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EADO Workshop Manual

Starting System

EADORM2G/1/1

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3.1.9 Starting System

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Description and Operation

System Overview

The start system includes the battery, the ignition switch, the starter motor and the related circuits. All the components are connected by wires. When the ignition switch is at position "ST", the power is supplied to the starter motor solenoid switch, the solenoid switch coil generates a magnetic field to move the plunger and the gear transfer pole to engage the engine flywheel ring gear and the pinion gear. The solenoid switch close to start the engine.

When the engine starts, the small gear overspeed clutch protects the armature to avoid the flywheel-drive running the small gear-drive armature till the switch is off, then return the spring to deviate the pinion.

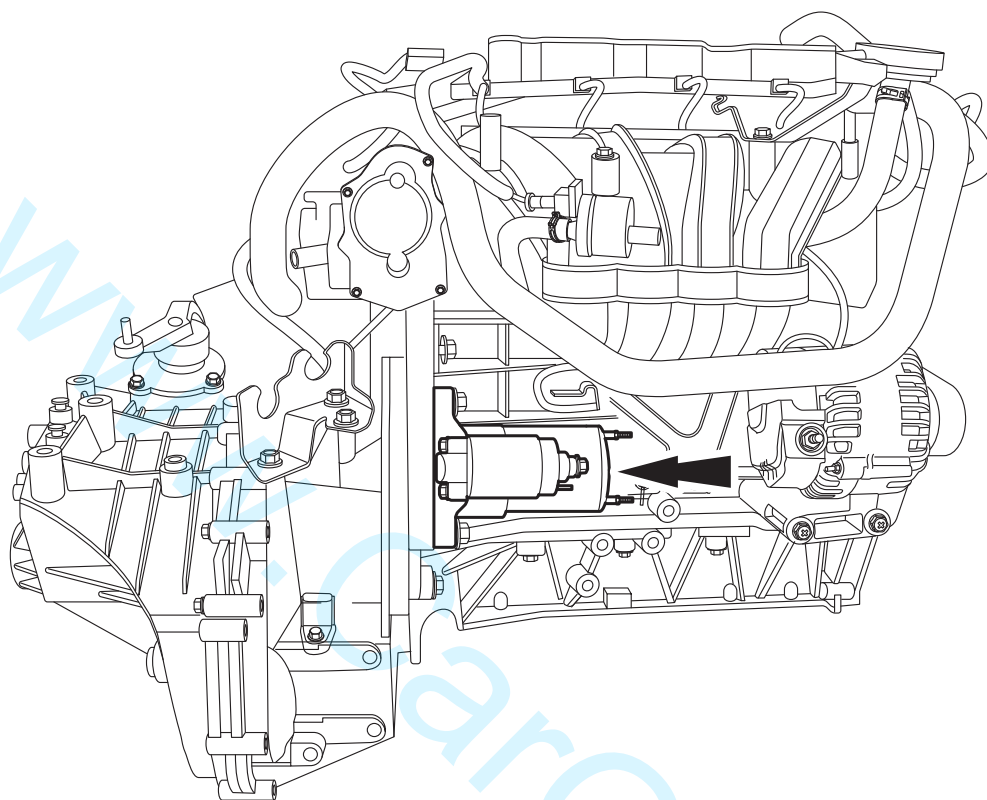
Component Description

Starter Motor

The starter motor includes the stator assembly, the armature assembly, the overspeed clutch assembly, the solenoid switch assembly, the front/rear cover, the brush holder and the drive rod. The starter motor is of reduction type to reduce the armature speed through a planetary gear and increase the drive torque. Armature is combined with the sun gear, The planetary carrier is connected with the drive pinion, fixed by the ring gear.

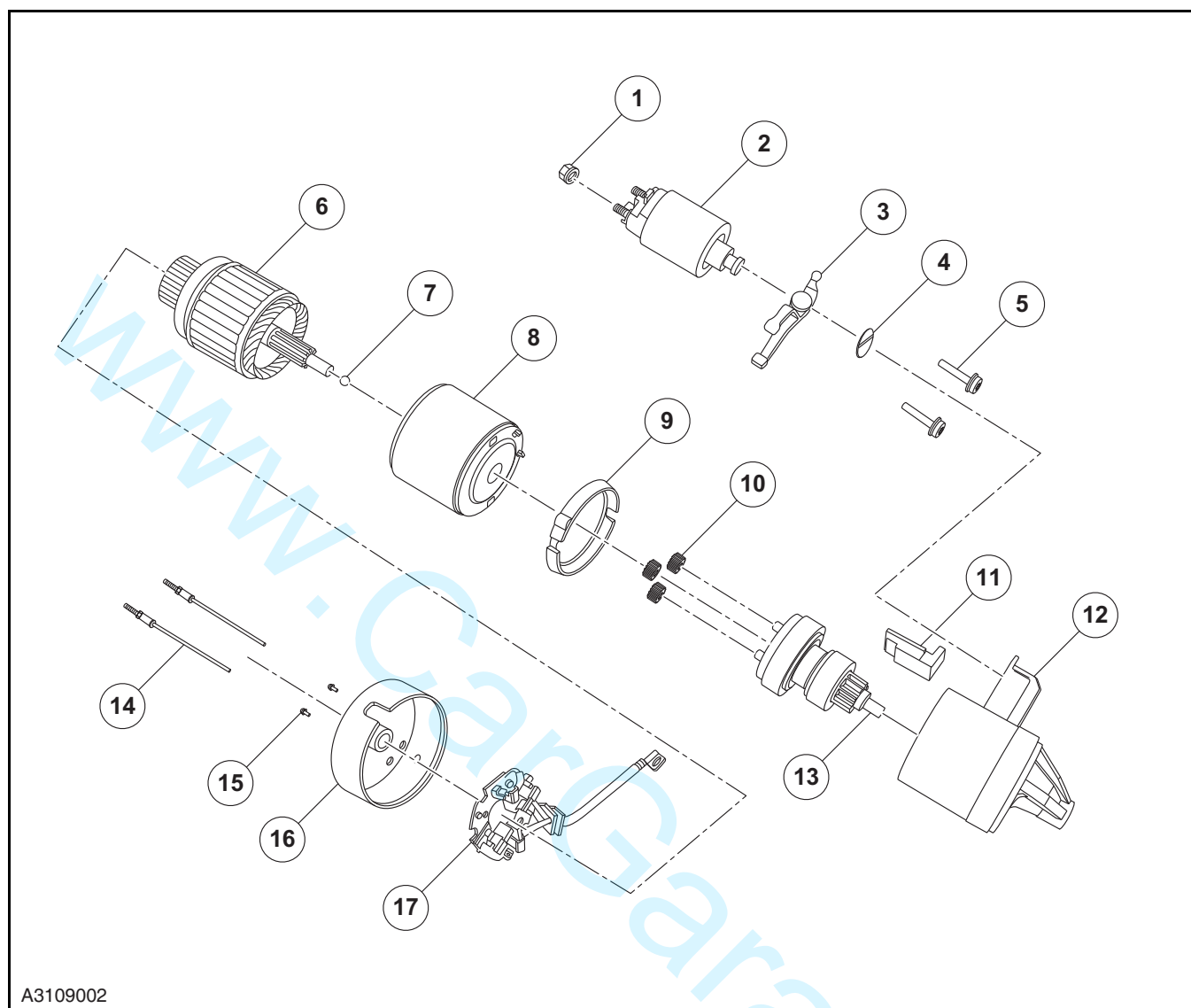
Location View

Starter Motor



A3109001

Exploded View



A3109002

Item	Description	Item	Description
1	Nut	10	Reduction gear
2	Solenoid switch	11	Gasket
3	Shifting yoke	12	Housing
4	Separation blade	13	One-way clutch
5	Screw	14	Bolt
6	Armature	15	Screw
7	Steel ball	16	Rear cover
8	Stator	17	Electric brake assembly
9	Seal ring		

General Procedures

General Equipment

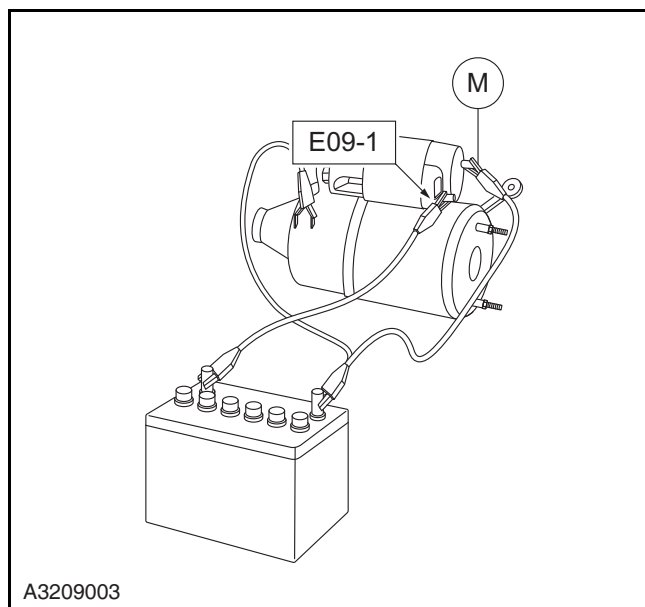
Multimeter

WARNING: Each test must be completed within 3 ~ 5s to avoid coil burnout.

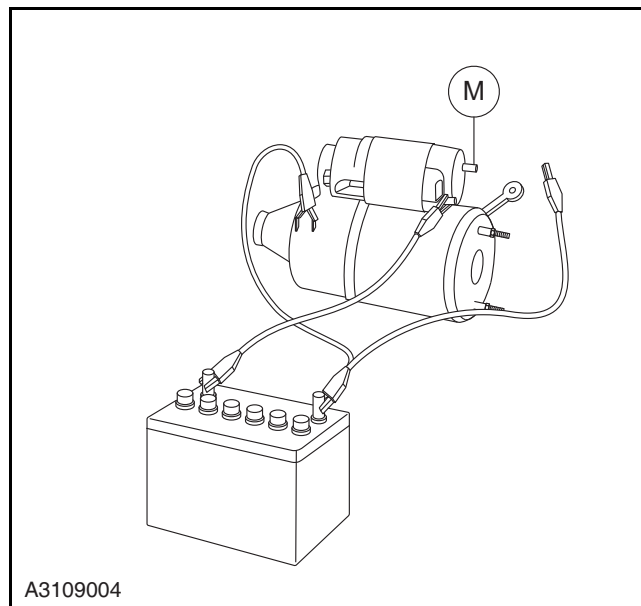
Solenoid Switch Test

CAUTION: Before the test, disconnect the excitation coils and the terminals 'M'.

1. Remove the starter motor armature wire from the solenoid switch.
2. Use a jumper wire to connect the starter motor housing and the solenoid switch housing and the battery negative reliably.
3. Use one end of another jumper wire to connect to the battery positive and the other end is connected to the starter motor wiring harness connector E09 terminal 1.
4. The starter motor pinion should be removed.
5. Remove the 'M' terminal negative cables, the starter motor pinion should not return to the original place.

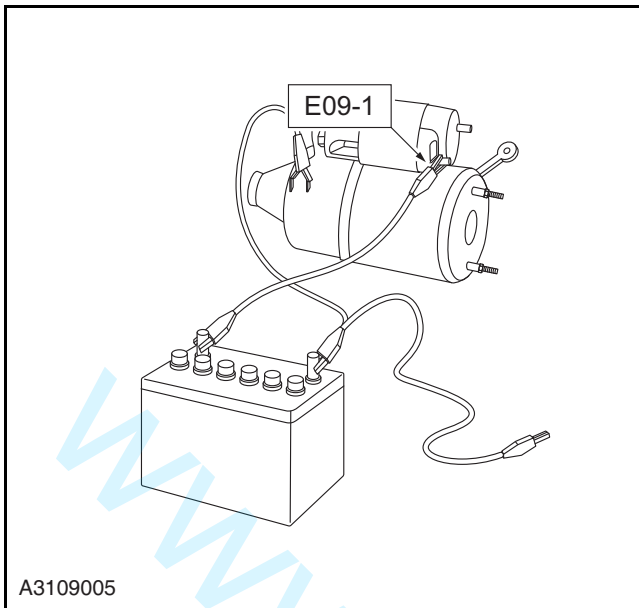


6. As mentioned above, connect the conductor of the small gear, then remove the 'M' terminal negative wire, check whether the small gear is outward transfer, otherwise should replace the solenoid switch.



