CHARGE SYSTEM

1451-01

GENERAL INFORMATION

1. SPECIFICATION

Unit	Description		Specification
Alternator	Crankshaft pulley : Alternator pulley		1 : 2.94
	Normal output (idling/2200 rpm)		70/140A
	Regulator voltage		14.6 V
	Brush	Length	12.5mm
		Wear limit	7mm
Battery	Type		MF
	Capacity		90 AH

Modification basis	
Application basis	
Affected VIN	

2. INSPECTION

1) Alternator Output Test

Item	How to check	DTC set value / Action
Output current	1. Disconnect the cable connected to the B terminal on the alternator. Connect one end of the ammeter to the B terminal and the other end to the cable connected to the B terminal. 2. Measure the maximum output value. (Maintain the engine speed between 2,500 and 3,000 rpm.) (Turn the headlamp and all the electrical switches on.)	- Pass: If the measured current is 45 A or higher. - Fail: If the measured current is less than 45 A. - Check the current of the B terminal.
B terminal current	1. Move the gear selector lever to the neutral position. 2. Maintain the engine speed at 2,500 rpm with the vehicle unloaded. (Turn all the electrical switches off.)	- Open circuit: If the measured current is 5 A or higher.
Rotor coil resistance	1. Disconnect the negative cable from the battery. 2. Remove the B terminal and turn off the ignition switch. 3. Measure the resistance between the L and F terminals with an ohmmeter.	- Pass: If the measured resistance is between 3 and 6 Ω. - Faulty rotor coil or slip ring: If the measured resistance is less than 3 Ω or greater than 6 Ω.
D terminal voltage	1. Connect the B terminal wiring. 2. Measure the voltage with the engine running.	- Specification: 12.5 V to 14.5 V - Faulty IC regulator or field coil: If the measured voltage is 14.5 V or higher.

CAUTION

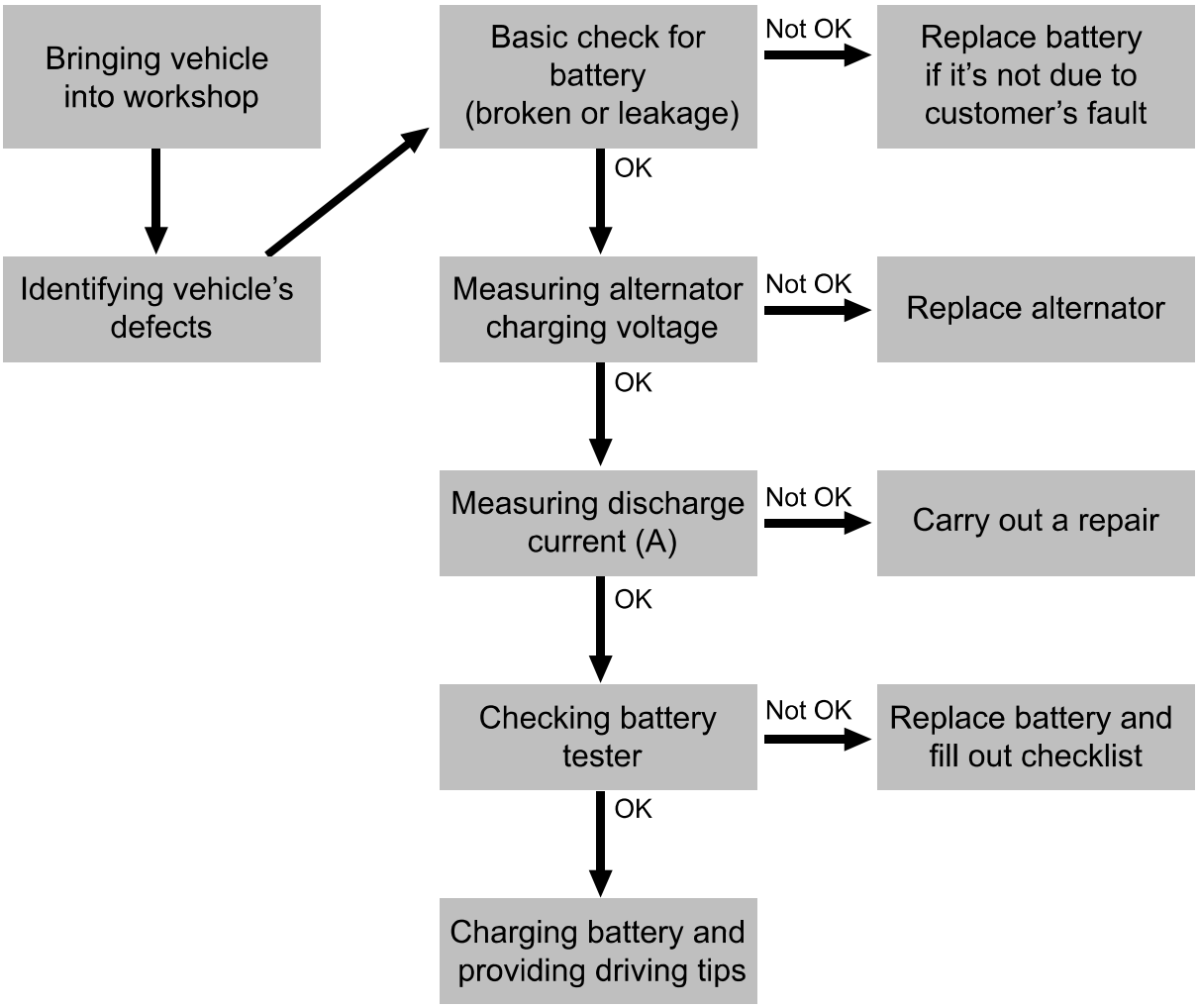
- Disconnect the negative battery cable.
- Connect the negative cable again after connecting the ammeter.

