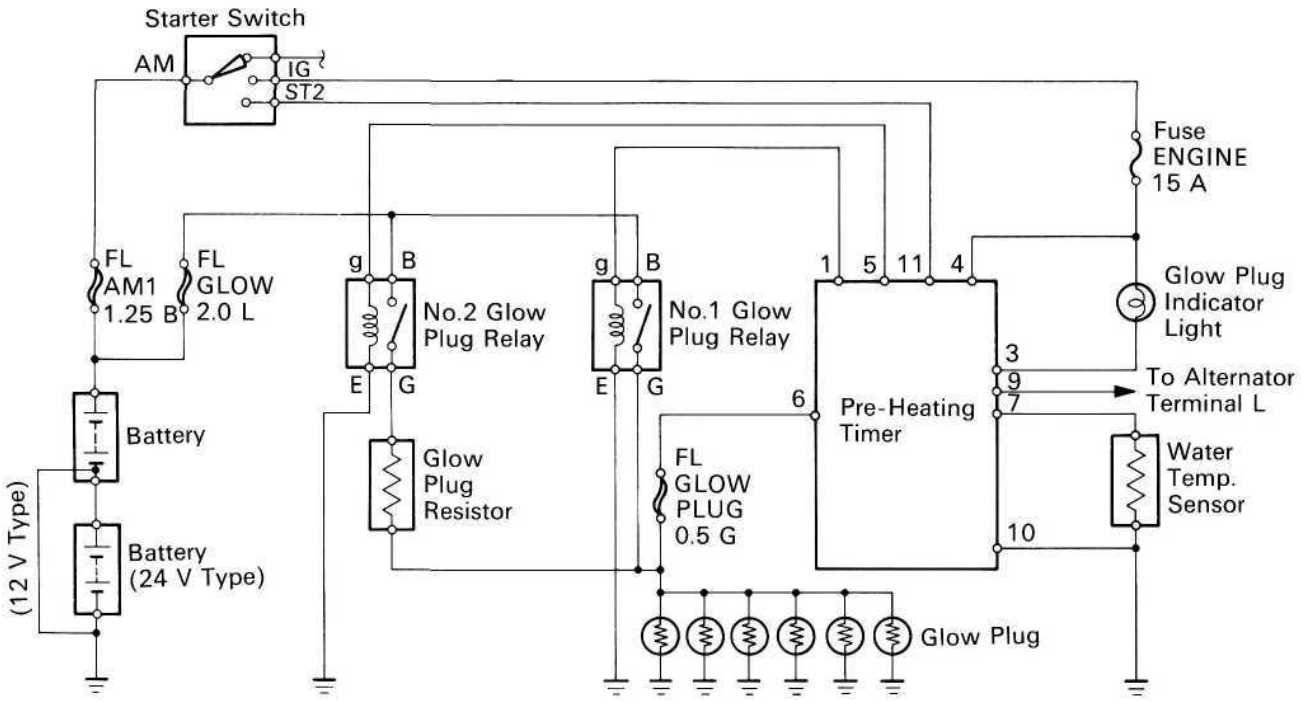
STARTING SYSTEM

PRE-HEATING SYSTEM

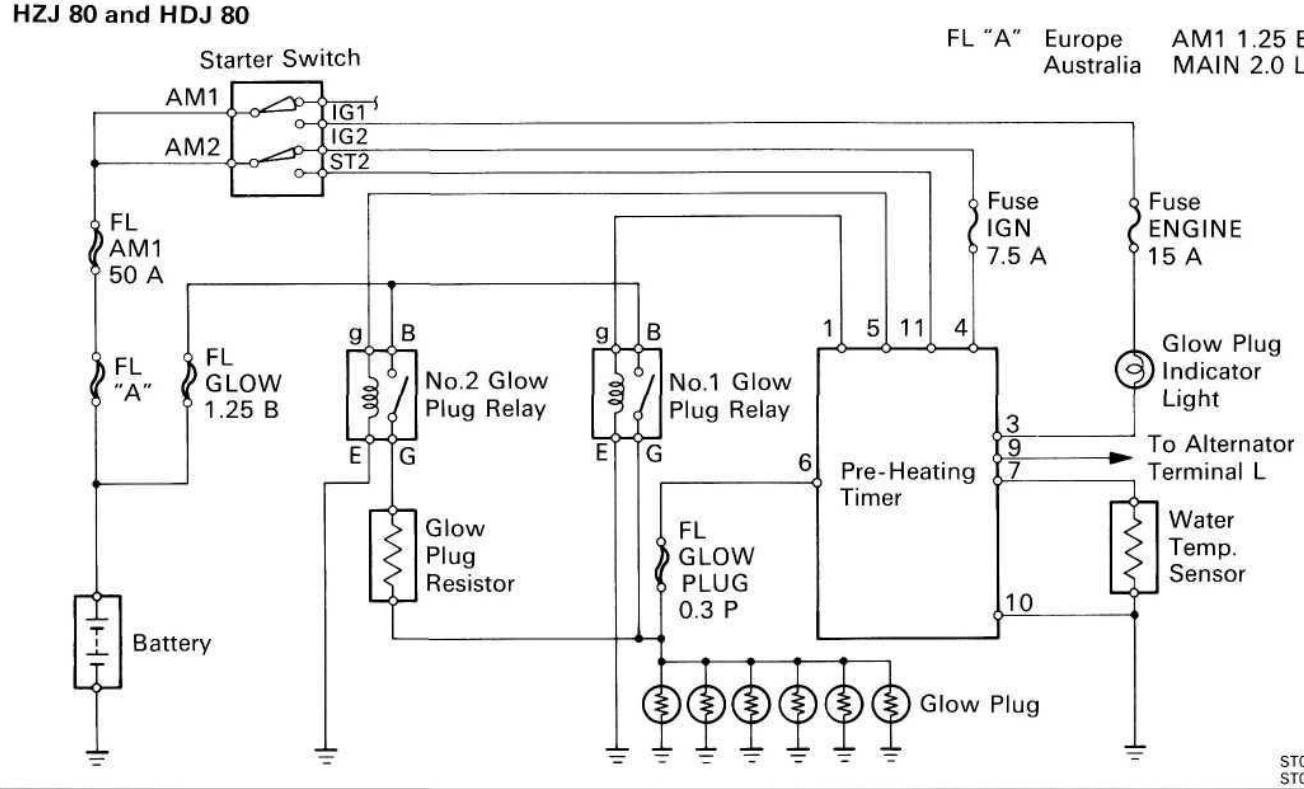
Super Glow Type (Europe and Australia)

SYSTEM CIRCUIT

PZJ 70, 73, 75 and HZJ 70, 73, 75

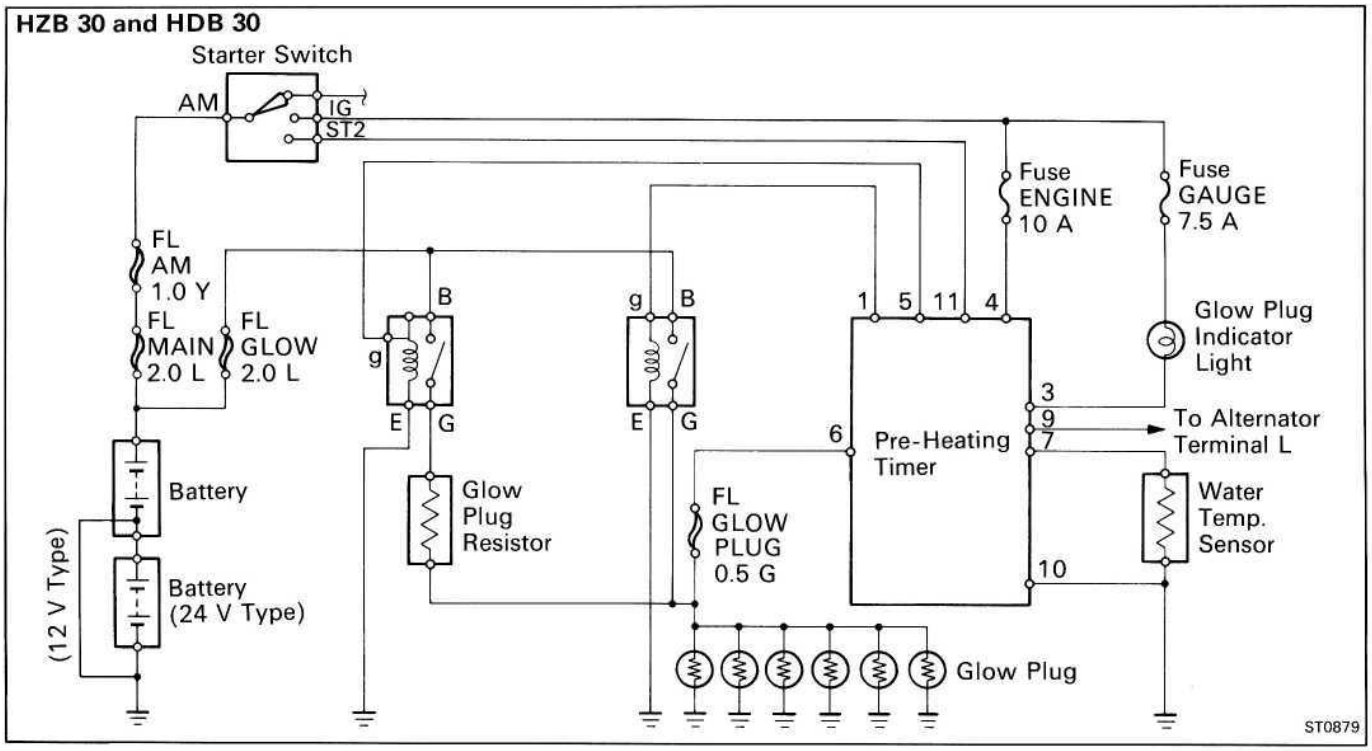


HZJ 80 and HDJ 80



SYSTEM CIRCUIT (Cont'd)

HZB 30 and HDB 30

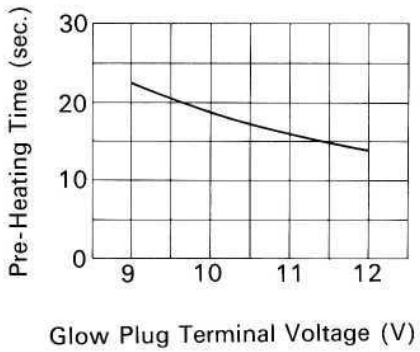


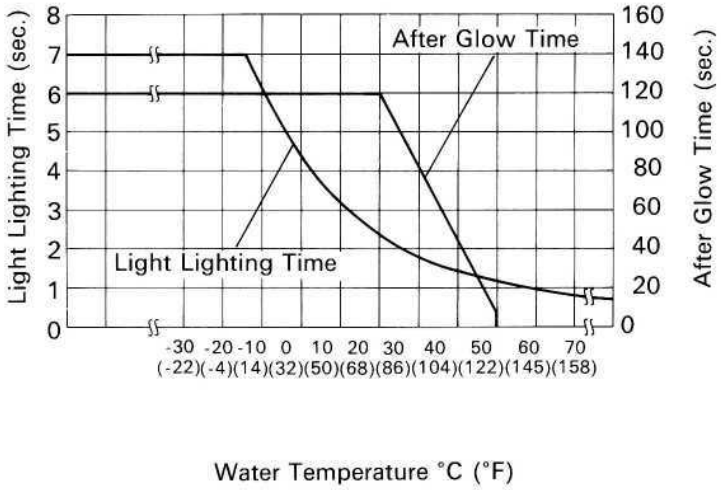
INSPECTION OF PRE-HEATING SYSTEM

HINT: Refer to Diesel Electrical System Diagnosis for inspection procedures. (See page EM-14)

TIMER CHARACTERISTIC DIAGRAM

12 V Type
(1PZ, 1HZ and 1HD-T for Australia)

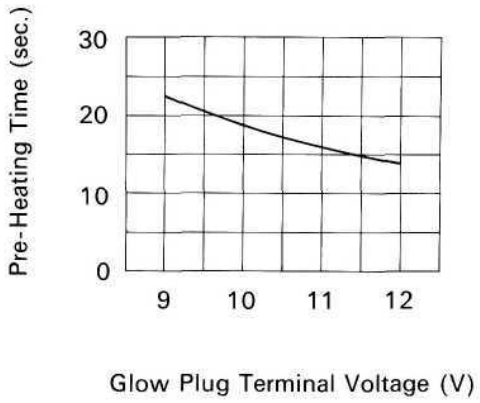


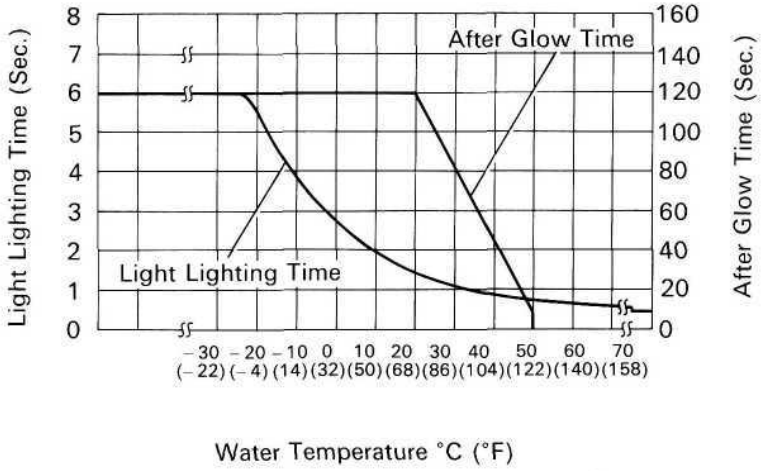


ST0867 ST0868

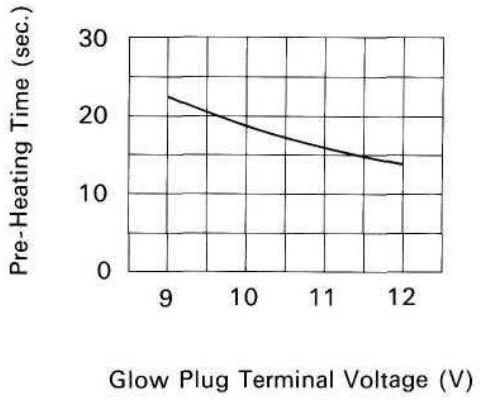
TIMER CHARACTERISTIC DIAGRAM (Cont'd)

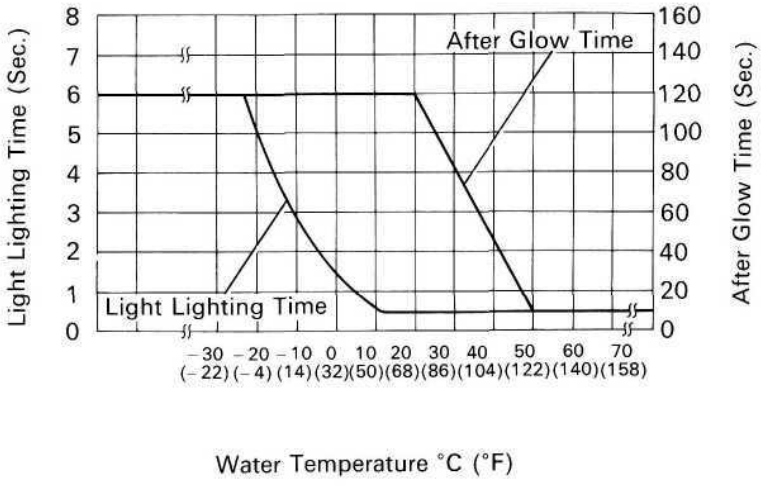
(1HZ for Europe)



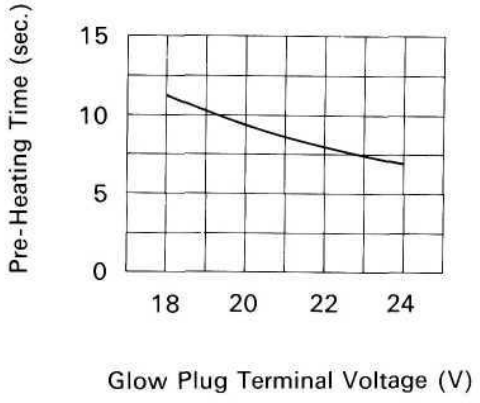


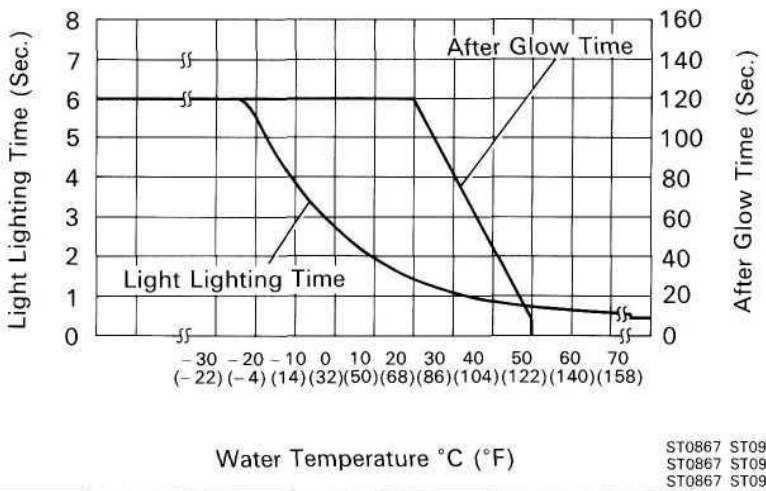
(1HD-T for Europe)



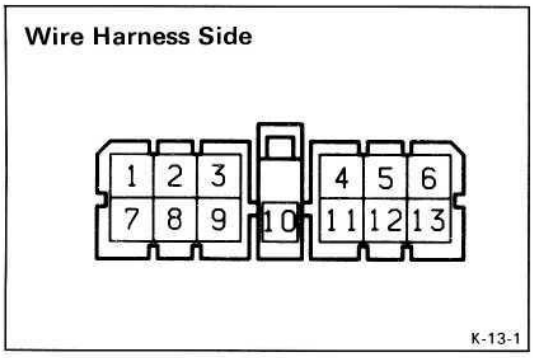


24 V Type





ST0867 ST0900
ST0867 ST0901
ST0867 ST0900



INSPECTION OF COMPONENTS

Pre-Heating Timer

LOCATION:

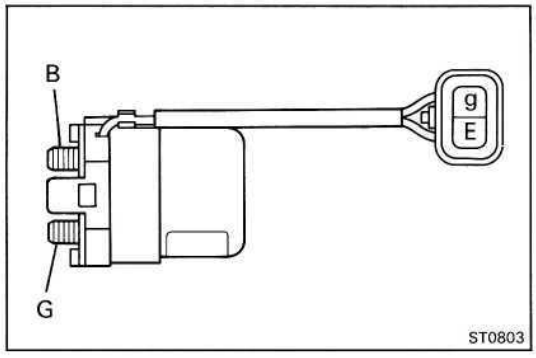
PZJ, HZJ, HDJ — Under the instrument panel on the passenger side.

HZB, HDB — Under the instrument panel center.

INSPECT PRE-HEATING TIMER CIRCUIT

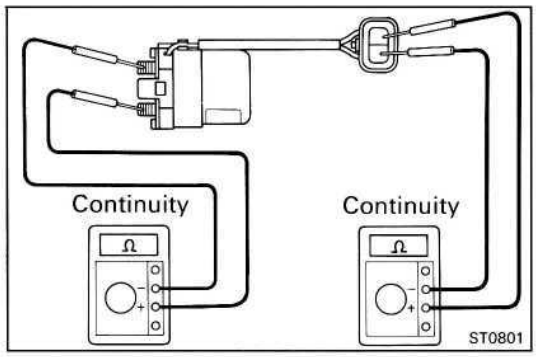
Disconnect the connector from the pre-heating timer, and check the connector on the wire harness side as shown in the following chart.

Check for	Tester connection	Condition	Specified value
Continuity	1 – Ground	–	Continuity
Voltage	3 – Ground	Turn starter switch OFF	No voltage
		Turn starter switch ON	Battery voltage
Voltage	4 – Ground	Turn starter switch OFF	No voltage
		Turn starter switch ON	Battery voltage
Continuity	5 – Ground	–	Continuity
Continuity	6 – Ground	–	Continuity
Continuity	7 – Ground	–	Continuity
Continuity	10 – Ground	–	Continuity
Voltage	11 – Ground	Turn starter switch OFF	No voltage
		Turn starter switch START	Battery voltage



No. 1 Glow Plug Relay

LOCATION: In the engine compartment on the left side.

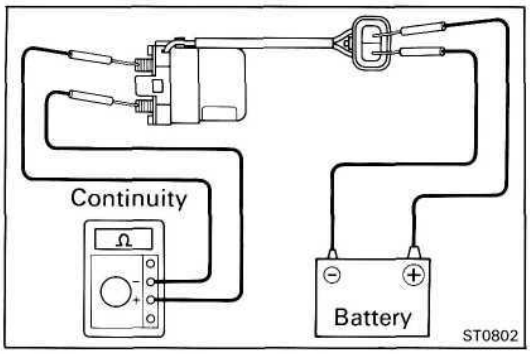


1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals E and g.

(b) Check that there is no continuity between terminals B and G.

If continuity is not as specified, replace the relay.

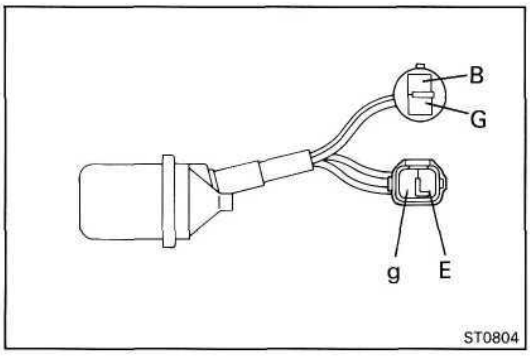


2. INSPECT RELAY OPERATION

(a) Apply battery voltage across terminals E and g.

