM00316-00000

- (5) Check the main journals and bearings for pitting or scratches.

If the main journals exhibit damage, repair or replace the crankshaft.

If the main journal bearings are damaged, replace the main journal bearings.

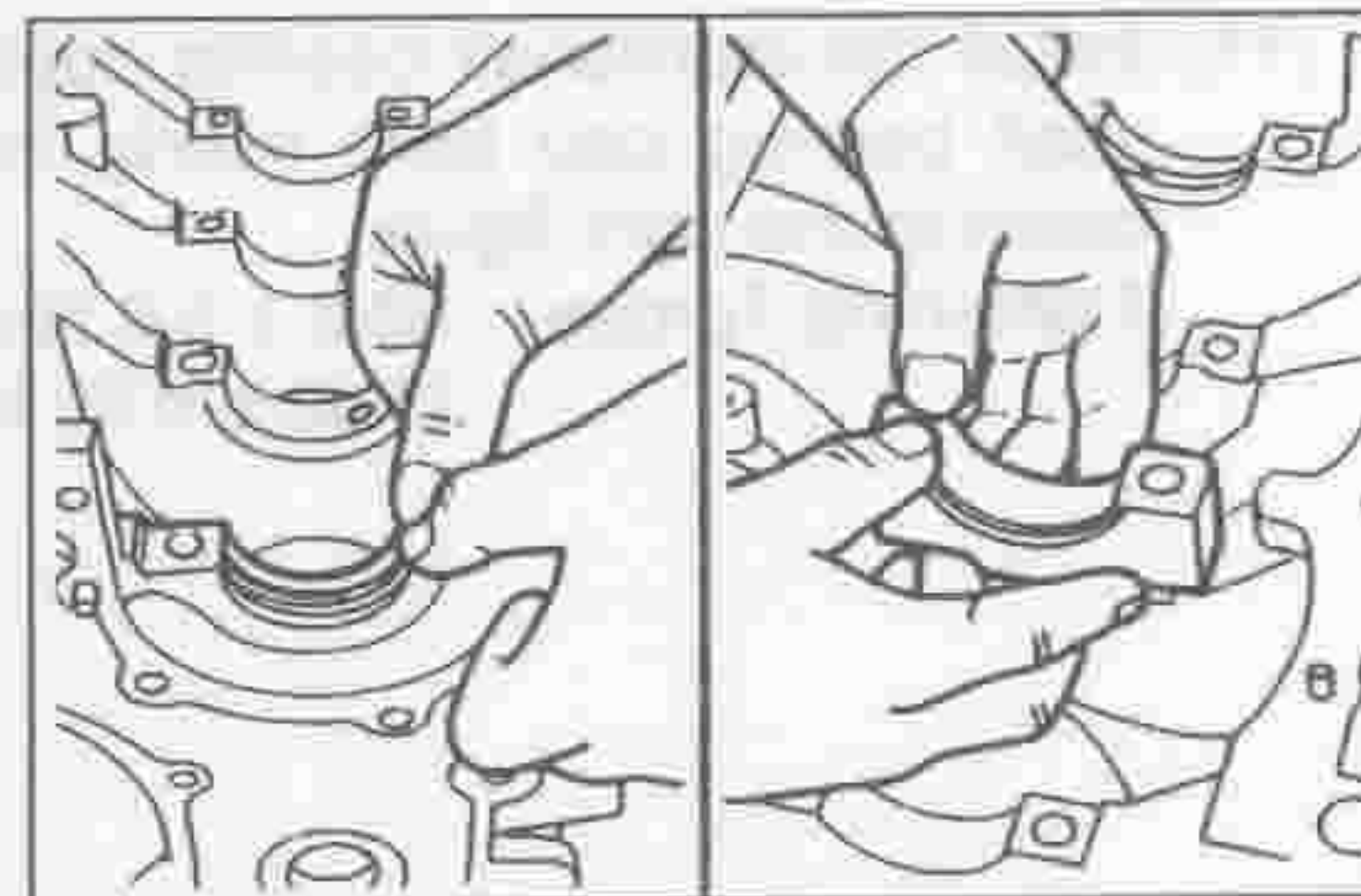


LEM00317-00297

- (6) Install the main bearings to the cylinder block and crankshaft main bearing cap.

**NOTE:**

- Do not touch the metal surface of the bearing.



LEM00318-00298

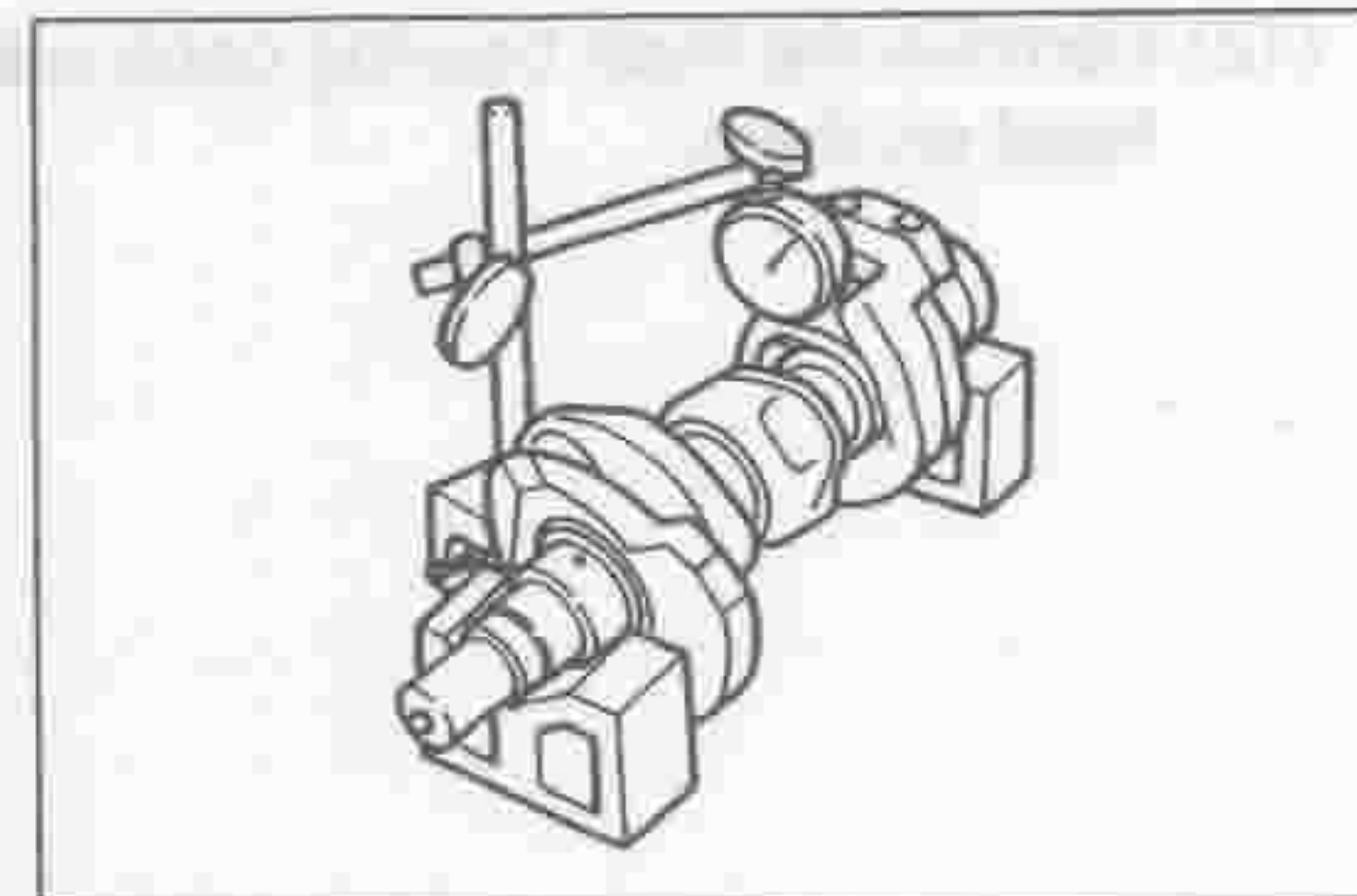
- (7) Support the both ends of the crankshaft with a V-block. Measure the crankshaft runout with a dial gauge at No. 3 journal.

Allowable Limit of Runout: 0.06 mm

**NOTE:**

- The allowable limit of bend is 0.03 mm.

If the runout exceeds the allowable limit, replace the crankshaft.



LEM00319-00299

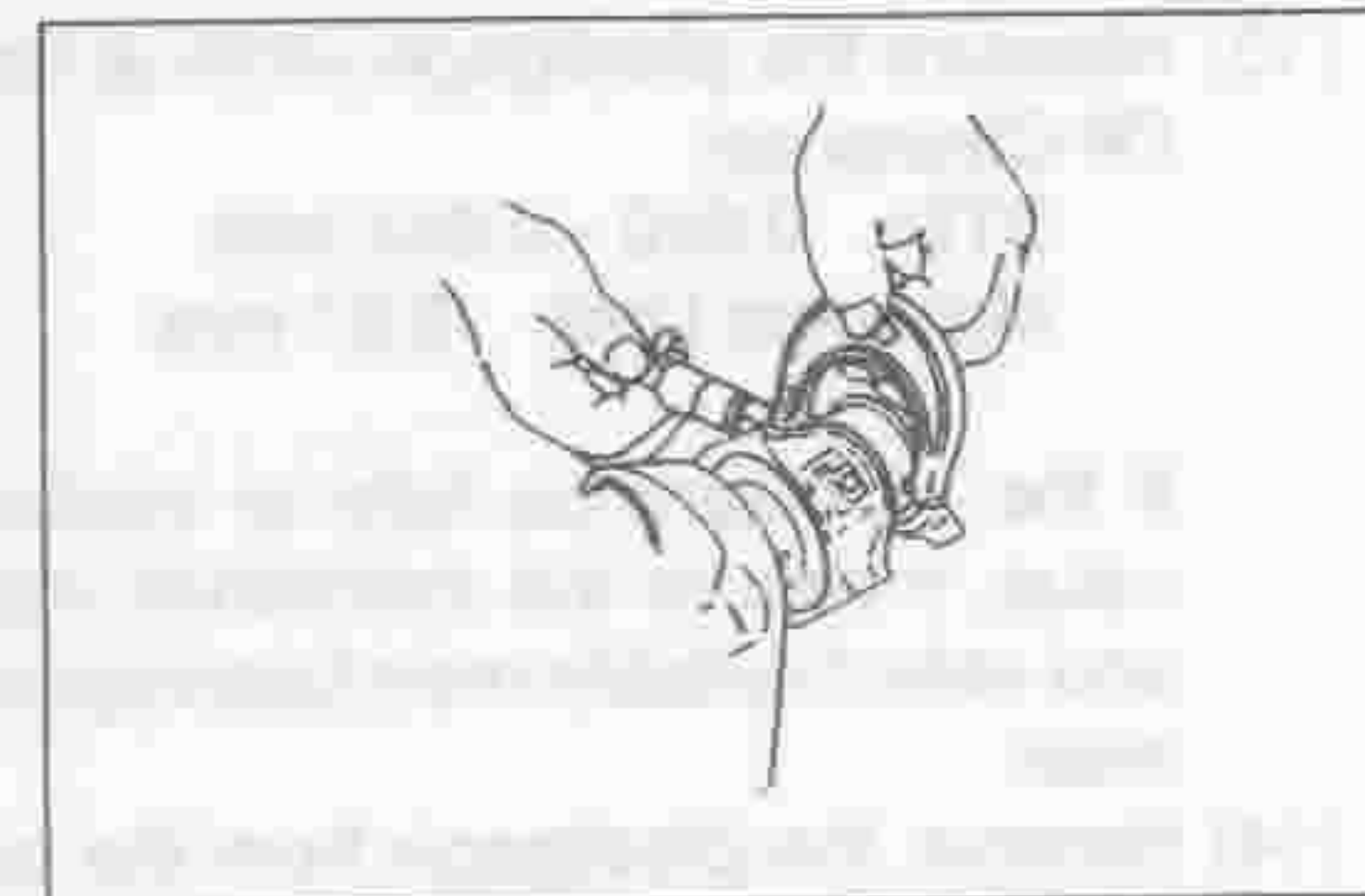
- (8) Ensure that the crankshaft main journal sections and crankpin journal sections exhibit no uneven wear (out of roundness and taper).

**NOTE:**

- The measurement should be conducted in the four directions for each journal section.

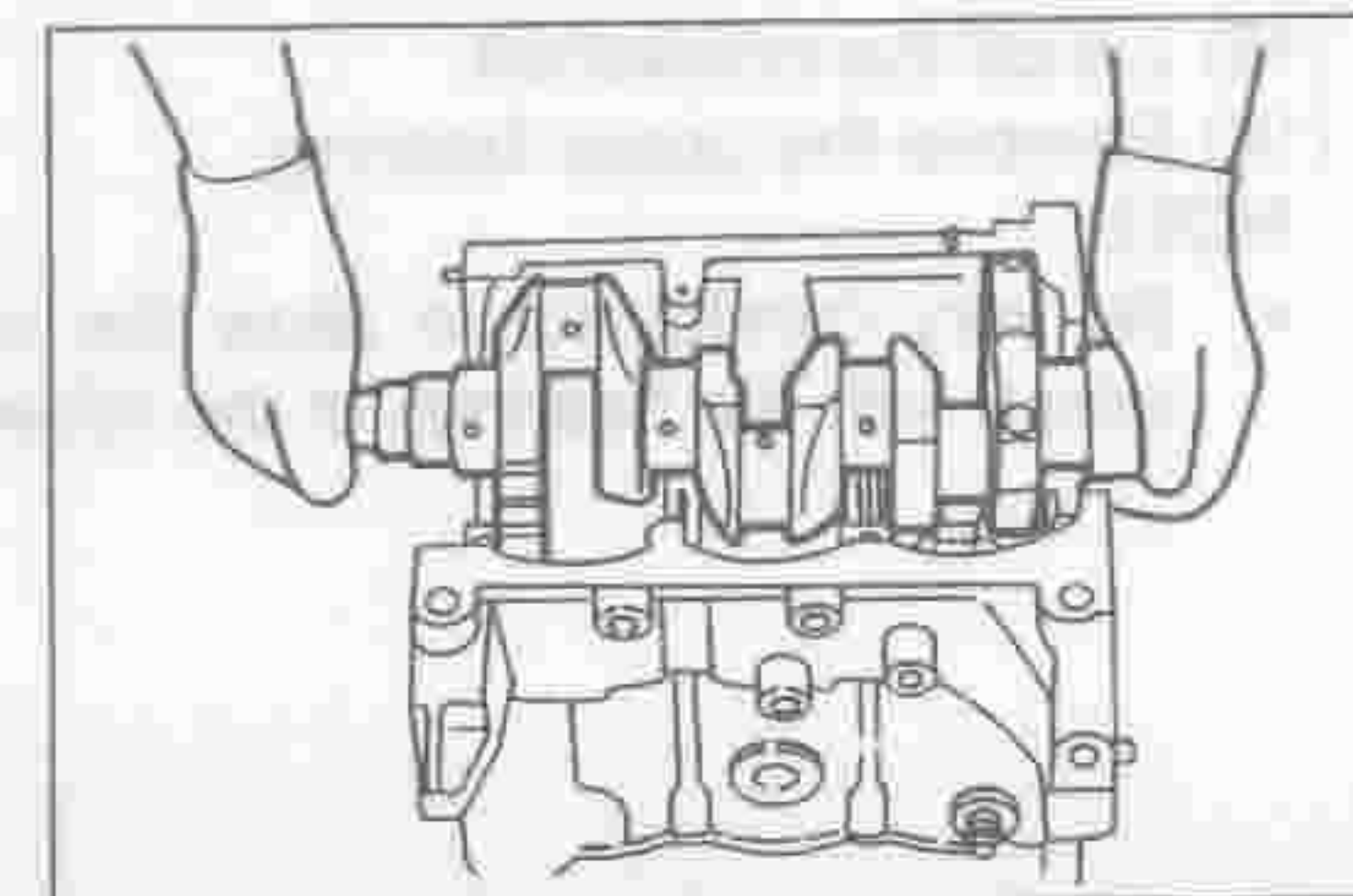
Uneven Wear Limit: 0.02 mm

If the uneven wear exceeds the allowable limit, repair or replace the crankshaft.



LEM00320-00300

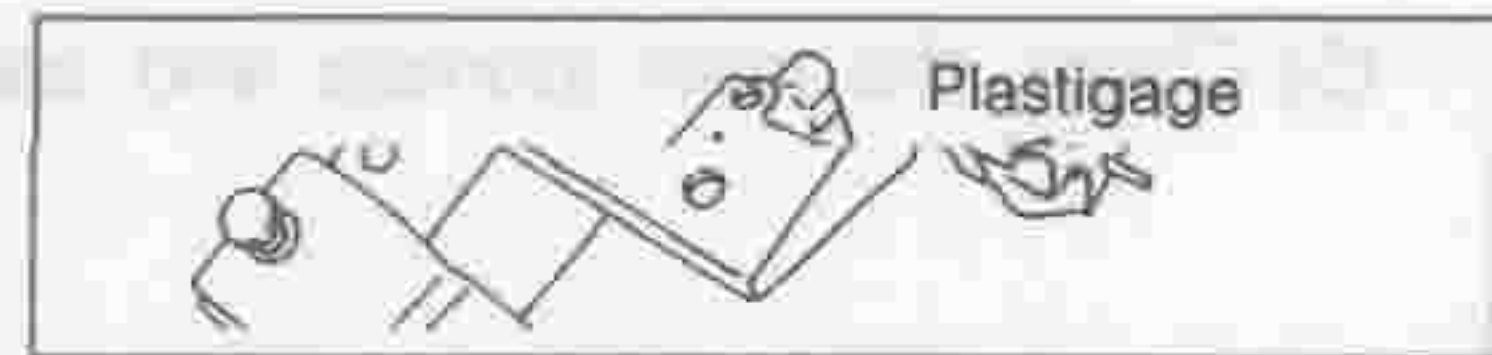
- (9) Place the crankshaft in the cylinder block.



LEM00321-00301

# EM-78

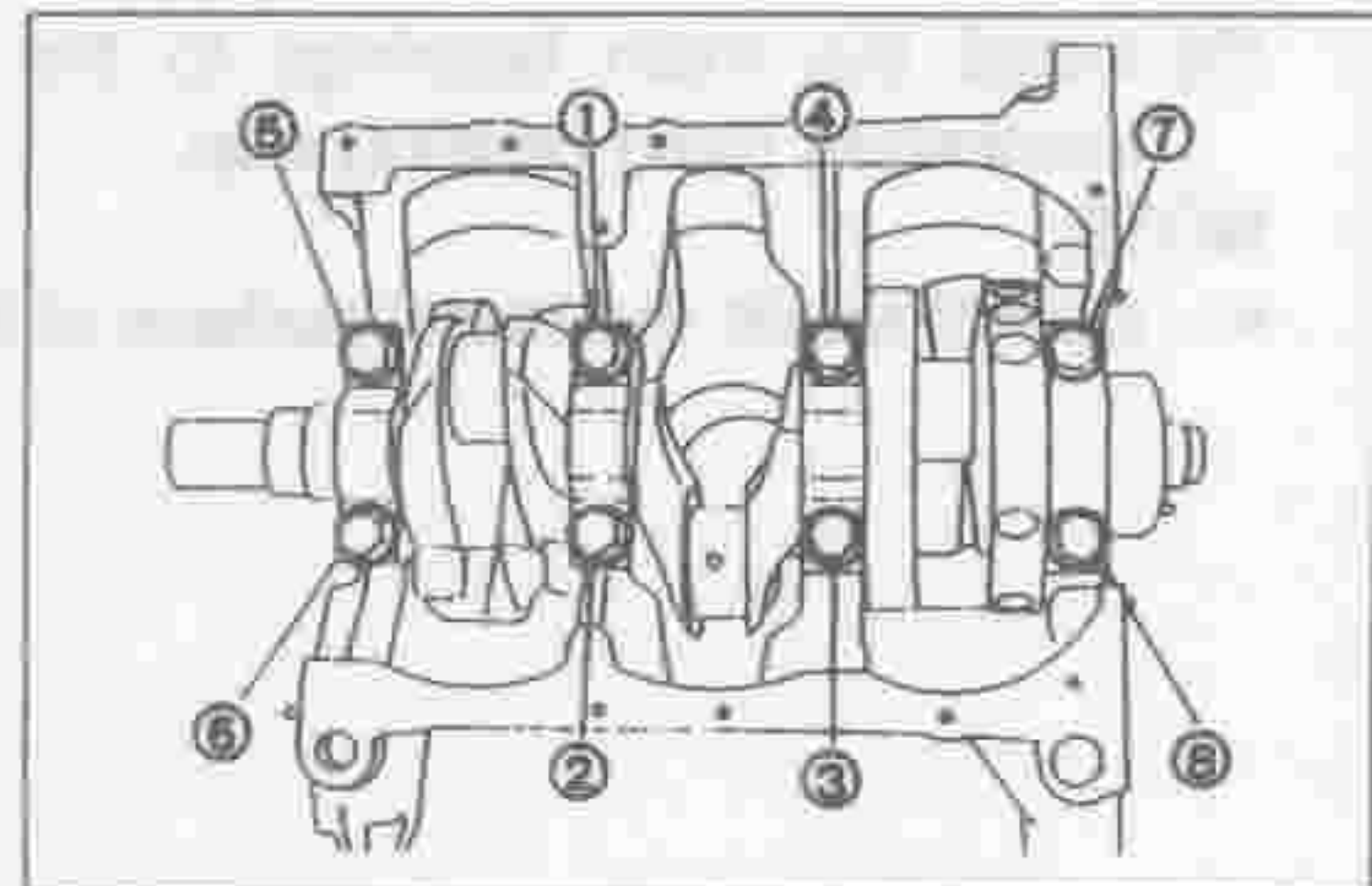
(10) Lay a strip of plastigage across each crankshaft main



LEM00322-00302

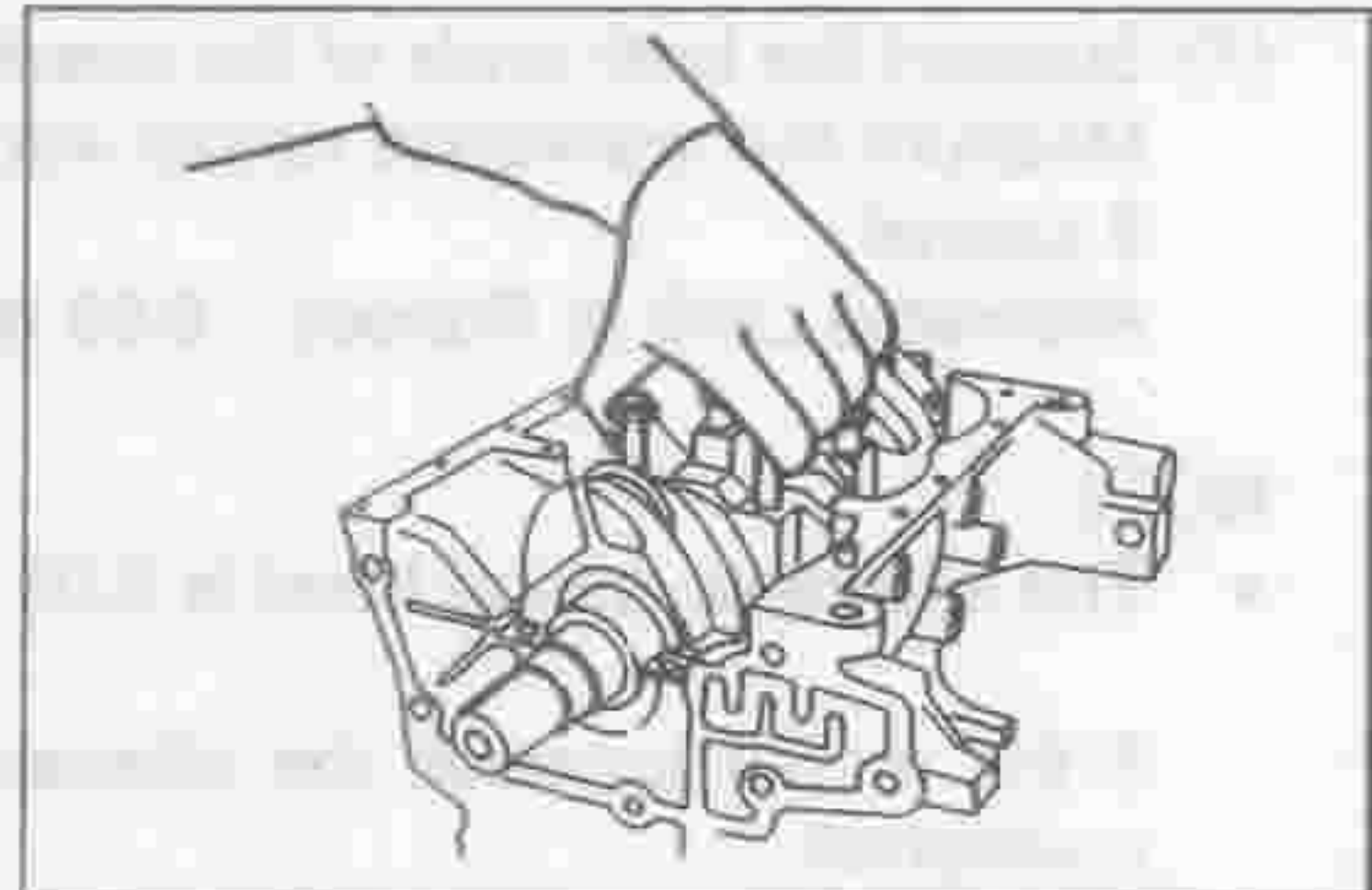
(11) Install the crankshaft bearing caps. Tighten the crankshaft bearing cap bolts evenly in the sequence indicated in the right figure.

Tightening Torque:  $58.8 \pm 5.9$  N·m  
( $6.00 \pm 0.60$  kgf·m)



LEM00323-00303

(12) Remove the main bearing caps with the lower bearings fitted on them.



LEM00324-00304

(13) Measure the plastigage width at its widest point.

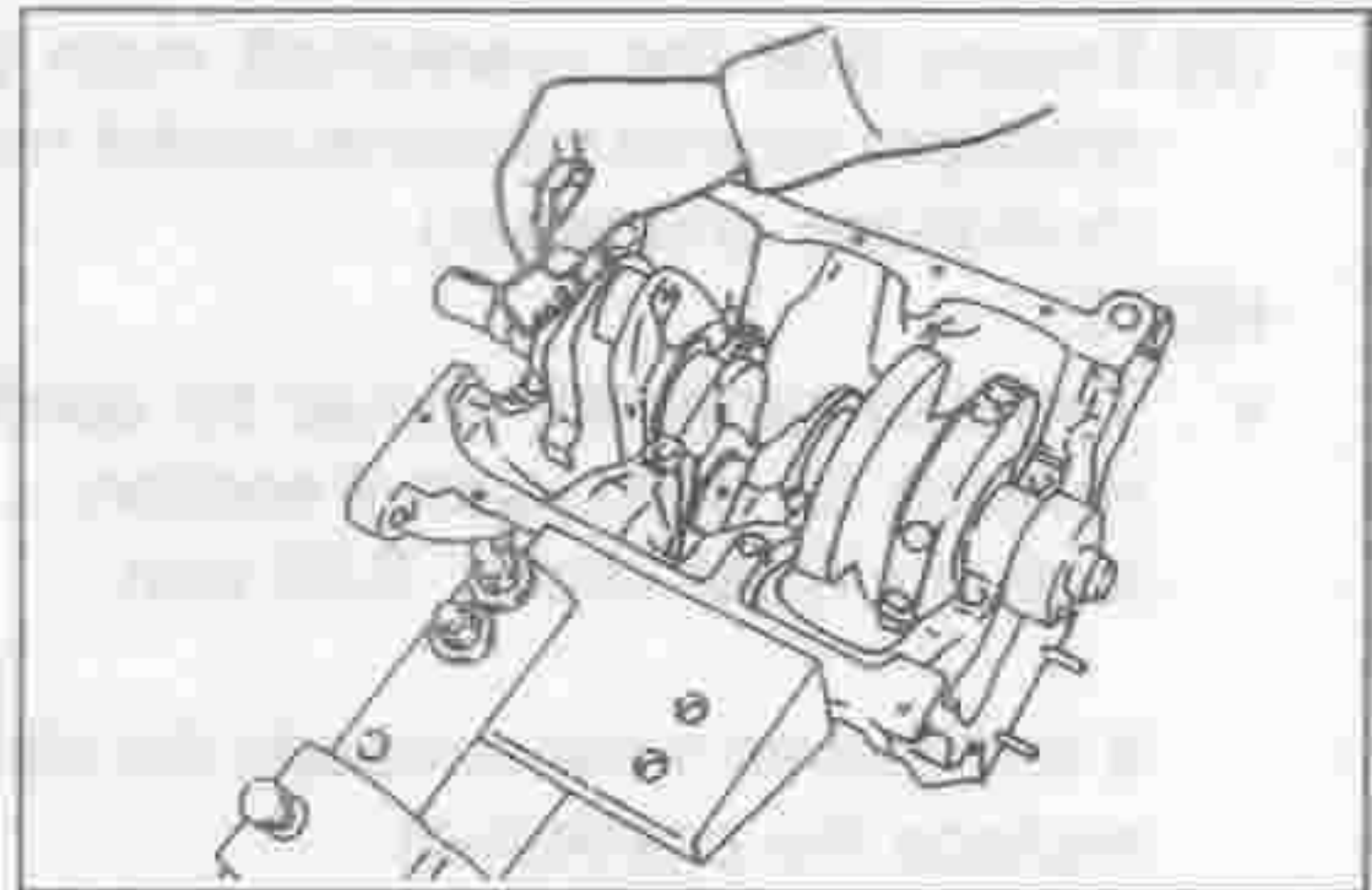
Oil Clearance:

STD: 0.020 - 0.044 mm

Maximum Limit: 0.07 mm

If the oil clearance fails to conform to the specified value, measure the crankshaft main journal diameter and select suitable main bearings or replace the crankshaft.

(14) Remove the plastigage from the crankshaft main journals.



LEM00325-00305

(15) Lift off the crankshaft.

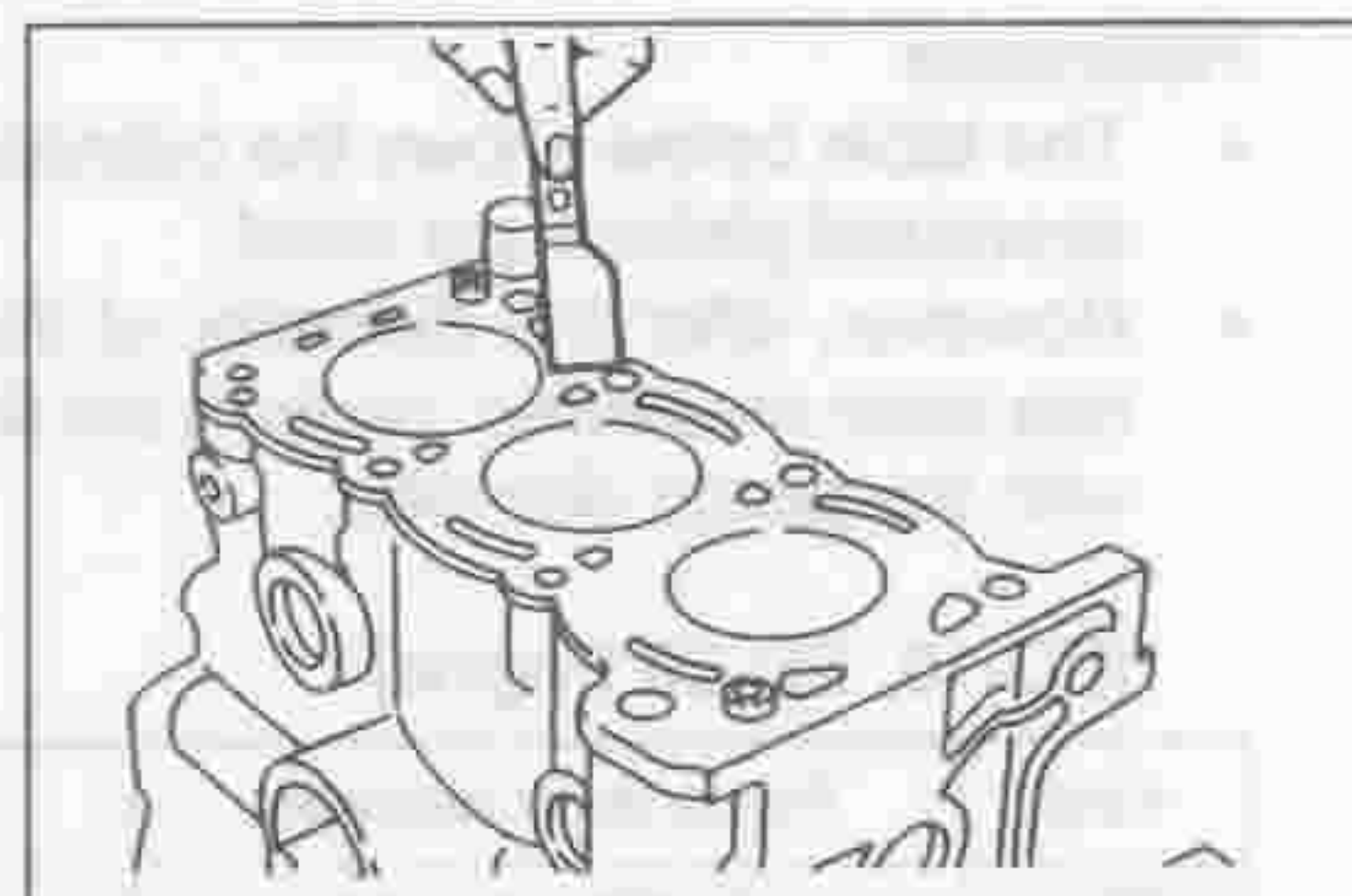
(16) Remove the upper bearing.

NOTE:

- Be very careful not to allow the main bearings to be mixed with the bearings of the other cylinders.

## INSPECTION OF CYLINDER BLOCK

1. Removal of gasket material  
Remove all gasket materials from the cylinder block.
2. Cleaning of cylinder block  
Clean the cylinder block, using a soft brush and cleaning solvent.

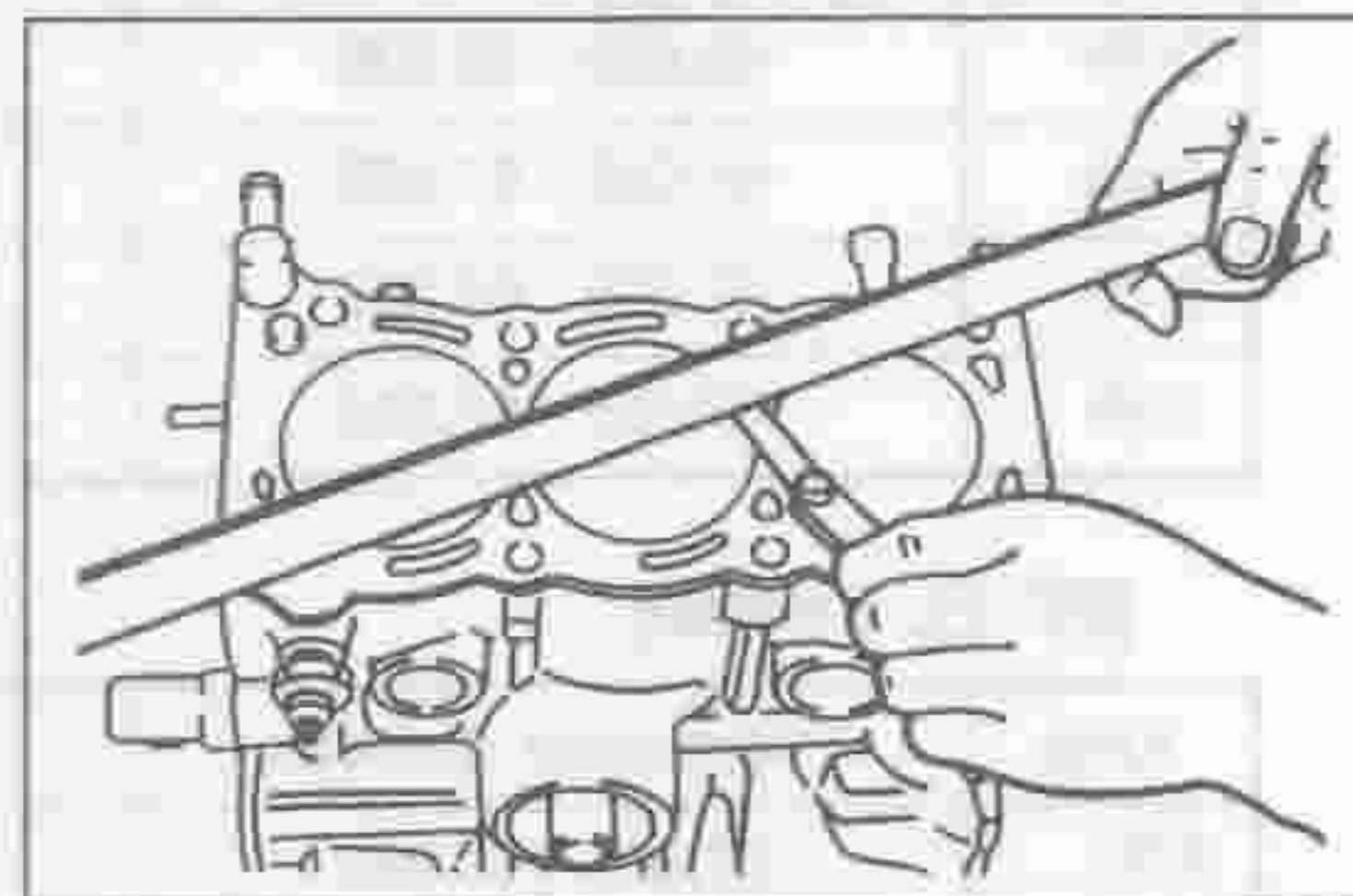


LEM00326-00306

3. Inspection of top surface of cylinder block  
Using a precision straightedge and a thickness gauge, check the surface contacting the cylinder head gasket for warpage in the six directions as shown in the figure.

Maximum Warpage: 0.08 mm

If the warpage exceeds the allowable limit, replace the cylinder block or reface the upper gasket surface of the cylinder block, referring to the following cylinder block height as a limit.

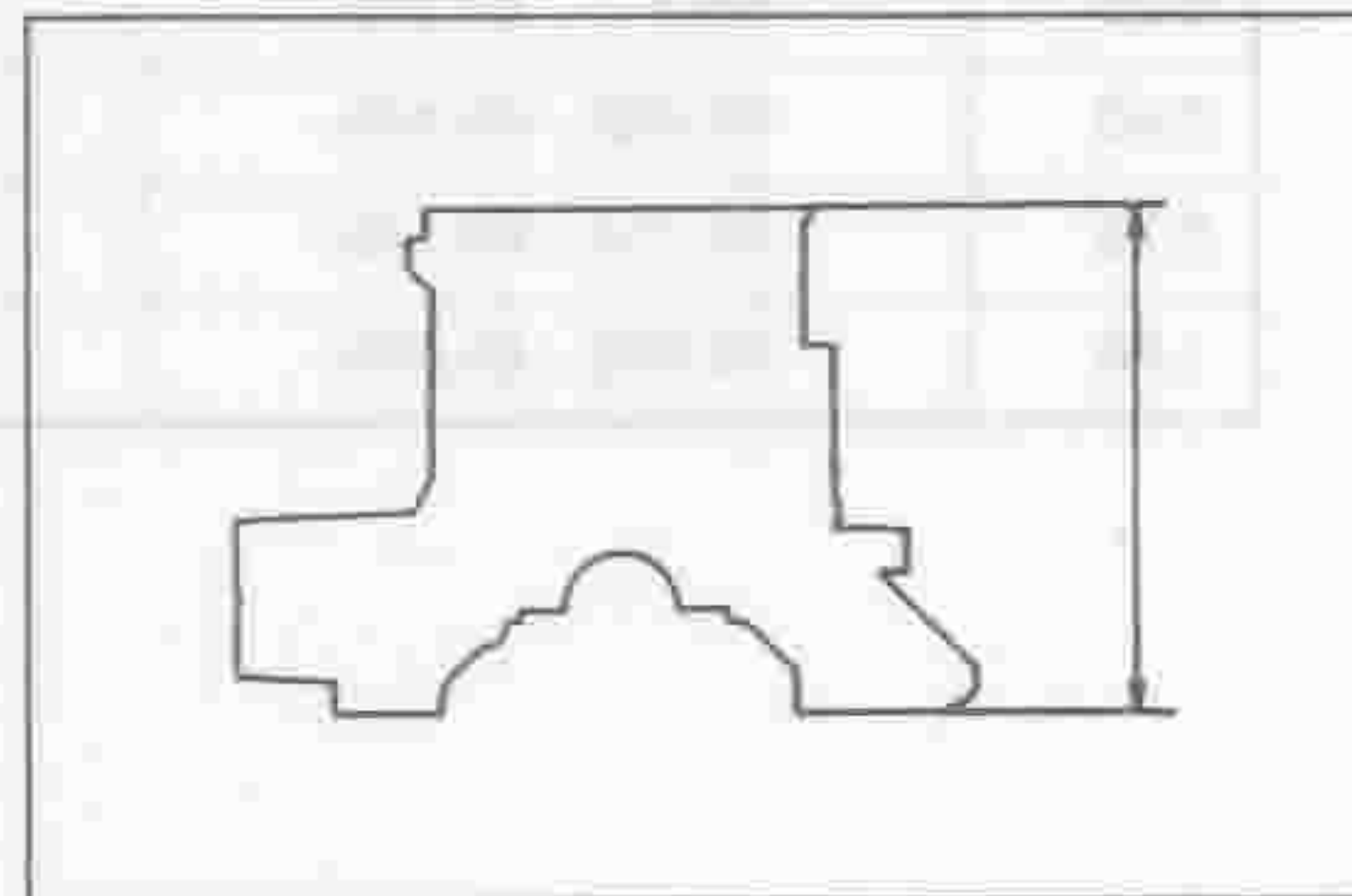


LEM00327-00307

Cylinder Block Minimum Height:  
235.8 mm [ED-10, ED-20 Engine]  
219.8 mm [EF-EL Engine]

(Reference)

Cylinder Block Height:  
STD: 235.9 - 236.1 mm [ED-10, ED-20 Engine]  
219.9 - 220.1 mm [EF-EL Engine]



LEM00328-00308

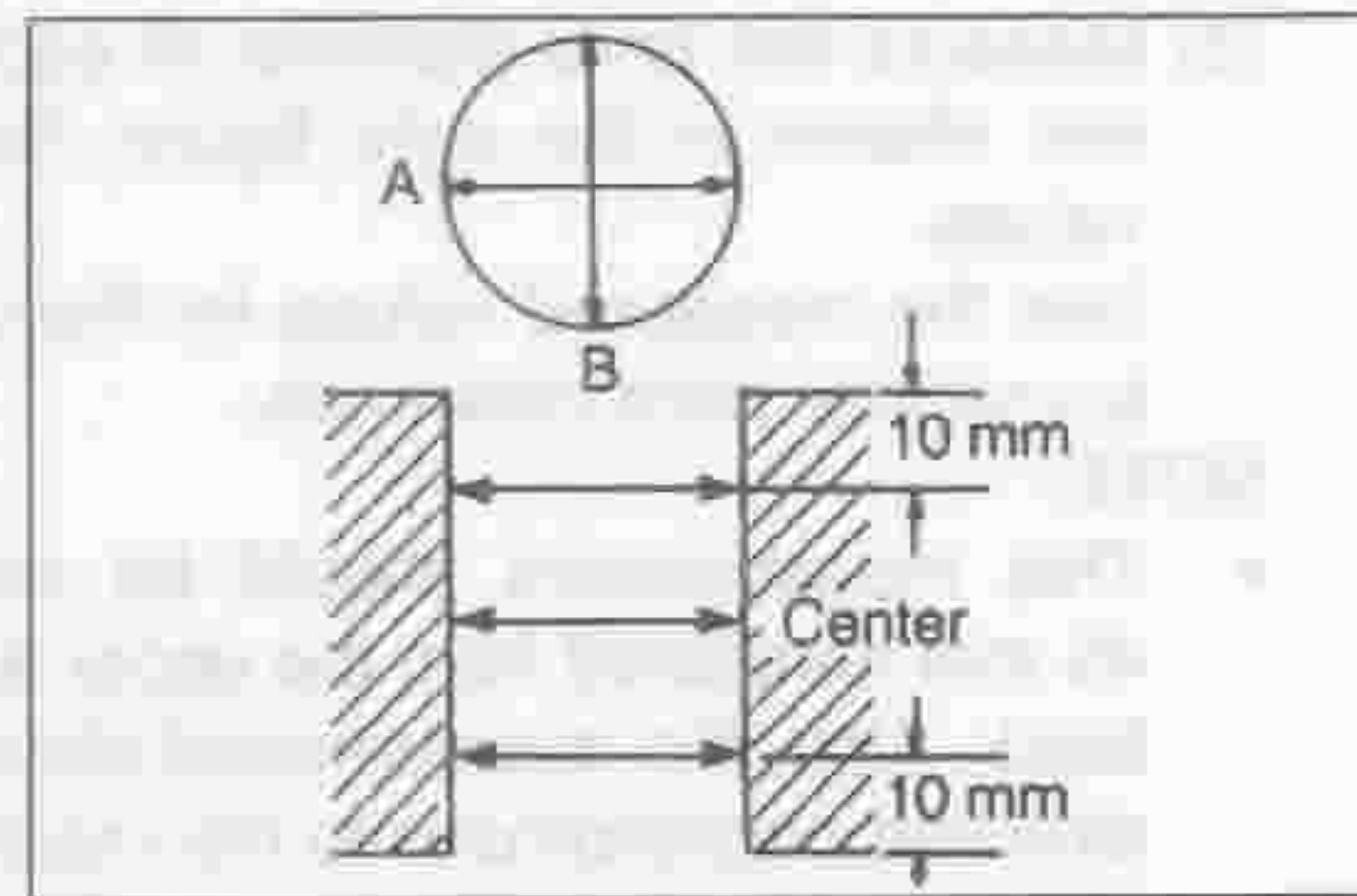
4. Measurement of cylinder bores  
(1) Measure the bore diameter of each cylinder at the six points shown in the right figure. Ensure that the difference between the maximum and minimum bore diameters of each cylinder is within 0.03 mm.

If the difference between the maximum and minimum values exceeds 0.03 mm, perform boring and/or honing for the cylinder bore in accordance with the oversized piston.

The honing angle is  $35^\circ \pm 5^\circ$ . The surface coarse degree is 1 - 4Z.

### NOTE:

- This boring or honing operation should be carried out at the same time for the three cylinders.



LEM00329-00309

## Reference:

- The table below shows the cylinder bore diameter when oversized pistons are used.
- However, after the diameter of the replacement piston has been measured, perform the finishing in accordance with the piston diameter.

### [ED-10, ED-20 Engine]

(mm)

Kind	Piston outer diameter	Cylinder bore
STD	66.555 - 66.585	66.600 - 66.630
0.25	66.805 - 66.835	66.850 - 66.880
0.50	67.055 - 67.085	67.100 - 67.130
0.75	67.305 - 67.335	67.350 - 67.380
1.00	67.555 - 67.585	67.600 - 67.630

### [EF-EL Engine]

(mm)

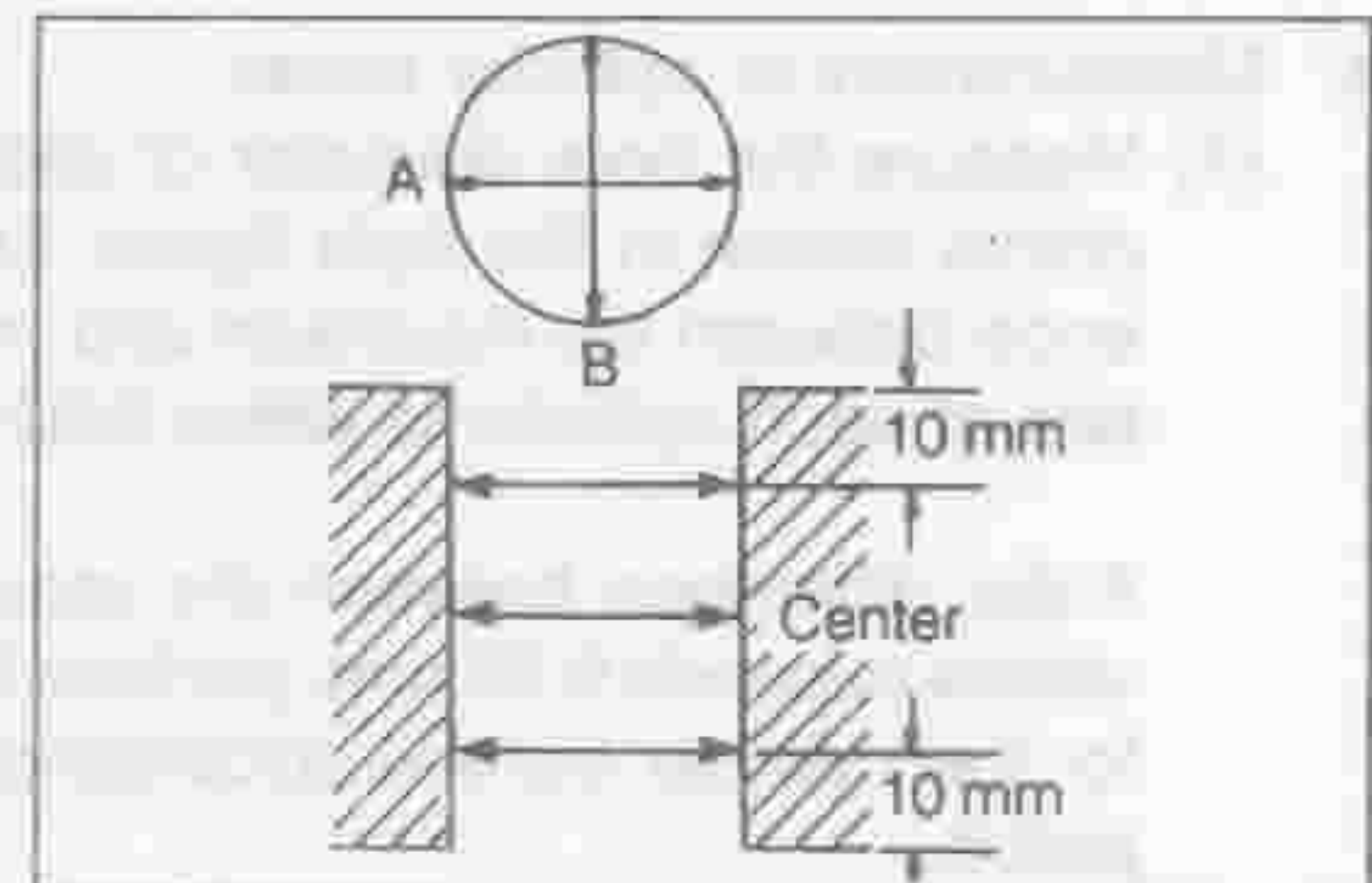
Kind	Piston outer diameter	Cylinder bore
STD	67.965 - 67.995	68.000 - 68.030
0.25	68.215 - 68.245	68.250 - 68.280
0.50	68.465 - 68.495	68.500 - 68.530
0.75	68.715 - 68.745	68.750 - 68.780
1.00	68.965 - 68.995	69.000 - 69.030

- (2) Measure the bore diameter of each cylinder at a position shown in the right figure. Record the measured values.

Use the measured values for the calculation of piston-to-cylinder bore clearance.

#### NOTE:

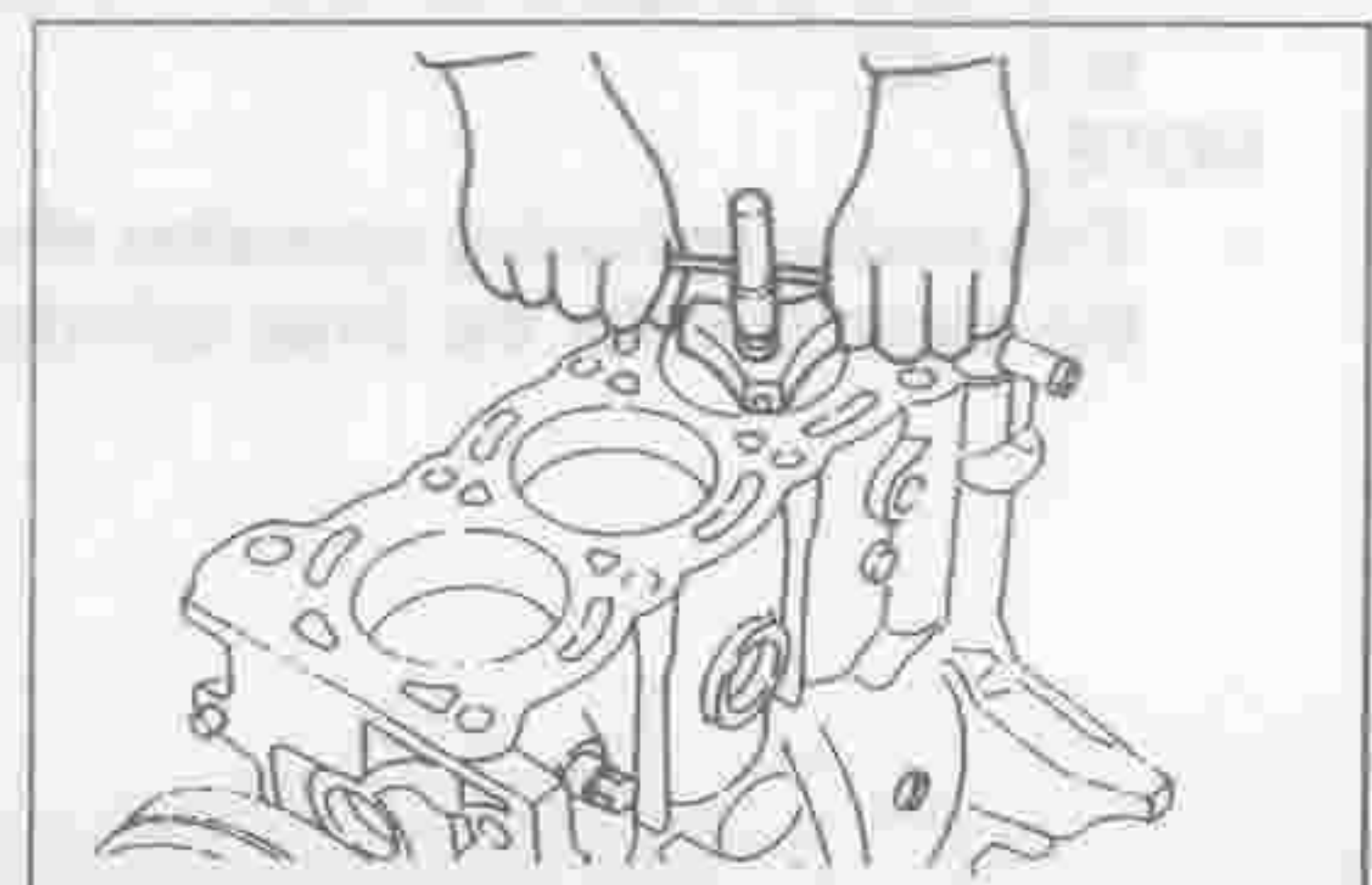
- This measurement should be conducted at a point 45 mm measured from the upper surface of the cylinder block. Also, the measurement should be performed in a direction perpendicular to the crankshaft.



LEM00331-00310

## 5. Removal of cylinder ridges

If ridges are formed at the upper parts of the cylinder bores, use a ridge reamer to remove the ridges.



LEM00332-00311



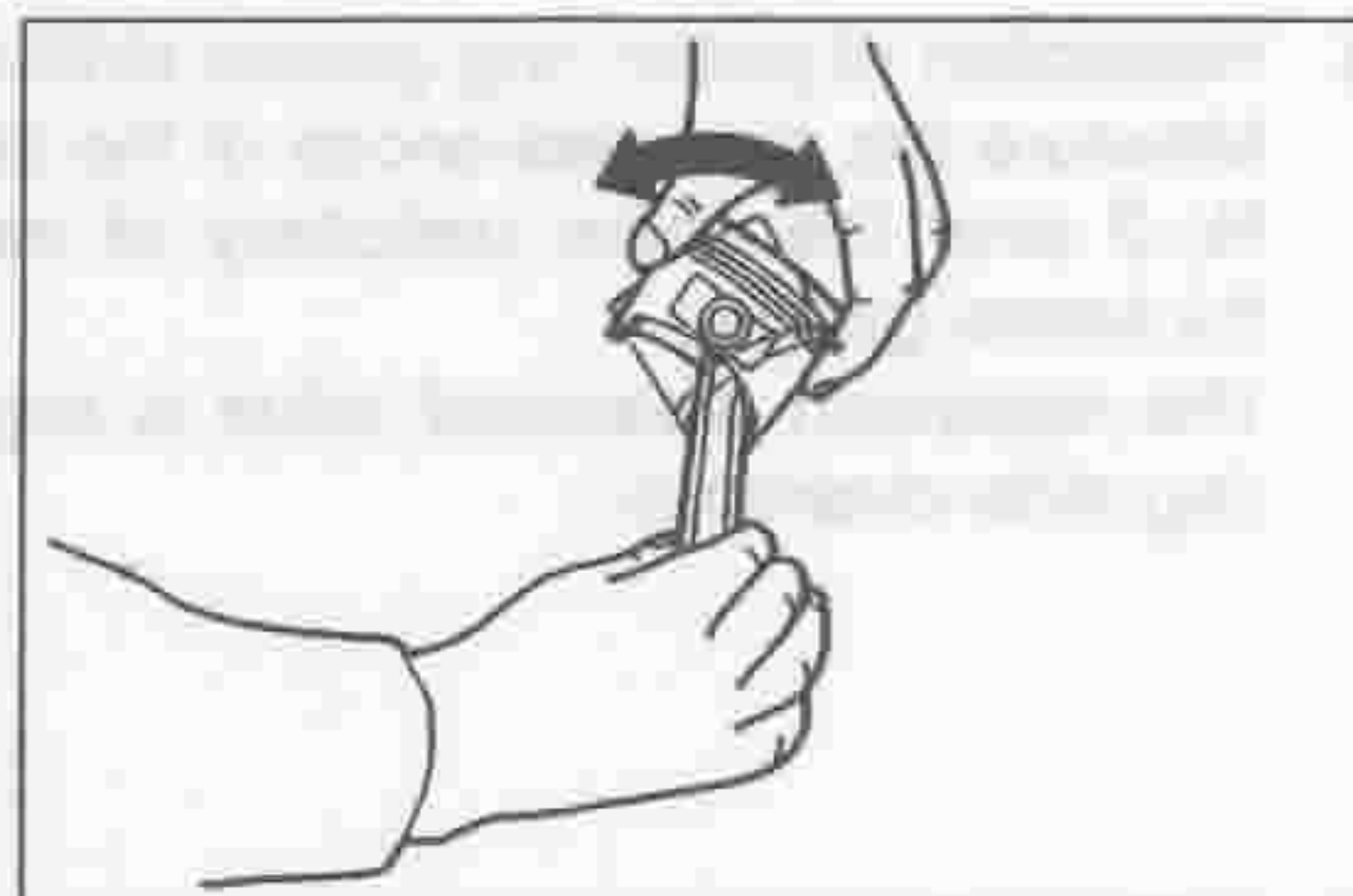
## INSPECTION OF PISTONS

### 1. Inspection of fit between piston and piston pin

Try to move the piston back and forth on the piston pin. If any movement is felt, inspect the piston and piston pin clearance.

#### NOTE:

- When the piston is moved back and forth on the piston pin, you may encounter hard movement. However, if the piston moves smoothly without any binding, this fitting of the piston is normal.



LEM00333-00312

### 2. Removal of piston rings

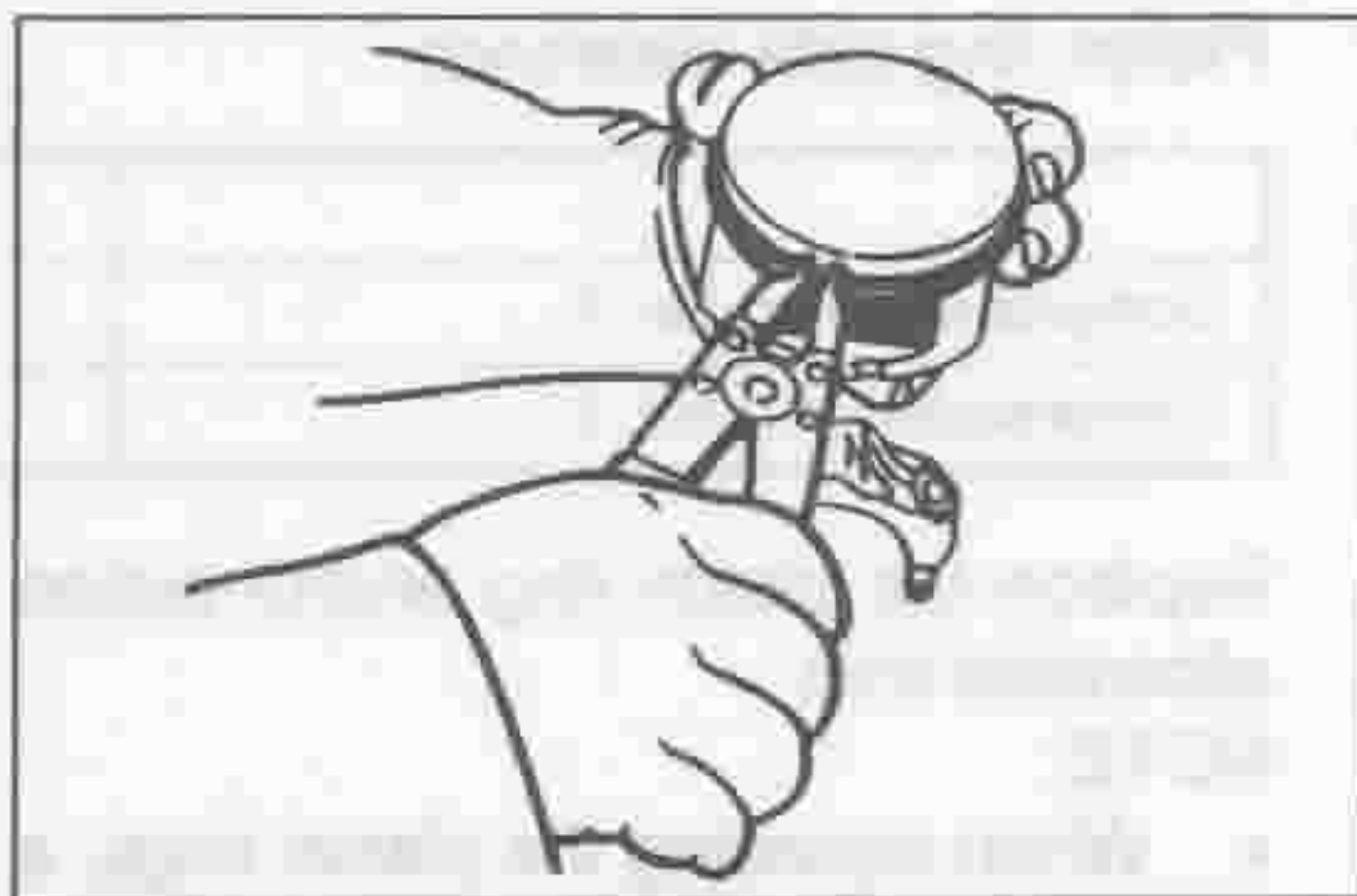
#### NOTE:

- Arrange the removed piston rings in order so that their installation positions may be known readily.
- Do not expand the piston ring unnecessarily beyond the required extent.

(1) Remove the piston rings No. 1 and No. 2 using a piston ring expander.

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

(3) Remove the oil ring expander by hand.



LEM00334-00313

### 3. Cleaning of pistons

(1) Remove the carbon deposits from the piston top, using a gasket scraper or the like.

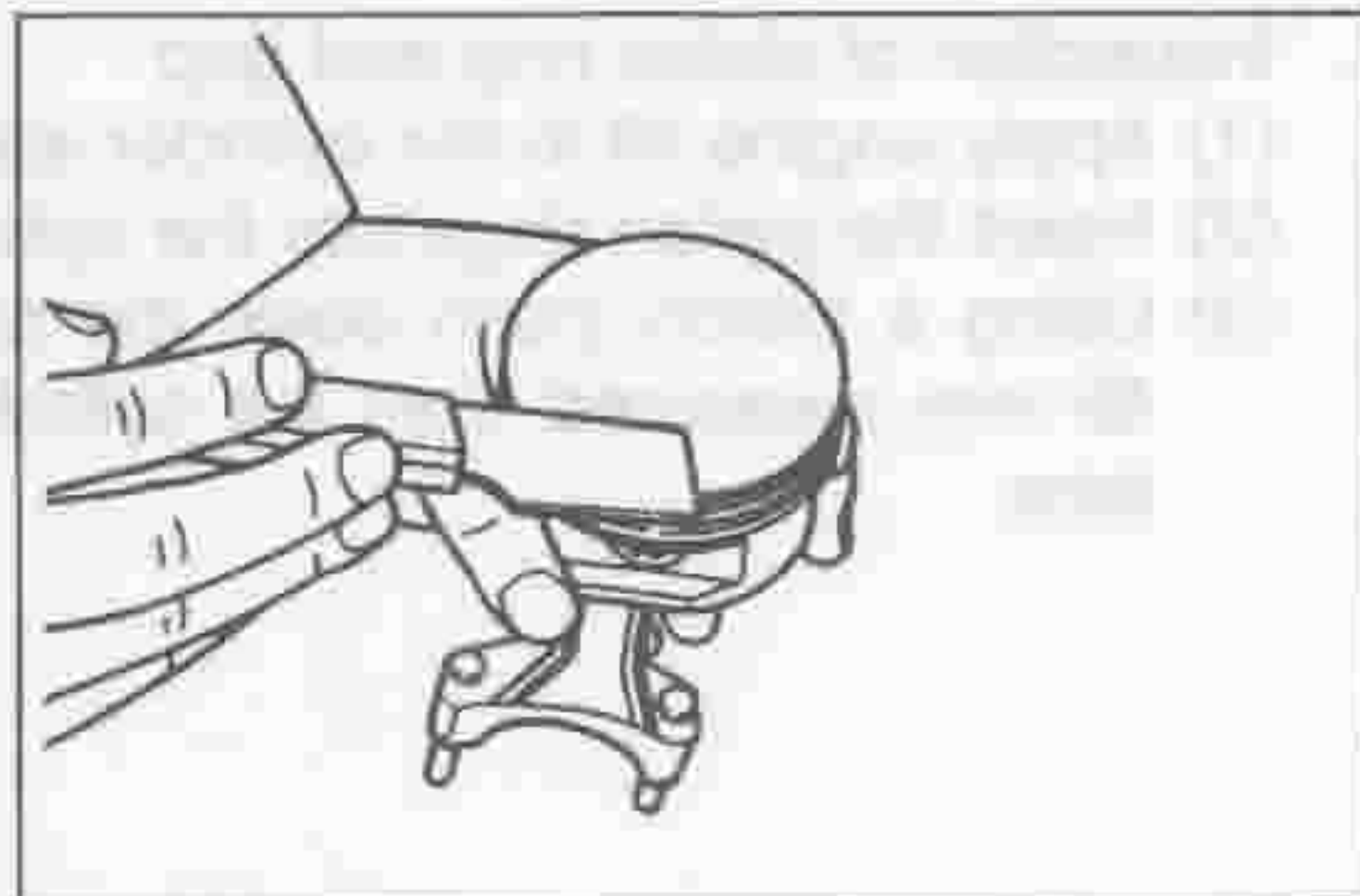
#### NOTE:

- Be very careful not to scratch the piston.

(2) Clean the piston grooves with a broken piston ring or a groove cleaning tool.

#### NOTE:

- Be very careful not to scratch the piston.



LEM00335-00314

### 4. Inspection of pistons

Visually inspect the piston for cracks, damage or seizure. Replace the piston, if necessary.

### 5. Measurement of piston diameter

(1) Measure the piston outer diameter horizontally at a point 13.5 mm (ED-10, ED-20), 11.5 mm (EF-EL) from the lower end of the piston at right angles to the piston pin.

(2) Calculation of piston-to-cylinder bore clearance  
Subtract the measured piston outer diameter from the measured cylinder bore diameter.

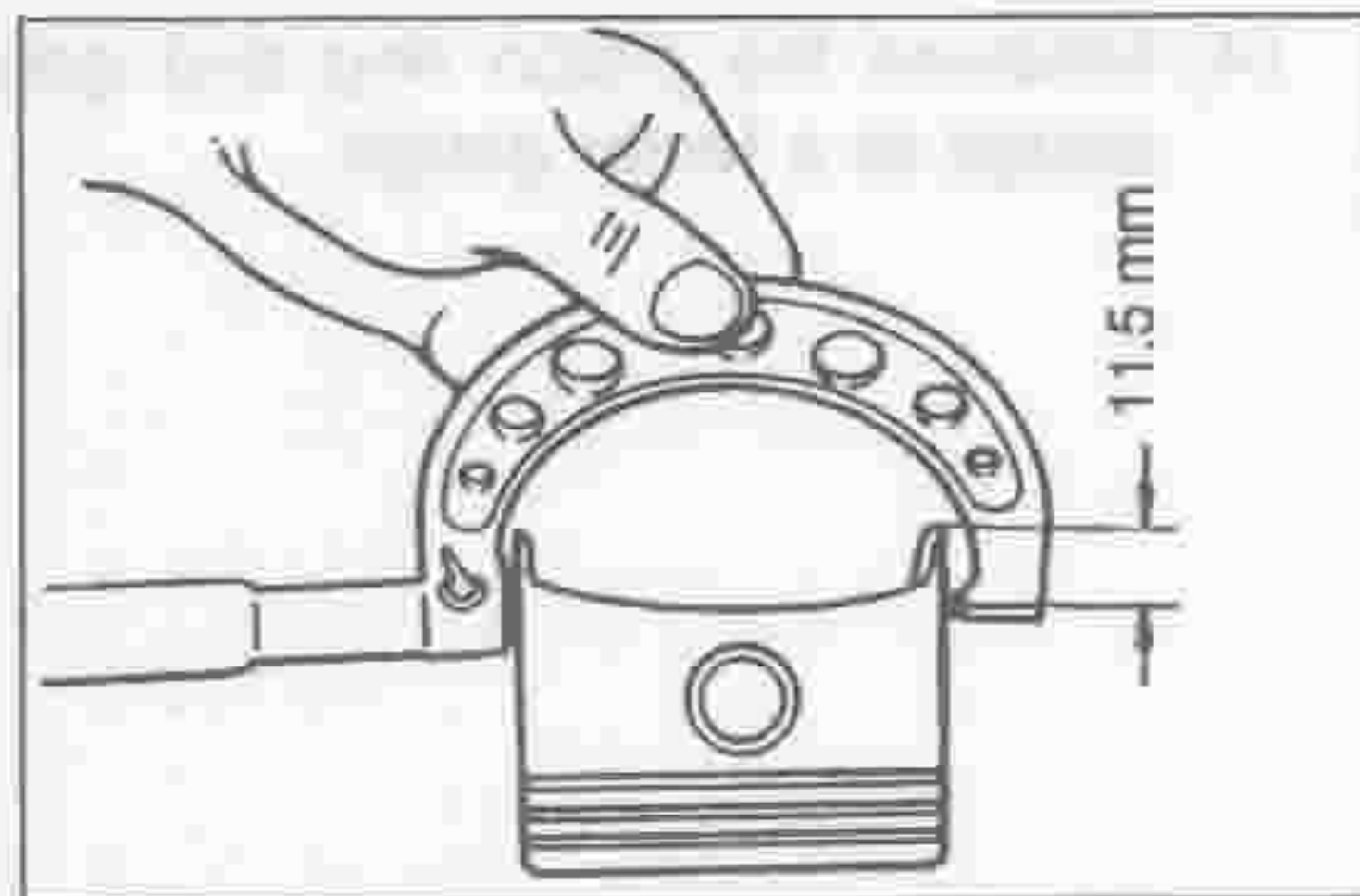
Piston-to-Cylinder Bore Clearance: Specified Value:

0.035 - 0.055 mm [ED-10, ED-20 Engine]

0.025 - 0.045 mm [EF-EL Engine]

Allowable Limit: 0.11 mm [ED-10, ED-20 Engine]

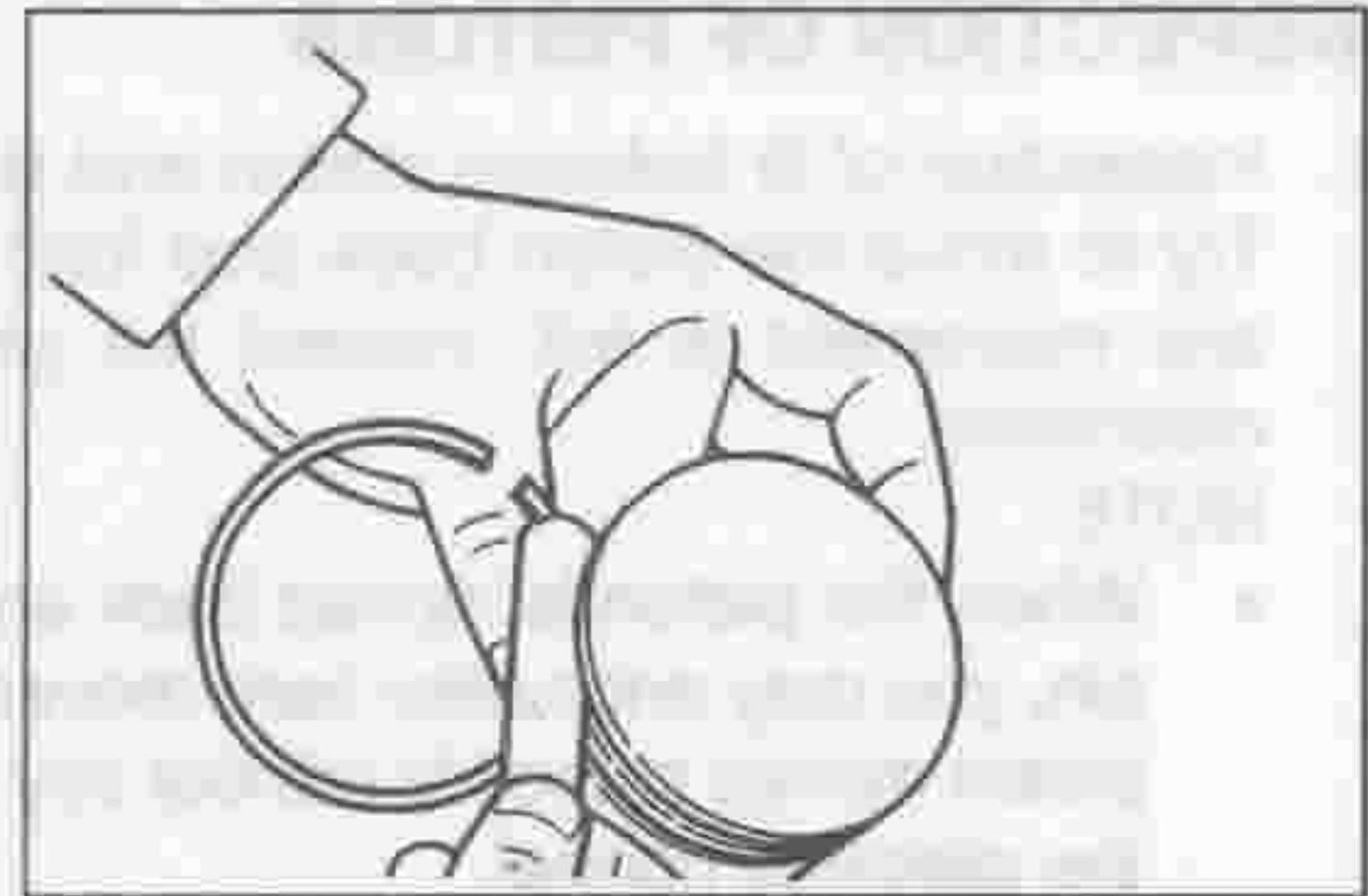
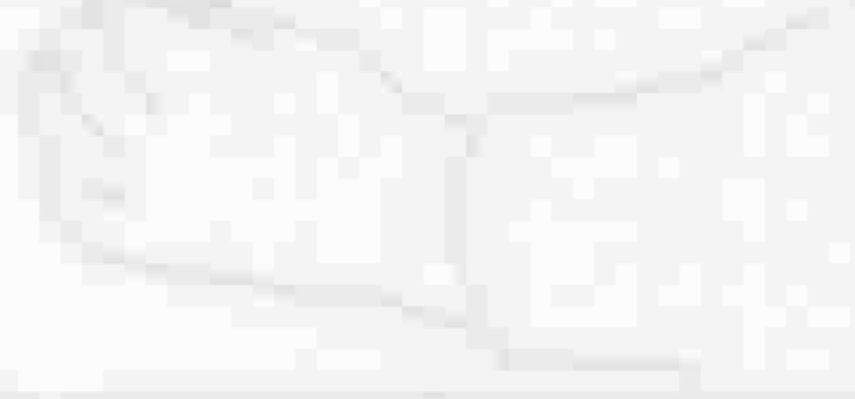
0.10 mm [EF-EL Engine]



LEM00336-00315

If the piston-to-cylinder bore clearance exceeds the allowable limit, perform boring and honing on the cylinder bores so that the cylinder bore diameter may match with the oversized piston. However, when the cylinder bore diameter exceeds 67.610 mm (ED-10, ED-20) 69.030 mm (EF-EL), replace the cylinder block.

6. Inspection of piston ring groove side clearance  
 Measure the side clearances of the piston rings No.1 and No.2 over the entire periphery of each groove, using a thickness gauge.  
 The maximum measured value is regarded as the piston ring side clearance.