Modification basis	
Application basis	
Affected VIN	

2) Troubleshooting for Alternator

Item	Cause	Action
Overcharged battery	Defective alternator voltage regulator	Replace the alternator
	Defective voltage detection wiring	Replace the alternator
	Defective voltage detection wiring	Repair or replace
Discharged battery	Loose alternator drive belt	Adjust the belt tension or replace
	Poor connection of related circuit or open circuit	Retighten the loose connection or repair open circuit
	Defective alternator voltage regulator	Replace the alternator
	Terminated battery	Replace the battery
	Defective ground	Repair
Charge warning lamp does not come on when turning on ignition switch with engine stopped	Defective alternator voltage regulator	Replace the alternator
	Open circuit in charge warning lamp, fuse or wiring	Replace or repair the charge warning lamp or fuse
	Defective ignition switch	Replace the ignition switch
	Defective ground of alternator circuit	Repair
Charge warning lamp is not turned off after starting engine	Defective alternator voltage regulator	Replace the alternator
	Corroded or worn battery cable	Repair or replace the battery cable
	Loose alternator drive bel	Replace the batteryAdjust the belt tension or replace the belt
	Defective wiring harness	Repair or replace
Warning lamp does not go off even after starting the engine	Corrosion or damage of battery cable	Repair or replace the battery cable
	Loose alternator drive belt	Adjust the belt tension or replace the belt
	Defective wiring harness	Repair or replace
Overcharged battery	Defective voltage regulator of alternator	Replace the alternator
	Defective voltage detecting wiring	Repair or replace

3) Checking Battery



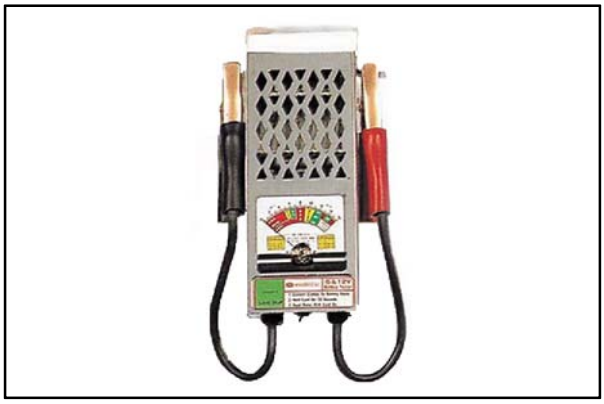
Modification basis	
Application basis	
Affected VIN	

