

ENGINE 4J SERIES

SECTION 6D ENGINE ELECTRICAL

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BATTERY

General Description

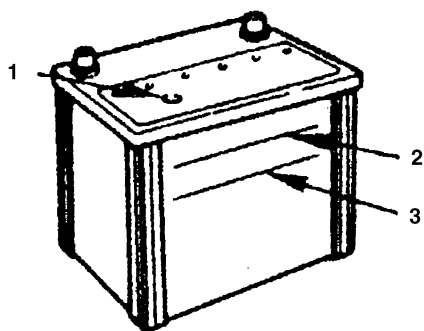
There are six battery fluid caps at the top of the battery. These are covered by a paper label.

The battery is completely sealed except for the six small vent holes at the side. These vent holes permit the escape of small amounts of gas generated by the battery. This type of battery has the following advantages over conventional batteries.

1. There is no need to add water during the entire service life of the battery.
2. The battery protects itself against overcharging. The battery will refuse to accept an excessive charge.
(A conventional battery will accept an excessive charge, resulting in gassing and loss of battery fluid.)
3. The battery is much less vulnerable to self discharge than a conventional type battery.

Diagnosis

1. Visual Inspection
Inspect the battery for obvious physical damage, such as a cracked or broken case, which would permit electrolyte loss.
Replace the battery if obvious physical damage is discovered during inspection.
Check for any other physical damage and correct it as necessary. If not, proceed to Step 2.
2. Fluid Level Check
The fluid level should be between the upper level line and lower level line on side of the battery.
 - a. Correct Fluid Level - Charge the battery.
 - b. Below Lower Level - Replace battery.



N6A3487E

Legend

1. Charge test indicator
2. Upper level
3. Lower level

3. Voltage Check

- 1) Put voltmeter test leads to battery terminals.
 - a. Voltage is 12.4V or Above - Battery condition OK.
 - b. Voltage is Under 12.4V - Go to procedure 2) below.
- 2) Determine fast charge amperage from specification (See Main Data and Specifications in this section).
Fast charge battery for 30 minutes at amperage rate no higher than specified value.
Take voltage and amperage readings after charge.
 - a. Voltage is Above 16V at Below 1/3 of Amperage Rate — Replace battery.
 - b. Voltmeter is Above 16V at Above 1/3 of Amperage Rate — Drop charging voltage to 15V and charge for 10 — 15 hours.
 - c. Voltage is Between 12V and 16V - Continue charging at the same rate for an additional 3 — 3.5 hours.
 - d. Voltage is Below 12V — Replace battery.

4. Load Test

- 1) Connect a voltmeter and a battery load tester across the battery terminals.
- 2) Apply 300 ampere load for 15 seconds to remove surface charge from the battery.
Remove load.
- 3) Wait 15 seconds to let battery recover. Then apply specified load from specifications (See Main Data and Specifications in this section).
Read voltage after 15 seconds, then remove load.
 - a. Voltage does not Drop Below the Minimum Listed in Following Table - The battery is good and should be returned to service.
 - b. Voltage is Less Than Minimum Listed - Replace battery.

Estimated Temperature		Minimum Voltage
°F	°C	Limit
70	21	9.6
60	16	9.5
50	10	9.4
40	4	9.3
30	-1	9.1
20	-7	8.9
10	-12	8.7
0	-18	8.5
The battery temperature must be estimated by atmosphere temperature and outside temperature (the battery has been exposed to for the preceding few hours).		

Battery Charging

Observe the following safety precautions when charging the battery:

1. Never attempt to charge the battery when the fluid level is below the lower level line on the side of the battery. In this case, the battery must be replaced.
2. Pay close attention to the battery during the charging procedure.
Battery charging should be discontinued or the rate of charge reduced if the battery feels hot to the touch.
Battery charging should be discontinued or the rate of charge reduced if the battery begins to gas or spew electrolyte from the vent holes.
3. In order to more easily view the hydrometer blue dot or ring, it may be necessary to jiggle or tilt the battery.
4. Battery temperature can have a great effect on battery charging capacity.
5. The sealed battery used on this vehicle may be either quick-charged or slow-charged in the same manner as other batteries.
Whichever method you decide to use, be sure that you completely charge the battery. Never partially charge the battery.

Jump Starting

Jump Starting With an Auxiliary (Booster) Battery

Caution:

Never push or tow the vehicle in an attempt to start it. Serious damage to the emission system as well as other vehicle parts will result.

Treat both the discharged battery and the booster battery with great care when using jumper cables.

Carefully follow the jump starting procedure, being careful at all times to avoid sparking.

WARNING:

FAILURE TO CAREFULLY FOLLOW THE JUMP STARTING PROCEDURE COULD RESULT IN THE FOLLOWING:

1. **SERIOUS PERSONAL INJURY, PARTICULARLY TO YOUR EYES.**
2. **PROPERTY DAMAGE FROM A BATTERY EXPLOSION, BATTERY ACID, OR AN ELECTRICAL FIRE.**
3. **DAMAGE TO THE ELECTRONIC COMPONENTS OF ONE OR BOTH VEHICLES PARTICULARLY.**

NEVER EXPOSE THE BATTERY TO AN OPEN FLAME OR ELECTRICAL SPARK. GAS GENERATED BY THE BATTERY MAY CATCH FIRE OR EXPLODE.

REMOVE ANY RINGS, WATCHES, OR OTHER JEWELRY BEFORE WORKING AROUND THE BATTERY. PROTECT YOUR EYES BY WEARING AN APPROVED SET OF GOGGLES.

NEVER ALLOW BATTERY FLUID TO COME IN CONTACT WITH YOUR EYES OR SKIN.

NEVER ALLOW BATTERY FLUID TO COME IN CONTACT WITH FABRICS OR PAINTED SURFACES.

BATTERY FLUID IS A HIGHLY CORROSIVE ACID. SHOULD BATTERY FLUID COME IN CONTACT WITH YOUR EYES, SKIN, FABRIC, OR A PAINTED SURFACE, IMMEDIATELY AND THOROUGHLY RINSE THE AFFECTED AREA WITH CLEAN TAP WATER.

NEVER ALLOW METAL TOOLS OR JUMPER CABLES TO COME IN CONTACT WITH THE POSITIVE BATTERY TERMINAL, OR ANY OTHER METAL SURFACE OF THE VEHICLE. THIS WILL PROTECT AGAINST A SHORT CIRCUIT.

ALWAYS KEEP BATTERIES OUT OF THE REACH OF YOUNG CHILDREN.

Jump Starting Procedure

1. Set the vehicle parking brake.
If the vehicle is equipped with an automatic transmission, place the selector lever in the "PARK" position.
If the vehicle is equipped with a manual transmission place the shift lever in the "NEUTRAL" position.
Turn "OFF" the ignition.
Turn "OFF" all lights and any other accessory requiring electrical power.
2. Look at the built-in hydrometer.
If the indication area of the built-in hydrometer is completely clear, do not try to jump start.
3. Attach the other end of the same cable to the positive terminal of the discharged battery.
Attach the end of one jumper cable to the positive terminal of the booster battery.
Do not allow the vehicles to touch each other.
This will cause a ground connection, effectively neutralizing the charging procedure.
Be sure that the booster battery has a 12 volt rating.
4. Attach one end of the remaining cable to the negative terminal of the booster battery.
Attach the other end of the same cable to a solid engine ground (such as the A/C compressor bracket or the generator mounting bracket) of the vehicle with the discharged battery.
This ground connection must be at least 450 mm (18 in) from the battery of the vehicle whose battery is being charged.

WARNING:

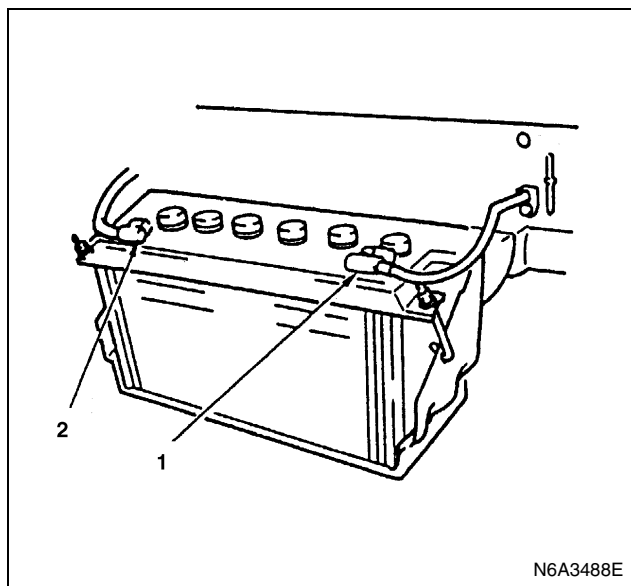
NEVER ATTACH THE END OF THE JUMPER CABLE DIRECTLY TO THE NEGATIVE TERMINAL OF THE DEAD BATTERY.

5. Start the engine of the vehicle with the good battery.
Make sure that all unnecessary electrical accessories have been turned "OFF".
6. Start the engine of the vehicle with the dead battery.
7. To remove the jumper cables, follow the above directions in the reverse order.
Be sure to first disconnect the negative cable from the vehicle with the discharged battery.

Removal and Installation of the Battery

Removal

1. All switches should be in the "OFF" position.
2. Disconnect the battery ground cable. (1)
3. Disconnect the battery positive cable. (2)
4. Disconnect the battery cable.



Caution:

It is important that the battery ground cable be disconnected first.

Disconnecting the battery positive cable first can result in a short circuit.

Installation

To install the battery, follow the removal procedure in the reverse order, noting the following points:

1. Make sure that the rod is hooked on the body side.

Main Data and Specifications

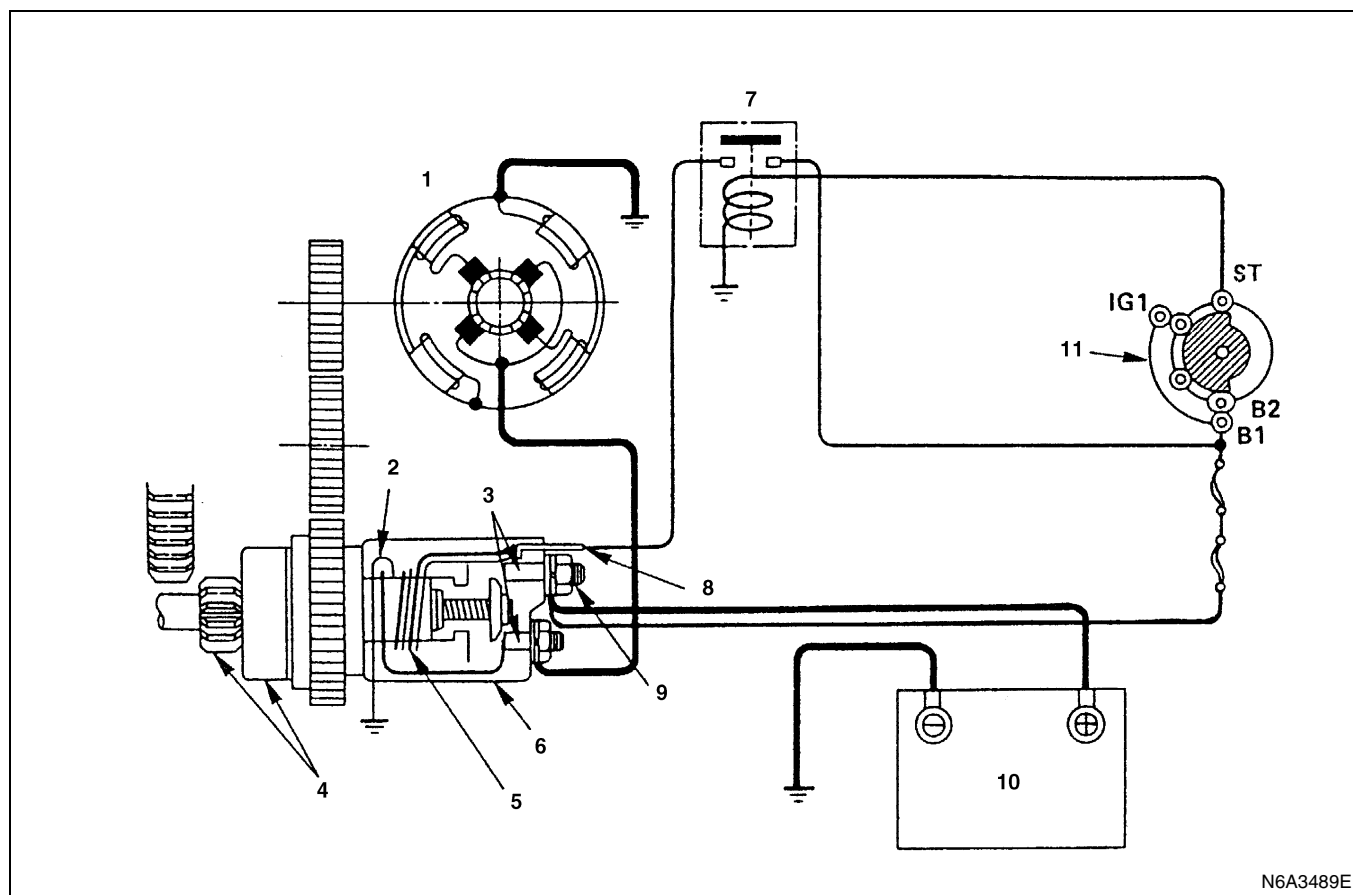
Model	(JIS)	115E41R-MF	130E41R-MF	95D31R-MF	80D26R-MF
Voltage	(V)	12	12	12	12
Cold-Cranking Performance	(Amp)	651	799	622	582
Reserve Capacity	(Min)	212	229	159	133
Load Test	(Amp)	325	400	310	290
Fast Charge Maximum Amperage	(Amp)	20	20	20	20
BCI Group No.		—	—	27	24
Overall Dimension L×W×H	(mm)	410×178×213	410×178×213	—	—

STARTING SYSTEM

General Description

Starting Circuit

The cranking system consists of a battery, starter, starter switch, starter relay, etc. and these main components are connected as shown in Figure. For details of the starting circuit.



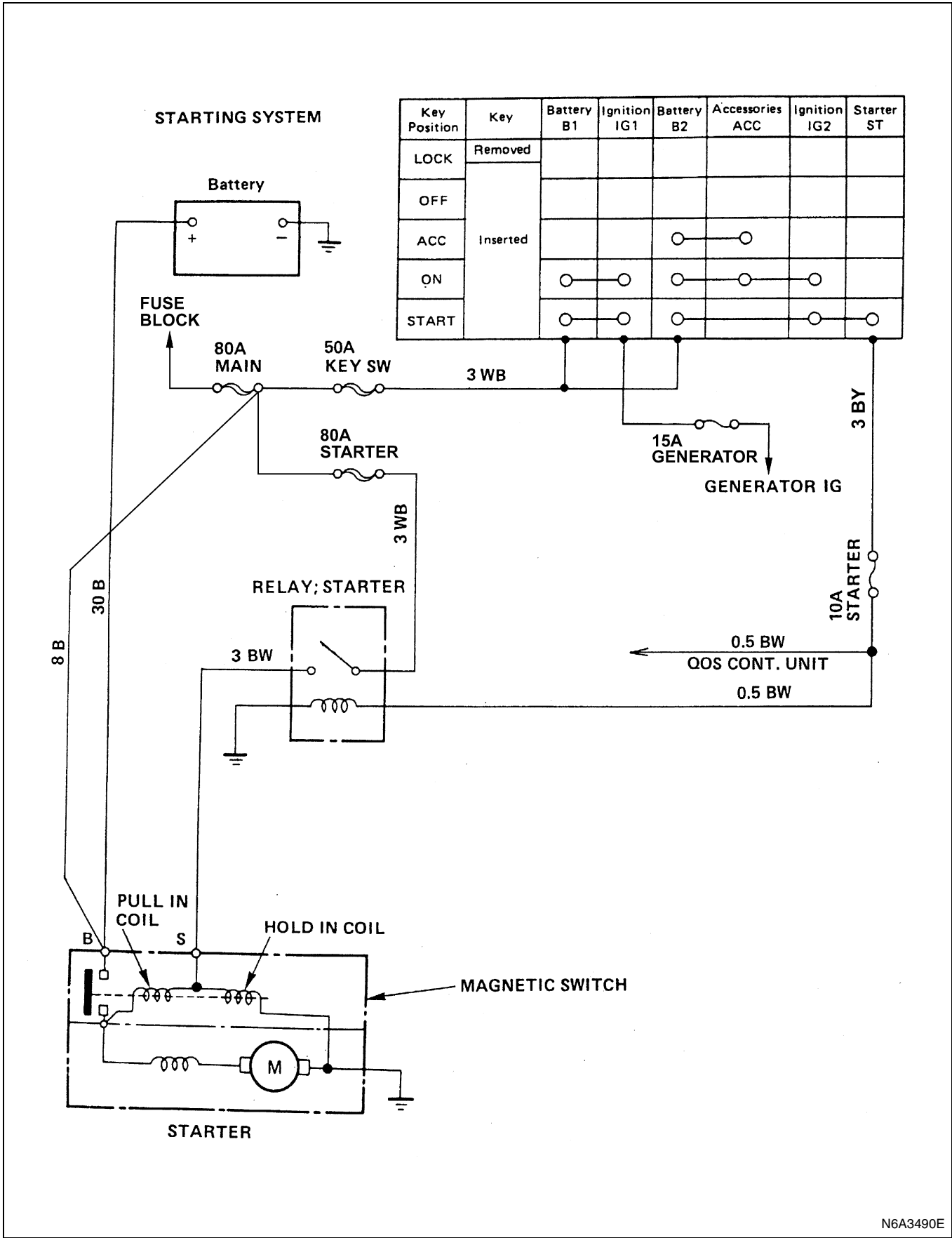
Legend

- | | |
|--------------------|--------------------|
| 1. Starter motor | 7. Relay; starter |
| 2. Hold coil | 8. "50" terminal |
| 3. Contacts | 9. "30" terminal |
| 4. Pinion clutch | 10. Battery |
| 5. Pull in coil | 11. Starter switch |
| 6. Magnetic switch | |

Starter

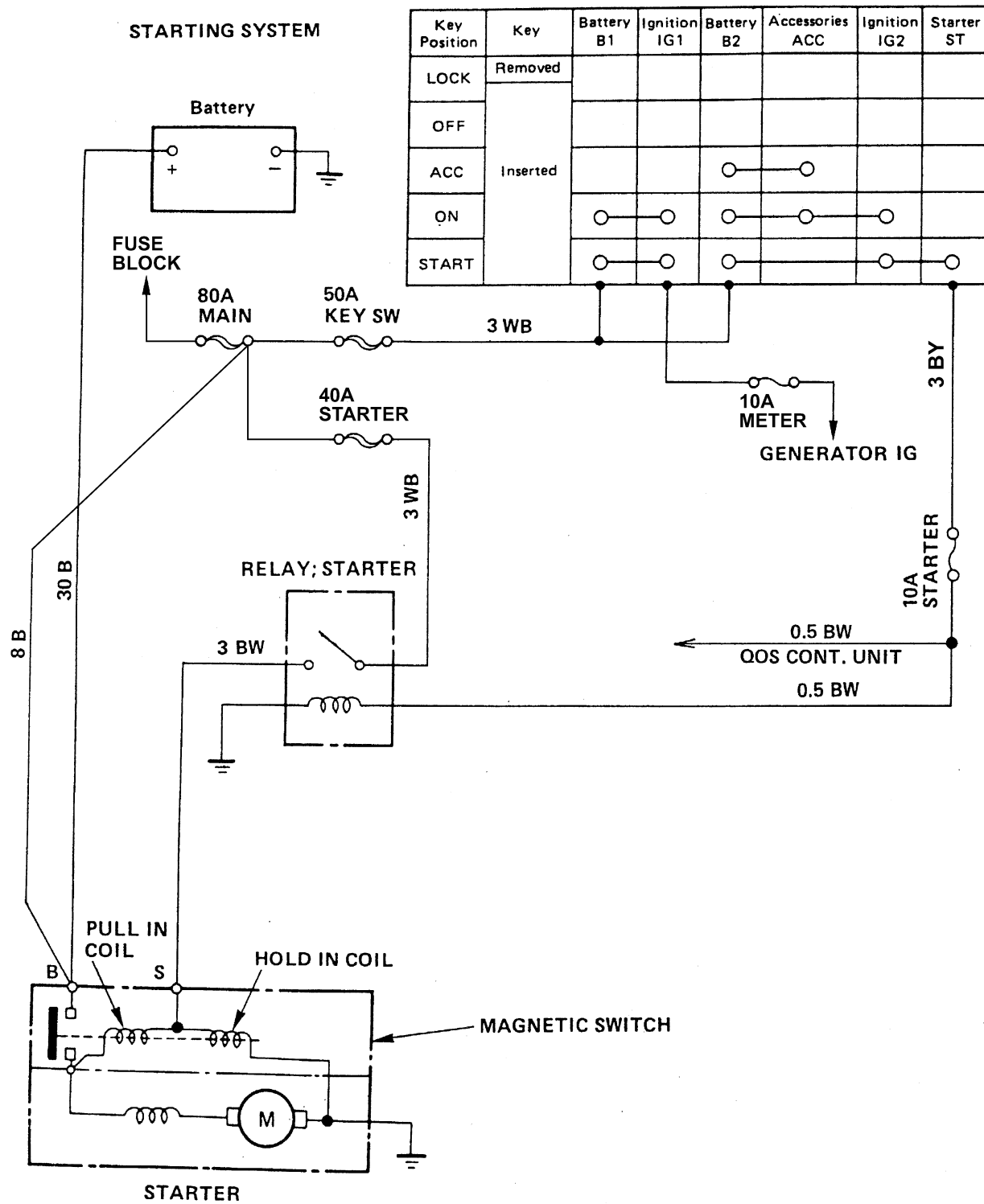
The starting system employs a magnetic type reduction starter in which the motor shaft is also used as a pinion shaft. When the starter switch is turned on, the contacts of magnetic switch are closed, and the armature rotates. At the same time, the plunger is attracted, and the pinion is pushed forward by the shift lever to mesh with ring gear. Then, the ring gear runs to start the engine. When the engine starts and the starter switch is turned off, the plunger returns, the pinion is disengaged from ring gear, and the armature stops rotation. When the engine speed is higher than the pinion, the pinion idles, so that the armature is not driven.