LEM00337-00316

### Piston ring side clearance

	Specified value (mm)	Allowable limit (mm)
Compression ring No. 1	0.03 - 0.07	0.12
Compression ring No. 2	0.02 - 0.06	0.11

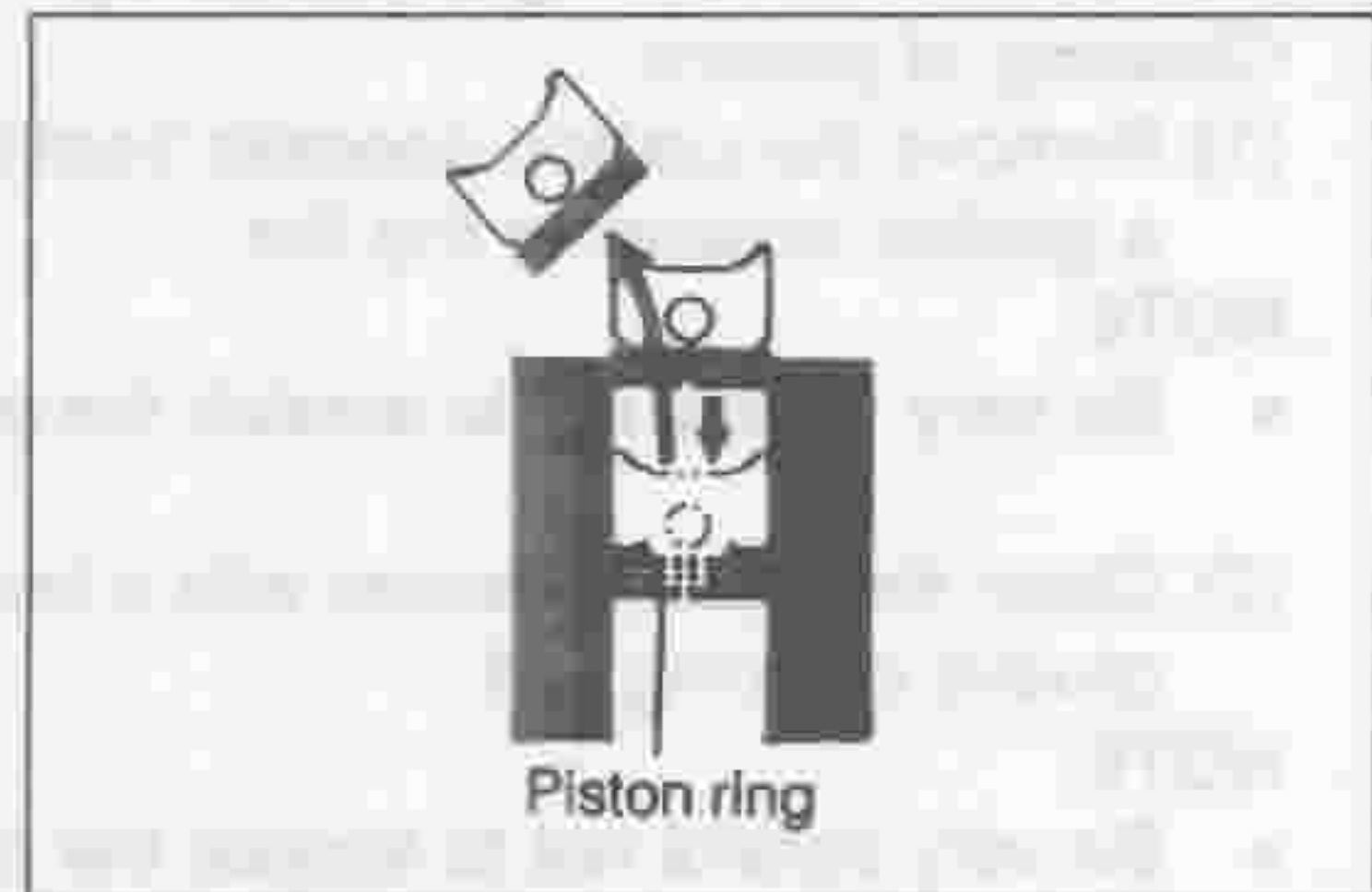
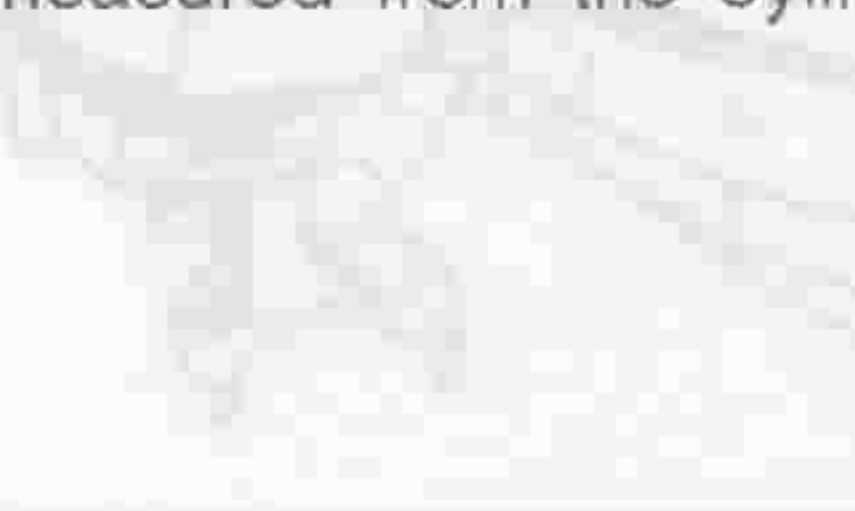
Replace the piston ring and/or piston so that the piston ring side clearance may become less than the allowable limit.

#### NOTE:

- When replacing the piston rings, a set of piston rings for one cylinder should be replaced.

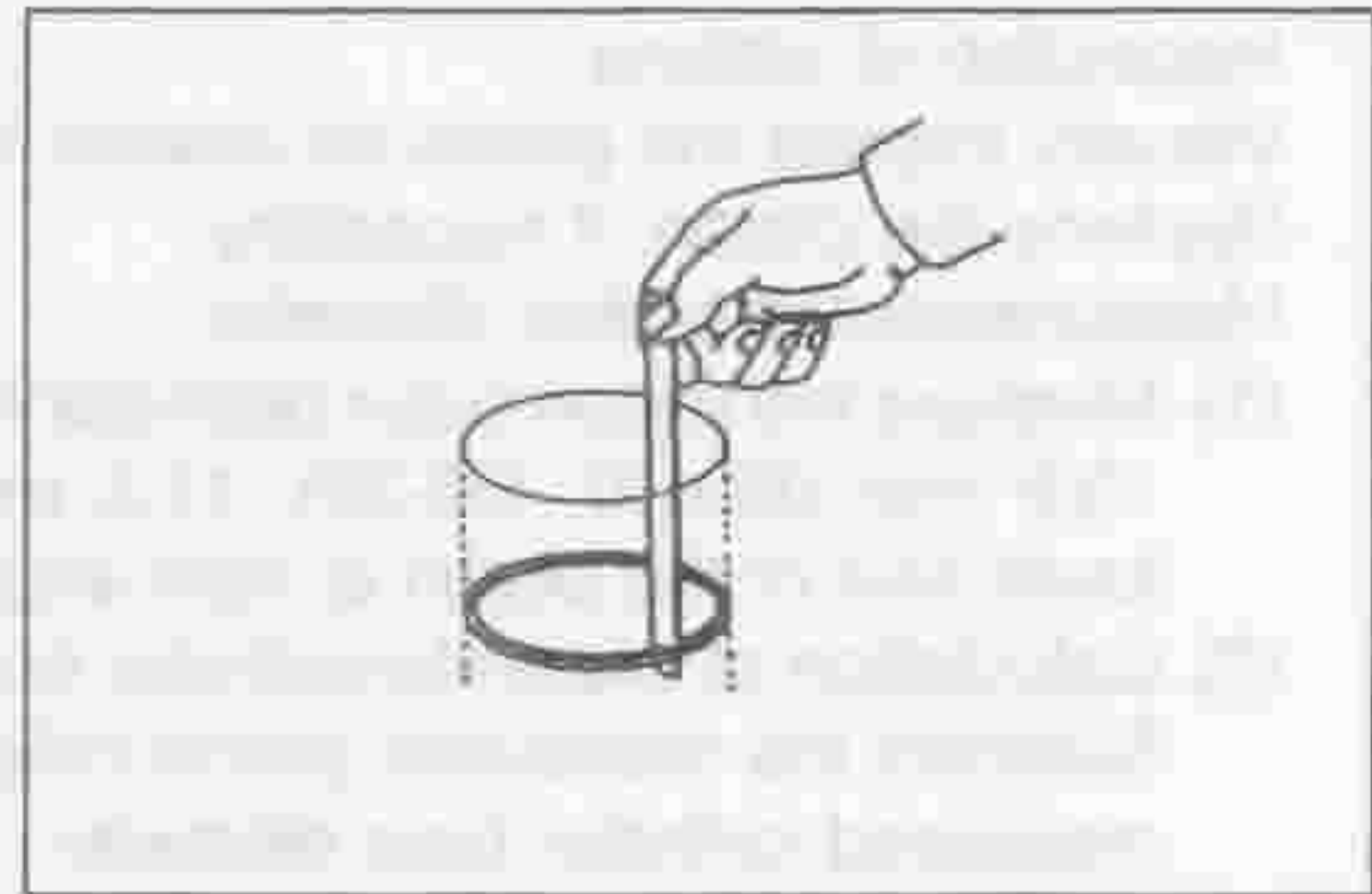
LEM00338-00000

7. Inspection of piston ring end gap  
 (1) Apply engine oil to the cylinder walls.  
 (2) Insert the piston rings into the cylinder bore.  
 (3) Using a piston, push down the piston ring to a point 45 mm measured from the cylinder block upper surface.



LEM00339-00317

- (4) Measure the piston ring end gap, using a thickness gauge or a feeler gauge.



LEM00340-00318

### Piston ring end gap

	Specified value (mm)	Allowable limit (mm)
Compression ring No. 1	0.25 - 0.40	0.65
Compression ring No. 2	0.20 - 0.35 [ED-10, ED-20 Engine] 0.40 - 0.55 [EF-EL Engine]	0.65
Oil ring (Side rail)	0.20 - 0.70	1.0

If the piston ring end gap exceeds the allowable limit, a set of piston rings for one cylinder should be replaced.

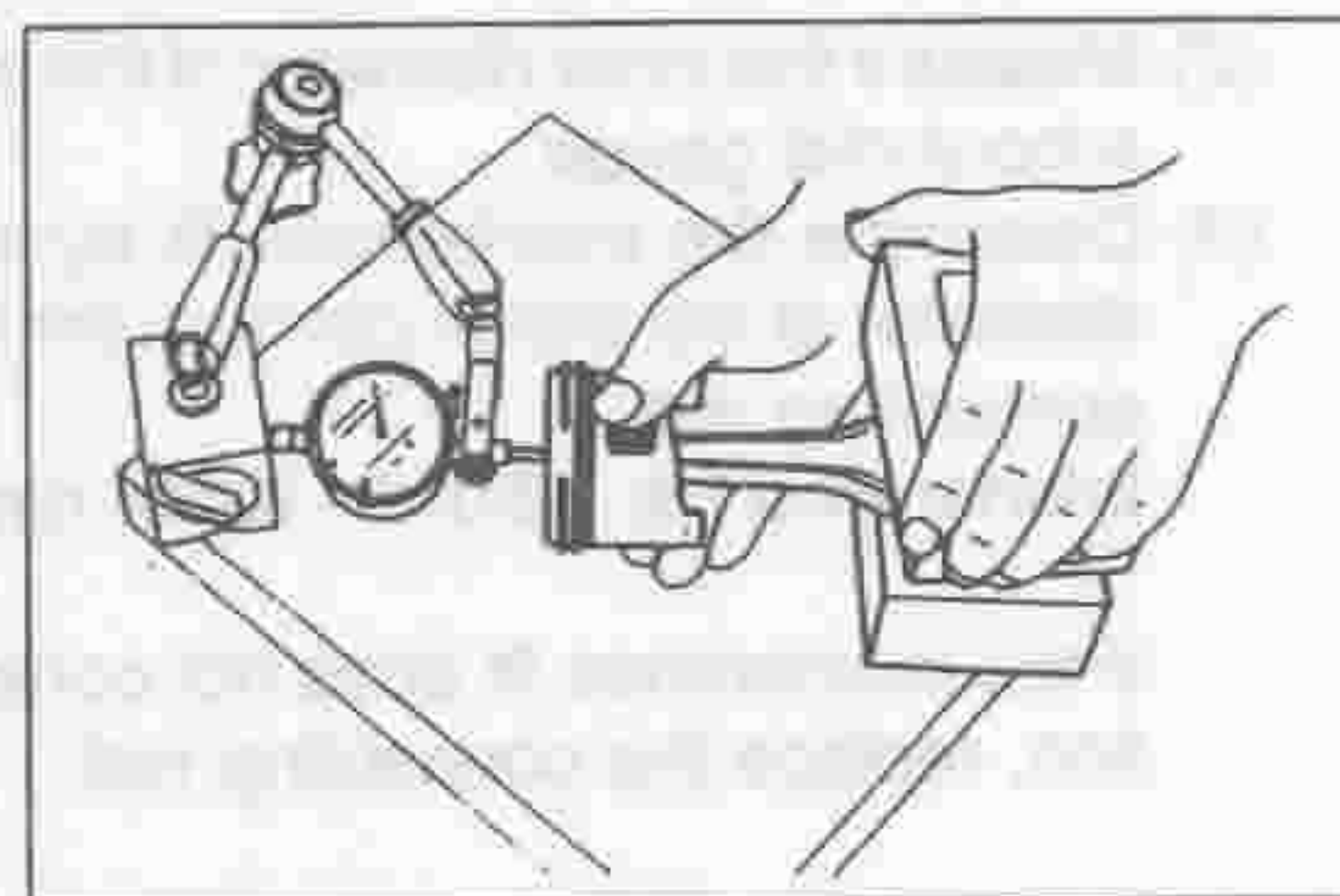
LEM00341-00000

8. Inspection of piston-to-piston pin oil clearance  
Interpose the big end of the connecting rod between V-blocks on a surface plate. Measure the play while moving the piston, as indicated in the right figure.

Piston-to-Piston Pin Clearance:

STD: 0.005 - 0.011 mm

Limit: 0.05 mm



LEM00342-00319

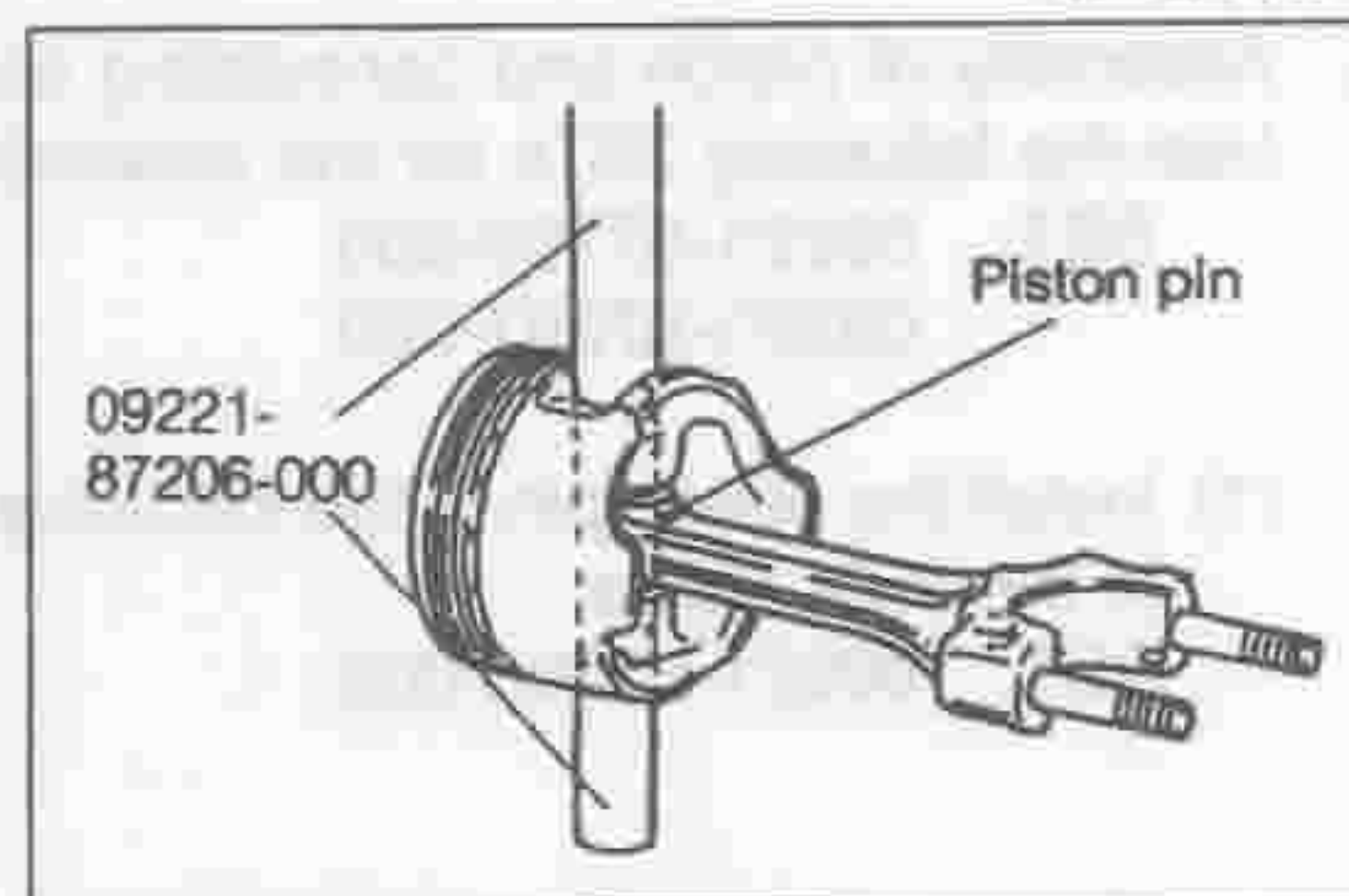
## ASSEMBLY/DISASSEMBLY OF PISTON AND CONNECTING ROD

1. Disassembly of piston and connecting rod  
Use the following SSTs for the disassembling operation.

SST: 09221-87206-000

09221-87207-000

- (1) Set the SST to the piston as shown in the right figure.  
SST: 09221-87206-000



LEM00343-00320

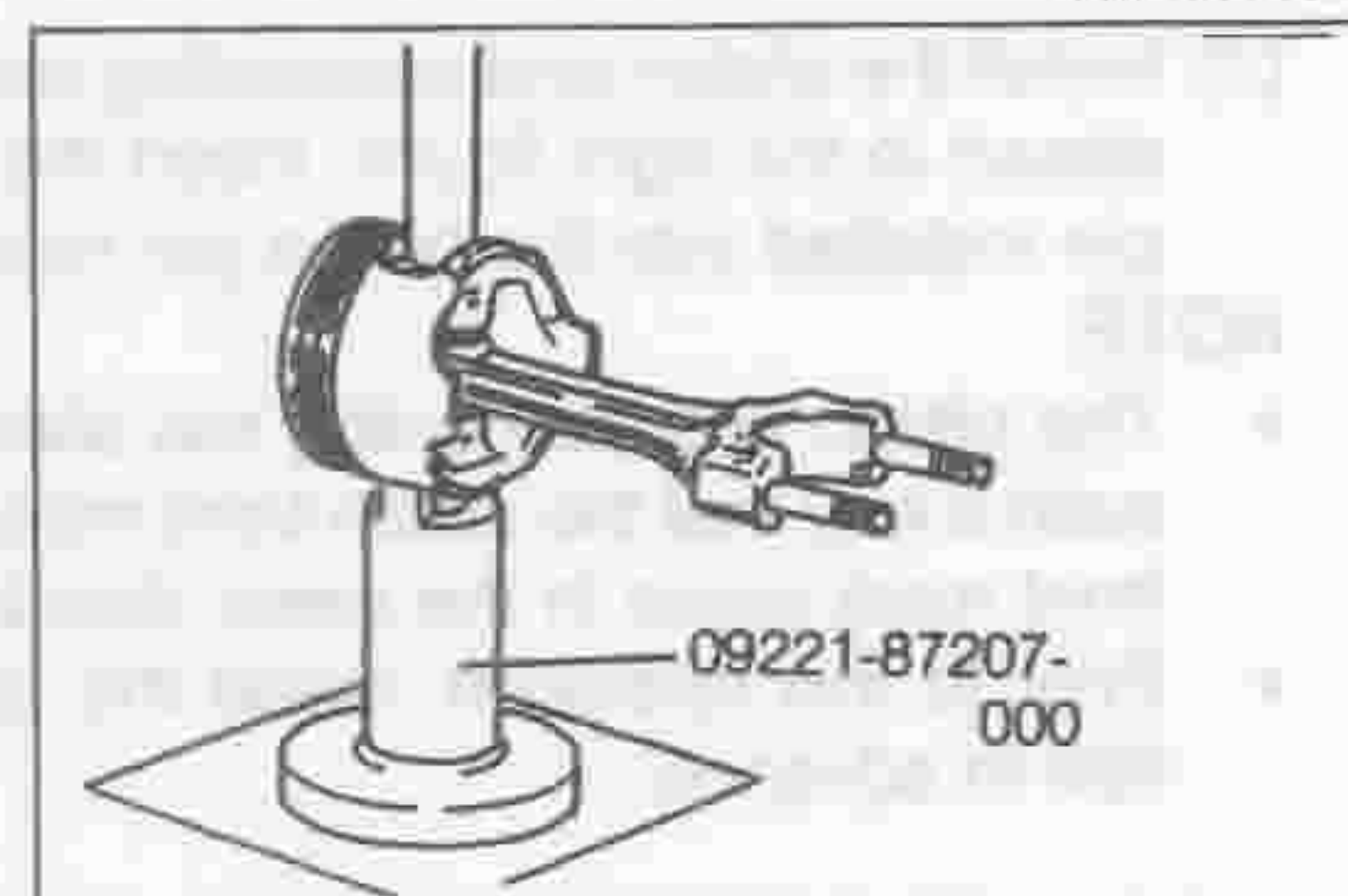
### NOTE:

- Prior to this operation, remove the spacer 09221-87206-000 in advance.

- (2) Install the connecting rod in the following SSTs as shown in the right figure.

### NOTE:

- Be sure to insert the shorter SST into the base side.  
SST: 09221-87207-000



LEM00344-00321

- (3) Press off the piston pin, using a hydraulic press.

2. Inspection of connecting rods

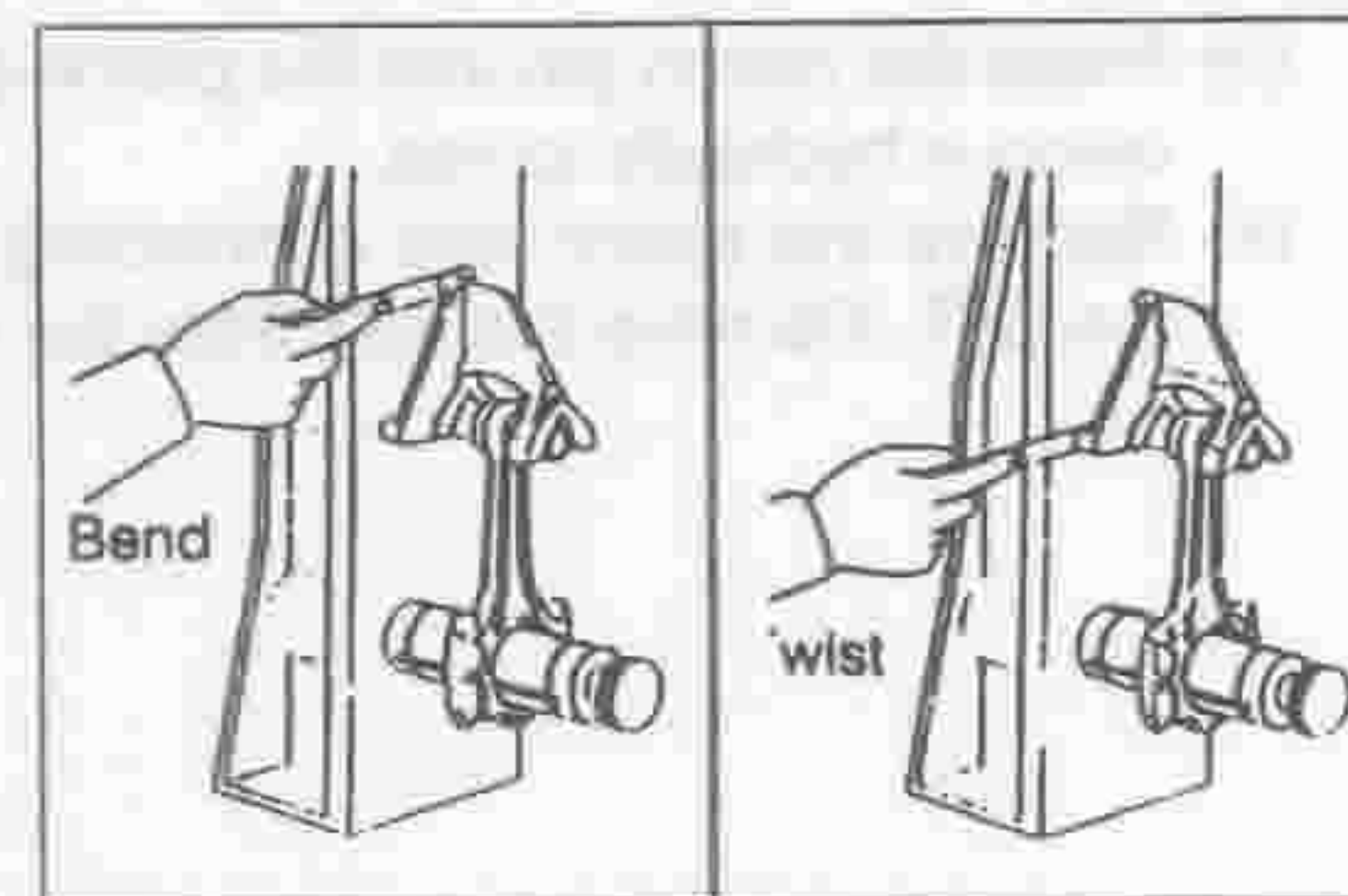
- (1) Visually inspect the connecting rods for damage or cracks.

- (2) Check the connecting rod for bend and twist, using a connecting rod aligner.

Maximum Bend: 0.05 mm

Maximum Twist: 0.05 mm

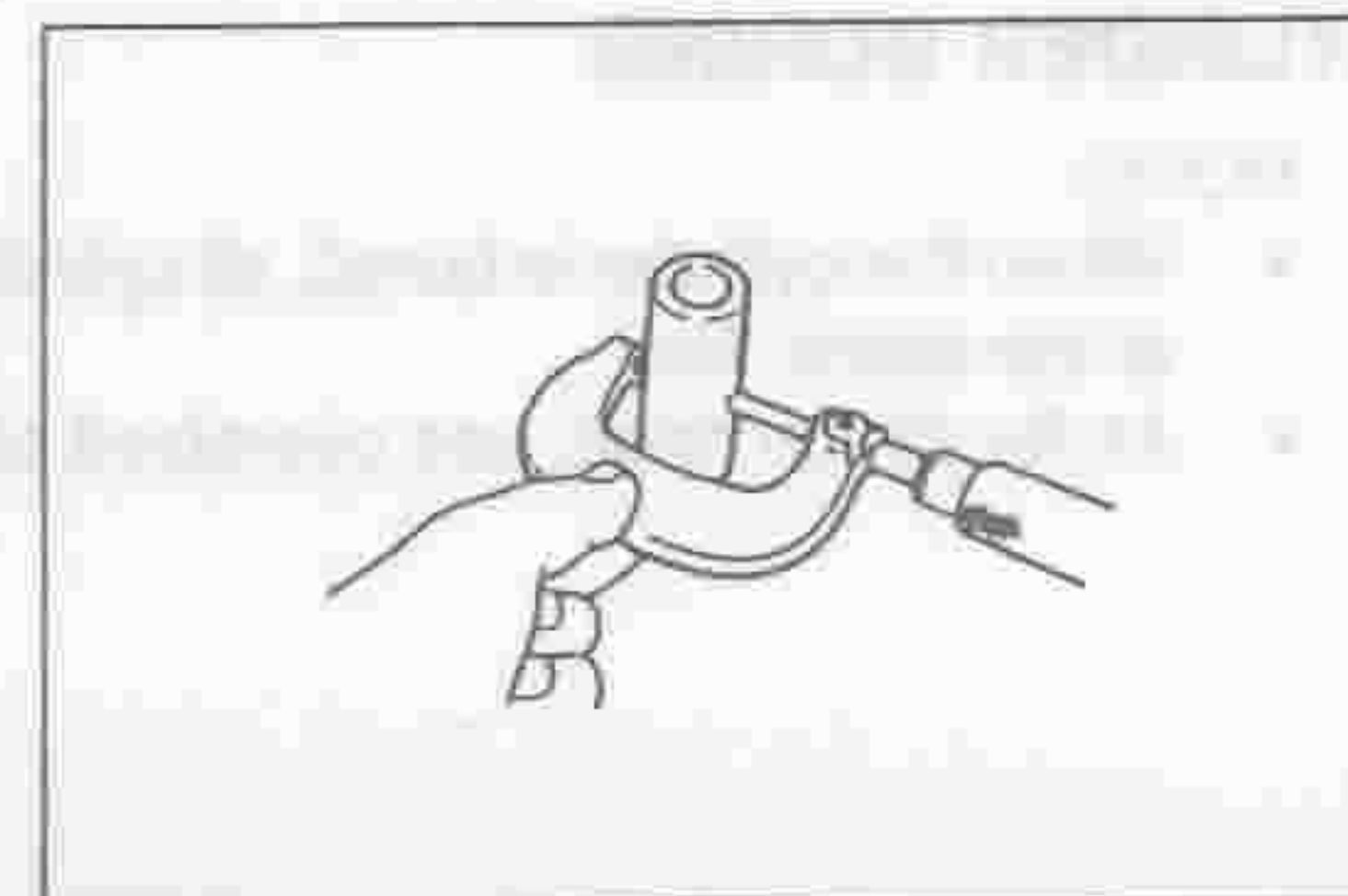
If the bend and/or twist is greater than the maximum limit, replace the connecting rod assembly.



LEM00345-00322

3. Inspection of piston pin-to-connecting rod interference fit

- (1) Measure the outer diameter of the piston pin contacting with the connecting rod, using a micrometer.

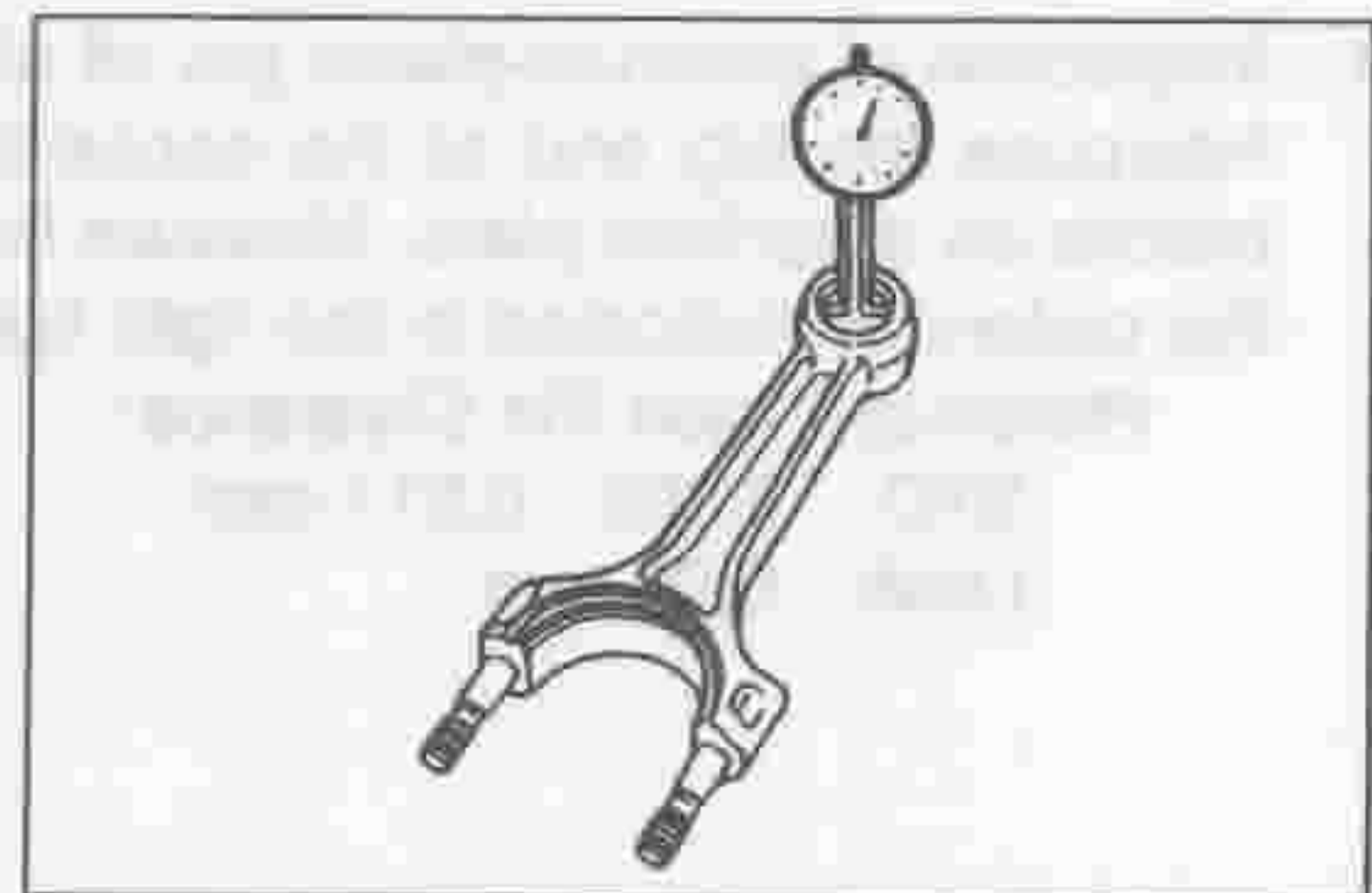


LEM00346-00323

- (2) Measure the inner diameter of the connecting rod, using a bore dial gauge.
- (3) Determine the interference fit by subtracting the outer diameter of the piston pin from the inner diameter of the connecting rod.

Interference Fit: 0.012 - 0.044 mm

If the interference fit does not conform to the specification, replace the connecting rod.



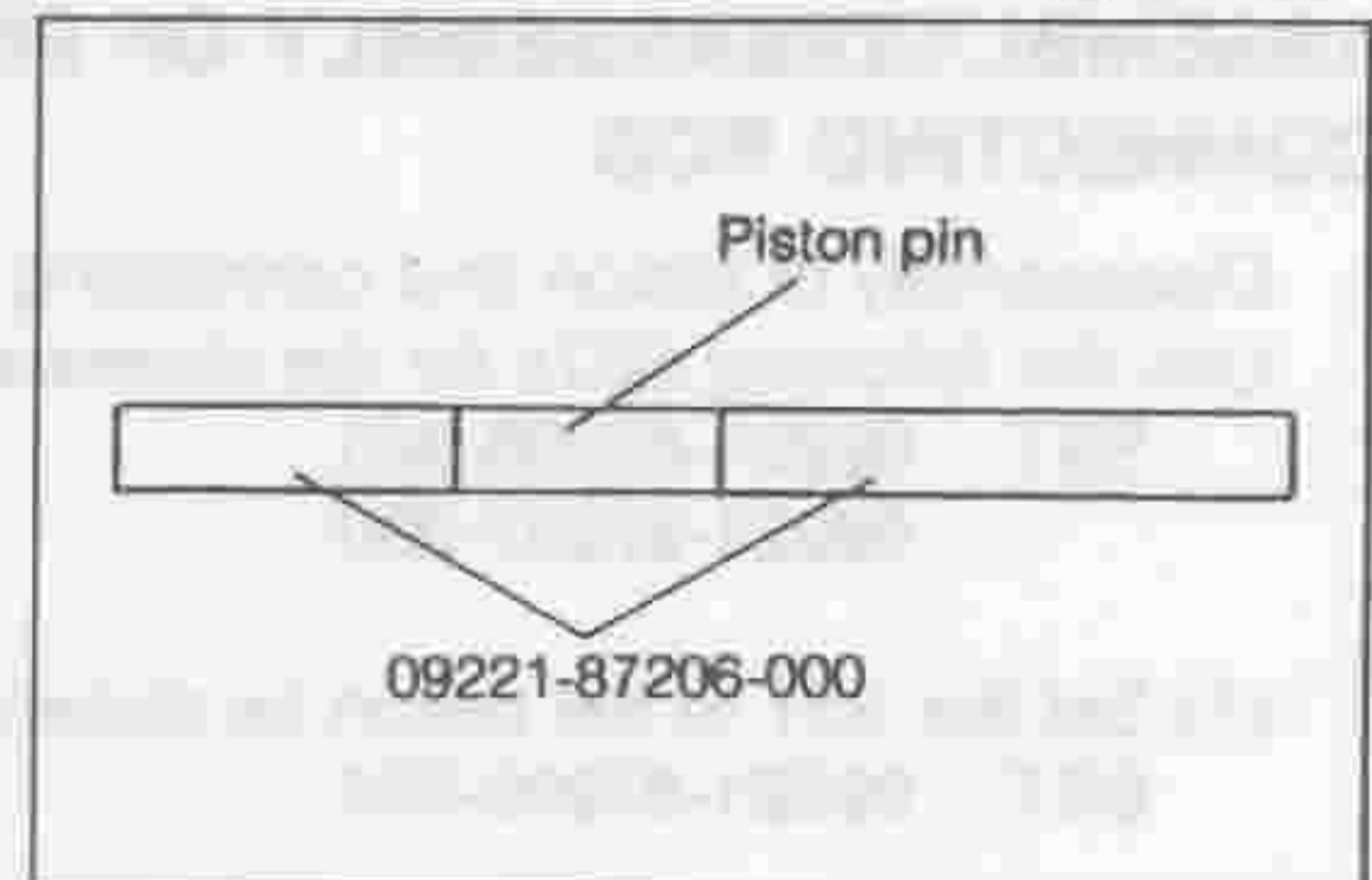
LEM00347-00324

4. Assembly of piston and connecting rod  
Use the following SSTs for the assembling operation.

SST: 09221-87206-000  
09221-87207-000

- (1) Install the piston pin to the following SST in a way shown in the right figure.

SST: 09221-87206-000

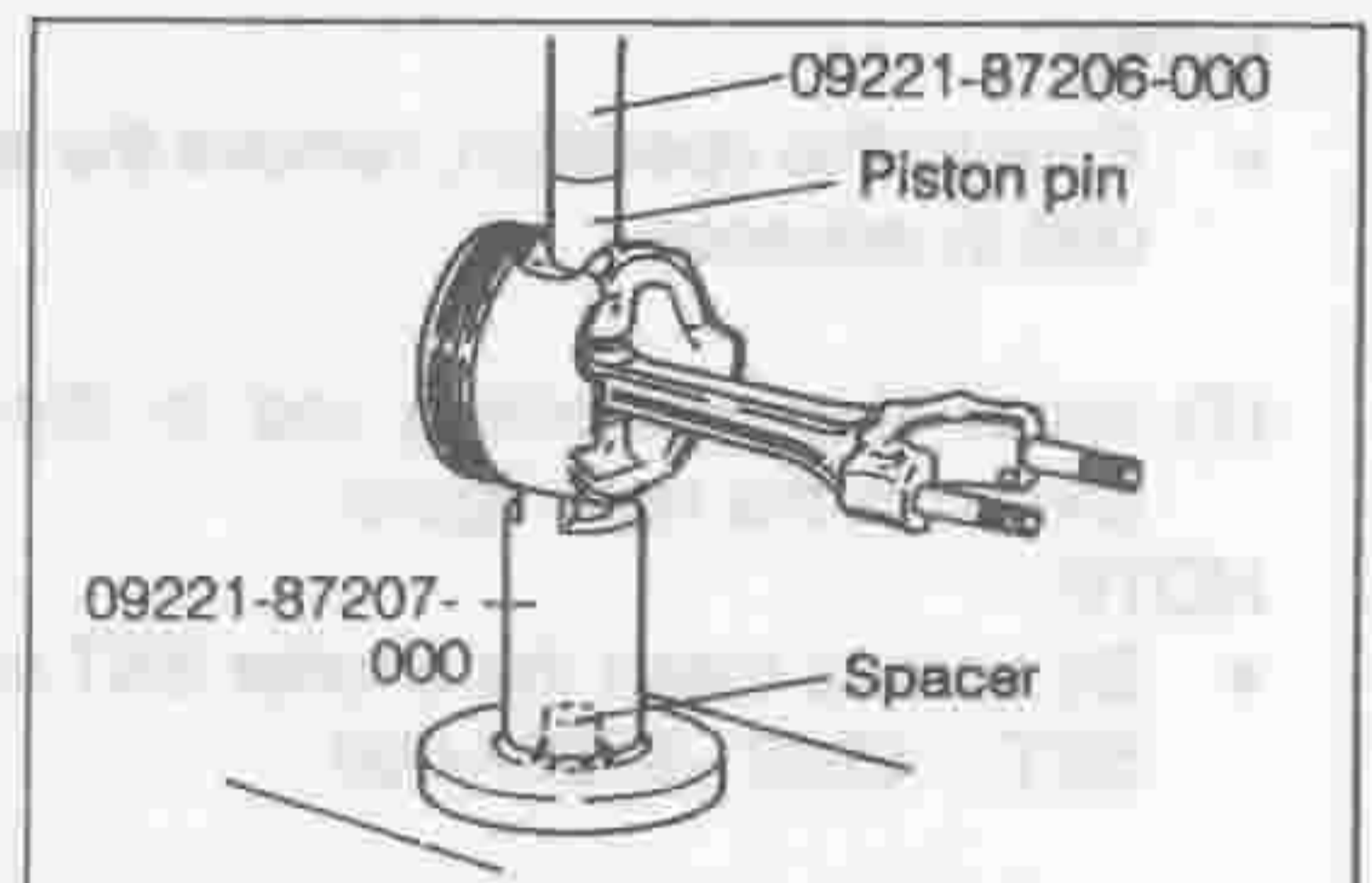


LEM00348-00325

- (2) Install the piston and connecting rod in the SST in a way shown in the right figure. Insert the SST with the piston pin installed into the piston pin hole.

**NOTE:**

- The piston and connecting rod should be assembled in such a way that the piston front mark and connecting rod front mark come in the same direction.
- Prior to this operation, install the spacer 09221-87207-000 in advance.



LEM00349-00326

- (3) Press the piston pin into the piston and connecting rod, using a hydraulic press.
- (4) Remove the piston and connecting rod assembly from the SST. Remove the SST from the piston pin.

LEM00350-00000

## CYLINDER BORING

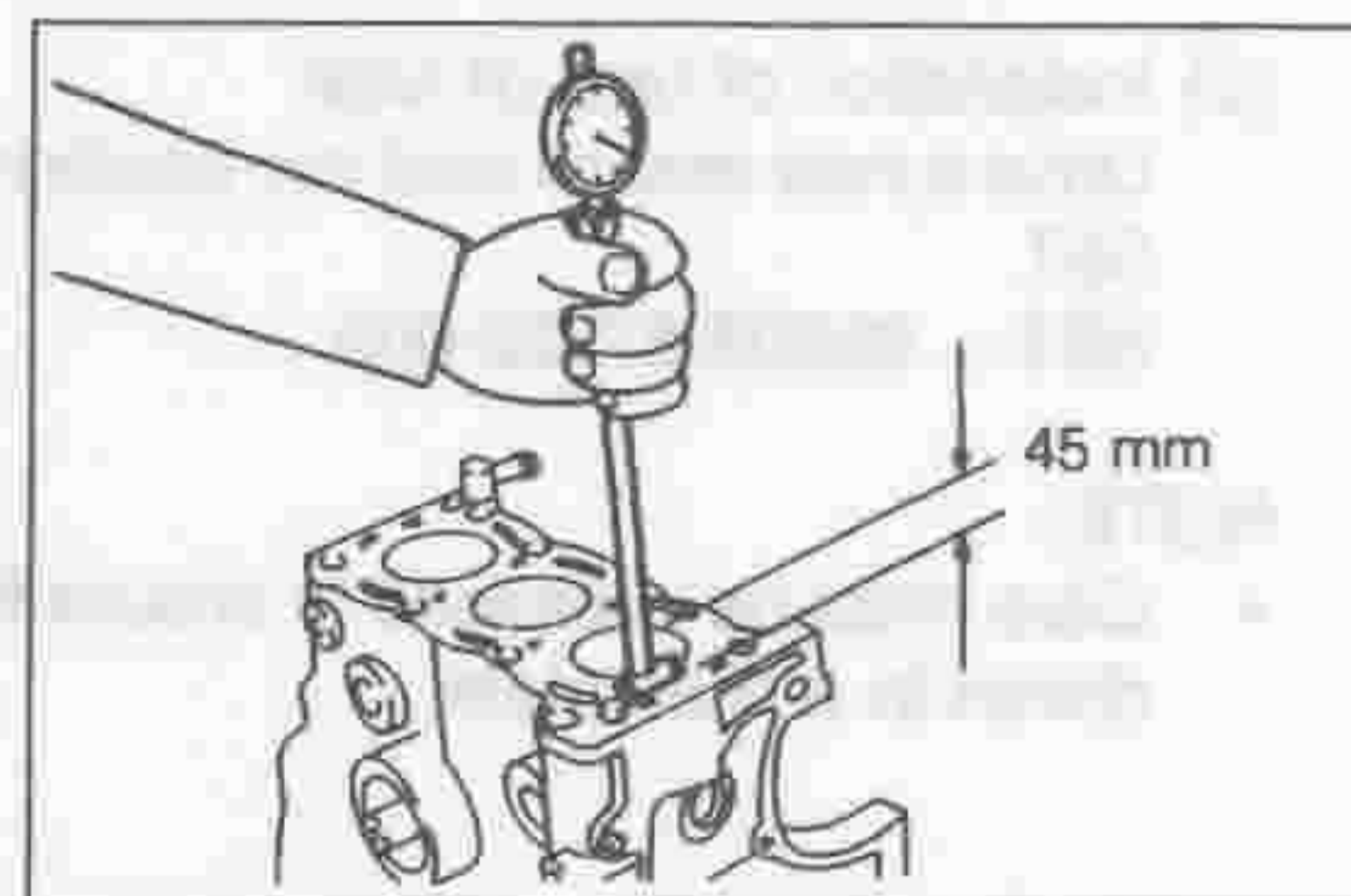
**NOTE:**

- When the cylinder is bored, all cylinders should be bored at the same time.
- As for piston rings, use oversized piston rings.

LEM00351-00000

## 1. Measurement of cylinder bore diameter

Measure the diameter at a point 45 mm from the cylinder upper surface in the direction shown in the right figure. If the measured value exceeds 67.630 mm (ED-10, ED-20), 69.030 mm (EF-EL), replace the cylinder block.



LEM00352-00327

## 2. Determining cylinder finishing diameter

(1) Measure the diameter of the oversized piston to be used, using a micrometer.

## NOTE:

- The measurement should be conducted at the skirt section 13 mm from the piston lower end.
- Perform the measurement horizontally, not in a tilted state.

LEM00353-00000

(2) Calculate the finishing dimension, as follows.

A: Piston diameter

B: Piston-to-cylinder bore clearance

0.035 - 0.055 mm (ED-10, ED-20 Engine)

0.025 - 0.045 mm (EF-EL Engine)

C: Honing allowance

0.02 mm

D: Finishing diameter

$$D = A + B - C$$

LEM00354-00000

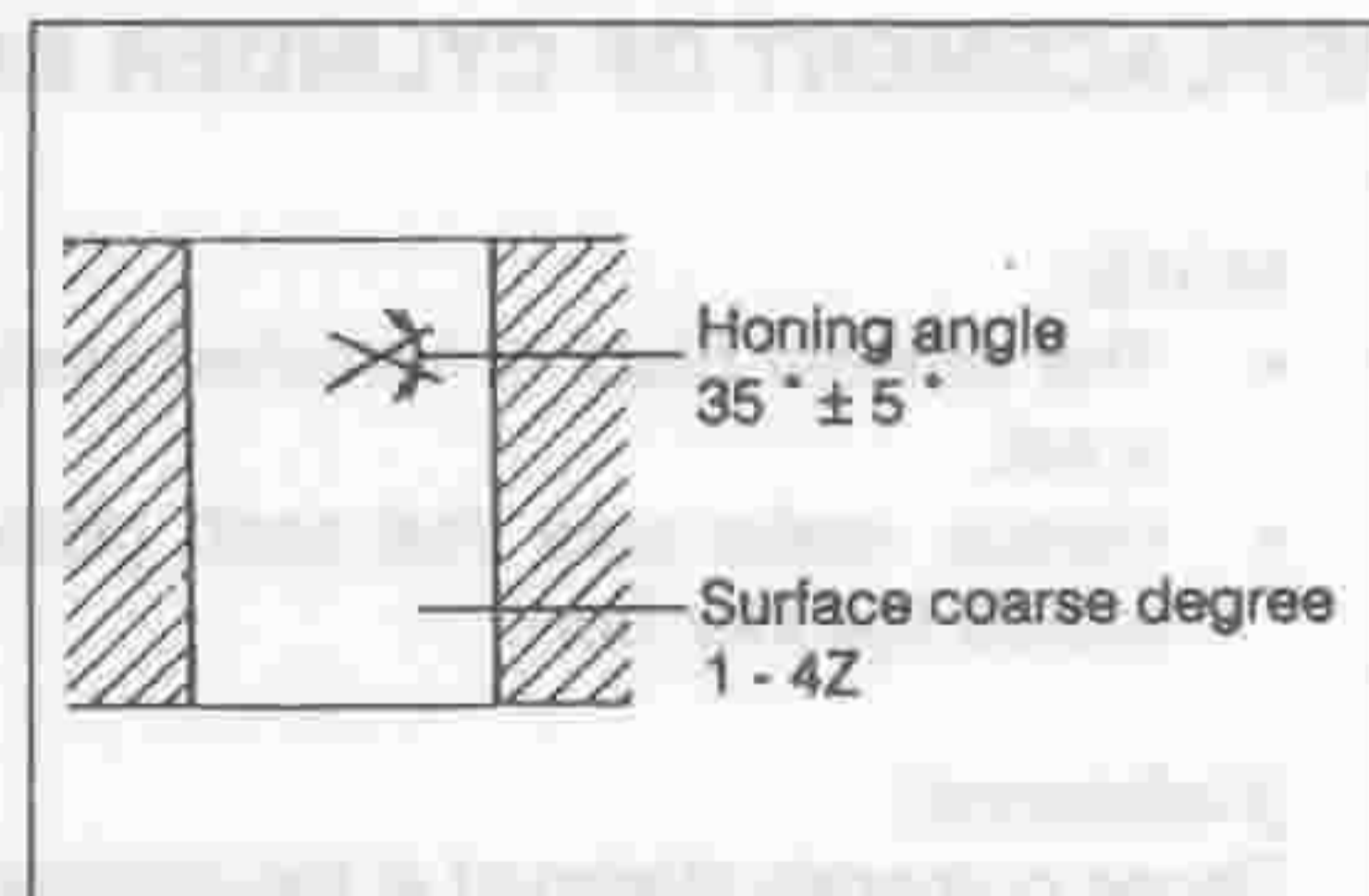
## 3.hone the cylinder after the boring.

(1) Bore the cylinder, leaving a honing allowance of 0.02 mm.

(2)hone the cylinder.

Honing Angle:  $35^{\circ} \pm 5^{\circ}$

Surface Coarse Degree: 1 - 4Z



LEM00355-00328

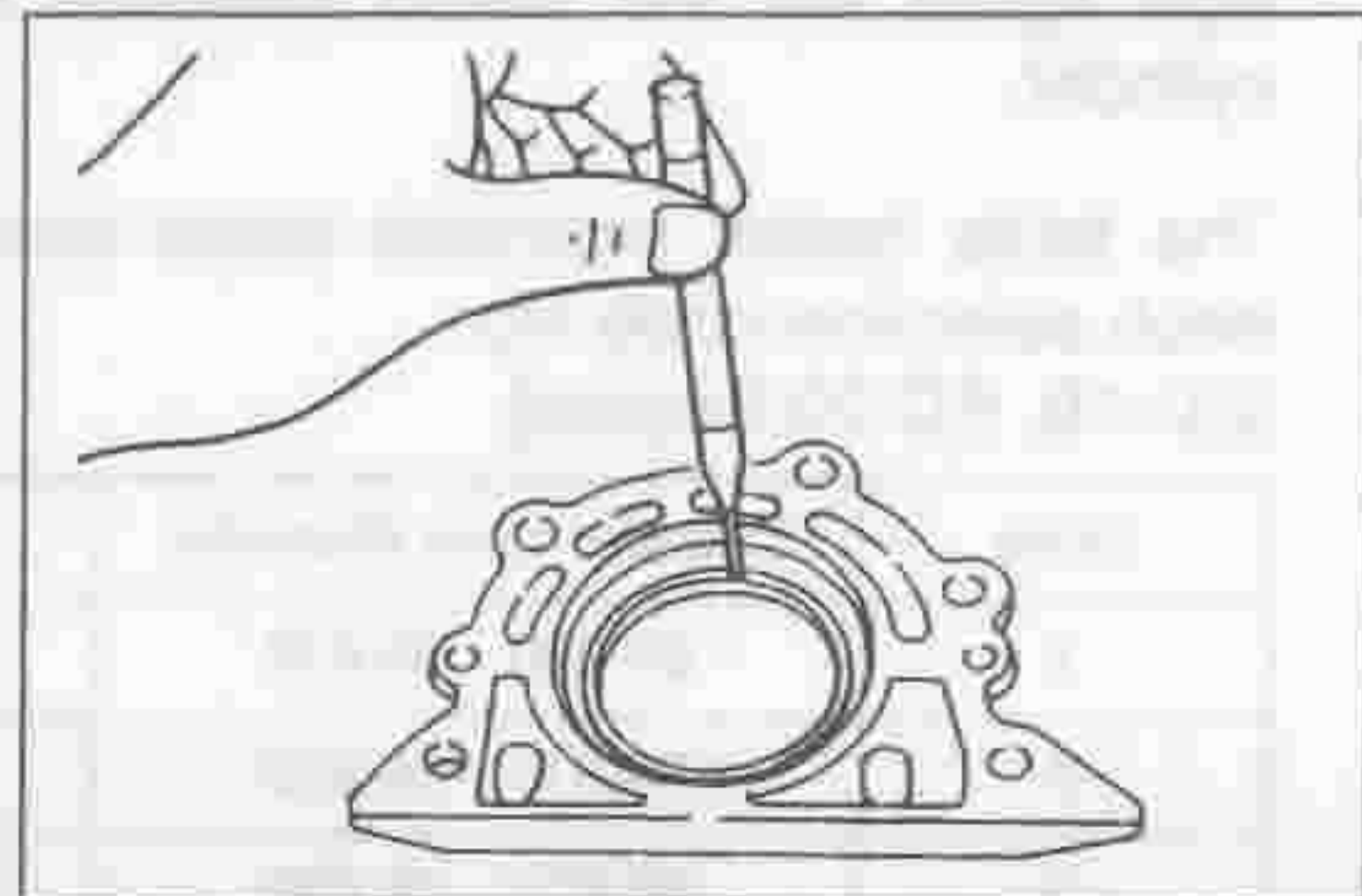
## REPLACEMENT OF REAR OIL SEAL

(1) Removal of rear oil seal

Remove the rear oil seal from the rear oil seal retainer, using a pin punch.

## NOTE:

- Be very careful not to damage the oil seal retainer.



LEM00356-00329

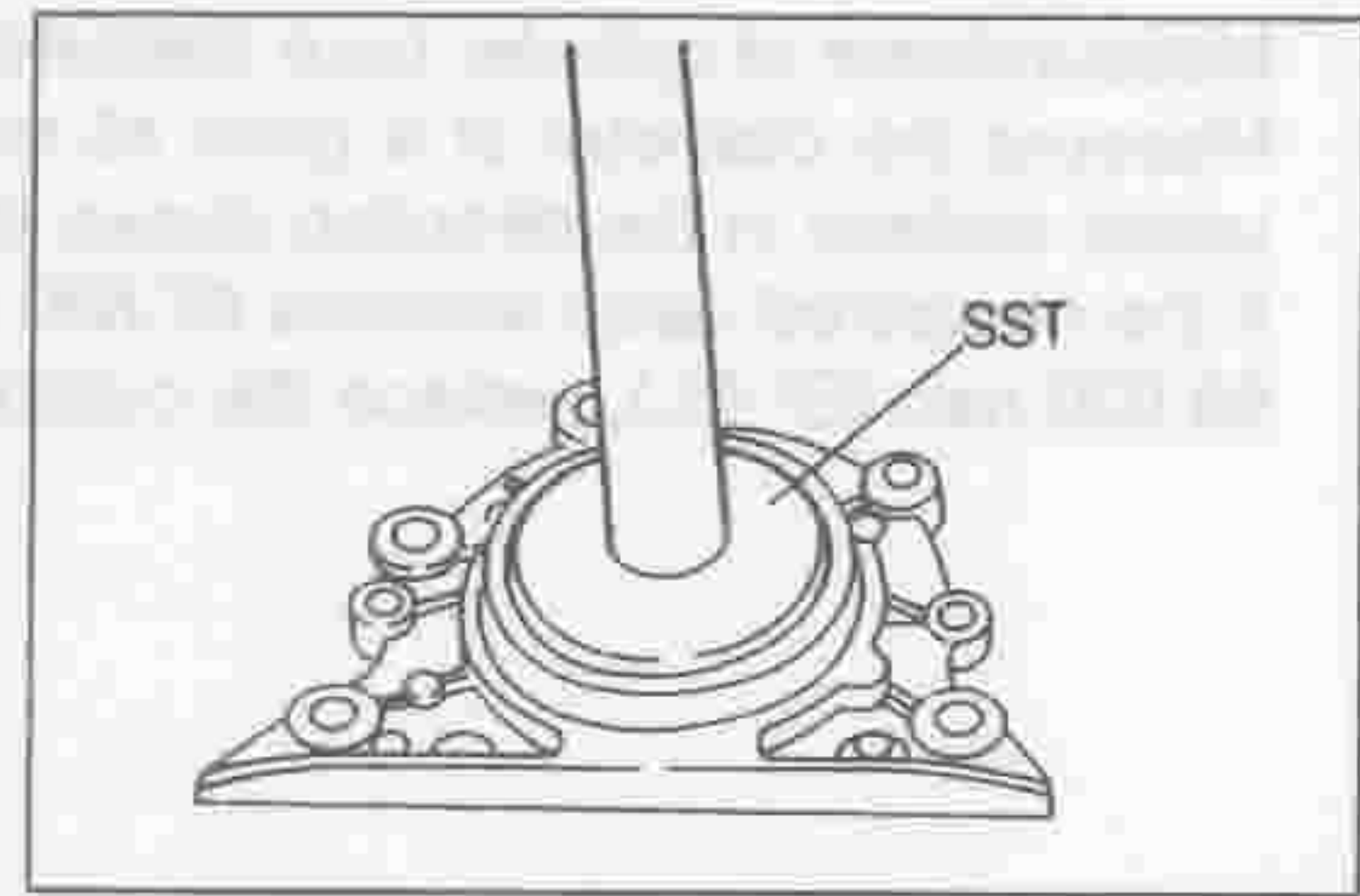
## (2) Installation of rear oil seal

Drive a new rear oil seal into position, using the following SST.

SST: 09608-87302-000

### NOTE:

- Care must be exercised to ensure that the oil seal is not driven in a tilted state.



LEM00357-00330

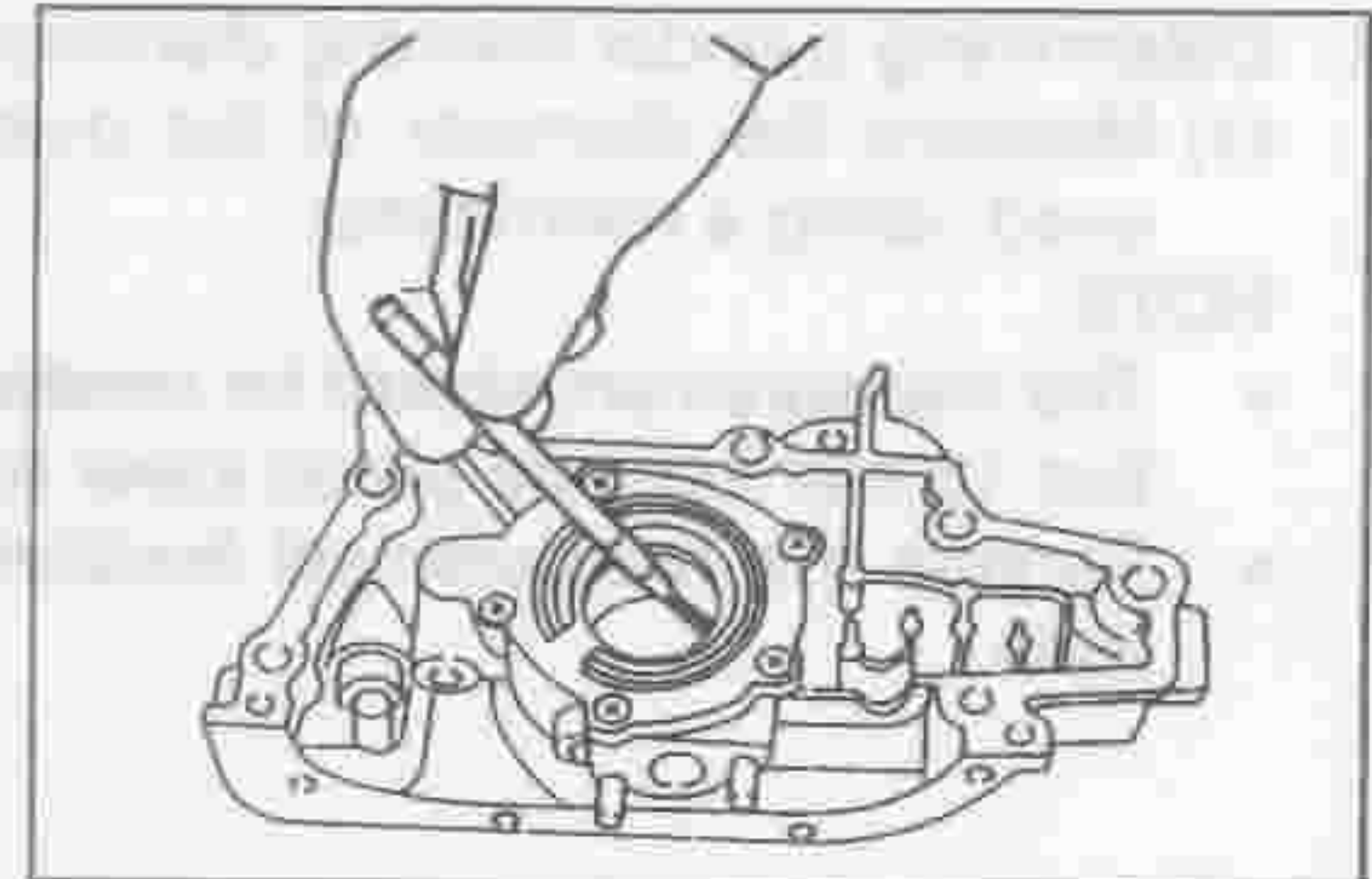
## REPLACEMENT OF FRONT OIL SEAL

### (1) Removal of front oil seal

Remove the front oil seal from the oil pump, using a pin punch.

### NOTE:

- Be very careful not to damage the oil pump during the removal.

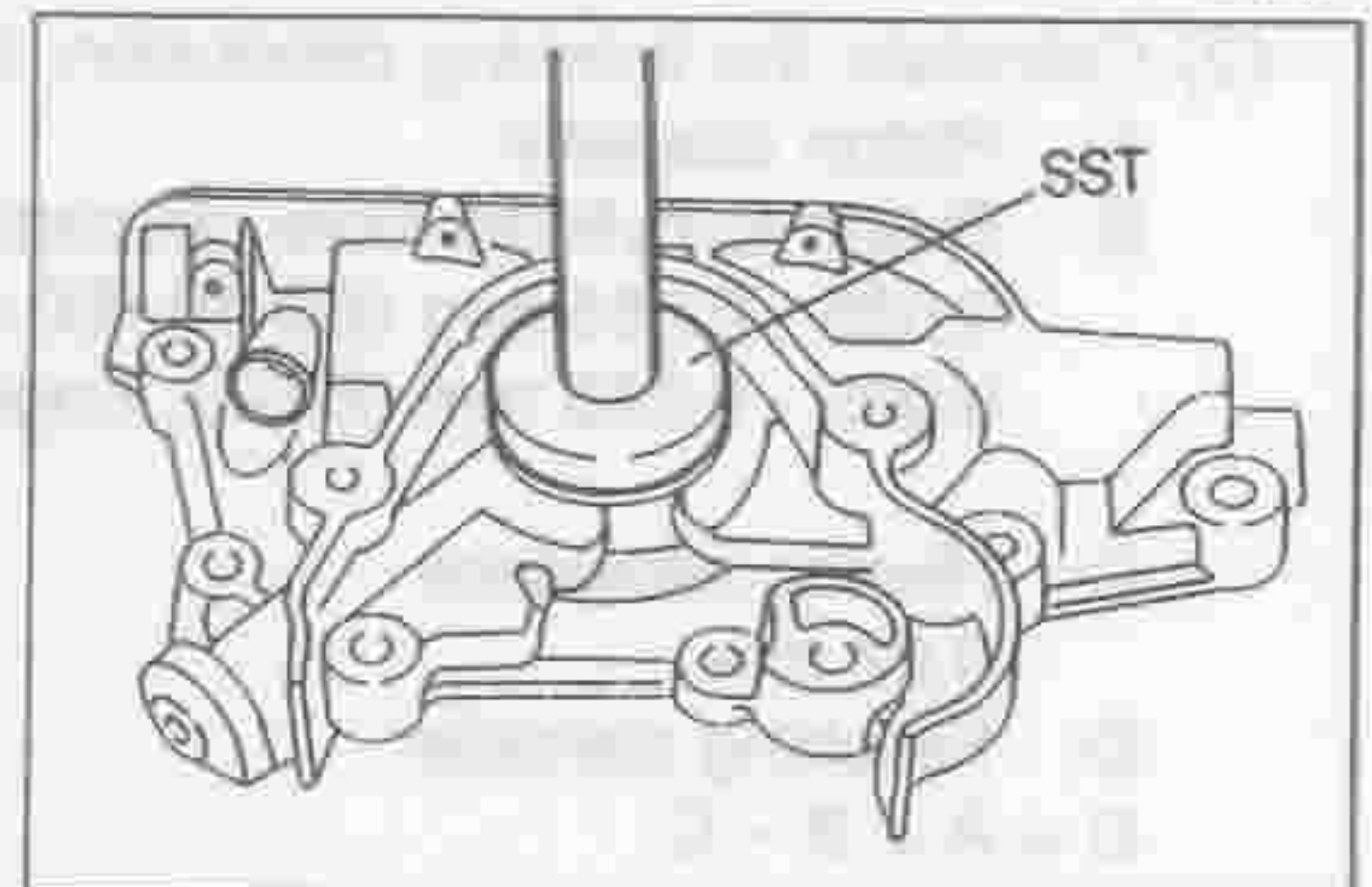


LEM00358-00331

### (2) Installation of front oil seal

Drive a new front oil seal into position, using the following SST.

SST: 09608-87302-000



LEM00359-00332

## REPLACEMENT OF CYLINDER BLOCK

### NOTE:

- The cylinder block is furnished along with the pistons as a set.
- Hence, make sure that each piston is installed in the mated cylinder bore.

### [Reference]

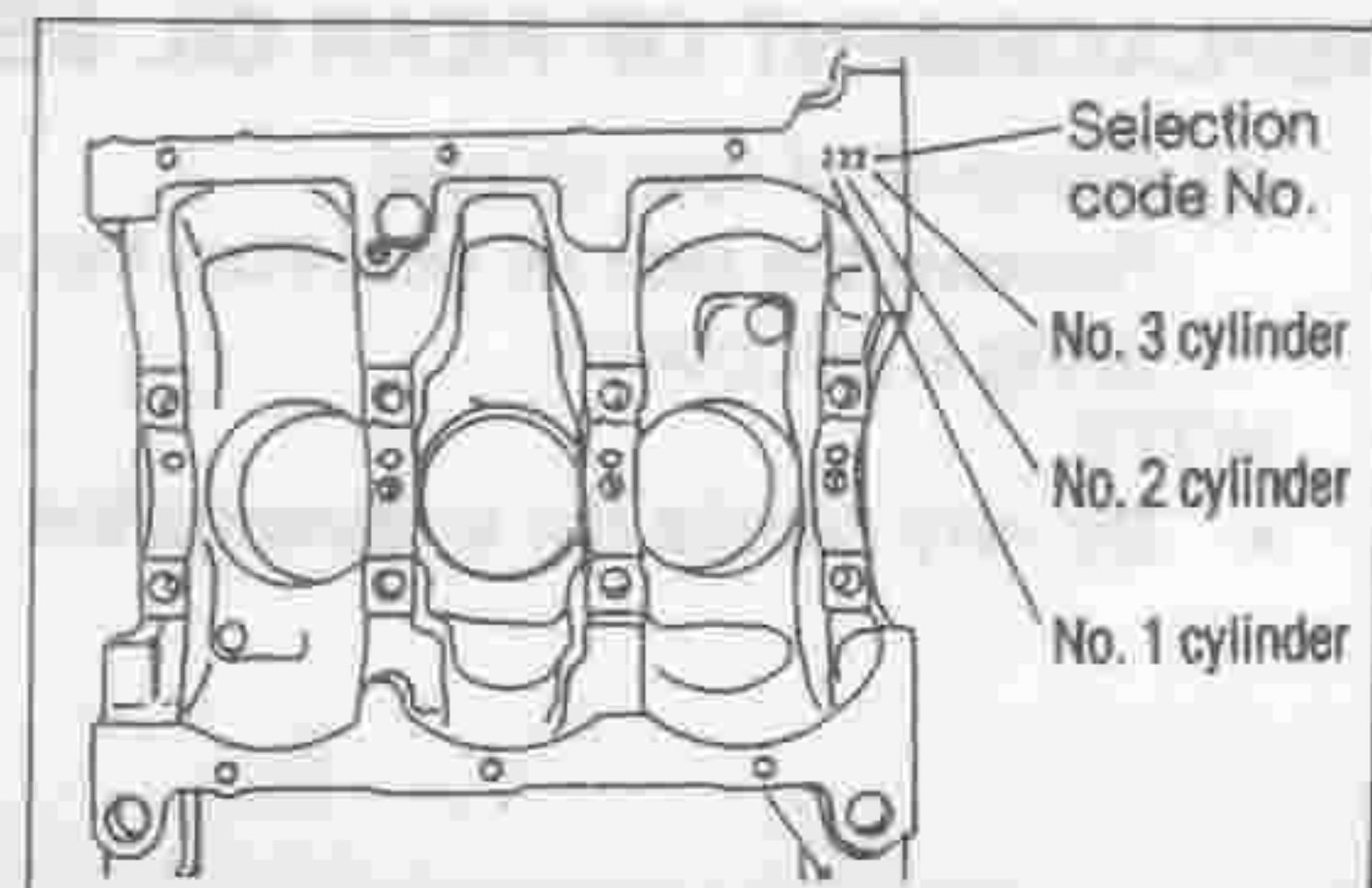
Those numerals stamped at the positions as indicated in the right figure are the piston selection code No. for each cylinder.

The table below indicates those sizes corresponding to each selection code No.

[ED-10, ED-20 Engine]

Code	Cylinder bore diameter	Piston outer diameter
1	66.600 - 66.610	66.555 - 66.565
2	66.611 - 66.620	66.566 - 66.575
3	66.621 - 66.630	66.576 - 66.585

(mm)



LEM00360-00000

LEM00361-00333

[EF-EL Engine]

(mm)

Code	Cylinder bore diameter	Piston outer diameter
1	68.000 - 68.010	67.965 - 67.975
2	68.011 - 68.020	67.976 - 67.985
3	68.021 - 68.030	67.986 - 67.995

LEM00362-00000

1. Wash the cylinder block, using cleaning solvent with a soft brush.
2. Dry them using compressed air.

**WARNING:**

- When you use compressed air, be sure to protect your eyes, wearing safety goggles.

LEM00363-00000

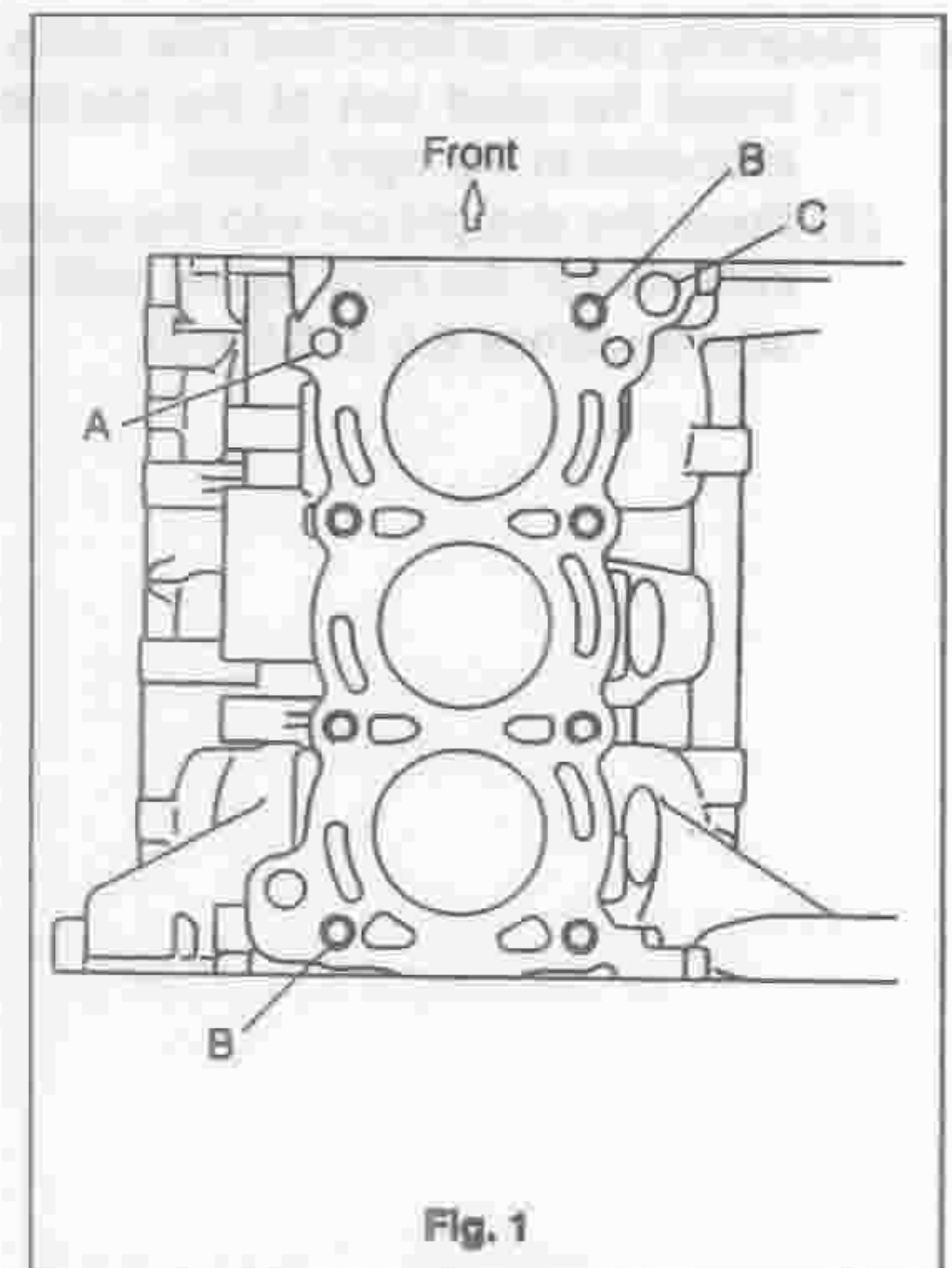
3. Assembling parts at upper surface of cylinder block

## (1) Oil orifice

Press the oil orifice into the section A as indicated in Fig. 1, until it is recessed 1.2 to 2.0 mm from the upper surface of the cylinder block.

**NOTE:**

- Never reuse the orifice.



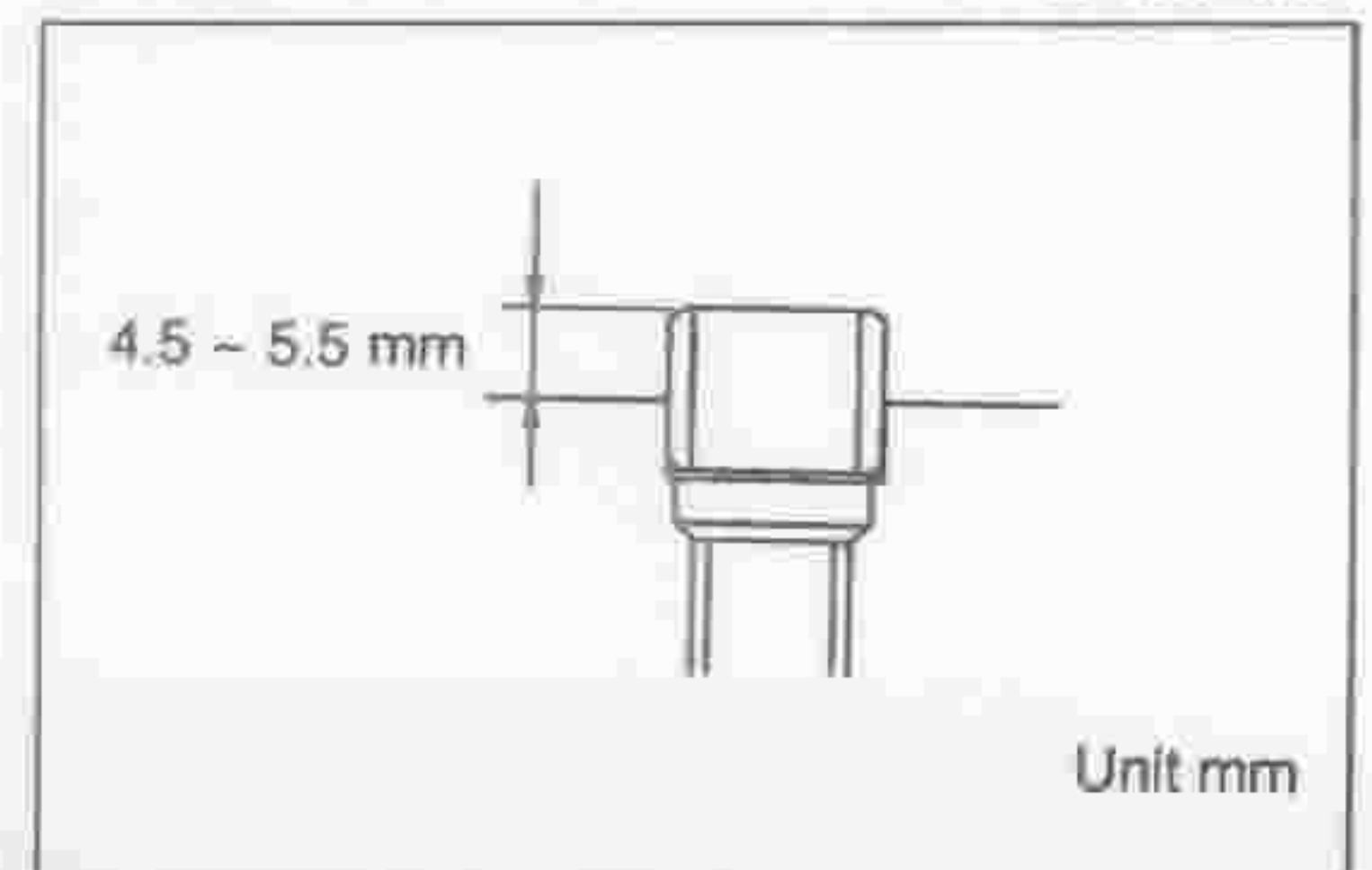
LEM00364-00334

## (2) Pin ring

Press the pin ring into the section B as indicated in Fig. 1, until the amount of protrusion becomes 4.5 to 5.5 mm.

