

Engine Electrical System

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EE -2

ENGINE ELECTRICAL SYSTEM

GENERAL**ELECTRICAL AND ELECTRONIC SPECIFICATIONS****SPECIFICATION** EEC7BAAD**IGNITION SYSTEM**

Item		Specifications		
		2.7	2.0	
Ignition coil	Type	Mold coil type	Mold coil type	
	Primary resistance	0.74 ± 10%(Ω)	0.58 ± 10%(Ω)	
	Secondary resistance	13.3 ± 15%(kΩ)	8.8 ± 15%(kΩ)	
Spark plugs	Leaded	NGK	BKR5ES	
		CHAMPION	RC10YC	
	Unleaded	NGK	PFR5N-11	BKR5ES-11
		CHAMPION	RC10PYPB4	RC10YC4
	Gap		1.0 mm ~ 1.1 mm (Unleaded) 0.7 mm ~ 0.8 mm (Leaded)	

STARTING SYSTEM

Item		Specifications			
		2.7	2.0	DIESEL	
Starter	Type	Reduction drive (with planetary gear)			
	Rated voltage	12V, 1.2KW	12V, 1.2KW	12V, 2.0KW	
	No. of pinion teeth	8	8	9	
	No-load characteristics	Voltage	11V	11V	11.5V
		Amperage	90A, MAX	90A, MAX	120A, MAX
		Speed	3,000rpm, MIN	3,000rpm, MIN	4,000rpm, MIN
	Commutator diameter	Standard	29.4 mm (1.157 in.)		35 mm (1.378 in)
		Limit	28.4 mm (1.118 in.)		
	Undercut depth	Standard	0.5 mm (0.02 in.)		0.7 mm (0.028 in)
		Limit	0.2 mm (0.008 in.)		

GENERAL

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CHARGING SYSTEM

Item		Specifications		
		2.7	2.0	DIESEL
Alternator	Type	Battery voltage sensing		
	Rated voltage	12V, 120A	13.5V, 90A	12V, 120A
	Speed	1,000 ~ 18,000 rpm		1,000 ~ 12,000 rpm
	Voltage regulator	Electronic built-in type		I.C regulator built-in type
	Regulator setting voltage	14.55 ± 0.2V	14.4 ± 0.3V	14.4 ± 0.3V
	Temperature compensation	-3.5 ± 1mV/°C	-10 ± 3mV/°C	-10 ± 3mV/°C
Battery	Type	MF 70 AH	MF 60 AH	MF 90 AH
	Cold cranking amperage at-18°C (0°F)	600A	550A	720A
	Reserve capacity	113min	92min	160min
	Specific gravity at 20°C (77°F)	1.280 ± 0.01	1.280 ± 0.01	1.280 ± 0.01

NOTE

- COLD CRANKING AMPERAGE is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2V or greater at a specified temperature.

- REVERSE CAPACITY RATING is amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5V at 26.7°C(80°F)

PREHEATING SYSTEM

Item		Specifications
Glow plug	Rated voltage	DC 11V
	Current	16A ± 1.5A after 4 seconds loading at rated voltage
Glow plug relay	Rated voltage	DC 12V
	Operating voltage range	DC 9V ~ DC 16V
	Operating temperature range	-40°C ~ 120°C
	Rated load current	DC 12V, 70A

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ENGINE ELECTRICAL SYSTEM

AUTO CRUISE CONTROL SYSTEM

Items	Specification
Setting error	Within ± 1.5 Km/h on level road
Vehicle speed memory variation	No variation
Setting time	0.1sec max.
Resuming time	0.1sec max.
Minimum operating speed	40 \pm 2Km/h
Cancel speed range	15 \pm 2Km/h
Maximum memorized speed	160 \pm 2Km/h
Pulling force	127N(13Kgf)
Main switch serial resistance value	3.9k Ω \pm 1%
Command switch serial resistance value	SET switch : 220 Ω \pm 1%
	RESUME switch : 910 Ω \pm 1%

TIGHTENING TORQUE

Items	Nm	kg-cm	lb-ft
Generator terminal (B+)	5 ~ 7	50 ~ 70	3.6 ~ 5.1
Starter motor terminal (B+)	10 ~ 12	100 ~ 120	7.3 ~ 8.8
Battery terminal	4 ~ 6	40 ~ 60	2.9 ~ 4.3
Spark plug	20 ~ 30	200 ~ 300	15 ~ 22
Glow plug	15 ~ 20	150 ~ 200	11 ~ 15
Glow plug plate attaching nut	0.8 ~ 1.5	8 ~ 15	0.6 ~ 1.1

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GENERAL

EE -5

GENERAL DIAGNOSTICS AND TESTS**TROUBLESHOOTING**

ED9ACB48

IGNITION SYSTEM

Symptom	Suspect Area	Remedy (See Page)
Engine will not start or is hard to start (Crank OK)	Ignition lock switch Ignition coil Spark plugs Ignition wiring disconnected or broken Spark plug cable	See page EE-23 See page EE-21 See page EE-19 Inspect See page EE-19
Rough idle or stalls	Ignition wiring Ignition coil Spark plug cable	Inspect See page EE-21 See page EE-19
Engine hesitates/poor acceleration	Spark plugs and spark plug cable Ignition wiring	See page EE-19 Inspect
Poor mileage	Spark plugs and spark plug cable	See page EE-19

CHARGING SYSTEM

Symptom	Suspect Area	Remedy (See Page)
Charging warning indicator does not light with ignition switch "ON" and engine off	Fuse blown Light burned out Wiring connection loose Electronic voltage regulator	Check fuses Replace light Tighten loose connections See page EE-29
Charging warning indicator does not go out with engine running (Battery requires frequent recharging)	Drive belt loose or worn Battery cables loose, corroded or worn Fuse blown Fusible link blown Electronic voltage regulator or generator Wiring	See page EE-28, 45 See page EE-48 Check fuses Replace fusible link See page EE-29 Repair wiring
Engine hesitates/poor acceleration Overcharge	Drive belt loose or worn Wiring connection loose or open circuit Fusible link blown Poor grounding Electronic voltage regulator or generator Worn battery Electronic voltage regulator Voltage sensing wire	See page EE-28, 45 Tighten loose connection or repair wiring Replace fusible link Repair See page EE-29 Replace battery See page EE-29 Repair wire

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ENGINE ELECTRICAL SYSTEM

STARTING SYSTEM

Symptom	Suspect Area	Remedy (See Page)
Engine will not crank	Battery charge low Battery cables loose, corroded or worn out Transaxle range switch (Vehicle with automatic transaxle only) Fusible link blown Starter motor faulty Ignition switch faulty	Charge or replace battery Repair or replace cables See page TR group-automatic transaxle Replace fusible link See page EE-54 See page EE-23
Engine cranks slowly	Battery charge low Battery cables loose, corroded or worn out Starter motor	Charge or replace battery Repair or replace cables See page EE-54
Starter keeps running	Starter motor Ignition switch	See page EE-54 See page EE-23
Starter spins but engine will not crank	Short in wiring Pinion gear teeth broken or starter motor Ring gear teeth broken	Repair wiring See page EE-54 See page EM group-fly wheel

CRUISE CONTROL SYSTEM



NOTE

Before troubleshooting :

- Check the ECM(10A), Horn(10A), ECU #3(10A) and ECU B+(15A) fuse in the under - hood fuse/relay box.
- Check that the horn sounds.
- Check the tachometer to see if it works properly.

Symptom	Suspect Area	See Page
Cruise control cannot be set	Remocon switch Brake switch A/T gear position switch Cruise control unit	See page EE-73 See page EE-74 See page TR group-automatic transaxle See page EE-8
Cruise control cannot be set but indicator light does not go on	Dimming circuit in gauge Cruise control unit	See page EE-8 See page EE-8
Cruise speed is noticeably higher or lower than what was set	Vehicle speed sensor Cruise control unit and actuator cable deflection Cruise control unit	See page TR group-automatic transaxle See page EE-74 See page EE-8
Excessive overshooting or undershooting when trying to set speed	Cruise control unit and actuator cable deflection Vehicle speed sensor Cruise control unit	See page EE-74 See page TR group-automatic transaxle See page EE-8
Speed fluctuation on a flat road with cruise control set	Vehicle speed sensor Cruise control unit and actuator cable deflection Cruise control unit	See page TR group-automatic transaxle See page EE-74 See page EE-8
Vehicle does not decelerate or accelerate accordingly when SET/RESUME/CANCEL button is pushed	Remocon switch Cruise control unit	See page EE-73 See page EE-8

GENERAL

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Symptom	Suspect Area	See Page
Cruise control does not cancel when shift lever is moved to N position (A/T)	A/T gear position switch Cruise control unit	See page TR group-automatic tranxaxle See page EE-8
Set speed is not cancelled when brake pedal is pushed	Brake switch Cruise control unit	See page EE-74 See page EE-8
Cruise control will not cancel when main switch is pushed OFF	Remocon switch Cruise control unit	See page EE-73 See page EE-8
Cruise control will not cancel when CANCEL button is pushed	Remocon switch Cruise control unit	See page EE-73 See page EE-8
Set speed will not resume when RESUME button (with main switch on, when set speed is temporarily cancelled)	Remocon switch Cruise control unit	See page EE-73 See page EE-8
The transmission shifts down slower than normal when going up a hill with the cruise control on (A/T)	Troubleshooting the cruise control communication circuit	See page EE-8

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EE -8

ENGINE ELECTRICAL SYSTEM

CRUISE CONTROL COMMUNICATION CIRCUIT TROUBLESHOOTING (A/T)

1. Start the engine.
2. Turn on the cruise control main switch, then drive the vehicle to speeds over 25 mph (40km/h) with the cruise control.

Does the cruise control operate ?

YES - Go to step 3.

NO - Check the cruise control unit or cruise control actuator.

3. Measure the voltage between the O/D control terminal of the cruise control unit connector and ground.

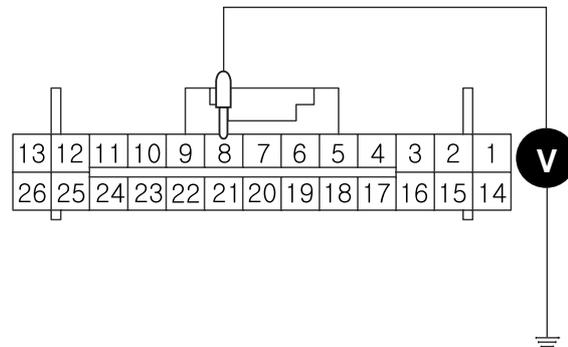
Is there approx. 1V?

YES - Go to step 4.

NO - Replace the cruise control unit.

4. Measure the voltage between the cruise control terminal of the TCM(or PCM) connector and ground.

2.7/Diesel



EBKE200D

2.0VVT



EBKE200C

EBKD200F

Is there approx. 1V?

YES - Check for loosen connectors. If necessary replace the TCM and recheck. (See Page TR group-automatic transaxle)

NO - Repair short or open in the wire between the TCM (or PCM) terminal and cruise control unit.

GENERAL

GENERAL INFORMATION

THE MICRO 570 ANALYZER EB27ECFA

The MICRO 570 Analyzer provides the ability to test the charging and starting systems, including the battery, starter and alternator.

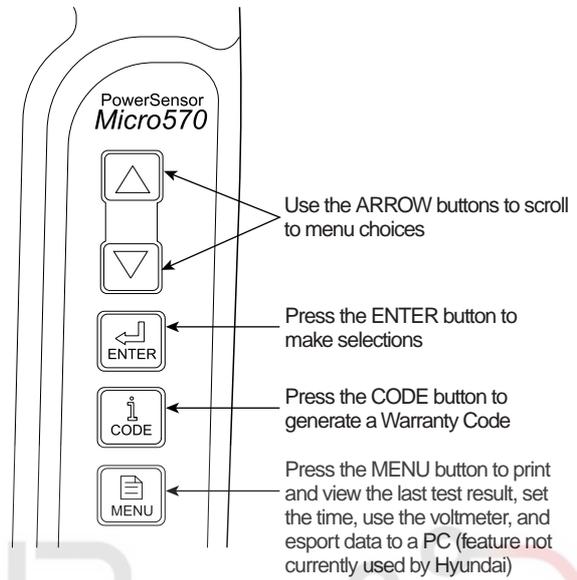
⚠ CAUTION

Because of the possibility of personal injury, always use extreme caution and appropriate eye protection when working with batteries.



KEYPAD

The MICRO570 button on the key pad provide the following functions :



EBKD001B

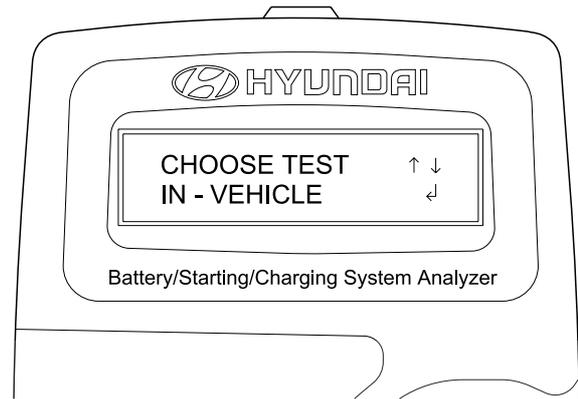
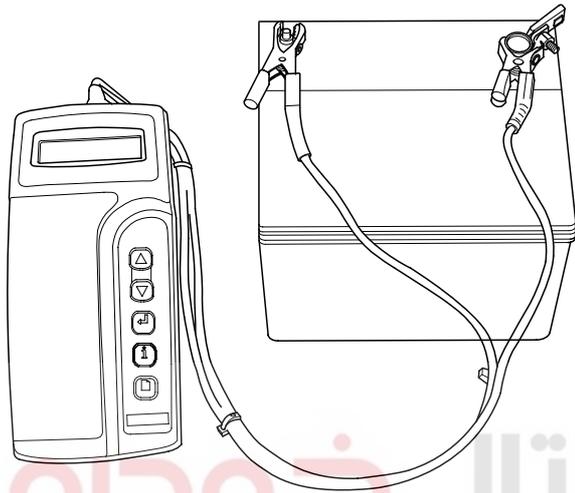
EBKD001A

EE -10

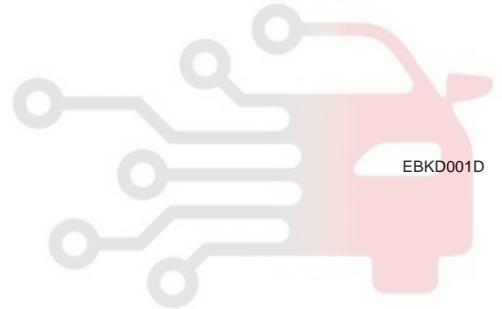
ENGINE ELECTRICAL SYSTEM

BATTERY TEST PROCEDURE

1. Connect the tester to the battery.
 - Red clamp to battery positive (+) terminal.
 - Black clamp to battery negative (-) terminal.
2. The tester will ask if the battery is connected "IN A VEHICLE" or "OUT OF A VEHICLE". Make your selection by pressing the arrow buttons; then press ENTER.



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EBKD001C

**CAUTION**

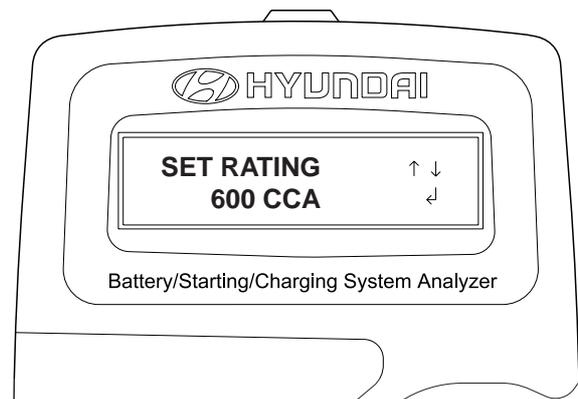
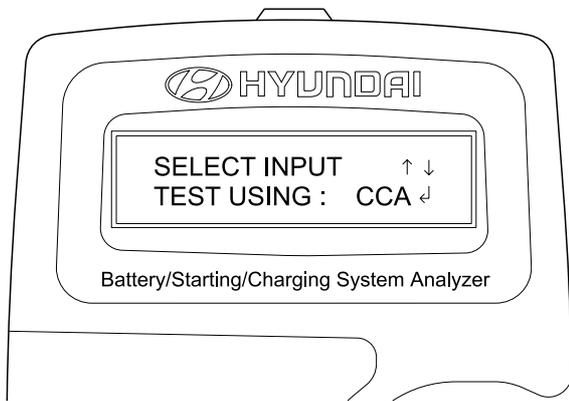
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Connect clamps securely. If "CHECK CONNECTION" message is displayed on the screen, reconnect clamps securely.

GENERAL

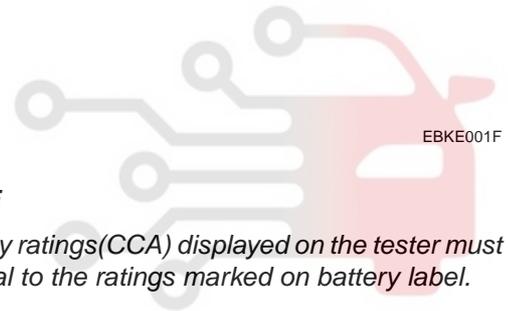
EE -11

3. Choose either CCA or CCP and press the ENTER button.
4. Set the CCA value displayed on the screen to the CCA value marked on the battery label by pressing up and down buttons and press ENTER.



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EBKD001E



EBKE001F

شرکت دیجیتال خودرو سامانه (مسئولیت خود)

**NOTE**

- CCA : Cold cranking amps, is an SAE specification for cranking batteries at 0° F (-18° C).
- CCP : Cold cranking amps, is an SAE specification for Korean manufacturer's for cranking batteries at 0° F (-18° C)

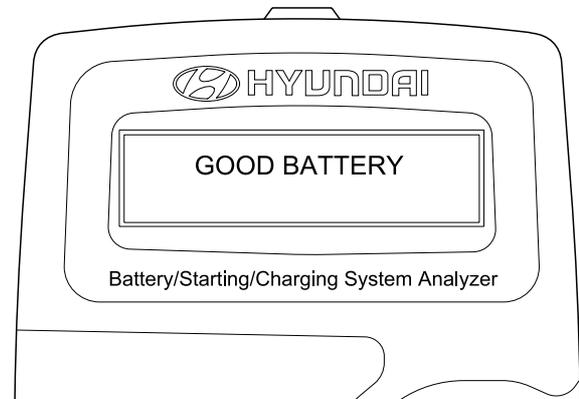
**NOTE**

The battery ratings(CCA) displayed on the tester must be identical to the ratings marked on battery label.

EE -12

ENGINE ELECTRICAL SYSTEM

5. The tester (Micro570) displays battery test results including voltage and battery ratings. A relevant action must be given according to the test results by referring to the battery test results as shown in the table below.



EBKD001G

6. To conduct starter test, continuously, press ENTER.

BATTERY TEST RESULTS

RESULT ON PRINTER	REMEDY
Good battery	No action is required
Good recharge	Battery is in a good state Recharge the battery and use
Charge & Retest	Battery is not charged properly ⇒ Charge and test the battery again (Failure to charge the battery fully may read incorrect measurement value)
Replace battery	⇒ Replace battery and recheck the charging system. (Improper connection between battery and vehicle cables may cause "REPLACE BATTERY", retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery)
Bad cell-replace	⇒ Charge and retest the battery. And than, test results may cause "REPLACE BATTERY", replace battery and recheck the charging system

⊗ WARNING

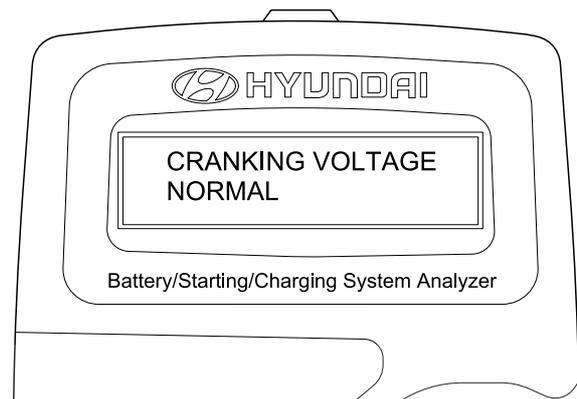
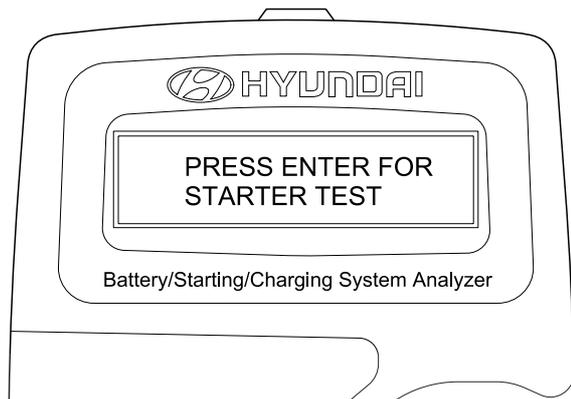
Whenever filing a claim for battery, the print out of the battery test results must be attached.

GENERAL

EE -13

STARTER TEST PROCEDURE

1. After the battery test, press ENTER immediately for the starter test.
3. Cranking voltage and starter test results will be displayed on the screen.
Take a relevant action according to the test results by referring to the starter test results as given below.



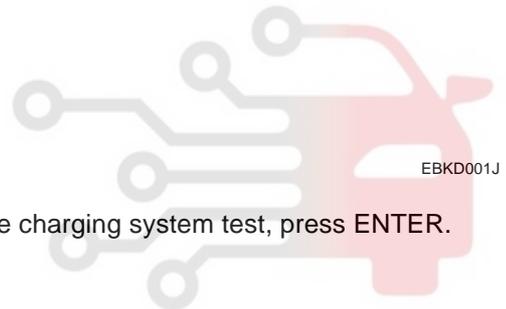
دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود) EBKD001H

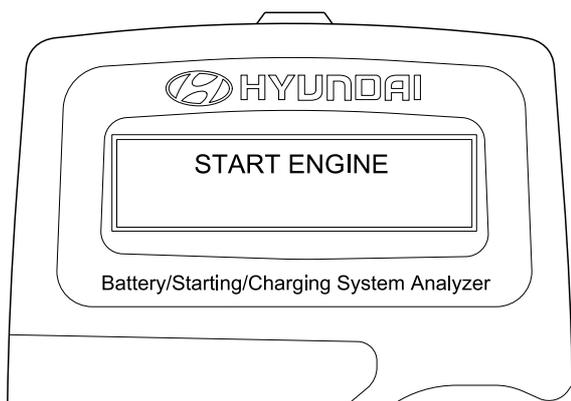
2. After pressing ENTER key, start the engine.

4. To continue charging system test, press ENTER.

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EBKD001J



EBKD001I

EE -14

ENGINE ELECTRICAL SYSTEM

STARTER TEST RESULTS

RESULT ON PRINTER	REMEDY
Cranking voltage normal	System shows a normal starter draw
Cranking voltage low	Cranking voltage is lower than normal level ⇒ Check starter
Charge battery	The state of battery charge is too low to test ⇒ Charge the battery and retest
Replace battery	⇒ Replace battery If the vehicle is not started though the battery condition of "Good and fully charged" is displayed. ⇒ Check wiring for open circuit, battery cable connection, starter and repair or replace as necessary. ⇒ If the engine does not crank, check fuel system.

 **NOTE**

When testing the vehicle with old diesel engines, the test result will not be favorable if the glow plug is not heated. Conduct the test after warming up the engine for 5 minutes.