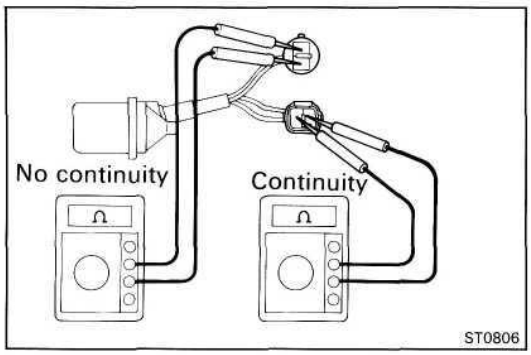
(b) Using an ohmmeter, check that there is continuity between terminals B and G.

If operation is not as specified, replace the relay.



No.2 Glow Plug Relay (PZJ, HZJ and HDJ)

LOCATION: In the engine compartment on the left side.

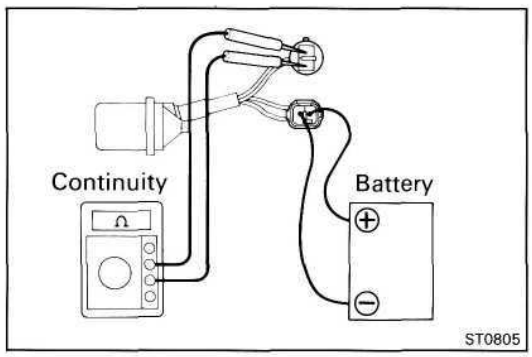


1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals E and g.

(b) Check that there is no continuity between terminals B and G.

If continuity is not as specified, replace the relay.

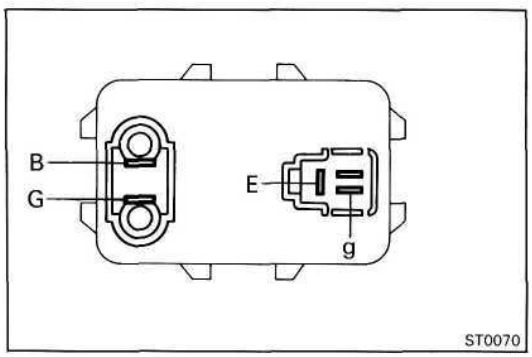


2. INSPECT RELAY OPERATION

(a) Apply battery voltage across terminals E and g.

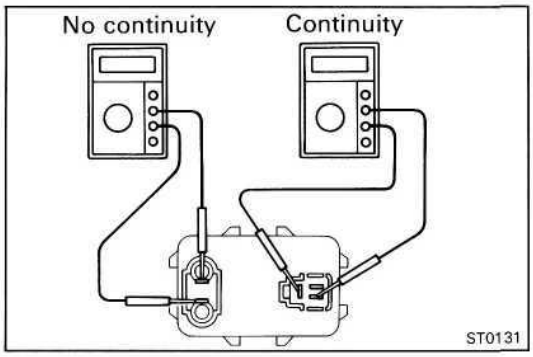
(b) Using an ohmmeter, check that there is continuity between terminals B and G.

If operation is not as specified, replace the relay.



No.2 Glow Plug Relay (HZB and HDB)

LOCATION: Inside wall adjacent to center door.

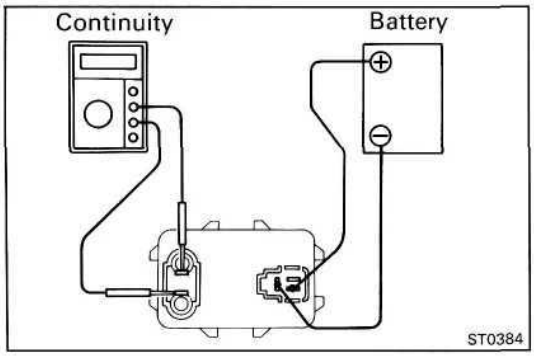


1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals E and g.

(b) Check that there is no continuity between terminals B and G.

If continuity is not as specified, replace the relay.



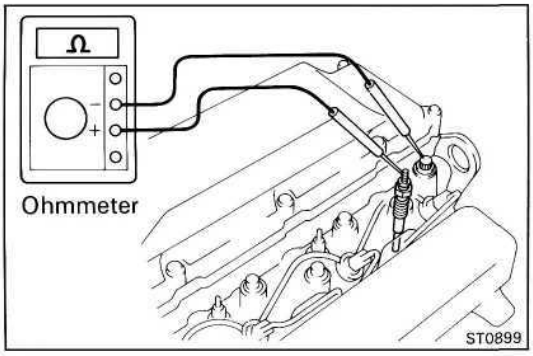
2. INSPECT RELAY OPERATION

(a) Apply battery voltage across terminals E and g.

(b) Using an ohmmeter, check that there is continuity between terminals B and G.

If operation is not as specified, replace the relay.

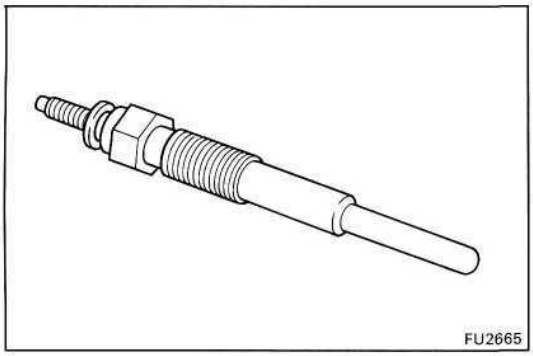
Glow Plug



INSPECT GLOW PLUG

Using an ohmmeter, check that there is continuity between the glow plug terminal and ground.

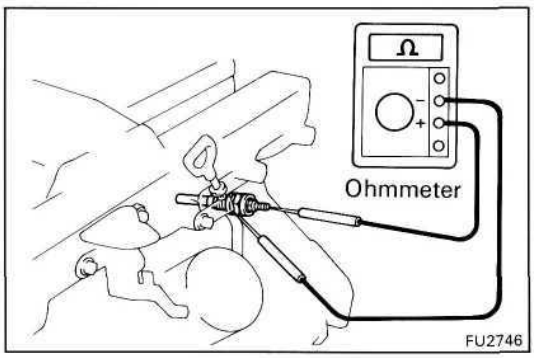
If there is no continuity, replace the glow plug.



HINT:

- Be careful not to damage the glow plug pipes as it could cause an open circuit or shorten life of the plugs.
- Avoid getting oil and gasoline on the glow plug when cleaning.
- During inspection, be sure to wipe any oil off the glow plug terminal and bakelite washer with a dry cloth.
- Be careful not to apply more than 11 volts (12 V type) or 22 volts (24 v type) to the glow plug as it could cause an open circuit.

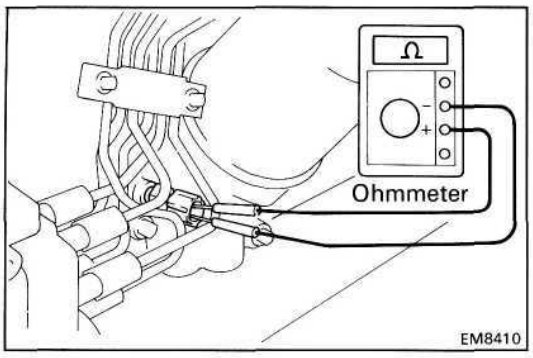
Glow Plug Resistor



INSPECT GLOW PLUG RESISTOR

Using an ohmmeter, check that there is continuity between the resistor terminals.

If there is no continuity, replace the resistor.



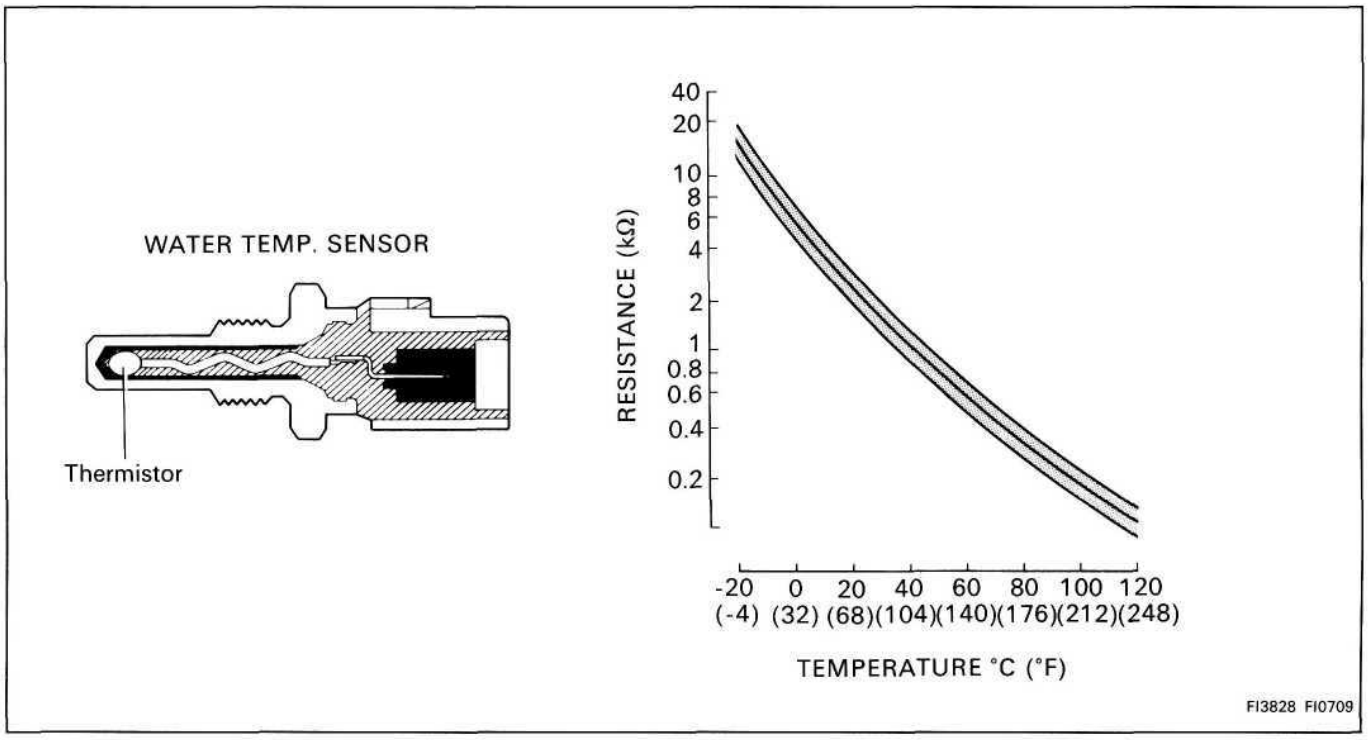
Water Temperature Sensor

INSPECT TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the sensor terminals.

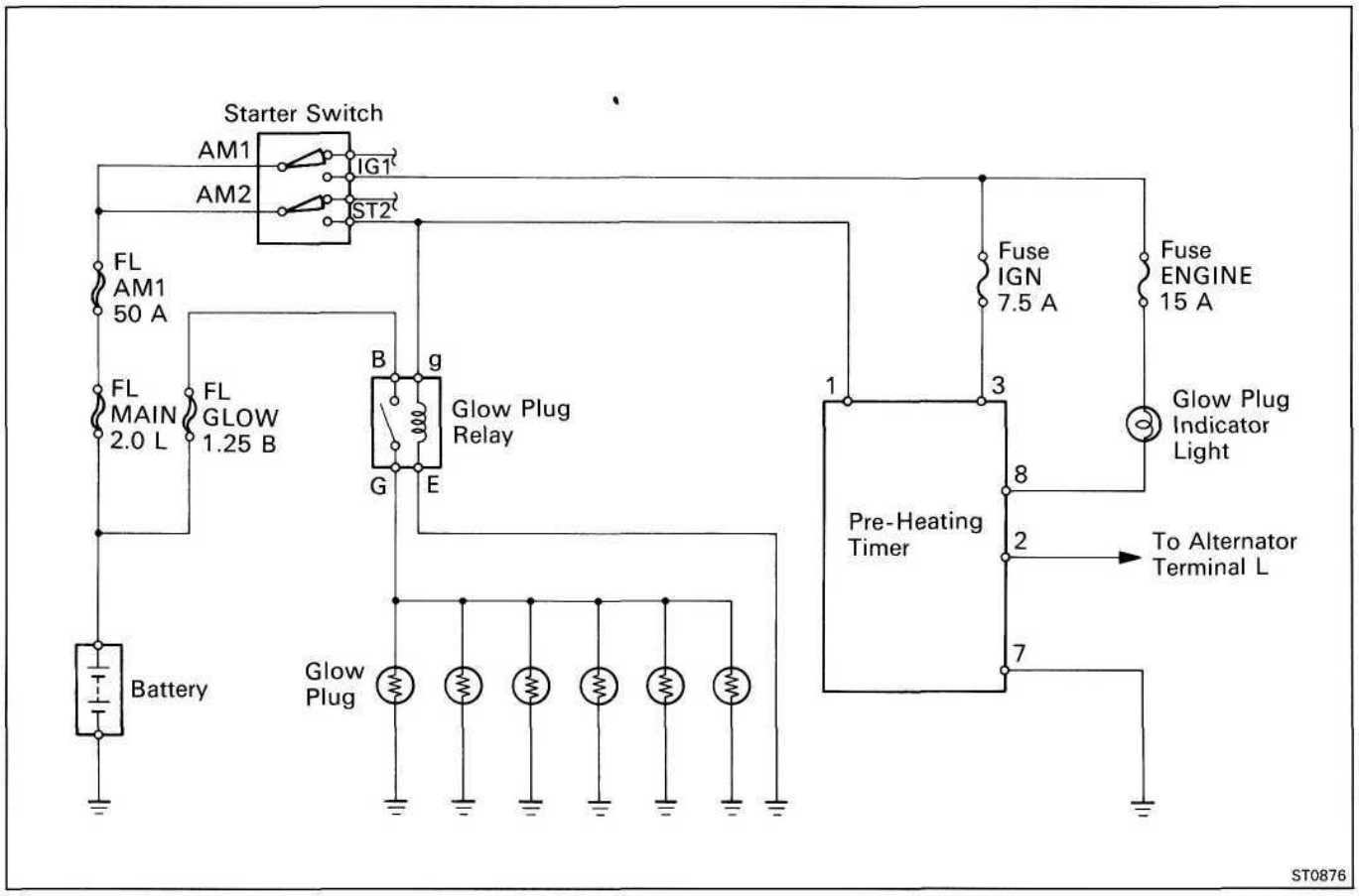
Resistance: Refer to chart

If the resistance is not as specified, replace the sensor.



Fixed Delay Type (HZJ80 and HDJ80) ex. (Europe and Australia)

SYSTEM CIRCUIT



INSPECTION OF PRE-HEATING SYSTEM

1. INSPECT LIGHTING TIME OF GLOW INDICATOR LIGHT

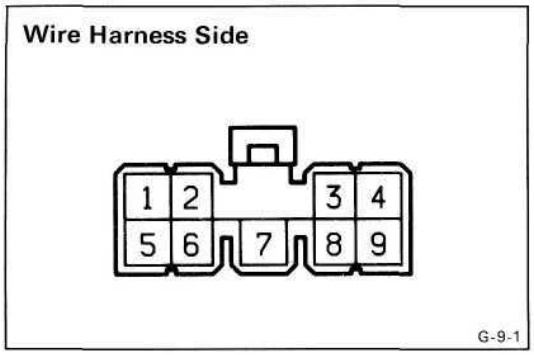
Turn the starter switch "ON", measure the lighting time.

Light lighting time: Approx. 5 seconds

2. INSPECT PRE-HEATING TIME

Turn the starter switch "ON", and measure the time battery voltage is applied to terminal 1 of the pre-heating timer.

Pre-heating time: Approx. 18 seconds



INSPECTION OF COMPONENTS

Pre-Heating Timer

INSPECT PRE-HEATING TIMER CIRCUIT

LOCATION: Under the instrument panel on the passenger side.

Disconnect the connector from the pre-heating timer, and check the connector on the wire harness side as shown in the following chart.

Check for	Tester connection	Condition	Specified value
Voltage	1 – Ground	Turn starter switch OFF	No voltage
		Turn starter switch START	Battery voltage
Voltage	3 – Ground	Turn starter switch OFF	No voltage
		Turn starter switch ON	Battery voltage
Continuity	7 – Ground	–	Continuity
Voltage	8 – Ground	Turn starter switch OFF	No voltage
		Turn starter switch ON	Battery voltage

Glow Plug Relay

(See No.2 Glow Plug Relay (PZJ. HZJ and HDJ) on page ST-6)

LOCATION: In the engine compartment on the left side.

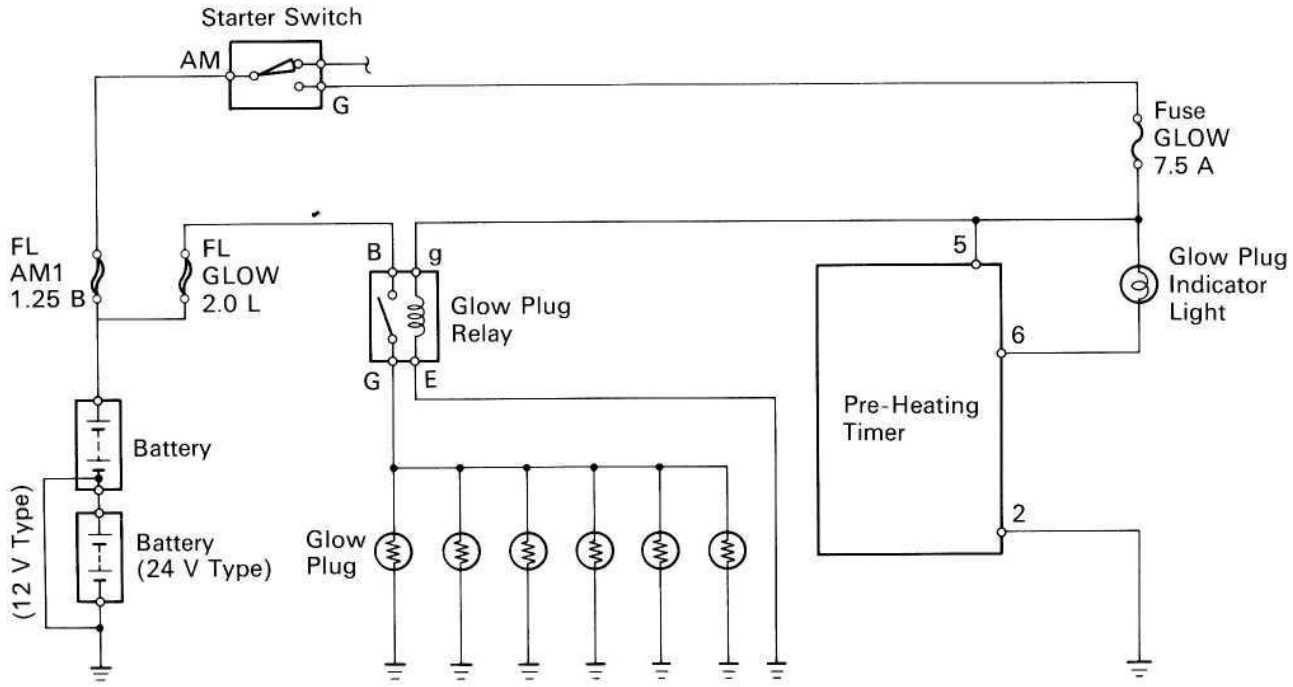
Glow Plug

(See page ST-7)

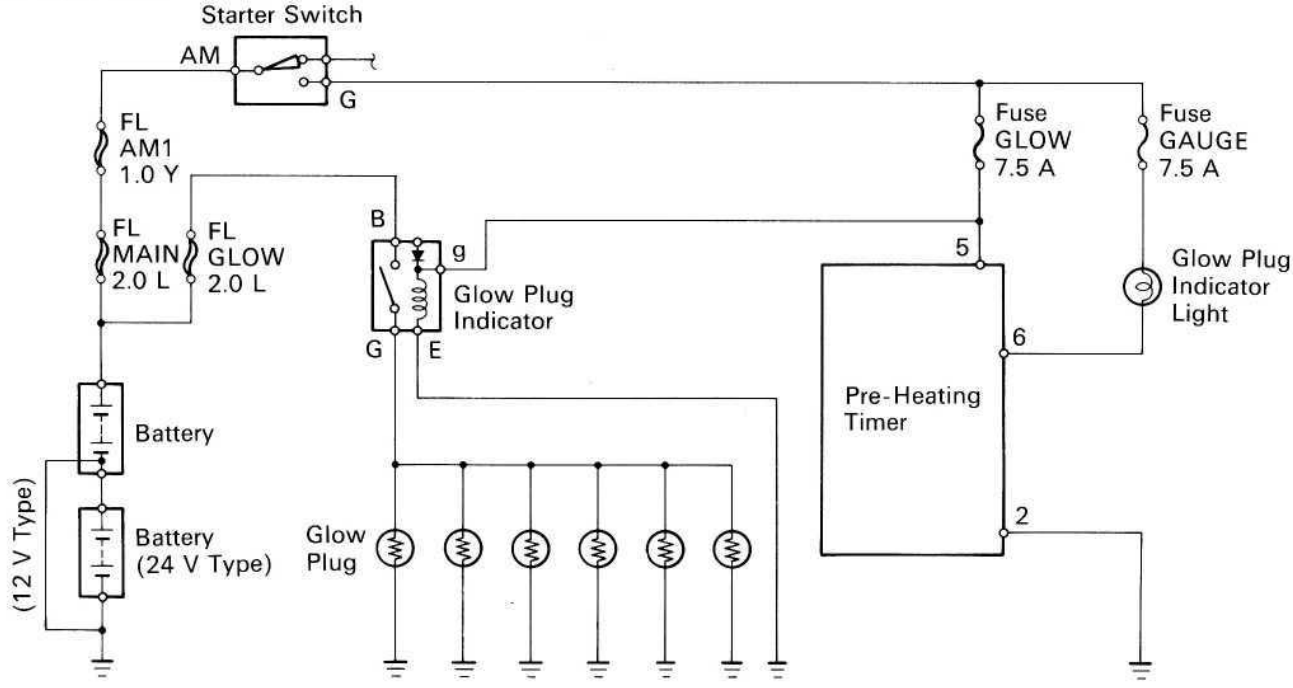
Fixed Delay Type (PZJ, HZJ75, HZB and HDB) ex. (Europe and Australia)

SYSTEM CIRCUIT

PZJ and HZJ 75



HZB and HDB



ST0880
ST0881

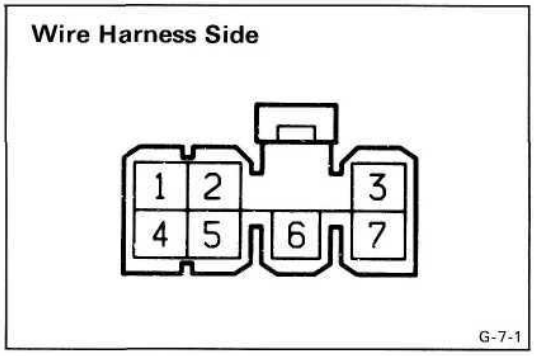
INSPECTION OF PRE-HEATING SYSTEM

INSPECT LIGHTING TIME OF GLOW INDICATOR LIGHT

Turn the starter switch "G", measure the lighting time.