(1) Checking

▶ Using battery tester

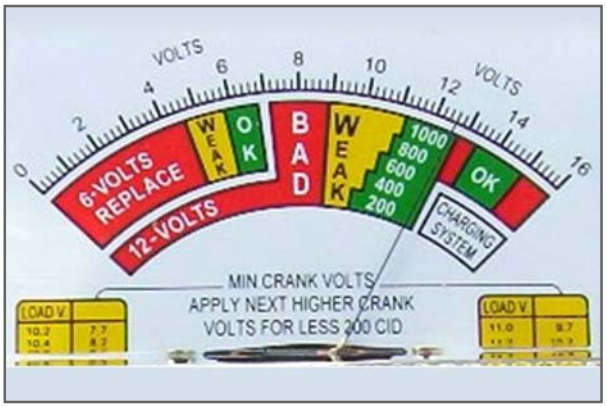
- PASS (11.0 V or more): Explain to the customer that the battery is reusable.
- Need to be charged (9.0 to 11.0 V): Charge the battery with a charger and reinstall it. Explain it to the customer.
- Need to be replaced (9.0 V or more): The battery should be replaced due to overdischarging.

(2) How to use battery tester



▶ How it works and How to use it

- Determine battery capacity by fixing current (load capacity) and time and varying voltage. Determine battery capacity based on the
- amount of voltage drop when discharging a fixed load capacity (120 A) for 5 seconds. Connect the tester to the battery and read the
- display while applying a load for 5 seconds.



▶ How to read display

- Red area (①): overdischarge or faulty battery
- Yellow area (②): Need to be charged (using a vehicle alternator and a battery charger)
- Green area (③): Normal
- Red area on the left-hand side of OK (④): Impossible to charge with an alternator
- Green area with OK (⑤): Normally charged
- Red area on the right-hand side of OK (⑥): Overcharged by an alternator

Modification basis	
Application basis	
Affected VIN	

(3) Starting with jumper cable

If the battery is weak or terminated, the battery from another vehicle can be used with jumper cables to start the engine.

▶ Connecting order

1. The positive (+) terminal of the discharged battery
2. The positive (+) terminal of the booster battery
3. The negative (-) terminal of the booster battery
4. Connect one end of the other jumper cable to the body of the discharged vehicle, such as the engine block or a front towing hook.

