

# CHARGING SYSTEM

## PRECAUTIONS

1. Check that the battery cables are connected to the correct terminals.
2. Disconnect the battery cables when the battery is given a quick charge.
3. Do not perform tests with a high voltage insulation resistance tester.
4. Never disconnect the battery while the engine is running.

## ON-VEHICLE INSPECTION

### 1. INSPECT BATTERY SPECIFIC GRAVITY AND ELECTROLYTE LEVEL

- (a) Check the specific gravity of each cell.

**Standard specific gravity**

**When fully charged at 20°C (68°F):**

**22R-E 1.25 – 1.27**

**3VZ-E 55D 23R 1.25 – 1.27**

**80D 26R 1.27 – 1.29**

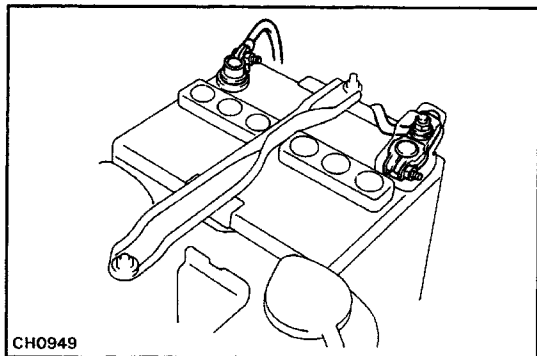
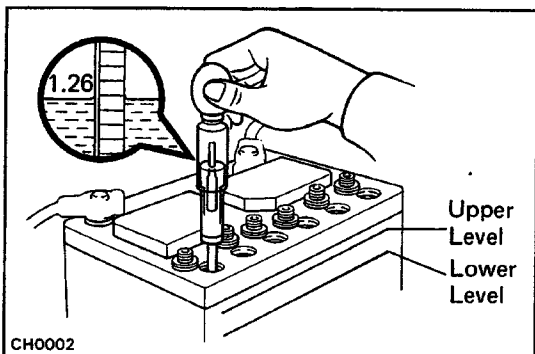
If not within specifications, charge the battery.

- (b) Check the electrolyte quantity of each cell.

If insufficient, refill with distilled (or purified) water.

### 2. CHECK BATTERY TERMINALS AND FUSIBLE LINKS

- (a) Check that the battery terminals are not loose or corroded.
- (b) Check the fusible links for continuity.

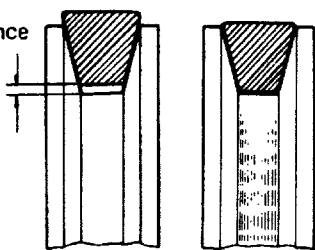


#### 22R-E Engine

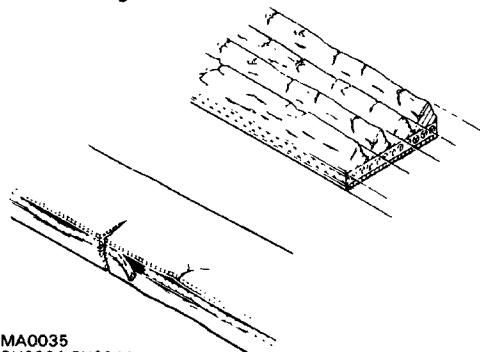
**CORRECT**

**WRONG**

Clearance



#### 3VZ-E Engine



### 3. INSPECT DRIVE BELT

- (a) Visually check the belt for excessive wear, frayed cords etc.

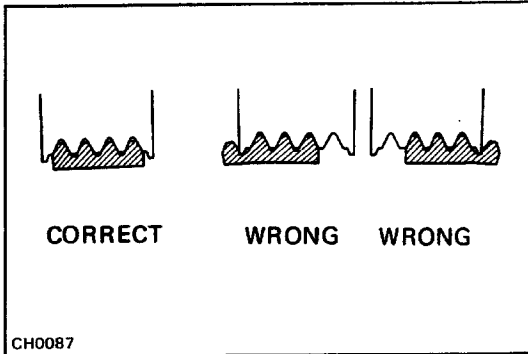
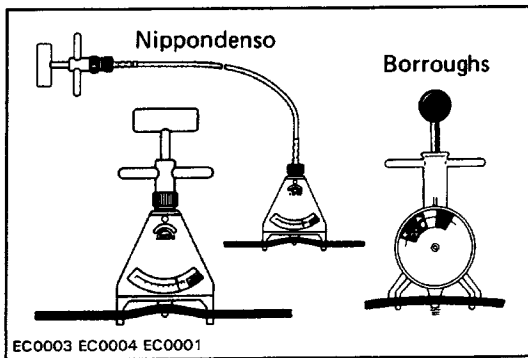
**HINT:**

22R-E: Check that the belt does not touch the bottom of the pulley groove.

If any defect has been found, replace the drive belt.

3VZ-E: Cracks on the ribbed side of the belt are considered acceptable.

If the belt has chunks missing from the ribs, it should be replaced.



- (b) Using a belt tension gauge, check the drive belt tension .

**Belt tension gauge:**

**Nippondenso BTG-20 (95506-00020) or  
Borroughs No. BT-33-73F**

**Drive belt tension:**

**22R-E New belt  $125 \pm 25$  lbf**

**Used belt  $80 \pm 20$  lbf**

**3VZ-E New belt  $160 \pm 20$  lbf**

**Used belt  $100 \pm 20$  lbf ,**

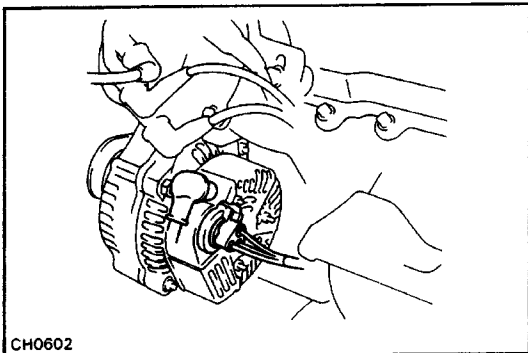
If necessary, adjust the drive belt tension.

**HINT:**

- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing the drive belt, check that it fits properly in the ribbed grooves. Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the crank pulley.
- After installing a new belt, run the engine for approx. 5 minutes and then recheck the tension.