**NOTE:**

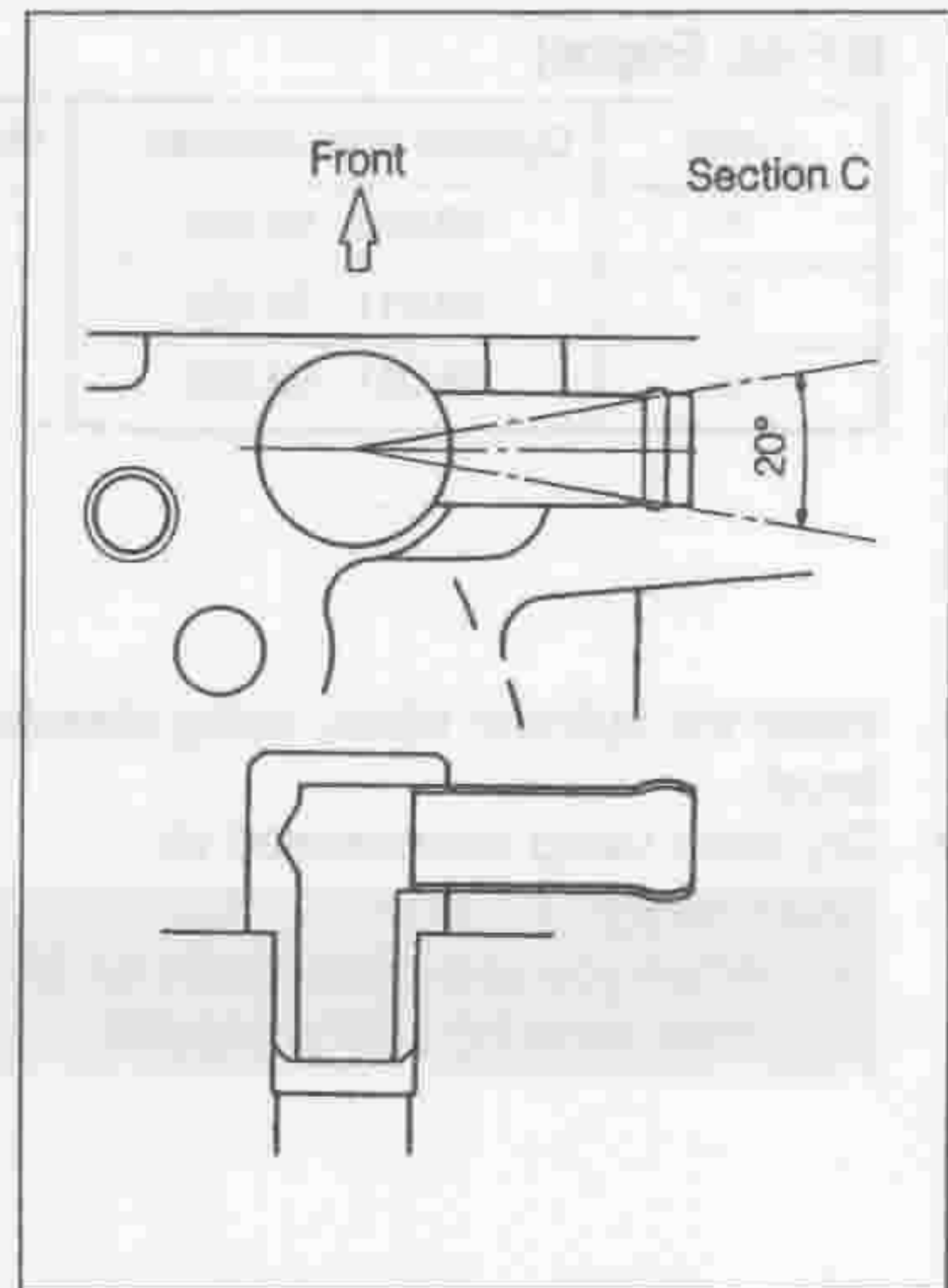
- Never reuse the pin ring.



LEM00365-00335

### (3) Elbow

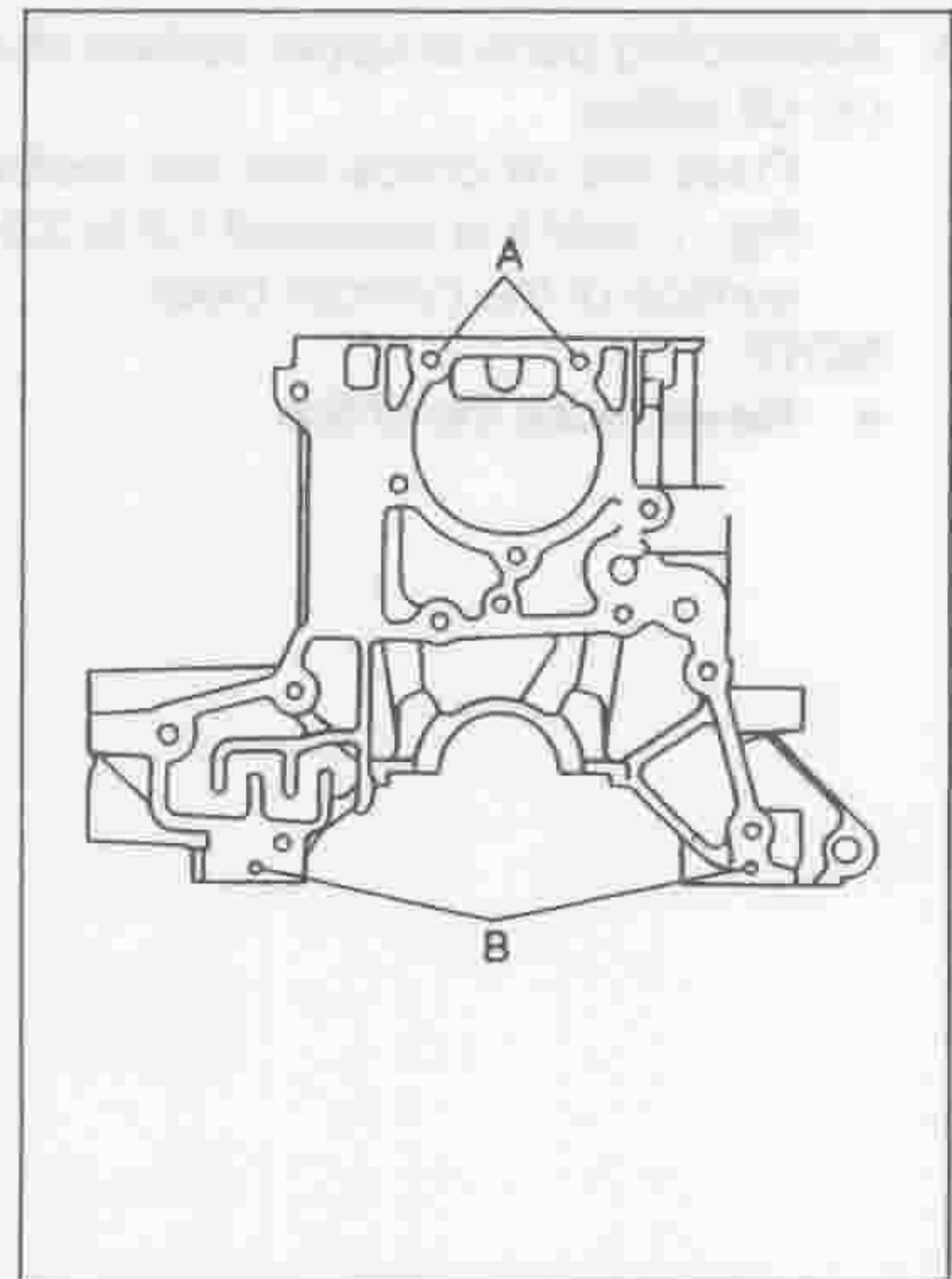
Press the elbow into the section C as indicated in Fig. 1 in such a way that its opening side may face toward the outside.



LEM00366-00335

### 4. Assembly parts at front and rear sides

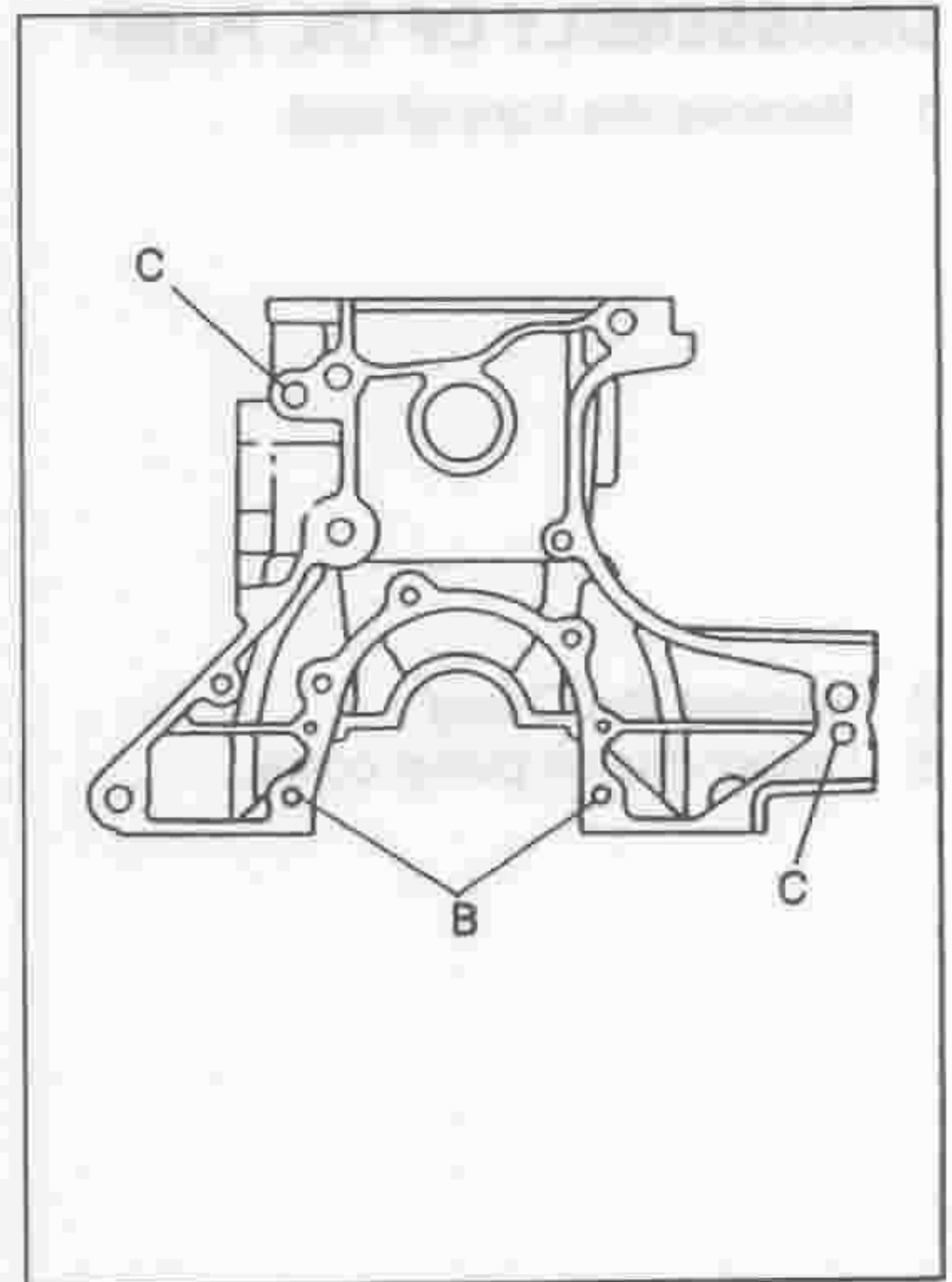
- (1) Install the stud bolt at the section A (two points) as indicated in the right figure.
- (2) Press the straight pin into the section B (four points) as indicated in the right figure, until the amount of protrusion becomes 6.5 to 8.5 mm.



LEM00367-00337



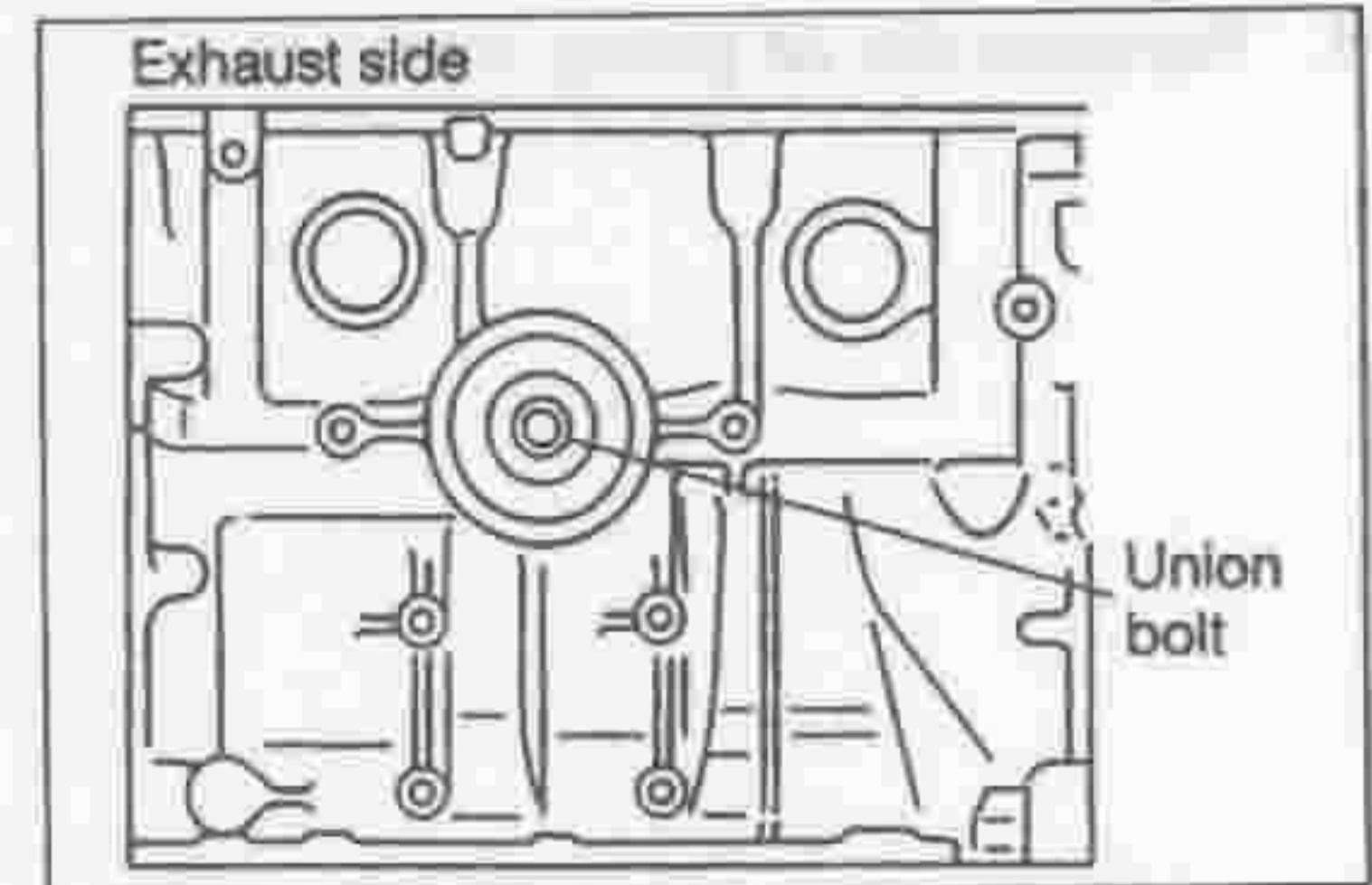
- (3) Press the straight pin into the section C (two points) as indicated in the right figure, until the amount of protrusion becomes 5.5 to 7.5 mm.



LEM00368-00338

5. Assembling parts at side

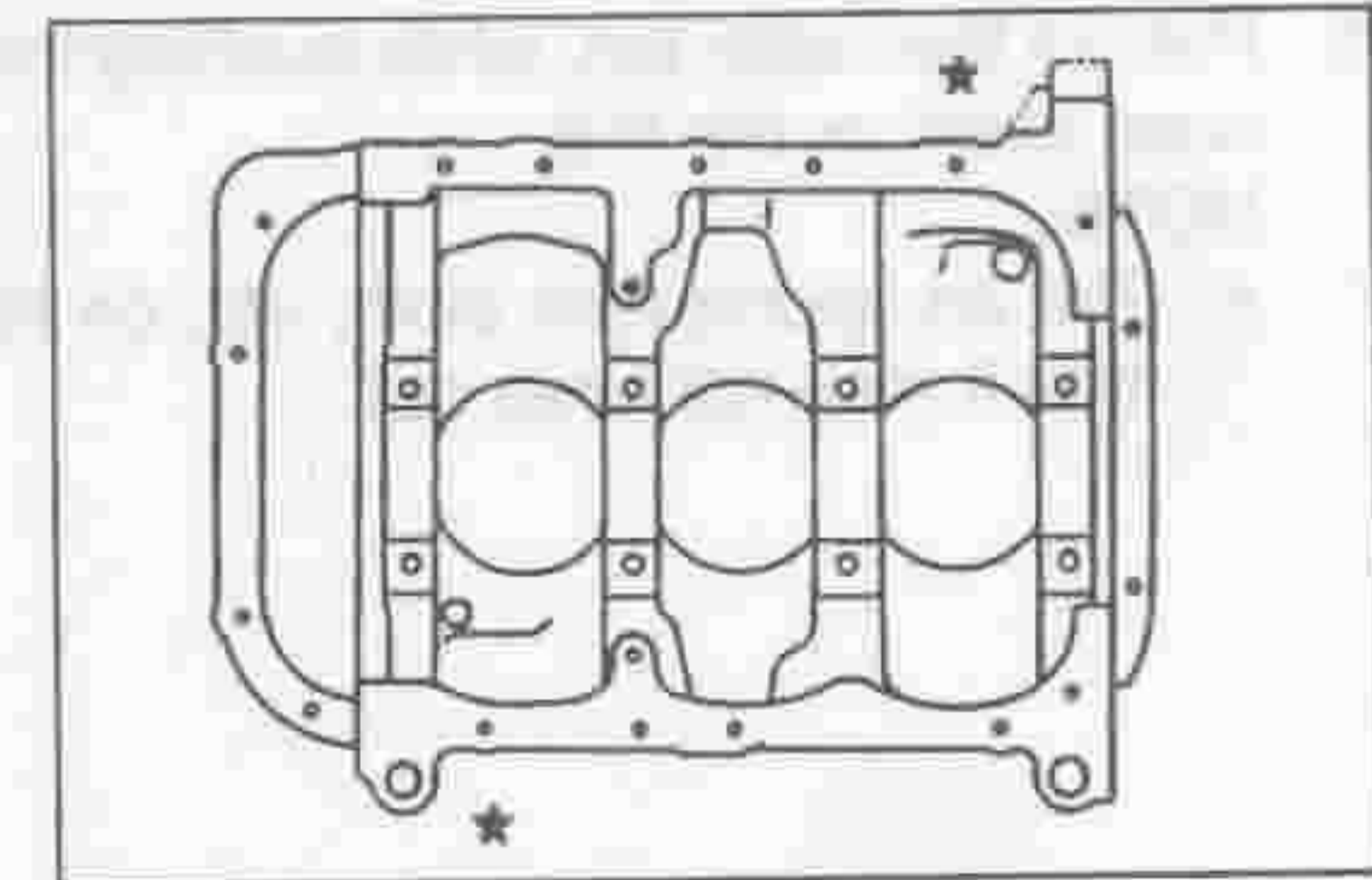
- (1) Install the union bolt for installing oil filter.



LEM00369-00339

6. Assembling parts at underside

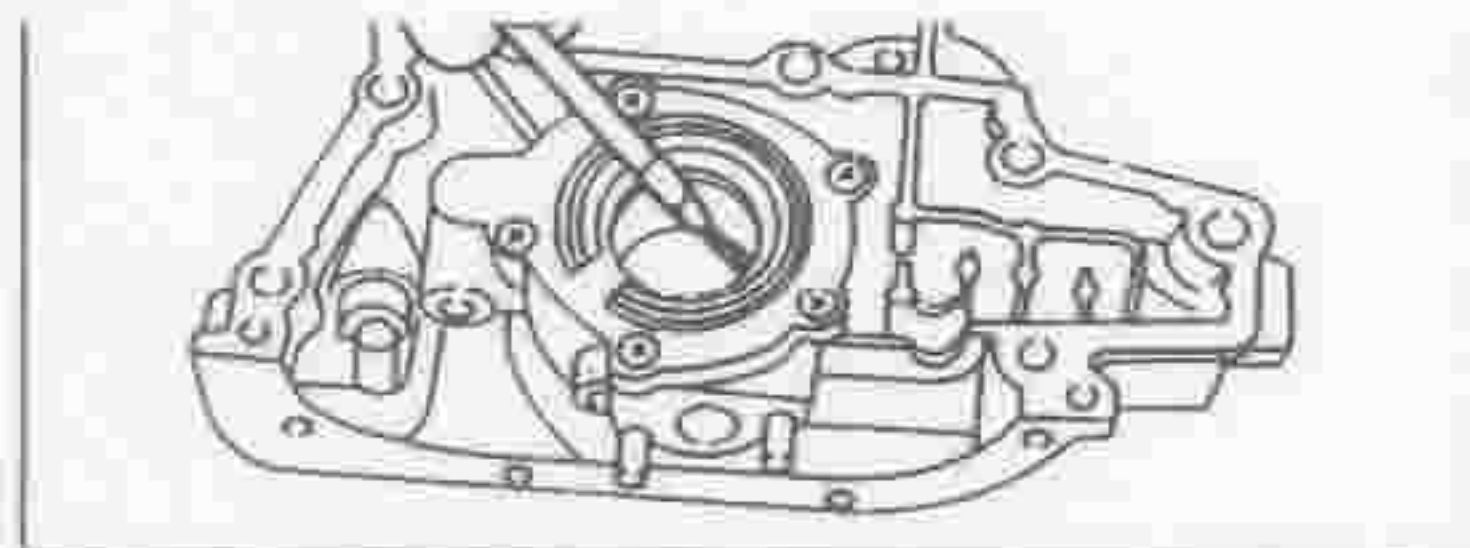
- (1) Install the stud bolt at the asterisked (\*) section (two points).



LEM00370-00340

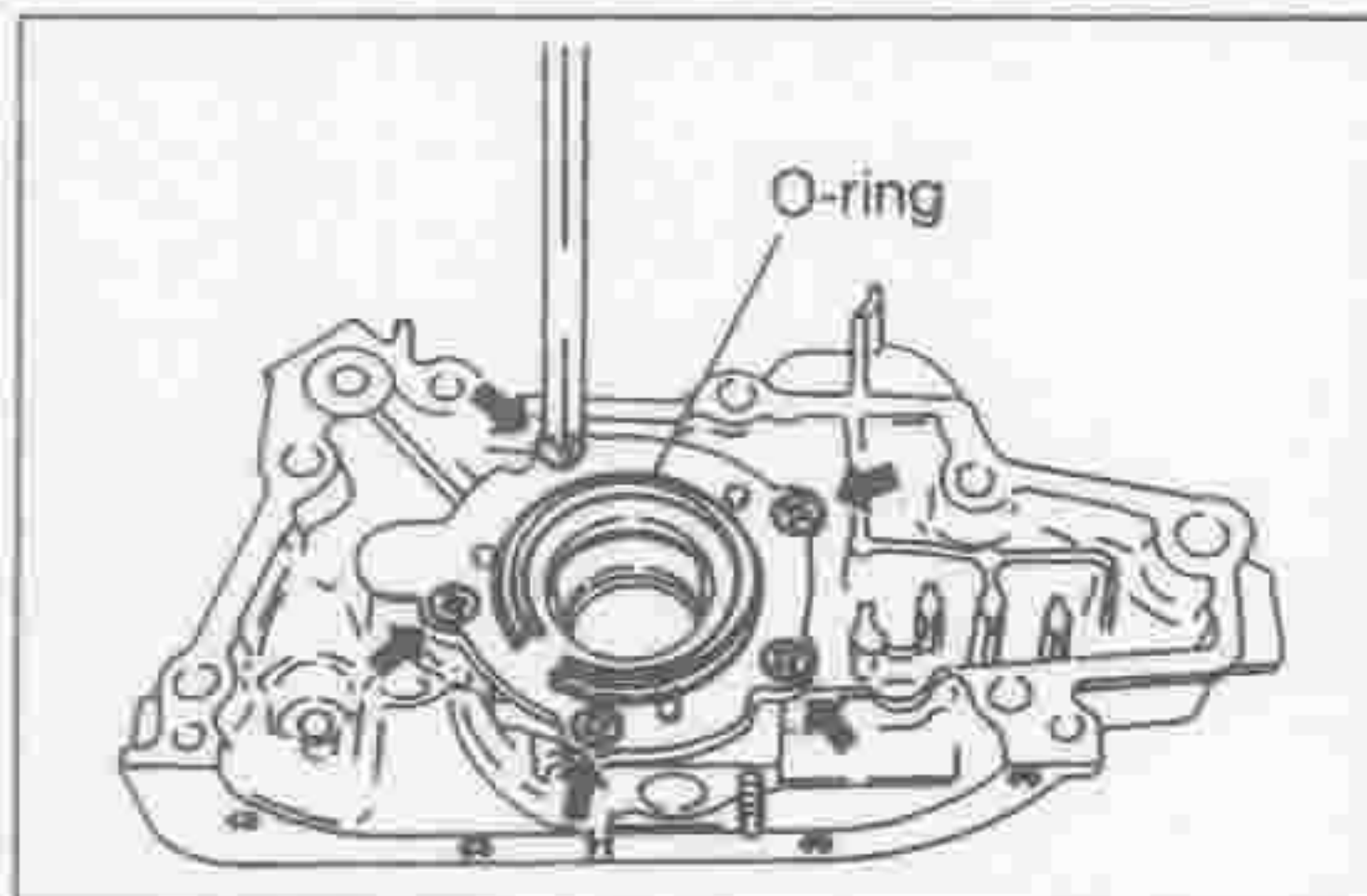


2. Remove the O-ring.
3. Detach the oil pump cover.



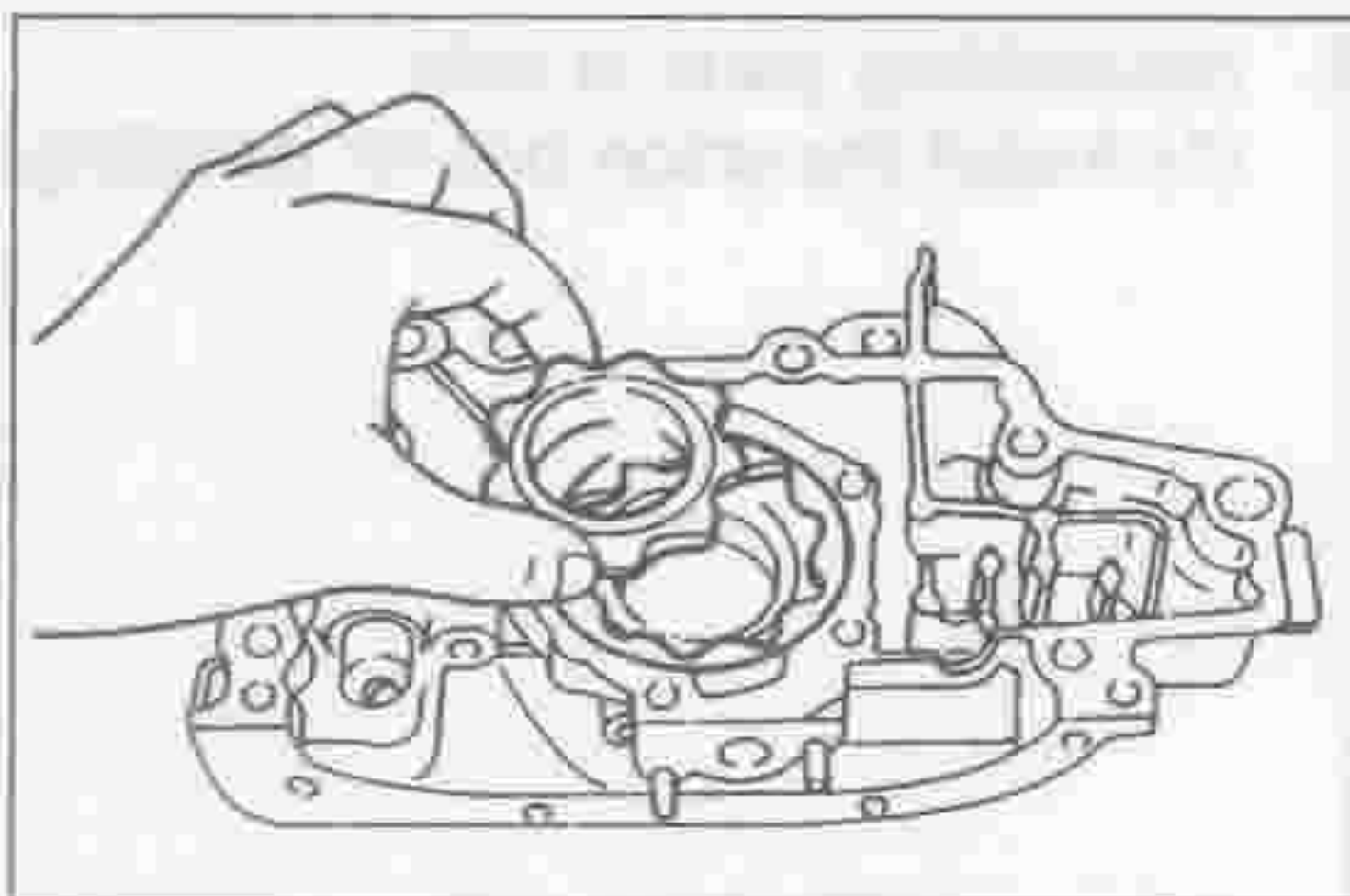
LEM00371-00341

4. Remove the oil pump rotor set.



LEM00372-00342

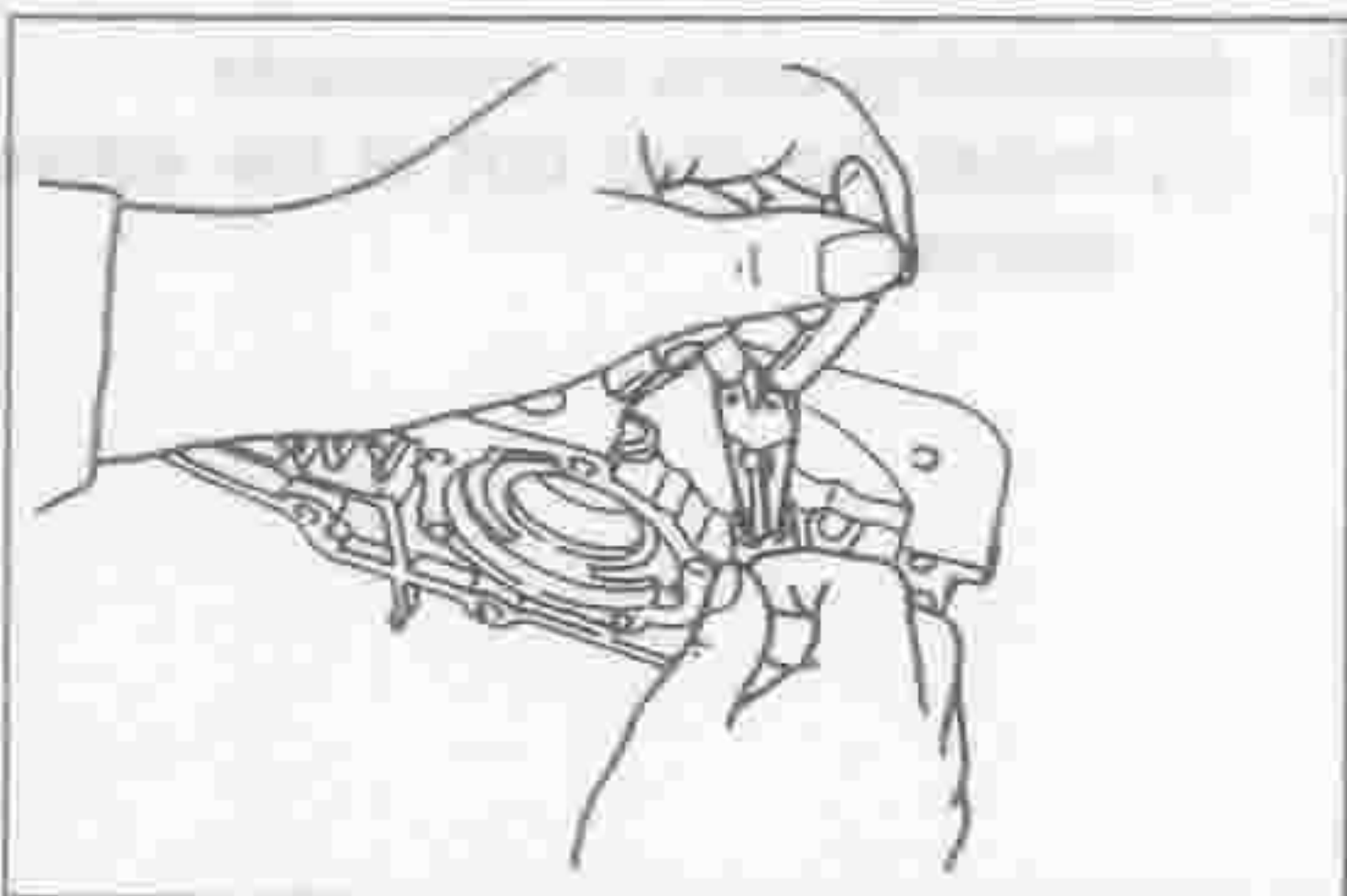
5. Pull out the cotter pin, while pushing the spring retainer with nose pliers or the like.



LEM00373-00343

**NOTE:**

- Put an appropriate cloth, etc. on the retainer spring so that it may not jump out.

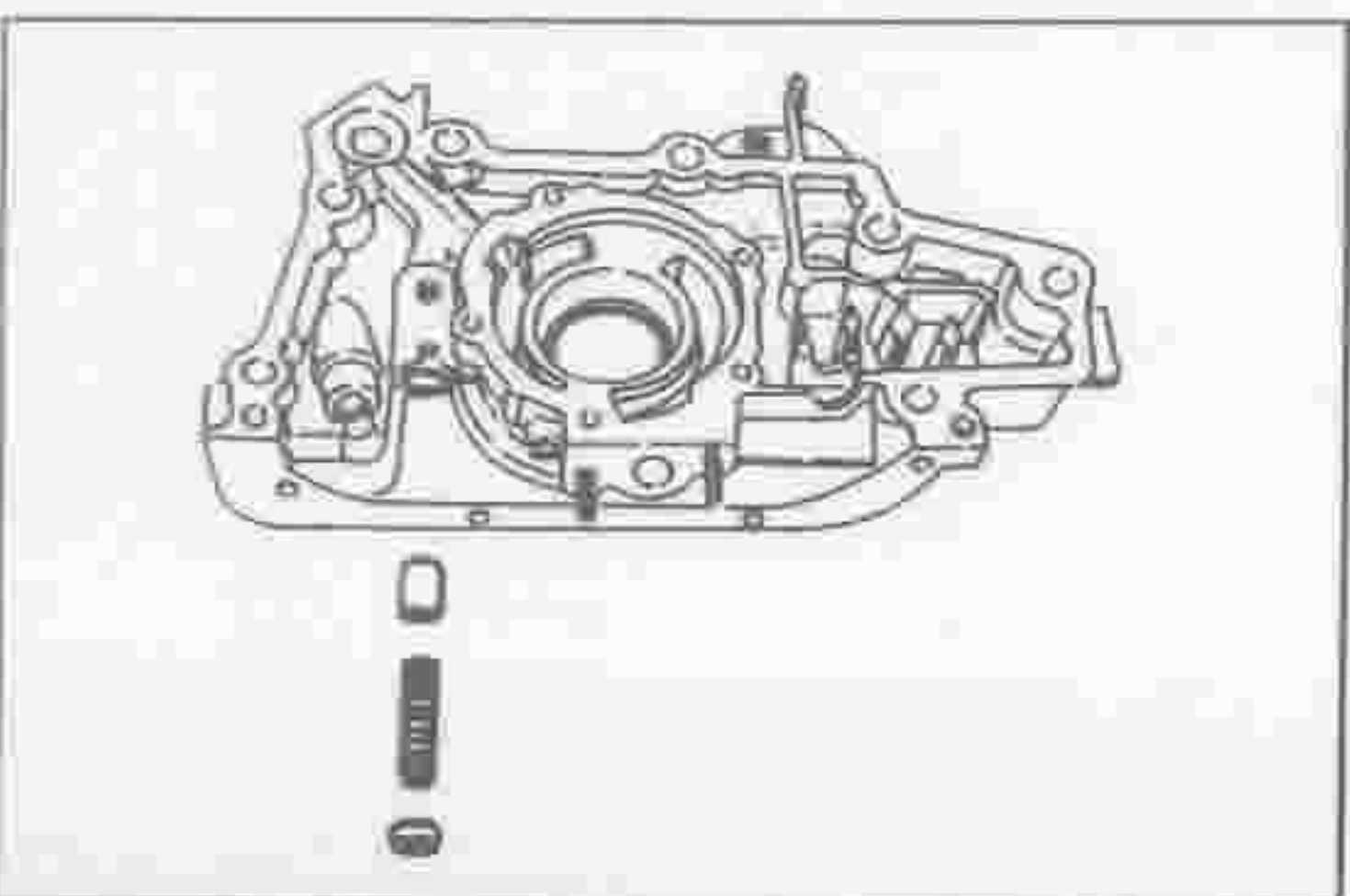


LEM00374-00344

6. Remove the oil pump relief valve spring retainer, compression spring and oil pump relief valve.

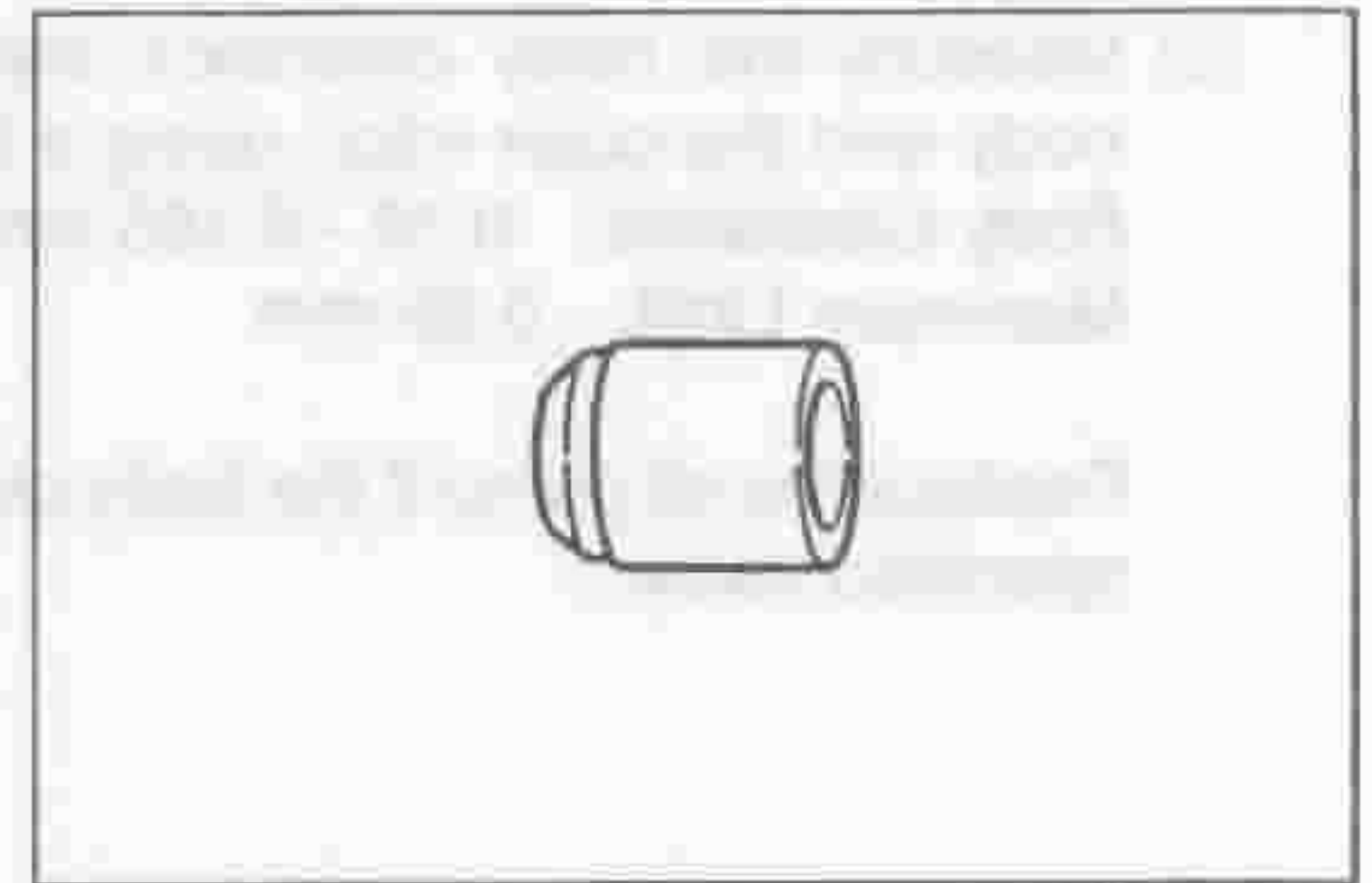
**NOTE:**

- Wash the disassembled parts in cleaning solvent.



LEM00375-00345

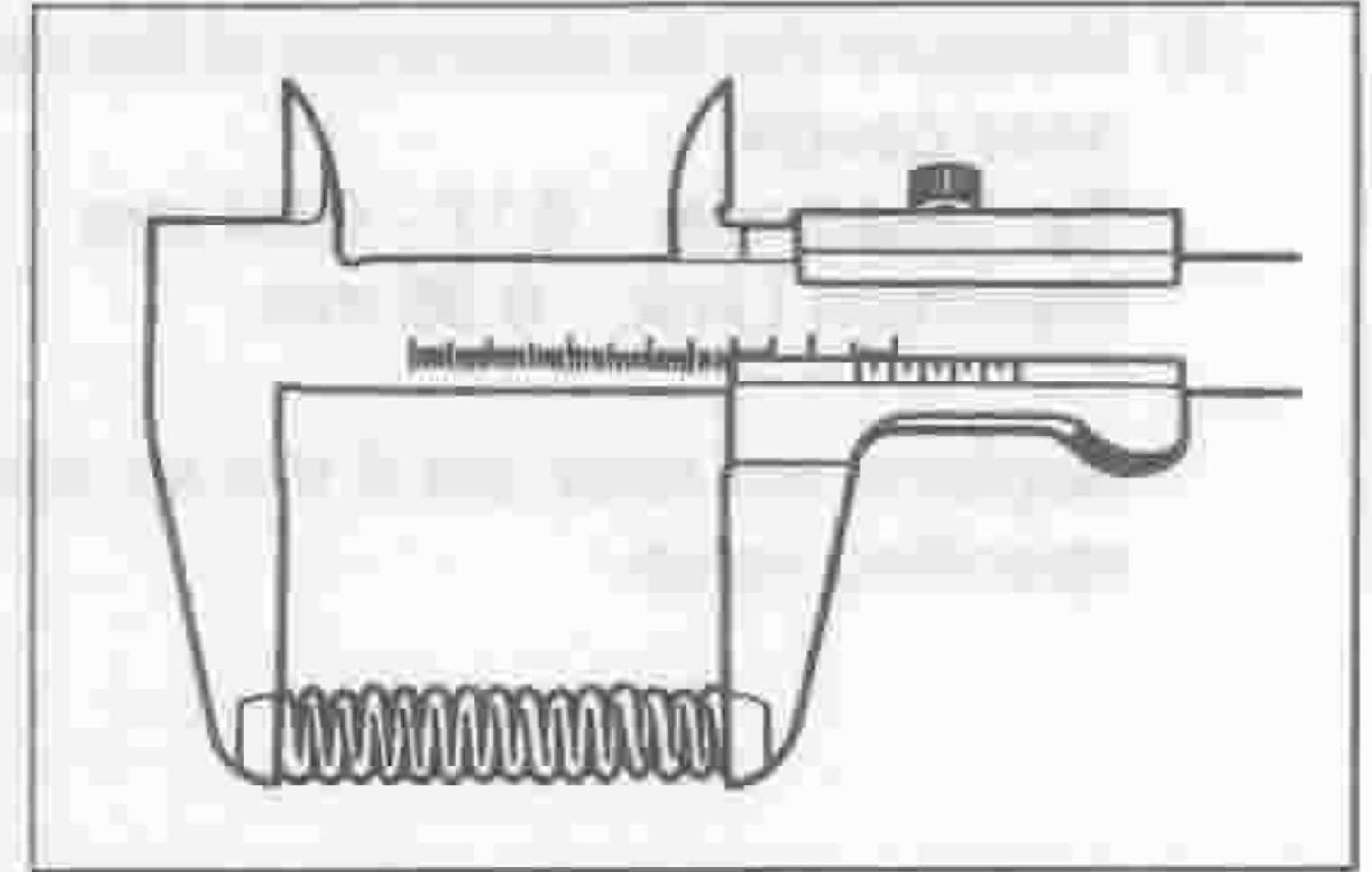
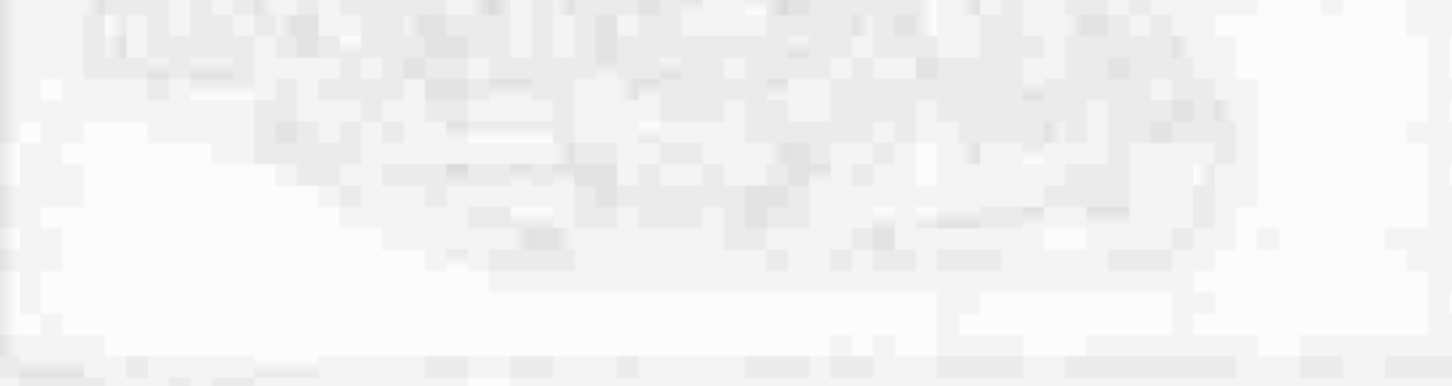
- (1) Check the oil pump relief valve for damage. Replace the relief valve if it exhibits damage. Also, check to see if any damage is present at the relief valve installation hole of the oil pump body.



LEM00376-00348

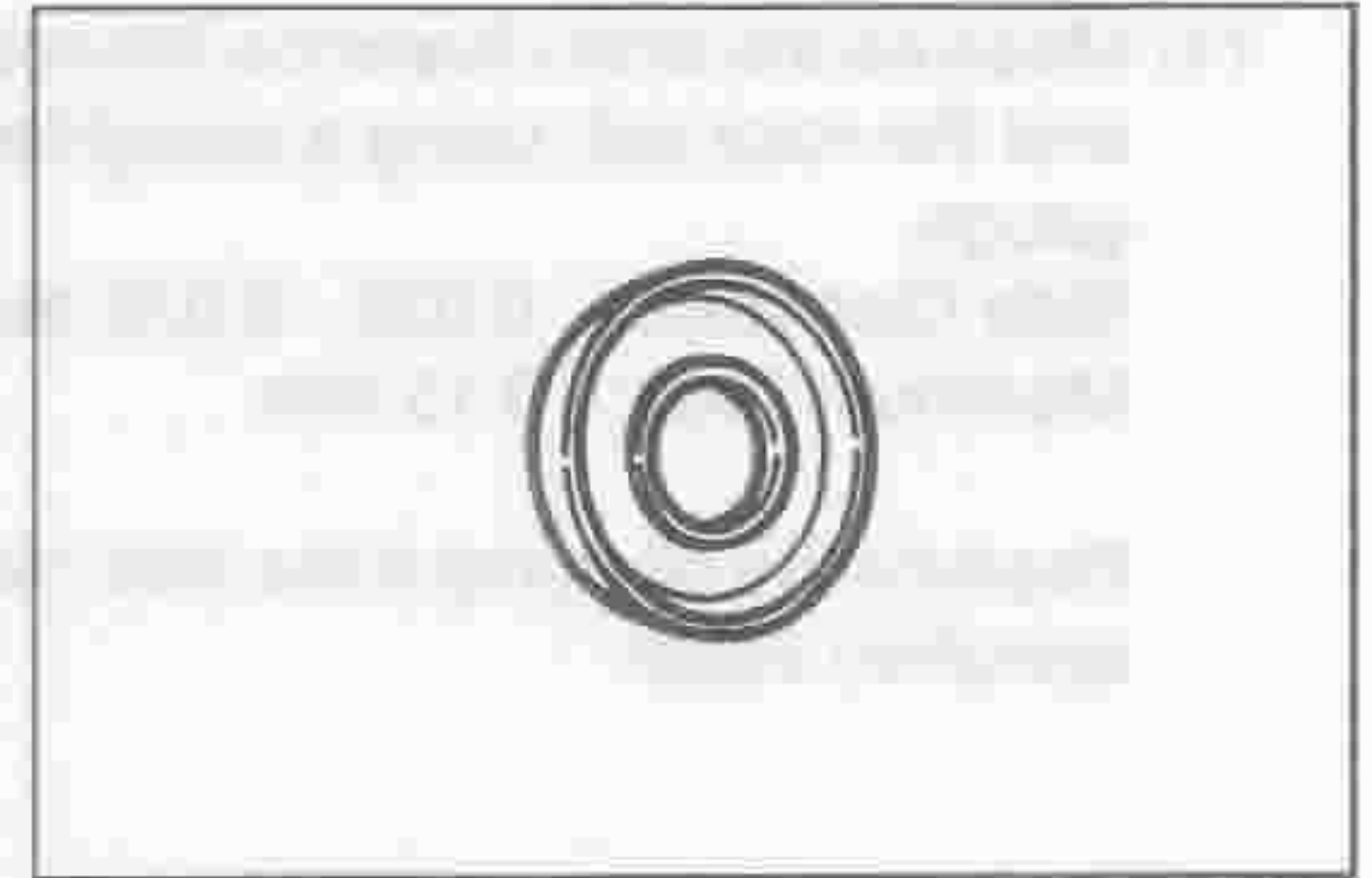
- (2) Check the compression spring for damage. Also, measure its free length.  
Specified Free Length: 35.5 mm

Replace the compression spring if it exhibits damage or the free length is less than the specified value.



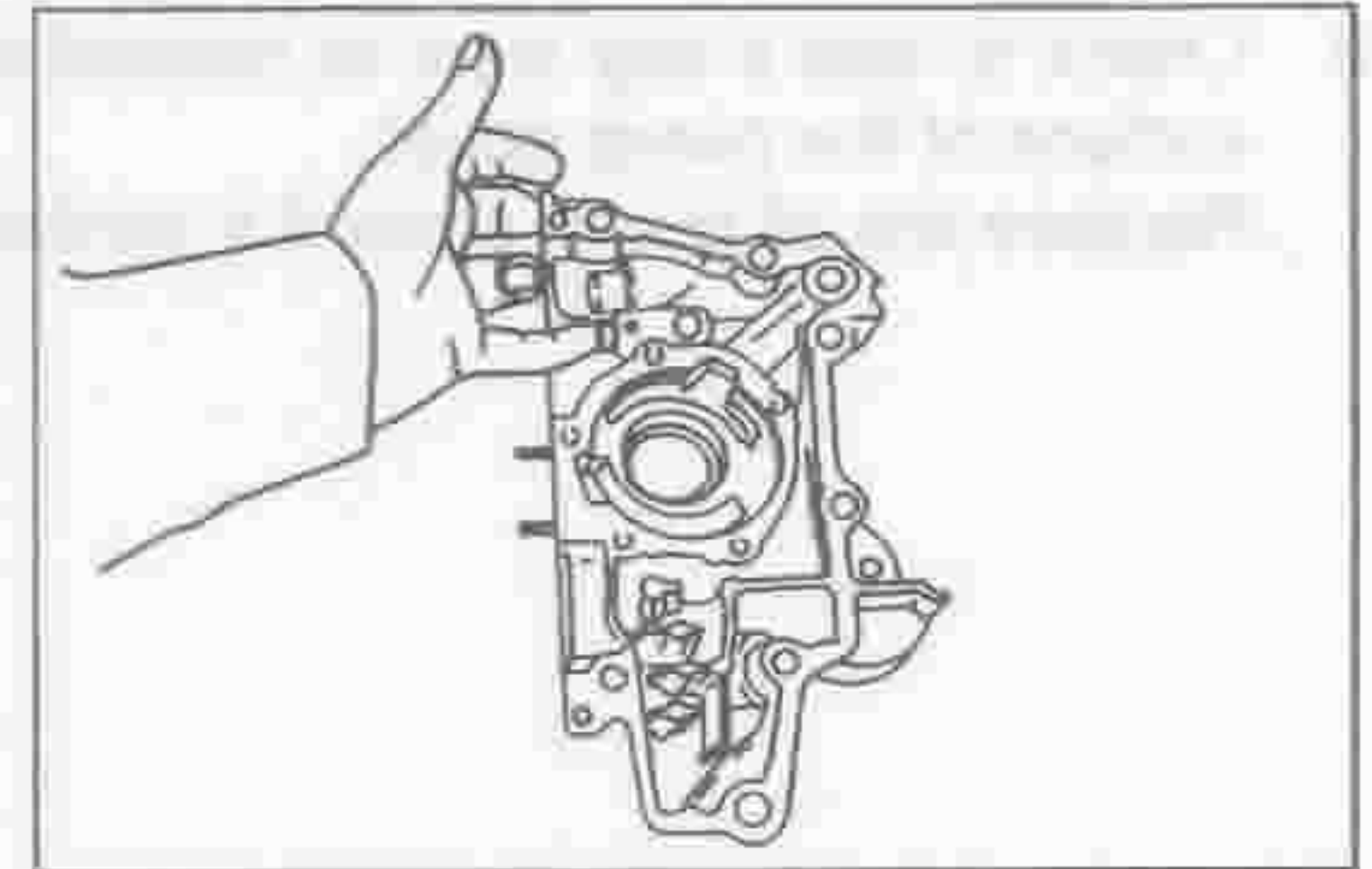
LEM00377-00347

- (3) Check the oil pump relief valve spring retainer for damage. Replace the retainer if it exhibits damage.



LEM00378-00348

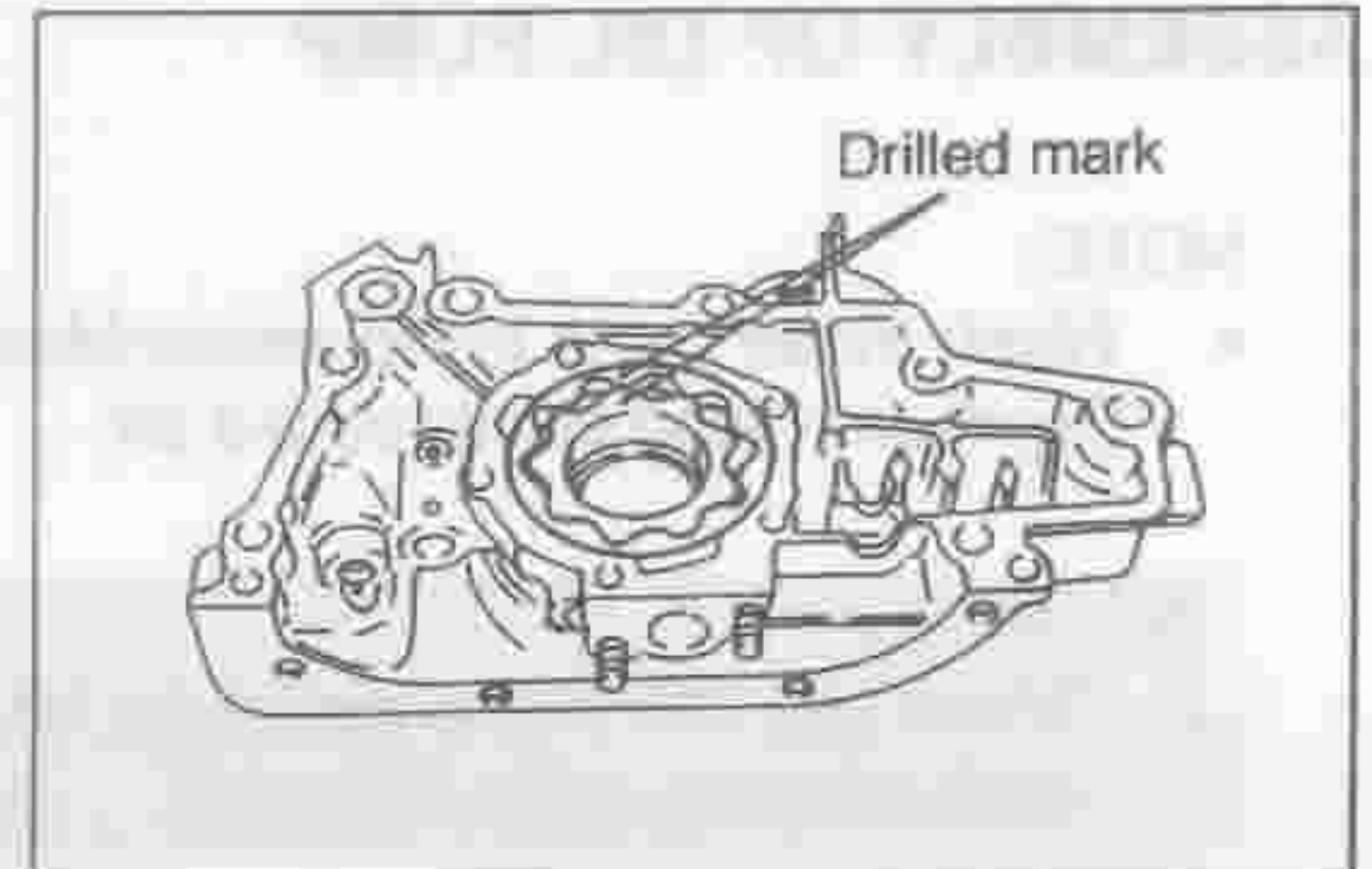
- (4) Apply engine oil to the oil pump relief valve. Insert the oil pump relief valve into the oil pump body. Check to see if the valve slides smoothly. Replace the oil pump body if the valve fails to slide smoothly.



LEM00379-00349

## 7. Measurement of body clearance, tip clearance and side clearance

- (1) Apply a thin film of engine oil to the rotor mate surface of the oil pump body as well as to the rotor set. Assemble the rotor set in the oil pump body in such a way that the drilled mark may be seen from the outside.

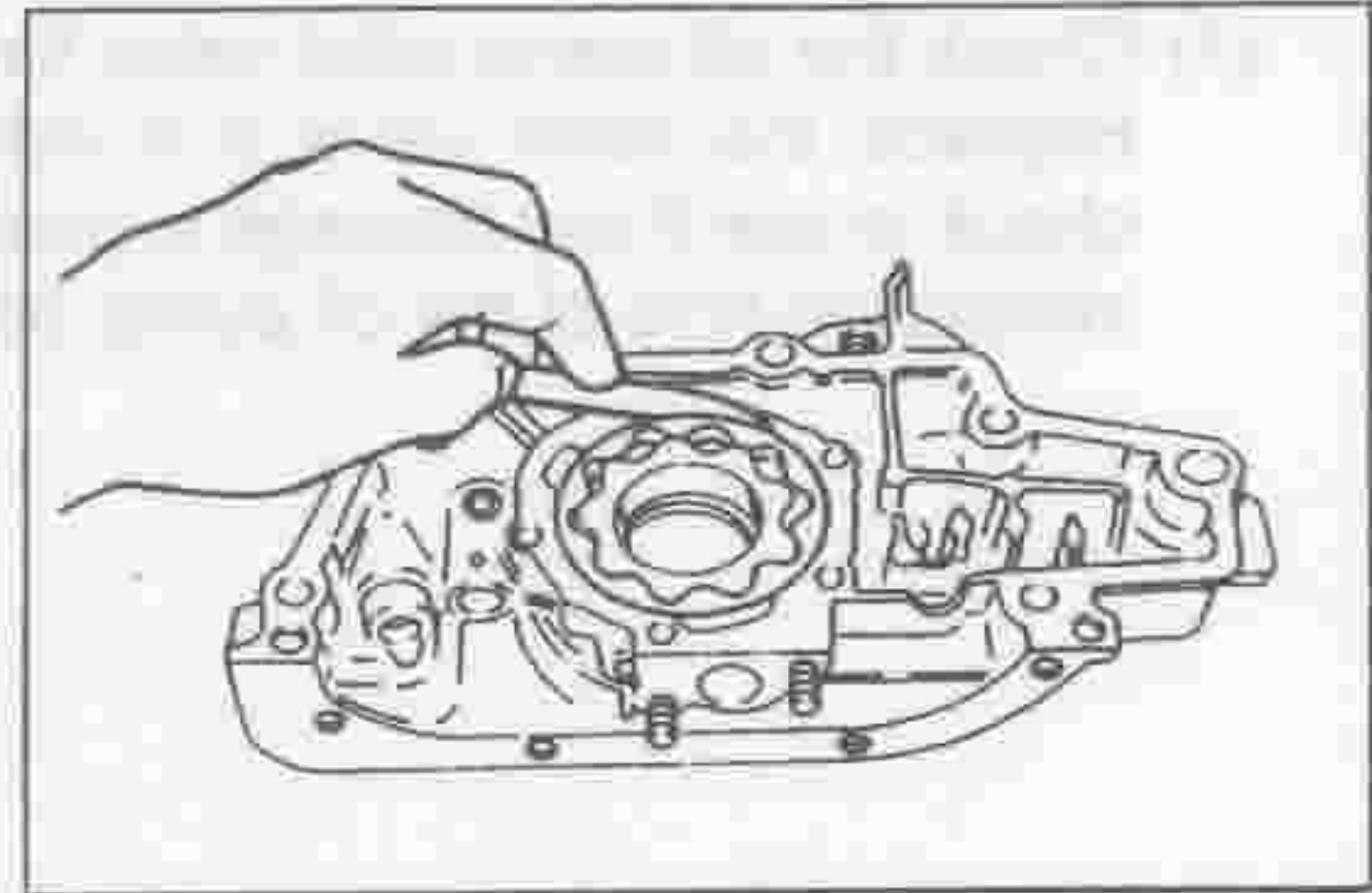


LEM00380-00350

- (2) Measure the body clearance between the oil pump body and the outer rotor, using a thickness gauge.

Body Clearance: 0.10 - 0.185 mm  
Maximum Limit: 0.25 mm

Replace the oil pump if the body clearance exceeds the specified value.

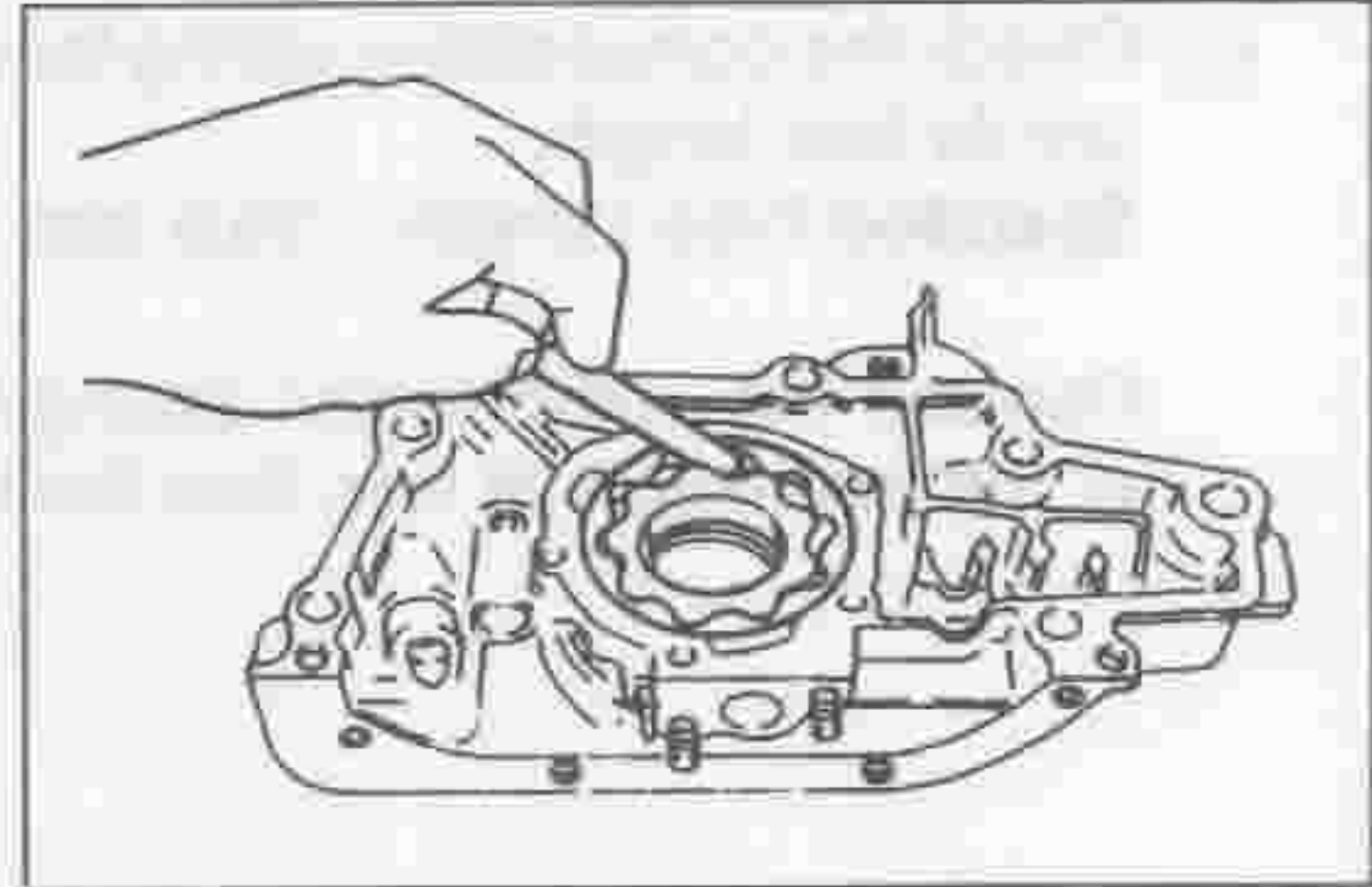


LEM00381-00351

- (3) Measure the tip clearance of the rotor set, using a thickness gauge.

Tip Clearance: 0.17 - 0.24 mm  
Maximum Limit: 0.35 mm

Replace the rotor set if the tip clearance exceeds the specified value.

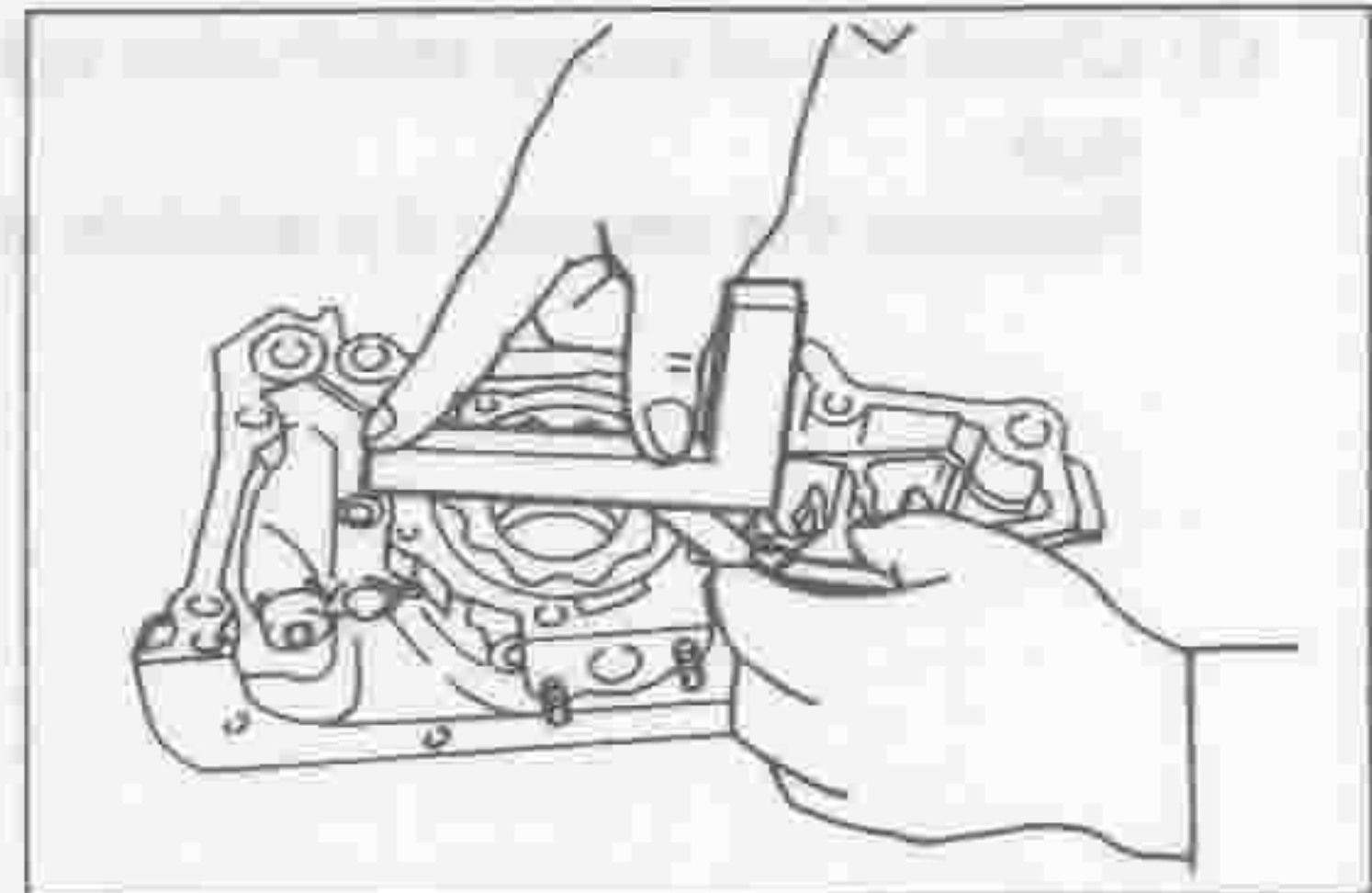


LEM00382-00352

- (4) Measure the side clearance between the oil pump body and the rotor set, using a straightedge and a thickness gauge.

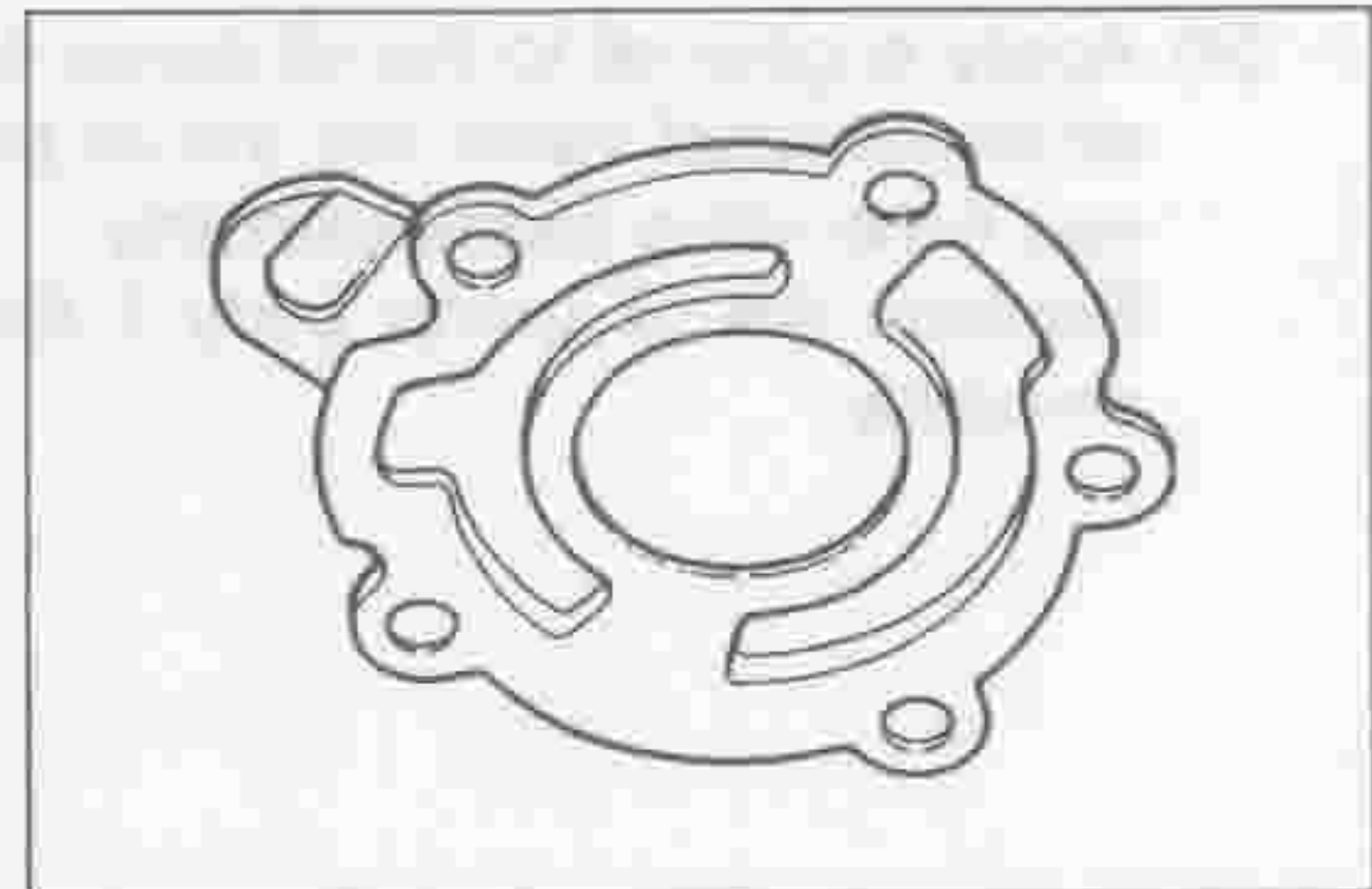
Side Clearance: 0.035 - 0.070 mm  
Maximum Limit: 0.15 mm

Replace the oil pump if the side clearance exceeds the specified value.



LEM00383-00353

8. Check to see if any wear is present at the rotor set mate surface of the pump cover.  
Replace the oil pump cover if it exhibits wear.



LEM00384-00354

## ASSEMBLY OF OIL PUMP

### NOTE:

- Wash those parts to be assembled in cleaning solvent.  
Dry them using compressed air.