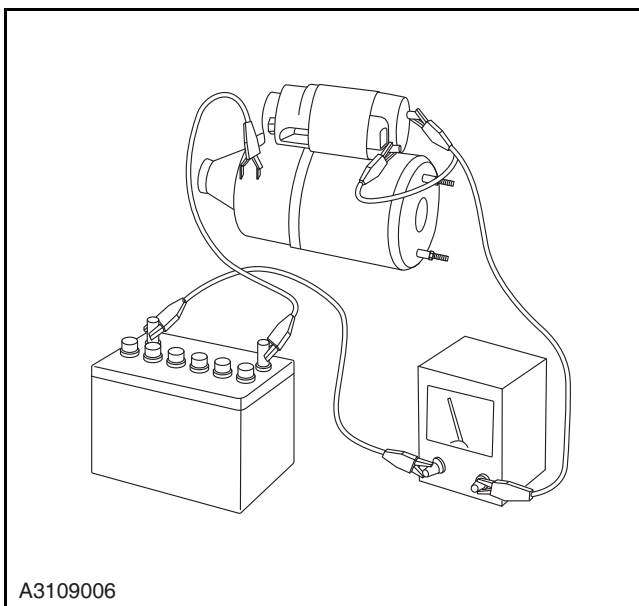
Pinion Return Test

1. Use a jumper wire to connect the starter motor housing and the solenoid switch housing and the battery negative reliably.
2. Use one end of another jumper wire to connect to the battery positive and the other end is connected to the starter motor wiring harness connector E09 terminal 1.
3. The starter motor pinion should be removed.
4. Disconnect the battery anode jumper wires, the small gear should quickly return.



Non-Load Test

1. Ensure the battery is fully charged.
2. Connect the starter motor, the battery and the tester as showed on the illustration.
3. Start the motor, and confirm it is run smoothly.
If the starter motor rotation is not smooth, inspect the starter motor device.
4. When the motor operates, measure the voltage and the current.
5. If it is not within the specification, replace the starter motor.



Stater Motor (Non-Low-Carbon Model)

Item	Voltage	Current	Speed
No-load performance	11 V	Less than or equal to 90 A	More than or equal to 2500r/min
Load performance	7.5 V	300 A	More than or equal to 880r/min
Brake performance	4 V	Less than or equal to 760 A	-

Stater Motor (Low-Carbon Model)

Item	Voltage	Current	Speed
No-load performance	11.5 V	Less than or equal to 110 A	More than or equal to 4500r/min
Load performance	10 V	Less than or equal to 325 A	More than or equal to 2600r/min
Brake performance	8.5 V	Less than or equal to 570 A	More than or equal to 1200r/min

Symptom Diagnosis and Testing

General Equipment

Multimeter

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage or electric damage.

Visual Inspection Chart

Mechanical	Electrical
Starter motor	Fuse Battery Starter relay Wiring harness Connectors loose or corrosion

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible), before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the symptom chart.

Symptom Chart

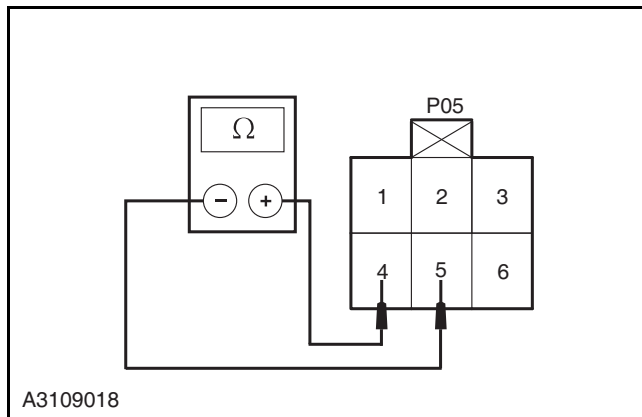
If the fault occurs, but there is no DTC stored in the ECM for this fault, and can not confirm the cause, then follow the procedure to diagnose the fault and eliminate it.

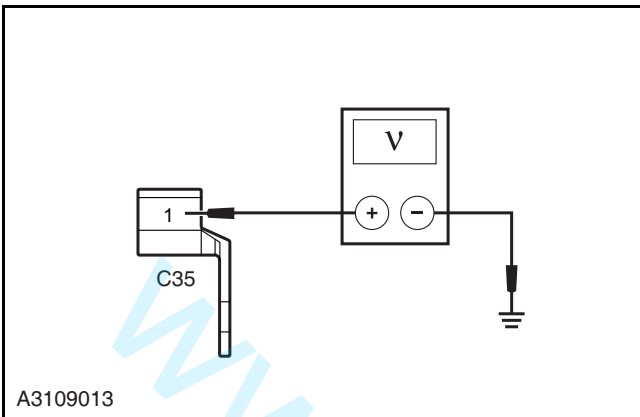
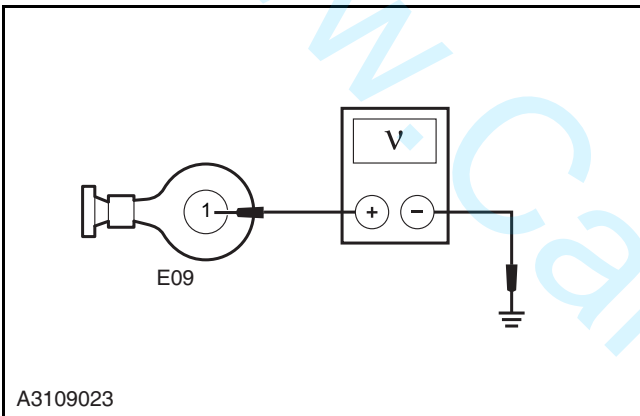
Symptom	Possible Sources	Solutions
• Starter motor fails to start	<ul style="list-style-type: none"> • Battery • Starter relay • Return circuit • Starter motor • Ignition switch 	Refer to: Starter Motor Fails to Start Diagnosis (3.1.9 Starting System, Symptom Diagnosis and Testing).
• Starter motor fails to stop	<ul style="list-style-type: none"> • Ignition switch • Starter relay • Starter motor 	Refer to: Starter Motor Fails to stop (3.1.9 Starting System, Symptom Diagnosis and Testing).
• Starter motor slow running	<ul style="list-style-type: none"> • Battery • Return circuit • Starter motor 	Refer to: Starter Motor Rotate Slowly Diagnosis (3.1.9 Starting System, Symptom Diagnosis and Testing).
• Starter motor rotating but engine does not run	<ul style="list-style-type: none"> • Starter motor • Flywheel 	<ul style="list-style-type: none"> • Inspect whether the flywheel ring gear is with missing tooth. • Inspect whether the correct starter motor is correctly fixed. If the problem exists, install a new starter motor. <p>Refer to: Starter Motor (3.1.9 Starting System, Removal and Installation).</p>
• Starter motor abnormal noise	<ul style="list-style-type: none"> • Starter motor • Flywheel ring gear 	<ul style="list-style-type: none"> • Inspect the flywheel ring gear. • Inspect whether the starter motor is aligned or the case is cracked. Ensure all the retaining bolts are well locked. If necessary, install new starter motor retaining bolts.

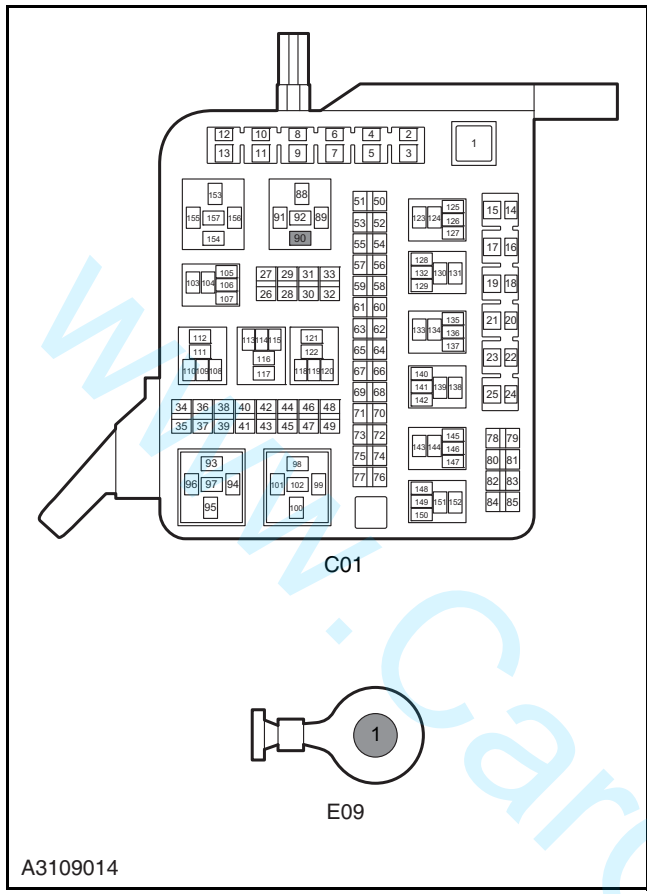
Starter Motor Fails to Start Diagnosis (MT)

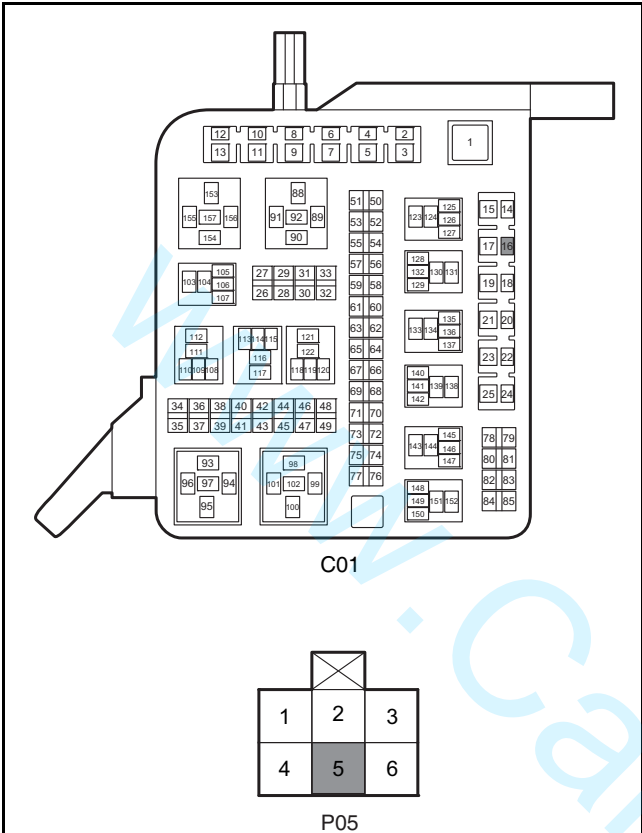
Test Conditions	Details/Results/Actions
1. General Procedures	<p>A. Inspect whether the battery positive & negative wiring harness connector for signs of damaged, oxidated, poor contacted or loosed.</p> <p>B. Inspect whether the battery positive and the starter connection wiring harness connector for signs of damaged, oxidated, poor contacted or loosed.</p> <p>C. Inspect whether the engine grounding wiring harness connector for signs of damaged, oxidated, poor contacted or loosed.</p> <p>Is it normal?</p> <p>Yes</p> <p>Go to step 2.</p> <p>No</p> <p>Repair the fault.</p>
2. Inspect the fuse	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Inspect the starter motor control circuit fuse SB08.</p> <p>Fuse Rated Capacity: 40 A</p> <p>C. Inspect the ignition switch control circuit fuse IF35 in the interior control center P01.</p> <p>Fuse Rated Capacity: 10 A</p> <p>D. Inspect the fuse between the terminal 1 and terminal 3 of the battery positive C37.</p> <p>Fuse Rated Capacity: 150 A</p> <p>Is the fuse normal?</p> <p>Yes</p> <p>Go to step 3.</p> <p>No</p> <p>Repair the fuse circuit, replace the fuse in rated capacity.</p>

