

CHARGING SYSTEM

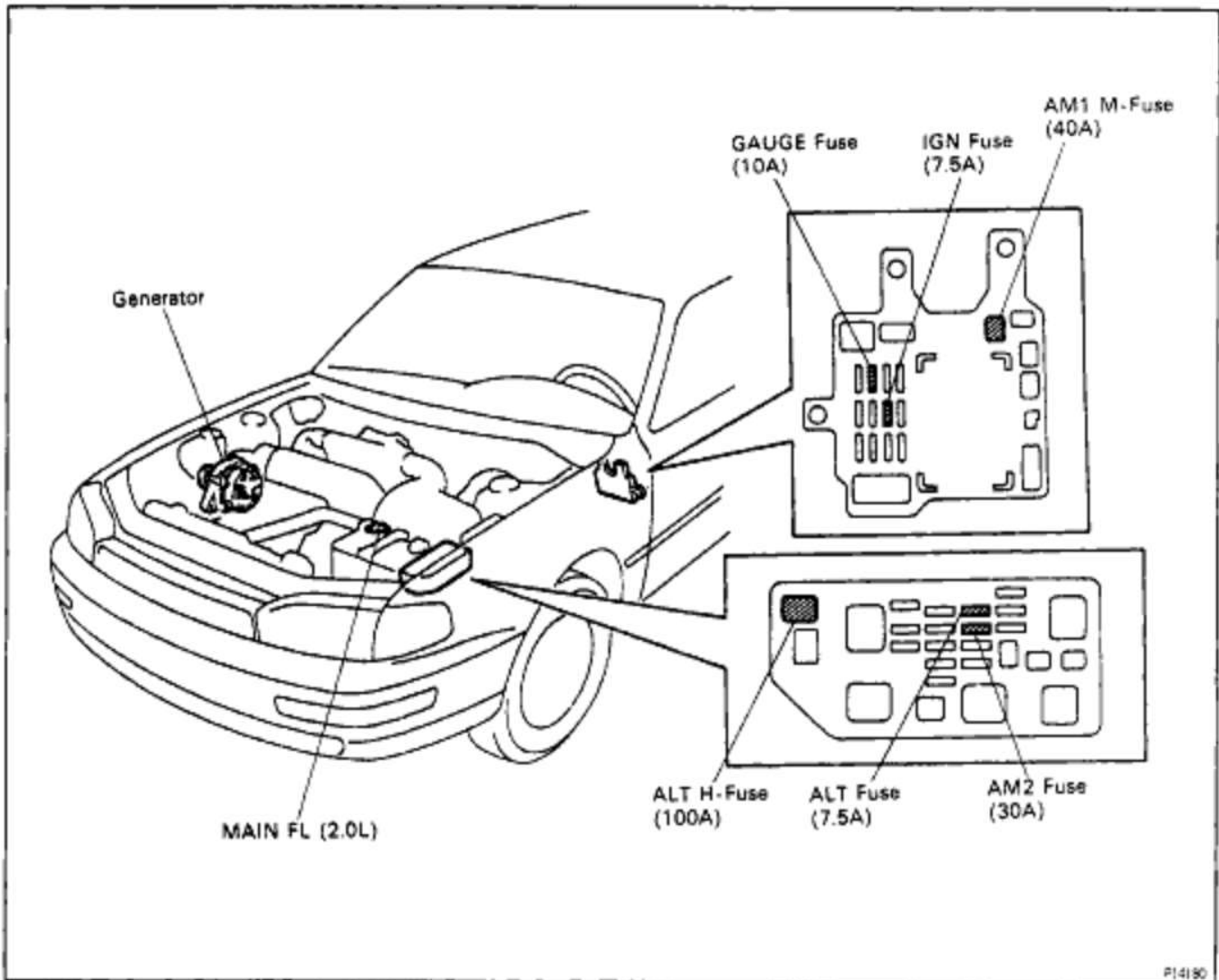
CH-2

CHARGING SYSTEM - (5S-FE)

(5S-FE)

DESCRIPTION

The generator is a small, high speed, high performance type with an voltage regulator incorporated. The voltage regulator uses integrated circuits and controls the voltage produced by the generator.

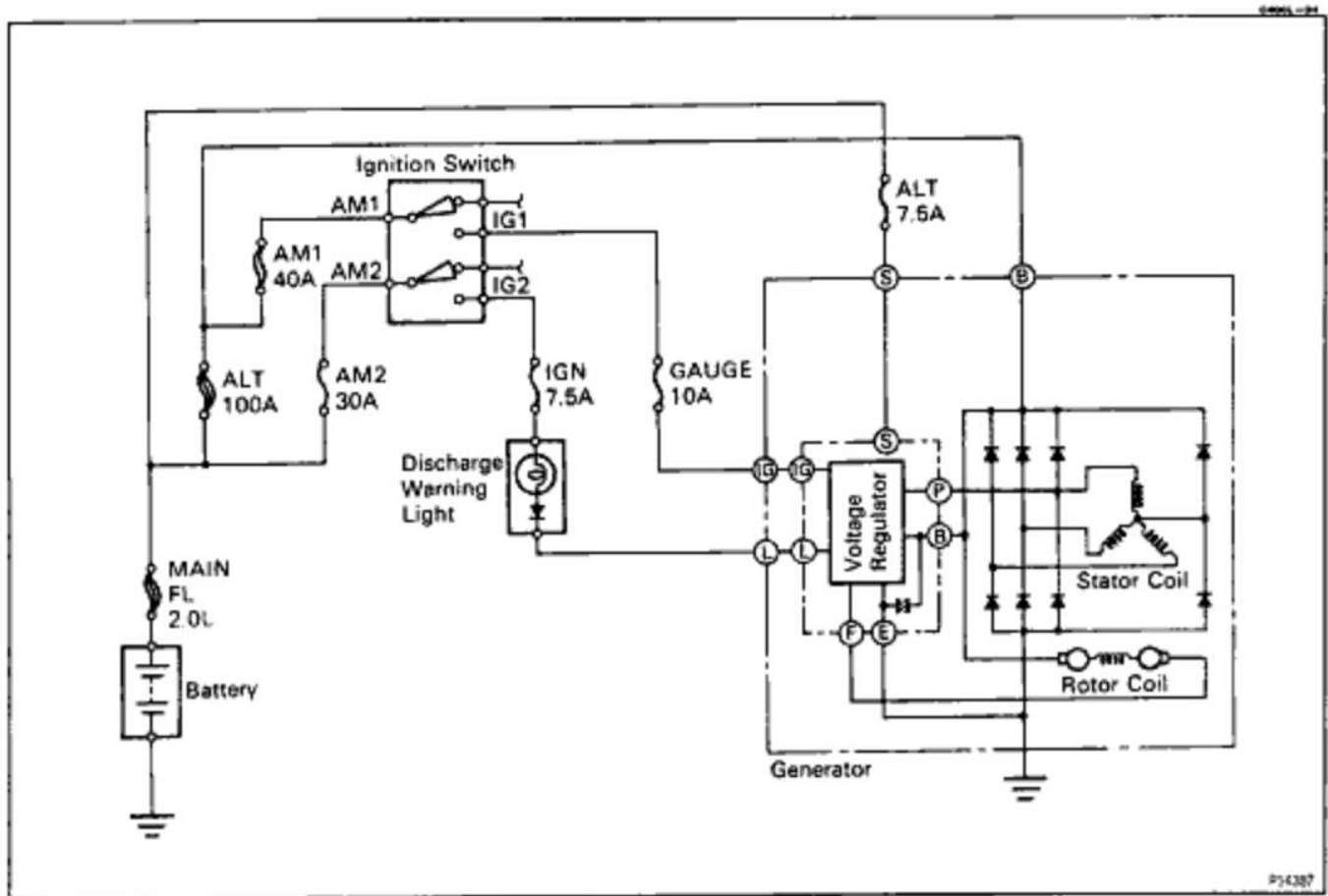


PRECAUTION

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.

ENH01-27

SYSTEM CIRCUIT



OPERATION

When the ignition switch is turned ON, current from the battery flows from terminal L of the generator through the voltage regulator to terminal E, causing the discharge warning light to light up.

Then when the engine is started, the voltage output increases as the generator rpm increases. When the voltage output becomes greater than the battery voltage, current for recharging flows from terminal B. Simultaneously, voltage at terminal L increases and the potential difference between battery and terminal L disappears, causing the discharge warning light to go off. When the voltage output exceeds the regulator adjustment voltage, the transistor inside the voltage regulator regulates the voltage so that the voltage from the generator remains constant.

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CHARGING SYSTEM - (5S-FE)

PREPARATION

SST (SPECIAL SERVICE TOOLS)

GROUP-01

	09285-76010 Injection Pump Camshaft Bearing Cone Replacer	Rotor rear bearing cover
	09286-46011 Injection Pump Spline Shaft Puller	Rectifier end frame
 	09608-20012 Front Hub & Drive Pinion Bearing Tool Set (09608-00030) Replacer	Rotor front bearing
	09820-00021 Alternator Rear Bearing Puller	
	09820-00030 Alternator Rear Bearing Replacer	Rotor rear bearing
	09820-63010 Alternator Pulley Set Nut Wrench Set	

GROUP-01

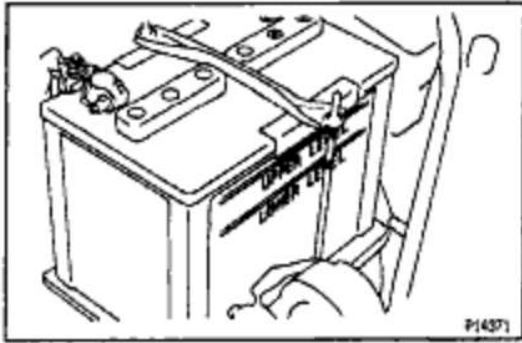
RECOMMENDED TOOLS

	09082-00050 TOYOTA Electrical Tester Set	
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GROUP-01

EQUIPMENT

Ammeter(A)	
Battery specific gravity gauge	
Belt tension gauge	
Torque wrench	
Vernier calipers	Rotor (Slip ring), Brush



ON-VEHICLE INSPECTION

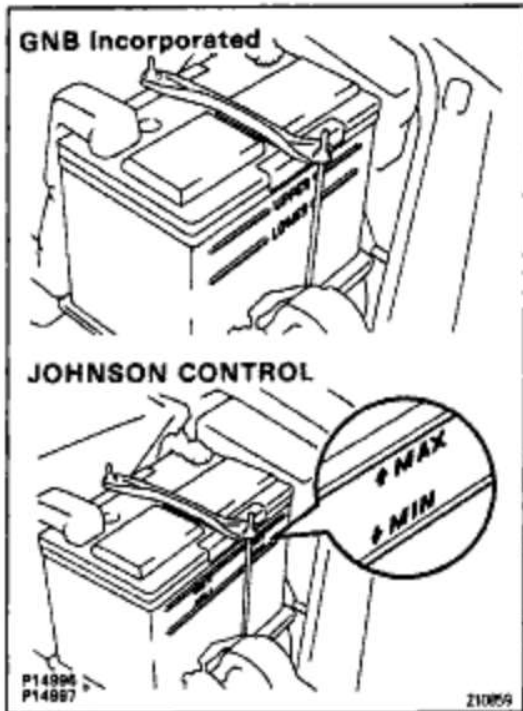
1. Except Delco Battery:

CHECK BATTERY ELECTROLYTE LEVEL

Check the electrolyte quantity of each cell.

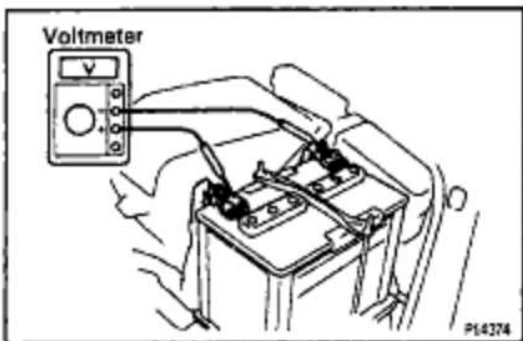
A. Maintenance Free Battery

If under the lower level, replace the battery (or add distilled water if possible). Check the charging system.



6. Except Maintenance Free Battery

If under the "LOWER" or "MIN" line, add distilled water.



2. Except Delco Battery:

CHECK BATTERY VOLTAGE AND SPECIFIC GRAVITY

A. Maintenance Free Battery

Measure the battery voltage between the terminals negative (-) and positive (+) of the battery.

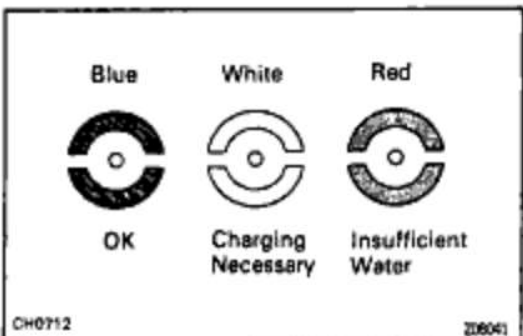
Standard voltage:

12.7 – 12.9 V at 200C (680F)

HINT:

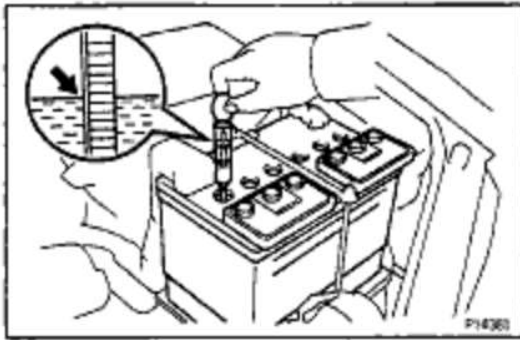
- Before measuring the voltage, turn the ignition switch to LOCK and turn off the electrical systems (headlight, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.
 - If the vehicle has been running, wait 5 minutes or more after the vehicle stops before measuring the battery voltage.
- If the voltage is less than specification, charge the battery.

HINT: Check the indicator as shown in the illustration.



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**B. Except Maintenance Free Battery**

Check the specific gravity of each cell.

Standard specific gravity:

55D23L battery for GNB Incorporated

1.25 – 1.27 at 20°C (68° F)

55D23L battery for JOHNSON CONTROLS

1.26 – 1.28 at 27°C (81°F)

80D26L battery for GNB Incorporated

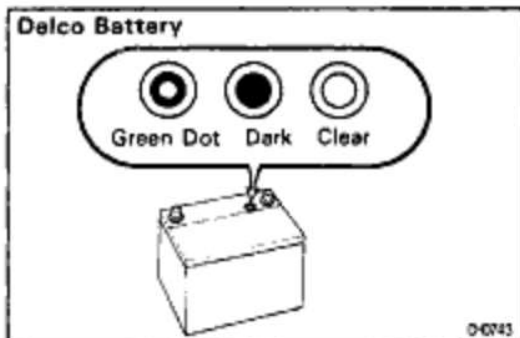
1.27 – 1.29 at 20°C (68°F)

80D26L battery for JOHNSON CONTROLS

1.28 – 1.30 at 27°C (81°F)

If the gravity is less than specification, charge the battery.

HINT: Check the indicator as shown in the illustration.

**3. Delco Battery:****CHECK HYDROMETER**

Green Dot visible:

Battery is adequately charged

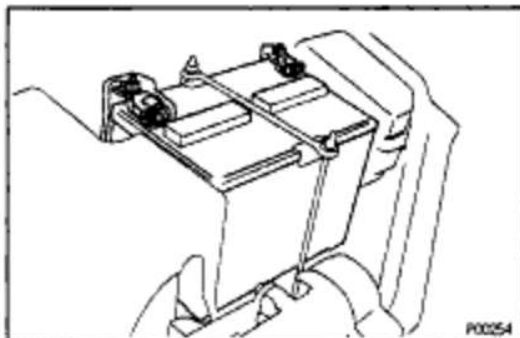
Dark (Green Dot not visible):

Battery must be charged

Clear or Light Yellow:

Replace battery

HINT: There is no need to add water during the entire service life of the battery.

**4. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES**

(a) Check that the battery terminals are not loose or corroded.

(b) Check the fusible link and fuses for continuity.

Fusible link:

MAIN 2.0L

H – Fuse:

ALT 100A

M – Fuse:

AM 1 40A

Fuse:

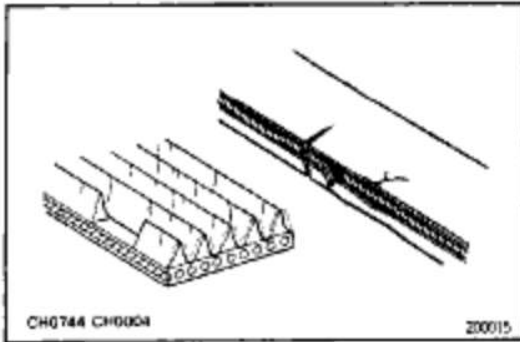
AM2 30A

IG2 7.5A

GAUGE 10A

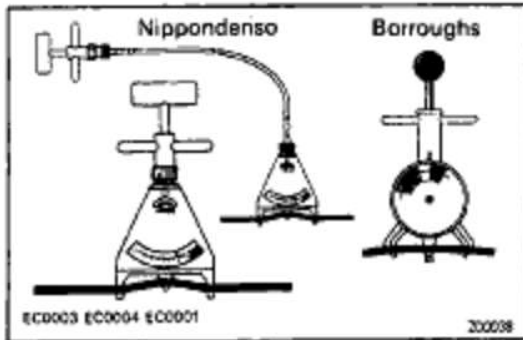
ALT 7.5A

CHARGING SYSTEM – (5S-FE)

**5. INSPECT DRIVE BELT**

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

If any defect has been found, replace the drive belt.
HINT: Cracks on the rib side of a drive belt are considered acceptable. If the drive belt has chunks missing from the ribs, it should be replaced.



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

Belt tension gauge:

Nippondenso BTG-20 (95506-00020)

Borroughs No. BT-33-73F

Drive belt tension:

w/ A/C

Now belt

$175 \pm 5 \text{ lbf}$

Used belt

$130 \pm 10 \text{ lbf}$

w/o A/C

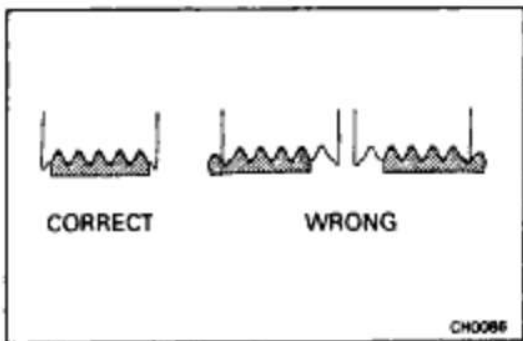
New belt

$125 \pm 25 \text{ lbf}$

Used belt

$95 \pm 20 \text{ lbf}$

If the belt tension is not as specified, adjust it.

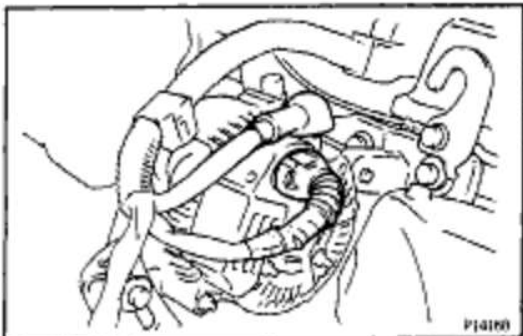


HINT:

- "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 a 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 pulley.
- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.

6. 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.

