

Last Modified: 3-27-2012	6.4 U	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM000000PDN0LXX
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: DATA LIST / ACTIVE TEST (2013 FR-S)		

DATA LIST / ACTIVE TEST

1. DATA LIST

HINT:

Using the Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

NOTICE:

In the table below, the values listed under Normal Condition are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.

- Warm up the engine.
- Turn the ignition switch off.
- Connect the Techstream to the DLC3.
- Turn the ignition switch to ON.
- Turn the Techstream on.
- Enter the following menus: Powertrain / Engine / Data List.
- Check the values by referring to the table below.

ECM

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	DIAGNOSTIC NOTE
Battery Voltage	Battery voltage: Min.: 0 V, Max.: 65.535 V	11 to 14 V: Idling	When the battery voltage is below 11 V, other systems may be affected. Reference figures: - IG ON: 12.5 V - When cranking: 9.834 V - When idling (after warming up): 13.359 V
Battery Current	Battery current: Min.: -125 A, Max.: 125 A	Changes in response to the amount of electricity generated by the alternator: while running after warming up.	When a malfunction occurs, there may be a problem with the IB voltage system or the sensor power source.
Battery Temperature	Battery temperature: Min.: -40°C (-40°F), Max.: 6513.5°C (11756.3°F)	Changes in response to the actual temperature: while running after warming up.	When a malfunction occurs, there may be a problem with the THB voltage system or the sensor power source.
	Displays the voltage		

Alt Vol - Non Active Test	required when the regulator is not being forcefully driven: Min.: 0 V, Max.: 80 V	Changes in response to the battery fluid temperature and running state (12.4 to 14.6 V): after starting the engine.	When a malfunction occurs, there may be problems with charging control systems.
Alt Vol - Active Test	Displays the voltage required when the regulator is being forcefully driven: Min.: 0 V, Max.: 80 V	Specified voltage required when performing the "generation required voltage" active test: after starting the engine.	- Displays the voltage generated when performing the active test. - When a malfunction occurs, there may be problems with the charging control systems.
Alternator Duty	Displays the charging control signal: Min.: 0%, Max.: 255 %	Changes in response to the amount of electricity generated by the alternator: while charging control.	When a malfunction occurs, there may be problems with the charging control systems.
Request Voltage to Alternator	Displays the alternator generation control mode: Min.: 0%, Max.: 255 %	Changes in response to the amount of electricity generated by the alternator: while charging control.	When a malfunction occurs, there may be problems with the charging control systems.
# Codes (Include History)	Number of DTCs: Min.: 0, Max.: 255	0	-

2. ACTIVE TEST

HINT:

Using the Techstream to perform Active Tests allows relays, VSVs, actuators and other items to be operated without removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

- Connect the Techstream to the DLC3.
- Turn the ignition switch to ON.
- Turn the Techstream on.
- Enter the following menus: Powertrain / Engine / Active Test.
- Perform the Active Test by referring to the table below.

ECM

TESTER DISPLAY	TEST PART	CONTROL RANGE	DIAGNOSTIC NOTE
Control the Voltage of Alternator	Fluctuations in the required alternator generated voltage.	Between 12.8 and 14.3 V	While engine running.



Last Modified: 3-27-2012	6.4 D	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM000000PDJ0VJX
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: DIAGNOSIS SYSTEM (2013 FR-S)		

DIAGNOSIS SYSTEM

1. DLC3 (Data Link Connector 3)

(a) Check the DLC3 INFO .

2. BATTERY VOLTAGE

Standard voltage:
11 to 14 V

If the voltage is below 11 V, replace or recharge the battery.



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Last Modified: 3-27-2012	6.4 S	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM000003MXP02KX
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: DIAGNOSTIC TROUBLE CODE CHART (2013 FR-S)		

DIAGNOSTIC TROUBLE CODE CHART

DTC CODE	DETECTION ITEM	SEE PAGE
P0516	Battery Temperature Sensor Circuit Low	INFO
P0517	Battery Temperature Sensor Circuit High	INFO
P1530	Short in Battery Current Sensor Circuit	INFO
P1531	Open in Battery Current Sensor Circuit	INFO
P1532	Battery Current Sensor Circuit	INFO



Last Modified: 3-27-2012	6.4 D	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM000000PDK0XKX
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: DTC CHECK / CLEAR (2013 FR-S)		

DTC CHECK / CLEAR

1. CHECK DTC

- (a) Connect the Techstream to the DLC3.
- (b) Turn the ignition switch to ON.
- (c) Turn the Techstream on.
- (d) Enter the following menus: Powertrain / Engine / DTC.
- (e) Check the DTC(s), and then write them down.
- (f) Check the details of the DTC(s)  .

2. CLEAR DTC

- (a) Connect the Techstream to the DLC3.
- (b) Turn the ignition switch to ON.
- (c) Turn the Techstream on.
- (d) Enter the following menus: Powertrain / Engine / DTC.
- (e) Clear the DTCs.



Last Modified: 3-27-2012	6.4 U	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM000003MXV01SX
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: FAIL-SAFE CHART (2013 FR-S)		

FAIL-SAFE CHART

If any of the following DTCs are stored, the ECM enters fail-safe mode to allow the vehicle to be driven temporarily.

DTC NO.	COMPONENT	FAIL-SAFE OPERATION	FAIL-SAFE DEACTIVATION CONDITION
P0516, P0517, P1530, P1531 and P1532	Generator	Generator command is fixed.	Pass condition detected



Last Modified: 3-27-2012	6.4 D	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM000000PD90TJX
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: HOW TO PROCEED WITH TROUBLESHOOTING (2013 FR-S)		

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

*: Use the Techstream.

1.	VEHICLE BROUGHT TO WORKSHOP
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NEXT



2.	CUSTOMER PROBLEM ANALYSIS
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HINT:

- In troubleshooting, confirm that the problem symptoms have been accurately identified. Preconceptions should be discarded in order to make an accurate judgment. To clearly understand what the problem symptoms are, it is extremely important to ask the customer about the problem and the conditions at the time the malfunction occurred.
- Gather as much information as possible for reference. Past problems that seem unrelated may also help in some cases.
 - The following 5 items are important points in the problem analysis:

What	Vehicle model, system name
When	Date, time, occurrence frequency
Where	Road conditions
Under what conditions?	Running conditions, driving conditions, weather conditions
How did it happen?	Problem symptoms

NEXT



3.	INSPECT BATTERY VOLTAGE
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Standard voltage:
11 to 14 V

If the voltage is below 11 V, recharge or replace the battery before proceeding to the next step.

NEXT



4. INSPECT COMMUNICATION FUNCTION OF CAN COMMUNICATION SYSTEM*

(a) Use the Techstream to check if the CAN communication system is functioning normally INFO

Result

RESULT	PROCEED TO
CAN DTCs are not output	A
CAN DTCs are output	B

B ► GO TO CAN COMMUNICATION SYSTEM .

A



5. CHECK FOR DTC*

HINT:

Refer to DTC Check / Clear INFO .

Result

RESULT	PROCEED TO
No code	A
Trouble code	B

B ► GO TO DTC CHART

A



6. REFER TO PROBLEM SYMPTOMS TABLE

HINT:

Refer to Problem Symptoms Table [INFO](#) .

Result

RESULT	PROCEED TO
Malfunctioning parts not confirmed	A
Malfunctioning parts confirmed	B

B ► GO TO STEP 10

A



7.	OVERALL ANALYSIS AND TROUBLESHOOTING*
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HINT:

Refer to Data List / Active Test [INFO](#) .

Result

RESULT	PROCEED TO
Malfunctioning parts not confirmed	A
Malfunctioning parts confirmed	B

B ► GO TO STEP 10

A



8.	CHECK ECU CIRCUIT
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HINT:

Refer to Terminals of ECU [INFO](#) .

NG ► GO TO STEP 10

OK
▼

9.	CHECK FOR INTERMITTENT PROBLEMS
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HINT:
Refer to Symptom Simulation [INFO](#) .

NEXT
▼

10.	CONDUCT PARTS INSPECTION
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NEXT
▼

11.	IDENTIFY PROBLEM
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NEXT
▼

12.	ADJUST AND/OR REPAIR
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NEXT
▼

13.	CONDUCT CONFIRMATION TEST
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NEXT ► END

Last Modified: 3-27-2012	6.4 G	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM000001AR909JX
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: ON-VEHICLE INSPECTION (2013 FR-S)		

ON-VEHICLE INSPECTION

1. CHECK BATTERY CONDITION

NOTICE:

If the battery is weak or if the engine is difficult to start, perform the following procedures.

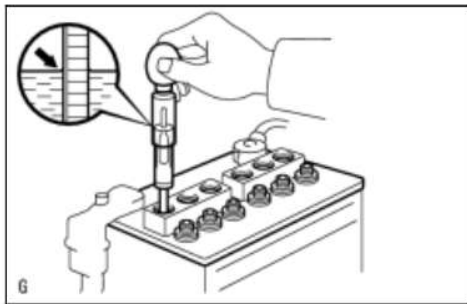
- (a) Check the battery for damage and deformation. If severe damage, deformation or leakage is found, replace the battery.

- (b) Check the volume of electrolyte quantity in each cell.

- If the electrolyte volume is below the lower line, add distilled water to each cell. Then, recharge the battery and check the electrolyte specific gravity.

Standard specific gravity:
1.25 to 1.29 at 20°C (68°F)

If the electrolyte volume is above the lower line, check the battery voltage when cranking the engine. If the battery voltage is less than 9.6 V, recharge or replace the battery.



HINT:

Before checking the battery voltage, turn off all the electrical systems (headlights, blower motor, rear defogger, etc.).

2. INSPECT BATTERY TERMINAL AND FUSE

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

If the terminal is corroded, clean the terminal.

- (b) Measure the resistance of the H-fuses and fuses.

Standard resistance:
Below 1 Ω

If the result is not as specified, replace the fuse.

3. INSPECT FAN AND GENERATOR V BELT INFO

4. INSPECT GENERATOR WIRING

- (a) Visually check the generator wiring.

- (1) Check that the wiring is in good condition.

