STARTING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	8

GENERAL

SYSTEM DESCRIPTION

Starting System Operation

Pressing the start button provides a ground signal to the pre-starting relay and the ECM, then the following takes place:

– The pre-starting relay provides battery voltage to the starter solenoid coil STS2 terminal.
– The ECM provides a ground to the starter solenoid coil STS1 terminal.

If the start button is activated when engine speed is above 1400 RPM, engine cranking will not be allowed. In other words, if the engine is running, no cranking will take place.

If the start switch is activated while the throttle is opened more than 60°, the engine will not be allowed to start but the starter will crank the engine (engine drowned mode).

Engine Cranking Conditions

SM5 Model

The following conditions must be met to allow engine cranking:

– Transmission in neutral (or in gear with clutch disengaged)
– Ignition switch "ON"
– Engine stop switch to "RUN"
– Mode button pressed in once (safety message acknowledgement)
– D.E.S.S. recognizes the key
– Start button pressed in.

The SM5 model can be started with the transmission in neutral without depressing the clutch lever, or in any gear with the clutch lever depressed.

NOTE: If the starter does not crank the engine with the transmission in neutral, depress the clutch lever. If the starter cranks the engine with the clutch depressed, the gearbox position sensor (GBPS) or its electrical circuits may be defective. Refer to the *GEARBOX* subsection.

SE5 Model

The following conditions must be met to allow engine cranking:

– Ignition switch "ON"
– Engine stop switch to "RUN"
– Mode button pressed in once (safety message acknowledgement)
– Transmission in neutral (or in gear with the brake pedal depressed)
– D.E.S.S. recognizes the key
– Start button pressed in.

NOTE: If the transmission was left in reverse or any forward gear when the engine was shut down, the starter will crank the engine when the start button is pressed. Commanded by the TCM (transmission control module), the HCM (hydraulic control module) will automatically shift the transmission to neutral during the engine start when there is sufficient oil pressure to do so. Having the parking brake set will not affect engine cranking, the normal brake pedal must be depressed for engine cranking if the transmission is not in neutral.

TROUBLESHOOTING

TROUBLESHOOTING TIPS

It is good practice to check for fault codes using the B.U.D.S. software as a first troubleshooting step. Refer to *COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE* subsection.

Refer to *POWER DISTRIBUTION* for fuses and relays information.

Always refer to the *WIRING DIAGRAM* when troubleshooting an electrical circuit.

Install a battery charger on battery terminals (under seat) for any tests that involve a prolonged "key ON" period. If battery voltage gets too low, some accessories are shut off by the ECM.

NOTICE Never force a multimeter probe into an electrical terminal.

If the gauge or lights do not come on when ignition switch is ON, refer to *TROUBLESHOOTING* in *IGNITION SYSTEM* subsection.

If gauge and lights come ON with the ignition switch ON and starter does not engage, start your testing sequence by carrying out *STARTER OPERATION TEST* in this subsection.

Refer to the following list for possible causes:
- F12 fuse
- Battery or connections (refer to *CHARGING SYSTEM*)
- D2 diode
- Start button
- Engine stop switch
- Starter solenoid
- Clutch engagement switch (**SM5 model**)
- Gear position sensor (**SM5 model**)
- D.E.S.S.
- Brake light switch (**SE5 model** if transmission in gear)
- Electrical cables/connections
- ECM.

PROCEDURES

F12 FUSE

If starter does not operate, check F12 fuse in front fuse box.

If fuse F12 continuously blows, isolate the following components to determine the source of the short circuit:
- Pre-starting relay
- Starter solenoid
- Heated oxygen sensors
- EVAP purge valve
- Fuel pump
- D2 diode
- ECM
- Clutch solenoid valve

ELECTRIC STARTER

Starter Operation Test

Before testing, make sure the battery is in good condition and completely charged.

1. Apply parking brake.
2. Carry out a normal start with throttle fully open to initiate "drown mode" (prevents engine from starting).

⚠ WARNING

While using drown mode to prevent engine starting, always release Start button before throttle.

The starter should rotate smoothly.

If the starter does not run smoothly, refer to the *MAGNETO AND STARTER* subsection.

