

CHARGING SYSTEM

1452-01/2610-01/2610-05/

INDEX**CHARGING SYSTEM****GENERAL INFORMATION**

1. SPECIFICATIONS.....	3
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**OVERVIEW AND OPERATING
PROCESS**

1. OVERVIEW.....	4
2. COMPONENTS.....	4
3. OPERATING PROCESS.....	5
4. CIRCUIT DIAGRAM.....	7

CONFIGURATION AND FUNCTIONS

1452-01 ALTERNATOR...	8
2610-01 BATTERY.....	10

REMOVAL AND INSTALLATION

0000-00 CHECK AND INSPECTION.....	12
1452-01 ALTERNATOR.....	21
2610-01 BATTERY.....	24
2610-05 BATTERY POSITIVE CABLE.....	26



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CHARGING SYSTEM**1452-01****GENERAL INFORMATION****1. SPECIFICATIONS**

Category		Specifications	Remarks
Battery	Capacity(ISG)	50 Ah(70 Ah)	-
	Type(ISG)	Maintenance free(AGM)	
	Size	206 * 175 * 190	
	Weight	13.5 Kg	
	Cold cranking ampere	500 A	
	Reserve capacity	80 min	
Alternator	Rated capacity	12 V / 120 A	

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ENGINE
GENERALENGINE
ASSEMBLFUEL
SYSTEMIGNITION
SYSTEMINTAKE
SYSTEMEXHAUST
SYSTEMLUBRICA
TIONCOOLING
SYSTEMCHARGIN
GSTARTIN
GCRUISE
CONTROENGINE
CONTRO

E E M

Modification basis	
Application basis	
Approval basis	

CHARGING SYSTEM

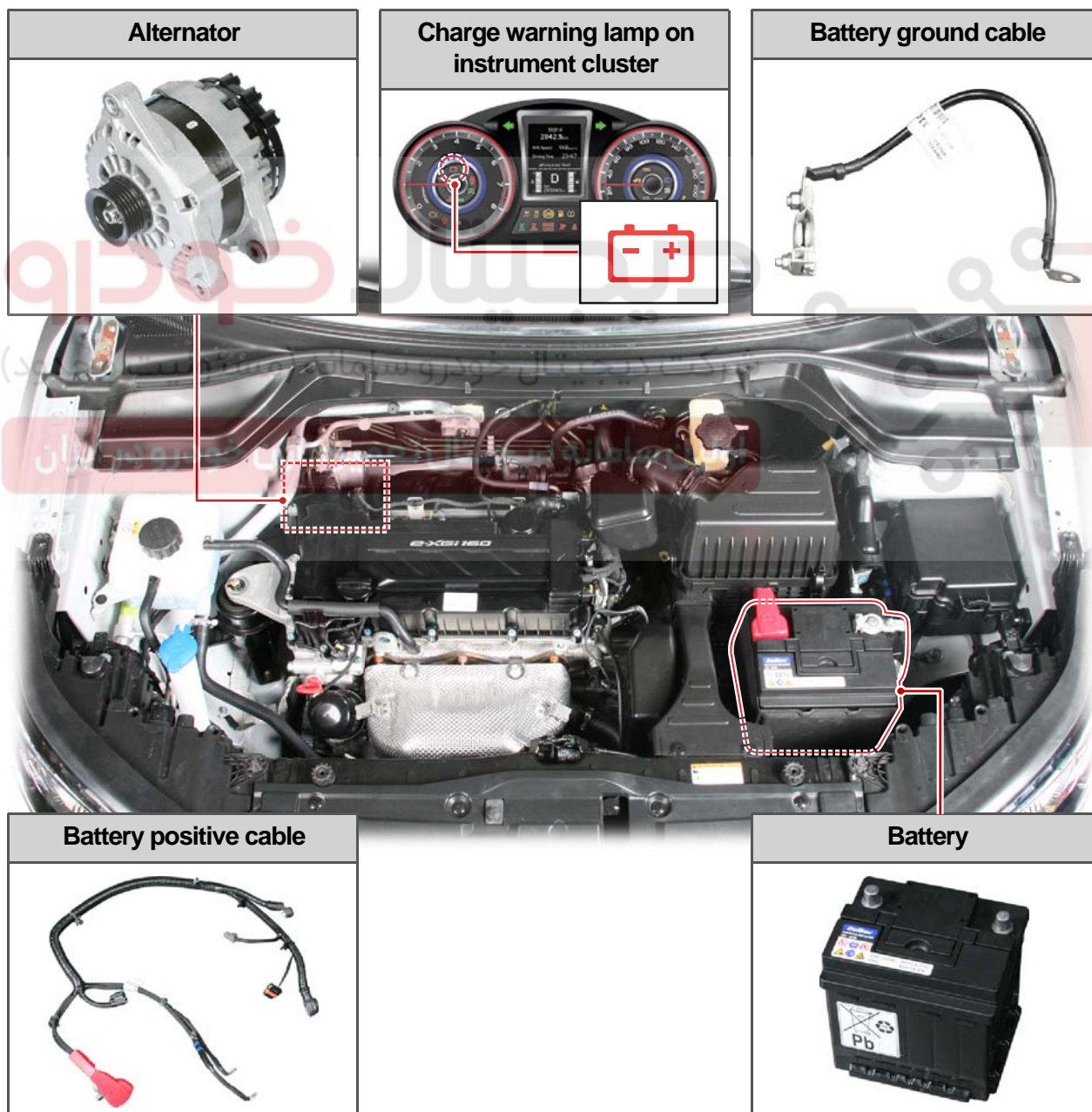
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OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

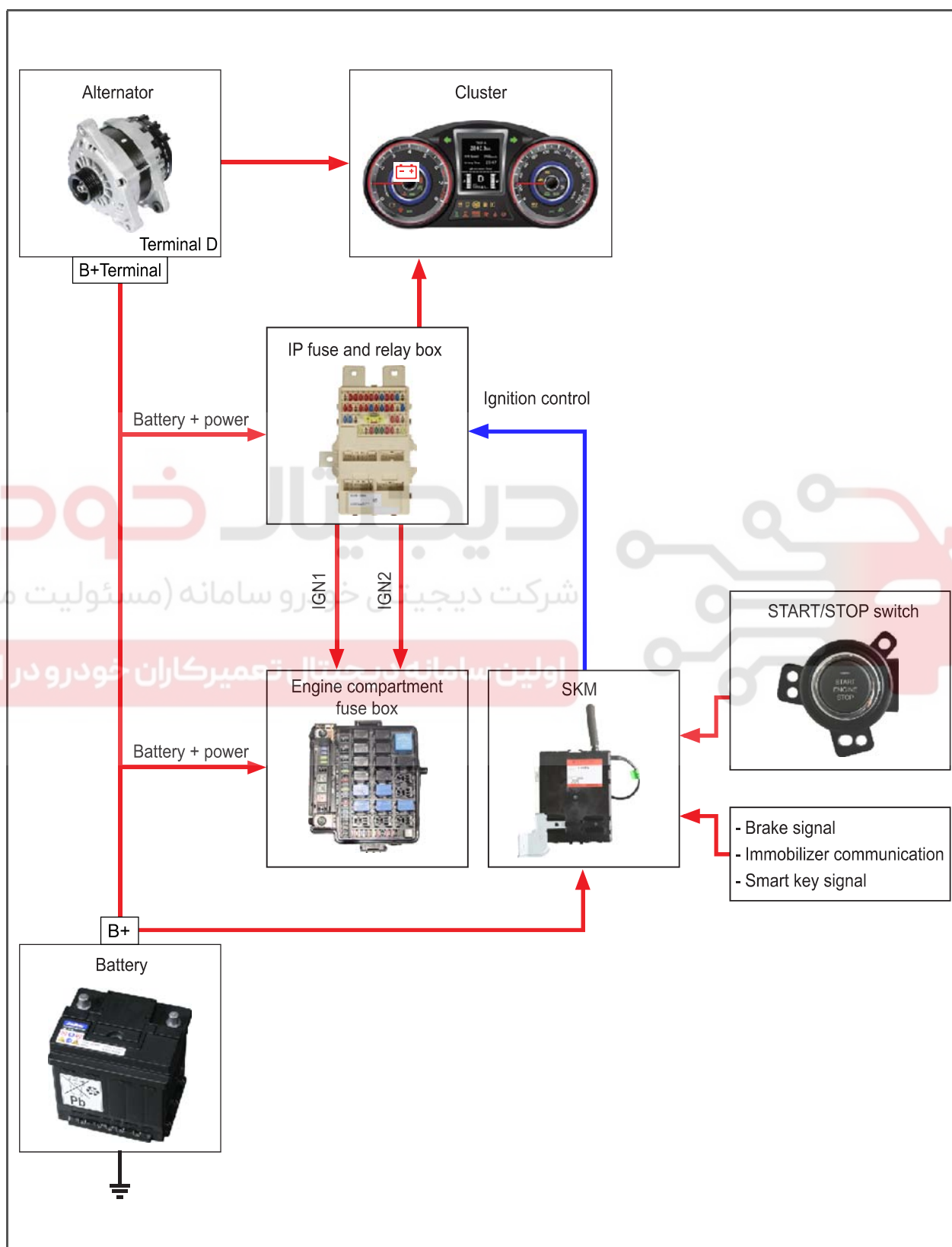
The charging system is designed to supply electrical energy to the vehicle while driving, and supplies a constant direct current voltage by converting mechanical rotational movement to electrical energy. The voltage regulator on the back of the alternator controls the generated voltage in all rotating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