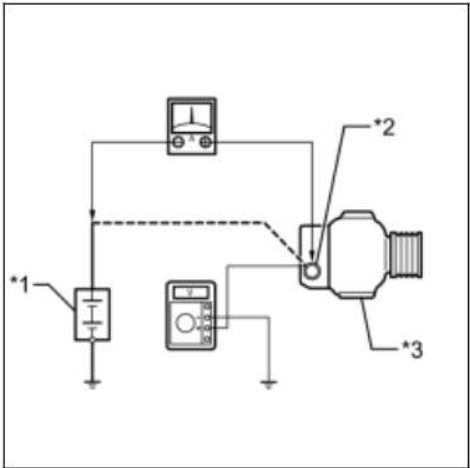
5. CHECK FOR ABNORMAL NOISES

- (a) Listen for abnormal noises from the generator.
- (1) Check that no abnormal noises are heard from the generator while the engine is running.

6. INSPECT CHARGE WARNING LIGHT CIRCUIT

- (a) Turn the ignition switch to ON. Check that the charge warning light comes on.
- (b) Start the engine and check that the light goes off.
- If the light does not operate as specified, troubleshoot the charge warning light circuit.

7. INSPECT CHARGING CIRCUIT WITHOUT LOAD



- (a) Connect a voltmeter and ammeter to the charging circuit as follows.
- (1) Disconnect the wire from terminal B of the generator, and then connect it to the negative (-) lead of an ammeter.

Text in Illustration

*1	Battery
*2	Terminal B
*3	Generator Assembly

- (2) Connect the positive (+) lead of the ammeter to terminal B of the generator.
- (3) Connect the positive (+) lead of a voltmeter to terminal B of the generator.
- (4) Ground the negative (-) lead of the voltmeter.

- (b) Check the charging circuit.
- (1) Maintain the engine speed at 2000 rpm and check the reading on the ammeter and voltmeter.
- Standard current:
10 A or less
- Standard voltage:
11.3 to 15.6 V

If the result is not as specified, replace the generator assembly.

HINT:

If the battery is not fully charged, the ammeter reading will sometimes be higher than the standard current.

8. INSPECT CHARGING CIRCUIT WITH LOAD

- (a) With the engine running at 2000 rpm, turn the high beam headlights on and turn the heater blower switch to the HI position.
- (b) Check the reading on the ammeter.
- Standard current:
30 A or higher
- If the ammeter reading is below the standard current, repair the generator.

HINT:

If the battery is fully charged, the indication will sometimes be below the standard current. If this is the case, add more electrical load (operate the wipers, rear window defogger, etc.) and check the reading on the ammeter again.

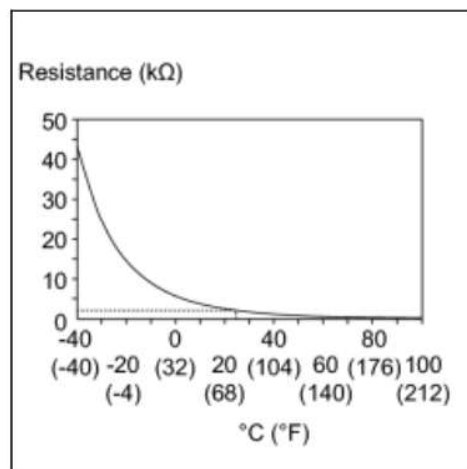


Last Modified: 3-27-2012	6.4 C	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM0000010BK0E1X
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: P0516,P0517: Battery Temperature Sensor Circuit Low (2013 FR-S)		

DTC	P0516	Battery Temperature Sensor Circuit Low
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DTC	P0517	Battery Temperature Sensor Circuit High
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DESCRIPTION



The battery temperature sensor installed on the battery current sensor assembly detects the battery temperature.

A thermistor is integrated into the battery temperature sensor, and the resistance in the battery temperature sensor changes according to the battery temperature.

The resistance of the thermistor in the battery temperature sensor decreases as the battery temperature increases. The resistance increases as the temperature decreases.

The battery temperature sensor is connected to the ECM. The ECM supplies 5 V from the THB terminal to the battery temperature sensor through resistor R.

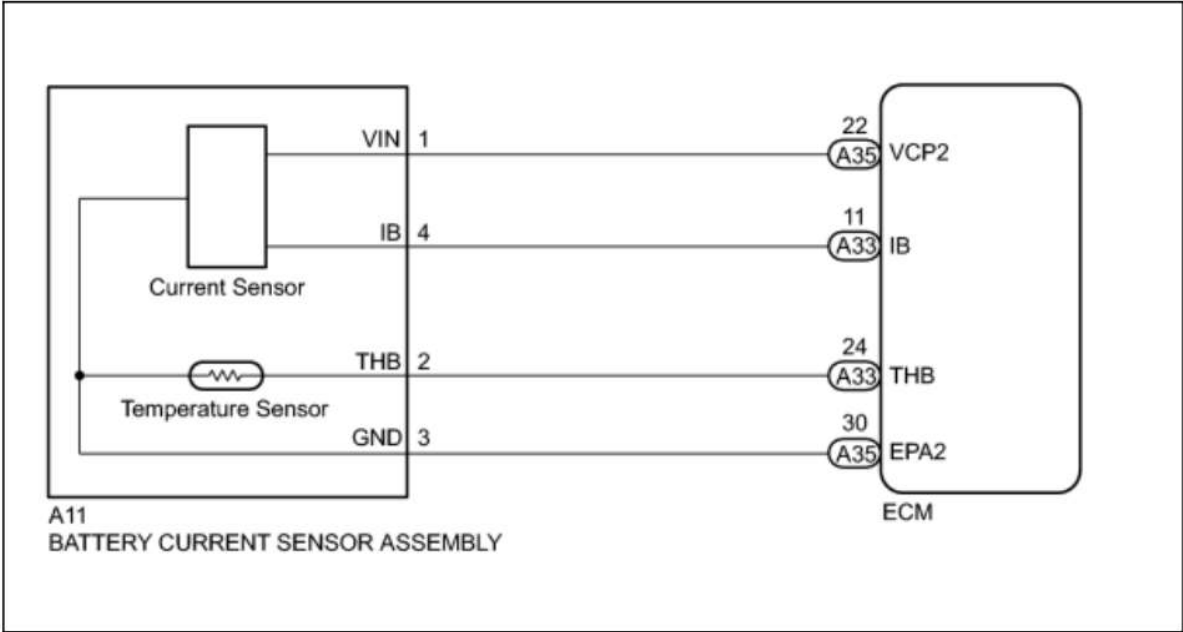
The battery temperature sensor and resistor R are connected in series. This results in fluctuations in the voltage supplied from the THB terminal when the resistance changes according to the battery temperature.

The ECM determines the battery temperature according to fluctuations in voltage. When the battery temperature is high, the ECM determines to reduce the amount of current supplied from the generator in order to protect the battery.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
		Battery current

P0516	• Engine speed is 500 r/min or more, battery voltage is 10.9 V or more, and 1 second or more have elapsed after starting. • Battery temperature sensor output is less than 0.104 V, and duration of the malfunction is 0.5 seconds or more (1-trip detection logic).	• sensor assembly (battery temperature sensor) • Short to GND in battery temperature sensor circuit • ECM
P0517	• Engine speed is 500 r/min or more, battery voltage is 10.9 V or more, and 1 second or more have elapsed after starting. • Battery temperature sensor output is more than 4.867 V, and duration of the malfunction is 0.5 seconds or more (1-trip detection logic).	• Battery current sensor assembly (battery temperature sensor) • Open in battery temperature sensor circuit • ECM

WIRING DIAGRAM

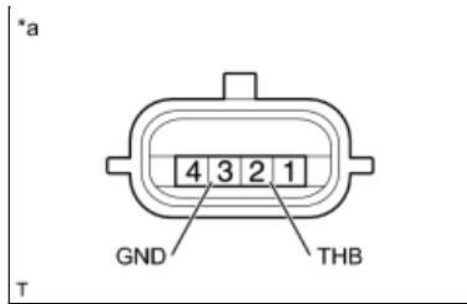


INSPECTION PROCEDURE

PROCEDURE

1.	INSPECT BATTERY CURRENT SENSOR ASSEMBLY
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(a) Disconnect the cable from the negative (-) battery terminal.



(b) Disconnect the A11 battery current sensor assembly connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2 (THB) - 3 (GND)	20 to 30°C (68 to 86°F)	1.5 to 2.6 kΩ

Text in Illustration

*a	Component without harness connected (Battery Current Sensor Assembly)
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(d) Reconnect the cable to the negative (-) battery terminal.

NG ► **REPLACE BATTERY CURRENT SENSOR ASSEMBLY**

OK



2.	CHECK HARNESS AND CONNECTOR (BATTERY CURRENT SENSOR ASSEMBLY - ECM)
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(a) Disconnect the A33 and A35 ECM connectors.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-24 (THB) - A11-2 (THB)	Always	Below 1 Ω
A35-30 (EPA2) - A11-3 (GND)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-24 (THB) or A11-2 (THB) - Body ground	Always	10 kΩ or higher

A35-30 (EPA2) or A11-3 (GND) - Body ground	Always	10 kΩ or higher
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NG ► **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ► **REPLACE ECM**



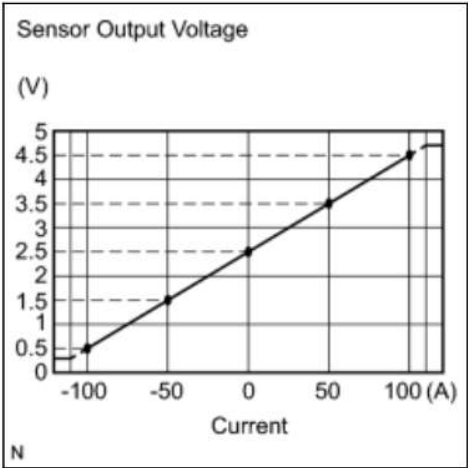
Last Modified: 3-27-2012	6.4 C	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM0000010BL058X
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: P1530-P1532: Short in Battery Current Sensor Circuit (2013 FR-S)		

DTC	P1530	Short in Battery Current Sensor Circuit
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DTC	P1531	Open in Battery Current Sensor Circuit
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DTC	P1532	Battery Current Sensor Circuit
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DESCRIPTION



The battery current sensor assembly installed on the negative (-) battery terminal detects the amount of current supplied from the generator.