Light lighting time:

12V type Approx. 6 seconds
24 V type Approx. 5 seconds



INSPECTION OF COMPONENTS

Pre-Heating Timer

INSPECT PRE-HEATING TIMER CIRCUIT

LOCATION:

PZJ, HZJ75 Under the instrument panel on the passenger side.

HZB, HDB Under the instrument panel center.

Disconnect the connector from the pre-heating timer, and check the connector on the wire harness side as shown in the following chart.

Check for	Tester connection	Condition	Specified value
Continuity	2 – Ground	–	Continuity
Voltage	5 – Ground	Turn starter switch OFF	No voltage
		Turn starter switch G	Battery voltage
Voltage	6 – Ground	Turn starter switch OFF	No voltage
		Turn starter switch G	Battery voltage

Glow Plug Relay (PZJ and HZJ75)

(See No.2 Glow Plug Relay (PZJ, HZJ and HDJ) on page ST-6)

LOCATION: In the engine compartment on the left side.

Glow Plug Relay (HZB and HDB)

(See No.2 Glow Plug Relay (HZB and HDB) on page ST-6)

LOCATION: Inside wall adjacent to center door.

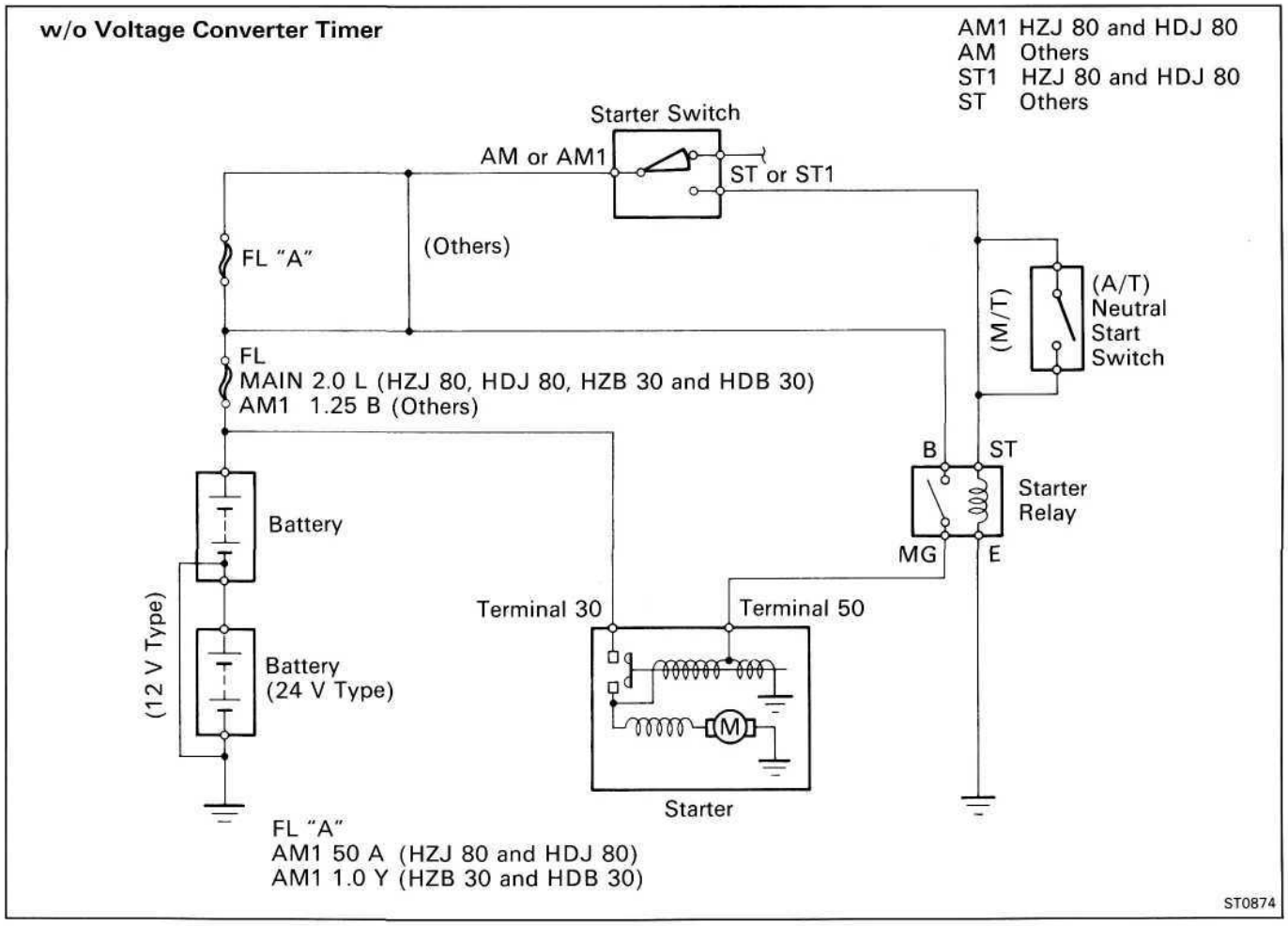
Glow Plug

(See page ST-7)

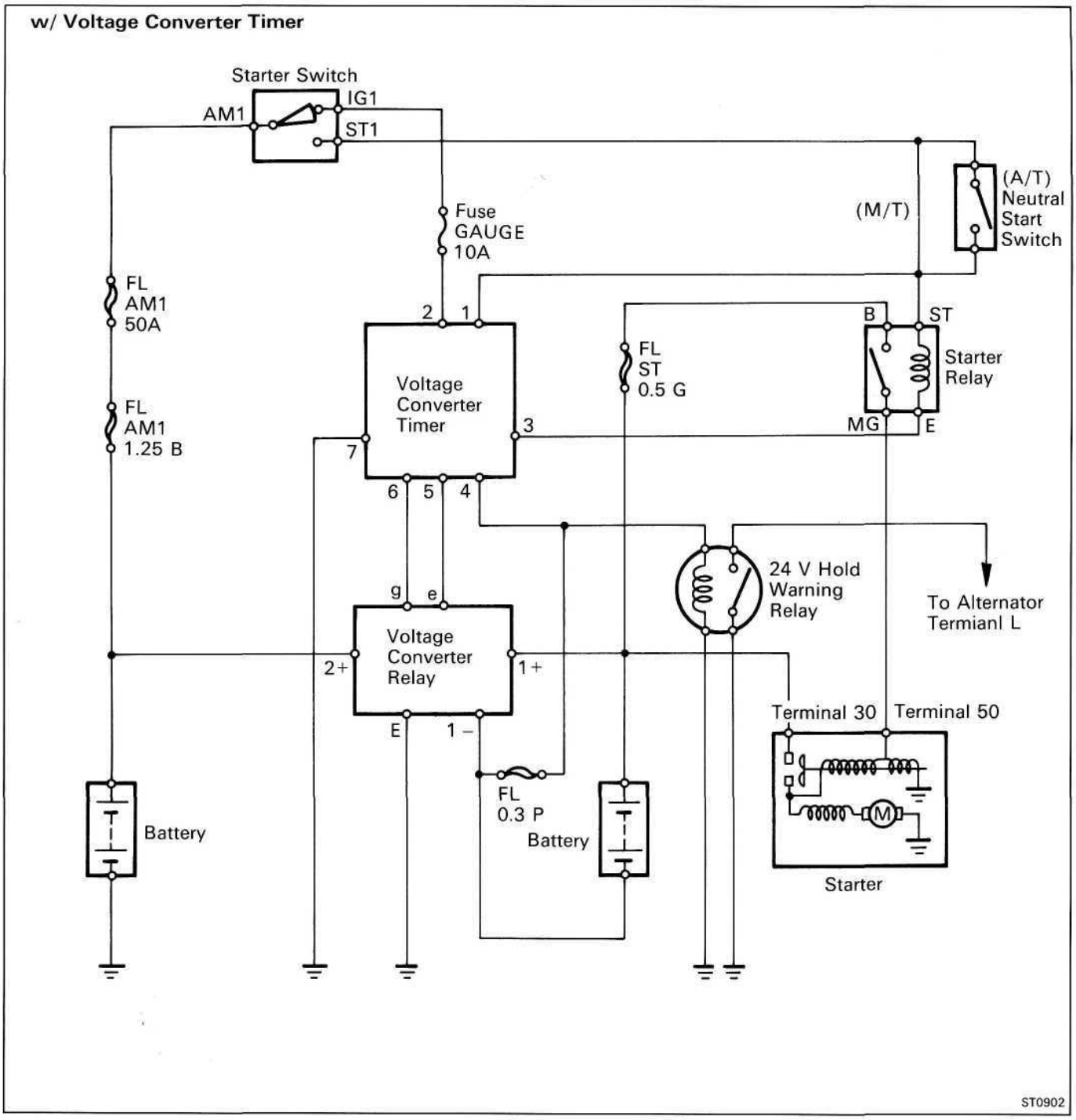
TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Engine will not crank	Battery charge low	Check battery specific gravity Charge or replace battery	CH-5
	Battery cables loose, corroded or worn	Repair or replace cables	
	Neutral start switch faulty (A/T only)	Replace switch	
	Fusible link blown	Replace fusible link	
	Starter relay faulty	Check relay	ST-25, 26
	Starter faulty	Repair starter	ST-15
	Starter switch faulty	Replace starter switch	
Engine cranks slowly	Battery charge low	Check battery specific gravity Charge or replace battery	CH-5
	Battery cables loose, corroded or worn	Repair or replace cables	
	Starter faulty	Repair starter	ST-15
Starter keeps running	Starter faulty	Repair starter	ST-15
	Starter switch faulty	Repalce starter switch	
	Short in wiring	Repair wiring	
Starter spins but engine will not crank	Pinion gear teach broken or faulty starter	Repair starter	ST-15
	Flywheel teeth broken	Replace flywheel	ST-15

STARTING SYSTEM CIRCUIT

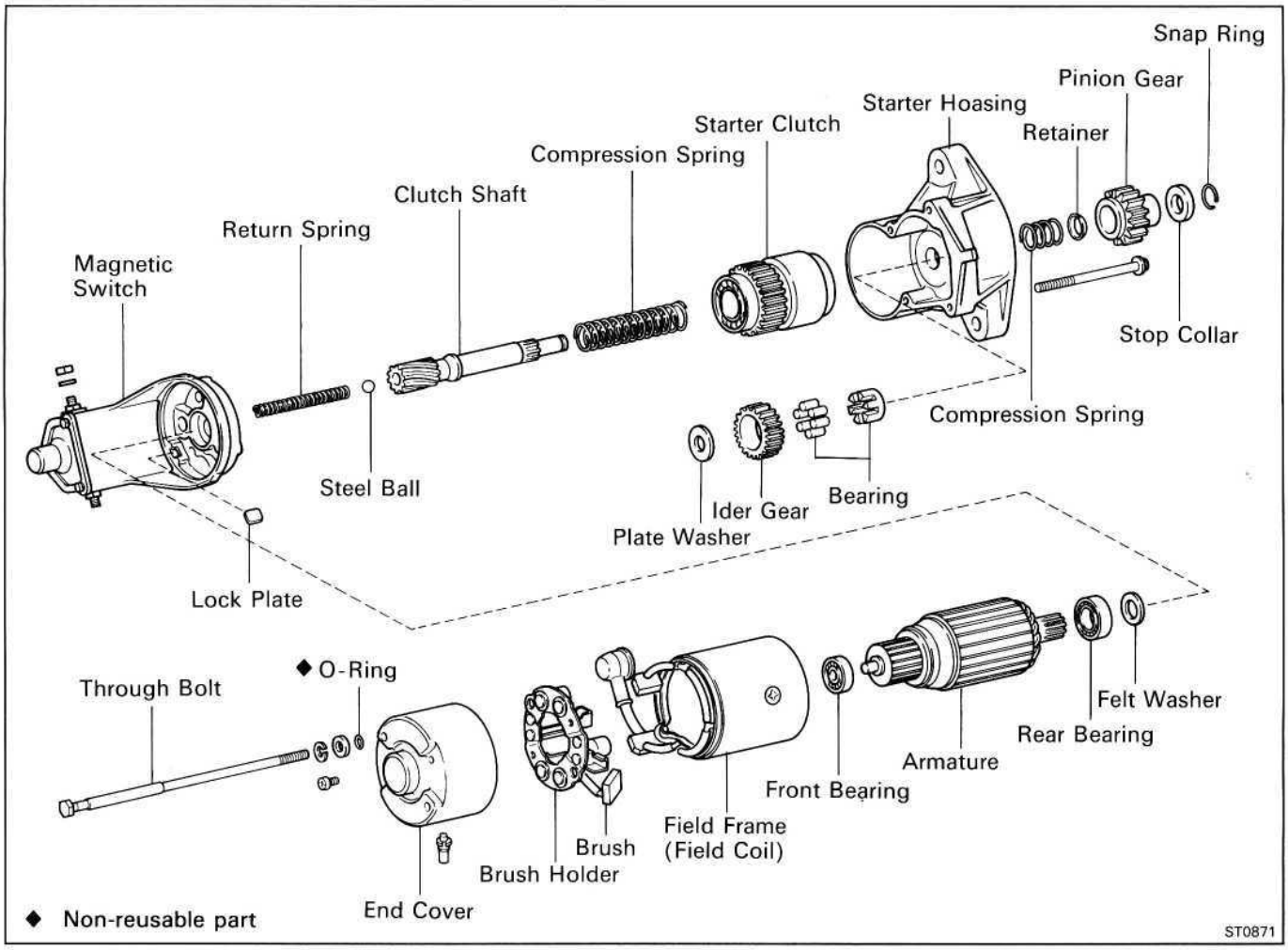


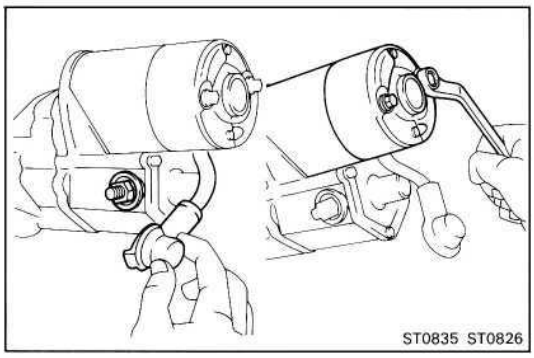
STARTING SYSTEM CIRCUIT (Cont'd)

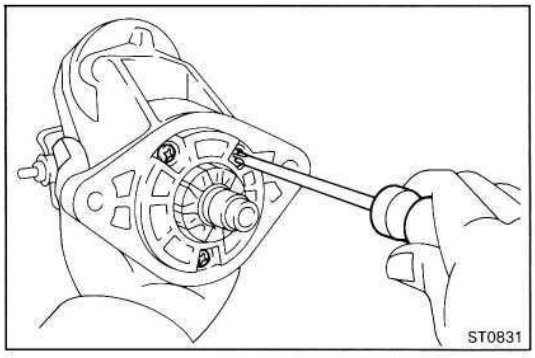


STARTER

COMPONENTS







DISASSEMBLY OF STARTER

1. REMOVE FIELD FRAME AND ARMATURE

(a) Remove the nut and spring washer, and disconnect the lead wire from the magnetic switch terminal.

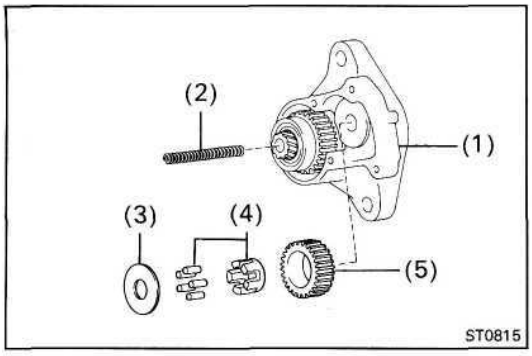
(b) Remove the two through bolts, spring washers, plate washers and O-rings.

(c) Pull out the field frame together with the armature.

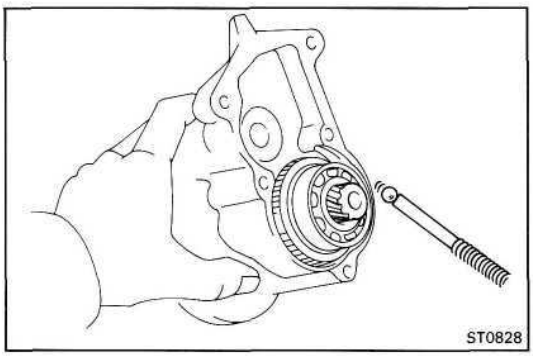
(d) Remove the felt washer and lock plate.

2. REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEARS

(a) Remove the three screws.

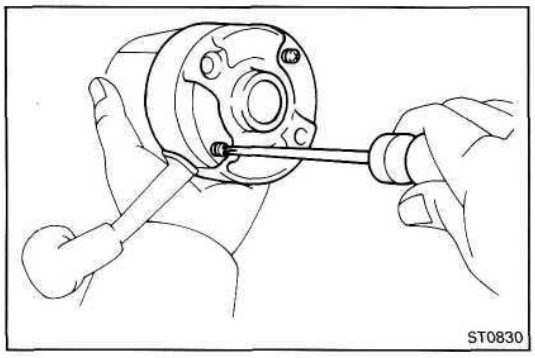


(b) Remove the following parts from the magnetic switch:
(1) Starter housing and clutch assembly
(2) Return spring
(3) Plate washer
(4) Idler gear
(5) Bearing



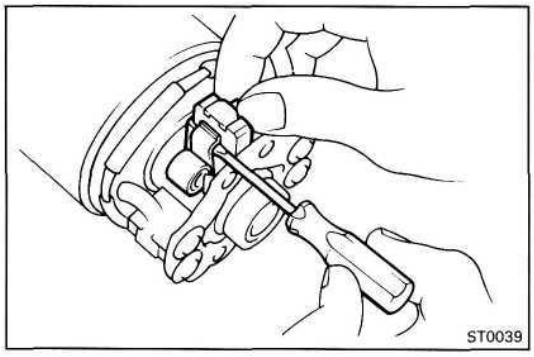
3. REMOVE STEEL BALL

Using a magnetic finger, remove the steel ball from the clutch shaft hole.



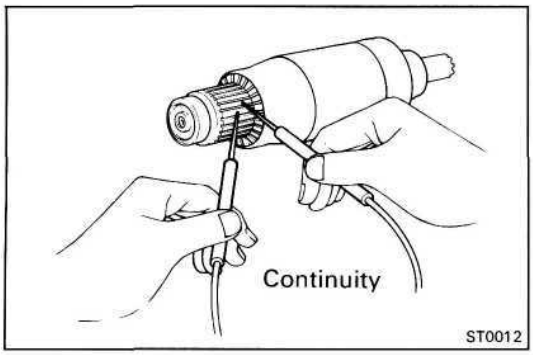
4. REMOVE BRUSH HOLDER

(a) Remove the two screws and end cover from the field frame.



(b) Using a screwdriver, hold the spring back and disconnect the brush from the brush holder. Disconnect the four brushes, and remove the brush holder.

5. REMOVE ARMATURE FROM FIELD FRAME



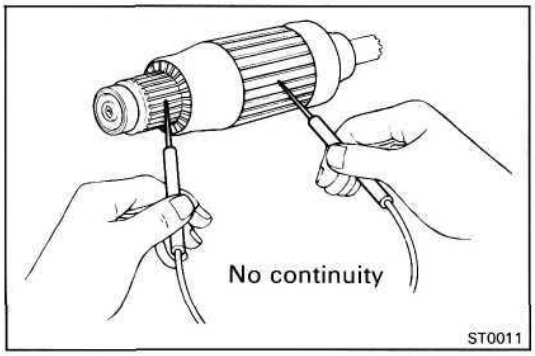
INSPECTION AND REPAIR OF STARTER

Armature Coil

1. INSPECT COMMUTATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the segments of the commutator.

If there is no continuity, replace the armature.



