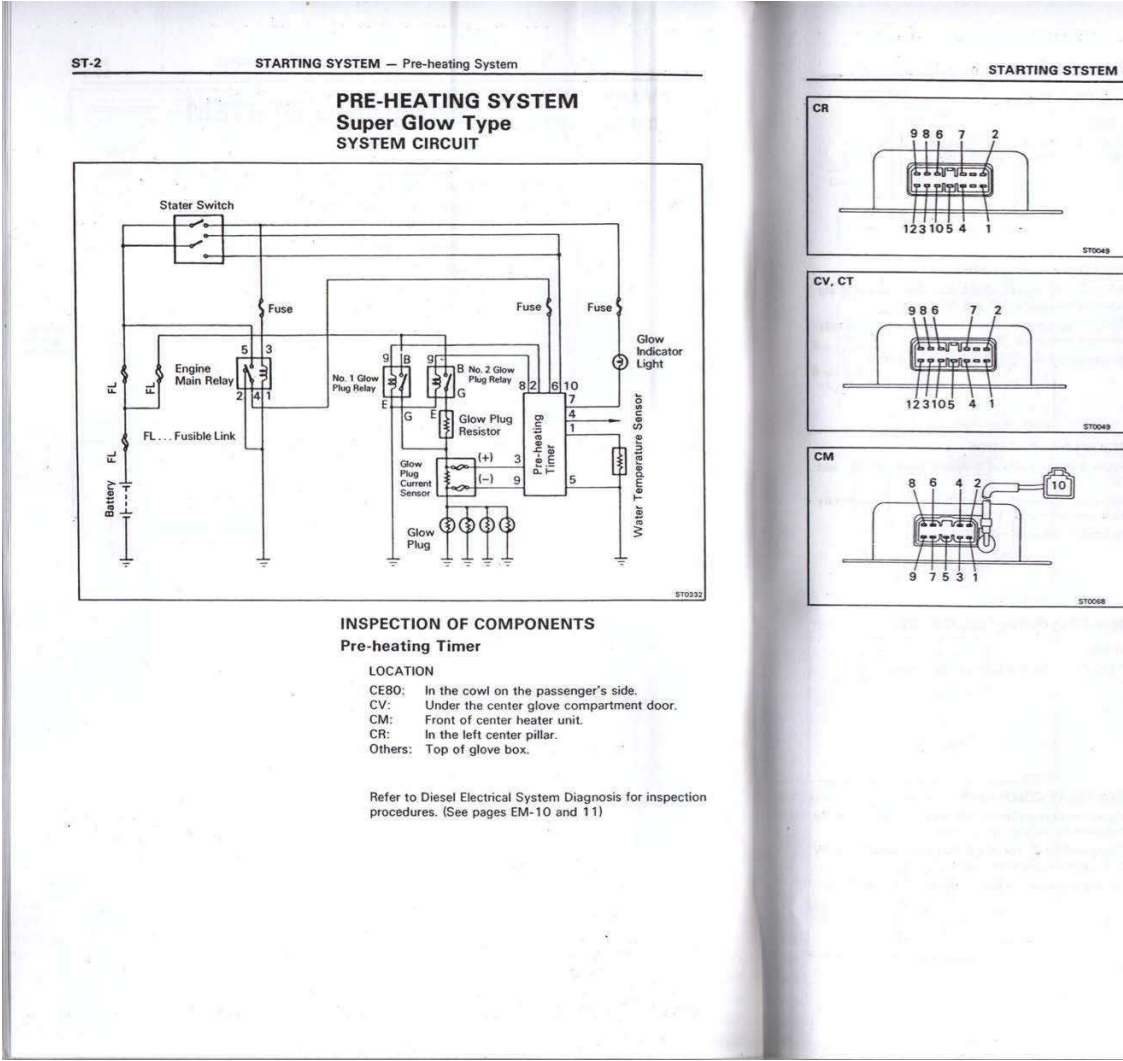


ST-1

STARTING SYSTEM

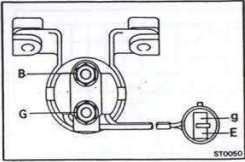
	Page
PRE-HEATING SYSTEM	ST-2
TROUBLESHOOTING	ST-10
STARTING SYSTEM CIRCUIT	ST-10
STARTER	ST-11
STARTER RELAY	ST-21