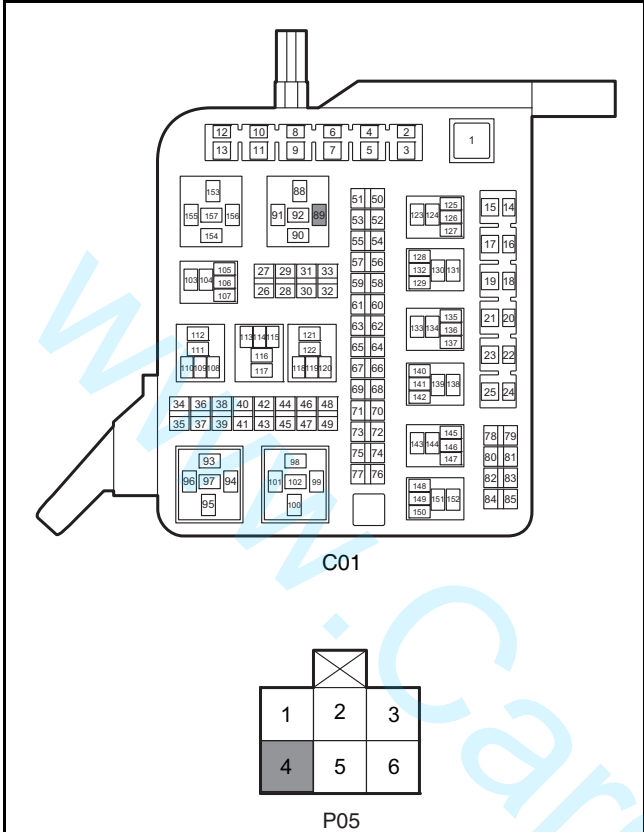
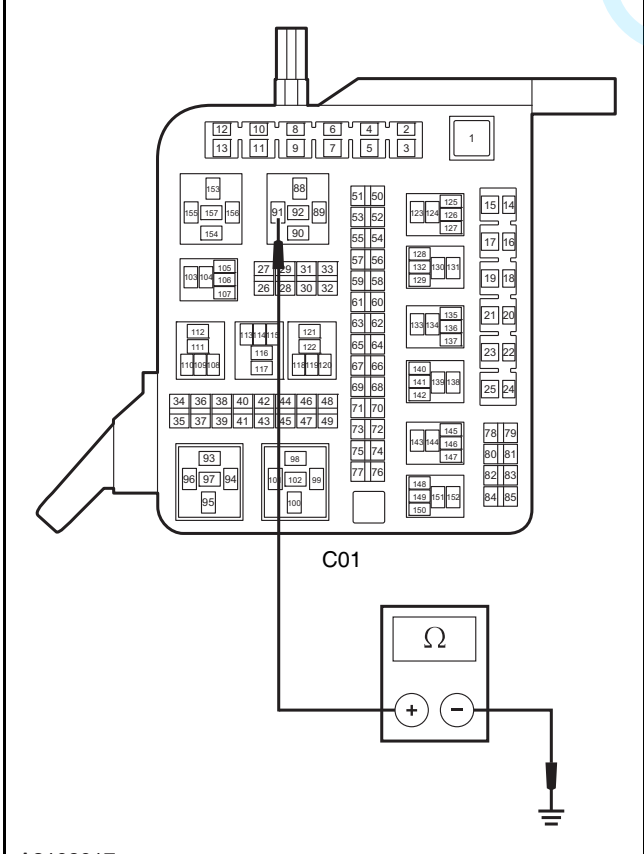
Test Conditions	Details/Results/Actions
3. Inspect the battery	<p>A. Inspect the battery voltage.</p> <p>Standard Voltage Value: 11 ~ 14 V</p> <p>Is the voltage normal?</p> <p>Y</p> <p>Go to step 4.</p> <p>N</p> <p>Charge the battery.</p> <p>Refer to: Battery Charging (3.1.10 Charging System, General Procedures).</p> <p>Or install a new battery.</p> <p>Refer to: Battery (3.1.10 Charging System, Removal and Installation).</p>
4. Inspect the starter relay ER02	<p>A. Replace a new relay.</p> <p>B. Turn the ignition switch to position "ST".</p> <p>Does the vehicle start normally?</p> <p>Yes</p> <p>Replace the relay.</p> <p>No</p> <p>Go to step 5.</p>
5. Inspect the ignition switch	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Disconnect the ignition switch wiring harness connector P05.</p> <p>C. Turn the ignition switch to position "ST".</p> <p>D. Measure the resistance between the terminal 4 and the terminal 5 of the ignition switch wiring harness P05.</p> <p>Standard Resistance Value: less than 1 Ω</p> <p>Is the resistance value normal?</p> <p>Yes</p> <p>Go to step 6.</p> <p>No</p> <p>Replace the ignition switch.</p>



Test Conditions	Details/Results/Actions
<p>6. Inspect the starter power supply circuit</p>  <p>A3109013</p>	<p>A. Measure the ground voltage of the terminal 1 of the wiring harness connector C35 of the starter motor solenoid switch.</p> <p>Standard Voltage Value: 11 ~ 14 V</p> <p>Is the voltage normal?</p> <p>Yes</p> <p>Go to step 7.</p> <p>No</p> <p>Repair or replace the related wiring harnesses.</p>
<p>7. Inspect the solenoid switch power supply circuit</p>  <p>A3109023</p>	<p>A. Turn the ignition switch to position "ST".</p> <p>B. Disconnect the wiring harness connector E09 of the start motor solenoid switch.</p> <p>C. Measure the ground voltage of the terminal 1 of the wiring harness connector E09 of the starter motor solenoid switch.</p> <p>Standard Voltage Value: 11 ~ 14 V</p> <p>Is the voltage normal?</p> <p>Yes</p> <p>Go to step 8.</p> <p>No</p> <p>Go to step 9.</p>
<p>8. Inspect the starter motor</p>	<p>A. Perform the no-load test.</p> <p>Refer to: Solenoid Switch Test (3.1.9 Starting System, General Procedures).</p> <p>Is the starter motor inspection normal?</p> <p>Y</p> <p>Replace the starter motor solenoid switch.</p> <p>Verify the system is normal.</p> <p>N</p> <p>Replace the the starter motor.</p> <p>Refer to: Starter Motor (3.1.9 Starting System, Removal and Installation).</p>

Test Conditions	Details/Results/Actions
<p>9. Inspect the solenoid switch power supply circuit</p>  <p>A3109014</p>	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Disconnect the relay ER02 of the engine compartment electrical center C01.</p> <p>C. Disconnect the wiring harness connector E09 of the start motor solenoid switch.</p> <p>D. Measure the resistance between the terminal 90 of the engine compartment electrical center C01 and the terminal 1 of the wiring harness connector E09 of the starter motor solenoid switch.</p> <p>Standard Resistance Value: less than 5 Ω</p> <p>Is the resistance normal?</p> <p>Yes</p> <p>Go to step 10.</p> <p>No</p> <p>Repair or replace the related wiring harnesses.</p>

Test Conditions	Details/Results/Actions
<p>10. Inspect the ignition switch power supply circuit</p>  <p>A3109015</p>	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Disconnect the fuse SB08 of the engine compartment electrical center C01.</p> <p>C. Disconnect the ignition switch wiring harness connector P05.</p> <p>D. Measure the resistance between the terminal 16 of the engine compartment electrical center C01 and the terminal 5 of the wiring harness connector E05 of the ignition switch.</p> <p>Standard Resistance Value: less than 5 Ω</p> <p>Is the resistance normal?</p> <p>Yes</p> <p>Go to step 11.</p> <p>No</p> <p>Repair or replace the related wiring harnesses.</p>

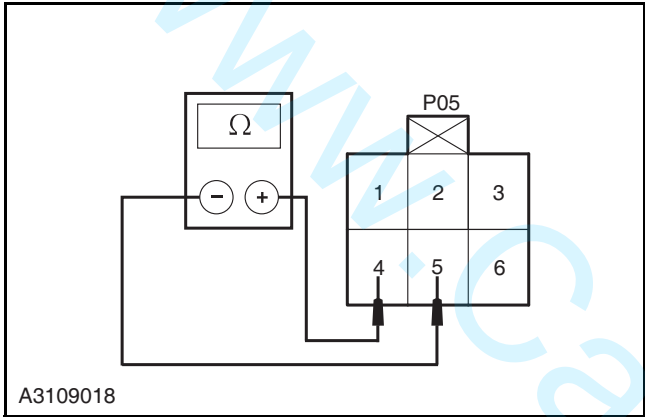
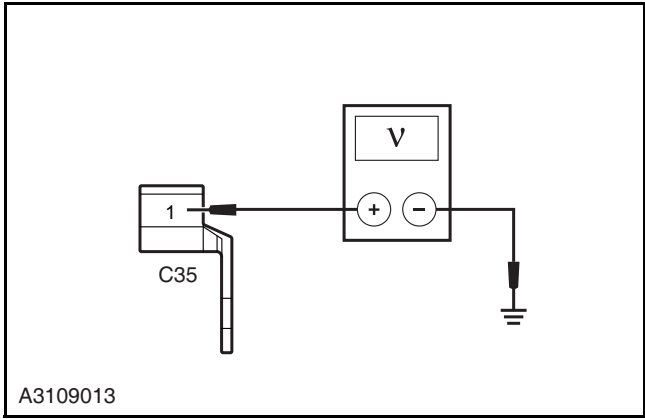
Test Conditions	Details/Results/Actions
<p>11. Inspect the relay ER02 control circuit</p>  <p>A3109016</p>  <p>A3109017</p>	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Disconnect the relay ER02 of the engine compartment electrical center C01.</p> <p>C. Disconnect the ignition switch wiring harness connector P05.</p> <p>D. Measure the resistance between the terminal 4 of the ignition switch wiring harness connector P05 and the terminal 89 of the engine compartment electrical center C01.</p> <p>E. Measure the resistance between the terminal 91 of the engine compartment electric center connector C10 terminal 91 and the body resistance.</p> <p>Standard Resistance Value: less than 5 Ω</p> <p>Is the resistance normal?</p> <p>Yes</p> <p>Go to step 12.</p> <p>No</p> <p>Repair or replace the related wiring harnesses.</p>

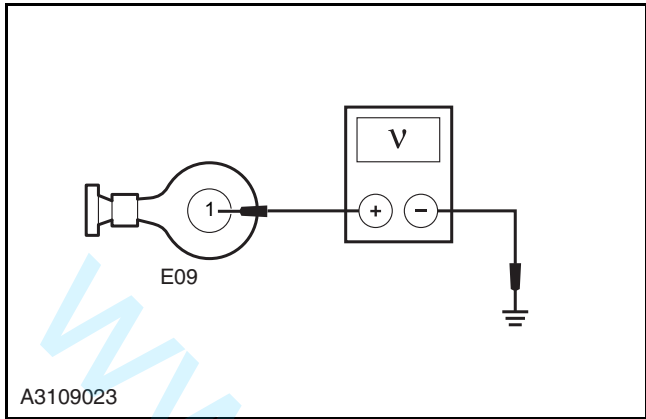
Test Conditions	Details/Results/Actions
12. Replace the engine compartment electrical center C01	
	<p>A.Turn the ignition switch to position "LOCK".</p> <p>B.Replace the engine compartment electrical center C01.</p> <p>Verify the system is normal.</p>

