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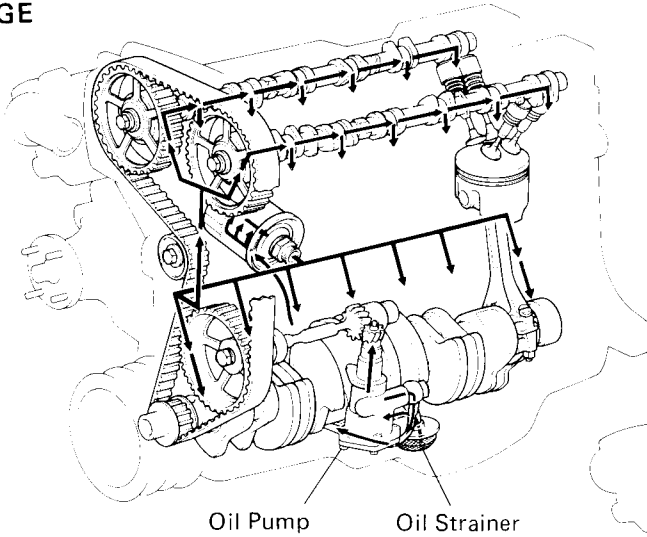
# LUBRICATION SYSTEM

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# DESCRIPTION

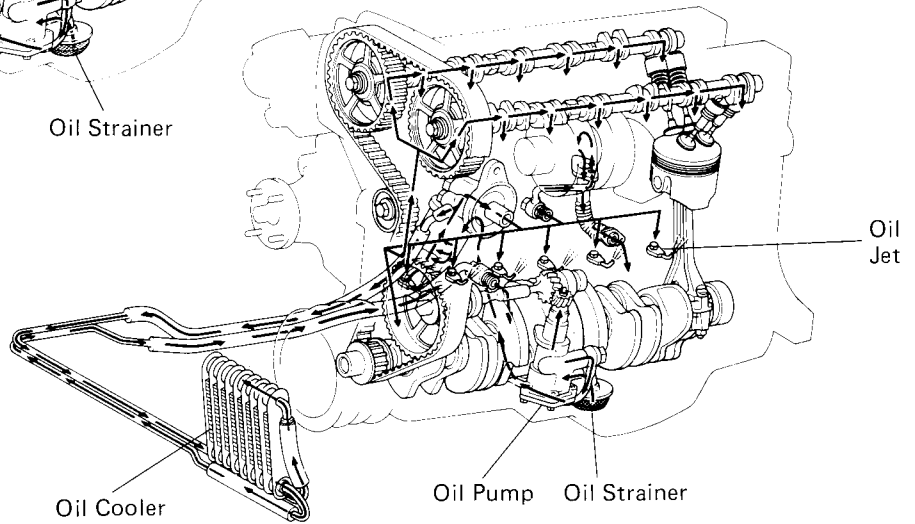
A fully pressurized, fully filtered lubrication system has been adopted for this engine.

7M-GE

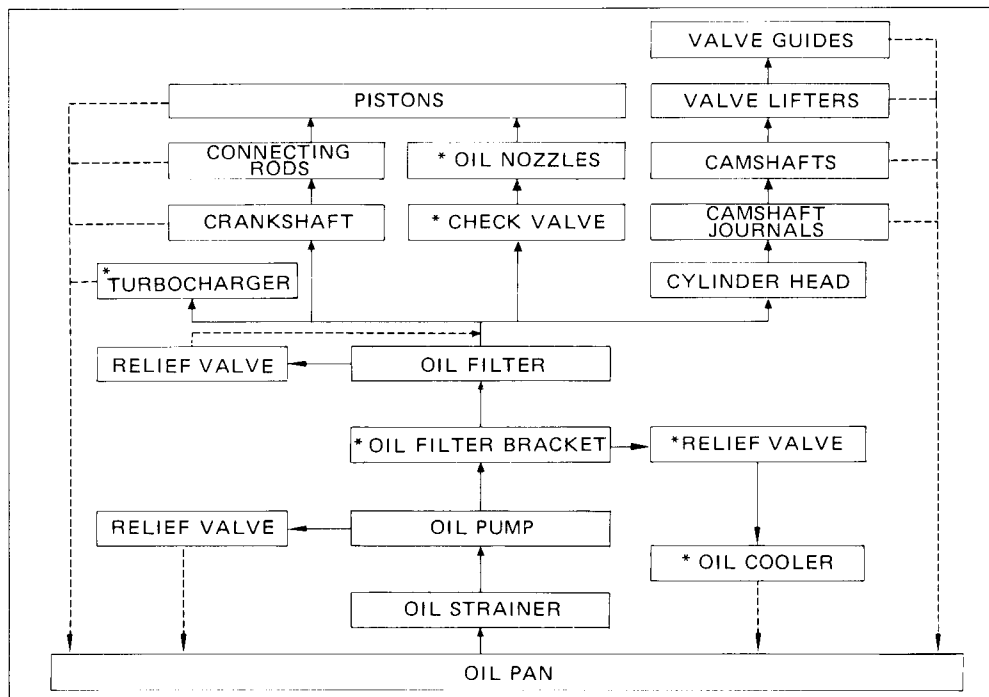


Oil Pump Oil Strainer

7M-GTE



Oil Cooler Oil Pump Oil Strainer Oil Jet



\* 7M-GTE only

A pressure feeding lubrication system has been adopted to supply oil to the moving parts of this engine. The lubrication system consists of an oil pan, oil pump, oil filter and other external parts which supply oil to the moving parts in the engine block. The oil circuit is shown in the illustration at the top of the previous page. Oil from the oil pan is pumped up by the oil pump. After it passes through the oil filter, it is fed through the various oil holes in the crankshaft and cylinder block. After passing through the cylinder block and performing its lubricating function, the oil is returned by gravity to the oil pan. A dipstick on the side of the cylinder block is provided to check the oil level.

### **OIL PUMP**

The oil pump pumps up oil from the oil pan and sends it under pressure to the various parts of the engine. An oil strainer is mounted in front of the inlet to the oil pump. The oil pump itself is a gear pump, which uses a drive gear and driven gear inside the pump body. When the drive gear rotates, the driven gear rotates in the opposite direction. When the gear teeth disengage oil is drawn in, and when the gear teeth engage oil is discharged.

### **OIL PRESSURE REGULATOR**

At high engine speeds, the engine oil supplied by the oil pump exceeds the capacity of the engine to utilize it. For that reason, the oil pressure regulator works to prevent an oversupply of oil. During normal oil supply, a coil spring and valve keep the bypass closed, but when too much oil is being fed, the pressure becomes extremely high, overpowering the force of the spring and opening the valves. This allows the excess oil to flow through the valve and return to the oil pan.

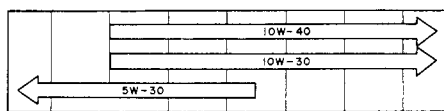
### **OIL FILTER**

The oil filter is a full flow type filter with a built-in paper filter element. Particles of metal from wear, airborne dirt, carbon and other impurities can get in the oil during use and could cause accelerated wear or siezing if allowed to circulate through the engine. The oil filter, integrated into the oil line, removes these impurities as the oil passes through it. The filter is mounted outside the engine to simplify replacement of the filter element. A relief valve is also included ahead of the filter element to relieve the high oil pressure in case the filter element becomes clogged with impurities. The relief valve opens when the oil pressure overpowers the force of the spring. Oil passing through the relief valve bypasses the oil filter and flows directly into the main oil hole in the engine.

## TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Oil leakage	Cylinder head, cylinder block or oil pump body damaged or cracked	Repair as necessary	EM-81
	Oil seal faulty	Replace oil seal	
	Gasket faulty	Replace gasket	
Low oil pressure	Oil leakage	Repair as necessary	LU-7 LU-7 LU-5 EM-63 EM-63 LU-5
	Relief valve faulty	Repair relief valve	
	Oil pump faulty	Repair oil pump	
	Engine oil poor quality	Replace engine oil	
	Crankshaft bearing faulty	Replace bearing	
	Connecting rod bearing faulty	Replace bearing	
	Oil filter clogged	Replace oil filter	
High oil pressure	Relief valve faulty	Repair relief valve	LU-7

Recommended Viscosity (SAE):



TEMPERATURE RANGE ANTICIPATED BEFORE NEXT OIL CHANGE

LU0884

## OIL PRESSURE CHECK

### 1. CHECK OIL QUALITY

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

If oil quality is poor, replace.

Use API grade SG, multigrade, fuel-efficient and recommended viscosity oil.

### 2. CHECK OIL LEVEL

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

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

### 3. REMOVE OIL PRESSURE SENDER GAUGE

### 4. INSTALL OIL PRESSURE GAUGE

### 5. START ENGINE

Start engine and warm it up to normal operating temperature.

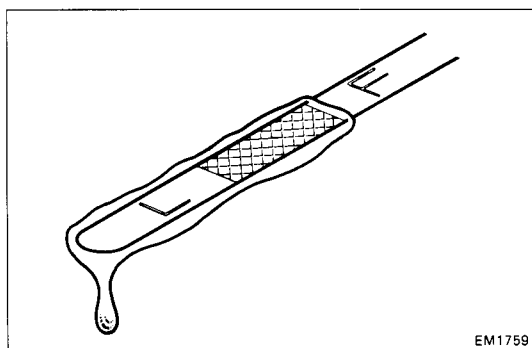
### 6. MEASURE OIL PRESSURE

Oil pressure:

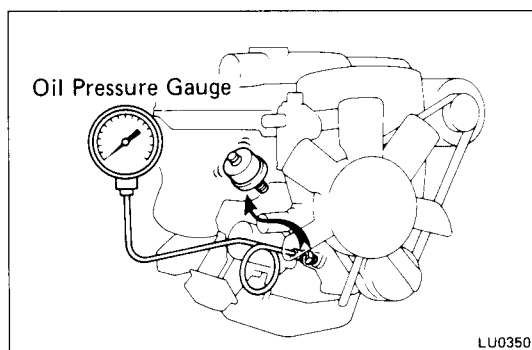
At idle speed 0.3 kg/cm<sup>2</sup> (4.3 psi, 29 kPa)  
or more

At 3,000 rpm 2.5 — 5.0 kg/cm<sup>2</sup>  
(36 — 71 psi, 245 — 490 kPa)

HINT: Check for oil leakage after reinstalling the oil pressure sender gauge.



EM1759

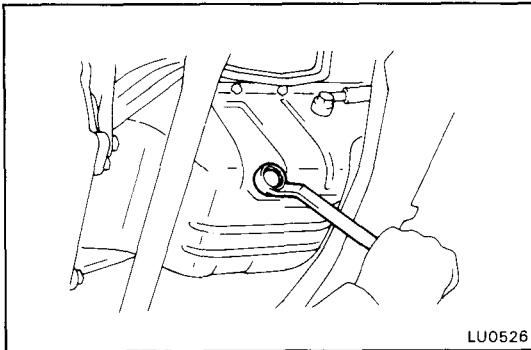


LU0350

## REPLACEMENT OF ENGINE OIL AND OIL FILTER

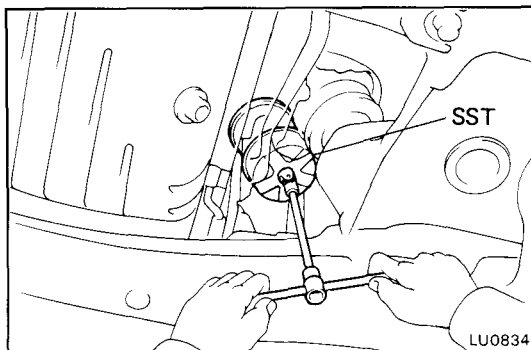
### NOTICE:

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



### 1. DRAIN ENGINE OIL

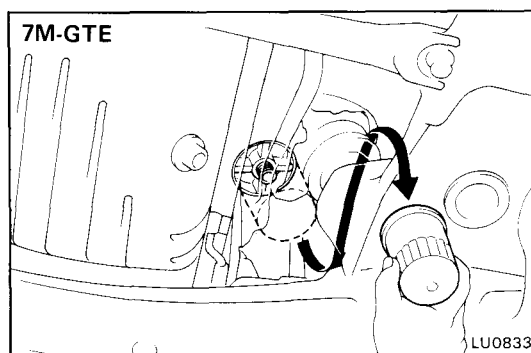
- Remove the oil filler cap.
- Remove the oil drain plug and drain the oil into a container.



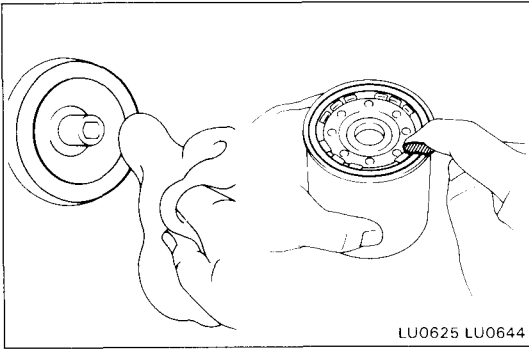
### 2. REPLACE OIL FILTER

- Using SST, remove the oil filter (located on right side of the engine block).

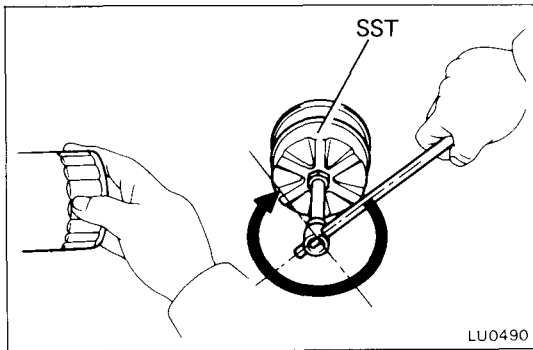
SST 09228-07500



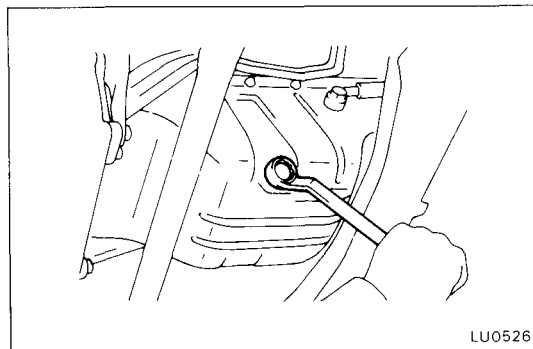
**HINT (7M-GTE):** Remove the oil filter taking it over the engine mounting bracket and down between the bracket and No. 1 suspension crossmember.



- (b) Clean and check the oil filter installation surface.
- (c) Apply clean engine oil to the gasket of the new oil filter.



- (d) Lightly screw in the oil filter until you feel resistance.
  - (e) Then, using SST, tighten the oil filter an extra 3/4 turn.
- SST 09228-07500



### 3. FILL WITH ENGINE OIL

- (a) Clean and install the oil drain plug with a new gasket.
- Torque: 350 kg-cm (25 ft-lb, 34 N·m)**
- (b) Fill the engine with new oil API grade SG, multigrade, fuel-efficient and recommended viscosity oil.