ST

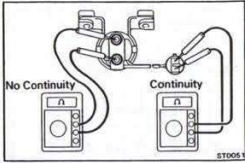


ST-4

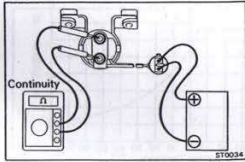
STARTING SYSTEM — Pre-heating System



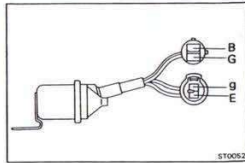
ST10090



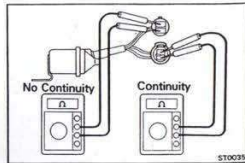
ST10091



ST10094



ST10092



ST10095

No. 1 Glow Plug Relay

LOCATION
CE80, CV, CT: On the right fender apron.
CM, CR: Under the left seat.

1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals "g" and "E".
(b) Using an ohmmeter, check that there is no continuity between terminals "B" and "G".
If continuity is not as specified, replace the relay.

2. INSPECT RELAY OPERATION

(a) Apply battery voltage between terminals "g" and "E".
(b) Using an ohmmeter, check that there is continuity between terminals "B" and "G".
If there is no continuity, replace the relay.

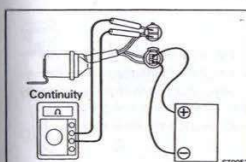
No. 2 Glow Plug Relay [CE, CV, CT]

LOCATION
CE80, CV, CT: On the right fender apron.

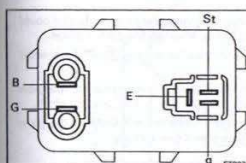
1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals "g" and "E".
(b) Using an ohmmeter, check that there is no continuity between terminals "B" and "G".
If continuity is not as specified, replace the relay.

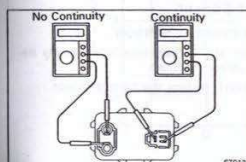
STARTING SYSTEM -



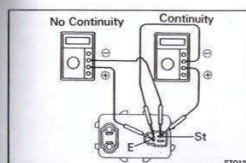
ST10093



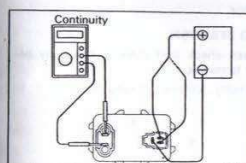
ST10076



ST10131



ST10132



ST10133

2. INSPECT RELAY OPERATION

(a) Apply battery voltage between terminals "g" and "E".
(b) Using an ohmmeter, check that there is continuity between terminals "B" and "G".
If there is no continuity, replace the relay.

1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals "g" and "E".
(b) Using an ohmmeter, check that there is no continuity between terminals "B" and "G".
If continuity is not as specified, replace the relay.

2. INSPECT RELAY OPERATION

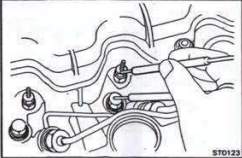
(a) Apply battery voltage between terminals "g" and "E".
(b) Using an ohmmeter, check that there is continuity between terminals "B" and "G".
If there is no continuity, replace the relay.

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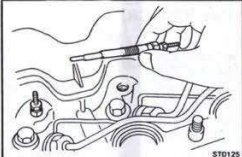
3/11

ST-6

STARTING SYSTEM — Pre-heating System

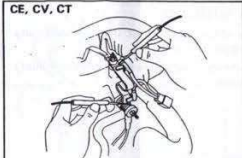


ST0123

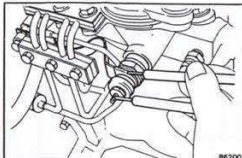


ST0125

CE, CV, CT



CM, CR



86200

Glow Plug

INSPECT GLOW PLUG

(a) Remove the four grommets from the glow plugs.

(b) Remove the four nuts and glow plug connector.

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

If there is no continuity, replace the glow plug.

NOTE:

• Be careful not to damage the glow plug pipes as it could cause an open circuit or shorten life of the plugs.

• Avoid getting oil and gasoline on the glow plugs when cleaning.

• During inspection, be sure to wipe any oil off the glow plug terminals and bakelite washer with a dry cloth.

• Be careful not to apply more than 7 volts to the glow plug as it could cause an open circuit.

Glow Plug Current Sensor

INSPECT GLOW PLUG CURRENT SENSOR

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

If there is no continuity, replace the current sensor.

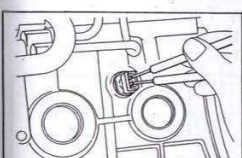
Glow Plug Resistor

INSPECT GLOW PLUG RESISTOR

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

If there is no continuity, replace the resistor.

