

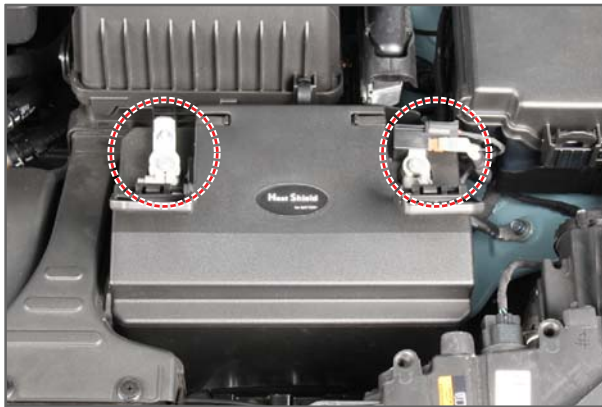
EEM (Energy Efficiency Management)**0000-00****GENERAL INFORMATION****1. SPECIFICATIONS**

Unit	Description	Specification
Alternator	Rated output	120A(13.25V) 70A/2000rpm, 99A/4000rpm, 103A/6000rpm
Battery	Capacity	AGM 70Ah
	Reserve capacity	110 minutes
	Starting current (when engine cooled)	760 A
	Weight	21 Kg
BSC(Battery Sensor Cable)	Operating current	Maximum 20mA
	Dark current	Maximum 0.35mA
	Operating voltage	9~18V
	Operating temperature	-30~110°C
	Communication	LIN 2.0

Modification basis	
Application basis	
Affected VIN	

2. BASIC INSPECTION

1) Battery Terminal



- Make sure the terminal connections are securely tightened. If the terminals are corroded, clean them or replace the battery.



NOTE

* Cleaning

Remove the corrosion or dirt with a wire brush or sand paper, and then wash out with lukewarm soapy water.

2) Measuring the Voltage Drop

► Measuring at battery terminal



- Measure the voltage between battery terminal (+, -) and wiring clamp.

Specified value
below 0.3V

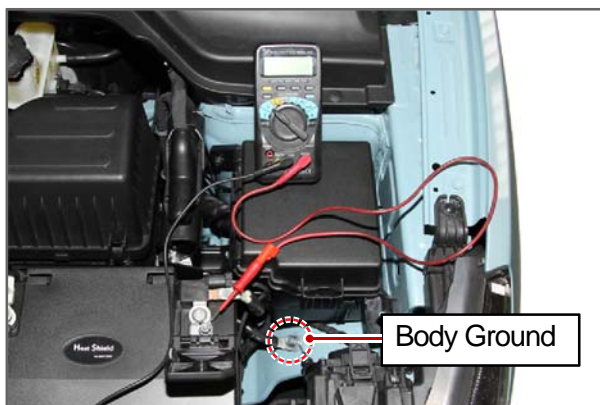


NOTE

If the terminals are corroded, clean and retightening them. If the specified tightening torque cannot be kept, replace the clamp.



Tightening torque $6.0 \pm 1.0\text{Nm}$

► Measuring at (-) wiring

- Measure the voltage between battery wiring and body ground.

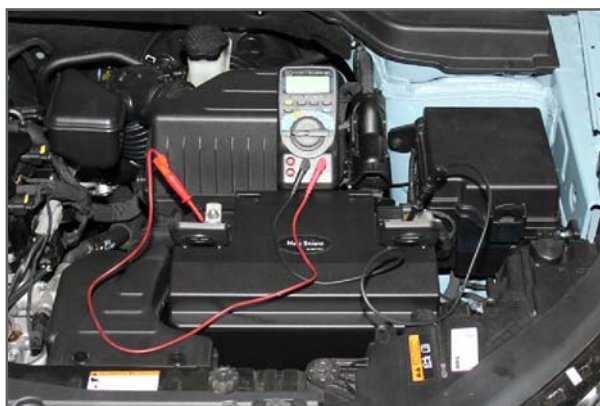
Specified value

below 0.3V

**NOTE**

If the voltage is out of the specified value, check the wiring mounting bolt for corrosion and looseness. If there is a poor contact due to corrosion or paint, wipe out the contact area and retighten it.