2. COMPONENTS



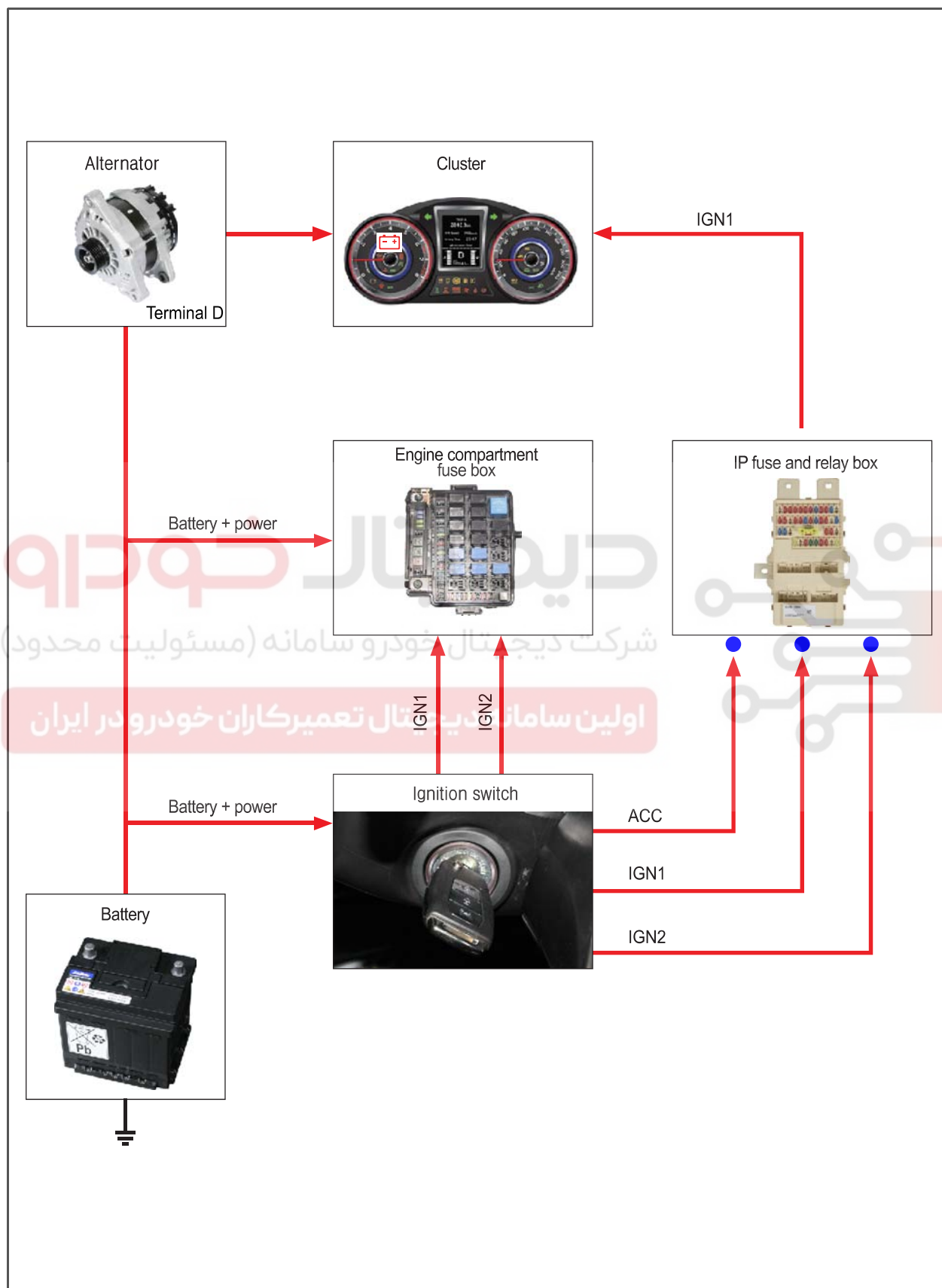
3. OPERATING PROCESS

1) For a vehicle with smart key

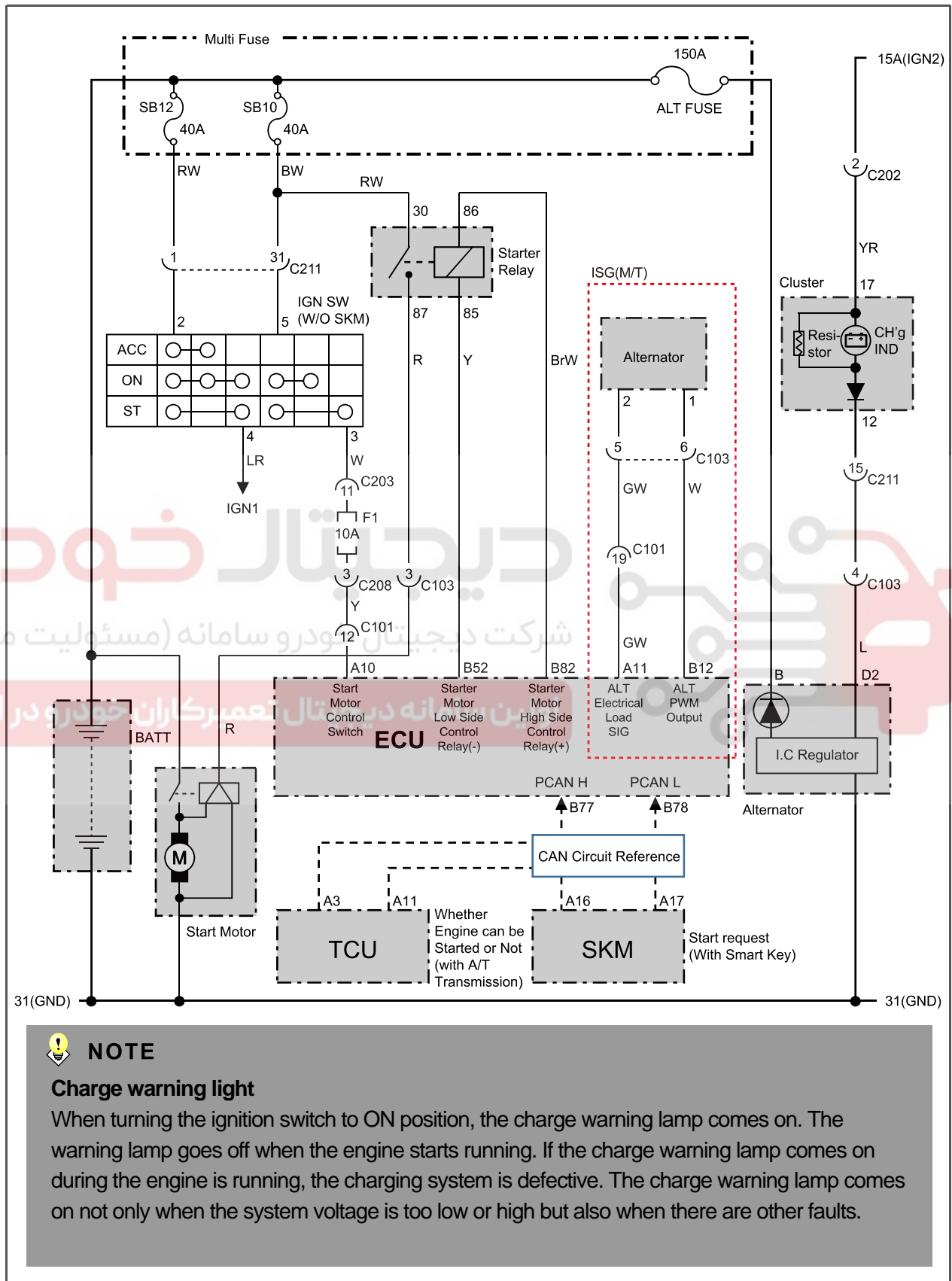


Modification basis	
Application basis	
Approval basis	

2) For a vehicle with REKES key



4. CIRCUIT DIAGRAM



Modification basis	
Application basis	
Approval basis	

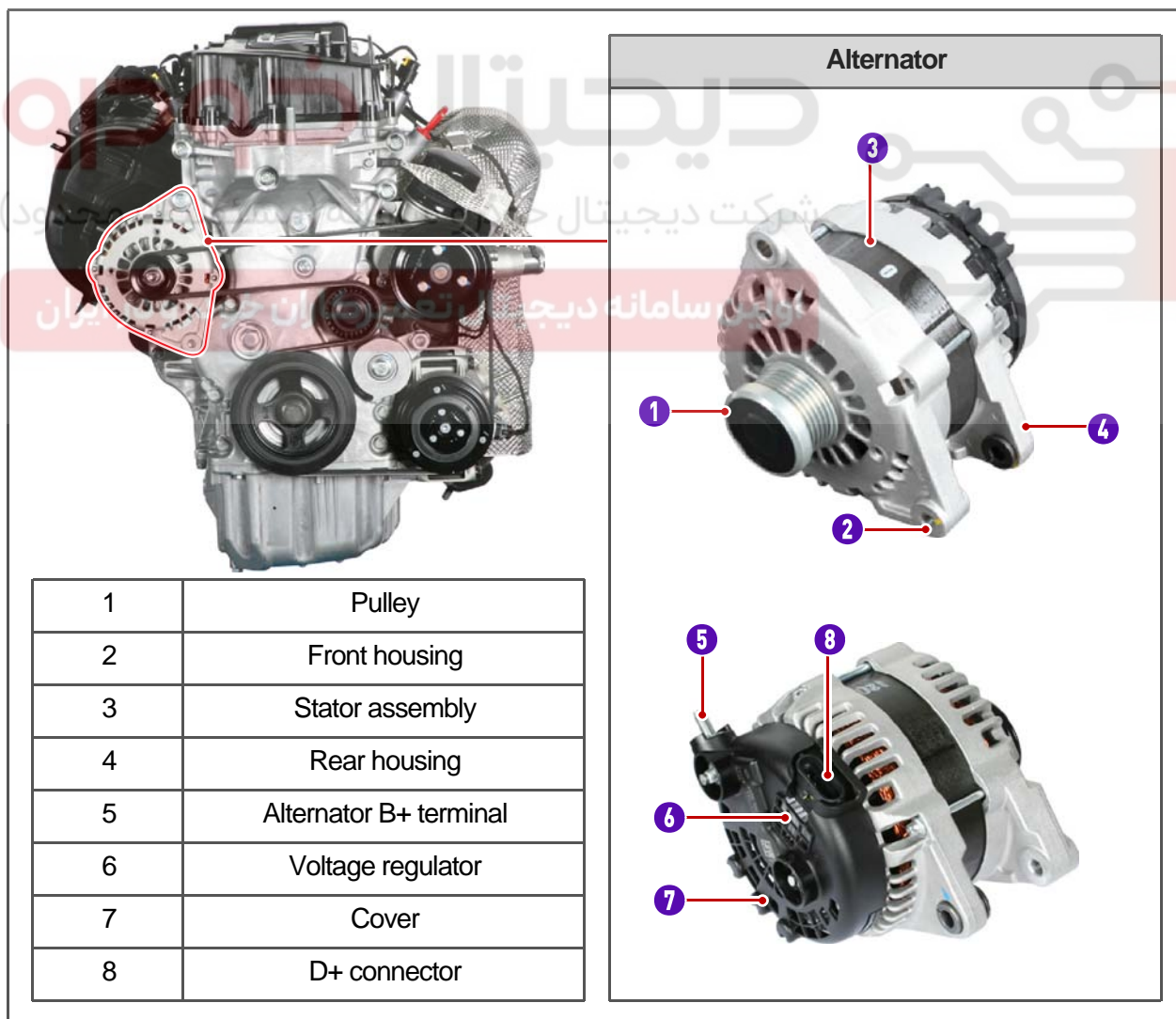
CONFIGURATION AND FUNCTIONS

1452-01 ALTERNATOR

1) Overview

The alternator charges the battery and supplies power to each electric unit by converting the mechanical energy to the electrical energy. The alternator uses the rectifier which has six diodes and consists of delta stator, regulator, rotor and brush. The alternator can use only two contact points which are positive battery terminal and the charge warning lamp D+ terminal. The voltage setting of the regulator varies depending on the temperature and system voltage threshold in relation to the current control of rotor field. The regulator takes a proper average field current to control the system voltage by changing the ON-OFF time. At a high speed, the ON time is 10% and the OFF time is 90%. At a low speed or with a large electrical load, the ON time is 90% and the OFF time is 10%.

2) Mounting Location and Components



3) Alternator D+ Terminal Connector