#### Oil capacity (7M-GE):

##### Dry fill

4.9 liters (5.2 US qts, 4.3 Imp. qts)

##### Drain and refill

w/o Oil filter change

4.1 liters (4.3 US qts, 3.6 Imp. qts)

w/ Oil filter change

4.4 liters (4.7 US qts, 4.4 Imp. qts)

#### Oil capacity (7M-GTE):

##### Dry fill

5.1 liters (5.4 US qts, 4.5 Imp. qts)

##### Drain and refill

w/o Oil filter change

4.1 liters (4.3 US qts, 3.6 Imp. qts)

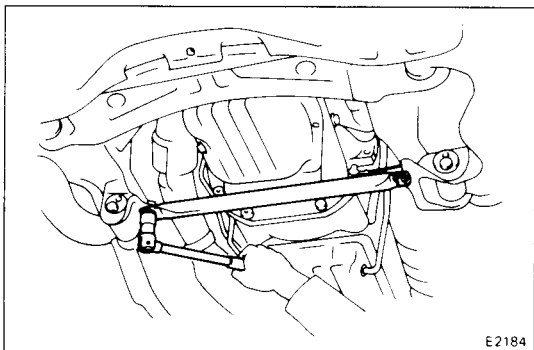
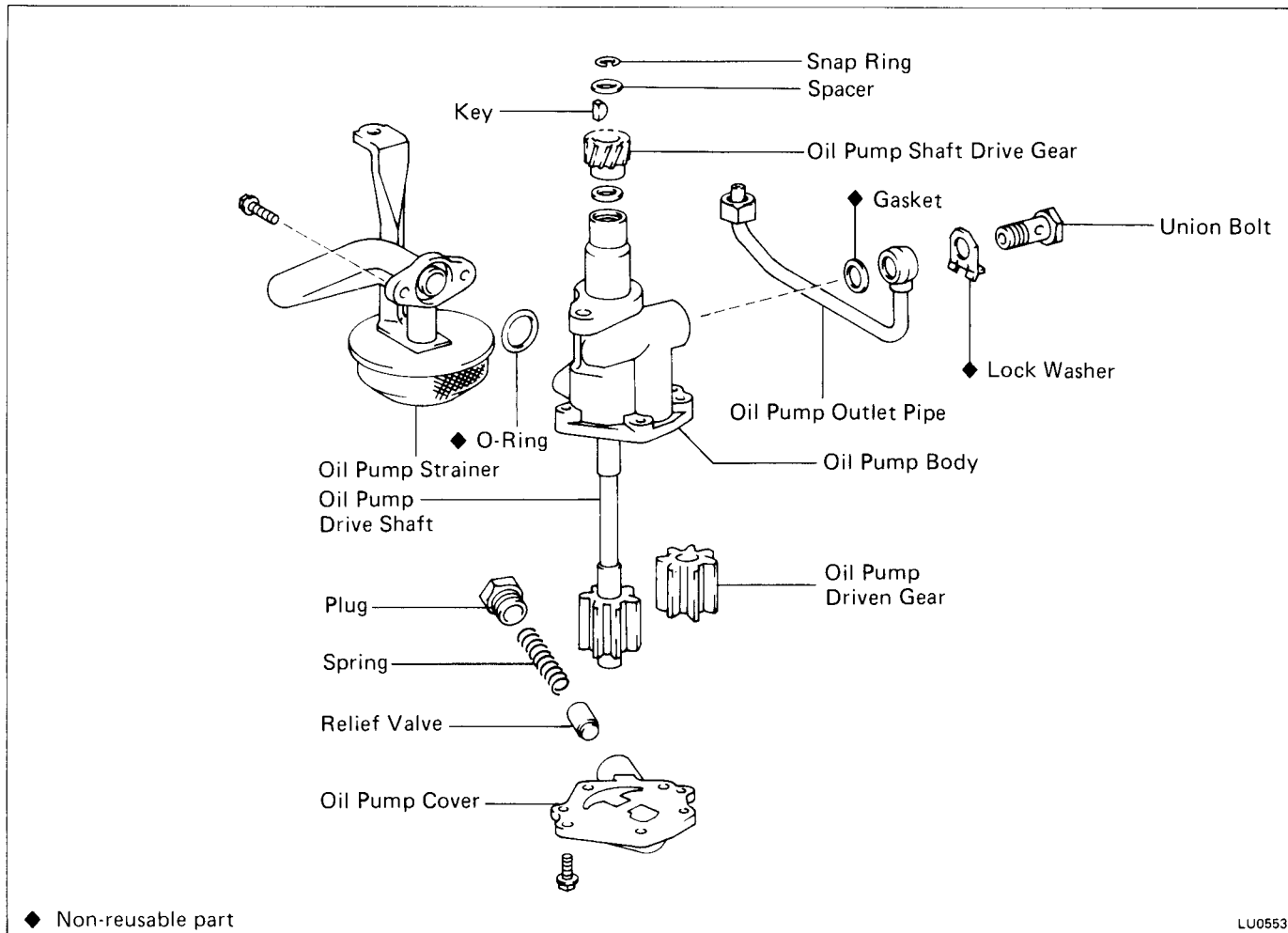
w/ Oil filter change

4.4 liters (4.7 US qts, 3.9 Imp. qts)

### 4. START ENGINE AND CHECK FOR LEAKS

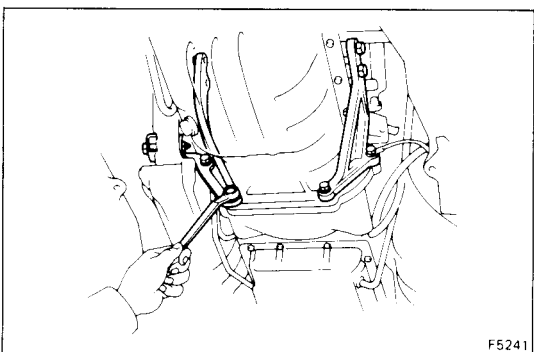
### 5. RECHECK ENGINE OIL LEVER (See page LU-4)

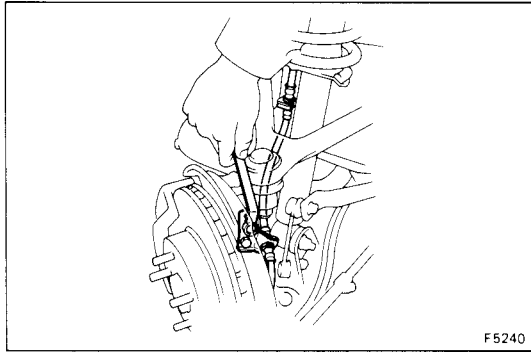
# OIL PUMP COMPONENTS



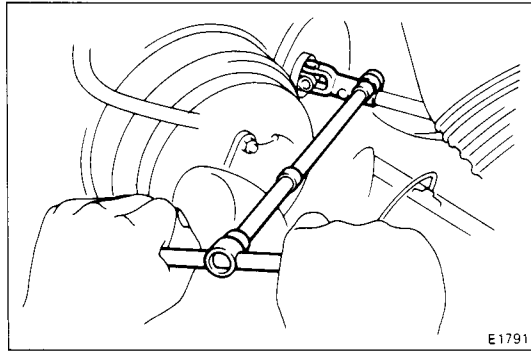
## REMOVAL OF OIL PUMP

1. REMOVE HOOD
2. REMOVE ENGINE UNDER COVER
3. DRAIN ENGINE OIL
4. (A/T)  
REMOVE A/T OIL COOLER HOSE CLAMP
5. REMOVE NO. 1 FRONT SUSPENSION CROSSMEMBER
6. REMOVE EXHAUST FRONT PIPE BRACKET AND STIFFENER PLATES
7. (7M-GTE)  
DISCONNECT ENGINE OIL COOLER HOSE FROM OIL PAN



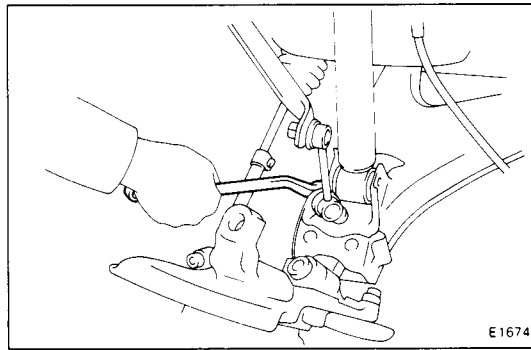


**8. REMOVE BRAKE HOSE BRACKETS AND CLIPS**



**9. DISCONNECT INTERMEDIATE SHAFT**

Loosen the bolt, disconnect the intermediate shaft.