Tightening torque Wiring mounting bolt to body ground (-): 17 Nm

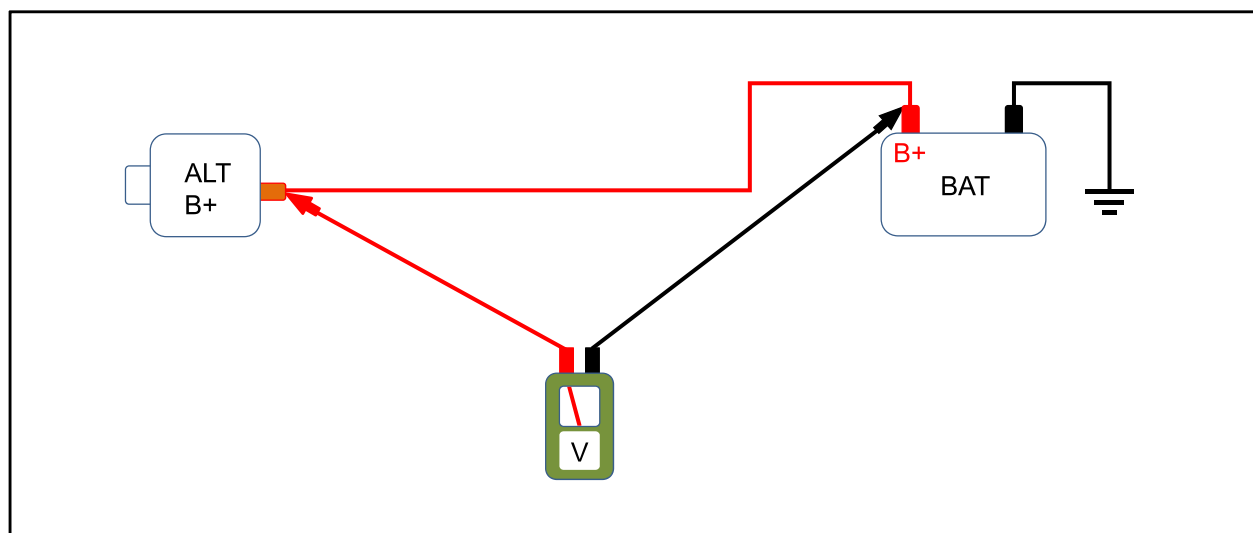
► Measuring the battery voltage

- Stop the engine and wait for 20 minutes. Measure the voltage between terminal (+) and terminal (-) with the ignition switch OFF and all electric devices OFF.

Specified value

over 12V

Modification basis	
Application basis	
Affected VIN	

► Measuring the voltage drop between lines

- Measure the voltage drop between alternator B+ and battery B+.

Specified value

below 0.3V

**NOTE**

If the value is out of the specified value, check the terminal and clamp for looseness.

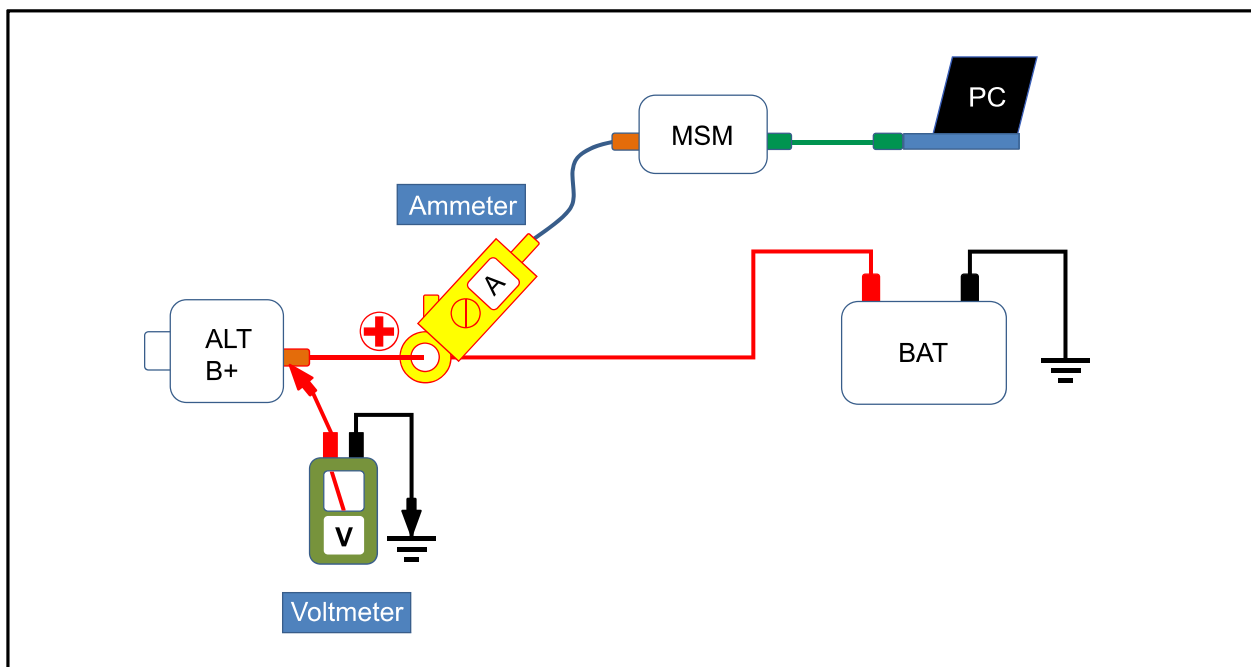
► Checking the charge warning lamp

1. Turn off all electric devices and put the ignition switch "ON" (Pre-warning).
2. Check if the charge warning lamp goes out.
 - If the charge warning lamp does not go off, inspect the electric circuit.
3. Start the engine and check if the charge warning lamp keeps off.

3. INSPECTION - CHARGING CURRENT

Preceding work - Perform the basic inspection.

► Setting up the testers



► Preparation



1. Set up the ammeter and voltmeter as shown in the figure.

CAUTION

Make sure to set up the tester while keeping its polarity.

Modification basis	
Application basis	
Affected VIN	

► Inspection

1. Start the engine and turns on the headlamp, blower and heated wire at their full load. Then, measure the maximum output current (MSM measurement value) when racing the engine to 2,700 rpm.