STARTING SYSTEM —



ST0124

Water Temperature Sensor

INSPECT WATER TEMPERATURE SENSOR

Remove the sensor from the engine block.

If the sensor is damaged, replace it.

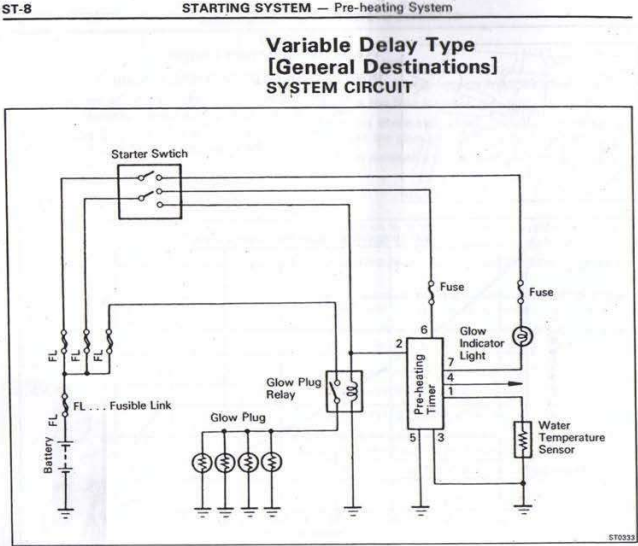
Water Temperature Sensor

Graph showing Sensor Resistance (kΩ) vs. Temperature (°C).

Temperature (°C)	Sensor Resistance (kΩ)
-20	20
0	5
20	2
40	1

<https://cardiagn.com/starting-c-engine/>

4/11

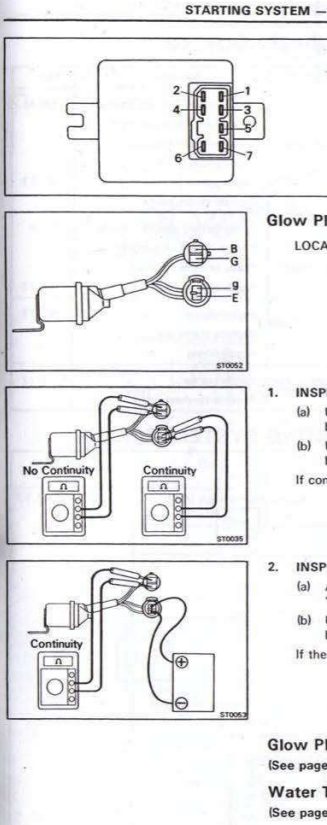


**INSPECTION OF COMPONENTS
Pre-heating Timer**

LOCATION
CE80: In the cowl on the passenger's side.
CE70: Top of glove box.

INSPECT PRE-HEATING TIMER

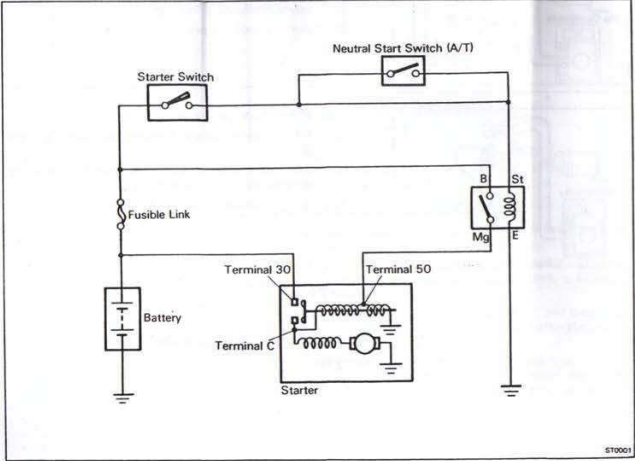
- (a) Turn the starter switch "ON" and measure the lighting time of the glow indicator light.
- (b) Check that there is voltage at terminal 2 of the pre-heating timer when the starter switch is turned to "ON".
- (c) Turn the starter switch to "START", and then check that there is no voltage at terminal 2 after starting the engine.
- (d) Turn the starter switch "OFF" and then turn the starter switch to "ON" and measure the current passing time (from battery to glow plug) at glow plug terminal.