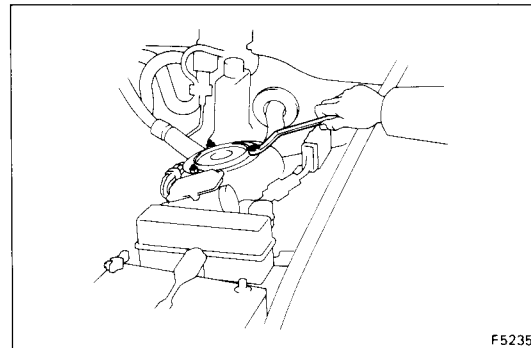


**10. DISCONNECT STABILIZER BAR LINKS FROM LOWER ARMS**

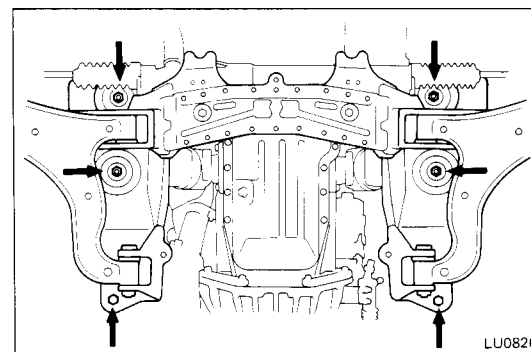
**11. REMOVE ENGINE MOUNTING NUTS AND WASHERS**

Attach the engine hoist chain to the two engine hangers.

**12. REMOVE TEMS ACTUATOR**



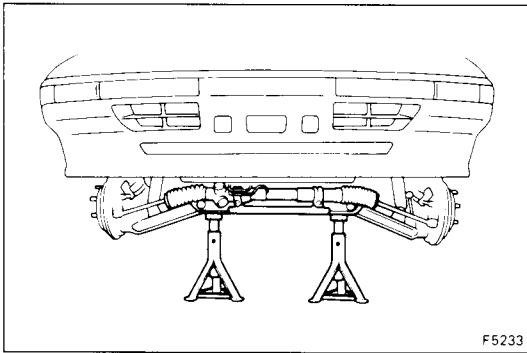
**13. REMOVE SHOCK ABSORBERS FROM BODY**



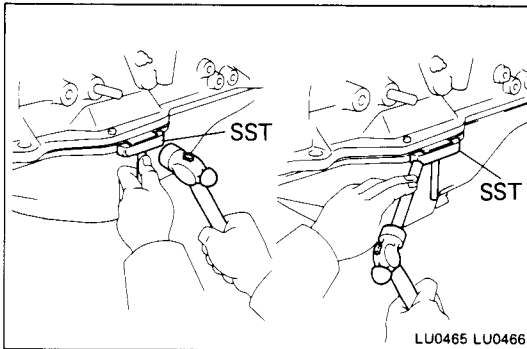
**14. DISCONNECT FRONT SUSPENSION MEMBER**

- (a) Hold the front suspension member with a jack.
- (b) Remove the two bolts and four nuts.





- (c) Lower the front suspension member, hold the member with safety stands.

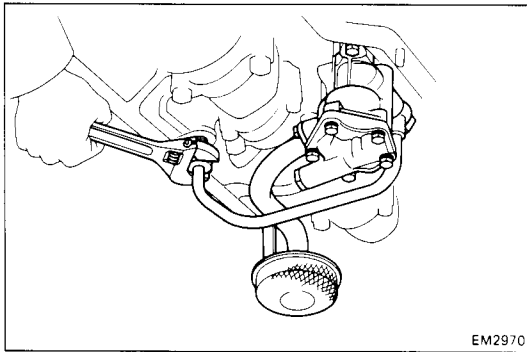


## 15. REMOVE OIL PAN

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

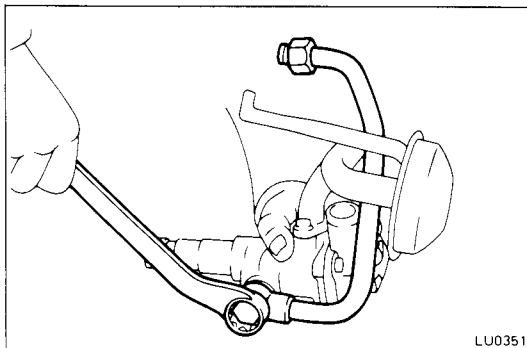
SST 09032-001000

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



## 16. REMOVE OIL PUMP

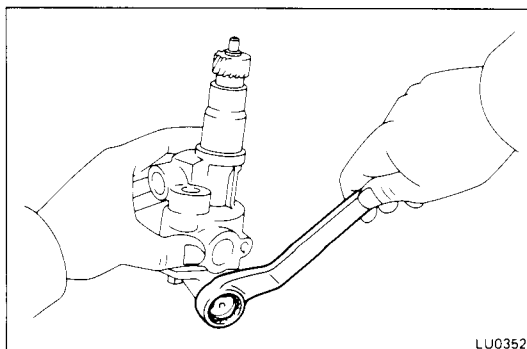
- (a) Loosen the union nut.  
 (b) Remove the bolts and oil pump.



## DISASSEMBLY OF OIL PUMP

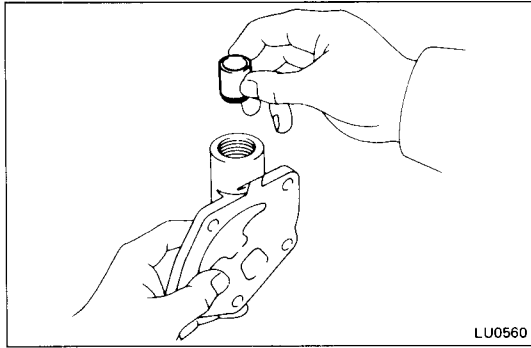
### 1. REMOVE OIL STRAINER AND OUTLET PIPE

- (a) Remove the two bolts, oil strainer and O-ring.  
 (b) Remove the union bolt, lock washer, oil pump outlet pipe and gasket.



### 2. DISASSEMBLY OIL PUMP

- (a) Unscrew the relief valve plug, spring and relief valve.  
 (b) Remove the five bolts, oil pump cover and driven gear.  
 (c) Remove the snap ring, shaft gear, key, spacer and drive shaft.

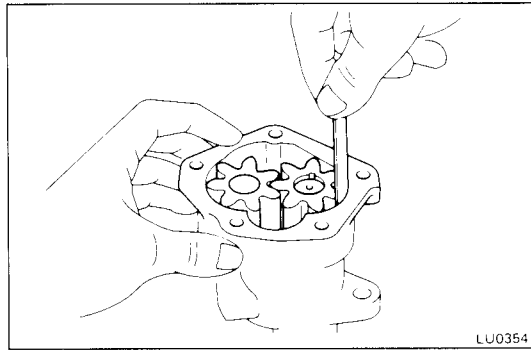


## INSPECTION OF OIL PUMP

### 1. INSPECT RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If it does not, replace the relief valve. If necessary, replace the oil pump assembly.