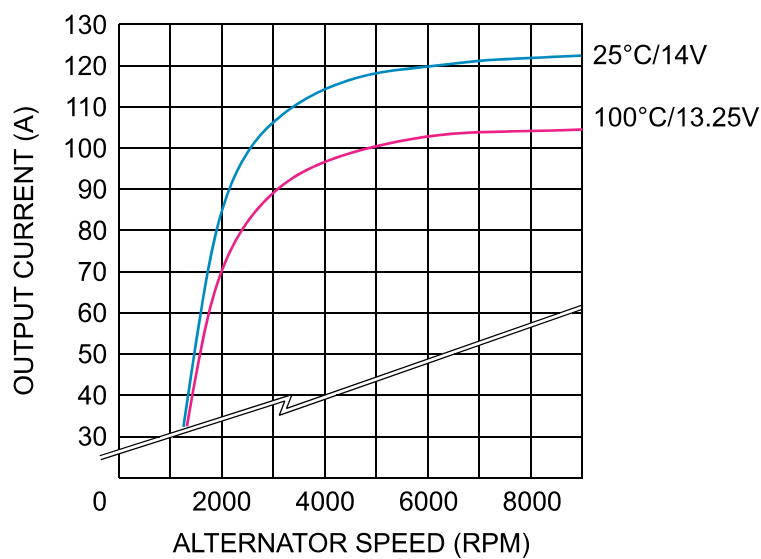
Specified value

60% of rated current (limit)

**NOTE**

The output current may not reach the limit value due to various parameters (high temperature or electric load etc.). Thus, do not perform the inspection with fully charged battery.

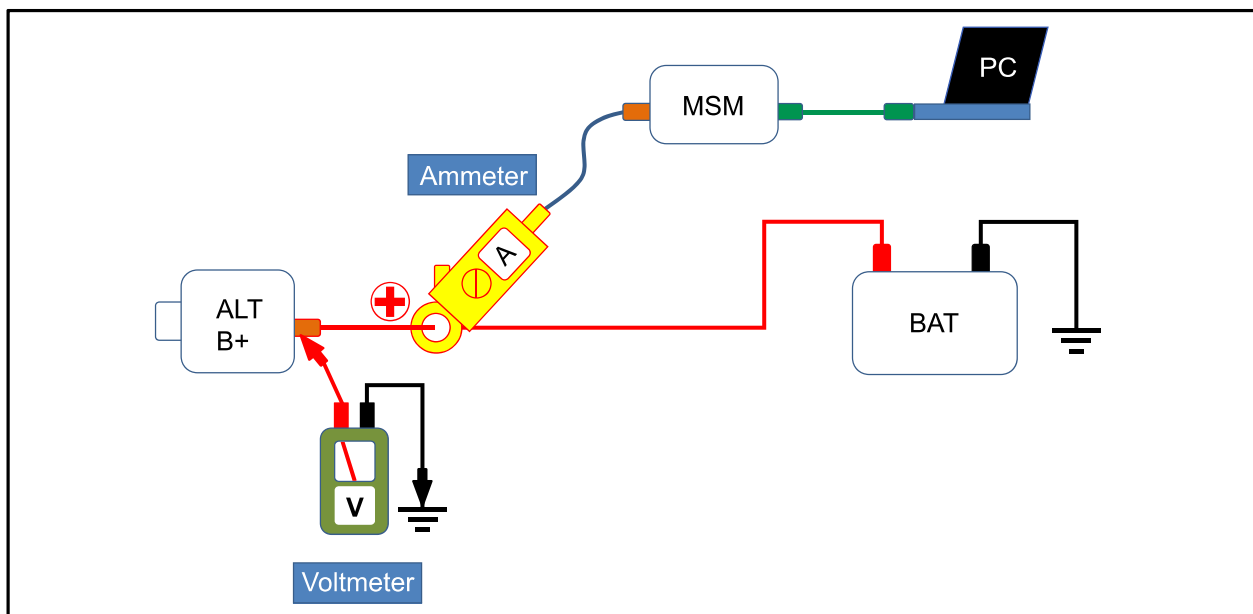
2. Turn the ignition OFF after inspection.
3. Disconnect the negative cable from the battery and remove the testers (ammeter and voltmeter).

► Characteristic curve (output from alternator)

4. INSPECTION - REGULATING VOLTAGE

Preceding work - Perform the basic inspection.

► Setting up the testers



► Preparation



1. Set up the ammeter and voltmeter as shown in the figure.

CAUTION

Make sure to set up the tester while keeping its polarity.

► Inspection

1. Turn the ignition ON and measure the voltage on the voltmeter.

Specified value	over 12V
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2. Start the engine and turn all electric devices OFF.
3. Increase the engine speed to 2,700 rpm and maintain the speed. Measure the voltage when the output current from alternator decrease below 30A.

Specified value	11.5 ~ 15.5V
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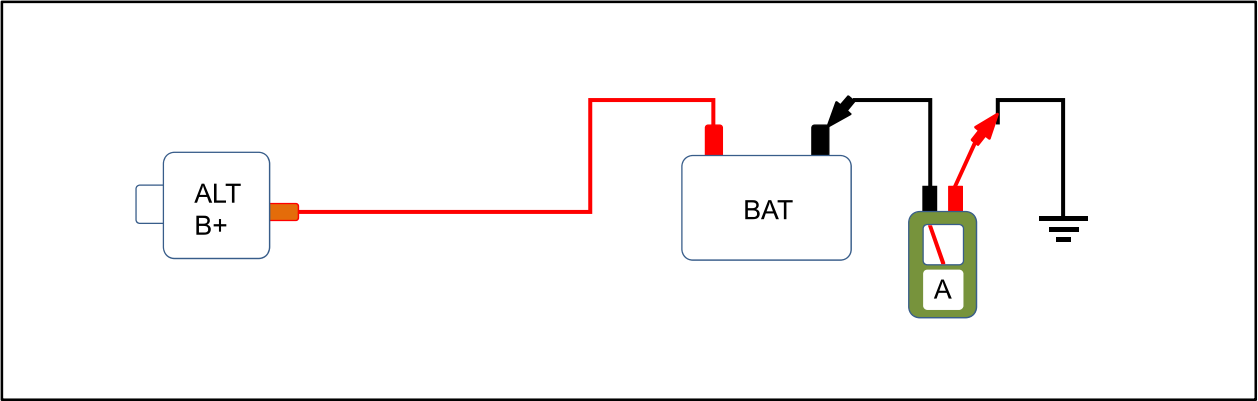
Modification basis	
Application basis	
Affected VIN	

5. INSPECTION - DARK CURRENT

Preceding work - Perform the basic inspection.