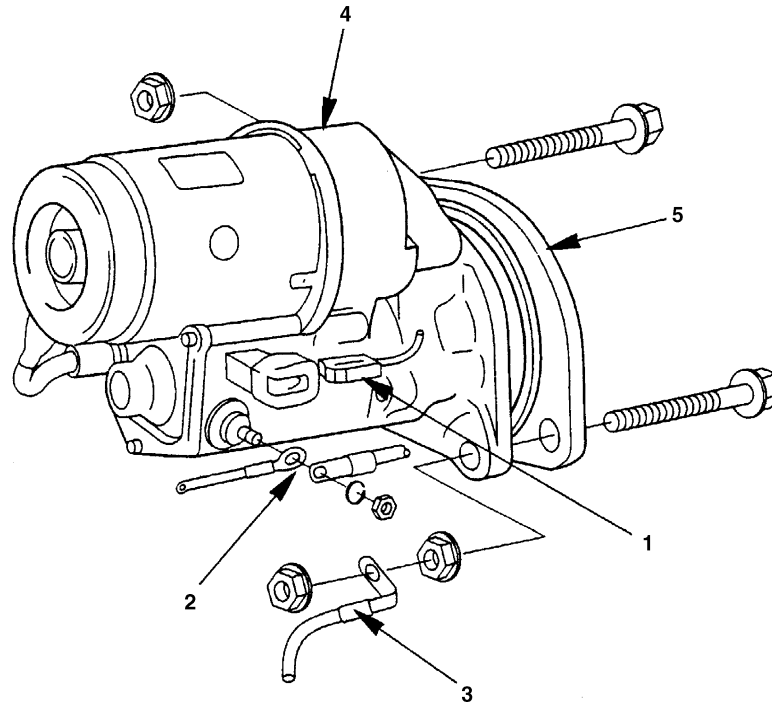
Starting Circuit
For 4JB1, 4JB1-TC



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Starting Circuit For 4JH1



On-Vehicle Service
Component

N6A3491E

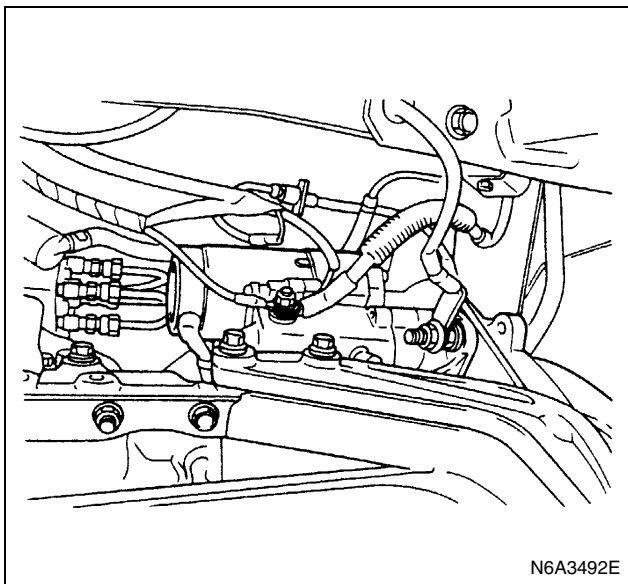
Legend

- | | |
|-------------------------|------------------------------------|
| 1. 50 terminal | 4. Starter assembly |
| 2. 30 terminal | 5. Spacer (4JB1, except cold area) |
| 3. Earth cable terminal | |

Removal

Preparation

- Disconnect Battery Ground Cable.
- 1. "50" Terminal
- 2. "30" Terminal
- 3. Earth Cable Terminal
- 4. Starter Assembly
- 5. Spacer (4JB1, Except cold area)



Installation

1. Spacer (4JB1, Except cold area)
2. Starter Assembly
 - Tighten the fixing bolt and nut to the specified torque

Tighten:

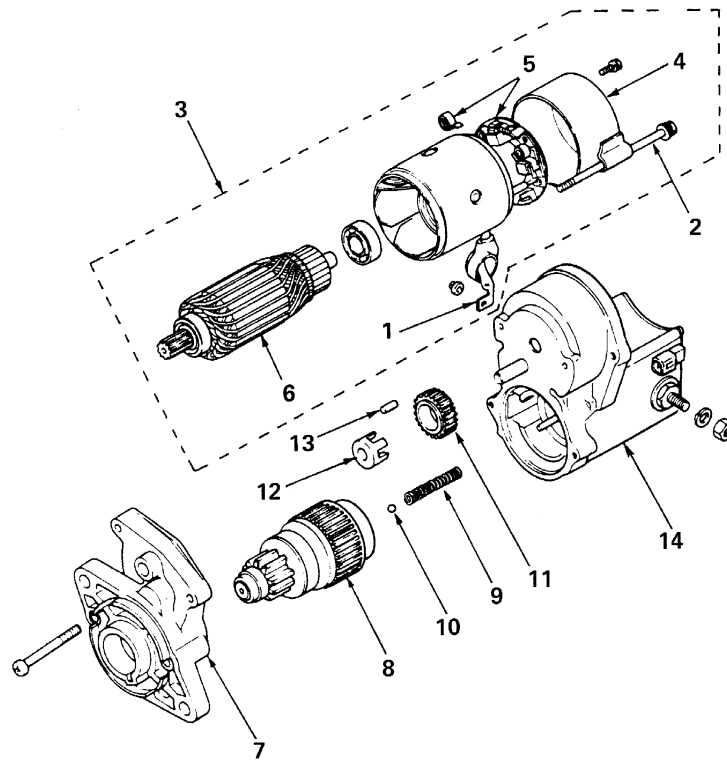
Starter Bolts and Nuts to 81 N·m (8.3 Kg·m/60 lb·ft)

3. Earth Cable Terminal
 - Connect the earth cable terminal.
4. "30" Terminal
 - Connect the harness connector.
5. "50" Terminal
 - Connect the battery cable terminal with starter switch harness terminal, then tighten nut to the specified torque.

Tighten:

Fixing Nut to 9 N·m (0.9 Kg·m/78 lb·in)

- Connect the battery cable.

**Unit Repair
Component**

N6A3493E

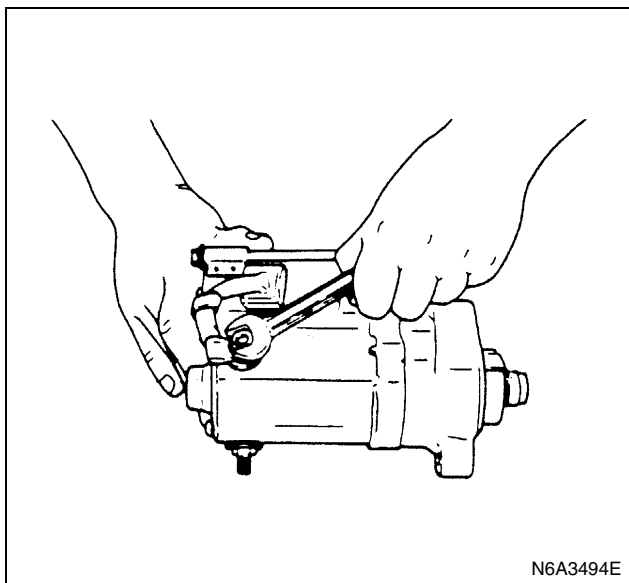
Legend

- | | |
|---------------------------|-----------------------|
| 1. Lead wire | 8. Overrunning clutch |
| 2. Through bolt | 9. Return spring |
| 3. Yoke assembly | 10. Steel ball |
| 4. Cover yoke | 11. Idle pinion |
| 5. Brush and brush holder | 12. Retainer |
| 6. Armature | 13. Roller |
| 7. Drive side housing | 14. Magnetic switch |

Disassembly

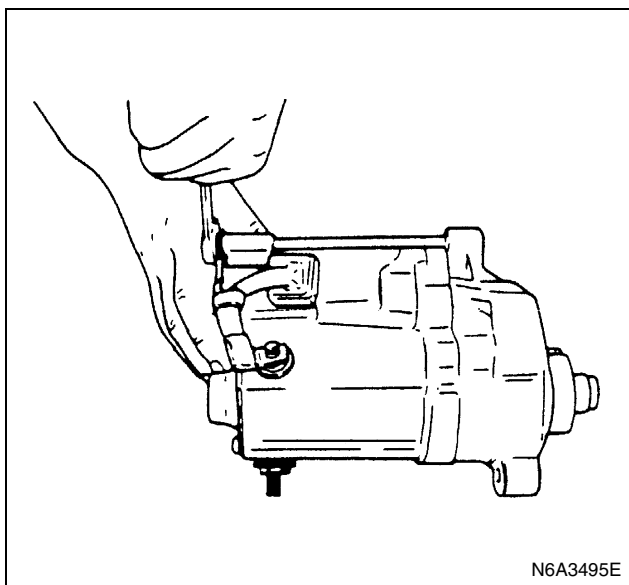
1. Lead Wire

Disconnect the lead wire from the magnetic switch.



2. Through Bolt

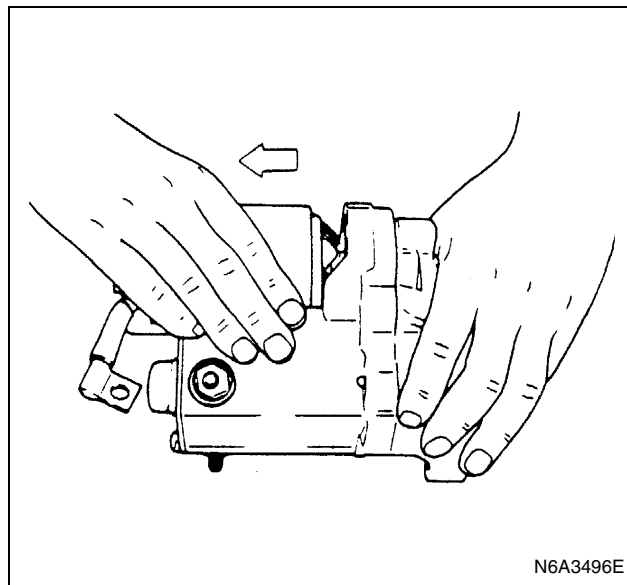
Remove the through bolts from the yoke.



3. Yoke Assembly

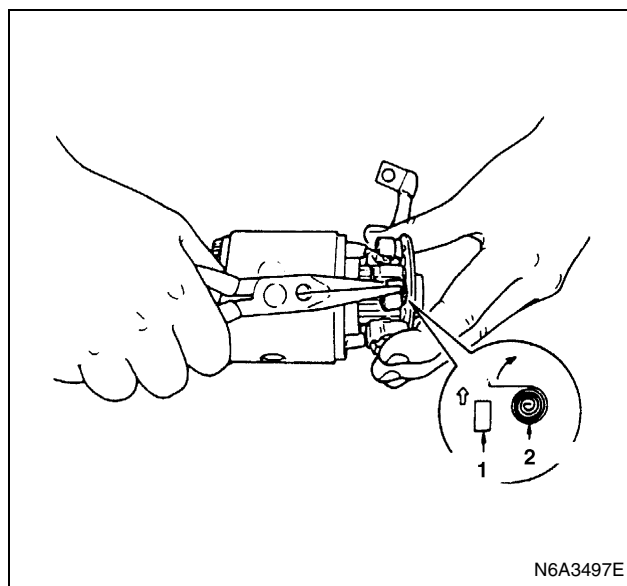
Separate the yoke from the solenoid switch.

4. Yoke Cover



5. Brush and Brush Holder

Remove (pull out) the brushes and the brush holder from the armature with a pair of long-nose pliers.



Legend

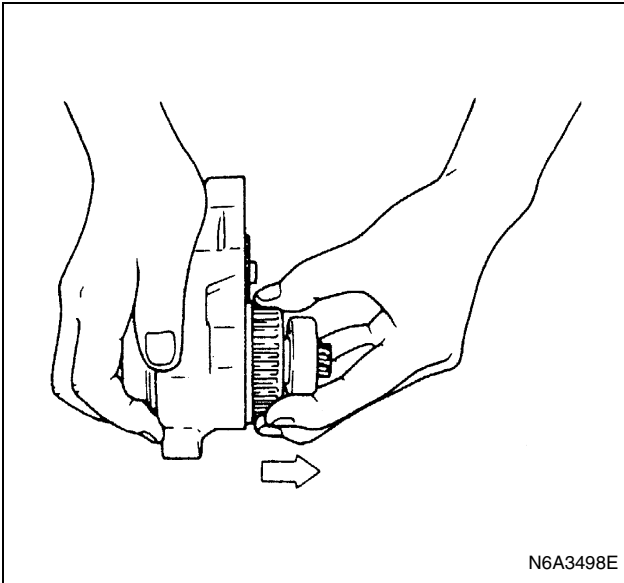
1. Bush
2. Spring

6. Armature

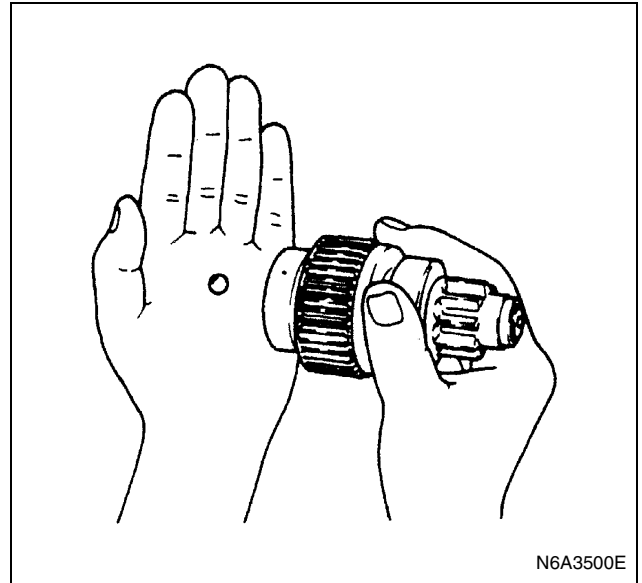
7. Drive Side Housing

8. Overrunning Clutch

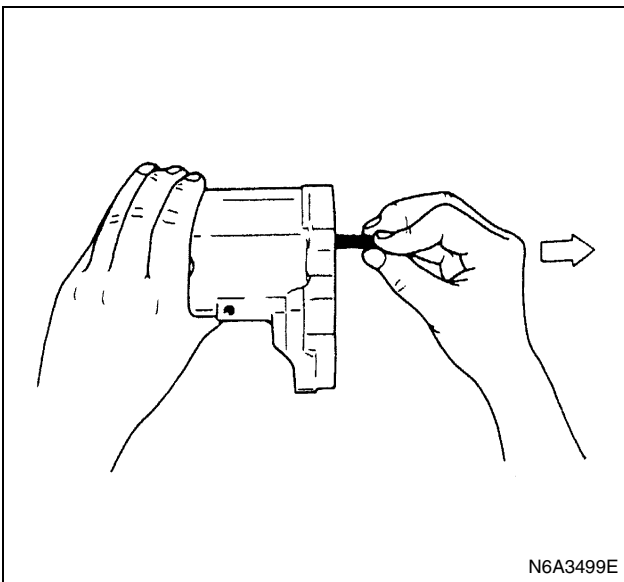
Remove the overrunning clutch from the housing.



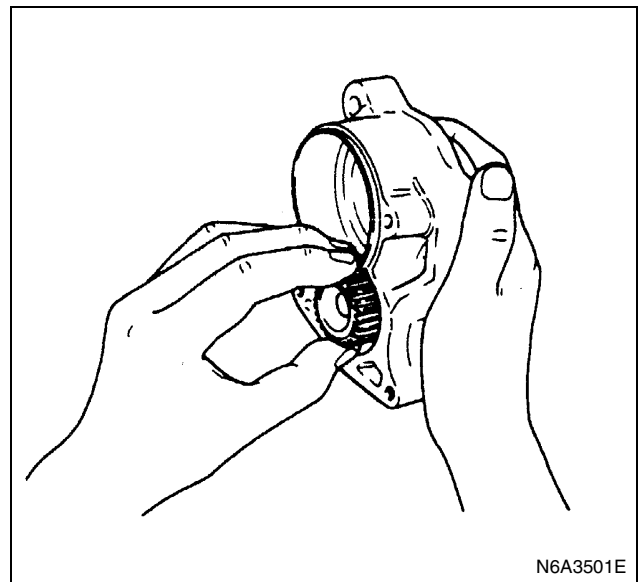
9. Return Spring
Remove the return spring from magnetic switch.



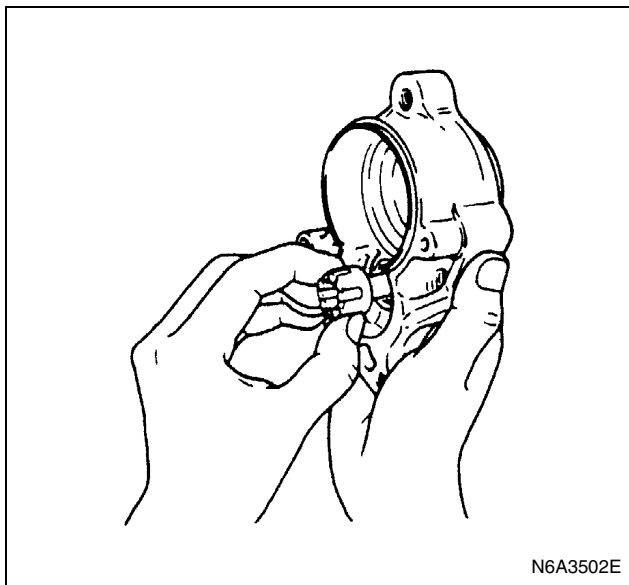
11. Idle Pinion
Remove the idle pinion from housing.



10. Steel Ball
Remove the steel ball from the overrunning clutch.



12. Retainer
Remove the retainer from housing.



13. Roller

14. Magnetic Switch

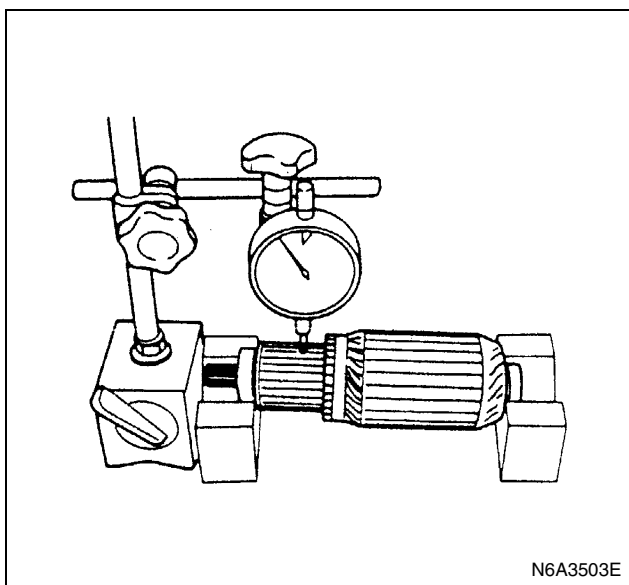
Inspection and Repair

Make necessary correction or parts replacement if wear, damage or any other abnormal condition are found through inspection.

Armature

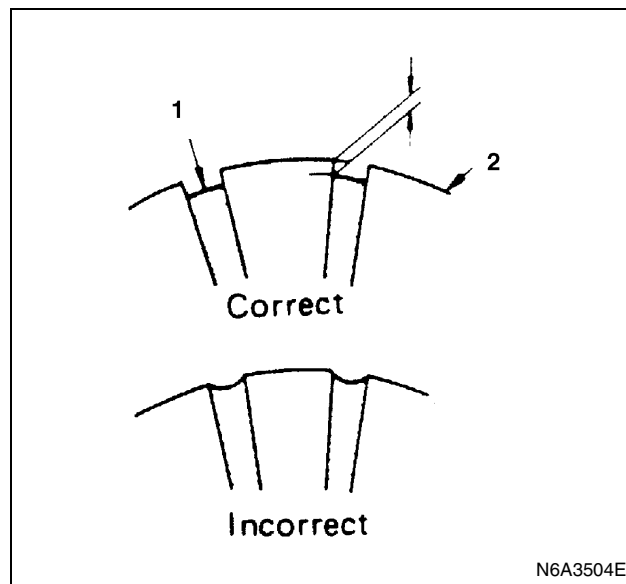
Check the commutator for run-out and replace if the amount of run-out exceeds the limit.