2. INSPECT COMMUTATOR FOR GROUND

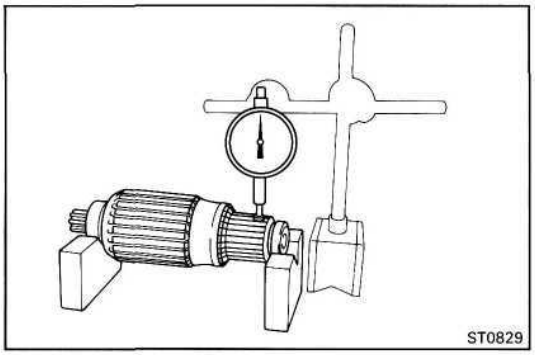
Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.

Commutator

1. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACE

If the surface is dirty or burnt, correct with sandpaper (No.400) or on a lathe.



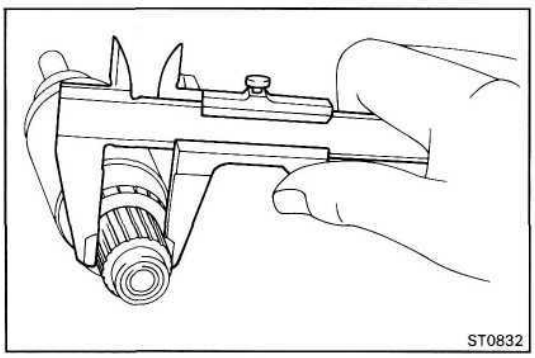
2. INSPECT COMMUTATOR FOR RUNOUT

(a) Place the commutator on V-blocks.

(b) Using a dial indicator, measure the circle runout.

Maximum circle runout: 0.05 mm (0.0020 in.)

If the circle runout is greater than maximum, correct it on a lathe.



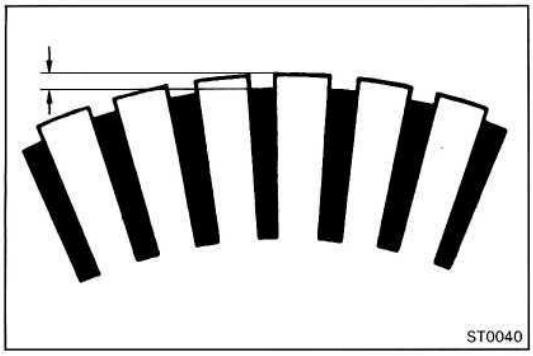
3. INSPECT COMMUTATOR DIAMETER

Using calipers, measure the diameter.

Standard diameter: 36.0 mm (1.417 in.)

Minimum diameter: 35.0 mm (1.378 in.)

If the diameter of the commutator is less than minimum, replace the armature.



4. INSPECT UNDERCUT DEPTH

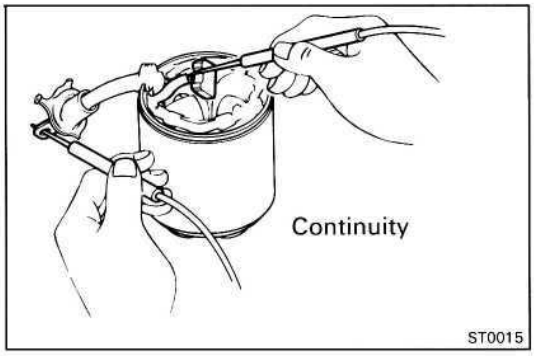
Check that the undercut depth is clean and free of foreign material. Smooth out the edge.

Standard undercut depth: 0.7-0.9 mm (0.028-0.035 in.)

Minimum undercut depth: 0.2 mm (0.008 in.)

If the undercut depth is less than minimum, correct it with a hacksaw blade.

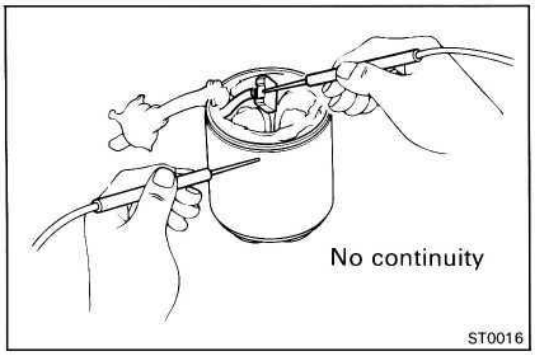
Field Coil (Field Frame)



1. INSPECT FIELD COIL FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

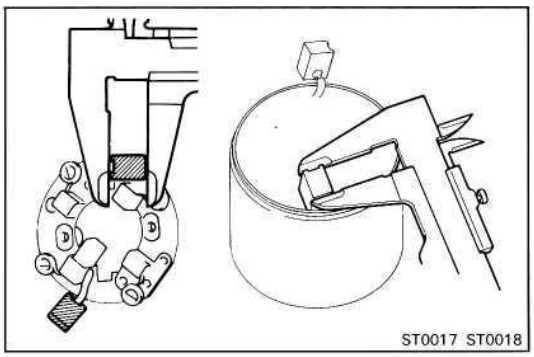
If there is no continuity, replace the field frame.



2. INSPECT FIELD COIL FOR GROUND

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

If there is continuity, replace the field frame.



Brushes

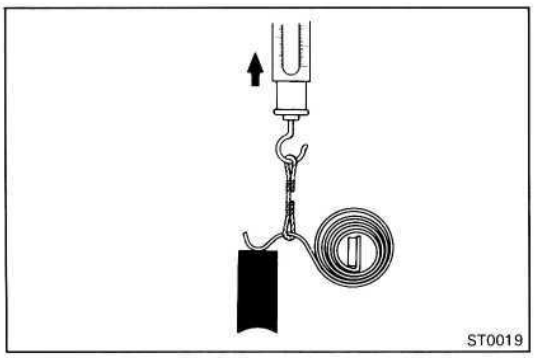
INSPECT BRUSH LENGTH

Using calipers, measure the brush length.

Standard length: 20.5-21.0 mm (0.807-0.827 in.)

Minimum length: 13.0 mm (0.512 in.)

If the length is less than minimum, replace the brush holder and field frame.



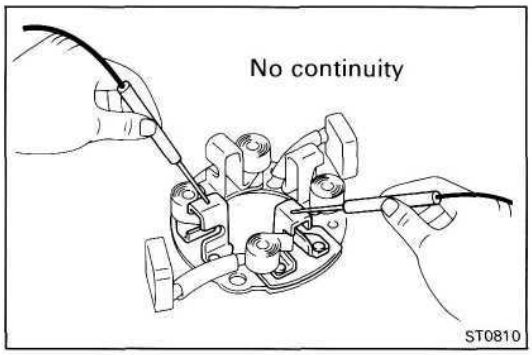
Brush Springs

INSPECT BRUSH SPRING LOAD

Take the pull scale reading the instant the brush spring separates from the brush.

Standard installed load: 3.2-4.0 kg (7.1 -8.8 lb, 31-39 N)

If the installed load is not as specified, replace the brush springs.



Brush Holder

INSPECT BRUSH HOLDER INSULATION

Using an ohmmeter, check that there is no continuity between the positive (+) and negative (-) brush holders.

If there is continuity, repair or replace the brush holder.

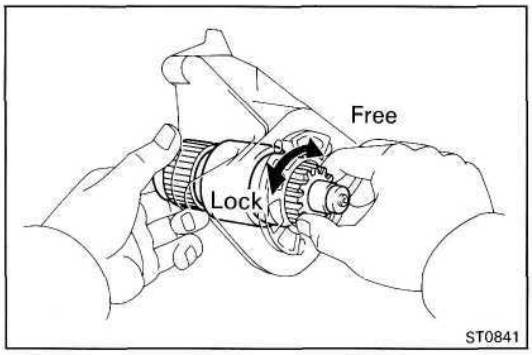
Clutch and Gears

1. INSPECT GEAR TEETH

Check the gear teeth on the pinion gear, idler gear and the clutch assembly for wear or damage.

If damaged, replace the gear or clutch assembly.

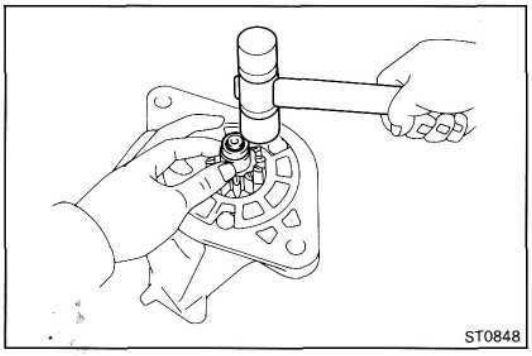
If damaged, also check the flywheel ring gear for wear or damage.



2. INSPECT CLUTCH PINION GEAR

Rotate the pinion gear clockwise and check that it turns freely. Try to rotate the pinion gear counterclockwise and check that it locks.

If necessary, replace the clutch assembly.

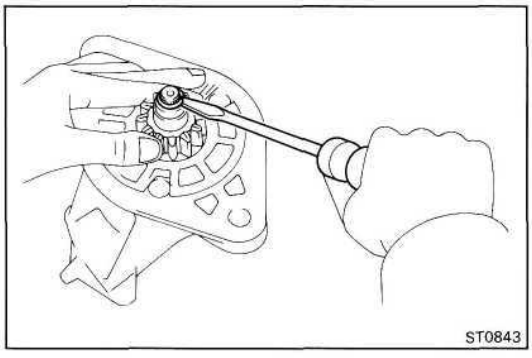


3. IF NECESSARY, REPLACE CLUTCH ASSEMBLY

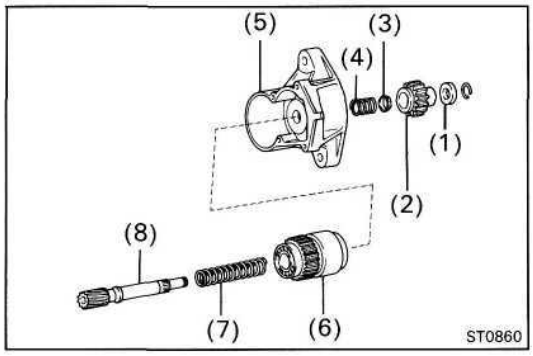
A. Disassembly starter housing and clutch assembly

(a) Push down the pinion gear and starter housing.

(b) Using a plastic-faced hammer, tap in the stop collar.



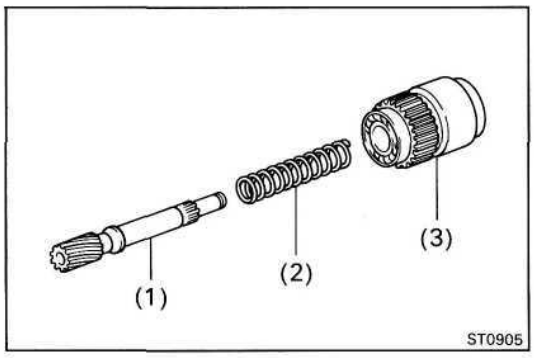
(c) Using a screwdriver, pry out the snap ring.



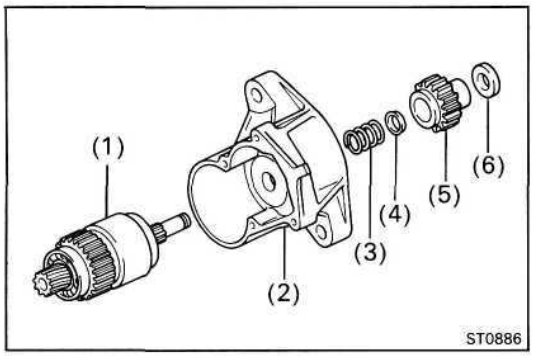
(d) Disassembly the following parts:
(1) Stop collar
(2) Pinion gear
(3) Retainer
(4) Compression spring
(5) Starter housing
(6) Starter clutch
(7) Compression spring
(8) Clutch shaft

B. Assemble starter housing and clutch assembly

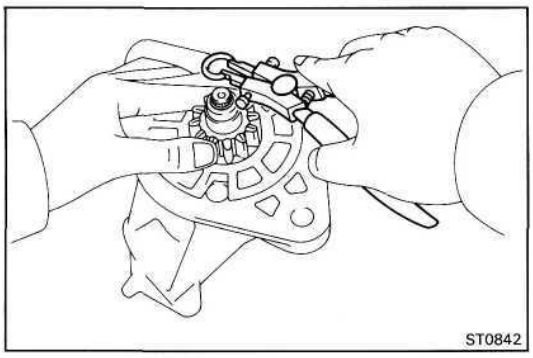
(a) 1st, assemble the following parts:
(1) Clutch shaft
(2) Compression spring
(3) Starter clutch



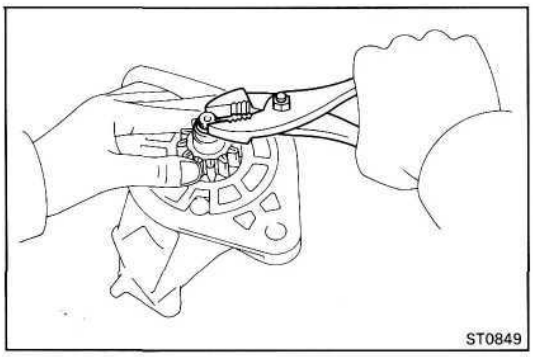
(b) 2nd, assemble the following parts:
(1) Clutch shaft and starter shaft assembly
(2) Starter housing
(3) Compression spring
(4) Retainer
(5) Pinion gear
(6) Stop collar

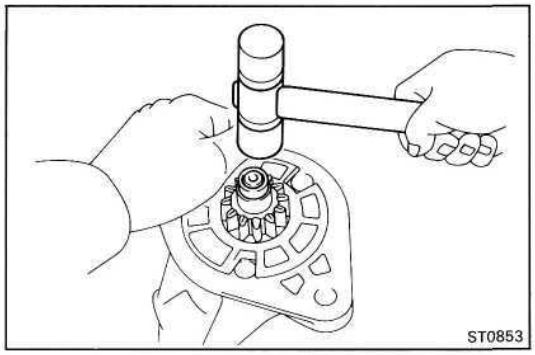


(c) Push down the pinion gear and starter housing.
(d) Using snap ring pliers, install the snap ring.

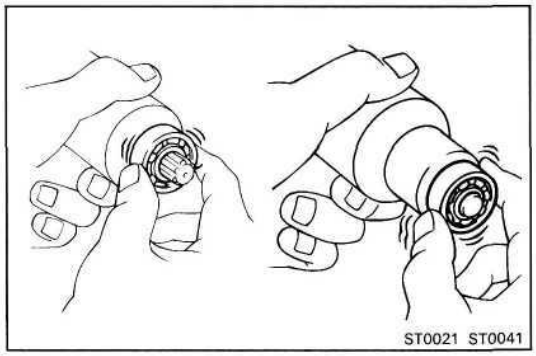


(e) Using pliers, compress the snap ring.
(f) Check that the snap ring fits correctly.





(g) Using a plastic-faced hammer, tap the clutch shaft and install the stop collar onto the snap ring.

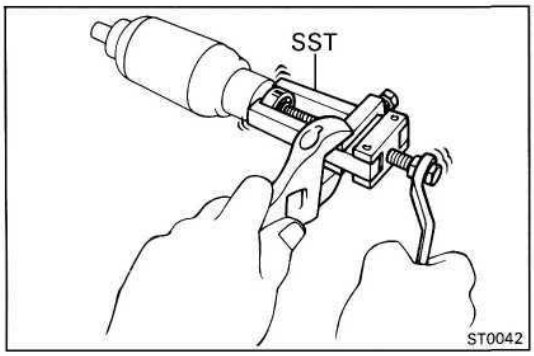


Bearings

1. INSPECT BEARINGS

Turn each bearing by hand while applying inward force.

If resistance is felt or if the bearing sticks, replace the bearing.

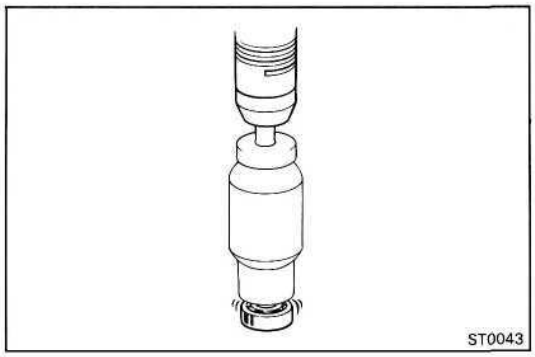


2. IF NECESSARY, REPLACE BEARINGS

A. Remove bearings

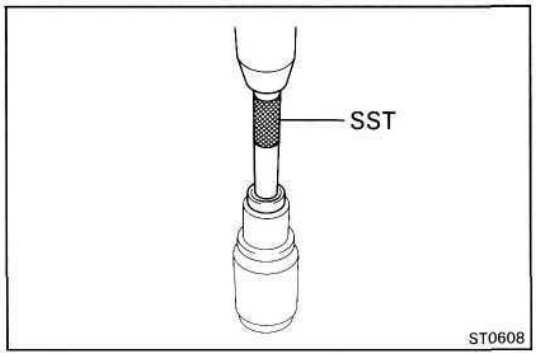
Using SST, remove the bearing.

SST 09286-46011



B. Install bearings
(Front)

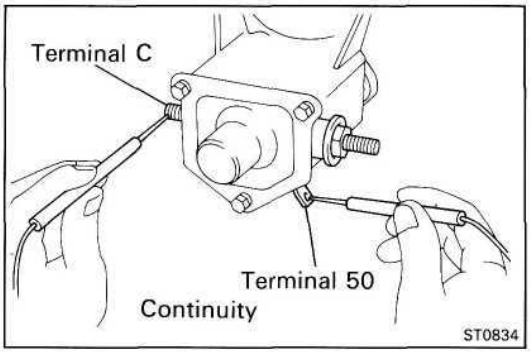
Using a press, press in a new bearing.



(Rear)

Using SST and a press, press in a new bearing.

SST 09285-76010

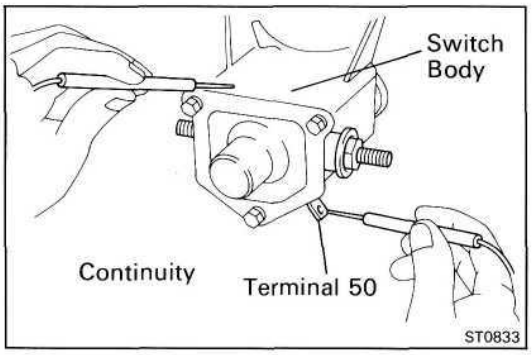


Magnetic Switch

1. PERFORM PULL-IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminals 50 and C.

If there is no continuity, replace the magnetic switch.



2. PERFORM HOLD-IN COIL OPEN CIRCUIT TEST

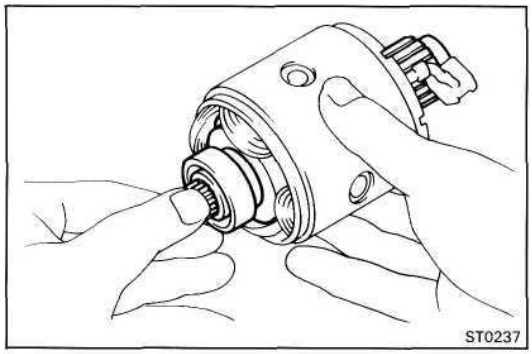
Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

If there is no continuity, replace the magnetic switch.

ASSEMBLY OF STARTER

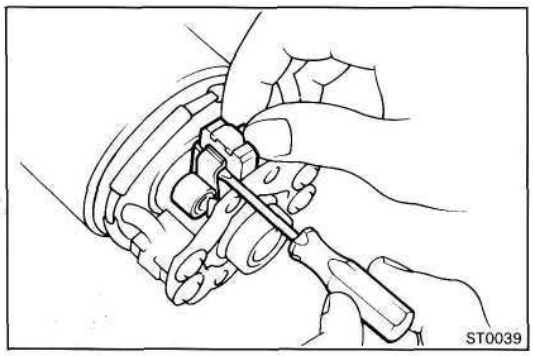
(See **pageST-15)**

HINT: Use high-temperature grease to lubricate the bearings and gears when assembling the starter.



1. PLACE ARMATURE INTO FIELD FRAME

Apply grease to the armature bearings, and insert the armature into the field frame.

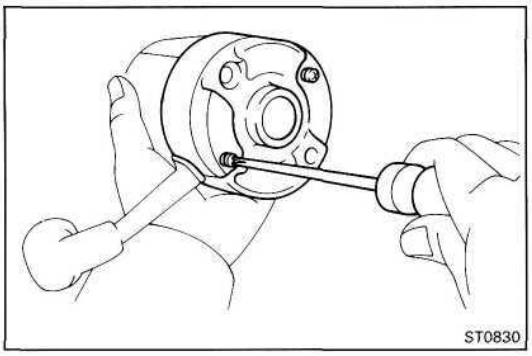


2. INSTALL BRUSH HOLDER

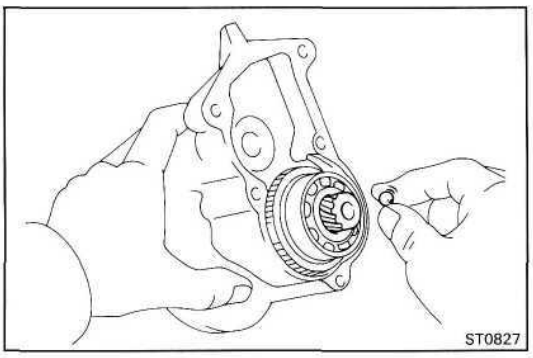
(a) Place the brush holder on the armature.