**4. INSPECT FUSES FOR CONTINUITY**

- ENGINE 10A
- CHARGE 7-5A
- IGN 7.5A



**5. VISUALLY CHECK GENERATOR WIRING AND LISTEN FOR ABNORMAL NOISES**

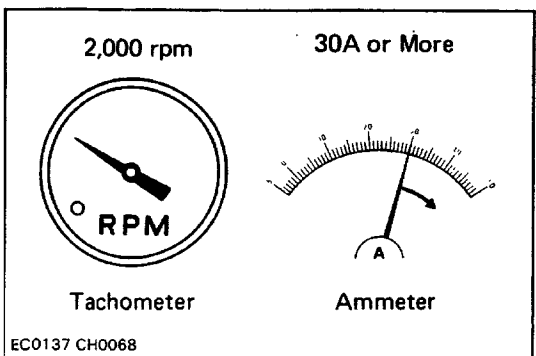
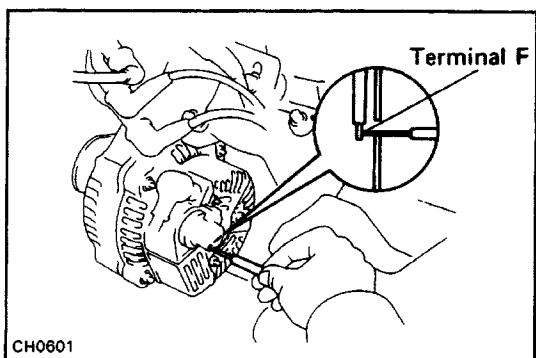
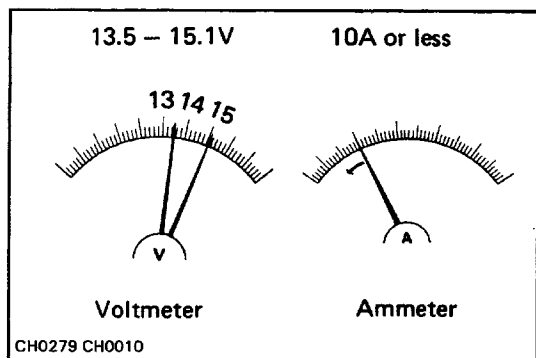
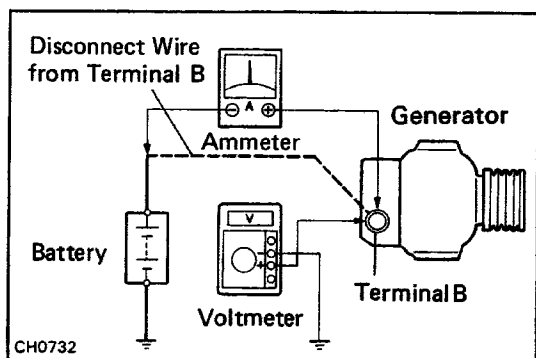
- (a) Check that the wiring is in good condition.
- (b) Check that there is no abnormal noise from the generator while the engine is running.

**6. INSPECT DISCHARGE WARNING LIGHT CIRCUIT**

- (a) Turn the ignition switch ON. Check that the discharge warning light is lit.
- (b) Start the engine. Check that the light goes off.
- If the light does not operate as specified, troubleshoot the warning light circuit.

## 7. CHECK CHARGING CIRCUIT WITHOUT LOAD

HINT: If a battery/generator tester is available, connect the tester to the charging circuit according to the manufacturer's instructions.



(a) If a tester is not available, connect a voltmeter and ammeter to the charging circuit as follows:

- Disconnect the wire from terminal B of the generator and connect the wire to the negative (–) terminal of the ammeter.
- Connect the test lead from the positive (+) terminal of the ammeter to terminal B of the generator.
- Connect the positive (+) lead of the voltmeter to terminal B of the generator.
- Ground the negative (–) lead of the voltmeter.

(b) Check the charging circuit as follows:

With the engine running from idling to 2,000 rpm, check the reading on the ammeter and voltmeter.

**Standard amperage: 10 A or less**

**Standard voltage: 13.9 – 15.1 V at 250C (770F)**

**13.5 – 14.3 V at 1150C (239°F)**

If the voltage reading is greater than standard voltage, replace the IC regulator.

If the voltage reading is less than standard voltage, check the IC regulator and generator as follows:

- With terminal F grounded, start the engine and check the voltage reading of terminal B.
- If the voltage reading is higher than standard voltage, replace the IC regulator.
- If the voltage reading is less than standard voltage, repair the generator.

## 8. INSPECT CHARGING CIRCUIT WITH LOAD

(a) With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater fan control switch at HI.

(b) Check the reading on the ammeter.

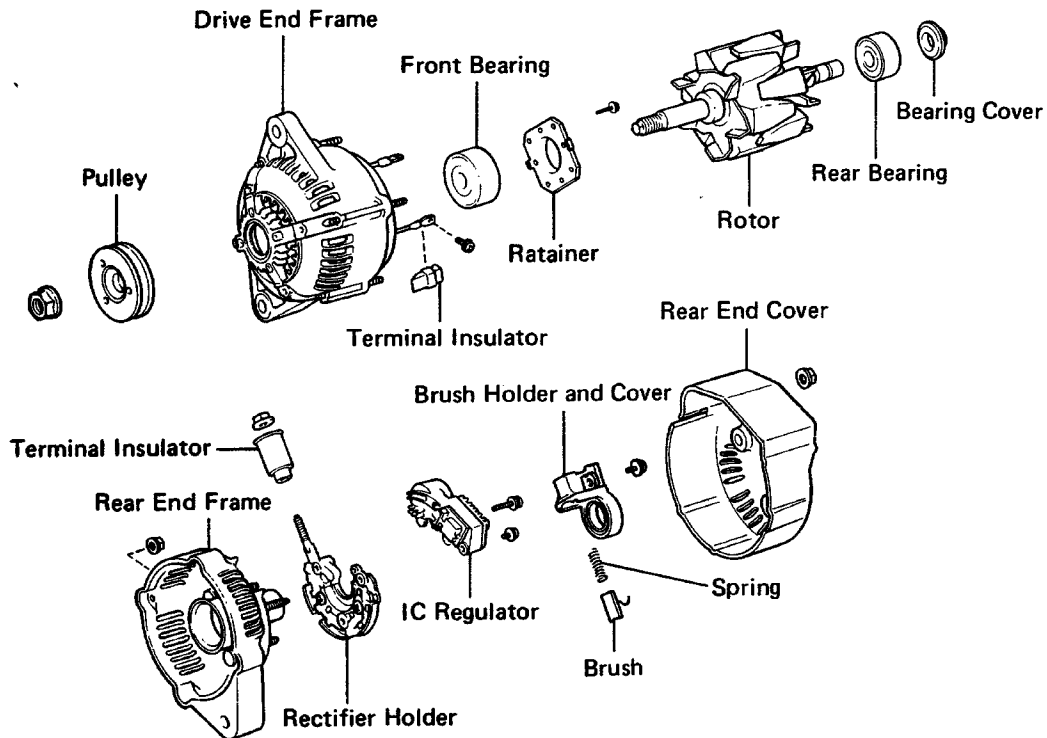
**Standard amperage: 30 A or more**

If the ammeter reading is less than 30 A, repair the generator. (See page [CH-5](#))