Run-out test			mm (in)
kw	Standard	Limit	
2.2	0.02 (0.0008)	0.05 (0.0020)	
2.0			



Check the mica segment for wear.

Depth of mica segment			mm (in)
kw	Standard	Limit	
2.2	0.7 — 0.9 (0.028 — 0.035)	0.20 (0.008)	
2.0			

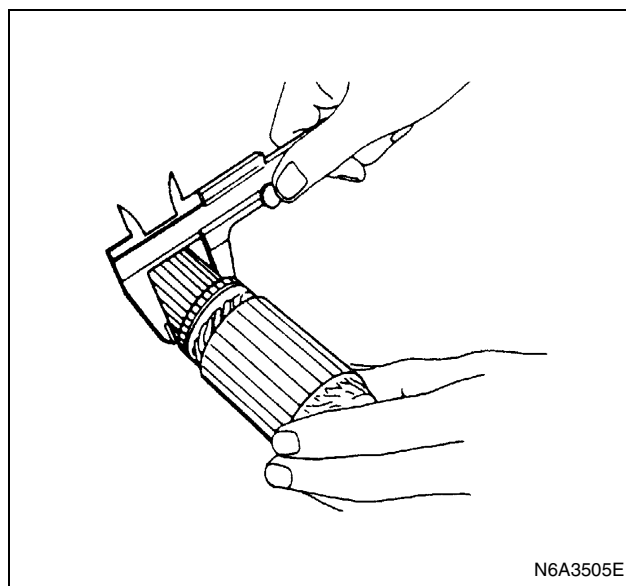


Legend

1. Insulator
2. Commutator segments

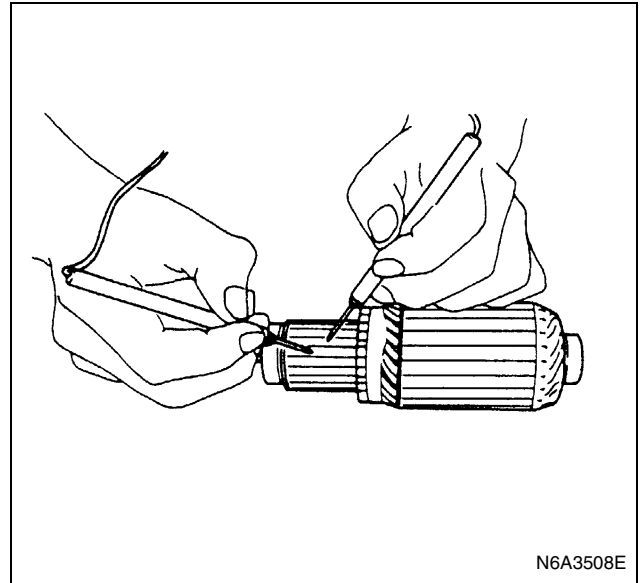
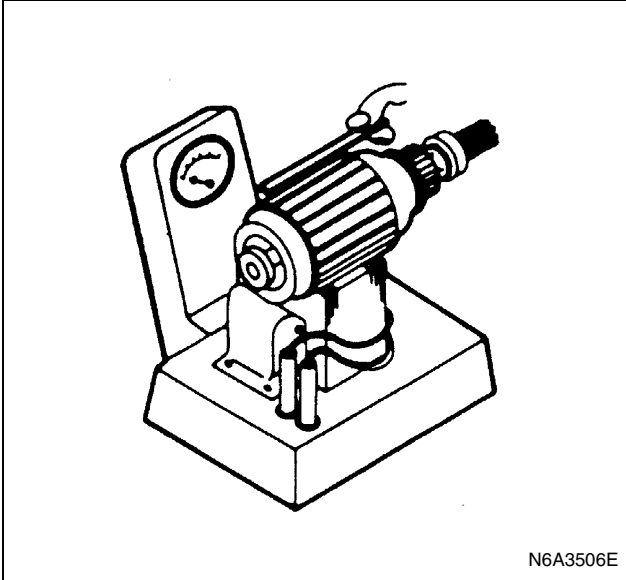
Check the commutator outer diameter.

Commutator outer diameter			mm (in)
kw	Standard	Limit	
2.2	35.00 (1.378)	34.00 (1.339)	
2.0			



Armature Short Circuit Test

Check the armature for short circuit by placing it on a growler tester. Hold a piece of hacksaw blade against the armature core while slowly rotating the armature. A short-circuited armature will cause the blade to vibrate and to be attracted by the core. If the hacksaw blade is attracted or vibrates, the armature, is short circuited, and must be replaced.

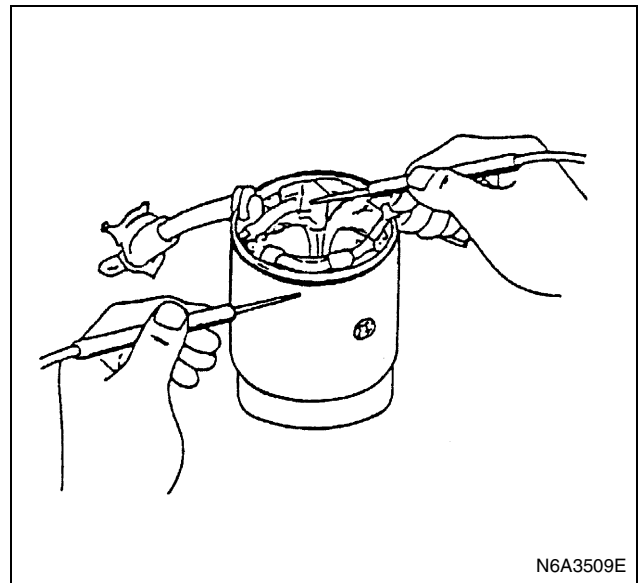
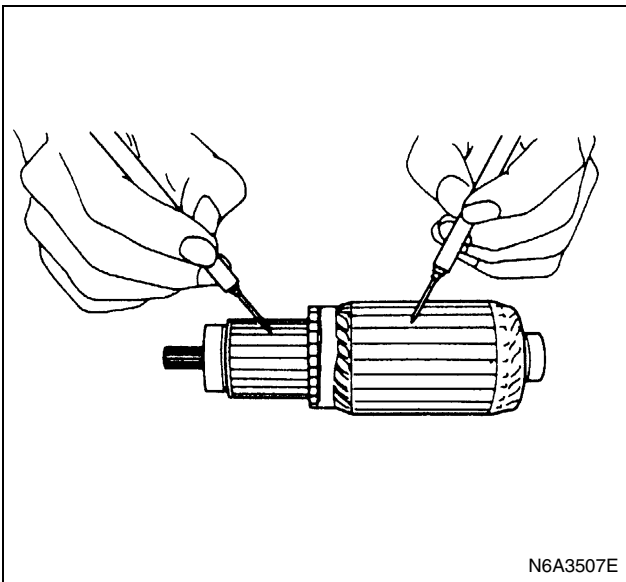
**Yoke****Field Winding Ground Test**

Using circuit tester, touch one probe to the field winding end or brush and the other to the bare surface of yoke body.

There should be no continuity. If the tester indicates a continuity, the field coil is grounded and yoke assembly should be replaced.

Armature Ground Test

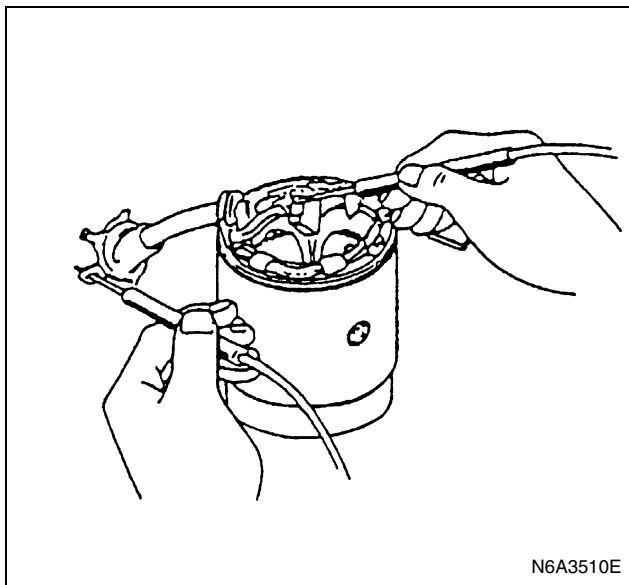
Touch one probe of a circuit tester to the commutator segment and the other to the armature core. There should be no continuity. If there is a continuity, the armature is grounded. Replace the armature if it is grounded.

**Field Winding Continuity Test**

Using a circuit tester, touch one probe to the "C" terminal lead wire and the other to the brush. There should be continuity. Replace the yoke if it is open.

Armature Continuity Test

Connect the probes of a circuit tester across the 2 segments. There should be continuity at any test points. Replace if it is open-circuited.

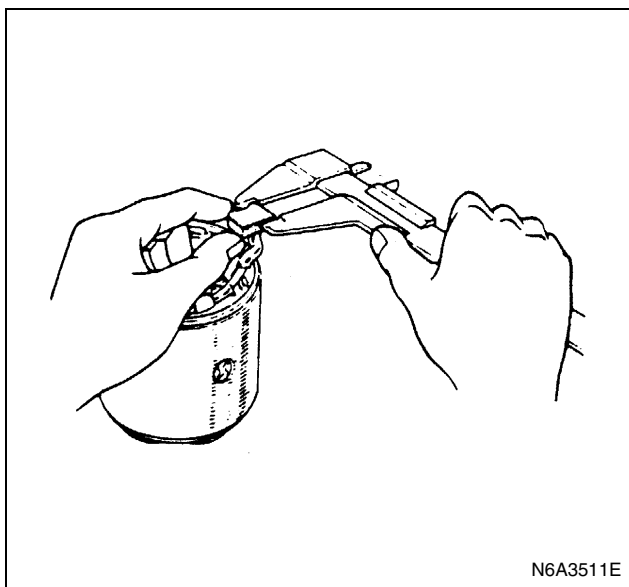


N6A3510E

Brush and Brush Holder

Measure the brush length and replace if it is worn beyond the service limit.

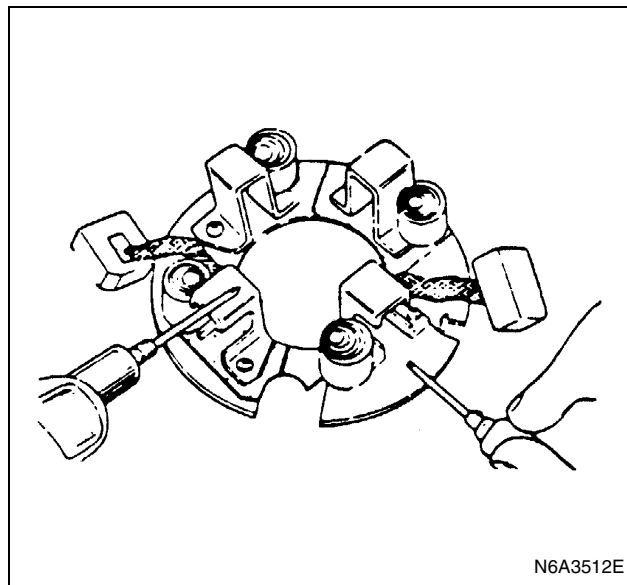
Brush length		mm (in)
kw	Standard	Limit
2.2	14.5 (0.57)	10 (0.39)
2.0	16 (0.63)	



N6A3511E

Brush Holder Insulation Test

Using a circuit tester, check the brush holder insulation. Touch one probe to the holder plate and the other to the positive brush holder. There should be no continuity.



N6A3512E

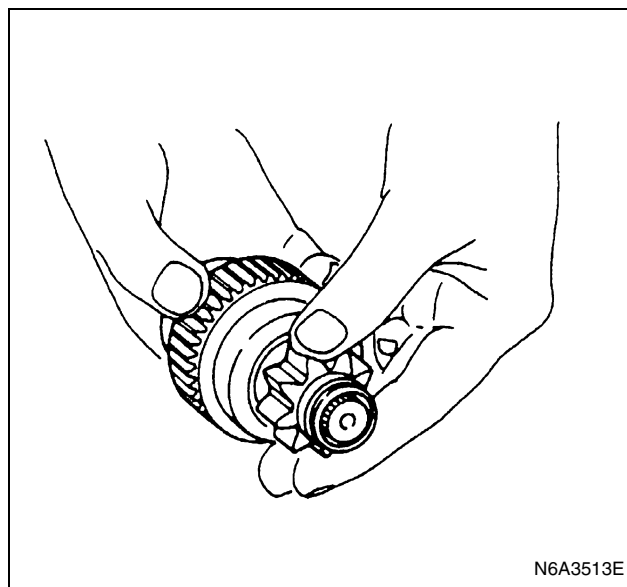
Overrunning Clutch

Inspect the teeth of pinion for wear and damage.

Replace if it damaged.

Rotate the pinion in direction of rotation (clockwise).

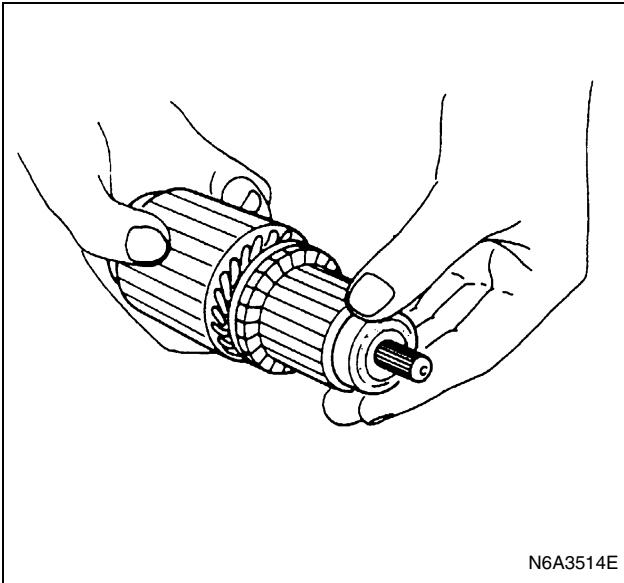
It should rotate smoothly. But in opposite direction, it should be locked.



N6A3513E

Bearing

Check the bearings for wear and damage. If the bearings are noisy during operation, they should be replaced.



Reassembly

To install, follow the removal steps in the reverse order, noting the following points:

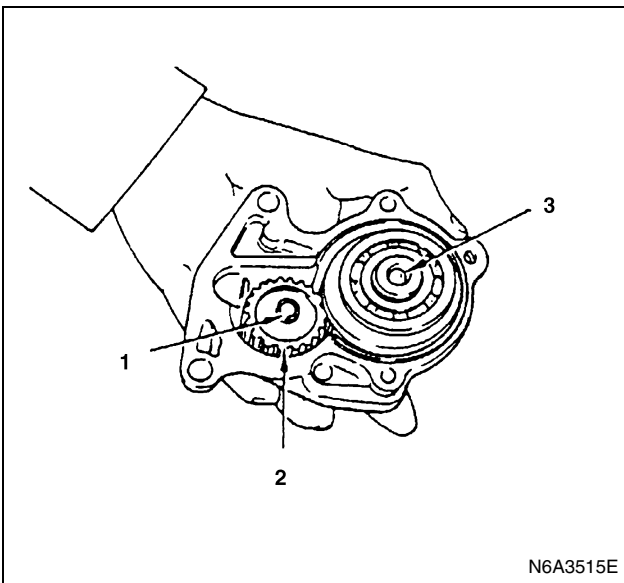
- Magnetic Switch
- Idle Gear
- Clutch assembly
- Housing

1. Install the clutch asm to the magnetic switch.
2. Install the idle gear and housing.

Notice:

Do not fail to assemble the steel ball and the spring between the clutch and magnetic switch.

Assemble the roller to the idle gear in advance.



Legend

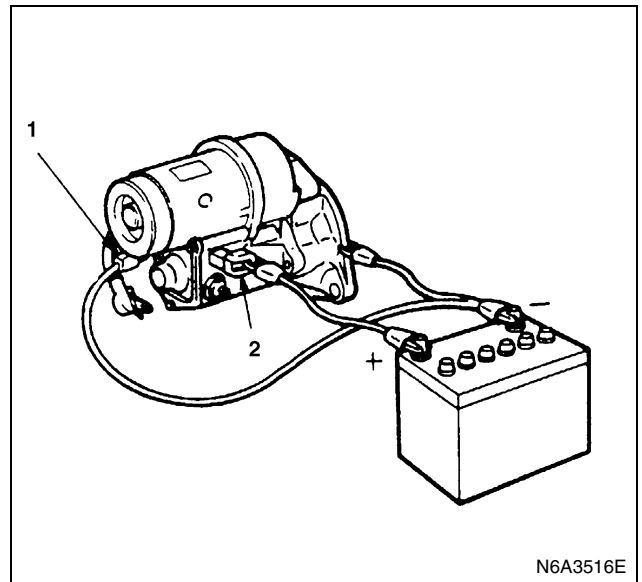
1. Roller
2. Idle gear
3. Steel ball

Magnetic Switch

Temporarily connect the solenoid switch between the clutch and the housing and run the following tests. Complete each test within three to five seconds.

1. Pull-in test

Connect the battery negative terminal with the solenoid switch body and the M terminal. When current is applied to the 50 terminal from the battery positive terminal, the pinion should flutter.

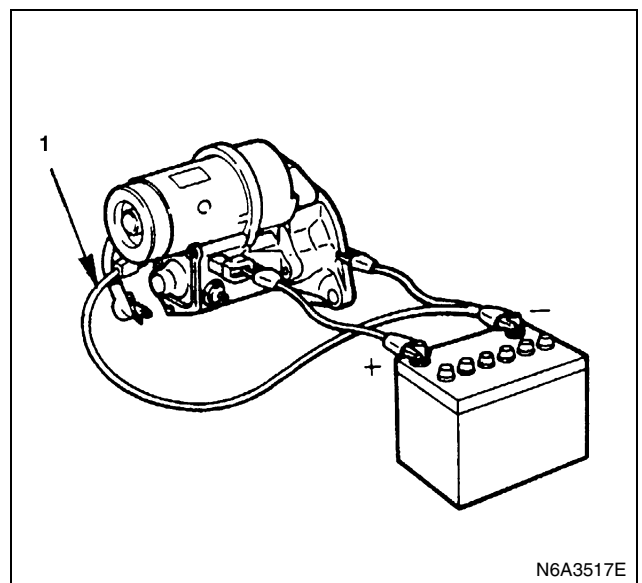


Legend

1. M terminal
2. 50 terminal

2. Hold-in test

Disconnect the lead at the M terminal. The pinion should continue to flutter.

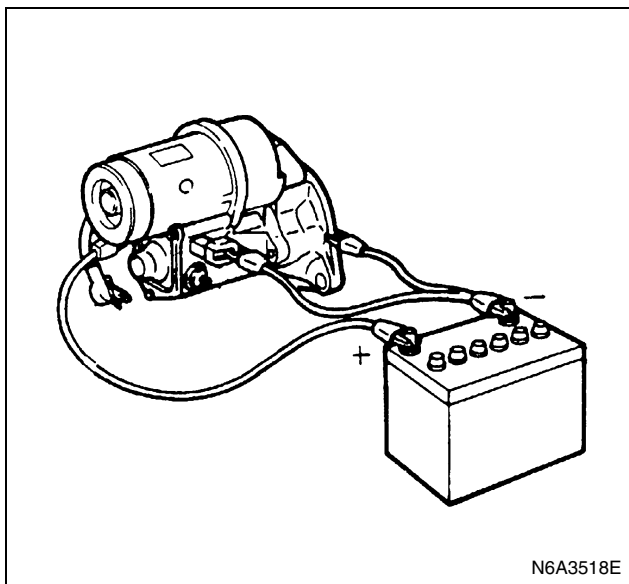


Legend

1. Disconnect

3. Return test

Connect the battery negative terminal to the 50 terminal and the body. Connect the battery positive terminal to the M terminal. The pinion will flutter. When the lead to the 50 terminal is disconnected, the pinion should immediately return to its stationary positions.



4. Current value

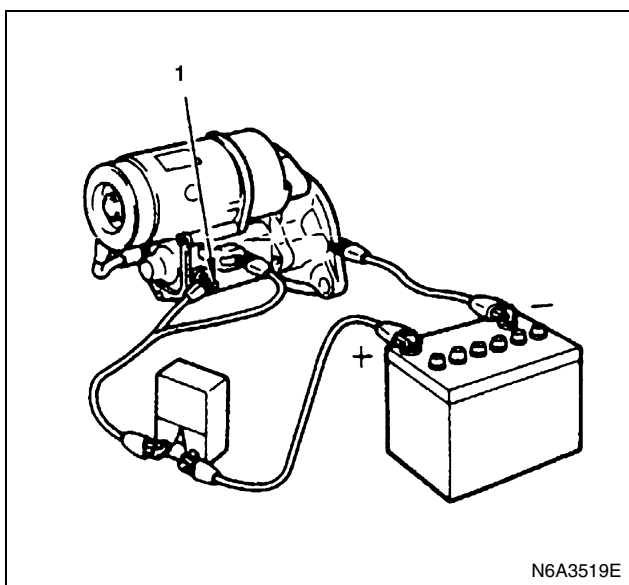
- Make connections as shown in the illustration, and measure the current value.