The battery current sensor assembly changes current to voltage (at the negative (-) battery terminal) and sends it to the ECM. The ECM controls the voltage of the generator based on the signals from the battery current sensor assembly.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P1530	- Engine speed is 500 r/min or more, battery voltage is 10.9 V or more, and 1 second or more have elapsed after starting. - Battery current sensor output is less than 0.347 V, and duration of the malfunction is 0.5 seconds or more (1-trip detection logic).	- Battery current sensor assembly - Open or short to GND in battery current

		- sensor circuit • ECM
P1531	- Engine speed is 500 r/min or more, battery voltage is 10.9 V or more, and 1 second or more have elapsed after starting. - Battery current sensor output is more than 4.653 V, and duration of the malfunction is 0.5 seconds or more (1-trip detection logic).	- Battery current sensor assembly • Short to +B or VC in battery current sensor circuit • ECM
P1532	- Ignition switch ON - Current sensor fixing diagnosis: The difference between the maximum and minimum current value when changing charging states is less than 0.07 V, and the charging state changes 10 times or more in succession when malfunctioning (1-trip detection logic). - Charging side properties diagnosis: After the alternator target DUTY has changed from 60% or more to less than 40%, with the alternator target DUTY is less than 40%, the battery voltage is less than 13.2 V and the battery current sensor voltage is 2.6 V or more and less than 5 V, and the duration of the malfunction is 30 seconds or more (1-trip detection logic). - Discharge side properties diagnosis: After the alternator target DUTY has changed from less than 40% to 60% or more, with the alternator target DUTY at 60% or more, the battery voltage is more than 13.7 V and the battery current sensor voltage is 0 V or more and less than 2.4 V and the duration of malfunction is 30 seconds or more (1-trip detection logic).	- Battery current sensor assembly • Short in battery current sensor circuit • ECM

WIRING DIAGRAM

Refer to DTC P0516 INFO.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO P1530, P1531, P1532)
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- (a) Connect the Techstream to the DLC3.
- (b) Turn the ignition switch to ON.
- (c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / DTC.

(e) Read the DTC.

Result

RESULT	PROCEED TO
DTC P1530, P1531 and P1532 are output	A
DTC P1530, P1531, P1532 and other DTCs are output	B

HINT:

If any DTCs other than P1530, P1531 and P1532 are output, troubleshoot those DTCs first.

B ► **GO TO DTC CHART**

A



2. READ VALUE USING TECHSTREAM (BATTERY CURRENT)

(a) Turn all of the electrical systems (headlights, blower motor, rear defogger, etc.) off.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine / Data List / Battery Current.

Result

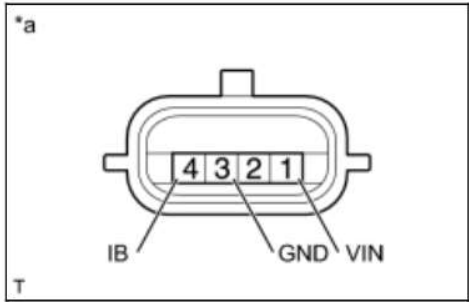
RESULT	PROCEED TO
Battery current is fixed at 0 A, or fluctuates by +/- 1 A or less between -100 and 100 A	A
Battery current fluctuates between -20 and 0 A	B

B ► **USE SIMULATION METHOD TO CHECK**

A



3. INSPECT BATTERY CURRENT SENSOR ASSEMBLY



(a) Disconnect the cable from the negative (-) battery terminal.

(b) Disconnect the A11 battery current sensor assembly connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (VIN) - 3 (GND)	Always	3 to 10 kΩ
1 (VIN) - 4 (IB)	Always	Below 0.5 kΩ
3 (GND) - 4 (IB)	Always	3 to 10 kΩ

Text in Illustration

*a	Component without harness connected (Battery Current Sensor Assembly)
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(d) Reconnect the cable to the negative (-) battery terminal.

NG **▶ REPLACE BATTERY CURRENT SENSOR ASSEMBLY**

OK
▼

4.	CHECK HARNESS AND CONNECTOR (BATTERY CURRENT SENSOR ASSEMBLY - ECM)
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(a) Disconnect the A33 and A35 ECM connectors.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-11 (IB) - A11-4 (IB)	Always	Below 1 Ω
A35-22 (VCP2) - A11-1 (VIN)	Always	Below 1 Ω

A35-30 (EPA2) - A11-3 (GND)	Always	Below 1 Ω
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Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-11 (IB) or A11-4 (IB) - Body ground	Always	10 k Ω or higher
A35-22 (VCP2) or A11-1 (VIN) - Body ground	Always	10 k Ω or higher
A35-30 (EPA2) or A11-3 (GND) - Body ground	Always	10 k Ω or higher

NG  **REPAIR OR REPLACE HARNESS OR CONNECTOR**

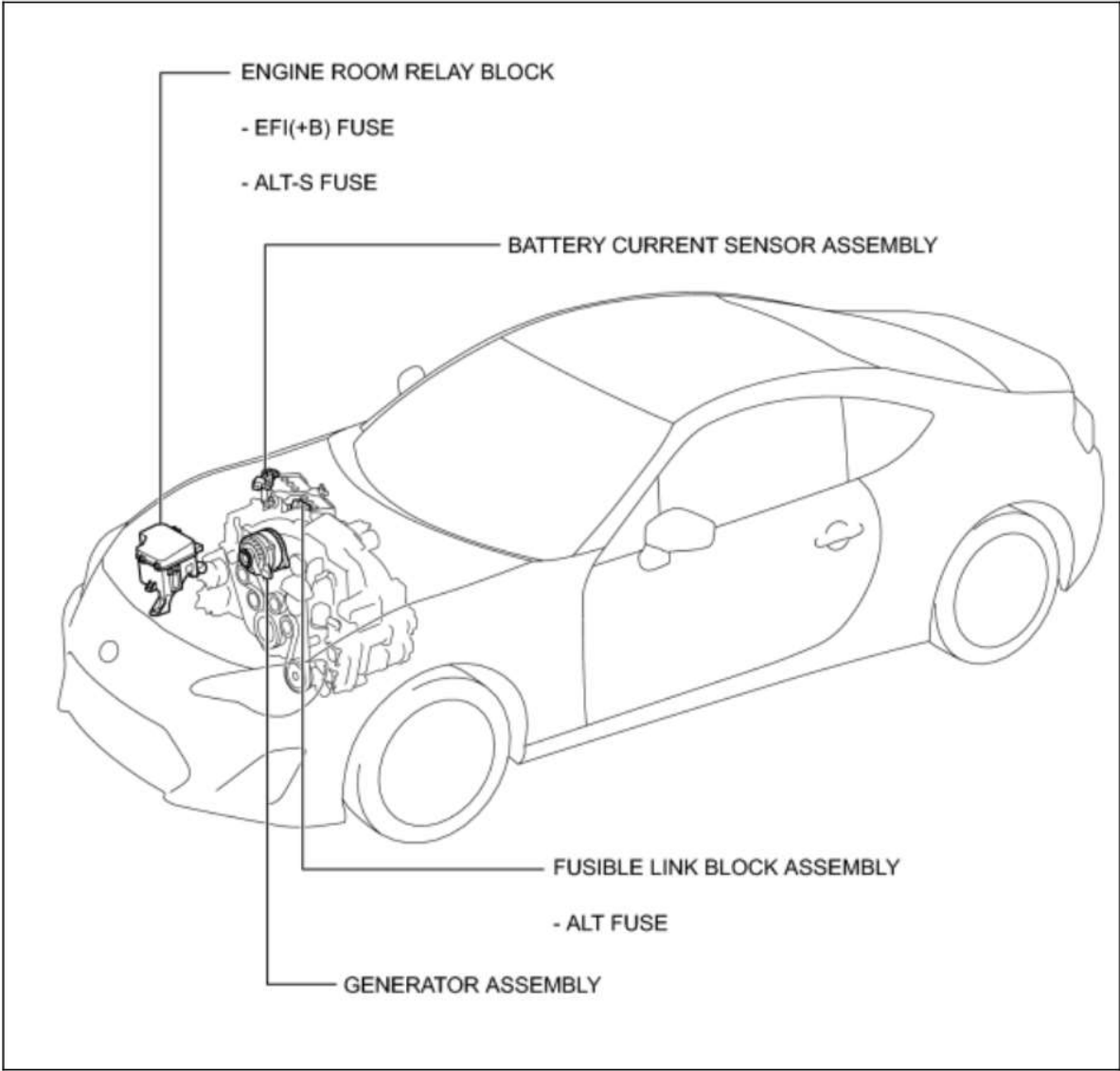
OK  **REPLACE ECM**



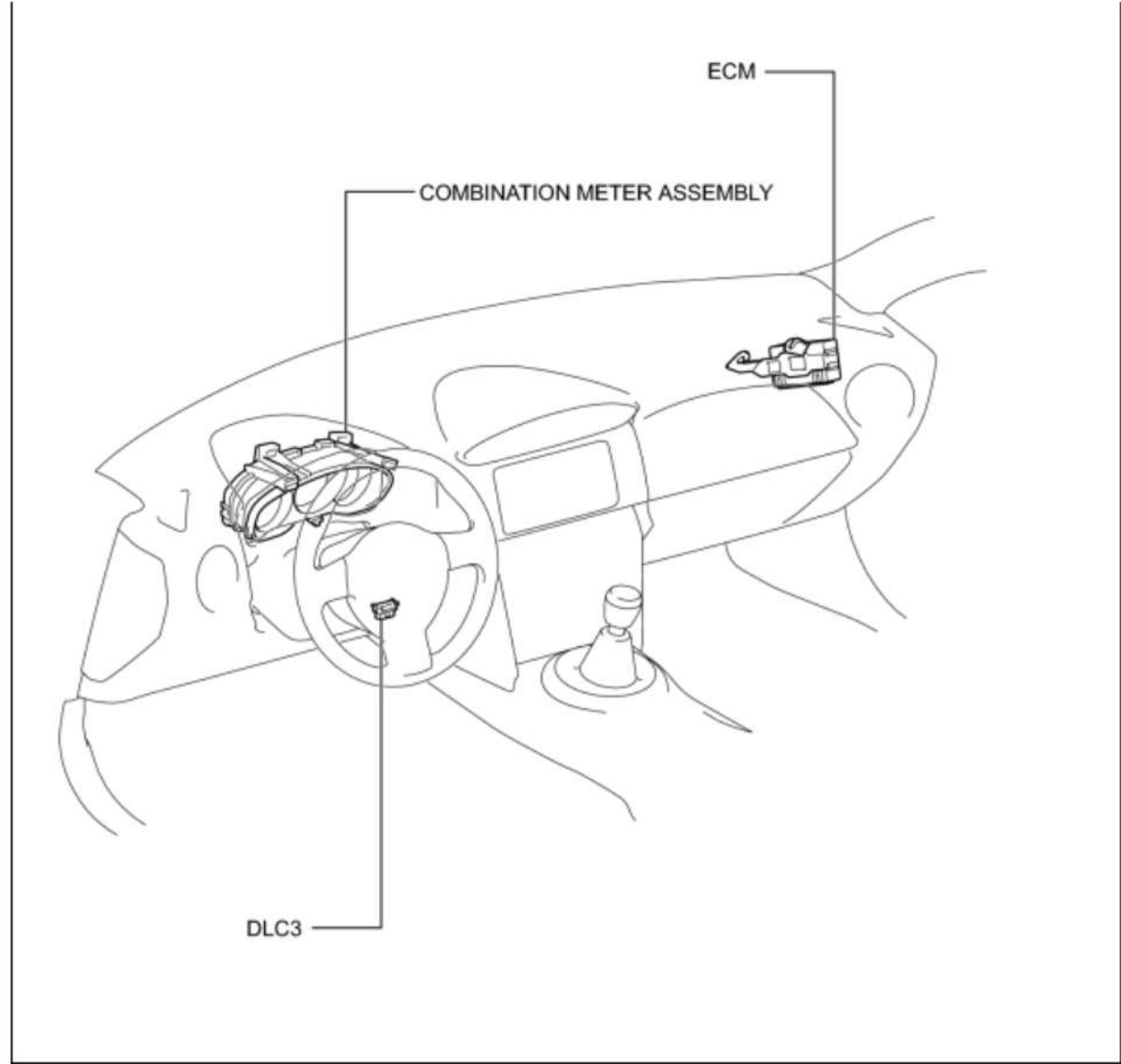
Last Modified: 3-27-2012	6.4 R	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM000003SCX00LX
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: PARTS LOCATION (2013 FR-S)		