Pin No.	Function
1	-
2	D+

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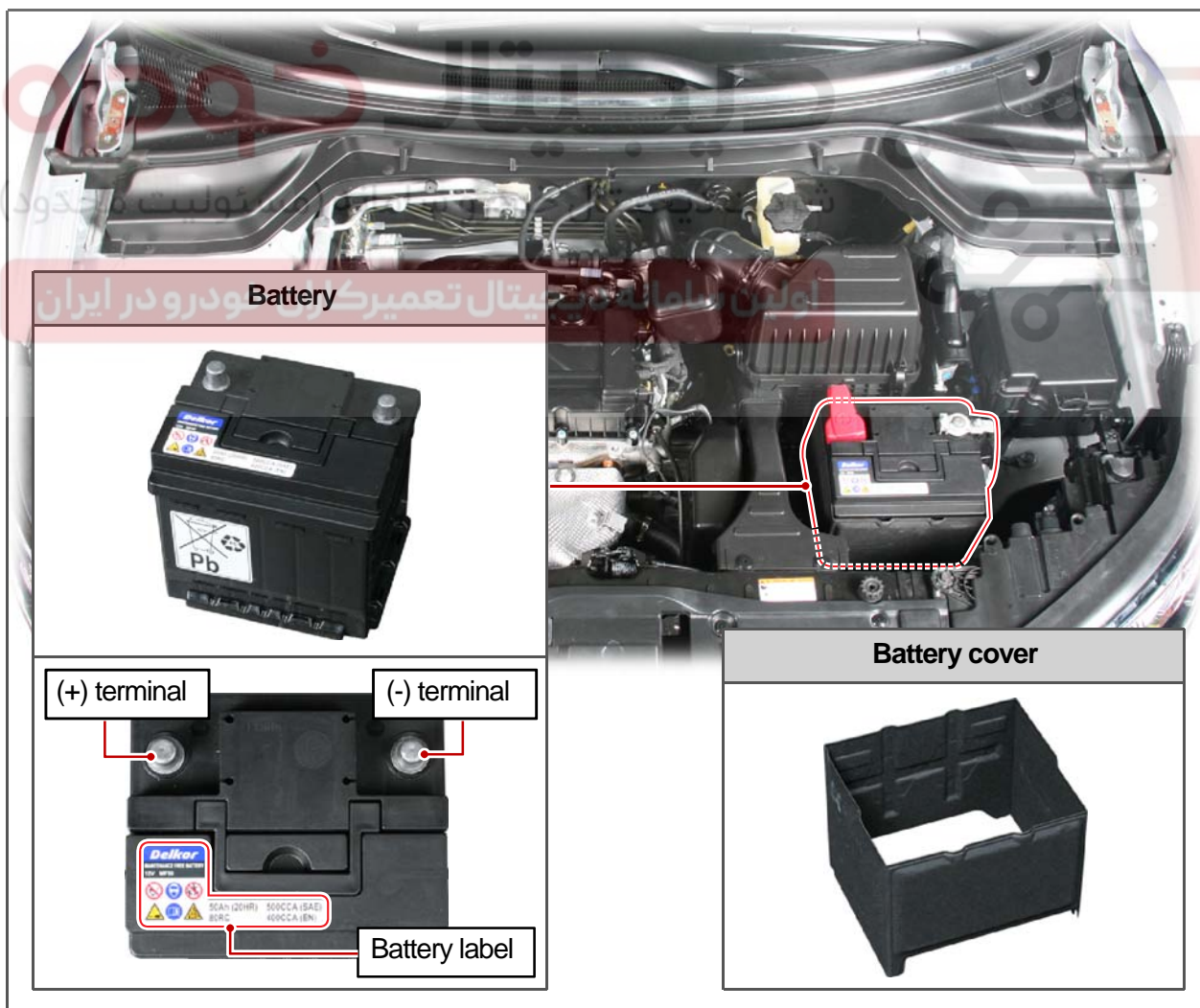
Modification basis	
Application basis	
Accessories	

S.G.N.

2610-01 BATTERY**1) Overview**

The battery is a device that converts the chemical energy of the chemicals in it to the electrical energy by redox reaction. The battery installed to this vehicle is a maintenance free battery which does not need maintenance, such as filling with distilled water, and is tightly sealed except the small vent hole on the side. The small amount of gas generated in the battery is evacuated through this vent hole. The MF battery provides the following benefits:

- There is no need to fill with distilled water to extend the battery life.
- Overcharge protection: Even if an excessive voltage is applied to the battery, it does not accept large amount of current. The traditional battery is charged by this excessive voltage. But this generates gas, resulting in loss of battery fluid.
- Less self-discharge compared with the traditional battery.

2) Mounting Location and Components

3) Battery Rating

► Reverse capacity

Reverse capacity (RC) is the maximum length of time during which a vehicle can be driven at night with the minimum electrical load and no output from the alternator.