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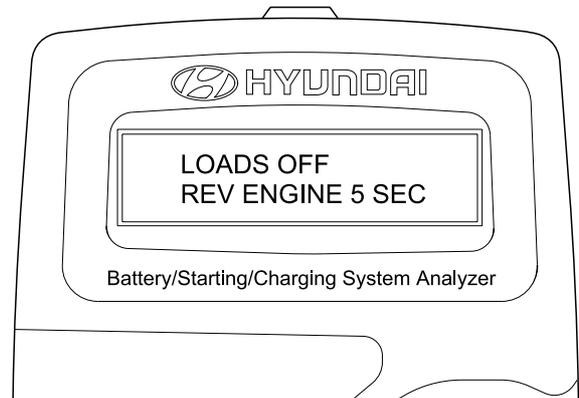
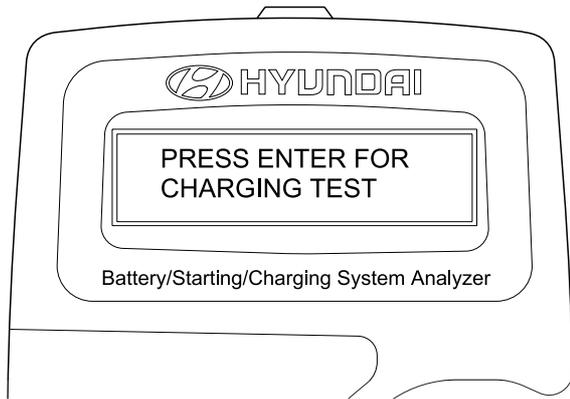
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GENERAL

CHARGING SYSTEM TEST PROCEDURE

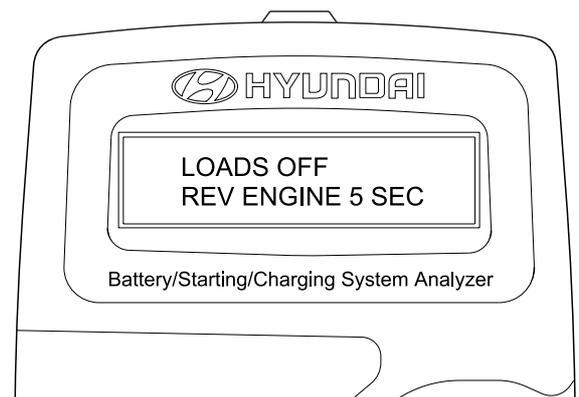
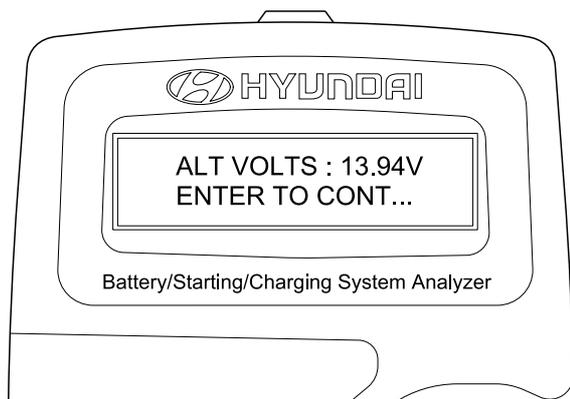
1. Press ENTER to begin charging system test.
3. Turn off all electrical load and rev engine for 5 seconds with pressing the accelerator pedal.



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EBKD001K

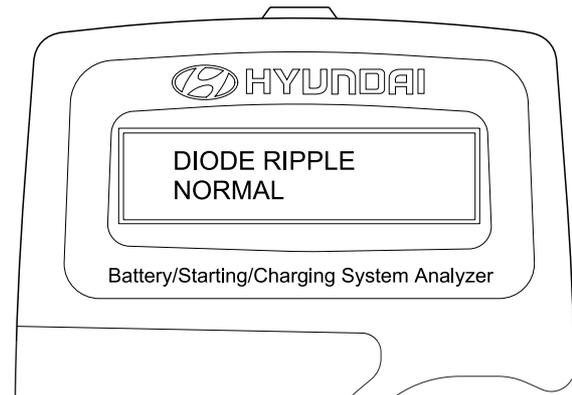
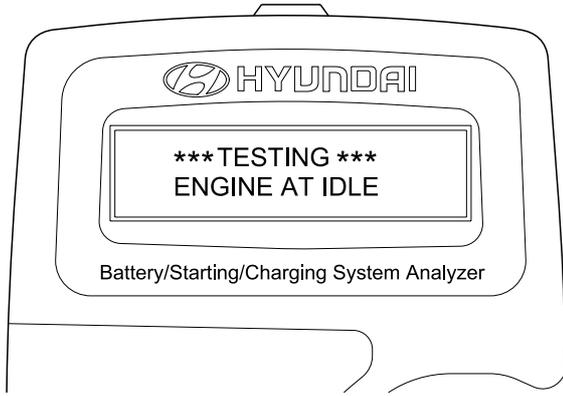
2. If ENTER button is pressed, the tester displays the actual voltage of alternator. Press ENTER to test the charging system.
4. Press ENTER.



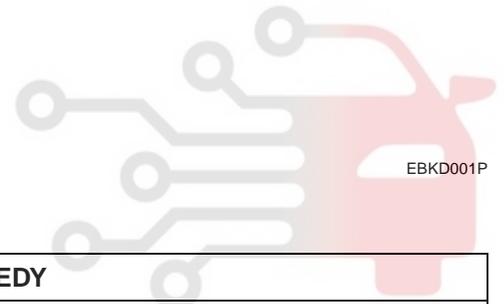
EBKD001N

EBKD001L

5. The MICRO 570 analyzer charging system output at idle for comparison to other readings.
6. Take a relevant action according to the test results by referring to the table below after shutting off the engine and disconnect the tester clamps from the battery.



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EBKD0010



CHARGING SYSTEM TEST RESULTS

RESULT ON PRINTER	REMEDY
Charging system normal/Diode ripple normal	Charging system is normal
No charging voltage	Alternator does not supply charging current to battery ⇒ Check belts, connection between alternator and battery Replace belts or cable or alternator as necessary
Low charging voltage	Alternator does not supply charging current to battery and electrical load to system fully ⇒ Check belts and alternator and replace as necessary
High charging voltage	The voltage from alternator to battery is higher than normal limit during voltage regulating. ⇒ Check connection and ground and replace regulator as necessary ⇒ Check electrolyte level in the battery
Excess ripple detected	One or more diodes in the alternator is not functioning properly ⇒ Check alternator mounting and belts and replace as necessary

IGNITION SYSTEM

ALL DESCRIPTION AND OPERATION

DESCRIPTION EFA97623

Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data for the engine operating conditions are pre-programmed in the memory of the ECM (engine control module).

The engine operating conditions (speed, load, warm-up condition, etc.) are detected by the various sensors. Based on these sensor signals and the ignition timing data, signals to interrupt the primary current are sent to the ECM. The ignition coil is activated, and timing is controlled.

CLEANING, INSPECTION, AND ADJUSTMENT

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



EE -18

ENGINE ELECTRICAL SYSTEM

ON-VEHICLE INSPECTION EDF8D76C

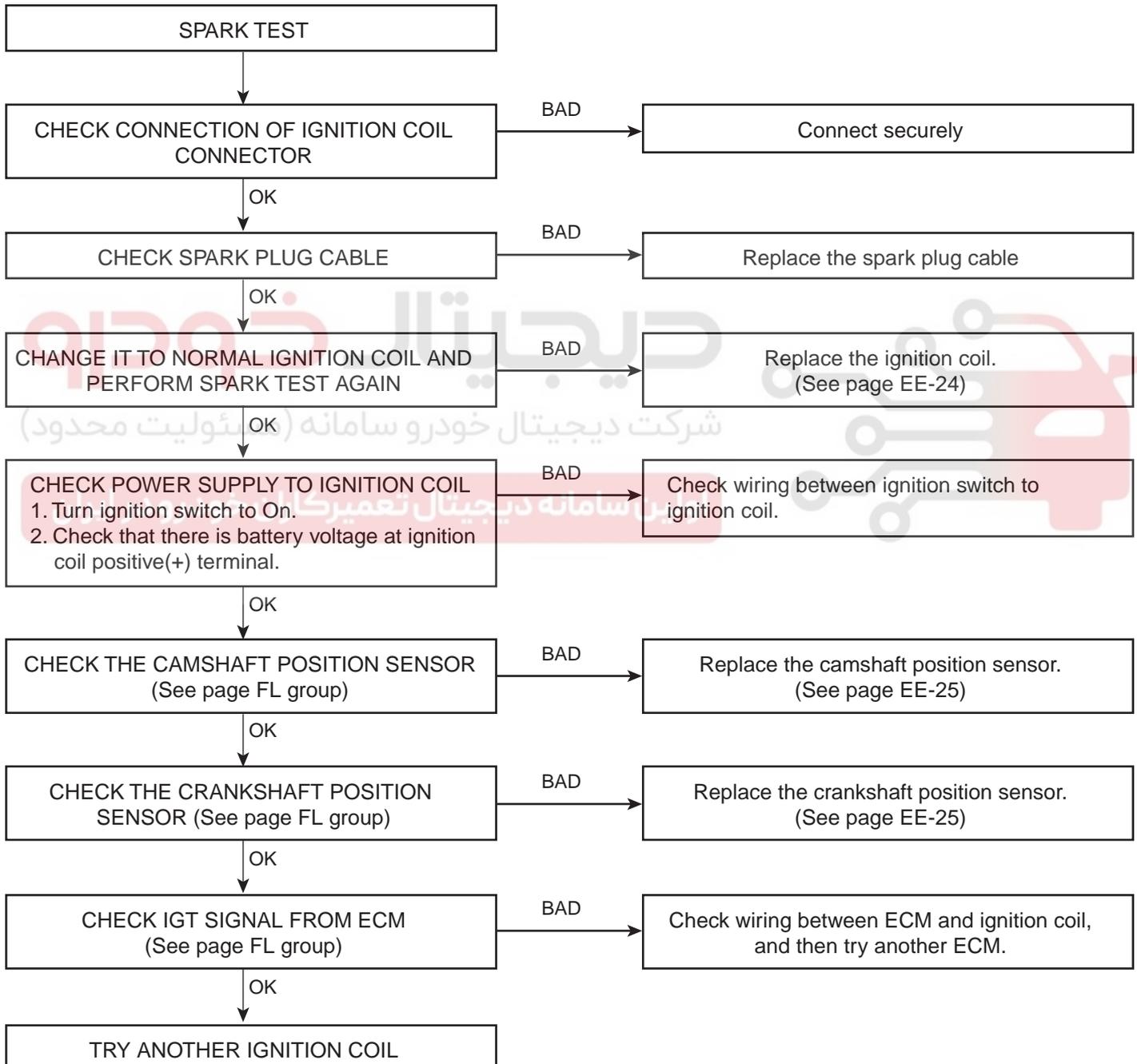
INSPECT SPARK TEST

1. Remove the spark plug cable.
2. Using a spark plug socket, remove the spark plug.
3. Remove the ignition coil.
4. Install the spark plugs to each spark plug cable.

5. Ground the spark plugs.
6. Check is spark occurs while engine is being cranked.

NOTE

To prevent gasoline from being injected from injectors during this test, crank the engine for no more than 5~10 seconds at time.



7. Using a spark plug socket, install the spark plugs.
8. Install the spark plug cable and ignition coil.

EBKD002E

IGNITION SYSTEM

EE -19

INSPECT SPARK PLUG AND SPARK PLUG CABLE

3. Inspect the electrodes(A) and ceramic insulator(B).

2.0

1. Remove the spark plug cable(A).

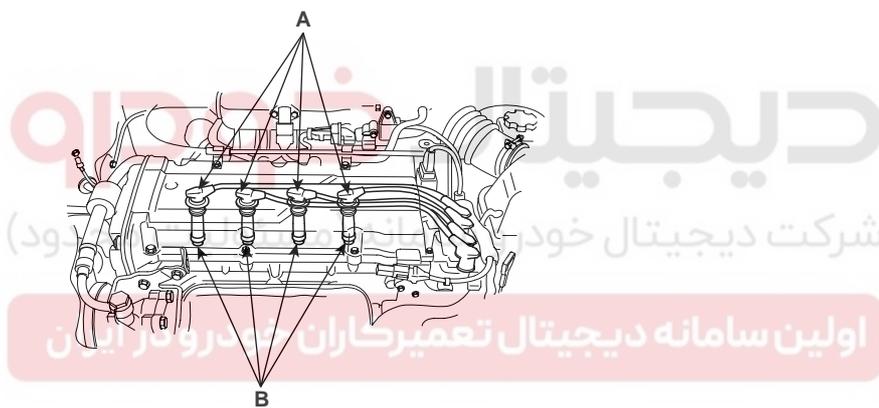
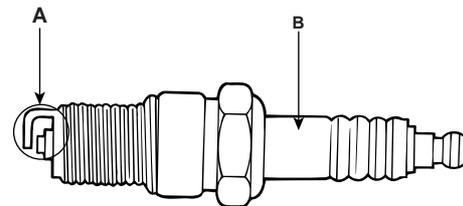
NOTE

When removing the spark plug cable, pull on the spark plug cable boot (not the cable), as it may be damaged.

2. Using a spark plug socket, remove the spark plug(B).

CAUTION

Be careful that no contaminants enter through the spark plug holes.



EBKD002K

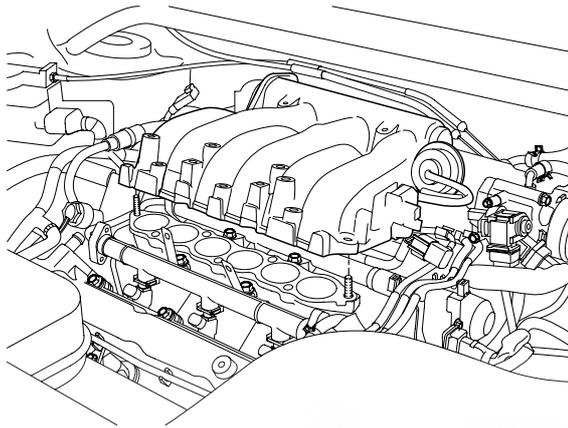
EBKD002A

EE -20

ENGINE ELECTRICAL SYSTEM

2.7

1. Remove the engine cover.
2. Disconnect the VIS actuator connectors and injector connectors.
3. Remove the accelerator cable.
4. Remove surge tank sub assembly.



INSPECTION OF ELECTRODES

CONDITION	DARK DEPOSITS	WITHE DEPOSITS
DESCRIPTION	<ul style="list-style-type: none"> - Fuel mixture too rich - Low air intake 	<ul style="list-style-type: none"> - Fuel mixture too lean - Advanced ignition timing - Insufficient plug tightening

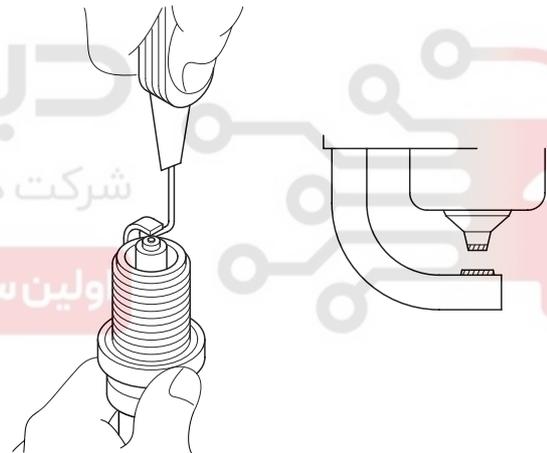
1. Check the electrode gap(A).

Standard (New)

1.0~1.1 mm (0.039~0.043 in.) - Unleaded
 0.7~0.8 mm (0.028~0.031 in) - Leaded

5. Remove the spark plug cable.
6. Remove the spark plug.
7. Inspect the electrodes and ceramic insulator.

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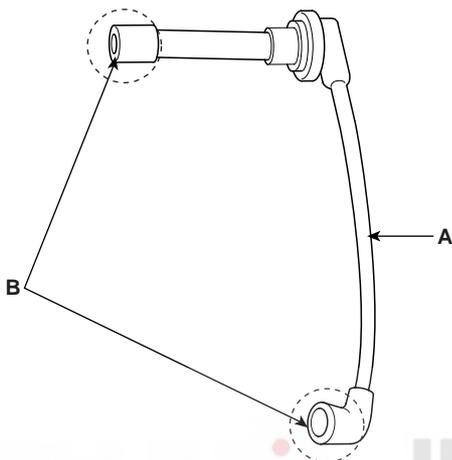


EBKE002L

IGNITION SYSTEM

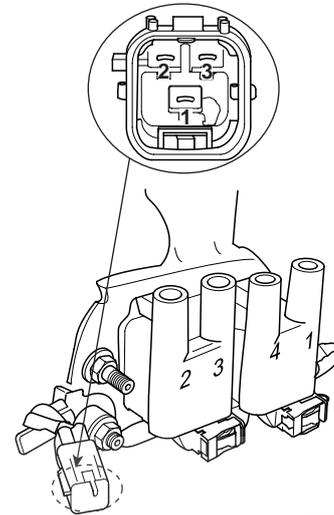
EE -21

- Carefully remove the spark plug cable by pulling on the rubber boots(A).
Check the condition of the spark plug cable terminals(B), if any terminal is corroded, clean it, and if it broken or distorted, replace the spark plug cable.



INSPECT IGNITION COIL

- Measure the primary coil resistance between terminals 1-2 and 1-3.



دیجیتال خودرو

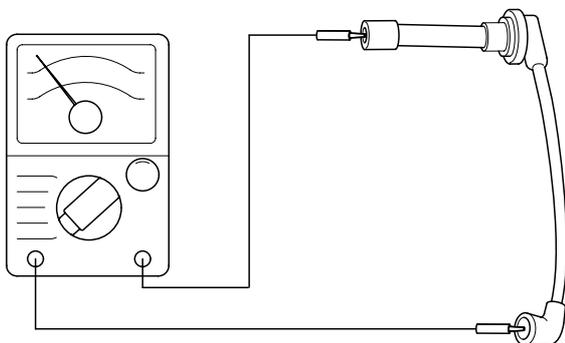
ت دیجیتالی خودرو سامانه (مسئولیت محدود) EBKD002M

Measure the primary coil resistance between terminals 1-4, 2-4 and 3-4.

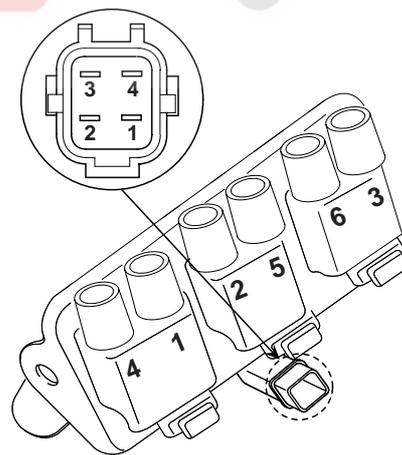
- Connect the ohmmeter probes and measure resistance.

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

RESISTANCE : $5.6K\Omega/m \pm 20\%$



EBKE002P



EBKE002B

EBKE002G

Standard value :
 $0.58\Omega \pm 10\%$ (2.0)
 $0.74\Omega \pm 10\%$ (2.7)

- Resistance should not be higher than $10K\Omega$ per meter of cable.
If resistance is higher, replace the cable.

EE -22

2. Measure the secondary coil resistance between the high-voltage terminal for the No.1 and No.4 cylinders, and between the high-voltage terminals for the No.2 and No.3 cylinders.

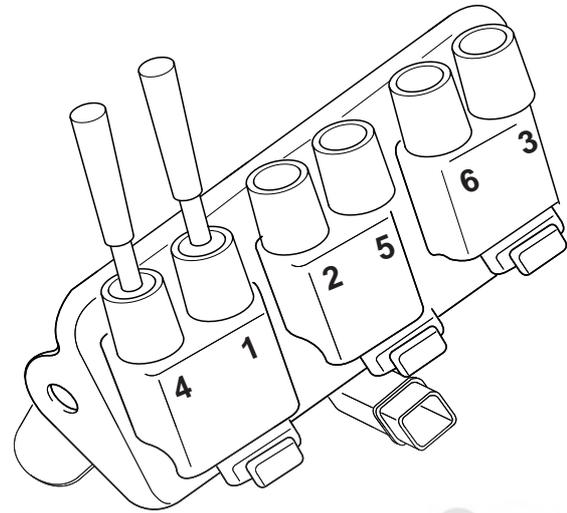
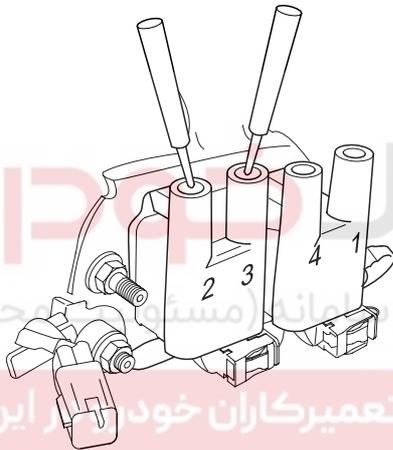
Standard value :

$8.8k\Omega \pm 15\%$ (2.0)

$13.3k\Omega \pm 15\%$ (2.7)

CAUTION

Be sure, when measuring the resistnace of the secondary coil, to disconnect the connector of the ignition coil.



EBKE002C

EBKD002C

IGNITION SYSTEM

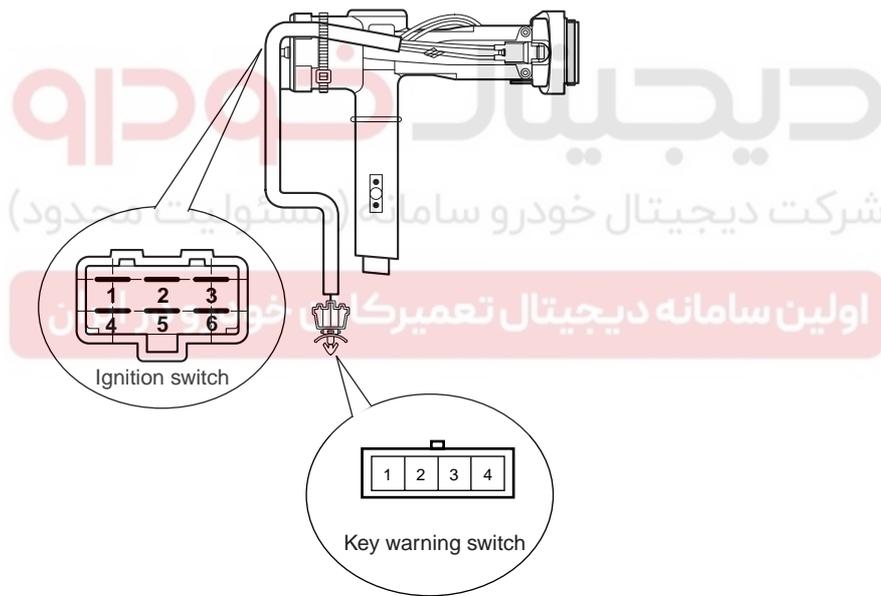
EE -23

INSPECT IGNITION SWITCH

1. Remove the connector located under the steering column.
2. Check for continuity between terminals.
If there is no continuity, replace the ignition switch.

TERMINAL		IGNITION SWITCH						STEERING		KEY WARNING SWITCH		KEY ILLUMINATION SWITCH	
		5	3	1	2	4	6	TRAVEL	TRAVEL	3	4	1	2
POSITION	KEY							LOCK	LOCK				
	REMOVAL							LOCK	UNLOCK				
LOCK	INSERT							UNLOCK					
ACC													
ON													
START													

EBKD002F



EBKD002D

REMOVAL, REPLACEMENT, AND INSTALLATION

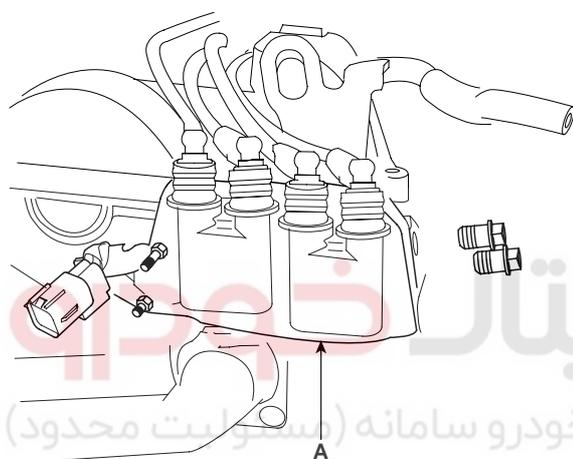
EE -24

ENGINE ELECTRICAL SYSTEM

REPLACEMENT E94361B6

IGNITION COIL

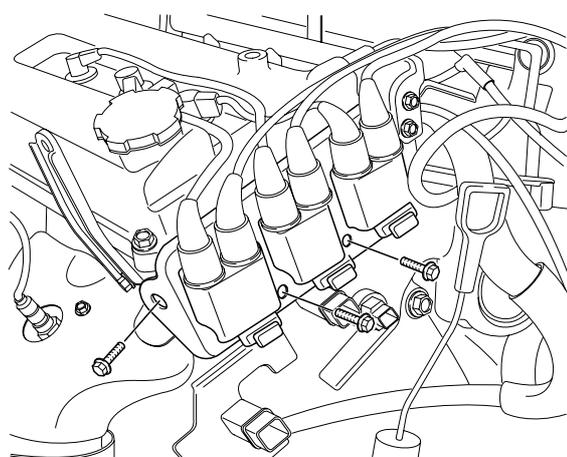
1. Remove the engine cover.
2. Disconnect the spark plug cable and connector.
3. Remove the ignition coil(A).
4. Installation is the reverse of removal.



شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

EBKD003A



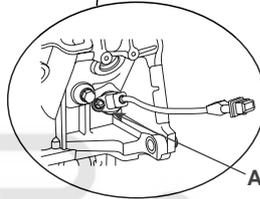
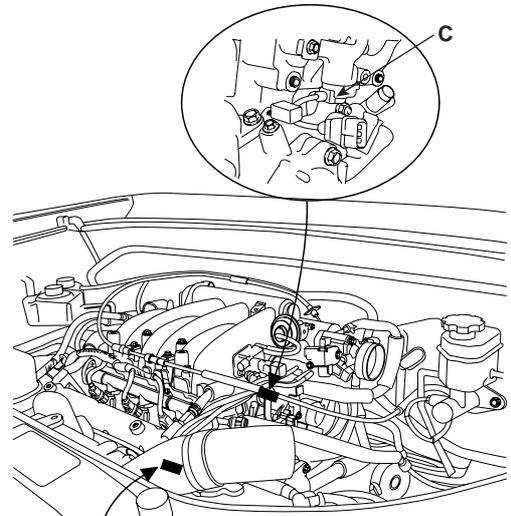
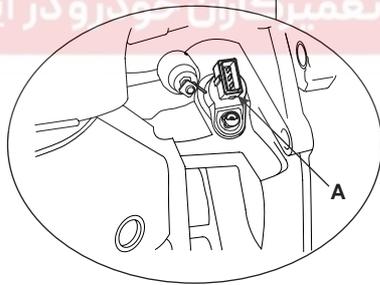
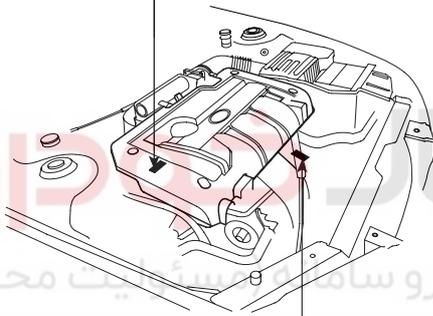
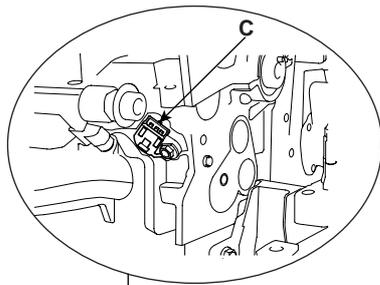
EDQF011A

IGNITION SYSTEM

EE -25

CAMSHAFT POSITION SENSOR

1. Remove the engine cover.
2. Disconnect the camshaft position sensor connector.
3. Remove the camshaft position sensor(C).



دیجیتال خودرو سامانه سیستم (شرکت دیجیتال خودرو سامانه سیستم محدود)
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EBKE003B

EBKD003B

EE -26

ENGINE ELECTRICAL SYSTEM

CHARGING SYSTEM

ALL DESCRIPTION AND OPERATION

DESCRIPTION EDCABFCE

GASOLINE

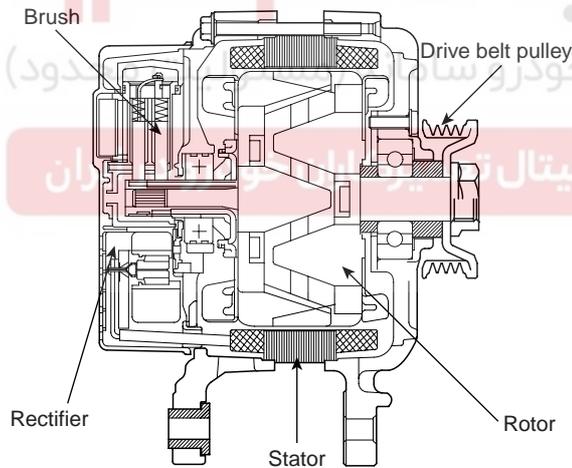
The charging system included a battery, an generator with a built-in regulator, and the charging indicator light and wire.

The generator has eight built-in diodes (four positive and four negative), each rectifying AC current to DC current. Therefore, DC current appears at generator "B" terminal. In addition, the charging voltage of this generator is regulated by the battery voltage detection system.

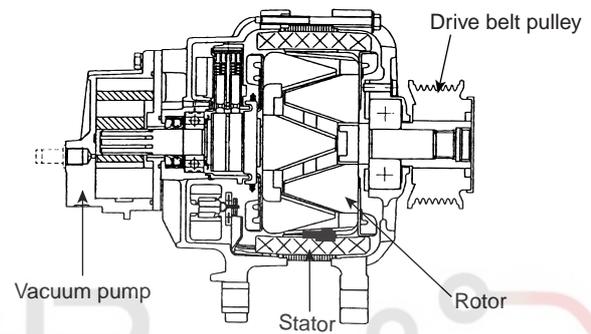
The generator is regulated by the battery voltage detection system. The main components of the generator are the rotor, stator, rectifier, capacitor brushes, bearings and V-ribbed belt pulley. The brush holder contains a built-in electronic voltage regulator.

DIESEL

The conventional internal voltage detection type alternator controls the charging voltage regardless of the battery condition and according to the external load change so that it sometimes causes battery under or over charging or causes flickering of meters and lamps due to ripples of generated voltage resulting from load fluctuation. The figure below show the internal circuits of the alternator and voltage regulator.



EBKD004A



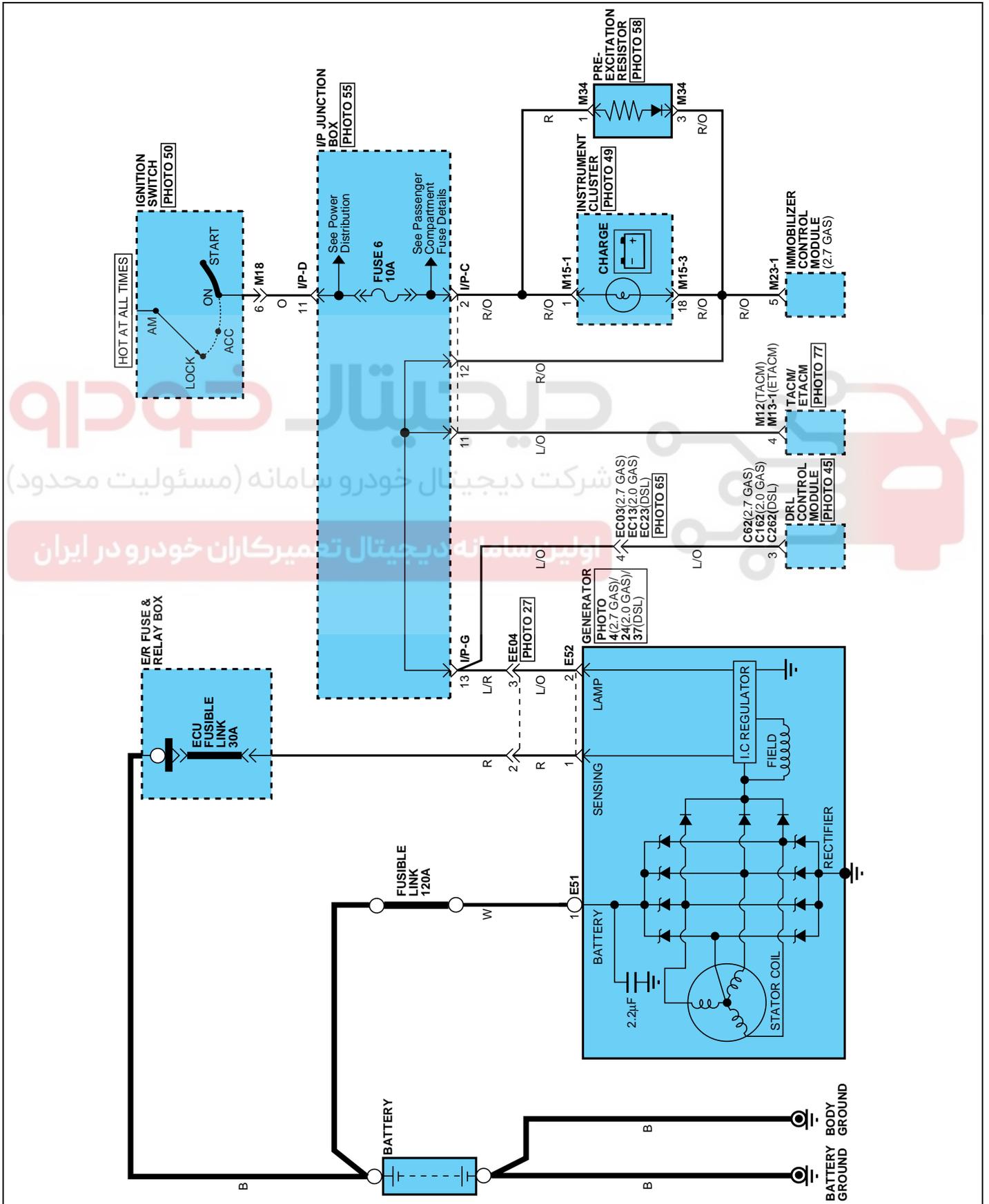
EBKD240A

CHARGING SYSTEM

ELECTRICAL AND ELECTRONIC SCHEMATIC DIAGRAMS

CIRCUIT DIAGRAM FOR CHARGING SYSTEM

E533CFF5



EE -28

ENGINE ELECTRICAL SYSTEM

CLEANING, INSPECTION, AND ADJUSTMENT

ON-VEHICLE INSPECTION EE8EC6C0 CAUTION

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Do not perform tests with a high voltage insulation resistance tester.
- Never disconnect the battery while the engine is running.

CHECK BATTERY VOLTAGE

1. After having driven the vehicle and in the case that 20 minutes have not passed after having stopped the engine, turn the ignition switch ON and turn on the electrical system (headlamp, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.
2. Turn the ignition switch OFF and turn off the electrical systems.
3. Measure the battery voltage between the negative (-) and positive (+) terminals of the battery.

Standard voltage : 12.5~12.9V at 20°C (68°C)

If the voltage is less than specification, charge the battery.

CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

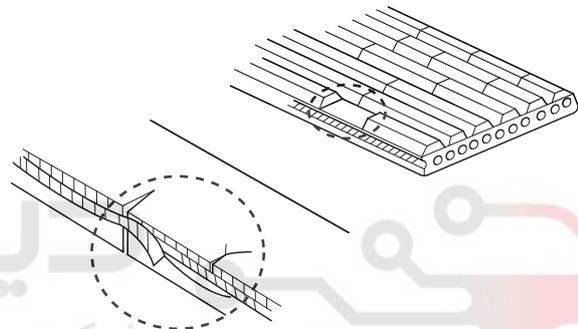
1. Check that the battery terminals are not loose or corroded.
2. Check the fusible link and fuses for continuity.

INSPECT DRIVE BELT

1. Visually check the belt for excessive wear, frayed cords etc. If any defect has been found, replace the drive belt.

 NOTE

Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



EBKD004B

2. Using a belt tension gauge(A), measure the drive belt(B) tension.

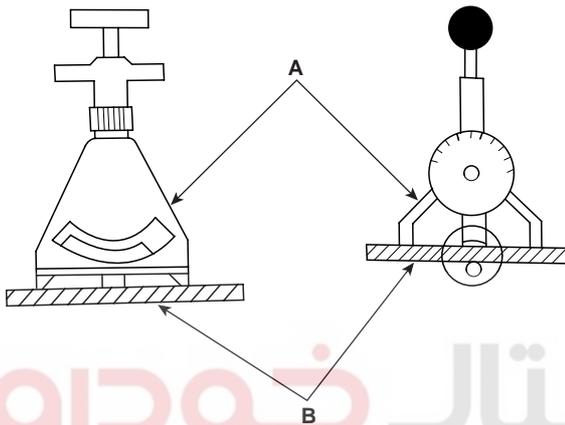
CHARGING SYSTEM

EE -29

DRIVE BELT TENSION

New belt	540~640 N (121~143 lb)
Used belt	340~490 N (77~110 lb)

If the belt tension is not as specified, adjust it.


 **NOTE**

- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing a belt, check that it fits properly in the ribbed grooves.
- Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.
- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.

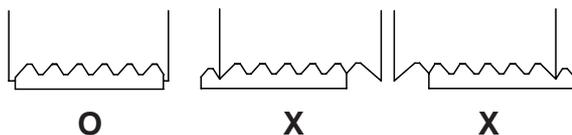
VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES

1. Check that the wiring is in good condition.
2. Check that there is no abnormal noise from the alternator while the engine is running.

CHECK DISCHARGE WARNING LIGHT CIRCUIT

1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is lit.
4. Start the engine. Check that the light goes off.

If the light does not go off as specified, troubleshoot the discharge light circuit.



EBKD004D

EE -30

ENGINE ELECTRICAL SYSTEM

INSPECT CHARGING SYSTEM

VOLTAGE DROP TEST OF ALTERNATOR OUTPUT WIRE

This test determines whether or not the wiring between the alternator "B" terminal and the battery (+) terminal is good by the voltage drop method.

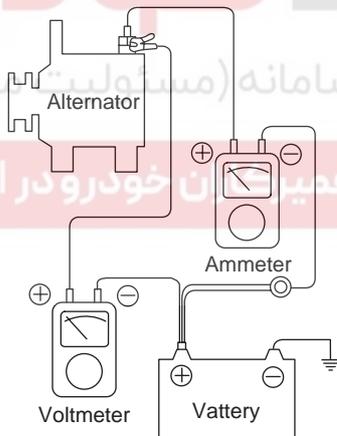
PREPARATION

1. Turn the ignition switch to "OFF".

 **NOTE**

To find abnormal conditions of the connection, actions should not be taken on the two terminals and each connection during the test.

2. Connect a digital voltmeter between the alternator "B" terminal and battery (+) lead wire to the battery (+) terminal. Connect the (+) lead wire of the voltmeter to the "B" terminal and the (-) lead wire to the battery (+) terminal.



ABQE010A

CONDITIONS FOR THE TEST

1. Start the engine.
2. Switch on the headlamps, blower motor and so on. And then, read the voltmeter under this condition.

RESULT

1. The voltmeter may indicate the standard value.

Standard value: 0.2V max.

2. If the value of the voltmeter is higher than expected (above 0.2V max.), poor wiring is suspected. In this case check the wiring from the alternator "B" terminal to the fusible link to the battery (+) terminal. Check for loose connections, color change due to an overheated harness, etc. Correct them before testing again.
3. Upon completion of the test, set the engine speed at idle. Turn off the head lamps, blower motor and the ignition switch.

OUTPUT CURRENT TEST

This test determines whether or not the alternator gives an output current that is equivalent to the nominal output.

PREPARATION

1. Prior to the test, check the following items and correct as necessary.

Check the battery installed in the vehicle to ensure that it is in good condition. The battery checking method is described in "BATTERY".

The battery that is used to test the output current should be one that has been partially discharged. With a fully charged battery, the test may not be conducted correctly due to an insufficient load.

Check the tension of the alternator drive belt.

2. Turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Disconnect the alternator output wire from the alternator "B" terminal.
5. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire of the ammeter to the disconnected output wire.

 **NOTE**

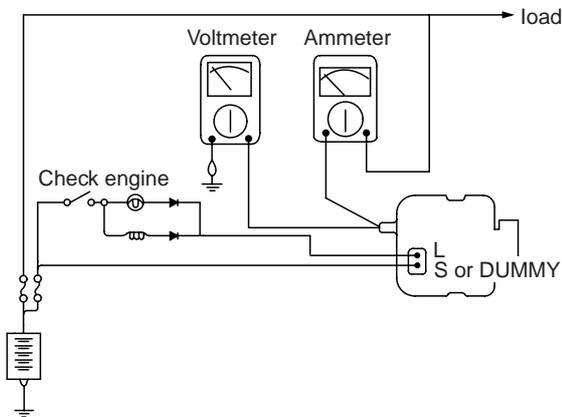
Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

6. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.
7. Attach an engine tachometer and connect the battery ground cable.

CHARGING SYSTEM

EE -31

8. Leave the engine hood open.



EBKD013H

TEST

1. Check to see that the voltmeter reads as the same value as the battery voltage. If the voltmeter reads 0V, and the open circuit in the wire between the alternator "B" terminal and battery (-) terminal, a blown fusible link or poor grounding is suspected.
2. Start the engine and turn on the headlights.
3. Set the headlights to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

NOTE

After the engine starts up, the charging current quickly drops. Therefore, the above operation must be done quickly to read the maximum current value correctly.

RESULT

1. The ammeter reading must be higher than the limit value. If it is lower but the alternator output wire is in good condition, remove the alternator from the vehicle and test it.

Limit value (90A alternator): 63A min.

NOTE

- The nominal output current value is shown on the nameplate affixed to the alternator body.
- The output current value changes with the electrical load and the temperature of the alternator itself. Therefore, the nominal output current may not be obtained. If such is the case, keep the headlights on the cause discharge of the battery, or use the lights of another vehicle to increase the electrical load.

The nominal output current may not be obtained if the temperature of the alternator itself or ambient temperature is too high.

In such a case, reduce the temperature before testing again.

3. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
4. Disconnect the battery ground cable.
5. Remove the ammeter and voltmeter and the engine tachometer.
6. Connect the alternator output wire to the alternator "B" terminal.
7. Connect the battery ground cable.

REGULATED VOLTAGE TEST

The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

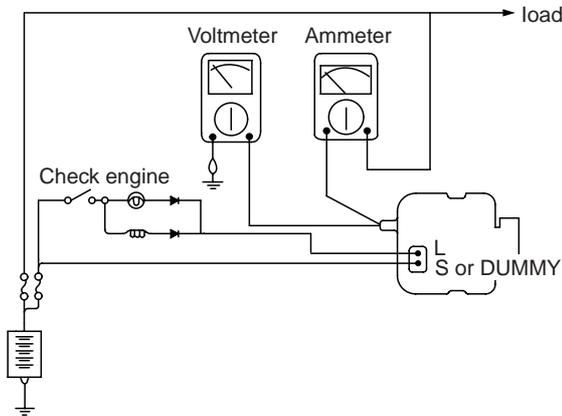
PREPARATION

1. Prior to the test, check the following items and correct if necessary.
Check that the battery installed on the vehicle is fully charged. For battery checking method, see "BATTERY".
Check the alternator drive belt tension.
2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.
5. Disconnect the alternator output wire from the alternator "B" terminal.
6. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Connect the (-) lead wire of the ammeter to the disconnected output wire.

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ENGINE ELECTRICAL SYSTEM

- Attach the engine tachometer and connect the battery ground cable.



EBKD013H

TEST

- Turn on the ignition switch and check to see that the voltmeter indicates the following value.

Voltage: Battery voltage

- If it reads 0V, there is an open circuit in the wire between the alternator "B" terminal and the battery and the battery (-), or the fusible link is blown.
- Start the engine. Keep all lights and accessories off.
- Run the engine at a speed of about 2,500 rpm and read the voltmeter when the alternator output current drops to 10A or less.

RESULT

- If the voltmeter reading agrees with the value listed in the Regulating Voltage Table below, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the alternator is faulty.

REGULATING VOLTAGE TABLE

GASOLINE

Voltage regulator ambient temperature °C (°F)	Regulating voltage (V)
-20 (-4)	14.2 ~ 15.4
20 (68)	14.0 ~ 15.0
60 (140)	13.7 ~ 14.9
80 (176)	13.5 ~ 14.7

DIESEL

Voltage regulator ambient temperature °C (°F)	Regulating voltage (V)
-30 (-22)	14.1 ~ 15.2
20 (68)	14.1 ~ 14.7
120 (248)	13.3 ~ 14.7

- Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
- Disconnect the battery ground cable.
- Remove the voltmeter and ammeter and the engine tachometer.
- Connect the alternator output wire to the alternator "B" terminal.
- Connect the battery ground cable.

CHARGING SYSTEM

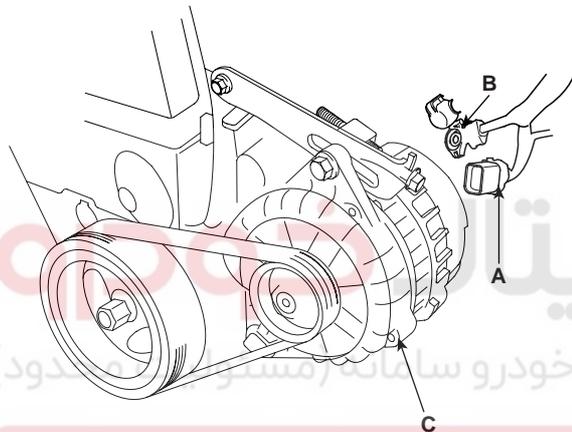
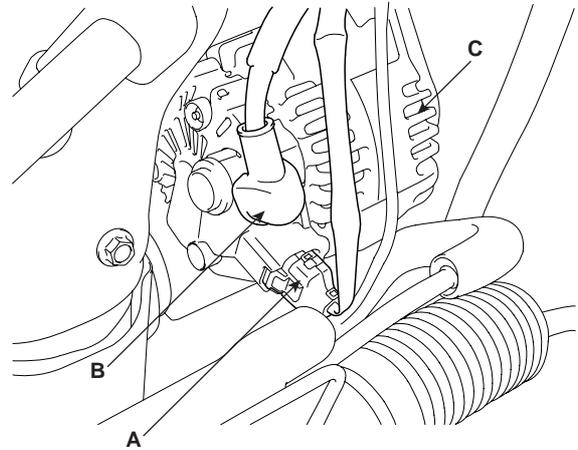
EE -33

ALTERNATOR

REPLACEMENT EB1AECC9

GASOLINE

1. Disconnect the battery negative terminal first, then the positive terminal.
2. Deisconnect the alternator connector(A) and "B" terminal cable(B) from the alternator(C).

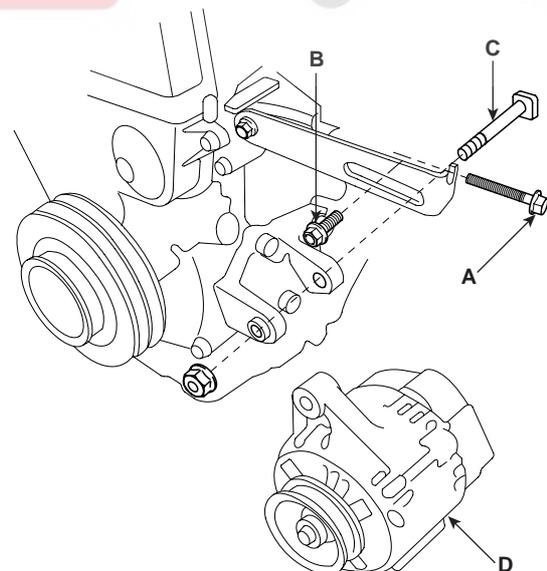


EBQF050A

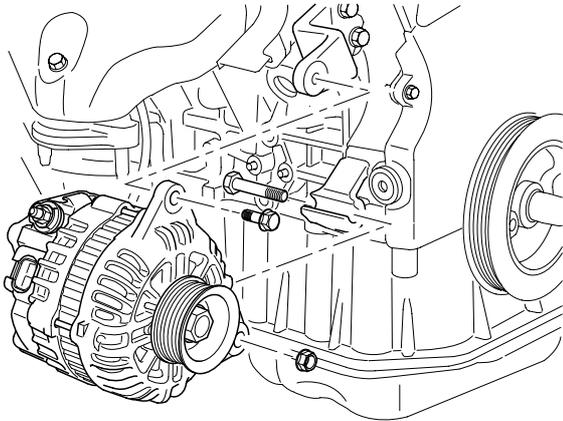
3. Remove the adjusting bolt(A) and mounting bolt(B), then remove the alternator belt.
4. Pull out the through bolt(C), then remove the alternator(D).

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EBKD005A



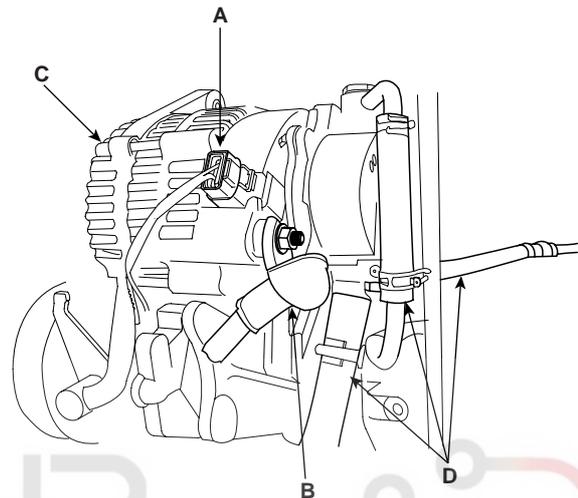
EBKD005B



EDQF101A

DIESEL

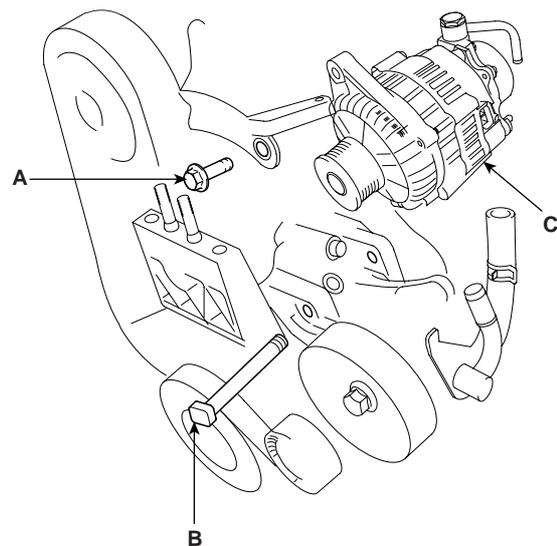
1. Disconnect the battery negative terminal first, then the positive terminal.
2. Disconnect the alternator connector(A) and "B" terminal cable(B) from the alternator(C).
3. Disconnect the vacuum pump hose(D).