PARTS LOCATION

ILLUSTRATION



ILLUSTRATION



Last Modified: 3-27-2012	6.4 L	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM000001GNI01AX
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: PRECAUTION (2013 FR-S)		

PRECAUTION

1. PRECAUTION

- (a) Check that the battery cables are connected to the correct terminals.
- (b) Disconnect the battery cables when the battery is given a quick charge.
- (c) Do not perform tests with a high voltage insulation resistance tester.
- (d) Never disconnect the battery cables while the engine is running.
- (e) Check that the charging cable nuts are tightened on terminal B of the generator and on the engine room relay block.



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Model Year: 2013	Model: FR-S	Doc ID: RM000003MXQ01AX
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: PROBLEM SYMPTOMS TABLE (2013 FR-S)		

PROBLEM SYMPTOMS TABLE

HINT:

- Use the table below to help determine the cause of problem symptoms. If multiple suspected areas are listed, the potential causes of the symptoms are listed in order of probability in the "Suspected Area" column of the table. Check each symptom by checking the suspected areas in the order they are listed. Replace parts as necessary.
- Inspect the fuses and relays related to this system before inspecting the suspected areas below.

Charging System

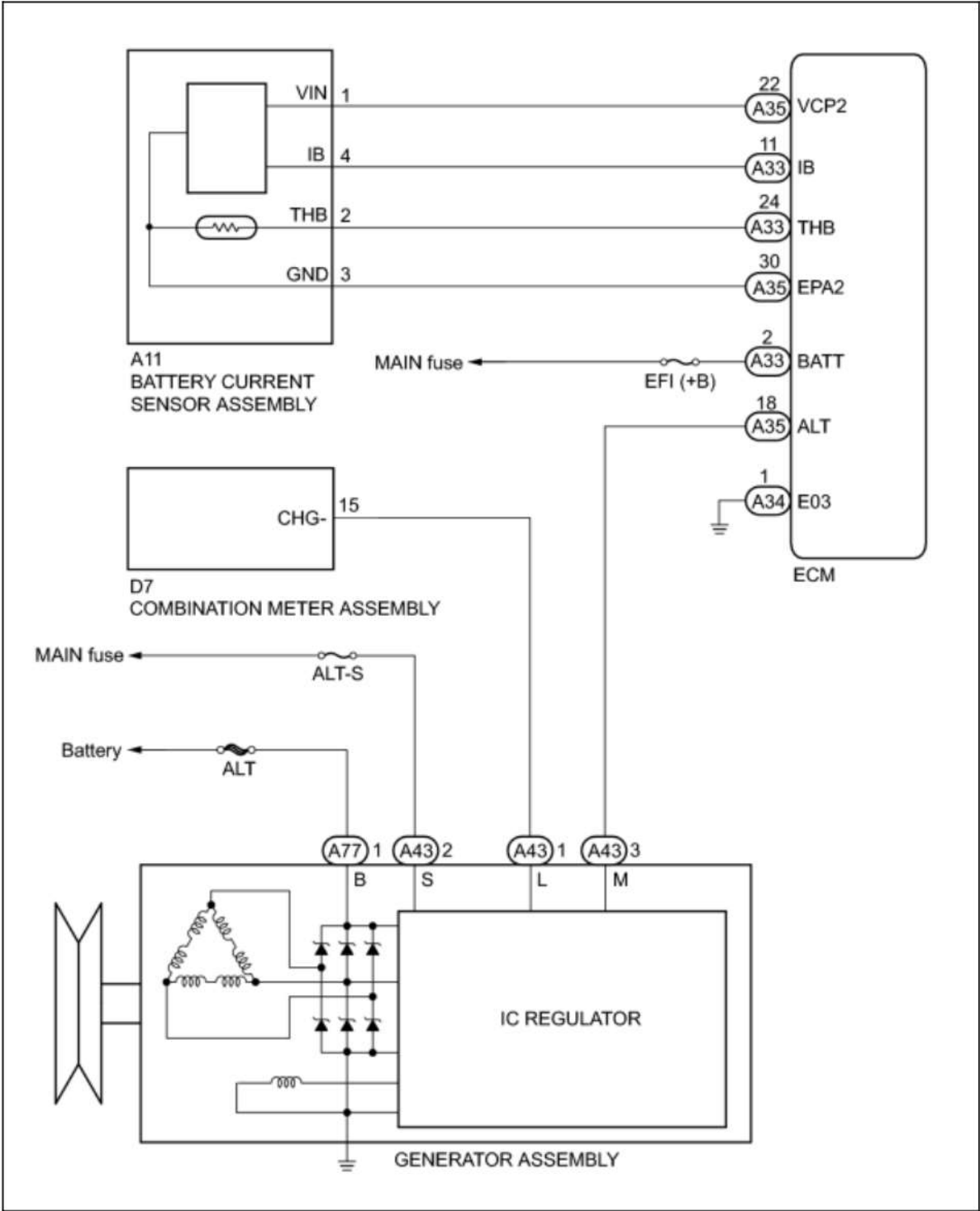
SYMPTOM	SUSPECTED AREA	SEE PAGE
Charging warning light comes on	Battery	INFO
	Generator assembly	INFO
	Charging system	INFO



TOYOTA

Last Modified: 3-27-2012	6.4 U	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM000001HWM00YX
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: SYSTEM DIAGRAM (2013 FR-S)		

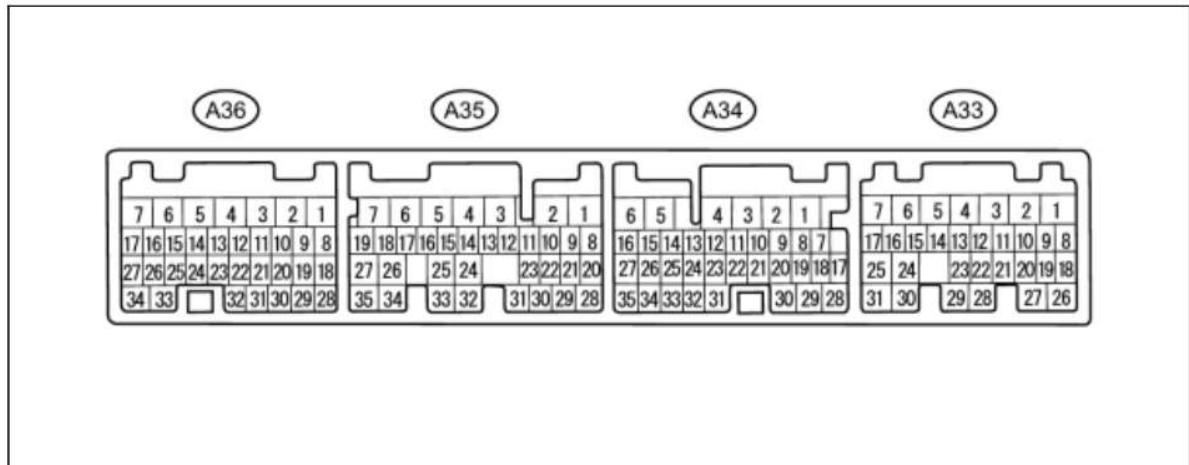
SYSTEM DIAGRAM



Last Modified: 3-27-2012	6.4 U	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM000002206040X
Title: FA20 BATTERY / CHARGING: CHARGING SYSTEM: TERMINALS OF ECU (2013 FR-S)		

TERMINALS OF ECU

1. CHECK ECM



(a) Measure the resistance, voltage and waveform according to the value(s) in the table below.

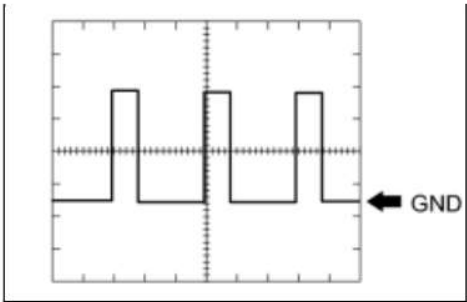
TERMINAL NO. (SYMBOL)	WIRING COLOR	TERMINAL DESCRIPTION	CONDITION	SPECIFIED CONDITION
A33-2 (BATT) - A34-1 (E03)	W - B-R	Battery power	Always	11 to 14 V
A33-11 (IB) - A35-30 (EPA2)	R-B - Y-B	Battery current sensor	Ignition switch ON	0.5 to 4.5 V
A33-24 (THB) - A35-30 (EPA2)	R-W - Y- B	Battery temperature sensor	Ignition switch ON 20 to 50°C (68 to 122°F)	1.1 to 2.4 V
A34-1 (E03) - Body ground	B-R - Body ground	Body ground	Always	Below 1 Ω
A35-18 (ALT) - A34-1 (E03)	V - B-R	Generator	Idling with warm engine	Pulse generation (See waveform 1)
A35-22 (VCP2) - A35-30 (EPA2)	G-B - Y-B	Power source of battery current sensor assembly	Ignition switch ON	4.5 to 5.5 V

If the result is not as specified, the ECU may have a malfunction.