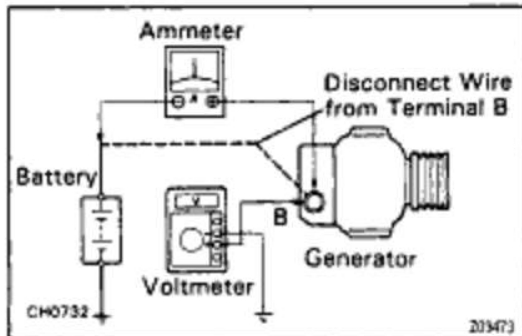


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CHARGING SYSTEM – (5S-FE)

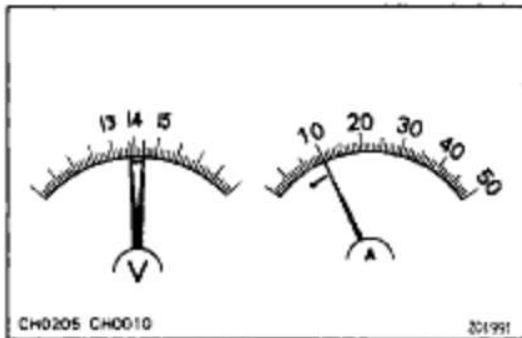
7. CHECK DISCHARGE WARNING LIGHT CIRCUIT

- Warm up the engine and then turn it off.
- Turn off all accessories.
- Turn the ignition switch "ON". Check that the discharge warning light is lit.
- Start the engine. Check that the light goes off.
If the light does not go off as specified, troubleshoot the discharge light circuit.

**8. INSPECT CHARGING CIRCUIT WITHOUT LOAD**

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

- 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 it to the negative (–) tester probe of the ammeter.
 - Connect the positive (+) tester probe of the ammeter to terminal B of the generator.
 - Connect the positive (+) tester probe of the voltmeter to terminal B of the generator.
 - Ground the negative (–) tester probe of the voltmeter.



- 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:

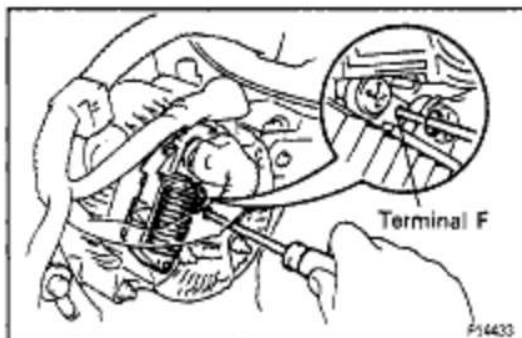
13.9 – 15.1 V at 25°C (77°F)

13.5 – 14.3 V at 115° C (239° F)

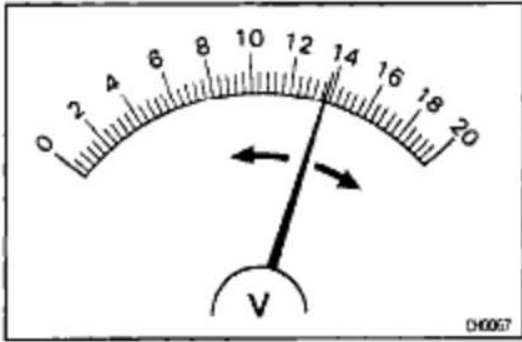
If the voltmeter reading is more than standard voltage, replace the voltage regulator.

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

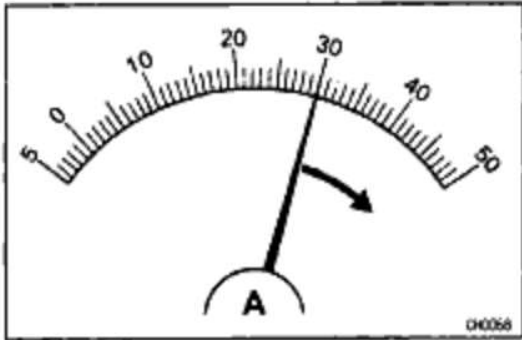
- With terminal F grounded, start the engine and check the voltmeter reading of terminal B.



CHARGING SYSTEM – (5S-FE)



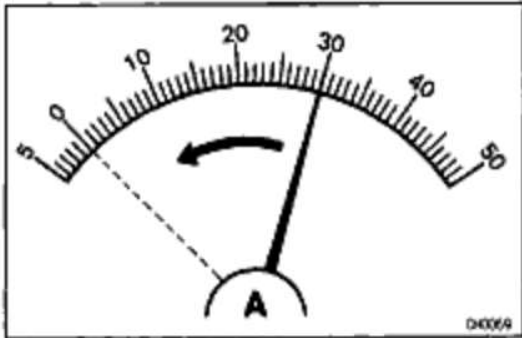
- If the voltmeter reading is more than standard voltage, replace the voltage regulator.
- If the voltmeter reading is less than standard voltage, check the generator.

**9. INSPECT CHARGING CIRCUIT WITH LOAD**

- With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater blower switch at 'HI'.
- Check the reading on the ammeter.

Standard amperage:

30 A or more



If the ammeter reading is less than the standard amperage, repair the generator.

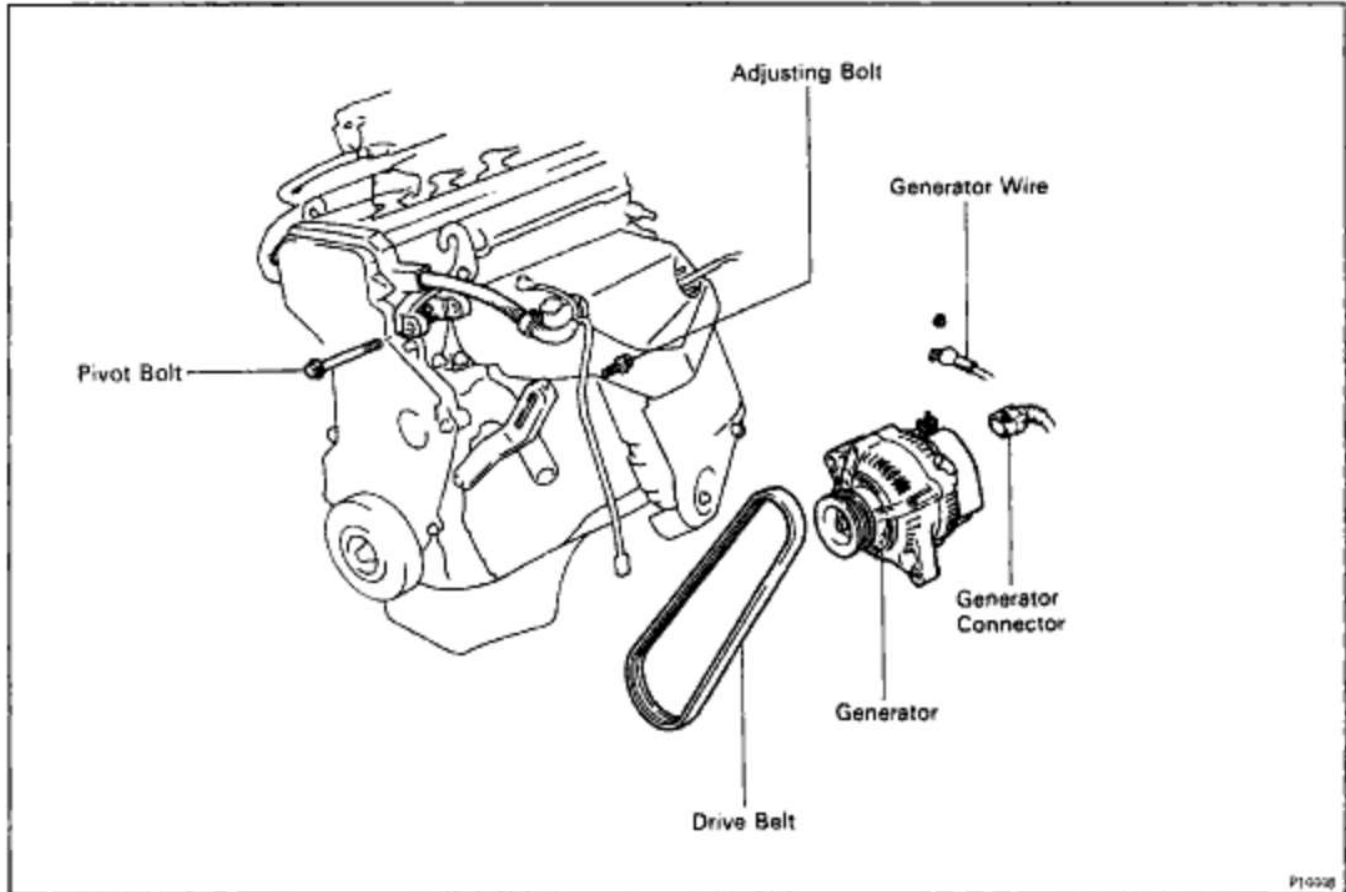
HINT: If the battery is fully charged, the indication will sometimes be less than standard amperage.

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CHARGING SYSTEM – (5S-FE)

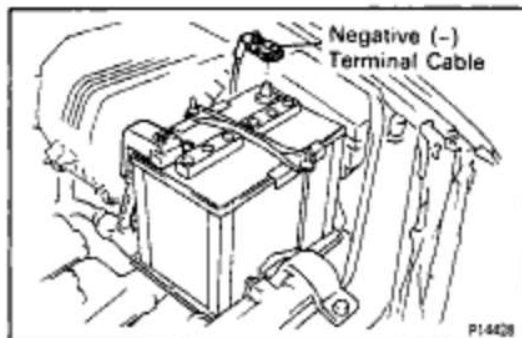
GENERATOR COMPONENTS FOR REMOVAL AND INSTALLATION

G4679-0C



P14328

G4679-01



P14428

GENERATOR REMOVAL

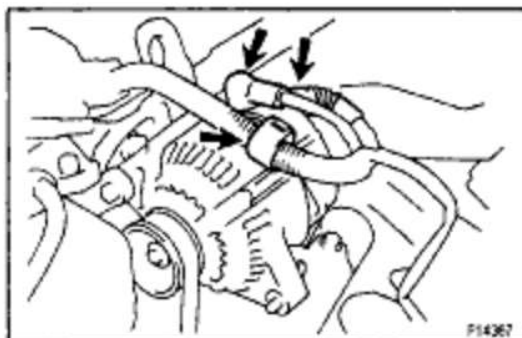
(See Components for Removal and installation)

1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

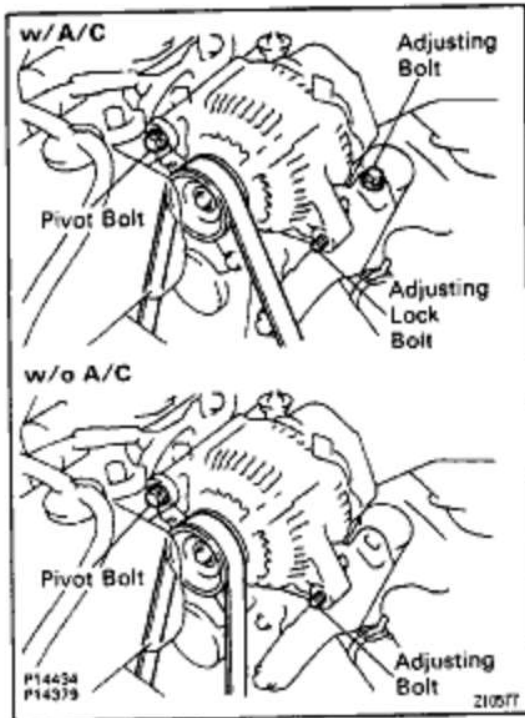
2. REMOVE GENERATOR

- Disconnect the wire clamp from the wire clip on the rectifier end frame.
- Disconnect the generator connector.
- Remove the rubber cap and nut, and disconnect the generator wire.

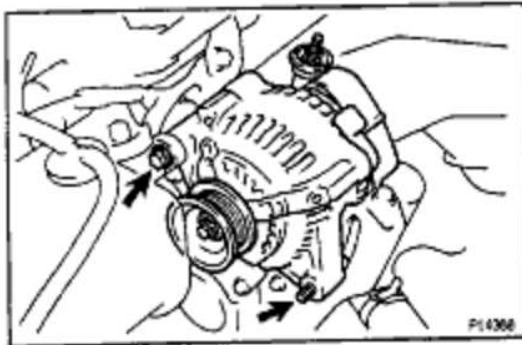


P14367

CHARGING SYSTEM - (5S-FE)



- (d) Loosen the adjusting lock bolt (w/ A/C), adjusting bolt and pivot bolt.
- (e) Remove the drive belt.

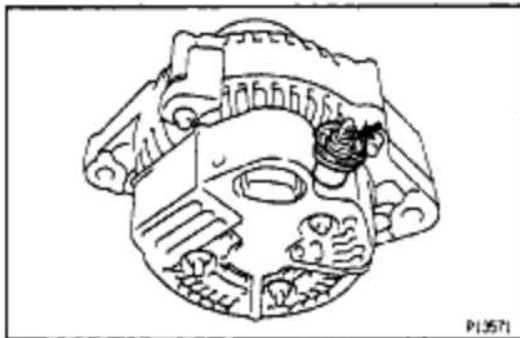
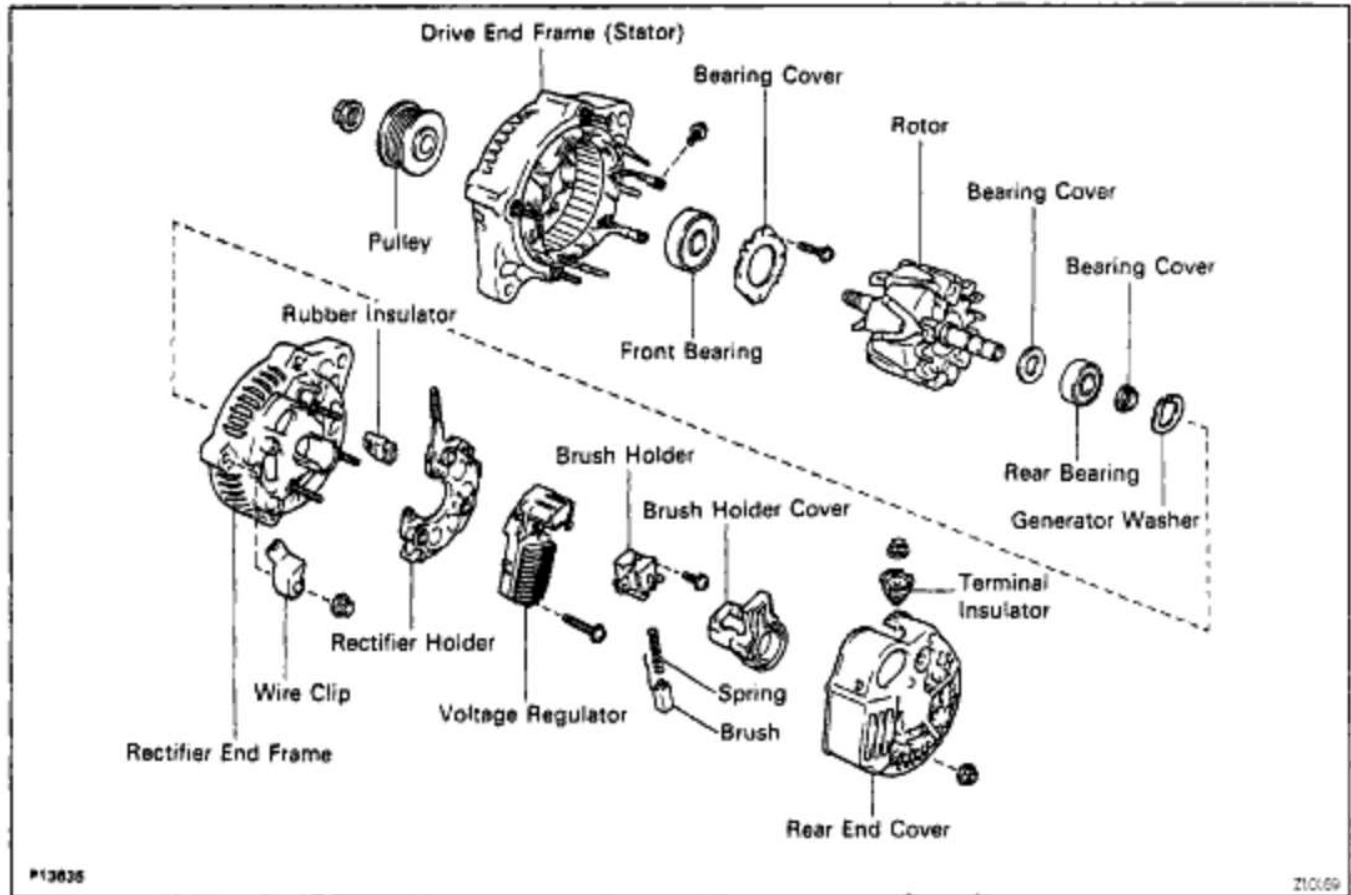


- (f) Remove the adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C) and pivot bolt.
- (g) Remove the generator.

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CHARGING SYSTEM - (5S-FE)

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

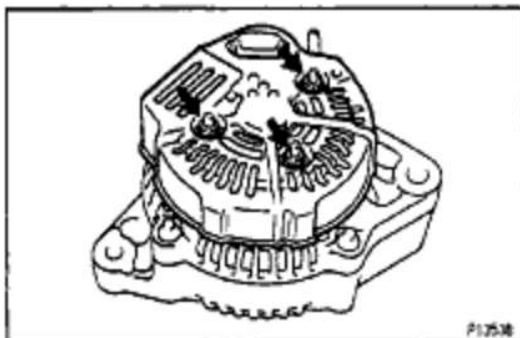


GENERATOR DISASSEMBLY

(See Components for Disassembly and Assembly)

1. REMOVE REAR END COVER

(a) Remove the nut and terminal insulator.

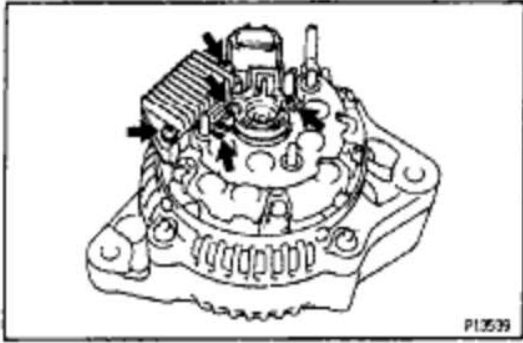


(b) Remove the 3 nuts and end cover.

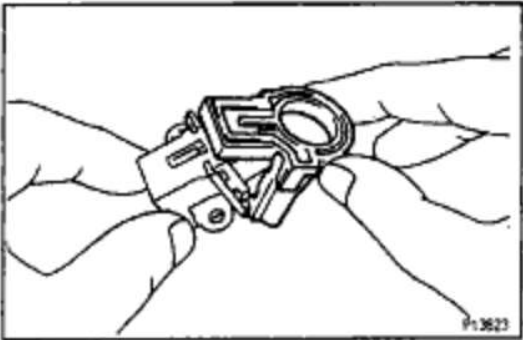
CHARGING SYSTEM - (5S-FE)

2. REMOVE BRUSH HOLDER AND VOLTAGE REGULATOR

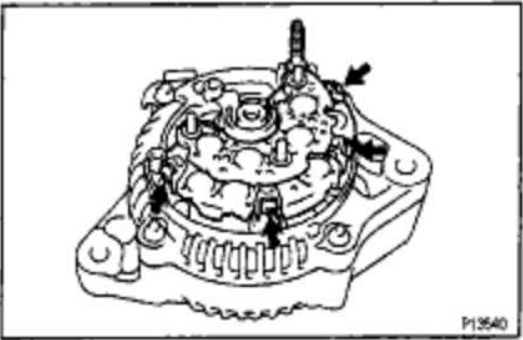
(a) Remove the 5 screws, brush holder and voltage regulator.



