

DAIHATSU

F73, F78

(F70, F75, F77)

☆ **STARTING SYSTEM**

ST

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R7ST00001-00000

In the sections bearing "☆" marks, the model codes "F70, 75, 77" should read as "F73 and F78".

After checking the contents of the relevant sections of the F73, F78 manual, we found that the contents remained the same. Therefore, we are using the sections as they are in this manual.

NO. 9705

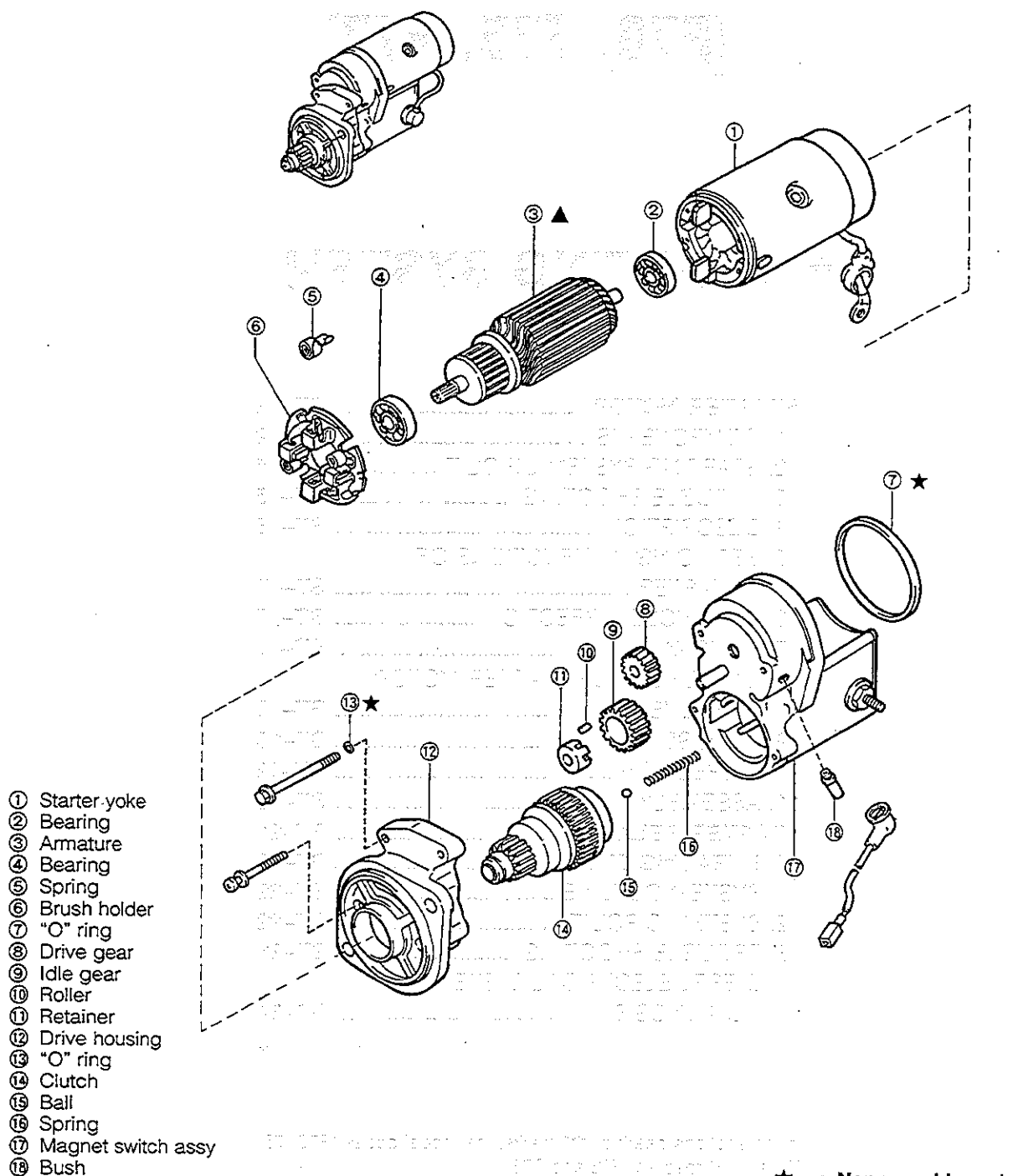
STARTING SYSTEM

STARTER MOTOR

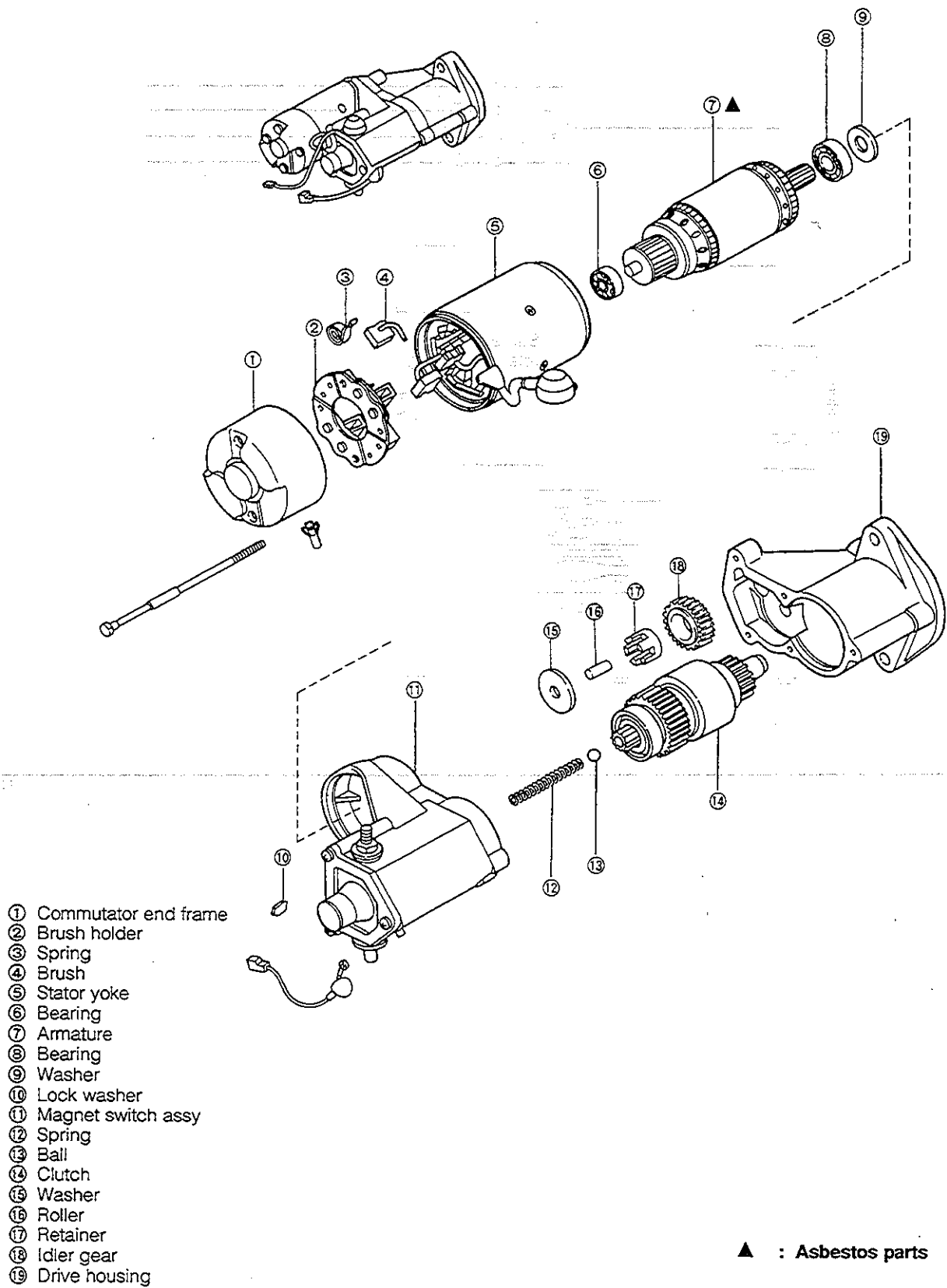
1. COMPONENTS

The starter consists of a solenoid switch and a motor. The power generated at the motor is transmitted to the clutch assembly through the idle gear. The rotation speed is reduced in accordance with the gear ratio between the drive gear provided at the motor and the clutch gear. On the other hand, the torque of the rotation increases.

2.2 kW

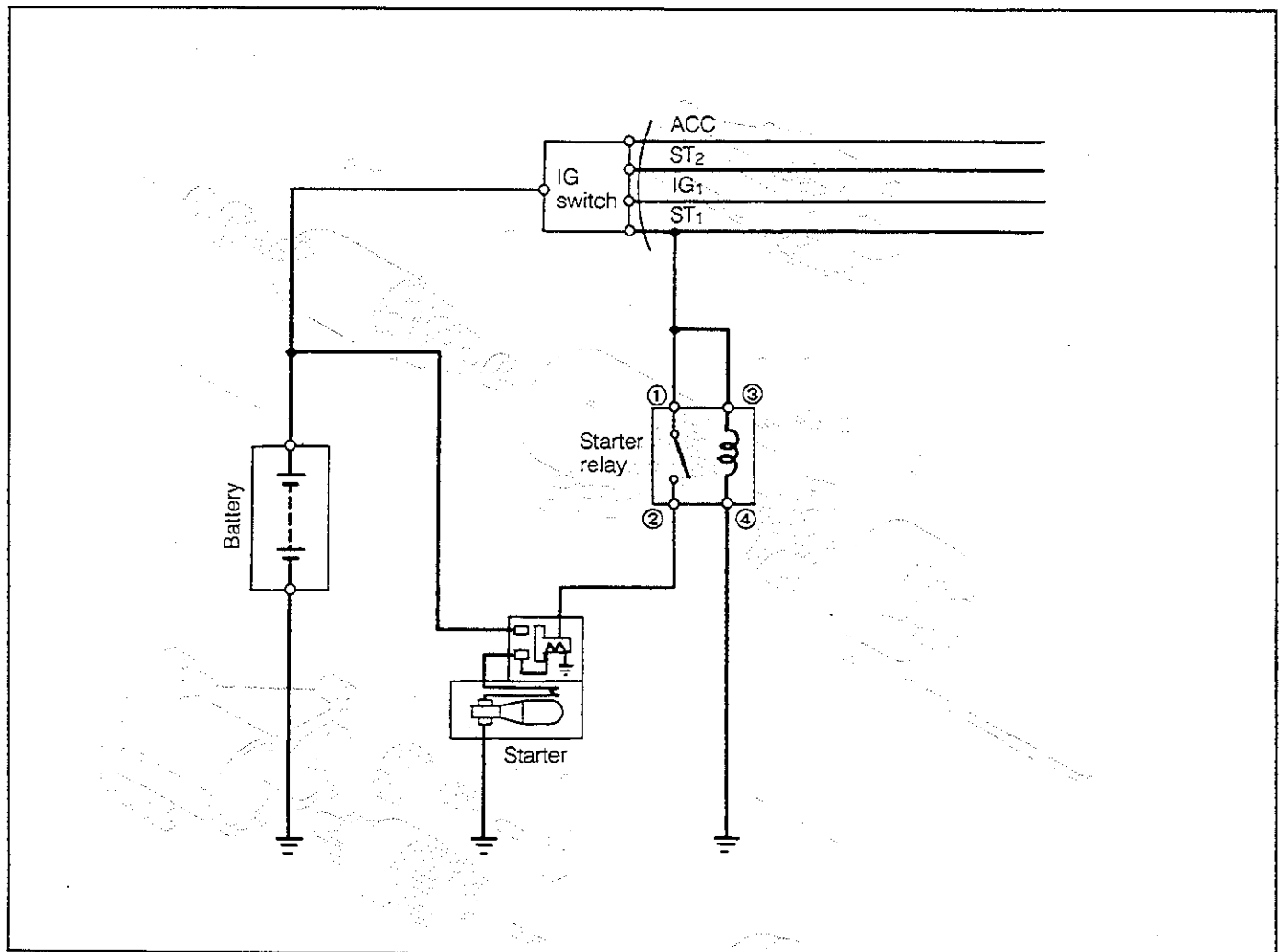


2.5 kW



STARTING SYSTEM

2. STARTING SYSTEM CIRCUIT



WRE91-ST004

3. TROUBLE SHOOTING

Problem	Possible cause	Remedies
Engine will not crank.	Battery not fully charged. Battery cables loose, corroded or worn. Starter relay faulty. Fusible link blown. Starter faulty. Ignition switch faulty. Clutch switch faulty.	Check specific gravity of battery electrolyte. Charge or replace battery. Repair or replace cables. Replace starter relay. Replace fusible link. Repair starter. Replace ignition switch. Replace clutch switch.
Engine cranks slowly.	Battery not fully charged. Battery cables loose, corroded or worn. Starter faulty.	Check specific gravity of battery electrolyte. Charge or replace battery. Repair or replace cables. Repair starter.
Starter keeps running.	Starter faulty. Ignition switch faulty. Short in wiring.	Repair starter. Replace ignition switch. Repair or replace wiring.
Starter spins. – Engine will not crank.	Pinion gear teeth broken or faulty starter. Flywheel teeth broken.	Repair starter. Replace flywheel.