(b) WAVEFORM 1

Generator

TESTER CONNECTION	TOOL SETTING	VEHICLE CONDITION	SPECIFIED CONDITION



A35-18 (ALT) - A34-1 (E03)	2 V/DIV., 2 msec./DIV.	Idling with warm engine	Correct waveform as shown in illustration

HINT:

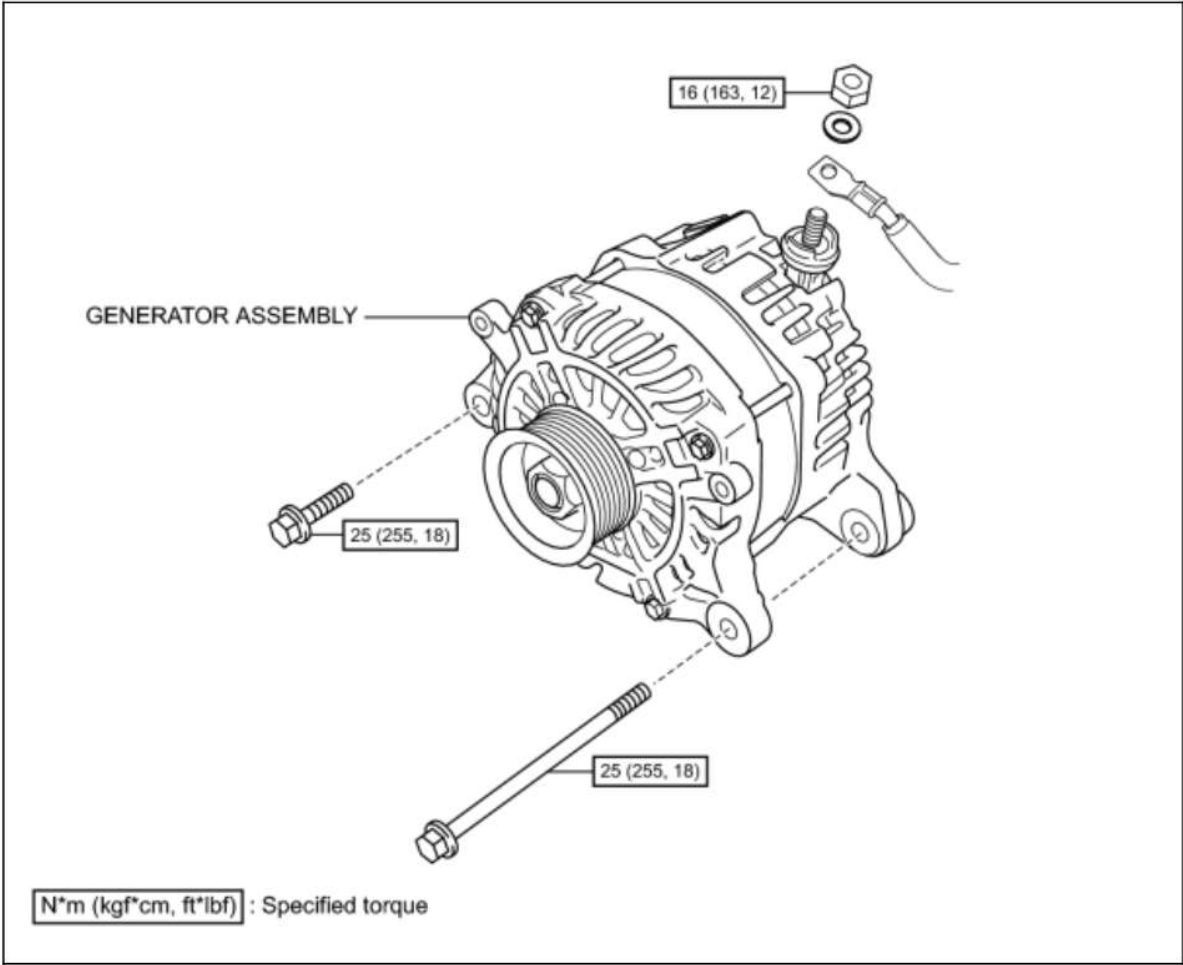
- The oscilloscope waveform shown in the illustration is an example for reference only. Noise, chattering, etc. are not shown.
- A constant value is not output, as the duty ratio varies depending on the electrical load and battery condition.



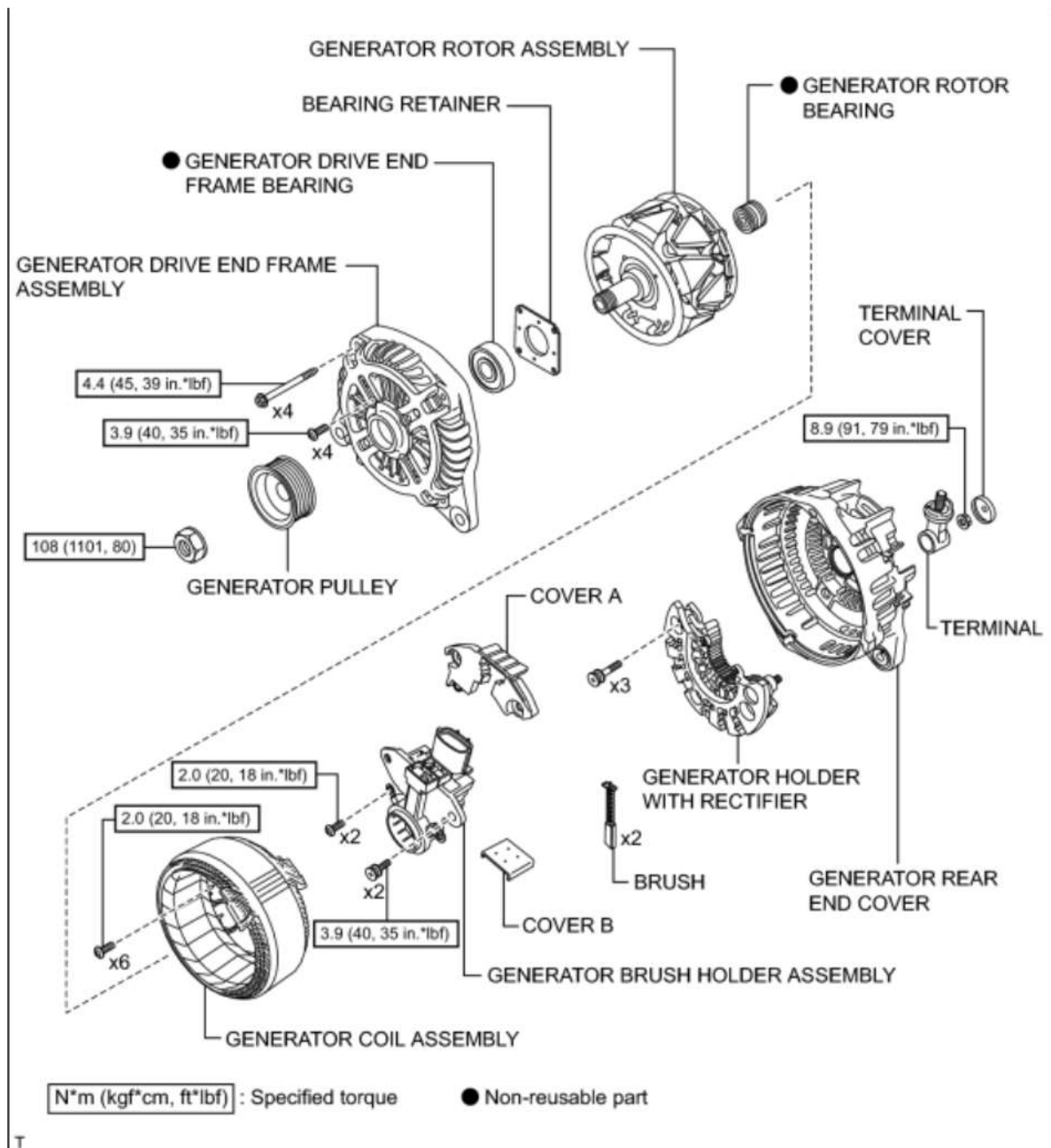
Last Modified: 3-27-2012	6.4 K	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM0000017VI01GX
Title: FA20 BATTERY / CHARGING: GENERATOR: COMPONENTS (2013 FR-S)		

COMPONENTS

ILLUSTRATION



ILLUSTRATION



T

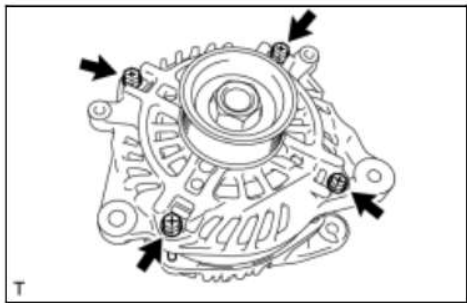


TOYOTA

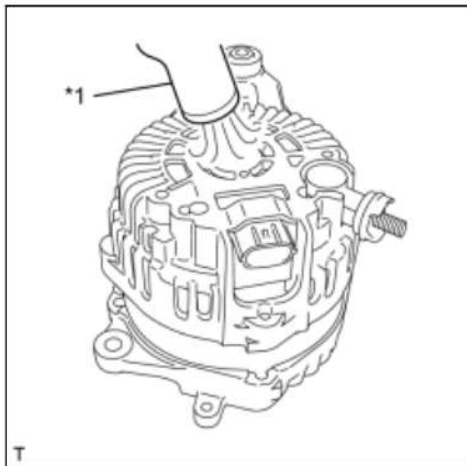
Last Modified: 3-27-2012	6.4 A	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM0000017VK02QX
Title: FA20 BATTERY / CHARGING: GENERATOR: DISASSEMBLY (2013 FR-S)		

DISASSEMBLY

1. REMOVE GENERATOR REAR END COVER



(a) Remove the 4 through bolts.