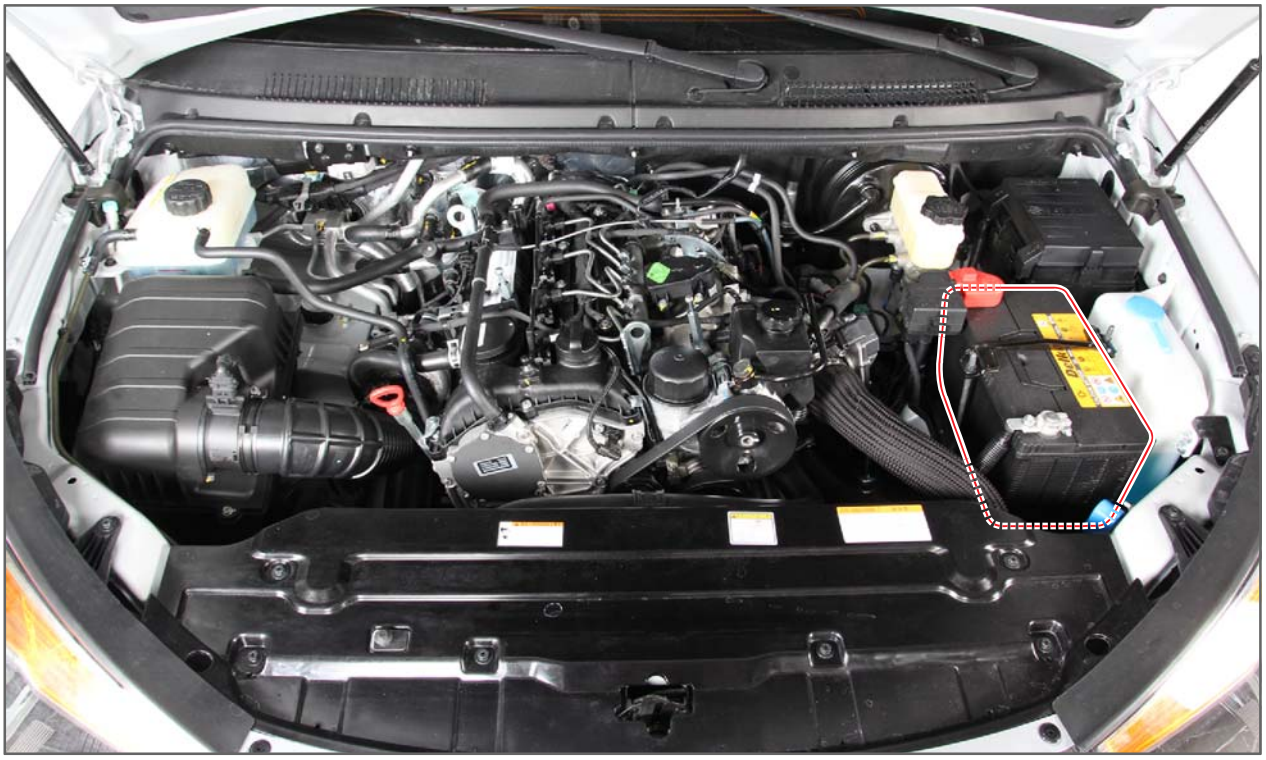
▶ Starting

1. Prepare a set of jumper cables.
2. Place another vehicle that has the same 12 V of power near to the discharged vehicle.
3. Switch off all electrical accessories for the discharged vehicle.
4. Apply the parking brake and shift the transaxle to the P position (automatic transaxle) or neutral (N) position (manual transaxle).
5. Connect the jumper cables.
6. Try to start the discharged vehicle while accelerating the engine rpm in the booster vehicle.
7. Attempt to start the engine with the discharged battery.
8. After starting the engine, carefully disconnect the jumper cables in the reverse sequence of connection.

Modification basis	
Application basis	
Affected VIN	

(4) Maintenance

If the charge warning lamp ( ) on the instrument cluster comes on while driving, there is a malfunction in the charge system including the battery. Therefore, carrying out the system check is needed.



- Make sure that the battery cables are firmly connected.
- If the terminals are corroded, clean them with a wire brush or sandpapers.
- Always disconnect the battery cables with the ignition key removed. When disconnecting the battery cables with the ignition key turned to ON or ACC position, several electric units can be damaged due to sudden voltage change.
- Check the battery for crack, damage or fluid leaks. Replace it if necessary.
  Wipe out the battery fluid on the battery surface using a rubber glove and a clean cloth wetted with soapy water.