If the starter does not rotate or rotates slowly, carry out a *STARTER INPUT VOLTAGE TEST*.

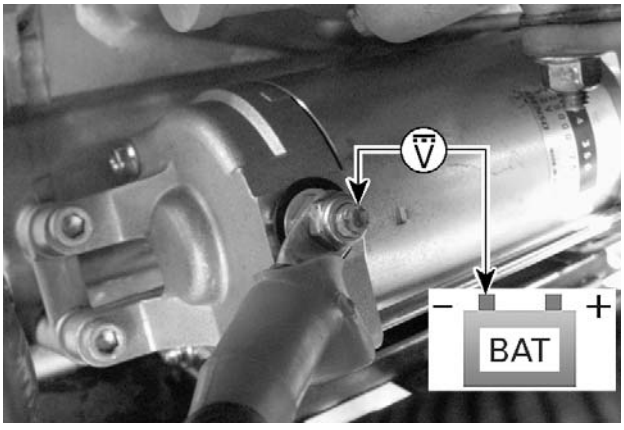
Starter Input Voltage Test

1. Remove the RH top side panel and air filter cover, refer to *BODY* and *AIR INTAKE SYSTEM* subsections.
2. Set multimeter to Vdc.
3. Measure voltage at starter terminal while cranking engine with the throttle fully open to initiate "drown mode" (prevents engine from starting).

⚠ WARNING

While using drown mode to prevent engine starting, always release Start button before throttle.

NOTE: Battery voltage will drop and fluctuate with starter cranking load.



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If there is no voltage at the starter terminal, check Start button and Stop button using B.U.D.S.

If voltage is low, carry out a *STARTER CABLE VOLTAGE DROP TEST*.

If battery voltage is good at starter terminal, make sure engine is not seized. If engine is not seized, carry out a *GROUND CIRCUIT VOLTAGE DROP TEST*.

Starter Cable Voltage Drop Test

This test confirms if there is parasitic resistance in the cable, solenoid or connections.

1. To access battery positive terminal, refer to *BODY* and remove LH rear side panel.
2. Set multimeter to Vdc.
3. Connect multimeter probes to the starter terminal and battery positive post.
4. Crank engine and read multimeter **while starting**.

STARTER CABLE VOLTAGE DROP TEST		
PROBES		RESULT (WHILE STARTING)
Battery positive post	Starter terminal	1 Vdc maximum

If voltage exceeds the specification, test voltage drop between the following points using the same method to determine what part of the circuit is at fault:

– Battery positive post and starter solenoid STS3
– Starter solenoid STS3 and STS4
– Starter solenoid STS4 and starter terminal.

Replace cable or solenoid if necessary.

Starter Ground Circuit Voltage Drop Test

This test confirms if there is parasitic resistance in the ground cables or connections.

1. Set multimeter to Vdc.
2. Connect multimeter probes to the starter housing and battery negative post.
3. Carry out a start and read multimeter **while starting**.

STARTER GROUND CIRCUIT VOLTAGE DROP TEST		
PROBES		RESULT (WHILE STARTING)
Starter housing	Battery negative post	0.8 Vdc maximum

If voltage exceeds the specification, ground cables and connections from battery to RH side of engine.

If voltage is as per specification, replace starter, refer to *MAGNETO AND STARTER* subsection.

Starter Replacement

If the starter needs to be replaced, refer to the *MAGNETO AND STARTER* subsection.

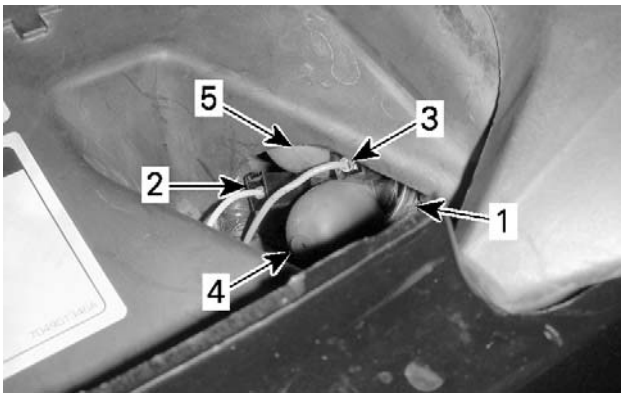
D2 DIODE (STARTER SOLENOID)

Diode Test

Diode D2 must be isolated from other parallel circuits for proper testing. Turn ignition switch OFF, then isolate diode D2 by disconnecting the following:

– ECM connector B
– Both small connectors on the starter solenoid.