(b) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder. Connect the four brushes.

HINT: Check that positive (+) lead wires are not grounded.



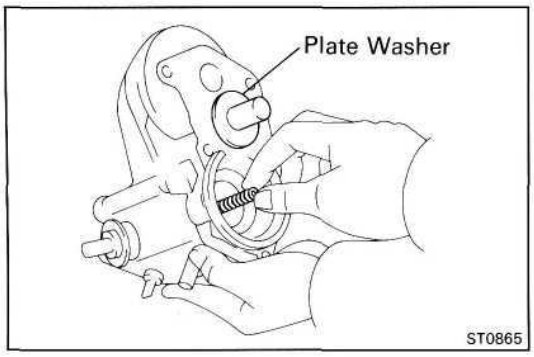
(c) Install the end cover with the two screws.



3. INSERT STEEL BALL INTO CLUTCH SHAFT HOLE

(a) Apply grease to the steel ball.

(b) Insert the steel ball into the clutch shaft hole.

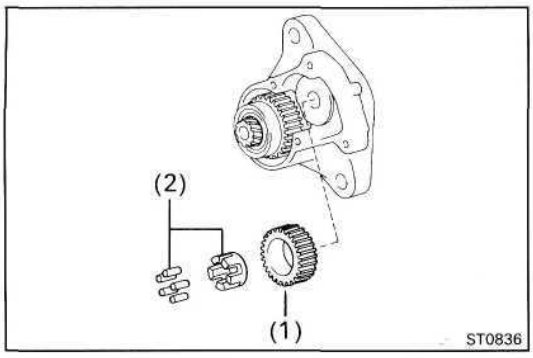


4. INSTALL GEAR, CLUTCH ASSEMBLY AND STARTER HOUSING

(a) Apply grease to the return spring.

(b) Insert the return spring into the magnetic switch hole.

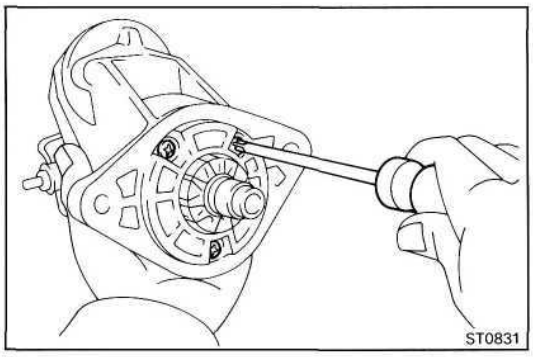
(c) Install the plate washer to the magnetic switch.



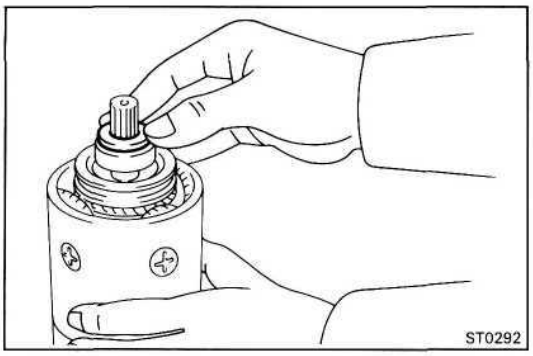
(d) Install the following parts to the starter housing:

(1) Idler gear

(2) Bearing

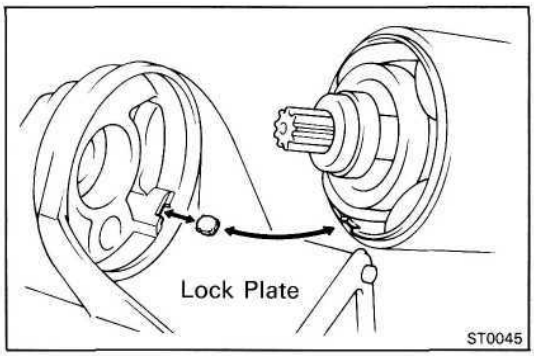


(e) Assemble the starter housing and magnetic switch with the three screws.



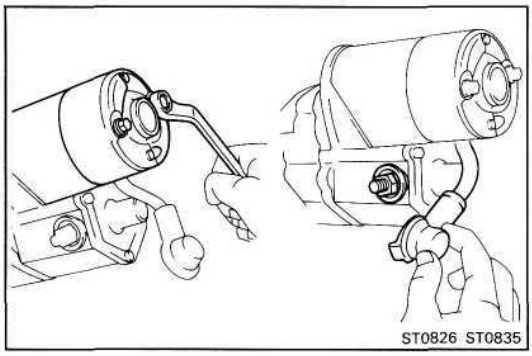
5. INSTALL FIELD FRAME AND ARMATURE ASSEMBLY

(a) Install a new felt washer to the armature.



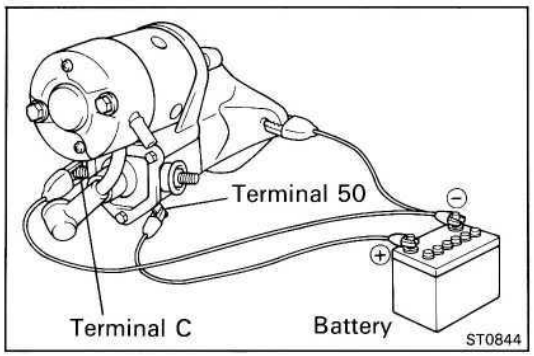
(b) Install the lock plate to the cutout portion of the magnetic switch.

(c) Align the lock plate with the cutout portion of the field frame.



(d) Install the field frame and armature assembly with two new O-rings, the two plate washers, spring washers and two through bolts.

(e) Connect the lead wire to terminal C, and install the spring washer and nut.



PERFORMANCE TEST OF STARTER

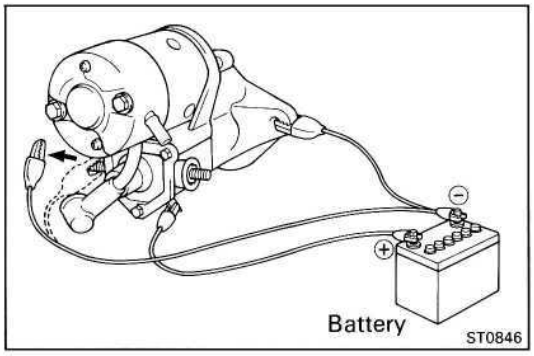
NOTICE: These tests must be performed within 3 to 5 seconds to avoid burning out the coil.

1. PERFORM PULL-IN TEST

(a) Disconnect the field coil lead wire from terminal C.

(b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.

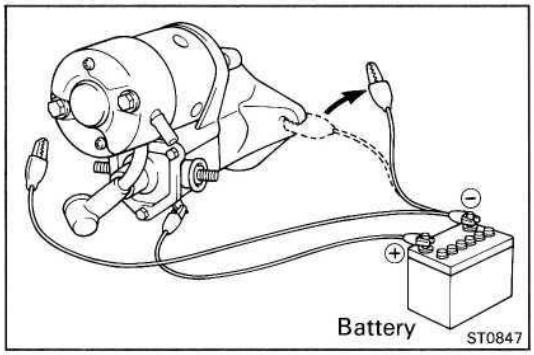
If the clutch pinion gear does not move, replace the magnetic switch assembly.



2. PERFORM HOLD-IN TEST

While connected as above with the clutch pinion gear out, disconnect the negative (-) lead from terminal C. Check that the pinion gear remains out.

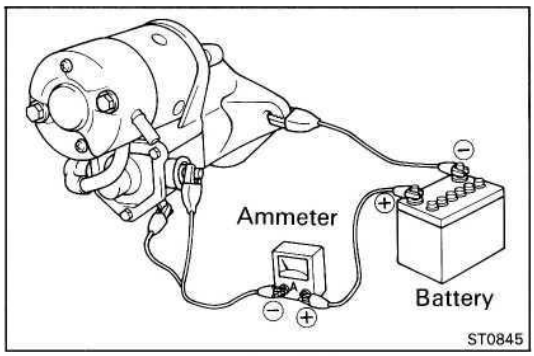
If the clutch pinion gear returns inward, replace the magnetic switch assembly.



3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (-) lead from the switch body. Check that the clutch pinion gear returns inward.

If the clutch pinion gear does not return, replace the magnetic switch assembly.



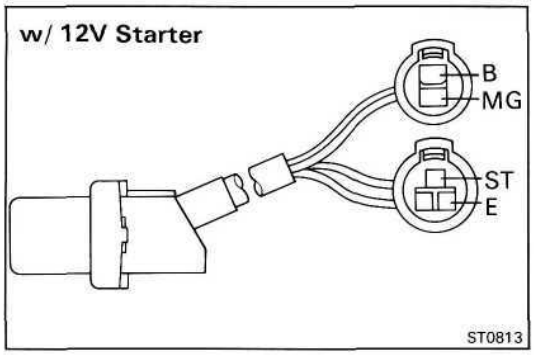
4. PERFORM NO-LOAD PERFORMANCE TEST

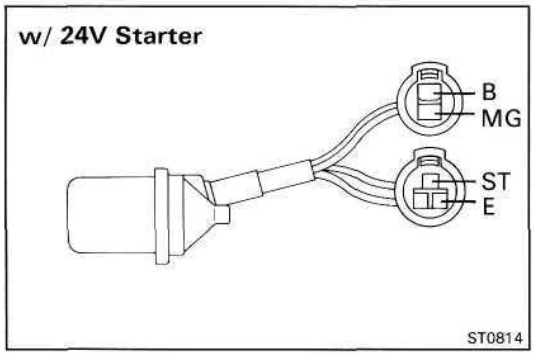
(a) Connect the battery and ammeter to the starter as shown.

(b) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the ammeter shows the specified current.

Specified current:

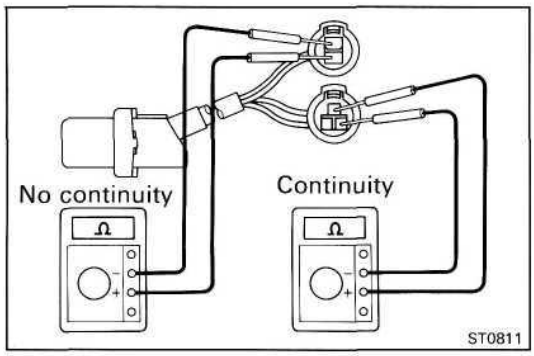
12 V type 180 A or less at 11 V
24 V type 90 A or less at 23 V





STARTER RELAY (PZJ, HZJ and HDJ)

LOCATION: In the engine compartment on the left side.



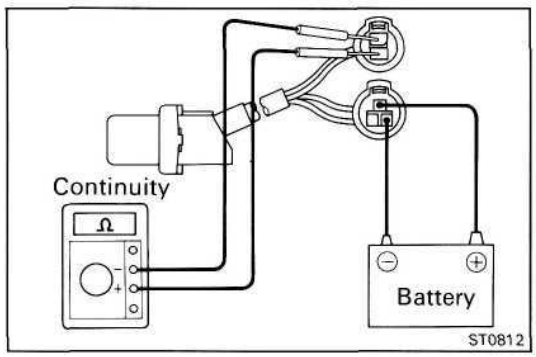
INSPECTION OF STARTER RELAY

1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals E and ST.

(b) Check that there is no continuity between terminals B and MG.

If continuity is not as specified, replace the relay.



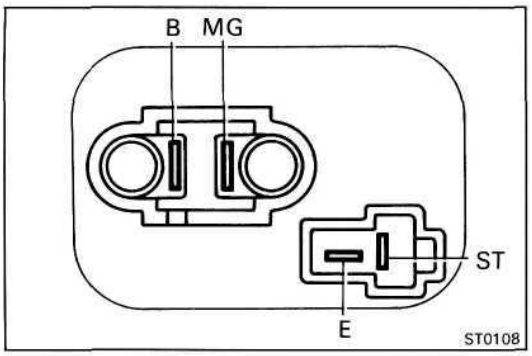
2. INSPECT RELAY OPERATION

(a) Apply battery voltage across terminals E and ST.

NOTICE: If the vehicle has a voltage coverter, **perform the check using a 12 V battery.**

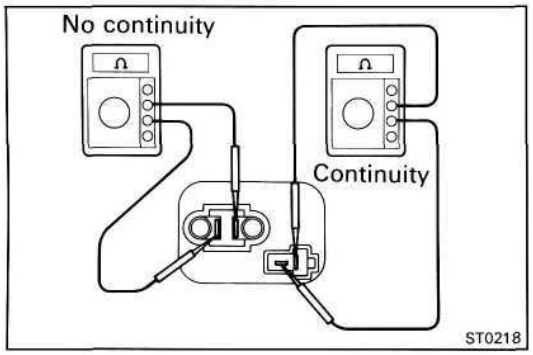
(b) Using an ohmmeter, check that there is continuity between terminals B and MG.

If operation is not as specified, replace the relay.



STARTER RELAY (HZB and HDB)

LOCATION: Inside wall adjacent to center door.



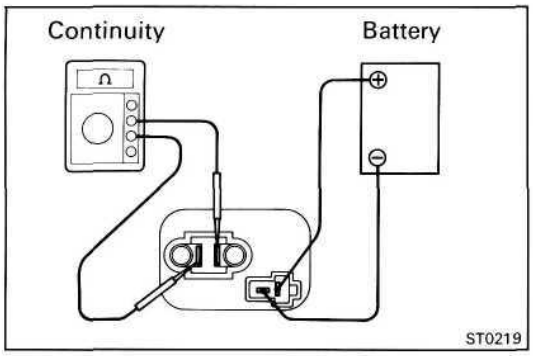
INSPECTION OF STARTER RELAY

1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals E and ST.

(b) Check that there is no continuity between terminals B and MG.

If continuity is not as specified, replace the relay.



2. INSPECT RELAY OPERATION

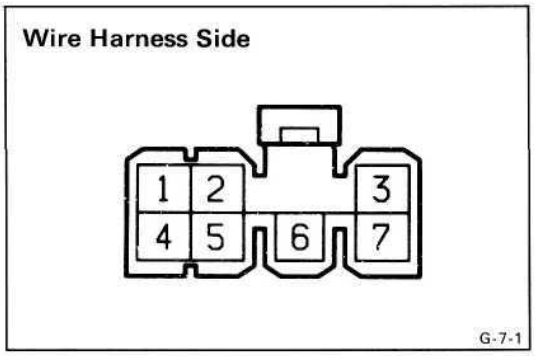
(a) Apply battery voltage across terminals E and ST.

(b) Using an ohmmeter, check that there is continuity between terminals B and MG.

If operation is not as specified, replace the relay.

VOLTAGE CONVERTER TIMER (HZJ80 and HDJ80) (w/ 24 V Starter)

LOCATION: In the cowl on the passenger's side.

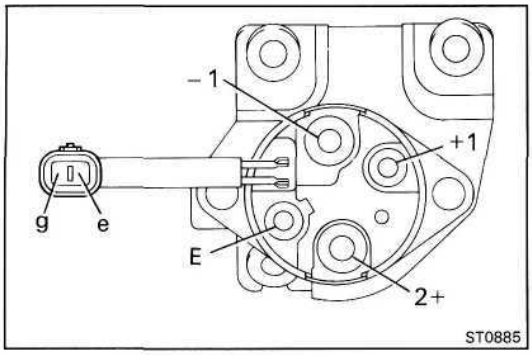


INSPECTION OF VOLTAGE CONVERTER TIMER

INSPECT VOLTAGE CONVERTER TIMER

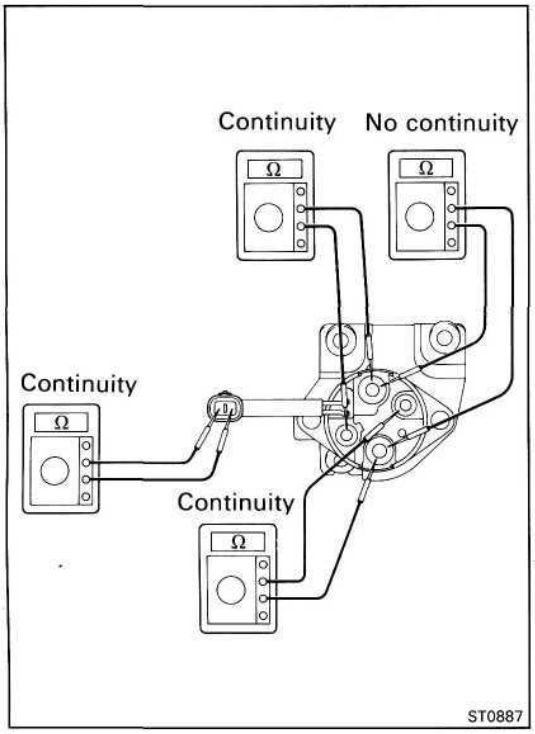
Disconnect the connector from the voltage converter timer, and check the connector on the wire harness side as shown in the following chart.

Check for	Tester connection	Condition	Specified value
Voltage	1 – Ground	Turn starter switch OFF	No voltage
		Turn starter switch START	Battery voltage
Voltage	2 – Ground	Turn starter switch OFF	No voltage
		Turn starter switch ON	Battery voltage
Voltage	3 – Ground	Turn starter switch OFF	No voltage
		Turn starter switch START	Battery voltage
Continuity	4 – Ground	–	Continuity
Continuity	5 – 6	–	Continuity
Continuity	7 – Ground	–	Continuity



VOLTAGE CONVERTER RELAY (HZJ80and HDJ80) (w/24 V Starter)

LOCATION: In the engine compartment on the left side.



INSPECTION OF VOLTAGE CONVERTER RELAY

1. INSPECT RELAY CONTINUITY

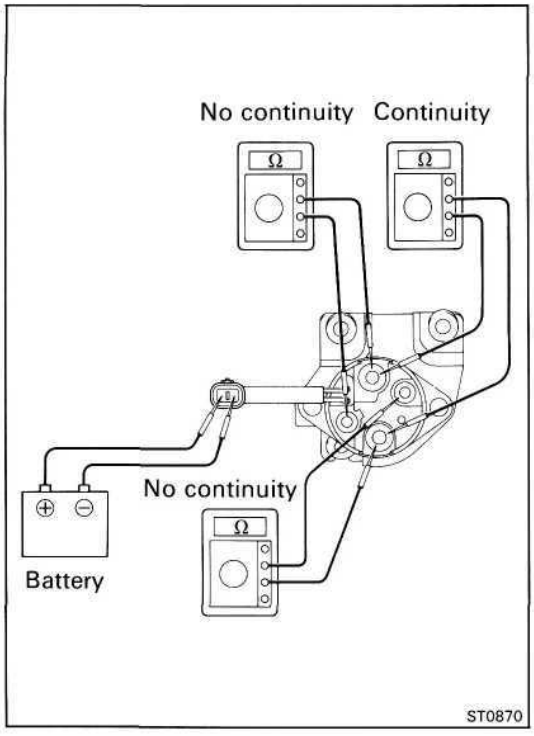
(a) Using an ohmmeter, check that there is continuity between terminals e and g.

(b) Check that there is continuity between terminals 1 - and E.

(c) Check that there is continuity between terminals 1 + and 2+.

(d) Check that there is no continuity between terminals 1 - and 2+.

If continuity is not as specified, replace the relay.



2. INSPECT RELAY OPERATION

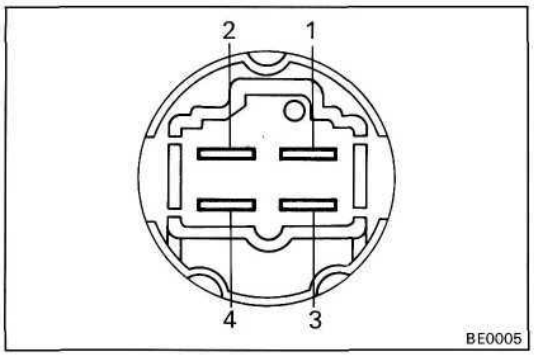
(a) Apply battery voltage across terminals e and g.

(b) Using an ohmmeter, check that there is continuity between terminals 1 - and 2+.

(c) Check that there is no continuity between terminals 1+ and 2+.

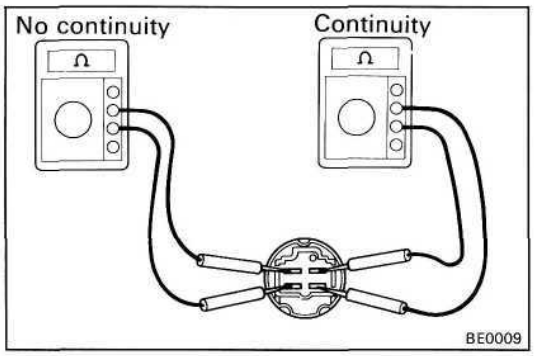
(d) Check that there is no continuity between terminals 1 - and E.

If operation is not as specified, replace the relay.



24 V HOLD WARNING RELAY (HZJ80and HDJ80) (w/ 24 V Starter)

LOCATION: In the driver's cowl side.



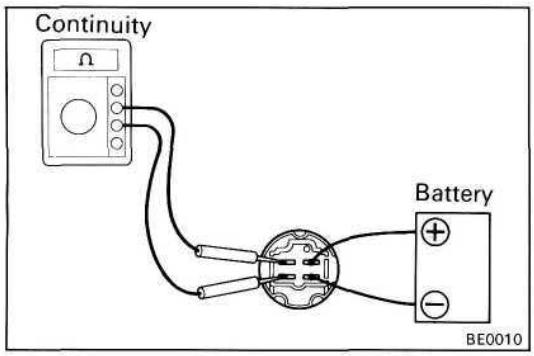
INSPECTION OF 24 V HOLD WARNING RELAY

1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 3.

