

CHAPTER 10

ELECTRICAL

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GENERAL INFORMATION

Special Tools

Part Number	Tool Description
PV-43568	Fluke™ 77 Digital Multimeter
PV-43526	Connector Test Kit
2870630	Timing Light
PU-50338	Battery Hydrometer
2460761	Hall Sensor Probe Harness
2871745	Static Timing Light Harness
PU-47063	Digital Wrench™ Diagnostic Software
PU-47471	Digital Wrench™ SmartLink Module Kit

SPX Corp: 1-800-328-6657 or <http://polaris.spx.com/>

Electrical Service Notes

Keep the following notes in mind when diagnosing an electrical problem:

- Refer to wiring diagram for stator and electrical component resistance specifications.
- When measuring resistance of a component that has a resistance value under 10 Ohms, remember to subtract meter lead resistance from the reading. Connect the leads together and record the resistance. The resistance of the component is equal to tested value minus the lead resistance.
- Become familiar with the operation of your meter. Be sure leads are in the proper jack for the test being performed (i.e. 10A jack for current readings). Refer to the Owner's Manual included with your meter for more information.
- Voltage, amperage, and resistance values included in this manual are obtained with a Fluke™ 77 Digital Multimeter (PV-43568). This meter is used when diagnosing electrical problems. Readings obtained with other meters may differ.
- Pay attention to the prefix on the multimeter reading (K, M, etc.) and the position of the decimal point.
- For resistance readings, isolate the component to be tested. Disconnect it from the wiring harness or power supply.

Components Under Hood

The following components can be accessed under the hood.

- Voltage Regulator (in front of radiator)
- Battery
- Battery Cables
- Terminal Block
- Starter Solenoid
- Relays
- Fuses
- Digital Wrench Diagnostic Connector

Components Behind Dash Panel

The following components can be accessed with the dash panel removed (see Chapter 5 for removal).

- Instrument Cluster (Speedometer)
- AWD/2WD/TURF Switch
- Headlight Switch
- 12 VDC Accessory Power Points
- Ignition Switch
- Parking Brake Switch

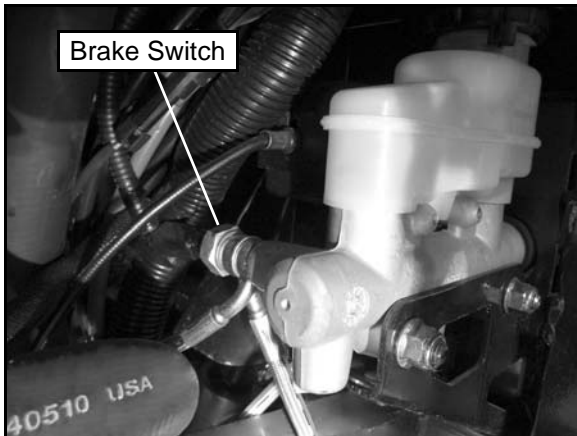
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SWITCHES / CONTROLS

Brake Light Switch

The brake light switch is located on the master cylinder behind the front left wheel well panel.

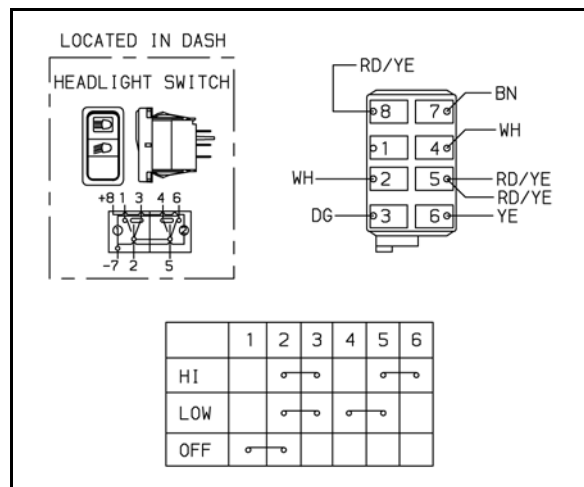
1. Remove the front left wheel well panel to access the back side of the master cylinder.
2. Disconnect the wire harness from the brake switch.



3. Connect an ohmmeter across switch contacts. Reading should be infinite (OL).
4. Apply foot brake and check for continuity between switch contacts. If there is no continuity or if resistance is greater than 0.5 ohms, clean the switch contacts and re-test. Replace switch if necessary.

Headlamp Switch

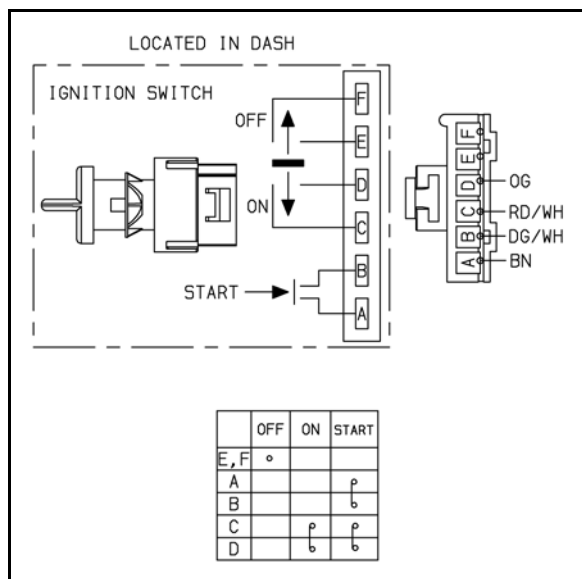
1. Disconnect the headlamp switch harness by depressing the connector locks and pulling on the connector. Do not pull on the wiring.
2. Test between the 3 sets of outputs (HIGH / LOW / OFF). If any of the tests fail, replace headlamp switch assembly.
 - Move the switch to HIGH. There should be continuity between switch pins 2 and 3; 5 and 6.
 - Move the switch to LOW. There should be continuity between switch pins 2 and 3; 4 and 5.
 - Move the switch to OFF. There should be continuity between switch pins 1 and 2.



NOTE: Pins 7 and 8 provide power and ground to light the switch lamp.

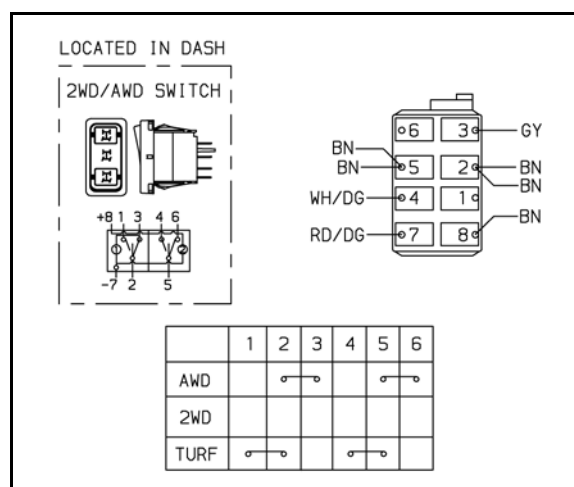
Ignition Key Switch

1. Disconnect the key switch harness by lifting the connector lock and pulling on the connector. Do not pull on the wiring.
2. Test between the 3 sets of outputs (OFF / ON / START). If any of the tests fail, replace ignition switch assembly.
 - Turn the ignition key to ON. There should be continuity between switch pins C and D.
 - Turn the ignition key to START. There should be continuity between switch pins A and B; C and D.



AWD / 2WD / TURF Switch

1. Disconnect the AWD / 2WD / TURF switch harness by depressing the connector locks and pulling on the connector. Do not pull on the wiring.
2. Test between the 3 sets of outputs (AWD / 2WD / TURF). If any of the tests fail, replace the switch assembly.
 - Move the switch to AWD. There should be continuity between switch pins 2 and 3; 5 and 6.
 - Move the switch to 2WD. There should be no continuity between any pins.
 - Move the switch to TURF. There should be continuity between switch pins 1 and 2; 4 and 5.

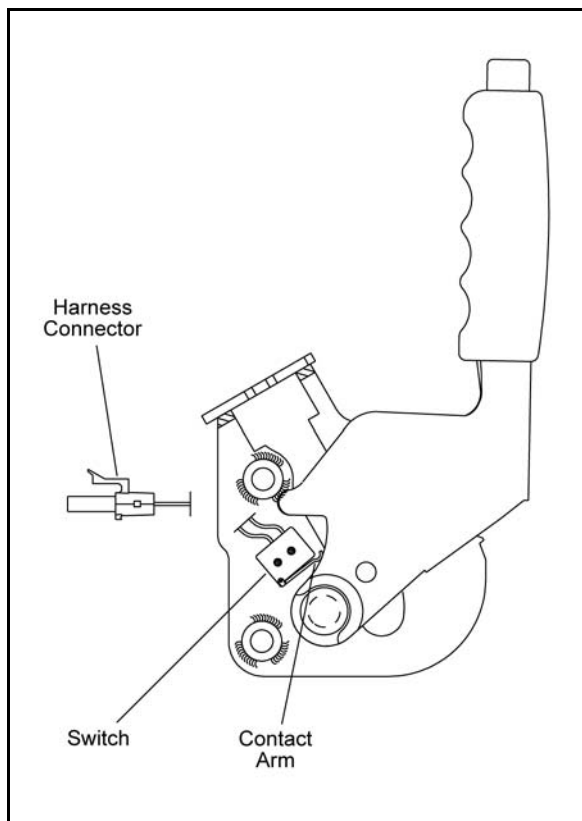


NOTE: Pins 7 and 8 provide power and ground to light the switch lamp.

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Parking Brake Switch

The parking brake switch is located within the parking brake lever. Follow the parking brake lever under the dash to locate the internally mounted switch.



The switch remains in the “open” position when the park brake lever is not applied.

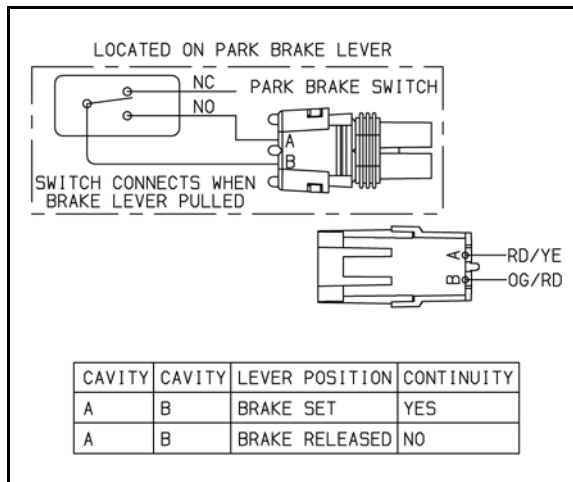
When the parking brake lever is applied, the switch makes contact and sends voltage to the ECU to illuminate “BRAKE” in the instrument cluster rider information display area (see “Park Brake Indicator”).

NOTE: If the parking brake is applied the ECU will rev limit the engine at 1300 RPM until the parking brake is released. This feature has been added to prevent drive-away with the parking brake applied.

If trying to perform an engine diagnostic running test with the parking brake applied, disconnect the switch harness connector to allow the engine to rev higher than 1300 RPMs.

Testing The Parking Brake Switch

1. Disconnect the harness connector at the parking brake switch (Orange/Red and Red/Yellow wires).
2. Place the ohmmeter leads onto the switch terminals. The reading should be infinite (OL).

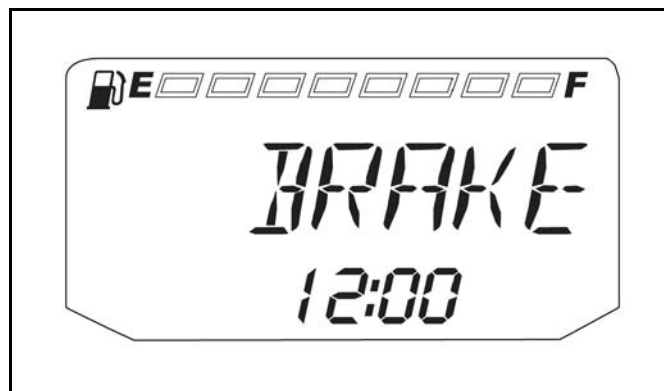


3. Apply the parking brake. Continuity should now exist between the switch terminals. If no continuity exists when the parking brake is applied, try to clean the switch terminals and re-test. Replace switch if necessary.

Park Brake Indicator

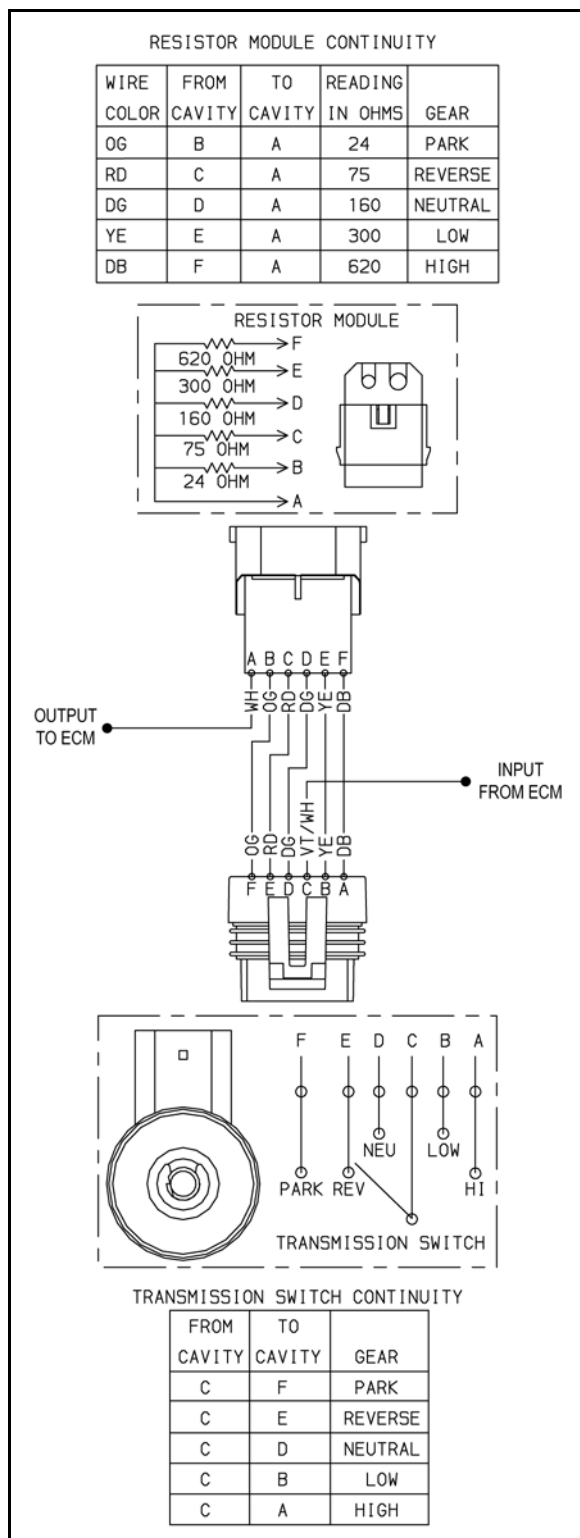
This warning is used to notify the operator that the park brake lever is engaged.

When the park brake is fully engaged, “BRAKE” appears in the rider information display. Engine speed is limited to 1300 RPM in all gears, except neutral. If throttle is applied, this limiting feature prevents operation, which protects the park brake pads from excessive wear.



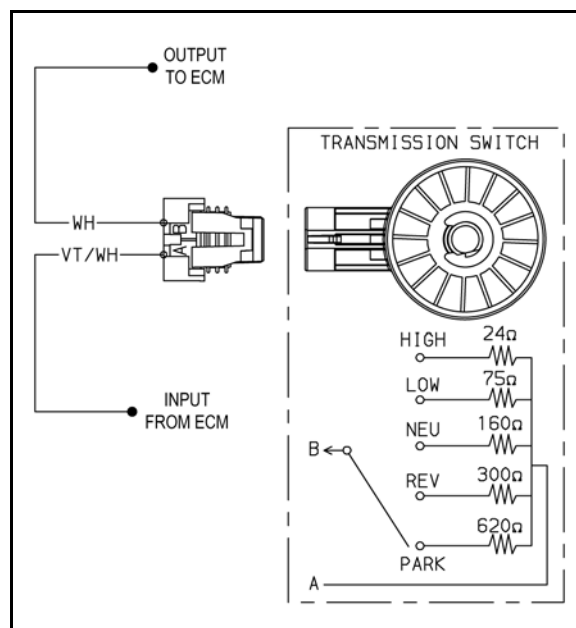
2011 Transmission (Gear Position) Switch

1. Disconnect the transmission switch harness by lifting the connector lock and pulling on the 6-pin connector. Do not pull on the wiring.
2. Test transmission switch for continuity in each gear position and compare to the specification table below.



2012 Transmission (Gear Position) Switch

1. Disconnect the transmission switch harness by lifting the connector lock and pulling on the 2-pin connector. Do not pull on the wiring.
2. Test transmission switch for continuity in each gear position and compare to the specifications below.

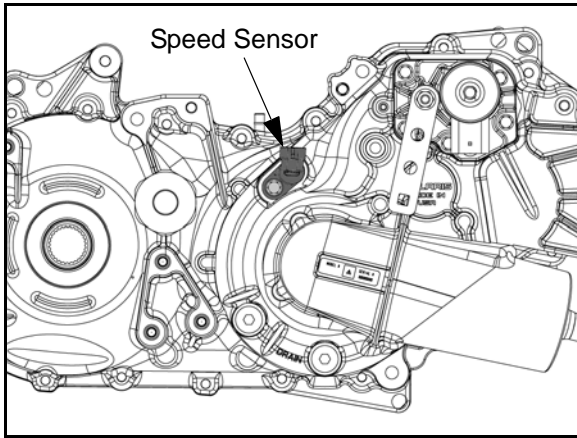


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VEHICLE SPEED SENSOR

Speed Sensor Location (4x4 Models)

The speed sensor is located in the transmission case and can be accessed through the rear RH wheel well area.



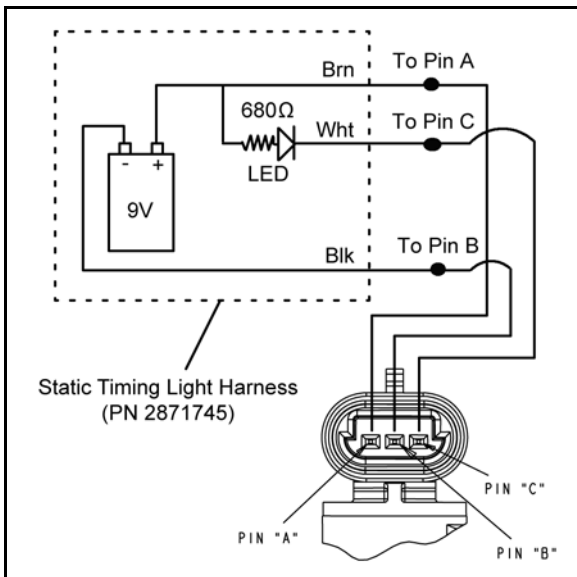
Speed Sensor Testing (4x4 Models)

Special Tools Required:

Static Timing Light Harness (PN 2871745)

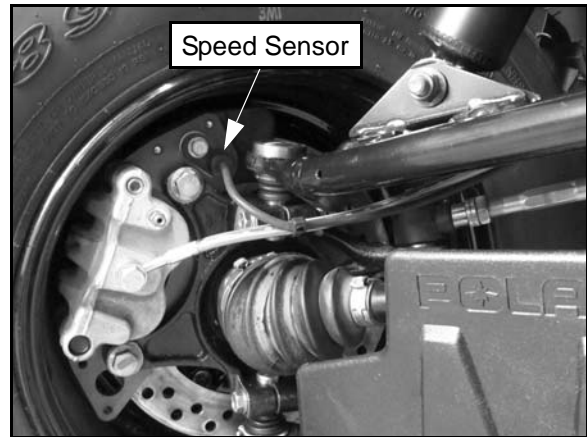
Hall Sensor Probe Harness (PN 2460761)

1. Disconnect wire harness from speed sensor and remove sensor from the transmission.
2. Connect the wires from the Static Timing Light Harness to the sensor 3 pin connector using the Hall Sensor Probe Harness (PN 2460761).
3. Pass a screwdriver back and forth in front of the sensor tip.
4. Be sure connections are good and 9V battery is in good condition. If the light flashes, the sensor is good.



Speed Sensor Location (6x6 Models)

The speed sensor is located on the right front brake caliper mount bracket and can be accessed from the front of the vehicle by turning the steering wheel to the full right.



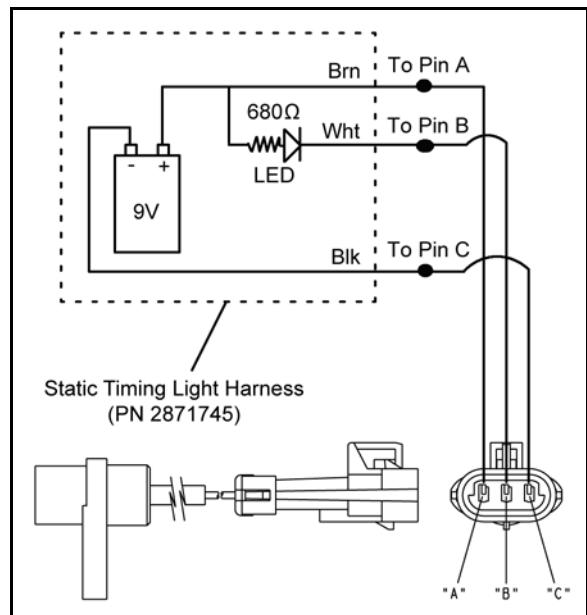
Speed Sensor Testing (6x6 Models)

Special Tools Required:

Static Timing Light Harness (PN 2871745)

Hall Sensor Probe Harness (PN 2460761)

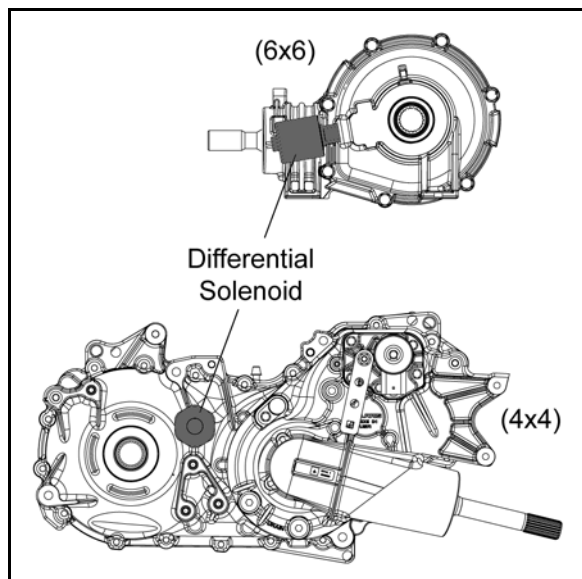
1. Disconnect wire harness from speed sensor and remove sensor from right front brake caliper mount.
2. Connect the wires from the Static Timing Light Harness to the sensor 3 pin connector using the Hall Sensor Probe Harness (PN 2460761).
3. Pass a screwdriver back and forth in front of the sensor tip.
4. Be sure connections are good and 9V battery is in good condition. If the light flashes, the sensor is good.



REAR DIFFERENTIAL SOLENOID

Differential Solenoid Overview

The differential solenoid is located on the right side of the transmission (4x4) or on the rear gear case (6x6). The solenoid actuates an engagement dog, which locks and unlocks the rear differential. Refer to Chapter 8 (4x4) or Chapter 7 (6x6) for information on mechanical operation.