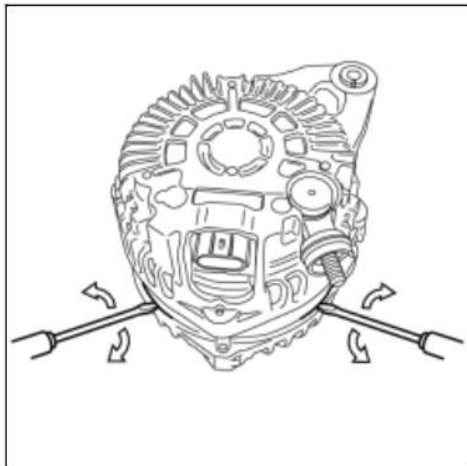


(b) Using the heat gun, heat the generator rear end cover.
Heating Temperature:

ITEM	TEMPERATURE
Generator Rear End Cover	50 to 60°C (122 to 140°F)

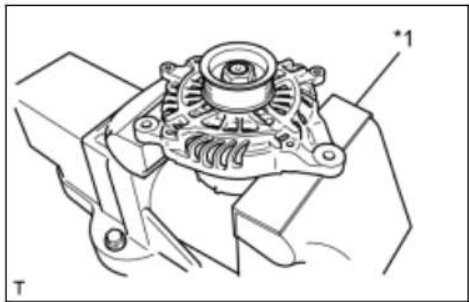
Text in Illustration

*1	Heat gun
----	----------



(c) Insert the 2 screw drivers, remove the generator rear end cover as shown in the illustration.

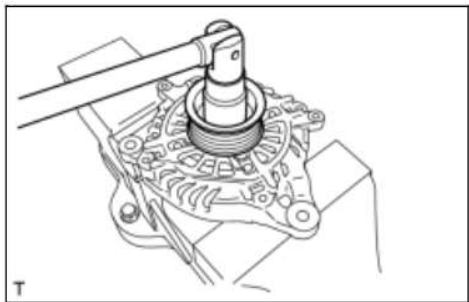
2. REMOVE GENERATOR PULLEY



(a) Mount the generator in a vise between aluminum plates.

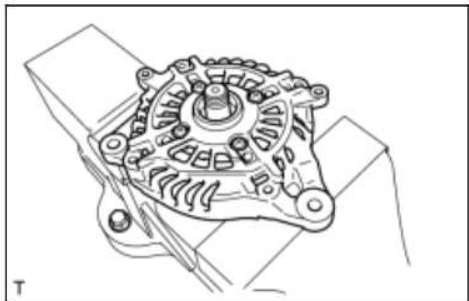
Text in Illustration

*1	Aluminium plate
----	-----------------



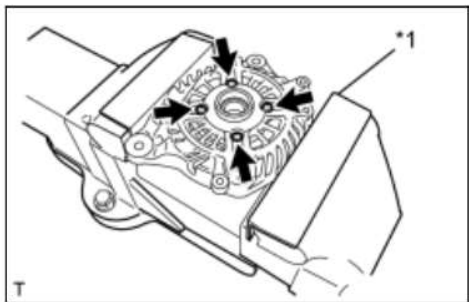
(b) Remove the nut and generator pulley.

3. REMOVE GENERATOR DRIVE END FRAME ASSEMBLY



(a) Remove the generator drive end frame assembly from the generator rotor assembly.

4. REMOVE GENERATOR DRIVE END FRAME BEARING

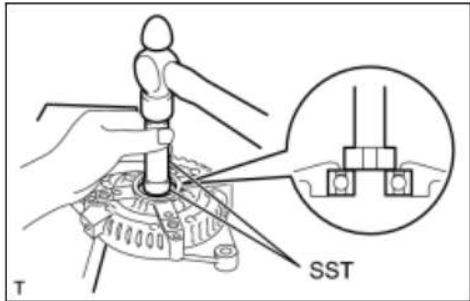


(a) Mount the generator drive end frame assembly in a vise between aluminum plates.

(b) Remove the 4 bolts and bearing retainer.

Text in Illustration

*1	Aluminium plate
----	-----------------



(c) Using SST and a hammer, tap out the bearing.

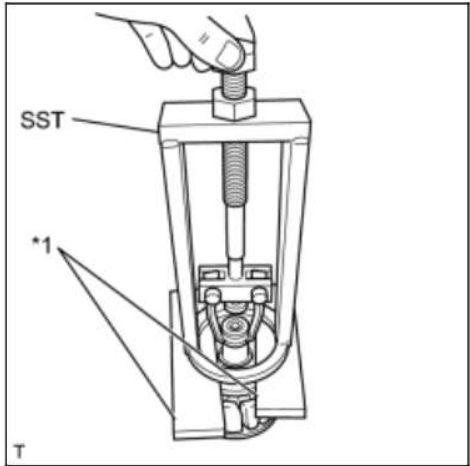
SST: 09950-60010

09951-00250

SST: 09950-70010

09951-07100

5. REMOVE GENERATOR ROTOR BEARING

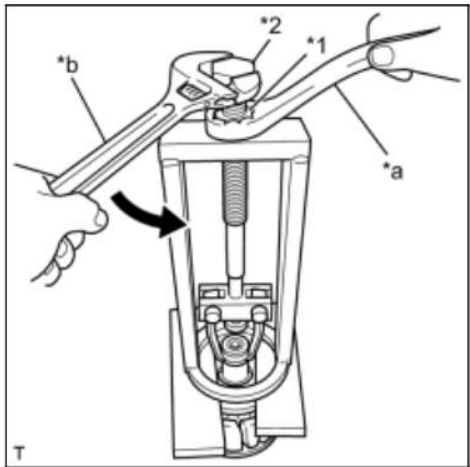


(a) Set the SST to the generator rotor assembly between wooden blocks.

SST: 09387-00041

Text in Illustration

*1	Wooden block
----	--------------

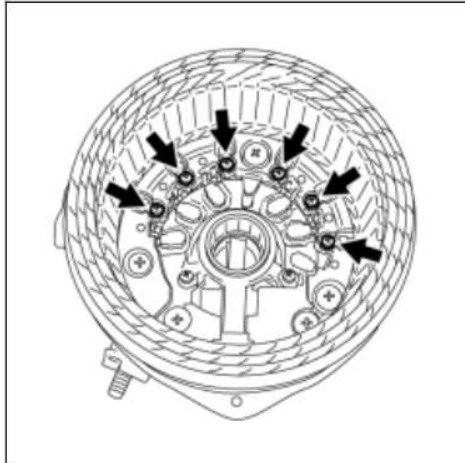


(b) Hold the SST nut, and turn the SST bolt to remove the generator rotor bearing.

Text in Illustration

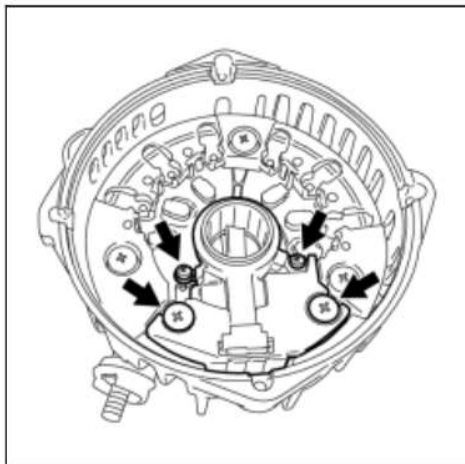
*1	SST Nut
*2	SST Bolt
*a	Hold
*b	Turn

6. REMOVE GENERATOR COIL ASSEMBLY



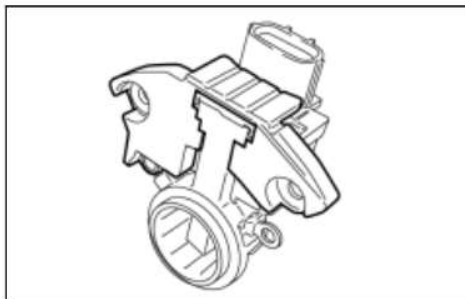
(a) Remove the 6 bolts and generator coil assembly.

7. REMOVE GENERATOR BRUSH HOLDER ASSEMBLY

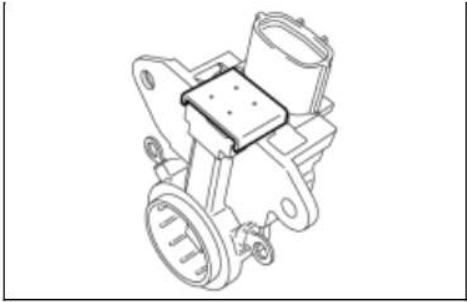


(a) Remove the 4 bolts and generator brush holder assembly.

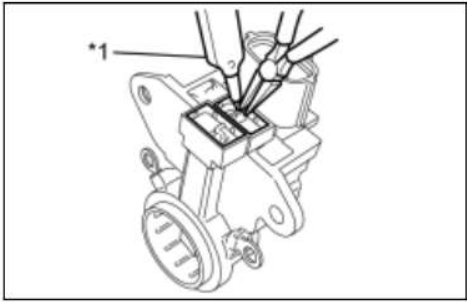
8. REMOVE BRUSH



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



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

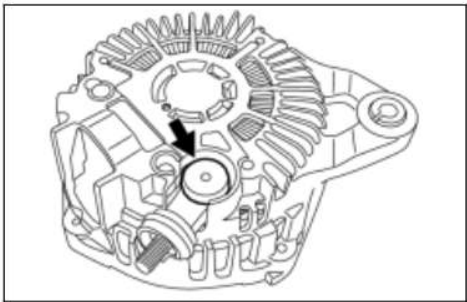


(c) Using a soldering iron, separate the 2 brushes from the brush holder assembly.

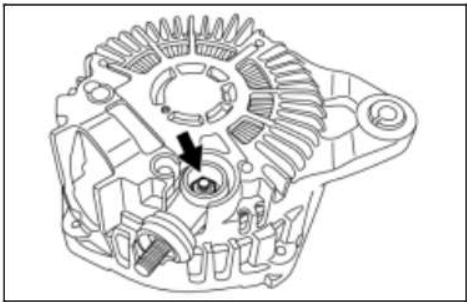
Text in Illustration

*1	Soldering iron
----	----------------

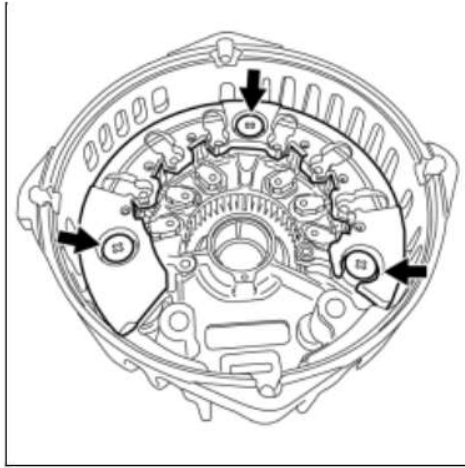
9. REMOVE GENERATOR HOLDER WITH RECTIFIER



(a) Remove the terminal cover.