(b) Check that there is no continuity is not as specified, replace the terminals 2 and 4.

If continuity is not as specified, replace the relay.



2. INSPECT RELAY OPERATION

(a) Apply battery voltage across terminals 1 and 3.

(b) Using an ohmmeter, check that there is continuity between terminals 2 and 4.

If operation is not as specified, replace the relay.

CHARGING SYSTEM

PRECAUTIONS

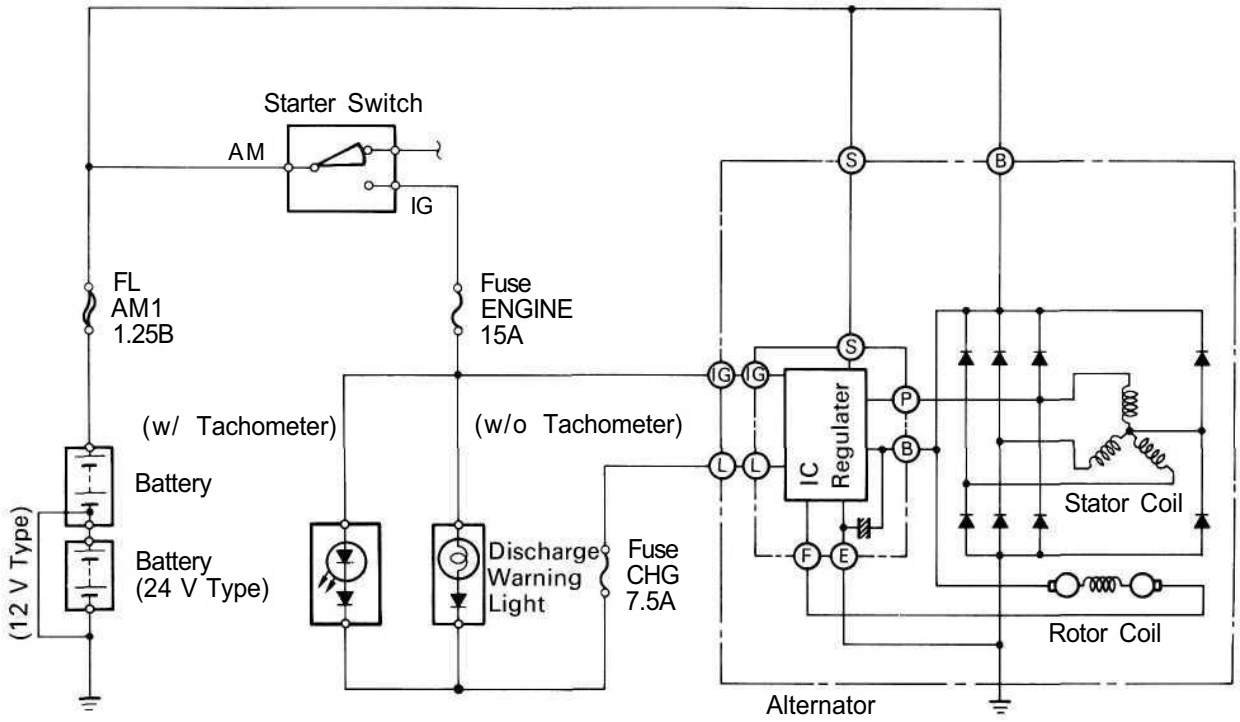
1. Check that the battery cables are connected to the correct terminals.
2. Disconnect the battery cables when the battery is given a quick charge.
3. Do not perform tests with a high voltage insulation resistance tester.
4. Never disconnect the battery while the engine is running.

TROUBLESHOOTING

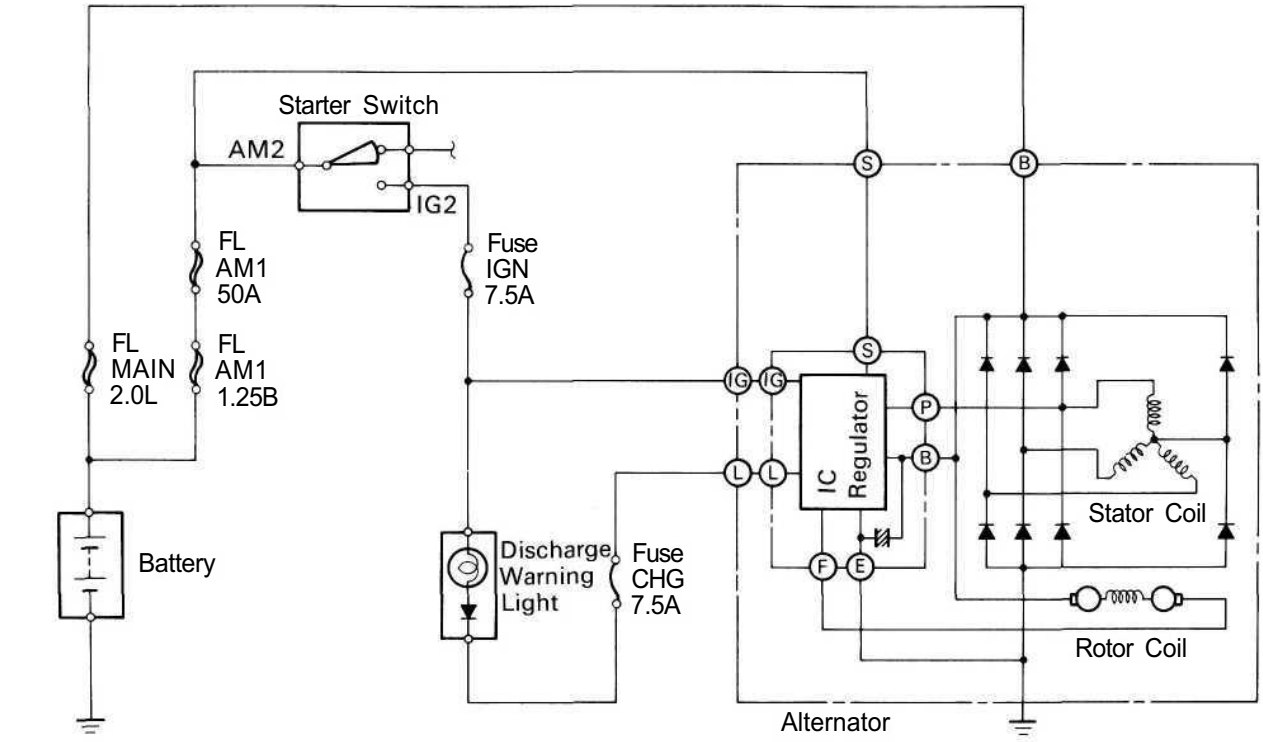
Problem	Possible cause	Remedy	Page
Discharge warning light does not light with starter switch at "ON" and engine not running	Fuse blown	Check fuses	
	Light burned out	Replace light	
	Wiring connection loose	Tighten loose connection	
	IC regulator faulty	Replace IC regulator	CH-8
Discharge warning light does not go out with engine running (battery requires frequent recharging)	Drive belt loose or worn	Adjust or replace drive belt	CH-5
	Battery cables loose, corroded or worn	Repair or replce cables	
	Fuse blown	Check fuse	
	Fusible link blown	Replace fusible link	
	IC regulator or alternator faulty	Check charging system	CH-5
	Wiring faulty	Repair wiring	

CHARGING SYSTEM CIRCUIT

PZJ70,73,75**and HZJ**70,73,75



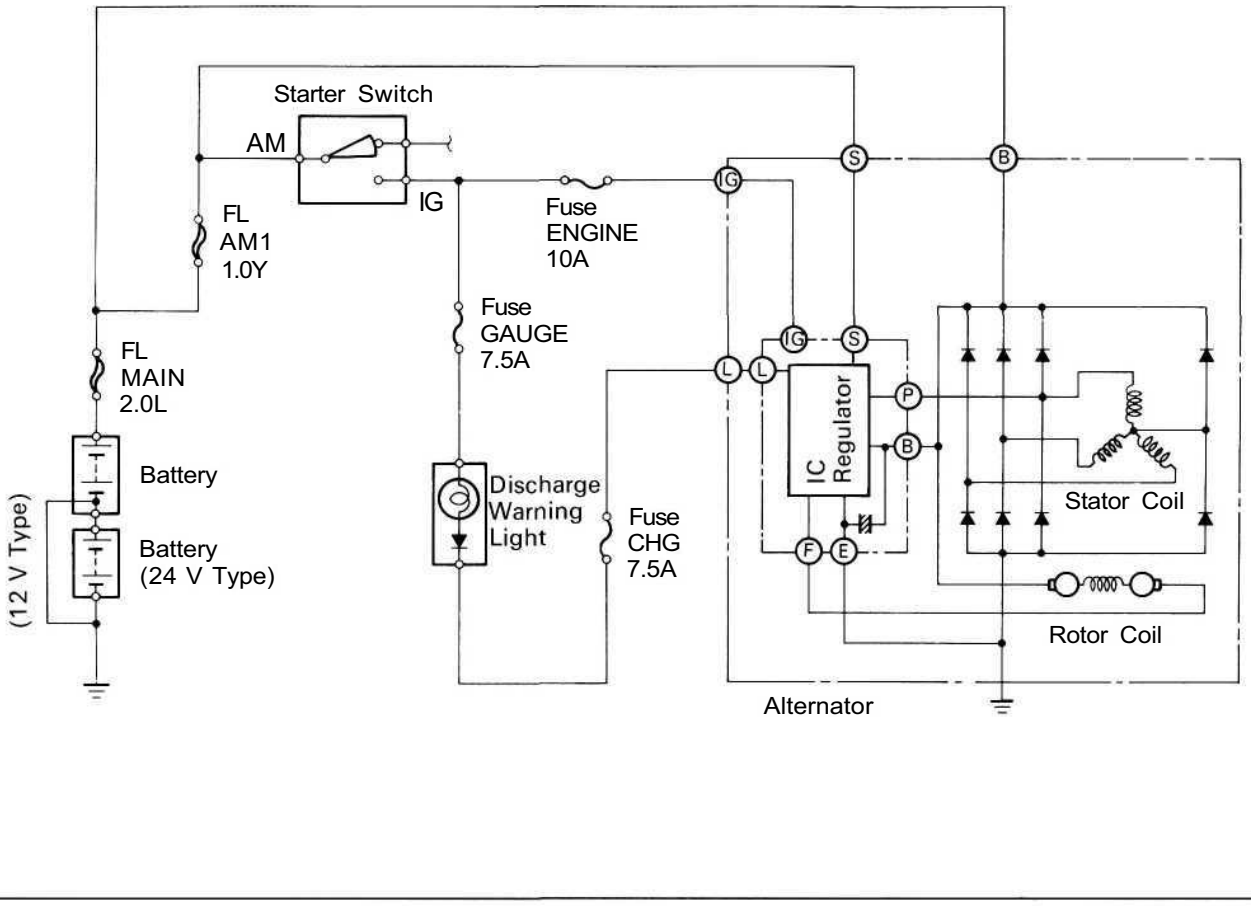
HZJ80**and HDJ**80



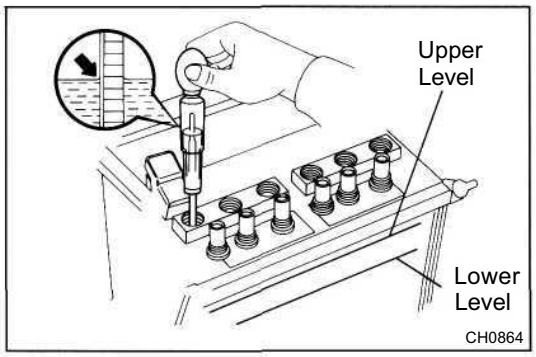
ST0884
ST0883

CHARGING SYSTEM CIRCUIT (Cont'd)

HZB 30 and HDB 30



ST0882



ON-VEHICLE INSPECTION

1. INSPECT BATTERY SPECIFIC GRAVITY AND ELECTROLYTE LEVEL

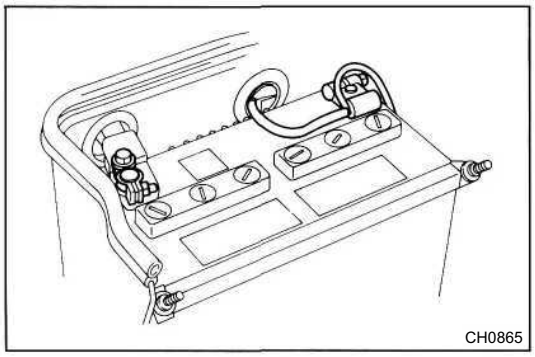
(a) Check the specific gravity of each cell.

Standard specific gravity:
When fully charged at 20°C (68°F)
1.25-1.27 (ex. (95D31 R and 95D31L))
1.27 -1.29 (95D31R and 95D31L)

If not as specified, charge the battery.

(b) Check the electrolyte quantity of each cell.

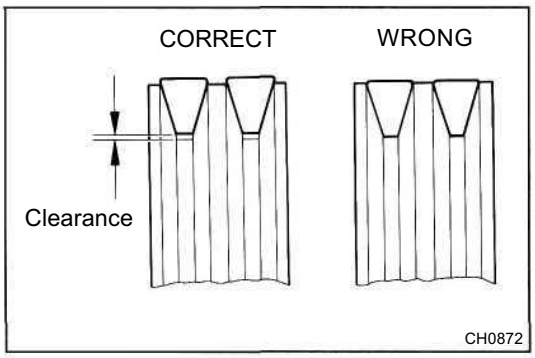
If insufficient, refill with distilled (or purified) water.



2. CHECK BATTERY TERMINALS, FUSIBLE LINKS AND FUSES

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

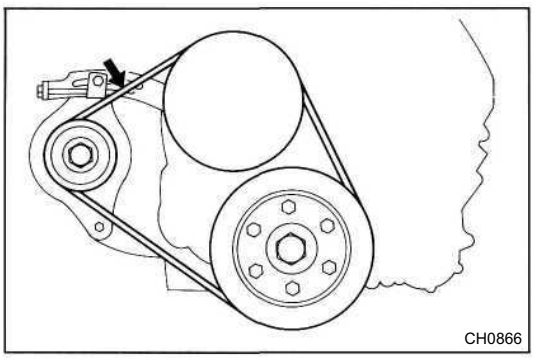
(b) Check the fusible links and fuses for continuity.



3. INSPECT DRIVE BELTS

(a) Visually check each belt for cracks, oiliness or wear. Check that the belt does not touch the bottom of the pulley groove.

If one belt has any of the above defects, replace both belts.



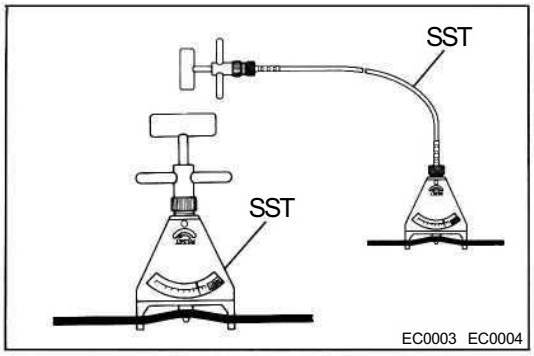
(b) Check the drive belt deflection by pressing on the belt at the points indicated in the illustration with 10 kg (22.0 lb, 98 N) of pressure.

Drive belt deflection:
New belt 6-7 mm (0.24-0.28 in.)
Used belt 8-11 mm (0.31 -0.43 in.)

If the deflection is not as specified, adjust it.

HINT:

- "New belt" refers to a belt which has been used 5 minutes or less 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 new belt, run the engine for about 5 minutes and recheck the deflection.

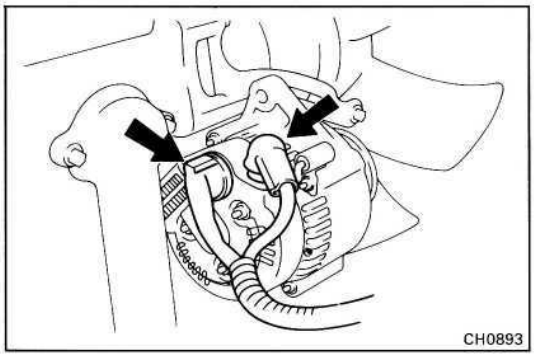


(c) (Reference)
Using SST, measure the drive belt tension.

SST 09216-00020 and 09216-00030

Drive belt tension: New belt 45-55 kg
Used belt 20-35 kg

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



4. VISUALLY CHECK ALTERNATOR 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 alternator while the engine is running.

5. INSPECT DISCHARGE WARNING LIGHT CIRCUIT

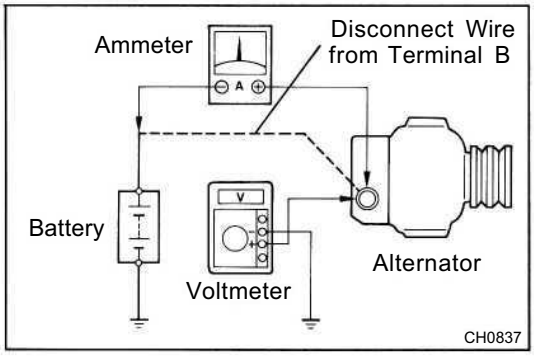
(a) Warm up the engine and then turn it off.

(b) Turn off all accessories.

(c) Turn the starter switch to "ON". Check that the discharge warning light is lit.

(d) Start the engine. Check that the light goes out.

If the light does not operate as specified, troubleshoot the discharge light circuit.

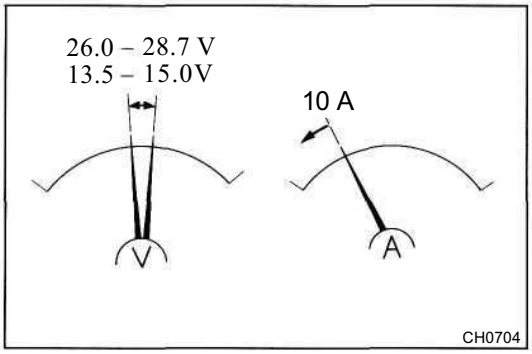


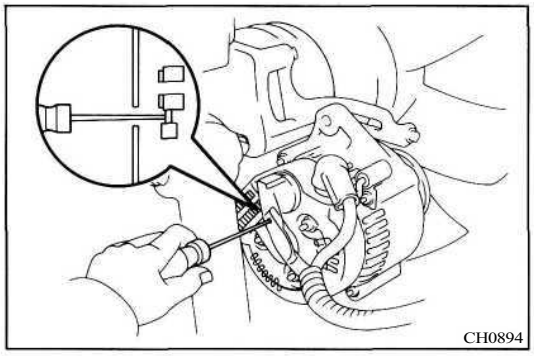
6. INSPECT CHARGING CIRCUIT WITHOUT LOAD

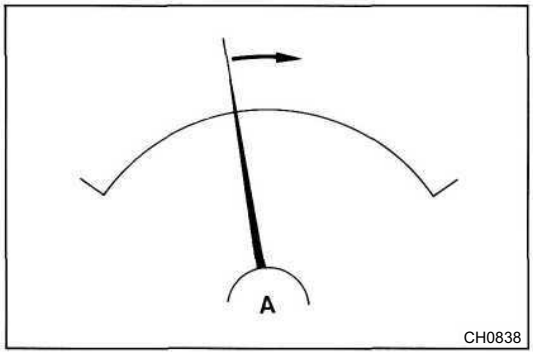
HINT: If a battery/alternator tester is available, connect the tester to the charging circuit as per manufacturer's instructions.

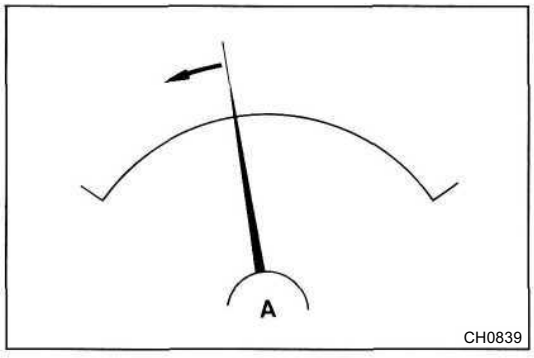
(a) If a tester is not available, connect a voltmeter and ammeter to the charging circuit as follows:

- Disconnect the wire from terminal B of the alternator and connect it to the negative (-) lead of the ammeter.
- Connect the positive (+) lead of the ammeter to terminal B of the alternator.
- Connect the positive (+) lead of the voltmeter to terminal B of the alternator.
- 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:

12 V type	**14.0-15.0 V at 25°C (77°F)**
	13.5-14.3 V at 135°C (275° F)
24 V type	**27.7-28.7 V at 25°C (77°F)**
	26.0-28.7 V at 135°C (275°F)

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

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

- With terminal F grounded, start the engine and check the voltmeter reading of terminalB.
- If the voltmeter reading is greater than standard , voltage, replace the IC regulator.
- If the voltmeter reading is less than standard voltage, check the alternator.

7. INSPECT CHARGING CIRCUIT WITH LOAD

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

(b) Check the reading on the ammeter.