For quick access to the starter solenoid connections, open vehicle seat. Solenoid connectors can be seen through an opening in the LH fuel tank cover.



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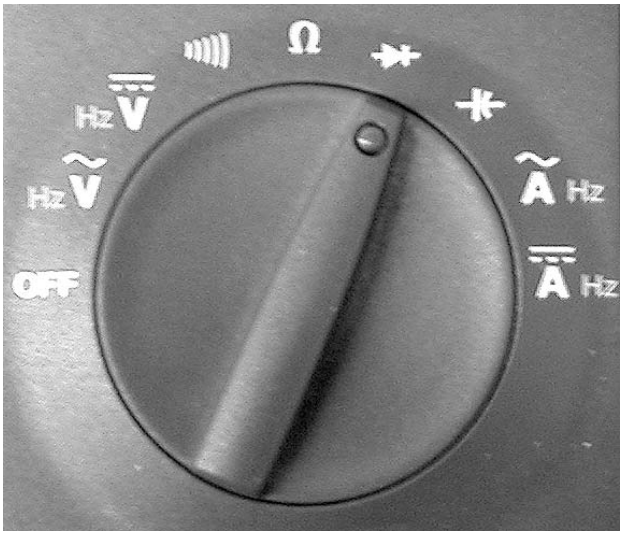
1. Starter solenoid
2. STS1 (YELLOW/PINK wire)
3. STS2 (VIOLET/BEIGE wire)
4. STS3 from battery
5. STS4 to starter

Set multimeter as shown.

NOTE: It is important to install the BLACK multimeter probe in the BLACK "com" connector of the multimeter and the RED probe in the RED connector for proper testing of diode polarity.



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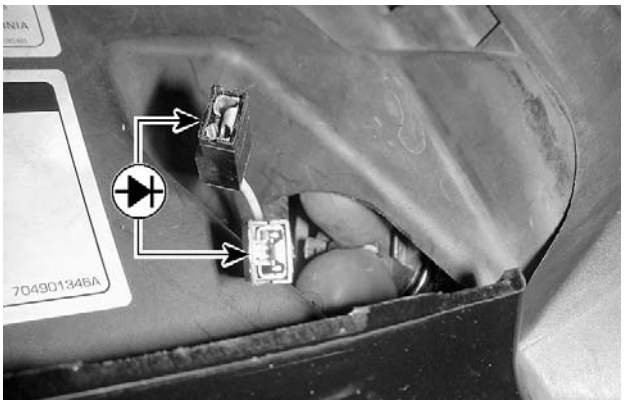
Disconnect the two small solenoid connectors.

Diode D2 can then be checked as follows, through the two small connectors on the solenoid harness.



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D2 DIODE TEST			
SOLENOID HARNESS CONNECTOR	STS1 (YELLOW/ PINK)	STS2 (VIOLET/ BEIGE)	READING
TEST PROBES	RED	BLACK	0.5 V
	BLACK	RED	Infinite OL

If the diode fails this test, the main harness will need to be opened to replace it.

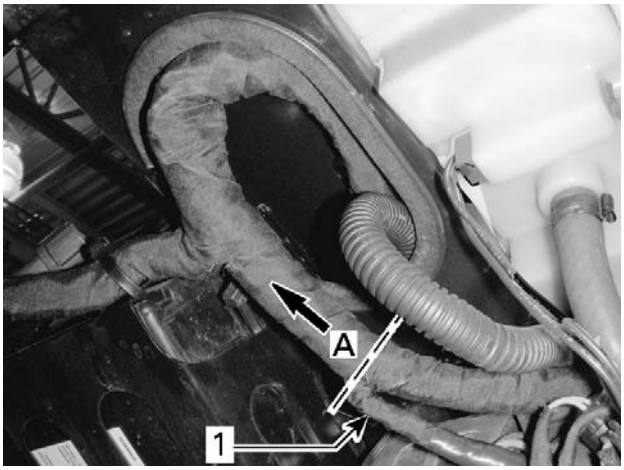
NOTE: If the diode is damaged and short circuits, fuse F12 will probably blow and open the circuit. If the diode blows and open circuits, it will not provide protection to the sensitive electronics. These components will be damaged, may function intermittently, or completely fail.