(b) Remove the nut and the terminal.



(c) Remove the 3 bolts and the generator holder with rectifier.

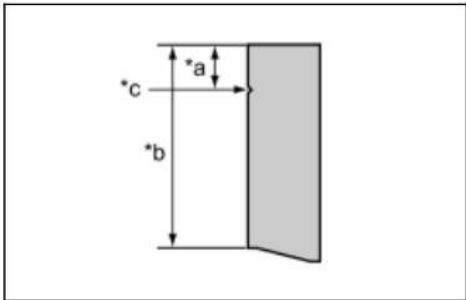


Last Modified: 3-27-2012	6.4 G	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM0000017VH02NX
Title: FA20 BATTERY / CHARGING: GENERATOR: INSPECTION (2013 FR-S)		

INSPECTION

1. INSPECT BRUSH

(a) Using a vernier caliper, measure the brush length.



Standard length:
22.5 mm (0.885 in)
Minimum length:
5.0 mm (0.196 in)

Text in Illustration

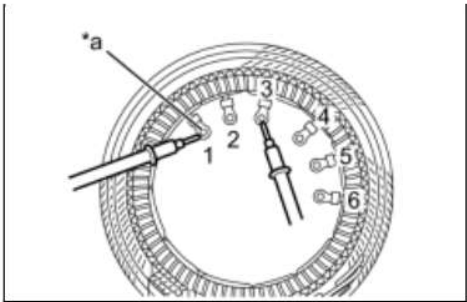
*a	Minimum length
*b	Standard length
*c	Mark of minimum length
	Brush

If the brush length is less than the minimum, replace the brush.

2. INSPECT GENERATOR COIL ASSEMBLY

- (a) Check the resistance.
- (1) Measure the resistance according to the value(s) in the table below.
- Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	Always	Below 1 Ω
1 - 3		
2 - 3		
4 - 5		



4 - 6		
5 - 6		

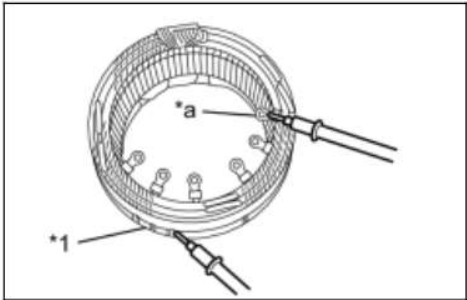
Text in Illustration

*a	Lead wire
----	-----------

If the result is not as specified, replace the generator coil assembly.

- (b) Check the resistance.
- (1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Stator core - Lead wire	Always	10 kΩ or higher

Text in Illustration

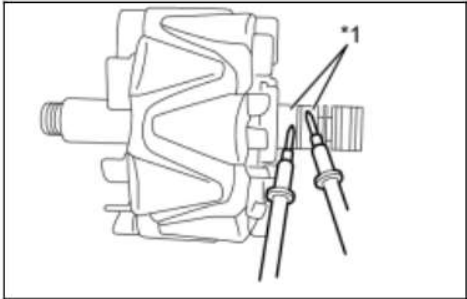
*1	Stator core
*a	Lead wire

If the result is not as specified, replace the generator coil assembly.

3. INSPECT GENERATOR ROTOR ASSEMBLY

- (a) Check the generator rotor assembly for an open circuit.
- (1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Slip ring - Slip ring	20°C (68°F)	2.0 to 2.4 Ω

Text in Illustration

*1	Slip Ring
----	-----------

If the result is not as specified, replace the generator rotor assembly.

- (b) Check if the generator rotor assembly is grounded.
- (1) Measure the resistance according to the value(s) in the table below.

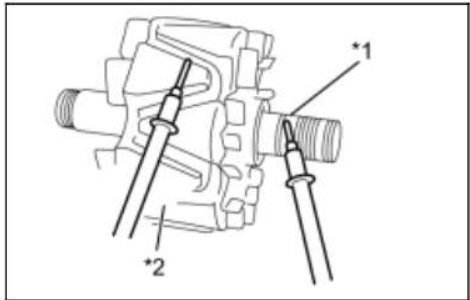
Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Slip ring - Rotor core	Always	10 kΩ or higher

Text in Illustration

*1	Slip Ring
*2	Rotor Core

If the result is not as specified, replace the generator rotor assembly.



- (c) Check the slip ring diameter.

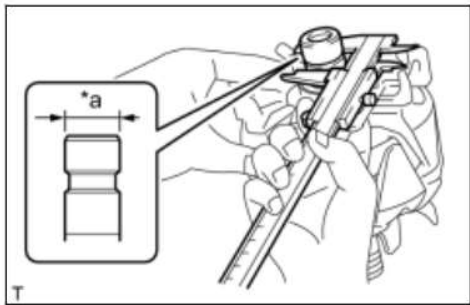
- (1) Using a vernier caliper, measure the diameter of each slip ring.

Standard diameter:
22.7 mm (0.893 in.)
Minimum diameter:
22.1 mm (0.870 in.)

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

Text in Illustration

*a	Diameter of Slip Ring
----	-----------------------

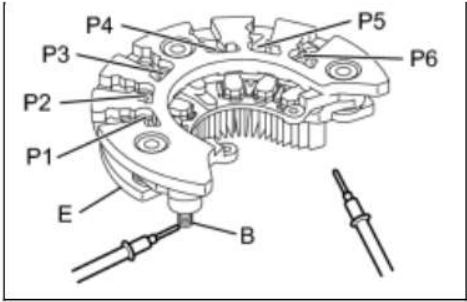


4. INSPECT GENERATOR HOLDER WITH RECTIFIER

- (a) Check the resistance.
- (1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
P1, P2, P3, P4, P5, P6 - B	P1, P2, P3, P4, P5, P6 (Tester positive) B (Tester negative)	Below 1 Ω
	P1, P2, P3, P4, P5, P6 (Tester negative) B (Tester positive)	10 kΩ or higher



P1, P2, P3, P4, P5, P6 - E	P1, P2, P3, P4, P5, P6 (Tester positive) E (Tester negative)	10 k Ω or higher
	P1, P2, P3, P4, P5, P6 (Tester negative) E (Tester positive)	Below 1 Ω

If the result is not as specified, replace the generator holder with rectifier.



Last Modified: 3-27-2012	6.4 A	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM0000017VG01NX
Title: FA20 BATTERY / CHARGING: GENERATOR: INSTALLATION (2013 FR-S)		

INSTALLATION

1. INSTALL GENERATOR ASSEMBLY

- (a) Install the generator with the 2 bolts.
Torque: 25 N·m (255 kgf·cm, 18ft·lbf)
- (b) Connect the generator connector.
- (c) Connect the generator wire with the nut.
Torque: 16 N·m (163 kgf·cm, 12ft·lbf)
- (d) Install the terminal cap.

2. INSTALL FAN AND GENERATOR V BELT



3. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

Torque: 6.0 N·m (61 kgf·cm, 53in·lbf)

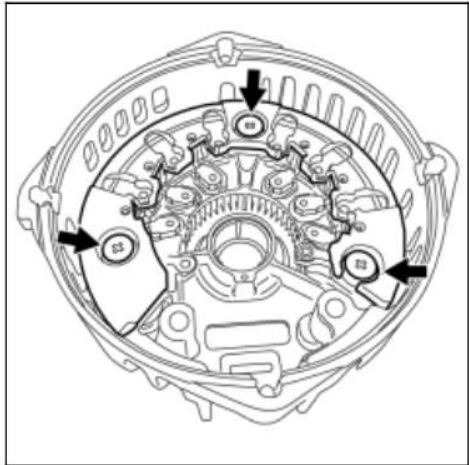


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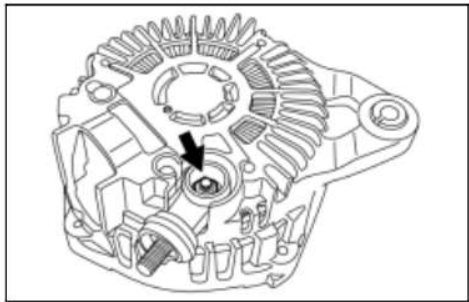
Last Modified: 3-27-2012	6.4 A	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM0000017VL02TX
Title: FA20 BATTERY / CHARGING: GENERATOR: REASSEMBLY (2013 FR-S)		

REASSEMBLY

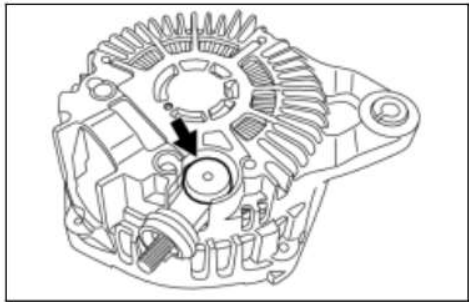
1. INSTALL GENERATOR HOLDER WITH RECTIFIER



(a) Install the generator holder with rectifier with the 3 bolts.

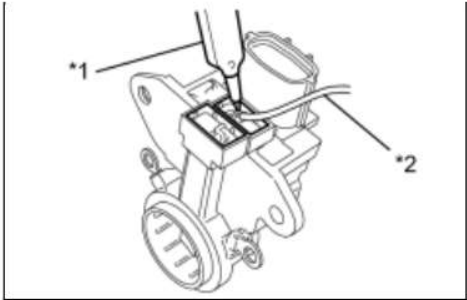


(b) Install the terminal with the nut.
Torque: 8.9 N·m (91 kgf·cm, 79in·lbf)



(c) Install the terminal cover.

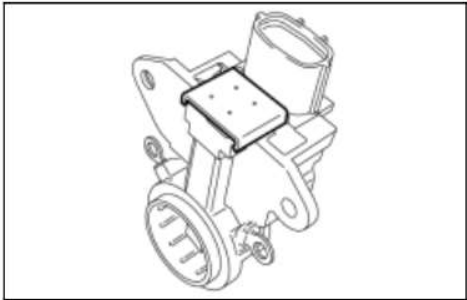
2. INSTALL BRUSH



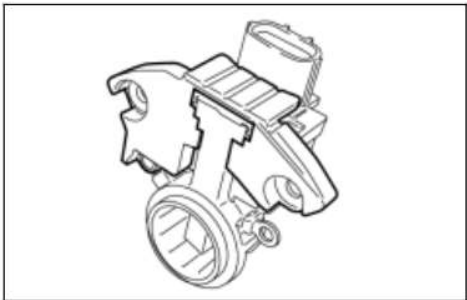
(a) Using a soldering iron, install the 2 brushes to the brush holder assembly.