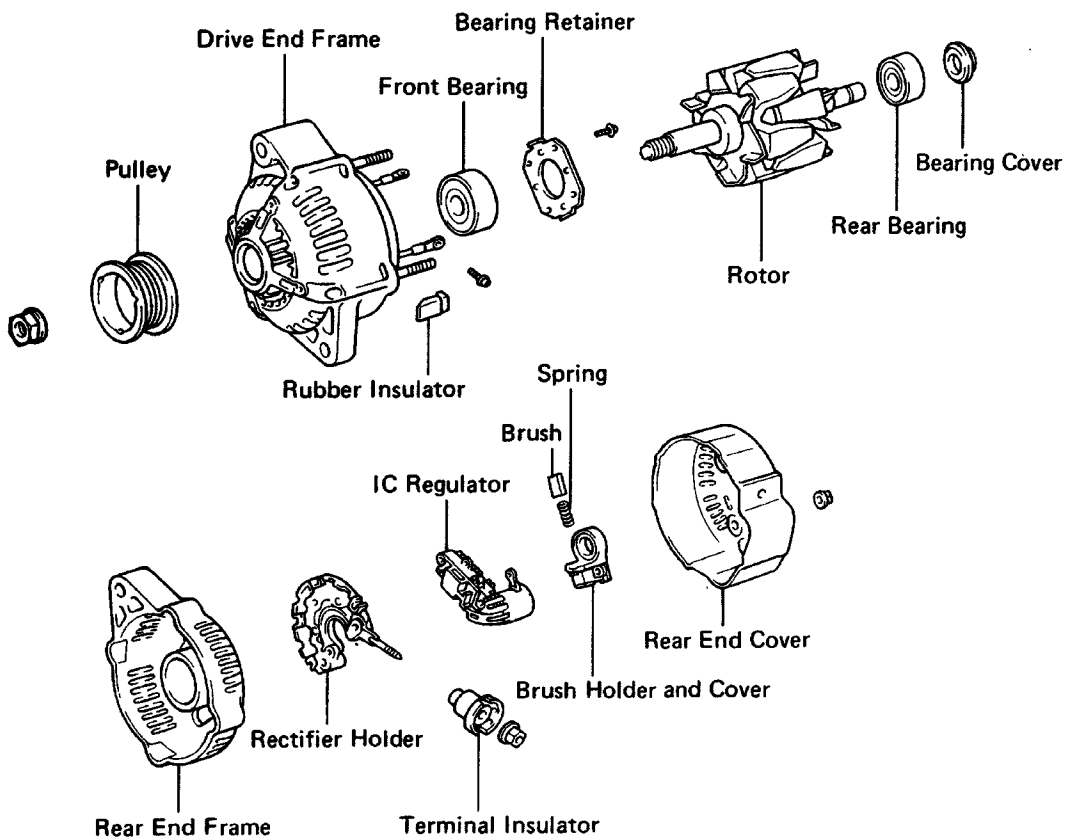
HINT: If the battery is fully charged, the indication will sometimes be less than 30 A.

# GENERATOR COMPONENTS

## 22R-E Engine



## 3VZ-E Engine



## REMOVAL OF GENERATOR (22R-E)

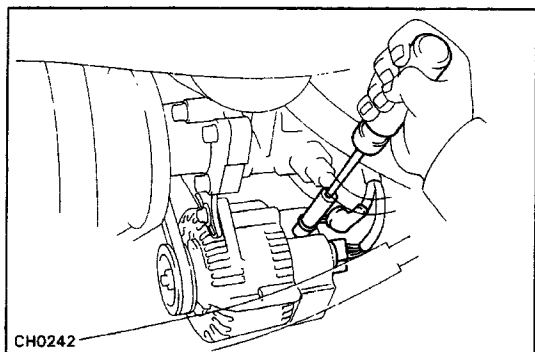
### 1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

### 2. (w/ PS)

#### DRAIN COOLANT

### 3. DISCONNECT WIRING FROM GENERATOR

- (a) Disconnect the connector from the generator.
- (b) Remove the nut and wire from the generator.

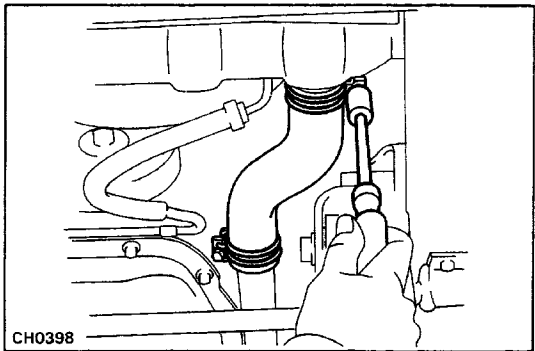


### 4. (w/ PS)

#### REMOVE WATER INLET HOSE

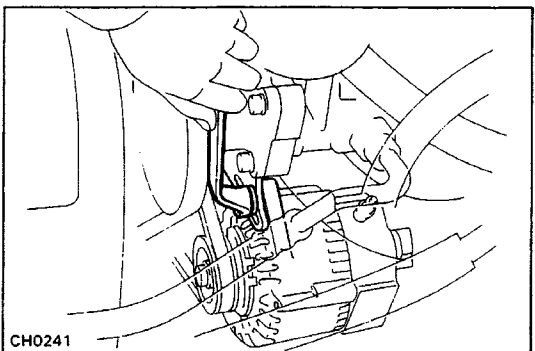
- (a) Remove the engine under cover.
- (b) Remove the water inlet hose.
- (c) (with A/C)

Remove the No. 2 fan shroud.



### 5. REMOVE GENERATOR DRIVE BELT

- (a) Loosen the generator pivot and remove the adjusting bolt.
- (b) Remove the drive belt.



### 6. REMOVE GENERATOR

- (a) Hold the generator and remove the pivot.
- (b) Remove the generator.