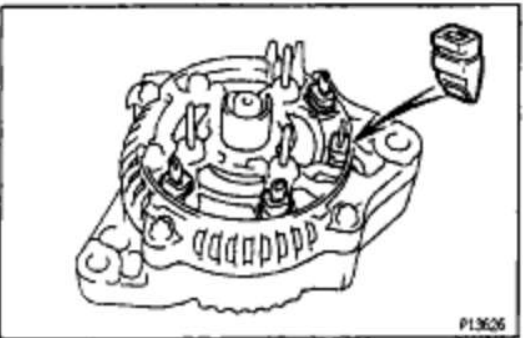
(b) Remove the brush holder cover from the brush holder.

**3. REMOVE RECTIFIER HOLDER**

(a) Remove the 4 screws and rectifier holder.



(b) Remove the 4 rubber insulators.

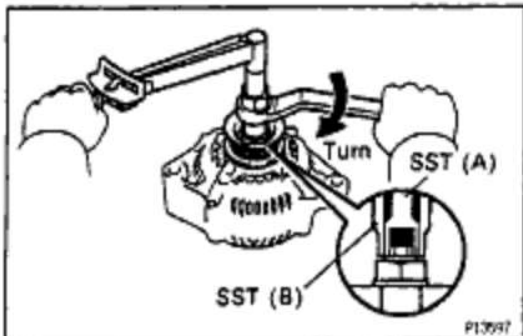
**4. REMOVE PULLEY**

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

SST 09820-63010

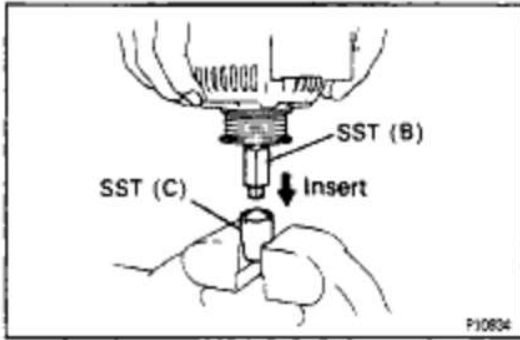
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

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

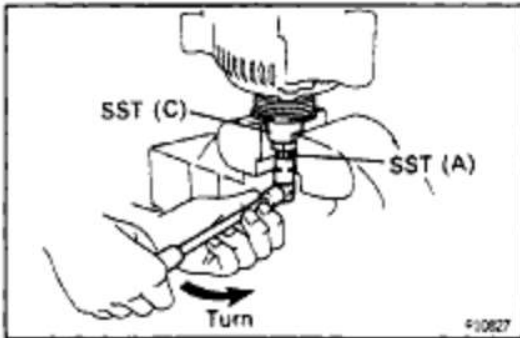


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CHARGING SYSTEM - (5S-FE)



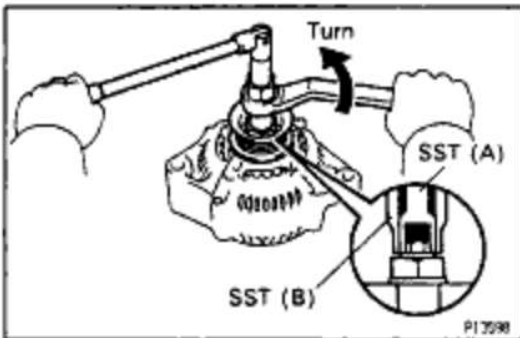
- (c) Mount SST (C) in a vise.
- (d) Insert SST (B) into SST (C), and attach the pulley nut to SST (C).



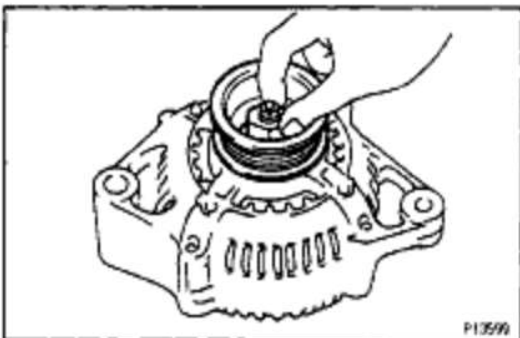
- (e) To loosen the pulley nut, turn SST (A) in the direction shown in the illustration.

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

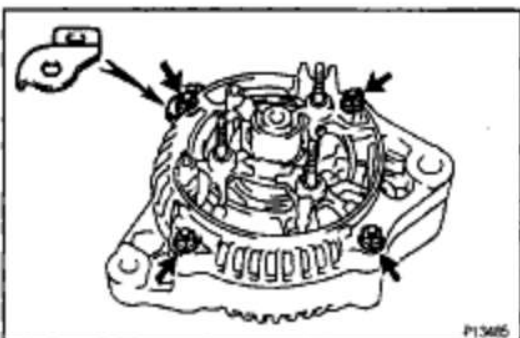
- (f) Remove the generator from SST (C).



- (g) Turn SST (B), and remove SST (A and B).



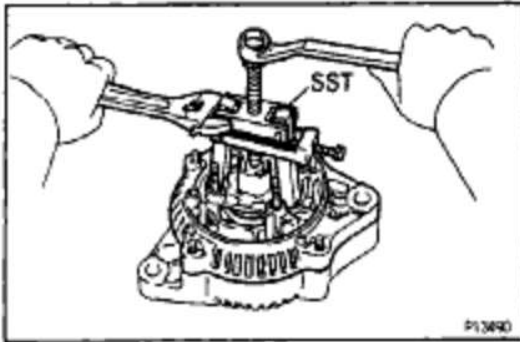
- (h) Remove the pulley nut and pulley.



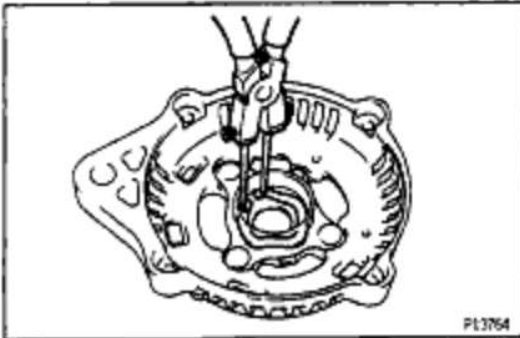
5. REMOVE RECTIFIER END FRAME

- (a) Remove the 4 nuts and wire clip.

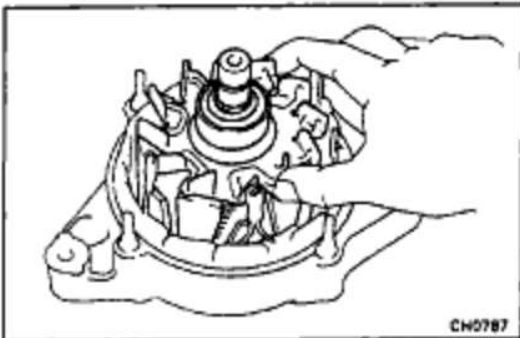
CHARGING SYSTEM - (5S-FE)



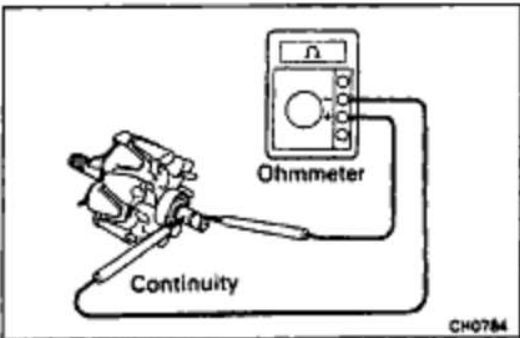
- (b) Using SST, remove the rectifier end frame.
SST 09286 - 46011



- (c) Using snap ring pliers, remove the generator washer from the rectifier end frame.



6. REMOVE ROTOR FROM DRIVE END FRAME



GENERATOR INSPECTION AND REPAIR

Rotor

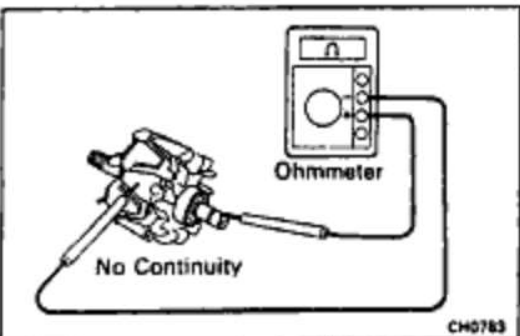
1. INSPECT ROTOR FOR OPEN CIRCUIT

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

Standard resistance:

2.8 - 3.0 Ω at 20°C (68°F)

If there is no continuity, replace the rotor.



2. INSPECT ROTOR FOR GROUND

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

If there is continuity, replace the rotor.

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CHARGING SYSTEM – (5S-FE)

**3. INSPECT SLIP RINGS**

- (a) Check that the slip rings are not rough or scored.
If rough or scored, replace the rotor.
- (b) Using a vernier caliper, measure the slip ring diameter.

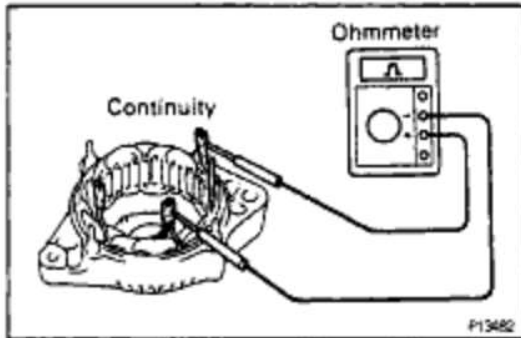
Standard diameter:

14.2 – 14.4 mm (0.559 – 0.567 in.)

Minimum diameter:

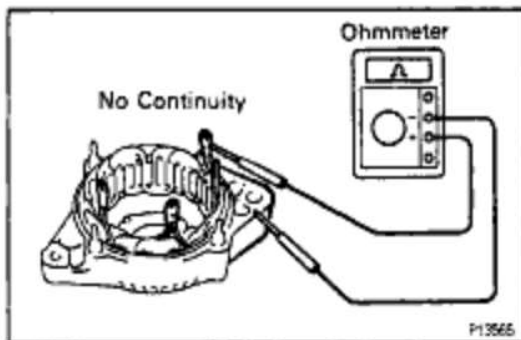
12.8 mm (0.504 in.)

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

**Stator (Drive End Frame)****1. INSPECT STATOR FOR OPEN CIRCUIT**

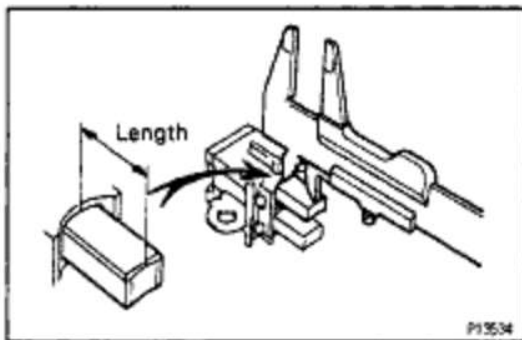
Using an ohmmeter, check that there is continuity between the coil leads.

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

**2. INSPECT STATOR FOR GROUND**

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

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

**Brushes****1. INSPECT EXPOSED BRUSH LENGTH**

Using vernier calipers, measure the exposed brush length.

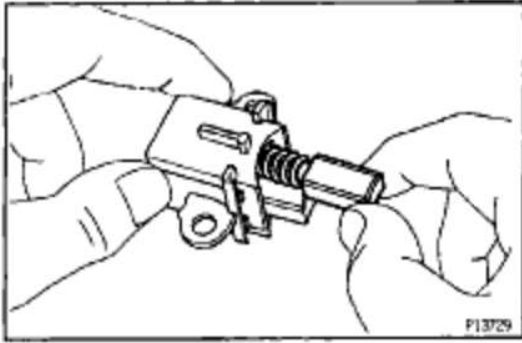
Standard exposed length:

10.5 mm (0.413 in.)

Minimum exposed length:

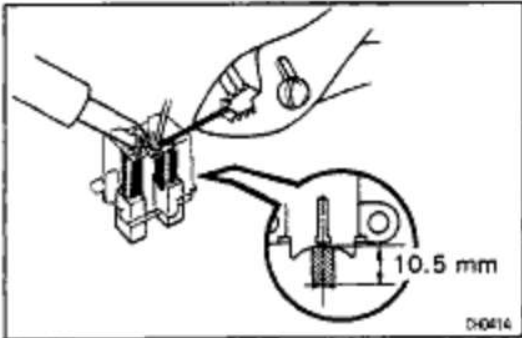
1.5 mm (0.059 in.)

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



2. IF NECESSARY, REPLACE BRUSHES

- Unsolder and remove the brush and spring.
- Run the wire of a new brush through the spring and the hole in the brush –holder, and insert the spring and brush into the brush holder.

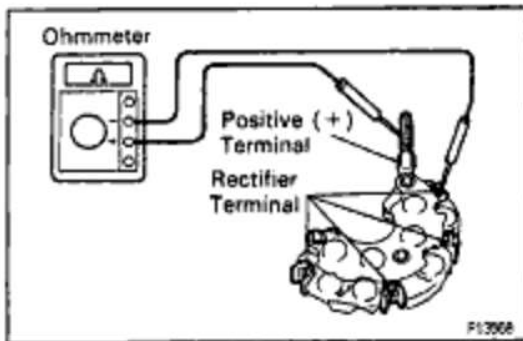


- Solder the brush wire to the brush holder at specified exposed length.

Exposed length:

10.5 mm (0.413 in.)

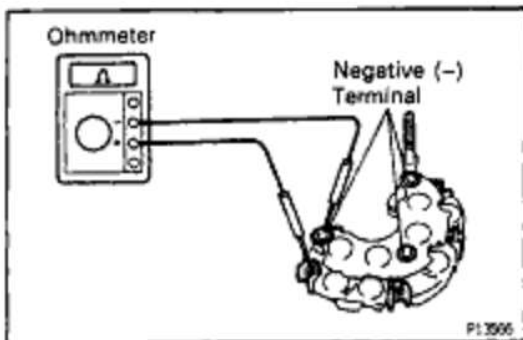
- Check that the brush moves smoothly in the brush holder.
- Cut off the excess wire.
- Apply insulation paint to *the soldered area.



Rectifiers (Rectifier Holder)

1. INSPECT POSITIVE RECTIFIER

- Using an ohmmeter, connect one tester probe to the positive (+) terminal and the other to each rectifier terminal.
- Reverse the polarity of the tester probes and repeat step (a).
- Check that one shows continuity and the other shows no continuity.
If continuity is not as specified, replace the rectifier holder.

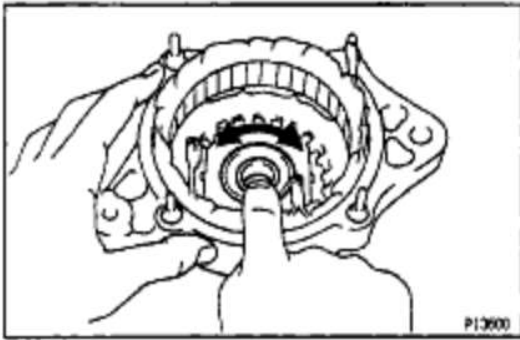


2. INSPECT NEGATIVE RECTIFIER

- Using an ohmmeter, connect one tester probe to each negative (-) terminal and the other to each rectifier terminal.
- Reverse the polarity of the tester probes and repeat step (a).
- Check that one shows continuity and the other shows no continuity.
If continuity is not as specified, replace the rectifier holder.

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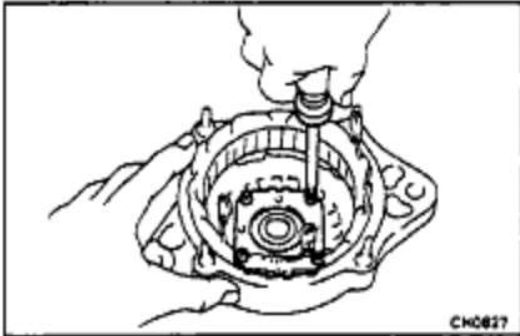
CHARGING SYSTEM – (5S-FE)



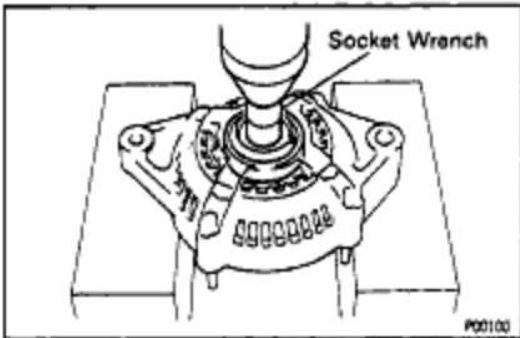
Bearings

1. INSPECT FRONT BEARING

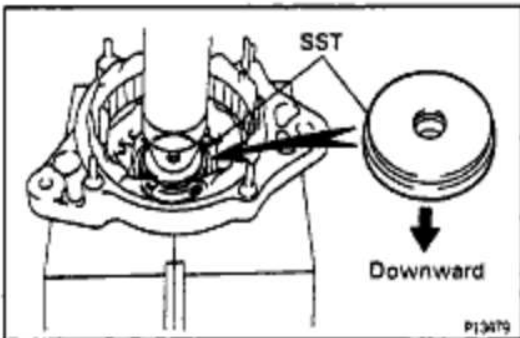
Check that the bearing is not rough or worn.

**2. IF NECESSARY, REPLACE FRONT BEARING**

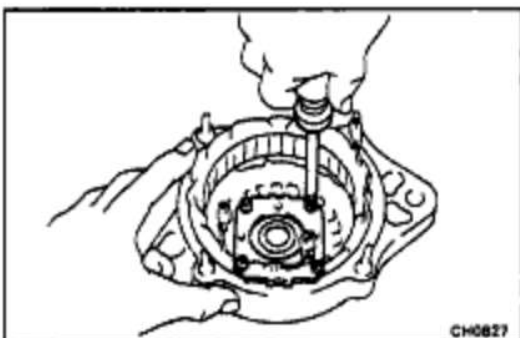
(a) Remove the 4 screws, bearing retainer and bearing.



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

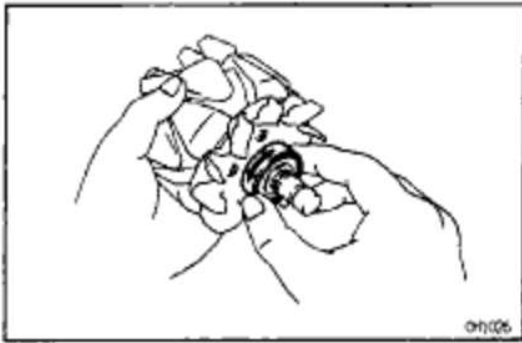


(c) Using SST and a press, press in a new bearing.
SST 09608-20012 (09608-00030)

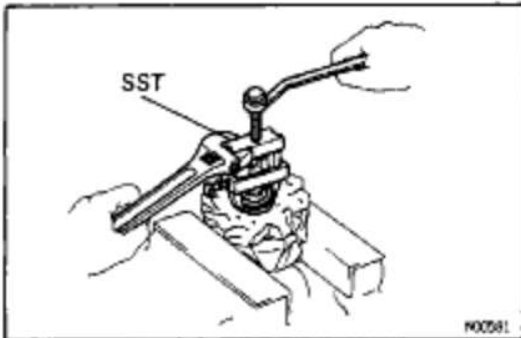


(d) Install the bearing retainer with the 4 screws.
Torque: 2.6 N·m (27 kgf·cm, 23 in.·lbf)

CHARGING SYSTEM - (5S-FE)

**3. INSPECT REAR BEARING**

Check that the bearing is not rough or worn.