Standard = 120 A or less

Notice:

For a battery, be sure to use one fully charged.

For lead wires, use thick ones since a large amount of current flows through them.



Legend

1. 30 terminal

CHARGING SYSTEM

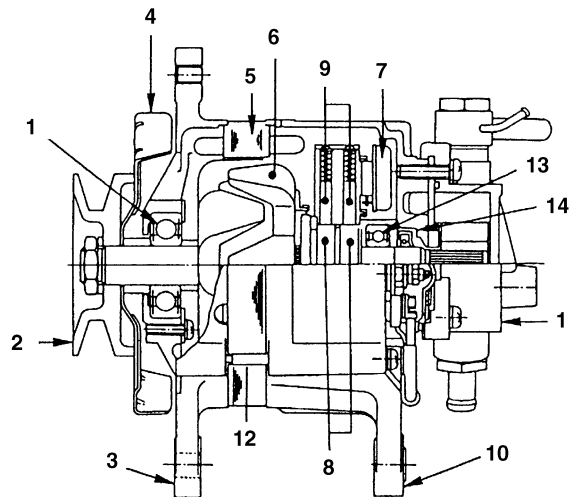
General Description

The charging system is the IC integral regulator charging system and its main components are connected as shown in Figure.

The regulator is a solid state type and it is mounted along with the brush holder assembly inside the generator installed on the rear end cover.

The generator does not require particular maintenance such as voltage adjustment. The rectifier connected to the stators coil has nine diodes to transform A.C. voltage into D.C. voltage. This D.C. voltage is connected to the output terminal of generator.

Generator (12V-50A)



N6A3521E

Legend

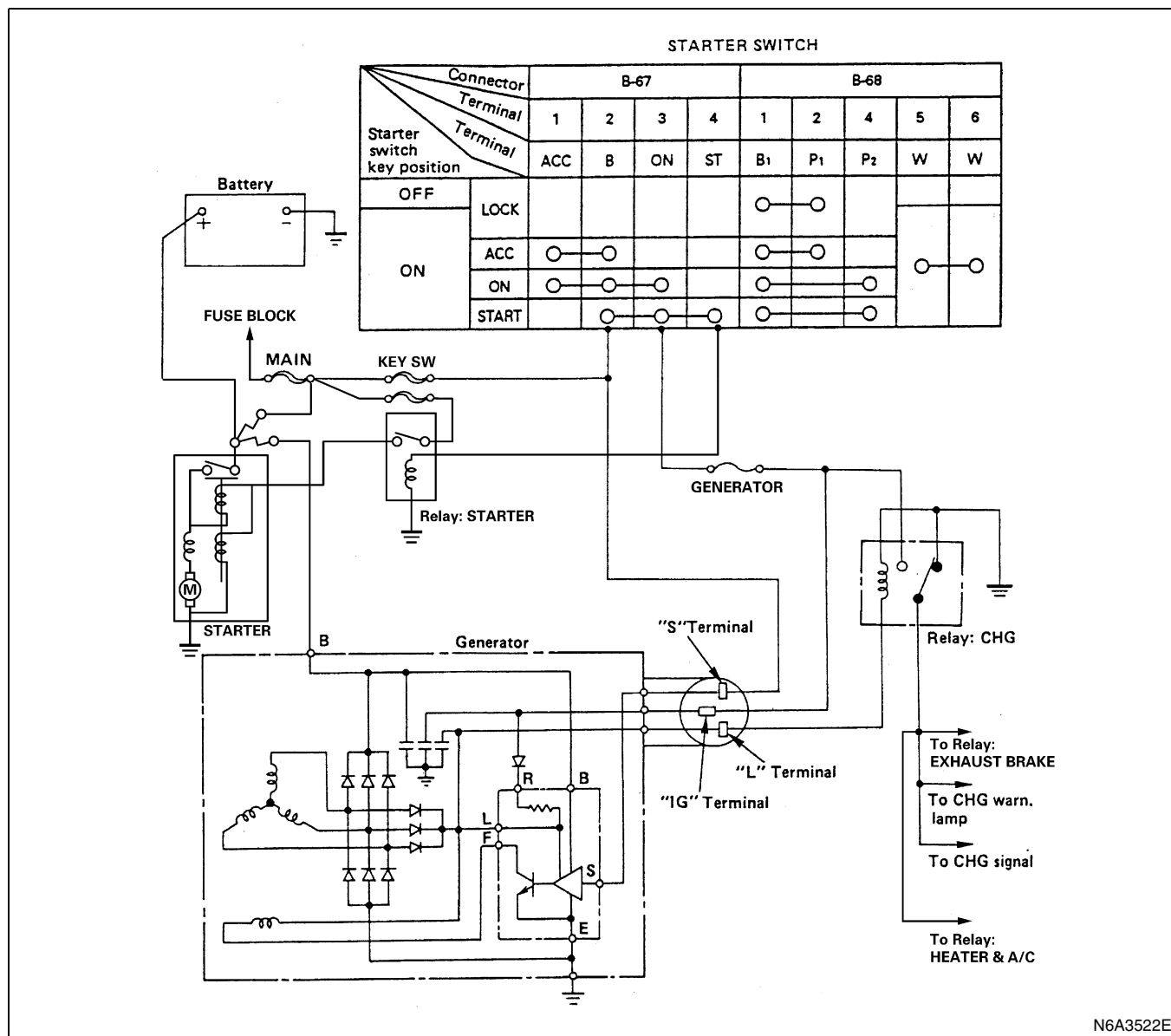
- | | |
|-----------------|------------------|
| 1. Ball bearing | 8. Slip ring |
| 2. Pulley | 9. Brush |
| 3. Front cover | 10. Rear cover |
| 4. Fan | 11. Vacuum pump |
| 5. Stator | 12. Through bolt |
| 6. Rotor | 13. Ball bearing |
| 7. IC regulator | 14. Oil seal |

Diagnosis

General On-Vehicle Inspection

The operating condition of charging system is indicated by the charge warning lamp. The warning lamp comes on when the starter switch is turned on "ON" position. The charging system operates normally if the lamp goes off when the engine starts. If the warning lamp shows abnormality or if undercharged or overcharged battery condition is suspected, perform diagnosis by checking the charging system as follows:

For 4JB1, 4JB1-TC



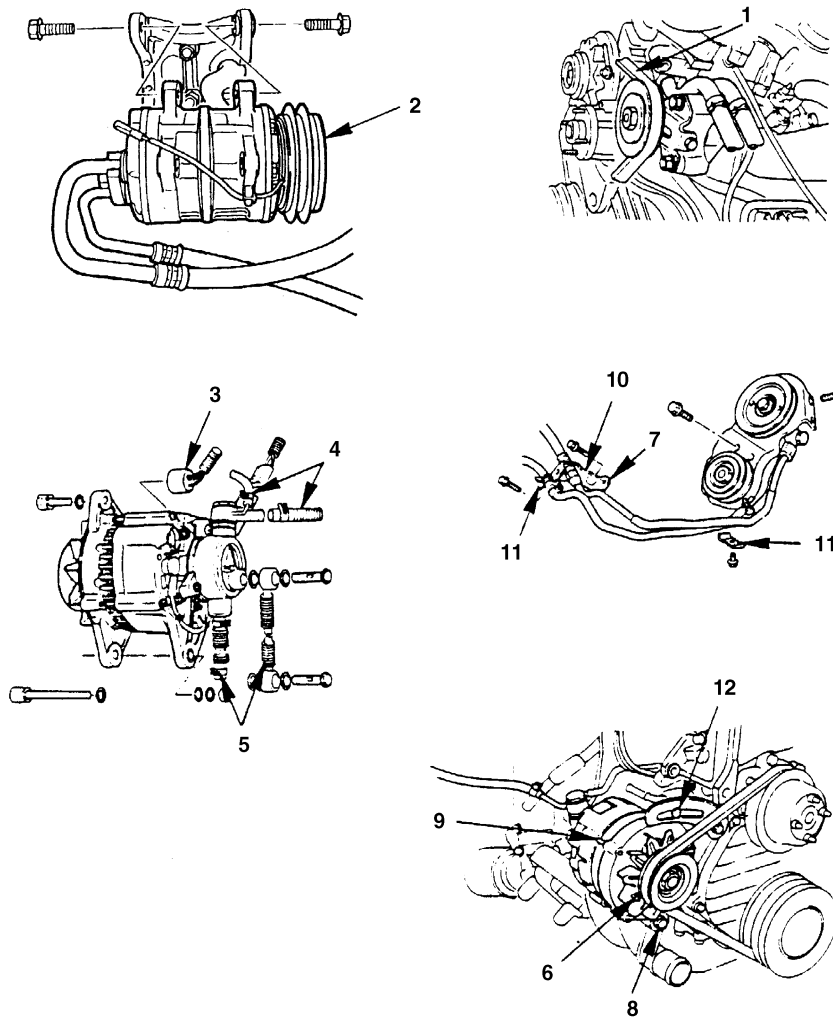
N6A3522E

1. Check visually the belt and wiring connector.
2. With the engine in stop status, turn the starter switch to "ON" position and observe the warning lamp.
 - If lamp does not come on:
Disconnect wiring connector from generator, and ground the terminal "L" on connector side.
 - If lamp comes on:
Repair or replace the generator.

On-Vehicle Service

Component

Generator



N6A3524E

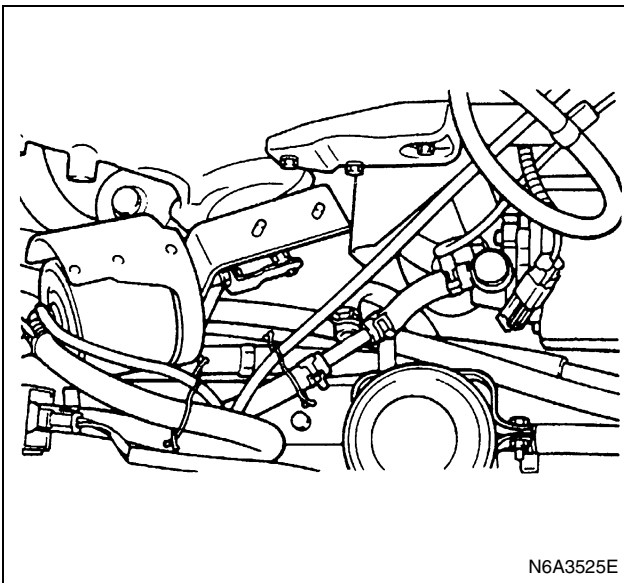
Legend

- | | |
|------------------------------|------------------------------------|
| 1. A/C compressor drive belt | 7. Power steering oil pipe bracket |
| 2. A/C compressor assembly | 8. AC generator fixing bolts |
| 3. Harness connector | 9. AC generator assembly |
| 4. Vacuum hose | 10. Bracket |
| 5. Oil hose | 11. Clip |
| 6. AC generator drive belt | 12. Lock bolt |

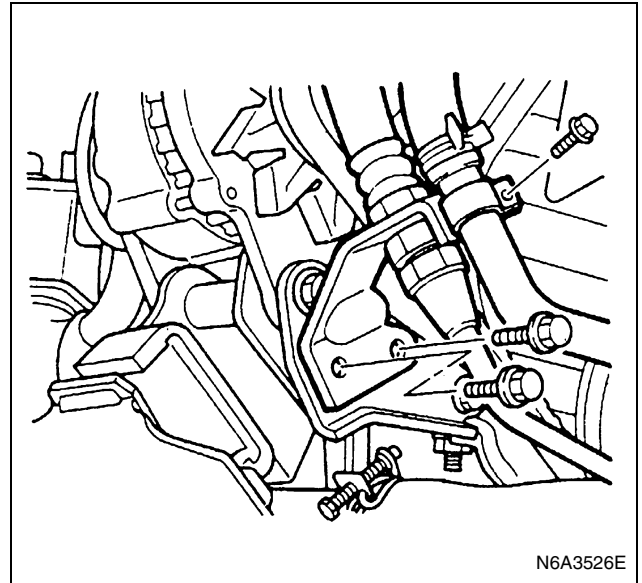
Removal

Preparation

- Disconnect battery ground cable.
- 1. A/C Compressor Drive Belt (A/C Model)
 - Loosen the idler pulley lock nut
 - Loosen the adjust bolt and remove the drive belt.
- 2. A/C Compressor Assembly (A/C Model)
 - Disconnect the clutch harness connector.
 - Remove the A/C compressor fixing bolts and temporarily tighten the A/C compressor to chassis frame side use the wire.
- 3. Harness Connector (A/C Model)
 - Disconnect the "L", "S", "IG" terminal.
 - Disconnect the "B" terminal.
- 4. Vacuum Hose (Exhaust Brake Model)
 - Remove the vacuum hose to vacuum tank and exhaust actuator.
- 5. Oil Hose
 - Remove the oil hose from oil pan.
 - Remove the oil hose of vacuum pump side.



- 6. AC Generator Drive Belt
 - Loosen the adjust plate fixing bolt.
 - Remove the adjust bolt.
 - Loosen the AC Generator fixing bolt then remove the fan belt.
- 7. Power Steering Oil Pipe Bracket (P/S Model)
 - Remove the oil pressure pipe bracket fixing bolt and pipe clip bolt.
 - Remove the oil suction pipe clip bolt.



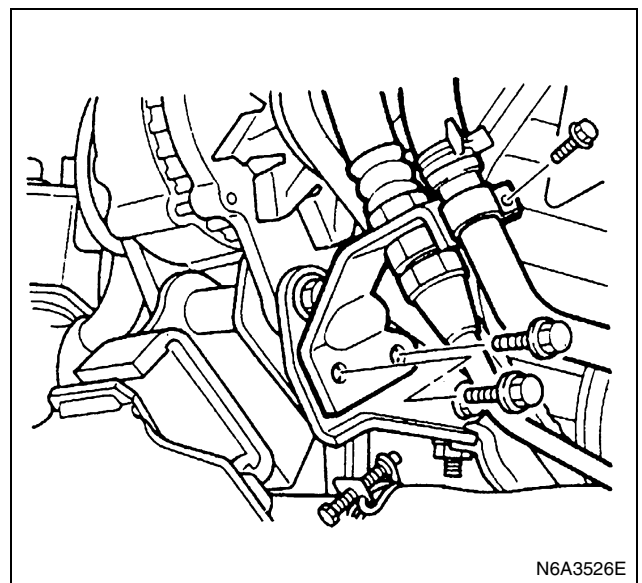
- 8. AC Generator Fixing Bolts
- 9. AC Generator Assembly

Installation

- 1. AC Generator Assembly
 - Set the AC generator.
- 2. AC Generator Fixing Bolts
 - Temporary install the AC generator fixing bolt.
- 3. Power Steering Oil Pipe Bracket (P/S Model)
 - Install the oil pipe bracket and tighten bolts to the specified torque.

Tighten:

Pipe Bracket Bolt to 19 N·m (1.9 kg·m/14 lb·ft)



- Install the suction pipe clip bolt and tighten bolt to the specified torque.

Tighten:

Pipe Clip Bolt to 10 N·m (1 kg·m/87 lb·in)

- Install the pressure pipe and suction pipe clip bolt, then tighten bolt to the specified torque.

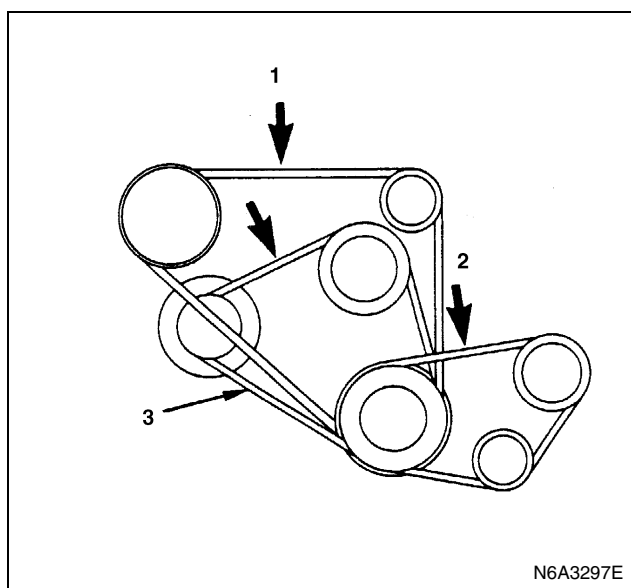
Tighten:

Pipe Clip Bolt to 10 N·m (1 kg·m/87 lb·in)

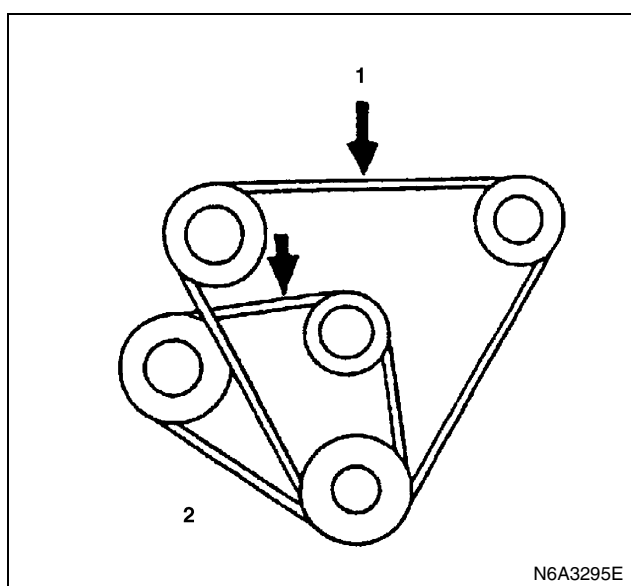
4. AC Generator Drive Belt

- Install the AC Generator drive belt and adjust belt tension.
- Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
8 (0.31) — 12 (0.47)	

4JG2**Legend**

1. A/C compressor drive belt
2. P/S oil pump drive belt
3. AC generator fan pulley drive belt

4JB1**Legend**

1. AC compressor drive belt & PS pump drive belt
2. AC generator & fan pulley drive belt

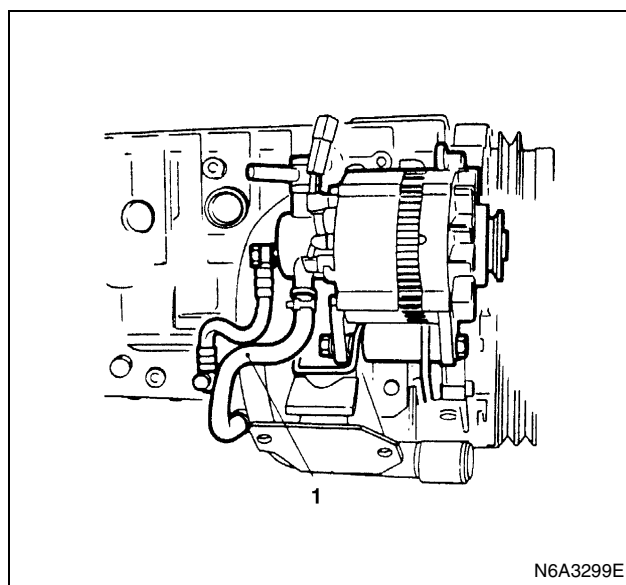
- Install the fixing bolt and tighten bolt to the specified torque.

Tighten:

- Generator Fixing Bolt to 40 N·m (4.1 kg·m/30 lb·ft)
- Adjust Plate Fixing Bolt to 19 N·m (1.9 kg·m/14 lb·ft)

5. Oil Hose

- Install the oil hose (1) to vacuum pump.
- Install the oil hose (2) to oil pan.



6. Vacuum Hose (Exhaust Brake Model)

- Install the vacuum hose to vacuum tank and exhaust actuator.

7. Harness Connector (A/C Model)

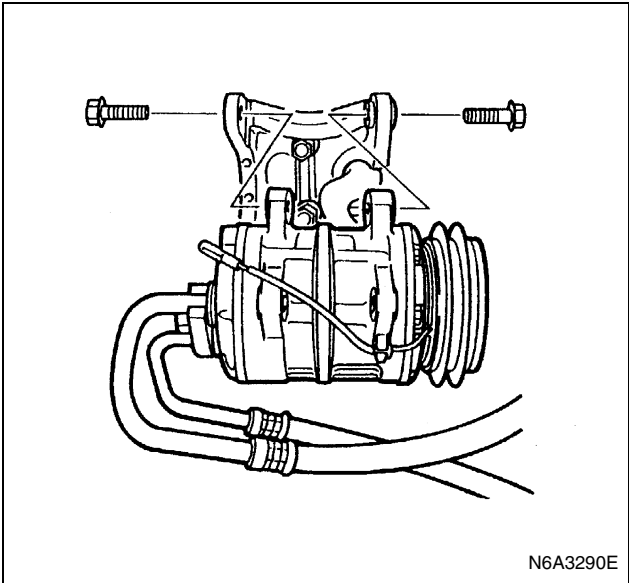
- Connect the "L", "S", "IG" terminal and "B" terminal connectors.

8. A/C compressor Assembly (A/C Model)

- Install the compressor assembly and tighten bolts to the specified torque.

Tighten:

Compressor Bolt to 19 N·m (1.9 kg·m/14 lb·ft)



- Connect the magnetic switch harness connector.