Expressed in minutes, reserve capacity (or RC rating) is the length of time until a fully charged battery reaches 10.5 V by discharging with a load of 25 A at 27°C (80°F).

► Cold cranking ampere (CCA)

The cold cranking ampere test is carried out at a temperature of -18°C (0°F). The current rating should be minimum level and the battery voltage should be maintained at 7.2 V or more for 30 seconds at the specified temperature. This rating is the measurement value of cold cranking capacity. The service life of a battery is limited but can be extended as long as possible by maintaining it properly.

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Modification basis	
Application basis	
Approved by	

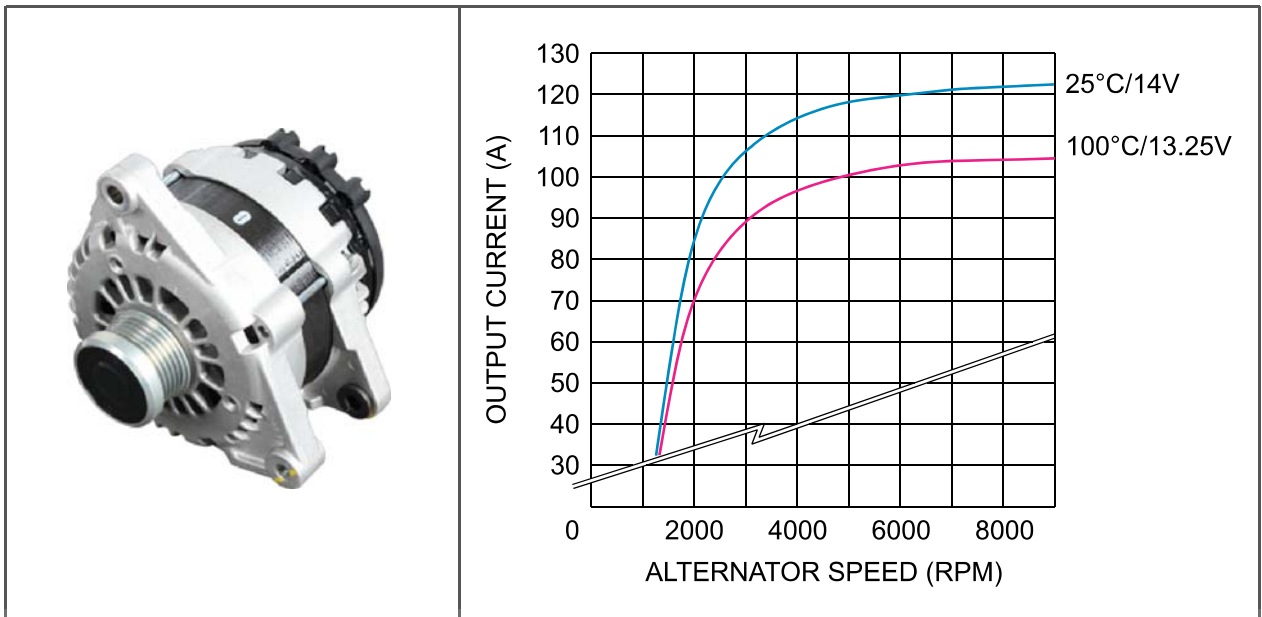
REMOVAL AND INSTALLATION

0000-00 CHECK AND INSPECTION

1) Troubleshooting For Alternator

Problems	Cause	Action
Overcharged battery	Defective alternator voltage regulator	Replace the alternator
	Defective alternator voltage regulator	Replace the alternator
	Defective voltage detection wiring	Repair or replace
Discharged battery	Loose alternator drive belt	Adjust the belt tension or replace the belt
	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 grounding	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 grounding of alternator circuit	Repair
Charge warning lamp is not turned off after the engine starts (frequent charging battery required)	Defective alternator voltage regulator	Replace the alternator
	Corroded or worn 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
Charge warning lamp is not turned off after the engine starts	Corroded or damaged battery cable	Replace or change the battery cable
	Loose alternator drive belt	Adjust the belt tension or replace the belt
	Defective wiring harness	Repair or replace
Overcharged battery	Defective alternator voltage regulator	Replace the alternator
	Defective voltage detection wiring	Repair or replace

2) Alternator Output Test



Items	Check method	Judgment criteria / Action
Output current	<ol style="list-style-type: none"> 1. Disconnect the cable connected to the B terminal of the alternator. Connect one end of the ammeter to the B terminal and the other end to the cable which was 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.) 	<ul style="list-style-type: none"> - Pass: If the measured current is 45 A or higher. - Fail: If the measured current is lower than 45 A. - Check the regulated current of the B terminal.
B terminal regulated current	<ol style="list-style-type: none"> 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.) 	<ul style="list-style-type: none"> - Open circuit: If the measured current is 5 A or higher.
Rotor coil resistance	<ol style="list-style-type: none"> 1. Disconnect the negative cable from the battery. Remove the B terminal and turn off the ignition switch. 2. Measure the resistance of the rotor coil using an ohmmeter. 	<ul style="list-style-type: none"> - Pass: If the measured resistance is between 1 and 6 Ω. - Faulty rotor coil or slip ring: If the measured resistance is less than 1 Ω or greater than 6 Ω.

Modification basis	
Application basis	
Effective date	

Items	Check method	Judgment criteria / Action
D terminal voltage	<ol style="list-style-type: none"> 1. Connect the D terminal wiring. 2. Measure the voltage with the engine running. 	<ul style="list-style-type: none"> - Specified value: 12.5 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.

دیجیتال خودرو

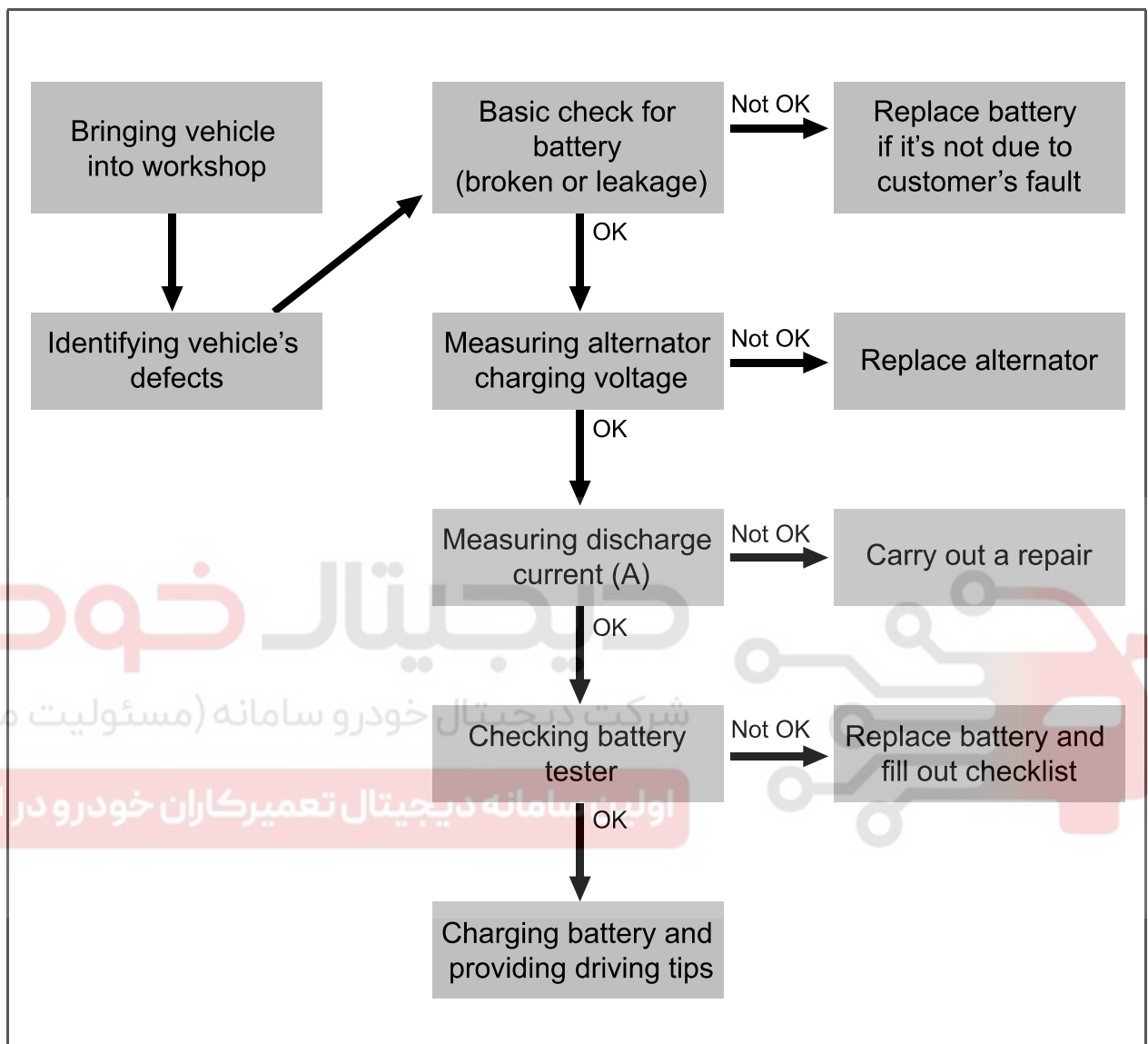
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3) Troubleshooting For Battery

(1) Checking battery



Modification basis	
Application basis	
Approval	

(2) Judgment Criteria

► Use battery load tester

- PASS (11.0 V or higher): 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 lower): The battery should be replaced because of over-discharging.

