CHARGE SYSTEM

1452-01/2610-01/2610-05

GENERAL INFORMATION

OVERVIEW AND OPERATING PROCESS

CONFIGURATION AND FUNCTION

REMOVAL AND INSTALLATION

CHARGE SYSTEM 1452-01

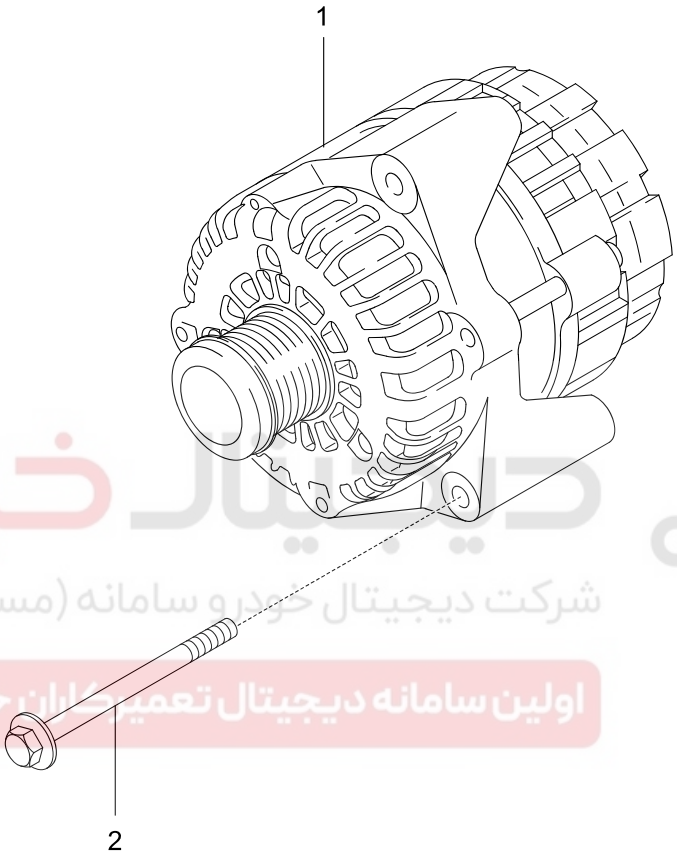
GENERAL INFORMATION

1. SPECIFICATION

Unit	Description		Specification	
Alternator	Type		HPS	EPS
	Crankshaft pulley : Alternator pulley		1 : 2.66	
	Normal output (idle/2200rpm)		70/140A	←
	Regulator voltage		12V	←
	Brush	Length	12.5mm	←
		Wear limit	7.0mm	←
Battery	Type		MF	←
	Capacity		90AH	←

2. LAYOUT

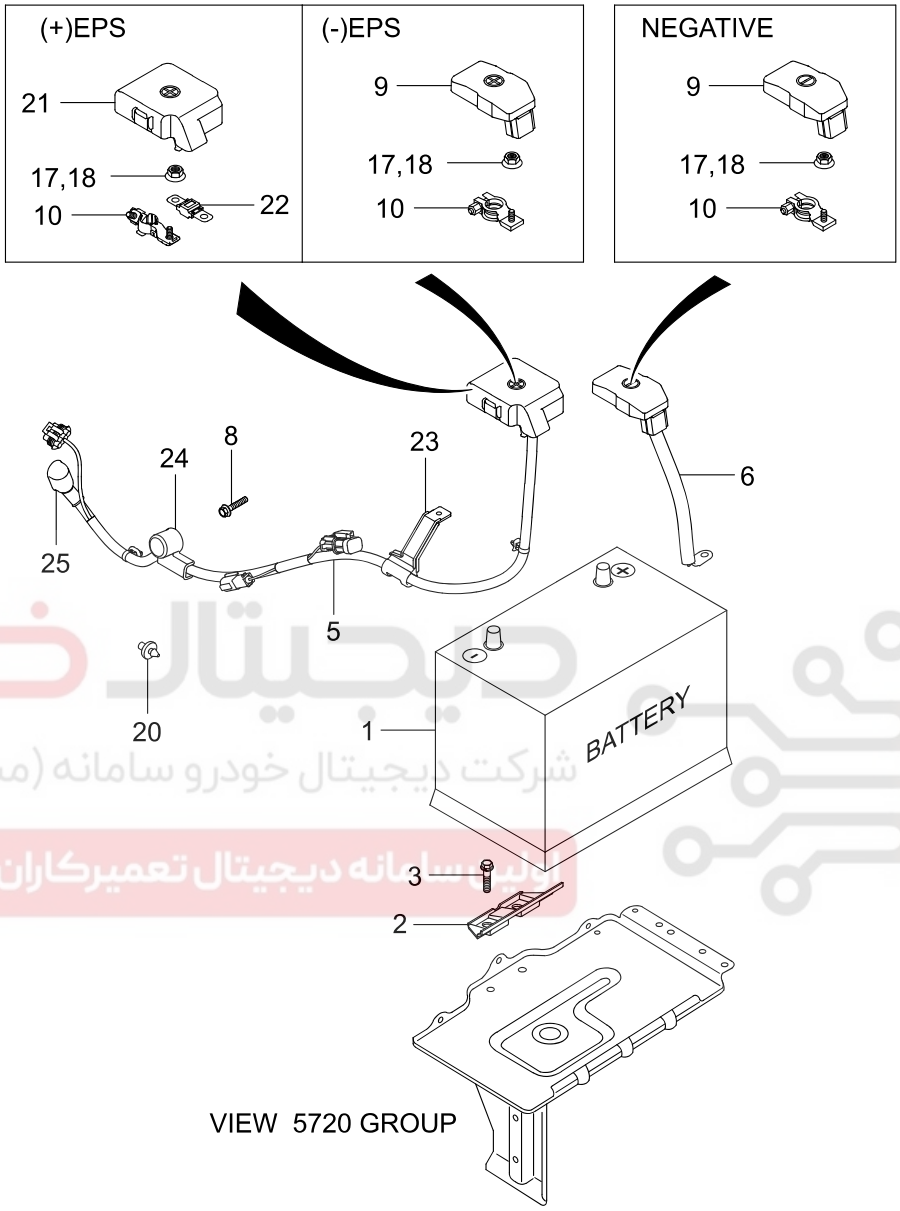
1) Alternator



1. Alternator assembly
2. Bolt

Modification basis	
Application basis	
Affected VIN	

2) Battery



1. Battery assembly
2. Clamp - Battery
3. Bolt
5. Cable assembly - Cable positive
6. Cable assembly - Battery ground
8. Bolt - Earth
9. Cap - Terminal
10. Connector - Battery
17. Nut
18. Nut
20. Cab - Earth
21. Box assembly - Battery sub
22. Fuse - MID 80A
23. Clamp - Battery cable
24. Grommet - Ring terminal
25. Grommet - Ring terminal

Modification basis	
Application basis	
Affected VIN	

3. 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 6Ω. - Faulty rotor coil or slip ring: If the measured resistance is less than 3Ω or greater than 6Ω.
L terminal voltage	1. Connect the B terminal wiring. 2. Measure the voltage with the engine running.	- Specification: 12.5V to 14.5V Faulty IC regulator or field - coil: If the measured voltage is 14.5V or higher.