Modification basis	
Application basis	
Affected VIN	

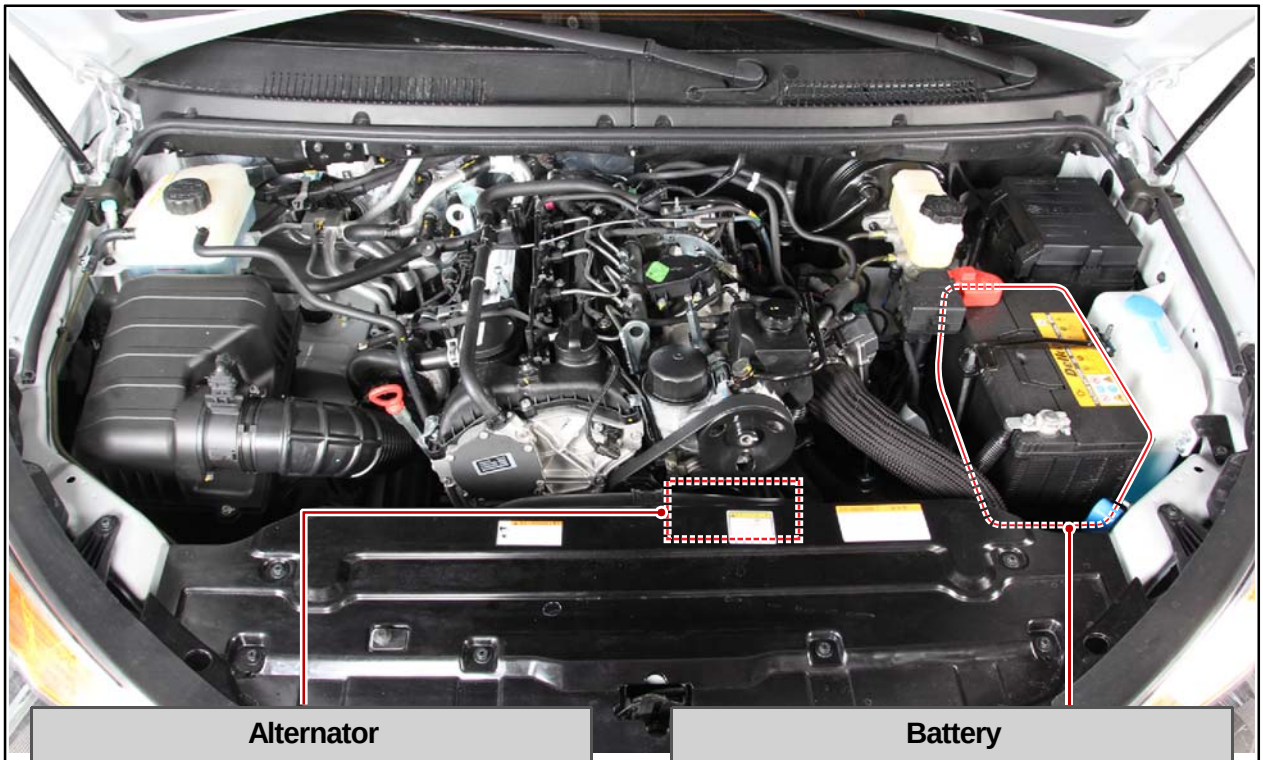
OVERVIEW AND OPERATING PROCESS

1. SYSTEM DESCRIPTION

1) Overview

The charge system is designed to supply electrical energy to the vehicle while driving, and supplies a constant direct current voltage by converting mechanical rotational movement to electrical energy.
The voltage regulator on the back of the alternator controls the generated voltage in all rotating ranges and adjusts the system voltage according to the electric load and ambient temperature change.

2) System Layout (Locations)