(3) Battery load tester



► How it works and How to use it

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



► How to read display

- Red area: over-discharge or faulty battery
- Yellow area: Need to be charged (using a vehicle alternator and a battery charger)
- Green area: Normal condition
- Red area on the left side of OK: Impossible to charge with an alternator
- Green area with OK: Normal condition
- Red area on the right side of OK: Over-charged by an alternator

(4) Measuring dark current

The dark current is the current that flows in sleep mode which cuts off all the power, except for the device used to inform reactivation of the system in order to prevent the battery from being discharged. This is the procedure that measures the dark current of the vehicle on which self-discharge will occur. It is determined as a self-discharge if the measuring value is above the specified range.

► **Dark current specification:** 0.05 A or less

► **How to measure dark current**



1. Set the current measuring range of the ammeter to 10 A.



2. Connect the red probe of an ammeter to the battery ground cable and black probe to the negative (-) battery terminal.



3. Unscrew the mounting nut (12 mm) to separate the battery ground cable from the negative (-) battery terminal.

Modification basis	
Application basis	
Approval basis	



4. Turn the ignition on. Once the voltage has been supplied to the various units turn the ignition off.



5. Press and hold the hood switch.



6. Press the button on the smart key to enter the theft deterrent mode.



7. Measure the current when the system enters sleep mode after 3 minutes have passed since the separation of ground cable and battery negative terminal.



(5) Jump starting

You can start a vehicle that has a discharged battery by connecting the battery to a battery with the same capacity and specifications installed in other vehicle or auxiliary battery.


► Connecting sequence of booster cables

1. + terminal of the discharged battery
2. + terminal of the rescue battery
3. - terminal of the rescue battery
4. body of the disabled vehicle (as far as possible from the battery)

► How to start a vehicle with discharged battery using booster cables

1. Prepare a set of booster cables.
2. Park the rescue vehicle with 12 V battery within the booster cable reach.
3. Cut power to all electric units of the disabled vehicle.
4. Place the gear selector lever of the disabled vehicle to P and apply the parking brake.
5. Connect the booster cables. (Connect the positive (+) booster cable to the + terminal of the discharged battery first. Then connect the positive (+) and negative (-) booster cables to the corresponding terminals of the rescue vehicle. Finally, connect the negative (-) booster cable to the engine/body of the disabled vehicle.)
6. Start the rescue vehicle and idle the engine for several minutes.
7. Start the disabled vehicle.
8. If the engine starts, remove the negative (-) booster cable first, and then the positive (+) booster cable.

(6) Maintenance

If the charge warning lamp () on the instrument cluster comes on while driving, there is a fault in the charging system including the battery. Therefore, servicing the system is required.

- Make sure that the battery terminals are securely tightened.
- If the terminals are corroded, clean them with a wire brush or sandpapers.
- Always disconnect the battery terminals with the ignition key removed. When disconnecting the battery terminals 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 cracks, damage or fluid leaks. Replace it, if necessary.
Wipe out any battery fluid on the battery surface. Wear rubber gloves and use a clean cloth dampened with soapy water.

Modification basis	
Application basis	
Effective date	

► Charging a fully depleted battery (removed from vehicle)

Comply with the working procedures to avoid replacing the good battery unnecessarily. Charge the completely discharged battery by following the procedures specified below:

1. Measure the voltage at the battery terminals with an accurate voltmeter. If the reading is 10 V or lower, the charging current is very low. It takes some time for the battery to accept the current in excess of a few milli-amperes. Refer to "required charging time" in this subsection. The ammeters available in the field can't detect a very low current.
2. Set the battery to high settings.



CAUTION

Some battery chargers feature a polarity protection circuit which protects the charger until its lead is correctly connected to the battery terminal. Even though the lead is properly connected, a completely discharged battery has too low voltage to activate this circuit and the battery may not accept the charging current. Therefore, follow the manufacturer's instruction for bypassing or overriding the circuit, so that the battery can be turned on and charged with a low voltage.

3. Keep charging the battery until the charging current can be measured. The battery charger changes the amount of voltage and current provided. The time required for the battery to accept a measurable charging current at various voltages is as follows:

Voltage (V)	Time
16.0 or higher	Up to 4 hours
14.0 to 15.9	Up to 8 hours
13.9 or lower	Up to 16 hours

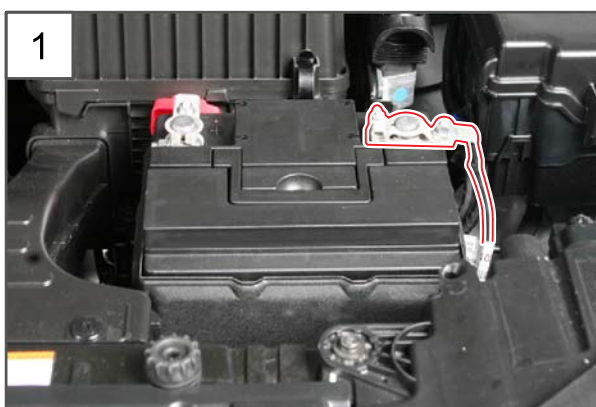
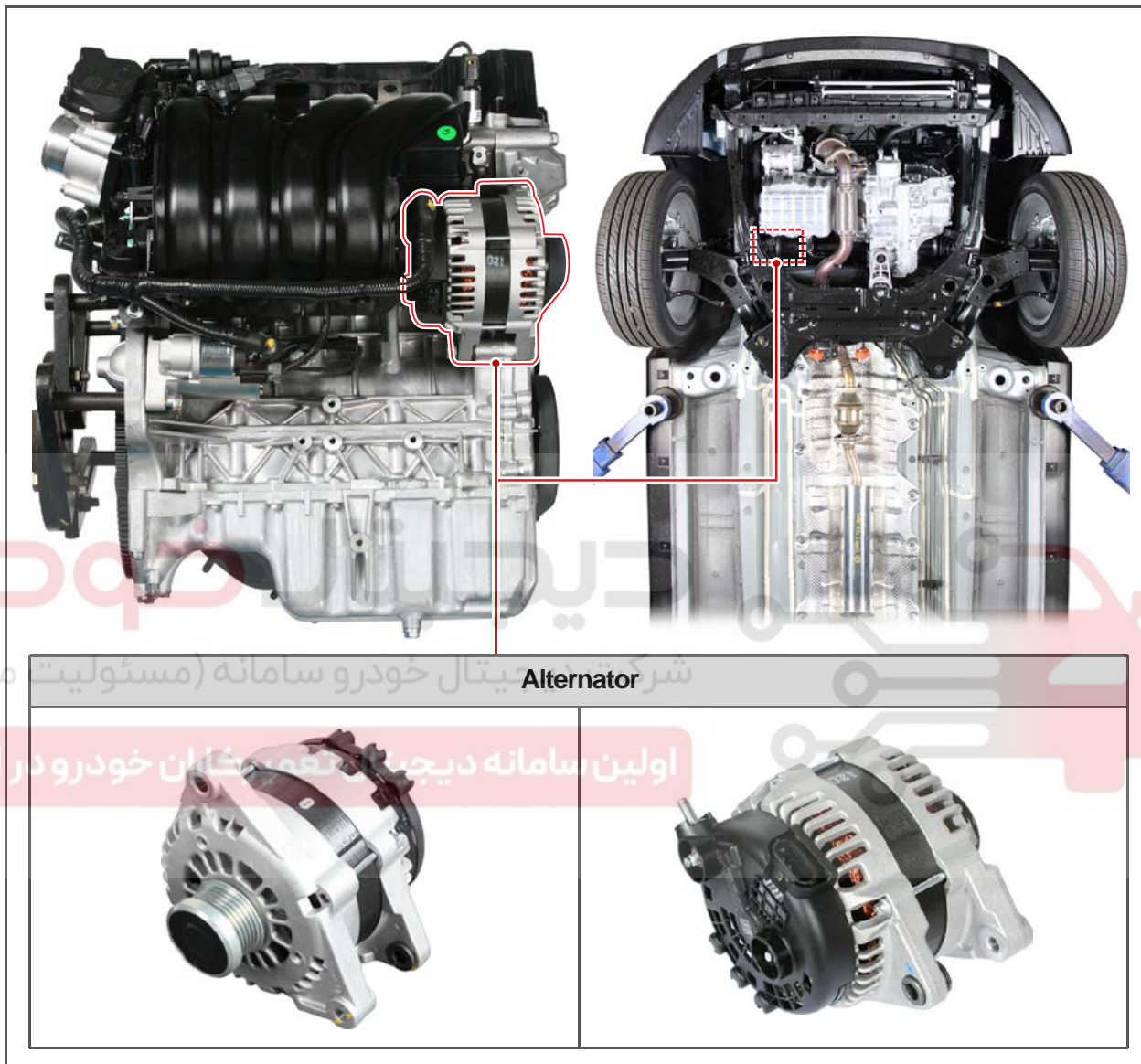
- If the charging current is not measured when the maximum charging time has been reached, the battery should be replaced.
- If the charging current is measured during the charging time, the battery is in good condition. The charging should be completed in the normal manner.
- If the charging current is still not measurable even after the charging time specified above has been passed, the battery should be replaced.