Differential Solenoid Circuit Operation

The Rear Diff Solenoid Relay is located on the frame under the rear cargo box.

When the switch is pushed to activate "TURF", a ground is provided to the ECU from the AWD/2WD/TURF Switch.

Depending on engine speed, gear position criteria and park brake input, the ECU energizes the Rear Diff Solenoid Relay allowing it to enable the differential solenoid. **NOTE: The rear differential will not unlock if the parking brake is set.**

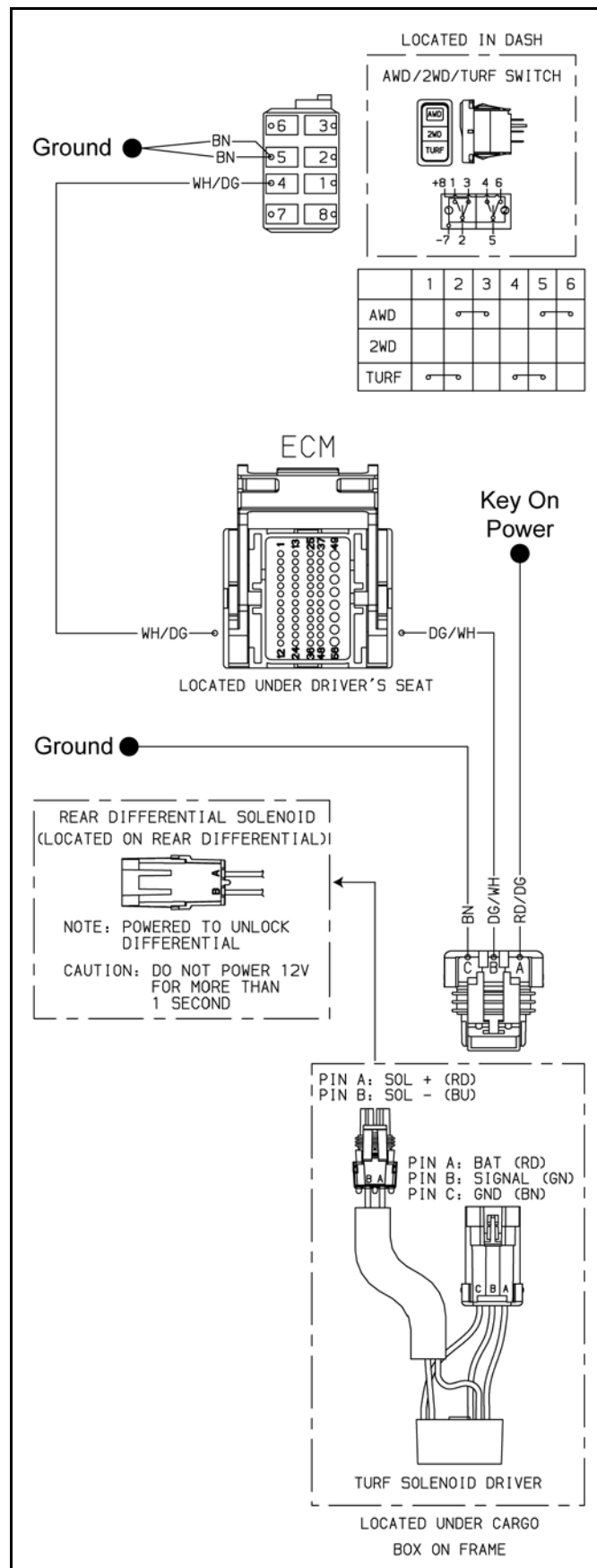
If the differential fails to switch from operational modes:

- Check the solenoid and relay connectors. Look for loose wires or bad connections.
- Check for power from the relay connector, to ensure the solenoid has power to be activated.
- Check the switch wires for loose connections.
- Remove solenoid from rear differential and ensure the solenoid plunger is actuating.



CAUTION

Do not power the solenoid with 12 Volts for more than 1 second, or damage may occur to solenoid.

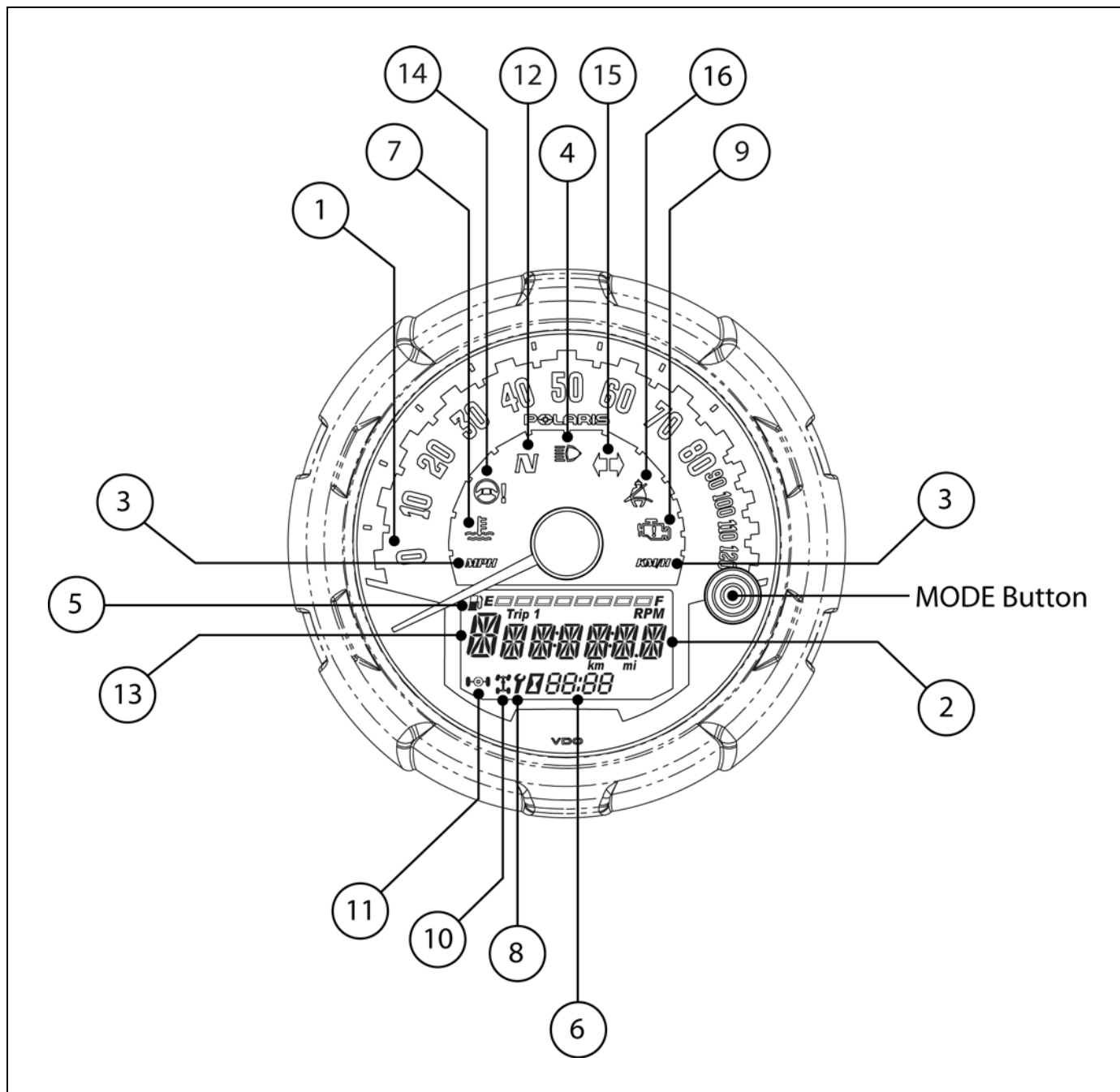


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INSTRUMENT CLUSTER

Overview

The instrument cluster displays critical vehicle information to the user. Reference the following page for display functions and descriptions.



NOTE: Some features are not applicable to all models.

IMPORTANT: The use of a high pressure washer may damage the instrument cluster. Wash the vehicle by hand or with a garden hose using mild soap. Certain products, including insect repellents and chemicals, will damage the instrument cluster lens. Do not use alcohol to clean the instrument cluster. Do not allow insect sprays to contact the lens. Immediately clean off any gasoline that splashes on the instrument cluster.

Rider Information Display

The rider information display is located in the instrument cluster. All segments will light up for 1 second at start-up.

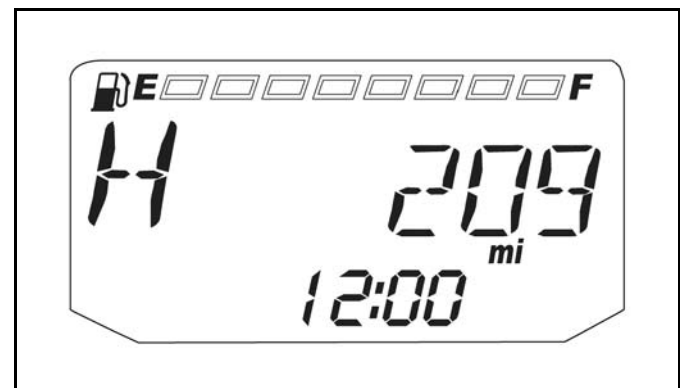
NOTE: If the instrument cluster fails to illuminate, a battery over-voltage may have occurred and the instrument cluster may have shut off to protect the electronic speedometer.

1. **Vehicle Speed Display** - Analog display of vehicle speed in MPH or km/h.
2. **Information Display Area - Odometer / Trip Meter / Tachometer / Engine Temperature / Engine Hours / Service Info / Clock** - LCD display of the service hour interval, total vehicle miles or km., total engine hours, a trip meter, engine RPM and engine temperature.
3. **MPH / KM/H Display** - MPH is displayed when the instrument cluster is in the *Standard* mode. KM/H is displayed when the instrument cluster is in the *Metric* mode.
4. **High Beam Indicator** LED icon illuminates whenever the Headlamp switch is in the high beam position.
5. **Fuel Level Indicator** - LCD bar graph indicating current fuel level. All segments will flash when the last segment is cleared indicating a low fuel warning.
6. **Clock** - Displays current time in either 12-hour or 24-hour formats.
7. **Engine Temperature Indicator** - LED icon illuminates when the ECM determines the engine is overheating. The indicators will initially flash to indicate the engine is overheating. The indicators will stay lit and not flash if a severe overheating condition exists.
8. **Service Interval Indicator** - Preset at the factory and adjustable by the user, a flashing wrench symbol alerts the operator that the preset service interval has been reached and maintenance should be performed. The wrench icon will flash for 10 seconds upon start-up once it reaches 0.
9. **Check Engine MIL** - Illuminated when the ECM has detected a Diagnostic Trouble Code in the engine management system.
10. **AWD Indicator** - Illuminated when the AWD / TURF switch is in the *AWD* position.
11. **TURF Indicator** - Illuminated when the AWD / TURF switch is in the *TURF* position.
12. **Neutral Gear Indicator** - LED icon illuminates when gear selector is in the neutral (N) position.
13. **Gear Position Indicator** - Displays gear selector position.
H = High
L = Low
N = Neutral
R = Reverse
-- = Gear Signal Error (shifter stuck between gears)
14. **Power Steering System MIL** - LED icon illuminates when a fault has occurred with the power steering system. This indicator illuminates when the key is turned to the ON position and goes off when the engine is started.
15. **Turn Signal / Hazard Lamp Indicator** - LED icon illuminates whenever the LH, RH or hazard lamps are activated (International Models Only).
16. **Helmet / Seat Belt Indicator** - LED icon illuminates for several seconds when the key is turned to the ON position. The lamp is a reminder to the operator to ensure all riders are wearing helmets and seat belts before operating the vehicle.

Information Display Area

The LCD portion of the instrument cluster is the information display area. Information displayed in this area includes: odometer, trip meter, engine RPM, engine hours, service interval, clock, engine Diagnostic Trouble Codes (DTCs) and power steering DTCs.

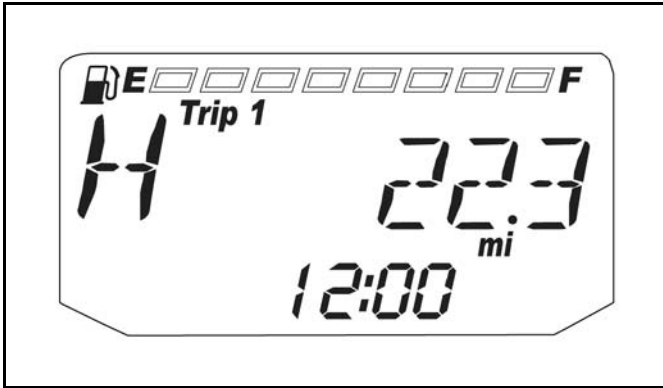
Odometer



The odometer records and displays the total distance traveled by the vehicle. The odometer can not be reset.

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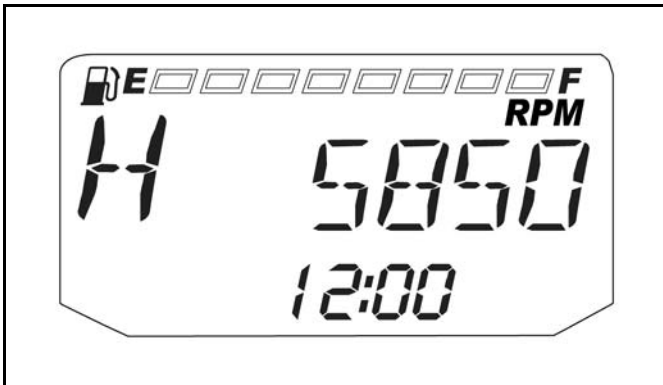
Trip Meter



The trip meter records the miles traveled by the vehicle on each trip. To reset the trip meter:

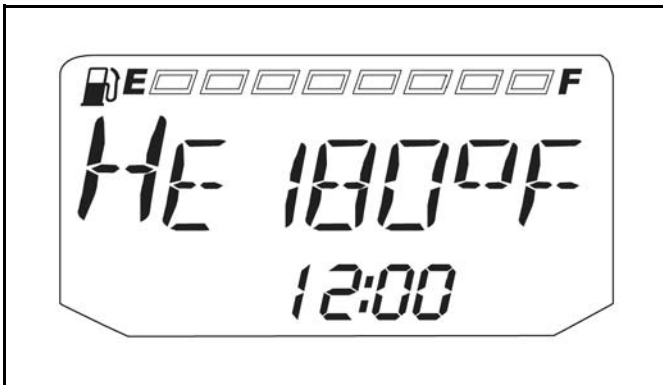
1. Toggle the MODE button to TRIP 1.
2. To reset to 0, push and hold the MODE button until the distance display changes to 0.

Tachometer (RPM)



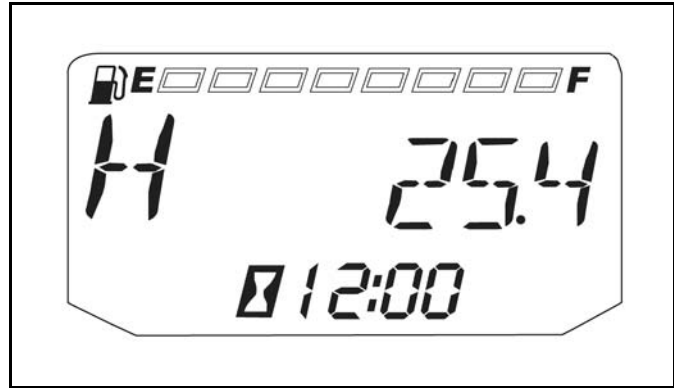
Engine RPM can be displayed digitally.

Engine Temperature



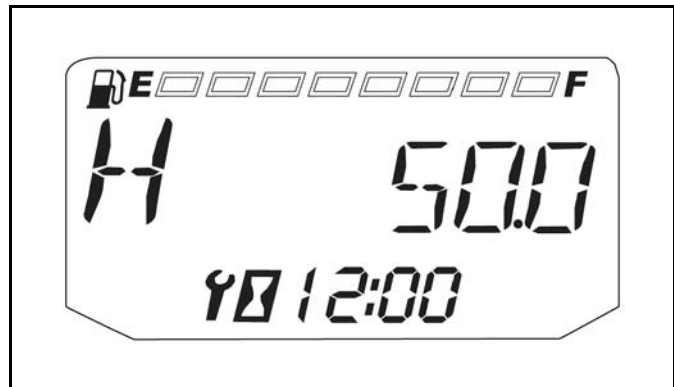
Engine temperature can be displayed in ° F or ° C. Refer to "Units of Measurement" to change the format.

Engine Hours



Engine hours are logged anytime the engine is running. Total hours can not be reset.

Programmed Service Interval

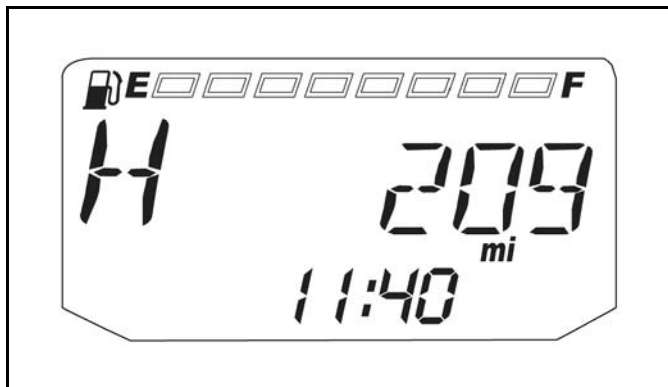


The initial factory service interval setting is 50 hours. Each time the engine is started, the engine hours are subtracted from the service interval hours. When the service interval reaches 0, the LCD wrench icon will flash for approximately 10 seconds each time the engine is started.

To change the hour setting or reset the function, follow these steps:

1. Toggle the MODE button until the wrench icon is displayed in the information area.
2. Press and hold the MODE button until the information display area begins to flash.
3. Toggle the MODE button to increase the service interval hours in 5 hour increments to a maximum of 100 hours.
4. To turn off the service interval function, toggle the MODE button until "OFF" is displayed.

Clock



The clock displays the time in a 12-hour or 24-hour format. Refer to "Units of Measurement" to change the format (Standard 12-hour / Metric-24 hour). To set the clock, follow these steps:

1. Toggle the MODE button until the odometer is displayed.
2. Press and hold the MODE button until the hour segment flashes. Release the button.
3. With the segment flashing, tap the MODE button to advance to the desired setting.
4. Press and hold the MODE button until the next segment flashes. Release the button.
5. Repeat steps 3-4 twice to set the 10 minute and 1 minute segments. After completing the 1-minute segment, step 4 will save the new settings and exit the clock mode.

Units of Measurement

	Standard Display	Metric Display
Distance	Miles (MPH)	Kilometers (KM/H)
Time	12-Hour Clock	24-Hour Clock
Temperature	Fahrenheit	Celsius

To change between Standard and Metric units of measurement, follow these steps:

1. Turn the key to the OFF position.
2. Press and hold the MODE button while turning the key to the ON position.
3. When the display flashes the distance setting, tap the MODE button to advance to the desired setting.



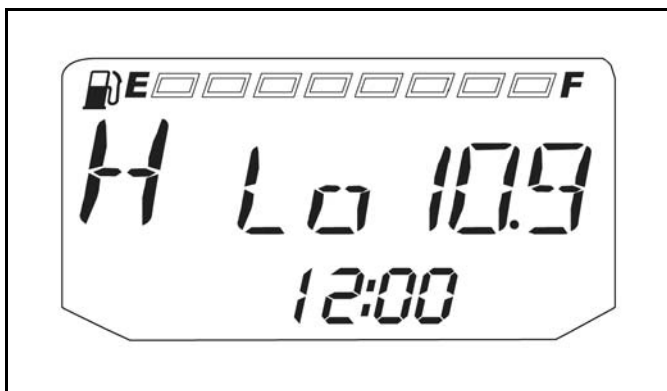
4. Press and hold the MODE button to save the setting and advance to the next display option.
5. Repeat the procedure to change remaining display settings.

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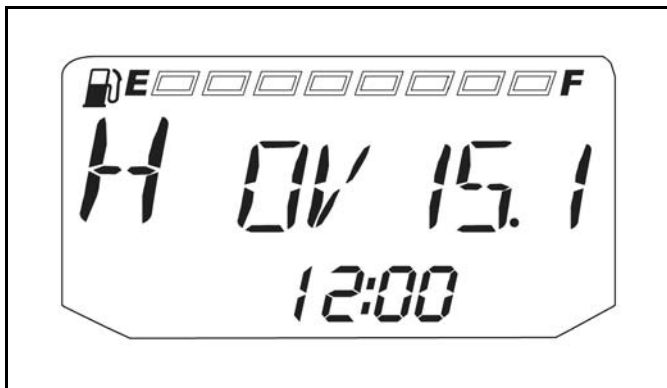
Under / Over Voltage

This warning usually indicates that the vehicle is operating at an RPM too low to keep the battery charged. It may also occur when the engine is at idle and a high electrical load is applied (lights, cooling fan or other accessories).

If battery voltage drops below 11 volts, a warning screen will display "Lo" and provide the present battery voltage. If voltage drops below 8.5 volts, LCD backlighting and icons will turn off.



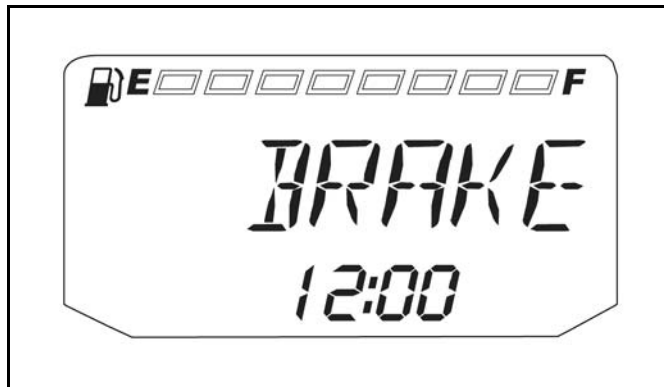
If battery voltage rises above 15 volts, a warning screen will display "OV" and provide the present battery voltage. If voltage rises above 16.5 volts, LCD backlighting and icons will turn off.



Park Brake Indicator

This warning is used to notify the operator that the park brake lever is engaged.

When the park brake is fully engaged, "BRAKE" appears in the rider information display. Engine speed is limited to 1300 RPM in all gears, except neutral. If throttle is applied, this limiting feature prevents operation, which protects the park brake pads from excessive wear.

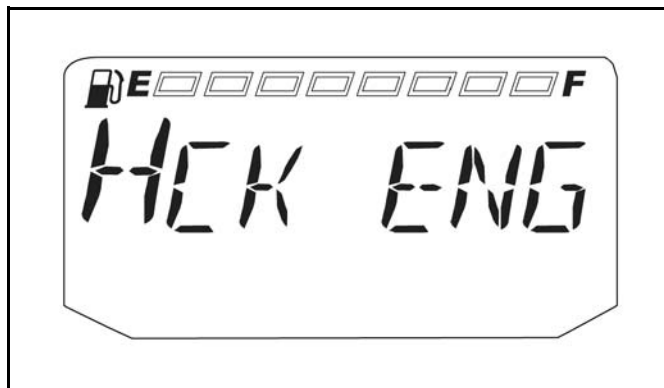


Diagnostic Mode

The diagnostic mode is accessible only when the check engine MIL has been activated.

Use the following procedure to display diagnostic trouble codes that were activated during current ignition cycle causing the MIL to illuminate. Diagnostic trouble codes will remain stored in the gauge (even if MIL turns off) until the key is turned off.