Diode Replacement

The diode (D2) is located in the rear harness underneath the frame.

1. Refer to *BODY* and remove the rear cargo module.
2. Remove the wheel well cover by removing the four reusable plastic rivets, then sliding cover rearwards.

The diode is located within a 500 mm (18 in) distance from the small harness junction.



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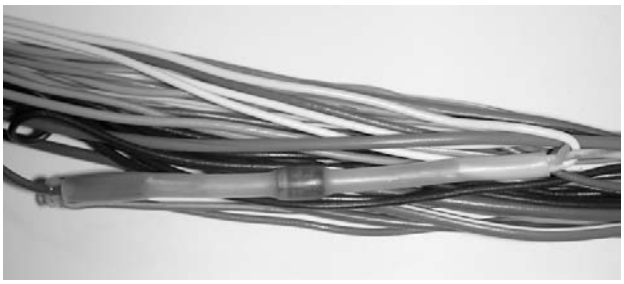
UNDER REAR OF FRAME
1. *Harness junction*

A. Diode within 500 mm (18 in) from this point in the direction of arrow

3. Open the harness protective sheath to access the diode.

NOTICE Be very careful not to damage wire insulation while opening protective sheath.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TYPICAL DIODE WITHIN HARNESS

4. Replace diode making sure to install it in the right direction. Use the "diode check" function of the multimeter and refer to te *WIRING DIAGRAM*.

NOTE: If the diode is installed in the reverse direction, the starter solenoid will not function. When the ECM completes the circuit to energize the starter solenoid coil, the current flow will by-pass the coil through the diode. Fuse F12 will probably blow and open the circuit.

Pay attention to the installation direction, refer to the *WIRING DIAGRAM* for proper diode installation polarity.

NOTE: When replacing the diode, always test the new diode with the diode checker on the multimeter, before installing it in the circuit.

ENGINE STOP SWITCH

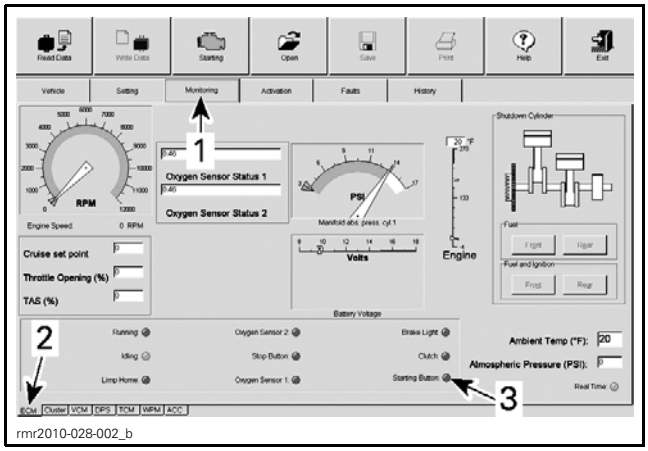
NOTE: The engine stop switch is located on the RH multifunction switch housing.

Engine Stop Switch Test with B.U.D.S.

1. Connect the vehicle diagnostic connector to a computer with the latest version of the B.U.D.S. software.
2. Select the **Read Data** button.
3. Select the **Monitoring** page tab.

Make sure you are on the **ECM Monitoring** page.

4. Place engine stop switch to RUN, then to STOP and look at the **Stop Button** indicator light at the bottom of the page.



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1. Monitoring page tab
2. ECM tab
3. Stop Button indicator light

If the **Stop Button** indicator light in B.U.D.S. comes ON when switch is RUN position and OFF when switch is in STOP position, it indicates that the switch and wiring are good and that the D.E.S.S. module gets the signal. Make sure Start button tests good, then carry out a *PRE-STARTING RELAY QUICK TEST*.