S.G.N.

1452-01 ALTERNATOR

Preceding work

- Remove the rear undercover.
(Tightening torque when installing: 13.8 to 17.6 Nm)



1. Disconnect the negative battery cable.

Modification basis	
Application basis	
Approval	

CHARGING SYSTEM

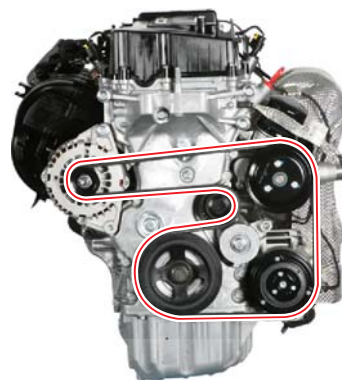
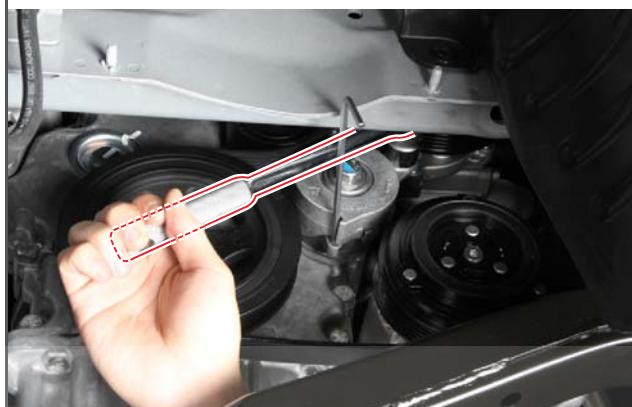
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2. Remove the fan belt from the vehicle.



NOTE

Refer to "BELT SYSTEM" under "REMOVAL AND INSTALLATION" subsection of "ENGINE ASSEMBLY" section in "G16DF ENGINE" chapter.



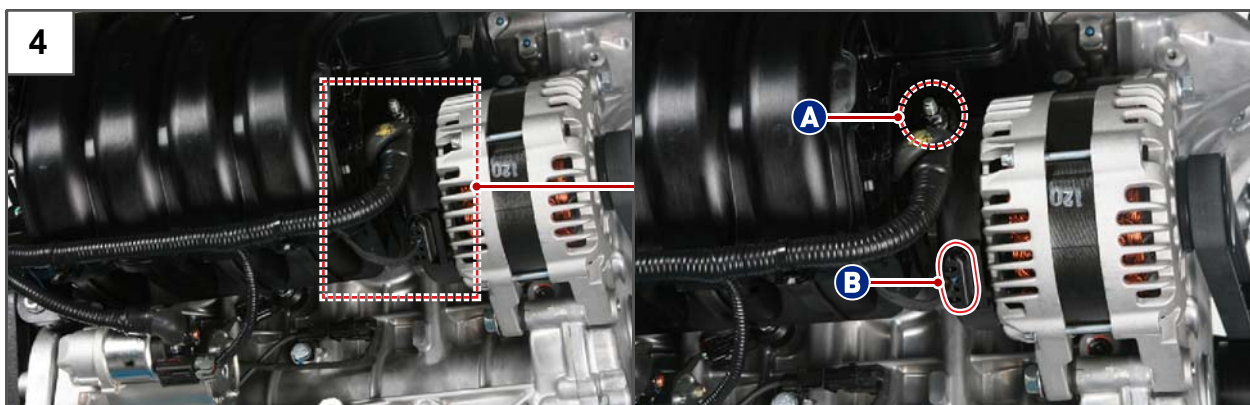
3. Remove the front exhaust pipe to make room for the alternator removal.



NOTE

Refer to "FRONT EXHAUST PIPE" under "REMOVAL AND INSTALLATION" subsection of "EXHAUST SYSTEM" section in "G16DF ENGINE" chapter.

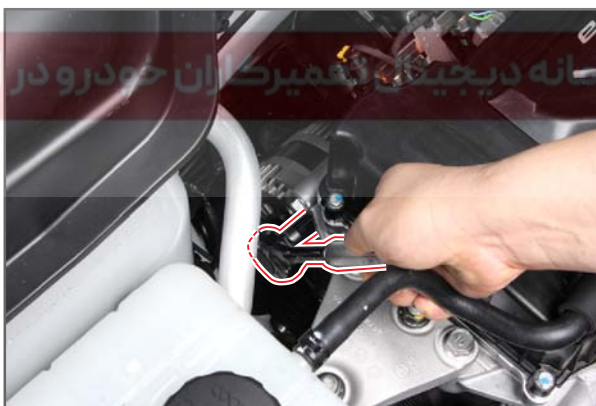
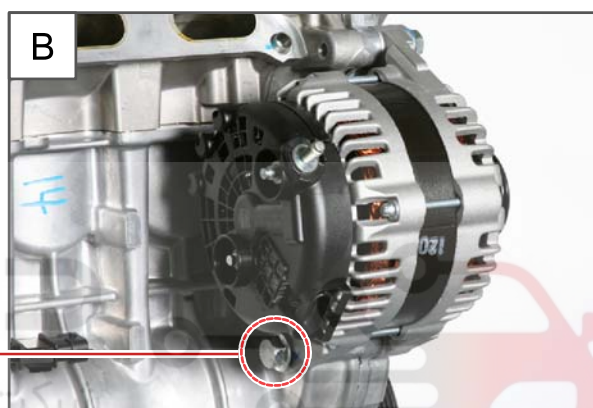
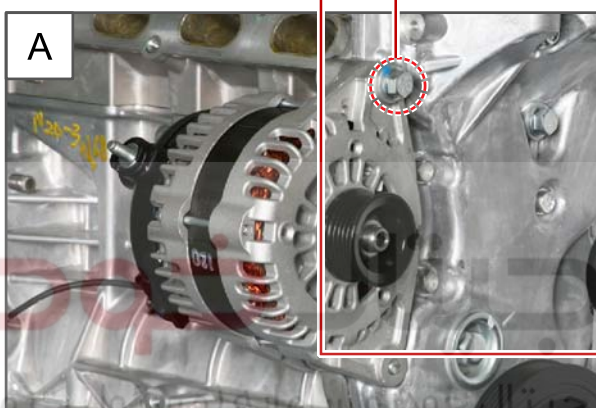
4. Unscrew the B+ terminal mounting nut (A, 12 mm) and disconnect the D+ terminal connector (B) from the alternator located under the vehicle.





5. Unscrew the mounting bolt (A, 15 mm) and (B, 17 mm) for the alternator.

Tightening torque $61 \pm 6.1 \text{ Nm}$



NOTE

Remove the upper mounting bolt (A) from the engine compartment as shown in the picture.