5. Installation is the reverse of removal.
6. Adjust the alternator belt tension after installation
(See page EE-40).

EBKD300A

4. Remove the mounting bolt(A) and through bolt(B), then remove the alternator(C).



EBKD300B

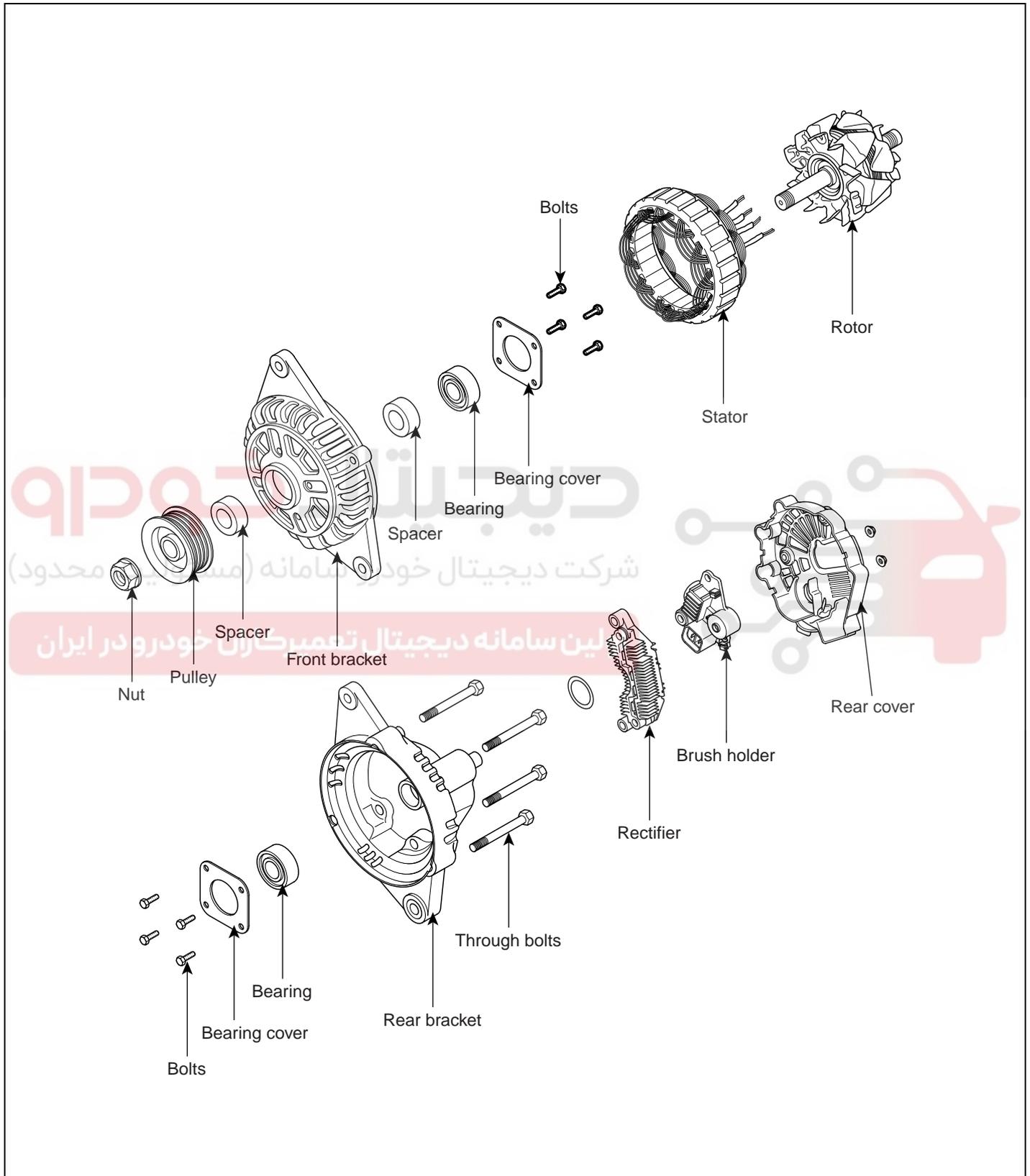
5. Installation is the reverse of removal.

CHARGING SYSTEM

EE -35

COMPONENTS E7BABA5C

GASOLINE (2.0)

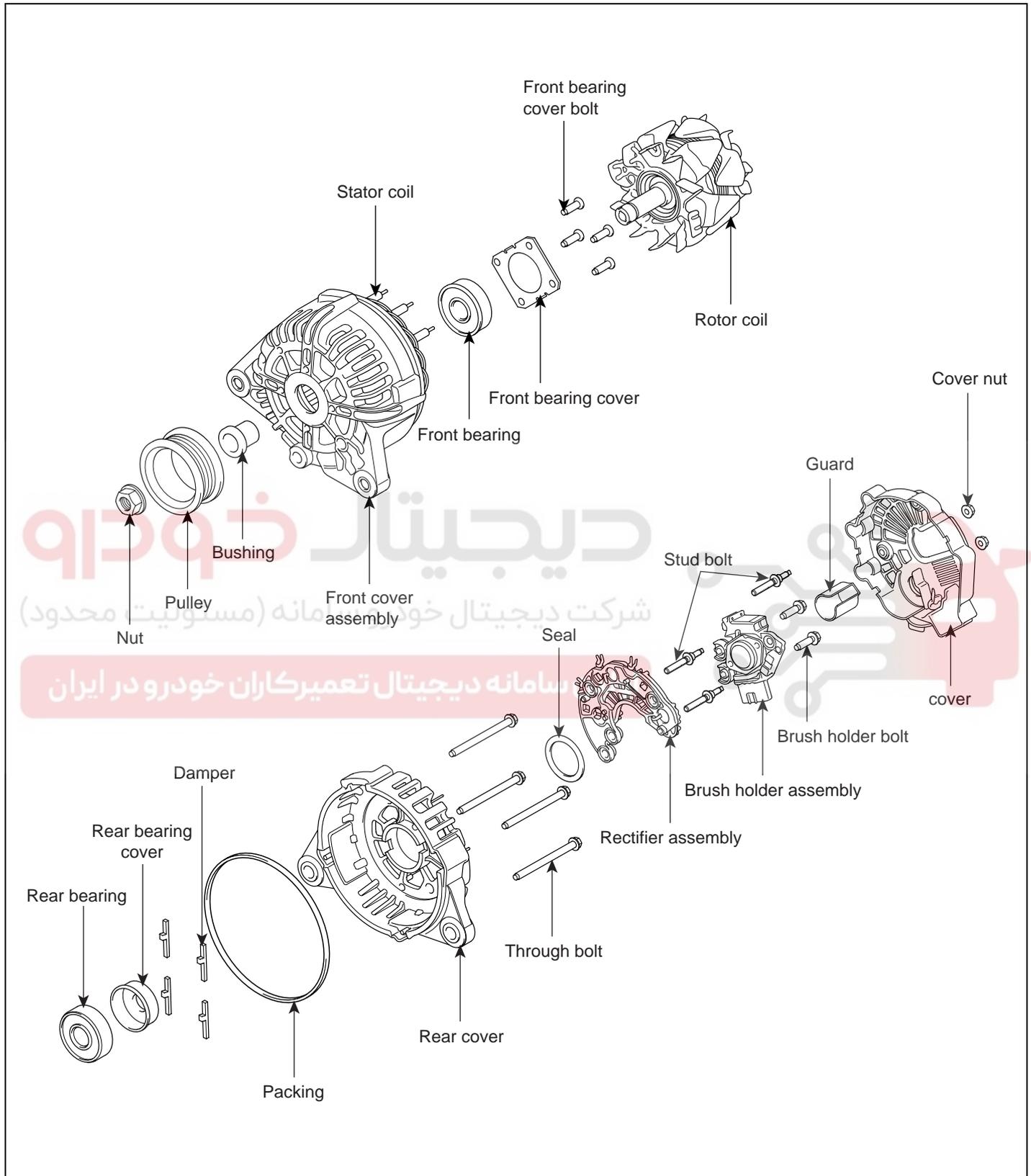


EBKD006A

EE -36

ENGINE ELECTRICAL SYSTEM

GASOLINE (2.7)

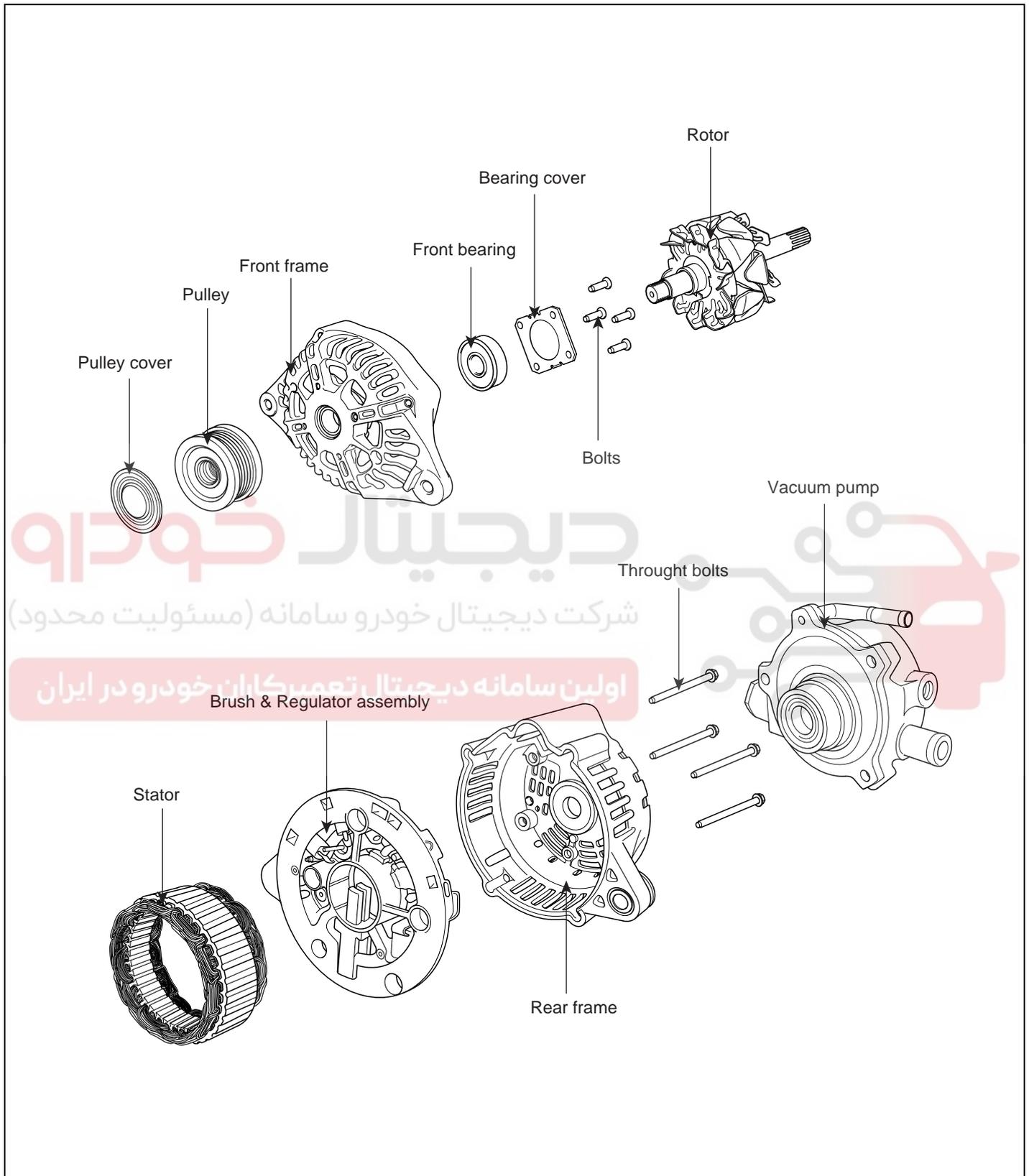


EBJD004A

CHARGING SYSTEM

EE -37

DIESEL



EBJD520A

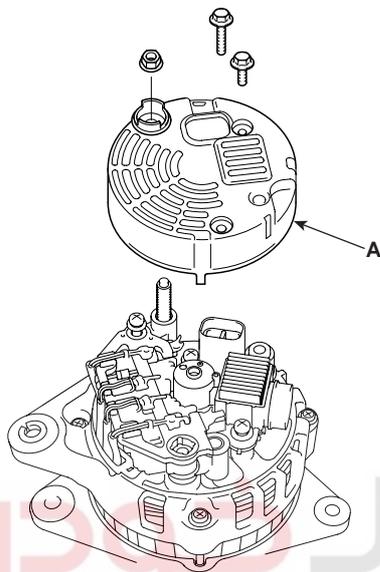
EE -38

ENGINE ELECTRICAL SYSTEM

DISASSEMBLY ECB8FF64

GASOLINE

1. Remove the rear cover(A).

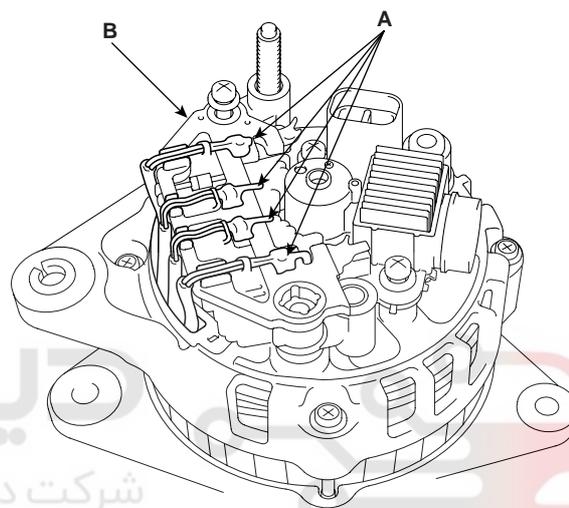


EBKD007A

2. Unsolder the 4 stator leads(A) to the main diodes on the rectifier(B).

 **CAUTION**

- *When soldering or unsoldering, be careful not to heat the diodes for too long.*
- *Be careful that excessive force is not exerted on the leads of the diodes.*



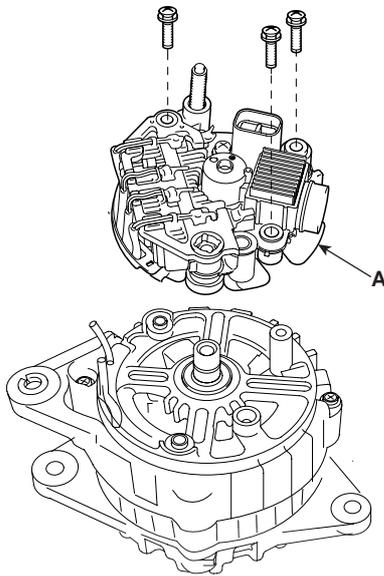
EBKD007B

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

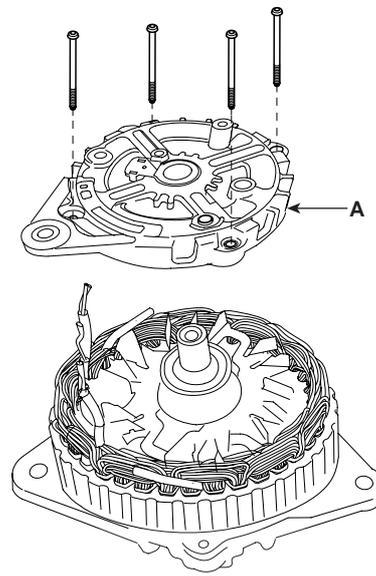
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

CHARGING SYSTEM

3. Remove the rectifier assembly(A).



5. Remove the rear bracket(A).

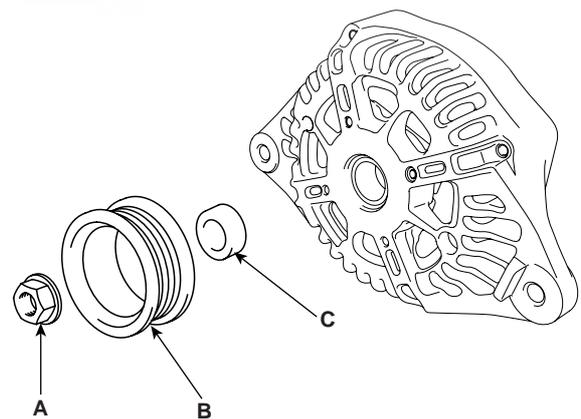
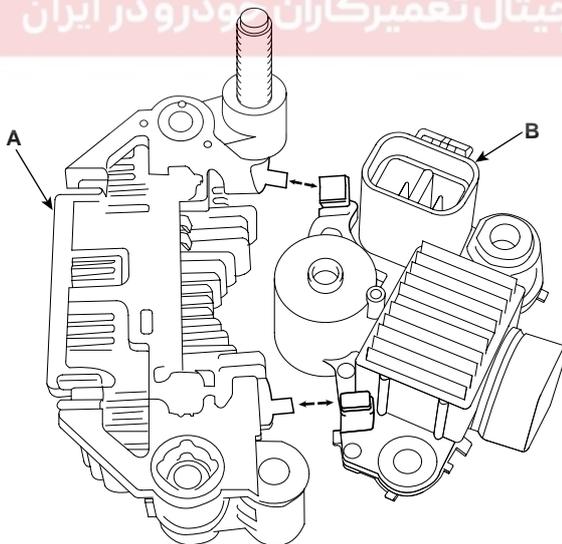


4. Unsolder between rectifier(A) and brush holder(B).

6. Remove the nut(A), pulley(B) and spacer(C)..

دیجیتال خودرو
 شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



EBKD007D

EBKD007E

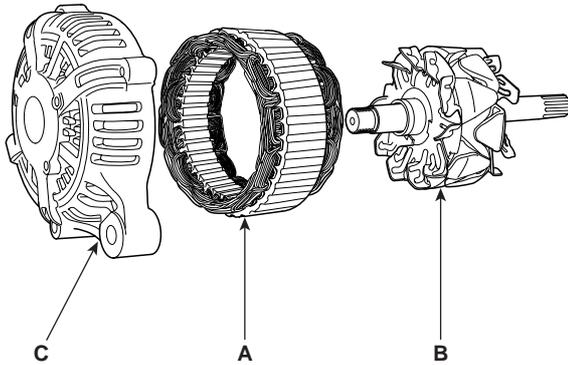
EE -40

ENGINE ELECTRICAL SYSTEM

7. Disconnect the stator(A), rotor(B) and front bracket(C). 9. Reassembly is the reverse or disassembly.

NOTE

Before the rotor is attached to the rear bracket, insert a wire through the small hole in the rear bracket to lock the brush. After the rotor has been installed, the wire can be removed.



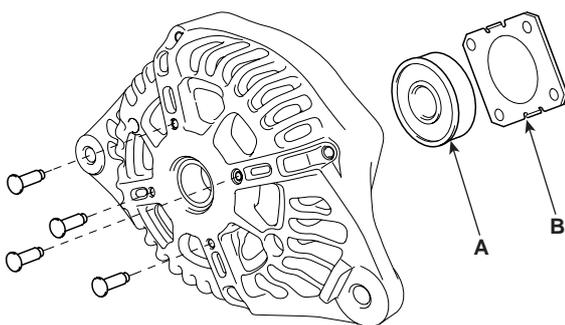
دیجیتال خودرو

EBKD007G

8. Remove the rear bearing(A) and cover(B).



اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



EBKD007H

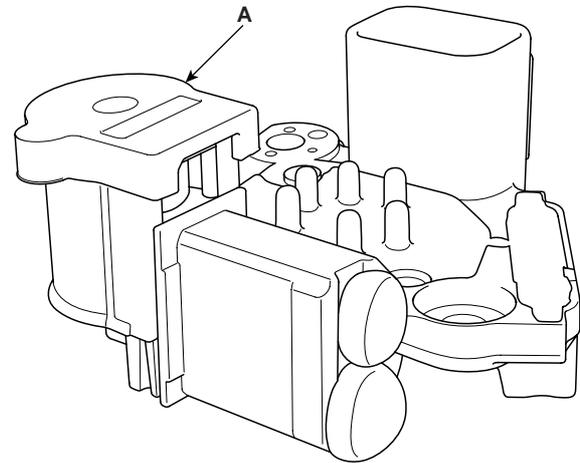
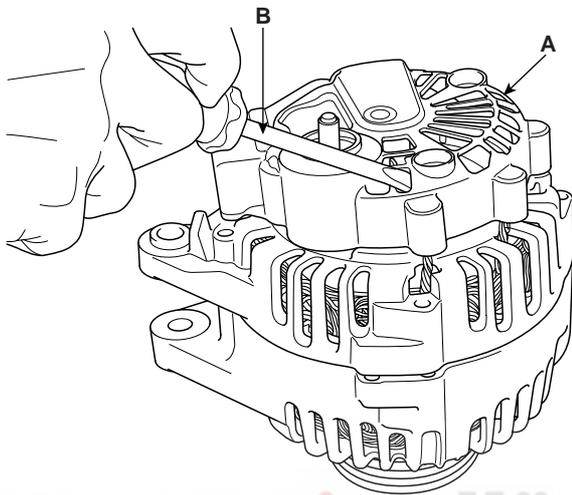
CHARGING SYSTEM

EE -41

GASOLINE (2.7)

1. Remove the alternator cover(A) using a screw driver(B).

3. Remove the slip ring guide(A).



دیجیتال خودرو

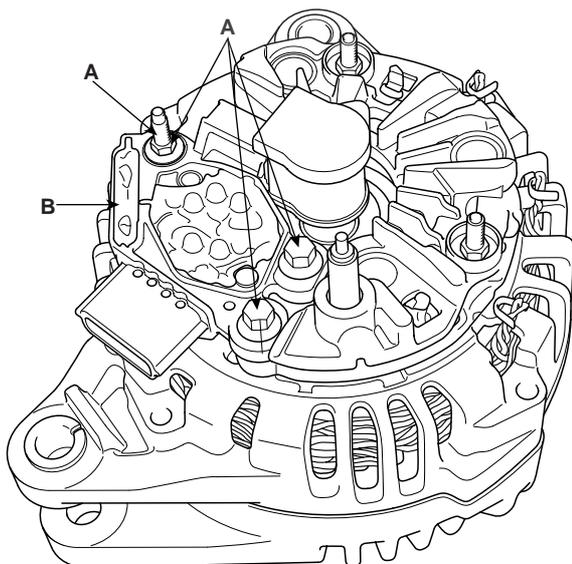
EBKD301A

4. Remove the nut, pulley(A) and spacer.

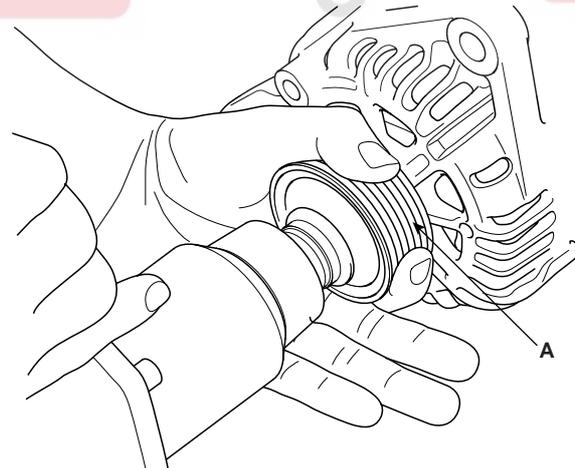
2. Loosen the mounting bolts(A) and disconnect the brush holder assembly(B).