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

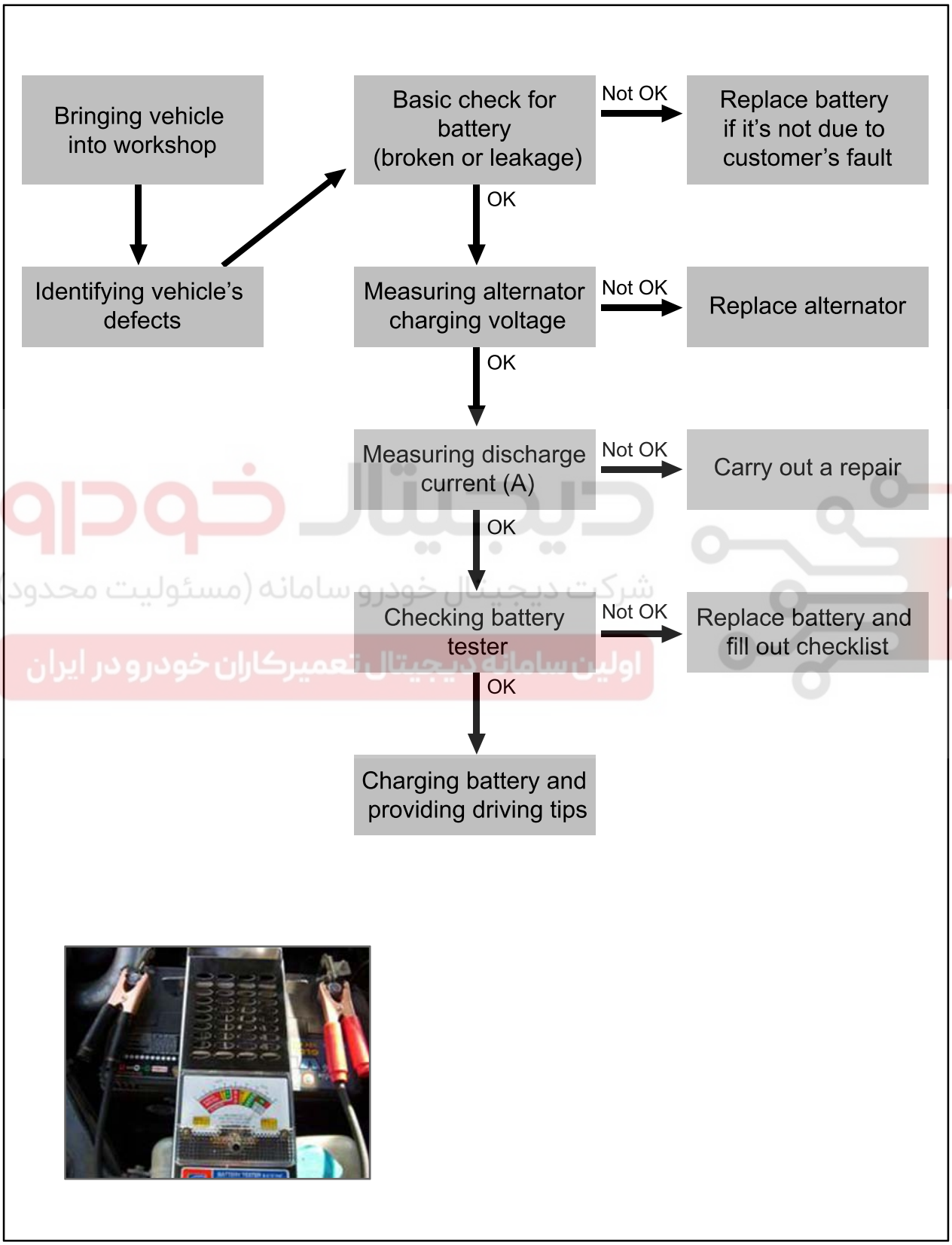
Modification basis	
Application basis	
Affected VIN	

▶ Troubleshooting

Item	Cause	Action
Overcharged battery	Defective alternator voltage regulator	Replace
	Defective voltage detection wiring	Repair or replace
Discharged battery	Loose alternator drive belt	just 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
	Terminated battery	Replace
	Defective ground	Repair
Charge warning lamp does not come on when turning on ignition switch with engine stopped	Defective alternator voltage regulator	Replace
	Open circuit in charge warning lamp, fuse or wiring	Replace or repair the charge warning lamp or fuse
	Defective ignition switch	Replace
	Defective ground of alternator circuit	Repair
Charge warning lamp does not go off after starting engine	Defective alternator voltage regulator	Replace
	Corroded or worn battery cable	Repair or replace
	Loose alternator drive belt	Adjust the belt tension or replace the belt
	Defective wiring harness	Repair or replace

2) Battery

▶ **Inspection**



Modification basis	
Application basis	
Affected VIN	

▶ 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.

▶ How to use battery tester

- 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.
-

- 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	

▶ Jump start

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.

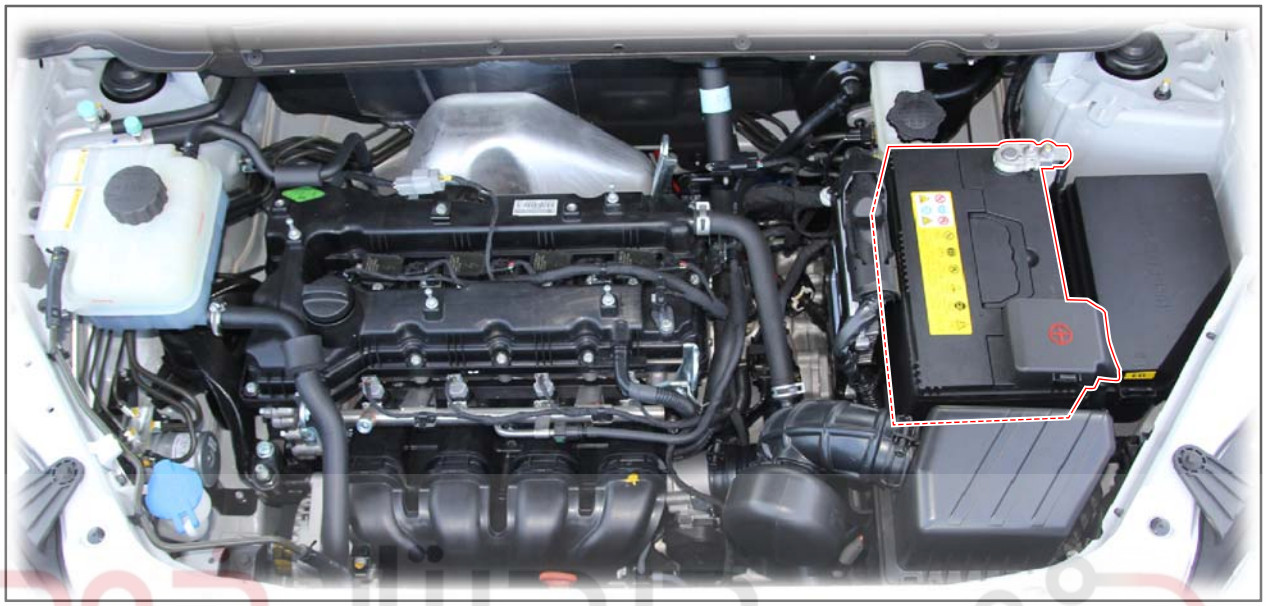
▶ Starting

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	

▶ 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.

OVERVIEW AND OPERATING PROCESS

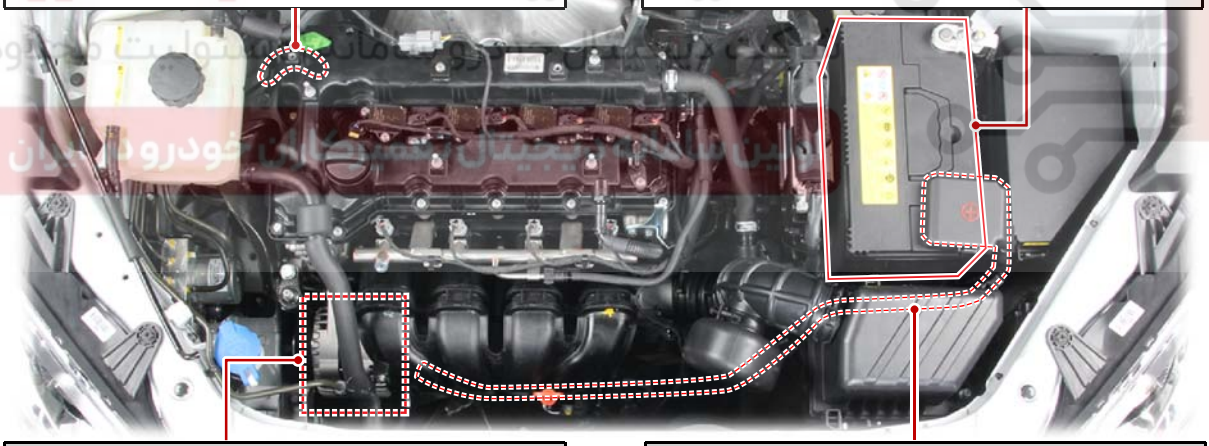
1. OVERVIEW

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.

Body ground

Battery

It converts the chemical energy to the electrical energy and supplies power to the corresponding electric units when starting the engine.