### WARNING:

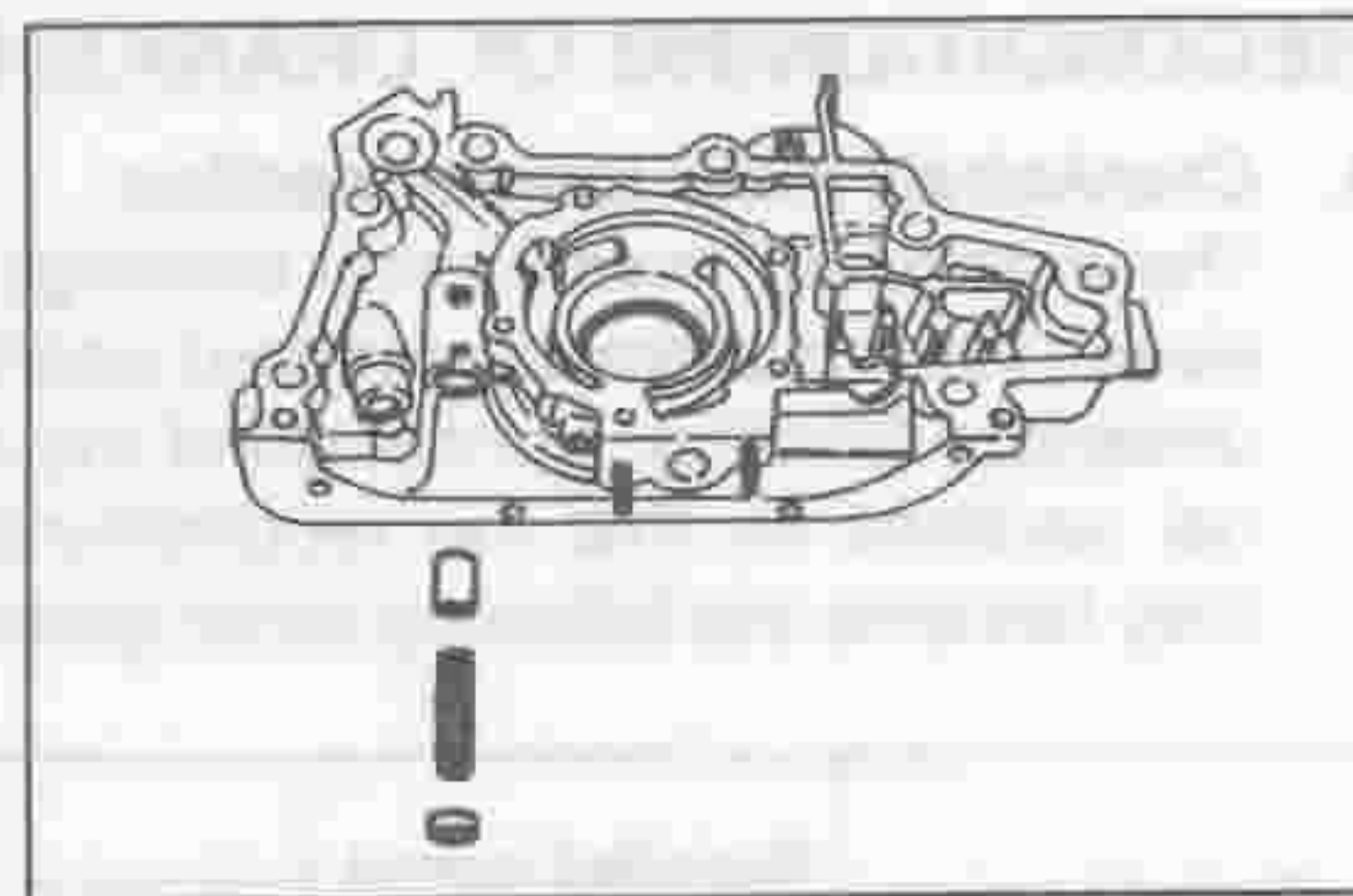
- When you use compressed air, be sure to protect your eyes, wearing safety goggles.

LEM00385-00000

1. Apply engine oil to the relief valve. Then, insert the relief valve into the oil pump body.
2. Insert the compression spring and retainer into the oil pump body.

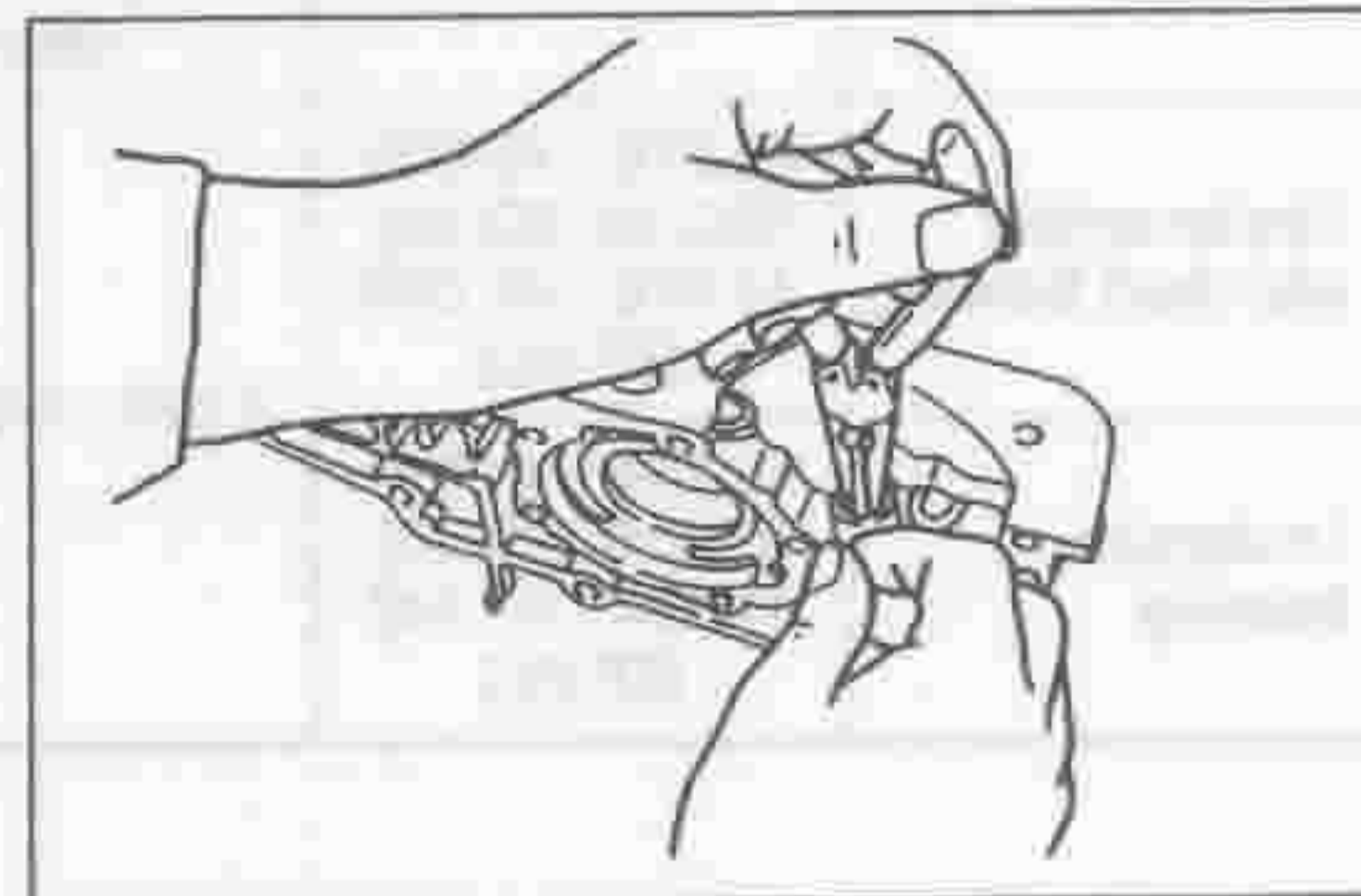
## NOTE:

- Install the retainer in such a direction that its projected side may come at the compression spring side.



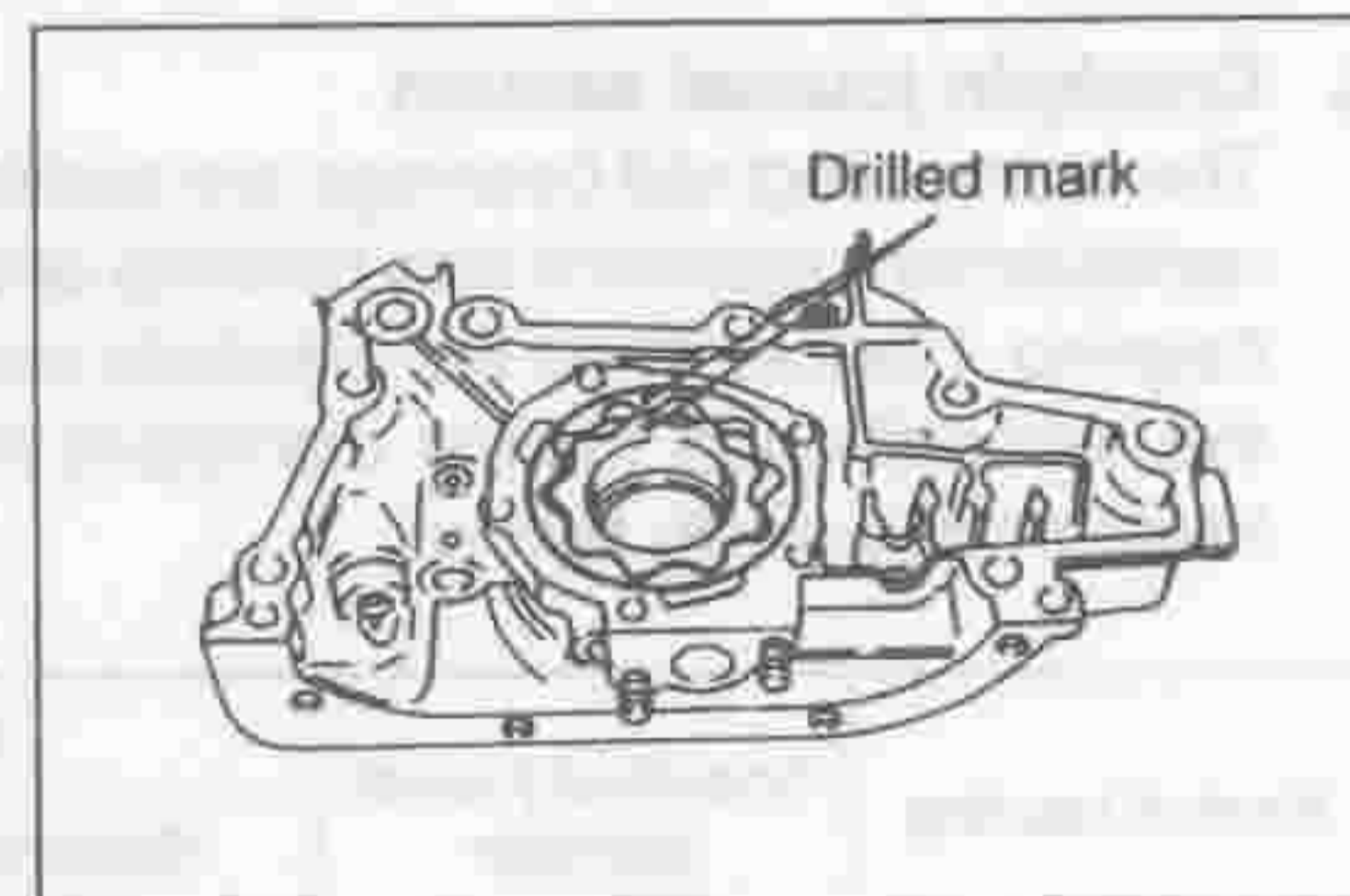
LEM00386-00355

3. Insert a new cotter pin into the retainer while the retainer is being compressed with pliers, etc. Split the end of the cotter pin to form an anchor-like shape.



LEM00387-00356

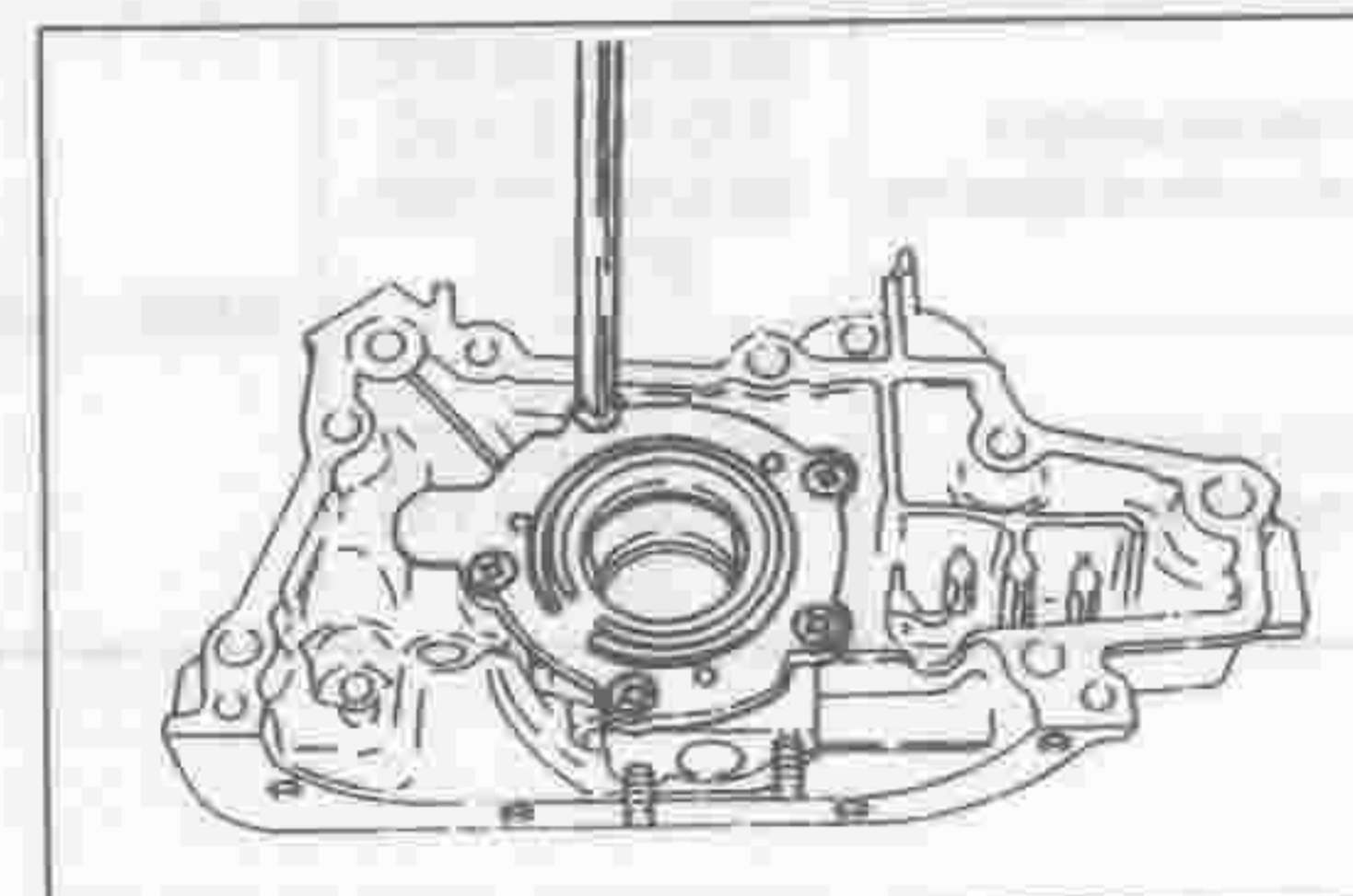
4. Apply engine oil to the rotor set. Assemble the rotor set in the pump body in such a direction that the drilled mark of the rotor may be seen from the outside.



LEM00388-00357

5. Install the oil pump cover. Tighten the cover to the specified torque.

Tightening Torque:  $10.3 \pm 2.5$  N·m  
 $(1.05 \pm 0.25$  kgf·m)

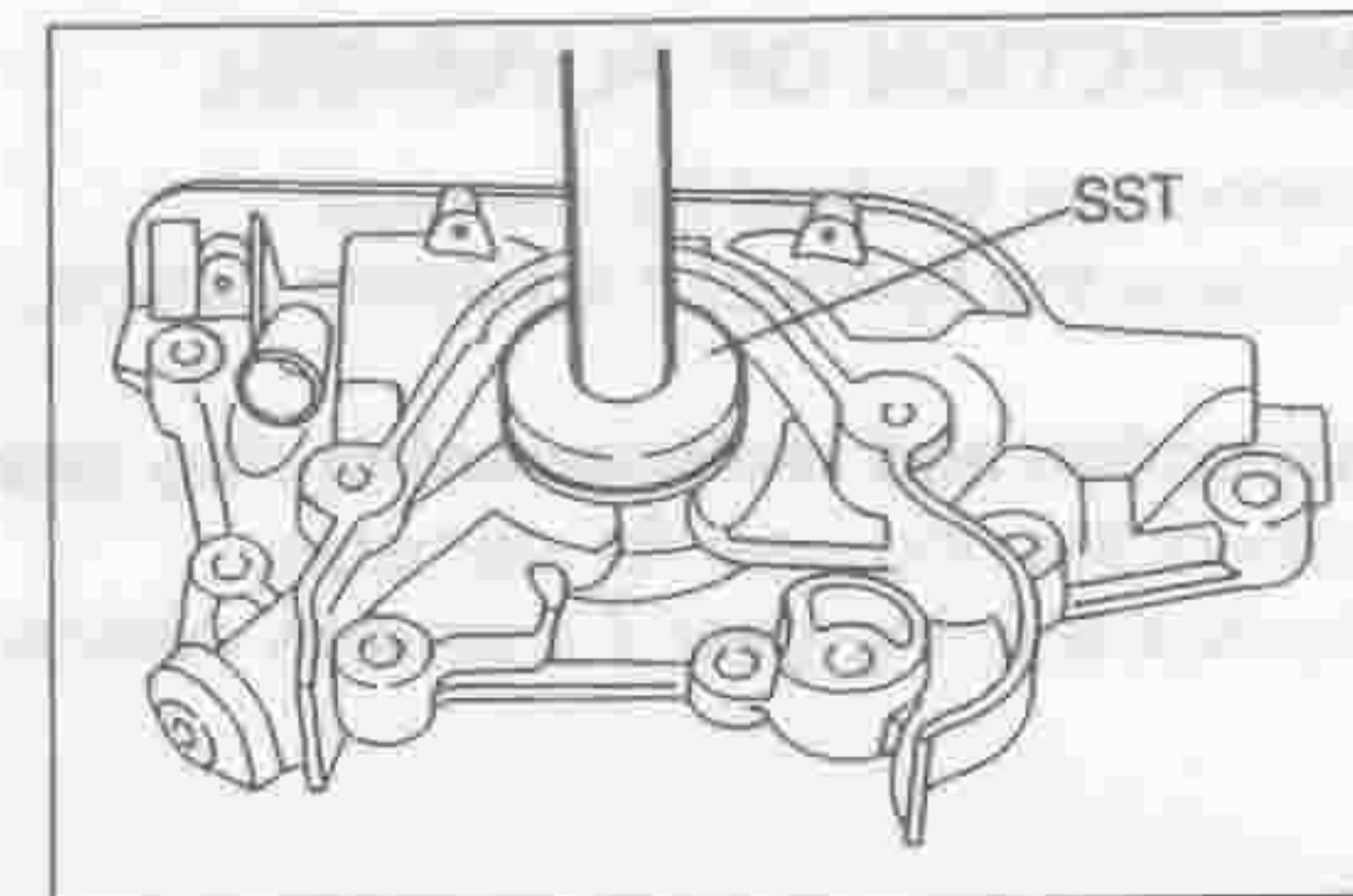


LEM00389-00358

6. Drive a new oil seal into position, using the following SST.  
 SST: 09608-87302-000

## NOTE:

- Be very careful not to damage the oil pump during the installation.
- Make sure that the oil seal is not driven into position in a tilted state.



LEM00390-00359

## RECONDITIONING OF CRANKSHAFT

(mm)

Kind of bearing	Specified journal diameter	Oil clearance	
		Specified value	Maximum limit
Replacement standard bearing	45.976 - 46.000 [ED-10, ED-20] 41.976 - 42.000 [EF-EL]	0.020 - 0.044	0.07
Undersize bearing	45.734 - 45.742 [ED-10, ED-20] 41.734 - 41.742 [EF-EL]		

LEM00391-00000

### 2. Crankpin journal section

The connecting rod bearings are available in two sizes: the replacement standard size bearing and 0.25 mm undersize bearing. Hence, grind the crankpin journal sections so that the reconditioned journal diameters may become the following sizes given below.

(mm)

Kind of bearing	Specified journal diameter	Oil clearance	
		Specified value	Maximum limit
Replacement standard bearing	39.976 - 40.000 [ED-10, ED-20] 36.976 - 37.000 [EF-EL]	0.020 - 0.044	0.07
Undersize bearing	39.734 - 39.742 [ED-10, ED-20] 36.734 - 36.742 [EF-EL]		

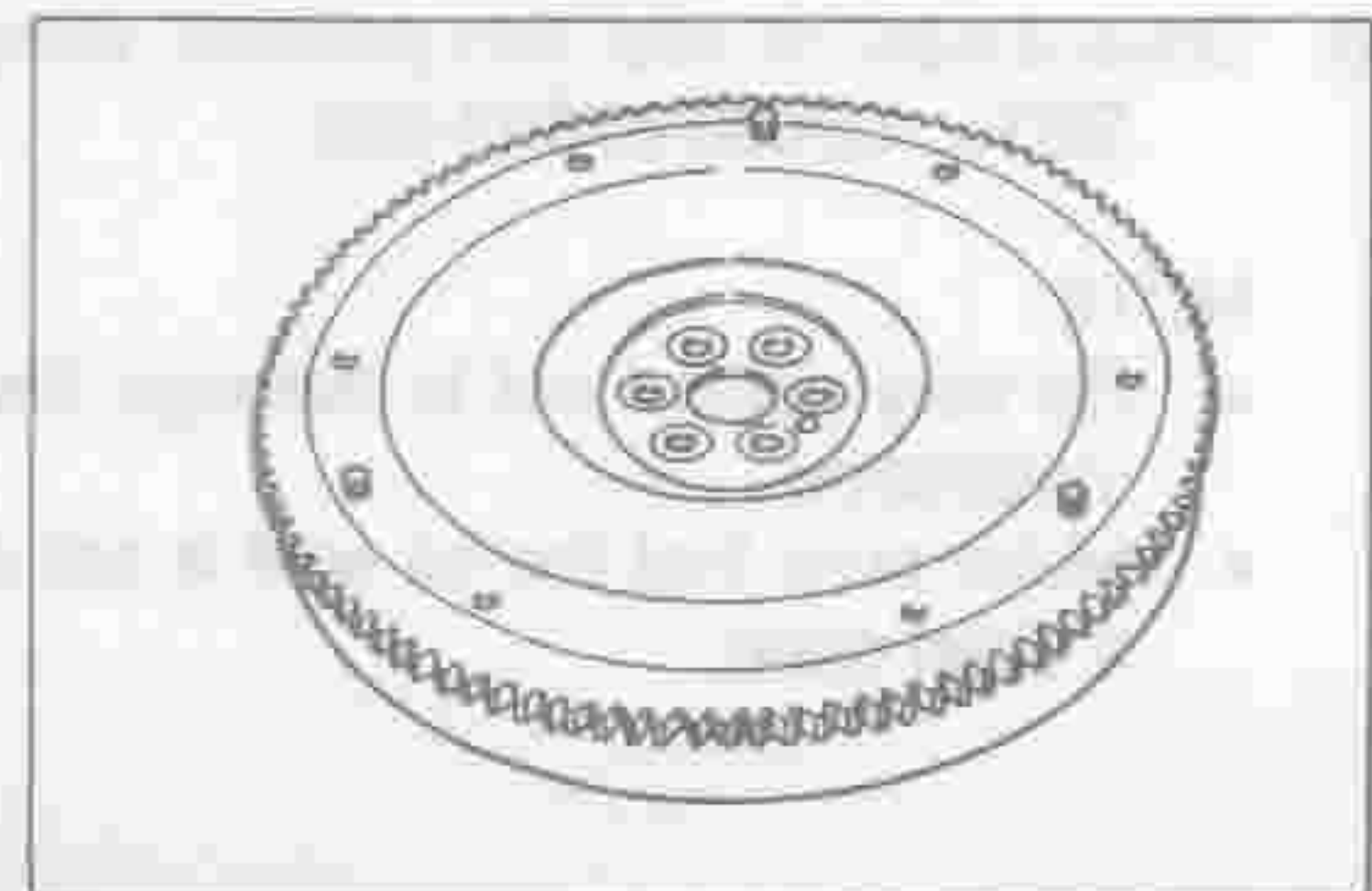
LEM00392-00000

### INSPECTION OF FLYWHEEL

Inspect the flywheel for damage.  
Replace the flywheel if it exhibits defects.

#### Inspection and replacement of ring gear

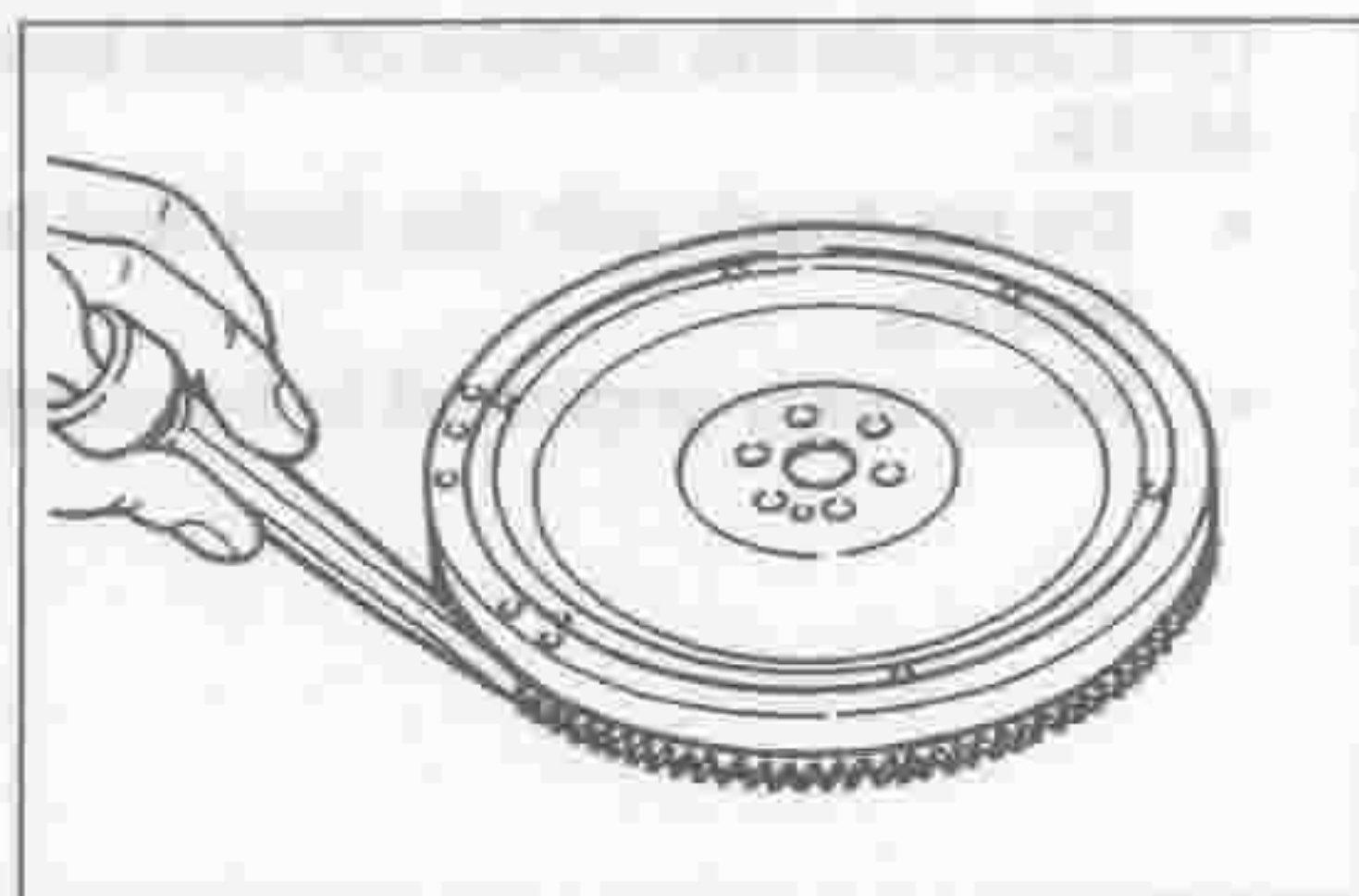
Inspect the ring gear for damage.  
Replace the ring gear if it exhibits defects.



LEM00393-00360

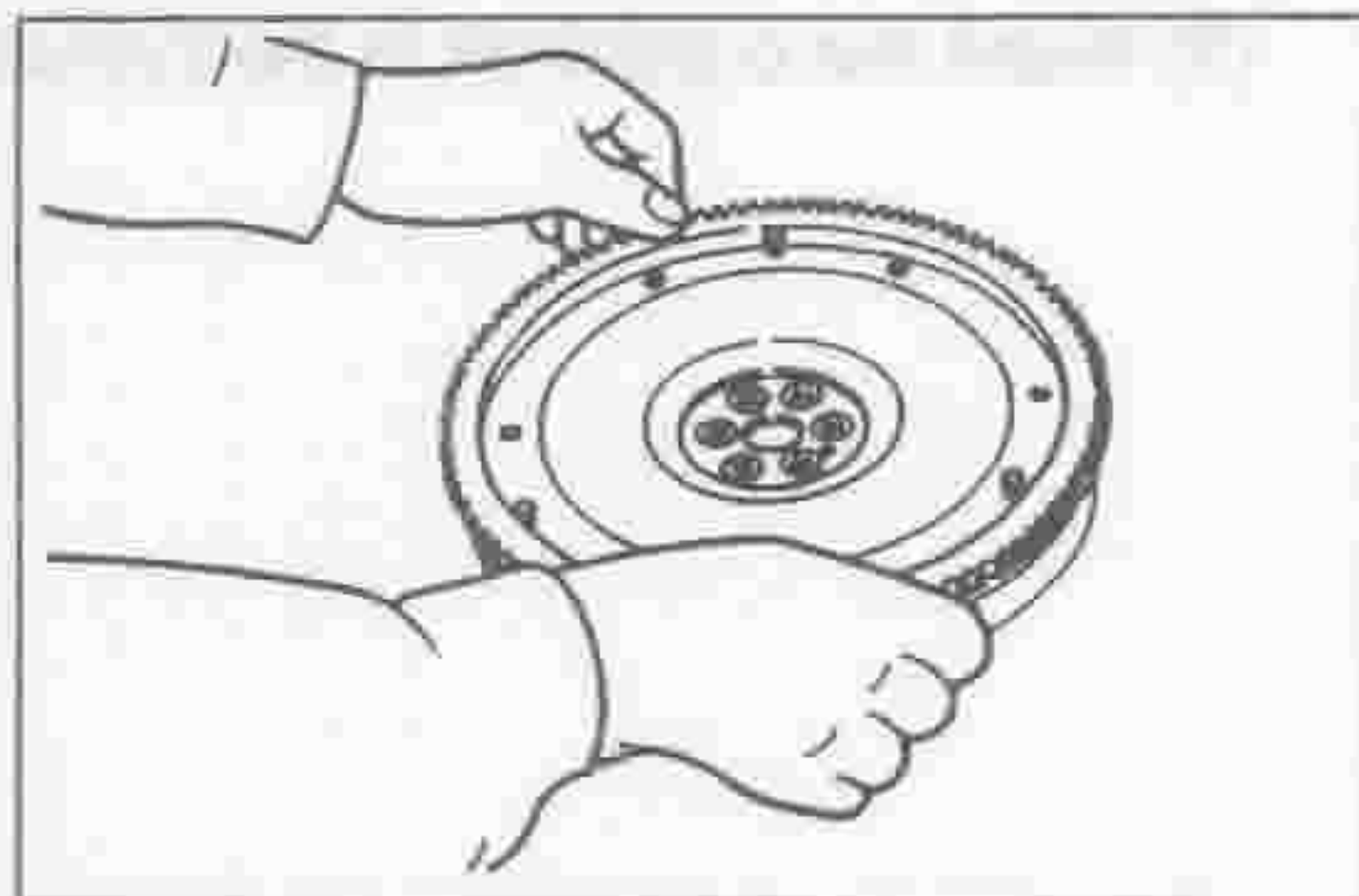
## REMOVAL/INSTALLATION OF RING GEAR

1. Place the flywheel on an adequate wooden block. Drive out the ring gear, using a chisel in combination with a hammer.



LEM00394-00361

2. Place a new ring gear horizontally on the flywheel.



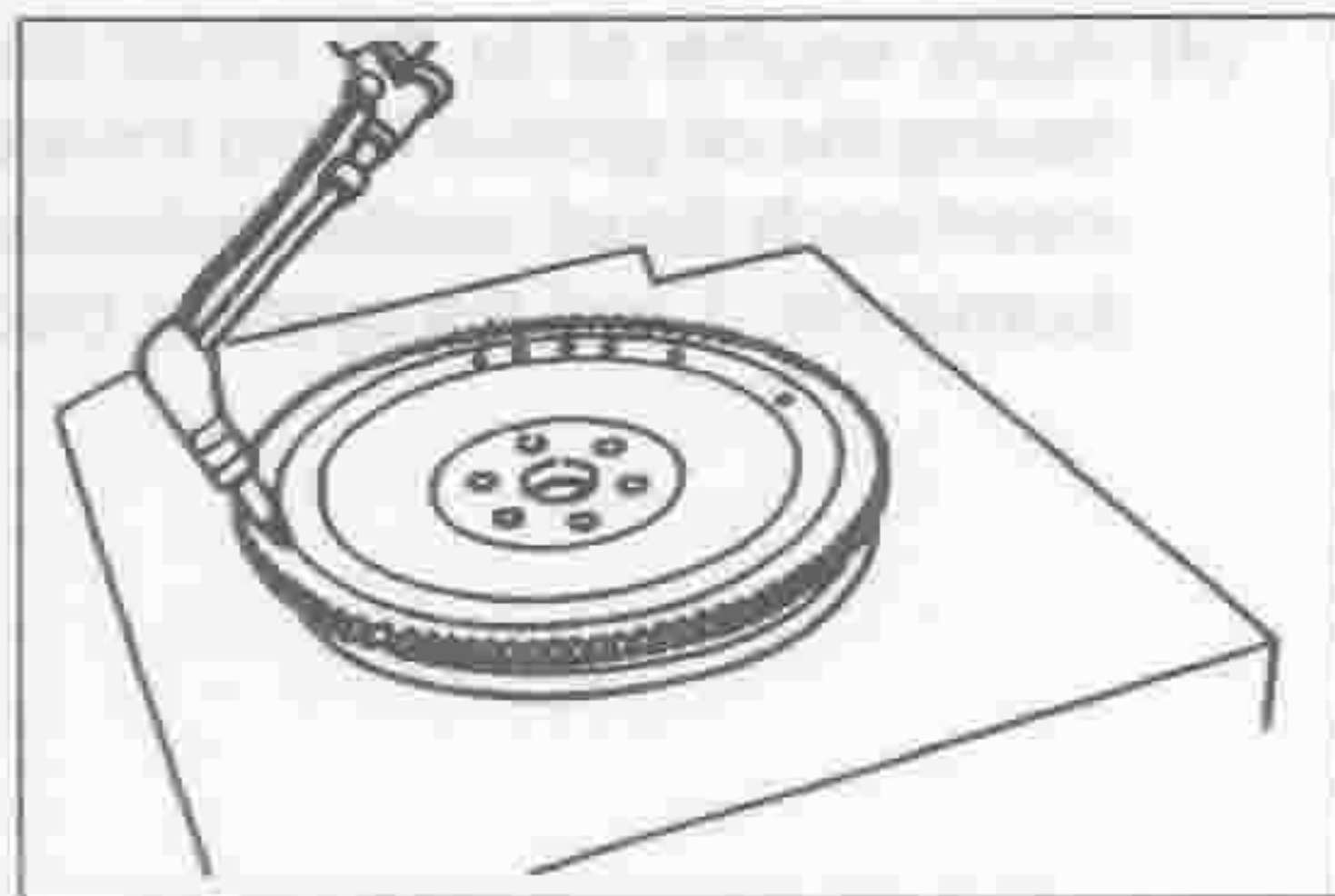
LEM00395-00362

3. Using a gas burner, heat the ring gear evenly, until the ring gear due to its own weight fits onto the flywheel.

### NOTE:

- Do not tap the ring gear using a hammer or the like.
- Never cool the ring gear quickly using water or the like.

4. Allow the ring gear to cool naturally.



LEM00396-00363

## ASSEMBLY OF CYLINDER BLOCK

### NOTE:

- As for those parts to be reassembled, wash them in cleaning solvent (excluding those parts, such as grease sealed type bearings, dust seals and electrical parts). Then, dry them using compressed air.
- Remove any remaining sealer, etc. from the threaded portions of the switches.

### WARNING:

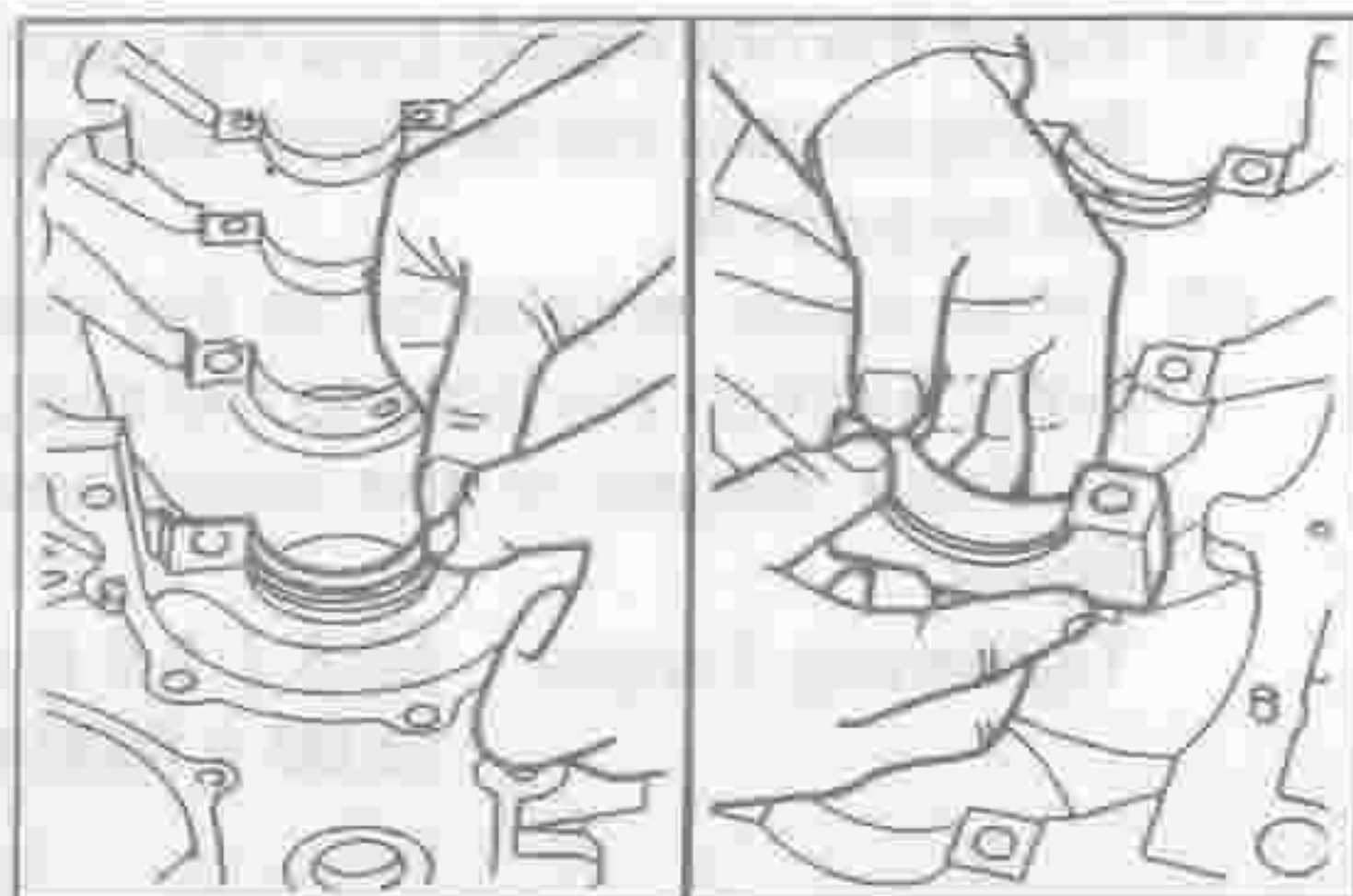
- When you use compressed air, be sure to protect your eyes with safety goggles.

LEM00397-00000

1. Crankshaft installation  
(1) Install the bearings to the cylinder block and crankshaft bearing caps.

### NOTE:

- Do not touch with the front and back surfaces of each bearing.
- Be sure to hold the bearing at its edge surfaces.

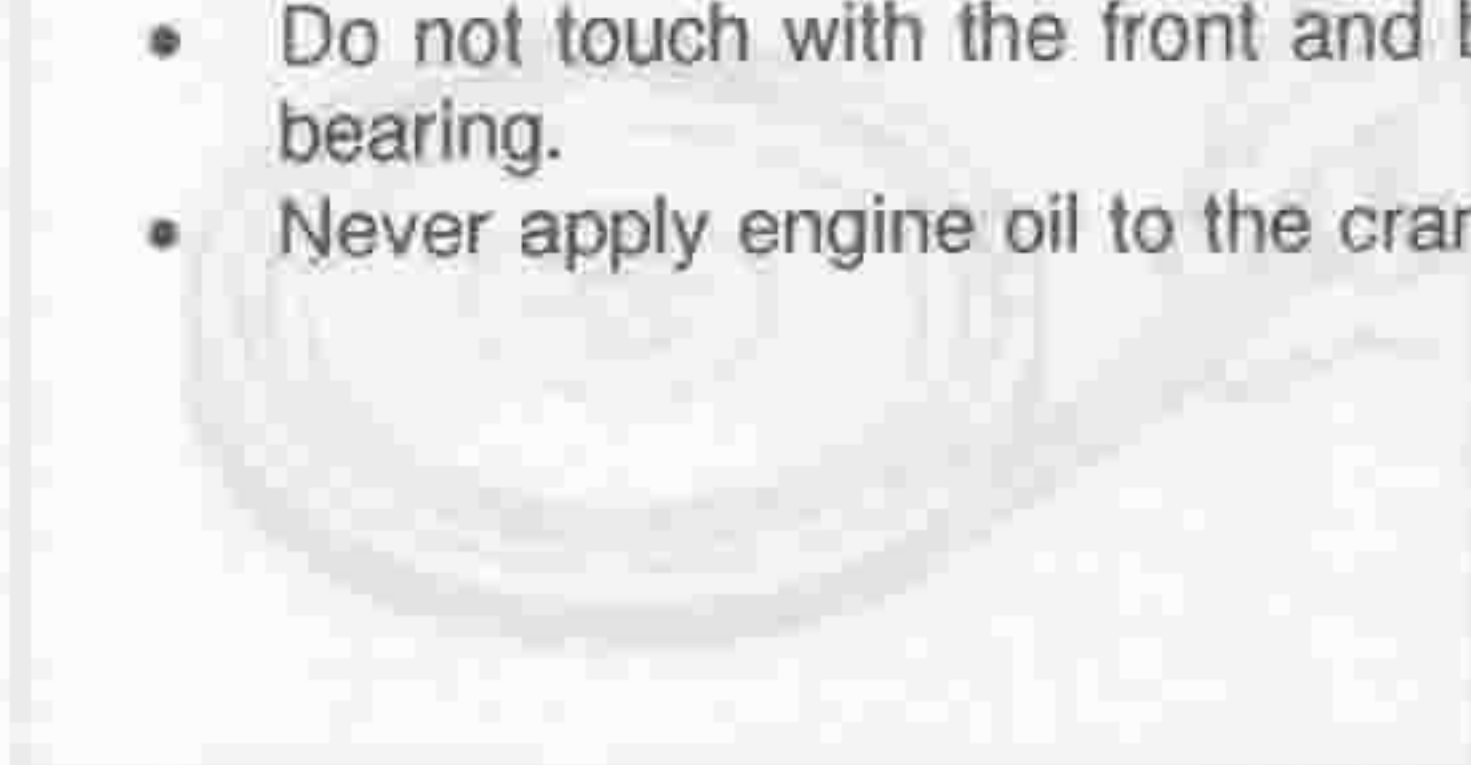


LEM00398-00364

(2) Lubricate the surface of each bearing with engine oil.

NOTE:

- Do not touch with the front and back surfaces of each bearing.
- Never apply engine oil to the crankshaft bearing caps.



(3) Install the crankshaft in the cylinder block.



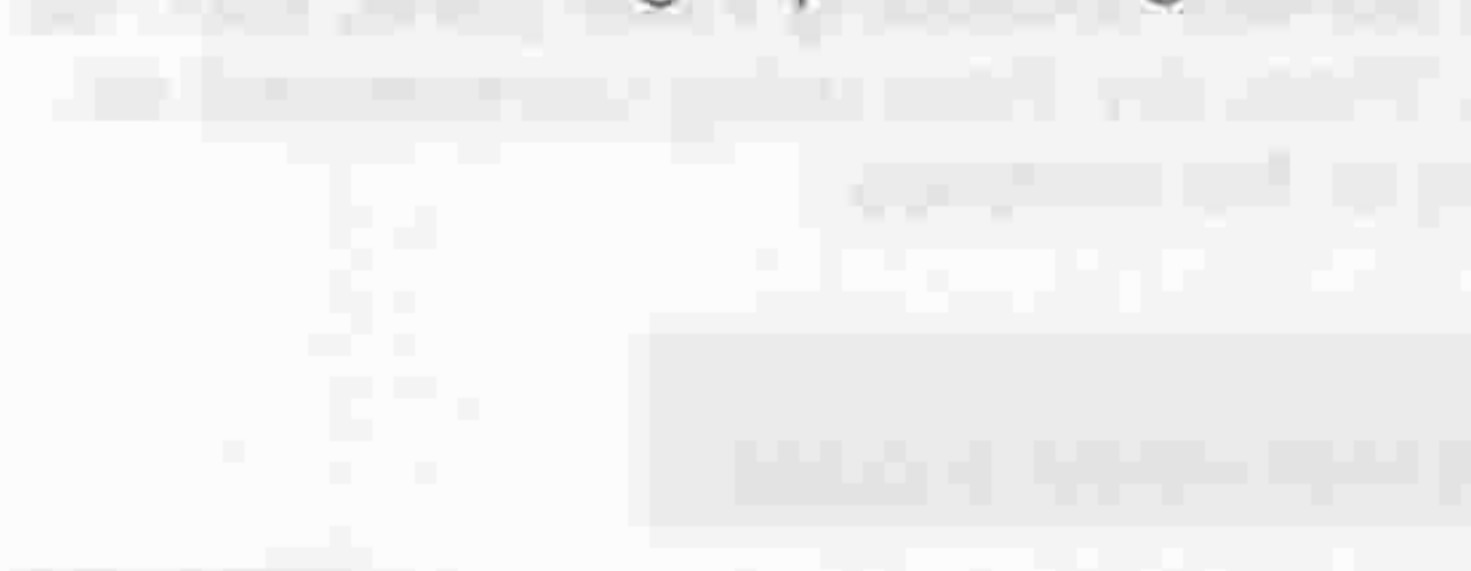
(4) Apply engine oil to the thrust washers. With the side having the oil groove facing toward the crankshaft side, insert each thrust washer between the crankshaft main journal No. 3 and the cylinder block.



(5) Apply engine oil to the crankshaft main journal sections.

NOTE:

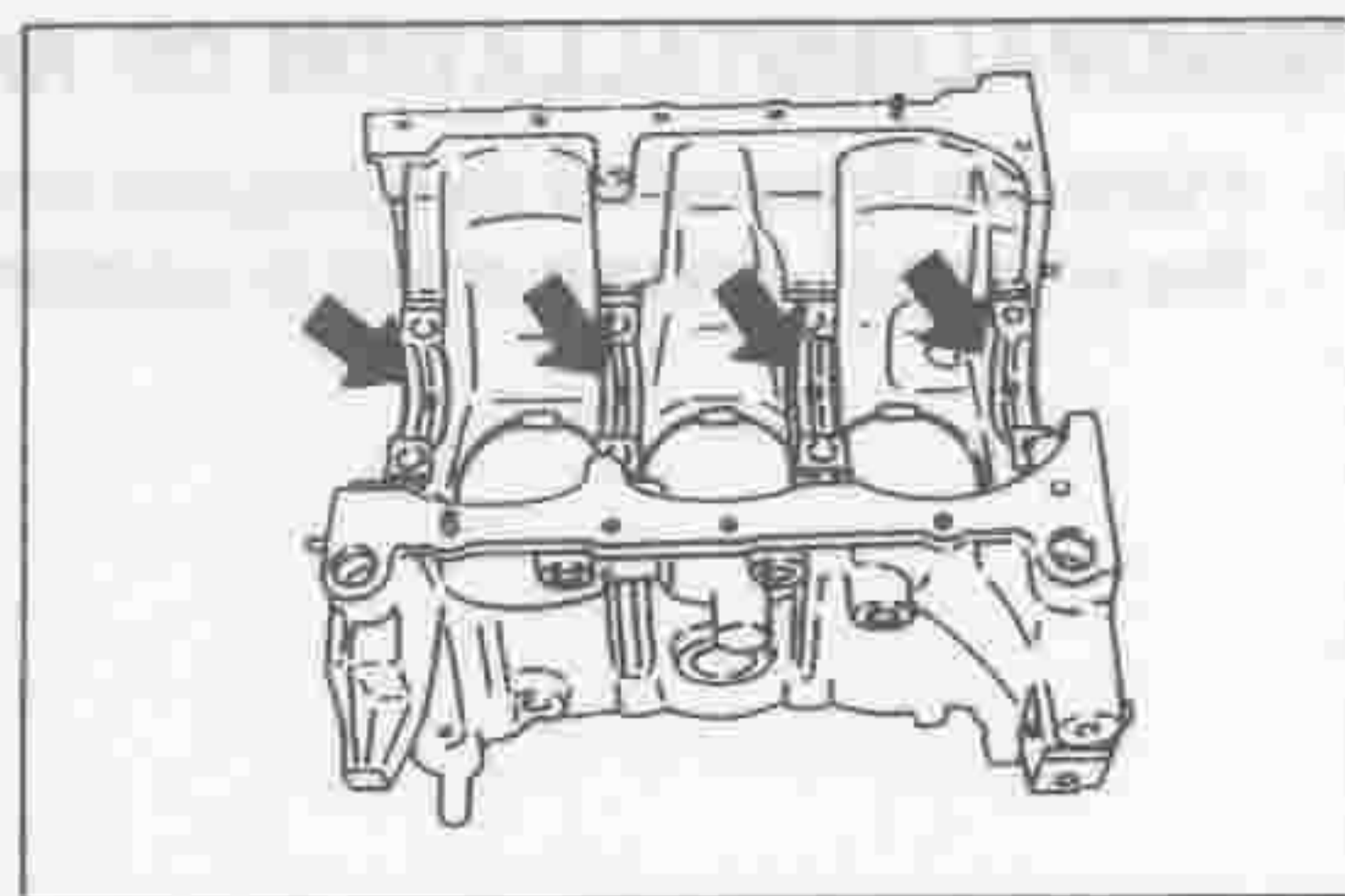
- Care must be exercised to ensure that no oil flows into the bearing cap attaching bolt holes.



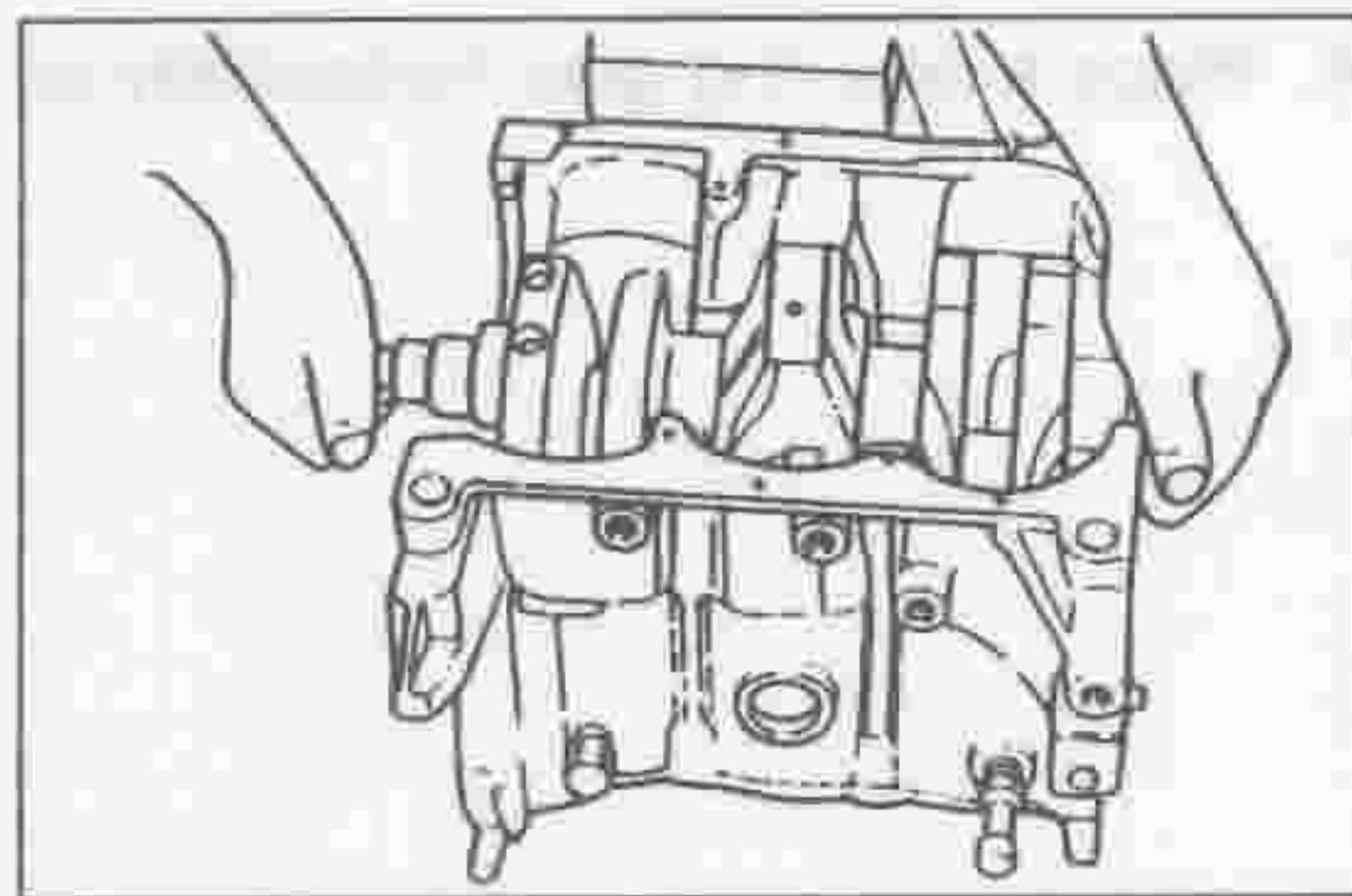
(6) Install the crankshaft bearing caps with the arrow marks facing toward the oil pump side and also in the numerical sequence.

(7) Thinly apply engine oil to the crankshaft bearing cap bolts. Tighten the bolts to the specified torque over two or three stages in the sequence shown in the right figure.

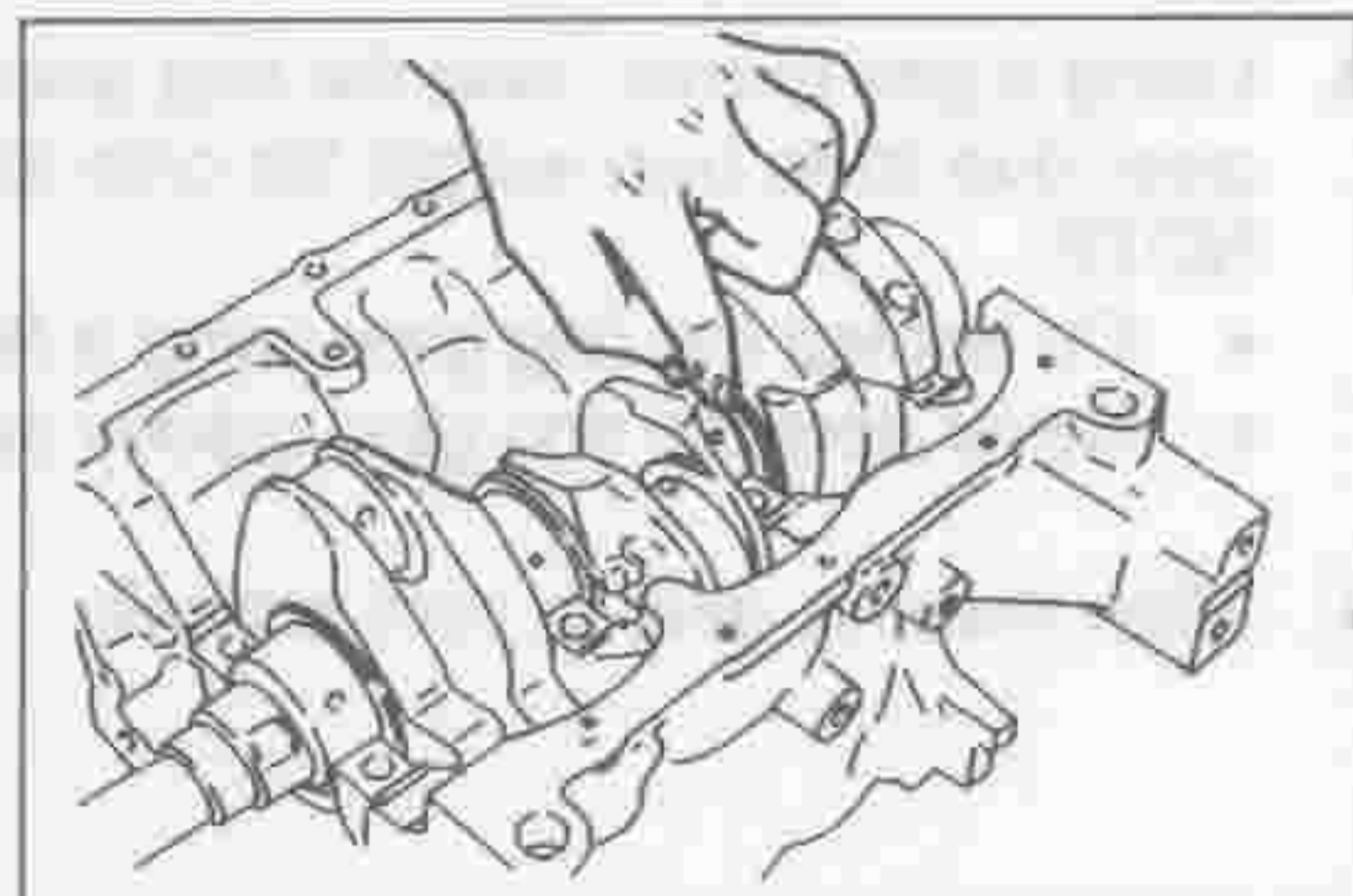
Tightening Torque:  $58.8 \pm 5.9$  N·m  
( $6.00 \pm 0.60$  kgf·m)



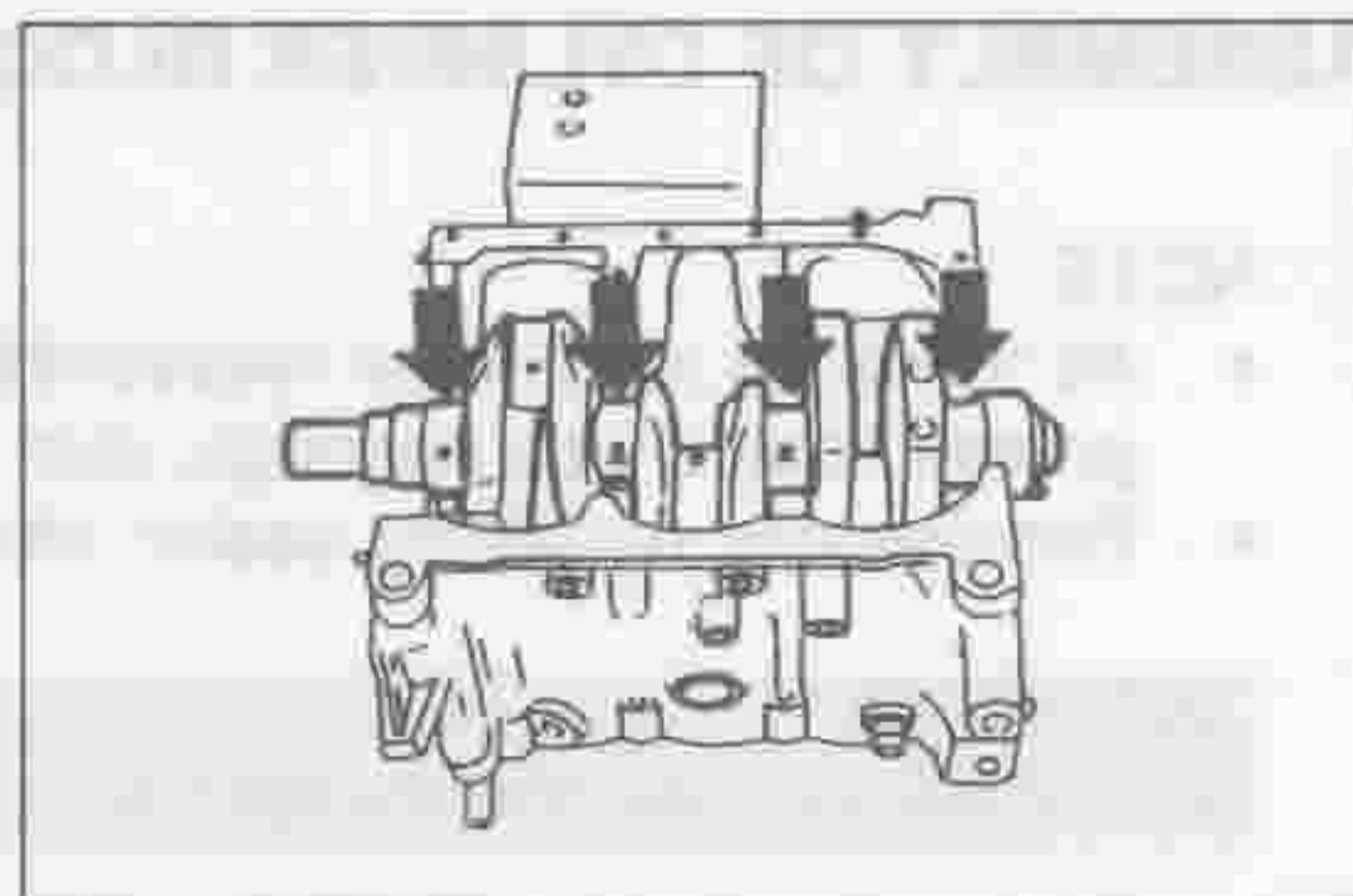
LEM00399-00365



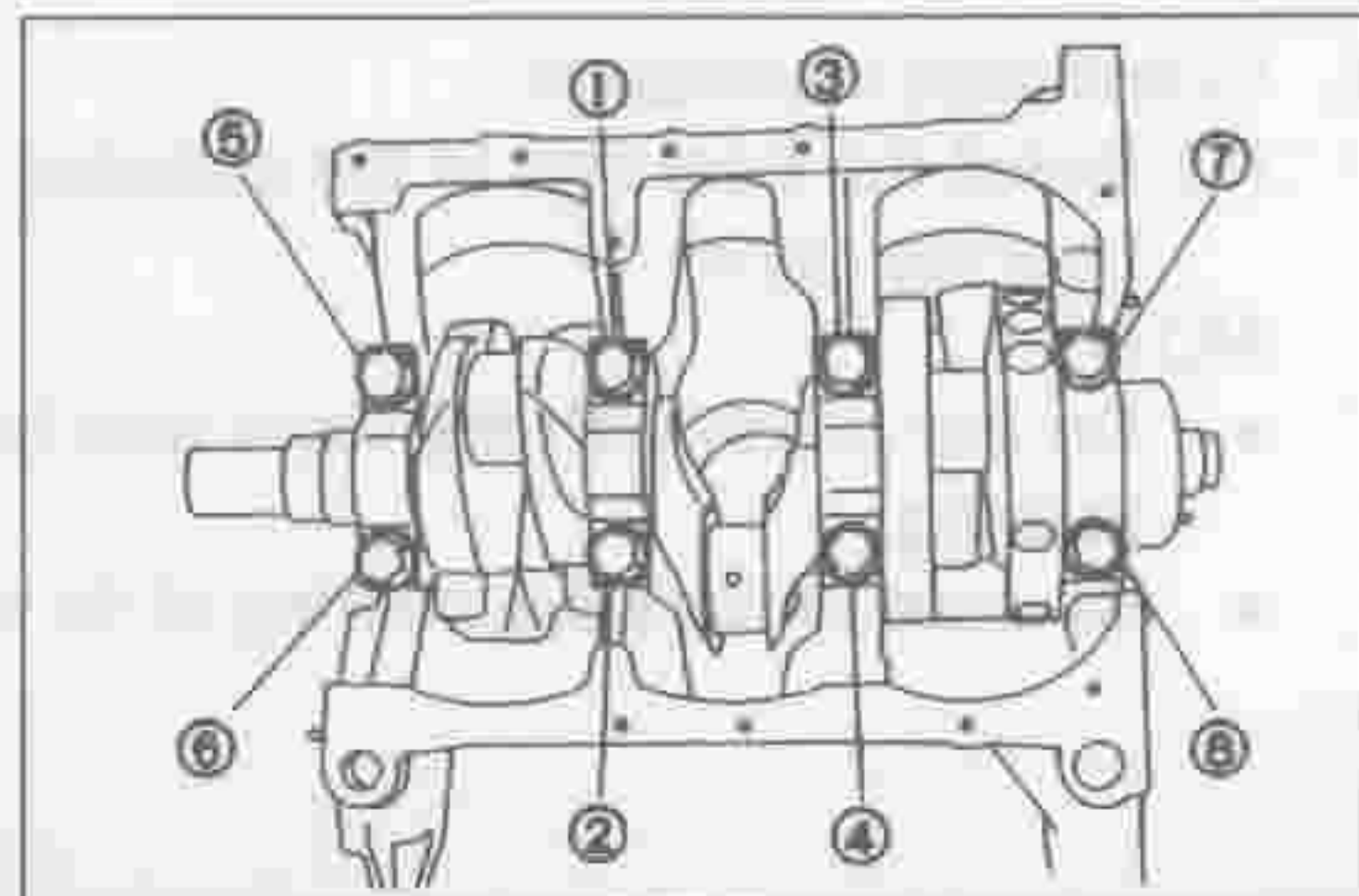
LEM00400-00366



LEM00401-00367



LEM00402-00368



LEM00403-00369

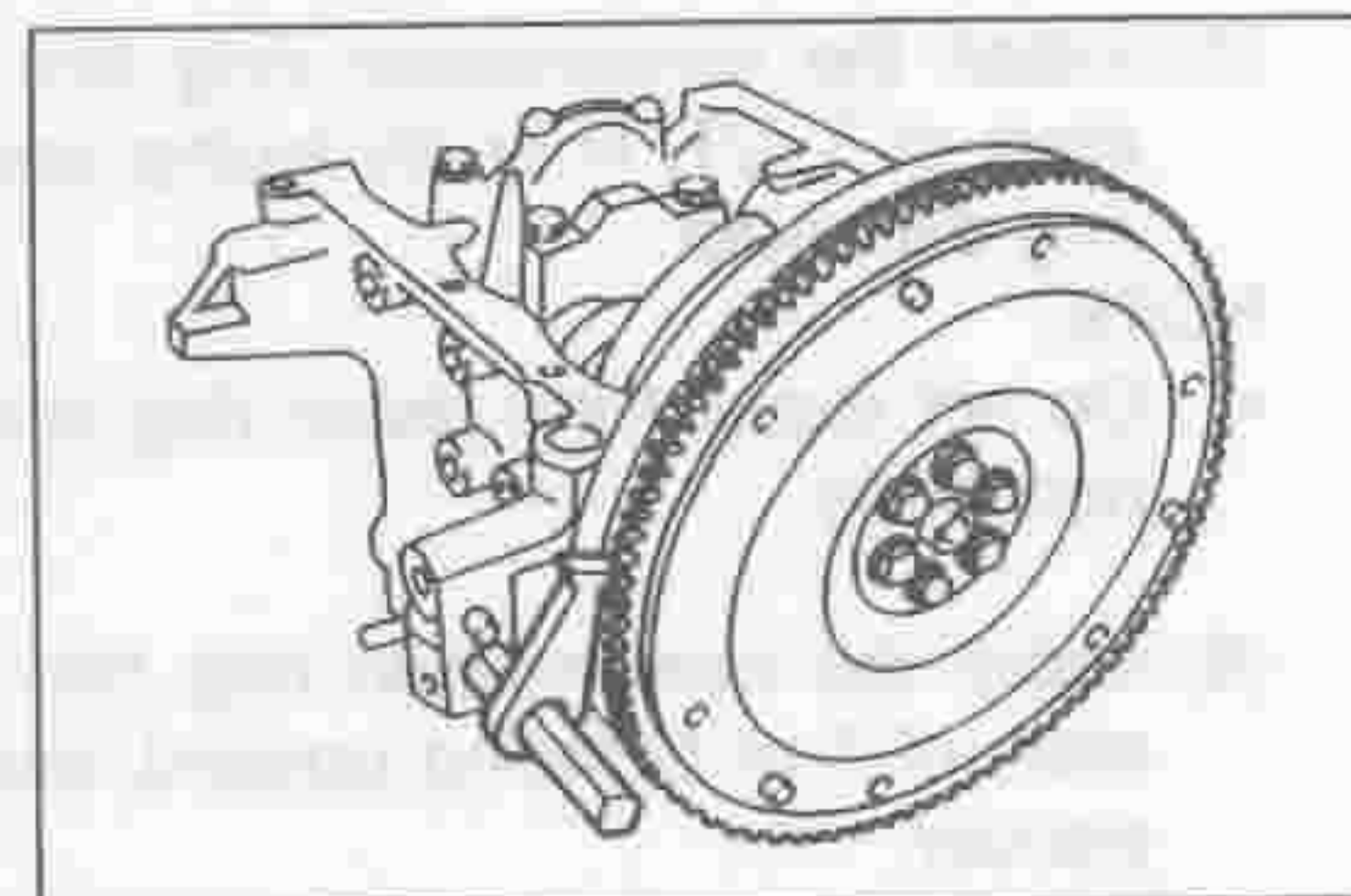


## 2. Assembly of piston and connecting rod

(1) Install the flywheel on the crankshaft temporarily

## NOTE:

- Care must be exercised to ensure that no oil, etc. gets to the bolts or bolt holes.

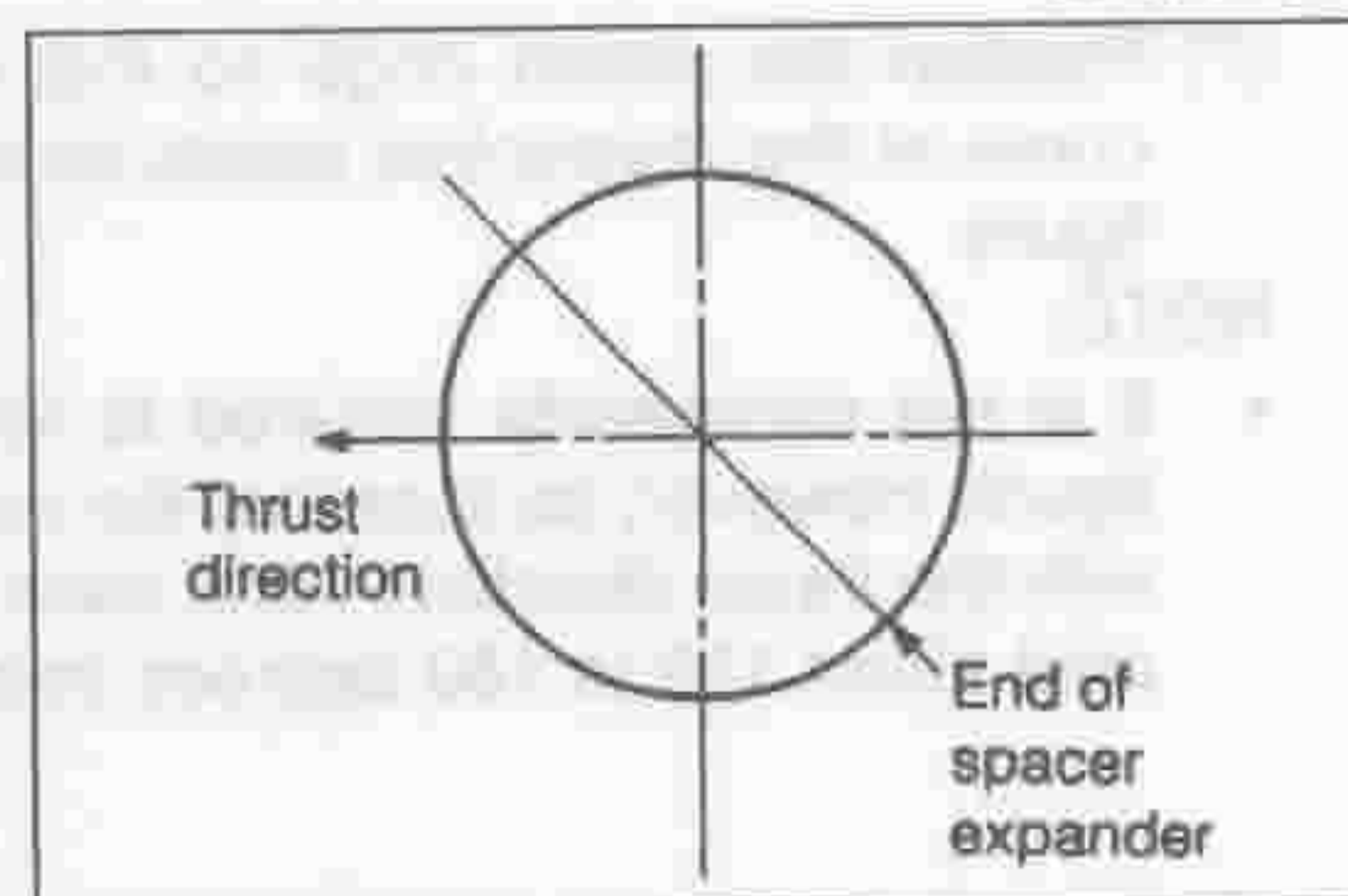


LEM00404-00370

(2) Install the oil ring spacer expander in the oil ring groove. Ensure that the expander end may not line up with the thrust direction nor with the axial direction.

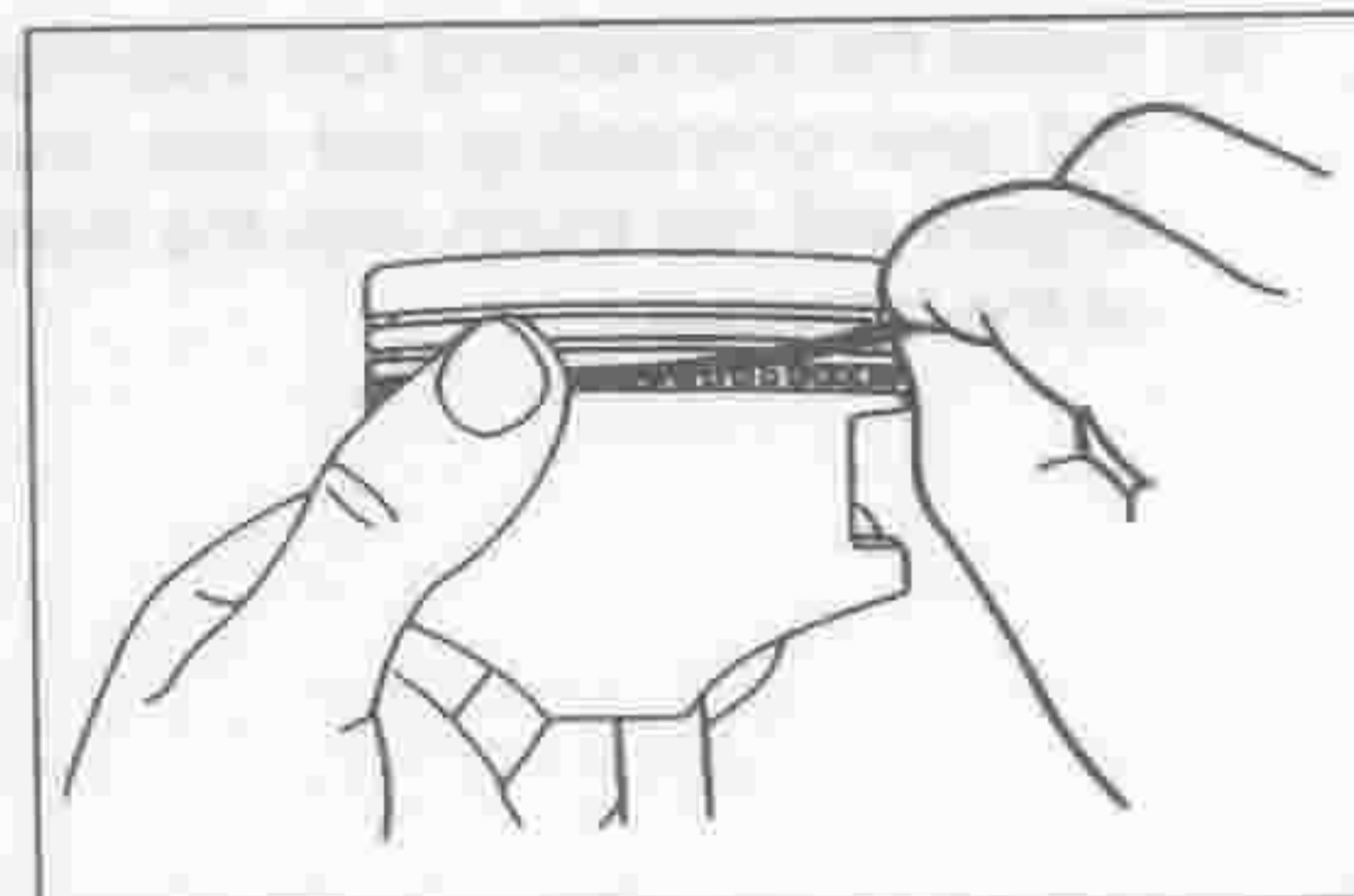
## NOTE:

- Do not expand the spacer expander to an extent more than necessary.