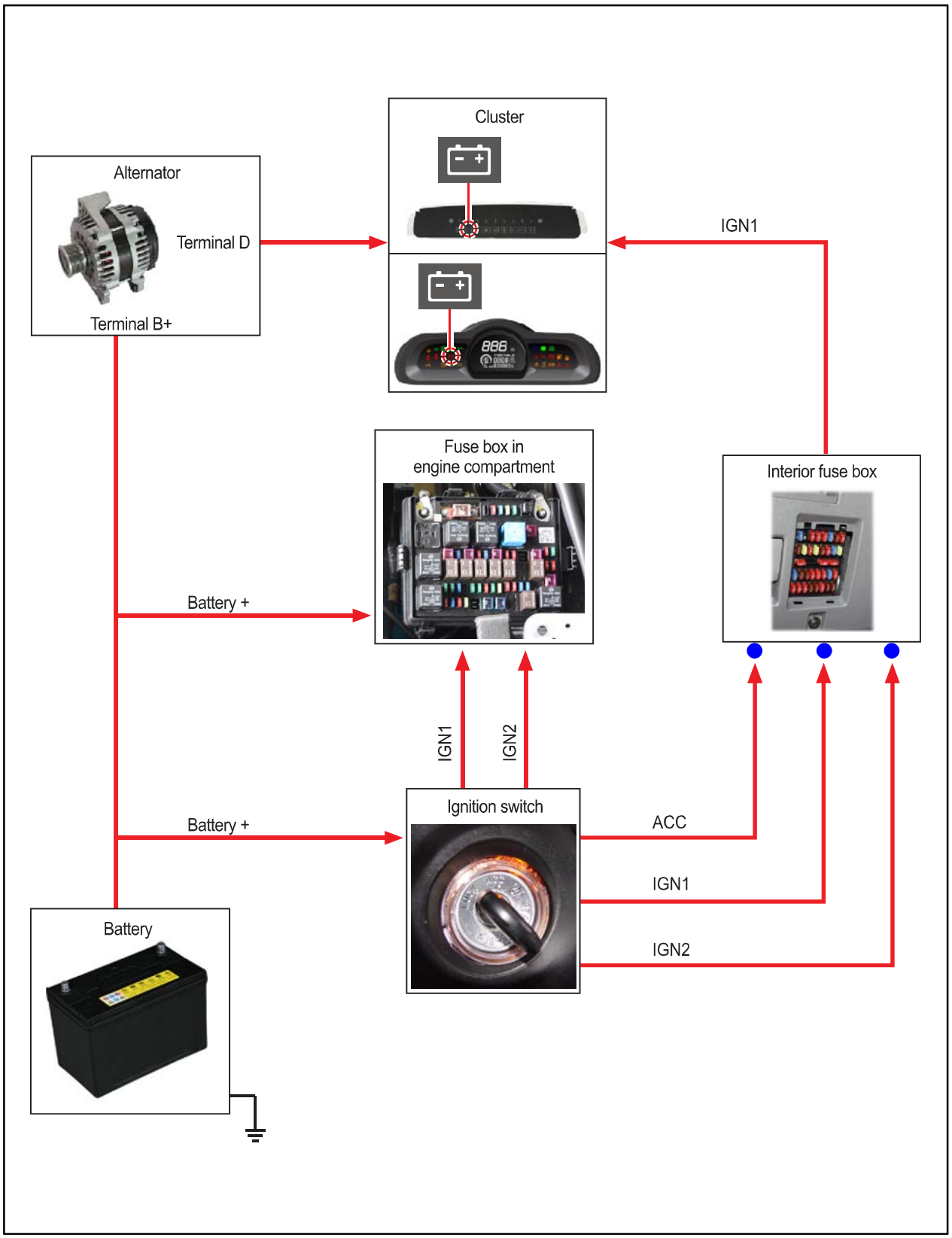


Alternator	Battery
	
The alternator charges the battery and supplies power to each electric unit by converting the mechanical energy to the electrical energy.	It converts the chemical energy to the electrical energy and supplies power to the corresponding electric units when starting the engine.

Modification basis	
Application basis	
Affected VIN	

2. OPERATING PROCESS

1) Charging Flow



ENGINE GENERAL
ENGINE ASSEMBL
ENGINE FUEL
INTAKE SYSTEM
ENGINE EXHAUST
TURBOC HARGER
LUBRICAT ION
COOLING SYSTEM
CHARGE SYSTEM
PRE-GLOW
STARTIN G
CRUISE CONTRO
E-EGR SYSTEM
CDPF SYSTEM
ENGINE CONTRO

Modification basis	
Application basis	
Affected VIN	

2) Charging

The alternator uses a new regulator which has three diodes. It consists of the delta stator, rectifier bridge, slip ring and brush.

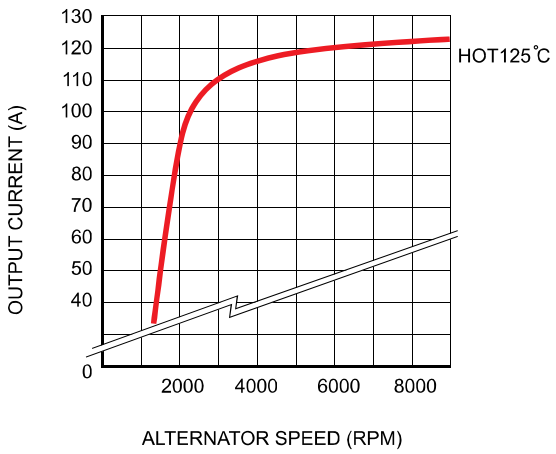
▶ **Charging time according to vehicle conditions and environment**

Specification: Charging a fully depleted high-capacity battery takes twice or more as long as charging a fully depleted battery for small vehicles.
Temperature: The lower the temperature is, the longer the time taken to charge the battery. When connecting the battery charger to the cold battery, the amount of current the battery can accept initially is very small. As the battery gets warmer, it can accept more current.

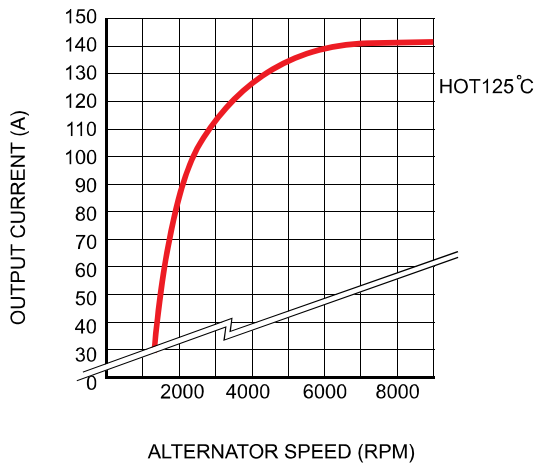
Charging capacity: Charging a battery with a low-capacity charger takes longer time than charging with a high-capacity charger.
Charging status: Charging a fully depleted battery takes twice or more as long as charging a half-depleted battery. Since the electrolyte in a fully depleted battery consists of nearly pure water and conductor, only a very small amount of current can be accepted by the battery initially. The charging current increases as the amount of acids in the electrolyte is increased by the charging current.