EBKD301C

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



EBKD301B

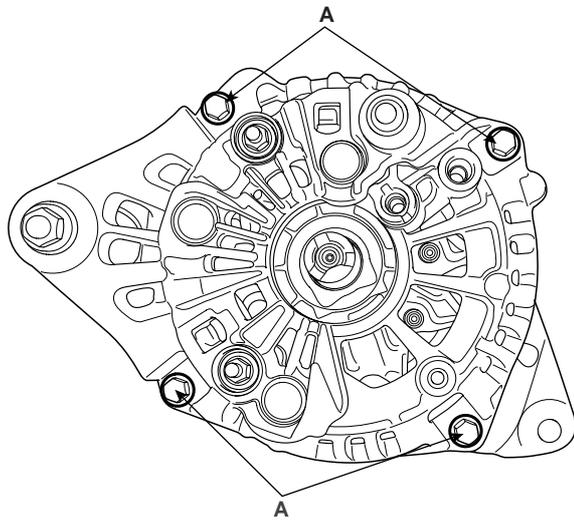


EBKD301D

EE -42

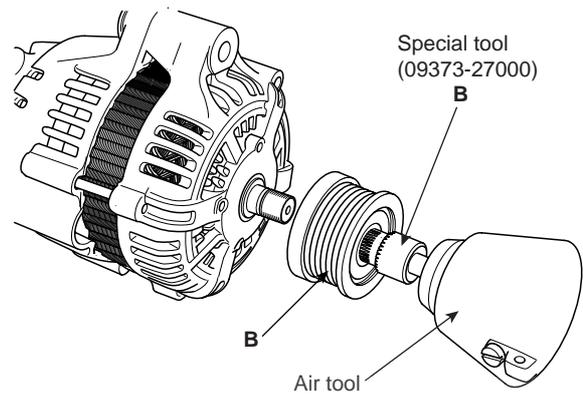
ENGINE ELECTRICAL SYSTEM

5. Loosen the 4 through bolts(A).

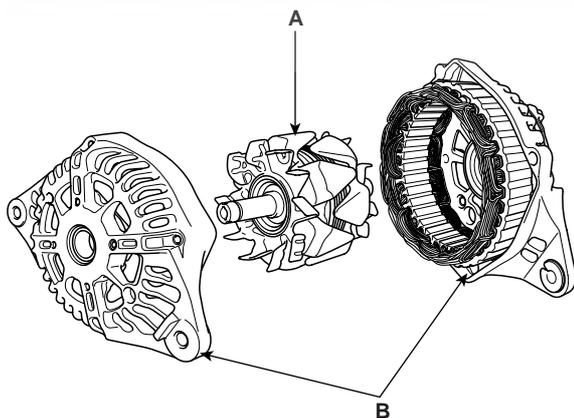


DIESEL

1. Remove the pulley cover.
2. Remove the pulley(A) using the special tool(B).

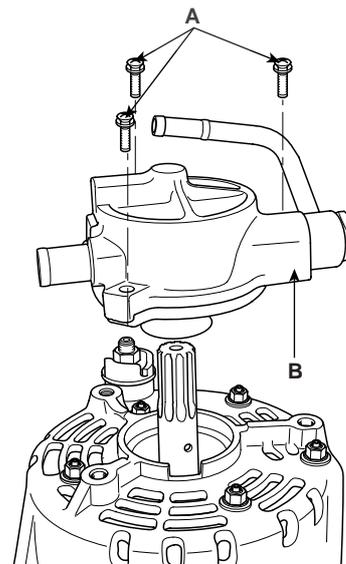


6. Disconnect the rotor(A) and cover(B).



EBKD301E

3. After loosening the three bolts(A). Remove the vacuum pump(B).



EBKD302A

7. Reassembly is the reverse of disassembly.

EBKD302B

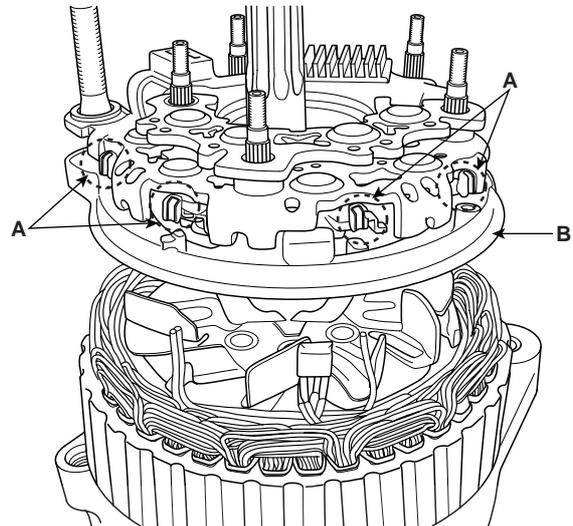
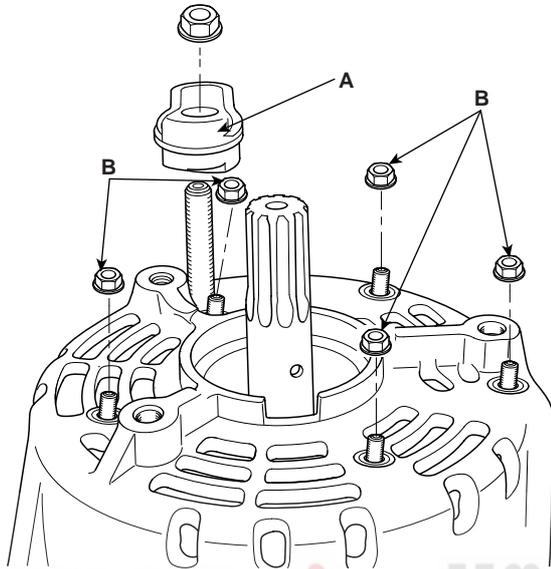
EBKD301G

CHARGING SYSTEM

EE -43

4. Remove the B terminal insulator(A) and loosen the five rear cover mounting nuts(B).

6. After removing the weld between the stator lead and diode lead(A), remove the regulator assembly(B).



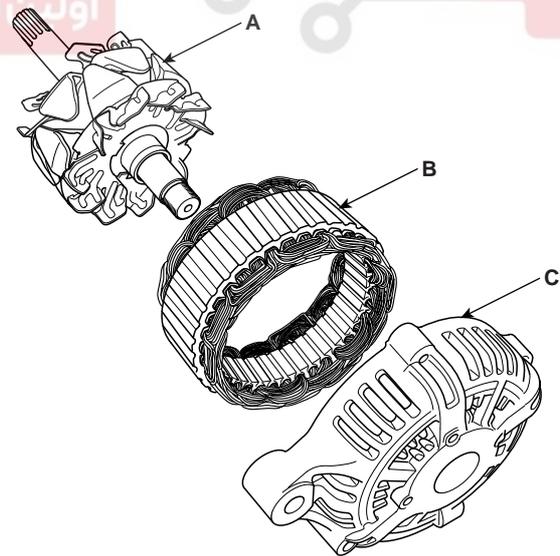
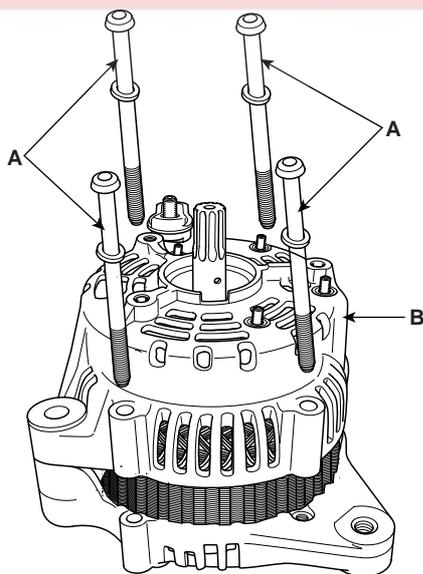
دیجیتال خودرو

EBKD302C

5. After loosening the four through bolts(A), remove the rear cover(B).

7. Separate the rotor(A), stator(B), and front cover(C).

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



EBKD302E

EBKD302G

EBKD302D

8. Installation is the reverse of removal.

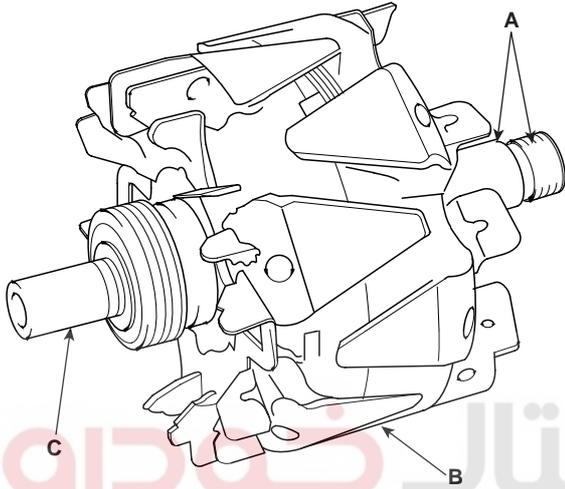
EE -44

ENGINE ELECTRICAL SYSTEM

INSPECTION E00B85EA

INSPECT ROTOR

1. Check that there is continuity between the slip rings(A).

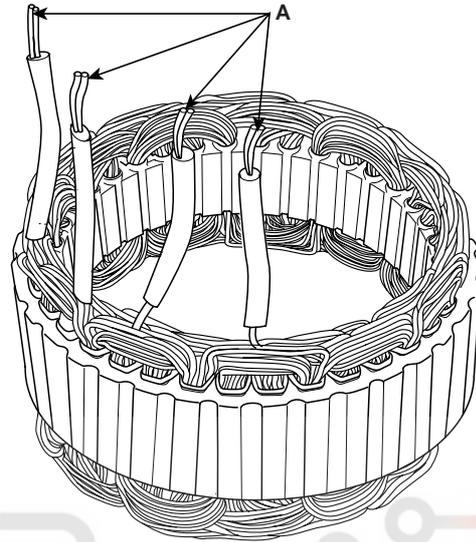


EBKD008A

2. Check that there is no continuity between the slip rings and the rotor(B) or rotor shaft(C).
3. If the rotor fails either continuity check, replace the alternator.

INSPECT STATOR

1. Check that there is continuity between each pair of leads(A).



EBKD008B

2. Check that there is no continuity between each lead and the coil core.
3. If the coil fails either continuity check, replace the generator.

CHARGING SYSTEM

EE -45

ALTERNATOR BELT INSPECTION AND ADJUSTMENT**NOTE**

When using a new belt, first adjust the deflection or tension to the values for the new belt, then readjust the deflection or tension to the values for the used belt after running engine for five minutes.

Deflection method :

Apply a force of 98N (10 kgf, 22 lbf), and measure the deflection between the alternator and crankshaft pulley.

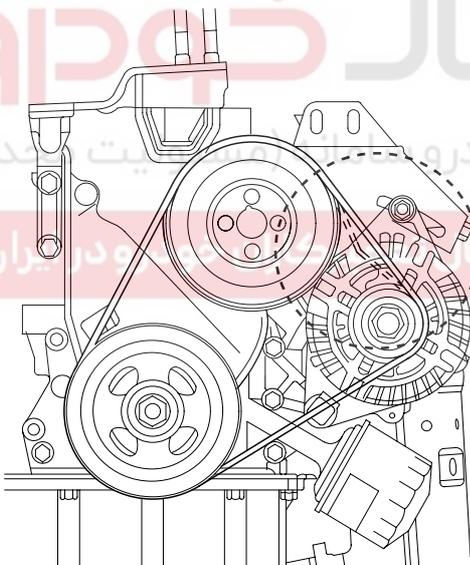
Deflection

Used Belt : 5.0 ~ 6.0 mm (0.20 ~ 0.23 in)

New Belt : 4.0 ~ 5.0 mm (0.16 ~ 0.20 in)

NOTE

If the belt is worn or damaged, replace it.



EBKD008C

Belt tension gauge method :

Attach the belt tension gauge to the belt and measure the tension. Follow the gauge manufacturer's instructions.

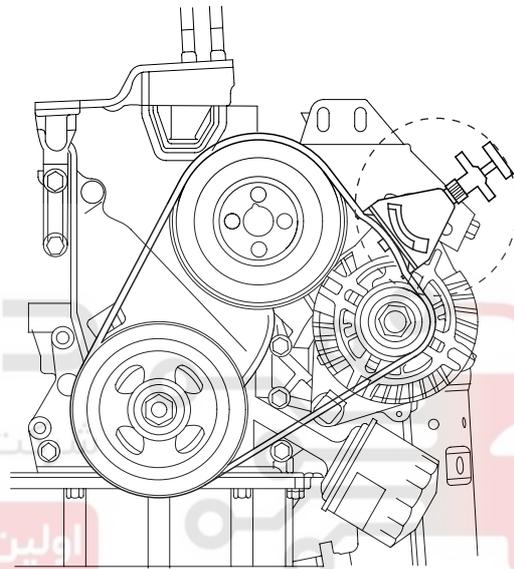
Tension

Used Belt : 340~490 N (35~50 kgf, 77~110 lbf)

New Belt : 540~640 N (55~65 kgf, 121~143 lbf)

NOTE

If the belt is worn or damaged, replace it.



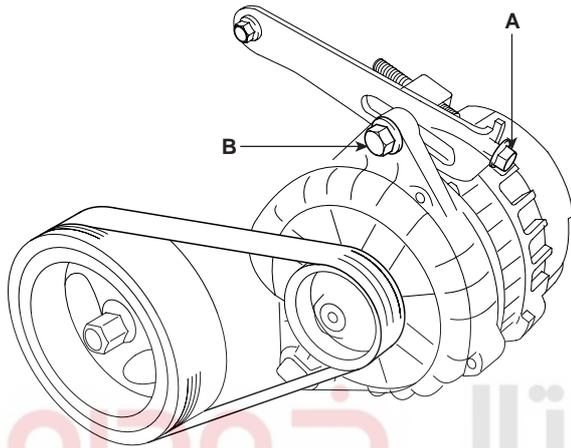
EBKD008D

EE -46

ENGINE ELECTRICAL SYSTEM

If adjustment is necessary :

1. Loosen the adjusting bolt(A) and the lock bolt(B).
2. Move the alternator to obtain the proper belt tension, then retighten the nuts.



3. Recheck the deflection or tension of the belt.

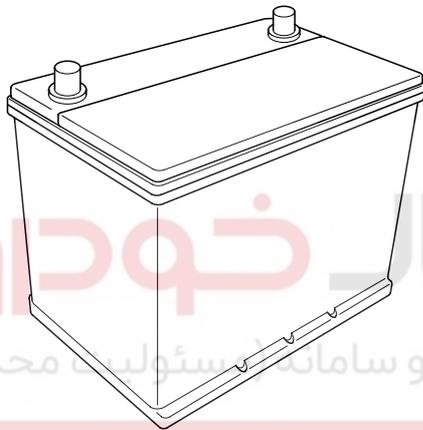
CHARGING SYSTEM

EE -47

BATTERY

DESCRIPTION ECBDB3EF

1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.

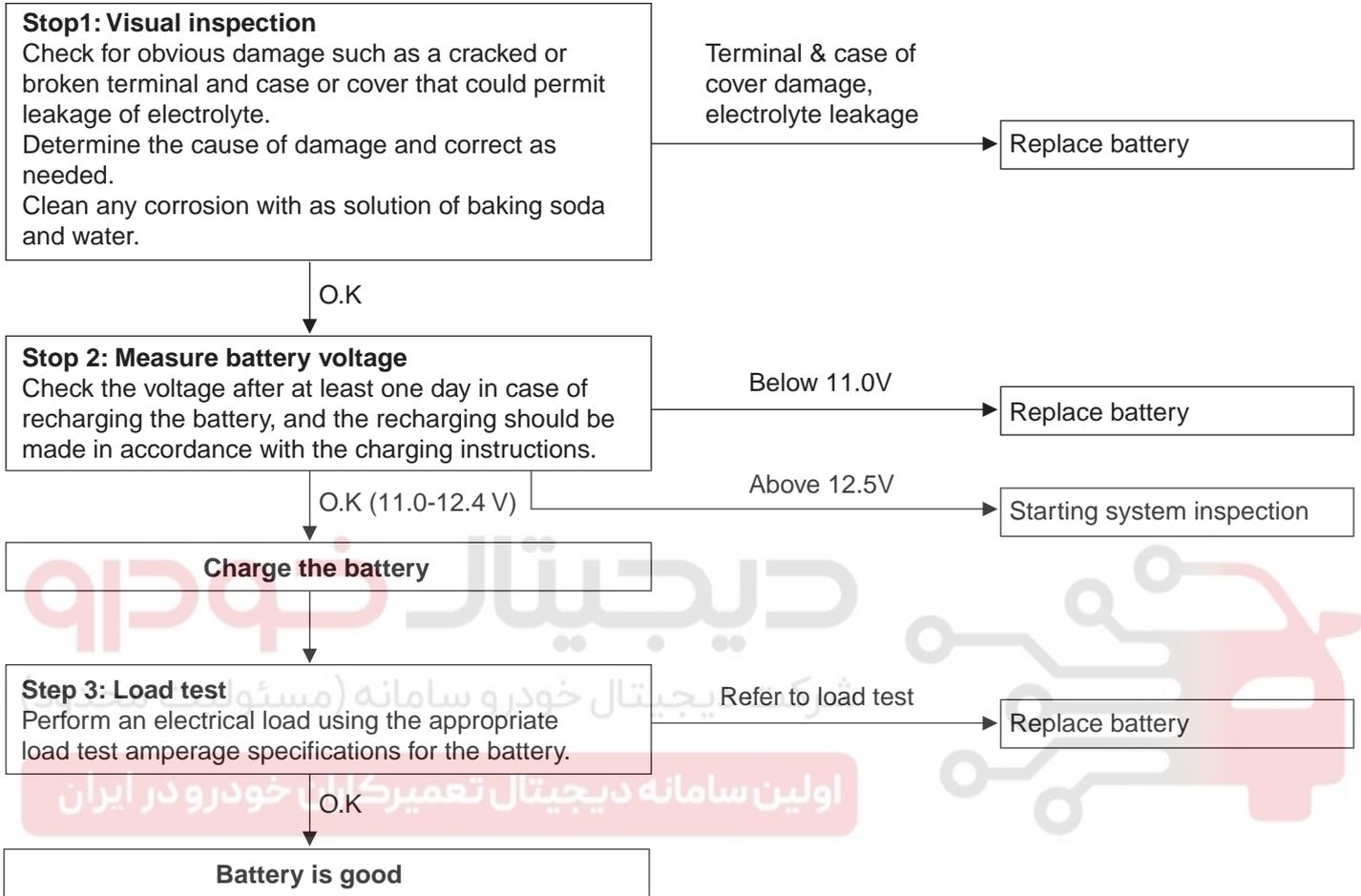


EBJD008A

INSPECTION EF4DE1EC

BATTERY DIAGNOSTIC TEST (1)

1. CHECKING FLOW



EBBD008C

CHARGING SYSTEM

EE -49

2. CHECKING SHEET

Inspection Items & contents	Judgment criteria	Responsibility		Remarks
		User	Manufacturer	
1. Acid Leakage * Type of acid leakage - Leakage on the fusion part for joining the case and cover. - Leakage on the terminal part - Leakage on the other parts * Clean the wet part or wash it, then dry it before checking with naked eyes. * Determine a part where leakage might have occurred ; check it by tipping the battery, if the leakage takes place again. * Conduct a visual inspection for breakage, deformation, or cracks.	1. Damage in the case or cover due to outside impact.			
	2. Acid leakage on the molding part of the case or cover. (weld line or gate hole)			
	3. Damage on the terminal or cracks in the cover.			
	4. Acid leakage due to the tipped battery or slant storage.			
	5. Acid leakage due to poor welding of the cover. (with no damage)			
2. Outside damage and breakage * Check with naked eyes.	1. Outside damage due to causes without damage due to mistreatment.			
	2. Outside damage due to mistreatment.			
	3. Damage due to a spark between terminals.			
	4. Damage and breakage due to heat.			
3. Measure the voltage for the battery ; but wait at least one day before measuring in case of recharging, and recharging should be made in accordance with the charging instructions.	1. 12.0V			Refer to load test
	2. 11.0V < battery voltage < 12.0V due to over-discharge.			Refer to load test
	3. Below 11.0V due to charge condition failure.			Refer to load test
	4. Below 11.0V due to discharged for a long period.			Refer to load test
	5. Below 11.0V due to internal short circuit.			Refer to load test
4. Load test ; For 15 seconds with a half of the CCA electric current value, but the voltage on the discharging stage should be above 9.6V (27±5°C) - Conduct the test with a battery tester. (Refer to the tester manual)	1. Load test result: below 9.5V			
	2. Load test result: above 9.6V			Mfg. Defect usable

EE -50

ENGINE ELECTRICAL SYSTEM

3. LOAD TEST

1. Perform the following steps to complete the load test procedure for maintenance free batteries.
2. Connect the load tester clamps to the terminals and proceed with the test as follow :
 - a. If the battery has been on charge, remove the surface charge by connect a 300 ampere load for 15 seconds.
 - b. Connect the voltmeter and apply the specified load.
 - c. Read the voltage after the load has been applied for 15 seconds.
 - d. Disconnect the load.
 - e. Compare the voltage reading with the minimum and replace the battery if battery test voltage is below that shown in the voltage table.

Voltage	Temperature
9.6	20°C (70°F) and above
9.5	16 °C (60 °F)
9.4	10 °C (50 °F)
9.3	4 °C (40 °F)
9.1	-1 °C (30 °F)
8.9	-7 °C (20 °F)
8.7	-12 °C (10 °F)
8.5	-18 °C (0 °F)

 **NOTE**

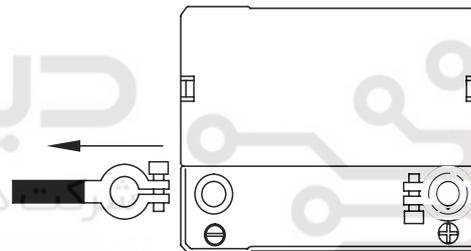
- If the voltage is less than shown in the table, the battery is good.
- If the voltage is greater than shown in the table, replace the battery.

BATTERY DIAGNOSTIC TEST (2)

1. Make sure the ignition switch and all accessories are in the OFF position.
2. Disconnect the battery cables (negative first).
3. Remove the battery from the vehicle.

 **CAUTION**

Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte. Heavy rubber gloves (not the household type) should be worn when removing the battery.



EBJD008B

4. Inspect the battery carrier for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described in Step(3).
6. Inspect the battery case and cover for cracks. If cracks are present, the battery must be replaced.
7. Clean the battery posts with a suitable battery post tool.
8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.

CHARGING SYSTEM

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10. Connect the cable terminals to the battery post, making sure the tops of the terminals are flush with the tops of the posts.
11. Tighten the terminal nuts securely.
12. Coat all connections with light mineral grease after tightening.

⚠ CAUTION

When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuits at the terminals of batteries being charged. A spark will occur when the circuit is broken. Keep open flames away from the battery.



EBJD008A

STARTING SYSTEM

ALL DESCRIPTION AND OPERATION

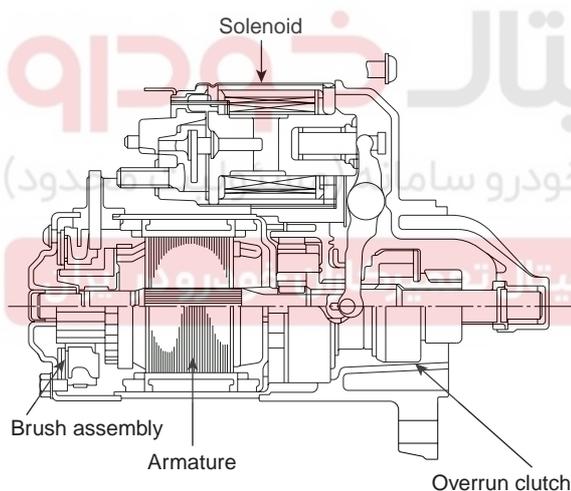
DESCRIPTION EFE0D698

The starting system includes the battery, starter motor, solenoid switch, ignition switch, inhibitor switch(A/T), ignition lock switch, connection wires and the battery cable.

When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil.

The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.

The contacts close and the starter motor cranks. In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.