WRE91-ST005

4. DESCRIPTION

Principles of operation & starting system circuit

The starter operations can be divided into two stages.

When the ignition switch is set to the start (ST) position, current from the battery flows to the motor through the solenoid. Then, the motor begins to rotate. Simultaneously, the solenoid pushes the shift fork forward, thereby moving the motor pinion gear forward into mesh with the ring gear.

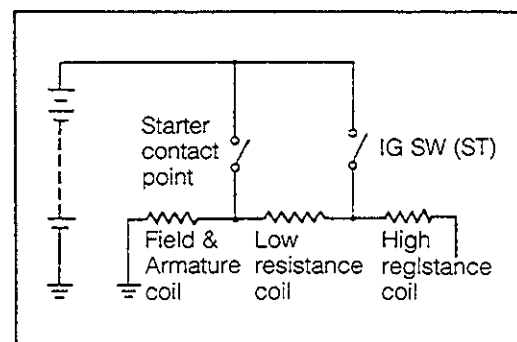
When the pinion gear has shifted into a complete mesh with the ring gear, the solenoid contact points are closed. The current from the battery now directly goes to the motor, thus supplying high power enough for cranking the engine. In this way, the starter motor begins cranking the engine.

The solenoid is composed of two coils. One is a low-resistance coil which moves the shift fork. The other is a high-resistance coil which retains the solenoid at the "start" position.

The low-resistance coil is connected to the battery ground through the motor brush (and armature coil) and field coil. The high-resistance coil is directly grounded to the solenoid case.

WRE91-ST006

During the engine cranking, the solenoid is energized at the high-resistance coil alone. Since the low-resistance coil has the same potential at its both ends, no current flows. Consequently, the solenoid is retained at the "start" position by means of the high-resistance coil only. The right figure shows an equivalent circuit of the system.



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STARTING SYSTEM

During the starting period, the low-resistance coil provides the solenoid with a large amount of current to move the shift fork. Afterward, however, it is no longer necessary to use a large amount of current to hold the solenoid. Therefore, the above-described circuit has been employed for the starting system so that no burning takes place.

The plunger of the solenoid has two functions; One is to move the shift fork and the other is to close the electric contact points, which is simultaneous with the first function. For positive contact, the contact points are connected to the plunger through a spring.

When the ignition switch is set to the start (ST) position, current from the battery goes to the low-resistance coil and the field and armature coils. As a result, the motor starts rotating. Simultaneously, the high-resistance coil is also energized. These two coils exert drawing force on the plunger, thus making the plunger overcome the force of a spring (a spring which is provided to return the plunger and differs from the aforesaid spring provided at the contact points). The plunger then moves the shift fork strongly and brings the pinion gear into mesh with the ring gear. Simultaneously, the starter contact points are closed and current is directly drawn from the battery. At this stage, the low-resistance coil has an equal potential at its both ends, as previously described. Hence, no current flows to the motor through the low-resistance coil.

After the engine has started, when the ignition switch is returned to the IG position, current to the solenoid is cut off (NOTE). The spring built in the solenoid returns the plunger, thereby opening the contact points and cutting the current to the motor. At the same time, the shift fork which has been pushing the pinion gear is returned to the original position by means of the aforesaid spring force. Consequently, the pinion gear is disengaged and separated from the ring gear.

This pinion gear's separation from the ring gear can not be performed positively and assuredly by the spring at the shift fork alone. To achieve positive separation, screw-shaped spline is provided between the motor shaft and the pinion gear. After start of the engine, the rotation speed of the ring gear continues to increase. Consequently, it becomes possible for the ring gear to drive the pinion gear. At this point, owing to the screw-shaped spline, the pinion gear is moved in such a direction that it tends to disengage from the ring gear. On the other hand, this screw-shaped spline helps the pinion gear to be pushed and moved into mesh with the ring gear during the starting period.

NOTE:

- In fact, at this moment, the current to the solenoid goes to the starter contact points and passes in series through the low-resistance coil and the high-resistance coil. Consequently, electromagnet function continues and drawing forces are generated. However, the electromagnetic forces generated at the low-resistance and high-resistance coils counteract, for the winding direction of the coil is opposite to each other. As a result, no drawing force is produced.
- On the other hand, when the ignition switch is set to the ON (ST/ON) position, a parallel circuit is formed. The electromagnetic forces generated at both coils are in the same direction, resulting in an increased drawing force.
- Namely, the direction of the current at the low-resistance coil changes reversely when the ignition switch is switched between the ON and OFF states. (This explanation applies only to the instance when the ignition switch is changed from the ST position to the IG position.)

WRE91-ST008

5. SERVICING INSTRUCTIONS OF STARTER

- (1) When connecting the starter terminal or battery terminal, perform positive tightening so as to avoid poor connection. If poor connection should exist, it presents the hazard of serious danger that a large amount of current flowing during starter operation can overheat the poor connection.
- (2) When removing the starter, first disconnect the negative $\ominus$ terminal of the battery. Then, disconnect the terminals (+B, ST) at the starter side. Since the battery voltage is always applied to the starter +B terminal, failure to observe this removing sequence may lead to battery short, which is extremely dangerous.
- (3) When installing the starter, install the starter in the clutch housing positively and be sure to tighten the attaching bolts to the specified torque. Improper installation can cause premature wear of the teeth of the pinion gear or ring gear and also can cause breakage of the clutch housing.

WRE91-ST009

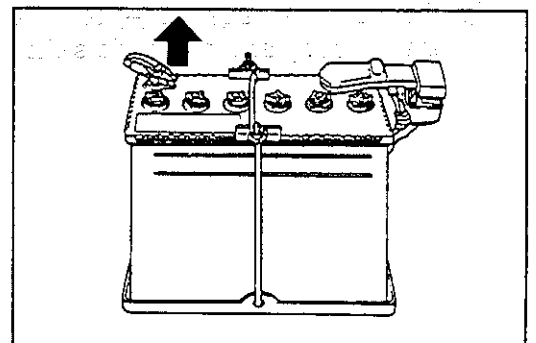
6. IN-VEHICLE INSPECTION

- (1) Place the shift lever to the neutral position. Apply the parking brake lever.
- (2) Set the ignition switch to the ST position. Check to see if the engine cranks.
- (3) If the engine will not crank, perform the following checks.
 - Inspect the battery for damage. Charge the battery.
 - Perform harness continuity test.
 - Perform the clutch switch check. See page ST-00.
- (4) If the starter motor still will not rotate even after the checks above have been performed, remove the starter motor and perform the unit check.

WRE91-ST011

7. REMOVAL

- (1) Disconnect the ground cable terminal from the negative (-) terminal of the battery.



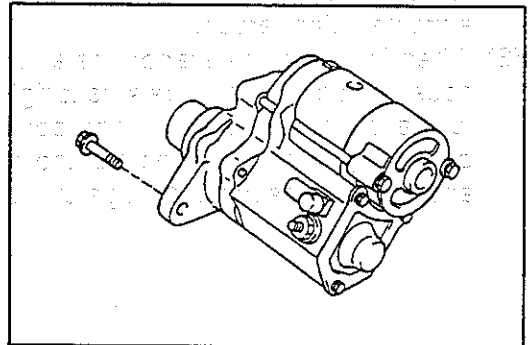
WRE91-ST012

STARTING SYSTEM

(2) Jack up the vehicle and support it with safety stands.

(3) Disconnect the starter terminals ST and B from the starter.

(4) Remove the starter motor from the clutch housing.

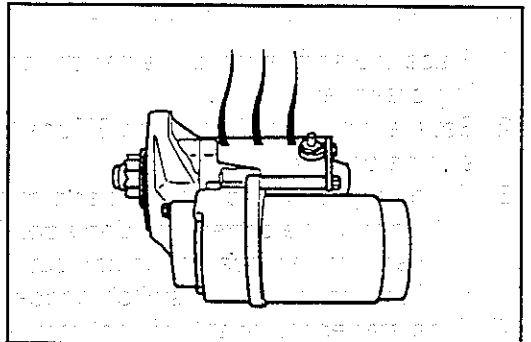


WRE91-ST014

8. UNIT CHECK OF STARTER MOTOR ASSEMBLY

CAUTION:

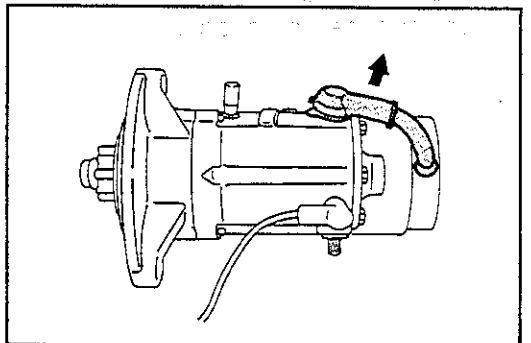
- Each of the following tests must be performed within three to five seconds. If you fail to observe this caution and the starter is energized for more than this duration, the coil may be burnt out.



WRE91-ST015

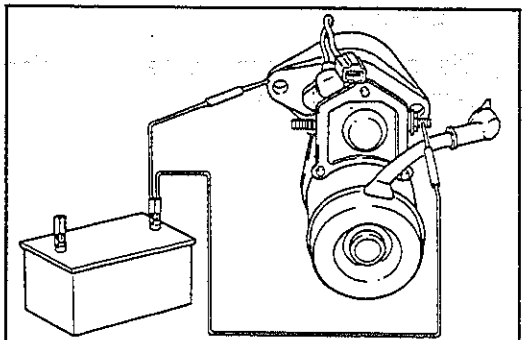
(1) Pull-in Test

- ① Disconnect the lead wire from the magnetic switch terminal.



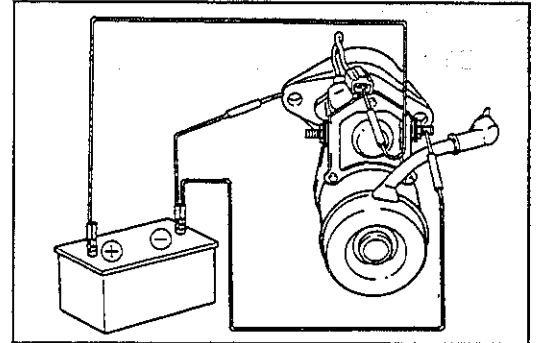
WRE91-ST016

- ② Connect the negative (-) terminal of the battery to the starter body and magnetic switch terminal.



WRE91-ST017

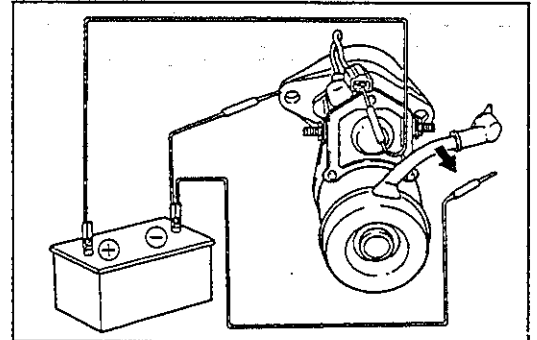
- ③ Connect the positive (+) terminal to the terminal ST. Ensure that the pinion is pushed outward. If the drive pinion fails to move out, replace the magnetic switch.