9. A/C compressor Drive Belt (A/C Model)

- Install A/C compressor drive belt and adjust belt tension.
- Depress the drive belt mid-portion with a 98N (10 kg/22 lb) force.

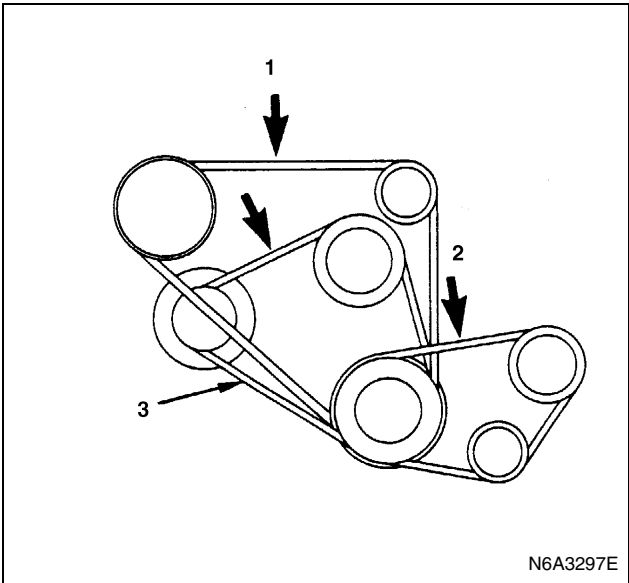
Drive Belt Deflection	mm (in)
New 7 — 8 (0.28 — 0.31)	
Check 12 — 14 (0.47 — 0.55)	

- Tighten the idler lock nut to the specified torque.

Tighten:

Idle Pulley Lock Nut to 27 N·m (2.8 kg·m/20 lb·ft)

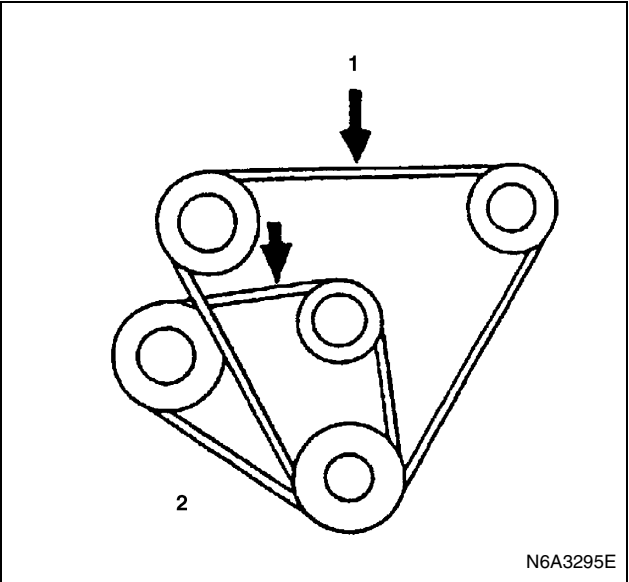
4JG2



Legend

1. A/C compressor drive belt
2. P/S oil pump drive belt
3. AC generator fan pulley drive belt

4JB1



Legend

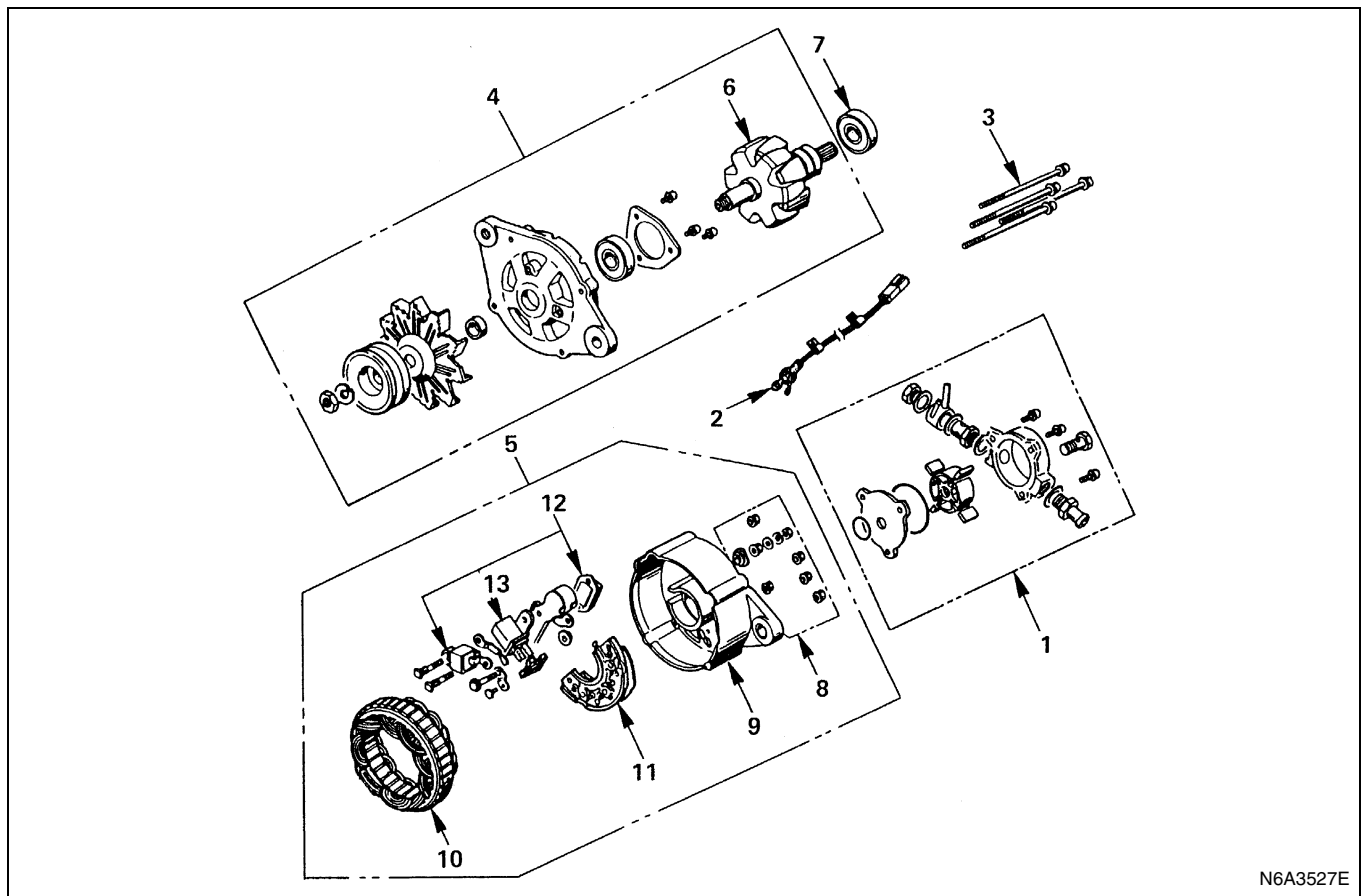
1. AC compressor drive belt & PS pump drive belt
2. AC generator & fan pulley drive belt

- Connect the battery ground cable.

Unit Repair

Component

12V-50A



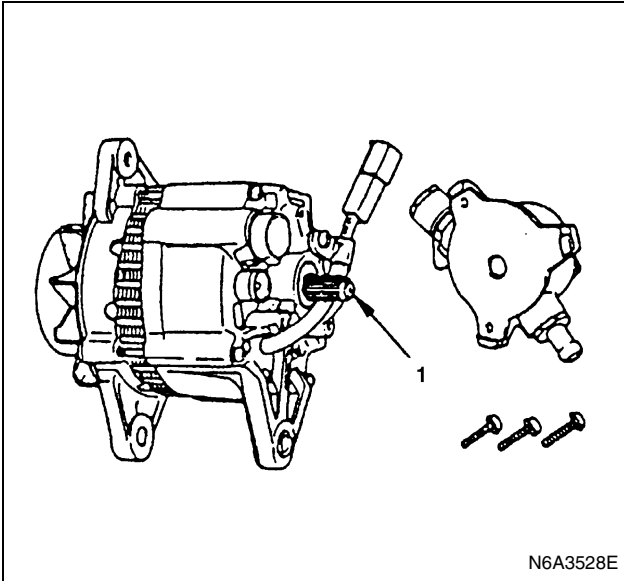
N6A3527E

Legend

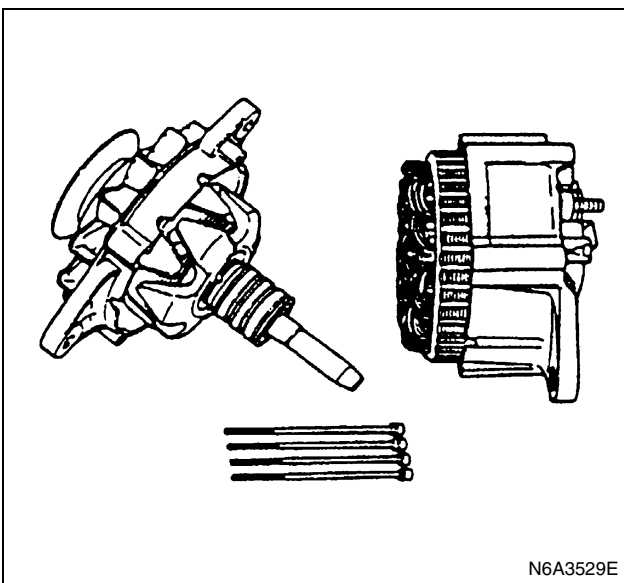
- | | |
|-----------------------------------|---------------------------|
| 1. Vacuum pump | 8. Terminal bolt and nut |
| 2. Lead wire | 9. Rear cover |
| 3. Through bolts | 10. Stator |
| 4. Rotor and front cover assembly | 11. Diode |
| 5. Stator and rear cover assembly | 12. IC regulator assembly |
| 6. Rotor | 13. Brush holder |
| 7. Rear bearing | |

Disassembly

1. Vacuum Pump
 - Drain fluid from discharged port.
 - Remove the vacuum pump fixing bolts. Hold the center plate and remove the vacuum pump horizontally in direction in line with the rotor shaft.
2. Lead Wire
3. Through Bolts

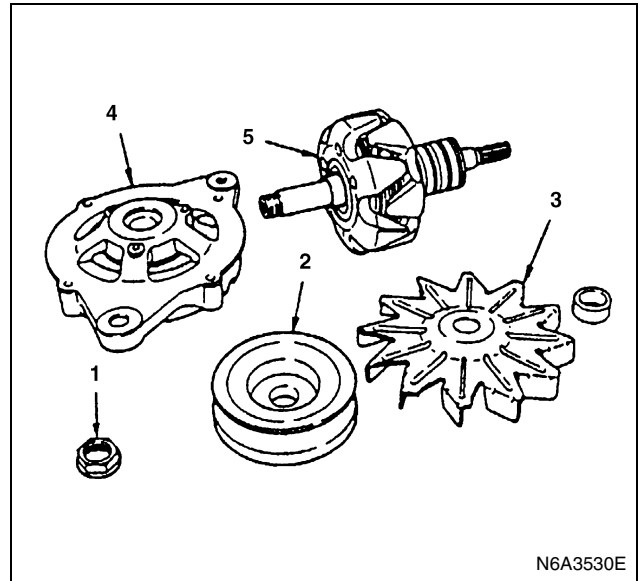
**Legend**

1. Seal protector
-
4. Rotor and Front Cover Assembly
 5. Stator and Rear Cover Assembly
 - Insert a screwdriver into the clearance between the front cover and the stator core, and remove the assembly.

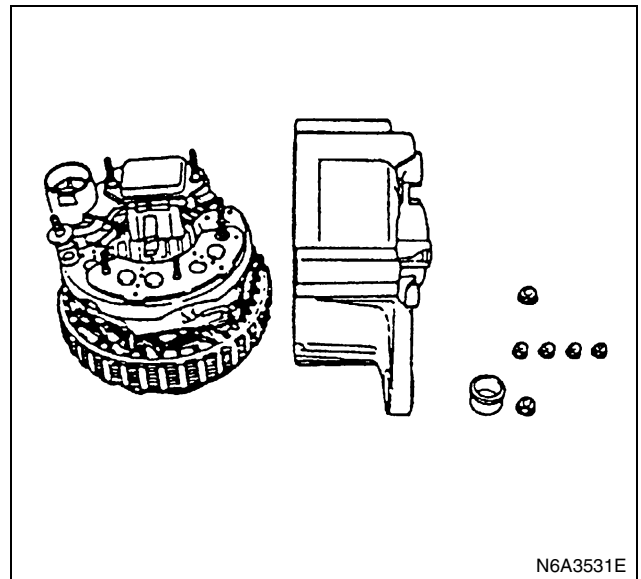
**Notice:**

Take care not to damage the stator coil with the screwdriver. When the assembly will not come off, hold down the rear cover and hit the end face of the shaft gently with a plastic hammer to detach it.

6. Rotor
 - With the rotor gripped with a vise, remove the pulley nut (1), and then take off the pulley (2), fan (3), front cover (4) and the rotor (5).



7. Rear Bearing
8. Terminal Bolt and Nut
9. Rear Cover
 - Remove the nuts fixing the B terminal and diode holder. Separate the stator and rear cover. Note the position of insulation washers to ensure reassembly into original position.

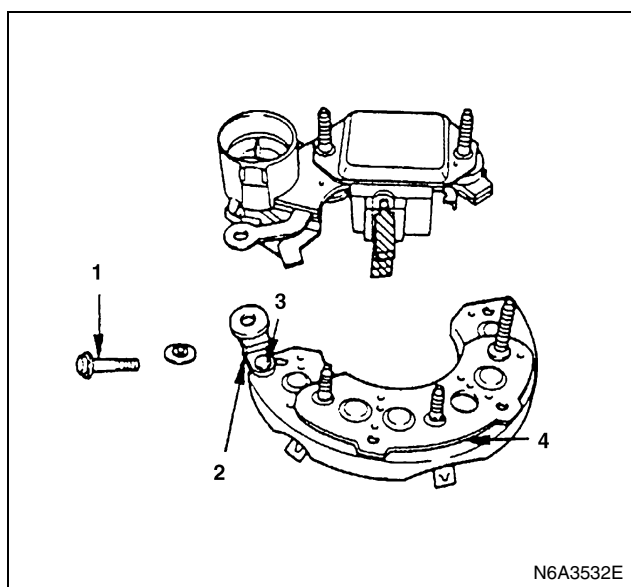


10. Stator
11. Diode

- Separate the diodes from the stator by melting away solder on stator coil and diode. When melting solder, hold the lead wire with long nose pliers to prevent heat from being transferred to the diodes.

12. IC Regulator Assembly

- Separate the IC regulator from the diode by melting away solder on IC regulator holder plate and removing the nut.

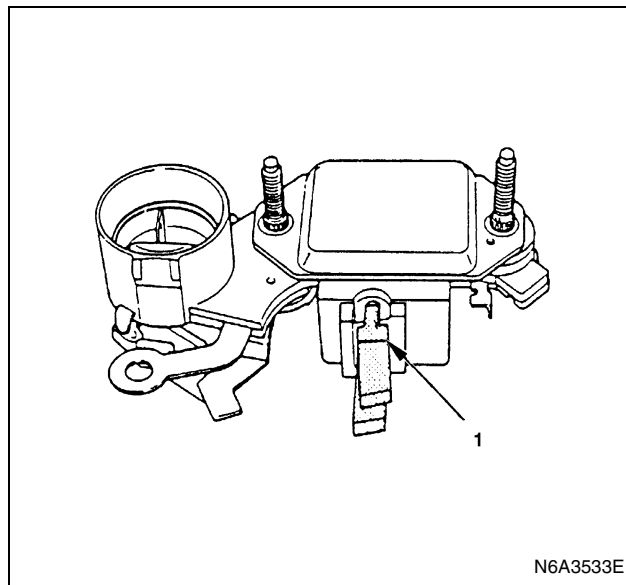


Legend

- Terminal bolt
- Terminal plate
- Rivet
- Diode

13. Brush Holder

- Remove the serrated bolts and melt away solder on IC regulator.
- Do not remove the serrated bolts unless the replacement of brush or condenser. To install, follow the removal steps in the reverse order.



Legend

- Wear limit

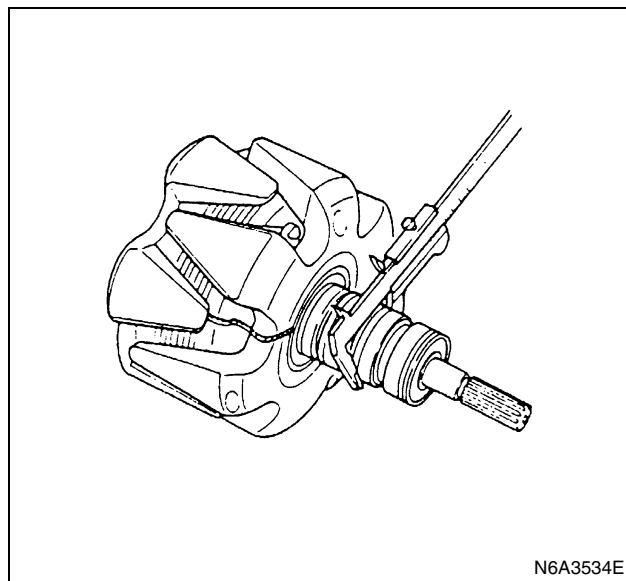
Inspection and Repair

Repair or replace necessary parts if extreme wear or damage is found during inspection.

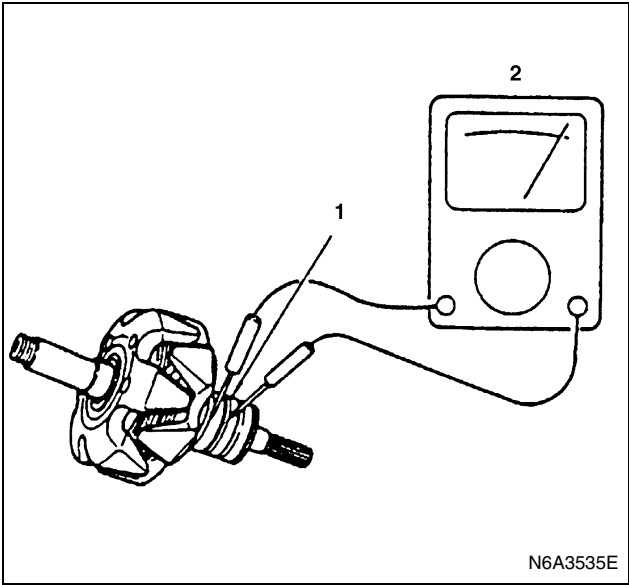
Rotor

- Check the rotor slip ring surfaces for contamination and roughness. If rough, polish with #500 — 600 sandpaper.
- Measure the slip ring diameter, and replace if it exceeds the limit.

mm (in)	
Standard	Limit
34.6 (1.36)	33.6 (1.32)



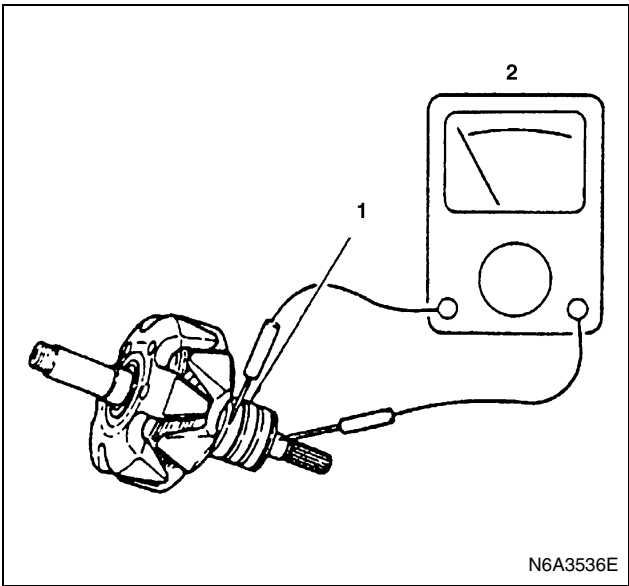
- Check for continuity between slip rings, and replace if there is no continuity.



Legend

- 1. Slip ring
- 2. Tester

4. Check for continuity between slip ring and rotor core or slip ring and rotor shaft.
In case of continuity, replace the rotor assembly.



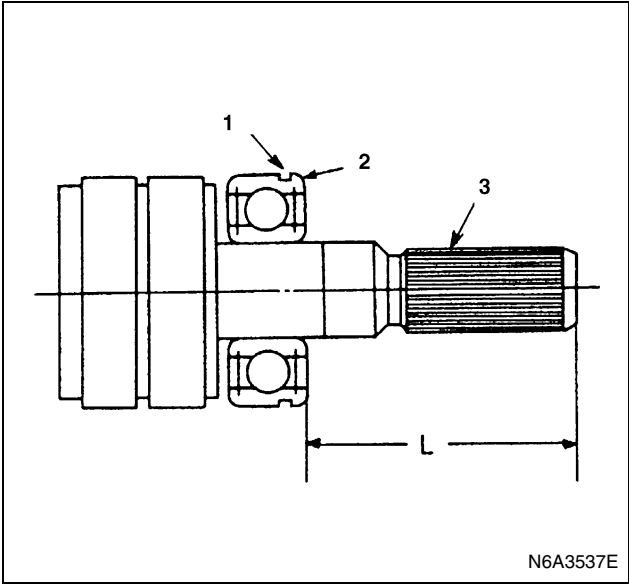
Legend

- 1. Slip ring
- 2. Tester

Rear Ball Bearing

Check to see if the ball bearing rotates smoothly with no noises.
When it does not rotate smoothly or any noises are heard, replace it with a new one.
When installing the bearing, press it in with the stopper ring turned to the spline side, while pushing the bearing inner ring.