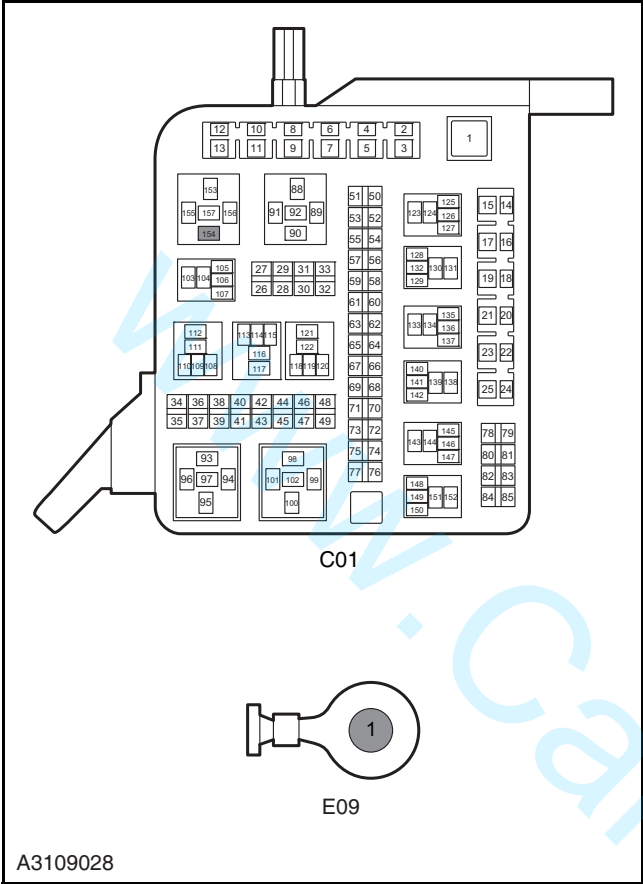
Starter Motor Fails to Start Diagnosis (Low-Carbon)

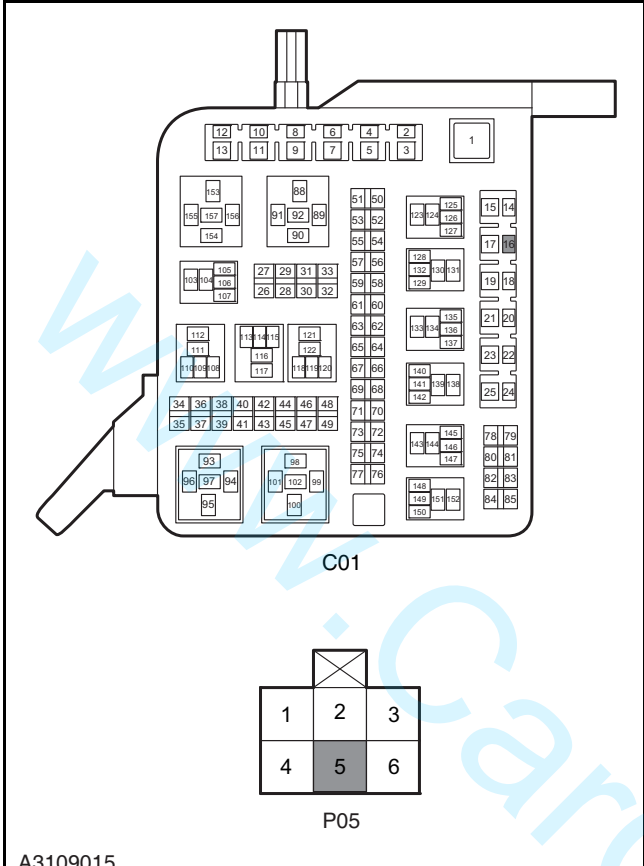
Test Conditions	Details/Results/Actions
1. Inspect the DTC	
	<p>A.Connect the diagnostic tool and turn the ignition switch to position "ON".</p> <p>B.Diagnose the engine system.</p> <p>Is there any DTC of the engine system and the idling start-stop system?</p> <p>Y</p> <p>Refer to: DTC Diagnostic Procedure Index (3.1.13 Electrical Control System - MT22.1, DTC Diagnosis and Testing).</p> <p>Refer to: DTC Diagnostic Procedure Index (3.1.14 Electronic Control System, DTC Diagnosis and Testing).</p> <p>N</p> <p>Go to step 2.</p>
2. General Procedures	
	<p>A.Inspect whether the battery positive & negative wiring harness connector for signs of damaged, oxidated, poor contacted or loosed.</p> <p>B.Inspect whether the battery positive and the starter connection wiring harness connector for signs of damaged, oxidated, poor contacted or loosed.</p> <p>C.Inspect whether the engine ground wiring harness connector for signs of damaged, oxidated, poor contacted or loosed.</p> <p>Is it normal?</p> <p>Yes</p> <p>Go to step 3.</p> <p>No</p> <p>Repair the fault.</p>

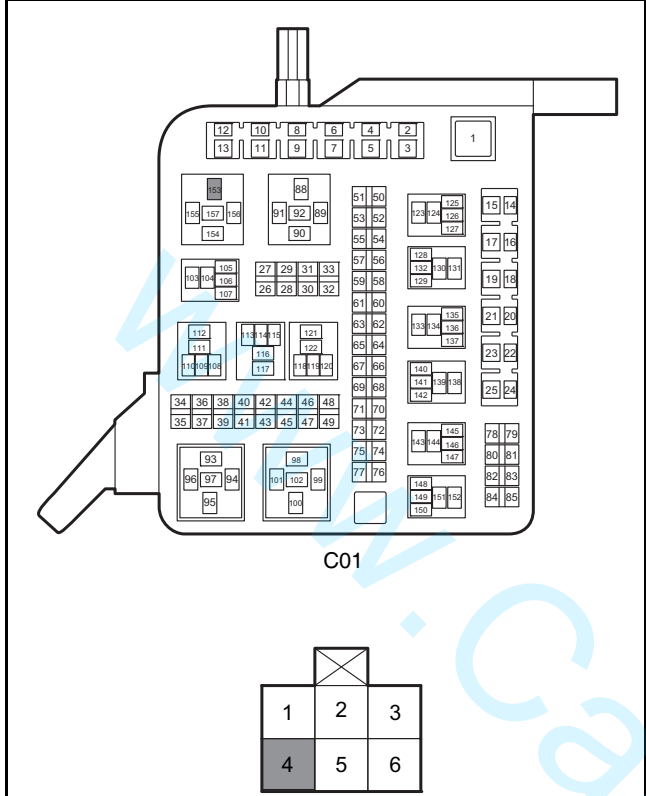
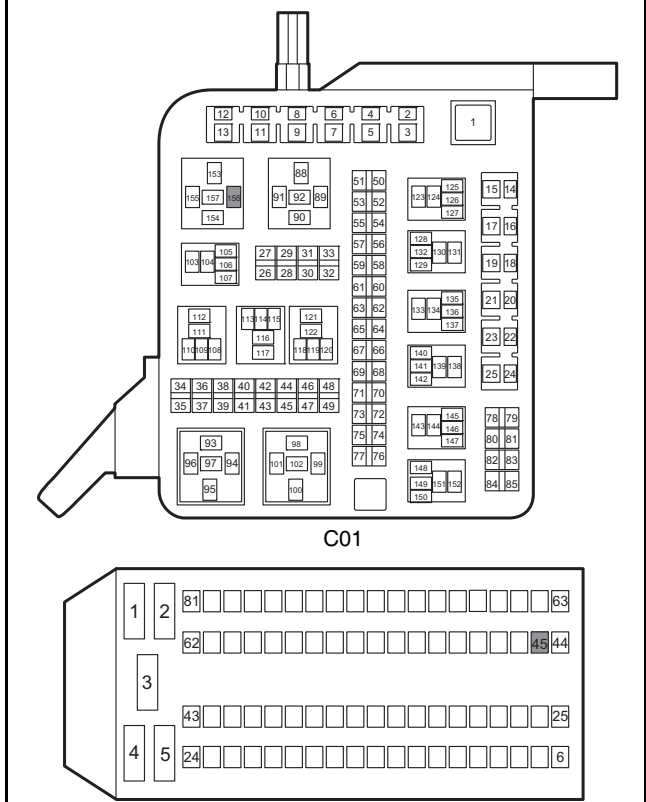
Test Conditions	Details/Results/Actions
3. Inspect the fuse	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Inspect the starter motor control circuit fuse SB08. Fuse Rated Capacity: 40 A</p> <p>C. Inspect the control fuse EF03 of the solenoid switch relay. Fuse Rated Capacity: 15 A</p> <p>D. Inspect the fuse between the terminal 1 and terminal 3 of the battery positive C37. Fuse Rated Capacity: 150 A</p> <p>Is the fuse normal? Yes Go to step 4. No Repair the fuse circuit, replace the fuse in rated capacity.</p>
4. Inspect the battery	<p>A. Inspect the battery voltage.</p> <p>B. Is the battery normal? Standard Voltage Value: 11 ~ 14 V</p> <p>Is the voltage normal? Y Go to step 5. N Charge the battery. Refer to: Battery Charging (3.1.10 Charging System, General Procedures).</p> <p>Or install a new battery. Refer to: Battery (3.1.10 Charging System, Removal and Installation).</p>

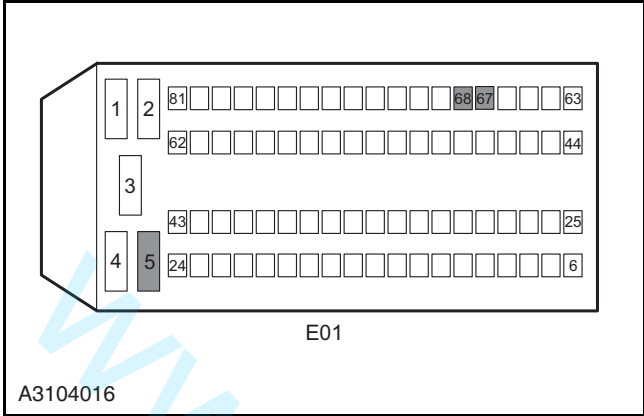
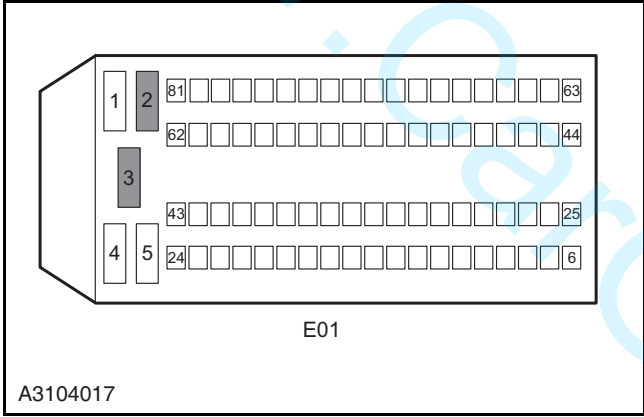
Test Conditions	Details/Results/Actions
5. Inspect the starter relay ER01 and ER02	<p>A. Replace the new relay respectively.</p> <p>B. Turn the ignition switch to position "ST". Does the vehicle start normally?</p> <p>Yes Replace the corresponding relay.</p> <p>No Go to step 6.</p>
6. Inspect the ignition switch	 <p>A3109018</p> <p>A. Turn the ignition switch to position LOCK".</p> <p>B. Disconnect the ignition switch wiring harness connector P05.</p> <p>C. Turn the ignition switch to position "ST".</p> <p>D. Measure the resistance between the terminal 4 and the terminal 5 of the ignition switch wiring harness P05.</p> <p>Standard Resistance Value: less than 1 Ω</p> <p>Is the voltage normal?</p> <p>Yes Go to step 7.</p> <p>No Replace the ignition switch.</p>
7. Inspect the starter power supply circuit	 <p>A3109013</p> <p>A. Measure the ground voltage of the terminal 1 of the wiring harness connector C35 of the starter motor solenoid switch.</p> <p>Standard Voltage Value: 11 ~ 14 V</p> <p>Is the voltage normal?</p> <p>Yes Go to step 8.</p> <p>No Repair or replace the related wiring harnesses.</p>