Text in Illustration

*1	Soldering iron
*2	Solder

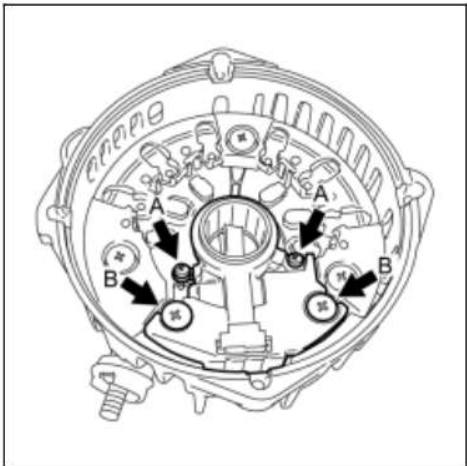


(b) Install the cover B to the brush holder assembly.



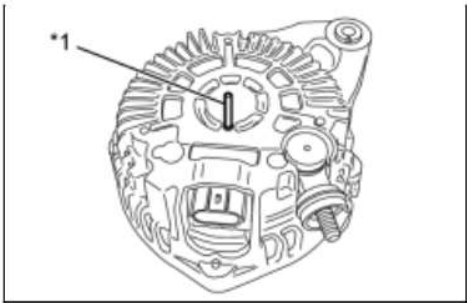
(c) Install the cover A to the brush holder assembly.

3. INSTALL GENERATOR BRUSH HOLDER ASSEMBLY



(a) Install the generator brush holder assembly with the 4 bolts.

Bolt A - Torque: 2.0 N·m (20 kgf·cm, 18in·lbf)
Bolt B - Torque: 3.9 N·m (40 kgf·cm, 35in·lbf)



(b) While pushing the 2 brushes into the generator rear end cover, insert a 1.0 mm (0.0394 in.) pin into the generator rear end cover.

NOTICE:
Remove the pin after reassembling the generator.

Text in Illustration

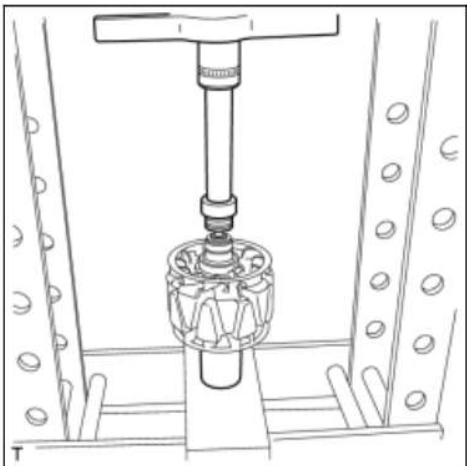
*1	Pin 1.0 mm (0.0394 in.)
----	-------------------------

4. INSTALL GENERATOR COIL ASSEMBLY



(a) Install the generator coil assembly with the 6 bolts.
Torque: 2.0 N·m (20 kgf·cm, 18in·lbf)

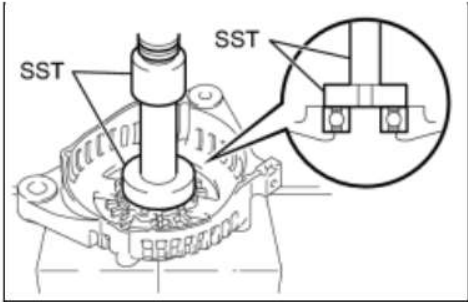
5. INSTALL GENERATOR ROTOR BEARING



(a) Using SST and a press, press in a new generator rotor bearing.
SST: 09632-36010
SST: 09820-36010

6. INSTALL GENERATOR DRIVE END FRAME BEARING

(a) Using SST and a press, press in a new generator drive



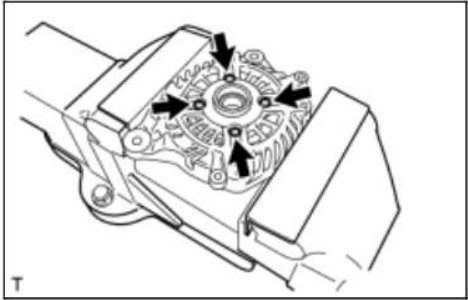
end frame bearing.

SST: 09950-60010

09951-00520

SST: 09950-70010

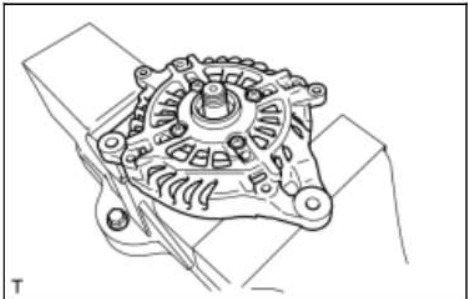
09951-07100



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

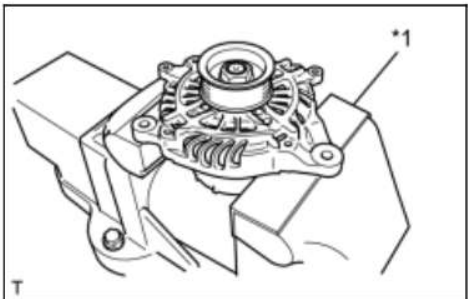
Torque: 3.9 N·m (40 kgf·cm, 35in·lbf)

7. INSTALL GENERATOR DRIVE END FRAME ASSEMBLY



(a) Install the generator drive end frame assembly to the generator rotor assembly.

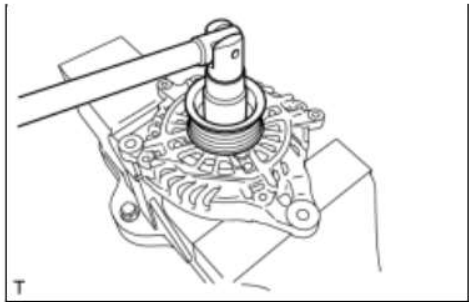
8. INSTALL GENERATOR PULLEY



(a) Mount the generator in a vise between aluminum plates.

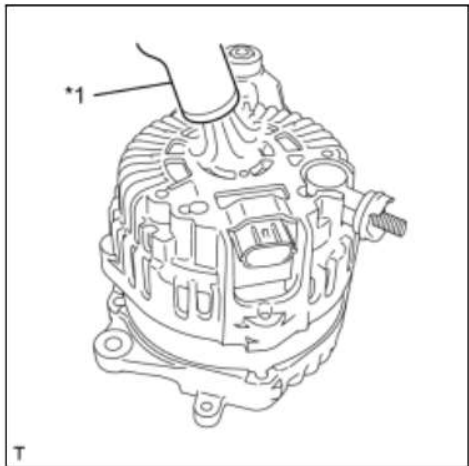
Text in Illustration

*1	Aluminium plate
----	-----------------



- (b) Install the generator pulley with the nut.
Torque: 108 N·m (1101 kgf·cm, 80ft·lbf)

9. INSTALL GENERATOR REAR END COVER



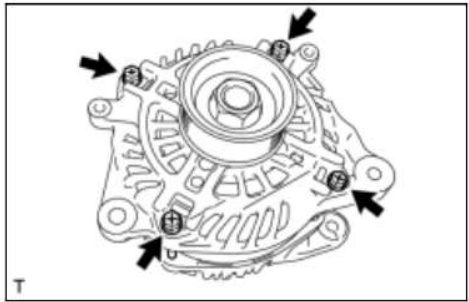
- (a) using the heat gun, heat the generator rear end cover.
Heating Temperature:

ITEM	TEMPERATURE
Generator Rear End Cover	50 to 60°C (122 to 140°F)

Text in Illustration

*1	Heat gun
----	----------

- (b) Install the generator rear end cover.
(c) Pull out the pin of the generator rear end cover.



- (d) Install the 4 through bolts.
Torque: 4.4 N·m (45 kgf·cm, 39in·lbf)

Last Modified: 3-27-2012	6.4 A	From: 201203
Model Year: 2013	Model: FR-S	Doc ID: RM0000017VJ01HX
Title: FA20 BATTERY / CHARGING: GENERATOR: REMOVAL (2013 FR-S)		

REMOVAL

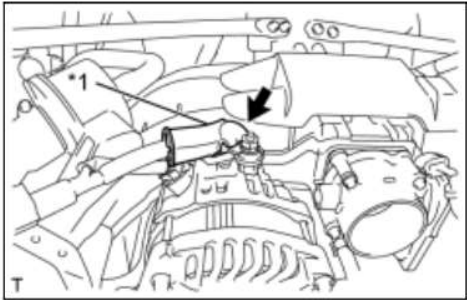
1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

NOTICE:
The power window system utilizes a mechanism in which the door glass moves down slightly when the door is opened, and in which the glass moves up when the door closed in order to prevent the door molding from being damaged. When the negative (-) battery terminal needs to be disconnected for servicing, fully open the driver and passenger door glasses in advance.

2. REMOVE FAN AND GENERATOR V BELT

INFO

3. REMOVE GENERATOR ASSEMBLY

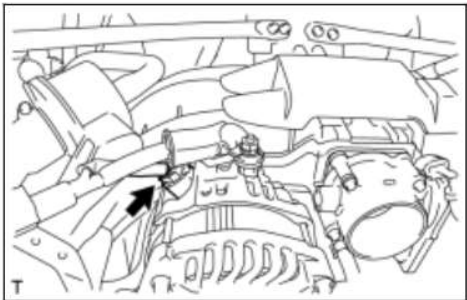


(a) Remove the terminal cap.

Text in illustration

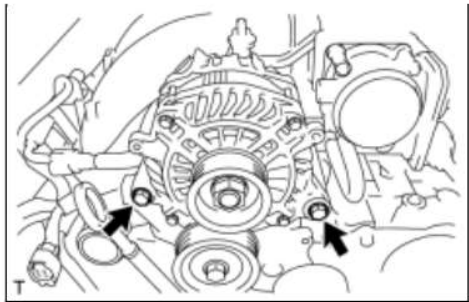
*1	terminal cap
----	--------------

(b) Remove the nut and disconnect the generator wire.



(c) Disconnect the generator connector.

(d) Remove the 2 bolts and generator assembly.



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