1) When Using Multi-tester

► Setting up the tester



► Preparation

- 1. Disconnect the negative cable from the battery.
- 2. Set up the ammeter as shown in the figure above.

⚠ CAUTION

Connect the “+” probe to ground wiring and “-” probe to “-” terminal of battery.

► Inspection

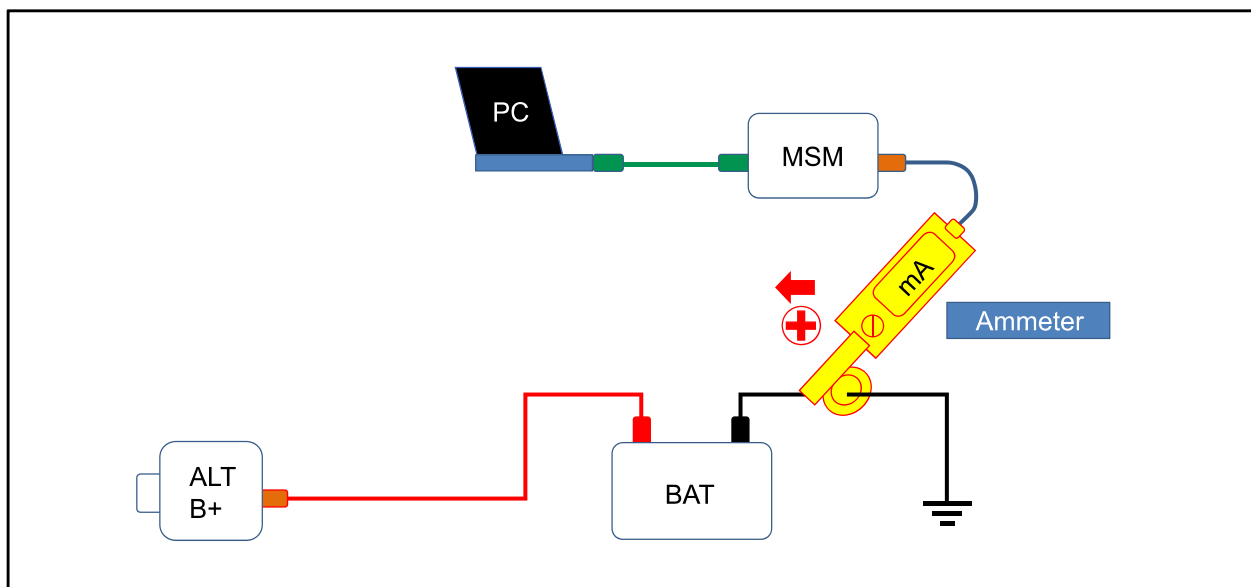
- 1. Measure the current while removing the fuses one by one. If the current drops sharply when a certain fuse is removed, inspect the affected circuit.

Specified value	below 0.05A
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Modification basis	
Application basis	
Affected VIN	

2) When Using MSM

► Setting up the tester



► Preparation



1. Disconnect the negative cable from the battery.
2. Set up the ammeter and MSM as shown in the figure above.

CAUTION

Make sure to set up the tester while keeping its polarity.

3. Connect the negative cable to the battery.

Specified value

below 0.05A

NOTE

Measure the current while removing the fuses one by one. If the current drops sharply when a certain fuse is removed, inspect the affected circuit.

Modification basis	
Application basis	
Affected VIN	

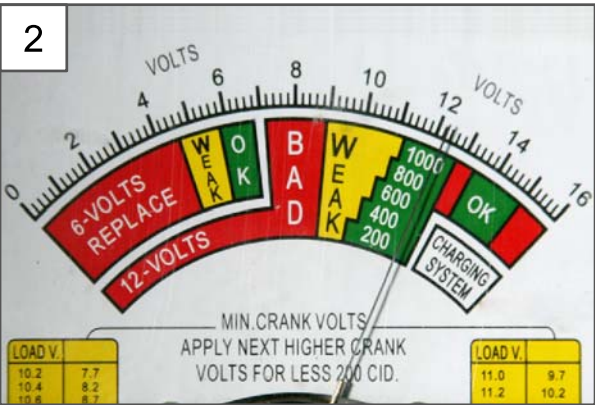
6. INSPECTION - BATTERY

Preceding work - Perform the basic inspection (all electric devices OFF).

1) Voltage Check (without load)



1. Connect one measuring clamp to “+” terminal of battery first, then connect the other one to “-” terminal. (Disconnect the clamps in the reverse order).



2. Read the measurement.

Specified value	over 11V: Normal
	9 ~ 11V: Charging required
	below: 9V: Over discharged, battery replacement required

Modification basis	
Application basis	
Affected VIN	

2) Voltage Check (with load)



1. Push the load switch to ON (to arrow direction) direction for less than 5 seconds.



NOTE

To identify the battery capacity with the voltage drop (V) value, discharge the fixed load capacity (120A) for a certain period (5 seconds).