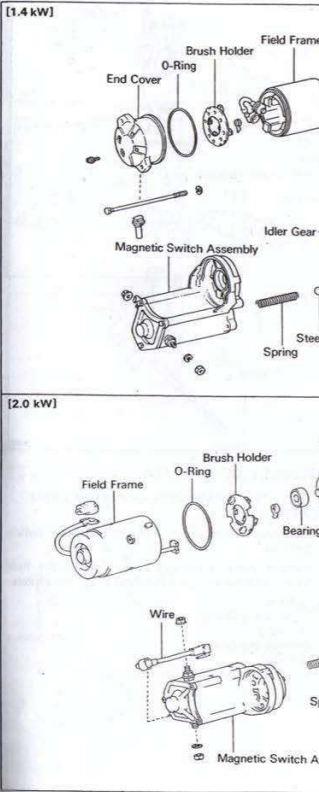
TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Engine will not crank	Battery charge low	Check battery specific gravity Charge or replace battery	CH-4
	Battery cables loose, corroded or worn	Repair or replace cables	
	Fusible link blown	Replace fusible link	
	Starter faulty	Repair starter	ST-12
	Starter switch faulty	Replace starter switch	
Engine cranks slowly	Battery charge low	Check battery specific gravity Charge or replace battery	CH-4
	Battery cables loose, corroded or worn	Repair or replace cables	
	Starter faulty	Repair starter	ST-12
Starter keeps running	Starter faulty	Repair starter	ST-12
	Starter switch faulty	Replace starter switch	
	Short in wiring	Repair wiring	
Starter spins - engine will not crank	Pinion gear teeth broken or faulty starter	Repair starter	ST-12
	Flywheel teeth broken	Replace flywheel	

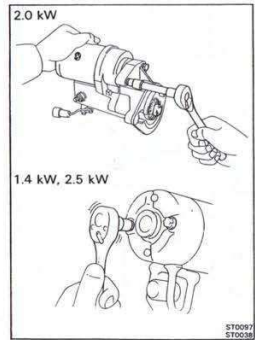
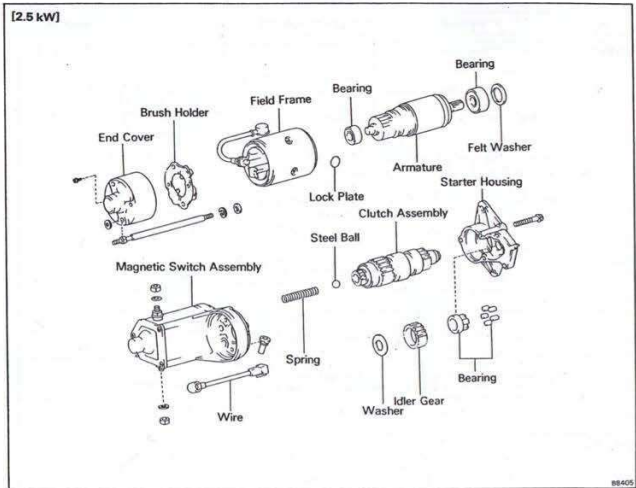
STARTING SYSTEM CIRCUIT



STAR
COMPC

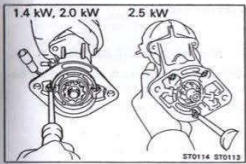


COMPONENTS (Cont'd)

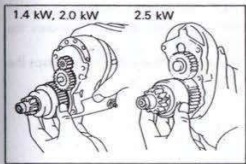


DISASSEMBLY OF STARTER

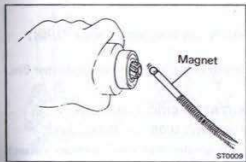
1. REMOVE FIELD FRAME WITH ARMATURE FROM MAGNETIC SWITCH
 - (a) Disconnect the lead wire from the magnetic switch terminal.
 - (b) Remove the two through bolts. Pull out the field frame with the armature from the magnetic switch.
 - (c) [1.4 kW]
Remove the O-ring.
[2.0 kW]
Remove the O-ring.
[2.5 kW]
Remove the lock plate and felt seal.