Bearing press-in measurement: L	
	mm (in)
Standard	41.8 — 42.0 (1.64 — 1.65)

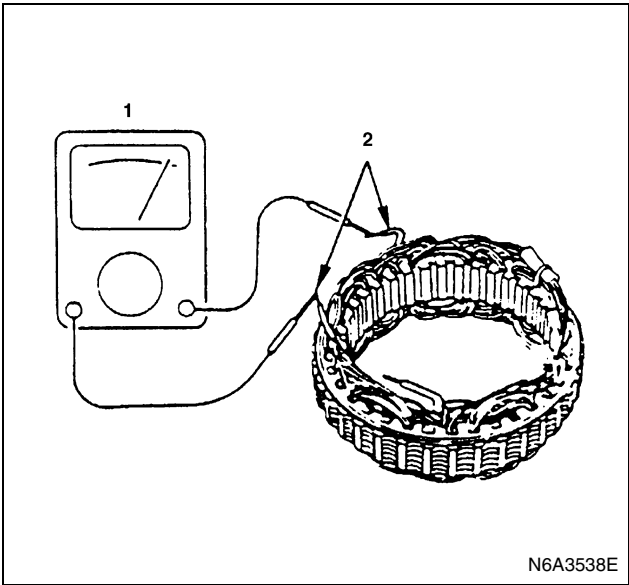


Legend

- 1. Stopper ring
- 2. Ball bearing
- 3. Spline

Stator Coil

1. Check for continuity between respective phases.
In case of no continuity, replace the stator.

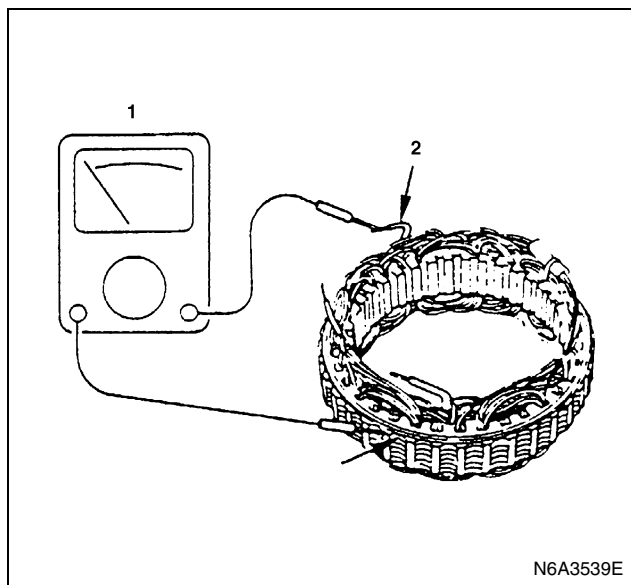


Legend

- 1. Tester
- 2. Lead wire

6D-30 ENGINE ELECTRICAL

- Check for continuity across one of the stator coils and stator core. If a continuity exists, replace the coil.



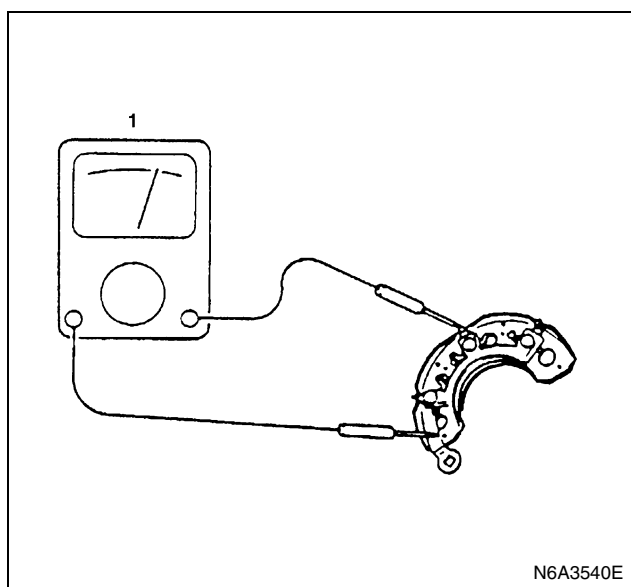
Legend

- Tester
- Lead wire

Diode

- Check for continuity across the terminal (example: across BAT and U). If a continuity exists, the diode is in satisfactory condition. If no continuity exists the diode is defective.
- Make a test with the polarities reversed. If no continuity exists, the diode is in satisfactory condition. If a continuity exists at any point, the diode is defective and should be replaced.

Auxiliary diodes are not provided with the terminal and continuity test should be made across the terminals of the conventional diodes.



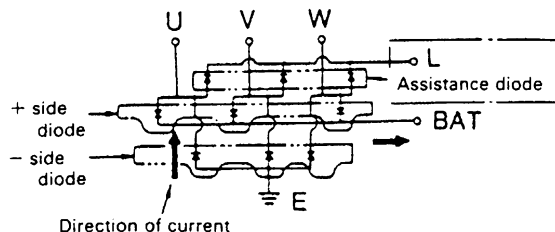
Legend

- Tester

- side diode check			
Across terminals		BAT (Positive side (+) diodes)	
	Tester pin	Positive side	Negative side
U.V.W	Positive side		No continuity
	Negative side	Continuity	

+ side diode check			
Across terminals		E (Negative side (-) diodes)	
	Tester pin	Positive side	Negative side
U.V.W	Positive side		Continuity
	Negative side	No continuity	

U.V.W. indicator stator coil lead terminals



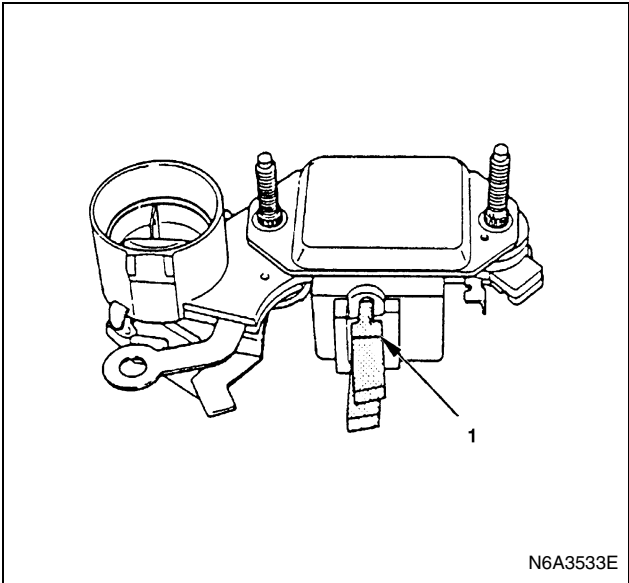
Brush

Measure length of brushes.

Brush length (L)

mm (in)	
Standard	Limit
20 (0.79)	6 (0.24)

Brushes are provided with a line which indicates the limit of usage.



Legend
1. Wear limit

IC Regulator

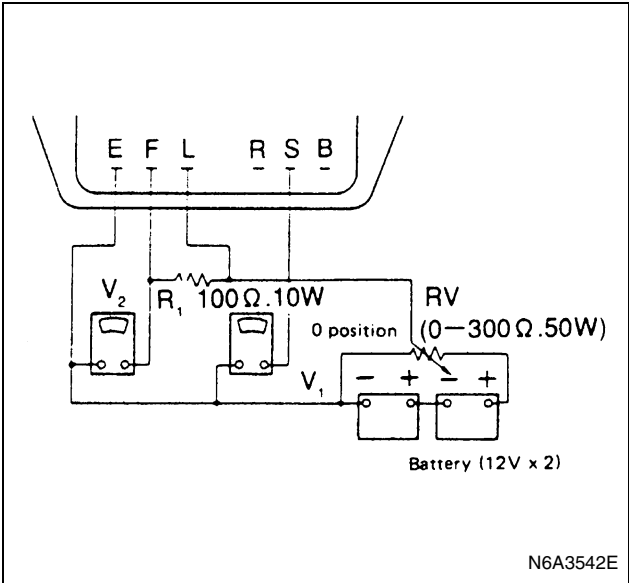
Measuring instruments is necessary.
Take the following measurements with the instruments connected as shown in the illustration.

V1 Voltage at Battery1		V
Standard	10 — 13	

V2 Voltage across F — E		V
Standard	Limit	
2 or less	2 or more	

Take measurement with 'S' terminal disconnected.

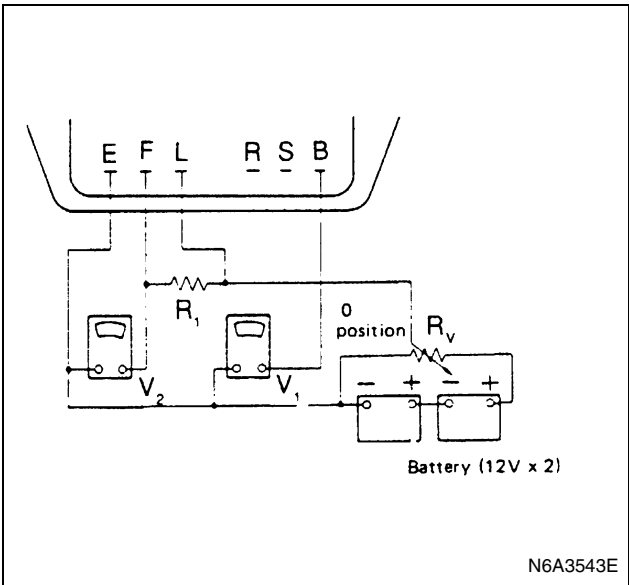
V3 Measure the voltage at Battery1 — Battery2.		V
Standard	20 — 26	



- Measurement the voltage across the E — F while varying resistance gradually from zero using variable resistor.
Then check that voltage increases from 2V to 10 — 13.
If increase in voltage is interrupted at any point, replace the regulator.
- V4 Measure the voltage across the intermediate tap on variable resistor and 'E' terminal without actuating the variable resistor.

		V
Standard voltage at 20°C (68°F)	14.0 — 14.9	

If measured value deviates from the standard, replace the regulator.



Check the following with the instrument connected as illustrated.
Measure the voltage across the terminals B and E by gradually increasing voltage with variable resistor RV.

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Check to see if voltage increases from lower than 2V to range from 10 to 13 volts.

If the voltage does not vary, the regulator is defective and should be replaced.

Check the voltage across the intermediate tap of the variable resistor and terminal E without actuating the variable resistor.

V	
Standard voltage at 20°C (68°F)	14.5 — 16.9

If measured voltage deviates from the standard value, replace the regulator.

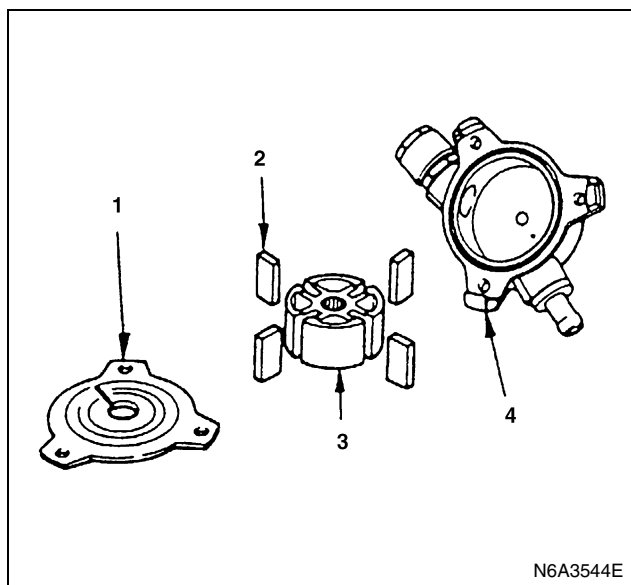
Vacuum Pump

Visual Check

- Inspect the following parts for wear, damage or other abnormal conditions.

Disassembly of Vacuum Pump

- For the center plate, rotor and vane in the mentioned.



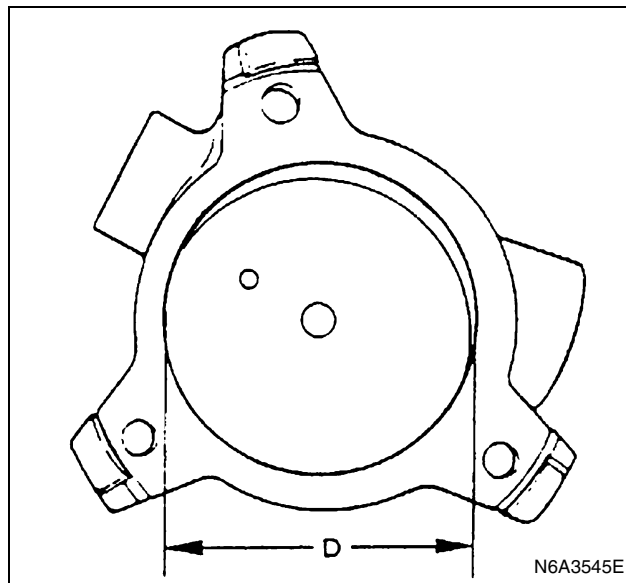
Legend

- Center plate
- Vane
- Rotor
- Housing

Housing

- Measure the inside diameter of housing and place if it exceed the standard.

mm (in)	
Standard	57.0 — 57.1 (2.244 — 2.248)



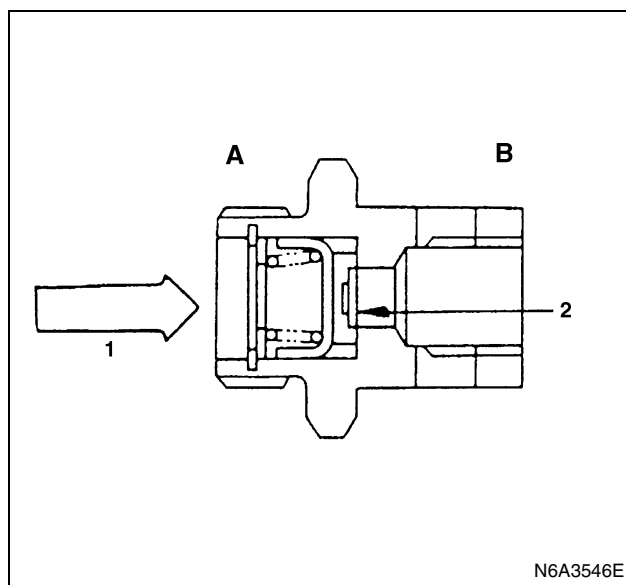
Vane

Measure the length of vanes

mm (in)	
Standard	12.5 — 13.5 (0.492 — 0.531)

Check Valve

- Apply a light pressure onto the "B" side of valve with a screwdriver and check that valve operates smoothly.
- Apply compressed air 100 — 500 kPa (1 — 5 kg/cm²/14.5 — 72.5 psi) onto "A" side of valve and check if there is air leak.

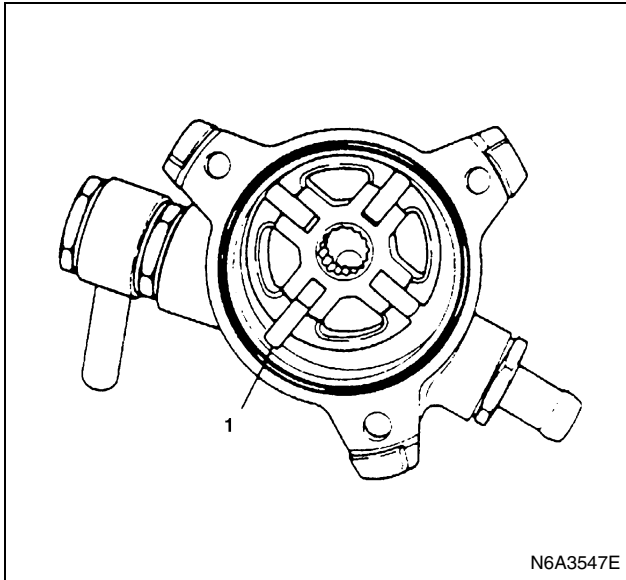


Legend

- Compressed air
- Push

Reassembly of Vacuum Pump

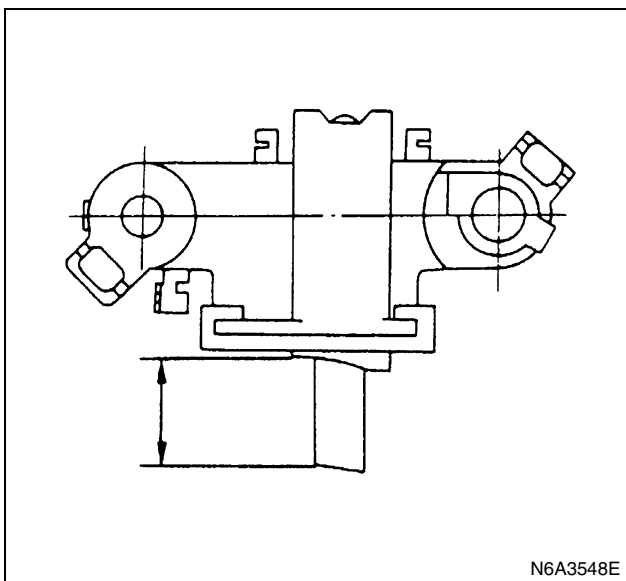
1. Position the rotor, with the serrated boss turned up, on the center plate and housing. Align the holes in center plate and rotor.
2. Install vanes into slits in rotor. The vanes should be installed with chamfered side turned outward.
3. Install the O-ring and center plate

**Legend**

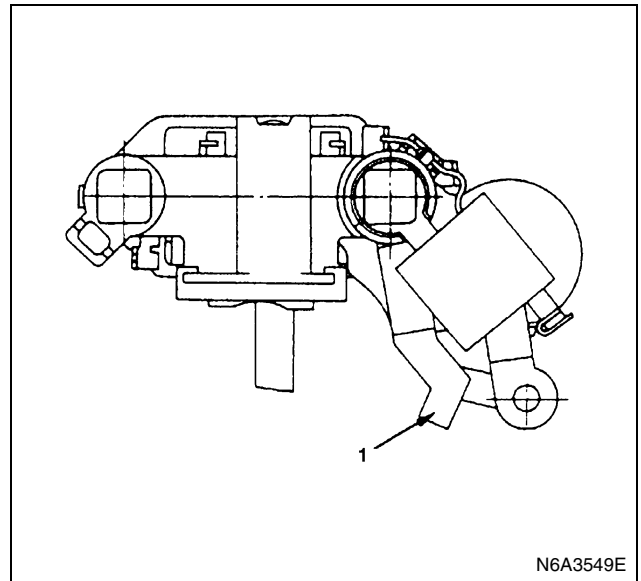
1. Chamfered side

Reassembly

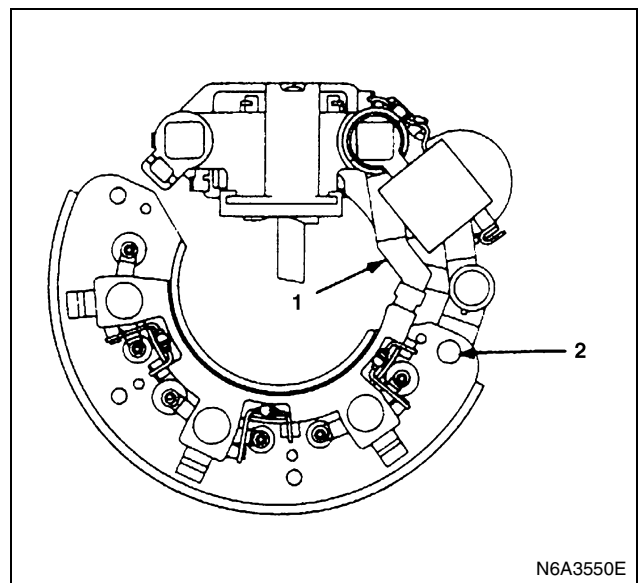
1. Brush Holder
2. IC Regulator Assembly
 - Hold the brush in the holder as shown in the illustration and solder the lead wire.



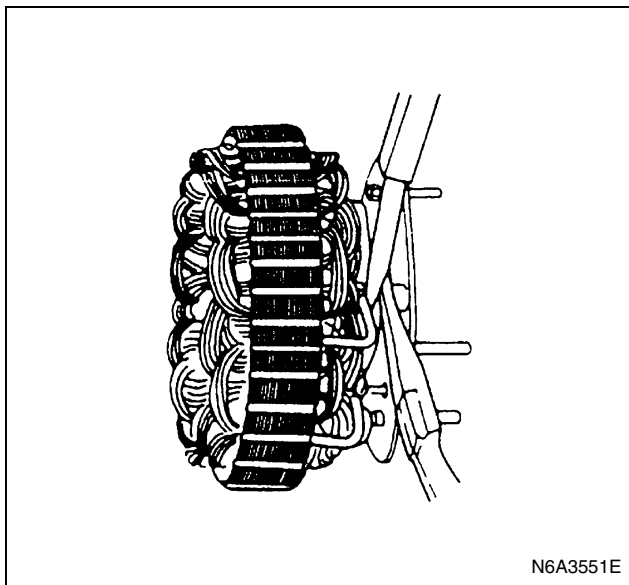
- Put the IC regulator on the brush holder and press the bolt. Bushing and connecting plate (1) must be installed when pressing the bolt.