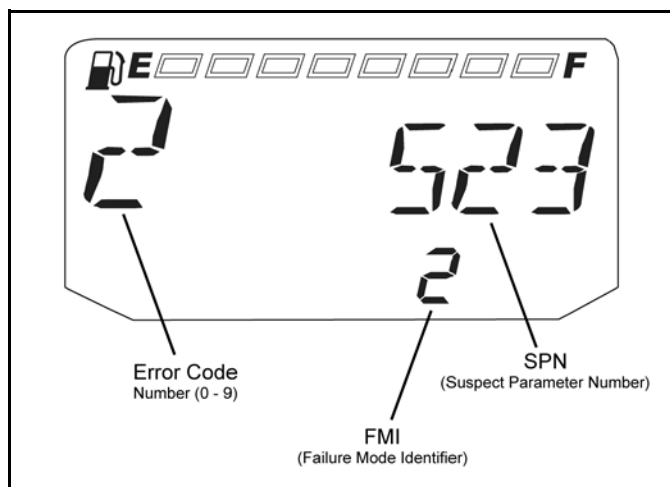
1. If the trouble code(s) are not displayed, use the MODE button to toggle until "CK ENG" displays on the information display area.



2. Press and hold the MODE button to enter the diagnostics code menu.

3. A set of three numbers will appear in the information area.

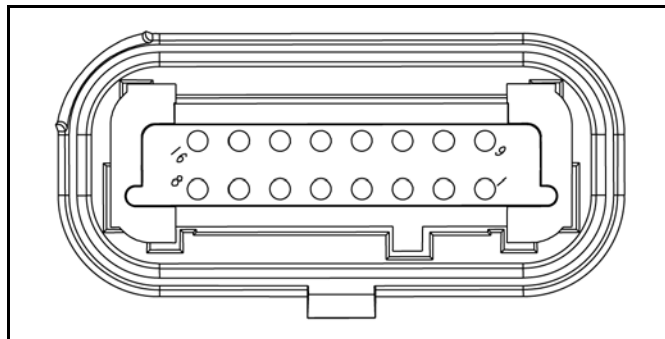
- The first number (located far left) can range from 0 to 9. This number represents the total number of trouble code present (example: 2 means there are 3 codes present).
- The second number (located top right) can be 2 to 6 digits in length. This number equates to the suspected area of fault (SPN).
- The third number (located bottom right) can be 1 to 2 digits in length. This number equates to the fault mode (FMI).



4. Use the trouble code reference table in the EFI Chapter for a description of each code.
5. If more than one code exists, press the MODE button to advance to the next trouble code.
6. To exit the diagnostic mode, press and hold the MODE button or turn the ignition key OFF once the codes are recorded.

NOTE: If there is a diagnostic problem with the power steering system, the power steering MIL will illuminate and blink in place of the check engine MIL.

Instrument Cluster Pinouts



FUNCTION	PIN
CAN High	1
CAN Low	2
Switched Power (Vdc)	3
Constant Power (Vdc)	4
Ground	5
High Beam Input	8
Fuel Level Sensor	11

ELECTRICAL

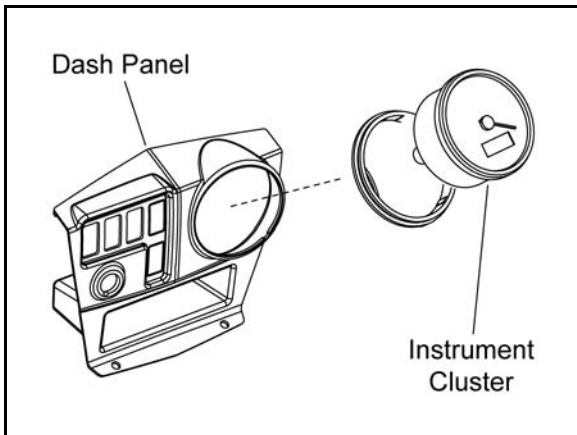
Instrument Cluster Removal

NOTE: Do not allow alcohol or petroleum products to come in contact with the instrument cluster lens.

1. Remove dash panel from the dash (see Chapter 5).
2. Disconnect the wire harness connector from the back side of the instrument cluster.



3. Push the instrument cluster out from the back side of the dash panel, while securely holding the panel and rubber mount.



NOTE: Do not remove the rubber mount from the dash panel. Only remove the rubber mount if necessary.

Instrument Cluster Installation

1. Spray a soap and water mixture onto the outer surface area of the instrument cluster. This will help the instrument cluster slide into the rubber mount more easily.



2. Be sure the rubber mount inside the dash panel is fully installed and that the indexing key on the rubber mount is lined up with the keyway in the dash panel.
3. Hold the dash panel securely and insert the instrument cluster into the dash panel. Twist the instrument cluster gently in a clockwise motion to properly seat the instrument cluster. Apply pressure on the bezel while pressing down on the instrument cluster.

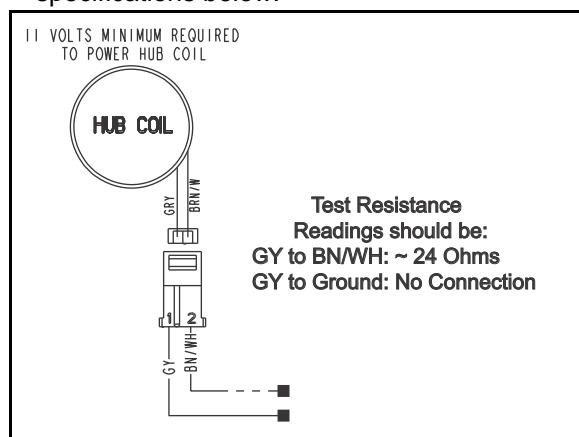
ALL WHEEL DRIVE COILS

Operation Overview

- When the AWD switch is "ON", 12 VDC power is present at the hub coil.
- If the criteria is met, the Engine Controller provides a ground path (brown/white wire). When this occurs the AWD icon should display in the instrument cluster.
- The AWD system must be grounded to operate.

Diagnosing System Failures

- Verify the AWD switch is functional and that a minimum of 11 volts is present at the hub coil.
- Verify the AWD hub coil is functional. Test the AWD hub coil using an ohm meter. See specifications below:



AWD Hub Coil Resistance:
24 Ω \pm 5%

- Verify the wiring harness, wiring, connectors, connector pins and grounds are undamaged, clean and connected properly.
- Verify continuity of wire connections with a volt/ohm meter.

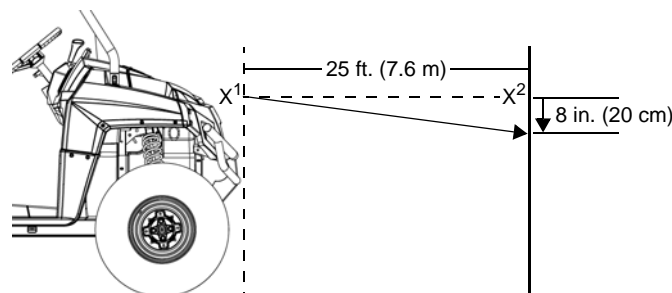
IMPORTANT: Verify all wires and wiring connections have been tested properly with a known good volt/ohm meter before suspecting a component failure. 80% of all electrical issues are caused by bad/failed connections and grounds.

HEADLIGHTS

Headlight Adjustment

The *RANGER* headlights are adjustable.

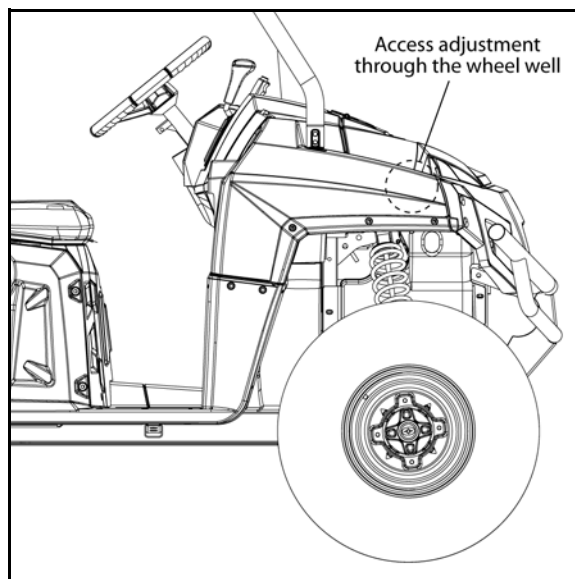
1. Place the vehicle on a level surface with the headlight approximately 25 ft. (7.6 m) from a wall.



2. Measure the distance from the floor to the center of the headlight (X^1) and make a mark on the wall at the same height (X^2).
3. With the vehicle in Neutral and parking brake applied, start the engine and turn the headlight switch on.
4. The most intense part of the headlight beam should be aimed 8 in. (20 cm) below the mark placed on the wall in Step 2.

NOTE: Rider weight must be included in the seat while performing this procedure.

5. Locate the T25 Torx-head adjustment screw through the wheel well (see illustration). Adjust the beam to the desired position by loosening the adjustment screw and moving the lamp to the appropriate height.



ELECTRICAL

6. Once the beam is set to the position, tighten the adjustment screw. Repeat the procedure to adjust the other headlight.

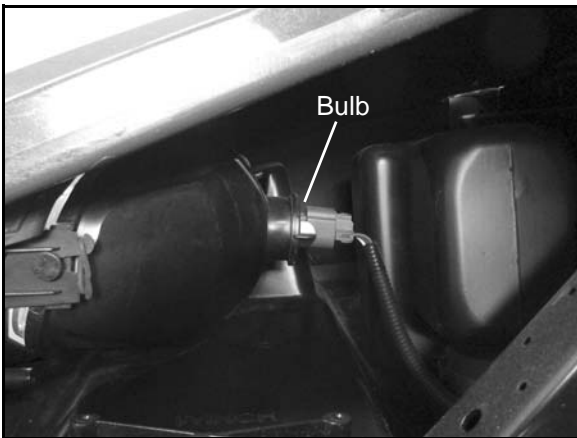


WARNING

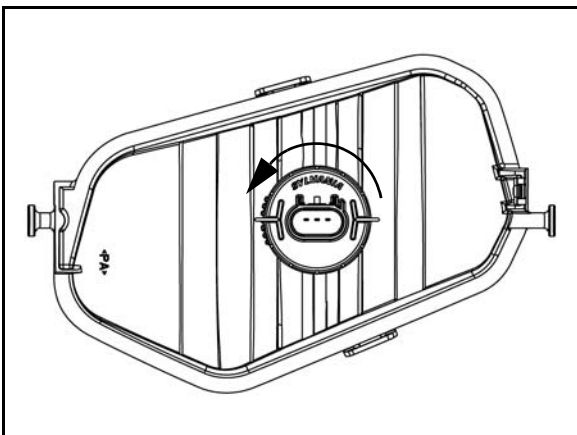
Due to the nature of light utility vehicles and where they are operated, headlight lenses become dirty. Frequent washing is necessary to maintain lighting quality. Riding with poor lighting can result in severe injury or death.

Headlight Bulb Replacement

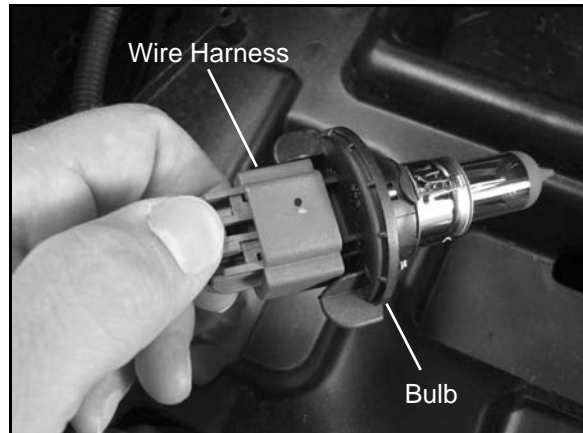
1. Open the hood.
2. Locate the bulb on the back side of headlight.



3. Turn the bulb counterclockwise to remove it.



4. Unplug the headlight bulb from the wiring harness. Be sure to pull on the connector, not on the wiring.

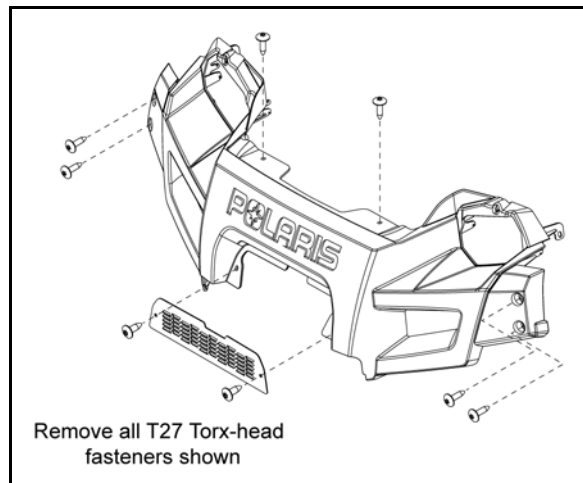


5. Install the wire harness onto the new headlight bulb.
6. Install the bulb into the housing and rotate it clockwise 90° to lock it in place.

NOTE: Make sure the tab on the bulb locates properly in the housing.

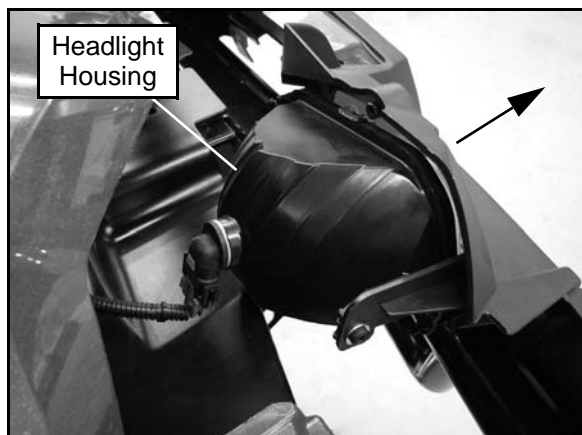
Headlight Housing Removal

1. Open the hood.
2. Remove the front facia to access the headlight housing.

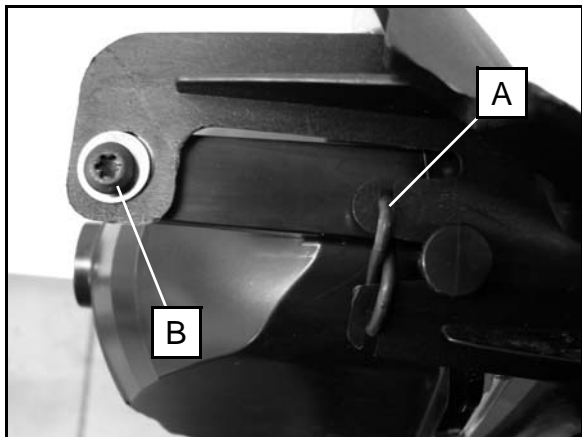


Remove all T27 Torx-head fasteners shown

- Carefully pull the fascia out far enough to access the headlight housing.



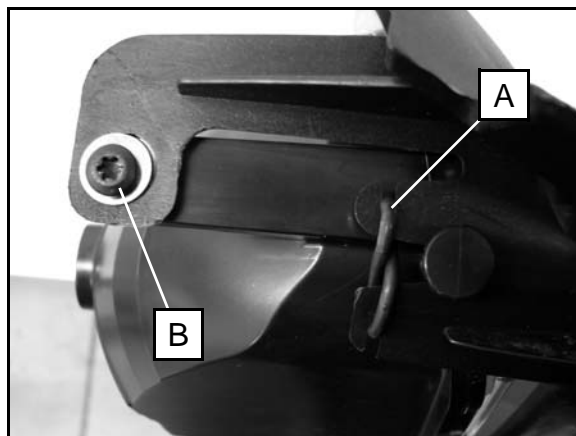
- Remove the bulb from the headlight housing (see "Headlight Bulb Replacement").
- Remove the O-rings (A) from each side of the headlight housing. Remove the adjustment screw (B) and pull the headlight from the brackets.



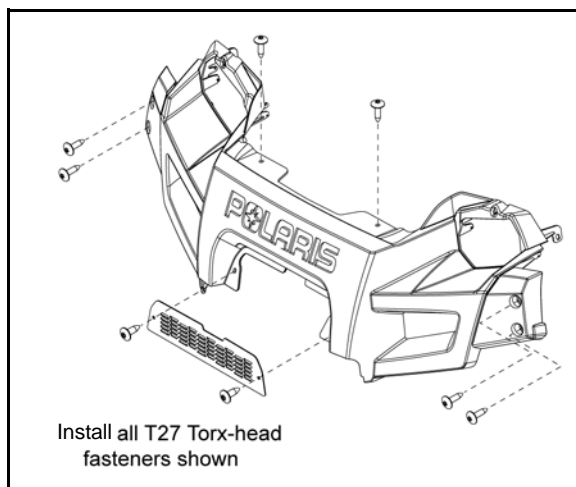
Headlight Housing Installation

- Install the headlight housing by pressing the headlight tabs back into the brackets.
- Secure the headlight housing with the rubber O-rings on each side (A). Install the adjustment screw (B).

NOTE: Be sure to twist the O-rings upon installation as shown below.



- Reinstall the bulb into the housing and rotate it clockwise 90° to lock it in place.
- Reinstall the front fascia and securely tighten all fasteners.



- Adjust headlights using the "Headlight Adjustment" procedure.

ELECTRICAL

TAIL LIGHT / BRAKE LIGHT

LED Lamp Replacement

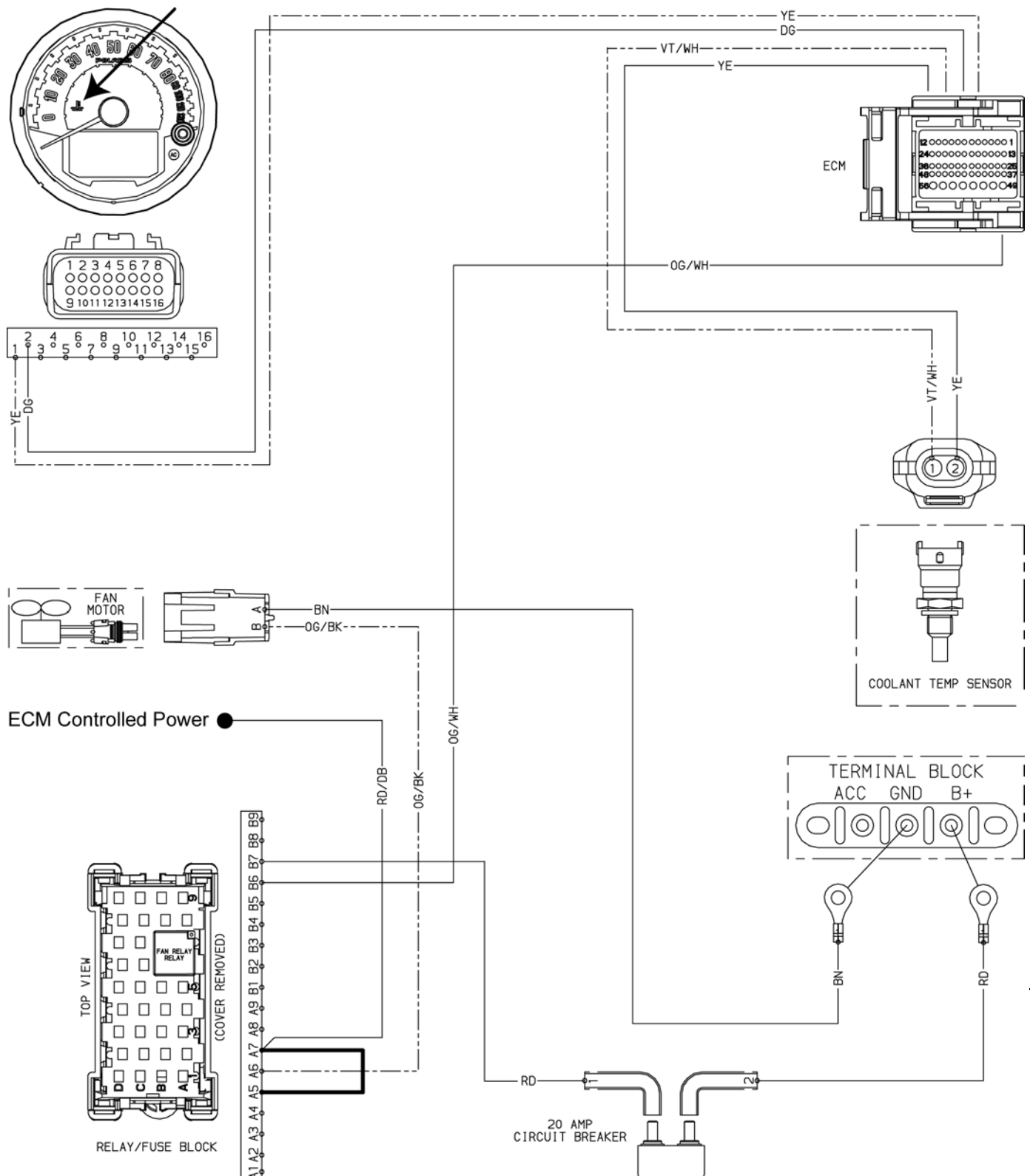
1. From the rear of the LED lamp, remove the (2) T20 Torx-head screws retaining the lamp assembly.



2. Remove the lamp from the cargo box and disconnect the tail light / brake light wire harness.

NOTE: Before replacing the LED lamp assembly, use a digital multi-meter to test the harness to ensure the lamp is receiving 12 volts and that a ground path is present.

3. If the LED still does not work, replace the LED lamp assembly with the recommended lamp.
4. Reinstall the assembly by reversing this procedure.
5. Test the tail light / brake light after installation to verify proper function.

COOLING SYSTEM**Cooling System Break-Out Diagram**

ELECTRICAL

Fan Control Circuit Operation / Testing

Power is supplied to the fan via the Orange/Black wire when the relay is ON. The ground path for the fan motor is through the Brown harness wire. Refer to "RELAYS" later in this chapter for more information on fan functions.



CAUTION

Keep hands away from fan blades during operation. Serious personal injury could result.

NOTE: The fan may not function or operation may be delayed if coolant level is low or if air is trapped in the cooling system. Be sure cooling system is full and purged of air. Refer to Chapter 2 "Maintenance" for cooling system information.

Fan Control Circuit Bypass Test

1. Disconnect harness from coolant temperature sensor on the engine cylinder head (see Chapter 4 for location).
2. Start the engine. After a few seconds, the fan should start running and the "Check Engine" indicator should display on the instrument cluster. This indicates all other components are working properly.
3. If the fan does not run or runs slowly, check the fan motor wiring, ground, motor condition, circuit breaker and mechanical relay for proper operation. Repair or replace as necessary. If the fan runs with the sensor harness disconnected, but will not turn on when the engine is hot, check the coolant temperature sensor and connector terminals.

Coolant Temperature Sensor

The coolant temperature sensor can be tested using an ohmmeter or voltmeter.

1. With the engine and temperature sensor at room temperature ($68^{\circ}\text{F} = 20^{\circ}\text{C}$), disconnect the harness.
2. With the meter in the ohms mode, place the meter leads onto the sensor contacts.
3. Use the table Temperature / Resistance table to determine if the sensor needs to be replaced.

TEMPERATURE $^{\circ}\text{F}$ ($^{\circ}\text{C}$)	RESISTANCE
68 $^{\circ}\text{F}$ (20 $^{\circ}\text{C}$)	2.5 k $\Omega \pm 6\%$
212 $^{\circ}\text{F}$ (100 $^{\circ}\text{C}$)	186 $\Omega \pm 2\%$

NOTE: If the coolant temperature sensor or circuit malfunctions the radiator fan will default to 'ON'.