Standard amperage:

12 V 45, 55, 60, 80 A type	**30 A or more**
12 V 100 A type	**40 A or more**
24 V 30 A type	**15 A or more**
24 V 55 A type	**30 A or more**

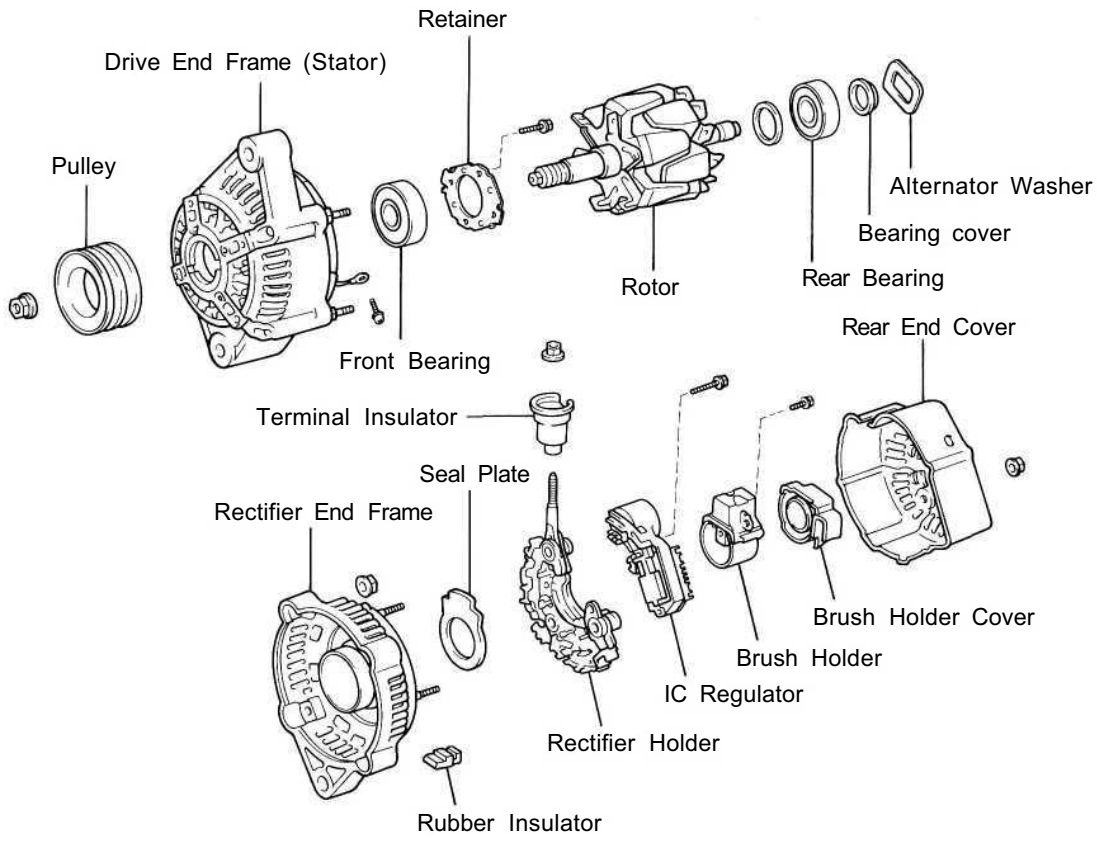
If the ammeter reading is less than standard amperage, repair the alternator. (See page CH-8)

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

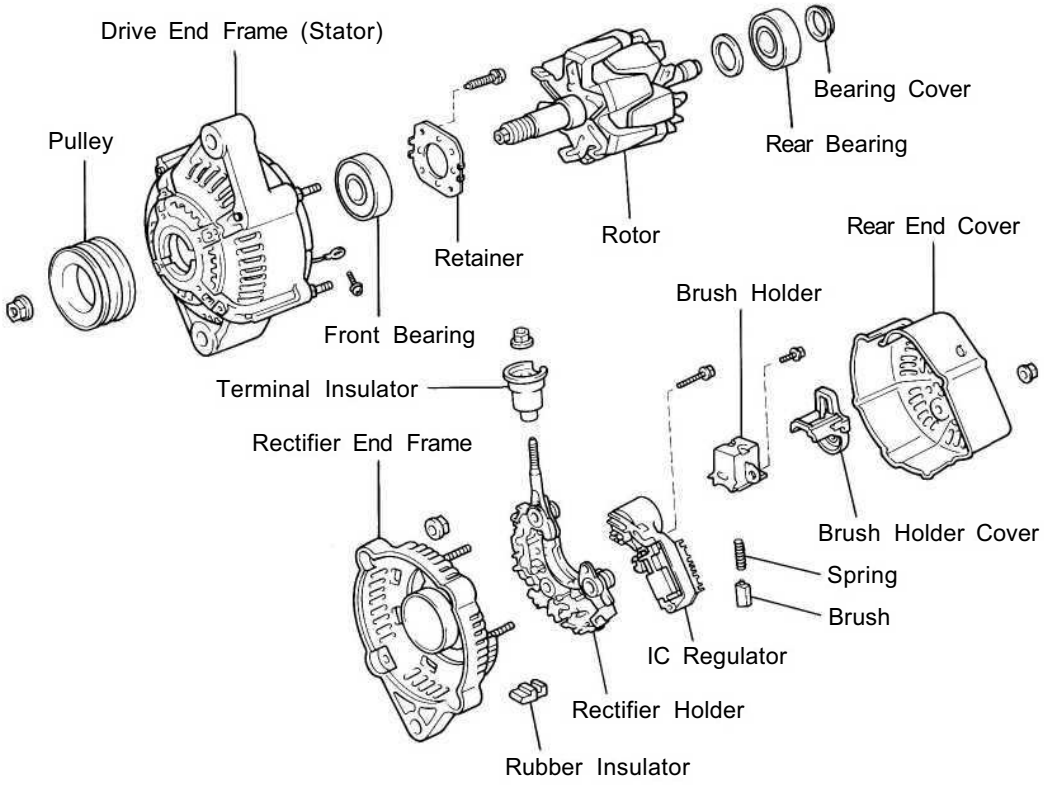
ALTERNATOR

COMPONENTS

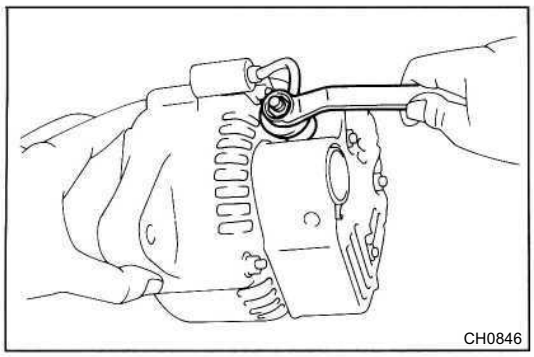
Type A



Type B



CH0857
CH0858



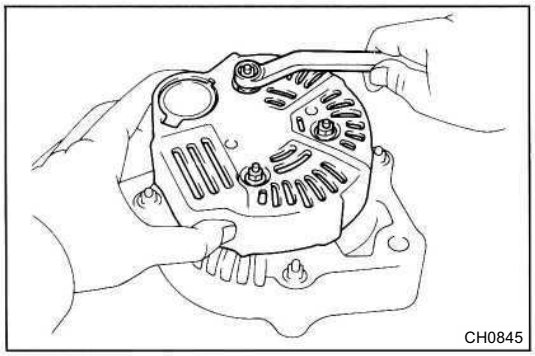
DISASSEMBLY OF ALTERNATOR

(See page CH-8)

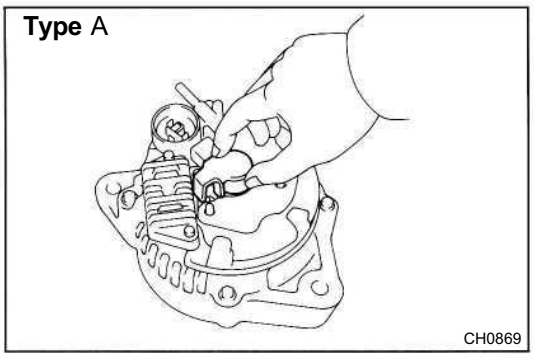
1. REMOVE REAR END COVER

(a) (PZJ, HZJ and HDJ)
Remove the nut, condenser lead wire and terminal insulator.

(b) (HZB and HDB)
Remove the nut and terminal insulator.

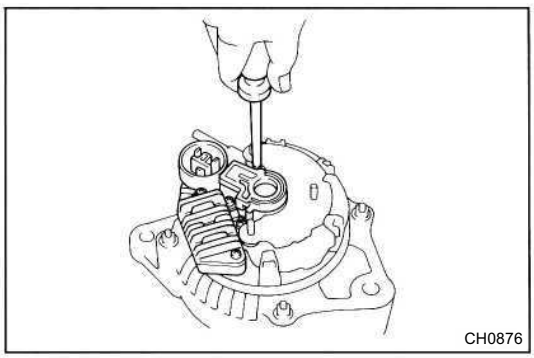


(c) Remove the three nuts and end cover.

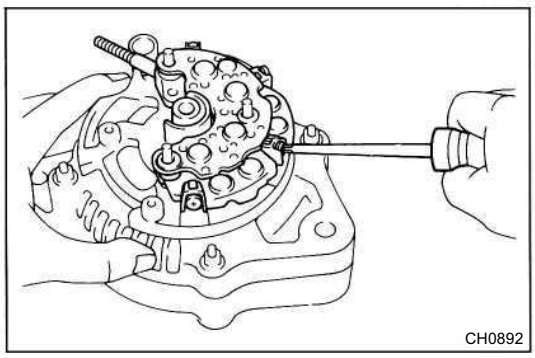


2. REMOVE BRUSH HOLDER AND IC REGULATOR

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

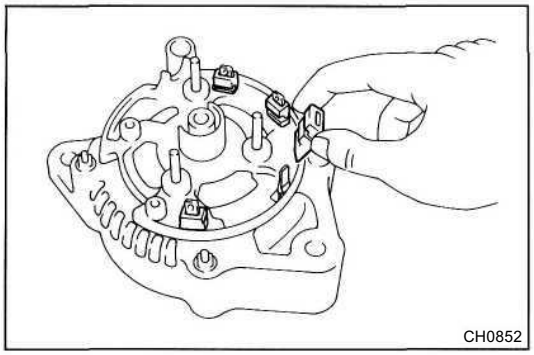


(b) Remove the five screws, brush holder, holder cover and IC regulator.

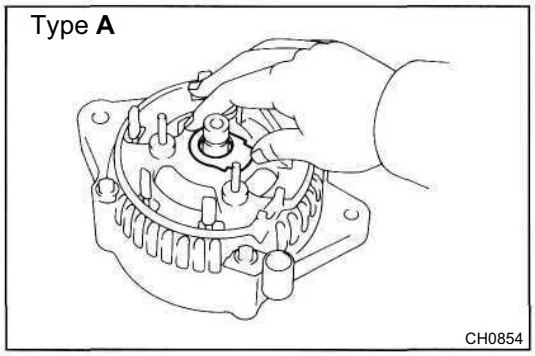


3. REMOVE RECTIFIER HOLDER

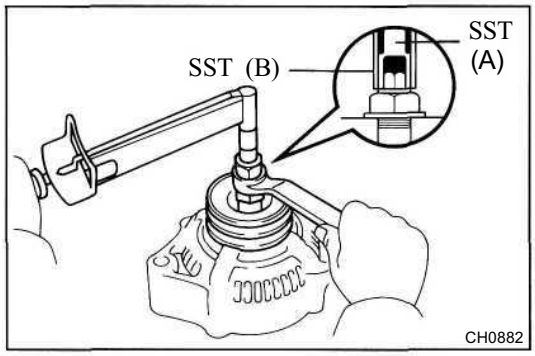
(a) Remove the four screws and rectifier holder.



(b) Remove the four rubber insulator.



(c) (Type A)
Remove the seal plate.



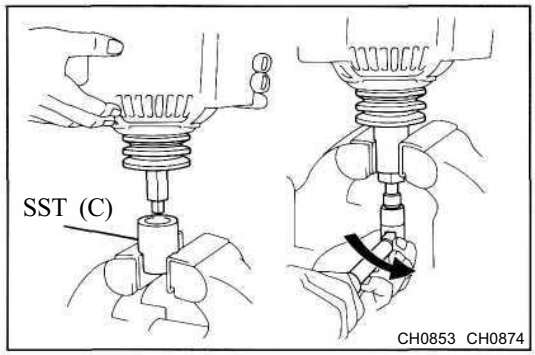
4. REMOVE PULLEY

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

SST 09820-63010

Torque: 400 kg-cm (29 ft-lb, 39 N-m)

(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 alternator to SST (C).

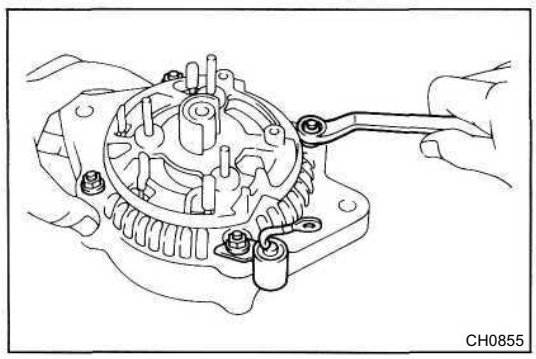
(d) To loosen the pulley nut, turn SST (A) in the direction shown in the illustration.

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

(e) Remove the alternator from SST (C).

(f) Turn SST (B) and remove SST (A and B).

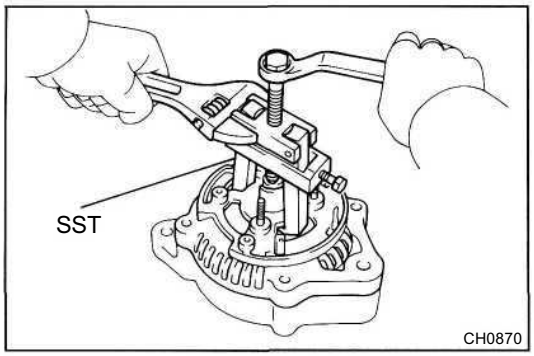
(g) Remove the pulley nut and pulley.



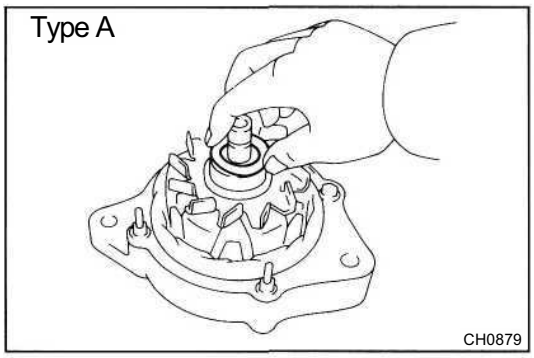
5. REMOVE RECTIFIER END FRAME

(a) (PZJ, HZJ and HDJ)
Remove the four nuts and condenser.

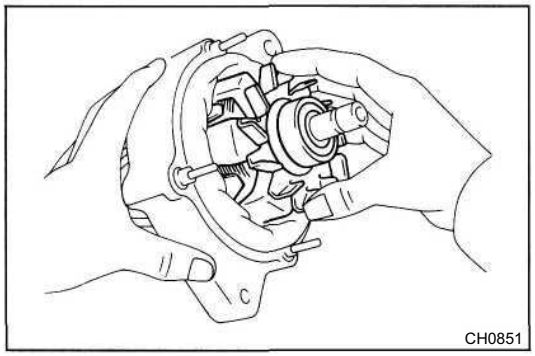
(b) (HZBandHDB)
Remove the four nuts.



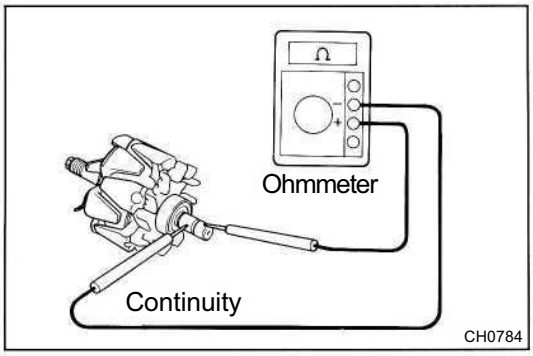
(c) Using SST, remove the rectifier end frame.
SST 09286-46011



(d) (Type A)
Remove the alternator washer.



6. REMOVE ROTOR FROM DRIVE END FRAME



INSPECTION AND REPAIR OF ALTERNATOR

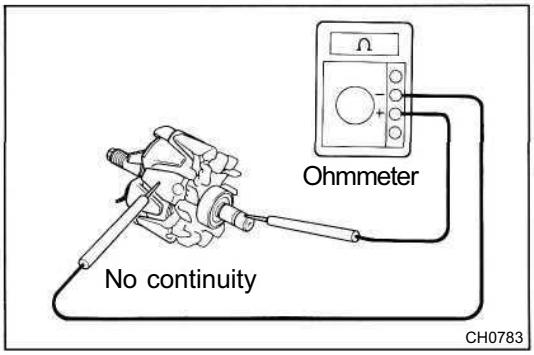
Rotor

1. INSPECT ROTOR FOR OPEN CIRCUIT

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

Standard resistance (cold): 12VType 2.7-3.1 Q
24 V Type 1.0-1.4Q

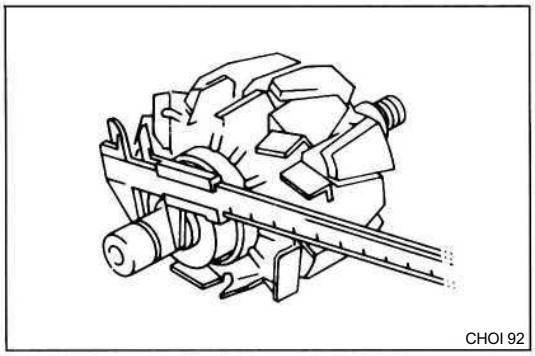
If there is no continuity, replace the rotor.



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.

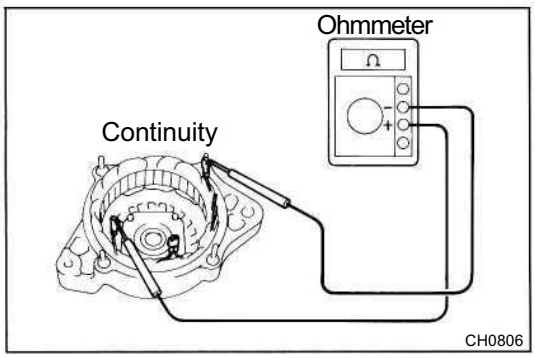
If rough or scored, replace the rotor.

(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.

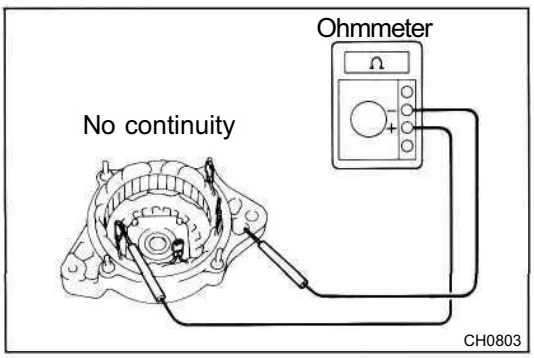


Stator (Drive End Frame)

1. INSPECT STATOR FOR OPEN CIRCUIT

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

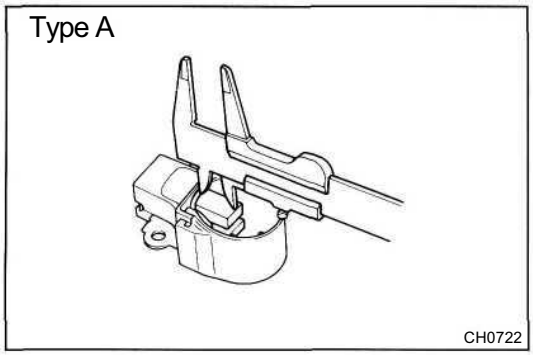
If there is no continuity, replace the drive end frame assembly.



2. INSPECT STATOR FOR GROUND

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

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



Brushes

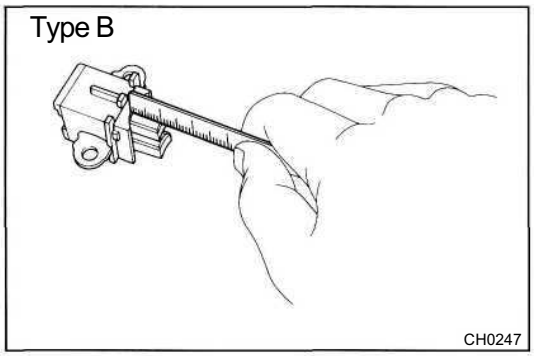
1. INSPECT EXPOSED BRUSH LENGTH

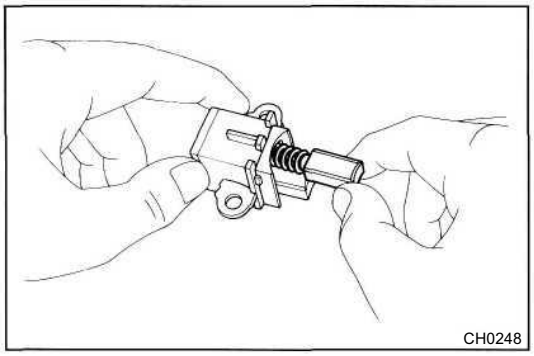
Using vernier calipers or scale, measure the exposed brush length.

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 and brush holder assembly (Type A) or brushes (Type B).

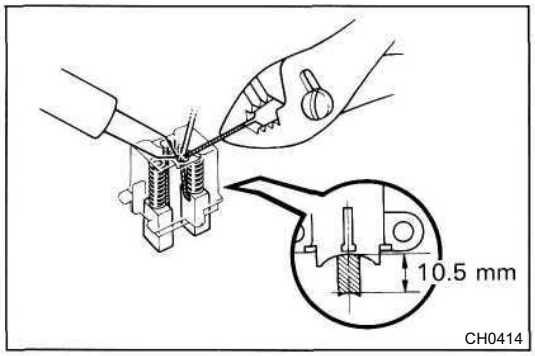




2. (Type B)
IF NECESSARY, REPLACE BRUSHES

(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.