LEM00405-00371

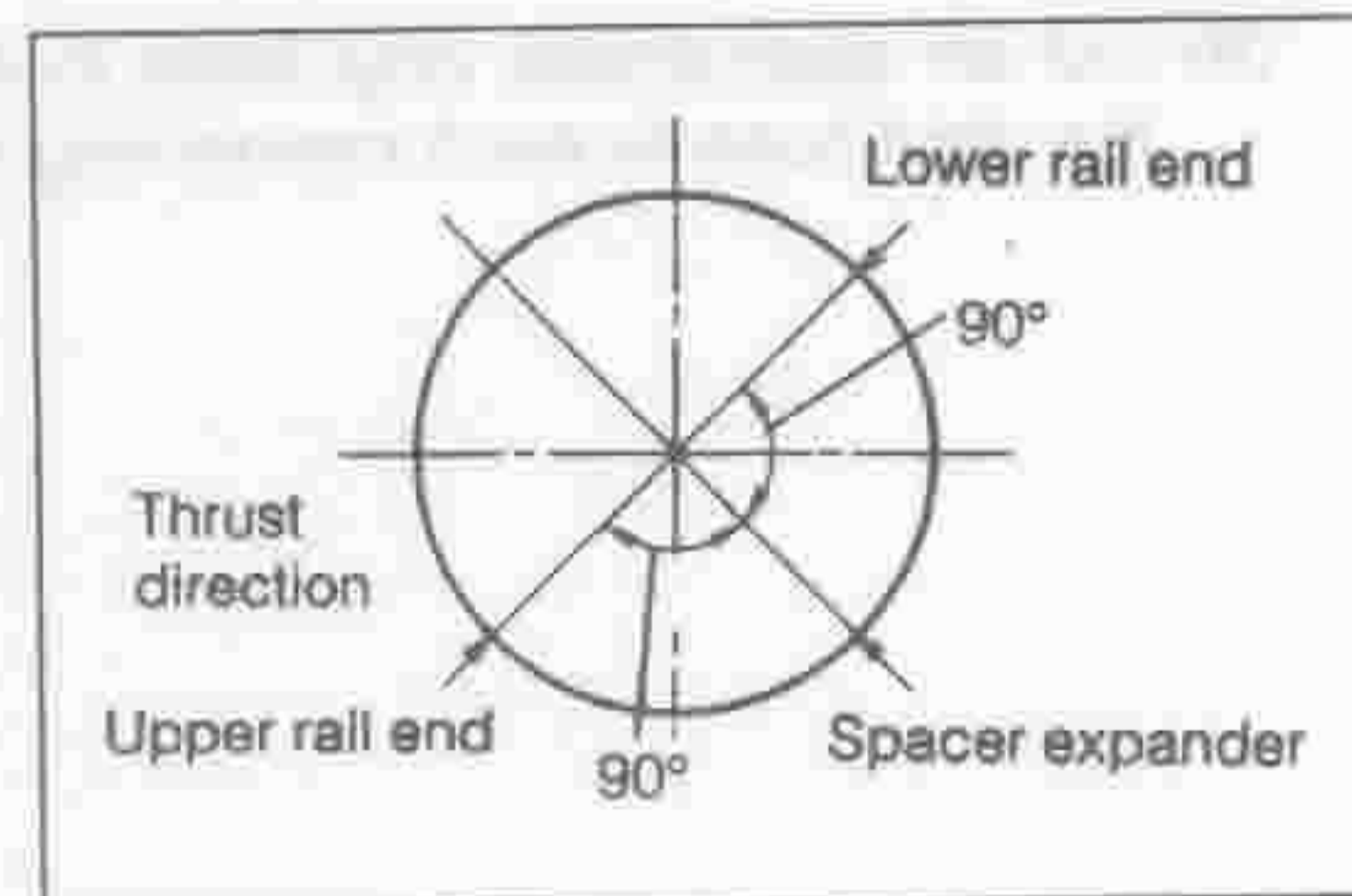
(3) Fit the upper rail into position in such a manner that it is wound up while pushing the edge section of the oil ring spacer expander with your thumb.



LEM00406-00372

## NOTE:

- Ensure that the rail end is deviated 90 degrees to the left from the end of the oil ring spacer expander.
- Do not expand the rail to an extent more than necessary.

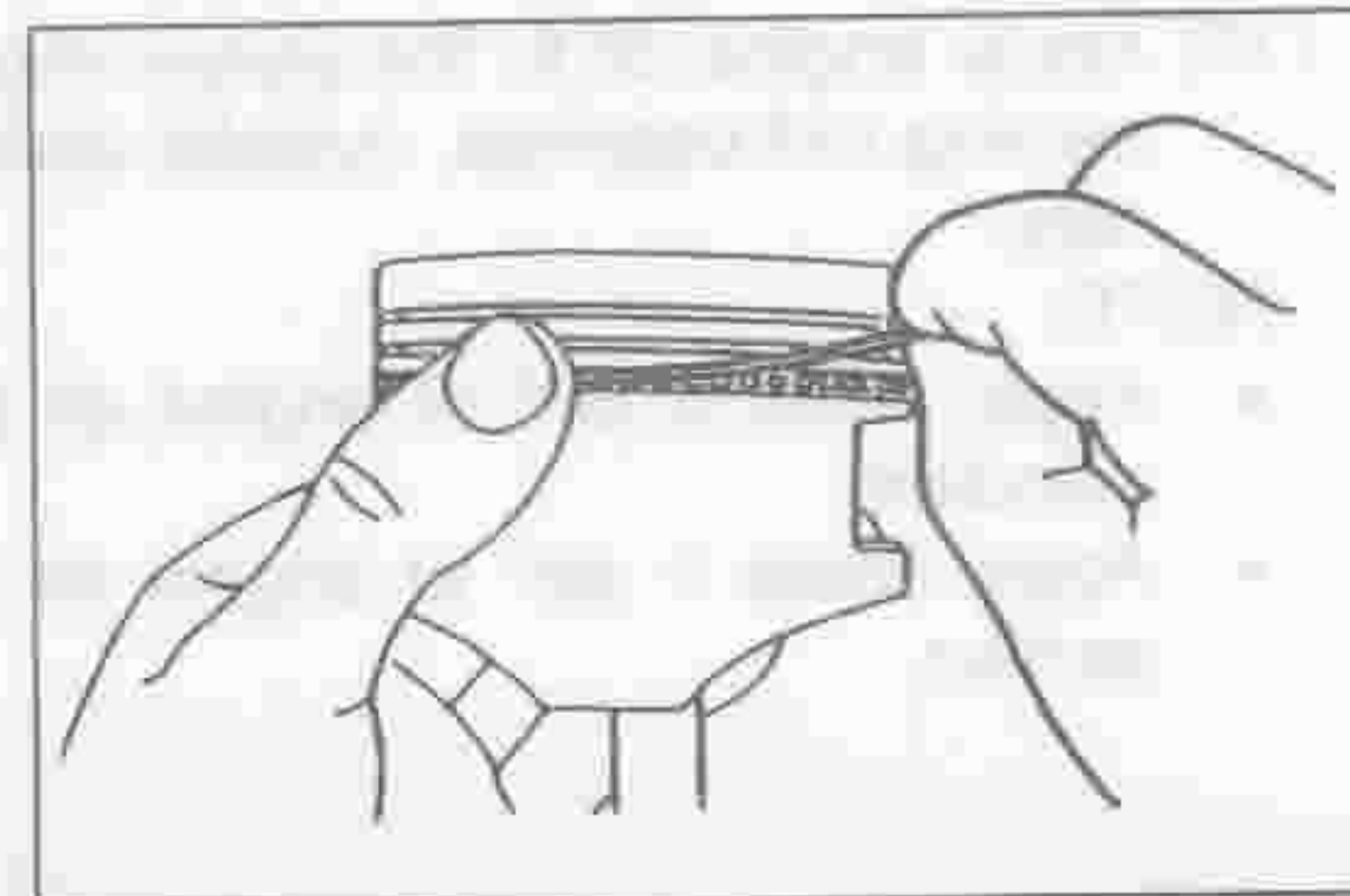


LEM00407-00373

(4) Fit the lower rail into position in such a manner that it is wound up.

## NOTE:

- Ensure that the rail end is deviated 90 degrees to the right from the end of the oil ring spacer expander.
- Do not expand the rail to an extent more than necessary.
- Make sure that the oil ring can be rotated smoothly.



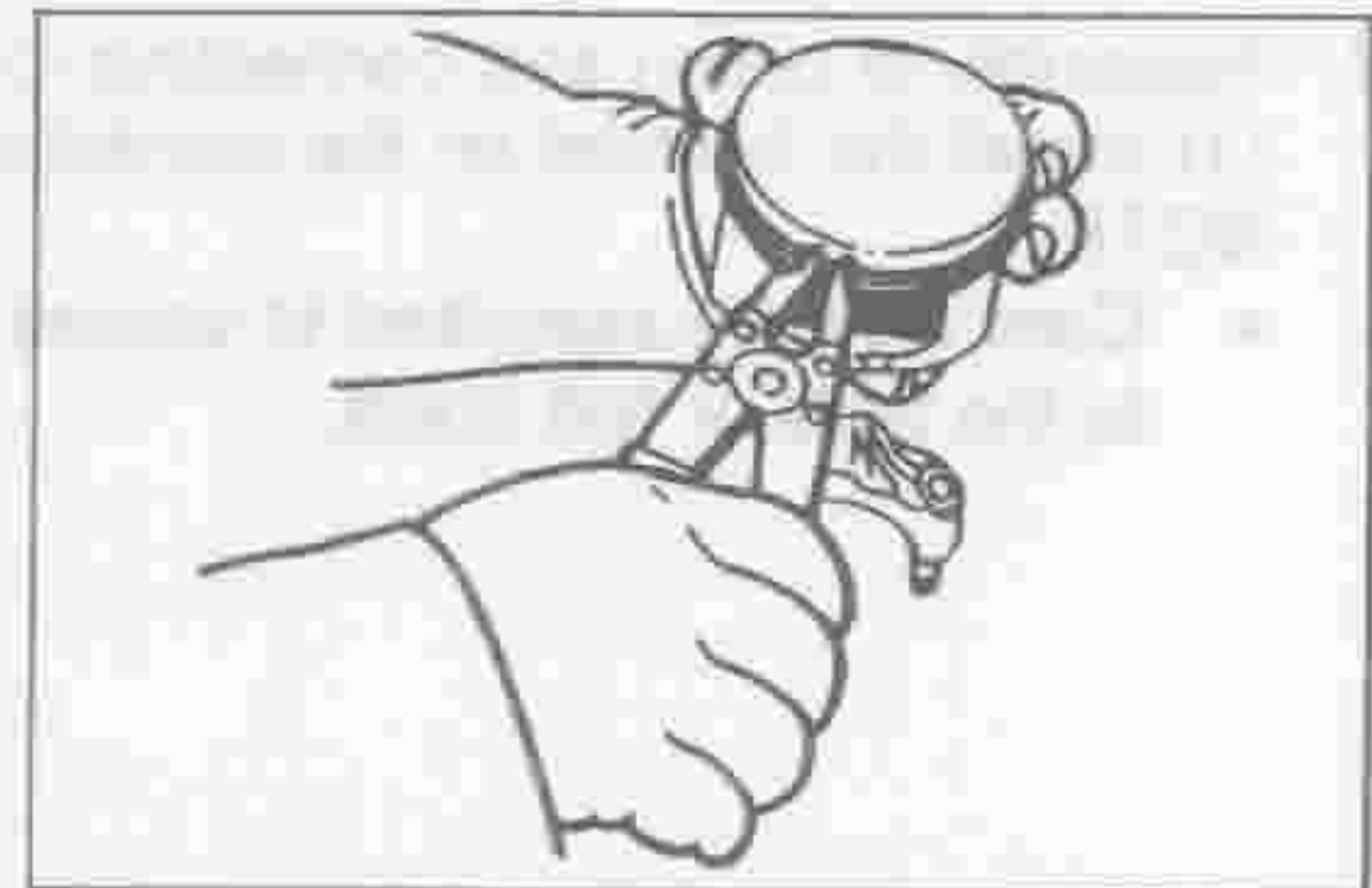
LEM00408-00374

(5) Install the compression ring No. 2 with the stamped mark of T, 2T, N or 2N facing upward, using a piston ring expander.

**NOTE:**

- Do not expand the piston ring to an extent more than necessary.

(6) Install the compression ring No. 1 with the stamped mark of T or N facing upward, using a piston ring expander.

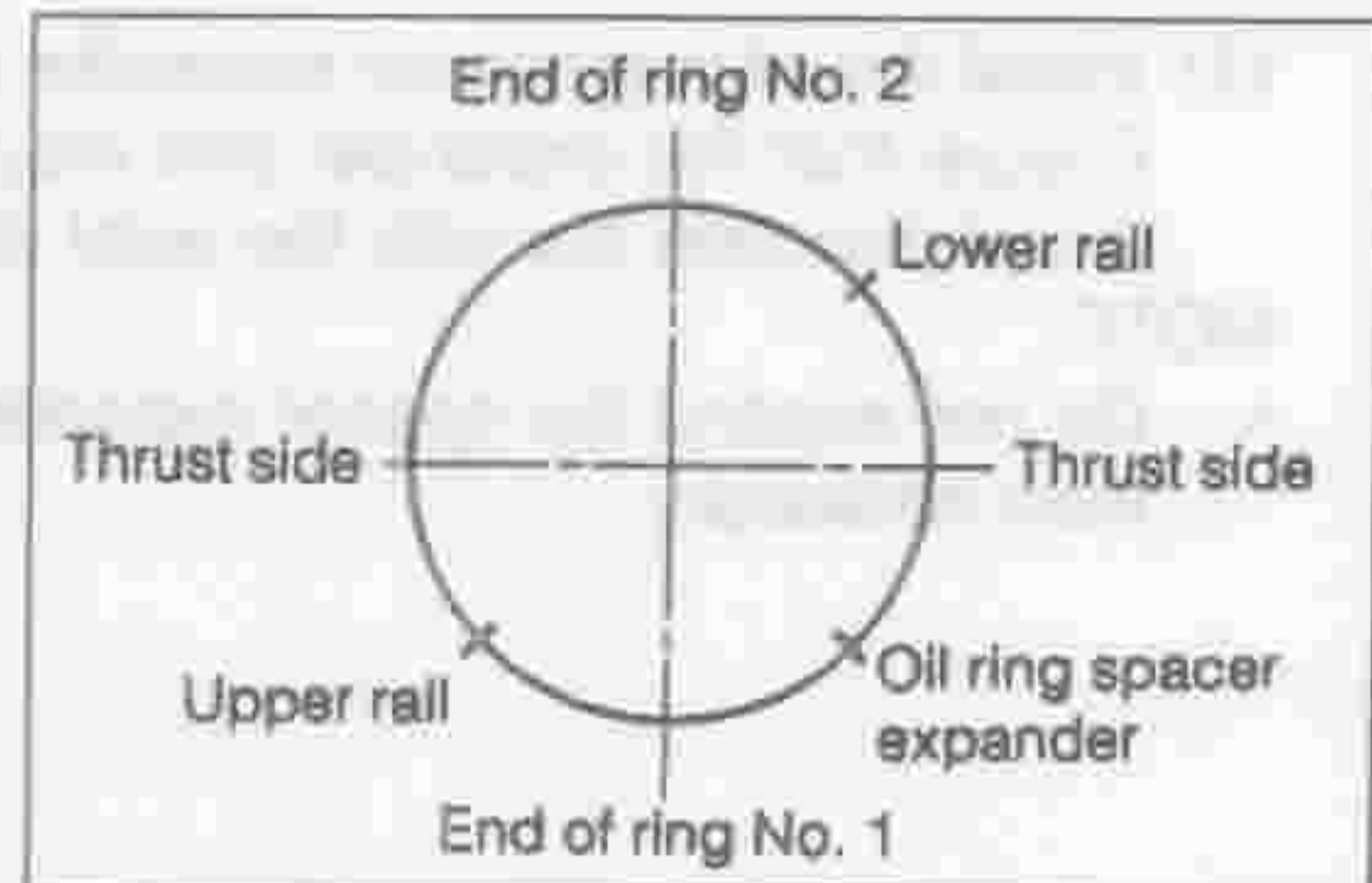


LEM00409-00375

(7) Position the piston rings so that each ring end may come at the respective points as indicated in the right figure.

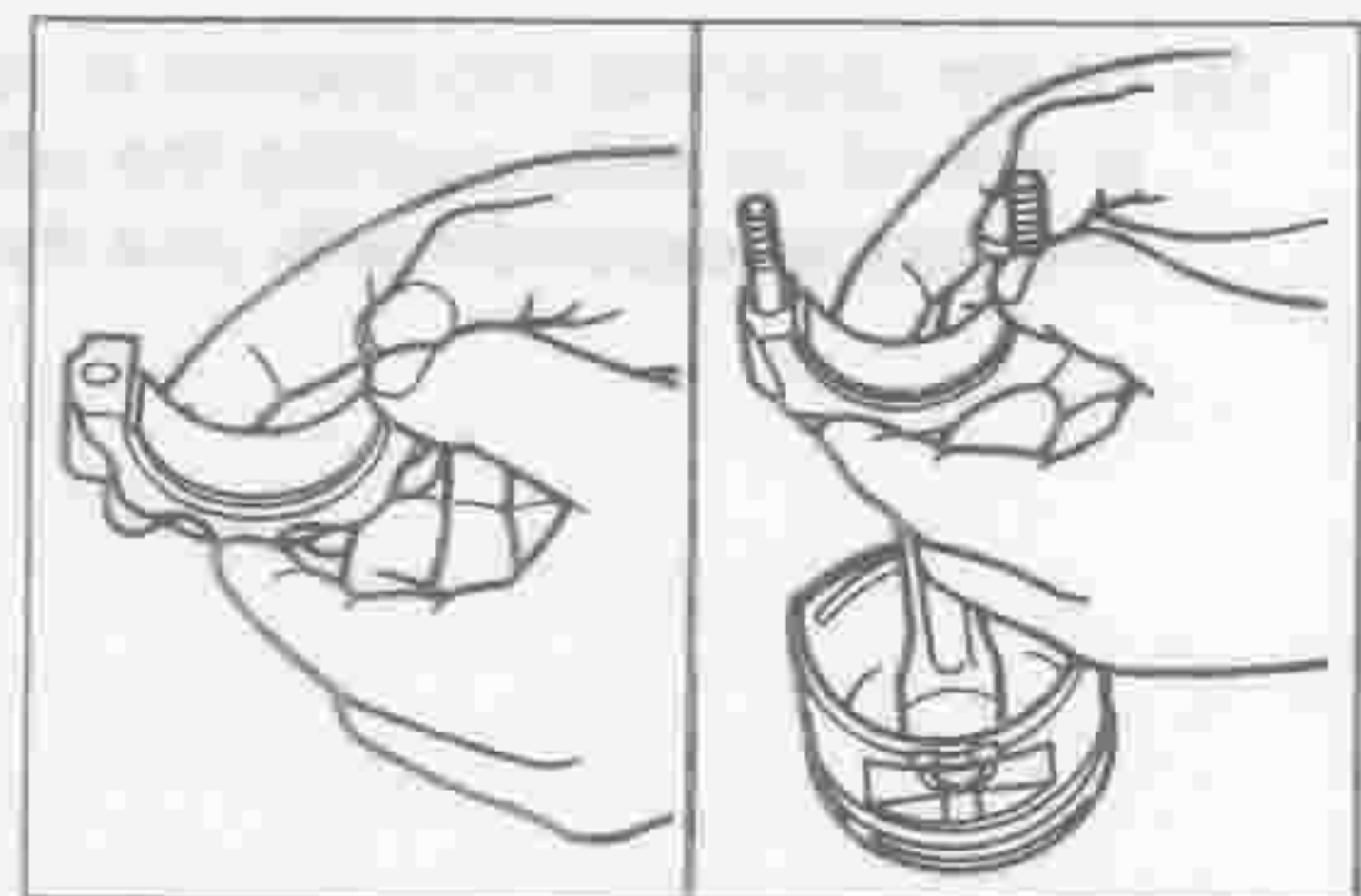
**NOTE:**

- It is not necessarily required to follow strictly the right figure. However, be sure that the ring end is not lined up with the thrust direction. Also, each ring should be deviated about 120 to 180 degrees from the adjacent ring.



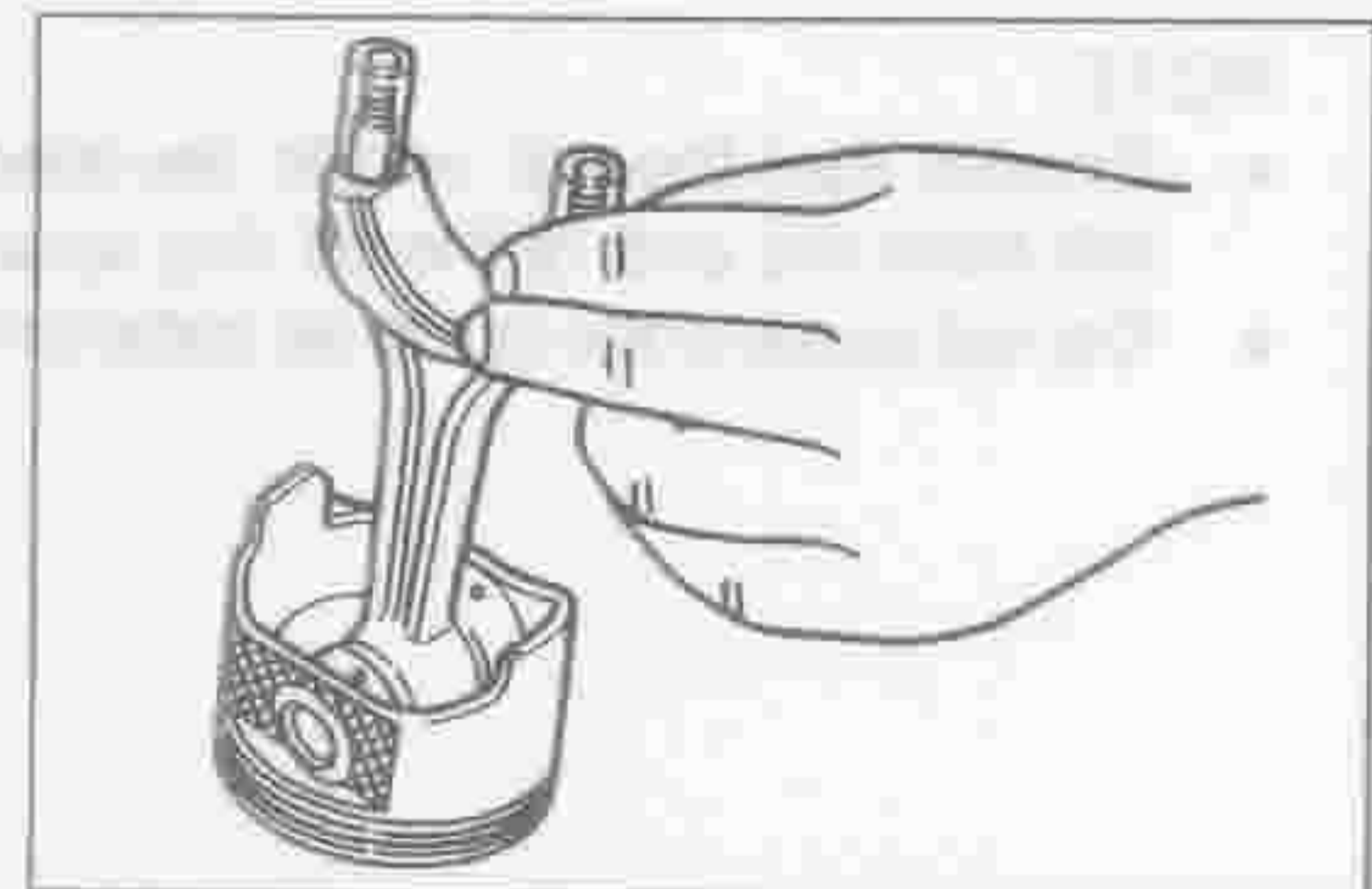
LEM00410-00376

(8) Install the connecting rod bearings on the connecting rod and connecting rod cap, making sure that your fingers will not touch with the front and back surfaces of the bearings.



LEM00411-00377

(9) Cut an appropriate vinyl hose to a suitable length. Fit the vinyl hose to each connecting rod bolt sections.

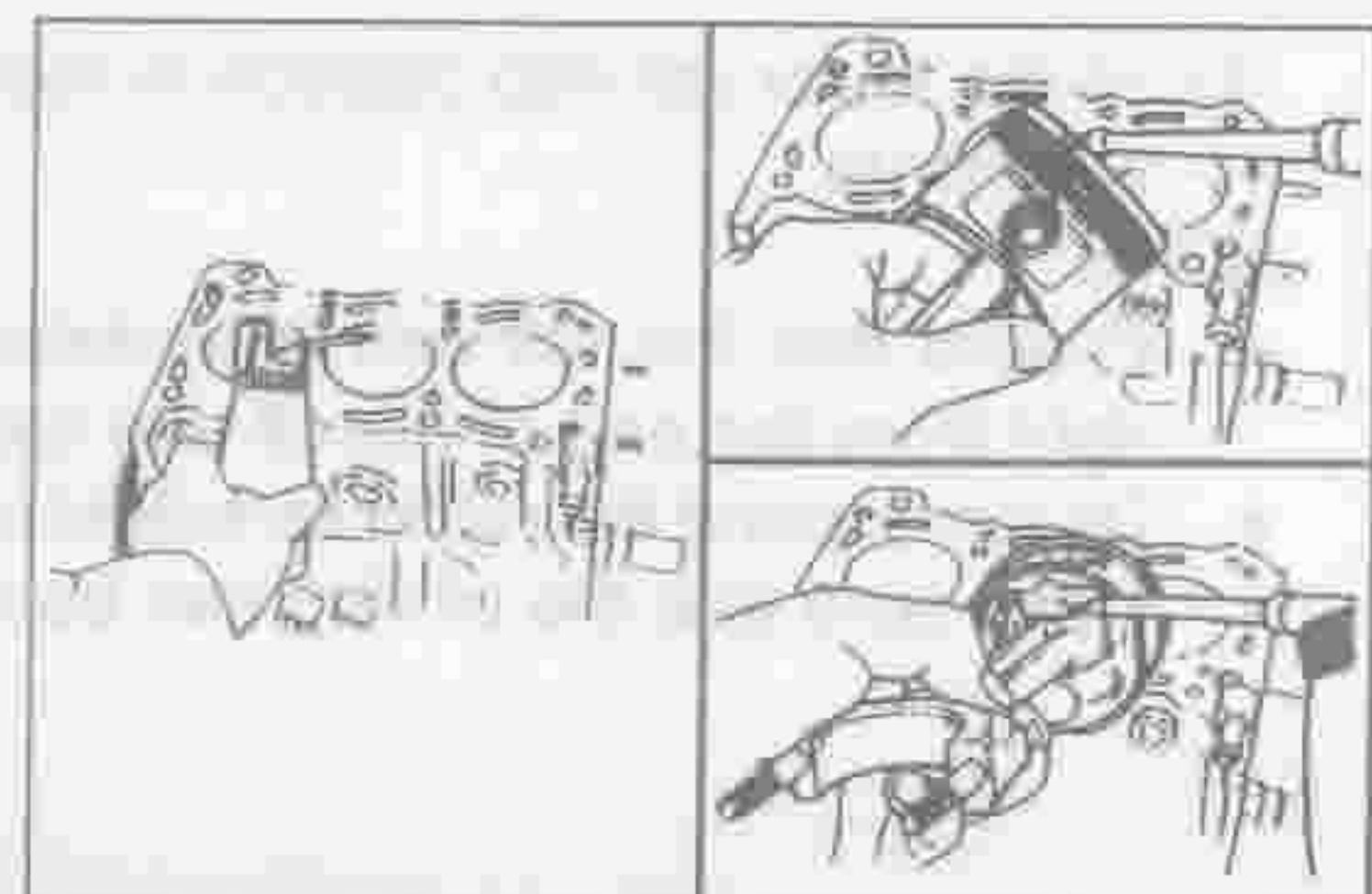


LEM00412-00378

(10) Apply engine oil to the piston rings, piston pins, connecting rod bearings, cylinder walls and crankpin journals.

**NOTE:**

- Apply about 5 cm<sup>3</sup> of engine oil to each bore of the cylinders.
- Apply about 1 cm<sup>3</sup> of engine oil to each piston ring section.



LEM00413-00379

- (11) Compress the piston rings by means of the piston ring compressor SST, making sure that the piston ring ends will not move during the installation.

SST: 09217-87001-000

- (12) Push the piston by hand into the cylinder bore with the front mark facing toward the oil pump side.

**NOTE:**

- Be very careful to avoid damaging the connecting rod bearings during the installation.
- Care must be exercised to ensure that the crankpin journal is not scratched by the connecting rod.

- (13) Push the piston with a suitable tool, until the connecting rod reaches the crankpin journal.

- (14) Apply engine oil to the bearing surface of each connecting rod bearing.

**NOTE:**

- Do not touch with the bearing front surface.

- (15) Remove the vinyl hoses which were attached to the connecting rod bolt sections.

- (16) Install the connecting rod cap with the front mark facing toward the oil pump side.

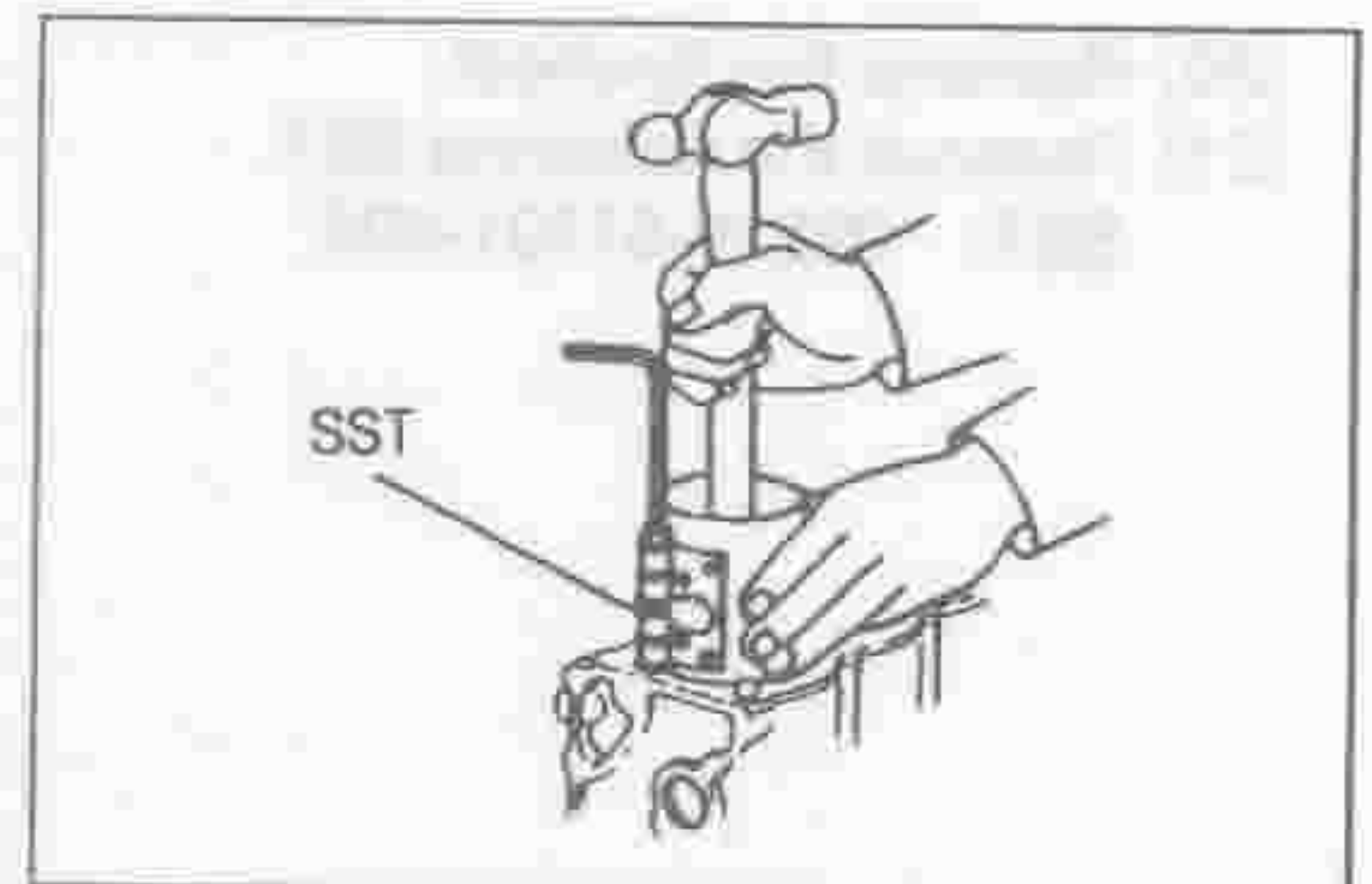
- (17) Prevent the crankshaft from turning, using the following SST.

SST: 09210-87701-000

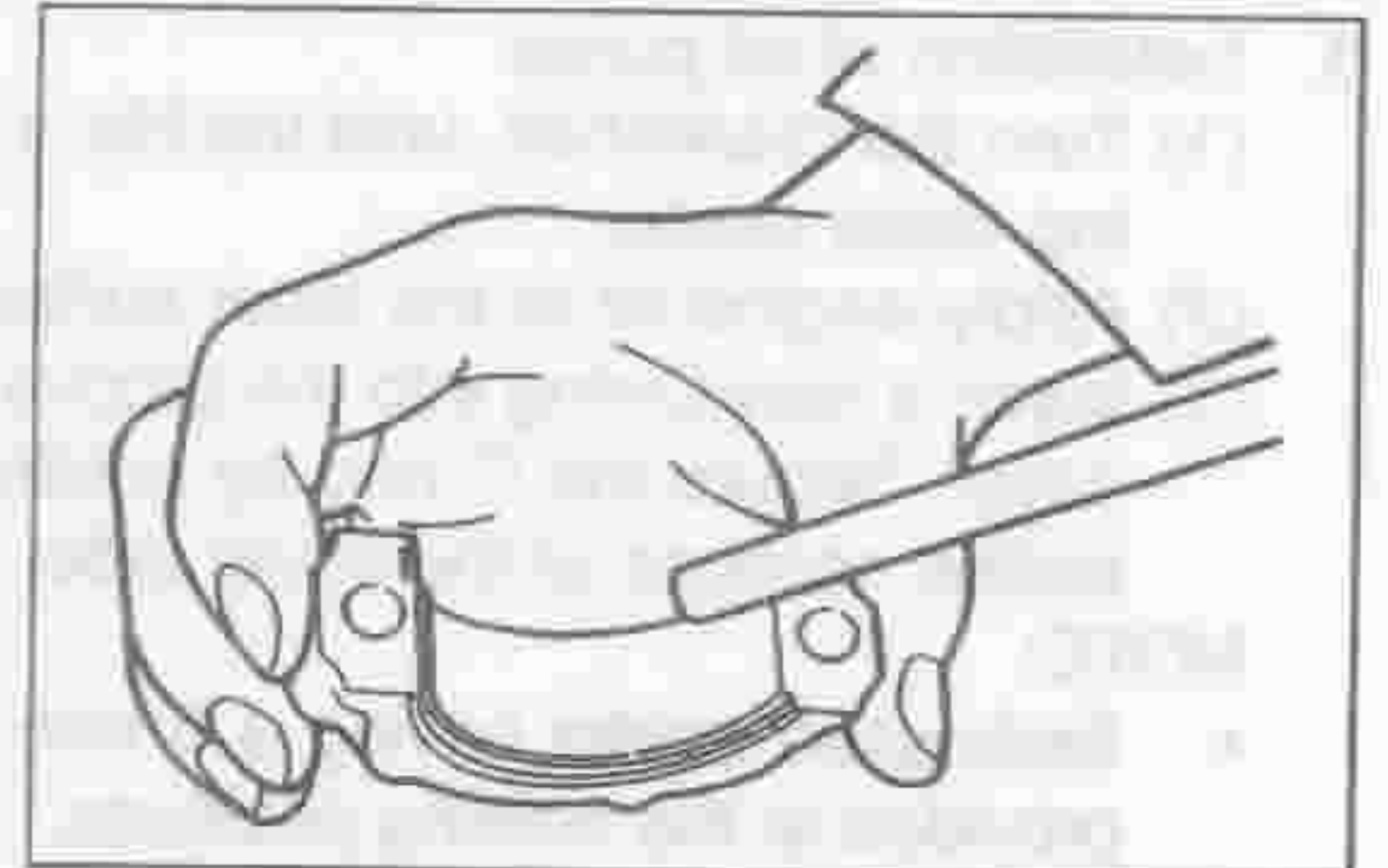
- (18) Thinly apply engine oil to the connecting rod cap attaching nuts. Tighten the nuts to the specified torque evenly over two or three stages.

Tightening Torque:  $36.3 \pm 5.9$  N·m  
( $3.70 \pm 0.60$  kgf·m)

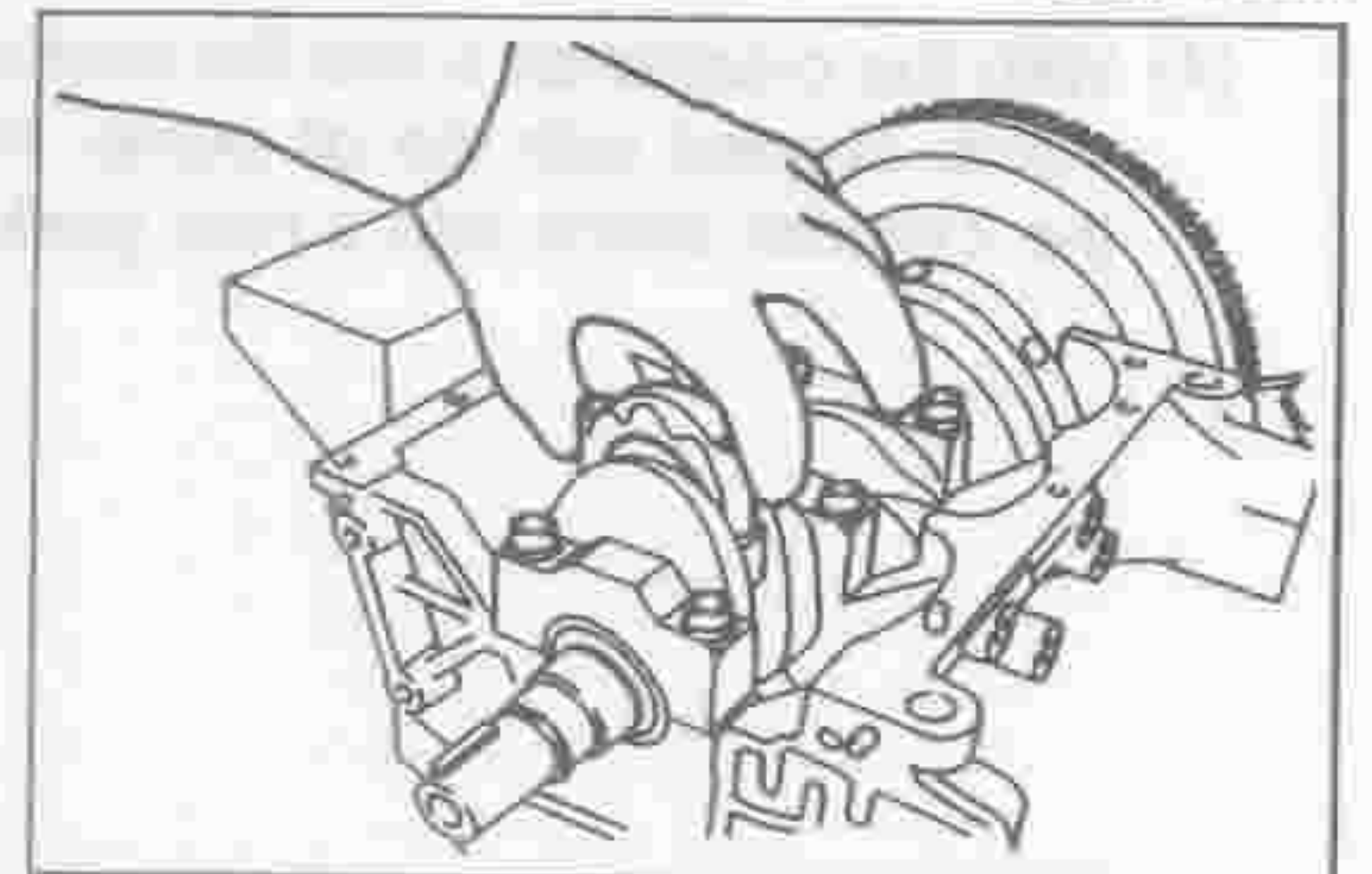
- (19) Perform the operations described in the steps (1) through (18) for each cylinder.



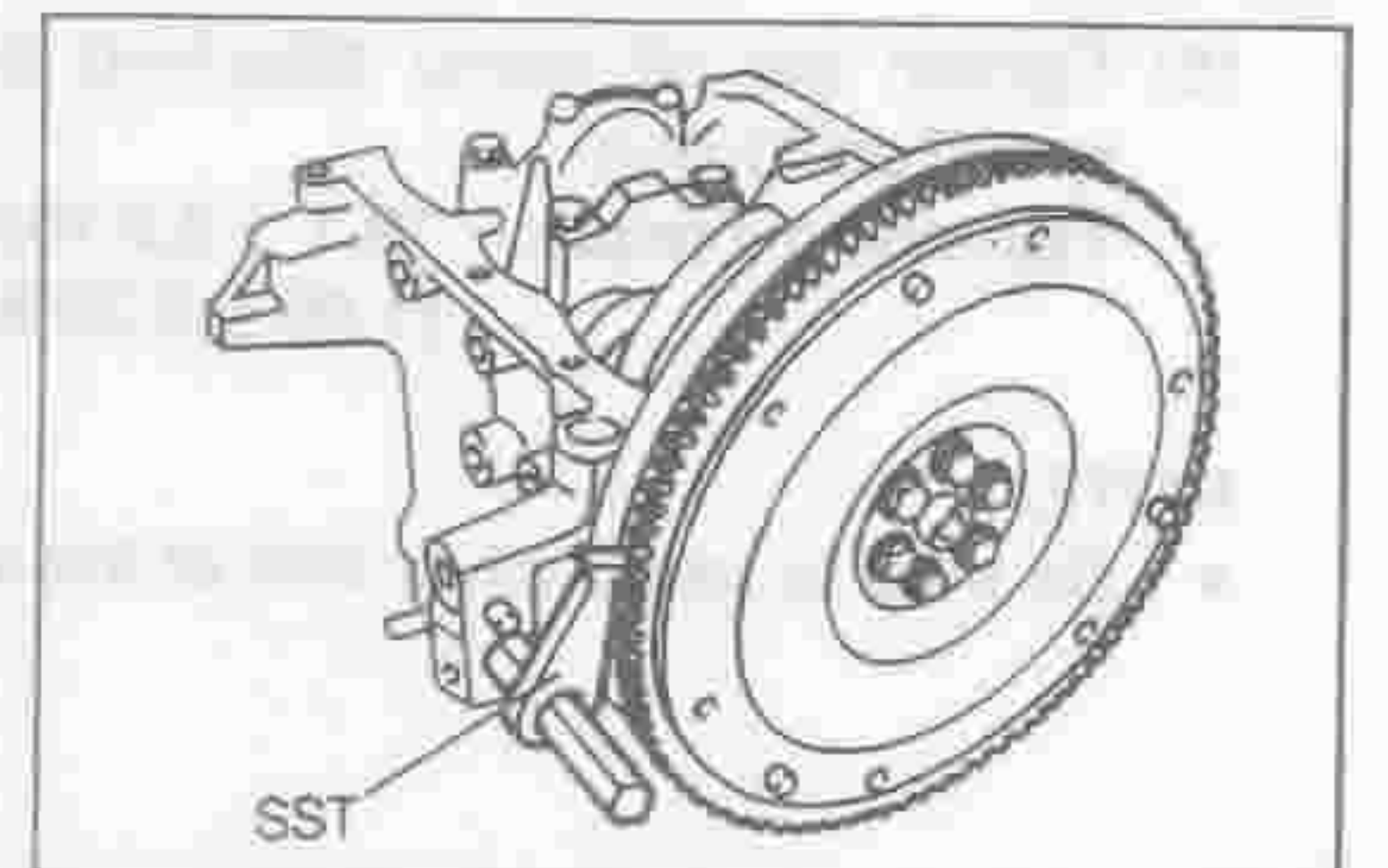
LEM00414-00380



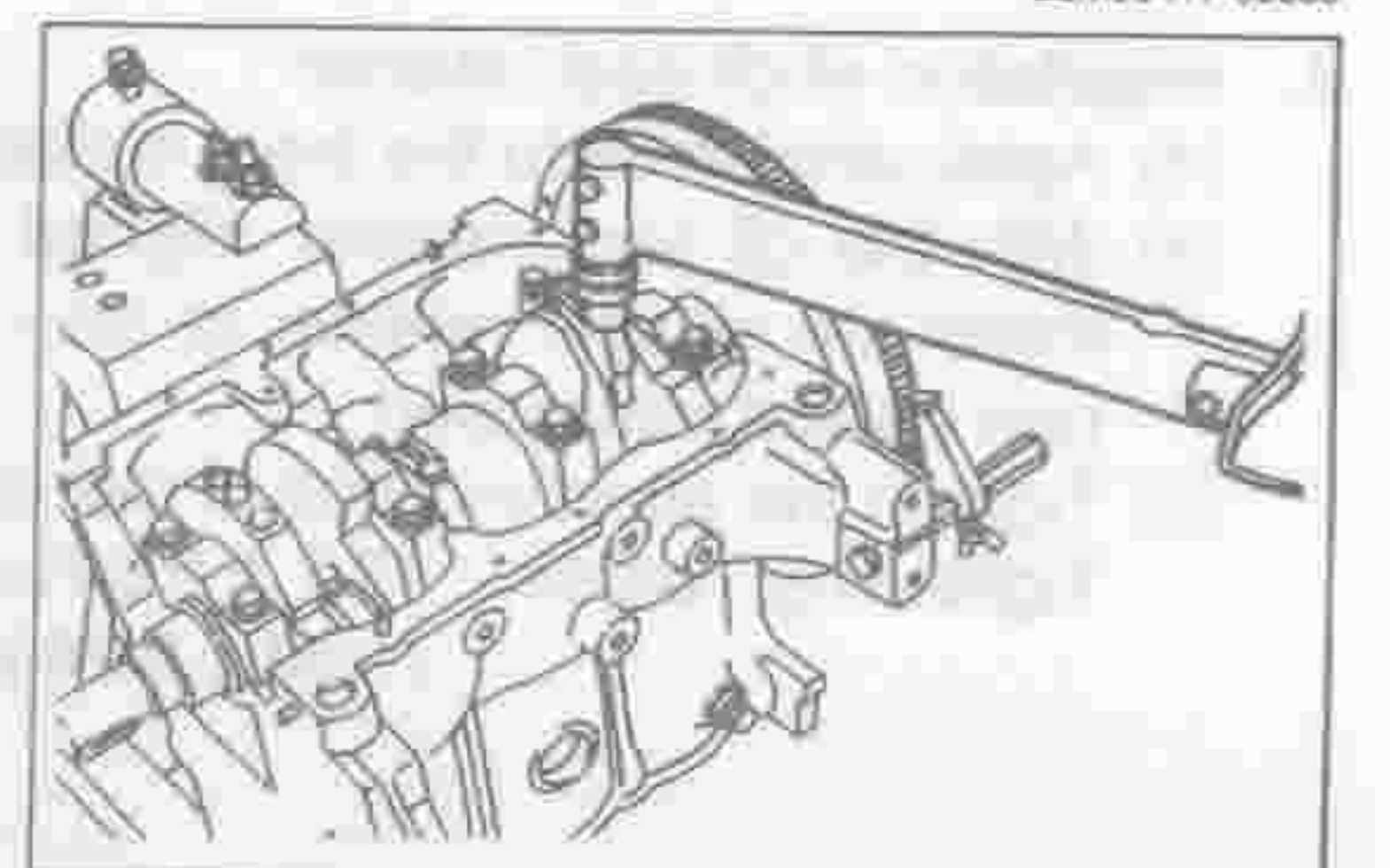
LEM00415-00381



LEM00416-00382



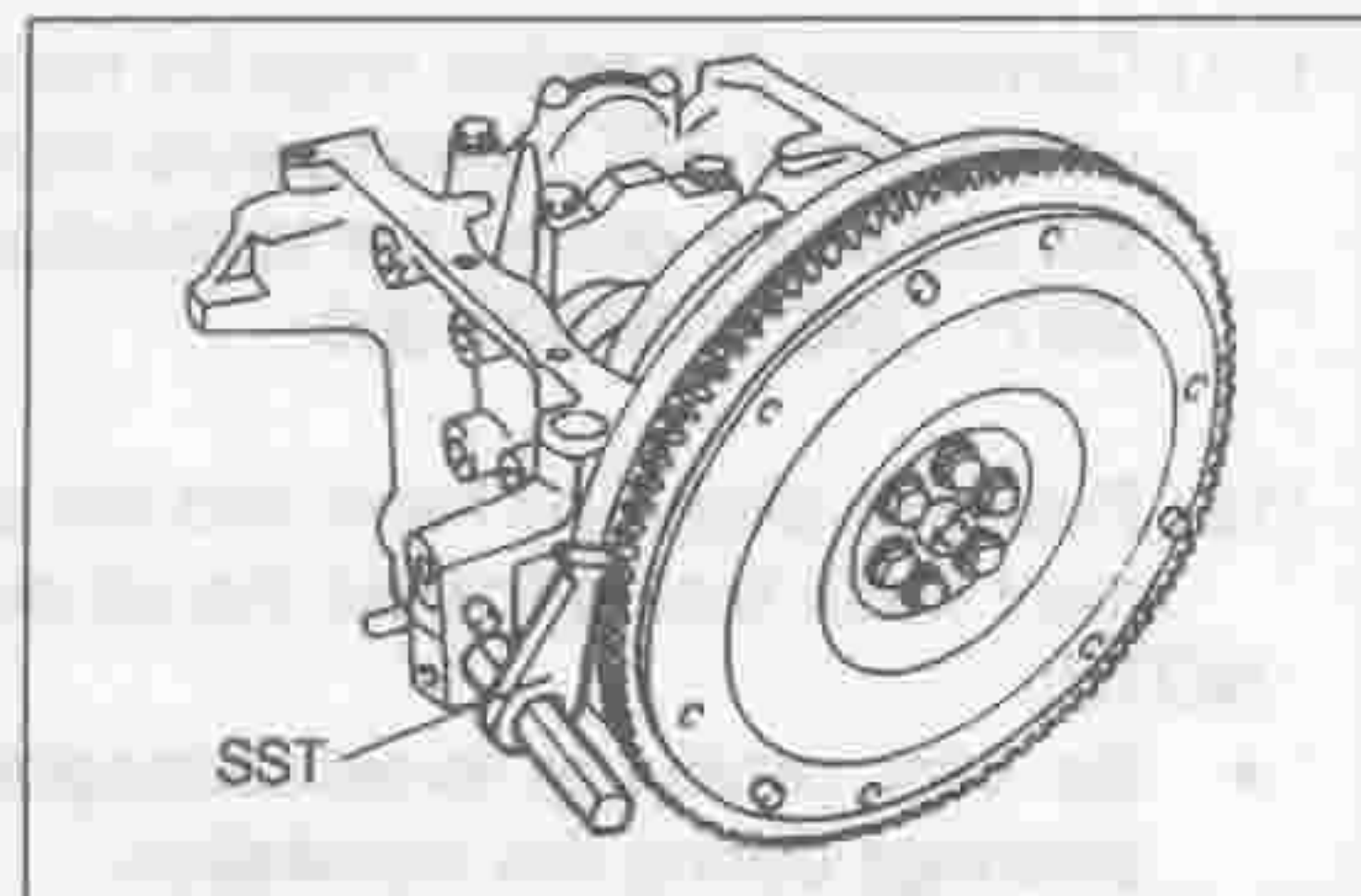
LEM00417-00383



LEM00418-00384

# EM-100

- (20) Remove the flywheel.
- (21) Remove the following SST.  
SST: 09210-87701-000

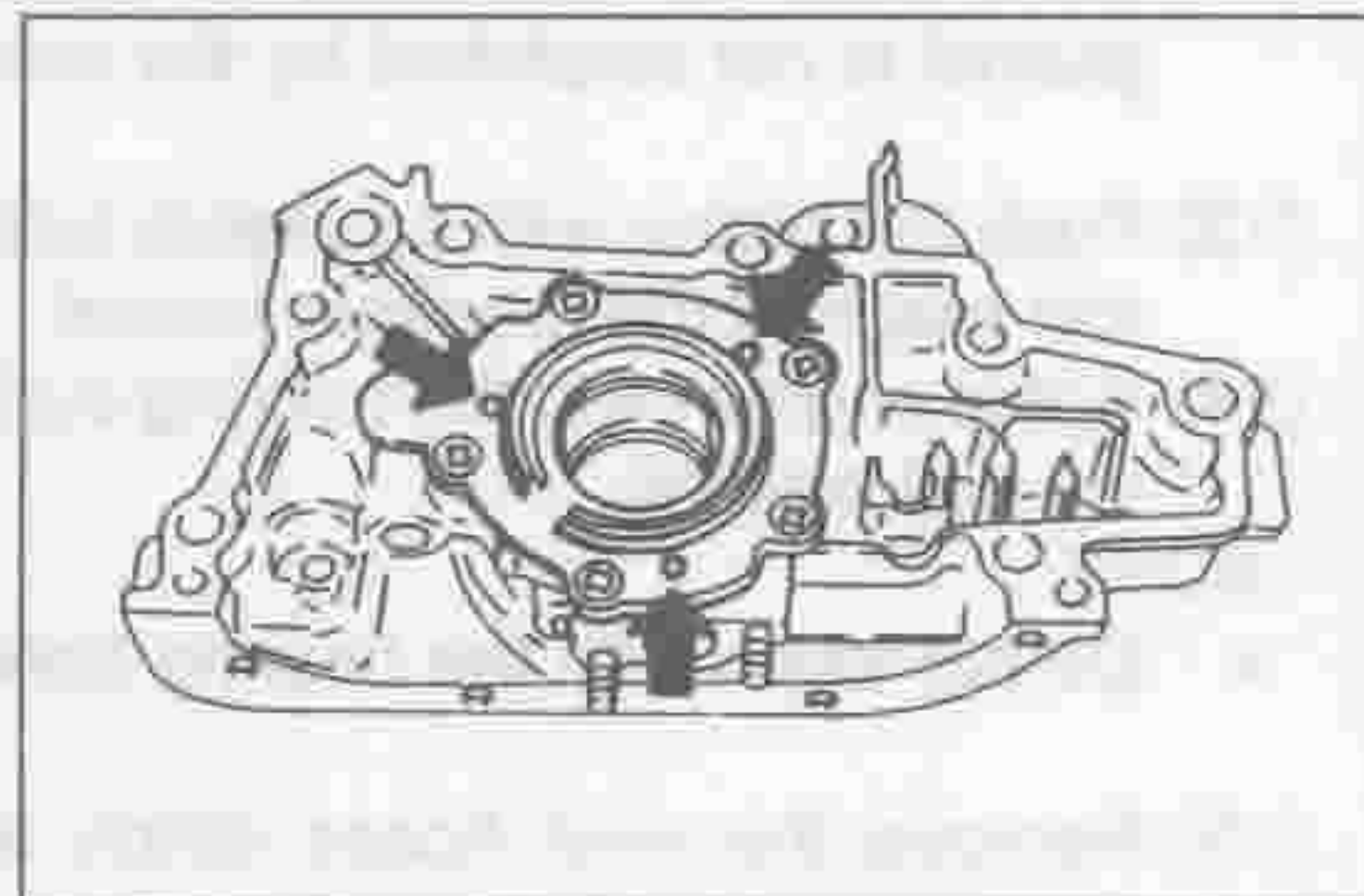


LEM00419-00385

- 3. Installation of oil pump
  - (1) Turn the crankshaft, until the No. 1 cylinder is set to the top dead center.
  - (2) Apply engine oil to the inner surface of the oil seal.
  - (3) Insert a new O-ring into the groove section of the pump cover. Secure the O-ring by holding it at the three projection sections at the cover side.

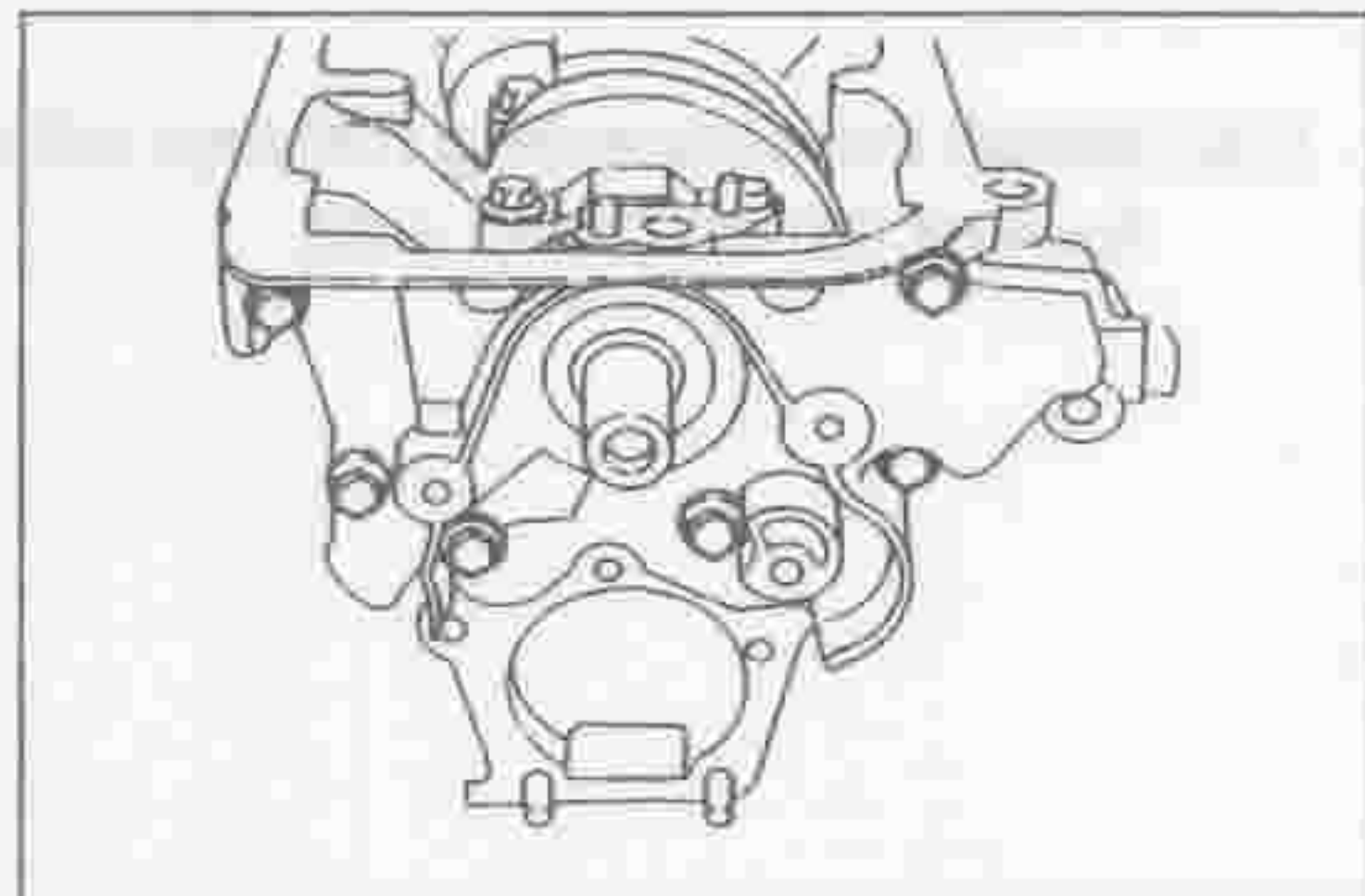
**NOTE:**

- Embossed marks having a 5 mm diameter have been provided at the holding positions.



LEM00420-00386

- (4) With the crankshaft's two-flat sections for driving the oil pump aligned with the oil pump, install the oil pump to the cylinder block with a new gasket interposed.



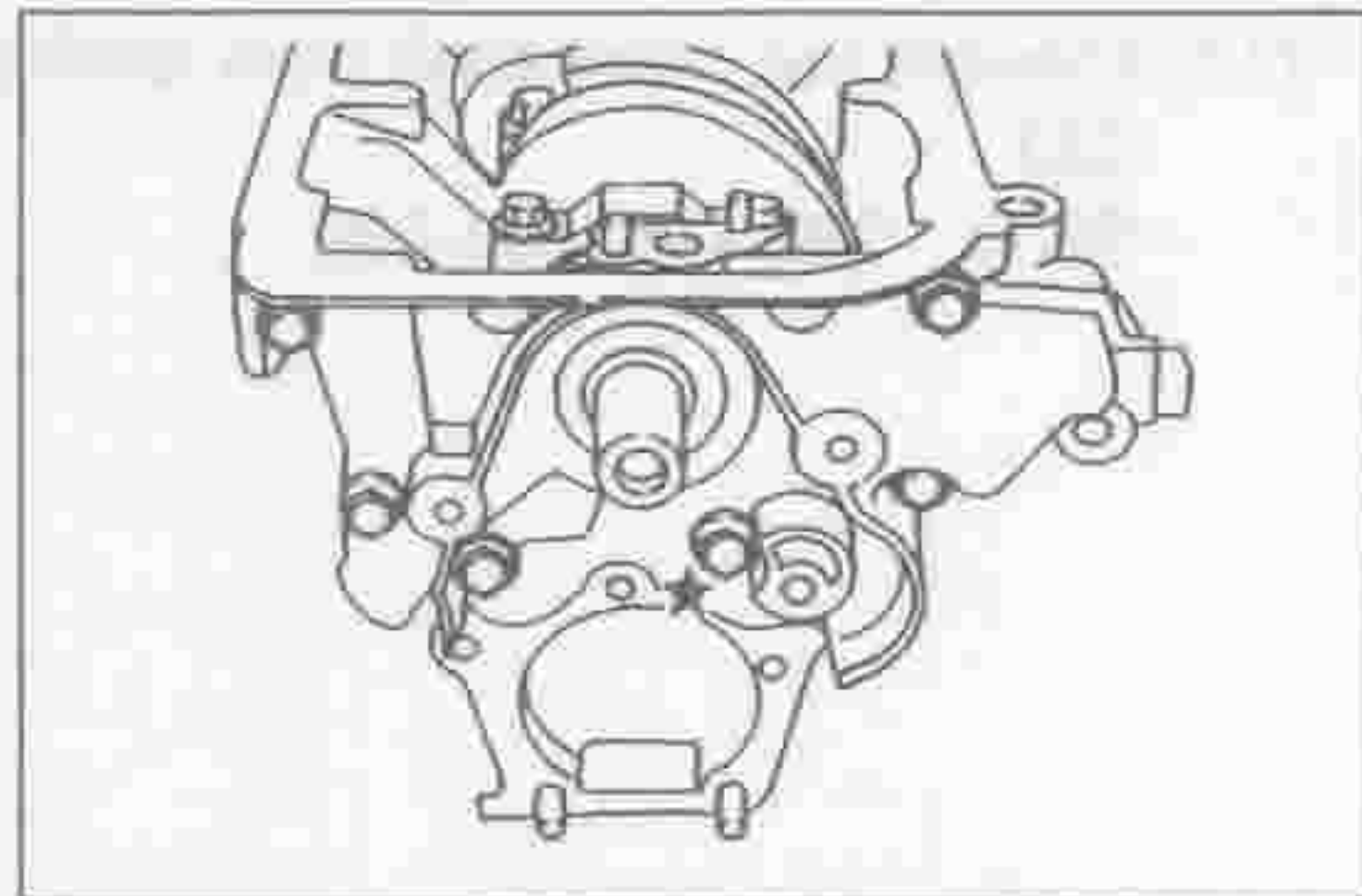
LEM00421-00387

- (5) Tighten the oil pump attaching bolt and nuts to the specified torque.

Tightening Torque:  $19.1 \pm 3.8$  N·m  
( $1.95 \pm 0.39$  kgf·m)

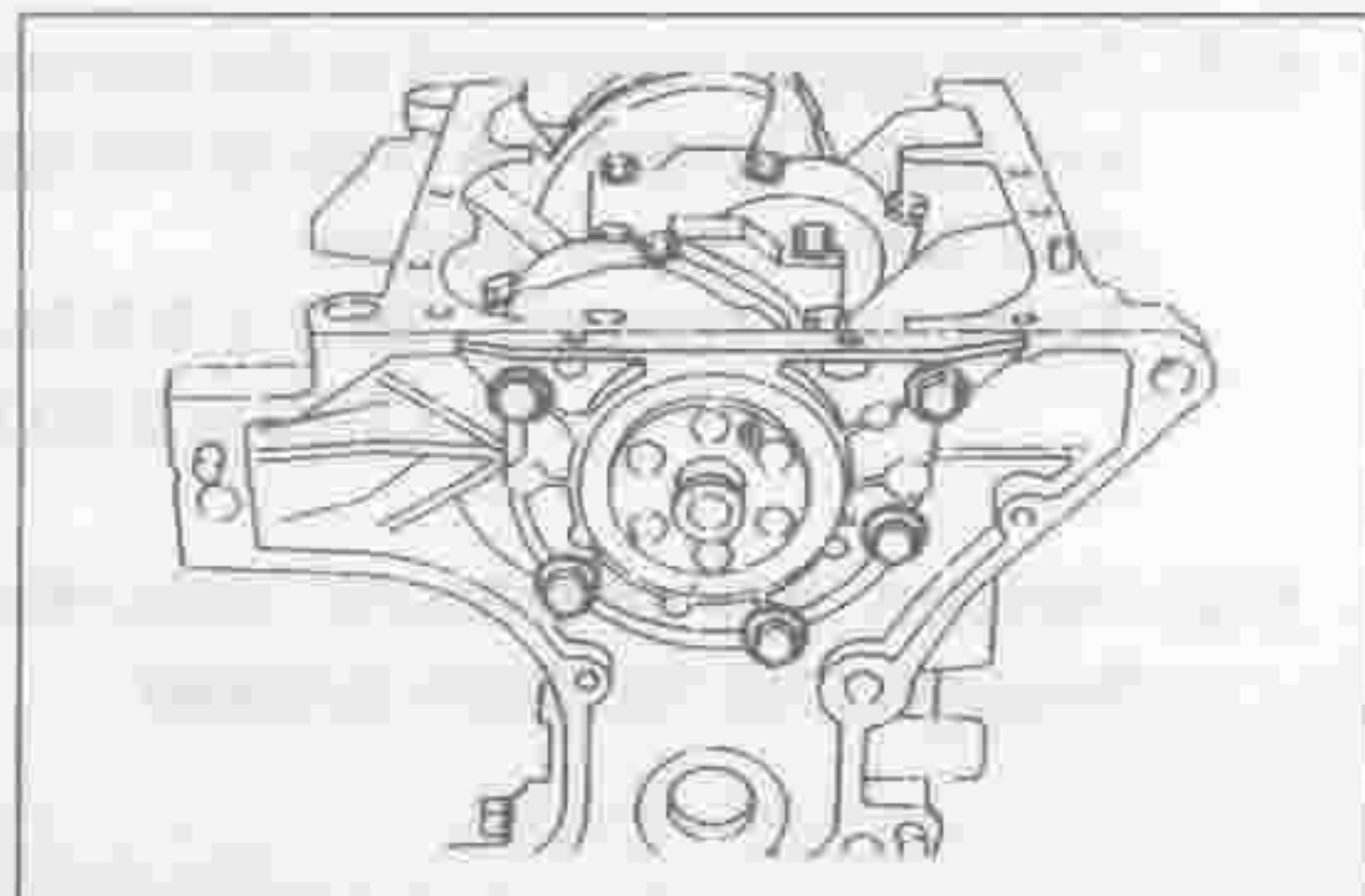
**NOTE:**

- Be sure to use a silver bolt at the asterisk (\*) mark.



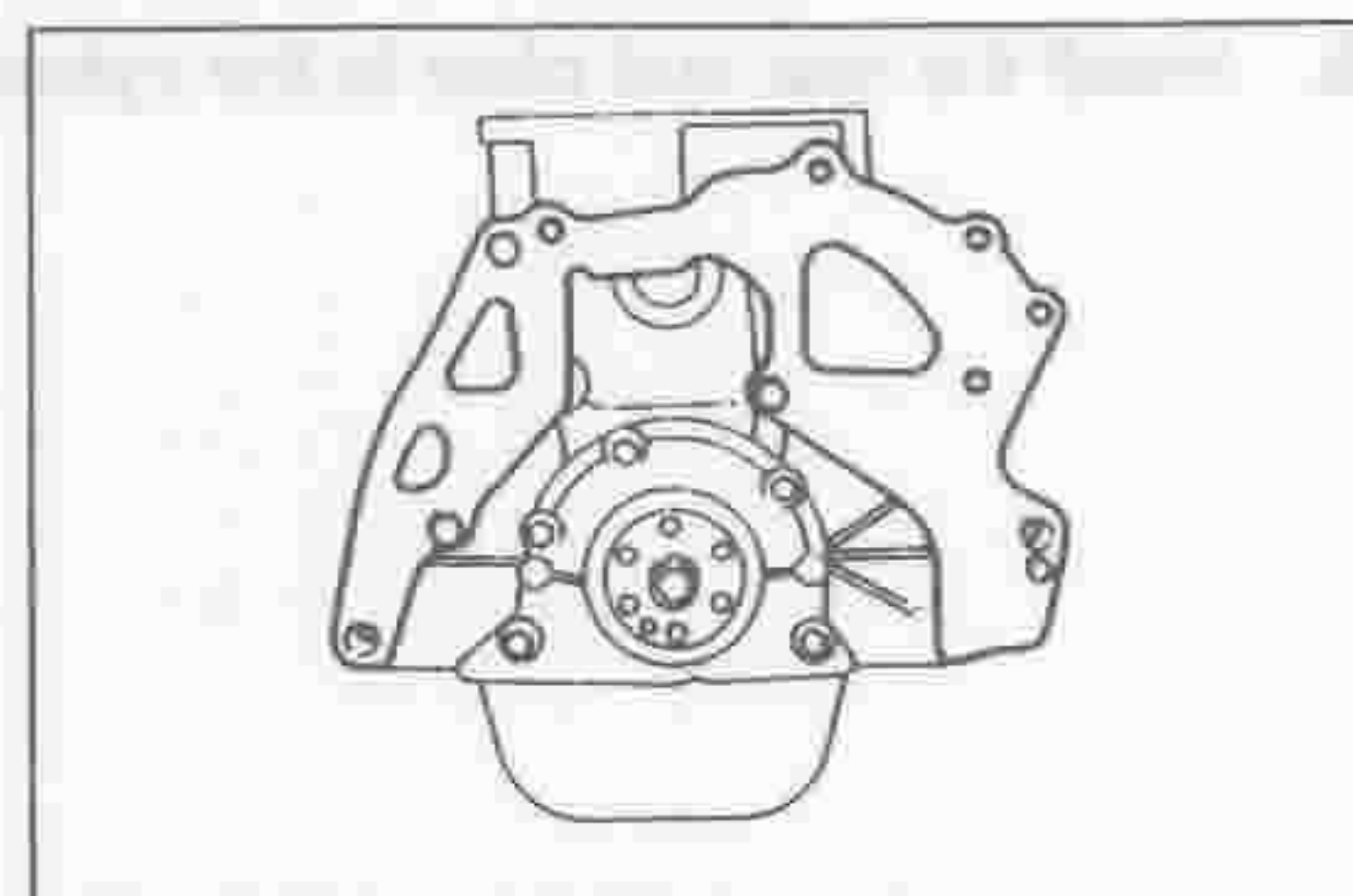
LEM00422-00388

- 4. Installation of oil seal retainer
  - (1) Apply engine oil to the inner surface of the oil seal.
  - (2) With the oil seal retainer aligned with the knock pin, install the oil seal retainer to the cylinder block with a new gasket interposed.
  - (3) Tighten the attaching bolt to the specified torque.  
Tightening Torque:  $12.7 \pm 2.5$  N·m  
( $1.30 \pm 0.26$  kgf·m)



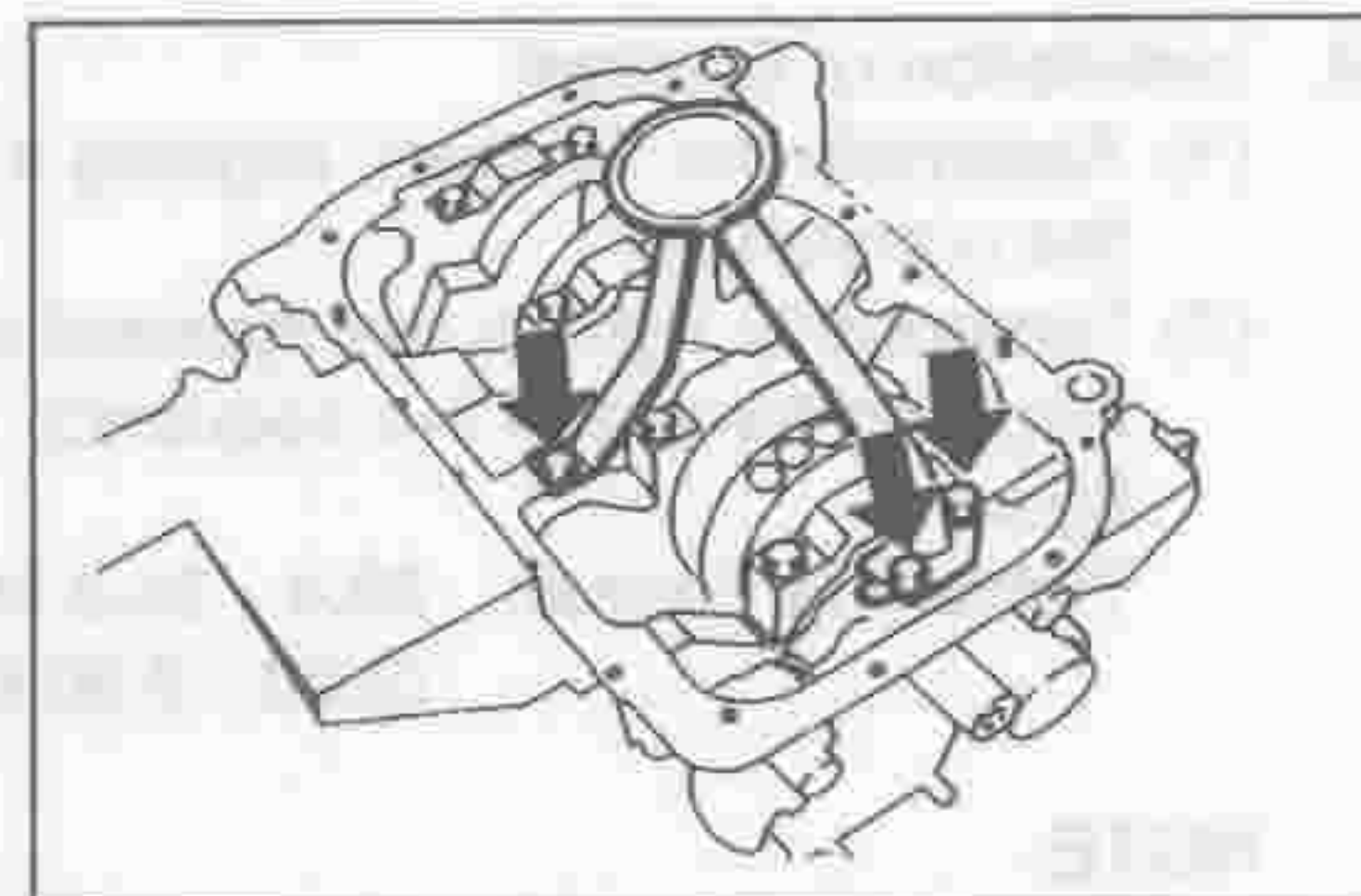
LEM00423-00389

5. Install the rear end plate.



LEM00424-00390

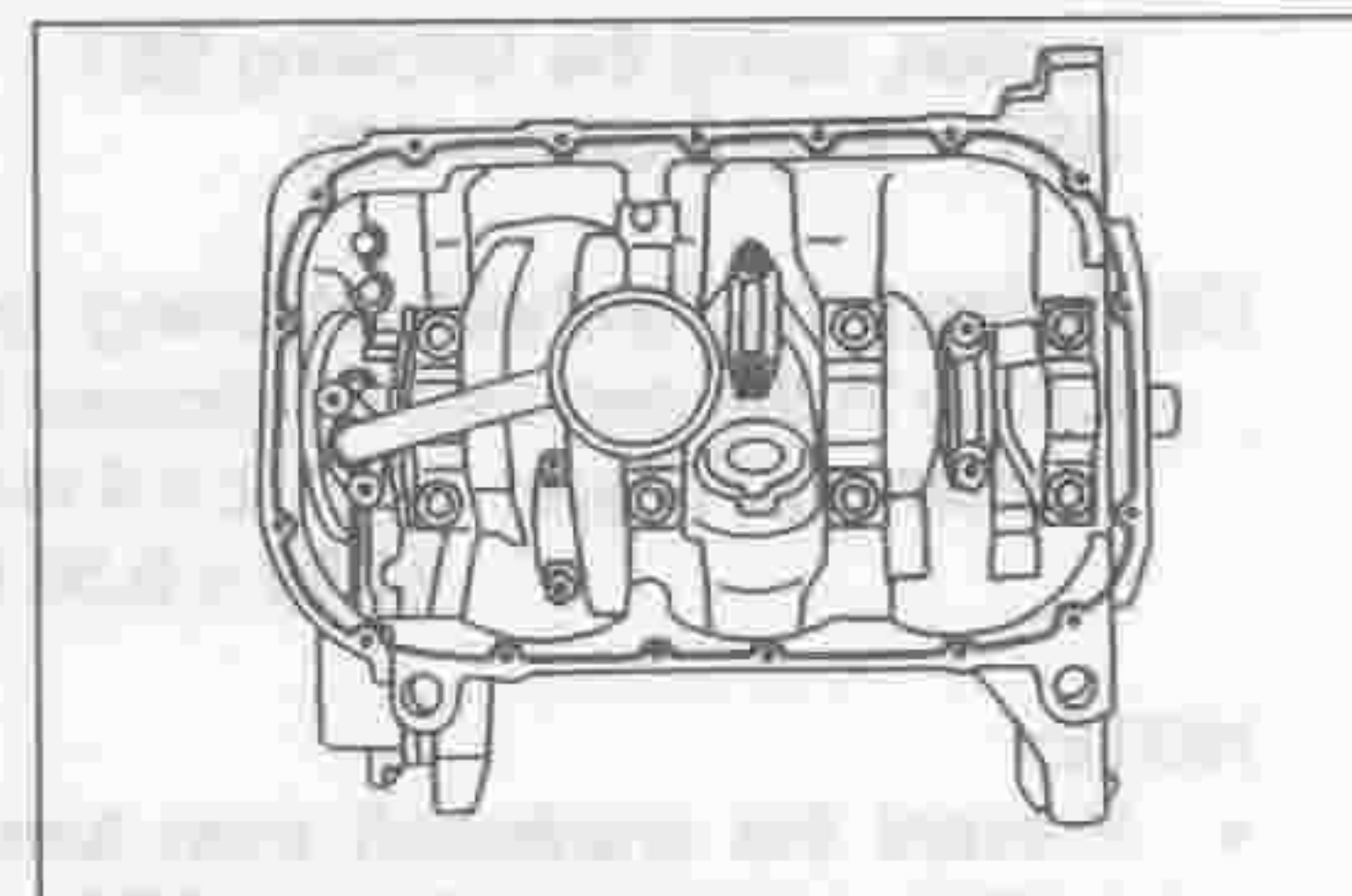
6. Install the oil pump strainer with a new gasket interposed.