EFI DIAGNOSTICS

EFI Component Testing

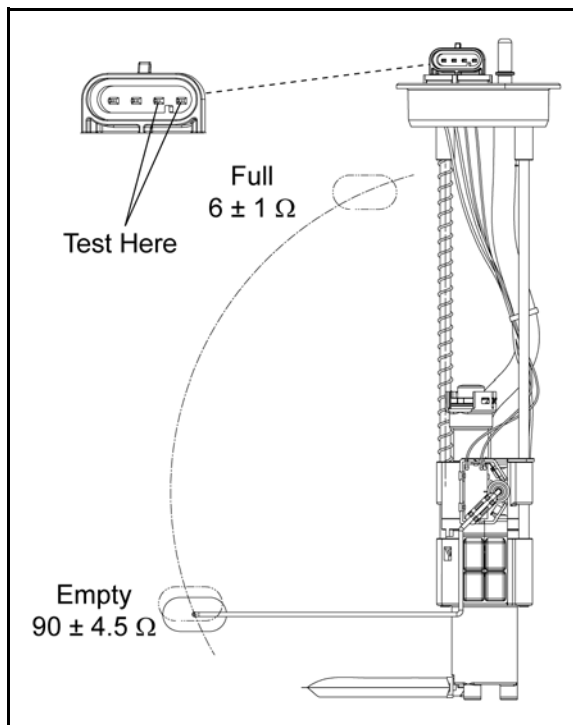
All EFI component information and diagnostic testing procedures are located in **Chapter 4**.

Refer to **Chapter 4** "Electronic Fuel Injection System (EFI)" when diagnosing an EFI System.

FUEL SENDER

Testing

1. Drain the fuel tank and remove it from the vehicle (see Chapter 4).
2. Set fuel tank on a flat surface. Using an Ohm meter, measure the resistance of the fuel sender.



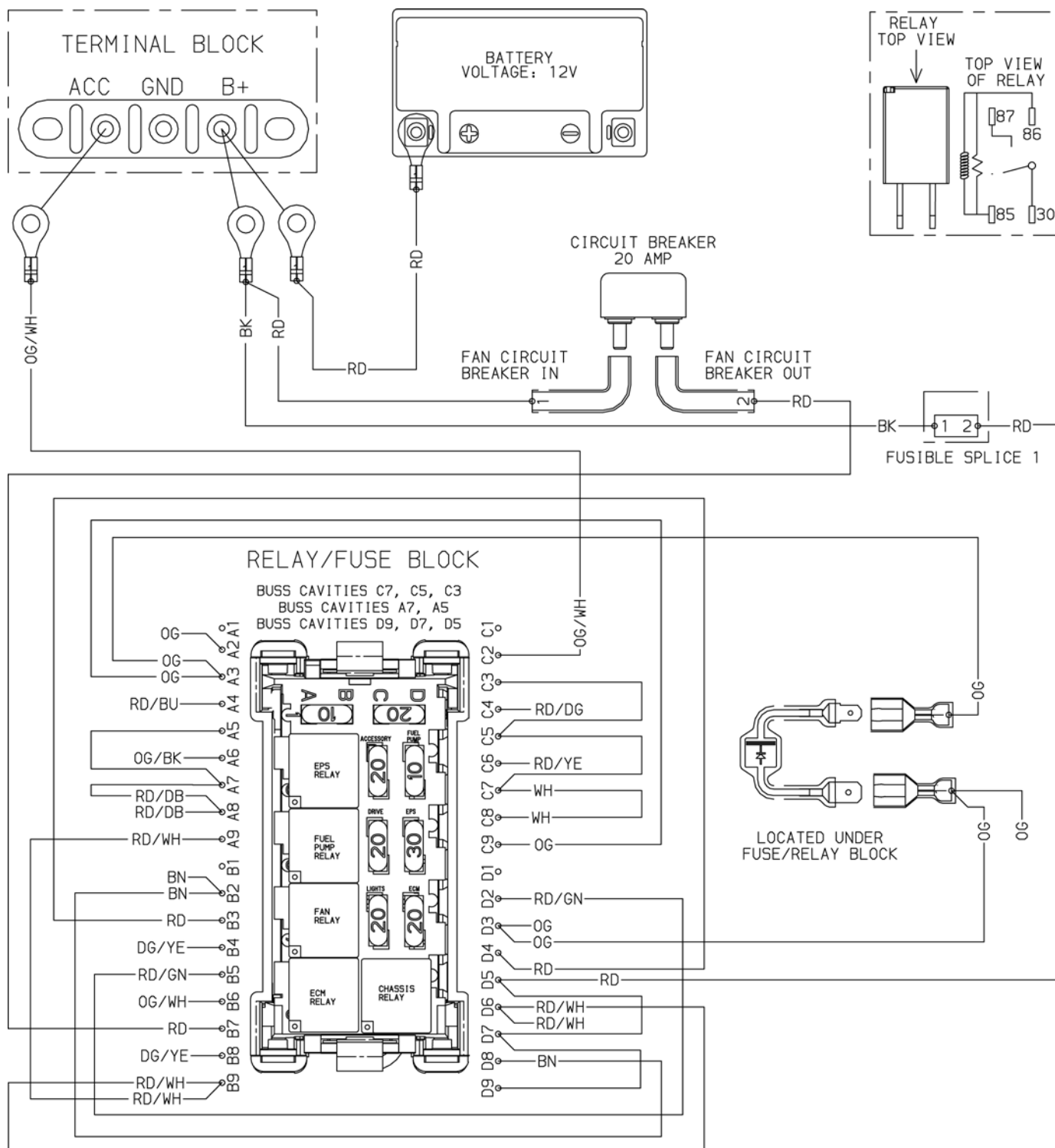
3. Allow the sender float to sit in the **empty position** and compare to specification.
4. Slowly tilt the tank so that gravity moves the sender float to the **full position** and compare to specification.
5. If the readings are out of specification, erratic or LCD display "sticks", check the following before replacing the fuel pump assembly:
 - Loose float
 - Float contact with tank
 - Bent float rod

If none of the conditions exist, the fuel sender assembly is faulty. Replace the fuel pump assembly (see Chapter 4).

FUSE BOX: FUSES / RELAYS / CIRCUIT BREAKER

Overview / Operation (Model Year 2011)

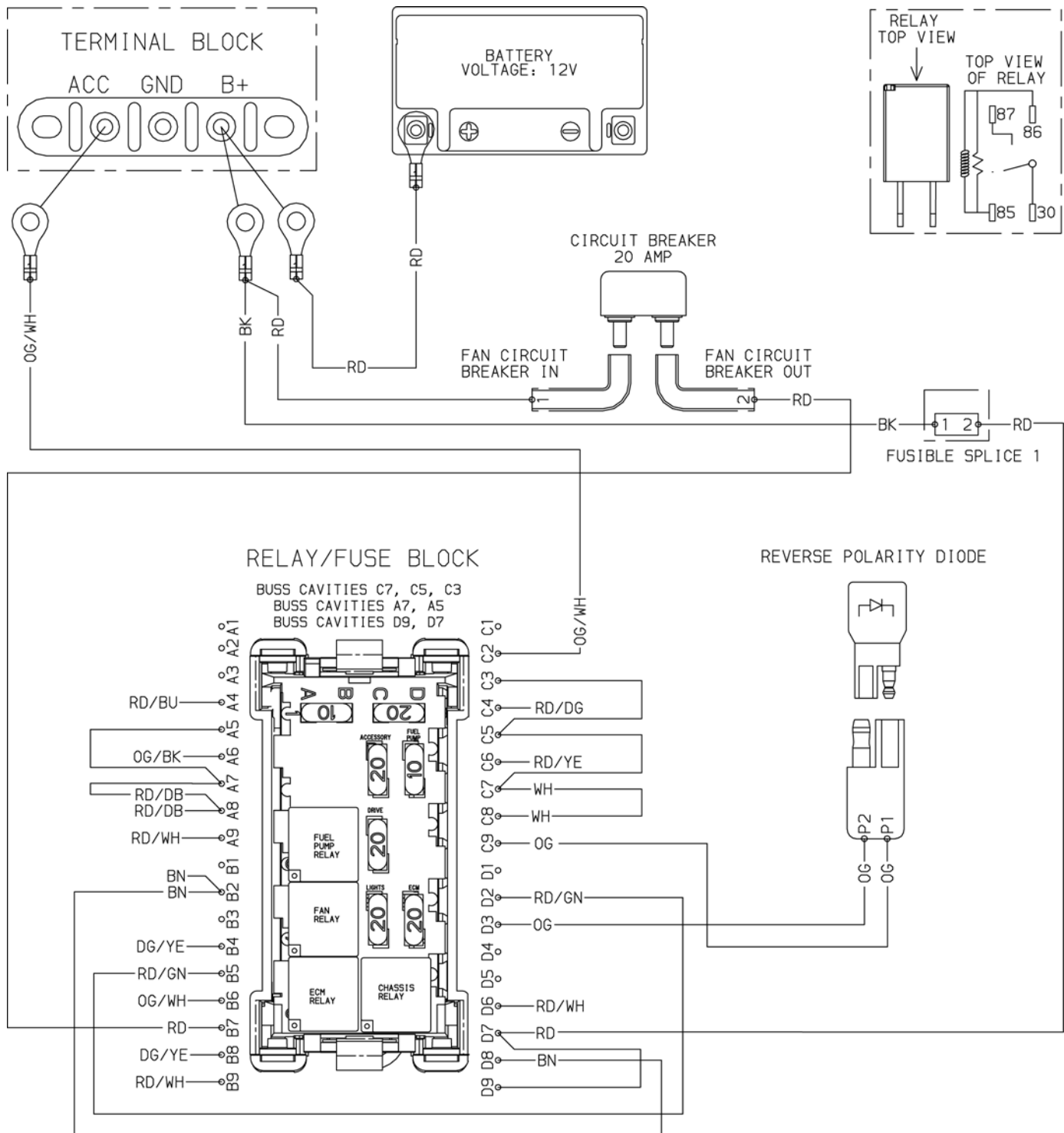
Located in the fuse box under the hood, the fuses provide overload protection for wiring and components such as the instrument cluster, ECU, EFI system, main harness, lights, accessories and power steering. The relays assist with component operation like the cooling fan, fuel pump, EFI system, drive system and electronic power steering. A separate 20-amp circuit breaker, located near the fuse/relay box, protects the fan motor circuit.



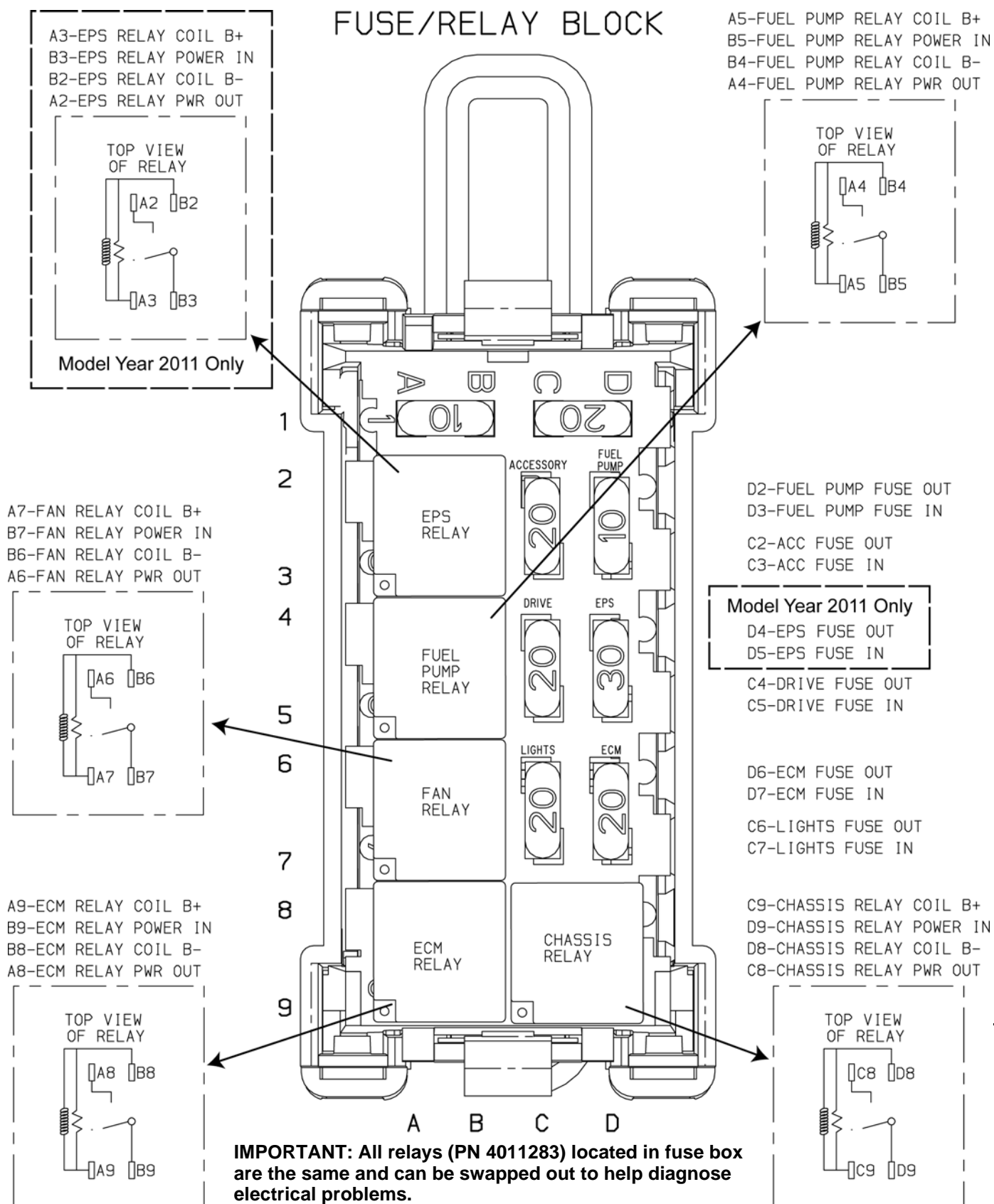
ELECTRICAL

Overview / Operation (Model Year 2012)

Located in the fuse box under the hood, the fuses provide overload protection for wiring and components such as the instrument cluster, ECU, EFI system, main harness, lights and accessories. The relays assist with component operation like the cooling fan, fuel pump, EFI system and drive system. A separate 20-amp circuit breaker, located near the fuse/relay box, protects the fan motor circuit. **NOTE: 2012 models with EPS have a separate electrical system which includes a 30-amp fuse and relay. Refer to “EPS System Breakout (2012)” for EPS electrical component details.**



Fuse Box Detail



ELECTRICAL

Relay Operation

Located in the fuse box under the hood, the relays assist with component operation like the cooling fan, fuel pump, EFI system, drive system and EPS.

CHASSIS RELAY provides power to the following systems:

- Lights (Headlights / Taillights)
- Drive (AWD / TURF)
- Accessory (12V Receptacles / Accessory Options)

CHASSIS RELAY

COLOR	FUNCTION
Red	BUSS Bar - 12 Vdc constant battery voltage (fusible link protected).
Brown	Relay coil ground.
Orange	12 Vdc power input from key switch to enable relay.
White	Provides 12 Vdc power for lights, drive and accessory circuits.

ECM RELAY provides power to the following systems:

- Fuel Injectors
- Cam Phase Sensor
- Ignition Coil
- Fan Relay
- Fuel Pump Relay

ECM RELAY

COLOR	FUNCTION
Red / White	20-Amp fuse protected 12 Vdc constant battery voltage.
Dark Green / Yellow	ECU ground input to enable relay.
Red / White	20-Amp fuse protected 12 Vdc constant battery voltage.
Red / Dark Blue	Provides 12 Vdc power for EFI system circuits.

FAN RELAY provides power to the following system:

- Fan Motor

FAN RELAY

COLOR	FUNCTION
Red	20-Amp circuit breaker protected 12 Vdc constant battery power.
Orange / White	ECU ground input to enable relay.
Red / Dark Blue	BUSS Bar - 12 Vdc switched power from ECM relay.
Orange / Black	Provides 12 Vdc power for fan operation.

FUEL PUMP RELAY provides power to the following system:

- Fuel Pump

FUEL PUMP RELAY

COLOR	FUNCTION
Red / Light Green	10-Amp fuse protected 12 Vdc battery voltage.
Dark Green / Yellow	ECU ground input to enable relay.
Red / Dark Blue	BUSS Bar - 12 Vdc switched power from ECM relay.
Red / Light Blue	Provides 12 Vdc power for fuel pump operation.

EPS RELAY provides power to the following system:

- Electronic Power Steering Unit

EPS RELAY

COLOR	FUNCTION
Red	30-Amp fuse protected 12 Vdc constant battery voltage.
Brown	Relay coil ground.
Orange	12 Vdc power input from key switch to enable relay.
Orange	Provides 12 Vdc power for EPS operation.

NOTE: The EPS Relay on Model Year 2012 vehicles is mounted separately (outside the fuse/relay box), to the electronic power steering harness.

REAR DIFF SOLENOID RELAY provides power to the following system:

- Rear Differential Solenoid

REAR DIFF SOLENOID RELAY

COLOR	FUNCTION
Red / Dark Green	20-Amp fuse protected 12 Vdc battery voltage.
Dark Green / White	ECU input to enable relay.
Brown	Relay coil ground.
Red	Relay switched power to operate the Rear Diff Solenoid.
Blue	Ground to energize the Rear Diff Solenoid.

NOTE: The Rear Diff Solenoid Relay is mounted separately, attached to the frame under the rear cargo box.

ELECTRICAL

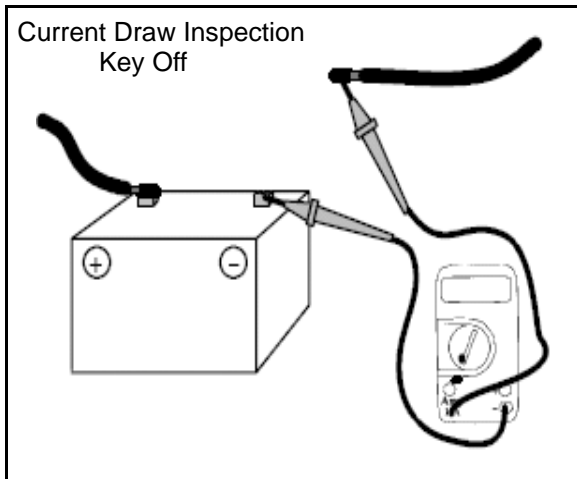
CHARGING SYSTEM

Current Draw - Key Off

CAUTION

Do not connect or disconnect the battery cable or ammeter with the engine running. Damage will occur to electrical components.

Connect an ammeter in series with the negative battery cable. Check for current draw with the key off. If the draw is excessive, loads should be disconnected from the system one by one until the draw is eliminated. Check component wiring as well as the component for partial shorts to ground to eliminate the draw.



Current Draw - Key Off:
Maximum of .01 DCA (10 mA)

Charging System “Break Even” Test

CAUTION

Do not allow the battery cables to become disconnected with the engine running. Follow the steps below as outlined to reduce the chance of damage to electrical components.

The “break even” point of the charging system is the point at which the alternator overcomes all system loads (lights, etc.) and begins to charge the battery. Depending on battery condition and system load, the break even point may vary slightly. The battery should be fully charged before performing this test.

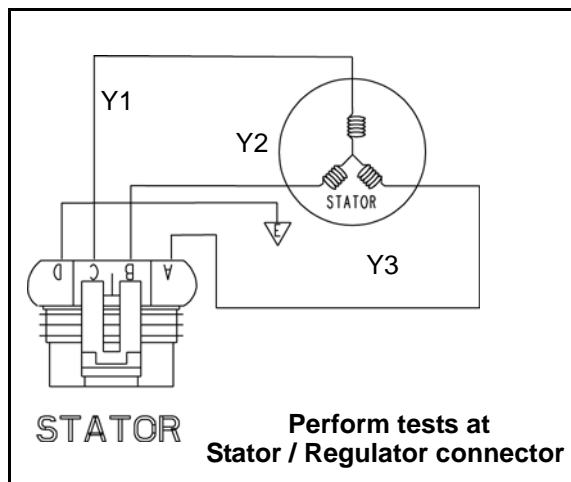
WARNING

Never start the engine with an ammeter connected in series. Damage to the meter or meter fuse will result.
Do not run test for extended period of time.
Do not run test with high amperage accessories.

1. Using an inductive amperage metering device, (set to DC amps) connect to the negative battery cable.
2. With engine off, and the key switch and lights in the ON position, the ammeter should read negative amps (battery discharge). Reverse meter lead if a positive reading is indicated.
3. Shift transmission into neutral with the parking brake applied and start the engine. With the engine running at idle, observe meter readings.
4. Increase engine RPM while observing ammeter and tachometer.
5. Note RPM at which the battery starts to charge (ammeter indication is positive).
6. With lights and other electrical loads off, the “break even” point should occur at approximately 1500 RPM or lower.
7. With the engine running, turn the lights on and engage parking brake to keep brake light on.
8. Repeat test, observing ammeter and tachometer. With lights on, charging should occur at or below 2000 RPM.

Charging System Alternator Tests

Three tests can be performed using a multi-meter to determine the condition of the stator (alternator).



TEST 1: Resistance Value of Each Stator Leg

1. Measure the resistance value of each of the three stator legs: Y1 to Y2, Y1 to Y3, and Y2 to Y3. Each test should measure: **$0.19\Omega \pm 15\%$**

Test	Connect Meter Leads To:	Ohms Reading
Battery Charge Coil	Y1 to Y2	$0.19\Omega \pm 15\%$
Battery Charge Coil	Y1 to Y3	$0.19\Omega \pm 15\%$
Battery Charge Coil	Y2 to Y3	$0.19\Omega \pm 15\%$

NOTE: If there are any significant variations in ohm readings between the three legs it is an indication that one of the three stator legs maybe weak or failed.

TEST 2: Resistance Value of Each Stator Leg to Ground

1. Measure the resistance value of each of the stator legs to ground: Y1 to Ground, Y2 to Ground, Y3 to Ground. Each test should measure: **Open Line (OL)**

Test	Connect Meter Leads To:	Ohms Reading
Battery Charge Coil	Y1, Y2, or Y3 to Ground	Open Line (Infinity)

NOTE: Any measurement other than Infinity (open) will indicate a failed or shorted stator leg.

TEST 3: Measure AC Voltage Output of Each Stator Leg at Charging RPM

1. Set the selector dial to measure AC Voltage.
2. Start the engine and let it idle.
3. While holding the engine at a specified RPM, separately measure the voltage across each 'leg' of the stator by connecting the meter leads to the wires leading from the alternator (Y1 to Y2, Y1 to Y3, Y2 to Y3).
4. Refer to the following table for approximate AC Voltage readings according to RPM. Test each leg at the specified RPM in the table.

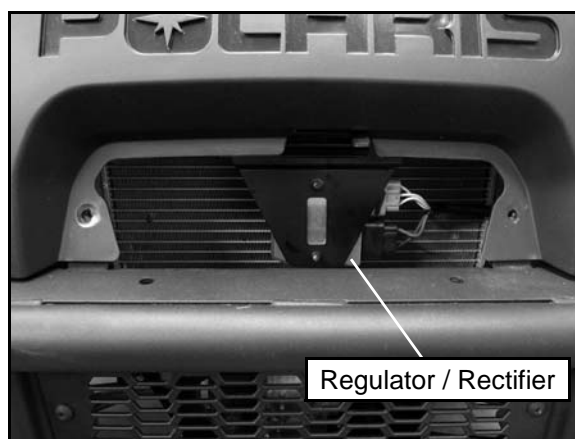
Example: The alternator current output reading should be approximately **18 VAC at 1300 RPM between each 'leg'**.