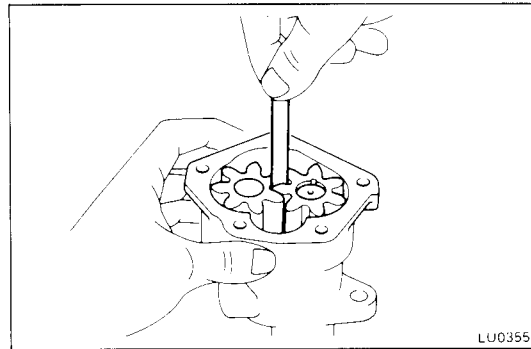
### 2. INSPECT BODY CLEARANCE

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

**Standard clearance:** 0.105 – 0.175 mm  
(0.0041 – 0.0069 in.)

**Maximum clearance:** 0.2 mm (0.008 in.)

If the clearance is greater than maximum, replace the drive gear and/or body.



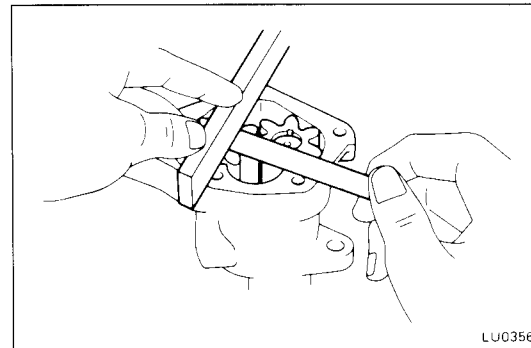
### 3. INSPECT GEAR BACKLASH

Using a thickness gauge, measure the backlash as shown.

**Standard backlash:** 0.5 – 0.6 mm  
(0.020 – 0.024 in.)

**Maximum backlash:** 0.9 mm (0.035 in.)

If the backlash is greater than maximum, replace the drive shaft and/or driven gear.



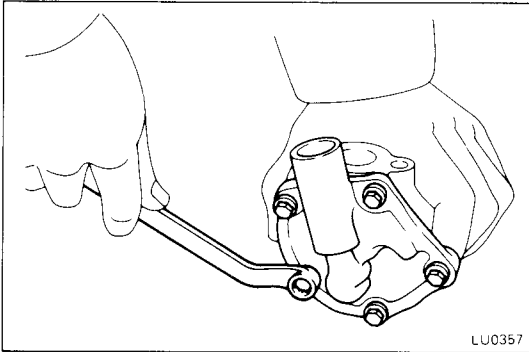
### 4. INSPECT SIDE CLEARANCE

Using a thickness gauge and flat block, measure the side clearance as shown.

**Standard clearance:** 0.03 – 0.09 mm  
(0.0012 – 0.0035 in.)

**Maximum clearance:** 0.15 mm (0.0059 in.)

If the clearance is greater than maximum, replace the drive shaft and driven gear and/or body.



## ASSEMBLY OF OIL PUMP

(See page LU-7)

### ASSEMBLY OIL PUMP

- (a) Install the drive shaft, spacer, key, shaft gear and snap ring.
- (b) Install the driven gear and pump cover with the five bolts.

**Torque: 75 kg-cm (65 in.-lb, 7.4 N·m)**

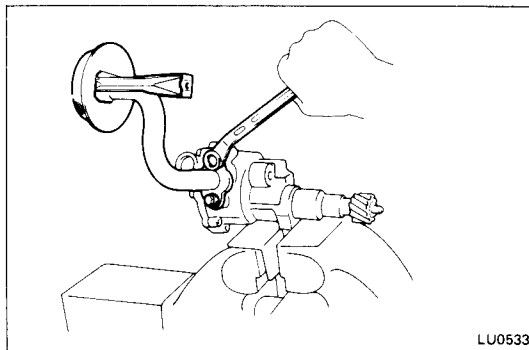
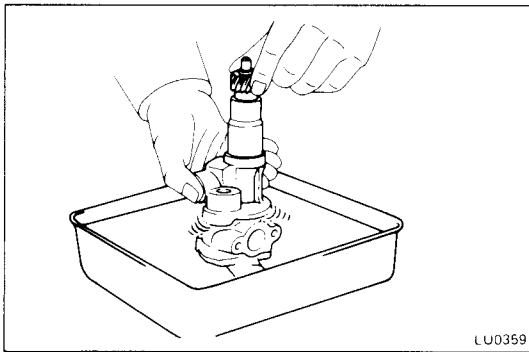
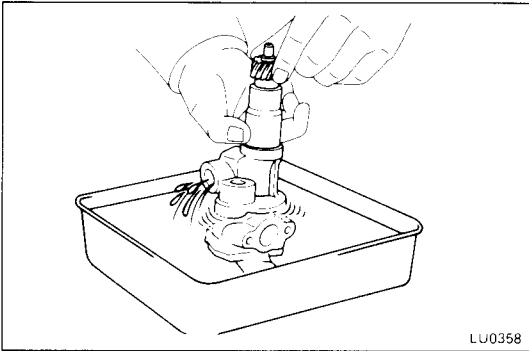
- (c) Install the relief valve and spring in the cover, and screw on the relief valve plug.

**Torque: 375 kg-cm (27 ft-lb, 37 N·m)**

### OPERATION CHECK OF OIL PUMP

#### 1. CHECK PUMP OPERATION

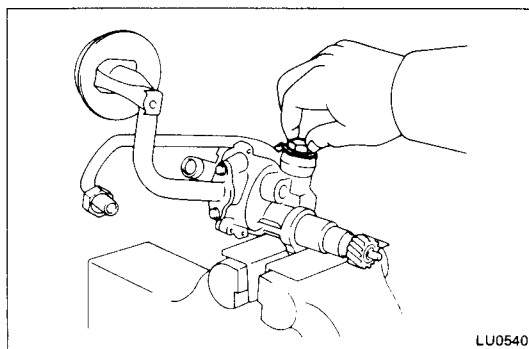
- (a) Immerse the suction end of the pump into clean engine oil and turn the shaft counterclockwise. Oil should come out of the discharge hole.
- (b) Close the discharge hole with your thumb, and turn the shaft as before. The shaft should be difficult to turn.



#### 2. INSTALL OIL PUMP STRAINER

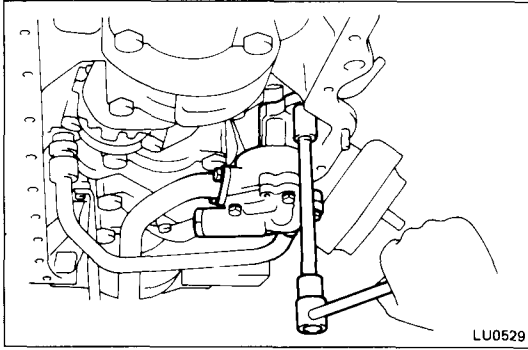
- (a) Install a new O-ring to oil pump strainer.
- (b) Install the oil pump strainer with the two bolts.

**Torque: 130 kg-cm (9 ft-lb, 13 N·m)**



#### 3. INSTALL OIL PUMP OUTLET PIPE

Install the oil pump outlet pipe with a new lock washer, gasket and the union bolt. Finger tighten the union bolt.

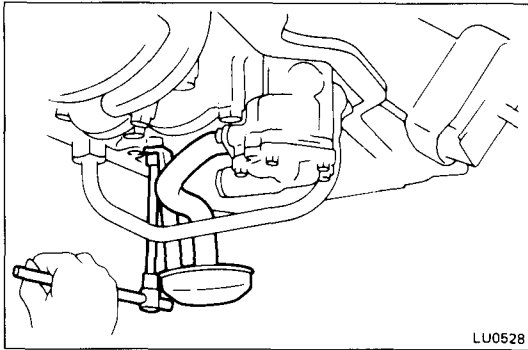


## INSTALLATION OF OIL PUMP

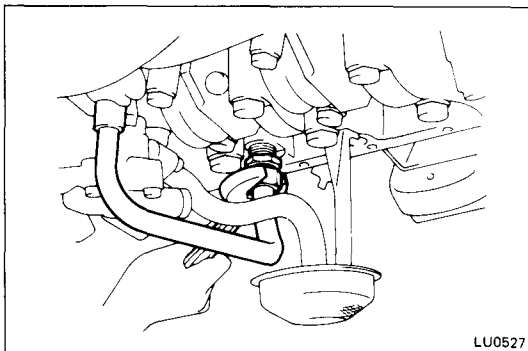
(See page LU-7)

### 1. INSTALL OIL PUMP

- (a) Install the oil pump with the bolt. Torque the bolt.  
**Torque: 220 kg-cm (16 ft-lb, 22 N·m)**



- (b) Install the mount bolt holding the oil pump strainer stay to block.  
**Torque: 60 kg-cm (52 in-lb, 5.9 N·m)**



- (c) Connect the outlet pipe with the union bolt.  
 Torque the union bolt and nut.