WRE91-ST018

(2) Hold-in Test

After the check has been performed following the same procedure as with the pull-in test, disconnect the negative terminal of the magnetic switch terminal. Ensure that the drive pinion is held in a pushed-out state. If the drive pinion fails to be held, replace the magnetic switch.



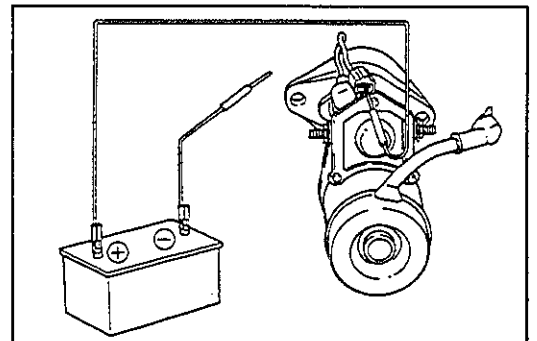
WRE91-ST019

(3) Inspection of Plunger Return

After the check has been performed following the same procedure as with the hold-in test, disconnect the ground terminal of the starter body. Ensure that the drive pinion is drawn into the drive housing. If the drive pinion fails to be drawn into the drive housing, replace the clutch assembly and return spring.

NOTE:

- Connect the lead wire to the magnetic switch terminal after inspection is carried out.



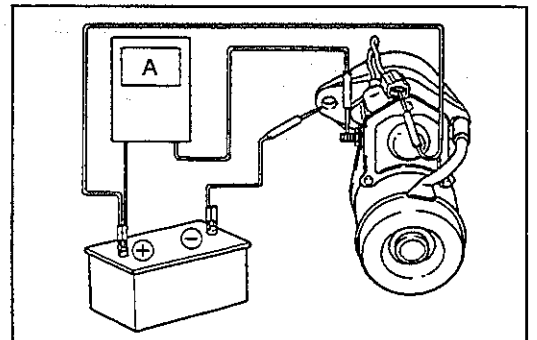
WRE91-ST020

(4) No-load Performance Test

Connect the battery and an ammeter to the starter as shown in the right figure. Ensure that the starter rotates smoothly with the pinion moving out.

Measure the current the starter is drawing:

Specified Current: Less than 120A at 11.5V (2.2 kW)
Less than 170A at 11.5V (2.5 kW)



WRE91-ST021

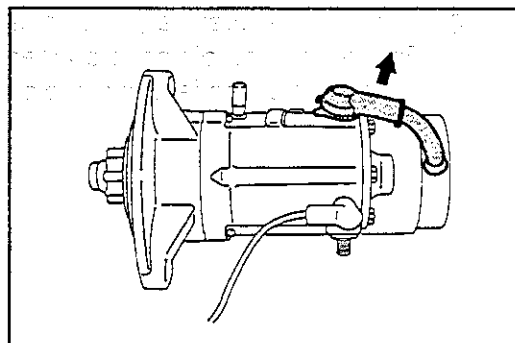
NOTE:

- Prior to the test, be sure to connect the lead wire to the magnetic switch.

STARTING SYSTEM

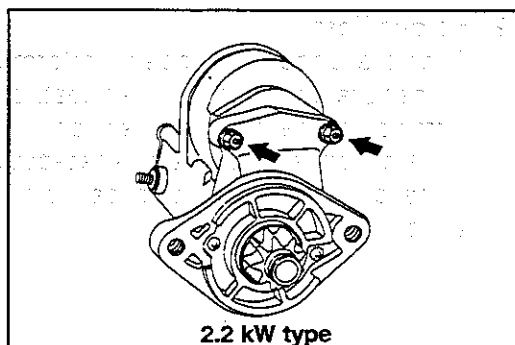
9. DISASSEMBLY

(1) Disconnect the lead wire from the magnetic switch.

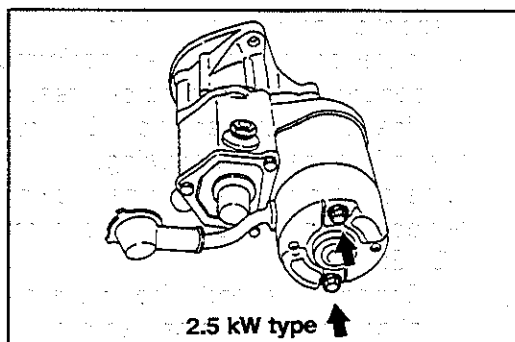


WRE91-ST022

(2) Remove the field frame together with the armature by removing the two through bolts.



2.2 kW type

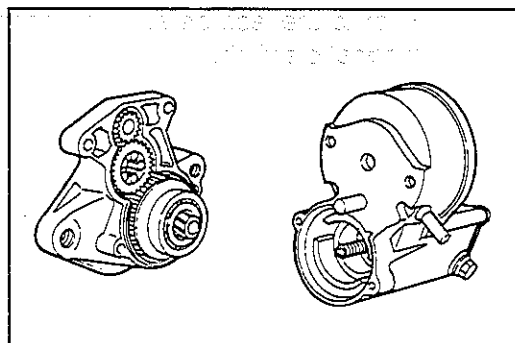
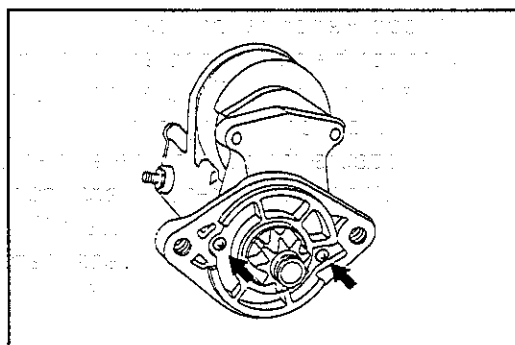


2.5 kW type ↑

WRE91-ST024

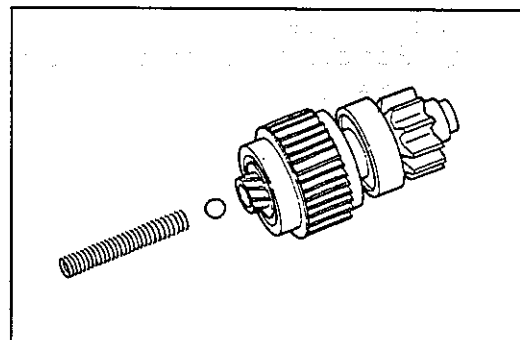
(3) Removal of starter housing, clutch assembly and gears
(2.2 kW type)

① Remove the two screws.



WRE91-ST026

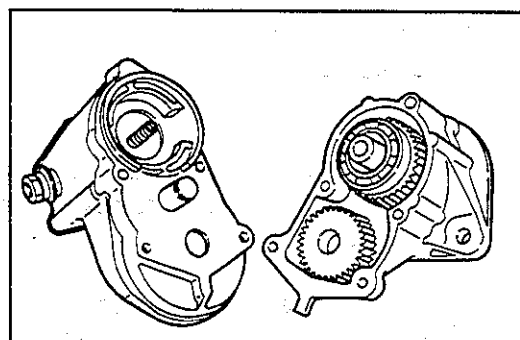
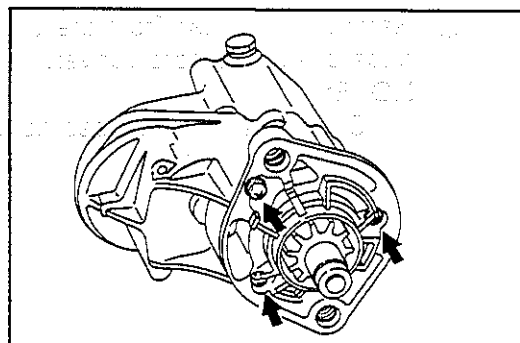
- ② Take out the clutch assembly, steel ball and return spring from the drive housing.



WRE91-ST027

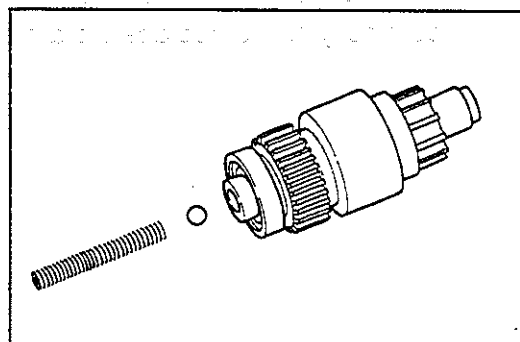
(2.5 kW type)

- ① Remove the three screws.



WRE91-ST029

- ② Take out the clutch assembly, steel ball and return spring from the drive housing.



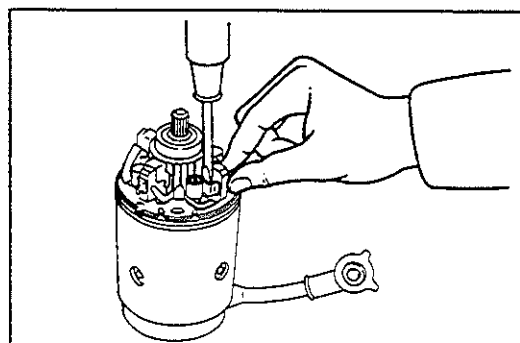
WRE91-ST030

(4) Removal of brush holder (2.2 kW type)

Remove the brush from the brush holder by means of nose pliers or a screwdriver.

NOTE:

- Care must be exercised not to damage the brushes during the removal.

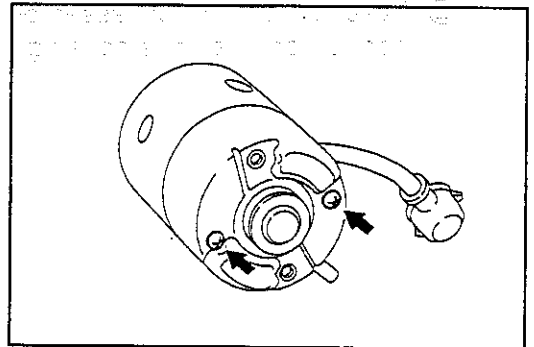


WRE91-ST031

STARTING SYSTEM

(2.5 kW type)

- ① Remove the commutator end frame by removing the two screws.

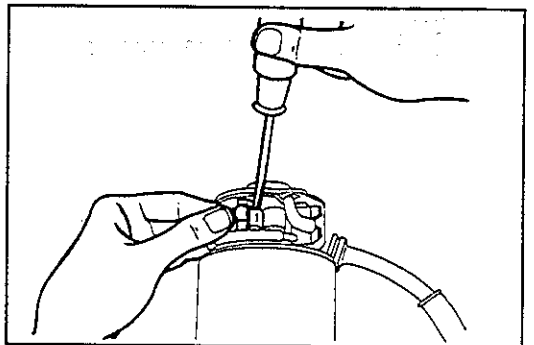


WRE91-ST032

- ② Remove the brush from the brush holder by means of nose pliers or a screwdriver.

NOTE:

- Care must be exercised not to damage the brushes during the removal.



WRE91-ST033

10. INSPECTION

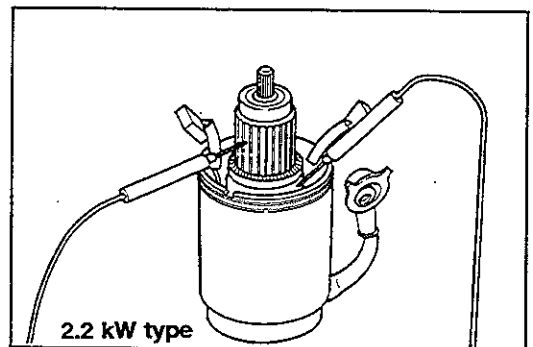
10-1 Check of armature

NOTE:

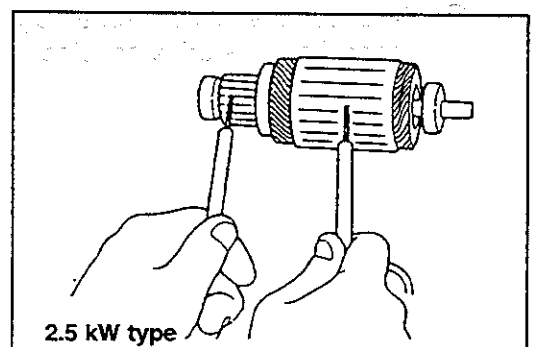
- In the case of the 2.2 kW type starter, perform the inspection without removing the armature from the starter yoke.