NOTE: If one or more of the stator leg output AC voltage varies significantly from the specified value, the stator may need to be replaced.

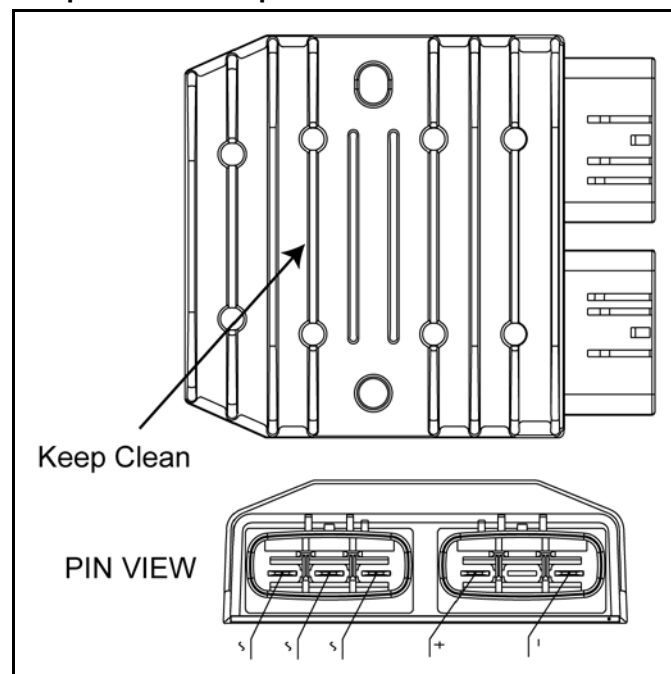
RPM Reading	AC Voltage (VAC) Reading
1300	18 VAC $\pm 25\%$
3000	42 VAC $\pm 25\%$
5000	64 VAC $\pm 25\%$

Regulator / Rectifier

The Regulator / Rectifier is located in front of the radiator, accessed by removing the upper fascia screen.

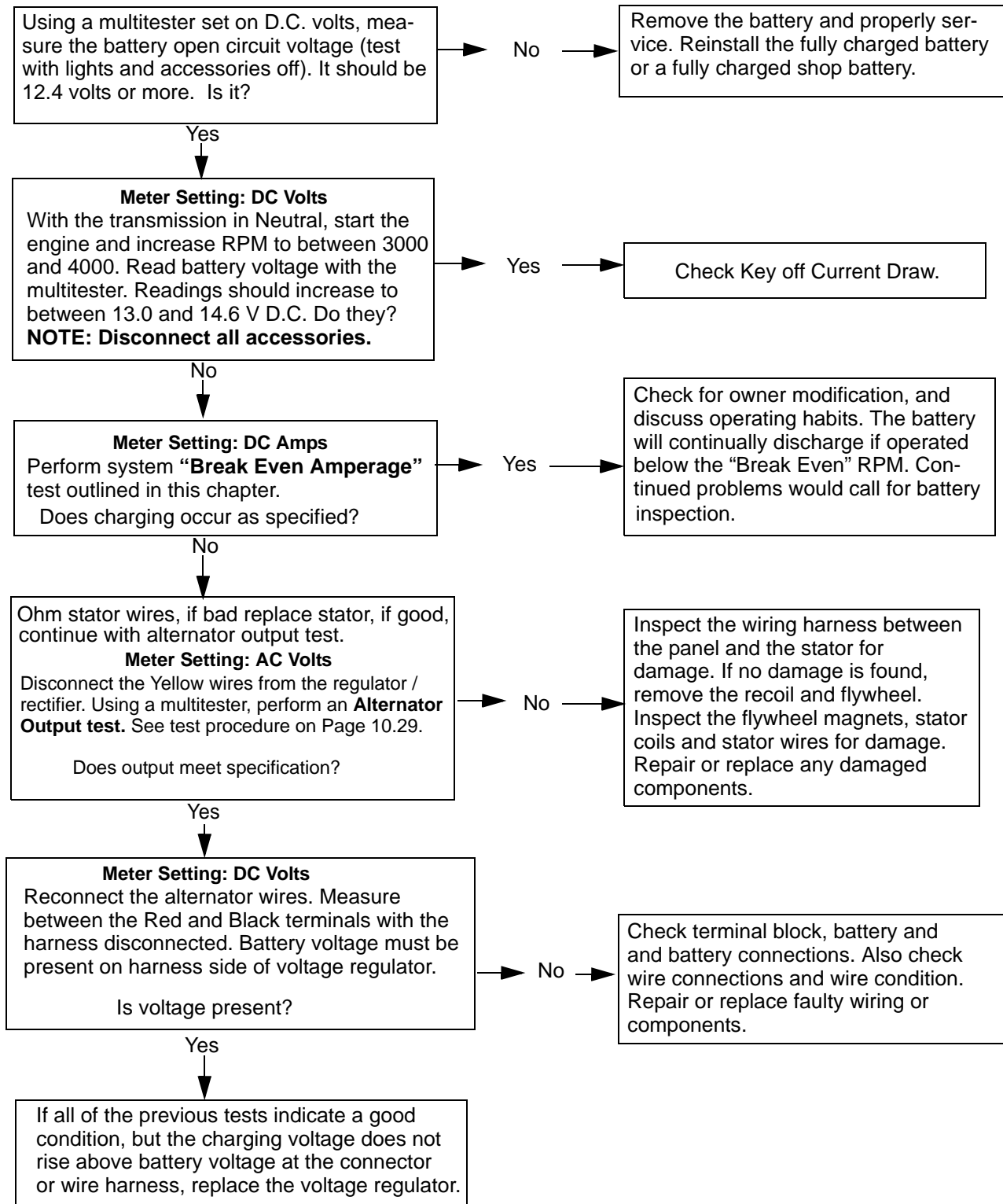


NOTE: If the regulator / rectifier overheats, the unit will turn itself off to cool down. The unit will turn on again after it has cooled down. If it turns off, verify the cooling fins are clean, free from debris and that adequate airflow is present.



Charging System Testing Flow Chart

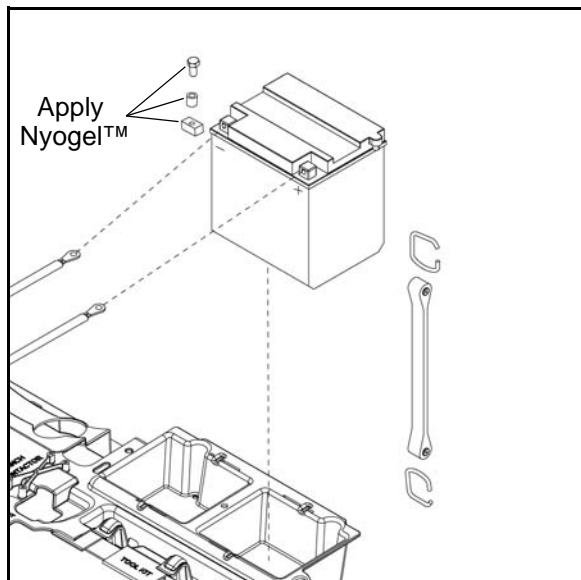
Whenever charging system problems are suspected, proceed with the following system check after verifying that all wires are in good condition, connected and not exposed or pinched:



BATTERY SERVICE

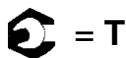
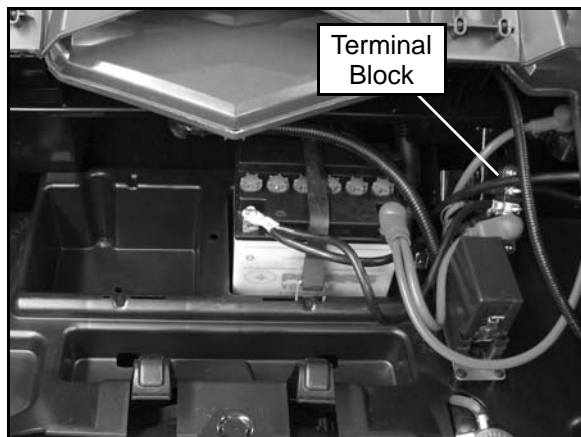
Battery Terminals / Bolts

Use Polaris corrosion resistant Nyogel™ grease (PN 2871329) on battery terminal bolts.



Battery Terminal Block

The terminal block is located under the hood next to the battery and fuse box. The terminal block provides easy hookup for accessories.



Terminal Block Nuts:
20-25 in. lbs. (2.3-2.8 Nm)

Battery Activation

WARNING

Battery electrolyte is poisonous. It contains sulfuric acid. Serious burns can result from contact with skin, eyes or clothing. Antidote:

External: Flush with water.

Internal: Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Call physician immediately.

Eyes: Flush with water for 15 minutes and get prompt medical attention.

Batteries produce explosive gases. Keep sparks, flame, cigarettes etc. away. Ventilate when charging or using in an enclosed space. Always shield eyes when working near batteries.

KEEP OUT OF REACH OF CHILDREN.

WARNING

The gases given off by a battery are explosive. Any spark or open flame near a battery can cause an explosion which will spray battery acid on anyone close to it. Should there be contact with battery acid, wash the affected area with large quantities of cool water and seek immediate medical attention.

To ensure maximum service life and performance from a new battery, perform the following steps. NOTE: Do not service the battery unless it will be put into regular service within 30 days. After initial service, add only distilled water to the battery. Never add electrolyte after a battery has been in service.

NOTE: New Battery: Battery must be fully charged before use or battery life will be significantly reduced 10-30% of the battery's full potential.

To activate a new battery:

1. Remove all the filling plugs.
2. Remove the sealing tube (red cap) from vent fitting.
3. Place battery on a level surface. Fill battery with electrolyte to upper level marks on the battery case.

ELECTRICAL

NOTE: Never activate a battery on the vehicle. Electrolyte spillage can cause damage.

4. Set battery aside to allow for acid absorption and stabilization for 30 minutes.
5. Add electrolyte to bring the level back to the upper level mark on the battery case.
6. Charge battery for 3 - 5 hours at 1/10 of its amp/hour rating. Examples: 1/10 of 9 amp battery = .9 amp; 1/10 of 14 amp battery = 1.4 amp; 1/10 of 18 amp battery = 1.8 amp (recommended charging rates).
7. Check during initial charging to see if electrolyte level has fallen, and if so, fill with acid to the upper level. After adding, charge for another hour at the same rate.

NOTE: This is the last time that electrolyte should be added. If the level becomes low after this point, add only distilled water.

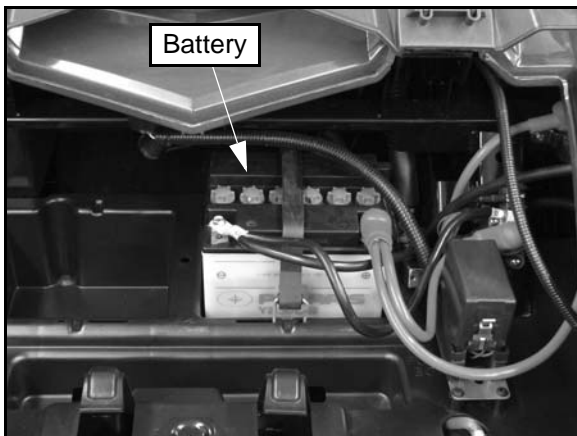
8. When charging is complete, install the filling plugs firmly.

IMPORTANT: Do not apply excessive pressure. Finger tighten only. Do not over-tighten.

9. Wash off spilled acid with water and baking soda solution, paying particular attention that any acid is washed off the terminals. Dry the battery case.

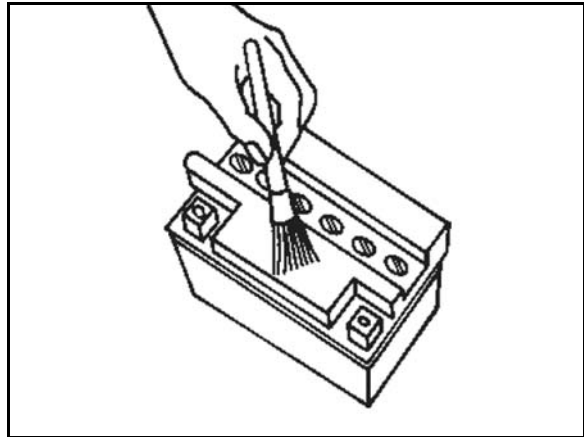
Battery Inspection

The battery is located under the hood.

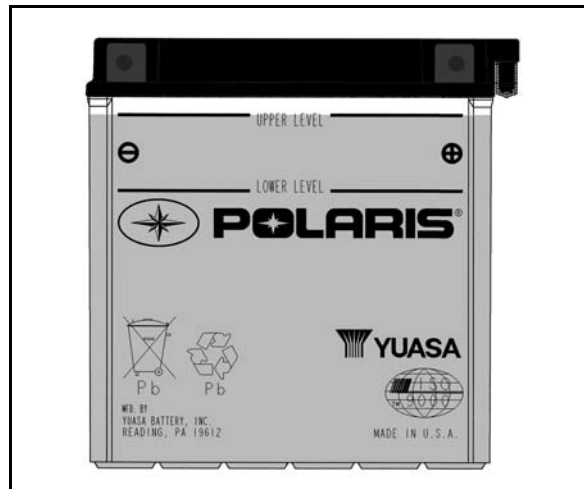


1. Inspect the battery case for obvious damage such as cracks or leaks. Look for discoloration, warping or raised top, which may indicate the battery has overheated or been overcharged.

2. Make sure the battery top is clean and dry. A dirty battery actually discharges across the grime on top of the case. Use a soft brush and a baking soda solution. Make sure plugs are finger tight so cleaning solution doesn't get into the cells and neutralize the acid.



3. Inspect the battery terminals, screws and cables for breakage, corrosion or loose connections. Clean the terminals and cable ends with a wire brush and coat terminals with Nyogel™.
4. Check the electrolyte level and add distilled water if necessary.



IMPORTANT: Don't add acid, use distilled water only!

5. Check the vent tube. Make sure it's not kinked, pinched or otherwise obstructed.

Battery Removal / Installation

See Chapter 2 "Maintenance" for battery service procedures.

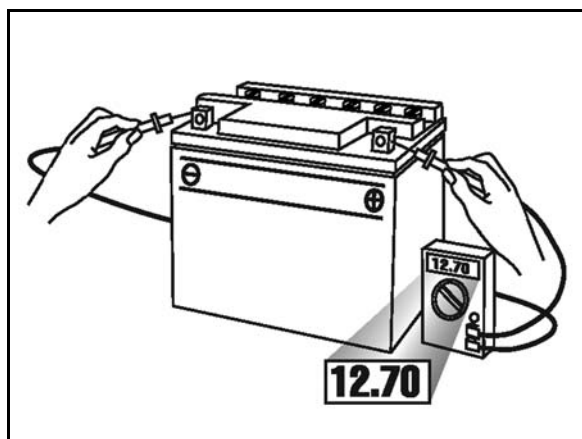
Conventional Battery Testing

Whenever a service complaint is related to either the starting or charging systems, the battery should be checked first.

Following are three tests which can easily be made on a battery to determine its condition: OCV Test, Specific Gravity Test and Load Test.

OCV - Open Circuit Voltage Test

Battery voltage should be checked with a digital multimeter. Readings of 12.6 volts or less require further battery testing and charging. See the following chart.

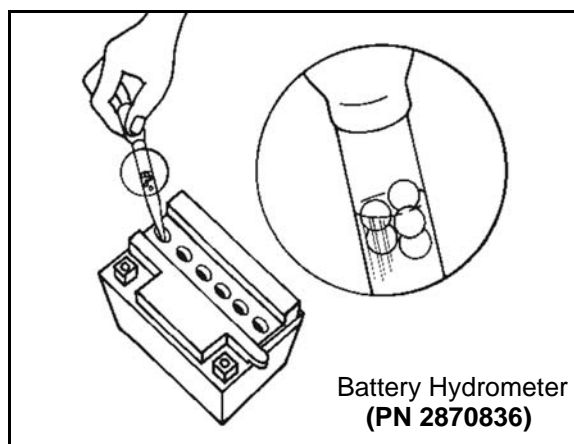


NOTE: Lead-acid batteries should be kept at or near a full charge as possible. Electrolyte level should be kept between the low and full marks. If the battery is stored or used in a partially charged condition, or with low electrolyte levels, hard crystal sulfation will form on the plates, reducing the efficiency and service life of the battery.

OPEN CIRCUIT VOLTAGE	
State of Charge	YuMicron™ Type
100% Charged	12.70 V
75% Charged	12.50 V
50% Charged	12.20 V
25% Charged	12.0 V
0% Charged	11.9 V or less

Specific Gravity Test

A tool such as a Battery Hydrometer (PN 2870836) can be used to measure electrolyte strength or specific gravity. As the battery goes through the charge/discharge cycle, the electrolyte goes from a heavy (more acidic) state at full charge to a light (more water) state when discharged. The hydrometer can measure state of charge and differences between cells in a multi-cell battery. Readings of 1.270 or greater should be observed in a fully charged battery. Differences of more than .025 between the lowest and highest cell readings indicate a need to replace the battery.



SPECIFIC GRAVITY	
State of Charge*	YuMicron™ Type
100% Charged	1.275
75% Charged	1.225
50% Charged	1.175
25% Charged	1.135
0% Charged	1.115 or less
* At 80° F. NOTE: Subtract .01 from the specific gravity reading at 40° F.	

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Load Test

A battery may indicate a full charge condition in the OCV test and the specific gravity test, but still may not have the storage capacity necessary to properly function in the electrical system. For this reason, a battery capacity or load test should be conducted whenever poor battery performance is encountered.

This is the best test of battery condition under starting load. Use a load testing device that has an adjustable load. Apply a load of three times the ampere-hour rating.

At 14 seconds into the test, check battery voltage. A good 12V battery will have at least 10.5 Volts. If the reading is low, charge the battery and retest.

Battery Conductance Analyzer

Conductance describes the ability of a battery to conduct current. A conductance tester functions by sending a low frequency AC signal through the battery and a portion of the current response is captured, from this output a conductance measurement is calculated. Conductance testing is more accurate than voltage, specific gravity, or load testing.

Authorized Polaris dealers/distributors are required to use the conductance analyzer when testing 12V Polaris batteries.



Polaris MDX-610P
SPX PN: PU-50296

Charging Procedure

1. Remove the battery to prevent damage from leaking or spilled acid during charging.
2. Charge the battery with a charging output no larger than 1/10 of the battery's amp/hr rating. Charge as needed to raise the specific gravity to 1.270 or greater.
3. Install battery in vehicle. Coat threads of battery bolt with a corrosion resistant dielectric grease.

Dielectric Grease:
(PN 2871329)

4. Connect battery cables.

 **WARNING**

To avoid the possibility of explosion, connect positive (+) cable first and negative (-) cable last.

5. After connecting the battery cables, install the cover on the battery and attach the hold down strap.
6. Install clear battery vent tube from vehicle to battery vent. **WARNING:** Vent tube must be free from obstructions and kinks and securely installed. If not, battery gases could accumulate and cause an explosion. Vent should be routed away from frame and body to prevent contact with electrolyte. Avoid skin contact with electrolyte, as severe burns could result. If electrolyte contacts the vehicle frame, corrosion will occur.
7. Route cables so they are tucked away in front and behind battery.

Off Season Storage

See Chapter 2 "Maintenance" for battery service procedures.

STARTER SYSTEM

Troubleshooting

Starter Motor Does Not Run

- Battery discharged - Low specific gravity
- Loose or faulty battery cables or corroded connections (see Voltage Drop Tests)
- Related wiring loose, disconnected, or corroded
- Poor ground connections at battery cable, starter motor or starter solenoid (see Voltage Drop Tests)
- Faulty key switch
- Faulty starter solenoid or starter motor
- Engine problem - seized or binding (can engine be rotated easily)

Starter Motor Turns Over Slowly

- Battery discharged - low specific gravity
- Excessive circuit resistance - poor connections (see Voltage Drop Test)
- Engine problem - seized or binding (can engine be rotated easily)
- Faulty or worn brushes in starter motor

Starter Motor Turns - Engine Does Not Rotate

- Faulty starter drive
- Faulty starter drive gears or starter motor gear
- Faulty flywheel gear or loose flywheel

Voltage Drop Test

The Voltage Drop Test is used to test for bad connections. When performing the test, you are testing the amount of voltage drop through the connection. A poor or corroded connection will appear as a high voltage reading. Voltage shown on the meter when testing connections should not exceed .1 VDC per connection or component.

To perform the test, place the meter on DC volts and place the meter leads across the connection to be tested. Refer to the voltage drop tests in the "Starter System Testing Flow Chart".

**Voltage should not exceed
.1 DC volts per connection**

Starter Motor Removal / Disassembly

NOTE: Use electrical contact cleaner to clean starter motor parts. Some solvents may leave a residue or damage internal parts and insulation.

1. Remove the starter from the engine.



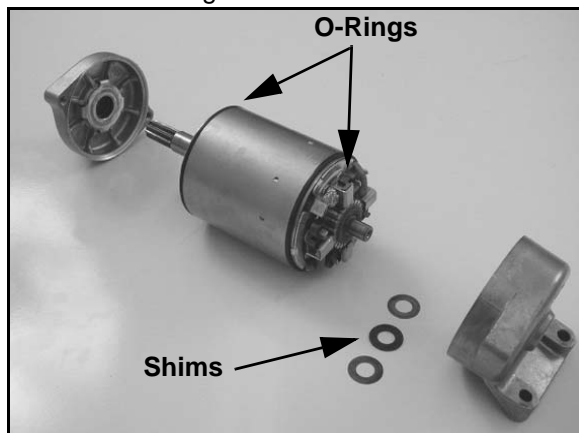
2. Remove the two bolts, washers, and sealing O-Rings. Inspect O-Rings and replace if damaged.



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NOTE: Note the alignment marks on both ends of the starter motor casing. These marks must align during reassembly.

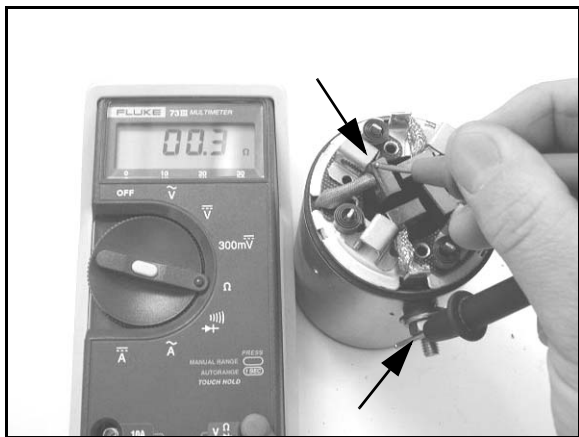
3. Remove the front bracket assembly and the rear bracket assembly. Remove the shims from the armature shaft and inspect the O-rings located on the armature housing.



NOTE: The shims will be replaced during reassembly.

Brush Inspection / Replacement

1. Measure resistance between starter input terminal and insulated brushes. The reading should be .3 ohms or less. Remember to subtract meter lead resistance.



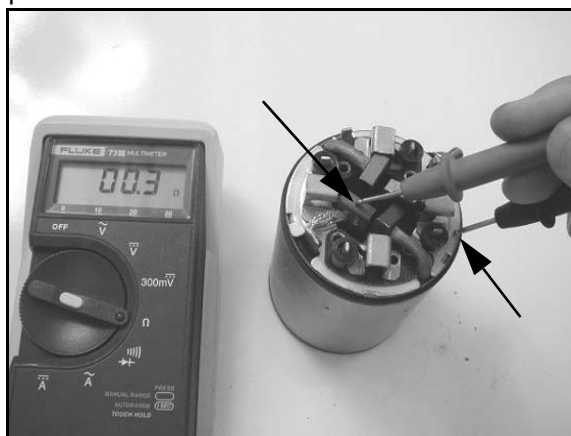
2. Measure resistance between insulated brush and starter housing. Reading should be infinite (OL). Inspect insulation on brush wires for damage and repair or replace as necessary.