Alternator

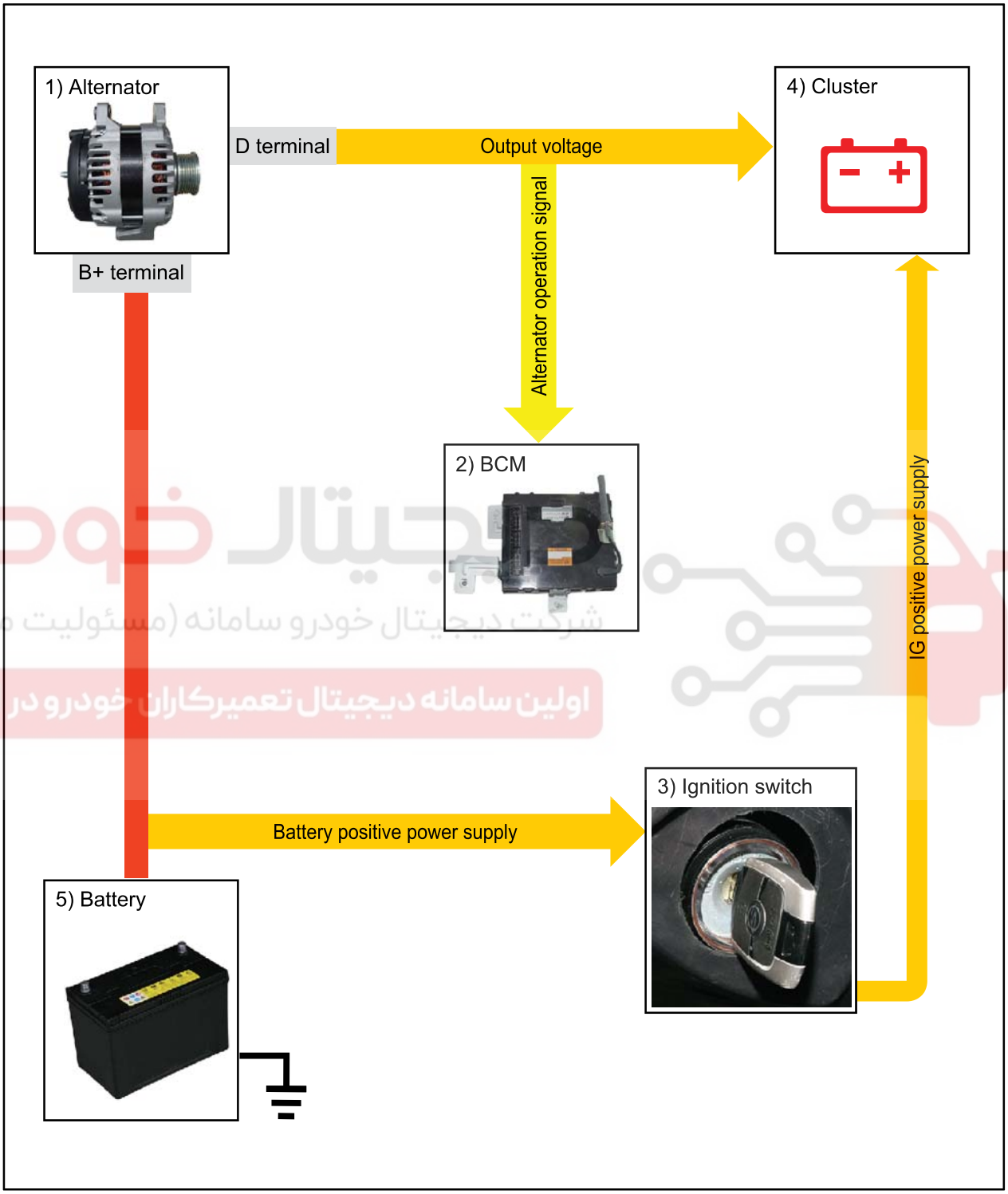
The alternator charges the battery and supplies power to each electric unit by converting the mechanical energy to the electrical energy.