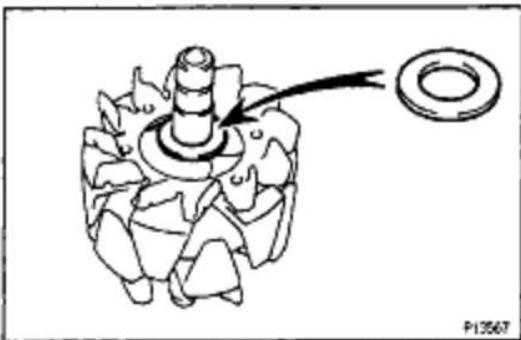
**4. IF NECESSARY, REPLACE REAR BEARING**

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

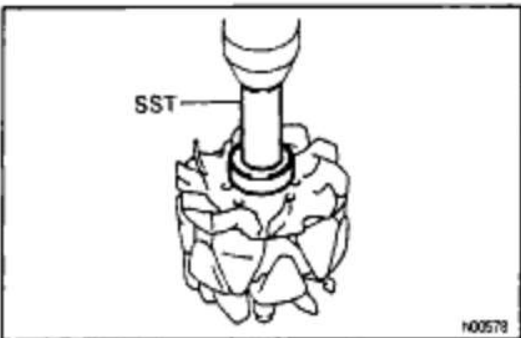
SST 09820-00021

NOTICE: Be careful not to damage the fan.

- (b) Remove the bearing cover (inside).

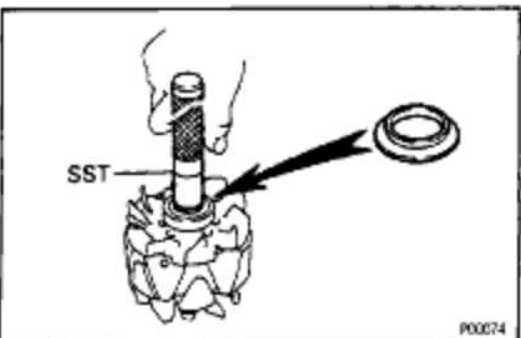


- (c) Place the bearing cover (inside) on the rotor.



- (d) Using SST and a press, press in a new bearing.

SST 09820-00030



- (e) Using SST, push in the bearing cover (outside).

SST 09285 - 76010

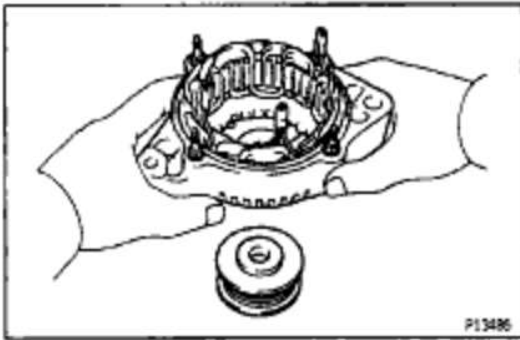
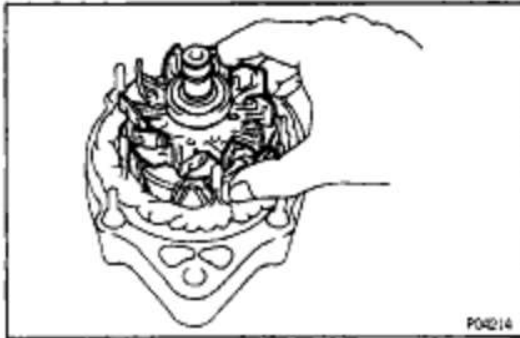
CH-20

CHARGING SYSTEM – (5S-FE)

CHARGE-B1

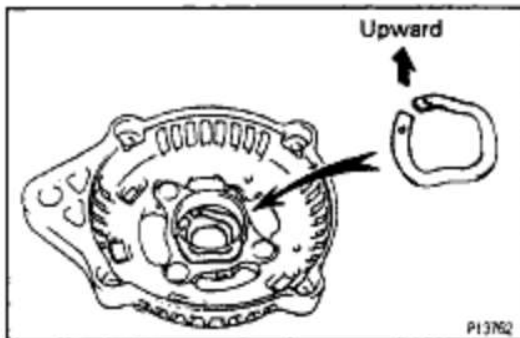
GENERATOR ASSEMBLY

(See Components for Disassembly and Assembly)

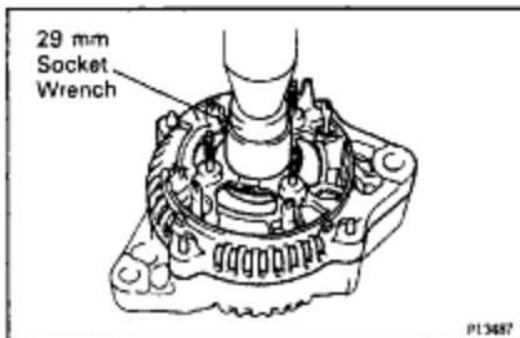
1. PLACE RECTIFIER END FRAME ON PULLEY**2. INSTALL ROTOR TO DRIVE END FRAME****3. INSTALL RECTIFIER END FRAME**

- (a) Insert the generator washer into the rectifier end frame.

NOTICE: Be careful of the generator washer installation direction.

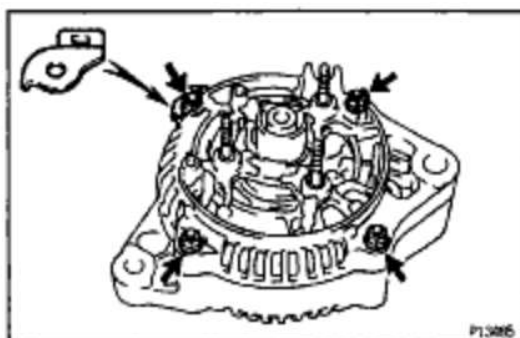


- (b) Using a 29 mm socket wrench and press, slowly press in the rectifier end frame.

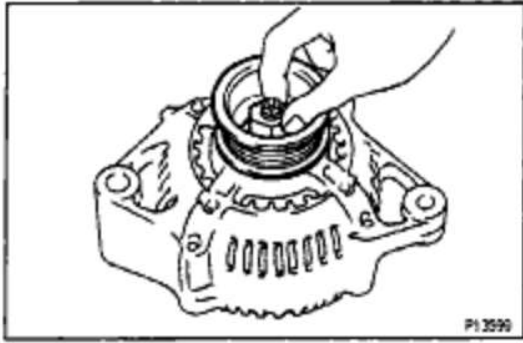


- (c) Install the wire clip and 4 nuts.

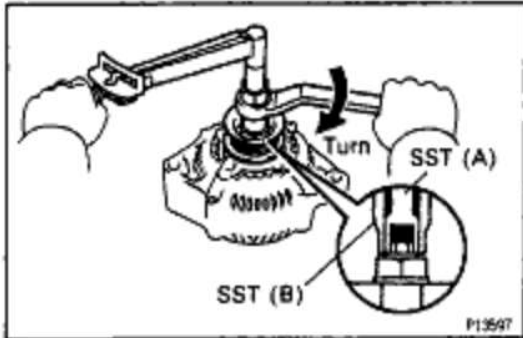
Torque: 4.5 N·m (46 kgf·cm, 40 in.·lbf)



CHARGING SYSTEM – (5S-FE)

**4. INSTALL PULLEY**

- (a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.

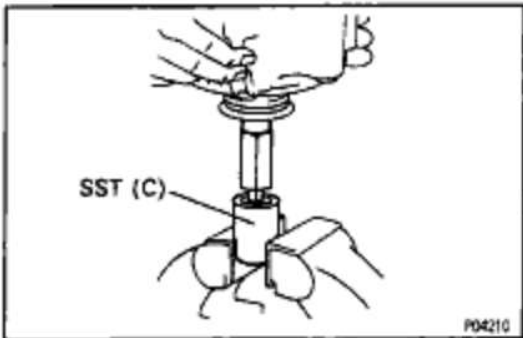


- (b) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.

SST 09820 – 63010

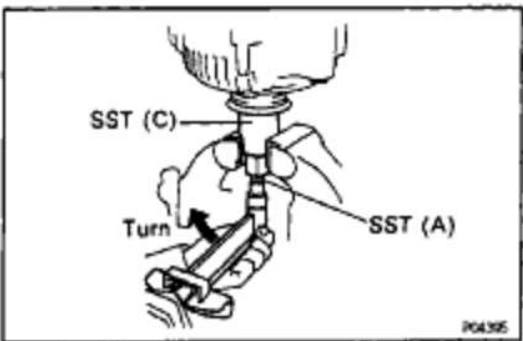
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

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



- (d) Mount SST (C) in a vise.

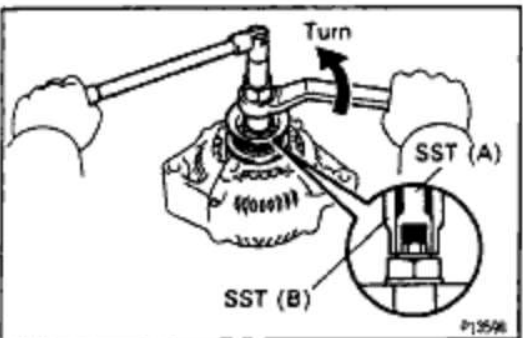
- (e) Insert SST (B) into SST (C), and attach the pulley nut to SST (C).



- (f) To torque the pulley nut, turn SST (A) in the direction shown in the illustration.

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

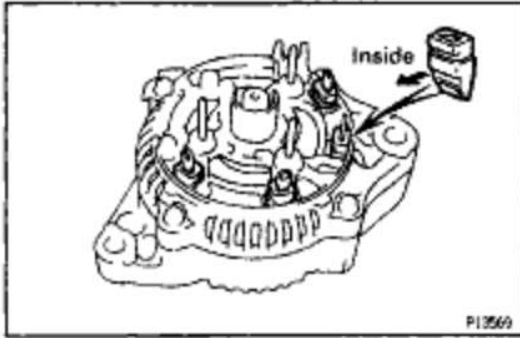
- (g) Remove the generator from SST (C).



- (h) Turn SST (B), and remove SST (A and B).

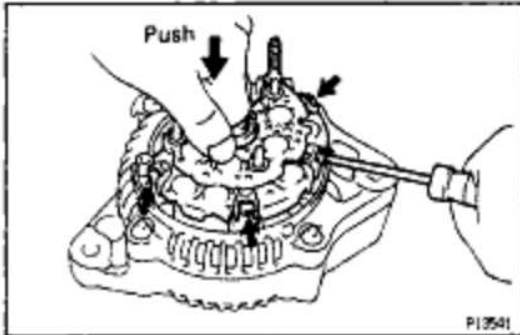
CH-22

CHARGING SYSTEM – (5S-FE)

**5. INSTALL RECTIFIER HOLDER**

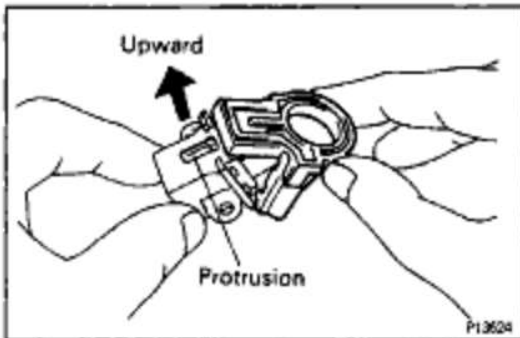
- (a) Install the 4 rubber insulators on the lead wires.

NOTICE: Be careful of the rubber insulators installation direction.



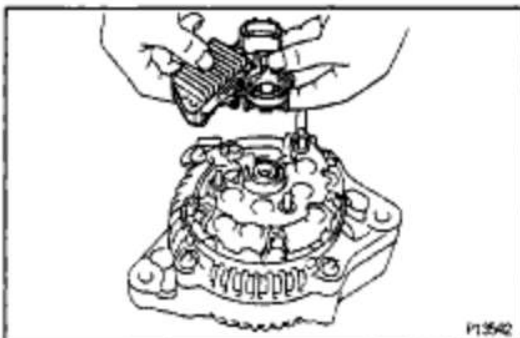
- (b) Install the rectifier holder while pushing it with the 4 screws.

Torque: 2.0 N·m (20 kgf·cm, 17 in.·lbf)

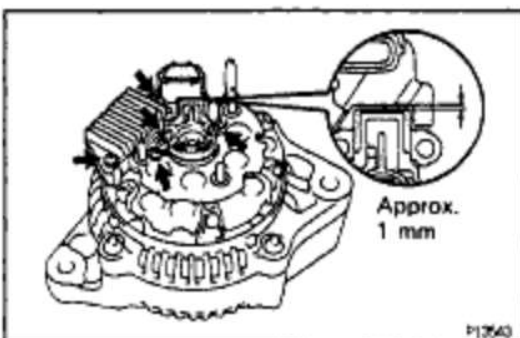
**6. INSTALL VOLTAGE REGULATOR AND BRUSH HOLDER**

- (a) Install the brush holder cover to the brush holder.

NOTICE: Be careful of the holder installation direction.

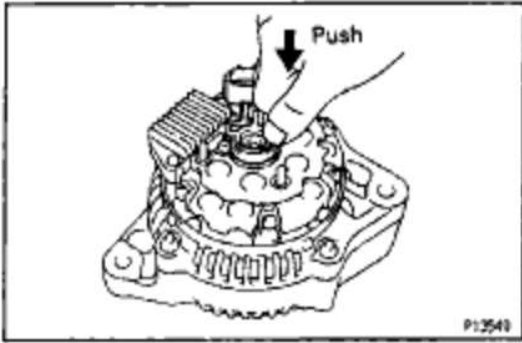


- (b) Place the voltage regulator together with the brush holder horizontally on the rectifier end frame.

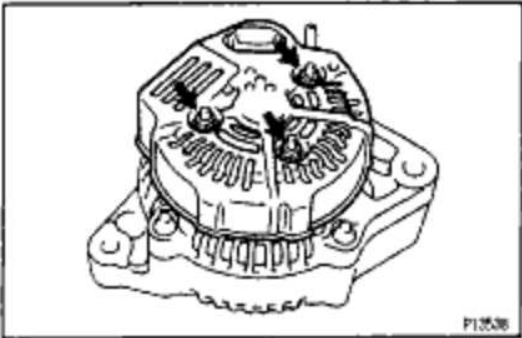


- (c) Install the 5 screws until there is a clearance of approx. 1 mm (0.04 in.) between the brush holder and voltage regulator.

CHARGING SYSTEM - (5S-FE)

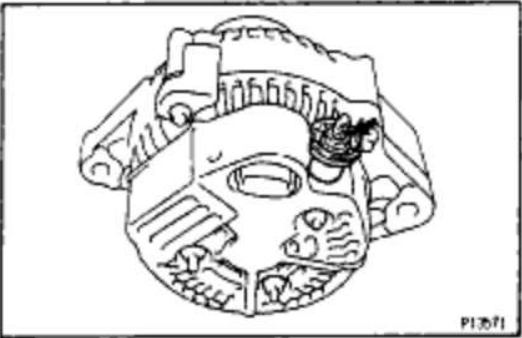


(d) Fit the brush holder cover.

**7. INSTALL REAR END COVER**

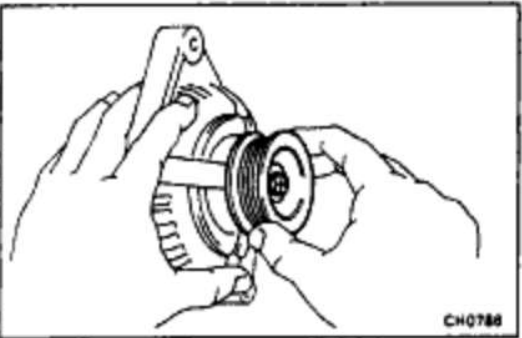
(a) Install the end cover with the 3 nuts.

Torque: 4.5 N·m (46 kgf·cm, 40 in·lbf)



(b) Install the terminal insulator with the nut.

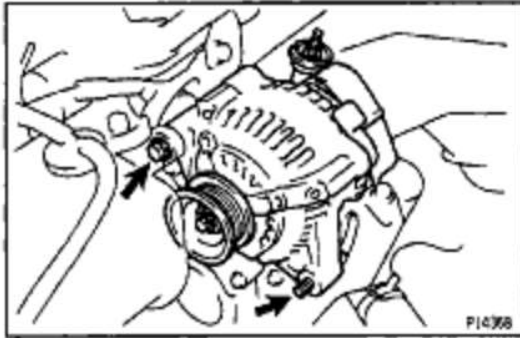
Torque: 4.1 N·m (42 kgf·cm, 36 in·lbf)

**8. CHECK THAT ROTOR ROTATES SMOOTHLY**

CH-24

CHARGING SYSTEM – (5S-FE)

G100F-01

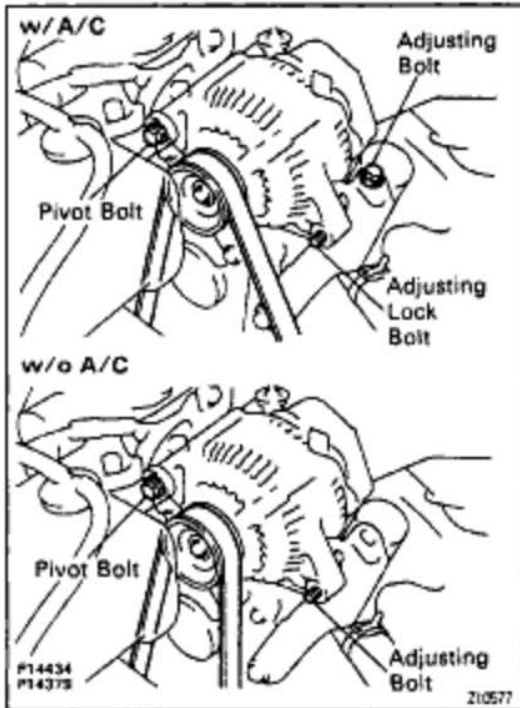


GENERATOR INSTALLATION

(See Components for Removal and Installation)

1. INSTALL GENERATOR

(a) Temporarily install the generator with the pivot bolt and adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C).



(b) Install the drive belt with the adjusting bolt.

(c) Adjust the drive belt with the adjusting bolt.

(See step 5 on page [CH-7](#))

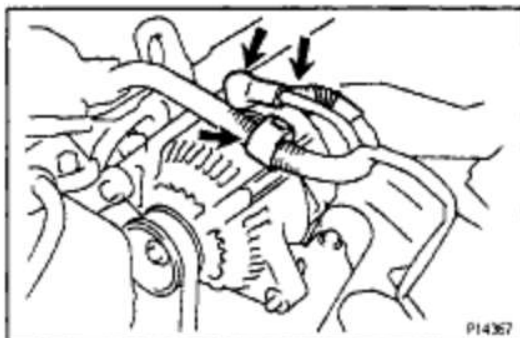
(d) Tighten the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt (w/o A/C).

Torque:**Pivot bolt**

52 N·m (530 kgf·cm, 38 ft·lbf)

**Adjusting lock bolt (w/ A/C) or
adjusting bolt (w/o A/C)**

18 N·m (185 kgf·cm, 13 ft·lbf)



(f) Connect the generator connector.