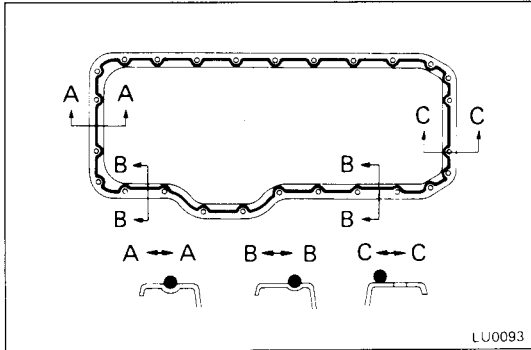
**Torque: 350 kg-cm (25 ft-lb, 34 N·m)**

- (d) Stake the lock washer.

### 2. INSTALL OIL PAN

- (a) Remove any packing material and be careful not to drop the oil on the contacting surfaces of the oil pan and cylinder block.
- Using a razor blade and gasket scraper, remove all the packing (FIPG) material from the gasket surfaces.
  - Thoroughly clean all components to remove all the loose material.
  - Clean both sealing surfaces with a non-residue solvent.

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

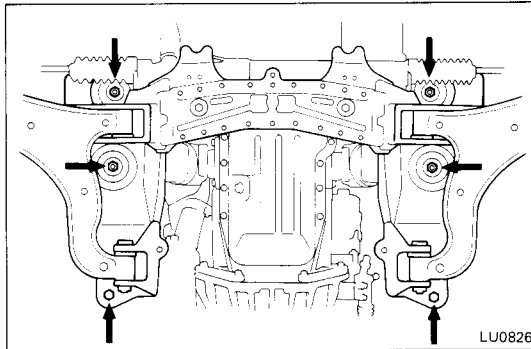


(b) Apply seal packing to the cylinder block installing surface of the oil pan.

**Seal packing: Part No. 08826-00080 or equivalent**

(c) Install the oil pan over the studs on the block with the twenty four bolts and two nuts.  
Torque the bolts and nuts.

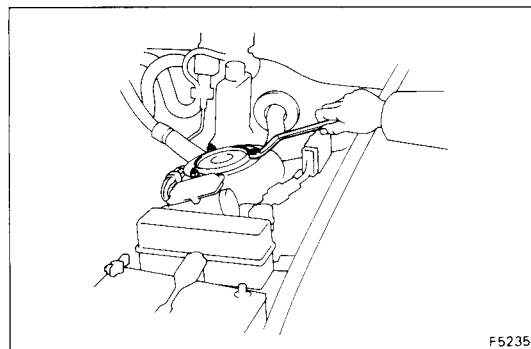
**Torque: 130 kg-cm (9 ft-lb, 13 N·m)**



### 3. INSTALL FRONT SUSPENSION MEMBER

Install the front suspension member to the body.

**Torque: 1,300 kg-cm (94 ft-lb, 127 N·m)**



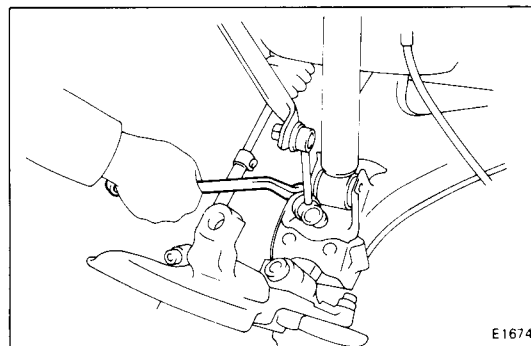
### 4. INSTALL SHOCK ABSORBERS TO BODY

Install the shock absorber to the body with the three nuts, torque the nuts.

**Torque: 360 kg-cm (26 ft-lb, 35 N·m)**

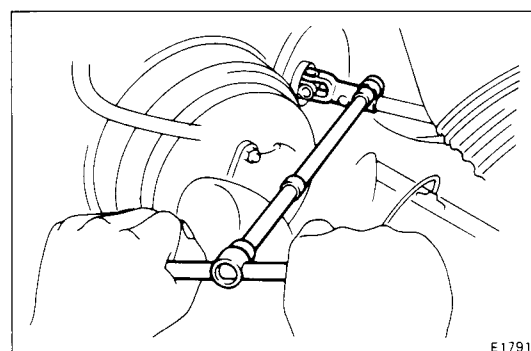
### 5. INSTALL TEMS ACTUATOR

### 6. INSTALL ENGINE MOUNTING WASHERS AND NUTS



### 7. CONNECT STABILIZER BAR LINKS TO LOWER ARM

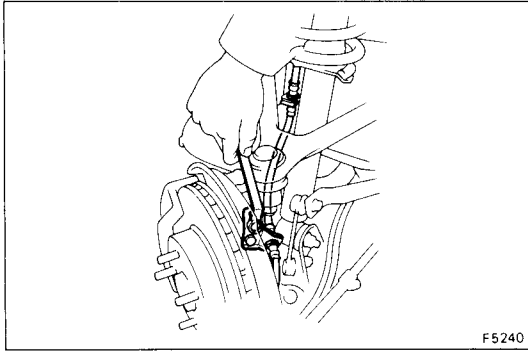
**Torque: 650 kg-cm (47 ft-lb, 64 N·m)**



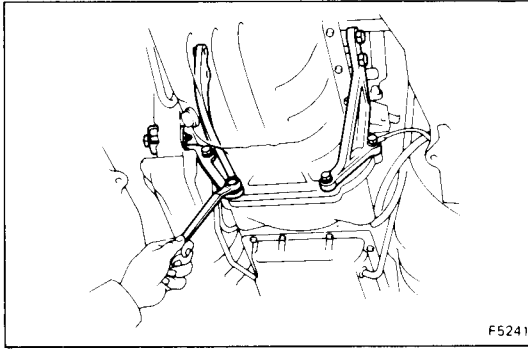
### 8. CONNECT INTERMEDIATE SHAFT

Connect the intermediate shaft, torque the bolts.