B+ wiring

Modification basis	
Application basis	
Affected VIN	

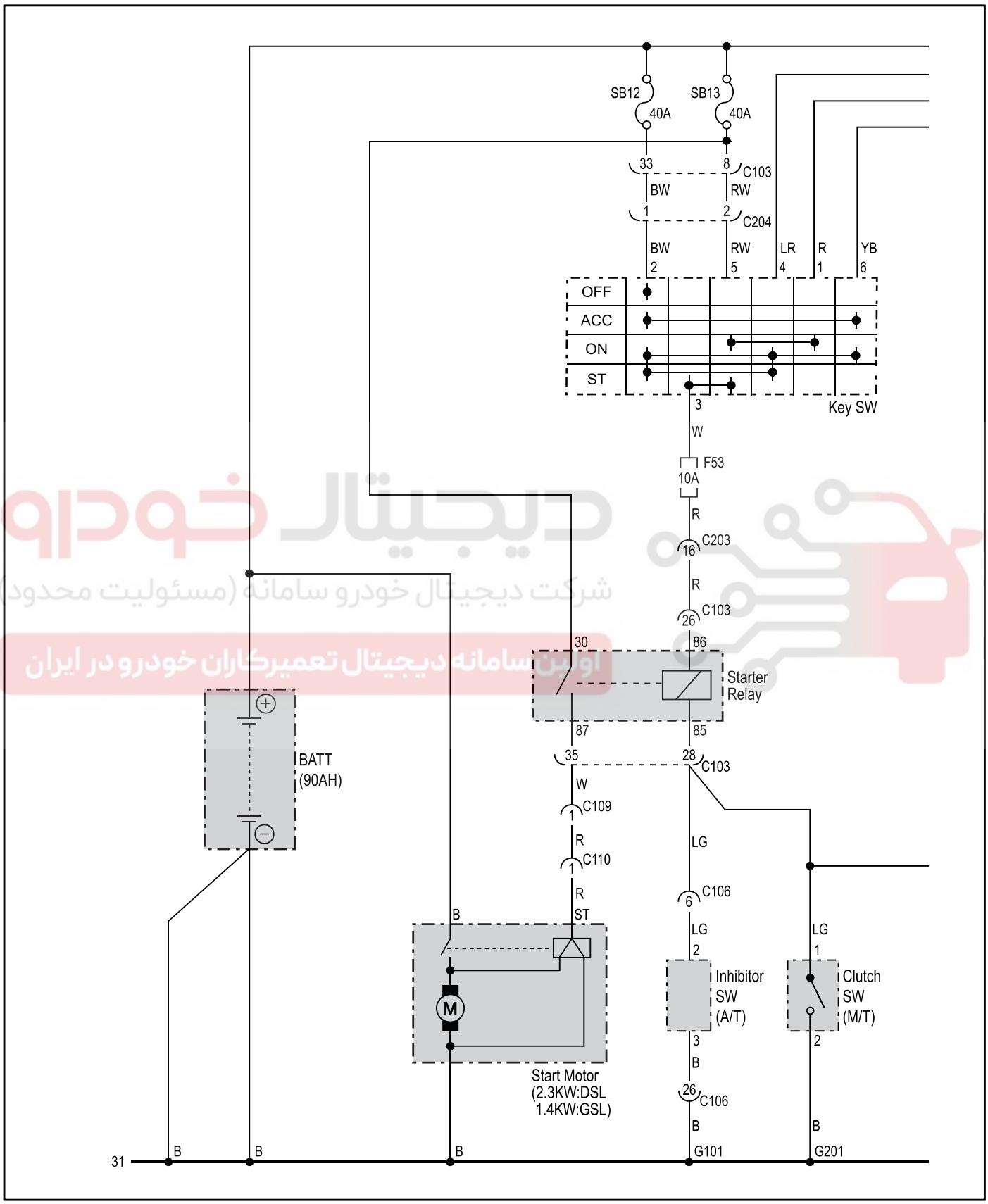
2. CHARGING OPERATION

1) Vehicle without Smart key system

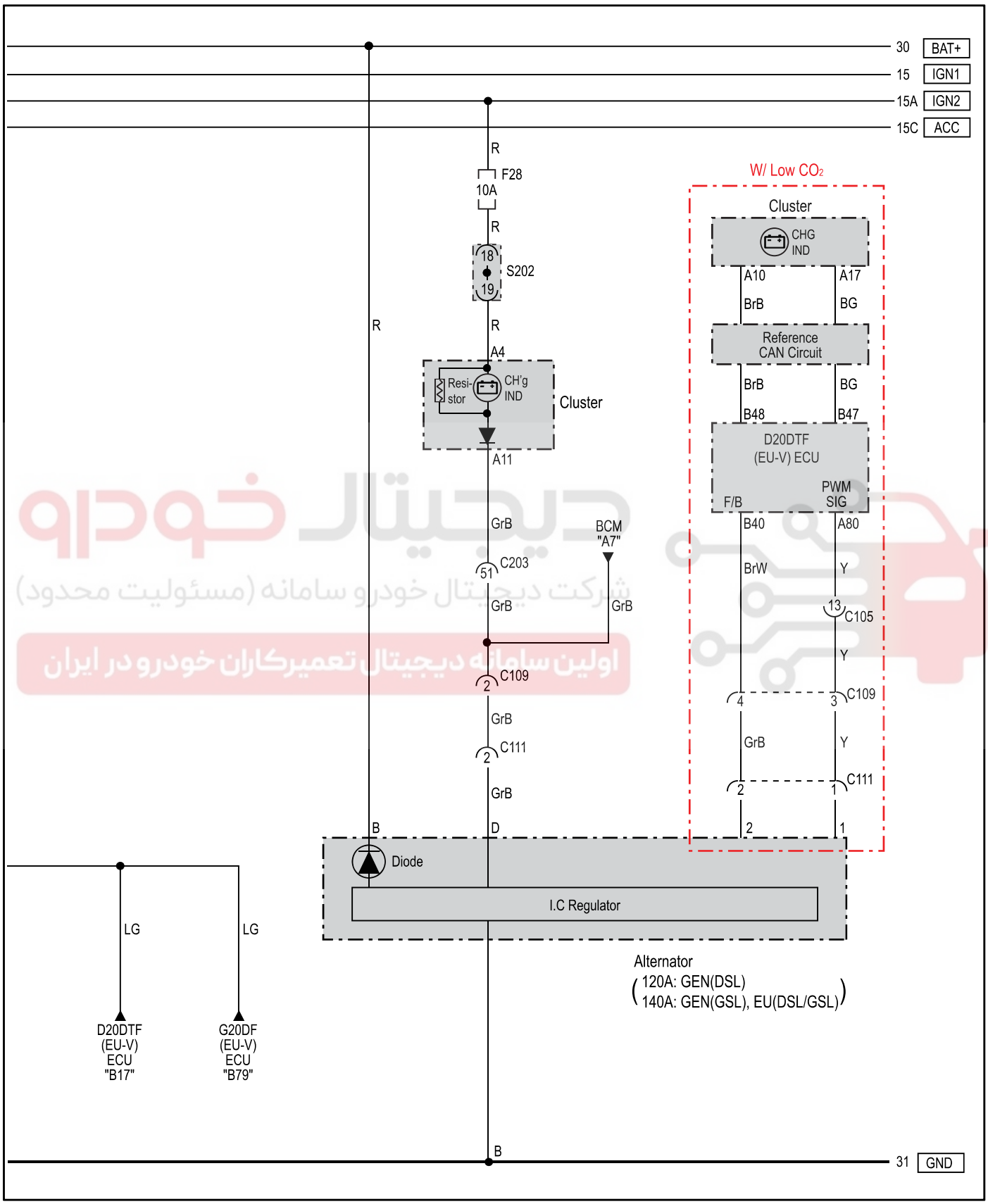


Modification basis	
Application basis	
Affected VIN	

2) Circuit Diagram



Modification basis	
Application basis	
Affected VIN	



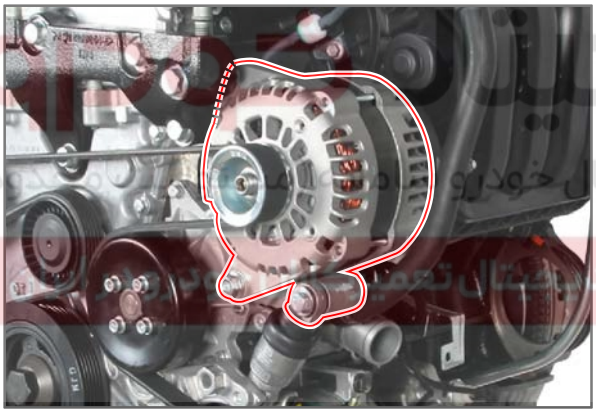
Modification basis	
Application basis	
Affected VIN	

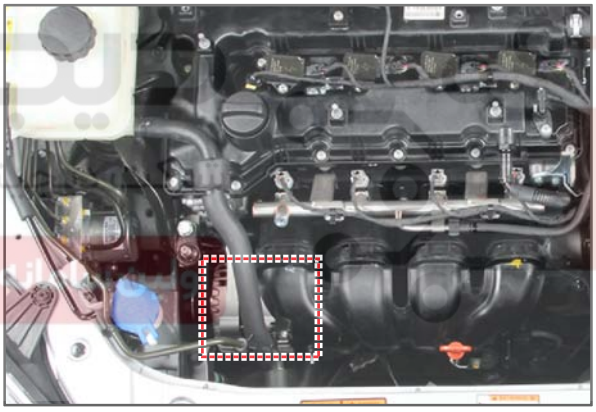
CONFIGURATION AND FUNCTION

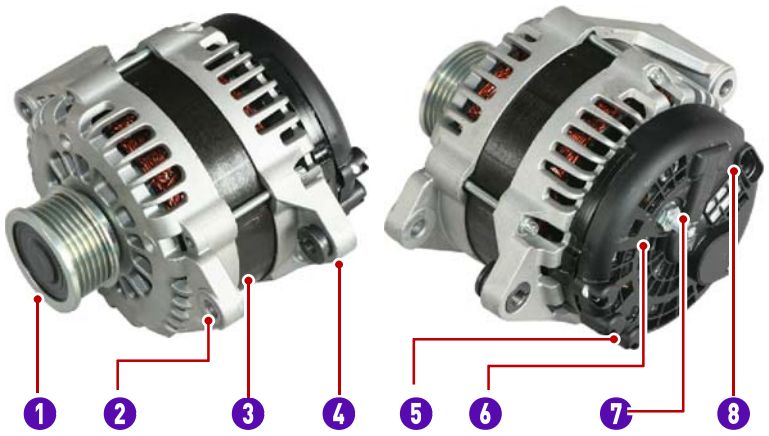
S.G.N. 1452-01 ALTERNATOR

1) Overview

The alternator charges the battery and supplies power to each electric unit by converting the mechanical energy to the electrical energy.
It has a integrated regulator. Unlike the 3-phase alternator, this alternator can use only two contact points which are the positive battery terminal and the charge warning lamp D+ terminal.
When turning the ignition switch to ON position, the charge warning lamp comes on. The warning lamp goes off when the engine starts running. If the charge warning lamp comes on during the engine is running, the charge system is defective. The charge warning lamp comes on not only when the system voltage is too low or high but also when there are other faults. The regulator obtains 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%.







1	**Pulley**
2	Front housing
3	Rotor assembly
4	Rear housing
5	Voltage regulator
6	Battery (+) terminal
7	Cooling fan
8	Plug connection

Modification basis	
Application basis	
Affected VIN	

3) 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.

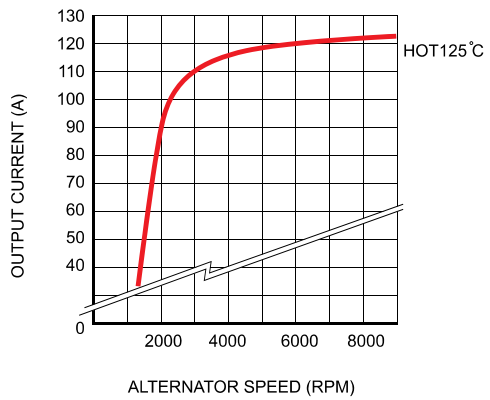
Temperature: The lower the temperature is, the longer the time taken to charge the battery. When connecting the battery charger to the cold battery, the amount of current the battery can accept initially is very small. As the battery gets warmer, it can accept more current.

Charging capacity: Charging a battery with a low-capacity charger takes longer time than charging with a high-capacity charger.

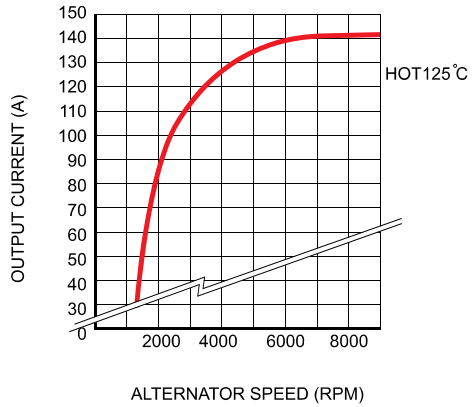
Charging status: Charging a fully depleted battery takes twice or more as long as charging a half-depleted battery. Since the electrolyte in a fully depleted battery consists of nearly pure water and conductor, only a very small amount of current can be accepted by the battery initially. The charging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

4) Output Characteristics

Alternator (120 A)



Alternator (140 A)



Modification basis	
Application basis	
Affected VIN	

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.