Test Conditions	Details/Results/Actions
8. Inspect the solenoid switch power supply circuit	
 <p>A3109023</p>	<p>A. Turn the ignition switch to position "ST".</p> <p>B. Disconnect the wiring harness connector E09 of the start motor solenoid switch.</p> <p>C. Measure the ground voltage of the terminal 1 of the wiring harness connector E09 of the starter motor solenoid switch.</p> <p>Standard Voltage Value: 11 ~ 14 V</p> <p>Is the voltage normal?</p> <p>Yes</p> <p>Go to step 9.</p> <p>No</p> <p>Go to step 10.</p>
9. Inspect the starter motor	
	<p>A. Perform the no-load test.</p> <p>Refer to: Solenoid Switch Test (3.1.9 Starting System, General Procedures).</p> <p>Is the starter motor inspection normal?</p> <p>Y</p> <p>Replace the starter motor solenoid switch.</p> <p>Verify the system is normal.</p> <p>N</p> <p>Replace the the starter motor.</p> <p>Refer to: Starter Motor (3.1.9 Starting System, Removal and Installation).</p>

Test Conditions	Details/Results/Actions
10. Inspect the solenoid switch power supply circuit	<div><div><p>A3109028</p></div><div><p>A.Turn the ignition switch to position "LOCK".</p><p>B.Disconnect the relay ER01 of the engine compartment electrical center C01.</p><p>C.Disconnect the wiring harness connector E09 of the start motor solenoid switch.</p><p>D.Measure the resistance between the terminal 154 of the engine compartment electrical center C01 and the terminal 1 of the wiring harness connector E09 of the starter motor solenoid switch.</p><p>Standard Resistance Value: less than 5 Ω</p><p>Is the resistance normal?</p><p>Yes</p><p>Go to step 11.</p><p>No</p><p>Repair or replace the related wiring harnesses.</p></div></div>

Test Conditions	Details/Results/Actions
<p>11. Inspect the ignition switch power supply circuit</p>  <p>A3109015</p>	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Disconnect the fuse SB08 of the engine compartment electrical center C01.</p> <p>C. Disconnect the ignition switch wiring harness connector P05.</p> <p>D. Measure the resistance between the terminal 16 of the engine compartment electrical center C01 and the terminal 5 of the wiring harness connector E05 of the ignition switch.</p> <p>Standard Resistance Value: less than 5 Ω</p> <p>Is the resistance normal?</p> <p>Yes</p> <p>Go to step 12.</p> <p>No</p> <p>Repair or replace the related wiring harnesses.</p>

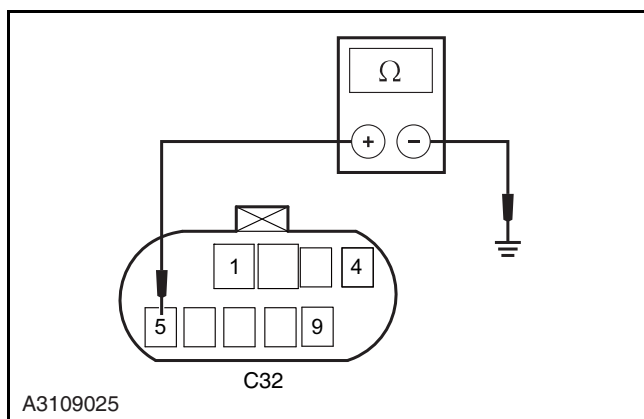
Test Conditions	Details/Results/Actions
<p>12. Inspect the relay ER01 control circuit</p>  <p>A3109029</p>	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Disconnect the battery negative cable.</p> <p>C. Disconnect the relay ER01 of the engine compartment electrical center C01.</p> <p>D. Disconnect the ignition switch wiring harness connector P05.</p> <p>E. Disconnect the wiring harness connector E01 of the engine ECM.</p> <p>F. Measure the resistance between the terminal 4 of the ignition switch wiring harness connector P05 and the terminal 153 of the engine compartment electrical center C01.</p> <p>G. Measure the resistance between the terminal 156 of the engine compartment electrical center C01 and the terminal 45 of the wiring harness connector E01 of the engine ECM.</p> <p>Standard Resistance Value: less than 5 Ω</p> <p>Is the resistance normal?</p> <p>Yes</p> <p>Go to step 13.</p> <p>No</p> <p>Repair or replace the related wiring harnesses, and replace the engine compartment electrical center C01 when necessary.</p>
 <p>A3109026</p>	

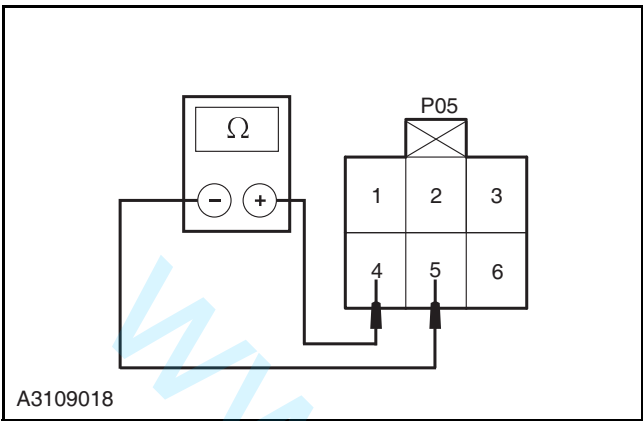
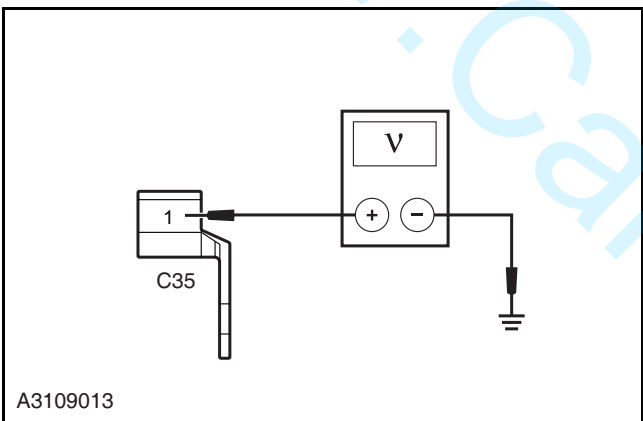
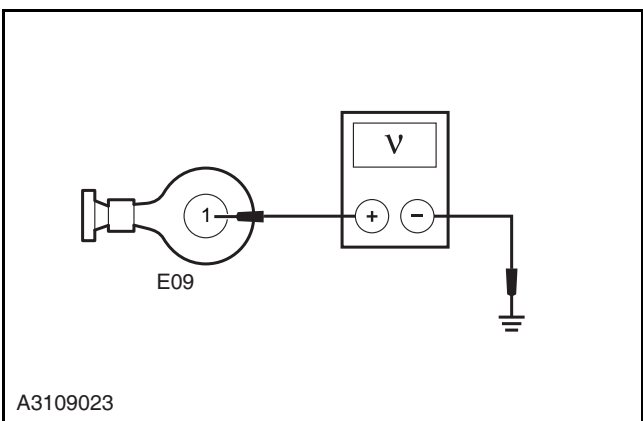
Test Conditions	Details/Results/Actions
<p>13. Inspect the ECM power supply circuit</p>  <p>A3104016</p>	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Measure from the back of the wiring harness connector E01 of the ECM.</p> <p>C. Turn the ignition switch to position "ON" and use a multimeter to measure the voltage between the terminal 5, 67 and 68 of the wiring harness connector E01 of the ECM and the power supply.</p> <p>Standard Voltage Value: 11~14 V</p> <p>Is the voltage normal?</p> <p>Y</p> <p>Go to step 14.</p> <p>N</p> <p>Inspect and repair the ECM power supply circuit.</p>
<p>14. Inspect the ECM ground circuit.</p>  <p>A3104017</p>	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Measure from the back of the wiring harness connector E01 of the ECM.</p> <p>C. Measure the resistance between the terminal 2 and 3 of the ECM wiring harness connector E01 and the reliable ground.</p> <p>Standard Resistance Value: less than 5 Ω</p> <p>Is the resistance value normal?</p> <p>Y</p> <p>Replace the ECM.</p> <p>Refer to: Engine Control Module (3.1.13 Engine Electronic Control System - MT22.1, Removal and installation).</p> <p>N</p> <p>Inspect the ECM ground circuit.</p>

Starter Motor Fails to Start Diagnosis (AT)

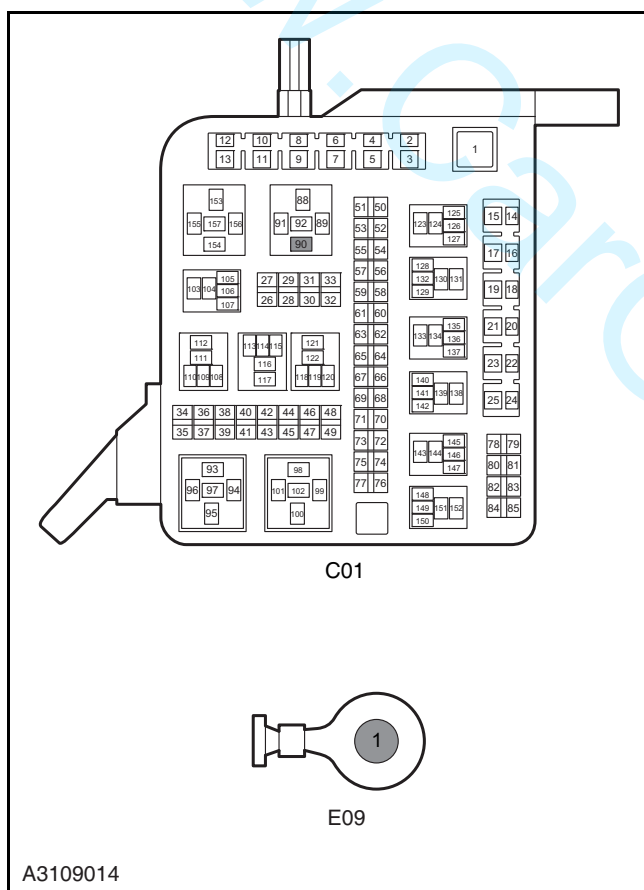
Test Conditions	Details/Results/Actions
1. General Procedures	<p>A. Inspect whether the battery positive & negative wiring harness connector for signs of damaged, oxidated, poor contacted or loosed.</p> <p>B. Inspect whether the battery positive and the starter connection wiring harness connector for signs of damaged, oxidated, poor contacted or loosed.</p> <p>C. Inspect whether the engine grounding wiring harness connector for signs of damaged, oxidated, poor contacted or loosed.</p> <p>Is it normal?</p> <p>Yes</p> <p>Go to step 2.</p> <p>No</p> <p>Repair the fault.</p>
2. Inspect the fuse	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Inspect the starter motor control circuit fuse SB08.</p> <p>Rated capacity: 40 A</p> <p>C. Inspect the ignition switch control circuit fuse IF35 in the interior control center P01.</p> <p>Rated capacity: 10 A</p> <p>D. Inspect the fuse between the terminal 1 and terminal 3 of the battery positive C37.</p> <p>Rated capacity: 150 A</p> <p>Is the fuse normal?</p> <p>Yes</p> <p>Go to step 3.</p> <p>No</p> <p>Repair the fuse circuit, replace the fuse in rated capacity.</p>