- (1) Check of armature insulation

Ensure that no continuity exists between the commutator and the armature coil, using an ohmmeter. If continuity exists, replace the armature.



2.2 kW type



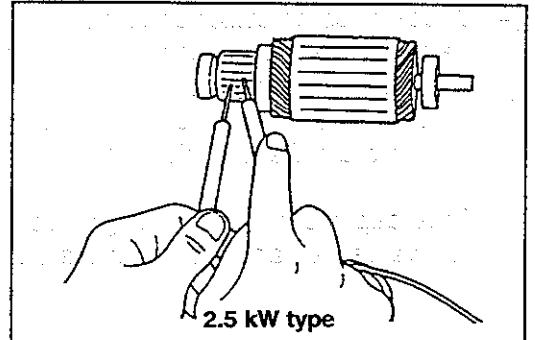
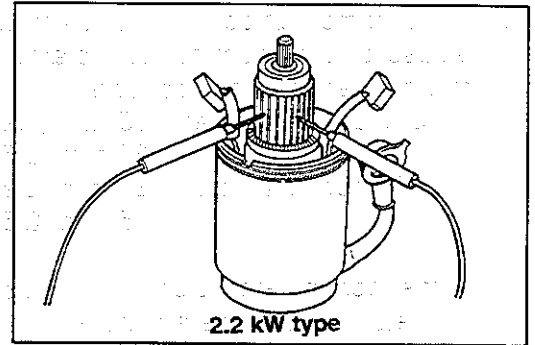
2.5 kW type

WRE91-ST035

(2) Check of commutator continuity

Check continuity between each adjacent segment of the commutator, using an ohmmeter.

If no continuity exists between any adjacent segments, replace the armature.



WRE91-ST037

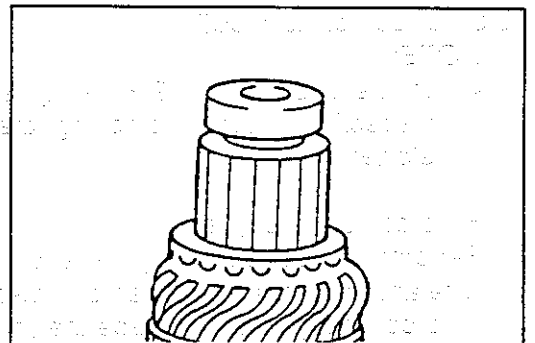
10-2 Check of commutator

NOTE:

- In the case of the 2.2 kW type starter, perform the inspection without removing the armature from the starter yoke.

(1) Check each contact surface of the commutator segments with the brushes for burning.

If the surfaces are dirty or burnt, correct the commutator surfaces, using abrasive paper (No. 400) or a lathe.



WRE91-ST038

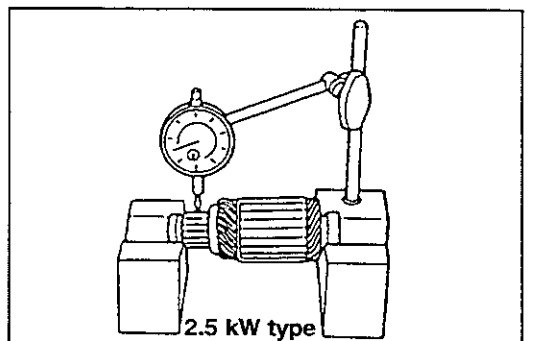
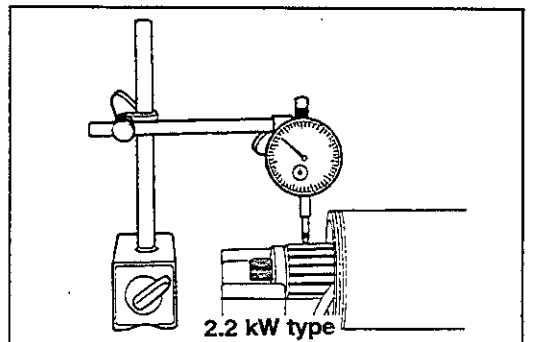
(2) Check of commutator for circle runout

Support the armature on a Vee block.

Check the commutator for circle runout, using a dial gauge.

Circle Runout Limit: 0.05 mm (0.002 inch)

If the circle runout exceeds the allowable limit, turn down the commutator on a lathe.



WRE91-ST040

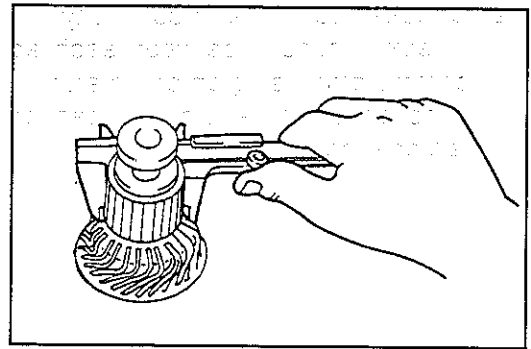
STARTING SYSTEM

(3) Measurement of commutator diameter

Measure the commutator diameter by means of a micrometer or vernier calipers.

Standard Diameter:	35 mm (2.2 kW)
	36 mm (2.5 kW)
Minimum Diameter:	34 mm (2.2 kW)
	35 mm (2.5 kW)

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

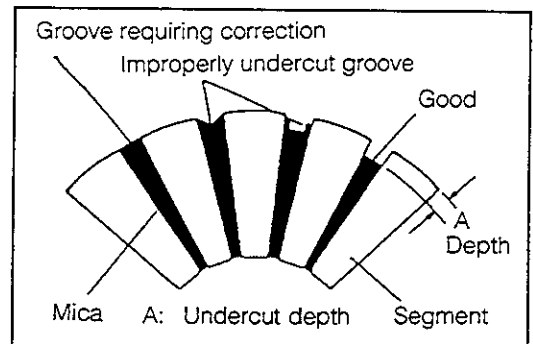


(4) Check of commutator undercut

Measure the depth of the insulator groove between the commutator segments.

Standard Depth:	0.7 - 0.9 mm
Minimum Depth:	0.2 mm

If the depth of the insulator groove becomes less than the limit value, replace the commutator.



WRE91-ST041

10-3 Check of field coil

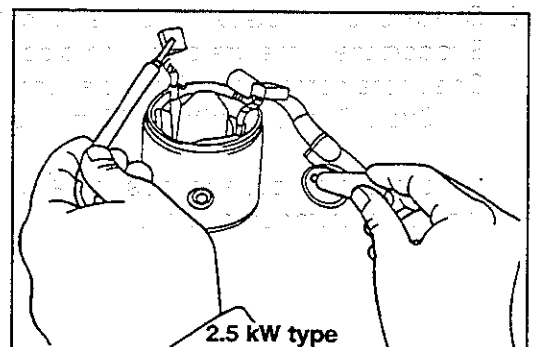
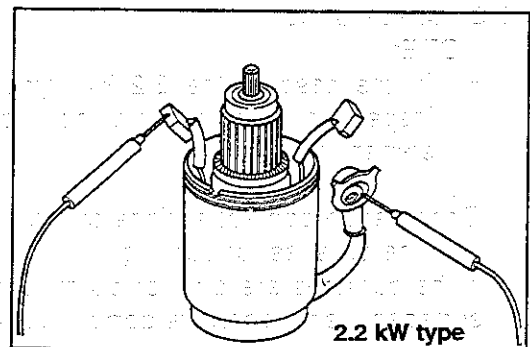
NOTE:

- In the case of the 2.2 kW type starter, perform the inspection without removing the armature from the starter yoke.

(1) Field coil continuity test

Perform field coil continuity test at a point between the lead wire and the brush; using an ohmmeter.

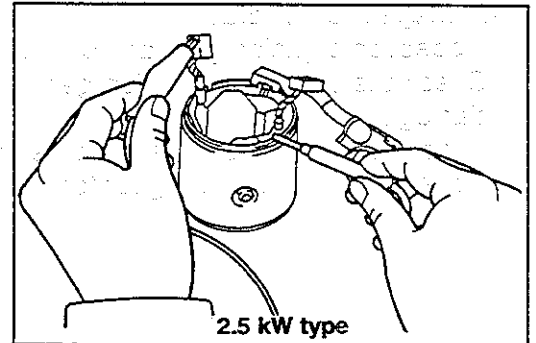
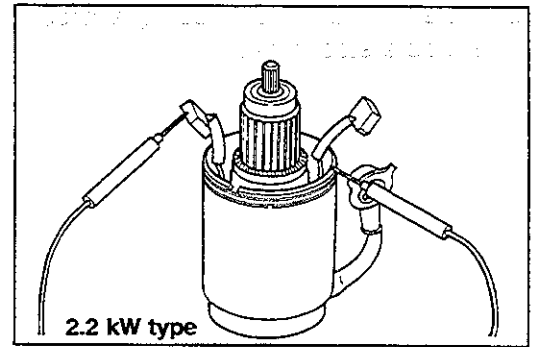
If no continuity exists, replace the yoke.



WRE91-ST043

(2) Field coil short test

Perform field coil short test at a point between the brush and the yoke proper, using an ohmmeter. If continuity exists, replace the yoke.



WRE91-ST045

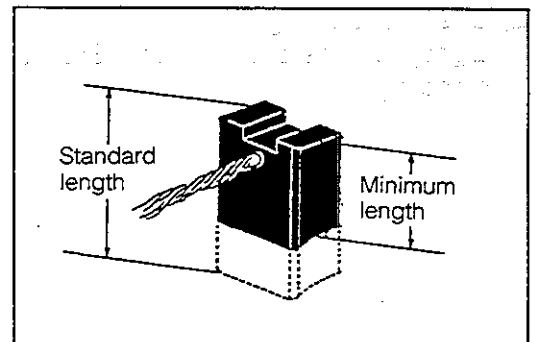
10-4 Check of brushes

Measurement of brush length

Measure the brush length, using vernier calipers.

Standard Length:	16 mm (2.2 kW)
	20.5 mm (2.5 kW)
Minimum Length:	10.0 mm (2.2 kW)
	18.3 mm (2.5 kW)

If the length is less than the minimum requirement, replace the brush holder or the yoke, as required.



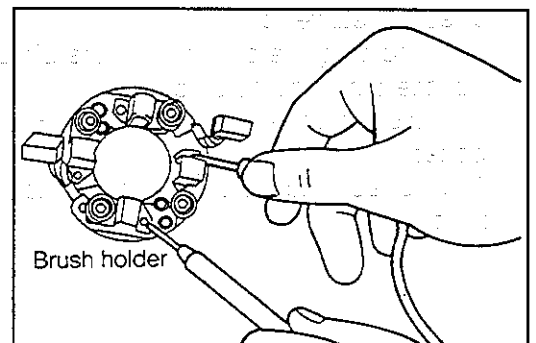
WRE91-ST046

10-5 Check of brush holder

Check of brush holder for insulation

Ensure that there is no continuity between the positive (+) and negative (-) brush holders.

If continuity exists, replace brush holder.



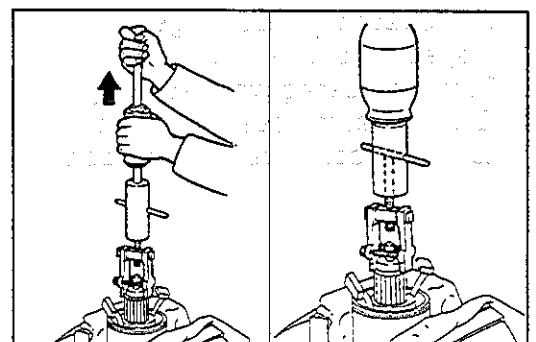
WRE91-ST047

10-6 Removal/installation of armature (2.2 kW type) from starter yoke (If necessary)

(1) Removal

The armature can be removed by means of an armature bearing puller in combination with the following SST, as indicated in the figure.