## **REMOVAL OF GENERATOR (3VZ-E)**

### **1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

### **2. DISCONNECT WIRING FROM GENERATOR**

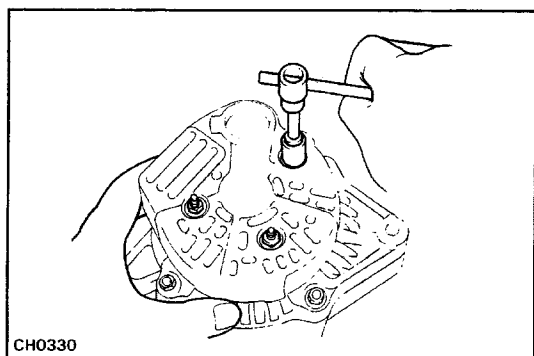
- (a) Disconnect the connector from the generator.
- (b) Remove the nut and disconnect the wire from the generator.

### **3. REMOVE GENERATOR DRIVE BELT**

Loosen the generator pivot bolts, adjusting nut and lock bolt and remove the generator drive belt.

### **4. REMOVE GENERATOR**

- (a) Remove the pivot bolt and adjusting lock bolts.
- (b) Remove the generator.

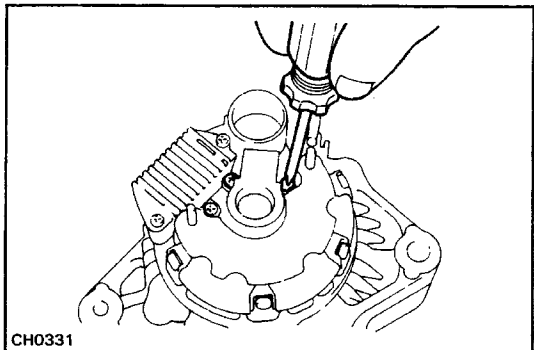


## DISASSEMBLY OF GENERATOR

(See page CH-5)

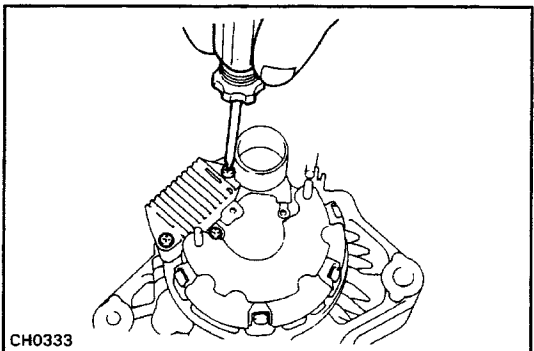
### 1. REMOVE REAR END COVER

- (a) Remove the nut and terminal insulator.
- (b) Remove the three nuts and end cover.



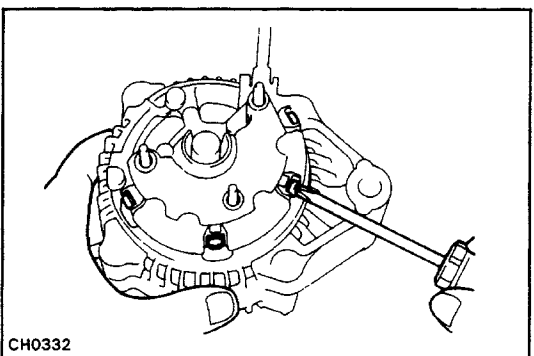
### 2. REMOVE BRUSH HOLDER

Remove the two screws, brush holder and cover.



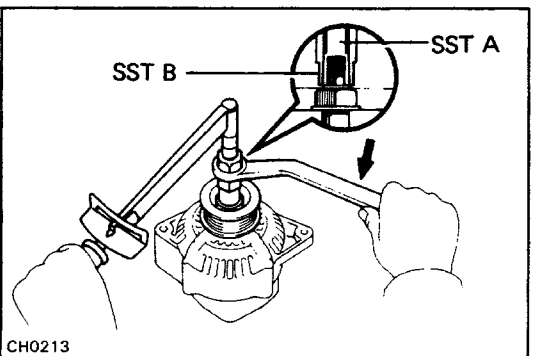
### 3. REMOVE IC REGULATOR

Remove the three screws and IC regulator.



### 4. REMOVE RECTIFIER HOLDER

- (a) Remove the four screws and rectifier holder.
- (b) Remove the four rubber insulators.



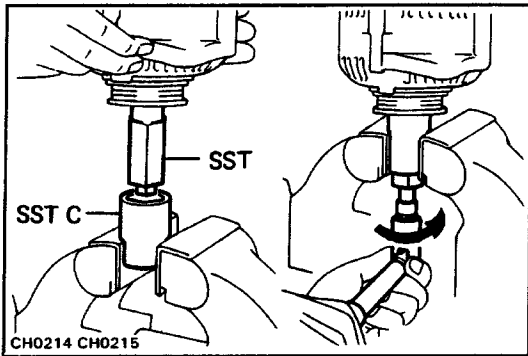
### 5. REMOVE PULLEY

- (a) Hold SST A with a torque wrench, and tighten SST B clockwise to the specified torque.  
SST 09820-63010

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

- (b) Check that SST A is secured to the rotor shaft.





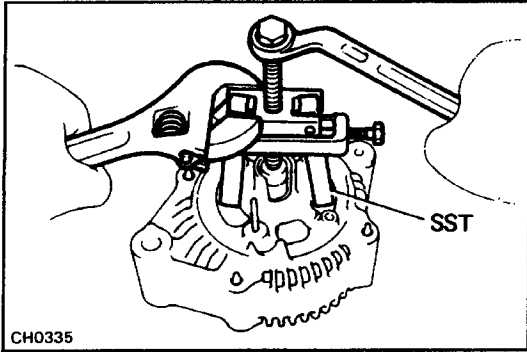
- (c) As shown in the illustration, mount SST C in a vise, and install the generator with SST (A and B) to SST C.
- (d) To loosen the pulley nut, turn SST A in the direction shown in the illustration.

**NOTICE:** To prevent damage to the rotor shaft, do not loosen the pulley nut more than one-half of a turn.

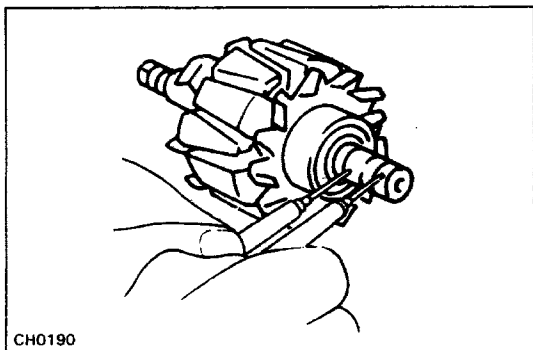
- (e) Remove the generator with SST (A and B) from SST C.
- (f) Turn SST B and remove SSTs A and B.
- (g) Remove the pulley nut and pulley.