3) Output Characteristics

Alternator (115 A)

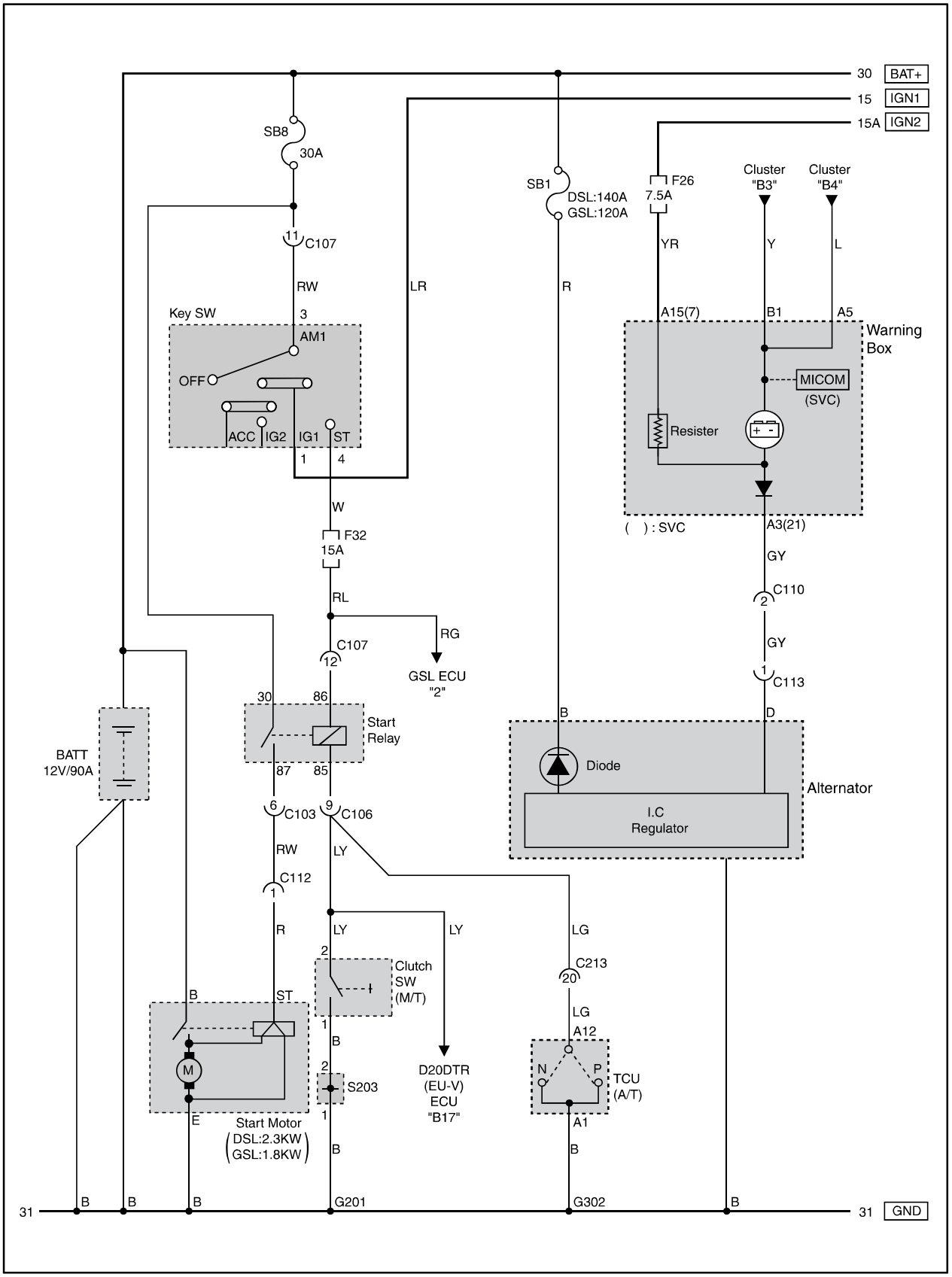


Alternator (140 A)



Modification basis	
Application basis	
Affected VIN	

3. CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	