3. Slide positive brush springs to the side, pull brushes out of their guides and remove brush plate. Slide brush end frame off end of starter.

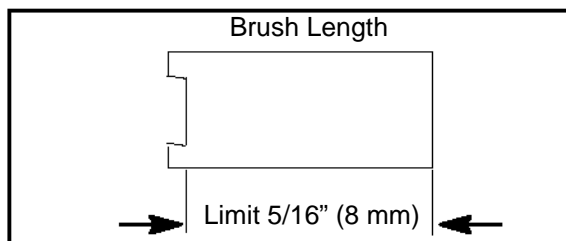
NOTE: The electrical input post must stay with the field coil housing.

4. Measure resistance between ground brush and brush plate. Resistance should be .3 ohms or less.



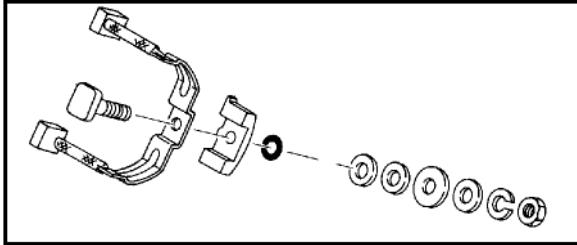
Brush Inspection

1. Measure length of each carbon brush. Replace brush assembly when worn to 5/16" (8 mm) or less. The brushes must slide freely in their holders.



Brush Replacement

1. Remove terminal nut with lock washer, flat washer, large phenolic washer, the small phenolic spacers, and sealing O-ring. Inspect O-ring and replace if damaged.



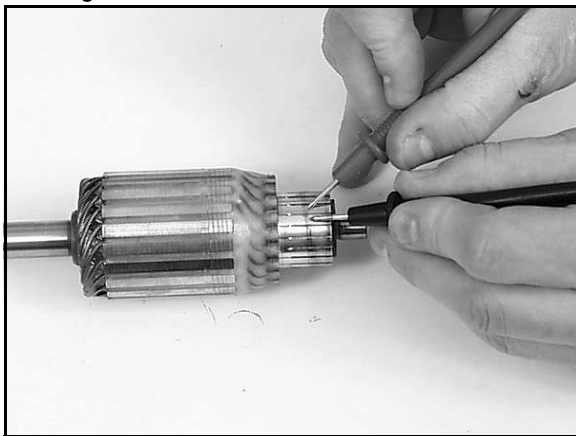
2. Slide positive brush springs to the side, pull brushes out of their guides and remove brush plate.

⚠ CAUTION

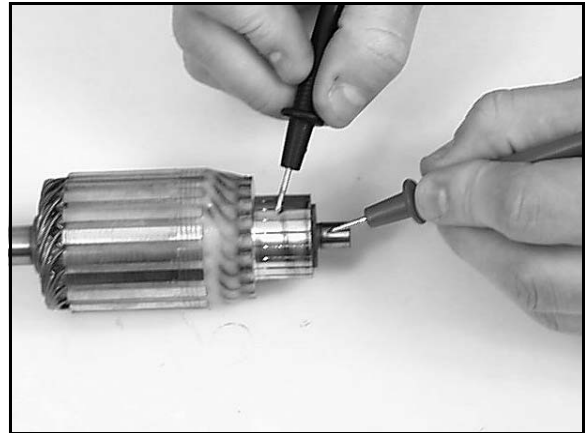
Some cleaning solvents may damage the insulation in the starter. Care should be exercised when selecting an appropriate solvent. If the commutator needs cleaning use only electrical contact cleaner.

Armature Testing

1. Remove armature from starter casing. Note order of shims on drive end for reassembly.
2. Inspect surface of commutator. Replace if excessively worn or damaged.
3. Using a digital multimeter, measure the resistance between each of the commutator segments. The reading should be .3 ohms or less.



4. Measure the resistance between each commutator segment and the armature shaft. The reading should be infinite (no continuity).



5. Check commutator bars for discoloration. Bars discolored in pairs indicate shorted coils, requiring replacement of the starter motor.
6. Place armature in a growler. Turn growler on and position a hacksaw blade or feeler gauge lengthwise 1/8" (.3 cm) above armature coil laminates. Rotate armature 360°. If hacksaw blade is drawn to armature on any pole, the armature is shorted and must be replaced.

⚠ CAUTION

Use care when handling starter housing. Do not drop or strike the housing as magnet damage is possible. If magnets are damaged, starter must be replaced.

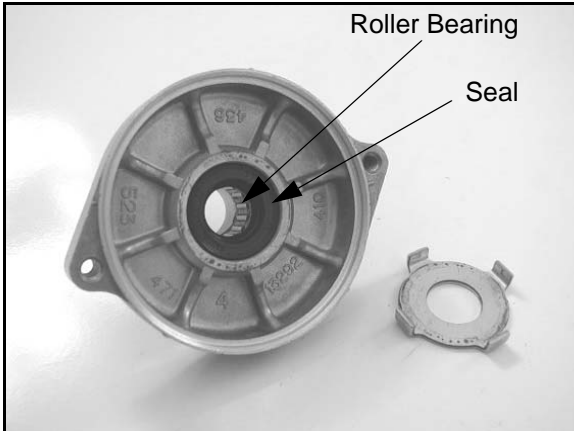
Starter Reassembly / Installation

1. Install brush plate to field magnet housing aligning index tab.

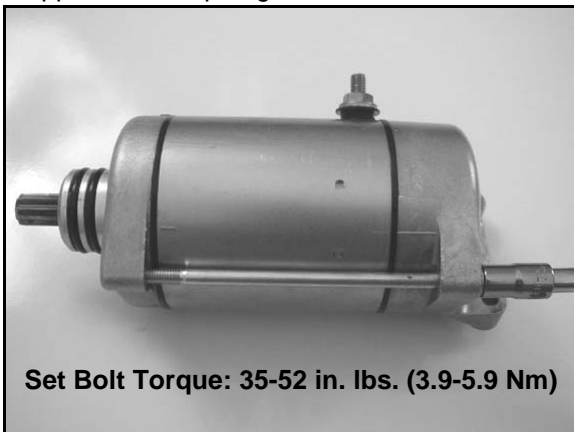


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2. Install O-ring, two small phenolic spacers, large phenolic washer, flat washer, lock washer, and terminal nut.
3. While holding brush springs away from brushes, push brushes back and hold in place.
4. Slide armature into field magnet housing. Release brushes.
5. Lightly grease the drive roller bearing and reinstall drive end frame on armature. Inspect seal for wear or damage. Replace drive end cap if necessary.



6. Be sure wire insulation is in place around positive brush wire and pushed completely into slot on phenolic plate.
7. Using Dielectric Grease (**PN 2871329**), lubricate brush end bushing and install shims.
8. Align brush plate and install cover and screws.
9. Lightly grease pinion shaft and install pinion, spring stopper, and snap ring.



Set Bolt Torque: 35-52 in. lbs. (3.9-5.9 Nm)

10. Completely assemble starter motor and torque set bolts to **35 - 52 in. lbs. (3.9 - 5.9 Nm)**.

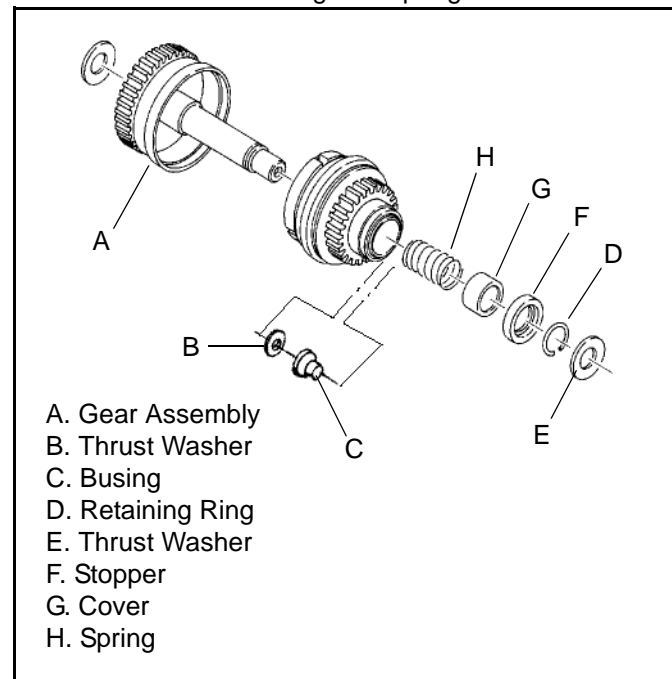
11. Install the starter onto the engine case. Hand tighten each bolt. **Torque the bottom bolt first to 9 ft. lbs. (12 Nm)**. Then torque the top bolt to the same specification.

NOTE: It is important to tighten the bottom starter bolt first (circle), as the bottom hole acts as a pilot hole to properly align the starter drive (bendix) with the flywheel. This helps to prevent binding and starter damage.



Starter Drive

If the garter spring is damaged, the overrun clutch may fail to return properly. Use either of the following methods to remove and install a new garter spring:

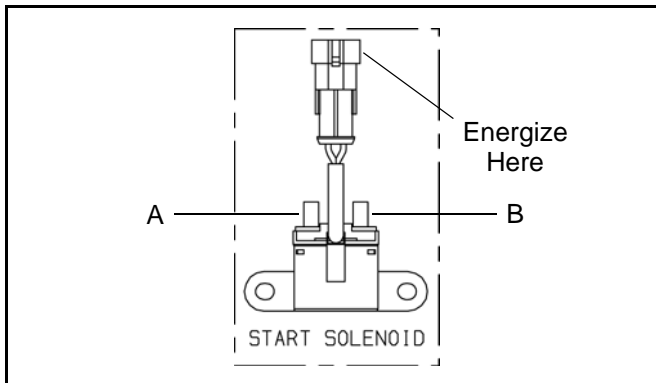


- A. Gear Assembly
- B. Thrust Washer
- C. Busing
- D. Retaining Ring
- E. Thrust Washer
- F. Stopper
- G. Cover
- H. Spring

1. Screw the overrun clutch out to the engaged position on the pinion shaft assembly. Use a small piece of wire with the end bent in a hook and pick the old spring out of its channel. Slide it off the end of the shaft. Slide the new spring over the overrun clutch and into the spring groove. Make sure that the spring is positioned between the shoe alignment pins and the back flange of the anti kick-out shoes.
2. Remove the retaining ring, thrust washer, spring retainers and clutch return spring. Screw the overrun clutch off the end of the pinion shaft. Remove the old spring and install a new one. Lightly grease the pinion shaft and reinstall the clutch, spring, retainers, end washer and lock ring in the reverse order. Make sure the end washer is positioned properly so that it will hold the lock ring in its groove.

Starter Solenoid Bench Test

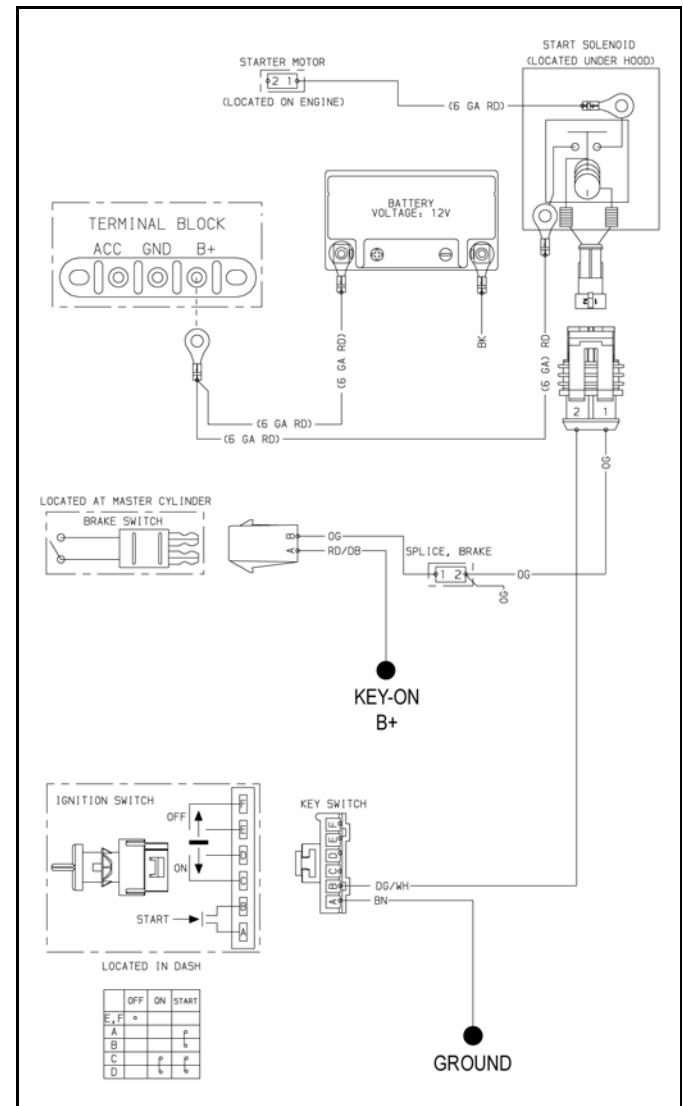
Test the start solenoid by powering the solenoid using battery voltage for a maximum of 5 seconds. With the solenoid energized, resistance should read about 0 - 0.5W between terminals (A) and (B). If resistance measurement is out of specification, replace the starter solenoid.



Starter Solenoid Operation

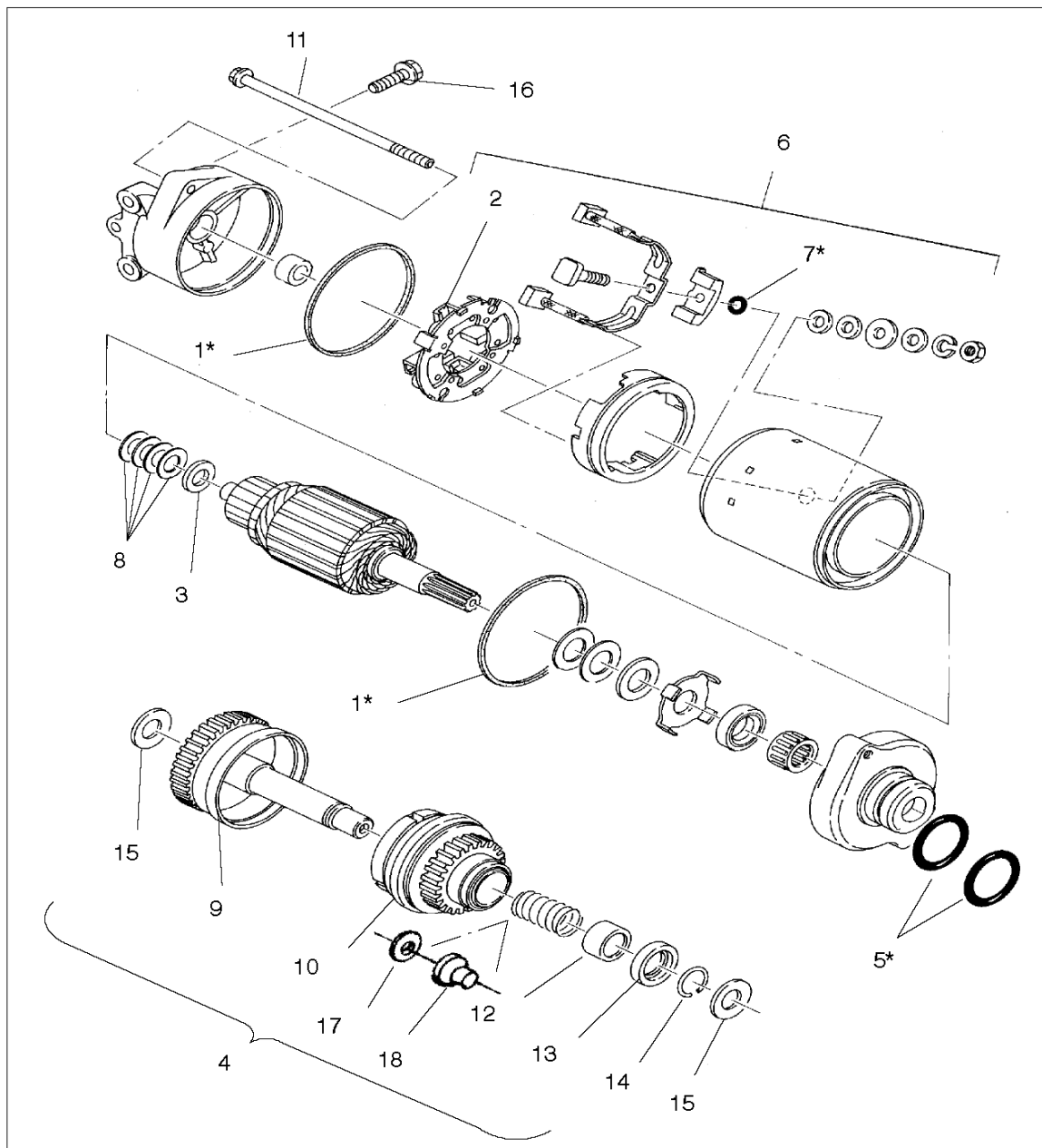
To energize the Starter Solenoid the following must occur:

- The brake must be applied to provide 12V power via the Orange wire.
- The key switch must be turned to the “Start” position to provide a ground path via the Green / White wire.
- Once the pull-in coil is energized, the solenoid provides a current path for 12V power to reach the starter motor.



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Starter Exploded View

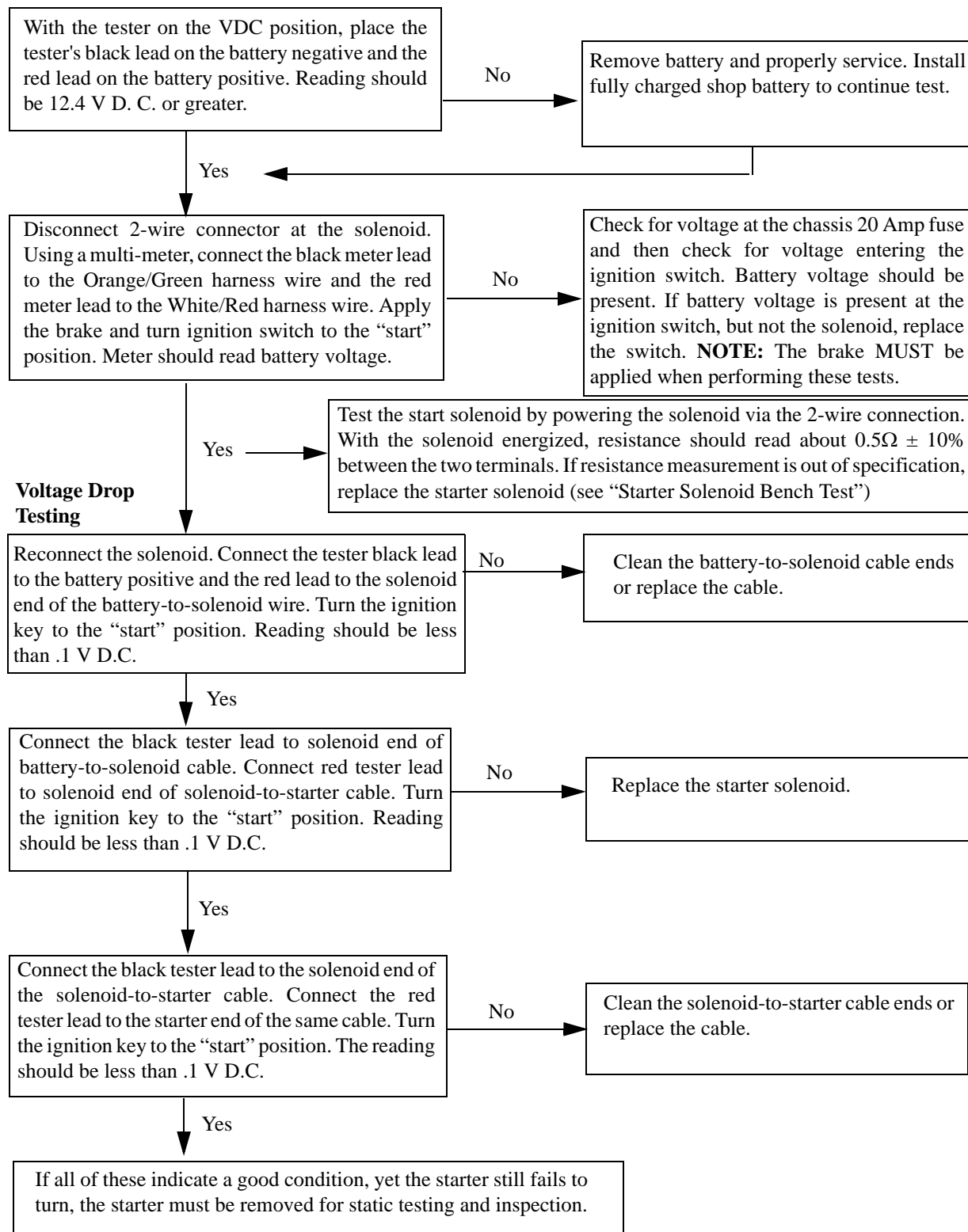


* Indicates - Do not reuse.
Replace with new parts.

- | | |
|-------------------|--------------------|
| 1. Rubber Ring* | 10. Gear Assembly |
| 2. Brush Spring | 11. Through Bolt |
| 3. Thrust Washer | 12. Cover |
| 4. Gear Assembly | 13. Stopper |
| 5. O-Ring* | 14. Snap Ring |
| 6. Brush Complete | 15. Washer |
| 7. O-Ring* | 16. Flange Bolt |
| 8. Thrust Washer | 17. Thrust Washer |
| 9. Shaft Complete | 18. Flange Bushing |

STARTING SYSTEM TESTING FLOW CHART

Condition: Starter fails to turn over the engine.



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ELECTRONIC POWER STEERING (EPS)

EPS Operation

The EPS module is an intelligent electronic power steering system that operates off of the vehicle's 12V electrical system. It calculates steering assist by sensing the difference between the input torque of the steering post and the output torque required to turn the wheels, and then provides assist by energizing an electric motor. The process provides a smooth, seamless assist.

The system is continuously running diagnostic checks and monitoring factors such as battery voltage, ground speed and engine speed. In the event an internal or external issue that affects the EPS system is detected, the system will illuminate a fault indicator and transition to a normal mechanically coupled steering system. The system is Polaris Digital Wrench™ compatible for simplified diagnostics and system troubleshooting through the vehicle's diagnostic port.

With the engine off and the key on, the power steering unit will operate for up to five minutes. After the five minutes, you will need to cycle the key switch and restart the engine to regain power steering operation.

The Power Steering 30A Fuse.

- If the fuse fails, the Power Steering Malfunction Indicator Light (MIL) on the instrument cluster will illuminate. During this time, the vehicle will have no power steering operation. You will be able to connect and communicate with the vehicle's Engine Controller, but not the Power Steering Controller, while using Digital Wrench™.

NOTE: DO NOT SPLICE OR CUT INTO THE CAN CIRCUITS.



WARNING

Electronic Power Steering (EPS) units are not interchangeable between ATV and *RANGER* product lines.

NOTE: See Chapter 5 "Body/Steering/Suspension" for power steering unit removal and installation procedures.