#### 6. REMOVE REAR END FRAME

- (a) Remove the four nuts.
- (b) Using SST, remove the rear end frame.  
SST 09286-46011



#### 7. REMOVE ROTOR FROM DRIVE END FRAME



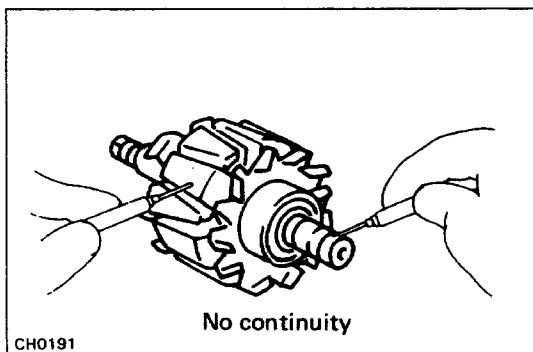
## INSPECTION AND REPAIR OF GENERATOR Rotor

### 1. INSPECT ROTOR FOR OPEN CIRCUIT –

Using an ohmmeter, check that there is continuity between the slip rings.

**Standard resistance (Cold): 2.8 – 3.0Ω**

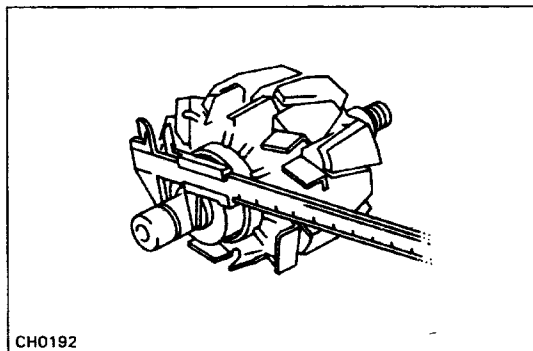
If there is no continuity, replace the rotor.



### 2. INSPECT ROTOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the slip ring and the rotor.

If there is continuity, replace the rotor.



### 3. INSPECT SLIP RINGS

(a) Check that the slip rings are not rough or scored.

If rough or scored, replace the rotor.

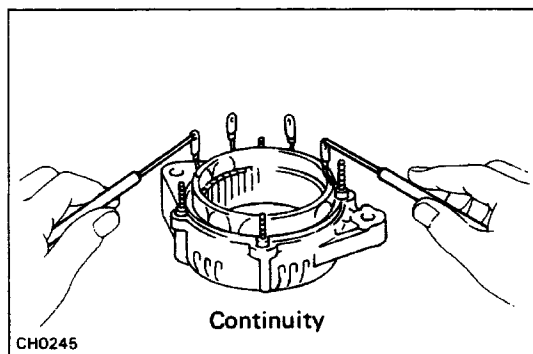
(b) Using vernier calipers, measure the slip ring diameters.

**Standard diameter: 14.2 – 14.4 mm**

**(0.559 – 0.567 in.)**

**Minimum diameter: 12.8 mm (0.504 in.)**

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

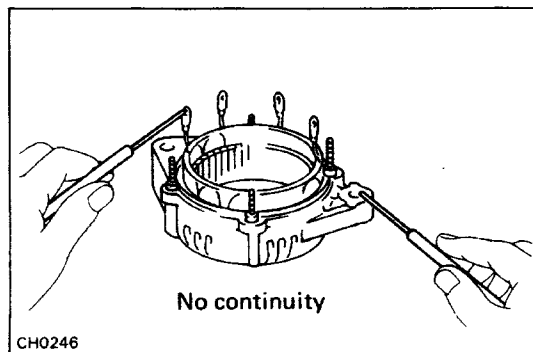


## Stator

### 1. INSPECT STATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the coil leads.

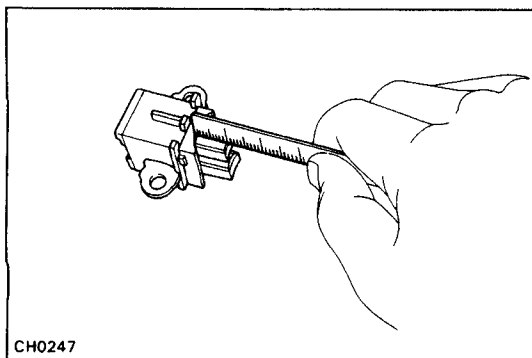
If there is no continuity, replace the drive end frame assembly.



### 2. INSPECT STATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil leads and drive end frame.

If there is continuity, replace the drive end frame assembly.



## Brushes

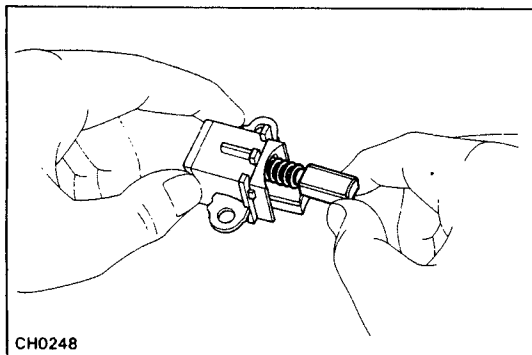
### 1. INSPECT EXPOSED BRUSH LENGTH

Using a scale, measure the exposed brush length.

**Standard exposed length: 10.5 mm (0.413 in.)**

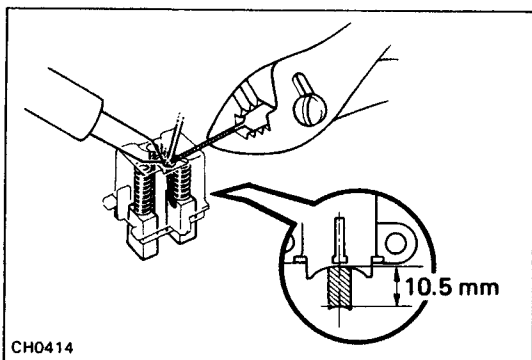
**Minimum exposed length: 1.5 mm (0.059 in.)**

If the exposed length is less than minimum, replace the brushes.