**3. Diode**

- Connect the terminals by fixing the rivet at (1) and soldering the terminal at (2).

**4. Stator**

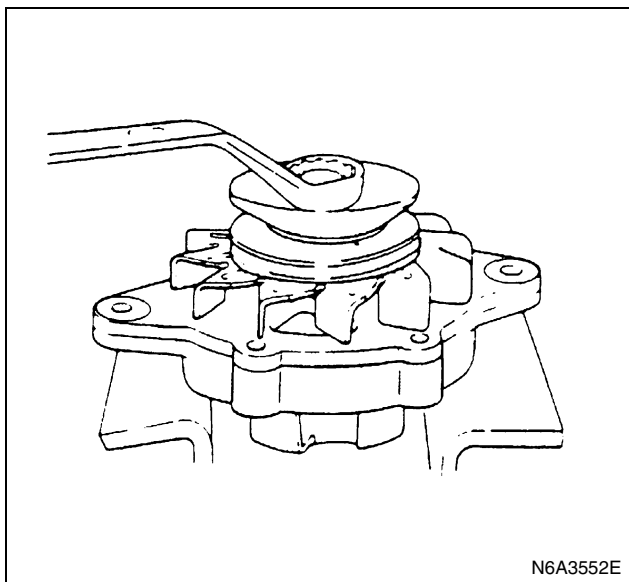
- When connecting stator coil leads and diode leads using solder, use long-nose pliers and finish the work as quickly as possible to prevent the heat from being transferred to the diodes.



5. Rear Cover
6. Terminal Bolt and Nut
7. Rear Bearing
8. Rotor
 - Cover vice with copper plates, clamp the rotor with the vice, and tighten nut to the specified torque.

Tighten:

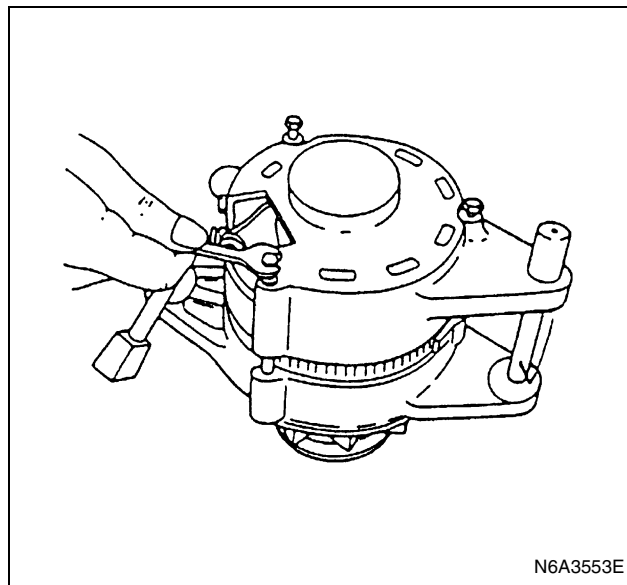
Pulley Nut to 90 N·m (9.2 kg·m/67 lb·ft)



9. Stator and Rear Cover Assembly
10. Rotor and Front Cover Assembly
11. Through Bolts
 - Place guide bar through the holes in front cover and rear cover flange for alignment, then install the through bolts.
 - Tighten the through bolts to the specified torque

Tighten:

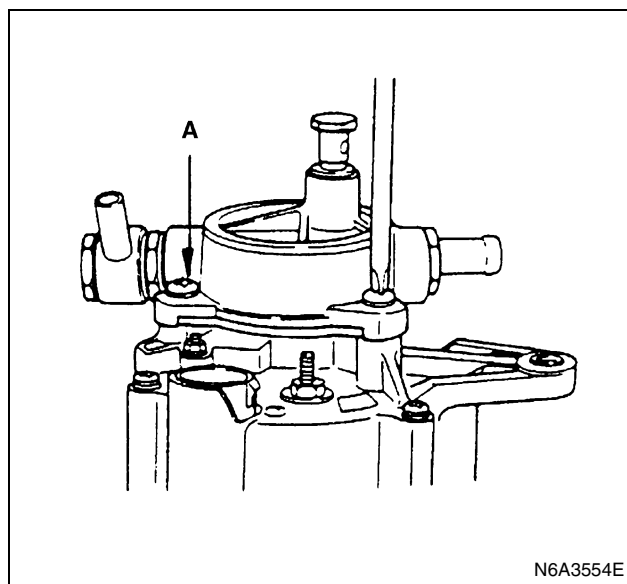
Through Bolts to 3.5 N·m (0.36 kg·m/31 lb·in)



12. Lead wire
13. Vacuum Pump
 - Install and mount the housing to the generator using 3 bolts.
 - Pour engine oil (5 cc or so) in through the filler port, then check that generator pulley can be turned smoothly with hand.
 - Tighten the pump fixing bolts (A) to the specified torque.

Tighten:

Through Bolts to 3.5 N·m (0.36 kg·m/31 lb·in)

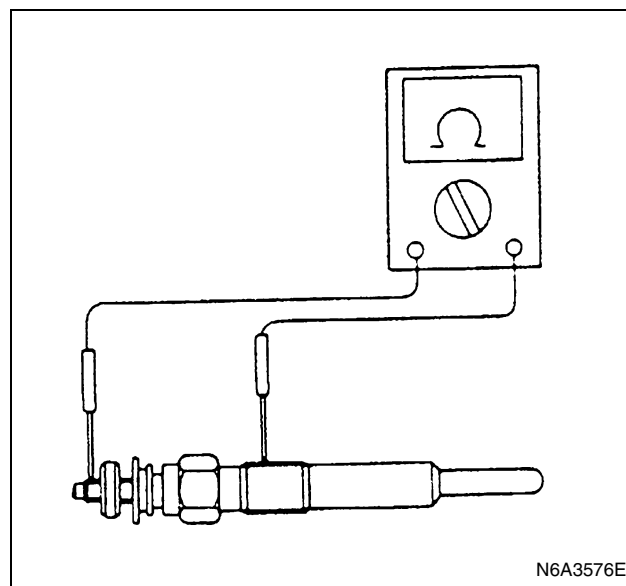
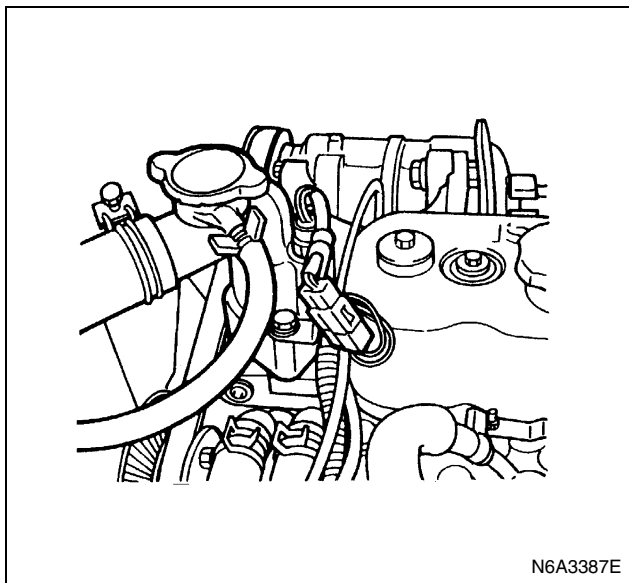


- Pour engine oil (5 cc or so) through the filler port, and then check the pulley for smooth rotation.

QOSII PREHEATING SYSTEM (4JB1/4JB1-TC/4JH1-TC ONLY)

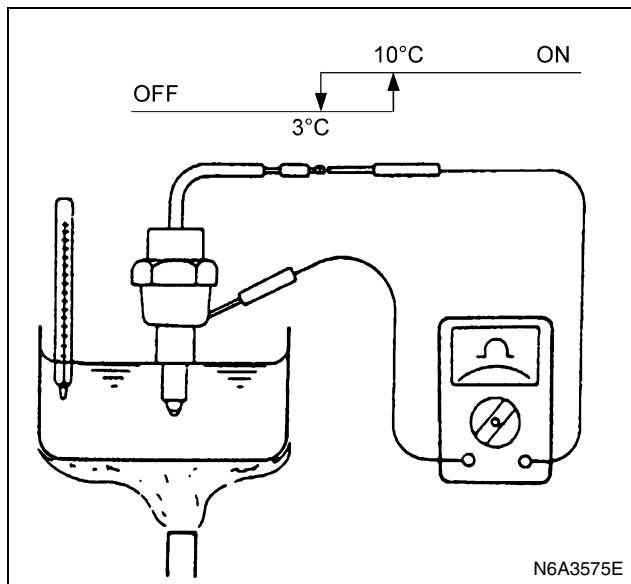
Inspection on QOSII System Operation Thermo Switch

The thermo switch is located on the water outlet pipe.



Use a circuit tester to check the thermo switch for continuity.

OFF → ON	: 7 — 13°C (44.6 — 55.4°F)
ON → OFF	: Below 3°C (37.4°F)

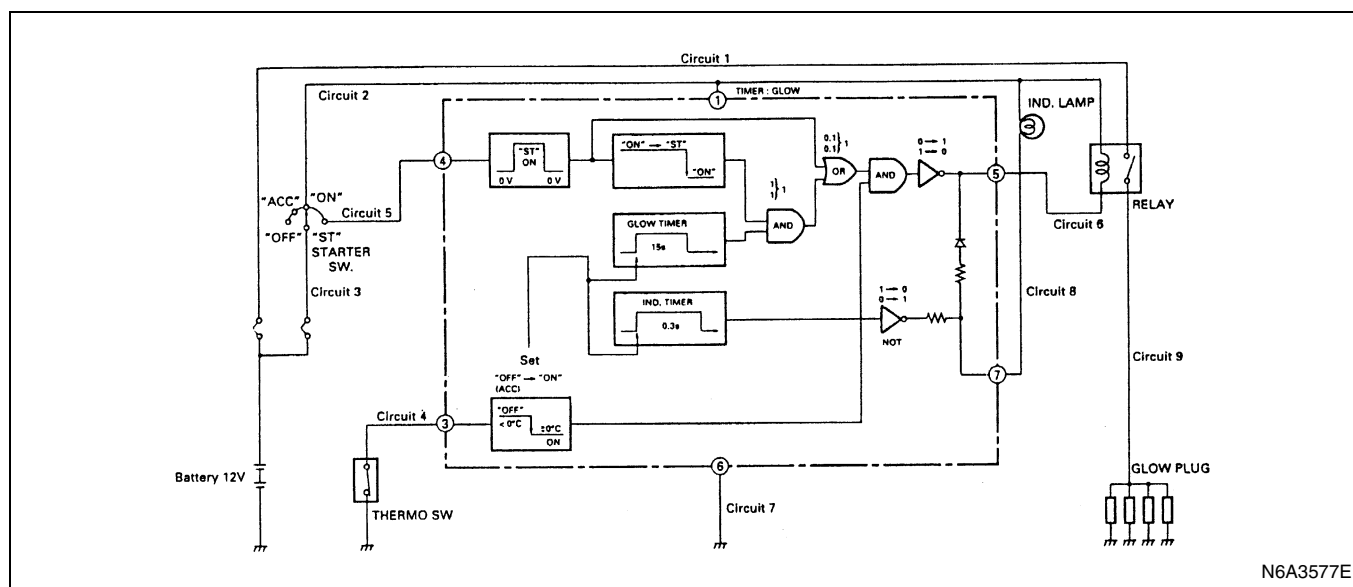


Glow Plug

Use a circuit tester to test the glow plugs for continuity.

Glow Plug Resistance (Reference)	
	Ohms
Conventional model	Approximately 1.5
Quick on start model	Approximately 0.9

QOSII System Troubleshooting



1. Problems when the water temperature of the engine is 0°C below.

Condition	Cause	Circuit
Glow plug relay will not be lit.	Bad connection of Fusible link wire between battery and starter.	3
	Bad connection or disconnection of starter SW circuit	
	Bad connection or disconnection of Fuse No. SBF3	2
	Malfunction of other circuits occurred simultaneously.	
	Bad starter switch.	
	Bad connection of glow plug relay terminal.	1
	Disconnection of glow plug relay excitation coil.	
	Disconnection of circuit between glow plug relay and timer.	6
	Bad glow relay. (The main contact does not pass electricity.)	
	Bad connection of timer.	
Through glow plug relay turns ON, pre-heating is not done.	Bad timer.	7
	Bad earth circuit of timer.	
	Bad thermoswitch. (It remains ON even in water temperature below 0°C.)	7
Glow plug relay turns ON, but does not go OFF.	Earth short-circuiting of thermo switch.	7
	Bad connection of Fusible link wire between battery and glow relay.	1
	Bad connection or disconnection in preheating circuit of glow relay main contact terminal connector.	
Glow plug relay turns ON, but does not go OFF.	Bad connection between plug connector and preheating circuit.	9
	Bad timer.	
	Bad timer. Short circuiting in circuit or earth between 5 terminal and glow relay.	6
Indication lamp is not lit.	Bad glow relay.	
	Burning-out of light bulb. 8	8

Notice:

Circuit number is shown in the previous pre-heating chart.

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2. Problems when the time water temperature of the engine is 0°C or above.

Condition	Cause	Circuit
Indicator lamp is not lit	Bad timer Burning-out of bulb. 8	8
Turn glow relay ON.	Bad thermost switch or disconnection of thermo SW circuit. (Indicator will light up for 3.5 seconds.) Bad timer. Bad timer. Short-circuiting in circuit or earth between terminals 5 and glow relay.	4

Notice:

Circuit number is shown in the previous pre-heating chart.

3. Burning-out of glow plug

When only one line is burned out, it has no effect on the start up of the engine. Even if one line is burned out, judging from the characteristics of the glow plug, the impressed voltage will change only slightly.

Therefore, no judgment can be made by normal testing while the glow plug is installed. In order to check for disconnections and burn-outs, the glow plugs will have to be removed from the connectors and checked one by one for continuity.

QOSIII PREHEATING SYSTEM (4JG2 ONLY)

General Description

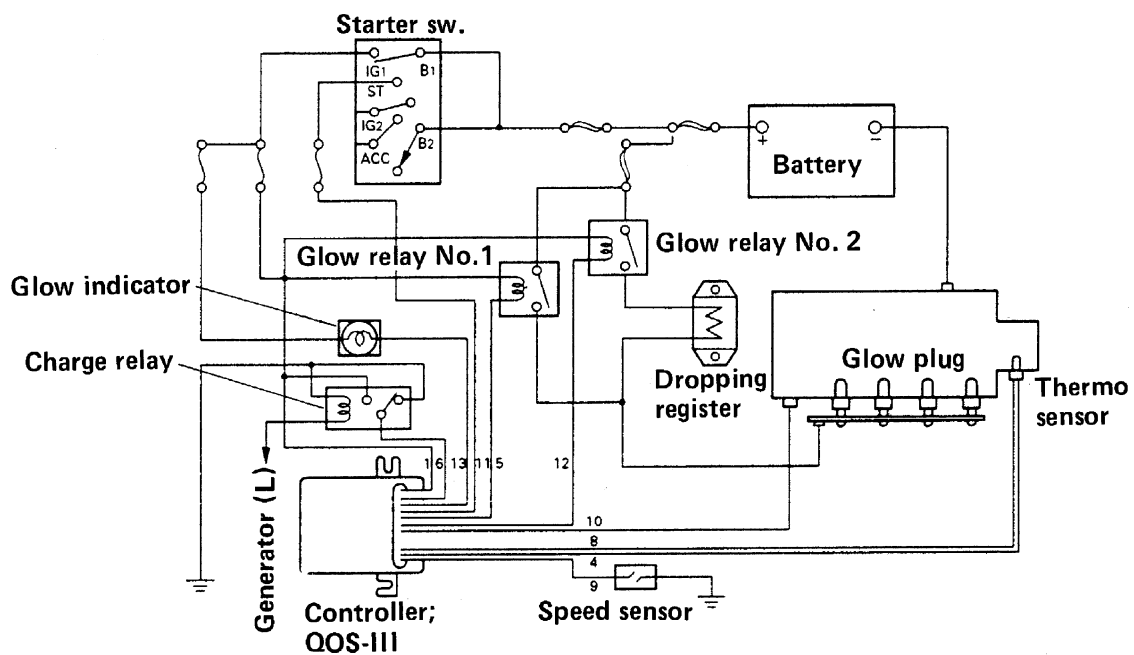
QOS III preheating system features a quick-on glow plug with thermometer control of the glowing time and the after-glow time function.

The system consists of a controller, indicator lamp, thermosensor, vehicle speed sensor, dropping resistor, relay (2 pcs), and temperature self-control type glow plug (4 pcs)

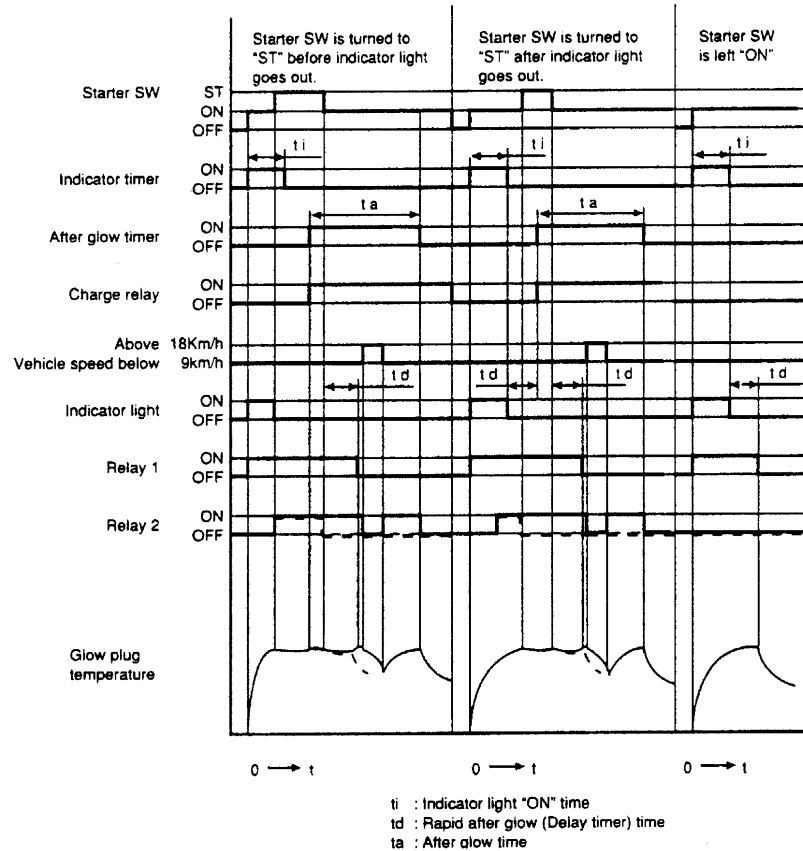
With the employment of the thermoswitch, the glow time changes according to the engine coolant temperature, thus allowing optimum starting conditions to be obtained.

The afterglow time function is controlled by thermosensor, vehicle speed sensor, and the engine runstall sensor (charge relay).