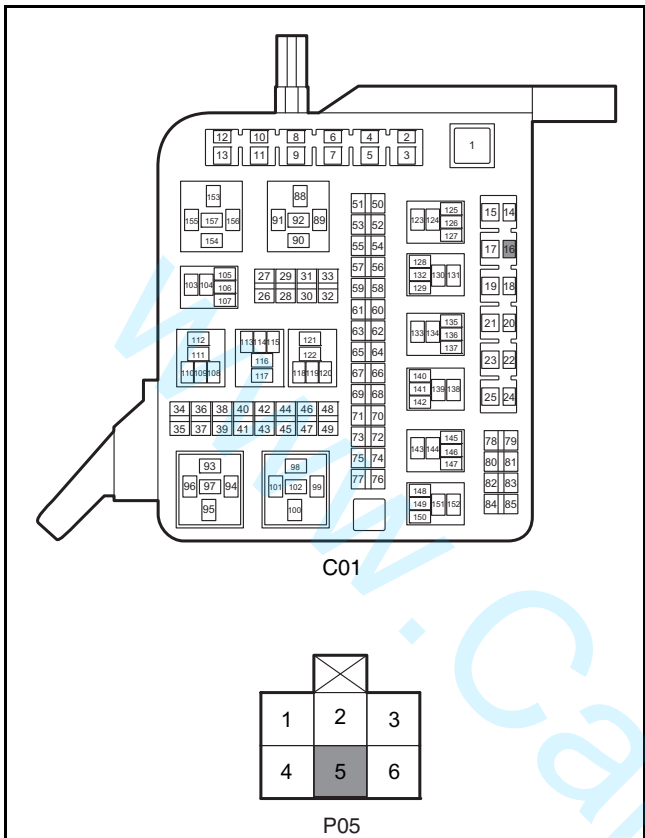
Test Conditions	Details/Results/Actions
3. Inspect the battery	<p>A. Inspect the battery voltage.</p> <p>Standard Voltage Value: 11 ~ 14 V</p> <p>Is the voltage normal?</p> <p>Y</p> <p>Go to step 4.</p> <p>N</p> <p>Charge the battery.</p> <p>Refer to: Battery Charging (3.1.10 Charging System, General Procedures).</p> <p>Or install a new battery.</p> <p>Refer to: Battery (3.1.10 Charging System, Removal and Installation).</p>
4. Inspect the starter relay ER02	<p>A. Replace a new relay ER02.</p> <p>B. Turn the ignition switch to position "ST".</p> <p>Does the vehicle start normally?</p> <p>Yes</p> <p>Replace the relay.</p> <p>No</p> <p>Go to step 5.</p>
5. Inspect the ground circuit of the gear switch	<p>A. Disconnect the gear switch wiring harness connector C32.</p> <p>B. Measure the resistance between the terminal 5 of the gear switch wiring harness connector C32 and the reliable ground.</p> <p>Standard Resistance Value: less than 5 Ω</p> <p>Is the resistance value normal?</p> <p>Yes</p> <p>Go to step 6.</p> <p>No</p> <p>Repair the open circuit fault of the circuit between the terminal 9 of the gear switch harness connector C32 and the grounding point GD102.</p>

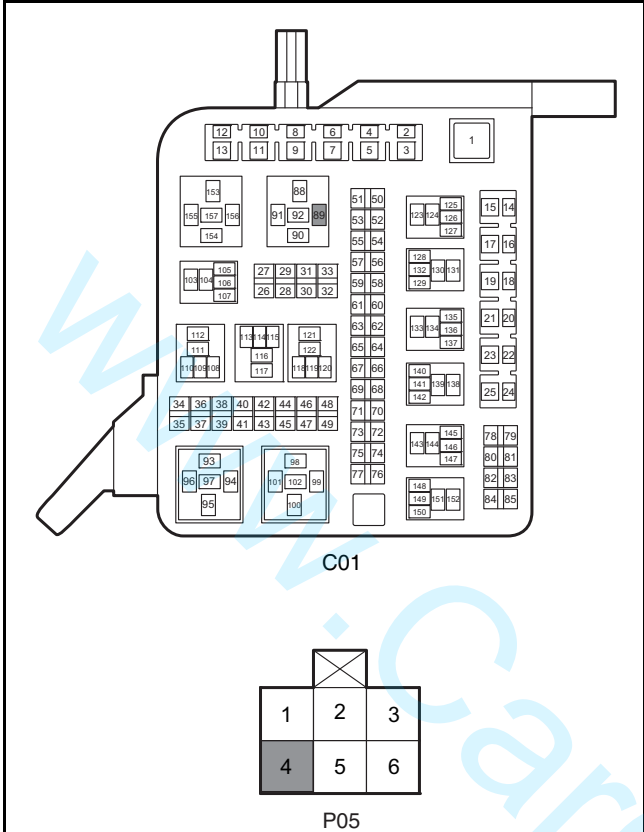
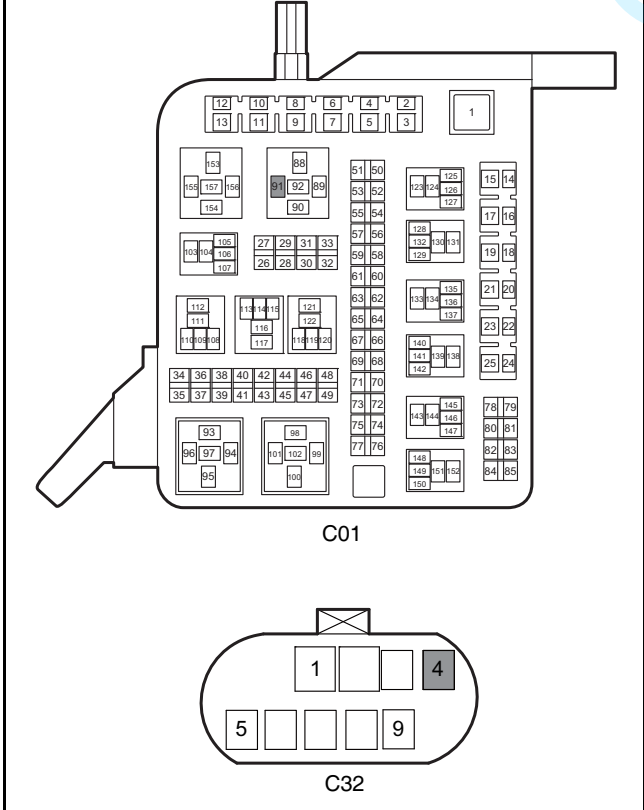


Test Conditions	Details/Results/Actions
<p>6. Inspect the ignition switch</p>  <p>A3109018</p>	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Disconnect the ignition switch wiring harness connector P05.</p> <p>C. Turn the ignition switch to position "ST".</p> <p>D. Measure the resistance between the terminal 4 and the terminal 5 of the ignition switch wiring harness P05.</p> <p>Standard Resistance Value: less than 1 Ω</p> <p>Is the voltage normal?</p> <p>Yes</p> <p>Go to step 7.</p> <p>No</p> <p>Replace the ignition switch.</p>
<p>7. Inspect the starter power supply circuit</p>  <p>A3109013</p>	<p>A. Measure the grounding voltage of the terminal 1 of the wiring harness connector C35 of the starter motor solenoid switch.</p> <p>Standard Voltage Value: 11 ~ 14 V</p> <p>Is the voltage normal?</p> <p>Yes</p> <p>Go to step 8.</p> <p>No</p> <p>Repair or replace the related wiring harnesses.</p>
<p>8. Inspect the solenoid switch power supply circuit</p>  <p>A3109023</p>	<p>A. Turn the ignition switch to position "ST".</p> <p>B. Disconnect the wiring harness connector E09 of the start motor solenoid switch.</p> <p>C. Measure the ground voltage of the terminal 1 of the wiring harness connector E09 of the starter motor solenoid switch.</p> <p>Standard Voltage Value: 11 ~ 14 V</p> <p>Is the voltage normal?</p> <p>Yes</p> <p>Go to step 9.</p> <p>No</p> <p>Go to step 10.</p>

Test Conditions	Details/Results/Actions
9. Inspect the starter motor	<p>A.Perform the no-load test.</p> <p>Refer to: Solenoid Switch Test (3.1.9 Starting System, General Procedures).</p> <p>Is the starter motor inspection normal?</p> <p>Y</p> <p>Replace the starter motor solenoid switch.</p> <p>Verify the system is normal.</p> <p>N</p> <p>Replace the the starter motor</p> <p>Refer to: Starter Motor (3.1.9 Starting System, Removal and Installation).</p>
10. Inspect the solenoid switch power supply circuit	<p>A.Turn the ignition switch to position "LOCK".</p> <p>B.Disconnect the relay ER02 of the engine compartment electrical center C01.</p> <p>C.Disconnect the wiring harness connector E09 of the start motor solenoid switch.</p> <p>D.Measure the resistance between the terminal 90 of the engine compartment electrical center C01 and the terminal 1 of the wiring harness connector E09 of the starter motor solenoid switch.</p> <p>Standard Resistance Value: less than 5 Ω</p> <p>Is the resistance normal?</p> <p>Yes</p> <p>Go to step 11.</p> <p>No</p> <p>Repair or replace the related wiring harnesses.</p>