### 2. IF NECESSARY, REPLACE BRUSHES

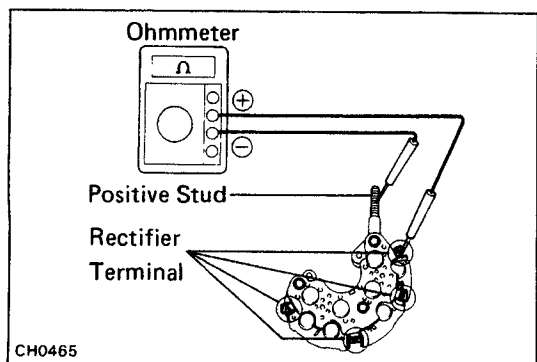
- (a) Unsolder and remove the brush and spring.
- (b) Run the wire of the brush through the hole in the brush holder, and insert the spring and brush into the brush holder.



- (c) Solder the brush wire to the brush holder at the exposed length.

**Exposed length: 10.5 mm (0.413 in.)**

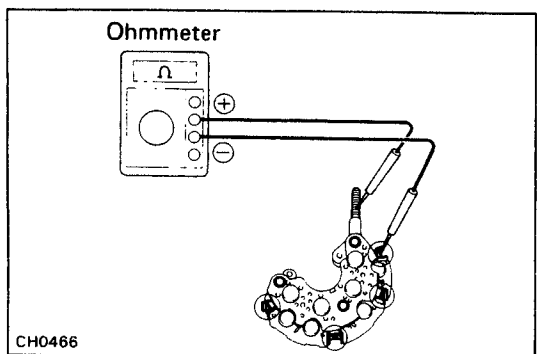
- (d) Check that the brush moves smoothly in the brush holder.
- (e) Cut off the excess wire.
- (f) Apply insulation paint to the soldered point.



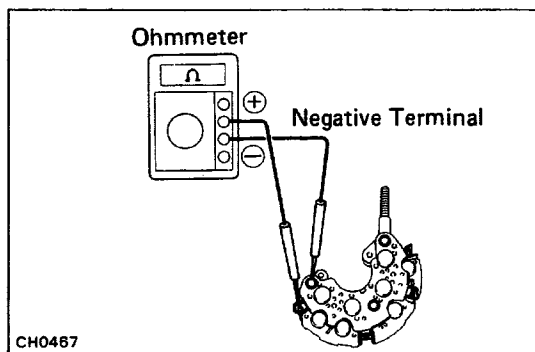
## Rectifier

### 1. INSPECT POSITIVE SIDE RECTIFIER

- (a) Using an ohmmeter, connect one tester probe to the positive stud and the other to each rectifier terminal.

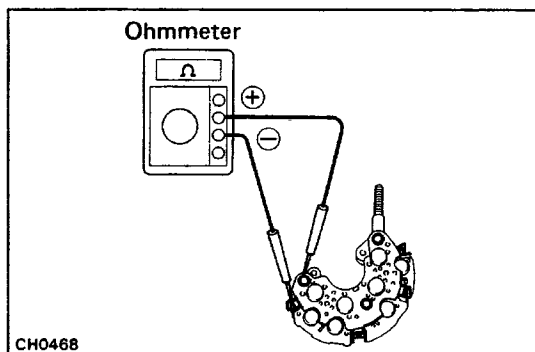


- (b) Reverse the polarity of the tester probes.
  - (c) Check that one shows continuity and the other shows no continuity.
- If not, replace the rectifier holder.

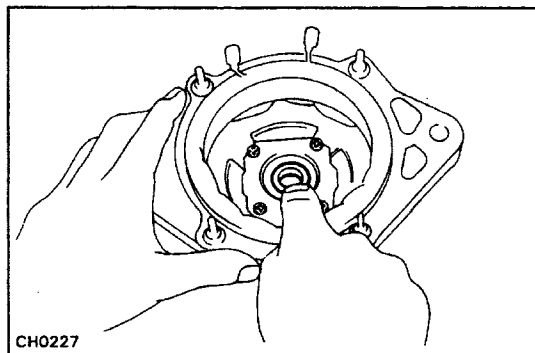


## 2. INSPECT NEGATIVE SIDE RECTIFIER

- (a) Connect one tester probe to each rectifier terminal and the other to each rectifier negative terminal.



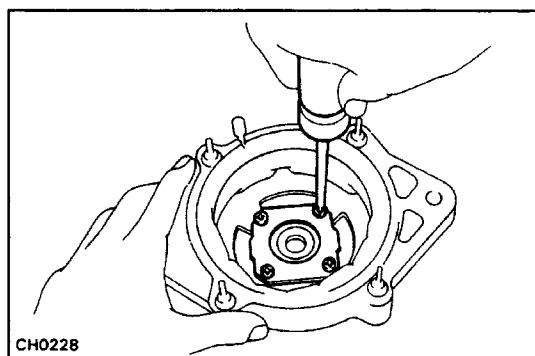
- (b) Reverse the polarity of the tester probes.  
 (c) Check that one shows continuity and the other shows no continuity.  
 If not, replace the rectifier holder.



## Bearings

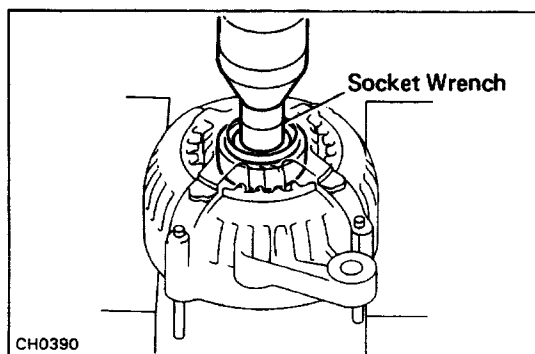
### 1. INSPECT FRONT BEARING

Check that the bearing is not rough or worn.

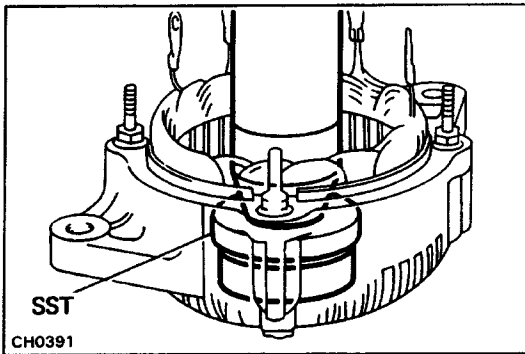


### 2. IF NECESSARY, REPLACE FRONT BEARING

- (a) Remove the four screws and bearing retainer.