If test fails, check for an open circuit or defective switch, refer to *WIRING DIAGRAM*. Keep in mind that one side of the switch is connected to the D.E.S.S. module and a failure of this circuit will disable starting.

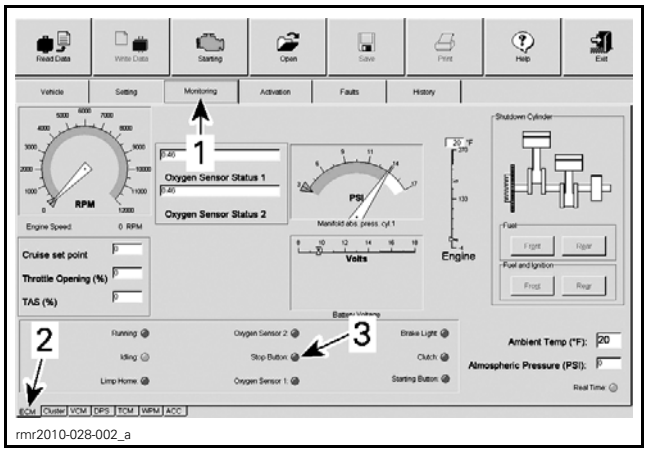
START BUTTON

Start Button Test with B.U.D.S.

1. Connect the vehicle diagnostic connector to a computer with the appropriate version of the B.U.D.S. software.
2. Select the **Read Data** button.
3. Select the **Monitoring** page tab.

Make sure you are on the **ECM Monitoring** page.

4. Press the vehicles start button and look at the **Start Button** indicator light at the bottom of the page.



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1. Monitoring page tab
2. ECM tab
3. Start Button indicator light

If the **Start Button** indicator light in B.U.D.S. comes "ON" while start button is pressed in, it indicates that the starting system input side is functioning normally (start button, ECM, wiring and connections). Make sure engine stop switch tests good, then carry out a *PRE-STARTING RELAY QUICK TEST*.

If the **Start Button** light does not come "ON" in B.U.D.S., check for an open circuit or defective switch, refer to *WIRING DIAGRAM*.

PRE-STARTING RELAY

Pre-Starting Relay Quick Test

1. Locate pre-starting relay in the front fuse box, refer to *POWER DISTRIBUTION*.

2. While carrying out a start, touch the relay. You should feel it "click" when you press start button.

If relay does not click when start button is pressed in, carry out a *PRE-STARTING RELAY INPUT VOLTAGE TEST*.

If relay clicks when start button is pressed in, carry out a *STARTER SOLENOID INPUT VOLTAGE TEST*.

Pre-Starting Relay Input Voltage Test

1. Remove pre-starting relay.
2. Set multimeter to Vdc.
3. Turn ignition switch (key) ON.
4. Measure voltage on pins C3 and D3 of front fuse box.

NOTE: Refer to *POWER DISTRIBUTION* for front fuse box pinout.

PRE-STARTING RELAY INPUT VOLTAGE TEST		
TEST PROBES		RESULT
Front fuse box pin C3	Ground	Battery voltage
Front fuse box pin D3		

If there is no voltage on pin C3, D3 or both, check for an open circuit.

If voltage is as specified, carry out a *PRE-STARTING RELAY CONTROL CIRCUIT TEST*.

Pre-Starting Relay Control Circuit Test

1. Remove pre-starting relay.
2. Set multimeter to Vdc.
3. Turn ignition switch (key) ON.
4. Place multimeter RED probe on a positive source such as the starter solenoid battery input.
5. Place the multimeter BLACK (COM) probe on pin C4 of front fuse box.

NOTE: Refer to *POWER DISTRIBUTION* for front fuse box pinout.

6. Measure voltage while cranking the engine.

PRE-STARTING RELAY CONTROL CIRCUIT TEST		
TEST PROBES		RESULT (WHILE STARTING)
Front fuse box pin C4	Positive source	Battery voltage

If voltage is as specified, the relay gets a proper ground signal. Check relay condition, refer to *POWER DISTRIBUTION*.

If voltage is not as specified, check for an open circuit.

STARTER SOLENOID

NOTE: The starter solenoid is mounted on the frame, behind the LH rear panel just ahead of the battery rack.