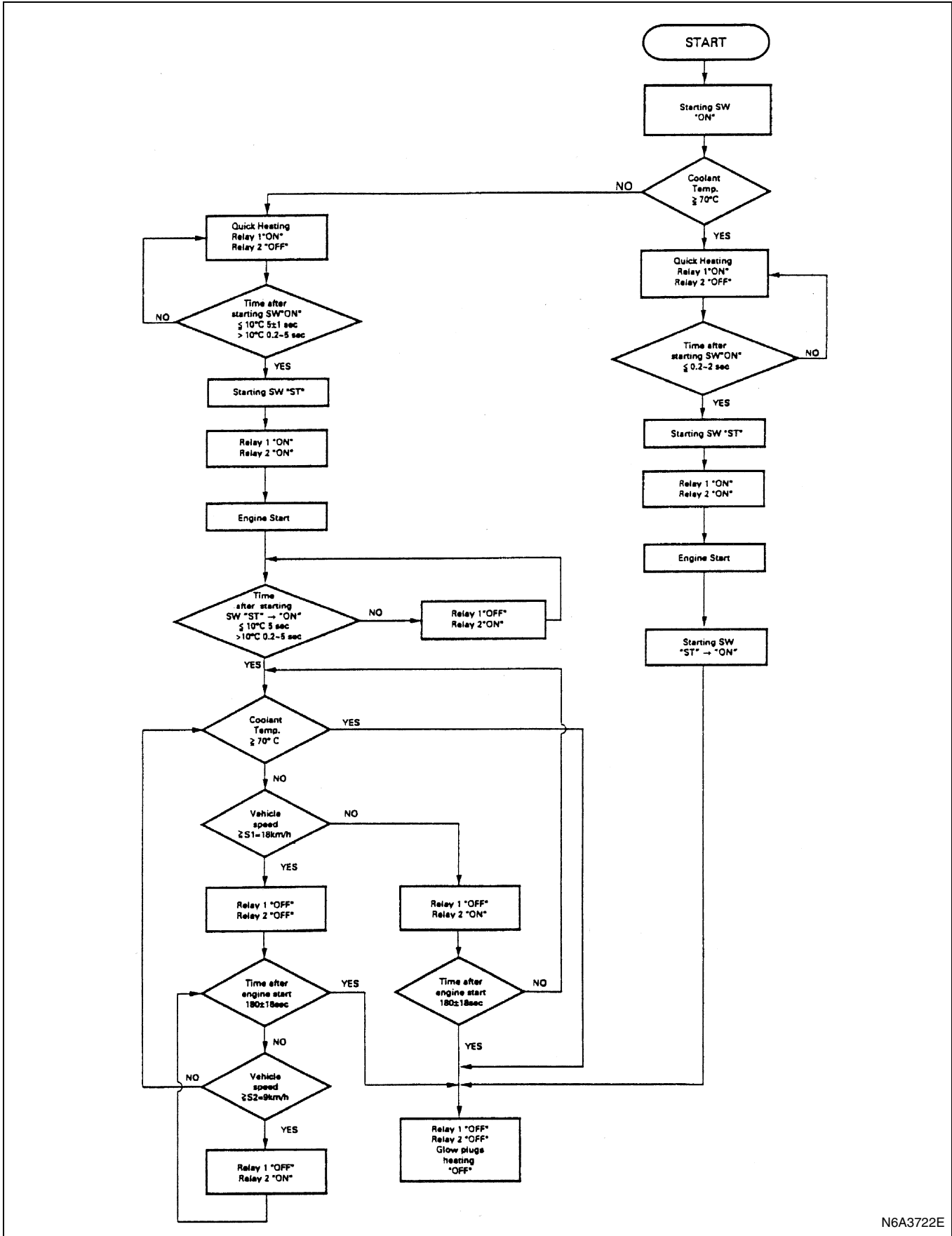
System Diagram



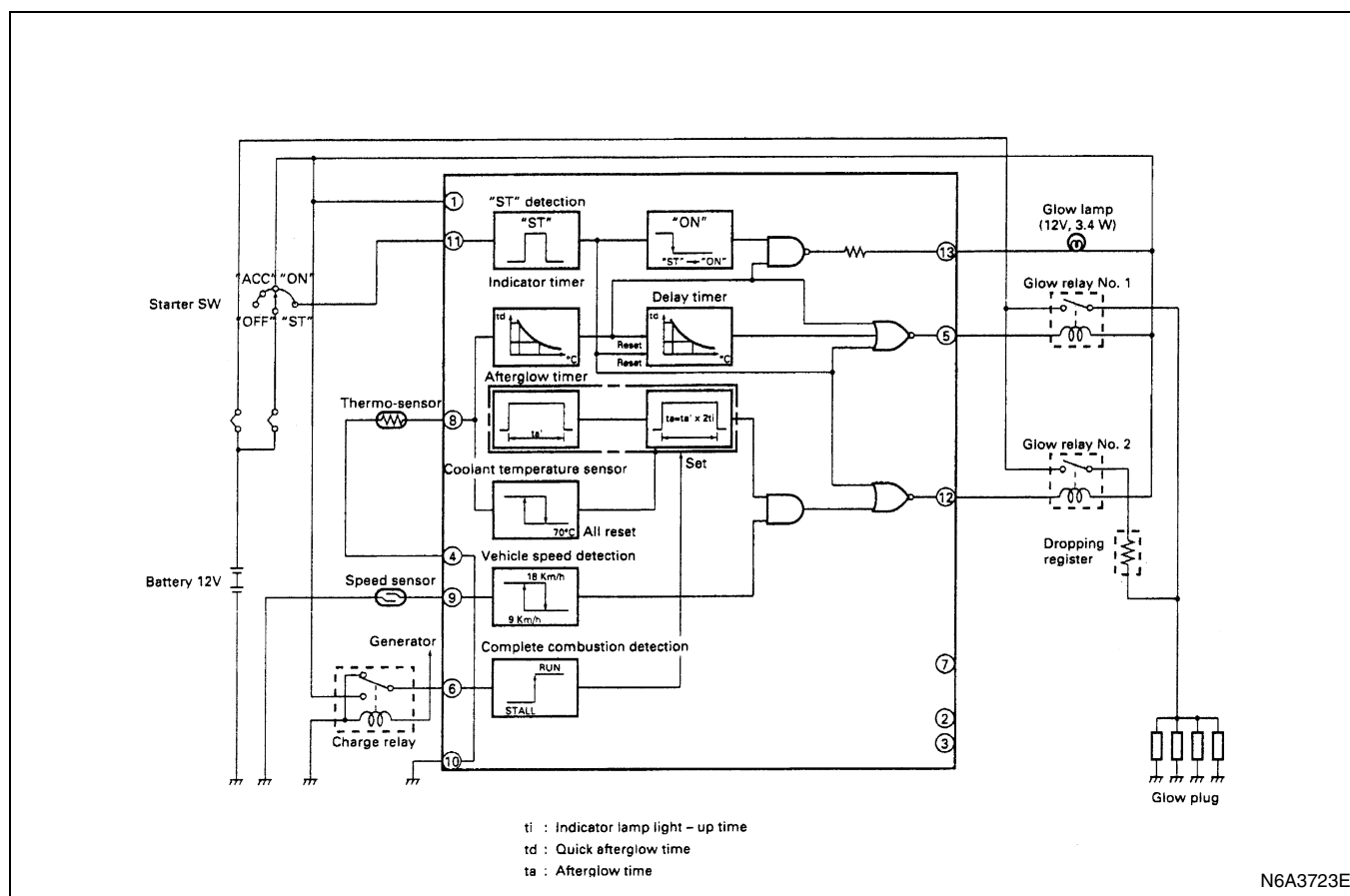
QOS II Timing Chart



QOS III Flow Chart



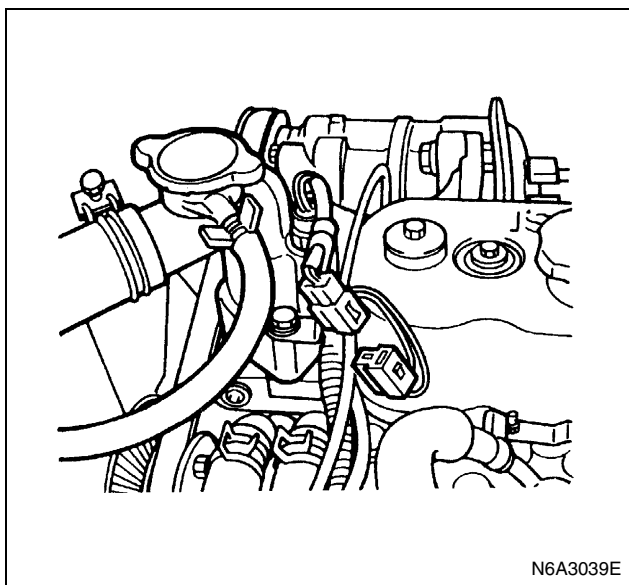
QOS II Timing Chart



Inspection on QOSIII System Operation

Inspection on Quick Heating Operation

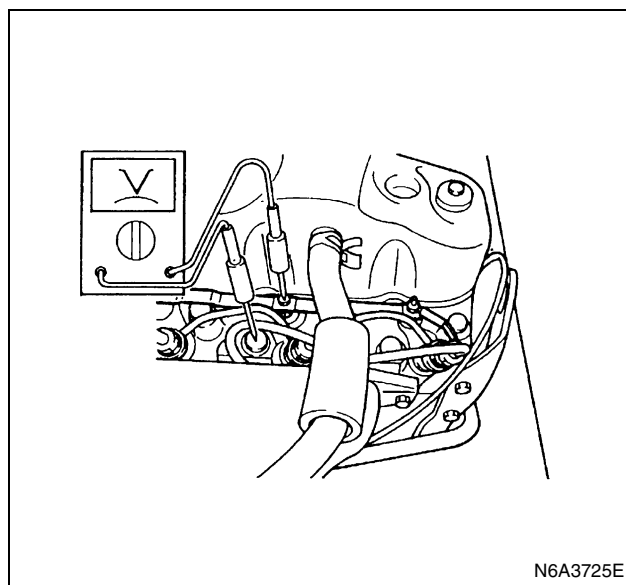
1. Disconnect thermo-sensor connection on the thermostat housing.



2. Connect the circuit tester between glow plug and engine earth.
3. Inspect the following items with starter switch set to ON position (but do not start the engine).
 - 1) The glow indicator shall light for 1 — 6 seconds.

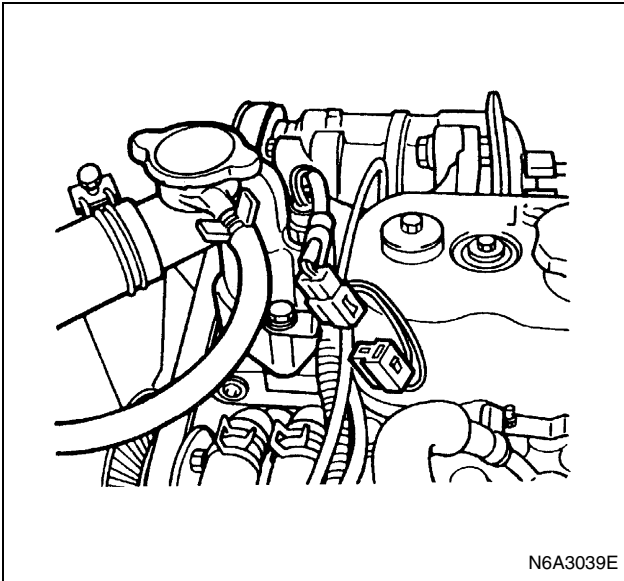
- 2) The circuit tester shall indicate power supply voltage for 9 — 13 seconds.

- If above specifications are not satisfied, inspect wire harness, glow relay and thermo-sensor. If satisfied, inspect glow plug.

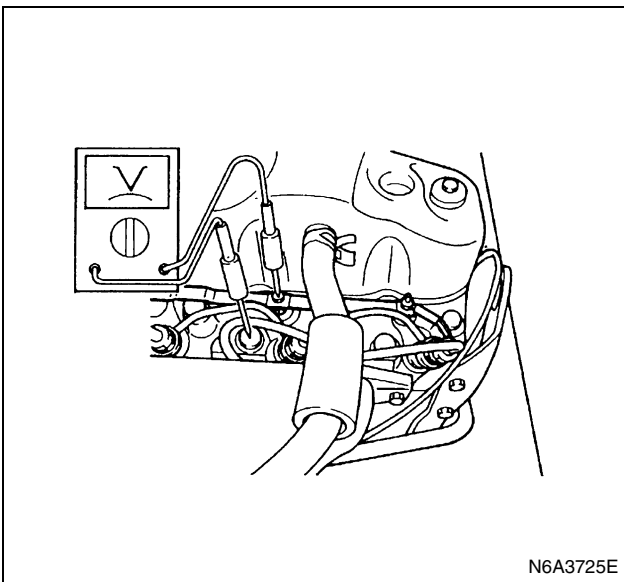


Inspection on Quick Heating Afterglow Operation

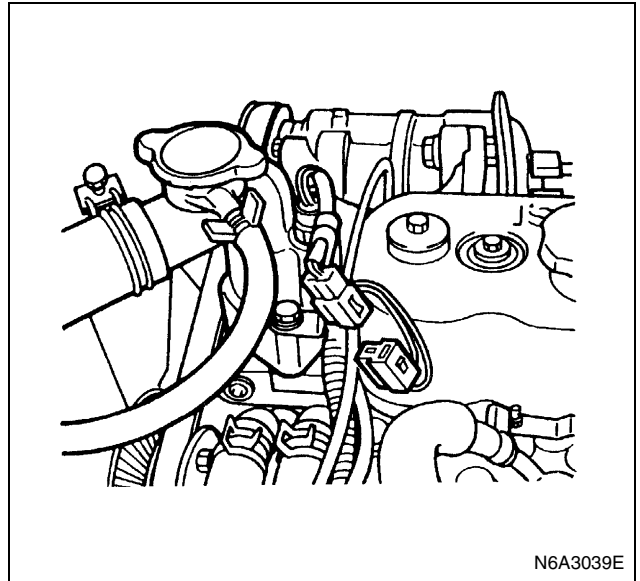
1. Disconnect thermo-sensor connection on the thermostat housing.



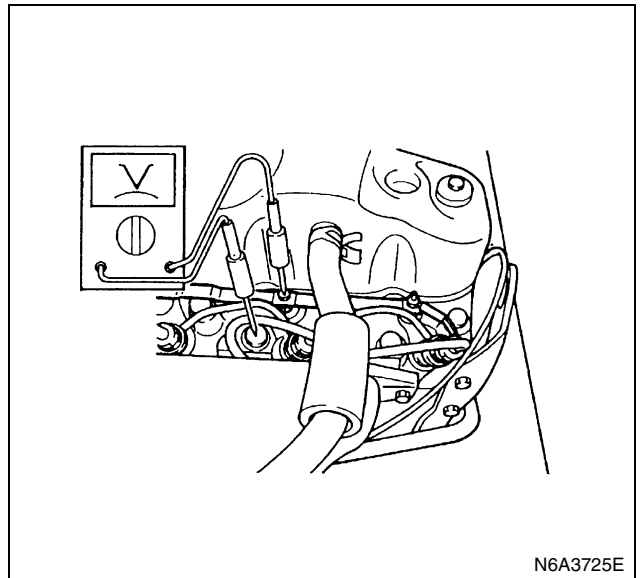
2. Connect the circuit tester between glow plug and engine earth.
3. Inspect the following item with start the engine.
 - 1) The circuit tester shall indicate power supply voltage for about 5 seconds.
 - If above specification is not satisfied, inspect battery voltage, engine earth, wire harness and starter switch "st" signal to control unit.
 - If satisfied, inspect wiring harness, engine earth and starter switch.

**Inspection on Afterglow Operation**

1. Disconnect thermo-sensor connection on the thermostat housing.



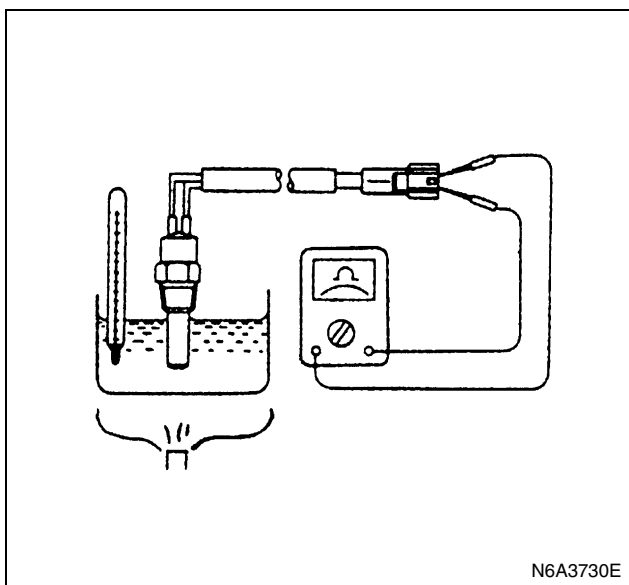
2. Connect the circuit tester between glow plug and engine earth.
3. Inspect the following items with start the engine.
 - 1) The circuit tester shall indicate about 7 volts after 360 seconds of engine start.
 - If above specifications are not satisfied, inspect battery voltage, engine earth, wiring harness, glow plug, dropping resistor, relay No. 2 and charge relay.



Thermo Sensor

Measure the resistance depending on the water temperature as shown in the left figure. (Measuring range: 10°C — 50°C)

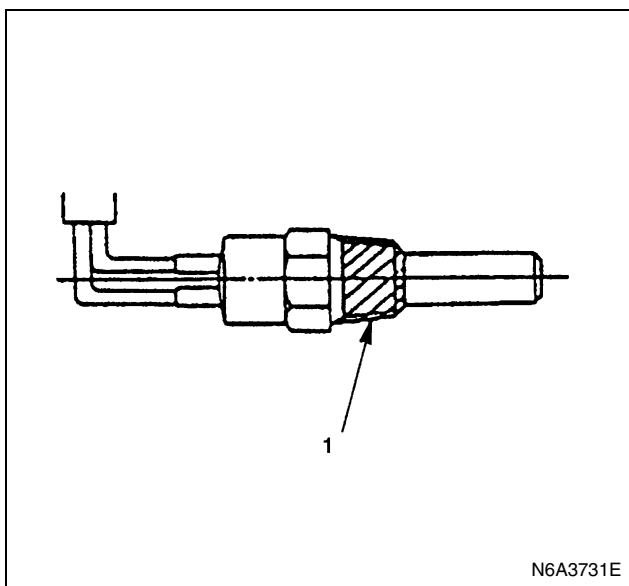
Temperature	Current (mA)	Resistance (KW)
20 ± 1	1.0	2.0 — 3.0
50 ± 1	1.0	0.68 — 1.0



When installing the thermo sensor, apply sealant (Loctite #262 or equivalent) (1) to narrowed portion in figure to prevent water leakage.

Tighten:

Thermo sensor to 8 N·m (0.8 kg·m/69 lb·in)

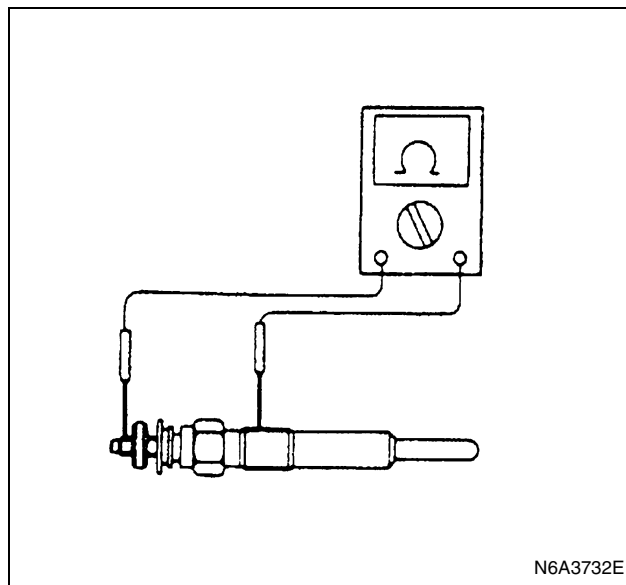
**Glow Plug**

Inspect the resistance

Resistance at normal temperature	Ω
0.8 — 1.0	

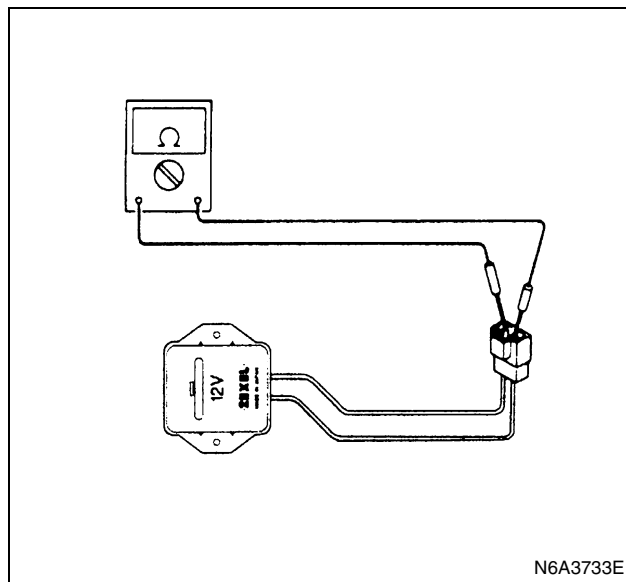
Tighten:

Glow plug to 23 N·m (2.3 kg·m/17 lb·ft)

**Dropping Resistor**

Inspect the resistance

Resistance of normal ambient temperature	m Ω
225 — 255	

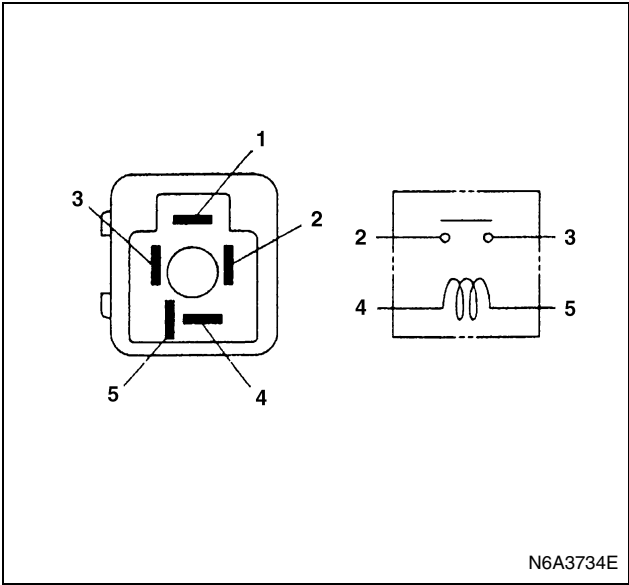
**Glow Plug Relay**

Inspect the continuity

2 — 3	No Continuity
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If apply the battery voltage to terminal between 4 — 5

2 — 3	Continuity
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Charge Relay

Inspect the continuity

3 — 5	Continuity
1 — 5	No Continuity

If apply the battery voltage to terminal between 2 — 4

3 — 5	No Continuity
1 — 5	Continuity