(g) Connect the generator wire with the nut and rubber cap.

(h) Install the wire clamp to the wire clip on the rectifier end frame.

2. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**3. PERFORM ON-VEHICLE INSPECTION**

(See page [CH-5](#))

SERVICE SPECIFICATIONS

CAM1A-04

SERVICE DATA

Battery (Except Delco Battery)	Voltage (Maintenance free battery) at 20°C (68°F)	12.7 - 12.9 V
	Specific gravity (Except maintenance free battery)	
	55D23L Battery	
	GNB Incorporated JHONSON CONTROLS at 20°C (68°F)	1.25 - 1.27
	80D26L Battery at 27°C (81°F)	1.26 - 1.28
Drive belt	GNB Incorporated at 20°C (68°F)	1.27 - 1.29
	JHONSON CONTROLS at 27°C (81°F)	1.28 - 1.30
	Tension w/ A/C New belt	175 ± 5 lbf
	Used belt	130 ± 10 lbf
	w/o A/C New belt	125 ± 25 lbf
Generator	Used belt	95 ± 20 lbf
	Rated output	12 V 70 A
	Rotor coil resistance	2.8 - 3.0 Ω
	Slip ring diameter	
	STD	14.2 - 14.4 mm (0.559 - 0.567 in.)
Voltage regulator	Limit	12.8 mm (0.504 in.)
	Brush exposed length	
	STD	10.5 mm (0.413 in.)
	Limit	1.5 mm (0.059 in.)
	Regulating voltage at 25 °C (77°F)	13.9 - 15.1 V
Voltage regulator	at 115°C (239°F)	13.5 - 14.3 V

CAM1C-04

TORQUE SPECIFICATIONS

Part tightened	N-m	kgf-cm	ft-lbf
Bearing cover x Drive end frame	2.6	27	23 in.-lbf
Rectifier end frame x Drive end frame	4.5	46	40 in.-lbf
Generator pulley x Rotor	110	1,125	81
Rectifier holder x Coil lead on rectifier end frame	2.0	20	17 in.-lbf
Rear end cover x Rectifier holder	4.5	46	40 in.-lbf
Terminal insulator x Rectifier holder	4.1	42	36 in.-lbf
Generator x Generator bracket	52	530	38
Generator x Adjusting bar	18	185	13

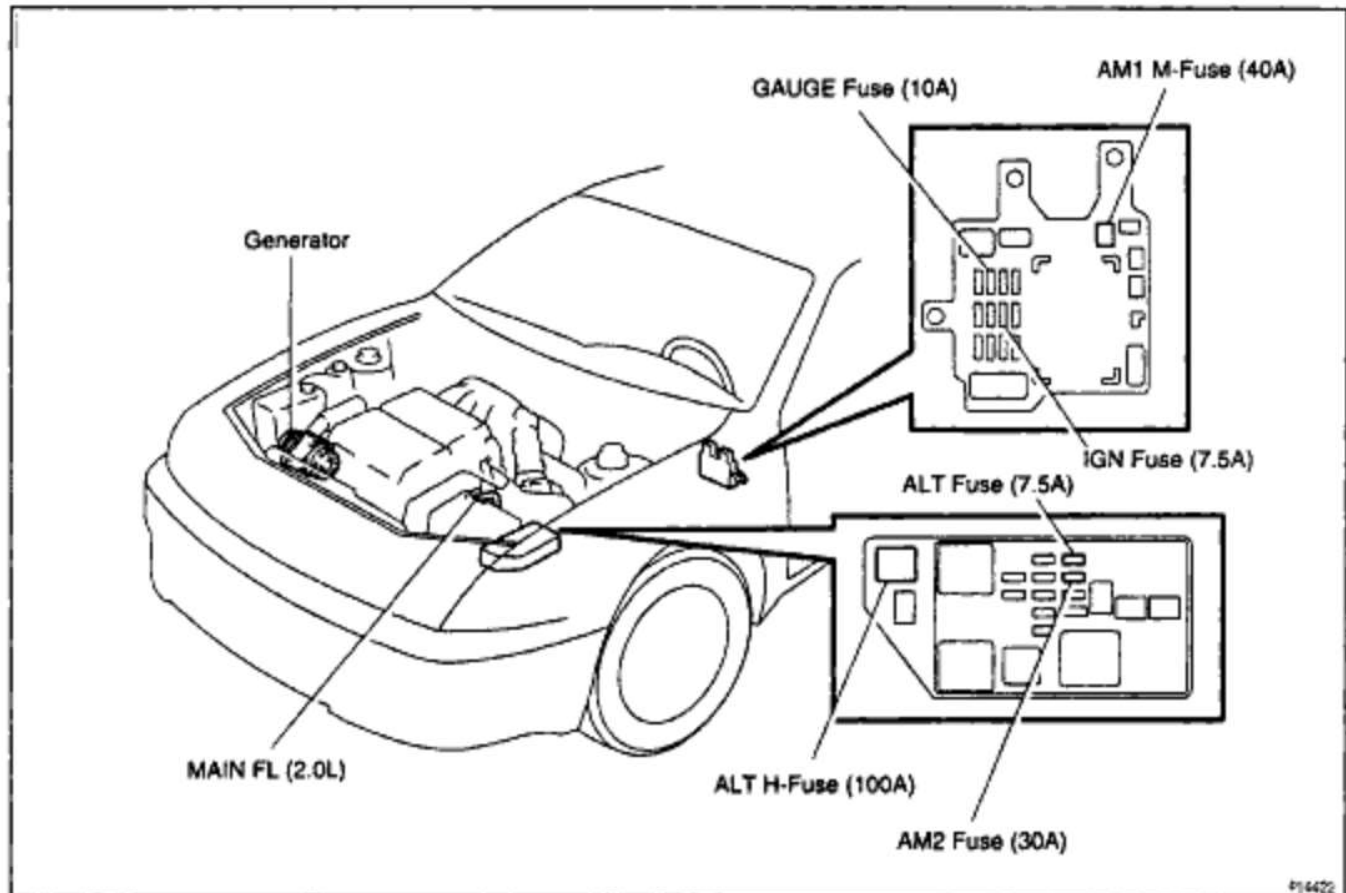
CH-26

CHARGING SYSTEM - (1MZ-FE)

(1MZ-FE)

DESCRIPTION

The generator is a small, high-speed, high-performance type with a voltage regulator incorporated. The voltage regulator uses integrated circuits and controls the voltage produced by the generator.

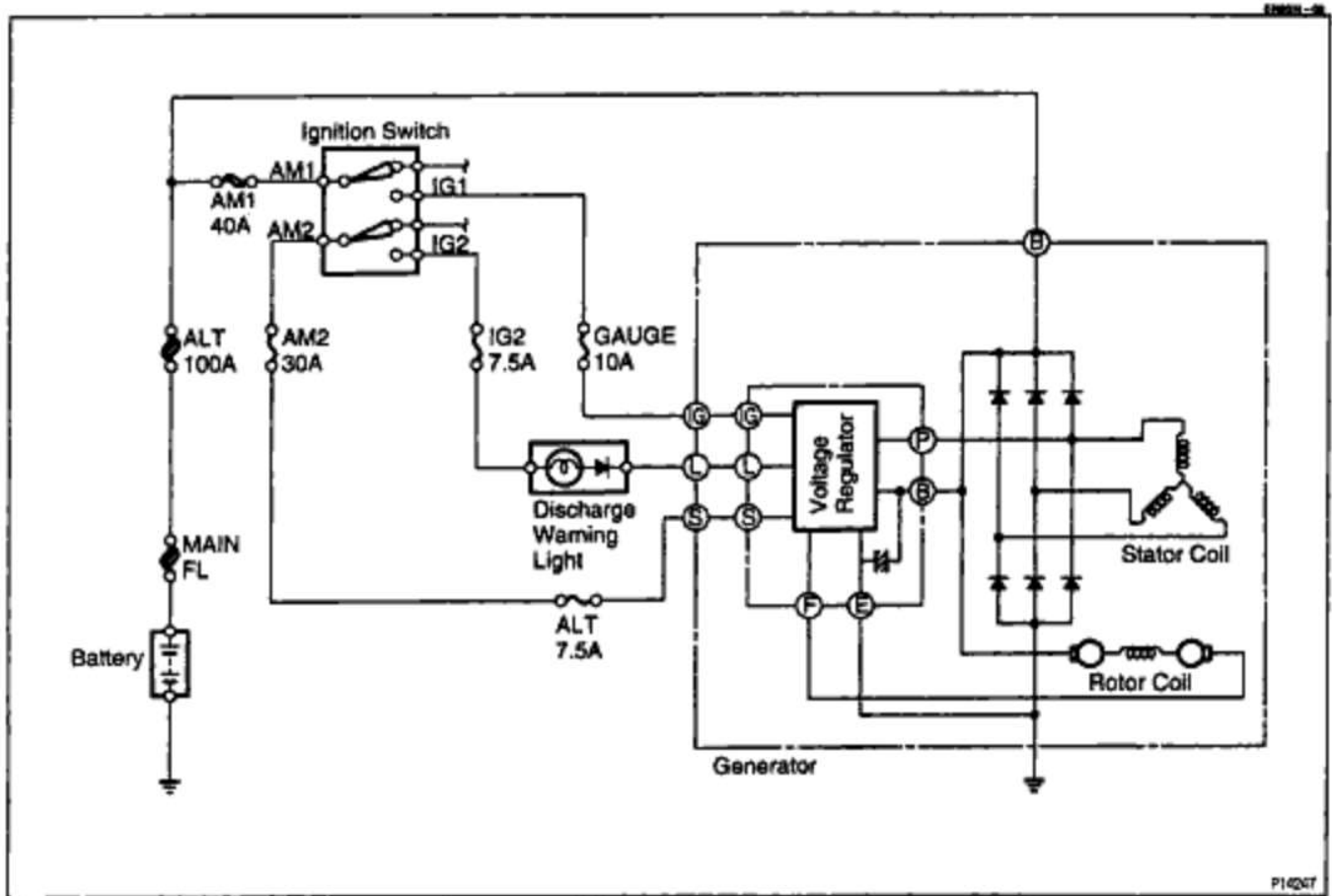


PRECAUTION

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.

CH26-91

SYSTEM CIRCUIT



OPERATION

When the ignition switch is turned ON, current from the battery flows from terminal L of the generator through the voltage regulator to terminal E, causing the discharge warning light to light up. Then when the engine is started, the voltage output increases as the generator speed increases. When the voltage output becomes greater than the battery voltage, current for recharging flows from terminal B. Simultaneously, voltage at terminal L increases and the potential difference between battery and terminal L disappears, causing the discharge warning light to go off. When the voltage output exceeds the regulator adjustment voltage, the transistor inside the voltage regulator regulates the voltage so that the voltage from the generator remains constant.

CH-28

CHARGING SYSTEM - (1MZ-FE)

PREPARATION

SST (SPECIAL SERVICE TOOLS)

CHART-31

	09285-76010 Injection Pump Camshaft Bearing Cone Replacer	Rotor rear bearing cover
	09286-46011 Injection Pump Spline Shaft Puller	Rectifier end frame
	09808-20012 Front Hub & Drive Pinion Bearing Tool Set	
	(09608-00030) Replacer	Rotor front bearing
	09820-00021 Alternator Rear Bearing Puller	
	09820-00030 Alternator Rear Bearing Replacer	Rotor rear bearing
	09620-63010 Alternator Pulley Set Nut Wrench Set	

RECOMMENDED TOOLS

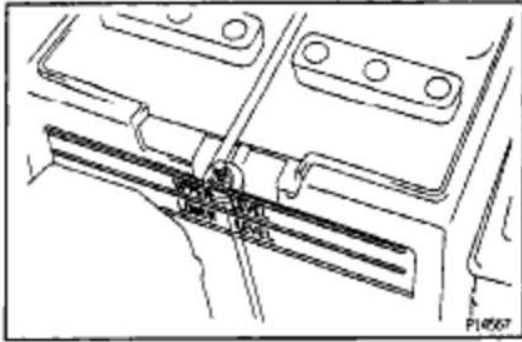
CHART-32

	09082-00050 TOYOTA Electrical Tester Set	
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EQUIPMENT

CHART-33

Ammeter(A)	
Battery specific gravity gauge	Except maintenance free battery
Belt tension gauge	
Torque wrench	
Vernier calipers	Rotor (Slip ring)



ON-VEHICLE INSPECTION

1. Except Delco Battery:

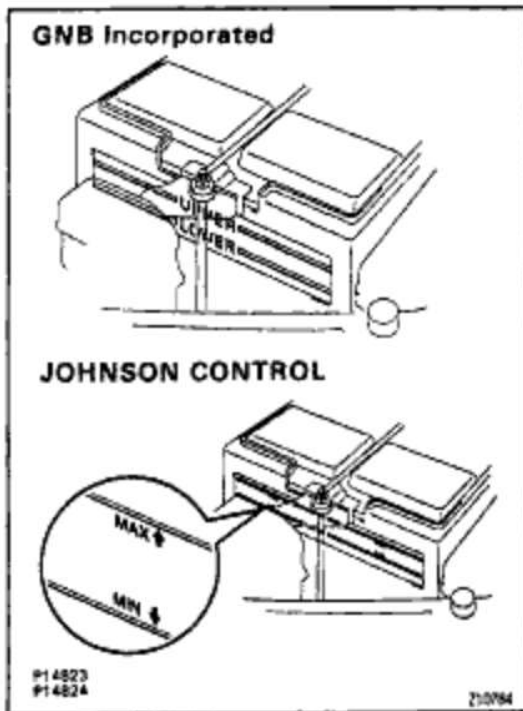
CHECK BATTERY ELECTROLYTE LEVEL

Check the electrolyte quantity of each cell.

A. Maintenance Free Battery

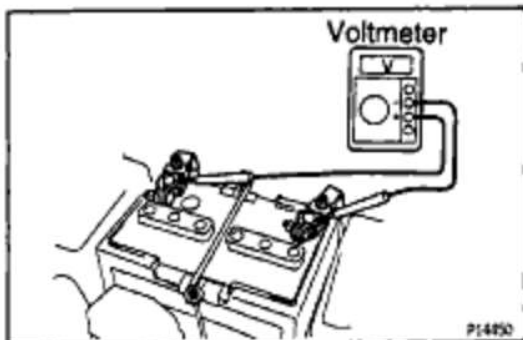
If under the lower level, replace the battery (or add distilled water if possible). Check the charging system.

CH084-01



B. Except Maintenance Free Battery

If under the "LOWER" or "MIN" line, add distilled water.



2. Except Delco Battery:

CHECK BATTERY VOLTAGE AND SPECIFIC GRAVITY

A. Maintenance Free Battery

Measure the battery voltage between the terminals negative (-) and positive (+) of the battery.

Standard voltage:

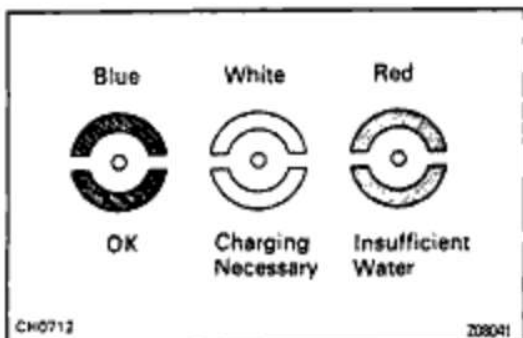
12.7 – 12.9 V at 20°C (68°F)

HINT:

- Before measuring the voltage, turn the ignition switch to LOCK and turn off the electrical systems (headlight, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.
- If the vehicle has been running, wait 5 minutes or more after the vehicle stops before measuring the battery voltage.

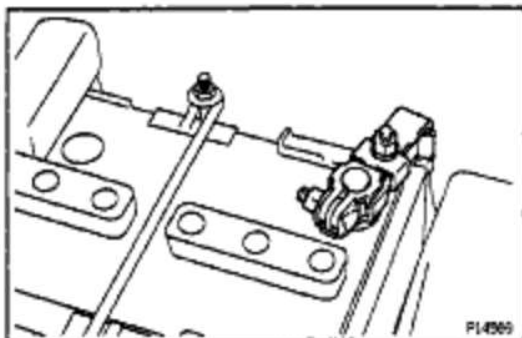
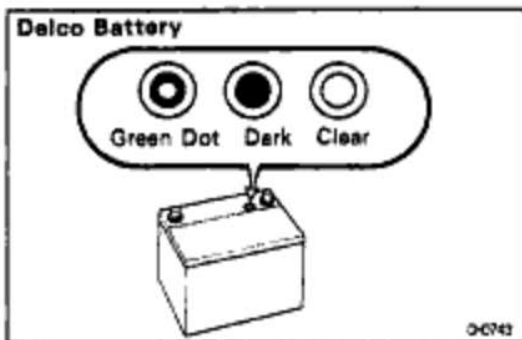
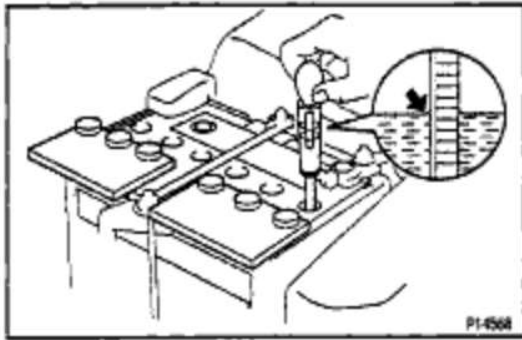
If the voltage is less than specification, charge the battery.

HINT: Check the indicator as shown in the illustration.



CH-30

CHARGING SYSTEM – (1MZ-FE)

**B. Except Maintenance Free Battery**

Check the specific gravity of each cell.

Standard specific gravity:

SSD23L battery for GNB Incorporated

1.25 – 1.27 at 20°C (68°F)

55D23L battery for JOHNSON CONTROLS

1.28 – 1.28 at 27°C (81°F)

80D26L battery for GNB Incorporated

1.27 – 1.29 at 20°C (68°F)

80D28L battery for JOHNSON CONTROLS

1.28 – 1.30 at 27°C (81°F)

If the gravity is less than specification, charge the battery.

HINT: Check the indicator as shown in the illustration.

3. Delco Battery:**CHECK HYDROMETER**

Green Dot visible:

Battery I: adequately charged

Dark (Green Dot not visible):

Battery must be charged

Clear or Light Yellow:

Replace battery

HINT: There is no need to add water during the entire service life of the battery.

4. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

(a) Check that the battery terminals are not loose or corroded.

(b) Check the fusible link and fuses for continuity.