Modification basis	
Application basis	
Affected VIN	

3) Characteristics

The battery installed to this vehicle is of maintenance free design which does not need maintenance, such as filling with distilled water, and is well secured from air except a small vent hole on the side. The 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 to a traditional battery.

▶ Class

Batteries can be divided into two classes:

1. Reverse capacity rating: Designated at the temperature of 27℃, which is the time that a fully charged battery can supply current of 25 A or higher and voltage of 10.5 V or higher.
2. Cold cranking ampere rating: Determined from the test performed at the temperature of -18℃, and this indicates the cranking load capacity.

▶ Reverse capacity

The reverse capacity (RC) is the maximum length of time that a vehicle can be driven at night with the minimum electrical load with no output from the alternator. Expressed in minutes, the reserve capacity (or RC rating) is the length of time that a fully charged battery can reach a terminal voltage of 10.5 V by being discharged at a current of 25 A and at a temperature of 27°C.

▶ Cold cranking ampere

The cold cranking ampere test is carried out at a temperature of −18℃ (0°F). The current rating should be minimum level and the battery is maintained for 30 seconds at the specified temperature while meeting a minimum voltage requirement of 7.2 V. This rating is a measurement of cold cranking capacity. The battery life is limited but can be extended as long as possible by maintaining it properly. The following factors may point to the cause of shortened battery life:

- Electric unit in the vehicle are left on overnight.
- Frequent low speed driving for a short period of time.
- When the vehicle's electrical load exceeds the alternator output, particularly with the addition of aftermarket equipment.
- Faults in the charge system, such as short circuit, slipping alternator belt and a malfunction of alternator or voltage regulator.
- Contamination or poor contact of battery cable terminal or careless handling, such as loose clamp. Short circuit or pinched wires.
-

▶ Charging a fully depleted battery (removed from vehicle)

Comply with the working procedures to avoid replacing the good battery unnecessarily. Charge the fully discharged battery according to the following procedures:

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 "Charging time required" in this section. The ammeter available in the field can't detect a very low current.

2. Set the battery on the high setting.

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 fully 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 is turned on and charged with a low voltage.

3. Keep charging the battery until the charging current can be measured. The battery charger varies 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	Time
16.0 or higher	Up to 4 hours
14.0~15.9	Up to 8 hours
13.9 or lower	Up to 16 hours

- If the charging current is not measured when the maximum charging time is 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.

CAUTION

It is important to remember that a completely discharged battery must be recharged for a sufficient time to restore the battery to a usable state.

- If the charging current is still not measurable even after the charging time, calculated using the calculated by the above method, has been passed, the battery should be replaced.

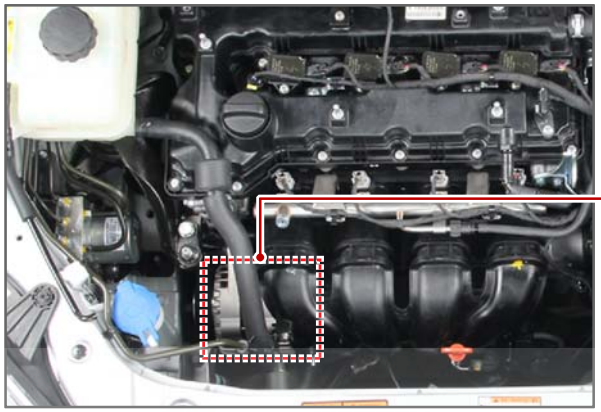
Modification basis	
Application basis	
Affected VIN	

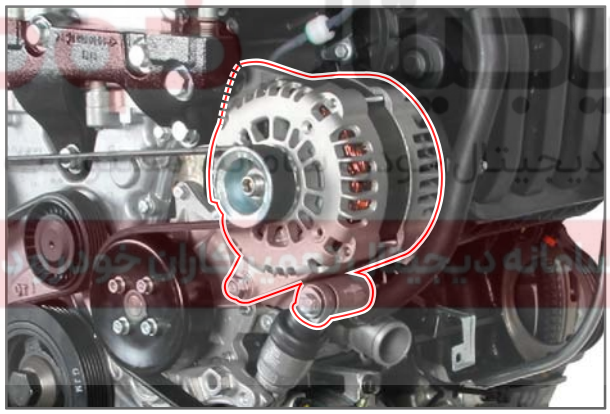
REMOVAL AND INSTALLATION

S.G.N. 1452-01

ALTERNATOR

Preceding work
- Disconnect the negative cable from the battery.
- Remove the engine acoustic cover.
- Remove the under cover.





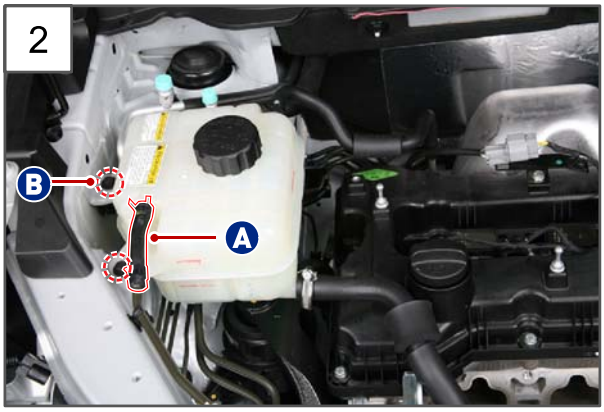
Alternator

1

1. Support the bottom of engine oil pan with a safety jack.

Modification basis	
Application basis	
Affected VIN	

2

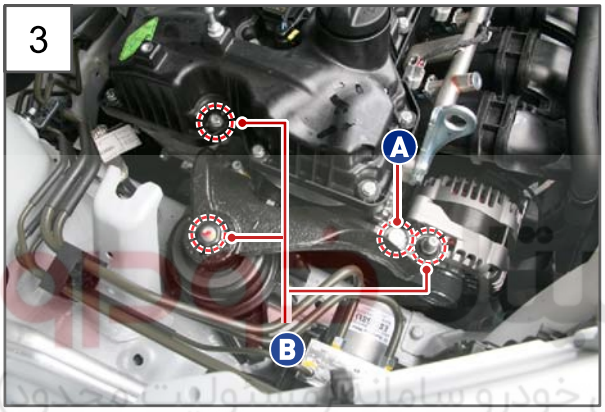


2. Separate the deaeration hose (A) and unscrew two bolts (B, 10 mm).

Tightening torque (B) 10.0 ± 1.0Nm

CAUTION
Do not allow the coolant to make contact with the body paintwork and engine.

3



3. Unscrew the bolt (A, 17 mm) and the nut (B, 17 mm) from the left bracket.

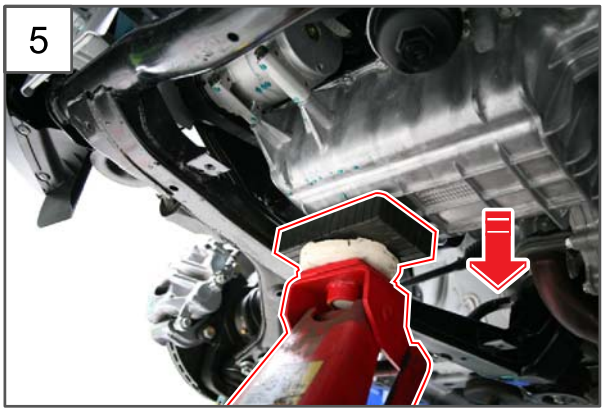
Tightening torque (A) 55.0 ± 5.0Nm

Tightening torque (B) 55.0 ± 5.0Nm

4

4. Remove the left bracket.

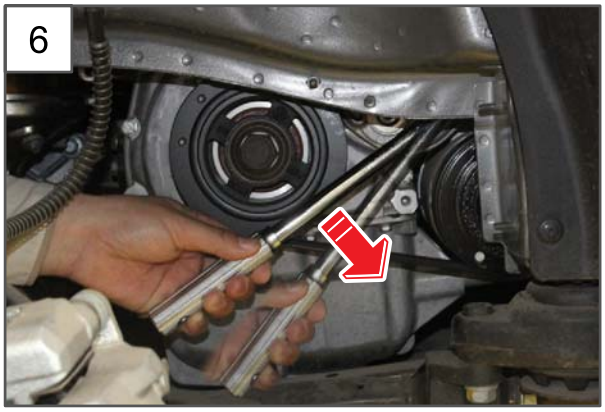
5



5. Slowly lower the floor jack as it goes without any overload to emgine mountings.

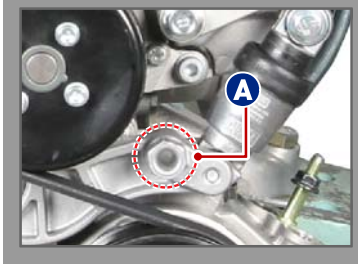
Modification basis	
Application basis	
Affected VIN	