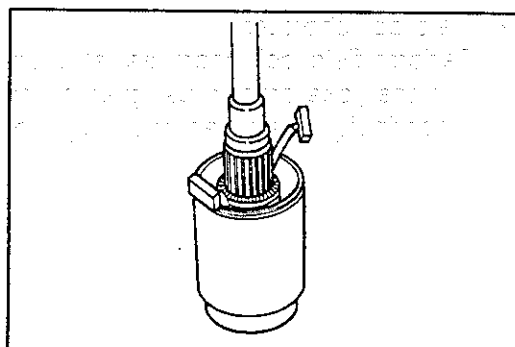
SST: 09912-87501



WRE91-ST048

STARTING SYSTEM

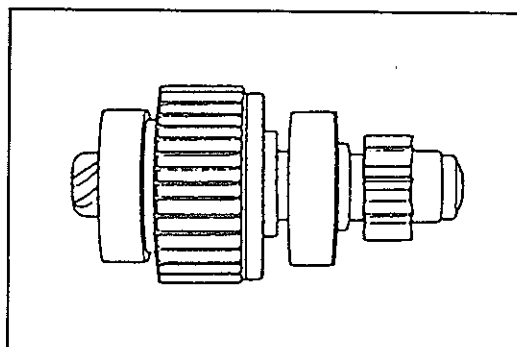
- (2) Install the armature, using a press in combination with a suitable steel pipe.



WRE91-ST049

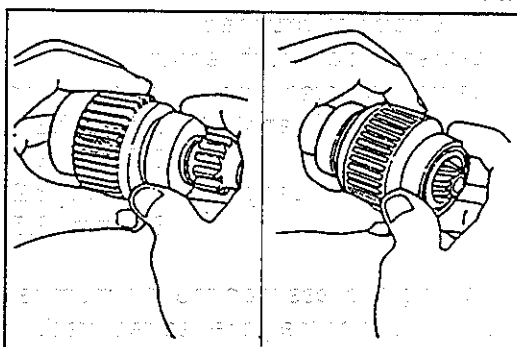
10-7 Inspection of clutch

- (1) Inspection of pinion gear and spline teeth
Check the teeth of the pinion gear and spline for wear or damage.
If the teeth exhibit any damage, replace the clutch. Also, inspect the flywheel ring gear for wear or damage.



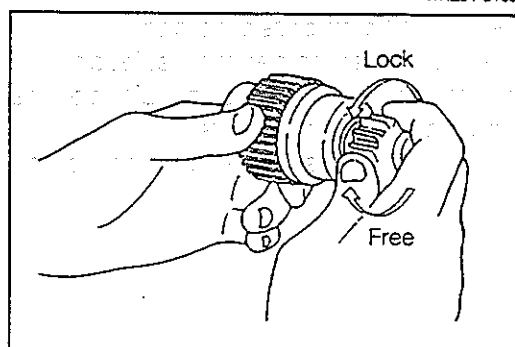
WRE91-ST050

- (2) Check of bearing
Lightly turn the bearing hand. Ensure that the bearing turns smoothly.



WRE91-ST051

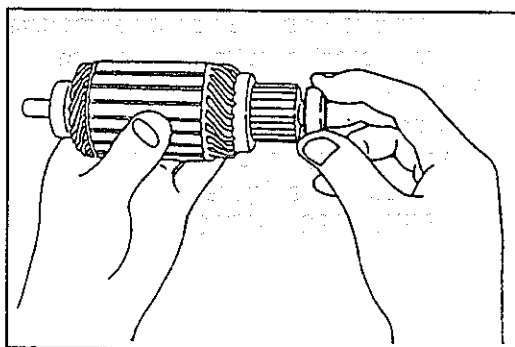
- (3) Check of starter clutch
While holding the clutch, turn the pinion clockwise. Ensure that the pinion turns smoothly.
Turn the pinion counterclockwise. Ensure that the pinion is locked.
If the check results are unsatisfactory, replace the starter clutch.



WRE91-ST052

10-8 Inspection of bearings

- (1) Inspection of bearings
Turn the bearing while applying force to it by your hand.
Ensure that the bearing turns smoothly. If the bearing fails to turn smoothly, replace the bearing.



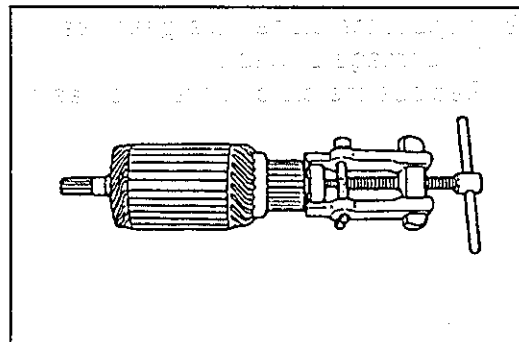
WRE91-ST053

(2) Replacement of bearings (Only when bearing is faulty.)

① Remove the bearing, using an armature bearing puller.

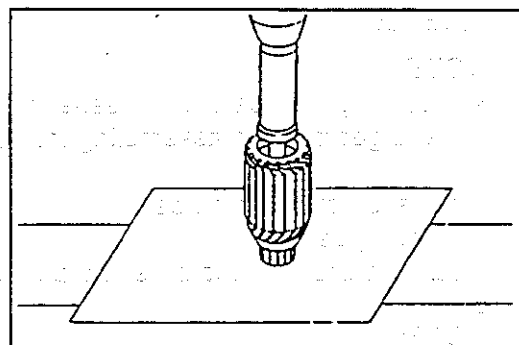
NOTE:

- In the case of 2.2 kW type, remove the bearing after removing the armature from the starter yoke.
Refer to page ST-15.



WRE91-ST054

② Press the bearing into the armature shaft, using a press in conjunction with the suitable tool.



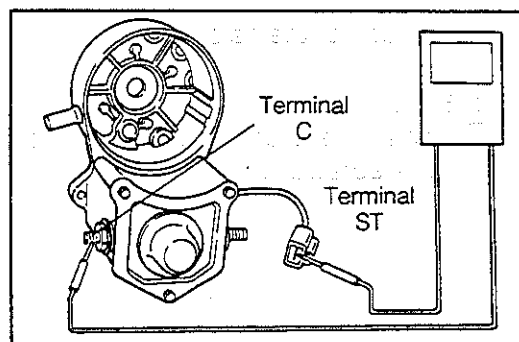
WRE91-ST055

10-9 Check of magnetic switch

(1) Pull-in coil test

Using an ohmmeter, ensure that continuity exists between the terminal ST of the starter and the terminal C.

If no continuity exists, replace the magnetic switch.

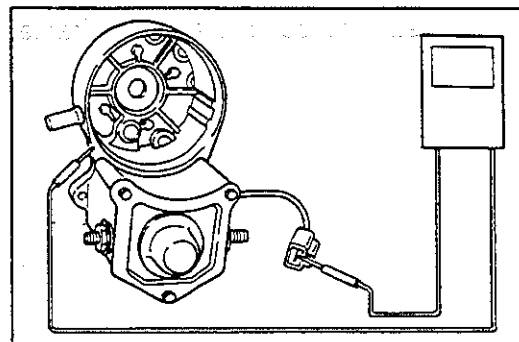


WRE91-ST056

(2) Hold-in coil test

Ensure that continuity exists between the terminal ST of the magnetic switch and the switch body.

If no continuity exists, replace the magnetic switch.

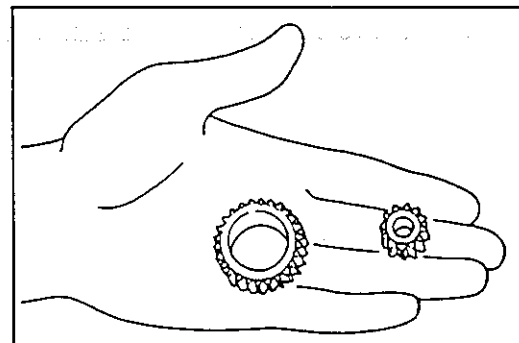


WRE91-ST057

10-10 Inspection of gears

(1) Inspect the starter drive gear (cold area specifications) and starter idle gear for damage or wear.

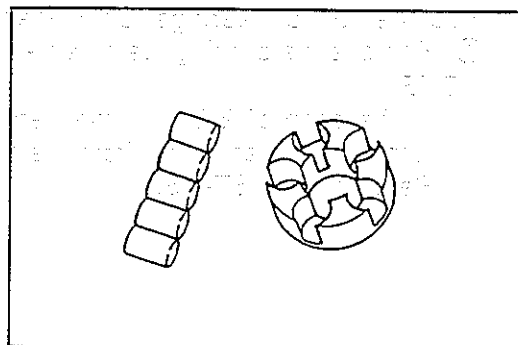
Replace the gear which exhibits damage or wear.



WRE91-ST058

STARTING SYSTEM

- (2) Inspect the starter idle gear bearing and bearing housing for damage or wear.
Replace the clutch or retainer, as required.



WRE91-ST059

11. ASSEMBLY

NOTE:

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

- (1) Installation of brush holder.

(2.2 kW type)

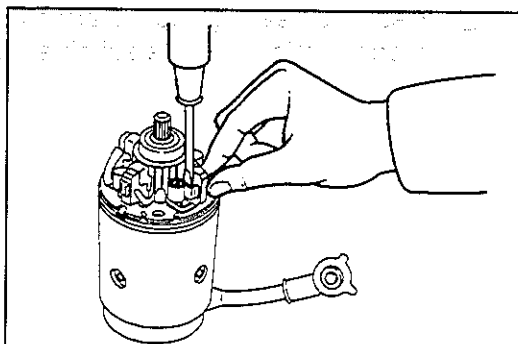
Install the brush to the brush holder, using nose pliers or a screwdriver.

NOTE:

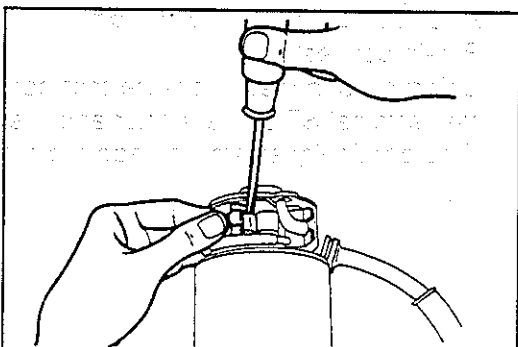
- Align the protrusion of the brush holder with the cut-out section of the field frame.

(2.5 kW type)

- ① Install the brush to the brush holder, using nose pliers or a screwdriver.

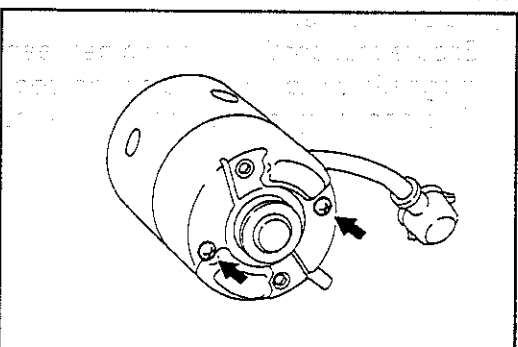


WRE91-ST060



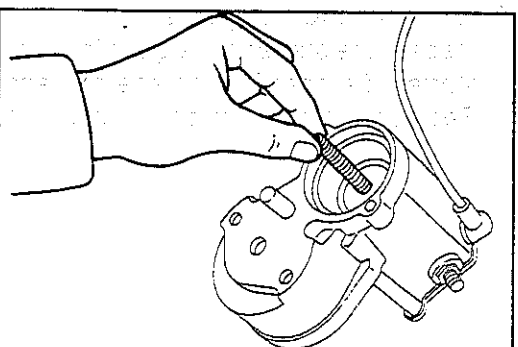
WRE91-ST061

- ② Install the commutator end frame.



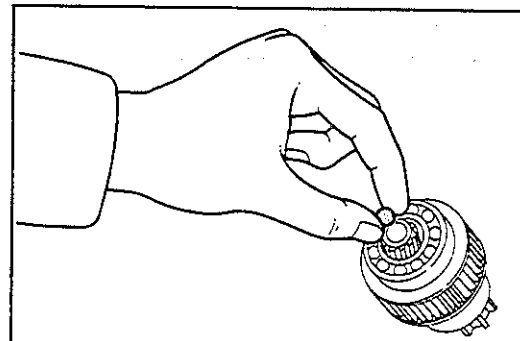
WRE91-ST062

- (2) Install the return spring in the starter switch assembly.