Fusible link:

MAIN 2.0L

H-fuse:

ALT 100A

M – fuse:

AM 1 40A

Fuse:

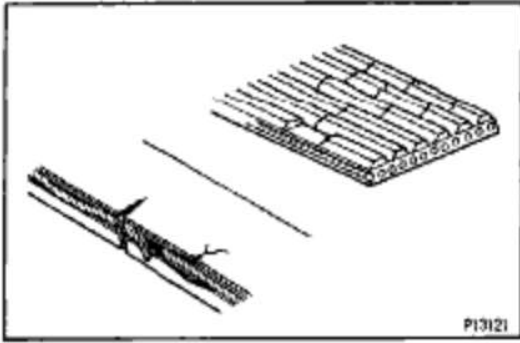
AM2 30 A

IG2 7.5A

GAUGE 10A

ALT 7.5A

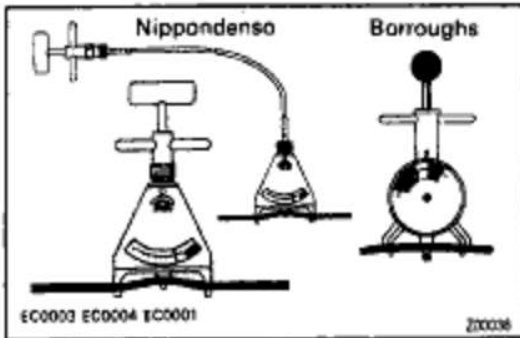
CHARGING SYSTEM – (1MZ-FE)

**5. INSPECT DRIVE BELT**

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

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

HINT: Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



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

Belt tension gauge:

Nippondenso BTG-20 (95506-00020)

Barroughs No.BT-33 – 73F

Drive belt tension:

New belt

175 ± 5 lbf

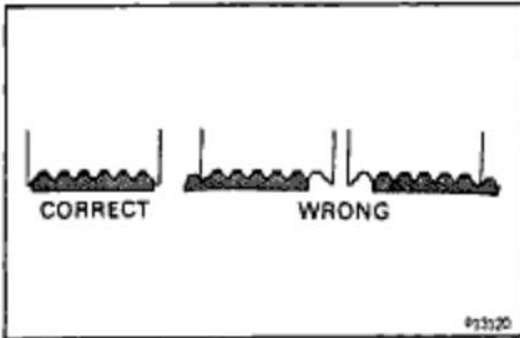
Used belt

115 ± 20 lbf

If the belt tension is not as specified, adjust it.

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 a belt, check that it fits properly in the ribbed grooves.
- Check with your hand to confirm that the belt has not slip out of the groove on the bottom of the pulley.
- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.

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

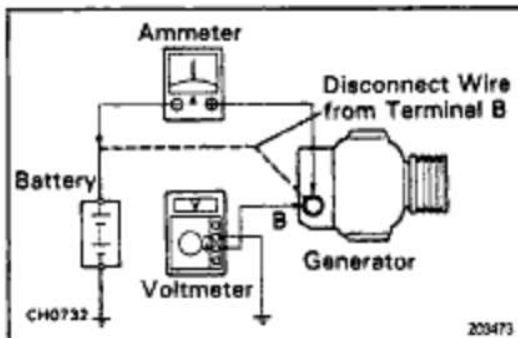
- (a) Check that the wiring is in good condition.
(b) Check that there is no abnormal noise from the generator while the engine is running.

CH-32

CHARGING SYSTEM – (1MZ-FE)

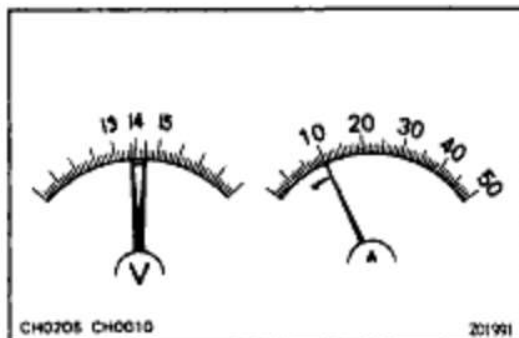
7. CHECK DISCHARGE WARNING LIGHT CIRCUIT

- Warm up the engine and then turn it off.
- Turn off all accessories.
- Turn the ignition switch 'ON'. Check that the discharge warning light is lit.
- Start the engine. Check that the light goes off.
If the light does not go off as specified, troubleshoot the discharge light circuit.

**8. INSPECT CHARGING CIRCUIT WITHOUT LOAD**

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

- 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 it to the negative (–) probe of the ammeter.
 - Connect the positive (+) probe of the ammeter to terminal B of the generator.
 - Connect the positive (+) probe of the voltmeter to terminal B of the generator.
 - Ground the negative (–) probe of the voltmeter.



- 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:

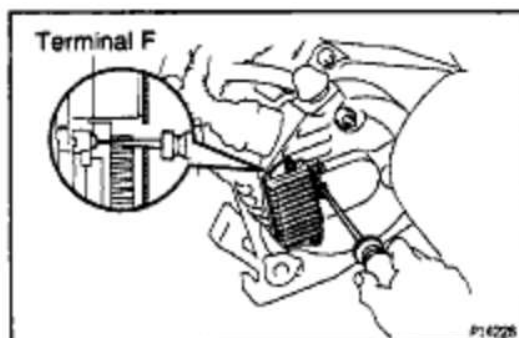
14.0 – 15.0 V at 25°C (77°F)

13.5 – 14.3 V at 115°C (239°F)

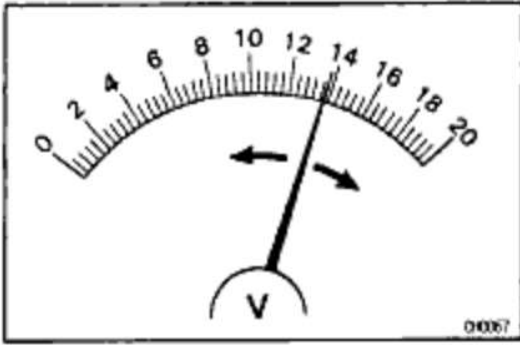
If the voltmeter reading is more than standard voltage, replace the voltage regulator.

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

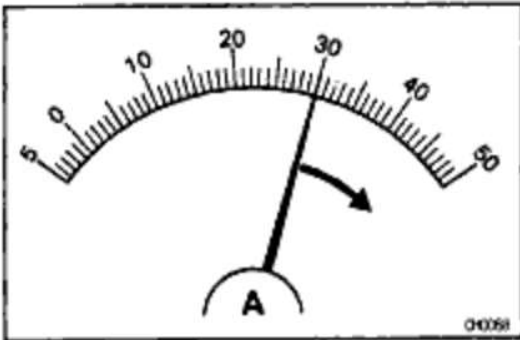
- With terminal F grounded, start the engine and check the voltmeter reading of terminal 6.



CHARGING SYSTEM – (1MZ-FE)



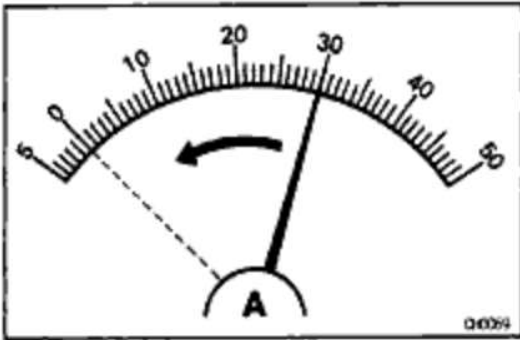
- If the voltmeter reading is more than standard voltage, replace the voltage regulator.
- If the voltmeter reading is less than standard voltage, check the generator.

**9. INSPECT CHARGING CIRCUIT WITH LOAD**

- With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater blower switch –at “HI”.
- Check the reading on the ammeter.

Standard amperage:

30 A or more



If the ammeter reading is less than the standard amperage, repair the generator.

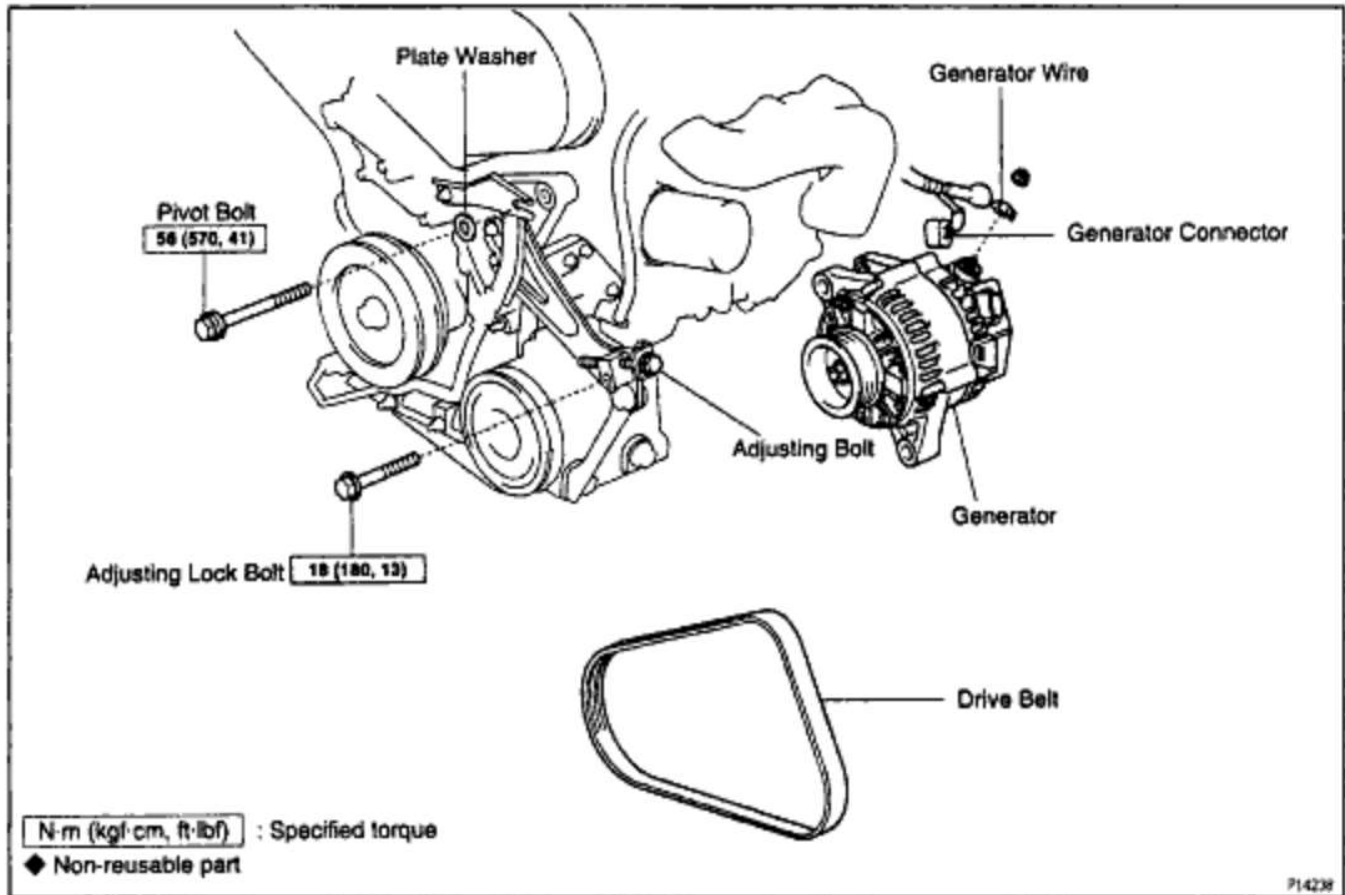
HINT: If the battery is fully charged, the indication will sometimes be less than standard amperage.

CH-34

CHARGING SYSTEM - (1MZ-FE)

GENERATOR COMPONENTS FOR REMOVAL AND INSTALLATION

CM11-6A



CM11-6B

GENERATOR REMOVAL

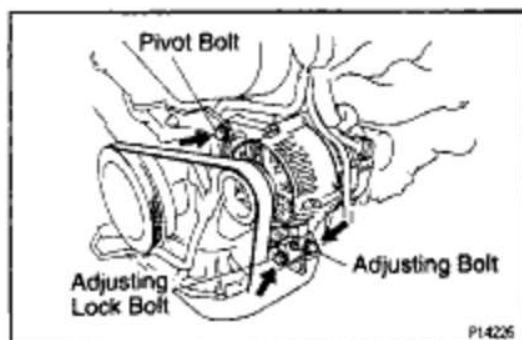
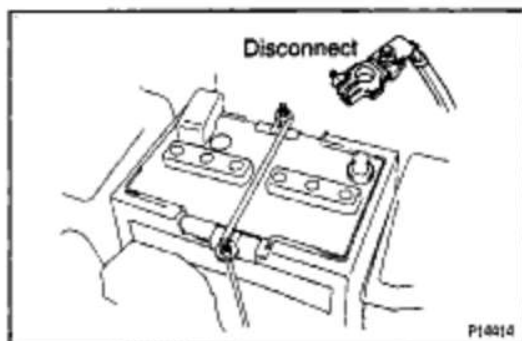
(See Components for Removal and Installation)

1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

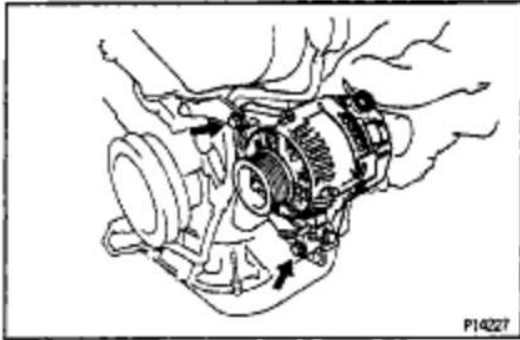
CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

2. REMOVE DRIVE BELT

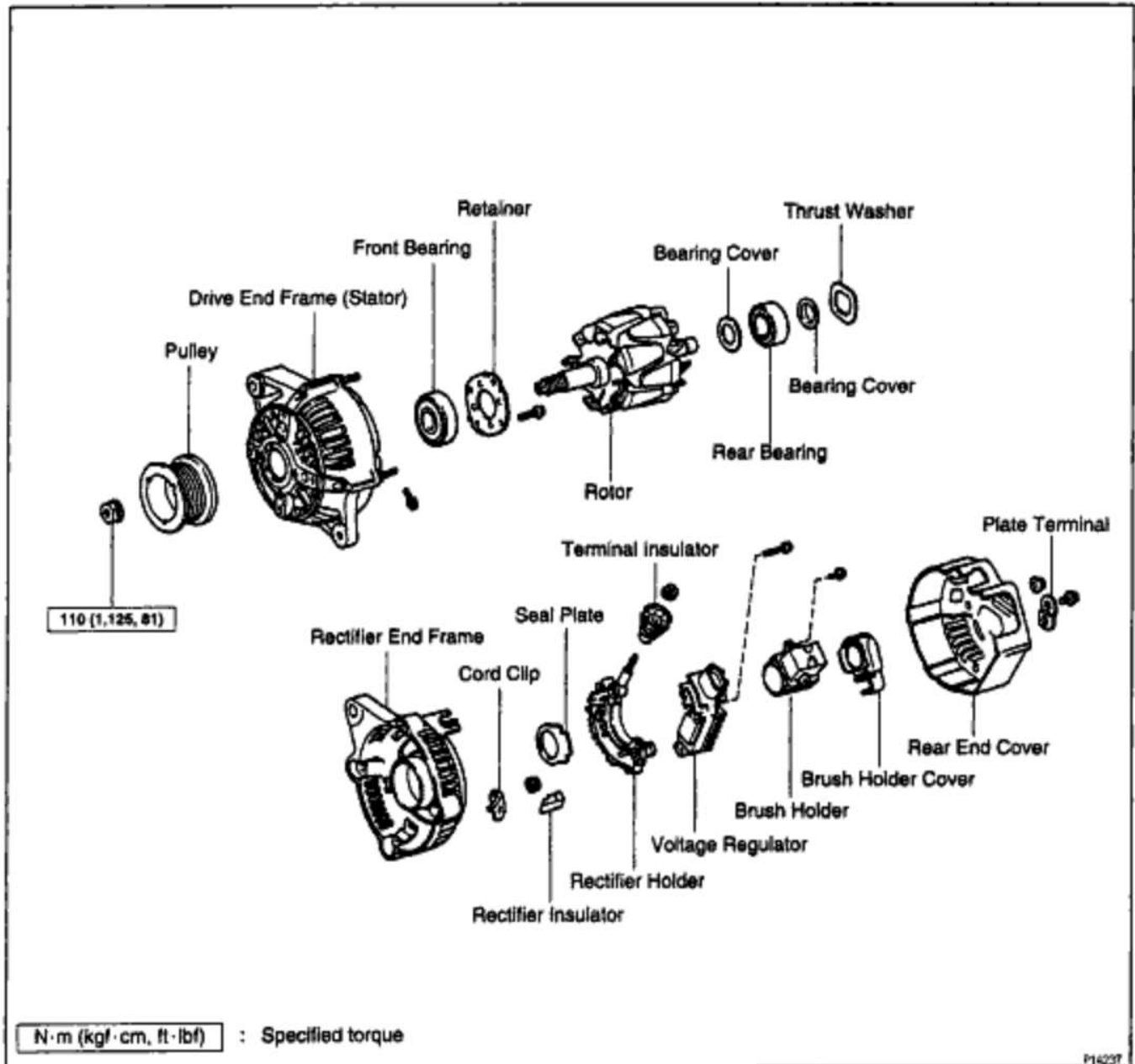
Loosen the pivot bolt, adjusting lock bolt, and adjusting bolt, and remove the drive belt.



CHARGING SYSTEM - (1MZ-FE)

**3. REMOVE GENERATOR**

- (a) Disconnect the generator connector.
- (b) Remove the nut, and disconnect the generator wire.
- (c) Disconnect the wire harness from the clip.
- (d) Remove the pivot bolt, plate washer, adjusting lock bolt and generator.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

CH-36

CHARGING SYSTEM - (1MZ-FE)

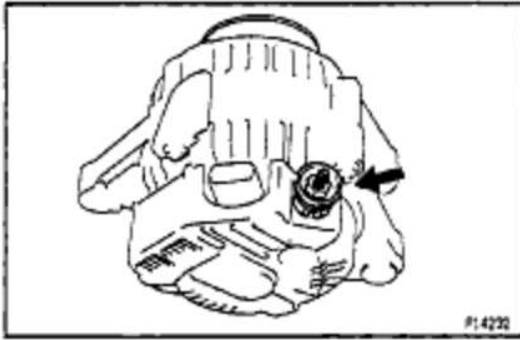
CH36-01

GENERATOR DISASSEMBLY

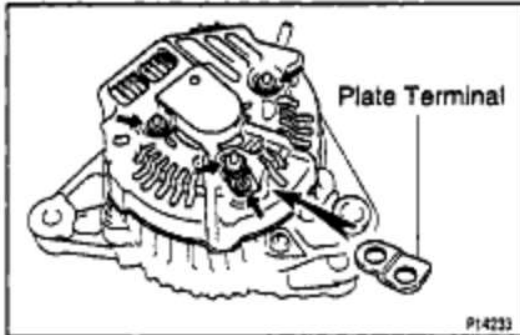
(See Components for Disassembly and Assembly)

1. REMOVE REAR END COVER

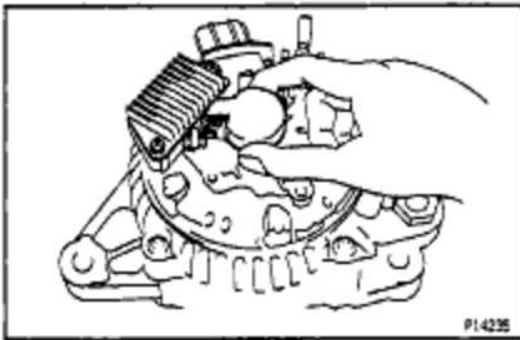
(a) Remove the nut and terminal insulator.



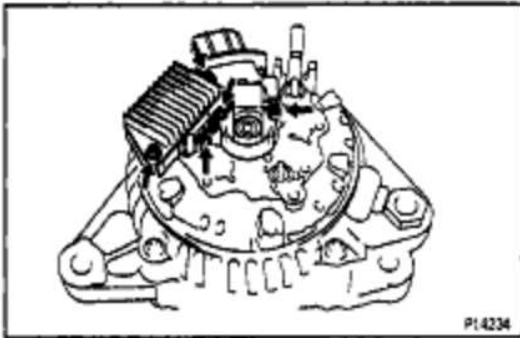
(b) Remove the screw, 3 nuts, plate terminal and end cover.