2. Read the measurement.

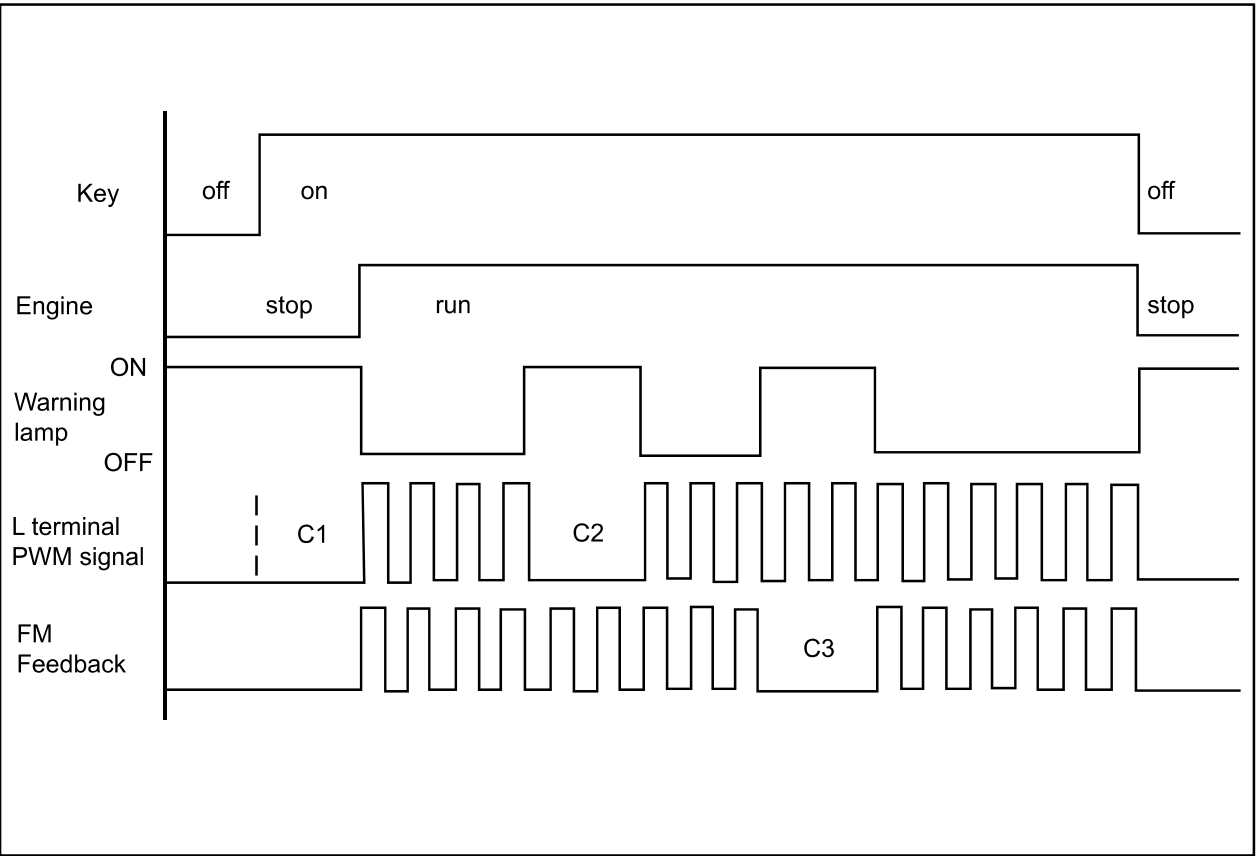
Specified value

7 ~ 9V (Red): Over discharged or faulty
9 ~ 11V (Yellow): Charging required
11 ~ 13V: Normal