To access starter solenoid, remove the following body panels, refer to the *BODY* subsection:

– LH rear panel
– LH fuel tank cover.


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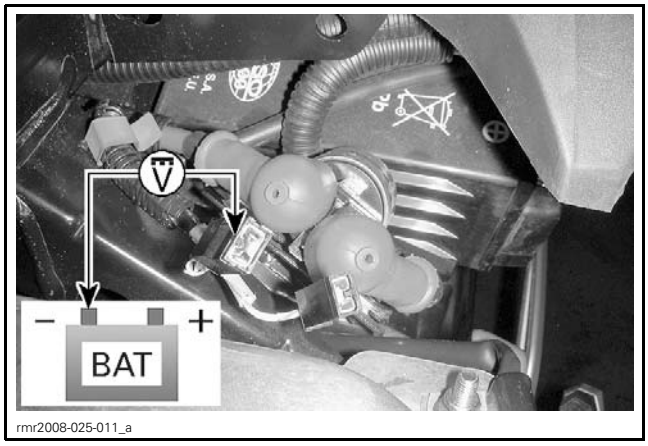
STARTER SOLENOID (RH FUEL TANK COVER REMOVED)

Inspect connections and clean as necessary.

Starter Solenoid Input Voltage Test

1. Disconnect connector STS2 (VI/BE wire) from solenoid, and test voltage as follows.
2. Turn ignition key ON and carry out a start.
3. Read voltage while start button is pressed in.

STARTER SOLENOID INPUT VOLTAGE TEST		
TEST PROBES		RESULT (WHILE STARTING)
VI/BE	Battery negative post	Battery voltage



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If there is no voltage while starting, check for an open circuit including pre-starting relay mechanical contacts. For relay testing procedure, refer to *POWER DISTRIBUTION*.

If voltage is as specified, carry out a *STARTER SOLENOID CONTROL CIRCUIT TEST*.

Starter Solenoid Control Circuit Test

1. Disconnect connector STS1 (YEL/PK wire) from solenoid.
2. Set multimeter to Vdc.
3. Turn ignition switch (key) ON.
4. Place multimeter BLACK (COM) probe on a positive source such as the starter solenoid battery input.
5. Place the multimeter RED probe on pin STS1 terminal (wire side).
6. Measure voltage while cranking the engine.

STARTER SOLENOID CONTROL CIRCUIT TEST		
TEST PROBES		RESULT (WHILE STARTING)
YEL/PK wire	Positive source	Battery voltage

If there is no voltage while starting, check for an open circuit.

If voltage is as specified, the solenoid gets a proper ground signal. Carry out a *STARTER SOLENOID STATIC TEST: CONTINUITY*.

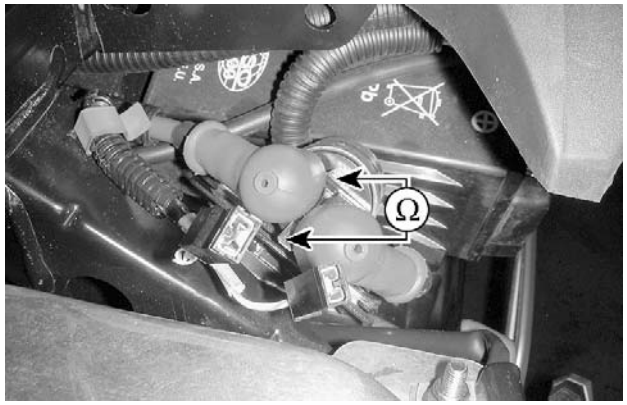
Starter Solenoid Static Test: Continuity

Disconnect battery.

Disconnect small terminals from solenoid.

With a multimeter, test the primary winding resistance as follows.