**2. REMOVE BRUSH HOLDER AND VOLTAGE REGULATOR**

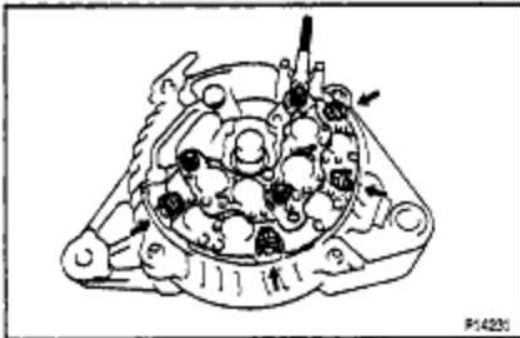
(a) Remove the brush holder cover from the brush holder.



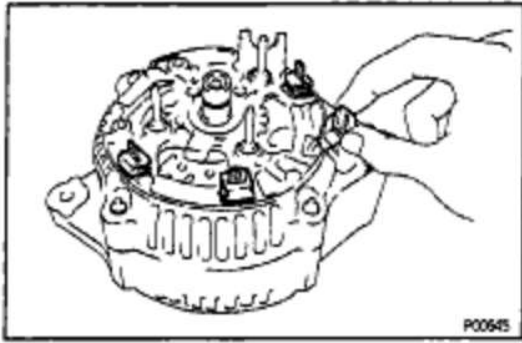
(b) Remove the 5 screws, brush holder and voltage regulator.

**3. REMOVE RECTIFIER HOLDER**

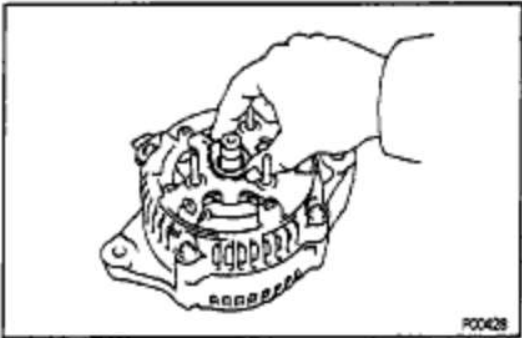
(a) Remove the 4 screws and rectifier holder.



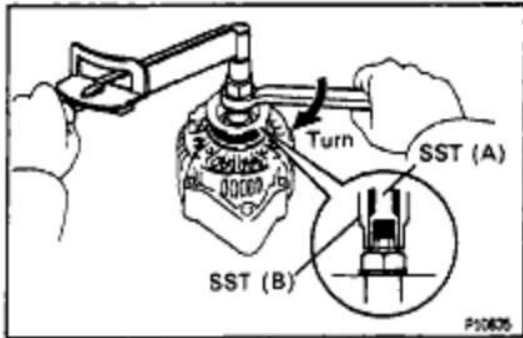
CHARGING SYSTEM - (1MZ-FE)



(b) Remove the 4 rubber insulators.



(c) Remove the seal plate.



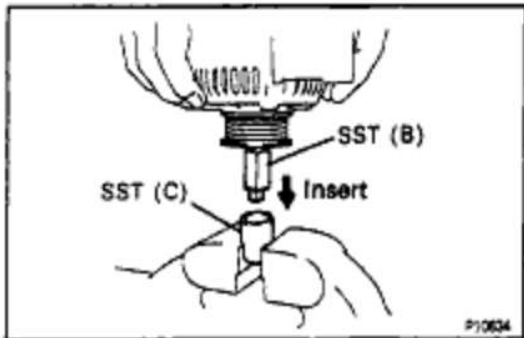
4. REMOVE PULLEY

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

SST 09820-63010

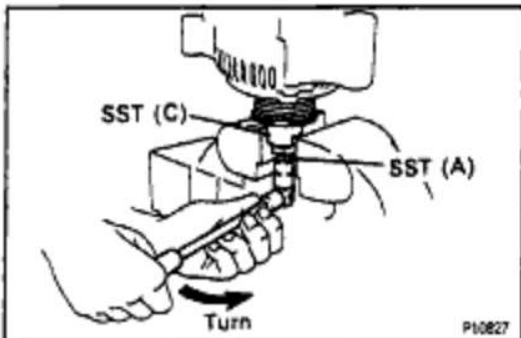
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

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



(c) Mount SST (C) in a vise.

(d) Insert SST (B) into SST (C), and attach the pulley nut to SST (C).



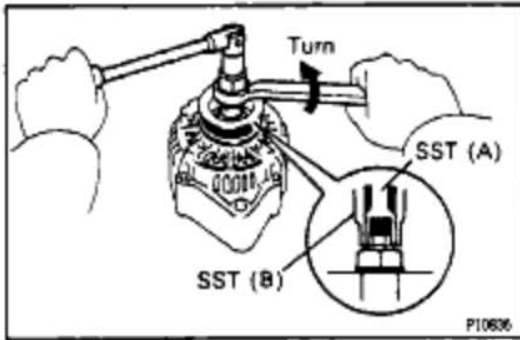
(e) To loosen the pulley nut, turn SST (A) in the direction shown in the illustration.

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

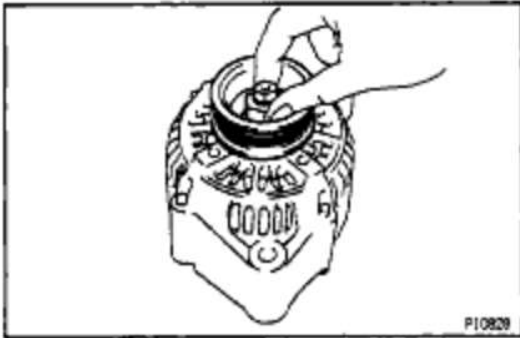
(f) Remove the generator from SST (C).

CH-38

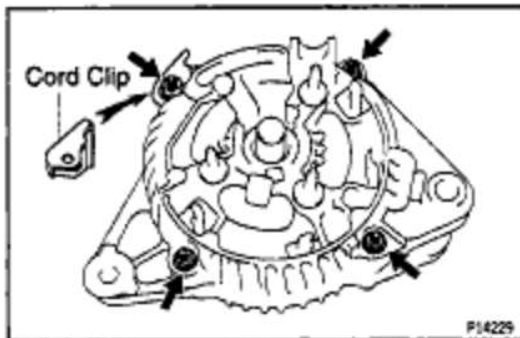
CHARGING SYSTEM - (1MZ-FE)



(g) Turn SST (B), and remove SST (A and B).

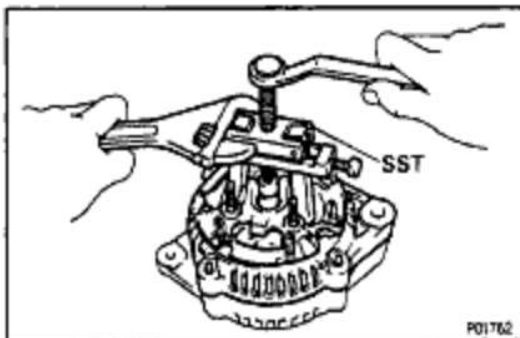


(h) Remove the pulley nut and pulley.

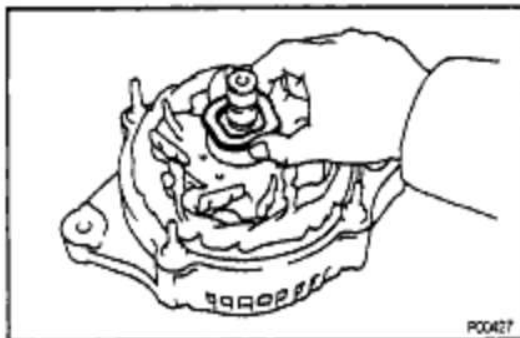


6. REMOVE RECTIFIER END FRAME

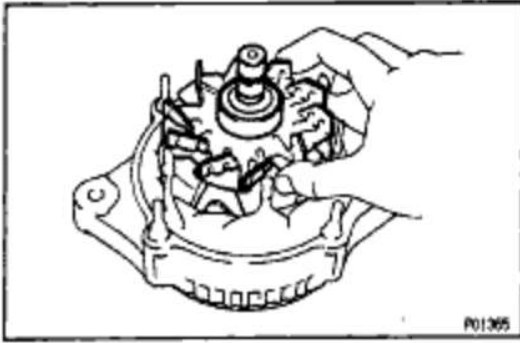
(a) Remove the 4 nuts and cord clip.



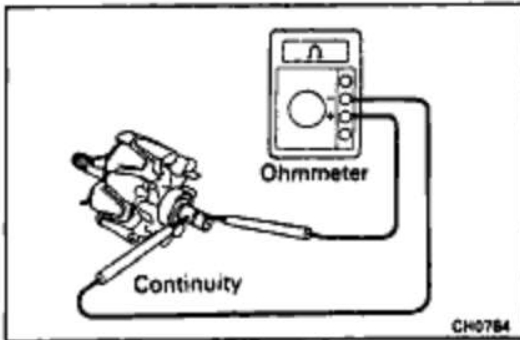
(b) Using SST, remove the rectifier end frame.
SST 09286-46011



(c) Remove the thrust washer.



6. REMOVE ROTOR FROM DRIVE END FRAME



GENERATOR INSPECTION AND REPAIR

Rotor

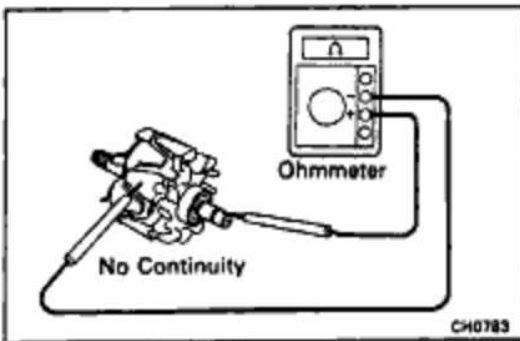
1. INSPECT ROTOR FOR OPEN CIRCUIT

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

Standard resistance:

2.8–3.0 Ω at 20°C (68°F)

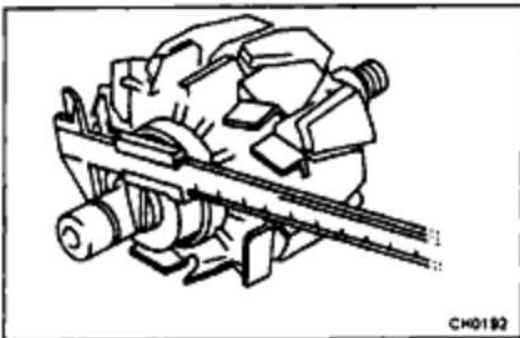
If there is no continuity, replace the rotor.



2. INSPECT ROTOR FOR GROUND

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

If there is continuity, replace the rotor.



3. INSPECT SLIP RINGS

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

If rough or scored, replace the rotor.

(b) Using a vernier caliper, measure the slip ring diameter.

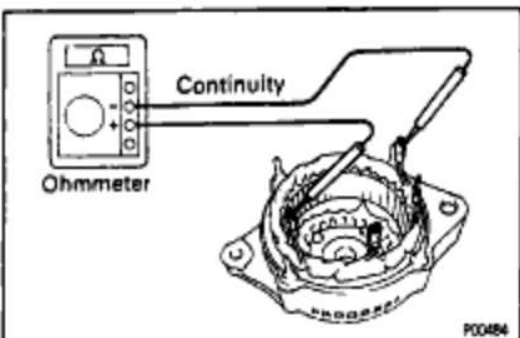
Standard diameter:

14.2–14.4 mm (0.559–0.587 In.)

Minimum diameter:

12.8 mm (0.504 In.)

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



Stator (Drive End Frame)

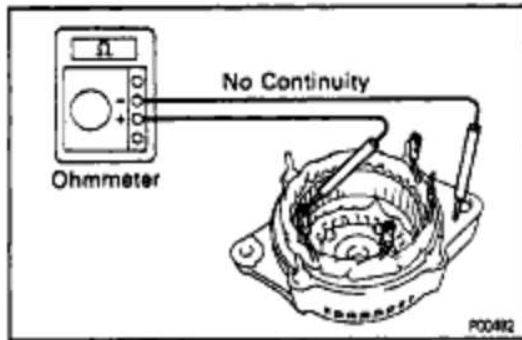
1. INSPECT STATOR FOR OPEN CIRCUIT

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

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

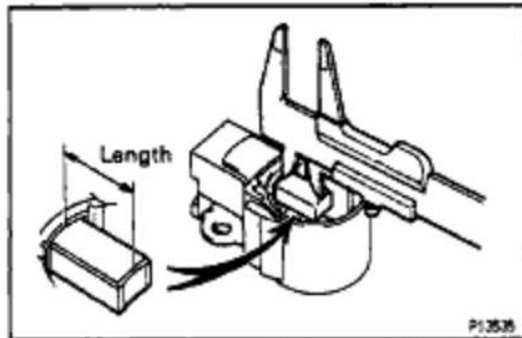
CH-40

CHARGING SYSTEM – (1MZ-FE)

**2. INSPECT STATOR FOR GROUND**

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

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

**Brushes****1. INSPECT EXPOSED BRUSH LENGTH**

Using a vernier caliper, measure the exposed brush length.

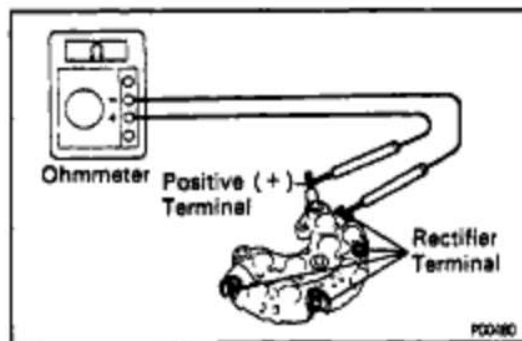
Standard exposed length:

10.5 mm (0.413 in.)

Minimum exposed length:

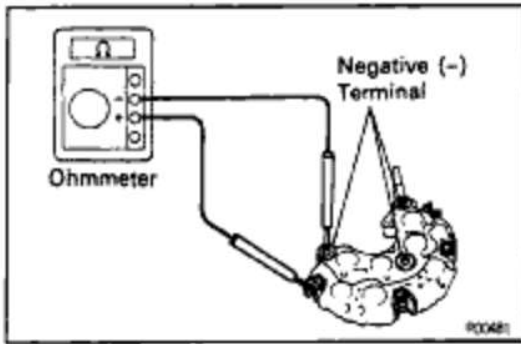
1.5 mm (0.059 in.)

If the exposed length is less than minimum, replace the brushes and brush holder assembly.

**Rectifiers (Rectifier Holder)****1. INSPECT POSITIVE RECTIFIER**

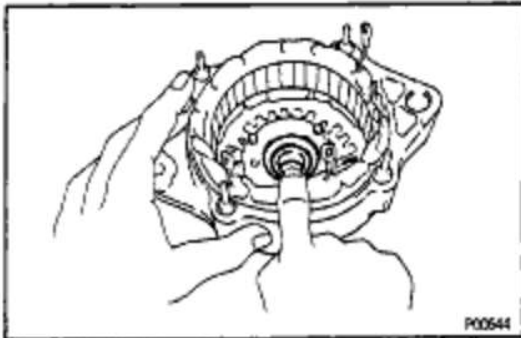
- Using an ohmmeter, connect one tester probe to the positive (+) terminal and the other to each rectifier terminal.
- Reverse the polarity of the tester probes and repeat step (a).
- Check that one shows continuity and the other shows no continuity.

If continuity is not as specified, replace the rectifier holder.



2. INSPECT NEGATIVE RECTIFIER

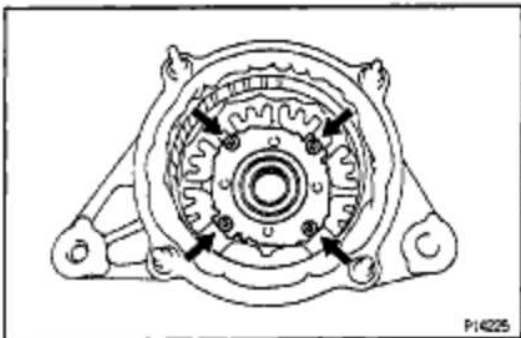
- Using an ohmmeter, connect one tester probe to each negative (–) terminal and the other to each rectifier terminal.
- Reverse the polarity of the tester probes and repeat step (a).
- Check that one shows continuity and the other shows no continuity.
If continuity is not as specified, replace the rectifier holder.



Bearings

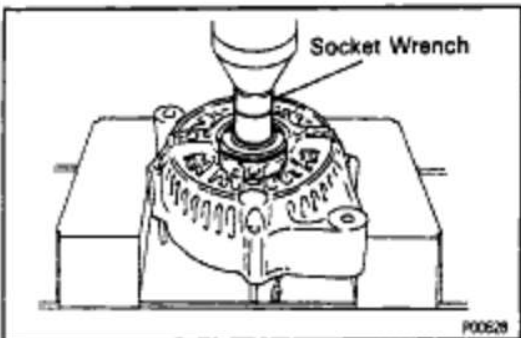
1. INSPECT FRONT BEARING

Check that the bearing is not rough or worn.

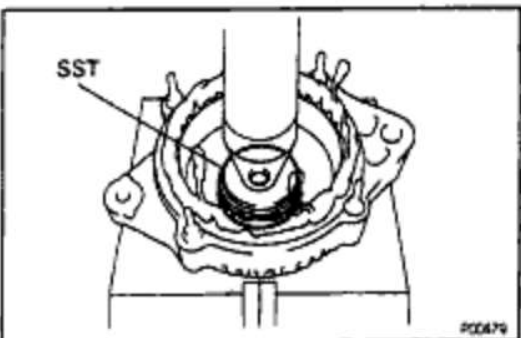


2. IF NECESSARY, REPLACE FRONT BEARING

- Remove the 4 screws, bearing retainer and bearing.



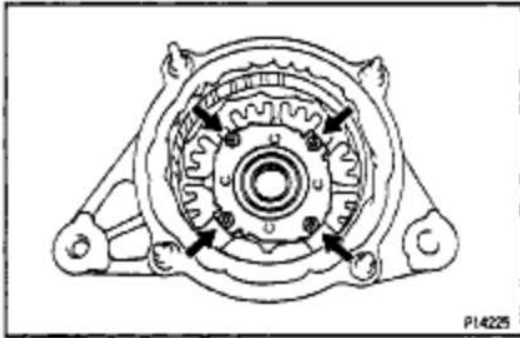
- Using a socket wrench and press, press out the bearing.



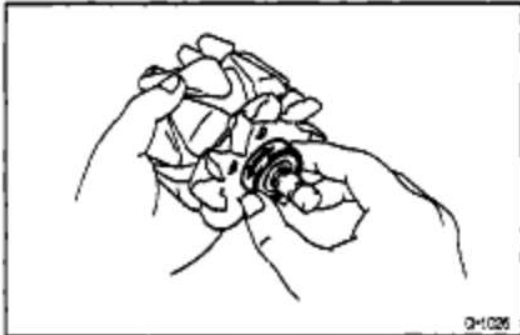
- Using SST and a press, press in a new bearing.
SST 09608 – 20012 (09608 – 00030)

CH-42

CHARGING SYSTEM – (1MZ-FE)

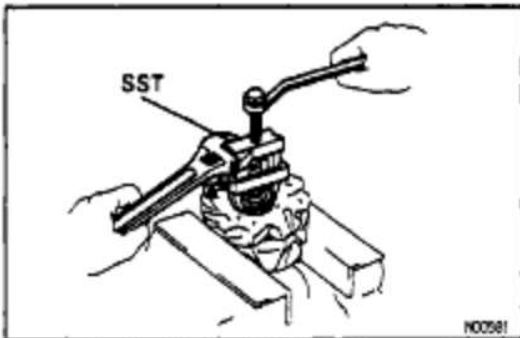


(d) Install the bearing retainer with the 4 screws.