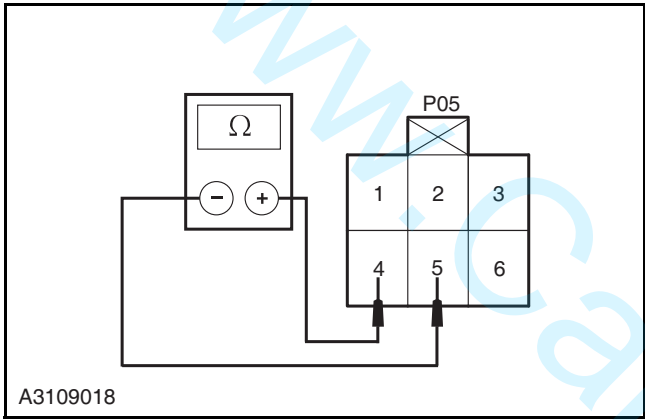


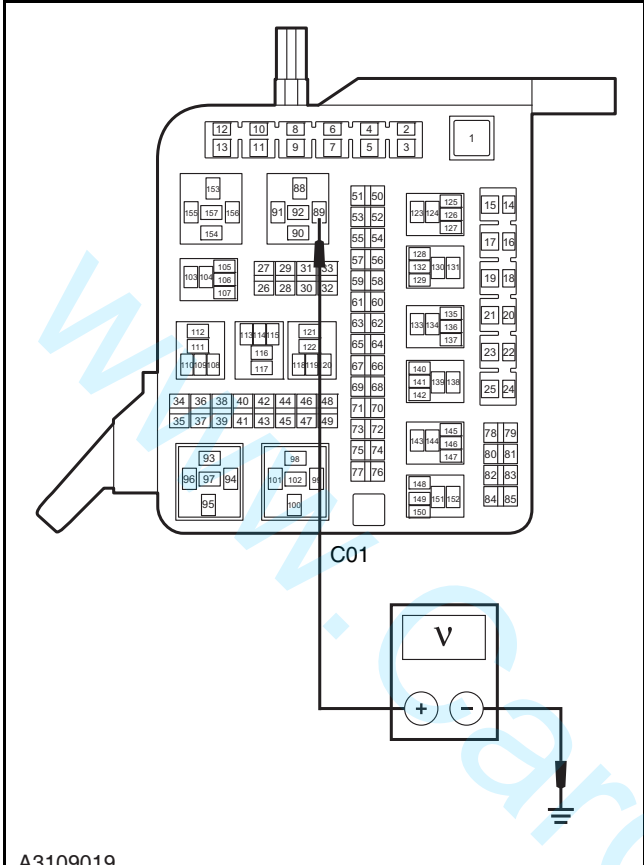
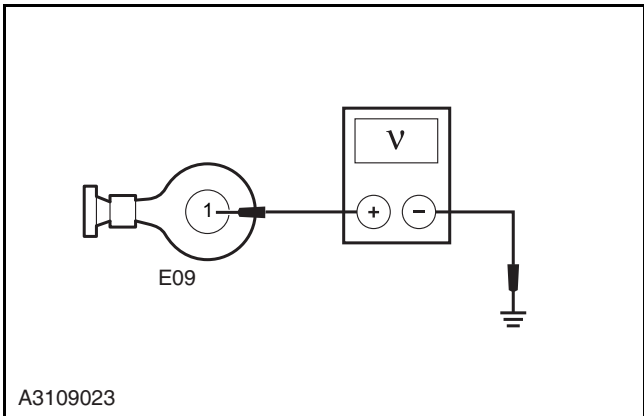
Test Conditions	Details/Results/Actions
11. Inspect the ignition switch power supply circuit	
 <p>A3109015</p>	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Disconnect the fuse SB08 of the engine compartment electrical center C01.</p> <p>C. Disconnect the ignition switch wiring harness connector P05.</p> <p>D. Measure the resistance between the terminal 16 of the engine compartment electrical center C01 and the terminal 5 of the wiring harness connector P05 of the ignition switch.</p> <p>Standard Resistance Value: less than 5 Ω</p> <p>Is the resistance normal?</p> <p>Yes</p> <p>Go to step 12.</p> <p>No</p> <p>Repair or replace the related wiring harnesses.</p>

Test Conditions	Details/Results/Actions
<p>12. Inspect the relay ER02 control circuit</p>  <p>A3109016</p>	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Disconnect the relay ER02 of the engine compartment electrical center C01.</p> <p>C. Disconnect the ignition switch wiring harness connector P05.</p> <p>D. Disconnect the gear switch wiring harness connector C32.</p> <p>E. Measure the resistance between the terminal 4 of the ignition switch wiring harness connector P05 and the terminal 89 of the engine compartment electrical center C01.</p> <p>F. Measure the resistance between the terminal 91 of the engine compartment electrical center C01 and the terminal 4 of the wiring harness connector C32 of the gear switch.</p> <p>Standard Resistance Value: less than 5 Ω</p> <p>Is the resistance normal?</p> <p>Yes</p> <p>Go to step 13.</p> <p>No</p> <p>Repair or replace the related wiring harnesses.</p>
 <p>A3109024</p>	

Test Conditions	Details/Results/Actions
13. Replace the engine compartment electrical center C01	
	A.Turn the ignition switch to position "LOCK". B.Replace the engine compartment electrical center C01. Verify the system is normal.

Starter Motor Fails to Stop Diagnosis

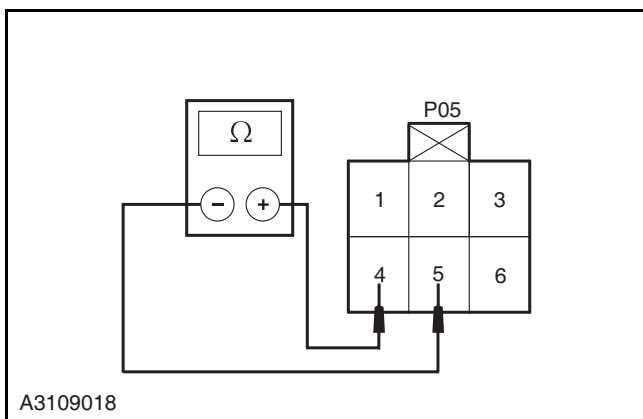
Test Conditions	Details/Results/Actions
1. Inspect the ignition switch automatic return function	
 <p>A3109018</p>	A.Turn the ignition switch to position "LOCK". B.Disconnect the ignition switch wiring harness connector P05. C.Turn the ignition switch to position "ST" and release the key quickly. D.Measure the resistance between the terminal 4 and terminal 5 of the ignition switch wiring harness connector P13. Standard Resistance Value: 10 MΩ or higher Is the resistance normal? Yes Go to step 2. No Replace the ignition switch.
2. Inspect the starter relay ER02	
	A.Replace a new relay. B.Turn the ignition switch to position "ST" and release the key quickly. Dose the starter motor stop rotating? Yes Replace the relay. No Go to step 3.

Test Conditions	Details/Results/Actions
<p>3. Inspect the starter motor relay control circuit to the power supply short circuit</p>  <p>A3109019</p>	<p>A. Turn the ignition switch to position "ST" and release the key quickly.</p> <p>B. Measure the voltage between the terminal 89 of the engine compartment electric center wiring harness connector C01 and the body ground.</p> <p>Standard Voltage Value: 0 V</p> <p>Is the voltage normal?</p> <p>Yes</p> <p>Go to step 4.</p> <p>No</p> <p>Repair the short circuit to the power supply positive fault of the circuit between the terminal 89 of the wiring harness connector C01 of the engine compartment electrical center and the terminal 4 of the ignition switch wiring harness connector P05.</p>
<p>4. Inspect the short circuit of the solenoid switch to the power supply circuit</p>  <p>A3109023</p>	<p>A. Turn the ignition switch to position "ST" and release the key quickly.</p> <p>B. Measure the voltage between the terminal 1 of the starter motor solenoid switch wiring harness connector E09 and the body ground.</p> <p>Standard Voltage Value: 0 V</p> <p>Is the voltage normal?</p> <p>Y</p> <p>Go to step 5.</p> <p>N</p> <p>Repair the short circuit to the power supply positive fault of the circuit between the terminal 1 of the wiring harness connector E09 of the engine solenoid switch and the terminal 90 of the engine compartment electrical center C01.</p>

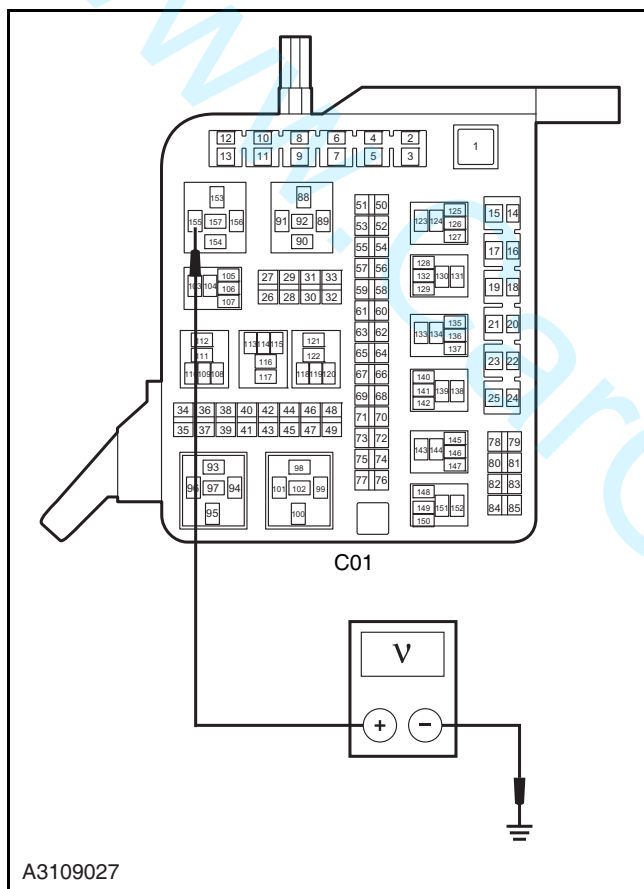
Test Conditions	Details/Results/Actions
5. Replace the the starter motor	<p>A.Turn the ignition switch to position "LOCK".</p> <p>B.Remove the battery positive cable.</p> <p>Replace the starter.</p> <p>Refer to: Starter Motor (3.1.9 Starting System, Removal and Installation).</p> <p>Verify the system is normal.</p>

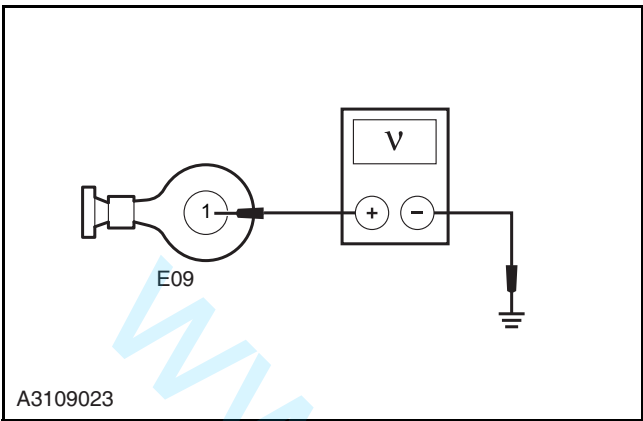
Starter Motor Fails to Stop Diagnosis (Low-Carbon)

Test Conditions	Details/Results/Actions
1. Inspect the DTC	<p>A.Connect the diagnostic tool and turn the ignition switch to position "ON".</p> <p>B.Diagnose the engine system.</p> <p>Is there any DTC of the engine system and the idling start-stop system?</p> <p>Y</p> <p>Refer to: DTC Diagnostic Procedure Index (3.1.13 Electrical Control System - MT22.1, DTC Diagnosis and Testing).</p> <p>Refer to: DTC Diagnostic Procedure Index (3.1.14 Electronic Control System (Low-Carbon, DTC Diagnosis and Testing).</p> <p>N</p> <p>Go to step 2.</p>
2. Inspect the ignition switch automatic return function	<p>A.Turn the ignition switch to position "LOCK".</p> <p>B.Disconnect the ignition switch wiring harness connector P05.</p> <p>C.Turn the ignition switch to position "ST" and release the key quickly.</p> <p>D.Measure the resistance between the terminal 4 and terminal 5 of the ignition switch wiring harness P05.</p> <p>Standard Resistance Value: 10 MΩ or higher</p> <p>Is the resistance normal?</p> <p>Yes</p> <p>Go to step 3.</p> <p>No</p> <p>Replace the ignition switch.</p>



Test Conditions	Details/Results/Actions
3. Inspect the starter relay ER01 and ER02	<p>A. Replace two new starter relay ER01 and ER02.</p> <p>B. Turn the ignition switch to position "ST" and release the key quickly.</p> <p>Dose the starter motor stop rotating?</p> <p>Yes</p> <p>Replace the starter relay ER01 and ER02.</p> <p>No</p> <p>Go to step 4.</p>
4. Inspect the starter motor relay control circuit to the power supply short circuit	<p>A. Turn the ignition switch to position "ST" and release the key quickly.</p> <p>B. Measure the voltage between the terminal 155 of the engine compartment electric center wiring harness connector C01 and the body ground.</p> <p>Standard Voltage Value: 11 ~ 14 V</p> <p>Is the voltage normal?</p> <p>Yes</p> <p>Repair the short circuit fault of the circuit to the power supply between the terminal 155 of the wiring harness connector C01 of the engine compartment electrical center and the terminal 4 of the ignition switch wiring harness connector P05.</p> <p>Replace the engine compartment electrical center C01 when necessary.</p> <p>No</p> <p>Go to step 5.</p>