LEM00425-00391

7. Installation of oil pan

- (1) Thoroughly remove any foreign matters (grease and water, etc.) from both the oil pan attaching surface of the cylinder block and the cylinder block attaching surface of the oil pan.
- (2) Apply Three Bond 1207F to the flange surface in such a way that the Three Bond sealing may be formed without any discontinued spot, in a size equivalent to a 3 mm to 4 mm diameter, following the procedure given in the right figure.



LEM00426-00392

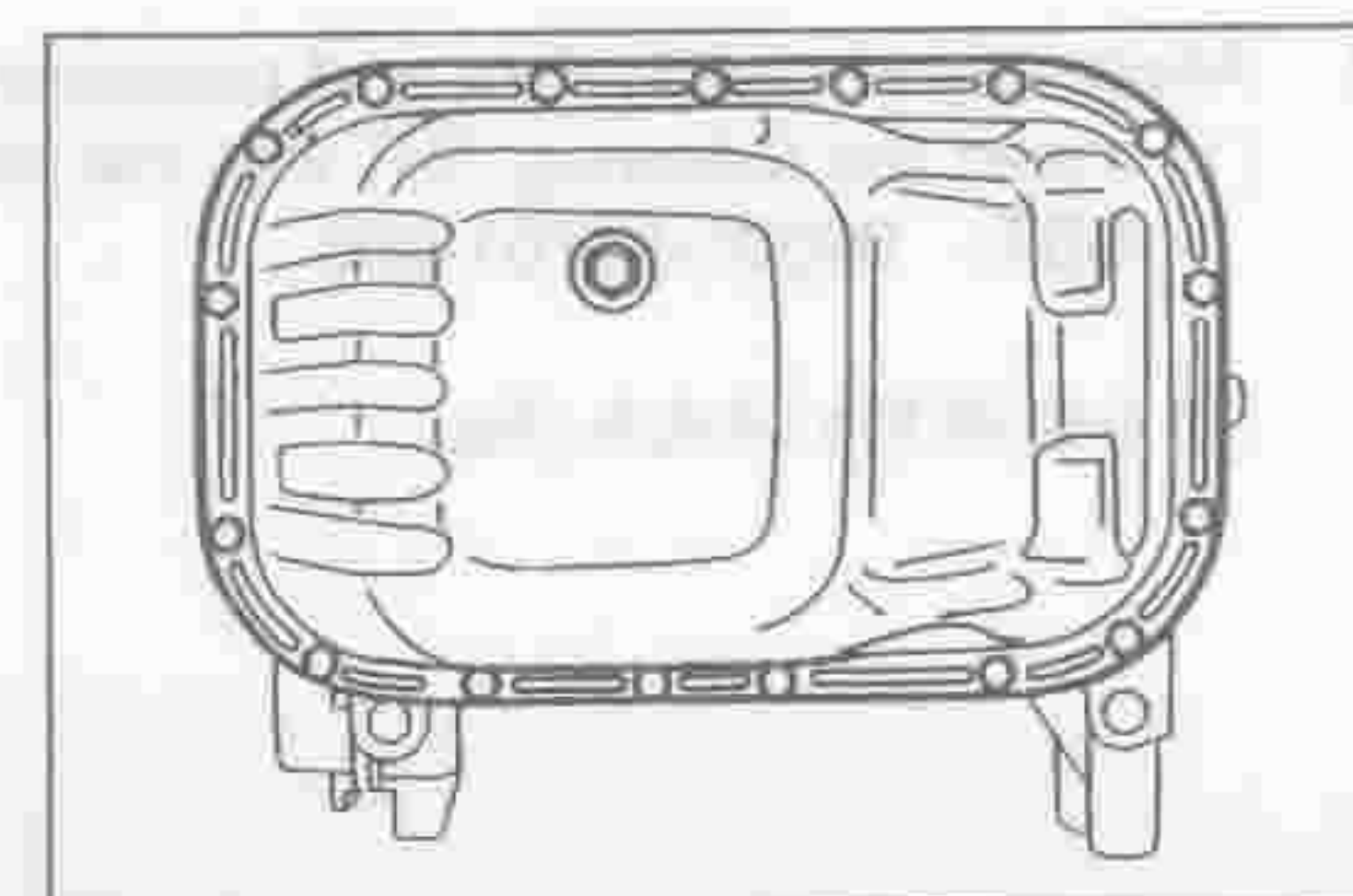
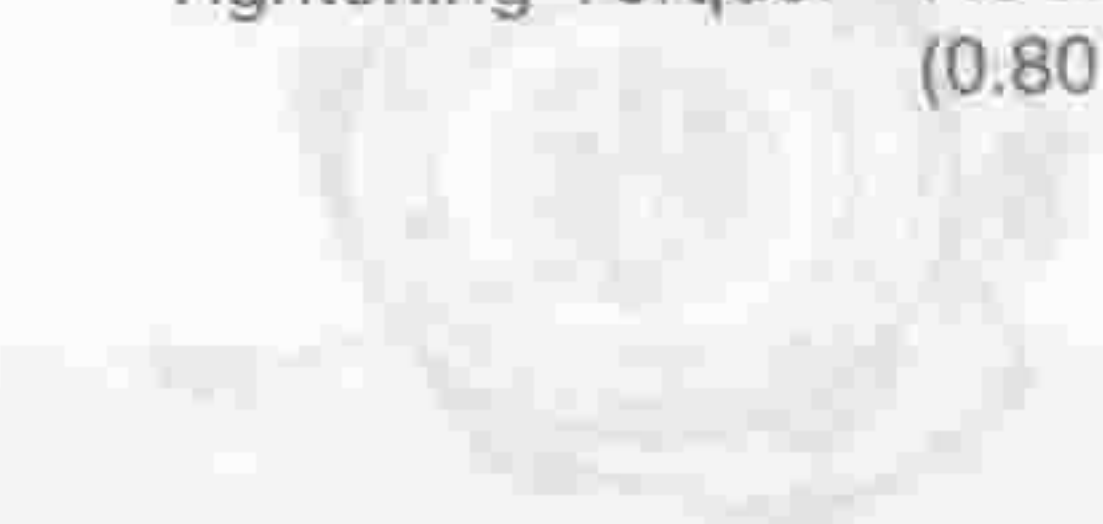
**NOTE:**

- Be sure to install the oil pan within 15 minutes after Three Bond 1207F has been applied.
- If it has elapsed more than 15 minutes, be sure to remove the sealer and redo the operation.

(3) Install the oil pan to the cylinder block.

(4) Tighten the oil pan attaching nuts and bolts to the specified torque over two or three stages.

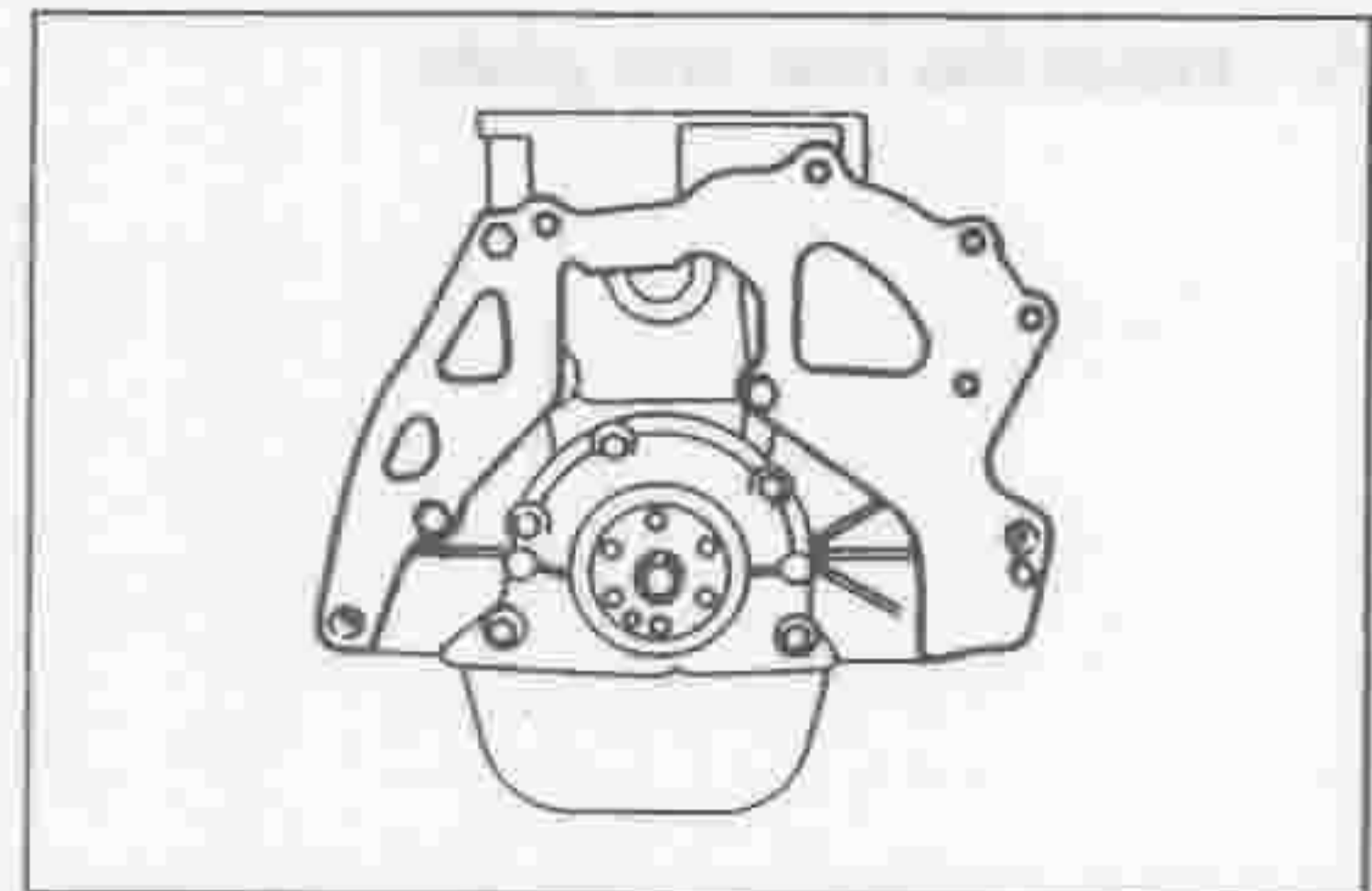
Tightening Torque:  $7.8 \pm 1.6$  N·m  
 $(0.80 \pm 0.16$  kgf·m)



LEM00427-00393

# EM-102

8. Install the rear end plate to the cylinder block.



LEM00428-00394

9. Installation of flywheel

- (1) Assemble the flywheel, aligning it with the knock pin of the crankshaft.
- (2) Temporarily tighten the flywheel attaching bolts to the following torque in the sequence indicated in the right figure.

Tightening Torque: 29.4 - 34.3 N·m  
(3.00 - 3.50 kgf·m)

**NOTE:**

- Prevent the crankshaft from turning at the ring gear section, using the following SST.

SST: 09210-87701-000

- (3) Tighten the flywheel attaching bolts to the specified torque in the sequence indicated in the right figure.

Tightening Torque:  $44.1 \pm 4.9$  N·m  
( $4.50 \pm 0.50$  kgf·m)

**NOTE:**

- Prevent the crankshaft from turning at the ring gear section, using the following SST.

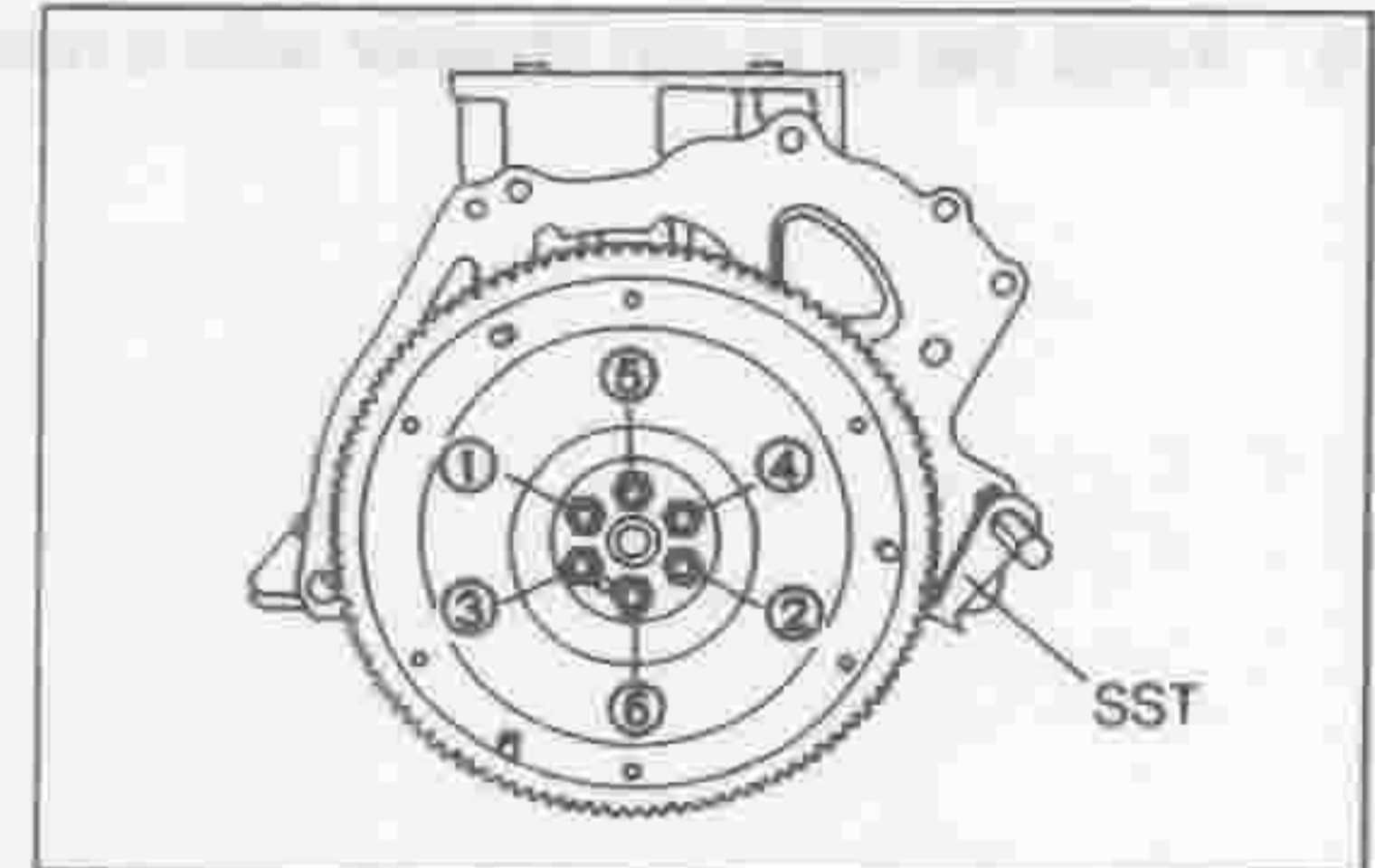
SST: 09201-87701-000

10. Measure the flywheel runout, using a dial gauge.

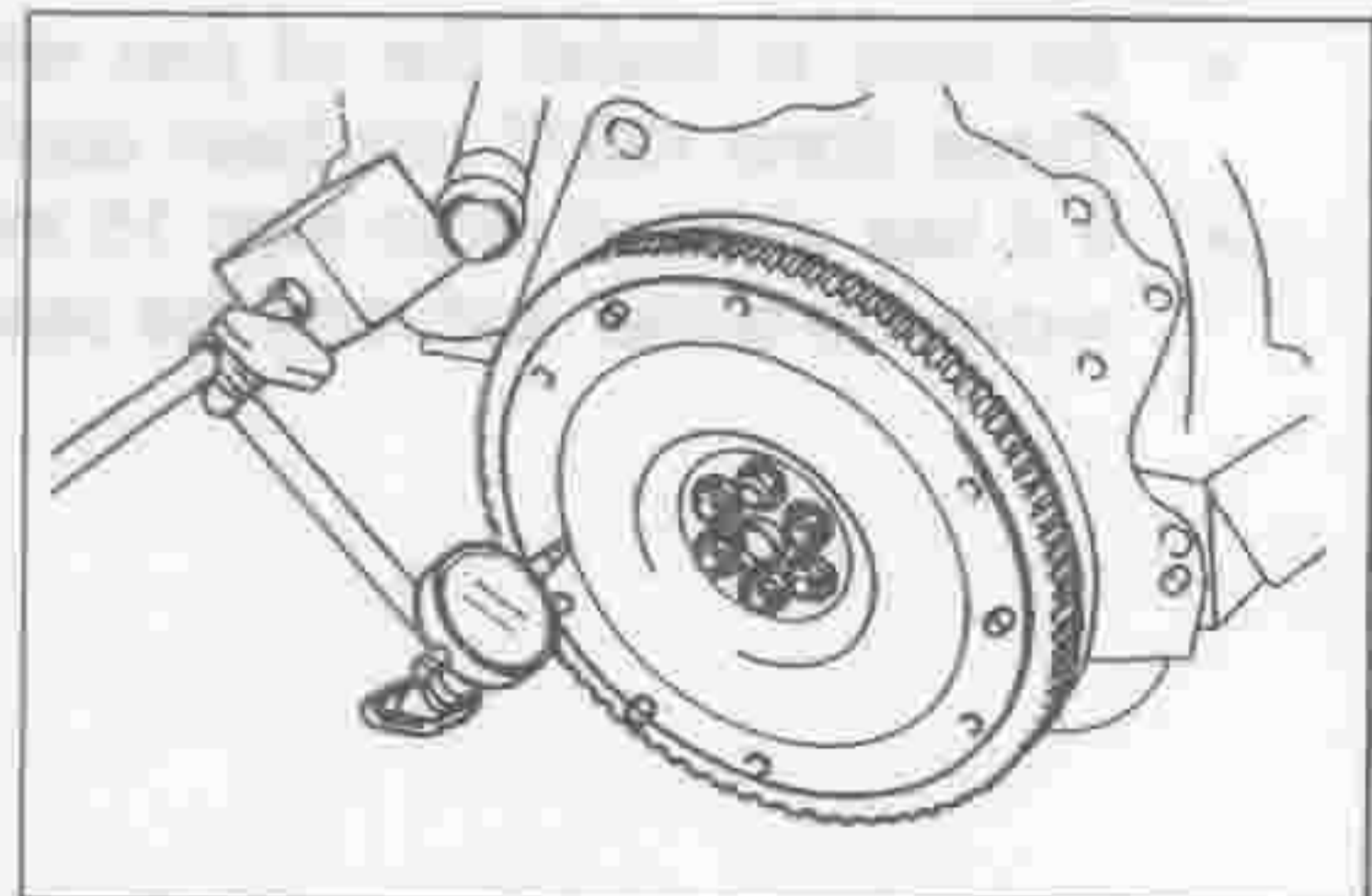
Allowable Runout Limit: 0.1 mm

**NOTE:**

- Replace the flywheel if its runout exceeds the allowable limit.



LEM00429-00395



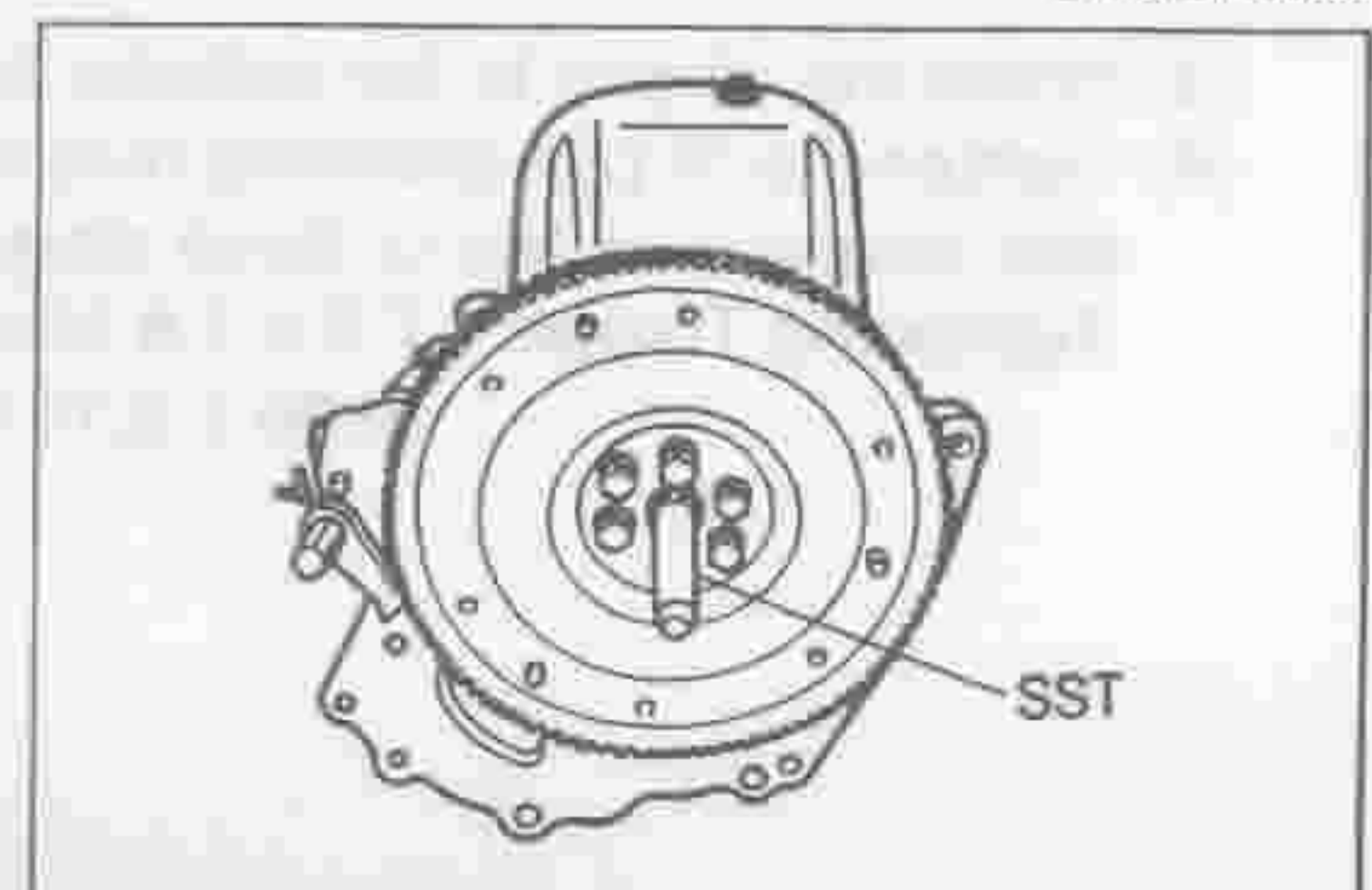
LEM00430-00000

11. Assembly of clutch disc and pressure plate

- (1) Insert the following SST into the crankshaft rear end.

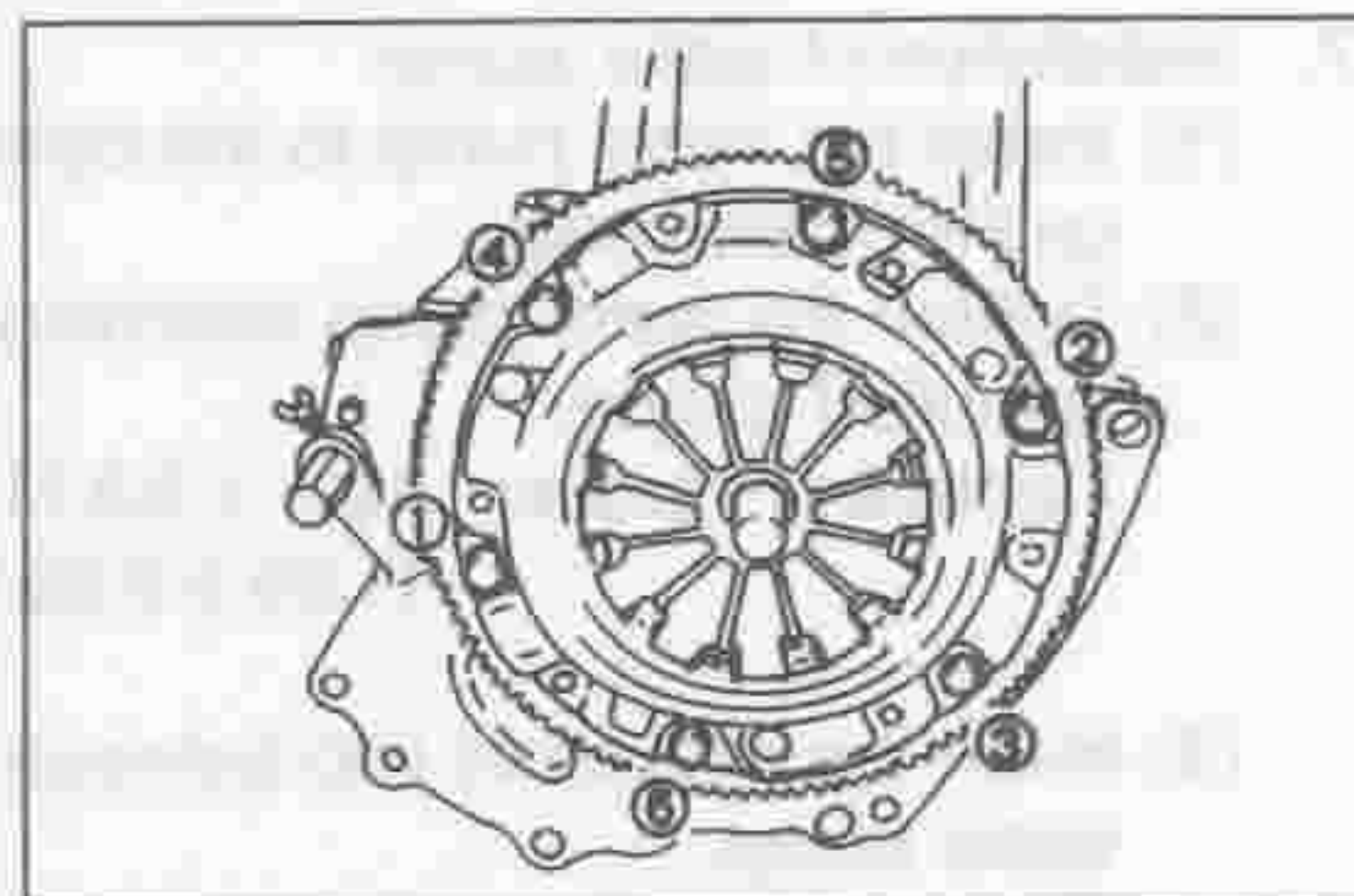
SST: 09301-87701-000

- (2) Install the clutch disc.



LEM00432-00397

- (3) Install the pressure plate, lining up the locating pin of the pressure plate.
- (4) Tighten the pressure plate attaching bolts in the sequence indicated in the right figure.  
Temporarily tighten the No. 1 bolt.  
Tightening Torque:  $18.1 \pm 3.4$  N·m  
( $1.85 \pm 0.35$  kgf-m)



LEM00433-00398

- (5) Remove the SST.

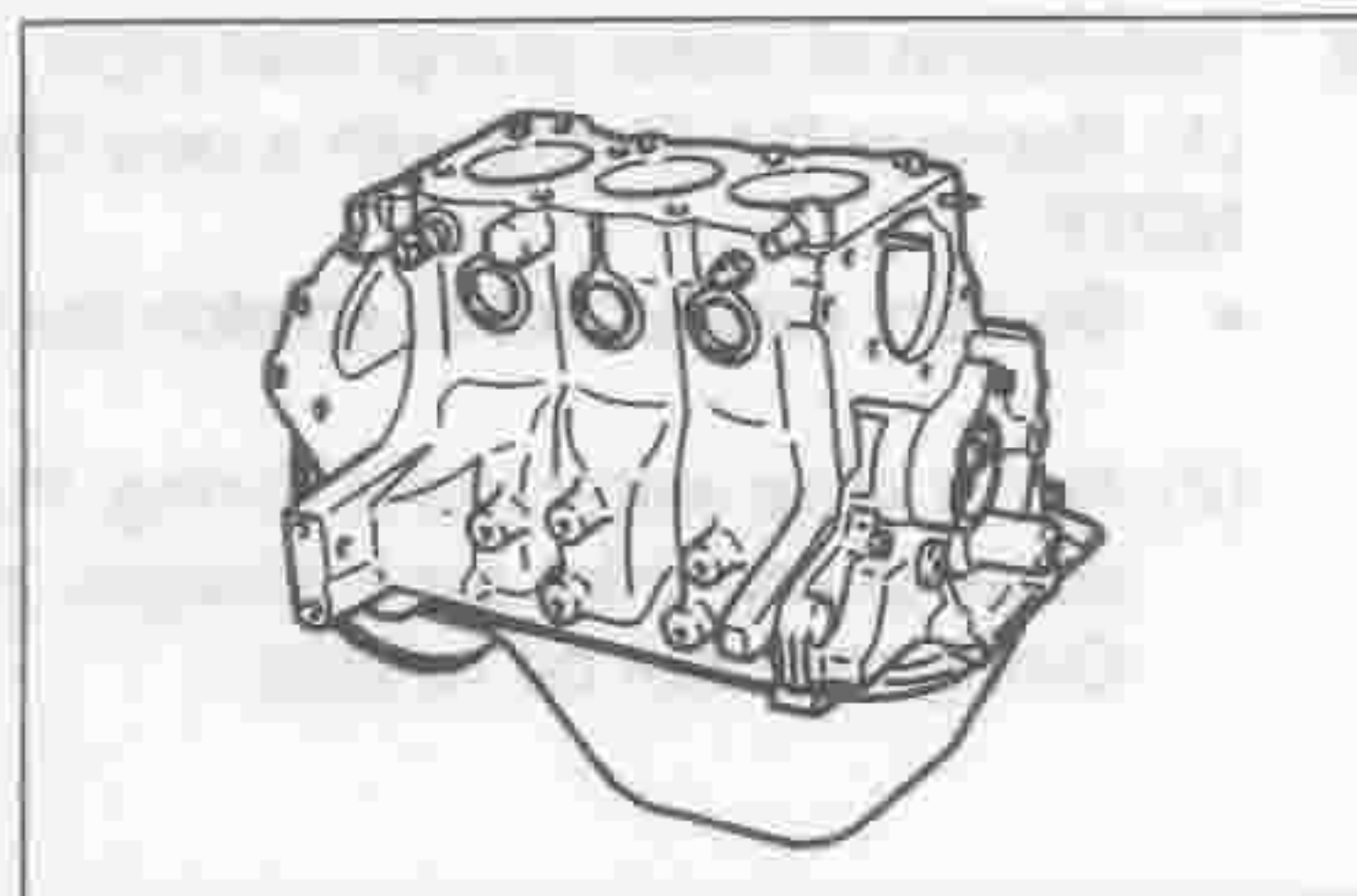
## NOTE:

- At this time, the SST should be removed easily and smoothly.
- If the SST can not be removed or it is hard to remove the SST, remove the pressure plate and redo the installation.

12. Installation of water temperature sensor  
[ED-20, EF-EL Engine]

- (1) Clean the threaded portion of the water temperature sensor. Wind seal tape around the threaded portion.
- (2) Tighten the water temperature sensor to the specified torque.

Tightening Torque:  $29.4 \pm 4.9$  N·m  
( $3.00 \pm 0.50$  kgf-m)



LEM00434-00399

13. Installation of water temperature switch  
[ED-10 Engine]

- (1) Clean the threaded portion of the water temperature switch. Wind seal tape around the threaded portion.
- (2) Tighten the water temperature switch to the specified torque.

Tightening Torque:  $29.4 \pm 4.9$  N·m  
( $3.00 \pm 0.50$  kgf-m)

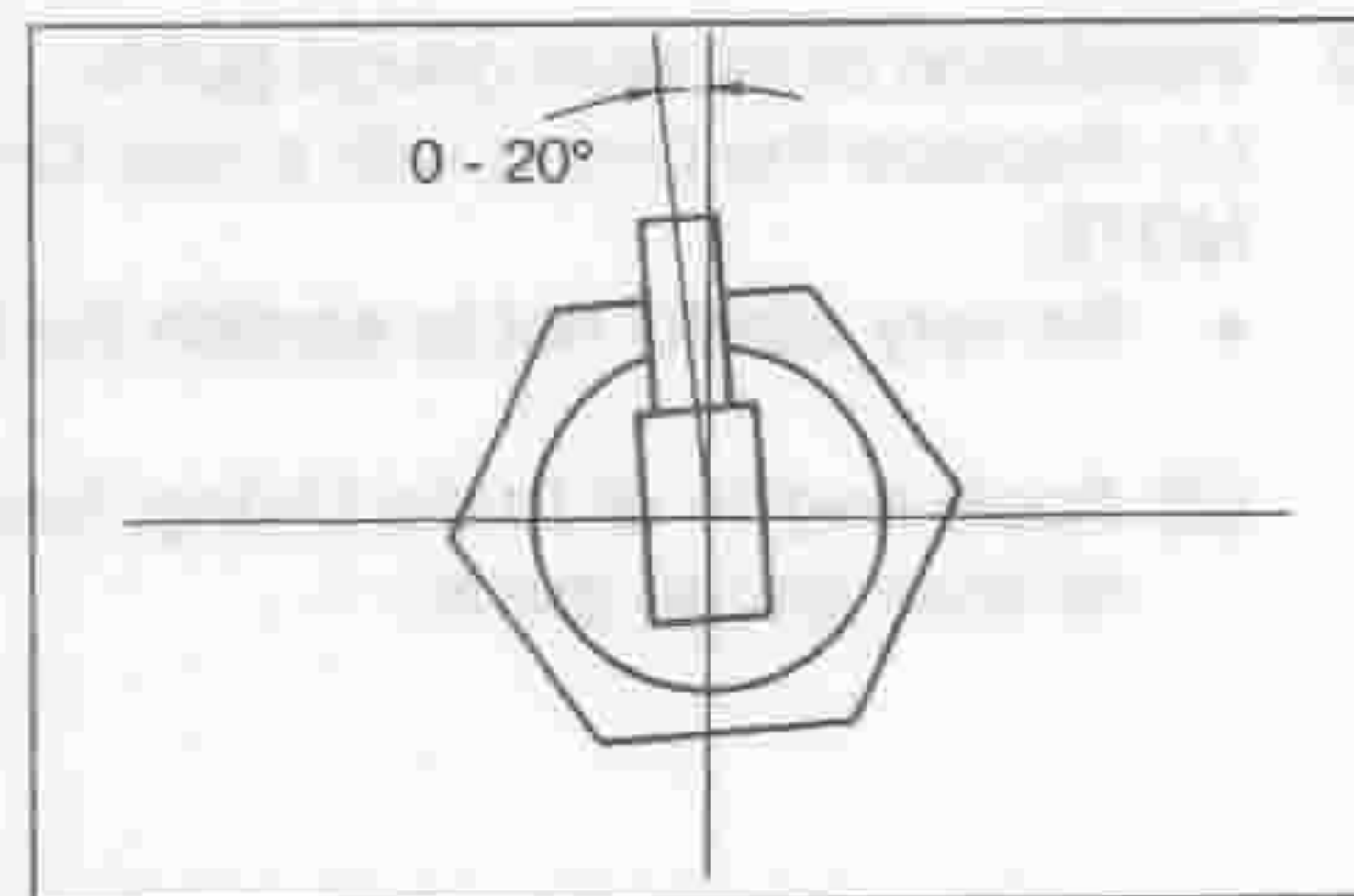
LEM00435-00000

14. Installation of BVSV  
[ED-10 Engine]

- (1) Clean the threaded portion of the BVSV. Wind seal tape around the threaded portion.
- (2) Attach the BVSV to the cylinder block. Tighten the BVSV to the specified torque.

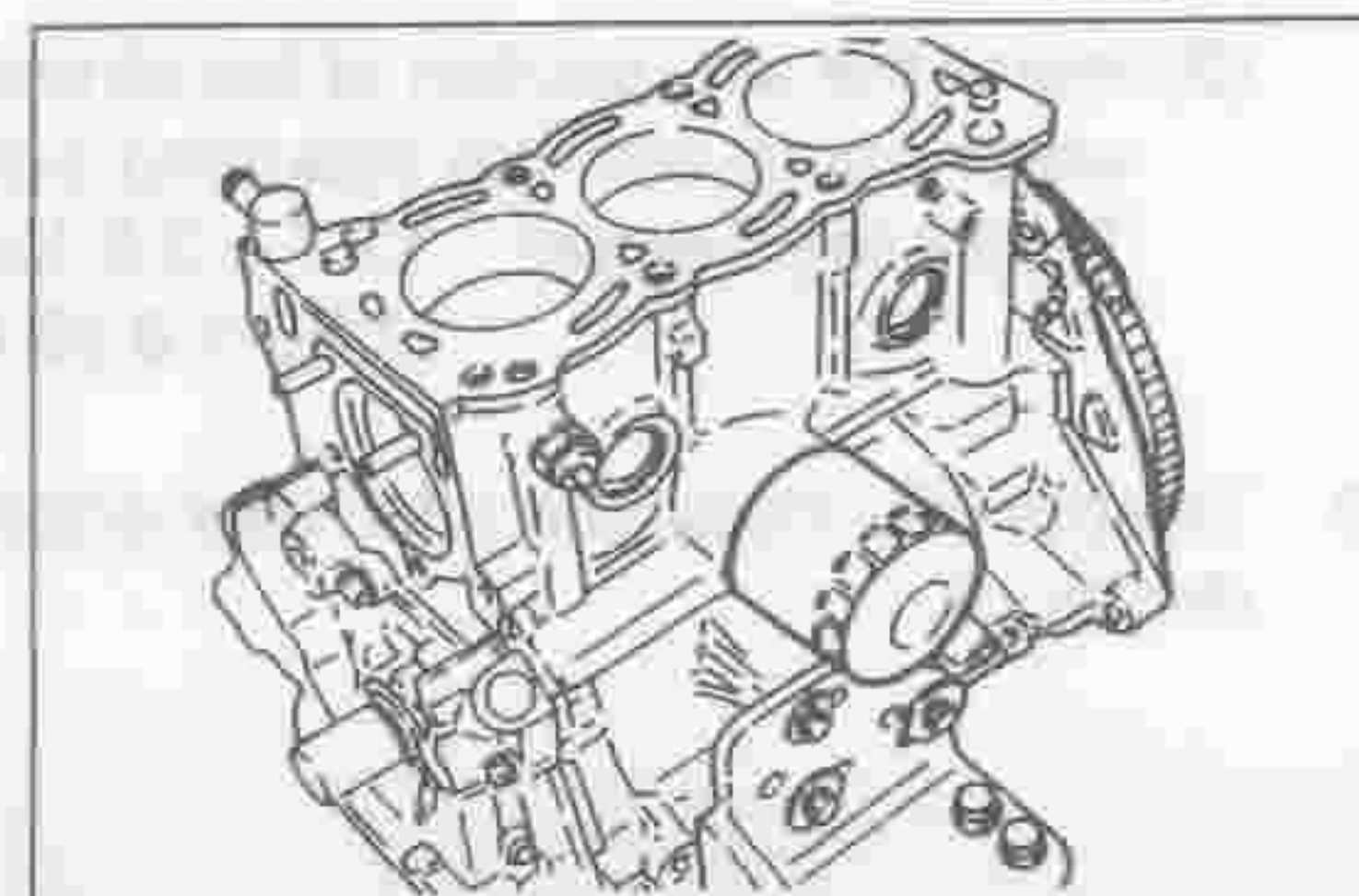
Tightening Torque:  $17.7$  N·m (1.80 kgf-m)

- (3) While retightening the BVSV, set the direction of the port as indicated in the right figure.



LEM00436-00400

15. Install the oil filter.
16. Install the oil pressure switch.



LEM00437-00401

# EM-104

Tightening Torque:  $19.1 \pm 3.0 \text{ N}\cdot\text{m}$   
( $1.95 \pm 0.39 \text{ kgf}\cdot\text{m}$ )

- (3) Insert the dust seals into between the oil pump and the water pump.



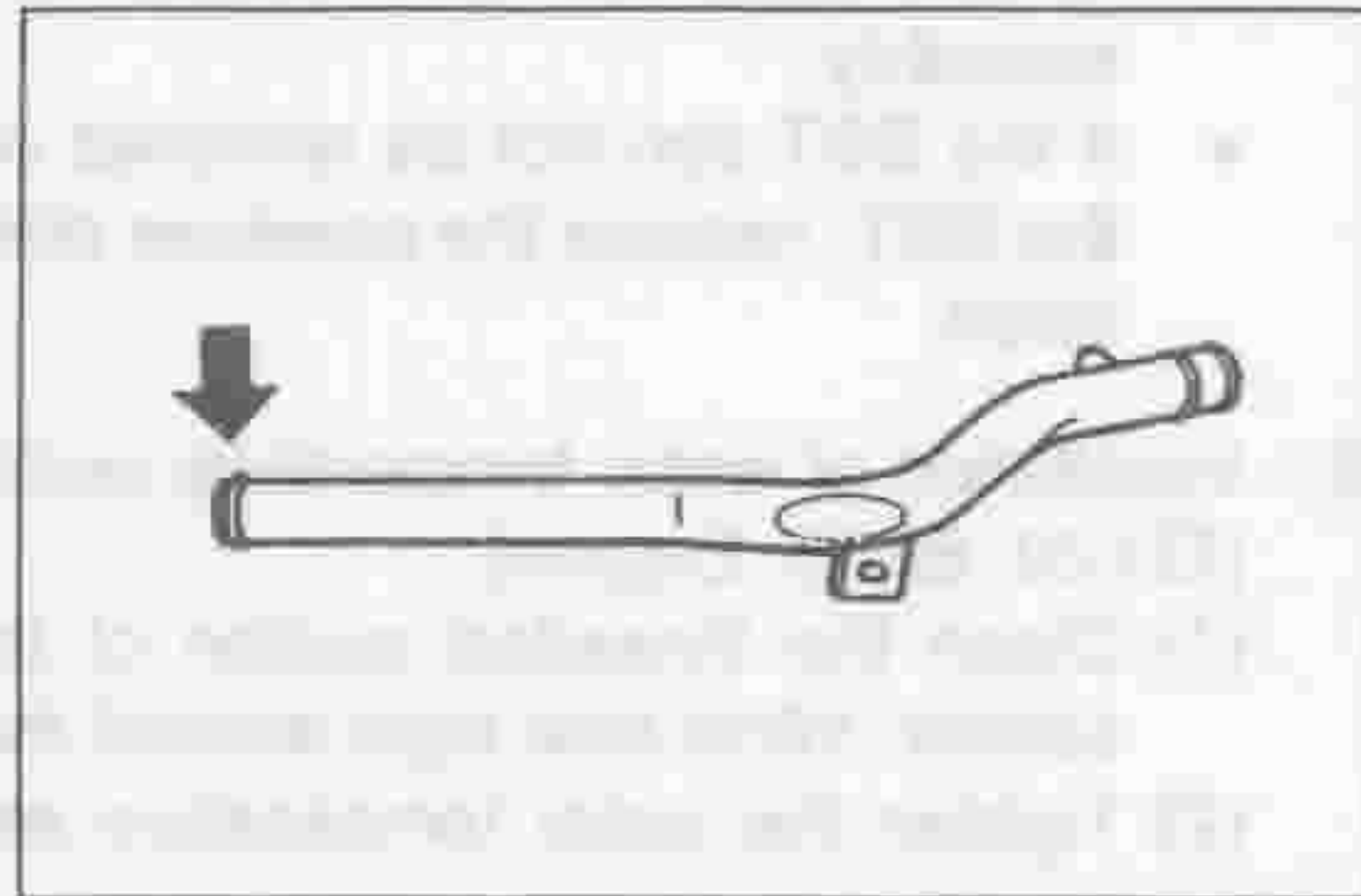
LEM00438-00402

## 18. Installation of water pump inlet pipe

- (1) Replace the O-ring with a new O-ring.

### NOTE:

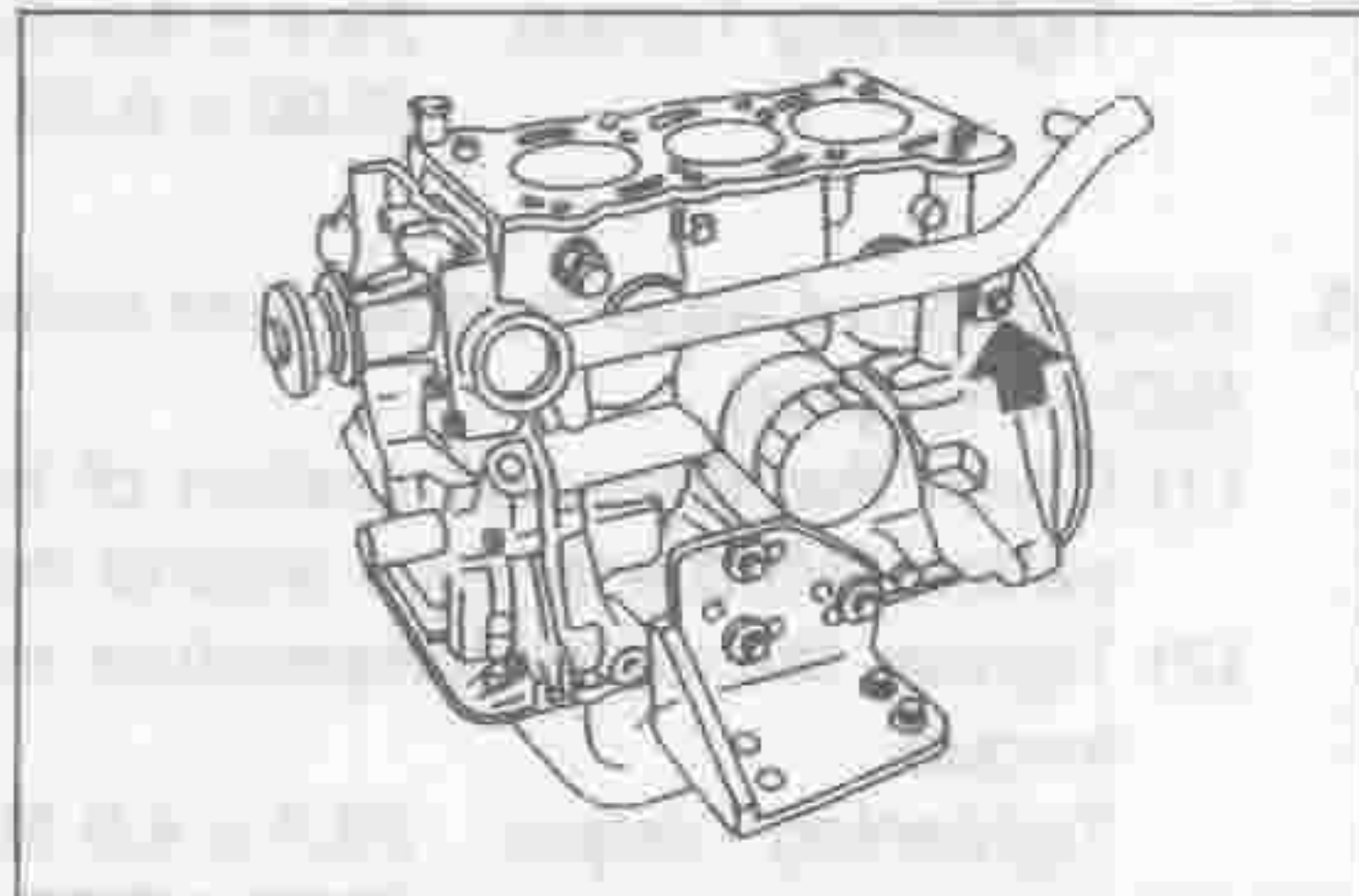
- Be very careful not to scratch the O-ring.
- (2) Apply soap water to the O-ring. Push the O-ring into the water pump inlet pipe straight, making sure that the O-ring may not be twisted.



LEM00439-00403

- (3) Install the water pump inlet pipe to the cylinder block.

Tightening Torque:  $12.7 \pm 2.5 \text{ N}\cdot\text{m}$   
( $1.30 \pm 0.26 \text{ kgf}\cdot\text{m}$ )



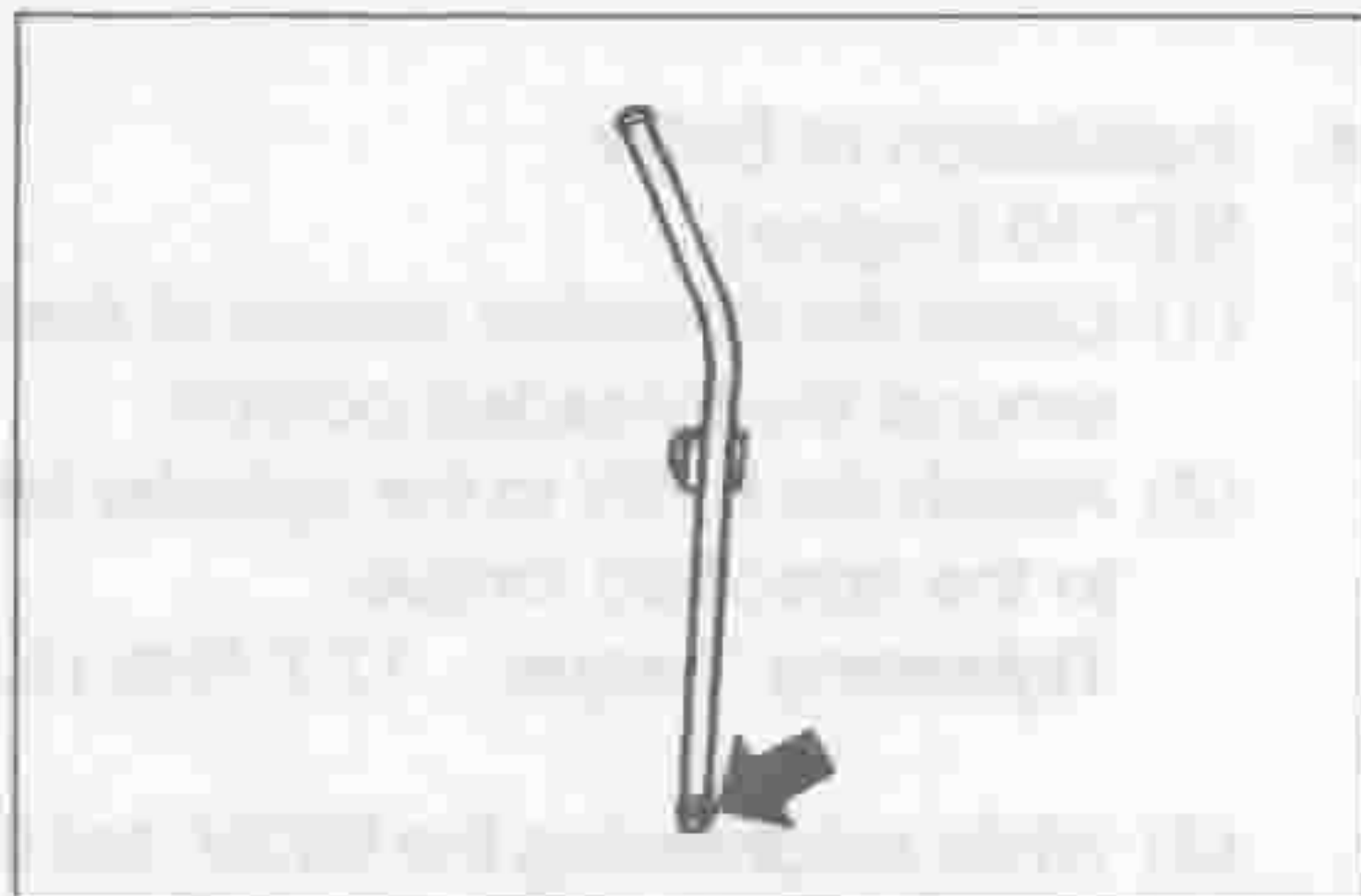
LEM00440-00404

## 19. Installation of oil level gauge guide

- (1) Replace the O-ring with a new O-ring.

### NOTE:

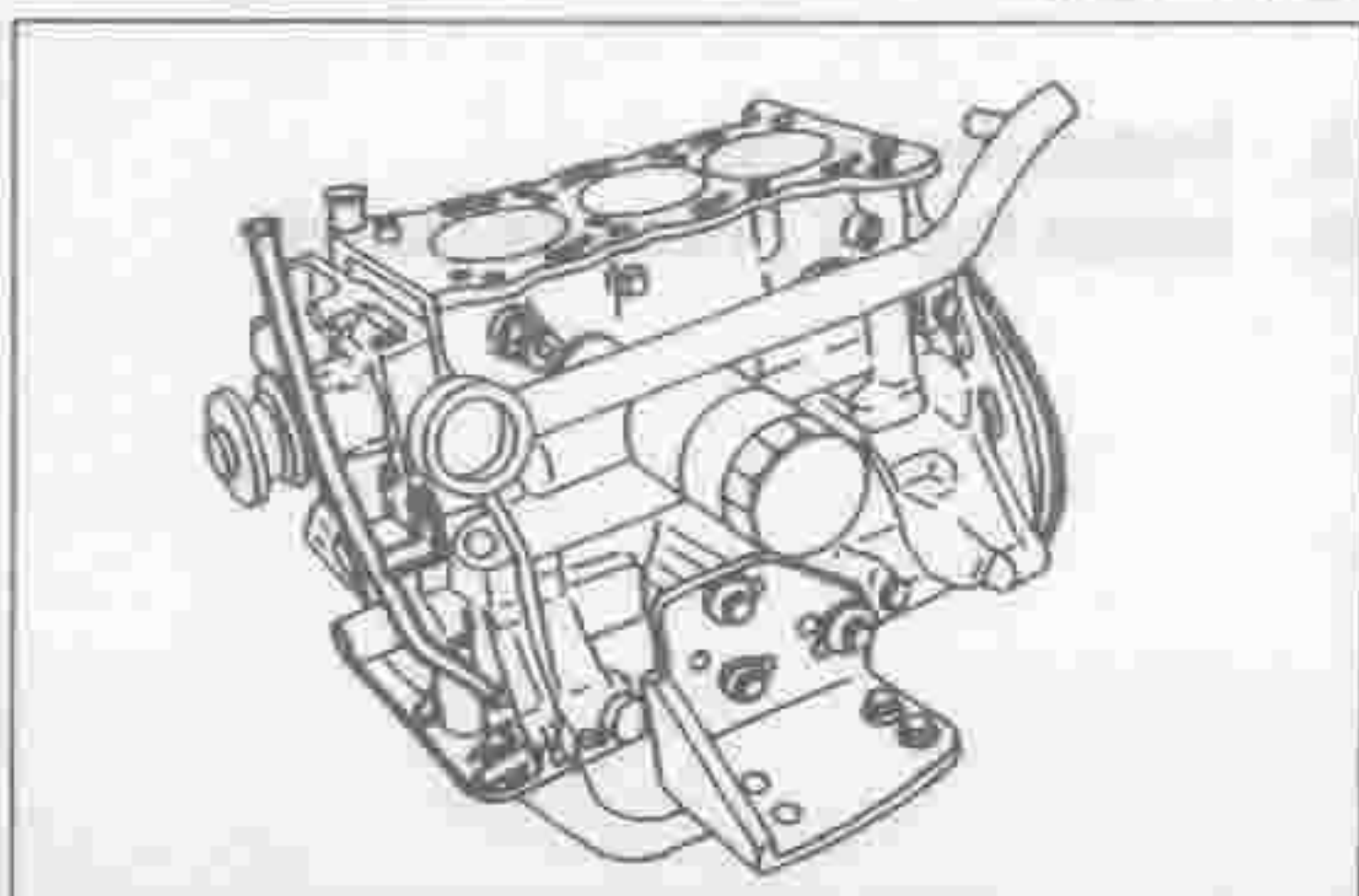
- Be very careful not to scratch the O-ring.
- (2) Apply engine oil to the O-ring. Insert the O-ring into the oil level gauge guide.



LEM00441-00405

- (3) Install the stay section of the oil level gauge guide to the water pump with the attaching bolts.

Tightening Torque:  $12.7 \pm 2.5 \text{ N}\cdot\text{m}$   
( $1.30 \pm 0.26 \text{ kgf}\cdot\text{m}$ )



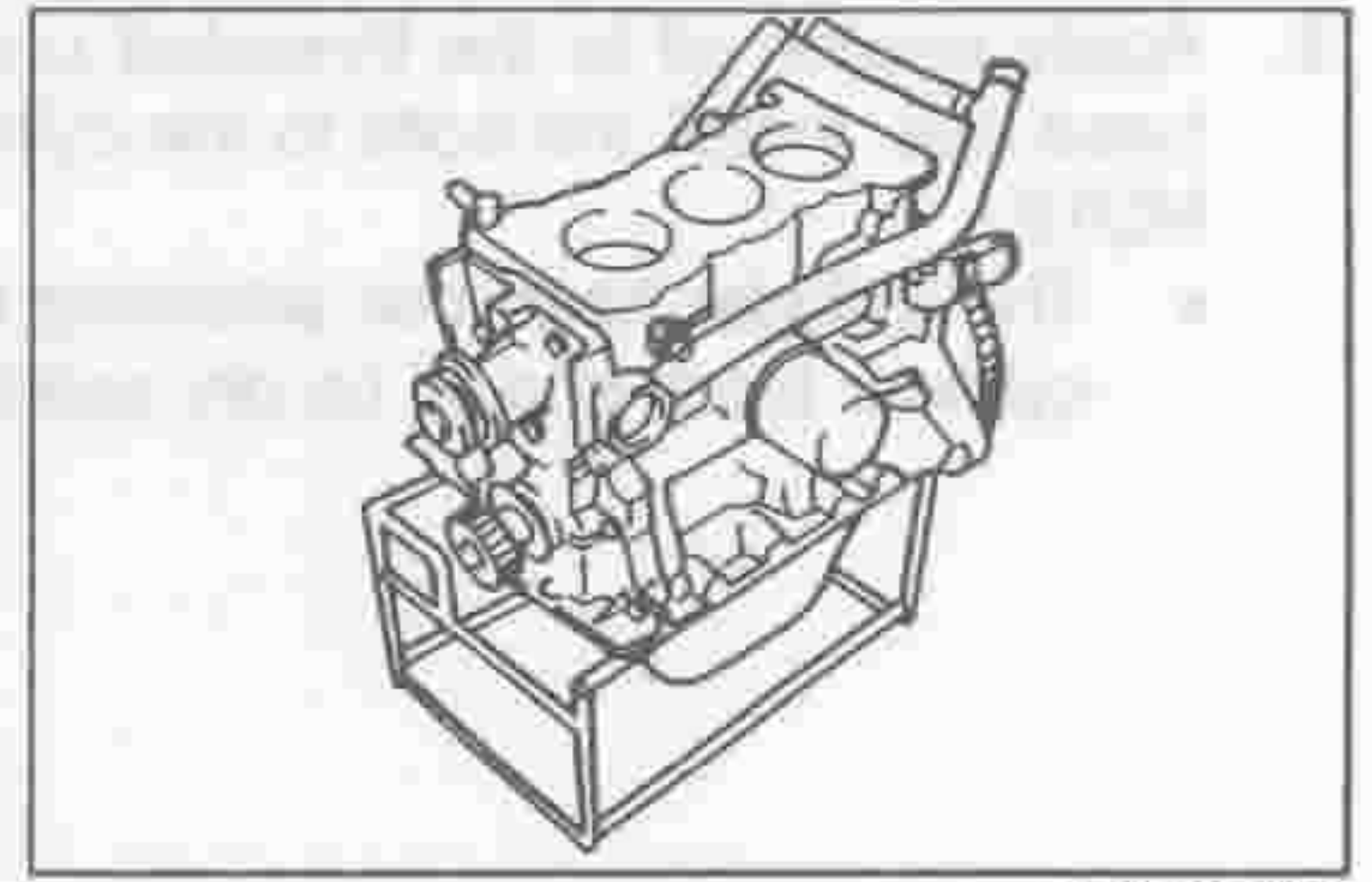
LEM00442-00406

20. Temporarily install the alternator adjusting bar to the cylinder block.



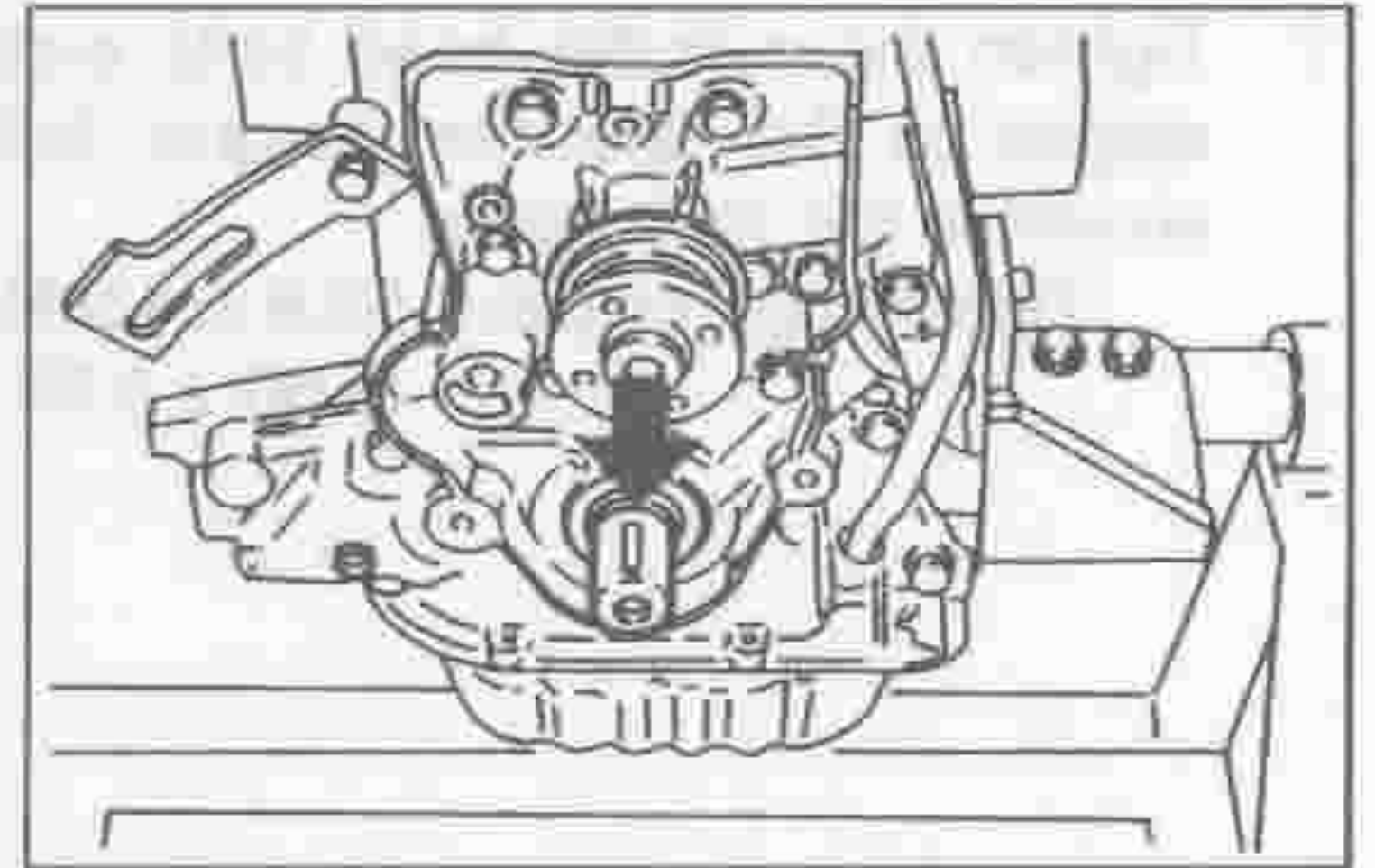
## INSTALLATION OF CYLINDER HEAD

1. Place the cylinder block on a suitable engine stand.



LEM00443-00407

2. Align the ignition timing mark of the flywheel with the indicator of the timing mark. Or set the key provided at the forward end of the crankshaft to such a direction that it faces upward exactly.

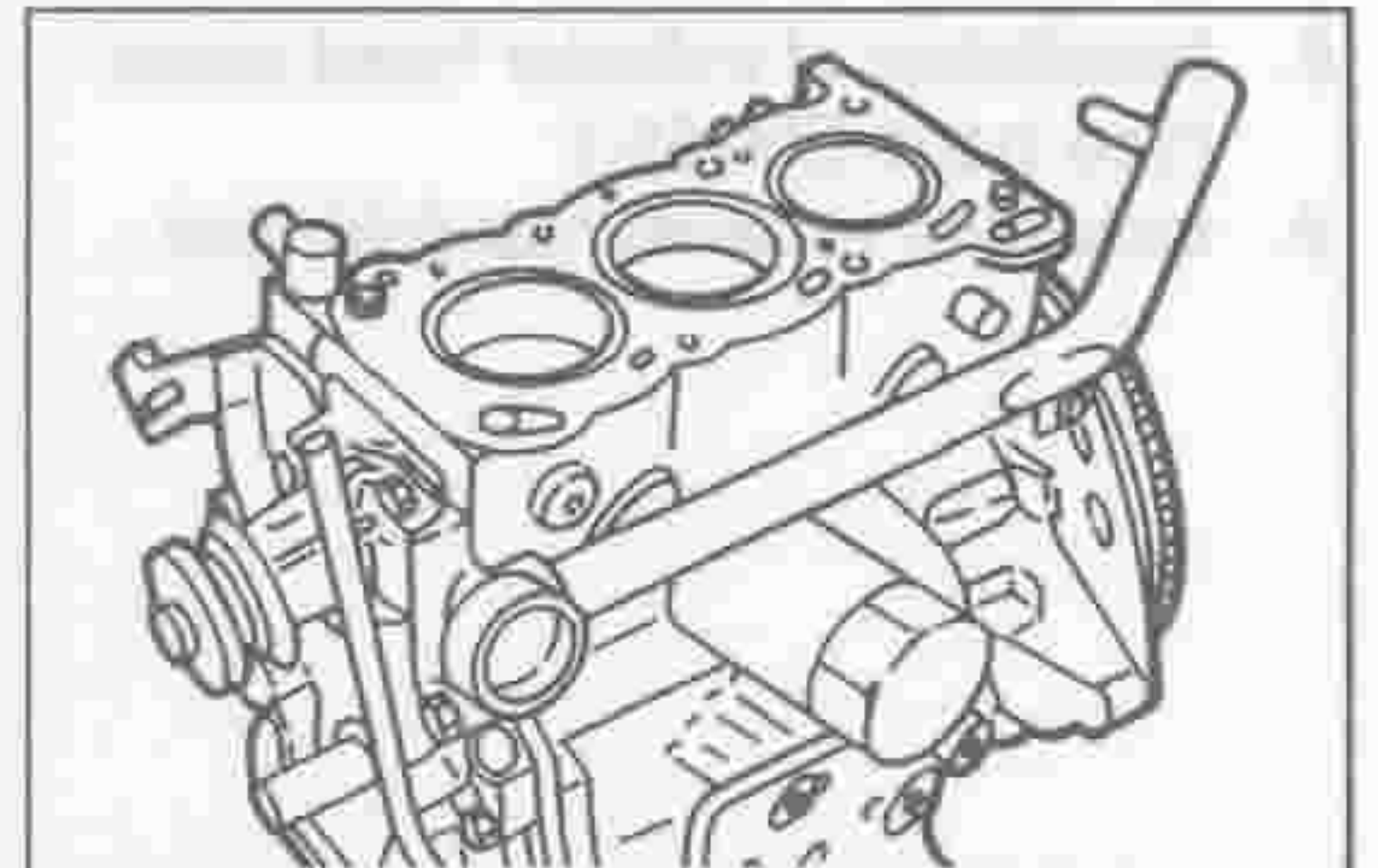


LEM00444-00408

3. Install a new cylinder head gasket on the cylinder block.

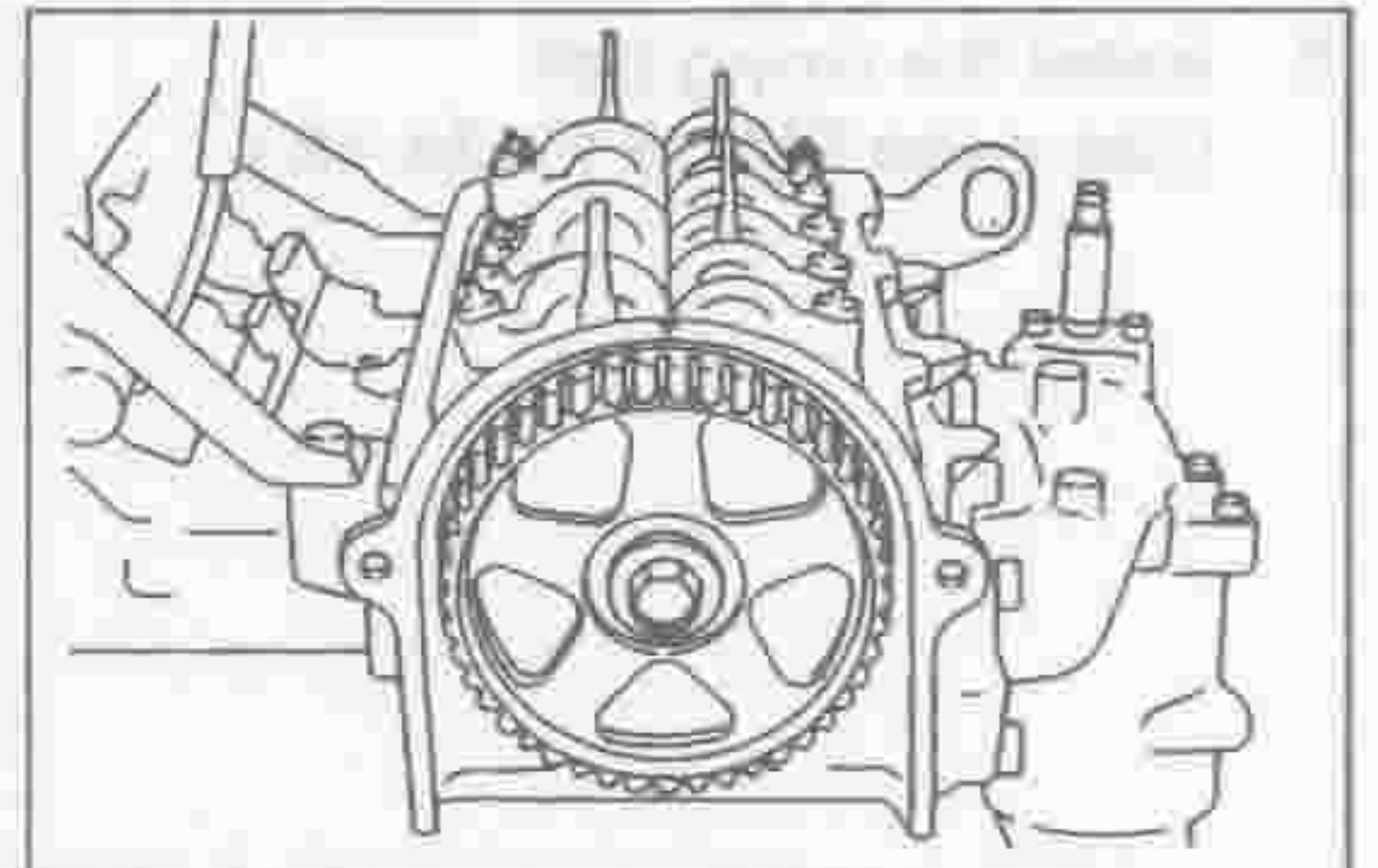
**NOTE:**

- Be sure to align the gasket with the locating ring at the cylinder block side.



LEM00445-00409

4. Turn the crankshaft, until the drilled hole of the camshaft timing belt pulley is aligned with the pressed mark of the timing belt cover No. 2.

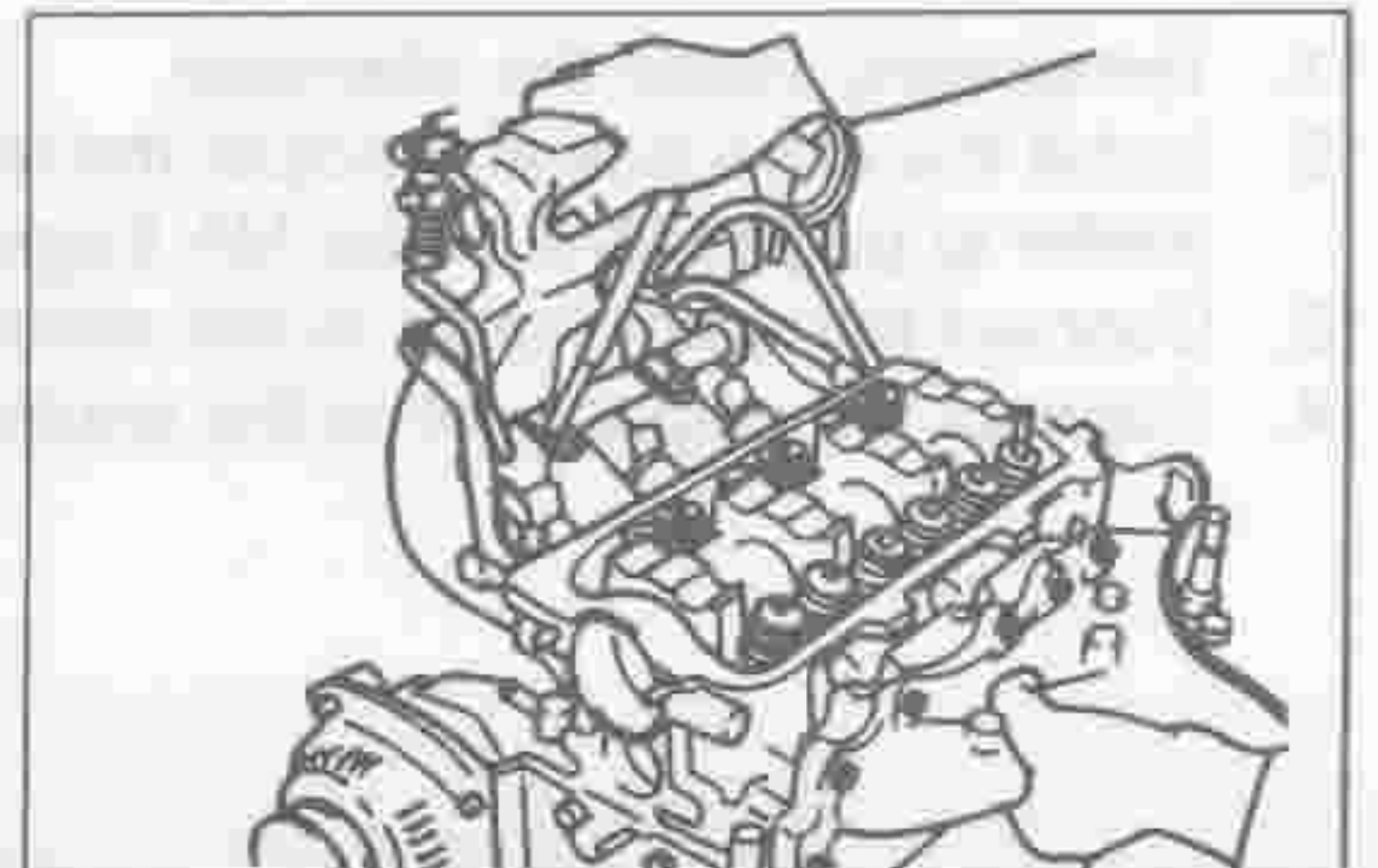


LEM00446-00410

5. Install the cylinder head assembly on the cylinder block.

**NOTE:**

- Be very careful not to damage the cylinder head gasket and cylinder head gasket surface.