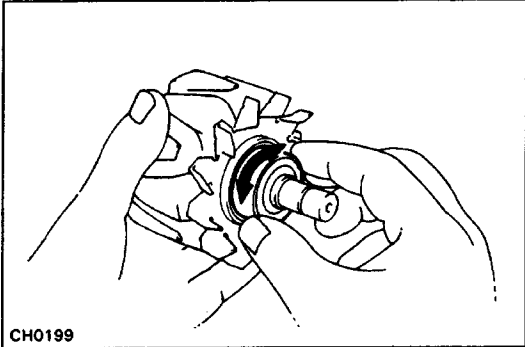
- (b) Using a press and socket wrench, press out the front bearing.



- (c) Using SST and a press, press the front bearing into the drive end frame.  
SST 09608-20012 (09608-00030)
- (d) Install the bearing retainer with the four screws.

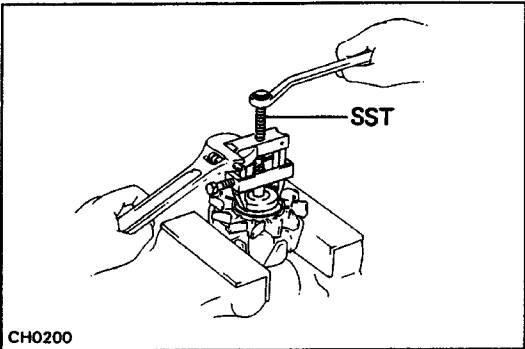
### 3. INSPECT REAR BEARING

Check that the bearing is not rough or worn.

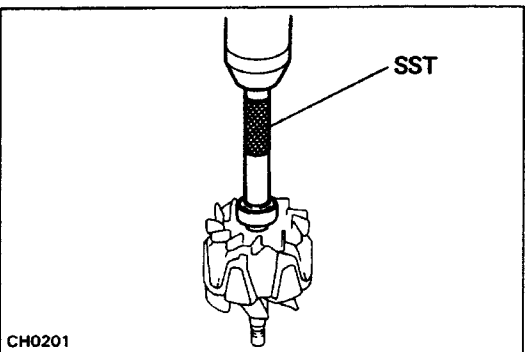


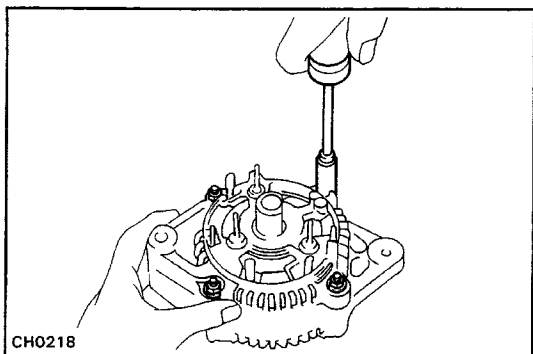
### 4. IF NECESSARY, REPLACE REAR BEARING

- (a) Using SST, remove the bearing cover and bearing.  
SST 09820-00021



- (b) Using SST and a press, press in a new bearing and the bearing cover.  
SST 09285-76010





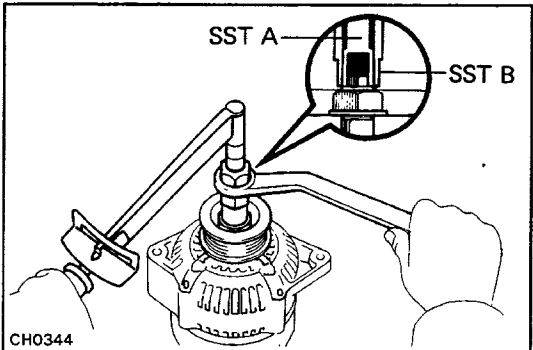
## ASSEMBLY OF GENERATOR

(See page CH-5)

### 1. INSTALL ROTOR TO DRIVE END FRAME

### 2. INSTALL REAR END FRAME

- (a) Using a plastic-faced hammer, lightly tap in the rear end frame.
- (b) Install the four nuts.

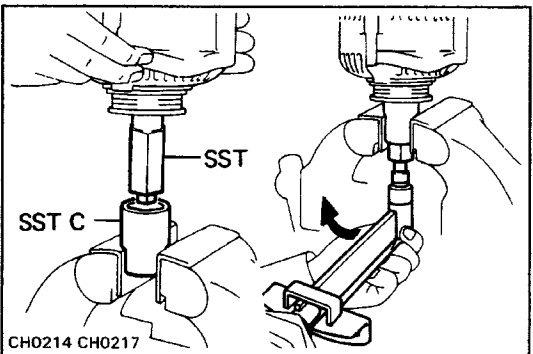


### 3. INSTALL PULLEY

- (a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.
- (b) Hold SST A with a torque wrench, and tighten SST B clockwise to the specified torque.  
SST 09820-63010

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

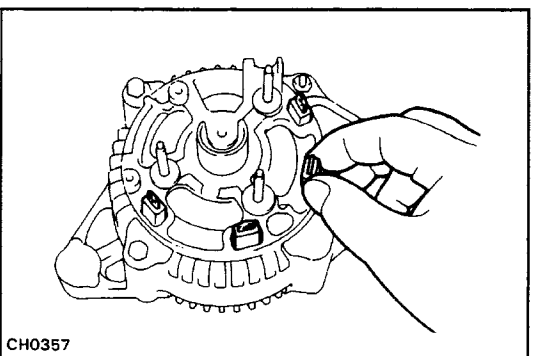
- (c) Check that SST A is secured to the pulley shaft.



- (d) As shown in the illustration, mount SST C in a vise, and install the generator with SST (A and B) to SST C.
- (e) To torque the pulley nut, turn SST A in the direction shown in the illustration.

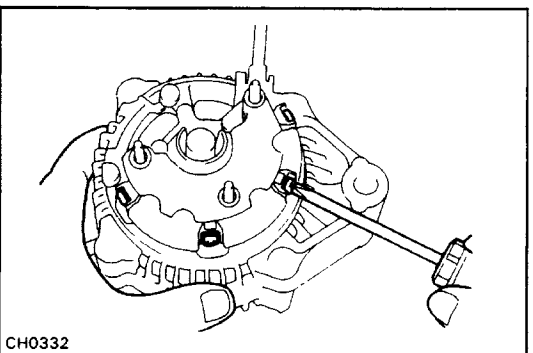
**Torque: 110 N-m (1,125 kgf -cm, 81 ft-lbf)**

- (f) Remove the generator with SST (A and B) from SST C.
- (g) Turn SST B and remove SSTs A and B.