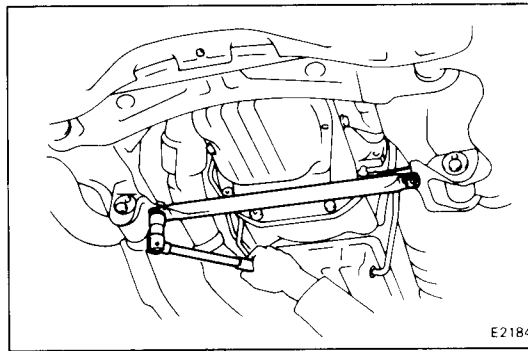
**Torque: 330 kg-cm (24 ft-lb, 32 N·m)**



9. INSTALL BRAKE HOSE BRACKETS AND CLIPS
10. (7M-GTE)  
CONNECT ENGINE OIL COOLER HOSE TO OIL PAN WITH  
NEW GASKETS



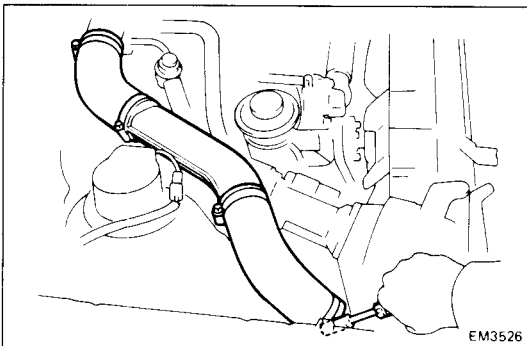
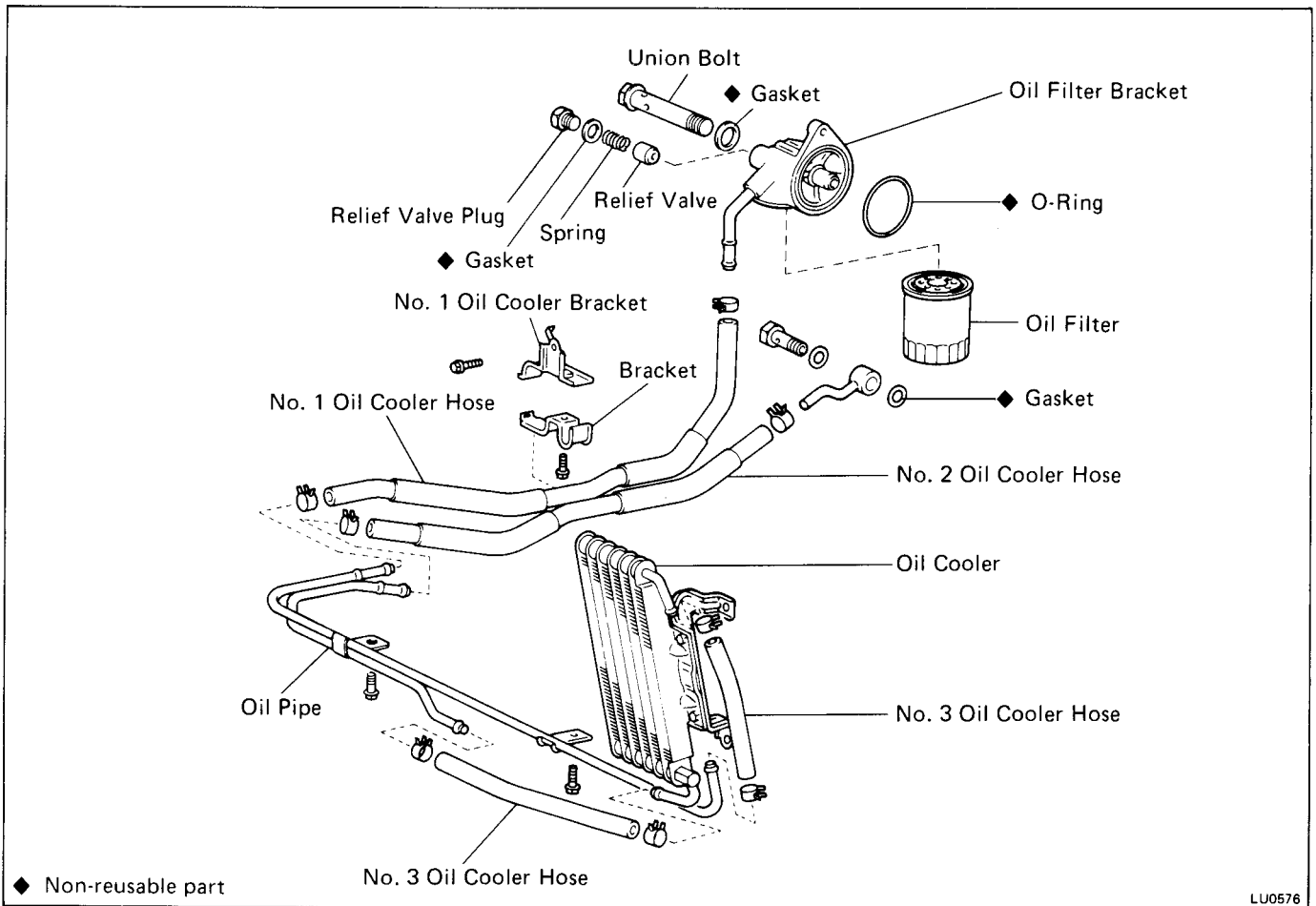
11. INSTALL STIFFENER PLATES AND EXHAUST FRONT PIPE  
BRACKET



12. INSTALL NO. 1 FRONT SUSPENSION CROSSMEMBER  
Torque: 930 kg-cm (67 ft-lb, 91 N·m)
13. (A/T)  
INSTALL A/T OIL COOLER HOSE CLAMP
14. FILL WITH ENGINE OIL  
(See page LU-5)
15. INSTALL HOOD
16. START ENGINE AND CHECK FOR LEAKS
17. INSTALL ENGINE UNDER COVER
18. INSPECTION OF FRONT WHEEL ALIGNMENT  
(See page FA-3)

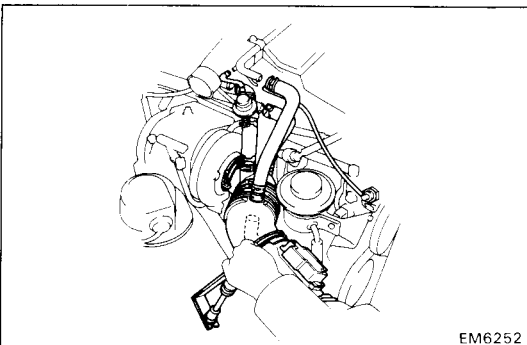
# OIL COOLER AND RELIEF VALVE (7M-GTE)

## COMPONENTS



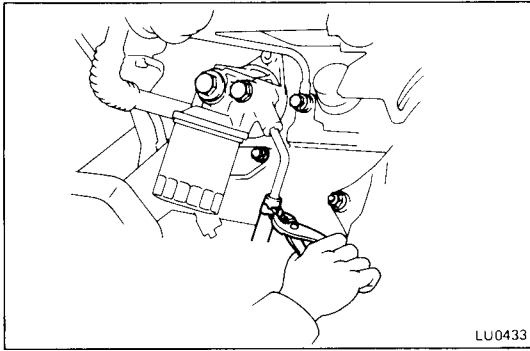
### REMOVAL OF OIL FILTER BRACKET

1. DRAIN ENGINE OIL
2. REMOVE NO.4 AIR CLEANER PIPE WITH NO.1 AND NO.2 AIR CLEANER HOSES



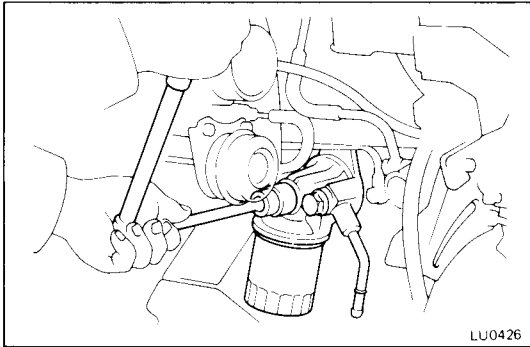
### 3. REMOVE NO.7 AIR CLEANER HOSE

- (a) Disconnect the air hoses from ISC pipe, air intake connector and PVC pipe.
- (b) Disconnect the air flow meter connector.
- (c) Loosen the two clamps and unlock the air cleaner case clip.
- (d) Remove the bolt and No.7 air cleaner hose.
- (e) Disconnect the PS idle up air hose.