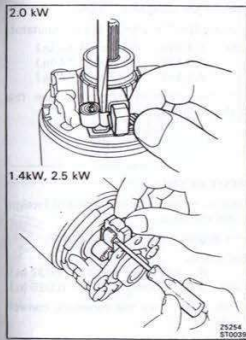
2. REM
SW/
Rem
and



3. REM
MA/
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kW)



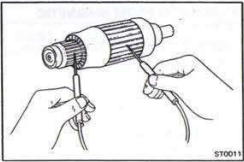
4. REM
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shal



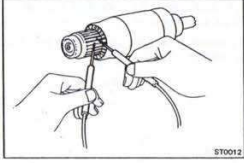
5. REM
(a)
(b)
(c)
6. REM

ST-14

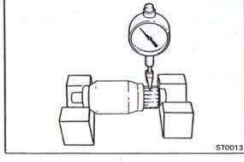
STARTING SYSTEM — Starter



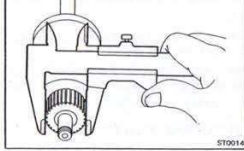
ST0011



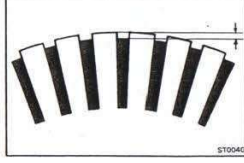
ST0012



ST0013



ST0014



ST0040

INSPECTION OF STARTER Armature Coil

1. INSPECT THAT ARMATURE IS NOT GROUNDED

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

2. INSPECT ARMATURE FOR OPEN CIRCUIT

Using an ohmmeter, check for continuity between the segments of the commutator. If there is no continuity between any segment, replace the armature.

Commutator

1. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES

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

2. INSPECT COMMUTATOR CIRCLE RUNOUT

Maximum circle runout: 0.05 mm (0.0020 in.)
If the circle runout is greater than the maximum, correct with a lathe.

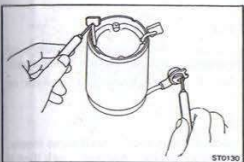
3. MEASURE DIAMETER OF COMMUTATOR

Using calipers, measure the diameter of the commutator.
Minimum diameter: 1.4 kW 29 mm (1.14 in.)
2.0 kW 34 mm (1.34 in.)
2.5 kW 35 mm (1.38 in.)
If the diameter of the commutator is less than the minimum, replace the armature.

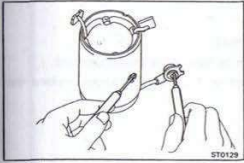
4. INSPECT UNDERCUT DEPTH

Check that the undercut depth is clean and free of foreign particles. Smooth out the edge.
Minimum undercut depth: 0.2 mm (0.008 in.)
Standard undercut depth:
1.4 kW 0.5 – 0.8 mm (0.020 – 0.032 in.)
2.0 kW, 2.5 kW 0.7 – 0.9 mm (0.028 – 0.035 in.)
If the undercut depth is less than the minimum, correct with a hacksaw blade.

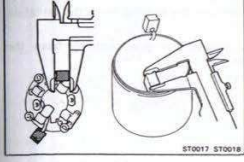
STARTING SYS



ST0130



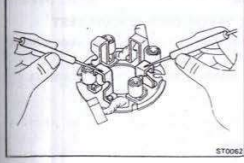
ST0129



ST0017 ST0018



ST0019



ST0062

Field C

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ST-16

STARTING SYSTEM — Starter

Free

Lock

ST0020

ST0041

ST0042

ST0126

Terminal C

Terminal 50

ST0128

Clutch and Gears

1. INSPECT GEAR TEETH

Check the gear teeth on the pinion gear, idler gear and clutch assembly for wear or damage. Replace if damaged. If damaged, also check the flywheel ring gear for wear or damage.

2. INSPECT CLUTCH

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

Bearings

1. INSPECT BEARINGS

Turn each bearing by hand while pushing inward. If resistance is felt or if the bearing sticks, replace the bearing.

2. IF NECESSARY, REPLACE BEARINGS

(a) Using SST, remove the bearing from the armature shaft.

(b) Using SST, remove the other bearing from the opposite side.

SST 09286-46011

(c) Using a press, install the front and rear bearings onto the shaft.

Magnetic Switch

1. PERFORM PULL-IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check for continuity between terminal 50 and terminal C.

If there is no continuity, replace the magnetic switch.