EBKD010A

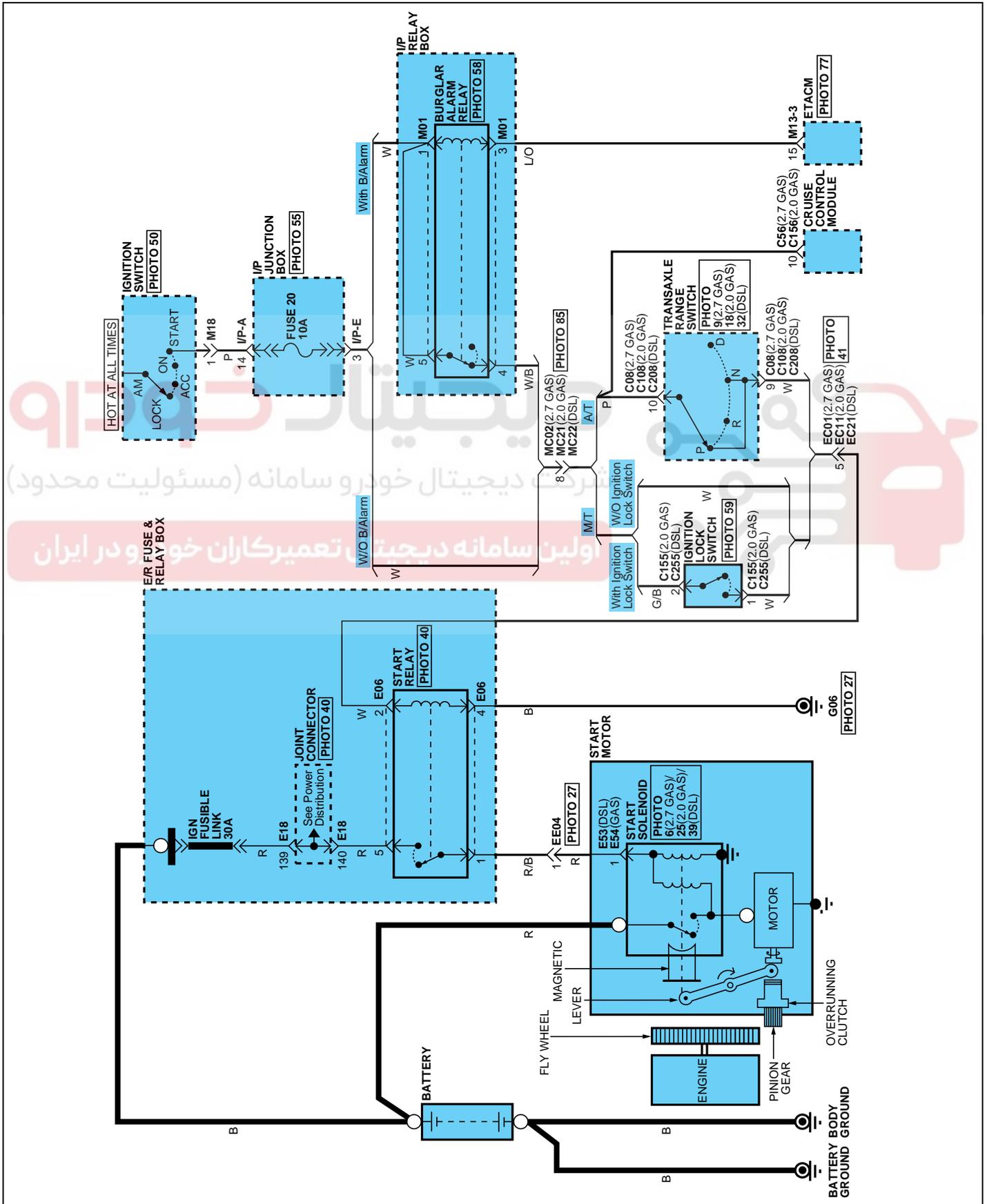


STARTING SYSTEM

ELECTRICAL AND ELECTRONIC SCHEMATIC DIAGRAMS

CIRCUIT DIAGRAM FOR STARTING SYSTEM

EBFE133F



EE -54

ENGINE ELECTRICAL SYSTEM

CLEANING, INSPECTION, AND ADJUSTMENT

INSPECTION E44C2FBC

START TEST

 **NOTE**

The air temperature must be between 59 and 100° F (15 and 38° C) before testing.

Recommended procedure :

- Use a starter system tester.
- Connect and operate the equipment in accordance with the manufacturer's instructions.
- Test and troubleshoot as described.

Alternate Procedure :

- Use the following equipment :
 - Ammeter, 0~400A
 - Voltmeter, 0~20V (accurate within 0.1 volt)
 - Tachometer, 0~1,200 rpm
- Hook up a voltmeter and ammeter as shown.

 **NOTE**

After this test, or any subsequent repair, reset the ECM/PCM to clear any codes.

Check the Starter Engagement :

1. Remove the ECM(B+) fuse from the fuse/relay box.
2. Turn the ignition switch to START (III) with the shift lever in N or P position (A/T) or with the clutch pedal depressed (M/T). The starter should crank the engine.
 - If the starter does not crank the engine, go to step 3.
 - If it cranks the engine erratically or too slowly, go to "Check for Wear and Damage" on the next page.
3. Check the battery, battery positive cable, ground, starter cut relay, and the wire connections for looseness and corrosion. Test again.
If the starter still does not crank the engine, go to step 4.
4. Unplug the connector from the starter.
5. Connect a jumper wire from the battery positive (+) terminal to the solenoid terminal.
The starter should crank the engine.
 - If the starter still does not crank the engine, remove it, and diagnose its internal problem.
 - If the starter cranks the engine, go to step 6.
6. Check the ignition switch (see page EE-23).

7. Check the starter relay (see page EE-69).
8. Check the A/T gear position switch (A/T) or the clutch interlock switch (M/T).
9. Check for an open in the wire between the ignition switch and starter.

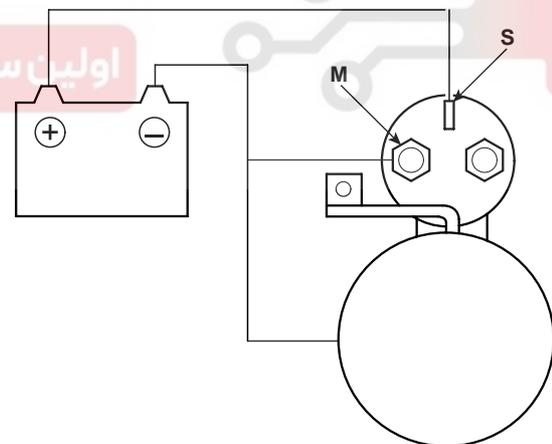
CHECK FOR WEAR AND DAMAGE

The starter should crank the engine smoothly and steadily. If the starter engages, but cranks the engine erratically, remove it, and inspect the starter drive gear and torque converter ring gear for damage.

Check the drive gear overrunning clutch for binding or slipping when the armature is rotated with the drive gear held. If damaged, replace the gears.

STARTER SOLENOID TEST

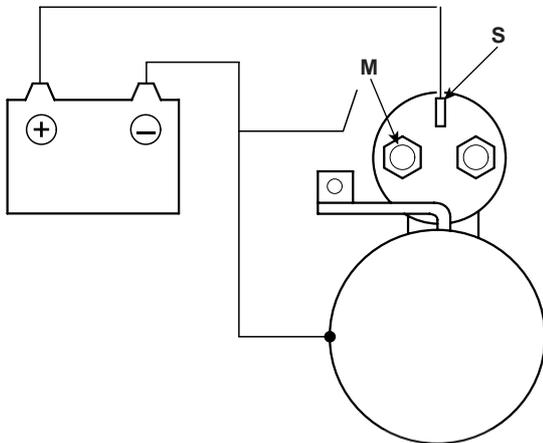
1. Disconnect the wires from the S terminal and the M terminal.
2. Connect the battery as shown. If the starter pinion pops out, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



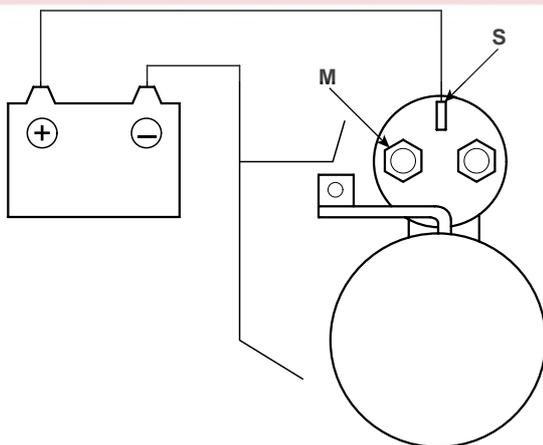
KBSE203D

STARTING SYSTEM

3. Disconnect the battery from the M terminal. If the pinion does not retract, the hold-in coil is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



KBSE203E

KBSE203F

FREE RUNNING TEST

1. Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows :
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostatas shown is the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.
4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11 volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely :

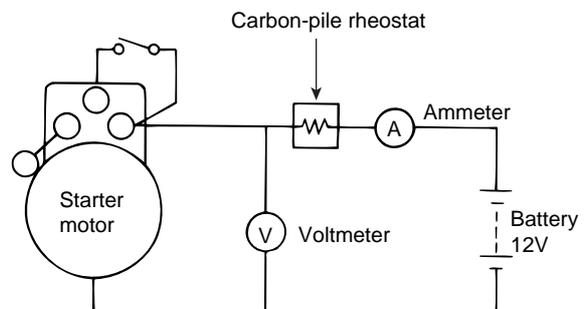
Current : Max. 90 Amps
Speed : Min. 2,800 rpm

2.0

Current: Max. 90 Amps
Speed: Min. 3,000 rpm

DIESEL

Current : Max. 120 Amps
Speed : Min. 4,000 rpm



EE -56

ENGINE ELECTRICAL SYSTEM

CLEANING, INSPECTION, AND ADJUSTMENT

CLEANING E8C3711A

1. Do not immerse parts in cleaning solvent. Immersing the yoke assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

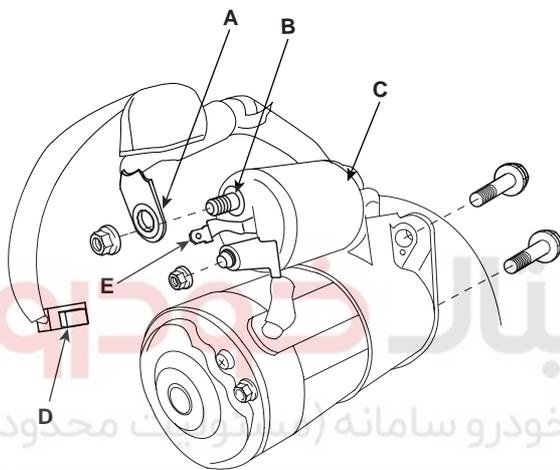


STARTING SYSTEM

EE -57

STARTER**REPLACEMENT** E1BE77DD

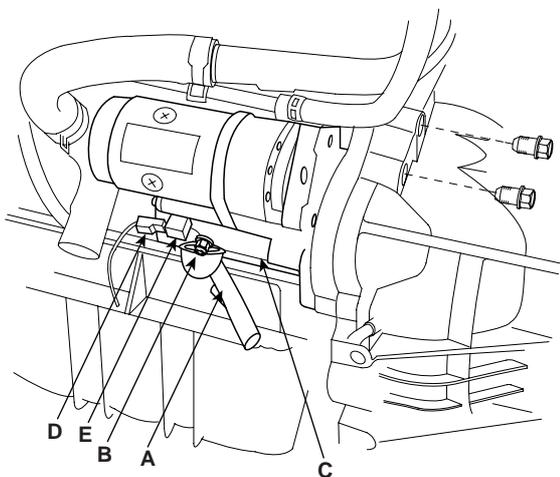
1. Disconnect the battery negative cable.
2. Disconnect the starter cable(A) from the B terminal(B) on the solenoid(C), then disconnect the connector(D) from the S terminal(E).
3. Remove the 2 bolts holding the starter, then remove the starter.
4. Installation is the reverse of removal.
5. Connect the battery positive cable and negative cable to the battery.

Gasoline

شرکت دیجیتال خودرو سامانه (سرویس و تعمیرات محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

EBKD303A

Diesel

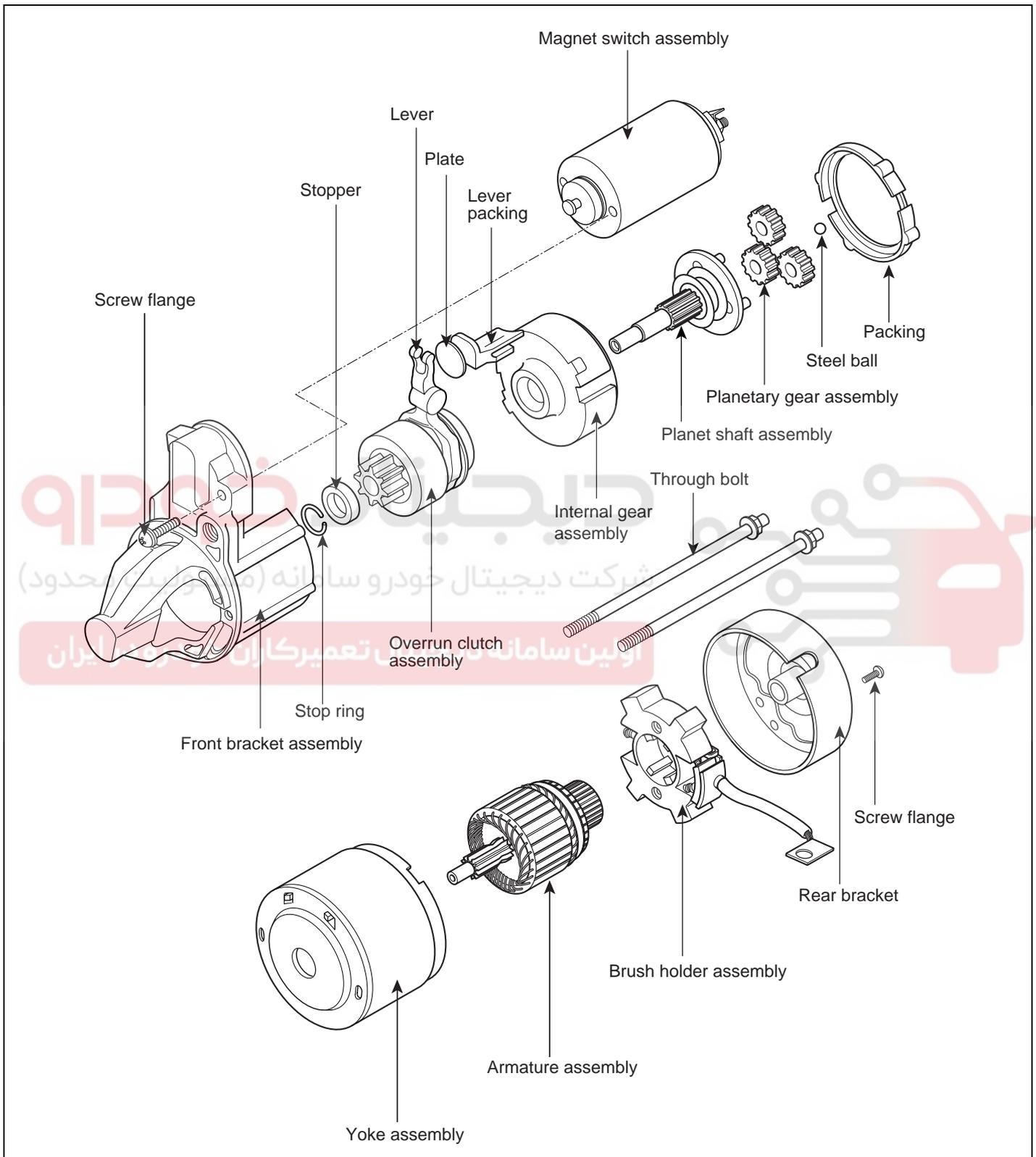
EBKD303B

EE -58

ENGINE ELECTRICAL SYSTEM

COMPONENTS EBAF73D6

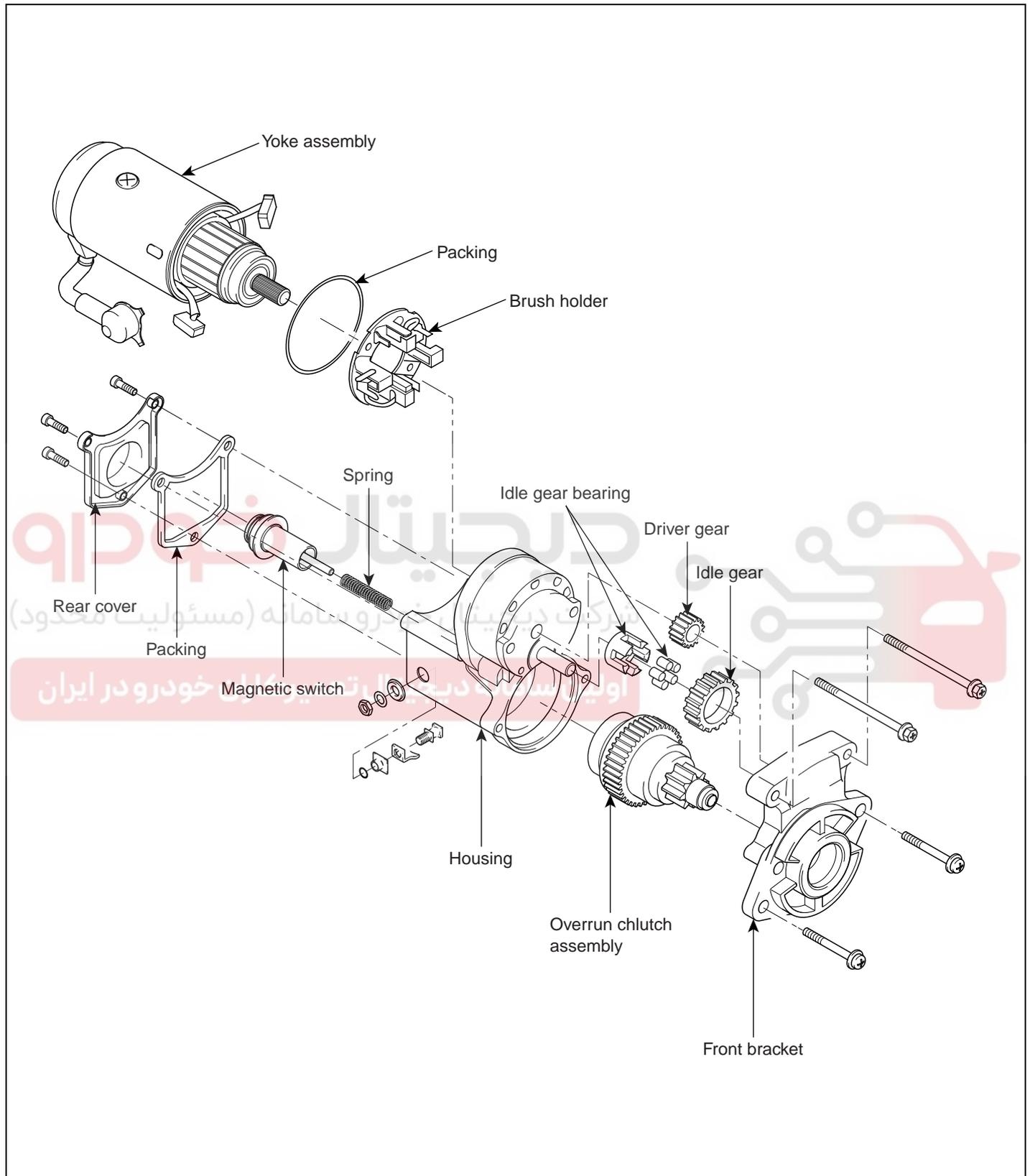
GASOLINE



EBJD007G

STARTING SYSTEM

DIESEL



EBKD300D

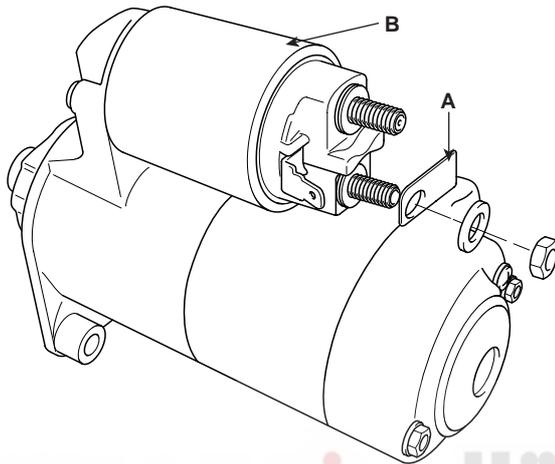
EE -60

ENGINE ELECTRICAL SYSTEM

DISASSEMBLY E8534E61

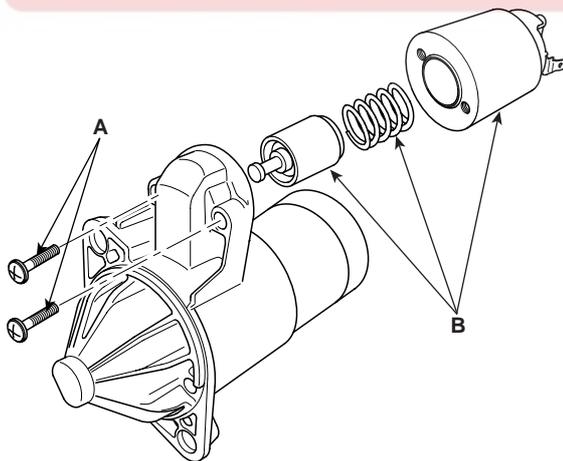
GASOLINE

- 1. Disconnect the M-terminal(A) on the magnet switch assembly(B).



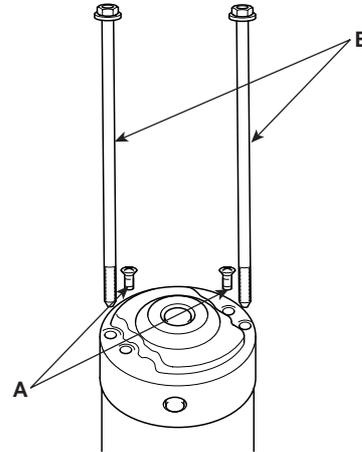
EBKD011C

- 2. After loosening the 2 screws(A), detach the magnet switch assembly(B).



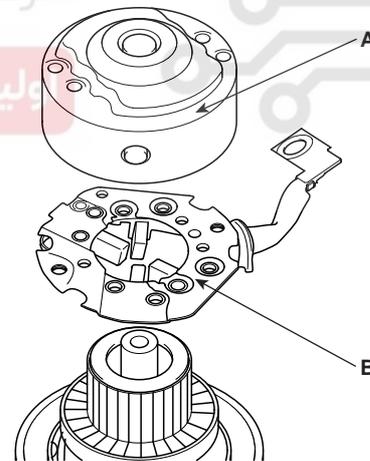
EBKD011D

- 3. Loosen the brush holder mounting screws(A) and through bolts(B).



EBKD011E

- 4. Remove the rear bracket(A) and brush holder assembly(B).



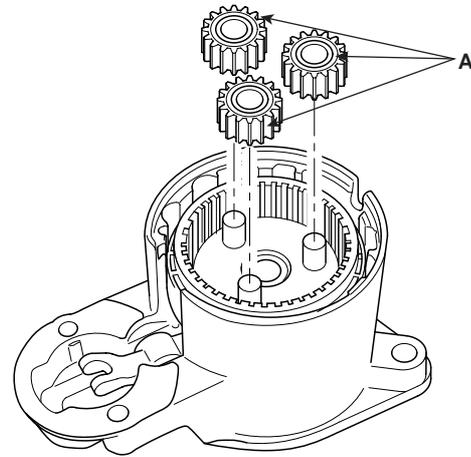
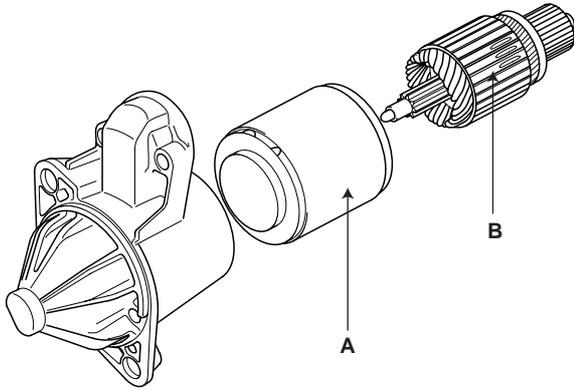
EBKD011F

STARTING SYSTEM

EE -61

5. Remove the yoke(A) and armature(B).

7. Disconnect the planet gear(A).

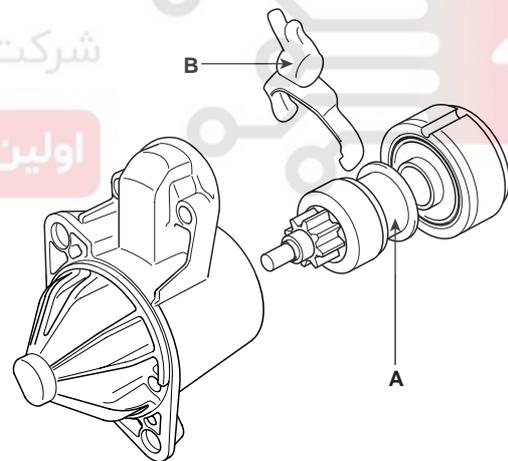


EBKD011G

EBKD011I

6. Remove the lever plate(A) and planet shaft packing(B).

8. Disconnect the planet shaft assembly(A) and lever(B).



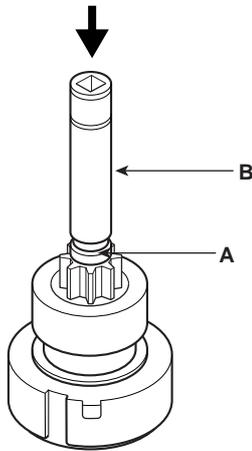
EBKD011H

EBKD011J

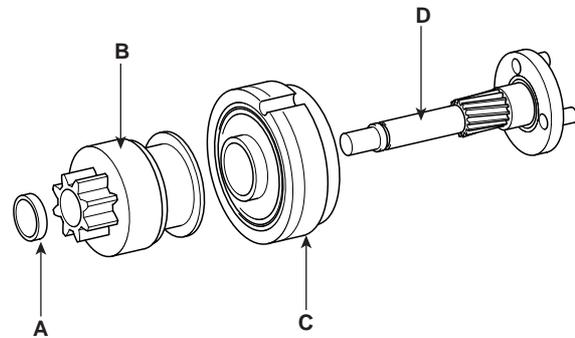
EE -62

ENGINE ELECTRICAL SYSTEM

9. Press the stop ring(A) using a socket(B).



11. Disconnect the stop ring(A), overrunning clutch(B), internal gear(C) and planet shaft(D).



EBKD011K

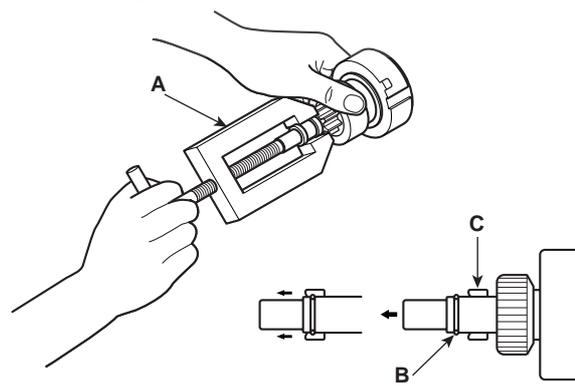
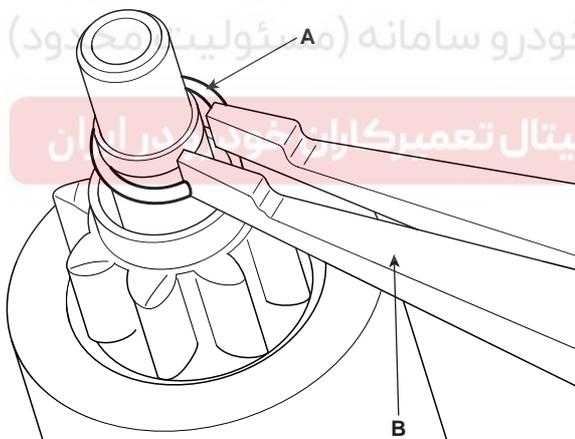
EBKD011M

10. After removing the stopper(A) using stopper pliers(B).

12. Reassembly is the reverse of disassembly.

NOTE

Using a suitable pulling tool(A), pull the overrunning clutch stopring(B) over the stopper(C).