Test Conditions	Details/Results/Actions
<p>5. Inspect the short circuit of the solenoid switch to the power supply circuit</p>  <p>A3109023</p>	<p>A. Turn the ignition switch to position "ST" and release the key quickly.</p> <p>B. Measure the voltage between the terminal 1 of the starter motor solenoid switch wiring harness connector E09 and the body ground.</p> <p>Standard Voltage Value: 11 ~ 14 V</p> <p>Is the voltage normal?</p> <p>Y</p> <p>Repair the short circuit fault of the terminal 1 of the starter motor solenoid switch wiring harness connector E09 to the power supply.</p> <p>N</p> <p>Go to step 6.</p>
<p>6. Inspect the engine ECM</p>	<p>A. Install the fault vehicle ECM on the normal vehicles.</p> <p>Refer to: Engine Control Module (3.1.13 Electronic Control System-MT22.1, Removal and Installation).</p> <p>Does the vehicle start normally?</p> <p>Y</p> <p>Go to step 7.</p> <p>N</p> <p>Replace ECM.</p>
<p>7. Replace the the starter motor</p>	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Remove the battery negative cable.</p> <p>Replace the starter.</p> <p>Refer to: Starter Motor (3.1.9 Starting System, Removal and Installation).</p> <p>Verify the system is normal.</p>

Starter Motor Rotate Slowly Diagnosis

Test Conditions	Details/Results/Actions
1. General Procedures	<p>A. Inspect whether the battery positive & negative wiring harness connector for signs of damaged, oxidated, poor contacted or loosed.</p> <p>B. Inspect whether the battery positive and the starter connection wiring harness connector for signs of damaged, oxidated, poor contacted or loosed.</p> <p>C. Inspect whether the engine ground wiring harness connector for signs of damaged, oxidated, poor contacted or loosed.</p> <p>Is it normal?</p> <p>Yes</p> <p>Go to step 2.</p> <p>No</p> <p>Repair the fault.</p>
2. Inspect the engine and belt drive system	<p>A. Inspect if the engine and belt drive system have mechanical clamping stagnation (the clamped engine and the alternator).</p> <p>Is there any clamping stagnation?</p> <p>Yes</p> <p>Repair the clamping stagnation fault.</p> <p>No</p> <p>Go to step 3.</p>
3. Inspect the battery	<p>A. Inspect the battery voltage.</p> <p>Standard Voltage Value: 11 ~ 14 V</p> <p>Is the voltage normal?</p> <p>Yes</p> <p>Go to step 4.</p> <p>No</p> <p>Charge the battery.</p> <p>Refer to: Battery Charging (3.1.10 Charging System, General Procedures).</p> <p>Install new battery.</p> <p>Refer to: Battery (3.1.10 Charging System, Removal and Installation).</p>

Test Conditions	Details/Results/Actions
4. Inspect the starter motor	<p>A.Perform the no-load test.</p> <p>Refer to: No-load Test (3.1.9 Starting System, General Procedures).</p> <p>Is the starter motor normal?</p> <p>Y</p> <p>Repair the engine mechanical failure.</p> <p>Refer to: (3.1.2 Mechanical System, Symptom Diagnosis and Testing).</p> <p>N</p> <p>Replace the the starter motor.</p> <p>Refer to: Starter Motor Assembly (3.1.9 Starting System, Removal and Installation).</p>

Disassembly and Assembly

Starter Motor

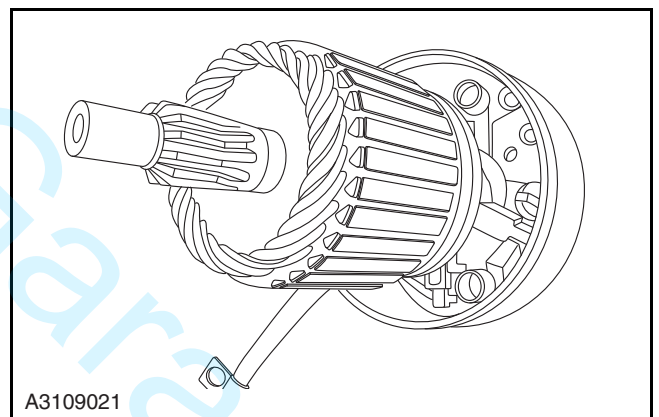
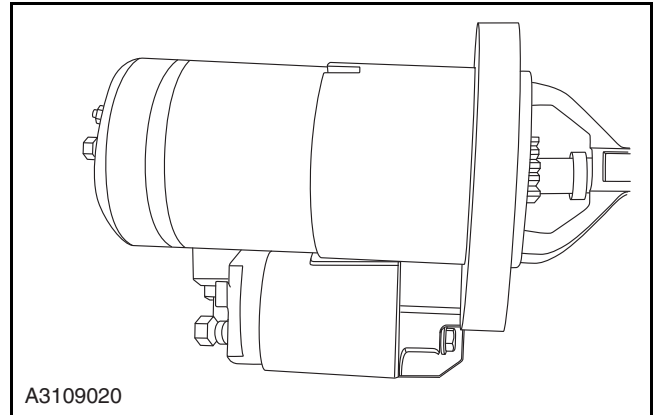
Disassembly

1. Remove the nut from the solenoid switch and disconnect the wire.
2. Remove two nuts, then pull the rear part of the solenoid switch to remove it, making the hook disengage from the transfer pole.



CAUTION: Do not remove the solenoid switch; replace it during assembly as necessary.

3. Remove the housing cover bolt and pull out the commutator end cap.
4. Remove the insulator and the brush spring, then remove the brush holder.
5. Remove the stator, the armature and the drive lever.
6. Use the clamp pliers and the screwdriver to remove the armature compaction, and then pull out the pinion snap ring and the overspeed clutch.



Assembly

1. Inspect and replace components as necessary.

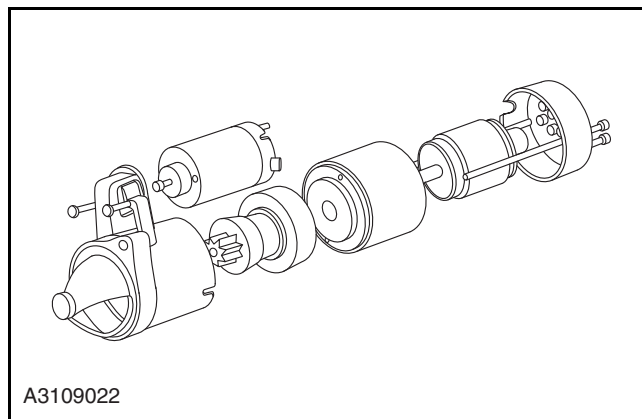
Refer to: (3.1.9 Starting System, General Procedures).

2. Before installing the overdrive clutch, apply some grease, then fix the stop ring with the snap ring.
3. Apply the drive lever with grease and install it together with the armature and the drive cover.

4. Install the stator and the brush holder, and then fix the four brushes with the spring, and then install the insulator.

CAUTION: When installing the brush, remove the grease on the brush and the commutator completely.

CAUTION: Make sure that there is no unnecessary contact between the brush and other components.



5. Fill the grease inside the bushing, and then install the rear cover.
6. Replace a new solenoid switch and its cover set. Apply grease on the top of on the plunger as necessary.
7. Turn the drive lever to hook the solenoid switch plunger and then use nuts to solid tight the solenoid switch assembly.
8. Connect wires in place and then inspect the solenoid switch.

CAUTION: Before installing the nut, make sure that the plunger is well connected to the drive lever.

CAUTION: Place the cover with the vent hole to downwards.

Removal and Installation

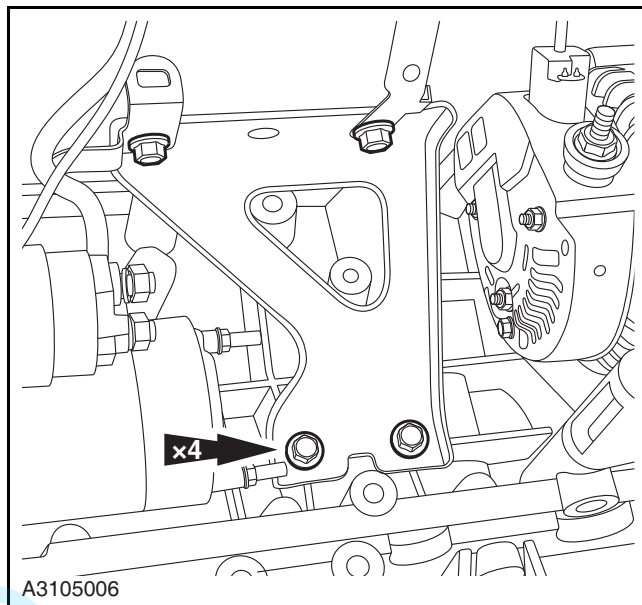
Starter Motor

Removal

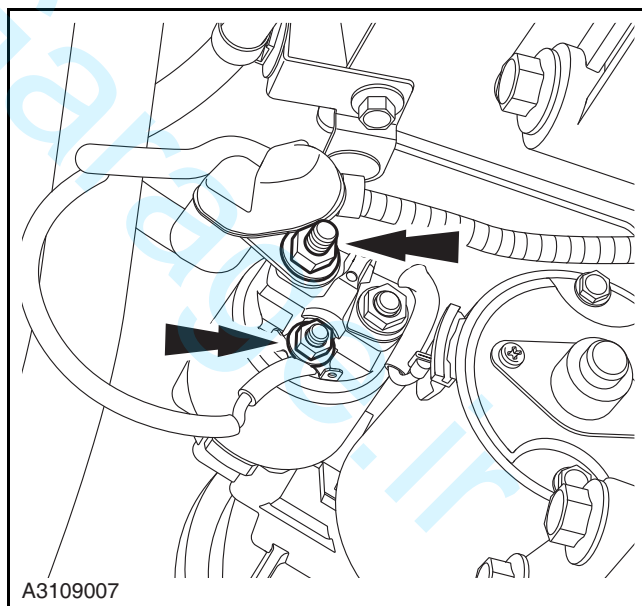
1. Disconnect the battery negative cable.

Refer to: Battery Inspection (3.1.10 Charging System, General Procedures).

2. Lift the vehicle.
3. Remove the intake manifold support.

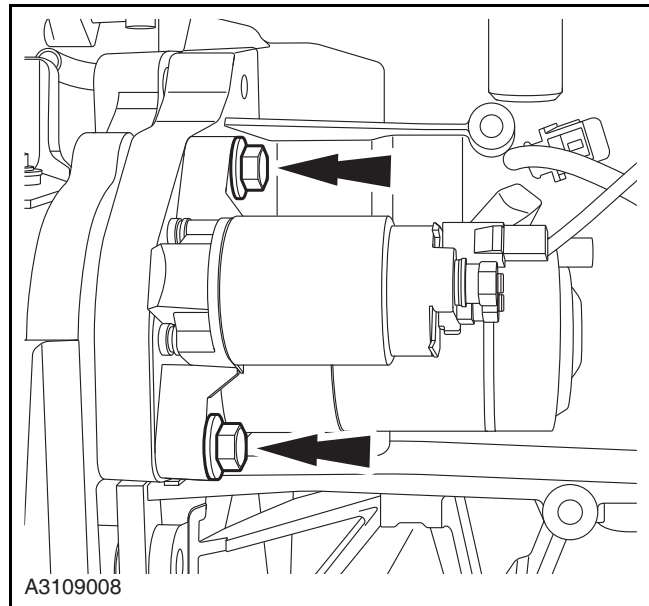


4. Remove starter motor harness wiring connector and the magnetic switch harness wiring connector.



5. Remove the retaining bolt of the starter motor.
6. Remove the starter motor assembly.

⚠ CAUTION: When detaching the support, pay attention to the starter for falling to avoid personal hurt or part damage.



Installation

1. To install, reverse the removal procedure.