Wire Color Functions

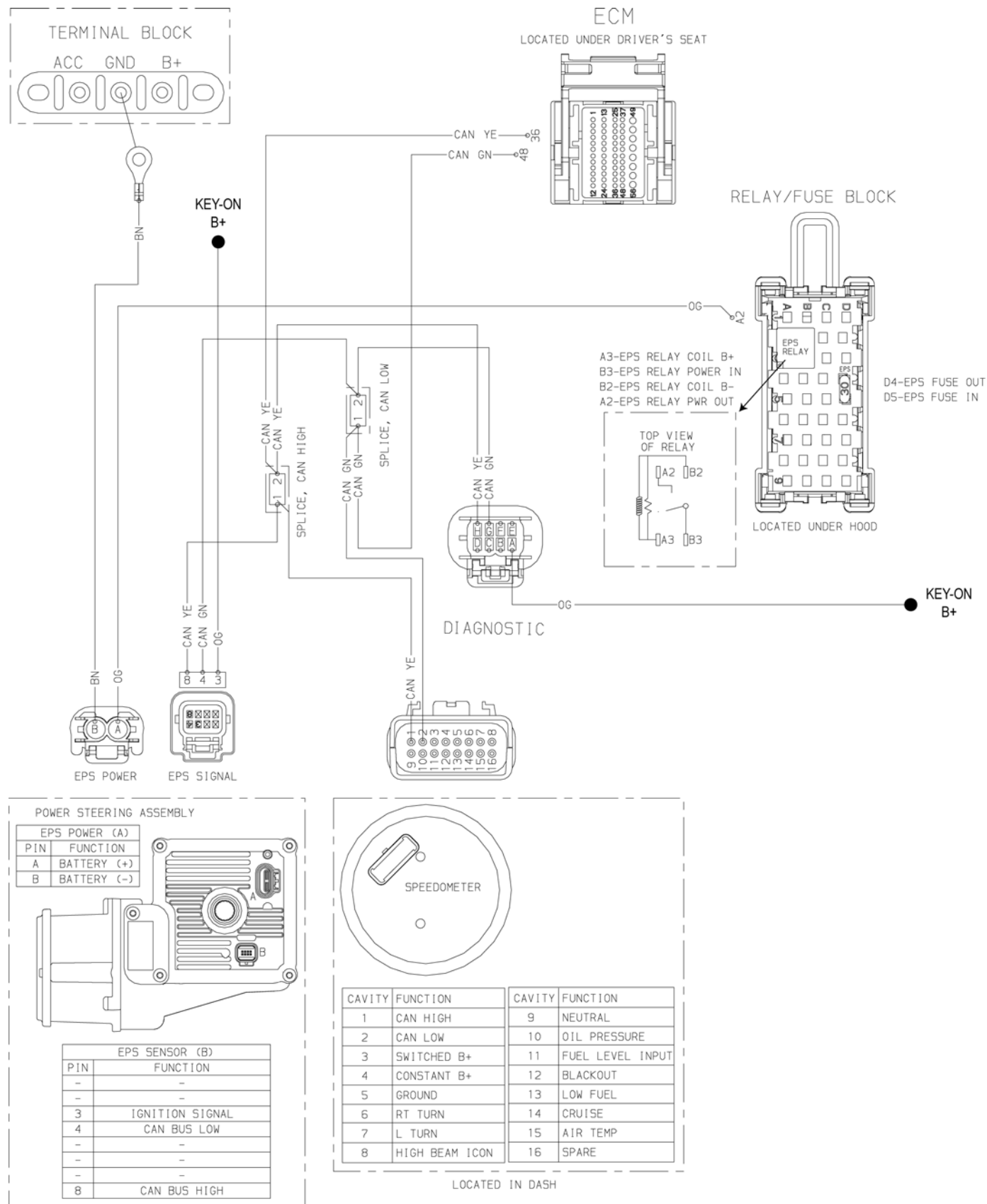
WIRE COLOR	FUNCTION
ORANGE (2-Pin)	Main Power (30A Protected)
BROWN (2-Pin)	Ground
ORANGE (8-Pin)	Key-On Battery Voltage
YELLOW (8-Pin)	CAN High Signal
GREEN (8-Pin)	CAN Low Signal

Proper EPS System Diagnosing

READ BEFORE YOU REPLACE THE EPS UNIT!

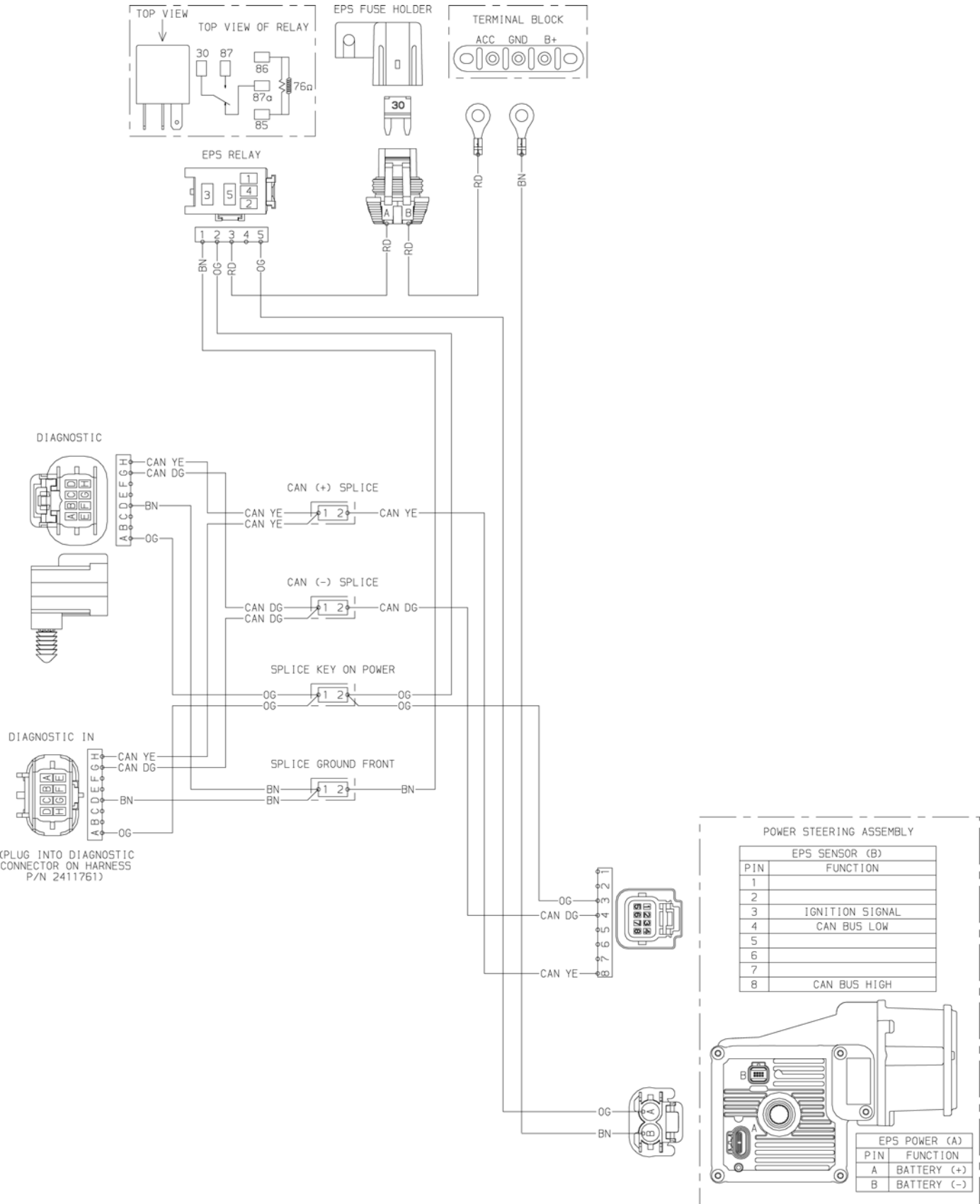
IMPORTANT: Try to reflash the EPS unit before attempting to replace it. A simple reflash may be all that is needed to repair the EPS problem. Always reflash the EPS unit as the first step in diagnosing an EPS problem.

EPS System Breakout (Model Year 2011)

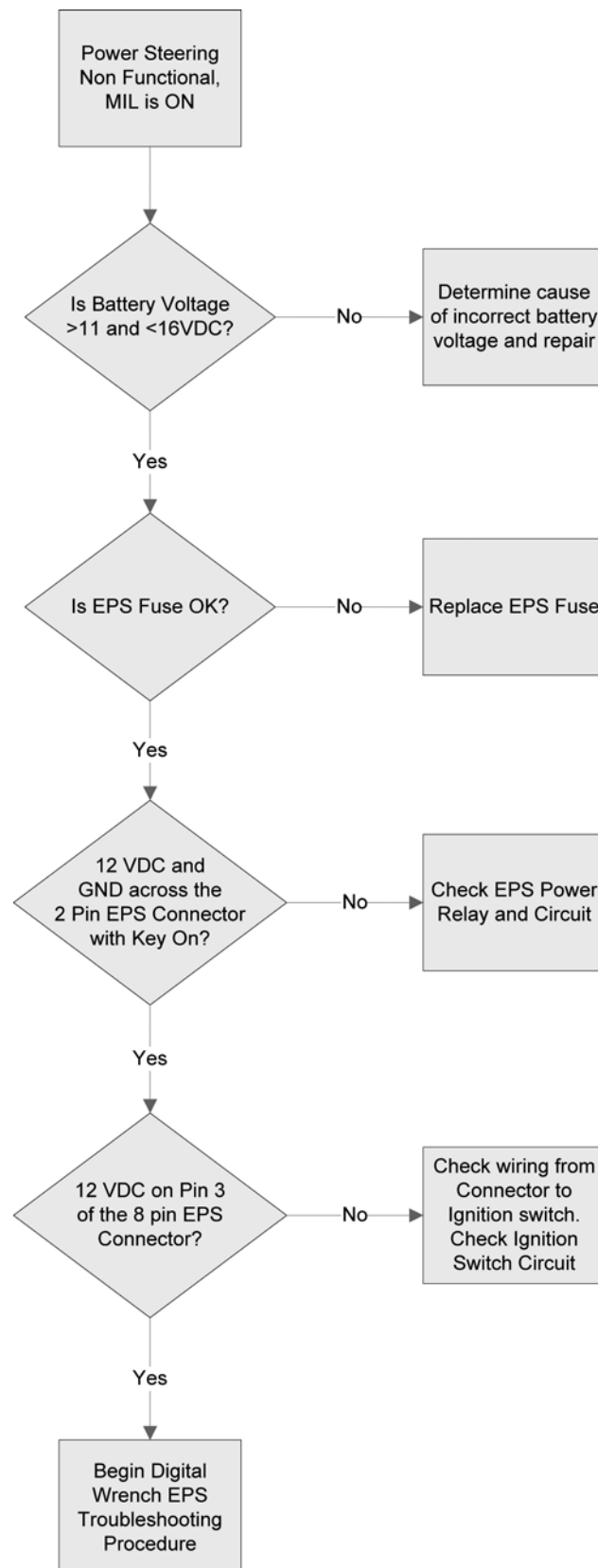


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EPS System Breakout (Model Year 2012)

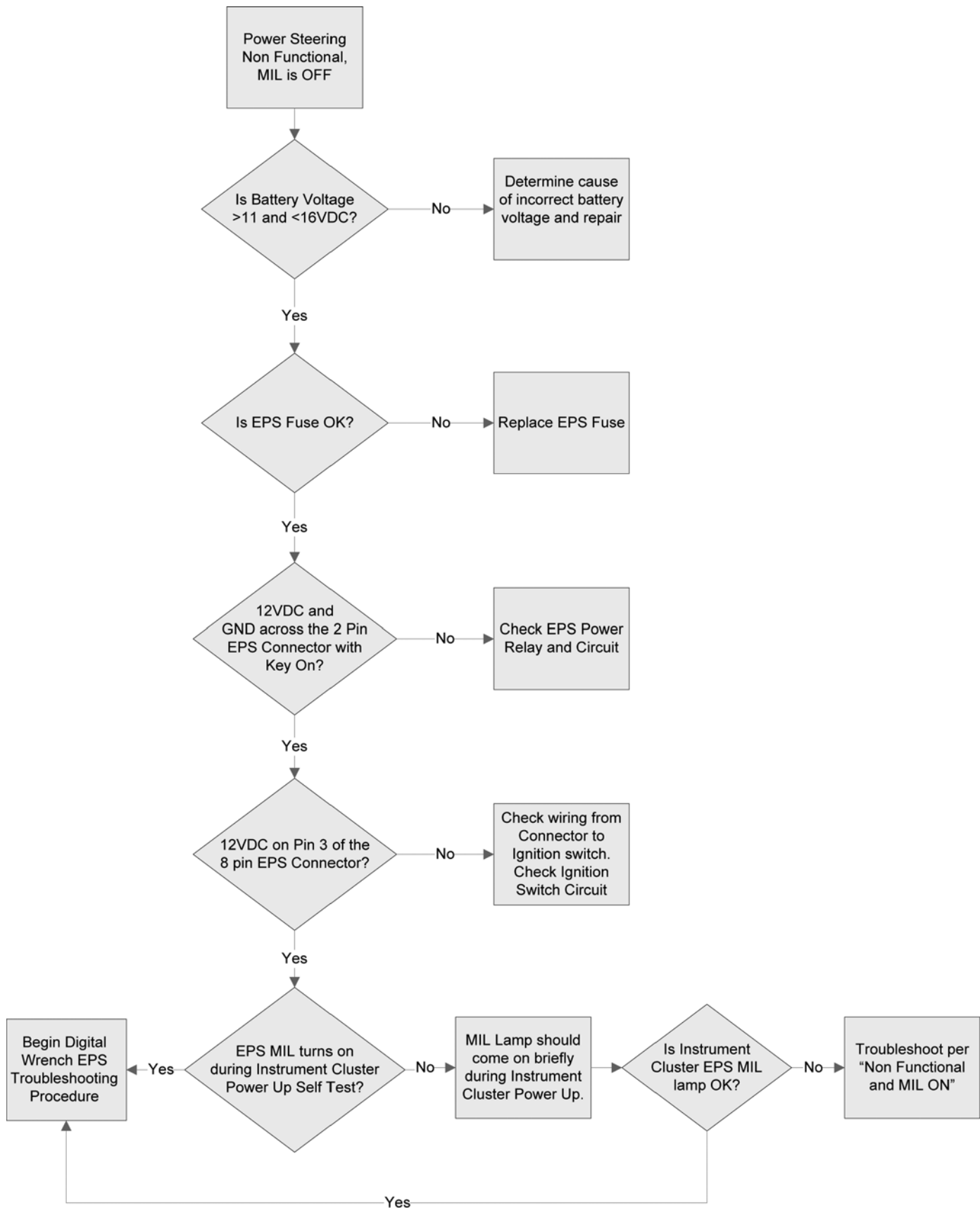


EPS Troubleshooting (Power Steering Non-Functional with MIL ON)

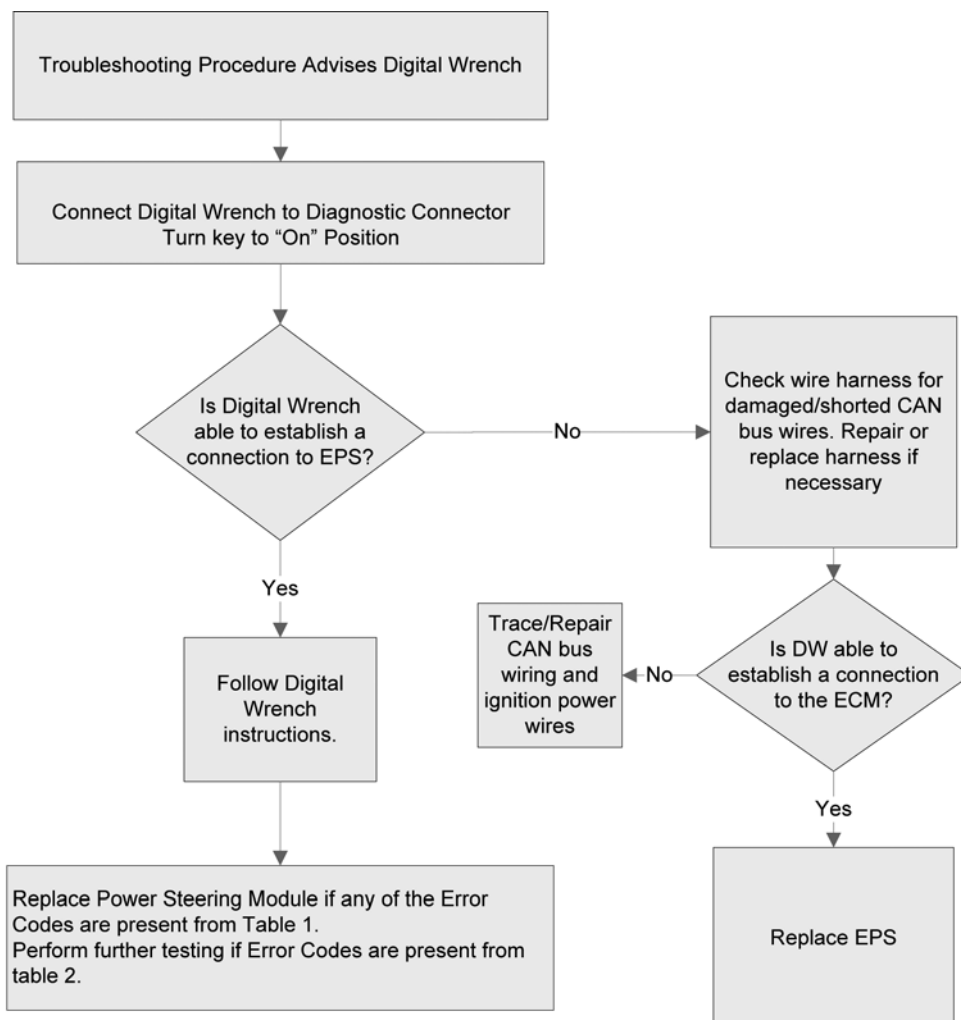


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EPS Troubleshooting (Power Steering Non-Functional with MIL OFF)



EPS Troubleshooting (Using Digital Wrench™)

**Table 1: Error Codes requiring Power Steering Replacement**

1. Position Encoder Error
2. EPS Software Error
3. Steering Torque Sensor Full Failure
4. Steering Excessive Current Error *
5. Steering Over Current Shutdown *

Table 2: Error Codes Requiring Additional Troubleshooting

1. EPS Inverter Temperature- check for mud/debris on EPS
2. Battery Voltage Over / Under- check bike's charging system and battery.
3. Calibration Error – Relfash EPS Unit

EPS Inverter Temperature Test:

1. Verify that Power Steering module heat sink surface (top surface) is clean and free of mud and dirt. Make a note of how much debris was on heat sink before cleaning. Record all power steering error codes and then clear all error codes. EPS inverter temperature can be monitored through Digital Wrench.
2. Allow vehicle to set and cool for at least 2 hours.
3. Drive vehicle for 30 minutes of left and right turning and then Connect Digital wrench and read Power Steering Error Codes. If Inverter Temperature Error Code is present, replace Power Steering Module. If error is not present, Module is OK. EPS inverter temperature can be checked using Digital wrench

Battery Voltage Over / Under Test:

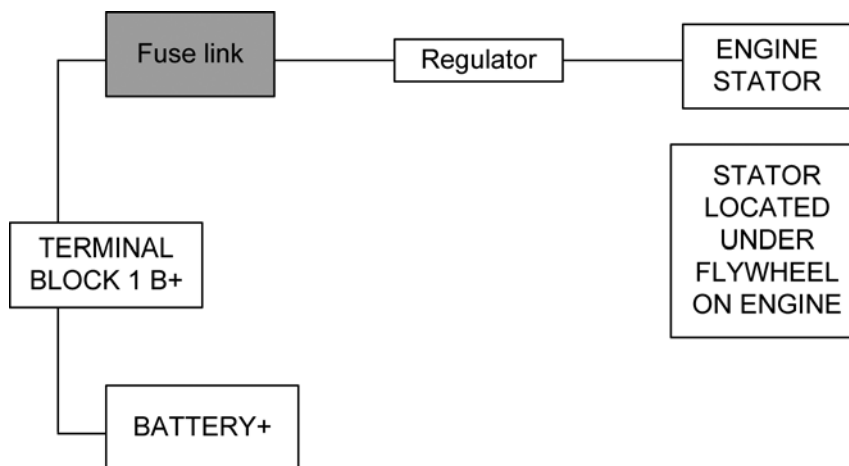
1. Disconnect 2 pin Power Connector to EPS and verify battery voltage (12-14 VDC) is present on pins with key on. If voltage is low, investigate and correct cause. If voltage at pins is correct, check all connections for corrosion, damage, and tightness. Check pin 3 on 8 pin connector for 12V signal with key on.

* These Error Codes must have multiple occurrences or you must be able to duplicate the condition before replacing the EPS unit.