Switch Body

Terminal 50

ST0127

2.0 kW

ST0129

2.0 kW

1.4 kW, 2.5 kW

ST0130

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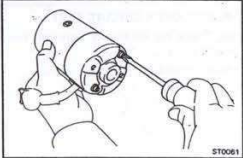
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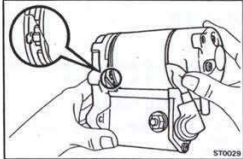
9/11

ST-18

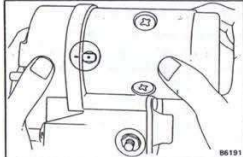
STARTING SYSTEM — Starter



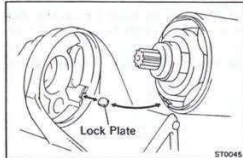
ST0061



ST0028

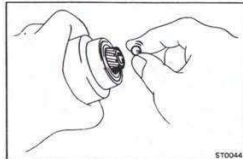


B6191



ST0045

Lock Plate



ST0044

(d) [1.4 kW, 2.5 kW]
Install the end cover and O-ring (1.4 kW) to the field frame with the two screws.

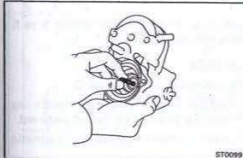
3. INSTALL FIELD FRAME WITH ARMATURE IN MAGNETIC SWITCH
[1.4 kW]
(a) Place the O-ring on the field frame.
(b) Align the protrusion of the field frame with the notch on the magnetic switch assembly and insert the field frame with the armature.

[2.0 kW]
(a) Place the O-ring on the field frame.
(b) Align the bolt anchor of the field frame with the mark on the magnetic switch assembly and insert the field frame with the armature.

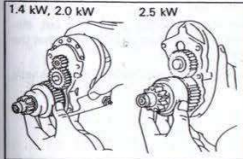
[2.5 kW]
(a) Place the felt seal on the armature shaft.
(b) Place the lock plate on the magnetic switch.
(c) Align the lock plate with the notch on the field frame and insert the field frame with the armature.

4. INSERT STEEL BALL INTO CLUTCH SHAFT HOLE
Apply grease to the ball, and then insert it into the clutch shaft hole.

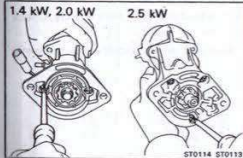
STARTING SY



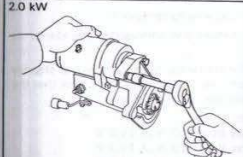
ST0099



ST0114 ST0113



ST0114 ST0113



ST0097 ST0098

5. INS
(a)
(b)
(c)

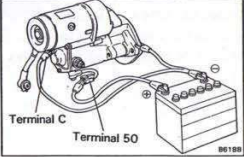
6. INS
(a)
(b)
(c)

<https://cardiagn.com/starting-c-engine/>

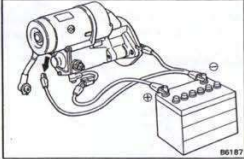
10/11

ST-20

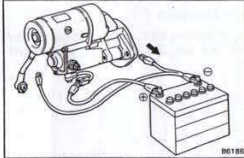
STARTING SYSTEM — Starter



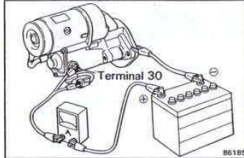
Terminal C
Terminal 50



Terminal 30



Terminal 30



Terminal 30

PERFORMANCE TEST OF STARTER

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

1. PERFORM PULL-IN TEST

(a) Disconnect the lead wire from terminal C.

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

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

2. PERFORM HOLD-IN TEST

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

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

3. INSPECT PINION GEAR RETURN

Disconnect the negative lead from the switch body. Check that the pinion gear returns inward.

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

4. PERFORM NO-LOAD PERFORMANCE TEST

(a) Connect the lead wire to terminal C.

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

(c) Check that the starter rotates smoothly and steadily with the pinion gear moving outward. Check that the ammeter reads the specified current.

Specified current:

1.4 kW Less than 90 A at 11.5 V

2.0 kW Less than 120 A at 11.5 V

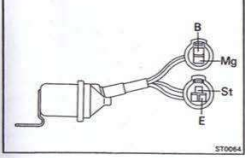
2.5 kW Less than 180 A at 11.0 V

STARTING SYSTEM

STAR

(CV wi

LOC



ST0064

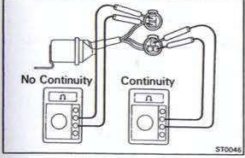
INSPE

1. INS

(a)

(b)

If cc



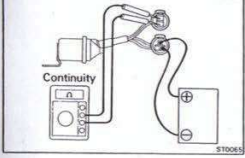
ST0065

2. INS

(a)

(b)

If th



ST0066