WRE91-ST063

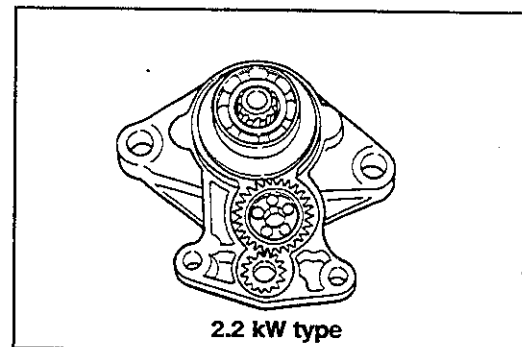
- (3) Insert the steel ball into the clutch assembly.



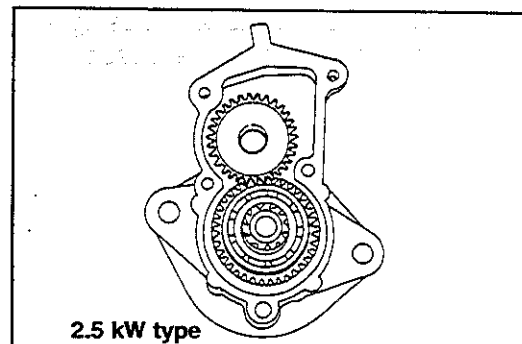
WRE91-ST064

- (4) Install the following parts to the starter housing.

- ① Clutch assembly
- ② Idle gear
- ③ Pinion gear (2.2 kW)



2.2 kW type

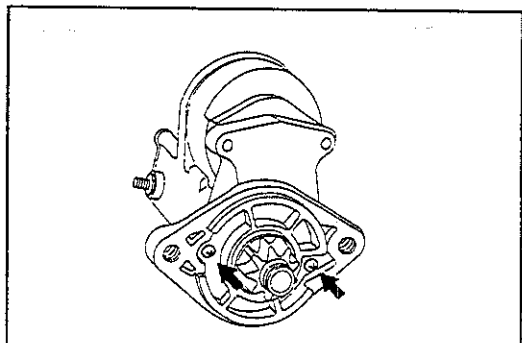
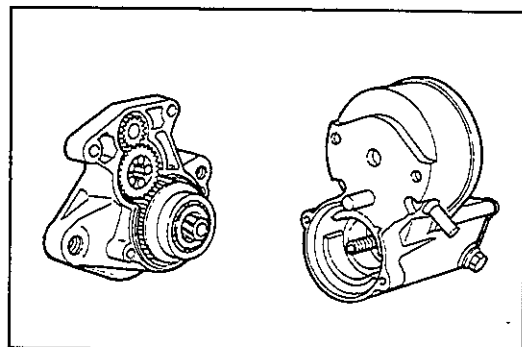


2.5 kW type

WRE91-ST066

- (5) Assembly of starter housing and magnetic switch
(2.2 kW type)

- ① Install the two screws.

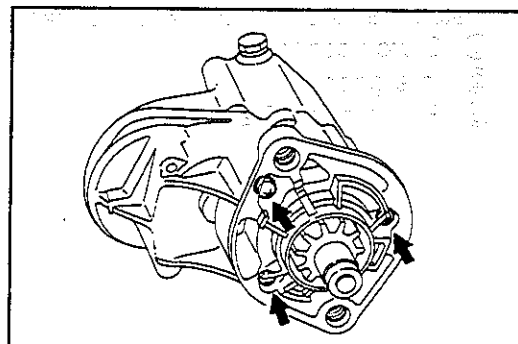
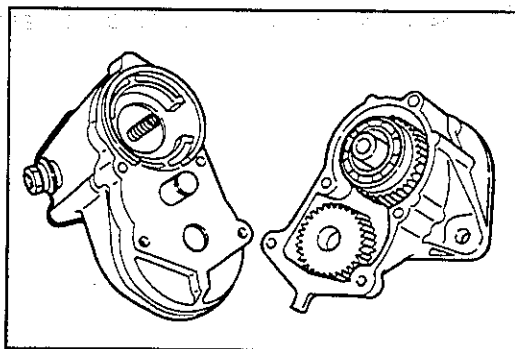


WRE91-ST068

STARTING SYSTEM

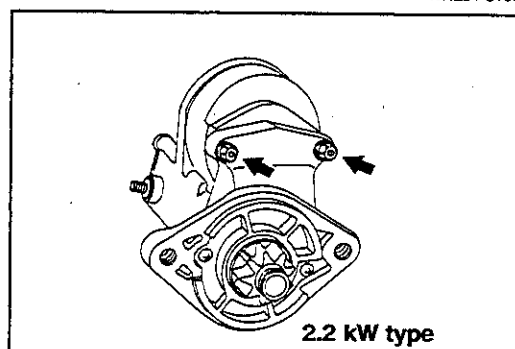
(2.5 kW type)

- ① Install the three screws.

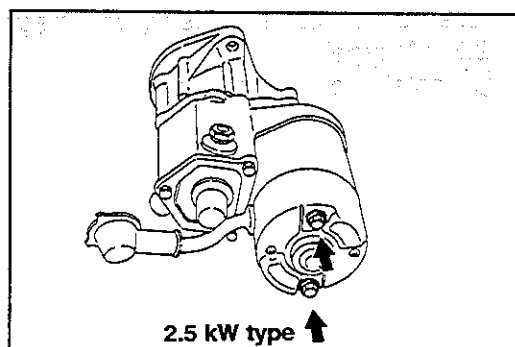


WRE91-ST070

- (6) Assemble the starter housing and field frame with the two through bolts interposed.



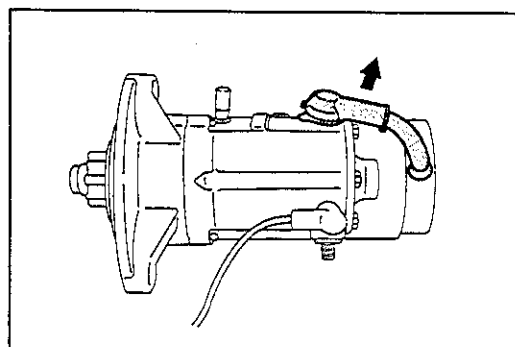
2.2 kW type



2.5 kW type

WRE91-ST072

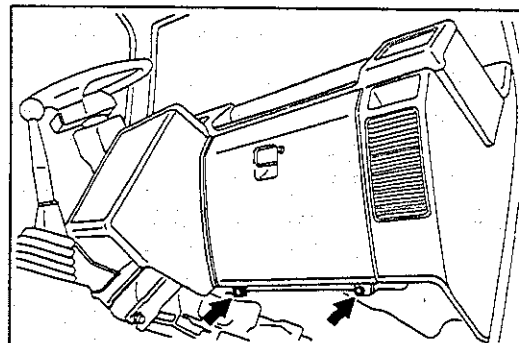
- (7) Connect a lead wire to the magnet switch.



WRE91-ST073

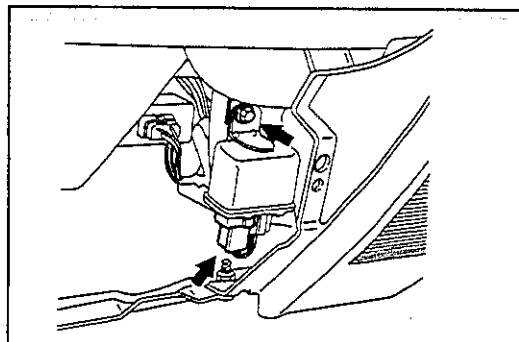
STARTER RELAY

- (1) Remove the glove compartment door subassembly by removing the two screws.



WRE91-ST074

- (2) Remove the starter relay.



WRE91-ST075

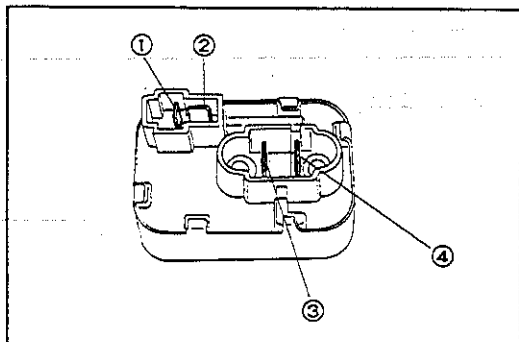
- (3) Inspection of relay continuity (See Page ST-4.)

- ① Ensure that continuity exists between the terminals ① and ②.

If no continuity exists, replace the relay with a new one.

- ② Ensure that no continuity exists between the terminals ③ and ④.

If continuity exists, replace the relay with a new one.

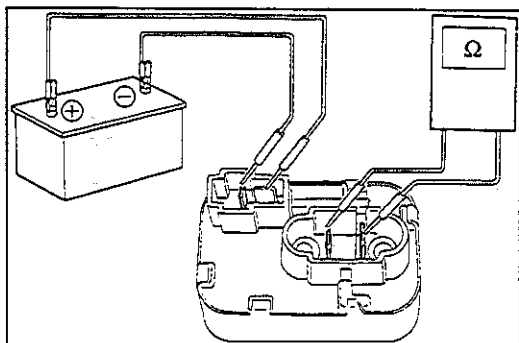


WRE91-ST076

- (4) Inspection of starter relay

Apply the battery voltage across the terminals ① and ②.
Ensure that there is continuity between the terminals ③ and ④.

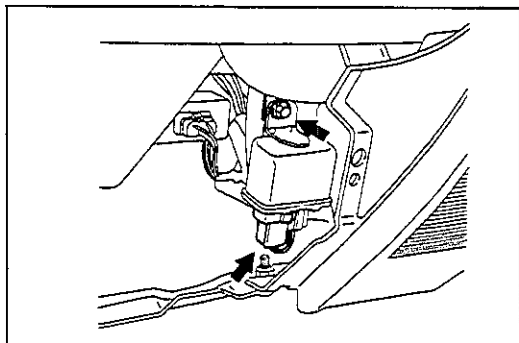
If no continuity exists, replace the relay with a new one.



WRE91-ST077

- (5) Installation of starter relay

- ① Install the starter relay.
- ② Connect the starter relay connector.
- ③ Install the glove compartment door assembly.



WRE91-ST078

STARTING SYSTEM

PRE-HEATING SYSTEM

1. SYSTEM OUTLINE

The pre-heating system of Type DL engine comes in two kinds: the fixed delay type system and the variable delay type system.

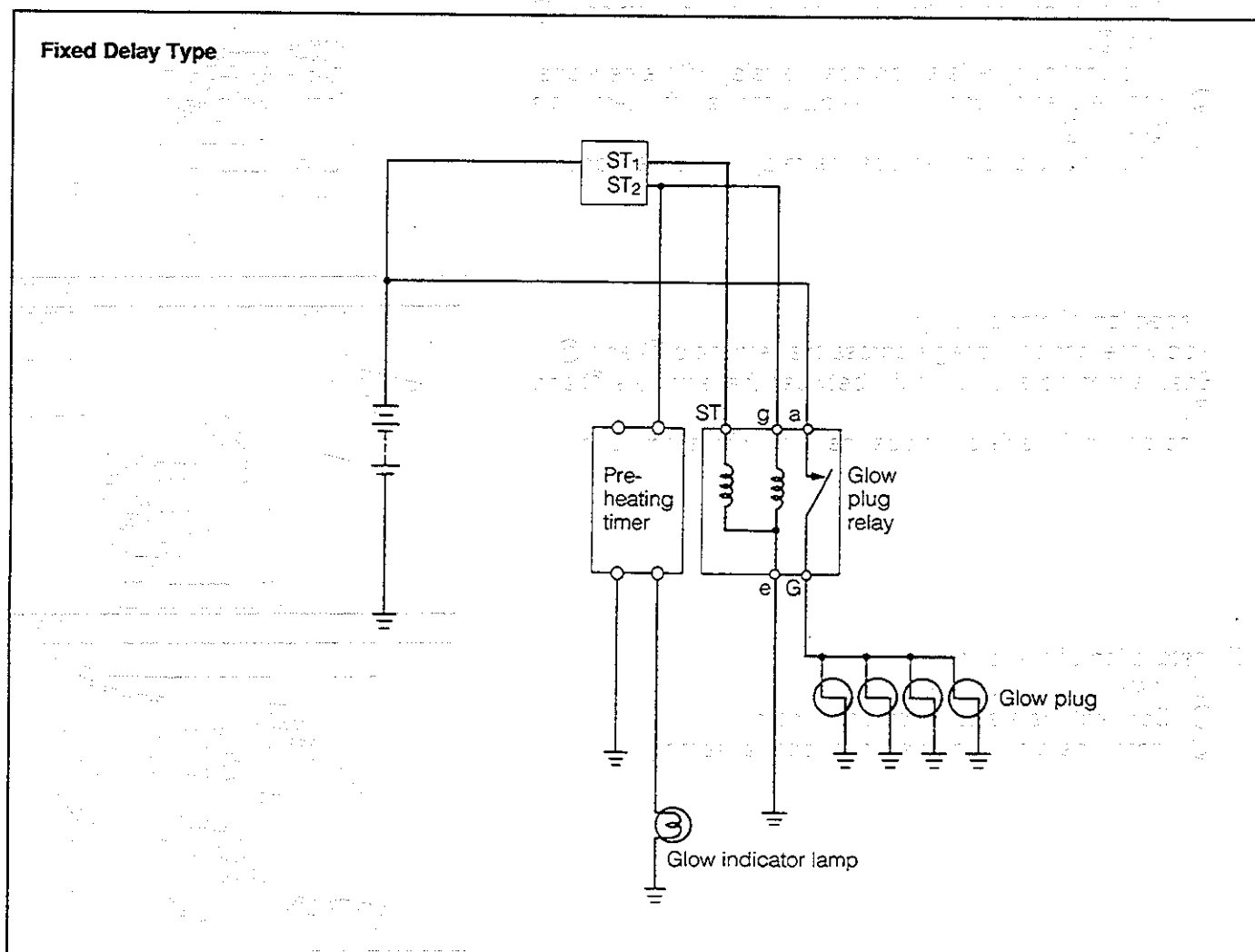
The fixed delay type pre-heating system, employed on some of Type DL-42 engine, consists of glow plugs, glow plug connectors, a glow plug relay and a pre-heating timer.