6



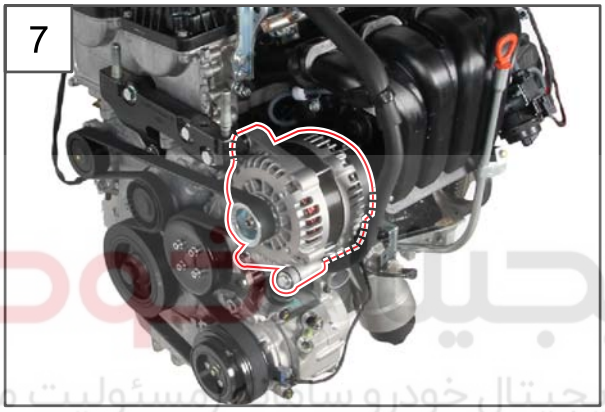
6. Release the tension by turning the hydraulic tensioner adjust bolt (A) counterclockwise.

NOTE

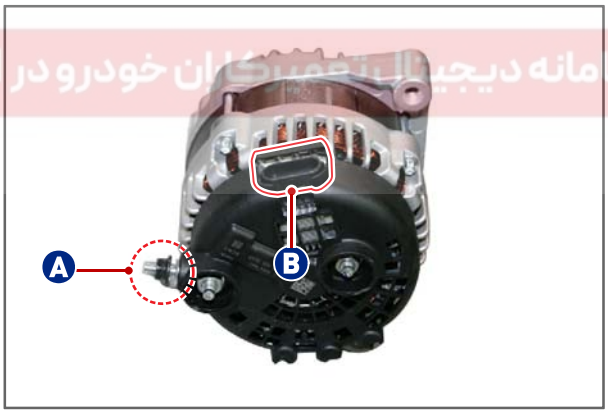


Carry out the work using a hinge handle connecting rod, if necessary.

7



7. Disconnect the alternator connector (A) and the battery plug connection (B).



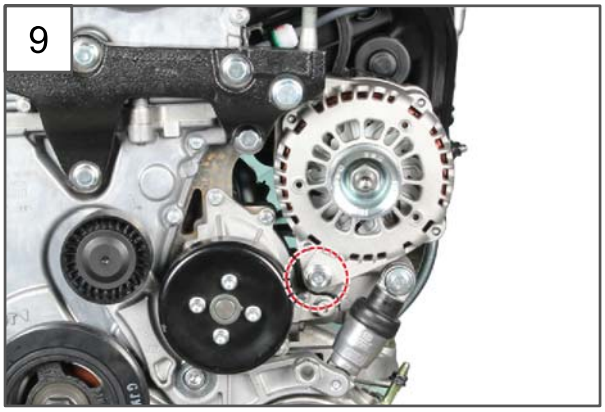
CAUTION

Poor contact of alternator ground can make the voltage between B+ terminal and ground.

8

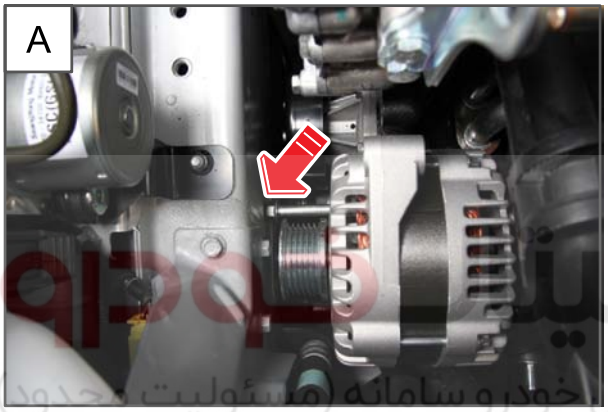
8. Unscrew the upper bolt (17 mm) from the alternator.

Tightening torque 45.0 ± 4.5Nm

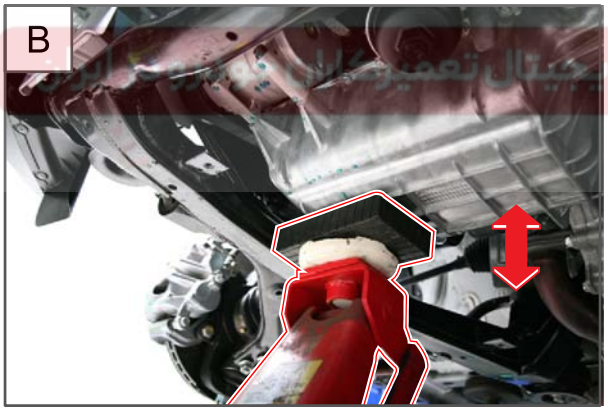


9. Unscrew the bolt (15 mm) and remove the alternator.

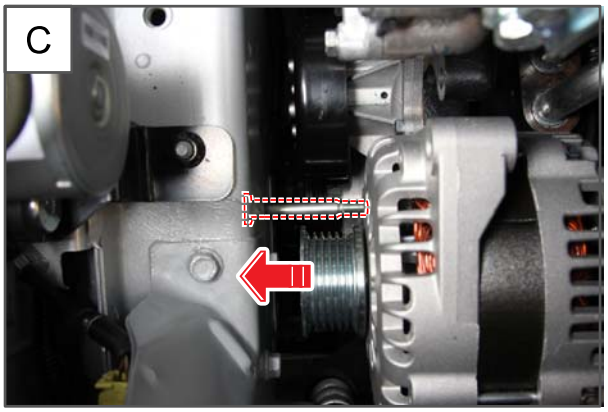
Tightening torque 45.0 ± 4.5Nm



A. Pull out the bolt near the hole in frame.



B. Move up or down the engine with the floor jack to align the hole in frame with the bolt.

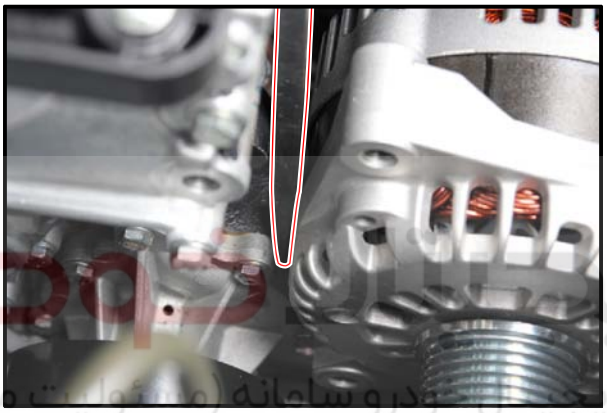


C. Remove the bolt through the hole.

Modification basis	
Application basis	
Affected VIN	

10

10.Separate the alternator.



11

11.Remove the alternator from engine compartment.