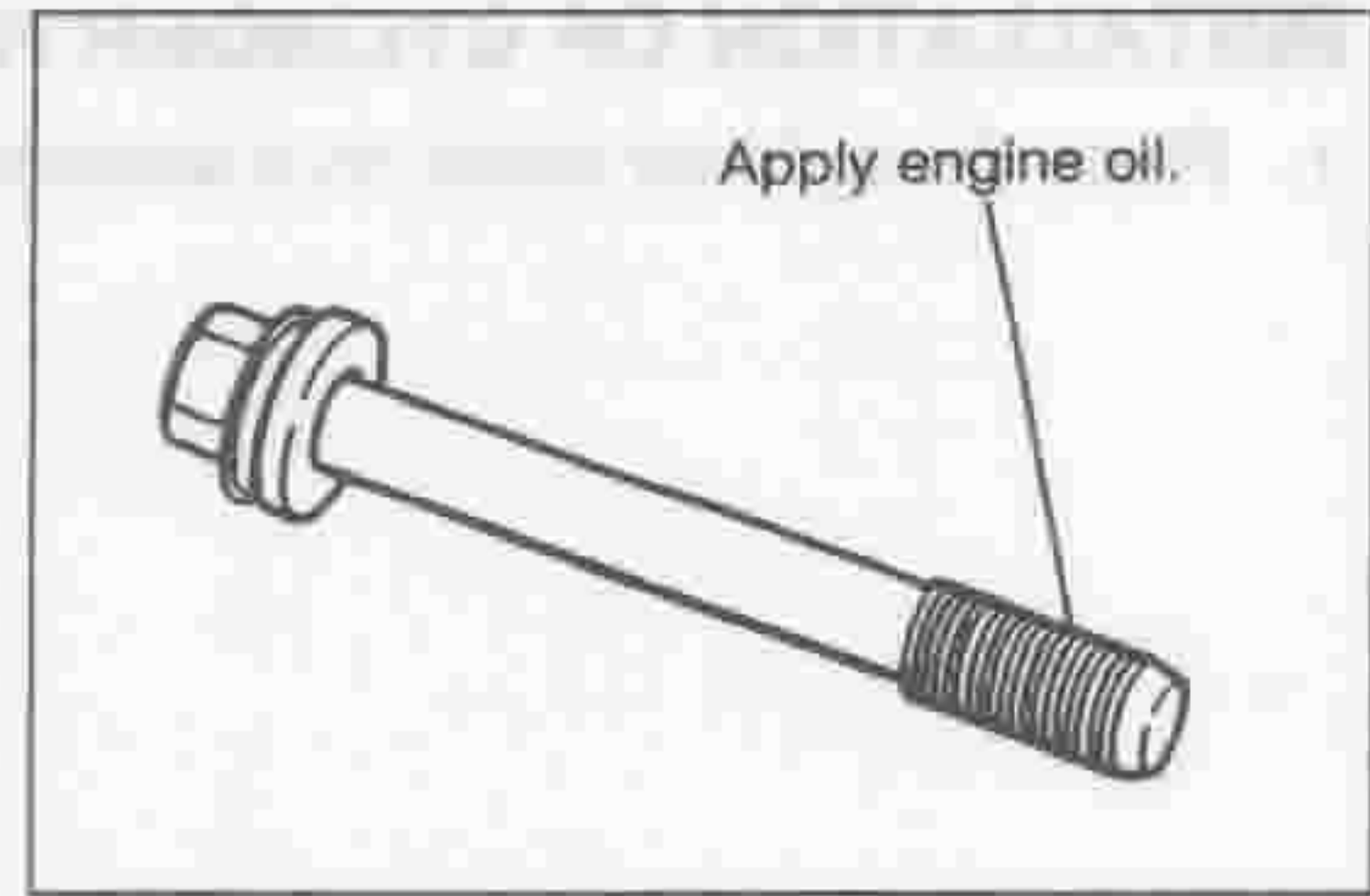
LEM00447-00411

# EM-106

6. Apply engine oil to the threaded portion of each cylinder head bolt. Install the bolts to the cylinder head.

**NOTE:**

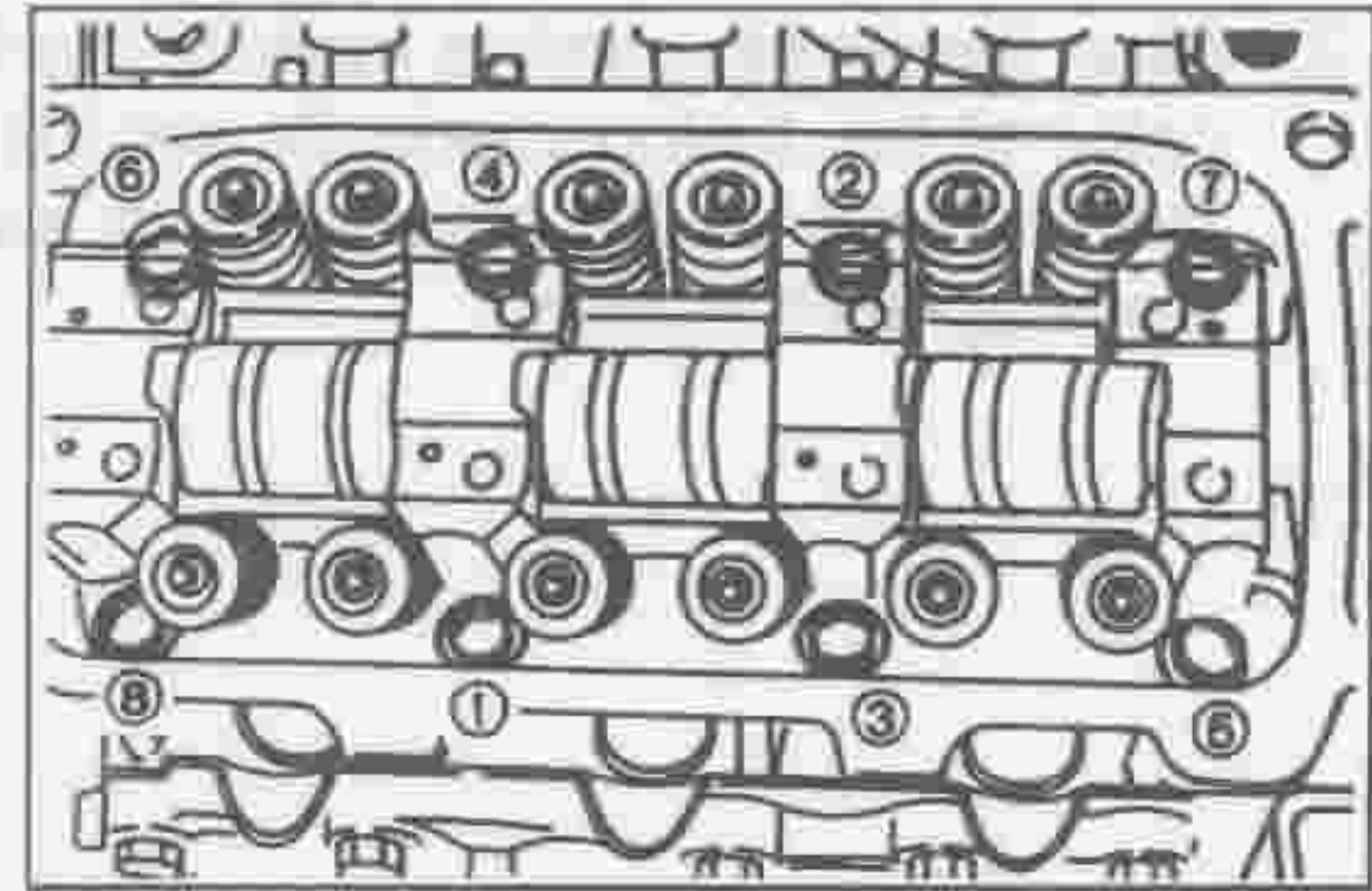
- The cylinder head bolt attaching holes provided on the cylinder block should be dry condition.



LEM00448-00412

7. Tighten the cylinder head bolts evenly over two or three stages to the specified torque, following the sequence shown in the right figure.

Tightening Torque:  $53.9 \pm 4.9$  N·m  
( $5.50 \pm 0.50$  kgf·m)

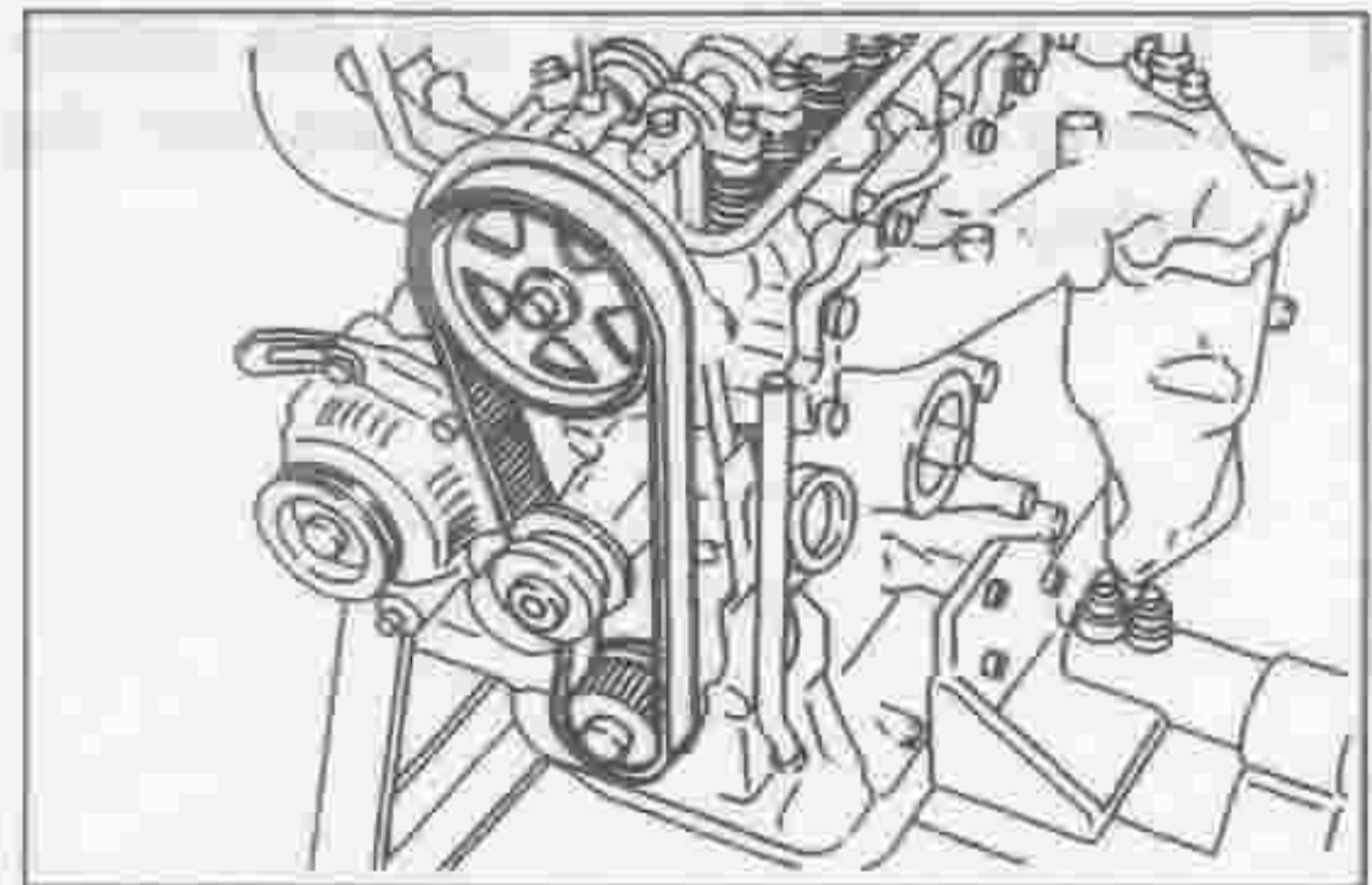


LEM00449-00413

8. Installation of cylinder head cover  
(See page EM-55.)
9. Install the exhaust manifold stay.

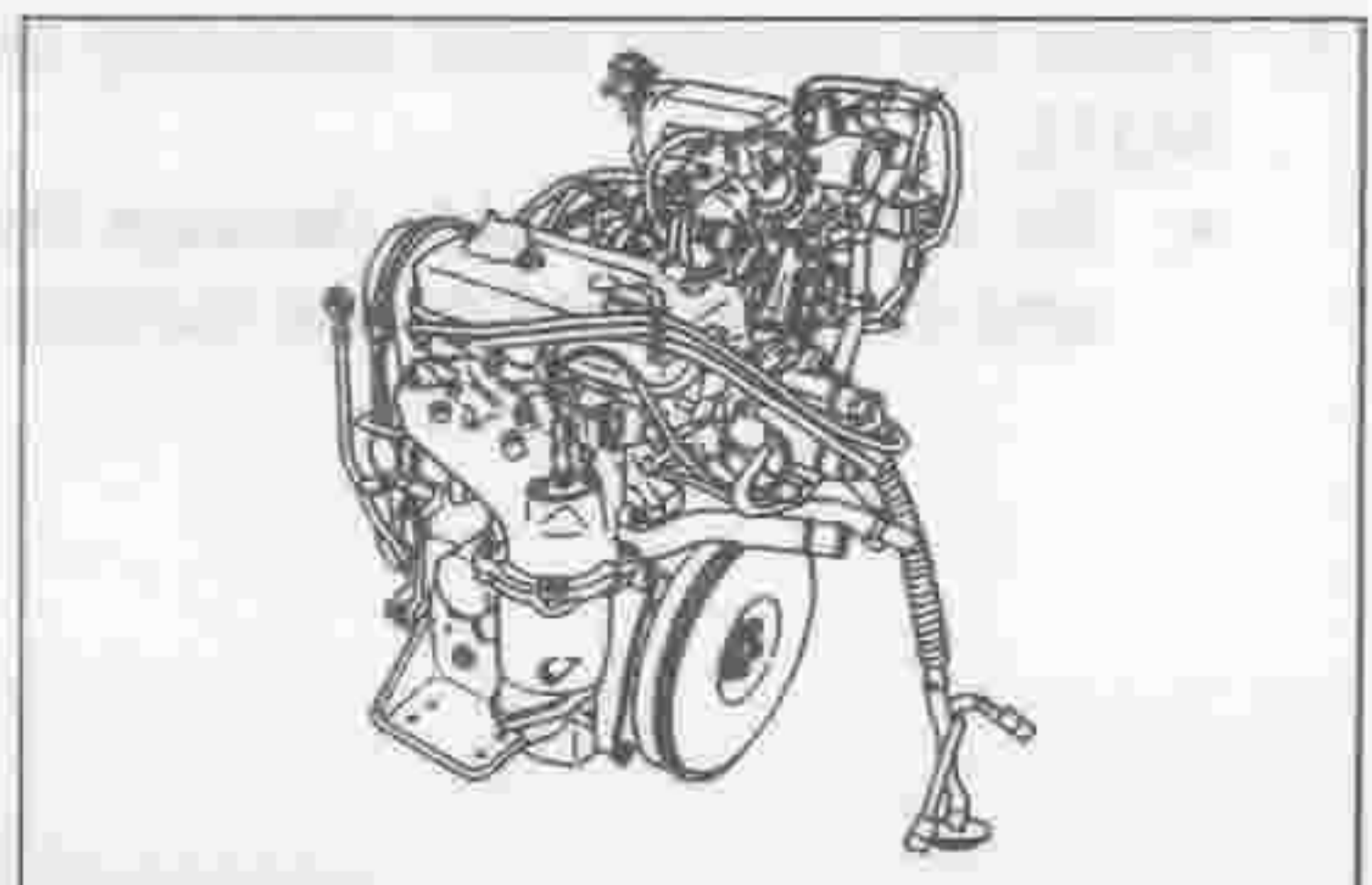
LEM00450-00000

10. Install the timing belt.  
(See page EM-13 to EM-18.)



LEM00451-00415

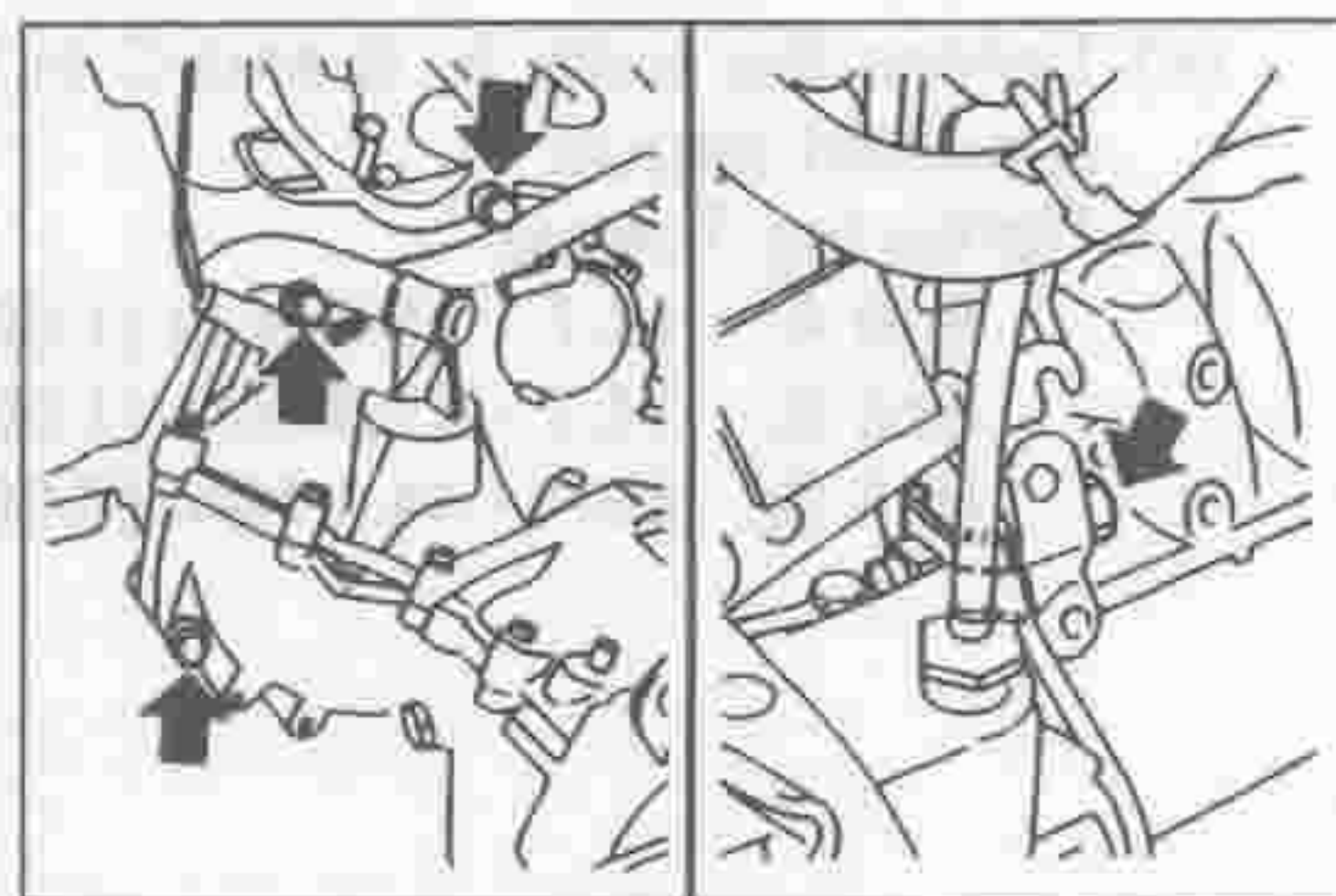
11. Temporarily install the alternator.
12. Install the drive belt and adjust the tension.  
(Refer to page MA-9 of the MA Engine section.)
13. Connect the water hoses to the water inlet hoses.
14. Connect the engine wire to the engine.



LEM00452-00416

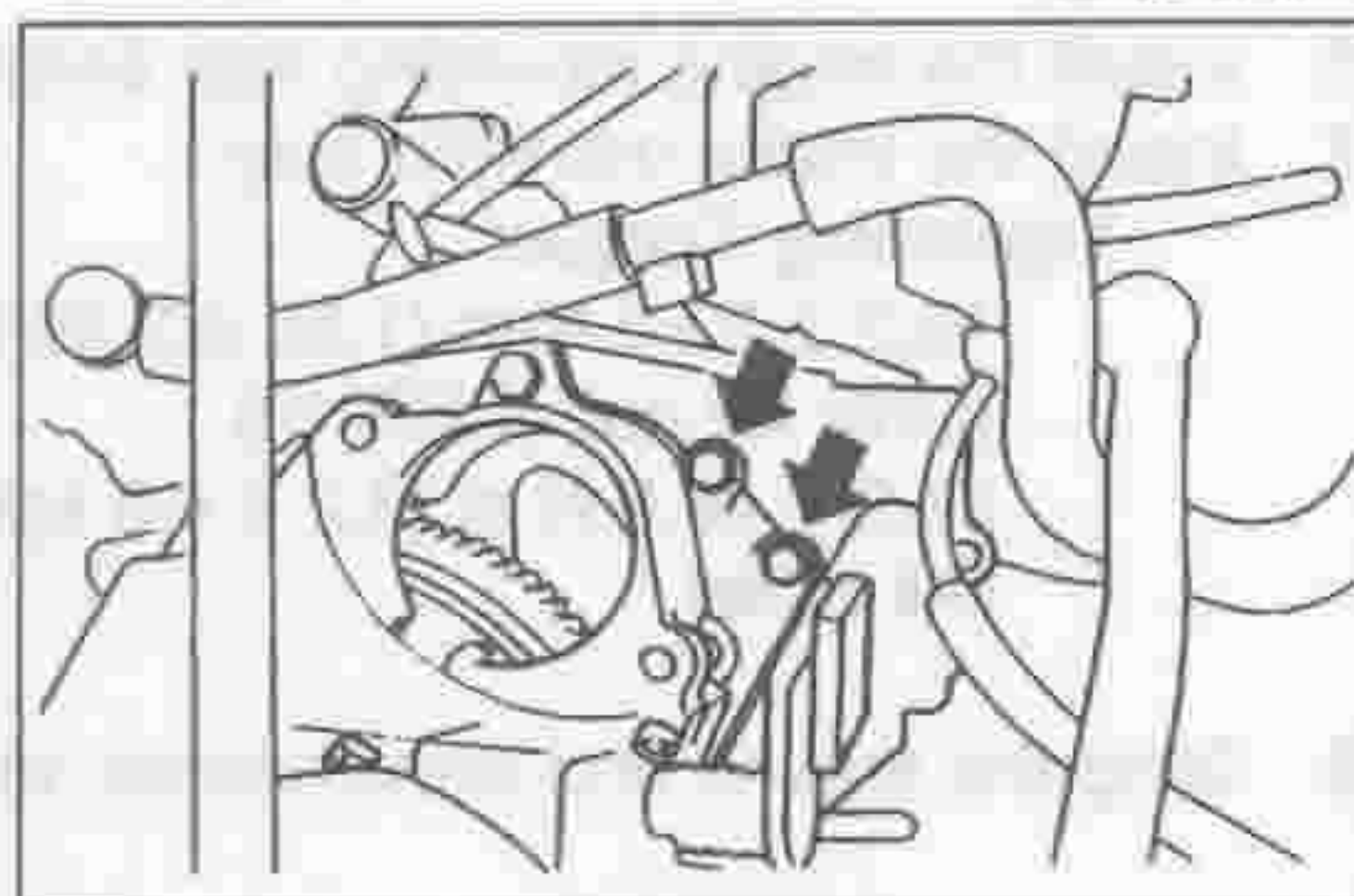
## PREPARATION FOR ENGINE MOUNTING

1. Install the engine to the transmission.
2. Tighten the attaching bolts.  
Tightening Torque: 49.0 - 78.4 N·m  
(5.00 - 8.00 kgf-m)



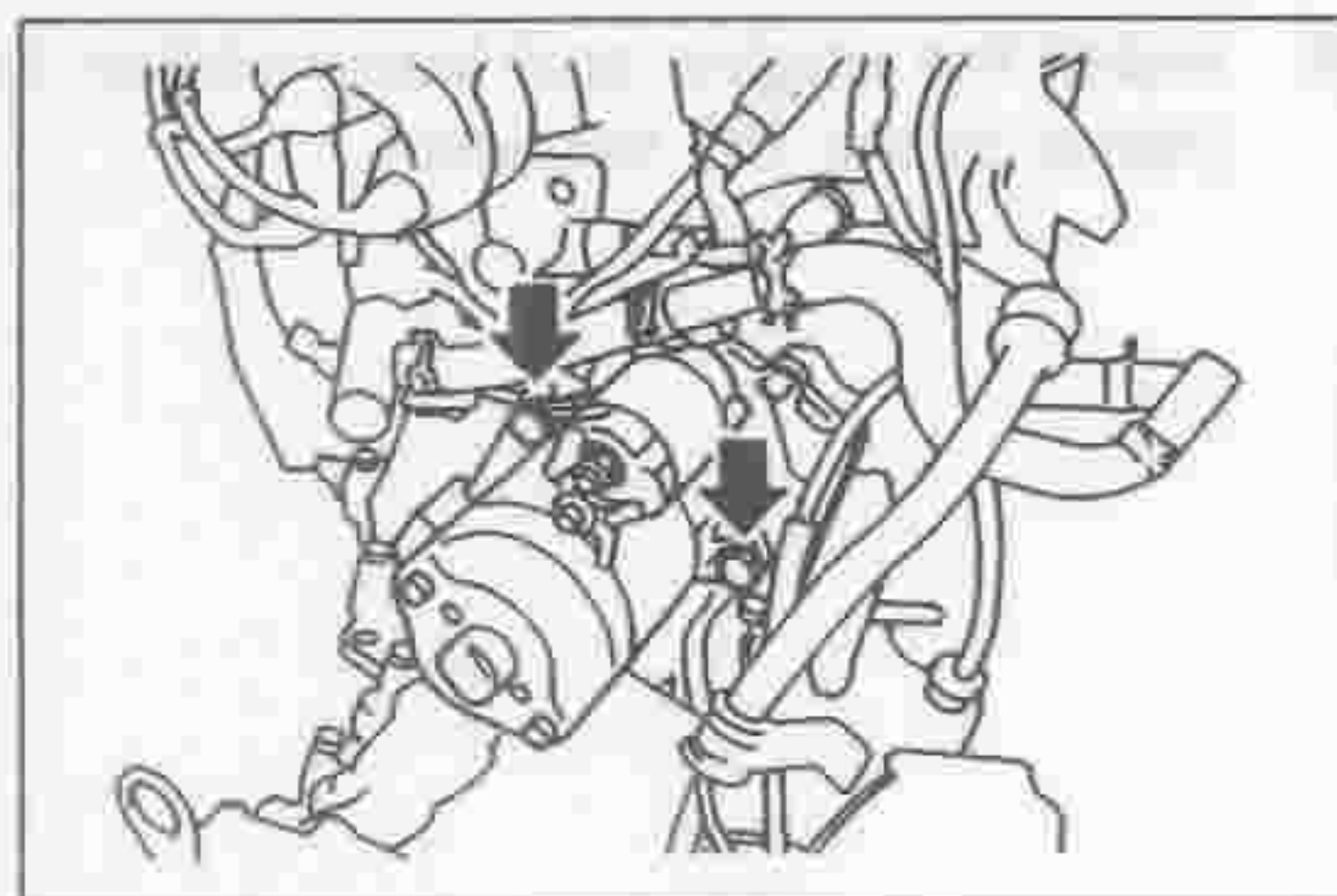
LEM00453-00417

3. Install the engine wire bracket to the transmission.



LEM00454-00418

4. Install the starter motor to the transmission and tighten the attaching bolts.

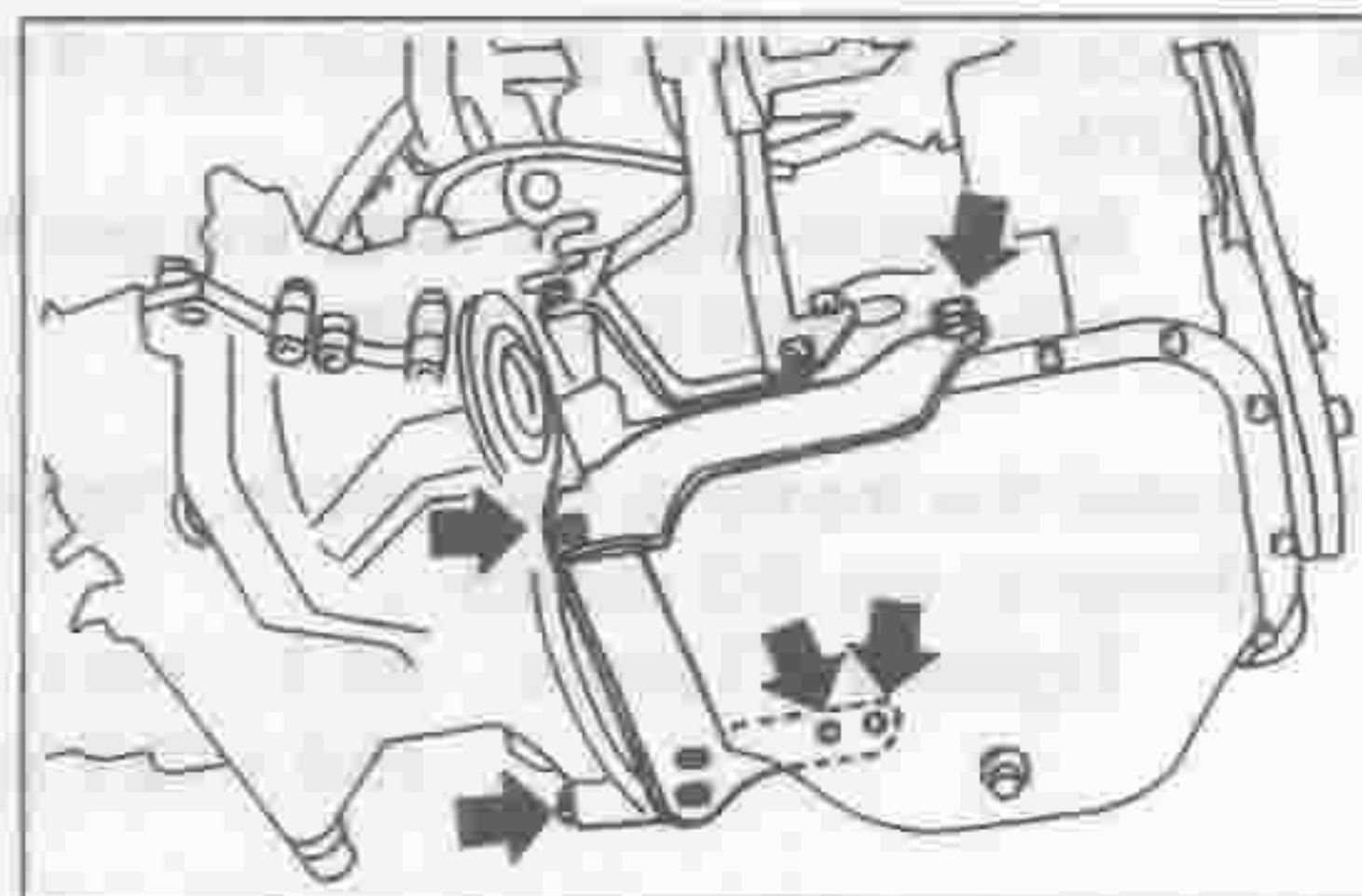


LEM00455-00419

5. Installation of power train stiffener.

### NOTE:

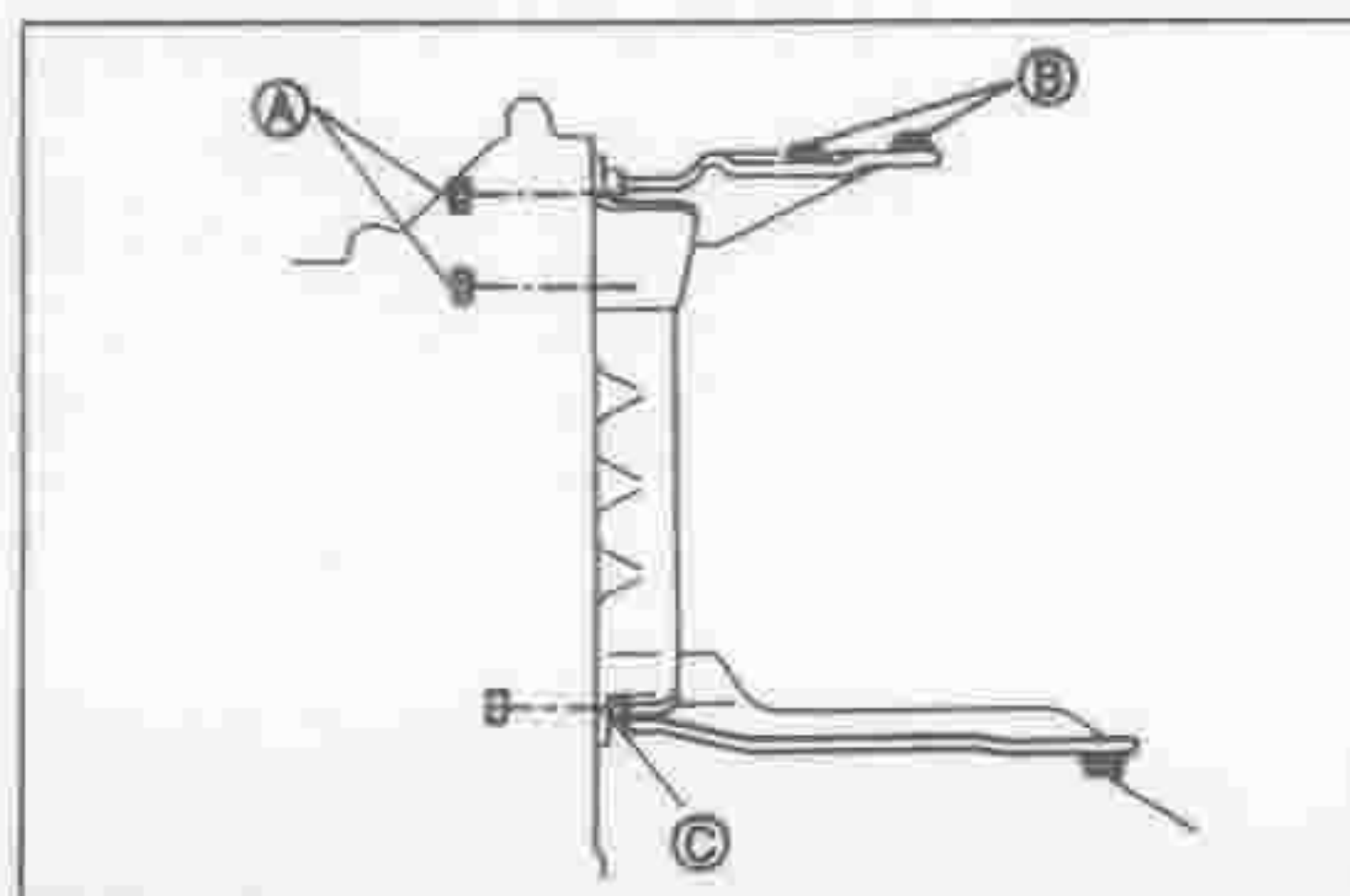
- If the attaching bolt at the engine side should be tightened first, the center of the input shaft of the transmission deviates from the crankshaft center at the engine side. It may cause rumbling noise of the transmission.



LEM00456-00420

- (1) With the clutch undercover interposed, temporarily install the power train stiffener with the bolt A in the right figure.
- (2) Temporarily tighten the bolt B in the right figure.
- (3) Tighten the bolt C in the right figure to the specified torque.

Tightening Torque: 14.7 - 21.6 N·m  
(1.5 - 2.2 kgf-m)



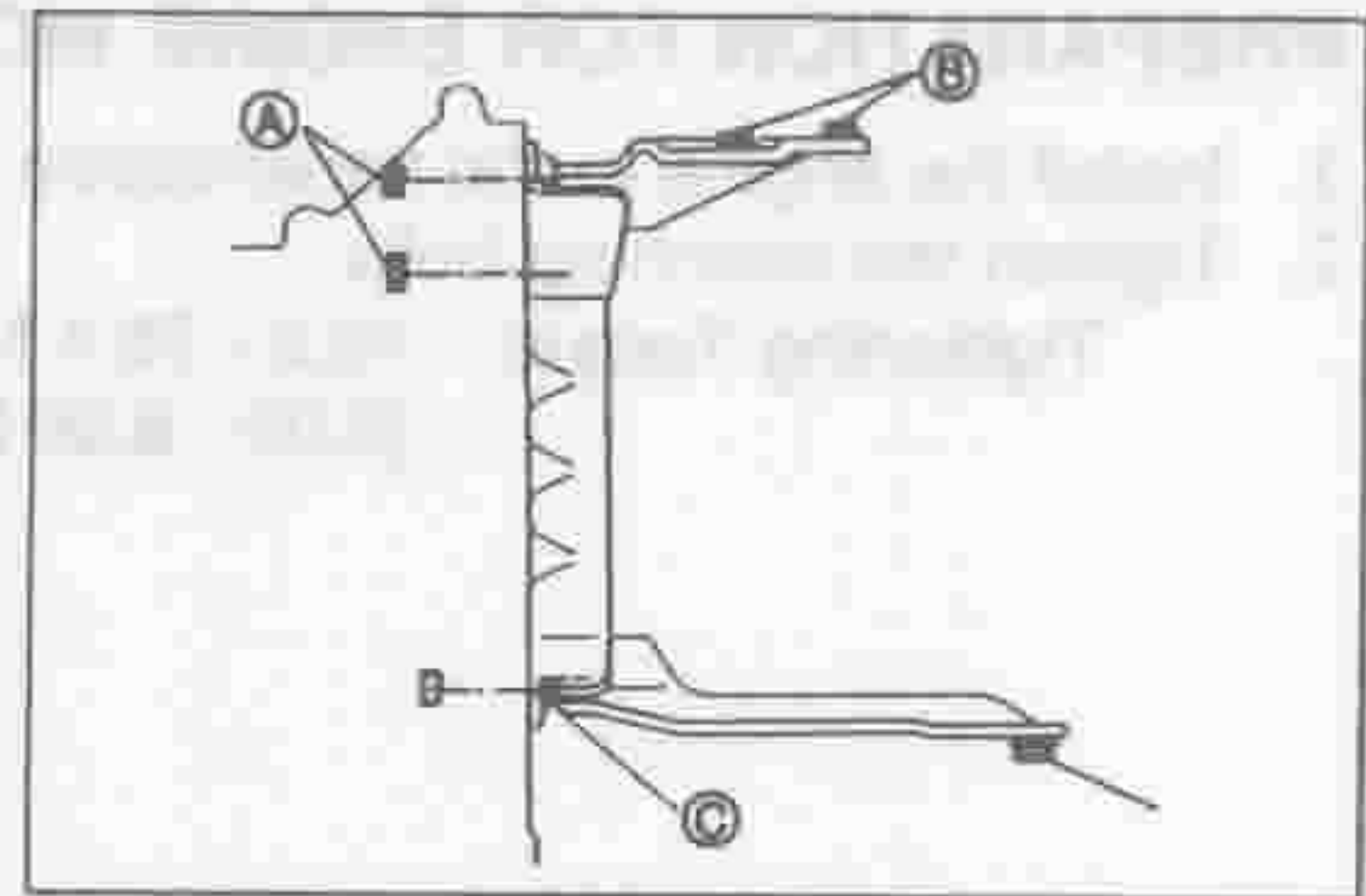
LEM00457-00421

# EM-108

- (4) Tighten the bolts A, B and C in the right figure to the specified torque.

Tightening Torque:

- Bolt A: 14.7 - 21.6 N·m (1.50 - 2.20 kgf-m)  
Bolt B: 14.7 - 21.6 N·m (1.50 - 2.20 kgf-m)  
Bolt C: 29.4 - 44.1 N·m (3.00 - 4.50 kgf-m)

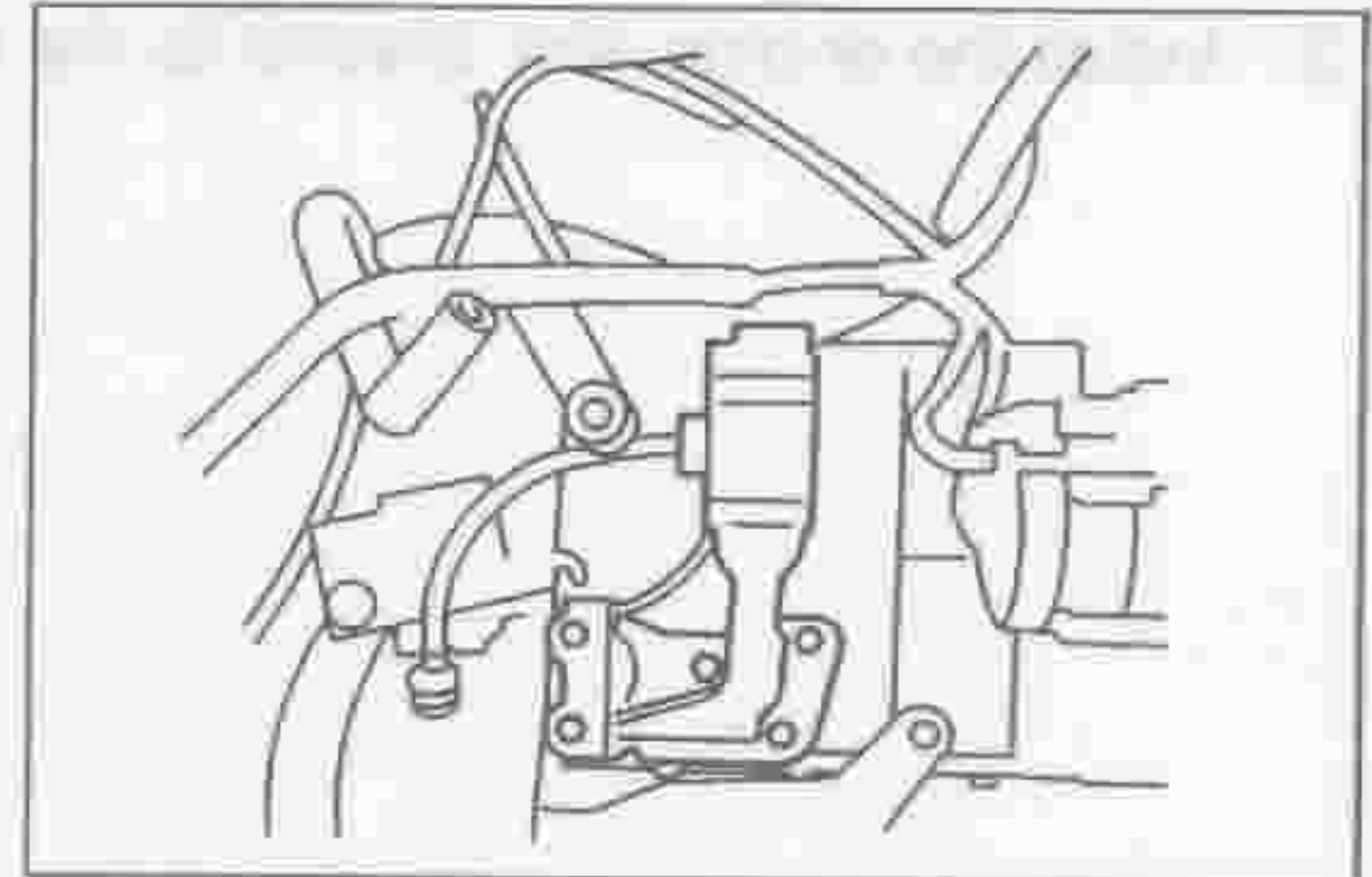


LEM00458-00422

6. Install the engine mounting rear bracket to the engine.  
7. Install the intake manifold stay.

Tightening Torque:

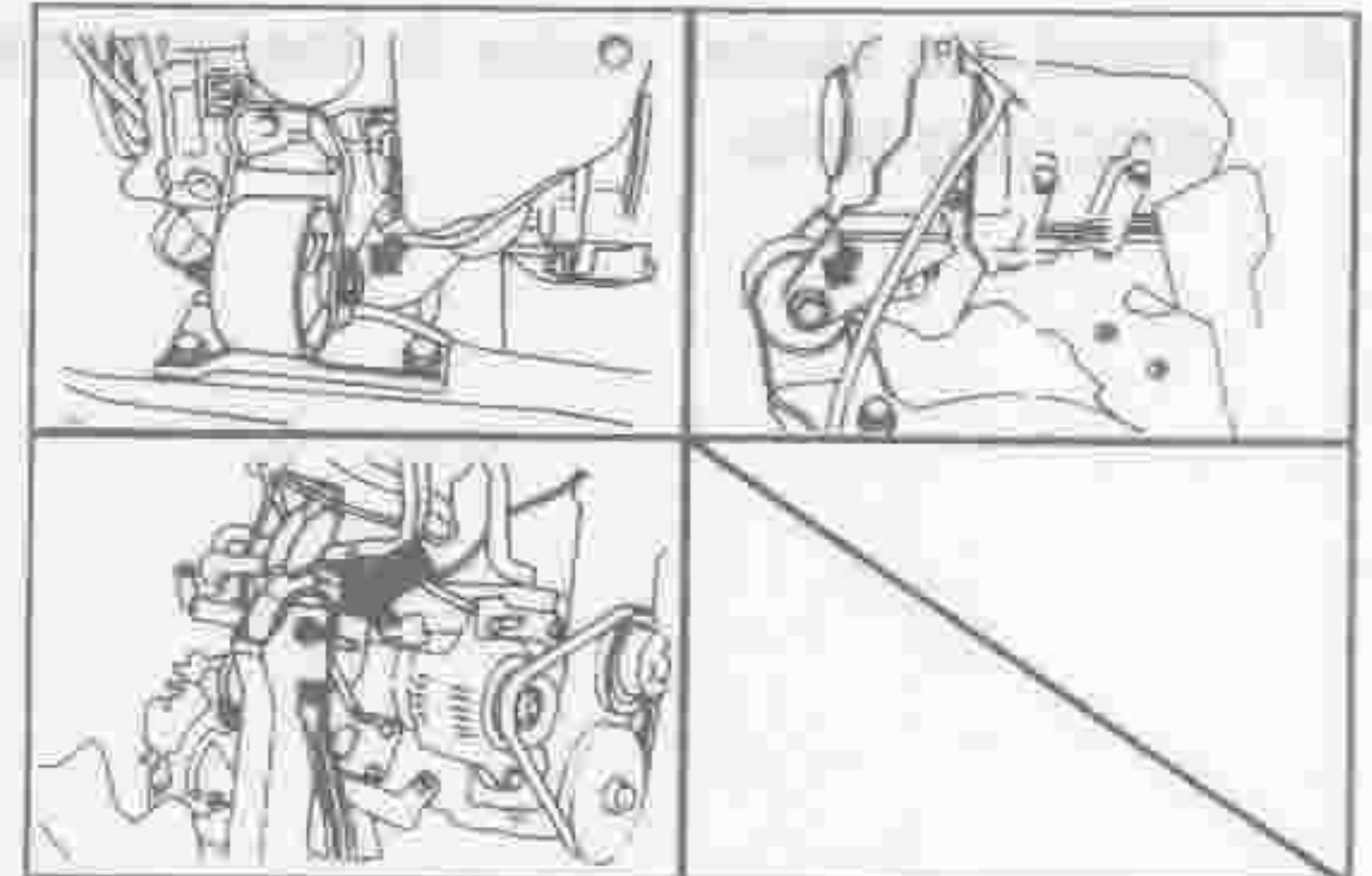
- $15.2 \pm 23.0$  N·m ( $1.55 \pm 2.35$  kgf-m)  
(Only for nut of ED-10)  
 $31.2 \pm 46.8$  N·m ( $3.2 \pm 4.8$  kgf-m)  
(All bolts)



LEM00459-00423

8. Sling the engine and transmission, using a chain block.

9. Install the engine and transmission to the frame.  
(Refer to the BO section.)



LEM00460-00424

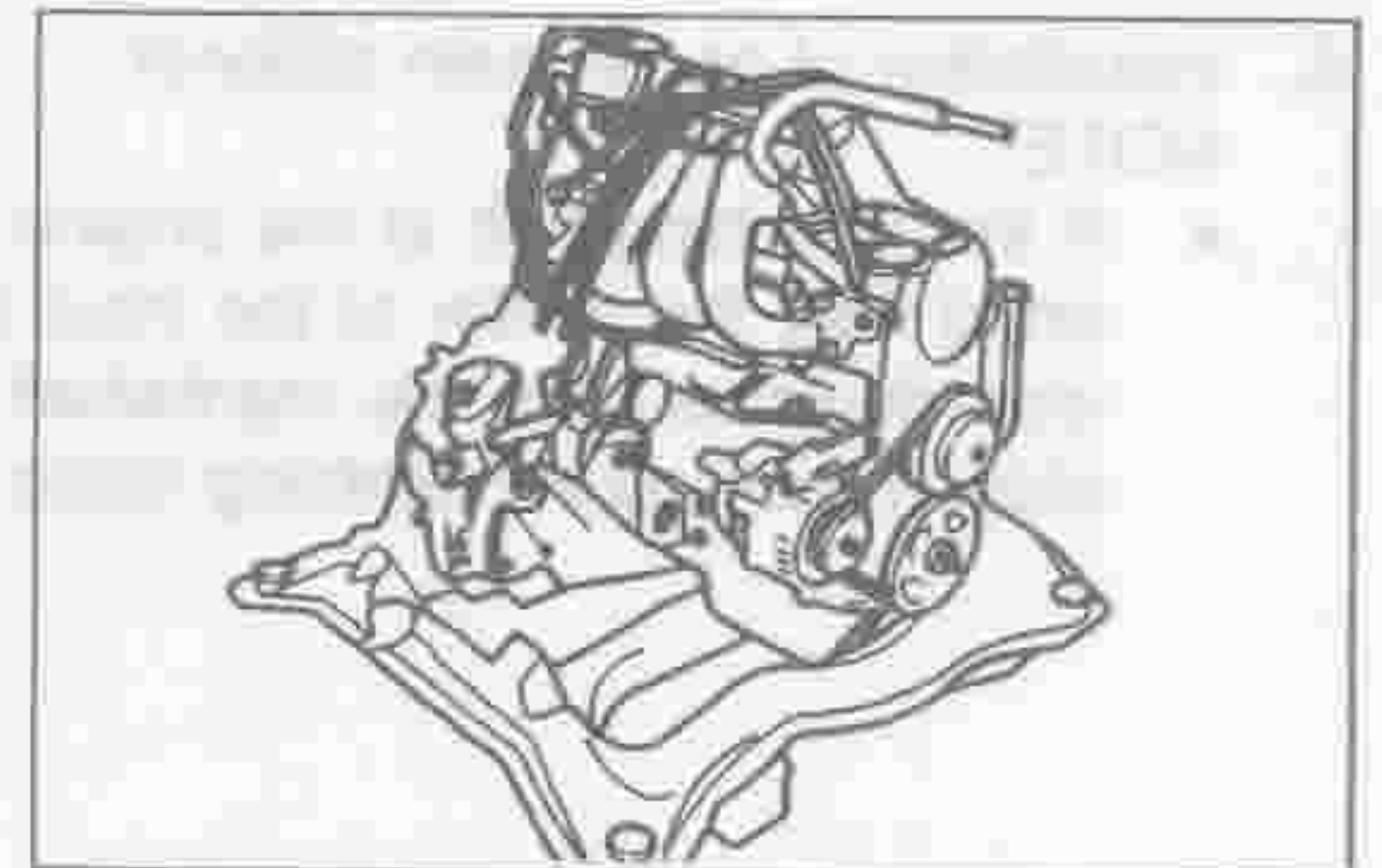
10. Place the frame to the lower side of the vehicle.

NOTE:

- Be sure to align the attaching bolt holes at the frame side with the stud bolt holes.

11. Install the frame to the vehicle. Tighten the bolts and nuts.  
(Refer to the BO section.)

Tightening Torque: 84.3 - 104.0 N·m  
(8.6 - 10.6 kgf-m)

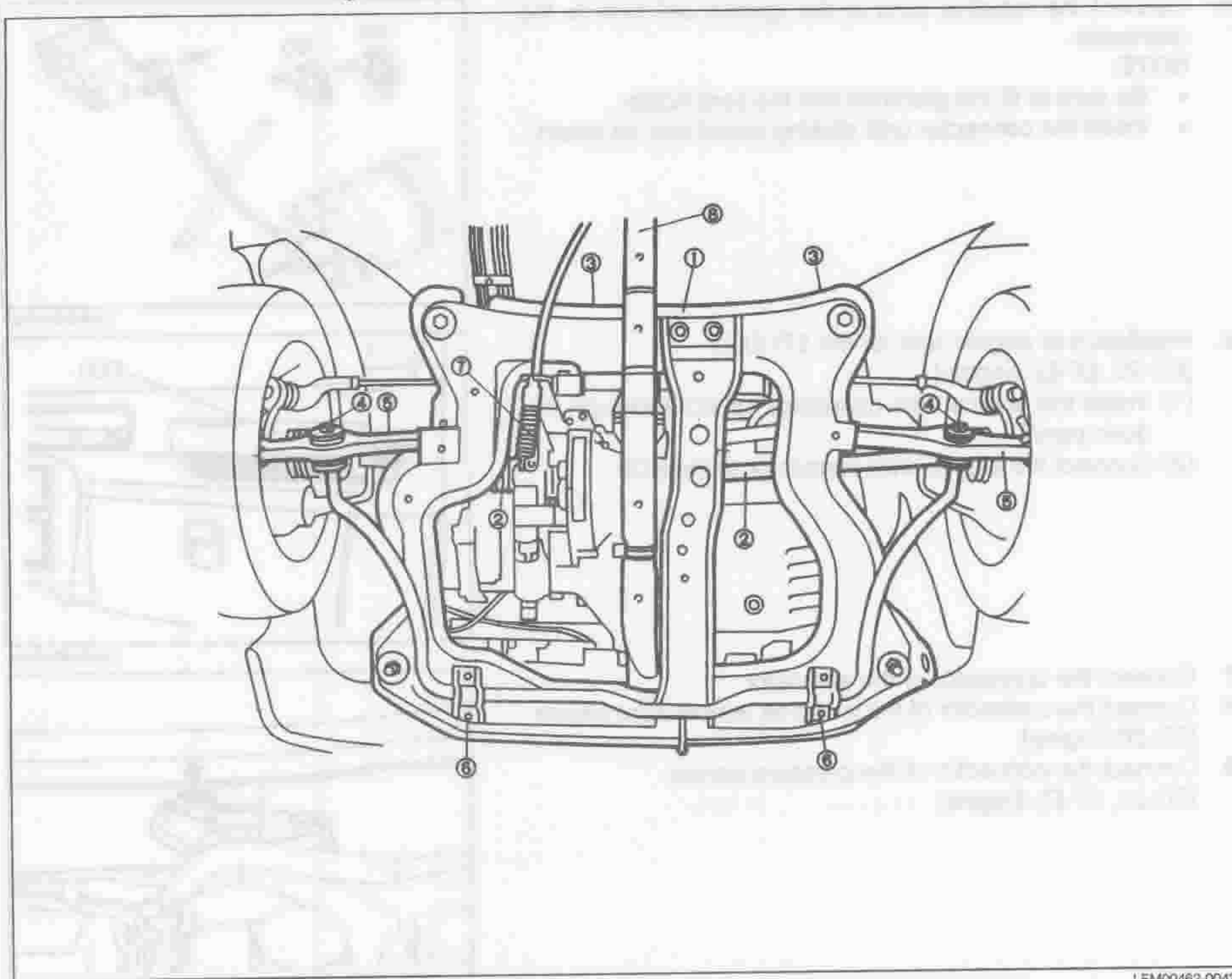


LEM00481-00425

12. Install or connect the following parts to the lower side of the vehicle.
- (1) Shift control cable (at shift side) clamp bolt (Refer to the MT section.)
  - (2) Drive shaft (Refer to the FS section.)
  - (3) Steering housing bracket attaching bolt (Refer to the SR section.)
  - (4) Front stabilizer (Refer to the FS section.)
  - (5) Lower arms (Refer to the FS section.)
  - (6) Front stabilizer bracket (Refer to the FS section.)
  - (7) Shift control cable (Refer to the MT section.)
  - (8) Exhaust front pipe (Refer to the BO section.)

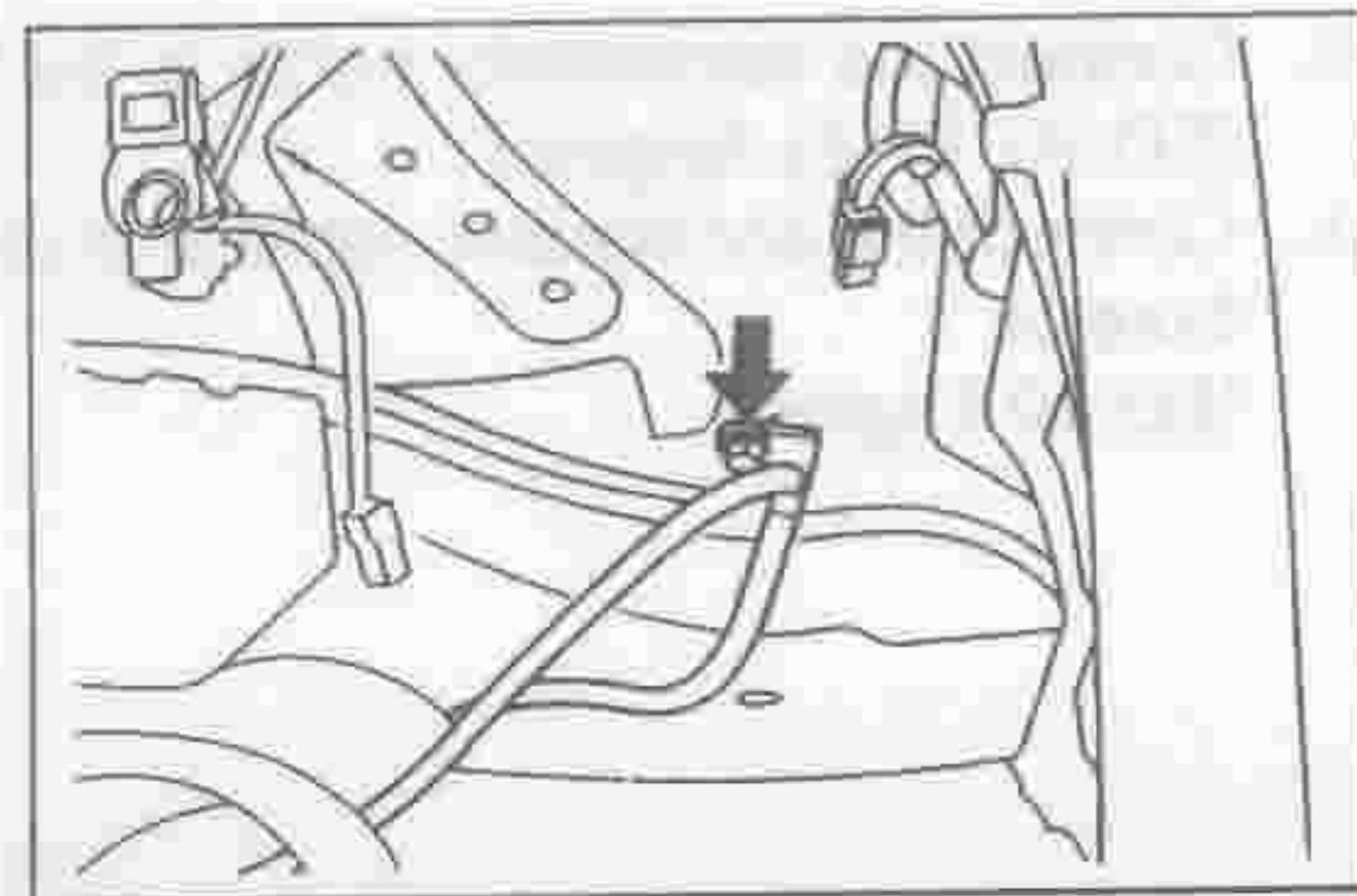
## NOTE:

- Be sure to use a new gasket.



LEM00462-00426

13. Connect the ground cable to the body.



LEM00463-00427

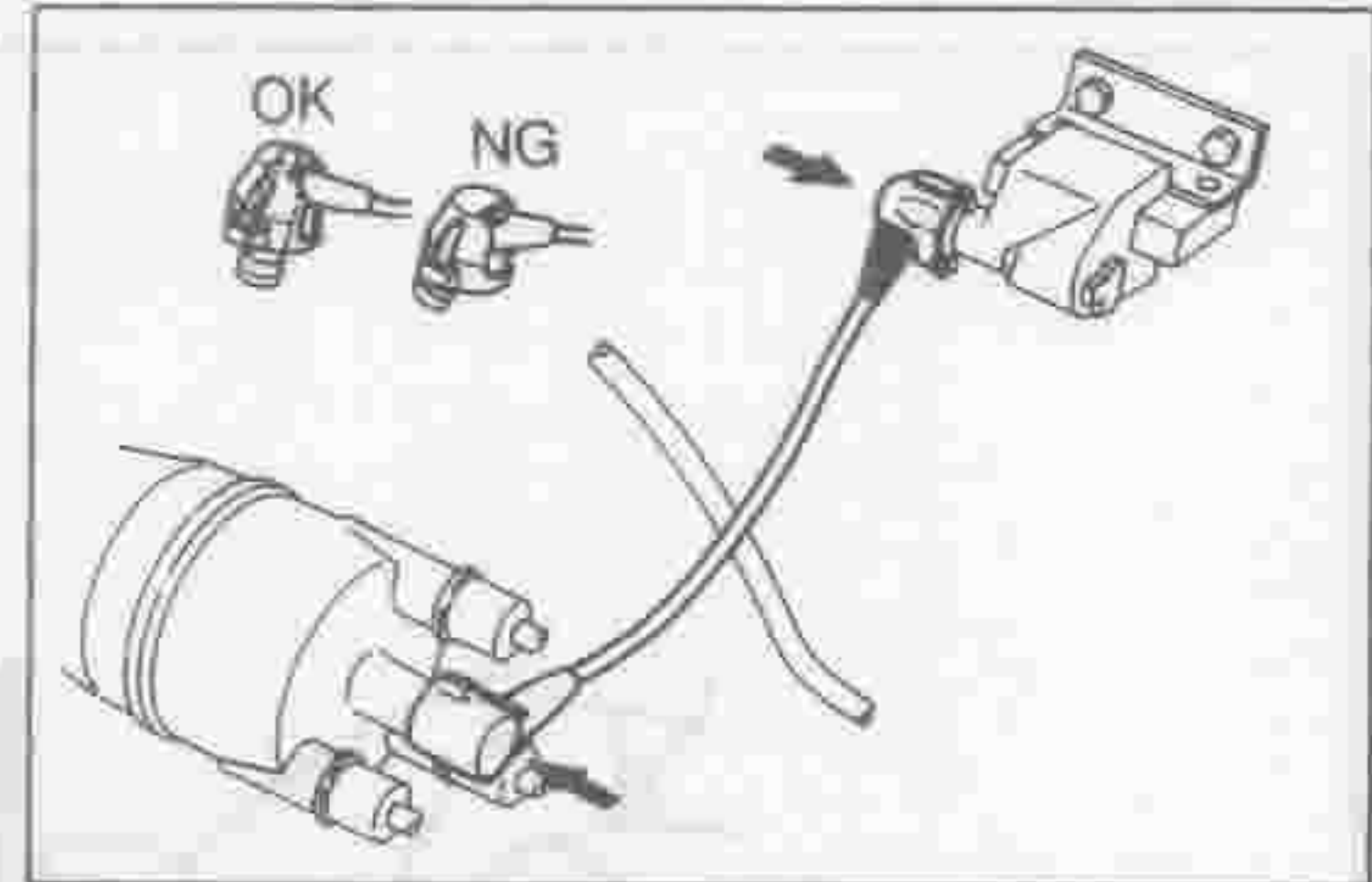
15. Connect the resistive cord at the ignition coil side to the distributor.

NOTE:

- Be sure to fit the grommet into the cord holder.
- Insert the connector until clicking sound can be heard.



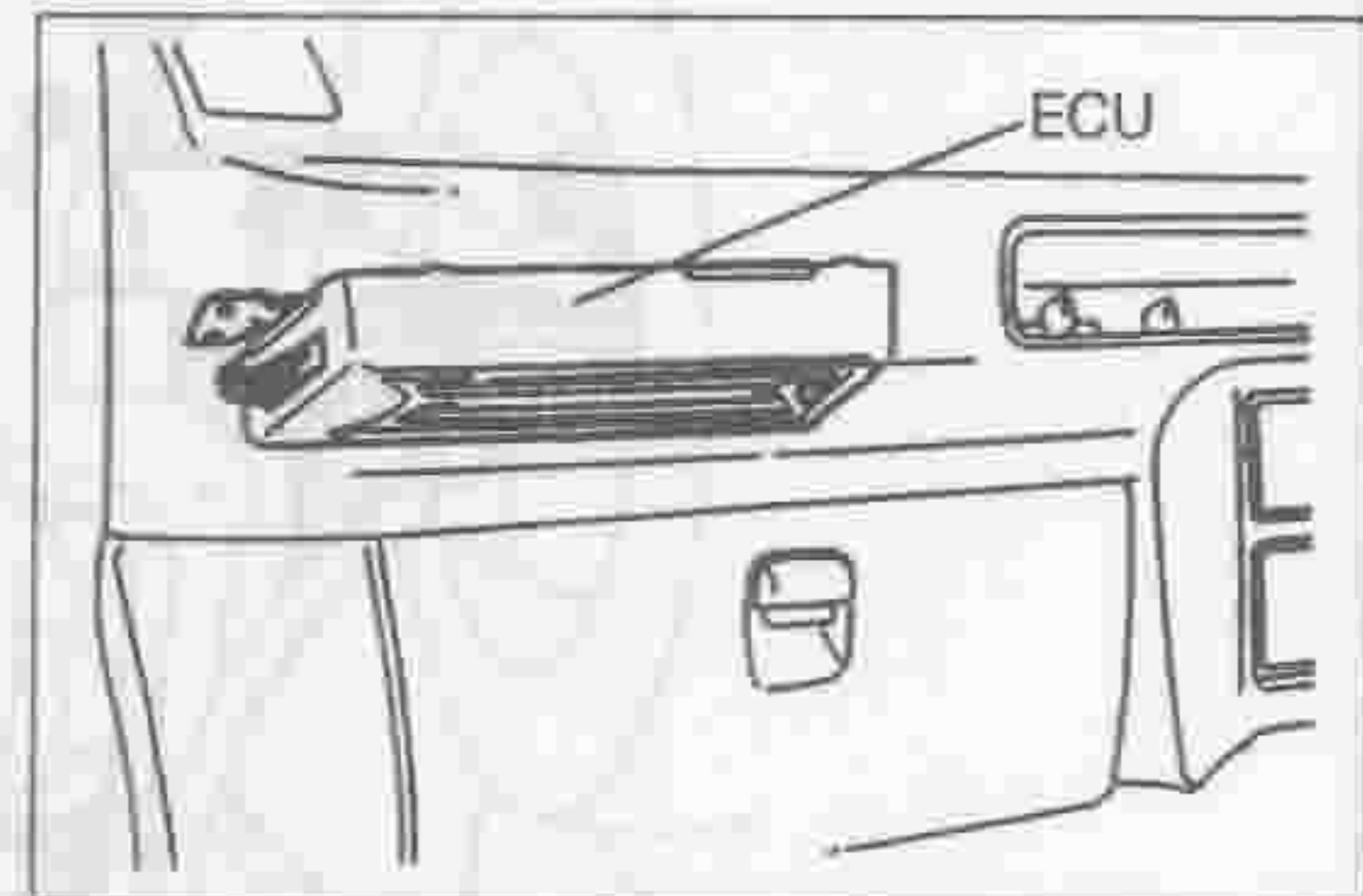
LEM00464-00428



LEM00465-00429

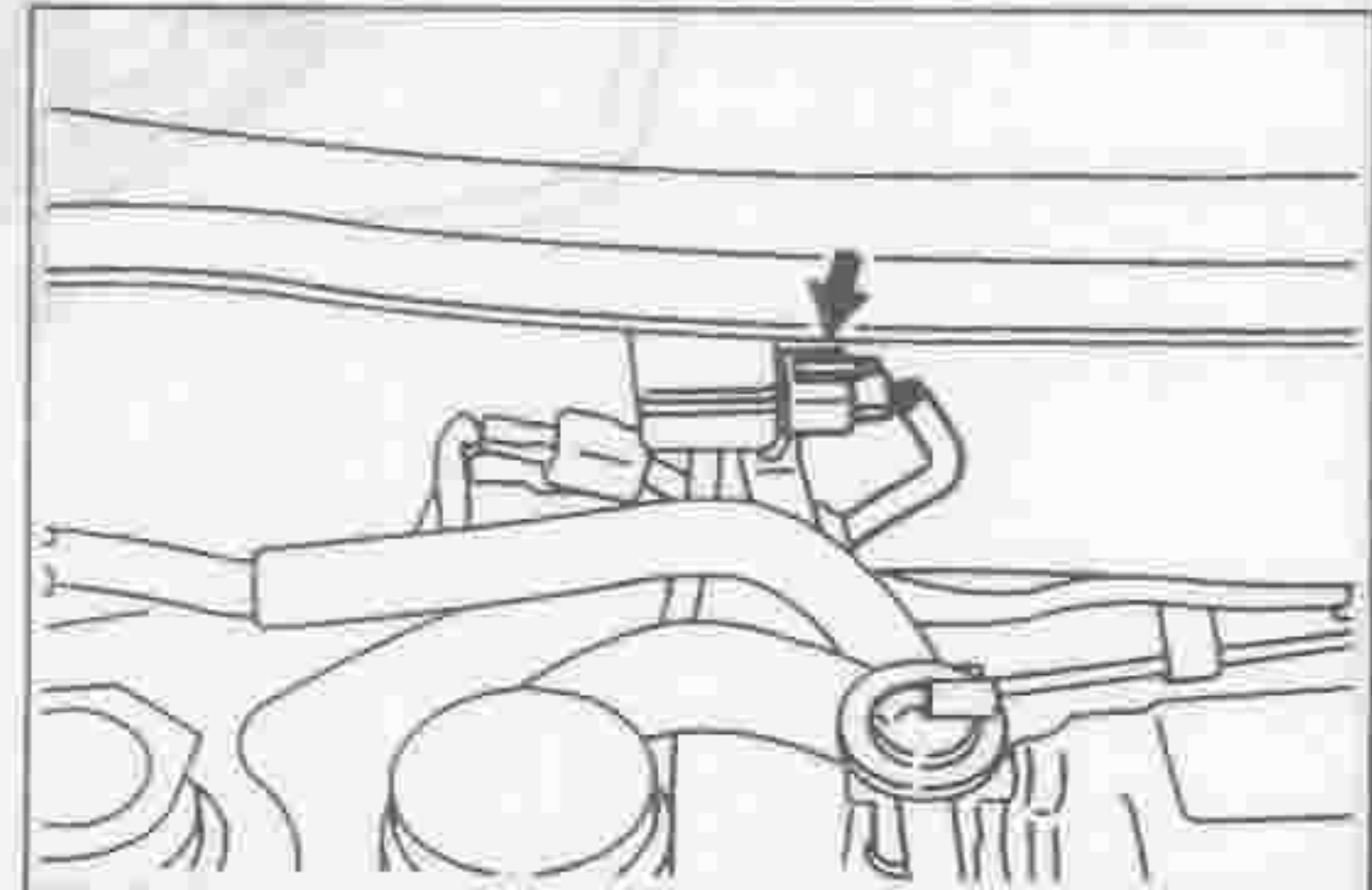
16. Installation of engine wire for the EFI ECU  
[ED-20, EF-EL Engine]

- (1) Install the engine wire connector for ECU through the dash panel.
- (2) Connect the engine wire connector to the ECU.