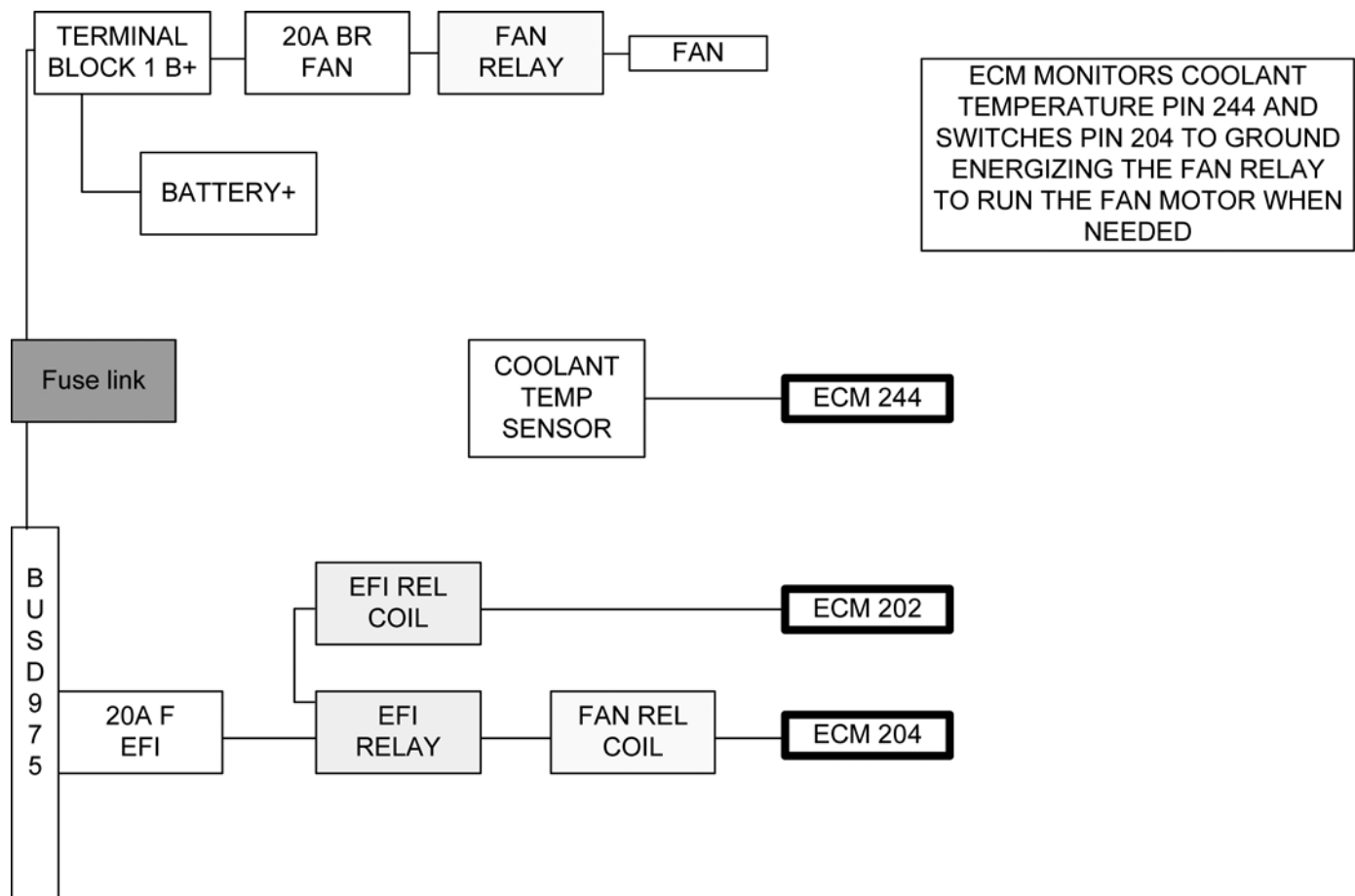
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ELECTRICAL SYSTEM BREAKOUTS

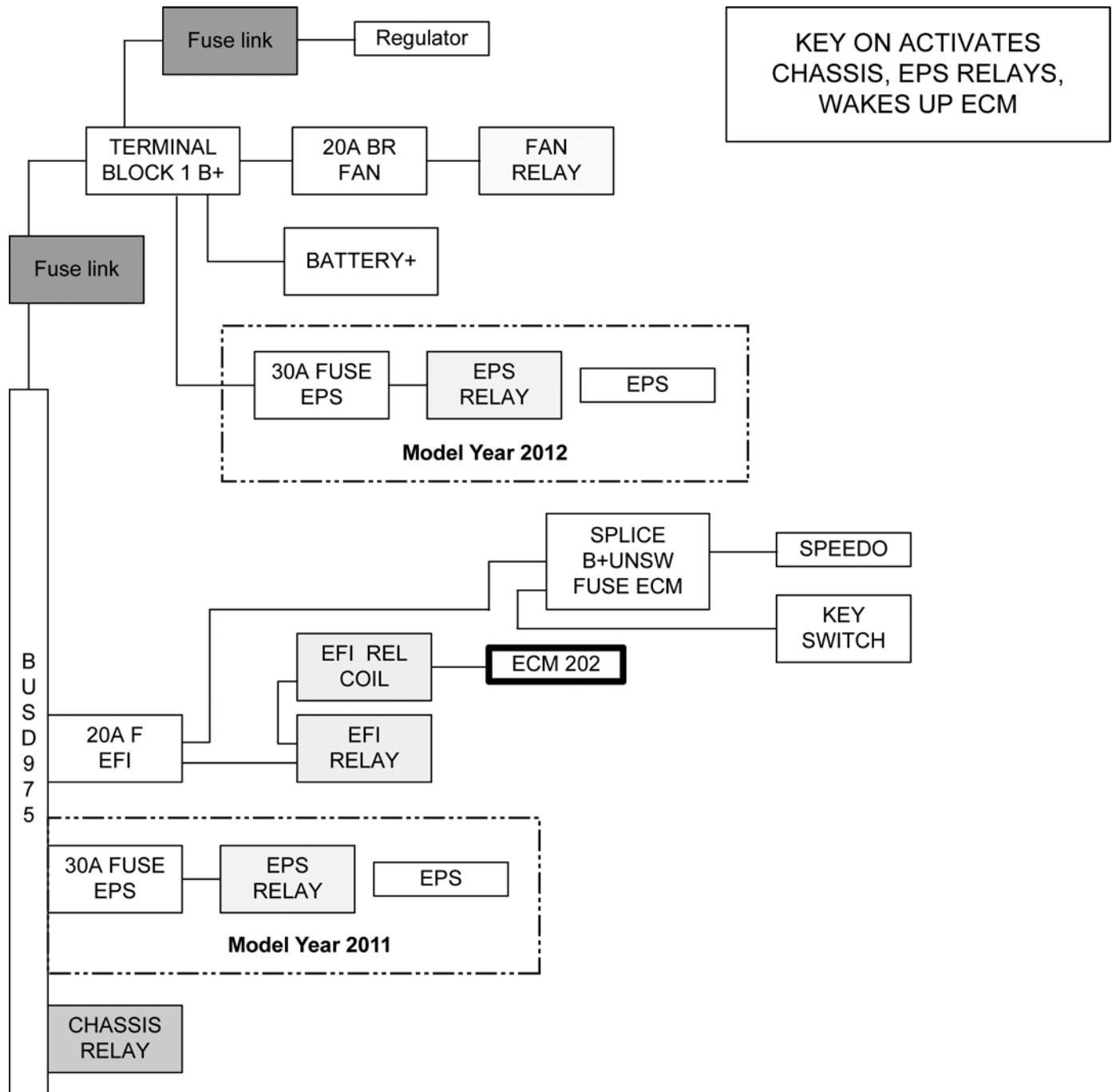
Charging System



Cooling Fan

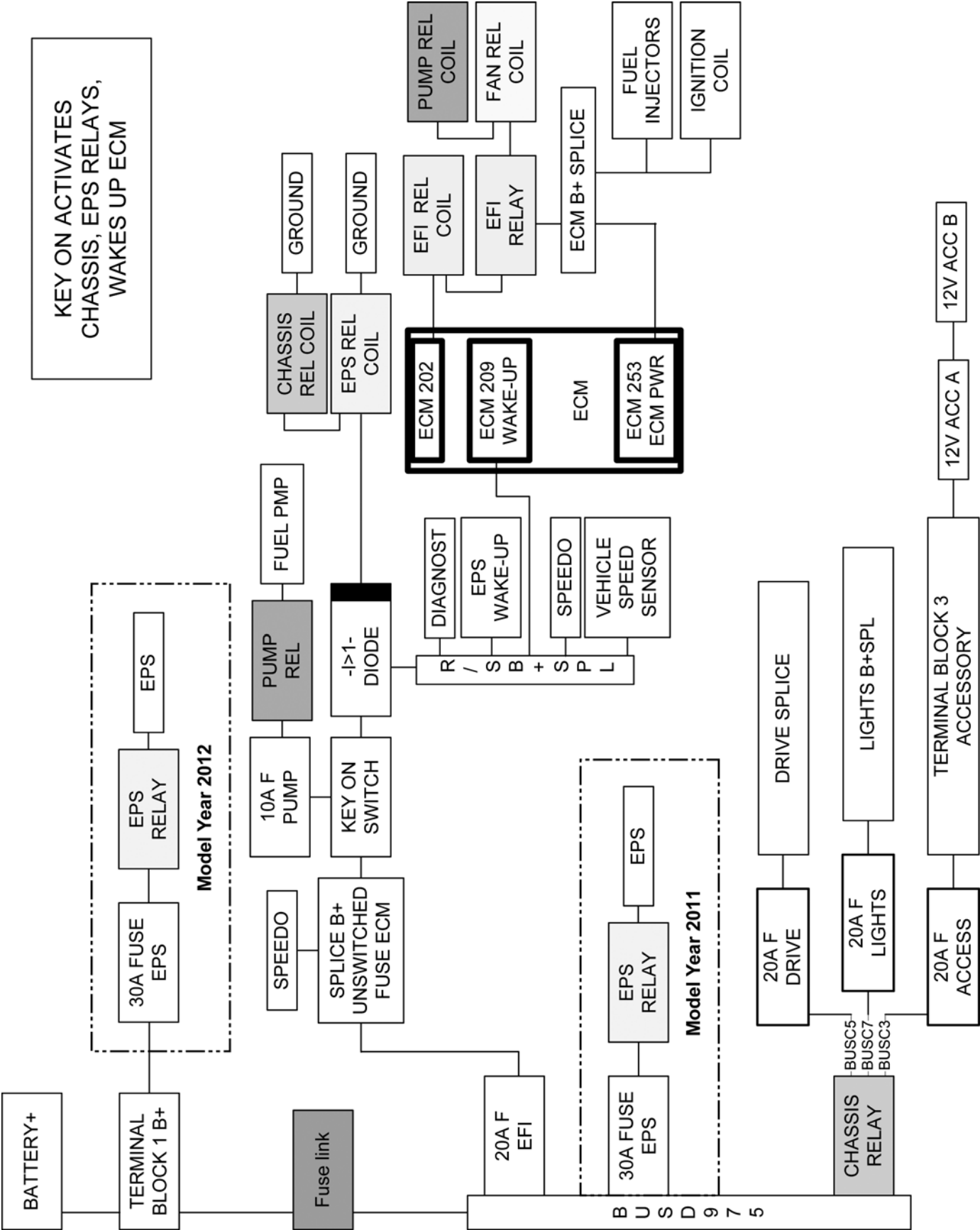


Constant Battery Power



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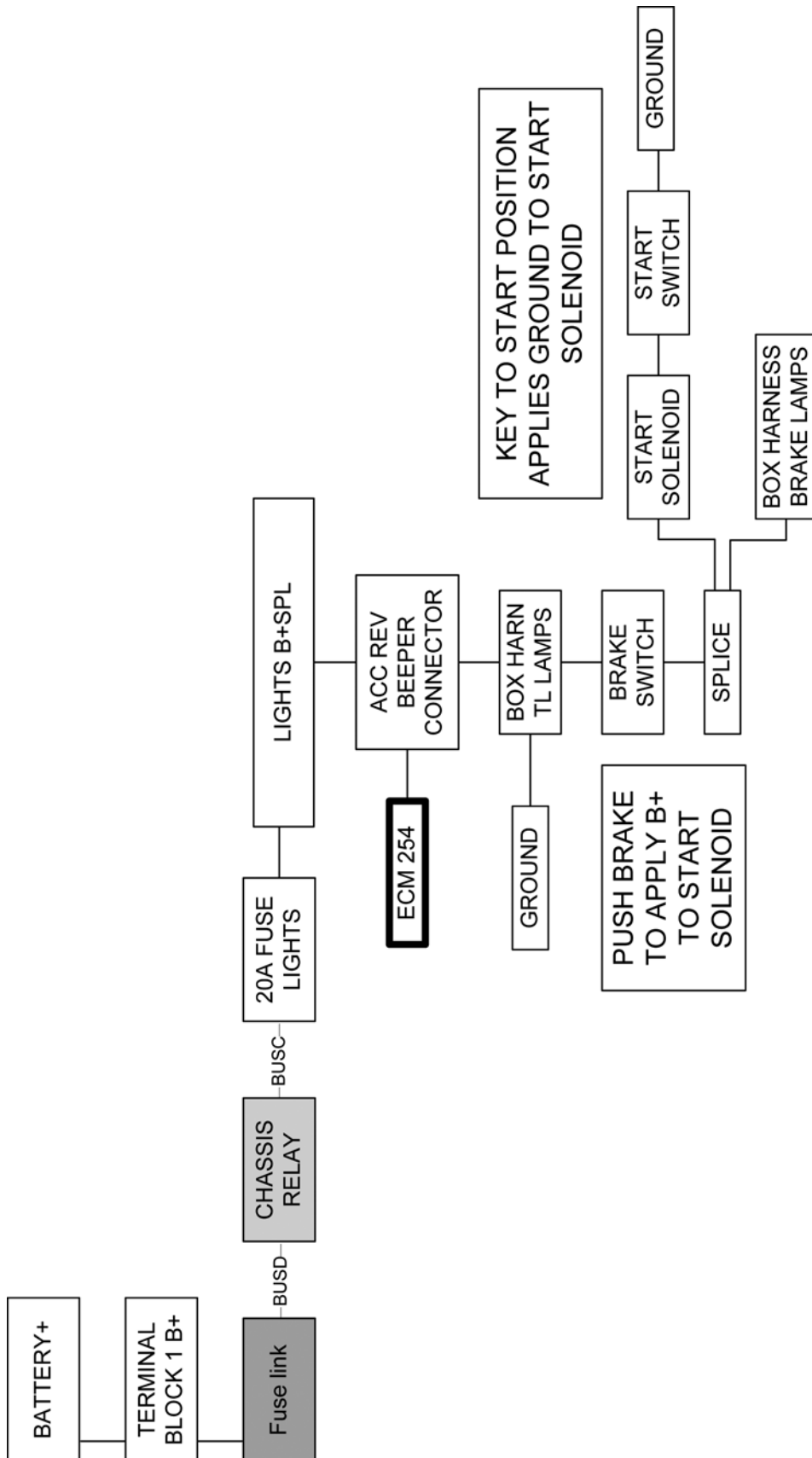
Key-On Battery Power



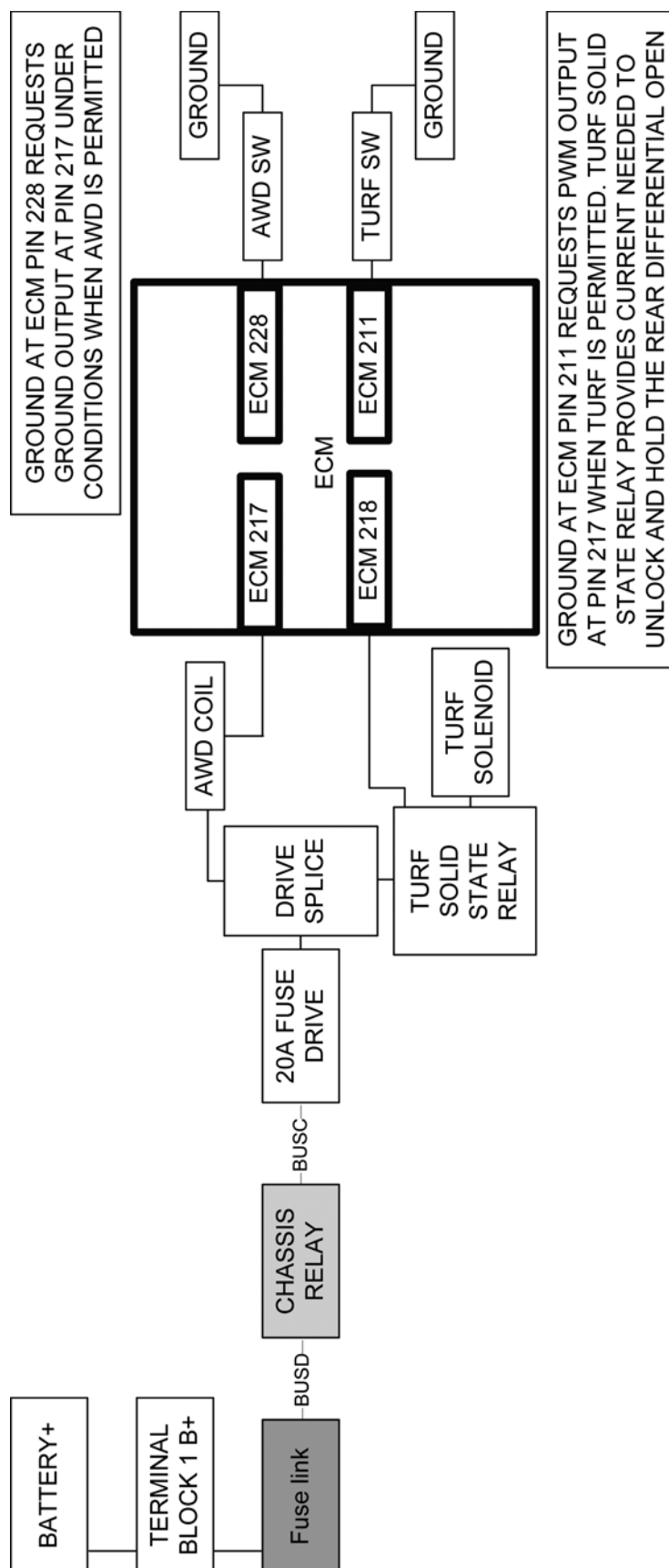
10.51



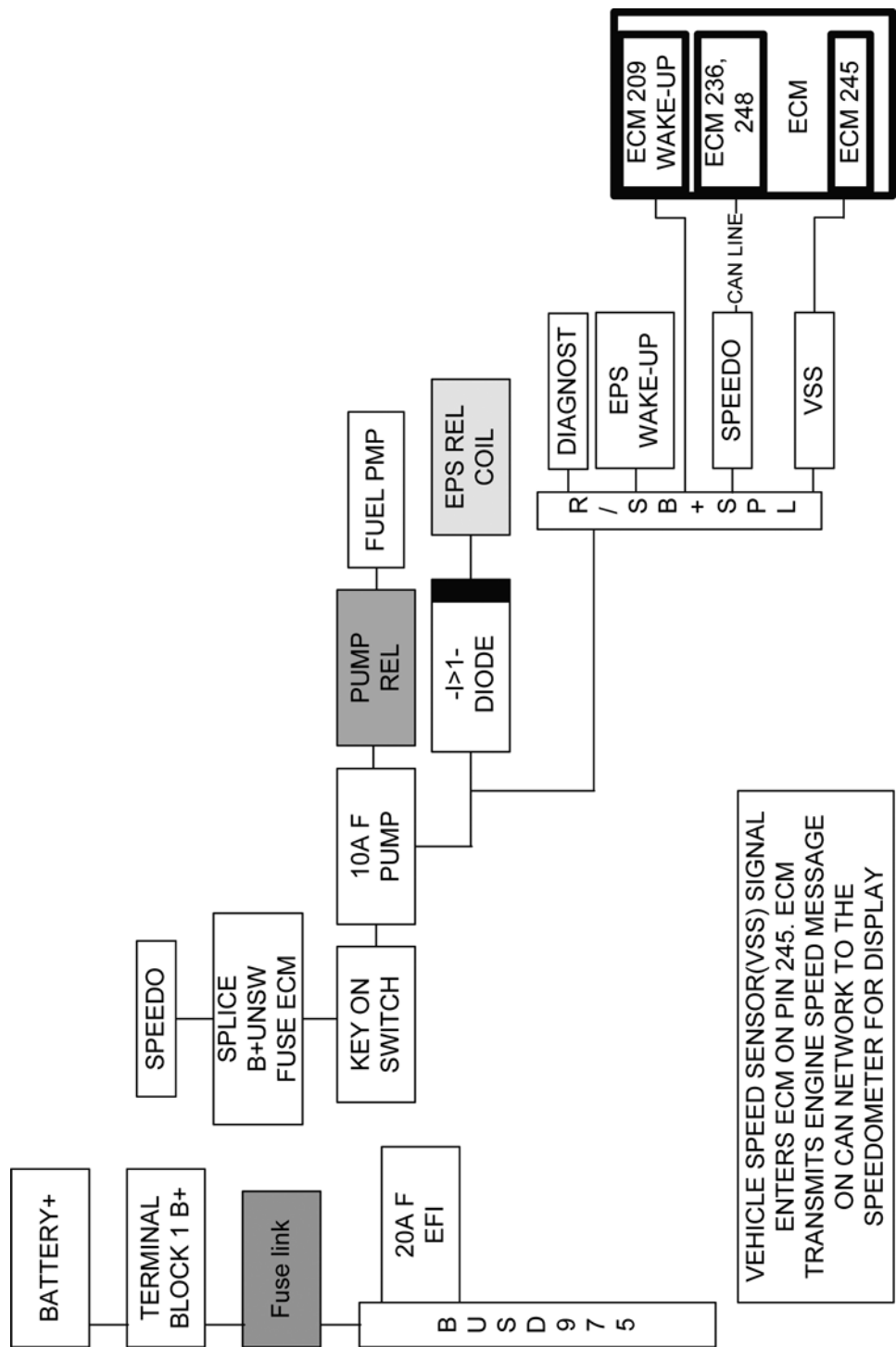
Engine Start (Starter Interlock)



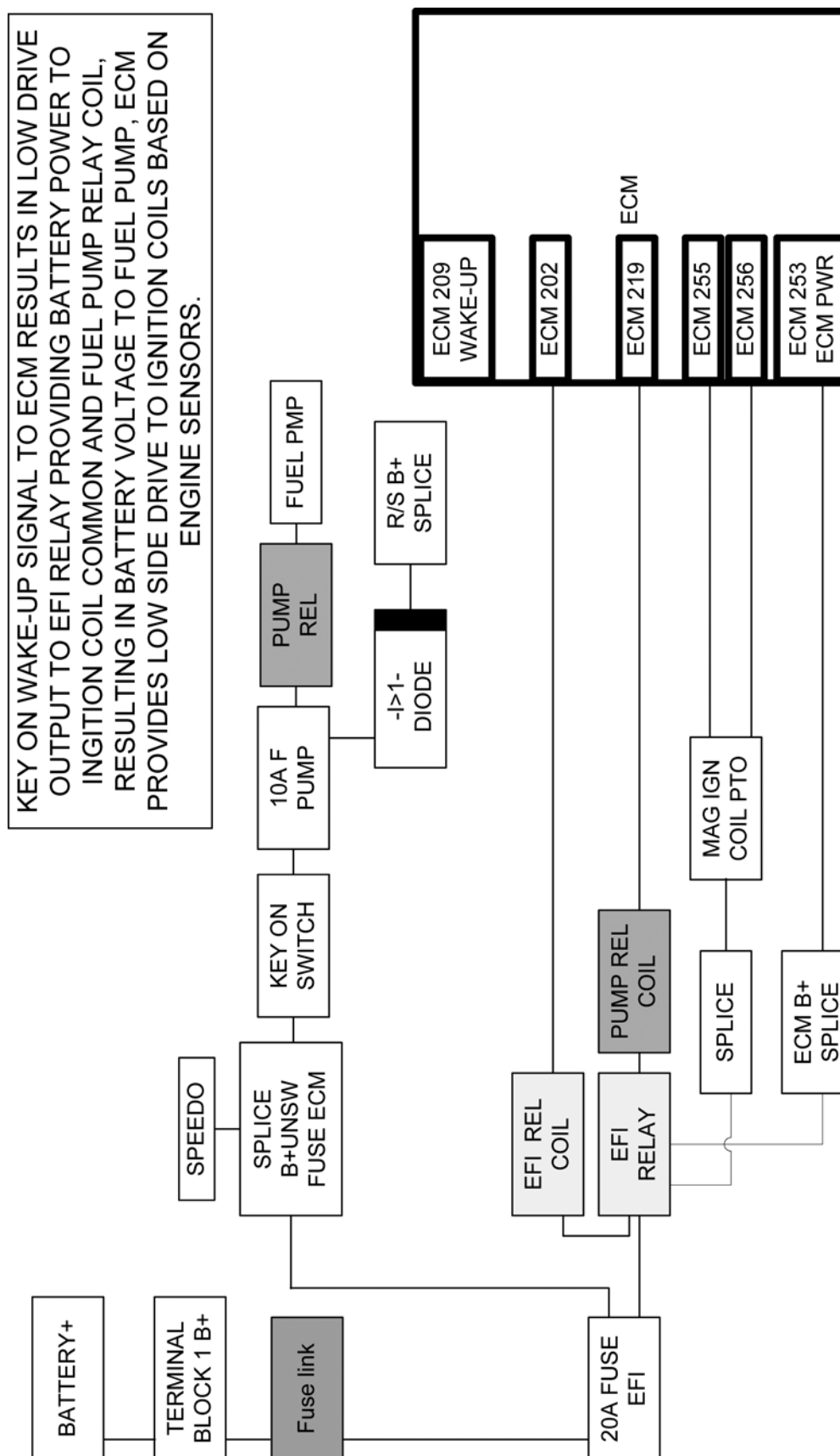
AWD / TURF



Vehicle Speed Sensor



ECM Wake-Up / Fuel Pump and Level / Ignition Coil



Lights