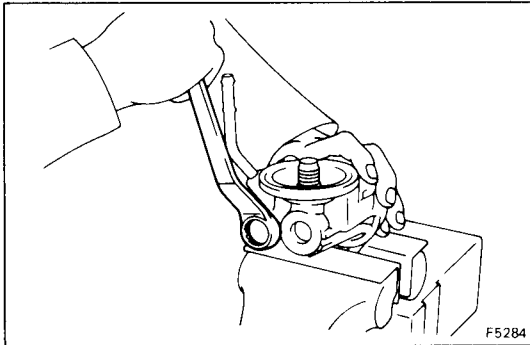


#### 4. REMOVE OIL FILTER BRACKET

(a) Disconnect the oil hose.



(b) Remove the union bolt, gasket, oil filter bracket and O-ring.

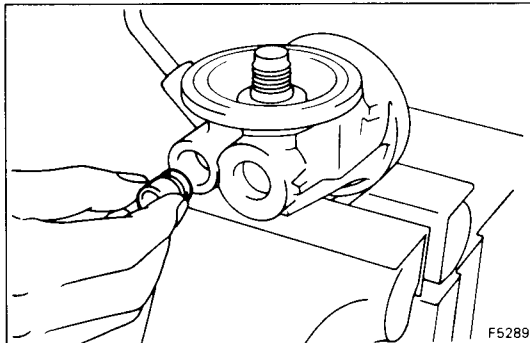


#### REMOVAL OF RELIEF VALVE

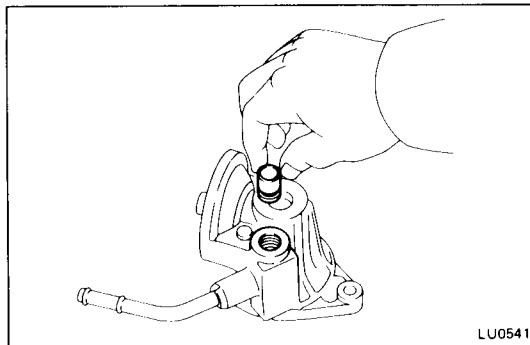
1. REMOVE OIL FILTER  
(See page LU-5)

2. REMOVE RELIEF VALVE

(a) Remove the relief valve plug and gasket.



(b) Remove the spring and relief valve.

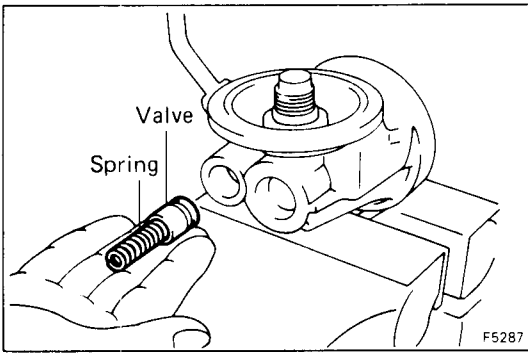


#### INSPECTION OF RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If it does not, replace the relief valve. If necessary, replace the oil filter bracket assembly.





## INSTALLATION OF RELIEF VALVE

### 1. INSTALL RELIEF VALVE

- (a) Install the relief valve and spring.

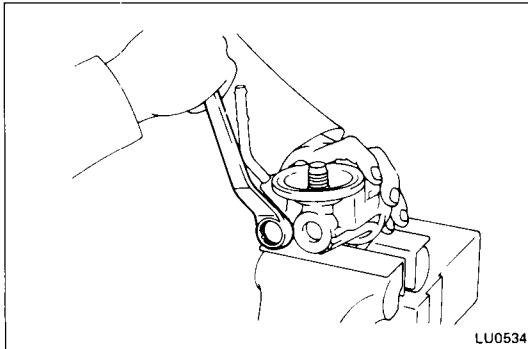
- (b) Install a new gasket to the plug.

- (c) Install and torque the plug.

**Torque: 375 kg-cm (27 ft-lb, 37 N·m)**

### 2. INSTALL OIL FILTER

(See page LU-5)



## INSTALLATION OF OIL FILTER BRACKET

### 1. INSTALL OIL FILTER BRACKET

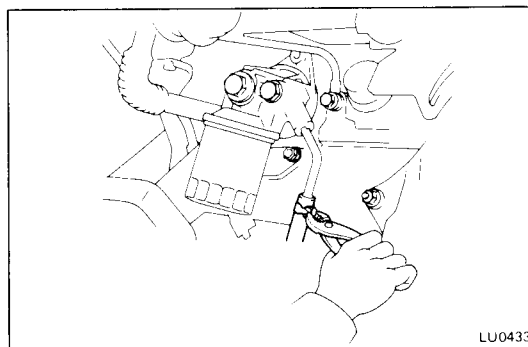
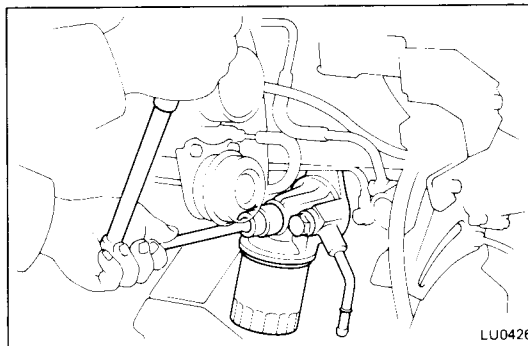
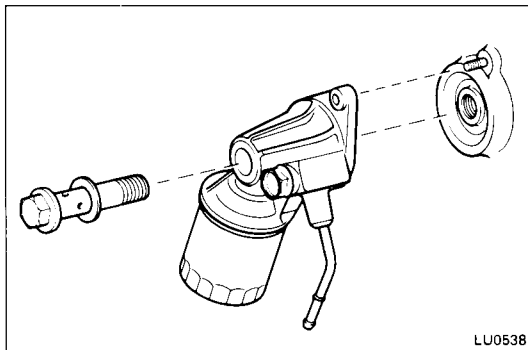
- (a) Install a new O-ring to bracket.

- (b) Install a new gasket to union bolt.

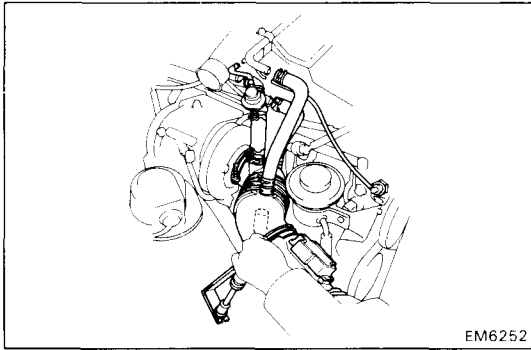
- (c) Put the oil filter bracket hole over the cylinder block stud bolt and install the oil filter bracket with the union bolt.

- (d) Torque the union bolt.

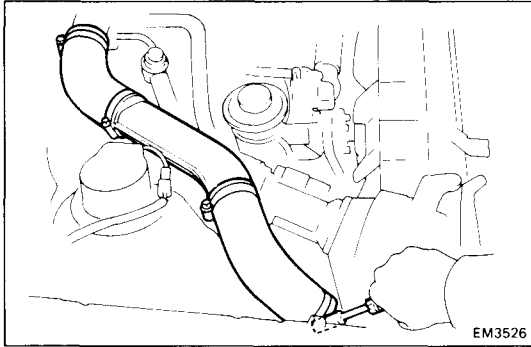
**Torque: 500 kg-cm (36 ft-lb, 49 N·m)**



- (e) Connect the oil hose.

**2. INSTALL NO.7 AIR CLEANER HOSE**

- (a) Connect the PS idle up air hose.
- (b) Install the No.7 air cleaner hose and bolt.
- (c) Tighten the clamps and lock the air cleaner case clips.
- (d) Connect the air flow meter connector.
- (e) Connect the air hoses to PCV pipe, air intake connector and ISC pipe.

**3. INSTALL NO.4 AIR CLEANER PIPE WITH NO.1 AND NO.2 AIR CLEANER HOSES****4. START ENGINE AND CHECK FOR LEAKS**