The variable delay type pre-heating system, employed on some of Type DL-42 engine and on Type DL-52 engine, consists of glow plugs, glow plug connectors, a current sensor, a glow plug relay, a water temperature sensor and a pre-heating timer.

The variable delay type pre-heating system detects the engine conditions by means of the water temperature sensor and current sensor and varies the pre-heating time.

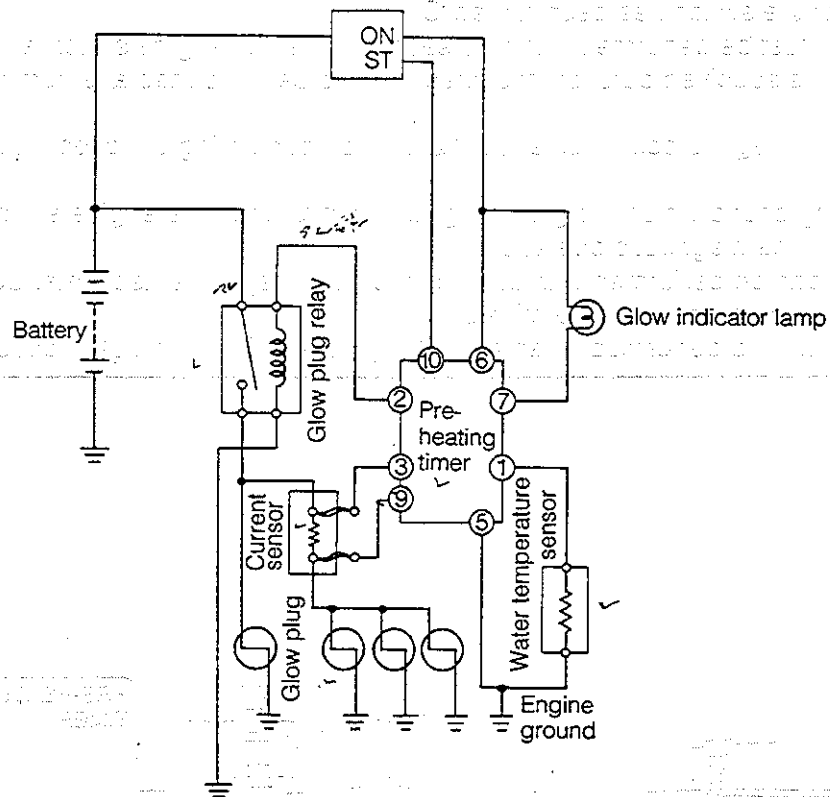
WRE91-ST079

2. SYSTEM CIRCUIT



WRE91-ST080

Variable Delay Type. (QSI)



3. TROUBLE SHOOTING

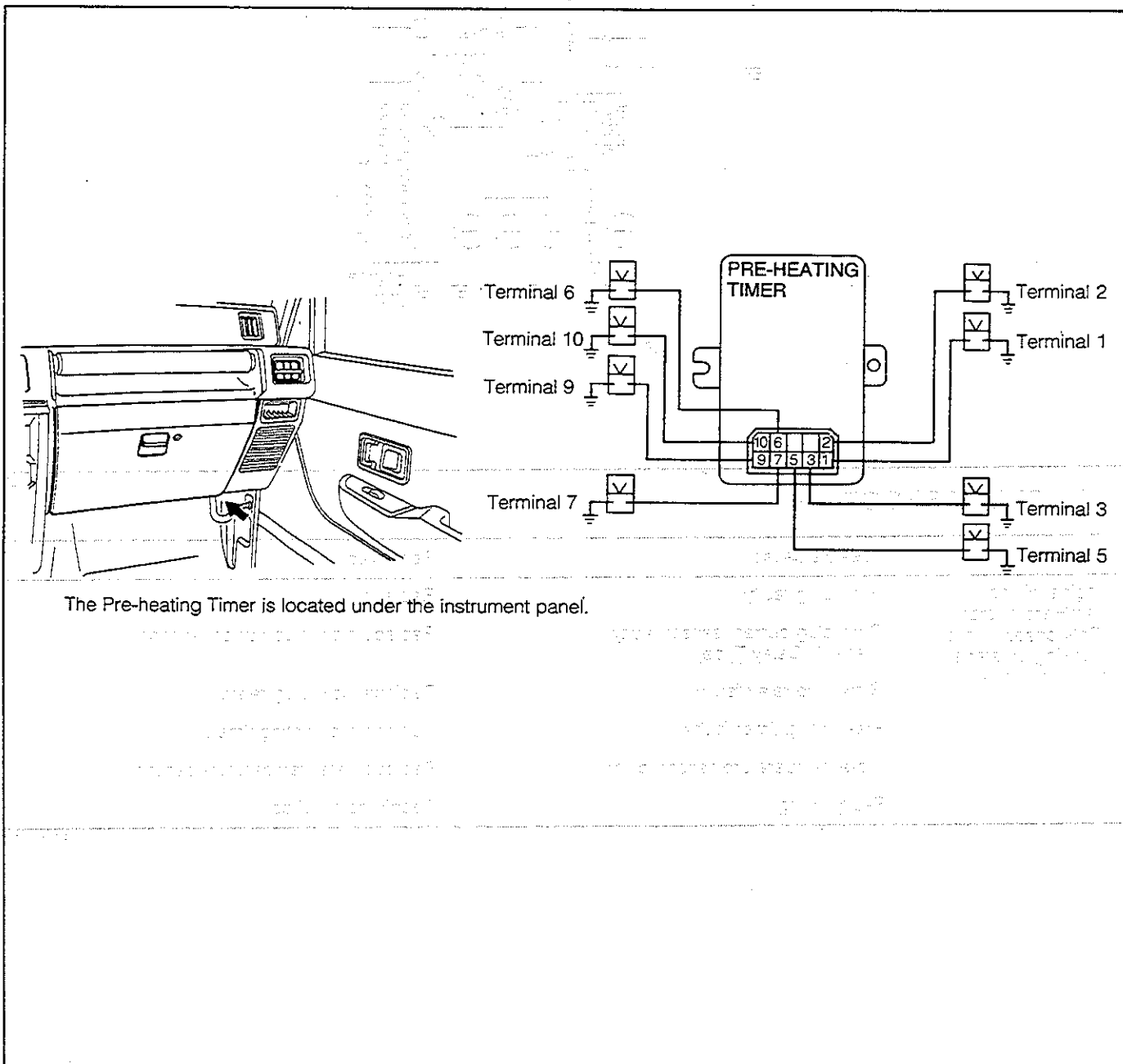
Problem	Possible cause	Remedies
Engine will not start/Hard to start (Only cases where cranking by starter motor is normal)	Glow plug faulty	Replace glow plug.
	Glow plug current sensor faulty (Variable Delay Type)	Replace glow plug current sensor.
	Glow plug relay faulty	Replace glow plug relay.
	Pre-heating timer faulty	Replace pre-heating timer.
	Water temperature sensor faulty	Replace water temperature sensor.
	Faulty wiring	Repair, as required.

STARTING SYSTEM

4. DIESEL ELECTRICAL SYSTEM DIAGNOSIS (Variable Delay Type)

Items to Which Special Attention Must Be Paid

1. Be sure to turn OFF the engine switch each time new check is performed for each step. Then turn ON the engine switch to start the measurement. Furthermore, the measurement must be carried out immediately after the switch has been turned ON.
2. The check must be performed within 10 seconds after the engine switch is turned ON. If the time elapses more than the specified duration, the check should be performed after turning OFF/ON the engine switch again.
3. The battery voltage is posted as about 12V. When performing the check, be sure to measure the battery voltage.
4. An operating sound which the glow plug relay emits when the engine switch is turned ON can be used effectively in the diagnostic operation.
5. The check can be performed with each connector in its connected state. Use wires or the like so that no damage may be made to the terminals.
6. The check can be performed when the battery voltage is within specification (about 12V).



(1) Checking of glow plug indicator light

Ensure that the indicator lamp glows for 1 to 5 seconds.

OK

Checking of glow plug voltage

(See page ST-26)

 GLOW

WRE91-ST084

1 When light will not glow

Checking of timer power supply circuit at terminal 6 of Pre-heating timer with voltmeter
About 12V

NO

Voltage remains at about 0V.
- Check and repair wiring of power supply circuit up to battery.

OK

Checking of timer earth circuit at terminal 5 of pre-heating timer with voltmeter
0V

NO

Reading other than 0V
- Check and repair earth circuit.

Checking of lamp circuit at terminal 7 of pre-heating timer with voltmeter
Voltage rises from about 2V to about 12V within 5 sec.

NO

1. Voltage remains at about 12V.
- Replace pre-heating timer.
2. Voltage remains at 0V.
- Check and repair light, blown fuse or wire.

WRE91-ST085

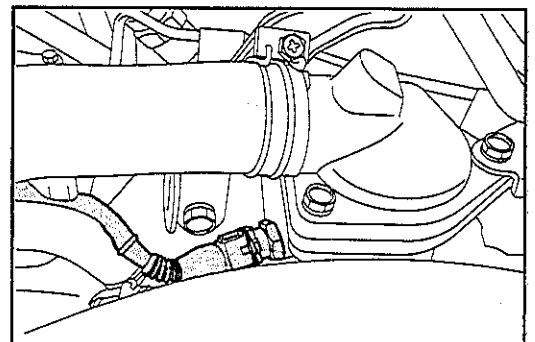
2 When light glow for 1 second (cooling water temperature is below 40°C) or, regardless of water temperature, when light remains illuminated for 6 seconds

Checking of water temperature sensor circuit at terminal 1 of pre-heating timer
About 2V when water temperature is 20°C

NO

1. Voltage remains at about 7V.
2. Voltage remains at 0V.
- Check wire up to water temperature sensor and water temperature sensor to earth. Then, check or replace sensor.

NOTE: Water Temperature Sensor
Specified Resistance: $2.4 \pm 0.24 \text{ k}\Omega$ at 20°C
 $0.322 \pm 0.0322 \text{ k}\Omega$ at 80°C



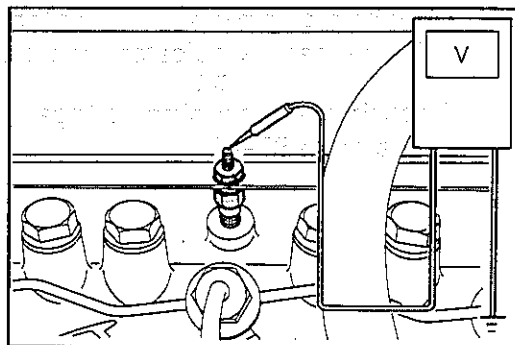
STARTING SYSTEM

(2) Checking of glow plug voltage

Ensure that voltage varies repeatedly between 0 and 10V for 10 to 80 seconds owing to water temperature.