12

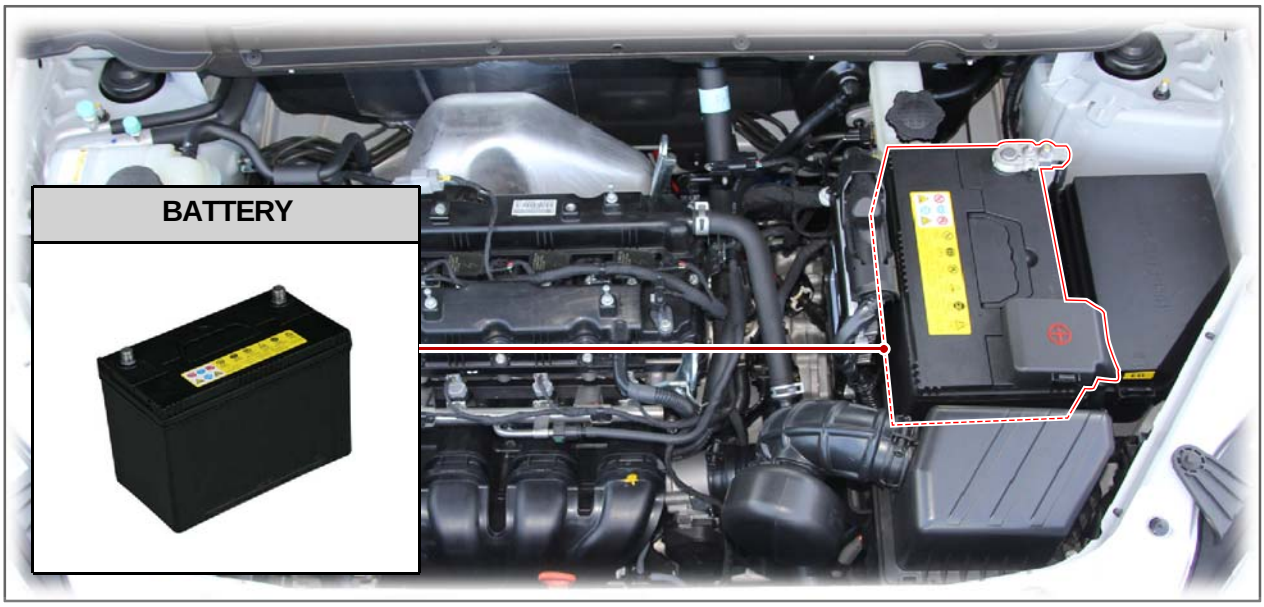
12.Install the alternator in the reverse order of removal.

Cautions when installing	
	To make the reassembly easy, slide the bushing in bracket to arrow direction (A).

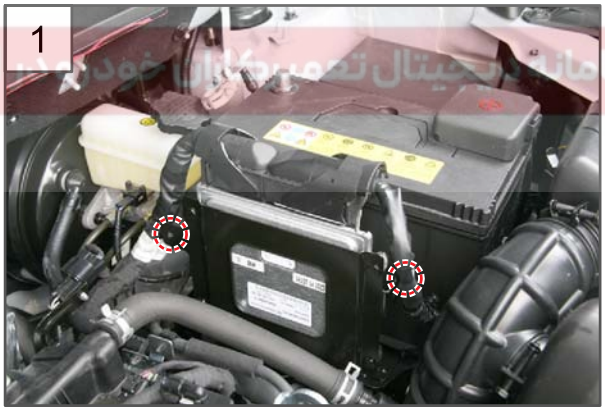
Modification basis	
Application basis	
Affected VIN	

S.G.N. 2610-01

BATTERY



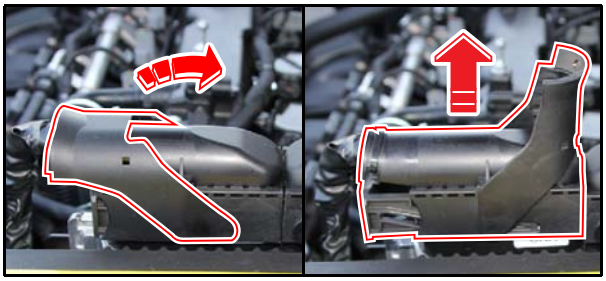
1



1. Release two clamps from the engine ECU wiring harness.

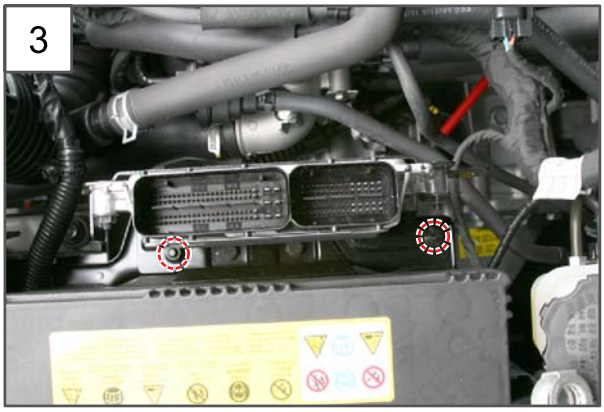
2

2. Disconnect the engine ECU connectors (A, B).



Modification basis	
Application basis	
Affected VIN	

3



3. Unscrew two nuts (12 mm) from the engine ECU bracket.

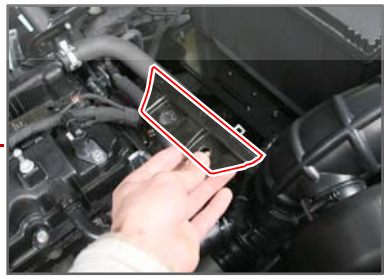
Tightening torque 9.0 ~ 10.0Nm

4

4. Remove the engine ECU assembly.

5

5. Unscrew two bolts (12 mm) and remove the battery holder.



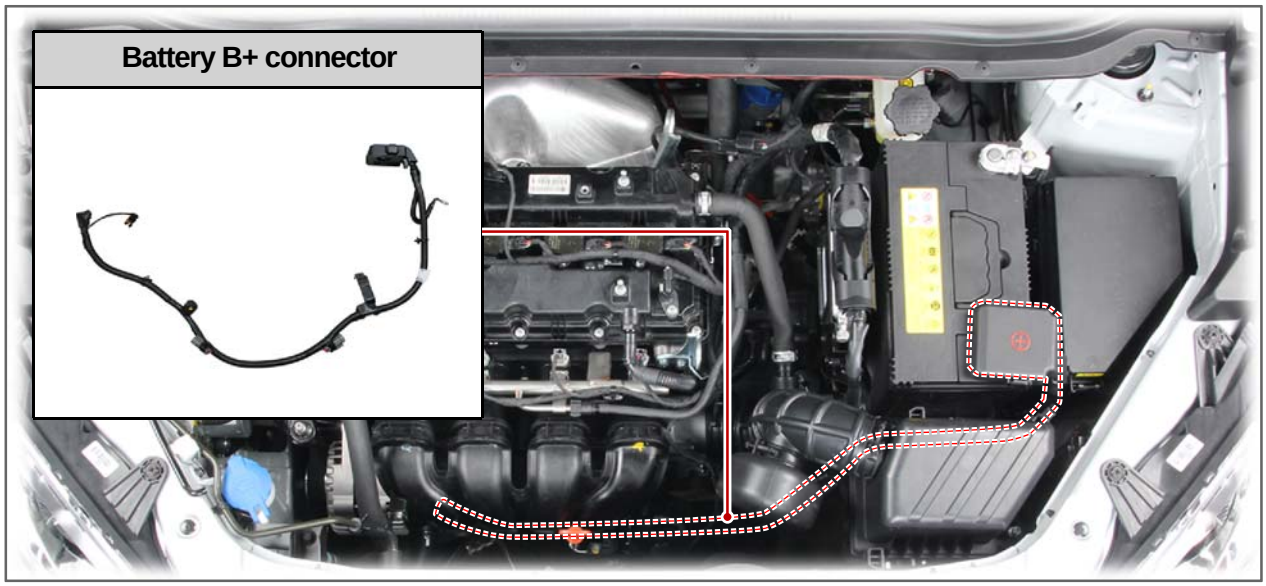
6

6. Remove the battery.

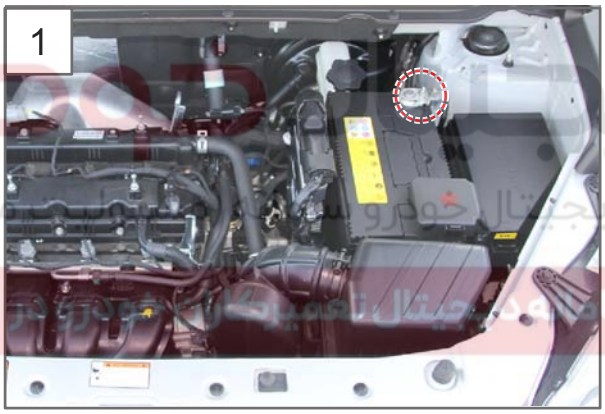
7. Install the battery in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