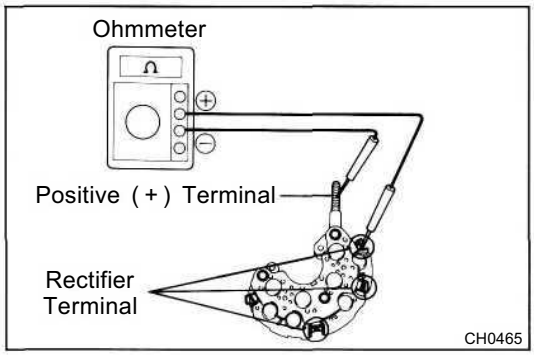
(c) Solder the brush wire to the brush holder at the exposed length.

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.

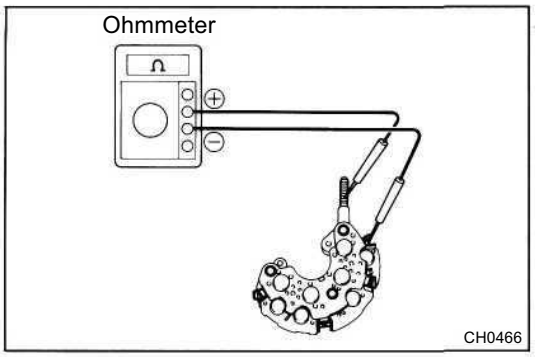
(f) Apply insulation paint to the soldered point.



Rectifiers (Rectifier Holder)

1. INSPECT POSITIVE SIDE RECTIFIER

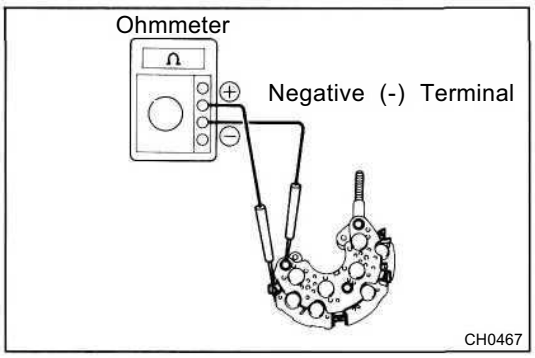
(a) Using an ohmmeter, connect one tester probe to the positive (+) terminal and the other to each rectifier terminal.



(b) Reverse the polarity of the tester probes and repeat step (a).

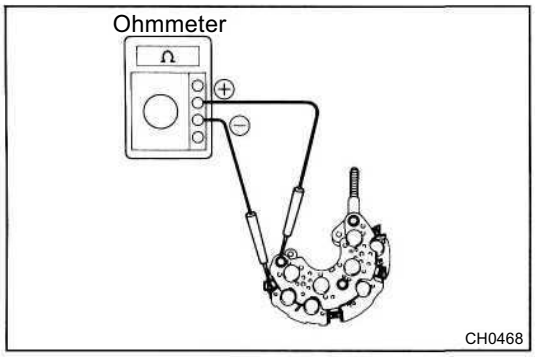
(c) Check that one shows continuity and the other shows no continuity.

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



2. INSPECT NEGATIVE SIDE RECTIFIER

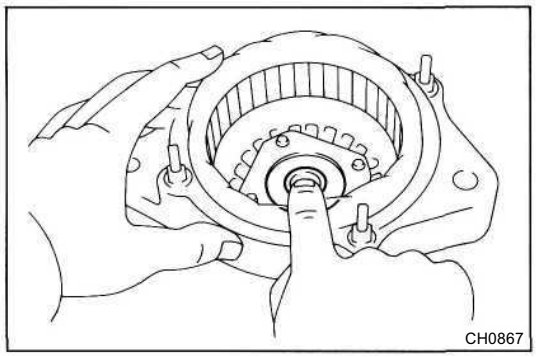
(a) Connect one tester probe to each rectifier terminal and the other to each rectifier negative (—) terminal.



(b) Reverse the polarity of the tester probes.

(c) Check that one shows continuity and the other shows no continuity.

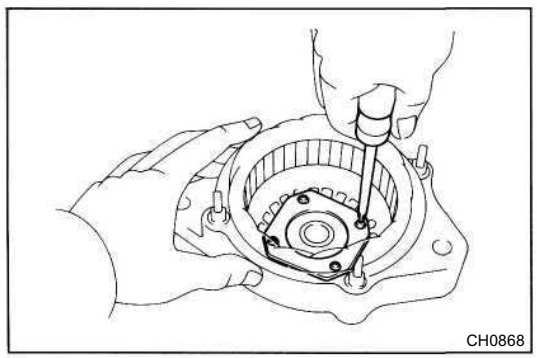
If continuity is not as specified, replace the rectifier holder.



Bearings

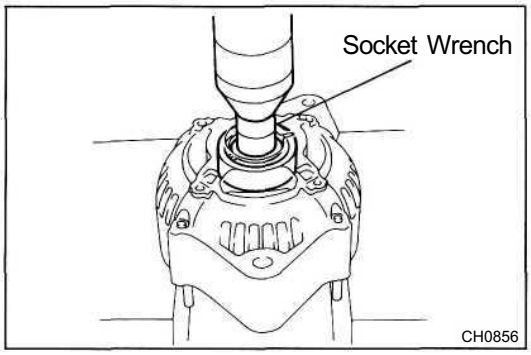
1. INSPECT FRONT BEARING

Check that the bearing is not rough or worn.

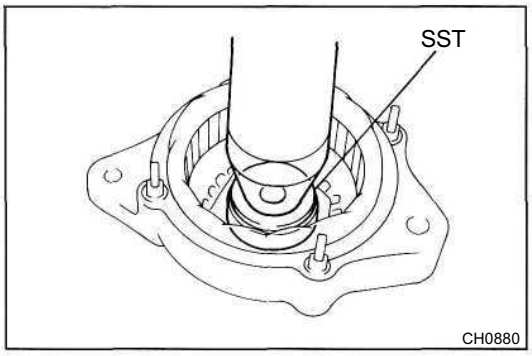


2. IF NECESSARY, REPLACE FRONT BEARING

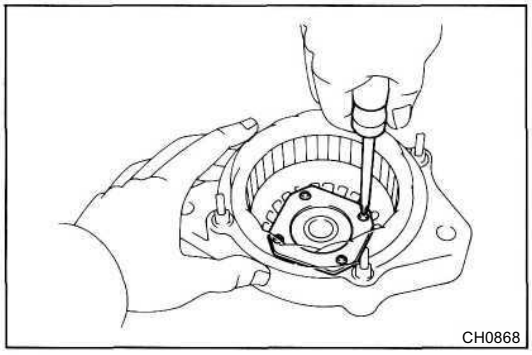
(a) Remove the four screws, and bearing retainer.



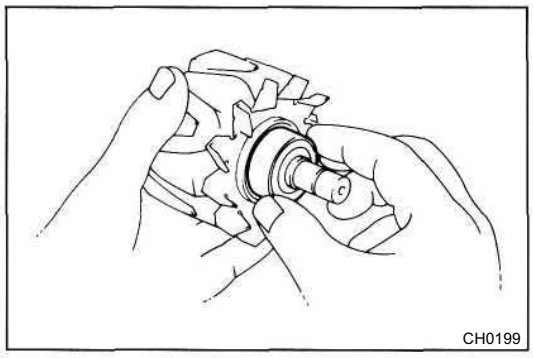
(b) Using a press and socket wrench, press out the front bearing.



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

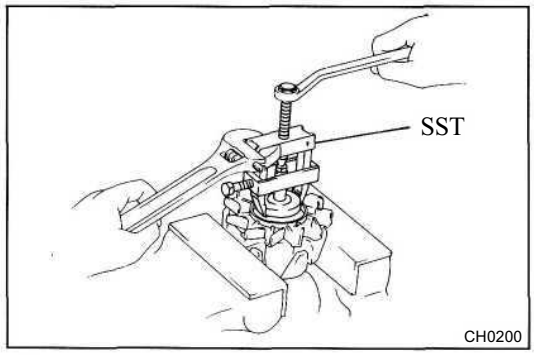


(d) Install the bearing retainer with the four screws.



3. INSPECT REAR BEARING

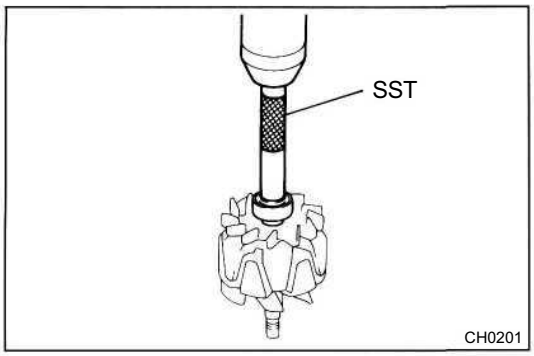
Check that the bearing is not rough or worn.



4. IF NECESSARY, REPLACE REAR BEARING

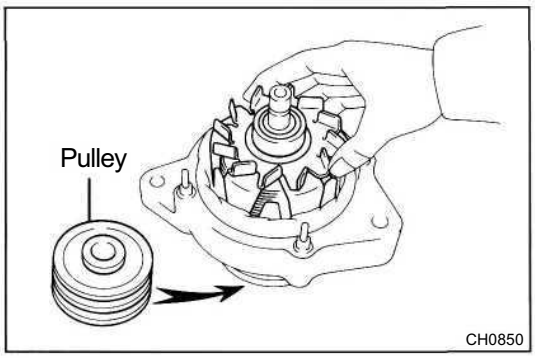
(a) Using SST, remove the bearing cover and bearing.
SST 09820-00021

NOTICE: Be careful not to damage the fan.



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

SST 09285-76010



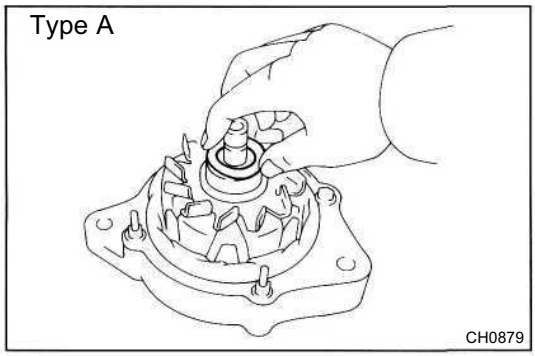
ASSEMBLY OF ALTERNATOR

(See page CH-8)

1. INSTALL ROTOR TO DRIVE END FRAME

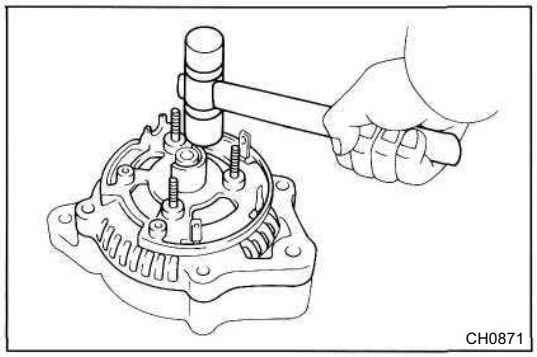
(a) Place the rectifier end frame on the pulley.

(b) Install the rotor to the rectifier end frame.

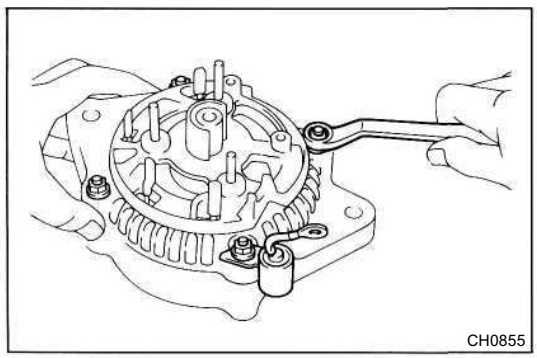


2. INSTALL RECTIFIER END FRAME

(a) (Type A)
Place the alternator washer on the rotor.

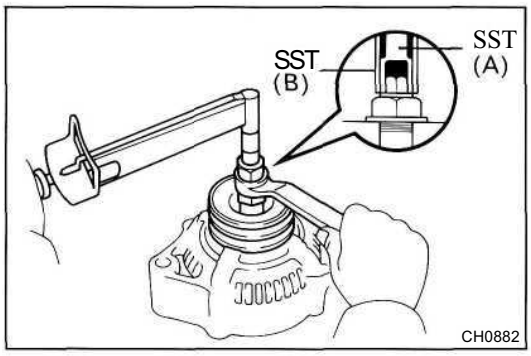


(b) Using a plastic-faced hammer, lightly tap in the end frame.



(c) (PZJ, HZJ and HDJ)
Install the codenser and four nuts.

(d) (HZBandHDB)
Install the four nuts.



3. INSTALL PULLEY

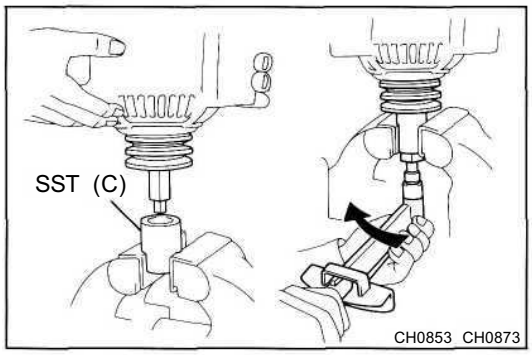
(a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.

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

SST 09820-63010

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

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



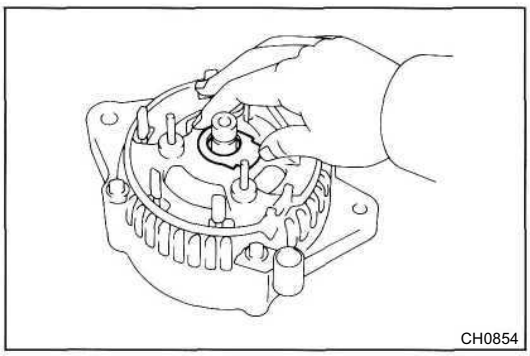
(d) As shown in the illustration, mount SST (C) in a vise, and install the alternator to SST (C).

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

Torque: 1,125 kg-cm (81 ft-lb, 110 N-m)

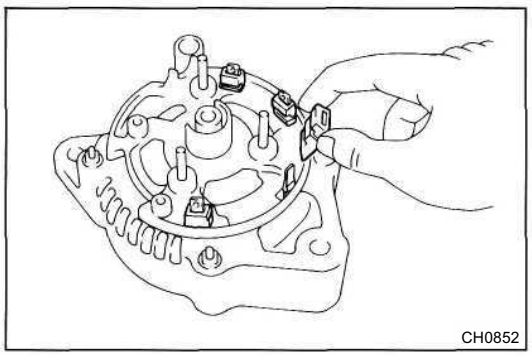
(f) Remove the alternator from SST (C).

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

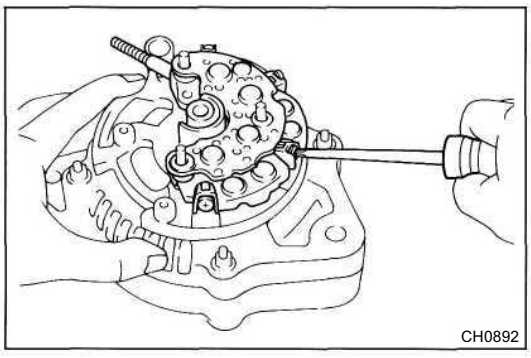


4. INSTALL RECTIFIER HOLDER

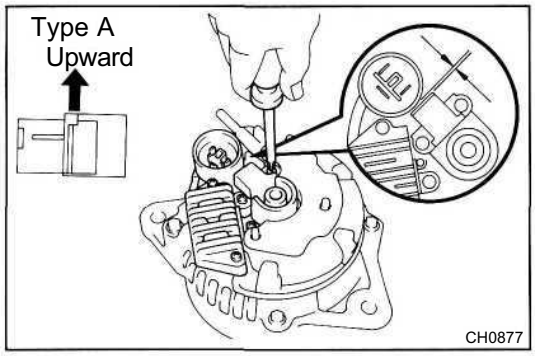
(a) (Type A)
Place the seal plate on the rectifier end frame.



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



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

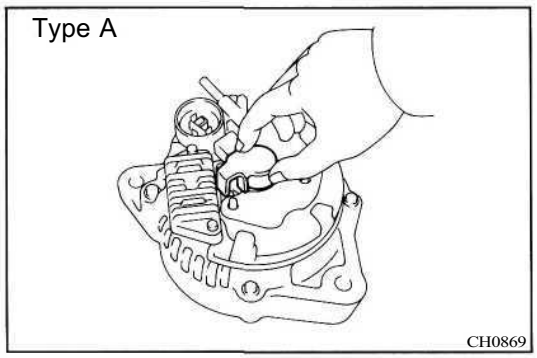


5. INSTALL IC REGULATOR AND BRUSH HOLDER (Type A)

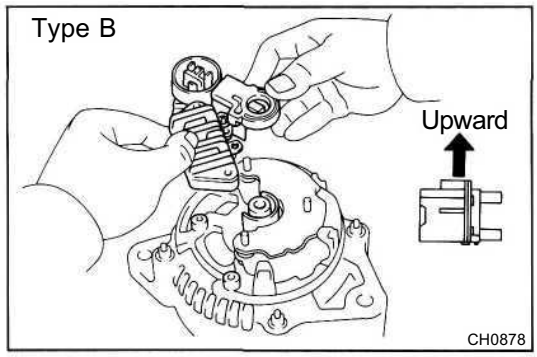
(a) Place on the IC regulator and brush holder on the rectifier end frame.

NOTICE: Be careful about the holder installation direction.

(b) Install the five screws until there is a clearance of approx. 1.1 mm (0.043 in.) between the brush holder and connector.



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

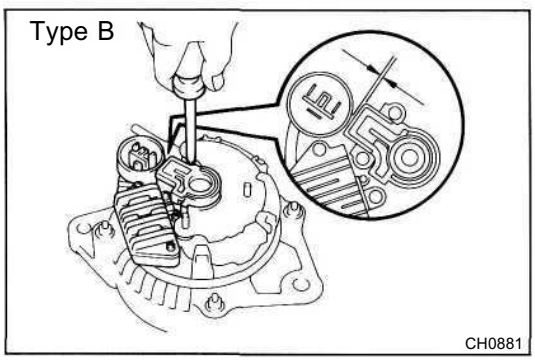


(Type B)

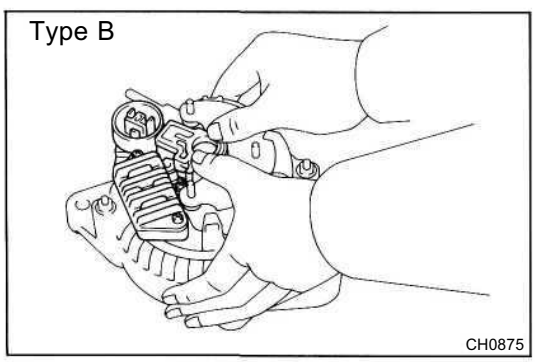
(a) Install the brush holder cover to the brush holder.

NOTICE: Be careful about the holder installation direction.

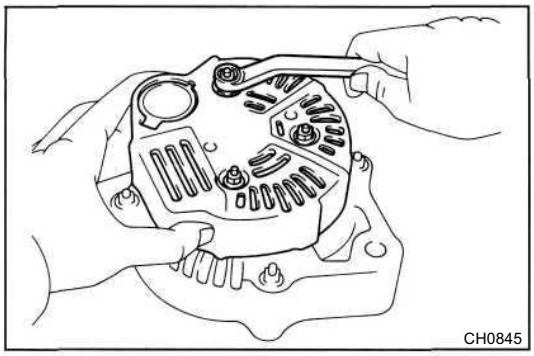
(b) Place the IC regulator together with the brush holder horizontally on the rectifier end frame.



(c) Install the five screws until there is a clearance of approx. 1.1 mm (0.043 in.) between the brush holder and connector.

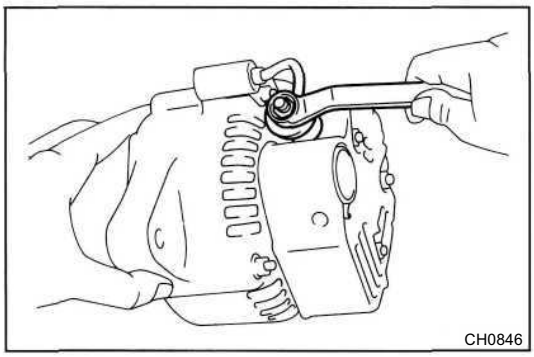


(d) Fit the brush holder cover.



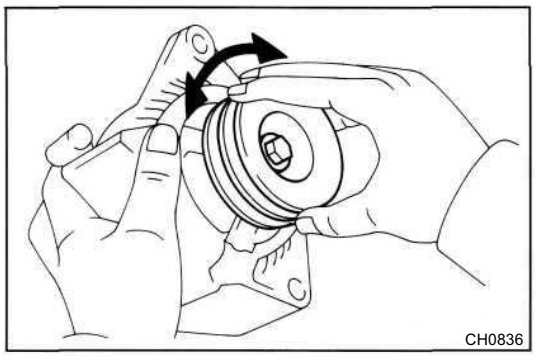
6. INSTALL REAR END COVER

(a) Install the rear end cover with the three nuts.



(b) (PZJ, HZJ and HDJ)
Install the terminal insulator, condenser lead wire with nut.

(c) (HZB and HDB)
Install the terminal insulator with the nut.



7. CHECK THAT ROTOR ROTATES SMOOTHLY