EBKD011L

EBKD011O

STARTING SYSTEM

EE -63

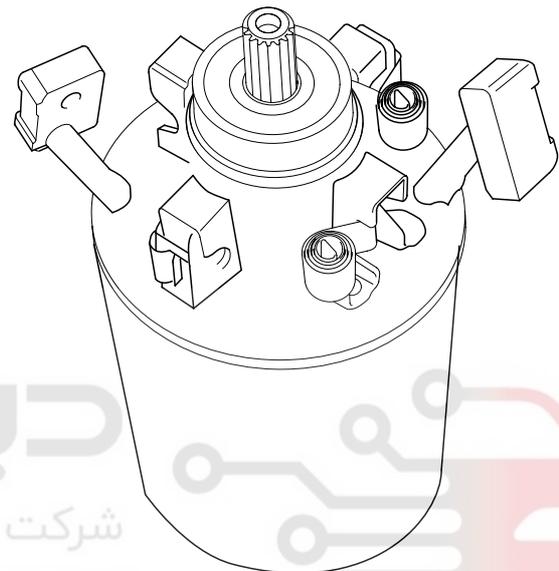
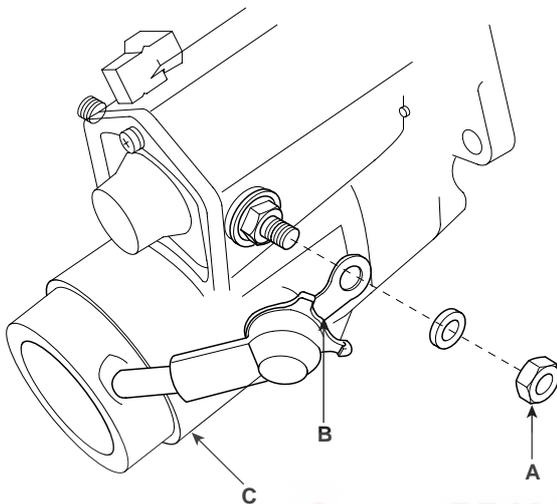
DIESEL

1. Remove the nut(A) and disconnect the lead wire(B) from the magnetic switch terminal(C).

3. Using a screwdriver, hold the spring tank back and disconnect the brush(A) from the brush holder(B). Disconnect the 2 brushes and remove the brush holder.

NOTE

Check that the positive(+) lead wires are not grounded.

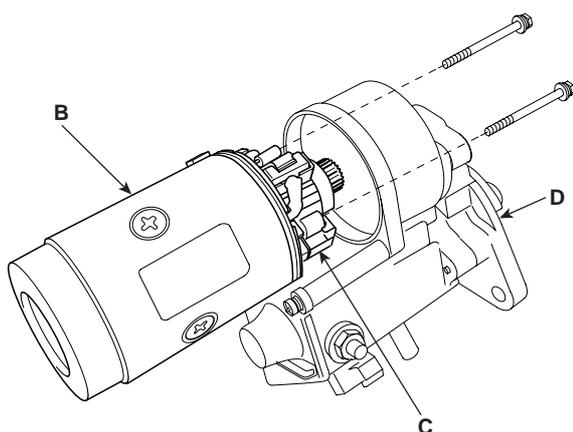


دیجیتال خودرو
 شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
 اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

EBKD300E

EBKD300G

2. Remove the 2 bolts(A) and pull out the yoke assembly(B) with the armature(C) from the front bracket(D).

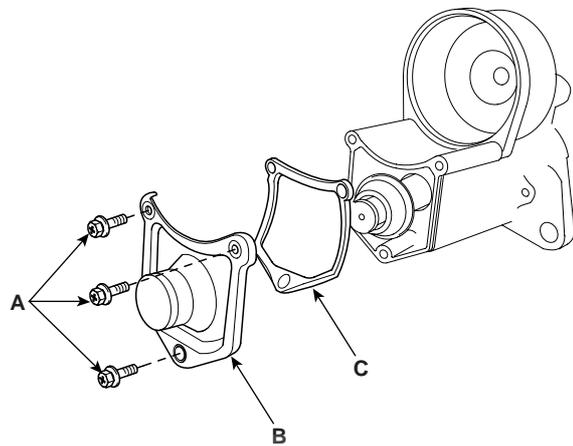


EBKD300F

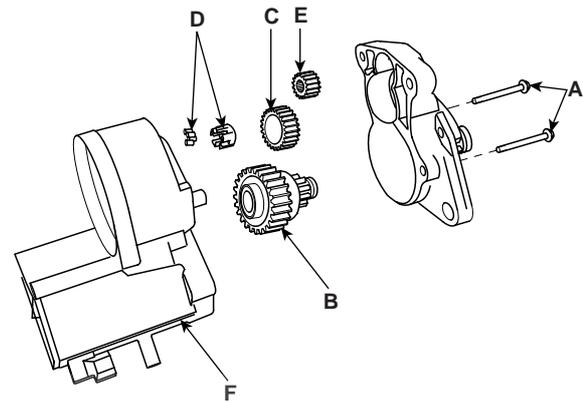
EE -64

ENGINE ELECTRICAL SYSTEM

4. Remove the 3 screws(A) and disconnect the housing rear cover(B) and packing(C).



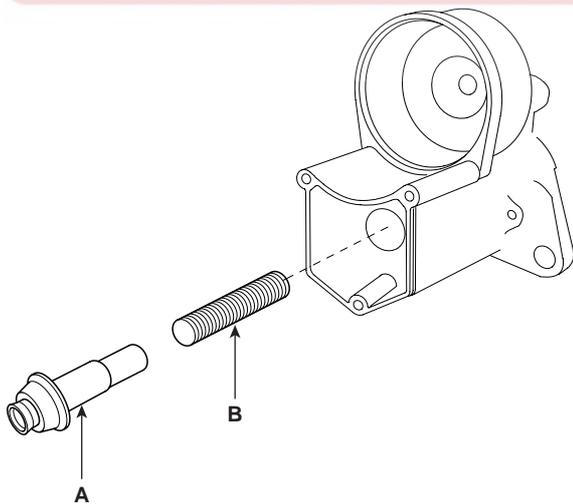
6. Remove the 2 screws(A) and disconnect the clutch sub assembly(B), idle gear(C), idle gear bearing(D) and drive gear(E) from the housing(F).



دیجیتال خودرو

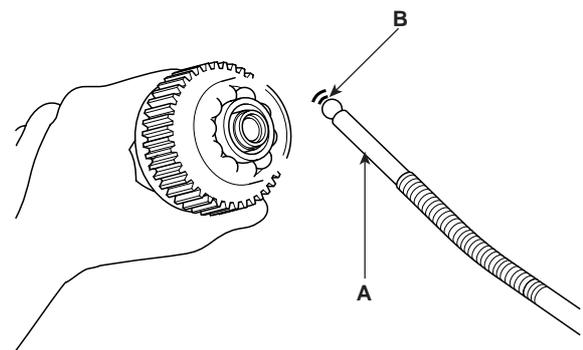
EBKD300I

5. Remove the magnetic switch(A) and spring coil(B).



EBKD300J

7. Using a magnetic finger(A), remove the steel ball(B) from the clutch shaft hole.



EBKD300K

EBKD300H

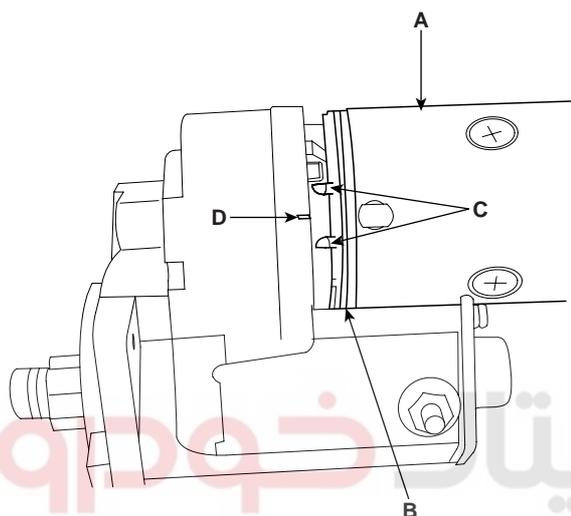
STARTING SYSTEM

EE -65

8. Reassembly is the reverse of disassembly.

NOTE

When installing the yoke assembly(A), use a new O-ring(B) and align the mark(C) on the housing to the mark(D) range of the brush holder.



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EBKD300L

EE -66

ENGINE ELECTRICAL SYSTEM

INSPECTION E712D053

ARMATURE INSPECTION AND TEST

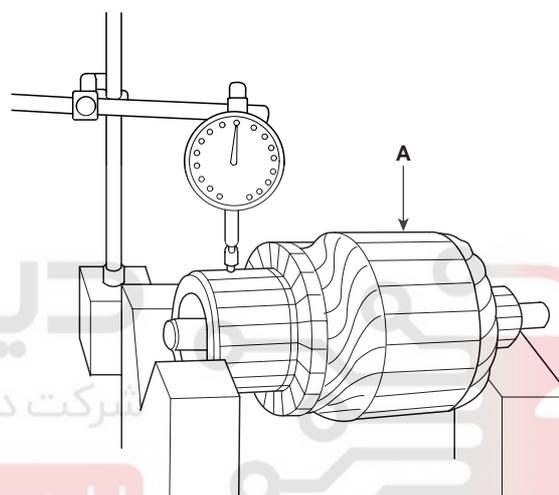
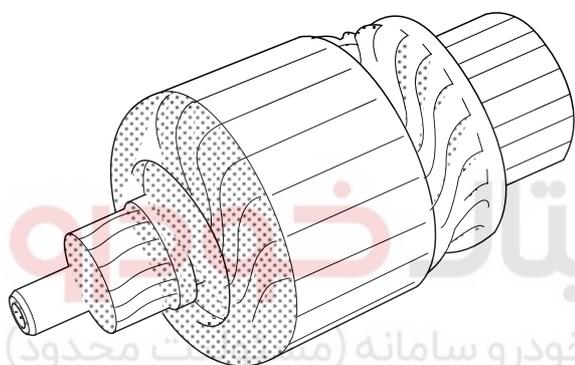
1. Remove the starter (see page EE-57).
2. Disassemble the starter as shown at the beginning of this procedure.
3. Inspect the armature for wear or damage from contact with the permanent magnet. If there is wear or damage, replace the armature.

4. Measure the commutator (A) runout.
 - If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
 - If the commutator runout is not within the service limit, replace the armature.

Commutator Runout

Standard (New) : 0.02mm (0.001 in.) max.

Service limit : 0.05mm (0.002 in.)



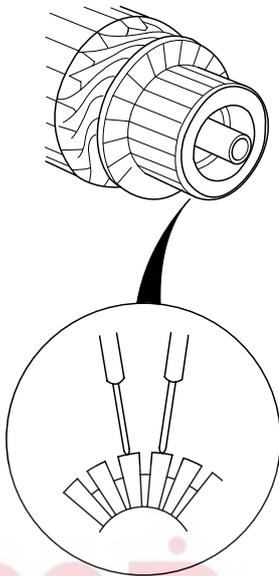
EBKD012A

EBKD012D

STARTING SYSTEM

EE -67

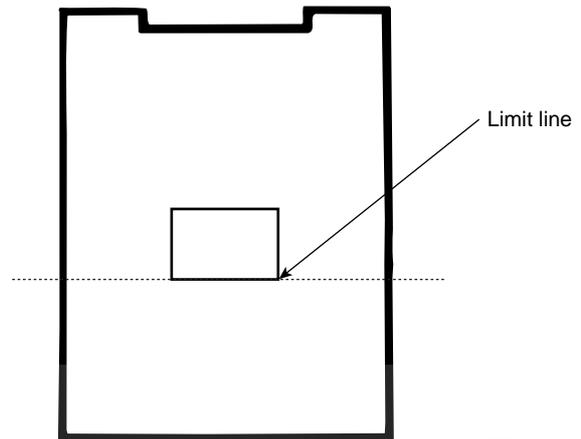
5. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.



EBKD012F

INSPECT STARTER BRUSH

Brushes that are worn out, or oil-soaked, should be replaced.

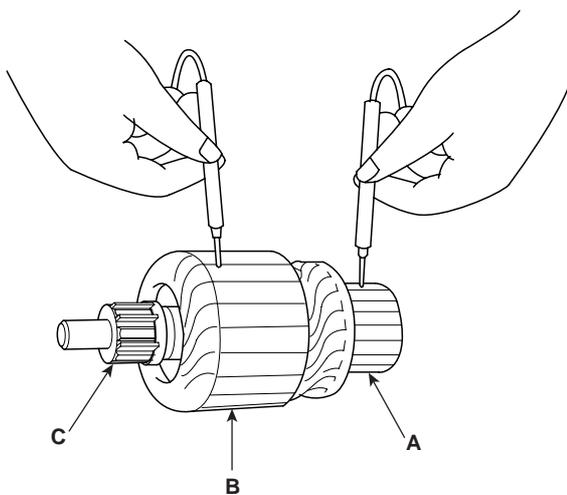


EBBD027A

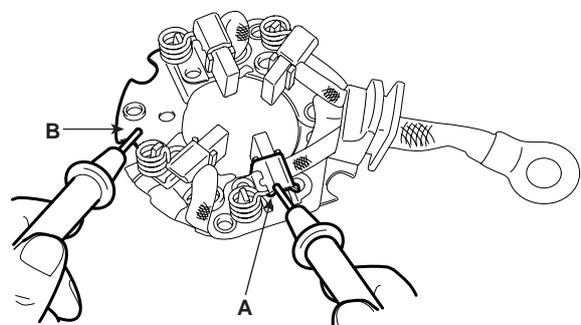
6. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.

STARTER BRUSH HOLDER TEST

Check that there is no continuity between the (+) brush holder (A) and (-) brush holder (B). If there is no continuity, replace the brush holder assembly.



EBKD012G



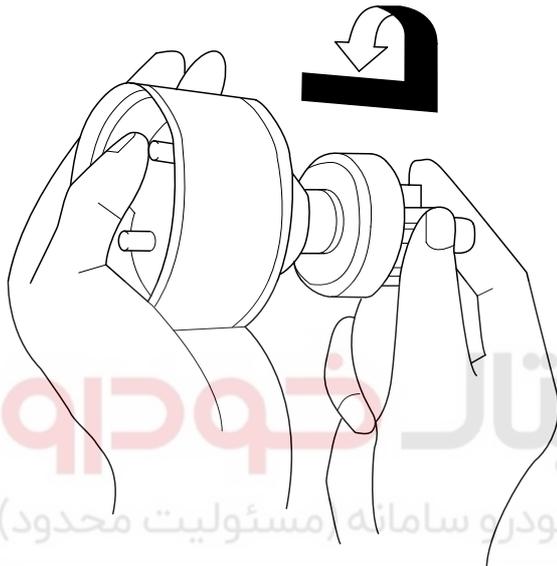
EBBD330A

EE -68

ENGINE ELECTRICAL SYSTEM

INSPECT OVERRUNNING CLUTCH

1. Slide the overrunning clutch along the shaft.
Replace it if does not slide smoothly.
2. Rotate the overrunning clutch (A) both ways.
Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction or it locks in both directions, replace it.



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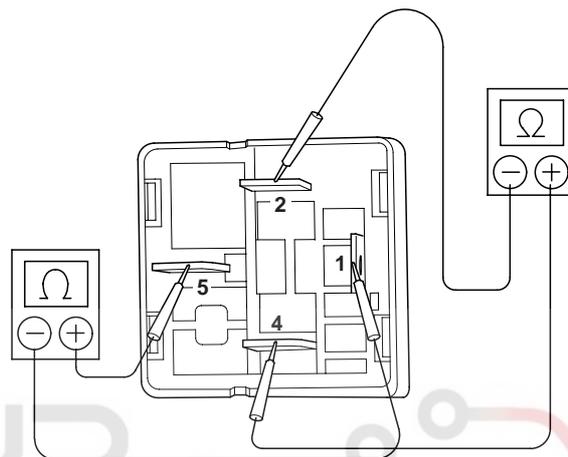
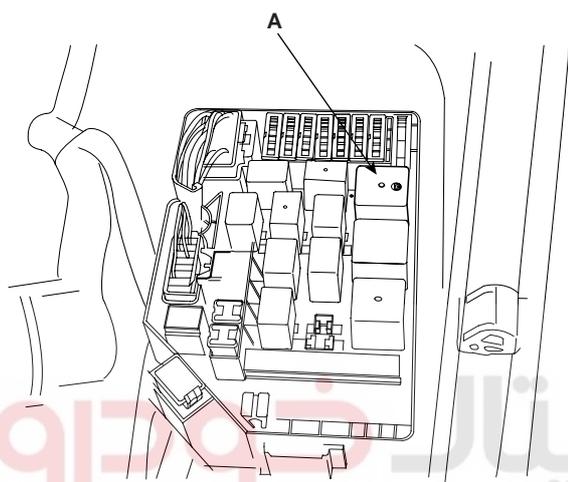
EBKD012J

3. If the starter driver gear (B) is worn or damaged, replace the overrunning clutch assembly: the gear is not available separately.
Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

STARTING SYSTEM**EE -69****STARTER RELAY****INSPECTION** E03A96B5

1. Remove the fuse box cover.
2. Remove the starter relay(A).

3. Inspect the relay continuity.
 - Using an ohmmeter, check that there is continuity between terminals 2 and 4.
 - Check that there is no continuity between terminals 1 and 5.
 If there is no continuity, replace the relay.
 If there is continuity, replace the relay.



شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

EBKD013A

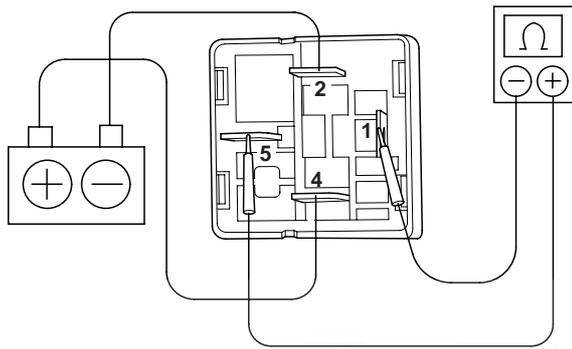
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

EBKD013B

EE -70

ENGINE ELECTRICAL SYSTEM

4. Inspect the relay operation.
 - Apply battery positive voltage across terminals 2 and 4.
 - Using an ohmmeter, check that there is continuity between terminals 1 and 5.If there is no continuity, replace the relay.



دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود) EBKD013C

5. Install the starter relay.
6. Install the fuse box cover.



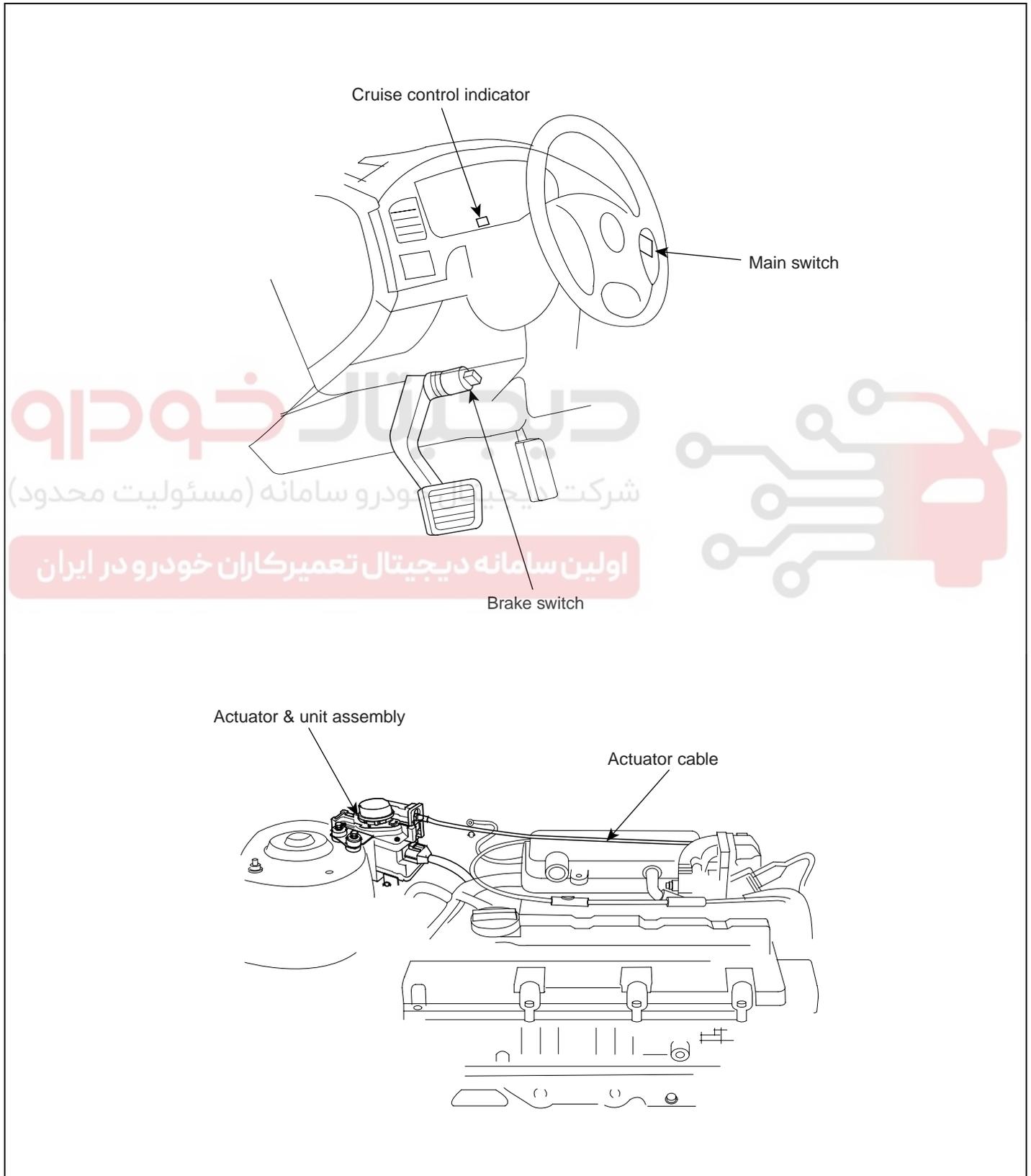
CRUISE CONTROL SYSTEM

EE -71

CRUISE CONTROL SYSTEM

ALL COMPONENT LOCATOR

COMPONENTS LOCATION EF26FAE8



EBKD020A

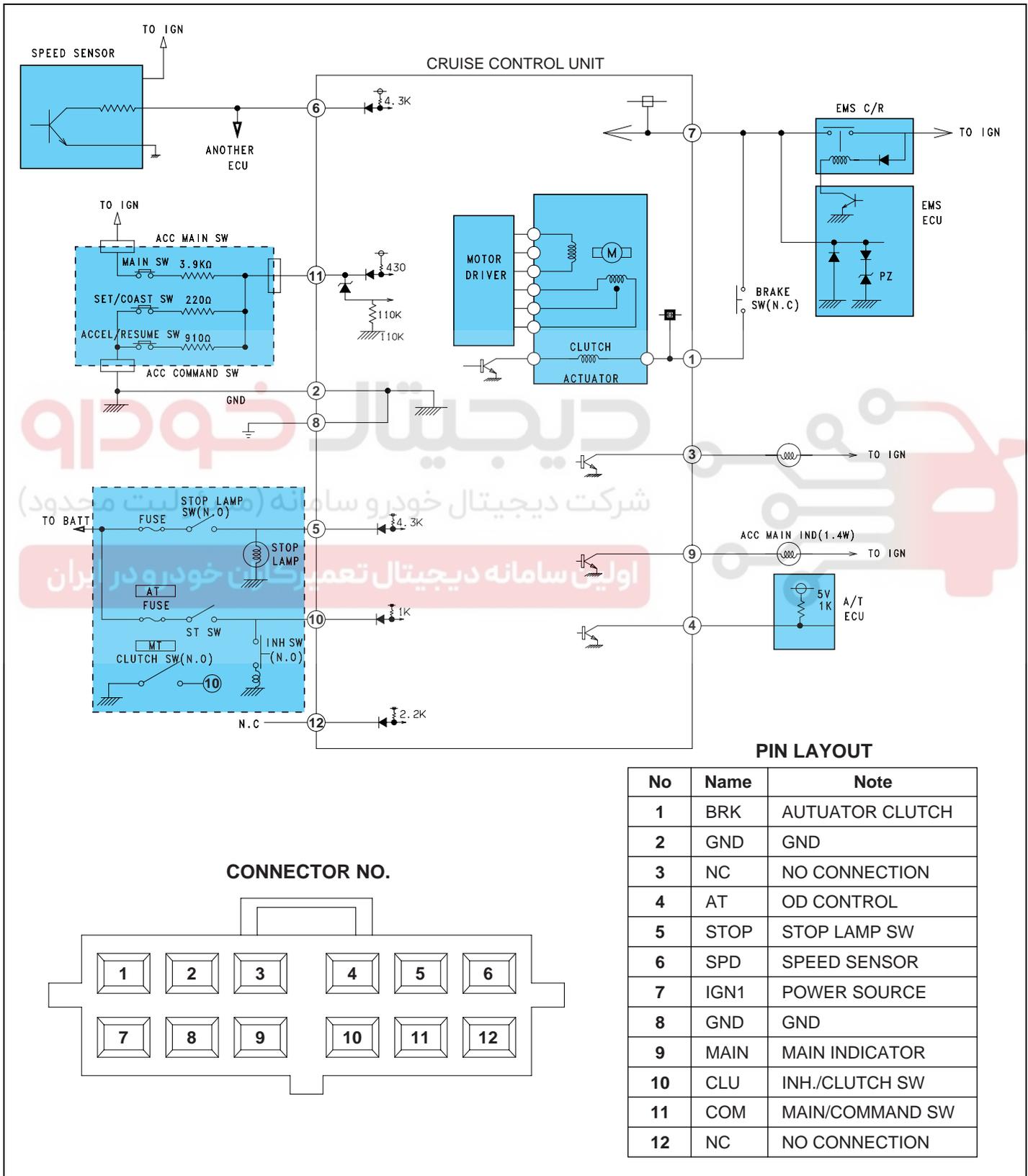
EE -72

ENGINE ELECTRICAL SYSTEM

ELECTRICAL AND ELECTRONIC SCHEMATIC DIAGRAMS

CIRCUIT DIAGRAM FOR CRUISE CONTROL SYSTEM

ECC73F72



EBKD020B

CRUISE CONTROL SYSTEM

EE -73

CLEANING, INSPECTION, AND ADJUSTMENT

INSPECTION E03C058C

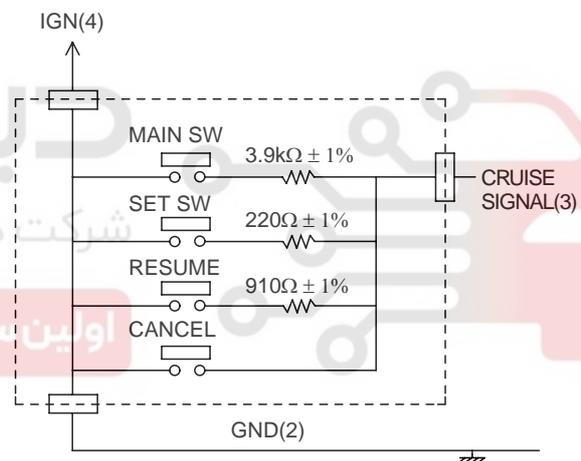
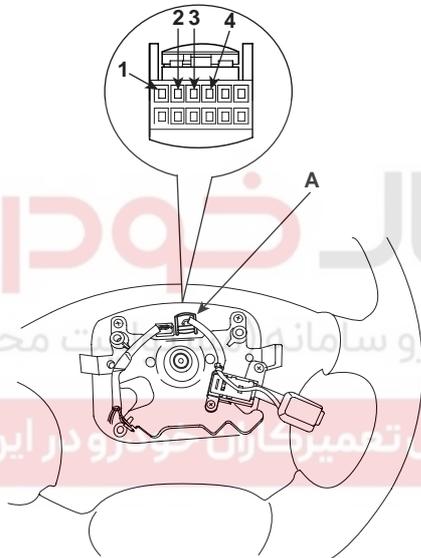
CRUISE REMOCON SWITCH TEST

1. Disconnect the battery negative cable, then disconnect the positive cable, and wait at least three minutes.
2. Remove the driver's airbag (See page RT group-air bag module).
3. Disconnect the remocon switch connector(A).

4. Check the continuity between the terminals of the connector in each switch position according to the table.
 - If there is continuity, and it matches the table, the switch is O.K.
 - If there is no continuity, replace the remocon switch.

Terminal Position	1	2	3	4
MAIN (ON)			○ — ○	
SET (ON)		○ — ○		
RESUME (ON)		○ — ○		
CANCEL (ON)		○ — ○		

EBKD021D



CIRCUIT DIAGRAM

EBKD021A

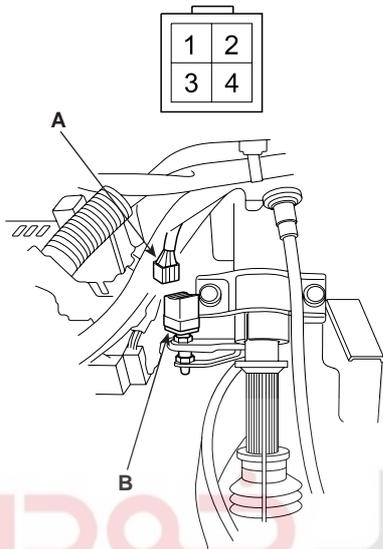
EBKD021B

EE -74

ENGINE ELECTRICAL SYSTEM

BRAKE SWITCH TEST

1. Disconnect the connector(A) from the brake switch.
2. Remove the brake switch(B).



EBKD021C

3. Check for continuity between the terminals according to the table.

Terminal \ Position	1	2	3	4
Depressed		○ — ○		
Released	○ — ○			

EBKD021E

4. If necessary, replace the switch or adjust the pedal height.

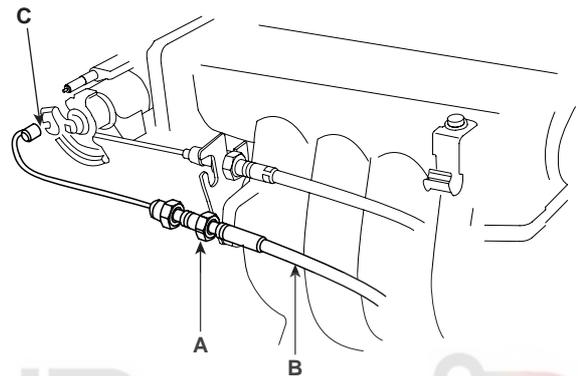
REMOVAL, REPLACEMENT, AND INSTALLATION

REPLACEMENT

E1C22A98

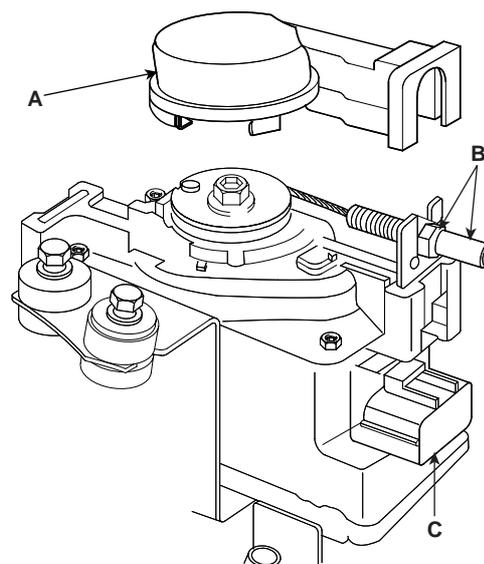
CRUISE CONTROL UNIT AND CABLE

1. Loosen the locknuts(A) and disconnect the actuator cable (B) from the throttle linkage(C).



EBKD022A

2. Disconnect the cover, actuator cable and connector.

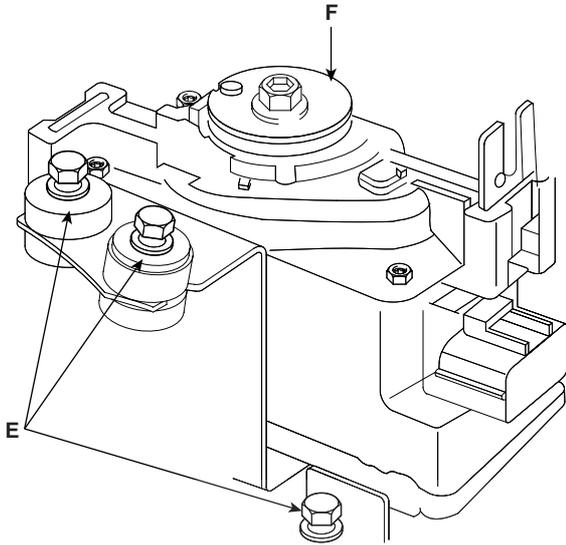


EBKD022C

CRUISE CONTROL SYSTEM

EE -75

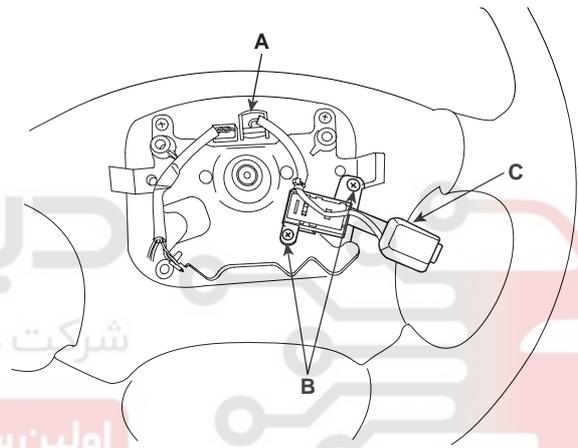
- Loosen the three mounting bolts(E), and remove the actuator(F) with the bracket.



- Installation is the reverse of removal.

CRUISE REMOCON SWITCH REPLACEMENT

- Disconnect the battery negative cable, then disconnect the positive cable, and wait at least three minutes.
- Remove the driver's airbag (See page RT group-air bag module).
- Disconnect the remocon switch connector(A).
- Loosen the two mounting screws(B), and remove the cruise remocon switch(C).



- Installation is the reverse of removal.
- Connect the battery positive cable and negative cable to the battery.

CLEANING, INSPECTION, AND ADJUSTMENT

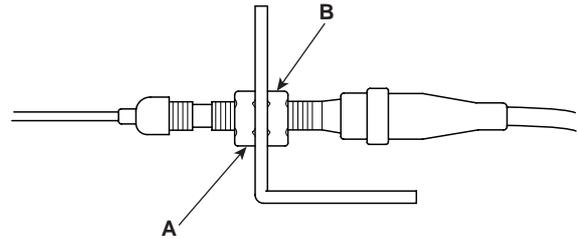
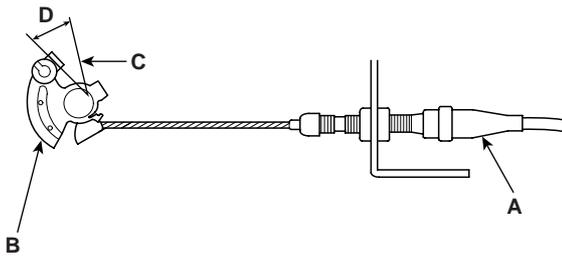
EE -76

ENGINE ELECTRICAL SYSTEM

ACTUATOR CABLE ADJUSTMENT E3E12C8D

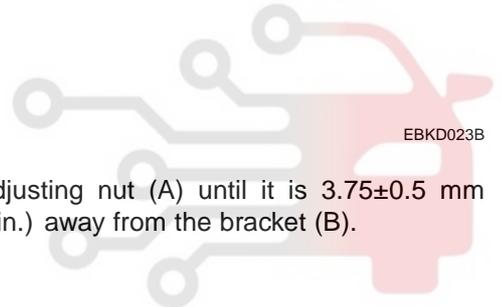
1. Check that the actuator cable (A) moves smoothly with no binding or sticking.

4. If the free play is not within specs, move the cable to the point where the engine speed starts to increase, and tighten the locknut (A) and adjusting nut (B).



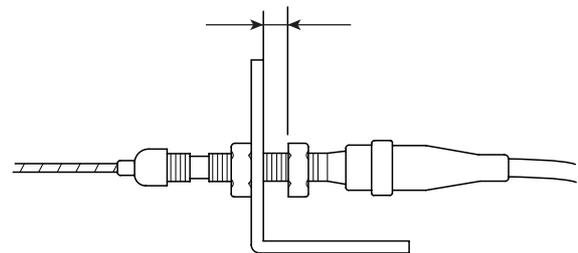
دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود) EBKD023A



2. Start the engine. Hold the engine at 3,000 rpm with no load (A/T in **N** or **P** position, M/T in neutral) until the radiator fan comes on, then let it idle.
3. Measure the amount of movement of the output linkage (B) until the engine speed starts to increase. At first, the output linkage should be located at the fully closed position (C). The free play (D) should be 3.75 ± 0.5 mm (0.15 ± 0.02 in.)

5. Turn the adjusting nut (A) until it is 3.75 ± 0.5 mm (0.15 ± 0.02 in.) away from the bracket (B).

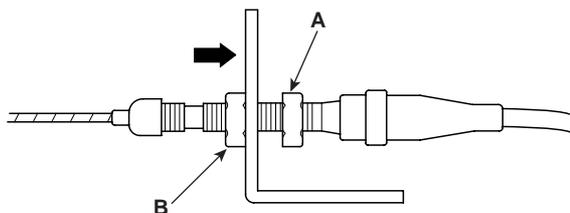


EBKD023C

CRUISE CONTROL SYSTEM

EE -77

6. Pull the cable so that the adjusting nut (A) touches the bracket, and tighten the locknut (B).



دیجیتال خودرو

EBKD023D

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



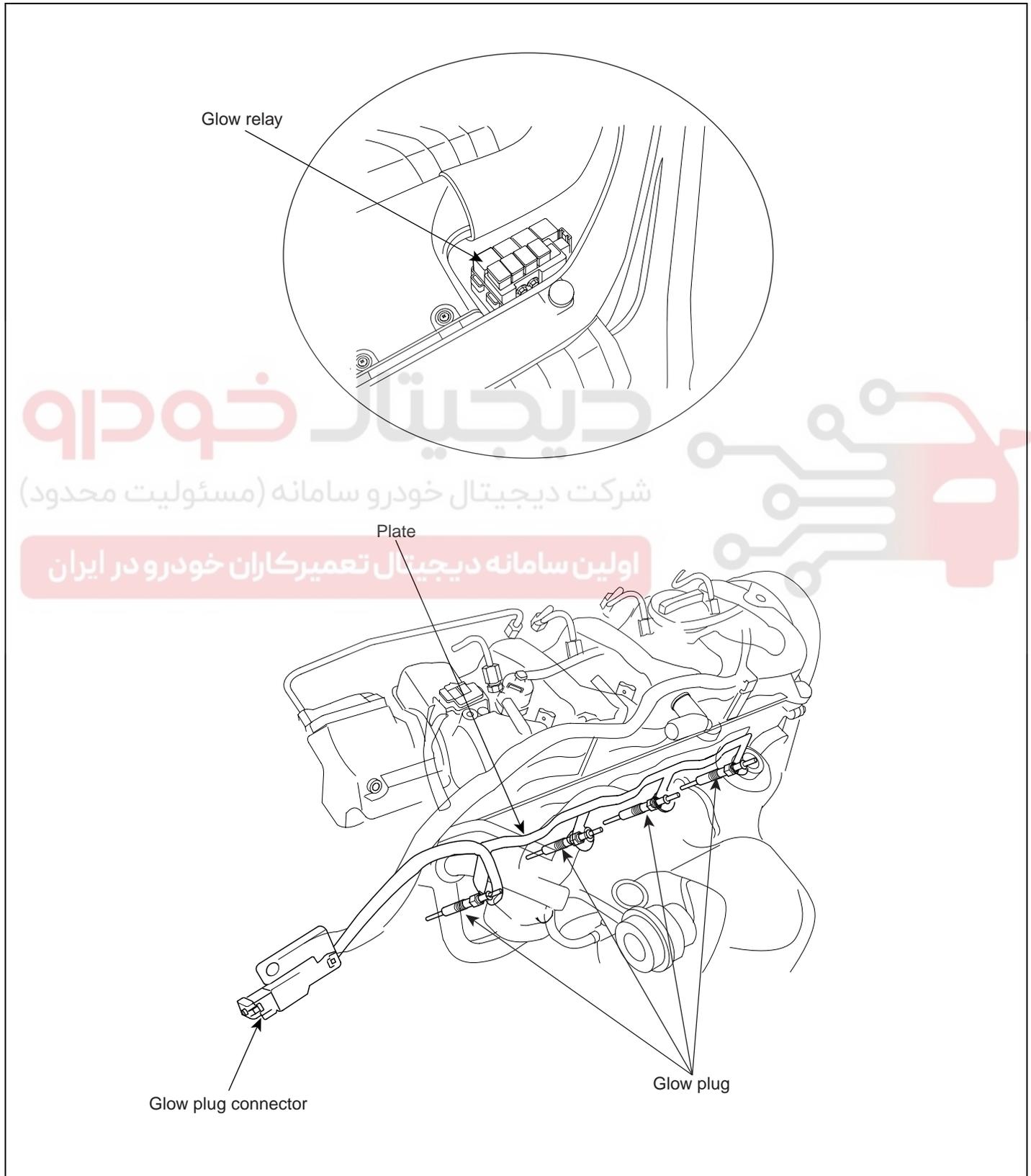
EE -78

ENGINE ELECTRICAL SYSTEM

PREHEATING SYSTEM

ALL COMPONENT LOCATOR

COMPONENT LOCATION E64278AC



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EBKE300M

PREHEATING SYSTEM

EE -79

CLEANING, INSPECTION, AND ADJUSTMENT**INSPECT PREHEATING SYSTEM** E812E6A0

Conditions before inspection :

Battery voltage : 12V

1. Connect voltmeter between glow plug plate and plug body (ground).
2. Check indicated value on voltmeter with ignition switch ON.
3. Check that preheat indication lamp lights for about 6 seconds and indicates battery voltage (about 9V or over) for about 36 seconds immediately after ignition-switch is turned on. [At cooling water temperature 20°C (68°F)]

NOTE

Continuity time varies depending upon cooling water temperature.

4. After checking 3, set ignition switch at START position.
5. The system is normal if battery voltage (about 9V or over) is generated for about 6 seconds during engine cranking and after start operation. [at cooling water temperature 20°C (68°F)]
6. When the voltage or continuity time is not normal, check the terminal voltage in glow control unit, and single parts.

INSPECT GLOW PLUS

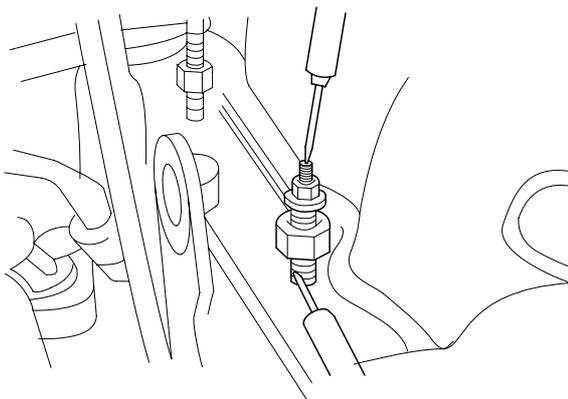
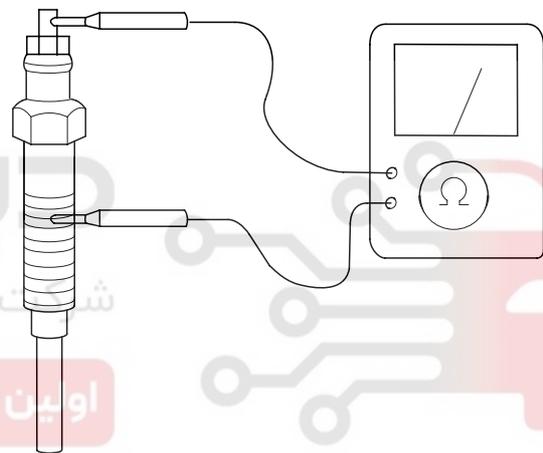
1. Check the continuity between the terminal and body as illustrated. Replace if discontinuity or with large resistance.

 Standard value : 0.25Ω

CAUTION

Remove oil from plug before measuring as glow plug resistance is very small.

2. Check for rust on glow plug plate.
3. Check glow plug for damage.



EBKD300P

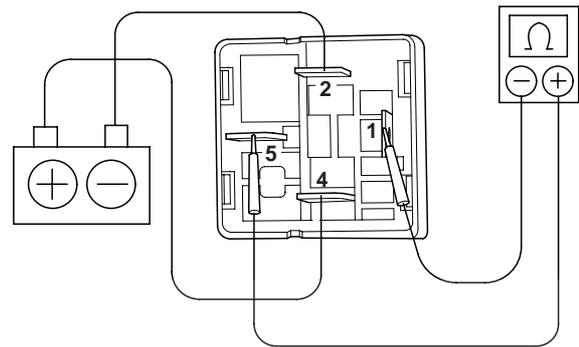
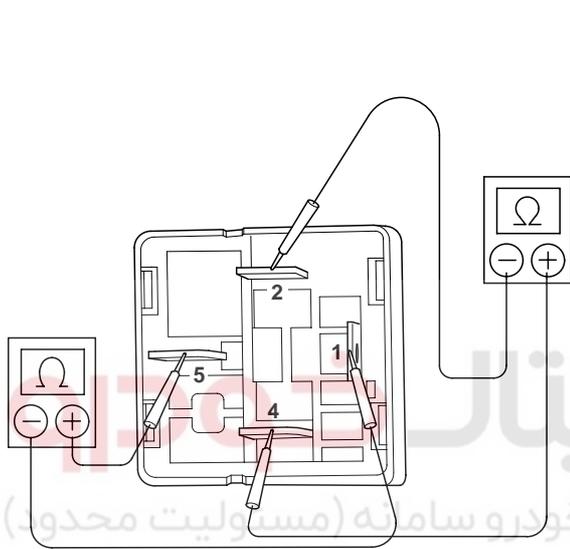
EBKD300O

EE -80

ENGINE ELECTRICAL SYSTEM

INSPECT GLOW PLUG RELAY

1. Remove the glow plug relay.
2. Inspect the relay continuity.
 - Using an ohmmeter, check that there is continuity between terminals 2 and 4.
If there is no continuity, replace the relay.
 - Check that there is no continuity between terminals 1 and 5.
If there is continuity, replace the relay.
3. Inspect the relay operation.
 - Apply battery positive voltage across terminals 2 and 4.
 - Using an ohmmeter, check that there is continuity between terminals 1 and 5.
If there is no continuity, replace the relay.



4. Install the glow plug relay.

EBKD013B

EBKD013C

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