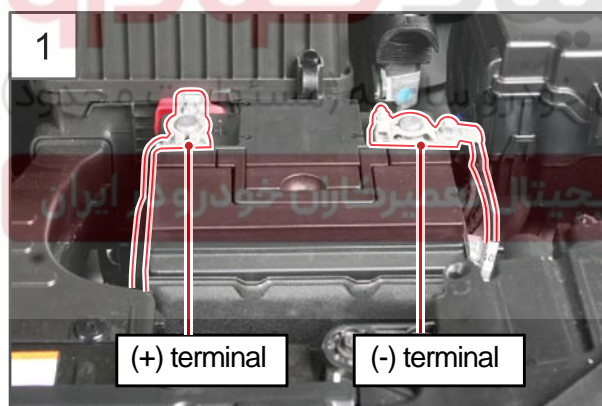
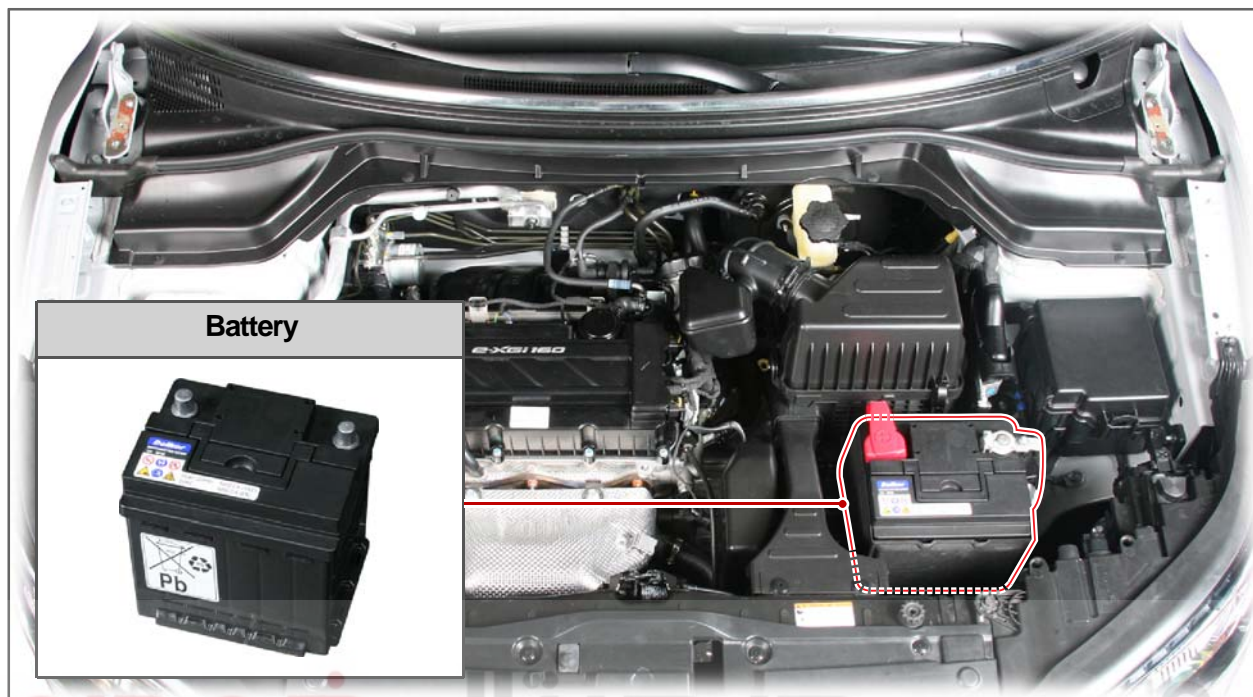


6. Remove the alternator under the vehicle.
7. Install in the reverse order of removal.

Modification basis	
Application basis	
Approval basis	

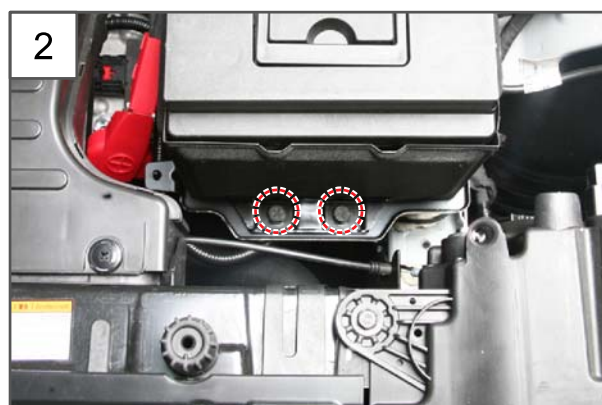
S.G.N.

2610-01 BATTERY



1. Turn off all electrical functions and loosen and disconnect the negative (-) terminal (10 mm) and positive (+) terminal (10 mm) from the battery.

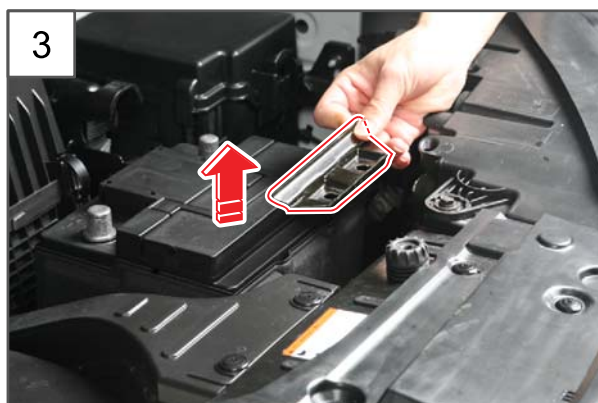
Tightening torque $6.0 \pm 1.0 \text{ Nm}$



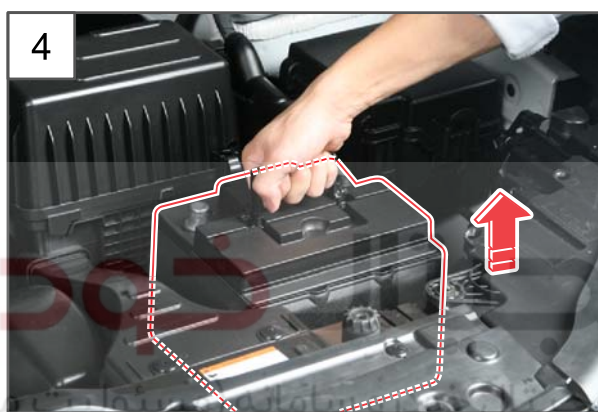
2. Unscrew the 2 mounting bolts (12 mm) for the battery clamp.

Tightening torque 3.7 to 7.8 Nm

Modification basis	
Application basis	
Affected VIN	021 62 99 92 92



3. Remove the battery clamp.



4. Remove the battery from the vehicle.



5. Separate the battery cover from the removed battery.

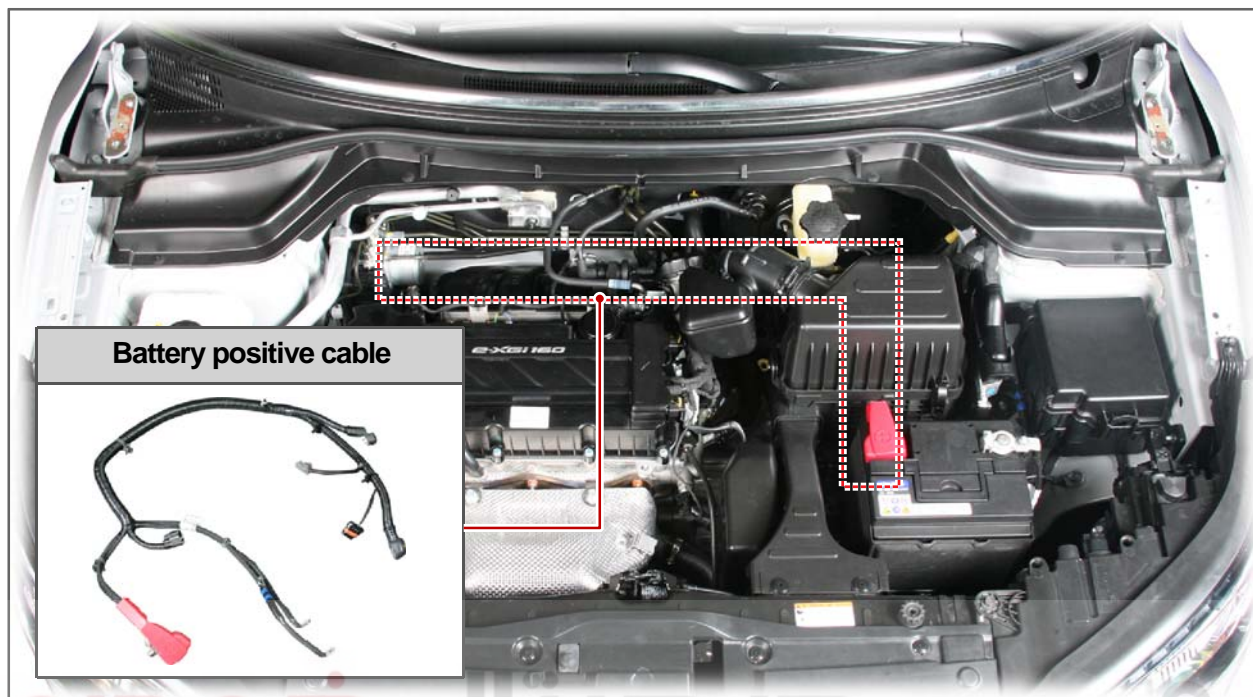


6. Install in the reverse order of removal.

Modification basis	
Application basis	
Life cycle	

S.G.N.

2610-05 BATTER POSITIVE CABLE



1. Remove the battery from the vehicle.

**NOTE**

Refer to "BATTERY" under this subsection.