SOLENOID WINDING CONTINUITY TEST		
solenoid terminals		measurement
		Resistance @ 20°C (68°F)
STS1	STS2	Approximately 5 Ω



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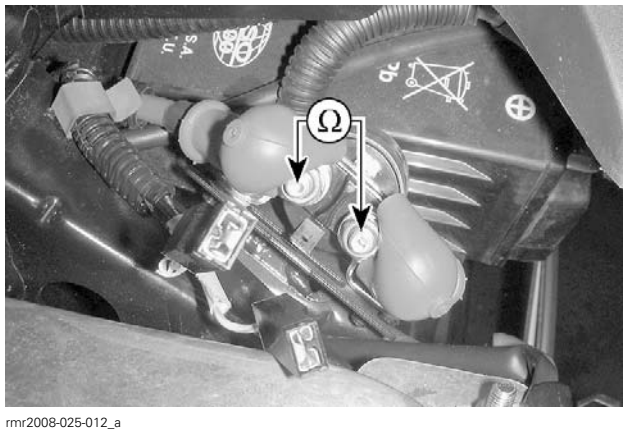
Test for a stuck solenoid plunger as follows.

SOLENOID CONTACTS CONTINUITY TEST		
solenoid connector		measurement
Battery terminal	Starter terminal	Open circuit



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If any measurement is out of specification, replace solenoid.

Reconnect battery and starter terminals.

Starter Solenoid Removal

To access starter solenoid for replacement, remove the following body panels, refer to the *BODY* subsection:

– LH rear side panel

– LH fuel tank cover.

Disconnect the battery.

Remove the four electrical connections from the starter solenoid.

Remove the two mounting bolts.

Starter Solenoid Installation

Install the new solenoid in the reverse order of the removal procedure.

Carry out a start of the vehicle to validate that the new solenoid functions well.

CLUTCH SWITCH

SM5 Model

Clutch Switch Continuity Test

Remove console module to access clutch switch connector. Refer to *BODY* subsection.

NOTE: The clutch switch connector is white and is located on top of the front heated grips connectors.

Disconnect clutch switch connector.

Using FLUKE 115 MULTIMETER (P/N 529 035 868), test clutch switch resistance.

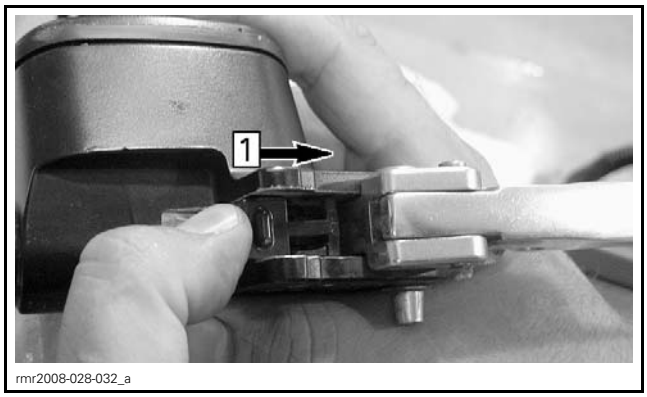
CLUTCH SWITCH CONTINUITY TEST			
CLUTCH SWITCH POSITION	PIN		RESISTANCE @ 20°C (68°F)
Firmly depressed	1	2	Below 3Ω
Released			Infinite (OL)

If switch is defective, replace with a new one.

Clutch Switch Removal

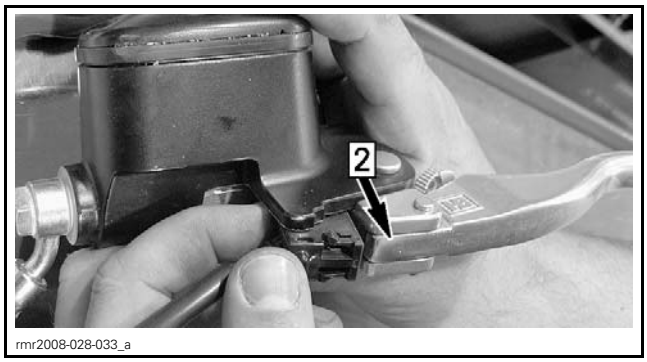
Remove clutch lever from handlebar, refer to *CLUTCH* subsection.

Push switch towards lever.



Step 1: Push switch

Then lift switch to remove it.



Step 2: Lift switch

Remove the console module, refer to *BODY* subsection.

Disconnect the clutch switch connector then remove the connector housing from the connector support.

Clutch Switch Installation

Clutch switch installation is the reverse of the removal procedure.