Modification basis	
Application basis	
Affected VIN	

7. DTC SETTING CONDITIONS

► Charge warning lamp ON condition

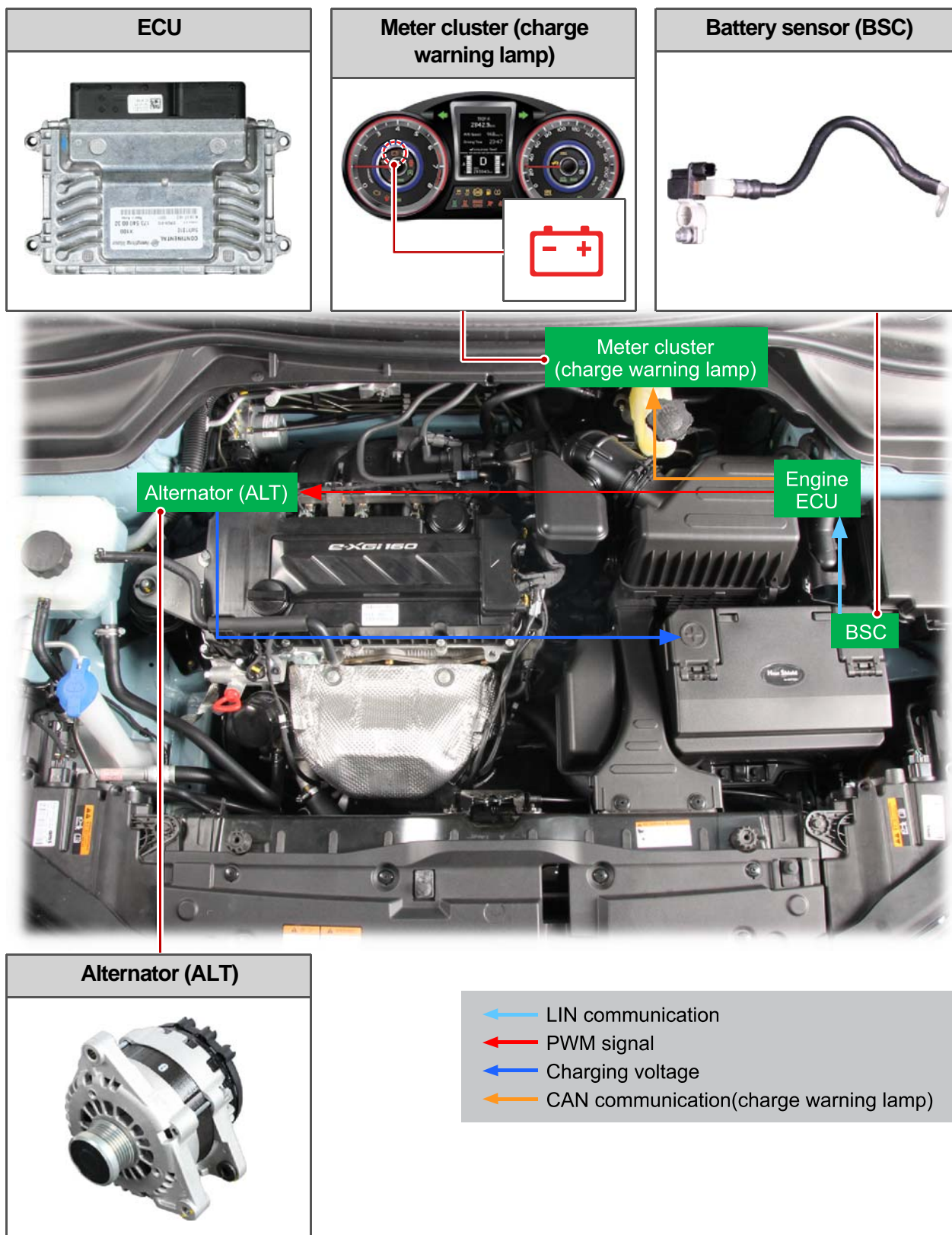


- 1. Turn the ignition ON (Engine stopped)
- 2. Open or short circuit of L terminal wiring, open or short internal circuit of alternator (fixed control of 13.8V)
- 3. Open or short circuit of F terminal wiring, no feedback output signal

Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATING PROCESS

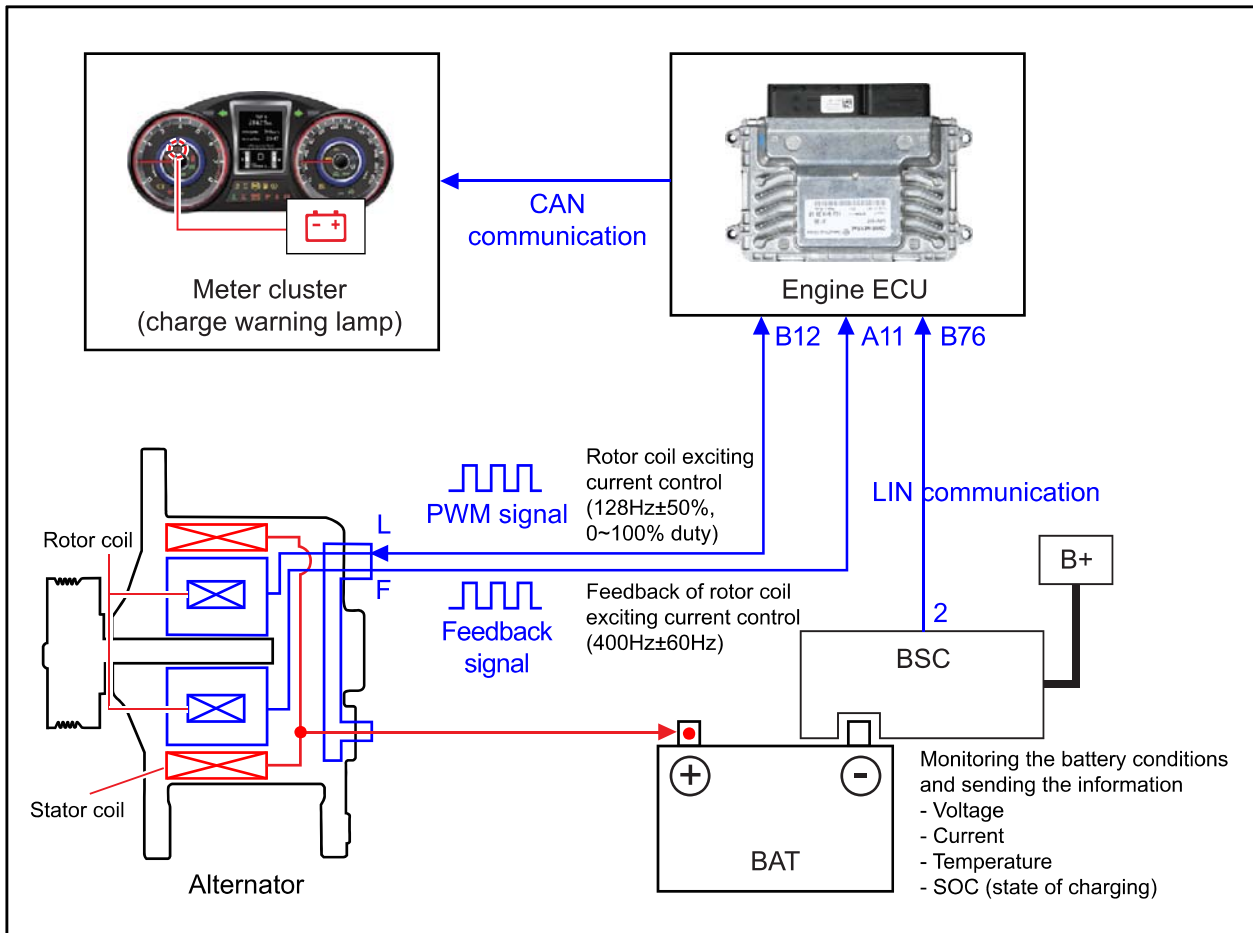
1. LAYOUT



Modification basis	
Application basis	
Affected VIN	

2. OPERATING PROCESS

► System diagram



► Operation

- The EEM is designed to monitor the vehicle's electrical load, battery charge status, battery temperature, voltage drop value at engine start-up and etc. to control the generating voltage. In this way, it reduces CO₂ emissions and improve the battery efficiency through the ISG (Idle Stop & Go) system and fuel economy improvement.
- BSC on “-” terminal of battery sends the battery information (voltage, current, temperature and SOC) to engine ECU with LIN communication.
- Engine ECU outputs the information from BSC and regulating control signal (PWM) according to the engine load conditions to “L” terminal on alternator.
- Engine ECU controls the magnetic resistance between stator coil and rotor coil by controlling the current in rotor coil according to PWM duty value.
- The alternating voltage induced to stator coil is converted to direct voltage by rectifier. And, BSC outputs the charging voltage to “B” terminal on alternator.

Modification basis	
Application basis	
Affected VIN	

► Basic control logic according to the driving conditions

Engine ECU determines the engine loads according to the fuel injection volume and engine speed. It charges the battery by increasing the generating voltage during deceleration. To improve the fuel economy by reducing the alternator load during acceleration, engine ECU decreases the generating voltage and consumes the battery voltage.

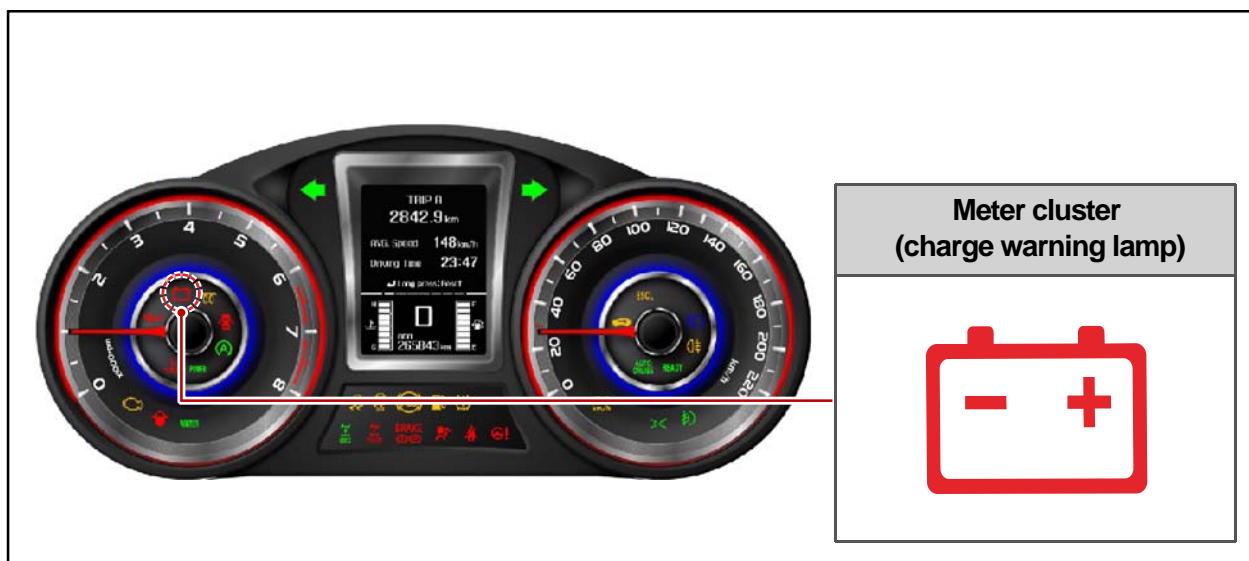
► Operation of charge warning lamp

ECU checks the generating voltage from alternator and circuit conditions and sends the warning lamp ON signal to meter cluster through CAN line.