S.G.N.
2610-05 BATTERY B+ CABLE



1



1. Unscrew the terminal "−" mounting nut (10 mm).

Tightening torque 10.0 ± 1.0Nm

2

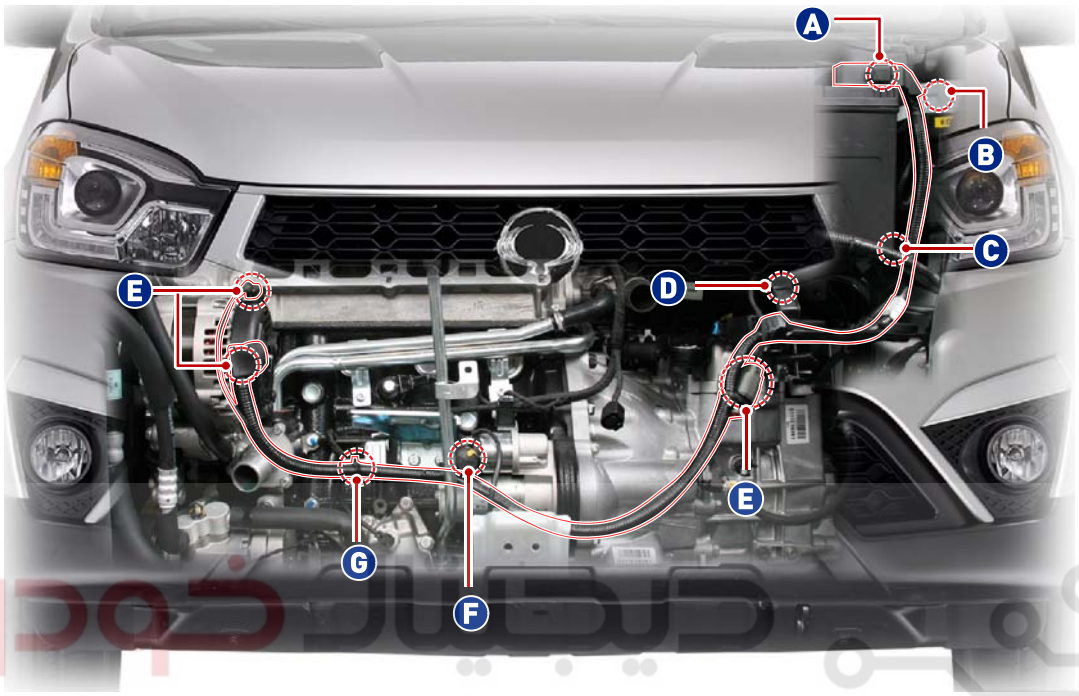
2. Remove the intake air cleaner assembly.

NOTE

Refer to Chapter "Intake System".

3. Remove the battery B+.

3



A

A. Push the lock of terminal "+" cover to open it.

B

B. Unscrew the power cable mounting nut (10 mm).

Tightening torque 10.0 ± 1.0Nm

Modification basis	
Application basis	
Affected VIN	

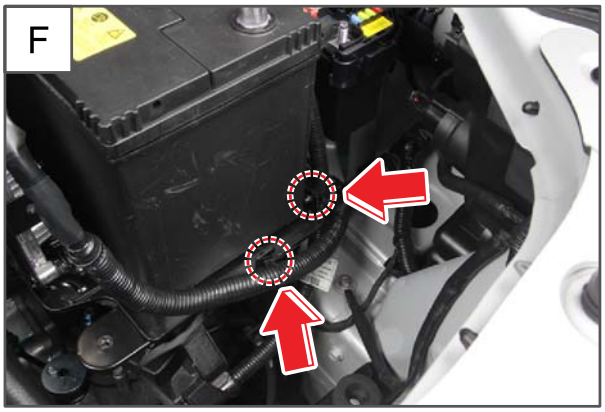
C. Unscrew the battery B+ mounting nut (10 mm).

Tightening torque 10.0 ± 1.0Nm

D. Remove the fuse and relay box cover.

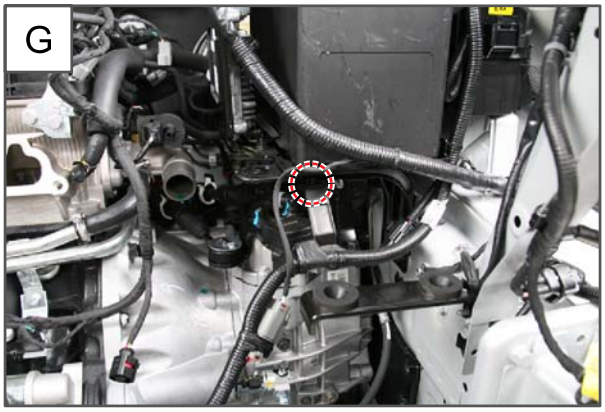
E. Unscrew “+” cable mounting nut (10 mm) in fuse and relay box.

Tightening torque 10.0 ± 1.0Nm



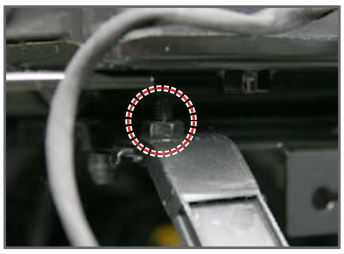
F. Release two locks on battery tray.

G



G. Unscrew the battery B+ mounting bracket nut (10 mm).

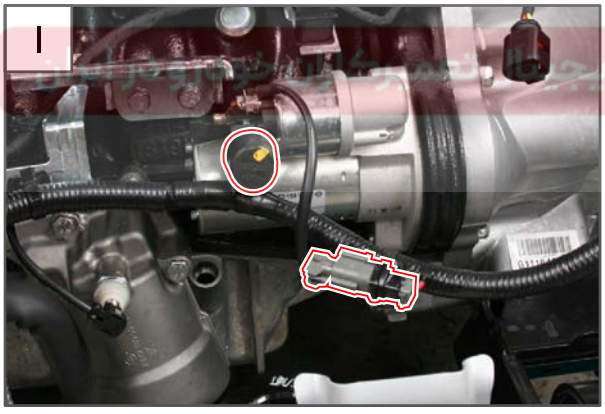
Tightening torque 10.0 ± 1.0Nm



H

H. Disconnect the connector.

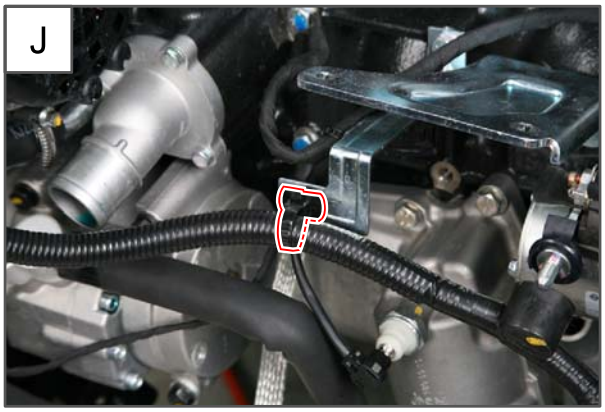
I



I. Disconnect the ST terminal and battery B+ from the start motor.

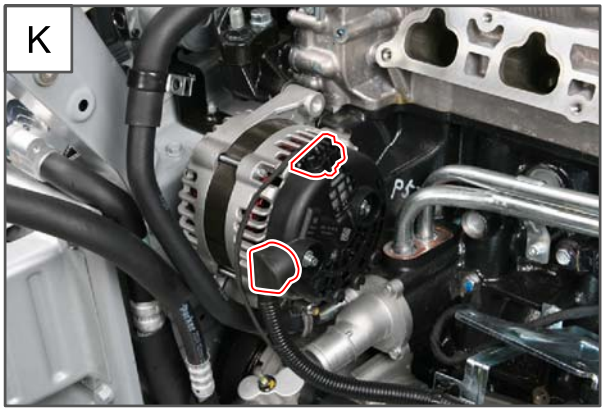
Tightening torque 15.0 ± 1.5Nm

J



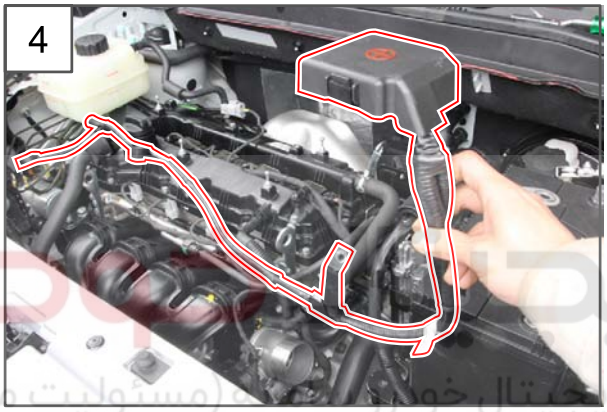
J. Release the lock of battery B+ between start motor and alternator.

Modification basis	
Application basis	
Affected VIN	



K. Disconnect the alternator connector and unscrew the alternator B+ mounting nut.

Tightening torque 12.0 ~ 15.0Nm



4. Remove the battery B+ cable from the vehicle.

5. Install the battery B+ cable in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

Memo