OK

Check other systems.



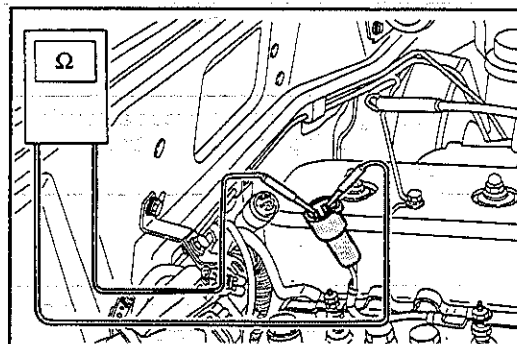
WRE91-ST087

1 When voltage is 0V

Check current sensor.
Specified Resistance: 10 mΩ

NO

If no continuity exists, replace current sensor.



Checking of timer power supply circuit at terminal 6 of Pre-heating timer with voltmeter
About 12V

NO

Voltage remains at about 0V.
- Check and repair wire of power supply circuit up to battery.

OK

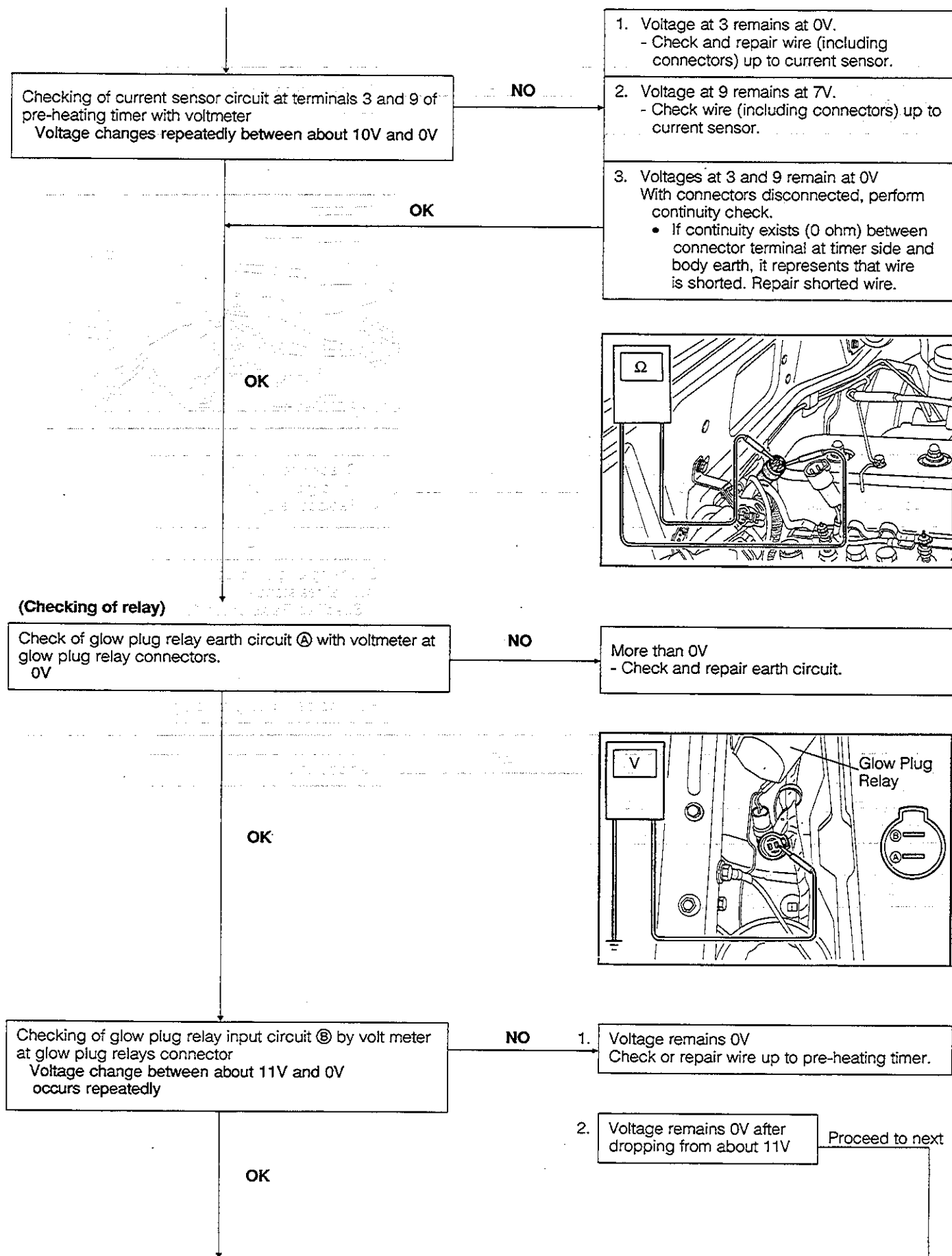
Checking of timer earth circuit at terminal 5 of pre-heating timer with voltmeter
0V

NO

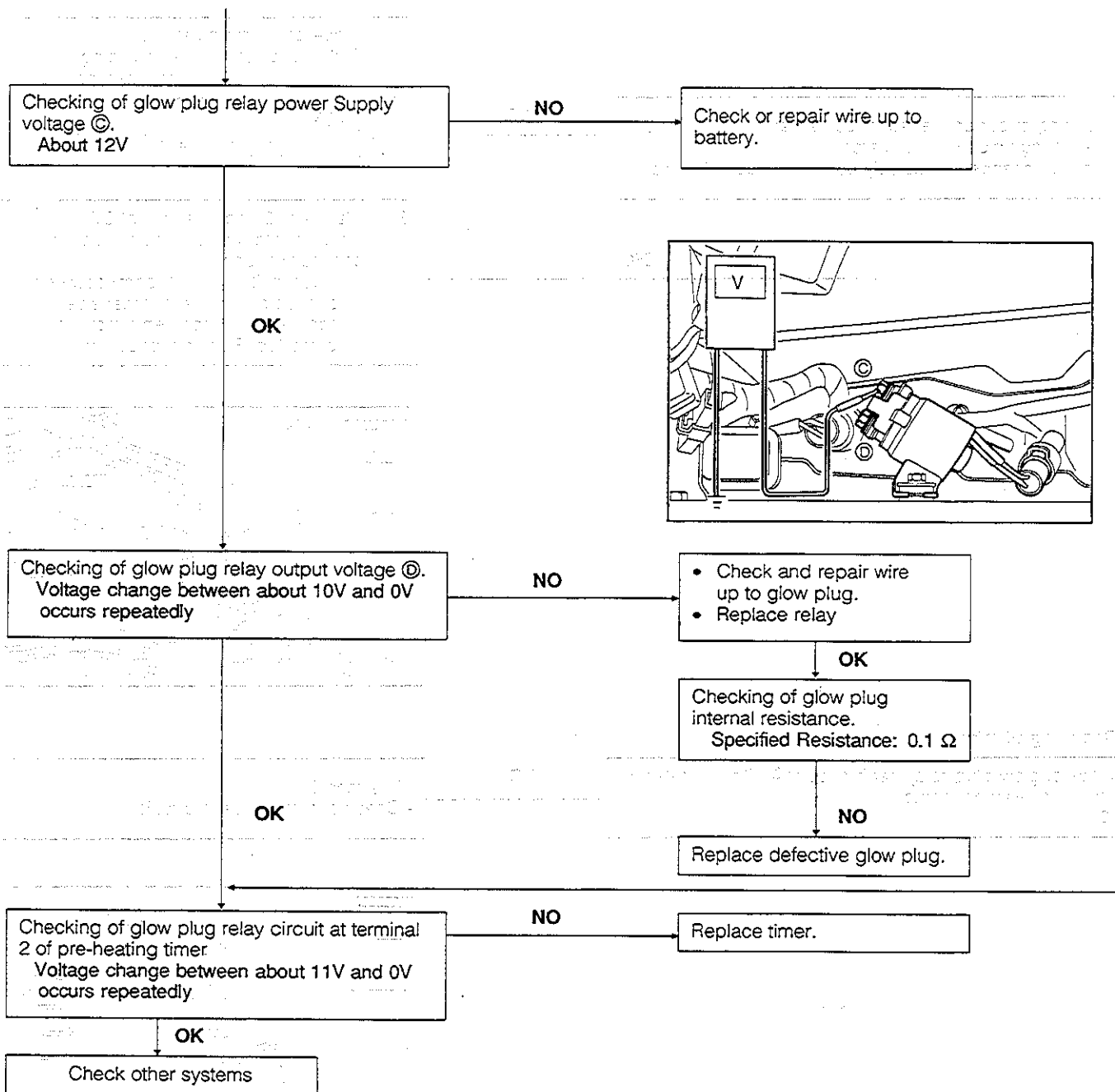
Reading other than 0V
- Check and repair earth circuit.

OK

WRE91-ST088



STARTING SYSTEM



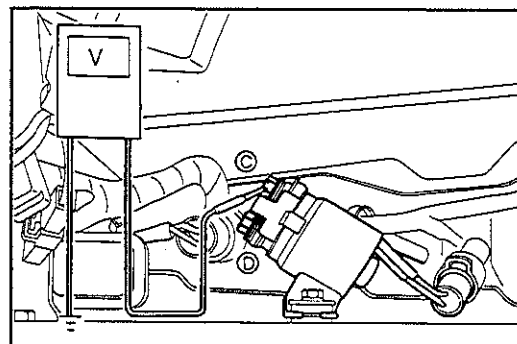
WRE91-ST090

② When voltage remains at 12V

Checking of glow plug relay output voltage ③
when engine switch, is turned OFF.
0V

NO

- Check and repair wire up to battery.
- Replace glow plug relay.



OK

Checking of pre-heating timer earth circuit at
terminal 5 of pre-heating timer.
0V

NO

Check and repair earth circuit.

OK

Checking of glow plug relay circuit at terminal 2 of
pre-heating timer
Voltage changes repeatedly between about 11V
and 0V.

NO

1. Voltage remains at 0V
- Replace timer

2. Voltage remains at 11V

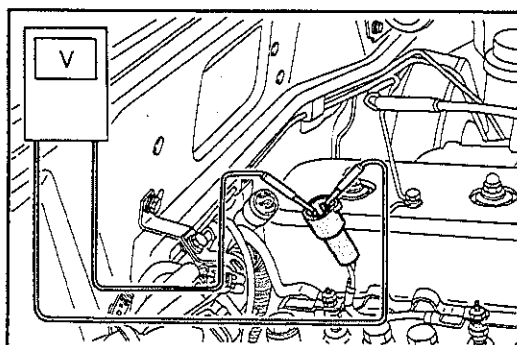
Proceed to next

Checking of current sensor
Specified Resistance: 10 mΩ

NO

Replace current sensor

OK



STARTING SYSTEM

Checking of current sensor circuit at terminals 3 and 9 of pre-heating timer with voltmeter
Voltage change repeatedly between about 10V and 0V.

NO

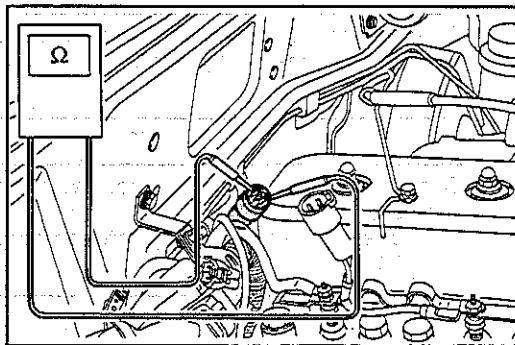
1. Voltage at 3 remains at 0V.
- Check and repair wire (including connectors) up to current sensor.
2. Voltage at 9 remains at 7V.
- Check wire (including connectors) up to current sensor.
3. Voltages at 3 and 9 remain at 0V
- With connectors disconnected.
Perform continuity check.
 - If continuity exists (0 ohm) between connector terminal at timer side and body earth, it represents that wire is shorted.
Repair shorted wire.

OK

Checking of glow plug internal resistance
Specified Resistance: 0.1 Ω

NO

Replace defective glow plug.



WRE91-ST091