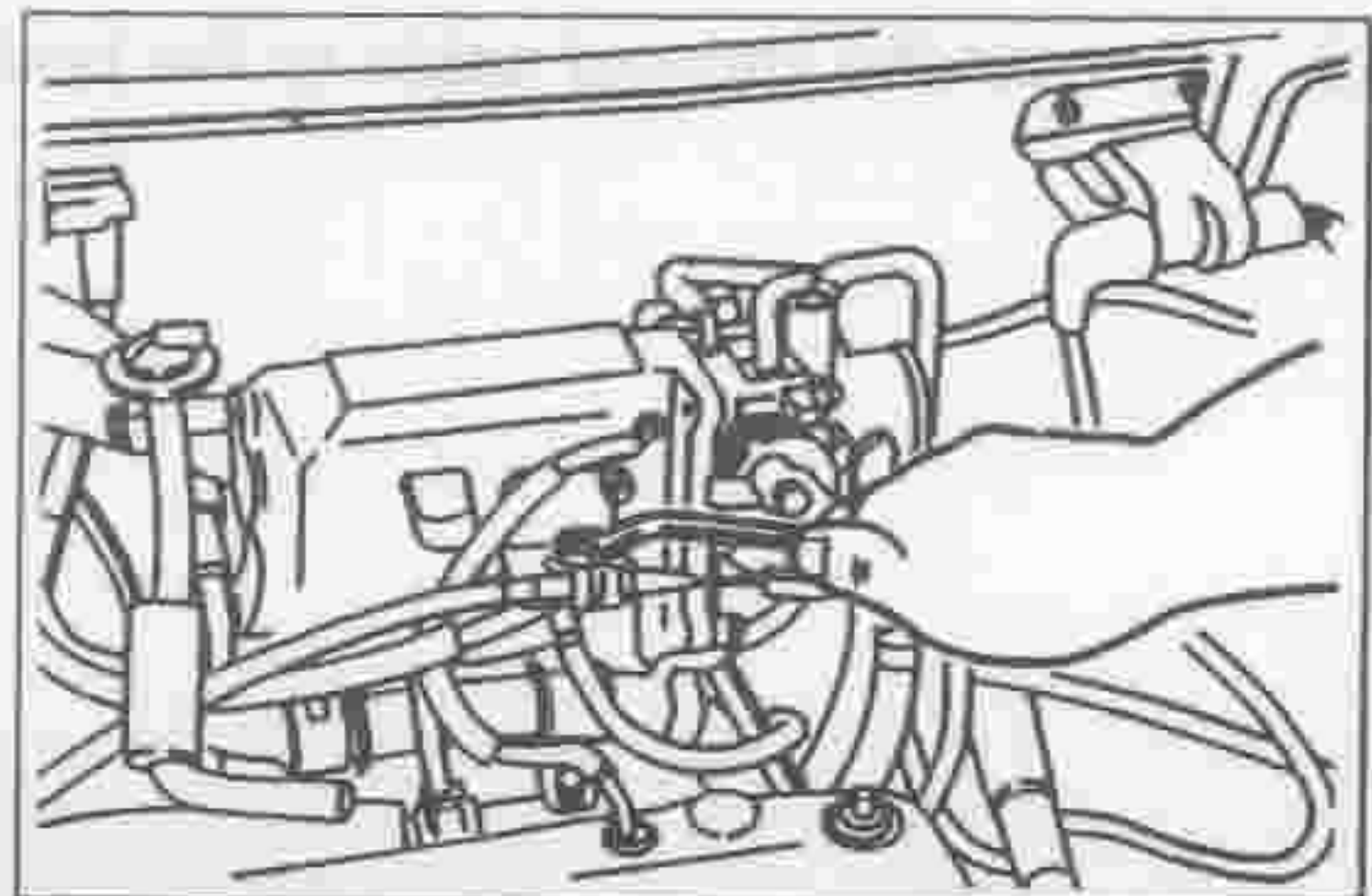
LEM00466-00430

17. Connect the connector of the alternator.
18. Connect the connector of the intake air temperature sensor.  
[ED-20 Engine]
19. Connect the connector of the pressure sensor.  
[ED-20, EF-EL Engine]



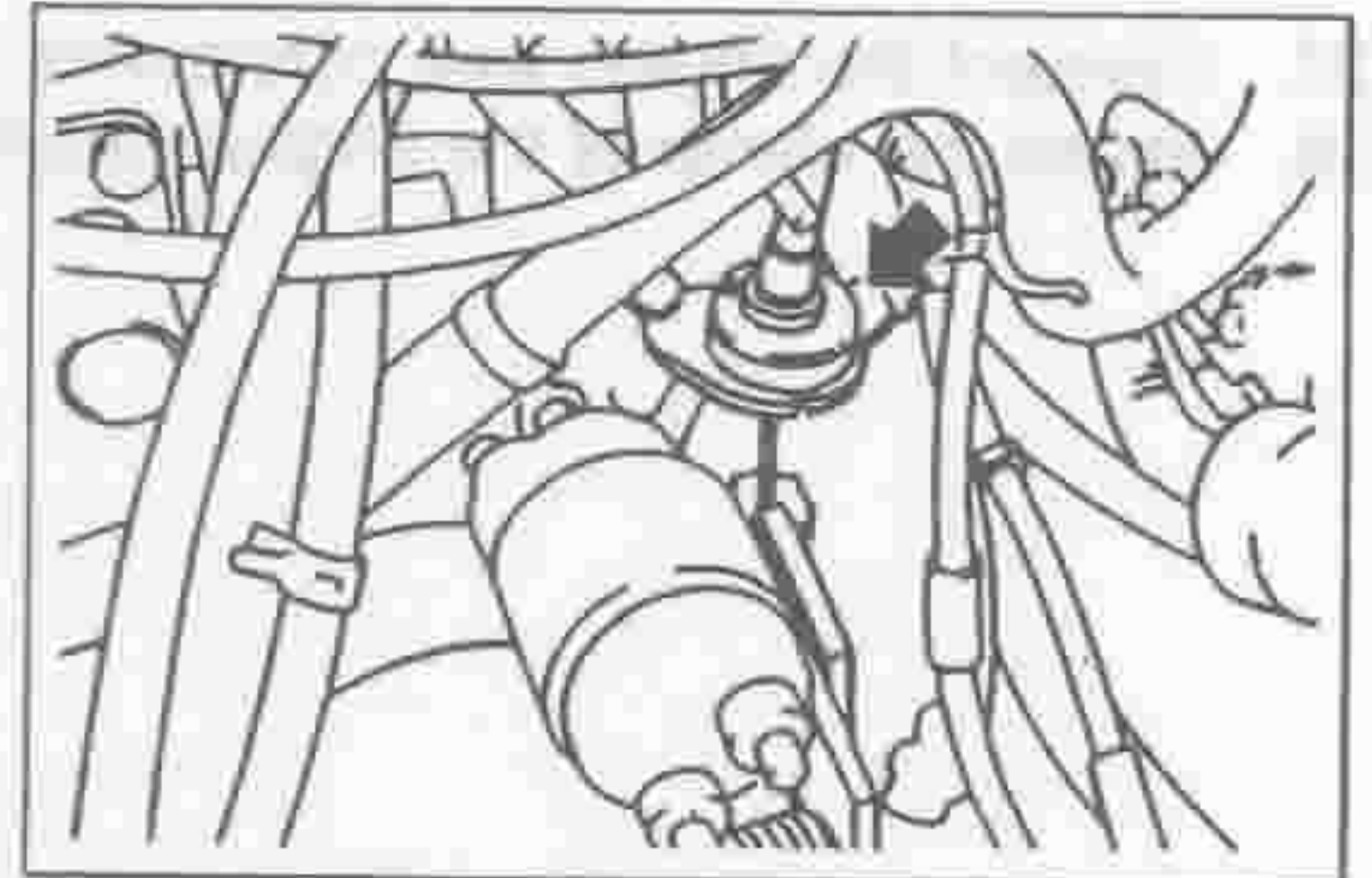
LEM00467-00431

20. Connect the accelerator cable to the throttle body.  
[ED-20, EF-EL Engine]
21. Connect the accelerator cable and choke cable to the carburetor.  
[ED-10 Engine]



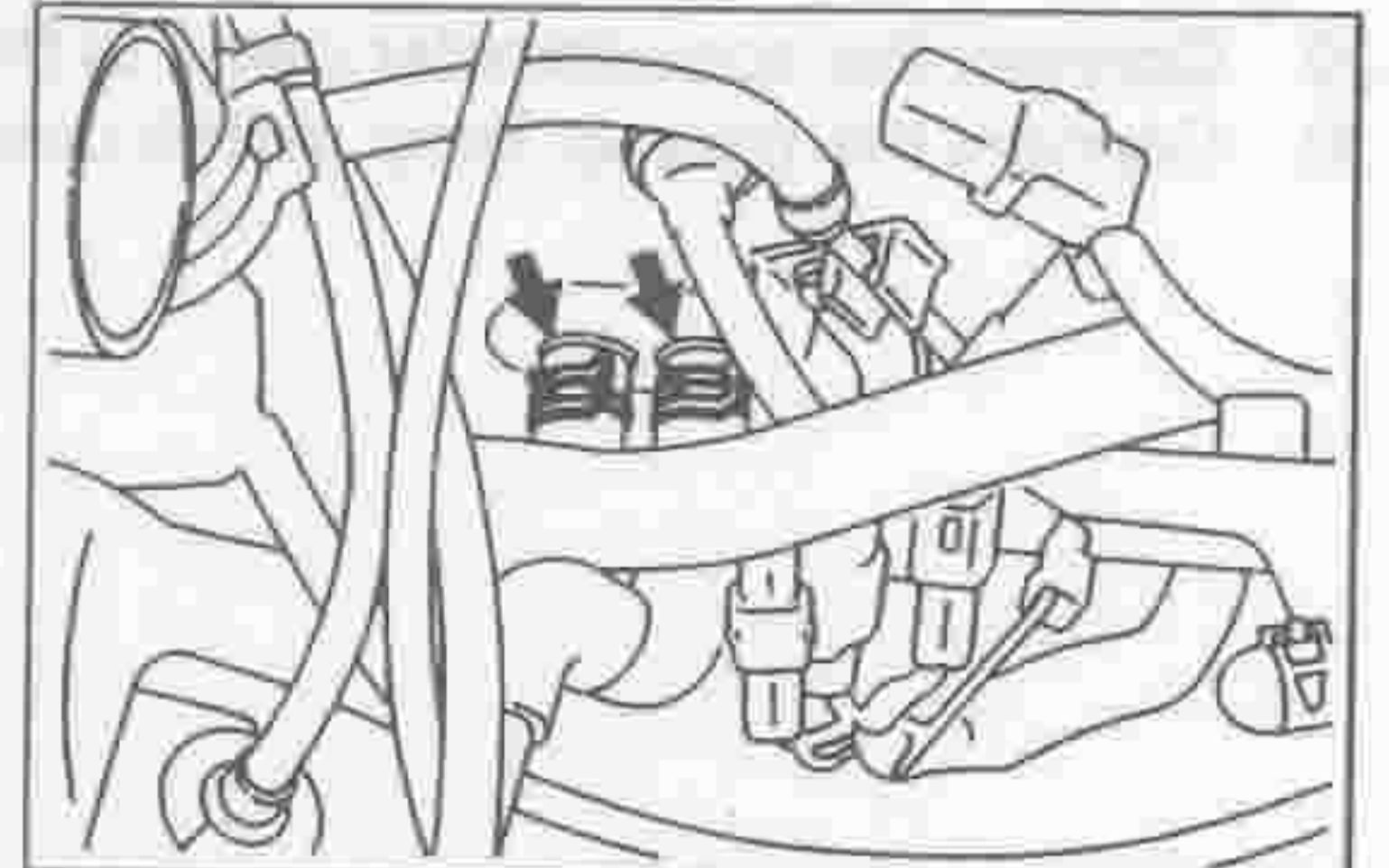
LEM00468-00432

22. Connect and adjust the clutch cable.  
(Refer to the CL section.)



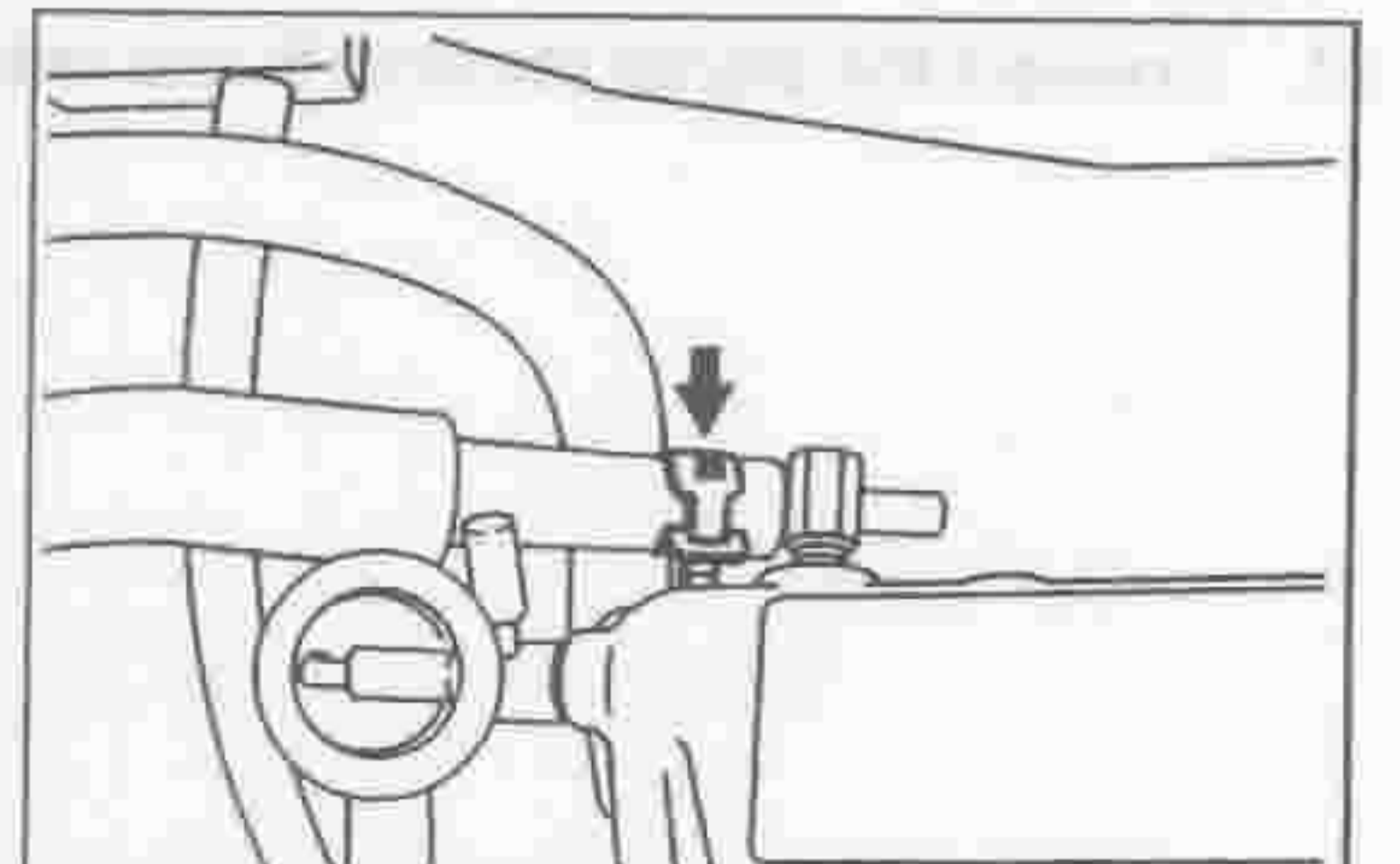
LEM00469-00433

23. Connect the heater hoses to the heater and secure the hoses with new hose bands.



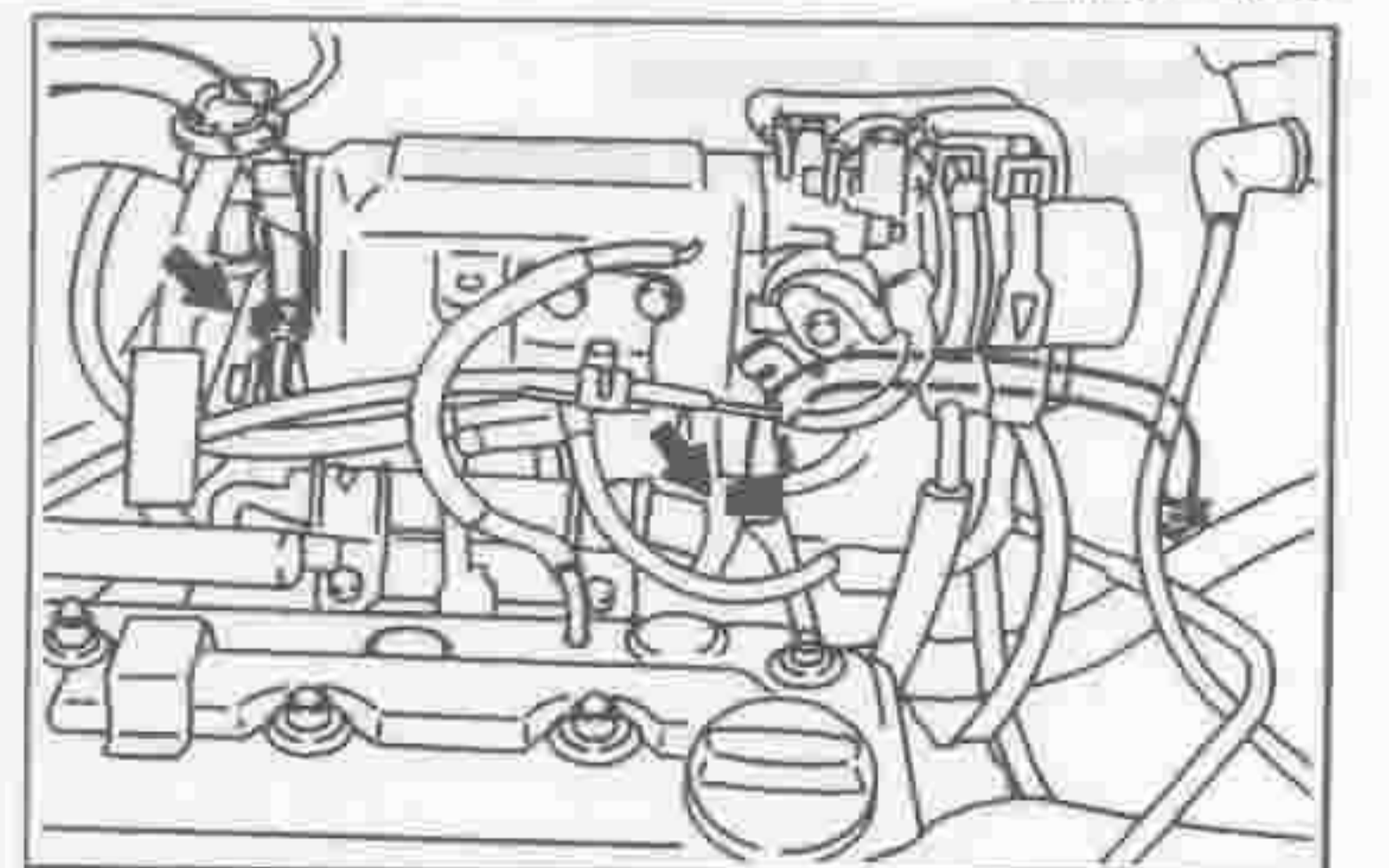
LEM00470-00434

24. Connect the brake booster hose to the intake manifold.



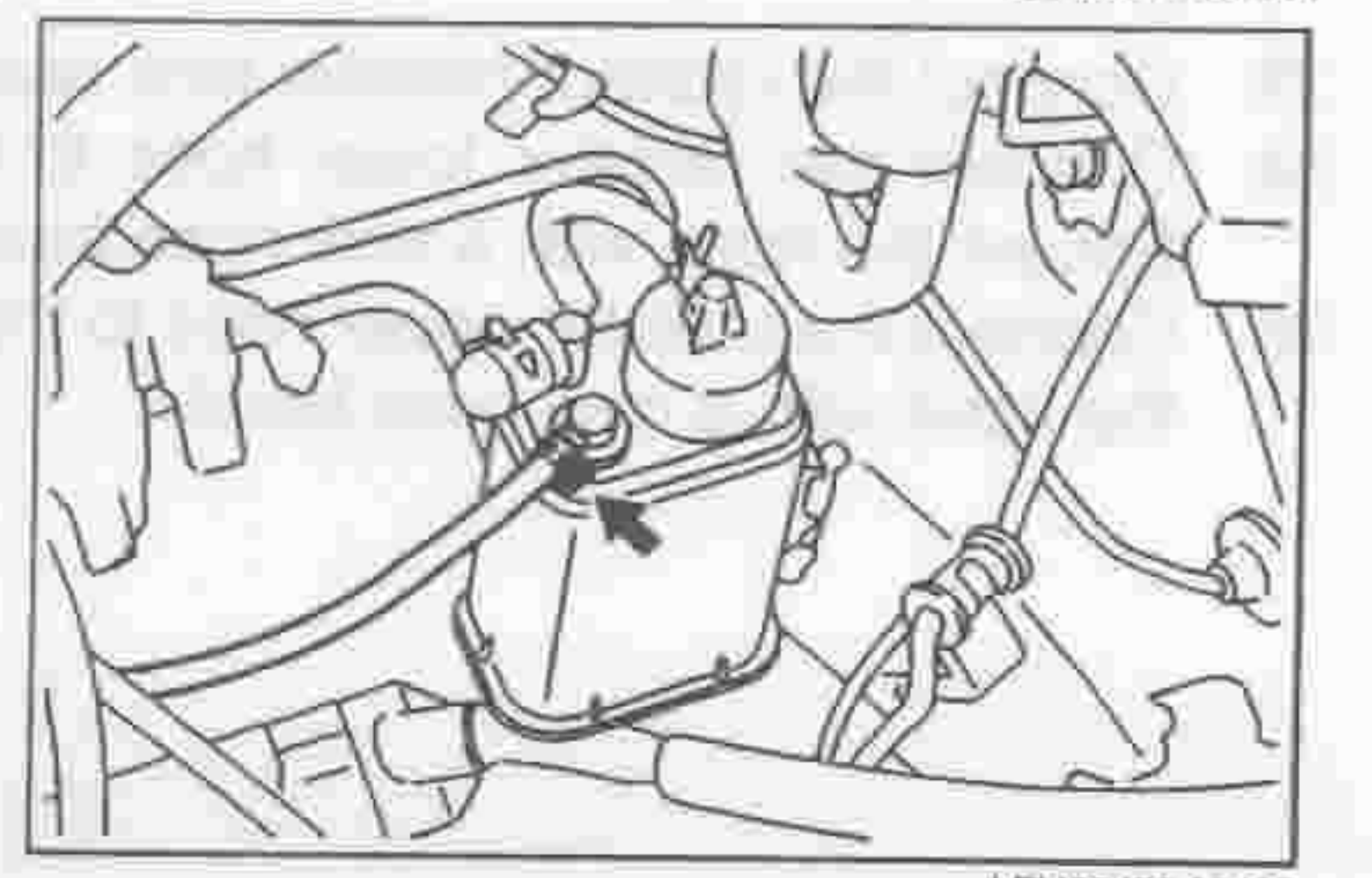
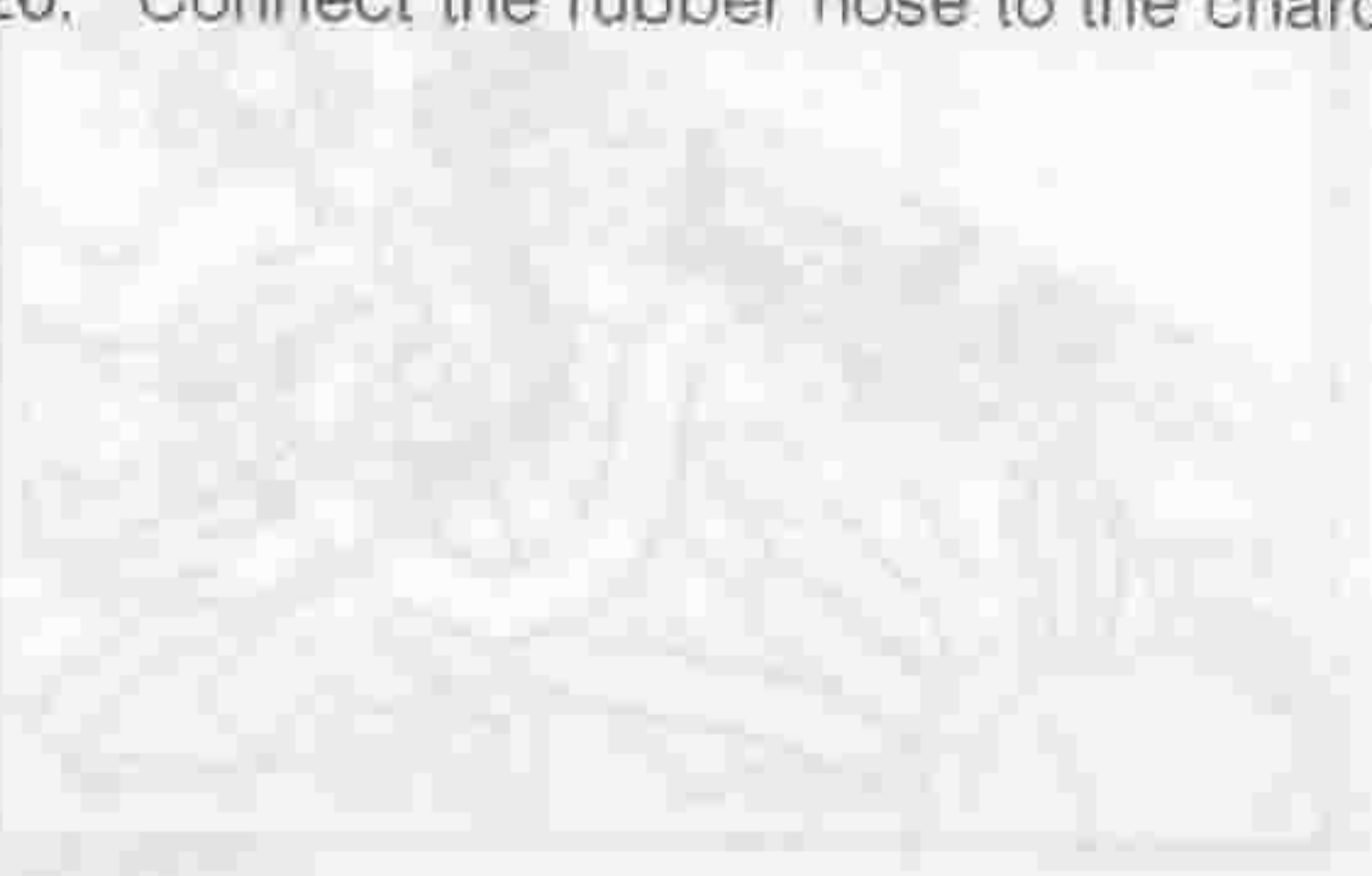
LEM00471-00435

25. Connect the fuel inlet and outlet hose to the engine. Secure the hoses with new hose bands.



LEM00472-00436

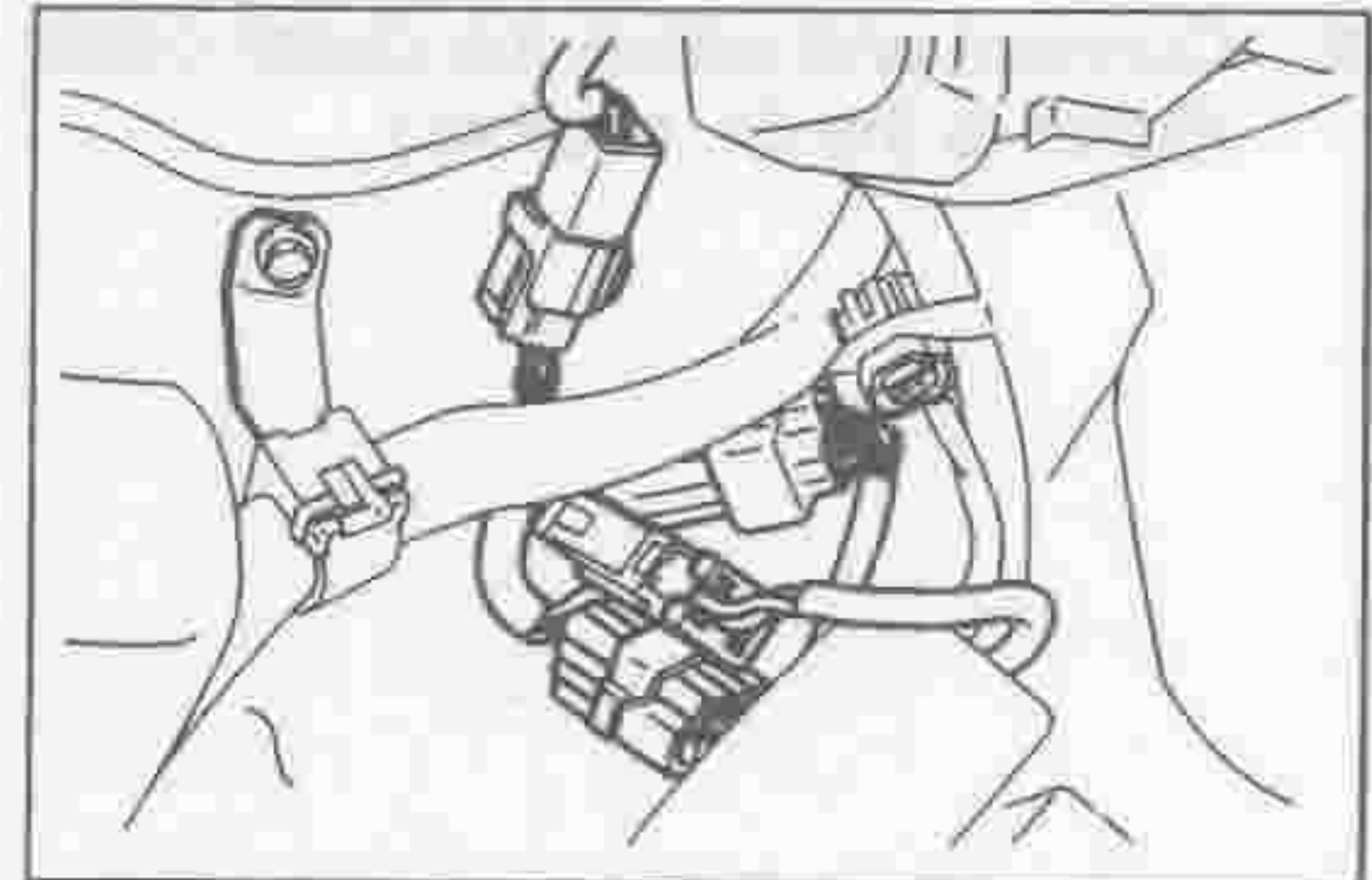
26. Connect the rubber hose to the charcoal canister.



LEM00473-00437

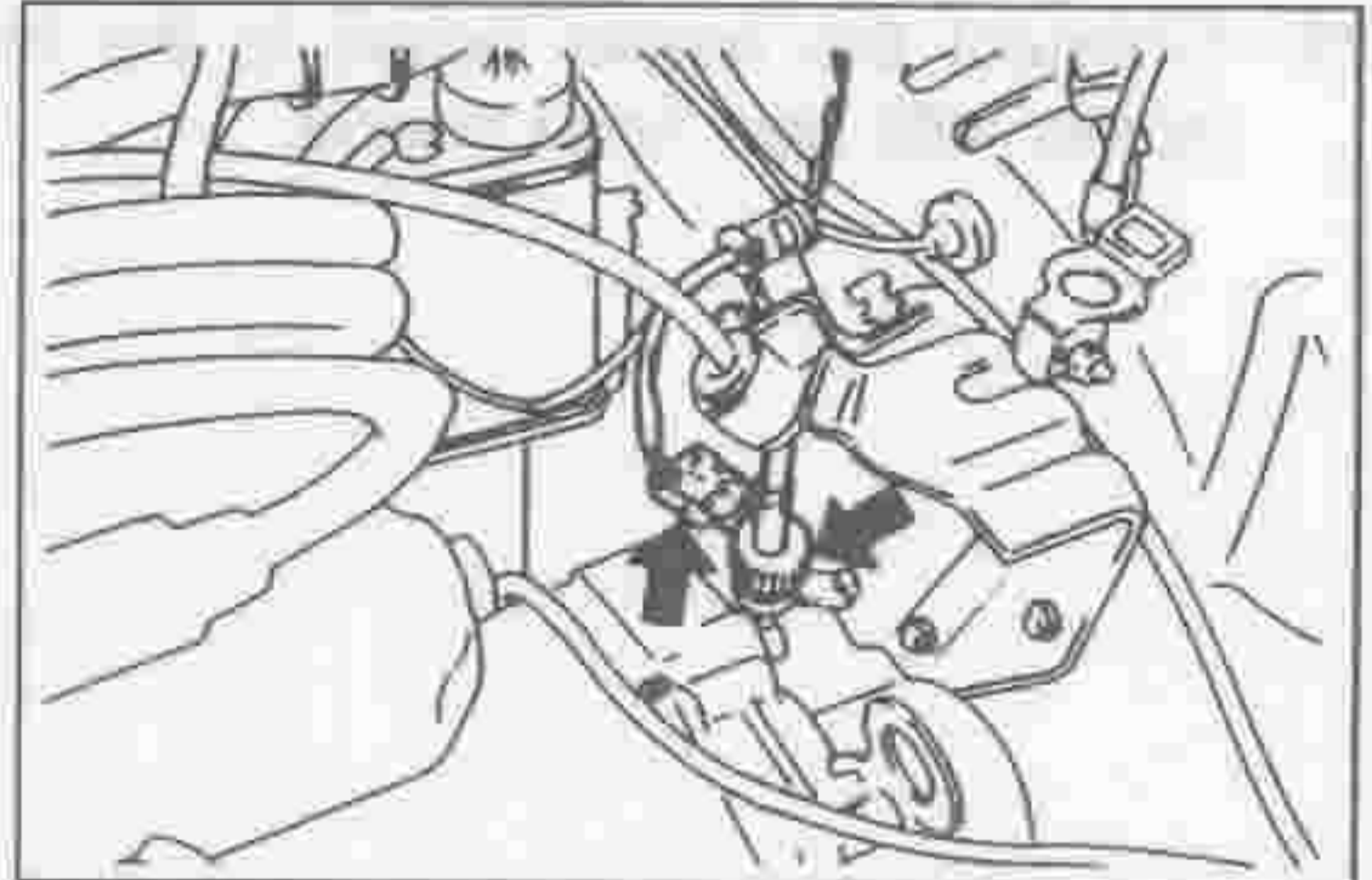
# EM-112

27. Connect the engine wire connectors.
28. Attach the clamp of the engine wire with bolts.



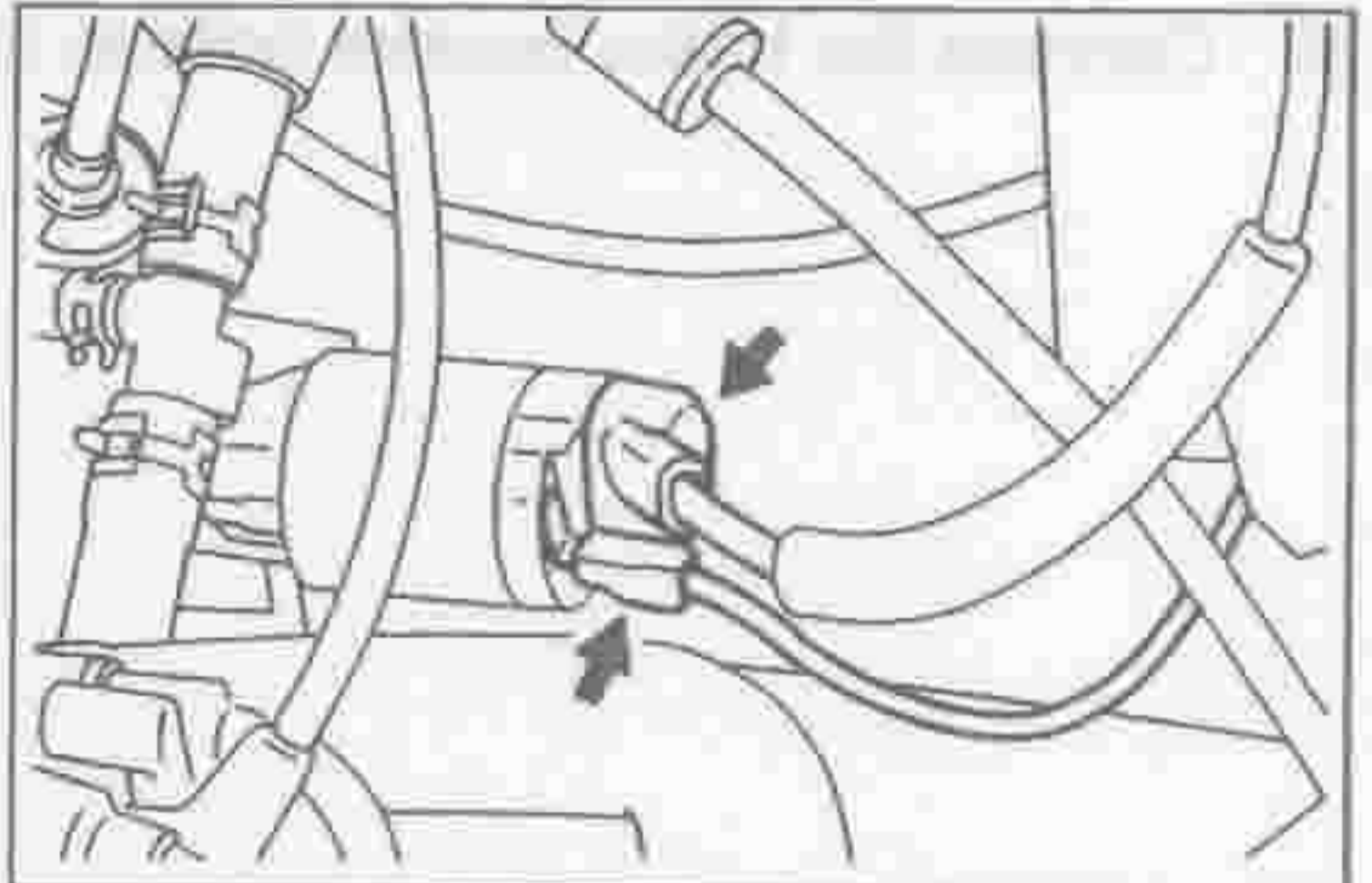
LEM00474-00438

29. Connect the speedometer cable to the transmission.
30. Connect the backup lamp switch connector.



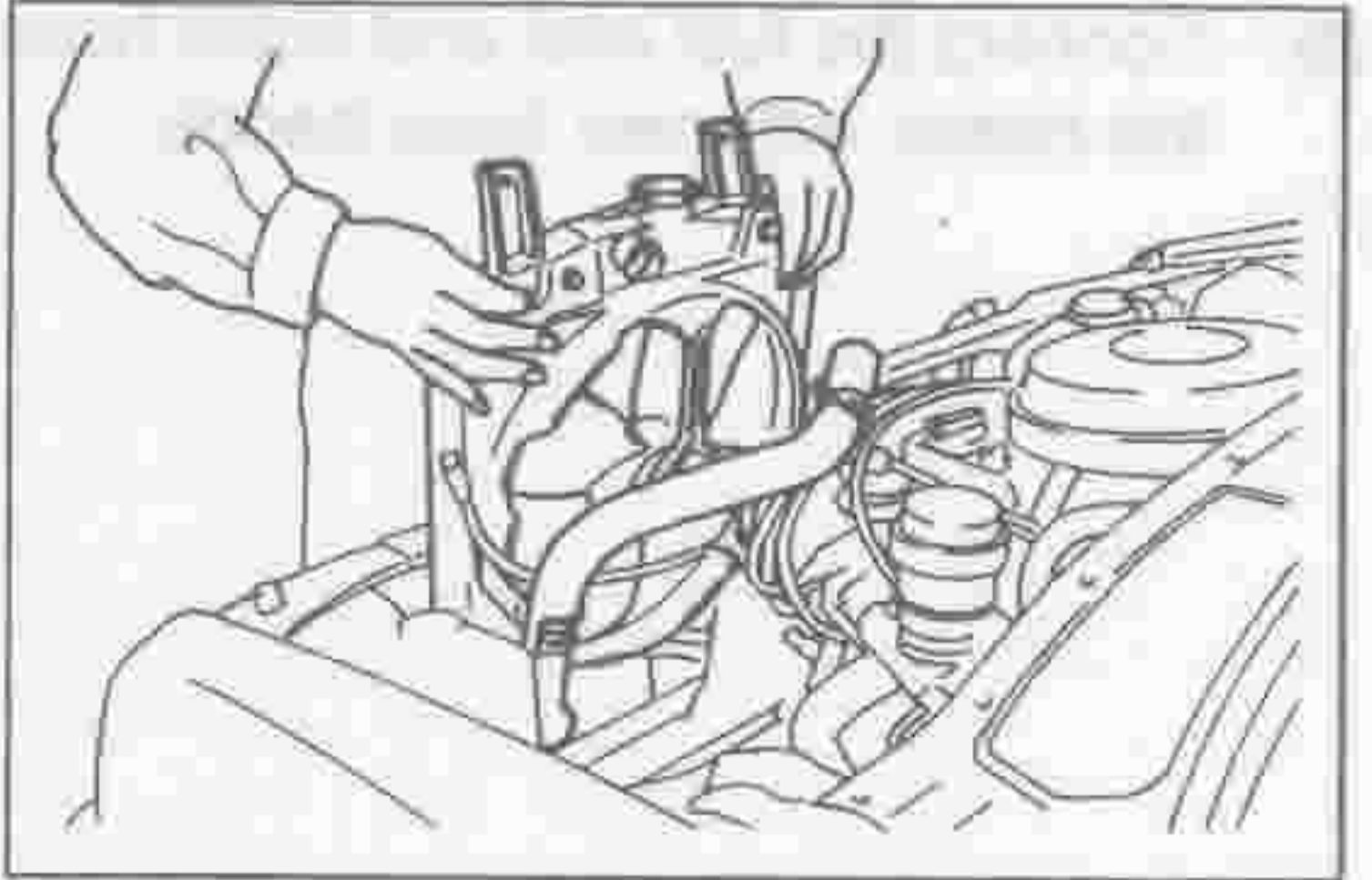
LEM00475-00439

31. Connect the starter terminal B and terminal ST to the starter.



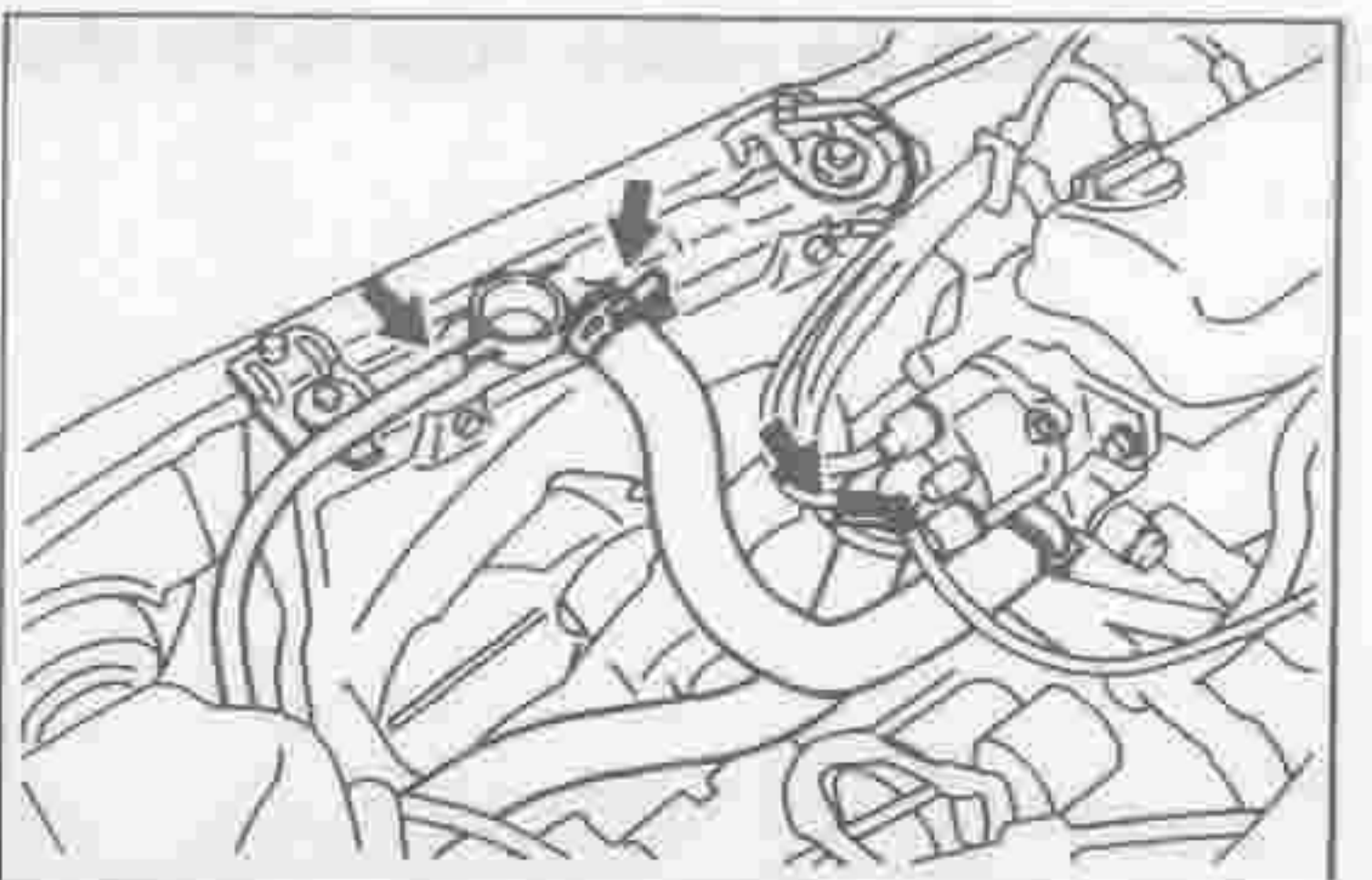
LEM00476-00440

32. Install the radiator.  
(Refer to the CO section.)



LEM00477-00441

33. Connect the radiator reserve tank hose.
34. Connect the radiator lower hose to the water inlet pipe. Secure the hose with a new hose band.
35. Connect the radiator upper hose to the radiator and secure the hose with a new hose band.



LEM00478-00442

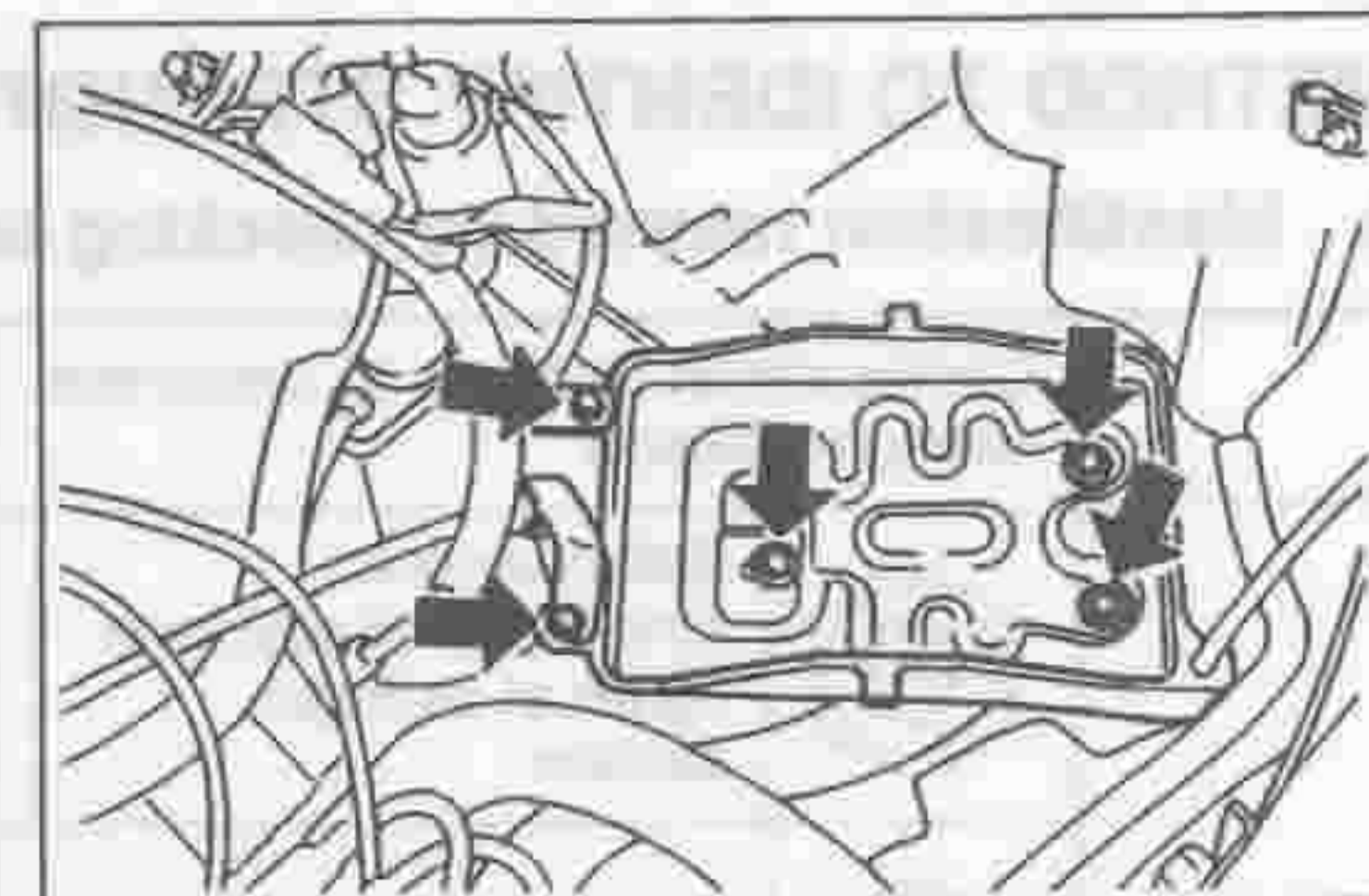




LEM00479-00443

## 37. Installation of battery carrier

- (1) Install the battery carrier with the three attaching bolts.
- (2) Install the speedometer cable clamp attaching bolt.
- (3) Install the ground cable to the clamp.
- (4) Install the wiring clamp bolt.



LEM00480-00444

## 38. Installation of battery

- (1) Place the battery on the battery carrier.

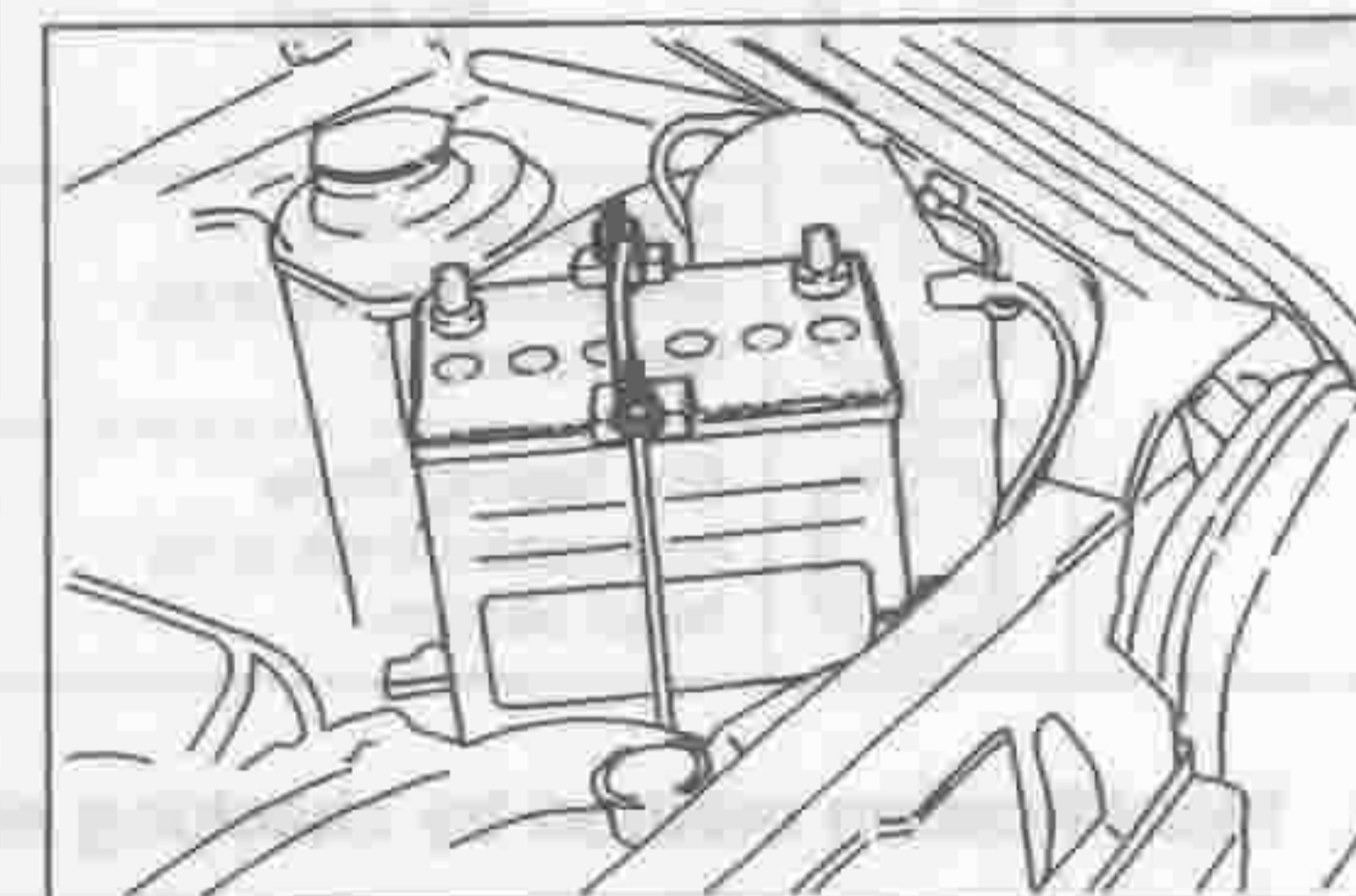
## NOTE:

- Be sure to install the battery in such a direction that the negative terminal faces toward the vehicle front.

- (2) Install the battery hold-down clamp.

## NOTE:

- Care must be exercised so as not to damage the battery due to excessive tightening of the attaching nuts of the battery hold-down clamp.



LEM00481-00445

## 39. Install the front bumper.

## 40. Install the air cleaner assembly to the engine.

## 41. Fill engine oil.

(Refer to the LU section.)

## 42. Fill transmission oil.

(Refer to the MT section.)

## 43. Fill engine coolant.

(Refer to the CO section.)

## 44. Reconnect the wire of the positive terminal to the battery positive (+) terminal.

## 45. Reconnect the battery ground cable to the negative (-) terminal of the battery.

## 46. Start the engine. Ensure that the engine exhibits no leakage of cooling water or oil.

## 47. Warm up the engine. Adjust the accelerator cable free travel in the axial direction to 3.0 to 8.0 mm.

## 48. Perform the engine tune-up.

## 49. Install the engine hood.

LEM00482-00000








## TIGHTENING TORQUE FOR MAIN COMPONENTS

1. When you want to find out a suitable tightening torque for a bolt, first determine the strength division of the said bolt, using the table below. Then, locate suitable tightening torque in the tightening torque table described later.
2. As for the tightening torque for nut, find out suitable tightening torque in the same way as with the paragraph 1 above, based on the mating bolt.
3. Tightening torque posted in the service manual is a standard value for steel fasteners. It is, therefore, necessary to modify these tightening torque when you tighten fasteners made of materials other than steel. This rule also applies to such instances where bolts are undergoing heat or other stress, such as vibratory loads and so forth.

LEM00483-00000

## METHOD TO IDENTIFY STRENGTH DIVISION OF BOLTS

### 1. Identification method by checking bolts themselves

	Configuration and how to determine strength division		Strength division		Configuration and how to determine strength division		Strength division
Hexagon bolt		Bolt having an embossed or stamped figure at its head section	4 = 4T 5 = 5T 6 = 6T 7 = 7T	Welded bolt			4T
		No mark	4T		Stud bolt		No mark
		Bolt having two embossed lines at its head section	6T			Bolt having about 2 mm deep recess at one end or both ends	
		Bolt having three embossed lines at its head section	7T 8T				6T

LEM00484-00446

### 2. Identification method by checking nuts themselves

	4T		5T		7T	
	3, 4, 5 12, 24	Others	3, 4, 5 12, 24	Others	3, 4, 5 12, 24	Others
Cold press nuts	Nut having one semi-spherical recess at its upper surface	No mark	Nut having two semi-spherical recesses	←	Nut having three semi-spherical recesses	←
Cutting machined nut	Nut having one recess or more at one side	No mark	Nut having one recess or more at two sides	Nut having cut-out section at hexagonal top surface	Nut having one recess or more at three sides	No mark

LEM00485-00000

## 3. Identification method by part numbers

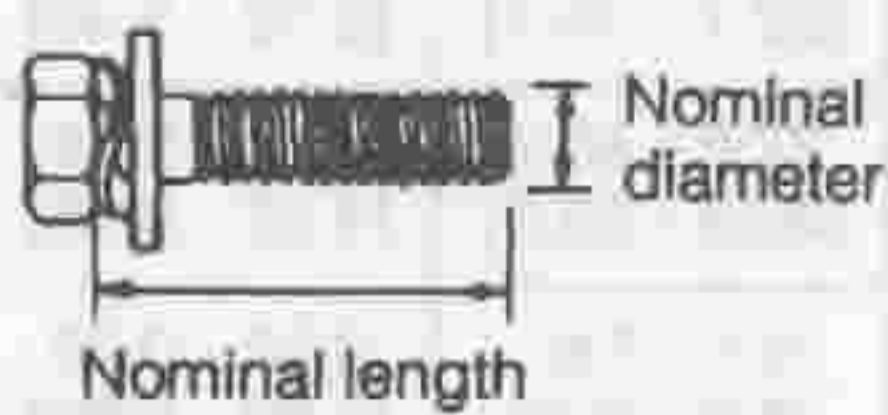
### Hexagon bolt

Example Part number 9 1 1 1 1 - 4 0 6 2 0

Nominal length (mm)

Nominal diameter (mm)

Strength division



### Stud bolt

Example Part number 9 2 1 3 2 - 4 0 6 2 0

Nominal length (mm)

Nominal diameter (mm)

Strength division

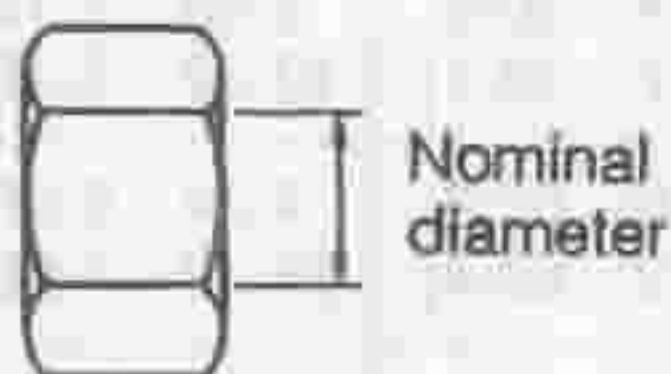


### Nut

Example Part number 9 4 1 1 1 - 4 0 8 0 0

Nominal diameter (mm)

Strength division



## TIGHTENING TORQUE TABLE FOR GENERAL STANDARD BOLTS & NUTS

**NOTE:**

- The table below indicates the tightening torques for those standard bolts and nuts which are not posted in the tightening torque table.

Category	Nominal diameter mm	Pitch mm	Standard tightening torque					
			Target value			Tightening range		
			N-m	kgf-m	ft-lb	N-m	kgf-m	ft-lb
<b>4T</b> (Bolt having a mark of "4" at its head section) Example of part number (91000 - 40000)	6	1.0	5.4 [5.9]	0.55 [0.60]	4.0 [4.3]	4.3 - 6.5 [4.7 - 7.1]	0.44 - 0.66 [0.48 - 0.72]	3.2 - 4.8 [3.5 - 5.2]
	8	1.25	12.7 [14.2]	1.30 [1.45]	9.4 [10.5]	10.2 - 15.3 [11.4 - 17.1]	1.04 - 1.56 [1.16 - 1.74]	7.5 - 11.3 [8.4 - 12.6]
	10	1.25	25.5 [28.4]	2.60 [2.90]	18.8 [21.0]	20.4 - 30.6 [22.7 - 34.1]	2.08 - 3.12 [2.32 - 3.48]	15.0 - 22.6 [16.8 - 25.2]
	12	1.25	47.0 [52.9]	4.80 [5.4]	34.7 [39.0]	37.6 - 56.4 [42.3 - 63.5]	3.84 - 5.76 [4.32 - 6.48]	27.8 - 41.6 [31.2 - 46.9]
<b>5T</b> (Bolt having a mark of "5" at its head section) Example of part number (91000 - 50000)	6	1.0	6.4 [7.4]	0.65 [0.75]	4.7 [5.4]	5.1 - 7.6 [5.9 - 8.8]	0.52 - 0.78 [0.60 - 0.90]	3.8 - 5.6 [4.3 - 6.5]
	8	1.25	15.7 [17.2]	1.60 [1.75]	11.6 [12.7]	12.5 - 18.8 [13.7 - 20.6]	1.28 - 1.92 [1.40 - 2.10]	9.3 - 13.9 [10.1 - 15.2]
	10	1.25	32.3 [35.3]	3.30 [3.60]	23.9 [26.0]	25.9 - 38.8 [28.2 - 42.3]	2.64 - 3.96 [2.88 - 4.32]	19.1 - 28.6 [20.8 - 31.2]
	12	1.25	58.8 [65.7]	6.00 [6.70]	43.4 [48.4]	47.0 - 70.6 [52.5 - 78.8]	4.80 - 7.20 [5.36 - 8.04]	34.7 - 52.1 [38.8 - 58.1]
<b>6T</b> (Bolt having a mark of "6" at its head section) Example of part number (91000 - 60000)	6	1.0	7.8 [8.8]	0.80 [0.90]	5.8 [6.5]	6.3 - 9.4 [7.1 - 10.6]	0.64 - 0.96 [0.72 - 1.08]	4.6 - 6.9 [5.2 - 7.8]
	8	1.25	19.1 [20.6]	1.95 [2.10]	14.1 [15.2]	15.3 - 22.9 [16.5 - 24.7]	1.56 - 2.34 [1.68 - 2.52]	11.3 - 16.9 [12.1 - 18.2]
	10	1.25	39.2 [43.1]	4.00 [4.40]	28.9 [31.8]	31.4 - 47.0 [34.5 - 51.7]	3.20 - 4.80 [3.52 - 5.28]	23.1 - 34.7 [25.4 - 38.2]
	12	1.25	71.5 [79.4]	7.30 [8.10]	52.8 [58.6]	57.2 - 85.8 [63.5 - 95.3]	5.84 - 8.76 [6.48 - 9.72]	42.2 - 63.3 [46.9 - 70.3]
<b>7T</b> (Bolt having a mark of "7" at its head section) Example of part number (91000 - 70000)	6	1.0	10.8 [11.8]	1.10 [1.20]	8.0 [8.7]	8.6 - 12.9 [9.4 - 14.1]	0.88 - 1.32 [0.96 - 1.44]	6.4 - 9.5 [6.9 - 10.4]
	8	1.25	25.5 [28.4]	2.60 [2.90]	18.8 [21.0]	20.4 - 30.6 [22.7 - 34.1]	2.08 - 3.12 [2.32 - 3.48]	15.0 - 22.6 [16.8 - 25.2]
	10	1.25	51.9 [57.8]	5.30 [5.90]	38.3 [42.7]	41.6 - 62.3 [46.3 - 69.4]	4.24 - 6.36 [4.72 - 7.08]	30.7 - 46.0 [34.1 - 51.2]
	12	12.5	95.1 [103]	9.70 [10.50]	70.1 [75.9]	76.0 - 114 [82.3 - 123]	7.76 - 11.64 [8.40 - 12.60]	56.1 - 84.2 [60.7 - 91.1]
Pipe tapered thread	PT1/8	*0.9071	16.7	1.70	12.3	11.8 - 21.6	1.20 - 2.20	8.7 - 15.9
	PT1/4	*1.3368	24.5	2.50	18.1	19.6 - 29.4	2.00 - 3.00	14.5 - 21.7
	PT3/8	*1.3368	29.4	3.00	21.7	24.5 - 34.3	2.50 - 3.50	18.1 - 25.3
	PT1/2	*1.8143	29.4	3.00	21.7	24.5 - 34.3	2.50 - 3.50	18.1 - 25.3

Numerals in [ ] denote those for flange bolts.

The asterisked mark (\*) represents pitch conversion value.

## TIGHTENING TORQUE

## Engine

Tightening components	Tightening torque			Remarks
	N·m	kgf·m	ft·lb	
Cylinder head × Spark plug	17.7 ± 2.9	1.80 ± 0.30	13.0 ± 2.2	
Cylinder head × Cylinder block	53.9 ± 4.9	5.50 ± 0.50	39.8 ± 3.6	Wet
Cylinder head cover × Cylinder head	5.4 ± 1.1	0.55 ± 0.11	4.0 ± 0.8	
Timing belt cover No. 1	5.4 ± 1.1	0.55 ± 0.11	4.0 ± 0.8	
Timing belt cover No. 2 (Bolt and Nut)	5.4 ± 1.1	0.55 ± 0.11	4.0 ± 0.8	
Crankshaft bearing cap × Cylinder block	58.8 ± 5.9	6.00 ± 0.60	43.4 ± 4.3	
Cylinder block × Oil filter union	44.1 ± 4.9	4.50 ± 0.50	32.5 ± 3.6	
Cylinder block × Oil seal retainer	12.7 ± 2.5	1.30 ± 0.26	9.4 ± 1.9	
Cylinder block × Rear end plate	12.7 ± 2.5	1.30 ± 0.26	9.4 ± 1.9	
Cylinder block × Oil pan	7.8 ± 1.6	0.80 ± 0.16	5.8 ± 1.2	
Oil pan × Drain plug	24.5 ± 4.9	2.50 ± 0.50	18.1 ± 3.6	
Connecting rod × Connecting rod cap	36.3 ± 5.9	3.70 ± 0.60	26.8 ± 4.3	Wet
Flywheel × Crank shaft	44.1 ± 4.9	4.50 ± 0.50	32.5 ± 3.6	Temporal lightening 3.0 - 3.5 kgf·m
Crankshaft pulley × Crankshaft	98.0 ± 9.8	10.00 ± 1.00	72.3 ± 7.2	
Camshaft timing belt pulley × Camshaft	73.5 ± 14.7	7.50 ± 1.50	54.2 ± 10.8	
Cylinder head × Camshaft thrust ring	8.8 ± 1.8	0.90 ± 0.18	6.5 ± 1.3	
Timing belt tensioner × Oil pump	39.2 ± 7.8	4.00 ± 0.80	28.9 ± 5.8	
Valve clearance adjusting screw × Nut	22.1 ± 2.5	2.25 ± 0.25	16.3 ± 1.8	Wet
Cylinder head × Valve rocker shaft attaching stud bolt and bolt	20.6 ± 4.1 39.2 ± 4.9	2.10 ± 0.42 4.00 ± 0.50	15.2 ± 3.0 28.9 ± 3.6	ED-10, ED-20 EF-EL
Cylinder block × Oil pump	19.1 ± 3.8	1.95 ± 0.39	14.1 ± 2.8	
Cylinder block × Oil strainer	7.9 ± 1.6	0.80 ± 0.16	5.8 ± 1.2	
Oil pump × Oil level gauge guide	12.7 ± 2.5	1.30 ± 0.26	9.4 ± 1.9	
Cylinder block × Oil filter element	9.8 ± 2.0	1.00 ± 0.20	7.2 ± 1.4	
Cylinder block × Water pump	19.1 ± 3.8	1.95 ± 0.39	14.1 ± 2.8	
Cylinder head × Water outlet	19.1 ± 3.8	1.95 ± 0.39	14.1 ± 2.8	
Water outlet × Thermostat	0.83 ± 0.05	0.085 ± 0.005	0.61 ± 0.04	
Water outlet × Fan motor switch	29.4 ± 4.9	3.00 ± 0.50	21.7 ± 3.6	PT 3/8
Water pump × Water pump pulley	5.4 ± 1.1	0.55 ± 0.11	4.0 ± 0.8	
Cylinder block × Adjusting bar	29.4 ± 5.9	3.00 ± 0.60	21.7 ± 4.3	
Alternator × Adjusting bar	29.4 ± 5.9	3.00 ± 0.60	21.7 ± 4.3	
Cylinder block × Alternator	39.2 ± 7.8	4.00 ± 0.80	28.9 ± 5.8	
Cylinder block × Water inlet pipe	12.7 ± 2.5	1.30 ± 0.26	9.4 ± 1.9	
Cylinder head × Intake manifold	19.1 ± 3.8	1.95 ± 0.39	14.1 ± 2.8	
Intake manifold × Booster union	10.8	1.10	8.0	PT 1/8
Intake manifold × Carburetor	12.7 ± 2.5	1.30 ± 0.26	9.4 ± 1.9	ED-10
Exhaust manifold stay	15.2 - 22.8	1.56 - 2.34	11.3 - 16.9	

# EM-118

Tightening components	Tightening torque			Remarks
	N·m	kgf·m	ft·lb	
Cylinder head × Distributor	19.1 ± 3.8	1.95 ± 0.39	14.1 ± 2.8	
Cylinder block × Plug	29.4 ± 4.9	3.00 ± 0.50	21.7 ± 3.6	
Cylinder block × Oil pressure switch	13.7 ± 3.9	1.40 ± 0.40	10.1 ± 2.9	
Cylinder head × Water temperature sender gauge	13.7 ± 3.9	1.40 ± 0.40	10.1 ± 2.9	
Cylinder head × Exhaust manifold	25.0 ± 5.0	2.55 ± 0.51	18.4 ± 3.7	
Flywheel × Clutch cover	18.1 ± 3.4	1.85 ± 0.35	13.4 ± 2.5	
Fuel pump × Cylinder head	19.1 ± 3.8	1.95 ± 0.39	14.1 ± 2.8	ED-10
BVSV × Cylinder block	17.7	1.80	13.0	PT 1/8 ED-10
Cylinder head cover × Stud bolt	5.4 ± 1.1	0.55 ± 0.11	4.0 ± 0.8	
Cylinder head × Head cover bolt	5.4 ± 1.1	0.55 ± 0.11	4.0 ± 0.8	
Exhaust manifold No.1 × No.2	25.0 ± 5.0	2.60 ± 0.52	18.8 ± 3.8	ED-20, EF-EL
Exhaust manifold No.1 × Oxygen sensor	34.3 ± 4.9	3.50 ± 0.50	25.3 ± 3.6	ED-20, EF-EL
Cylinder block × Water temperature sensor	29.4 ± 4.9	3.00 ± 0.50	21.7 ± 3.6	ED-20, EF-EL
Intake manifold × Gas filter	10.8	1.10	8.0	EF-EL
Throttle body × Surge tank	7.8 ± 1.6	0.80 ± 0.16	5.8 ± 1.2	ED-20, EF-EL
Surge tank stay	20.6 ± 4.1	2.10 ± 0.42	15.2 ± 3.0	ED-20, EF-EL
Intake manifold × Fuel delivery pipe	19.1 ± 3.8	1.95 ± 0.39	14.1 ± 2.8	ED-20, EF-EL
Intake manifold × Stud bolt	19.1 ± 3.8	1.95 ± 0.39	14.1 ± 2.8	
Carburetor × Fuel pipe subassembly	5.4 ± 1.1	0.55 ± 0.11	4.0 ± 0.8	ED-10
Cylinder head × Fuel pump/Fuel pump hold cover	19.1 ± 3.8	1.95 ± 0.39	14.1 ± 2.8	ED-10
Intake manifold stay × Nut	19.1 ± 3.8	1.95 ± 0.39	14.1 ± 2.8	ED-10
Air cleaner case	7.8 ± 1.6	0.80 ± 0.16	5.8 ± 1.2	
Oil pump × Cover	10.3 ± 2.5	1.05 ± 0.25	7.6 ± 1.8	
Flywheel × Clutch cover	18.1 ± 3.4	1.85 ± 0.35	13.4 ± 2.5	

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## SERVICE SPECIFICATIONS

### ENGINE TUNE-UP

Engine Type		ED-10	ED-20	EF-EL	
Coolant capacity	(ℓ)	3.4	M/T: 3.4 A/T: 3.3	M/T: 3.3 A/T: 3.5	
Oil capacity	Full level	2.2			
	Low level	1.4			
	When oil and oil filter are replaced	2.5			
	Whole capacity	2.6			
Valve clearances [Hot]	Intake	0.25 ± 0.05			
	Exhaust	0.30 ± 0.05		0.35 ± 0.05	
Spark plug	NIPPONDENSO	Type	W20EXR-U	W20EXR-U11	QL22TR-S
		Gap (mm)	0.7 - 0.8	1.0 - 1.1	0.9 - 1.0
	NGK	Type	BPR6EY	BPR6EY-11 BPR6ES-11	BCPR7EKD
		Gap (mm)	0.8 - 0.9	1.1 - 1.2	0.9 - 1.0
	CHAMPION	Type	RN7YC RN7YCC	RN7YC4	
		Gap (mm)	0.7 - 0.8	1.0 - 1.1	
	BOSCH	Type	WR7DC	WR7DCX	
		Gap (mm)	0.8 - 0.9	1.0 - 1.1	
	Ignition timing	(BTDC°/rpm)	5 ± 2/900 <sup>+100</sup> / <sub>-30</sub>	5 ± 2/900	5 ± 2/800
	Idle speed	(rpm)	900 <sup>+100</sup> / <sub>-50</sub>	900 ± 50	800 ± 50
	Compression pressure		[at 300 rpm]		[at 400 rpm]
		STD	(kPa/kgf/cm <sup>2</sup> )	1471/15	1412/14.4
Minimum requirement		(kPa/kgf/cm <sup>2</sup> )	1177/12	1078/11	
Difference between cylinders		(kPa/kgf/cm <sup>2</sup> )	147/1.5	147/1.5	

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# EM-120

Components	Item		Engine type		
			ED-10	ED-20	EF-EL
Timing belt pulley	Wear limit (Minimum limit)	(mm)	Camshaft	110.57	
			Crankshaft	54.65	
Timing belt tension	Force required for causing central part of timing belt at tensioner side to deflect 5 mm		26.4 - 39.2 N (2.7 - 4.0 kgf)		19.6 - 29.4 N (2 - 3 kgf)
Camshaft	Oil clearance [ED-10, ED-20] [EF-EL]				
	Front	No. 1 STD Max limit	0.040 - 0.085 0.13		
	Center	No. 2 STD Max limit	0.040 - 0.085 0.13		
	Rear	No. 3 STD Max limit	0.040 - 0.085 [EF-EL] 0.13 [EF-EL]		
		No. 4 STD Max limit	0.040 - 0.081 0.12		
	Reference Journal diameter		Front No. 1 Center No. 2 Rear No. 3 Rear No. 4 (mm)	42.44 - 42.46 41.94 - 41.96 29.94 - 29.96	42.44 - 42.46 41.44 - 41.46 40.94 - 40.96 29.94 - 29.96
Thrust clearance		STD Minimum limit (mm)	0.05 - 0.30 0.45		
Runout		[Bend] (mm)	0.06 [0.03]		
Uneven wear of camshaft journal		Maximum limit (mm)	0.04		
Cylinder head	Flatness		Cylinder block side Intake manifold side Exhaust manifold side (mm)	0.1 0.1 0.1	
	Cylinder head lower surface grinding tolerance		Grinding may be performed with cylinder head height of 99.8 mm as limit.		
	Valve seat angel		Intake Exhaust	30° - 45° - 70° 20° - 45° - 70°	
	Valve contacting angel			45°	+
	Valve seat contacting width		STD Maximum limit (mm)	1.2 - 1.6 2.3	
Valve guide bushes	Inner diameter		Intake Exhaust Replacement part (mm)	7.000 - 7.020 6.4 - 6.6	5.500 - 5.520 4.9 - 5.1
	Outer diameter		Replacement part (mm)	12	10
	Overall length		Intake Exhaust (mm)	Approx. 50 Approx. 48	Approx. 52 Approx. 52
	Interference fit		Intake Exhaust (mm)	0.031 - 0.060 0.031 - 0.060	
	Bush projection height		Intake Exhaust Replacement part (mm)	15.5 15.5 15.5	



Components	Item	Engine type		
		ED-10	ED-20	EF-EL
Valves	Contact width with valve seat STD Maximum limit (mm)	1.2 - 1.6 2.3		
	Valve face angle	44.5°		
	Valve stock thickness Intake STD Minimum limit Exhaust STD Minimum limit (mm)	1.0 - 1.4 0.9 1.3 - 1.7 1.1		
	Valve stem outer diameter Intake STD Exhaust STD (mm)	6.960 - 6.975 6.955 - 6.970	5.468 - 5.483 5.455 - 5.470	
Valve rocker arm and valve rocker shaft	Oil clearance between valve stem to valve guide bush Intake STD Maximum limit Exhaust STD Maximum limit (mm)	0.025 - 0.060 0.105 0.030 - 0.065 0.110	0.017 - 0.052 0.08 0.030 - 0.065 0.08	
	Overall length Intake STD Exhaust STD (mm)	112.34 112.64	110.0 111.2	
	Reference Valve stem end grinding tolerance (mm)	0.2	0.2	
Valve spring	Free length Intake Exhaust (mm)	44.3 44.3	41.5 41.0	
	Squareness (mm)	1.6	1.5	
Exhaust manifold	Oil clearance between rocker arm and rocker shaft STD Maximum limit (mm)	0.012 - 0.050 0.08		
	Reference Valve rocker arm inner diameter Valve rocker shaft outer diameter (mm)	1 16.000 - 16.018 15.968 - 15.988	18.000 - 18.018 17.968 - 17.988	
Exhaust manifold	Warpage (mm)	0.1		
Intake manifold	Warpage (mm)	0.1		
Cylinder block height	Flatness cylinder head gasket attaching surface STD Maximum limit (mm)	Less 0.05 0.08		
	Cylinder block height STD Minimum limit (mm)	235.9 - 236.1 235.8	219.9 - 220.1 219.8	
	Cylinder bore out of roundness and taper Maximum limit (mm)	0.03		

# EM-122

Components	Item	Engine type		
		ED-10	ED-20	EF-EL
Cylinder	Oil clearance between piston-to-cylinder STD Maximum limit	0.035 - 0.055 0.110		0.025 - 0.045 0.100
	Reference Cylinder bore diameter (When over size piston is used) STD O/S 0.25 O/S 0.50 O/S 0.75 O/S 1.00	66.600 - 66.630 66.850 - 66.880 67.100 - 67.130 67.350 - 67.380 67.600 - 67.630		68.000 - 68.030 68.250 - 68.280 68.500 - 68.530 68.750 - 68.780 69.000 - 69.030
	NOTE: The boring and/or honing operation should be carried out in accordance with the size of the replacement piston. (mm)			
Piston, piston pin and piston rings	Piston-to-cylinder bore oil clearance STD Maximum limit	0.035 - 0.055 0.110		0.025 - 0.045 0.100
	Reference Piston outer diameter STD O/S 0.25 O/S 0.50 O/S 0.75 O/S 1.00	66.555 - 66.585 66.805 - 66.835 67.055 - 67.085 67.305 - 67.335 67.555 - 67.585		67.965 - 67.995 68.215 - 68.245 68.465 - 68.495 68.715 - 68.745 68.965 - 68.995
	NOTE: The boring and/or honing operation should be carried out in accordance with the size of the replacement piston. (mm)			
Piston, piston pin and piston rings	Piston ring groove-to-piston ring side clearance STD Maximum limit	No. 1 No. 2	0.03 - 0.07 0.02 - 0.06	
		No. 1 No. 2 (mm)	0.12 0.11	
Piston, piston pin and piston rings	Piston ring end gap STD Maximum limit	No. 1 No. 2 Oil No. 1 No. 2 Oil (mm)	0.25 - 0.40 0.20 - 0.35 0.20 - 0.70 0.65 0.65 1.00	0.25 - 0.40 0.40 - 0.55 0.20 - 0.70 0.65 0.65 1.00
	Piston-to-piston pin oil clearance STD Maximum limit (mm)		0.005 - 0.011 0.05	
Piston, piston pin and piston rings	Piston pin-to-connecting rod interference fit STD Maximum limit (mm)		0.012 - 0.044 0.044	
	Reference Piston pin outer diameter (mm)		17.991 - 17.994	
Connecting rod	Big end thrust clearance STD Maximum limit (mm)		0.15 - 0.25 0.3	
	Reference Big end thrust side width (mm)		19.80 - 19.85	
	Maximum bend Maximum twist (mm)		0.05 0.05	





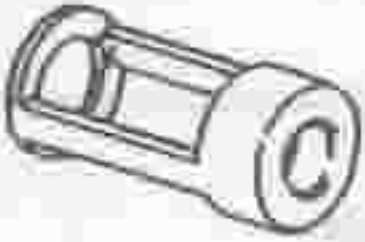


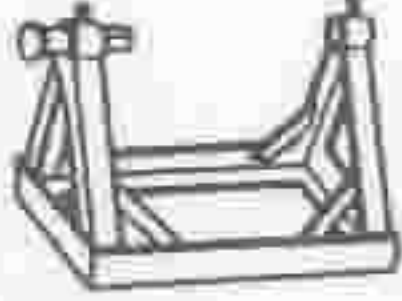


Components	Item	Engine type		
		ED-10	ED-20	EF-EL
Crankshaft	Crankshaft runout Maximum limit (mm)	0.06		
	Uneven wear of main journal and crankpin journal Maximum limit (mm)	0.02		
	Main and crankpin journal oil clearance STD Maximum limit	0.02 - 0.044 0.07		0.02 - 0.044 0.07
	Reference Crankpin journal diameter STD U/S 0.25 (When undersize bearing is used)	39.976 - 40.000 39.734 - 39.742		36.976-37.000 36.734-36.742
	Crankshaft main journal diameter STD U/S 0.25 (When undersize bearing is used) (mm)	45.976 - 46.000 45.734 - 45.742		41.976-42.000 41.734-41.742
	Crankshaft thrust clearance STD Maximum limit (mm)	0.02 - 0.22 0.30		
Timing belt pulley	Camshaft timing belt pulley outer diameter STD Minimum limit	110.633 - 110.813 110.57		110.673-110.793 110.62
	Crankshaft timing belt pulley outer diameter STD Minimum limit (mm)	54.701 - 54.801 54.64		54.651 - 54.751 54.60
Fly wheel	Run out Maximum limit (mm)	0.1		
Oil pump	Body clearance STD Maximum limit	0.06 - 0.12 0.25		
	Tip clearance STD Maximum limit	0.17 - 0.24 0.35		
	Side clearance STD Maximum limit (mm)	0.035 - 0.070 0.15		



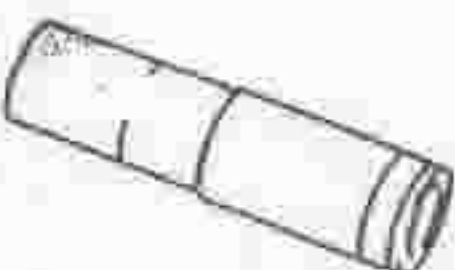







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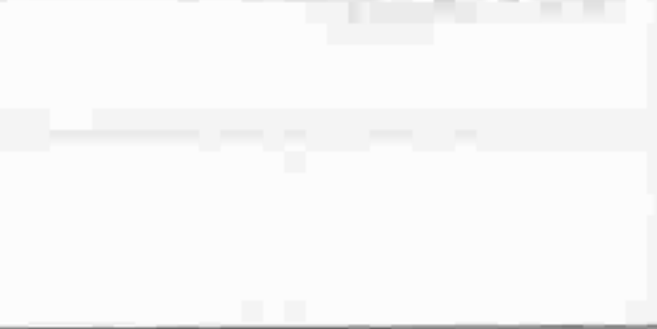





# EM-124

## SSTs

Shape	Part number and part name	Purpose	Remarks
	09032-00100-000 Oil pan seal cutter	Removal of oil pan	
	09201-87201-000 [ED-10, 20] 09201-87203-000 [EF-EL] Valve guide remover & replacer	Removal and installation of valve guide bush	
	09201-87704-000 Valve stem oil seal remover	Removal of valve stem oil seals	
	09202-87202-000 Valve cotter remover & replacer	Removal and installation of valves	
	09202-87202-0A0 Valve cotter attachment	Removal/installation of valves	This attachment is to be used in combination with 09202-87202-000
	09210-87701-000 Flywheel holder	Preventing flywheel from turning	
	09217-87001-000 Piston replacing guide	Installation of piston	
	09219-87202-000 Engine over haul stand	This stand is to be used in combination with engine overhaul attachment	
	09219-87701-000 Engine overhaul attachment	This attachment is to be used in combination with engine overhaul stand	Machining is required.
	09221-87206-000 Piston pin remover & replacer body	Removal and installation of piston pin	This remover & replacer is to be used in combination with guide.

Shape	Part number and part name	Purpose	Remarks
	09221-87207-000 Piston pin remover & replacer guide	Removal and installation of piston pin	This remover & replacer is to be used in combination with body.
	09228-87201-000 Oil filter wrench	Removal and installation of oil filter	
	09268-87703-000 [EF-EL] Plug wrench	Removal/installation of spark plug	
	09278-87201-000 Timing belt pulley holding tool	Removal/installation of timing belt pulley	
	09286-87201-000 Alternator adjusting bar	Adjusting of V belt tension	
	09301-87701-000 Clutch guide tool	Installation of clutch disc	
	09608-87302-000 Axle hub & drive pinion bearing tool set	Installation of crankshaft rear oil	
	09707-87302-000 Spring bush remover & replacer	Installation of camshaft oil seal	
	09991-87203-000 Engine control system inspection sub harness	Short of T terminal	
	09991-87604-000 Tachometer pulse pickup wire	Connecting engine tachometer	

# EM-126

Shape	Part number and part name	Purpose	Remarks
	09330-87301-000 [ED-10, 20] Drive pinion flange holding tool	Preventing crankshaft pulley from turning	Use in combination with suitable bolts
	09511-87202-000 [ED-10, 20] Brake drum stopper	Preventing crankshaft timing pulley from turning	Use in combination with suitable bolts and nuts
	09201-87202-000 [ED-10, 20] Valve stem oil seal replacer	Installation of valve stem oil seal	
	09258-00030-000 [ED-10, 20] Plug set	Plugging rubber hose	
	09243-87201-000 [ED-10, 20] Idle adjusting wrench	Adjustment of carburetor idle mixture adjusting screw	

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**Reference:****LIST OF EQUIPMENT AND OTHER TOOLS REQUIRED****General tools****General service equipment**

- Two-post lift
- Garage jack
- Safety stands
- Valve refacer
- Valve seat cutters
- Hydraulic press
- Ridge reamer
- Air compressor
- Reamer
- CO/HC meter/analyzer
- Radiator tester

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**Measuring equipment**

- Torque wrench
- Vernier calipers
- Dial gauge (with magnet base)
- Dial caliper gauge (for bore measurement use)
- Micrometers (for bore measurement use and depth measurement use)
- Thickness gauge
- Tachometer and dwell angle tester
- Ohmmeter, ammeter and voltmeter (Circuit tester)
- Cylinder gauge
- Connecting rod aligner
- Measuring cylinder
- Straightedge
- Surface plate
- Spring tester
- Compression gauge
- Hydrometer
- Battery tester
- Square gauge
- Megger (ohmmeter)
- Spring scale
- Connecting rod aligner
- Thermocouple thermometer
- Vibrator

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**Consuming articles**

- Plastigauge
- Blue lead or red lead
- Dye penetrant
- Compound (for valve lapping)
- Solvent
- Engine oil (5W-30/SE or higher)

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