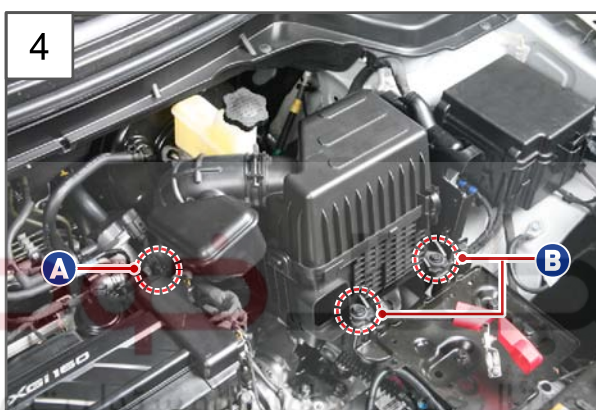


2. Remove the 2 screw rivets securing the snorkel assembly.

Modification basis	
Application basis	
Affected VIN	021 62 99 92 92



3. Remove the snorkel assembly.



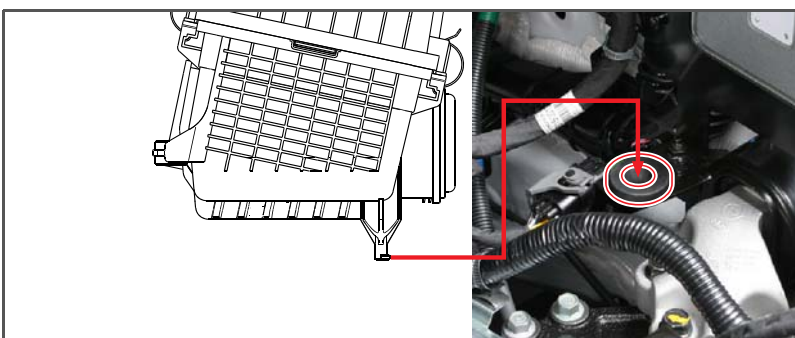
4. Remove the spring clamp (A, 10 mm) for the air cleaner hose and 2 mounting bolts (B, 12 mm) for the air cleaner housing.

Tightening torque (A) 6 to 7 Nm
(B) 25 ± 2.5 Nm



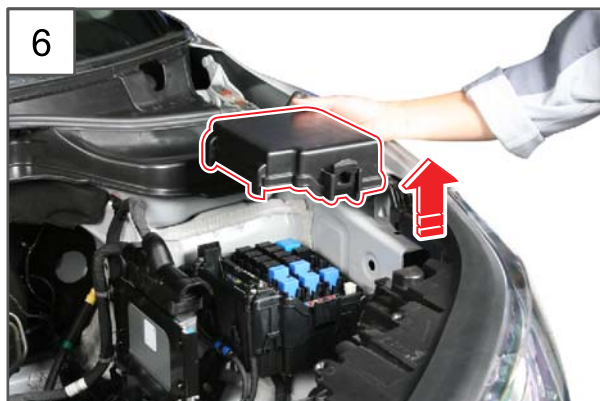
5. Remove the air cleaner housing with the air cleaner hose.

CAUTION



When installing the air cleaner housing, make sure that the retaining key at the bottom of the housing is seated correctly on the recessed area of the engine compartment.

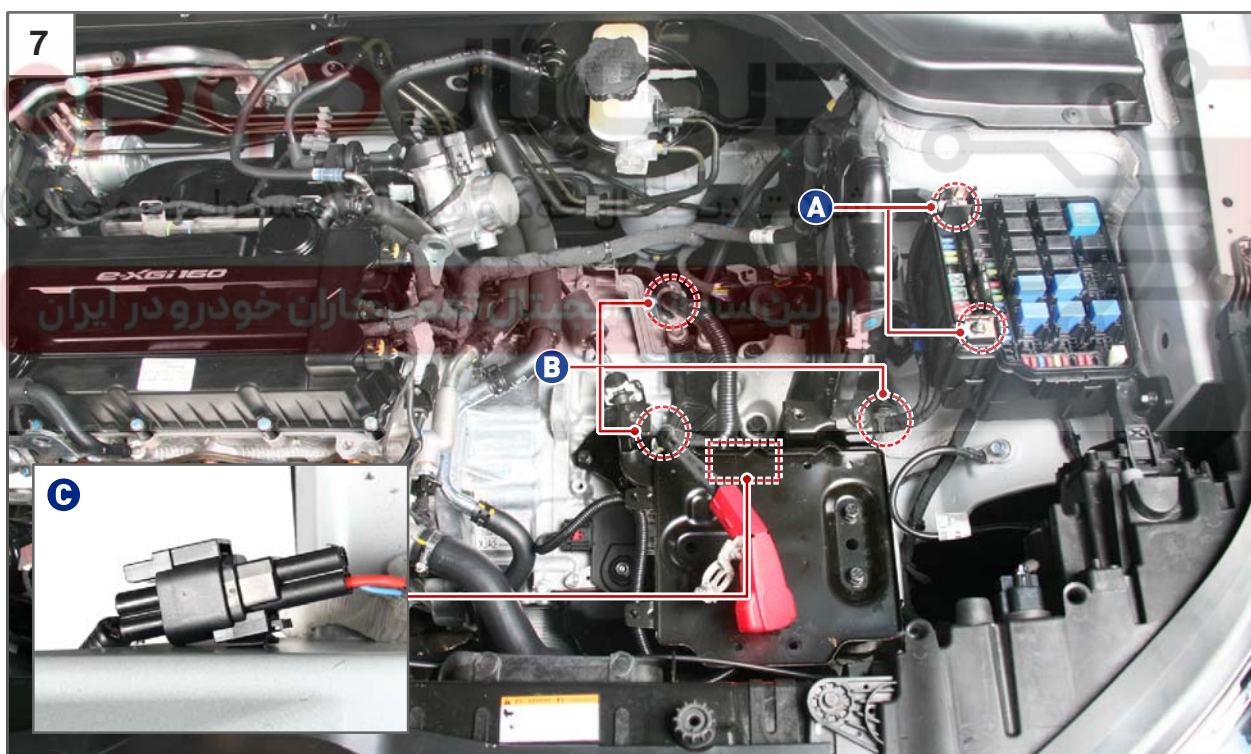
Modification basis	
Application basis	
Aftermarket	

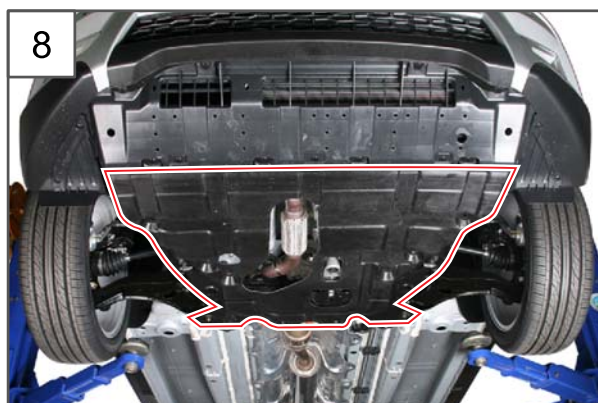


6. Remove the fuse box in the engine compartment.

7. Remove the 2 mounting nuts (10 mm) for the underhood fuse box (+) terminal and the 3 wiring clamps (B) to disconnect the battery positive cable connector (C).

Tightening torque $10 \pm 1.0 \text{ Nm}$





8. Remove the rear under cover under the vehicle.

Tightening torque 13.8 to 17.6 Nm

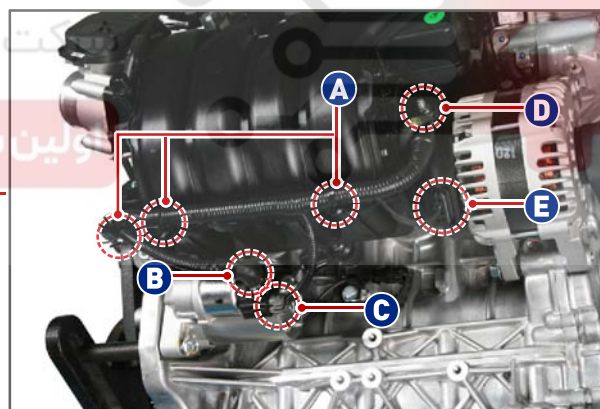
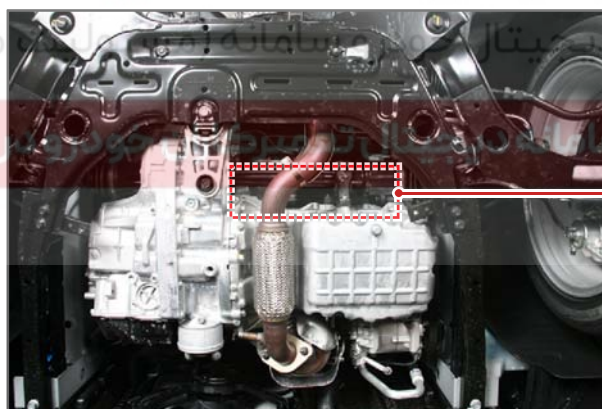
CAUTION

Tighten the mounting bolt to the specified torque. Excessive tightening torque can cause damage to the rear under cover.

9. Remove the wiring clamp and connector to positive (+) battery cable and unscrew the B+ terminal mounting nut securing the starter motor and alternator.

- (A) Battery positive cable wiring clamp
- (B) starter motor B+ terminal mounting nut (12 mm)
- (C) starter motor ST terminal connector

- (D) Alternator B+ terminal mounting nut (A) (12 mm)
- (E) Disconnect the D+ terminal connector (B).



10. Disconnect the battery positive cable from the engine compartment.

11. Install in the reverse order of removal.

Modification basis	
Application basis	
Approval basis	

Memo

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