3. INSPECT REAR BEARING

Check that the bearing is not rough or worn.



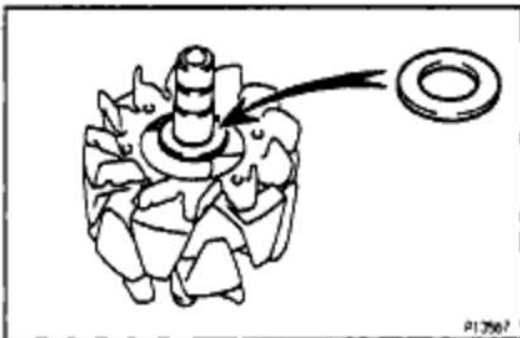
4. IF NECESSARY, REPLACE REAR BEARING

(a) Using SST, remove the bearing cover (outside) and bearing.

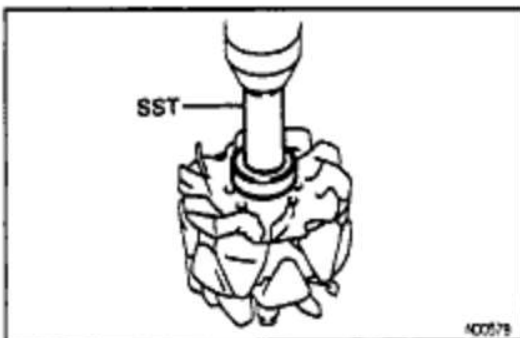
SST 09820-00021

NOTICE: Be careful not to damage the fan.

(b) Remove the bearing cover (inside).

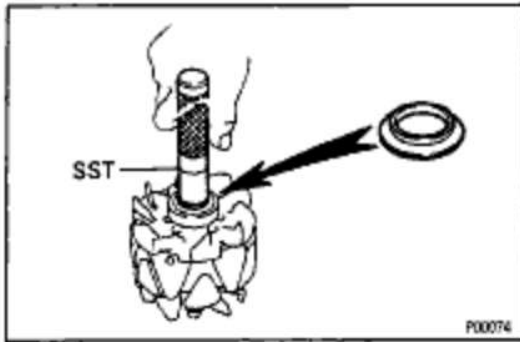


(c) Place the bearing cover (inside) on the rotor.

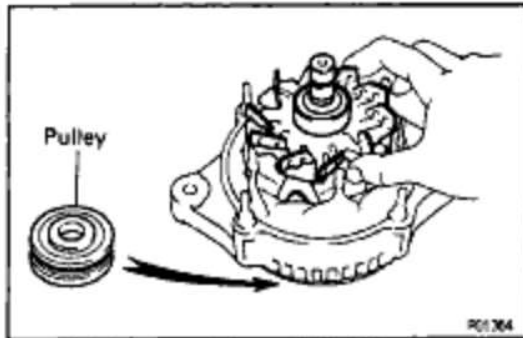


(d) Using SST and a press, press in a new bearing.

SST 09820-00030



- (e) Using SST, push in the bearing cover (outside).
SST 09285 – 76010

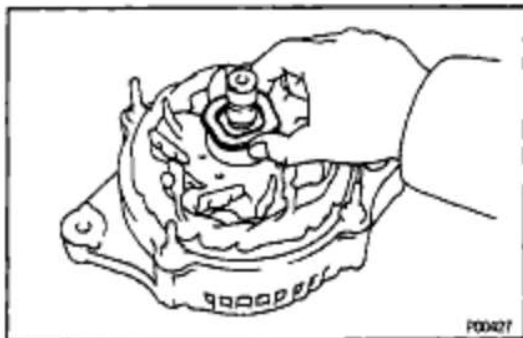


GENERATOR ASSEMBLY

(See Components for Disassembly and Assembly)

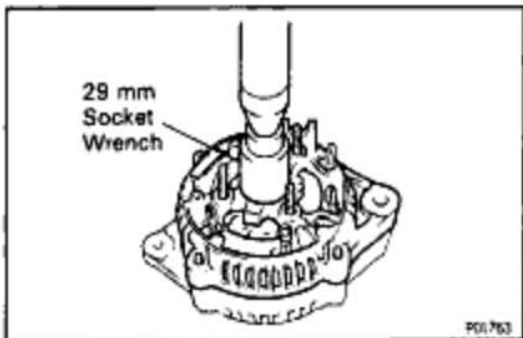
1. INSTALL ROTOR TO DRIVE END FRAME

- (a) Place the rectifier end frame on the pulley.
(b) Install the rotor to the rectifier end frame.

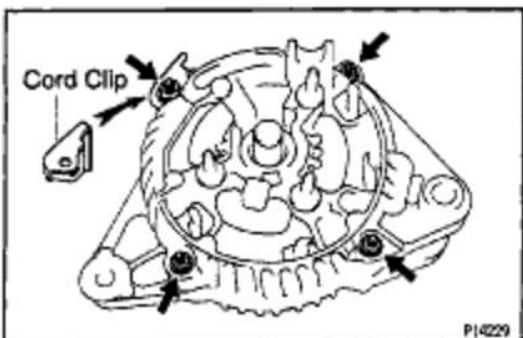


2. INSTALL RECTIFIER END FRAME

- (a) Place the thrust washer on the rotor.



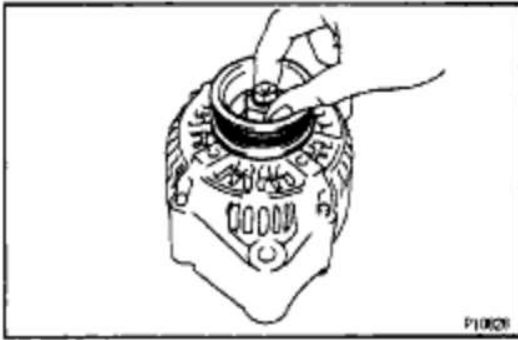
- (b) Using a 29 mm socket wrench and press, slowly press in the rectifier end frame.



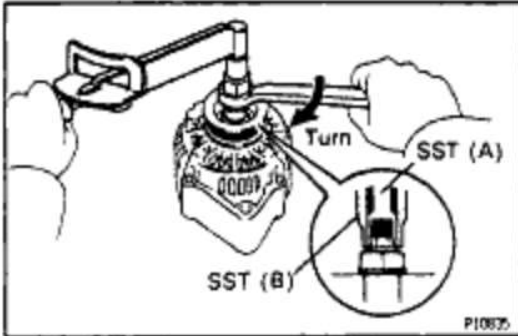
- (c) Install the 3 nuts.
Torque: 4.5 N·m (46 kgf·cm, 40 in·lbf)
(d) Install the cord clip with the nut.
Torque: 5.4 N·m (55 kgf·cm, 48 in·lbf)

CH-44

CHARGING SYSTEM - (1MZ-FE)

**3. INSTALL PULLEY**

- (a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.

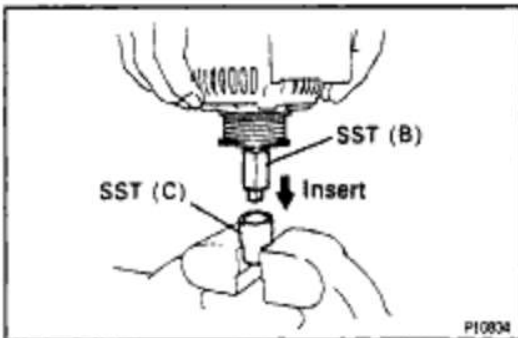


- (b) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.

SST 09820 - 63010

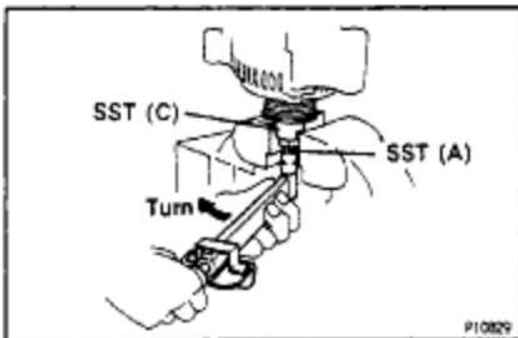
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

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



- (d) Mount SST (C) in a vise.

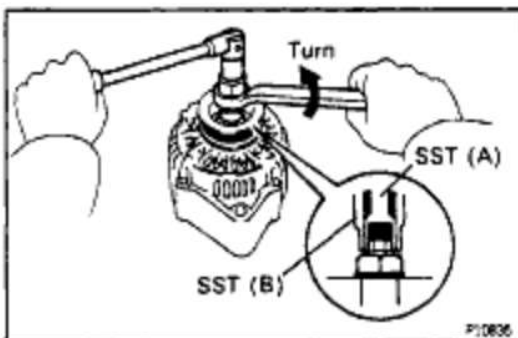
- (e) Insert SST (B) into SST (C), and attach the pulley nut to SST (C).



- (f) To torque the pulley nut, turn SST (A) in the direction shown in the illustration.

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

- (g) Remove the generator from SST (C).

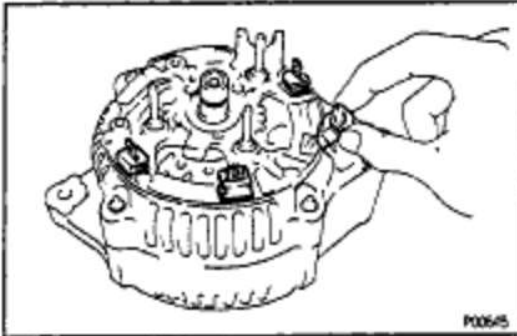


- (h) Turn SST (B), and remove SST (A and B).

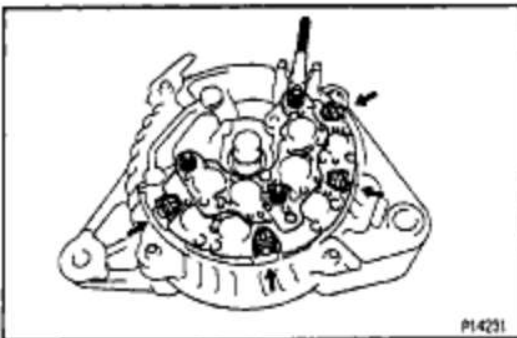
CHARGING SYSTEM - (1MZ-FE)

**4. INSTALL RECTIFIER HOLDER**

(a) Place the seal plate on the rectifier end frame.

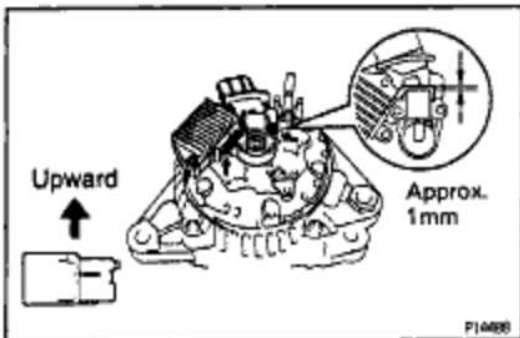


(b) Install the 4 rubber insulators on the lead wires.



(c) Install the rectifier holder with the 4 screws.

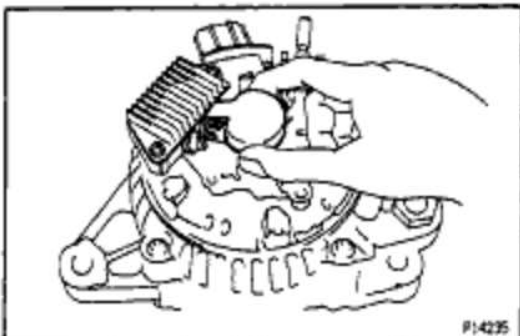
Torque: 2.94 N·m (30 kgf·cm, 26 In·lbf)

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

(a) Place the voltage regulator and brush holder on the rectifier end frame.

NOTICE: Be careful of the holder installation direction.

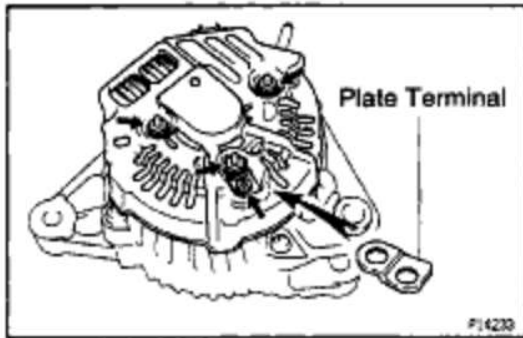
(b) Install the 5 screws until there is a clearance of approx. 1 mm (0.04 in.) between the brush holder and connector.



(c) Place the brush holder cover on the brush holder.

CH-46

CHARGING SYSTEM – (1MZ-FE)

**6. INSTALL REAR END COVER**

- (a) Install the end cover and plate terminal with the 3 nuts and screw.

Torque:

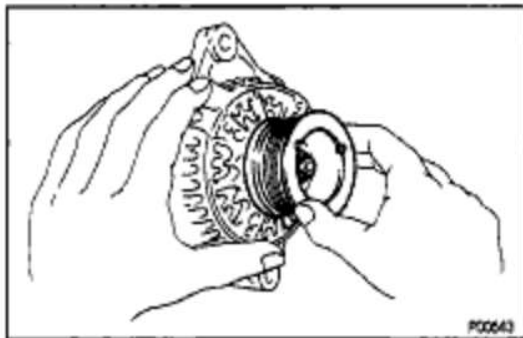
3.85 N·m (39 kgf·cm, 34 in.·lbf) for screw

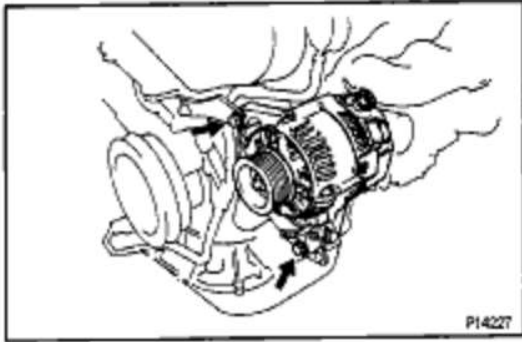
4.4 N·m (45 kgf·cm, 39 in.·lbf) for nut



- (b) Install the terminal insulator with the nut.

Torque: 4.1 N·m (41.5 kgf·cm, 36 in.·lbf)

**7. CHECK THAT ROTOR ROTATES SMOOTHLY**

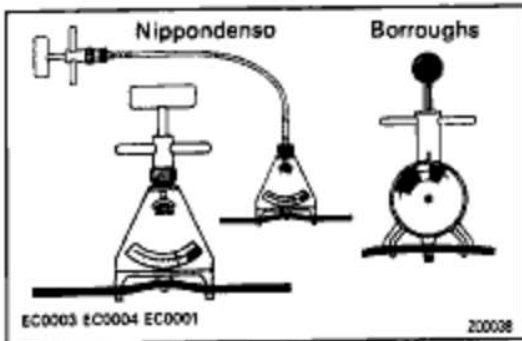


GENERATOR INSTALLATION

(See Components for Removal and Installation)

1. INSTALL GENERATOR

- Mount generator on the generator bracket with the pivot bolt and adjusting lock bolt. Do not tighten the bolts yet.
- Connect the generator connector.
- Connect the generator wire with the nut.



2. INSTALL DRIVE BELT

- Install the drive belt with the adjusting bolt.
- Using a belt tension gauge, measure the drive belt tension.

Belt tension gauge:

Nippondenso BTG-20 (95506-00020)

Borroughs No. BT-33-73F

Drive belt tension:

New belt

175 ± 5 lbf

Used belt

115 ± 20 lbf

- Tighten the pivot bolt and adjusting lock bolt.

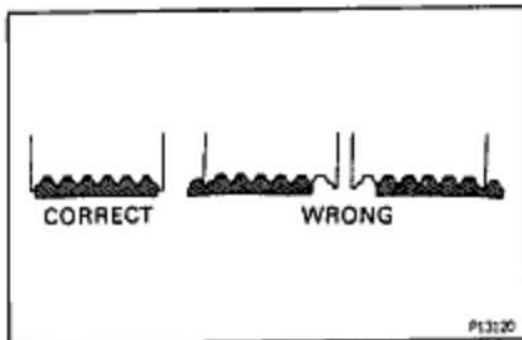
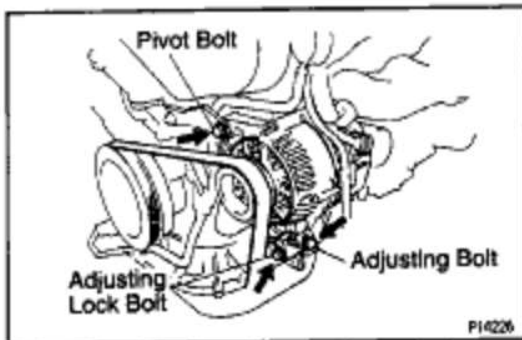
Torque:

56 N·m (570 kgf·cm, 41 ft·lbf) for pivot bolt

18 N·m (180 kgf·cm, 13 ft·lbf) for lock bolt

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 a belt, check that it fits properly in the ribbed grooves.
- Check by hand to confirm that the belt has not slip out of the groove on the bottom of the pulley.
- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.



3. CONNECT NEGATIVE (-) TERMINAL CABLE TO BATTERY

4. PERFORM ON-VEHICLE INSPECTION

(See steps 7 to 9 on pages [CH-32](#) and 33)

CH-48

CHARGING SYSTEM – (1MZ-FE)

SERVICE SPECIFICATIONS

CH-48-94

SERVICE DATA

Battery (Except Delco Battery)	Voltage (Maintenance free battery) at 20°C (68°F)	12.7 – 12.9 V
	Specific gravity (Except maintenance free battery)	
	55D23L Battery	
	GNB Incorporated JHONSON CONTROLS at 20°C (68°F)	1.25 – 1.27
	80D26L Battery at 27°C (81°F)	1.26 – 1.28
	GNB Incorporated JHONSON CONTROLS at 20°C (68°F)	1.27 – 1.29
	at 27°C (81°F)	1.28 – 1.30
Drive belt	Tension	
	New belt Used belt	175 ± 5 lbf 115 ± 20 lbf
Generator	Rated output	12 V 80 A
	Rotor coil resistance	2.8 – 3.0 Ω
	Slip ring diameter	
	STD	14.2 – 14.4 mm (0.559 – 0.567 in.)
	Limit	12.8 mm (0.504 in.)
	Brush exposed length	
	STD	10.5 mm (0.413 in.)
	Limit	1.5 mm (0.059 in.)
Voltage regulator	Regulating voltage at 25°C (77°F)	14.0 – 15.0 V
	at 115°C (239°F)	13.5 – 14.3 V

TORQUE SPECIFICATIONS

CH-48-94

Part tightened	N·m	kgf·cm	ft·lbf
Rectifier end frame x Drive end frame	4.5	46	40 in·lbf
Cord clamp x Rectifier end frame	5.4	55	48 in·lbf
Generator pulley x Rotor	110	1,125	81
Rectifier holder x Coil lead on rectifier end frame	2.94	30	26 in·lbf
Rear end cover x Rectifier holder	4.4	45	39 in·lbf
Plate terminal x Rectifier holder	3.85	39	34 in·lbf
Terminal insulator x Rectifier holder	4.1	41.5	36 in·lbf
Generator x Generator bracket	56	570	41
Generator x Adjusting bar	18	180	13