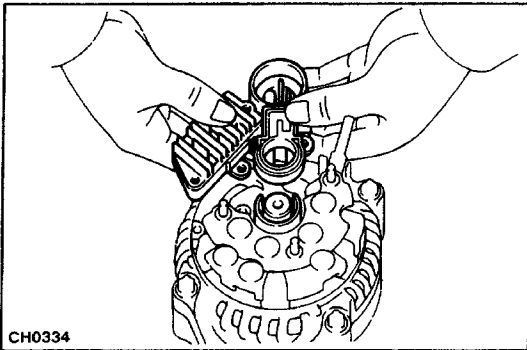


### 4. INSTALL RECTIFIER HOLDER

- (a) Install the four rubber insulators on the lead wires.

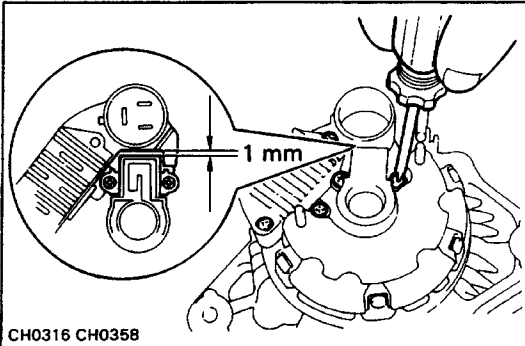


- (b) Install the rectifier with the four screws.

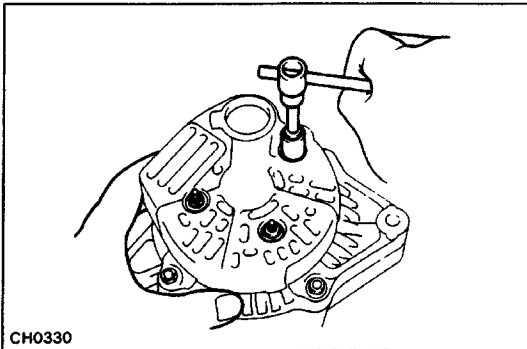
**5. INSTALL BRUSH HOLDER AND IC REGULATOR**

- (a) Place the brush holder cover to the brush holder.
- (b) Install the IC regulator and brush holder to the rear end frame horizontally as shown in the illustration.

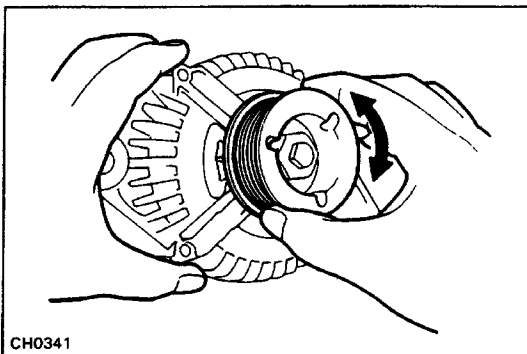
HINT: Check that the brush holder's cover doesn't slip to one side during installation.

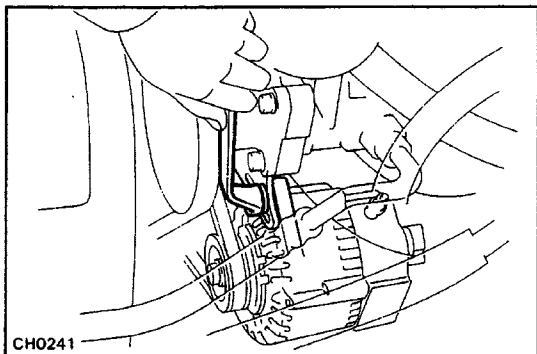


- (c) Tighten the five screws until there is a clearance of at least 1 mm (0.04 in.) between the brush holder cover and connector.

**6. INSTALL REAR END COVER**

- (a) Install the end cover with the three nuts.
- (b) Install the terminal insulator with the nut.

**7. MAKE SURE ROTOR ROTATES SMOOTHLY**



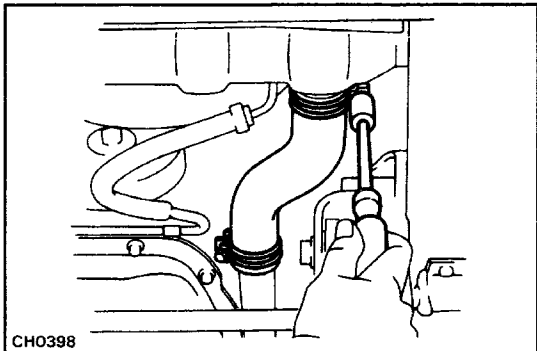
## INSTALLATION OF GENERATOR (22R-E)

### 1. INSTALL GENERATOR

Mount the generator on the bracket with the pivot and adjusting bolt.

### 2. INSTALL AND ADJUST DRIVE BELT

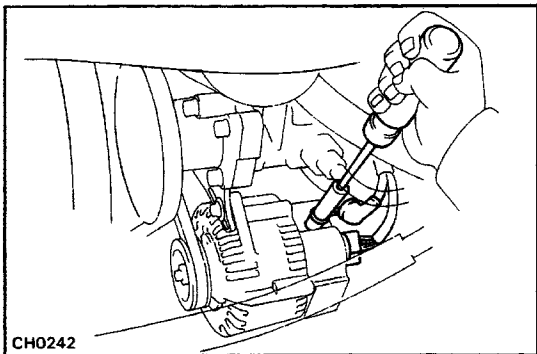
(See page [MA-6](#))



### 3. INSTALL WATER INLET HOSE

- (a) Install the water inlet hose.
- (b) Install the engine under cover.
- (c) (with A/C)

Install the No.2 fan shroud.



### 4. CONNECT WIRING TO GENERATOR

- (a) Connect the wire to the generator and install the nut.
- (b) Connect the connector to the generator.

### 5. FILL WITH COOLANT

Close the radiator drain cock and fill with coolant.

### 6. CONNECT NEGATIVE CABLE TO BATTERY

### 7. PERFORM ON-VEHICLE INSPECTION

(See page [CH-2](#))



## **INSTALLATION OF GENERATOR (3VZ-E)**

### **1. INSTALL GENERATOR**

Mount the generator on the generator bracket with pivot bolt and adjusting lock bolts.

Do not tighten the bolts.

### **2. INSTALL DRIVE BELT**

(See step 3 on page [CH-2](#))

### **3. CONNECT WIRING TO GENERATOR**

(a) Connect the wire to the generator with the nut.

(b) Connect the connector to the generator.

### **4. CONNECT NEGATIVE CABLE TO BATTERY**

### **5. PERFORM ON-VEHICLE INSPECTION**

(See pages [CH-2](#) to 3)