Modification basis	
Application basis	
Affected VIN	

3. CAN COMMUNICATION (Charge Warning Lamp)

► Overview

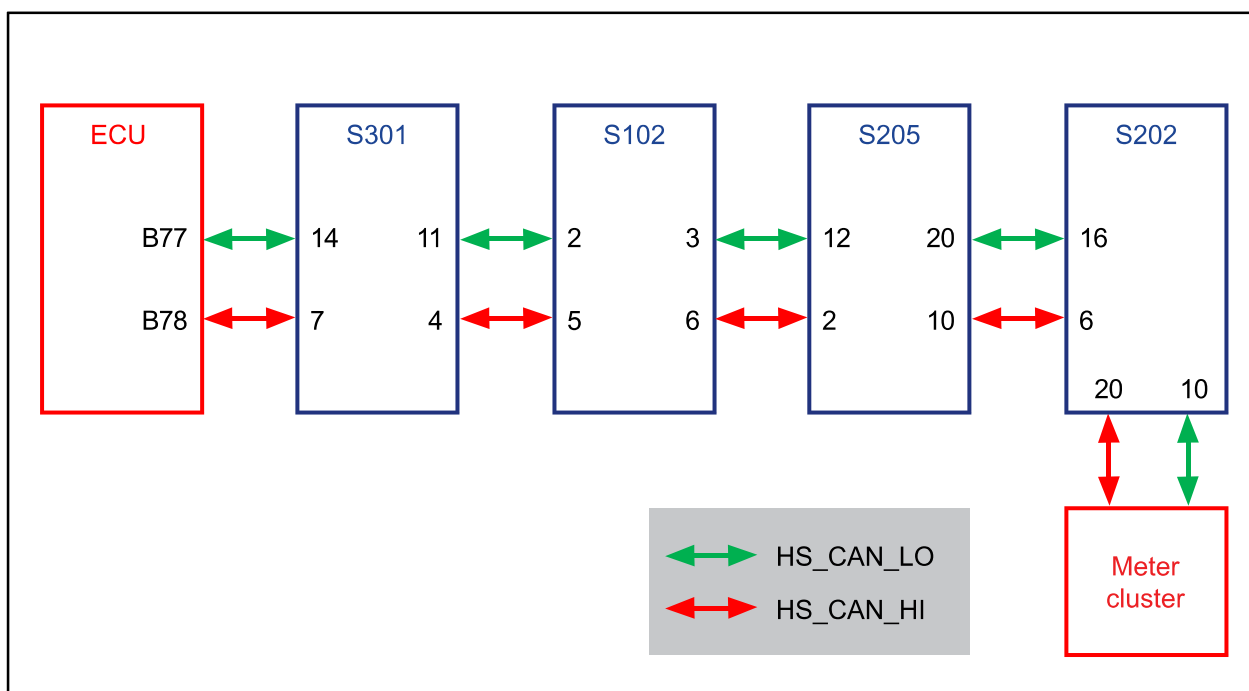


The meter cluster receives the charge warning lamp ON signal from ECU through CAN line.

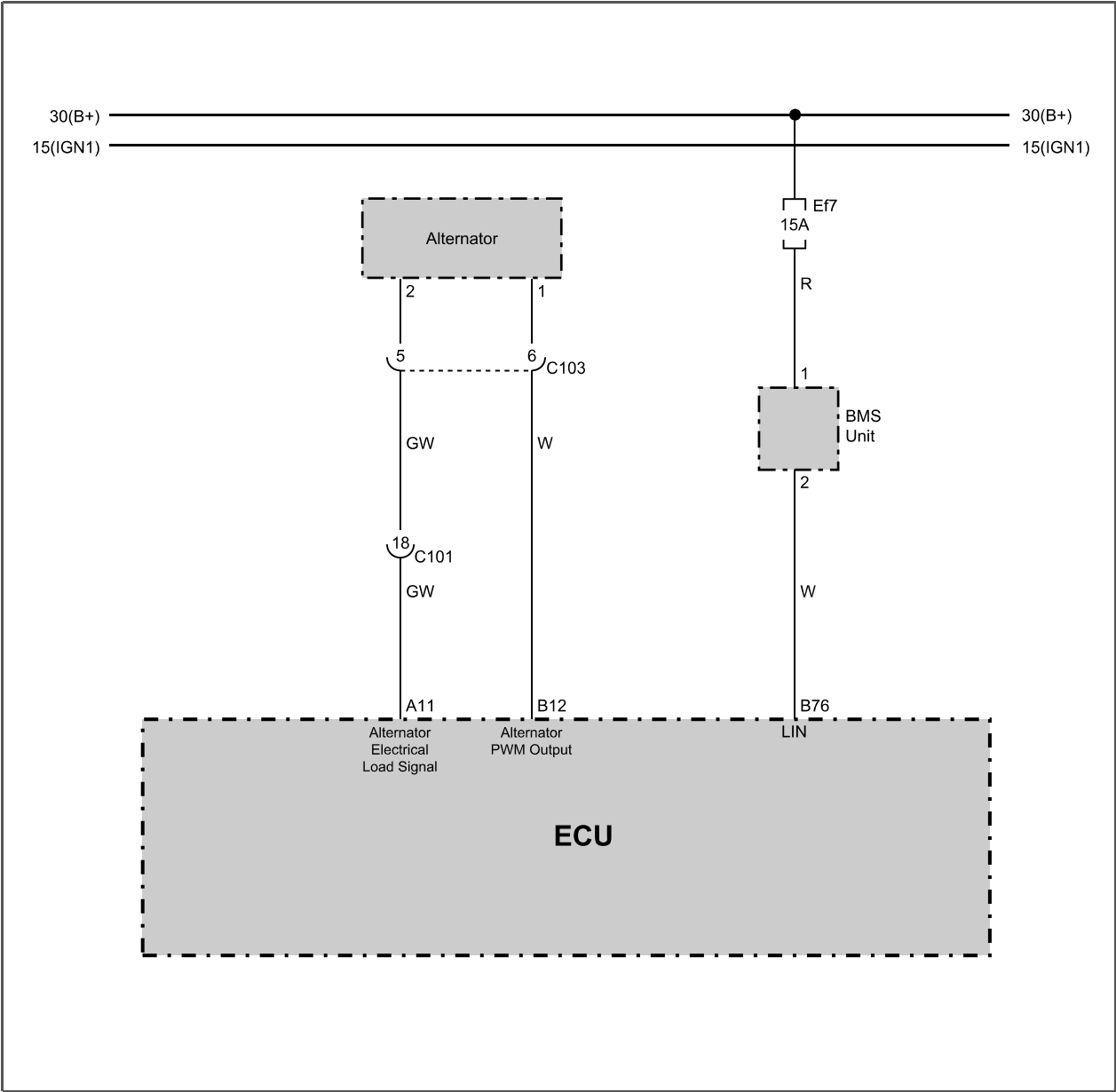
Charge warning lamp ON conditions

- Pre-warning
- When DTC related EEM set
- Open or short circuit in alternator

► Circuit diagram



4. CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	